Bid Reference No. 2361 Book No. _____

ONEIDA COUNTY DEPARTMENT OF PUBLIC WORKS
DIVISION OF ENGINEERING

VOLUME II

SPECIFICATION BOOK (DIVISIONS 21-23)

FOR

REBID

MOHAWK VALLEY COMMUNITY COLLEGE
SCIENCE AND TECHNOLOGY BUILDING
NEW CONSTRUCTION
1101 SHERMAN DRIVE, UTICA, NY

BID PACKAGES:

ROOFING CONSTRUCTION - CONTRACT NO. H2455703
FIRE PROTECTION CONSTRUCTION - CONTRACT NO. H2455704

SEPTEMBER 23, 2025

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ONEIDA COUNTY EXECUTIVE

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SECTION 21 59 01

GENERAL PROVISIONS

PART 1 – GENERAL

1.01 RELATED PORTIONS OF THE SPECIFICATION

A. Work in this division shall be subject to the applicable portions of the bidding documents.

1.02 SCOPE OF WORK

A. Furnish and install equipment and materials required to provide a complete fire protection system.

1.03 MANUFACTURER'S SAFETY DATA SHEETS (MSDS)

A. Provide a bound, indexed assembly of pertinent equipment and materials (including applicable subcontractor items).

1.04 CONNECTIONS TO UTILITIES

A. Furnish and install piping connections with public and/or site utilities (water supply) in accordance with the sizes and locations shown on the drawings IN STRICT COMPLIANCE WITH THE RULES AND REGULATIONS SET FORTH BY THE AUTHORITY HAVING JURISDICTION complete with tests and final connections with provisions for shutoff and adapters as required.

B. Connections causing interruption of service shall be performed "off-hours" employing "premium time" labor rates as applicable.

C. The Owner will pay all related public utility charges

1.05 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

A. Prior to installation, submit fabrication drawings, material lists and equipment submittals (shop drawings) for approval in accordance with the following:

1. It is the intent of these specifications to define the requirements for fabrication drawings, material lists and equipment submittals. Questions regarding these requirements shall be directed to the Engineer prior to submission.

2. Material lists shall conform with the requirements, herein specified.

3. Fabrication drawings, unless otherwise specified, shall conform with the following:

a. Prepare 1/4 inch scale fabrication drawings (using the contract drawings as a basis) showing all elements of the complete fire protection system in accordance with the herein mentioned Standards and/or Codes.

b. Execute the associated hydraulic calculations in context with the governing parameters.

c. Submit the above drawings and calculations to secure approval from the authority having jurisdiction (governing insurance rating organization) and thereafter to the Engineer.

d. Furnish copies of approved drawings to affected trades to insure a coordinated installation.

4. Equipment submittals, unless otherwise specified, shall conform with the following:

   a. Submittals shall be complete with the manufacturer's product description literature. SUBMITTALS WITH INSUFFICIENT LITERATURE WILL BE DISAPPROVED.

   b. Submittals shall include a complete listing of associated parameters contained in the bidding documents (materials, finishes, capacities, temperatures, pressures, electrical characteristics, etc.). THE ENGINEER WILL NOT TRANSFER INFORMATION FROM THE BIDDING DOCUMENTS TO THE SUBMITTALS. INCOMPLETE SUBMITTALS WILL BE DISAPPROVED.

   c. Submittals shall be clearly marked to differentiate between the applicable and extraneous portions. THE ENGINEER WILL NOT MARK THE SUBMITTALS. UNMARKED SUBMITTALS WILL BE DISAPPROVED.

   d. The attached Submittal Cover Sheet shall be copied, filled out and attached to each item submitted.

5. SUBMITTALS (INCLUDING RE-SUBMISSIONS), PREPARED AND TRANSMITTED IN ELECTRONIC FORMAT, SHALL BE ACCOMPANIED WITH A HARD COPY.

6. ADDITIONALLY, ELECTRONIC SUBMITTALS WHICH DO NOT CONFORM WITH THE ABOVE REQUIREMENTS WILL NOT BE REVIEWED, BUT RATHER DELETED WITH A CORRESPONDING TRANSMISSION: "REJECTED, NON-COMPLIANT SUBMISSION!"

7. Unless otherwise noted or herein specified, the following are required:

   a. Material lists:

      1) Piping systems.

      2) Pipe hangers and supports.

      3) Fire stopping.

b. Equipment submittals:

1) Sprinkler

2)

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Materials and equipment shall be in strict accordance with the following:

1. Underwriters Laboratories, *Approved Fire Protection Equipment List*.

2. NFPA Standard 13, *Installation of Sprinkler Systems*.

3. NFPA Standard 14, *Standpipe, Private Hydrant, and Hose Systems*.

4. The authority having jurisdiction.

2.02 ACCESSORIES AND COMPONENTS

A. It is the intent of this specification that all systems and equipment shall be complete with the necessary quantity of accessories and components required to insure a properly functioning installation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Work shall be expeditiously executed in a well planned, organized, neat workmanship like manner [by a qualified fire sprinkler system contractor].

B. Unless otherwise noted or herein specified, materials and equipment shall be installed in strict accordance with the following:

1. The manufacturer's recommendation.

2. NFPA Standard 13, *Installation of Sprinkler Systems*.

3. NFPA Standard 14, *Standpipe, Private Hydrant, and Hose Systems*.

4. The authority having jurisdiction.

C. Electrical work herein specified and/or noted shall be executed in strict conformance with the National Electrical Code.

D. The above mentioned standards shall be considered minimum and shall not be construed to allow deviation from requirements in excess of these Codes.

E. Work shall be executed by tradesmen licensed as requires by the authority having jurisdiction.

3.02 REMOVALS

A. Unless otherwise noted or herein specified, equipment and materials shown and/or specified to be removed (including related accessories and appurtenances) shall become the Contractor's property and shall not be permitted to accumulate, but shall be promptly removed from the job site.

B. The disposal of components containing asbestos and/or polychlorinate biphenyls (PCB's) shall be in strict conformance with governing federal, state and local regulations.

C. Work shall be carefully executed to prevent the disruption of or damage to new work or existing work that is to remain.

3.03 CEILING PLENUM SPACE COORDINATION

A. Unless otherwise shown and/or noted, mechanical/electrical distribution systems shall generally be arranged in the following descending order:

1. Branch sprinkler piping and feeder conduits (highest).

2. Ductwork.

3. HVAC hydronic piping and plumbing piping (lowest).

B. Gravity drainage piping systems (steam, steam condensate, sanitary, storm, etc.) shall be accommodated in context with their necessary precedence.

C. Branch circuit conduits shall be accommodating as required.

3.04 PROTECTION

A. Materials, equipment and accessories shall be suitable covered and protected during construction.

B. Materials, equipment and accessories damaged during construction shall be replaced at no cost to the Owner.

3.05 SUPPORTS

A. Provide all auxiliary steel (beams, channels, angles, formed shapes, etc.) required to properly support equipment and distribution systems.

B. Utilize galvanized components (wherever practical) or field-apply two coats of corrosion resistant primer.

C. Seismic anchorages, restraints and equipment supports shall comply with National Uniform Seismic Installation Guidelines.

3.06 FINAL CLEANING, EQUIPMENT ROOMS

A. Remove trash and debris.

B. Thoroughly sweep (using sweeping compound) and subsequently vacuum floors.

C. Hand wash wall surfaces and equipment and remove any foreign substance (adhesive, extraneous paint, droppings, etc.).

D. Damp-mop floors.

3.07 RECORD DRAWINGS

A. Promptly record (in a neat, legible and red-color-only accentuated fashion, on a complete, designated set of bidding documents containing no other markings) all significant differences reflected by the actual installation (sizes, capacities, locations and features of distribution systems and equipment).

3.08 OPERATION AND MAINTENANCE MANUAL

A. Upon completing the material lists and equipment submittal process, submit two bound, neatly arranged, indexed Operation and Maintenance manuals for approval.

B. Manuals shall be contained in heavy duty, 3-ring vinyl covered loose-leaf binders (suitable sets of MANAGEABLE SIZE, like equipment and systems grouped) complete with:

1. Typewritten description of contents within a clear plastic sleeve on the spine.

2. Dividers with labeled, celluloid covered tabs.

3. Protective plastic jacket enclosures for diagnostic software.

C. Manuals shall contain:

1. Title page delineating:

a. Name of project.

b. General nature of contents.

c. Name and address of Contractor and Engineer.

d. Applicable cross-references to related volumes.

2. Table of contents listing equipment (including the associated alphanumerical designation) and the corresponding section (tab).

3. Pertinent equipment information, including:

a. Manufacturer and serial number.

b. Approved submittal.

c. Operating and maintenance instructions.

d. Names, addresses and telephone numbers relative to parts and service.

4. Closeout documentation:

a. Wavier of liens.

b. Electrical inspection certificate.

c. Pertinent equipment warranties.

d. Fire alarm system test report and device addresses.

e. Record drawings.

3.09 INSTRUCTION

A. Provide thorough, organized instruction regarding equipment and systems operation to the Owner's authorized representatives (secure written acknowledgement and forward to the Engineer).

3.10 INSPECTION

A. After completion of the installation and at the start of the guarantee year, this Contractor shall execute the National Automatic Sprinkler and Fire Control Association, Inc., Standard Form of "Inspection Agreement", without charge to the Owner, calling for four (4) inspections of the sprinkler system during the guarantee year.

B. The Standard Form of the National Automatic Sprinkler and Fire Control Association, Inc., *Report of Inspection*, shall be filled out in triplicate after each inspection and the copies sent to the Owner (two) and the Engineer (one). The Contractor shall conduct flow test as directed by the authority having jurisdiction and shall submit a Certificate of Acceptance prior to request for final payment.

END OF SECTION

ATTACHMENT: Submittal Cover Sheet.

SUBMITTAL COVER SHEET

CONTRACTOR: _____

ADDRESS: _____

_____

TELEPHONE: _____

DATE: _____

NOTE: ATTACH A COMPLETED COVER SHEET TO EACH COPY

PROJECT: MVCC Science & Technology Building Renovation
MARCH PROJECT #23000

TYPE OF SUBMITTAL (CHECK):

[ ] FABRICATION DRAWING
[ ] MATERIAL LIST
[ ] EQUIPMENT
[ ] SAMPLE
[ ] COLOR SAMPLE
[ ] _____

DESCRIPTION:

PRODUCT NAME: _____

MANUFACTURER: _____

SUBCONTRACTOR/SUPPLIER: _____

ENGINEER REVIEW STAMP

[ ] NO EXCEPTION TAKEN [ ] REVISE AND RESUBMIT
[ ] FURNISH AS CORRECTED [ ] REJECTED

Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the fabrication process or to techniques of construction, and for coordination of the work of all trades.

TOWNE ENGINEERING
Consulting Engineers

Date _____ By _____

CONTRACTOR REVIEW STAMP

REMARKS:

SECTION 21 59 05

GENERAL PROVISIONS, PIPING SYSTEMS

PART 1 – GENERAL

1.01 STANDARDS

A. Pipe, tube and fittings shall comply with all governing Codes and shall conform to the applicable standards of ASTM, ASME, ASCE, ANSI and AWWA.

1.02 OPTIONS

A. Whenever these specifications describe more than one material and/or component under a particular category, it is the intent that this Contractor may exercise his option (in consistent fashion) in accordance with the same unless otherwise specifically shown on the drawings.

1.03 MATERIAL LISTS

A. Prior to installation, submit a list of materials to the Engineer for approval that shall conform with the following:

1. Each piping system (including pipe material, pipe joints, fittings, valves, etc.) shall be listed separately.

2. Listing of pipe material, pipe joints (including the associated joining materials) and fittings shall be complete with a description of all parameters contained in the Bidding Documents (schedule number, material, pressure classification, standards, etc.). THE ENGINEER WILL NOT TRANSFER INFORMATION FROM THE BIDDING DOCUMENTS TO THE LISTINGS. INCOMPLETE LISTINGS WILL BE DISAPPROVED.

3. Listings of valves shall be similar to those for pipe material, pipe joints and fittings and shall be complete with the manufacturer's product description literature. LISTINGS WITH INSUFFICIENT LITERATURE WILL BE DISAPPROVED.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Valves:

1. Above grade piping systems:

   a. Crane, Fairbanks, Jenkins, Lukenheimer, Nibco, Powell, Stockham or approved equal.

2. Valves, below grade piping systems:

a. Grinnell, Kennedy, Mueller or approved equal.

B. Grooved piping systems:

1. Victaulic, Anvil or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. Changes in direction shall be made through fittings, except that welding outlet fittings may be used for branch piping greater than or equal to two (2) inches when the branch piping is a minimum of two pipe sizes smaller than the associated main piping.

2. Provide isolating valves at all equipment requiring service.

3. Provide unions, flanges or disconnects required to facilitate convenient equipment removal.

4. Provide anchors, swings, thrust blocks, tie rods, flexible connectors, etc. required to prevent noise and allow for expansion.

B. Above grade:

1. Furnish and install piping substantially as shown on the drawings, as high as possible, parallel to building walls, clear of structural members (except when penetrations are shown or approved) and clear of equipment removal areas.

C. Below grade:

1. Furnish and install piping substantially as shown on the drawings, parallel to building walls (except where shown otherwise) and in strict accordance with the designated inverts.

2. Provide trenching, backfilling and compacting in accordance with the requirements set forth in Division 2 and/or as shown on the drawings.

3. Plug or cap open ends of piping below grade when work is stopped and thoroughly flush piping (using water flow rates with velocities of 5 to 6 ft/sec) upon completion of work.

D. Sleeves:

1. Provide sleeves at ALL points (unless otherwise noted or specified) where piping systems pass through building walls, floors and partitions:

a. Units penetrating walls below grade shall be as detailed ("Sleeves Below Grade").

b. Units penetrating floors shall be Schedule 40, black steel (ASTM A-53) arranged to provide a waterproofing flange by projecting 1/2 inch above finished floor (except in Mechanical/Electrical Equipment Rooms where the projection shall be 2 inches above finished floor).

c. Units penetrating walls or partitions (constructed of masonry and/or fire or smoke rated) shall be Schedule 40, black steel (ASTM A-53), neatly fitted and sealed to the associated opening.

d. Units penetrating walls or partitions (not constructed of masonry nor fire or smoke rated) shall be neatly fitted and not require sleeves.

e. Openings through existing walls or partitions constructed of solid masonry shall be core drilled and shall not require sleeves.

2. Seal annular spaces with intumescent, synthetic elastomer (3M brand fire barrier; Caulk CP 25, Putty 303).

E. Escutcheons:

1. Provide chrome plated, flat plate type escutcheons at ALL POINTS where EXPOSED piping systems pass through building walls, floors and partitions in FINISHED areas.

F. Painting:

1. Provide rust inhibitive primer and two finish coats (fire engine red) for exposed exterior and interior piping systems.

3.02 TESTS

A. Piping system tests, as herein specified, shall be conducted in the presence of the authority having jurisdiction (as arranged with the Engineer) before backfilling, concealment and/or insulation as applicable, and leaky joints shall be remade and retested.

END OF SECTION

SECTION 21 59 06

PIPING SYSTEMS, ABOVE GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete above grade piping systems in accordance with the sizes and/or locations shown on the drawings.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material, pipe joints, fittings:

1. Ferrous in strict accordance with the specified standards.

B. Valves:

1. General:

a. Underwriters Laboratories listed.

b. Factory Mutual approved.

2. Ball (line control):

a. Bronze two-piece body, screwed, bronze ball, full port, replaceable reinforced TFE trim, 300 spig N-SCW.

b. Worm gear actuator, hand wheel, raised position indicator, supervisory switch compatible.

c. Nibco No. KT-505W.

3. Butterfly (line control):

a. Ductile iron body, lug type for dead end service (to facilitate equipment isolation, removal and service) or wafer type for in-line service; stainless steel stem, nickel plated ductile iron disk; molded-in, resilient BUNA-N seat.

b. Worm gear actuator, hand wheel, raised position indicator, supervisory switch compatible.

c. Nibco No. D3510-8.

4. Check:

a. 2 inches and smaller:

1) Bronze body, screwed, swing type, screwed cap, replaceable bronze disk, 200 psig N-SCW.

2) Nibco No. KT-403-W.

b. 2-1/2 inches and larger:

1) Iron body, flanged, swing type, bolted cap, replaceable bronze trim, 175 psig N-SCW.

2) Nibco No. F-908-W.

5. Gate (line control):

a. 2 inches and smaller:

1) Bronze body, screwed, OS&Y, screw-over bonnet, solid wedge disk, 175 psig N-SCW.

2) Nibco No. T-104-0.

b. 2-1/2 inches and larger:

1) Iron body, flanged, OS&Y, bolted bonnet, solid wedge disk, replaceable bronze trim, supervisory switch compatible, 175 psig N-SCW.

2) Nibco No. F-607-OTS.

6. Drain and trim:

a. Ball:

1) Bronze two-piece body, screwed, blow-out proof stem, chrome plated bronze ball, full port, replaceable reinforced TFE trim, 175 psig N-SCW.

2) Nibco No. KT-585-70.

b. Globe:

1) Bronze body, screwed, rising stem, union bonnet, replaceable rubber disk, 175 psig N-SCW.

2) Nibco No. KT-65UL.

C. Gaskets:

1. Metal type.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Pitch piping to permit system drainage by gravity.

B. Furnish and install drain valves at all low points.

C. Furnish and install 30” x 30” x 6” thick concrete pads to serve as splash blocks where system drain and/or test valves discharge on grade.

3.02 TEST

A. Test the entire system (new work, isolated from existing) hydrostatically at 200 psig.

B. The system shall be leak-tight after a 3-hour duration.

END OF SECTION

SECTION 21 59 09

PIPING SYSTEMS HANGERS AND SUPPORTS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install piping systems hangers and supports for the piping systems shown on the drawings.

1.02 STANDARDS

A. Units, including piping system attachments, structural attachments, hanger rods, anchors, bracing, alignment guides and all necessary accessories shall be in accordance with ANSI Standard B31.1 and MSS Standard SP-58.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. F & S, Carpenter & Patterson, Fee & Mason, Grinnell or approved equal.

2.02 DESCRIPTION

A. Basic components (piping system attachments, structural attachments, hanger rods, alignment guides, etc.):

1. Stock, production units.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be capable of properly supporting each piping system under all operating conditions imposed by the transported medium (gas or liquid) including provisions for:

1. Expansion and contraction (movement shall not cause disengagement).

2. Preventing excessive stress.

3. Threaded vertical adjustment subsequent to installation.

4. Shock absorbing devices as required.

B. Hanger rods shall be subjected to tensile loads only; where axial or lateral movements are anticipated, suitable linkages shall be provided.

C. Piping system attachments serving copper piping systems shall be copper-clad.

D. Structural attachments shall be secured to the building structural system, not to roof decks or components of the mechanical and electrical systems (ductwork, piping, conduit, etc.); however, attachments serving piping 1” and smaller may be secured to floor decks.

E. Piping systems support shall be completely independent of the associated equipment.

3.02 ARRANGEMENT

A. Locate and position units to complement an associated piping system arrangement which assures proper access for maintenance and service.

B. Position structural attachments to accommodate piping system elevations which complement a coordinated ceiling plenum space arrangement.

END OF SECTION

SECTION 21 59 20

RISERS, WET PIPE SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install wet pipe system risers in accordance with the sizes and locations shown on the drawings.

B. Arrangements shall be the positive operating type; complete with alarm check valve, retarding chamber, alarm devices and trim.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Reliable, Viking or approved equal.

2.02 DESCRIPTION

A. Alarm check valve:

1. Ductile iron body, brass seat.

2. EPDM faced clapper.

B. Retarding chamber:

1. Ductile iron body.

2. Alarm device interface accessories, drain, drain restriction.

C. Alarm devices:

1. Water pressure switch.

D. Trim:

1. Main drain, external bypass.

2. Piping, fittings, unions, valves, strainers, gauges.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Arrange risers to assure sufficient access for maintenance and testing.

B. Provide auxiliary vents as required.

END OF SECTION

SECTION 21 59 30

SPRINKLERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install sprinklers in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be complete with all features required by each particular system (wet pipe, dry pipe, deluge, preaction, etc.) and all special circumstances resulting from job conditions.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Reliable, Viking or approved equal.

2.02 DESCRIPTION

A. General:

1. Center strut solder in compression principle, individually hydrostatically tested.

2. Appropriate fusing point and orifice size (marked and color-coded).

3. Configuration (concealed, pendent, sidewall, upright) as scheduled.

B. Construction:

1. Copper based alloy, finish as scheduled.

2. Matching escutcheon (units served via concealed piping).

C. Emergency sprinkler cabinet:

1. Steel enclosure, red lacquer finish.

2. Six sprinkler heads of each type and temperature rating.

3. Two wrenches.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be installed (arrangement and spacing) in strict accordance with the requirements set forth in the specified standards.

B. Additionally, the aesthetic value of the associated reflected ceiling plan (as applicable) shall be maintained by providing symmetry with all other involved elements, including visible portions of ceiling support systems, lighting, air distribution terminals, etc.

C. Cover each sprinkler subsequent to installation with a small plastic bag until space painting is complete.

END OF SECTION

SECTION 21 59 50

HOSE STATIONS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install hose stations in accordance with the sizes and locations shown on the drawings.

B. Units shall be configured (hose rack, hose valves, hose, and cabinet) as shown.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Elkhart, Potter-Roemer or approved equal.

2.02 DESCRIPTION

A. Hose rack:

1. Steel.
2. Nipple, reducer, pin lug coupling.
3. Baked enamel finish.

B. Hose valves:

1. Brass body, screwed, 300 psig.
2. Pin lug cap and chain.

C. Hose:

1. Synthetic jacket, extruded polyester liner.
2. 100 ft.

D. Cabinet:

1. Heavy gauge steel.
2. Glass door, piano hinge.
3. Baked enamel finish.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be installed in strict accordance with the requirements set forth in the specified standards.

B. Additionally, associated general construction features shall be properly coordinated.

END OF SECTION

SECTION 21 59 60

FIRE DEPARTMENT CONNECTIONS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install fire department connections in accordance with the configurations and locations shown on the drawings.

B. Arrangements shall be the flush type, complete with body, faceplate and trim.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Potter-Roemer, Elkhart, Sierra or approved equal.

2.02 DESCRIPTION

A. Body:

1. Cast brass, drop clapper (each inlet).

B. Faceplate:

1. Polished brass, appropriate system indication ("auto sprinkler", "standpipe", etc.), chain holder.

C. Trim:

1. Polished brass snoot, swivel and plug.

2. Local Utica Fire Department thread.

END OF SECTION

SECTION 21 59 62

ALARM DEVICES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install waterflow detectors, air pressure switches, waterflow pressure switches and supervisory switches in accordance with the parameters shown on the drawings herein specified.

B. Units shall be Underwriters Laboratories listed.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Notifier, Potter or approved equal.

2.02 DESCRIPTION

A. Waterflow detectors:

1. Vane type, suitable for horizontal or vertical installation, adjustable sealed retard.

2. Weather resistant, cast aluminum cover with security fasteners.

B. Air pressure switches:

1. Adjustable (0-20 psig).

2. Weather resistant, cast aluminum cover with security fasteners, plated steel base, 175 psig.

C. Waterflow pressure switches:

1. Bleeder valve (for testing), adjustable (20 to 225 psig).

2. Weather resistant, cast aluminum cover with security fasteners, plated steel base, 250 psig.

D. Supervisory switches:

1. Straight conduit entry (arranged to obviate interference with normal valve operation), adjustable.

2. Weather resistant, cast aluminum cover with security fasteners.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Adjust waterflow detector retard to complement water supply system pressure surge characteristics.

B. Adjust supervisory switches to actuate whenever the associated valve wheel passes two revolutions or stem travel exceeds 20%.

END OF SECTION

SECTION 21 59 64

BACKFLOW PREVENTER ASSEMBLIES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install backflow preventer assemblies in accordance with the sizes and locations shown on the drawings.

B. Units shall be the double check detector type; designed to provide maximum protection with low head loss; certified by the American Society of Sanitary Engineers; complete with body, check valves, relief assembly, meter and isolating valves.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Watts, Wilkens or approved equal.

2.02 DESCRIPTION

A. Housing/sleeve:

1. Schedule 40, 304 stainless steel.

2. Test ports.

B. Check valves:

1. Linked, stainless steel spring assemblies.

2. Replaceable disk and seats.

C. Meter:

1. 100 ft3 increment.

2. Interconnecting piping.

D. Isolating valves:

1. Tamper switch.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Arrange unit in strict accordance with the requirements set forth by the public utility having jurisdiction.

3.02 TEST

A. Unit testing shall be executed by a New York State Certified tester, with the results (in appropriate format) submitted to the public utility having jurisdiction for approval.

END OF SECTION

SECTION 21 59 90

GAUGES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install gauges in accordance with the locations shown on the drawings.

B. Units shall operate within the middle third of a range selected to suit the measured medium under normal operating conditions.

C. Units measuring mediums subject to quickly changing pressures shall be complete with dampening device at the inlet.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Trerice, Taylor, Weiss or approved equal.

2.02 DESCRIPTION

A. Pressure gauges:

1. Units shall be the bourden type (4-1/2 inch dial, larger where required to permit easy reading), complete with flanged cast aluminum case, clear glass window, white face, black embossed figures, black pointer, bused phosphor bronze bearings and 1/4 inch NPT inlet with gauge cock (1% accuracy over middle half of range unless otherwise noted).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Unit locations shown on the drawings are indicative of the approximate point where measurement is required. Actual locations must permit easily accessible reading and prevent error due to the relative location of other system components (e.g., pressure gauges shall be located 5 pipe diameters downstream from fittings and valves, etc).

END OF SECTION

SECTION 21 59 91

IDENTIFICATION

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install identification for all equipment, piping and valves.

B. Identification shall include labels, valve location indicators and warning tape.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Seton, Brady or approved equal.

2.02 DESCRIPTION

A. Labels:

1. Equipment:

   a. Standard, phenolic, engraved nameplates.

   b. 3/8" high by 1/4" letter size.

2. Piping:

   a. 2 inches and smaller:

      1) Semi-rigid plastic with pre-set curl (designed to "snap-on" with substantial overlap), sized and color-coded in accordance with ANSI Standard A 13.1, complete with pipe size and directional flow arrows.

   b. 2 ½ inches and larger:

      1) Neatly stenciled (with appropriately sized lettering indicating pipe size, and directional flow arrows), 50 foot intervals.

B. Valve location indicators:

1. 1 inch diameter, pressure sensitive adhesive spot markers.

2. Color-coded (yellow).

C. Warning tape (underground utilities):

a. 3.5 mils thick, 6” wide, appropriate APWA color code, heavy duty polyethylene.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Equipment labels (using the precise alphanumerical designation shown on the drawings) shall be securely mounted (in a conspicuous position) with appropriate fasteners and shall be applied to ALL equipment.

B. Piping labels shall be located to ensure continuous systems identity.

C. Valve location indicators shall be adhered to suspended ceiling system grids and/or access doors at all main, branch main and branch piping valve locations.

END OF SECTION

SECTION 22 56 01

GENERAL PROVISIONS

PART 1 – GENERAL

1.01 RELATED PORTIONS OF THE SPECIFICATION

A. Work in this section shall be subject to the applicable portions of the bidding documents.

1.02 SCOPE OF WORK

A. Furnish and install equipment and materials required to provide a complete plumbing system.

1.03 MANUFACTURER'S SAFETY DATA SHEETS (MSDS)

A. Provide a bound, indexed assembly of pertinent equipment and materials (including applicable Subcontractor items).

1.04 CONNECTIONS TO EQUIPMENT THAT IS EXISTING AND/OR FURNISHED BY OTHERS

A. Furnish and install branch piping serving equipment that is existing and/or furnished by others in accordance with the sizes and locations shown on the drawings, complete with final connections, including provisions for shut-off and adapters as required.

1.05 CONNECTIONS TO UTILITIES

A. Furnish and install piping connecting with public and/or site utilities (water supply, sanitary drainage, storm drainage, natural gas, propane, or liquefied petroleum gas, medical gas) in accordance with the sizes and locations shown on the drawings, IN STRICT COMPLIANCE WITH THE RULES AND REGULATIONS SET FORTH BY THE LOCAL AUTHORITY HAVING JURISICTION, complete with tests and final connections, with provisions for shut-off and adaptors as required.

B. Connections causing interruption of service shall be performed "off-hours" employing "premium time" labor rates as applicable.

C. The Owner will pay all related public utility charges.

1.06 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

A. Prior to installation, submit fabrication drawings, material lists and equipment submittals (shop drawings) for approval in accordance with the following:

1. It is the intent of these specifications to define the requirement for fabrication drawings, material lists and equipment submittals. Questions regarding these requirements shall be directed to the Engineer prior to submission.

2. Fabrication drawings and material lists shall conform with the requirements herein specified.

3. Equipment submittals, unless otherwise specified, shall conform with the following:

   a. Submittals shall be complete with the manufacturer's product description literature. SUBMITTALS WITH INSUFFICIENT LITERATURE WILL BE DISAPPROVED.

   b. Submittals shall include a complete listing of associated parameters contained in the bidding documents (materials, finishes, capacities, temperatures, pressures, electrical characteristics, etc.). THE ENGINEER WILL NOT TRANSFER INFORMATION FROM THE BIDDING DOCUMENTS TO THE SUBMITTALS. INCOMPLETE SUBMITTALS WILL BE DISAPPROVED.

   c. Submittals shall be clearly marked to differentiate between the applicable and extraneous portions. THE ENGINEER WILL NOT MARK THE SUBMITTALS. UNMARKED SUBMITTALS WILL BE DISAPPROVED.

   d. The attached Submittal Cover Sheet shall be copied, filled out and attached to each item submitted.

4. SUBMITTALS (INCLUDING RE-SUBMISSIONS), PREPARED AND TRANSMITTED IN ELECTRONIC FORMAT, SHALL BE ACCOMPANIED WITH A HARD COPY COMPRISED OF ORIGINAL, PRINTED PRODUCT LITERATURE (PHOTOCOPIES ARE NOT ACCEPTABLE).

5. ADDITIONALLY, ELECTRONIC SUBMITTALS WHICH DO NOT CONFORM WITH THE ABOVE REQUIREMENTS WILL NOT BE REVIEWED, BUT RATHER DELETED WITH A CORRESPONDING TRANSMISSION: "REJECTED, NON-COMPLIANT SUBMISSION!"

6. Unless otherwise noted or herein specified, the following are required:

   a. Material lists:

      1) Piping systems.

      2) Piping hangers and supports.

      3) Insulation systems.

      4) Fire stopping.

   b. Fabrication drawings:

1) Piping systems.

c. Equipment submittals:

1) Fixtures.

2) Floor Drains.

3) Roof Drains.

4) Domestic Water Storage Heaters.

5) Electric Water Coolers.

6) Insulation.

7) Air compressors.

8) Backflow preventer assemblies.

9) Emergency equipment.

10) Laboratory vacuum pumps.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Materials and equipment shall be in strict accordance with the parameters herein specified.

2.02 ACCESSORIES AND COMPONENTS

A. It is the intent of this specification that systems and equipment shall be complete with the necessary quantity of all accessories and components required to insure a properly functioning installation.

2.03 MOTORS AND MOTOR STARTERS

A. Units serving driven equipment herein specified shall conform with the parameters set forth in Sections 22 58 94 and 22 58 95, respectively.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Work shall be expeditiously executed in a well-planned, organized, neat, workmanship like manner.

B. Unless otherwise noted or herein specified, all materials and equipment shall be installed in strict accordance with the manufacturer's recommendations.

C. System components shall be installed in a fashion ensuring easy serviceability.

D. Electrical work herein specified and/or noted shall be executed in strict conformance with the National Electrical Code (NEC).

E. Work shall be executed by tradesmen licensed as required by the authority having jurisdiction.

3.02 REMOVALS

A. Unless otherwise noted or herein specified, equipment and materials shown and/or specified to be removed (including related accessories and appurtenances) shall become the Contractor's property and shall not be permitted to accumulate but shall be promptly removed from the job site.

B. The removal and disposal of glycol solutions, petroleum products, refrigerants and components containing asbestos and/or polychlorinate biphenyls (PCB's) shall be in strict conformance with governing federal, state and local regulations.

C. Work shall be carefully executed to prevent the disruption of or damage to new work or existing work that is to remain.

3.03 CEILING PLENUM SPACE COORDINATION

A. Unless otherwise shown and/or noted, mechanical/electrical distribution systems shall generally be arranged in the following descending order:

1. Branch sprinkler piping and feeder conduits (highest).

2. Ductwork.

3. HVAC hydronic piping and plumbing piping (lowest).

B. Gravity drainage piping systems (steam, steam condensate, sanitary, storm, etc.) shall be accommodated in context with their necessary precedence.

C. Branch circuit conduits shall be accommodating as required.

3.04 PROTECTION

A. Materials, equipment and accessories shall be suitably covered and protected during construction.

B. Materials, equipment and accessories damaged during construction shall be replaced at no cost to the Owner.

3.05 SUPPORTS

A. Provide auxiliary steel (beams, channels, angles, formed shapes, etc.) required to properly support equipment and distribution systems.

B. Utilize galvanized components (wherever practical) or field apply two coats of corrosion resistant primer.

C. Seismic anchorages, restraints and equipment supports shall comply with National Uniform Seismic Installation Guidelines.

3.06 FINAL CLEANING, EQUIPMENT ROOMS

A. Remove trash and debris.

B. Thoroughly sweep (using sweeping compound) and subsequently vacuum floors.

C. Hand wash wall surfaces and equipment and remove any foreign substance (adhesive, extraneous paint, droppings, etc.).

D. Damp-mop floors.

3.07 RECORD DRAWINGS

A. Promptly record (in a neat, legible and red-color-only accentuated fashion, on a complete, designated set of bidding documents containing no other markings) significant differences reflected by the actual installation (sizes, capacities, locations and features of distribution systems and equipment).

3.08 OPERATION AND MAINTENANCE MANUAL

A. Upon completing the material lists and equipment submittal process, submit two bound, neatly arranged, indexed Operation and Maintenance Manuals for approval.

B. Manuals shall be contained in heavy duty, 3-ring vinyl covered loose-leaf binders (suitable sets of MANAGEABLE SIZE, like equipment and systems grouped) complete with:

1. Typewritten description of contents within a clear plastic sleeve on the spine.

2. Dividers with labeled, celluloid covered tabs.

3. Protective plastic jacket enclosures for diagnostic software.

C. Manuals shall contain:

1. Title page delineating:

a. Name of project.

b. General nature of contents.

c. Name and address of Contractor and Engineer.

d. Applicable cross-references to related volumes.

2. Table of contents listing equipment (including the associated alphanumerical designation) and the corresponding section (tab).

3. Pertinent equipment information, including:

a. Manufacturer and serial number.

b. Approved submittal.

c. Operating and maintenance instructions.

d. Names, addresses and telephone numbers relative to parts and service.

4. Field checking start-up reports.

5. Closeout documentation:

a. Wavier of liens.

3.09 FIELD CHECKING START-UP

A. Provide field checking start-up for systems and equipment in accordance with the requirements herein specified.

3.10 INSTRUCTION

A. Provide thorough, organized instruction regarding equipment and systems operation to the Owner's authorized representatives (secure written acknowledgement and forward to the Engineer); refer to respective specification sections for designated requirements.

END OF SECTION

ATTACHMENT: Submittal Cover Sheet

SUBMITTAL COVER SHEET

CONTRACTOR: _____

ADDRESS: _____

_____

TELEPHONE: _____

DATE: _____

NOTE: ATTACH A COMPLETED COVER SHEET TO EACH COPY

PROJECT: MVCC Science & Technology Building Renovation
MARCH PROJECT #23000

TYPE OF SUBMITTAL (CHECK):

[ ] FABRICATION DRAWING
[ ] MATERIAL LIST
[ ] EQUIPMENT
[ ] SAMPLE
[ ] COLOR SAMPLE
[ ] _____

DESCRIPTION:

PRODUCT NAME: _____

MANUFACTURER: _____

SUBCONTRACTOR/SUPPLIER: _____

ENGINEER REVIEW STAMP

[ ] NO EXCEPTION TAKEN
[ ] REVISE AND RESUBMIT
[ ] FURNISH AS CORRECTED
[ ] REJECTED

Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the fabrication process or to techniques of construction, and for coordination of the work of all trades.

TOWNE ENGINEERING
Consulting Engineers

Date _____ By _____

CONTRACTOR REVIEW STAMP

REMARKS:

SECTION 22 56 05

GENERAL PROVISIONS, PIPING SYSTEMS

PART 1 – GENERAL

1.01 STANDARDS

A. Pipe, tube and fittings shall comply with governing codes and shall conform to the applicable standards of ASTM, ASME, ASCE, ANSI and AWWA.

1.02 OPTIONS

A. Whenever copper and ferrous piping systems are specified two (2) inches and smaller and two and one-half (2-1/2) inches and larger, respectively, copper piping systems may be provided (in consistent fashion, by piping system) for sizes four (4) inches and smaller (unless otherwise noted).

B. Ferrous (excluding cast iron) piping systems are generally specified with screwed joints and fittings serving sizes two (2) inches and smaller and with flanged joints and weld fittings or (for designated systems) grooved joints and fittings serving sizes two and one-half (2-1/2) inches and larger; unless otherwise noted, flanged joints and weld fittings or (for designated systems) grooved joints and fittings may be provided (in consistent fashion, by piping system) for piping one and one-half (1-1/2) inches and larger and/or screwed joints and fittings for sizes four (4) inches and smaller.

C. Copper piping systems are generally specified with soldered joints; mechanical joints (for designated systems) may be provided (in consistent fashion, by piping system).

D. Bronze body valves are generally specified with screwed ends; unless otherwise noted, solder ends (in strict accordance with the listed parameters) may be provided (in consistent fashion, by piping system) for copper piping systems.

1.03 MATERIAL LISTS

A. Prior to installation, submit a list of materials to the Engineer for approval that shall conform with the following:

1. Each piping system (including pipe material, pipe joints, fittings, valves, etc.) shall be listed separately.

2. Listings of pipe material, pipe joints (including the associated joining materials) and fittings shall be complete with a description of all parameters contained in the bidding documents (schedule number, material, pressure classification, standards, etc.). THE ENGINEER WILL NOT TRANSFER INFORMATION FROM THE BIDDING DOCUMENTS TO THE LISTINGS. INCOMPLETE LISTINGS WILL BE DISAPPROVED.

3. Listings of valves shall be similar to those for pipe material, pipe joints and fittings and shall be complete with the manufacturer's product description literature. INCOMPLETE LISTINGS WILL BE DISAPPROVED.

PART 2 – PRODUCTS

2.01 ACCEPTABLE VALVE MANUFACTURERS

A. Valves:

1. Apollo, Crane, Fairbanks, Jenkins, Keystone, Lukenheimer, Nibco, Powell, Stockham or approved equal.

B. Grooved piping systems:

1. Griswold, Victaulic or approved equal.

C. Mechanical joint systems:

1. Ridgid, Viega or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. Changes in direction shall be made through fittings, except that welding outlet fittings may be used for branch piping two (2) inches and larger, provided the branch piping is a minimum of two pipe sizes smaller than the associated main piping.

2. Provide isolating valves at equipment requiring service.

3. Provide unions, flanges or disconnects required to facilitate convenient equipment removal.

4. Provide anchors, swings, thrust blocks, tie rods, flexible connectors, etc. required to prevent noise and allow for expansion.

B. Above grade:

1. Furnish and install piping substantially as shown on the drawings, as high as possible (except that piping shall generally be run below ductwork to facilitate access to valves, vents, flow meters, etc.), parallel to building walls, clear of structural members (except when penetrations are shown or approved) and clear of equipment removal areas.

C. Below grade:

1. Furnish and install piping substantially as shown on the drawings, parallel to building walls (except where shown otherwise) and in strict accordance with the designated inverts.

2. Provide trenching, backfilling and compacting in accordance with the requirements set forth in Division 2 and/or as shown on the drawings.

3. Plug or cap open ends when work is stopped and thoroughly flush (using water flowrates with velocities of five to six ft/sec) upon completion of work.

D. Sleeves:

1. Provide sleeves at ALL points (unless otherwise noted or specified) where piping systems pass through building walls, floors and partitions:

a. Units penetrating walls below grade shall be as detailed (Sleeves Below Grade).

b. Units penetrating floors shall be Schedule 40, black steel (ASTM A-53) arranged to provide a waterproofing flange by projecting 1/2" above finished floor (except in Mechanical/Electrical Equipment Rooms where the projection shall be 2" above finished floor).

c. Units penetrating walls or partitions (constructed of masonry and/or fire or smoke rated) shall be Schedule 40, black steel (ASTM A-53), neatly fitted and sealed to the associated opening.

d. Units penetrating walls or partitions (not constructed of masonry nor fire or smoke rated) shall be neatly fitted and not require sleeves.

e. Openings through existing walls or partitions constructed of solid masonry shall be core drilled and shall not require sleeves.

