

Description:

The purpose of the section is to highlight the current applicable UMD Design Standards the University has set for HVAC (Heating, Ventilating and Air Conditioning) equipment that have been established through decades of operating and maintaining campus HVAC equipment.

Related Sections:

- TBD

Effective Date:

January 1, 2021

Applicable Standards:

- ASHRAE Standard 15

General Requirements:

The University has set standards for HVAC (Heating, Ventilating and Air Conditioning) equipment that have been established through decades of operating and maintaining campus HVAC equipment.

Products**Chillers**

- Carrier, York, Trane, and McQuay are acceptable manufacturers, subject to performance criteria identified during design by the University and AE. Chiller plant performance shall be certified in accordance with AHRI 550/590, all performance shall provide for part load capacity control to 15% efficiently as identified in AHRI certification.
 - Approved refrigerants are HFC 410a (up to 30 tons) and HFC 134a (over 30 tons) as certified by ASHRAE 34 newest edition.
 - The provisions of ASHRAE Standard 15, newest edition, shall apply to the chiller installation and chiller plant equipment room.
- Chiller load selections for design shall utilize 12 degrees delta T utilizing 42 °F CHWS at 54 °F CHWR.

Cooling Towers

- Induced Draft Baltimore Cooling Tower, Marley, and Evapco are acceptable brands, subject to performance criteria identified during design by the University and AE.
- The engineer shall select towers for operation at 95 degree dry bulb and 78 degree wet bulb.
- The cooling tower shall be CTI certified.
- The specification shall require stainless steel sump pump and stainless steel strainer.
- Multiple towers are the standard, arranged and piped such that individual cells can be drained and maintained while others continue to operate.

Commercial Air Handling Units for Academic/Office Environments

- Carrier, York, Trane, and McQuay are acceptable standard commercial manufacturers for academic, office environments, subject to performance criteria identified during design by the University and AE.
- Casings shall be double-walled with 2 inch rigid foam insulation.
- Unit shall have modular construction.
- Fans on VFD driven AHU's are to be direct drive whenever possible.

- Hot and Chilled water coils shall be copper tubes with aluminum fins.
 - Chilled water coils to be provided with stainless steel coil support.
 - Select coil fin spacing so that coils can be cleaned, i.e. 10 FPI maximum.
 - Provide access section between coils to allow access for coil cleaning whenever space permits.
 - Select coils anticipating SCUB-related entering chilled water temperatures in the future (ECHWT 42-44 °F).
- Drain pans shall be specified to be stainless steel, completely drainable, with no standing water.
- Filters shall be provided for initial filtration (pre-filters) at MERV 7 (30%) and a secondary high efficiency filtration at MERV 13 (65%) utilizing pleated box filter design.
- Provide new air filters immediately prior to the arrival of the testing and balancing contractor.
- Provide an extra set of new air filters to the University HVAC Shop representative.
- Provide vibration isolation. Avoid providing both internal and external vibration isolation.

Custom Grade Air Handling Units for Laboratory Environments

Where Air Handling Units serve specialized research applications such as; chemical, BSL, animal, physical science laboratories manufactures shall be utilized capable of meeting specific purpose application such as; York International Custom, Air Enterprises and Temptrol, Buffalo Air Handling Units, CES Group, (*Note: where Custom Air handling Units are utilized base criteria noted below shall not necessarily be utilized. Specific purpose performance and AHU construction criteria will supersede based upon design requirements*).

- Aluminum AHU's with true thermal break design may be considered.
- Fans on VFD driven AHU's are to be direct drive whenever possible.

