

Refrigerated System Solutions

Armstrong®

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Bringing Energy Down to Earth

Say Energy. Think Environment. And Vice Versa.

Any company that is energy conscious is also environmentally conscious. Less energy consumed means less waste, fewer emissions and a healthier environment.

In short, bringing energy and environment together lowers the cost industry must pay for both. By helping companies manage energy, Armstrong products and services are helping to protect the environment.

Armstrong has been sharing know-how since we invented the energy-efficient inverted bucket steam trap in 1911. In the years since, customers' savings have proven again and again that knowledge not shared is energy wasted.

Armstrong's developments and improvements in Refrigerated Purger design and function have led to countless savings in energy, time and money. Since the original patent designs of 1940, this Handbook has grown out of our decades of sharing and expanding what we've learned. It deals with the operating principals of Refrigerated Purgers and outlines their specific applications to the refrigeration industry.

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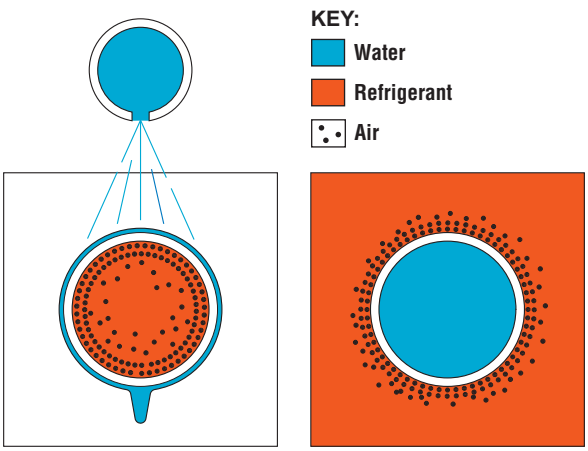
This Handbook should be utilized as a guide for the installation and operation of Refrigerated Purging equipment by experienced personnel. Competent technical assistance or advice should always accompany selection or installation. We encourage you to contact Armstrong or its local representative for complete details.

Why Purge Air From Your Refrigeration System?

In this discussion of purging and purgers, the word "Air" is intended to cover all non-condensable gases in a refrigeration system.

"Air" in the condenser will raise head pressure, mainly due to its insulating properties. Air molecules in the gas from the compressor will be blown to the quiet end of the condenser. This air accumulates on the heat transfer surfaces as shown in Fig. 3-1.

When condenser surfaces are insulated with air, the effective condenser size is reduced. This size reduction is offset by increasing the temperature and pressure of the refrigerant gas–this is an expensive luxury.



Air in tube of evaporative condenser insulates the surface.

Air surrounding tube of a horizontal shell and tube, or a vertical condenser.

Fig. 3-1. Air (black dots) keeps refrigerant gas away from the condensing surface, effectively reducing condenser size.

Air in the Condenser is Expensive.

Power Costs.
Each 4 psig (0.28 barg) of excess head pressure caused by air increases compressor power costs by 2% and reduces compressor capacity by 1%. Losses caused by reduced capacity may far exceed the extra costs for operating the compressor.

Cooling Water.
More cooling water will improve condenser performance but cooling water is expensive too!

Wear and Tear.
Excess head pressure puts more strain on bearings and drive motors. Belt life is shortened and gasket seals can fail.

High Temperature.
Increased pressure leads to increased temperature, which shortens the life of compressor valves and promotes the breakdown of lubricating oil.

Gasket Failure.
Increased head pressure increases the likelihood of premature gasket failures.

Explosions.
Some so-called "ammonia explosions" have been traced to the accumulation of non-condensable hydrogen.

How To Tell If Air Is Present.

To determine the amount of air in a refrigeration system, check the condenser pressure and temperature of the refrigerant leaving the condenser against the data in Table 14-1. If, for example your ammonia temperature is 85°F (30°C), the theoretical condenser pressure should be 151.8 psig (10.66 barg). If your gauge reads 171 psig (11.8 barg), you have 20-psi (1.3 bar) excess pressure that is increasing power costs 10% and reducing compressor capacity by 5%.

CAUTION: Air is not the only cause of excessive condenser pressure. A condenser that is too small or a condenser with fouled and scaled tubes will give excess pressure without air. Air, however is by far the most likely cause of excess condenser pressure, and the air must be purged before the head pressure can be reduced to the proper level.

Where Does Air Come From?

Air can enter any refrigeration system:

1. By leaking through condenser seals and valve packings when suction pressure is below atmospheric.
2. When the system is open for repairs, coil cleaning, equipment additions, etc.
3. When charging by refrigerant trucks.
4. When adding oil.
5. By the breakdown of refrigerant or lubricating oil.
6. From impurities in the refrigerant.

Savings: Compressor Operating Costs

Annual dollars savings per 100 tons at 6,500 hr./yr.
Power cost per kWh

Pressure Reduction PSI	$0.05	$0.06	$0.08	$0.10	$0.12
5 (.3 bar)	$670	$800	$1070	$1330	$1600
10 (.6 bar)	$1330	$1600	$2130	$2660	$3200
15 (1 bar)	$2000	$2400	$3200	$4000	$4800
20 (1.3 bar)	$2660	$3200	$4260	$5330	$6390

Table 3-2. Shows the (U.S. Dollars) savings in compressor operating costs achieved by using a Refrigerated Purger to reduce excess high-side pressure.

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How To Purge Your System Of Air

Manual Purging

Manual purging is too expensive and too troublesome except for very small systems. It does not take a large percentage of air to cause a noticeable increase in high-side pressure. Manual purging at the condenser or receiver will discharge much more refrigerant than air into the atmosphere. Worse yet, as the air is purged from the system, even larger quantities of refrigerant must be wasted to get rid of the remaining air. Besides wasting refrigerant, manual purging:

- Takes a lot of valuable time.
- Does not totally eliminate air.
- Permits escape of refrigerant gas that may be dangerous and disagreeable to people and the environment, and may also be illegal.
- Is easily neglected until the presence of air in the system causes problems.

Refrigerated Purging

Table 4-1 illustrates the principles of refrigerated purging and why it is needed. Table 4-1 is based on an ammonia system. In lines 1–4, the temperature is held constant while the amount of air varies. Note how the total pressure (the "high-side" pressure) rises–Column E and F.

Even when there is enough air to significantly raise the high-side pressure, the gas mixture is still mostly refrigerant–Column I and J. (See Condenser in Fig. 4-1.)

In lines 5–10, the total pressure is held constant. As the purger is chilled, the refrigerant pressure drops. The balance of the pressure is due to the air, so this means that the concentration of air inside the purger is increasing. (See Purger in Fig. 4-1.)

Line 2 represents a moderately low amount of air in the system, but achieving this condition by manual blow-down means that 28 pounds of ammonia is lost for every pound of air removed. By keeping the same total pressure as line 2, but cooling the gas to 0°F (-17.8˚C) as shown in line 8, only 0.13 pound of ammonia is lost when purging a pound of air. This means the refrigerated purge is 215 times as more efficient.

Similar gains will be seen with an R-134a system (Table 4-2). Note, however, that obtaining low weight ratios of refrigerant gas to air may require lower temperatures than for the ammonia system.

The pressures and required purger temperatures will vary with other refrigerants, but the principles are still the same.

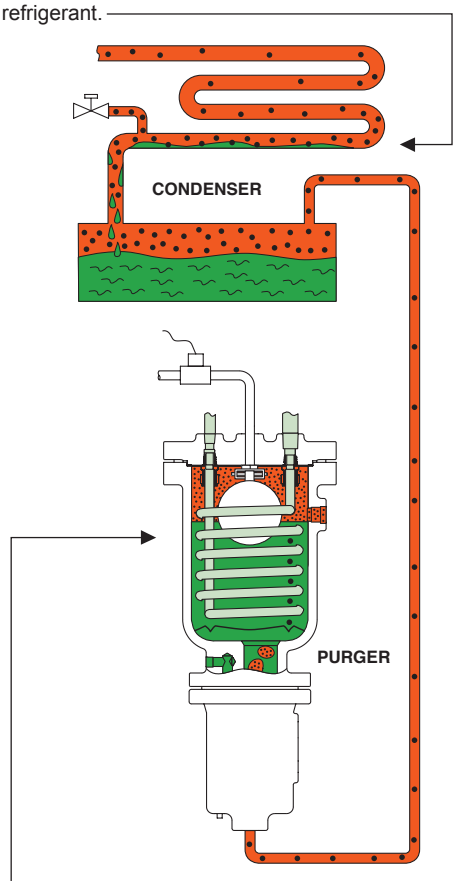
Table 4-1: Refrigerated purging with an ammonia system

Line	Temperature °F	Temperature °C	Refrig. Press. psia	Air Press. psia	Total pressure psia	Total pressure bar (a)	Refrig. Density lb/ft³	Air Density lb/ft³	Weight Ratio Gas/air	Volume Ratio Gas/air
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
	Keeping the temperature (Cols. A and B) constant as we vary the amount of air (Col. D), note the effect on total pressure (Cols. E and F) and on the ratios of refrigerant gas to air (Cols. I and J):									
1	85	29.4	166.5	1.0	167.5	11.55	0.556	0.005	112	167
2	85	29.4	166.5	4.0	170.5	11.76	0.556	0.020	28	42
3	85	29.4	166.5	8.0	174.5	12.03	0.556	0.040	14.0	20.8
4	85	29.4	166.5	16.0	182.5	12.59	0.556	0.079	7.0	10.4
	Now, holding total pressure (Cols. E and F) constant, we reduce the temperature (Cols. A and B). This reduces the refrigerant pressure (Col. C) and allows the air pressure (Col. D) to increase, dramatically reducing the ratios of refrigerant gas to air (Cols. I and J):									
5	85	29.4	166.5	4.0	170.5	11.76	0.556	0.020	28	42
6	50	10.0	89.2	81.3	170.5	11.76	0.304	0.430	0.71	1.10
7	10	-12.2	38.5	132.0	170.5	11.76	0.137	0.758	0.18	0.29
8	0	-17.8	30.4	140.1	170.5	11.76	0.110	0.822	0.13	0.22
9	-10	-23.3	23.7	146.8	170.5	11.76	0.087	0.881	0.099	0.16
10	-20	-28.9	18.3	152.2	170.5	11.76	0.068	0.934	0.073	0.120

Table 4-2: Refrigerated purging with a R-134a system

Line	Temperature °F	Temperature °C	Refrig. Press. psia	Air Press. psia	Total pressure psia	Total pressure bar (a)	Refrig. Density lb/ft³	Air Density lb/ft³	Weight Ratio Gas/air	Volume Ratio Gas/air
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
	Keeping the temperature (Cols. A and B) constant as we vary the amount of air (Col. D), note the effect on total pressure (Cols. E and F) and on the ratios of refrigerant gas to air (Cols. I and J):									
1	80	26.7	101.4	1.0	102.4	7.06	2.121	0.005	424	101
2	80	26.7	101.4	4.0	105.4	7.27	2.121	0.020	106	25
3	80	26.7	101.4	8.0	109.4	7.54	2.121	0.040	53	12.7
4	80	26.7	101.4	16.0	117.4	8.09	2.121	0.080	27	6.3
	Now, holding total pressure (Cols. E and F) constant, we reduce the temperature (Cols. A and B). This reduces the refrigerant pressure (Col. C) and allows the air pressure (Col. D) to increase, dramatically reducing the ratios of refrigerant gas to air (Cols. I and J):									
5	80	26.7	101.4	4.0	105.4	7.27	2.121	0.020	106	25
6	50	10.0	60.1	45.3	105.4	7.27	1.262	0.240	5.27	1.33
7	20	-6.7	33.1	72.3	105.4	7.27	0.709	0.406	1.74	0.46
8	0	-17.8	21.2	84.2	105.4	7.27	0.463	0.494	0.94	0.25
9	-20	-28.9	12.9	92.5	105.4	7.27	0.290	0.567	0.51	0.14
10	-40	-40.0	7.4	97.9	105.4	7.27	0.173	0.630	0.27	0.076

"Foul gas"–refrigerant vapor contaminated with air. "Blowing down" at this point wastes large amounts of refrigerant.



When the foul gas is subcooled, most of the refrigerant gas condenses, leaving a high concentration of air.

Fig. 4-1. Refrigerated Purging.

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Where To Make Purge Connections

A refrigerated purger is a device that will separate air from refrigerant gas in a purge stream. **Therefore, purge point connections must be at places where air will collect.**

Refrigerant gas enters a condenser at high velocity. By the time the gas reaches the far (and cool) end of the condenser, its velocity is practically zero. This is where the air accumulates and where the purge point connection should be made. Similarly, the purge point connection at the receiver should be made at a point furthest from the liquid inlet.

Purge point connection locations shown in Figures 5-1 through 5-5 are based on thousands of successful purger installations. In these drawings, the long arrows show high velocity gas. Arrow length decreases as gas velocity decreases approaching the low velocity zone. Air accumulation is shown by the black dots.

Be prepared to purge from both the condensers and the receivers. Air will migrate from the condenser to receiver and back again depending on the load and plant conditions.

Air will remain in the condensers when the receiver liquid temperature is higher than condenser liquid temperature. This can happen when:

1. The receiver is in a warm place.
2. Cooling water temperature is falling.
3. Refrigerating load is decreasing.

Conversely, air will migrate to the receiver when the condenser liquid temperature is higher than the receiver temperature. This can happen when:

1. The receiver is in a cold place.
2. The cooling water temperature is rising.
3. The refrigeration load is increasing.

Purge Connections For Condensers

In these drawings, long arrows show high gas velocity. Arrow lengths decrease as gas velocity decreases approaching the no-velocity zone. Air accumulation is shown by black dots.

Evaporative Condenser

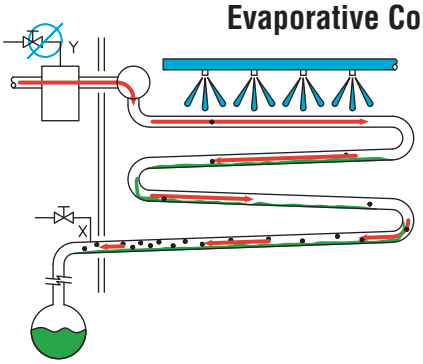


Fig. 5-1. (Left) High velocity of entering refrigerant gas prevents any significant air accumulation upstream from point X. High velocity past point X is impossible because receiver pressure is substantially the same as pressure at point X. **Purge from point X.** Do not try to purge from point Y at the top of the oil separator because no air can accumulate here when the compressor is running.

Vertical Shell and Tube Condenser

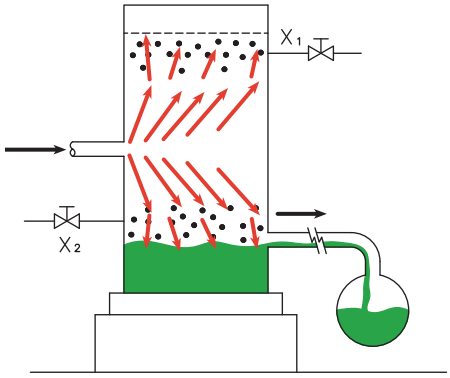


Fig. 5-4. Low gas velocity will exist at both top and bottom of the condenser. Purge connections desirable at both X_1 and X_2.

Horizontal Shell and Tube Condensers

Side Inlet Type

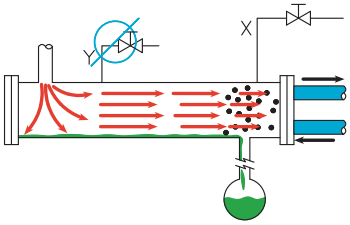


Fig. 5-2. Incoming gas carries air molecules to far end of the condenser near the cooling water inlet as shown. **Purge from point X.** If purge connection is at Y, air will not reach the connection until the condenser is more than half full of air.

Center Inlet Type

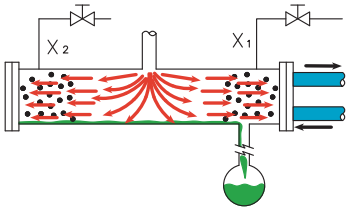


Fig. 5-3. Incoming refrigerant blows air to each end of the condenser. Air at the left hand end can't buck the flow of incoming gas to escape through the right hand connection at X_1. **Provide a purge connection** at each end but never purge from both ends at the same time.

Purge Connection for Receiver

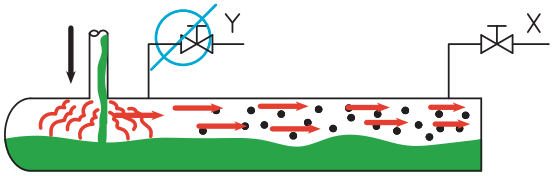


Fig. 5-5. Purge from Point X farthest away from liquid inlet. "Cloud" of pure gas at inlet will keep air away from point Y.

How The Armstrong Purger Removes Air From Refrigerant Gas

(Refrigeration coil needed to chill liquid and condense refrigerant gas.)

KEY: Liquid Refrigerant | Refrigerant Gas | Air in Refrigerant | Boiling Refrigerant | Chilled Compressed Air | Water

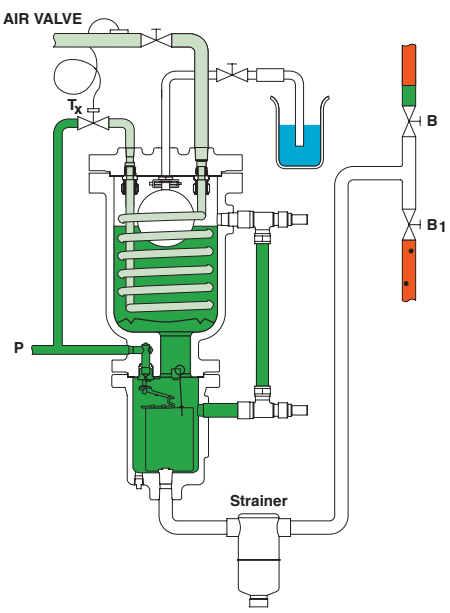


Figure 6-1. Priming the Purger
The purger is primed (filled with liquid) through P. At the same time liquid flows through T_X to cool the purger. The ball float senses when the body is full and filling stops.

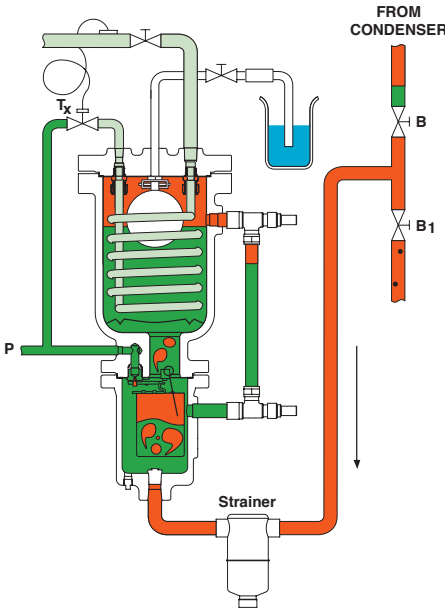


Figure 6-2. Opening Purge Point
When the purger is chilled, allow foul gas to enter the bottom of the purger. Be sure to purge from one purge point at a time only.

