PART 1 – SYSTEM DESCRIPTION

The University of Colorado Central Power Plant supplies high-pressure, saturated steam to the campus community through a system of inter-connected tunnels and direct-bury piping. The steam pressure in the mains runs at approximately 140 psig and may potentially be raised as future need arises. For this reason, before pressure is reduced for consumer use, we use valves, fittings, pipe, and flanges that are designed to safely carry pressures of at least 300 psig.

Steam pressure is generally regulated in each individual building and may include multiple pressure reductions, depending on the equipment being serviced. Typical reduced pressures vary from 65 to 5 psig. Steam uses in buildings include direct radiant heating, forced air heating using steam fan coils, heating hot water generation, domestic hot water generation, autoclaving and sterilization, chilled water generation, humidification, food service preparation and clean-up, laundry processes, filter cleaning, drying, and other miscellaneous processes. In addition, the Central Power Plant uses high-pressure steam to generate all campus electrical needs.

Condensate generated by the various steam uses on campus is returned to the Central Power Plant by both gravity return systems and pumped systems.
Space in tunnels and mechanical rooms has become extremely limited and it is a University requirement that pipe routing and equipment location be reviewed by a Steam Shop representative, ideally during the design phase but definitely before installation begins. This is not limited to only steam piping and equipment, but all mechanical installations that impact accessibility to, and maintainability of, steam equipment. It is also critical that mechanical work performed on any system [plumbing, electrical, telecommunication, etc.] that involves the “abandonment” of any equipment, wiring, cabling, piping, etc. include the removal of these items to allow for the future use of the space.

The campus steam system and all steam sub-systems are under the direct control of the Facilities Management Steam Shop. Steam and condensate valves are to be operated by Steam Shop personnel only. This is a serious rule and is regarded as such by the University. Any work that either directly or indirectly impacts the system must be approved by, and coordinated with, a Steam Shop representative. Meetings scheduled with Steam Shop personnel for site visits, inspections, spec/print reviews, etc. must be made 72 hours in advance and attended in a timely manner. Failure to show for an appointment may result in lost Steam Shop time being charged to the job. The 72-hour notification requirement may be waived as urgency dictates and time permits.

PART 2 – DESIGN REQUIREMENTS

2.01 AIR VENTS
   A. Specify air vent for high point in any system controlled by a modulating control valve (i.e. fan coils, heat exchangers).

2.02 ANTI-SEIZE
   A. Specify anti-seize for flange bolts only.

2.03 CONDENSATE COOLERS
   A. Due to the use of pressure-powered condensate pumps and the desire to return condensate to the Central Power Plant at as high a temperature as possible, condensate coolers are no longer approved for use on the CU Boulder campus.

2.04 CONDENSATE PUMPS
   A. The pump package shall be provided to the University of Colorado according to the schedule and based on the following specifications:
      1. The condensate pump package shall have a capacity of __________ lbs/hr, with fully redundant capabilities. That is, each pump package shall be capable of pumping __________ lbs/hr, with the ability to fully isolate each pump and/or package from the system.
      2. The pump package shall have the above stated capacity of __________ lbs/hr, with a motive pressure (air or steam) of ________ PSIG, and a system back pressure of ________ PSIG.
3. Each pump and receiver in the package shall be an ASME 150# rated vessel.

4. The package must be a low-profile with a maximum of a ________ trip point from the floor.

5. The pumps shall sense level and activate via an electrode probe-style mechanism (no mechanical float mechanism), utilizing a pin-style Warrick relay.

6. The probe mechanism shall have a third probe for high level alarm, utilizing a two position switch.

7. The pumps shall have a dual-feed capability for the motive pressure. That is, the package shall incorporate both an air filter regulator set (air motive) and a steam pressure reducing valve, strainer w/ blowdown (steam), and check valves.

8. Each pump package shall have its own control panel.

9. Each panel shall incorporate an electronic cycle counter and a high level alarm contact. Signal for cycle count and high level alarm shall be sent to an Andover control system.

10. Each pump shall utilize a 3-way pneumatic actuated ball valve for the motive force. Ball valve shall be carbon steel body x stainless steel trim.

