ServiceFirst™

# Refrigeration Specialties

## By Emerson Climate Technologies – Flow Controls Division

Coils

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Oil Controls

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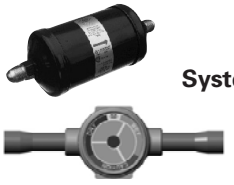
Storage Devices



System Protectors

Temperature Pressure Controls

Thermo Expansion Valves

Ball Valves

EMERSON™
Climate Technologies

June 2005

RSP-PRC022-EN

# Contents

# Quick Select

*Quick Select - Alpha and Numeric by Product*

# Thermo Expansion Valves

## Fundamentals of Thermo® Expansion Valves

ALCO's thermostatic expansion valves are designed for a wide range of air conditioning, refrigeration, heat pump and chiller applications.

ALCO's integral valve line includes valves for commercial and refrigeration applications, as well as heat pump and residential applications. The "Take-A-Part Series" valves are the answer to your unique needs, available for almost any type of application, temperature range, or any known refrigerant. ALCO also offers a complete line of specialty valves. Consult us for your specific system requirements.

The Thermo® Expansion Valve is a precision device designed to regulate the rate of refrigerant liquid flow into the evaporator in the exact proportion to the rate of evaporation of the refrigerant liquid in the evaporator. The amount of refrigerant gas leaving the evaporator can be regulated since the Thermo Valve responds to 1. the temperature of the refrigerant gas leaving the evaporator and 3. the pressure in the evaporator. This controlled flow prevents the return of refrigerant liquid to the compressor. The Thermo Expansion Valve (TEV) controls the flow of gas by maintaining a pre-determined superheat.

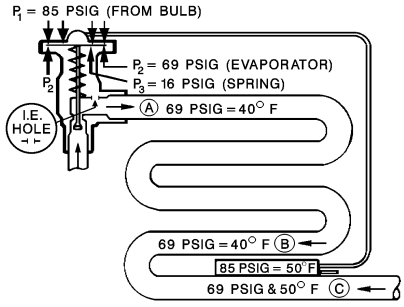
Three forces which govern the TEV's operation are: 1. the power element and remote bulb pressure, $P_1$; 2. the evaporator pressure, $P_2$; and 3. the superheat spring equivalent pressure, $P_3$. See figure 1.

We are here concerned with a single outlet type of TEV and shall discuss it under 2 headings: 1. A valve with an internal equalizer, and 2. the use of the external equalizer feature.

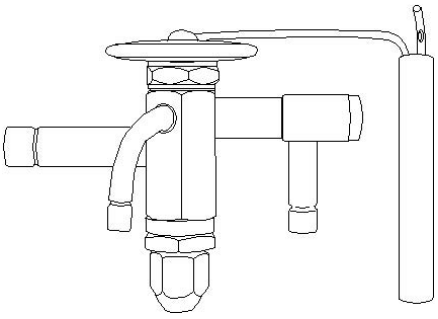
Three conditions present themselves in the operation of this valve: first, the balanced forces; second, an increase in superheat; third, a decrease in superheat. The remote bulb and power element make up a closed system (power assembly), and in thefollowing discussion, it is assumed that the remote bulb and power element are charged with the same refrigerant as that in the system. The remote bulb and power element pressure ($P_1$), which corresponds to the saturation pressure of the refrigerant gas temperature leaving the evaporator, moves the valve pin in the opening direction.

Opposed to this opening force on the underneath side of the diaphragm and acting in the closing direction are two forces: 1. the force exerted by the evaporator pressure ($P_2$) and 2. that exerted by the superheat spring ($P_3$). In the first condition, the valve will assume a stable control position when these three forces are in balance (see figure 2) that is, when $P_1 = P_2 + P_3$. In the next step, the temperature of the refrigerant gas at the evaporator outlet (remote bulb location) increases above the saturation temperature corresponding to the evaporator pressure as it becomes superheated. The pressure thus generated in the remote bulb, due to this higher temperature, increases above the combined pressures of the evaporator pressure and the superheat spring ($P_1$ greater than $P_2 + P_3$) and causes the valve pin to move in an opening direction.

***Figure 1. Thermo expansion valve with internal equalizer on evaporator with no pressure drop. Note internal equalizer hole.***

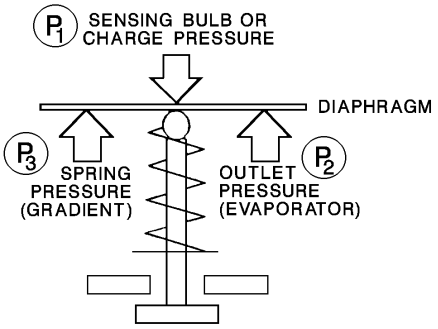



Conversely, as the temperature of the refrigerant gas leaving the evaporator decreases, the pressure in the remote bulb and power assembly also decreases and the combined evaporator and spring pressure cause the valve pin to move in a closing direction ($P_1$ less than $P_2 + P_3$). For example, when the evaporator is operating with R-22 at a temperature of 40°F or a pressure of 69 psig and the refrigerant gas leaving the evaporator at the remote bulb location is 50°F, a condition of 10°F superheat exists. Since the remote bulb and power assembly are charged with the same refrigerant as that used in the system, R-22, its pressure ($P_1$) will follow its saturation pressure & temperature



characteristics. With the liquid in the remote bulb at 50°F the pressure inside the remote bulb and power assembly will be 85 psig acting in an opening direction. Beneath the diaphragm and acting in a closing direction are the evaporator pressure ($P_2$) of 69 psig and the spring pressure ($P_3$) for a 10°F superheat setting of 16 psig (69 + 16 = 85) making a total of 85 psig. The valve is in balance, 85 psig above the diaphragm and 85 psig below the diaphragm. Changes in load, increasing the superheat, will cause the TEV pin to move in an opening direction. Conversely, a change, decreasing the superheat, will cause the TEV pin to move in a closing direction (see figure 1).

***Figure 2. Thermo valve equilibrium***




$P_1 = P_2 + P_3$
Charge pressure = spring + outlet pressures

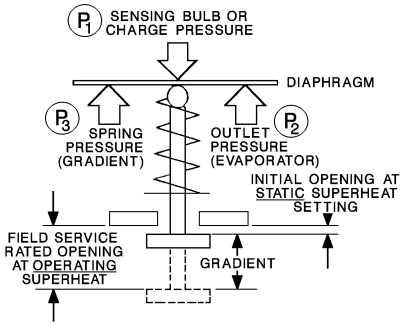
# Thermo Expansion Valves

**TEV's Factory Setting**
The factory superheat setting of Thermo Expansion Valves (TEVs) is made with the valve pin just starting to move away from the seat. The superheat increase necessary to get the pin ready to move is called **static** superheat. TEVs are so designed that an increase in superheat of the refrigerant gas leaving the evaporator, usually 4 to 6°F over and beyond the factory **static** superheat setting, is necessary for the valve pin to open to its rated position. This additional superheat is known as **gradient**. For example, if the factory static setting is 6°F superheat, the operating superheat at the rated stroke or pin position (full load rating of valve) will be 10 to 14°F superheat (see figure 3). Manufacturers usually furnish the adjustable type TEVs with a factory **static** superheat setting of 6 to 10°F, unless otherwise specified by the customer.

When using non-adjustable TEVs, it is important that they be ordered with the correct factory superheat setting. For manufacturer's production lines it is recommended that an adjustable TEV be used in a pilot model lab test to determine the correct factory setting before ordering the non-adjustable type of Thermo Expansion Valves. If the operating superheat is raised unnecessarily high, the evaporator capacity decreases, since more of the evaporator surface is required to produce the superheat necessary to operate the TEV. It also is obvious then that a minimum change of superheat to open the valve is of vital importance because it provides savings in both initial evaporator cost and cost of operation.

The TEV operation discussed thus far pertains to the internal equalizer type of Thermo Valve. The evaporator pressure at the valve outlet is admitted internally and allowed to exert its force beneath the diaphragm.

***Figure 3. Thermo expansion valve static superheat and gradient***

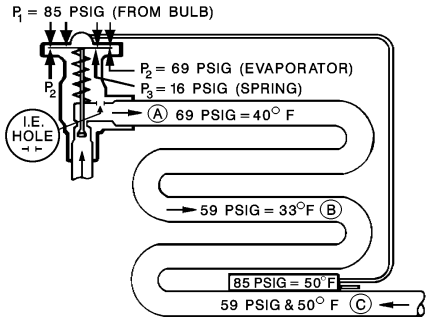



**External Equalizer**
When the pressure drop through the evaporator is of any consequence, (i.e., in general a pressure drop of 3°F in the air conditioning range; 2°F in the commercial temperature range; and 1°F in the low temperature range) it will hold the TEV in a relatively "restricted" position and reduce the system capacity, unless a TEV with an external equalizer is used. The evaporator should be designed or selected for the operating conditions and the TEV selected and applied accordingly.

For example, an evaporator is fed by a TEV with an internal equalizer, where a sizeable pressure drop of 10 psi is present (see figure 4). The pressure at point "C" is 59 psig or 10 psi lower than at the valve outlet, point "A"; however, the pressure of 69 psig at point "A" is the pressure acting on the lower side of the diaphragm in a closing direction. With the valve spring set at a compression equivalent to 10°F superheat or a pressure of 16 psig, the required pressure above the diaphragm to equalize the forces is (69 + 16) or 85 psig. This pressure corresponds to a saturation temperature of 50°F. It is evident that the refrigerant temperature at point "C" must be 50°F if the valve is to be in equilibrium. Since the pressure at this point is only 59 psig and the corresponding saturation temperature is 33°F, a superheat of 17°F (50° – 33°F) is required to open the valve. This increase in superheat, from 10 to 17°F makes it necessary to use more of the evaporator surface to produce this higher superheated refrigerant gas. Therefore, the amount of evaporator surface available for absorption of latent heat of vaporization of the refrigerant is reduced; the evaporator is starved before the required superheat is reached.

Since the pressure drop across the evaporator, which caused this high superheat condition, increases with the load because of friction, this "restricting" or "starving" effect is increased when the demand on the TEV capacity is greatest. In order to compensate for an excessive pressure drop through an evaporator, the TEV must be of the external equalizer type, with the equalizer line connected either into the evaporator at a point beyond the greatest pressure drop or into the suction line at a point on the compressor side of the remote bulb ocation. In general and as a rule of thumb, the equalizer line should be connected to the suction line at the evaporator outlet. If the external equalizer type of TEV is used, with the equalizer line connected to the suction line, the true evaporator outlet pressure is exerted beneath the TEV diaphragm. The operating pressures on the valve diaphragm are now free from any effect of the pressure drop through the evaporator, and the TEV will respond to the superheat of the refrigerant gas leaving the evaporator.

***Figure 4. Thermo expansion valve with internal equalizer on evaporator with 10 psi drop. Note internal equalizer hole.***




When the same conditions of pressure drop exist in a system with a TEV which has the external equalizer feature (see figure 5), the same pressure drop still exists through the evaporator; however, the pressure under the diaphragm is now the same as the pressure at the end of the evaporator, point "C", or 59 psig. The required pressure above the diaphragm for equilibrium is 59 +16 or 75 psig. This pressure, 75 psig, corresponds to a saturation temperature of 44°F and the superheat required is now 11°F (44° – 33°F). The use of an external equalizer has reduced the

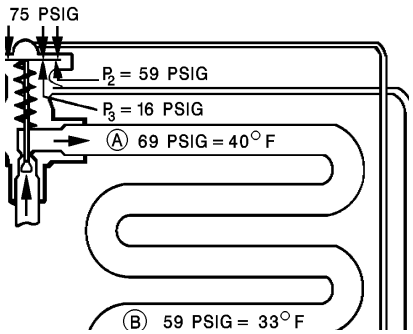
# Thermo Expansion Valves

superheat from 17 to 11°F. Thus, the capacity of a system, having an evaporator with a sizable pressure drop, will be increased by the use of a TEV with the external equalizer as compared to the use of an internally equalized valve.

When the pressure drop through an evaporator is in excess of the limits previously defined, or **when a refrigerant distributor** is used at the evaporator inlet, the TEV must have the external equalizer feature for best performance.

The diagrams used thus far have shown the single outlet type of TEV. Although a multi-circuit evaporator in itself may not have an excessive pressure drop, the device used to obtain liquid distribution will introduce a pressure drop that will limit the action of the TEV without external equalizer, because the distributor is installed between the valve outlet and the evaporator inlet (see figure 6).

***Figure 5. Thermo expansion valve with external equalizer on evaporator with 10 psi drop.***

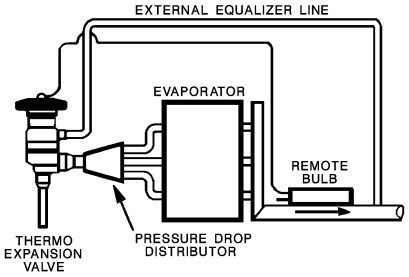



**Installation Location of External Equalizer**

As pointed out earlier, the external equalizer line must be installed beyond the point of greatest pressure drop. Since it may be difficult to determine this point, as a general rule it is safest to connect the equalizer line to the suction line at the evaporator outlet on the compressor side of the remote bulb location (see figures 5 and 6). When the external equalizer is connected to a horizontal line, always make the connection at the top of the line in order to avoid oil logging in the equalizer line.

When the pressure drop thru the evaporator is known to be within the limits defined on page 6, it is permissible to install the external equalizer connection at one of the return bends midway through the evaporator. Such an equalizer location will provide smoother valve control particularly when the TEV is used in conjunction with an Evaporator Pressure Regulator. However, in all cases where any type of control valve is installed in the suction line, the external equalizer line for the TEV must always be connected on the evaporator side of such a control valve or regulator.

***Figure 6. Single outlet thermo expansion valve and distributor.***




On a multi-evaporator system including two or more evaporators each fed by a separate Thermo Expansion Valve (TEV), the external equalizer lines must be located so that they will be free from the effect of pressure changes in the evaporators fed by the other TEVs. At no time should the equalizer lines be joined together in one common line to the main suction line. If individual suction lines from the separate evaporator outlets to the common suction line are short, then install the external equalizer lines into the separate evaporator suction headers, or as described in the preceding paragraph.

Do not under any circumstances cap or plug the external equalizer connection on a TEV, as it will not operate. If the TEV is furnished with the external equalizer feature, the external equalizer line must be installed (see figures 5 and 6).

**Superheat**

A vapor is superheated whenever its temperature is higher than the saturation temperature corresponding to its pressure. The amount of the superheat equals the amount of temperature increase above the saturation temperature at the existing pressure.

For example, a refrigeration evaporator is operating with Refrigerant 22 at 69 psig suction pressure (see figure 7). The Refrigerant 22 saturation temperature at 69 psig is 40°F. As long as any liquid exists at this pressure, the refrigerant temperature will remain 40°F, as it evaporates or boils off in the evaporator.

As the refrigerant moves along in the coil, the liquid boils off into a vapor, causing the amount of liquid present to decrease. All of the liquid is finally evaporated at point B because it has absorbed sufficient heat from the surrounding atmosphere to change the refrigerant liquid to a vapor. The refrigerant gas continues along the coil and remains at the same pressure (69 psig); however, its temperature increases due to continued absorption of heat from the surrounding atmosphere. When the refrigerant gas reaches the end of the evaporator (point C), its temperature is 50°F. This refrigerant gas is now superheated and the amount of superheat is 10°F (50 – 40). The degree to which the refrigerant gas is superheated depends on (1) the amount of refrigerant being fed to the evaporator by the TEV and (2) the heat load to which the evaporator is exposed.

**Adjustment of Superheat**

The function of a TEV is to control the superheat of the suction gas leaving the evaporator in accordance with the valve setting.

A TEV which is performing this function within reasonable limits can be said to be operating in a satisfactory manner.

Good superheat control is the criterion of TEV performance. It is important that this function be measured as accurately as possible, or in the absence of accuracy, to be aware of the magnitude and direction of whatever error is present.

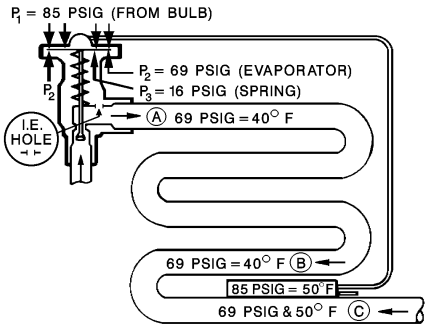
# Thermo Expansion Valves

Superheat has been previously defined as the temperature increase of the refrigerant gas above the saturation temperature at the existing pressure. Based on this definition, the pressure and temperature of the refrigerant suction gas passing the TEV remote bulb are required for an accurate determination of superheat.

Thus, when measuring superheat, the recommended practice is to install a calibrated pressure gauge in a gauge connection at the evaporator outlet. In the absence of a gauge connection, a tee installed in the TEV external equalizer line can be used just as effectively.

A refrigeration type pocket thermometer with appropriate bulb clamp may be used, or more effective is the use of a service type potentiometer (electric thermometer) with thermocouples (leads and probes).

***Figure 7. Thermo expansion valve with internal equalizer on evaporator with no pressure drop.***




The temperature element from your Temperature Meter should be clamped to the suction line at the point of remote bulb location and must be insulated against the ambient. Temperature elements of this type, as well as thermometers, will give an average reading of suction line and ambient if not insulated. Assuming an accurate gauge and Temperature Meter, this method will provide sufficiently accurate superheat readings for all practical purposes.

On installations where a gauge connection is not available and the valve is internally equalized there are two alternate methods possible. Both of these methods are **approximations** only and their use is definitely not recommended.

The first of these is the two temperature method, which utilizes the difference in temperature between the evaporator inlet and outlet as the superheat. This method is in error by the temperature equivalent of the pressure drop between the two points of temperature.

Where the pressure drop between the evaporator inlet and outlet is 1 psi or less, the two temperature method will yield fairly accurate results. However, evaporator pressure drop is usually an unknown and will vary with the load. For this reason, the two temperature method cannot be relied on for absolute superheat readings. It should be noted that the error in the two temperature method is negative and always indicates a superheat lower than the actual figure.

The other method commonly used to check superheat involves taking the temperature at the evaporator outlet and utilizing the compressor suction pressure as the evaporator saturation pressure. The error here is obviously due to the pressure drop in the suction line between the evaporator outlet and the compressor suction gauge.

On self-contained equipment, the pressure drop and resulting error are usually small. However, on large built-up systems or systems with long runs of suction line, considerable discrepancies will usually result.

Since estimates of suction line pressure drop are usually not accurate enough to give a true picture of the superheat, this method cannot be relied on for absolute values. It should be noted that the error in this instance will always be positive and the superheat resulting will be higher than the actual value.

Restating, **the only method of checking superheat that will yield an absolute value involves a pressure and temperature reading at the evaporator outlet.**

Other methods employed will yield a fictitious superheat that can prove misleading when used to analyze TEV performance.

By realizing the limitations of these approximate methods and the direction of the error, it is often possible to determine that the cause of a trouble call is due to the use of improper methods of instrumentation rather than any malfunction of the valve.

One other error that will be present when troubleshooting in mountain areas (such as Denver, Colorado or Salt Lake City, Utah) is the low gauge pressure compared to sea level readings. Use a Pressure-Temperature chart that has corrected readings such as ALCO's 5000 foot correction pocket chart.

**Factors Involved in Valve Selection**
These design conditions must be available: maximum evaporator load; evaporator temperature; maximum and minimum condensing and liquid temperatures; and refrigerant.

ALCO has prepared extended capacity tables for use with the above mentioned conditions in mind. Specific valve extended capacity tables can be found in this catalog.

**Where possible, always select Thermo Expansion Valves (TEVs) for actual operating conditions rather than nominal valve capacities.**

The conditions from above along with the following considerations will determine if the specific valve has enough capacity for the evaporator being considered:

1. Determine pressure drop across valve, using both the maximum and minimum condensing pressures, subtract the evaporating pressure from each to obtain the total high-to-low side pressure drop. From these values subtract the other possible pressure losses–piping and heat exchanger losses; pressure drop thru accessories; vertical lift pressure drop; and the pressure drop across the refrigerant distributor. This last item is very important to obtain proper refrigerant distribution under all operating conditions. The example provided at the end of this section illustrates all these factors in the selection process.
2. Consider the maximum and minimum liquid temperatures of the refrigerant entering the valve and select the correction factors for those temperatures from the table below

# Thermo Expansion Valves

the capacity ratings. Determine the corrected capacity requirement by dividing the maximum evaporator load in tons by the liquid correction factors. These values will allow the final selection to be made.

3. Select the valve size from the appropriate capacity table for the evaporator temperature, pressure drop available, and corrected capacity requirement. If the valve has less capacity than required, contact your ALCO Sales Engineer or Alco Controls for assistance.
4. Select the proper thermostatic charge based on the evaporator temperature, refrigerant, and whether a MOP type charge is needed.
5. Appropriate connections and whether an externally equalized model is required completes the selection. Always use an externally equalized valve when a distributor is used.

Since the capacity and the performance of the TEV is based on solid liquid entering the valve, careful consideration must be given to the total pressure drop in the liquid line to determine if there will be sufficient subcooling of the liquid refrigerant to prevent the formation of flash gas. If the subcooling of the liquid refrigerant from the condenser is not adequate, then a heat exchanger, liquid subcooler, or some other means must be used to obtain enough subcooling of the liquid refrigerant to insure solid liquid entering the TEV *at all times*.

**Thermo Valve Charges**

Over the years, or more precisely, since ALCO produced the first valve for ammonia in 1925, the matter of a proper charge in the thermal sensing element has been of major concern. Liquid charges, gas charges, cross liquid charges, cross vapor charges, high temperature charges, ultralow temperature charges, commercial charges, etc., all have been tried with varying degrees of success.

**M.O.P.**

Maximum Operating Pressure (or Motor Overload Protection) is the ability of the TEV to close down, starve, or completely shut off if the suction pressure should approach a dangerously high predetermined limit condition. A condition such as to cause overheating a suction cooled compressor, or loading the crankcase with too dense a vapor pressure.

With the TEV in a closed condition due to MOP, the compressor has a chance to gain on the excess low side pressure and pull the suction back down to satisfactory operating conditions. At this point (below the MOP) the TEV will re-open and feed in a standard manner or until such time as there is an overload again.

Certain bulb charges can be supplied with this MOP feature. One of the most common is the "G" (gas) charge. It is always supplied with "MOP".

The ALCO "W" charge can be supplied with the MOP feature if needed for system protection. This need rarely occurs in modern day refrigeration except such conditions as immediately after defrost or on gasoline driven compressors such as truck refrigeration.

CAUTION: Any bulb charge with MOP will be affected by extreme cross ambient conditions. If this condition should exist, install an electric strip heater around the top part of the TEV.

**Power Element Charges**

For many years ALCO used a variety of bulb charges in their expansion valves. Letters such as L, G, W, C, X, Z, A, Q and others designated a particular chemical or mixture of ingredients that gave a specific curve or line on a graph to match a definite pattern of a refrigerant condition.

In 1978, ALCO introduced a new bulb charge (BA) to assist the outside coil of air-to-air heat pumps using R-22 in providing 0°F superheat, or "wet gas", back to the windings of hermetic heat pump compressors during very low outdoor temperatures.

At 40°F ambients (or higher) this charge operates the same as any regular air conditioning bulb charge with a standard superheat. In 1983, the charge was improved and given the designation CA.

**C** = +50°F to –20°F
**Z** = +10°F to –50°F
**W-(MOP)** = MOP to –50°F
**L** = +50°F to –50°F
**G-(MOP)** = Depends on the refrigerant. Some, such as R-14 to –200°F
**CA** = Heat pump charge outside coil

When G charges, and any other type of MOP charge (i.e. W-MOP) is used for low temperature applications (–40°F and lower) a small heater strip should be wrapped around the head of the TEV. For special applications, other charges may be used from time to time.

For assistance in selecting a charge with Motor Overload Protection (if required by compressor manufacturer) see the table below and the TEV Charge Selector on page 9.

***Table 1. Maximum dehydration temperature (in °F)***

| | Thermostatic Charge | | | | | |
|---|---|---|---|---|---|---|
| Refrigerant | L | C | Z | G | WMOP/CA | X |
| R134a | 195 | 190 | 250 | 250 | 250 | N/A |
| R22 | 160 | 160 | 185 | 250 | 250 | N/A |
| R404A/R507 | 150 | 150 | 170 | 250 | 250 | N/A |
| R717 | N/A | N/A | 150 | N/A | N/A | 200 |

The table above refers to the maximum dehydration temperatures when the bulb and valve body are subjected to the same temperature. On **L, C, Z,** and **X** charges, 250°F maximum valve body temperature is permissible **(if the bulb temperature)** does not exceed those shown in the table.

# Thermo Expansion Valves

## TEV Charges: What they do, and How they do it

The basic function of a thermal expansion valve (TEV) is to control superheat. But there are several types of TEVs, and several types of charges in them. Each has its own specific use; understanding the power element charge and how it affects the pressure to the power diaphragm is basic to good valve service.

There are several basic types of charges in use today. Most common are the: liquid charge; gas charge; liquid cross-charge; gas cross-charge; and the adsorption charge.

**Liquid Charges**
The power element contains the *same* refrigerant as the system in which the valve is used. When manufactured, it is put into the remote bulb in a *liquid* state. Volume is controlled so that within the design temperature range of the power element, some liquid *always* remains in the bulb. Therefore, power element pressure is always the saturation pressure corresponding to the temperature of the remote bulb.

Liquid charges have both advantages and disadvantages. They include: not subject to cross-ambient control loss; little or no superheat at start-up; superheat increases at lower evaporator temperatures; and slow suction pressure pulldown after start-up.

**Liquid Cross-Charges**
The power element contains a liquid refrigerant *different* from the system refrigerant in which the valve is used. The pressure temperature curve of the charge crosses the curve of the system refrigerant (hence, *cross*-charge).

Among the liquid cross-charge advantages are:
- Moderately slow pull down.
- Insensitive to cross-ambient conditions.
- Dampened response to suction line temperature changes (minimizes tendency for valve "hunting").
- Superheat characteristics can be tailored for special applications.

NOTE: ALCO charges "C" and "Z" are liquid cross-charges.

**Gas & Gas Cross-Charges**
Using a gas charge in place of a liquid alters the operational characteristics, because gas compresses. At some predetermined temperature, the gas in the remote bulb becomes superheated, limiting the force it exerts. This produces higher superheats at higher evaporator pressures and is labelled the Maximum Operating Pressure (MOP) effect.

Any MOP point temperature depends on how that bulb was initially charged and where it will be used. All gas charges are susceptible to cross-ambient control loss when the power element is colder than the remote bulb. They are inherently faster to respond, but tend to "hunt" for the proper operating level — so a ballast is often added to the remote bulb to minimize that tendency.

As in liquid charges, the remote bulb can be filled with the *same* refrigerant as the system refrigerant (producing a gas charge). Or, it can be filled with a *different* refrigerant, producing a gas cross-charge.

**Which Charge to Use?**
To help you match the correct charge to your specific application, see the TEV Charge Code Selector on the next page. Also provided here are some typical examples of applications by refrigerant charge.

**Liquid Charge – L**
Ice makers, pilots, liquid injection valves

**Liquid Cross-Charges – C, Z**
Commercial refrigeration (low & medium temp.), ice makers, transport refrigeration and air conditioning

**Gas Charge – G**
Air conditioning (including mobile), water chillers

**Gas Cross-Charge – CA**
Heat pumps and air conditioning

**Gas Cross-Charge – HAA**
Heat pumps and air conditioning

**W(MOP)**
Maximum Operating Pressure

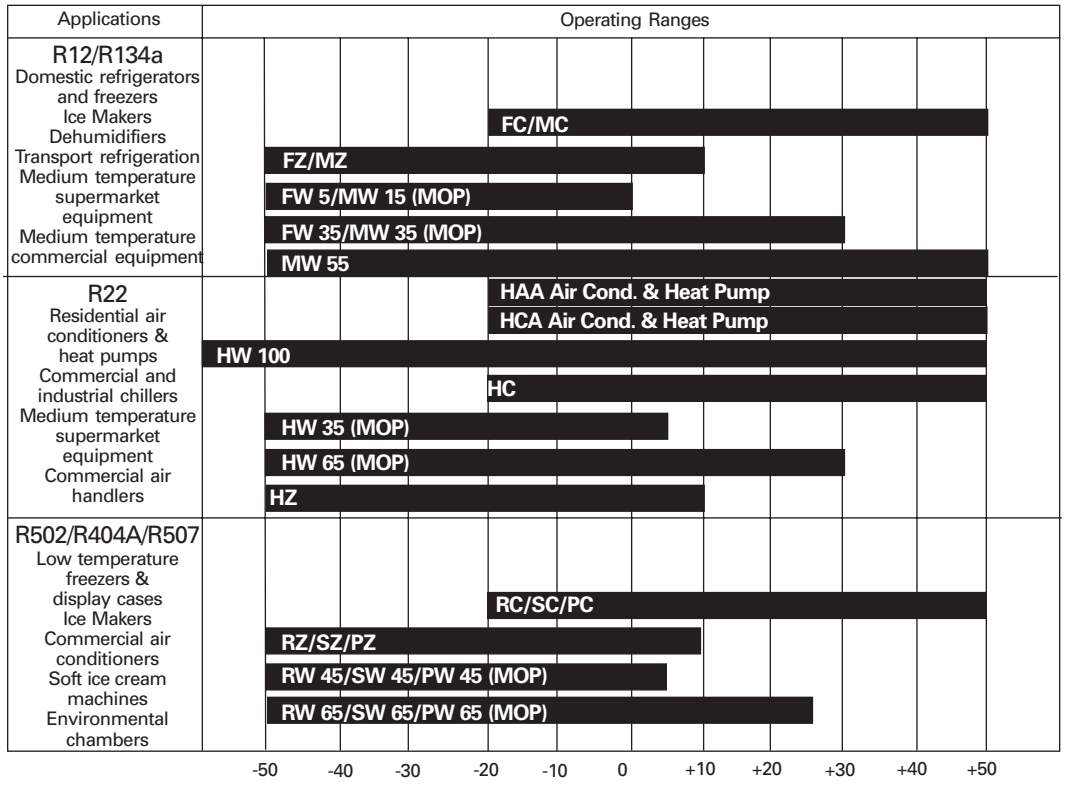
***Refrigerant Code Names***

ARI Standard 750-81 recommends the following color coding of thermostatic expansion valves: R-12 White; R-22 Green; R-502 Orchid; R-40 Red; R-500 Orange. Uncommon refrigerants with no designated color should use Blue.

| ASHRAE Ref. No. | Trade or Chemical Name | Alco Code Color | Alco Code Letter |
|---|---|---|---|
| R-12 | Dichlorodifluoromethane | white | F |
| R-22 | Chlorodifluoromethane | Green | H |
| R-502 | 22/115 | Purple | R |
| R-134a | Tetrafluoroethane | Blue | M |
| R-404A | 125/134a/143A | Light Orange | S |
| R-401A | 22/152A/124 | Coral | X |
| R-507 | 125/143A | Teal | P |

# Thermo Expansion Valves

***Thermo Expansion Valve Charge Code Selector***



# Thermo Expansion Valves

***TEV Replacement Charge Symbols Cross Reference***
***Old Bulb Charges vs. New Replacement Bulb Charge***

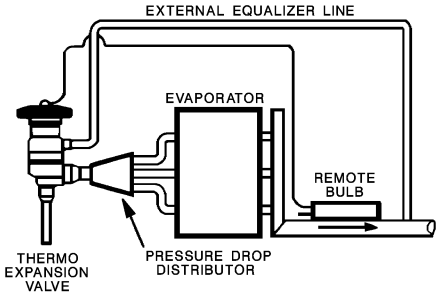
| Air Conditioning | | Commercial Refrigeration | | Low Temperature | |
|---|---|---|---|---|---|
| Old Charge | Replacement | Old Charge | Replacement | Old Charge | Replacement |
| Refrigerant R12/R134a | | | | | |
| | FC | F or FL | FC | — | — |
| | | FC | | — | FZ |
| FW | | FW | | FWZ | |
| FG55 | | FG35 | FW35 | — | — |
| FW55 | | FW35 | | FW15 | FW15/MW15 |
| FQ55 | | FQ35 | | FW15 | |
| FGA | | | — | — | — |
| FLA | | | | | |
| FGS | FWS | FGS35 | FGS35 | | |
| | | | | FWS | FWS |
| FWS | | FWS | | FZ/MZ | FZ/MZ |
| | | | | FX | FX |
| Refrigerant R22 | | | | | |
| | HC | H or HL | HC | — | — |
| | | HC | | — | |
| HW | HCA | HW | | HWZ | |
| HG100 | HC | HG65 | HW65 | — | — |
| HW100 | | HW65 | | HW35 | HZ |
| HQ100 | | HQ65 | | HQ35 | |
| HGA | | — | — | — | — |
| HLA | | | | | |
| HW85 | HW85 | | | | |
| HGS | HWS | HGS65 | HGS65 | | |
| | | HWS | HWS | HWS | HWS |
| HWS | | | | HZ | HZ |
| | | | | HX | HX |
| Refrigerant R502/R404A/R507 | | | | | |
| | RC/SC/PC | RL | RC/SC/PC | — | — |
| RW | | RW | | RWZ | RZ |
| RW110 | | RW65 | RW65 | RW35 | RW45/SW45 |
| RWS | RWS | RWS | RWS | RWS | RWS |
| | | | | RZ | RZ/SZ/PZ |

**Note:** All other charge symbols must be replaced with an identical model or at the option of the Alco technical service department who may make engineering authorized substitution of equivalent type to provide equivalent operation and performance.
**Note:** For field replacement purposes, **hc** can be used to replace **hca**.

# Thermo Expansion Valves

**Thermo Valve Application**
In general, for best evaporator performance, the Thermo Expansion Valve (TEV) should be applied as close to the evaporator as possible and in such a location as to make it easily accessible for adjustment and servicing. On pressure drop and centrifugal type distributors, apply the valve as close to the distributor as possible. (See figure 8.)

