

Under Section 23 21 13, delete the existing .05 Hydronic Specialties header, hyperlink, and all associated text (items A. – G.) in their entirety (deletions are shown struck through).

[23 21 13 Hydronic Piping](#)

[.01 General Requirements](#)

[.02 Gauge Piping](#)

[.03 Cooling Coil Condensate Drain Piping](#)

[.04 Guide Specifications:](#)

~~[.05 Hydronic Specialties](#)~~

Add the following new section 23 21 16 in its entirety.

23 21 16 Hydronic Piping Specialties

.01 General Owner Requirements and Design Intent

A. General Requirements:

1. Professional shall design each hydronic piping application with all the required specialties to achieve the functional intent of effective and safe operation, high reliability, and minimizing maintenance costs on those systems.
2. Construction documents shall include all drawings and specifications necessary to clearly define the scope of work for the contractor to furnish and install all the hydronic piping specialties required to meet the functional intent above.
 - a. Ensure details comply with manufacturer's installation instructions.
 - b. Locate in safe and convenient area and provide convenient means for frequently inspecting and cleaning. Maintain manufacturer's recommended clearances.
 - c. Coordinate requirements between Specifications and Drawings.
3. Hydronic piping specialties work includes the following:
 - a. Special Purpose Valves

1. Pressure Reducing/Regulating Valves
2. Safety Valves
3. Combination Shut-off /Balancing Valves
4. Differential Pressure Control Valves
5. Packaged Coil Hook-up Sets
- b. Air Vents
 1. Manual Air Vents
 2. Automatic Air Vents
- c. Expansion Tanks
- d. Air and Dirt Removal Devices
 1. Air Separators
 2. Dirt Separators
 3. Strainers
 4. Side Stream Water Filters
 5. Open Systems Solids Separator Systems
- e. Flexible Pipe Connectors

B. Applications and Selection Criteria:

1. Flow Balancing Valves
 - a. Refer to guidelines in [23 21 00 HYDRONIC SYSTEMS, .02 Flow Balance and Differential Pressure Control](#).
 - b. Balancing valves shall be sized to allow accurate and reliable measurement for the specified flow rates, which may not necessarily be the same as the line size.
2. Packaged Coil Hook-up Sets
 - a. Piping system longevity is important, so hard piping is required. Flexible neoprene/EPDM hoses are not to be used due to much shorter expected life of resilient material failing due to combination of effects of heat, chemicals, and dry rotting of rubber.
3. Air Eliminator and Dirt Separators:
 - a. General: Refer to guidelines in [23 21 00 HYDRONIC SYSTEMS, .03 Air and Dirt Elimination](#)
 - b. High Performance **Coalescing type** air eliminator and dirt separators shall be installed in each closed hydronic system.
 - c. The following types of air separator units shall NOT be used:
 1. Tangential type that depend on vortex action
 2. In-line type that depend on internal weir
 3. Units using PALL rings
 4. Units with strainer type screens requiring routine removal and cleaning.
 - d. Select units at the point of peak efficiency per the manufacturer's recommendation. Units shall be selected for low system pressure drop, not to exceed maximum of 4 feet of head at maximum design flow rate.

- e. Dirt separator only and combination air/dirt separator units shall include removable bottom and mounted with sufficient clearance for accessing, pulling media and cleaning of interior of unit.
- f. Include detail and specifications to require a separate ball isolation valve of same inlet pipe connection size as auto air vent .
 - 1. This may not be a standard feature offered by manufacturers. However, auto air vents have float and small orifice mechanism that can clog or stick (especially with glycol fluids). **These isolation valves are an important OPP requirement to enable quick and cost effective repair or replacement of auto air vent without shutting off and/or draining the main system.**
- g. Refer to Guideline Details descriptions later in this section and select the best fit for each specific application. Review and coordinate application with OPP Engineering Services and Water Treatment Supervisor.
 - 1. Exception: If main piping distribution system uses all non-ferrous piping materials, then a single combined air and dirt eliminator model installed prior to the pump is recommended.
- h. Do not retrofit coalescing air eliminators to existing air control type systems with open (air cushion in direct contact with water) type expansion tanks without also upgrading the expansion tank to closed, pressurized type (bladder or diaphragm).