11. Each pump shall have an isolation valve on the condensate inlet and outlet.
   a.) 3” and above – 150# lugged style high performance lever operated steam rated butterfly valve.
   b.) 2” and below – full port forged steel ball valve with stainless steel ball and stem, rated for 250 psig WSP.

12. Each pump shall have a check valve on the condensate inlet and outlet.
   a.) 3” and above – Durabla model WLC CI/BR wafer body check.
   b.) 2” and below – Durabla model SCV wafer style, stainless steel construction. Check valves shall be Durabla wafer style (no substitutes).

13. Each pump shall have a rising-stem, class 800, forged steel gate valve with a steel strainer and steam regulator for the steam supply. The strainer must also have a forged steel ball valve for blowdown, all ball valves, if utilized, shall be full port carbon steel body x stainless steel ball and stem.

14. Pump tanks shall be Armstrong 300 or 400 series tanks ASME rated at 150#.

15. Each tank (pumps and receivers) must be individually drainable, utilizing forged steel ball valves.

16. Each pump trap must have high pressure gauge glass assembly and pressure gauge assembly (gauge, siphon and ¼” carbon steel isolation ball valve.

17. All pipe 2” and smaller shall be threaded ASTM type A106 seamless black steel – schedule 80.

18. All steam pipe 2 ½” and larger shall be welded ASTM type A106 seamless black steel – schedule 40.

19. All condensate pipe 2 ½” and larger be welded ASTM type A106 seamless black steel – schedule 80.
20. 300 lb malleable iron unions with brass seats and 2000 psig forged steel fittings shall be used in all threaded applications.
21. 150 psig raised face, steel weld neck flanged and steel butt weld fittings shall be used in all welded applications.
22. All flange gaskets shall be spiral-wound where the windings are manufactured with type304SS with non-asbestos filler and the outer ring (gauge ring) is manufactured with carbon steel.
23. All threaded fittings will be assembled with 100% virgin Teflon tape. No pipe joint compound will be permitted.
24. Pump packages shall be pre-fabricated on a stand with leveling pads and all interconnecting piping.
25. All components, pieces and parts, whether or not the are specifically shown or indicated on the submittal, shall be in accordance with all University of Colorado – Boulder standard mechanical specifications.

Acceptable Manufactures:
1. Armstrong
2. Johnson

2.05 EXPANSION JOINTS

A. Design

1. The expansion joint shall be designed for (150/300psig) 500 degree F for steam or condensate service.
2. Expansion joint shall be (single/double) slip design and furnished with an anchor base. The ends of the slop and body shall be furnished with 150/300 lb. raised face flanges.
3. The stuffing box shall have integral and external guide surfaces. The guide shall have low friction, non-metallic inserts.
4. The expansion joint shall have 2’ minimum diameter packing cylinders welded in place to allow packing to be injected under full line pressure. The packing cylinder tip shall incorporate a “check valve effect” tip design to prevent the blow back of packing while adding packing to he expansion joint at full line pressure.
5. The packing friction force of the expansion joint shall not exceed 1,000 Lbs. Per inch of expansion joint nominal diameter.
6. All circumferential body welds shall be of the butt weld type.

B. Materials

1. The stuffing box and body shall be machined form A106 or equivalent heavy wall mechanical tubing, of seamless pipe.
2. The slip shall be machined from ASME A106 schedule 80 seamless pipe. All slops are to be machined and ground to achieve a 16RMS finish before plating. Plating shall consist of 1 mil minimum of industrial hard chrome over 1 mil minimum of crack free hard chrome.
3. Expansion joint shall be factory packed for the intended service with Flake Graphite Injectable Packing. The stuffing box packing area in contact
with the slop shall be at least 15 times the nominal diameter of the expansion joint. Spare packing plugs are to be furnished with each expansion order.

C. Insulation Blankets

1. A two piece removable reusable insulation blanket is to be provided with the expansion joint to cover the expansion joint body and slip, and is to incorporate access to the packing cylinders without removal of the body portion of the blanket.

2. The inner and outer covers are to be made from Silicone Impregnated Nomex Cloth. An Inconel wire mesh liner is to be attached to the inner cover.