2. Seal annular spaces with intumescent, synthetic elastomer (3M brand fire barrier; Caulk CP 25, Putty 303).

E. Escutcheons:

1. Provide chrome plated flat plate type escutcheons at ALL POINTS where EXPOSED piping systems pass through building walls, floors and partitions in FINISHED areas.

F. Painting:

1. Provide rust inhibitive primer and two finish coats for uninsulated, exposed exterior and interior, ferrous piping systems; color as noted, scheduled or directed.

3.02 TESTS

A. Piping systems tests herein specified shall be conducted in the presence of the authority having jurisdiction before backfilling, concealment and/or insulation as applicable and all leaky joints shall be remade and retested.

END OF SECTION

SECTION 22 56 07

DOMESTIC WATER PIPING SYSTEMS, ABOVE GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete above grade domestic water piping systems in accordance with the sizes and locations shown on the drawings.

B. All fittings, joints, valves, fixture fittings etc. shall be NSF372 and NSF61 compliant.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material:

1. Type L, hard copper tubing conforming to ASTM Specification B-88.

B. Pipe joints:

1. Soldered type, joined with lead free, tin-copper-selenium solder.

C. Fittings:

1. Wrought solder joint type conforming to ANSI Standard B16.22.

D. Valves:

1. Ball:

a. Bronze two-piece body, screwed, chrome plated bronze ball, full port, replaceable reinforced TFE trim, lever handle, 600 psig WOG.

b. Non-conductive extended handles, insulation protection sleeve, adjustable memory stop, hose end with cap and chain for drain service.

c. Nibco No. T-585-70.

2. Check:

a. 3 inches and smaller:

1) Bronze body, screwed, swing type, screwed cap, replaceable bronze disk, 200 psig WOG.

2) Nibco No. T-413.

b. 4 inches and larger:

1) Iron body, flanged, swing type, bolted cap, replaceable bronze disk and seat, 200 psig WOG.

2) Nibco No. F-918.

3. Globe:

a. 3 inches and smaller:

1) Bronze body, screwed, globe or angle pattern, rising stem, union bonnet, replaceable bronze disk, 200 psig WOG.

2) Nibco No. T-235-B or T-335-Y.

b. 4 inches and larger:

1) Iron body, flanged, globe or angle pattern, OS&Y, bolted bonnet, replaceable bronze disk and seat, 200 psig WOG.

2) Nibco No. F-718 or F-818.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Pitch domestic hot water recirculation piping up in the direction of flow 1/4 inch in 25 ft.

B. Furnish and install manual air vents at high points in domestic hot water recirculating piping, complete with remote air chambers and connecting tubing as required to provide easy access.

C. Furnish and install drain valves at low points.

3.02 TEST

A. Test the entire water distribution system (new work, isolated from existing) hydrostatically at 200 psig.

B. The system shall be leak-tight after a 3-hour duration.

C. Test all new piping and fixtures for lead in water in accordance with NYS DOH standards.

3.03 DISINFECTION

A. General:

1. Before being placed in service, the entire system (new work, isolated from existing) shall be chlorinated in strict accordance with AWWA standard C601-54 and regulations set forth by local building and health department codes.

2. Chlorination may be applied by:

   a. Introducing a chlorine gas-water mixture.

   b. Directly feeding chlorine gas using a solution feed chlorinator, pressure feed chlorinator or pressure feed chlorinator with pipeline diffuser.

   c. Applying a mixture of calcium hypochlorite and water (mixed to form a paste and thinned to a slurry prior to injection).

B. Procedure:

1. Prior to disinfection, thoroughly flush system and post warning signs at all outlets.

2. Fill system to insure a chlorine concentration of 50 parts per million of available chlorine.

3. Retain solution for 8 hours and operate all accessories and valves.

4. Subsequently, thoroughly flush system until the bacteriological and chemical composition of its content matches that of the associated permanent potable water supply.

5. Submit test results (conducted and prepared by an approved, certified laboratory) to the authorities having jurisdiction and the Engineer.

END OF SECTION

SECTION 22 56 10

DOMESTIC WATER PIPING SYSTEMS, BELOW GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete below grade domestic water piping systems in accordance with the sizes and locations shown on the drawings.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Copper tubing system:

1. Pipe material:

a. Type K, soft copper tubing conforming to ASTM Specification B-88.

2. Pipe joints:

a. Flared, mechanical type.

B. Ductile iron system:

1. Pipe material:

a. Ductile iron, Class 52, conforming to ANSI Standard A21.51.

2. Pipe joints:

a. Neoprene compression gasket type.

3. Fittings:

a. Service weight cast iron conforming to ASTM Specification A-74.

C. Polyethylene system:

1. Pipe material:

a. Polyethylene pipe conforming to ASTM Standard Specification D2239, 160 psig.

2. Fittings & joints:

a. Mechanical type, barbed insert fittings, double clamped.

D. Curb box valves:

1. Valve:

a. Gate, iron body, flanged, inside screw, non-rising stem, parallel seats, double disk, renewable bronze trip, 275 psig.

2. Valve box:

a. Cast iron, bitumastic coating, adjustable, indicating lid.

PART 3 – EXECUTION

3.01 TEST

A. Test the entire water distribution system (new work, isolated from existing) hydrostatically at 125 psig.

B. The system shall be leak-tight after a 3-hour duration.

3.02 DISINFECTION

A. General:

1. Before being placed in service, the entire system (new work, isolated from existing) shall be chlorinated in strict accordance with AWWA Standard C601-54 and regulations set forth by local Building and Health Department Codes.

2. Chlorination may be applied by:

a. Introducing a chlorine gas-water mixture.

b. Directly feeding chlorine gas using a solution feed chlorinator, pressure feed chlorinator or pressure feed chlorinator with pipeline diffuser.

c. Applying a mixture of calcium hypochlorite and water (mixed to form a paste and thinned to a slurry prior to injection).

B. Procedure:

1. Prior to disinfection, thoroughly flush system and post warning signs at all outlets.

2. Fill system to insure a chlorine concentration of 50 parts per million of available chlorine.

3. Retain solution for 8 hours and operate all accessories and valves.

4. Subsequently, thoroughly flush system until the bacteriological and chemical composition of its content matches that of the associated permanent potable water supply.

5. Submit test results (conducted and prepared by an approved, certified laboratory) to the authorities having jurisdiction and the Engineer.

END OF SECTION

SECTION 22 56 15

SANITARY WASTE AND VENT PIPING SYSTEMS, ABOVE AND BELOW GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete above and below grade sanitary waste and vent piping systems in accordance with the sizes and locations shown on the drawings.

B. Systems scope shall be as shown and/or noted on the drawings.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material:

1. Rigid, Schedule 40, polyvinyl chloride (PVC) conforming to ASTM Specification D-1785.

B. Pipe joints:

1. Solvent cement type.

C. Fittings:

1. Rigid, Schedule 40, polyvinyl chloride (PVC) conforming to ASTM Specification D-1785.

PART 3 – EXECUTION

3.01 TEST

A. Test the entire sanitary waste and vent system (new work, isolated from existing) hydrostatically at 5 psig, minimum.

B. The system shall be leak-tight after a 3-hour duration.

END OF SECTION

SECTION 22 56 18

STORM DRAINAGE PIPING SYSTEMS, ABOVE AND BELOW GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete above and below grade storm drainage piping systems in accordance with the sizes and locations shown on the drawings.

B. Systems scope shall be as shown and/or noted on the drawings.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material:

1. Rigid, Schedule 40, polyvinyl chloride (PVC) conforming to ASTM Specification D-1785.

B. Pipe joints:

1. Solvent cement type.

C. Fittings:

1. Rigid, Schedule 40, polyvinyl chloride (PVC) conforming to ASTM Specification D-1785.

PART 3 – EXECUTION

3.01 TEST

A. Test the entire storm drainage system (new work, isolated from existing) hydrostatically at 5 psig, minimum.

B. The system shall be leak-tight after a 3-hour duration.

END OF SECTION

SECTION 22 56 28

NATURAL GAS PIPING SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete natural gas piping systems in accordance with the sizes and locations shown on the drawings.

B. Systems shall be compliant with ANSI Z21.30 or Z83.1, Public Service Commission Regulation NYCRR Part 255 and Federal Department of Transportation Part 192.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material (except vent piping):

1. Welded, Schedule 40, black steel conforming to ASTM Specification A-53.

B. Pipe joints (except vent piping):

1. 2 inches and smaller:

a. 150 psig, screwed, malleable iron, bronze-to-iron seat, spherical ground joint unions.

2. 2-1/2 inches and larger:

a. 150 psig, forged steel, welding neck flanges conforming to ASTM Specification A-181 and ANSI Standard B16.5.

C. Fittings (except vent piping):

1. 2 inches and smaller:

a. 150 psig, screwed, malleable iron conforming to ASTM Specification A-197 and ANSI Standard B16.3.

2. 2-1/2 inches and larger:

a. Butt-welding, standard wrought steel conforming to ASTM Specification A-234 and ANSI Standard B16.9.

D. Gas vent pipe material:

1. Welded, Schedule 40, galvanized steel conforming to ASTM Specification A-53.

E. Gas vent pipe joints:

1. 2 inches and smaller:

a. 150 psig, screwed, galvanized, malleable iron, bronze-to-iron seat, spherical ground joint unions.

2. 2-1/2 inches and larger:

a. Galvanized, malleable iron companion flanges, conforming to ASTM Specification A-126 and A-153 and ANSI Standard B16.1.

F. Gas vent fittings:

1. 150 psig, screwed, galvanized, malleable iron conforming to ASTM Specification A-153 and A-197 and ANSI Standard B16.3.

G. Valves:

1. 3/8" to 1":

a. Brass body, screwed, chrome plated brass ball, full port, nitrile o-ring, red painted aluminum handle, conforming to ANSI standard Z21.15 and ASME specification B16.44.

b. Nibco GB1A

2. 1 1/4" to 2":

a. Bronze two-piece body, screwed, chrome plated bronze ball, full port, replaceable reinforced TFE trim, lever handle, 600 psig WOG.

b. Nibco No. T-585-70.

3. 2 1/2" to 3":

a. Brass two-piece body, screwed, chrome plated brass ball, full port, PTFE seat, chrome plated lever handle, 400 PSIG WOG, conforming to ASME specification section B16.44.

b. Nibco T-FP-600A

4. 4" and larger:

a. Lubricated plug type.

b. Teflon lined, tapered, flanged, bolted cover, 175 psig WOG.

c. Rockwell-Nordstrom No. 143.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Pitch piping down in the direction of flow 1/4 inch in 25 ft.

B. Furnish and install shutoff valves, dirt pockets and appropriate pressure regulators at appliances and equipment.

C. Venting:

1. General:

   a. Terminate outdoors 18 inches or greater from openings and overhangs in a fashion that prevents water entry.

   b. Manifold like vents with line sizes equal to the total cross sectional area of associated individual vents.

2. Atmospheric pressure balanced diaphragm devices (pressure switches, pressure regulators, etc.):

   a. Less than 20 feet, 3/4 inch.

   b. 20 feet or greater, 1 inch.

3. Relief valves, normally open vent valves:

   a. Line size.

3.02 TEST

A. Test the entire system (new work, isolated from existing) pneumatically at 50 psig.

B. The system shall be leak-tight after a 1-hour duration.

END OF SECTION

SECTION 22 56 29

NATURAL GAS PIPING SYSTEMS, BELOW GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete below grade natural gas piping systems in accordance with the sizes and locations shown on the drawings.

B. Systems shall comply with the requirements set forth in NFPA Standards 54 and 58.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material and fittings:

1. 2 inches and smaller:
   Flexible polyethylene tubing conforming to ASTM D-2513 and ASME D-B31.8 (Gastight or approved equal).

2. 2½ inches and larger:
   High density, extra high molecular weight, polyethylene conforming to ASTM Specification D3350 (Type III, Class C, Category 5, Grade P34; Plastics Pipe Institute designation PE3408). Standard Dimension Ratio (SDR) 11 (100 psig).

B. Pipe joints:

1. 2 inches and smaller:
   Stab type unibody mechanical fittings complete with internal seals, stiffener, self locking gripper and moisture lip conforming to ASTM D-2513 and ASME D-B31.8 (Continental Industries Con-Stab ID seal or approved equal).

2. 2½ inches and larger:
   Thermal fusion type.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All work shall be executed in strict accordance with direction set forth by the manufacturer's authorized representative and the associated public utility.

3.02 TEST

A. Test the entire system (new work, isolated from existing) pneumatically at 90 psig.

B. The system shall be leak-tight after a 3-hour duration.

3.03 LOCATION INDICATORS

A. Provide a locator wire (coated, #12 awg, stranded copper) alongside piping, terminated by an accessible junction box.

END OF SECTION

SECTION 22 56 32

COMPRESSED AIR PIPING SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete compressed air piping systems in accordance with the sizes and locations shown on the drawings.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material:

1. Welded, Schedule 40, black steel conforming to ASTM Specification A-53.

B. Pipe joints:

1. 2 inches and smaller:

a. 150 psig, screwed, malleable iron, bronze-to-iron seat, spherical ground joint unions.

2. 2-1/2 inches and larger:

a. 150 psig, forged steel, welding neck flanges conforming to ASTM Specification A-181 and ANSI Standard B16.5.

b. 150 psig, grooved, gasketed, bolted, rigid (flexible where shown and/or noted) ductile iron couplings.

C. Fittings:

1. 2 inches and smaller:

a. 150 psig, screwed, malleable iron conforming to ASTM Specification A-197 and ANSI Standard B16.3.

2. 2-1/2 inches and larger:

a. Butt-welding, standard wrought steel conforming to ASTM Specification A-234 and ANSI Standard B16.9.

b. 150 psig, grooved, ductile iron or malleable iron conforming to ASTM Specification A-536 and ASTM Specification A-47, respectively.

D. Gaskets:

1. Metal type.

E. Valves:

1. Ball (2 inches and smaller):

a. 1 inch and smaller:

1) Bronze 2-piece body, screwed, chrome plated bronze ball, full port, replaceable reinforced TFE trim, lever handle, 600 psig WOG.

2) Nibco No. T-585-70.

b. 1-1/4 inches and larger:

1) Bronze 2-piece body, screwed, chrome plated bronze ball, standard port, replaceable reinforced TFE trim, lever handle, 600 psig WOG.

2) Nibco No. T-585-70.

2. Butterfly:

a. 6 inches and smaller:

1) Iron body, lug type for dead end service (to facilitate equipment isolation, removal and service) or wafer type for in-line service; molded-in, resilient EPDM seat (250F); extended neck, top plate.

2) One piece, stainless steel shaft; concentric seating, polished aluminum bronze disk; inboard bronze bearings, heavy duty top bushing, self adjusting stem seal; indicator, locking handle, 200 psig WOG.

3) Keystone 221/222.

b. 8 inches and larger:

1) Same as 6 inches and smaller with worm gear actuator.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Pitch piping down in the direction of air flow 1/4” in 25 ft.

B. Furnish and install shut-off valves at equipment.

C. Furnish and install dirt pockets with 1/2” blowdown valve and cap at changes in elevation and at equipment.

3.02 TEST

A. Test the entire system (new work, isolated from existing) pneumatically at 100 psig.

B. The system shall be leak-tight after a 24-hour duration.

END OF SECTION

SECTION 22 56 36

ACID WASTE AND VENT PIPING SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete acid waste and vent piping systems in accordance with the sizes and locations shown on the drawings.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material:

1. Schedule 40, flame retardant polypropylene conforming to ASTM Specification F-1412.

B. Pipe joints:

1. Above grade:

a. Polypropylene sealing element conforming to ASTM Specification D-4101.

b. Series 300 stainless steel band.

2. Below grade:

a. Heat fusion type.

C. Fittings:

1. Above grade:

a. Schedule 40, factory grooved, flame retardant polypropylene conforming to ASTM Specification F-1412.

2. Below grade:

a. Heat fusion type.

PART 3 – EXECUTION

3.01 TEST

A. Test the entire sanitary waste and vent system (new work, isolated from existing) hydrostatically at 5 psig, minimum.

B. The system shall be leak-tight after a 3-hour duration.

END OF SECTION

SECTION 22 56 49

PIPING SYSTEMS HANGERS AND SUPPORTS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install piping systems hangers and supports for the piping systems shown on the drawings.

1.02 STANDARDS

A. Units, including piping system attachments, structural attachments, hanger rods, anchors, bracing, alignment guides and all necessary accessories shall be in accordance with ANSI Standard B31.1 and MSS Standard SP-58.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. F & S, Carpenter & Patterson, Fee & Mason, Grinnell.

2.02 DESCRIPTION

A. Basic components (piping system attachments, structural attachments, hanger rods, alignment guide, etc.):

1. Stock, production units.

B. High density insulation filler pieces:

1. Molded, rigid urethane, thickness equal to that of the specified adjoining insulation, 6 inches long, 4 lbs/cu ft, 0.03 perm inches (ASTM Specification C-355, dry cup), 125 lbs/sq in (compressive strength).

C. Protective shields:

1. Galvanized steel, formed to fit the adjoining insulation, 180 degrees arc.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be capable of properly supporting each piping system under operating conditions imposed by the transported medium (gas or liquid), including provisions for:

1. Expansion and contraction (movement shall not cause disengagement).

2. Preventing excessive stress.

3. Threaded vertical adjustment subsequent to installation.

4. Shock absorbing devices as required.

B. Hanger rods shall be subjected to tensile loads only; where axial or lateral movements are anticipated, suitable linkages shall be provided.

C. Piping system attachments serving copper piping systems shall be copper clad.

D. Structural attachments shall be secured to the building structural system (as shown), NOT to ROOF decks or components of the mechanical and electrical systems (ductwork, piping, conduit, etc.); however, attachments serving piping 2 inches and smaller may be secured to FLOOR decks.

E. Hangers and/or supports for cast iron piping shall be within 18 inches of each joint (both sides).

F. Piping systems support shall be completely independent of the associated equipment and terminals.

END OF SECTION

SECTION 22 56 50

FLASHING

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install flashing serving roof drains and piping penetrating the building roof.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Roof drain application:

1. 4-pound lead, extending 6 inches beyond the drain pans, securely held by clamping rings.

B. Piping roof penetration application:

1. 14-ounce cold rolled copper, extending 12 inches beyond the piping and within 2 inches of top, counter flashing extending 1 inch inside piping and overlapping flashing 4 inches.

END OF SECTION

SECTION 22 56 51

CLEANOUTS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install cleanouts in accordance with the locations shown on the drawings, where required by code and where necessary to facilitate the maintenance of sanitary and storm systems.

B. Units shall be compatible with all design parameters shown on the drawings and as herein specified, complete with features and all necessary accessories required for a coordinated installation (carpet markers, recess for tile, access cover, etc.).

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Josam, Smith, Wade, Zurn or approved equal.

2.02 DESCRIPTION

A. Units for installation in floors:

1. Body:

   a. Cast iron, round, 2-piece, adjustable, flashing clamp (as applicable).

2. Plug:

   a. Bronze, screwed, lead or neoprene seal.

3. Top:

   a. Pedestrian and light wheel traffic:

      1) Nickel alloy, scoriated, round or square (as appropriate), secured, carpet marker (as required).

   b. Heavy wheel traffic:

      1) Cast iron, scoriated, round, loose set.

B. Units for installation in piping:

1. Body:

   a. Cast iron, wye (preferred) or tee (as required).

2. Plug:

   a. Bronze, screwed, lead or neoprene seal.

3. Access cover:

   a. Polished brass, frame (as required), secured.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be line size for pipe sizes up to and including 4-inch, 4-inch for pipe sizes 5-inch through 8-inch, and 6-inch for pipe sizes 10 inches and larger.

B. Units serving non-ferrous and ferrous piping systems shall possess similar features.

END OF SECTION

SECTION 22 56 52

SHOCK ABSORBERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install shock absorbers in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the hydro-pneumatic type.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Josam, Smith, Wade, Zurn or approved equal.

2.02 DESCRIPTION

A. Basic unit:

1. Polished stainless steel shell, enclosed charging device, flow control orifice, elastomer bellows.

2. Hydraulic displacement fluid, inert gas pneumatic displacement cushion.

B. Accessories:

1. Threaded female coupling.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Arrange units to effectively dampen hydrodynamic shock, complete with provision for access as required.

END OF SECTION

SECTION 22 56 60

FIXTURES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install fixtures in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be complete with all necessary supports, equipment, trim, fittings, accessories and connections to the associated piping systems.

C. Units shall comply with flowrate parameters set forth by the New York State Department of Environmental Conservation and the requirements mandated by the Americans with Disabilities Act (ADA).

1.02 SUBMITTALS

A. Fixture submittals shall be tendered in bound form with a designated, indexed section for each type.

B. Fixture descriptions shall include:

1. Alphanumeric designation (matching bidding documents) and corresponding generic description.

2. Product literature edited and highlighted to indicate all parameters set forth in the bidding documents.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Vitreous china, enameled cast iron, enameled steel units:

1. Kohler or approved equal.

B. Stainless steel sinks:

1. Elkay, Just or approved equal.

C. Wash fountains:

1. Bradley or approved equal.

D. Molded stone service sinks:

1. Fiat or approved equal.

E. Trim:

1. Faucets and fittings:

a. Chicago Faucet, or approved equal.

2. Flush valves:

a. Sloan, Zurn or approved equal.

3. Solenoid operators:

a. Sloan Optima Plus or approved equal.

F. Seats:

1. Beneke, Bemis, Church, Osonite or approved equal.

G. Supports:

1. Carriers:

a. Josam, Smith, Wade, Zurn or approved equal.

2. Roughing:

a. Sumner or approved equal.

2.02 DESCRIPTION

A. General:

1. Units shall be constructed of materials free from defects in a manner of first class workmanship.

2. Units shall be suitable for service corresponding to the working pressures specified for the associated piping systems.

3. Vitreous china units shall be "first quality", vitreous china, thoroughly fused and vitrified to a homogeneous mass, white (unless otherwise scheduled).

4. Enameled cast iron units shall be one piece high grade cast iron with a thoroughly fused enamel surface, white (unless otherwise scheduled).

5. Enameled steel units shall be suitable for cold drawing, with a thoroughly fused enamel surface, white (unless otherwise scheduled).

6. Unless otherwise shown or herein specified, all associated trim and exposed piping (including valves, fittings, escutcheons, etc.) shall be (polished) chromium plated.

B. Water closets:

1. Basic unit:

    a. Flush valve type:

        1) Vitreous china, elongated bowl (unless otherwise scheduled), 2-1/4” passageway, siphon jet action.

2. Trim:

    a. Flush valve:

        1) Diaphragm type, screwdriver check angle stop with vandal resistant cap, vacuum breaker, adjustable tailpiece, spud coupling and flange, cover tube, escutcheon.

        2) Non-hold-open handle operator:

            a) ADA compliant.

            b) Triple seal packing.

        3) Solenoid operator:

            a) General:

                (1) ADA compliant.

                (2) Hardwired:

                (a) Vandal resistant chrome plated wall plates.

                (b) Control transformer.

            b) Sensor:

                (1) Infrared.

                (2) Replaceable lens window.

            c) Solenoid valve:

                (1) Low energy latching.

                (2) Self-cleaning bypass, integral strainer/filter.

            d) Features:

                (1) Self-adaptive sensor range adjustment.

                (2) Flush delay.

                (3) Courtesy flush.

(4) Sentinel flush.

(5) Mechanical override.

4) Bedpan washer:

a) Diverter valve, balanced pivot assembly.

b) Spray arm.

3. Seat:

a. Extra heavy solid plastic, modified open back, integral molded bumpers, white (unless otherwise scheduled).

b. Self-sustaining, stainless steel, check hinge.

4. Support:

a. Adjustable single or back-to-back carrier (as applicable), arranged to accommodate prevailing circumstances.

b. Cast iron body with pylon feet, face plate, coupling, nipple, extension, gaskets, zinc plated fasteners.

C. Urinals:

1. Basic unit:

a. Vitreous china, extended shields, integral flush spreader, slanted front rim, integral trap.

b. Blowout, siphon jet or washout flushing action as scheduled.

2. Trim:

a. Diaphragm type flush valve, screwdriver check angle stop with vandal resistant cap, vacuum breaker, adjustable tailpiece, spud coupling and flange, cover tube, escutcheon.

b. Non-hold-open handle operator:

1) ADA compliant.

2) Triple seal packing.

c. Solenoid operator:

1) General:

(1) ADA compliant.

(2) Hardwired:

(a) Vandal resistant chrome plated wall plates.

(b) Control transformer.

2) Sensor:

a) Infrared.

b) Replaceable lens window.

3) Solenoid valve:

a) Low energy latching.

b) Self-cleaning bypass, integral strainer/filter.

4) Features:

a) Self-adaptive sensor range adjustment.

b) Flush delay.

c) Courtesy flush.

d) Sentinel flush.

e) Mechanical override.

3. Support:

a. Adjustable single carrier, arranged to accommodate prevailing circumstances.

b. Floor mounted block bases, structural steel uprights, support plate, bearing plate, adjustable supporting rods.

D. Lavatories:

1. Basic unit:

a. Wall hung:

1) Vitreous china, designed for concealed arm support, integral backsplash, concealed front overflow.

b. Wall hung handicapped:

1) Vitreous china, designed for concealed arm support and wheel chair occupants, ledge back, curved front, shallow basin, concealed rear overflow.

c. Counter top:

1) Vitreous china, self-rimming, concealed front overflow (rear, handicapped application).

2. Trim:

a. General:

1) Solid cast bronze.

2) Perforated strainer, 1-1/4" tailpiece (offset, handicapped application).

b. Faucet:

1) Easily replaceable cartridge.

2) Integral flow control, heavy duty seat.

3) Heavy duty, forged brass, service indexed handles or wrist blades as scheduled.

c. Knee operator:

1) Fixture supported, self-closing mixing valve, stirrup handle.

d. Foot operator:

1) Floor mounted, self-closing mixing valve, hinged foot pedals.

e. Solenoid operator:

1) General:

(1) ADA compliant.

(2) Hardwired:

(a) Vandal resistant chrome plated wall plates.

(b) Control transformer.

2) Spout:

a) Cast brass.

b) Pressure compensating flow control.

c) Integral sensor.

3) Sensor:

a) Infrared.

b) Replaceable lens window, jacketed wiring.

4) Solenoid valve:

a) Low energy latching.

b) Self-cleaning bypass, integral strainer/filter.

5) Features:

a) Self-adaptive sensor range adjustment.

b) Adjustable continuous detection operating time.

c) Splash proof control module.

6) Accessories:

a) Centerset trim plate.

b) Concealed thermostatic mixing valve.

c) Vandal resistant enclosure.

3. Supplies:

a. Wall supply, nipple-to-wall, escutcheon, loose key stop.

b. ADA compliant piping cover, IPS Truebro Lavguard or equal.

4. Trap:

a. Adjustable P Type, 17 gauge cast brass body, slip inlet, ground swivel joint, cleanout plug, escutcheon, 1-1/4” x 1-1/2”.

b. ADA compliant piping cover, IPS Truebro Lavguard or equal.

5. Support:

a. Adjustable single or back-to-back carrier (as applicable), arranged to accommodate prevailing circumstances.

b. Invertible cast iron headers, floor mounted, block bases, steel pipe uprights, concealed arms, leveling and securing screws.

E. Sinks:

1. Basic unit:

a. Countertop (stainless steel):

1) 18 gauge, Type 304, seamlessly drawn stainless steel; satin finish, undercoating (bottom and sides).

2) Self-rimming, recessed faucet ledge and compartment.

b. Free Standing (stainless steel):

1) 18 gauge, Type 300 seamlessly drawn stainless steel; satin finish, undercoating (bottom and sides).

2) 9” high, full length backsplash.

c. Epoxy:

1) By GC.

2. Trim:

a. General:

1) Solid cast bronze.

2) Perforated strainer, 1-1/4” tailpiece.

b. Faucet:

1) Easily replaceable cartridge.

2) Integral flow control, heavy duty seat.

3) Heavy duty, forged brass, service indexed handles or wrist blades as scheduled.

c. Knee operator:

1) Fixture supported, self-closing mixing valve, stirrup handle.

d. Foot operator:

1) Floor mounted, self-closing mixing valve, hinged foot pedals.

e. Solenoid operator:

1) General:

(1) ADA compliant.

(2) Hardwired:

(a) Vandal resistant chrome plated wall plates.

(b) Control transformer.

2) Spout:

a) Cast brass.

b) Pressure compensating flow control.

c) Integral sensor.

3) Sensor:

a) Infrared.

b) Replaceable lens window, jacketed wiring.

4) Solenoid valve:

a) Low energy latching.

b) Self-cleaning bypass, integral strainer/filter.

5) Features:

a) Self adaptive sensor range adjustment.

b) Adjustable continuous detection operating time.

c) Splash proof control module.

6) Accessories:

a) Centerset trim plate.

b) Concealed thermostatic mixing valve.

c) Vandal resistant enclosure.

3. Supplies:

a. Wall supply, nipple-to-wall, escutcheon, loose key stop.

b. ADA compliant piping cover, IPS Truebro Lavguard or equal.

4. Trap:

a. Adjustable P type, 17 gauge cast brass body, slip inlet, ground swivel joint, cleanout plug, escutcheon, 1-1/4” x 1-1/2”.

b. ADA compliant piping cover, IPS Truebro Lavguard or equal.

5. Support:

a. Adjustable single or back-to-back carrier (as applicable), arranged to accommodate prevailing circumstances.

b. Invertible cast iron headers, floor mounted, block bases, steel pipe uprights, concealed arms, leveling and securing screws.

F. Service sink:

1. Basic unit:

a. Low silhouette, one piece, homogeneous white molded stone.

b. Cast brass drain body, dome strainer, lint basket, vinyl bumperguard.

2. Trim:

a. Solid cast brass, spout with pail hook, adjustable wall brace, integral stops, vacuum breaker.

3. Hose and hose bracket:

a. 5/8" diameter x 30" long heavy duty, cloth reinforced rubber hose, 3/4" chrome plated couplings.

b. 5" long x 3" wide stainless steel bracket with rubber grip.

4. Mop hanger:

a. 24" long x 3" wide, 18 gauge stainless steel, 3 rubber tool grips.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be set securely, level and plumb with joints at building surfaces neatly caulked.

B. Roughing shall be neatly arranged and anchored using high impact polystyrene supports complete with stainless steel bands, clamps and fasteners.

C. Whenever scheduled and/or noted on the drawings or herein specified, units shall be in strict conformance with the requirements set forth by the Americans with Disabilities Act (ADA), including:

1. Arrangement, clearances, roughing dimensions.

2. DHW piping arrangement, insulation/protection.

END OF SECTION

SECTION 22 56 70

FLOOR DRAINS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install floor drains in accordance with the sizes and locations shown on the drawings.

B. Units shall conform with the parameters shown on the drawings and as herein specified, complete with body, strainer, deep seal trap and accessories required for a properly coordinated installation.

1.02 SUBMITTALS

A. DRAIN SUBMITTALS SHALL BE COMPLETE WITH A TYPEWRITTEN COVER SHEET CONTAINING A SEPARATE PARAGRAPH THOROUGHLY DESCRIBING ALL PARAMETERS OF EACH DRAIN INCLUDING ITS GENERAL AREA OF APPLICATION AND ASSOCIATED ALPHANUMERICAL DESIGNATION SHOWN ON THE DRAWINGS AND HEREIN SPECIFIED (SUBMITTALS WITHOUT A COVER SHEET WILL BE DISAPPROVED).

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Josam, Watts or approved equal.

2.02 DESCRIPTION

A. Body:

1. 2-piece.
2. Double drainage flange with weepholes.
3. Non-puncturing flashing clamp.

B. Strainer:

1. Adjustable collar.
2. Narrow, slotted openings.
3. High area drainage.
4. Vandal resistant secured.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Adjust strainer elevation to complement finished floor level.

END OF SECTION

SECTION 22 56 71

ROOF DRAINS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install roof drains in accordance with the sizes and locations shown on the drawings.

B. Units shall conform with the parameters shown on the drawings and as herein specified, complete with body, dome/grate and accessories required for a properly coordinated installation.

1.02 SUBMITTALS

A. DRAIN SUBMITTALS SHALL BE COMPLETE WITH A TYPEWRITTEN COVER SHEET CONTAINING A SEPARATE PARAGRAPH THOROUGHLY DESCRIBING ALL PARAMETERS OF EACH DRAIN INCLUDING ITS GENERAL AREA OF APPLICATION AND ASSOCIATED ALPHANUMERICAL DESIGNATIONS SHOWN ON THE DRAWINGS AND HEREIN SPECIFIED (SUBMITTALS WITHOUT A COVER SHEET WILL BE DISAPPROVED).

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Zurn or approved equal.

2.02 DESCRIPTION

A. Body:

1. Cast iron, 2-piece.
2. Non-puncturing flashing clamp, integral gravel stop with drainage weirs.
3. Adjustable collar, support ring, gasket.
4. Coated, formed steel drain receiver.
5. Heavy duty deck clamp.
6. Combined primary/secondary drain.

B. Dome/grate:

1. Narrow, slotted openings.

2. High free area drainage.

3. Vandal resistant secured.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Adjust dome/grate elevation to complement roof insulation thickness.

B. Calk adjustable collar/body interface.

END OF SECTION

SECTION 22 56 90

WALL HYDRANTS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install wall hydrants in accordance with locations shown on the drawings.

B. Units shall be non-freeze box type, complete with wall casing, trim and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Josam, Smith, Wade, Zurn or approved equal.

2.02 DESCRIPTION

A. Wall casing:

1. Cast bronze, polished face, locking hinged cover.

B. Trim:

1. 3/4" H.P.T. outlet, 3/4" female and 1" male N.P.T. inlet, bronze trim, renewable nylon seats.

C. Accessories:

1. Operating handle, vacuum breaker.

D. Josam Series 71000.

END OF SECTION

SECTION 22 57 00

DOMESTIC HOT WATER CIRCULATORS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install domestic hot water circulating pumps in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the line mounted, single stage, close coupled, vertical split case type; factory tested.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Bell & Gossett, Armstrong, Taco or approved equal.

2.02 DESCRIPTION

A. Basic construction:

1. Bronze body, bronze fitted.

B. Motor:

1. Horizontal, open drip-proof (unless otherwise noted).

2. Solid shaft, permanently lubricated ball bearing assembly.

C. Seal:

1. Mechanical type, carbon on silicon carbide.

2. Stainless steel faceplate.

D. Volute:

1. Arranged to permit servicing pump intervals without disturbing adjoining piping.

2. 150 psig working pressure.

E. Impeller:

1. Enclosed, dynamically and hydraulically balanced.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The associated piping system shall be rigidly supported near the pump and precisely aligned with suction and discharge connections.

3.02 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating instructions as required and requested by the Owner's authorized representative) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 22 57 03

SUMP PUMPS, SUBMERSIBLE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install sump pumps in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the close coupled, single stage, submersible type; complete with pump(s), basin, cover, removal system, power cables, controls and control panel.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Bell & Gossett or approved equal.

2.02 DESCRIPTION

A. Pump:

1. Volute:

   a. Cast iron, suction strainer.

2. Impeller:

   a. Bronze, semi-open, statically and dynamically balanced.

3. Motor:

   a. NEMA 6, submersible, Class F insulation.

   b. Air filled, hermetically sealed.

   c. Cast iron shell, integral cooling fins.

   d. NEMA 6, air filled, cast iron end bell/terminal box.

4. Shaft:

   a. 300 Series stainless steel.

5. Seals:

   a. Mechanical type, double opposed arrangement.

6. Bearings:

a. Permanently lubricated ball type (20,000 hours).

B. Basin:

1. Arranged to accommodate the sizes and inverts of the associated piping.

C. Cover:

1. Steel, gasketed, arranged to accommodate removal system, controls and piping.

D. Removal system:

1. Steel base plate, cast iron discharge elbows (stationary, movable, gasketed locking devices).

2. Galvanized steel guide poles, stainless steel lifting rope, rectangular access door.

E. Power cables:

1. Neoprene jacketed, armored sheathing, NEMA 6 junction box.

F. Controls (mercury float switch type):

1. Support pole, support brackets, cable, cable clamp.

2. Float (polypropylene shell, molded cable connection), mercury contacts.

G. Control panel:

1. NEMA 1 enclosure.

2. Fused combination magnetic starters (H.O.A.).

3. Alternator, control circuit transformer.

4. Pilot lights, high water alarm, alarm silence switch.

PART 3 – EXECUTION

3.01 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating instructions as required and requested by the Owner's authorized representative) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 22 57 36

DOMESTIC WATER STORAGE HEATERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install domestic water storage heaters in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the gas fired CONDENSING type; constructed in accordance with ASME Standards, National Sanitation Foundation and National Fire Protection Association requirements; Underwriters Laboratories listed; AGA certified; factory assembled and tested; complete with jacket, tank, burner, anodic protection, controls, accessories and warranty.

1.02 WARRANTY

A. Units shall be complete with a three-year material and workmanship provision for the associated storage tank.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. A.O. Smith or approved equal.

2.02 DESCRIPTION

A. Jacket:

1. Heavy gauge steel, baked enamel finish, easily removable for access.

B. Tank:

1. Glass lined (alkaline borosilicate composition, fused to steel at 1500F), stainless steel dip tube (isolated from tank), factory applied heavy density foam insulation, 150 psig working pressure.

2. ASME pressure and temperature relief valve, drain valve, handhole cleanout.

C. Burner:

1. Forced draft.

2. Spiral action, submerged combustion chamber.

3. Helical heat exchanger.

4. Hot surface ignition.

D. Anodic protection:

1. Dual, full length, high density, extruded magnesium rods.

E. Controls:

1. Operating:

a. Microprocessor based.

b. Integral diagnostics, digital display.

2. Safety:

a. Automatic reset high limit.

b. Airflow switch.

c. Low gas pressure switch.

d. Blocked inlet switch.

e. Blocked outlet switch.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Electrical wiring:

1. It is the intent of this specification that the associated control wiring shall be the responsibility of this Contractor and that it shall be installed in strict accordance with the National Electrical Code.

2. Wiring shall be installed in dedicated electrical metallic tubing with set-screw and compression type couplings and connectors for interior dry locations and interior wet locations, respectively.

B. Set unit level on concrete pad.

3.02 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating instructions as required and requested by the Owner's authorized representative) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 22 57 55

ELECTRIC WATER COOLERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install electric water coolers in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be lead free; ADA compliant; Underwriters Laboratories listed; complete with chassis, fountain top, bubbler, bottle filling station and refrigeration system.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Elkay, Oasis or approved equal.

2.02 DESCRIPTION

A. Chassis:

1. Floor standing, wall hung:

   a. Structural steel frame; removable, louvered, heavy gauge steel panels.

   b. Baked enamel finish, color selected by Architect.

2. Fully recessed:

   a. Wall mounting box.

   b. Removable, louvered, polished 302 stainless steel front panel.

B. Fountain top:

1. Polished, 18 gauge, 302 stainless steel.

2. Anti-splash, embossed bubbler mount, integral drain.

C. Bubbler:

1. Constant flowrate pressure regulator.

D. Bottle Filing Station:

1. Sensor activated.

2. Wall mounted.

E. Refrigeration system:

1. Compressor:

a. Hermetic, reciprocating, permanently lubricated.

2. Condenser:

a. Air cooled, copper tube, aluminum fins, permanently lubricated fan motor.

3. Evaporator:

a. Tube tank type, self-cleaning, insulated reservoir.

4. Control:

a. Calibrated capillary tube, easily accessible, adjustable thermostat.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be set securely, level and plumb.

B. Provide remote mounted refrigeration system as scheduled and/or noted.

C. Roughing shall be neatly arranged and anchored using high impact polystyrene supports complete with stainless steel bands, clamps and fasteners.

D. Joints at building surfaces shall be neatly caulked.

END OF SECTION

SECTION 22 57 60

INSULATION

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete insulation systems in accordance with the parameters shown on the drawings and herein specified, including the re-insulation of all equipment and/or piping systems that are shown, schedule or noted to be abated (refer to related documents), relocated and wherever "tie-ins" (new work to existing) require the removal of existing insulation.