***Figure 8. Thermo expansion valve and pressure drop type distributor feeding an evaporator.***




All expansion valves [with the exception of the W-(MOP), G-(MOP), or GS-(MOP) gas charged types] may be installed in any location in the system. The gas charged type must always be installed in such a manner that the power assembly will be warmer than the remote bulb. The remote bulb tubing must not be allowed to touch a surface colder than the remote bulb location. If the power assembly or remote bulb tubing becomes colder than the remote bulb, the vapor change will condense at the coldest point and the remote bulb will lose control.

**Remote Bulb Location**

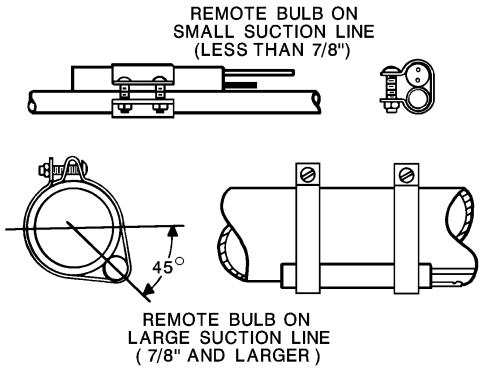
**Strap-on Type Remote Bulb**
Since evaporator performance depends largely upon good TEV control, and good valve control depends upon response to temperature change of the refrigerant gas leaving the evaporator, considerable care must be given to types of remote bulbs and their locations. In general, the external remote bulb meets the requirements of most installations. It should be clamped to the suction line near the evaporator outlet, and on a horizontal run. If more than one TEV is used on adjacent evaporators or evaporator sections, make sure that the remote bulb of each valve is applied to the suction line of the evaporator **fed by that valve**.

Clean the suction line thoroughly before clamping the remote bulb in place. When a steel suction line is used, it is advisable to paint the line with aluminum paint to minimize future corrosion and faulty remote bulb contact with the line. On lines over 7/8" OD the remote bulb should be installed at the position of about 4 or 8 o'clock. See figure 9.

If it is necessary to protect the remote bulb from the effect of an air stream, after it is clamped to the line, use material that will not absorb water with evaporator temperatures above 32°F. Below 32°F, cork or similar material sealed against moisture is suggested to prevent ice logging at the remote bulb location. The use of hair felt is not recommended. When the remote bulb location is below the water or brine level of a submerged coil, use a waterproofing material or pitch, that does not require heating above 120°F in applying it, to protect the remote bulb tubing and remote bulb.

**Remote Bulb Well**
When it becomes desirable to increase the sensitivity of the remote bulb to a change in the refrigerant gas temperature leaving the evaporator, it may be necessary to use a remote bulb well. This is particularly true for short coupled installations and installations with large suction lines (2-1/8" OD or larger). Remote bulb wells should be used (1) when very low super-heats are desired and (2) where convected heat from a warm room can influence the remote bulb (see figure 10).

***Figure 9.***

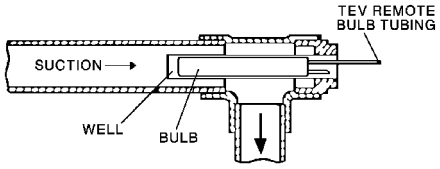



Do not under any circumstances locate either type of remote bulb in a location where the suction line is trapped (see figure 11). If the liquid refrigerant collects at the point of remote bulb location, the TEV operation will be erratic and possibly the valve thought to be defective. Large fluctuations in superheat in the suction gas are usually the result of trapped liquid at the remote bulb location. Even on properly designed suction lines, it is sometimes necessary to move the remote bulb a few inches either way from the original location to obtain best valve action. *Always locate the remote bulb on the evaporator side of any heat exchanger.*

On multi-circuit evaporators fed by one valve, locate the remote bulb away from immediate suction outlet at point where the suction gas from the several parallel circuits has had an opportunity to mix in the suction header.

Be sure to pull up tight on clamps so that the remote bulb makes good contact with the suction line. *Never apply heat near the remote bulb location without first removing the remote bulb.*

***Figure 10.***



# Thermo Expansion Valves

**Thermo Valve Hunting**
"Hunting" of the Thermo Expansion Valve can be defined as the alternate overfeeding and starving of the refrigerant flow to the evaporator. It is recognized by extreme cyclic changes in both the superheat or the refrigerant gas leaving the evaporator and the evaporator or suction pressure.

"Hunting" is a function of the evaporator design, length and diameter of tubing in each circuit, load per circuit, refrigerant velocity in each circuit, temperature difference under which the evaporator is operated, arrangement of suction piping and application of the TEV remote bulb.

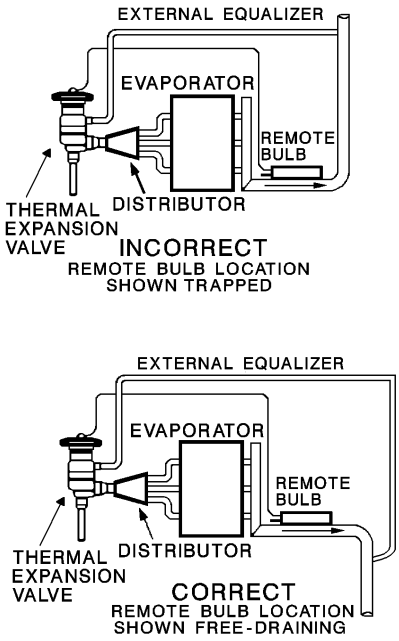
"Hunting" can be minimized or eliminated by the correct rearrangement of the suction piping, relocation of the remote bulb and use of the recommended remote bulb and power assembly charge for the Thermo Expansion Valve.

**Operation at Reduced Capacity**
The conventional TEV is a self-contained, direct operated regulator which does not have any built-in anticipating or compensating factors. Therefore, the TEV is susceptible to "hunting" for causes which are peculiar to both valve design and the design of the systems to which it is applied.

The ideal TEV flow rate would require a valve with perfect dynamic balance, capable of instantaneous response to any change in the rate of evaporation (anticipation) and with a means of preventing the valve from overshooting the control point due to inertia (compensation). With these features the TEV would be in phase with the system demand at all times and "hunting" would not occur.

A conventional TEV does not have built-in anticipating or compensating factors. This means that a time lag will exist between demand and response, along with the tendency to overshoot the control point. Thus the conventional TEV may get out of phase with the system and "hunt".

*Figure 11.*




Assume that an increase in load occurs, causing the superheat of the suction gas to increase. The time interval between the instant the remote bulb senses the increased superheat and causes the valve pin to move in the opening direction, allows the superheat of the gas to increase still further.

In response to the rising superheat during the time lags, the valve has moved further in the opening direction, overshot the control point and admitted more refrigerant to the evaporator than can be boiled off by the load. During the time lag between the instant the remote bulb senses the returning liquid refrigerant and the valve responds by moving in the closing direction, the valve continues to overfeed the coil. Thus, when the valve does move in the closing direction, it will again overshoot the control point and remain in an overly throttled position until most of the liquid refrigerant has left the evaporator. The ensuing time delay before the valve moves in the opening direction allows the superheat of the suction gas to again rise beyond the control point. This cycle, being self-propagating, continues to repeat itself.

Experience has shown that a TEV is more liable to "hunt" at low load conditions when the valve pin is close to the valve seat. This is generally thought to be due to an unbalance between the forces which operate the valve.

In addition to the three main forces that operate a TEV, the pressure difference across the valve port acts against the port area, and depending on valve construction, tends to force the valve either open or closed. When operating with the pin close to the seat, the following will occur.

With the valve closed, we have liquid pressure on the inlet side of the pin and evaporator pressure on the outlet. When the valve starts to open allowing flow to take place, the velocity through the valve throat will cause a point of lower pressure at the throat, increasing the pressure difference across the pin and seat. This sudden increase in pressure differential acting on the port area will tend to force the valve pin back into the seat. When the valve again opens, the same type of action occurs and the pin bounces off the seat with a rapid frequency.

This type of phenomenon is more frequently encountered with the larger single ported TEVs as the force due to the pressure differential is magnified by the larger port area.

We have seen that a TEV may "hunt" due to lack of anticipating and compensating features and an unbalance in the equilibrium forces at the lower end of its stroke.

We know from experience that a TEV when intelligently selected and applied, will overcome these factors and operate with virtually no "hunt" over a fairly wide load range.

Single ported TEVs will generally operate satisfactory to somewhat below 50% of nominal capacity but this is again dependent on evaporator design, refrigerant piping, size and length of evaporator circuits, load per circuits, refrigerant velocity, air flow over the evaporator, and rapid changes in loading.

Nothing will cause a TEV to "hunt" quicker than unequal feeding of the parallel circuits by the distributor or unequal air loading across the evaporator circuits.

# Thermo Expansion Valves

**Balanced Port Thermo Valve Operation**
In conventional expansion valves, as the pressure drop across the valve port changes due to changes in head pressure and/or suction pressure; the operating superheat of the expansion valve varies due to this "unbalance".

Depending on the operating conditions under which the superheat was originally set, this "unbalance" can in some situations result in compressor flooding or evaporator starvation. An unique design concept called "Balanced Port" cancels the effect of this pressure unbalance, permitting the expansion valve to operate at a relatively constant superheat over a wide range of operating conditions.

Any refrigeration system which experiences changes in operating pressures due to varying ambients, gas defrost, heat reclaim, or swings in evaporator load will benefit from using ALCO's Super HF Balanced Port Thermo Expansion Valve.

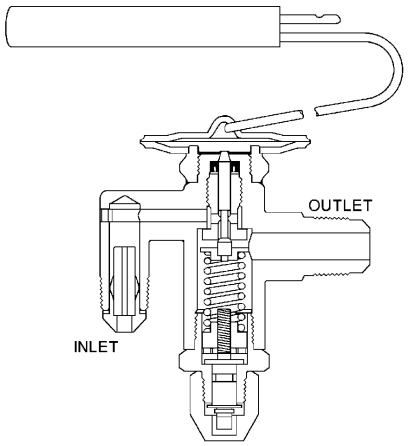
**Double Ported Balanced Ported TEVs**
The flow pattern of the single ported TEV can cause difficulties at low load conditions. The larger the port area (larger tonnages) the more prone is the valve to "hunt". Certain type ALCO Thermo Valves have been designed with two ports or "double ported". The inlet is so designed as to create a "counterflow" against the double ported balance ported valves and thus eliminate any unbalance across the two ports. See figure 13.

Flow through the upper port enters the upper radial holes of the cage seat assembly, moves upward and across the upper seat, down through the internal passage of the spool and out the holes in the bottom of the spool. The pressure drop across this port exerts a force in a closing (upward) direction.

Flow through the bottom port enters the lower radial holes of the cage seat assembly and moves downward through the port formed by the cage seat and the valve spool. High pressure liquid acts downward on the spool and the pressure drop across the spool and seat exerts a force in an opening direction.

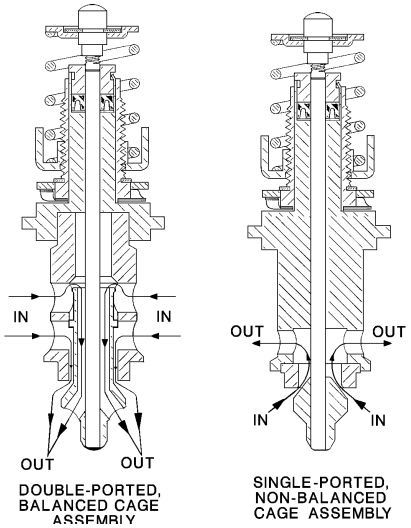
Since the effective port area of both the upper and lower cage ports is very nearly the same, the net force unbalanced across them is negligible.

*Figure 12. Cutaway view of Alco's super HF balanced port and thermo expansion valve.*




This feature makes it possible for the new double ported cage assemblies to modulate over a much wider load range than was possible with the old style, single port valves. The reverse-flow valves provide satisfactory control at loads less than 15% of nominal valve capacity. Their performance is superior to any competitive product available. Actual field performance has proven the superiority of double ported ALCO Thermo Valves and their ability to reduce "hunting" to a very minimum.

*Figure 13.*




**Bleed Holes for System Pressure Equalization**
When a permanent split-capacitor motor is used to drive a refrigeration compressor, it is necessary to provide some means of equalizing the high and low side pressures during the "off" cycle so that the motor can start with minimum torque.

**Note:** An external equalizer feature on TEVs does not perform this function; a separate internal bleed hole is required.

The letter "B" is used after the valve series number to denote a valve with bleed hole construction. For example: TCLEBHC. The body flange is stamped with the letter "B" followed by the bleed hole diameter, for example: B036. See figure 14.

The required bleed hole size for a particular system is a function of the high side and low side volumes, the pressure difference across the valve at time of shut-down, the equalization time required and quantity of refrigerant charge. Due to the many variables, each application must be tested to determine the correct size required. It should be remembered that bleed hole size adds to the total effective port area of the TEV and may affect size selection. Final selection of bleed hole size should be made ONLY after thorough testing.

# Thermo Expansion Valves

**Ammonia Expansion Valve**
The same Take-A-Part construction and design principles found in ALCO Thermo Valves for the common halocarbon refrigerants are also found in the ALCO TG line of Ammonia Thermo Valves.

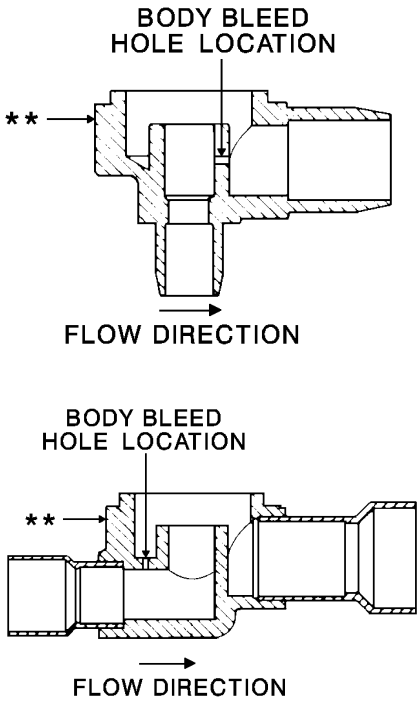
Except for a built-in Y-type strainer and body construction of high grade steel alloy, the approach to application of ammonia TEVs is the same as the brass halocarbon TEVs.

The internal cage construction of the TG ammonia expansion valve is the same as its brass counterpart, except in some instances a small discharge tube or orifice is used for the refrigerant outlet of the cage.

The function of this discharge tube is to provide a secondary restriction to provide more accurate tonnage requirements, and to slow down the velocity of the liquid ammonia across the primary orifice.

***Figure 14. Bleed hole for sysem equalization.***

** Bleed hole size stamped on body here




Any vapor present (flash gas) in the liquid line will cause the ammonia to enter the primary orifice at exceptionally high velocities thereby causing erosion of the pin and seat. The discharge tube or secondary orifice helps to reduce this velocity and increase the life of the pin and seat.

CAUTION: Should an ALCO TG ammonia Thermo Valve be used on an evaporator with a refrigerant distributor employing an orifice plate, the discharge tube in the cage must be removed prior to installation.

The combination of the discharge tube and distributor orifice plate will create too much pressure drop and a starving condition will probably be noted.

**Solder Bodies Take-A-Part Style Thermo Valves**
When soldering, remove power assembly, cage assembly, and all gaskets. Keep heat away from all valve parts, except body flange. Use a brazing alloy or low temperature solder. Be careful to retain all the solder in the connection. For integral (one-piece) body types, be sure to use plenty of wet rags or chill blocks and direct the flame away from the valve body.

**For external adjustment of ALCO Take-A-Part Valves–Types TCL, TJL, TJR, TER, TIR and THR:** To adjust, remove seal cap on side of valve and turn adjusting stem. Turning stem to right decreases flow and raises superheat. Turning stem to left increases flow and lowers superheat. Adjust all "T" series 2 turns (1°F) at a time.

Adjust each valve separately and wait between each adjustment to observe all results. Always tighten any loosened connections and replace seal cap.

It should be noted that superheat adjustment of "W–MOP", "G", and "GS" charged valves will change the MOP point. An increase in superheat setting will lower the MOP point and a decrease in superheat setting will raise the MOP.

**Direction of Flow**
Always be sure the flow of refrigerant is in the direction indicated by the arrow on the valve body.

**Installation and Service**
ALCO "T" Series Thermo Valves have three component parts: the power assembly, cage assembly, and body flange. There are no working parts in the body flange. It is never necessary to break the line connections to service the valve.

ALCO types HF, AFA and other hermetic integral Thermo Valves are assembled units which cannot be taken apart in the field, except that the strainer may be easily removed for inspection and cleaning by disconnecting the valve from the liquid line and removing the inlet flare connection.

**Servicing**

## ⚠ WARNING

**Before opening any system for servicing, use EPA approved methods to bring the system to atmospheric pressure. Failure to comply may result in system damage and/or personal injury.**

To inspect, clean, or replace parts on all Take-A-Part Valves, remove the two cap screws—lift off the power assembly—and remove cage assembly. Be sure gaskets are replaced in proper places when reassembling valve (see figure 15). When assembling external adjustment valves (TCL, TJL, TER, TIR, or THR) be sure the two lugs on the cage assembly fit into the grooves provided for them in the power assembly (see figure 16). Don't force valve together—make the cage fit properly before tightening body flange.

**Solenoid Liquid Stop Valves**
The TEV, while produced as a tight seating device, cannot be depended on for positive shut-off since the seating surfaces are exposed to dirt, moisture, corrosion, and erosion. In addition, if the remote bulb is installed in a location where during the "off" cycle it is influenced by a higher ambient temperature than the evaporator, the valve will open during a portion of the "off" cycle, and admit liquid to the evaporator. For these reasons the installation of a Solenoid Liquid Stop Valve ahead of any Thermo Expansion Valve (TEV) is highly recommended.

# Thermo Expansion Valves

**Filter-Driers for System Protection**
To protect the precision working parts of control valves from dirt and chips which can damage them and render them inoperative, and to protect the entire system from the damaging effects of moisture, sludge and acids a filter-drier should be installed on every system.

The ALCO Liquid Line Filter-Drier provides the finest possible protection available with superior filtering action and the removal of moisture, sludges, corrosive acids and waxes.

***Figure 15.***

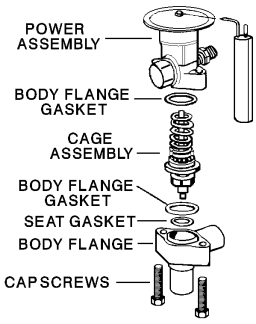
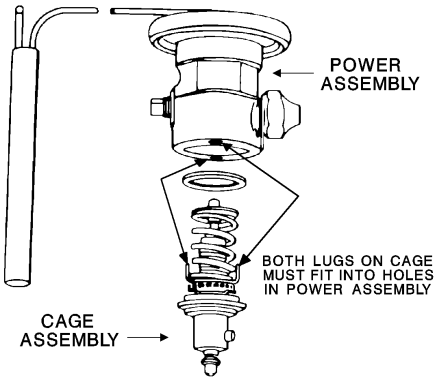



***Figure 16.***




**Factory Superheat Setting**
Unless otherwise specified, all valves will be preset at the factory at a bath temperature which is predetermined by the charge symbol and/or the MOP rating.

The bath temperature at which the valve superheat has been set is coded alphabetically in the superheat block on the valve nameplate, as shown in the table below.

| Bath Temperature | Code Letter |
|---|---|
| +32°F | A |
| +10°F | B |
| 0°F | C |
| –10°F | D |
| –20°F | E |

Thus a valve with "10A" stamped in the nameplate superheat block has been set for 10°F static superheat with a 32°F bath. In like manner, a valve stamped "10C" has been set for 10°F static superheat with a 0°F bath.

When ordering a valve for an exact replacement, specify the code letter as well as the superheat setting desired. When ordering for general stock, it will not be necessary to specify either the superheat or the code letter, since the standard setting will cover most applications and minor superheat adjustments may be made in the field.

**Pressure Switch Setting**
On valves with MOP—the Pressure Switch must be set to cut in at a pressure lower than the MOP rating of the valve.

# Thermo Expansion Valves

## Selection of Thermo® Expansion Valves

**Expansion Valve Selection**
The following conditions must be known to correctly size an expansion valve:
1) Refrigerant type
2) Evaporator Temperature
3) Evaporator Capacity
4) Condensing Temperature/Pressure
5) Liquid Temperature
6) Distributor type (if used)

NOTE: The valve is sized to the evaporator and not the compressor.

**Refrigerant Type**
A valve's capacity will change for different refrigerants.

**Evaporator Temperature**
As the evaporator temperature changes the valve capacity will also change. As the evaporator temperature drops, the valve capacity will decrease, and as the temperature increases, so does the valve capacity.

**Evaporator Capacity**
The valve is sized to the evaporator capacity since it is the evaporator superheat that the valve controls.

**Condensing Temperature**
What we really want here is the high side pressure. The condensing pressure along with the evaporator pressure will give us the pressure drop (Delta P) across the valve.

**Liquid Temperature**
The valve capacity is directly related to the liquid temperature.

**Distributor Type**
We need to know this to determine if we need an external or internal equalizer for the valve. We also need the type to calculate the pressure drop across the valve. The higher the pressure drop, the higher the capacity of the valve.

NOTE: The valve is sized to the evaporator and not the compressor.

NOTE: There is no mention here about line sizes. They are selected last, after the correct sized valve has been selected.

- Pressure drop across the valve is determined by the difference between the inlet pressure and the outlet pressure of the valve.
- If the condensing pressure is not known, it can be found by using the above temperatures and converting to pressures using a P/T chart.
- Along with the distributor pressure drop, the line losses and any other high side pressure losses should be subtracted from the condensing pressure to get the valve inlet pressure.
- If only the evaporator temperature is known then a P/T chart is used to find the pressure.
- Always select thermostatic expansion valves for actual operating conditions rather than nominal valve capacities.

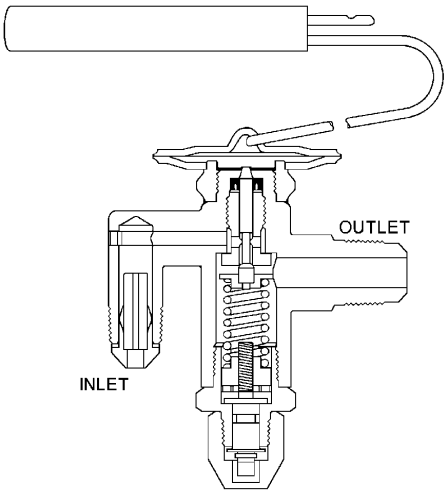
**Condensing Pressure**
Medium Temp. = 110°F, or
Low Temp. = 105°F, or
Air Conditioning = 120°F

**– Distributor Pressure Drop**
Orifice Type = 35 psi, or
Venturi Type = 15 psi

**– Evaporator Pressure**

**= Net Pressure Drop**

***Net Pressure Drop Across the Valve***



# Thermo Expansion Valves

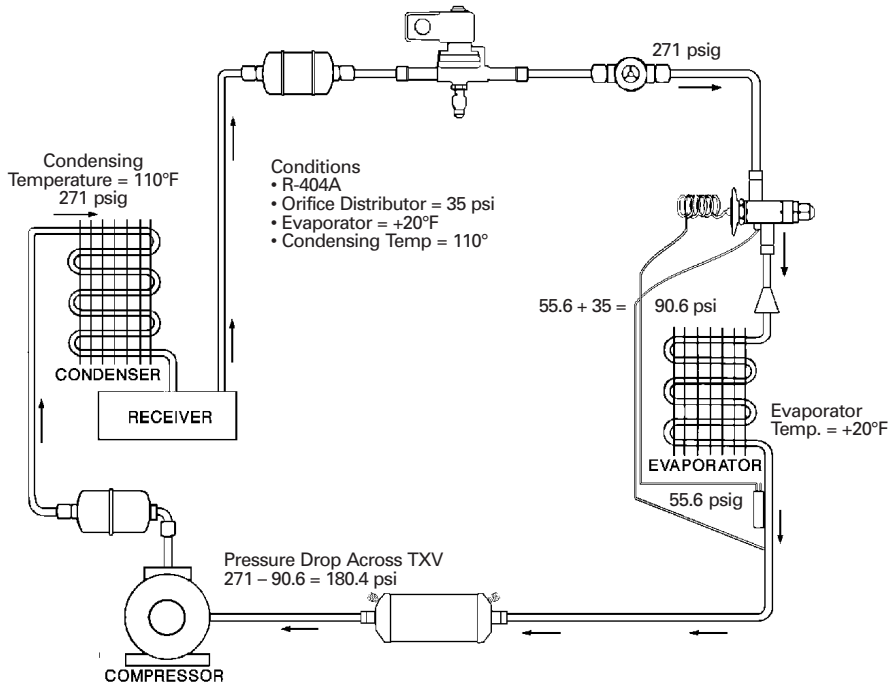
Our first step toward sizing the TXV will be to calculate the pressure drop across the valve. The diagram at right will help us to visualize how the pressure drop is calculated.

Our condensing temperature is 271 psig and since we have no high side losses, the pressure at the inlet of the valve is 271 psig.

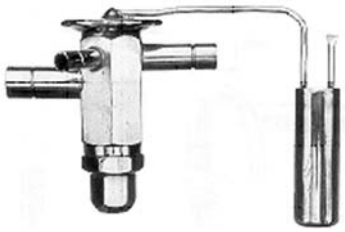
The low side is a little different, we have an evaporator pressure of 55.6 psig and now we have a 35 psi drop across the distributor, which means that the pressure at the outlet of the valve is 35 psi greater than the evaporator pressure. The pressure at the outlet of the valve is the sum of the distributor pressure drop plus the evaporator pressure, or 90.6 psi (35 + 55.6).

The pressure drop across the valve is the difference between the valve inlet and the valve outlet or in this case 180.4 psi (271 – 90.6).

***TXV Pressure Drop Calculation with distributor***



# Thermo Expansion Valves



## A-Series Thermo® Expansion Valve

"A" Series Thermo Expansion Valves are used for heat pump, air conditioning, food service and commercial applications.
"A" Series valves provide stable and accurate control over a wide range of operating conditions.

**Features**
- Hermetic construction eliminates external leakage
- Compact size allows installation in limited spaces
- Mass spectrometer tested to ensure less than 0.10 oz/year external leakage rate
- Stainless steel power element eliminates corrosion and prevents valve failure

**Options**
- HAA wide range charge allows two valves ( 2 1/2 and 5 ton, R-22) to cover all capacities from 1 to 5 tons on most residential systems ***(see below)***
- New ZW155 charge available for R-410A systems
- Available adjustable or non-adjustable superheat for application flexibility
- SAE or ODF connections standard – chatleff or aeroquip are available
- Available external or internal equalizer to satisfy the broadest possible range of applications
- Available internal check valve allows reverse flow heat pump applications, eliminating the need for external piping and external check valve, thus reducing installation costs (ANC Series)
- Bleed type pressure equalization available to accommodate PSC type compressors
- Pressure limiting charges (MOP) available – consult factory

**Specifications**
Maximum working pressure: 700 psig

UL recognized: SA5312

**Nomenclature** example: AACEB 2 HC 30 IN 3/8 x 1/2 ODF ANG

| A | A | C | E | B | 2 | H | C | 30 IN | 3/8 x 1/2 | ODF | ANG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Valve Series** | **Superheat Adjustment** | **Internal Check Valve** (optional) Reverse Flow Bypass Application | **Equalizer** E=External (Omit for Internal) | **Bleed Hole** (optional) Omit for no bleed hole | **Capacity** Nominal Rating in Tons See nominal capacity table below | **Refrigerant Code** F = R12 H = R22 M = R134a N = R407C P = R507 R = R502 S = R404A Z = R410A | **Charge Code** C = medium temp CA = heat pump W(MOP)=press. limiting Z = low temp AA = wide range | **Capillary Tube Length** 30 IN (std) other lengths are available | **Inlet x Outlet Connection Sizes** I O 1/4 3/8 3/8 1/2 1/2 5/8 5/8 7/8 | **Connection Type** SAE = flare ODF = solder Chatleff (optional) Aeroquip (optional) | **Configuration** S/T = straight-thru ANG = 90° angle |
| Economy, Hermetic Design | A = Adjustable N = Non-Adjustable | | | | | | | | | | |

# Thermo Expansion Valves

## Ordering Information for A-Series Valves (15% Bleed), HCA Charge

| Valve Series | Capacity Tons | Connections | ServiceFirst Part Number | Cap Tube |
|---|---|---|---|---|
| AAE | 3 | 3/8" x 1/2" ODF S/T | VAL08238 | 30" Cap |
| | 5 | 1/2" x 5/8" ODF S/T | VAL08239 | 30" Cap |
| AAEB | 1 | 3/8" x 1/2" ODF S/T | VAL02368 | 5′ Cap |
| | 1 1/2 | 3/8" x 1/2" ODF S/T | VAL02369 | 5′ Cap |
| | 2 | 3/8" x 1/2" ODF S/T | VAL02370 | 5′ Cap |
| | 2 1/2 | 3/8" x 1/2" ODF S/T | VAL02371 | 5′ Cap |
| | 2 1/2 | 3/8" x 1/2" ODF S/T | VAL00889 | 30" Cap |
| | 3 | 3/8" x 1/2" ODF S/T | VAL02372 | 5′ Cap |
| | 3 | 3/8" x 5/8" ODF S/T | VAL00891 | 30" Cap |
| | 4 | 3/8" x 1/2" ODF S/T | VAL02373 | 5′ Cap |
| | 4 | 3/8" x 5/8" ODF S/T | VAL02374 | 5′ Cap |
| | 4 | 1/2" x 7/8" ODF S/T | VAL02375 | 5′ Cap |
| | 5 | 3/8" x 1/2" ODF S/T | VAL02376 | 5′ Cap |
| | 5 | 1/2" x 5/8" ODF S/T | VAL02377 | 5′ Cap |
| | 5 | 1/2" x 7/8" ODF S/T | VAL02378 | 5′ Cap |

## Universal Replacement

**HAA Wide Range Charge for HVAC Applications**

- The AACE wide range valve allows several TXV to replace the majority of residential air conditioning and heat pump applications.
- The new HAA charge is a special high stability charge designed for R-22 HVAC applications and is used by leading original equipment manufacturers.
- The HAA is a wide range charge providing greater superheat stability, allowing in most cases two valves to cover a wide range of capacities from 1 to 5 tons.
- The HAA charge also offers customers the benefit of inventory reduction by replacing several valves with two HAA wide range valves, while continuing to meet system performance needs.
- The HAA charge is now available for "A" series expansion valves for R-22 applications. With the addition of an integral check valve, four expansion valves can meet the majority of residential HVAC, light commercial and heat pump applications as shown in Table 1.

***Table 1***

| ServiceFirst Part Number | Description | R-22 Capacity Range |
|---|---|---|
| VAL07065 | AACE 2 1/2 HAA ODF EE 30" 3/8 x 1/2 ODF S/T 6A | 1 to 3 Tons |
| VAL07066 | AACE 5 HAA ODF EE 30" 3/8 x 1/2 ODF S/T 6A | 3 1/2 to 5 Tons |
| VAL07067 | AACE 2 1/2 HAA Cap Tube EE w/Nut 30" Chatleff x Chatleff S/T 6A | 1 to 3 Tons |
| VAL07068 | AACE 5 HAA Cap Tube EE w/Nut 30" Chatleff x Chatleff S/T 6A | 3 1/2 to 5 Tons |

# Thermo Expansion Valves

**HFESC**
ODF Connections

Replacement Screen Kit
KIT04955

## HF Balanced Port Thermo® Expansion Valve

### Features
- Large, removable power element
- Balanced port construction compensates for changes in operating pressures due to varying ambients, gas defrost, heat reclaim, or widely varying evaporator loads
- Two body sizes provide capacities from 1/4 to 20 tons
- Bi-Flow capability up to 5-1/2 tons R22 allows one valve to control the superheat in both cooling and heating modes for package unit heat pump applications
- Wrench flats on inlets and outlets (SAE only) for easy installation
- Stainless steel power element for maximum corrosion resistance

### Options
- Bleed type pressure equalization available to accomodate PSC type compressors
- ODF or SAE connections
- Removable strainer
- Adjustable or non-adjustable superheat

### Specifications
- Maximum Working Pressure: 450 psig
- Operating Temperature: -40°F to 50°F
- 5' capillary tube length (standard)
- Use with R-22, R134a, R-404A, R-507, R-12, R-502

For Ordering Information, see following page.

**Nomenclature** example: HFNESCB 2 HC 5 FT 3/8 x 1/2 ODF S/T

| HF | N | E | S | C | B | 2 | H | C | 5 FT | 3/8 x 1/2 | ODF | S/T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Valve Series** | **Superheat Adjustment** | **Equalizer** | **Connection Type** | **Removable Inlet Strainer** | **Bleed Hole** (optional) | **Capacity** Nominal Rating in Tons | **Refrigerant Code** | **Charge Code** | **Capillary Tube Length** | **Inlet x Outlet Connection Sizes** I O | **Connection Type** | **Configuration** |
| | N = Non-Adjustable<br>Omit for Adjustable | E=External<br>(Omit for Internal) | S=Solder<br>(Omit for SAE Flare) | (optional)<br>C=Inlet Strainer (ODF only) | Omit for no bleed hole | See nominal capacity table (on page 17) | F = R12<br>H = R22<br>M = R134a<br>*P = R507<br>*R = R502<br>*S = R404A | C = medium temp<br>CA = heat pump<br>W(MOP)=press. limiting<br>Z = low temp | 5 FT (std)<br>other lengths are available | 1/4 3/8<br>3/8 1/2<br>1/2 5/8<br>5/8 7/8 | SAE = flare<br>ODF = solder | S/T = straight-thru<br>ANG = 90° angle |

* P, R and S charges are interchangeable

**Replacement Power Assemblies**

| R12 POWER ASSEMBLY | | R22 POWER ASSEMBLY | | R502 POWER ASSEMBLY | |
|---|---|---|---|---|---|
| Description | ServiceFirst Part Number | Description | ServiceFirst Part Number | Description | ServiceFirst Part Number |
| X26300-FC-1 | HED00344 | X26300-HC-1 | HED00348 | X26300-RC-1 | HED00355 |
| X26300-FZ-1 | HED00347 | X26300-HZ-1 | HED00351 | X26300-RZ-1 | HED00358 |
| X26300-FW15-1 | HED00345 | X26300-HW35-1 | HED00349 | X26300-RW45-1 | HED00357 |
| X26300-FW35-1 | HED00346 | X26300-HW65-1 | HED00350 | | |

Torque Power Element 300-360 inch pounds.