Approved Manufacturers
1. Advanced Thermal Systems
2. Or approved equal

D. Guides

1. All pipe guides shall be fabricated by a supplier regularly engaged in the manufacture of these items.

2. Pipe guides shall utilize ½” thick low friction graphite on both the upper and lower backing plates of each assembly. The guides shall have sufficient contact surface between the upper and lower assemblies to ensure the loading does not exceed 300 psi.

3. Steel components shall be fabricated from ASTM A36 steel or equivalent.

4. Pipe guides shall accommodate as a minimum the insulation thickness specified for the mating pipe.

5. The upper assembly shall be attached to the pipeline by field welding. The lower assembly shall be attached to the structural support by field welding or bolting as shown on the plans.

6. All guides shall be constructed to allow a minimum 8” of axial movement and maximum + or - 1/16” of lateral and 1/8” vertical up movement.

7. The graphite shall be epoxy bonded to the backing plate for all applications. If service conditions exceed 350 degree F the graphite shall be both epoxy bonded and mechanically attached.

Approved Manufacturers
1. Advanced Thermal Systems
2. Or approved equal

2.06 FITTINGS

A. Elbows, tees, reducers, couplings, crosses:
1. Specify forged steel threaded for 2” and below. All 2 1/2” and above shall be schedule 40 seamless, butt-welded steel conforming to ASTM A234 standard, rated for 2000 psig.

2. Only Teflon tape allowed.

B. Unions:

1. Specify 300 lb malleable iron with brass seats, ground-joint, unions for all pipe sizes 2” and below. Specify flanges for pipe sizes 2 1/2” and above.

2. Unions need to be installed with correct flow, correct side of isolation valve, and be accessible.

3. Pipe lengths need to be cut correctly, so that pipe-fittings are not in a bind.

C. Flanges:

1. Specify raised-face, welding neck flanges conforming to ASTM A181 standard. Specify 150 lb. flange for pressures of 100 psig or less and 300 lb. flange for pressures exceeding 100 psig. Flange bolts shall be hexhead, Grade 8, no substitutions. Sized such that no more than 1/2” of bolt protrudes beyond the end of the nut when fully torqued. Stud bolts will not be permitted.

2. Flanges must match in ratings and when assembled, they must be aligned correctly.

2.07 GASKETS

A. Specify spiral-wound gaskets where the windings are manufactured with Type 304 stainless steel with non-asbestos filler and the outer ring [gauge ring] is manufactured with carbon steel. No other gaskets will be permitted.

2.08 GAUGES, PRESSURE

A. Specify a 4” dry gage with 1/4” MPT connection. Use 0-15 gage for operating pressures of 7 psig or less, 0-30 gage for pressures of 8-15 psig, 0-60 gage for pressures of 16-30 psig, 0-100 gage for pressures of 31-50 psig, and 0-200 gage for pressures greater than 50 psig. Gage must be supplied with an anti-siphon tube [pigtail] and an approved ball valve for isolation. Isolation valve must go before anti-siphon tube.

2.09 HOT WATER CONVERTERS / HEAT EXCHANGER

1. The instantaneous water heater shall operate on water differential using the feed forward principle. A temperature control device with capillary system shall not be acceptable.

2. The water controlling valve of the unit shall be mounted integral to the heat exchanger without the use of connecting piping.

