

SECTION 23 22 16

STEAM AND STEAM CONDENSATE SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Condensate meters
- B. Flash tanks
- C. Pressure reducing stations
- D. Pressure regulating valves
- E. Relief valves
- F. Steam flow meters
- G. Steam traps
- H. Strainers
- I. Unions and flanges
- J. Flexible pipe connectors
- K. Flexible expansion loops
- L. Expansion joints
- M. Pipe alignment guides

1.2 RELATED SECTIONS

- A. Section 23 05 00: Common Work Results for HVAC
- B. Section 22 05 19: Gauges and Thermometers
- C. Section 23 05 53: Painting and Identification
- D. Section 23 22 00: Steam and Steam Condensate Piping
- E. Section 23 21 23: HVAC Pumps
- F. Section 23 57 00: Heat Exchangers

1.3 REFERENCE STANDARDS

- A. ANSI (American National Standards Institute).
- B. ASME (The American Society of Mechanical Engineers).

#### 1.4 SUBMITTALS

- A. Submit shop drawings on all equipment provided under this section.
- B. Where required, submit certified data sheets for equipment complying with ASME requirements.

#### PART 2 - PRODUCTS

##### 2.1 ACCEPTABLE MANUFACTURERS

- A. ~~Condensate Meters: Badger, Cadillac.~~
- B. Flash Tanks: Adamson.
- C. Pressure Reducing Valves: Spence, Fisher.
- D. Pressure Regulating Valves: Spirax Sarco.
- E. Relief Valves: Bell and Gossett, Watts or approved equal.
- F. Safety Valves: Kunkle, Crosby.
- G. Steam Flow Meters: BIF, Gervase or approved equal.
- H. Steam Traps: Armstrong, Spirax Sarco, Illinois, Dunham, Trane, Hoffman Specialty or approved equal.
- I. Strainers: Armstrong, Dunham-Bush, Hayward, Metra-Flex, Mueller, Spirax-Sarco, Watts, Hoffman Specialty or approved equal.
- J. Flexible connectors: Hyspan, Mason Industries, Metra-Flex or approved equal.
- K. Flexible expansion loops: Mason Industries, Metra-Flex or approved equal.
- L. Expansion joints: Hyspan, Mason Industries, Metra-Flex or approved equal.
- M. Pipe alignment guides: Hyspan or approved equal

Deleted: <#> Blowdown Separators:  
Penn or approved equal.¶

##### 2.2 BLOWDOWN SEPARATORS

- A. Equal to Penn blowdown separator constructed of [3/16 inch plate steel rated at 100 psig] [5/16 inch plate steel rated at 225 psig] [3/8 inch plate steel rated at 250 psig], meeting ASME code requirements. Provide with screwed, weld bevel or flashed connections. Separator shall have a stainless steel plate at the point of inlet impingement.
- B. Provide [3 angle legs for floor mounting] [wall bracket for wall mounting].
- C. Furnish and install automatic aftercooler, complete with cold water inlet, temperature regulator valve, strainer and 2-1/2" bi-metal thermometer dial.

##### 2.3 CONDENSATE METER

- A. Equal to Badger Model magnetic drive turbo meter with accuracy of  $\pm 1-1/2\%$  over the meter's entire flow range and rated to handle 500 F. water. Locate on discharge side of condensate

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pump return unit. Meter shall have five-digit odometer type totalizer and have an output signal that will interface with the Building Automation System.

## 2.4 FLASH TANKS

- A. Tanks equal to Adamson, designed and constructed to ASME code with required stamping.
- B. Provide complete with steam inlet, outlet, vent and drain connections.
- C. Tanks 12 inches through 20 inches designed and constructed for a maximum working pressure of 150 psig with a 225 psig test.
- D. Tanks over 20 inches designed and constructed for a maximum working pressure of 125 psig with a 188 psig test.
- E. Steel construction with one cote primer on exterior. Provide inspection openings as required. Provide manholes on tanks 42 inches in diameter and larger.