4. Strainers:

- a. Strainers shall be strategically applied as necessary to protect system elements, but sparingly and with screens/mesh size appropriate to the location in the system to enhance energy efficiency.
- b. Piping systems shall be designed in a way to most effectively trap the bulk of the particles coming from the main and large branches of the piping distribution system in as few strainers as practical (particularly during cleaning and flushing operations) and to minimize the need for continually servicing individual strainers while still providing adequate protection of terminal coils and control valves.
 - 1. In general, subdivide the branch piping to serve groups of terminals that do not exceed 2" (the typical upper limit for use of copper pipe sizes) and provide a strainer assembly in the branch supply pipe with mesh size to protect each group of terminals downstream.
 - 2. Coordinate and combine the branch strainer with self-regulating pressure regulator as applicable for subdivided branches serving hydronic modules of similar terminal loads. Refer to 23 21 00 HYDRONIC PIPING AND PUMPS, .02 Flow Balance and Differential Pressure Control for additional information.

3. The individual strainers at each heating/cooling terminal unit shall still be installed. They are required to protect the small orifices in terminal unit characterized control valves that are susceptible to trapping any soldering flux or other small debris that would initially be in the piping downstream of the branch strainers during cleaning and flushing operations. However, the intent would be to remove the screens after the system has been properly cleaned and flushed but kept with the strainer body to reinsert if/when needed for future system chemical cleaning/flushing.
 4. Include a flushing bypass valve assembly across the terminal runouts of each device protected by strainers and at the branch strainer assemblies to allow for main system chemical cleaning/flushing circulation without clogging downstream device or strainer assemblies with materials intended to be removed by the process back at the central plant dirt removal equipment. Coordinate with requirements in Water Treatment Standards and Guidespec sections.
 5. Coordinate these requirements for Branch strainers for groups of multiple small terminal units with the Guidespec and well-defined drawing plans and details.
- c. Do not apply fine mesh strainers in suction side of pumps serving open cooling tower condenser loops or other open systems that can quickly clog.
 1. Not only will pressure drop quickly increase, dropping performance in increasing energy cost, but cavitation will occur which will quickly damage equipment.
5. Side Stream Water Filters
 - a. Refer to HVAC Water Treatment design standard [23 25 00](#) and guidespec section to coordinate requirements.
 6. Open Systems Solids Separator Systems
 - a. Solids separator systems (similar to HVAC options offered by LAKOS) that minimize maintenance and reduce energy, water and chemical consumption and that do not impose a varying pressure drop to the primary loop shall be engineered for each open application for lowest life-cycle cost.
 - b. Include automatic means to purge solids while minimizing makeup water requirements.
 - c. Coordinate with Water Treatment for Open Hydronic Systems.

.02 Guide Specifications:

- A. Design Professional shall carefully review and edit the guideline specifications below, adapting them as needed to achieve application-specific, fully developed specifications for each project.
- B. These shall be edited using the process described in the instructions contained at the beginning of the document. Proposed modifications shall be reviewed with OPP staff.
- C. Finalized version shall be included in the project contract documents. Use of other specifications is not acceptable.

Document	Version Date	Description
23 21 16 Hydronic Piping Specialties Guide Specification  232116 HYDRONIC PIPING SPECIALTIES	November 15, 2013	OPP minimum specification requirements for HVAC Hydronic Piping Specialties.

Note to Standards Editor: Create a hyperlink to the above document. Omit this note in the version to be posted to the webpage.

.03 Guideline Details

- A. Professional shall carefully review and edit the guideline installation details below, adapting them as needed to achieve application-specific, fully developed details for each project.

Document	Version Date	Description
Detail # 232113-D01 Hydronic Plant Piping Schematic (AutoCAD) Hydronic Plant Piping Schematic (PDF)	November 9, 2011	This schematic detail indicates general requirements and arrangement of hydronic specialties associated with each closed hydronic plant system with a <u>combined</u> air and dirt eliminator. This is NOT the preferred arrangement, due to the undesirable complexity of the blowdown arrangement and associated procedures. However, in cases where a combined air and dirt eliminator has been installed

Document	Version Date	Description
		relatively recently (determined to be in excellent to good condition and working satisfactorily), or when existing space constraints do not allow separate units, then this arrangement may be considered. Review these specific cases with OPP.
Detail # 232113-D02 Hydronic Plant Piping Schematic #2 (AutoCAD) Hydronic Plant Piping Schematic #2 (PDF)	June 5, 2012	This schematic detail indicates general requirements and arrangement of hydronic specialties associated with each closed hydronic plant system with <u>separate air and dirt eliminators</u> . This is the strongly preferred arrangement for all new construction and where it can be applied cost effectively to upgrades of existing systems.

