xylem
Let's Solve Water

Air Management

FOR HYDRONIC HEATING AND COOLING SYSTEMS

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

TB A307C

Bell & Gossett
a xylem brand

Bell & Gossett

A Complete Line of Air Elimination Products for Commercial Heating and Cooling Applications

Every heating, cooling or dual hydronic system requires effective air management to provide maximum performance efficiency. Proper air control enhances hydronic system energy efficiency by helping reduce pipe corrosion and scaling which adds extra unnecessary friction losses. Less internal corrosion decreases maintenance costs, increasing system life, and with air removed there can be less system noise, reducing occupant complaints.

Bell & Gossett has been the hydronic systems innovator with over 100 years' experience in providing reliable products and systems design advice for hydronic, HVAC and plumbing systems. Our air management products are designed to make your system more energy efficient, trouble-free and long lasting.

A

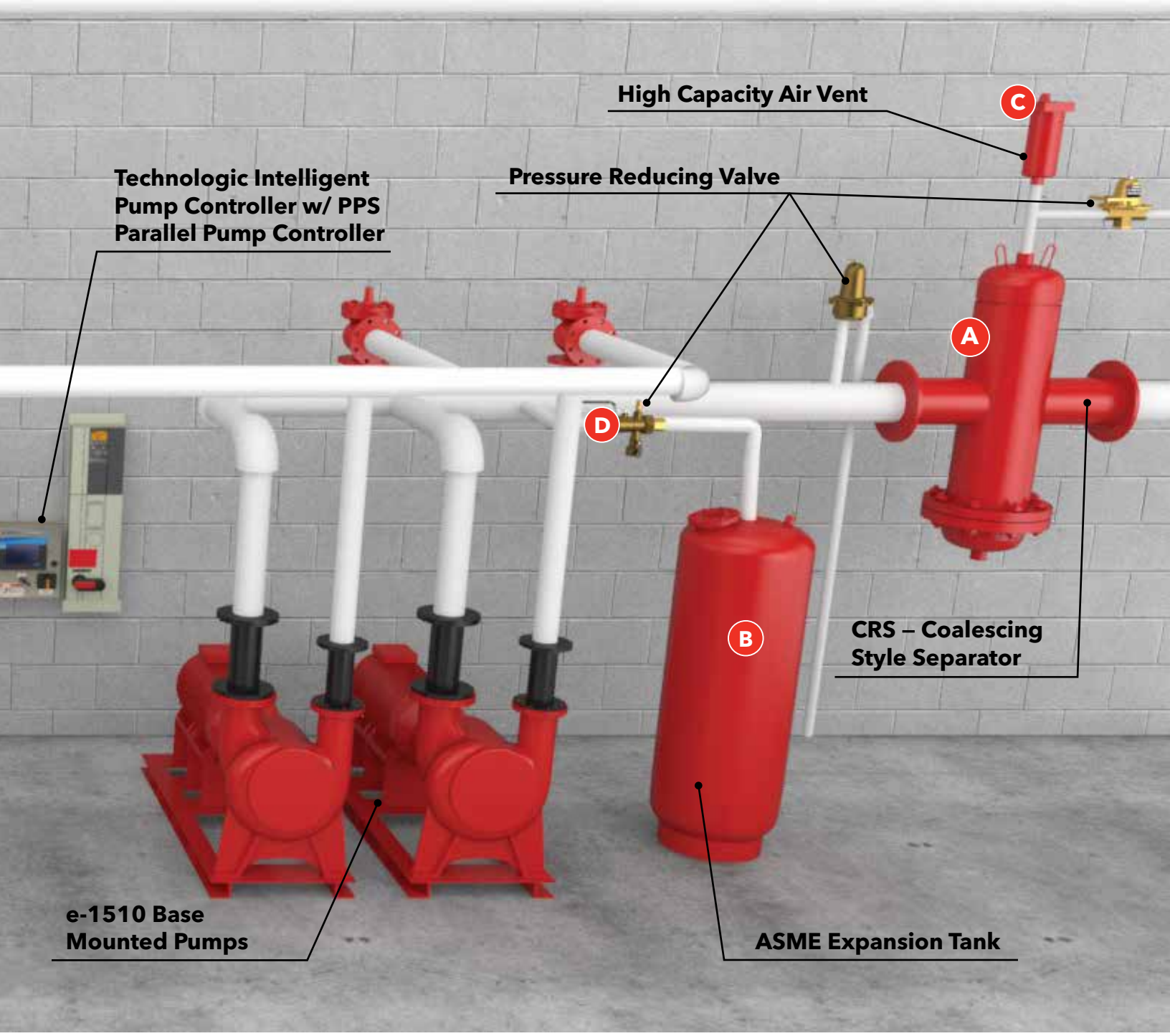
Air & Sediment Separators For Hot and Chilled Water Systems