## 2.5 PRESSURE REDUCING STATIONS

- A. General:
  - 1. Furnish and install, as shown on drawings, a pressure reducing station to reduce steam from 100 psig using two valves in parallel.
  - 2. Each valves shall be 125 pound 450°F. cast iron construction, single seat for dead end service with stainless steel diaphragm and internal trim. It shall be arranged to allow inlet velocities below 10,000 feet per minute and valve capacities shall not to exceed 10% above the required maximum. Valves 2-1/2 inch and larger shall have flanged ends with 125 pound flanges. Smaller valves shall have screwed ends.
  - 3. Noise suppression shall be by a Spence flange-mounted multi-hole plate. Maximum noise produced by the station when measured by the standard method shall not exceed 80 db.
  - 4. Provide gate valves, noise suppression plate, traps, strainers, flash tank and piping as shown on drawings.
- B. Pressure Reducing Station:
  - 1. The reducing station shall consist of two pressure reducing valves, one valve sized for approximately 1/3 of total capacity required and the other sized for approximately 2/3 of the total capacity.
  - 2. Valve No. 1 shall be , Spence ED , with capacity of Hr.
  - 3. Valve No. 2 shall be , Spence ED , with capacity of Hr.
  - 4. Safety Valve: x Kunkle No. 252 . Set at 15 psig, with capacity of lb/hr.
  - 5. Drip Pan Elbow: size, Kunkle; Figure 299. Pipe condensate discharge to nearest floor drain.

## 2.6 PRESSURE REGULATING VALVES

- A. Equal to Spirax Sarco Model 25P.
- B. Furnish and install, as shown on drawings, pressure regulating valves to reduce steam pressure as indicated.

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Deleted: <#> PRESSURE REDUCING STATIONS¶

<#> General:¶

<#>Furnish and install, as shown on drawings, a pressure reducing station consisting of six valves; two high pressure valves, two trip valves and two low pressure valves.¶

<#>The primary valves shall reduce 250 psig to approximately 125 psig; the secondary valves shall reduce 125 psig to 12 psig. Control lines and accessories shall be arranged to provide the following sequence:¶

<#>The high pressure valves shall be capable of reducing from 250 psig to 12 psig by operation of the safety pilot in the event that the low pressure valves fails.¶

<#>The low pressure valve shall be capable of reducing from 250 psig to 12 psig in the event that the high pressure valve fails.¶

<#>The trip valve shall be arranged to stop all steam flow in the event that the reducing valves fail. The arrangement shall be such as to meet the requirements of ANSI B-21.1, Paragraph 102.2.5.¶

<#>All valves shall be 300 pound 600°F. cast steel construction, single seat for dead end service with stainless steel diaphragm and internal trim and shall be arranged to allow inlet velocities below 10,000 feet per minute. Valve capacities shall not exceed 10% above the required maximum. Valves 2-1/2 inch and larger shall have flanged ends with 250 pound flanges. Smaller valves shall have screwed ends.¶

<#>Noise suppression shall be by a Spence multi-hole plate. Maximum noise produced by the station when measured by the standard method shall not exceed 85 decibels.¶

<#>Pressure Reducing Valves No. 1 and No. 2 (250 - 125 psig)¶

<#>size, Spence Type ED , LB/HR¶

<#>size, Spence Type ED , LB/HR¶

<#>Pressure Reducing Valves No. 3 and No. 4 (125 - 10 psig)¶

... [1]

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- C. Valves shall provide maximum capacities shown on the drawings with an accuracy of regulation equal to 1 psi, and allow for variation of the set pressure while in service.
- D. The pilot operated regulator shall be ~~cast iron body. Unit to be self actuating, taking its control signal from the process fluid.~~
- E. The regulator shall be pilot actuated and diaphragm operated. The regulator shall be packless, single seated globe type suitable for ANSI Class IV shut off.
- F. All regulators shall have hardened stainless steel trim to 38 - 46 Rockwell C scale.
- G. Pilot operated regulators are to consist of two main components, main valve and pressure pilot. Main valve stem shall be top and bottom guided with the bottom guide providing a patent self scrubbing design to minimize sticking. pilots can be top, side or remote mounted with set pressure adjustment by either a spring or air loading force. Trim, spring, stem, guide, and diaphragms shall be stainless steel. Regulators will be threaded, with larger sizes ANSI flanged to meet the system pressure.

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## 2.7 RELIEF VALVES

- A. Equal to Watts Type 174A or 740. ASME rated, with test lever, bronze bodies, selected for a relief pressure applicable with the installation.

## 2.8 STEAM FLOW METER

- A. Equal to Gervase, "Gilflo" differential pressure flow sensor with linear output directly proportional to flow rate, using a variable area annular orifice. Accuracy shall be  $\pm 1\%$  over a 100:1 range. Body shall be carbon steel with stainless steel trim and constructed at 150 ANSI standards. Output shall be indicated at a wall mounted redout panel, with totalizing counter and with a signal that will interface with the existing Building Automation System.

