PRESSURIZATION AND AIR ELIMINATION SYSTEM
TECHNICAL BULLETIN

The AMTROL pressurization and air elimination system accommodates the expanded water generated by the increase in temperature in a water heating or chilled water system. It maintains the necessary minimum operating pressure and ensures that all system air will be eliminated. It controls the increase in pressure at all critical components in the system to the maximum allowable for those components.

TANGENTIAL AIR SEPARATOR

EXTROL® EXPANSION TANK

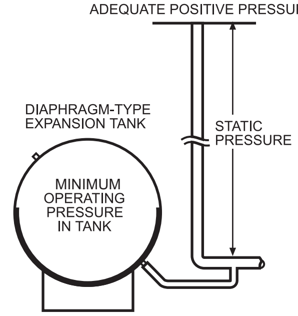
APPLICATION OF THE PRESSURIZATION AND AIR ELIMINATION SYSTEM

COMPONENTS

1. Pressurization Controller

The pressurization controller is a diaphragm or bladder-type expansion tank with a permanent sealed-in air cushion, pre-charged to the minimum operating pressure at the location in the system where it is installed.

The minimum operating pressure consists of the static pressure plus adequate positive pressure required at the top of the system to eliminate air bubbles.



STATIC PRESSURE + ADEQUATE POSITIVE PRESSURE = MINIMUM OPERATING PRESSURE IN TANK

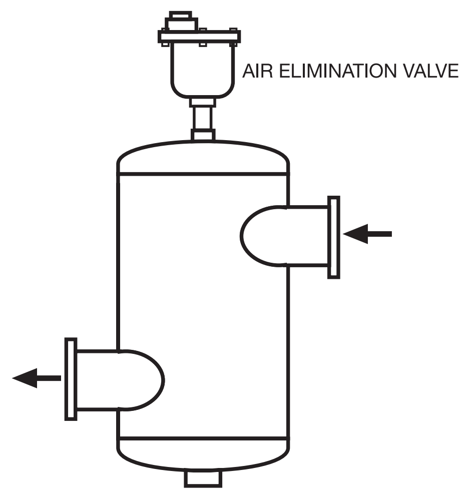
2. Air Separating and Elimination Components

Air separating and elimination components are normally installed at the point of lowest solubility of air in water, typically at a high point in the system.

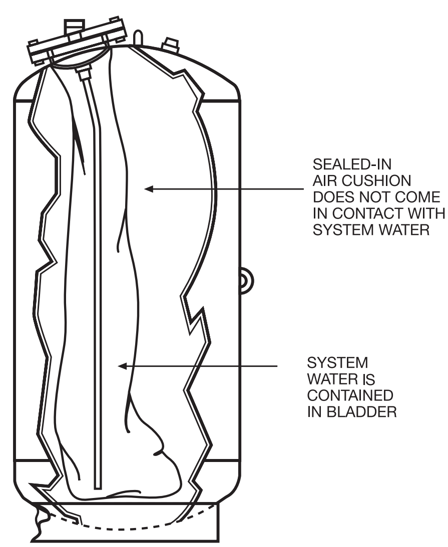
It consists of:

a. Tangential type air separator which separates entrained air from flowing system water by the creation of a vortex that allows free air bubbles to rise in the center, the point of lowest velocity, to an air collection chamber.

b. A unique, pilot-operated, air elimination valve, capable of eliminating air to the atmosphere as fast as it is separated from system water, through a full open orifice. In the closed position, the exit ports are sealed tight by the positive sealing force created by system pressure exerted upon surfaces of dissimilar areas.



TANGENTIAL TYPE AIR SEPARATOR



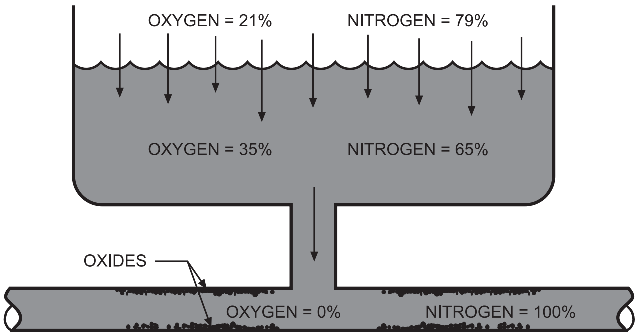
BLADDER-TYPE EXPANSION TANK

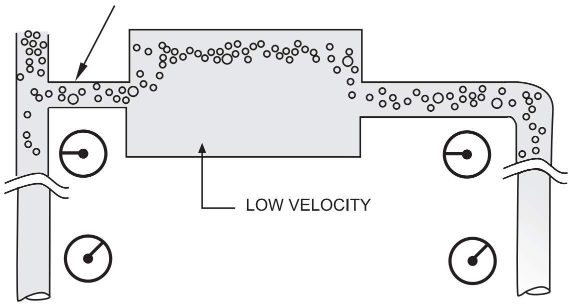
APPLICATION

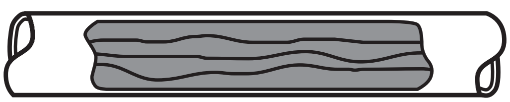
The pressurization and air elimination system is reliable, simple and saves valuable space in the building as well as labor to install.

The problem of system air can be avoided by proper system design, exercising care to ensure a reasonably leak-proof system, and by following air elimination procedures.

