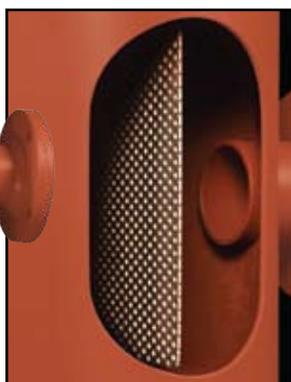


## 5900 FlexBalance and 5900 FlexBalance~Plus Series Separators

Taco's patented 5900 FlexBalance and FlexBalance~Plus Separators act as a hydraulic bridge between the primary and secondary circuits in hydronic heating and cooling applications. The FlexBalance~Plus product line incorporates Taco's patented Pall Ring technology for deep micro-bubble and dirt removal. All Taco FlexBalance Separators are designed, manufactured and tested to the requirements of ASME Section VIII, Div I. This Green Building friendly series provides improved system energy efficiency, allowing the use of smaller pumps for each system circuit.



FlexBalance Separator



The FlexBalance Series features Internal Baffles



5900 FlexBalance~Plus Separator



5900 FlexBalance~Plus Series features Pall Rings



## Features and Benefits

### Improve comfort and reduce cost.

Improve comfort and system performance.

- Achieve hydraulic separation between primary and secondary circuits.
- Prevent hydraulic coupling of pumps or pumps in series in primary secondary configurations.
- Prevent unanticipated or ghost flows in connected primary and secondary circuits.
- Control system is not affected by flow in a connected circuit.

Reduce installed costs

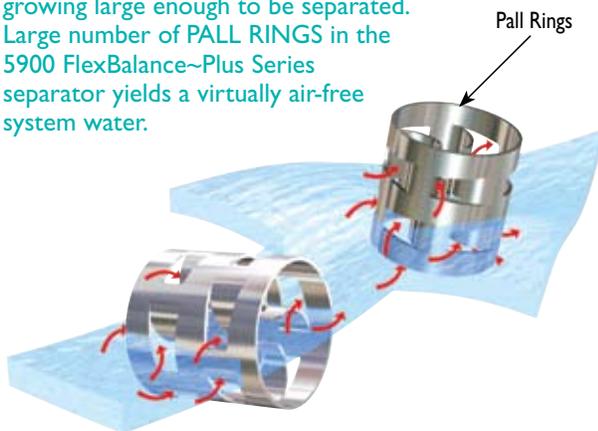
- Integral PALL RING microbubble high efficiency air and dirt separator in the Plus series eliminates separate air separator.
- Requires less mechanical room space than separate components.
- Integral air vent.
- Optional ½” temperature/pressure ports on all nozzles.

Reduce operating costs

- Pressure drop of FlexBalance is less than separate field installed components.

#### Patented Pall Ring micro-bubble separation technology

When water is brought into contact with a PALL RING, the stream is deflected in many directions. Microbubbles attach to the ring surface by coalescence growing large enough to be separated. Large number of PALL RINGS in the 5900 FlexBalance~Plus Series separator yields a virtually air-free system water.

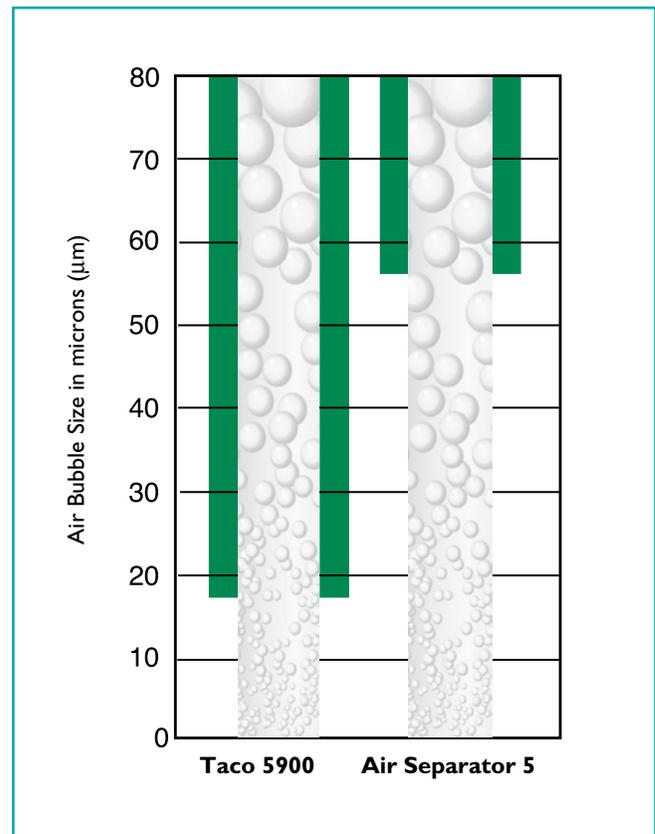


The 5900 series separators remove up to 99.6% of the dissolved air through the action of coalescence. This feature is especially beneficial in correcting problems in air entrained systems.