## 2.9 STEAM FLOW METER

- A. Provide one small capacity shuntflow meter in parallel with another shuntflow meter of larger capacity, both located in low pressure steam piping downstream of pressure reducing valves.
- B. Small capacity meter shall be size axial-turbine type shuntflow meter, with output contactor and standard register for in-line mounting. Meter shall be accurate 2% of actual flow over a range of 10:1, and shall have maximum capacity of lb/hr.
- C. Large capacity meter shall be size, similar to small meter, 150 lb. flanged ends, with maximum capacity of lb/hr.
- D. Each meter shall have four figure digital totalizer and shall provide an output signal that will interface with the Building Automation System.
- E. Provide convenient valving arrangement to permit switching from large meter to shall meter during summer and vice versa in the winter.

## 2.10 STEAM TRAPS

- A. Low Pressure Steam Traps:
  1. Provide float and thermostatic traps for low pressure steam service. Traps with integral strainers are acceptable.

2. Steam traps shall be sized in accordance with following tables, based on actual capacity of steam trap at 1/2 psig pressure differential across trap. In a case where actual pressure differential is known and is greater than 1/2 psig, this pressure may be used for sizing.

Trap Size - Inches	Cap. (#/Hr. at 1/2 psig Diff.)
3/4	100
1	250
1-1/4	600
1-1/2	1200
2	2500

- a. Size for 3 to 1 safety factor for the following items:
- 1) Preheat coils
  - 2) Shell and tube heat exchangers (steam in shell)
  - 3) Unit heaters
  - 4) Reheat coils
  - 5) Storage water heaters

B. ~~Drip Traps - High or Low Pressure:~~

1. Provide float and thermostatic trap or inverted bucket trap with thermic vent for low pressure drips and inverted bucket traps without thermic vents for high pressure drips. Following schedule shall apply to steam main drip traps.

2. Low Pressure Steam to 15 psig:

Steam Main Size	Trap Capacity at 15 psig
1" - 10"	600 lb/hr
12" - 24"	1060 lb/hr

3. High Pressure Steam - 15 psig to 250 psig:

Steam Main Size	Trap Capacity at 25 psig
1" - 10"	750 lb/hr
12" - 16"	1300 lb/hr
18" - 24"	3000 lb/hr

C. Low Pressure Thermostatic Traps:

1. Traps shall have multiple seamless bellows type thermostatic elements, stainless steel head and removable seat.
2. Trap sizes and capacities shall be in accordance with the following table:
- | Trap Size | Capacity(Lb/Hr @ 1/2 PSIG Diff.) |
|-----------|----------------------------------|
| 1/2"      | 28                               |
| 3/4"      | 55                               |
| 1"        | 98                               |

**Deleted:** <#> High Pressure Steam Traps (to 250 psig):¶  
 <#> High pressure traps shall be inverted bucket traps without thermic vents. Traps shall be sized for operating pressure of equipment to be trapped based on tables shown for low pressure traps and installed in same manner. Integral strainers are acceptable.¶

2.11 STRAINERS

- A. Y-type strainer designed for line pressure serving coil with strainer ahead of control valve in steam supply to coil. Strainers shall be designed for line pressure.

2.12 UNIONS AND FLANGES

- A. For systems with pressures less than 150 psig, use 150 pound malleable iron ground joint unions, ANSI B16.39, in steel piping 2 inch and smaller. For the same piping 2-1/2 inch and larger, use cast iron flanges, Class 125.

- B. For systems with pressures 150 - 300 psig, 300 pound malleable iron ground joint unions in steel piping 2 inch and smaller. For same piping 1-1/2 inch and larger, use cast iron flanges, Class 250.
- C. Provide gaskets and bolts for flanges, as required for the temperature and pressure of the piping system.

#### 2.13 FLEXIBLE CONNECTORS

- A. Provide flexible piping connectors at the following locations or where indicated on drawings.
  - 1. Vibration isolation.
  - 2. Misalignment compensation.
- B. For steel piping application use Hyspan Series 4500 with an inner hose of annular corrugated stainless steel, an exterior sleeve of braided stainless steel, a pressure rating of 300 pounds per square inch gauge, joints for 2 inch diameter and larger shall be flanged and for smaller than 2-inch diameter shall be threaded with unions. Size shall be same size as piping connected to.

#### 2.14 FLEXIBLE EXPANSION LOOPS

- A. Provide flexible piping connectors at the following locations or where indicated on drawings.
  - 1. Seismic joint.
  - 2. Building expansion joint.
  - 3. Building construction joint.
- B. Expansion joints shall be of the braided stainless steel type. Joints to consist of two flexible sections of hose and braid, two 30° elbows, and a 60° return. Flexible hose section to be stainless steel, close pitch, annular corrugated hose with a braided outer covering of stainless steel. End connections to match mating piping. The overall length shall allow for a minimum of  $\pm 4$ " movement in any direction. Expansion joints shall be equal to Mason Industries model "VFL" for flanged, "VCPS" for copper, "VMN" for male thread, "VGN" for grooved.