- Remove entrained air and sediment to protect systems against damage
- Improve system operating efficiency
- Eliminate noise caused by air bubbles
- Both coalescing style (CRS) and centrifugal style (Rolairtrol & SRS) available
- Chilled water buffer tank capability

B

ASME Expansion Tanks

- Improve system performance
- Protect your system from thermal expansion
- Provide proper pressurization
- Reduce oxygen corrosion
- Provide positive air control



C

High Capacity Air Vent – Model 107A

- Float-actuated operation for the instant venting of free air
- Rugged cast iron construction with stainless steel, brass and EPDM internal components
- Positive shut-off at pressures up to 150 psig

D

TPV – Tank Purge Valve

- Combination full port shut-off valve and drain valve
- Allows for the expansion tank to be drained for easy servicing or tank replacement

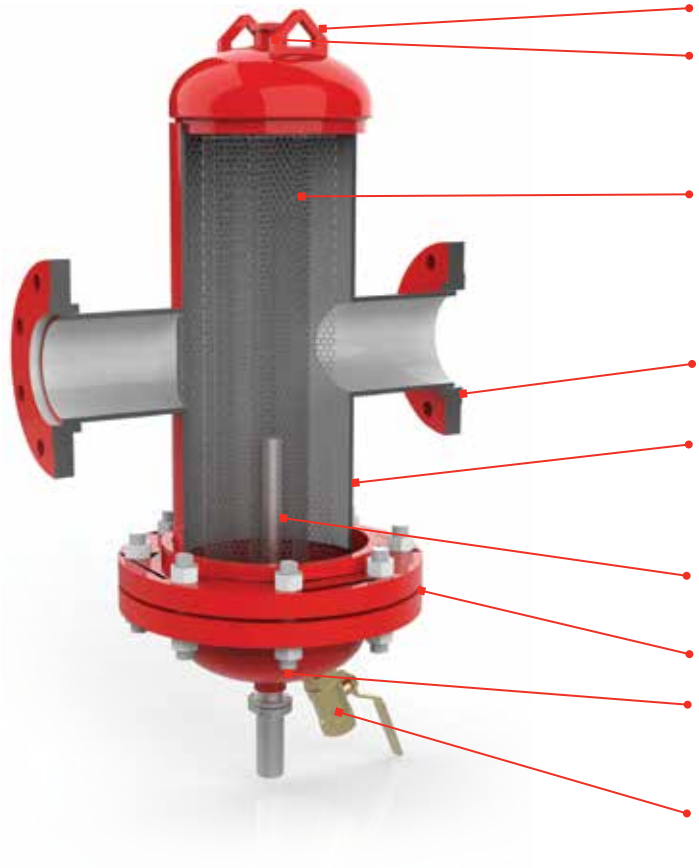
A Great Solution for Any HVAC Application

The Bell & Gossett CRS coalescing-style air and sediment separator is available for use in any HVAC system. Its internal coalescing media helps break entrained air and suspended solids out of your system fluid. The CRS efficiently removes these contaminants, therefore improving heat transfer capabilities. This results in lower energy costs while protecting pumps, boilers and other components, and extending the life of your system. With its wide variety of sizes, connections and configurations, the Bell & Gossett CRS is a great solution for any HVAC application.

Features/Benefits:

- **Improved system efficiency:**
  - Lowers energy costs and improves comfort by removing poor heat transfer media like air and sediment from system fluid
- **Removal of system impurities:**
  - Removes up to 100% of free air and 100% of entrained air from your hydronic system
  - Removes sediment to 30 µm within 100 passes
- **Prolonged system performance:**
  - Improves and extends the life of your system components
  - Withstands system operating conditions to provide long life expectancy, thanks to a robust design with stainless steel coalescing media

Built to Perform



Lifting lugs help movement and installation.