B. Systems shall include (unless specifically excepted as herein specified or shown and/or noted on the drawings) all associated components (pipe, fittings, valves, pumps, expansion tanks, storage tanks, equipment, accessories, etc.).

1.02 DEFINITION OF TERMS

A. Finished areas:

1. Those areas intended for habitation or occupancy where rough surfaces are plastered, paneled or otherwise finished.

B. Unfinished areas:

1. Those areas intended for use as storage or work areas where rough surfaces are not plastered, paneled or otherwise finished (e.g., unexcavated spaces, crawl spaces, certain storage rooms, equipment rooms, tunnels, etc.).

C. Concealed spaces:

1. Those spaces between ceiling and floor construction, between double walls or furred-in spaces.

D. Exposed:

1. "Open to view".

1.03 FIRE HAZARD CLASSIFICATION

A. Insulation systems, unless otherwise specified herein, shall have Fire Hazard Classification not to exceed Flame Spread 25 and Smoke Developed 50 when tested in accordance with ASTM Specification E-84. (Evidence of classification shall be an Underwriters Laboratories label or listing).

1.04 ENGINEER'S INSPECTION

A. The Engineer, at his discretion, in the presence of the Contractor's authorized representative, may take samples of installed insulation for the purpose of

checking materials and/or method of application, whereafter, the Contractor shall patch the sample areas.

1.05 LABELS

A. Each insulation and accessory component shall bear the manufacturer's label of description.

1.06 SUBMITTALS

A. Unless otherwise specified, submit the following for approval:

1. A description of the type of insulation and all accessories (jackets, wiring, banding, fastening devices, adhesives, coatings, mastics, sealing tape, etc.) proposed for each type of service, including the manufacturer's product literature.

2. Samples of insulation and/or accessories as requested.

3. A SIGNED AFFIDAVIT (attached) attesting to strict compliance with the schedule mandates and installation requirements hereinafter described.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General:

1. Owens-Corning, Johns-Manville (Schuller International), Knauf, CSG, Armstrong, Dow Chemical or approved equal.

B. Fibrous glass, 2-piece, preformed (molded) fitting, flange and valve body insulation:

1. Hamfab or approved equal.

C. Adhesives, coatings and mastics:

1. Foster or approved equal.

2.02 DESCRIPTION

A. Fibrous glass insulation:

1. Density:

a. Pipe insulation, 4.0 lbm/cu ft.

b. Pipe fitting and valve body insulation, 4-5 lbm/cu ft.

c. Board insulation, concealed application 3 lbm/cu ft.

d. Board insulation, exposed application 6 lbm/cu ft.

e. Blanket insulation, 1 lbm/cu ft.

2. Thermal conductivity:

a. Pipe, block, board and fitting insulation, 0.26 Btu/hr/sq ft/F/in at 75F.

b. Blanket insulation, 0.28 Btu/hr/sq ft/F/in at 75F.

3. Moisture absorption:

a. 0.2% by volume after 96 hours at 120F and 95% rh.

4. Capillarity:

a. Negligible after 24 hours.

5. Shrinkage or expansion:

a. Fully cured to insure negligible dimensional changes when tested in accordance with ASTM Specification C-312.

B. Flexible foamed plastic insulation:

1. Density:

a. 4.5 to 8.5 lbm/cu ft when tested in accordance with ASTM Specification D-1622.

2. Thermal conductivity:

a. 0.28 Btu/hr/sq ft/F/in at 75F when tested in accordance with ASTM Specification C-177.

3. Water vapor transmission:

a. 0.1 perm inches when tested in accordance with ASTM Specification C-355 (wet cup).

4. Operating temperature range:

a. 0 to 200F.

5. Fire Hazard Classification:

a. Flame Spread 25, Smoke Developed 150 when tested in accordance with ASTM Specification E-84.

6. Thermal stability:

a. 7.0% shrinkage during 7 days at 200F when tested in accordance with ASTM Specification C-548.

C. Insulation jackets:

1. Class 1 jackets:

a. Heavy duty, embossed, white Kraft paper, puncture resistance of 50 breach units, bonded to heavy duty aluminum foil (reinforced with glass fiber yarn), water vapor permeance of 0.02 perms.

2. Class 4 jackets:

a. High impact resistant, 0.028 inch thick, rigid, ULTRA-VIOLET RESISTANT, polyvinyl chloride, factory cut, preset curl, 1-1/2 inch overlap.

D. Wiring, banding and fastening devices:

1. Wire:

a. No. 16 gauge, copper clad or galvanized, annealed, steel wire (unless otherwise specified).

2. Wire mesh:

a. Woven, galvanized, (galvanized after weaving) No. 20 gauge steel wire, nominal 1 inch hexagonal openings.

3. Insulation fasteners:

a. Adhesive secured type, installed in accordance with all necessary provisions to avoid damaging the equipment, capable of supporting an axial load of 40 lbs, sized in accordance with the thickness of the associated insulation, metal speed washer designed to secure the insulation firmly in place without excessive compression.

b. Duro-dyne stop clips and spotter pins.

E. Adhesives, coatings and mastics:

1. Lagging adhesive/coating:

a. Foster 30–36.

2. Vapor barrier coating:

a. Foster 30–15.

3. Vapor barrier mastic:

a. Foster 30–35.

F. Pressure sensitive sealing tape:

1. Serving Class 1 jacketed systems:

    a. Same material as associated jacketing.

2. Serving Class 2 jacketed systems:

    a. 2 mil, smooth aluminum foil.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

A. Installation shall be exemplary, EXECUTED IN A FIRST-CLASS MANNER BY SKILLED WORKERS NORMALLY ENGAGED IN INSULATION WORK.

B. Insulation shall be applied to clean, dry surfaces after the associated distribution systems and equipment have been leak-tested, approved and accepted and shall be continuous through sleeves, wall and ceiling openings, etc.

C. Vapor barrier jacketing shall be applied with a continuous unbroken vapor seal, including points of penetration (anchors, gauges, hangers, sensors, supports, thermometers, etc.).

D. Adhesives, coatings and mastics shall be compatible with the materials to which they are applied and shall not soften, corrode or otherwise attack said materials whether dry or wet.

E. Hangers, supports and appurtenances shall be installed in their permanent location before insulation is applied and shall be restored to their original position if displacement is necessary to ensure proper insulation installation.

F. Flexible vibration eliminators serving piping systems distributing liquid and gasses below ambient shall be insulated with flexible foamed plastic insulation with circumferential and longitudinal (as applicable) butt joints adhesive sealed.

3.02 INSTALLATION, SPECIFIC

A. Jacketing, installation (unless otherwise noted or specified):

1. Class 1 jacketing:

    a. Jacketing shall be factory applied complete with pressure sensitive longitudinal sealing lap (1-1/2 inch width).

    b. Circumferential joints shall be sealed with pressure sensitive sealing tape (3-inch width).

    c. Longitudinal sealing laps and sealing tape shall be neatly pressed into place (with seams turned "away from view") and stapled (complete with vapor barrier coating for systems operating below ambient).

2. Class 4 jacketing:

a. Jacketing shall be neatly cemented in place using weld adhesive with longitudinal seams turned "away from view".

b. All voids shall be neatly sealed with silicone caulking.

B. Insulation installation for PIPING systems:

1. Piping insulation (fibrous glass):

a. Exposed ends for systems operating below and above ambient shall be neatly sealed with vapor barrier coating and lagging adhesive/coating, respectively.

2. Piping insulation (flexible foamed plastic):

a. Insulation shall be the unslit type whenever feasible (slipped on the piping prior to pipe installation), or the slit type whenever the unslit type is not feasible, with circumferential and longitudinal joints adhesive sealed.

b. Exposed ends of the insulation shall be adhesive sealed (to the piping) to provide a neat finished appearance and prevent moisture infiltration.

3. Fitting, flange and valve insulation (fibrous glass):

a. Insulation shall be the 2-piece, pre-formed (molded) type of the same material and thickness as the adjoining insulation.

b. Insulation applied to valves shall extend up to and include bonnets without interfering with packing glands.

c. Insulation shall be secured in place with No. 14 gauge copper wire with ends turned down into the insulation.

d. Insulation shall butt neatly and firmly against fittings, flanges and valves.

e. Finish:

1) Insulation systems operating ABOVE ambient which are CONCEALED:

a) Insulation shall be covered with premolded polyvinyl chloride jacketing.

b) Circumferential joints shall be sealed with pressure sensitive tape (3 inch width).

2) Insulation systems operating BELOW ambient that are EXPOSED or CONCEALED and ABOVE ambient that are EXPOSED:

a) Insulation surfaces shall be smoothed out by applying a leveling coat of insulating cement completely covering wiring.

b) After the insulating cement has THOROUGHLY dried, 2 layers of white, open weave, glass cloth with not less than 10 threads per inch in both directions (lapped on itself and the adjoining insulation a minimum of 2 inches) shall be neatly bedded with lagging adhesive coating and vapor barrier mastic for systems operating above and below ambient, respectively.

c) Finally, the installation shall be completed by applying Class 3 or class 4 jacketing as schedule.

4. Fitting, flange and valve insulation (flexible foamed plastic):

a. Insulation shall be the same material and thickness as the adjoining insulation.

b. Adhesive shall be the type recommended by the insulation manufacturer.

c. Insulation seams and joints shall be adhesive sealed.

d. Insulation for SWEAT AND BRAZED FITTINGS shall be miter-cut pieces of pipe insulation.

e. Insulation for SCREWED AND WELDED FITTINGS shall be sleeved type covers fabricated from miter-cut pieces of pipe insulation, except screwed fittings 2 inches and larger which may be cut from flexible foamed plastic sheets using template patterns.

f. Insulation for VALVES shall be sleeved type covers fabricated from miter-cut pieces of pipe insulation, except large valves which shall be insulated with covers cut from flexible foamed plastic sheets using template patterns.

C. Piping systems or portions thereof and equipment NOT requiring insulation (unless otherwise shown and/or specified):

1. Compressed air piping systems.

2. Gas piping systems and meters.

3. Actual heat transfer surfaces.

4. Flow meters serving domestic hot water systems.

5. Discharge piping from safety and relief valves.

6. Water piping buried in direct contact with the ground.

7. Water meters.

8. Chrome plated components.

9. Factory insulated equipment.

END OF SECTION

ATTACHMENT: Schedule and installation compliance affidavit

INSULATION SCHEDULE Ⓒ												SPEC SECTION 22 57 60
DESIGNATION	EQUIPMENT OR SYSTEM SERVED	TYPE Ⓐ			JACKETING CLASS Ⓑ			THICKNESS IN				
								NOMINAL PIPE SIZE IN				
		INTERIOR CONCEALED	INTERIOR EXPOSED	EXTERIOR	INTERIOR GENERAL	EQUIPMENT ROOMS	EXTERIOR	½ - 1½	2 - 4	5 - 6	8 - 10	12 & UP
A	DCW, DWV Ⓓ	FP	---	---	Ø	---	---	½	½	½	½	½
		---	FP	---	Ø	4	---	½	½	½	½	½
B	DHW, DHWR	FG	---	---	1	---	---	1½	2	2	2	2
		---	FG	---	1	1 & 4	---	1½	2	2	2	2
C	STORM WATER Ⓔ	FP	---	---	Ø	---	---	---	½	½	½	½
		---	FP	---	Ø	4	---	---	½	½	½	½

Ⓐ FG - FIBROUS GLASS
FP - FLEXIBLE FOAMED PLASTIC

Ⓑ Ø - NONE
1 - ALL SERVICE
4 - POLYVINYL CHLORIDE

Ⓒ INSULATION TYPE, JACKETING & THICKNESS FOR EQUIPMENT SHALL MATCH THE CORRESPONDING PIPING SYSTEM'S PARAMETERS LISTED FOR: EQUIPMENT ROOMS, NOMINAL PIPE SIZE 8" AND LARGER

Ⓓ DWV: LATERALS (INCLUDING FLOOR DRAIN BODY AND TRAP) SERVING COOLING COIL CONDENSATE TO STACK

Ⓔ ROOF DRAIN BODIES, HORIZONTAL RUNS AND OFF-SETS, AND VERTICAL PORTION OF EACH CONDUCTOR TO JUNCTURE WITH BELOW GRADE PIPING

PLUMBING INSULATION SYSTEMS INSTALLATION

INSTALLATION, GENERAL

A. Installation will be exemplary, EXECUTED IN A FIRST-CLASS MANNER BY SKILLED WORKERS NORMALLY ENGAGED IN INSULATION WORK.

B. Insulation will be applied to clean, dry surfaces after the associated distribution systems and equipment have been leak-tested, approved and accepted and will be continuous through sleeves, wall and ceiling openings, etc.

C. Vapor barrier jacketing will be applied with a continuous unbroken vapor seal, including points of penetration (anchors, gauges, hangers, sensors, supports, thermometers, etc.).

D. Adhesives, coatings and mastics will be compatible with the materials to which they are applied and will not soften, corrode or otherwise attack said materials whether dry or wet.

E. Hangers, supports and appurtenances will be installed in their permanent location before insulation is applied and will be restored to their original position if displacement is necessary to ensure proper insulation installation.

F. Flexible vibration eliminators serving piping systems distributing liquid and gasses below ambient will be insulated with flexible foamed plastic insulation with circumferential and longitudinal (as applicable) butt joints adhesive sealed.

INSTALLATION, SPECIFIC

A. Jacketing, installation (unless otherwise noted or specified):

1. Class 1 jacketing:

    a. Jacketing will be factory applied complete with pressure sensitive longitudinal sealing lap (1-1/2 inch width).

    b. Circumferential joints will be sealed with pressure sensitive sealing tape (3-inch width).

    c. Longitudinal sealing laps and sealing tape will be neatly pressed into place (with seams turned "away from view") and stapled (complete with vapor barrier coating for systems operating below ambient).

2. Class 2 jacketing:

    a. Jacketing will be factory applied.

    b. Insulation joints will be sealed with pressure sensitive sealing tape (3-inch width for plane joints, 5-inch width for angle joints).

3. Class 3 jacketing:

    a. Jacketing will be neatly sized with lagging adhesive/coating.

    b. Additionally, jacketing serving systems operating below ambient will be complete with vapor barrier coating finish.

    c. Jacketing will be applied with a minimum of circumferential seams and with longitudinal seams turned "away from view".

    d. Jacketing will be applied to fittings, flanges and valves using template patterns.

4. Class 4 jacketing:

    a. Jacketing will be neatly cemented in place using weld adhesive with longitudinal seams turned "away from view".

    b. All voids will be neatly sealed with silicone caulking.

B. Insulation installation for PIPING systems:

1. Piping insulation (fibrous glass):

    a. Exposed ends for systems operating below and above ambient will be neatly sealed with vapor barrier coating and lagging adhesive/coating, respectively.

2. Piping insulation (flexible foamed plastic):

    a. Insulation will be the unslit type whenever feasible (slipped on the piping prior to pipe installation), or the slit type whenever the unslit type is not feasible, with circumferential and longitudinal joints adhesive sealed.

b. Exposed ends of the insulation will be adhesive sealed (to the piping) to provide a neat finished appearance and prevent moisture infiltration.

3. Fitting, flange and valve insulation (fibrous glass):

   a. Insulation will be the 2-piece, pre-formed (molded) type of the same material and thickness as the adjoining insulation.

   b. Insulation applied to valves will extend up to and include bonnets without interfering with packing glands.

   c. Insulation will be secured in place with No. 14 gauge copper wire with ends turned down into the insulation.

   d. Insulation will butt neatly and firmly against fittings, flanges and valves.

   e. Finish:

      1) Insulation systems operating ABOVE ambient which are CONCEALED:

         a) Insulation will be covered with premolded polyvinyl chloride jacketing.

         b) Circumferential joints will be sealed with pressure sensitive tape (3 inch width).

      2) Insulation systems operating BELOW ambient that are EXPOSED or CONCEALED and ABOVE ambient that are EXPOSED:

         a) Insulation surfaces will be smoothed out by applying a leveling coat of insulating cement completely covering wiring.

         b) After the insulating cement has THOROUGHLY dried, 2 layers of white, open weave, glass cloth with not less than 10 threads per inch in both directions (lapped on itself and the adjoining insulation a minimum of 2 inches) will be neatly bedded with lagging adhesive coating and vapor barrier mastic for systems operating above and below ambient, respectively.

         c) Finally, the installation will be completed by applying Class 3 or class floor jacketing as schuled.

4. Fitting, flange and valve insulation (flexible foamed plastic):

   a. Insulation will be the same material and thickness as the adjoining insulation.

b. Adhesive will be the type recommended by the insulation manufacturer.

c. Insulation seams and joints will be adhesive sealed.

d. Insulation for SWEAT AND BRAZED FITTINGS will be miter-cut pieces of pipe insulation.

e. Insulation for SCREWED AND WELDED FITTINGS will be sleeved type covers fabricated from miter-cut pieces of pipe insulation, except screwed fittings 2 inches and larger which may be cut from flexible foamed plastic sheets using template patterns.

f. Insulation for VALVES will be sleeved type covers fabricated from miter-cut pieces of pipe insulation, except large valves which will be insulated with covers cut from flexible foamed plastic sheets using template patterns.

C. Insulation installation for EQUIPMENT distributing or storing liquids and gases at temperatures BELOW ambient (flexible foamed plastic; curved, irregular and flat surfaces):

1. General requirements:

a. Metal protrusions in direct contact with the insulated equipment will be covered with a thickness equal to that specified for the associated equipment.

2. Specific requirements:

a. Insulation will be the sheet type installed with the smooth skin out.

b. With butt edges slightly lapped, insulation will be secured in place by applying adhesive to both the equipment surface and the inside insulation surface and thereafter pressing the insulation into place when the adhesive has dried to a tacky state.

c. With adjoining sheets firmly in place, butt edges will be spread apart and adhesive applied to both edges which will then be firmly pressed back together and aligned.

d. Joints will be staggered according to the aspect ratio of the equipment (vertical joints when height exceeds width and horizontal joints when width exceeds height) and when applied in multi-layers.

D. Insulation installation for EQUIPMENT distributing or storing liquids and gases at temperatures ABOVE ambient (fibrous glass):

1. General requirements:

a. Insulation applied to vertical surfaces will be complete with properly installed supports 12 feet on center.

b. Insulation supports, stiffeners and other metal protrusions in direct contact with the insulated equipment will be covered with insulation of a thickness equal to that specified for the associated equipment.

c. Equipment manholes, hand holes, access plates, ASME stamp, nameplate, etc. will not be insulated, with the adjacent insulation neatly beveled.

2. Specific requirements:

a. Curved and irregular surfaces:

1) Insulation will be beveled or scored to suit the equipment contours; voids will be filled and butting edges will be sealed with insulating cement.

2) Insulation will be secured in place with No. 14 gauge copper wire (6 inches on center) or galvanized steel bands (10 inches on center).

3) Finish:

a) Insulation surfaces will be smoothed out by applying a leveling coat of insulating cement to completely cover wiring and/or banding.

b) After the insulating cement has THOROUGHLY dried, a layer of white, open weave, glass cloth with not less than 10 threads per inch in both directions will be neatly sized with lagging adhesive/coating.

c) Finally, the installation will be completed by applying Class 3 jacketing.

b. Flat surfaces:

1) Installation will be as specified for curved and irregular surfaces, except that the insulation will be secured to metal surfaces with insulation fasteners spaced 12 inches on center, both directions.

_____

CONTRACTOR:

_____ _____

BY: DATE:

MVCC Science and Technology Building
TE Project # 4038

SECTION 22 58 10

AIR COMPRESSORS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install air compressors in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the reciprocating, air cooled type; factory assembled, tested, piped and wired (in accordance with the National Electrical Code), Underwriters Laboratories listed, shipped and packaged complete with compressor, refrigerated dryer, high efficiency motor, drive, receiver, all necessary operating and safety controls, electrical components, vibration isolators, initial charges of lubricating oil, accessories, warranty and field checking start-up service.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Kaeser or approved equal.

2.02 DESCRIPTION

A. Compressor:

1. Reciprocating, 2-stage (extended surface intercooler), air cooled, large gas passages, minimum clearance volumes, pressure lubrication, extended bearing surface.

B. Refrigerated dryer:

1. Hermetically sealed refrigerant circuit.

2. Energy saving, cycling refrigerant compressor.

3. Hot gas bypass control.

4. Electronic condensate drain.

C. Drive:

1. Belt type, guard, statically and dynamically balanced (one set spare belts).

D. Receiver:

1. Designed in accordance with ASME requirements for unfired pressure vessels, ASME safety relief valve, 200 psig working pressure.

E. Operating and safety controls:

1. Adjustable "cut-in" and "cut-out" switches, no-load start, low oil pressure "cut-out".

F. Accessories:

1. Inlet filter/muffler, oil pressure gauge.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Electrical wiring:

1. It is the intent of this specification that all electrical wiring required to complement the unit operating and safety controls shall be the responsibility of this Contractor and that it shall be installed in strict accordance with the National Electrical Code.

2. All wiring shall be installed in electrical metallic tubing.

3.02 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating instructions as required and requested by the Owner's authorized representative) shall be performed by the manufacturer's authorized representative with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 22 58 23

BACKFLOW PREVENTER ASSEMBLIES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install backflow preventer assemblies in accordance with the sizes and locations shown on the drawings.

B. Units shall be the reduced pressure type; designed to provide maximum protection with low head loss; certified by the American Society of Sanitary Engineers; complete with body, check valves, relief assembly and isolating valves.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Watts or approved equal.

2.02 DESCRIPTION

A. Body:

1. 2 inches and smaller:

   a. Cast bronze.

2. 2 ½ inches and larger:

   a. Stainless steel.

B. Check valves:

1. Captured, stainless steel spring assemblies.

2. Replaceable bronze seats.

C. Relief assembly:

1. Designated air-in (vacuum relief) water-out (drain) channels.

2. Elbow (as applicable)/air gap discharge.

D. Isolating valves:

1. Screwed, bronze body, full-port ball.

2. Flanged, cast iron body, resilient seated OS &Y.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Arrange unit in strict accordance with the requirements set forth by the public utility having jurisdiction.

B. Position unit sufficiently above finished floor, complete with relief assembly discharge piping, via air gap, full size to grade (unless otherwise shown and/or noted).

3.02 TEST

A. Unit testing shall be executed by a New York State Certified tester, with the results (in appropriate format) submitted to the public utility having jurisdiction for approval.

END OF SECTION

SECTION 22 58 29

EMERGENCY EQUIPMENT TEMPERING VALVES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install emergency equipment tempering valves in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the highly sensitive, thermostatic type (accommodating high and low flow demand), multiple (parallel) valve arrangement as scheduled; ANSI Z358.1 and ASSE 1071 compliant; complete with body, trim and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Powers, Symmons or approved equal.

2.02 DESCRIPTION

A. Body:

1. Bronze, screwed.

2. Union inlets.

B. Trim:

1. Liquid filled thermostatic actuator, expandable restrictor, tamper resistant temperature adjustment control.

2. Fouling resistant poppet/seat, union inlet/strainer/checkstops.

C. Accessories:

1. Dial thermometer.

2.03 PERFORMANCE PARAMETERS:

A. Set point adjustment:

1. 60F to 95F.

B. Set point offset:

1. ± 3F.

C. Approach temperature:

1. Maximum:

a. 180F.

2. Minimum:

a. 60F.

PART 3 – EXECUTION

3.01 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating instructions as required and requested by the Owner's authorized representative) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 22 58 60

GAS VENT SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install gas vent systems in accordance with the sizes and locations shown on the drawings.

B. Systems shall be the double wall (annular air space insulated) type; Underwriters Laboratories listed, conform with NFPA Standards 54 and 211 for Type B and B-W gas vents; complete with standard short lengths and adjustable fittings (to avoid all cutting and allow for expansion), outer pipe, inner pipe and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Metalbestos, Metal-Fab or approved equal.

2.02 DESCRIPTION

A. Outer pipe:

1. Galvanized steel, internal spacing beads (to insure a symmetrical annular air space), die formed ends.

B. Inner pipe:

1. Aluminum, attached to outer pipe at one end for differential expansion.

C. Accessories:

1. Thimbles, flashing, weather resistant cap, guides, supports, etc.

END OF SECTION

SECTION 22 58 90

GAUGES, THERMOMETERS AND TEMPORARY PRESSURE/TEMPERATURE WELLS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install gauges, thermometers and temporary pressure/temperature wells in accordance with the locations shown on the drawings.

B. Units shall operate within the middle third of a range selected to suit the measured medium under normal operating conditions.

C. Units measuring mediums subject to quickly changing pressures shall be complete with dampening device at the inlet.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Gauges and thermometers:

1. Trerice, Taylor, Weiss, Winters or approved equal.

B. Temporary pressure/temperature wells:

1. Pete's Plug or approved equal.

2.02 DESCRIPTION

A. Pressure gauges:

1. Phospher bronze internals, ± 1% accuracy.

2. White face, black embossed figures, adjustable black pointer, safety glass window.

3. 1/4" NPT bottom inlet, gauge cock, over/under stop, snubber.

B. Thermometers:

1. Linear scale:

a. Adjustable, ± 1% accuracy.

b. White face, black embossed figures, organic liquid filled tube, safety glass window.

c. 3/4” NPT separable socket, back inlet, stem, Thermowell (33% pipe penetration).

2. Dial:

a. Adjustable, bi-metal, ± 1% accuracy.

b. White face, black embossed figures, adjustable black pointer, safety glass window.

c. 1/2” NPT connection, back inlet, stem, Thermowell (33% pipe penetration), braided remote reading capillary as required.

3. Digital:

a. Adjustable, solar (light) powered (15 lux), glass passivated thermistor, ± 1% accuracy, 10 seconds update frequency.

b. Linear scale unit interchangeable; -30F to 140F, 100% rh ambient.

C. Temporary pressure/temperature well:

1. Brass body and cap with retaining strap.

2. 1/4” Nordel or neoprene core; 45F to 275F, 400 psig.

3. Spare gauges (2) and thermometers (4).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Unit locations shown on the drawings are indicative of the approximate point where measurement is required.

B. Actual locations must permit easily accessible reading and prevent error due to the relative location of other system components (e.g., pressure gauges shall be located 5 pipe diameters downstream from fittings and valves; avoid locating thermometers where nearby mediums of temperatures, other than that being measured, may affect reading, etc.).

C. Install gauges and thermometers after construction is substantially complete; thereafter calibrate, clean and adjust viewing angle.

D. Temporary pressure/temperature well probes shall be carefully inserted and promptly removed.

END OF SECTION

SECTION 22 58 91

IDENTIFICATION

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install identification for all equipment, piping and valves.

B. Identification shall include labels, valve location indicators and warning tape.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Seton, Brady or approved equal.

2.02 DESCRIPTION

A. Labels:

1. Equipment:

    a. Standard, phenolic, engraved nameplates.

    b. Appropriately sized lettering:

        1) Large equipment:

            a) ¾ inch high by ½ inch.

        2) Small equipment:

            a) 3/8 inch high by ¼ inch.

2. Piping:

    a. 2 inches and smaller:

        1) Semi-rigid plastic with pre-set curl (designed to "snap-on" with substantial overlap) sized and color-coded in accordance with ANSI Standard A 13.1, complete with pipe size and directional flow arrows.

    b. 2 1/2 inches and larger:

        1) Neatly stenciled (with appropriately sized lettering indicating pipe size and directional flow arrows), 50 foot intervals.

B. Valve location indicators:

1. 1/2 inch diameter, pressure-sensitive adhesive spot markers.

2. Color-coded:

   a. Domestic hot water (RED).

   b. Domestic cold water (BLUE).

   c. Non potable water (VIOLET).

C. Warning tape (underground utilities):

1. 3.5 mils thick, 6 inch wide, appropriate APWA color code, heavy duty polyethylene.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Equipment labels (using the precise alphanumerical designation shown on the drawings) shall be securely mounted (in a conspicuous position) with appropriate fasteners and shall be applied to ALL equipment.

B. Piping labels/stencils shall be located to ensure continuous systems identity; visible from below or side for concealed systems and exposed systems outside finished spaces, from top for exposed systems within finished spaces.

C. Valve location indicators shall be adhered to suspended ceiling system grids and/or access doors at all main, branch main and branch piping valve locations.

END OF SECTION

SECTION 22 58 94

MOTORS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install motors in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be designed and constructed in accordance with guidelines set forth in the NEMA Standards.

C. Units shall be Underwriters Laboratories listed, New York State Energy Conservation Construction Code compatible.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General Electric, Siemens, Toshiba or approved equal.

2.02 DESCRIPTION

A. Unit characteristics (starting torque, full-load torque, breakdown torque) shall properly match the respective driven machine demands.

B. Unless otherwise noted or specified (refer to equipment/motor-wiring-contactor/motor starter-disconnect schedule and specific equipment specification sections) units shall be the squirrel cage induction type and conform with the following:

1. Enclosure:

   a. Open, drip-proof.

2. Bearings:

   a. Extended life design, compatible with driven machine implied radial and thrust loads.

3. Insulation:

   a. Class B (130C).

C. Single phase units:

1. Low starting torque:

a. Permanent split capacitor.

2. Intermediate starting torque:

a. Split phase (split phase start, induction run).

3. High starting torque:

a. Capacitor start, capacitor run.

D. Polyphase units:

1. Adjustable frequency controller (inverter) compatible in accordance with NEMA Specification MG-1, Part 31.

2. Premium efficiency.

E. Mounting arrangement:

1. Compatible with driven machines (solid, resilient, flanged, lug, etc.).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Mount units (position, angle, etc.) relative to enclosure definition.

B. Properly align (direct driven arrangements and belt driven pulleys) and adjust belt tension.

END OF SECTION

SECTION 22 58 95

MOTOR STARTERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install motor starters in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be constructed and sized in accordance with guidelines set forth in the NEMA standards; Underwriters Laboratories; factory assembled and wired ancillary components.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Asea Brown Boveri, General Electric, I.T.E., Square D, Westinghouse or approved equal.

2.02 DESCRIPTION

A. Manual (fractional horsepower):

1. Enclosure:

   a. NEMA 1 (unless otherwise noted).

2. Mechanism:

   a. Operator:

      1) Toggle (unless otherwise noted) lockable, ("On"—"Off") indication.

   b. Action:

      1) Quick-make, quick-break.

   c. Contacts:

      1) Double break, silver alloy.

3. Overload protection:

   a. Melting alloy type thermal overload relay(s), interchangeable thermal unit (starter inoperative without thermal unit).

B. Magnetic (across-the-line, non-reversing):

1. Enclosure:

    a. NEMA 1 (unless otherwise noted).

2. Coil:

    a. Replaceable (without removing starter), molded construction, mechanical linkage, replaceable control circuit contacts.

3. Main contacts:

    a. Replaceable (without removing power wiring or starter), double break, silver alloy, straight-through wiring.

4. Overload protection:

    a. Interchangeable melting alloy type thermal overload relays and replaceable contacts (each leg).

5. Disconnect switch (combination units, common enclosure):

    a. Mechanism:

        1) Operating handle:

            a) Integral with box (not cover), lockable, color-coded ("On"—"Off") indication.

        2) Action:

            a) Quick-make, quick-break, cover interlock with defeater.

    b. Fuse clips:

        1) Class R (dual element), positive pressure type.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Change thermal overload relays as required to ensure compatibility with installed motor characteristics.

END OF SECTION

SECTION 23 50 01

GENERAL PROVISIONS

PART 1 – GENERAL

1.01 RELATED PORTIONS OF THE SPECIFICATION

A. Work in this division shall be subject to the applicable portions of the bidding documents.

1.02 SCOPE OF WORK

A. Furnish and install equipment and materials required to provide **a** complete mechanical system.

B. Refer [also] to ME drawings for pertinent work as applicable.

1.03 MANUFACTURER'S SAFETY DATA SHEETS (MSDS)

A. Provide a bound, indexed assembly of pertinent equipment and materials (including applicable Subcontractor items).

1.04 CONNECTIONS TO EQUIPMENT THAT IS EXISTING AND/OR FURNISHED BY OTHERS

A. Furnish and install branch piping serving equipment that is existing and/or furnished by others in accordance with the sizes and locations shown on the drawings complete with final connections, including provisions for shut-off and adapters as required.

1.05 CONNECTIONS TO UTILITIES

A. Furnish and install piping connections with public and/or site utilities sanitary drainage, heating hot water, chilled water, natural gas, and air distribution connections in accordance with the sizes and locations shown on the drawings in strict compliance with the rules and regulations set forth by the local Authority having jurisdiction complete with test and final connections, with provisions for shut-off and adapters as required.

B. Connections causing interruption of service shall be performed "off hours" employing "premium time" labor as applicable.

C. The Owner will pay all related public utility charges.

1.06 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

A. Prior to installation, submit fabrication drawings, material lists and equipment submittals (shop drawings) for approval in accordance with the following:

1. It is the intent of these specifications to define the requirements for fabrication drawings, material lists and equipment submittals. Questions

regarding these requirements shall be directed to the Engineer prior to submission.

2. Fabrication drawings and material lists shall conform to the requirements herein specified.

3. Equipment submittals, unless otherwise specified, shall conform to the following:

   a. Submittals shall be complete with the manufacturer's product description literature. SUBMITTALS WITH INSUFFICIENT LITERATURE WILL BE DISAPPROVED.

   b. Submittals shall include a complete listing of associated parameters contained in the bidding documents (materials, finishes, capacities, temperatures, pressures, electrical characteristics, etc.). THE ENGINEER WILL NOT TRANSFER INFORMATION FROM THE BIDDING DOCUMENTS TO THE SUBMITTALS. INCOMPLETE SUBMITTALS WILL BE DISAPPROVED.

   c. Submittals shall be clearly marked to differentiate between the applicable and extraneous portions. THE ENGINEER WILL NOT MARK THE SUBMITTALS. UNMARKED SUBMITTALS WILL BE DISAPPROVED.

   d. The attached Submittal Cover Sheet shall be copied, filled out and attached to EACH item submitted.

4. SUBMITTALS (INCLUDING RE-SUBMISSIONS), PREPARED AND TRANSMITTED IN ELECTRONIC FORMAT, SHALL BE ACCOMPANIED WITH A HARD COPY.

5. ADDITIONALLY, ELECTRONIC SUBMITTALS WHICH DO NOT CONFORM WITH THE ABOVE REQUIREMENTS WILL NOT BE REVIEWED, BUT RATHER DELETED WITH A CORRESPONDING TRANSMISSION: "REJECTED, NON-COMPLIANT SUBMISSION!"

6. Unless otherwise noted or herein specified, the following are required:

   a. Material lists:

      1) Piping systems.

      2) Piping hangers and supports.

      3) Insulation systems.

      4) Fire stopping.

   b. Fabrication drawings:

      1) Air distribution systems.

      2) Piping systems.

      3) Refrigerant piping systems.

c. Equipment submittals:

1) Boilers/burners.

2) Chiller.

3) Pumps.

4) Hydronic systems accessories.

5) Flow meters.

6) Coils, hot glycol reheat coils.

7) Unit heaters.

8) Panel Radiators.

9) Gas pressure regulators.

10) Humidifiers.

11) Thermal acoustical lining.

12) Fire dampers.

13) Central station heating, ventilating and air conditioning units.

14) Central station make up air units.

15) Central station heating and ventilating units.

16) Laboratory exhaust fans.

17) Power roof ventilators.

18) Utility fan sets.

19) Diffusers and grilles.

20) Variable air volume terminals.

21) Intake ventilators.

22) Downdraft grinding tables and welding exhaust arms.

23) Insulation.

24) Automatic temperature controls.

25) Gauges, thermometers.

26) Adjustable frequency controllers.

27) Motor starters.

28) Gas vent systems.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Materials and equipment shall be in strict accordance with the parameters herein specified.

2.02 ACCESSORIES AND COMPONENTS

A. Systems and equipment shall be complete with the necessary quantity of accessories and components required to insure a properly functioning installation.

2.03 REFRIGERANTS

A. Chlorofluorocarbon refrigerants shall not be used in refrigeration systems.

2.04 ADJUSTABLE FREQUENCY CONTROLLERS, MOTORS AND MOTOR STARTERS

A. Units serving driven equipment herein specified shall conform with the parameters set forth in Sections 23 55 92, 23 55 94, and 23 55 95, respectively.

B. Refer also to Equipment/Motor-Wiring-Contractor/Motor Stater-Disconnect Schedule (ME Drawings).

PART 3 - EXECUTION

3.01 INSTALLATION

A. Work shall be expeditiously executed in a well-planned, organized, neat, workmanship like manner.

B. Unless otherwise noted or herein specified, materials and equipment shall be installed in strict accordance with the manufacturer's recommendations.

C. System components shall be installed in a fashion ensuring easy serviceability.

D. Electrical work herein specified and/or noted shall be executed in strict conformance with the National Electrical Code (NEC).

E. Work shall be executed by tradesmen licensed as required by the authority having jurisdiction.

3.02 REMOVALS

A. Unless otherwise noted or herein specified, equipment and materials shown and/or specified to be removed (including related accessories and appurtenances) shall become the Contractor's property and shall not be permitted to accumulate, but shall be promptly removed from the job site.

B. The removal and disposal of glycol solutions, petroleum products, refrigerants and components containing asbestos and/or polychlorinate biphenyls (PCB's) shall be in strict conformance with governing federal, state and local regulations.

C. Work shall be carefully executed to prevent the disruption of, or damage to, new work or existing work that is to remain.

3.03 CEILING PLENUM SPACE COORDINATION

A. Unless otherwise shown and/or noted, mechanical/electrical distribution systems shall generally be arranged in the following descending order:

1. Branch sprinkler piping and feeder conduits (highest).

2. Ductwork.

3. HVAC hydronic piping and plumbing piping (lowest).

B. Gravity drainage piping systems (steam, steam condensate, sanitary, storm, etc.) shall be accommodated in context with their necessary precedence.

C. Branch circuit conduits shall be accommodating as required.

3.04 PROTECTION

A. Materials, equipment and accessories shall be suitably covered and protected during construction.

B. Materials, equipment and accessories damaged during construction shall be replaced at no cost to the Owner.

3.05 SUPPORTS

A. Provide auxiliary steel (beams, channels, angles, formed shapes, etc.) required to properly support equipment and distribution systems.

B. Utilize galvanized components (wherever practical) or field apply two coats of corrosion resistant primer.

C. Seismic anchorages, restraints and equipment supports shall comply with National Uniform Seismic Installation Guidelines.

3.06 FINAL CLEANING, EQUIPMENT ROOMS

A. Remove trash and debris.

B. Thoroughly sweep (using sweeping compound) and subsequently vacuum floors.

C. Hand wash wall surfaces and equipment and remove any foreign substance (adhesive, extraneous paint, droppings, etc.).

D. Damp-mop floors.

3.07 RECORD DRAWINGS

A. Promptly record (in a neat, legible and red-color only accentuated fashion, on a complete, designated set of bidding documents containing no other markings) significant differences reflected by the actual installation (sizes, capacities, locations and features of distribution systems and equipment).

B. Thoroughly review such recordings weekly with the Engineer's field representative and submit the completed set to the Engineer for electronic formatting.

3.08 FIELD CHECKING START-UP

A. Provide field checking start-up for systems and equipment in accordance with the requirements herein specified.

3.09 PUNCH LIST

A. When the Engineer is directed or requested to prepare a summary of incomplete work, the Contractor's Project Manager and Foreman shall visit the job site with the Engineer's Representative(s).

B. Thereafter, the Contractor's Project Manager shall direct his Foreman and subcontractors to complete observed incomplete work.

C. Finally, the Contractor's Project Manager and Forman shall visit the job site with engineer's representative(s) to determine any remaining incomplete work.

D. As required, items B. and C. shall be repeated until work is properly completed.

3.10 SYSTEMS CHECK-OUT (COMMISSIONING)

A. Subsequent to completing the HVAC systems, the Mechanical Contractor, in conjunction with the Engineer, shall orchestrate a demonstrative "check-out" of the systems operation.

B. In addition to the Engineer's representative(s), the following parties shall participate:

1. The Mechanical Contractor's Project Manager and Foreman.

2. The major mechanical equipment suppliers' service technicians.

3. The Automatic Temperature Control Subcontractor's Project Manager and Installation Supervisor.

4. The Balancing Subcontractor's Job Site Technician(s).

C. The above assembly, under the conjunctive direction of the mechanical Contractor's project manager and the Engineer's representative shall demonstrate the disposition of the system(s) sequence of operation relative to the proper response of related equipment, controlled devices, controllers and balancing influences.

D. Shortcomings shall be defined and assigned (verbally and confirmed in writing) to the appropriate participant(s) relative to required corrective measures, including an appropriate date for completion.

