

4900 Series Air Separators — Standard & High Velocity

Save money and lengthen the life of system pumps, piping, and components with the Taco 4900 Series air and dirt removal separators. The 4900 Series scrubber system is designed and constructed to ASME code, with technology proven in the field, around the world. Built with the quality and dependability that's made Taco famous for its performance and reliability. 4900 Series' internal PALL Ring basket assemblies have been developed with safety and ease of maintenance in mind.



Patent# 5, 123, 938



Available with and without removable cover



Eliminate bubbles and dirt in the system before they cause trouble.

Air and dirt trapped in the system can produce major problems such as reduced heat transfer, loss of efficiency, pipe corrosion, pump damage, increased energy consumption, and irritating noise. The highly efficient Taco 4900 Series separator, now with optional removable covers, clears the system of microbubbles, sand, dirt, and rust to save money, energy, and component wear. 4900 Series' stainless steel PALL Ring baskets can be removed by one person. Unlike many competitive models each 4900 unit is designed and constructed to the requirements of Section VIII of the ASME code as standard.

European PALL Ring technology. Taco ingenuity.

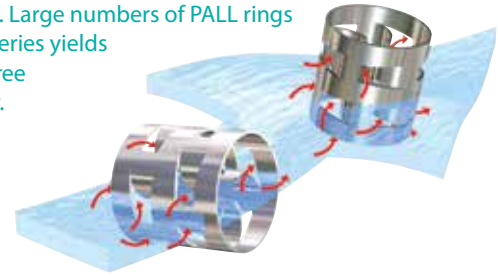
The 4900 Series' integral PALL ring technology has been proven in countless European installations. PALL rings are used in the processing industry to mix gases with, or separate gases from liquids. The use of PALL rings in hydronic air separation is so unique, it's patented. By applying PALL ring technology to air and dirt separation, the 4900 Series will:

- Remove microbubbles as small as $18 \times 10^{-6}\text{m}$ (18 microns) from the system
- Remove air which has dissolved in the system's water
- Remove air from places where an air vent cannot be installed
- Remove and separate solid particles from the flow
- **2 PSI or less pressure drop at optimal flow rate***

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 4900 Series provides higher efficiency, with reduced pressure drops, so a somewhat smaller pump may be used for maximum efficiency.

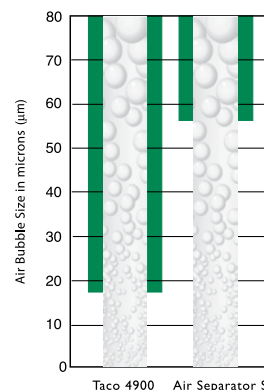
When water is brought into contact with a PALL RING, the stream is deflected in many directions. Microbubbles attach to the ring surface, by coalescence growing large enough to be separated. Large numbers of PALL rings in the 4900 Series yields virtually air-free system water.



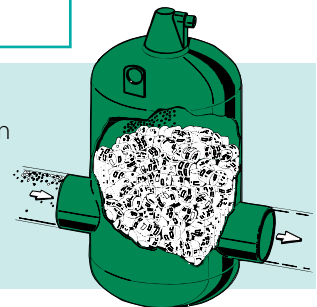
Removable Cover and Stainless Steel Pall Ring Basket Assembly