### High efficiency cleaning of air and dirt.

PALL ring technology has been used for many years in the processing industry. Taco's application of PALL rings to hydronic air and dirt separation is new to the HVAC industry. While air bubbles are separated by the PALL rings through a process known as coalescence, dirt particles are actually caught and sifted to the bottom of the tank, where they can be removed through a blowdown valve. The 5900 Series provides higher efficiency, with reduced pressure drops, so a somewhat smaller pump may be used for maximum efficiency.

### Superior air bubble removal



## Primary Secondary Pumping

Primary secondary pumping is used extensively in HVAC systems to hydraulically isolate different circuits in the same hydronic system.

This can be useful to save energy by shutting off or reducing the speed of pumps in areas of the system with no or low loads. This can also be useful to increase comfort by supplying areas of a system with different water temperatures or different flow rates.

To successfully accomplish these tasks the flow rates of these different circuits must be independent of each other, i.e., the flow in one circuit must not affect the flow in another circuit. This is known as decoupling or hydraulic separation.

To decouple or hydraulically separate one circuit from another, an area of very low pressure drop must be created in the common piping between the two circuits. This pipe sometimes referred to as the decoupler or hydraulic separator. This decoupler must be as short (tee to tee) as possible to insure that the path of least resistance for the flow of water of one circuit is through the decoupler and not through the opposing connected circuit.

This decoupler or common pipe is shown in Figure 1 in red.

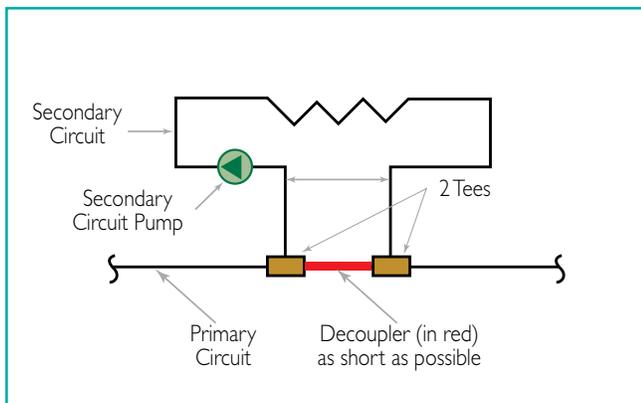


Figure 1 — Decoupler

If this decoupler is installed correctly then the flow in one circuit does not affect the flow in the other circuit. The flow in each circuit is only a function of the pump head in its circuit. This flow is not influenced by the pumps in the opposing circuit being in series with the pumps in its circuit.

There are 3 combinations of flow and temperature possible depending on the relationship of the primary and secondary flow rates.

Figure 2 shows the relationship for the primary ( $Q_{\text{primary}}$ ) and secondary ( $Q_{\text{secondary}}$ ) flow equal.

In this instance the secondary circuit supply temperature is equal to the primary circuit supply temperature. For example a building secondary circuit supply water temperature will be the same as a boiler or chiller primary circuit supply water temperature.