E. Thereafter, the above process will be repeated until all the requirements set forth in the bidding documents are properly satisfied.

F. Finally, submit a detailed report to the Engineer, summarizing corrective measures and/or implemented alterations.

3.11 TESTING AND BALANCING

A. Promptly complete all work necessary to complement testing and balancing as herein specified.

B. Subsequently, orchestrate the on-site, simultaneous presence of the piping and sheet metal foremen, automatic temperature control technicians and testing and balancing agency representatives to assure their necessary corroborative effort.

3.12 INSTRUCTION

A. Provide thorough, organized instruction regarding equipment and systems operation to the Owner's authorized representatives (secure written acknowledgement and forward to the Engineer); refer to respective specification sections for designated requirements.

3.13 OPERATION AND MAINTENANCE MANUAL

A. Upon completing the material lists and equipment submittal process, submit two bound, neatly arranged, indexed Operation and Maintenance Manuals for approval.

B. Manuals shall be contained in heavy duty, 3-ring vinyl covered loose-leaf binders (suitable sets of MANAGEABLE SIZE, like equipment and systems grouped) complete with:

1. Typewritten description of contents within a clear plastic sleeve on the spine.

2. Dividers with labeled, celluloid covered tabs.

3. Protective plastic jacket enclosures for diagnostic software.

C. Manuals shall contain:

1. Title page delineating:

a. Name of project.

b. General nature of contents.

c. Name and address of Contractor and Engineer.

d. Applicable cross-references to related volumes.

2. Table of contents listing equipment (including the associated alphanumerical designation) and the corresponding section (tab).

3. Pertinent equipment information, including:

a. Manufacturer and serial number.

b. Approved submittal.

c. Operating and maintenance instructions.

d. Names, addresses and telephone numbers relative to parts and service.

4. Field checking start-up reports.

5. Test and balance reports.

6. Systems check-out (commissioning) reports.

7. Closeout documentation:

a. Wavier of liens.

END OF SECTION

Attachment: Submittal Cover Sheet

SUBMITTAL COVER SHEET

CONTRACTOR: _____

ADDRESS: _____

_____

TELEPHONE: _____

DATE: _____

NOTE: ATTACH A COMPLETED COVER SHEET TO EACH COPY

PROJECT: MVCC Science & Technology Building Renovation
MARCH PROJECT #23000

TYPE OF SUBMITTAL (CHECK):

[ ] FABRICATION DRAWING
[ ] MATERIAL LIST
[ ] EQUIPMENT
[ ] SAMPLE
[ ] COLOR SAMPLE
[ ] _____

DESCRIPTION:

PRODUCT NAME: _____

MANUFACTURER: _____

SUBCONTRACTOR/SUPPLIER: _____

ENGINEER REVIEW STAMP

[ ] NO EXCEPTION TAKEN
[ ] REVISE AND RESUBMIT
[ ] FURNISH AS CORRECTED
[ ] REJECTED

Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the fabrication process or to techniques of construction, and for coordination of the work of all trades.

TOWNE ENGINEERING
Consulting Engineers

Date _____ By _____

CONTRACTOR REVIEW STAMP

REMARKS:

SECTION 23 50 05

GENERAL PROVISIONS, PIPING SYSTEMS

PART 1 – GENERAL

1.01 STANDARDS

A. Pipe, tube and fittings shall comply with governing codes and shall conform to the applicable standards of ASTM, ASME, ASCE, ANSI and AWWA.

1.02 OPTIONS

A. Whenever copper and ferrous piping systems are specified two (2) inches and smaller and two and one-half (2-1/2) inches and larger, respectively, copper piping systems may be provided (in consistent fashion, by piping system) for sizes four (4) inches and smaller (unless otherwise noted).

B. Ferrous piping systems are generally specified with screwed joints and fittings serving sizes two (2) inches and smaller and with flanged joints and weld fittings or (for designated systems) grooved joints and fittings serving sizes two and one-half (2-1/2) inches and larger; unless otherwise noted, flanged joints and weld fittings or (for designated systems) grooved joints and fittings may be provided (in consistent fashion, by piping system) for piping one and one-half (1-1/2) inches and larger and/or screwed joints and fittings for sizes four (4) inches and smaller.

C. Copper piping systems are generally specified with soldered joints; mechanical joints (for designated systems) may be provided (in consistent fashion, by piping system).

D. Bronze body valves are generally specified with screwed ends; unless otherwise noted, solder ends (in strict accordance with the listed parameters) may be provided (in consistent fashion, by piping system) for copper piping systems.

E. Piping connections at air/water terminals (cabinet unit heaters, unit heaters, reheat coils) and naturally convective radiation are generally shown to be field/shop assembled; unless otherwise noted, factory assembled piping connections matching the detailed parameters may be provided (in consistent fashion, by piping system).

1.03 MATERIAL LISTS

A. Prior to installation, submit a list of materials to the Engineer for approval that shall conform with the following:

1. Each piping system (including pipe material, pipe joints, fittings, valves, etc.) shall be listed separately.

2. Listings of pipe material, pipe joints (including the associated joining materials) and fittings shall be complete with a description of parameters contained in the bidding documents (schedule number, material, pressure classification, standards, etc.). THE ENGINEER WILL NOT TRANSFER

INFORMATION FROM THE BIDDING DOCUMENTS TO THE LISTINGS. INCOMPLETE LISTINGS WILL BE DISAPPROVED.

3. Listings of valves shall be similar to those for pipe material, pipe joints and fittings and shall be complete with the manufacturer's product description literature. INCOMPLETE LISTINGS WILL BE DISAPPROVED.

PART 2 – PRODUCTS

2.01 PIPE JOINTS AND FITTINGS

A. Pipe joints and fittings specified as 150 psig and 300 psig shall be standard weight and extra heavy weight, respectively (150 psig shall indicate nominal ranges of 125-150 psig SWP and 150-200 psig WOG; 300 psig shall indicate nominal ranges of 250-300 psig SWP and 300-400 psig WOG).

2.02 ACCEPTABLE MANUFACTURERS

A. Valves:

1. Apollo, Crane, Jenkins, Keystone, Lukenheimer, Nibco, Powell, Stockham or approved equal.

B. Grooved piping systems:

1. Victaulic, Anvil or approved equal.

C. Factory assembled piping connections:

1. Griswold, Victaulic or approved equal.

D. Mechanical joint systems:

1. Nvent, Ridgid, Viega or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. Changes in direction shall be made through fittings, except that welding outlet fittings may be used for branch piping two (2) inches and larger, provided the branch piping is a minimum of two pipe sizes smaller than the associated main piping.

2. Provide isolating valves at equipment requiring service.

3. Provide unions, flanges or disconnects required to facilitate convenient equipment removal.

4. Provide anchors, swings, thrust blocks, tie rods, flexible connectors, etc. required to prevent noise and allow for expansion.

B. Above grade:

1. Furnish and install piping substantially as shown on the drawings, as high as possible (except that piping shall generally be run below ductwork to facilitate access to valves, vents, flow meters, etc.), parallel to building walls, clear of structural members (except when penetrations are shown or approved) and clear of equipment removal areas.

C. Sleeves:

1. Provide sleeves at ALL points (unless otherwise noted or specified) where piping systems pass through building walls, floors and partitions:

   a. Units penetrating walls and floors below grade shall be as detailed (*Sleeves Below Grade, Floors and Walls*).

   b. Units penetrating floors shall be Schedule 40, black steel (ASTM A-53) arranged to provide a waterproofing flange by projecting 1/2 inch above finished floor (except in Mechanical/Electrical Equipment Rooms where the projection shall be 2 inches above finished floor).

   c. Units penetrating walls or partitions (constructed of masonry and/or fire or smoke rated) shall be Schedule 40, black steel (ASTM A-53), neatly fitted and sealed to the associated opening.

   d. Units penetrating walls or partitions (not constructed of masonry nor fire or smoke rated) shall be neatly fitted and not require sleeves.

   e. Openings through existing walls or partitions constructed of solid masonry shall be core drilled and shall not require sleeves.

2. Seal annular spaces with intumescent, synthetic elastomer (3M brand fire barrier; Caulk CP 25, Putty 303).

D. Escutcheons:

1. Provide chrome plated flat plate type escutcheons at ALL POINTS where EXPOSED piping systems pass through building walls, floors and partitions in FINISHED areas.

E. Painting:

1. Provide rust inhibitive primer and two finish coats for uninsulated, exposed exterior and interior, ferrous piping systems; color as noted, scheduled or directed.

3.02 TESTS

A. Piping systems tests herein specified shall be conducted in the presence of the authority having jurisdiction before backfilling, concealment and/or insulation as applicable and all leaky joints shall be remade and retested.

3.03 TESTING AND BALANCING ASSISTANCE

A. Review completed systems with testing and balancing agency representatives and relate variations in the actual installation from the drawings and specifications.

B. Ensure air control accessories (air separators, expansion tanks, air vents, fill pressures, relief valve settings, etc.) are properly installed.

C. Thoroughly vent distribution piping and heat transfer equipment.

D. Remove and clean strainers.

E. Place automatic 2-way valves in their full-open position, automatic 3-way valves closed to bypass (unless otherwise indicated by the design concept) and all associated shut-off and/or balancing valves in their required full-closed or full-open position.

END OF SECTION

SECTION 23 50 13

HYDRONIC PIPING SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete hydronic piping systems (glycol solution) in accordance with the sizes and locations shown on the drawings.

B. All reference to grooved piping systems shall apply only to un-insulated condenser water piping systems and piping systems operating at temperatures above ambient.

C. All reference to mechanical joint piping systems shall apply only to (glycol solution) piping systems.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material:

1. 2 inches and smaller:

   a. Welded, Schedule 40, black steel conforming to ASTM Specification A-53.

   b. Type L, hard copper tubing conforming to ASTM Specification B-88.

2. 2-1/2 inches and larger:

   a. Welded, Schedule 40, black steel conforming to ASTM specification A-53.

B. Pipe joints:

1. 2 inches and smaller:

   a. 150 psig, screwed, malleable iron, bronze-to-iron seat, spherical ground joint unions.

   b. Soldered type, joined with lead free, tin-copper-selenium solder.

   c. Mechanical type, EPDM o-ring seal.

2. 2-1/2 inches and larger:

   a. 150 psig, forged steel, welding neck flanges conforming to ASTM Specification A-181 and ANSI Standard B16.5.

b. 150 PSIG, grooved, gasketed, bolted, rigid (flexible where shown and/or noted) ductile iron couplings.

C. Fittings:

1. 2 inches and smaller:

a. 150 psig, screwed, malleable iron conforming to ASTM Specification A-197 and ANSI Standard B16.3.

b. Wrought solder joint type conforming to ANSI Standard B16.22.

c. Mechanical joint type, conforming to ANSI Standard B16.22.

2. 2-1/2 inches and larger:

a. Butt-welding, standard wrought steel conforming to ASTM Specification A-234 and ANSI Standard B16.9.

b. 150 psig, grooved, ductile iron or malleable iron conforming to ASTM Specification A-536 and ASTM Specification A-47, respectively.

D. Gaskets:

1. Metal type.

E. Valves:

1. Ball:

a. Bronze two-piece body, screwed, chrome plated bronze ball, full port, replaceable reinforced TFE trim, lever handle, 600 psig WOG.

b. Non-conductive extended handles, insulation protection sleeve, adjustable memory stop, hose end with cap and chain for drain service.

c. Nibco No. T-585-70.

2. Check:

a. 2 inches and smaller:

1) Swing type:

a) Bronze body, screwed, screwed cap, replaceable bronze disk, 200 psig WOG.

b) Nibco No. T-413.

2) Lift type:

a) Bronze body, screwed, horizontal or vertical pattern, replaceable TFE disk and seat, 200 psig WOG.

b) Nibco No. T-480.

3) Silent guided spring type:

a) Bronze body, screwed, stainless steel spring, replaceable bronze trim, 300 psig WOG.

b) Muessco No. 203.

b. 2-1/2 inches and larger:

1) Swing type:

a) Iron body, flanged, bolted cap, replaceable bronze disk and seat, 200 psig WOG.

b) Nibco No. F-918.

2) Silent guided spring type:

a) Iron body, flanged, wafer or globe pattern, stainless steel spring, replaceable bronze trim, 175 psig WOG.

b) Muessco No. 101 or 105.

3. Gate:

a. 2 inches and smaller:

1) Bronze body, screwed, rising stem, union bonnet, solid wedge disk, 200 psig WOG.

2) Nibco No. T-124.

b. 2-1/2 inches and larger:

1) Iron body, flanged, OS&Y, bolted bonnet, solid wedge disk, replaceable bronze trim, 200 psig WOG.

2) Nibco No. F-617-0.

4. Globe:

a. 2 inches and smaller:

1) Bronze body, screwed, globe or angle pattern, rising stem, union bonnet, replaceable bronze disk, 200 psig WOG.

2) Nibco No. T-235 or T-335.

b. 2-1/2 inches and larger:

1) Iron body, flanged, globe or angle pattern, OS&Y, bolted bonnet, replaceable bronze disk and seat, 200 psig WOG.

2) Nibco No. F-718 or F-818.

5. Lubricated plug:

a. 2 inches and smaller:

1) Teflon lined, tapered, screwed, bolted cover, 175 psig WOG.

2) Rockwell-Nordstrom No. 142.

b. 2-1/2 inches and larger:

1) Teflon lined, tapered, flanged, bolted cover, 175 psig WOG.

2) Rockwell-Nordstrom No. 143.

F. Strainers:

1. Y-pattern:

a. 2 inches and smaller:

1) Iron body, screwed, 200 psig WOG.

2) Stainless steel screen, 20 mesh.

3) Keckley style B.

b. 2-1/2 inches and larger:

1) Iron body, flanged, 200 psig WOG.

2) Stainless steel screen, 0.125 inch perforations.

3) Keckley style A.

2. Basket:

a. Iron body, flanged, 200 psig WOG.

b. Bolted cover, closed systems; clamp cover, open systems.

c. Stainless steel basket, 0.125 inch perforations.

d. Kleckley style GFV and HLC.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Pitch piping up in the direction of flow 1/4 inch in 25 ft.

B. Furnish and install manual air vents at high points, complete with remote air chambers and connecting tubing as required to provide easy access.

C. Furnish and install drain valves at low points.

3.02 TEST

A. Test the entire system (new work, isolated from existing) hydrostatically at 125 psig.

B. The system shall be leak-tight after a 3-hour duration.

3.03 GLYCOL SOLUTION SYSTEMS FILL

A. Execute a complete program of initial cleaning as prescribed by the glycol manufacturer.

B. Provide glycol solution in sufficient quantity to fill new system volume, including temporary units and hoses, and make up for any glycol solution lost during construction as a result of draining and/or contamination.

C. Unless otherwise noted and/or specified, glycol shall be inhibited [propylene] glycol [Dowfrost].

D.

E. Mix the appropriate solution concentration (by volume) prior to introduction into system.

F. Provide two test kits to permit easy measurement of the solution freeze point and reserve alkalinity (inhibitor level).

END OF SECTION

SECTION 23 50 16

CONDENSER WATER PIPING SYSTEMS, BELOW GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete below grade condenser water piping systems in accordance with the sizes and locations shown on the drawings.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material and fittings:

1. High density, extra high molecular weight, polyethylene conforming to ASTM Specification D3350 (Type III, Class C, Category 5, Grade P34; Plastics Pipe Institute designation PE3408).

2. Standard Dimension Ratio (SDR) 26 (65 psig).

B. Pipe joints:

1. Thermal fusion type.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All work shall be executed in strict accordance with direction set forth by the manufacturer's authorized representative.

3.02 TEST

A. Test the entire system (new work, isolated from existing) hydrostatically at 100 psig.

B. The system shall be leak-tight after a 3-hour duration.

END OF SECTION

SECTION 23 50 18

NATURAL GAS PIPING SYSTEMS, BELOW GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete below grade natural gas piping systems in accordance with the sizes and locations shown on the drawings.

B. Systems shall comply with the requirements set forth in NFPA Standards 54 and 58.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material and fittings:

1. 2 inches and smaller:

   a. Flexible polyethylene tubing conforming to ASTM D-2513 and ASME D-B31.8 (Gastite or approved equal).

2. 2½ inches and larger:

   a. High density, extra high molecular weight, polyethylene conforming to ASTM Specification D3350 (Type III, Class C, Category 5, Grade P34; Plastics Pipe Institute designation PE3408). Standard Dimension Ratio (SDR) 11 (100 psig).

B. Pipe joints:

1. 2 inches and smaller:

   a. Stab type unibody mechanical fittings complete with internal seals, stiffener, self locking gripper and moisture lip conforming to ASTM D-2513 and ASME D-B31.8 (Continental Industries Con-Stab ID seal or approved equal).

2. 2½ inches and larger:

   a. Thermal fusion type.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All work shall be executed in strict accordance with direction set forth by the manufacturer's authorized representative and the associated public utility.

3.02 TEST

A. Test the entire system (new work, isolated from existing) pneumatically at 90 psig.

B. The system shall be leak-tight after a 3-hour duration.

3.03 LOCATION INDICATORS

A. Provide a locator wire (coated, #12 awg, stranded copper) alongside piping, terminated by an accessible junction box.

END OF SECTION

SECTION 23 50 19

NATURAL GAS PIPING SYSTEMS, ABOVE GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete above grade natural gas piping systems in accordance with the sizes and locations shown on the drawings.

B. Systems shall be compliant with ANSI Z21.30 or Z83.1, Public Service Commission Regulation NYCRR Part 255 and Federal Department of Transportation Part 192.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material (except vent piping):

1. Welded, Schedule 40, black steel conforming to ASTM Specification A-53.

B. Pipe joints (except vent piping):

1. 2 inches and smaller:

a. 150 psig, screwed, malleable iron, bronze-to-iron seat, spherical ground joint unions.

2. 2-1/2 inches and larger:

a. 150 psig, forged steel, welding neck flanges conforming to ASTM Specification A-181 and ANSI Standard B16.5.

C. Fittings (except vent piping):

1. 2 inches and smaller:

a. 150 psig, screwed, malleable iron conforming to ASTM Specification A-197 and ANSI Standard B16.3.

2. 2-1/2 inches and larger:

a. Butt-welding, standard wrought steel conforming to ASTM Specification A-234 and ANSI Standard B16.9.

D. Gas vent pipe material:

1. Welded, Schedule 40, galvanized steel conforming to ASTM Specification A-53.

E. Gas vent pipe joints:

1. 2 inches and smaller:

   a. 150 psig, screwed, galvanized, malleable iron, bronze-to-iron seat, spherical ground joint unions.

2. 2-1/2 inches and larger:

   a. Galvanized, malleable iron companion flanges, conforming to ASTM Specification A-126 and A-153 and ANSI Standard B16.1.

F. Gas vent fittings:

1. 150 psig, screwed, galvanized, malleable iron conforming to ASTM Specification A-153 and A-197 and ANSI Standard B16.3.

G. Valves:

1. 3/8 inch to 1 inch:

   a. Brass body, screwed, chrome plated brass ball, full port, nitrile o-ring, red painted aluminum handle, conforming to ANSI standard Z21.15 and ASME specification B16.44.

   b. Nibco GB1A

2. 1-1/4 inches to 2 inches:

   a. Bronze two-piece body, screwed, chrome plated bronze ball, full port, replaceable reinforced TFE trim, lever handle, 600 psig WOG.

   b. Nibco No. T-585-70.

3. 2-1/2 inches to 3 inches:

   a. Brass two-piece body, screwed, chrome plated brass ball, full port, PTFE seat, chrome plated lever handle, 400 PSIG WOG, conforming to ASME specification section B16.44.

   b. Nibco T-FP-600A

4. 4 inches and larger:

   a. Lubricated plug type.

   b. Teflon lined, tapered, flanged, bolted cover, 175 psig WOG.

   c. Rockwell-Nordstrom No. 143.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Pitch piping down in the direction of flow 1/4 inch in 25 ft.

B. Furnish and install shutoff valves, dirt pockets and appropriate pressure regulators at appliances and equipment.

C. Venting:

1. General:

a. Terminate outdoors 18 inches or greater from openings and overhangs in a fashion that prevents water entry.

b. Manifold like vents with line sizes equal to the total cross sectional area of associated individual vents.

2. Atmospheric pressure balanced diaphragm devices (pressure switches, pressure regulators, etc.):

a. Less than 20 feet, 3/4 inch.

b. 20 feet or greater, 1 inch.

3. Relief valves, normally open vent valves:

a. Line size.

3.02 TEST

A. Test the entire system (new work, isolated from existing) pneumatically at 50 psig.

B. The system shall be leak-tight after a 1-hour duration.

END OF SECTION

SECTION 23 50 32

CONDENSATE DRAINAGE PIPING SYSTEMS, ABOVE GRADE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete condensate drainage piping systems in accordance with the sizes and locations shown on the drawings.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Pipe material:

1. Rigid, Schedule 40, polyvinyl chloride (PVC) conforming to ASTM Specification D-1785.

B. Pipe joints:

1. Solvent cement type.

C. Fittings:

1. Rigid, Schedule 40, polyvinyl chloride (PVC) conforming to ASTM Specification D-1785.

PART 3 – EXECUTION

3.01 TEST

A. Test the entire sanitary waste and vent system (new work, isolated from existing) hydrostatically at 5 psig.

B. The system shall be leak-tight after a 3-hour duration.

END OF SECTION

SECTION 23 50 44

PIPING SYSTEMS HANGERS AND SUPPORTS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install piping systems hangers and supports for piping systems shown on the drawings.

1.02 STANDARDS

A. Units, including piping system attachments, structural attachments, hanger rods, anchors, bracing, alignment guides and all necessary accessories shall be in accordance with ANSI Standard B31.1 and MSS Standard SP-58.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. F & S, Carpenter & Patterson, Fee & Mason, Grinnell or approved equal.

2.02 DESCRIPTION

A. Basic components (piping system attachments, structural attachments, hanger rods, alignment guides, etc.):

1. Stock, production units.

B. High density insulation filler pieces:

1. Molded, rigid urethane, thickness equal to that of the specified adjoining insulation, 6 inches long, 4 lbs/cu ft, 0.03 perm inches (ASTM Specification C-355, dry cup), 125 lbs/sq inch (compressive strength).

C. Protective shields:

1. Galvanized steel, formed to fit the adjoining insulation, 180 degree arc.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be capable of properly supporting each piping system under operating conditions imposed by the transported medium (gas or liquid), including provisions for:

1. Expansion and contraction (movement shall not cause disengagement).

2. Preventing excessive stress.

3. Threaded vertical adjustment subsequent to installation.

4. Shock absorbing devices as required.

B. Hanger rods shall be subjected to tensile loads only; where axial or lateral movements are anticipated, suitable linkages shall be provided.

C. Piping system attachments serving copper piping systems shall be copper clad.

D. Structural attachments shall be secured to the building structural system (as shown), NOT to ROOF decks or components of the mechanical and electrical systems (ductwork, piping, conduit, etc.); however, attachments serving piping 2 inches and smaller may be secured to FLOOR decks.

E. Hangers and/or supports for cast iron piping shall be within 18 inches of each joint (both sides).

F. Piping systems support shall be completely independent of the associated equipment and terminals.

3.02 ARRANGEMENT

A. Locate and position units to complement an associated piping system arrangement which assures proper access for maintenance and service.

B. Position structural attachments to accommodate piping system elevations which complement a coordinated ceiling plenum space arrangement.

END OF SECTION

SECTION 23 50 57

BOILERS/BURNERS, HOT WATER

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install boiler/burner(s) in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the sectional, eutectic cast iron, field-assembled type; constructed in accordance with New York State Labor Department Code for low pressure steam boilers, ASME Standards, National Fire Protection Association requirements; Underwriters Laboratories listed; factory tested (in accordance with IBR requirements) and wired (in accordance with the National Electrical Code); complete with eutectic cast iron sections, jacket, channel supports, ASME relief valves, burner, oil filter, operating and safety controls (120 volts), field testing, field checking start-up and cleaning tools.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. DeDietrich or approved equal.

2.02 DESCRIPTION

A. Boiler:

1. Sections:

   a. Water-backed wet base combustion chamber, water circulation around entire firebox, convective airflow between bottom of sections and floor.

   b. Aligning lugs, water-tight flexible elastomer sealing rings, individual draw rod assembly, sealing grooves, gas-tight silicone thermocord seal.

   c. Balanced water flow, integral return headers.

   d. Fireside refractory insulated access panels and clean-out openings, waterside inspection/clean-out tapings.

   e. Refractory insulated steel burner mounting plate, observation ports (front and back), control tapings, flanged smoke collar/quadrant type breeching damper, relief door.

2. Jacket:

   a. Insulated (heavy density, fibrous glass), reinforced heavy gauge steel, baked enamel finish.

B. Burner:

1. General:

   a. Forced draft, flame retention type.

   b. Microprocessor based control, password protection.

   c. Programmable, dedicated servomotor actuators, parallel positioning:

      1) Suction side, air inlet vanes.

      2) Pressure side air, sliding diffuser assembly.

      3) Gas valve.

   d. Flame safeguard, building management system interface.

2. Housing:

   a. Cast aluminum, hinged (left or right swing).

   b. Differential combustion air pressure switch, flange safety interlock switch.

   c. Large sight glass, removable access cover.

3. Fan:

   a. Cast aluminum, backward inclined blades.

   b. Statically and dynamically balanced.

   c. Variable speed, TEFC motor.

4. Combustion air arrangement:

   a. Suction side:

      1) Multiple cast aluminum inlet vanes.

      2) Sound attenuation.

   b. Pressure side:

      1) Sliding diffuser assembly.

5. Combustion head:

   a. Stainless steel alloy (flame tube, diffuser assembly), 1470F.

   b. Serviceable (without burner removal).

6. Emissions:

a. Staged combustion principle.

b. Nitrous oxide level:

1) 30 ppm, gas.

7. Performance:

a. Turndown:

1) 8:1, gas.

2) 4:1, light oil.

b. Oxygen:

1) 3%, high fire.

2) 4.5%, low fire.

c. Carbon monoxide:

1) 20 ppm, gas.

C. Operating and limit controls:

1. High temperature limit:

a. Manual reset, water temperature actuated, set point 20F greater than operating controller (240F, maximum), set point locking bar, two contacts (one normally closed, one normally open).

2. Low water limit:

a. Float actuated, automatic reset, gauge glass assembly.

3. Auxiliary low water limit:

a. Float actuated, manual reset, two contacts (one normally closed, one normally open).

4. Temperature operating (multiple boilers):

a. General:

1) Microprocessor based, battery backup, Building Management System (BMS) interface.

2) Digital display:

a) System operating temperature.

b) System set point temperature.

c) Percent of modulation, each stage.

3) Indication:

a) Lead stage.

b) Status, each stage.

4) Switches:

a) On-Off-Auto, Lead-Lag-Standby, each stage.

b) Auto rotate, on-off.

c) Normal-Setup.

5) Adjustments:

a) System gain.

b) Prepurge.

c) Standby time.

d) Percent modulation to next stage.

6) Auxiliary equipment contact closure.

b. Operation:

1) Arranged to stage and vary boiler burner(s) firing rate to maintain system set point temperature.

2) Maintain over-fire pressure.

3) Capable of resetting system set point temperature according to ambient OA temperature and thermal inertia influenced PID control determined reset ration while maintaining a non-condensing limit.

4) Programming potential for set-back and warm-up.

D. Combustion safeguards:

1. Gas pressure regulators:

a. Spring loaded, dead weight or balanced pressure type (weight and lever type shall not be used); 10% offset through firing range.

2. High and low gas pressure limit control:

a. Manual reset, set points conforming with burner parameters, two contacts (one normally open, one normally closed).

3. Automatic valves:

a. Gas:

1) Main burner:

a) One motorized (spring return, closure interlock switch), one solenoid (both normally closed).

2) Pilot:

a) Two, solenoid (normally closed).

b. Oil:

1) Two, solenoid (normally closed).

4. Airflow switch:

a. Normally open.

5. Programmer:

a. General:

1) Microprocessor based, self-diagnostic, non-volatile memory.

2) Ignition and main flame failure protection (in conjunction with operating and limit controls and interlock devices).

3) Automatic recycle subject to operating controls and power interruption; manual reset following safety shutdown.

4) Message center display description for program status, hold, lockout, check and diagnostics.

b. Flame detection:

1) Ultraviolet scanner, meter test jacks.

c. Start-up:

1) With power "On", the operating/limit control circuit closed and the main fuel valve interlock closed:

a) Burner/blower motor shall be energized.

b) Running interlock circuit (airflow switch) shall close.

c) The firing rate motor shall be driven to its high purge or "open" damper position, whereafter, an end switch shall initiate a 30-second prepurge.

2) At the conclusion of prepurge:

a) The firing rate motor shall be driven to its "low fire" position.

3) Following a 30-second delay (to permit firing rate motor travel):

a) A check shall be made for low fire start interlock.

b) A pause (as necessary) shall ensue until low fire start interlock closure.

4) With proven low fire position:

a) Ignition and automatic gas pilot valves shall be energized.

5) Following a 10-second proven gas pilot stabilization period:

a) The main automatic gas valves shall be energized.

d. Normal shutdown:

1) When the operating control circuit opens, the automatic valves shall be de-energized and the firing rate motor shall be driven to its closed damper position.

2) Following a 15-second post purge, the burner/blower motor shall be de-energized.

e. Safety shutdown:

1) Whenever the running interlock (airflow switch) fails to close, the burner/blower motor shall be de-energized and the control shall lock-out.

2) Whenever (after a 10-minute delay) the firing rate motor fails to reach its full open position, thereby preventing actuation of prepurge, the burner/blower motor shall be de-energized and the control shall lock-out.

3) Whenever the running interlock (airflow switch) circuit opens during a firing period, all automatic valves shall be de-energized and the control shall lock-out.

4) Whenever the pilot flame is not detected during the 10-second pilot trial for ignition period, the automatic pilot valves and ignition transformer shall be de-energized and the control shall lock-out.

5) Whenever the main flame is not detected at the end of the main flame trial for ignition period, the automatic valves shall be de-energized and the control shall lock-out.

6) Whenever the main flame fails during a firing cycle, all automatic fuel valves will be de-energized within 4 seconds after loss of flame signal and the control shall lock-out.

E. Miscellaneous equipment:

1. Combination water pressure/temperature gauge:

a. Bourden type, bushed phosphor bronze bearings, under and over range protection, calibration setting screw, flanged cast aluminum case, white face (6 inch diameter), black embossed figures (evenly graduated, appropriate range) black pointer (180° arc).

2. Safety relief valve(s):

a. National Board of Boiler and Pressure Vessel Inspectors certified, ASME stamped; capacity equal to boiler nozzle output or 85% of burner rating (whichever is greater); side outlet; 1 inch (minimum), 4 inch (maximum); flanged base; lifting assembly (pull chain and pulley, independent support, 1/16 inch disk/seat lift); 50 psig set point.

F. Electrical components:

1. All required motors, motor starters, control circuit transformer, combustion safeguard programmer, switches, relays.

2. Complete short circuit and overload protection.

G. Factory testing:

1. Hydrostatic test of composite section assembly in accordance with the procedures outlined by the ASME Boiler and Pressure Vessel Code.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Cleanup:

1. Clean units in strict accordance with procedures set forth by the manufacturer.

B. Electrical wiring:

1. It is the intent of this specification that all electrical wiring required to accomplish the unit control shall be the responsibility of this Contractor and that it shall be installed in strict accordance with the National Electrical Code.

2. All wiring shall be installed in electrical metallic tubing with compression type couplings and connectors.

3. The control circuit shall be a two-wire (one side grounded), 120V, dedicated branch circuit with all operating and limit controls arranged to interrupt the ungrounded conductor.

4. The combustion safeguard programmer shall be wired from the load side of the burner blower motor disconnect through the operating and limit controls, complete with fast acting type fuse (125% FLA) and control circuit switch arranged to de-energize burner operation while leaving the combustion safeguard programmer energized; flame sensor wiring shall be run in a dedicated, securely mounted conduit.

5. Each burner assembly motor shall be arranged with a dedicated disconnect switch.

6. All limit controls with manual reset shall be arranged for visual and audible indication.

3.02 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

3.03 FIELD TESTING

A. General:

1. Testing shall be sub-divided into the following segments:

   a. Slow drain test.

   b. Hydrostatic test.

   c. Combustion efficiency test.

2. All evident deficiencies shall be corrected and services incidental to insuring proper conformance with the governing parameters shall be provided without charge.

B. Slow drain test:

1. The Contractor shall perform a slow drain test, verifying the proper mechanical action of float and probe actuated controllers.

C. Hydrostatic test:

1. Subsequent to installation (with the pressure controls and safety relief valves removed), the Contractor shall execute hydrostatic test equal to one and one-half times the boiler allowable working pressure for a period of one-half hour.

D. Combustion efficiency test:

1. The Contractor shall execute a combustion efficiency test (using Bacharach equipment) to perform a flue gas analysis and measure draft, smoke density and stack temperature.

3.04 INSTRUCTION

A. Provide thorough demonstrative instruction (4 hours, minimum) via factory trained technicians (representatives of the manufacturer's authorized distributor), secure the Owner's written acknowledgement and submit to the Engineer.

END OF SECTION

SECTION 23 50 78

DRAFT CONTROL SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install draft control systems as shown on the drawings and as herein specified.

B. Systems shall be the electronic modulated type; Underwriters Laboratories listed; factory assembled, tested and wired, complete with controller, damper and actuator.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Autoflame, Preferred Instruments or approved equal.

2.02 DESCRIPTION

A. Controller:

1. Microprocessor based, panel mounted, NEMA 4 face, building management system interface.

2. Liquid crystal bar graph display:

   a. Draft set point.

   b. Draft.

   c. Alarm set point.

   d. Time delayed, high pressure (low draft) alarm:

      1) Visual indication.

      2) Audible, silence push button.

3. Alarm/flame safeguard interface.

4. Operating features:

   a. Burner, 'Off':

      1) Damper closed.

   b. Burner, 'Call for Operation':

1) Damper open for pre-purge.

2) Burner fan start after time delay.

3) Damper open for light-off (adjustable position).

4) Damper released for modulation when fuel valve opens.

c. Burner, 'Shut-down':

1) Damper open for post-purge.

2) Damper closed when burner fan stops.

d. Burner, 'Shut-down (safety lock-out)':

1) Damper open.

e. Damper modulation:

1) Characterizable firing rate based via feed-forward signal.

2) Proportional-integral-derivative responsive via electrically isolated actuator feedback potentiometer.

B. Draft damper:

1. Frame:

a. 10 gauge carbon steel, rolled channel.

b. Mounting holes.

2. Blades:

a. 10 gauge carbon steel.

b. Opposed blade configuration.

3. Finish:

a. High temperature primer.

C. Draft damper actuator:

1. Enclosure:

a. Factory mounted, dust-tight, splash-proof.

2. Controller interface:

a. Draft transmitter.

b. Time delayed high pressure (low draft) cut-out.

c. Integral, snap-action switch:

1. Travel limit.

2. Open proving.

d. Electrically isolated feedback, potentiometer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Electrical wiring:

1. Wiring required to accomplish system control shall be the responsibility of this Contractor and installed in strict accordance with the National Electrical Code.

2. Exposed wiring shall be installed in DEDICATED electrical metallic tubing with set-screw and compression type couplings and connectors for interior dry locations and interior wet locations or exterior locations, respectively.

3.02 SUPERVISION

A. General:

1. Supervision shall be executed by a representative of the manufacturer's authorized distributor.

B. Execution:

1. Provide on-site observation throughout the system construction period lending all guidance necessary to insure a correct installation of all associated equipment.

2. Perform field checking start-up conjunctive with automatic temperature personnel executing related work.

3.03 FIELD CHECKING START-UP

A. System field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

3.04 SERVICE

A. General:

1. Service shall be executed by a representative of the manufacturer's authorized distributor.

B. Execution:

1. Subsequent to the system being placed in operation, observe the system operation bi-weekly for 60 days; thereafter, monthly throughout the warranty period.

2. Institute all corrective measures necessary to assure proper operation and so advise the Owner verbally and in written form.

END OF SECTION

SECTION 23 51 10

CHILLERS, HELICAL, AIR COOLED

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install chillers in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the helical, twin screw, air cooled type; constructed in accordance with ANSI and ASHRAE standards; factory assembled, tested (in accordance with ARI requirements), piped and wired (in accordance with the National Electrical Code); Underwriters Laboratories listed, shipped as a package, complete with compressors, motors, adjustable frequency controllers evaporator, condenser section, all necessary operating and safety controls, accessories, initial charges of refrigerant and lubricating oil, warranty, field checking start-up service and instruction.

1.02 WARRANTY

A. Units shall be complete with a one-year (from start-up) parts and labor warranty.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Daikin or approved equal.

2.02 DESCRIPTION

A. Compressor:

1. Field serviceable.

2. Refrigerant tight, close grained cast iron casing; isolators.

3. Dual, semi-hermetic, gear driven, rotary, twin screw.

4. Discharge check valve, muffler, suction screen, relief valve.

5. Pressure lubrication system (pump, cooler, pressure regulator, filter, low watt density sump heater).

B. Motor:

1. Premium efficiency, 3600 rpm, squirrel cage, induction type.

2. Refrigerant cooled.

3. Internal thermal/external current overload protection (each phase).

C. Adjustable frequency controller:

1. Unit mounted, NEMA 1 enclosure, lockable door operator handle.

2. Specification Section 15592, *Adjustable Frequency Controllers*, compliant.

3. Adjustable:

   a. Starting voltage (torque).

   b. Acceleration time (ramp).

4. Current imbalance detector.

5. Single point power supply, non-fused disconnect, control transformer.

6. Ammeter, voltmeter.

7. Line reactor.

8. BACNET compatible Building Management System monitoring interface, third party programming compatible.

D. Evaporator:

1. Shell-and-tube type, constructed in accordance with ASME requirements for unfired pressure vessels.

2. Individually replaceable seamless copper tubes (mechanically bonded to carbon steel tube sheets); 150 psig design working pressure.

3. Intermediate support sheets, eliminators (to prevent refrigerant carryover), refrigerant distribution components (to insure even, moderate velocity profiles).

4. Dual refrigerant circuits (solenoid valve, expansion valve, charging port, sight glass, filter drier with 3-valve bypass), economizer.

5. Flanged, hinged, nozzles-in-heads marine waterboxes ; drain, vent.

E. Condenser section:

1. Aluminum fins mechanically bonded to seamless copper tubing, sub-cooling circuit, accumulator, guards, 425 psig leak test.

2. Direct-drive, vertical discharge fans; statically and dynamically balanced, permanently lubricated ball bearings, built-in thermal overload protection, guards.

3. Louvered protective panels.

F. Controls:

1. General:

    a. Microprocessor based, self-diagnostic, non-volatile memory.

    b. Main processor input/output module, power supply, adjustable frequency controller management module, relay board; flow, temperature and pressure sensors.

    c. Liquid crystal display (16 lines, 40 characters) for monitoring, alarms, status, schedule, set point and service.

    d. BACNET compatible Building Management System monitoring interface.

2. Operating:

    a. Arranged to complement the temperature control sequences hereinafter specified.

    b. Integral control for:

        1) Capacity via adjustable frequency controller (100% to 10%; proportional-integral-derivative).

        2) Lubrication, including pre-start and cost-down.

        3) Ramp loading rate.

        4) Demand limiting in response to:

            a) User set point (40% to 100%).

            b) External signal (4 mA to 20 mA).

        5) Soft stop.

        6) Automatic recycle subject to operating controls and power interruption; manual reset following safety shutdown.

        7) Anti-recycle:

            a) Minimum start-to-start.

            b) Minimum stop-to-start.

    c. Safety:

        1) Automatic shutdown, lockout (manual reset) and alarm display for:

            a) Motor overcurrent.

            b) Over voltage.

            c) Under voltage.

            d) Single phase dropout.

e) Bearing oil high temperature.

f) Low evaporator refrigerant temperature.

g) High condenser pressure.

h) High motor temperature.

i) High compressor discharge temperature.

j) Low oil pressure.

k) Loss of cooler water flow.

l) Adjustable frequency controller fault.

2) Self-corrective action (capacity reduction) and alarm alert display for:

a) High condenser pressure.

b) High motor temperature.

c) Low evaporator refrigerant temperature.

d) High motor amperage.

d. Monitoring/display:

1) Analog parameters:

a) Entering chilled water temperature.

b) Leaving chilled water temperature.

c) Evaporator refrigerant temperature.

d) Entering condenser air temperature.

e) Leaving condenser air temperature.

f) Condenser refrigerant temperature.

g) Oil supply pressure.

h) Oil sump temperature.

i) Evaporator refrigerant pressure.

j) Condenser refrigerant pressure.

k) Bearing oil supply temperature.

l) Compressor discharge temperature.

m) Motor winding temperature.

n) Percent full-load (each compressor).