Pumps

- Bell and Gossett shall be identified as Basis of Design, Armstrong, Patterson Pumps, Ingersoll Rand, Fairbanks Morse, and Weil-McLain are acceptable brands, subject to performance.
- All pumps shall be provided with internally flushed seals, OSHA coupling guards, grouted when installed. VFD controlled pump motors shall be provided with motor end ceramic bearing, shaft grounding ring at the drive end, motor insulation shall be specifically rated for VFD ratings. Couplings shall be rated for VFD duty.
- Provide UMD HVAC Systems with stock parts for Bell and Gossett, Patterson, Armstrong and other noted pumps.
- Pumps shall be capable of being serviced without disturbing piping connections or motors.
- The University prefers base mounted, end suction pumps.
- Unless the application requires otherwise, pump motors shall not exceed 1750 RPM and impellers shall be selected to be no more than 5% below the point of maximum efficiency. Impellers shall be selected at no more than 85% of diameter and pump motor horsepower shall be selected with a service factor of no less than 15% greater than the motor rating. Motors shall be non-overloading across the entire pump curve.
- A means of vibration isolation shall be provided for all pumps. Vibration isolation for in-line pumps shall be the spring type and they shall be located in the first support hanger directly upstream and downstream of the pump. Avoid flexible pipe connections for in-line pumps.
- Provide a shut-off valve downstream of the triple duty valve.
- Pump designs utilizing VFD's shall have coupling rated for use with VFD applications.

Boilers

- A.O. Smith, Weil McLain, and Peerless are acceptable brands, subject to performance criteria identified during design by the University and AE.
- Boilers shall be gas-fired, low-pressure, water-tube, cast-iron, sectional with forced-draft venting.
- Gas fired equipment shall not exceed 1MBH, where designs require higher capacity (Natural Gas Input) parallel boilers shall be installed, staged through controls (CCMS) to meet operation and design capacity.

Humidification Equipment

- Nortec, Carel, and Dristeem are acceptable brands, subject to performance criteria identified during design by the University and AE.
- Electric steam generating canisters are the preferred method to provide humidity. The engineer shall consider the use of a water softener or RO/DI system for clean water for the humidifiers.
- Whole building humidification systems? Cemline, Armstrong, Aerco or Fulton unfired steam to chemical free steam generators? I would think that these are preferred to multiple local steam generators. Stainless steel wetted surfaces with automated total dissolved solids blow down. Stainless steel piping. Schedule 10 can be used to offset material cost.

High Plume Dilution Laboratory Exhaust Fans:

- Strobic Air, M.K. Plastics and Plastic Air are acceptable manufacturers for new buildings. Greenheck Twin City Fan and Loren Cook are acceptable manufacturers for lower cost retrofits. Design for the use direct drive fans whenever possible.

Other Mechanical Criteria comments for DCFS incorporation;

- Inoperable exterior windows are the preferred selection for new buildings. Design consideration for the use of any operable window type must be reviewed and approved by UMD P&C at the initial design phases.
- Building pressurization shall be maintained at 0.05" positive referenced to atmosphere.
- Fume Hood applications shall be of a manifolded design incorporating manifolded fan systems (with N+1) with centrally connected fume hood exhaust and general exhaust, (less specific purpose exhaust such as radioisotope applications). Laboratory exhaust fans shall be based upon specific laboratory grade fan manufacturers utilizing Strobic as Basis of Design. Fume hoods, general air supply and exhaust shall be balanced utilizing specific purpose VAV or 2 position CV laboratory valves. Basis of Design for laboratory valves shall be Phoenix, dependent upon rate of response valves shall utilize electronic actuation. All laboratory systems shall integrate into the University CCMS (BAS-ATC) system.
- Fume hoods are to be controlled by venturi valves with either fume hood sash position sensor or fume hood side wall velocity probe. Face velocity monitor is required if sash height sensing is used. If fume hood controller with side wall face velocity measurement is provided, an additional face velocity monitor is not required. Fume hood exhaust flow rate should be designed for an 18" sash height. If the sash is raised above the 18" design height, the fume hood local audible and local alarm is to annunciate. Fume hoods are to be fitted with mechanical sash stops at 18" sash height. Acceptable venturi valve manufacturers are Phoenix, TSI and Siemens.

