DIVISION 33 - UTILITIES
33 60 00 CENTRAL COOLING CHILLED WATER

PART 1 - GENERAL

1.01 SCOPE

A. These standards and procedures apply to the use and interface requirements of the Washington State University Central Chilled Water (CCW) System. Operation is year round, and all cooling within access of this loop shall operate from it. Furthermore, no water-wasting cooling devices shall be installed in any facility.

B. The Consultant shall discuss the proposed system(s) with the WSU Project Manager and WSU Engineering Services before design begins. The Consultant shall work with WSU Engineering Services to develop a satisfactory “total system” design solution.

1.02 REFERENCES

A. Detail drawing 33 60 00 M1 “Standard Chilled Water Loop”

1.03 DESCRIPTION OF THE PULLMAN CAMPUS CENTRAL CHILLED WATER LOOP SYSTEM:

A. Central Chilled Water (CCW) is the terminology used for the campus distribution system that generates and distributes campus-chilled water for HVAC cooling and process cooling loads. The system is a primary-secondary variable flow system.

B. During winter months the distribution system is also used like a heat pump system to transfer waste heat for energy conservation and provide “free cooling.”

C. Chilled water produced by local building systems and not physically connected to the campus distribution loop shall be termed Chilled Water (CHW), and is also addressed in this document.

D. The CCW system consists of five central chiller plants:

1. West Campus Chilled Water Plant has one (1) 2200-ton centrifugal chiller, two (2) 1500-ton centrifugal chillers, with adjacent cooling towers located outside the facility. Each unit has its associated equipment and condenser water circulating pumps, which are constant volume. There are three distribution pumps in the plant that provide distribution from the plant into the loop system; these operate from variable speed controllers.

2. East Campus Chilled Water Plant has two (2) 1500 ton centrifugal chillers and a winter use plate heat exchanger that is capable of producing 1200 tons. There is space for a third chiller at this facility.

3. Clark Chiller Plant has two (2) 1380-ton chillers with cooling towers located on Clark Hall roof. Each unit has its associated condenser water circulating pumps, which are constant volume. Each unit has its own chilled water distribution pump which is variable water volume.

4. Johnson Hall Chiller has a 500-ton capacity.

5. Smith Center for Undergraduate Education (SCUE) Chiller has a 400-ton capacity.

E. Storage: The CCW system includes a 2,000,000-gallon storage tank to level the load, store chilling for the next day and avoid the capital investment required for peak chilling capability. The tank controls the CCW system operating differential pressure by allowing cold water in or supplying cold water out through the two variable speed distribution pumps. The recharge rate is limited to 5,000 GPM. Experience has proven that recharge rate for stable thermocline exists until about 5,200 GPM. Discharge rate from the tank shall be limited to 5,000 GPM with the current piping connection limitations.

F. Chilled Water (CHW) Capacity: There are five (5) chillers in existing buildings that supplement the loop and/or provide emergency backup chilling to critical items in these buildings. These are a combination of air and water-cooled electric chillers totaling an additional 1385 tons that can supplement cooling the loop. When a need for locally dedicated emergency chiller capacity dictates including these chillers, they shall be connected to the CCW system. These special support chillers can be connected to cool the building only, cool the CCW loop only, or support both functions simultaneously. WSU standard connection typical can be provided as needed.

1.04 GENERAL REQUIREMENTS

A. Maintain differential pressure at the lowest possible pressure needed to transport the cooling water. This is due primarily to the high cost of excess pumping of this large system.

1. Design the decoupler valve to control downstream differential pressure to 10 psi.

2. Each building chilled water connection shall have a dirt separator located at the building CCW supply line. The discharge shall be controlled by solenoid valve (controlled by WSU BAS) and spill to SS floor drain.

i. Pre-Approved Manufacturer: Spirodirt

3. Provide air vents at high points and drain valves at coils for all CCW building systems.

4. Consult WSU Engineering Services for design review and assistance for design of these components.

B. Pumping shall be provided for coil or other loads using "Pumped Coil configuration." This method will be employed at all air handling units, process cooling, heat exchangers, and computer room A/C. Pumped coil components shall consist of the following:

1. Inline circulating pump which covers the pressure losses through the loop

2. Griswold flow control valve for pump protection

3. Check valve and balance valve located in the bypass.

4. Two way control valve on the return line outside the loop. Balance valves for each coil circuit will also be applied where appropriate. Control valve pressure drop is compensated by the central loop pressure and must be sized accordingly.

5. All pumped loops to include strainers downstream of the pump.

6. See standard drawing 33 60 00 M1 "Standard Chilled Water Loop" for pump/piping configuration and components.

C. See section 25 50 00 Integrated Automation Facility Controls for control instrumentation and measurement and verification requirements for each system.