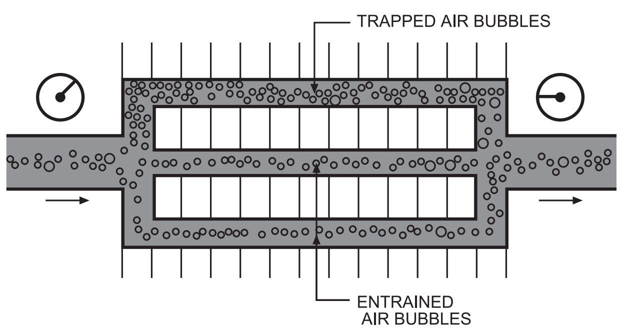
The only air in the system will be the sealed-in air cushion in the diaphragm-type or bladder-type tank protected against contact with system water. Chemical treatment to counteract potential corrosion due to oxygen is unnecessary.







AIR IN SOLUTION



SYSTEM AIR

To approach the problem of System Air, we must understand its source and its effect on the system:

1. Changes in Chemical Composition

Initially, air in the system is 79% nitrogen by volume (including a small mixture of other gases) and 21% oxygen. Oxygen is absorbed more readily than nitrogen, is carried through the system in a dissolved state (in solution), and combines with metallic surfaces to form oxides. Eventually system air consists only of nitrogen – unless more air enters the system, either in gaseous form, or in solution in make-up water.

2. Changes in Physical Form

a. Free Air Bubbles

Free air bubbles collect at the top of vertical or horizontal pipes and system components.

b. Entrained Air Bubbles

When system water flows at a velocity of 1.5 to 2 feet per second or more, the free air bubbles are not allowed to rise, but are carried through the piping system.

c. Air in Solution

Air in direct contact with water is absorbed and carried through the system in a dissolved state (in solution).

The amount of air which will be absorbed depends upon temperature and pressure. Water at higher temperature is capable of holding less air in solution. Water at lower pressures is capable of holding less air in solution.

Because pressure and temperature in a system are constantly changing, depending on location and the operating cycle, the capability of system water to hold air in solution is constantly changing.

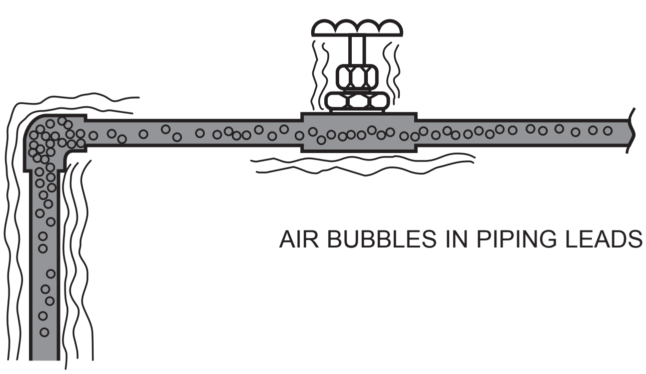
To solve the problem of system air, it is necessary to evaluate the effect of these changes.

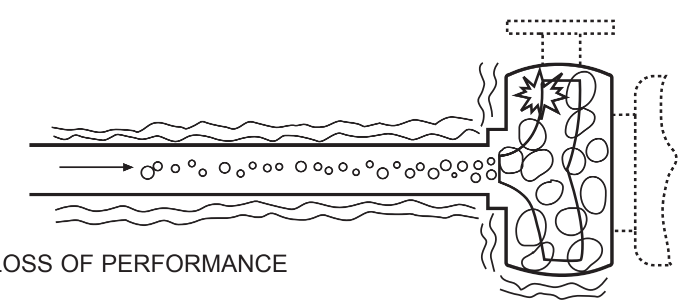
SYMPTOMS OF SYSTEM AIR

Air binding of terminal units and the accumulation of air bubbles in piping causes noise and inefficient operation.

Loss of performance in pumps and serious damage to equipment, because of corrosion, create expensive maintenance and replacement problems.

The energy wasted due to the presence of system air is substantial and seldom appreciated by maintenance personnel.



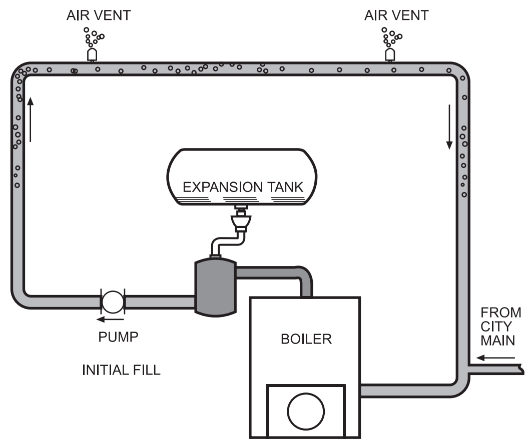


AIR BUBBLES IN PIPING LEADS TO LOSS OF PERFORMANCE

SOURCES OF SYSTEM AIR

1. **Initial Fill**

   Ideally, air should be removed at high points in the piping system and components during initial fill. However, air pockets can occur in horizontal piping. When system water velocity exceeds 1.5 to 2 feet per second, the air bubbles become entrained. Because of the increase in pressure at lower elevations in the piping, most or all of these bubbles will be absorbed and become air in solution.



2 **Make-up Water**

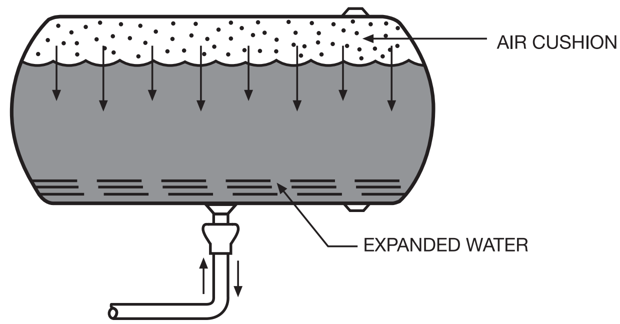
   The closed hydronic system should be a tight system with as little fresh make-up water added as possible. Any air introduced to the system with make-up water should be eliminated immediately.