Superior air bubble removal



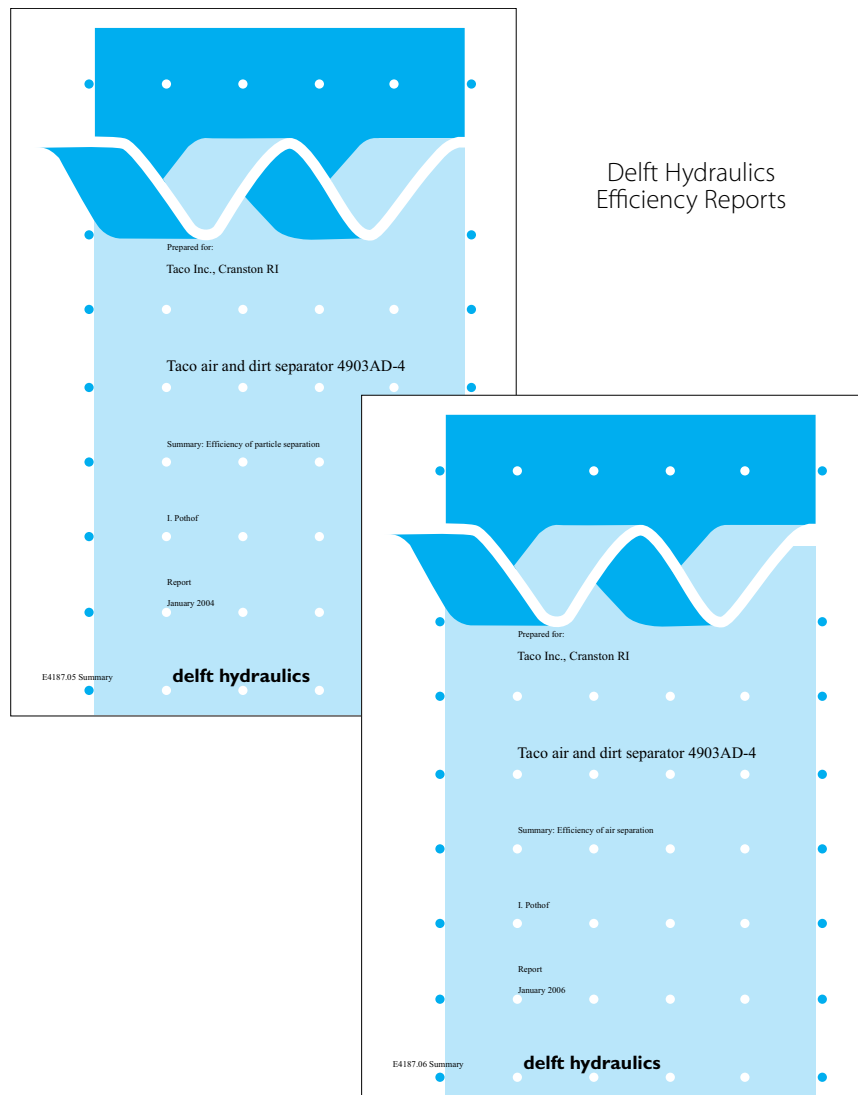
Series 4900-A models clean the system of free air and microbubbles; Series 4900-AD models remove both air AND dirt from the hydronic system. 304 stainless steel screens are provided on the inlet/outlet of each separator to isolate the separator's internals from the hydronic system. A flushing cock allows for the cleaning of the PALL rings. A full port ball valve is provided at the bottom of the unit to permit blowdown of accumulated particles. While construction of both models differs somewhat, the PALL ring operating principle is the same.



* See pages 13 & 14 for optimal flow rates.

The choice is yours.

Delft Hydraulics has tested and certified the 4900 Series' superior performance for dirt and micro bubble removal. Choose from the 4900-A Series for air removal only, or the 4900-AD Series for air and dirt removal from any hydronic heating or chilled water system. Delft Hydraulics' 2004 and 2006 test reports for particle separation efficiency (shown below) provide information on the test procedures followed, show test results for particle separation, and offer conclusions and practical implications.



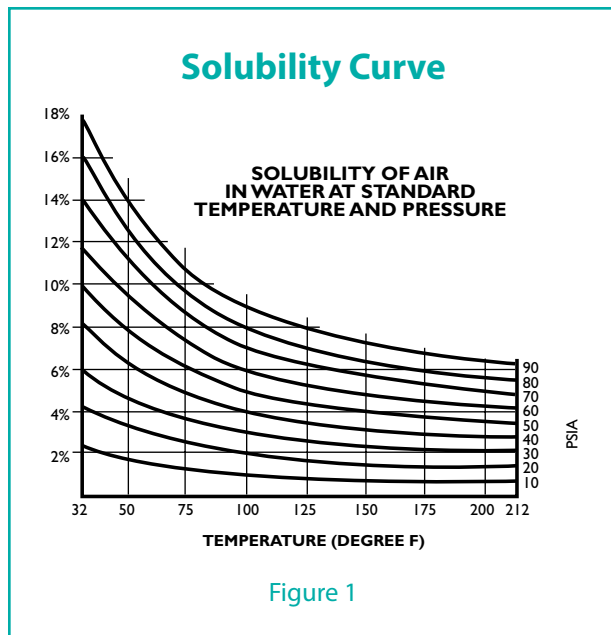
Applications

Air Control and Elimination

Water contains a certain amount of entrained air. If this air comes out of solution, it can increase corrosion rates of metals within the system. In addition, air can form pockets at the top of pipes and heating units. These air pockets can actually restrict or block flow in a hydronic piping system. This is referred to as "air locking".

The table below shows a solubility curve for air in water. Note that at a fixed pressure, increasing the temperature reduces the amount of air that can be dissolved. For example, at 60 PSIA and 40°F, the water can contain just over 10% air by volume. At 60 PSIA and 200°F, the percentage decreases to just over 4%.