END of revision

Update Commentary:

Section was updated primarily for the following reasons:

- 1) *To create distinct section to follow industry standard section number and to correlate with new guide specification section.*
- 2) *To reorganize information more appropriately into Standards (to convey design intent) and Guide Specifications and Details (to be edited and included in Contract Documents) for clearer and more user-friendly and effective implementation between design and construction phases.*

SECTION 232116 - HYDRONIC PIPING SPECIALTIES

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

General Notes:

- 1. This guide specification is intended to provide the Design Professional with a basic guideline of minimum OPP requirements.*
- 2. The guide specification shall be carefully reviewed and edited with respect to application-specific project requirements. Proposed modifications shall be reviewed with OPP Staff.*
- 3. Finalized version shall be included in the project contract documents.*

Editing Notes

- 1. This OPP Guide specification must only be altered by notation (i.e. deleted text with strikethrough and additional text with double underline). This shall be accomplished by using Tools /Track Changes / Highlight Changes, and select "Track changes while editing" in MS Word or equivalent.*
- 2. The Review Submittal Specification section shall be provided in electronic form for OPP Review.*
- 3. Leave the following Note ("For Construction Document Review, Design Submittal") as part of the Review Submittal, to aid any Reviewer to understand WHY there are strikeouts and underlines. Also, leave any "DESIGNER NOTE" placed in this Guide Spec.*
- 4. AFTER comments are received from PSU and incorporated, the strikeouts and underlines shall be removed, and the REVIEWER NOTES deleted, before the spec is issued for Bidding.*

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All sections of the project manual are directly applicable to this specification section. Should a conflict arise between specification sections or between specifications and drawings and/or code

requirements, the contractor shall notify the Architect/Engineer of the conflict in writing. If direction is not provided prior to the submission of the bid, the contractor shall price the more extensive system.

1.2 SUMMARY

A. Perform all Work required to furnish and install all hydronic piping specialties as described herein and as indicated by the Contract Documents with supplementary items necessary for their proper installation and operation for the following hydronic systems:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Dual-temperature heating and cooling water piping.
4. Condenser-water piping.
5. Glycol cooling-water piping.
6. Makeup-water piping.
7. Condensate-drain piping.
8. Blowdown-drain piping.
9. Air-vent piping.
10. Safety-valve-inlet and -outlet piping.

B. Hydronic piping specialties work shall include the following:

1. Special Purpose Valves
 - a. Pressure Reducing/Regulating Valves
 - b. Safety Valves
 - c. Combination shut-off/balancing Valves
 - d. Differential Pressure Control Valves
 - e. Packaged Coil Hook-up Sets
2. Air Control / Elimination Devices
 - a. Manual Air Vents
 - b. Automatic Air Vents
3. Expansion Tanks
4. Air and Dirt Removal Devices
 - a. Air Separators
 - b. Dirt Separators
 - c. Strainers
 - d. Open Systems Solids Separator Systems
5. Flexible Pipe Connectors

1.3 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

- C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
1. ANSI/ASME Boilers and Pressure Vessel Code, Section VIII, Division 1 Design and Fabrication of Pressure Vessels.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves.
 2. Hydronic specialties: Clearly indicate project specific selected performance data, options and settings for each application.
 - a. Pressure Regulating Valves: Indicate proper spring range selection for each system.
 - b. Strainers: Include screen perforation/mesh size schedule or table for each application.
 - c. Air and dirt separators: Include air and dirt removal test performance and maximum pressure drop at design flow.
 - d. Automatic Air Vents: Include isolation service valve.
 - e. Open System Solid Separator Systems: Include all product data for components of packaged systems.

1.5 CLOSEOUT SUBMITTALS

- A. Refer to "Closeout Procedures" specification for submittal closeout procedures.

