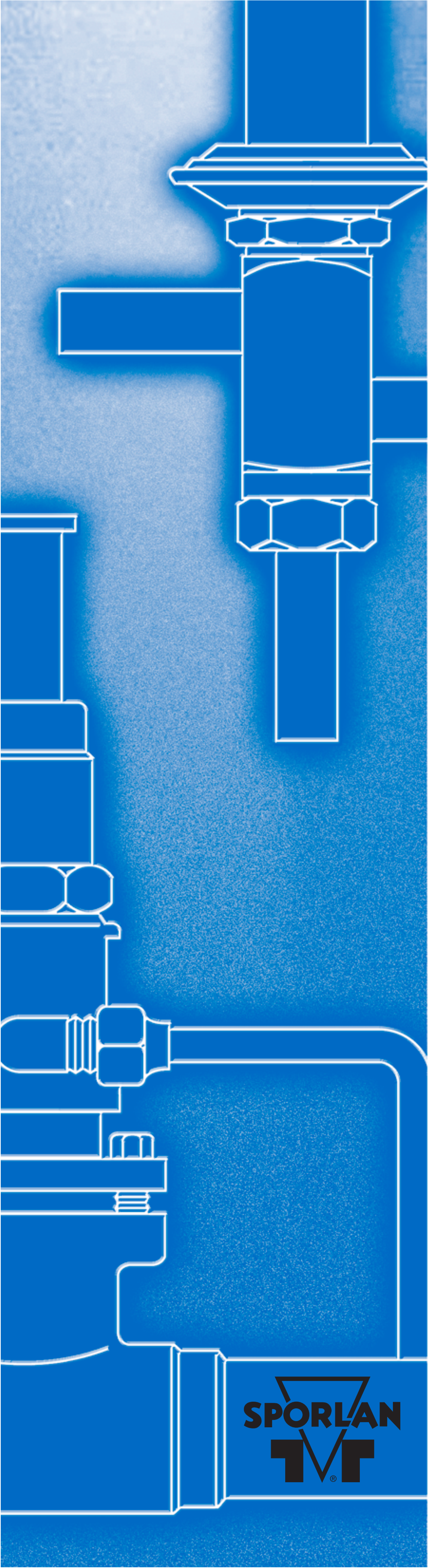
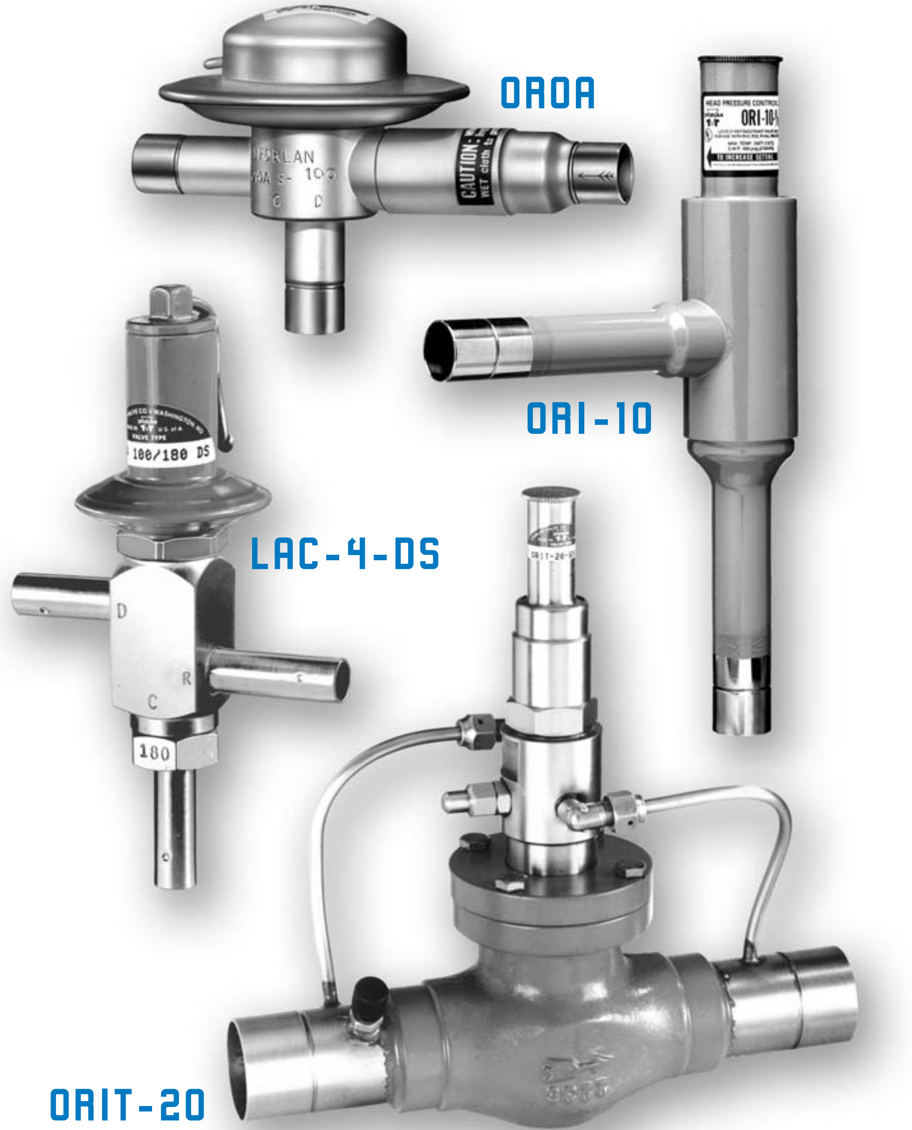
January 2004 / **BULLETIN 90-30**

HEAD PRESSURE CONTROL VALVES

for High and Low Ambient Stability





The design of air conditioning and refrigeration systems utilizing air cooled condensing units involves two main problems that must be solved if the system is to operate reliably and economically . . . **high ambient** and **low ambient** operation. If the condensing unit is properly sized, it will operate satisfactorily during extremely high ambient temperatures. However, since most units will be required to operate at ambient temperatures below their design dry bulb temperature during most of the year, the solution to low ambient operation is more complex.

FOR USE ON REFRIGERATION and/or AIR CONDITIONING SYSTEMS ONLY

Bulletin 90-30, January 2004, supersedes Bulletin 90-30, dated September 1986, Bulletin 90-30-2, dated May 1999, F90-30-4, dated July 1999, and all prior publications.

Without good head pressure control during low ambient operation, the system can experience both running cycle and off-cycle problems. Two running cycle problems are of prime concern:

1. Since the pressure differential across the thermostatic expansion valve port affects the rate of refrigerant flow, low head pressure generally causes insufficient refrigerant to be fed to the evaporator.

2. Any system using hot gas for defrost or compressor capacity control must have a normal head pressure to operate properly. In either case failure to have sufficient head pressure will result in low suction pressure and/or iced evaporator coils.

The primary off-cycle problem is the possible inability to get the system on-line if the refrigerant has migrated to the condenser. The evaporator pressure may not build up to the cut-in point of the low pressure control and the compressor can't start even though refrigeration is required. Even if the evaporator pressure builds up to the cut-in setting, insufficient flow through the TEV will cause a low suction pressure, which results in compressor cycling.

The typical method of maintaining normal head pressure in a refrigeration system during periods of low ambient temperature is to restrict liquid flow from the condenser to the receiver, and at the same time divert hot gas to the inlet of the receiver. This backs liquid refrigerant up into the condenser reducing its capacity which in turn increases the condensing pressure. At the same time the hot gas raises liquid pressure in the receiver, allowing the system to operate normally.