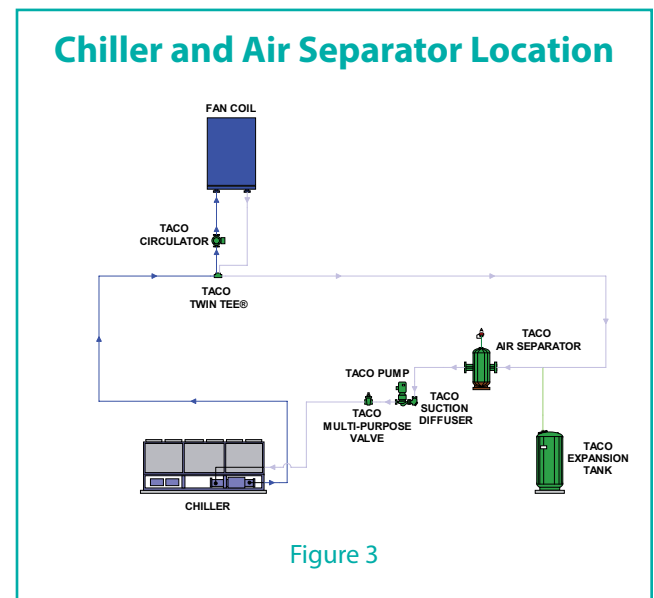
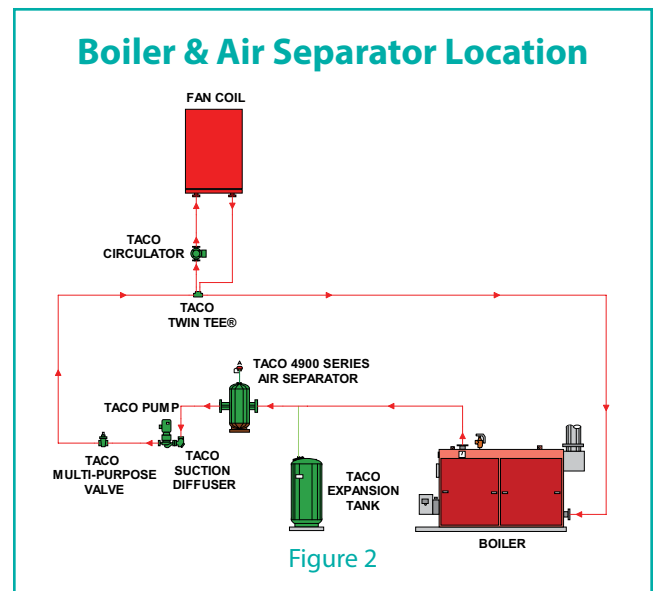
Conversely, at fixed temperature reducing the pressure reduces the amount of air that can be dissolved. For example at 100°F and 80 PSIA the water can contain 8% air by volume. At 100°F and 20 PSIA the percentage decreases to 2%.



The conclusion is that air is least soluble in water at the highest temperature and lowest pressure. Air separators should therefore be located at these points.

The highest temperature in a system is typically on the discharge of boilers and inlet of chillers. Therefore, the general rule of thumb in hydronic systems is that **"Air separators should be located downstream of boilers (Figure 2) and upstream of chillers (Figure 3)."**

The lowest pressure in a system is typically at the expansion tank, since this is the point of no pressure change and the location of the fill valve. Therefore, the general rule of thumb in hydronic systems is that **"Air separators should be located at the expansion tank connection to the system."**



In addition, as water is heated from the fill temperature to the operating temperature, a great deal of air is released. Therefore, the simple act of bringing the water to operating temperature could lead to corrosion and air pockets, both of which should be avoided.

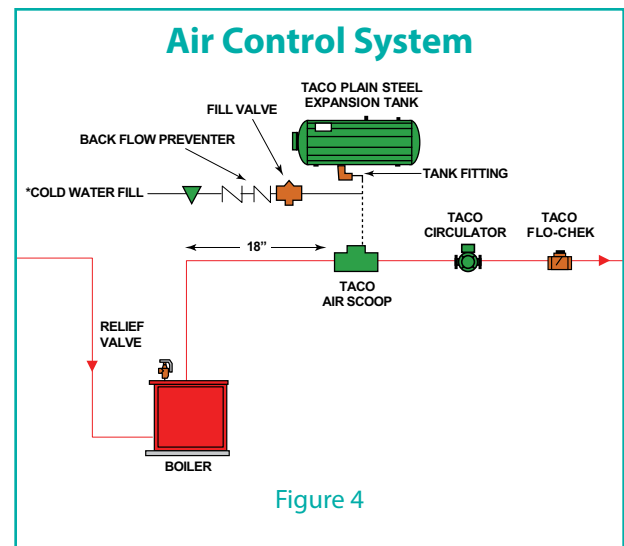
A method of removing this released air from the piping system is therefore required. Enter the air separator. An air separator is a device that removes the air from the circulating fluid.

There are several types of air separators in use today. Depending upon the type of expansion tank used in the system, the air separator is part of an Air Control System or an Air Elimination System.