1.6 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

[See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."](#)

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the working pressures and temperatures defined in Section 232113 – Hydronic Piping, unless otherwise indicated:

2.2 SPECIAL PURPOSE VALVES

- A. Diaphragm-Operated, Pressure-Reducing Valves:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo Model PRC (36C Series) or comparable product by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. CLA-VAL, Model 990
 - e. Conbraco Industries, Inc.
 - f. Spence Engineering Company, Inc.
 - g. Watts Regulator Co.
2. General: Provide pressure reducing valves designed to control pressure in makeup water connection to hydronic systems. The valves shall be built for long reliable service with corrosion resistant, proven ASTM grade materials.
3. Features:
 - a. Suitable for supply pressures up to 300 psi.
 - b. In-line repairable
 - c. Body: Bronze
 - d. Cover: Bronze or Glass Filled/Reinforced Copolymer
 - e. Disc: Glass and carbon-filled PTFE.
 - f. Seat Disc: EPDM.
 - g. Stem Seals: EPDM O-rings.
 - h. Diaphragm: Reinforced EPDM.
 - i. Screen: Stainless Steel
 - j. Spring: Stainless Steel
 - k. Valve Seat and Stem: Noncorrosive.
4. Options:

Designer Note: For most Hydronic System makeup applications in low-rise projects (system static fill heights up to approximately 70 feet), a ¾" size valve with 10-35 psi adjustable outlet pressure range is sufficient. Drawings or specifications shall define the system fill pressure required.

- a. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- b. Stainless Steel Trim
- c. Double union connections.
- d. Gauge Port with Pressure Gauge selected for operating pressure of each application.

B. Diaphragm-Operated Safety Relief Valves:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Amtrol, Inc.](#)
 - b. [Armstrong Pumps, Inc.](#)
 - c. [Bell & Gossett Domestic Pump.](#)
 - d. [Apollo / Conbraco Industries, Inc. Model RVW60 \(10600 Series\).](#)
 - e. [Spence Engineering Company, Inc.](#)
 - f. [Watts Regulator Co.](#)
2. General: Provide safety relief valves designed for overpressure protection of hydronic systems. The valves shall be built for long reliable service with corrosion resistant, proven ASTM grade materials.
3. Features:
 - a. Shall be capable of being pre-set to any pressure ranging from 15 to 160 psig up to 250 deg. F. max.
 - b. Body: Bronze or brass.
 - c. Seat: Silicone.
 - d. Diaphragm Isolated Spring Chamber
 - e. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed.

C. Calibrated-Orifice, Balancing Valves:

General: In all hydronic systems, provide combination positive drip-tight shut-off and precision flow measuring devices at heat transfer terminals as required for service isolation and means to quickly, conveniently and accurately measure flow. 90° 'circuit-setter' style ball valves are not acceptable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong CBV
 - b. Gruvlok GBV
 - c. Tour Andersson STA
 - d. Victaulic STA
2. General: Combination shut-off/balancing valve shall provide the functions of positive drip-tight shut-off and precise flow measurement.

- a. Valve shall include multi-turn 360° adjustment with precise position indicators located on the ergonomically designed handwheel. Valves shall have a minimum of four full 360° handwheel turns. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced.
 - b. Valves shall have P/T ports for connecting standard differential pressure meter, extended type as required to be accessible without having to remove primary finished insulation.
 - c. Provide manufacturer's optional pre-formed insulation meeting ASTM standards and with a flame spread rating of 25 or less and a smoke development rating of 50 or less. Refer to HVAC Insulation specification, Coordinate installation with piping insulation installer to ensure that complete vapor barrier is maintained on systems operating below ambient dew point.
3. ½-2" Valves:
- a. Body: Bronze, or brass alloy with calibrated orifice or venturi.
 - b. Stem and disk: Brass or stainless steel.
 - c. Seat: EPDM.
 - d. End Connections: Threaded or socket.
 - e. CWP Rating: Minimum 300 psig.
 - f. Operating Temperature range: -4 to 300 deg F.
4. 2½-12" Valves:
- a. Body: Cast Iron with integral flanges or ductile iron with industrial standard grooved ends with calibrated orifice.
 - b. Stem and disk: Bronze, Brass alloy or stainless steel.
 - c. Seat: Optional Viton Elastomers for temperature rating up to 300 deg F.
 - d. CWP Rating: Minimum 250 psig.
 - e. Operating Temperature range: -4 to 300 deg F.

