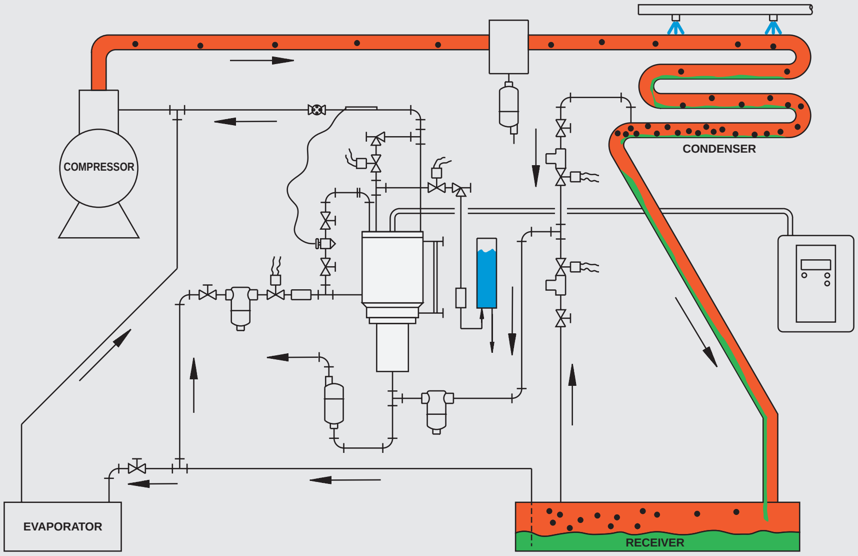
The Guide to Refrigerated Purging



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. 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.

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.

Temperature-Pressure Chart — Metric

All pressures: bar (gauge)

Temp. °C	Ammonia R-717	R-22	R-134a	R-502	Propane R-290	Propylene R-1270
	REFRIGERANT					
-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

Ref.: ASHRAE 1997 Fundamentals Handbook

Temperature-Pressure Chart

Vacuum:
Inches of mercury
Bold italic figures

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

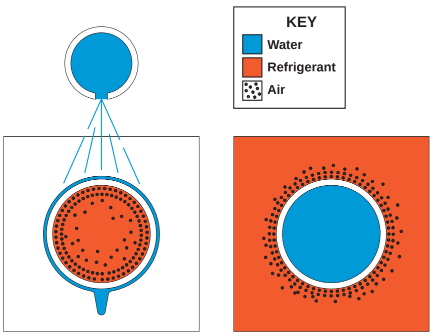
Temp. °F	REFRIGERANT Ammonia R-717	R-22	R-134a	R-502	Propane R-290	Propylene R-1270
-50	***14.3***	***6.1***	***18.7***	***0.2***	***4.3***	1.5
-45	***11.7***	***2.7***	***16.9***	1.9	***0.9***	3.6
-40	***8.8***	0.6	***14.8***	4.1	1.4	5.9
-35	***5.4***	2.6	***12.5***	6.5	3.4	8.4
-30	***1.6***	4.9	***9.9***	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 1997 Fundamentals Handbook

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.



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.

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 the Condenser is Expensive.

Power Costs.

For each 4 lbs. of excess head pressure caused by air increases compressor power costs by 2% and reduces compressor capacity by 1%. And, 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 also!

Wear and Tear.

Excess head pressure puts more strain on bearing and drive motors. Belt life is shortened and gasket seals are ruptured.

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.

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 conditions.
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.

How To Tell If Air Is Present.

To determine the amount air in a refrigeration system, check the condenser pressure and temperature of the refrigerant leaving the condenser against the data in Table 2-1 (Gatefold B for metric). If, for example your ammonia temperature is 85°F, the theoretical condenser pressure should be 151.8 psig. If your gauge reads 171 psig, you have 20-psi excess pressure that is increasing power costs 10% and reducing compressor capacity by 5%.

If you do not have digital readouts or liquid line mercury well, reasonably good readings can be obtained by strapping the bulb of an immersion thermometer to the liquid line. Cover the bulb with about 1″ of permagum and then insulate with heavy cloth. In 3 to 4 minutes, it should be possible to take a reading accurate to within ½ to ¾ of a degree.