Sporlan has adjustable and fixed setting direct acting head pressure control valves for systems from 1 to 35 tons; and pilot operated valves for systems over 35 tons.

OPERATION

LAC-4 — The valve designation LAC stands for **Low Ambient Control**. The LAC-4 is a three way modulating valve that responds to discharge pressure. As shown in Figures 1 and 2, the discharge pressure bleeds around the pushrod to the underside of the diaphragm. The discharge pressure opposes the dome pressure. When the outdoor ambient falls, the condensing pressure falls. This causes the discharge pressure to fall as well. When the discharge pressure falls below the dome pressure, the valve modulates open to the discharge port which allows discharge gas to bypass the condenser. Mixing the discharge gas with the liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up in the condenser. Flooding the condenser reduces the area available for condensing. This reduction in effective condenser surface area results in a rise in condensing pressure. During summer conditions, the discharge pressure is high thus closing the discharge port. Hence, there is full liquid flow from the condenser to the receiver.

LAC-5, LAC-10 — The LAC-5 and LAC-10 are also three-way modulating valves but they respond to receiver pressure. As shown in Figure 3, the receiver pressure acts under the diaphragm. As the receiver pressure drops below the valve setting, the seat moves away from the discharge port allowing discharge gas to bypass the condenser. This discharge gas warms the liquid in the receiver and raises the pressure to the valve setting. At the same time discharge gas is bypassing the condenser, liquid flow from the condenser is restricted, which allows liquid to back up in the condenser. Flooding the condenser reduces the area available for condensing thus raising the condensing pressure. During summer conditions, the seat closes the discharge port due to high pressure in the receiver. Therefore, there is full liquid flow from the condenser to the receiver.

Figure 1
LAC-4

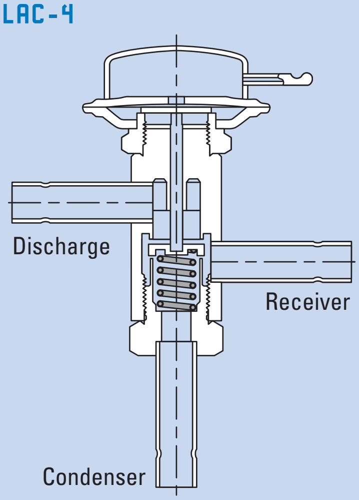


Figure 2
LAC-4-DS

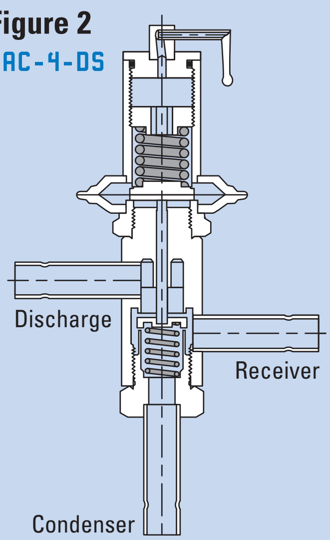
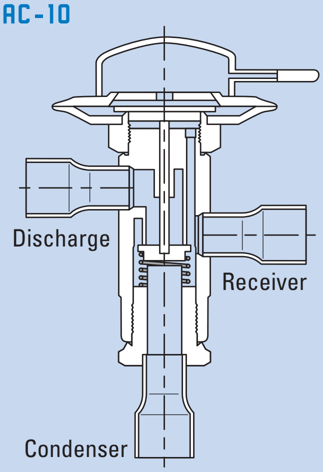
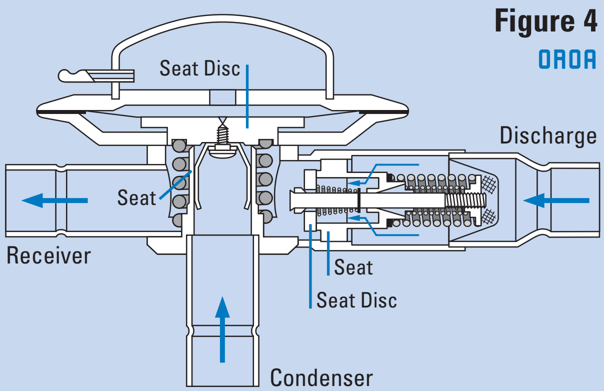


Figure 3
LAC-5
LAC-10



OROA — The OROA is a nonadjustable head pressure control valve which performs the function of limiting the flow of liquid refrigerant from the condenser and at the same time regulates the flow of hot gas around the condenser to the receiver. The main orifice of the OROA valve is controlled by the valve diaphragm which causes the orifice to **Open on Rise of Outlet** pressure. As shown in Figure 4, the **inlet** and **outlet** pressures are exerted on the underside of the seat disc in an opening direction. Since the area of the port is small in relationship to the diaphragm area, the inlet pressure has little direct effect on the operation of the valve. Therefore, the outlet or receiver pressure is the control pressure which actuates the valve. The force on top of the diaphragm, which opposes the control pressure, is due to the air charge in the element. These two forces are the operating forces of the OROA valve that control the main orifice.

Figure 4
OROA



When the outdoor ambient temperature changes, the condensing pressure changes. This causes the receiver pressure to fluctuate accordingly. As the receiver pressure decreases, the OROA throttles the flow of liquid from the condenser. And as the receiver pressure increases, the valve modulates in an opening direction to maintain a nearly constant pressure in the receiver. Since the ambient temperature of the element affects the valve pressure setting, the control pressure may change slightly when the ambient temperature changes. However, the valve and element temperature remain fairly constant.

An ORD valve is an integral part of the OROA valve. The operation of the ORD is described later.

ORI — The ORI head pressure control valve is an inlet pressure regulating valve and responds to changes in condensing pressure only. The valve designation stands for **Opens on Rise of Inlet** pressure. As shown in Figure 5, the **outlet** pressure is exerted on the underside of the bellows and on top of the seat disc. Since the effective area of the bellows is equal to the area of the port, the **outlet** pressure is cancelled and the **inlet** pressure acting on the bottom of the seat disc opposes the adjusting spring force. These two forces are the operating forces of the ORI.

When the outdoor ambient temperature changes, the ORI opens or closes in response to the change in condensing pressure. An increase in **inlet** pressure above the valve setting tends to open the valve. If the ambient temperature drops, the condenser capacity is increased and the condensing pressure falls, causing the ORI to modulate toward the closed position.

Figure 5
ORI

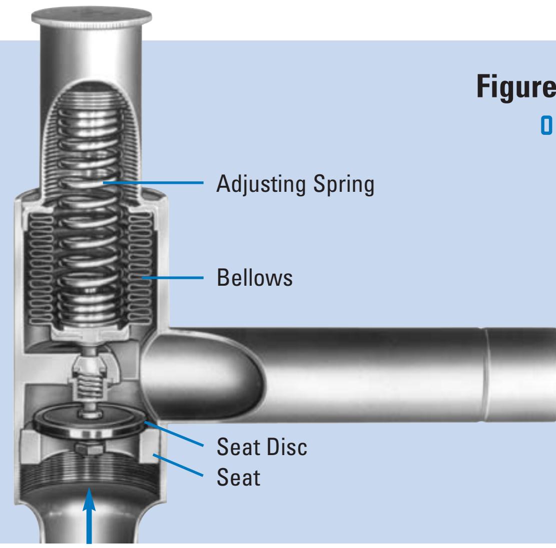
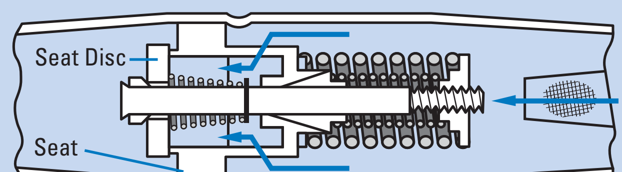


Figure 6
ORD



ORD — The ORD valve is a pressure differential valve that responds to changes in the pressure difference across the valve, Figure 6. The valve designation stands for **Opens on Rise of Differential** pressure. Therefore, the ORD is dependent on some other control valve or action for its operation. And in this respect, it is used with the ORI for head pressure control.