D. Adjustable, Self-acting, Differential Pressure Controllers:

Designer Note: [Strategically locate self-regulating differential pressure controllers throughout distribution system, only as needed, to stabilize wide variations in differential pressure. Coordinate requirements with OPP Design and Construction Standards section 23 21 00 HYDRONIC SYSTEMS, .02 Flow Balance and Differential Pressure Control](#)

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings Victaulic TA Series Differential Pressure Controller or comparable product by one of the following:
 - a. Tour Andersson
 - b. Flow Design DA516 On Branches serving multiple similar terminals (up to total of approximately 220 gpm):
 - c. Tour Andersson DA 50 Series: On large mains or risers (greater than approximately 220 gpm):
2. General: Provide adjustable, self-acting differential pressure control valves designed to stabilize the downstream pressure on branches of hydronic systems with variable speed pumping. Shall have adjustable differential control, pressure-temperature ports, dead end

service shut off capabilities, stainless steel spring, polymer handle, and drain. The valves shall be built for long reliable service with corrosion resistant, proven materials.

3. Body: A metal or Ductile Iron.
4. O-rings, seat seal, and membrane: EPDM or HBNR.
5. Connections: ½"-2" Threaded, 2-1/2"-8" Flanged
6. Identification Tag: Marked with zone identification, valve number, and performance characteristics.
7. Size: Select based on design flow. Choose the smallest suitable assembly for best accuracy of regulation.
8. Performance: The controller shall be selected to be capable of stabilizing the differential pressure within an adjustable range, typically approximately **3-12 or 4-15 psi**, depending on the controller series and spring options.
9. Minimum CWP Rating: **230 psig** / 16 bar.
10. Max Differential Pressure Rating (Minimum allowable): 51 psig
11. Operating Temperature Range: [**14-248 deg F**].
12. Include manufacturer's optional capillary tube, drain and extension kits to ensure proper operation of installed valves.
13. Provide manufacturer's optional pre-formed insulation meeting ASTM standards and with a flame spread rating of 25 or less and a smoke development rating of 50 or less. Refer to HVAC Insulation specification, Coordinate installation with piping insulation installer to ensure that complete vapor barrier is maintained on systems operating below ambient dew point.

E. Coil Package Valve Sets

Refer to [OPP Standard 23 21 16 Hydronic Piping Specialties](#) regarding prohibition of hoses containing resilient rubber/neoprene/EPDM material.

1. Manufacturers: Individual components of the coil package valve set shall meet or exceed the individual component specification.
2. Tour and Anderson STAP differential pressure controllers may be installed in conjunction with preset standard TA valves and coil components. Supply side coil package shall include a ball valve Y strainer combo with PT port, union, and blow down. Return side coil package shall include a union port fitting with PT port, manual air vent, union, and male threaded tail piece as well as the TA balancing valve. STAP shall be installed per manufacturer's recommendations and at the locations shown on drawings with a partner TA valve adjacent on the supply line for capillary connection.

2.3 AIR VENTS

[Air vents aid in system filling. Air removal after initial startup is accomplished by air separator, automatic air vents or boiler dip-tube.](#)

[Leakage from automatic air vents may cause damage to ceilings and other finished surfaces. Manual air vents may be preferred over automatic air vents in finished spaces.](#)

A. Manual Air Vents:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. **Manufacturers:** Subject to compliance with requirements, **following** available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Amtrol, Inc.](#)
 - b. [Armstrong Pumps, Inc.](#)
 - c. [Bell & Gossett Domestic Pump.](#)
 - d. [Taco, Inc.](#)
2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2
6. Discharge Connection: NPS 1/8
7. CWP Rating: 150 psig
8. Maximum Operating Temperature: 225 deg F

B. Automatic Air Vents:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. **Manufacturers:** Subject to compliance with requirements, provide products by the following:
 - a. [Spirotherm](#)
 - b. [Thrush](#)
2. Body: **[Brass] [or] [Cast Iron]**.
3. Internal Parts: Nonferrous or stainless steel.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS **[1/2] [or] [3/4]**
6. Discharge Connection: NPS **[1/2] or [3/8]**
7. CWP Rating: 150 psig
8. Maximum Operating Temperature: 250 deg F

2.4 EXPANSION TANKS

A. **[Diaphragm] [Bladder]**-Type Expansion Tanks:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. **Manufacturers:** Subject to compliance with requirements, provide products by the following:

- a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
 - e. Wessels.
2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 3. **[Diaphragm] [Bladder]**: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
 4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

2.5 AIR AND DIRT REMOVAL DEVICES

A. Coalescing-Type Air, Dirt, or Air/Dirt Separators:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

Refer to the PSU water treatment detail for the appropriate application and type of air and dirt separation.