3. **The Plain Steel Expansion Tank**

   The plain steel expansion tank (with no diaphragm or bladder) is a constant source of air. It is the one place in the system where water is in constant direct contact with air.

   a. In a heating system, during each operating cycle, expanded water enters the tank, absorbs air from the air cushion (at conditions of relatively high pressure and low temperature) and re-enters the system piping.

   b. In a chilled water system, the plain steel expansion tank is a prime source of air. At lower temperatures, water can hold much higher concentrations of air in solution. Air will migrate from the tank until either the system has reached its full capability to hold air in solution or until the tank is waterlogged.



FORMATION OF BUBBLES

The table, Solubility of Air in Water (enlarged on page 11), shows the maximum amount of air which can be held in solution in system water at varying pressures and temperatures. When the amount of air present in the water is equal to or less than its capability to hold air in solution, absorbed air will stay in solution. When the amount of air present is greater than its capability, bubbles of released air must form.

SOLUBILITY OF AIR IN WATER
RATIO OF ABSORBED AIR VOLUME TO WATER VOLUME
EXPRESSED AS A DECIMAL

TEMP. (t) °F	PRESSURE, PSIG												
	0	10	20	30	40	50	60	70	80	90	100	110	120
40°	0.0258	0.0435	0.0613	0.0790	0.0967	0.1144	0.1321	0.1499	0.1676	0.1853	0.2030	0.2207	0.2384
50°	0.0223	0.0376	0.0529	0.0683	0.0836	0.0989	0.1143	0.1296	0.1449	0.1603	0.1756	0.1909	0.2063
60°	0.0197	0.0333	0.0469	0.0505	0.0742	0.0878	0.1017	0.1150	0.1296	0.1423	0.1559	0.1695	0.1831
70°	0.0177	0.0300	0.0423	0.0546	0.0669	0.0792	0.0916	0.1039	0.1162	0.1285	0.1408	0.1531	0.1654
80°	0.0161	0.0274	0.0387	0.0501	0.0614	0.0727	0.0840	0.0954	0.1067	0.1180	0.1293	0.1407	0.1520
90°	0.0147	0.0253	0.0358	0.0464	0.0569	0.0674	0.0750	0.0885	0.0990	0.1090	0.1201	0.1306	0.1412
100°	0.0136	0.0235	0.0334	0.0433	0.0532	0.0631	0.0730	0.0829	0.0928	0.1027	0.1126	0.1225	0.1324
110°	0.0126	0.0220	0.0314	0.0408	0.0501	0.0595	0.0689	0.0753	0.0877	0.0971	0.1065	0.1158	0.1252
120°	0.0117	0.0206	0.0296	0.0385	0.0475	0.0564	0.0654	0.0744	0.0833	0.0923	0.1012	0.1102	0.1191
130°	0.0107	0.0193	0.0280	0.0366	0.0452	0.0538	0.0624	0.0710	0.0796	0.0882	0.0968	0.1054	0.1140
140°	0.0098	0.0182	0.0265	0.0348	0.0432	0.0515	0.0598	0.0681	0.0765	0.0848	0.0931	0.1015	0.1098
150°	0.0089	0.0170	0.0251	0.0332	0.0413	0.0494	0.0574	0.0655	0.0736	0.0817	0.0898	0.0979	0.1060
160°	0.0079	0.0158	0.0237	0.0316	0.0395	0.0474	0.0553	0.0632	0.0711	0.0790	0.0869	0.0945	0.1027
170°	0.0068	0.0145	0.0223	0.0301	0.0378	0.0456	0.0534	0.0611	0.0689	0.0767	0.0844	0.0922	0.1000
180°	0.0055	0.0132	0.0208	0.0285	0.0361	0.0438	0.0514	0.0591	0.0667	0.0744	0.0820	0.0879	0.0973
190°	0.0041	0.0116	0.0192	0.0268	0.0344	0.0420	0.0496	0.0571	0.0647	0.0723	0.0799	0.0875	0.0950
200°	0.0024	0.0099	0.0175	0.0250	0.0326	0.0401	0.0477	0.0552	0.0628	0.0703	0.0779	0.0854	0.0930
210°	0.0004	0.0080	0.0155	0.0230	0.0306	0.0381	0.0457	0.0532	0.0607	0.0683	0.0758	0.0833	0.0909

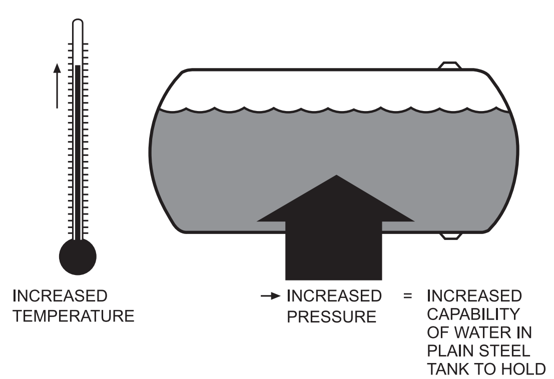
Based on derivation by Professor Ferdinand Votta, Jr.,
Department of Chemical Engineering, University of Rhode Island.