A threaded connection is provided for an optional air vent, or for connection to an expansion tank. An optional skim valve (not pictured) removes large volumes of air during system fill, and skims off floating sediment.

The CRS's internal stainless steel coalescing media (patent pending) helps to break the surface tension within the system fluid, making it easier for air to come out of the solution. Air bubbles can then rise to the top of the tank where they can either be removed with an air vent or directed to your expansion tank.

End connections are available in NPT (2-4" only), flanged and grooved, to meet all of your system connection needs.

A tank body twice as large as the inlet and outlet nozzles provides a reduction in fluid velocity, making it easier for entrained air and suspended solids to come out of the solution so they can be removed.

An optional insert with a powerful neodymium 45H magnet can offer additional protection against ferrous sediment.

A removable head is shown; a non-removable head is available.

Suspended solids sink to the bottom of the tank where system pressure helps to remove them once the blowdown valve has been opened.

A threaded connection is provided for an optional blowdown valve to remove collected solids.

The CRS is designed, constructed, inspected and stamped per Section VIII, Division 1 of the ASME Code.

Models for all applications

The CRS is available in a wide variety of models and sizes. Whether you are looking for an air separator, sediment separator, or combo separator, standard velocity or high velocity, or models with or without removable coalescing media the CRS has an option that is perfectly suited to meet your system needs.

Model Family	Description
CRS	Combo Separator, Standard Velocity, Removable Medium
CRSN	Combo Separator, Standard Velocity, Non-Removable Medium
CRS-HV	Combo Separator, High Velocity, Removable Medium
CRSN-HV	Combo Separator, High Velocity, Non-Removable Medium
CRSA	Air Separator, Standard Velocity, Non-Removable Medium
CRSA-HV	Air Separator, High Velocity, Non-Removable Medium
CRSD	Sediment Separator, Standard Velocity, Removable Medium
CRSDN	Sediment Separator, Standard Velocity, Non-Removable Medium
CRSD-HV	Sediment Separator, High Velocity, Removable Medium
CRSDN-HV	Sediment Separator, High Velocity, Non-Removable Medium

CRS Mag

For additional protection against ferrous sediment, the CRS is available with an optional magnetic insert. Comprised of neodymium 45H magnets with a strength of 13,550 Gauss, the magnetic rod helps remove metallic sediment that can pose a serious threat to modern system components. The insert can be easily moved from its position inside the separator to facilitate blow down and sediment removal.

Supreme Air Separation for Commercial Systems

The Rolairtrol is a patented air separator with significant advantages for all types of HVAC systems. It removes air that commonly causes problems in commercial hot and chilled water systems, and provides air-free flow, improving system efficiency and performance.

The Rolairtrol removes entrained air from the system fluid through time-tested centrifugal action. It provides maximum air separation efficiency through a combination of centrifugal force and velocity reduction. Unwanted air is separated by the differences in density between air and water.

Its tangential design creates a whirlpool inside the vessel, sending denser air-free water to the outer section near the shell, while the separated air migrates to the low-velocity center where it is drawn to the air collector. The separated air is removed from the system through the Hi-Capacity Air Vent in an air elimination system, or directed to the compression tank in an air control system.

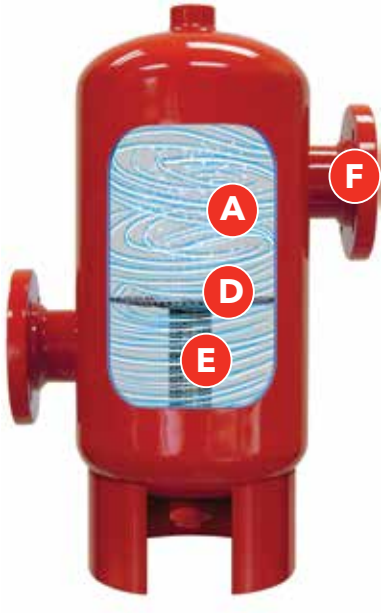
A removable strainer is standard on the "R" model, reducing the quantity of components required for installation. The strainer has a free area of not less than five times the cross sectional area of the flange connection size. All debris that is collected within the strainer can be removed from the vessel through the blowdown connection on the bottom of the vessel.

In chilled water applications the Rolairtrol acts as a buffer tank to increase the chilled water volume. The increased water volume of the Rolairtrol improves chiller water temperature control, stabilizing system operation, and reducing compressor cycling compared to chiller loops with insufficient water volume.

