Basis of Design

This section applies to the utilization and interface requirements of the University's Central Cooling Water (CCW) system.

Background

- CCW is the terminology used for the campus distribution system, which consists of five 2,000 ton centrifugal chillers, one 1,000 ton centrifugal chiller, one 1,000 ton absorption chiller and the associated cooling towers and pumps. The chillers are located at the Central Power Plant (CPP) and generate and distribute chilled water for summer cooling from early May through early October. The distribution piping is located in the utility tunnels and currently serves the central and south portions of campus. See civil section Utility Trenches and Tunnel for utility tunnel piping details.

Programming

- Discuss the intent of using CCW with Campus Engineering before design begins. Due to limitations in CCW capacity and distribution, the CCW system may not have adequate capacity to serve new loads, particularly in South Campus.
- Provide other cooling systems for projects that are located outside the CCW System. See section Process and Environmental Chilled Water.
- Provide a supply air temperature of 60^{o} F for buildings cooled by the CCW System.

Design Criteria

- The CCW System is operated as a primary pumping system with the pressure differential manually controlled at the CPP. Additional controls located at the building control the building differential pressure.
- The CCW System temperature and pressure varies during the operating season. Use the following for design conditions:
    1) Supply Temperature 42^{o} F (at CPP)
    2) Return Temperature 56^{o} F (at CPP)
- A typical building header and coil connection is shown in the Central Cooling Water Building Header and Coil Connection detail at the end of this section. Provide the appurtenances such as bypass relief valves, pressure gauges, thermometers and isolation valves shown on this detail.
- Pipe the bypass relief valves to relieve pressure from the building side of the isolation valve to the CPP side of the isolation valve. The valves shall relieve water when the differential across the relief valves exceeds 15 psig.
- See Metering and Gauges section for CCW meters.
- During the winter months a nominal flow of water is maintained through the CCW System. Provide each building with a winter/summer control switch as noted in detail Central Cooling Water Building Header and Coil Connection.
- As a general practice, mechanical cooling will not be provided in general use buildings, except for libraries and large auditoria. Other exceptions will be considered. Discuss with Campus Engineering and the Project Manager. General use buildings, including libraries that

are provided with mechanical cooling will be cooled to 78° F unless further restricted by the City or State Energy Codes.

Design Evaluation

The following information is required to evaluate the design:

- Programming: Description of proposed system.
- Schematic Design Phase: Provide location of header and preliminary one-line system diagrams.
- Design Development Phase: Provide a CCW header diagram and preliminary calculations.
- Construction Document Phase: Provide pipe sizes, final CCW header diagram, final one-line system diagram, and design calculations, tunnel pipe supports design and calculations.

Construction Submittals

- Provide standard industry submittal requirements.
- Provide calculation showing the added CCW volume to the existing system.

Related Sections

- Facilities Services Design Guide – Civil - Utility Tunnel and Trenches
- Facilities Services Design Guide – Mechanical - General Requirements
- Facilities Services Design Guide – Mechanical - Heating, Ventilating and Air Conditioning
  - Process and Environmental Chilled Water
  - Coils
  - Plumbing Pressure Testing
- Facilities Services Design Guide – Mechanical - Piping, Valves & Accessories
- Facilities Services Design Guide – Mechanical - Hangers and Supports
- Facilities Services Design Guide – Mechanical - Metering and Gauges
- Facilities Services Design Guide – Mechanical - Nonstructural Component Seismic Design
- Facilities Services Design Guide – Mechanical - Identification
- Facilities Services Design Guide – Mechanical - Insulation
- Facilities Services Design Guide – Mechanical - Water Treatment and Flushing
- Facilities Services Design Guide – Mechanical - Environmental Control Systems
- Facilities Services Design Guide – Mechanical - Testing, Adjusting and Balancing
- Facilities Services Design Guide – Mechanical - Commissioning

Products, Material and Equipment

Piping

- See Piping, Valves and Accessories section.
- All piping and fittings shall be rated at 200 psig working pressure when located below elevation 150 feet (City of Seattle Datum).
- Insulate piping in accordance with Insulation section.