1. **Basis-of-Design Product**: Subject to compliance with requirements provide coalescing air and dirt separators by one of the following that offer standard options for separate air or dirt models or combination air and dirt models:
 - a. Spirotherm, Spirovent.
 - b. Thrush Company AAR-O Vent.
2. Other manufacturers offering similar products that may be considered - subject to compliance with requirements, and depending on whether they offer options for separate air and dirt units in addition to the combined air/dirt units, and final review and approval by OPP - include the following:
 - a. Armstrong Pump, DAS series
 - b. Bell and Gossett, CRS series
3. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg maximum operating temperature.
 - a. All shall be fabricated steel, rated for a minimum working pressure of 150 psig and temperature of 250°F.
 - b. Any units not meeting the exemption criteria for unfired pressure vessels in the PA L&I Boiler and Unfired Pressure Vessel Regulations must be constructed and stamped in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code.
4. Coalescing Media: Stainless or Copper Mesh
5. Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
6. Blowdown Connection: Threaded.

7. Size: Pipe size is not a factor. All units shall be selected at the point of peak efficiency per the manufacturer's recommendations, with entering velocities not to exceed 4 feet per second at maximum flow. Units specifically designed for high velocity systems may have an entering velocity of up to 10 feet per second. Units shall be selected for low to negligible permanent system pressure drop, not to exceed maximum of 4 feet of head.
8. Performance:
 - a. Air Eliminators shall be capable of removing 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system fluid. Dirt separation shall be at least 80% of all particles 30 micron and larger within 100 passes. Performance shall be third party tested by independent laboratory.
 - b. Units shall include an internal bundle of highly durable, superior corrosion resistant, coalescing media filling the entire vessel to suppress turbulence and provide high efficiency. The bundle shall consist an assembly of rigidly constructed vertical tubes of stainless steel or copper wire matrix designed to coalesce microbubbles out of solution and form larger air bubbles that rise to the top of the vessel and to separate dirt particles that collect at the bottom.
 - c. Each air eliminator shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be a high capacity, automatic float actuated air venting mechanism

The valve below may not be a standard feature offered by manufacturers. However, auto air vents have float and small orifice mechanism that can clog or stick (especially with glycol fluids). **These isolation valves are an important OPP requirement to enable quick and cost effective repair or replacement of auto air vent without shutting off and/or draining the main system.**

- d. Also provide with a separate ball isolation valve of same inlet pipe connection size as auto air vent to enable repair or replacement of auto air vent without shutting off and/or drain the main piping.
- e. Units shall include a side tap near the top with a manual ball skim valve to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.
- f. Dirt separators shall have the vessel extended below the main pipe connections for dirt separation with a bottom tap and blow down valve of sufficient size to not easily become blocked. Unit shall be designed such that pressure drop does not increase as the dirt collection area fills. Dirt separator only units and combination air/dirt separator units shall include removable bottom cover for easy cleaning of interior of unit.

B. Y-Pattern Strainers:

1. Provide strainers full line size of connecting piping, with body and ends matching piping system materials. Select strainers for respective working pressure of piping system.
2. Threaded Ends, 2" and Smaller: Bronze body (for copper or plastic piping applications) or alternatively Cast-iron (for steel piping applications), screwed screen retainer with centered blowdown. Press-joint pipe fittings are an acceptable option.

3. Flanged Ends, 2½" and Larger: Cast-iron or steel body, bolted screen retainer with off-centered blowdown.
4. Grooved Ends, 2½" and Larger: Wye pattern, steel, ductile-iron or malleable-iron body and access end cap with off-center blowdown, access coupling with EDPM gasket.

In "Strainer Screen" Subparagraph below, larger mesh numbers have larger passages, thus allowing larger objects to pass.

5. Strainer Screen: Provide type 304 stainless steel screens, with perforations (or mesh for sizes under 2") per schedule below.

SERVICE	PIPE SIZE	Coarse Straining (typically at central plant equipment)	Medium Straining (typically at terminal equipment, i.e. with temperature or pressure control valves)
Water	1/4 to 2"	1/16" (0.057)	1/32" (0.033) (20 mesh)
Water	2 1/2 to 4"	1/8"	1/16" (0.057)
Water	5" and up	3/16"	1/8"

6. CWP Rating: 125 psig

C. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: [40] [60]-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig

D. Side Stream Water Filters:

1. Shall be furnished by Owner, installed by Contractor.

Refer to [OPP Guideline Detail – Hydronic Plant Piping Schematic and HVAC Water Treatment design standard 23 25 00](#) and associated guidespec section to coordinate requirements.

