1. This information provides guidelines for control systems design and equipment for heating, ventilating and cooling (HVAC) systems. HVAC steam and water distribution systems, piping, insulation, commissioning, and temporary facilities and controls are covered in other parts of these standards or are available from the Facilities Management (FM) project representative.

2. FM project representative, FM, Public Safety Office, and Environmental Health and Safety Office shall approve selection of materials, means, and methods. Unless otherwise approved, the design intent requires means and methods that provide minimal disruption to adjacent building activities and operations.

3. When working in or adjacent to occupied buildings, require means and methods that protect occupants from exposure to noise, dust, traffic, and other hazards.

4. FM project representative shall inform FM and other campus departments or groups affected by the work.

5. The University utilizes a Siemens DESIGO System, host based computer control system (latest version) to control building HVAC systems, pumps, fans, heat exchangers, chillers, cooling towers, outside lighting, and other support systems on campus. This system shall hereinafter be referred to as the University’s BACS (Building Automation and Control System).

6. The University has an on-going contract with Siemens Building Technologies, Inc. (hereinafter referred to as the "control contractor"). FM and Technical Maintenance approve the scope and negotiate the cost of all work performed by the control contractor. The control contractor works closely with Technical Maintenance to modify, upgrade, test, program, and calibrate the BACS.

7. The University utilizes two methods for constructing new and modifying existing mechanical control systems.
   a. The control contractor provides (furnish, install, test, and calibrate) the control system. This method is used for substantial control work for public works projects and complex in-house projects.
   b. Utilize in-house Technical Maintenance personnel. This method is an option for simple systems or limited scope projects where it is more economical to accomplish the work with in-house staff.

8. Early in the design phase, the project mechanical engineer shall recommend one of the two methods for construction of the control system. The FM project representative and FM and Technical Maintenance shall approve the method based on availability of budget and manpower resources.

9. Steam Plant Controls:
   a. The Steam Plant is not included in the campus BACS system. Due to the high temperatures and pressures involved, steam plant equipment shall only be direct controlled by the trained and certified operators.
   b. The campus BACS system will monitor overall operation sensors for purposes of sounding general trouble or emergency alarm.
   c. For consistency and interoperability of all equipment, Steam Plant controls shall match the existing systems – no substitutions allowed:
      i. Electronic Control System Programmable Logic Controllers (PLCs) are to be Yokogawa YS 100 series, or future available compatible lines.
10. Design requirements:
   a. It is the responsibility of the project mechanical engineer (consultant or in-house engineer) and the control contractor to coordinate with the University in developing a cost effective control system which meets the University’s requirements.
   b. The design intent is to provide all functions necessary for current project needs and to facilitate, not impede, potential future adjustments and modifications.
   c. Whenever possible, provide direct control of all equipment by the University’s BACS. Avoid manufacturer’s proprietary interface control packages that only allow monitoring by the central system.
   d. The project mechanical engineer and the control contractor shall coordinate development of preliminary control diagrams, sequences of operation, and control points matrix for review by the FM project representative, FM, and Technical Maintenance.
   e. The project mechanical engineer shall utilize the University’s BACS standard terminology for equipment marks, logical point names, points to be monitored, points to be controlled, and points to be alarmed. See the link to the University’s current naming conventions. The control contractor will use these standards as a guideline when developing databases and programs for input into the field equipment.
   f. The FM project representative, FM, and Technical Maintenance shall review all phases of design and construction work.
   g. The control contractor shall develop a preliminary cost estimate and negotiate final scope and cost with FM and Technical Maintenance. The project mechanical engineer shall incorporate all changes made during these negotiations into the final construction documents. The cost of the control system shall be included in the total project costs. For public works projects, the cost shall be provided in the “Allowance” section of the specification. See “DIVISION 20 Mechanical & Plumbing.”
   h. Require all mechanical controls system components to be compatible with the University’s BACS.
   i. Require all controls to be tied into the network to the central host computer through Building Controllers (PXCs & DXRs).
   j. All control units shall support the most current firmware and software at the time of installation.
   k. The PXC and all cabinet point density shall not exceed 80% of the cabinet’s total point capacity.

