

2. Conbraco Industries, Inc.
 B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
 B. Where large air quantities can accumulate, provide enlarged air collection standpipes.
 C. Provide manual air vents at system high points and as indicated.
 D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
 E. Provide air separator on suction side of system circulation pump and connect to expansion tank.
 F. Provide valved drain and hose connection on strainer blow down connection.
 G. Support pump fittings with floor mounted pipe and flange supports.
 H. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.
 I. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
 J. Pipe relief valve outlet to nearest floor drain.
 K. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
 L. Clean and flush glycol system before adding glycol solution.
 M. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

END OF SECTION 232120

SECTION 232123 - HVAC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. In-line pumps.

1.2 SUBMITTALS

- A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. ITT Bell & Gossett
 B. Grundros

2.2 HVAC PUMPS - GENERAL

- A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
 B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.3 VERTICAL IN-LINE PUMPS

- A. Type: Vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 175 psi working pressure.
 B. Casing: Cast iron, with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
 C. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.
 D. Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.
 E. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

PART 3 EXECUTION

3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
 B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.
 C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings.
 D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.
 E. Lubricate pumps before start-up.

END OF SECTION 232123

SECTION 232513 - CHEMICAL WATER TREATMENT - CLOSED LOOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cleaning of piping systems
 B. Chemical feeder equipment

- C. Chemical treatment

1.2 SUBMITTALS

- A. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
 B. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. GE Water Technologies
 B. Nalco Company

2.2 MATERIALS

- A. System Cleaner:
 1. Manufacturers:
 a. GE Water Technologies
 b. Nalco Company
 2. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
 B. Closed System Treatment (Water):
 1. Manufacturers:
 a. GE Water Technologies
 b. Nalco Company
 2. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
 3. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium tolyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
 4. Conductivity enhancers; phosphates or phosphonates.

2.3 BY-PASS (POT) FEEDER

- A. Manufacturers:
 1. Griswold Controls
 2. Neptune Chemical Pump Company

2.4 GLYCOL SOLUTION

- A. Furnish Dow-Frost or approved equal factory inhibited propylene glycol to fill the ground heat exchanger heating loop with a blend of 25% glycol and 75% deionized water.
 B. The solution shall be pre-mixed at the manufacturers factory with the appropriate inhibitors, buffers, and deionized water which meets the following industry standards for water quality: Less than 25 PPM sulfate; less than 25 PPM chloride; less than 50 PPM sodium; less than 1 PPM magnesium and less than 1 PPM calcium.
 C. Under no circumstances should tap water or raw water be added to the system initially for make-up requirements.
 D. Supplier must notify customer by written correspondence each (6) months form the date of delivery reminding the customer that the fluid should undergo chemical analysis to insure the fluid is operating within industry standards for corrosion protection, pH, reserve alkalinity, degradation products and contamination identification if present. Supplier will analyze at no cost to the custom on a bi-annual basis and make available for purchase additive packages for remediation of the coolant if required.

PART 3 EXECUTION

3.1 PREPARATION

- A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
 B. Place terminal control valves in open position during cleaning.
 C. Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

- A. Concentration:
 1. As recommended by manufacturer.
 B. Ground Heat Exchanger Systems:
 1. Circulate for 48 hours, and then drain systems as quickly as possible.
 2. Refill with clean water, circulate for 24 hours, then drain.
 3. Refill with clean water and repeat until system cleaner is removed.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION 232513

SECTION 233100 - HVAC DUCTWORK

PART 1 GENERAL

1.1 SUBMITTALS

- A. Product Data: Provide data for duct materials, duct liner, duct connections, and factory fabricated fittings.

1.2 REGULATORY REQUIREMENTS

- A. Construct ductwork based on latest: SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; NFPA Standards

PART 2 PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
 B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 2. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.
 C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
 D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as required.
 E. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. pressure class, galvanized steel.
 2.2 DUCTWORK FABRICATION
 A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
 C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
 D. T's, bends, and elbows: Construct according to SMACNA (DCS).
 E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
 F. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
 H. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

END OF SECTION 233100

SECTION 233300 - DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Air turning vanes
 B. Flexible duct connections
 C. Volume control dampers
 D. Duct test holes

1.2 SUBMITTALS

- E. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.1 AIR TURNING VANES

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.
 2.2 FLEXIBLE DUCT CONNECTIONS
 A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
 B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.3 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
 B. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
 1. Blade: 24 gage, minimum.
 C. End Bearings: Except in round ducts 12 inches and smaller,

- provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

D. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.4 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
 B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 B. Provide duct test holes where indicated and required for testing and balancing purposes.
 C. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
 D. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
 E. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

SECTION 237323 - WATER SOURCE HEAT PUMPS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

- A. Water Source Heat Pumps
 B. Controls

1.3 SUBMITTALS

- A. Product Data: Provide drawings indicating dimensions, rough-in connections, and electrical characteristics and connection requirements.
 B. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.4 DELIVERY, STORAGE, AND PROTECTION

- A. Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.

1.5 WARRANTY

- A. Manufacturer shall warranty equipment for a period of 12 months from startup or 18 months from shipping (whichever occurs first).