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.*

Savings: Compressor Operating Costs

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

Pressure Reduction PSI	$0.03	$0.04	$0.05	$0.06	$0.08	$0.10	$0.12
5	$400	$530	$670	$800	$1070	$1330	$1600
10	$800	$1070	$1330	$1600	$2130	$2660	$3200
15	$1200	$1600	$2000	$2400	$3200	$4000	$4800
20	$1600	$2130	$2660	$3200	$4260	$5330	$6390

Table 3-1 shows the savings (in U.S. Dollars) in compressor operating costs achieved by using a refrigerated purge to reduce excess high side pressure.

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 & F. Even when there is enough air to significantly raise the high-side pressure, the gas mixture is still mostly refrigerant – Column I & 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 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 effective.

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.

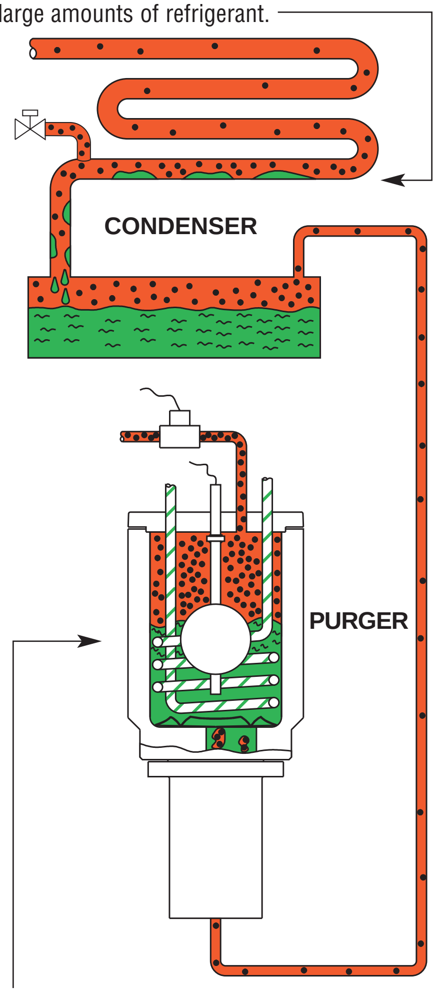
Table 4-1: Refrigerated purging with an ammonia system

Line	Temperature °F (A)	Temperature °C (B)	Refrig. Press. psia (C)	Air Press. psia (D)	Total pressure psia (E)	Total pressure bar (a) (F)	Refrig. Density lb/ft³ (G)	Air Density lb/ft³ (H)	Weight Ratio Gas/air (I)	Volume Ratio Gas/air (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 an R-134a system

Line	Temperature °F (A)	Temperature °C (B)	Refrig. Press. psia (C)	Air Press. psia (D)	Total pressure psia (E)	Total pressure bar (a) (F)	Refrig. Density lb/ft³ (G)	Air Density lb/ft³ (H)	Weight Ratio Gas/air (I)	Volume Ratio Gas/air (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.

Figure 4-1. Refrigerated Purging.

Where To Make Purge Connections

A refrigerated purger does not have magic fingers that can reach into a refrigeration system and find air. It 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 red 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 red 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

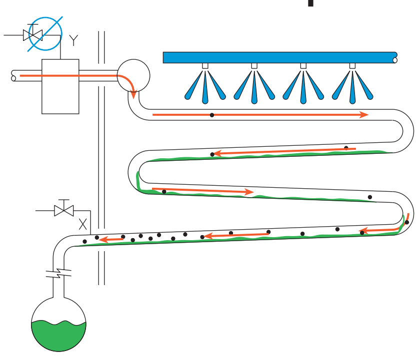


Fig. 5-1. (left) High velocity of entering refrigerant gas prevents any significant air accumulation upstream from point X. High velocity past point X is impossible because receiver pressure is substantially the same as pressure at point X. **Purge from point X.** Do not try to purge from point Y at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

Horizontal Shell and Tube Condensers

Side Inlet Type

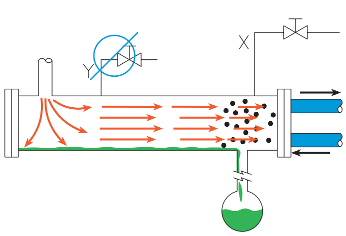


Fig. 5-2. Incoming gas carries air molecules to far end of the condenser near the cooling water inlet as shown. **Purge from point X.** If purge connection is at Y, no air will reach the connection countercurrent to the gas flow until the condenser is more than half full of air.