2) Status:

a) Primary message.

b) Secondary message.

c) Operating hours.

d) Compressor starts.

e) Compressor lead/lag.

f) Adjustable frequency controller.

g) Set points.

H. Accessories:

1. Mounting package:

a. Soleplates, jacking screws, leveling pads.

b. Neoprene pads.

2. Insulation:

a. 3/4 inch thick, flexible foamed plastic.

b. Evaporative shell, economizer, compressor suction, motor shell, motor cooling piping.

3. Isolation valves:

a. Compressor discharge.

b. Compressor suction.

c. Liquid line.

4. Flow switch.

5. Acoustically designed condenser fans and lined compressor enclosure.

6. Architectural louvered panels.

7. Low ambient operation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Electric wiring:

1. It is the intent of this specification that all electrical wiring required to accomplish the unit control shall be the responsibility of this Contractor and that it shall be installed in strict accordance with the National Electrical Code.

2. All wiring shall be installed in electrical metallic tubing with compression type couplings and connectors.

3.02 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

3.03 INSTRUCTION

A. Provide thorough demonstrative instruction (__, __-hour sessions) via factory trained technicians (representatives of the manufacturer's authorized distributor), secure the Owner's written acknowledgement and submit to the Engineer.

END OF SECTION

SECTION 23 51 28

CIRCULATING PUMPS, BASE MOUNTED, END SUCTION

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install base mounted circulating pumps in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the single stage, end suction type; factory tested and shipped as a package.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Bell & Gossett or approved equal.

2.02 DESCRIPTION

A. Volute:

1. Cast iron, 175 psig working pressure.

2. Piping connection, flanges; gauge (suction and discharge), vent and drain tappings.

3. Arranged to permit servicing pump intervals without disturbing adjoining piping.

B. Impeller:

1. Stainless steel, enclosed type.

2. Dynamically and hydraulically balanced.

C. Shaft:

1. Hardened alloy steel.

2. Heavy duty, greaseable ball bearings.

D. Seal:

1. Mechanical type.

2. Ceramic seat, carbon ring, bronze shaft sleeve.

3. Internal flush (chilled water, hot water), external flush (condenser water).

E. Bearing frame assembly:

1. Hardened alloy steel shaft.

2. Heavy duty, greaseable ball bearings.

F. Motor:

1. Refer to Specification Section 23 55 94, *Motors*.

G. Coupling:

1. Flexible type, center dropout arrangement.

2. Guard.

H. Baseplate:

1. Heavy structural steel, open grouting area.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The associated piping system shall be supported independently and precisely aligned with suction and discharge connections.

B. Set unit level on concrete housekeeping pad as detailed, complete piping connections and realign as required.

C. Remove start-up strainer from suction diffuser and attach to pump base.

3.02 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 51 30

CIRCULATING PUMPS, LINE MOUNTED

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install line mounted circulating pumps in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the single stage, close coupled; factory tested, cleaned and painted.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Bell & Gossett or approved equal.

2.02 DESCRIPTION

A. Volute:

1. Cast iron, 175 psig working pressure.

2. Mounting flanges; gauge (suction and discharge), vent and drain tappings.

3. Arranged to permit servicing pump intervals without disturbing adjoining piping.

B. Impeller:

1. Glass filled noryl/PPS.

2. Dynamically and hydraulically balanced.

C. Shaft:

1. Hardened alloy steel.

2. Permanently lubricated ball bearings.

D. Seal:

1. Internally flushed, mechanical type.

2. Carbon/silicon carbide.

E. Motor:

1. Refer to Specification Section 23 55 94, *Motors*.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The associated inlet and outlet piping shall be rigidly supported near the pump and precisely aligned with suction and discharge connections.

END OF SECTION

SECTION 23 51 45

HYDRONIC SYSTEMS ACCESSORIES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install hydronic systems accessories in accordance with the sizes, capacities and locations shown on the drawings.

B. Systems accessories shall include air separators, expansion tanks, pump suction diffusers, relief valves, reducing valves and combination balancing/check/shut-off valves.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Bell & Gossett, Armstrong or approved equal.

2.02 DESCRIPTION

A. Air separators:

1. Tangential type, designed in accordance with the ASME Code for unfired pressure vessels, 125 psig working pressure.

2. Blow-down connection, galvanized steel strainer (with 5 times the free area of adjoining piping).

B. Expansion tanks (Bladder Type):

1. Designed in accordance with the ASME Code for unfired pressure vessels, 125 psig working pressure.

2. System, drain and charging connections.

3. Heavy duty butyl rubber bladder.

4. Lifting rings, floor mounting skirt.

B. Pump suction diffusers:

1. Cast iron body, 175 psig working pressure.

2. Stainless steel diffuser/strainer, full-length stainless steel straightening vanes, bronze start-up strainer.

3. Support foot.

C. Relief valves:

1. Designed in accordance with ASME requirements.

2. Sized in context with the associated system.

D. Reducing valves:

1. Bronze, anti-siphon check valve, cleanable built-in strainer.

E. Combination balancing/check/shutoff valves:

1. Cast iron body, bronze seat, replaceable bronze disc, EDPM seat insert.

2. Brass readout valves (to facilitate differential pressure readings and balancing).

PART 3 – EXECUTION

3.01 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 51 46

HYDRONIC SYSTEMS FLOW METERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install hydronic systems flow meters serving mains and branch mains in accordance with the capacities and locations shown on the drawings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Bell & Gossett, Tour & Anderson or approved equal.

2.02 DESCRIPTION

A. Function:

1. Positive shutoff.
2. Throttling.
3. Temperature and differential pressure measurement.
4. Draining.
5. Filling.

B. Performance:

1. Positioning accuracy: ± 1.0%.
2. Measuring accuracy: ± 10.0%.

C. Features:

1. Low pressure drop, "Y" pattern, globe style.
2. Digital/vernier handwheel, memory stop, anti-tamper lock cap.
3. Easily accessible self-sealing test ports, standard insertion probe compatible.
4. Drain valve with hose end, cap and chain.
5. Preformed polyurethane insulation.

D. Construction:

1. 2 inches and smaller:

a. Bronze body, screwed, 200 psig wog.

2. 2-1/2 inches and larger:

a. Iron body, flanged, brass trim, 125 psig working pressure.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be properly sized within their respective range as scheduled.

END OF SECTION

SECTION 23 51 48

EXPANSION COMPENSATORS AND FLEXIBLE CONNECTORS, HYDRONIC SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install expansion compensators and flexible connectors in accordance with the sizes and locations shown on the drawings.

B. Units shall be arranged to accommodate thermal expansion, eliminate vibration and provide for nominal offset at piping connections to equipment.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Flexonics, Keflex, Mason or approved equal.

2.02 DESCRIPTION

A. General:

1. Suitable for service relative to the temperature and pressure parameters of the associated piping system.

B. Expansion compensators:

1. Multi-ply, stainless steel bellows; telescoping shroud (designed to prevent torsional stress).

C. Flexible connectors:

1. Metal hose:

a. Bronze, close pitch corrugation.

b. Closely braided, high tensile strength, bronze protective cover.

2. Non-metallic:

a. Molded EPDM covers, bias-ply tire cord reinforcing.

b. Steel flanges, galvanized aircraft cable control.

END OF SECTION

SECTION 23 51 66

COILS, HOT GLYCOL

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install hot glycol reheat coils in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be designed for slip flange installation, ARI certified; complete with casing, headers, fins and tubes.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Daikin or approved equal.

2.02 DESCRIPTION

A. General:

1. Proof tested at a working pressure of 300 psig and 200 psig (at 220F), respectively.

2. Capped and plugged for shipment.

B. Casing:

1. Formed heavy gauge galvanized steel, center tube supports (as required to prevent sagging).

C. Headers:

1. Grey cast iron, drain and vent connections.

D. Fins:

1. Die formed aluminum, full collars (for maximum tube contact and precise spacing), mechanical bond.

E. Tubes:

1. 1/2 inch or 5/8 inch OD (in context with a minimum permissible velocity of 1.0 FPS and listed pressure drop parameters), 0.024 inch wall, seamless copper, bronze spring turbulators (as applicable).

END OF SECTION

SECTION 23 51 75

CABINET UNIT HEATERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install cabinet unit heaters in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the fan and coil type; wired in accordance with the National Electrical Code; Underwriters Laboratories listed; complete with chassis, cabinet, front panel, coil, fans, motor, filters and factory applied finish.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Sterling or approved equal.

2.02 DESCRIPTION

A. Chassis:

1. Heavy gauge galvanized steel wraparound structural frame, 18 gauge steel recessing flanges, levelers.

B. Cabinet (wall and floor mounted units):

1. Rigidly reinforced 14 gauge steel, integral stamped top outlet grille, bottom inlet, heavy density foil-faced fibrous glass insulation, tamperproof access doors or panels, levelers.

C. Front panel (vertical and horizontal recessed units):

1. Rigidly reinforced 14 gauge steel, gasketed four-side overlap, integral stamped inlet and outlet grilles, heavy density foil-faced fibrous glass insulation, tamperproof access doors or panels.

D. Coil:

1. Hydronic:

a. Seamless copper tubes, aluminum fins with integral collar spacers, fin-to-tube mechanical bond, supports, 125 psig working pressure.

E. Fans:

1. Double width, forward curved centrifugal type, statically and dynamically balanced, easily removable rigid fan board mounting.

F. Motor:

1. Permanent split capacitor, multiple speed, resilient mounting, integral thermal overload protection.

2. Refer to Specification Section 23 55 95, *Motors*.

G. Filters:

1. 1 inch thick, pleated cotton/polyester blend, two sets.

H. Factory applied finish:

1. Baked enamel, color selected by Architect.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Set units level and plumb in a fashion complementing the associated wall construction and aesthetics.

END OF SECTION

SECTION 23 51 77

CONVECTORS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install convectors in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be complete with chassis/cabinet, coil and factory applied finish.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Sterling or approved equal.

2.02 DESCRIPTION

A. Chassis/cabinet:

1. General:

   a. Heavy gauge galvanized steel structural frame, recessing flanges or levelers (as applicable).

2. Wall mounted:

   a. Rigidly reinforced 14 gauge front and top panels, 16 gauge side panels, bottom inlet, stamped outlet grille.

3. Accessories:

   a. Tamperproof access door, capacity control damper as shown.

B. Coil:

1. Hydronic:

   a. Seamless copper tubes, aluminum fins with integral collar spacers, fin-to-tube mechanical bond, supports, 125 psig working pressure.

C. Factory applied finish:

1. Baked enamel, color selected by Architect/Engineer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Set units level and plumb in a fashion complementing the associated wall construction and aesthetics.

END OF SECTION

SECTION 23 51 79

UNIT HEATERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install unit heaters in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the horizontal and/or vertical projection type; wired in accordance with the National Electrical Code; Underwriters Laboratories listed; complete with enclosure, coil, fan, motor and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Sterling or approved equal.

2.02 DESCRIPTION

A. Enclosure:

1. Heavy gauge zinc coated steel, baked enamel finish.

B. Coils:

1. Hydronic:

a. Seamless copper tubes, aluminum fins with integral collar spacers, fin-to-tube mechanical bond, supports, 125 psig working pressure.

2. Steam:

a. Seamless copper tubes (tube-in-tube distribution), aluminum fins with integral collar spacers, fin-to-tube mechanical bond, supports, 125 psig working pressure.

3. Electric:

a. Nickel/chromium resistance elements, compacted magnesium oxide insulation, finned copper plated steel sheath, baked-on high temperature corrosion resistant finish, over temperature protection (primary automatic reset; secondary manual reset), airflow interlock.

C. Fans:

1. Axial flow, statically and dynamically balanced.

D. Motor:

1. Permanent split capacitor, totally enclosed, permanently lubricated, integral overload protection.

2. Refer to Specification Section 23 55 94, *Motors*.

E. Accessories:

1. Horizontal louver fin diffuser and/or louver cone diffuser.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Position units to assure appropriate clearance.

END OF SECTION

SECTION 23 51 82

PANEL RADIATORS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install convectors in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be complete with mounting brackets, piping connectors, manual air vent, flow setter valve and factory applied finish.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Runtal or approved equal.

2.02 DESCRIPTION

A. Chassis/cabinet:

1. General:

   a. 18 gauge steel, water filled panels with internal baffles.

2. Accessories:

   a. Thermostatic control, temperature sensing flow setter valve head.

B. Factory applied finish:

1. Gloss powder coat, color selected by Architect.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Set units level and plumb in a fashion complementing the associated wall construction and aesthetics.

END OF SECTION

SECTION 23 52 46

GAS PRESSURE REGULATORS

PART 1 – GENERAL

1.01 REQUIRMENTS

A. Furnish and install gas pressure regulators in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the direct acting type; conform with ANSI standard Z21.80/CSA6.22; complete with housing, diaphragm, stem, interchangeable range spring, integral sensing port and vent connection.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Maxitrol or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Adjust or change the range of the spring to maintain the required downstream pressure.

B. Extend vent connection, full size to atmosphere.

END OF SECTION

SECTION 23 52 69

HUMIDIFIERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install humidifiers in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the adiabatic, cascading evaporative, reflow type; factory assembled, tested, piped and wired (in accordance with the National Electrical Code), Underwriters Laboratories listed, shipped as a package (except for field piping and wiring), complete with evaporative media, nozzle grid, hydraulic assembly, electrical components, accessories, operating controls and water treatment.

1.02 WARRANTY

A. System shall be complete with an overall parts and labor warranty extending two years from the Owner's acceptance.

B. Service work shall be executed by factory trained personnel.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Condair or approved equal.

2.02 DESCRIPTION

A. Evaporative media:

1. Porous ceramic.

2. Individual removable tiles.

B. Nozzle grid:

1. 316 stainless-steel, adjustable spray, low-pressure nozzles.

2. Preassembled nozzle grid, color coded for solenoid valve connections.

C. Hydraulic Assembly:

1. Corrosion resistant, circulating pump with variable frequency drive.

2. Silver ion cartridge.

2. EPDM hoses, distribution manifold.

3. Valves:

    a. Pressure regulating.

    b. Staging.

    c. Balancing.

    d. Float.

4. Drain, overflow connection.

D. Electrical components:

1. Contactors, switches, relays, transformers.

2. Complete overload protection.

E. Accessories:

1. UV treatment.

2. Conductivity monitoring.

3. Air proving switch.

F. Operating controls:

1. General:

    a. Microprocessor based.

    b. LCD touch screen display.

    c. Building management system compatible.

2. Provisions:

    a. Building management system interface (refer to Specification 23 55 70, *Automatic Temperature Controls*).

    b. Capacity control.

    c. Filling cycle.

    d. Self-maintenance cycles:

        1) Flushing.

        2) Drain.

        3) Drying.

G. Water treatment:

1. General:

    a. System capacity shall meet or exceed the associated humidifier capacity as scheduled (450 lbm/hr, or approximately 1 gpm).

    b. System shall remove any water impurities prior to adiabatic evaporation.

2. Components:

    a. 5-micron prefilter.

    b. Activated carbon filter:

        1) High-capacity black granular carbon.

        2) High density, large surface area, rugged grain structure.

        3) Fiberglass wrapping reinforced, NSF approved, polyethylene tank.

    c. Water softener:

        1) Ion exchange type.

        2) High-capacity cation exchange resin.

        3) Automatic regeneration.

        4) Dual alternating arrangement for continuous use.

        5) Self-adjusting backwash flow control valve.

    d. Brine storage tank:

        1) High density polyethylene.

    e. Reverse osmosis skid assembly complete with:

        1) Reverse osmosis membrane(s).

        2) Reverse osmosis pump(s).

        3) Stainless steel reinforced, NSF compliant, interconnecting hoses.

        4) Powder coated steel frame.

        5) Control Panel.

    f. Storage tank:

        1) 0.2 micron inlet filter.

        2) Black and opaque, allowing no light through (restricts bacteria growth).

    g. Ultraviolet disinfection system.

h. Distribution pump.

2. Operating controls:

a. Microprocessor type.

b. BMS compatible.

c. Automatic disinfection, cleaning, and equipment flushing cycles.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Electrical wiring:

1. It is the intent of this specification that all electrical wiring required to accomplish the unit control shall be the responsibility of this Contractor and that it shall be installed in strict accordance with the National Electrical Code.

2. Wiring shall be installed in dedicated electrical metallic tubing with set-screw and compression type couplings and connectors for interior dry locations and interior wet locations or exterior locations, respectively.

3.02 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 52 86

GLYCOL SOLUTION, MAKE-UP SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install glycol solution make-up systems in accordance with the sizes and locations shown on the drawings.

B. Systems shall be arranged to facilitate initial fill and maintain operating pressure of the associated hydronic systems complete with tank, stand, pump and operating controls.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Wessels or approved equal.

2.02 DESCRIPTION

A. Tank:

1. Self-supporting, translucent, 1/4 inch thick, high density polyethylene.

2. Hinged cover.

B. Stand:

1. Floor mounted, heavy duty, corrosion resistant coated steel.

C. Pump:

1. Type:

a. Base mounted (below tank), close-coupled, vertical split case, gear type.

b. Integral relief valve.

1. Basic construction:

a. Ductile iron housing, bronze bearings.

2. Motor:

a. Horizontal, solid shaft, open drip-proof, permanently lubricated ball bearings.

3. Seals:

a. Mechanical type, self-flushing, carbon seal, ceramic seat.

c. Operating controls:

1. Panel mounted, NEMA 1 enclosure.

2. Motor starter, adjustable pressure operating switch, low level cutout switch.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Adjust operating pressure switch to complement the associated piping system(s) air control parameters.

3.02 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 53 00

GENERAL PROVISIONS, AIR DISTRIBUTION SYSTEMS

PART 1 – GENERAL

1.01 STANDARDS

A. Systems shall comply with the applicable standards set forth in the following references:

1. *HVAC Duct Construction Standards, Metal and Flexible* as published by the Sheet Metal and Air Conditioning Contractors' National Association, Inc., 8224 Old Courthouse Road, Tysons Corner, Vienna, VA 22180.

2. *NFPA Standard 90A* in this specification shall mean the *Standard for the Installation of Air Conditioning and Ventilating Systems*, as published by the National Fire Protection Association, 60 Batterymarch Street, Boston, MA 02110.

3. *NFPA Standard 96* in this specification shall mean the *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, as published by the National Fire Protection Association, 60 Batterymarch Street, Boston, MA 02110.

4. *ASHRAE Standard 62, Ventilation For Acceptable Indoor Air Quality*, as published by the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., 1791 Tullie Circle NE, Atlanta, GA 30329.

1.02 OPTIONS

A. Whenever these specifications describe more than one system under a particular classification, it is the intent that this Contractor may exercise his option (in consistent fashion) in accordance with the same unless otherwise specifically shown on the drawings.

1.03 FABRICATION DRAWINGS

A. Prior to installation, submit fabrication drawings to the Engineer for approval, conforming with the following:

1. Drawings (1/4 inch scale, minimum) shall illustrate each air distribution system in context with ALL parameters contained in the contract documents (type, applicable standard, layout, arrangement, materials, etc.).

2. Drawings shall include those portions of other work (architectural features, structural members, piping, conduit, etc.) necessary to insure a coordinated installation.

B. Upon request, the Engineer will provide building background electronic files.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. Ductwork shall be installed substantially as shown on the drawings, as high as possible, parallel to building walls (except where shown otherwise), clear of structural members (except where penetrations are shown or approved), clear of equipment removal areas and coordinated with other trades to avoid interferences.

2. Ductwork shall be adjusted to conform with field conditions as required, provided such adjustments are approved by the Contracting Officer.

3. Clean ductwork prior to installation and cover openings with plastic or metal caps to prevent the entry of dirt and/or debris.

4. Cover supply air diffusers with cheesecloth prior to operating the associated systems' fans wherever directed by the Contracting Officer.

5. Attach a 24 inch long, red plastic ribbon (location indicator) to volume damper operators.

B. Penetrations:

1. Neatly seal (safe-off) openings (complete with sleeves, as required) wherever ductwork penetrates walls, floors and partitions (preserving fire and/or smoke separation integrity as applicable).

2. Seal "approved" duct penetrations made by other trades (conduit, piping, structural steel, etc.).

C. Moisture conditions:

1. Low points of ductwork serving as fresh air intakes, humidification sections, coil banks, vertical connections through roofs, fume exhaust hoods and other applications where condensation may occur shall be made water-tight by soldering, brazing or welding joints and seams with materials compatible with the associated duct material and sloped up 1 inch (minimum) to adjoining non water-tight sections.

3.02 CORROSION PROTECTION

A. Furnish and install neoprene gaskets at the junction of ductwork constructed of dissimilar metals.

3.03 TESTING AND BALANCING ASSISTANCE

A. Review completed systems with testing and balancing agency representatives and relate variations in the actual installation from the drawings and specifications.

B. Place all dampers (volume, fire and smoke) in their full-open position.

END OF SECTION

SECTION 23 53 01

AIR DISTRIBUTION SYSTEMS, LOW PRESSURE, LOW VELOCITY, SHEET METAL

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete low pressure, low velocity, sheet metal air distribution systems in accordance with the sizes, locations and arrangements (type of fittings, take-offs, transitions, etc.) shown on the drawings.

1.02 CLASSIFICATION

A. Systems shall provide for 2 inches wg static pressure.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Basic duct construction:

1. Material, construction, reinforcement, attachments, sealing, etc. shall conform with Sections I and III of the *HVAC Duct Construction Standards, Metal and Flexible*.

2. Unless otherwise shown or specified, systems shall be galvanized steel.

B. Fittings and accessories:

1. Elbows, vanes, vane support, parallel flow branches, branch connections, offsets, transitions, obstructions, access doors, volume dampers, flexible connections, etc. shall conform with Section II and III of the *HVAC Duct Construction Standards, Metal and Flexible*.

C. Joining systems:

1. Less than 24 inches (shop fabricated system):

   a. Drive slips, joints, slips, seams, locks, caps, reinforcing, gaskets, sealant, etc. shall conform with Section I and III of the *HVAC Duct Construction Standards, Metal and Flexible*.

2. 24 inches and greater (prefabricated, manufactured system):

   a. Flanges, corners, cleats, latches, gaskets, fasteners, sealant.

   b. Mez-flange, Nexus.

3. Dust collection systems:

   a. Bolted, sleeve type.

b. Ductmate.

D. Kitchen hood (grease) exhaust duct:

1. Material, construction, openings, installation, termination, etc. shall conform with NFPA Standard 96.

2. Concealed and exposed portions shall be carbon steel and stainless steel, respectively.

E. Kitchen hood (condensation) and dishwasher exhaust duct:

1. Welded, 18 gauge, 304 stainless steel.

F. Hangers and supports:

1. Attachments, hangers, supports, etc. shall conform with Section IV of the *HVAC Duct Construction Standards, Metal and Flexible*.

G. Built-up central station air handling equipment casings:

1. Material, construction, reinforcement, appurtenances (close-off sheets, base angles, coil support stands, drain pans, access doors), etc. shall conform with Section VI (standing seam type) of the *HVAC Duct Construction Standards, Metal and Flexible*.

H. Flexible connections:

1. Units (unless otherwise specified) shall be constructed of heavy canvas or neoprene impregnated fabric.

2. Units for connection to kitchen exhaust ducts (or other ducts operating at temperatures in excess of 100F) shall be constructed of heavy woven cloth or neoprene coated glass fabric weighing 30 ounces per square yard.

3. Units exposed to the elements shall be constructed of neoprene coated glass fabric weighing 30 ounces per square yard.

I. Duct Sealer:

1. Rolled sealant:

a. 15 mil, 100% solids, elastomeric modified butyl.

b. 2 mil aluminum foil finish.

c. Hardcast 1402/181, Underwriters Laboratories listed.

2. Sealant:

a. Heavy textured, water based, polyester/synthetic resin base.

b. Hardcast 102/181, Underwriters Laboratories listed.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide access doors at branch trunk duct volume dampers, automatic control dampers, coils, humidifier distribution manifolds, smoke detectors, smoke and fire dampers, air monitoring devices, filters and other system components that require access.

B. Carefully apply duct sealer to ensure airtight joints and seams.

3.02 APPLICATION

A. The following systems shall be categorized as low pressure, low velocity, sheet metal air distribution systems:

1. HVACU – WELD.
2. HVACU – HVAC.
3. HVACU – MACHCNC.
4. HVACU – CIVIL.
5. HVACU – MAT.
6. HVACU - ELEC.
7. HVACU – CONTROLS.
8. HVACU – CLASS.
9. HVACU – NHEAD.
10. HVU – BOILER.

END OF SECTION

SECTION 23 53 03

AIR DISTRIBUTION SYSTEMS, HIGH VELOCITY, MEDIUM PRESSURE, SHEET METAL

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete high velocity, medium pressure, sheet metal air distribution systems in accordance with the sizes, capacities and locations shown on the drawings.

B. Systems shall provide for static pressures greater than two (2) inches wg but less than six (6) inches wg and velocities greater than 2000 fpm.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Ductwork, round:

1. Construction:

   a. Units shall be constructed of (galvanized steel, stainless steel, black iron) in accordance with Tables 3-1 through 3-13, Figures 3-1 through 3-3, and Figure 3-8 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition*.

2. Hangers and supporting systems:

   a. Units shall be in accordance with Figures 5-1 through 5-13, Figures 3-10 and 3-13 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition*.

3. Elbows:

   a. Units shall be in accordance with Table 3-1 and Figure 3-4 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition.*

4. Fittings:

   a. Units shall be in accordance with Figures 3-5 through 3-7 and Figure 3-9 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition* and shall be of the (combination, straight, conical type).

5. Sealants:

   a. Units shall be used in accordance with the recommendations in Chapter 1.4 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition*.

B. Ductwork, rectangular:

1. Construction:

a. Units shall be constructed of (galvanized steel, stainless steel, black iron) in accordance with Tables 2-1 through 2-52 of *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition*.

2. Hangers and supporting systems:

a. Units shall be in accordance with Figures 5-1 through 5-10 and Figures 5-12 through 5-16 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition*.

3. Elbows, radius:

a. Units shall be in accordance with Figures 4-1 through 4-5, 4-10, and Chart 4-1 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition*.

4. Fittings:

a. Units shall be in accordance with Figures 4-6 through 4-9 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition*.

5. Sealants:

a. Units shall be used in accordance with the recommendations in Chapter 1.4 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition*.

C. Access doors, ductwork:

1. Units shall be the hinged type, insulated or non-insulated (in accordance with the associated ductwork system), fabricated in accordance with Figures 7-2 and 7-3 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition Standards* and LOCATED AT THE UPSTREAM SIDE OF DUCT MOUNTED VOLUME DAMPERS, AUTOMATIC CONTROL DAMPERS, COILS, SMOKE DETECTORS, SMOKE AND FIRE DAMPERS, AIR MONITORING DEVICES, FILTERS AND ALL OTHER EQUIPMENT THAT REQUIRES ACCESS.

D. Dampers, volume (manual):

1. Units shall be in accordance with Chapter 7, *Volume Dampers*, and Figures 7-4 and 7-5, of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition* and the locations shown on the drawings.

E. Flexible connections:

1. Units (unless otherwise specified) shall be constructed of heavy canvas or neoprene impregnated fabric.

2. Units exposed to the elements shall be constructed of neoprene coated glass fabric weight 30 ounces per square yard, minimum.

PART 3 – EXECUTION

3.01 TEST

A. Test system in accordance with Chapter 11 of the *SMACNA HVAC Duct Construction Standards – Metal and Flexible, 4th edition*.

3.02 APPLICATION

A. The following systems shall be categorized as high velocity, medium pressure, sheet metal air distribution systems:

1. MUAU – WELD.

2. MUAU – CHEM.

3. Welding/Grinding Station Exhaust (CNC lab, Welding lab, and HVAC lab).

4. Chemistry Lab Exhaust.

END OF SECTION

SECTION 23 53 04

AIR DISTRIBUTION SYSTEMS, THERMAL ACOUSTICAL LINING

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install air distribution systems, thermal acoustical lining in accordance with the locations shown and/or noted on the drawings and herein specified.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Johns Manville Linacoustic RC or approved equal.

2.02 DESCRIPTION

A. Material:

1. General:

a. Thermosetting resin bonded, fibrous glass.

b. Edge coated, mat faced.

c. Non-corrosive, anti-microbial.

d. Maximum flame and smoke index of 25 and 50 respectively.

2. Specific:

a. Distribution ductwork:

1) Flexible, 1-1/2 inch thick, 1-1/2 lbm/cu ft.

b. Plenums and distribution ductwork within 30 feet of supply and/or return exhaust central station air handling fans:

1) Rigid, 2 inches thick, 3 lbm/cu ft.

B. Properties:

1. Thermal conductivity:

a. 0.16 Btuh/sq ft/F/in at 75F.

2. Air friction coefficient:

a. 1.25 at 700 fpm based upon an absolute roughness (e) of 0.0022 ft and applied to the ASHRAE chart *Friction of Air in Straight Ducts of Galvanized Sheet Metal*.

3. Sound absorption coefficient:

a. Greater than or equal to 0.85 NRC or 0.1, 0.47, 0.85, 1.01, 1.02 and 0.99 at 125, 250, 500, 1000, 2000 and 4000 hertz, respectively, when tested in accordance with the requirements of ASTM C423.

C. Duct insulation fasteners:

1. Weld secured type installed in accordance with all necessary provisions to avoid damaging the ductwork; capable of supporting an axial load of 40 lbs, sized in accordance with the thickness of the associated insulation, complete with nylon speed washer designed to secure the insulation firmly in place without excessive compression.

2. Duro-Dyne stop clips and spotter pins.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. Unit surface designed for exposure shall face the air stream.

2. Units shall be applied with 100% adhesive coverage.

3. Units shall be firmly held in place with duct insulation fasteners spaced in accordance with the above mentioned reference.

4. The associated inside dimensions shall be the nominal sizes shown on the drawings.

5. Prior to installation, submit a 24 inches x 24 inches x 36 inches long section, complete with midway transverse joint, for approval.

B. Joints:

1. Transverse joints shall be neatly butted with no interruption or gaps,

2. Longitudinal corner joints shall be neatly lapped and compressed.

3. Joints in the associated sheet metal ductwork shall be sealed to provide an unbroken vapor barrier.

3.02 APPLICATION

A. Unless otherwise shown and/or noted on the drawings, the following portions of the specified air distribution systems shall be complete with thermal acoustical lining:

1. Transfer air ductwork.

2. Ductwork serving gravity relief ventilators.

3. Concealed or exposed supply air, return air and exhaust air ductwork requiring acoustical treatment as shown and/or noted on the drawings.

END OF SECTION

SECTION 23 53 06

FLEXIBLE DUCTWORK

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install flexible ductwork branches in accordance with the sizes and locations shown on the drawings.

B. Units shall be the insulated type; conform with UL Standard 181 as Class I Air Duct and NFPA Standards 90A and 90B; Underwriters Laboratories listed; complete with wire, core, insulation, vapor barrier and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Atco, Thermaflex or approved equal.

2.02 DESCRIPTION

A. Wire:

1. Coated heavy gauge steel, helixacle shape.

2. Permanently bonded to core.

B. Core:

1. Woven, coated fibrous glass.

2. Airtight seal.

C. Insulation:

1. Fibrous glass, 1.0 lbm/ft^3.

D. Vapor barrier:

1. Fibrous glass reinforced, metalized film laminate.

E. Accessories:

1. Stainless steel bands, support saddles.

2.03 PERFORMANCE

A. Working pressure:

1. 10.0 inch wg, positive; 2.0 inch wg, negative.

B. Thermal conductance:

1. 0.25 Btuh/ft^2-F at 75F mean temperature.

C. Surface burning characteristics:

1. Flame spread, 25; smoke developed, 50.

D. Vapor transmission:

1. 0.10 perm.

E. Air friction:

1. 0.10 inch wg/100 ft (12 inch diameter at 600 fpm).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Route units in a direct fashion properly supported and joined to adjoining sheet metal ductwork, diffusers and grilles (avoiding tight radius changes in direction).

B. Unless otherwise shown or noted, individual lengths shall not exceed 6 feet.

END OF SECTION

SECTION 23 53 20

FIRE DAMPERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install fire dampers in accordance with the sizes and locations shown on the drawings.

B. Units shall be the dynamic curtain type; conform with NFPA and Underwriters Laboratories Standards 90A and 555, respectively; complete with frame, blades, closure springs, fusible link and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Air Balance, Prefco, Ruskin or approved equal.

2.02 DESCRIPTION

A. Rating classification:

1. 1-1/2 hour (fire partitions less than 3 hours).

B. Frame:

1. 16 gauge galvanized steel.

C. Blades:

1. 24 gauge galvanized steel, arranged to stack outside the airstream defined by the associated ductwork dimensions.

D. Closure springs:

1. 301 stainless steel, constant force type.

E. Fusible link:

1. 165F (unless otherwise noted).

F. Accessories:

1. Galvanized steel sleeve (constructed in accordance with the *HVAC Duct Construction Standards, Metal and Flexible* as published by the Sheet Metal and Air Conditioning Contractor's National Association, Inc., factory or field fabricated).

2. Sleeve mounting angles.

3. Breakaway connection (factory or field fabricated, arranged to ensure unit stability).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be installed in accordance with the *Fire Damper and Heat Stop Guide for Air Handling Systems* as published by the Sheet Metal and Air Conditioning Contractor's National Association, Inc.

B. Access for units serving ductwork with a nominal dimension of 12 inches and smaller shall be accommodated by a removable (flanged, gasketed) ductwork section in lieu of access door.

C. Access points shall be visibly labeled.

END OF SECTION

SECTION 23 53 30

CENTRAL STATION AIR HANDLING UNITS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install central station heating, ventilating and air conditioning units in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the factory fabricated, modular, central station type; designed and constructed for in complete with the appropriate components (as shown on the drawings) including casing, fan sections, coil sections, humidifier section, filter sections, access sections, dampers and accessories and operating controls.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Daikin or approved equal.

2.02 DESCRIPTION

A. Casing:

1. Structural steel frame; removable, insulated, 2” thick, solid double-wall, 20 gauge galvanized steel panels, perforated supply fan casing interior wall.

2. Closed-cell, foam gasketing (panels and module junctures).

3. Removable, hinged (two-step, safety handles), full size, double-wall access doors (each section).

4. 10 gauge galvanized steel base rails.

5. Insulated, double-wall, galvanized steel drain pan (extending under coil and fan sections, pitched, drain connections one side).

6. Unit mounted motor starter or adjustable frequency controller (as applicable), factory wired to motor terminals.

B. Fan section:

1. AMCA certified, wheel characteristics (DWDI, SWSI, FC, BI, AF) as scheduled, statically and dynamically balanced, shaft rpm less than 75% of its first critical speed.

2. Self-aligning, anti-friction, pillow block bearings (200,000 hours), extended grease fittings.

3. Internally spring isolated fan and motor assembly.

4. Premium efficiency motor, (refer to Specification Section 23 55 94, *Motors*).

5. Direct drive, 1.5 service factor.

C. Coil section:

1. General:

a. Certification:

1) AHRI.

b. Testing:

1) 150% of working pressure.

c. Arrangement:

1) Removable through casing sides or top, capped and plugged for shipment.

d. Casings:

1) Formed heavy gauge galvanized steel, end and center supports.

e. Headers:

1) Grey cast iron, drain (each row) and vent connections.

f. Fins:

1) Die formed aluminum, full collars (for maximum tube contact and precise spacing), mechanical bond.

2. Hydronic:

a. 1/2” OD or 5/8” OD (in context with a minimum permissible velocity of 1.0 FPS and listed pressure drop parameters), 0.025” wall, seamless copper tubes; bronze spring turbulators.

b. Counterflow, drainable, 200 psig working pressure.

D. Humidifier section:

1. General:

a. Adiabatic type.

b. EPDM hoses, distribution manifold.

2. Casing:

a. Stainless steel.

E. Filter section:

1. General:

a. Parameters and type as scheduled.

b. One spare set.

2. Final filter:

a. Cartridge type:

1) Media:

a) Non-combustible, waterproof, continuous sheet, microglass.

b) Pleated configuration; radi-edge, corrugated aluminum separators (support).

2) Casing:

a) 28 gauge galvanized steel.

b) Non-toxic adhesive, media bond.

3. Housing:

a. Flanged, weather resistant, 16 gauge galvanized steel.

b. Dual, gasketed access doors.

c. Adjustable mounting tracks.

d. Gasketed holding frames, multiple fasteners.

e. Static pressure taps.

4. Accessories:

a. Magnehelic pressure gauge, pre-filter/final filter selector.

F. Dampers:

1. Low leakage, airfoil design dampers (parallel blade mixing, opposed blade face and bypass); compressible metal jamb seals, extruded vinyl edge seals, stainless steel sleeve bearings.

2. Jackshaft driven, mechanically linked.

G. Accessories (as shown and/or noted on the drawings):

1. Marine light (each section; single point wiring connection).

2. Access/inspection sections.

3. Air blender.

4. Discharge plenum.

5. Moisture eliminators.

6. Airfoil plenum fan inlet attenuator.

PART 3 – EXECUTION

3.01 DRIVE MODIFICATION

A. Subsequent to system balancing, each central station air handling system (supply and return fans) shall be fitted with fixed sheaves (sized to provide the required air flow rate).

3.02 INSTALLATION

A. Electrical wiring:

1. It is the intent of this specification that all electrical wiring required to accomplish the temperature control sequences herein specified shall be the responsibility of this Contractor and that it shall be installed in strict accordance with the National Electrical code.

2. All wiring associated with DDC components shall be twisted, low voltage, shielded (as required), plenum cable.

3. All exposed wiring shall be installed in dedicated electrical metallic tubing with set screw and compression type couplings and connectors for interior dry locations and interior wet locations or exterior locations, respectively.

3.03 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 53 70

POWER ROOF VENTILATORS, CENTRIFUGAL

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install centrifugal power roof ventilators in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be AMCA certified; wired in accordance with the National Electrical Code; Underwriters Laboratories listed; complete with housing, fan, motor/drive compartment, motor support assembly, motor, drive and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Loren Cook or approved equal.

2.02 DESCRIPTION

A. Housing:

1. Heavy gauge aluminum.

2. Support structure, fan plate, windband, curb cap, drain opening.

3. Welded, heavy gauge, galvanized steel birdscreen.

B. Fan:

1. Centrifugal, airfoil blades, spun venturi inlet.

2. Statically and dynamically balanced.

C. Motor/drive compartment:

1. Heavy gauge aluminum, removable.

2. Exhaust airstream isolated, ventilation louvers.

D. Motor support assembly:

1. Heavy gauge galvanized steel.

2. Vibration isolators.

E. Motor/Drive:

1. ½ horsepower and less:

a. Motor:

1) Single phase, premium efficiency.

2) Open drip proof (unless otherwise scheduled and/or noted).

3) Overload protection.

4) Electronically commutated (0-10V).

5) Speed Controller.

b. Drive:

1) Direct.

2. Greater than ½ Horsepower:

a. Motor:

1) Polyphase, premium efficiency.

2) Open drip proof (unless otherwise scheduled and/or noted).

b. Drive:

1) 1.5 service factor.

2) Variable pitch, cast iron sheaves.

3) Oil-resistant, non-static belts.

4) Ground, polished, corrosion resistant finished shaft.

5) Permanently lubricated, pillowblock ball bearings (200,000 hours).

F. Accessories:

1. Roof curb:

a. Insulated, 12" high, welded aluminum.

b. Wood nailer, aluminum liner, damper shelf, gasket, cant (raised where required).

2. Damper:

a. Heavy duty frame.

b. Felt edged aluminum blades.

c. Motor operator as scheduled, control transformer as required, wiring in liquid-tight flexible metal conduit.

3. Anti-condensation undercoating.

4. Disconnect switch.

5. Corrosion resistant coating as scheduled.

PART 3 – EXECUTION

3.01 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 53 82

LABORATORY EXHAUST FANS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install laboratory exhaust fans in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be AMCA certified; wired in accordance with the National Electrical Code; Underwriters Laboratories listed; complete with fans, mixing plenum, motor/drive, and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Strobic Air or approved equal.

2.02 DESCRIPTION

A. Fans:

1. Mixed flow induced dilution high plume.
2. Combination axial/backward curved blades.
3. Welded steel blade construction.
4. Statically and dynamically balanced.
5. Seismic rated vibration isolators.
6. Modular construction, field assembled.