### Tailored Bulb Charges

The use of ALCO tailored charges makes the HF valve reliable for HVAC, refrigerated display cases, walk-in coolers, reach-in coolers, and all other small refrigeration systems — both low and medium temperature.

The thermostatic charge is selected on the basis of the evaporator temperature only, as indicated in Table 2.

***Table 2***

| | Refrigerant | | | |
|---|---|---|---|---|
| Evaporator Temperature | R12 | R134a | R22 | R502, R404A, R507 |
| Med temp (– 20 to +50°F) | FC | MC | HC | *C |
| Low temp (–50 to +10°F) | FZ | MZ | HZ | *Z |
| MOP low temp (–50 to 0°F) | FW15 | MW15 | HW35 | *W45 |
| MOP med temp (0 to +25°F) | – | MW35 | HW65 | *W65 |

* Add refrigerant code: "R" for R502, "S" for R404A, "P" for R507.

***Replacement parts - HFSC & HFESC only***

| ServiceFirst Part Number | Description |
|---|---|
| KIT04955 | Repair Kit (KT20264) includes seal cap, gasket, o-ring, screen, spring |

# Thermo Expansion Valves

## Ordering Information for HF Series Valves

| Valve Series | Capacity Tons | Connections | ServiceFirst Part Number External HCA | Internal MC | Refrig. |
|---|---|---|---|---|---|
| HF | 1 | 3/8 x 1/2 SAE ANG IE 5' CAP TUBE | | VAL07984 | R134a |
| HFES | 1 | 3/8 x 1/2 ODF ANG 5' CAP TUBE | | VAL07962 | R134a |
| HF(E)(S) | 8 | 1/2 x 7/8 ODF S/T | VAL04911 | | R-22 |
| | | 5/8 x 7/8 ODF S/T | VAL05516 | | |
| | 10 | 5/8 x 7/8 ODF S/T | VAL04444 | | |
| | | 5/8 x 1 1/8 ODF S/T | VAL04445 | | |
| | | 7/8 x 1 1/8 ODF S/T | VAL04406 | | |
| | 15 | 5/8 x 7/8 ODF S/T | VAL05471 | | |
| | | 7/8 x 1 1/8 ODF S/T | VAL04448 | | |
| | | 5/8 x 1 1/8 ODF S/T 5' CAP | VAL04447 | | |
| | | 7/8 x 1 3/8 SAE EE 5' S/T | VAL04407 | | |
| | 20 | 7/8 x 1 1/8 ODF S/T | VAL05487 | | |

## HF(E)/HFK(E) Extended Product Information

## TXV Superheat Change

Listed below are superheat change per turn for the listed refrigerants in °F.

**HF(E)/HFK(E) < 5 1/2 tons R-22**

**HF(E)/HFK(E) < 3 1/2 tons R-502**

***Approximate Superheat change per turn @ 20°F***

| Charge Type | R404A | R507 | R22 | R12 | R502 | R134a |
|---|---|---|---|---|---|---|
| C,Z | 1.5 - 2.0 | 1.5 - 2.0 | 2 - 2.5 | 3 - 4 | 1.5 - 2 | 3 - 4 |

***Approximate Superheat change per turn @ -20°F***

| Charge Type | R404A | R507 | R22 | R502 |
|---|---|---|---|---|
| C,Z | 3 - 3.5 | 3 - 3.5 | 4 - 4.5 | 3 - 3.5 |

HF(E)/HFK(E) valves typically have between 9 and 11 turns of adjustment depending on tolerances from full lower stop to upper stop.

## HF(E)/HFK(E) > 5 1/2 tons R-22

## HF(E)/HFK(E) > 3 1/2 tons R-502

***Approximate Superheat change per turn @ 20°F***

| Charge Type | R404A | R507 | R22 | R12 | R502 | R134a |
|---|---|---|---|---|---|---|
| C,Z | 3.5 - 4 | 3.5 - 4 | 3.5 - 4 | 6 - 6.5 | 3.5 - 4 | 6 - 6.5 |

***Approximate Superheat change per turn @ -20°F***

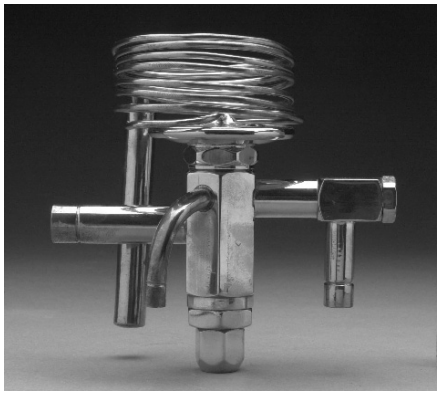
| Charge Type | R404A | R507 | R22 | R502 |
|---|---|---|---|---|
| C,Z | 6 - 6.5 | 6 - 6.5 | 7 - 7.5 | 6 - 6.5 |

HF(E)/HFK(E) extended valves typically have between 4 and 6 turns of adjustment depending on tolerances from full lower stop to upper stop.

# Thermo Expansion Valves

**HFKESC**
ODF Connections

Replacement Screen Kit
KIT04955



## HFK Balanced Port Thermo® Expansion Valve

**Features**
- The new HFK features interchangeable bodies, cages, and power elements providing maximum flexibility for ¼ to 5½ ton applications (nom. R-22).
- The HFK is offered several ways:
  - — *Pre-packaged service kits* – Include a mix of bodies and power elements with a complete set of cages to serve the most applications with a minimum of parts.
  - — *Individual components* - Bodies, cages, & power elements may be ordered separately and can be used to build personalized service kits or replenish pre-packaged kits.
  - — *Finished valves* – Assembled valves ready for immediate installation.
- All HFK valves use a balanced port cage design that compensates for changes in operating pressures due to varying ambients, gas defrost, heat reclaim, or widely varying evaporator loads.
- The HFK offers the following additional features:
  - — Bi-Flow capability
  - — Stainless steel power element
  - — Adjustable superheat
  - — Solid copper connections

**Options**
- ODF or SAE connections
- Straight-through or angle flow configurations
- Removable inlet strainer available (ODF only)
- Internal or external equalizer

**Specifications**
- Maximum working pressure: 450 psig
- Operating Temperature: -40°F to 50°F
- Use with R-22, R-134a, R-404A, R-507, R-12, R-502

**Note:** HFK cages are not interchangeable with HF valve bodies. Power elements can be interchanged.

**Nomenclature** example: HFKESC 2 HC 5 FT 3/8 x 1/2 ODF S/T

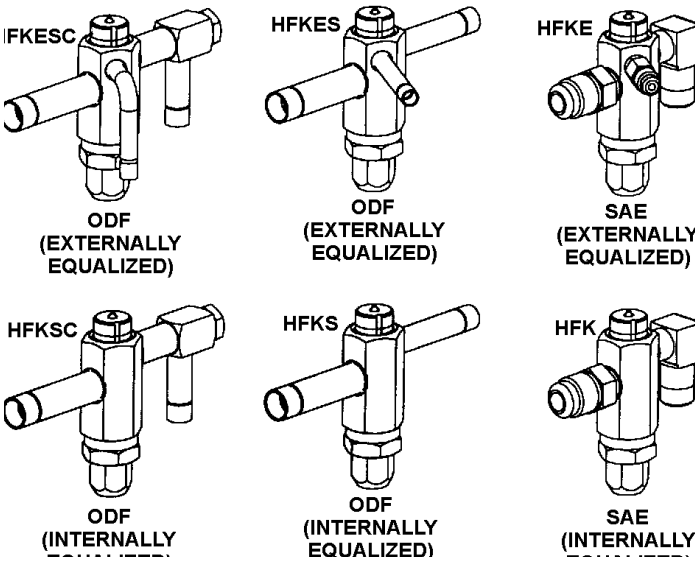
| HFK | E | S | C | 2 | H | C | 5 FT | 3/8 x 1/2 | ODF | S/T |
|---|---|---|---|---|---|---|---|---|---|---|
| **Valve Series** | **Equalizer** | **Connection Type** | **Removable Inlet Strainer** (optional) | **Capacity** Nominal Rating in Tons | **Refrigerant Code** F = R12 H = R22 M = R134a N = R407C P = R507 R = R502 S = R404A Z = R410A | **Charge Code** C = medium temp CA = heat pump W(MOP)=press. limiting Z = low temp | **Capillary Tube Length** 5 FT (std) other lengths are available | **Inlet x Outlet Connection Sizes** See Body Table on page 23 | **Connection Type** SAE = flare ODF = solder | **Config-uration** S/T = straight-thru ANG = 90° angle |
| | E=External (Omit for Internal) | S=Solder (Omit for SAE Flare) | C=Inlet Strainer (ODF only) | See nominal capacity table (on page 23) | | | | | | |

# Thermo Expansion Valves

## HFK Balanced Port TEV

### HFK Selection Process

Step 1: Body Selection

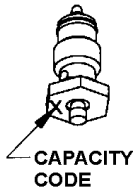



***Body Selection Table***

| ServiceFirst Part Number | Description | Type | Connections (Inlet x Outlet) |
|---|---|---|---|
| BOD00819 | KT-20298-1 | HFK | 1/4 x 1/2 SAE Ang Inlet |
| BOD00820 | KT-20298-2 | HFK | 3/8 x 1/2 SAE Ang Inlet |
| BOD00821 | KT-20298-3 | HFKE | 1/4 x 1/2 SAE Ang Inlet |
| BOD00822 | KT-20298-4 | HFKE | 3/8 x 1/2 SAE Ang Inlet |
| BOD00823 | KT-20298-5 | HFKSC | 3/8 x 1/2 ODF Ang Inlet w/ Strainer |
| BOD00824 | KT-20298-6 | HFKESC | 3/8 x 1/2 ODF Ang Inlet w/ Strainer |
| BOD00825 | KT-20298-7 | HFKS | 3/8 x 1/2 ODF S/T |
| BOD00826 | KT-20298-8 | HFKS | 3/8 x 5/8 ODF S/T |
| BOD00827 | KT-20298-9 | HFKS | 1/2 x 5/8 ODF S/T |
| BOD00828 | KT-20298-10 | HFKS | 1/2 x 7/8 ODF S/T |
| BOD00829 | KT-20298-11 | HFKES | 3/8 x 1/2 ODF S/T |
| BOD00830 | KT-20298-12 | HFKES | 3/8 x 5/8 ODF S/T |
| BOD00831 | KT-20298-13 | HFKES | 1/2 x 5/8 ODF S/T |
| BOD00832 | KT-20298-14 | HFKES | 1/2 x 7/8 ODF S/T |

# Thermo Expansion Valves

Step 2: Cage Selection

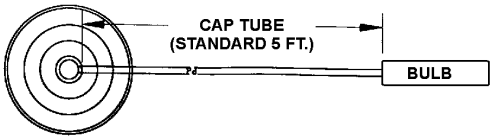



***Cage Capacity Table (Nominal)***

| ServiceFirst Part Number | Description[1] | Cage Code | R-12 | R-22 | R-134a | R-404 | R-507 | R-502 | R-407C |
|---|---|---|---|---|---|---|---|---|---|
| CAG00127 | KT-20299-0 | 0 | 1/8 | 1/4 | 1/4 | 1/8 | 1/8 | 1/8 | 1/4 |
| CAG00128 | KT-20299-1 | 1 | 1/4 | 1/2 | 1/2 | 1/4 | 1/4 | 1/4 | 1/2 |
| CAG00129 | KT-20299-2 | 2 | 1/2 | 1 | 3/4 | 1/2 | 1/2 | 1/2 | 1 |
| CAG00130 | KT-20299-3 | 3 | 1 | 1 1/2 | 1 | 1 | 1 | 1 | 1 1/2 |
| CAG00131 | KT-20299-4 | 4 | 1 1/4 | 2 | 1 1/2 | 1 1/4 | 1 1/4 | 1 1/4 | 2 |
| CAG00132 | KT-20299-5 | 5 | 1 1/2 | 2 1/2 | 1 3/4 | 1 1/2 | 1 1/2 | 1 1/2 | 2 1/2 |
| CAG00133 | KT-20299-6 | 6 | 2 | 3 | 2 1/2 | 2 | 2 | 2 | 3 |
| CAG00134 | KT-20299-7 | 7 | 3 1/2 | 5 1/2 | 4 | 3 1/2 | 3 1/2 | 3 1/2 | 5 1/2 |

[1]Cage Kit includes Cage, Insertion Tool and ID Clips.

Step 3: Power Element Selection

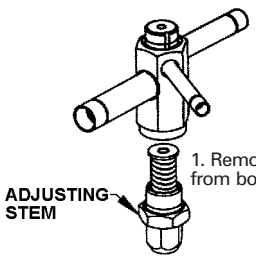



***Power Element Table[1]***

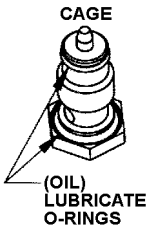
| ServiceFirst Part Number | Description | System Refrigerant(s) | Application |
|---|---|---|---|
| HED00346 | X26300-FW35-1 | R-12/R-134a | Low Temp MOP |
| HED00631 | X26300-HW100-1 | R-22/R-407C | AC MOP |
| HED00214 | X26300-HCA-1 | R-22/R-407C | Heat Pump |
| HED00635 | X26300-SW45-1 | R-404/ R-507/ R-502 | Low Temp MOP |
| HED00344 | X26300-FC-1 | R-12/R-134a | Medium Temp |
| HED00348 | X26300-HC-1 | R-22/R-407C | A/C Med. Temp |
| HED00634 | X26300-SC-1 | R-404/ R-507/ R-502 | Medium Temp |
| HED00347 | X26300-FZ-1 | R-12/R-134a | Low Temp |
| HED00351 | X26300-HZ-1 | R-22/R-407C | Low Temp |
| HED00633 | X26300-SZ-1 | R-404/ R-507/ R-502 | Low Temp |

[1] Additional power element charges available, call for availability.

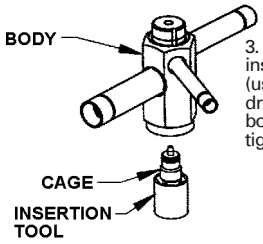
# Thermo Expansion Valves



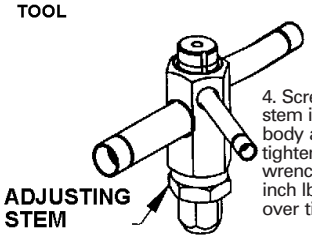

1. Remove adjusting stem from body.



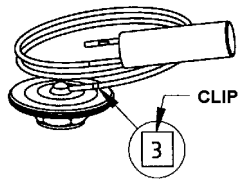

2. Lubricate O-rings on cage.



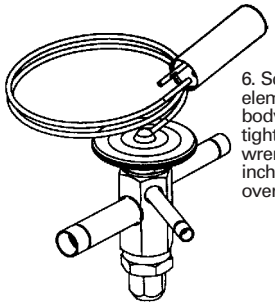

3. Place cage into insertion tool (using 1/4" square nut driver) and insert into body (do not over tighten).




4. Screw adjusting stem into bottom of body and hand tighten plus one wrench flat. (300-360 inch lbs. – Do not over tighten.)




5. Attach cage identification clip on power element cap tube.



6. Screw power element onto top of body and hand tighten plus one wrench flat. (300-360 inch lbs. – Do not over tighten.)

## HFK Balanced Port TEV

### HFK Assembly Procedure

(see 6 assembly steps & diagrams below)

1. Remove adjusting stem from body.
2. Lubricate o-rings on cage.
3. Place cage into insertion tool (using ¼" nut driver) and insert into body (do not over tighten).
4. Screw adjusting stem into bottom of body and hand tighten plus one wrench flat. (300-360 inch lbs. – Do not over tighten.)
5. Attach cage identification clip on power element cap tube.
6. Screw power element onto top of body and hand tighten plus one wrench flat. (300-360 inch lbs. – Do not over tighten.)

### *R-22 Kit – KIT07555*

| ServiceFirst Item # | Description | Qty |
|---|---|---|
| BOD00825 | HFKS 3/8 x 1/2 body | 1 |
| BOD00829 | HFKES 3/8 x 1/2 body | 3 |
| BOD00830 | HFKES 3/8 x 5/8 body | 1 |
| BOD00831 | HFKES 1/2 x 5/8 body | 1 |
| HED00631 | HW power element | 1 |
| HED00214 | HCA power element | 2 |
| HED00348 | HC power element | 1 |
| KIT07524 | Cage Kit | 1 |

### *ODF Kit – KIT07522*

| ServiceFirst Item # | Description | Qty |
|---|---|---|
| BOD00823 | HFKSC 3/8 x 1/2 body | 1 |
| BOD00829 | HFKES 3/8 x 1/2 body | 1 |
| BOD00824 | HFKESC 3/8 x 1/2 body | 2 |
| HED00344 | FC power element | 2 |
| HED00348 | HC power element | 1 |
| HED00351 | HZ power element | 1 |
| HED00633 | SZ power element | 2 |
| KIT07524 | Cage Kit | 1 |

### *Cage Kit – KIT07524*

| ServiceFirst Item # | Description | Qty |
|---|---|---|
| CAG00127 | Size 0 cage (1/4 ton R-22) | 2 |
| CAG00128 | Size 1 cage (1/2 ton R-22) | 2 |
| CAG00129 | Size 2 cage (1 ton R-22) | 2 |
| CAG00130 | Size 3 cage (1-1/2 ton R-22) | 2 |
| CAG00131 | Size 4 cage (2 ton R-22) | 2 |
| CAG00132 | Size 5 cage (2-1/2 ton R-22) | 2 |
| CAG00133 | Size 6 cage (3 ton R-22) | 2 |
| CAG00134 | Size 7 cage (5-1/2 ton R-22) | 2 |
| TOL01494 | Insertion tool | 1 |
| BOT00009 | Oil Bottle | 1 |
| | Cage ID tags | — |

### HFK Pre-Packaged Kits

The HFK is available in a pre-packaged kit consisting of a mix of popular bodies and power elements with a complete selection of cages. These kits provide great flexibility allowing valves to be assembled as needed for each application. Three kits are provided as shown below. In addition, custom kits can be assembled by stocking an empty kit case with desired components.

### *SAE Kit – KIT07521*

| ServiceFirst Item # | Description | Qty |
|---|---|---|
| BOD00819 | HFK 1/4 x 1/2 body | 1 |
| BOD00820 | HFK 3/8 x 1/2 body | 1 |
| BOD00822 | HFKE 3/8 x 1/2 body | 2 |
| HED00344 | FC power element | 2 |
| HED00348 | HC power element | 1 |
| HED00351 | HZ power element | 1 |
| HED00633 | SZ power element | 2 |
| KIT07524 | Cage Kit | 1 |

### *ODF/SAE Mix Kit – KIT07523*

| ServiceFirst Item # | Description | Qty |
|---|---|---|
| BOD00820 | HFK 3/8 x 1/2 body | 1 |
| BOD00822 | HFKE 3/8 x 1/2 body | 1 |
| BOD00823 | HFKSC 3/8 x 1/2 body | 1 |
| BOD00824 | HFKESC 3/8 x 1/2 body | 1 |
| HED00344 | FC power element | 2 |
| HED00348 | HC power element | 1 |
| HED00351 | HZ power element | 1 |
| HED00633 | SZ power element | 2 |
| KIT07524 | Cage Kit | 1 |

### *Kit Accessories*

| ServiceFirst Item # | Mfg. # | Description |
|---|---|---|
| BOX01428 | KT-20302-1 | HFK Replacement Service Box (Empty) |
| BOX01429 | KT-20303 | HFK Replacement Box for Cage Kit (Empty) |
| TOL01494 | KT-20304 | HFK Insertion Tool |
| BOT00009 | Oil Bottle | HFK Oil Bottle |

# Thermo Expansion Valves

## TRAE+ Thermo® Expansion Valve

Alco's ***TRAE Plus*** thermostatic expansion valve (TXV) is a large capacity series designed for refrigeration, air conditioning, heat pump, and chiller applications. The new series introduces a new replaceable stainless steel power element, a fully interchangeable cage assembly and a square body.

This valve type features double balanced port design, which provides stable and accurate control over wide loads and evaporator temperature ranges. Furthermore, a permanent inlet strainer and external adjustment are standard on every valve.

**Features**
- Suitable for Bi-Flow applications.
- Removable power element and cage assembly for full serviceability.
- Stainless steel power element for enhanced corrosion resistance
- Double balanced port design improves operation and stability under low load conditions.
- Square body with straight-thru connections.
- Solid copper connections.
- External superheat adjustment.
- Large diaphragm provides superior stability
- HCA charge designed especially for R22 air conditioning applications.

**Options**
- Cages KIT07318 thru KIT07322
- Remote Bulb Tubing Length 10' standard, other lengths are available
- Replaceable Power Assembly HED00567 (X-28458)

**Specifications**
- Ratings from 10 to 40 tons.
- Maximum working pressure: 450 psig
- Torque Power Assembly: 375 - 425 in. lb.
- Torque Cage: 60 in. lb.

For ordering information, see page 30.

**Nomenclature** example: TRAE+ 30 HC 10 Ft 7/8 x 1 1/8 ODF S/T

| TRA | E | + | 30 | H | C | 10 FT | 7/8 x 1 1/8 | ODF | S/T |
|---|---|---|---|---|---|---|---|---|---|
| **Valve Series** | **Equalizer** | **Replaceable Components** | **Capacity** Nominal Rating in Tons | **Refrigerant Code** | **Charge Code** | **Capillary Tube Length** | **Inlet x Outlet Connection Sizes** | **Connection Type** | **Config-uration** |
| | E=External 1/4" SAE | Cage and Power Assembly | See nominal capacity table (below) | F = R12<br>H = R22<br>M = R134a<br>N = R407C<br>P = R507<br>R = R502<br>S = R404A | C = medium temp<br>CA = heat pump<br>W(MOP)=press. limiting<br>Z = low temp | 10 Ft (standard)<br>Other lengths are available | I O<br>5/8 7/8<br>7/8 1 1/8<br>1 1/8 1 3/8 | ODF = solder (Only) | S/T = Straight-thru (Only) |

***TRAE+ Series – Nominal Capacity Table in Tons (kWatts)***

| R12 | R134a | R22 | R502 | R507/R404A | R407C |
|---|---|---|---|---|---|
| 7½ (27) | 9 (32) | 10 (35) | 8 (28) | 8 (28) | 10 (35) |
| 10 (35) | 13 (46) | 15 (53) | 12 (42) | 12 (42) | 15 (53) |
| 12 (42) | 14 (50) | 20 (71) | 14 (50) | 14 (50) | 20 (71) |
| 18 (64) | 22 (78) | 30 (106) | 20 (71) | 20 (71) | 30 (106) |
| 25 (88) | 30 (106) | 40 (142) | 30 (106) | 30 (106) | 40 (142) |

# Thermo Expansion Valves

Seal Nut
27676-1

## TRAE Thermo® Expansion Valve

TRAE Thermo Valves are a large capacity series for chiller, heat pump, refrigeration, and air conditioning applications. Its balanced port design provides stable and accurate control over wide load and evaporator temperature ranges.

**Features**
- Suitable for Bi-Flow applications.
- External superheat adjustment.
- Integral body with straight-thru connections.
- TRAE's balanced port design improves valve operation & stability under low load conditions.
- Solid copper connections.
- Large diaphragm provides superior stability.
- Stainless steel power element for maximum corrosion resistance

**Options**
- HCA charge designed especially for R22 air conditioning applications.

**Specifications**
- Ratings from 50 to 70 tons.
- Maximum Working Pressure: 450 psig

For ordering information, see page 30.

**Nomenclature** example: TRAE 50 HC 10 Ft 7/8 x 1 1/8 ODF S/T

| TRA | E | 50 | H | C | 10 FtT | 7/8 x 1 1/8 | ODF | S/T |
|---|---|---|---|---|---|---|---|---|
| **Valve Series** | **Equalizer** | **Capacity** | **Refrigerant Code** | **Charge Code** | **Capillary Tube Length** | **Inlet x Outlet Connection Sizes** | **Connection Type** | **Configuration** |
| Hermetic Design, Solder Connections, Balanced Port, Larger Tonnages | E=External 1/4" SAE | Nominal Rating in Tons<br>See nominal capacity table (below) | F = R12<br>H = R22<br>M = R134a<br>N = R407C<br>P = R507<br>R = R502<br>S = R404A | C = medium temp<br>CA = heat pump/AC<br>W(MOP)=press. limiting<br>Z = low temp | 10 FT (standard) other lengths are available | I O<br>1/4 3/8<br>3/8 1/2 | ODF = solder (Only) | S/T = Straight-thru (Only) |

# Thermo Expansion Valves

## Ordering Information for TRAE/TRAE+ Series Valves

| ServiceFirst Item # | Valve Series | PCN Charge | Cap Tube Length | Connections |
|---|---|---|---|---|
| VAL06618 | TRAE+ 10 | HCA | 10 Ft. | 7/8 x 1 1/8 ODF S/T |
| VAL06619 | TRAE+ 15 | HCA | 10 Ft. | 7/8 x 1 1/8 ODF S/T |
| VAL06605 | TRAE+ 10 | HCA | 5 Ft. | 1/2 x 7/8 ODF S/T |
| VAL06606 | TRAE+ 10 | HCA | 5 Ft. | 5/8 x 7/8 ODF S/T |
| VAL06607 | TRAE+ 15 | HCA | 5 Ft. | 5/8 x 7/8 ODF S/T |
| VAL06608 | TRAE+ 15 | HCA | 5 Ft. | 5/8 x 1 1/8 ODF S/T |
| VAL06609 | TRAE+ 20 | HCA | 5 Ft. | 5/8 x 1 1/8 ODF S/T |
| VAL06610 | TRAE+ 20 | HCA | 5 Ft. | 7/8 x 1 1/8 ODF S/T |
| VAL06611 | TRAE+ 20 | HCA | 5 Ft. | 7/8 x 1 3/8 ODF S/T |
| VAL06612 | TRAE+ 30 | HCA | 5 Ft. | 7/8 x 1 1/8 ODF S/T |
| VAL06613 | TRAE+ 30 | HCA | 5 Ft. | 7/8 x 1 3/8 ODF S/T |
| VAL06614 | TRAE+ 40 | HCA | 5 Ft. | 7/8 x 1 1/8 ODF S/T |
| VAL06615 | TRAE+ 40 | HCA | 5 Ft. | 1 1/8 x 1 3/8 ODF S/T |
| VAL07765 | TRAE 50 | HC | 10 Ft. | 1 1/8 x 1 3/8 ODF S/T |
| VAL07766 | TRAE 60 | HC | 10 Ft. | 1 1/8 x 1 3/8 ODF S/T |
| VAL07767 | TRAE 70 | HC | 10 Ft. | 1 1/8 x 1 3/8 ODF S/T |

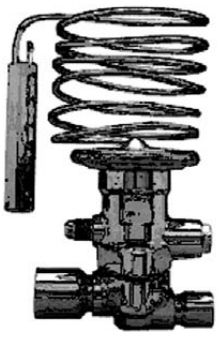
**Cage Replacement Kits for TRAE+ Series Valves**

Replacement cage assemblies for TRAE+ are available as separate sale items. Cage kits are cross referenced by capacity and tonnage in the table to the right. Each cage kit consists of a replacement cage and cage removal wrench. In addition, the cage removal wrench (KIT07323) can be ordered as a separate item.

| | | Nominal Capacity - Tons | | | |
|---|---|---|---|---|---|
| ServiceFirst Item # | TRAE+ Kit | R-22 | R-12/R-134a | R-507/R-404A | R-502 |
| KIT07318 | KT-20289 Cage Kit | 10 | 9 | 8 | 8 |
| KIT07319 | KT-20290 Cage Kit | 15 | 13 | 12 | 12 |
| KIT07320 | KT-20291 Cage Kit | 20 | 14 | 14 | 14 |
| KIT07321 | KT-20292 Cage Kit | 30 | 22 | 20 | 20 |
| KIT07322 | KT-20293 Cage Kit | 40 | 30 | 30 | 30 |
| KIT07323 | KT-20294 Cage Wrench Kit | | | | |

## Power Assembly Replacement: HED00567

# Thermo Expansion Valves



## T-Series Take-A-Part Thermo® Valve

ALCO Take-A-Part Series TEVs, with adjustable superheat and replaceable, interchangeable components are ideal for original equipment and field replacements in air conditioning, heat pump, and refrigeration applications.

### Features

- Take-A-Part construction for easy field service
- External superheat adjustment
- Bi-Flo capability
- Stainless steel power assembly up to 20 ton

### Options

- Interchangeable, replaceable cages for TEV versatility (1/4 to 100 tons capacity)
- Interchangeable body flanges for any connection you need
- Interchangeable power heads for refrigerants listed
- Charges for other applications available (consult Alco Application Engineering)

### Specifications

- Maximum working pressure: 450 psig
- Torque Bolts: 300 in. lb.

**Nomenclature** Example: TCLEB 5 HC 5 Ft 3/8 x 1/2 SAE ANG

| TCL | E | B | 5 | H | C | 5 FT | 3/8 x 1/2 | SAE | ANG |
|---|---|---|---|---|---|---|---|---|---|
| **Valve Series*** | **Equalizer** | **Bleed Hole** (optional) | **Capacity** Nominal Rating in Tons | **Refrigerant Code** | **Charge Code** | **Capillary Tube Length** | **Inlet x Outlet Connection Sizes** | **Connection Type** | **Config-uration** |
| Take-A-Part Adjustable | E=External | B = Bleed Hole | See Cage Assembly Interchangeability Tables (pages 32-33) | F = R12<br>H = R22<br>M = R134a<br>N = R407C<br>P = R507<br>R = R502<br>S = R404A | C = medium temp<br>CA = heat pump<br>W(MOP)=press. limiting<br>Z = low temp | Various lengths are available (see p.34-35) | Various sizes are available (see p.32-33) also, valve is available less flange | SAE = flare<br>ODF = solder | ANG = 90° Angle<br>S/T = Straight-thru |
| *See p. 30 for other T-Series families | Omit for Internal | Omit for no bleed hole | | | | | | | |

### Bolt Torque

The cap screws on all ALCO Take-A-Part TEVs require 300 inch pound bolt torque.

### Field Replacement of Valve Types TL(E), TLX

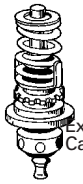
For field replacement of valve types TLX & TL(E), substitute a valve type TCL(E) of equivalent tonnage and re-use the old body flange. This substitution provides a valve equal in performance with provision for external superheat adjustment and eliminates the need to remove the old flange.

# Thermo Expansion Valves

## T-Series Take-A-Part Valve Small Capacity ½ to 18 tons

**(R22 Nominal – Bi Flow)**

### Step 1: Select Cage from Capacity Table



Externally Adjustable Cage Assembly

**Note:** Nominal capacities shown here are based on 40°F evaporator temperature and 100°F vapor-free liquid refrigerant entering the valve. R-12 and R-134a rated at 60 PSID. All other refrigerants rated at 100 PSID.

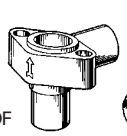
| | Nominal Capacity – Tons | | | | | | Cage Assembly[1] | |
|---|---|---|---|---|---|---|---|---|
| Valve Type | R12 | R134a | R22 | R404A/ R507 | R502 | R407C | Part # | ServiceFirst Item # |
| TCL TCLE | 1/4 | 1/4 | 1/2 | 1/4 | 1/4 | 1/2 | X22440B1B | CAG00045 |
| | 1/2 | 3/4 | 1 | 1/2 | 1/2 | 1 | X22440B2B | CAG00046 |
| | 1 | 1-1/2 | 2 | 1 | 1 | 2 | X22440B3B | CAG00047 |
| | 2 | 2-1/2 | 3 | 2 | 2 | 3 | X22440B4B | CAG00048 |
| | 3 | 3-1/2 | 5 | 3 | 3 | 5 | X22440B5B | CAG00049 |
| | 4 | 5-1/2 | 7-1/2 | 4-1/2 | 4-1/2 | 7-1/2 | X22440B6B | CAG00050 |
| | 6-1/2 | 7-1/2 | 10 | 7 | 7 | 10 | X22440B7B | CAG00051 |
| | 7-1/2 | 9 | 12 | 8 | 8 | 12 | X22440B8B | CAG00052 |

| | Nominal Capacity – Tons | | | | | | Cage Assembly[1] | |
|---|---|---|---|---|---|---|---|---|
| Valve Type | R12 | R134a | R22 | R404A/ R507 | R502 | R407C | Part # | ServiceFirst Item # |
| TJLE | 7 | 9 | 11 | 7 | 7 | 11 | XC724B4B | CAG00106 |
| | 8 | 11 | 14 | 9 | 9 | 14 | XC724B5B | CAG00107 |

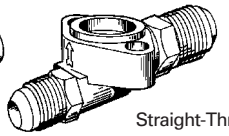
| | Nominal Capacity – Tons | | | | | | Cage Assembly[1] | |
|---|---|---|---|---|---|---|---|---|
| Valve Type | R12 | R134a | R22 | R404A/ R507 | R502 | R407C | Part # | ServiceFirst Item # |
| TJR | 8 | 11 | 14 | 9 | 9 | 14 | X11873B4B | CAG00053 |
| | 11 | 13 | 18 | 12 | 12 | 18 | X11873B5B | CAG00054 |

[1]Gaskets included on cage.
Gasket strip GKT01836 replaces all older T-Series Gasket kits.