As the ORI valve starts to throttle the flow of liquid refrigerant from the condenser, a pressure differential is created across the ORD. When the differential reaches setpoint, the ORD starts to open and bypasses hot gas to the liquid drain line. As the differential increases, the ORD opens further until its full stroke is reached at a differential of 10 psi above setpoint. Due to its function in the control of head pressure, the full stroke can be utilized in selecting the ORD.

The standard pressure setting for the ORD is 20 psig. For systems where the pressure drop between the compressor and the receiver is higher than 14 psi, an ORD with a higher setting is available. See Table 1 below.

Table 1

Maximum Pressure Drop Between Compressor and Receiver – psi	Head Pressure Component Selection
Below 14	ORO**A**-5-100 or -180 ORD-4-**20** & ORI
15 – 19	*ORO**AB**-5-100 or -180 *ORD-4-**25** & ORI
20 – 24	*ORO**AC**-5-100 or -180 *ORD-4-**30** & ORI
25 – 29	*ORO**AD**-5-100 or -180 *ORD-4-**35** & ORI

Bold type indicates pressure range.
*Available on Special Order ONLY.

ORIT-15 and ORIT-20 — The pilot on the valve senses pressure from the valve's inlet (condenser pressure) connection through a pilot tube (See Figure 7). This pressure acts on the underside of the bellows and is opposed by the adjustment spring and bellows force. The pilot port also regulates the inlet pressure to the top of the main piston. Pressure on top of the main piston is bled to the valve's outlet connection through a fixed restrictor. As the pressure on top of the main piston decreases and increases it causes the main piston to modulate opened and closed.

As the inlet pressure increases above the valve's setting, the pilot port modulates in a closing direction. This causes the pressure on top of the main piston to decrease, which allows the piston to rise and modulate the main port open. As the inlet pressure decreases below the valves setting, the pilot port opens, which increases the pressure above the main piston, driving it in the closing direction.

MANUAL OPEN - ORIT-15 and ORIT-20 — The manual open override stem can be turned fully in the clockwise direction to manually open the valve. This opens the main port by closing the passageway that allows pressure to enter the chamber on top of the main piston. This pressure then bleeds off and the main piston remains in the open position.

CROT-12 and CROT-15 — The valve designation CROT stands for **Close on Rise of Outlet Pressure**. Inlet pressure enters the area on top of the main piston through a fixed orifice. This pressure is bled to the outlet of the valve through the pilot port (See Figure 8). The pressure from the outlet of the valve (receiver pressure) acts on the underside of the bellows opening and closing the pilot port, which controls the pressure on top of the main piston, modulating it opened or closed. As the outlet pressure rises the pilot port closes, building pressure on top of the main piston, driving it in a closing direction. As the outlet pressure falls, the pilot port opens, bleeding pressure from the top of the main piston, and moving the main piston in the open direction.

MANUAL CLOSE - CROT-12 and CROT-15 — The manual pilot override stem can be turned fully in the clockwise direction to manually close the valve. This causes the main piston to close by blocking the passageway that bleeds pressure from the top of the main piston. The pressure on top of the main piston then builds up and the main piston remains closed.

Figure 7
ORIT-15-65/225
ORIT-20-65/225

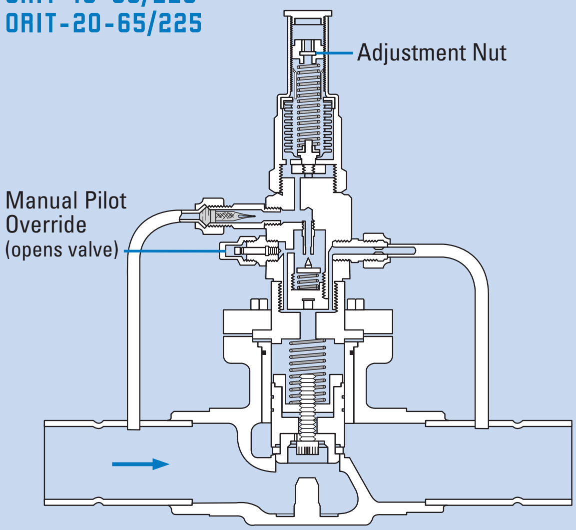


Figure 8
CROT-12-65/225
CROT-15-65/225

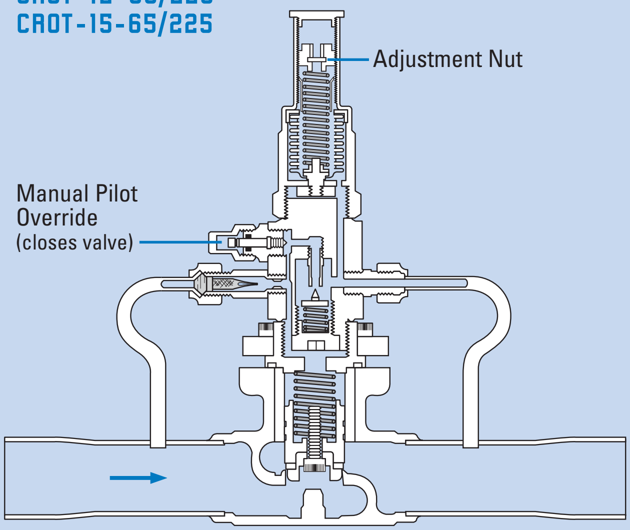


Figure 9

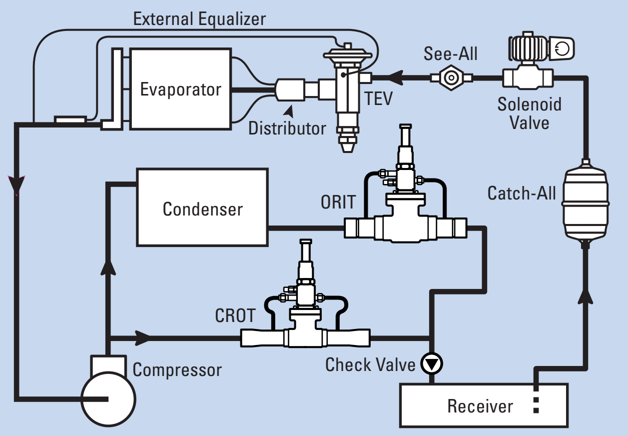
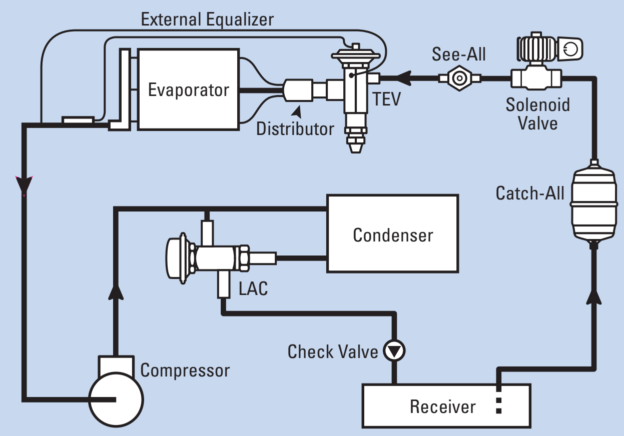


Figure 10



ADJUSTABLE ORIT/CROT System — Figure 9 shows the general location of the large pilot-operated head pressure control valves. The ORIT-15 and ORIT-20 are located in the liquid drop leg from the condenser. These valves respond to their inlet pressure. Thus, they modulate closed as the condenser pressure falls to back up refrigerant in the condenser. This reduces the effective condenser area, keeping condenser pressure up during low ambient conditions.