3. The instantaneous water heater shall be pre-piped with only steam, water, and condensate hookups necessary.
4. The controlling valve of the instantaneous water heater shall fail in the closed position, to prevent overheating and scalding.
5. The instantaneous water heater shall have easy access to the individual tubes without moving the heater from its installed position.
6. The shell of the heat exchanger shall be carbon steel, and designed for a maximum allowable pressure of 150 psig.
7. The tubes shall be admiralty brass
8. The water controlling valve body shall be bronze with stainless steel internals.
9. The maximum water pressure drop shall not exceed 10 psi.
10. Outlet water temperature shall be controlled to within plus or minus 5° f.
11. A mixing valve shall be installed for over-temperature protection on the hot water side. A bypass shall be installed along with isolation valves and unions for maintenance on mix valve without shutting down the unit.
12. Operational steam pressure shall be 2-15 psig.
13. Operational water pressure shall be 20-125 psig.
14. The instantaneous water heater package shall have a capacity of _____________ gpm. with fully redundant capabilities.
15. All pipe 2” and smaller, shall be threaded ASTM A106 seamless black steel, schedule 80.
16. All steam pipe 2½” and larger, shall be welded ASTM A106 seamless black steel, schedule 40.
17. All condensate pipe 2½” and larger, shall be welded ASTM A53 Grade B seamless black steel, schedule 80.
18. All copper to be type K.
19. 300 lb malleable iron unions with brass seats, and 2000 lb. forged steel fittings shall be used in all threaded applications.
20. 150 psig. raised face, steel weld neck flanged, and steel butt weld fittings shall be used in all welded applications.
21. All flanged gaskets shall be spiral-wound where the windows are manufactured with type 304SS, with non-asbestos filler, and the outer ring (gauge ring) is manufactured with carbon steel.
22. All threaded fittings will be assembled with 100% virgin Teflon tape. No pipe joint compound will be permitted.
23. All gate valves shall be class 800 Forged steel with rising stem
24. All ball valves shall be Apollo full port, with stainless steel trim.
25. Steam traps shall be Armstrong inverted bucket traps.
26. Package to be assembled with unions and valves, so equipment can be worked on without shutting system down.
27. Instantaneous water heater packages shall be pre-fabricated on a stand, with leveling pads, and all interconnecting piping.
28. The package will incorporate a monitoring system that will shut steam off to the unit upon loss of water pressure.
29. All components, pieces, and parts, whether or not they are specifically shown or indicated on the submittal, shall be in accordance with all University of Colorado, Boulder, standard mechanical specifications.
30. The instantaneous water heater shall have a one year guarantee against defective material, or faulty workmanship.
Acceptable Manufactures

1.) Armstrong Flo-rite
2.) Leslie Constantemp

B. Heating Hot Water Converters:

1. Specify tube and shell design where water circulates in the tubes and steam in the jacket. The design need not require double-wall tubes for heating hot water.

2.10 INSULATION JACKETS, REMOVABLE / REUSEABLE

A. Removable insulation jackets are to be specified for use on the following: all pressure-powered condensate pumps, all pressure regulators, traps 1” and larger, gate/globe/butterfly valves 2” and larger, and strainers 2” and larger.

2.11 METERS

A. Steam Meters:

1. Specify insertion turbine style steam meter for steam line sizes 3” and above. Meter must have pressure compensation capability to adjust for pressure fluctuation, both 4 to 20 mA and pulse output signals, and a flow processor. Specify meter with a 150 lb. flange for line pressures of less than 100 psig and a 300 lb. flange for line pressures of 100 psig or more. The meter must be installed with a 2” cast steel, full-port, rising-stem gate valve to allow for removal of the meter without interruption of steam service.

2. Specify inline vortex style steam meter for steam line sizes 2 1/2” and below. Requirements are the same as for the insertion turbine meter with the exception of the isolation valve. Instead, two isolation valves and a bypass line with globe valve must be used.

B. Condensate Meters:

1. Specify a cycle counter for mechanical style pressure-powered condensate pumps.

2.12 NUTS AND BOLTS

1. Nuts and bolts to be no less than grade 8. No substitutions.

2.13 PIPING

1. Pipe size: Size to allow not greater than 8.000 FPM (feet/minute) based on maximum load.
2.14 REGULATORS / PRV’s

1. When winter seasonal steam load exceeds summer seasonal steam load by 50 times, specify a 25%-100% automatic switchover system. See Appendix A for details.

2.15 SEALS, MECHANICAL

1. Any piping penetrations through tunnel walls or lids, or through building foundations, must be sealed with a mechanical seal that is both expandable and water-tight. In addition, the penetration must be sealed on the exterior with a water-tight, non-shrink grout.

2.16 STRAINERS

1. Specify a cast steel Y-type strainer with stainless steel mesh or screen basket for all screwed applications [2’’ and below]. Strainer must have a threaded fitting for use as a blowdown. All strainer blowdowns shall be ball valves with a short pipe nipple-sch 80 on the outlet side.

2. Specify a cast steel Y-type strainer with stainless steel mesh or screen basket for all flanged applications. Strainer must have a threaded fitting for use as a blowdown. All strainer blowdowns shall be ball valves with a short pipe nipple-sch 80 on the outlet side.