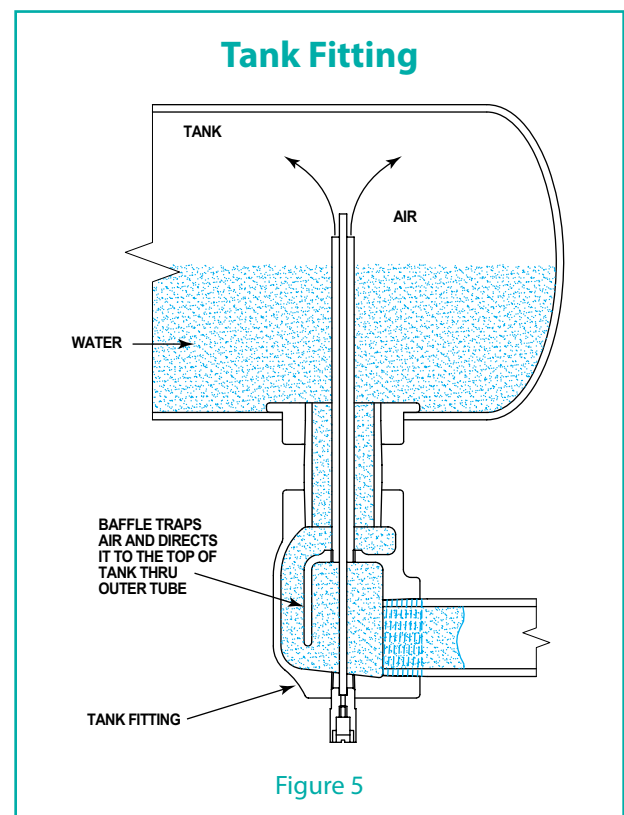
Air Control Systems

If a conventional (non-bladder) style expansion tank is used, it is desirable to redirect the separated air to the space above the water level in the expansion tank (Figure 4). The dotted line from the air separator (scoop) to the plain steel tank shows the proper connection, with the air piped from the scoop to the expansion tank through a special tank fitting.

This fitting directs the air to the top portion of the tank, and discourages air from migrating back into the system (Figure 5), when the system cools on the "off" cycle. Note that since the air is "recycled" to provide a cushion in the expansion tank, this system is called an "Air Control" system.



Note that the circulator is on the supply side of the boiler. This is the proper location, as it results in the highest pressure at the top of the system (if the circulator was on the return side of the boiler, the boiler pressure drop reduces the pressure at the top.) Having a higher pressure at the top keeps air in solution, and helps prevent problems and air binding.



Air Elimination Systems

If a Captive Air or Bladder Style expansion tank is used, there is no reason to “save” the separated air (Figure 6). Therefore, if an air separator (scoop) is used in an air elimination system rather than an air control system, the separator is fitted with an automatic air vent (Taco’s Hy-Vent® series), which discharges the separated air to the atmosphere. Note that since the air is eliminated through an air vent this system is called an “Air Elimination” system.

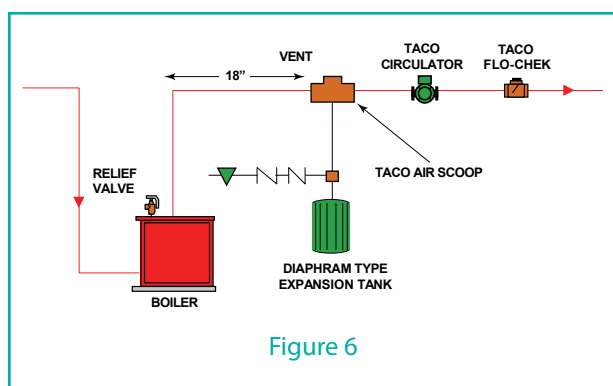


Figure 6

Types of Air Separators

Air Scoop®

Taco Air scoops are applied in residential and light commercial applications for the removal of free air in water or water/glycol systems. The body of each air scoop provides an increased cross sectional area which lowers velocity within the piping network thereby allowing free air to rise due to buoyant force. To assist with the removal of smaller air bubbles integral baffles are incorporated within most air scoops.



Optimum performance is achieved at line velocities up to 4 ft/sec. However, air scoops have been successfully installed on applications with velocities up to 8 ft/sec. Air scoops are specifically designed for the line size which they are to be installed. These sizes range from 1 inch to 4 inch.

Most manufacturers rate their air scoop product lines for 125 psi with a maximum operating temperature of 300°F. Air scoops are installed in conjunction with an expansion tank and air vent as shown in figure 7.

(See Taco Catalog# 100-7.2 for additional information.)

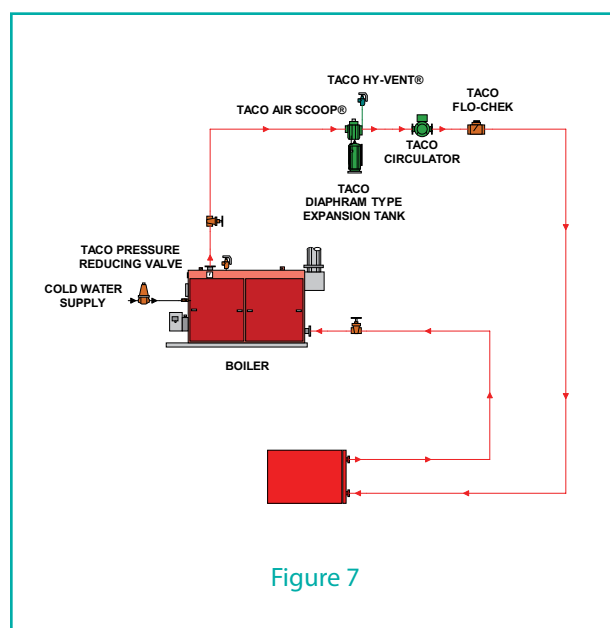


Figure 7

Applications

- **Smaller systems**
- **Lower cost**
- **Compact installation**

VorTech®

Taco VorTech® Air Separators are applied in residential and light commercial applications for the removal of free air in water or water/glycol systems. The body of a VorTech features a primary separation chamber where the process of air elimination is controlled and optimized.