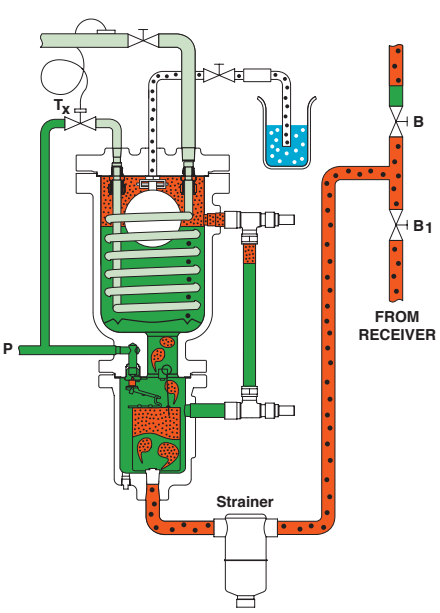


Figure 6-3. Gas and Air Removal
The sub-cooled liquid will condense refrigerant gas. Non-condensables will accumulate at the top of the purger to be vented to atmosphere.

Characteristics Of Armstrong Purgers

Armstrong offers three configurations:

- **Mechanical Purger:** The mechanical version XR-1500 incorporates an air vent and inverted bucket mechanisms for non-electric operations.
- **Electric Single Point Purger:** This style of Armstrong Purger XR-1501 incorporates an inverted bucket mechanism and an electronic float switch assembly rather than the air vent mechanism utilized in the mechanical version The electronic float switch serves two functions:
  1. To tell the controller if there is a pocket of air at the top of the purger;
  2. To tell the controller the temperature of the refrigerant inside the body.

These two functions ensure that the purger is not discharging non-condensable gases at a temperature **too** high for efficient and cost effective purging.

- **Multi-Point Purger:** The completely automatic electronic XR-1502 Multi-Point Purger utilizes a float switch to tell the PLC what is happening in the purger body. Depending on the refrigerant level in the purger body, the PLC will activate the appropriate solenoid valve to maintain the liquid level inside the purger body. There is no need to have the inverted bucket mechanism. The PLC control operates the purge point solenoid valves and allows for totally unmanned, automatic control of the purging system.

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How The Armstrong Purger Fits Into A Refrigeration System

KEY: Liquid Refrigerant | Refrigerant Gas | Air | Water

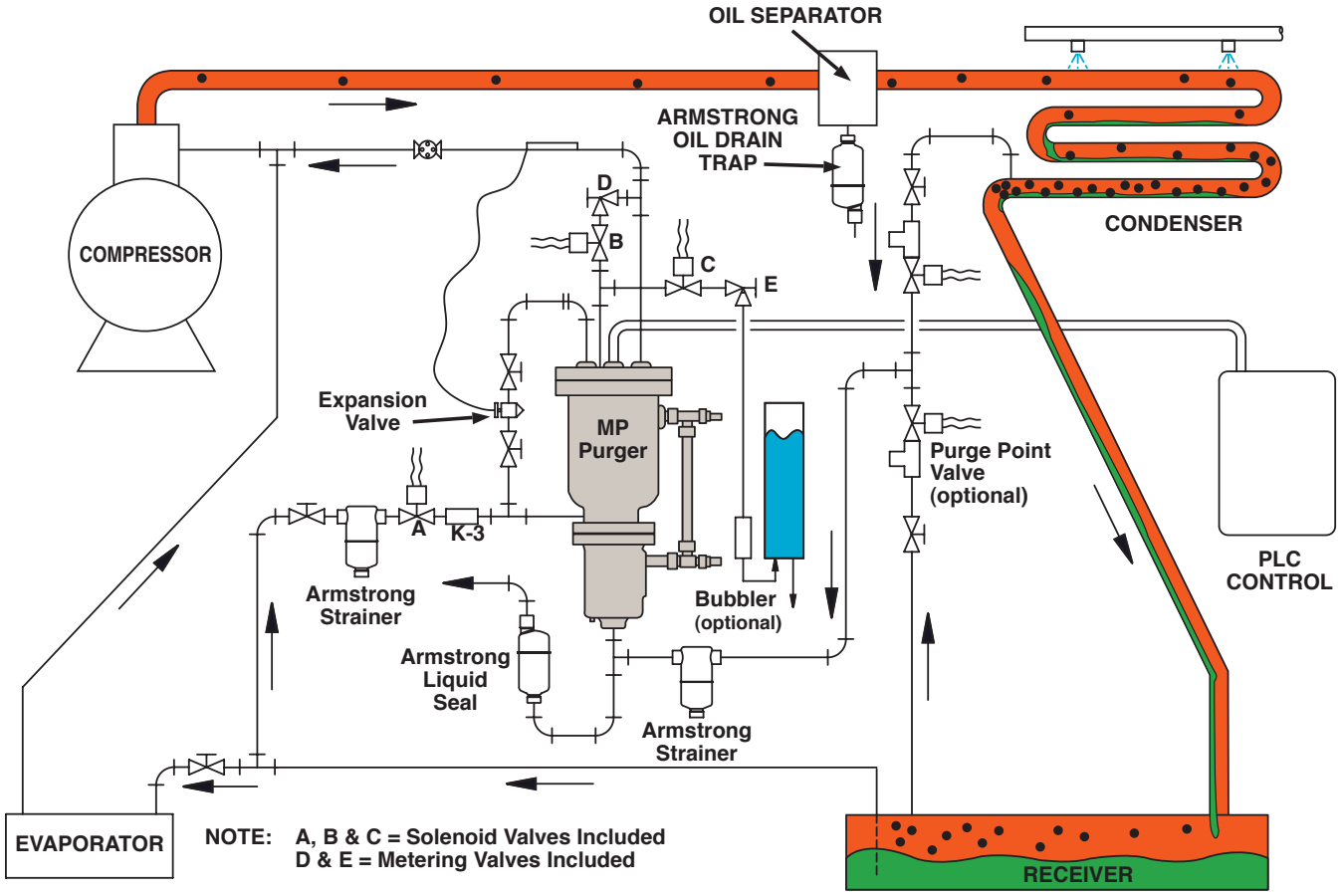


Figure 7-1 Refrigeration System

How the Armstrong Multi-Point purger fits into a refrigeration system.

The Multi-Point Purger can handle from 1 to 34 purge points in a single refrigeration system. The mechanical purger and the Electronic Single Point purger also fit into the system in the same manner. The mechanical purger does not facilitate the use of solenoid valves A, B or C and does not use automatic purge point solenoid valves. These valves would be of the manual variety.

The Electronic Single Point control does not have the ability to operate solenoid valves A and B, it can operate only purge solenoid valve C. If the system in question has more than one purge point, then a Multi-Point purger should be used for maximum efficiency. **If more than 18 purge points are in the system, then, for the most efficient system operation, two Multi-Point Purgers should be considered.**

Which Purging Method To Use?

Single Point Purging

Purging several points at the same time would result in flow of air from only the purge point at the highest pressure, even though such differences of pressure are very slight. There would be no flow of air from the other purge points and the concentration of air would continue to increase in these components. With that in mind, it is only feasible and economical to purge from a single point at a time.

Without an automatic system, each purge point valve must be opened and then closed independent of the others manually. This can mean that some purge points do not get purged until it is convenient for the maintenance personnel to get there.

For smaller systems with only one purge point, this is not a concern. For larger systems, this can cause delays in air removal, which leads to decreased system efficiency.

Multi-Point Purging

With multiple condensers, receivers, etc., it is difficult to determine the exact location of air. Condenser piping design, component arrangement and operation affects the location of air concentrations.

Seasonal weather changes may have an added effect on the location of the air. In summer, the air may be driven to the cooler, higher-pressure receivers located inside the building. In winter, the opposite may be true. The air may migrate to the cooler outdoor condensers, especially during off cycles. Therefore it is important to purge regularly and frequently each purge point in the system, one at a time, to ensure that all the air is removed from every possible location.

There are two common ways to automatically purge multiple points. A clock timer controller being one way and the other being a PLC system.

Auto-Adaptive™ Multi-Point Purging

The Armstrong Multi-Point Purger automatically adapts the sampling frequency of individual purge points based on that particular points historical need for purging.

The Auto-Adaptive™ PLC controlled purge system accomplishes this by remembering how long each purge point has purged. The sequence of purging each point is based on that data. The first point purged on subsequent cycles is the point that historically required the most purging time on the last cycle. Because of its unique learning capability, it is not necessary to set or even seasonally adjust timers to accomplish high efficiency purging. A smaller purger can now effectively purge a much larger system.

Which Purger Piping Method To Use?

The Armstrong series of purgers may be piped for use in either HIGH DIFFERENTIAL or LOW DIFFERENTIAL systems. The Armstrong purgers may also be used in systems where one refrigerant is used to cool another refrigerant or gas.

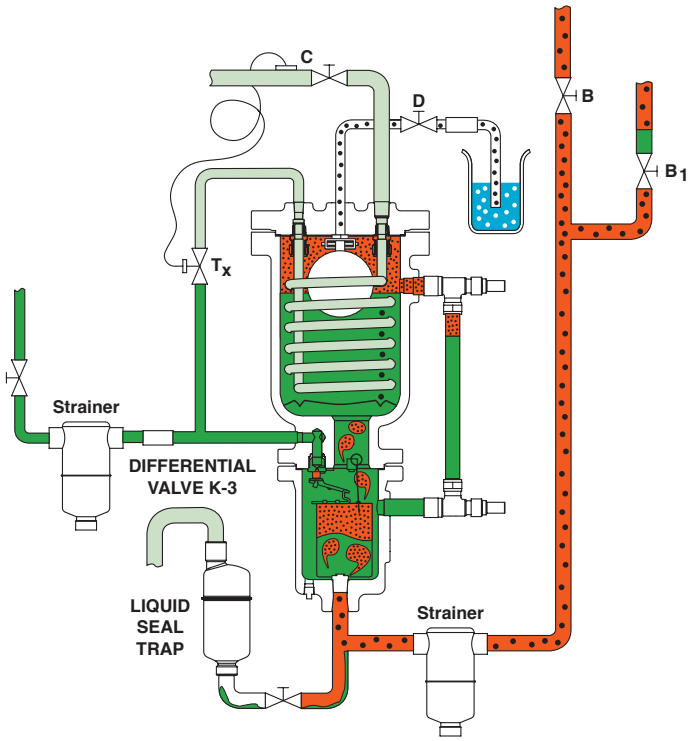
Low Differential

A LOW DIFFERENTIAL system is one in which the purger is installed at the same level or above the receiver. In this case, a standard K-3 valve supplied with a purger package or separately by Armstrong is sufficient to create the differential to have the proper flow into the purger, see **Piping Method 1.** This is the most common occurrence. The liquid seal trap, shown on the foul gas inlet side of the purger, is recommended to remove any refrigerant liquid condensed in the purge point lines coming from the condensers. Having the Armstrong liquid seal trap in this location ensures that only foul gas (non-condensable gas mixed with refrigerant gas) gets into the purger, thus, purging can happen faster.

Piping Method 1

Low differential hook-up for continuous purging where purge lines may condense enough refrigerant gas to create a liquid seal.

Fig. 8-1. A trap for the purge gas line may be needed to avoid a liquid seal in the purge gas line when purger is hooked up for full time purging. (Mechanical purger shown.)



Which Purger Piping Method To Use?

High Differential

A HIGH DIFFERENTIAL system is one in which the purger can not be installed above the liquid level in the receiver. This would be the case in systems that have the receiver and condenser on the roof and the purger installed in the compressor room below. In these cases, there needs to be differential pressure regulator (noted on Fig. 9-1 as DPR) used on the liquid inlet side of the purger. The regulator needs to be set so that any "excess head pressure" from the height difference of the receiver being above the purger is eliminated before the liquid enters the side of the purger or the expansion valve, see **Piping Method 2.** The differential pressure regulator takes the place of the K-3 valve in **Piping Method 1** and is the difference in these two piping arrangements.

Piping Method 2

High differential hook-up for continuous purging with thermostatic control when condenser and receiver are high above the purger.

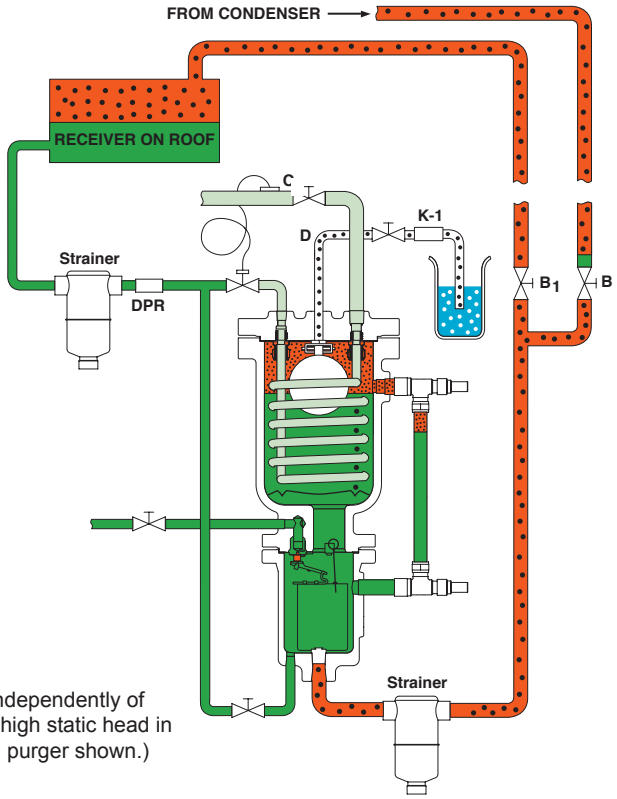


Fig. 9-1. Hook-up to refrigerate coil independently of purger liquid discharge to overcome high static head in liquid refrigerant supply. (Mechanical purger shown.)

Two Gas Systems

For TWO GAS SYSTEMS that want to utilize the lower temperature of another refrigerant system (X) to sub-cool the refrigerant or gas (Y), utilize **Piping Method 3.** This piping method can be utilized for situations with only one refrigerant system. For example, R-12 has been used as the cooling medium in the coil of the purger to remove air from vinyl chloride gas. When a gas requiring purification is expensive or noxious, refrigerated purging will give maximum air removal with minimal gas loss and minimal air pollution. This is a modification of the previous piping methods as two systems now are completely independent of each other.

Piping Method 3

Hook-up where one refrigerant chills the coil of a purger used to remove air from a second, separate system.

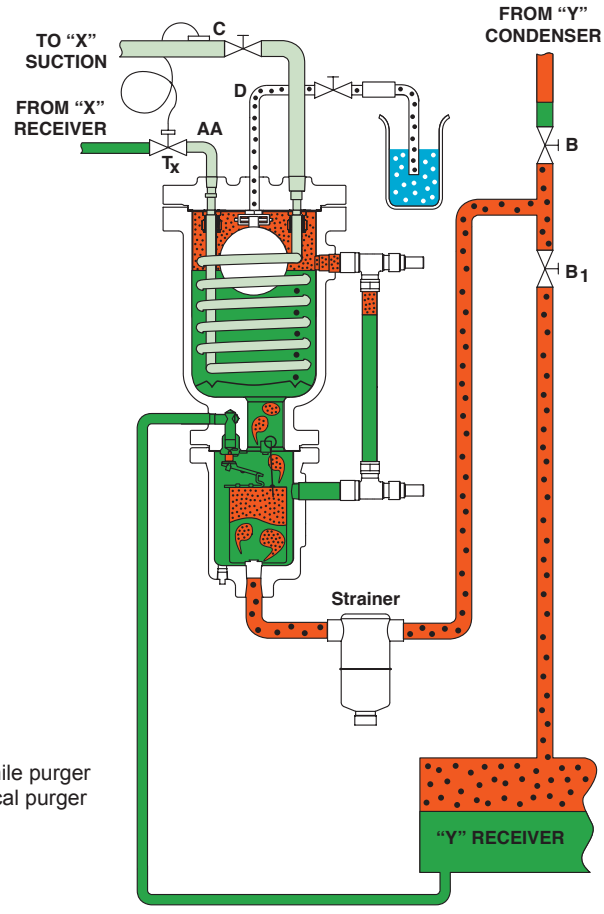
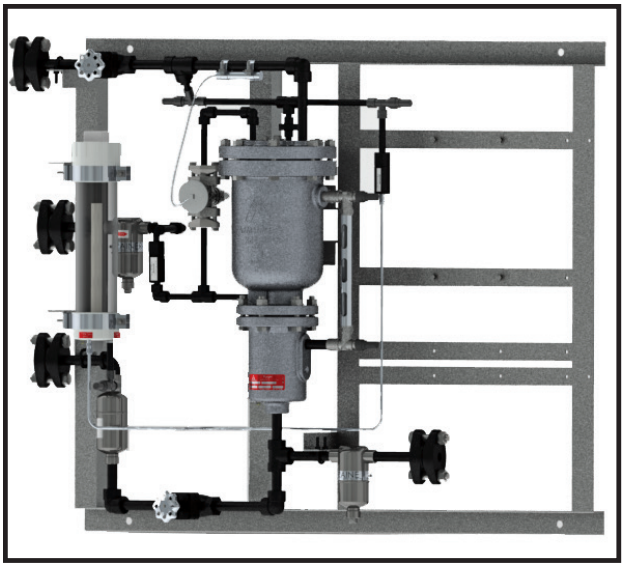


Fig. 9-2. Coil is chilled by refrigerant "X" while purger removes air from refrigerant "Y." (Mechanical purger shown.)