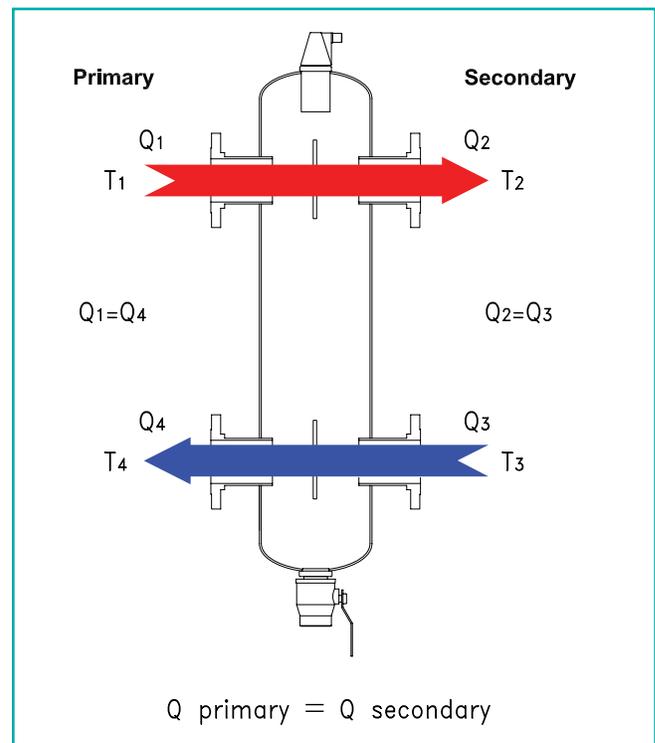


Figure 2

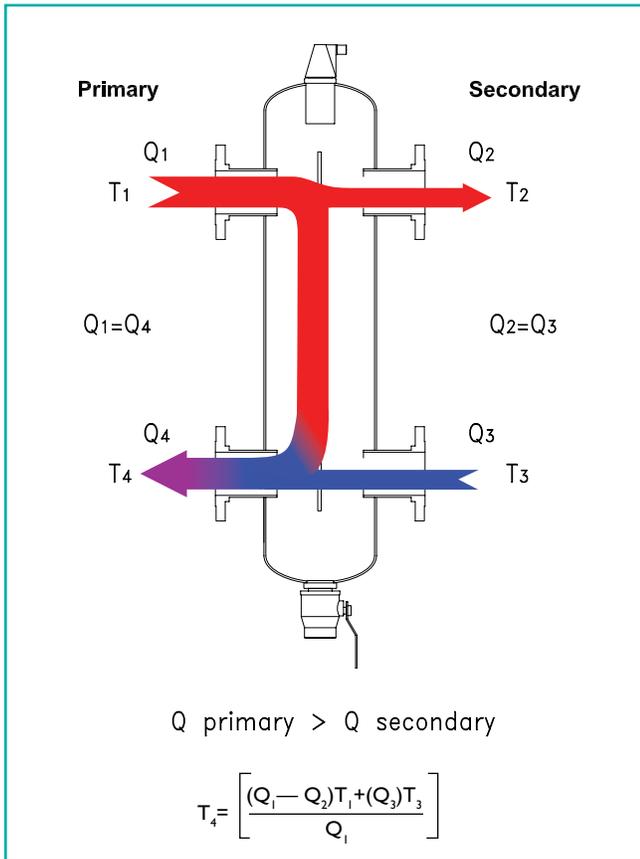


Figure 3

Figure 3 shows the relationship if the primary flow ( $Q$  primary) is greater than the secondary flow ( $Q$  secondary).

In this instance the secondary circuit supply temperature is the same as the primary circuit temperature. For example a building secondary circuit supply water temperature will be the same as a boiler or chiller primary circuit supply water temperature.

Figure 4 shows the relationship if the primary flow ( $Q$  primary) is less than the secondary flow ( $Q$  secondary).

In this instance the secondary circuit supply temperature is less than the primary circuit temperature. For example a building secondary circuit supply water temperature will be lower than a boiler and higher than the chiller primary circuit supply water tem-

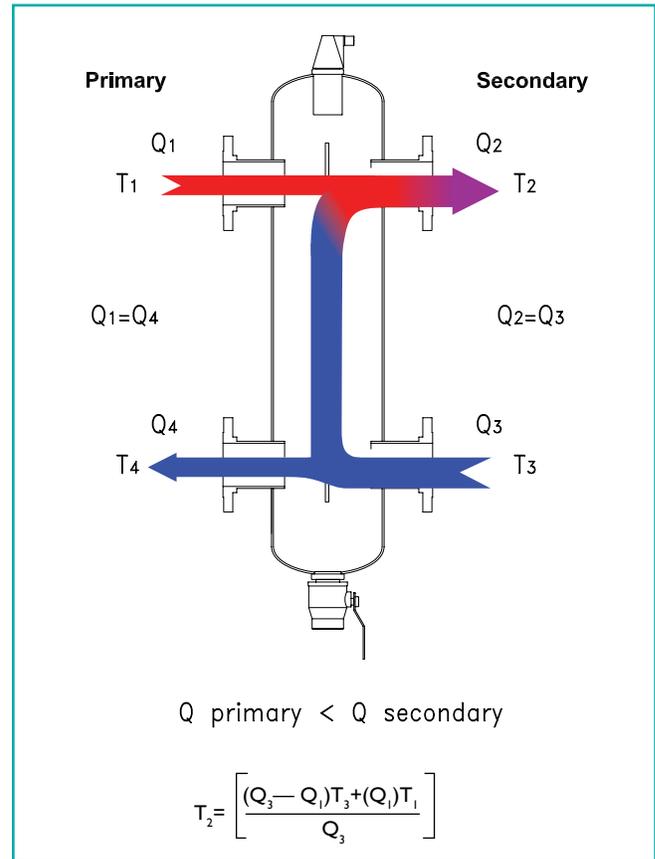


Figure 4

perature. This is because some of the secondary flow mixes with the primary flow and dilutes the supply water temperature to the secondary circuit.

This can cause system performance problems, especially in chilled water systems, since the building secondary supply water temperature cannot be maintained at the chiller primary supply water temperature.

This can result from staging off of multiple boiler or chillers while maintaining a constant volume building secondary circuit flow rate.

This application can also be used for low mass boilers that have flow limits below the building secondary flow rate. In this application system water is bypassed around the boiler to limit the boiler flow to manufacturer's maximum flows.