Center Inlet Type

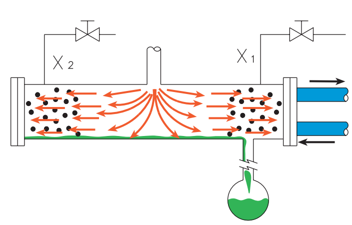


Fig. 5-3. Incoming refrigerant blows air to each end of the condenser. Air at the left hand end can't buck the flow of incoming gas to escape through the right hand connection at X_1. **Provide a purge connection** at each end but never purge from both at the same time.

Vertical Shell and Tube Condenser

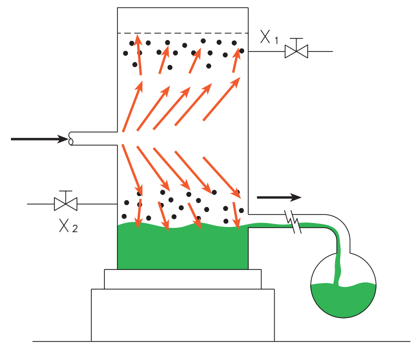


Fig. 5-4. Low gas velocity will exist at both top and bottom of the condenser. Purge connections desirable at both X_1 and X_2.

Purge Connection for Receiver

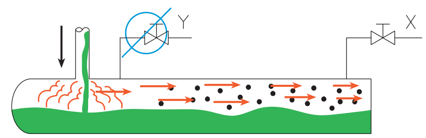


Fig. 5-5. Purge from Point X farthest away from liquid inlet. "Cloud" of pure gas at inlet will keep air away from point Y.

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

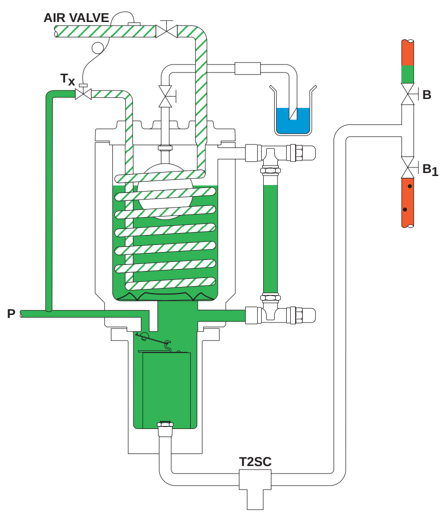


Figure 6-1. Priming the Purger
The purger is primed (filled with liquid) through P. At the same time liquid flows through T_X to cool the purger. The float senses when the body is full and filling stops.

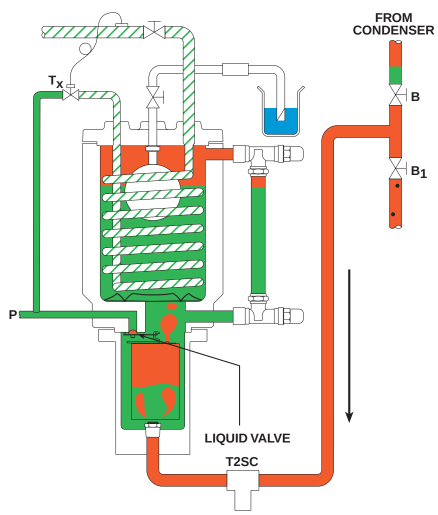


Figure 6-2. Opening Purge Point
When the purger is chilled, allow foul gas to enter the bottom of the purger. Be sure to purge from one purge point at a time only.