#### 2.15 EXPANSION JOINTS

- A. For steel piping 3 inch and smaller, provide stainless steel bellows type expansion joints at locations indicated on drawings. Units to be Hyspan Series 1500 or equal with a pressure rating of 150 pounds per square inch gauge and 750 degrees F., maximum compression as indicated on drawing schedule, joint as specified for pipe joints, size shall be same size as piping.
- B. For steel piping larger than 3 inch, provide externally pressurized guided stainless steel bellows type expansion joints at locations indicated on drawings. Units to be Hyspan Series 3500 or equal with a pressure rating of 300 pounds per square inch gauge and 750 degrees F., maximum compression as indicated on drawing schedule, flanged joints, size shall be same size as piping.

#### 2.16 PIPE ALIGNMENT GUIDES

- A. Provide pipe alignment guides equal to Hyspan Series 9500. Guides to be pressed steel joined together by fusion welding with a protective black lacquer paint finish.

## PART 3 - EXECUTION

### 3.1 BLOWDOWN SEPARATOR

- A. Install in accordance with manufacturer's recommendations. Connect separator aftercooler to available cold water source.

### 3.2 FLASH TANKS

- A. Install in accordance with manufacturer's recommendations. Provide steel support framing as required.

### 3.3 INSTALLATION OF PRESSURE REDUCING STATIONS

- A. Use Schedule 80 pipe at the pressure reducing stations and within a minimum distance of 20 feet upstream and downstream of the reducing stations, to aid in noise suppression.
- B. Pressure Gauges:
  - 1. Provide a pressure gauge on all inlets and outlets of reducing station and every other point of pressure change.
  - 2. Gauges shall have a range equal to 1-1/2 times the highest operating pressure and be as specified in Section 22 05 19, Gauges and Thermometers.

### 3.4 INSTALLATION OF PRESSURE REGULATING VALVES

- A. Install per manufacturers recommendations. Set to pressures indicated on drawings.
- B. Pressure Gauges:
  - 1. Provide a pressure gauge on all inlets and outlets of each regulating valve.
  - 2. Gauges shall have a range equal to 1-1/2 times the highest operating pressure and be as specified in Section 22 05 19, Gauges and Thermometers.

### 3.5 RELIEF VALVES

- A. Pipe discharge from relief valves to an area that will afford protection to people in the vicinity in the event of relief valve discharge.

### 3.6 INSTALLATION OF STEAM TRAPS

- A. Provide steam trap on condensate return side of all equipment utilizing steam, ahead of steam control valves and to drip low points in the piping.
- B. Run condensate piping from traps at humidifiers to be wasted at floor drains, unless shown connected to condensate return system.
- C. Installation of each steam trap shall be as follows, starting at condensate leg; gate valve, union, strainer, trap and gate valve. Omit strainer where trap is serving coil with strainer ahead of control valve in steam supply to coil.
- D. Drip traps shall be provided at end of steam mains, at base of vertical risers, ahead of expansion joints, valves and pressure regulators. Following schedule shall apply to steam main drip traps. Provide a trap every 300 feet for both low and high pressure steam mains.

- E. Drip legs shall be 5 inch long and pipe diameter of main or apparatus return to 4 inch in pipe size and on steam lines over 4 inch in diameter, drip leg of not less than 4 inch shall be used. Installation of each steam trap used on drip legs shall be as follows, starting at condensate leg; gate valve, union, strainer, steam trap and gate valve.
- F. Provide thermostatic traps for low pressure steam runouts, down feed risers to unit heaters and for radiation and convectors.

### 3.7 STRAINERS

- A. Provide Y-type strainer ahead of each steam trap (except thermostatic trap), pressure reducing valve and control valve. Omit strainer where trap is serving coil with strainer ahead of control valve in steam supply to coil.

### 3.8 UNIONS AND FLANGES

- A. Provide flanged or screwed unions in connections to equipment and where shown on drawings.

### 3.9 VACUUM BREAKERS

- A. Provide a 1/2 inch check valve as a vacuum breaker at each steam coil. When vacuum breaker is installed ahead of steam trap, an integral vacuum breaker may be installed in steam trap, vented to atmosphere.

### 3.10 FLEXIBLE CONNECTORS

- A. Provide flexible pipe connectors on pipes connected to vibration isolated equipment where shown. Do not allow weight of piping to be carried by equipment
- B. Install devices in accordance with manufacturer's recommendations.