## Types of Pre-Manufactured Decouplers/Hydraulic Separators

Taco has developed several pre-manufactured decouplers or hydraulic separators that insure hydraulic isolation of connected hydronic circuits. Use of manufactured units insures not only hydraulic isolation of connected circuits from improperly field installed tees, but also saves installation and field labor costs.

### Twin Tee®

For smaller pipe up to 6" in diameter when connecting terminal units up to 2-1/2" branch circuits to single pipe systems Taco offers our patented Twin Tee as shown in Figure 5.

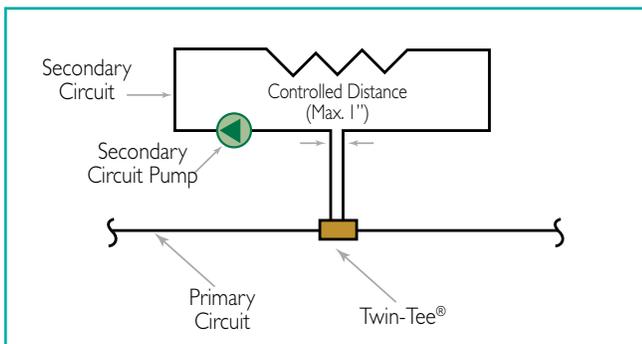


Figure 5 — Twin-Tee Decoupler

## 5900 FlexBalance Separator

We offer our patented 5900 FlexBalance Series Separator for larger pipe beyond the capability of a Twin Tee. In addition it can be used for connecting generation equipment such as boilers and chillers to primary piping systems. It can also be used for applications where air removal is desired.

This separator offers a low pressure decoupler or common pipe between two circuits. To achieve this low pressure region the optimum velocity of the flow entering the Separator should be 6.6 fps and the velocity in the Separator should be .66 fps.

A typical piping schematic for the Hydraulic Balancer Separator in a multiple chiller application is shown in Figure 6.

Our 5900 FlexBalance Separator meets this configuration. The system water passes directly through to the chiller circuit without impacting into a Bull Head tee. In addition, the distance between the connections in the bypass is at least 10 pipe diameters.

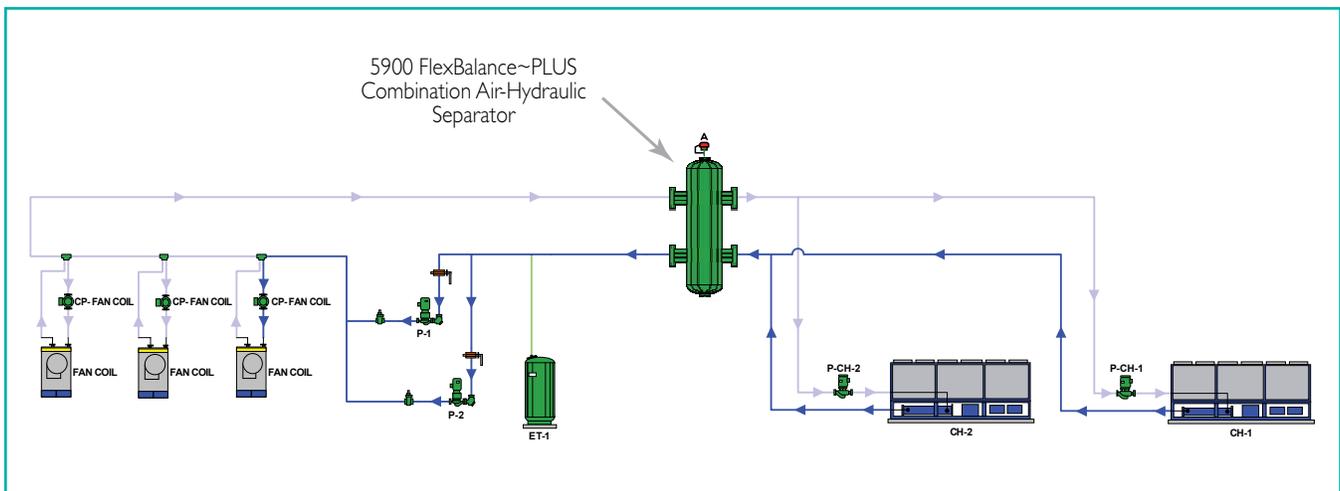


Figure 6 — Multiple Chillers

# Applications

With any primary secondary piping arrangement the piping of the common or decoupler bypass pipe between the primary and secondary circuits is of importance.

For chilled water systems this piping is of prime importance to maintain system performance.

A common problem in large chilled water systems is bypassing of warm return water to mix with the supply water from the chillers. This results in chilled water supply water temperatures to the system above the chiller supply water temperature. (See Figure 7)

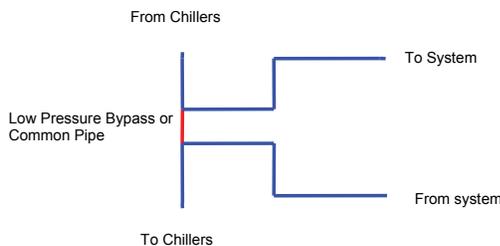


Figure 7 — Low Pressure Bypass

This is the classic low pressure bypass for a primary secondary piping connection. In this case the arrangement results in a Bull Head tee configuration for the system return water.