The CROT-12 and CROT-15 should be located in a discharge line bypassing the condenser. These valves respond to their outlet pressure and modulate open as the receiver pressure falls. Discharge gas enters the receiver thus raising the pressure.

NOTE: During an off-cycle there is a potential for refrigerant to migrate from the warm receiver to the cold condenser. An **auxiliary check valve should be used** in the liquid line between the ORIT and the receiver to prevent this from occurring. See Figure 9.

APPLICATION

LAC and OROA Pressure Settings — The LAC and OROA valves are available with three standard settings which should handle the majority of applications: 100 psig for R-134a; 180 psig for R-22, R-407C and R-502; and 210 psig for R-402A, R-404A and R-507. The LAC valves can also be used with other commonly used refrigerants including 401A. Generally, standard settings may be used for these refrigerants but special settings may be preferred for some applications.

The standard element is a non-adjustable dome element as shown in Figure 3. However, there are many valves in the field with non-adjustable remote bulbs indicated by an "R" following the valve setting. Valves and elements with the remote bulb are available on special order. The valve designation and setting are stamped on the valve body. Many valves in the field have special settings and should be replaced with the same valve to ensure satisfactory system performance.

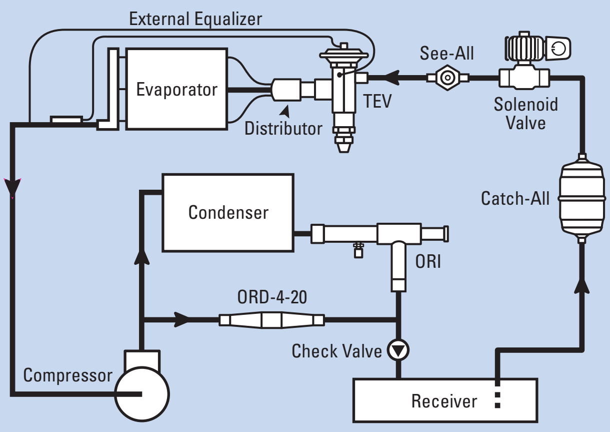
The LAC-4-DS has a dual setting feature that allows a choice between two fixed settings, see Figure 2. The DS element has an internal spring that is set to maintain the lower setting. The element is then charged with air to obtain the higher setting and the capillary tube is pinched and fused. An example is an LAC-4-DS-100/180. If the capillary tube is left intact the valve will maintain a 180 psig setting. If the capillary tube is clipped and fused again, the valve will maintain a 100 psig setting. It is important to fuse the capillary tube tip after clipping to prevent moisture from entering the element.

Refrigerant Migration — During an off cycle there is a potential for refrigerant to migrate from the warm receiver to the cold condenser. An auxiliary check valve should be used in the liquid line between the LAC and the receiver to prevent this from occurring. See Figure 10.

ORI/ORD — The operation of the ORI/ORD system is such that a constant receiver pressure is maintained for normal system operation. Since the ORI is adjustable over a nominal range of 65 to 225 psig, the desired pressure can be maintained for **all** of the commonly used refrigerants.

As shown in Figure 11, the ORI is located in the liquid drain line between the condenser and the receiver. And the ORD is located in a hot gas line bypassing the condenser. During periods of low ambient temperature, the condensing pressure falls

Figure 11



until it approaches the setting of the ORI valve. The ORI then throttles, restricting the flow of liquid from the condenser. This causes refrigerant to back up in the condenser thus reducing the active condenser surface and raising the condensing pressure. Since it is really receiver pressure that needs to be maintained, the bypass line with the ORD is required.

The ORD opens after the ORI has offered enough restriction to cause the differential between condensing pressure and receiver pressure to exceed the ORD setpoint. The hot gas flowing through the ORD serves to heat the cold liquid being passed by the ORI. Thus the liquid reaches the receiver warm and with sufficient pressure to assure proper expansion valve operation. As long as sufficient refrigerant charge is in the system, the two valves modulate the flow automatically to maintain proper receiver pressure regardless of outside ambient temperature.

While valve capacity ratings and basic selection procedures are given later, two other factors affect the proper selection of head pressure control valves . . . paralleling valves for larger systems and pressure settings. These are discussed separately below along with the other application factors that affect the operation of a system.

Paralleling Valves — If the system capacity is greater than any of the head pressure control valves' ratings, these valves can be applied in parallel. The ORD-4 is used with two sizes of head pressure control valves, ORI-6 and ORI-10. In those cases where the ORI-10 is applied on systems with more capacity than the ORD-4 or when more than one head pressure control valve is used, it is necessary to use two or more ORD-4 valves in parallel. Since it is **not** harmful to oversize any of these valves, it is better to select them equal to or larger than the system capacity to minimize pressure drop.

Head Pressure Control for Reclaim Systems — When employing heat reclaim on a refrigeration system, the addition of head pressure controls is important not only to maintain liquid pressure at the expansion valve inlet, but also to assure the availability of quality hot gas at the reclaim heat exchanger.

Some precautions must be taken when installing heat reclaim on a system equipped with head pressure control. If reclaim coils are piped in a series circuit, additional pressure drop is created between the compressor discharge valve and the receiver inlet by the added components. This additional pressure drop in two condensers, three-way diverting valve, the head pressure control and associated piping might cause the ORD-4-20 or OROA-5-100 or -180 to stay in the bypass position at all times.

If this pressure drop is determined to be above 14 psi, consult Table 1 for recommended HPC components.

When heat reclaim is added to a parallel system, the only increase in pressure drop is introduced by the diverting valve. This additional pressure drop must be considered when selecting head pressure controls. See Table 1 for proper selection. Refer to Sporlan Bulletin 30-20 for more information on heat reclaim systems.

Pressure Settings — The pressure settings of these valves determine to a great extent how well the system will operate once they are installed. The proper setting is a function of the specific system on which the valves are applied. Generally, the setting should be equivalent to a condensing temperature of approximately 90 to 100°F or a receiver pressure equivalent to a temperature of approximately 80 to 90°F. This means that when the ambient temperature falls below approximately 70°F, the head pressure control valve will start to throttle. Normally, it is not necessary or economical to operate with a higher setting than this. On systems with hot gas defrost, hot gas bypass for capacity control, or heat reclamation it is important that proper head pressure control be utilized to ensure sufficient heat to operate. One factor to keep in mind is that the valve setting doesn't make any difference if the system is short of refrigerant. This is discussed below.

The ORI valves are adjustable over a nominal range of 65 to 225 psig. And because of their adjustability, they can be used with **all** commonly used refrigerants. The standard factory setting is 120 psig for R-134a. If a higher adjustment range is necessary, replacement spring kits are available. KO-6-100/290 (for ORI-6-65/225) and KO-10-100/290 (for ORI-10-65/225) can be used to achieve the higher pressure range. See Bulletin 122. This change will result in approximately 12% less capacity than is stated on page 9 because of the stronger spring. Valves with other settings and ranges are available in reasonable quantities on special order. Adjustment instructions are included in Bulletin 90-31.