2.17 TRAPS

A. Inverted Bucket: All Applications that are fed by a modulating control valve must use the “LV” (large vent) model. Sizing shall be as follows:

2 to 1 @ .5 psi for 0-15 psi
2 to 1 @ 2 psi for 16-30 psi
3 to 1 @ 1/2 of maximum pressure drop above 30 psi
3 to 1 at operating pressure differential on constant pressure

B. Thermostatic traps used only for air vents and direct steam radiation.

PART 3 – STEAM SPECIALTIES, RELATED EQUIPMENT, AND ACCEPTABLE PRODUCT MANUFACTURERS

*Please note: the term “approved equal” refers to approval by the University of Colorado Boulder, Facilities Management Steam Shop only, no exceptions.

3.01 AIR VENTS

1. Use balanced-pressure type with stainless steel bellows, valve, and seat.

2. Acceptable Manufacturers:
a. Spirax/Sarco  
b. Armstrong  
c. Hoffman ITT  
d. Approved equal

3.02 ANTI-SEIZE

1. Use only 100% virgin teflon tape for all threaded pipe fittings. No thread sealing compound or “pipe dope” will be permitted.
2. Use a metal-based [typically nickel] anti-seize with a 2000-degree rating for all flange bolts.
3. Acceptable Manufacturers, metal-based anti-seize:
   a. Permatex  
   b. Approved equal

3.03 CONDENSATE COOLERS

1. Acceptable Manufacturers: none

3.04 CONDENSATE PUMPS

1. Use probe style, pressure-powered pump with compressed air as the motive medium.
2. Acceptable Manufacturers:
   a. Johnson Liqui-Mover  
   b. Armstrong

3.05 EXPANSION JOINTS

1. Use bellows style expansion joints where the bellows are designed in accordance with sections C1-C8 of the Standards of Expansion Joint Manufacturers Association.
2. Acceptable Manufacturers:
   a. Pathway CTU  
   b. Approved equal

3.06 FITTINGS

A. Elbows, tees, reducers, couplings, crosses:
   1. Use forged steel for threaded fittings. 2000 Lb.
   2. Use schedule 40 seamless, butt-welded steel conforming to ASTM A234 standard for welded fittings.

B. Unions:
   1. 300 lb malleable iron with brass seats.
C. Flanges:

1. Use raised-face, welding neck flanges conforming to ASTM A181 standard.
2. Acceptable Manufacturers:
   a. Ladish
   b. Grinnel
   c. Bonney Forge
   d. Approved equal

3.07 GASKETS

1. Use spiral-wound gaskets where the windings are manufactured with Type 304 stainless steel with non-asbestos filler and the outer ring [gauge ring] is manufactured with carbon steel. No other gaskets will be permitted.
2. Acceptable Manufacturers:
   a. Flexitallic
   b. Garlock
   c. Lamons
   d. Approved equal

3.08 GAUGES, PRESSURE

1. Use 4” dry gage with 1/4” MPT connection. Rated for steam with stainless steel intervals.
2. Acceptable Manufacturers:
   a. U.S. Gauge
   b. Winters LF
   c. Trerice 700 Series
   d. WIKA 23 X .59 Series

3.09 HOT WATER CONVERTERS / HEAT EXCHANGERS

A. Domestic Hot Water Converters:

B. Instantaneous Hot Water Converter: Use a feed-forward design that utilizes pressure for control rather than temperature. Tube design can be either be straight-through or helical but helical design must have Hastelloy seats.
   1. Tube and Shell style [with storage] Hot Water Converters: Use type with double-wall tube construction where steam is in the tube bundle and water in the jacket.