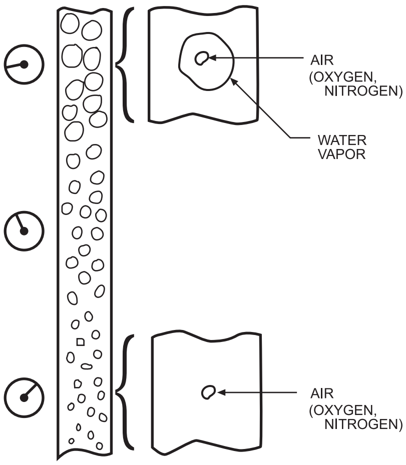
1. **The Plain Steel Tank in a Heating System**

   As system temperature increases, system pressure increases and the capability of the water in the plain steel expansion tank to hold air in solution increases. During each operating cycle, expanded water is forced into the tank, and then re-enters the system piping carrying its full capability, air in solution, absorbed from the air cushion in the tank. At higher elevations in the piping system, the decrease in static pressure will normally cause the capability to drop below the equilibrium point and bubbles will form. The bubbles will not only contain air released from solution, but water vapor. As the bubbles are carried to the top of the system, their size increases rapidly. There are three reasons for this:

   a. The law of perfect gases (Boyle-Mariott) will result in the volume of a given amount of gas increasing as the pressure decreases.

   b. As the pressure decreases, the amount of air released from solution will increase.



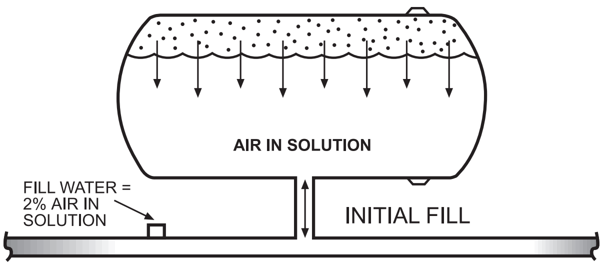


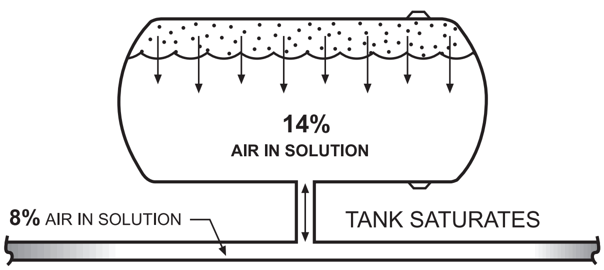
c. The amount of water vapor in the bubbles is proportional to increasing temperature, decreasing pressure and increase in bubble size. The vapor pressure is a function of the water temperature. At the top of the system, with no static pressure, the total pressure on the bubble will be much closer to the vapor pressure. As a result, the amount of water vapor in the bubble may be many times greater than the amount of air in the bubbles.

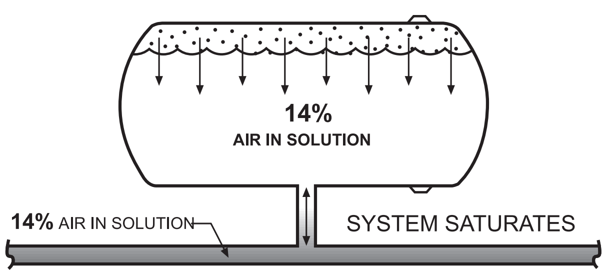
Under the most ideal conditions, we could hope that the entrained gas bubbles would be carried back down to the bottom of the system, where the air would be re-absorbed in the system water and the water vapor would condense.

Experience has proven otherwise. Pervasive problems exist – noise in the piping, accumulation of bubbles in terminal units, blockage of circuit and inefficient operation.

Temporary relief can be achieved by the use of manual air vents, or by automatic air vents. However, as air is removed from the system, water-logging of the plain steel tank is accelerated.







2. The Plain Steel Tank in the Chilled Water System

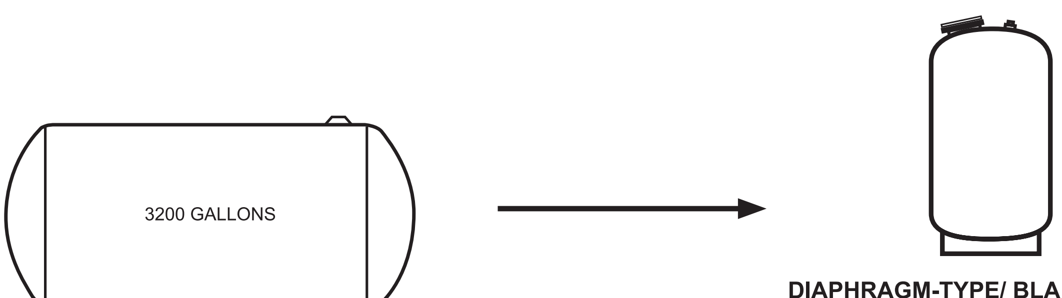
In the chilled water system, because of lower operating temperatures, system water can hold a much higher percentage of its volume, air in solution. As a result, the air charge in a plain steel tank is transferred as absorbed air in solution to system water in a relatively short period of time.

As a result, designers historically have used tank sizes much larger than necessary to accommodate the expanded water in the system, in order to postpone water-logging as long as possible.

After the tank has been re-charged with air a number of times, system water will become saturated to its full capability – carrying entrained air bubbles at the top of the system, which are re-absorbed at the bottom.

A diaphragm or bladder-type tank with a sealed-in air cushion can be sized accurately to accommodate the amount of expanded water in the system; without oversizing which is necessary only with the plain steel tank.