Energy and Sustainability

- The University is committed to providing a mechanical infrastructure that is sustainable over the institutional life of the facility. Equipment shall be required to be installed to meet accessibility requirements for maintenance and service.
- Energy performance shall meet or exceed ASHRAE 90.1 (latest edition) incorporating where feasible heat recovery utilizing return air exchange or "run around hydraulic coils" shall be utilized for both sensible and latent exchange. Filtration of coil or heat wheel entering air (fresh air and exhaust air shall be installed). LEED 3.0 requires that new construction exceed ASHRAE 90.1 performance by 15% as a prerequisite.
- New construction needs to meet LEED-Silver requirements as minimum criteria.
- Utilization of technology such as Under Floor Air Distribution (UFAD), heat pipes, and chilled beam (active and passive) technology shall be considered.

Fan Coil Units

- Carrier, York, Trane, and McQuay are acceptable brands, subject to performance criteria identified during design by the University and AE.
- Units mounted under windows shall have a stamped steel sloped top.
- Coils shall be copper tubes with aluminum fins.
- Integral direct digital controls where not directly utilizing UMD CCMS (Automated Logic or Staefa Talon) shall be directly integrated without micro-gateway utilizing BacNet protocol to the University CCMS.
- Fan Coil Fans shall utilize ECM motors integrated to unit digital control panels utilizing UMD CCMS

Liquid to Liquid Heat Exchangers

- Tranter, Bell and Gossett, and Alfa-Laval are acceptable brands, subject to performance criteria identified during design by the University and AE.
- Plate-and-frame, (P&F) type for Chilled Water utilizing a 2 °F approach is preferred by the University and shall be the basis of design.
- The heat exchanger shall be piped on the suction side of the pump. P&F heat exchangers shall be controlled by 2-way pressure independent modulating valves and shall at the inlets have installed strainers. Each connection shall have installed a geared isolation high performance butterfly valve or gate valve.

Steam to Liquid Shell and Tube Heat Exchangers

- Bell and Gossett, Alfa-Laval and Armstrong are acceptable brands, subject to performance criteria identified during design by the University and AE..
- Shell-and-tube type with 90/10 copper nickel tubes is preferred by the University.

Air Compressors

- Quincy and Champion are acceptable brands, subject to performance. Air Compressor / Pumps Shop stocks parts for Quincy, Sullair and Gardner Denver.

Variable Air Volume Terminals

- VAV terminals are to pressure independent type, with multi-axis, center averaging air flow sensors.
- VAV terminals for air that is expected to operate below dew point are to be insulated with internal, non-fibrous insulation.
- VAV terminal sequences are to include cooling maximum, terminal minimum and heating maximum airflows.

Walk-in Cold / Freezer Box Evaporators and Condensing Units

- Copeland, Bohn / Heatcraft or Keep-rite are generally considered acceptable manufacturers.
- Units are to be provided with scroll compressors for sizes 3 HP and above and hermitically sealed “tin can” compressors below 3 HP. Semi-hermetic compressors are not acceptable.
- Thermal Expansion Valves (TXV's) are to be provided with soldered connections, flared connections are not acceptable.
- Unit are to be installed with motor starters with adjustable overload and integral phase monitor.
- Condensing unit voltage is to be 208-230 volt / 3 phase / 60 Hz. Voltage for evaporators for cold boxes is to be 120 volt / 1 phase / 60 Hz. Voltage for evaporator for freezers is to be 208-230 / 1 phase / 60 Hz.
- Freezer defrost clock is to be electronic defrost clock.

Ice Makers

1. Ice Makers are to be either flaker or cuber types.
2. Units are to be Energy Star rated.
3. Ice Makers are to be equal to Manitowac.
4. Water lines are to be fitted with in-line replaceable filters.

Design Standards

Redundancy

The design shall provide for redundancy in equipment, if such equipment has not been expressly waived by the Program with documented concurrence by the Owner. The use of parallel pumping for spare capacity is disallowed.