D. When local chillers are connected to the CCW system, the distribution pump (secondary pump) shall be sized to provide for 110 ft. head at design flow rate, provide 20% excess flow rate over chiller evaporator design flow rate, be variable primary and secondary flow, and operate with Variable Frequency Drives (VFD); see section 26 29 23 (VFDs).

1. Pump selection shall provide non-overloading operation at all differential pressure conditions.

2. Local chillers shall not be connected to the system without specific approval from WSU Engineering Services.

E. CCW Header Design:

1. Process cooling loops will include heat exchangers, expansion tank, circulating pump with differential pressure pump controls, and domestic water backup if the need is critical.

    i. Equipment loops installed for systems that normally would be connected to domestic water shall be temperature controlled from the return water but shall be monitored on supply and return.

    ii. Provide redundant pumps on both the process and chilled water sides of the heat exchanger.

    iii. Specify bladder expansion tanks in process cooling loops.

    iv. See standard drawing 33 60 00 M1 “Standard Chilled Water Loop” for CCW header design.

F. Thrust Blocks:

1. Install thrust blocks in accordance with the design standards of the most current Water Agencies’ Standards Design Guidelines for Water and Sewer Facilities.

PART 2 - PRODUCTS

2.01 PIPING:

A. All direct buried piping in the CCW system shall be non-insulated, high-pressure PVC ASTM C905 with hub and spigot and mechanical joints.

B. Ductile iron pipe shall be used when crossing under campus utility tunnels (can be used as a sleeve).

1. All ductile iron pipe shall be wrapped or encased in plastic (in accordance with AWWA standards) to prevent corrosion.

C. Megalug-type systems are the only materials acceptable for male-to-male joints. Grip rings and saddle taps are not acceptable.

D. All piping and fittings must be rated at two hundred (200) psig working pressure.

E. Pipe insulation requirements shall be in accordance with Section 22 00 00 Plumbing.

2.02 CHILLED WATER INSTRUMENTATION

A. Thermometers:

1. Provide thermometers where equipment causes fluid temperature changes (except for chilled beams).

2. Thermometers shall be installed in wells so that they can also be removed from the system and replaced without shutting the system down.

B. Pressure Gauges:

1. Install a single water-filled pressure gauge across both supply and return lines to compare pressure.

2. Gauge selection shall typically center on design operating pressure and cover safe system operating range without damage.

3. Provide a throttle valve for each gauge to allow snubbing and isolation function.

C. Thermometers and pressure gauges shall be installed where easily accessible and legible for Maintenance and Utilities personnel.

D. Provide valved taps at each gauge for Testing & Balancing.

E. Pressure Measurement and Control Devices:

1. The pressure differential for control purposes shall be measured by a differential pressure transmitter.

i. Pre-Approved Manufacturer: Setra

ii. Where differential sensors are installed, provide a three-valve manifold for service and calibration.

F. Flow Measuring and Control Devices:

1. Provide liquid flow measuring/control devices at service entrances for district chilled water and chiller primary and secondary loops.

i. Data Industrial pinwheel style insertion meters

ii. 2-inch Weldolet installation with a ball valve shall be used for “hot removal” applications.

2.03 CHILLED WATER METERING

A. BTU Meter: Provide an integral, system-type BTU meter for reading total energy consumption.

1. Pre-Approved Manufacturers: ONICON

B. See standard drawing 33 60 00 M1 “Standard Chilled Water Loop” for metering components and locations.

2.04 BURIED VALVES:

A. Valves shall be High-Performance Butterfly Valves with valve box and valve stem extension. Valve boxes shall float with pavement.

B. Pre-Approved Manufacturers:

1. High-Performance Butterfly Valves:

i. Nibco

ii. Pentair

iii. Milwaukee Valve

2. Valve Stem Extension: Trumbull

2.05 VALVES WITHIN BUILDINGS

A. High-Performance Butterfly Valves shall be required at isolation points for seasonal shutdown applications.

B. Butterfly valves or ball valves are acceptable at all other locations.

2.06 VENTS:

A. Install manual air vents at all high points of the system.

PART 3 - EXECUTION

A. Schedule testing and shutdown of campus distribution a minimum of 14 days prior to activity, in writing, through the WSU Construction Manager.

B. Pressure Test: All system piping must be pressure tested at 200 psig for a minimum of 2 hours with zero leakage.

C. Chilled Water piping shall be buried as the deepest utility in area, with minimum six (6) feet of cover and indicator tape for pipe locating.

1. Maintain a minimum of one foot separation between pipes.

END OF SECTION

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