53 GALS.



PLAIN STEEL TANK

DIAPHRAGM-TYPE/ BLADDER TYPE
EXPANSION TANK

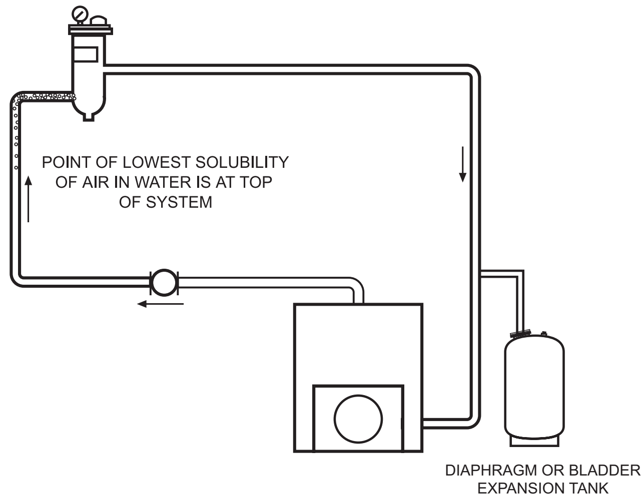
ELIMINATION OF AIR BUBBLES

The installation of a diaphragm or bladder type tank with a properly sized, sealed-in air cushion allows the designer to eliminate system air and solve the problems of bubble formation.

Air separation must be accomplished at the location in the piping system where entrained air bubbles form – the point of lowest solubility of air in water, usually at the top of the system.

An air separating and elimination component at the top of the system, will allow flowing system water to enter terminal units in a deaerated condition.

The expansion tank should be placed in the system at a location where it can best perform its function in the system – usually on the suction side of the pump at the bottom of the system.



PUMP PERFORMANCE IN A HYDRONIC SYSTEM

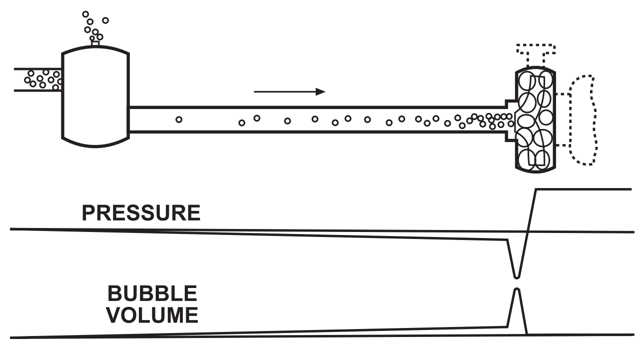
A key pump characteristic is the phenomenon of pressure reduction in the impeller eye – usually described as “required net positive suction head” (NPSH®). It is generally understood that the net positive suction head available must exceed the net positive suction head requirement of a specific pump in order that the pressure at the eye of the impeller will not be less than the vapor pressure of the water at the pumping temperature.

1. Cavitation Dynamics

Cavitation occurs when vapor bubbles form in the pump impeller. As system water flows from the eye of the impeller outward to the periphery of the pump, the regained velocity head at the impeller tip increases static pressure causing any bubbles to collapse, and implosion occurs.

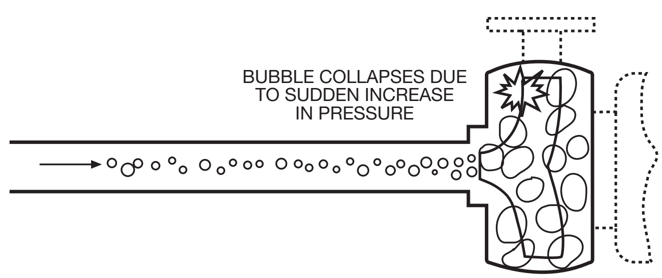
If the magnitude of the implosion is severe, particles of water are propelled with tremendous force against the surface of the impeller. The impingement of these particles can cause pitting of the surface, noise, vibration, and damage to seals and bearings.

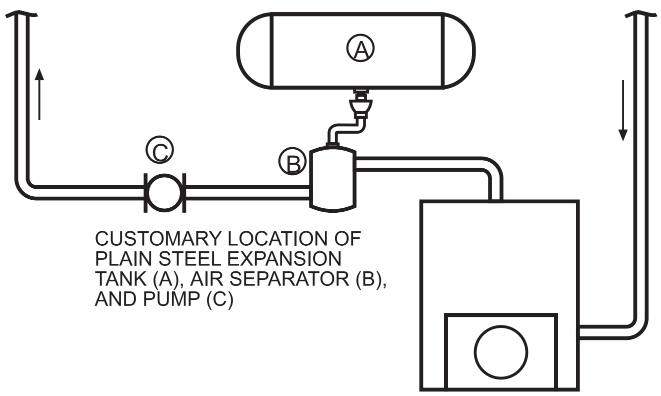
When no air in solution is present, the bubbles are pure vapor. When there is air in solution, the bubbles consist of both air and water vapor.

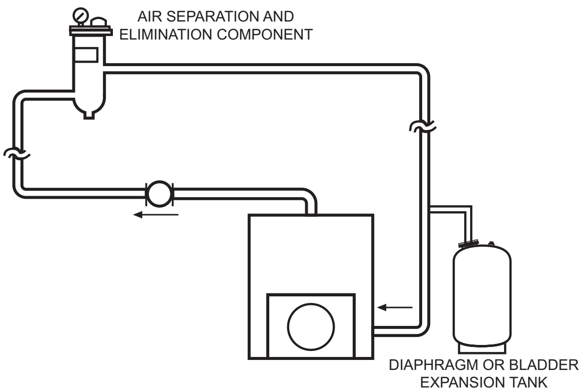


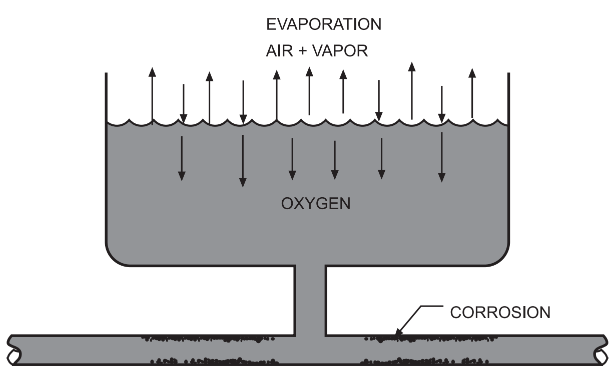
2. Formation of Air Bubbles at the Pump Interior