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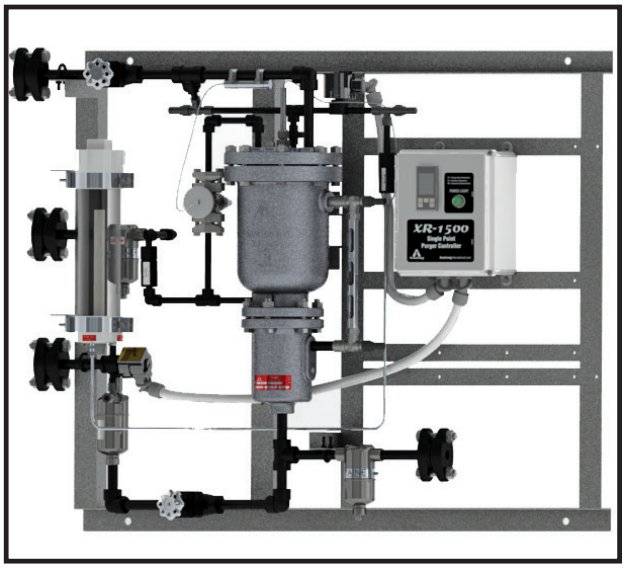
Armstrong Purgers And Options

Mechanical Purgers (XR-1500)



Mechanical Purgers have been around since their invention and patent in 1940 by Armstrong. They are designed to remove non-condensable gases from refrigeration systems by the density difference between the liquid refrigerant and gasses. As the name implies, its operation is mechanical, no automation, no electronic controls. This style of purger requires an operator to open and close valves in order to start and stop the purging operation in a refrigeration system. The mechanical purger has been used successfully in many refrigeration systems and for many refrigerants over the decades since its invention. Today, the mechanical purger is used primarily in applications where there is no electricity at the point of use or in hazardous applications where electric components are not allowed. Mechanical purgers are available as a single unit that must have the piping assembled at the point of use, or, as a completely packaged unit that only needs to be mounted and minimal connections made. The standard mechanical purger is **cast stainless steel.** (Ref IB-75)

Electronic Single Point (XR-1501)



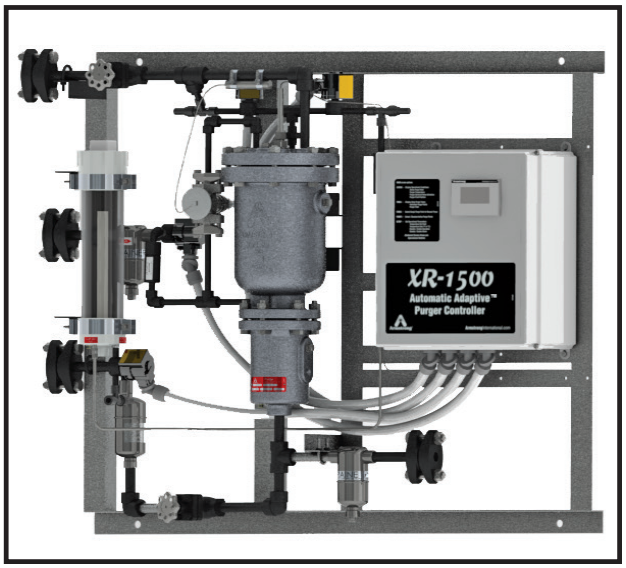
Electronic Single Point Purgers are designed for the systems that have one point to be purged. These can be skid-mounted packaged refrigeration units, ice rink systems and the like. The Electronic Single Point purger has a float switch assembly that reads the liquid level and the temperature inside the purger body. The controller can operate the purge solenoid valve and a water flush solenoid. For the electronic purgers to make a purge to atmosphere there are two conditions that must be met beforehand. First, there must be a pocket of air in the purger body. The air is detected by sensors in the float stem that are liquid level dependent. The second condition is the liquid temperature inside the purger. This temperature must be below the programmed set point. The temperature inside the purger will run close to the suction side temperature of the system. The set temperature of the controller is adjustable and should be set 5-7°F above the suction temperature. This will ensure that non-condensable gasses are purged at the lowest temperature possible, unlike a pre-set discharge temperature in some purge units. As with all Armstrong purgers, the XR-1501 models are available ready-to-pipe or can be pre-piped on a frame for easy installation. This single point control can also be purchased in a retrofit kit to upgrade older Armstrong mechanical purgers. (Ref IB-77)

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Auto-Adaptive™ Multi-Point (XR-1502)

Multi-Point Purgers are designed for systems that have as many as 34 points to be purged. The Multi-Point purger has an operation similar to the XR-1501 due to a similar float switch. The PLC control has the advantage over other purgers due to the ability to start and stop itself. The PLC control operates all operational solenoids for the purger along with up to 34 purge point solenoid valves. This gives the advantage over clock timers in the fact that the controller can "learn" as it cycles through the system. As the purger accumulates air and purges, the controller records and prioritizes each purge point in its memory. The next time through the purge points, the **Auto-Adaptive™** controller opens the points in the order in which the most air was found on the previous cycle. This leads to the most efficient purge operation possible. As with all Armstrong purgers, the XR-1502 series is available ready-to-pipe or can be pre-piped on a frame for easy installation. This **Auto-Adaptive™** purge system can also be purchased in a retrofit kit to upgrade older Armstrong purgers. (Ref IB-73)



Specification for XR-1502 Series

The purge unit shall be capable of removing non-condensables from an industrial refrigeration system over a wide range of system pressures and temperatures. The controller shall be a pre-programmed PLC that will automatically start-up, shut-down and alarm the system when necessary. This program shall include a real time refrigerant "LOSS" calculator. The PLC will record purge times and number of purges for each purge point as well as totals for the **Auto-Adaptive™** control system. Programming the controller or turning on or off any purge point shall be done through a touch screen monitor.

The controller shall be **Auto-Adaptive™** which allows the purge sequence to learn where to find the non-condensables in a system that shall have up to 34 purge point capability. The **Auto-Adaptive™** algorithm will direct the operation and sequencing of each purge point based on the historical need for purging. Purge point sequence may not be numerically sequential. This unique electronic learning capability replaces the need for seasonally adjusting timers to accomplish high efficiency purging of any size system.

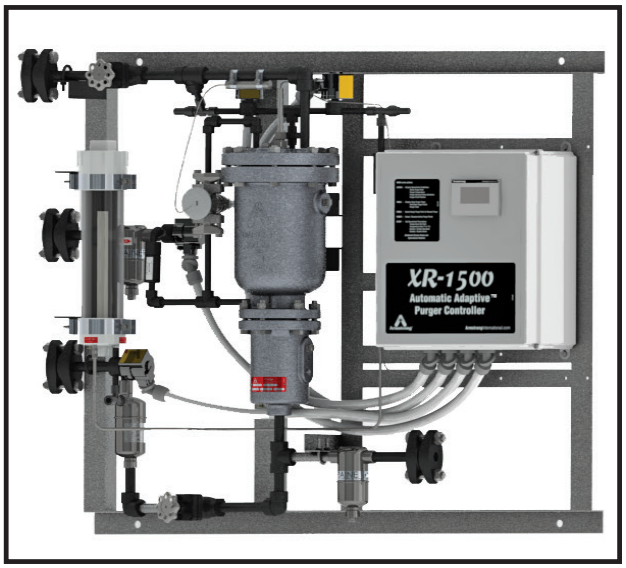
The purge unit shall be frame-mounted, pre-piped and pre-wired with a NEMA 4 enclosure for the controller. The purger shall be Armstrong International.

The following are recommended selection considerations for Armstrong Purgers.

XR-1500 Series is primarily used for hazardous gases or locations where electricity is not an option.

XR-1501 Series is primarily used on packaged refrigeration systems or systems that only have one or two purge points.

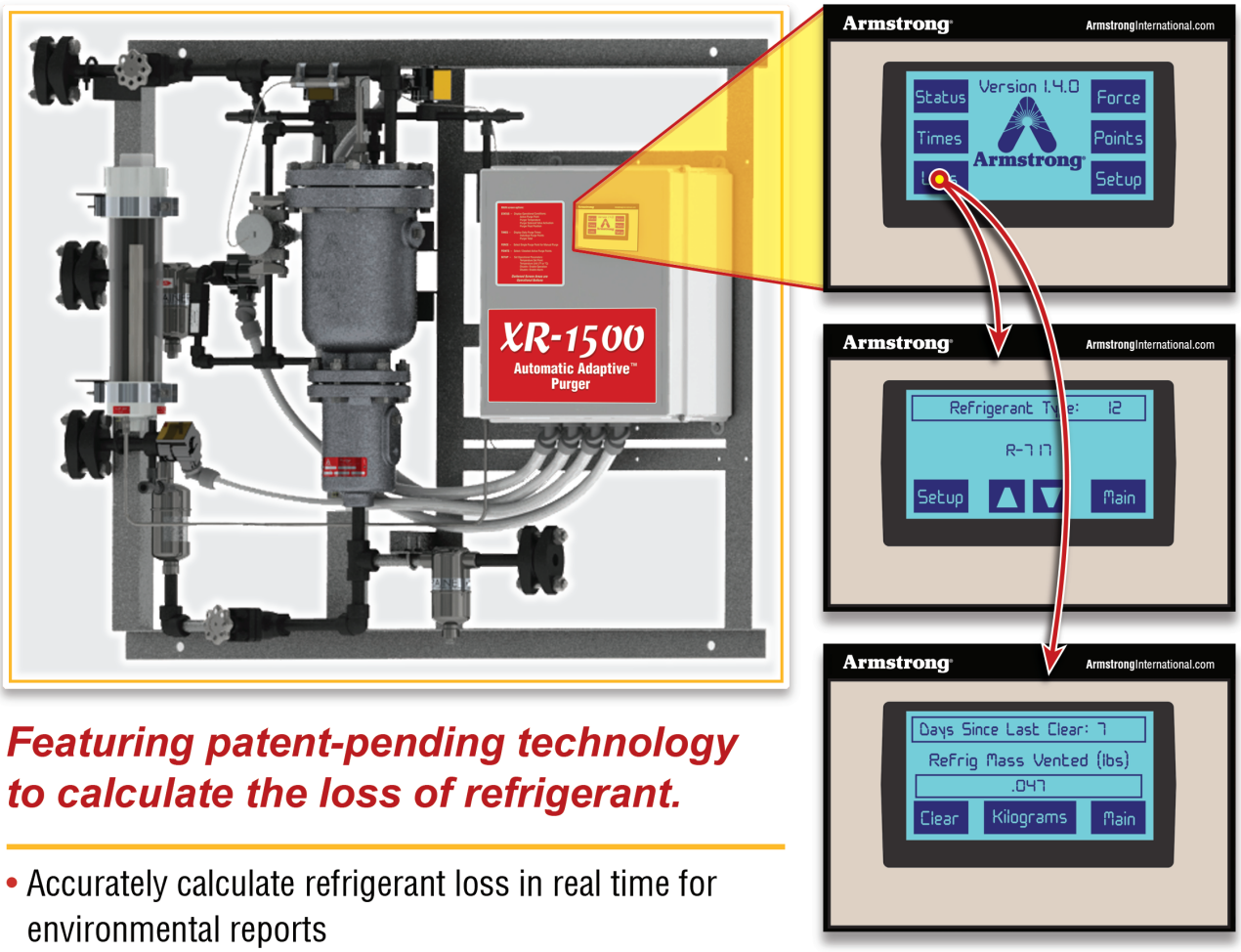
XR-1502 Series is used in systems with as few as one purge point and as many as 34 purge points. This system has total automatic operation and includes a real time refrigerant "LOSS" calculator.



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Refrigerant Loss Calculator

XR-1500 Series Purgers



Featuring patent-pending technology to calculate the loss of refrigerant.

- Accurately calculate refrigerant loss in real time for environmental reports
- Ability to select type of refrigerant
- Information is specific to selected refrigerant
- Data retrieval from touch screen monitor or via Ethernet connection

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Armstrong Purgers And Options

XR-1500 Mechanical Purger includes:

1 Purger

1 Glass Gauge Set

Optional:

- Vortex Bubbler
- Packaged Purger



XR-1501 Single Point Purger includes:

1 Purger

1 Electric Purge Controller

NEMA 4 Enclosure

1 Solenoid Valve

1 Metering Valve

Optional:

- Vortex Bubbler
- Packaged Purger



XR-1502 MultiPoint Purger includes:

1 Electronic PLC Controller

NEMA 4 Enclosure

3 Solenoid Valves (A, B, C)

2 Metering Valves (D, E)

Auto-Adaptive™ Controller

Optional:

- Purge Point Valves
- Vortex Bubbler
- Packaged Purger



Armstrong Purgers And Options

370XR01 Purger Retrofit Package includes:

1 Electric Purge Controller
NEMA 4 Enclosure
1 Cap, Coil & Float Assembly
1 Solenoid Valve
1 Metering Valve
1 Cap Gasket

Optional:

- Vortex Bubbler



370XR02, 10, 18, 26, 34 Multi-Point Purger Retrofit Package includes:

1 PLC Purger Controller
NEMA 4 Enclosure
1 Cap, Coil & Float Assembly
3 Solenoid Valves (A, B, C)
2 Metering Valves (D, E)
2 Gaskets (Cap & Body)
Auto-Adaptive™ Controller

Optional:

- Purge Point Valves
- Vortex Bubbler



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Temperature-Pressure Charts

Table 15-1: Fahrenheit Pressure Chart

Vacuum: Inches of mercury - **Bold figures**

Positive Pressures: Pounds per square inch (gauge) - Black regular figures

Temp. °F	REFRIGERANT					
	Ammonia R-717	R-22	R-134a	R-502	Propane R-290	Propylene R-1270
-50	**14.3**	**6.1**	**18.7**	**0.2**	**4.3**	1.5
-45	**11.7**	**2.7**	**16.9**	1.9	**0.9**	3.6
-40	**8.8**	0.6	**14.8**	4.1	1.4	5.9
-35	**5.4**	2.6	**12.5**	6.5	3.4	8.4
-30	**1.6**	4.9	**9.9**	9.2	5.6	11.1
-25	1.3	7.4	**6.9**	12.1	8.1	14.1
-20	3.6	10.2	**3.7**	15.3	10.7	17.4
-15	6.2	13.2	**0.1**	18.8	13.6	20.9
-10	9.0	16.5	1.9	22.6	16.7	24.7
-5	12.2	20.1	4.1	26.7	20.0	28.8
0	15.7	24.0	6.5	31.1	23.7	33.2
5	19.6	28.3	9.1	35.9	27.6	38.0
10	23.8	32.8	11.9	41.0	31.8	43.1
15	28.4	37.8	15.0	46.5	36.3	48.6
20	33.5	43.1	18.4	52.5	41.1	54.4
25	39.0	48.8	22.1	58.8	46.3	60.6
30	45.0	55.0	26.1	65.6	51.8	67.3
35	51.6	61.5	30.4	72.8	57.7	74.4
40	58.6	68.6	35.0	80.5	63.9	81.9
45	66.3	76.1	40.0	88.7	70.6	89.8
50	74.5	84.1	45.4	97.4	77.6	98.3
55	83.4	92.6	51.2	106.6	85.1	107.2
60	92.9	101.7	57.4	116.4	93.0	116.7
65	103.2	111.3	64.0	126.7	101.4	126.7
70	114.1	121.5	71.1	137.6	110.2	137.2
75	125.9	132.3	78.6	149.1	119.5	148.3
80	138.4	143.7	86.7	161.2	129.3	159.9
85	151.8	155.8	95.2	174.0	139.6	172.2
90	166.0	168.5	104.3	187.4	150.5	185.1
95	181.2	181.9	113.9	201.4	161.9	198.6
100	197.3	196.0	124.1	216.2	173.9	212.8
105	214.4	210.8	134.9	231.7	186.4	227.7
110	232.5	226.4	146.4	247.9	199.6	243.2
115	251.6	242.8	158.4	264.9	213.4	259.5
120	271.9	260.0	171.1	282.7	227.8	276.5
125	293.3	278.0	184.6	301.4	242.9	294.2
130	315.8	296.9	198.7	320.8	258.6	312.7
135	339.6	316.7	213.6	341.2	275.1	332.0
140	364.6	337.4	229.2	362.6	292.3	352.3
145	391.0	359.0	245.6	385.0	310.2	373.6
150	418.7	381.6	262.9	408.4	328.9	396.2

Ref.: ASHRAE 2013 Fundamentals Handbook

Table 15-2: Celcius Pressure Chart

All pressures: bar (gauge)

Temp. °C	REFRIGERANT					
	Ammonia R-717	R-22	R-134a	R-502	Propane R-290	Propylene R-1270
-46	-0.50	-0.22	-0.64	-0.03	-0.15	0.08
-44	-0.44	-0.14	-0.59	0.07	-0.07	0.18
-42	-0.37	-0.06	-0.55	0.17	0.01	0.29
-40	-0.30	0.04	-0.50	0.28	0.10	0.41
-38	-0.22	0.14	-0.44	0.40	0.20	0.53
-36	-0.13	0.25	-0.38	0.53	0.30	0.66
-34	-0.03	0.37	-0.31	0.67	0.42	0.80
-32	0.07	0.49	-0.24	0.81	0.54	0.95
-30	0.18	0.63	-0.17	0.97	0.66	1.11
-28	0.30	0.77	-0.09	1.13	0.80	1.28
-26	0.43	0.92	0.00	1.31	0.94	1.46
-24	0.57	1.08	0.10	1.49	1.10	1.64
-22	0.73	1.26	0.20	1.69	1.26	1.84
-20	0.89	1.44	0.31	1.90	1.43	2.05
-18	1.06	1.63	0.43	2.12	1.61	2.27
-16	1.25	1.84	0.56	2.35	1.80	2.51
-14	1.45	2.06	0.69	2.60	2.00	2.75
-12	1.67	2.29	0.84	2.86	2.22	3.01
-10	1.89	2.54	0.99	3.13	2.44	3.28
-8	2.14	2.79	1.16	3.42	2.67	3.57
-6	2.40	3.06	1.33	3.72	2.92	3.86
-4	2.68	3.35	1.51	4.04	3.18	4.18
-2	2.97	3.65	1.71	4.37	3.45	4.50
0	3.28	3.97	1.91	4.72	3.73	4.85
2	3.61	4.30	2.13	5.08	4.03	5.20
4	3.96	4.65	2.36	5.47	4.34	5.58
6	4.33	5.01	2.61	5.86	4.66	5.97
8	4.72	5.40	2.86	6.28	5.00	6.37
10	5.14	5.80	3.13	6.72	5.35	6.80
12	5.57	6.22	3.42	7.17	5.72	7.24
14	6.03	6.66	3.71	7.64	6.10	7.70
16	6.52	7.11	4.03	8.14	6.50	8.17
18	7.03	7.59	4.36	8.65	6.92	8.67
20	7.56	8.09	4.70	9.18	7.35	9.19
22	8.12	8.61	5.06	9.74	7.80	9.72
24	8.71	9.15	5.44	10.31	8.27	10.28
26	9.33	9.72	5.84	10.91	8.75	10.85
28	9.98	10.30	6.25	11.53	9.25	11.45
30	10.66	10.91	6.69	12.18	9.78	12.07
32	11.37	11.54	7.14	12.84	10.32	12.71
34	12.11	12.20	7.61	13.53	10.88	13.38
36	12.89	12.89	8.10	14.25	11.46	14.06
38	13.70	13.59	8.62	14.99	12.06	14.77
40	14.54	14.33	9.15	15.76	12.68	15.51
44	16.34	15.88	10.29	17.37	13.99	17.05
48	18.29	17.54	11.51	19.09	15.38	18.70
52	20.40	19.32	12.84	20.94	16.87	20.46
56	22.68	21.23	14.27	22.90	18.46	22.33
60	25.14	23.26	15.80	25.00	20.15	24.31
64	27.79	25.43	17.45	27.25	21.94	26.42