11. Control equipment requirements:
   a. Require materials and equipment to be catalogued products of manufacturers regularly engaged in production of such materials or equipment and be of the manufacturers’ latest standard design.
   b. Prefer single source manufacturer for like equipment.
   c. Control valves shall be standard industrial grade valves manufactured by Siemens.
   d. Require all equipment and component parts not manufactured by Siemens to be fully compatible with the BACS products used at Western.
   e. Require electronic actuation control for all new installations and modifications to existing systems (AERCO model requires preapproval of Technical Maintenance). Prohibit
pneumatic actuation (except steam to domestic hot water heat exchangers) without written approval from the FM project representative, FM, and Technical Maintenance.

f. When pneumatic actuation is approved, connect to campus central distribution compressed air system. See “DIVISION 20 General Mechanical” to determine actual pressure available for the project. Require pneumatic dial type gauges for each transmitter, control valve and damper operator.

g. Freeze-protection shall be a function of the discharge air sensor and alarmed through the BACS software. Physical freeze-stats are not necessary for freeze protection and alarm.

h. Programming for and installation of the field control equipment shall be the responsibility of the control contractor.

i. All programming shall be approved by the University’s BACS personnel prior to loading. All programming shall meet current University programming standards and utilize assigned equipment numbers. Equipment numbering is limited to two digits, 01-99.

j. Equipment numbering in existing buildings will continue from the last pre-existing piece of equipment so as to avoid any overlapping ID’s.

12. The following minimum information shall be shown on project drawings:

a. Complete one-line control diagrams for all mechanical equipment showing all sensors and controllers and controlled devices. Indicate functions such as N.O., N.C., etc. Indicate all set points and provide reset schedule.

b. A complete sequence of operations for each piece of mechanical equipment and system.

c. A complete control point matrix.

d. Control valve information including flow rates, minimum Cv or maximum PD, action (modulating vs. two position). Provide a "Control Valve Schedule."

e. Locations of Building Control panels on floor plans.

f. Locations of thermostats on floor plans.

g. A table for indoor and outdoor design conditions. Indicate by room or area if they differ.

h. Terminology on project drawings and in specifications shall be consistent with the University’s BACS standard terminology and naming conventions.

13. Operations and maintenance and training:

a. O&M Manuals:

i. Following the completion of the control work and prior to the instructional period and final acceptance of the contract, the control contractor shall furnish Technical Maintenance with one (1) set of operating manuals bound in three-ring binders. Furnish an additional four (4) sets to the general contractor for submittal of the project O&M manuals with a hardcover screw and post binding. A complete electronic copy in .pdf format shall also be provided.

ii. These manuals will be indexed by system number and shall include reproducible Auto CAD (current version) control diagrams which shall include part numbers, detailed descriptions of sensors and final control elements, set points, flow charts used for developing programs, the sequence of operations, Building Control panel layout, and a copy of the program.

iii. A software as-built back up of all databases and programs shall be provided to Technical Maintenance.

iv. Include copy of final balancing report.

b. Training:

i. The control contractor shall provide appropriate operator training to instruct the University’s personnel. Coordinate the duration of training with Technical Maintenance and include the cost in the allowance.
ii. Training shall include manuals, DDC display diagrams, alarm and status descriptors, requesting data execution of commands and request logs.
iii. Notify the project mechanical engineer and the FM project representative two weeks prior to all training sessions.

14. Western’s Equipment naming and Point naming system follows. The table referenced – Link - shall be excerpted from these standards and inserted as a schedule at the end of the Mechanical Controls section of the construction specifications.
   a. Contract documents shall use WWU descriptor and acronym as listed below to identify equipment and control points.
   b. Coordinate naming and numbering for non-standard equipment (not included on the list) with WWU project representative and Technical Maintenance early in the design process.
   c. The "Controls Contractor" for the University will establish final point naming codes in conjunction with Technical Maintenance consistent with the University’s BACS programming protocol. These will be established at the Controls shop drawing review and submittal stage.
   d. Required BACS record documents will be the WWU archive record of control point names assigned.
   e. Avoid project specific Plumbing & HVAC equipment ID acronyms that overlap WWU equipment acronyms listed.
   f. Control point naming for individual BACS control points required for operation of a particular piece of equipment may follow normally understood industry convention for purposes of producing contract documents and a control points summary matrix.
   g. All point names at a minimum require 8 character minimum.
   h. Before assigning point names to physical devices, review & approval with FM Technical Maintenance supervisor is required. This typically occurs at the design development stage of the project.

End