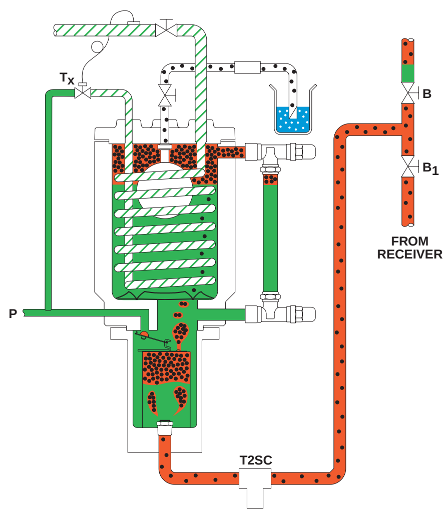


Figure 6-3. Gas and Air Removal
The subcooled liquid will condense refrigerant gas. Non-condensables will accumulate at the top of the purger to be vented to atmosphere.

Characteristics of Armstrong Purgers

Armstrong offers three configurations for the Automatic Purger Line:

- **Mechanical Purger:** The mechanical version incorporates an air vent and inverted bucket mechanisms for non-electric operations.
- **Electric Single Point Purger:** This style of Armstrong Purger 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:
  - To tell the controller if there is a pocket of air at the top of the Purger;
  - 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 Multi-Point Purger utilizes a float switch to tell a microprocessor controller what is happening in the Purger body at all times. Depending on the refrigerant level in the Purger body, the float switch has the controller activate the appropriate solenoid valve to maintain the liquid level and temperature inside the Purger body. There is no need to have the inverted bucket mechanism in the lower portion of the Purger due to the controller opening and closing solenoid valves. The Multi-Point controller can also operate the purge point valves. The functionality of the Multi-Point Controller allows for totally unmanned, automatic control and operation of the purging side of the system.