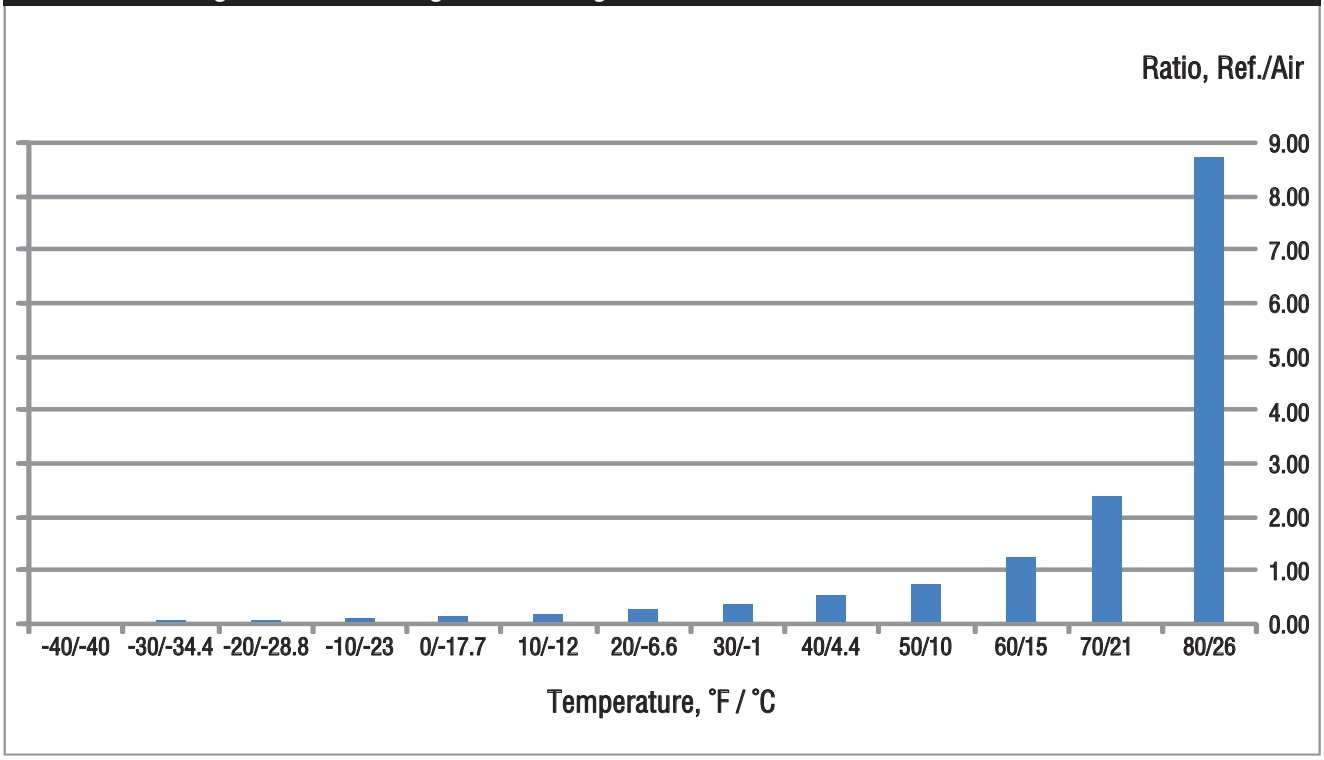
Ratio Of Refrigerant To Air In Discharge Using Armstrong Refrigerated Purging

Refrigerant: R-717 – Ammonia
Operating Pressure 150 psi gage – 10.3 barg
164.7 psia –11.4 bara

Table 16-1. Ratio of Refrigerant to Air in Discharge Using Armstrong Refrigerated Purging

Temperature ˚F / ˚C	Refrig. Press., psia	Air Press., psia	Vol. ratio of gas, Ref/air	Refrig. Density, lb/ft³	Air Density, lb/ft³	Wt. Ratio of gas, Ref/air
80 / 26	153.00	11.70	13.08	0.512	0.058	8.74
70 / 21	128.80	35.90	3.59	0.433	0.183	2.37
60 / 15	107.60	57.10	1.88	0.364	0.296	1.23
50 / 10	89.19	75.51	1.18	0.304	0.400	0.76
40 / 4.4	73.32	91.38	0.80	0.252	0.493	0.51
30 / -1	59.74	104.96	0.57	0.207	0.578	0.36
20 / -6.6	48.21	116.49	0.41	0.169	0.655	0.26
10 / -12	38.51	126.19	0.31	0.137	0.725	0.19
0 / -17.7	30.42	134.28	0.23	0.110	0.788	0.14
-10 / -23	23.74	140.96	0.17	0.087	0.846	0.10
-20 / -28.8	18.30	146.40	0.13	0.068	0.898	0.08
-30 / -34.4	13.90	150.80	0.09	0.053	0.947	0.06
-40 / -40	10.41	154.29	0.07	0.040	0.992	0.04

Chart 16-1. Weight Ratio of Refrigerant in Purged Gas



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Stop Valves - Straight (Globe)

Description

Armstrong's SSW and SBW Series are designed and constructed as low pressure drop shut-off valves. The Stop Valves are welded directly to steel piping, thereby eliminating potential leaky flanges or threaded joints and simplifying installations.



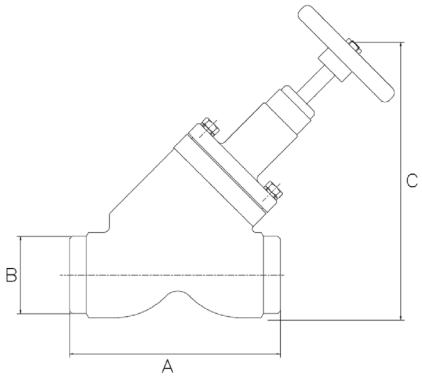
Material:

Body and Bonnet:	Carbon Steel ASTM A-352 Grade LCB
Internal:	Stainless Steel
Stem:	Stainless Steel
Seat Disc:	PTFE Teflon®
Stem Packing:	Neoprene "O" Rings with graphite gland packing
Back Seat:	PTFE Teflon®

Maximum Allowable Pressure:	450 psi (31 bar)
Maximum Operating Pressure:	365 psi (25 bar)
Temperature Rating:	-50°F to +240°F (-46°C to +116°C)
Connection Type:	Socketweld or Buttweld

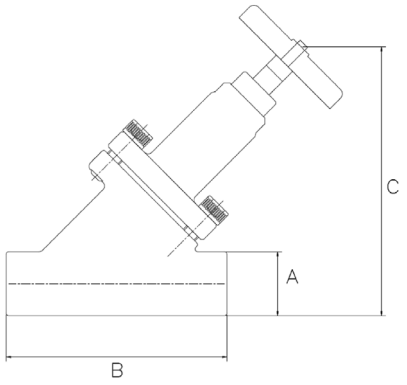
Stop Valves - Straight - Buttweld

Size		A		B		C		Weight		CV
in	mm	in	mm	in	mm	in	mm	lb	kg	
1/2"	15	4-3/16	107	13/16	21	6-1/8	155	4	2	6
3/4"	20	4-5/16	110	1-1/16	27	6-1/4	159	4	2	9
1"	25	5-11/16	144	1-5/16	34	7-11/16	195	7	3	26
1-1/4"	32	5-11/16	144	1-5/8	42	7-13/16	198	7	3	30
1-1/2"	40	5-9/16	142	1-7/8	48	9-1/4	235	10	5	48
2"	50	6-7/16	164	2-3/8	60	10-1/16	255	15	7	83
2-1/2"	65	7-7/8	200	2-7/8	73	12-3/16	310	21	10	141
3"	80	9-3/8	238	3-1/2	89	12-13/16	326	33	15	204
4"	100	10-7/8	276	4-1/2	114	15-1/16	382	38	17	310
5"	125	18	458	5-9/16	141	19-7/16	494	97	44	596
6"	150	21-5/8	550	6-5/8	168	20-7/8	530	121	55	818
8"	200	27-9/16	700	8-5/8	219	22	558	220	100	1435



Stop Valves - Straight - Socketweld

Size		A		B		C		Weight		CV
in	mm	in	mm	in	mm	in	mm	lb	kg	
in	mm	in	mm	in	mm	in	mm	lb	kg	
1/2"	15	1-1/16	27	4-5/16	110	6-3/8	162	4	2	6
3/4"	20	1-7/16	37	4-5/16	110	6-7/16	164	4	2	9
1"	25	1-3/4	44	5-1/16	129	7-7/8	200	7	3	26
1-1/4"	32	1-15/16	49	5-1/16	129	8-3/16	208	7	3	30
1-1/2"	40	2-3/8	60	5-3/4	146	9-1/2	241	10	5	48
2"	50	2-13/16	72	6-7/16	164	10-5/8	270	15	7	83



Stop Valves - Angle

Description

Armstrong's SSW and SBW Series are designed and constructed as low pressure drop shut-off valves. The Stop Valves are welded directly to steel piping, thereby eliminating potential leaky flanges or threaded joints and simplifying installations.



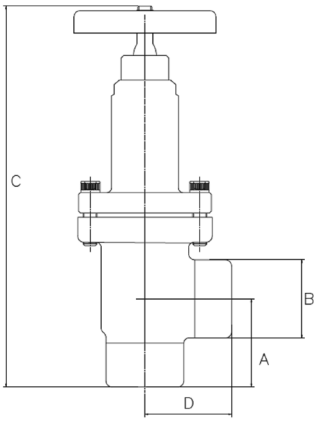
Material:

Body and Bonnet:	Carbon Steel ASTM A-352 Grade LCB
Internal:	Stainless Steel
Stem:	Stainless Steel
Seat Disc:	PTFE Teflon®
Stem Packing:	Neoprene "O" Rings with graphite gland packing
Back Seat:	PTFE Teflon®

Maximum Allowable Pressure:	450 psi (31 bar)
Maximum Operating Pressure:	365 psi (25 bar)
Temperature Rating:	-50°F to +240°F (-46°C to +116°C)
Connection Type:	Socketweld or Buttweld

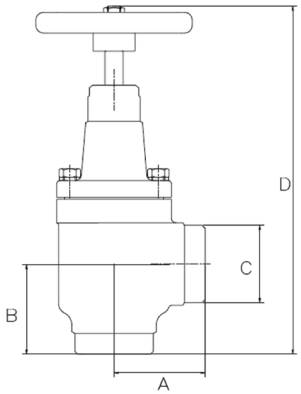
Stop Valves - Angle - Socketweld

Size		A		B		C		D		Weight		CV
in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg	
1/2"	15	1-9/16	39	1-1/4	31	7-3/4	197	1-5/8	42	4	2	6
3/4"	20	1-9/16	40	1-7/16	37	7-13/16	198	1-5/8	42	4	2	9
1"	25	2	50	1-3/4	44	8-7/8	226	2-1/16	52	6	3	26
1-1/4"	32	2	50	2-1/8	54	8-15/16	227	2-1/16	52	6	3	30
1-1/2"	40	2-3/8	60	2-1/8	54	10-7/16	265	2-1/2	63	10	5	48
2"	50	2-3/4	70	2-13/16	72	11	280	2-15-16	74	13	6	83



Stop Valves - Angle- Buttweld

Size		A		B		C		D		Weight		CV
in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg	
1/2"	15	1-9/16	40	1-9/16	40	13/16	21	7-11/16	195	4	2	6
3/4"	20	1-9/16	40	1-9/16	40	1-1/16	27	7-3/4	196	4	2	9
1"	25	1-15/16	49	1-15/16	49	1-5/16	34	8-7/8	225	6	3	26
1-1/4"	32	2	51	2	51	1-5/8	42	9-1/16	230	6	3	30
1-1/2"	40	2-3/8	60	2-3/8	60	1-7/8	48	10-5/8	270	10	5	48
2"	50	2-3/4	70	2-3/4	70	2-3/8	60	11	280	13	6	83
2-1/2"	65	3-1/8	80	3-1/8	80	2-7/8	73	13	330	18	8	141
3"	80	3-3/4	95	3-3/4	95	3-1/2	89	14	355	29	13	204
4"	100	4-3/4	120	4-3/4	120	4-1/2	114	16-5/16	415	44	20	310
5"	125	5-15/16	150	5-15/16	150	5-9/16	141	20-3/4	527	84	38	596
6"	150	6-1/8	155	6-1/8	155	6-5/8	168	21-5/16	542	99	45	818
8"	200	7-7/8	200	7-7/8	200	8-5/8	219	23-5/8	600	176	80	1435



Designs, materials, weights and performance ratings are approximate and subject to change without notice. Visit www.armstronginternational.com for up-to-date information.

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Stop Check Valves - Straight

Description

Low pressure drop Refrigerant Stop Check Valves are weldable directly to steel piping, thereby eliminating potential leaky flanges or threaded joints and simplifying installation. The important features of these valves are non-leak packing and have a patented back seat design. In valve open position, if the inlet pressure drops below outlet pressure, the valve acts as a check valve and does not allow reverse flow of liquid.



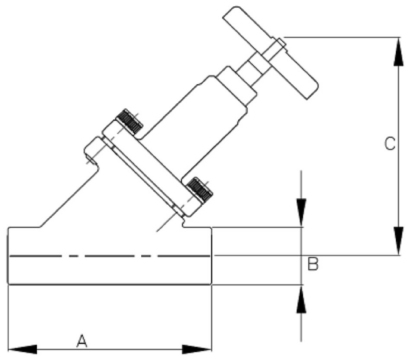
Material:

Body and Bonnet:	Carbon Steel ASTM A-352 Grade LCB
Internal:	Stainless Steel
Stem:	Stainless Steel
Seat Disc:	PTFE Teflon®
Stem Packing:	Neoprene “O” Rings with graphite gland packing
Back Seat:	PTFE Teflon®

Maximum Allowable Pressure:	450 psi (31 bar)
Maximum Operating Pressure:	365 psi (25 bar)
Temperature Rating:	-50°F to +240°F (-46°C to +116°C)
Connection Type:	Socketweld or Buttweld

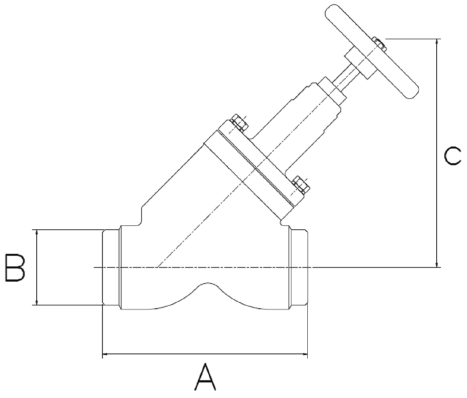
Stop Check Valves - Straight - Socketweld

Size		A		B		C		Weight	
in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	4-5/16	110	1-1/16	27	6-7/8	175	5	2
3/4"	20	4-5/16	110	1-7/16	37	6-7/8	175	5	2
1"	25	5-11/16	144	1-3/4	44	8-3/4	223	8	4
1-1/4"	32	5-11/16	144	1-15/16	49	8-3/4	223	9	4
1-1/2"	40	5-3/4	146	2-3/8	60	10-3/16	259	10	5
2"	50	6-7/16	164	2-13/16	72	12	304	11	5



Stop Check Valves - Straight - Buttweld

Size		A		B		C		Weight	
in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	4-3/16	107	13/16	21	6-1/8	155	5	2
3/4"	20	4-5/16	110	1-1/16	27	6-1/4	159	5	2
1"	25	5-1/16	129	1-5/16	34	7-11/16	195	8	4
1-1/4"	32	5-1/16	129	1-5/8	42	7-13/16	198	9	4
1-1/2"	40	5-9/16	142	1-7/8	48	9-1/4	235	10	5
2"	50	6-7/16	164	2-3/8	60	10-1/16	255	11	5
2-1/2"	65	7-7/8	200	2-7/8	73	12-3/16	310	15	7
3"	80	9-3/8	238	3-1/2	89	12-13/16	326	30	14
4"	100	10-7/8	276	4-1/2	114	15-1/16	382	40	18



Armstrong® Stop Check Valves - Angle

Description

Low pressure drop Refrigerant Stop Check Valves are weldable directly to steel piping, thereby eliminating potential leaky flanges or threaded joints and simplifying installation. The important features of these valves are non-leak packing and have a patented back seat design. In valve open position, if the inlet pressure drops below outlet pressure, the valve acts as a check valve and does not allow reverse flow of liquid.



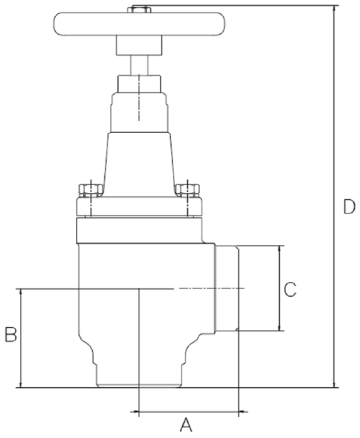
Material:

Body and Bonnet:	Carbon Steel ASTM A-352 Grade LCB
Internal:	Stainless Steel
Stem:	Stainless Steel
Seat Disc:	PTFE Teflon®
Stem Packing:	Neoprene "O" Rings with graphite gland packing
Back Seat:	PTFE Teflon®

Maximum Allowable Pressure:	450 psi (31 bar)
Maximum Operating Pressure:	365 psi (25 bar)
Temperature Rating:	-50°F to +240°F (-46°C to +116°C)
Connection Type:	Socketweld or Buttweld

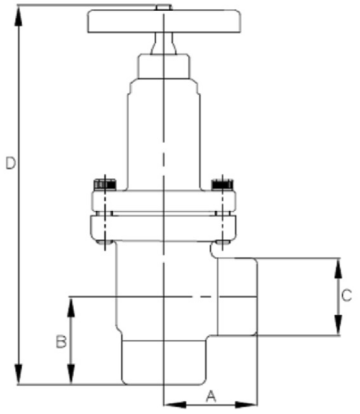
Stop Check Valves - Angle - Buttweld

Size		A		B		C		D		Weight	
in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	1-9/16	40	1-9/16	40	13/16	21	4-5/16	109	4	2
3/4"	20	1-9/16	40	1-9/16	40	1-1/16	27	7-3/4	196	4	2
1"	25	1-15/16	49	1-15/16	49	1-5/16	34	8-7/8	225	7	3
1-1/4"	32	2	51	2	51	1-5/8	42	9-1/16	230	8	4
1-1/2"	40	2-3/8	60	2-3/8	60	1-7/8	48	10-5/8	270	9	4
2"	50	2-3/4	70	2-3/4	70	2-3/8	60	11	280	11	5



Stop Check Valves - Angle - Socketweld

Size		A		B		C		D		Weight	
in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	1-5/8	42	1-9/16	40	1-1/4	31	8-1/2	216	4	2
3/4"	20	1-5/8	42	1-9/16	40	1-9/16	40	8-9/16	217	4	2
1"	25	2-1/16	52	2	51	1-3/4	44	10-3/16	259	7	3
1-1/4"	32	2-1/16	52	2	51	2-1/8	54	10-1/4	260	8	4
1-1/2"	40	2-1/2	63	2-3/8	60	2-1/8	54	11	279	9	4
2"	50	2-15/16	74	2-3/4	70	2-13/16	72	12-5/8	320	11	5



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Seal Cap

Description

The Seal Cap is a valve stem and seal cover. The Seal Cap prevents tampering with the valve and is available for the Armstrong stop and stop check valves.

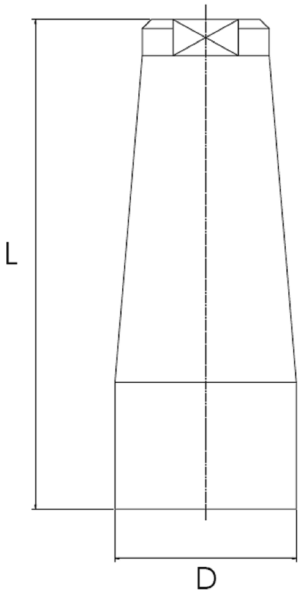
Material:

Body: Carbon Steel ASTM A-105

Connection Type: Threaded



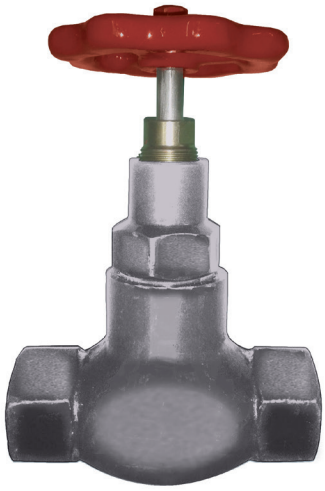
Seal Cap							
Size		D		L		Weight	
in	mm	in	mm	in	mm	lb	kg
3/4"	20	1-7/16	37	3-9/16	90	2	1
1"	25	1-3/4	44	4-1/8	105	2	1
1-1/2"	40	2	50	5-3/8	136	2	1
2"	50	2	50	5-13/16	148	2	1
2-1/2"	65	2	50	6-1/2	165	2	1
3"	80	2-3/16	55	7-1/4	185	4	2
4"	100	2-3/16	55	7-11/16	195	4	2
6”	150	2-9/16	65	8-11/16	220	6	3
8”	200	3-7/16	87	6-7/8	175	8	4



Armstrong® Hand Expansion Valves

Description

The Hand Expansion Valves SEV series features a calibrated, adjustable seat nut flow regulating valve. Expansion valves are ideal for metering of flashing expansion of liquid refrigerants. The slotted seat nut design is more tolerant to dirt particles than tapered plug expansion. Hand wheels are red to distinguish them from shut-off valves.