Patented in 1951, the Rolairtrol has been the best overall air separator in the commercial HVAC market with respect to initial cost, effectiveness, maintenance and operating cost for over 40 years.

Scales Hall, Southwestern Adventist University

Scales Hall on the campus of Southwestern Adventist University is a long, low building. Therefore its combination heating/cooling system has little static height and long pipe runs. The system often experienced pump noise and air bound circuits causing poor performance in both the heating and cooling modes. When it came time to replace the original cast iron boiler, Putnam Services searched for a better solution to control the air in the system and reduce operating costs. They installed a new boiler and selected a Bell & Gossett Rolairtrol to act as the air separator on this retrofit project. They were pleased with the results. The complaints about uneven heating and pump noise went away. The efficiency and performance of Scale Hall's hot and chilled water system both improved. "We've never had to run the boiler on full," says Jere W. Putnam, President of Putnam Services, "the 1.2 million BTU boiler only needs to be run on 800,000 BTU's and our 120-ton chiller operates at only 60 ton." The Rolairtrol proved to be the solution for getting the suspended air out of Scales Hall's chilled and hot water and providing better overall heat transfer.



Features/Benefits:

- High operating flow capacities.
- Low pressure drop, greatly reducing overall pump operation costs.
- Designed, constructed, and stamped in accordance with ASME Section VIII, Division 1.
- Patented tangential flow-through design maximizes air separation efficiency.
- Proven reliability – Rolairtrol has successfully increased system efficiencies for 40 years.
- Buffer tank ability – The Rolairtrol contributes to meeting the minimum loop volume.
- Backed by Bell & Gossett's 100+ years' experience in hydronic, HVAC and plumbing systems.

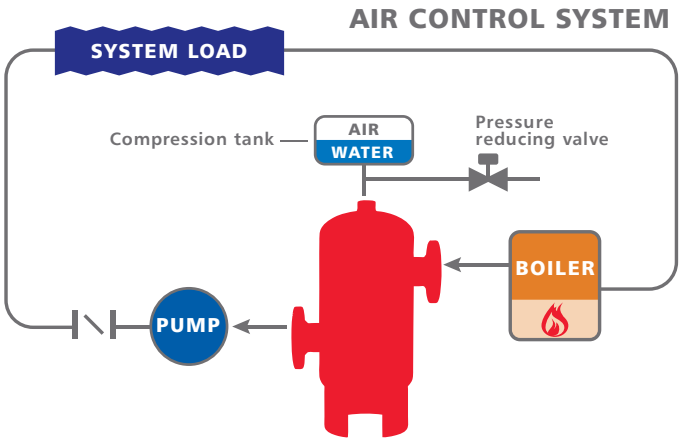
Rolairtrol Features	Rolairtrol Benefits
A Tangential Flow-Through Design	Patented B&G Design – The Rolairtrol provides maximum air separation efficiency due to a combination of centrifugal force and velocity reduction. The Rolairtrol's tangential design creates a whirlpool inside the vessel. The tangential design had the greatest air separation efficiency when compared to less effective, straight flow separators or coalescing designs.
B Designed for Typical Commercial HVAC Flow Rates	B&G sized the Rolairtrol for typical flow rates found in U.S. commercial HVAC applications. You won't need an 8" size unit for 6" piping.
C Low Pressure Drops	Compared to coalescing air separators, the Rolairtrol has much less pressure loss at the flow rates recommended with the popular coalescing designs. Extra pressure drop costs money in monthly electric bills to operate the pump. The Rolairtrol costs less to operate, and has superior multi-pass air removal efficiency.
D Baffle	The baffle assures that air-free water is transferred to the outlet connection while separated air is directed to the air collector.
E Vertical Strainer with Bottom Access	Unlike the upper, horizontal strainer location in competitive air separators, the Rolairtrol's lower, vertical strainer does not interfere with the vortex action, maximizing efficiency. In addition, the strainer is accessible from the bottom of the unit, reducing floor space while simplifying maintenance.
F NPT, Grooved and Flanged Connections	Three connection options offer installation flexibility.
G Up to 36" Pipe Size Connections	Models up to 36" in pipe diameter meet the air separation requirements in the largest HVAC systems.
H Optional B&G Manual Blowdown Valve	Simplifies installation, general maintenance and removal of start-up debris.

