

**23 00 00 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**

**SECTIONS INCLUDED:**

- 23 00 00 . HVAC GENERAL / MECH ROOM DESIGN
- 23 05 00 . COMMON WORK RESULTS FOR HVAC
- 23 07 00 . INSULATION
- 23 08 00 . COMMISSIONING OF HVAC
- 23 09 00 . INSTRUMENTATION AND CONTROL FOR HVAC
- 23 20 00 . HVAC PIPING & PUMPS
- 23 25 00 . WATER TREATMENT
- 23 30 00 . HVAC AIR DISTRIBUTION
- 23 60 00 . CENTRAL COOLING EQUIPMENT
- 23 70 00 . CENTRAL HVAC EQUIPMENT

**23 00 00 – HVAC GENERAL**

Facilities Management | 2160 East 17th Avenue | Fort Collins, CO 80526 | (970) 221-3200 | www.uncc.edu



An areaway or doorway large enough to accommodate the largest component in the mechanical room shall be provided. If knock-out panels are provided, coordinate location with outside utilities.

Equipment rooms shall be arranged and located such that heat and sound will not transmit to other parts of the building.

Mechanical rooms must have adequate ventilation. This is especially critical with the increase use of electronic controls and other components.

Provide floor drains. When located above an occupied area, surround the area with a 6" high curb, and waterproof the floor. Provide sleeves for pipe penetrations

Provide an tempered emergency eye wash unit in each primary mechanical room.

Provide roof ladders to all upper level roofs for equipment access, unless walkout access is provided.

Provide adequate lighting and electrical receptacles in all mechanical spaces. Lighting layout must not be finalized until after equipment and ductwork installation.

Provide adequate access openings in pipe and duct chases for service and maintenance. Access doors shall be sized to allow adequate access to equipment located within. Coordinate access door type and size with Architect for consistency. Allow for specialty doors such as in shower rooms and other areas as needed.

Provide ventilation for elevator equipment (air conditioning if required) to meet elevator manufacturers requirements.

Coordinate final location of all field equipment with adjacent walls, lighting, piping, etc. to ensure adequate access for maintenance. Some installations may require a mock-up.

## **23 05 00 – COMMON WORK RESULTS FOR HVAC**

### **VALVES**

Provide valves to isolate logical segments of the building. Floors, wings etc.

Provide valves on all branch lines, fixtures and on both sides of all equipment, located for easy access. Locate valves at equipment to allow isolation of control valves and strainers without draining coils.





Provide labeled tape above direct buried piping.

Controls - engraved nameplates on all connecting or controlled equipment. Include automatic controls, control panels, zone valves, relays, PE or EP switches and starters.

Pumps - stencils or engraved nameplates - service and zone served.

Heat Exchangers, fans, AC equipment - plan code number and area or zone served.

Access doors - engraved nameplates to identify equipment within.

Lift out ceilings . Specify color coded self adhesive dots to be installed on suspended ceiling system grids identifying access points to mechanical and electrical components located above the ceiling. Paint? Marker?

Exterior insulation shall be metal jacketed.

## **23 08 00 – COMMISSIONING OF HVAC**

### COMMISSIONING

The level of commissioning will vary with each project. Some projects will require full 3<sup>rd</sup> party commissioning. At a minimum, all projects will require the following:

- \* Specify General Contractor led commissioning of all mechanical, plumbing, controls and electrical systems to verify operational and functional performance and
- \* Coordinate commissioning requirements with other divisions as needed.
- \* All system tests and inspections are to be full documented.
- \* Complete commissioning of mechanical and electrical systems during initial start-up
- \* Provide advance notice to UNC Facilities Management prior to all commissioning activities.
- \* Contractor to submit for review, an outline of the organizational plan,

Notify Facilities Management at least two weeks prior to scheduled start-up date of all mechanical equipment and systems.