Since the OROA is a non-adjustable valve, the desired **receiver** pressure setting must be specified. Three standard settings have been set up to handle the majority of applications: 100 psig, 180 psig, and 210 psig. Valves with other pressure settings are available in reasonable quantities on **special** order. Since the OROA controls receiver pressure, these settings approximate the nominal condensing pressure settings of 120 psig and 200 psig for the ORI valves because of the opening pressure differential of the ORD.

The standard setting for the ORD is 20 psig. That is, it will start to open when the pressure difference between the discharge line and the receiver is 20 psig. This setting is suitable for all systems where the combined pressure drop through the condenser, the ORI or OROA, and connecting piping is **less than 14 psi**. Therefore, if the ORI or OROA is selected for 2 psi ΔP, then the maximum allowable pressure drop through the condenser is 12 psi. Normally, condenser pressure drop on refrigeration systems is less than 10 psi. However, many condensers on air conditioning systems may have pressure drops up to 25 psi. Therefore, when in doubt, consult with the equipment manufacturer or, if possible, measure it by reading the discharge pressure at the compressor and the receiver pressure **during full load operation**. This reading should be taken with a normal condensing temperature at full load. For systems where the condenser pressure drop is higher than normal, ORD valves with higher settings are available. See Table l.

Piping Suggestions — Figures 9, 10, and 11 are piping schematics only to illustrate the general location of the head pressure control valves in the system. Sporlan recommends that recognized piping references be consulted for assistance in piping procedures. Sporlan is not responsible for system design, any damage arising from faulty system design, or for misapplication of its products. If these valves are applied in any manner other than as described in this bulletin, the Sporlan warranty is void.

The inlet connections on the ORI-6, ORI-10, and OROA valves should be sized the same as the outlet of the condenser where possible. The ORD-4 is available with 5/8” ODF connections only, since a 5/8” OD bypass line will handle flow capacities up to the capacity rating of this valve. On systems with discharge lines smaller than 5/8” OD, the bypass line can be the same size as the discharge line and the ORD-4 and the OROA bypass connections can be bushed down. The 5/8” ODF connection on the OROA is used as the hot gas bypass line. This is available in this manner for two reasons — to allow the bypassed hot gas to flow through the OROA to maintain the element temperature and to eliminate the need of a separate tee connection in the liquid drain line. Installation flexibility is possible when the OROA valve is utilized, since the ORD valve is installed in the bypass line.

Inlet strainers are available for all head pressure control valves. Due to the construction of the ORD, it is only available with the strainer included. However, the strainer is optional for the ORI and OROA valves. Just as with any refrigerant flow control devices, the need for an inlet strainer is a function of system cleanliness.

ORIT/CROT Valve Adjustment and Pressure Settings — The ORIT and CROT valves are both adjustable from 65 to 225 psig. The standard setting for the ORIT valve is 150 psig, and is 140 psig for the CROT valve. These valves use a bellows type pilot to achieve the 65 to 225 psig adjustment range. The CROT valve setting can be adjusted to allow for a pressure drop between the compressor and the receiver. The adjustable ORIT and CROT can be used with all common refrigerants including 22, 134a, 401A, 402A, 404A, 407C, 502 and 507.

Either type valve can be adjusted by removing the seal cap on top of the valve and adjusting the setting with a 1/4 hex wrench. A clockwise rotation increases the valve setting, and a counterclockwise rotation decreases the valve setting. The setting of the CROT valve should always be **less than** the setting of the ORIT valve. The difference in the settings should be **greater** than the amount of pressure drop between the compressor and the receiver. If the setting of the CROT valve is too close to the setting of the ORIT valve, the CROT may bypass discharge gas continually.

SELECTION PROCEDURES

The actual selection of Sporlan Head Pressure Control Valves involves four basic items:

1. System capacity in tons
2. Refrigerant
3. Minimum ambient design temperature
4. Allowable pressure drop across the valve

When selecting these valves it is necessary to consider the valve’s capacity when it is controlling at the minimum ambient design temperature. The minimum ambient design temperature is a factor because

HEAD PRESSURE CONTROL VALVE CAPACITIES

High Ambient (SUMMER) Capacities - Tons of Refrigeration

Capacities are based on 0°F evaporator temperature.

Refrigerant	Pressure Drop Across Valve (psi)	Valve Type							
		LAC-4	LAC-5	LAC-10	ORI-6	ORI-10	OROA-5	ORIT-15	ORIT-20
22	1	2.72	5.82	12.4	7.79	20.8	11.0	---	---
	2	3.80	8.24	17.2	11.3	28.7	15.5	---	---
	3	4.63	10.1	20.8	14.1	34.7	19.0	---	---
	4	5.32	11.7	23.9	16.5	39.7	21.9	35.3	82.8
	5	5.92	13.0	26.5	18.6	44.0	24.5	46.7	149
	6	6.47	14.3	28.9	20.5	47.9	26.8	58.7	163
	8	7.43	16.5	33.2	23.9	54.8	30.9	84.2	189
	10	8.28	18.4	36.8	27.0	60.8	34.5	94.8	212
134a	1	2.46	5.28	11.2	5.26	13.0	9.98	---	---
	2	3.45	7.47	15.6	7.65	18.0	14.1	---	---
	3	4.19	9.15	18.9	9.52	21.7	17.2	---	---
	4	4.82	10.6	21.6	11.1	24.9	19.8	31.9	75.1
	5	5.37	11.8	24.0	12.5	27.6	22.2	42.3	135
	6	5.86	12.9	26.2	13.8	30.0	24.3	53.1	148
	8	6.73	14.9	30.0	16.2	34.3	28.0	76.3	171
	10	7.50	16.7	33.4	18.2	38.1	31.2	85.9	192

Refrigerant	Pressure Drop Across Valve (psi)	Valve Type							
		LAC-4	LAC-5	LAC-10	ORI-6	ORI-10	OROA-5	ORIT-15	ORIT-20
404A	1	1.78	3.81	8.14	5.53	15.3	7.21	---	---
	2	2.49	5.39	11.3	8.05	21.2	10.2	---	---
	3	3.03	6.60	13.7	10.0	25.6	12.4	---	---
	4	3.49	7.62	15.7	11.7	29.2	14.3	23.1	54.1
	5	3.88	8.52	17.4	13.2	32.4	16.0	30.6	96.9
	6	4.24	9.33	19.0	14.6	35.3	17.5	38.5	106
	8	4.87	10.8	21.8	17.0	40.4	20.2	55.2	123
	10	5.43	12.1	24.2	19.2	44.8	22.6	62.2	138
507	1	1.73	3.70	7.90	5.46	15.1	7.01	---	---
	2	2.42	5.24	11.0	7.94	20.9	9.88	---	---
	3	2.95	6.42	13.3	9.88	25.2	12.1	---	---
	4	3.39	7.41	15.2	11.5	28.8	13.9	22.5	52.6
	5	3.77	8.29	16.9	13.0	32.0	15.6	29.7	94.3
	6	4.12	9.08	18.5	14.4	34.8	17.0	37.4	104
	8	4.74	10.5	21.2	16.8	39.8	19.6	53.6	120
	10	5.28	11.7	23.5	18.9	44.2	21.9	60.5	134

the bypassed discharge gas must heat the subcooled liquid leaving the condenser to maintain the receiver pressure. This subcooled liquid will approach the ambient temperature. It is the flow of the discharge gas and liquid mixture flowing through the valve at the minimum design ambient conditions that will determine the valve's capacity. Once the valve's capacity and pressure drop have been determined at minimum design ambient conditions, the capacity of the valve during high ambient conditions should be checked to determine the pressure drop of the valve with full liquid flow.