The body of each VorTech is specially designed to direct the flow of the system fluid tangentially exiting at the bottom of the chamber. To assist with the removal of larger air pockets each VorTech incorporates a 300 series stainless bubble breaker cartridge to breakup larger air volumes.

Due to the tangential effect the system fluid with its higher density is pushed to the outside wall of the chamber as the less dense air is directed toward the vortex of the flow and vented from the system.

Optimum performance is achieved at line velocities up to 4 ft/sec. However, VorTech style units have been successfully installed on applications with velocities up to 8 ft/sec. VorTech separators are specifically designed for the line size which they are to be installed. These sizes range from 3/4 inch to 2 inch.

VorTech style separators are rated for 150 psi with a maximum operating temperature of 240°F. VorTech are commonly installed in conjunction with an expansion tank and air vent as shown in Figure 8.

(See Taco Catalog #100-2.9 for additional information.)

Applications

- **Smaller systems**
- **Higher efficiencies**
- **Compact installation**

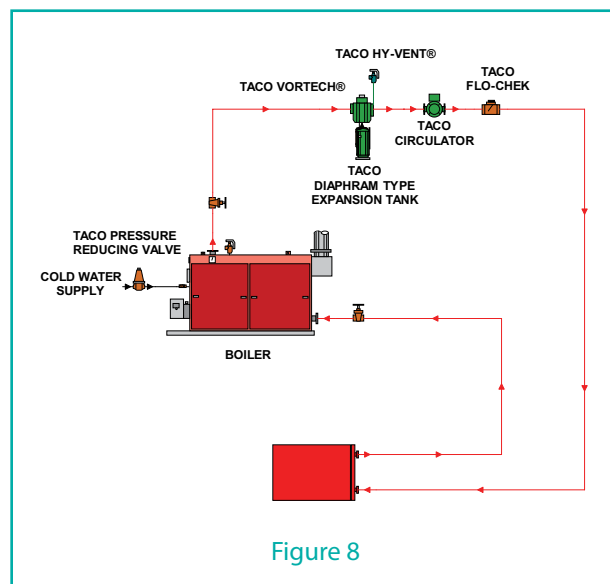


Figure 8

In-Line ASME Air Separators

Taco In-Line Air Separators are applied in commercial, institutional and industrial applications for the removal of free air in water or water/glycol systems. The In-Line designed air separator utilizes the advantages resulting from large body diameter in relation to the entering nozzle diameter.



The design of in-line air separators depends upon the lowering of the system fluid velocity within the separator, the change in direction of fluid flow within the unit, and buoyant force to direct air to the automatic air vent normally positioned at the top of the separator.

These air separators are designed, built and stamped to the requirements of ASME. The rated working pressure of these units is dependent upon the design pressure of the hydronic system into which they are being installed. Manufacturers offer these units in working pressures of 125, 150, 175, 250, 300 psi and higher if required.

Optional stainless steel strainers are specified to capture and allow the removal of larger debris. These screens are normally specified with 3/16 inch perforations and free area of not less than 5 times the open area of the nozzle to minimize pressure drop. Most manufacturers provide a blowdown connection at the bottom of the unit.

When In-Line Air Separators are installed in conventional Air Control systems with plain steel expansion tanks (Figure 9) care must be taken to insure that piping between the air separator and the plain steel expansion tank is pitched at least 3 degrees to facilitate the migration of captured air back into the expansion vessel. Systems with plain steel expansion tanks must not have automatic vents installed as this will lead to the loss of the expansion tank compression cushion.

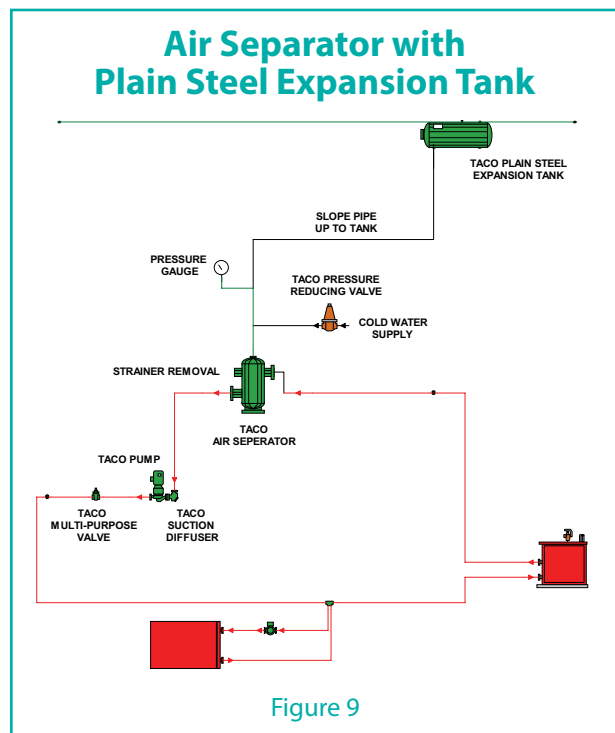


Figure 9

When In-Line Air Separators are installed in Air Elimination systems (Figure 10) with Captive Air bladder or diaphragm style expansion tanks, automatic air vents should be installed at the top of each separator. As Air Elimination systems have a permanent separation provided by the bladder or diaphragm between the initial tank pre-charge and the system fluid, no loss of pre-charge air will occur.