Prior to start-up, all piping systems shall be cleaned and flushed. Notify Facilities Management prior to cleaning and flushing operation. Hot water heating and chilled water systems including pumps, converters, coils, etc. shall be flushed with an alkaline material containing dispersants, detergent and organic corrosion inhibitors. Preferred product is Rocky Mountain Aquatech (RMA) 6100 or equivalent. For effective cleaning, system is properly dosed with chemical, circulated for 24 hours and, if possible, heated to 140 . 180 deg. F. Following circulation, drain, flush, fill and circulate 30 minutes and flush system until the water is clear and TDS is +/- 50 ohms that of city water. Once system has been flushed, add closed loop inhibitor (nitrate based) to boost chilled water system to 375 . 500 PPM NO<sub>2</sub> and heating water systems to 500 . 750 PPM. Preferred inhibitor is RMA 5338..

Coordinate all start-up and testing operations with the work of other trades. Include manufacturers representatives and all sub-contractors in the start-up planning.



Honeywell installed by Honeywell  
Lynxpring by Dynamic Controls

Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

AHU controllers and terminal unit controllers will be same brand as BAS. Chiller controllers will come with the chillers and have a BACnet I/P or BACnet MSTP interface. Boilers controls can be done either way (by boiler manufacturer of BAS • ] ] | a | DZÓ @ | ^ | Á a | Á a | a | ^ { ^ } | Á | Á ^ | ^ | t | ! | ^ a | Á ^ | @ | Á | C | E | X | C | Ö | q | Á | | Á | have a BACnet interface to directly communicate with the BAS as any other controller

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The University currently has in place a server and Tridium front end and is based on the N4 format. The Controls Contractor shall provide the new equipment, hardware, software, and licensing to be fully integrated and compatible with the current system. BACnet IP

Remote Building Temperatures . Measured at Candelaria and Butler Hancock Halls

Temperatures

- Winter (high load) . 285 Deg F

Original HTHW System Design

- EWT 380 Deg F
- LWT 240 Deg F
- 140 Deg F delta T (large delta T is required to reduce system flow requirements)

HTHW Control Valves

HTHW control valves for converters shall be located on the return piping. HTHW Control valves for heating water converters shall be interlocked with the heating water circulating pumps(s) to prevent valve opening unless heating water is circulating. All HTHW control valves shall have a full line size bypass with valve. Control valves shall have a strainer located immediately upstream. Control valves on HTHW shall be normally closed, positive shut off type, ANSI 200# or 300# control valves. HTHW control valves to be Honeywell or Fisher only. HTHW control valves shall be flanged 300#. Refer to drawings in appendix.

SHELL & TUBE HEAT EXCHANGERS

Hot water heating system shall include duplex converters for redundancy, each sized for 100% load.

Converters shall be A.S.M.E. constructed and stamped.

U tube type with 3/4" OD minimum copper nickel, tube wall = .049 thick, suitable for 400 PSI working Pressure, tube gauge = 18.0 B.W.G. suitable for 400 Deg. Provide steel tube sheet with bronze or brass spacers. Head to be ductile iron.

AIR SEPERATORS (Combination air separator/strainer/dirt filter)

Acceptable manufacturers: Spirovent Air / Dirt

HEATING AND COOLING PIPING .

Flanges: In general, flanges are not allowed in the Heating Plant, Tunnel system or for building root valves. Where allowed, ASTM A105, 300 pound slip-on or weld neck raised faced.

Gaskets: 1/16" ring gaskets - Garlock Graphonic flexible graphite facing w/ 304 SS corrugated core, dimensions per ANSI B16.21, or spiral wound or as approved by Facilities Management.

Bolts: Grade 8 bolts or Grade B7 studs with 2H nuts. Bolt length selection must be approved by UNC Facilities Management. All bolts are to be torqued to specifications.

## HYDRONIC PUMPS

Refer to the standard pump and accessory piping detail in the appendix.

Provide a minimum of two pumps for main building heating pumps. One primary pump and one stand-by for full redundancy in a lead lag configuration.