- Condensate (steam) return units: Incorporate duplex pumping in the design.
- Package sump pumps (storm water): Incorporate duplex pumping with automatic alternators.
- Chillers: Provide of N+1 redundancy in chiller plant design, where consolidation of redundancy or stand by pumps can be consolidated into a redundant chiller systems (chiller, CW & CHW pumps) the University will evaluate and consider such options. This in lieu of individual stand by redundant pumps noted below for Condenser and Chiller pumps. Similar design strategy may be applied to Cooling Tower design where the tower is manifolded into multiple cells each controlled as a system utilizing VFD fan and control isolation valving.
- Chilled water pumps: In single chiller applications, provide a second, full sized pump. It is permissible to use the spare pump as a standby pump for an associated condenser water pump.
- Condenser water pumps: In single chiller / tower applications, provide a second full sized pump.
- Primary hot water pumps: In single boiler applications, provide a second full sized pump.
- Control air compressors: A single tank is acceptable. The design shall incorporate two-stage duplex air compressors / motors with automatic alternator.

Spare Capacity

Allowance for load growth beyond that specified in the program documents.

- In the case of local heating boilers, size each boiler for 2/3 the full calculated boiler load.
- No spare capacity requirement for boilers intended for use only during the annual steam outage.
- CHW P&F Heat Exchangers shall be initially designed with 20% spare capacity.
- HW steam to water heat exchangers shall be selected to provide 60% design capacity each.
- Chillers shall be selected at peak design provided with turndown capability utilizing VFD controller and where directed by the Owner utilize a hot gas bypass integrated directly to the chiller control panel allowing turn down to a minimum 10% continuous operation.

Electrical Back-up

Electrical emergency generator power back-up shall be provided for:

- Condensate (steam) return pumps
- Submersible sump pumps (includes cooling tower sump pumps)
- Sewage ejector pumps
- Electrical heat trace cable
- Domestic water booster pumps
- Equipment noted as having emergency generator back-up in the Program.
- CCMS controls
- Air compressors
- Lab air handling units

Alarms

Connection to the Central Control and Monitoring System (CCMS) shall be provided for:

- Submersible sump pumps in elevator pits: Provide a high water alarm.
- Sewage ejector pumps.
- Control air compressors.

Equipment Pads

Provide equipment pads for all floor mounted mechanical equipment.

- Mechanical equipment with motors 5HP and greater shall have inertia pads.
- Concrete poured for each pad shall come from the same batch.
- Pads shall exceed the equipment parameter by at least 6 inches on all sides

Mock ups

- Mock ups shall have written approval from the university mechanical inspector.
 - Provide for systems that have floor mounted fan coil units.
- Pressure testing requirement on duct systems designed with a pressure class above 2" W.C. is ASHRAE 90.1 and IECC requirement. A written report is to be prepared and submitted for University records.
- Acoustical lining shall be limited to the extent possible. If required, use of non-fibrous sound lining is preferred and acoustical consultant report identifying its necessity. Non-fibrous silencers preferred method of acoustical attenuation.
- Flexible ductwork: Maximum lengths for flexible ductwork is to be 5 feet. Should be installed without sharp elbows or kinks. Use of supporting devices, similar to SMART Flow Elbow technology is strongly encouraged.
- Wicking material insulation for systems that operate below ambient, i.e. Owens Corning Vapor Wick. If standard insulation, provide a protective coat to protect the factory applied jacket protecting the vapor barrier, i.e. PVC jacket, self-adhesive aluminum jacket, two coats mastic., etc.
- Duct wrap is acceptable where pinned to ductwork above 10' AFF. Below 10' use duct board. Ductwork installed on building exterior utilize round ductwork as preferred. If rectangular, provide tapered rigid board insulation with a peak at the duct longitudinal centerline and slope 1 inch vertical / 1 foot horizontal, i.e. 1-1/2" vertical / 1.5 foot (18 inch) horizontal width. Wrap with either pre-fabricated self-adhering, sheet-type protective aluminum membrane or glued or light colored EPDM rubberized sheets, e.g., Venture Clad.
- Refrigerant Systems Pressure Testing: NOTE- Ultimate reference to ASHRAE Standard 15 latest edition and EPA CAA Section 608 adherence.
 - Refrigerant systems are to be pressure tested using nitrogen gas without the use of trace gases.
 - Refrigerant piping systems are to be pressure tested to 300 PSIG. Followed by an evacuation to 500 microns of vacuum.
 - R-134A refrigerant piping systems are to be pressure tested to 150 PSIG. Followed by an evacuation to 350 microns of vacuum.
 - R-404A refrigerant piping systems are to be pressure tested to 300 PSIG. Followed by an evacuation to 350 microns of vacuum.
 - R-407C refrigerant piping systems are to be pressure tested to 300 PSIG. Followed by an evacuation to 350 microns of vacuum.
 - R-410A refrigerant piping systems are to be pressure tested to 500 PSIG. Followed by an evacuation to 350 microns of vacuum.