The large pilot-operated **ORIT** and **CROT** valves require a minimum of **4 psi pressure drop** across the main port to open. Therefore, the **ORIT** should not be oversized such that the capacity of the system is less than the rating at a 4 psi pressure drop. The **CROT** valve is normally sized for a 10 to 20 psi pressure drop. The ORD-4-20 is normally sized for a 25 to 30 psi pressure drop.

Example #1 — Select a LAC valve for a 12 ton, R-22 unit with a minimum design ambient temperature of -20°F. The LAC-10 has a capacity of 12.6 tons at a 5 psi drop across the valve according to the Low Ambient Capacity Table on page 9. The LAC-10 also has a capacity of 12.4 tons at a 1 psi drop across the valve according to the High Ambient Capacity Table above. The LAC-10 is the correct selection.

Example #2 — Select a head pressure control system for a 100 ton R-22 air conditioning system. The minimum ambient is 0°F.

The table shows the ORIT-20-65/255 with a capacity of 149 tons at a 5 psi pressure drop. The 100 ton capacity would require a pressure drop of approximately 4.5 psi. The table also shows the CROT-15-65/225 with a capacity of 94.8 tons at a 10 psi pressure drop. The 100 ton capacity would require a pressure drop of approximately 10 psi. Therefore, the ORIT-20-65/225 and the CROT-15-65/225 are the correct selections for this application.

UNDERWRITER'S LABORATORY INFORMATION

Both the ORI-6 and ORI-10 are U.L. Listed valves. They have a maximum rated pressure (MRP) of 450 psig. The LAC valves and the OROA-5 are all U.L. Recognized components. The MRP for the LAC-4 is 500 psig, while the OROA-5, LAC-5, and LAC-10 have a MRP of 450 psig. All valves are in U.L. file SA-5460.

HEAD PRESSURE CONTROL VALVE CAPACITIES

Low Ambient (WINTER) Capacities - Tons of Refrigeration

Capacities are based on 0°F evaporator temperature.

Refrigerant Valve Setting (psig)	Minimum Ambient Design Temp. °F	Pressure Drop Across Valve (psi)	Valve Type					
			LAC-4	LAC-5	LAC-10	ORD-4	ORIT-15 CROT-12	ORIT-20 CROT-15
22	-20	1	1.77	3.13	7.53	2.90	---	---
		2	2.49	4.43	10.6	4.09	---	---
		5	3.89	6.98	16.4	6.41	32.9	58.6
		10	5.44	9.84	22.8	8.95	46.3	82.6
		15	6.59	12.0	27.6	10.8	56.4	101
		20	7.54	13.8	31.4	12.3	64.7	116
		25	8.34	15.4	34.6	13.6	72.0	129
		30	9.05	16.8	37.4	14.7	78.4	141
	0	1	1.91	3.37	8.08	3.33	---	---
		2	2.68	4.77	11.3	4.70	---	---
		5	4.20	7.52	17.6	7.37	37.8	67.4
		10	5.86	10.6	24.5	10.3	53.2	95.0
		15	7.10	12.9	29.5	12.4	64.8	116
		20	8.12	14.9	33.6	14.2	74.4	133
		25	8.99	16.6	37.0	15.6	82.8	149
		30	9.75	18.1	40.0	16.8	90.2	162
	+20	1	2.09	3.68	8.79	4.00	---	---
		2	2.93	5.20	12.3	5.64	---	---
		5	4.59	8.21	19.1	8.85	45.4	80.8
		10	6.40	11.6	26.5	12.3	63.8	114
		15	7.75	14.1	31.9	14.9	77.8	139
		20	8.86	16.2	36.3	17.0	89.3	160
		25	9.81	18.1	40.0	18.7	99.3	179
		30	10.6	19.7	43.2	20.2	108	195
134a	-20	1	1.47	2.61	6.30	2.29	---	---
		2	2.07	3.69	8.82	3.22	---	---
		5	3.23	5.82	13.7	5.02	25.9	46.2
		10	4.49	8.17	18.9	6.95	36.3	65.0
		15	5.41	9.95	22.6	8.32	44.1	79.2
		20	6.15	11.4	25.6	9.39	50.5	91.0
		25	6.77	12.7	28.0	10.3	55.9	101
		30	7.30	13.8	30.0	11.0	60.7	110
	0	1	1.60	2.84	6.81	2.63	---	---
		2	2.25	4.01	9.54	3.70	---	---
		5	3.51	6.31	14.8	5.78	29.8	53.2
		10	4.88	8.87	20.4	8.00	41.8	74.8
		15	5.88	10.8	24.4	9.58	50.7	91.2
		20	6.69	12.4	27.6	10.8	58.1	105
		25	7.36	13.8	30.2	11.8	64.4	117
		30	7.94	15.0	32.3	12.6	69.9	127
	+20	1	1.78	3.14	7.51	3.18	---	---
		2	2.50	4.44	10.5	4.48	---	---
		5	3.89	6.99	16.3	6.99	36.0	64.2
		10	5.41	9.82	22.4	9.67	50.5	90.4
		15	6.51	12.0	26.8	11.6	61.3	110
		20	7.40	13.7	30.3	13.1	70.2	127
		25	8.15	15.2	33.1	14.3	77.8	141
		30	8.79	16.6	35.5	15.2	84.5	154

Refrigerant Valve Setting (psig)	Minimum Ambient Design Temp. °F	Pressure Drop Across Valve (psi)	Valve Type					
			LAC-4	LAC-5	LAC-10	ORD-4	ORIT-15 CROT-12	ORIT-20 CROT-15
404A	-20	1	1.27	2.24	5.41	2.02	---	---
		2	1.78	3.17	7.59	2.85	---	---
		5	2.79	5.01	11.8	4.48	22.9	40.9
		10	3.91	7.06	16.5	6.26	32.3	57.6
		15	4.74	8.61	19.9	7.58	39.4	70.4
		20	5.43	9.91	22.7	8.65	45.3	81.1
		25	6.02	11.0	25.1	9.56	50.4	90.4
		30	6.54	12.1	27.2	10.3	55.0	98.8
	0	1	1.35	2.39	5.74	2.29	---	---
		2	1.90	3.38	8.05	3.23	---	---
		5	2.98	5.33	12.5	5.07	26.0	46.2
		10	4.17	7.51	17.5	7.09	36.6	65.2
		15	5.05	9.17	21.1	8.58	44.6	79.7
		20	5.78	10.6	24.0	9.79	51.2	91.8
		25	6.41	11.8	26.5	10.8	57.0	102
		30	6.97	12.8	28.7	11.7	62.2	112
	+20	1	1.46	2.58	6.18	2.70	---	---
		2	2.06	3.64	8.65	3.81	---	---
		5	3.22	5.75	13.5	5.99	30.7	54.6
		10	4.50	8.11	18.7	8.37	43.2	77.0
		15	5.45	9.90	22.6	10.1	52.6	94.1
		20	6.24	11.4	25.7	11.6	60.5	108
		25	6.92	12.7	28.4	12.8	67.3	121
		30	7.51	13.9	30.7	13.8	73.4	132
507	-20	1	1.24	2.21	5.31	2.01	---	---
		2	1.75	3.12	7.45	2.83	---	---
		5	2.75	4.92	11.6	4.45	22.8	40.6
		10	3.84	6.94	16.2	6.22	32.1	57.2
		15	4.66	8.47	19.6	7.53	39.1	69.9
		20	5.34	9.74	22.3	8.59	45.0	80.5
		25	5.92	10.9	24.6	9.50	50.0	89.8
		30	6.43	11.9	26.7	10.3	54.6	98.1
	0	1	1.34	2.37	5.68	2.31	---	---
		2	1.88	3.34	7.96	3.26	---	---
		5	2.95	5.28	12.4	5.12	26.2	46.7
		10	4.13	7.44	17.3	7.16	36.9	65.9
		15	5.01	9.08	20.8	8.67	45.0	80.5
		20	5.73	10.5	23.8	9.89	51.7	92.7
		25	6.35	11.7	26.2	10.9	57.6	103
		30	6.90	12.7	28.4	11.8	62.8	113
	+20	1	1.46	2.57	6.15	2.78	---	---
		2	2.05	3.63	8.61	3.92	---	---
		5	3.21	5.73	13.4	6.16	31.6	56.2
		10	4.48	8.08	18.6	8.62	44.4	79.3
		15	5.44	9.87	22.5	10.4	54.2	96.8
		20	6.22	11.4	25.6	11.9	62.3	112
		25	6.90	12.7	28.3	13.2	69.3	124
		30	7.49	13.8	30.6	14.2	75.6	136