B. Mixing plenum:

1. Continuously welded, heavy gauge steel.
2. Chemical resistant gaskets.
3. 316 stainless steel fasteners.
4. Hinged access doors.
5. Welded, heavy gauge, galvanized steel birdscreen at fan inlets.

B. Motor/drive compartment:

1. Heavy gauge aluminum, removable.

2. Exhaust airstream isolated, ventilation louvers.

C. Motor support assembly:

1. Heavy gauge galvanized steel.

2. Vibration isolators.

D. Motor/Drive:

1. Motor:

a. Polyphase, premium efficiency.

b. Open drip proof (unless otherwise scheduled and/or noted).

2. Drive:

a. Direct.

b. Permanently lubricated, pillowblock ball bearings (200,000 hours).

E. Accessories:

1. Roof curb:

a. Insulated, 18”, 14-gauge galvanized steel.

b. Wood nailer, aluminum liner, damper shelf, gasket, cant (raised where required).

2. Bypass dampers:

a. Heavy duty frame.

b. Felt edged aluminum blades.

c. Adjustable counterbalance spring, as scheduled.

d. Motor operator as scheduled, control transformer as required, wiring in liquidtight flexible metal conduit.

e. Complete with rain hood.

3. Fan insolation dampers:

a. Heavy duty frame.

b. Felt edged aluminum blades.

c. Adjustable counterbalance spring, as scheduled.

d. Motor operator as scheduled, control transformer as required, wiring in liquidtight flexible metal conduit.

4. Painting:

   a. All surfaces shall be coated with a chemical and UV resistant epoxy exceeding 7000 hour ASTM B117 Salt Spray Resistance.

   b. Gray.

5. Disconnect switch.

PART 3 – EXECUTION

3.01 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 53 85

UTILITY FAN SETS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install utility fan sets in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the centrifugal type, AMCA certified; complete with housing, wheel, motor, drive and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Loren Cook, or approved equal.

2.02 DESCRIPTION

A. Housing:

1. Reinforced heavy gauge steel, corrosion resistant baked enamel finish.

2. Extended inlet collars, aerodynamically spun inlet cones, precisely positioned cutoffs.

3. Convertible (8 standard discharge positions), motor/bearing pedestal.

B. Wheel:

1. Heavy gauge steel, SWSI, blade characteristics as scheduled.

2. Statically and dynamically balanced.

C. Motor:

1. Adjustable base.

2. Premium efficiency.

D. Drive:

1. 1.5 service factor.

2. Variable pitch, cast iron sheaves.

3. Oil-resistant, non-static belts.

4. Ground, polished, corrosion resistant finished shaft.

5. Permanently lubricated, pillowblock ball bearings (200,000 hours).

E. Accessories:

1. Weather hood (exterior application).

2. Access doors, vibration isolation.

3. Inlet or outlet guard (free inlet or outlet condition), belt guard, flanged outlet (ducted condition).

4. Damper (except kitchen exhaust hood application):

a. Heavy duty frame.

b. Felt edged aluminum blades.

c. Adjustable counterbalance spring.

d. Motor operator as scheduled, control transformer as required, wiring in liquidtight flexible metal conduit.

5. Herisite coating as scheduled.

PART 3 – EXECUTION

3.01 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 54 00

DIFFUSERS AND GRILLES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install diffusers and grilles in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be capable of meeting all air distribution parameters shown on the drawings and as hereinafter specified.

1.02 SUBMITTALS

A. Submittals shall include a spread sheet (designating each item by alphanumerical tag, room name and number) listing a description (LS, LR, LC, LI, LB, SW, DR, PP, etc.; material, finish accessories) and all pertinent parameters shown on the drawings (airflow, throw/direction/terminal velocity, pressure drop, sound rating, etc.).

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Price or approved equal.

2.02 DESCRIPTION

A. Diffuser (louvered, square), D-1, D-2:

1. Designed to minimize smudging, alternative (1-way, 2-way opposite, 2-way corner, 3-way, 4-way) directional pattern as shown, fully adjustable pattern (capable of changing the air diffusion pattern from 360 degrees horizontal to vertical without removing core).

2. Round, square or rectangular neck as shown (square-to-round transition adaptor as scheduled).

3. Removable center core (permitting easy access to accessories), duct mounting rings, adjustable equalizing device (suitable for straightening and proportioning air distribution within the diffuser).

4. Opposed blade volume control (where indicated on the drawings), air turning devices (suitable for mounting in the duct collar), blankoff baffles (as applicable and required to provide air direction patterns shown on the drawings).

5. Tight fitting margins for optimum ceiling appearance.

B. Diffuser (linear, slot type, continuous), D-3:

1. Slot size and number as noted, positive positioning, adjustable pattern deflectors (180 degrees horizontal, down pattern horizontal/vertical combination, constant static pressure, constant outlet area, coated dull black).

2. Mounting frames (as required) with positive holding concealed fasteners, interlocking splines (ensuring hairline joints with continuous diffuser sections).

3. Opposed blade volume control (arranged to permit exterior adjustment and provide blankoff capability for unused sections).

C. Diffuser (louvered, round), D-4, D-5:

1. Designed to minimize smudging, fully adjustable pattern (capable of changing the air diffusion pattern from 360 degrees horizontal to vertical without removing core).

2. Removable center core (permitting easy access to accessories), duct mounting rings, adjustable equalizing device (suitable for straightening and proportioning air distribution within the diffuser).

3. Opposed blade volume control (where indicated on the drawings), air turning devices (suitable for mounting in the duct collar), blankoff baffles (as required to provide air direction patterns shown on the drawings).

4. Tight fitting margins for optimum ceiling appearance.

D. Diffuser (sidewall), D-6, D-7, D-8:

1. Double deflection arrangement, blade deflection as noted.

2. Opposed blade volume control (where indicated on the drawings), air turning devices, gasket.

E. Grille (perforated panel, square or rectangular), G-1, G-2:

1. Perforated face panel, compatible with duct or plenum type return air system as shown.

2. Black painted rear panel surface (side visible through face panel).

3. Opposed blade volume control (where indicated on the drawings).

F. Grille (sidewall), G-3, G-4, G-5:

1. Blade deflection as noted.

2. Opposed blade volume control (where indicated on the drawings).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Units shall be complete with design features and all necessary accessories required for coordinated installation (i.e. suitable for installation in exposed grid, concealed spline, plaster, metal pan, etc. as applicable).

3.02 PERFORMANCE

A. Units shall diffuse air uniformly throughout the conditioned space (based upon a 20F temperature differential between the average room and supply air temperatures) with velocities in the occupied zone (5 feet above the floor and no closer then 6 feet from a wall) less than or equal to 30, 50 and 75 fpm at temperature differentials (between room and supply air temperature) less than or equal to 2, 1.5 and 1 degree F, respectively.

END OF SECTION

SECTION 23 54 11

VARIABLE AIR VOLUME TERMINALS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install variable air volume terminals in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be factory fabricated, pressure independent type; complete with cabinet, airflow controlled device, hot water heating coil, accessories and operating control components.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Enviro-Tec or approved equal.

2.02 DESCRIPTION

A. Casings:

1. Insulated (1/2” thick, 1-1/2 lbm density, fibrous glass, foil-faced lining), 22 gauge galvanized steel.

2. Inlet collar, flanged discharge connection, access door.

B. Air controlled device:

1. 16 gauge galvanized steel multiple blade damper/frame, 90º travel (to assure uniform airflow throughout capacity range), open cell foam seals.

2. Steel linkages, nylon self-lubricating bearings.

C. Hot water heating coil:

1. General:

a. Proof tested at and a working pressure of 300 psig and 200 psig (at 220F), respectively.

b. Capped and plugged for shipment.

2. Casing:

a. Formed heavy gauge galvanized steel, center tube supports (as required to prevent sagging).

3. Headers:

a. Grey cast iron, drain and vent connections.

4. Fins:

a. Die formed aluminum, full collars (for maximum tube contact and precise spacing), mechanical bond.

5. Tubes:

a. 1/2” OD or 5/8” OD (in context with a minimum permissible velocity of 1.0 FPS and listed pressure drop parameters), 0.024” wall, seamless copper, bronze spring turbulators (as applicable).

D. Operating control components:

1. Suitable for control system interface (refer to Automatic Temperature Controls, Specification Section 23 55 70), factory mounted and wired.

2. Airflow sensor, control transformer, damper actuator, control terminal strip.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Support units securely from building structure complete with secondary framing.

B. Position units to facilitate maintenance.

END OF SECTION

SECTION 23 54 30

LOUVERS, STATIONARY

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install louvers in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the stationary weather resistant type, AMCA certified (air performance and water penetration), complete with frame, blades, concealed mullions, bird screen, factory applied finish and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Louvers and Dampers or approved equal.

2.02 DESCRIPTION

A. Frame/blades:

1. Extruded aluminum, 0.080” thick.

2. Integral downspouts/gutters.

B. Bird screen:

1. Expanded aluminum, 1/2” mesh, removable.

C. Water penetration:

1. Less than 0.005 ounces per square foot of face area (15-minute duration).

D. Finish:

1. As scheduled.

E. Options and accessories:

1. Flanges, sill extensions, clip angles, caulking, etc.

PART 3 – EXECUTION

3.01 INSTALLATION

A. As detailed.

B. Arrange ductwork connection to include a transition section pitching down to louver.

END OF SECTION

SECTION 23 54 40

EXHAUST AND INTAKE VENTILATORS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install exhaust and intake ventilators in accordance with the sizes, capacities and locations shown on the drawings.

B. Units shall be the low silhouette type; wind tunnel tested; complete with housing and accessories

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Loren Cook or approved equal.

2.02 DESCRIPTION

A. Housing:

1. General:

   a. Welded corner and internal support bracing.

   b. Caulked welded seams.

   c. Extended discharge/intake chamber.

   d. Hinged.

2. Construction:

   a. Roof:

      1) 0.081” aluminum.

      2) Cross broken, chamfered ends.

   b. Throat:

      1) 0.081” aluminum.

      2) Extension as scheduled.

   c. Curb cap:

      1) 0.063” aluminum.

B. Accessories:

1. Roof curb:

a. Insulated, 16” high, welded aluminum.

b. Wood nailer, aluminum liner, damper shelf, gasket, cant (raised where required).

2. Anti-condensation undercoating.

3. Corrosion resistant coating as scheduled.

PART 3 – EXECUTION

3.01 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer’s authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 54 52

GAS VENT SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install gas vent systems in accordance with the sizes and locations shown on the drawings.

B. Systems shall be the double-wall (annular air space insulated) type; Underwriters Laboratories listed; conform with NFPA Standards 54 and 211 for Type B and B-W gas vents; complete with standard short lengths and adjustable fittings (to avoid all cutting and allow for expansion), outer pipe, inner pipe and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Metalbestos, Metal-Fab or approved equal.

2.02 DESCRIPTION

A. Outer pipe:

1. Galvanized steel, internal spacing beads (to insure a symmetrical annular air space), die formed ends.

B. Inner pipe:

1. Aluminum, attached to outer pipe at one end for differential expansion.

C. Accessories:

1. Thimbles, flashing, weather resistant cap, guides, supports, etc.

PART 3 - EXECUTION

3.01 SUPERVISION

A. System installation supervision shall be performed by the manufacturer's authorized representative.

END OF SECTION

SECTION 23 55 60

INSULATION

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install complete insulation systems in accordance with the parameters shown on the drawings and herein specified, including the re-insulation of all equipment and/or distribution systems (piping and air) that are shown, scheduled or noted to be abated (refer to related documents), relocated or modified and wherever "tie-ins" (new work to existing) require the removal of existing insulation.

B. Systems shall include (unless specifically excepted as herein specified or shown and/or noted on the drawings) all associated components (pipe, fittings, valves, pumps, air separators, heat exchangers, steam condensate receivers, expansion tanks, storage tanks, ductwork, fittings, plenums, breeching, engine/alternator exhaust, equipment, accessories, etc.).

1.02 DEFINITION OF TERMS

A. Finished areas:

1. Those areas intended for habitation or occupancy where rough surfaces are plastered, paneled or otherwise finished.

B. Unfinished areas:

1. Those areas intended for use as storage or work areas where rough surfaces are not plastered, paneled or otherwise finished (e.g. unexcavated spaces, attic spaces, crawl spaces, certain storage rooms, equipment rooms, tunnels, etc.).

C. Concealed spaces:

1. Those spaces between suspended ceiling and floor above or roof construction, between double walls or furred-in spaces.

D. Exposed:

1. "Open to view".

E. Low pressure, low velocity air distribution systems:

1. Those systems with velocities limited to 2500 fpm and static pressures limited to 2-inch wg.

F. Medium pressure, high velocity air distribution systems:

1. Those systems with velocities exceeding 2000 fpm and static pressures limited to 6-inch wg.

G. High pressure, high velocity air distribution systems:

1. Those systems with velocities exceeding 2000 fpm and static pressures ranging from 6-inch wg. to 10-inch wg.

1.03 FIRE HAZARD CLASSIFICATION

A. Insulation systems, unless otherwise specified herein, shall have Fire Hazard Classification not to exceed Flame Spread 25 and Smoke Developed 50 when tested in accordance with ASTM Specification E-84. (Evidence of classification shall be an Underwriters Laboratories label or listing.)

1.04 ENGINEER'S INSPECTION

A. The Engineer, at his/her discretion, in the presence of the Contractor's authorized representative, may take samples of installed insulation for the purpose of checking materials and/or method of application, after which, the Contractor shall patch the sample areas.

1.05 LABELS

A. Each insulation and accessory component shall bear the manufacturer's label of description.

1.06 SUBMITTALS

A. Unless otherwise specified, submit the following for approval:

1. A description of the type of insulation and all accessories (jackets, wiring, banding, fastening devices, adhesives, coatings, mastics, sealing tape, etc.) proposed for each type of service, including the manufacturer's product literature.

2. Samples of insulation and/or accessories as requested.

3. A SIGNED AFFIDAVIT (attached) attesting to strict compliance with the scheduled mandates and installation requirements hereinafter described.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General:

1. Owens-Corning, Johns-Manville (Schuller International), Knauf, CSG, Armstrong, Dow Chemical or approved equal.

B. Fibrous glass, 2-piece, preformed (molded) fitting, flange and valve body insulation:

1. Hamfab or approved equal.

C. Adhesives, coatings and mastics:

1. Foster or approved equal.

D. Removable/replaceable insulation pads:

1. M.I.T. International, Shannon Enterprises or approved equal.

2.02 DESCRIPTION

A. Fibrous glass insulation:

1. Density:

a. Pipe insulation, 4.0 lbm/cu ft.

b. Pipe fitting and valve body insulation, 4-5 lbm/cu ft.

c. Board insulation, concealed application 3 lbm/cu ft.

d. Board insulation, exposed application 6 lbm/cu ft.

e. Blanket insulation, 1 lbm/cu ft.

2. Thermal conductivity:

a. Pipe, block, board and fitting insulation, 0.26 Btu/hr/sq ft/F/in at 75F.

b. Blanket insulation, 0.28 Btu/hr/sq ft/F/in at 75F.

3. Moisture absorption:

a. 0.2% by volume after 96 hours at 120F and 95% rh.

4. Capillarity:

a. Negligible after 24 hours.

5. Shrinkage or expansion:

a. Fully cured to insure negligible dimensional changes when tested in accordance with ASTM Specification C-312.

B. Flexible foamed plastic insulation:

1. Density:

a. 4.5 to 8.5 lbm/cu ft when tested in accordance with ASTM Specification D-1622.

2. Thermal conductivity:

a. 0.28 Btu/hr/sq ft/F/in at 75F when tested in accordance with ASTM Specification C-177.

3. Water vapor transmission:

a. 0.1 perm inches when tested in accordance with ASTM Specification C-355 (wet cup).

4. Operating temperature range:

a. 0 to 200F.

5. Fire hazard classification:

a. Flame Spread 25, Smoke Developed 150 when tested in accordance with ASTM Specification E-84.

6. Thermal stability:

a. 7.0% shrinkage during 7 days at 200F when tested in accordance with ASTM Specification C-548.

C. Urethane (rigid, cellular foamed plastic) insulation:

1. Density:

a. 2.0 lbm/cu ft when tested in accordance with ASTM Specification A-1622.

2. Thermal conductivity (aged):

a. 0.18 Btu/hr/sq ft/F/in at 75F when tested in accordance with ASTM Specification C-518.

3. Compressive yield:

a. 25 lbf/sq in.

4. Water vapor transmission:

a. Less than 2.0 perm inches when tested in accordance with ASTM Specification C-355 (wet cup).

5. Operating temperature range:

a. -250F to 225F.

6. Fire hazard classification:

a. Flame spread 25, Fuel Contributed 0, Smoke Developed 150 when tested in accordance with ASTM Specification E-84.

7. Coefficient of linear expansion (-20F to 90F):

a. 7×10^{-5} in/in/F.

D. Mineral wool insulation:

1. Density:

a. 6.0 lbm/co ft tested in accordance with ASTM Specification C-303.

2. Thermal conductivity:

a. 0.47 Btu/hr/sq ft/F/in at 500F when tested in accordance with ASTM Specification C-177.

3. Moisture absorption:

a. 1.0% by weight when tested in accordance with ASTM Specification C-1104

4. Operating temperature range:

a. -20F to 1200F.

5. Fire hazard classification:

a. Flame Spread 0, Smoke Development 0 when tested in accordance with ASTM Specification E-84

6. Compressive yield:

a. 2 lbf/sq in.

F. Insulation jackets:

1. Class 1 jacket:

a. Heavy duty, embossed, white Kraft paper, puncture resistance of 50 breach units, bonded to heavy duty aluminum foil (reinforced with glass fiber yarn), water vapor permeance of 0.02 perms.

2. Class 2 jacket:

a. Heavy duty aluminum foil (reinforced with glass fiber yarn), puncture resistance of 25 breach units, bonded to heavy duty Kraft paper, water vapor permeance of 0.02 perms.

3. Class 3 jacket:

a. Best quality canvas, 6 ounces per square yard, 4 ounces per square yard for fittings 2 inches and smaller.

4. Class 4 jacket:

a. High impact resistance, 0.028 inch thick, rigid, ULTRA-VIOLET RESISTANT, polyvinyl chloride, factory cut, preset curl, 1-1/2 inch overlap.

5. Class 6 jacket:

a. Flat (not corrugated), mill finish, 16-mil, Type 3003 or 5005 aluminum.

6. Class 8 jacket:

a. 13-ply fabric reinforced, self adhesive.

b. Weather resistant, zero permeability vapor barrier.

c. Aluminum finish.

d. Venture Clad Plus or approved equal.

H. Wiring, banding and fastening devices:

1. Wire:

a. No. 16 gauge, copper clad or galvanized, annealed, steel wire (unless otherwise specified).

2. Wire mesh:

a. Woven, galvanized, (galvanized after weaving) No. 20 gauge steel wire, nominal 1 inch hexagonal openings.

3. Banding (foil encapsulated ceramic fiber, kitchen exhaust insulation):

a. 3/4 inch wide, 0.015 inch thick, 304 stainless steel.

4. Duct insulation fasteners:

a. Adhesive secured type, installed in accordance with all necessary provisions to avoid damaging the ductwork, capable of supporting an axial load of 40 lbs, sized in accordance with the thickness of the associated insulation, metal speed washer designed to secure the insulation firmly in place without excessive compression.

b. Duro-dyne stop clips and spotter pins.

I. Adhesives, coatings and mastics:

1. Lagging adhesive/coating:

a. Foster 30-36.

2. Vapor barrier coating:

a. Foster 30-15.

3. Vapor barrier mastic:

a. Foster 30-35.

J. Pressure sensitive sealing tapes:

1. Serving Class 1 jacketed systems:

a. Same material as associated jacketing.

2. Serving Class 2 jacketed systems:

a. 2 mil, smooth aluminum foil.

K. Removable/replaceable insulation pads:

1. Insulation:

a. Needled fibrous glass.

2. Jacket:

a. Silicone impregnated fibrous glass cloth, 17 ounces per square yard.

b. Stainless steel lacing anchors and wire.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

A. Installation shall be exemplary, EXECUTED IN A FIRST-CLASS MANNER BY SKILLED WORKERS NORMALLY ENGAGED IN INSULATION WORK.

B. Insulation shall be applied to clean, dry surfaces after the associated distribution systems and equipment have been leak-tested, approved and accepted and shall be continuous through sleeves, wall and ceiling openings, etc.

C. Vapor barrier jacketing shall be applied with a continuous unbroken vapor seal, including points of penetration (anchors, gauges, hangers, sensors, supports, thermometers, etc.).

D. Adhesives, coatings and mastics shall be compatible with the materials to which they are applied and shall not soften, corrode or otherwise attack said materials whether dry or wet.

E. Hangers, supports and appurtenances shall be installed in their permanent location before insulation is applied and shall be restored to their original position if displacement is necessary to ensure proper insulation installation.

F. Angle bracing, reinforcing, etc. of concealed ductwork to be insulated shall be bent back upon itself or have all 90 degree projections trimmed off to minimize the probability of puncturing the insulation.

G. Flexible vibration eliminators serving piping systems distributing liquid and gasses below ambient shall be insulated with flexible foamed plastic insulation with circumferential and longitudinal (as applicable) butt joints adhesive sealed.

3.02 INSTALLATION, SPECIFIC

A. Jacketing installation:

1. Class 1 jacketing:

a. Piping systems:

1) Jacketing shall be factory applied complete with pressure sensitive longitudinal sealing lap (1-1/2 inch width).

2) Circumferential joints shall be sealed with pressure sensitive sealing tape (3 inch width).

3) Longitudinal sealing laps and sealing tape shall be neatly pressed into place (with seams turned "away from view") and stapled (complete with vapor barrier coating for systems operating below ambient).

b. Ductwork systems:

1) Jacketing shall be factory applied.

2) Joints shall be sealed with pressure sensitive sealing tape (3 inch width for plane joints, 5 inch width for angle joints).

3) Sealing tape shall be neatly pressed into place and stapled (complete with vapor barrier coating for systems operating below ambient).

2. Class 2 jacketing (ductwork systems):

a. Jacketing shall be factory applied.

b. Joints shall be sealed with pressure sensitive sealing tape (3 inch width for plane joints, 5 inch width for angle joints).

3. Class 3 jacketing:

a. Jacketing shall be neatly sized with lagging adhesive/coating.

b. Additionally, jacketing serving systems operating below ambient shall be complete with vapor barrier coating finish.

c. Jacketing shall be applied with a minimum of circumferential seams and with longitudinal seams turned "away from view".

d. Jacketing shall be applied to fittings, flanges and valves using template patterns.

4. Class 4 jacketing:

a. Jacketing shall be neatly cemented in place using weld adhesive with longitudinal seams turned "away from view".

b. Voids shall be neatly sealed with silicone caulking.

B. Insulation installation for PIPING systems:

1. Piping insulation (fibrous glass, urethane, calcium silicate):

a. Exposed ends for systems operating below and above ambient shall be neatly sealed with vapor barrier coating and lagging adhesive/coating, respectively.

b. ADDITIONALLY, fibrous glass insulation within 10'-0" of connections to suspended or elevated central station air handling systems shall be completed by applying Class 3 or Class 4 jacketing as scheduled.

2. Piping insulation (flexible foamed plastic):

a. Insulation shall be the unslit type whenever feasible (slipped on the piping prior to pipe installation), or the slit type whenever the unslit type is not feasible, with circumferential and longitudinal joints adhesive sealed.

b. Exposed ends of the insulation shall be adhesive sealed (to the piping) to provide a neat finished appearance and prevent moisture infiltration.

3. Fitting, flange and valve insulation (fibrous glass, urethane, calcium silicate):

a. Insulation shall be the 2-piece, pre-formed (molded) type of the same material and thickness as the adjoining insulation.

b. Insulation applied to valves shall extend up to and include bonnets without interfering with packing glands.

c. Insulation shall be secured in place with No. 14 gauge copper wire with ends turned down into the insulation.

d. Insulation shall butt neatly and firmly against fittings, flanges and valves.

e. Finish:

1) Fibrous glass insulation systems operating ABOVE ambient which are CONCEALED:

a) Insulation shall be covered with premolded polyvinyl chloride jacketing.

b) Circumferential joints shall be sealed with pressure sensitive sealing tape (3 inch width).

2) Fibrous glass insulation systems operating BELOW ambient which are EXPOSED or CONCEALED and ABOVE ambient which are EXPOSED and urethane and calcium silicate insulation systems:

a) Insulation surfaces shall be smoothed out by applying a leveling coat of insulating cement completely covering wiring.

b) After the insulating cement has THOROUGHLY dried, 2 layers of white, open weave, glass cloth with not less than 10 threads per inch in both directions (lapped on itself and the adjoining insulation a minimum of 2 inches) shall be neatly bedded with lagging adhesive coating and vapor barrier

mastic for systems operating above and below ambient, respectively.

c) Finally, the installation shall be completed by applying Class 3 or Class 4 jacketing as scheduled.

4. Fitting, flange and valve insulation (flexible foamed plastic):

a. Insulation shall be the same material and thickness as the adjoining insulation.

b. Adhesive shall be the type recommended by the insulation manufacturer.

c. Insulation seams and joints shall be adhesive sealed.

d. Insulation for SWEAT AND BRAZED FITTINGS shall be miter-cut pieces of pipe insulation.

e. Insulation for SCREWED AND WELDED FITTINGS shall be sleeved type covers fabricated from miter-cut pieces of pipe insulation, except screwed fittings 2 inches and larger which may be cut from flexible foamed plastic sheets using template patterns.

f. Insulation for VALVES shall be sleeved type covers fabricated from miter-cut pieces of pipe insulation, except large valves which shall be insulated with covers cut from flexible foamed plastic sheets using template patterns.

C. Insulation installation for EQUIPMENT distributing or storing liquids and gasses at temperatures BELOW ambient (flexible foamed plastic; curved, irregular and flat surfaces):

1. General requirements:

a. Metal protrusions in direct contact with the insulated equipment shall be covered with a thickness equal to that specified for the associated equipment.

2. Specific requirements:

a. Insulation shall be the sheet type installed with the smooth skin out.

b. With butt edges slightly lapped, insulation shall be secured in place by applying adhesive to both the equipment surface and the inside insulation surface and thereafter pressing the insulation into place when the adhesive has dried to a tacky state.

c. With adjoining sheets firmly in place, butt edges shall be spread apart and adhesive applied to both edges which shall then be firmly pressed back together and aligned.

d. Joints shall be staggered according to the aspect ratio of the equipment (vertical joints when height exceeds width and horizontal joints when width exceeds height) and when applied in multi-layers.

D. Insulation installation for EQUIPMENT distributing or storing liquids and gasses at temperatures ABOVE ambient:

1. General requirements:

a. Insulation applied to vertical surfaces shall be complete with properly installed supports 12 feet on center.

b. Insulation supports, stiffeners and other metal protrusions in direct contact with the insulated equipment shall be covered with insulation of the type and thickness equal to that specified for the associated equipment.

c. Equipment manholes, handholes, access plates, ASME stamp, nameplate, etc. shall not be insulated with the adjacent insulation neatly beveled.

2. Specific requirements:

a. Curved and irregular surfaces (fibrous glass, mineral wool):

1) Insulation shall be beveled or scored to suit the equipment contours; voids shall be filled and butting edges shall be sealed with insulating cement.

2) Insulation shall be secured in place with No. 14 gauge copper wire (6 inches on center) or galvanized steel bands (10 inches on center).

3) Finish:

a) Insulation surfaces shall be smoothed out by applying a leveling coat of insulating cement to completely cover wiring and/or banding.

b) After the insulating cement has THOROUGHLY dried, a layer of white, open weave, glass cloth with not less than 10 threads per inch in both directions shall be neatly sized with lagging adhesive/coating.

c) Finally, the installation shall be completed by applying Class 3 jacketing.

b. Flat surfaces (fibrous glass, mineral wool):

1) Installation shall be as specified for curved and irregular surfaces, except that the insulation shall be secured to metal surfaces with duct insulation fasteners spaced 12 inches on center, both directions.

E. Piping systems or portions thereof and equipment NOT requiring insulation (unless otherwise scheduled and/or specified):

1. Compressed air piping systems.

2. Condenser water piping systems.

3. Gas piping systems and meters.

4. Air to water heat pumps piping systems.

5. Unheated fuel oil piping systems.

6. Actual heat transfer surfaces.

7. Hot water and/or steam piping installed inside convector and/or fin tube radiation enclosures.

8. Hydronic accessories, including flexible connectors, suction diffusers, expansion tanks (including the associated air line piping) and flow meters serving systems operating ABOVE ambient.

9. Hot water, boiler feed and fuel oil pumps.

10. Vacuum return pumps and receiver.

11. Condensate return pumps and receivers.

12. Pressure reducing valves and the associated pilot lines.

13. Water columns, float chambers and level controllers.

14. Safety, relief and back pressure valves.

15. Discharge piping from safety and relief valves.

16. Vent piping to atmosphere from blow-down, flash and condensate tanks.

17. Blow-down and drain piping.

18. Water treatment system components.

19. Factory insulated equipment.

F. Insulation installation for air distribution systems:

1. General requirements:

a. Insulation for ductwork to be installed adjacent to walls, ceilings, equipment, other ductwork, etc. may be applied to ductwork prior to its installation, provided the insulation is maintained in first class condition.

b. When the specified exterior application of insulation is not practical, interior application (thermal acoustical lining) may be substituted, provided permission is obtained from the Engineer and that nominal clear inside dimensions are maintained.

c. Vapor barriers penetrations at duct insulation fasteners, hangers and/or supporting devices shall be sealed with vapor barrier mastic and/or pressure sensitive sealing tape before the final finish is applied.

d. Exposed ends for systems operating below and above ambient shall be neatly sealed with vapor barrier coating and lagging adhesive/coating, respectively.

2. Rigid board insulation:

a. Insulation shall be secured with duct insulation fasteners spaced 16 inches on center in all directions, 3 inches from corners.

b. Edges shall be firmly butted and voids filled with like insulation.

c. Insulation shall butt into cross seams, angle bracing, reinforcing, etc. which does not extend a greater distance than the insulation thickness and voids shall be filled with like insulation.

d. Insulation thickness shall be increased as required to provide a total thickness greater than the extended dimension of cross seams, angle bracing, reinforcing, etc.

e. Corners shall be covered with 28 gauge x 1 inch x 1 inch galvanized steel corner angles or prefabricated corner angle tape complete with bonded prefabricated metal corner angle.

f. Finish (unless otherwise scheduled):

1) All protrusions shall be completely covered by applying 2 coats of insulating cement, with the outer coat neatly troweled, brushed or rubber gloved.

2) After the insulating cement has THOROUGHLY dried, the installation shall be completed by applying Class 3 jacketing.

3. Blanket insulation:

a. Insulation shall be fastened to the bottom of horizontal ductwork and all four sides of vertical ductwork with duct insulation fasteners in accordance with the following spacing:

Duct Dimension Inches	**Rows**	**Spacing Inches**
23 or less	None	- - -
24 thru 32	1	16
33 thru 48	2	16
49 thru 60	3	16
61 or more	- - -	16*

***** Both Directions

b. Insulation shall be secured in place with No. 14 gauge copper wire (12 inches on center for straight runs, 6 inches on center for fittings and at circumferential joints).

G. Air distribution system components NOT requiring insulation (unless otherwise scheduled and/or specified):

1. Internally lined (with thermal acoustical lining) ductwork.

2. Insulated prefabricated duct systems.

3. Flexible connections.

4. Factory insulated equipment.

END OF SECTION

ATTACHMENT: Schedule and Installation Compliance Affidavit

INSULATION SCHEDULE Ⓒ

SPEC SECTION 23 55 60

DESIGNATION	EQUIPMENT OR SYSTEM SERVED	TYPE Ⓐ			JACKETING CLASS Ⓑ			THICKNESS IN				
								NOMINAL PIPE SIZE IN				DUCTWORK Ⓔ
		INTERIOR CONCEALED	INTERIOR EXPOSED	EXTERIOR	INTERIOR GENERAL	EQUIPMENT ROOMS	EXTERIOR	½ - 1½	2 - 4	5 - 6	8 & UP	
A	RHG, RL, RS	FP	---	---	Ø	---	---	1	1	1	1½	
		---	FP	---	Ø	4	---	1	1	1	1½	
		---	---	FP	---	---	4	1	1	1	1½	
B	CHWS, CHWR CGSS, CGSR	FP	---	---	1	---	---	1½	1½	1½	1½	
		---	FP	---	Ø	4	---	1½	1½	1½	1½	
		---	---	UR	---	---	4	2	3	3	3	
C	DCW, COOLING COIL Ⓚ CONDENSATE	FP	---	---	Ø	---	---	½	½	½	½	
		---	FP	---	Ø	4	---	½	½	½	½	
D	DHW, DHWR SMS, SMR	FG	---	---	1	---	---	1	1	1½	1½	
		---	FG	---	1	1 & 4	---	1	1	1½	1½	
E	STORM WATER Ⓓ	FP	---	---	Ø	---	---	---	½	½	½	
		---	FP	---	Ø	4	---	---	½	½	½	
F	DTS, DTR HWS, HWR HGSS, HGSR	FG	---	---	1	---	---	1½	2	2½	3	
		---	FG	---	1	1 & 4	---	1½	2	2½	3	
		---	---	UR	---	---	6	2	3	3	4	
G	LPS, LPC, PC Ⓛ	FG	---	---	1	---	---	1½	3	3	3	
		---	FG	---	1	1 & 3	---	1½	3	3	3	
		---	---	UR	---	---	6	2	3	3	4	
H	MPS, MPC Ⓛ	FG	---	---	1	---	---	1½	3	3	4	
		---	FG	---	1	1 & 3	---	1½	3	3	4	
		---	---	CS	---	---	6	2	3	4	4	
I	DUCTWORK Ⓘ	FG Ⓕ	---	---	2	---	---	---	---	---	---	1½
		---	FG Ⓖ	---	2	2 & 3	---	---	---	---	---	2 Ⓗ
		---	---	FG Ⓖ	---	---	8	---	---	---	---	2
J	CONCEALED KITCHEN EXHAUST DUCTWORK	CF	---	---	2	---	---	---	---	---	---	1½ Ⓙ
K	BOILER Ⓘ BREECHING Ⓘ	---	MW	---	---	3	---	---	---	---	2	

Ⓐ FG -- FIBROUS GLASS
FP -- FLEXIBLE FOAM PLASTIC
UR -- URETHANE
CS -- CALCIUM SILICATE
MW -- MINERAL WOOL
CF -- CERAMIC FIBER

Ⓑ Ø -- NONE
1 -- ALL SERVICE
2 -- ALUMINUM FOIL
3 -- CANVAS
4 -- POLYVINYL CHLORIDE
5 -- STAINLESS STEEL
6 -- ALUMINUM
7 -- EPDM
8 -- WEATHER RESISTANT VAPOR BARRIER

Ⓒ INSULATION TYPE, JACKETING & THICKNESS FOR EQUIPMENT SHALL MATCH THE CORRESPONDING PIPING SYSTEM'S PARAMETERS LISTED FOR: EQUIPMENT ROOMS, NOMINAL PIPE SIZE 8" AND LARGER

Ⓓ ROOF DRAIN BODIES, HORIZONTAL RUNS AND OFF-SETS, AND VERTICAL PORTION OF EACH CONDUCTOR TO JUNCTURE WITH BELOW GRADE PIPING

Ⓔ SUPPLY AIR, OUTSIDE AIR AND MIXED AIR ; EXHAUST AIR WITHIN 20 FT OF BUILDING EXTERIOR

Ⓕ BLANKET Ⓖ RIGID BOARD

Ⓗ EXCEPT SUPPLY AIR IN CONDITIONED SPACE

Ⓘ RETURN AIR AND/ OR EXHAUST AIR AS SHOWN AND/OR NOTED

Ⓙ TWO LAYERS, 3 IN TOTAL

Ⓚ INCLUDING ASSOCIATED FLOOR DRAIN BODY, TRAP & LATERAL TO STACK

Ⓛ INCLUDING REMOVABLE/REPLACEABLE INSULATION PADS SERVING PRESSURE REDUCING STATIONS.

POTENTIAL FOOTNOTES/REMARKS:

① ENGINE/ALTERNATOR EXHAUST

② SMOKEHOOD, INDUCED DRAFT FAN ASSEMBLY

PDF AND REPLACE THE ABOVE SCHEDULE FOR EACH PROJECT

HVAC INSULATION SYSTEMS INSTALLATION

INSTALLATION, GENERAL

A. Installation will be exemplary, EXECUTED IN A FIRST-CLASS MANNER BY SKILLED WORKERS NORMALLY ENGAGED IN INSULATION WORK.

B. Insulation will be applied to clean, dry surfaces after the associated distribution systems and equipment have been leak-tested, approved and accepted and will be continuous through sleeves, wall and ceiling openings, etc.

C. Vapor barrier jacketing will be applied with a continuous unbroken vapor seal, including points of penetration (anchors, gauges, hangers, sensors, supports, thermometers, etc.).

D. Adhesives, coatings and mastics will be compatible with the materials to which they are applied and shall not soften, corrode or otherwise attack said materials whether dry or wet.

E. Hangers, supports and appurtenances will be installed in their permanent location before insulation is applied and will be restored to their original position if displacement is necessary to ensure proper insulation installation.

F. Angle bracing, reinforcing, etc. of concealed ductwork to be insulated will be bent back upon itself or have all 90 degree projections trimmed off to minimize the probability of puncturing the insulation.

G. Flexible vibration eliminators serving piping systems distributing liquid and gasses below ambient will be insulated with flexible foamed plastic insulation with circumferential and longitudinal (as applicable) butt joints adhesive sealed.

INSTALLATION, SPECIFIC

A. Jacketing installation:

1. Class 1 jacketing:

a. Piping systems:

1) Jacketing will be factory applied complete with pressure sensitive longitudinal sealing lap (1-1/2 inch width).

2) Circumferential joints will be sealed with pressure sensitive sealing tape (3 inch width).

3) Longitudinal sealing laps and sealing tape will be neatly pressed into place (with seams turned "away from view") and stapled (complete with vapor barrier coating for systems operating below ambient).

b. Ductwork systems:

1) Jacketing will be factory applied.

2) Joints will be sealed with pressure sensitive sealing tape (3 inch width for plane joints, 5 inch width for angle joints).

3) Sealing tape will be neatly pressed into place and stapled (complete with vapor barrier coating for systems operating below ambient).

2. Class 2 jacketing (ductwork systems):

a. Jacketing will be factory applied.

b. Joints will be sealed with pressure sensitive sealing tape (3 inch width for plane joints, 5 inch width for angle joints).

3. Class 3 jacketing:

a. Jacketing will be neatly sized with lagging adhesive/coating.

b. Additionally, jacketing serving systems operating below ambient will be complete with vapor barrier coating finish.

c. Jacketing will be applied with a minimum of circumferential seams and with longitudinal seams turned "away from view".

d. Jacketing will be applied to fittings, flanges and valves using template patterns.

4. Class 4 jacketing:

a. Jacketing will be neatly cemented in place using weld adhesive with longitudinal seams turned "away from view".

b. Voids will be neatly sealed with silicone caulking.

B. Insulation installation for PIPING systems:

1. Piping insulation (fibrous glass, urethane, calcium silicate):

a. Exposed ends for systems operating below and above ambient will be neatly sealed with vapor barrier coating and lagging adhesive/coating, respectively.

b. ADDITIONALLY, fibrous glass insulation within 10'-0" of connections to suspended or elevated central station air handling systems will be completed by applying Class 3 or 4 Class jacketing as scheduled.

2. Piping insulation (flexible foamed plastic):

a. Insulation will be the unslit type whenever feasible (slipped on the piping prior to pipe installation), or the slit type whenever the unslit type is not feasible, with circumferential and longitudinal joints adhesive sealed.

b. Exposed ends of the insulation will be adhesive sealed (to the piping) to provide a neat finished appearance and prevent moisture infiltration.

3. Fitting, flange and valve insulation (fibrous glass, urethane, calcium silicate):

   a. Insulation will be the 2-piece, pre-formed (molded) type of the same material and thickness as the adjoining insulation.

   b. Insulation applied to valves shall extend up to and include bonnets without interfering with packing glands.

   c. Insulation will be secured in place with No. 14 gauge copper wire with ends turned down into the insulation.

   d. Insulation shall butt neatly and firmly against fittings, flanges and valves.

   e. Finish:

      1) Fibrous glass insulation systems operating ABOVE ambient which are CONCEALED:

         a) Insulation will be covered with premolded polyvinyl chloride jacketing.

         b) Circumferential joints will be sealed with pressure sensitive sealing tape (3 inch width).