- Once system is up to pressure, test is to last for a minimum of 12 hours. Once piping system has been evacuated, vacuum is to be held for a minimum of 4 hours. System solenoids are to be energized for both pressure test and vacuum in order to test all system components.
- Systems that are not capable of holding pressure or vacuum shall have leaks repaired prior to being charged with refrigerant.
- Facilities Management HVAC Systems maintains EPA refrigerant database. FM HVAC Systems Associate Director is the UMD campus Refrigerant manager. Contractors removing or installing systems that utilize refrigerants must submit copies of EPA refrigerant technician certifications for input into the database. A contractor refrigerant disposal form or contractor refrigerant installation form is to be prepared and submitted for each piece of equipment: model number, serial number, voltage, phase, location, refrigerant types and quantities are to be provided for input into refrigerant database.
- Whenever equipment is being removed, HVAC Systems is to recover refrigerant or contractor is to turn over recovered refrigerant to the FM HVAC Systems Unit. Where FM HVAC Systems does not require return of refrigerant the contractor shall dispose of the refrigerant following EPA Section 608 requirements and provide to the University FM HVAC Systems the quantity of refrigerant removed for record.

Demonstration and Training:

- System Demonstration: Once systems are installed and under control, system demonstration is to occur with witness by FM personnel. Systems are to automatically transition from one mode of operation to another without controls technician intervention, except to change setpoints to create mode transitions. Demonstrations need to occur during both heating and cooling seasons.
- Equipment Training: Once system has been demonstrated in one season, training of individual equipment is to occur. Equipment training is to be provided by equipment supplier, through mechanical contractor.
- System Training: Once equipment training has been completed, CCMS control system training is to occur. System control training is to be provided by the control vendor.
- Training agenda describing topics to be covered during equipment and system training is to be provided. Document hand-outs will be provided, including O&M manuals for equipment and sequences of operations and flow diagrams for equipment. Training videos are to be provided for future refreshers and new employees.

Utility Meters

- The University relies on real time energy (meter) data is for the daily operation of the UMD Campus Electrical and Mechanical Systems. Energy data is compared with building occupancy and comfort levels and is a critical input to the CCMS Building Automation System (BAS) for Demand Shedding. Energy data is also required by the UMD Office of Energy and Utilities and the Energy Plant for demand monitoring, billing and trending of Campus Utilities. Energy data from the meters is communicated via integration to the BAS. The Energy Meters are maintained by the UMD Meter Shop and the UMD CCMS Group who provide the campus customers one source for all meter data.
- Design Guidelines. Each building shall be integrated into the Campus CCMS. The BAS vendor shall reserve adequate virtual points in the BAS to be able to read and display a minimum of 40 data points from each flow computer and meter. The UMD Meter shop will approve the final points list for each meter and display format for each point (KWH, Tons, BTUs, Etc.). All local meter displays shall be mounted 2-5'AFF or a remote display shall be installed at 5'AFF.
- Listed below are the current acceptable meters and their required features and/or components for the successful integration. All components and features are required for the vendor to deliver a turnkey BAS interface to the campus. Substitutions to the list below will be considered by the MEDCO Energy Manager. The UMD Energy Plant accepts only one steam meter. The final selection and sizing of the steam meter should be coordinated with the MEDCO Energy Manager.