In larger pipe, especially over 8", the system water impacts forcefully with the Bull Head tee. As a result some of the return water is forced backwards through the bypass. This is sometimes referred to as diffusion. This is illustrated in figure 8.

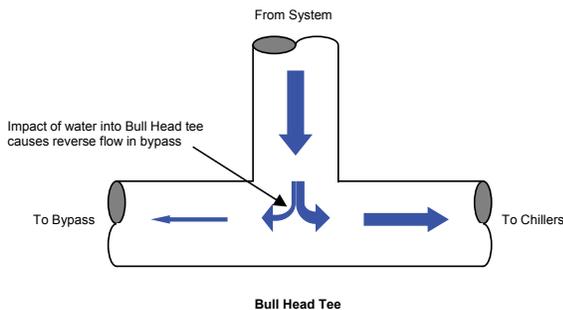


Figure 8 — Reverse Flow or Diffusion in Bypass

The mixing of warm return water with supply water from the chillers will result in chilled water supply water temperatures to the system above the chiller supply water temperature.

In one larger system the chillers' supply temperature was 40°F. However, the supply water temperature to the system was 46°F.

The solution to this problem is to abandon the classic low pressure bypass arrangement and connect the bypass as shown in figure 9. In this case the tee is rotated so that the system water passes directly to the chiller circuit and not into a Bull Head tee. In addition it is recommended that the distance between the tees in the bypass be at least 10 pipe diameters.

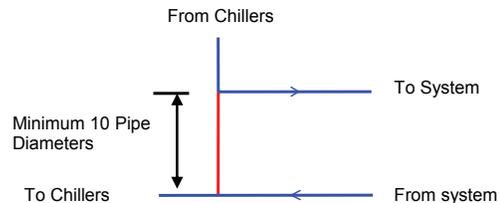
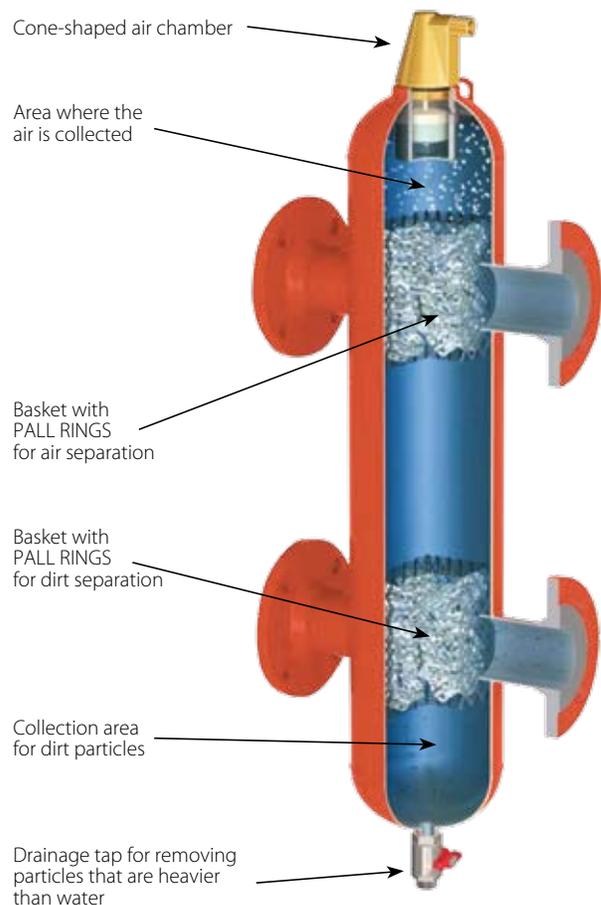


Figure 9 — Recommended Bypass Piping

## 5900 FlexBalance ~ Plus Separator

5900 FlexBalance Plus Separator includes the use of PALL RINGS for the coalescence of micro air bubbles around the PALLRINGS to separate from a system fluid. The 5900 Plus series incorporates the highest available coalescence surface area available on the market today. This enhanced surface area allows the removal of microbubbles as small as 18 microns in diameter.