      2) Fibrous glass insulation systems operating BELOW ambient which are EXPOSED or CONCEALED and ABOVE ambient which are EXPOSED and urethane and calcium silicate insulation systems:

         a) Insulation surfaces will be smoothed out by applying a leveling coat of insulating cement completely covering wiring.

         b) After the insulating cement has THOROUGHLY dried, 2 layers of white, open weave, glass cloth with not less than 10 threads per inch in both directions (lapped on itself and the adjoining insulation a minimum of 2 inches) will be neatly bedded with lagging adhesive coating and vapor barrier mastic for systems operating above and below ambient, respectively.

         c) Finally, the installation will be completed by applying Class 3 or Class 4 jacketing as scheduled.

4. Fitting, flange and valve insulation (flexible foamed plastic):

   a. Insulation will be the same material and thickness as the adjoining insulation.

b. Adhesive will be the type recommended by the insulation manufacturer.

c. Insulation seams and joints will be adhesive sealed.

d. Insulation for SWEAT AND BRAZED FITTINGS will be miter-cut pieces of pipe insulation.

e. Insulation for SCREWED AND WELDED FITTINGS will be sleeved type covers fabricated from miter-cut pieces of pipe insulation, except screwed fittings 2 inches and larger which may be cut from flexible foamed plastic sheets using template patterns.

f. Insulation for VALVES will be sleeved type covers fabricated from miter-cut pieces of pipe insulation, except large valves which will be insulated with covers cut from flexible foamed plastic sheets using template patterns.

C. Insulation installation for EQUIPMENT distributing or storing liquids and gasses at temperatures BELOW ambient (flexible foamed plastic; curved, irregular and flat surfaces):

1. General requirements:

a. Metal protrusions in direct contact with the insulated equipment will be covered with a thickness equal to that specified for the associated equipment.

2. Specific requirements:

a. Insulation will be the sheet type installed with the smooth skin out.

b. With butt edges slightly lapped, insulation will be secured in place by applying adhesive to both the equipment surface and the inside insulation surface and thereafter pressing the insulation into place when the adhesive has dried to a tacky state.

c. With adjoining sheets firmly in place, butt edges will be spread apart and adhesive applied to both edges which shall then be firmly pressed back together and aligned.

d. Joints will be staggered according to the aspect ratio of the equipment (vertical joints when height exceeds width and horizontal joints when width exceeds height) and when applied in multi-layers.

D. Insulation installation for EQUIPMENT distributing or storing liquids and gasses at temperatures ABOVE ambient:

1. General requirements:

a. Insulation applied to vertical surfaces will be complete with properly installed supports 12 feet on center.

b. Insulation supports, stiffeners and other metal protrusions in direct contact with the insulated equipment will be covered with insulation of the type and thickness equal to that specified for the associated equipment.

c. Equipment manholes, handholes, access plates, ASME stamp, nameplate, etc. shall not be insulated with the adjacent insulation neatly beveled.

2. Specific requirements:

a. Curved and irregular surfaces (fibrous glass, mineral wool):

1) Insulation will be beveled or scored to suit the equipment contours; voids will be filled and butting edges will be sealed with insulating cement.

2) Insulation will be secured in place with No. 14 gauge copper wire (6 inches on center) or galvanized steel bands (10 inches on center).

3) Finish:

a) Insulation surfaces will be smoothed out by applying a leveling coat of insulating cement to completely cover wiring and/or banding.

b) After the insulating cement has THOROUGHLY dried, a layer of white, open weave, glass cloth with not less than 10 threads per inch in both directions will be neatly sized with lagging adhesive/coating.

c) Finally, the installation will be completed by applying Class 3 jacketing.

b. Flat surfaces (fibrous glass, mineral wool):

1) Installation will be as specified for curved and irregular surfaces, except that the insulation will be secured to metal surfaces with duct insulation fasteners spaced 12 inches on center, both directions.

c. Curved, irregular and flat surfaces (calcium silicate):

1) Insulation will be the block type, fitted with staggered joints; all butt edges, voids and irregular surfaces will be filled with insulating cement.

2) Insulation will be secured in place with No. 14 gauge copper wire (6 inches on center).

3) Insulation covering large areas will be secured in place with No. 12 gauge copper wire or 0.115 x 1-1/2 inch galvanized steel bands (10 inches on center).

4) Insulation will be covered with wire mesh stretched tight and secured to anchors with wire edges laced together.

5) Finish:

a) Insulation surfaces will be smoothed out by applying two coats of insulating cement (1/4 inch thick, each) with the outer coat neatly troweled, brushed or rubber gloved.

b) After the insulating cement has THOROUGHLY dried, the installation will be completed by applying Class 3 jacketing.

E. Insulation installation for air distribution systems:

1. General requirements:

a. Insulation for ductwork to be installed adjacent to walls, ceilings, equipment, other ductwork, etc. may be applied to ductwork prior to its installation, provided the insulation is maintained in first class condition.

b. When the specified exterior application of insulation is not practical, interior application (thermal acoustical lining) may be substituted, provided permission is obtained from the Engineer and that nominal clear inside dimensions are maintained.

c. Vapor barriers penetrations at duct insulation fasteners, hangers and/or supporting devices will be sealed with vapor barrier mastic and/or pressure sensitive sealing tape before the final finish is applied.

d. Exposed ends for systems operating below and above ambient will be neatly sealed with vapor barrier coating and lagging adhesive/coating, respectively.

2. Rigid board insulation:

a. Insulation will be secured with duct insulation fasteners spaced 16 inches on center in all directions, 3 inches from corners.

b. Edges will be firmly butted and voids filled with like insulation.

c. Insulation shall butt into cross seams, angle bracing, reinforcing, etc. which does not extend a greater distance than the insulation thickness and voids will be filled with like insulation.

d. Insulation thickness will be increased as required to provide a total thickness greater than the extended dimension of cross seams, angle bracing, reinforcing, etc.

e. Corners will be covered with 28 gauge x 1 inch x 1 inch galvanized steel corner angles or prefabricated corner angle tape complete with bonded prefabricated metal corner angle.

f. Finish (unless otherwise scheduled):

1) All protrusions will be completely covered by applying 2 coats of insulating cement, with the outer coat neatly troweled, brushed or rubber gloved.

2) After the insulating cement has THOROUGHLY dried, the installation will be completed by applying Class 3 jacketing.

g. Concealed kitchen exhaust:

1) Layers will overlap (traverse and longitudinal joints) 3 inches.

2) Outer layer, complete with Class 2 jacketing, will be secured in place with stainless steel banding, 12 inches on center.

3. Blanket insulation:

a. Insulation will be fastened to the bottom of horizontal ductwork and all four sides of vertical ductwork with duct insulation fasteners in accordance with the following spacing:

Duct Dimension Inches	**Rows**	**Spacing Inches**
23 or less	None	- - -
24 thru 32	1	16
33 thru 48	2	16
49 thru 60	3	16
61 or more	- - -	16*

***** Both Directions

b. Insulation will be secured in place with No. 14 gauge copper wire (12 inches on center for straight runs, 6 inches on center for fittings and at circumferential joints).

_____

CONTRACTOR:

_____ _____

BY: DATE:

Project Name
TE Project #

SECTION 23 55 70

AUTOMATIC TEMPERATURE CONTROLS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install a complete automatic temperature control system as shown on the drawings and herein specified.

B. System shall be the distributed-processing, direct digital control (DDC), non-proprietary communication protocol, building management system (BMS) type; networked for single point programming and information sharing; CAPABLE OF MULTI-SITE INTERFACE VIA PASSWORD SECURED INTERNET OR OWNER NETWORK ACCESS; complete with master station hardware, programmable control modules, specific function control modules, software, portable editing device (laptop computer), dampers, valves, actuators, sensors, ancillary controllers, relays, switches, start-up service and all necessary accessories required to accomplish the sequences herein specified.

C. System shall interface with microprocessor controlled equipment heating plant boilers/pumps, humidifiers, chilled water plant chiller/pumps complete with monitoring, alarms and set point adjustment.

D. PROVIDE ON-SITE TECHNICAL ASSISTANCE AS REQUESTED DURING TESTING AND BALANCING.

E. All temperature control equipment and labor for this project shall be purchased through the GSA Schedule from PASCO Building Automation Systems (attached in Front End Specifications) under the "Mechanical Construction – Contract No. 2455706".

F. It shall be the responsibility of PASCO to deliver controlled devices to the mechanical contractor for installation.

1.02 SUBMITTALS

A. ALL REFERENCES TO EQUIPMENT, CONTROLLERS, CONTROLLED DEVICES, ETC. **SHALL MATCH EXACTLY** THE TITLES AND ALPHANUMERIC DESIGNATIONS SHOWN IN THE BIDDING DOCUMENTS.

B. THE SEQUENCES OF OPERATION (EXCEPT FOR THE INSERTION OF REFERENCES TO SPECIFIC DEVICES) **SHALL MATCH PRECISELY THE VERNACULAR OF THIS SPECIFICATION**; UPON REQUEST, THE ENGINEER WILL PROVIDE DIGITAL FILES.

C. THE SYSTEMS SCHEMATICS CONFIGURATION **SHALL MATCH EXACTLY** THOSE SHOWN IN THE BIDDING DOCUMENTS; UPON REQUEST, THE ENGINEER WILL PROVIDE DIGITAL FILES.

D. The SYSTEMS GRAPHICS **SHALL MATCH EXACTLY** THOSE SHOWN ON THE BIDDING DOCUMENTS AND SHALL BE INCLUDED AS A DESIGNATED PART OF THE

SUBMITTAL IN ELECTRONIC FORMAT; UPON REQUEST, THE ENGINEER WILL PROVIDE DIGITAL FILES.

1.03 GUARANTEE

A. The system shall be guaranteed to be free from defects in materials and workmanship for a period of 2 years from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

1.04 START-UP

A. System start-up shall include the provision of initial programming, setting, testing and checking and all subsequent programming modifications and adjustments required to insure proper operation.

B. Seasonal related influences for heating and cooling shall be appropriately phased.

1.05 INSTRUCTIONS

A. Instructions for system operation as required and/or requested throughout the guarantee period by the Owner's authorized representative shall consist of 2, 4-hour sessions requiring written acknowledgement (refer to "Owner Instruction Log", attached).

PART 2 – PRODUCTS

2.01 ACCEPTABLE SUBCONTRACTORS

A. PASCO.

2.02 DESCRIPTION

A. Master station hardware:

1. Central processing unit (CPU):

a. Microprocessor:

1) Intel core i7, 10th generation.

b. Memory:

1) Random access (RAM):

a) 16 gigabytes DDR4.

2) Storage (read/write):

a) 1,0246 gigabytes PCIE NVME solid state drive.

3) Read only (ROM):

a) 32X CD-ROM drive.

c. Communication ports:

1) 1 Gbps/100 Mbps ethernet adapter.

2) 4 USB Gen 3.2.

d. Graphics Adapter:

1) 2560 x 1440 pixel resolution minimum.

2) 32 bit color quality.

e. Integral time clock real time clock, RTC.

f. HP, Dell, ACER, Lenovo.

2. Peripheral hardware:

a. Monitor:

1) Two, 27 inch LCD or LED flat panel display.

2) 1920 x 1080 pixel resolution, minimum.

b. Input devices:

1) Enhanced 104 key keyboard, USB compatible.

2) Optical mouse.

c. Printer:

1) Laser.

2) 600 x 600 DPI resolution.

3) 12 PPM, black; 10 PPM, color.

B. Programmable control modules (PCM):

1. General:

a. Stand-alone, microprocessor based.

b. Modular (allowing point expansion).

c. Direct digital control (DDC) algorithms (2-position, incremental, proportional, proportional plus integral, proportional plus integral plus derivative) programmed in a fashion properly complementary with the sequences herein specified.

d. Field programmable (local or from master station).

2. Input:

a. Analog:

1) 12 bit resolution, common sensing device(s) compatible.

b. Binary:

1) Supervised, common sensing device(s) compatible.

3. Output:

a. Analog:

1) 0 to 10 VDC or 4 to 20 milliamperes.

2) Designated (individual) for each controlled device.

b. Binary:

1) Continuous low voltage signal, normally open or normally closed, 3-position manual override ("On/Off/Auto") as required.

4. Alarms (audio and visual; local and master station annunciation):

a. Program failure.

b. Card failure.

c. Sensor failure.

d. Other (as herein specified).

5. Power loss protection:

a. Battery backup (RAM), 24 hours.

b. Automatic diagnostic resumption (prior to battery failure) following commercial power restoration.

c. Manual restoration (subsequent to battery failure) from mass storage.

6. Integral (local) display:

a. Monitored points.

b. Alarms.

7. Enclosure:

a. Steel, Underwriters Laboratories listed; key lock, piano hinged, full access door; baked enamel finish.

b. Arranged to permit timely (construction phased), internal termination of all associated wiring.

C. Specific function control modules (SFCM):

1. Units shall conform with the parameters outlined for programmable control modules, except that the memory shall be permanent and unaffected by loss of commercial power.

2. Units shall be employed as designated (never as a substitute for PCM's).

D. Master station software:

1. Anti-recycle protection:

a. Designated programmable timers (0 to 120 minutes).

2. User access:

a. Multiple level, password secured; recorded log "On"/log "Off".

b. Prompted, menu driven, English language communication; contiguous, help key actuated, instruction display.

c. Configuration software replete.

3. Time-of-day scheduling:

a. Individually editable 8-day (7 plus holiday; 6 events per day) master schedules.

4. Features:

a. Custom control language, optimum start/stop, after hours override, run time and maintenance messages.

5. Operator interface:

a. Graphic displays:

1) Subcontractor created, dynamic, time dominion relevant, point data (descriptors, values and/or symbols).

2) ALPHANUMERICAL DESIGNATIONS (EQUIPMENT, CONTROLLERS, CONTROLLED DEVICES, ETC.) AND GRAPHICAL CONFIGURATIONS MATCHING BIDDING DOCUMENTS TERMINOLOGY AND SCHEMATICS; UPON REQUEST, THE ENGINEER WILL PROVIDE DIGITAL FILES.

3) Operator controlled (using mouse and/or function keys in conjunction with pop-up menu windows), sequential link, multiple access, manual point override, remote panel programming access (via single keystroke).

4) Alarm notification (specific, removable pop-up message windows; permanent, alarm pending message display).

5) CRT blank (subject to designated duration of non-use), automatic restoration (subject to audible alarm or keyboard use).

6) CURRENT DISPLAY (SUPERIMPOSED UPON PROPERLY CONFIGURED SCHEMATICS) OF ALL SPECIFIED MONITORING AND ALARMS.

b. User editing:

1) Prompted, fill-in-the-blank format.

6. Trend log(s):

a. General:

1) Capacity to address all inputs, outputs and calculated values.

2) Retrievable in file format or graphical display.

b. Initial requirements:

1) Thermal demand:

a) CGS system.

b) HGS heating system.

c) DHW generation system.

2) Thermal energy consumed:

a) CGS system.

b) HGS heating system.

c) DHW generation system.

d) Gas service.

3) Electrical demand:

a) CGS generators.

b) Service entrance.

4) Electrical energy consumed:

a) CGS generators.

b) Service entrance.

E. Portable editing device (laptop computer):

1. General:

a. Operator terminal (briefcase size), battery powered, full alphanumeric keypad, disk storage.

b. Storage, data download and local display (monitoring and alarm) capacity.

c. Remote interface capacity for point of use programming and commissioning of field level controllers.

d. Operating system: Windows 7 Professional 64 bit.

2. Central processing unit (CPU):

a. Microprocessor:

1) Intel Core Processor i7 10th generation.

b. Memory:

1) Random access (RAM):

a) 16 gigabytes, DDR4.

2) Storage (read/write):

a) 1,024 gigabyte PCIE NVME solid state drive.

c. Communication ports:

1) 10/100/1000 PCMCIA ethernet adapter.

2) 2 USB 3.2 generation, 1 USB generation 3.2 type-c.

3. Display:

a. 15” widescreen, LED backlit.

4. WiFi wireless networking.:

a. 802.11 b/g/n.

5. Acceptable manufacturers:

a. HP, Dell, Lenovo, Acer.

F. Diagnostics:

1. Basic operation:

a. Self-testing; automatic storage; user notification via printer, audible tone and flashing display.

2. Troubleshooting guides:

a. Symptom/diagnosis displays (for master station, PCM’s and SFCM’s).

G. Automatic dampers:

1. Low leakage type (parallel blade for mixing service and opposed blade for volume/throttling service).

2. 16 gauge galvanized steel roll-formed blades, 13 gauge galvanized steel roll-formed frame, zinc plated hardware, interlocking blade edges with inflatable closed cell neoprene seal, friction type spring-loaded stainless steel blade ends with zero clearance.

3. Spring return (unless physical limitations are incompatible).

H. Automatic control valves:

1. General:

a. Complementary with all parameters (temperature, pressure, medium, etc.) related to the associated piping system.

b. Spring return (unless physical limitations are incompatible).

2. Hydronic, 2-way, proportional:

a. Ball pattern, 2 inches and smaller; globe pattern, 2 ½ inches and larger.

b. Single-seated, equal percentage characteristics (unless otherwise noted or specified), renewable trim.

c. Adjustable start point and operating range as required.

3. Hydronic, 3-way, mixing/bypass, proportional:

a. Globe pattern, constant total flow characteristics, renewable trim, adjustable start point and operating range as required.

b. Configuration (NO, NC, C) as shown.

4. Self-contained, thermostatic, 2-way, proportional:

a. Cast brass body, stainless steel trim, EPDM seat.

b. Locking/limiting stops, removable insert.

c. ISTEC.

I. Actuators:

1. Linkage, cams, stroke, timing, torque, etc. complementary with the needs of the associated controlled device.

2. Controlled device (damper, valve) position monitoring (except units serving heating and/or cooling terminals) shall be 'feedback' via their associated actuator(s).

J. Sensors:

1. General:

a. Appropriate range.

b. Suitable for service in accordance with the associated medium and ambient conditions.

2. Temperature:

a. General:

1) Resistance temperature device (RTD), thermistor.

2) Performance parameters:

a) Accuracy: ± 0.10% FS.

b) Non-linearity: ± 0.10% FS.

b. Space:

1) General:

a) Location coordinated with other elements contributing to the function and aesthetics of the associated wall elevation.

b) Compatible with local and remote editing:

(1) Set point adjustment.

(2) Indication.

(3) Time of day schedule override.

2) Attributes:

a) Adjustable (± 2F).

b) Indicating (liquid crystal display).

c) Blank cover.

d) Vandalproof (recessed, stainless steel cover).

c. Immersion/insertion:

1) Well, easily removable probe.

2) Weather resistant housing as required.

2. Humidity:

   a. General:

      1) Resistance bulk polymer.

      2) Zero and span potentiometers.

   b. Performance parameters:

      1) Accuracy: ± 2.0% (20% rh to 95% rh).

3. Pressure:

   a. General:

      1) Capacitance type.

      2) Thermal coefficient matched components, temperature compensated.

   b. Gases:

      1) Stainless steel diaphragm, insulated stainless steel electrode.

      2) Performance parameters:

         a) Accuracy: ± 1.0% FS.

         b) Non-linearity: ± 1.0% FS.

         c) Hysteresis: 0.10% FS.

         d) Non-repeatability: 0.05% FS.

   c. Liquids:

      1) Stainless steel components, elastomer seals.

      2) 3-valve manifold assembly, bleed ports.

      3) Performance parameters:

         a) Accuracy: ± 0.25% FS.

         b) Non-linearity: ± 0.20% FS.

         c) Hysteresis: 0.10% FS.

         d) Non-repeatability: 0.05% FS.

4. Hydronic flowrate:

a. General:

1) Insertion type, non-magnetic impeller.

2) Programmable pulse transmitter.

b. Performance parameters:

1) Accuracy: ± 1.0% FS.

2) Non-linearity: ± 0.20% FS.

3) Repeatability: ± 0.30% FS.

4) Rangeability: 30:1.

5) Flowrate: 0.5 FPS to 30 FPS.

6) Working pressure: 200 psig.

7) Working temperature: 220F.

5. Refrigerant:

a. General:

1) Single pass, infrared, non-dispersive.

2) 50 ft sampling tube, end filter.

b. Features:

1) Self diagnostic.

2) Programmable, multiple refrigerants.

3) Adjustable alarm levels.

a) Leak.

b) Spill.

c) Evacuation.

4) 4-20 milliampere output.

5) Indication:

a) Audible (horn):

(1) 90 DBA at 10 ft.

b) Visual (strobe):

(1) Red

(2) 20 candela.

6) Alarm silence.

c. Performance parameters:

1) Accuracy: ± 1ppm, ± 10% reading.

2) Sensitivity: 1 ppm.

3) Range: 0-1,000 ppm.

4) Operating temperature: 32F-122F.

K. Water leak detection:

1. Isolated dry contacts.

2. Building management system compatible.

L. Water meters:

1. Sealed register, magnetic drive.

2. Center sweep hand dial, leak indicator, dome glass lens.

3. Impulse contactor, building management system interface compatible.

M. Gas meter:

1. Provided by public utility.

2. Impulse contactor, building management system interface compatible.

N. Thermostat (line voltage):

1. Indicating (as shown on the drawings or herein specified), 120 volt, appropriate set point range, adjustable sensitivity (2F, minimum), adjustable heating anticipator.

2. Concealed adjustment and/or guard (as shown on the drawings), accessories necessary to accommodate the associated control sequence.

3. Final location coordinated with other elements contributing to the aesthetics of the associated wall elevation.

O. Low limit thermostats (serving hydronic coils):

1. Appropriate set point range, 120 volt, adjustable sensitivity (2F, minimum), manual reset (remote accessibility as directed), connecting capillary tube (20 feet long, minimum).

2. Capable of responding to the lowest temperature sensed by any one foot portion.

P. Illuminated pushbutton "on/off" switches:

1. Wide range voltage compatibility.

2. LED bulb, with red mushroom lens.

3. UL listed.

4. IDEC / TWND Series or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Electrical wiring:

1. Wiring required to accomplish the temperature control sequences herein specified shall be the responsibility of this Contractor and installed in strict accordance with the National Electrical Code.

2. Power wiring required to energize the control systems shall be the responsibility of this Contractor and executed by the Electrical Contractor.

3. Wiring associated with DDC components shall be twisted, low voltage, shielded (as required), plenum cable.

4. Exposed wiring shall be installed in DEDICATED electrical metallic tubing with set-screw and compression type couplings and connectors for interior dry locations and interior wet locations or exterior locations, respectively.

5. Provide conduit labels (located to ensure continuous systems recognition) and identification at wiring terminations).

B. Automatic dampers:

1. Units which are shown on the drawings to serve as automatic mixing dampers shall be sized and arranged as shown with the blades of the automatic outside air and return air dampers (6" width, maximum) positioned to ensure impingement of their respective air streams.

C. Identification:

1. Provide controlled variable sensors labels (temperature, pressure, hydronic flowrate, etc.) serving controlled devices (dampers and valves).

3.02 SEQUENCES

A. System Control, General:

1. The fundamental objective of the control sequences is to provide system control of reasonable complexity that minimizes energy consumption while meeting the associated demands.

2. Unless otherwise specified and/or noted, all temperatures shall be considered as dry bulb graduations.

3. Airside economizer/return air related enthalpy preference shall be determined in context with global outside air and return air temperature and humidity sensors.

4. Software formulated optimization relative to systems and/or systems components operation shall be manifested by appropriately developed algorithms considering pertinent variables and associated trend logs.

5. Time-of-day scheduling shall automatically (with manual over-ride) select the system cycles (occupied, unoccupied) of operation.

6. Included in the Electrical Contract are provisions for the installation of a relay(s) in the fire alarm control panel(s) which shall be activated in the event of an alarm; provide the switches, relays, etc. necessary to interface with the above mentioned relay(s) and shut down all fans as noted in the motor and starter schedule.

7. The building systems may be subdivided as follows:

   a. Central Station Heating, Ventilating, and Air Conditioning Constant Volume Systems.

   b. Central Station Heating, Ventilating and Air Conditioning Variable Air Volume Systems.

   c. Boiler Room Heating and Ventilating System.

   d. Materials Laboratory Heating, Ventilating, and Air Conditioning System.

   e. Chemistry Laboratory Exhaust/Make-Up Air Systems.

   f. Welding Laboratory Exhaust/Make-up Air Systems.

   g. HVAC Laboratory Refrigerant Exhaust Systems.

   h. Chilled Water Plant.

   i. Hot Water Heating Plant.

   j. Isolated Variable Air Volume Terminals.

   k. Variable Air Volume Terminals/Naturally Convective Radiation.

   l. Isolated Reheat Terminals Control.

m. Isolated Naturally Convective Radiation.

n. Cabinet Unit Heaters.

o. Unit Heaters.

B. Central Station Heating, Ventilating and Air Conditioning Constant Volume Systems Control (HVACU-WELD, REF-WELD, HVACU-HVAC, REF-HVAC, HVACU-MACHCNC, REF-MACHCNC, HVACU-ELEC, REF-ELEC):

1. General:

a. Each system shall provide heating, ventilating and air conditioning in context with their respective scheduled "Occupied", "Unoccupied", and "Warm-Up"/"Cool-Down" cycles of operation as determined by an Owners authorized representative.

b. Controls shall prevent the simultaneous operation of heating and airside economizer and heating and mechanical cooling.

c. Operation related to the appropriate sequence categorized as "below" heating/airside economizer and "above" mechanical cooling change-over shall be initiated automatically in response to software formulated, minimum enthalpy differential optimization.

d. At temperatures below its set point 40F, a low limit thermostat located at the heating coil discharge shall stop the system fans, maintain the exhaust air and outside air and return air dampers in their normally closed and normally open position, respectively, and maintain the control valve serving the associated heating coil in its normally open full coil flow position.

2. Occupied cycle control, below change-over:

a. System controlled devices position:

1) Normally closed control valve serving the associated cooling coil shall maintain its full open position.

b. System fans control:

1) Supply fan and return/exhaust fan shall operate continuously.

c. System temperature and ventilation air control:

1) As the required capacity for heating and cooling varies, a PCM in combination with a space temperature sensor shall modulate the control valve serving the associated heating coil and the automatic exhaust air, outside air and return air dampers in sequence to maintain its set point 72F by resetting the supply air temperature admitting up to 100% outside air, but never less than the minimum quantity shown on the drawings while maintaining a minimum mixed air temperature of 55F.

3. Occupied cycle control, above change-over:

a. System fans control:

1) Supply fan and return/exhaust fan shall operate continuously.

b. System ventilation air control:

1) Exhaust air, outside air and return air dampers shall maintain their respective minimum quantity outside air position as shown in the drawings.

c. System temperature control:

1) As the required capacity for cooling varies, a PCM in combination with a space temperature sensor shall modulate the control valve serving the associated cooling coil to maintain its set point 75F by resetting the supply air temperature.

4. Unoccupied cycle control:

a. System controlled devices position:

1) Exhaust air and outside air and return air dampers shall maintain their normally closed and normally open position, respectively.

2) Control valve serving the associated cooling coil shall maintain its full open and normally closed position below and above changeover, respectively.

b. System plenum temperature control:

1) A PCM in combination with a mixed air temperature sensor shall cycle the control valve serving the associated heating coil to maintain its set point 75F.

c. System fans control:

1) As the required capacity for heating varies, a PCM in combination with a space temperature sensor shall cycle the supply fan and return/exhaust fan to maintain its set point 60F.

5. Warm-up/cool-down cycle control:

a. System controlled devices position:

1) Exhaust air and outside air and return air dampers shall maintain their normally closed and normally open position, respectively.

b. System fans control:

1) Supply fan and return/exhaust fan shall operate continuously.

c. System temperature control:

1) As the required capacity for heating and cooling varies, a PCM in combination with a return air temperature sensor shall modulate the respective control valve serving the associated heating or cooling coil to maintain its set point 72F/75F by resetting the supply air temperature.

6. Monitoring:

a. Supply fan status.

b. Return/exhaust fan status.

c. Supply air temperature.

d. Return air temperature.

e. Space temperature.

f. Outside air temperature.

g. Mixed air temperature.

h. Exhaust air damper position.

i. Outside air damper position.

j. Return air damper position.

k. Heating coil valve position.

l. Cooling coil valve position.

m. Space/atmosphere pressure differential.

n. Space/space pressure differential.

o. Filters pressure differential.

7. Alarms:

a. Equipment failure:

1) Supply fan.

2) Return/exhaust fan.

b. Low space temperature.

c. High space temperature, occupied cycle.

d. Low limit temperature.

e. Fire alarm status.

f. Change filters.

C. Central Station Heating, Ventilating and Air Conditioning Variable Air Volume Systems Control (HVACU-CIVIL, REF-CIVIL, HVACU-CONTROLS, REF-CONTROLS, HVACU-CLASS, REF-CLASS, HVACU-FAB, REF-FAB, HVACU-NHEAD, REF-NHEAD):

1. General:

a. Each system shall provide heating, ventilating and air conditioning in context with their respective scheduled "Occupied", "Unoccupied", and "Warm-Up"/"Cool-Down" cycles of operation as determined by an Owners authorized representative.

b. Controls shall prevent the simultaneous operation of heating and airside economizer and heating and mechanical cooling.

c. Operation related to the appropriate sequence categorized as "below" heating/airside economizer and "above" mechanical cooling change-over shall be initiated automatically in response to software formulated, minimum enthalpy differential optimization.

d. At temperatures below its set point 40F, a low limit thermostat located at the heating coil discharge shall stop the system fans, maintain the exhaust air and outside air and return air dampers in their normally closed and normally open position, respectively, and maintain the control valve serving the associated heating coil in its normally open (full coil flow) position.

e. As the required flow rate of conditioned air varies and the variable volume terminals modulate accordingly, a PCM in combination with a static pressure sensor located in the system supply air ductwork, as shown on the drawings, shall vary the system supply fan and return/exhaust fan speed via their respective adjustable frequency controller to maintain its set point 1.0 in, wg.

2. Occupied cycle control, below change-over:

a. System controlled devices position:

1) Normally closed control valve serving the associated cooling coil shall maintain its full open position.

b. System fans control:

1) Supply fan and return/exhaust fan shall operate continuously.

c. System temperature and ventilation air control:

1) As the required capacity for heating and cooling varies, a PCM in combination with a supply air temperature sensor shall modulate the control valve serving the associated heating coil and the automatic exhaust air, outside air and return air dampers in sequence to maintain its set point 60F admitting up to 100% outside air, but never less than the minimum quantity shown on

the drawings while maintaining a minimum mixed air temperature of 55F.

3. Occupied cycle control, above change-over:

   a. System fans control:

      1) Supply fan and return/exhaust fan shall operate continuously.

   b. System ventilation air control:

      1) Exhaust air, outside air and return air dampers shall maintain their respective minimum quantity outside air position as shown in the drawings.

   c. System temperature control:

      1) As the required capacity for cooling varies, a PCM in combination with a supply air temperature sensor shall modulate the control valve serving the associated cooling coil to maintain its set point 55F.

4. Unoccupied cycle control:

   a. System controlled devices position:

      1) Exhaust air and outside air and return air dampers shall maintain their normally closed and normally open position, respectively.

      2) Control valve serving the associated cooling coil shall maintain its full open and normally closed position below and above changeover, respectively.

      3) The variable air volume terminal dampers shall maintain their normally open position.

   b. System plenum temperature control:

      1) A PCM in combination with a mixed air temperature sensor shall cycle the control valve serving the associated heating coil to maintain its set point 75F.

   c. System fans control:

      1) As the required capacity for heating varies, a PCM in combination with a space temperature sensor shall cycle the supply fan and return/exhaust fan to maintain its set point 60F.

5. Warm-up/cool-down cycle control:

   a. System controlled devices position:

      1) Exhaust air and outside air and return air dampers shall maintain their normally closed and normally open position, respectively.

b. System fans control:

1) Supply fan and return/exhaust fan shall operate continuously.

c. System temperature control:

1) As the required capacity for heating and cooling varies, a PCM in combination with a return air temperature sensor shall modulate the respective control valve serving the associated heating or cooling coil to maintain its set point 72F/75F by resetting the supply air temperature.

6. Monitoring:

a. Supply fan status.

b. Return/exhaust fan status.

c. Supply air temperature.

d. Return air temperature.

e. Space temperature.

f. Outside air temperature.

g. Mixed air temperature.

h. Exhaust air damper position.

i. Outside air damper position.

j. Return air damper position.

k. Heating coil valve position.

l. Cooling coil valve position.

m. Space/atmosphere pressure differential.

n. Filters pressure differential.

7. Alarms:

a. Equipment failure:

1) Supply fan.

2) Return/exhaust fan.

b. Low return air temperature.

c. High return air temperature, occupied cycle.

d. Low limit temperature.

e. Fire alarm status.

f. Change filters.

D. Boiler Room Heating and Ventilating Systems Control (HVU-BOILER, EF-BOILER):

1. General:

a. System shall provide heating, ventilating, and tempered combustion air.

b. Controls shall prevent the simultaneous operation of heating and airside economizer.

c. At temperatures below its set point 40F, a low limit thermostat located at the heating coil discharge shall stop the system fans, maintain the outside air and return air dampers in their normally closed and normally open position, respectively, and maintain the control valve serving the associated heating coil in its normally open full coil flow position.

2. System fans control:

a. Supply fan shall operate continuously.

b. Exhaust fan shall operate continuously at variable speed capacity, via an adjustable frequency controller, in context with the associated central station air handling unit outside air and return air dampers position ranging from minimum airflow for combustion to maximum airflow at full airside economizer.

3. System temperature and ventilation air control:

a. As the required capacity for heating and cooling varies, a PCM in combination with a space temperature sensor shall modulate the control valve serving the associated heating coil and the automatic outside air and return air dampers in sequence admitting up to 100% outside air, but never less than the minimum quantity shown on the drawings to maintain its set point 65F by resetting the supply air temperature.

4. Monitoring:

a. Supply fan status.

b. Exhaust fan status.

c. Space temperature.

d. Supply air temperature.

e. Outside air temperature.

f. Mixed air temperature.

g. Outside air damper position.

h. Return air damper position.

i. Exhaust fan speed.

j. Heating coil valve position.

k. Filters pressure differential.

5. Alarms:

a. Equipment failure:

1) Supply fan.

2) Exhaust fan.

b. Low space temperature.

c. Low limit temperature.

d. Fire alarm status.

e. Change filter.

E. Materials Laboratory Heating, Ventilating and Air Conditioning Constant Volume System Control (HVACU-MAT, REF-MAT, EF-7, EF-8, EF-9):

1. General:

a. System shall provide heating, ventilating, air conditioning, exhaust and tempered makeup air in context with "Occupied", "Unoccupied", and "Warm-Up"/"Cool-Down" cycles of operation as determined by an Owners authorized representative.

b. Controls shall prevent the simultaneous operation of heating and airside economizer and heating and mechanical cooling.

c. Operation related to the appropriate sequence categorized as "below" heating/airside economizer and "above" mechanical cooling change-over shall be initiated automatically in response to software formulated, minimum enthalpy differential optimization.

d. At temperatures below its set point 40F, a low limit thermostat located at the heating coil discharge shall stop the system fans, maintain the exhaust air and outside air and return air dampers in their normally closed and normally open position, respectively, and maintain the control valve serving the associated heating coil in its normally open full coil flow position.

2. Occupied cycle control, below change-over:

a. System controlled devices position:

1) Normally closed control valve serving the associated cooling coil shall maintain its full open position.

b. System fans control:

1) Supply fan and return/exhaust fan shall operate continuously.

2) Exhaust fans shall operate as needed in response to owner activated, respective "on/off" illuminated pushbutton switches.

c. System temperature and ventilation air control:

1) As the required capacity for heating and cooling varies, a PCM in combination with a supply air temperature sensor shall modulate the control valves serving the associated heating coil and the automatic exhaust air, outside air and return air dampers in sequence to maintain its set point 65F admitting up to 100% outside air, but never less than the minimum quantity shown on the drawings while maintaining a minimum mixed air temperature of 55F.

2) As the required capacity for makeup air varies, a PCM in combination with an adjacent Electric Codes laboratory/Materials laboratory differential pressure sensor shall override the outside air and return air damper signal admitting up to 100% outside air, but never less than the minimum quantity shown on the drawings to maintain its differential setpoint (-0.05 in wg).

3. Occupied cycle control, above change-over:

a. System fans control:

1) Supply fan and return/exhaust fan shall operate continuously.

2) Exhaust fans shall operate as needed in response to owner activated, respective "on/off" illuminated pushbutton switches.

b. System ventilation air control:

1) Exhaust air, outside air and return air dampers shall maintain their respective minimum quantity outside air position as shown in the drawings.

2) As the required capacity for makeup air varies, a PCM in combination with an adjacent Electric Codes laboratory/Materials laboratory differential pressure sensor shall override the outside air and return air damper signal admitting up to 100% outside air, but never less than the minimum quantity shown on the drawings to maintain its differential setpoint (-0.05 in wg).

c. System temperature control:

1) As the required capacity for cooling varies, a PCM in combination with a supply air temperature sensor shall modulate the control valve serving the associated cooling coil to maintain its discharge set point (60F).

4. Unoccupied cycle control:

   a. System controlled devices position:

      1) Exhaust air and outside air and return air dampers shall maintain their normally closed and normally open position, respectively.

      2) Control valve serving the associated cooling coil shall maintain its full open and normally closed position below and above changeover, respectively.

   b. System fans control:

      1) As the required capacity for heating varies, a PCM in combination with averaged space temperature sensors shall cycle the supply fan and return/exhaust fan to maintain their set points (60F).

      2) Exhaust fans shall operate as needed in response to owner activated respective "on/off" switches.

   c. System temperature and ventilation air control:

      1) A PCM in combination with a supply air temperature sensor shall cycle the control valve serving the associated heating coil to maintain its discharge set point (65F).

      2) As the required capacity for makeup air varies, a PCM in combination with an adjacent Electric Codes laboratory/Materials laboratory differential pressure sensor shall override the supply fan, return/exhaust fan, outside air damper, and return air damper signals to cycle the fans and admitting up to 100% outside air to maintain its differential setpoint (-0.05 in wg).

5. Warm-up/cool-down cycle control:

   a. System controlled devices position:

      1) Exhaust air and outside air and return air dampers shall maintain their normally closed and normally open position, respectively.

   b. System fans control:

      1) Supply fan and return/exhaust fan shall operate continuously.

   c. System temperature control:

      1) As the required capacity for heating and cooling varies, a PCM in combination with a return air temperature sensor shall modulate the respective control valve serving the associated heating or cooling coil to maintain its set point 72F/75F by resetting the supply air temperature.

6. Monitoring:

   a. Supply fan status.

b. Return/exhaust fan status.

c. Supply air temperature.

d. Return air temperature.

e. Space temperatures.

f. Outside air temperature.

g. Mixed air temperature.

h. Exhaust air damper position.

i. Outside air damper position.

j. Return air damper position.

k. Heating coil valve position.

l. Cooling coil valve position.

m. Space/space pressure differential.

n. Filters pressure differential.

7. Alarms:

a. Equipment failure:

1) Supply fan.

2) Return/exhaust fan.

b. Low space temperature.

c. High space temperature, occupied cycle.

d. Low limit temperature.

e. Fire alarm status.

f. Change filters.

F. Chemistry Laboratory Make-Up Air and Exhaust Air Systems Control (MUAU-CHEM, PRV-1A, PRV-1B & PRV-1C):

1. General:

a. System shall provide heating, ventilating and air conditioning in context with "Occupied" and "Unoccupied" cycles of operation as determined by an Owners authorized representative.

b. At temperatures below its set point (40F), a low limit thermostat located at the preheat coil discharge shall stop the system fans, maintain the exhaust air and outside air dampers in their normally closed position and maintain the control valve serving the associated preheat coil in its normally open (full coil flow) position.

2. Occupied cycle control, below change-over:

a. System controlled devices position:

1) Normally closed exhaust air and outside air dampers shall maintain their full-open position.

2) Normally closed laboratory fan bypass damper shall maintain its partially open position (set to maintain fan discharge velocity of >4000 fpm).

b. System fans control:

1) Supply fan and exhaust fan shall operate continuously at full speed.

c. System temperature control:

1) As the required capacity for heating varies, a PCM in combination with a discharge temperature sensor shall modulate the control valve serving the associated heating coils to maintain its set point (65F), by resetting the supply air temperature.

d. System humidification control:

1) Integral control serving the associated humidifier shall be energized to maintain its low limit set point (35% RH).