How The Armstrong Purger Fits Into A Refrigeration System

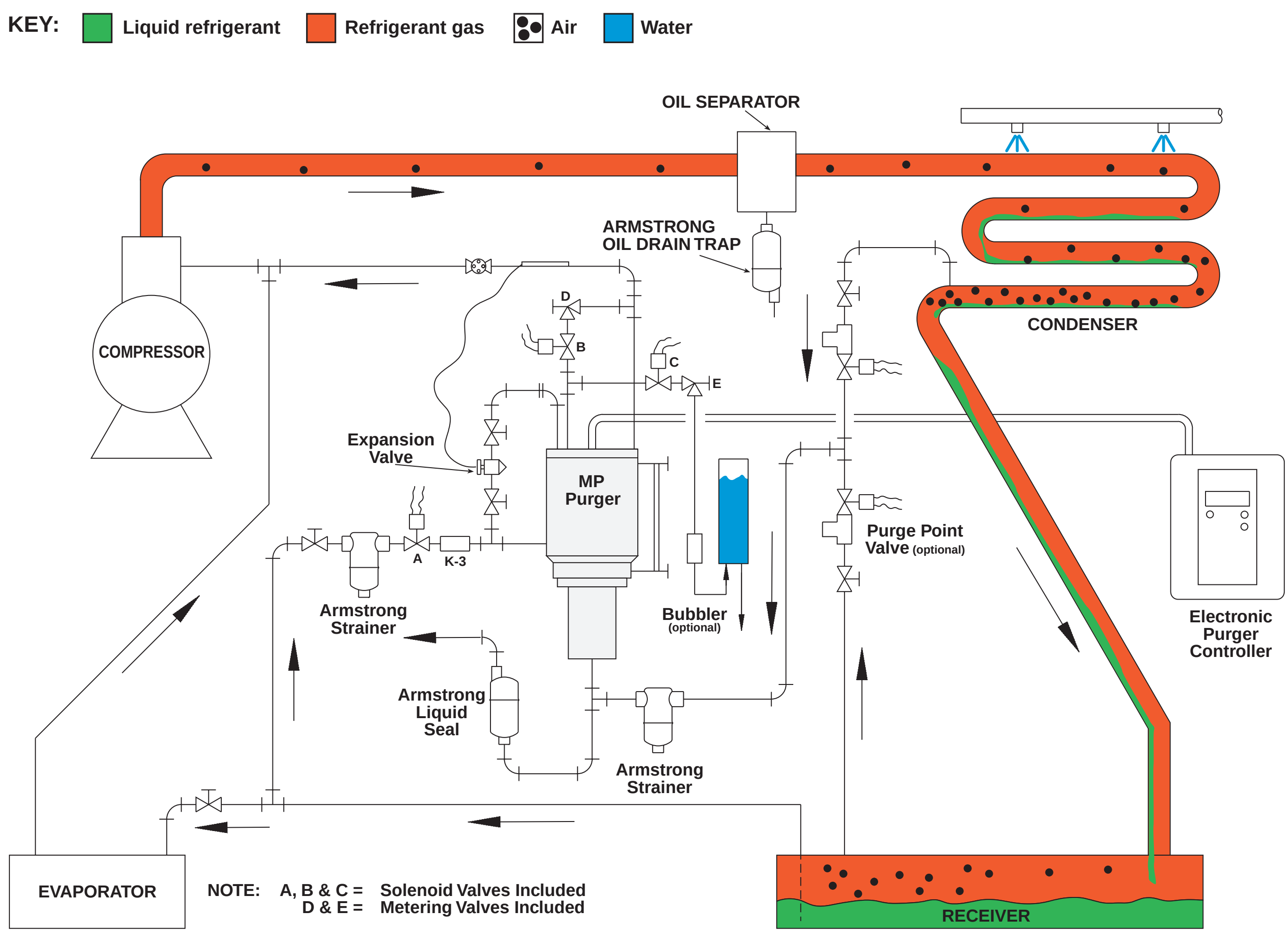


Figure 7.1 Refrigeration System
How the Armstrong Multi-Point purger fits into a refrigeration system.

The Multi-Point Purger and controller can handle from 1 to 16 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 the solenoid valves A, B or C and does not use automatic purge point valves. These valves would be of the manual variety.

The Electronic Single Point purger does not have the ability to use solenoid valves A and B and can operate only 1 purge point valve. The Electronic Single Point Purger can be used in systems that incorporate a PLC to run the refrigeration system. 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 12 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 condenser 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 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. An automatic electronic 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 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.

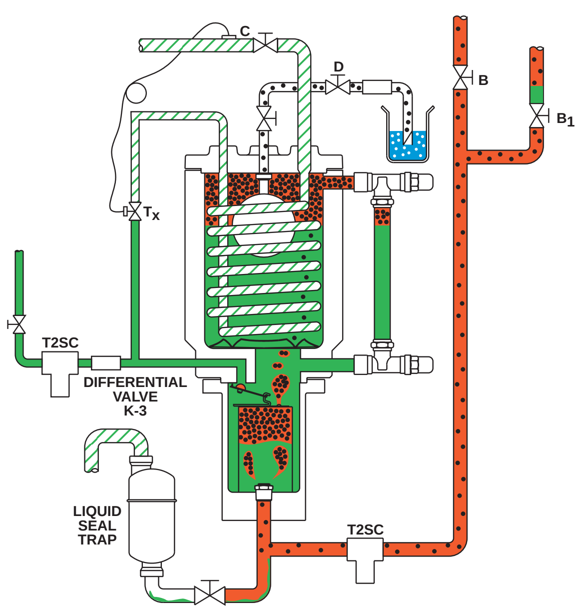
Low Differential

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 I**. 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 I

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 (continued)

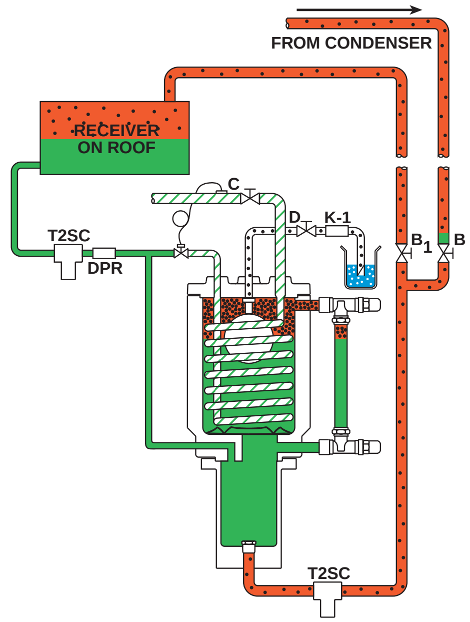
High Differential

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 II**. The differential pressure regulator takes the place of the K-3 valve in Piping Method I and is the difference in these two piping arrangements.