### Selection Examples

#### Example 1:

*Problem:*

Select a hydraulic separator for a new installation. The hydraulic separator will be installed between a chiller primary pumping circuit and a building loop secondary pumping circuit

*Conditions:*

Flow rate = 700 gpm

Pipe size = 6"

Pipe Velocity = 7.8 fps

#### Selection Procedure:

1. Determine the type of hydraulic separator required. If no air removal is required this would require a Taco 5900 Series FlexBalance Separator.
2. Determine the pipe velocity range of the 5900 Series that is suitable for these conditions. The optimal pipe velocity range for the 5900 is 6.6 fps. The velocity in the 6" specified pipe size is 7.8 fps. This exceeds the recommended pipe velocity of 6.6 fps. Therefore, select an 8" pipe size unit. This pipe velocity = 5.5 fps.
3. Determine the shell velocity range of the 5900 Series that is suitable for these conditions. The recommended shell velocity range for the 5900 is .66 fps. The shell diameter for an 8" pipe size unit is 24". The shell velocity at 24" shell diameter is .5 fps. This is within the recommended shell velocity. Therefore, select an 8" pipe size unit model 5908A.

#### Example 2:

*Problem:*

Select a hydraulic separator for an existing installation with air entrainment and dirt problems. The system has less than average maintenance.

*Conditions:*

Flow rate = 150 gpm

Pipe size = 3"

Pipe Velocity = 6.5 fps

#### Selection Procedure:

1. Determine the type of hydraulic separator required. For removal of micro air bubbles and dirt this would require a Taco 5900 Series FlexBalance Plus Separator with integral PALL RINGS for air and dirt removal
2. Determine the pipe velocity range of the 5900 Series that is suitable for these conditions. The recommended pipe velocity range for the 5900 is 6.6 fps. The velocity in the 3" specified pipe size is 6.5 fps. This is within the recommended pipe velocity of 6.6 fps. Therefore, select a 3" pipe size unit.
3. Determine the shell velocity range of the 5900 Series that is suitable for these conditions. The recommended shell velocity range for the 5900 is .66 fps. The shell diameter for a 3" pipe size unit is 10 3/4". The shell velocity at 10 3/4" shell diameter is .5 fps. This is within the recommended shell velocity. Therefore, select a 3" pipe size unit model 5903P Plus.

## Features

US Patent# 7,117,888  
Manufactured to ASME Section VIII Div. I  
Energy Saving Green Product

## Specifications

**Working Pressure:** 125 psi @ 270°F  
(150 psi @ 270°F Option Available)

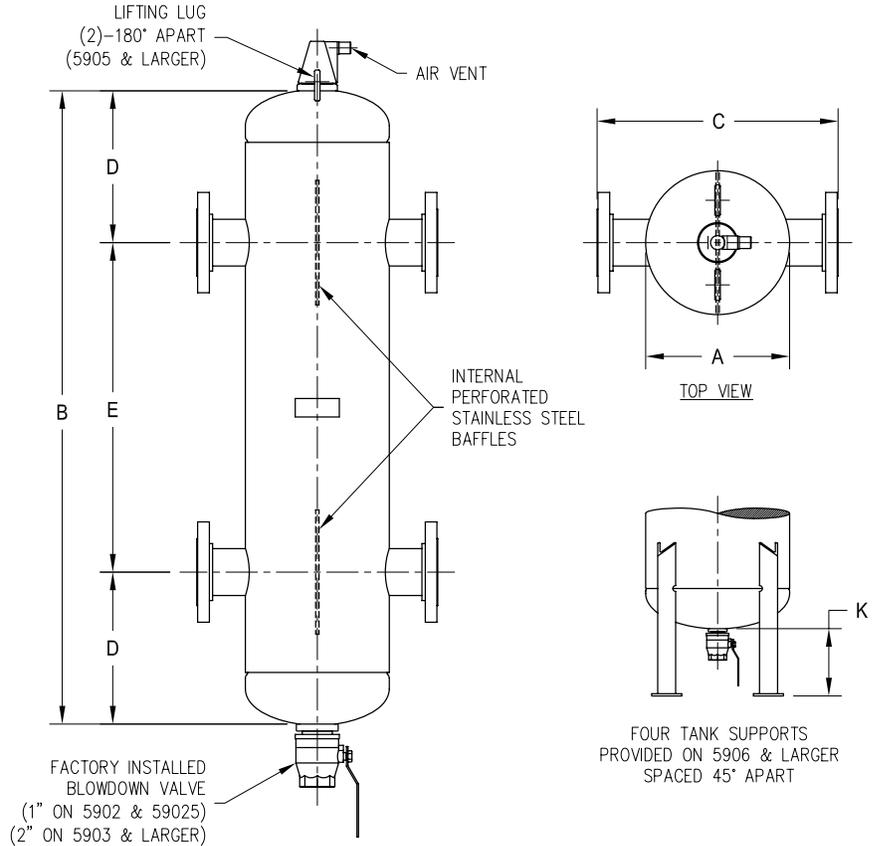
**Internal Body Diameter:**  
3X the cross-sectional area of the  
combined entering nozzle area.

**Connection Options:**  
Flanged, threaded (up to 3") and Victaulic  
available.

**Available Sizes:** 2" thru 12"



Each separator is equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly.