(See Taco Catalog# 400-1.1 for additional information.)

Air Separator with Captive Air Tank

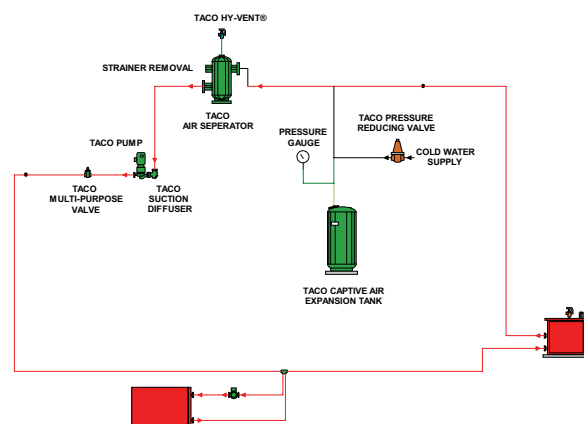


Figure 10

Applications

- Larger systems
- Lower pressure drop
- Removal of larger particles

Tangential ASME Air Separators

Taco Tangential Air Separators are applied in commercial, institutional and industrial applications for the removal of free air in water or water/glycol systems. The Tangential design air separators utilize the difference in density to separate free air from system fluid.



System fluid within a tangential air separator is forced to the wall of the separator due to centrifugal force. The less dense air then migrates to the center of the separator for venting at the top of the unit. Tangential air separators produce higher pressure drops than in-line or micro-bubble separators due to the vortex development within the unit. These units are designed, built and stamped to the requirements of ASME. Manufacturers offer tangential separators in working pressures of 125, 150, 175, 250, 300 psi and higher if required.

Optional stainless steel strainers are specified to capture and allow the removal of large debris. These screens are normally specified with 3/16 inch perforations and free area of not less than 5 times the open area of the nozzle

to minimize pressure drop. Most manufacturers provide a blowdown connection at the bottom of the unit.

When Tangential Air Separators are installed in conventional Air Control systems with plain steel expansion tanks (Figure 9) care must be taken to insure that piping between the air vent and the plain steel tank is pitched at least 3 degrees to facilitate the migration of captured air back into the expansion vessel. Systems with plain steel expansion tanks must not have automatic air vents installed as this will lead to the loss of the expansion tank compression cushion.

When Tangential Air Separators are installed in Air Elimination systems (Figure 10) with Captive Air bladder or diaphragm style expansion tanks, automatic air vents should be installed at the top of each air separator. As Air Elimination systems have a permanent separation provided by the bladder or diaphragm between the initial tank pre-charge and the system fluid, no loss of pre-charge will occur.

(See Taco Catalog# 400-2.8 for additional information.)

Applications

- **Larger systems**
- **Removal of larger particles**

4900 Series High Efficiency Micro-Bubble Air and Dirt ASME Separator

Taco 4900 Series High Efficiency Micro-Bubble Air and Dirt Separators are applied in commercial, institutional and industrial applications for the removal of free and entrained air. The 4900 Series utilize the coalescence of micro air bubbles around PALL rings to separate free air from a system fluid.

The 4900 Series incorporates the highest available coalescence surface area available on the market today. This enhanced surface area allows the removal of micro-bubbles as small as 18 microns in diameter. The 4900 Series separators remove up to 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system fluid. This feature is especially beneficial in correcting problems in air entrained systems. An additional feature of the 4900 Series is the capability to remove dirt from hydronic systems. 4900 Series dirt separators are capable of removing dirt particles as



small as 5 microns in diameter. This feature is especially beneficial in cleaning up dirty systems with clogged strainers, balance and control valves.

The 4900 Series has been designed in two velocity ranges, a standard product series suitable for line velocity to 4.9 ft/sec. and a high velocity series suitable for line velocities up to 11 ft/sec. The performance of the 4900 product line has been independently tested and published. *(These test results are available through your local Taco representative.)*

These units are designed, built and stamped to the requirements ASME Section VIII, Division 1. Manufacturers offer micro bubble air and dirt separators in working pressures of 125, 150, 175, 250, 300 psi.

When High Efficiency Micro Bubble Air and Dirt Separators are installed in conventional Air Control systems with plain steel expansion tanks (Figure 9) care must be taken to insure that piping between the air vent and the plain steel tank is pitched at least 3 degrees to facilitate the migration of captured air back to the expansion vessel. Systems with plain steel expansion tanks must not have automatic vents installed as this will lead to the loss of the expansion tank compression cushion.