SPECIFICATIONS

Valve Type	Standard Factory Setting (psig)	Connections ODF Solder (Inches) Inlet(s)	Outlet	Dimensions (Inches) A	B	C	D	E	F	G	H	I	Weight (lbs.) Net	Ship	Replacement Parts
LAC-4	100, 180, or 210	1/4	1/4	1.78	1.87	3.02	2.38	4.73	---	---	---	---	0.77	0.85	Not Available
		3/8	3/8										0.80	0.88	
		1/2	1/2										0.82	0.90	
LAC-4-DS		3/8	3/8	1.78	1.87	3.02	2.38	6.11					0.87	1.02	
		1/2	1/2										0.94	1.09	
LAC-5		1/2	1/2	1.65	1.60	3.77	2.99	D3L 6.10 / R3L 5.59					2.50	2.65	Replacement Elements: Non-Adjustable Dome Element: D3L (specify setting) or Non-Adjustable Remote Bulb Element: R3L (specify setting)
		5/8	5/8	1.74	1.69	3.86	3.08	D3L 6.19 / R3L 5.68					2.55	2.70	
		7/8	7/8	2.23	2.18	4.35	3.57	D3L 6.68 / R3L 6.17					2.60	2.75	
		1-1/8	1-1/8	2.38	2.33	4.50	3.72	D3L 6.83 / R3L 6.32					2.75	2.90	
LAC-10		① 1-3/8 ② 7/8	7/8	2.82	2.67	4.39	3.43	D3L 6.91 / R3L 6.40					3.20	3.42	
		① 1-3/8 ② 1-1/8	1-1/8		2.56	4.83	3.87	D3L 7.35 / R3L 6.84					3.28	3.50	
ORI-6-65/225-H	120	5/8	5/8	9.85	5.04	6.37	---	---	---	---	---	---	1.00	1.25	Inlet Strainer: 825-5
		7/8	7/8												825-7
		1-1/8	1-1/8										1.25	1.50	825-9
ORI-10-65/225-H	120	1-1/8	1-1/8	11.04	5.48	6.56	---						2.50	2.75	825-9
		1-3/8	1-3/8												825-11
ORD-4-20	20	5/8	5/8	6.56	0.97	---	---						0.33	0.50	825-5
OROA-5	100, 180, or 210	① 5/8 ② 5/8	5/8	5.94	3.75	1.88	2.16						2.00	2.25	825-5
		① 5/8 ② 7/8	7/8	6.19	4.00	2.12	2.41								825-7
ORIT-15-65/225	150	1-3/8	1-3/8	5.53	5.53	1.378/1.3815	0.97	8.80	0.88	3.55	4.61	5.02	6.50	7.50	---
ORIT-20-65/225	150	1-5/8	1-5/8	5.53	5.53	1.6285/1.6325	1.16	9.65	1.44	4.40	6.51	7.98	10.5	11.5	---
CROT-12-65/225	140	1-1/8	1-1/8	4.25	4.25	1.128/1.132	0.91	8.72	0.72	4.40	---	4.36	5.10	6.10	---
CROT-15-65/225	140	1-3/8	1-3/8	5.53	5.53	1.378/1.3815	0.97	8.80	0.88	4.32	---	4.43	6.50	7.50	---

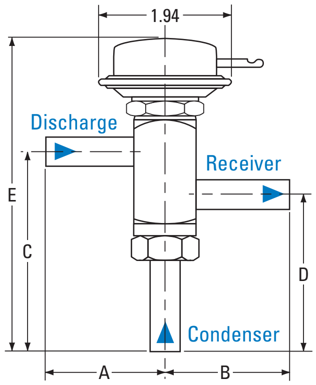
① Discharge Connection
② Condenser Connection

MATERIALS and CONSTRUCTION DETAILS

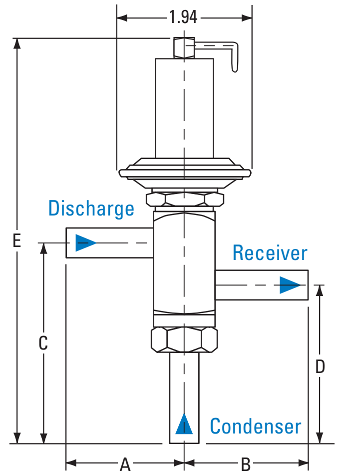
Valve Type	Adjustable	Port Size (Inches)	Element Type & Material	Connections Type	Connections Material	Body Material	Seating Material	Type of Joints
LAC-4	No	1/2	Domed Steel	Solder	Copper	Brass	Metal to Metal	Knife Edge (Metal to Metal)
LAC-5		5/8						
LAC-10		3/4						
ORI-6	Yes	3/4	Bellows - Brass	Solder	Copper	Brass	Metal to Metal	Hermetic Construction
ORI-10		1.218						
ORD-4	No	1/2	---			Copper		
OROA		5/8	Diaphram Stainless Steel			Brass		
ORIT-15-65/225	No	1	Bellows - Brass	Solder	Copper	Steel - Powder Coated	Synthetic to Metal	Knife Edge (Metal to Metal), Gasket
ORIT-20-65/225		1-3/8						
CROT-12-65/225		25/32				Brass		
CROT-15-65/225		1				Steel - Powder Coated		

VALVE DESIGNATION/ORDERING INSTRUCTIONS

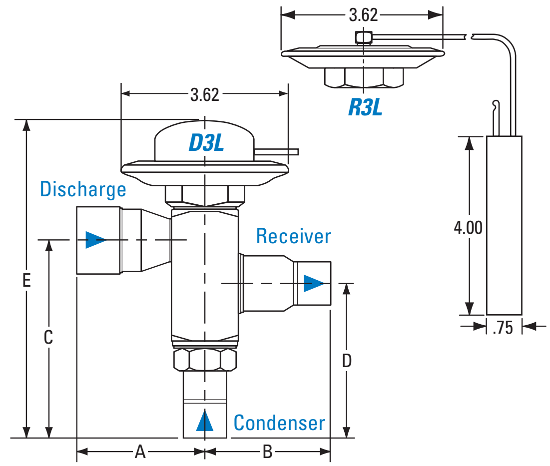
To eliminate shipment delays, specify complete valve designation.