## 5900 FlexBalance Series Dimensions & Weights:

Pipe Size	Model Number	A	B	C	D	E	K	Approx. Weight (LBS.)
		Dia. (Inch)	Max. (Inch)	(Inch)	(Inch)	(Inch)	(Inch)	
2	5902A	6-5/8	35	13-3/4	7-7/8	19-1/4	---	100
2-1/2	59025A	6-5/8	40	13-1/4	7-1/2	25	---	110
3	5903A	10-3/4	50	17-1/2	10-3/8	29-1/4	---	180
4	5904A	10-3/4	59	20	10-1/2	38	---	205
5	5905A	14	77	23	15-1/4	46-1/2	---	365
6	5906A	18	90	27	16-7/8	56-1/4	14	500
8	5908A	24	120	34-1/2	23-3/8	73-1/4	14	890
10	5910A	30	151	41-1/4	29-1/2	92	14	1350
12	5912A	30	168	42-3/4	29	110	14	1450

Designed and constructed per ASME Section VIII Div. I

All dimensions shown are subject to change and should not be used for pre-piping. Contact your local Taco representative should certified dimensional drawings be required.

**Features**

US Patent# 7,117,888  
Manufactured to ASME Section VIII Div. I  
Energy Saving Green Product

**Specifications**

**Working Pressure:** 125 psi @ 270°F  
(150 psi @ 270°F Option Available)

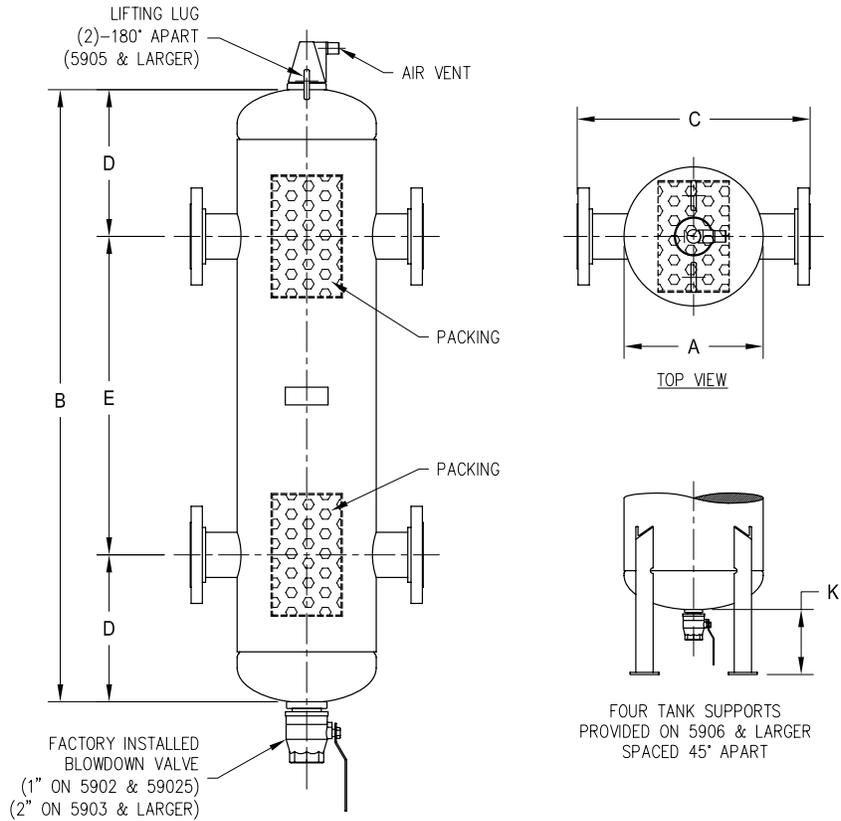
**Internal Body Diameter:**  
3X the cross-sectional area of the  
combined entering nozzle area.

**Connection Options:**  
Flanged, threaded (up to 3") and Victaulic  
available.

**Available Sizes:** 2" thru 12"



Each separator is equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly.



**5900 FlexBalance ~ Plus Series Dimensions & Weights:**

Pipe Size	Model Number	A	B	C	D	E	K	Optimum Flow (GPM)	Surface Area* (Sq. Ft.)	Approx. Weight (LBS.)
		Dia. (Inch)	Max. (Inch)	(Inch)	(Inch)	(Inch)	(Inch)			
2	5902P	6-5/8	33	13-3/4	8-5/8	15-3/4	---	63	7.7	130
2-1/2	59025P	6-5/8	33	13-1/4	8-5/8	15-3/4	---	63	7.7	140
3	5903P	10-3/4	50	17-1/2	12-3/4	24-1/2	---	173	33.9	240
4	5904P	10-3/4	50	20	12-3/4	24-1/2	---	173	33.9	265
5	5905P	14	75	23	21-1/4	32-1/2	---	293	58.7	460
6	5906P	18	88	27	23-1/2	41	14	499	129.5	650
8	5908P	24	119	34-1/2	32	55	14	896	282.4	1210
10	5910P	30	153	41-1/4	40-1/8	72-3/4	14	1409	455.5	1880
12	5912P	30	153	42-3/4	40-1/8	72-3/4	14	1409	455.5	1980

Designed and constructed per ASME Section VIII Div. I  
\* Total Coalescence (Pall Ring) Surface Area

All dimensions shown are subject to change and should not be used for pre-piping. Contact your local Taco representative should certified dimensional drawings be required.