### Step 2: Select Flange



Angle, ODF



Straight-Thru SAE

| Valve Type | Flow | Size & Style Connections Inlet | Outlet | Body Flange Part Number | ServiceFirst Item # |
|---|---|---|---|---|---|
| TCL TCLE | Angle | 3/8 SAE | 1/2 SAE | C500-4 | FLG00240 |
| | | 3/8 SAE | 5/8 SAE | C500-5 | FLG00241 |
| | | 1/2 SAE | 5/8 SAE | C500-6 | FLG00242 |
| | | 1/4 ODF | 3/8 ODF | C501-1 | FLG00243 |
| | | 3/8 ODF | 1/2 ODF | C501-4 | FLG00244 |
| | | 3/8 ODF | 5/8 ODF | C501-5 | FLG00245 |
| | | 1/2 ODF | 5/8 ODF | C501-7 | FLG00246 |
| | | 5/8 ODF or 7/8 ODM | 7/8 ODF or 1-1/8 ODM | A576 | FLG00247 |
| | Straight-Thru | 3/8 SAE | 1/2 SAE | X6669-4 | FLG00248 |
| | | 3/8 SAE | 5/8 SAE | X6669-1 | FLG00249 |
| | | 1/2 SAE | 1/2 SAE | X6669-5 | FLG00250 |
| | | 1/2 SAE | 5/8 SAE | X6669-2 | FLG00251 |
| | | 3/8 ODF | 1/2 ODF | 9761-5 | FLG00252 |
| | | 3/8 ODF | 5/8 ODF | 9761-3 | FLG00253 |
| | | 1/2 ODF | 1/2 ODF | 9761-6 | FLG00254 |
| | | 1/2 ODF | 5/8 ODF | 9761-4 | FLG00255 |
| | | 1/2 ODF | 7/8 ODF | 9761-2 | FLG00256 |
| | | 5/8 ODF | 5/8 ODF | X6346-16 | FLG00257 |
| | | 5/8 ODF | 7/8 ODF | X6346-17 | FLG00258 |
| | | 5/8 ODF | 1-1/8 ODF | X6346-18 | FLG00259 |
| | | 7/8 ODF | 1-1/8 ODF | X6346-34 | FLG00260 |

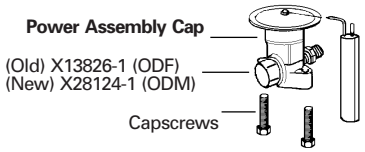
| Valve Type | Flow | Size & Style Connections Inlet | Outlet | Body Flange Part Number | ServiceFirst Item # |
|---|---|---|---|---|---|
| TJLE | Angle | 5/8 ODF or 7/8 ODM | 7/8 ODF or 1-1/8 ODM | B504 | FLG00571 |
| | Straight-Thru | 5/8 ODF | 1-1/8 ODF | X6347-2 | FLG00582 |
| | | 7/8 ODF | 1-1/8 ODF | X6347-6 | FLG00583 |
| | | 7/8 ODF | 1-3/8 ODF | X6347-7 | FLG00584 |

| Valve Type | Flow | Size & Style Connections Inlet | Outlet | Body Flange Part Number | ServiceFirst Item # |
|---|---|---|---|---|---|
| TJR[2] | Angle | 7/8 ODF or 1-1/8 ODM | 7/8 ODF or 1-1/8 ODM | 10331 | FLG00261 |
| | Straight-Thru | 7/8 ODF or 1-1/8 ODM | 7/8 ODF or 1-1/8 ODM | 10332 | FLG00262 |

[2]TJR is balanced ported. TJR flange includes extended length capscrews.

# Thermo Expansion Valves

## Step 3: Select Power Assembly




| TCL-TCLE-TJLE-TJR Power Assemblies [3] | | | | | | |
|---|---|---|---|---|---|---|
| Refrig-erant | Equalizer Type | Cap Tube Length | Application | | Power Assembly | ServiceFirst Item # |
| | | | Temp Range | MOP [4] (psi) | | |
| R12 | Internal | 5 Ft. | -20 to +50 | None | XB-1019 FC 1A | |
| | ¼ SAE | 5 Ft. | -20 to +50 | None | XB-1019 FC 1B | |
| | Internal | 10 Ft. | -20 to +50 | None | XB-1019 FC 2A | |
| | ¼ SAE | 10 Ft. | -20 to +50 | None | XB-1019 FC 2B | |
| | ¼ SAE | 15 Ft. | -20 to +50 | None | XB-1019 FC 3B | |
| | ¼ SAE | 5 Ft. | -50 to +30 | 35 | XB-1019 FW 35 1B | |
| | ¼ SAE | 5 Ft. | -50 to +50 | 55 | XB-1019 FW 55 1B | |
| | ¼ SAE | 10 Ft. | -50 to +50 | 55 | XB-1019 FW 55 2B | |
| | ¼ SAE | 5 Ft. | -50 to +10 | None | XB-1019 FZ 1B | |
| R22 | Internal | 5 Ft. | -20 to +50 | None | XB-1019 HC 1A | |
| | ¼ SAE | 5 Ft. | -20 to +50 | None | XB-1019 HC 1B | HED00371 |
| | ¼ SAE | 5 Ft. | -20 to +50 | None | XB-1019 HW 1B | HED00013 |
| | ¼ SAE | 10 Ft. | -20 to +50 | None | XB-1019 HC 2B | HED00782 |
| | ¼ SAE | 5 Ft. | -50 to +5 | 35 | XB-1019 HW35 1B | |
| | ¼ SAE | 5 Ft. | -50 to +20 | 55 | XB-1019 HW55 1B | |
| | ¼ SAE | 5 Ft. | -50 to +30 | 65 | XB-1019 HW65 1B | HED00374 |
| | ¼ SAE | 5 Ft. | -20 to +50 | 100 | XB-1019 HW100 1B | HED00373 |
| | ¼ SAE | 10 Ft. | -20 to +50 | 100 | XB-1019 HW100 2B | |
| | ¼ SAE | 5 Ft. | -50 to +10 | None | XB-1019 HZ 1B | HED00376 |
| | ¼ SAE | 10 Ft. | -50 to +10 | None | XB-1019 HZ 2B | |
| R134a | ¼ SAE | 5 Ft. | -20 to +50 | None | XB-1019 MC 1B | |
| | ¼ SAE | 10 Ft. | -20 to +50 | None | XB-1019 MC 2B | |
| | ¼ SAE | 10 Ft. | -50 to +30 | 35 | XB-1019 MW35 2B | |
| | ¼ SAE | 5 Ft. | -50 to +50 | 55 | XB-1019 MW55 1B | HED00331 |
| | ¼ SAE | 10 Ft. | -50 to +50 | 55 | XB-1019 MW55 2B | |
| | ¼ SAE | 5 Ft. | -50 to +10 | None | XB-1019 MZ 1B | |
| | ¼ SAE | 10 Ft. | -50 to +10 | None | XB-1019 MZ 2B | |
| R407C | ¼ SAE | 5 Ft. | -20 to +50 | None | XB-1019 NC 1B | |
| | ¼ SAE | 5 Ft. | -20 to +50 | 100 | XB-1019 NW100 1B | |
| R404A | ¼ SAE | 5 Ft. | -20 to +50 | None | XB-1019 SC 1B | |
| | ¼ SAE | 5 Ft. | -50 to 0 | 40 | XB-1019 SW40 1B | |
| | ¼ SAE | 5 Ft. | -50 to +25 | 65 | XB-1019 SW65 1B | |
| | ¼ SAE | 10 Ft. | -50 to +10 | None | XB-1019 SZ 2B | |

Capscrews included with Power Assembly
[4] Maximum Operating Pressure Limit to prevent motor overload

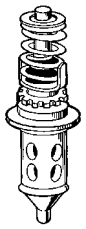
# Thermo Expansion Valves

## T-Series Take-A-Part Valve Large Capacity 22 to 100 tons

**(R22 Nominal – Balanced Ported and Bi Flow)**

**Note:** Nominal capacities shown here are based on 40°F evaporator temperature and 100°F vapor-free liquid refrigerant entering the valve. R-12 and R-134a rated at 60 PSID. All other refrigerants rated at 100 PSID.

### Step 1: Select Cage from Capacity Table



Externally Adjustable Double Ported Cage Assembly

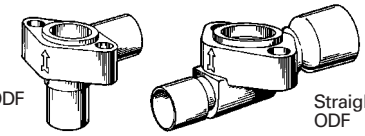
| Valve Type | Nominal Capacity – Tons R12 | R134a | R22 | R404A/ R507 | R502 | R407C | Cage Assembly[1] Part # | ServiceFirst Item # |
|---|---|---|---|---|---|---|---|---|
| TER | 13 | 16 | 22 | 14 | 14 | 22 | X9117B6B | CAG00055 |
| | 15 | 19 | 26 | 16 | 16 | 26 | X9117B7B | CAG00056 |
| | 20 | 25 | 35 | 21 | 21 | 35 | X9117B8B | CAG00057 |
| | 25 | 31 | 45 | 27 | 27 | 45 | X9117B9B | CAG00058 |

| Valve Type | Nominal Capacity – Tons R12 | R134a | R22 | R404A/ R507 | R502 | R407C | Cage Assembly[1] Part # | ServiceFirst Item # |
|---|---|---|---|---|---|---|---|---|
| TIR | 35 | 45 | 55 | 37 | 37 | 55 | X9166B10B | CAG00059 |

| Valve Type | Nominal Capacity – Tons R12 | R134a | R22 | R404A/ R507 | R502 | R407C | Cage Assembly[1] Part # | ServiceFirst Item # |
|---|---|---|---|---|---|---|---|---|
| THR | 45 | 55 | 70 | 48 | 48 | 70 | X9144B11B | CAG00060 |
| | 55 | 68 | 85 | 60 | 60 | 85 | X9144B13B | CAG00061 |

[1]Gaskets included on cage.
Gasket strip GKT01836 replaces all older T-Series Gasket kits.

### Step 2: Select Flange



Angle, ODF

Straight-Thru ODF

| Valve Type | Flow | Size & Style Connections Inlet | Outlet | Body Flange Part Number | ServiceFirst Item # |
|---|---|---|---|---|---|
| TER[2] | Angle | 7/8 ODF or 1-1/8 ODM | 7/8 ODF or 1-1/8 ODM | 9153 | FLG00263 |
| | Straight-Thru | 7/8 ODF or 1-1/8 ODM | 7/8 ODF or 1-1/8 ODM | 9152 | FLG00264 |

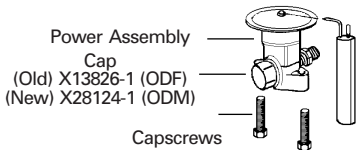
| Valve Type | Flow | Size & Style Connections Inlet | Outlet | Body Flange Part Number | ServiceFirst Item # |
|---|---|---|---|---|---|
| TIR | Angle | 7/8 ODF or 1-1/8 ODM | 7/8 ODF or 1-1/8 ODM | 9151 | FLG00265 |
| | Straight-Thru | 7/8 ODF or 1-1/8 ODM | 7/8 ODF or 1-1/8 ODM | 9150 | FLG00266 |

| Valve Type | Flow | Size & Style Connections Inlet | Outlet | Body Flange Part Number | ServiceFirst Item # |
|---|---|---|---|---|---|
| THR | ANGLE | 1-1/8 ODM | 1-1/8 ODM | 9149 | FLG00267 |
| | Straight-Thru | 1-1/8 ODM | 1-1/8 ODM | 9148 | FLG00268 |

[2] TER flange includes extended length capscrews.

# Thermo Expansion Valves

**Step 3: Select Power Assembly**




| TER-TIR-THR-TMR Power Assemblies [3] | | | | | | |
|---|---|---|---|---|---|---|
| Refrig-erant | Equalizer Type | Cap Tube Length | Application Temp Range | MOP [4] (psi) | Power Assembly | ServiceFirst Item # |
| R12 | ¼ SAE | 10 Ft. | -20 to +40 | None | XC-726 FC 2B | HED00387 |
| | ¼ SAE | 10 Ft. | -50 to 0 | 15 | XC-726 FW15 2B | |
| | ¼ SAE | 10 Ft. | -50 to +50 | 55 | XC-726 FW55 2B | HED00389 |
| | ¼ SAE | 10 Ft. | -50 to 0 | None | XC-726 FZ 2B | |
| R22 | ¼ SAE | 10 Ft. | -20 to +50 | None | XC-726 HC 2B | HED00779 |
| | ¼ SAE | 20 Ft. | -20 to +50 | | XC-726 HC 4B | HED00753 |
| | ¼ SAE | 10 Ft. | -20 to +50 | None | XC-726 HW 2B | HED00015 |
| | ¼ SAE | 10 Ft. | -50 to +5 | 35 | XC-726 HW35 2B | HED00393 |
| | ¼ SAE | 10 Ft. | -50 to +30 | 65 | XC-726 HW65 2B | |
| | ¼ SAE | 15 Ft. | -20 to +50 | 85 | XC-726HW85 3B | HED00679 |
| | ¼ SAE | 10 Ft. | -20 to +50 | 100 | XC-726 HW100 2B | HED00392 |
| | ¼ SAE | 10 Ft. | -50 to +10 | None | XC-726 HZ 2B | HED00394 |
| R134a | ¼ SAE | 10 Ft. | -20 to +50 | None | XC-726 MC 2B | |
| | ¼ SAE | 10 Ft. | -50 to +50 | 55 | XC-726 MW55 2B | |
| | ¼ SAE | 10 Ft. | -50 to +10 | None | XC-726 MZ 2B | |
| R502 | ¼ SAE | 10 Ft. | -20 to +50 | None | XC-726 RC 2B | HED00395 |
| | ¼ SAE | 10 Ft. | -50 to -20 | 15 | XC-726 RW15 2B | |
| | ¼ SAE | 10 Ft. | -50 to +5 | 35 | XC-726 RW35 2B | HED00396 |
| | ¼ SAE | 10 Ft. | -50 to +25 | 65 | XC-726 RW65 2B | HED00397 |
| | ¼ SAE | 10 Ft. | -50 to +10 | None | XC-726 RZ 2B | |
| R404A | ¼ SAE | 10 Ft. | -20 to +50 | None | XC-726 SC 2B | |
| | ¼ SAE | 10 Ft. | -50 to +10 | 40 | XC-726 SW40 2B | |
| | ¼ SAE | 10 Ft. | -50 to +25 | 65 | XC-726 SW65 2B | |
| | ¼ SAE | 10 Ft. | -50 to +10 | None | XC-726 SZ 2B | |

Capscrews included with Power Assembly
[4] Maximum Operating Pressure Limit to prevent motor overload

# Thermo Expansion Valves

## Ordering Information for T-Series Valves (complete valves – less flange – VLF)

***TCL, TCLE, TJLE & TJRE SAE External 5 Ft. Cap Tube Length***

| Valve Description | | | |
|---|---|---|---|
| R-12 | ServiceFirst Item # | R-22 | ServiceFirst Item # |
| TCLE ½ FC | VAL05690 | TCLE 3 HC | VAL03014 |
| TCLE 1 FC | VAL05682 | TCLE 5 HC | VAL03015 |
| TCLE 2 FC | VAL05697 | TCLE 7½ HC | VAL03016 |
| TCLE 3 FC | VAL05704 | TCLE 10 HC | VAL03017 |
| TCLE 4 FC | VAL05708 | TCLE 12 HC | VAL03018 |
| TCLE 6½ FC | VAL05710 | TJLE 11 HC* | VAL05735 |
| TCLE 7½ FC | VAL05711 | TJLE 14 HC* | VAL05736 |
| TJLE 8 FC* | VAL05738 | TJRE 14 HC | VAL05740 |
| TJRE 8 FC | – | TJRE14 HW | VAL03019 |
| TJRE 11 FC | VAL05739 | TJRE 18 HC | VAL05741 |
| | | TJRE 18 HW | VAL03020 |

***TER, TIR & THR 10 Ft. Cap Tube Length***

| Valve Description | | | |
|---|---|---|---|
| R-12 | ServiceFirst Item # | R-22 | ServiceFirst Item # |
| TER 20 FC | VAL05719 | TER 22 HW | VAL03021 |
| TER 25 FC | VAL05723 | TER 26 HW | VAL03022 |
| THR 55 FC | VAL05729 | TER 35 HW | VAL03023 |
| | | TER 45 HW | VAL03024 |
| | | TIR 55 HW | VAL03025 |
| | | THR 75 HW | VAL03026 |
| | | THR 100 HW | VAL03027 |

***TJLE New Nomenclature***

| | New | Old |
|---|---|---|
| R-12 | TJLE 7 | TJLE 800 |
| | TJLE 8 | TJLE 1100 |
| R-22 | TJLE 11 | TJLE 1400 |
| | TJLE 14 | TJLE 1800 |
| R-502 | TJLE 7 | TJLE 900 |
| | TJLE 9 | TJLE 1200 |

# Thermo Expansion Valves

## Ordering Information for T-Series Valves (Cont'd)

Note:
TCL/TCLE Remote Bulb Tubing Length

R-12 (FC) = 30"
1/4 thru 3 ton

R-22 (HC) = 30"
1/2 thru 3 ton

R-502 (RC) = 30"
1/4 thru 3 ton

TER, TIR & THR
5 FT Cap Tube Length

Note: T-Series does not include flange.

***TCLE External Equalized — SAE External, 30" Cap Tube Length***

| Valve Description | | | |
|---|---|---|---|
| R-12 | ServiceFirst Item # | R-22 | ServiceFirst Item # |
| TCLE ¼ FC | VAL05694 | TCLE ½ HC | VAL05687 |
| TCLE ½ FC | VAL05689 | TCLE 2 HC | VAL05695 |

***TER, TIR & THR 5 Ft. Cap Tube Length***

| Valve Description | | | |
|---|---|---|---|
| R-12 | ServiceFirst Item # | R-22 | ServiceFirst Item # |
| TIR 35 FC | VAL05732 | TIR 55 HW | VAL00339 |
| THR 45 FC | VAL05729 | | |

***Replacement Cap Screw Kits***

| ServiceFirst Item # | Description | Contains Screw # | Pcs. Per Pkg.** |
|---|---|---|---|
| SCR02021 | KT-30021 | PS-286-5 | 10 |
| SCR02011 | KT-30022 | PS-168-5 | 10 |
| SCR02013 | KT-30023 | PS-259 | 10 |
| SCR02012 | KT-30024 | PS-370 | 10 |

** 10 Pc. kits are in poly bags for hanging on peg board.

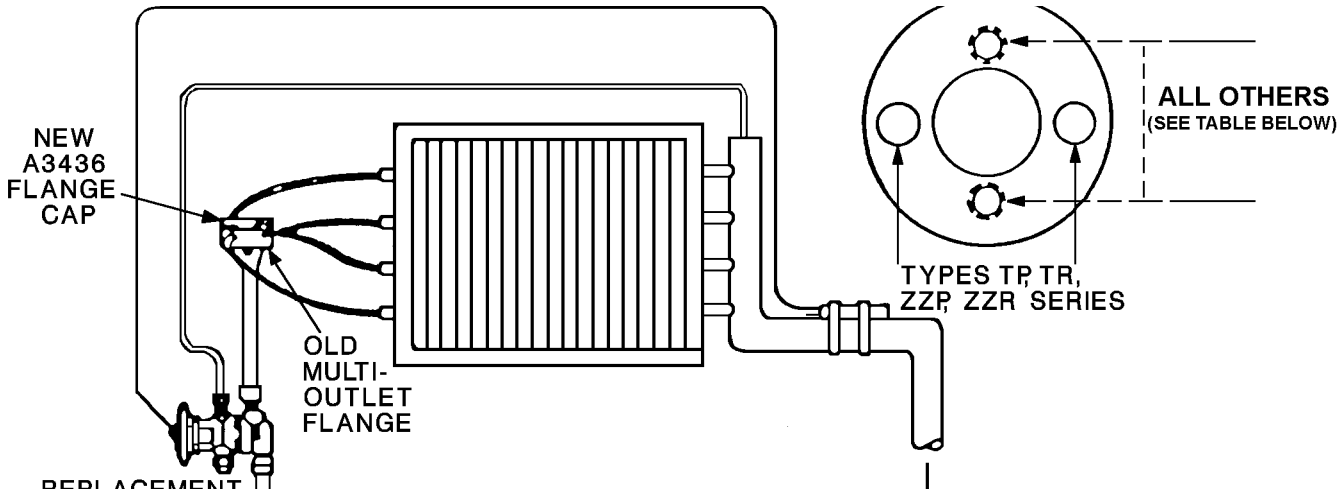
***Alternate Refrigerant Charge Codes***

| Refrigerant | Code |
|---|---|
| R134a | M |
| R507 | R |
| R404A | R |
| R402A | R |
| MP39 | X |

# Thermo Expansion Valves

## Expansion Valve Accessories

**Replacement Flange Cap for Obsolete ALCO Multi-Outlet Valves**




Occasionally it becomes necessary to replace out-dated or obsolete ALCO multi-outlet Thermo® Valves. Where replacements are not readily available, the following procedure may be followed.

1. Remove multi-outlet cage and power assembly, save capscrews.
2. Install flange cap FLG00269 (A3436) and flange gasket A625-A4 (packed with A3436).
3. Move backward a few inches, cut the liquid line, and install a standard externally equalized single outlet Take-A-Part Thermo® Valve properly selected for an equivalent capacity and refrigerant to that of the old multi-outlet valve.
4. Attach the remote bulb of the new valve and connect the external equalizer in a standard manner.

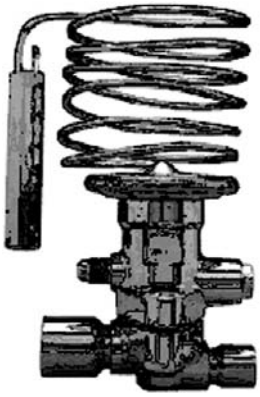
The capped multi-outlet flange effectively serves as an adequate refrigerant distributor.

***Replacement Flange Cap for Multi-Outlet Thermo® Valves***

| Obsolete Valve Types | Flange Cap # | ServiceFirst Item # |
|---|---|---|
| TN, TO, TOC, TU, TV, TS, TP, TR<br>ZZU, ZZO, ZZS, ZZP, ZZR | A3436 | FLG00269 |

For additional information, contact your ABU sales or ALCO representative.

# Thermo Expansion Valves



## LCL Take-A-Part DeSuperheating Thermo® Valve

**Application**
- Desuperheating (Liquid Injection) valve used in conjunction with hot gas bypass to prevent excessive suction line superheat.
- Interstage cooling for compound systems

**Features**
- Take-A-Part construction for easy field service
- Contoured, durable power element for long life
- Stainless steel power assembly

**Options**
- Interchangeable, replaceable cages for versatility
- External superheat adjustment
- Interchangeable body flanges for any connection you need
- Interchangeable power heads for different temperature ranges
- Charges for all applications

**Specifications**
- Maximum working pressure: 450 psig

See the section on Liquid Injection Applications, in Fundamentals of Regulators.

# Thermo Expansion Valves

## LCL DeSuperheating Thermo® Valves

### Nomenclature

| LCL | E | 2 | B | 5 Ft. | 3/8 x 1/2 | ODF | S/T |
|---|---|---|---|---|---|---|---|
| **Valve Series** | **Equalizer** | **Capacity** | **Charge Code** | **Capillary Tube Length** | **Inlet x Outlet Connection Sizes** | **Connection Type** | **Configuration** |
| DeSuperheating Liquid Injection Take-A-Part | E = External<br>(omit for Internal) | Note: This is not system capacity. See hot gas bypass charts for valve sizing (p. 97) | See Hot Gas Bypass charts for selection (p. 97) and chart below | 5 Ft. (standard) | | SAE = flare<br>ODF = solder | ANG = 90° angle<br>S/T = straight-thru |

For new applications, consult the factory for proper selection and sizing. For field replacement, select a LCL/LCLE valve with the exact same capacity and charge.

***Ordering Information for LCL Valves***

| Description | Equalizer Type | PCN* By Charge Select fromTable Below A | B | C | Connections |
|---|---|---|---|---|---|
| LCL 11 | Internal | VAL05847 | VAL05848 | | Same as TCL & TCLE |
| LCL 21 | | VAL05850 | VAL05851 | VAL05852 | |
| LCL 31 | | VAL05853 | VAL05854 | | |
| LCL 61 | | | VAL05858 | – | |
| LCLE 11 | ¼" SAE External | VAL05859 | | | |
| LCLE 21 | | VAL05861 | VAL05862 | – | |
| LCLE 31 | | VAL05863 | VAL05864 | – | |
| LCLE 41 | | | | VAL05865 | |
| LCLE 71 | | VAL05867 | | | |

1 Note: Add charge suffix symbol "A", "B" or "C" based on the following table.
Example: LCLE 4-A

Note: Standard remote bulb tubing is 5'.

***LCL (LA) Charge Codes***

| Sat'd Suction Temp. | Refrigerant R-134a Required Suction Gas Temp 45°F | R-134a 65°F | R-22 Required Suction Gas 45°F | R-22 65°F | R-404A/R-507 Required Suction Gas 45°F | R-404A/R-507 65°F |
|---|---|---|---|---|---|---|
| 40°F | — | B (GL) | — | A (CL) | — | — |
| 30°F | B (GL) | B (GL) | — | A (CL) | — | A (CL) |
| 20°F | B (GL) | C (UL) | A (CL) | B (GL) | — | A (CL) |
| 10°F | B (GL) | C (UL) | B (GL) | B (GL) | A (CL) | B (GL) |
| 0°F | C (UL) | C (UL) | B (GL) | B (GL) | A (CL) | B (GL) |
| – 10°F | C (UL) | C (UL) | B (GL) | C (UL) | B (GL) | B (GL) |
| – 20°F | C (UL) | C (UL) | B (GL) | C (UL) | B (GL) | C (UL) |
| – 30°F | C (UL) | C (UL) | C (UL) | C (UL) | B (GL) | C (UL) |
| – 40°F | C (UL) | C (UL) | C (UL) | C (UL) | B (GL) | C (UL) |

( ) Denotes LA Series Valve Charge Code

# Solenoid Valves

## Fundamentals of Solenoid Valves

**Introduction**
In most refrigeration applications, in order to automatically control the flow of fluids in a system, it is necessary to be able to start or stop the flow in the refrigerant circuit. An electrically operated solenoid valve is usually used for this purpose. Its basic function is the same as a manually operated shutoff valve, but it can be positioned in remote locations, and may be conveniently controlled by simple electrical switches. Solenoid valves can be operated by a thermostatic switch (the most common in refrigeration systems), float switches, low pressure switches, high pressure switches or any other device used for making or breaking an electric circuit.

**What are Solenoid Valves?**
A solenoid valve consists of two distinct, but integral acting parts, a solenoid and a valve. The solenoid is nothing more than electrical wire wound in a spiral around the surface of a cylindrical form, usually of circular cross section. When an electric current is sent through the windings, they act as an electro-magnet. The force field created in the center of the solenoid is the driving force for opening the valve. Inside is a moveable magnetic iron plunger that is drawn toward the center of the coil when energized. See figure 1.

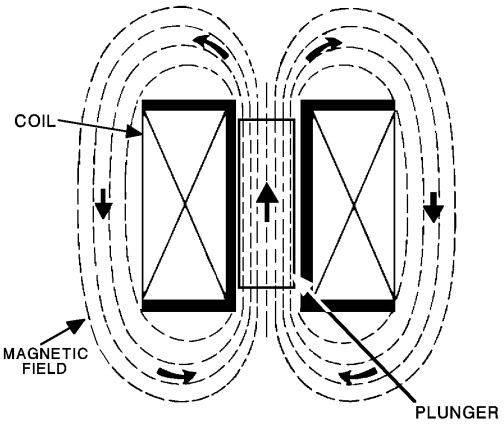



*Figure 1. Solenoid operation – coil energized*

**Principles of Solenoid Operation**
The valve contains an orifice through which fluid flows when open. A needle or rod is seated on or in the orifice, and is attached directly to the lower part of the plunger. When the coil is energized, the plunger is forced toward the center of the coil, lifting the needle valve off the orifice and allowing flow. When the coil is de-energized, the weight of the plunger, and in some designs a spring, causes it to fall and close off the orifice, stopping the flow through the valve. See figure 2.

**Types of Solenoids**
Solenoids are either direct acting or pilot operated. The application determines the type of solenoid used. The direct acting solenoid is used on valves with low capacities and small port sizes. The pilot operated solenoid is used on larger valves, eliminating the need for larger coils and plungers.

**Direct Acting Solenoids**
In the direct acting valve, the plunger is mechanically connected to the needle valve or poppet. When the coil is energized, the plunger pulling the needle off the orifice is raised into the center of the coil. This type of valve will operate from zero pressure differential to its maximum operating pressure differential (MOPD), regardless of the line pressure. See figure 2.

The following forces act on a solenoid valve to keep it closed, or to keep it open and flowing.

**When closed:**
A. Inlet pressure pushes the plunger or poppet down onto the orifice.
B. Gravity pulls the plunger down on the orifice.
C. Difference between high inlet and lower outlet pressure holds the plunger on the orifice.

Note: The greater the pressure differential between inlet and outlet pressure, the more difficult it is to open the valve.

**When open:**
A. Inlet flow passing through the orifice tends to help hold the plunger up or open.
B. Magnetic attraction holds the plunger up.

Forces available for opening or closing a solenoid valve:
1. Inlet pressure
2. Outlet pressure
3. Weight of plunger on the orifice
4. Spring force applied to the plunger
5. Magnetic attraction of the plunger

# Solenoid Valves

## Fundamentals of Solenoid Valves

To open the direct acting valve when closed, or shutoff with the plunger, poppet, or pin resting on the orifice or port, allowing no flow:

A. Energize the coil (electrical flow in wires).
B. Magnetic attraction jerks plunger up and off of orifice.
C. Inlet pressure being greater, flow occurs from inlet to outlet.

To close the valve when open with flow occurring:

A. De-energize coil (electrical flow stops).
B. Magnetic attraction stops, plunger falls by gravity and/or is assisted by spring action in a closing direction.
C. Blockage of the orifice by the plunger causes all flow to stop.

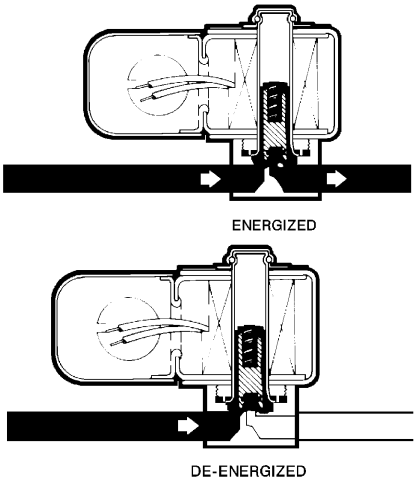



***Figure 2. Direct acting solenoids – coil energized & de-energized***

### Maximum Opening Pressure Differential (MOPD)

The greater the inlet pressure, or the greater the difference between the inlet and outlet pressures, the tighter the plunger is held down on the orifice. The larger the orifice, the greater is the area affected by the pressure differential, holding the plunger closed. Therefore, a small orifice with low pressure differential is easy to open magnetically. Increase the orifice size or the pressure differential, the harder it becomes to open the plunger. If both the plunger area is large and the pressure differential is great, it is possible to exceed the ability of the magnet to pull the plunger up or open the valve orifice. When the ability of the magnet to open is overcome by the forces holding the plunger closed, it is said that the MOPD has been exceeded.

When the MOPD is low (area of orifice is small and the difference between inlet and outlet pressures is small), it does not take much effort for the solenoid coil to pull the plunger open. As the orifice becomes larger and the pressure drop greater, a *larger magnetic coil* must be used to create a greater magnetic force for opening.

The MOPD is determined by how much magnetic attraction is necessary to overcome the resistance to stay closed. When the pressure differential is below the MOPD rating, the solenoid valve will open quickly, and easily when energized. When the MOPD is exceeded, the valve will not open when energized, and may possibly overheat with dangerous results unless de-energized quickly.

The direct acting valve is only used on small capacity circuits. To use the coil size required to counteract the large pressure differential of large capacities would be uneconomical, and not feasible for very large capacity circuits. In order to overcome this problem, pilot operated solenoid valves are used.

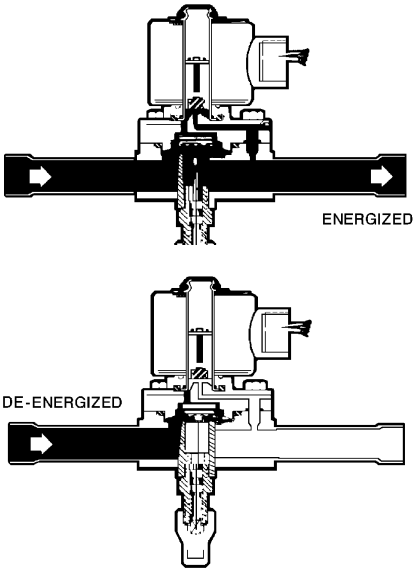



***Figure 3. Pilot operated solenoids – coil energized & de-energized***

### Pilot Operated Solenoids

The pilot operated solenoid valves use a combination of the solenoid coil and line pressure to operate. In this valve, the plunger is attached to a needle valve covering a pilot orifice rather than the main port. The line pressure holds a floating or independent piston or diaphragm closed against the main port. See figure 3.

When the coil is energized, the plunger is pulled into the center of the coil, opening the pilot orifice. Once the pilot port is opened, the line pressure above the diaphragm is allowed to bleed off to the low side or outlet of the valve, relieving the pressure on the top of the diaphragm. The inlet pressure then pushes the diaphragm up and off of the main valve port and holds it there allowing full flow of the fluid.

# Solenoid Valves

## Fundamentals of Solenoid Valves

When the coil is de-energized, the plunger drops and closes the pilot orifice. Pressure begins to build up above the diaphragm by means of a bleed hole in the piston or diaphragm until it, plus the diaphragm's weight and spring, cause it to close on the main valve port. The pilot operated solenoid valve requires a minimum opening pressure differential, between the inlet and outlet, in order to open the main port.