LAC-4



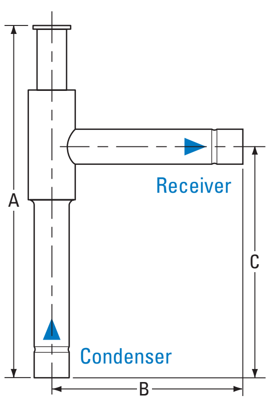
LAC-4-DS



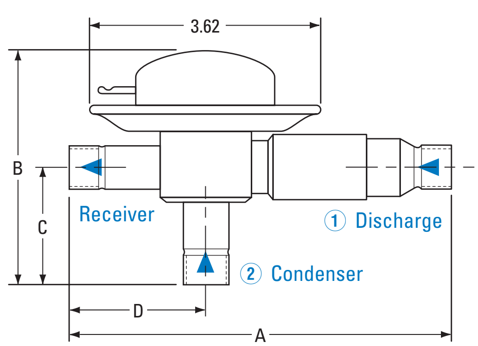
LAC-5 and LAC-10

LAC	–	4	–	DS	–	100/180	–	3/8	x	3/8	x	3/8		ODF
Valve Type: **L**ow **A**mbient **C**ontrol		Valve Size		Dual Setting Omit for standard dome element		Valve Setting(s) (psig) Specifiy one setting for standard dome element		Discharge Connection (Inches)		Condenser Connection (Inches)		Receiver Connection (Inches)		Solder Connections

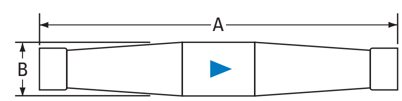
LAC	–	5	–	180		R	–	5/8	x	5/8	x	3/8		ODF
Valve Type: **L**ow **A**mbient **C**ontrol		Valve Size		Valve Setting (psig)		Indicates Remote Bulb Model Delete for standard dome element		Discharge Connection (Inches)		Condenser Connection (Inches)		Receiver Connection (Inches)		Solder Connections



ORI



OROA

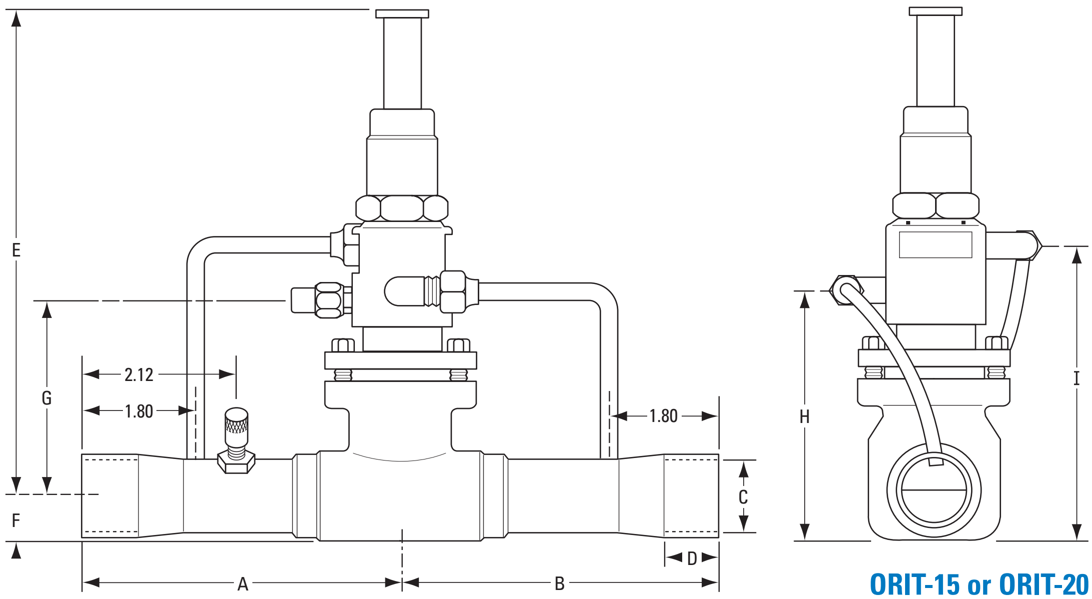


ORD-4

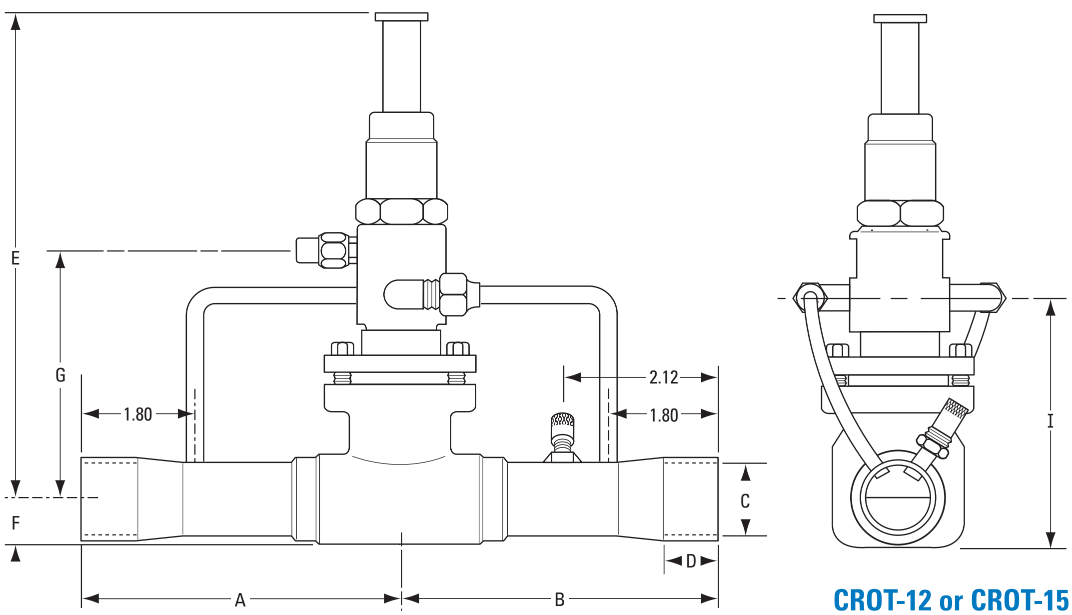
ORI	–	6	–	65/225	–	7/8" ODF	–	With Strainer	–	H
Valve Type: **O**pen on **R**ise of **I**nlet Pressure		Port Size Eighths of an inch		Nominal Adjustment Range (psig)		Connections - Solder		Inlet Strainer (Optional)		Designates High Pressure Bellows

OROA	–	5	–	180	–	5/8" ODF	–	With Strainer
Valve Type: **O**pen on **R**ise of **O**utlet Pressure		Port Size Eighths of an inch		Pressure Setting (psig)		Connections - Solder		Inlet Strainer (Optional)

ORD	–	4	–	20
Valve Type: **O**pen on **R**ise of **D**ifferential Pressure		Port Size Eighths of an inch		Opening Pressure Differential (psi)



ORIT-15 or ORIT-20



CROT-12 or CROT-15

ORI	T	15	65/225	1-3/8 ODF
Valve Type: **O**pen on **R**ise of **I**nlet Pressure	Pressure Tap on Inlet Connection	Valve Size	Adjustment Range (psig)	Connection Size (Inlet & Outlet)

CRO	T	12	65/225	1-1/8 ODF
Valve Type: **C**lose on **R**ise of **O**utlet Pressure	Pressure Tap on Outlet Connection	Valve Size	Adjustment Range (psig)	Connection Size (Inlet & Outlet)

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