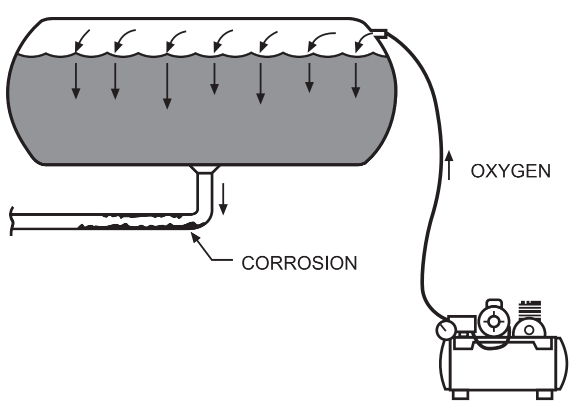
When water flowing to the pump suction is not deaerated but is at the equilibrium point, containing air in solution, bubbles will form at pressures far higher than the vapor pressure. Just as the decrease in static pressure at higher elevations in the system causes bubbles to form, the decrease in pressure which occurs as water flows to the interior of the pump causes bubbles to form. Similarly, the bubbles will not only contain air released from solution, but also water vapor, and the bubbles will grow rapidly in size as the pressure decreases.











With a plain steel expansion tank and air separation device installed at the customary location adjacent to the pump suction, it can be assumed that any time during the operating cycle that entrained air bubbles are separated, the system water entering the pump will be at the saturation point. Since bubbles form with any pressure decrease, the net positive suction pressure available should be increased to minimize the effect of these bubbles. The effects of these bubbles may be a reduction in pump performance, and in some cases a complete loss of head.

AIR ELIMINATION SOLVES THE PROBLEM

The diaphragm or bladder type tank installed at the best location for proper system operation (normally at the pump suction at the bottom of the system) combined with the air separation and elimination component installed at the best location for this device (normally at the top of the system) will allow the problem of bubble formation to be solved.

The table, Solubility of Air in Water (page 11), shows the amount of air remaining in solution in the system water after elimination has taken place. If this amount is lower than the capability of water to hold air in solution at the pressure and temperature at the eye of the pump impeller, no bubbles will form unless the actual vapor pressure is reached.

CORROSION

1. **Open System**

   The expansion tank installed at the top of the system, open to the atmosphere, is a source of continuous oxygen contamination.

   At the exposed surface of the water, oxygen is absorbed and transferred to system piping – an open system. Water vapor forms at the surface and escapes to the atmosphere. The water lost through evaporation must be replaced by make-up water carrying more oxygen.

   Dust carried in the atmosphere is accumulated in system water. Suspended solids cause erosion in piping and equipment. In spite of chemical treatment, deposits of dirt at the bottom of horizontal piping cause localized pitting.

2. **Closed Systems**

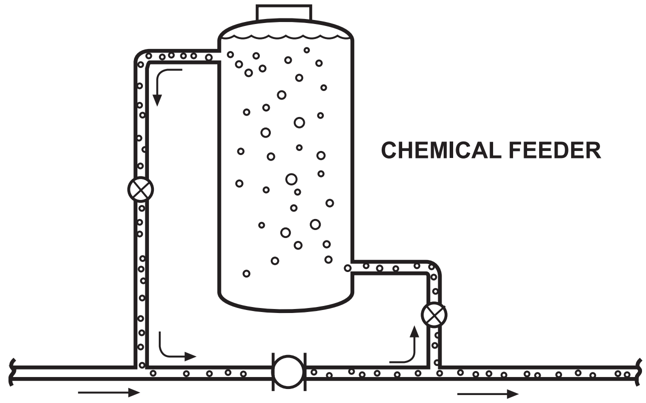
   The plain steel expansion tank (no diaphragm or bladder) contains, in theory, a trapped air cushion; and the system is referred to as a closed system. Actually, the trapped air eventually escapes into the system water and the tank becomes waterlogged – recharging with new air is necessary. The use of a compressor to maintain the air cushion has become quite common, particularly on larger jobs. In a sense, the system is no longer a closed system, but has become an open system. Oxygen is absorbed readily by water in the system and combines with metal to form oxides. An efficient oxygen pump is created.

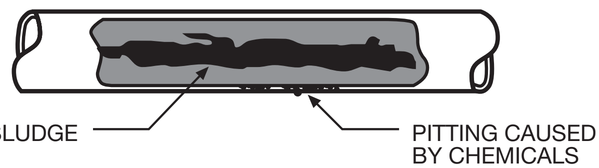
   In a chilled water system, the corrosion rate is slower than in a heating system, but because of the lower temperature, the water can hold a relatively high percentage of its volume, oxygen in solution. Eventually, all the oxygen in the system will unite with metal. Corrosion is potentially very serious in the chilled water system.

CHEMICAL TREATMENT

Because a closed system so often becomes an open system, chemical treatment has become more common. Applying chemical treatment to the problem of corrosion is, in some ways, as troublesome as the original problem.