**Minimum Opening Pressure Differential (MinOPD)**

As previously explained, the direct operated solenoid valve must not exceed its MOPD or it will not open when energized. If pressure differential is too great or orifices are too large in diameter, it would take a very large and very expensive coil to overcome the large MOPD. Therefore, the pilot operated valve is used on larger size solenoid valves. The main idea is to open the pilot orifice with as little effort as possible. However, a certain amount of pressure differential is required to float the piston or diaphragm off of the main orifice after the pilot orifice has allowed both the inlet and outlet pressure to equalize. This small amount of required pressure is called the minimum opening pressure differential (MinOPD).

*All pilot operated solenoids require a MinOPD* to raise the main poppet or floating piston or diaphragm off of the main orifice. Direct operated solenoids do not require a MinOPD, but both direct operated and pilot operated have to avoid exceeding their MOPD in order to flow properly.

The manual stem shown in figure 3 is used to manually open the valve if the line current is not available, or for flushing in cleanup, or other service maintenance functions.

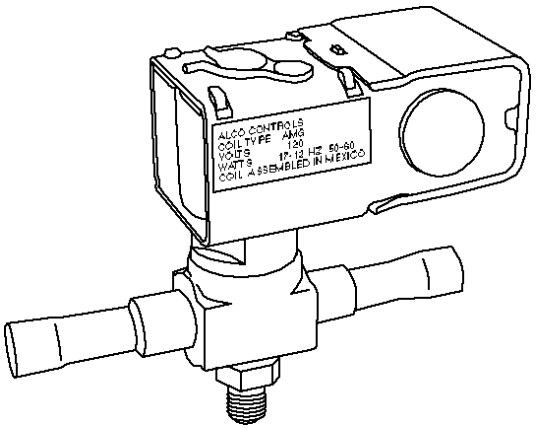



*Figure 4. Two-way solenoid: 200RB*

The above basic principles of operation hold true for all refrigerant solenoid valves, although certain mechanical variations in construction can be found. Examples of these variations are:

1. Short stroke plungers, which are rigidly connected to the valve or poppet (these will always be the "direct acting" type).
2. Long stroke lost motion plungers, which during opening, impart a "hammer blow" to the valve.
3. Mechanically interlinked piston to plunger construction, which is used where no pressure differential is available to float the piston. This construction enables a large solenoid valve to open and remain in an open position with a minimum pressure drop across the valve. It is used primarily for suction line duty.
4. Pilot operated spring loaded valves used in large port sizes.
5. Condenser pressure powered stop valves which use a high pressure pilot connection.

Solenoid valves having a spring loaded plunger may be installed and operated in any position. These valves include most all modern day refrigeration solenoids.

**Different Types of Valves**

So far we have explained how a solenoid valve operates. Now we will discuss the many types of valves and their respective applications. The three main types of valves are: two-way, three-way, and four-way.

**Two–Way Valves**

The two-way valve, which is the most common type of solenoid valve, controls fluid flow in one line. It has an inlet and an outlet connection. This valve can be a direct acting or pilot operated valve, depending on the need. When the coil is de-energized, the two-way valve is "normally closed." Although normally-closed is the most widely used, two-way valves are also manufactured to be "normally-open" when the coil is de-energized. See figure 4.

**Select Two-way valves can be converted to reverse flow operation by the addition of a bi-flow kit.**

# Solenoid Valves

## Fundamentals of Solenoid Valves

**Three–Way "Diverting" Valves**
The three-way valve has a connection which is common to either of two different outlets and controls refrigerant flow in two different lines. It is used chiefly on commercial refrigeration units for heat reclaiming applications, hot gas defrost, and discharge gas unloading applications. See figure 5 for an illustration of a three-way solenoid valve.

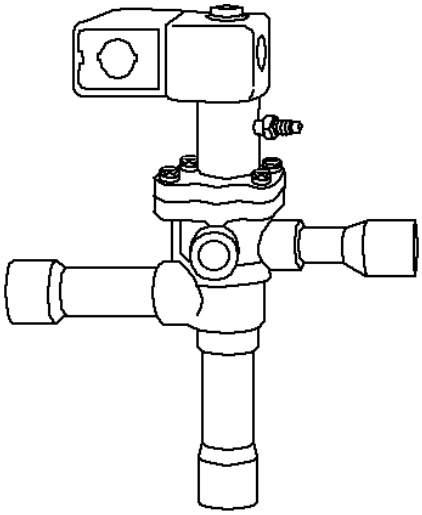


*Figure 5. Three-way solenoid: 3031RC*

**Heat Reclaiming Applications**
The three-way valve has its common inlet attached to the compressor discharge line. The other two outlets connect to the normal condenser and the auxiliary condenser, as shown in figures 6 and 7.

When the solenoid coil is de-energized, the pilot line to the suction side of the compressor is closed. Discharge gas pressure escapes thru the bleed port onto the top of the piston and drives it downward, closing the bottom seat. This allows discharge gas to flow to the normal, or outside condenser. Energizing the solenoid opens the pilot line to the suction side of the compressor, and permits the discharge gas pressure on top of the piston to escape to the suction side. The discharge gas pressure below the piston now causes the piston to be driven upward closing the outlet to the condenser and diverting the discharge gas to the auxiliary condenser. Some valves are available with an internal bleed, which drains the reclaim coil during normal operation.

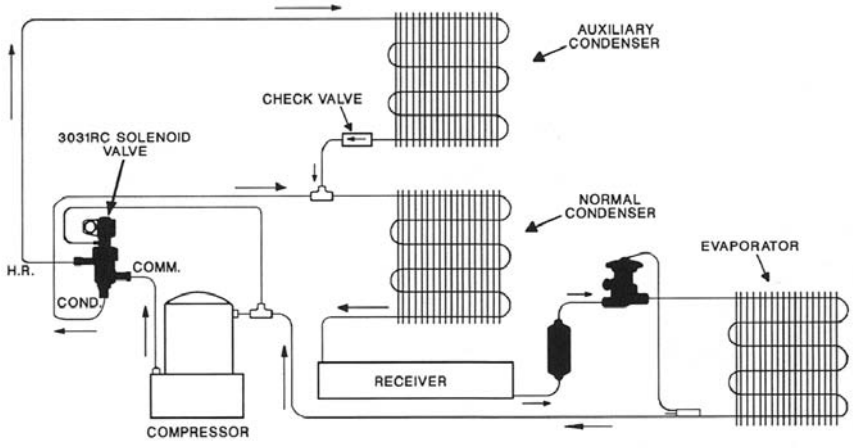



*Figure 6. Heat reclaiming system condensers in series*

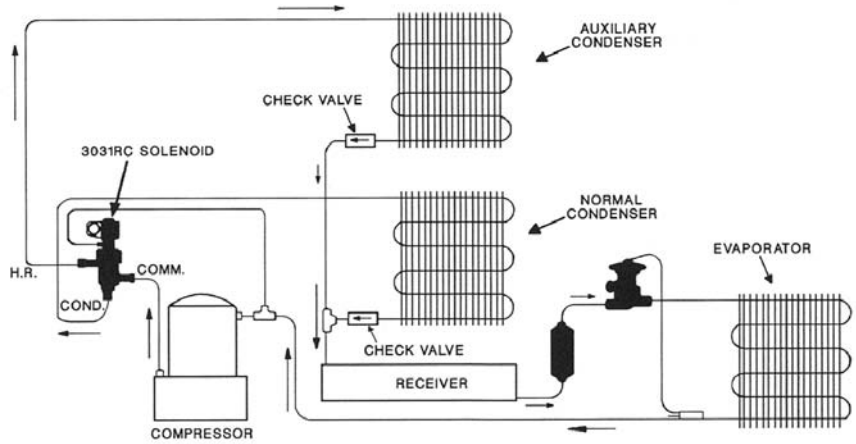



*Figure 7. Heat reclaiming system condensers in parallel*

# Solenoid Valves

## Fundamentals of Solenoid Valves

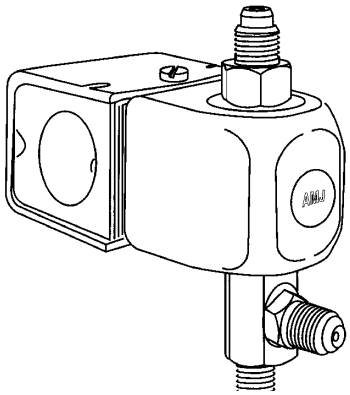


*Figure 8. Small three-way solenoid 702RA*

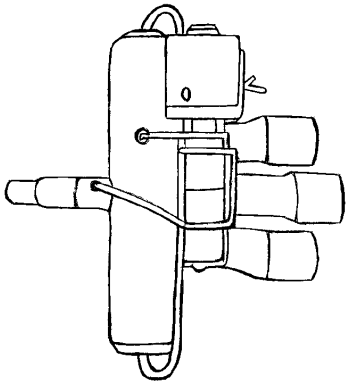


*Figure 11. 401RD 4-way valve used in home & small building equipment.*

**Discharge Gas Unloading (Using a 3-Way Valve)**
The three-way solenoid valve (figure 5), is designed to meet the requirements of high temperatures and pressures existing in compressor discharge gas applications. It is specifically designed for discharge gas diverting in compressor unloading. In most cases, when de-energized, the compressor discharge gas follows the normal cycle to the condenser. When energized, discharge gas is then diverted to flow to the system low side for defrost or compressor unloading. These valves are available over a wide tonnage range. Small size three-way solenoids are sometimes used for cylinder unloading compressor capacity reduction. See figure 8. These valves for compressor unloading applications are usually designed to provide mounting directly on the compressor. Some are specifically designed for OEMs (ALCO 700 Series).

**Four–Way "Reversing" Valves**
Four-way solenoid valves, often called reversing valves, are used almost exclusively on reverse cycle heat pumps, to select either the heating or cooling mode, depending upon requirements. These valves have one common inlet and three outlets. Figure 11 is a drawing of a typical four-way valve used in home or small building equipment.

A heat pump is a central air conditioner with reverse cycle for heating. In the summer, the refrigerant absorbs heat from the house and exhausts it outdoors. In winter, the cycle is reversed, with the refrigerant absorbing heat from outdoors and releasing it inside the house. The next sections explain how the reversing valve operates.

**Four–Way "Reversing" Valve Operation**
Figures 12 and 13 are schematic diagrams of a four-way valve on a typical reverse cycle heat pump system.

# Solenoid Valves

## Fundamentals of Solenoid Valves

**4–Way Valve Heating Cycle**
In figure 12, the system is in the heating cycle with the discharge gas from the compressor flowing thru the reversing valve ports D to C2, which makes the indoor coil the condenser. The suction gas is flowing from the outdoor coil (now the evaporator) through reversing valve ports C1 to S and back to the compressor. With the 4-way solenoid pilot de- energized, the high pressure discharge gas builds up on "top" of the main slide holding the main slide down (or on the bottom). The area below the main slide is isolated from the high pressure by a seal and is exposed to low pressure suction gas by way of port A to S1 and on to S. Thus the unbalanced forces acting on the end areas of the main slide (top vs. bottom) hold the slide in the down position as shown in figure 12. The compressor discharge gas now flows to the indoor coil and heats the interior.

**4–Way Valve Cooling Cycle**
When the coil is energized, the slide in the pilot solenoid moves to its top, now connecting pilot ports D1 to A and B to S1 and on to S. With the pilot solenoid so positioned, the discharge pressure is imposed on the bottom of the main slide and it will move to the top of the main valve. This unbalanced force will move and hold the main slide to the UP position as shown in figure 13. The compressor discharge gas now flows to the outdoor coil allowing the indoor coil to cool the interior.

**Solenoid Valve Selection**
The selection of a solenoid valve for a particular control application requires the following information:
1. Fluid to be controlled.
2. Capacity required.
3. Maximum operating pressure differential (MOPD).
4. Electrical characteristics.
5. Safe working pressure required (SWP).

The capacities of solenoid valves for normal liquid or suction gas refrigerant service are given in tons of refrigeration at some nominal pressure drop and standard conditions. Manufacturers' catalogs provide extended tables to cover nearly all operating conditions for common refrigerants. Follow the manufacturer's sizing recommendations. *Do not* select a valve based on line size. Pilot operated valves require a minimum pressure drop to operate, and selecting an oversized valve will result in the valve failing to open. Undersized valves result in excessive pressure drops.

The solenoid valve selected must have a MOPD rating equal to or in excess of the maximum possible differential against which the valve must open. The MOPD takes into consideration both the inlet and outlet valve pressures. If a valve has a 500 psi inlet pressure and a 250 outlet pressure, and a MOPD rating of 300 psi, it will operate, since the difference (500–250 = 250) is less than the 300 MOPD rating. If the pressure difference is larger than the MOPD rating, the valve will not open.

Consideration of the safe working pressure required is also important for proper and safe operation. A solenoid valve should not be used for an application when the working pressure is higher than the safe working pressure maximum.

Solenoid valves are designed for a given type of fluid so that the materials of construction will be compatible with that fluid. Steel or ferrous metals and aluminum are used in solenoid valves for ammonia service. Special seat materials and synthetics may be used for high temperature or ultra-low temperature service. Special materials are required for corrosive fluids.

Attention to the electrical characteristics is also important. Required voltage and hertz must be specified to ensure proper selection. Valves for DC service often have different internal construction than valves for AC application, so it is important to study the manufacturer's catalog information carefully.

**Solenoid Valve Installation**
Solenoid valves having a spring loaded plunger or diaphragm may be installed and operated in any position. However, the older, conventional solenoid valve with a plunger which depends on gravity to close, must always be installed with the plunger in an upright vertical position, with the pipe horizontal. An adequate strainer or filter drier should be installed ahead of each solenoid valve to keep scale, pipe dope, solder, and other foreign matter out of the valve.

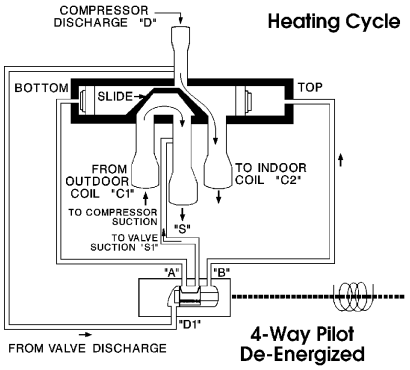



*Figure 12.*

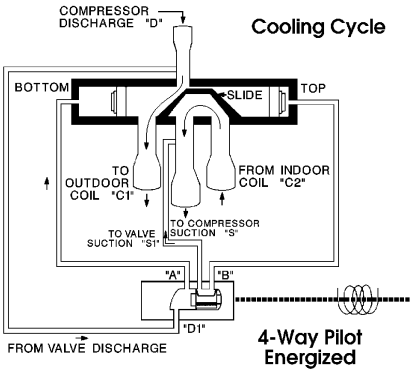
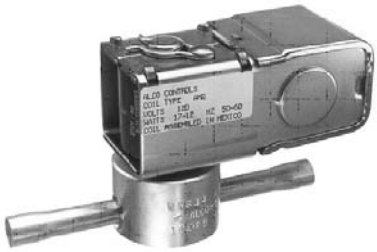



*Figure 13.*

Before installation, disconnect electrical power source, shut off fluid power source, and bring the system pressure to atmospheric. When installing a solenoid valve, be sure the arrow on the valve body points in the direction of refrigerant flow. With brazing or solder type connections, do not use too hot a torch, and point the flame away from the valve body. Allow the valve body to cool before replacing the valve's operating internal parts to insure that the seat material and gaskets are not damaged by the heat. Wet rags and or chill blocks are recommended during brazing. They are necessary to keep the valve body cool so that body warpage on close coupled valves will not occur. When reassembling, do not overtorque.

# Solenoid Valves



Note: Coil sold separately - see Coils Section. See Nomenclature for ordering information.

## 100RB Solenoid Valves

**Application**
- Used for liquid or discharge gas refrigerant service
- Direct-acting, 2-way, normally closed valve
- Solenoid actuated shut-off valve

**Features**
- One coil fits all valve sizes
- Extended ends for easy installation (standard)
- Long-life molded coils provide water, shock, and vibration protection in coil winding

**Options**
- Connection sizes to fit your system
- SAE or ODF connection sizes in 1/4" and 3/8", 1/4 NPTF
- Coil voltages: 120V 50/60Hz, 208V 50/60HZ, 24V 50/60HZ
- Use with R-22, R-134a, R-404A, R-507

**Specifications**
- Maximum fluid temp: 250°F
- Maximum working pressure: 500 psig
- MOPD: 300 psig
- UL file number: MP604
- CSA file number: LR44912
- CV and TUV approved

Note: Mounting enclosing tube more than 90° off vertical up position is not recommended.

**Nomenclature** Example: 100RB 2F2 VLC

| 100R | B | 2 | F | 2 | VLC |
|---|---|---|---|---|---|
| Valve Series | Design Series | Port Size (in 1/16") | Connection Type<br>F = SAE<br>S = ODF<br>P = FPT | Connection Size (in 1/8") | Coil* |

*Note: Valves are shipped without the solenoid coils (VLC = Valve Less Coil) See page 56 for available coils.

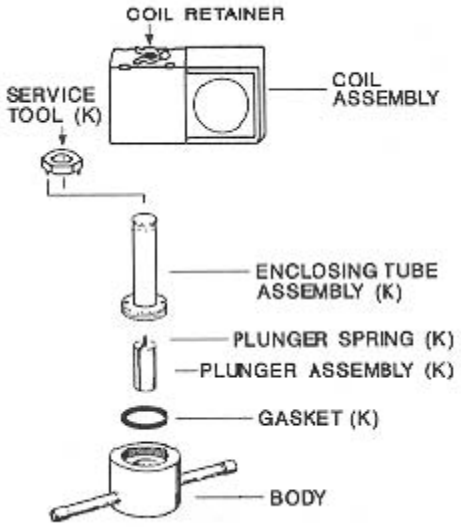
***Ordering Information and Nominal Capacity Table for 100RB Valves - Tons***

| ServiceFirst Item # | Product Description | Connection Size | R-12 | R-134a | R-22 | R-407C | R-404A/R-507 | R-502 |
|---|---|---|---|---|---|---|---|---|
| VAL04122 | 100RB 2S2 VLC | 1/4" ODF | .80 | .96 | 1.27 | 1.21 | .85 | .83 |
| VAL02395 | 100RB 2S3 VLC | 3/8" ODF | | | | | | |
| VAL02396 | 100RB 2S4 VLC | 1/2" ODF | | | | | | |
| VAL02397 | 100RB 2F2 VLC | 1/4" SAE | | | | | | |
| VAL02398 | 100RB 2F3 VLC | 3/8" SAE | | | | | | |

Capacities based on 100°F liquid and 40°F saturated evaporator for ARI standard 760-87.

# Solenoid Valves

## 100RB Exploded View & Parts Kit Data




Valve Kit: "**K**" indicates part is supplied in valve repair kit **KIT04959 (KS30112)**.

Note: Spanner wrench X11981-1 included in complete valve kit.

KIT04959

**Coil Assembly**
Consists of coil, coil nameplate, and conversion spacer (AMG). For voltages and frequencies available see the tables on page 56.

# Solenoid Valves

Note: Mounting enclosing tube more than 90° off vertical up position is not recommended.

Note: Coil sold separately - see Coils Section. See Nomenclature for ordering information.

## 200RB Solenoid Valves

### Application
- Pilot-operated, 2-way, normally closed valves
- Ideal for liquid, discharge or suction gas refrigerant service
- Solenoid actuated shut-off valves

### Features
- One coil fits all valve sizes
- Extended ends for easy installation (standard)
- Long-life molded coils provide water, shock, and vibration protection in coil winding
- Low pressure differential required for full opening

### Options
- Connection sizes to fit your system
- Can be converted for bi-flo applications
- Available in 8 orifice sizes
- Manual stem or mounting bracket adapter

### Specifications
- Maximum fluid temp: 250°F
- Maximum working pressure: 500 psig
- MOPD: 300 psig
- UL file number: MP604
- CSA file number: LR44912

**Nomenclature** Example: 200RB 4T3M VLC

| 200R | B | 4 | T | 3 | M | VLC |
|---|---|---|---|---|---|---|
| Valve Series | Design Series | Port Size (in 1/16") | Connection Type F = SAE | Connection Size (in 1/8") S = ODF P = FPT T = Copper Extended Ends | M = manual stem T = mounting bracket adapter (M & T optional) | Coil* |

*Note: Valves are shipped without the solenoid coils (VLC = Valve Less Coil) See page 56 for available coils.

***Ordering Information and Nominal Capacity Table for 200RB Valves - Tons (kW)***

| ServiceFirst Part Number Standard Valve | Manual Stem[2] | Description | Connection Size | R-12 | R-134a | R-22 | R-407C | R-404A/R-507 | R-502 |
|---|---|---|---|---|---|---|---|---|---|
| VAL0 | N/A | 200RB 2 F 3 | 3/8 SAE | 2.0 | 2.4 | 3.1 | 2.9 | 2.1 | 2.0 |
| VAL05126 | N/A | 200RB 2 T 2 | 1/4 ODF | | | | | | |
| VAL05128 | N/A | 200RB 2 T 3 | 3/8 ODF | | | | | | |
| VAL05130 | N/A | 200RB 3 F 2 | 1/4 SAE | | | | | | |
| VAL05131 | N/A | 200RB 3 F 3 | 3/8 SAE | | | | | | |
| VAL05133 | N/A | 200RB 3 F 4 | 1/2 SAE | 3.0 | 3.6 | 4.8 | 4.5 | 3.2 | 3.1 |
| VAL04441 | N/A | 200RB 3 T 3 | 3/8 ODF | | | | | | |
| VAL05136 | N/A | 200RB 3 T 4 | 1/2 ODF | | | | | | |
| VAL05137 | VAL05138 | 200RB 4 F 3 | 3/8 SAE | | | | | | |
| VAL05144 | VAL05139 | 200RB 4 S 3 | 3/8 ODF x 1/2 ODM | 3.6 | 4.3 | 5.6 | 5.3 | 3.7 | 3.6 |
| VAL05147 | VAL05145 | 200RB 4 S 4 | 1/2 ODF x 5/8 ODM | | | | | | |
| VAL02399 | VAL05148 | 200RB 4 T 3 | 3/8 ODF | | | | | | |
| VAL04442 | VAL05149 | 200RB 4 T 4 | 1/2 ODF | | | | | | |
| VAL04444 | VAL04443 | 200RB 4 T 5 | 5/8 ODF | | | | | | |
| VAL05152 | VAL05151 | 200RB 5 F 4 | 1/2 SAE | | | | | | |
| | VAL05153 | 200RB 5 F 5 | 5/8 ODF | | | | | | |
| | VAL05155 | 200RB 5 S 4 | 1/2 ODF x 5/8 ODM | | | | | | |
| | VAL05158 | 200RB 5 S 5 | 5/8 ODF | 5.3 | 6.4 | 8.2 | 7.8 | 5.4 | 5.3 |
| | VAL05163 | 200RB 5 T 4 | 1/2 ODF | | | | | | |
| VAL02403 | VAL05164 | 200RB 5 T 5 | 5/8 ODF | | | | | | |
| | VAL05167 | 200RB 6 F 4 | 1/2 SAE | | | | | | |
| | VAL05169 | 200RB 6 F 5 | 5/8 SAE | | | | | | |
| | VAL05171 | 200RB 6 S 4 | 1/2 ODF x 5/8 ODM | 6.4 | 7.7 | 10.0 | 9.5 | 6.5 | 6.5 |
| VAL05175 | VAL05173 | 200RB 6 S 5 | 5/8 ODF | | | | | | |
| | VAL05176 | 200RB 6 T 4 | 1/2 ODF | | | | | | |
| VAL02407 | VAL05178 | 200RB 6 T 5 | 5/8 ODF | | | | | | |
| VAL07768 | -- | 200RB 7 S 5 | 5/8 ODF x 7/8 ODM | | | | | | |
| VAL07769 | -- | 200RB 7 T 4 | 1/2 ODF | 10.0 | 12.1 | 15.6 | 14.8 | 10.3 | 10.1 |
| VAL07770 | VAL07777 | 200RB 7 T 5 | 5/8 ODF | | | | | | |
| VAL07771 | VAL07778 | 200RB 7 T 7 | 7/8 ODF | | | | | | |
| VAL07772 | VAL07779 | 200RB 9 T 5 | 5/8 ODF | 14.9 | 18.0 | 23.3 | 22.2 | 15.3 | 15.1 |
| | VAL07780 | 200RB 9 T 7 | 7/8 ODF | 19.6 | 23.6 | 30.5 | 29.0 | 20.1 | 19.8 |
| VAL07774 | VAL07781 | 200RB 9 T 9 | 1 1/8 ODF | | | | | | |
| VAL07775 | VAL07782 | 200RB 12 T 7 | 7/8 ODF | 22.5 | 27.1 | 34.9 | 33.2 | 23.0 | 22.7 |
| | VAL07783 | 200RB 12 T 9 | 1 1/8 ODF | | | | | | |

[1] Add "T" to the end of description for Mounting Stud [2] Add "M" to the end of the description for Manual Stem

# Solenoid Valves

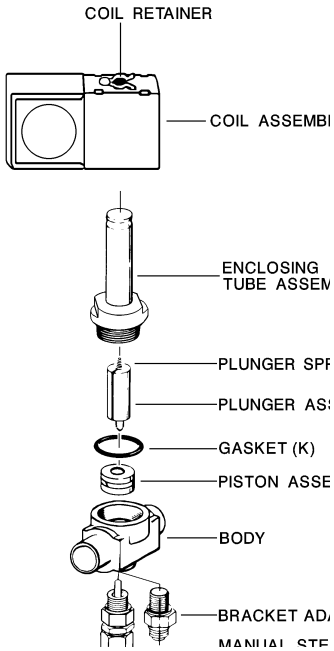
***Ordering Information and Nominal Capacity Table for 200RB BiFlow Solenoids - Tons***

| ServiceFirst Part # | Standard Valve Description | Connection Size | R-12 | R-134a | R-22 | R-407C | R-404A/R-507 | R-502 |
|---|---|---|---|---|---|---|---|---|
| VAL05180 | 200RB GS-1925 3 T 3 | 3/8 ODF | 3.0 | 3.6 | 4.8) | 4.5 | 3.2 | 3.1 |
| VAL05181 | 200RB GS-1926 4 T 3 | 1/2 ODF | 3.6 | 4.3 | 5.6 | 5.3 | 3.7 | 3.6 |
| VAL05183 | 200RB GS-1928 5 T 4 | 1/2 ODF | | | | | | |
| VAL05184 | 200RB GS-1929 5 T 5 | 5/8 ODF | | | | | | |
| VAL05185 | 200RB GS-1930 6 T 5 | 5/8 ODF | 6.4 | 7.7 | 10.0 | 9.5 | 6.5 | 6.5 |

* Product Code Number

**200RB Bi-Flow Conversion**
Standard 200RB uni-directional valves can be converted to Bi-Flow operation by replacing the internal parts with the components in kit KIT04961. Unlike the standard valve which permits flow in one direction only when energized, the Bi-Flow version allows the valve to flow in either direction, depending on differential pressures, when energized. If the valve is not energized when flowing in the reverse direction, valve "flutter" will occur. Also, with the valve de-energized, a higher downstream pressure than upstream (back-flow) will force the valve open. ***Note: A 200RB7, 200RB9 and 200RB12 cannot be converted to a Bi-Flow valve.***

***200RB Exploded View & Parts Kit Data***




"**K**" indicates part is supplied in valve repair kit **KIT04960.**
Gasket Kit **KIT06344** (contains 12 pieces).
Bi-Flo Conversion Kit **KIT04961.**
Manual stem kit KS30117 (not available for 200RB2, 200RB3).

**Coil Assembly**
For voltages and frequencies available see Coils Section.

***200RB Valve Kits***

| Valve | Complete Kit | ServiceFirst Item # | Manual Opening Kit | ServiceFirst Item # | Bi-flow Kit | ServiceFirst Item # | Gasket Kit | ServiceFirst Item # |
|---|---|---|---|---|---|---|---|---|
| 200RB2 | KS30115 | KIT04960 | | | KS30293 | KIT04961 | KG10025 | KIT06344 |
| 200RB3 | KS30115 | KIT04960 | | | KS30293 | KIT04961 | KG10025 | KIT06344 |
| 200RB4 | KS30115 | KIT04960 | | | KS30293 | KIT04961 | KG10025 | KIT06344 |
| 200RB5 | KS30115 | KIT04960 | | | KS30293 | KIT04961 | KG10025 | KIT06344 |
| 200RB6 | KS30115 | KIT04960 | | | KS30293 | KIT04961 | KG10025 | KIT06344 |
| 200RB7 | KS30354 | KIT08285 | KS30361 | KIT08288 | N/A | N/A | KG00002 | KIT08290 |
| 200RB9 | KS30362 | KIT08286 | KS30364 | KIT08289 | N/A | N/A | KG00003 | KIT08291 |
| 200RB12 | KS30365 | KIT08287 | KS30364 | KIT08289 | N/A | N/A | KG00004 | KIT08292 |

# Solenoid Valves

Note: Coil sold separately - see Coils Section. See Nomenclature for ordering information.

## 240RA Solenoid Valves

### Application
- 2-way, normally closed diaphragm valves
- Ideal for liquid, suction and hot gas service
- Solenoid actuated shut-off valve

### Features
- One coil fits all valve sizes
- Can be brazed into the line without disassembly
- Reinforced Teflon diaphragm with woven fiberglass for superior control
- Durable, stainless enclosing tube
- Extended ends for easy installation (standard)
- Long-life molded coils provide water, shock, and vibration protection in coil winding
- Low pressure differential required for full opening
- Mounting stud models can be field converted to manual lift stem

### Options
- Connection sizes to fit your system
- Manual stem or mounting bracket adapter

### Specifications
- Maximum fluid temp: 250°F
- Maximum working pressure: 500 psig
- MOPD: 300 psig
- UL file number: MP604
- CSA file number: LR44912

Note: Mounting enclosing tube more than 90° off vertical up position is not recommended.

**Nomenclature** Example: 240RA 8T5M VLC

| 240R | A | 8 | T | 5 | M | VLC |
|---|---|---|---|---|---|---|
| Valve Series | Design Series | Port Size (in 1/16") | Connection Type T = copper extended ends | Connection Size (in 1/8") | M = manual stem (optional) T = mounting bracket adapter (optional) | Coil* |

*Note: Valves are shipped without the solenoid coils (VLC = Valve Less Coil). See page 56 for available coils.

***Ordering Information and Nominal Liquid Capacity Table for 240RA Valves - Tons***

| ServiceFirst Part Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Standard Valve | Manual Stem[1] | Description | Connection Size | R-12 | R-134a | R-22 | R-407C | R-404A/R-507 | R-502 |
| VAL05199 | VAL05198 | 240RA 8 T 5 | 5/8 ODF | 10.0 | 12.1 | 15.6 | 14.8 | 10.3 | 10.1 |
| VAL05201 | VAL05200 | 240RA 8 T 7 | 7/8 ODF | | | | | | |
| VAL05203 | VAL05202 | 240RA 9 T 5 | 5/8 ODF | 14.9 | 18.0 | 23.3 | 22.1 | 15.3 | 15.1 |
| VAL05205 | | 240RA 9 T 7 | 7/8 ODF | 19.6 | 23.6 | 30.5 | 29.0 | 21.0) | 19.8 |
| VAL05207 | VAL05206 | 240RA 9 T 9 | 1 1/8 ODF | | | | | | |
| VAL05186 | VAL05909 | 240RA 12 T 7 | 7/8 ODF | 22.5 | 27.1 | 34.9 | 33.2 | 23.0 | 22.7 |
| VAL05187 | VAL05910 | 240RA 12 T 9 | 1 1/8 ODF | | | | | | |
| VAL05191 | VAL05190 | 240RA 16 T 9 | 1 1/8 ODF | 37.3 | 45.0 | 58.0 | 55.2 | 38.3 | 37.7 |
| VAL05189 | VAL05188 | 240RA 16 T 11 | 1 3/8 ODF | | | | | | |
| VAL05193 | VAL05192 | 240RA 20 T 11 | 1 3/58 ODF | 58.8 | 70.9 | 95.4 | 90.8 | 65.7 | 62.0 |
| | VAL05194 | 240RA 20 T 13 | 1 5/8 ODF | | | | | | |
| VAL05196 | VAL05195 | 240RA 20 T 17 | 2 1/8 ODF | | | | | | |

[1] Add "M" to the end of the description for Manual Stem

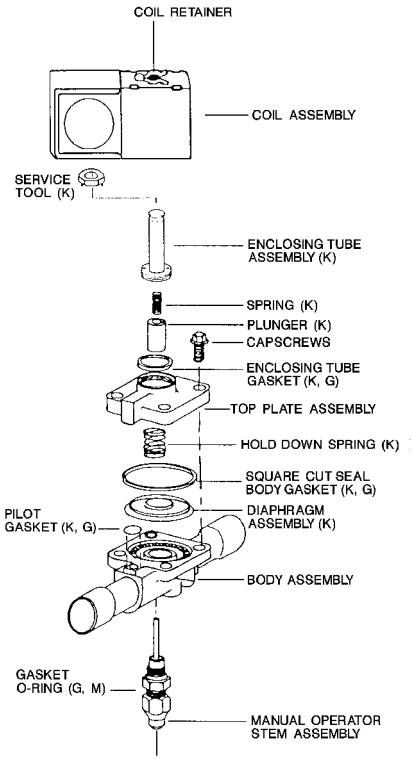
# Solenoid Valves

### *240RA Valve Kits*

| Valve | Complete Kit | ServiceFirst Item # | Manual Opener Kit | ServiceFirst Item # |
|---|---|---|---|---|
| 240RA8 | KS30321 | KIT04979 | KS30066 | KIT04963 |
| 240RA9 | KS30322 | KIT04980 | KS30067 | KIT04964 |
| 240RA12 | KS30323 | KIT04981 | KS30067 | KIT04964 |
| 240RA16 | KS30324 | KIT04982 | KS30068 | KIT04965 |
| 240RA20 | KS30325 | KIT04983 | KS30098 | KIT04969 |

Gasket Kit all 240RA valves is KIT05054 (KG10028)

### *240RA Exploded View & Parts Kit Data*




"**K**" indicates part is supplied in complete valve repair kit.
"**M**" indicates part is supplied in manual opener kit.
"**G**" indicates gasket is supplied in gasket kit.
Note: Spanner wrench (X11981-1 service tool) included in complete valve kit.