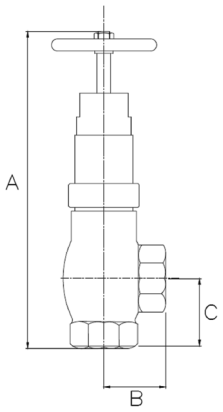
Material:

Body:	Ductile Iron ASTM A-536
Bonnet:	Carbon Steel ASTM A-105
Stem:	Stainless Steel
Packing Nut:	Steel

Maximum Allowable Pressure:	450 psi (31 bar)
Maximum Operating Pressure:	365 psi (25 bar)
Temperature Rating:	-50°F to +240°F (-46°C to +116 °C)
Connection Type:	NPT

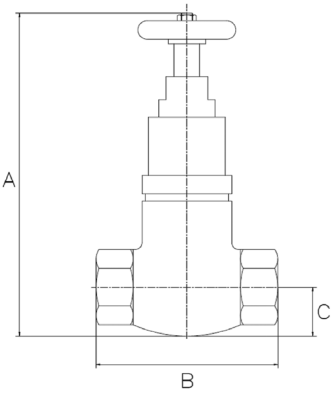
Hand Expansion Valve- Angle

Size		A		B		C		Weight	
in	mm	in	mm	in	mm	in	mm	lb	kg
1/4"	6	6-3/8	162	1-9/16	39	1-9/16	40	2	1
3/8"	10	6-3/8	162	1-9/16	40	1-13/16	46	2	1
1/2"	15	7-1/4	184	1-11/16	43	1-3/4	45	6	3
3/4"	20	8-3/8	212	2	51	2-1/4	58	8	4
1"	25	9-5/8	244	2-1/2	63	2-1/2	64	8	4



Hand Expansion Valve- Straight

Size		A		B		C		Weight	
in	mm	in	mm	in	mm	in	mm	lb	kg
1/4"	6	5-13/16	147	3-1/16	78	1	25	2	1
3/8"	10	6	153	3-1/4	83	1	25	3	1
1/2"	15	7-1/4	184	3-1/4	83	1-5/8	42	8	4
3/4"	20	7-11/16	195	5-1/16	128	1-5/8	42	10	5
1"	25	8-9/16	218	5-7/16	138	1-5/8	42	11	5



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Solenoid Valve

Description

The primary purpose of an electrically operated solenoid valve is to automatically control the flow of fluids. Armstrong's SFA Series Solenoid Valves may be applied on a variety of applications. These flanged, industrial refrigeration solenoid valves are simple and compact, but rugged in construction. The solenoid valves are direct acting valves for ammonia or from service.



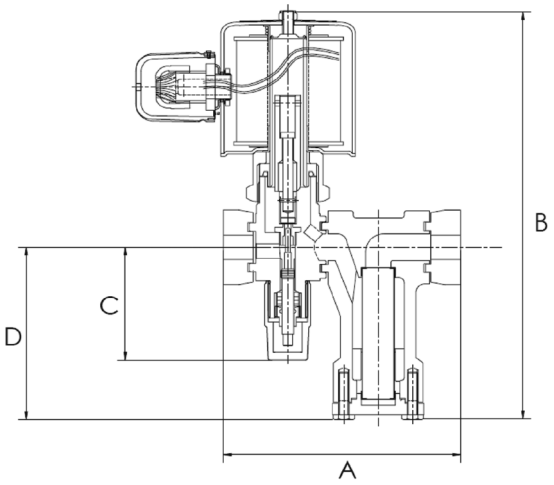
Material:

Body: Ductile Iron ASTM-536
Internal: Stainless Steel
Stem: Stainless Steel
Coil: 18 Watt. 120 VAC or 240 VAC

Maximum Allowable Pressure: 450 psi (31 bar)
Maximum Operating Pressure: 300 psi (21 bar)
Temperature Rating: -40°F to +176°F (-40°C to +80°C)
Connection Type: NPT Flange, Socketweld Flange

Direct Acting Solenoid Valves

Flanged End		A		B		C		D		Weight	
in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	6-7/8	174	9-1/16	230	2-15/16	74	3-11/16	94	7	3



Inline Check Valves

Description

Armstrong's Inline Check Valves are ideally suited for refrigerant applications. The valves are full ported for maximum flow. These valves close quickly and are reliable when flow reversal occurs. The Inline Check Valves feature a plated body, stainless steel disc and spring to enable them to withstand industrial refrigeration conditions.



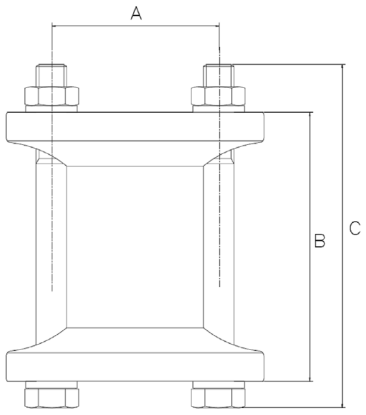
Material:

Body and Flanges:	Steel ASTM A-108
Piston:	304 Stainless Steel
Retainer:	Steel ASTM A-108 Zinc Plated
Seat Ring:	PTFE Teflon®
Spring:	Stainless Steel
Piston Guide:	Ductile iron ASTM A-536

Maximum Allowable Pressure:	450 psi (31 bar)
Maximum Operating Pressure:	365 psi (25 bar)
Temperature Rating:	-50°F to +240°F (-46°C to +116°C)
Connection Type:	Socketweld Flange

Inline Check Valve

Size		A		B		C		Weight	
in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	3-3/8	86	5-3/8	137	6-7/8	175	8	4
3/4"	20	3-3/8	86	5-3/8	137	6-7/8	175	8	4
1"	25	3-3/8	86	5-3/8	137	6-7/8	175	9	4
1-1/4"	32	3-3/8	86	5-3/8	137	6-7/8	175	9	4
1-1/2"	40	3-3/4	96	5-15/16	150	7-7/8	200	10	5
2"	50	4-7/16	112	6-7/8	174	8-1/4	210	17	8
2-1/2"	65	5-11/16	144	7	177	8-3/8	213	27	12
3"	80	5-11/16	144	7-3/16	182	8-11/16	220	30	14
4"	100	7	177	7-1/16	180	8-11/16	220	36	16



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Description

Armstrong's Refrigeration Strainers are designed for either liquid or suction line application. They provide free flow with negligible pressure drop and can be used for a variety of liquids. Armstrong Strainers have the maximum effective screen area. Screen assemblies are seam welded, and the ends are reinforced or capped with seal rings. This design reduces the possibility of bursting the screen assembly. The end of the screen assembly seats against the flange plate to form a tight seal thereby preventing dirt from bypassing the strainer screen. All cleanable strainers have an access for easy removal of the screen assembly. This facilitates cleaning and inspection without breaking the line connection. Strainers are usually close-coupled to solenoid valves, pressure regulators and other flanged valves.



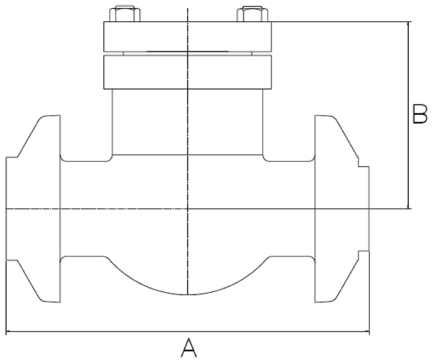
Material:

Body: Carbon ASTM A-105
Screen: Stainless Steel, 40 x 40 Mesh

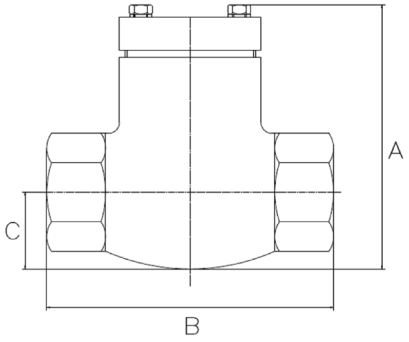
Maximum Allowable Pressure: 450 psi (31 bar)
Maximum Operating Pressure: 365 psi (25 bar)
Temperature Rating: -20°F to +240°F (-29°C to +116°C)
Connection Type: Buttweld, Flanged or NPT

Strainer - Straight - Flanged

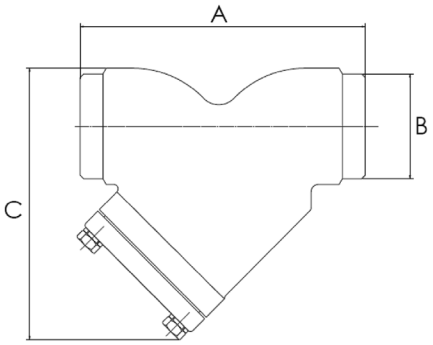
Size		A		B		Weight	
in	mm	in	mm	in	mm	lb	kg
1/2"	15	6-5/8	168	4	101	13	6
3/4"	20	6-5/8	168	4	101	14	7
1"	25	7-1/16	180	4-5/8	118	15	7
1-1/4"	32	9-1/16	230	4-7/16	112	19	9
1-1/2"	40	9-1/4	235	4-5/8	118	24	11
2"	50	10-7/16	265	4-13/16	122	34	15
2-1/2"	65	12-3/16	310	5	127	48	22
3"	80	13-3/8	340	5-1/4	134	58	26
4"	100	14-15/16	380	6-7/8	175	93	42



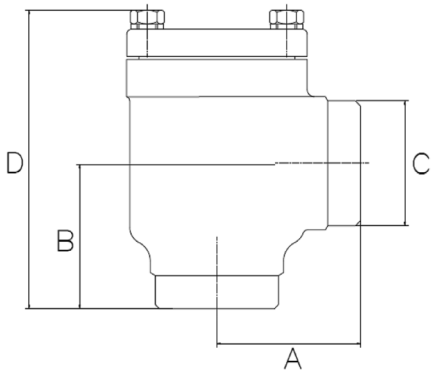
Strainer - Straight - NPT									
Size		A		B		C		Weight	
in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	6-1/8	156	5-3/16	132	1-13/16	46	11	5
3/4"	20	6-1/8	156	5-3/16	132	1-13/16	46	11	5
1"	25	6-1/2	165	5-11/16	145	1-13/16	46	13	6



Strainer - Straight - Buttweld									
Size		A		B		C		Weight	
in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	5-1/8	130	13/16	21	4-3/16	106	3	2
3/4"	20	5-1/8	130	1-1/16	27	4-3/16	106	3	2
1"	25	5-1/8	130	1-5/16	34	4-3/16	106	4	2
1-1/4"	32	5-1/8	130	1-5/8	42	4-3/16	106	4	2
1-1/2"	40	5-9/16	142	1-7/8	48	5-1/16	128	7	3
2"	50	6-7/16	164	2-3/8	60	6-3/4	171	9	4
2-1/2"	65	7-7/8	200	2-7/8	73	8-3/8	213	14	6
3"	80	9-3/8	238	3-1/2	89	9-1/2	242	22	10
4"	100	10-7/8	276	4-1/2	114	11-11/16	297	26	12
5"	125	18	458	5-9/16	141	16-9/16	420	79	36
6"	150	21-5/8	550	6-5/8	168	18-1/2	470	112	51
8"	200	27-9/16	700	8-5/8	219	20-11/16	525	244	111



Strainer - Angle - Buttweld											
Size		A		B		C		D		Weight	
in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	1-9/16	40	1-9/16	40	13/16	21	4-13/16	123	3	2
3/4"	20	1-9/16	40	1-9/16	40	1-1/16	27	4-13/16	123	3	2
1"	25	1-15/16	49	1-15/16	49	1-5/16	34	4-13/16	123	3	2
1-1/4"	32	2	51	2	51	1-5/8	42	4-13/16	123	3	2
1-1/2"	40	2-3/8	60	2-3/8	60	1-7/8	48	5-3/8	137	6	3
2"	50	2-3/4	70	2-3/4	70	2-3/8	60	6	152	8	4
2-1/2"	65	3-1/8	80	3-1/8	80	2-7/8	73	7	178	11	5
3"	80	3-3/4	95	3-3/4	95	3-1/2	89	8-3/8	213	18	8
4"	100	4-3/4	120	4-3/4	120	4-1/2	114	9-15/16	252	29	13
5"	125	5-15/16	150	5-15/16	150	5-9/16	141	12-3/16	310	59	27
6"	150	6-1/8	155	6-1/8	155	6-5/8	168	14-3/4	375	79	36
8"	200	7-7/8	200	7-7/8	200	8-5/8	219	16-1/8	410	187	85



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Flange Unions

Description

The Flange Unions are available in threaded and Socketweld. They are suitable for all common refrigerants including R-717 (ammonia), R-22 and R-134a.



Material:

Body: Carbon Steel ASTM A-105

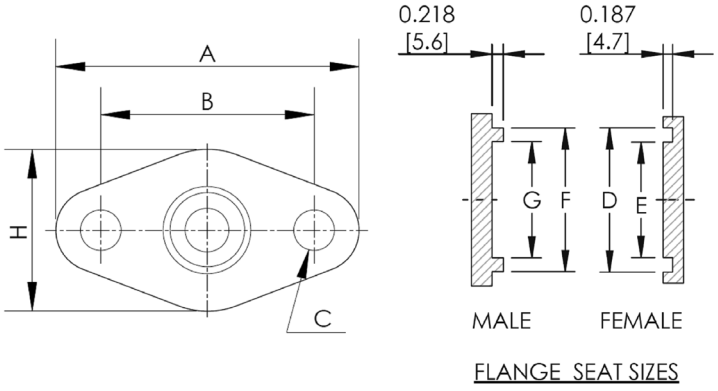
Pressure Rating: 365 psi (25 bar)
Temperature Rating: -20°F to +240°F (-29°C to +116 °C)
Connection Type: Socketweld and NPT

Note:

Flange Unions are compatible with York and HA Phillips.

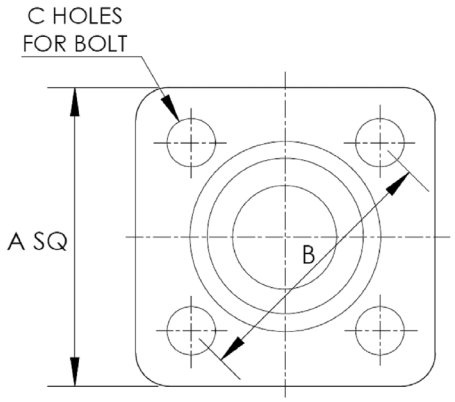
Flanges - Oval

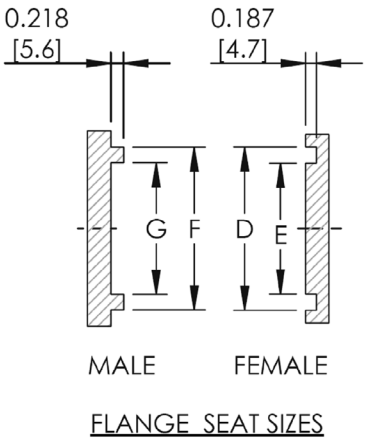
Pipe Size		A		B		C		D		E		F		G		H		Bolt Size	
in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1/4	6	3-1/2	89	2-1/8	54	9/16	15	1-5/16	34	15/16	23	1-5/16	33	15/16	23	1-7/8	48	1/2	15
3/8	10	4-1/4	108	3	76	9/16	15	1-3/4	45	1-5/16	33	1-3/4	45	1-5/16	33	2-1/4	58	1/2	15
1/2	15	4-1/4	108	3	76	9/16	15	1-3/4	45	1-5/16	33	1-3/4	45	1-5/16	33	2-1/4	58	1/2	15
3/4	20	4-1/4	108	3	76	9/16	15	1-13/16	46	1-3/8	35	1-3/4	45	1-3/8	35	2-1/4	58	5/8	16
1	25	4-9/16	116	3-1/4	83	3/4	19	2-1/8	54	1-5/8	41	2-1/16	53	1-5/8	42	2-5/8	66	5/8	16



Flange Unions

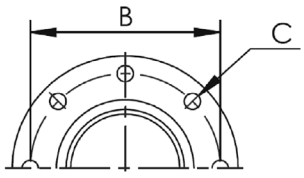
Flanges - Square																	
Pipe Size		A		B		C		D		E		F		G		Bolt Size	
in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1-1/4	32	4	101	3-9/16	90	3/4	19	2-5/16	59	1-7/8	48	5-5/16	59	1-15/16	49	5/8	16
1-1/2	40	4-1/4	108	3-7/8	99	3/4	19	2-13/16	71	2-1/4	57	2-13/16	71	2-1/4	57	5/8	16
2	50	4-3/4	120	4-5/8	118	3/4	19	3-5/16	84	2-1/2	64	3-5/16	84	2-1/2	64	5/8	16
2-1/2	65	6	152	5-11/16	144	7/8	22	3-13/16	97	3	76	3-13/16	97	3	76	5/8	16
3	75	6-5/16	160	5-15/16	150	7/8	22	4-7/16	113	3-11/16	93	4-7/16	112	3-11/16	94	3/4	20
4	100	6-11/16	170	7	178	7/8	22	5-7/16	138	4-5/8	117	5-7/16	138	4-5/8	117	3/4	20

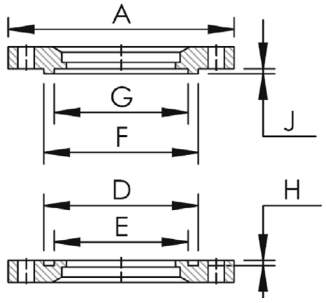




FLANGE SEAT SIZES

Flanges - Round																					
Pipe Size		A		B		C		D		E		F		G		H		J		Bolt Size	
in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
5	125	11-7/16	291	9-5/8	245	13/16	21	7-7/8	200	6-13/16	173	7-13/16	199	6-13/16	173	1/4	7	1/4	7	3/4	20
6	150	11-7/16	291	9-5/8	245	13/16	21	7-7/8	200	6-13/16	173	7-13/16	199	6-13/16	173	1/4	7	1/4	7	3/4	20
8	200	17-7/16	443	14-11/16	373	1-3/16	30	11-3/16	284	9-9/16	243	11-1/8	283	9-9/16	243	3/8	10	3/8	10	1	25
10	250	19-7/16	494	16-11/16	424	1-3/16	30	13-3/16	335	11-9/16	294	13-1/8	334	11-9/16	294	9/16	15	9/16	15	1	25



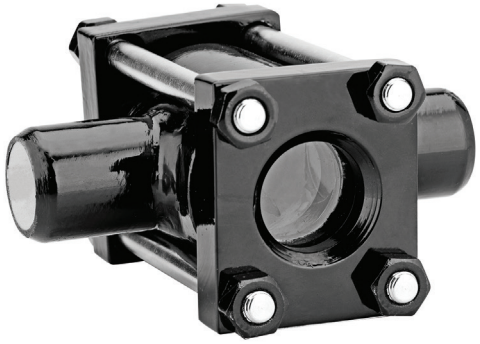


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Description

Flow Indicators for refrigeration service provide a quick, reliable and economical way to verify the flow of refrigerant in your systems.