Piping Method II

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.)



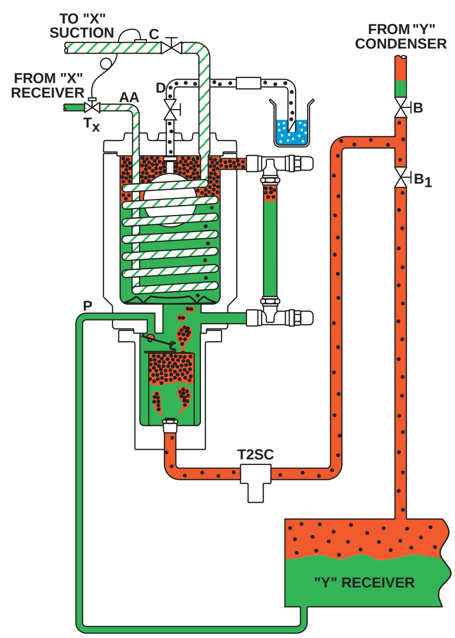
Two Gas Systems

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 V**. 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 V

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.)



Armstrong Purgers and Options Available

Mechanical Purgers (H)

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 need to be mounted and minimal connections made. The standard mechanical purger is **forged steel** for temperatures down to –50°F (-45°C). (Ref IB-72 and Bulletin 701)

Electronic Purgers

The options available for electronic purgers are many. From Electronic Single Point (ESP) Purgers to Multi-Point Purgers (MP) that can handle from 1 to 16 purge points, each in many different configurations and for most all refrigerants. Either style can retrofit the non-electric mechanical purger to electronic.

Electronic Single Point (ESP)

ESP 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 point 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 purger. The set temperature of the controller is adjustable and should be set to 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 ESP models can come ready to pipe or pre-piped on a frame for easy installation. Most refrigerants can be used with this style purger. (REF IB-77 and Bulletins 706, 707 & 708)

Electronic Multi-Point (MP)

Multi-Point Purgers are designed for systems that have as many as 16 points to be purged. The Multi-Point purger has an operation similar to the ESP Purger due to a similar float switch. The MP controller has the advantage over other purgers due to the ability to start and stop itself. The MP controller operates all operational solenoids for the purger along with up to 16 purge point solenoid valves. The fully programmable MP Controller is microprocessor based. 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 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. (REF IB-73 and Bulletins 705, 706 & 707)

Packaged Purgers

Packaged purgers are available in many configurations for each of the three models mentioned. The Packaged Purger offers the ease of installation along with the cost savings associated with piping requirements of standard units.

Requirements when ordering: Refrigerant being purged, suction temperature, voltage (if ESP or MP), high and low side pressures.

Purger Selection

The following are recommended selection considerations for Armstrong Purgers.

370-H Series are primarily used for hazardous gases or locations where electricity is not an option.

370-ESP Series are primarily used on packaged refrigeration systems or systems that only have one or two purge points.

370-MP Series are used in systems with as few as one point and as many as 16. These systems have total automatic operation of purging components in the system.