- Too small an amount of one chemical could cause pitting.
- Excessive amounts added intermittently causes problems which could be avoided by constant feeding.
- The method of feeding the chemicals can result in more oxygen being introduced to the system.
- Standard materials used for pump seals fail when exposed to high concentrations of certain chemicals, leading to costly use of special materials.
- Accumulation of sludge causes inefficient operation. Frequent boiler blowdown is expensive.
- Continued dumping of toxic waste into public sewer systems or streams creates environmental and safety hazards.
- The technology of applying chemicals can require highly trained specialists following careful, consistent, monitoring procedures.

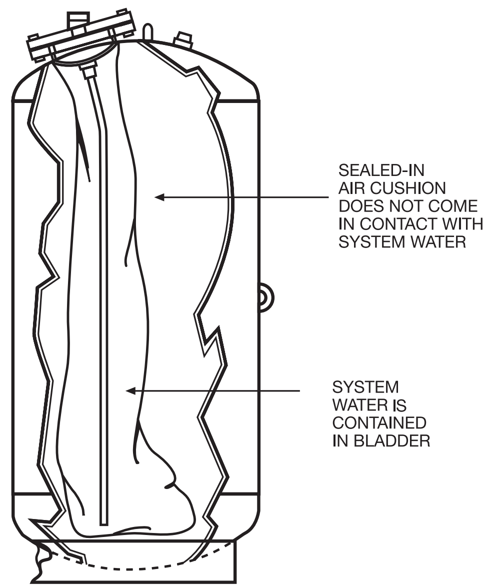




AIR ELIMINATION SOLVES THE PROBLEM OF OXYGEN CORROSION

The diaphragm or bladder type tank offers a better solution to the problem of corrosion caused by oxygen. Because the required size air cushion is permanently sealed in, all other air in the system can be eliminated. The oxygen in system water at initial fill can be eliminated before system corrosion takes place.

With reasonable care, the addition of make-up water can be minimized. No air needs to be added to re-charge a water-logged plain steel tank. The oxygen pump can be replaced. With proper pH control, except in areas with abnormal water conditions, chemicals to combat oxygen corrosion are not required.



BLADDER-TYPE EXPANSION TANK

PRESSURIZATION AND AIR ELIMINATION SYSTEM COMPONENTS

L-SERIES EXTROL

EXTROL® L-SERIES

- For use in closed hydronic non-potable water systems
- Replaceable bladder design
- Designed and constructed per ASME Section VIII, Division 1 Standards
- Free-standing on integral floor stand
- Factory pre-charged to 12 psig
- Maximum working pressure is 125 psig (8.8 kg/cm^2)
- Available with optional 175 psig (12.3 kg/cm^2) or 250 psig (17.6 kg/cm^2) for high-pressure applications (L Series)
- Maximum operating temperature is 240°F (115°C)
- Up to 1057 gallons (4000 Liters)
- Heavy-duty butyl bladder

AX-SERIES EXTROL®

EXTROL® AX-SERIES

- For use in closed hydronic non-potable water systems
- Proven diaphragm design
- Designed and constructed per ASME Section VIII, Division 1 Standards
- Vertical models are available
- Horizontal models are available with optional saddles
- Factory pre-charged to 12 psig
- Maximum working pressure is 125 psig (8.8 kg/cm^2)
- Maximum operating temperature is 240°F (115°C)
- Up to 211 gallons (800 liters)
- Heavy-duty butyl/EPDM diaphragm

AS AIR SEPARATOR

Tangential Air Separators AS, AS-L Series

- For use in non-potable water systems
- Designed and constructed per ASME Section VIII, Division 1 Standards
- Available in tangential (vortex) or In-Line (air scoop) styles
- Tangential models available with stainless steel strainer (AS) to collect unwanted system debris

INSTALLATION

The air separation and elimination package should be installed at the top of the supply risers to protect the system and on the suction side of the system pump to protect the pump.

Shut off valves should be provided to facilitate cleaning and replacement of the float and pilot assembly if necessary.

Because vapor can escape with system air and condense, good practice indicates that a line should be piped to a drain, sink or container which could be readily checked by maintenance personnel.

TYPICAL INSTALLATIONS

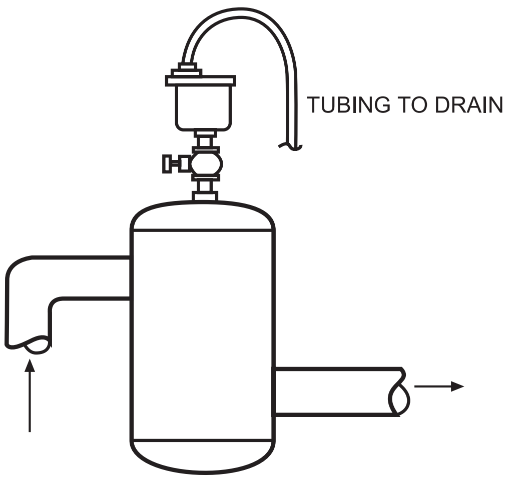


Figure 1

The air separator and air elimination valve installed at the top of the supply riser where most air bubbles will form. The valve can also be installed at the top of the return riser.

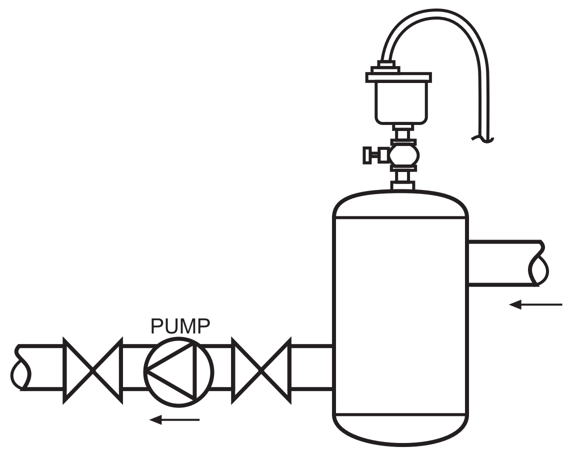


Figure 2

An air separator and air elimination valve should be installed on the suction side of the pump to prevent entrained air bubbles from causing cavitation.