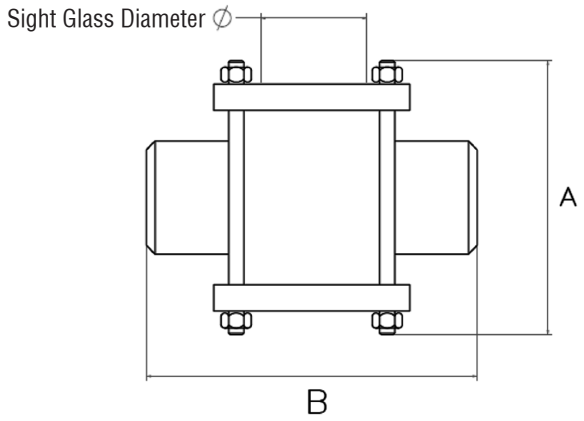


Material:

Body: Carbon Steel ASTM A-108
Reflex: Clear, borosilicate tempered glass

Maximum Allowable Pressure: 365 psi (25 bar)
Temperature Rating: -50°F to +240°F (-46°C to +116 °C)
Connection Type: Buttweld

Flow Indicator									
Size		A		B		Sight Glass Diameter		Weight	
in	mm	in	mm	in	mm	in	mm	lb	kg
1"	25	5-1/16	128	5-11/16	144	1-1/4	32	7	3
1-1/4"	32	5-1/16	128	5-11/16	144	1-1/4	32	7	3
1-1/2"	40	6-3/4	171	7-3/8	187	2-1/16	52	9	4
2"	50	6-3/4	171	7-3/8	187	2-1/16	52	11	5



Armstrong® Reflex Glass Liquid Level Gauge

Description

The unbreakable Reflex Glass Liquid Level Gauge is designed for safe and accurate visual indication of liquid level in vessels. The liquid chamber is a one-piece metal body covered by glass. The light striking the glass in the liquid portion is absorbed by the liquid whereas the light striking the glass in the vapor portion is reflected making the liquid appear black.



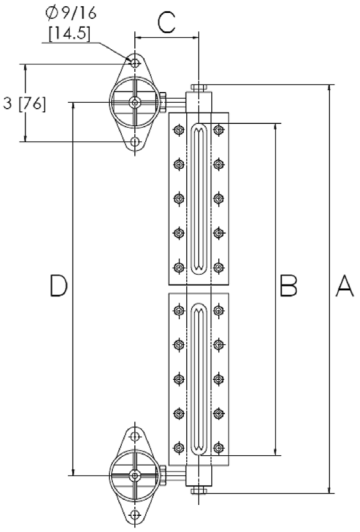
Material:

Front and Back Frame: Carbon Steel ASTM A-105
Sight Glass: Clear borosilicate tempered glass
Stop Check Valve: Carbon Steel ASTM A-352 Grade LCB

Maximum Operating Pressure: 365 psi (25 bar)
Temperature Rating: -20°F to +240°F (-29°C to +116°C)
Connection Type: Socketweld Flange

Reflex Glass Liquid Level Indicator

Flanged End		A		B		C		D		Weight	
in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg
6"	150	10-5/16	262	4-3/4	120	4-3/4	120	6	152	25	11
12"	305	16-1/4	413	10-1/4	260	4-3/4	120	11-15/16	303	31	14
18"	457	22-5/16	567	16-9/16	420	4-3/4	120	18	457	42	19
24"	610	28-3/8	720	22-1/16	560	4-3/4	120	24	610	49	22
30"	762	34-5/16	872	28-3/8	720	4-3/4	120	30	762	60	27
36"	914	40-5/16	1024	33-7/8	860	4-3/4	120	36	914	66	30
42"	1067	46-5/16	1177	40-3/16	1020	4-3/4	120	42	1067	77	35
48"	1219	52-5/16	1329	45-11/16	1160	4-3/4	120	48	1219	84	38
54"	1372	58-3/8	1482	52	1320	4-3/4	120	54	1372	95	43
60"	1524	64-5/16	1634	57-1/2	1460	4-3/4	120	60	1524	102	46



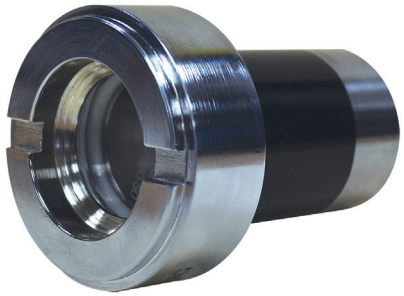
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Level Port

Description

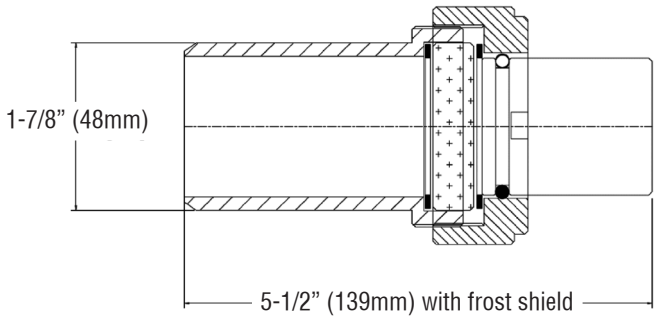
Level Port is a simple device to see actual levels in refrigeration system. It has reflex glass. When liquid is present behind the glass, it appears dark. When vapor is present, it is light. The neck is provided long for ease of welding and insulation clearance for low temperature service. To see level clearly in frosting condition, a frost shield may be provided.
The Level Port is suitable for ammonia, R22, R134a and other refrigerants. It can be installed on receivers, level columns, accumulators, intercoolers, suction lines, oil lines and liquid lines.



Material:

Body:	Carbon Steel ASTM A-105
Cover:	Carbon Steel ASTM A-105
Glass:	Borosilicate

Maximum Operating Pressure:	300 psi (21 bar)
Temperature Rating:	-20°F to +240°F (-29°C to +116°C)
Connection:	Buttweld



Armstrong® Dual Relief Valve Manifold

Description

The Dual Relief Valve Manifold meets the ANSI/ASHRAE 15-1994 safety requirements for mechanical refrigeration in which pressure vessels that have 10 cubic feet or more of internal gross volume shall be fitted with dual pressure relief valves. This is typically accomplished using a pair of pressure relief valves interconnected by a three-way dual manifold. Operation is not disrupted while the other valve is being replaced thereby eliminating the need to remove refrigerant from the vessel.

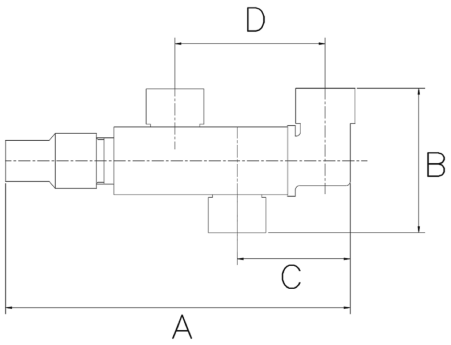


Material:

Body: Ductile Iron ASTM A-536

Maximum Allowable Pressure: 450 psi (31 bar)
Maximum Operating Pressure: 350 psi (24 bar)
Temperature Rating: -50°F to +240°F (-46°C to +116°C)
Connection Type: NPT

Dual Relief Valve											
Flanged End		A		B		C		D		Weight	
in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg
1/2"	15	9-13/16	250	4	102	2-1/2	63	4-3/16	106	14	6
3/4"	20	9-13/16	250	4	102	2-1/2	63	4-3/16	106	14	6
1"	25	10-1/4	261	5	127	3-1/2	89	4-5/16	110	20	9



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For Draining Liquids from Gasses Under Pressure

Armstrong liquid seal drainers are offered in a wide variety of sizes, materials and types to meet the most specific requirements. The most widely used models and sizes utilize bodies, caps and some operating parts that are mass produced for Armstrong steam traps. The proven capabilities of these components, along with volume production economies, enable us to offer you exceptionally high quality at attractive prices. You can choose the smallest and least costly model that will meet your requirements with confidence.

Selection Procedure for Draining Liquid Refrigerant From Vapor

1. Multiply the maximum liquid load (lb/hr) by a safety factor of 1.5 or 2.0 See paragraph headed “Safety Factors.”
2. From the Orifice Capacity Charts, find the orifice size that will deliver the required liquid capacity at the maximum operating pressure. For halocarbon refrigerants other than R-22, convert to an equivalent R-22 flow rate using Table 33-1.
3. From the Orifice Size Operating Pressure Table 35-1, find the ball float liquid seal capable of opening the required orifice size at a particular pressure and at the specific gravity appropriate for the refrigerant.

Safety Factors

Safety factor is the ratio between actual continuous discharge capacity of the drain trap and the amount of liquid to be discharged during any given period.
The capacity charts in this bulletin show the maximum continuous rate of discharge of the drain traps. However, you must provide capacity for maximum loads and, possibly, lower than normal pressures. A safety factor of 1.5 or 2 is generally adequate if applied to the maximum load and the minimum pressure at which it occurs. If the load discharge to the drainer is sporadic, a higher safety factor may be required. Contact your Armstrong Representative for details.

Where Not to Use

Float type drain traps are **not** recommended where heavy oil, sludge or considerable dirt are encountered. Dirt can prevent the valve from seating tightly, and cold oil can prevent float traps from opening. Where these conditions exist, Armstrong inverted bucket liquid seal drainers should be used.

How to Order Liquid Seal Drainers

Specify:

- Liquid seal drainer size by model number
- Orifice size
- Pipe connection size and type
- Maximum operating pressure (differential)
- Refrigerant used

If the correct liquid seal can not be determined, advise the capacity required, maximum pressure, and the SPECIFIC GRAVITY of the liquid.

Table 33-1. Refrigerant Flowrate Conversion Table

Refrigerant	Specific Gravity of Liquid	Lb/hr Equivalent to 1 ton of Refrigerant	Conversion Factor to Find R-22 Equivalent of Other Refrigerants*
R-717	0.60	25.3	N.A.
R-11	1.46	180	0.90
R-12	1.29	240	0.95
R-22	1.17	171	1.00
R-134a	1.20	127	1.00
R-502	1.19	267	1.00

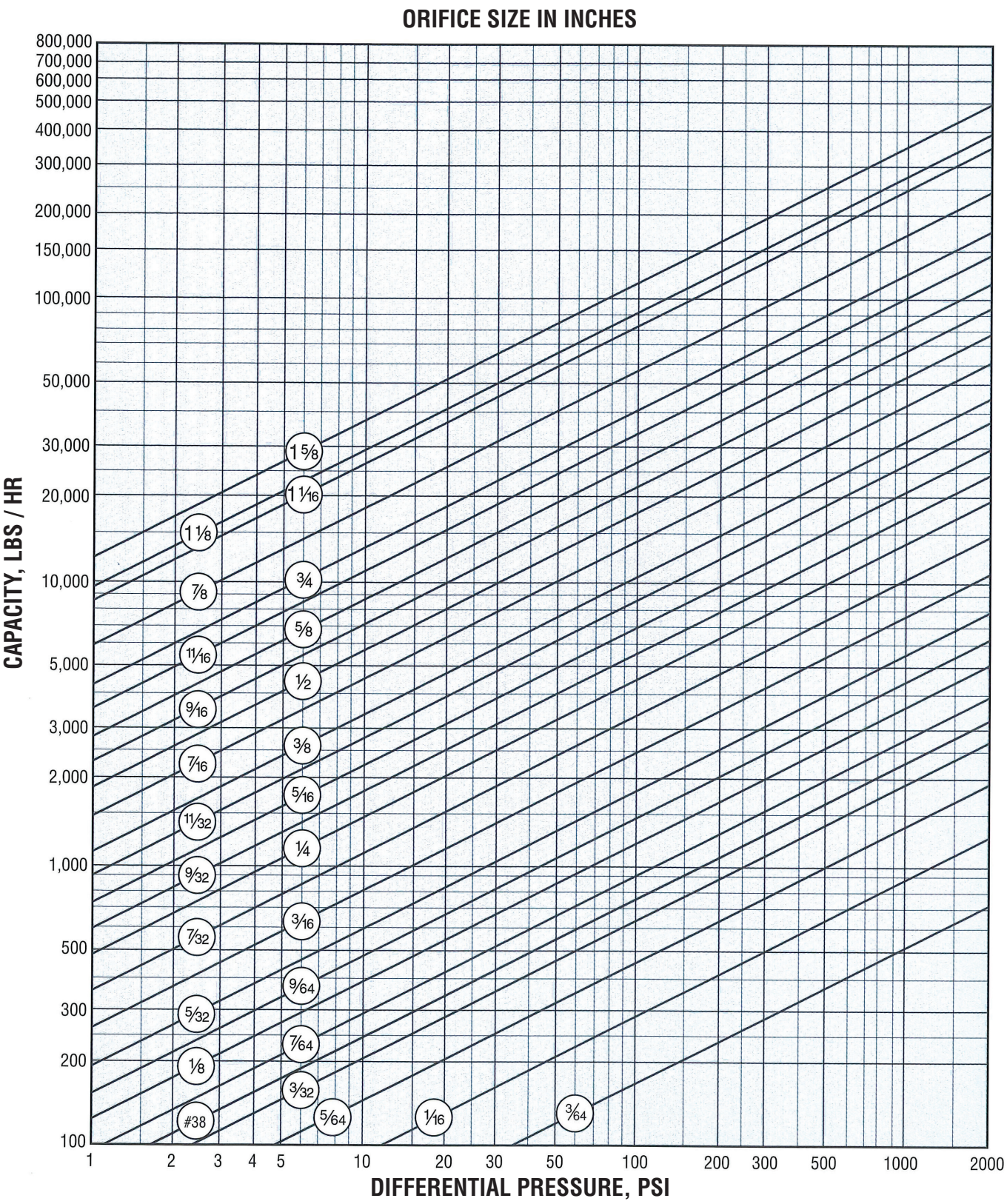
*Flow of other refrigerant x factor = Required equivalent capacity of R-22.
Based on mass flowrates (lb/hr) NOT on tonnage equivalents.
This factor is for use with Chart 34-1 to find required orifice sizes.

Ball Float Liquid Seal Drainers - Capacity For Ammonia

Chart 34-1

Calculated Liquid Ammonia Capacity of Armstrong Liquid Seal Drainer Orifices at Various Pressures.

Actual capacity also depends on drainer configuration, piping, and flow to trap.



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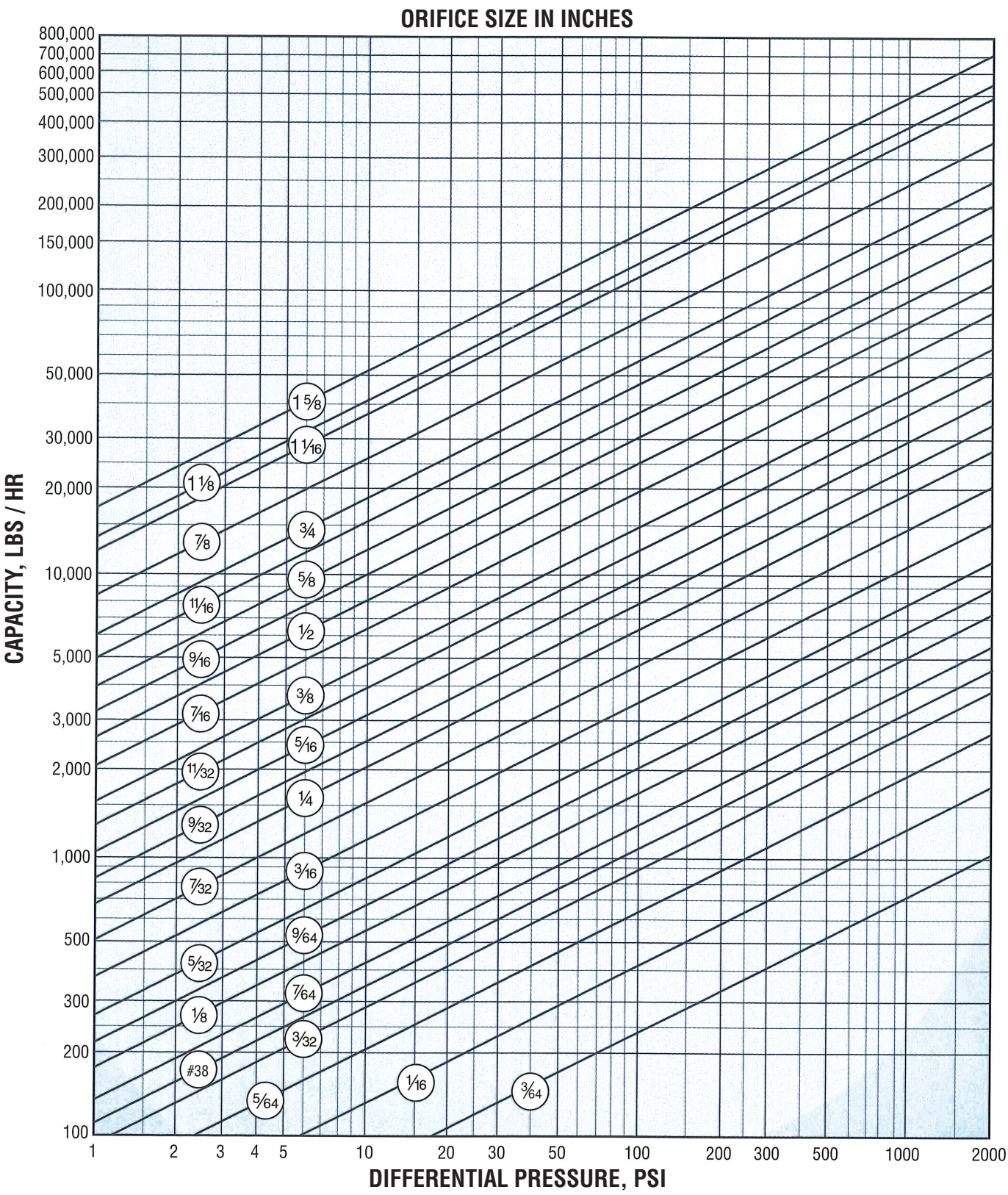
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Ball Float Liquid Seal Drainers - Capacity For R-22

Chart 35-1

Calculated Liquid R-22 Capacity of Armstrong Liquid Seal Drainer Orifices at Various Pressures.