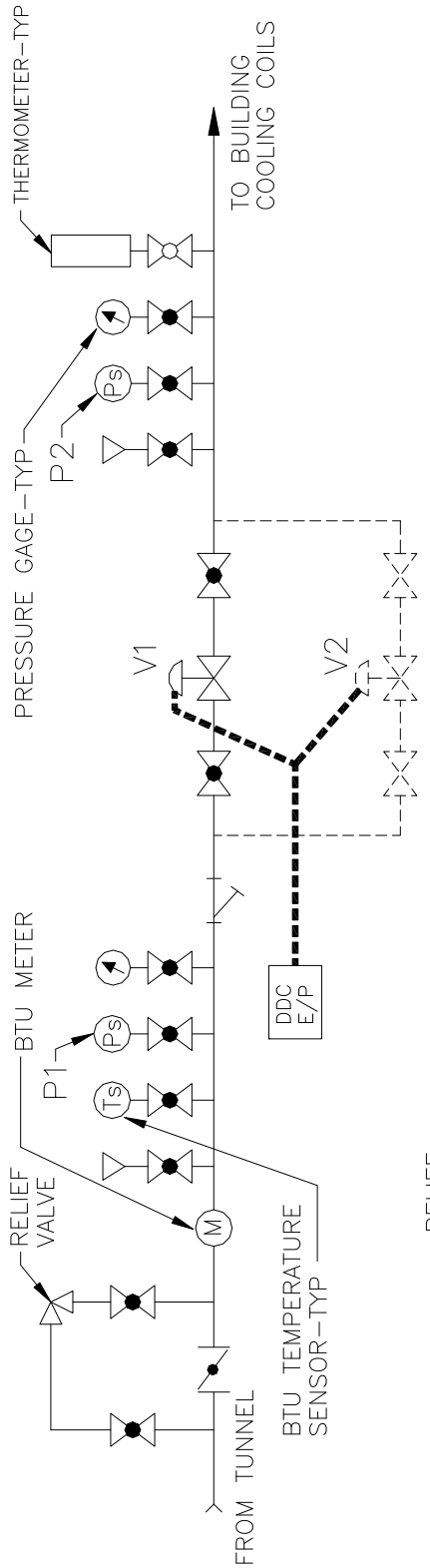
Bypass Relief Valve

- Provide initial setpoint of 15 psig.
- Shall be rated to function with a back pressure (pressure on the tunnel side) of up to 150 psig.
- Metal nameplate with manufacturer, model and spring range shall be fastened to valve.
- Cash Acme, Kunkel or approved substitution.

Installation, Fabrication and Construction

- Comply with the University's shutdown procedures for all connections to the CCW System.
- Locate the CCW header along a wall adjacent to the tunnel entrance at a convenient height for maintenance and repair access.
- If two-way control valves are used, provide a 1-inch bypass line with globe valve for throttling at the most remote coil to allow continuous flow through the building piping.
- Perform the system pressure test and flushing in the presence of Campus Engineering, who will then provide written approval to allow the system to become operational after all required repairs have been made. Flush with water at a velocity of 5 to 6 feet per second in the pipes. Since CCW cannot be used for flushing, provide temporary pumps. Piping shall be filled with clean water after flush and prior to opening valves. University personnel will open the valves to the main CCW system after approval by Engineering Services.
- Provide testing and balancing in accordance with Testing, Adjusting and Balancing section. The University will set the differential pressure of the system to perform the required tests.
- Perform flow tests during both the winter and summer modes. Temperature tests can only be made on a design day. The balancing firm and Commissioning Agent shall be responsible to return to the site on a design day to complete these tests.

END OF DESIGN GUIDE SECTION



Header location: Locate header near tunnel entrance in main mechanical room.

Header valve selection: Select CVS for the CCW header differential pressure (dp) control valve(s) (V1 and V2) to provide a 5 psi pressure drop across the control valves at design flow (p1−p2=5). Select the valve(s) to provide a turndown ratio such that the control valves can hold a 55 psi pressure (p1−p2=55) drop at 10% design flow. Design should show two dp control valves in parallel if necessary to provide turndown capability.

Control sequence: Pressure sensor p1 is for monitoring purposes only. The DDC control system shall modulate the CCW building header dp valve(s) to control the differential pressure across the building (p2−p3). The differential pressure setpoint is 15 psi (p2−p3=15) during the Summer mode, 3 psi during the winter mode. During the summer mode, the CCW coil control valves (not shown) shall modulate to control temperature. During the Winter mode, the CCW coil control valves shall be commanded full open by the DDC control system.

Control graphics: Transfer between Summer and Winter mode shall be achieved by operator command at the operator station of the DDC system through a graphic icon for Summer/Winter mode switch over on the CCW system graphic. (Winter operation represents a heat recovery strategy; the central power plant chillers are off, and local chillers on campus use the CCW loop as a heat sink instead of the local cooling towers.)

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Central Cooling Water Building Header and Coil Connection