### 3.11 FLEXIBLE EXPANSION LOOPS

- A. Provide piping passing through seismic, expansion, and construction joints. Anchor piping on both sides of joint so that building movement will not cause structural stress on piping supports.
- B. Install devices in accordance with manufacturer's recommendations.

### 3.12 EXPANSION JOINTS

- A. Use multiple flexible pipe connectors or manufactured seismic separation assemblies to achieve deflection capabilities specified above.
- B. Install devices in accordance with manufacturer's recommendations.

### 3.13 PIPE ALIGNMENT GUIDES

- A. Install guides as shown on drawings and where recommended by expansion joint manufacturer.
- B. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so that movement takes place along axis of pipe only.

END OF SECTION

## PRESSURE REDUCING STATIONS

## General:

Furnish and install, as shown on drawings, a pressure reducing station consisting of six valves; two high pressure valves, two trip valves and two low pressure valves.

The primary valves shall reduce 250 psig to approximately 125 psig; the secondary valves shall reduce 125 psig to 12 psig. Control lines and accessories shall be arranged to provide the following sequence:

The high pressure valves shall be capable of reducing from 250 psig to 12 psig by operation of the safety pilot in the event that the low pressure valves fails.

The low pressure valve shall be capable of reducing from 250 psig to 12 psig in the event that the high pressure valve fails.

The trip valve shall be arranged to stop all steam flow in the event that the reducing valves fail. The arrangement shall be such as to meet the requirements of ANSI B-21.1, Paragraph 102.2.5.

All valves shall be 300 pound 600°F. cast steel construction, single seat for dead end service with stainless steel diaphragm and internal trim and shall be arranged to allow inlet velocities below 10,000 feet per minute. Valve capacities shall not exceed 10% above the required maximum. Valves 2-1/2 inch and larger shall have flanged ends with 250 pound flanges. Smaller valves shall have screwed ends.

Noise suppression shall be by a Spence multi-hole plate. Maximum noise produced by the station when measured by the standard method shall not exceed 85 decibels.

Pressure Reducing Valves No. 1 and No. 2 (250 - 125 psig)

size, Spence Type ED , LB/HR  
size, Spence Type ED , LB/HR

Pressure Reducing Valves No. 3 and No. 4 (125 - 10 psig)

size, Spence Type ED , LB/HR  
size, Spence Type ED , LB/HR

Trip Valves

size, Spence Type EP  
size, Spence Type EP

Provide gate valves, flange mounted noise suppression plate, traps, strainers, flash tank and piping as shown on drawings.

Furnish and install pressure switches, wiring and pilot lights to indicate status of reducing valves.

## PRESSURE REDUCING STATIONS

## General:

Furnish and install, as shown on drawings, a pressure reducing station consisting of two high pressure valves, two low pressure valves, and a relief valve.

Primary valves shall reduce 250 psig steam to approximately 125 psig; the secondary valves shall reduce 125 psig to 12 psig. Control lines and accessories shall be arranged to provide the following sequence.

The high pressure valves shall be capable of reducing 250 psig steam to 12 psig by operation of the safety pilot in the event that the low pressure valve fails.

The low pressure valves shall be capable of reducing 250 psig steam to 12 psig in the event that the high pressure valve fails.

All valves shall be 300 pound 600°F. cast steel construction, single seat for dead end service with stainless steel diaphragm and internal trim, arranged to allow inlet velocities below 10,000 feet per minute and valve capacities shall not exceed 10% above the required maximum. Valves 2-1/2 inch and larger shall have flanged ends with 250 pound flanges. Smaller valve shall have screwed ends.

Noise suppression shall be by a Spence flange mounted multi-hole plate. Maximum noise produced by the station when measured by the standard method shall not exceed 95 decibels.

Pressure Reducing Valves No. 1 and No. 2 (250 - 125 psig)  
size, Spence Type ED , LB/HR  
size, Spence Type ED , LB/HR

Pressure Reducing Valves No. 3 and No. 4 (125 - 12 psig)  
size, Spence Type ED , LB/HR  
size, Spence Type ED , LB/HR

Provide gate valves, noise suppression plate, traps, strainers, flash tank, and piping as shown on drawings.

Provide Kunkle, or approved equal, Model 252 , safety relief valve, x x set at 15 psig with capacity of lb/hr with 3% accumulation.

Provide Kunkle, drip pan elbow, size, Model 299. Pipe condensate discharge to nearest floor drain.

Provide size, Cochrane, exhaust head, installed above floor.