Actual capacity also depends on drainer configuration, piping, and flow to trap.



Armstrong® Ball Float Liquid Seal Drainers

Armstrong ball float liquid seals use many of the same parts as the Armstrong ball float liquid drainers that have been proven in years of service. Oblong floats and high leverage make it possible to open large orifices to provide adequate capacity for drain trap size and weight. The hemispherical valve, seat, and leverage are identical in design, materials and workmanship to those for saturated steam service up to 1,000 psig with the exception of the addition of a guidepost to assure a postive, leak-tight valve closing under all conditions.

High Temperature Service

Maximum allowable working pressures of floats decrease at temperatures above 100°F (37.8°C). Allow for approximately:

- 10% decrease at 200°F (93.3°C)
- 15% decrease at 300°F (148.9°C)
- 20% decrease at 400°F (204.4°C)

The float is not always the limiting factor, however. Consult with Armstrong if you have a high-temperature application that also requires maximum operating pressures.

Table 36-1. Maximum Operating Pressures for Handling Different Specific Gravity Liquids With Orifices Available in Guided Free Floating Lever Drainers.

Model No.	Sp. Grav	1.17		1.00		.65		.60		.55		.50	
	Orifice	Maximum Operating Pressure psig (bar)											
	in	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
1-LD	1/8	160	9.5	121	8.3	41	2.8	29	2.0	18	1.2	6	0.4
	7/64	190	13	143	9.9	48	3.3	35	2.4	21	1.4	7	0.5
	#38	240	16.5	182	12.5	61	4.2	44	3.0	26	1.8	9	0.6
	5/64	300	20.6	300	20.7	107	7.4	77	5.3	47	3.2	16	1.1
11-LD	1/8	228	15.7	176	12.1	69	4.8	54	3.7	39	2.7	24	1.6
	7/64	270	18.6	209	14	82	5.7	64	4.4	46	3.2	28	1.9
	#38	342	23.5	264	18	104	7.2	81	5.6	59	4.0	36	2.5
	5/64	400	27.6	400	28	183	13	143	9.9	103	7.1	63	4.3
2-LD to 250 psi (17 bar) 22-LD to 533 psi (37 bar)	5/16	29	2	22	1.5	10	0.7	8	0.5	6	0.4	4	0.3
	1/4	48	3.3	36	2.5	16	1.1	13	0.9	10	0.7	7	0.5
	3/16	105	7.2	79	5.5	35	2.4	28	2.0	22	1.5	16	1.1
	5/32	181	12.5	137	9.4	60	4.1	49	3.4	38	2.6	27	1.8
	1/8	310	21.4	234	16.1	102	7.1	83	5.8	65	4.5	46	3.2
	7/64	397	27.4	299	20.6	131	9.0	107	7.4	83	5.7	59	4.0
	#38	494	34	372	25.7	163	11.2	133	9.2	103	7.1	73	5.0
	5/64	555	38.3	533	37	240	17	196	14	152	10.5	108	7.4
32-LD	5/16	41	2.8	29	2.0	10	0.7	7	0.5	4	0.3	2	0.1
	1/4	67	4.6	47	3.3	16	1.1	12	0.8	7	0.5	3	0.2
	3/16	149	10.3	104	7.2	35	2.4	25	1.8	16	1.1	6	0.4
	5/32	256	17.6	180	12	61	4.2	44	3.0	27	1.9	10	0.7
	1/8	438	30.2	307	21	104	7.2	75	5.2	46	3.2	17	1.2
	7/64	560	38.6	393	27	133	9	96	6.6	59	4.1	22	1.5
	#38	600	41.4	489	34	166	11	120	8	73	5.1	27	1.9
	5/64	600	41.4	600	41	244	17	176	12	108	7	40	2.8
3-LD to 250 psi (17 bar) Cast Iron 13-LD to 570 psi (39 bar) Stainless 33-LD to 900 psi (62 bar) Steel	1/2	21	1.4	16	1.1	6	0.4	5	0.3	3	0.2	2	0.1
	3/8	44	3	33	2.3	13	0.9	10	0.7	7	0.5	4	0.3
	5/16	70	4.8	54	3.7	20	1.4	16	1.1	11	0.8	6	0.4
	9/32	93	6.4	71	4.9	27	1.9	21	1.4	15	1.0	8	0.6
	1/4	139	9.6	107	7.4	41	2.8	32	2.2	22	1.5	13	0.9
	7/32	199	13.7	153	10.5	59	4.0	45	3.1	32	2.2	18	1.2
	3/16	298	20.5	230	16	88	6.1	68	4.7	48	3.3	27	1.9
	5/32	467	32.2	359	25	138	9.5	106	7.3	74	5.1	43	2.9
	1/8	900	62	726	50	278	19	214	15	150	10.3	86	5.9
	7/64	900	62	900	62	356	25	274	19	192	13	110	7.6
6-LD Cast Iron and 36-LD Forged Steel 28.25oz Float	1-1/16	26	1.8	21	1.4	10	0.7	9	0.6	7	0.5	6	0.4
	7/8	40	2.8	32	2.2	16	1.1	14	1.0	12	0.8	9	0.6
	3/4	58	4	47	3.2	24	1.6	20	1.4	17	1.2	14	0.9
	5/8	89	6	72	4.9	36	2.5	31	2.1	26	1.8	21	1.4
	9/16	118	8	95	6.5	48	3.3	41	2.8	34	2.4	28	1.9
	1/2	171	11.8	138	9.5	69	4.8	59	4.1	50	3.4	40	2.8
	7/16	243	16.8	196	13	98	6.8	85	5.8	71	4.9	57	3.9
	3/8	250	17.2	250	17	155	11	133	9.0	111	7.7	90	6.2
	11/32	250	17.2	250	17	207	14	178	12	148	10	119	8.2
	5/16	250	17.2	250	17	250	17	228	16	191	13	153	11
	9/32	250	17.2	250	17	250	17	250	17	250	17	201	14
	1/4	250	17.2	250	17	250	17	250	17	250	17	250	17
	7/32	250	17.2	250	17	250	17	250	17	250	17	250	17
	3/16	250	17.2	250	17	250	17	250	17	250	17	250	17
36-LD Forged Steel 43.5oz Float	1-1/16	21	1.4	16	1.1	6	0.4	4	0.3	3	0.2	1	0.1
	7/8	33	2.3	25	1.7	9	0.63	7	0.47	5	0.31	2	0.16
	3/4	48	3.3	36	2.5	13	0.91	10	0.68	7	0.45	3	0.22
	5/8	73	5	56	3.9	20	1.4	15	1.05	10	0.69	5	0.34
	9/16	97	6.7	74	5.1	27	1.8	20	1.4	13	0.92	7	0.46
	1/2	140	9.6	107	7.4	39	2.7	29	2.0	19	1.3	10	0.66
	7/16	200	13.8	152	10.5	55	3.8	41	2.9	27	1.9	14	0.94
	3/8	315	21.7	240	17	87	6.0	65	4.5	43	3.0	21	1.5
	11/32	419	29	320	22	116	8.0	87	6.0	58	4.0	29	2.0
	5/16	539	37	411	28	149	10.3	112	7.7	74	5.1	37	2.5
	9/32	706	48.7	539	37	195	13	146	10.1	97	6.7	48	3.3
	1/4	1,000	69	788	54	286	20	214	15	142	9.8	70	4.9
	7/32	1,000	69	1,000	69	403	28	302	21	201	14	99	6.9
	3/16	1,000	69	1,000	69	660	46	494	34	328	23	163	11.2
Specific Gravity		1.17		1.00		.65		.60		.55		.50	

NOTE: If specific gravity falls between those shown in the chart, use the next lower gravity. For example, if specific gravity is 0.73, use 0.70 gravity data.

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Ball Float Liquid Seal Drainers

Table 37-1. List of Materials

Model No.	Valve & Seat	Leverage System	Float	Body & Cap	Gasket
1-LD 2-LD 3-LD 6-LD	Stainless Steel	Stainless Steel	Stainless Steel	Cast Iron ASTM A-48 Class 30	Compressed Asbestos-free
11-LD 22-LD 13-LD	Stainless Steel	Stainless Steel	Stainless Steel	Sealed Stainless Steel 304-L	–
32-LD 33-LD 36-LD	Stainless Steel	Stainless Steel	Stainless Steel	Forged Steel ASTM A-105	Compressed Asbestos-free

For information on special materials consult factory.

Table 37-2. Physical Data

Model No.	Cast Iron				Stainless Steel			Forged Steel		
Pipe Connections	1-LD	2-LD	3-LD	6-LD	11-LD**	22-LD	13-LD	32-LD †	33-LD †	36-LD †
(in) (mm)	1/2* 15*	1/2, 3/4 15, 20	1/2, 3/4, 1 15, 20, 25	1-1/2, 2 40, 50	3/4*** 20***	3/4 20	1 25	1/2, 3/4, 1 15, 20, 25	1/2, 3/4, 1 15, 20, 25	1-1/2, 2 40, 50
"A"	3-3/4" 95mm	5-1/4" 133mm	6-3/8" 162mm	10-3/16" 259mm	2-3/4" 70mm	3-15/16" 100mm	4-1/2" 114mm	6-3/4" 171mm	8" 203mm	11-7/8" 302mm
"B"	5-1/2" 140mm	8-3/4" 222mm	11-1/2" 292mm	18" 457mm	7-1/4" 184mm	8-13/16" 224mm	11-3/8" 289mm	10-3/16" 259mm	11-9/16" 294mm	17-1/8" 435mm
"D"	2-7/8" 73mm	5-1/8" 130mm	7" 188mm	9-3/8" 238mm	–	3" 76mm	6-1/8" 156mm	5-9/16" 141mm	6-1/16" 154mm	9" 229mm
"K"	13/16" 21mm	–	–	–	9/16" 14mm	7/8" 22mm	1-3/16" 30mm	1-1/4" 32mm	1-7/16" 37mm	2-1/8" 54mm
"L"	1-7/8" 48mm	2-7/16" 62mm	2-7/8" 73mm	4-5/8" 117mm	–	2-5/8" 67mm	3-9/32" 83mm	3-3/8" 86mm	3-9/16" 90mm	6-1/16" 154mm
Approx. Wt.	4lb 2kg	12lb 5.5kg	21lb 9.5kg	78lb 35.5kg	1-3/4lb 0.79kg	3-1/4lb 1.5kg	7-1/2lb 3.4kg	31lb 14kg	49lb 22kg	163lb 74kg
Max. Allow. Pressure (Vessel Design)	300 psig @ 200°FΔ (21 bar @ 93°C)	250 psig @ 450°F (17 bar @ 232°C)			500 psig @ 100°F (35 bar @ 38°C) 440 psig @ 500°F (30 bar @ 260°C)	600 psig @ 100°F (41 bar @ 38°C) 475 psig @ 500°F (33 bar @ 260°C)	570 psig @ 100°F (39 bar @ 38°C) 490 psig @ 500°F (34 bar @ 260°C)	600 psig @ 100°F (41 bar @ 38°C) 500 psig @ 750°F (35 bar @ 400°C)	1,000 psig @ 100°F (69 bar @ 38°C) 600 psig @ 750°F (41 bar @ 400°C)	

NOTE: Vessel design pressure may exceed float collapse pressure in some cases. Pipe size of vent connection is same as that of inlet and outlet connections.
† Available in type 316 stainless steel. Consult factory.
Δ For pressures not exceeding 250 psig (17 bar), a maximum temperature of 450˚F (232˚C) is allowed.
* 1/4" (6mm) outlet.
** No side connection.
*** 1/2" (15mm) outlet.

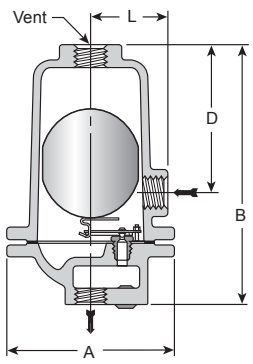


Figure 37-1.
No. 2-LD, 3-LD and 6-LD cast iron guided lever drainers. No. 1-LD has standard top inlet and optional side connection.

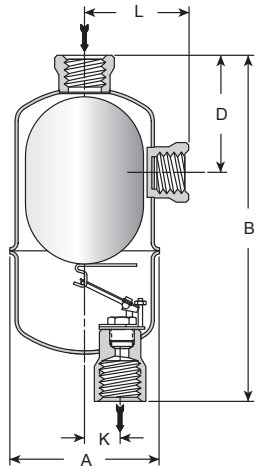


Figure 37-2.
No. 22-LD and 13-LD stainless steel guided lever liquid drainers with sealed, tamperproof construction.

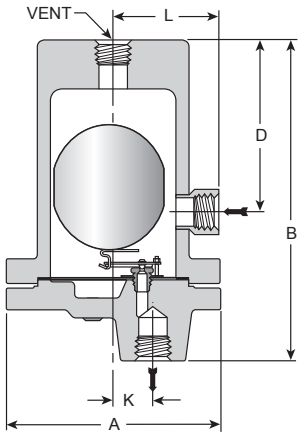


Figure 37-3.
No. 32-LD, 33-LD and 36-LD forged steel guided lever drainers. Socketweld or flanged connections are also available.

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Inverted Bucket Liquid Seal Drainers for Ammonia Service

How Armstrong Inverted Bucket Liquid Seal Drainers Work to Prevent System Problems

The Problem:

When the liquid level in a refrigerant receiver drops below the end of the outlet pipe (See Figure 38-1), high-pressure gas will enter the evaporator. This is not desirable.

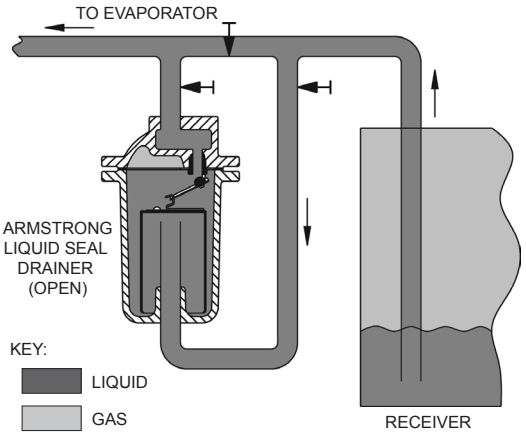


Figure 38-2

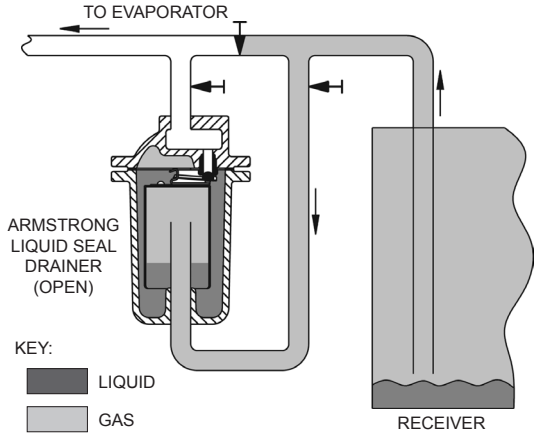


Figure 38-3

Multiple Seals:

If a single Armstrong liquid seal drainer does not have sufficient capacity, multiple seals can be used as shown in Figure 38-4. This drawing represents an actual installation in a 1000 ton ammonia system in a large ice cream plant.

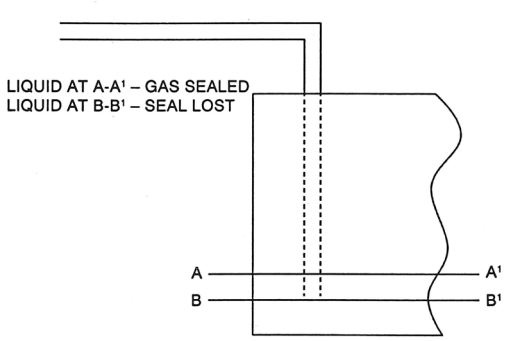


Figure 38-1

The Solution:

To prevent this condition, install an Armstrong liquid seal drainer. Figure 38-2 shows normal operation with the liquid level in the receiver above the end of the outlet pipe. The liquid seal is full of refrigerant. The inverted bucket is down and the valve is wide-open offering little resistance to the flow of refrigerant. When high-pressure gas enters the liquid line, the gas will displace the refrigerant from under the bucket, and will cause the bucket to float and close the liquid seal's valve as shown in figure 38-3. No high-pressure gas can now enter the evaporator. As soon as the liquid supply is restored, the end of the drain pipe will become submerged and refrigerant will reach the liquid seal where it will now displace the gas under the bucket. The bucket will then sink and open. Conditions will now be normal.