**Coil Assembly**
For voltages and frequencies available see the tables on page 56.

# Solenoid Valves

All RV's require RM-Type style coil.

Coil sold separately - see Coils Section.

## RV Brass Reversing Valves

### Application

- Designed for use on heat pump systems
- Reverse cycle gas defrost

### Features

- High strength slide carrier
- Fewer parts
- High capacity pilot
  – Greater tolerance to contaminates
- Low heat transfer slide
- Greater wear resistance of seals
- Stainless steel pilot bracket

### Options

Tube connection sizes:

- Discharge 3/8 through 7/8 ODF/ODM
- Suction & Coil 1/2 through 1 3/8 ODF

### Specifications

- Nominal 2, 3, 4 & 6 ton sizes
- Maximum working pressure:
  For RV sizes 1-6: 680 psig
  For RV size 10: 500 psig
- MOPD: 400 psig
- Minimum operating pressure differential: 10 psi
- Maximum operating temperature: 250°F
- External leakage: 0.1 oz/yr
- UL file number: MP604
- CSA file number: LR44912

**Nomenclature** Example: RV 4F46

| RV | 4 | F | 4 | 6 |
|---|---|---|---|---|
| Valve Series | Nominal Rating (in tons) | F=ODF connections *(omit for ODM) | Discharge Connection (in 1/8") | Suction Connection (in 1/8") |

***RV Suction Gas Extended Capacity Table in Tons for R22 and R410A***

| | | Pressure Drop Across Valve – PSI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Evaporator Temp. °F | Valve Type | R22/R407C 1 | 2 | 3 | 4 | 5 | R410A 1 | 2 | 3 | 4 | 5 |
| + 45°F | RV2 | 1.66 | 2.35 | 2.87 | 3.32 | 3.71 | 2.14 | 3.03 | 3.71 | 4.29 | 4.56 |
| | RV3 | 2.23 | 3.15 | 3.86 | 4.46 | 4.99 | 2.88 | 4.07 | 4.99 | 5.76 | 6.16 |
| | RV4 | 3.24 | 4.58 | 5.61 | 6.48 | 7.25 | 4.19 | 5.92 | 7.25 | 8.37 | 8.69 |
| | RV6 | 4.51 | 6.38 | 7.81 | 9.02 | 10.08 | 5.83 | 8.24 | 10.09 | 11.65 | 12.31 |
| + 25°F | RV2 | 1.36 | 1.92 | 2.35 | 2.71 | 3.03 | 1.75 | 2.48 | 3.03 | 3.50 | 3.92 |
| | RV3 | 2.57 | 3.63 | 4.45 | 5.13 | 5.74 | 3.42 | 4.84 | 5.93 | 6.84 | 7.65 |
| | RV4 | 2.65 | 3.75 | 4.59 | 5.30 | 5.92 | 2.35 | 3.33 | 4.08 | 4.71 | 5.26 |
| | RV6 | 3.69 | 5.21 | 6.39 | 7.37 | 8.25 | 4.76 | 6.73 | 8.25 | 9.52 | 10.65 |
| + 5°F | RV2 | 1.09 | 1.54 | 1.88 | 2.06 | 2.27 | 1.41 | 1.99 | 2.44 | 2.64 | 2.90 |
| | RV3 | 1.46 | 2.07 | 2.53 | 2.78 | 3.02 | 1.89 | 2.67 | 3.27 | 3.54 | 3.83 |
| | RV4 | 2.12 | 3.00 | 3.68 | 3.93 | 4.27 | 2.75 | 3.88 | 4.76 | 5.01 | 5.42 |
| | RV6 | 2.95 | 4.18 | 5.12 | 5.57 | 6.08 | 3.82 | 5.41 | 6.62 | 7.11 | 7.75 |
| - 15°F | RV2 | 0.86 | 1.21 | 1.39 | 1.56 | 1.70 | 1.11 | 1.57 | 1.77 | 1.98 | 2.14 |
| | RV3 | 1.15 | 1.63 | 1.87 | 2.06 | 2.19 | 1.49 | 2.10 | 2.35 | 2.57 | 2.71 |
| | RV4 | 1.67 | 2.37 | 2.64 | 2.91 | 3.11 | 2.16 | 3.06 | 3.33 | 3.65 | 3.86 |
| | RV6 | 2.33 | 3.29 | 3.75 | 4.17 | 4.49 | 3.01 | 4.26 | 4.75 | 5.26 | 5.62 |

Valve capacities are based on 120°F liquid, saturated evaporator, and 10°F superheat at the valve inlet.

***Ordering Information for RV Series Valves***

| ServiceFirst Item # | Description |
|---|---|
| VAL07034 | RV 2 - F 34 VLC |
| VAL06370 | RV 2 - 35 VLC* |
| VAL06011 | RV 2 - F 35 VLC |
| VAL06010 | RV 3 - F 45 VLC |
| VAL04971 | RV 4 - F 46 VLC |
| VAL05052 | RV 4 - 56 VLC |
| VAL04972 | RV 4 - 57 VLC* |
| VAL04973 | RV 6 - F 46 VLC |
| VAL04974 | RV 6 - F 47 VLC |
| VAL04975 | RV 6 - F 57 VLC |
| VAL04976 | RV 6 - F 67 VLC |

# Solenoid Valves

Coil sold separately - see Coils Section.

## 704RB/RC Unloader Valve

**Application**
- 2-Way Unloader Valves
- Electrically operated valve for compressor unloading

**Features**
- Stainless steel and brass construction
- OEM drop-in replacement

**Specifications**
- Maximum working pressure: 450 psig
- MOPD: 300 psig
- 704RB - Drop-in replacement for Trane part number X13320486-01
- 704RC - Drop-in replacement for Trane part number X13320310-01

**Nomenclature** Example: 704RC VLC

| 704RC | VLC |
|---|---|
| Valve Series | Coil* |

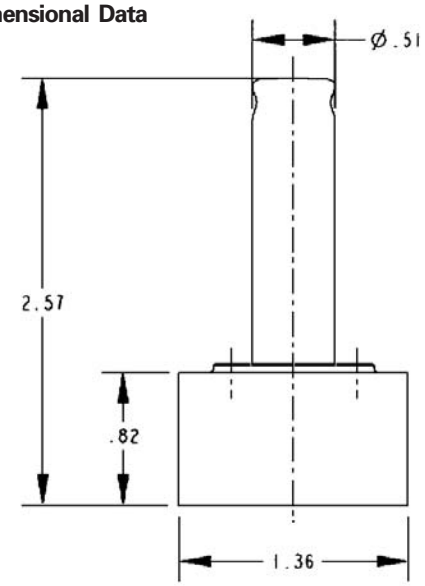
*Note: Valves are shipped without the solenoid coils (VLC = Valve Less Coil). See page 56 for available coils.

***Ordering Information***

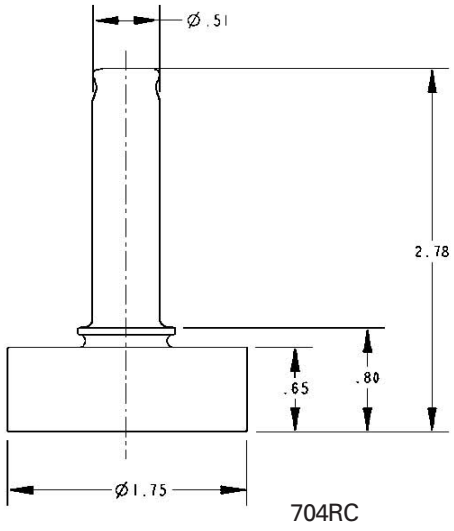
| ServiceFirst Item # | Description | OEM Part Number |
|---|---|---|
| VAL05111 | 704RB-001 VLC | X13320486-01 |
| VAL02236 | 704RC-001 VLC | X13320310-01 |

Note: Body gasket not included. Consult compressor manufacturer for body gasket information.

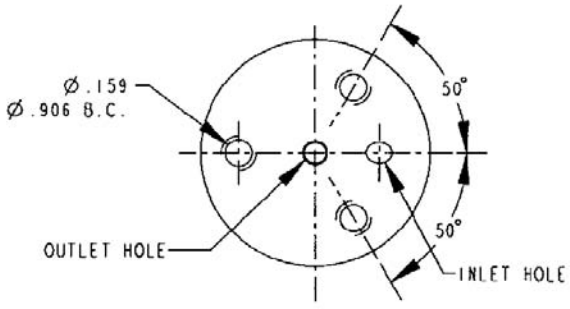
**Dimensional Data**

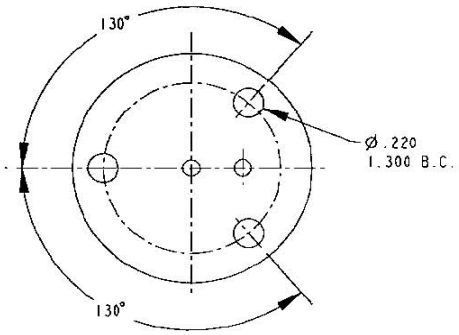



704RB




704RC




Dimensions shown are in inches: Fractions (Decimal)

# Solenoid Valves

Coil sold separately - see Coils Section.

## 708RA Unloader Valve

### Application
- 3-Way Unloader Valves
- Electrically operated valve for compressor unloading

### Features
- Stainless steel and brass construction
- OEM drop-in replacement

### Specifications
- Maximum working pressure: 450 psig
- MOPD: 300 psig
- U.L. approved: File number MP604
- Drop-in replacement for Trane part number VAL05774 (X13320676-01)

**Nomenclature** Example: 708RA VLC

| 708RA | VLC |
|---|---|
| Valve Series | Coil* |

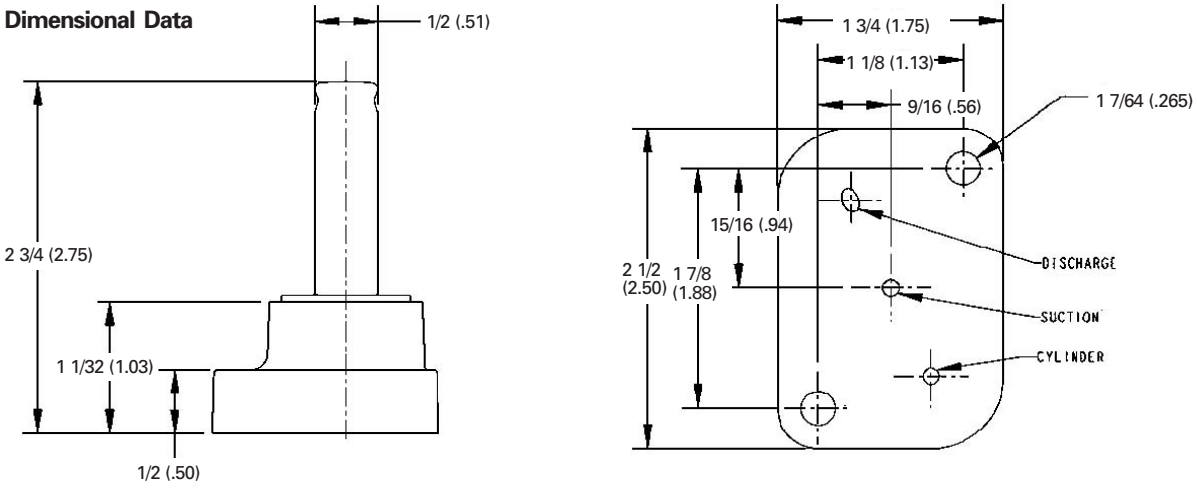
*Note: Valves are shipped without the solenoid coils (VLC = Valve Less Coil). See page 56 for available coils.

***Ordering Information***

| ServiceFirst Item # | Description | OEM Part Number |
|---|---|---|
| VAL05774 | 708RA-001 VLC | X13320676-01 |
| VAL05054 | 708RA-003 VLC | X133206740-01 |

Note: Body gasket not included. Consult compressor manufacturer for body gasket information.

**Dimensional Data**




Dimensions shown are in inches: Fractions (Decimal)

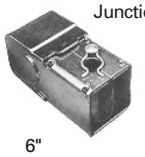
# Solenoid Valves

## Solenoid Valve Coils

***Ordering Information for Coils***

***Note: All Alco coils fit on all Alco Solenoid Valves***

Junction Box



6" Leads

Lead Wires

18" Leads

Open Frame/Spaded

Molded

RM Style

| Alco Coil Style | Configuration | Voltage Frequency | Lead Length | ServiceFirst Item # |
|---|---|---|---|---|
| AMG | Junction Box | 24V 50/60Hz | 6" | COL03779 |
| AMG | Junction Box | 120V 50/60Hz | 6" | COL03780 |
| AMG | Junction Box | 208-220/208-240 50/60Hz | 6" | COL03781 |
| AMG | Junction Box | 480V 50/60Hz | 6" | COL03782 |
| AMG | Junction Box | 120-240V 50/60Hz | 6" | COL09638 |
| AMG | Junction Box | 277V 60Hz | 6" | COL09637 |
| AMG | Junction Box | 12V DC[1] | 6" | COL09634 |
| AMG | Junction Box | 24V DC[1] | 6" | COL09635 |
| AMG | Junction Box | 32V DC[1] | 6" | COL09636 |
| AHG | Hi Temp Junction Box | 120/50-60 | 6" | COL09651 |
| AHG | Hi Temp Junction Box | 208-240/50-60 | 6" | COL09649 |
| AHG | Hi Temp Junction Box | 24/50-60 | 6" | COL09650 |
| DMG | Junction Box | 24/50-60 | 6" | COL09647 |
| DMG | Junction Box | 120/50-60 | 6" | COL09648 |
| DMG | Junction Box | 208-240/50-60 | 6" | COL09646 |
| AMC | Conduit | 24/50-60 | 18" | COL05345 |
| AMC | Conduit | 120/50-60 | 18" | COL09468 |
| AMC | Conduit | 208-220/208-240 50/60 | 18" | COL01639 |
| AMC | Conduit | 480/50-60 | 18" | COL09628 |
| AMC | Conduit | 12/DC | 18" | COL05347 |
| AHC | Conduit Hi Temp | 24/50-60 | 18" | COL09654 |
| AHC | Conduit Hi Temp | 120/50-60 | 18" | COL09652 |
| AHC | Conduit Hi Temp | 208-240/50-60 | 18" | COL09653 |
| AMS | 1/4" Spade | 24/50-60 | None | COL09641 |
| AMS | 1/4" Spade | 120/50-60 | None | COL01638 |
| AMS | 1/4" Spade | 208-240/50-60 | None | COL09640 |
| AMS | 1/4" Spade | 277/60 | None | COL09642 |
| AMF | Open Frame | 24/50-60 | 18" | COL09629 |
| AMF | Open Frame | 120/50-60 | 18" | COL09630 |
| AMF | Open Frame | 208-240/50-60 | 18" | COL09633 |
| AMF | Open Frame | 277/60 | 18" | COL09631 |
| AMF | Open Frame | 480/50-60 | 18" | COL09632 |
| ASC2 | Molded[2] | 24V 50/60Hz | None | COl01038 |
| ASC2 | Molded[2] | 120V 50/60Hz | None | COL11850 |
| RMF | Open Frame | 24V 50-60Hz | 18" | COL12762 |
| RMF | Open Frame | 120V 50/60Hz | 18" | COL12763 |
| RMF | Open Frame | 208-220/208-240 50 - 60Hz | 18" | COL12768 |
| RMS | Open Frame | 24V 50-60Hz | 18" | COL12764 |
| RMS | Open Frame | 120V 50/60Hz | 18" | COL12765 |
| RMS | Open Frame | 208-220/208-240 50 - 60Hz | 18" | COL12769 |

[1]AM style DC coils should not be used for direct replacements on OEM equipment. The use of this coil on new applications may result in the valve not opening. New applications should use the MM coil because of the significant increase in opening power of the MM coil over the standard AM style DC coil.
[2]ASC2 female connector CON01228 (X-28616 - 18" in length).

| Coil Enclosure Options | |
|---|---|
| Options | Code |
| Junction Box | G |
| Conduit, 18" Leads | C |
| Open Frame, 18" Leads | F |
| Open Frame, Spades | S |

# Ball Valves

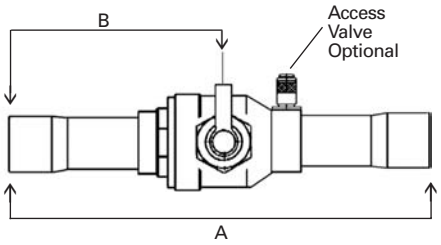
## ABV Refrigeration Ball Valve

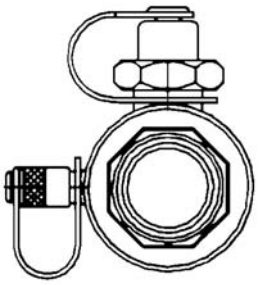
### Application
- Isolate suction, discharge, and liquid pipework during maintenance shutdown periods.

### Features
- Forged brass body
- Hermetic design
- Compatible with new refrigerants/ lubricants
- Full internal ports through 2 1/8″
- Bi-directional flow characteristics
- Valve stem cap retained by strap attached to main body
- Integrated access port available on all sizes

### Specifications
- Body: Forged Brass
- Extension Stubs: 100% Copper Connections
- Maximum working pressure: 500 psig
- Not for use with R-123
- Fluid temperature range: +300°F to -40°F
- UL file number: SA5312
- CSA file number: LR32462

### Dimensional Data



**Nomenclature** Example: ABV 5A

| A | BV | 5 | A |
|---|---|---|---|
| Series | Ball Valve | Connection Size (in 1/8″) | Access Valve |

***Selection and Ordering Information for ABV***

| ServiceFirst Item # without Access Valve | ServiceFirst Item # with Access Valve | Valve | Port Size | Connection Size | Dimensions A | Dimensions B |
|---|---|---|---|---|---|---|
| | VAL07508 | ABV 2 | 1/2 | 1/4 ODF | 5.47 | 2.55 |
| VAL06650 | VAL06651 | ABV 3 | 1/2 | 3/8 ODF | 5.47 | 2.55 |
| VAL06652 | VAL06653 | ABV 4 | 1/2 | 1/2 ODF | 6.35 | 2.97 |
| VAL06654 | VAL06655 | ABV 5 | 1/2 | 5/8 ODF | 6.35 | 2.97 |
| | VAL08182 | ABV 6 | 3/4 | 3/4 ODF | 7.42 | 3.49 |
| VAL06656 | VAL06657 | ABV 7 | 3/4 | 7/8 ODF | 7.42 | 3.49 |
| VAL06658 | VAL06659 | ABV 9 | 1 | 1 1/8 ODF | 9.11 | 4.47 |
| VAL06640 | VAL06641 | ABV 11 | 1 1/4 | 1 3/8 ODF | 9.97 | 4.84 |
| VAL06642 | VAL06643 | ABV 13 | 1 1/2 | 1 5/8 ODF | 10.98 | 5.38 |
| VAL06644 | VAL06645 | ABV 17 | 2 | 2 1/8 ODF | 11.72 | 5.77 |
| VAL06646 | VAL06647 | ABV 21[1] | 2 | 2 5/8 ODF | 11.72 | 5.77 |
| VAL06648 | VAL06649 | ABV 25[1] | 2 | 3 1/8 ODF | 11.81 | 5.82 |

[1]Reduced port

# System Protectors

## Fundamentals of System Protectors

Alco's liquid line and suction line filter-driers are often referred to as System Protectors because they remove harmful elements from the circulating refrigerant before serious damage results.

Keeping the system clean and free of foreign contaminants that can restrict the operation of valves, block capillary tubes or damage compressors is the best way to assure trouble-free operation. These contaminants can be solids, such as metal filings, flux, dust and dirt. Other equally menacing contaminants are solubles, such as acid, water, resins and wax.

No matter how many precautions are taken during assembly and installation or servicing of a system, contaminants can find a way into the system. Filter-driers are designed to protect a system during operation. It is the function of this all important unit to remove those residual elements that can attack and eventually destroy the system components.

All of the liquid line filter-driers on the market today are a variation of one of two types: the molded block type or the bead type.

A. The block style filter-drier is manufactured by mixing the drying elements, which remove the soluble contaminants, with a suitable bonding element. This mixture is then poured into molds and finally placed in ovens where the blocks take a permanent form and the drying ingredients are activated.

B. The bead style filter-drier uses a less complicated manufacturing process, so there is less change of error. The active drying material is in the form of beads or pellets. No bonding material is used to hold the beads together, but rather compacting is normally performed through some type of mechanical pressure. On the upstream side of the compacted beads is a filter network which cushions flow and traps the solid contaminants.

Alco's filter-driers protect the refrigerant system from liquid and solid contaminants. They incorporate various desiccants for maximum moisture and acid removal and a special compound to prevent wax build-up.

Certain characteristics of system protectors must be understood in order to make the proper selection. When performing service work on a refrigeration system in the field it is next to impossible to determine the quantity or type of contamination which may be in the system. For this reason it is good practice to select the largest size filter-drier which fits the available space and economical considerations.

**Filtration Capacity**
Solid particles or semi-solids such as sludges circulating in a refrigerant system can destroy valve seats, plug control valves, and score cylinder walls or compressor bearings. These contaminants can be the result of manufacturing, servicing, or can be generated during normal system operation.

Of prime importance, is removing these contaminants as quickly as possible and preventing them from returning to the system. All Alco filter-driers are designed to trap and hold large quantities of these contaminants while maintaining acceptable flow rates during their service life.

**Moisture Capability**
Moisture in a refrigeration system can mean frozen valves, copper plating, damaged motor insulation, corrosion, and resulting sludges. Filter-driers accomplish the task of removing and retaining moisture through the use of one or more desiccants. The most popular and effective desiccant in use today for the removal of moisture is molecular sieve which can hold three to four times the water of other commercial absorbents. Moisture capacity of a filter-drier is normally given in drops of water

per ARI Standard 710. These rated capacities are in addition to any residual moisture that might be absorbed during manufacturing.

**Acid Pick-Up Capability**
Various organic acids result during the decomposition of the refrigerant and oil in a system. This decomposition can be the result of moisture in the system, excessive temperatures, air, or exposure to foreign substances in the system. It is important that acid in a system is absorbed as soon as it is formed to prevent the acid from causing system damage. Activated alumina is the most popular of the desiccants used to remove acid.

**Wax Removal**
The ability of a filter-drier to remove wax and resins is of major importance in low temperature applications that use R-22 . Wax when present in a system has a tendency to solidify on valve seats and pins, resulting in system malfunctions.

**Flow Rate**
Published flow rates for Alco filter-driers are established in accordance with ARI Standard 710 for liquid line driers, and ARI Standard 730 for suction line driers.

# System Protectors

## Clean-up Procedure For Compressor Motor Burnout

1. Determine the extent of the burnout. For mild burnouts where contamination has not spread thru the system - it may be economical to save the refrigerant charge, if the system has service valves on the compressor. A severe burnout exists if the oil is discolored, an acid odor is present, and contamination products are found on the high and low side. In this condition, caution should be exercised to avoid breathing the acid vapors - also, avoid skin contact with the contaminated liquid.
2. Thoroughly clean and replace all system controls such as Thermo valves, solenoids, check valves, reversing valves, etc.. Remove all strainers and filter-driers.
3. Install replacement compressor and make a complete electrical check.
4. Make sure that the suction line adajacent to compressor is clean. Install an over-sized liquid line filter-drier and an Alco suction line filter-drier.
5. Pressure and leak-test the system according to unit manufacturer's recommendations.
6. Triple evacuate to at least 500 microns. Break the vacuum with clean, dry refrigerant at 0 psig.
7. Charge the system through an Alco EK filter-drier to equipment manufacturer's recommendations.
8. Start the compressor and put the system in operation. Record the pressure drop across the Alco suction line filter-drier on the enclosed label and apply label to the side of the shell.
9. Replace the suction line filter-drier if the pressure drop becomes excessive.
10. Observe the system during the first 4 hours. Repeat step 9 as often as required, until no further change in pressure drop is observed.
11. After the system has been in operation for 48 hours, check the condition of the oil with the Alco Acid Alert test kit. If the oil test indicates an acid condition, replace both the liquid and suction line filter-drier.
12. Check the system again after approximately 2 weeks of operation. If the oil is still discolored, replace the liquid and suction line filter-drier.
13. Clean-up is complete when the oil is clean and odor-free, and is determined to be acceptable with the Alco Acid Alert test kit.

# System Protectors

***Recommended System Tonnage For kW, Multiply tons by 3.5[1]***

**Take Apart Liquid Line Filter Driers**

| Alco Description | Refrigeration, Low Temp. & Commercial Installations | | | Air Conditioning: Field Replacement & Field Installations | | Air Conditioning: OEM Self Contained Equipment | |
|---|---|---|---|---|---|---|---|
| | R-12/134a | R-22/407C | R-404A/507A | R-12/134a | R-22/407C | R-12/134a | R-22/407C |
| STAS 485T | 8 | 10 | 8 | 8 | 10 | 13 | 15 |
| STAS 487T | 10 | 13 | 10 | 10 | 12 1/2 | 15 | 20 |
| STAS 489T | 10 | 15 | 10 | 10 | 15 | 15 | 20 |
| STAS 4811T | 13 | 20 | 13 | 13 | 20 | 20 | 25 |
| STAS 967T | 20 | 25 | 15 | 20 | 25 | 25 | 35 |
| STAS 969T | 25 | 30 | 20 | 25 | 30 | 35 | 45 |
| STAS 9611T | 30 | 35 | 25 | 30 | 35 | 35 | 45 |
| STAS 9613T | 35 | 40 | 30 | 35 | 40 | 40 | 50 |
| A-TD-9625S-V | 40 | 45 | 35 | 40 | 45 | 50 | 60 |
| STAS 1449T | 30 | 40 | 30 | 30 | 40 | 40 | 55 |
| STAS 14411T | 40 | 50 | 35 | 40 | 50 | 50 | 65 |
| STAS 14413T | 45 | 55 | 40 | 45 | 55 | 55 | 75 |
| STAS 14417T | 60 | 50 | 45 | 50 | 60 | 60 | 80 |
| STAS 19211T | 50 | 70 | 45 | 50 | 70 | 60 | 80 |
| STAS 19213T | 60 | 80 | 55 | 60 | 80 | 75 | 100 |
| STAS 19217T | 65 | 85 | 60 | 65 | 85 | 80 | 110 |
| ADKS 30013T | 50 | 65 | 45 | 50 | 65 | 55 | 70 |
| ADKS 30017T | 60 | 80 | 50 | 60 | 80 | 65 | 90 |
| ADKS 40017T | 65 | 85 | 55 | 65 | 85 | 70 | 95 |
| ADKS 40021T | 75 | 100 | 65 | 75 | 100 | 80 | 105 |

***Hermetic Liquid Line Filter Driers (EK, ADK, BFK, BOK)***

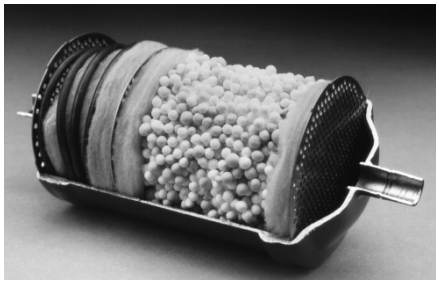
| Alco Description | Recommended capacities at 2 psi Drop: Refrigeration, Low Temp. & Commercial Installations | | | Air Conditioning: Field Replacement & Field Installations | |
|---|---|---|---|---|---|
| | R-12/134a | R-22/407C/R-410A | R-404A/507A | R-12/134a | R-22/407C/R-410A |
| 032, 032S, 033, 033S | 1/2 | 1/2 | 1/2 | 1 | 1 1/2 |
| 052, 052S | 3/4 | 3/4 | 1/2 | 1 | 1 1/2 |
| 053, 053S | 1 1/2 | 2 | 1 1/2 | 3 | 4 |
| 082, 082S | 1 | 1 | 3/4 | 1 1/2 | 2 |
| 0825S | 1 | 2 | 1 | 3 | 4 |
| 083, 083S | 2 | 3 | 2 | 4 | 5 |
| 084, 084S | 2 | 4 | 2 | 5 | 7 1/2 |
| 162, 162S | 1 1/2 | 2 | 1 | 1 1/2 | 2 |
| 1625S | 2 | 3 | 2 | 3 | 4 |
| 163, 163S | 3 | 5 | 3 | 4 | 5 |
| 164, 164S | 3 | 5 | 3 | 5 | 10 |
| 165, 165S | 3 | 7 1/2 | 3 | 7 1/2 | 12 |
| 303, 303S | 4 | 5 | 3 | 4 | 6 |
| 304, 304S | 4 | 7 1/2 | 4 | 7 1/2 | 10 |
| 305, 305S | 7 1/2 | 10 | 5 | 10 | 15 |
| 307S | 7 1/2 | 10 | 5 | 18 | 24 |
| 309S | 7 1/2 | 15 | 5 | 20 | 26 |
| 413 | 4 | 5 | 4 | 5 | 5 |
| 414, 414S | 4 | 5 | 5 | 7 1/2 | 12 |
| 415, 415S | 7 1/2 | 7 1/2 | 7 1/2 | 12 | 18 |
| 417S | 10 | 10 | 7 1/2 | 18 | 25 |
| 419S | 10 | 12 | 10 | 20 | 27 |
| 757S | 20 | 25 | 15 | 22 | 30 |
| 759S | 22 | 30 | 20 | 25 | 34 |

***Spun Copper Liquid Line Service Driers***

| Alco Description | Refrigeration, Low Temp. & Commercial Installations | | | Air Conditioning: Field Replacement & Field Installations | | Air Conditioning: OEM Self Contained Equipment | |
|---|---|---|---|---|---|---|---|
| | R-12/134a | R-22/407C | R-404A/507A | R-12/134a | R-22/407C | R-12/134a | R-22/407C |
| CU-80, 619 | 1/3 | 1/2 | 1/3 | 1/3 | 1/2 | 1/2 | 1/2 |
| CU-620, 621 | 1/2 | 3/4 | 1/2 | 1 | 2 | 1 1/5 | 2 |
| CU-200 | 1/2 | 3/4 | 1/2 | 3/4 | 1 | 1 | 1 1/2 |
| CU-319 | 1/2 | 3/4 | 1/2 | 1 | 2 | 1 1/2 | 2 |

[1]Example: 1.0 tons x 3.5 = 3.5 kW

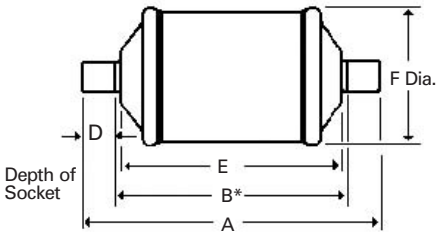
# System Protectors



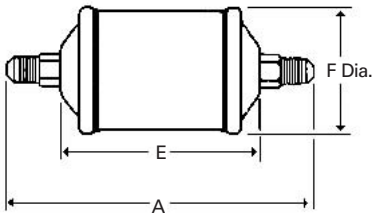
**Nomenclature** Example: EK-083S

| EK | 08 | 3 | S |
|---|---|---|---|
| Drier Series | Unit Size (in cu. in.) | Connection Size (in 1/8″) | S = ODF connections (omit for SAE) |

***Dimensional Data***




* Indicates Lay-in Length




## EK Extra-Klean Liquid Line Filter-Drier

**R-410A - Premium Universal replacement liquid line filter-drier for CFC, HCFC and HFC refrigerants including R-410A (R-410A through 16″ size only).**

### Application

- Alco's premium compacted bead filter-drier with a finer 20 micron final outlet pad for maximum filtration

### Features

- Filtration first for more effective use of surface area of desiccant
- High moisture and acid removal
- Solid copper fittings
- Corrosion resistant epoxy powder paint finish
- Copeland approved for POE Oils

### Specifications

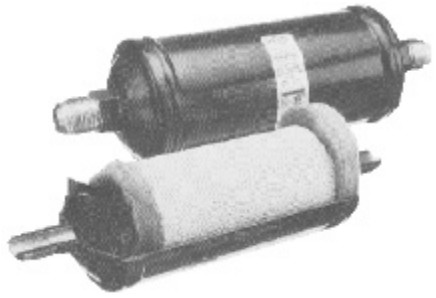
- Desiccant blend - 75% molecular sieve and 25% activated alumina
- Filtration: 20 microns
- Maximum working pressure: 680 psig
- UL file number: SA 3124