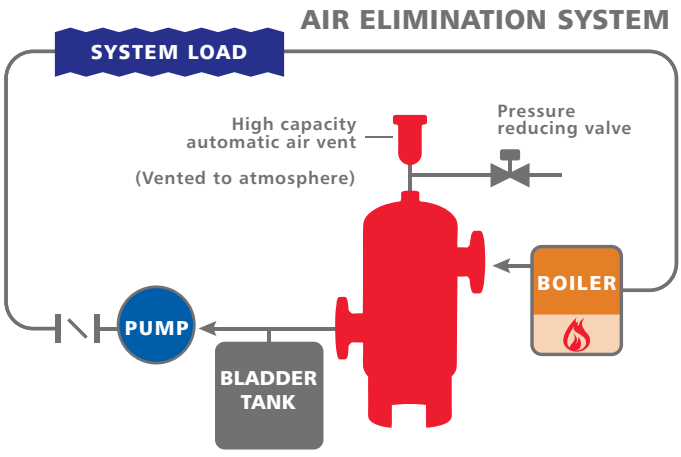
Velocity Gradient of Water in a Rolairtrol

The picture to the right illustrates the velocity change for water passing through an RL Rolairtrol. A computational fluid dynamics program, using color to depict the changes of fluid velocity and flow path within the Rolairtrol vessel, was used to create this illustration. The green color indicates the higher velocity fluid; the dark blue a low velocity fluid. The Rolairtrol uses a combination of low velocity and centrifugal action to help separate entrained air from the water. The difference in density of the two fluids forces the air toward the low velocity area in the center, where it rises to the top of the vessel and accumulates in the air collector. The air then passes through an air vent and is vented to the atmosphere or it is directed to a compression tank.

Reduced Life Cycle Costs

No doubt, when operated at manufacturer's recommendations, the pressure loss of an air separator in a hydronic system will be very low compared to the rest of the system. When the Rolairtrol is operated at the same flow rate recommended for the competitors units, not only does multi-pass efficiency increase, but operating costs are also significantly reduced. Pumping costs of a Rolairtrol can be from 50% to 25% of competitive devices. That helps make attaining green energy design guidelines easier for the designer. Considering that many competitive units are more expensive than the Rolairtrol, and that the Rolairtrol costs less to operate and has better air removal performance, the Rolairtrol just makes good sense.





The air in a closed hydronic system is managed by using one of two techniques. In the Air Control method, the air cushion and system water actually touch. During the fill and system pressurization step, all excess air is vented and the required air is stored in a compression tank where it acts as a cushion for the expansion and contraction of the system water volume. Changes in the system temperature and pressure change the solubility of air in water. The air separator constantly removes entrained air as the system air solubility falls.

In the Air Elimination method, a flexible diaphragm, or bladder, physically separates the system water and the air cushion. The entire hydronic system, piping, radiation and boiler of chiller is completely purged of air during the initial fill and any free air introduced later is separated in the air separator and vented to atmosphere.

- Tank can be mounted on the floor.
- Air cushion and system water do not touch.
- Tank smaller than standard tank for a given system.

The Science of Air Separation

In order to evaluate air management of a specific application a better understanding of how temperature and pressure affect the solubility of air in water is required. The separation of air from water is described by Henry's Law and Stokes' Law. Henry's Law describes the amount of air water can hold in solution depending on the temperature and pressure. Higher pressure or lower temperature water can absorb or hold more air in solution than water that is warmer or at lower pressure. Even the narrow temperature range of chilled water systems demonstrates the effect of temperature on solubility. Air bubbles released from fresh tap water as it rises to room temperature show how a small change in temperature will give off free air from solution.

Air is a mixture of gases, approximately 80% nitrogen, 20% oxygen and trace amounts of others. Within a short time after the initial fill, the air in a properly operating closed system begins to lose its oxygen content through oxidation. Unless fresh water is added, which contains 2% air, the gas remaining is nitrogen, an inert gas. The chart in Figure 2 illustrates the effects of pressure and temperature on the solubility of air in water. With the air out of solution, the air separator will isolate the air and move it to the air vent for air elimination, or send it to the compression tank for air management. The principles governing the design of air separators are simple. One is by reducing the water velocity to 1/2 ft/ sec or less. Water will not carry along free air bubbles at that velocity. Stokes' Law explains the separation process. Separation occurs when the buoyancy of the air particle exceeds the gravitational force and the friction force created by the system water. The Rolairtrol enhances the separation process by using centrifugal force to separate the air from the water rather than relying on gravity alone. Gravity is the only variable that can be improved in the formula. The centrifugal force created by the Rolairtrol pushes the heavier water toward the shell and the lighter air toward the air collector where it will move to the top of the Rolairtrol. This is the most efficient method of separating air in large commercial HVAC applications.