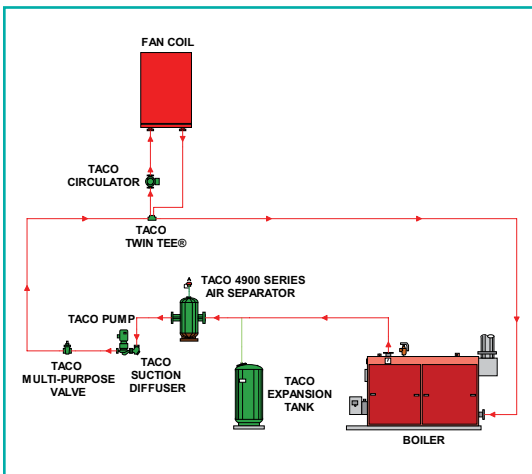
When High Efficiency Micro Bubble Air and Dirt Separators are installed in Air Elimination systems (Figure 10) with Captive Air bladder or diaphragm style expansion tanks, automatic air vents are built into the top of each air separator. As Air Elimination systems have permanent separation provided by the bladder or diaphragm between the initial tank pre-charge and the system fluid, no loss of pre-charge air will occur.

Applications

- **Larger systems**
- **Higher efficiencies**
- **Higher velocities**
- **Removal of smaller air bubbles**
e.g. removal of air in air entrained systems (removes micro air bubbles)
- **Removal of smaller particles** e.g. cleaning of dirty systems (removes particles and dirt)



Non-Removable Head Cover



Boiler & Air Separator Location

Selection Examples

Example 1

Problem:

Select an air separator for a new installation. For maximum performance of the hydronic system the project requires removal of micro air bubbles from the system. The system will have better than average maintenance.

Conditions:

Flow rate = 700 gpm

Pipe size = 6"

Velocity = 8 fps

Maximum pressure drop - 3 ft.

1. Determine the type of air separator required. For removal of micro air bubbles this would require a Taco 4900 Series Air Separator with a model number 4906AH (See #2 below)

For systems requiring dirt removal select the standard non-removable top head cover design with a blown down valve located at the bottom of the unit. Add letter designation "D" to indicate dirt removal. (e.g. 4906ADH).

2. Determine the velocity range of the 4900 Series that is suitable for these conditions. The velocity range for the standard unit is 4.9 fps. The velocity range for the high velocity unit is 11 fps. Therefore, select the high velocity model number ending with an "H".
3. Determine the size of the 4900 for the specified maximum pressure drop. For a maximum pressure drop of 3 ft. the unit size required is a 6" (2.7 ft.). This is Model 4906ADH.

Selection Examples

Example 2

Problem:

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

Conditions:

Flow rate = 150 gpm

Pipe size = 4"

Velocity = 4 fps

Maximum pressure drop - 3 ft.

1. Determine the type of air separator required.
For removal of micro air bubbles and dirt this would require a Taco 4900 Series Air and Dirt Separator with a model number ending with an "AD".

For a system with less than average maintenance or open systems select the removable top head cover for easier cleaning. This is a model number ending with an "R".

2. Determine the velocity range of the 4900 Series that is suitable for these conditions. The velocity range for the standard unit is up to 4.9 fps. The velocity range for the high velocity unit is 11 fps. If the velocity is under 4.9 fps select the standard velocity unit. If the application velocity is above 4.9 fps and below 11 fps a high velocity unit would be required. This would require the addition of the letter "H" at the end of the model number.

No additional letter designation is required for low velocity selections.

3. Determine the size of the 4900 for the specified maximum pressure drop. For a maximum pressure drop of 3 ft. the unit size required is a 4" (1.6 ft.). This is Model 4904ADR



Removable Top Head Cover

Taco recommends the use of a removable top head cover option on all open systems.

Typical Specifications

Furnish and install air and dirt removal device of the size and type shown on the plans. Air and dirt separation devices shall be Taco 4900 series or approved equal. Listing of a manufacturers name does not allow their construction standards to deviate from the requirements of this specification.



Air and dirt removal device shall be constructed of steel. It shall be designed, fabricated and stamped per ASME Section VIII Division 1 with a maximum working pressure of 125psi, 150, 175, 250, 300 optional at 240°F. Units up to three 3-inch in size shall be provided with threaded connections as standard. Units 4-inch and larger shall be provided with flanged system connections as standard.

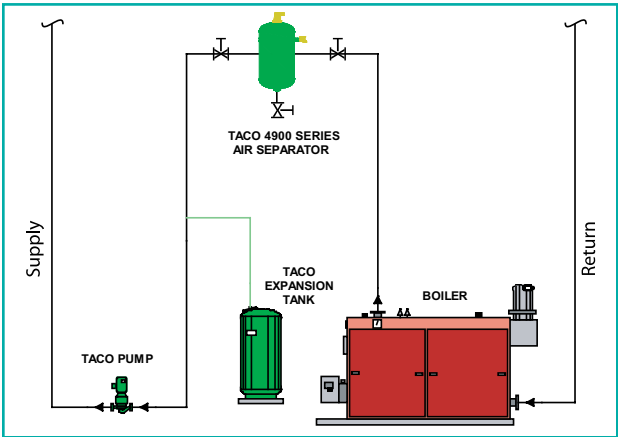
Pressure drops not to exceed 2 psi.