***Ordering Information for EK***

| ServiceFirst Item # | Model Number | Dimensions A | B | D | E | F[1] | Ship Wt. Lbs. |
|---|---|---|---|---|---|---|---|
| DHY00131 | EK-032 | 4 3/8 | — | — | | | |
| DHY00132 | EK-032S | 3 7/8 | 3-1/8 | 3/8 | | | |
| DHY00133 | EK-032FM | 3 1/2 | — | — | 2 9/16 | 1 5/8 | 1/2 |
| DHY00816 | EK-032MF | 3 1/2 | — | — | | | |
| DHY00135 | EK-033 | 4 11/16 | — | — | | | |
| DHY00136 | EK-033S | 4 1/16 | 3 3/16 | 7/16 | | | |
| DHY00137 | EK-052 | 4 13/16 | — | — | | | |
| DHY00817 | EK-052MF | 4 1/2 | — | — | | | |
| DHY00138 | EK-052S | 4 7/16 | 3 11/16 | 3/8 | 3 | 2 5/8 | 7/8 |
| DHY00139 | EK-053 | 5 1/8 | — | — | | | |
| DHY00140 | EK-053S | 4 1/2 | 3 5/8 | 7/16 | | | |
| DHY00141 | EK-082 | 5 5/8 | — | — | | | |
| DHY00142 | EK-082S | 5 1/4 | 4 1/2 | 3/8 | | | |
| DHY00324 | EK-0825S | | | | | | |
| DHY00143 | EK-083 | 5 15/16 | — | — | | | |
| DHY00144 | EK-083S | 5 5/16 | 4 7/16 | 7/16 | 3 13/16 | 2 5/8 | 1 1/4 |
| DHY01186 | EK-083MF | | | | | | |
| DHY00145 | EK-084 | 6 3/16 | — | — | | | |
| DHY00146 | EK-084S | 5 3/8 | 4 3/8 | 1/2 | | | |
| DHY00147 | EK-162 | 6 9/16 | — | — | | | |
| DHY00148 | EK-162S | 6 3/16 | 5 7/16 | 3/8 | | | |
| DHY00818 | EK-1625S | 5 15/16 | 5 5/16 | 5/16 | | | |
| DHY00149 | EK-163 | 6 7/8 | — | — | | | |
| DHY00150 | EK-163S | 6 1/4 | 5 7/16 | 7/16 | 4 3/4 | 2 5/8 | 1 1/2 |
| DHY00151 | EK-164 | 7 1/16 | — | — | | | |
| DHY00152 | EK-164S | 6 5/16 | 5 5/16 | 1/2 | | | |
| DHY00153 | EK-165 | 7 1/2 | — | — | | | |
| DHY00154 | EK-165S | 6 9/16 | 5 5/16 | 5/8 | | | |
| DHY00155 | EK--167S | | | | | | |
| DHY00156 | EK-303 | 9 5/8 | — | — | | | |
| DHY00157 | EK-303S | 9 | 8 1/8 | 7/16 | | | |
| DHY00158 | EK-304 | 9 7/8 | — | — | | | |
| DHY00159 | EK-304S | 9 1/8 | 8 1/8 | 1/2 | | | |
| DHY00160 | EK-305 | 10 5/16 | — | — | 7 1/2 | 3 1/16 | 3 3/4 |
| DHY00161 | EK-305S | 9 5/16 | 8 1/16 | 5/8 | | | |
| DHY00819 | EK-306S | 9 11/16 | 8 7/16 | 5/8 | | | |
| DHY00820 | EK-307S | 9 7/8 | 8 3/8 | 3/4 | | | |
| DHY00821 | EK-309S | 10 1/4 | 8 7/16 | 15/16 | | | |
| DHY00165 | EK-413 | 9 3/4 | — | — | | | |
| DHY00166 | EK-414 | 10 | — | — | | | |
| DHY00167 | EK-414S | 9 1/4 | 8 1/4 | 1/2 | | | |
| DHY00168 | EK-415 | 10 7/16 | — | — | 7 5/8 | 3 11/16 | 4 3/4 |
| DHY00169 | EK-415S | 9 7/16 | 8 3/16 | 5/8 | | | |
| DHY00170 | EK-417S | 10 | 8 1/2 | 3/4 | | | |
| DHY00171 | EK-419S | 10 5/16 | 8 1/2 | 3/4 | | | |
| DHY00172 | EK-757S | 15 7/16 | 13 15/16 | 3/4 | 13 1/16 | 3 11/16 | 7 1/2 |
| DHY00173 | EK-759S | 15 3/4 | 13 7/8 | 15/16 | | | |

[1]Does not include weld bead

# System Protectors



**Nomenclature** Example: ADK 083S

| ADK | 08 | 3 | S |
|---|---|---|---|
| Series | Unit Size (in cu. in.) | Connection Size (in 1/8") | S = ODF connection (Omit for SAE) |

## ADK Block Style Liquid Line Filter-Drier

**R-410A - Although Alco recommends the EK or UDK driers for R-410A applications, the ADK filter-drier is UL listed for 600 PSIG maximum working pressure for all sizes through 16 cubic inches.**

### Application

- Economy solid core liquid line filter-drier ideal for use with CFC and HCFC refrigerants (R-410A through 16" size only

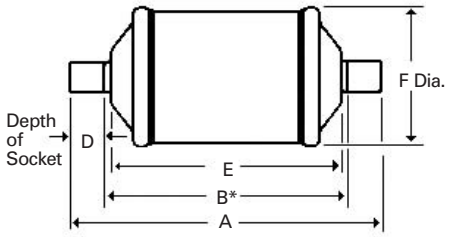
### Features

- Solid copper fittings
- Shock resistant steel shell construction
- High moisture and acid removal capacity
- Corrosion resistant epoxy powder paint finish

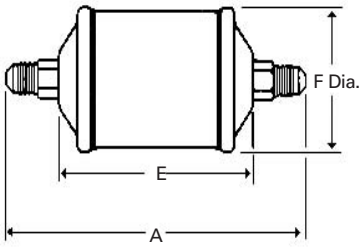
### Specifications

- Desiccant Blend: Activated Alumina with Molecular Sieve
- Filtration: 40 microns
- Maximum working pressure: 680 psig
- UL file number: SA 3124

***Dimensional Data***




* Indicates lay-in length




***Ordering Information for ADK***

| ServiceFirst Item # | Part Number | Connection Size | Dimensions A | B | D | E | F 1 | Ship Wt. Llbs. |
|---|---|---|---|---|---|---|---|---|
| DHY00387 | ADK-032 | 1/4 SAE | 4 3/8 | — | — | 2 9/16 | 1 5/8 | 1/2 |
| DHY00388 | ADK-032S | 1/4 ODF | 3 7/8 | 3 1/8 | 3/8 | 2 9/16 | 1 5/8 | 1/2 |
| DHY00389 | ADK-033 | 3/8 SAE | 4 11/16 | — | — | 2 9/16 | 1 5/8 | 1/2 |
| DHY00390 | ADK-033S | 3/8 ODF | 4 1/16 | 3 3/16 | 7/16 | 2 9/16 | 1 5/8 | 1/2 |
| DHY00391 | ADK-052 | 1/4 SAE | 4 13/16 | — | — | 3 | 2 5/8 | 3/4 |
| DHY00392 | ADK-052S | 1/4 ODF | 4 7/16 | 3 11/16 | 3/8 | 3 | 2 5/8 | 3/4 |
| DHY00393 | ADK-053 | 3/8 SAE | 5 1/8 | — | — | 3 | 2 5/8 | 3/4 |
| DHY00097 | ADK-053S | 3/8 ODF | 4 1/2 | 3 5/8 | 7/16 | 3 | 2 5/8 | 3/4 |
| DHY00395 | ADK-082 | 1/4 SAE | 5 5/8 | — | — | 3 13/16 | 2 5/8 | 1 1/4 |
| DHY00396 | ADK-082S | 1/4 ODF | 5 1/4 | 4 1/2 | 3/8 | 3 13/16 | 2 5/8 | 1 1/4 |
| DHY00825 | ADK-083 | 3/8 SAE | 5 15/16 | — | — | 3 13/16 | 2 5/8 | 1 1/4 |
| DHY00826 | ADK-083S | 3/8 ODF | 5 5/16 | 4 7/16 | 7/16 | 3 13/16 | 2 5/8 | 1 1/4 |
| DHY00827 | ADK-084S | 1/2 ODF | 5 3/8 | 4 3/8 | 1/2 | 3 13/16 | 2 5/8 | 1 1/4 |
| DHY00828 | ADK-162 | 1/4 SAE | 6 7/16 | — | — | 4 5/8 | 2 5/8 | 2 |
| DHY00829 | ADK-163 | 3/8 SAE | 6 3/4 | — | — | 4 5/8 | 2 5/8 | 2 |
| DHY00830 | ADK-163S | 3/8 ODF | 6 1/8 | 5 1/4 | 7/16 | 4 5/8 | 2 5/8 | 2 |
| DHY01025 | ADK-164 | 1/2 SAE | 6 15/16 | — | — | 4 5/8 | 2 5/8 | 2 |
| DHY00831 | ADK-164S | 1/2 ODF | 6 3/16 | 5 3/16 | 1/2 | 4 5/8 | 2 5/8 | 2 |
| DHY00402 | ADK-165 | 5/8 SAE | 7 7/16 | — | — | 4 5/8 | 2 5/8 | 2 |
| DHY00832 | ADK-165S | 5/8 ODF | 6 3/8 | 5 1/8 | 5/8 | 4 5/8 | 2 5/8 | 2 |
| DHY00834 | ADK-303 | 3/8 SAE | 9 5/8 | — | — | 4 5/8 | 2 5/8 | 2 |
| DHY00854 | ADK-303S | 5/8 ODF | 9 | 8 1/8 | 7/16 | 7 1/2 | 3 1/16 | 3 3/4 |
| DHY00404 | ADK-304 | 1/2 SAE | 9 7/8 | — | — | 7 1/2 | 3 1/16 | 3 3/4 |
| DHY00835 | ADK-304S | 1/2 ODF | 9 1/8 | 8 1/8 | 1/2 | 7 1/2 | 3 1/16 | 3 3/4 |
| DHY01026 | ADK-305 | 5/8 SAE | 10 5/16 | — | — | 7 1/2 | 3 1/16 | 3 3/4 |
| DHY00836 | ADK-305S | 5/8 ODF | 9 5/16 | 8 1/16 | 5/8 | 7 1/2 | 3 1/16 | 3 3/4 |
| DHY00837 | ADK-307S | 7/8 ODF | 9 7/8 | 8 3/8 | 3/4 | 7 1/2 | 3 1/16 | 3 3/4 |
| DHY00838 | ADK-309S | 1 1/8 ODF | 10 3/16 | 8 3/8 | 15/16 | 7 1/2 | 3 1/16 | 3 3/4 |
| DHY01022 | ADK-414 | 1/2 SAE | 10 | — | — | 7 5/8 | 3 11/16 | 4 3/4 |
| DHY00839 | ADK-414S | 1/2 ODF | 9 1/4 | 8 1/4 | 1/2 | 7 5/8 | 3 11/16 | 4 3/4 |
| DHY01023 | ADK-415 | 5/8 SAE | 10 7/16 | — | — | 7 5/8 | 3 11/16 | 4 3/4 |
| DHY00840 | ADK-415S | 5/8 ODF | 9 7/16 | 8 3/16 | 5/8 | 7 5/8 | 3 11/16 | 4 3/4 |
| DHY00841 | ADK-417S | 7/8 ODF | 10 | 8 1/2 | 3/4 | 7 5/8 | 3 11/16 | 4 3/4 |
| DHY00842 | ADK-419S | 1 1/8 ODF | 10 5/16 | 8 1/2 | 15/16 | 7 5/8 | 3 11/16 | 4 3/4 |
| DHY01024 | ADK-757S | 7/8 ODF | 15 7/16 | 13 15/16 | 3/4 | 13 1/16 | 3 11/16 | 7 1/2 |
| DHY00843 | ADK-759S | 1 1/8 ODF | 15 3/4 | 13 7/8 | 15/16 | 13 1/16 | 3 11/16 | 7 1/2 |

# System Protectors

**Nomenclature** Example: BFK 165S

| BFK | 16 | 5 | S |
|---|---|---|---|
| Series | Unit Size (in cu. in.) | Connection Size (in 1/8") | S = ODF connections (omit for SAE) |

## BFK/EBF Liquid Line Bi-Directional Heat Pump

**R-410A - The BFK filter-drier is UL listed for 600 PSIG maximum working pressure for all sizes through 16 cubic inches.**

### Application

- Bi-directional liquid line filter-drier for heat pump applications
- For use with CFC, HCFC, HFC refrigerants

### Features

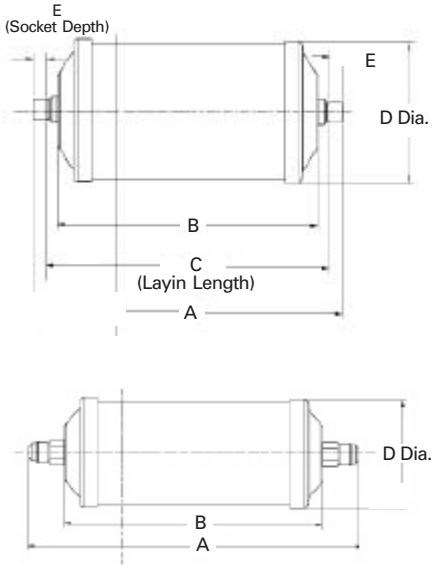
- 16 cubic inches in a 2 1/2" diameter shell
- Internal check valves allow flow and filtration in either direction. External check valves eliminated
- High moisture and acid removal
- Corrosion resistant epoxy powder paint finish
- Copeland approved for POE oils

### Specifications

- Desiccant blend - 75% molecular sieve and 25% activated alumina (Bead)
- Filtration 40 microns
- Maximum working pressure: 680 psig
- UL file number: SA 3124

Note: For sizing, see recommended system tonnage on page 60.

***Dimensional Data***





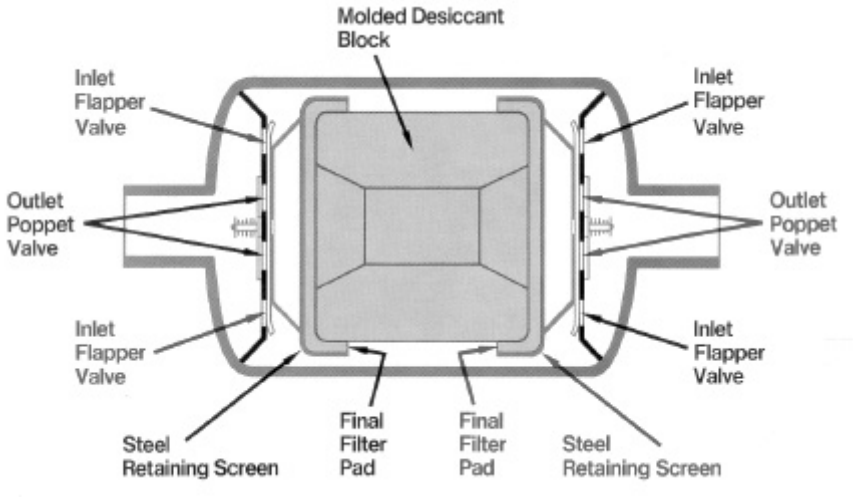


| | | | Dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|
| ServiceFirst Item # | Part Number | Connection Size | A | B | C | D | E | Ship Wt. Llbs. |
| DHY00098 | BFK-083 | 3/8 SAE | 5.94 | 3.94 | | 2.31 | | 1 |
| DHY00099 | BFK-083S | 3/8 ODF | 5.29 | | 4.48 | | .40 | |
| DHY00809 | BFK-084 | 1/2 SAE | 6.16 | | | | | |
| DHY00101 | BFK-084S | 1/2 SAE | 5.38 | | 4.38 | | .50 | |
| DHY00103 | BFK-085S | 5/8 ODF | 5.60 | | 4.35 | | .63 | |
| DHY00325 | BFK-0825S | 5/16 ODF | | | | | | |
| DHY00104 | BFK-163 | 3/8 SAE | 6.74 | 4.61 | | 3.06 | | 2 |
| DHY00105 | BFK-163S | 3/8 ODF | 6.08 | 4.61 | 5.28 | | .40 | |
| DHY00899 | EBF 163S | 3/8" ODF | 6 1/8 | 4 5/8 | 5 1/4 | | 7/16 | |
| DHY00106 | BFK-164 | 1/2 SAE | 6.96 | 4.61 | | | | |
| DHY00107 | BFK-164S | 1/2 ODF | 6.17 | 4.61 | 5.17 | 3.17 | .50 | 3.85 |
| DHY00900 | EBF 164S | 1/2" ODF | 6 3/16 | 4 5/8 | 5 3/16 | | 1/2 | |
| DHY00108 | BFK-165 | 5/8 SAE | 7.41 | 4.61 | | | | |
| DHY00109 | BFK-165S | 5/8 ODF | 6.39 | 4.61 | 5.14 | | .63 | |
| DHY01091 | BFK-304S | 1/2 ODF | 9.02 | 7.50 | 8.02 | | .50 | 3.75 |
| DHY01030 | BFK-305S | 5/8 ODF | 9.31 | 7.50 | 8.18 | 3.17 | .63 | .375 |
| DHY00970 | BFK 307S | 7/8 ODF | 9.91 | 7.50 | 8.41 | | .75 | |

# System Protectors

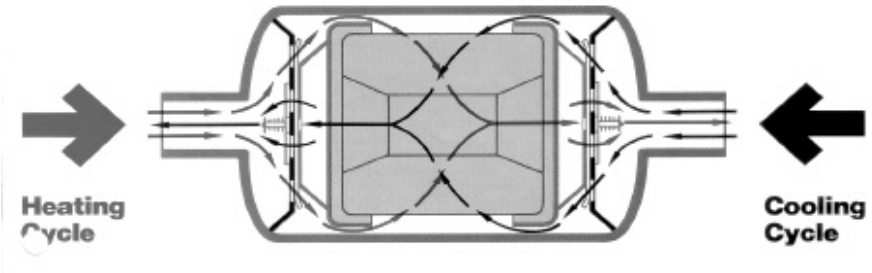
## BFK Internal Construction

- The BFK uses a conventional block style desiccant filter-drier supplemented with a final outlet filter pad and a heavy steel perforated retaining screen
- The valving system and filter is symmetrical end to end
- This construction guarantees that trapped particles are not flushed out when flow through the BFK is reversed or surged, even while the BFK is agitated or rapped
- On actual system tests, BFK's have been submitted to over one million flow cycles with no detrimental effect on the check valves




## BFK Basic Flow Patterns

- Refrigerant always flows from outer surface of block, through block to center core and through final filter pad
- Filtration: Large particles retained on surface of or within the block; smaller particles are retained in outlet filter pads



# System Protectors

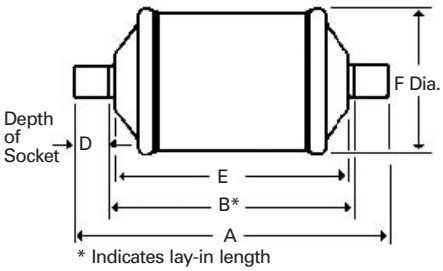
## BOK-HH Liquid Line Burnout Filter-Drier

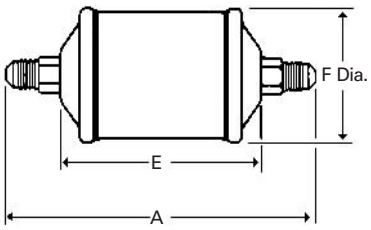
### Application

- Alco's BOK-HH incorporates an HH blended solid core for the effective clean-up of systems following a severe burnout

Note: For sizing, see recommended system tonnage on page 60.

***Dimensional Data***




- Liquid line filter drier for Burnout clean-up and wax removal

### Features

- Designed for maximum effectiveness in the clean-up of systems following a severe burnout
- Corrosion resistant epoxy powder paint finish
- Charcoal blend for soluble contaminant and wax removal
- Solid copper fittings

### Specifications

- Filtration: 40 microns
- Maximum working pressure: 680 psig
- UL file number: SA 3142

### Nomenclature

| BOK | 30 | 5 | S | HH |
|---|---|---|---|---|
| Series | Unit Size (in cu. in.) | Connection Size (in 1/8") | S = ODF connections (omit for SAE) | Charcoal Blend |
| Above example: BOK 305S-HH | | | | |

| ServiceFirst Item # | Part Number | Connection Size | Dimensions A | B | D | E | F[1] | Ship Wt. Llbs. |
|---|---|---|---|---|---|---|---|---|
| DHY00887 | BOK-082-HH | 1/4 SAE | 5 5/8 | — | — | | | |
| DHY00888 | BOK-083-HH | 3/8 SAE | 5 15/16 | — | — | | | |
| DHY00889 | BOK-162-HH | 1/4 SAE | 6 7/16 | — | — | 3 15/16 | 2 15/16 | 1 |
| DHY00890 | BOK-163-HH | 3/8 SAE | 6 3/4 | — | — | | | |
| DHY00891 | BOK-163S-HH | 3/8 ODF | 6 1/8 | 5 1/4 | 7/16 | | | |
| DHY00892 | BOK-164-HH | 1/2 SAE | 6 15/16 | — | — | | | |
| DHY00893 | BOK-164S-HH | 1/2 ODF | 6 3/16 | 5 3/16 | 1/2 | 4 5/8 | 2 7/8 | 2 |
| DHY00894 | BOK-165-HH | 5/8 SAE | 7 7/16 | — | — | | | |
| DHY00895 | BOK-165S-HH | 5/8 ODF | 6 3/8 | 5 1/8 | 5/8 | | | |
| DHY00201 | BOK-303-HH | 3/8 SAE | 9 5/8 | — | — | | | |
| DHY00326 | BOK-303S-HH | 3/8 ODF | | | | | | |
| DHY00898 | BOK-304-HH | 1/2 SAE | 9 7/8 | — | — | | | |
| DHY00810 | BOK-304S-HH | 1/2 ODF | 9 1/8 | 8 1/8 | 1/2 | 7 1/2 | 3 1/16 | 3 3/4 |
| DHY00896 | BOK-305-HH | 5/8 SAE | 10 5/16 | — | — | | | |
| DHY00328 | BOK-305S-HH | 5/8 ODF | 9 5/16 | 8 1/16 | 5/8 | | | |
| DHY00897 | BOK-414-HH | 1/2 SAE | 10 | — | — | | | |
| DHY00207 | BOK-415-HH | 5/8 SAE | 9 1/4 | 8 1/4 | 1/2 | 7 5/8 | 3 11/16 | 4 3/4 |
| DHY00208 | BOK-417S-HH | 7/8 ODF | 10 7/16 | — | — | | | |

[1]Does not include weld bead

# System Protectors


## ALF Liquid Filter

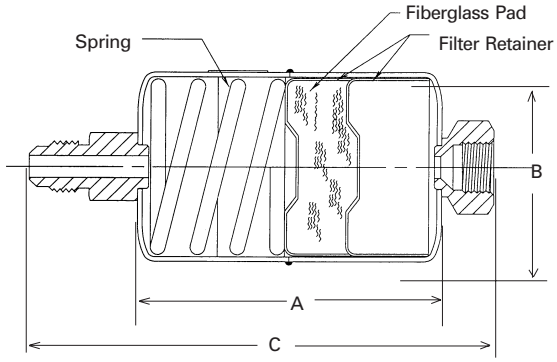
The ALF liquid line refrigerant filter is ideal for protecting solenoid and expansion valve parts from debris.

**Application**
- Liquid Line Filter
- Recovery, recycle and reclaim filter

**Features**
- Filtering media that maximizes removal of finer particles
- Corrosion resistant epoxy powder paint finish

**Specifications**
- Filtration: 40 microns
- Maximum working pressure: 600 psig
- UL file number: SA 3124
- CSA file number: LR 100624
  LR 32462

***Dimensional Data***
***ALF-032-MF Pictured***



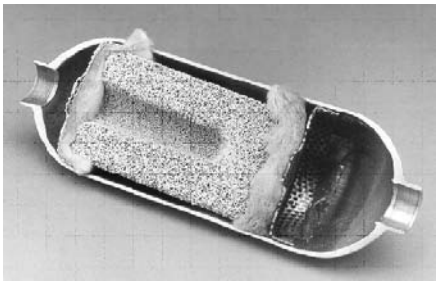

**Nomenclature** Example: ALF 033S

| ALF | 03 | 3 | S |
|---|---|---|---|
| Series | Unit Size | Connection Size | S = ODF Inlet (in 1/8") Connection Style<br>Omit for SAE (Male in-Male Out)<br>MF = Male SAE in female SAE Out<br>FM = Female SAE in - Male SAE Out |

| | | | Dimensions | | |
|---|---|---|---|---|---|
| ServiceFirst Item # | Part Number | Connection Size | A | B[1] | C |
| FLR03843 | ALF-032S | 1/4 ODF | 2 9/16 | 1 5/8 | 3 7/8 |
| FLR03842 | ALF-032MF | 1/4 SAE Male in 1/4 SAE Female out | 2 9/16 | 1 5/8 | 4 |
| FLR03841 | ALF-032FM | 1/4 SAE Female in 1/4 SAE Male out | 2 9/16 | 1 5/8 | 4 |
| FLR03844 | ALF-0323 | 1/4 SAE Male | | | |
| FLR03845 | ALF-033S | 3/8 ODF | 2 9/16 | 1 5/8 | 4 |
| FLR03846 | ALF-034S | 1/2 ODF | 2 9/16 | 1 5/8 | 4 1/8 |

| Recovery, Recycle and Reclaim Refrigerant Flow Capacity (lbs./min. liquid) | | |
|---|---|---|
| R-134a | R-22 | R-404A/R-507 |
| 7.6 | 8.0 | 8.0 |

# System Protectors



## Spun Copper Liquid Line Filter-Drier

### Application

- Large capacity spun copper solid core driers for superior corrosion resistance in ocean going vessels and coastal applications

### Features

- All copper construction
- 100% molecular sieve solid core drier
- Corrosion resistant
- For use with CFC, HCFC and HFC refrigerants

### Specifications

- Maximum Working Pressure: 500 psig
- Filtration: 40 microns
- UL/CUL file number: SA7175

### Nomenclature

| CU | 16 | 3 | S |
|---|---|---|---|
| Series | Unit Size | Connection Size in 1/8″ | ODF |

### *CU Capacity Tables and Ordering Information*

| ServiceFirst Item # | ALCO Description | Connections | Flow Capacity Tons @ 1 psi DP[1,4] (For kW, multiply tons by 3.5) R-12 | R-134a | R-22 | R-407C | R-404A/507 | R-502 | Water Capacity[2] Drops of Water[3] R-12 75°F | R-12 125°F | R-134a 75°F | R-134a 125°F | R-22 75°F | R-22 125°F | R-407C 75°F | R-407C 125°F | R-404A/507 75°F | R-404A/507 125°F | R-502 75°F | R-502 125°F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DHY00939 | CU 08 3 S | 3/8 ODF | 2.9 | 3.5 | 3.8 | 3.7 | 2.5 | 2.5 | 212 | 191 | 205 | 191 | 191 | 177 | 156 | 122 | 212 | 205 | 198 | 177 |
| DHY00957 | CU 08 4 S | 1/2 ODF | 3.5 | 4.2 | 4.6 | 4.5 | 3.1 | 3.0 | | | | | | | | | | | | |
| DHY00940 | CU 16 3 S | 3/8 ODF | 3.3 | 4.0 | 4.3 | 4.2 | 2.9 | 2.8 | 287 | 257 | 277 | 257 | 257 | 237 | 207 | 158 | 287 | 277 | 267 | 237 |
| DHY00958 | CU 16 4 S | 1/2 ODF | 3.9 | 4.7 | 5.1 | 5.0 | 3.4 | 3.3 | | | | | | | | | | | | |

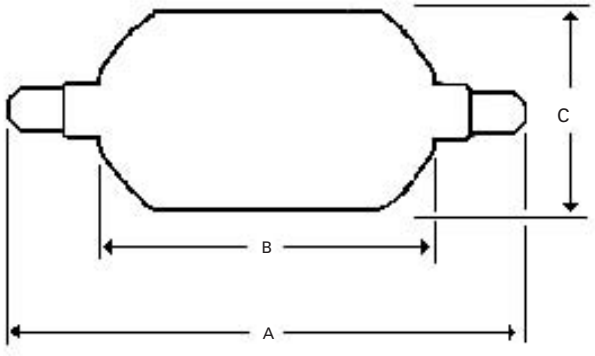
[1] All ratings in accordance with ARI Standard 710-86. 86°F liquid refrigerant temperature
5°F saturated vapor temperature
3.1 lbs./min./ton for R-134a
2.9 lbs./min./ton for R-22 and R-407C
4.0 lbs./min./ton for R-404A/507 and R-12
4.4 lbs./min./ton for R-502

[2] Water Capacities are based on:
Equilibrium Point Dryness (EPD) of:
50 parts per million for R-134a, R404-A/507, R-410A and R-407C
60 parts per million for R-22
15 parts per million for R-12
30 parts per million for R-502

[3] 20 drops of water = 1 gram = 1 cc

[4] For 2 PSI ΔP, Multiply values by 1.4

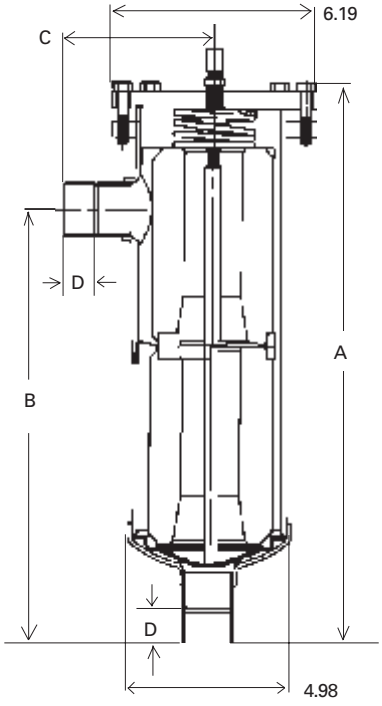
### *Dimensional Data*




| Model | Overall Length A | Lay-In Dimension B | Diameter C |
|---|---|---|---|
| CU 03 | 3 15/16″ | 3 1/4″ | 1 5/8″ |
| CU 05 | 5 3/16″ | 4 1/2″ | 1 5/8″ |
| CU 08 | 6 1/16″ | 5 3/8″ | 2 1/8″ |
| CU 16 | 6 5/8″ | 6″ | 2 1/8″ |

# System Protectors

***Dimensional Data***




STAS models are shipped without filter cores or filter-drier blocks - see Cores Section.

## STAS Steel Liquid and Suction Filter-Drier

### Application

- Replaceable core filter-drier for CFC, HCFC and HFC refrigerants for use in large commercial air conditioning and refrigeration systems

### Features

- Unique internal hardware for hassle-free installation
- Full flow fittings for low pressure drop
- Corrosion resistant epoxy powder paint finish
- Sturdy steel shells for long life durability
- Solid copper fittings
- 100 mesh outlet screen

### Specifications

- Filtration (with block): 40 microns
- Maximum working pressure:
  500 psig T (Liquid Line)
  400 psig SV (Suction Line)
- UL file number: SA 3124
- CSA file number: LR 100624
  LR 32462
- Bolt torque: 25 foot-lbs

### Options

See Cores Section.

**Nomenclature** Example: STAS 489T

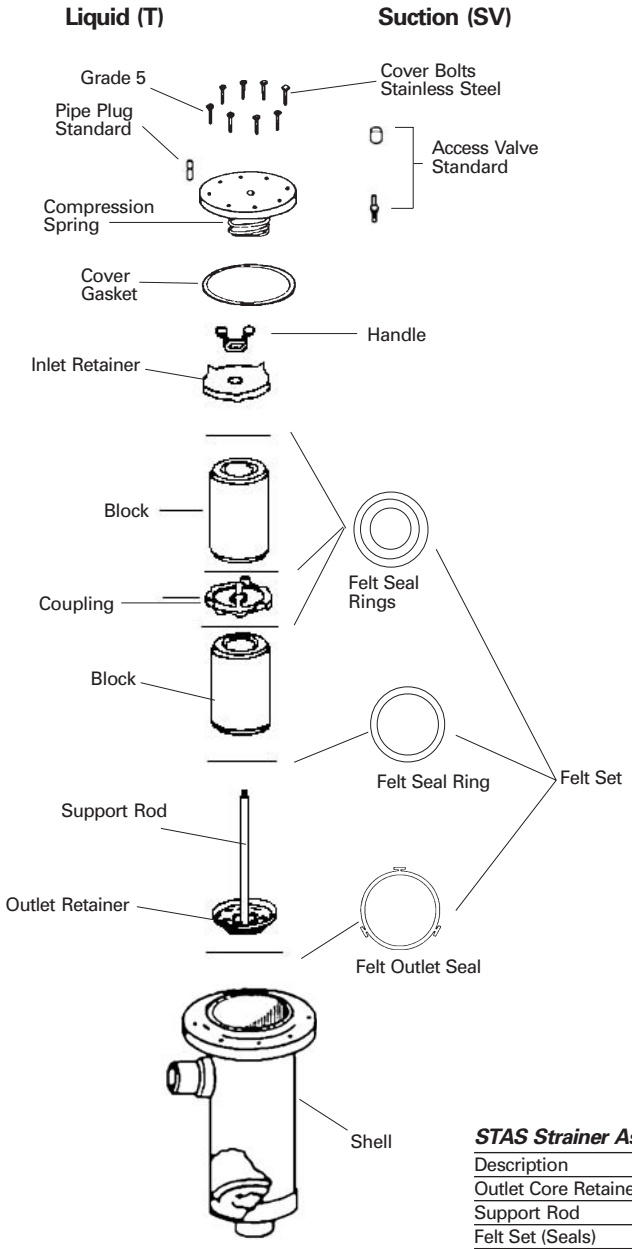
| STAS | 48 | 9 | T |
|---|---|---|---|
| System Protector Series | Unit Size (in cu. in.) | Connection Size (in 1/8") | System Service<br>T = Liquid Line Service<br>SV = Suction Line Service |

***Ordering Information for STAS***

| ServiceFirst Item # | Catalog Number | Connection Size & Type | Number of Blocks | Desiccant Volume Cu. In. | Dimensions A | B | C | D |
|---|---|---|---|---|---|---|---|---|
| DHY00110 | STAS-485T | 5/8 ODF | | | 9 15/32 | 6 | 3 25/32 | 5/8 |
| DHY00111 | STAS-487T | 7/8 ODF | | | 9 11/16 | 6 1/4 | 3 3/4 | 25/32 |
| DHY00112 | STAS-489T | 1 1/8 ODF | | | 9 3/4 | 6 5/16 | 3 27/32 | 15/16 |
| DHY00343 | STAS-489SV | 1 1/8 ODF | | | | | | |
| DHY00113 | STAS-4811T | 1 3/8 ODF | 1 | 48 | 9 27/32 | 6 7/16 | 3 31/32 | 15/16 |
| DHY00345 | STAS-4813SV* | 1 5/8 ODF | | | 9 7/8 | 6 1/2 | 4 1/32 | 1 1/8 |
| DHY00114 | STAS-4813T | 1 5/8 ODF | | | | | | |
| DHY00339 | STAS-4817SV* | 2 1/8 ODF | | | 10 1/16 | 6 9/16 | 4 9/16 | 1 11/32 |
| DHY00340 | STAS-4821SV* | 2 5/8 ODF | | | 10 7/16 | 7 1/32 | 4 3/4 | 1 1/2 |
| DHY00115 | STAS-967T | 7/8 ODF | | | 15 3/16 | 11 23/32 | 3 3/4 | 25/32 |
| DHY00116 | STAS-969T | 1 1/8 ODF | | | 15 7/32 | 11 25/32 | 3 27/32 | 15/16 |
| DHY00117 | STAS-9611T | 1 3/8 ODF | | | 15 5/16 | 11 29/32 | 3 31/32 | 1 1/32 |
| DHY00118 | STAS-9613T | 1 5/8 ODF | | | 15 3/8 | 11 31/32 | 4 1/32 | 1 1/8 |
| DHY00346 | STAS-9617SV* | 2 1/8 ODF | 2 | 96 | 15 9/16 | 12 1/32 | 4 9/16 | 1 11/32 |
| DHY00119 | STAS-9617T | 2 1/8 ODF | | | | | | |
| DHY00341 | STAS-9621SV* | 2 5/8 ODF | | | 15 15/16 | 12 1/2 | 4 3/4 | 1 1/2 |
| DHY00342 | A-TD-9625SV* | 3 1/8 ODF | | | 15 11/16 | 10 5/16 | 4 5/8 | 1 3/4 |
| DHY00120 | STAS-1449T | 1 1/8 ODF | | | 21 1/4 | 17 3/8 | 3 27/32 | 15/16 |
| DHY00121 | STAS-14411T | 1 3/8 ODF | | | 21 11/32 | 17 17/32 | 3 31/32 | 1 1/32 |
| DHY00122 | STAS-14413T | 1 5/8 ODF | 3 | 144 | 21 3/8 | 17 19/32 | 4 1/32 | 1 1/8 |
| DHY00123 | STAS-14417T | 2 1/8 ODF | | | 21 9/16 | 17 5/8 | 4 9/16 | 1 11/32 |
| DHY00124 | STAS-19211T | 1 3/8 ODF | | | 26 29/32 | 23 | 3 31/32 | 1 1/32 |
| DHY00125 | STAS-19213T | 1 5/8 ODF | 4 | 192 | 26 15/16 | 23 1/6 | 4 1/32 | 1 1/8 |
| DHY00126 | STAS-19217T | 2 1/8 ODF | | | 27 1/8 | 23 1/8 | 4 9/16 | 1 11/32 |

NOTE: "T" style can be used for suction by removing pipe plug and installing KIT09565 (X-11562-2).
* "SV" style include stainless steel bolts and access valve.