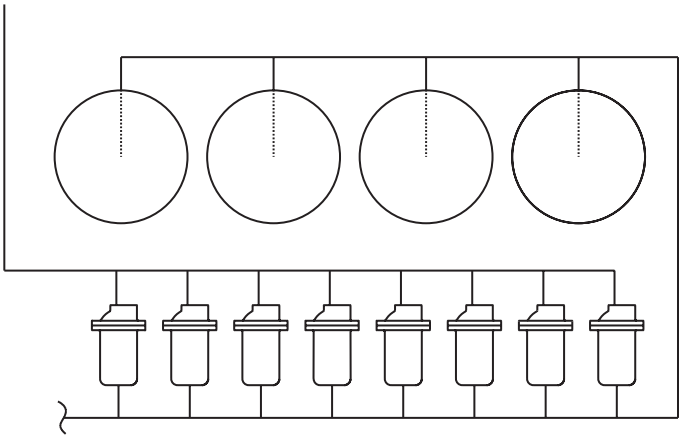
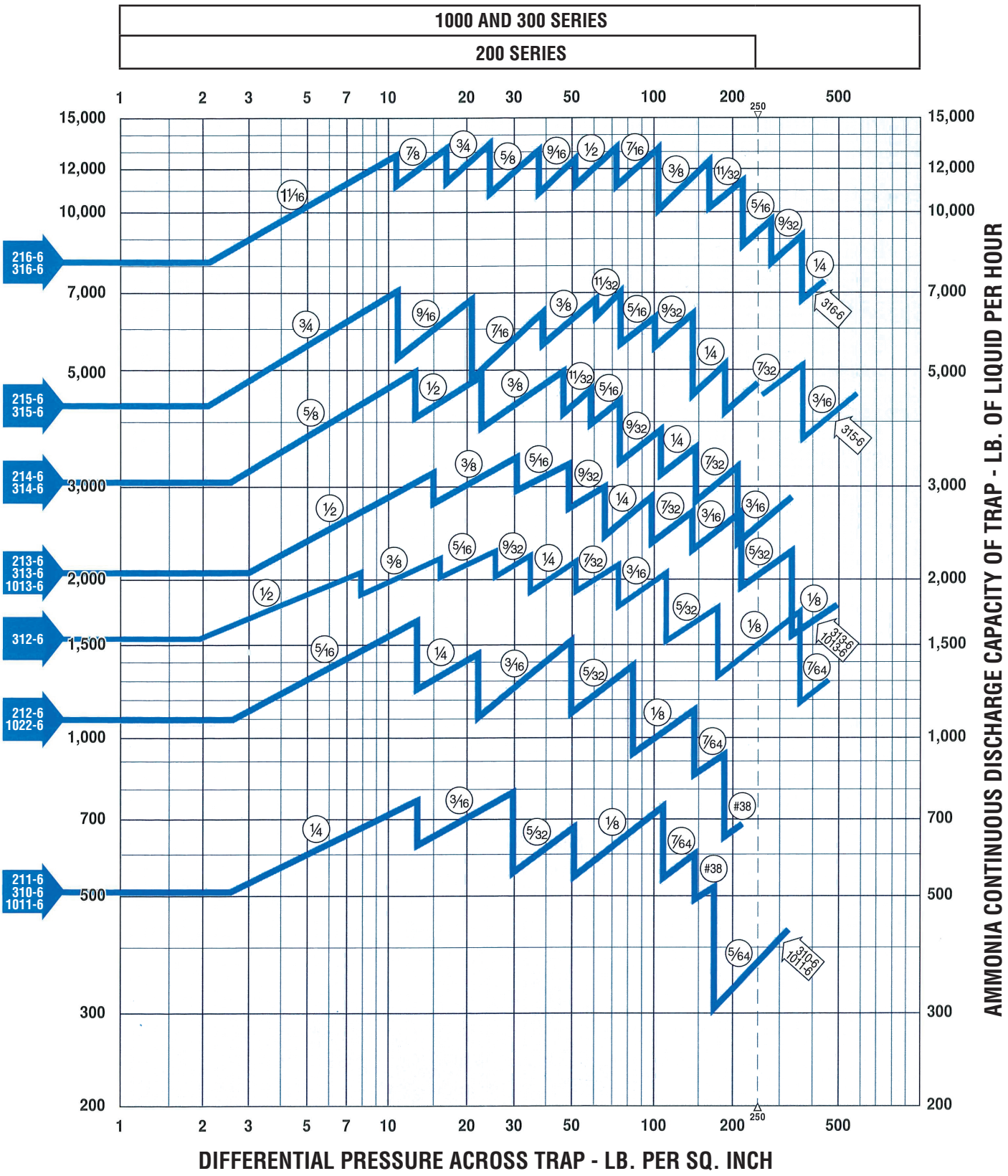


Figure 38-4

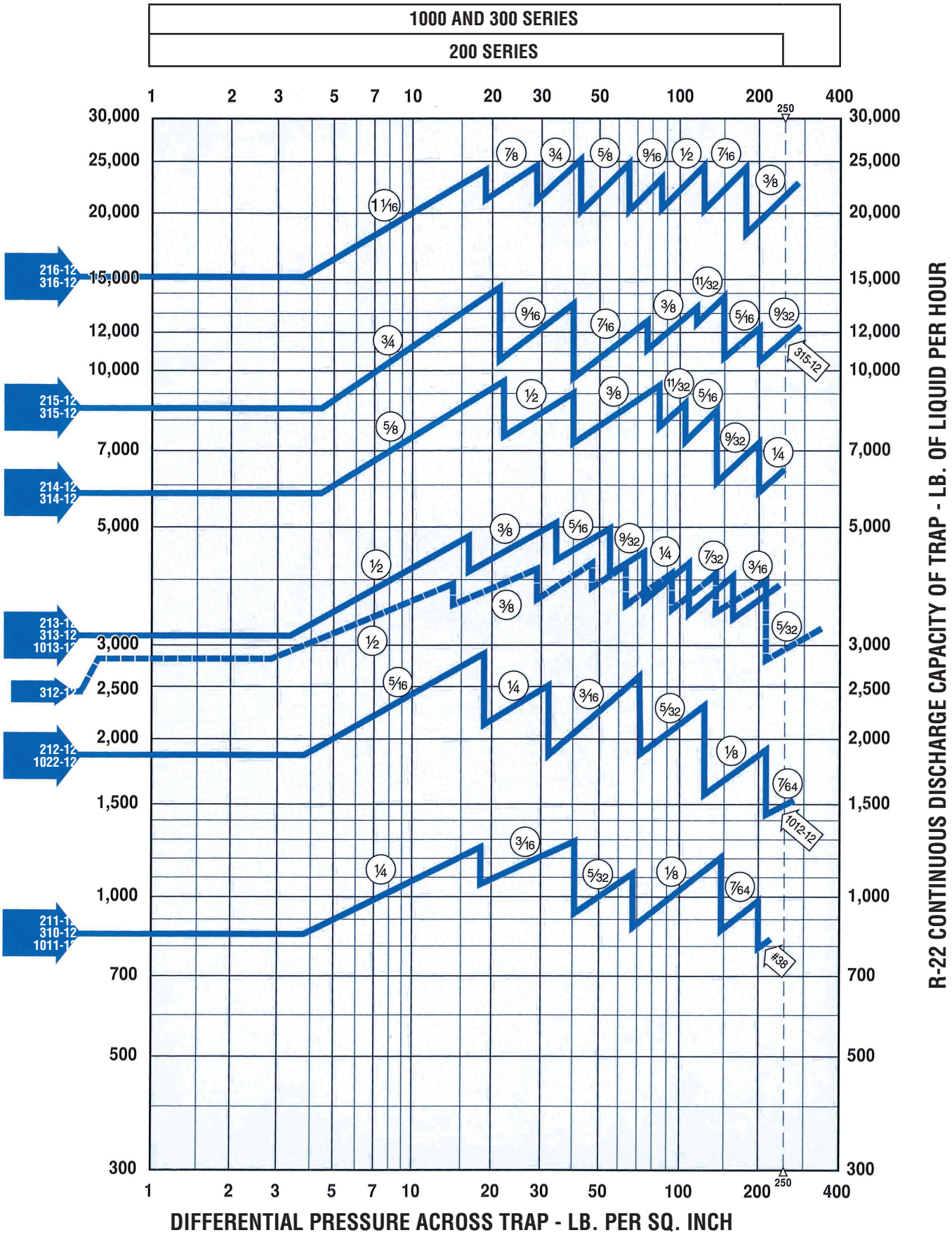
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Inverted Bucket Liquid Seal Capacity Chart For Ammonia



Armstrong® Inverted Bucket Liquid Seal Capacity Chart For R-22



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Series 200 & 300 Inverted Bucket Liquid Seal Traps

Table 41-1. List of Materials

Model No.	Body & Cap	Valve & Seat	Internals
211, 212, 213, 214, 215, 216	Cast Iron ASTM A48 Class 30	Hardened Chrome Steel	All Stainless Steel-304
310, 312, 313, 314, 315, 316	Forged Steel ASTM A105	Hardened Chrome Steel or Titanium	All Stainless Steel-304 (larger sizes have cast iron bucket weights)



Options:

- Stainless Steel Internal Check Valve
- Socketweld Connections
- Cast 316 Stainless Steel Bodies are available on Models 312, 313, 316

Table 41-2. Physical Data

Model No.	211	212	213	214	215	216	310	312	313	314	315	316
Pipe Connections (in) (mm)	1/2 15	1/2, 3/4 15, 20	1/2, 3/4, 1 15, 20, 25	1, 1-1/4 25, 32	1, 1-1/4, 1-1/12 25, 32, 40	1-1/2, 2 40, 50	1/2, 3/4 15, 20	1/2, 3/4, 1 15, 20, 25	1/2, 3/4,1 15, 20, 25	1, 1-1/4 25, 32	1, 1-1/4, 1-1/2 25, 32, 40	1-1/2, 2 40, 50
Test plug	1/8" 3mm	3/8" 10mm	1/2" 15mm	1/2" 15mm	3/4" 20mm	1" 25mm	-	-	-	-	-	-
"A" (Flange Diameter)	4-1/4" 108mm	5-1/4" 133mm	6-3/8" 162mm	7-1/2" 190mm	8-1/2" 216mm	10-3/16" 259mm	4-5/8" 117mm	6-3/4" 171mm	8" 203mm	8-5/8" 219mm	9-3/4" 248mm	11-7/8" 302mm
"B" (Height)	6-3/8" 162mm	8-3/4" 222mm	11-1/2" 292mm	12-1/2" 317mm	14-5/16" 364mm	18" 457mm	7-15/16" 202mm	10-3/16" 259mm	11-1/2" 292mm	13-11/16" 348mm	15" 381mm	17-1/8" 435mm
"G" (Body OD)	-	-	-	-	-	-	3-1/16" 78mm	4-3/4" 121mm	5-1/8" 130mm	5-3/4" 146mm	6-5/8" 168mm	8-3/8" 213mm
"K" (℄ Outlet to ℄ Inlet)	-	-	-	-	-	-	9/16" 14.3mm	1-1/4" 31.7mm	1-7/16" 36.5mm	1-7/16" 36.5mm	1-3/4" 44.4mm	2-1/8" 54mm
Number of Bolts	6	8	6	8	8	12	6	6	8	8	9	10
Weight	6lb 2.7kg	12lb 5.5kg	21lb 9.5kg	33lb 15.0kg	44-3/4lb 20.3kg	77-1/2 35.2kg	10lb 4.5kg	30lb 13.6kg	50lb 22.7kg	70lb 31.8kg	98lb 44.5kg	179lb 81.2kg
Max. Allowable Pressure, psig @ 100°F (Vessel Design)	250 psig @ 450˚F (17 bar @ 232˚C)						770	600	1080	1130	1015	1100

Note: Add Suffix to Model No. -6 for Ammonia Service, -12 for Freon Service (Specify Refrigerant).

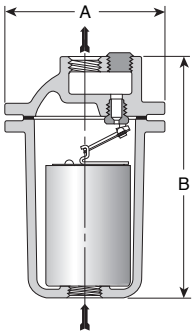


Figure 41-1.
Series 200 Traps

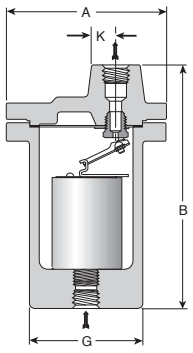


Figure 41-2.
Series 300 Traps

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Series 1000 Stainless Steel Inverted Bucket Liquid Seal Traps

Table 42-1. List of Materials

Name of Part	Series 1000
Body	ASTM A240 304-L Stainless Steel
Connections	304 Stainless Steel
Valve Seat	Hardened Chrome Steel-17-4PH or Titanium
Valve	Hardened Chrome Steel-17-4PH or Titanium
Valve Retainer	Stainless Steel
Lever	Stainless Steel
Guide Pin Assembly	Stainless Steel
Bucket	Stainless Steel

Options:

- Stainless Steel Internal Check Valve
- Socketweld Connections



Figure 42-1
Series 1010 Liquid Seals

Table 42-2. Physical Data

Model No.	1011		1022		1013	
Pipe Connections	in	mm	in	mm	in	mm
	1/2, 3/4	15, 20	3/4	20	1	25
"A" (Diameter)	2-3/4	68.9	3-7/8	100	4-1/2	114
"B" (Height)	7-1/4	184	8-13/16	224	11-3/8	289
"K" (℄ Inlet to ℄ Outlet)	9/16	14.3	3/4	18	1-3/16	30.2
Weight lb (kg)	1-3/4 (0.8)		4 (2)		7-1/2 (3.4)	
Maximum Allowable Pressure (Vessel Design)	400 psig @ 800˚F (28 bar @ 427˚C)		650 psig @ 600˚F (45 bar @ 316˚C)		450 psig @ 800˚F (31 bar @ 427˚C)	

Note: Model 1013 – Only available with screwed connections. Choice of NPT or British Standard screwed connections or socketweld connections.

Note: Add Suffix to Model No. -6 for Ammonia Service, -12 for Freon Service (Specify Refrigerant)

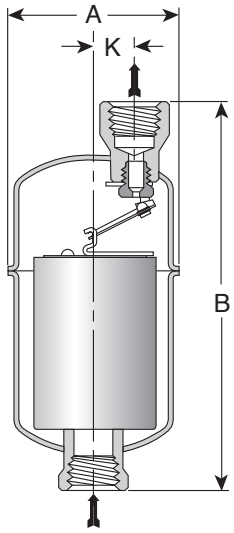


Figure 42-2
Model 1010 Trap

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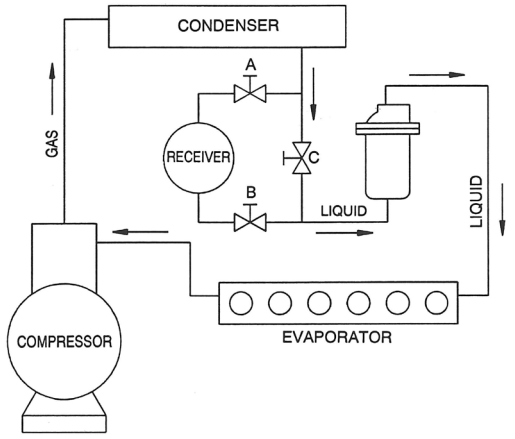


Figure 43-1
Inverted bucket expansion valve installation. Where no receiver is used, the installation is the same except for the receiver. When the receiver is used it is then by-passed. See explanation below.

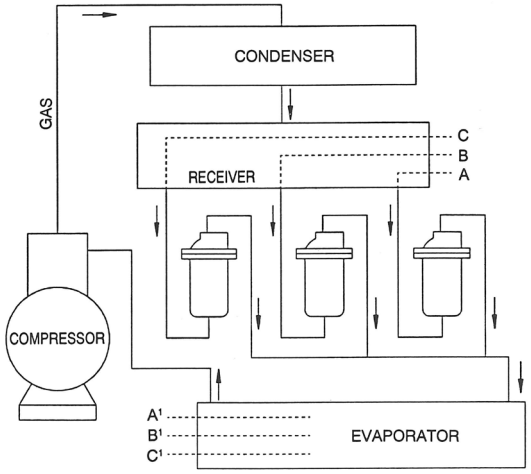


Figure 43-2
Multiple Installation of inverted bucket expansion valves for widely variable loads. See explanation below.

Armstrong Inverted Bucket Expansion Valves – or High-Side Floats – are small- to medium-sized float traps that will discharge liquid from the high side to the low side as fast as the liquid is formed. This requirement usually is limited to refrigeration systems where all liquid is carried in the evaporator.

Installed in the liquid line coming from the condenser, the Armstrong high-side float will open for refrigerant liquid and close when refrigerant gas floats the inverted bucket.

Operation: Same as liquid seal application shown in figures 38-2 and 38-3.

Advantages:

1. Cannot become gas bound
2. Open float cannot collapse
3. Not effected by ordinary amounts of dirt or oil
4. Large capacity in small size

Receiver in by-pass: Where there is some variation in the amount of liquid required in the evaporator, install a by-pass around the receiver, as shown in Figure 43-1. When more liquid is required in the evaporator, open valve B until the required evaporator liquid level is obtained. To lower liquid level in the evaporator, close valve C and open valve A.

Multiple Floats: Where the load varies widely, as in air conditioning, it is better to use two or more small or medium size Armstrong Inverted Bucket Expansion valves instead of a single large one. Figure 43-2 shows the location of the high-side float inlet pipes at different levels in the receiver. When the load is light, one high-side float is sufficient. The liquid level will be at line A in the receiver and line A1 in the evaporator. At maximum load all floats open and the liquid levels are at lines C and C1.

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Armstrong® Drain Traps For Hot Gas Defrost

Armstrong drain traps, for Hot Gas Defrost Systems, drain condensed liquid from evaporator coils while preventing hot gases from passing through the drainer

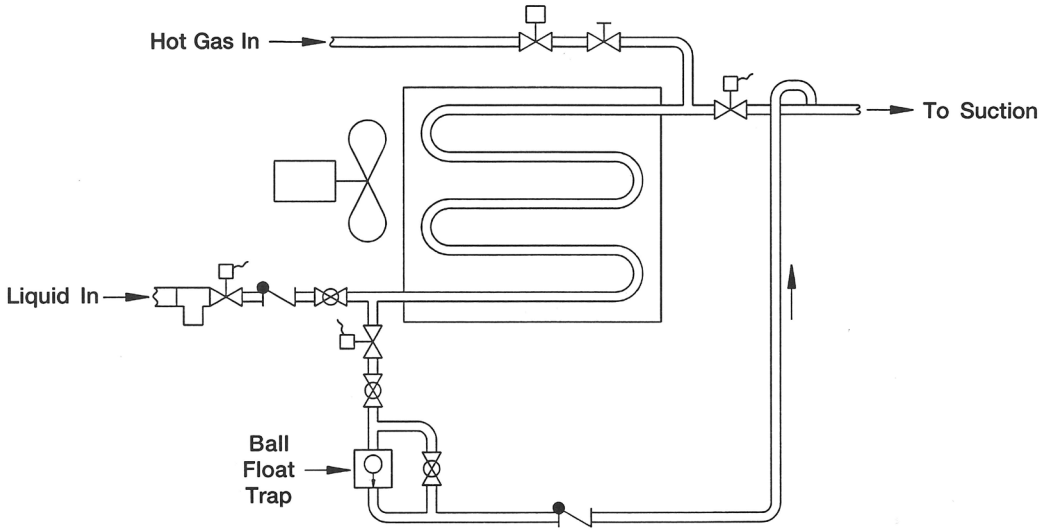


Figure 44-1
Typical Ball Float Application

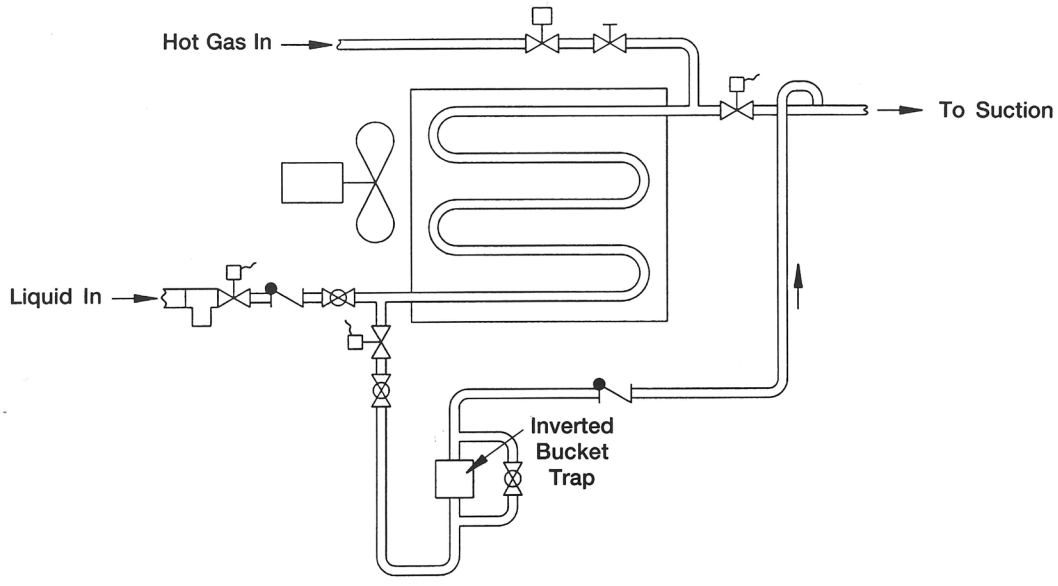


Figure 44-2
Typical Inverted Bucket Application

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Special Warranty Periods are as follows: Stainless Steel Products Series 1000, 1800, 2000 — Three (3) years after installation, but not longer than 39 months after shipment from Armstrong’s factory; OR for products operated at a maximum steam pressure of 400 psig/28 barg saturated service, the warranty shall be Five (5) years after installation, but not longer than 63 months after shipment from Armstrong’s factory.

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Notes

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