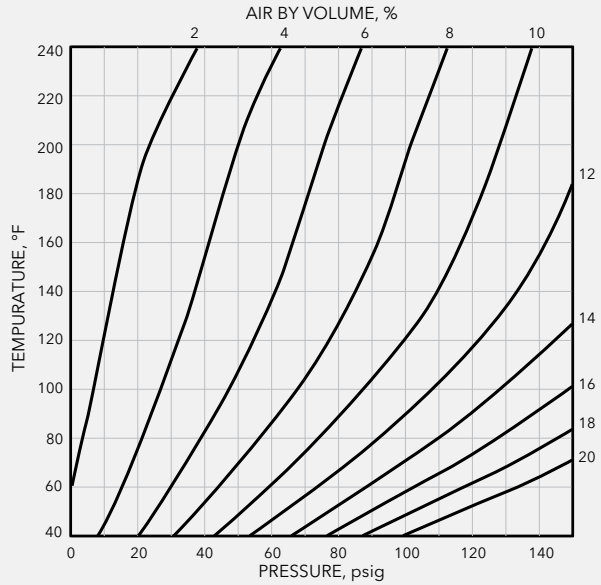


Fig. 2 Solubility Versus Temperature and Pressure for Air/Water Solutions (Coad 1980a)

Stokes' Law

$$\nu = (2gr^2)(\rho_1-\rho_2)/9\eta$$

Where:

ν = velocity of rise (cm sec^{-1}),
g = acceleration of gravity (cm sec^{-2}),
r = "equivalent" radius of particle (cm),
$\rho 1$ = density of particle (g cm^{-3}),
$\rho 2$ = density of medium (g cm^{-3}), and
η = viscosity of medium (dyne sec cm^{-2}).

Compression Tank & Airtrol Fittings

Pre-charge tanks are designed to absorb the forces of thermal expansion in hydronic heating and cooling systems. The rubber membrane completely isolates the air from the system fluid, which prevents waterlogging of the tank. The pre-charge minimizes the size of the tank.

Series B

- ASME Section VIII, Division 1 design and construction
- Heavy Duty full acceptance replaceable butyl bladder
- Sizes 10 – 3,963 gallon
- Integrated bladder integrity monitor
- Factory pre-charge to 40 PSI, adjustable in the field
- High pressure models to 250 psi available
- Seismic restraints available
- California-code sight glass available

Series D

- ASME Section VIII, Division 1 design and construction
- Economical fixed butyl diaphragm
- Sizes 8 – 211 gallon
- Integrated bladder integrity monitor
- Suitable for both vertical and horizontal installation
- Factory pre-charge to 40 PSI, adjustable in the field
- High pressure models to 250 psi available
- Seismic restraints available
- California-code sight glass available

Plain Steel Compression Tanks

The plain steel compression tank absorbs the expansion of system fluid in hydronic heating and cooling systems, and provides proper pressurization under varying operating conditions. When used with Airtrol Tank Fittings, it provides positive air control.

- ASME Section VIII, Division 1 design and constructed
- Sizes: 15 – 505 gallons
- Gauge glass tappings are standard
- High pressure models available
- Custom tanks with additional tappings and alternative materials of construction are available

Airtrol® Tank Fittings

Airtrol® Tank Fittings direct free air to the compression tank and restrict thermal circulation to the boiler. The fitting establishes initial tank air level and allows a reduction in compression tank size. An Airtrol Tank Fitting should always be used with a plain steel compression tank. Do not use with pre-charged diaphragm and bladder tanks.

In-Line Air Separator Model IAS Air Control

Bell & Gossett In-Line Air Separators are designed to effectively separate free air in hydronic heating/cooling systems. The air separators are a single piece of cast iron with an integral weir, designed to reduce system flow to maximize air separation. The IAS-1-1/2 and IAS-3 have a 3/4" NPT tapping to accept a high capacity air vent or can be piped to a plain steel compression tank. The IAS-1 and IAS-1-1/4" have a 1/8" vent tapping to accept an air vent. All models have a 1/2" NPT bottom tank connection.