Each air and dirt removal device shall be equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly. 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.

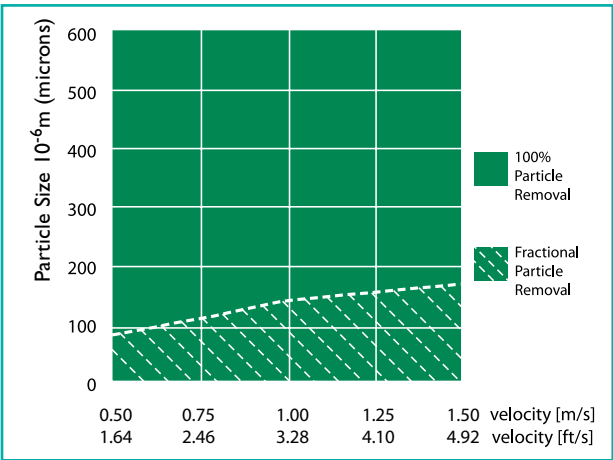
A blow down valve shall be provided by the unit manufacturer on the bottom of each unit to allow blow down and cleaning. On units 2-1/2" and smaller the valve and all of its fittings shall be 1". On units three 3" and larger the valve and all openings shall be 2".

The air and dirt removal device shall remove air down to 18 microns and shall remove dirt particles as small as 5 microns in diameter. The unit shall be 100% efficient at removing dirt down to 90 microns in 100 passes or less. 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.

Typical installation



Dirt Removal Efficiency of Separator



The 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. The minimum allowable surface area of the straining medium shall be ____ sq ft for the ____ model and ____sq ft for the ____model.

(OPTIONAL) The unit shall be manufactured with a removable upper head to facilitate removal, inspection, and cleaning of the pall ring basket.

4900 Series Removable Cover, Air Separators

(Submittal 401-175)

Pipe Size	Model Number ⁽¹⁾	A Dia. (Inch)	B Max. (Inch)	C (Inch)	D (Inch)	E (Inch)	F Dia. (Inch)	G (Inch)	H (Inch)	K (Inch)	Surface Area ⁽²⁾ (Sq.Ft)	GPM @ 4.9 Ft./Sec.	Approx. Wt. (LBS.)
2	4902ATR-125	10	20	12*	7-1/2	5-1/4	---	---	8	11	13.3	51	85
2	4902AR-125	10	20	20	7-1/2	5-1/4	---	---	8	11	13.3	51	85
2-1/2	49025AR-125	10	20	12*	7-1/2	5-1/4	---	---	8	11	13.3	73	90
2-1/2	49025ATR-125	10	20	20	7-1/2	5-1/4	---	---	8	11	13.3	73	90
3	4903AR-125	12	23	14-1/2*	8-5/8	6	---	---	9	12	22.5	113	125
3	4903ATR-125	12	23	22	8-5/8	6	---	---	9	12	22.5	113	125
4	4904AR-125	12	23	22	8-5/8	6	---	---	9	12	22.5	204	130
5	4905AR-125	14	29-1/2	24	10-1/2	6	12	6-3/4	10	17	29.6	306	380
6	4906AR-125	14	29-1/2	24	10-1/2	6	12	6-3/4	10	17	29.6	469	385
8	4908AR-125	18	36-5/8	28	13-1/4	7-1/4	14	7	12	21	63.9	816	550
10	49010AR-125	24	47-3/4	36	16-7/8	8-7/8	20	6-3/4	15	28	109.7	1291	1000
12	4912AR-125	24	54-3/4	36	17-7/8	8-7/8	20	6-3/4	15	35	140.4	1837	1030
14	4914AR-125	30	63	42	22	10-1/2	24	8	18	38	221.0	2106	1300
16	4916AR-125	30	68-3/4	42	22	10-1/2	24	8	18	44	258.8	2790	1350

*Dimensions for "T" option only

(1) FOR 150 PSI MODEL NUMBERS, REPLACE -125 WITH -150

(2) COALESCENCE (PALL RING) SURFACE AREA

Designed and constructed per
ASME Section VIII, Div. 1

Registered with the National Board
of Pressure Vessel Manufacturers

Standard Design Pressure and Temperature:
125 PSI @ 240°F

Optional Design Pressure and Temperature:
(150 PSI @ 240°F Option Available)

Particle removal down to 5 microns

Construction:
Carbon Steel with exterior
red oxide primer finish

304 Stainless Steel Coalescence Pall Rings

Taco 4900 units are designed to be
self-supporting in the piping system.
Factory review is necessary should
any piping loads be present.

**CAUTION: LIFTING LUGS FOR RIGGING
AND LIFTING USE ONLY, NOT FOR
ANCHORING OR HANGING.**