Sealed stainless steel versions are available for operating temperatures lower than –50°F (-45°C) or highly corrosive environments. (Reference Bulletine 706)

Limited Warranty and Remedy

Armstrong International, Inc. warrants to the original user that those products supplied by it and used in the service and in the manner for which they are intended shall be free from defects in materials and workmanship for a period of one (1) year after installation, but not longer than fifteen (15) months from date of shipment. Except as may be expressly provided for in a written agreement between Armstrong International, Inc. and the user, which is signed by both parties, Armstrong International, Inc. DOES NOT MAKE ANY OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

The sole and exclusive remedy with respect to the above limited warranty or with respect to any other claim relating to the products or to defects or any condition or use of the products supplied by Armstrong International, Inc. however caused, and whether such claim is based upon warranty, contract, negligence, strict liability or any other theory, is limited to Armstrong International, Inc.’s repair or replacement of the part or product, excluding any labor or any other cost to remove or install said part or product or, at Armstrong International, Inc.’s option, to repayment of the purchase price. Notice of any such claim must be given in writing to Armstrong International, Inc. within fifteen months after the first installation or use of the products. In no event shall Armstrong International, Inc. be liable for special, direct, indirect, incidental or consequential damages, including, but not limited to, loss of use or profits or to interruptions of business activity.

Prices, designs and materials are subject to change without notice.

Armstrong Refrigeration Products

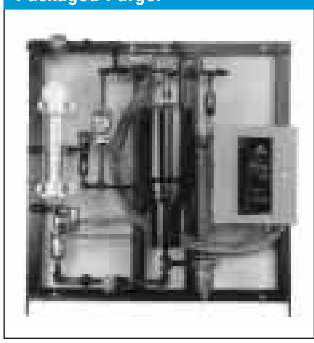
Multi-Point Refrigeration Purger

When properly applied to new or existing Armstrong purgers, the Multi-Point Purger Control will automatically start-up and monitor 1 to 16 purge points without the assistance of plant personnel. Built-in recording capabilities makes it possible for the operator to view an LED readout that indicates the amount of time that was spent purging and at which purge point it occurred. Request Bulletin No. 705

Single Point Purger

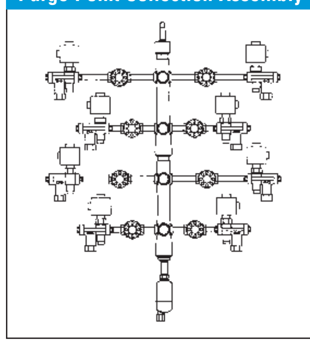
The Single Point Purger Controller is used with Armstrong 370-Series refrigerant purgers fitted with a float and temperature sensor assembly. This combination provides a simple, effective and efficient means of removing air and other non-condensables from refrigeration systems. Request Bulletin No. 708

Packaged Purger



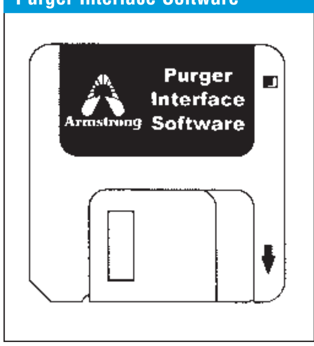
The Packaged Purger allows you to quickly mount and install your purger so that both time and money can be saved on pipe fittings, refrigeration accessories and labor costs. Request Bulletin No. 707. For Stainless Steel Purgers Request Bulletin No. 706

Purge Point Collection Assembly



The Armstrong PPCA for Refrigeration Systems allows you to quickly and efficiently assemble a purge location. The modular design significantly reduces design and installation costs and minimizes field assembly lead-time. Request Bulletin No. 715

Purger Interface Software



The Purger Interface Software allows two-way communication and full control of an Armstrong Multi-Point Purger Controller from a personal computer. Communication is established using RS-232 protocol allowing connection remotely through a modem or hardwired. Request Interface Software Card

T-Type Strainers

Armstrong stainless steel T-Type strainers remove solids from either liquid or gas. Protect your system by catching particles before they can harm valves or other sensitive equipment. Request Bulletin No. 175

Liquid Seal Traps

Automatically protect your long and exposed purge lines from liquid refrigerant with Armstrong Liquid Seal Traps. Liquid Seals Traps can drain the liquid to suction, to an evaporator or to an accumulator. Request Bulletin No. 760

Refrigeration Valves

Armstrong refrigeration valves to meet virtually all piping configurations. Request Bulletin No. 717

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