Model Number	Part Number	Size NPT	Vent Tapping	Max Flow Rate (GPM)
IAS-1	112118	1"	1/8"	15
IAS-1-1/4	112119	1-1/4"	1/8"	25
IAS-1-1/2	112097	1-1/2"	3/4"	35
IAS-2	112098	2"	3/4"	50
IAS-2-1/2	112099	2-1/2"	3/4"	75
IAS-3	112100	3"	3/4"	125

Construction: One piece cast iron

Maximum operating limitations:
Working pressure: 175 psig (12.1 Bar)
Temperature: 300°F (149°C)

Model EAS Enhanced Air Separator

The Enhanced Air Separator is an efficient device designed for air separation in residential or light commercial hydronic heating or cooling systems. It differs from an air scoop because it has an internal diffuser and coalescing medium. The diffuser forces the system fluid to cover the entire inlet portion of the coalescing medium. Air bubbles, including micro air bubbles, will separate from the system fluid and adhere to the stainless steel coalescing medium. The separated air rises to the top of the separator where it is vented to the atmosphere through an automatic air vent or directed to a standard compression tank. The EAS comes ready for installation as a straight or angle-pattern pipe design.

Model Number	Part Number	Size Inches	Max Flow Rate (GPM)
EAS-1	112105	1"	35
EAS-1-1/4	112106	1-1/4"	35
EAS-1-1/2	112107	1-1/2"	45
EAS-2	112108	2"	70

Construction: Enhanced Air Separator cast iron body and cap; stainless steel internal Air Vent: brass body, nonferrous internals

Maximum operating limitations:
Working pressure: 150 psig (10.3 Bar)
Temperature: 250°F (121°C)

Turney Center Correctional Facility, TN

Although the original specification called for a Bell & Gossett product, the contractor installed a competitor's unit. Within the first year of its installation, the facility started to experience air lock and heat transfer difficulties. The original air separator device was enhanced with a coalescing medium to increase its efficiency but it just couldn't get the air out properly. The competitor's unit was taken out and it was replaced with a Bell & Gossett RL-8. The system is now operating properly with no air problems. The facility has operated without air problems for over 10 years.

Trust the name that set the standard in the HVAC industry – Bell & Gossett.

For over 100 years Bell & Gossett has brought you the most reliable and innovative products for hydronic, HVAC and plumbing systems. From pumps and heat exchangers, to air management systems and valves, Bell & Gossett knows what you need to get the job done right the first time and provide lasting value.

Your local Bell & Gossett representative is an experienced professional with a wealth of technical expertise. Because they know systems from design to operation, they can give you the advice and support you need to successfully install, operate and maintain your hydronic systems.

The Little Red Schoolhouse® – Training the Industry

Seminars currently offered are:

- Modern Hydronic System Design - Basic*
- Modern Hydronic System Design - Advanced*
- Design & Application of Water Based HVAC Systems
- Large Chilled Water System Design*
- Pump Service & Maintenance School
- Steam Systems Design & Applications
- Steam System Operation & Maintenance
- Plumbing Systems Design

Bell & Gossett has long been known for its dedication to training. The "Little Red Schoolhouse®" has graduated over 60,000 students since it was founded in 1954.

Graduates from the "Little Red Schoolhouse" may be found throughout North America, Europe, Africa, Asia and Australia.

For applications to attend these seminars, please contact a Bell & Gossett Representative in your area. They will have the schedule dates for all seminars and will make all the arrangements for you. As a service and a continuing educational source to the HVAC industry, these seminars are offered free of charge. IACET certified CEU credits are awarded for each seminar.

* The USGBC has approved the technical and instructional quality of the Modern Hydronic Heating Systems - Basic Seminar (15 GBCI CE Hours) and the Large Chilled Water Design Seminar (11 GBCI CE Hours). These courses are approved for GBCI Continuing Education Hours towards LEED Credential Maintenance Programs.

We value your feedback. Please take our 3 question survey at **bellgossett.com/survey** to let us know how we are doing.

xylem
Let's Solve Water

Xylem Inc.
8200 N. Austin Avenue
Morton Grove, Illinois 60053
Phone: (847) 966-3700
Fax: (847) 965-8379
www.xylem.com/bellgossett