1. Electrical Meters				
Manufacturer	Model	Communication Requirement	Campus Customer	Additional Features Required
Square D	PM 800 (820,850,870)	ModBus RTU or BACnet MSTP RS 485	UMD Energy & Utilities, UMD CCMS, SUEZ	Modbus or BACNet communications over RS485, Panel Display.
GE	PQM II	ModBus RTU or BACnet MSTP RS 485	UMD Energy & Utilities, UMD CCMS, SUEZ	Modbus or BACNet communications over RS485, Panel Display.
ION	7650	ModBus RTU or BACnet MSTP RS 485	UMD Energy & Utilities, UMD CCMS, SUEZ	Modbus or BACNet communications over RS485, Panel Display.
Veris	H8437V	ModBus RTU or BACnet MSTP RS 485	UMD Energy & Utilities, UMD CCMS, SUEZ	Modbus or BACNet communications over RS485, Panel Display.

1.1.1 Chilled Water, Heating Water, Energy Recovery BTU Thermal Meters				
Manufacturer	Model	Communication Requirement	Campus Customer	Additional Features Required
Onicon	F3100 (Magnetic Flow Meter) w/ Remote Display	DC Pulse or 4-20ma or 0-10VDC	UMD Energy & Utilities, UMD CCMS, SUEZ	KEP ST2 (Supertroll II) ES 749 Flow Computer Totalizer, (2) 3-Wire 100 Ohm Platinum RTD Match Pair Temperature Sensors, Modbus RTU or BACnet MSTP RS485, Flanged or Onicon System 10 BTU Flow Computer w/ Modbus RTU or BACnet MSTP

				over RS485.
Rosemount	8705 (Magnetic Flow Meter) w/ Remote Display	DC Pulse or 4-20ma or 0-10VDC Pulse	UMD Energy & Utilities, UMD CCMS, SUEZ	KEP ST2 (Supertroll II) ES 749 Flow Computer Totalizer, (2) 3-Wire 100 Ohm Platinum RTD Match Pair Temperature Sensors, Modbus RTU or BACnet MSTP RS485, Flanged 2" & above , Unions below 2"
Yokogawa	AFX (Magnetic Flow Meter) w/ Remote Display	DC Pulse or 4-20ma or 0-10VDC	UMD Energy & Utilities, UMD CCMS, SUEZ	KEP ST2 (Supertroll II) ES 749 Flow Computer Totalizer, (2) 3-Wire 100 Ohm Platinum RTD Match Pair Temperature Sensors, Modbus RTU or BACnet MSTP RS485, Flanged 2" & above, Unions below 2".

1.1.2 Steam Meters				
Manufacturer	Model	Communication Requirement	Campus Customer	Additional Features Required
Yokogawa	DYA-Vortex with ITC	DC Pulse or 4-20ma or 0-10VDC	UMD Energy & Utilities, UMD CCMS, SUEZ	Moore Industries HCS Hart to Modbus Converter, Modbus RTU RS485, Flanged 2" & above, Unions below 2".

1.1.3 Domestic Water Meters / Other Liquids (Condensate, Tower Bleed, Etc...)				
Manufacturer	Model	Communication Requirement	Campus Customer	Additional Features Required
Onicon	F3100 (Magnetic Flow Meter) w/ Remote Display	DC Pulse or 4-20ma or 0-10VDC	UMD Energy & Utilities, UMD CCMS, SUEZ	KEP ST2 (Supertroll II) ES 749 Flow Computer Totalizer, Modbus RTU or BACnet MSTP RS485, or Onicon System 10 BTU Flow Computer w/ Modbus RTU or BACnet MSTP over RS485 Flanged 2" & above , Unions below 2"
Rosemount	8705 (Magnetic Flow Meter) w/ Remote Display	DC Pulse or 4-20ma or 0-10VDC Pulse	UMD Energy & Utilities, UMD CCMS, SUEZ	KEP ST2 (Supertroll II) ES 749 Flow Computer Totalizer, Modbus RTU or BACnet MSTP RS485, Flanged 2" & above , Unions below 2"
Yokogawa	AFX (Magnetic Flow Meter) w/ Remote Display	DC Pulse or 4-20ma or 0-10VDC	UMD Energy & Utilities, UMD CCMS, SUEZ	KEP ST2 (Supertroll II) ES 749 Flow Computer Totalizer, Modbus RTU or BACnet MSTP RS485, Flanged 2" & above , Unions below 2"

General

This section outlines the requirements for piping and valves.