E. Open Systems Solids Separator Systems:

1. **[EDIT PER PROJECT SPECIFIC REQUIREMENTS]**

For open hydronic systems, solids separator systems (similar to HVAC options offered by LAKOS) that minimize maintenance and reduce energy, water and chemical consumption and that do not impose a varying pressure drop to the primary loop shall be engineered for each open application for lowest life-cycle cost. Include automatic means to purge solids while minimizing makeup water requirements. Develop and coordinate equipment specifications with Water Treatment for Open Hydronic Systems.

2.6 FLEXIBLE PIPE CONNECTORS

A. Spherical, Rubber, Flexible Connectors:

1. **Manufacturers:** Subject to compliance with requirements, provide SAFEFLEX series as manufactured by Mason Industries, Inc. Substitutions must have certifiable equal or superior characteristics
2. Body: Peroxide cured EPDM throughout with Kevlar® tire cord reinforcement.
3. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
 - a. The assembly shall encase solid steel rings molded within the rubber to prevent pull out.
 - b. Flexible cable wire is not acceptable.
4. Performance: Capable of misalignment.
 - a. Sizes 3/4" through 2" may have one sphere with bolted threaded flange assemblies.
 - b. Sizes 2-1/2" through 14" shall have a ductile iron external ring between the two spheres.
 - c. Sizes 16" through 24" may be single sphere
 - d. Submittals shall include test reports by independent consultants showing minimum reductions of 20 DB in vibration acceleration and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer.
5. CWP Rating: 150 psig.
6. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 EXAMINATION AND COORDINATION

- A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before specialties installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Independently support large devices and piping so weight of piping is not supported by equipment and weight of equipment is not supported by piping.
- E. Where installing piping adjacent to specialty equipment, allow space for service and maintenance.

3.2 SPECIAL PURPOSE VALVE INSTALLATION

- A. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.
- B. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- C. Install balancing or differential pressure control valves at each branch connection to return main as required by the design documents and per the manufacturer's instructions.
 - 1. The differential pressure controllers must be placed in the pipe with correct flow direction.
 - 2. Mechanical Contractor and Balancing Contractor shall be trained and certified on installation, connections and balancing procedures of differential pressure controllers by certified manufacturer's representative.
- D. Install balancing valves in the return pipe of each heating or cooling terminal.
- E. Valve bodies and /or piping components that meet ISO 6509 and ASTM B858 made with dezincification resistant brass alloy designated with acronym (DZR) do not require dielectric unions on piping installations with dissimilar metals.

3.3 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual vents at heat-transfer coils and elsewhere as required for air venting. Provide manual air vents at entrance to all heating hot water coils, with a "cane" shaped discharge tube, positioned to permit draining to a portable receptacle.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms or rooftop equipment only.
- C. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

[Retain one of first two paragraphs below according to air separator specified in Part 2.](#)

- D. Install coalescing **[air][air/dirt]** separator in pump suction.
 - 1. Dirt blowdown connection shall be connected with a tee. The side tap shall be piped to bag filter assembly with isolation valve. During filtered blowdown, system water shall be continuously recirculated back into main piping to minimize fluid loss and addition of makeup water and associated air. The straight through bottom tap shall include blow down valve to allow optional start-up flushing and purging significant dirt in the system without going through the bag filter. Refer to Hydronic Plant Piping Detail.
 - 2. Do not retrofit to air management type systems with existing open (non-diaphragm) type expansion tanks without also upgrading the expansion tank to closed diaphragm type.
- E. Install coalescing **[dirt]** separator per design documents

1. Dirt blowdown connection shall be connected with a tee. The side tap shall be piped to bag filter assembly with isolation valve. During filtered blowdown, system water shall be continuously recirculated back into main piping to minimize fluid loss and addition of makeup water and associated air. The straight through bottom tap shall include blow down valve to allow optional start-up flushing and purging significant dirt in the system without going through the bag filter. Refer to Hydronic Plant Piping Detail.
2. Do not retrofit to air management type systems with existing open (non-diaphragm) type expansion tanks without also upgrading the expansion tank to closed diaphragm type.

Designer Note: Coordinate below with Drawings to show location of strainers to protect components from water born debris.