C. Heating Hot Water Converters:

   1. Use tube and shell style with single-wall tube construction where steam is in the tube bundle and water in the jacket.
2. Acceptable Manufacturers, Instantaneous Hot Water Converters:
   a. Armstrong Flo-Rite
   b. Leslie Constantemp

3. Acceptable Manufacturers, Tube and Shell Hot Water Converters:
   a. Bell & Gossett
   b. Armstrong Pump
   c. Approved equal

3.10 INSULATION JACKETS, REMOVABLE / REUSEABLE

1. Use jacket with teflon-coated fiberglass cloth, #6 density fiberglass, stainless steel hardware, Velcro tabs, and Nomex drawcords.
2. Acceptable Manufacturers:
   a. Insultech by Shannon Enterprises
   b. Approved equal

3.11 METERS

A. Steam Meters:
   1. Insertion turbine style steam meter: Meter must have pressure compensation capability to adjust for pressure fluctuation, both 4 to 20 mA and pulse output signals, and a flow processor. For line sizes 3” and larger.
   2. Inline vortex style steam meter: Requirements are the same as for the insertion turbine meter. For line sizes 2 1/2” and smaller.
   3. Acceptable Manufacturer, Insertion Turbine Steam Meter:
      a. Emco Model TMP-910 with Model FP-93 flow processor only.
   4. Acceptable Manufacturer, Inline Vortex Steam Meters:
      a. Emco Model Vortex PhD only

B. Condensate Meters:
   1. Use a cycle counter for pressure-powered condensate pumps.

3.12 PIPING

A. Steam Piping:
   1. Use only ASTM type A106 seamless black steel pipe. All welded applications shall be schedule 40 and all threaded applications must be schedule 80.

B. Condensate Piping:
   1. Use only ASTM type A106 seamless black steel pipe. All condensate piping must be schedule 80.
C. Direct-Bury Underground Piping:

1. Acceptable Manufacturers, Direct-Bury Piping:
   a. Ricwil / Perma-Pipe
   b. Approved equal

3.13 REGULATORS / PRV’s

1. Use Leslie Model GPK air-loaded steam regulator with Leslie Airmate Model AG-2 air pressure reducing valve with filter and gauge for actuation. Due to the critical nature of regulators and the goal of reducing spare parts inventory, this is the only allowable manufacturer and model. Use screwed connections for 2” and below, flanged connections for 2 1/2” and above.

3.14 SEALS, MECHANICAL

1. Use a mechanical seal that is heat-rated, expandable, and water-tight.
2. Acceptable Manufacturers:
   a. Link-Seal Model “T” [silicone] by Thunderline
   b. Approved equal

3.15 STRAINERS

A. Use cast steam rated steel, 250 lb. Y-type strainer with stainless steel mesh or screen basket for all screwed applications. Strainer must have a threaded fitting for use as a blowdown.

B. Use a cast steel Y-type strainer with stainless steel mesh or screen basket for all flanged applications. Strainer must have a threaded fitting for use as a blowdown.

C. Acceptable Manufacturers:

1. Spirax/Sarco
2. Leslie
3. Armstrong
4. Approved equal

3.16 TRAPS

A. Float and Thermostatic Traps:

1. Trap must be fully modulating type suitable for continuous operation with a cast iron body and cover. Internal parts must be fully accessible without disturbing piping. Float, air vent, head, seat, and valve mechanism shall be manufactured of stainless steel. An integral vacuum breaker is required.

B. Inverted Bucket Traps:

1. For design loads exceeding 600 lbs./hr. of condensate, use a trap with a cast iron body and cover where internal parts are fully accessible without disturbing piping.
The bucket and lever mechanism shall be stainless steel and the valve and seat must be chromed steel that has been hardened, ground, and lapped.

2. For design loads of 600 lbs./hr. or less of condensate, use a trap with a stainless steel body and separate inline swivel connector. All other components shall be made of stainless steel as well.

C. Thermostatic Radiator Traps:

1. Due to the goal of reducing spare parts inventory, only three thermostatic radiator trap models are utilized on campus.