End-suction centrifugal, flexible coupled. Provide standard single mechanical seal with carbon seal ring and ceramic seat. Replaceable shaft sleeve shall be furnished to cover the wetted area of the shaft under the seal. Use of in-line pumps shall be limited to coil circulation. Specify stainless braided steel bellows connector expansion joint.

Pumps shall be end suction, vertical split case design, cast iron with bronze fitted construction. Pump internals shall be capable of being serviced without disturbing piping connections or motors.

Maximum pump speed shall be 1800 RPM. Mechanical seals shall be selected for intended temperature service.

Pump and motor shall be base mounted on common base plate. Grout base plate in accordance with manufacturers instructions. Laser align all pumps after final piping connections and grouting of base plate.

Provide suction diffuser with in stream magnet, start-up strainer and adjustable foot support.

Acceptable manufacturers: Bell & Gossett, Taco, Armstrong, A-C Pumps (ITT), Aurora, Gould, Grundfos.

## MOTORS





Acceptable manufacturers: Engineer shall define the minimum component specifications. Prefer Cook, Greenheck or approved equivalent.

## 23 60 00 – CENTRAL COOLING EQUIPMENT

### REFRIGERATION

Air Conditioning Equipment - Electrical

### CHILLERS

Review chiller type options with Facilities Management. Life cycle cost analysis will be reviewed before selection.

Water flow switches shall be wired into control circuit so that chiller will not operate unless water flows are proven and maintained.

Provide two pumps each for chilled and condenser water systems. One primary and one stand-by for full redundancy in a lead lag configuration.

Sequence of operations . Chiller systems shall be activated by the Building Automation System based on time of day, outdoor air temperature or load depending on the building or system function. (NOTE: BAS shall be provided with only the points listed in the schedule.)

All functions initiated from the chiller control panel start / stop command from BAS. Start / Stop command initiates chilled water pump, proof of flow initiates condenser water pump, proof of condenser flow initiates chiller functions.

Provide the services of a factory trained mechanic employed by the chiller manufacturer to provide test and start-up services, and field training for maintenance personnel.

Provide Harmonic filter for chiller power. Coordinate with electrical engineer

Compressor driven equipment to have 5 year extended warranty (Compressor only)

Chillers shall be eddy current tested at commissioning for warranty and baseline purposes.

Acceptable manufacturers: Trane, Carrier, or Smardt. Others as approved by Facilities Management

## COOLING TOWERS

Cooling towers to be supplied with drain outlet in bottom of sump. Drain line to be piped to nearest roof drain.

All towers to have access ladders, full height and platforms to service hot decks and motors.

Tower by-pass valve to be full size to completely bypass tower in low ambient conditions.

Acceptable manufacturers: Marley, BAC. Others as approved by Facilities



Units shall be provided with external bearings only. Shafts 3/4" and larger shall have spherical roller bearings. All bearings shall be accessible for lubrication and maintenance. Bearings to be greaseable, L20, 200,000 rated.

Specify VFD for AHU motor.

Acceptable manufacturers: Trane, Carrier, Engineered Air, York, M+I, Pace

## COILS

Coils shall be drainable and have manual relief vent located at high point.

Allow access to both coil faces for cleaning. Provide space for removing and repairing.

Coils shall be drainable and have manual relief vent located at high point.

Cooling coils to have drain from condensate pans piped to the nearest floor drain. Drain line shall be copper, with trap and union at connection to pan. Trap to be sized per manufacturers recommendations. Condensate pans to be stainless steel or galvanized coated with approved coating.

## FILTERS / BELTS

Provide throwaway pleated media filters, 2" thick non woven cotton fabric, 25-35 % efficiency. Some buildings may require washable type filters or bag type filters in addition to the throwaway filters as determined by Facilities Management.

Provide a start-up set of filters for all air handling units. Remove and replace with clean filters at substantial completion, and sooner if necessary. Provide an additional set of spare filters for use by the owner.

Most air handlers over 10 HP should be specified with synchronous drive belts, Goodyear Eagle PD or approved equivalent.

Provide one spare set of belts for each belt driven air handling unit.