- F. Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions.
1. Install in entering line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:
 - a. Chillers (as recommended by chiller manufacturer)
 - b. Heat Transfer Equipment
 - c. Pressure reducing or regulating valves
 - d. Pumps (except for the following)
 - 1) If suction diffuser with integral strainer is used, then omit separate y-strainer.
 - 2) DO NOT install strainers with fine screens that can quickly clog on suction side of pumps serving open tower condenser water loops or other open systems expected to encounter high rates of suspended solids.
 - e. Temperature control valves.
 2. Y-type strainers in horizontal steam or gas lines shall be installed so that the pocket is in the horizontal plane. This stops water collecting in the pocket, helping to prevent water droplets being carried over, which can cause erosion and affect heat transfer processes.
 3. On liquid systems the pocket should point vertically downwards. This ensures that the removed debris is not drawn back into the upstream pipework during low flow conditions.
 4. Whenever possible, install strainers in horizontal lines. If necessary, they may be installed in vertical pipelines, but only if the flow is downwards, in which case the debris is naturally directed into the pocket. Installation is prohibited with upward flow.
 5. Install pipe nipple and ball drain valve with ¾" hose end connection, cap and chain in strainer blowdown connection,
 6. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blowdown connection.

Designer Note: Coordinate requirements with OPP Design and Construction Standards for Branch strainers for groups of multiple small terminal units.

7. Where strainers are installed in pipe branches serving multiple terminals rather than at each individual terminal, each branch strainer assembly shall include:
 - a. Line size isolation valves on each end.
 - b. A bypass valve assembly (required only for critical branches that require continuous flow even during strainer servicing).
 - c. Install pipe nipple and ball drain valve with ¾" hose end connection, cap and chain in strainer blowdown connection.
 - d. Strainer mesh selected to protect control valves downstream.

- e. NOTE: The individual strainers at each heating/cooling terminal unit shall still be installed.
 - 1) Screens shall be temporarily inserted during initial start-up cleaning and flushing and any future piping system maintenance cleaning and flushing to protect the terminal and control valve during those processes.
 - 2) During regular operation the screens shall be removed from the bodies and chained to the strainer bodies to shift primary straining function to the branch strainers.
 - 3) Provide plastic service tag on chain with such directions.
- 8. Install a flushing bypass valve assembly at ends of mains to allow for main system chemical cleaning/flushing circulation without clogging branch or terminal strainer assemblies with materials intended to be removed by the process back at the central plant dirt removal equipment.
- 9. Install a flushing bypass valve assembly across the terminal runouts of each device protected by strainers and at the branch strainer assemblies to allow for main system chemical cleaning/flushing circulation without clogging downstream device or strainer assemblies with materials intended to be removed by the process back at the central plant dirt removal equipment.
- 10. Be sure to remove any temporary fine mesh start up screens if used during initial cleaning and flushing of systems. After being removed, temporary start up screens shall be tagged and attached with small brass jack chain and s-hook to the outside of the strainer body for future re-use during future cleaning and flushing.

G. Side Stream Bag Filter Assembly Installation:

- 1. Obtain filter housing from OPP.
- 2. In general, refer to appropriate version of the PSU OPP Standard Detail – Hydronic Plant Piping Schematic depending on the application of separate or combined air and dirt separators. Also, coordinate final details of installation of housing and associated appurtenances with OPP Water Treatment Specialist.
- 3. Confirm proper sizing of autoflow regulating valve for required sidestream bag filter flow with Engineer and OPP Water Treatment Specialist.
- 4. Install manual air vent in tap at high point of bolt-on top.
- 5. Install individual pressure gauges to indicate entering and leaving pressures.
- 6. Coordinate insulation of units operating below ambient dew point to prevent condensation. Provide removable insulating cover on removable top portion.

3.4 DEMONSTRATION AND TURNOVER

- A. **[Engage a factory-authorized service representative to train] [Train]** Owner's maintenance personnel to adjust, operate, and maintain the following HVAC hydronic specialties and equipment.
 - 1. Differential Pressure Control Valves
 - 2. Air and Dirt Separators
 - 3. Open Systems Solids Separator Systems
- B. Compile a thorough list, including system type, function and location, of all specialties that need routine scheduled inspection and maintenance to ensure proper operation. Coordinate with OPP and provide electronic documentation (signed and dated) to the Owner's Preventive Maintenance

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(PM) representatives during start-up to ensure all such specialty units get input in the PM database as part of project turnover.

END OF SECTION 232116