SOLUBILITY OF AIR IN WATER

RATIO OF ABSORBED AIR VOLUME TO WATER VOLUME

EXPRESSED AS A DECIMAL

TEMP. (t) ˚F	PRESSURE, PSIG												
	0	10	20	30	40	50	60	70	80	90	100	110	120
40˚	0.0258	0.0435	0.0613	0.0790	0.0967	0.1144	0.1321	0.1499	0.1676	0.1853	0.2030	0.2207	0.2384
50˚	0.0223	0.0376	0.0529	0.0683	0.0836	0.0989	0.1143	0.1296	0.1449	0.1603	0.1756	0.1909	0.2063
60˚	0.0197	0.0333	0.0469	0.0505	0.0742	0.0878	0.1017	0.1150	0.1296	0.1423	0.1559	0.1695	0.1831
70˚	0.0177	0.0300	0.0423	0.0546	0.0669	0.0792	0.0916	0.1039	0.1162	0.1285	0.1408	0.1531	0.1654
80˚	0.0161	0.0274	0.0387	0.0501	0.0614	0.0727	0.0840	0.0954	0.1067	0.1180	0.1293	0.1407	0.1520
90˚	0.0147	0.0253	0.0358	0.0464	0.0569	0.0674	0.0750	0.0885	0.0990	0.1090	0.1201	0.1306	0.1412
100˚	0.0136	0.0235	0.0334	0.0433	0.0532	0.0631	0.0730	0.0829	0.0928	0.1027	0.1126	0.1225	0.1324
110˚	0.0126	0.0220	0.0314	0.0408	0.0501	0.0595	0.0689	0.0753	0.0877	0.0971	0.1065	0.1158	0.1252
120˚	0.0117	0.0206	0.0296	0.0385	0.0475	0.0564	0.0654	0.0744	0.0833	0.0923	0.1012	0.1102	0.1191
130˚	0.0107	0.0193	0.0280	0.0366	0.0452	0.0538	0.0624	0.0710	0.0796	0.0882	0.0968	0.1054	0.1140
140˚	0.0098	0.0182	0.0265	0.0348	0.0432	0.0515	0.0598	0.0681	0.0765	0.0848	0.0931	0.1015	0.1098
150˚	0.0089	0.0170	0.0251	0.0332	0.0413	0.0494	0.0574	0.0655	0.0736	0.0817	0.0898	0.0979	0.1060
160˚	0.0079	0.0158	0.0237	0.0316	0.0395	0.0474	0.0553	0.0632	0.0711	0.0790	0.0869	0.0945	0.1027
170˚	0.0068	0.0145	0.0223	0.0301	0.0378	0.0456	0.0534	0.0611	0.0689	0.0767	0.0844	0.0922	0.1000
180˚	0.0055	0.0132	0.0208	0.0285	0.0361	0.0438	0.0514	0.0591	0.0667	0.0744	0.0820	0.0879	0.0973
190˚	0.0041	0.0116	0.0192	0.0268	0.0344	0.0420	0.0496	0.0571	0.0647	0.0723	0.0799	0.0875	0.0950
200˚	0.0024	0.0099	0.0175	0.0250	0.0326	0.0401	0.0477	0.0552	0.0628	0.0703	0.0779	0.0854	0.0930
210˚	0.0004	0.0080	0.0155	0.0230	0.0306	0.0381	0.0457	0.0532	0.0607	0.0683	0.0758	0.0833	0.0909

Based on derivation by Professor Ferdinand Votta, Jr.,
Department of Chemical Engineering, University of Rhode Island.

TYPICAL SPECIFICATION PRESSURIZATION AND AIR ELIMINATION SYSTEM

COMPRISING

1. EXPANSION TANK (EXTROL® – DIAPHRAGM-TYPE OR BLADDER-TYPE PRE-PRESSURIZED):

The pressurization system shall include a diaphragm-type or bladder-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. It shall maintain minimum operating pressure necessary to eliminate all air. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type or bladder-type tank.

Model No. ____ Dimensions shall be as indicated on the drawings.

The expansion tank shall be welded steel, constructed, tested and stamped in accordance with Section VIII, Division 1 of the ASME Code for a working pressure of (125) (175) (250) (___) psig and air pre-charged.

The manufacturer shall be AMTROL Inc. The manufacturer should have at least five years experience in the fabrication of diaphragm-type/bladder-type ASME expansion tanks.

The tank shall be supported by steel legs or a base (integral ring mount) for a vertical installation or steel saddles for a horizontal installation. Each tank will have a heavy-duty butyl/EPDM diaphragm or butyl bladder.

2. AIR SEPARATOR (TANGENTIAL TYPE models AS and AS-L):

All free air originally contained in the system, and all entrained air bubbles carried by system water shall be eliminated at all system points as indicated on the drawings.

The unit shall have a removable stainless steel system strainer with 3/16” (4.8mm) diameter holes (perforations). A blowdown connection shall be provided to facilitate routine cleaning of the strainer. (Delete this paragraph if system strainer is not specified.)

The air separator shall be cast iron or welded steel, constructed, tested and stamped in accordance with Section VIII, Division 1 of the ASME Code for a working pressure of 125 or 150 psig as manufactured by AMTROL Inc.

The pressure drop through the air separator at the specified flow rate shall be as shown on the drawings.

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