2. Acceptable Manufacturer, Float and Thermostatic Trap:
   a. Armstrong only

3. Acceptable Manufacturer, Inverted Bucket Trap with Cast Iron Body:
   a. Armstrong only

4. Acceptable Manufacturers, Inverted Bucket Trap with Stainless Steel Body:
   a. Spirax/Sarco Model UIB30

5. Acceptable Manufacturer, Thermostatic Radiator Trap:
   a. Armstrong Model TS-2
   b. Nicholson Model N-125
   c. Sterlco Model 70 or Model 77

3.17 VACUUM BREAKERS

A. Use hardened ball check valve design with all working parts manufactured from stainless steel.

B. Acceptable Manufacturers:

1. Spirax/Sarco Model VB21
2. Armstrong
3. Johnson
4. Approved equal

3.18 VALVES

A. Butterfly Valves:

1. Use only high–performance, steam-rated, lug-style wafer [between flanges] body with gear-driven actuator.

2. Acceptable Manufacturers, Butterfly Valves:
   a. Keystone
   b. DeZurik
   c. Jamesbury
   d. Vanessa
3. **Acceptable Manufacturers, Gate Valves / Class 800:** [no Nibco, Red-White, or Toyo]
   a. Vogt
   b. Bonney Forge
   c. Anvil
   d. Approved equal

4. **Acceptable Manufacturers, Globe Valves / Class 800:** [no Nibco, Red-White, or Toyo]
   a. Vogt
   b. Bonney Forge
   c. Anvil
   d. Approved equal

5. **Acceptable Manufacturers, Ball Valves:**
   a. Apollo Model 73A-Size-64
   b. Spirax/Sarco Model M10S
   c. Approved equal

6. **Acceptable Manufacturers, Swing Check Valves:**
   a. Crane
   b. Stockham
   c. Mueller
   d. Milwaukee
   e. Approved equal

7. **Acceptable Manufacturers, Spring Check Valves:**
   a. Durabla Model SCV 750 CWP / 500 WSP
   b. Armstrong
   c. Approved equal

8. **Acceptable Manufacturers, Wafer Check Valve:**
   a. Durabla
   b. Spirax/Sarco Model DCV 4
   c. Mueller
   d. Marlin
   e. Approved equal

9. **Acceptable Manufacturers, Radiator Control Valves:**
   a. Ammark
   b. American Steam

10. **Acceptable Manufacturers, Safety Relief Valves:**
    a. Leslie
    b. Spence

B. **Gate Valves:**
1. Use rising-stem Class 800 forged steel [A105] valve with spiral-wound top gasket.

C. Globe Valves:
1. Specifications are the same as for gate valves.

D. Ball Valves:
1. Use only a valve with forged steel body, full-port construction, MTFE seats and packing, stainless steel ball and, stainless steel blowout-proof stem. The valve must be rated to 150 psig saturated steam.

E. Check Valves:
1. Swing check valves must be bronze-bodied, Class 300 [300 psi WSP] with bronze disc and stainless steel hinge pin.
2. Spring check valves must be of all stainless steel construction and rated at 300 psi WSP or better.
3. Wafer check valves are designed to fit between two flanges. They must be manufactured of all stainless construction [body, disc, spring, and spring retainer] and have an opening rate of 1/2 psi or less.

F. Radiator Control Valves:
1. Use a chrome-plated, bronze-bodied, steam-rated valve with a thermostatically actuated controller where the thermostat is integral to the controller.

G. Safety Relief Valves:
1. Use a steam-rated safety relief valve that has a cast iron body, a bolted bonnet design, seats lapped to optical flatness, and dual control rings. The valve must have bronze semi-nozzle trim. Due to the varying steam pressure reducing valve manufacturers’ safety relief valve requirements, the safety relief valve shall be of the same manufacture brand as the steam PRV.

H. If piping run is longer than 10’, the pipe size must be increased one pipe size larger.

PART 4 – INSTALLATION REQUIREMENTS

4.01 AIR VENTS

A. Do not install on post-pressure control systems (steam coils). Pipe relief discharge to floor.
4.02 ANTI-SEIZE
   A. Use on all bolts and cap screws.

4.03 CONDENSATE PUMP
   A. All welds to be done by a ASME certified welder.
   B. Threads on pipe must be cut correctly. Not allowing more then 3 ½ turn
      by hand and a minimum of 2 ½ turns.
   C. Pumps to be leveled and plumb.
   D. All equipment should be set for ease of maintenance.
   E. Vent piping to be taken to an outside location. 1st Choice would be the roof.
   F. All piping should be individually hung to secure.
   G. Motive steam should have drip trap.
   H. Air lines will use black pipe or rigid copper.