## SECTION 15181 - HYDRONIC SPECIALTIES

### PART I - GENERAL

#### I.1 SECTION INCLUDES

- A. Hydraulic Separators

#### I.2 RELATED SECTIONS

- A. Section - Plumbing Piping Specialties:
- B. Section - Hydronic Piping.

#### I.3 REFERENCES

- A. ASME (BPV VIII, I) - Boiler and Pressure Vessel Code, Section VIII, Division I - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2004.

#### I.4 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.
- C. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.
- D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- E. Project Record Documents: Record actual locations of flow controls.
- F. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

#### I.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

#### I.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping components from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

#### I.7 MAINTENANCE SERVICE

- A. Contractor to furnish service and maintenance for one year from date of substantial completion.

#### I.8 EXTRA MATERIALS

- A. See Section 01400 - Quality Requirements, for additional provisions.

### PART 2 - PRODUCTS

#### 2.1 HYDRAULIC SEPARATORS

- A. Manufacturers:
  1. Taco, Inc.; 5900 (size and capacity as called for on plans).
  2. Caleffi
  3. Substitutions: See Section 01600 - Product Requirements.
- B. Hydraulic Separator device shall be constructed of steel. It shall be designed, fabricated and stamped per ASME Section VIII Division I with a maximum working pressure of 125 psi at 270°F. Manufacturer shall be holder of ASME U stamp. Manufacturer to have optional 250 psi and 150 psi ASME units available.
- C. Units provided with flanged system connections as standard. Inlet and outlet connections to the primary and secondary circuits to be on the same side of the unit.
- D. Each hydraulic separator device shall be equipped with a brass conical shaped air venting chamber designed to minimize system

fluid from fouling the venting assembly. The air vent shall be able to be closed to allow flushing and purging of dirt via side port with out dirt passing through vent on initial system fill.

- E. A brass flushing cock shall be located on the side of each separator to facilitate system fast-fill and removal of the floating impurities from the air system interface within the separator.
- F. A blow down valve shall be provided by the unit manufacturer on the bottom of each unit to allow blow down and cleaning. On units 2 ½" and smaller the valve and all of its fittings shall be 1". On units three 3" and larger the valve and all openings shall be 2".
- G. The integral air and dirt separator shall remove air down to 18 microns and shall remove dirt/debris down to 35 microns. The unit shall be 100% efficient at removing dirt down to 90 microns in 100 passes or less.
- H. The unit manufacturer shall provide the owner and design engineer third party independent test data certifying that their unit performs to the above standards. Suppliers not providing these independent performance test results will not be acceptable.
- I. The integral air and dirt separator shall employ the use of high surface area pall rings to achieve optimal separation of air and dirt with minimal pressure drop. The pall rings shall be made of stainless steel. Stainless steel will be the only acceptable material used for suppressing turbulence and increasing surface area for high efficiency air and dirt removal. Inferior materials of construction such as copper for the straining medium will not be acceptable.

Chilled water unit: The minimum allowable surface area of the straining medium shall be \_\_\_\_ sq ft for the \_\_\_\_\_ model.

Hot water unit: The minimum allowable surface area of the straining medium shall be \_\_\_\_ sq ft for the \_\_\_\_\_ model.

- J. Manufacturer must have at least 15 years of experience with microbubble coalescing and dirt removal technology.
- K. (OPTIONAL) The unit shall be manufactured with a removable cover to facilitate removal, inspection, and cleaning of the pall ring basket. The entire pall ring basket shall be constructed of stainless steel. For safety and ease of service the unit shall be accessed from the top and the pall ring basket shall be accessed as one complete assembly housed in a stainless steel cage.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- C. Provide manual air vents at system high points and as indicated.
- D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- E. Hydraulic separator to be installed between a primary and secondary piping circuit.
- F. Provide valved drain and hose connection on strainer blow down connection.

END OF SECTION 15181

# Taco quality through & through



Hydronic professionals everywhere trust Taco for the highest quality systems, components, technology, and support. Visit [taco-hvac.com](http://taco-hvac.com) for more information on FlexBalance, FlexBalance~Plus, additional products, systems, software & training.



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Taco (Canada) Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3 / (905) 564-9422 / Fax (905) 564-9436  
[www.taco-hvac.com](http://www.taco-hvac.com)