Products

- Piping
 - Grooved joint piping is not acceptable.
 - Furnish piping in accordance with the following schedule:

Description

AC Condensate Drain
Acid Waste and Vent
Chilled Water, 2" and below
Chilled Water, above 2"
Compressed Air
Condenser Water
Domestic Water above grade
Domestic Water below grade
Heating Hot Water, 2" and below
Heating Hot Water, above 2"
Natural Gas
Refrigerant
Sanitary Sewer
Sanitary Vent
Steam
Steam Condensate
Storm Drain

Material

Type L Copper tube
PVDF blue line flame retardant
Type L Copper tube Schedule 40 Black Steel Type L Copper tube
Schedule 40 Black Steel Type L Copper tube Type K Copper tube Type L
Copper tube Schedule 40 Black Steel Schedule 40 Black Steel Type L
Copper tube
Service Weight Cast Iron
Service Weight Cast Iron / Schedule 40 PVC Schedule 40 Black Steel
Schedule 80 Black Steel
Service Weight Cast Iron

Fittings

- Install fitting in accordance with the following schedule:

Joint and Fitting

High Pressure Steam - Socket or butt weld
All other services - Threaded
Welded joints
Wrought, silver solder (45% minimum, cadmium free)
Wrought, 95Sn/5 Sb solder or 95.5 Sn/4 Cu/.5 Ag
Bell and spigot with neoprene gasket or No-hub neoprene gasket and
stainless steel clamp assembly
Bell and spigot with neoprene gasket

Description

Steel, 2" and below Steel, 2" and below Steel, above 2"

Copper, refrigerant

Copper, plumbing, chilled water, heating hot water, compressed air

Cast Iron - Above Grade

Cast Iron - Below Grade

Underground Chilled and Heating Water Piping: Prefabricated, preinsulated conduit piping system. Carrier pipe to be Schedule 40, ASTM A53B ERW black steel. Insulation to be closed cell polyurethane foam insulation and outer conduit shall be high density polyethylene (HDPE) jacket. Equal to either Xtru-Therm by Perma-Pipe or Ferro-Therm by Thermacor Process Inc.

Underground Steam Piping: Prefabricated, preinsulated double conduit piping system. Carrier pipe is Schedule 40, ASTM A53B ERW black steel. Carrier pipe insulation to be mineral wool insulation and steel conduit. Outer conduit shall be high density polyethylene (HDPE) jacket insulated with polyurethane foam. Equal to either Multi-Therm 500 by Perma-Pipe or Duo-Therm 505 by Thermacor Process Inc.

Underground Condensate Return Piping: Prefabricated, preinsulated double conduit piping system. Carrier pipe is Schedule 80, ASTM A53B ERW black steel. Carrier pipe insulation to be mineral wool insulation and steel conduit. Outer conduit shall be high density polyethylene (HDPE) jacket insulated with polyurethane foam. Equal to either Multi-Therm 500 by Perma-Pipe or Duo-Therm 505 by Thermacor Process Inc.

Underground piping is to be installed in accordance with ASME 31.1, Power Piping.

All pipe welds are to be double-vee full penetration butt welds, and are to be made utilizing Submerged Metal Arc Welding (SAW).

Root and hot weld passes are to be made with AWS E6010 electrodes and weld cap is to be made using AWS E7018 electrodes. Cover caps shall be made with a weave manipulation pattern.

Visual Examination (VT) of field welds are to be completed, paying particular attention to the root pass and cap. Radiographic Testing (RT) of the final weld is required for all underground field welds.

Above ground piping is to be installed in accordance with ASME 31.9, Building Service Piping.

Visual Examination (VT) of field welds are to be completed, paying particular attention to the root pass and cap. Radiographic Testing (RT) maybe employed by the owner in the event that questions about weld quality arise. If field welds are deemed to not meet the acceptance criteria in ASME B31.9, the contractor will replace the piping at no cost to the University.