4.04 EXPANSION JOINTS
   A. All weld to be done shall be done by a certified welder.
   B. Expansion joints to be properly anchored according to drawings.
   C. Guides to be spaced per manufactures recommendation.

4.05 HOT WATER CONVERTERS/HEAT EXCHANGES
   A. Unit must be piped for ease of tube removal.
   B. Unit must be set at a height for ease of maintenance.
   C. Feed forward units must have thermal loops. (18” minimum)
   D. Feed forward units with receive must have a diverting valve installed.
   E. Condensate to be returned by gravity.
   F. Isolation valves on all piping to unit.
   G. Vacuum breaker must be installed after unit and before trap.
4.06 PRESSURE REDUCING STATION

A. Support piping on each side of reducing valve using pipe saddles (for full wrap of insulation).

B. Install drip traps on the high and low sides of reducing station (see detail on drips for proper piping).

C. Install strainers with blowdown valves before all regulating valves and traps.

D. Install gauges, isolation valve, and pigtail on high and low side of station.

E. Use a flanged globe valve (300#) on bypass for 2.5” pipe and above. Use a forged steel globe valve on 2” pipe and smaller.

F. Use a high performance butterfly valve with gear operator (lug style) on 2.5” pipe and larger. Use a forged steel gate valve on 2” and smaller pipe.

G. Use a concentric reducer on the outlet of the regulator.

H. Use ½” pipe for the control piping between GPK and low pressure steam main.

I. Mount Leslie AF-2 air mate where it is accessible. Use rigid copper to pipe from the air mate to the GPK.

J. Mount safety relief valve where it is accessible.

K. Mount drip pan elbow as close to safety relief as possible. Use a flange or a union (depending on size) for ease of replacing valve if needed.

L. Drain from drip pan shall be run to a floor drain with a union at the drip pan for ease of removal if necessary. If run is longer than 10’ ft. increase by one pipe size.

M. Apply anti-seize on all bolts.

N. Use Teflon tape only on all threaded joints.

O. Use only spiral wound gaskets on flanges.

P. All welding being performed to be done by a ASME certified welder.

Q. Use 250# steam rated ball valves on all blowdowns.

R. Pilot lines need to be run with slope down away from GPK.

S. All pressure reducing valves to have unions or flanges on each side for ease of removal.

T. See Appendix Diagram A.
4.07 TESTING

A. All new steam and condensate piping shall be hydrostatically tested to 1 ½ times the operating pressure of the system, of 100 psig, whichever is higher. The test must hold zero pressure for a minimum time period of two hours.

B. Must inspect all piping – welded, threaded and any type of soldering before piping can be insulated. Systems must be inspected by UCB Steam Shop before operation.

4.08 TRAPS

A. All traps to be installed with unions and isolation valves for ease of removal.

B. All traps to be installed below equipment.

C. Do not bull head multiple trap applications.

D. Check valves on inlet of all bucket traps (see drawing)

E. Test tee’s after trap to point down.

F. See Diagram for Main Drip Appendix A.

PART 5 – INSTALLER (CONTRACTOR) QUALIFICATION REQUIREMENTS

5.01 QUALIFICATION

Any Journeyman Steamfitter working on jobsite shall be licensed by “City and County of Denver.” The license must be carried on their person at all times while on the jobsite, and be available for inspection by UCB staff at anytime.

5.02 ALLOWABLE JOURNEYMAN/APPRENTICE RATIOS

The installer (contractor) may use apprentice steamfitters on the jobsite. At no time shall the ratio of two apprentices to one journeyman be exceeded on the jobsite.

5.03 WELDER QUALIFICATIONS AND QUALIFICATONS AND PROCEDURES FOR STEAM AND CONDENSATE PIPING

1. UCB may ask for welding certifications at any time.

2. Welder must be certified in SMAW-E6010, E7018, which falls under Section IX of the ASME code, Boiler and Pressure Vessel (welding and brazing), ASME B31 and Appendix B31.1 2007, Power Piping Welding Procedures.
5.04 WELD INSPECTION

Weld will be visually inspected by UCB personnel. If weld does not meet UCB Standards (visually), then Contractor may be required to X-ray weld or “cut out” weld for further inspection. Contractor will be responsible for costs associated with X-raying or removal and re-welding.

END OF SECTION