PART 2 PRODUCTS

2.1 VERTICAL HEAT PUMPS

- A. Manufacturers
 1. ClimateMaster
 2. Carrier
 3. Water Furnace
 4. Bosch
 B. General
 1. Refer to drawings for equipment information.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.
 B. All controller addressing shall be coordinated with the temperature controls contactor prior to the startup of the unit.
 C. Provide a certified manufacturer's representative to do startup of all equipment.
 1. Manufacturer representative shall have all software tools required for programming and/or tuning required functions of the unit during the start-up.
 D. Coordinate installation of units with architectural, mechanical, and electrical work.

END OF SECTION 237323

DIVISION 26 ELECTRICAL

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary Conditions, Specification Sections, and other

- applicable Specification Sections, in particular the Related Sections listed below, apply to this Section.

1.2 SUMMARY

- A. Provide all equipment, materials, labor and services necessary to furnish, install, test and turn over to the Owner the following electrical work as required by these specifications and as shown on the drawings, including all shop drawings, test reports, record drawings, operations and maintenance manuals, Owner training and incidental items necessary to complete the project in every respect.

1.3 REFERENCES

- A. Provide equipment and materials that conform to the applicable standards of the following organizations:
 1. American National Standards Institute (ANSI).
 2. Institute of Electrical and Electronic Engineers (IEEE).
 3. National Electrical Manufacturers Association (NEMA).
 4. National Fire Protection Association (NFPA).
 5. Telecommunications Industry Organization/Electronic Industries Alliance (TIA/EIA)
 B. All materials and equipment shall be listed and labeled by Underwriters Laboratories (UL), Electrical Testing Laboratories (ETL), MET Laboratories (MET), or the Canadian Standards Association (CSA).
 C. Install equipment and materials in compliance with the following:
 1. Michigan Electrical Code (MEC).
 2. Michigan Building Code (MBC).
 3. Michigan Mechanical Code (MMC).
 4. Michigan Plumbing Code (MPC).
 5. Americans with Disabilities Act (ADA).
 6. State of Michigan DLEG Bureau of Fire Services.
 7. Manufacturers' instructions.

1.4 DESIGN DOCUMENTS

- A. Contact the Owner's Representative about design questions and discrepancies between design documents before performing the work.
 B. Notify the Owner's Representative if existing code violations are uncovered that are not addressed in the design documents.

1.5 SUBMITTALS

- A. Submit for approval copies of shop drawings and product literature for the following equipment. Submittals shall include adequate information to prove that the systems, equipment and materials comply with the contract documents. Each copy of the submittals shall be marked to indicate the specific models, sizes, types and options being provided. Submittals not so marked will be rejected.
 B. Primary Equipment and Unit Substations.
 1. Power Distribution, Lighting, and Receptacle Panels.
 2. Disconnect and Safety Switches.
 3. Wiring Devices.
 4. Conduits and Fittings.
 5. Cables, Wires and Terminations.
 6. Grounding Connections.
 C. Participate in the coordination drawing process and submit coordination drawings for approval.

1.6 RECORD DOCUMENTS

- A. Submit record "Red Line" drawings to Owner at the end of the project. Drawings to show the locations of equipment, sizes of conduits and conductors, circuit numbers, and deviations from the design. Dimension the locations of buried, embedded and concealed primary and feeder conduits from permanent building features.

1.7 OPERATIONS AND MAINTENANCE MANUALS

- A. Submit for approval copies of operations and maintenance manuals for all equipment.

1.8 QUALITY ASSURANCE

- A. Electrical work shall be performed by licensed Journeyman or registered Apprentice Electricians. The number of Apprentices on a project shall not exceed the number of Journeymen. Electricians shall carry a copy of their license or registration while working on The Owner's projects.
 B. Contact the Authority Having Jurisdiction before starting the project to arrange for periodic inspections.

1.9 SHIPPING, HANDLING AND STORAGE

- A. Contractor is responsible for receiving and handling all equipment and parts.

1.10 WARRANTY

- A. Guarantee work for a period of one year from the date of the Owner's final acceptance of the project (Substantial Completion). A manufacturer's warranty beginning upon equipment receipt or startup shall be extended to one year from final project acceptance. A manufacturer's warranty in excess of one year shall remain in effect for its entire time period.

PART 2 PRODUCTS -

NOT USED

PART 3 EXECUTION

3.1 SUBSTITUTIONS

- A. Provide equipment and materials from the manufacturers specified.



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B	ISSUED FOR BID	8/20/14
A	REVIEW	7/22/14
△	REVISION	DATE

PLOT DATE: 08/21/2014 9:33 AM
 DRAWN BY: S. JONES
 REVIEWED BY: D. NIETHAMMER
 PROJECT MANAGER: D. NIETHAMMER
 FILE:

AAHC GEOTHERMAL

ANN ARBOR, MICHIGAN

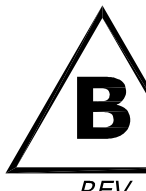
SPECIFICATIONS

**MECHANICAL
 SPECIFICATIONS**

PROJ. NO.:

SP1.2

SHEET NO.



REV