Valves

Furnish ball valves in accordance with the following schedule:

- Domestic water valves are to be Clow or M&H AWWA butterfly valves with mechanical joints, 150 psig seats, ANSI Class 150B bodies and 450 ft-lb operator. Valves are to close clockwise.
- All lugged butterfly valves shall be fully bi-directional and bi-directionally dead-endable to the full pressure rating of the seat. This is defined to mean that the seat rating is not reduced when pressure is applied in either direction and the valve is capable of serving as a blank flange, when bolted to the end of a line from either side of the valve body and no mating flange is attached. The means of attaching the body to the pipe flange, and of attaching the seat ring to the body shall meet the ANSI class rating of the valve without mechanical failure. This requirement normally results in partially lugged butterfly valves not being acceptable.

- Packing shall be able to be tightened without removing the insulation.
- External disc position indicators shall be provided.
- Valves must be fully factory assembled, set and tested.
- Gear operators on steam valves shall be spaced 4" (four inches) above packing assembly.
- Install all steam valves with the stem at least 30° off vertical to protect the bottom bearing from debris.
- On all butterfly valve actuators located greater than 5ft above the floor install chain wheels to 5ft above the floor when the design engineer determines valve service is critical.

Check Valves

- Two inches (2") and under: 45° swing check, screwed end.
- Two and one half inches (2 1/2") and over: Non-slam type globe style lift check, non-slam type tilting disc or wafer body non-slam type lift check. Double disc or bi-folding disc type valves are not acceptable.

Design Standards

- Type 1 ball valves are for all water services, low pressure steam, low pressure condensate and all other normal non-corrosive services.
- Gate valves are for high pressure steam.
- Type 1 butterfly valves are for water services (except direct buried or in the primary chilled water within a building) and all other normal non-corrosive services.
- Type 2 butterfly valves are for low and high pressure steam, condensate, the chilled water building entrance or primary chilled water in a building.
- Valves for balancing shall not be ball or butterfly. Why not just use multi-turn balancing valves?
- F. Valves installed on insulated piping shall have extended handle stems exceeding insulation by at minimum 1 inch. For chilled water systems, Valve extensions are to be non-conductive type, or be provided with plastic cup, that allows for continuous insulation vapor barrier, sealed to cup.
- Install valves after completing all welds adjacent to the valve to protect the valve and seat.
- All valves used for vent or drain service on water systems shall have a brass hose connection with brass cap and chain.
- Use Globe, angle and Y-valves for throttling services.
- Chilled water and heating water valves in underground systems shall have as an enclosure a concrete valve box with sufficient space to maintain and operate valves. Vaults should be provided. Valve boxes are not a good substitute. We have many failures of valves in poorly installed valve boxes.
- Avoid using circuit setters 2 inches and below. Use multi-turn balancing valves, equal to Bell and Gossett Circuit Sentry Flow Setter, Danfoss STV series balancing valves or Tour and Anderson TA Model 787 for threaded pipe connections and TA model 788 for flanged pipe connections.
- In pumped system that have strainers, use a start-up strainer for the flush out. Then remove that strainer and provide an operating strainer.
- Pipe strainers shall be installed horizontally.
- Pipe Flushing: Hydronic piping systems are to be flushed prior to being placed into service. Flush piping systems to remove welding slag and particulate prior to startup. Circulate water, with detergents and degreasers, at a minimum velocity of 6 ft/sec in largest main for 24 hours. Cleaning agents are to be provided by water treatment contractor. When connecting into existing systems, temporary pumps are to be provided prior to opening new system to existing. A written report is to be prepared for University records.
- Piping System Pressure Testing: All piping systems shall be pressure tested to 150% of system operating pressure or 150 psig, whichever is less, for 24 hours. All piping joints shall be leak tested prior to being put in service. A written report is to be prepared for university records.

- Provide means for water treatment in both open and closed systems. Utilize the University campus water treatment contractor where possible. The University water will provide the present contractor contact information and UMD water treatment standards for Open and Closed loop systems (CHW & HHW).