3. Occupied cycle control, above change-over:

a. System controlled devices position:

1) Normally closed exhaust air and outside air dampers shall maintain their full-open position.

2) Normally closed laboratory fan bypass damper shall maintain its partially open position (set to maintain fan discharge velocity of >4000 fpm).

b. System fans control:

1) Supply fan and exhaust fan shall operate continuously at full speed.

c. System temperature control:

1) As the required capacity for cooling varies, a PCM in combination with a space temperature sensor shall modulate the control valves

serving the associated cooling coils in sequence to maintain its set point (75F) by resetting the supply air temperature.

d. System dehumidification control:

1) As the required capacity for dehumidification varies, a PCM in combination with space and cooling coils discharge temperature sensors and space humidity sensor shall modulate the control valves serving the associated cooling coils (by resetting the cooling coil discharge temperature) to maintain space set point (55% rh) while modulating the normally open control valve serving the associated reheat coil to maintain the space temperature set point (75F) by resetting the supply air temperature.

4. Unoccupied cycle control, below change-over:

a. System controlled devices position:

1) Normally closed exhaust air damper shall maintain its balanced 50% airflow position.

2) Normally closed outside air damper shall maintain its full open position.

3) Normally closed laboratory fan bypass damper shall maintain its full open position (set to maintain fan discharge velocity of >4000 fpm while reducing lab exhaust airflow rate to 50%).

b. System fans control:

1) Supply fan shall operate continuously at half speed.

2) Exhaust fan shall operate continuously at full speed.

c. System temperature control:

1) As the required capacity for heating varies, a PCM in combination with a space temperature sensor shall modulate the control valves serving the associated heating coils to maintain its set point (72F), by resetting the supply air temperature.

d. Humidifier shall not operate.

5. Unoccupied cycle control, above change-over:

a. System controlled devices position:

1) Normally closed exhaust air damper shall maintain its balanced 50% airflow position.

2) Normally closed outside air damper shall maintain its full open position.

3) Normally closed laboratory fan bypass damper shall maintain its full open position (set to maintain fan discharge velocity of >4000 fpm while reducing lab exhaust airflow rate to 50%).

b. System fans control:

3) Supply fan shall operate continuously at half speed.

4) Exhaust fan shall operate continuously at full speed.

c. System temperature control:

1) As the required capacity for cooling varies, a PCM in combination with a space temperature sensor shall modulate the control valves serving the associated cooling coils in sequence to maintain its set point (75F) by resetting the supply air temperature.

6. Monitoring:

a. Supply fan status.

b. Exhaust fan(s) status.

c. Space temperature.

d. Space humidity.

e. Outside air temperature.

f. Outside air damper position.

g. Exhaust air damper position.

h. Heating coils valve position.

i. Cooling coils valves positions.

j. Filters pressure differential.

7. Alarms:

a. Equipment failure:

1) Supply fan.

2) Exhaust fan(s).

b. Low space temperature.

c. High space temperature.

d. Low space humidity.

e. High space humidity.

f. Low limit temperature.

g. Fire alarm status.

h. Change filters.

G. Welding Laboratory Central Station Make-Up Air and Exhaust Air Systems Control (MUAU-WELD, EF-1, EF-2, EF-3, EF-4, EF-5):

1. General:

a. System shall provide exhaust air and tempered make-up air when needed.

b. At temperatures below its set point 40F, a low limit thermostat located at the heating coils discharge shall stop the system fans, maintain the exhaust air and outside air dampers in their normally closed position and maintain the control valve serving the associated heating coil in its normally open (full coil flow) position.

2. Occupied and Unoccupied cycle control:

a. System controlled devices position:

1) Exhaust air and outside air dampers shall maintain their normally closed position.

b. System fans control:

1) Exhaust fans shall operate as needed in response to owner activated, respective "on/off" illuminated pushbutton switches.

2) As the number of operating welding stations varies, a PCM in combination with an adjustable frequency controller shall open the respective normally closed motorized exhaust damper and vary the associated exhaust fan speed (airflow) in stages (4 or 6 respectively) to maintain each operating welding stations' exhaust airflow (500 cfm).

3) As the number of operating downdraft grinding stations and portable welding stations varies, a PCM in combination with an adjustable frequency controller shall open the respective normally closed motorized exhaust damper and vary the associated exhaust fan speed (airflow) in stages (2) to maintain the downdraft grinding table exhaust airflow (1,500 cfm) and collective portable welding stations airflow (1,600 cfm).

4) After initial "on/off" illuminated pushbutton activation, provisions shall be made to ensure a five-minute minimum and a two-hour maximum station runtime.

5) As the demand for exhaust air varies, a PCM in combination with an adjacent corridor/welding laboratory differential pressure sensor shall vary the make-up air unit fan speed via its adjustable

frequency controller to maintain its differential setpoint (-0.05 in wg).

c. System temperature control:

1) As the required capacity for tempering make-up air varies, a PCM in combination with a supply air temperature sensor shall modulate the control valves serving the associated heating and cooling coils in sequence to maintain the heating and cooling discharge set point (65F, and 75F respectively).

3. Monitoring:

a. Exhaust fans status.

b. Make-up air fans status.

c. Supply air temperature.

d. Outside air temperature.

e. Exhaust air dampers position.

f. Outside air damper position.

g. Heating coil valve position.

h. Cooling coils valves position.

i. Filters pressure differential.

4. Alarms:

a. Equipment failure:

1) Exhaust fans.

2) Supply fan.

b. Low supply air temperature.

c. High supply air temperature.

d. Low limit temperature.

e. Fire alarm status.

f. Change filters.

H. HVAC Laboratory Exhaust Air Systems Control (EF-12):

1. General:

a. System shall provide emergency exhaust air in response to an A2L refrigerant leak detector.

b. Automatic exhaust air dampers shall be normally open, powered closed when system is not in "emergency operation".

2. Systems control:

a. The following shall be initiated in sequence in response to a refrigerant leak detection signal ("emergency operation"):

1) Normally open exhaust air dampers shall maintain their full-open position.

2) Exhaust fan shall energize via its respective adjustable frequency controller and modulate to its full speed setpoint.

3) Alert BMS and activate building fire alarm trouble.

4) System shall run continuously until it is manually deactivated by authorized facility or emergency personnel via a keyed, wall mounted switch.

I. Chilled Water Plant Control:

1. General:

a. System operation shall be determined by authorized facility personnel.

2. Operation above changeover:

a. System pumps control:

1) CGS generation (P-CGSG-1, P-CGSG-2):

a) Units shall operate conjunctively with a programmed "lead-lag"/equal run time arrangement.

b) The lead unit shall operate continuously.

c) Should the lead unit fail, a current sensing arrangement shall energize the lag unit.

2) CGS distribution (P-CGSD-1, P-CGSD-2):

a) Units shall operate conjunctively with a programmed "lead-lag"/equal run time arrangement.

b) The lead unit shall operate continuously.

c) Should the lead unit fail, a current sensing arrangement shall energize the lag unit.

d) As the required capacity of terminal heat transfer surfaces varies and the associated 2-way control valves modulate

accordingly, a PCM, in combination with system flowrate sensor and a differential pressure sensing arrangement indicated on the drawings, shall vary the unit speed via an adjustable frequency controller to maintain its empirically determined set point while modulating a bypass valve to maintain minimum 25% system flowrate.

b. System temperature control:

1) Generation:

a) Flow switches sensing established flow shall energize their respective chiller integral control system, which shall stage and vary the compressor(s) speed via an adjustable frequency controller to maintain the selected set point, that shall be reset in context with ambient outside air temperature:

(1) 46F CGS at 55F (or less) OA.

(2) 42F CGS at 80F (or greater) OA.

2. Operation below changeover:

a. System equipment (chillers and pumps) shall not operate.

3. Monitoring:

a. Pumps lead/lag designation.

b. Pumps status.

c. Chiller status.

d. Generation CGSS temperature.

e. Generation CGSR temperature.

f. Distribution CGSS temperature.

g. Distribution CGSR temperature.

h. Generation CGS flowrate.

i. Distribution CGS flowrate.

4. Alarms:

a. Equipment failure:

1) Chiller.

2) Pumps.

b. High distribution CGSS temperature.

J. Heating Plant Control:

1. General:

a. System shall provide seasonal heating, tempered ventilation and reheat.

b. System operation shall be determined by authorized facility personnel.

2. System pumps control:

a. Hot Glycol generation (P-HGSG-1, P-HGSG-2):

1) Units shall operate conjunctively with a programmed "lead-lag"/equal run time arrangement.

2) The lead unit shall operate continuously.

3) Should the lead unit fail, a current sensing arrangement shall energize the lag unit.

4) Should the lead unit's associated boiler/burner fail, a current sensing arrangement shall energize and de-energize the lag and lead units, respectively.

5) The lag unit shall operate in context with the system temperature control herein described.

b. Hot Glycol distribution (P-HGSD-1, P-HGSD-2):

1) Units shall operate conjunctively with a programmed "lead-lag"/equal run time arrangement.

2) The lead unit shall operate continuously.

3) Should the lead unit fail, a current sensing arrangement shall energize the lag unit.

4) As the required capacity of terminal heat transfer surfaces varies and the associated 2-way control valves modulate accordingly, a PCM, in combination with system flowrate sensor and a differential pressure sensing arrangement indicated on the drawings, shall vary the associated unit speed via an adjustable frequency controller to maintain its empirically determined set point while modulating a bypass valve to maintain minimum 25% system flowrate.

3. System temperature control:

a. Generation:

1) A PCM in combination with flow switches located in the lead and lag pump discharge piping and temperature sensors located in the supply header and ambient outside air shall modulate the

respective boiler burners to maintain its set point, which shall be reset in accordance with the following:

a) 210F HGSS at –10F (or less) OA.

b) 170F HGSS at 60F (or greater) OA.

b. Distribution:

1) A PCM in combination with temperature sensors located in the distribution pumps discharge piping and ambient outside air shall modulate the associated 3-way control valve to maintain its set point, which shall be reset in accordance with the following while maintaining a minimum generation HWR temperature of 140F:

a) 190F HGSS at –10F (or less) OA.

b) 150F HGSS at 60F (or greater) OA.

4. Monitoring:

a. Generation pumps/boiler/burners lead/lag designation.

b. Distribution pumps lead/lag designation.

c. Pumps status.

d. Boiler/burners status.

e. Ambient outside air temperature.

f. Generation HGSS temperature.

g. Generation HGSR temperature.

h. Distribution HGSS temperature.

i. Distribution HGSR temperature.

j. Distribution HGS flowrate.

k. Control valve position.

l. Percent modulation each boiler/burner.

m. Distribution thermal demand.

5. Alarms:

a. Equipment failure:

1) Boiler/burners.

2) Pumps.

b. Low distribution HGSS temperature.

c. Low generation HGSR temperature.

K. Isolated, Variable Air Volume Terminals Control:

1. Occupied cycle:

a. Below changeover:

1) Controlled devices position:

a) The normally open terminal damper shall maintain its scheduled maximum airflow.

2) Temperature control:

a) As the required capacity for heating varies, a SFCM in combination with a space temperature sensor shall modulate the normally open control valve serving the associated reheat coil to maintain its set point (72F).

b. Above changeover (mechanical cooling):

1) As the required capacity for heating and cooling varies, a SFCM in combination with a space temperature and zone airflow sensors shall initiate the following in sequence, on a **FALL** in space temperature, to maintain its set point (75F):

a) Modulate the normally open terminal damper (by resetting the zone air flow rate in accordance with the prevailing space temperature) to its low limit set point.

b) Modulate the normally open control valve serving the associated reheat coil to its full-open position.

2. Unoccupied cycle:

a. Controlled devices position:

1) The normally open terminal damper shall maintain its scheduled maximum airflow.

b. Temperature control:

1) As the required capacity for heating varies, an SFCM in combination with a space temperature sensor shall modulate the normally open control valve serving the associated reheat coil to maintain its set point (60F).

3. Monitoring:

a. Space temperature.

b. Discharge air temperature.

c. Air flowrate.

d. Damper position.

e. Reheat coil valve position.

4. Alarms:

a. Low space temperature.

b. High space temperature, occupied cycle.

L. Variable Air Volume Terminals/Naturally Convective Radiation Control:

1. Occupied cycle:

a. Below changeover:

1) Controlled devices position:

a) The normally open terminal damper shall maintain its scheduled maximum airflow.

2) Temperature control:

a) As the required capacity for heating varies, a SFCM in combination with a space temperature and zone airflow sensors shall initiate the following in sequence, on a **FALL** in space temperature, to maintain its set point (72F):

(1) Modulate the normally open control valve serving the associated reheat coil to its full-open position.

(2) Modulate the normally open control valve serving the associated naturally convective radiation to its full-open position.

b. Above changeover (mechanical cooling):

1) Temperature control:

a) As the required capacity for heating and cooling varies, a SFCM in combination with a space temperature and zone airflow sensors shall initiate the following in sequence, on a **FALL** in space temperature, to maintain its set point (75F):

(1) Modulate the normally open terminal damper (by resetting the zone air flow rate in accordance with the prevailing space temperature) to its low limit set point.

(2) Modulate the normally open control valve serving the associated reheat coil to its full-open position.

(3) Modulate the normally open control valve serving the associated naturally convective radiation to its full-open position.

2. Unoccupied cycle:

a. Controlled devices position:

1) The normally open terminal damper shall maintain its scheduled maximum airflow.

b. Temperature control:

1) As the required capacity for heating varies, a SFCM in combination with a space temperature and zone airflow sensors shall initiate the following in sequence, on a **FALL** in space temperature, to maintain its set point (60F):

(1) Modulate the normally open control valve serving the associated reheat coil to its full-open position.

(2) Modulate the normally open control valve serving the associated naturally convective radiation to its full-open position.

3. Monitoring:

a. Space temperature.

b. Discharge air temperature.

c. Air flowrate.

d. Terminal damper position.

e. Reheat coil valve position.

f. Naturally convective radiation valve position.

4. Alarms:

a. Low space temperature.

b. High space temperature, occupied cycle.

M. Isolated Reheat Terminals Control:

1. As the required capacity for space heating and cooling varies, an SFCM in combination with a space temperature sensor shall modulate the normally open control valve serving the associated reheat terminal coil to maintain its respective occupied and unoccupied set point (72F and 60F).

2. Monitoring:

a. Space temperature.

b. Reheat coil valve position.

c. Reheat coil status.

3. Alarms:

a. Low space temperature (occupied cycle).

b. High space temperature (occupied cycle).

N. Isolated naturally convective radiation control:

1. Temperature control:

a. As the required capacity for space heating varies, a SFCM in combination with a space temperature sensor shall modulate the associated normally open control valve to maintain its set point (72F).

2. Monitoring:

a. Control valve position.

b. Space temperature.

O. Cabinet Unit Heaters Control:

1. Temperature control:

a. As the required capacity for space heating varies, a SFCM in combination with a temperature sensor below the unit coil or wall mounted as shown on the drawings shall cycle the unit fan to maintain its set point 72F.

2. Monitoring:

a. Unit status.

b. Space temperature.

P. Unit Heaters Control:

1. Temperature control:

a. As the required capacity for space heating varies, a PCM in combination with a space temperature sensor shall modulate the normally open control valve to its full open position and cycle the unit fan to maintain its set point 55F.

2. Preventative maintenance sequencing:

a. Below changeover:

1. Unoccupied cycle:

    a) Once per period of time as determined by an owners authorized representative (weekly, biweekly, monthly), a PCM shall modulate the normally open control valve serving the unit heater to its full open position and cycle the unit fan for 15 minutes.

    b) If the unit heater temperature control sequence is activated outside of this preventative maintenance program, reset the preventative maintenance period timer.

    c) Once the above unit heater maintenance sequencing is completed, return systems controlled devices to normal temperature control operation and reset the preventative maintenance period timer.

3. Monitoring:

    a. Unit status.

    b. Preventative maintenance timer.

    c. Space temperature.

SECTION 23 55 80

AIR SYSTEMS AND HYDRONIC SYSTEMS TEST AND BALANCE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Provide a complete program of air systems and hydronic systems test and balance (including adjustments to existing systems as shown and/or noted) in accordance with the drawings and as herein specified, which shall permit achieving design objectives.

B. Upon completion of the HVAC system, this Contractor, in order to accomplish the above, shall:

1. Operate the HVAC system as required for testing and balancing.

2. Secure the services of an independent testing and balancing agency (approved by the Engineer) which specializes in testing and balancing HVAC systems.

3. Assist the testing and balancing agency as required relative to completing the *preliminary procedure* herein described.

C. Testing and balancing shall complement the needs of PHASED CONSTRUCTION, including rebalancing when systems are completed.

D. Testing and balancing, if requested, shall be conducted in the presence of the Engineer and/or the Owner's authorized representative.

E. Instruments used for testing and balancing shall be accurately calibrated and in good working order.

1.02 PROPOSAL

A. A complete proposal, to be submitted to the Engineer for review, shall include the following:

1. The name of the testing and balancing agency.

2. A complete outline of the proposed testing and balancing methods and procedures; configured to provide technicians with explicit, pertinent direction.

3. A warranty period of one year (after completion of testing and balancing), during which time the Engineer, at his discretion, may request a recheck or readjustment of any system component or perform testing of his conception (assisted by technicians employed and compensated by the testing and balancing agency) as required.

4. A SIGNED AFFIDAVIT (attached) attesting to strict compliance with the procedures hereinafter described.

1.03 REPORT

A. Upon completion of testing and balancing, a complete report shall be submitted to the Engineer for review. All data and calculations shall be neatly typewritten and presented in accordance with the methods and procedures herein specified.

PART 2 – PRODUCTS

2.01 ACCEPTABLE TESTING AND BALANCING AGENCIES

A. Energy Balance, Mechanical Testing, Inc., New York Technologies or approved equal.

PART 3 – EXECUTION

3.01 TEST AND BALANCE AIR SYSTEMS IN ACCORDANCE WITH THE FOLLOWING:

A. Preliminary procedure (HVAC contractor and testing and balancing agency):

1. Thoroughly review drawings and specifications to determine design objectives.

2. Verify variations in actual installation from the drawings and specifications with sheet metal foreman.

3. Check filters, dampers and temperature control components for completeness of installation and correct position.

4. Obtain the terminal unit manufacturer's outlet factors and recommended procedures for determining airflow.

5. Prepare schematic diagrams to facilitate reporting as required or as requested by the Engineer.

6. Verify dampers (volume, fire and smoke) are in their full-open position.

7. Correct airflow rate measurements for temperature and barometric pressure when the compound error exceeds 10%.

8. Verify filter media has been replaced as required to ensure appropriate resistance.

B. Equipment and distribution systems testing and balancing:

1. General:

a. With all fans in operation, immediately check rotation and motor amperage (to guard against possible overload).

b. Adjust fan speed to compensate for normal duct leakage and additional static pressure imposed by balancing requirements as required.

c. Whenever possible, flowrate measurements at terminal units shall be obtained by using calibrated airflow measuring cones.

d. Adjust terminal outlets to obtain proper distribution patterns.

e. Make final adjustments as required after the building is occupied.

2. Constant Volume Systems:

a. Drill traversing holes at appropriate points in ductwork at AHU's (EA, OA, RA, SA).

b. Traverse unit to establish baseline, then manipulate AHU drives and dampers position to achieve scheduled CFM at minimum OA.

c. Adjust manual volume dampers in main trunk and branch trunk ducts proceeding in a downstream direction to obtain the proper flowrate.

d. Adjust terminal units proceeding in a downstream direction using manual volume dampers in branch ducts for major adjustment and terminal unit dampers for minor adjustment only. Provide additional dampers in branch ductwork as required to prevent objectionable noise caused by terminal unit dampers.

e. Total the tested terminal unit flowrate and compare with required total system flowrate to determine ductwork leakage.

3. Variable Air Volume Systems:

a. Drill traversing holes at appropriate points in ductwork at AHU's (EA, OA, RA, SA).

b. Place VAV dampers in their wide-open position.

c. Traverse unit to establish baseline, then manipulate AHU drives and dampers position to achieve scheduled block load CFM at minimum OA.

d. Begin calibrating VAV flow sensors to their maximum CFM, progressing from smallest to largest VAV.

e. Begin placing calibrated VAV's to their minimum flow CFM; thereby forcing air to VAV's with greater maximum flow CFM, continuing until additional VAV's can not attain maximum flow CFM.

f. Increase the ductwork SP to produce the scheduled, established block load CFM while checking SP at AHU to avoid exceeding ductwork limit.

g. Continue this iteration until all VAV air sensors are calibrated for maximum flow CFM.

h. Release VAV's to predetermined ductwork SP, permitting them to operate diversely within equipment and ductwork limits.

C. Record the following data as applicable for each system component and incorporate in the complete report for submittal:

1. Fan DESIGN conditions, including location, area served, type, flowrate, static pressure, discharge static pressure, outlet velocity, motor BHP and motor HP.

2. INSTALLED fan description, including manufacturer, model number, size, class, belt number and size, drive and driven sheave size, belt position on adjustable sheaves, motor nameplate HP and motor nameplate current characteristics.

3. MEASURED fan conditions, including flowrate, speed, static pressure, discharge static pressure, outlet velocity, calculated BHP (based on average current readings of all legs at motor terminals) and motor speed.

4. Terminal unit DESIGN conditions, including location, area served, type, pattern, flowrate, throw, static pressure drop and NC rating.

5. INSTALLED terminal unit description, including manufacturer model number, size (neck area for diffusers and core area for grilles), outlet factor (based upon manufacturer's data when available or calculated based on field testing when necessary) and pattern.

6. MEASURED terminal unit conditions, including test velocity and flowrate.

7. Duct DESIGN conditions at points of traverse, including location, area served, size, velocity and flowrate.

8. MEASURED duct conditions at points of traverse, including average velocity and flowrate.

9. Differential pressure between the building interior and exterior at operating conditions of minimum and maximum outside air.

10. All significant variations of the actual installation from the drawings and specifications.

3.02 TEST AND BALANCE HYDRONIC SYSTEMS IN ACCORDANCE WITH THE FOLLOWING:

A. Preliminary procedure (HVAC contractor and testing and balancing agency):

1. Thoroughly review drawings and specifications to determine design objectives.

2. Verify variations in actual installation from the drawings and specifications with pipe fitter foreman.

3. Air systems test and balance and hydronic systems initial cleaning and water treatment shall be complete prior to test and balance.

4. Check air control accessories (air separators, expansion tanks, air vents, fill pressures, relief valve settings, etc.) for proper installation.

5. Verify distribution piping and heat transfer equipment are properly vented.

6. Verify strainers are properly cleaned.

7. Verify automatic 2-way valves are in their full-open position, automatic 3-way valves closed to bypass (unless otherwise indicated by the design concept) and all associated shut-off and/or balancing valves are in their required full-closed or full-open position.

8. Prepare schematic diagrams to facilitate reporting as required or as requested by the Engineer.

B. Equipment and distribution systems testing and balancing:

1. With pumps in operation, immediately check rotation and motor amperage (to guard against possible overload).

2. Adjust throttling valves at pump discharge to obtain the required design flowrate.

3. Adjust throttling in main and branch main piping, proceeding in a downstream direction from the pumps, according to the associated flow measurement devices to obtain the required design flowrate.

4. Adjust throttling valves in branch piping serving terminal heat transfer units, proceeding in a downstream direction from the pumps, according to the associated flow measurement devices to obtain the required design flowrate.

5. Readjust throttling valves in pump discharge as required to maintain system design flowrate.

6. Calibrated flow measurement devices as shown on the drawings and as herein specified shall be used to determine flowrate. Automatic control valves and calibrated balancing devices may be used in lieu of the above where indicated or applicable.

7. The temperature difference method of flowrate measurement shall be used ONLY when the above mentioned methods are not possible and then ONLY when employing a carefully calculated air side load adjustment.

8. Make final adjustments as required after the building is occupied.

C. Record the following data as applicable for each system component and incorporate in the complete report for submittal:

1. Pump DESIGN conditions, including location, area served, type, flowrate, head and motor HP.

2. INSTALLED pump description, including manufacturer, model number, size, motor nameplate HP and motor nameplate current characteristics.

3. MEASURED pump conditions, including flowrate, differential pressure, discharge pressure, calculated BHP (based on average current readings of all legs at motor terminals) and motor speed.

4. Main, branch main and branch piping DESIGN conditions, including identification of the associated flow measurement device, area served and flowrate.

5. INSTALLED flow measurement device description, including manufacturer, model number, size and necessary application factors.

6. MEASURED main, branch main and branch piping flowrate.

7. All significant variations of the actual installation from the drawings and specifications.

3.03 BALANCING DEVICE SET POINT INDICATION

A. Clearly mark (in permanent, easily visible fashion) each balancing device (dampers and flow meters) set point at the conclusion of the entire HVAC system balancing.

END OF SECTION

ATTACHMENT: Procedure compliance sheet

HVAC TESTING AND BALANCING PROCEDURES

A. Procedures will be in accordance with those set forth in specification section 23 55 80, Part 3 - Execution.

B. _____
TESTING AND BALANCING AGENCY:

_____ _____
BY: DATE:

SECTION 23 55 90

GAUGES, THERMOMETERS AND TEMPORARY PRESSURE/TEMPERATURE WELLS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install gauges, thermometers and temporary pressure/temperature wells in accordance with the locations shown on the drawings.

B. Units shall operate within the middle third of a range selected to suit the measured medium under normal operating conditions.

C. Units measuring mediums subject to quickly changing pressures shall be complete with dampening device at the inlet.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Gauges and thermometers:

1. Taylor, Trerice, Weiss, Winters or approved equal.

B. Temporary pressure/temperature wells:

1. Pete's Plug or approved equal.

2.02 DESCRIPTION

A. Pressure gauges:

1. Phospher bronze internals, ± 1% accuracy.

2. White face, black embossed figures, adjustable black pointer, safety glass window.

3. 1/4 inch NPT bottom inlet, gauge cock, over/under stop, snubber.

B. Thermometers:

1. Linear scale:

a. Adjustable, ± 1% accuracy.

b. White face, black embossed figures, organic liquid filled tube, safety glass window.

c. 3/4 inch NPT separable socket, back inlet, stem, Thermowell (33% pipe penetration).

2. Dial:

a. Adjustable, bi-metal, ± 1% accuracy.

b. White face, black embossed figures, adjustable black pointer, safety glass window.

c. 1/2 inch NPT connection, back inlet, stem, Thermowell (33% pipe penetration), braided remote reading capillary as required.

3. Digital:

a. Adjustable, solar (light) powered (15 lux), glass passivated thermistor, ± 1% accuracy, 10 seconds update frequency.

b. Linear scale unit interchangeable; -30F to 140F, 100% rh ambient.

C. Temporary pressure/temperature well:

1. Brass body and cap with retaining strap.

2. 1/4 inch Nordel or neoprene core; 45F to 275F, 400 psig.

3. Spare gauges (2) and thermometers (4).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Unit locations shown on the drawings are indicative of the approximate point where measurement is required.

B. Actual locations must permit easily accessible reading and prevent error due to the relative location of other system components (e.g., pressure gauges shall be located 5 pipe diameters downstream from fittings and valves; avoid locating thermometers where nearby mediums of temperatures, other than that being measured, may affect reading, etc.).

C. Install gauges and thermometers after construction is substantially complete; thereafter calibrate, clean and adjust viewing angle.

D. Temporary pressure/temperature well probes shall be carefully inserted and promptly removed.

END OF SECTION

SECTION 23 55 91

IDENTIFICATION

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install identification for equipment, ductwork, piping and valves.

B. Identification shall include labels, stenciling, concealed location indicators and warning tape.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Brady, Seton or approved equal.

2.02 DESCRIPTION

A. Labels:

1. Equipment:

    a. Standard, phenolic, engraved nameplates.

    b. Appropriately sized lettering:

        1) Large equipment:

            a) 3/4 inch high by 1/2 inch.

        2) Small equipment:

            a) 3/8 inch high by 1/4 inch.

2. Ductwork (concealed and exposed outside finished spaces):

    a. Neatly stenciled (with appropriately sized lettering), 50 foot intervals (15 foot intervals within equipment rooms).

3. Piping:

    a. General:

        1) Concealed and exposed outside equipment rooms:

            a) 25 foot intervals.

        2) Equipment rooms:

a) 15 foot intervals.

b) Near equipment connections.

b. 2 inches and smaller:

1) Semi-rigid plastic with pre-set curl (designed to "snap-on" with substantial overlap), sized and color-coded in accordance with ANSI Standard A 13.1, complete with pipe size and directional flow arrows.

c. 2 ½ inches and larger:

1) Neatly stenciled (with appropriately sized lettering indicating pipe size, and directional flow arrows).

B. Concealed location indicators:

1. Equipment:

a. 1/4 inch text (appropriate alphanumerical designation) secured to suspended ceiling system grid or respective access door (Kroy or equal).

b. Positioned to indicate filter access.

c. Variable air volume terminals, terminal reheat coils.

2. Valves:

a. 1/2 inch diameter, pressure-sensitive adhesive spot markers.

b. Color coded:

1) Steam and steam condensate (ORANGE).

2) Heating hot water (PURPLE).

3) Chilled water (GREEN).

4) Domestic hot water (RED).

5) Domestic cold water (BLUE).

C. Warning tape (underground utilities):

1. 3.5 mils thick, 6 inch wide, appropriate APWA color code, heavy duty polyethylene.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Equipment labels (using the precise alphanumerical designation shown on the drawings) shall be securely mounted (in a conspicuous position) with appropriate fasteners and shall be applied to ALL equipment.

B. Piping and ductwork labels/stencils shall be located to ensure continuous systems identity; visible from below or side for concealed systems and exposed systems outside finished spaces, from top for exposed systems within finished spaces.

C. Valve location indicators shall be adhered to suspended ceiling system grids and/or access doors at all main, branch main and branch piping valve locations.

END OF SECTION

SECTION 23 55 92

ADJUSTABLE FREQUENCY CONTROLLERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install adjustable frequency controllers (AFC) in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be the voltage vector controlled type; factory assembled, wired and tested; Underwriters Laboratories listed; complete with enclosure, converter, DC bridge, inverter, operating features/parameters/adjustments, protection, local control panel/keypad, disconnect/bypass (as scheduled), accessories, warranty and field checking start-up service.

1.02 SOURCE AND SERVICE

A. Source:

1. Units shall be furnished by a factory authorized distributor.

B. Service:

1. Unit service shall be available from the manufacturer's authorized distributor (located within a 100 mile radius) 24 hours of every day via qualified factory trained technicians.

1.03 WARRANTY

A. Units shall be warranted by the manufacturer to be free from defects in equipment, materials and workmanship for a period of two years from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Asea Brown Boveri, Danfoss, Reliance Electric or approved equal.

2.02 DESCRIPTION

A. Enclosure:

1. NEMA 1.

2. Sized to accommodate all associated components, including options and modifications as noted and/or herein specified.

3. Arranged to insure safety related isolation of all line voltage components.

4. Central station air handling unit plenum mounting compatible.

B. Converter:

1. Full-wave controlled rectifier.

C. DC Bridge:

1. Dual (positive/negative) DC bus link reactors.

D. Inverter:

1. Insulated gate bi-polar transistors.

E. Operating features:

1. Voltage vector control (optimum motor magnetization by continuous output frequency and voltage adjustment in context with current magnitude and phase angle monitoring).

2. Motor preheat.

3. Run permissive (motor operation delay for controlled devices/auxiliary equipment coordination).

4. Motor soft start.

5. Rotating motor start (synchronous with any speed/either direction).

6. Automatic ramping (controlled acceleration/deceleration rate within current limitation).

7. Sleep mode (intermittent motor operation during periods of low controlled variable demand).

8. Automatic restart.

9. Proportional integral derivative controller.

F. Operating parameters:

1. Input voltage:

a. As scheduled.

2. Motor voltage:

a. As scheduled.

3. Full output, input voltage range:

a. ± 10%.

4. Trip:

    a. Under voltage:

        1) 208 volts:

            a) 164 volts.

        2) 480 volts:

            a) 313 volts.

    b. Over voltage:

        1) 208 volts:

            a) 299 volts.

        2) 480 volts:

            a) 538 volts.

5. Input frequency:

    a. 50/60 Hz, ± 2 Hz.

6. Displacement power factor:

    a. ≥ 0.98, any speed/load condition.

7. Input signal:

    a. Direct/reverse acting.

    b. 0 volts DC to 5 volts DC, 0 volts DC to 10 volts DC.

    c. 0 milliamperes to 20 milliamperes, 4 milliamperes to 20 milliamperes.

8. Starting torque:

    a. Constant until controlled variable set point is satisfied.

9. Preset speeds:

    a. Sixteen (16).

10. Frequency step-overs:

    a. Four (4).

11. Acceleration/deceleration rates:

    a. Four (4).

12. Digital inputs:

a. Eight (8).

13. Analog inputs:

a. Voltage:

1) Two (2).

b. Current:

1) One (1).

14. Analog outputs:

a. Two (2).

15. Relay outputs:

a. One (1).

16. Ambient operating conditions:

a. Temperature:

1) 14F to 104F.

b. Humidity:

1) ≤ 95% rh.

c. Elevation (without derating):

1) ≤ 3300 ft.

17. Total harmonic distortion:

a. 3% when tested in accordance with IEEE Standard 519.

G. Operating adjustments:

1. Output frequency:

a. 0 Hz to 120 Hz.

2. Lost input signal default:

a. Disposition:

1) Stop.

2) Off.

3) Trip.

b. Speed:

1) Preselected.

2) Maximum.

3) Last.

3. Lost input signal time delay:

a. 1 second to 99 seconds.

4. Output current limit:

a. Adjustable to 110%.

5. Current limit time delay:

a. 0 to 60 seconds.

6. Speed:

a. Maximum:

1) Minimum to 120 Hz.

b. Minimum:

1) Maximum to 0 Hz.

7. Acceleration/deceleration:

a. ≤ 3600 seconds.

8. Automatic restart time delay:

a. 0 to 600 seconds.

9. Breakaway torque time delay:

a. 0 to 0.5 seconds.

10. Warnings:

a. Low/high frequency:

1) 0 to 120 Hz.

b. Low/High current:

1) 0 to maximum.

c. Low/High reference/feedback:

1) -999,999 to 999,999.

11. Start voltage:

    a. 0 to 10%.

12. Start time delay:

    a. 0 to 120 seconds.

13. DC breaking:

    a. Time:

        1) 0 to 60 seconds.

    b. Start frequency:

        1) 0 to maximum Hz.

    c. Rated motor current:

        1) 0 to 50%.

14. Automatic restart:

    a. Attempts:

        1) 0 to 20.

    b. Time delay between attempts:

        1) 0 to 600 seconds.

15. Relay on/off time delay:

    a. 0 to 600 seconds.

H. Protection:

1. Input:

    a. Transients.

    b. Phase loss.

    c. Disconnect.

2. Output:

    a. Short circuit.

    b. Ground fault.

    c. Over/under voltage.

d. Programmable overload.

e. Disconnect.

3. Temperature:

a. Adjustable frequency controller.

b. Motor.

I. Local control panel/keypad:

1. General:

a. Programmable, alphanumeric, liquid crystal display.

b. Integral/remote mounted, removable (for tamper-proof operation).

2. Features:

a. Programming:

1) Download/upload:

a) Operating parameters.

b) Operating adjustments.

2) Transferable (among units).

b. Display:

1) Inputs/outputs.

2) Operating parameters.

3) Operating adjustments.

4) Controlled variable (temperature, pressure, flowrate, etc.).

5) Cumulative data:

a) Operational.

b) Log.

c) Fault.

d) Reset.

e) Mode.

c. Indication:

1) Power on.

2) Warning.

3) Fault.

d. Control:

1) Automatic/manual, start/stop.

2) Automatic/manual, speed.

3) Reset.

J. Disconnect:

1. Line-side power interruption.

2. Fused, door interlocked service personnel defeat, lockable.

K. Bypass:

1. Three (3) contactor arrangement.

2. Fused disconnect, door interlocked/service personnel defeat, lockable.

3. Motor starter.

4. Four (4) position selector switch:

a. “Drive” (motor operates at variable speed via AFC).

b. “Off” (motor and AFC are de-energized).

c. “Bypass” (motor operates at full speed, AFC is de-energized for service).

d. “Test” (motor operates at full speed, AFC is energized for testing).

L. Accessories (as scheduled):

1. Input electromagnetic interference (EMI) filtering.

2. Output radio frequency interference (RFI) filtering.

3. Output LC filtering (motor noise suppression).

4. Input line reactors (harmonic suppression).

5. Floor stand assembly.

6. RS-485 communications port/building management system (BMS) interface.

PART 3 – EXECUTION

3.01 UNIT OPERATION

A. Units (so designated) shall respond to the signal purveyed via the mechanical system automatic temperature control network by varying the controlled device (driven machine) speed to maintain the associated controlled variable (airside static pressure, hydronic pressure differential, etc.) set point; interface (at control input terminals) with units without bypass shall be complete with parallel switching arrangement to permit manual operation of driven equipment at full speed.

3.02 FIELD CHECKING START-UP

A. Unit field checking, testing and start-up (including verbal operating and maintenance instructions required and requested by the Owner) shall be performed by the manufacturer's authorized representative, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 23 55 94

MOTORS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install motors in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be designed and constructed in accordance with guidelines set forth in the NEMA Standards and The National Electric Code.

C. Units shall be Underwriters Laboratories listed, New York State Energy Conservation Construction Code compatible.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Baldor, General Electric, Siemens, Toshiba or approved equal.

2.02 DESCRIPTION

A. Unit characteristics (starting torque, full-load torque, breakdown torque) shall properly match the respective driven machine demands.

B. Unless otherwise noted or specified (refer to equipment/motor-wiring-contactor/motor starter-disconnect schedule and specific equipment specification sections) units shall be the squirrel cage induction type and conform with the following:

1. Enclosure:

    a. Heavy Duty cast iron.

    b. Open drip proof (unless otherwise scheduled, shown or noted).

    c. Totally enclosed fan cooled (as specified).

    d. Explosion proof (as shown or noted).

2. Bearings:

    a. Extended life design, compatible with driven machine imposed radial and thrust loads.

3. Insulation:

    a. Class B (130C rise).

C. Single phase units:

1. Low starting torque (direct driven fans):

a. Electronically commutated (0-10v).

b. Overload protection.

2. Intermediate starting torque (belt driven fans, centrifugal pumps):

a. Split phase (split phase start, induction run).

3. High starting torque (compressors, positive displacement pumps):

a. Capacitor start, capacitor run.

4. Premium efficiency.

D. Polyphase units:

1. Adjustable frequency controller (inverter) compatible in accordance with NEMA Specification MG-1, Part 31.

2. Premium efficiency, NEMA design (unless otherwise noted).

E. Mounting arrangement:

1. Compatible with driven machines (solid, resilient, flanged, lug, etc.)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Mount units (position, angle, etc.) relative to enclosure definition.

B. Properly align (direct driven arrangements and belt driven pulleys) and adjust belt tension.

END OF SECTION

SECTION 23 55 95

MOTOR STARTERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install motor starters in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be constructed and sized in accordance with the guidelines set forth in the NEMA standards; Underwriters Laboratories listed, factory assembled and wired ancillary components.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Asea Brown Boveri, General Electric, I.T.E., Square D or approved equal.

2.02 DESCRIPTION

A. Manual (fractional horsepower):

1. Enclosure:

   a. NEMA 1 (unless otherwise noted).

2. Mechanism:

   a. Operator:

      1) Toggle (unless otherwise noted) lockable, ("On" – "Off") indication.

   b. Action:

      1) Quick-make, quick-break.

   c. Contacts:

      1) Double break, silver alloy.

3. Overload protection:

   a. Melting alloy type thermal overload relay(s), interchangeable thermal unit (starter inoperative without thermal unit).

B. Magnetic (across-the-line, non-reversing):

1. Enclosure:

a. NEMA 1 (unless otherwise noted).

2. Coil:

a. Replaceable (without removing starter), molded construction, mechanical linkage, replaceable control circuit contacts.

3. Main contacts:

a. Replaceable (without removing power wiring or starter), double break, silver alloy, straight-through wiring.

4. Overload protection:

a. Interchangeable melting alloy type, thermal overload relays, replaceable contacts (each leg).

5. Disconnect switch (combination units, common enclosure):

a. Mechanism:

1) Operating handle:

a) Integral with box (not cover), lockable, color-coded ("On" – "Off") indication.

2) Action:

a) Quick-make, quick-break, cover interlock with defeater.

b. Fuse clips:

1) Class R (dual element), positive pressure type.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Change thermal overload relays as required to ensure compatibility with installed motor characteristics.

END OF SECTION