# System Protectors




**STAS Internals**

## Replacement Parts For STAS

| Flange Cover Assembly | Part Number | ServiceFirst Item # |
|---|---|---|
| All STAS driers - include flange cover, compression spring and pipe plug | X12176-3 | KIT05023 |

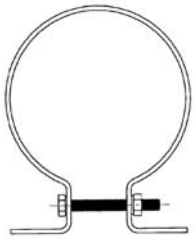
***STAS Strainer Assembly***

| | | |
|---|---|---|
| STAS-48 | X27458-1 | KIT05019 |
| STAS-96 | X27458-2 | KIT05020 |
| STAS-144 | X27458-3 | KIT05021 |
| STAS-192 | X27458-4 | KIT05022 |

*See STAS Strainer Assembly Breakdown below.

***Miscellaneous Parts***

| | | |
|---|---|---|
| Cover Bolts (Stainless Steel-Suction Line Service) | X25787-7 | KIT05018 |
| Cover Gasket (Includes Felt Set) | X11983-1 | KIT04993 |
| Handle | 26446-1 | KIT04999 |
| Inlet Retainer | 26447-1 | KIT05000 |
| Spring | 26439-1 | KIT04998 |



Mounting Bracket for STAS 48*

*More than one mounting bracket may be required for shell sizes 96 and above.

See Cores Section for blocks and core information.

***STAS Strainer Assembly Breakdown***

| Description | STAS-48 | STAS-96 | STAS-144 | STAS-96 |
|---|---|---|---|---|
| Outlet Core Retainer | 1 | 1 | 1 | 1 |
| Support Rod | 1 | 1 | 1 | 1 |
| Felt Set (Seals) | 1 | 1 | 1 | 1 |
| Screen Retainer | 1 | 1 | 1 | 1 |
| Screen | 1 | 1 | 1 | 1 |
| Felt Pad (for end of cores) | 2 | 4 | 6 | 8 |
| Core to Core Coupling | 0 | 1 | 2 | 3 |
| Inlet Core Retainer | 1 | 1 | 1 | 1 |
| Tightening Handle | 1 | 1 | 1 | 1 |

# System Protectors

## ADKS Liquid and Suction Line Filter-Drier

### Application
- Replaceable core filter-drier for CFC, HCFC and HFC refrigerants for very large commercial air conditioning and refrigeration systems

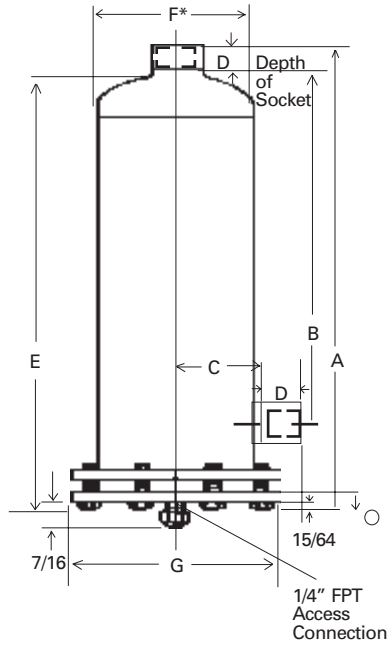
### Features
- Full flow fittings for low pressure drop
- Corrosion resistant epoxy powder paint finish
- Sturdy steel shells for long life durability

### Specifications
- Maximum working pressure: 500 psig
- UL file number: SA 3124
- CSA file number: LR 100624
- Filtration (with block) 40 micron
- Bolt torque: 25 ft., lb.

### Options
See Cores Section for Blocks and Filters.

Note: For sizing, see recommended system tonnage on page 60.

***Dimensional Data***




**Nomenclature** Example: ADKS 30013T

| ADKS | 300 | 13 | T |
|---|---|---|---|
| System Protector Series | Unit Size (in cu. in.) | Connection Size (in 1/8") | T = Tap Access Connection |

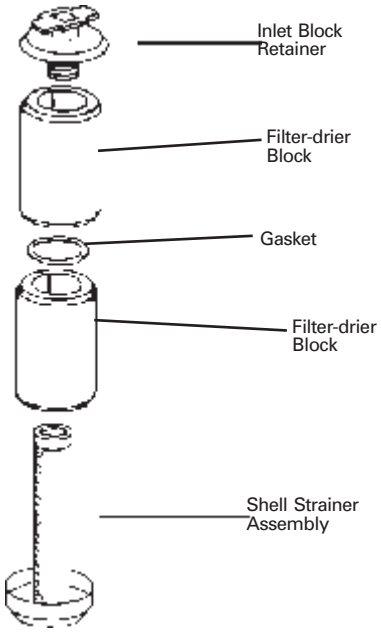
***Ordering Information for ADKS***

| ServiceFirst Item # | Catalog Number | Connections Size & Type | Dimensions A | B | C | D | E | F* | G | H [1] | Ship Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DHY00127 | ADKS-30013T | 1 5/8 ODF | 25 1/2 | 19 15/32 | 4 3/16 | 1 1/8 | 23 3/16 | 6 | 7 9/16 | 22 1/4 | 39 |
| DHY00128 | ADKS-30017T | 2 1/8 ODF | 25 19/32 | 1 9 | 3 25/32 | 1 22/32 | | | | | |
| DHY00129 | ADKS-40017T | 2 1/8 ODF | 32 3/32 | 25 1/2 | 3 25/32 | 1 21/32 | 29 31/32 | | | 28 7/8 | 46 |
| DHY00130 | ADKS-40021T | 2 5/8 ODF | 33 1/8 | 26 23/32 | 4 13/16 | 1 15/32 | | | | | |

* Does not include weld bead
[1] "H" Dimension is the clearance required to change the internal hardware assembly
T = 1/4" FPT access connection

See Cores Section for Blocks and Filters.

# System Protectors




**ADKS Internals**

***Replacement Parts For ADKS***

| Flange Cover | Part Number | ServiceFirst Item # |
|---|---|---|
| ADKS-300, ADKS-400 | X12176-2 | KIT05023 |

| Shell Strainer Assembly | Part Number | ServiceFirst Item # |
|---|---|---|
| ADKS-300 | X10574-5 | KIT05010 |
| ADKS-400 | X10574-6 | KIT05011 |

ADKS models are shipped without filter cores or filter-drier blocks.

See Cores Section for Blocks and Filters.

# System Protectors

## Blocks and Filter Cores

### Application
- Universal replacement cores for use in Alco and all other take-apart type filter-drier shells

### Features
- Water capacities to suit specific system conditions
- Exceptional acid capacities for normal system protection, or to effectively clean-up following a compressor burnout
- Wax removal capabilities for complete clean-up following a compressor burnout (W Series)

### Specifications
- Interchangeable with competitive products

**Note: Blocks are suitable for use with R-11 but filters are not suitable.**

### Nomenclature

| H | 48 |
|---|---|
| Series | Cubic Inch |

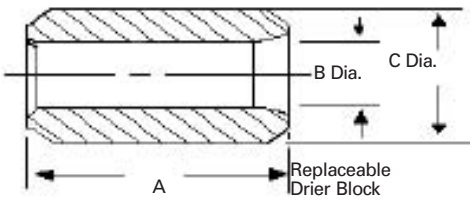
***Ordering Information and Capacity Tables***

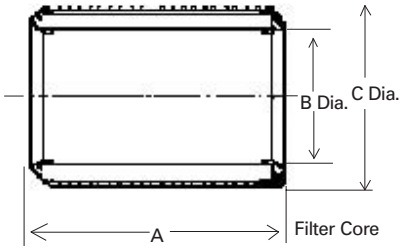
| ServiceFirst Item # | ALCO Description | Recommended Refrigerant Type | Function | Water Capacity [1] Drops Of Water [2] R-12 75 F | R-12 125 F | R-134a 75 F | R-134a 125 F | R-22 75 F | R-22 125 F | R-407C 75 F | R-407C 125 F | R-404A/507 75 F | R-404A/507 125 F | R-502 75 F | R-502 125 F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COR00096 | D-42 | CFC, HCFC | High Acid Removal | 782 | 515 | 493 | 384 | 432 | 303 | 320 | 196 | 528 | 378 | 473 | 339 |
| COR00052 | H-42 | CFC,HCFC | High Acid And Water Removal | 933 | 681 | 686 | 576 | 617 | 491 | 478 | 333 | 724 | 587 | 656 | 519 |
| COR00018 | D-48 | CFC, HCFC | High Acid Removal | 810 | 453 | 415 | 340 | 363 | 254 | 225 | 95 | 457 | 343 | 388 | 225 |
| COR00019 | H-48 | CFC, HCFC | High Acid And Water Removal | 1020 | 688 | 676 | 538 | 597 | 436 | 445 | 285 | 721 | 535 | 643 | 475 |
| COR00020 | W-48-HH | CFC, HCFC, HFC | Burnout Cleanup | 772 | 488 | 387 | 294 | 335 | 226 | 290 | 165 | 417 | 289 | 444 | 306 |
| COR00057 | UK-48 | CFC, HCFC, HFC | Universal Replacement | 1579 | 1319 | 1272 | 1168 | 1181 | 1072 | 1033 | 786 | 1319 | 1241 | 1332 | 1150 |
| COR00021 | H-100 | CFC, HCFC | High Acid And Water Removal | 1958 | 1225 | 1112 | 834 | 962 | 673 | 726 | 418 | 1199 | 839 | 1109 | 758 |
| COR00022 | W-100-HH | CFC, HCFC, HFC | Burnout Cleanup | 1668 | 1054 | 1077 | 812 | 938 | 621 | 629 | 363 | 1162 | 792 | 960 | 663 |
| COR00067 | F-48R | CFC, HCFC, HFC | Filter (Suction Only) | — | — | — | — | — | — | — | — | — | — | — | — |
| KIT07667 | F-100 | CFC, HCFC, HFC | Filter (Suction Only) | — | — | — | — | — | — | — | — | — | — | — | — |
| COR00049 | RH-48 | CFC, HCFC | High Water | 1020 | 688 | 676 | 538 | 597 | 436 | 445 | 285 | 721 | 535 | 643 | 475 |

[1] Water Capacities are based on:
Equilibrium Point Dryness (EPD) of:
50 parts per million for R-134a, R404-A/507 and R-407C
60 parts per million for R-22
15 parts per million for R-12
30 parts per million for R-502

[2] 20 drops of water = 1 gram = 1 cc

***Dimensional Data***

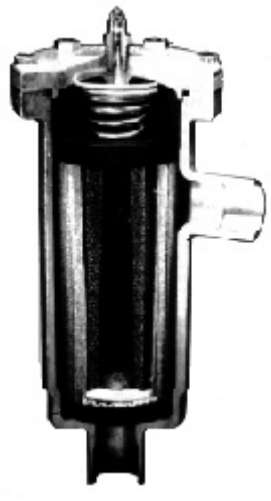



| Filter-drier Block Size | Dimensions A | B | C | Ship Wt. Lbs. |
|---|---|---|---|---|
| 42 | 6 | 1.58 | 3.12 | 1 |
| 48 | 5.5 | 1.77 | 3.72 | 1 1/2 |
| 100 | 6.5 | 2.06 | 4.81 | 4 |

| Catalog Number | Dimensions A | B | C | Ship Wt. Lbs. |
|---|---|---|---|---|
| F-48/F-48R | 5 1/2 | 2 13/16 | 3 7/8 | 3/4 |
| F-100 | 6 1/2 | 3 3/4 | 4 13/16 | 1 1/2 |

# System Protectors



## BTAS Brass Take-Apart Suction Line Filter-Drier

### Application
- Replaceable core filter-drier for suction line service is ideal for commercial refrigeration applications

### Features
- Full flow fittings for low pressure drop
- Corrosion resistant brass body with stainless steel bolts
- Special cartridge design exclusive to brass shell

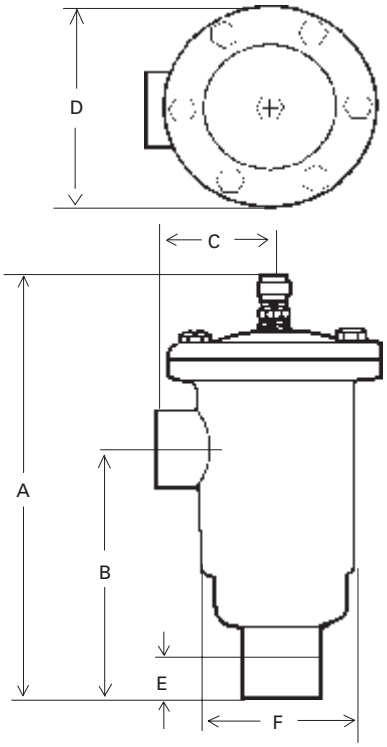
### Specifications
- Filtration (with cartridge) 40 microns
- Maximum working pressure: 400 psig
- UL file number: SA 3124

### Options
- Flexibility of using either filter-driers or filter cartridges

**Nomenclature** Example: BTAS 311SV

| BTAS | 3 | 11 | SV |
|---|---|---|---|
| System Protector Series | Unit Size | Connection Size (in 1/8″) | Suction Line Service |

***Dimensional Data***




***Ordering Information for BTAS***

| ServiceFirst Item # | Catalog Number | Connection Size | Nominal Shell Size | Dimensions A | B | C | D | E | F | Ship Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| DHY00245 | BTAS-39 S-V | 1 1/8 ODF | 3″ | 10 5/16 | 6 13/16 | 3 5/16 | 4 5/8 | .910 | 3 15/32 | 10 1/4 |
| DHY00246 | BTAS-311 S-V | 1 3/8 ODF | 3″ | 11 1/16 | 6 15/16 | 3 7/16 | 4 5/8 | .970 | 3 15/32 | 10 1/2 |
| DHY00366 | BTAS-313 S-V | 1 5/8 ODF | 3″ | 11 1/4 | 7 1/8 | 3 5/8 | 4 5/8 | 1.090 | 3 15/32 | 11 |
| DHY00367 | BTAS-317 S-V | 2 1/8 ODF | 3″ | 11 1/2 | 7 3/8 | 3 7/8 | 4 5/8 | 1.340 | 3 15/32 | 11 1/2 |
| DHY01251 | BTAS-411 S-V | 1 3/8 ODF | 4" | 11 13/32 | 7 13/16 | 4 1/8 | 5 3/4 | .780 | 4 15/32 | 16 1/2 |
| DHY00247 | BTAS-413 S-V | 1 5/8 ODF | 4″ | 12 1/32 | 7 13/16 | 4 1/8 | 5 3/4 | 1.090 | 4 15/32 | 16 3/4 |
| DHY00248 | BTAS-417 S-V | 2 1/8 ODF | 4″ | 12 9/32 | 8 1/16 | 4 3/8 | 5 3/4 | 1.340 | 4 15/32 | 17 1/2 |
| DHY00368 | BTAS-421 S-V | 2 5/8 ODF | 4″ | 12 13/32 | 8 3/16 | 4 15/16 | 5 3/4 | 1.470 | 4 15/32 | 18 |
| DHY00369 | BTAS-517 S-V | 2 1/8 ODF | 5″ | 13 7/16 | 8 13/32 | 4 3/16 | 7 3/32 | 1.340 | 5 9/16 | 28 3/4 |
| DHY00249 | BTAS-521 S-V | 2 5/8 ODF | 5″ | 13 9/16 | 8 15/32 | 4 15/16 | 7 3/32 | 1.470 | 5 9/16 | 29 |
| DHY00250 | BTAS-525 S-V | 3 1/8 ODF | 5″ | 13 1/4 | 8 5/32 | 4 5/8 | 7 3/32 | 1.660 | 5 9/16 | 29 1/4 |

***Type A-F Replaceable Filter Cartridges***

| ServiceFirst Item # | Filter Core | For Shell No. | Core O.d. | Core Length | Filter Area Sq. In. | Weight Lb. |
|---|---|---|---|---|---|---|
| COR00107 | A2F | BTAS-2 | 1 29/32″ | 6 3/8″ | 66 | 1/3 |
| COR00063 | A3F | BTAS-3 | 2 3/4 | 6 7/8 | 115 | 1/2 |
| COR00064 | A4F | BTAS-4 | 3 3/4 | 7 1/2 | 189 | 7/8 |
| COR00065 | A5F | BTAS-5 | 4 5/16 | 8 1/2 | 270 | 1 |

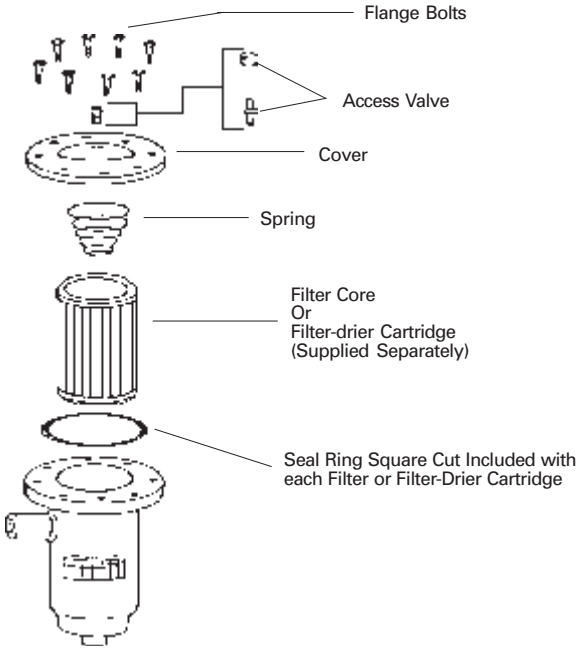
***Type A-F-D Replaceable Filter-Drier Cartridges***

| ServiceFirst Item # | Filter-drier Cartridge | For Shell No. | Cartridge O.D. | Desiccant Cartridge Length | Volume Cu. In. | Weight Lb. |
|---|---|---|---|---|---|---|
| COR00108 | A2F-D | BTAS-2 | 1 29/32″ | 6 3/8″ | 4.2 | 1/2 |
| COR00043 | A3F-D | BTAS-3 | 2 3/4 | 6 7/8 | 13.3 | 7/8 |
| COR00044 | A4F-D | BTAS-4 | 3 3/4 | 7 1/2 | 26.0 | 1 1/2 |
| COR00045 | A5F-D | BTAS-5 | 4 5/16 | 8 1/2 | 36.5 | 2 |

# System Protectors

***Replacement Parts For BTAS***

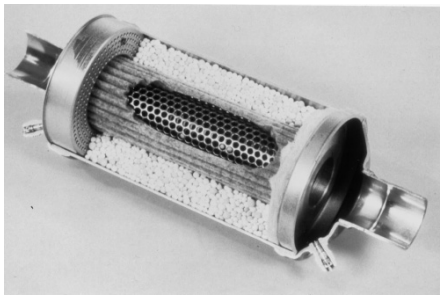
| Miscellaneous Parts | Part Number | ServiceFirst Item # |
|---|---|---|
| Seal Ring BTAS-2 | PS23380-2 | KIT05002 |
| Seal Ring BTAS-3 | PS23380-3 | KIT05003 |
| Seal Ring BTAS-4 | PS23380-4 | KIT05004 |
| Seal Ring BTAS-5 | PS23380-5 | KIT05005 |




**BTAS Internals**

**BTAS models are shipped without filter cartridge or filter-drier cartridge.**
See Cores Section for core information.

# System Protectors



## ASD Premium Suction Line Filter-drier

### Application

- Alco's ASD is a premium suction line filter-drier that incorporates beaded desiccant plus a filter
- Premium suction line filter drier for moisture, acid and contaminant removal
- For use with CFC, HCFC and HFC refrigerants

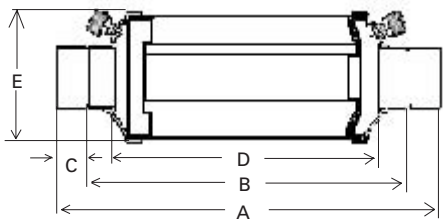
### Features

- Premium filtration
- Dual access valves
- Solid copper fittings
- Corrosion resistant epoxy powder paint finish

### Specifications

- Filtration: 40 microns
- Maximum working pressure: 500 psig
- UL file number: SA 3124
- CSA file number: LR 100624
  LR 32462

***Dimensional Data***




### Nomenclature/Selection

| ASD | 35 | S | 5 | VV |
|---|---|---|---|---|
| Series | Unit Size (in cu. in.) | S = ODF connections F = SAE | Connection Size (in 1/8") | Dual Access Valves |
| Above example: ASD 35S5VV | | | | |

***Ordering Information for ASD***

| ServiceFirst Item # | Catalog Number | Connection Size | Dimensions | | | | | Ship Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E 1 | |
| DHY00174 | ASD 28S3-VV | 3/8 ODF | 5 19/32 | 4 23/32 | 7/16 | 4 1/8 | 3 11/16 | 2 |
| DHY00361 | ADS28F3-VV | 3/8 SAE | | | | | | |
| DHY00175 | ASD 28S4-VV | 1/2 ODF | 5 11/16 | 4 11/16 | 1/2 | 4 1/8 | 3 11/16 | 2 |
| DHY00176 | ASD 35F5-VV | 5/8 SAE | 7 9/16 | — | — | 4 3/4 | 3 11/16 | 2 1/2 |
| DHY00177 | ASD 35S5-VV | 5/8 ODF | 6 17/32 | 5 9/32 | 5/8 | 4 3/4 | 3 11/16 | 2 1/2 |
| DHY00178 | ASD 45S6-VV | 3/4 ODF | 7 3/4 | 6 1/2 | 5/8 | 5 9/16 | 3 11/16 | 3 |
| DHY00179 | ASD 45S7-VV | 7/8 ODF | 7 15/16 | 6 7/16 | 3/4 | 5 9/16 | 3 11/16 | 3 |
| DHY00180 | ASD 50S9-VV | 1 1/8 ODF | 8 27/32 | 7 1/32 | 29/32 | 6 1/8 | 3 11/16 | 3 1/2 |
| DHY00181 | ASD 75S11-VV | 1 3/8 ODF | 12 1/4 | 10 5/16 | 31/32 | 8 1/4 | 3 11/16 | 5 |
| DHY00182 | ASD 75S13-VV | 1 5/8 ODF | 12 5/32 | 9 29/32 | 1 1/8 | 8 1/4 | 3 11/16 | 5 |

# System Protectors

## SFD Suction Line Filter-Drier

### Application

- Alco's standard compacted bead suction filter-drier for use after a burnout or when major work has been performed
- Suction line filter drier for moisture, acid and contaminant removal
- For use with CFC, HCFC and HFC refrigerants

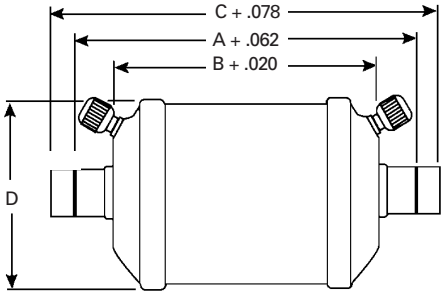
### Features

- Solid copper fittings
- Dual access valves
- Corrosion resistant epoxy powder paint finish

### Specifications

- Filtration: 40 microns
- Maximum working pressure: 400 psig
- UL file number: SA 3124
- CSA file number: LR 100624
  LR 32462

***Dimensional Data***




**Nomenclature** Example: SFD 13S5-VV

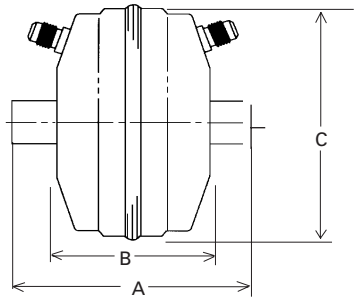
| SFD | 13 | S | 5 | VV |
|---|---|---|---|---|
| Series | Unit Size (in cu. in.) | S= ODF Connections F = SAE | Connection Size (in 1/8") | Dual Access Valves |

***Ordering Information for SFD***

| ServiceFirst Item # | Catalog Number | Connection Size | Dimensions A | B | C | D | Shipping Weight Lbs. |
|---|---|---|---|---|---|---|---|
| DHY01267 | SFD 08S5-VV | 5/8 ODF | 3 29/32 | 3 3/8 | 5/32 | 3 1/8 | 2 |
| DHY00284 | SFD 13F3-VV | 3/8 SAE | — | 3 3/8 | 5 1/2 | 3 11/16 | 2 |
| DHY00235 | SFD 13S3-VV | 3/8 ODF | 3 31/32 | 3 3/8 | 4 27/32 | 3 11/16 | 2 |
| DHY00236 | SFD 13S4-VV | 1/2 ODF | 3 15/16 | 3 3/8 | 4 15/16 | 3 11/16 | 2 |
| DHY00237 | SFD 13S5-VV | 5/8 ODF | 3 29/32 | 3 3/8 | 5 5/32 | 3 11/16 | 2 |
| DHY00238 | SFD 13S6-VV | 3/4 ODF | 4 | 3 3/8 | 5 1/4 | 3 11/16 | 2 |
| DHY00239 | SFD 13S7-VV | 7/8 ODF | 4 1/4 | 3 3/8 | 5 3/4 | 3 11/16 | 2 |
| DHY00240 | SFD 27S7-VV | 7/8 ODF | 6 | 5 1/8 | 7 1/2 | 3 11/16 | 3 |
| DHY00241 | SFD 27S9-VV | 1 1/8 ODF | 5 13/16 | 5 1/8 | 7 5/8 | 3 11/16 | 3 |
| DHY00242 | SFD 54S11-VV | 1 3/8 ODF | 10 5/16 | 8 1/4 | 12 1/4 | 3 11/16 | 4 1/2 |
| DHY00243 | SFD 54S13-VV | 1 5/8 ODF | 9 29/32 | 8 1/4 | 12 5/32 | 3 11/16 | 4 1/2 |

# System Protectors

***Dimensional Data***




## CSFD Compact Suction Line Filter-Drier

### Application

- The CSFD has a compact 14 cubic inch, solid block desiccant core, design that is perfect for short lay-ins
- Compact suction line filter drier for moisture, acid and contaminant removal
- For use with CFC, HCFC and HFC refrigerants

### Features

- Dual access valves
- High acid removal
- Solid copper fittings
- Corrosion resistant epoxy powder paint finish

### Specifications

- Maximum working pressure: 500 psig**
- UL file number: SA 3124
- CSA file number: LR 100624
- Filtration: 40 micron

**Nomenclature** Example: CSFD 14S4- VV

| CSFD | 14 | S | 4 | VV |
|---|---|---|---|---|
| Series | Unit Size | S = ODF Connection | Connection Size (in 1/8") | Dual Access Valves |

| ServiceFirst Item # | Model | Connection Type (in) | Dimensions (in) A | B | C |
|---|---|---|---|---|---|
| DHY00811 | CSFD-14S4-VV | 1/2 SOLDER | 4 1/4 | 2 3/4 | 4 5/8 |
| DHY00812 | CSFD-14S5-VV | 5/8 SOLDER | 4 1/2 | 2 3/4 | 4 5/8 |
| DHY00813 | CSFD-14S6-VV | 3/4 SOLDER | 4 3/8 | 2 3/4 | 4 5/8 |
| DHY00814 | CSFD-14S7-VV | 7/8 SOLDER | 4 9/16 | 2 3/4 | 4 5/8 |
| DHY00815 | CSFD-14S9-VV** | 1 1/8 SOLDER | 4 7/8 | 2 3/4 | 4 5/8 |

**400 Maximum Working Pressure

# System Protectors

## ASK-HH Suction Line Filter-Drier

### Application

- Alco's ASK utilizes a solid core with an HH blend to maximize acid, moisture and wax removal
- Suction line filter drier for moisture, acid and contaminant removal
- For use with CFC, HCFC and HFC refrigerants

### Features

- Dual access valves
- Corrosion resistant epoxy powder paint finish
- Charcoal blend for soluble contaminant and wax removal
- Solid copper fittings

### Specifications

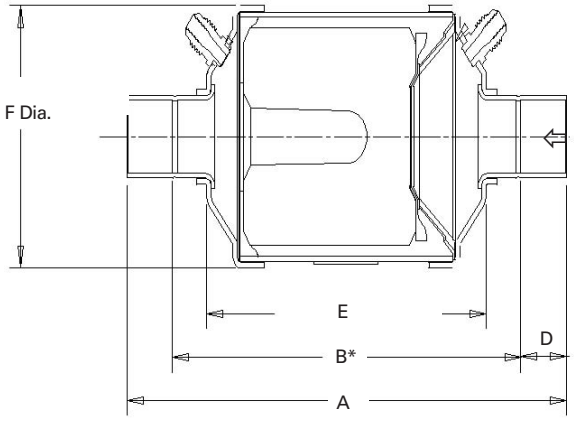
- Maximum working pressure: 500 psi
- UL file number: SA 3124
- CSA file number: LR 100624
  LR 32462
- Filtration: 40 micron

**Nomenclature** Example: ASK 165S-V-HH

| ASK | 16 | 5 | S | VV | HH |
|---|---|---|---|---|---|
| Series | Unit Size (in cu. in.) | Connection Size (in 1/8") | S = ODF connection | Dual Access Valves | Charcoal Blend |

| ServiceFirst Item # | Catalog Number | Connection Size & Style | Dimensions A | B | D | E | F 1 | Ship Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|
| DHY00905 | ASK 165S-VV-HH | 5/8 ODF | 6 3/8 | 5 1/8 | 5/8 | 4 5/8 | 3 9/64 | 2 |
| DHY00806 | ASK 166S-VV-HH | 3/4 ODF | 6 3/4 | 5 1/2 | 3/8 | 4 5/8 | 3 9/64 | 2 |
| DHY00807 | ASK 167S-VV-HH | 7/8 ODF | 6 15/16 | 5 7/16 | 3/4 | 4 5/8 | 3 9/64 | 2 |
| DHY00972 | ASK 306S-VV-HH | 3/4 ODF | 9 11/16 | 8 9/16 | 5/8 | 7 1/2 | 3 9/64 | 3 3/4 |
| DHY00973 | ASK-307S-VV-HH | 7/8 ODF | 9 7/8 | 8 3/8 | 3/4 | 7 1/2 | 3 9/64 | 3 3/4 |
| DHY00808 | ASK 309S-VV-HH | 1 1/8 ODF | 10 3/16 | 8 3/8 | 15/16 | 7 1/2 | 3 9/64 | 3 3/4 |

***Dimensional Data***




*B Indicates lay-in length

# System Protectors

## ASF Suction Line Filter

### Application
- Alco's ASF line filters are specifically designed to protect the compressor from dirt and all solid contaminants
- Suction line filter for removing solid contaminants

### Features
- Dual access valves
- Solid copper fittings
- Corrosion resistant epoxy powder paint finish

### Specifications
- Maximum working pressure: 500 psi
- UL file number: SA 3124
- CSA file number: LR 100624
  LR 32462
- Filtration: 40 microns

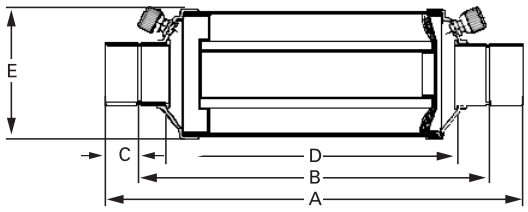
**Nomenclature** Example: ASF 35S5-VV

| ASF | 3 5 | S | 5 | VV |
|---|---|---|---|---|
| Series | Unit Size (in cu. in.) | S = ODF connections F=SAE | Connection Size (in 1/8") | Dual Access Valves |

| ServiceFirst Item # | Model Number | Connection Size & Style | Dimensions A | B | C | D | E[1] | Ship Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|
| FLR05795 | ASF 28S3-VV | 3/8 ODF | 5 19/32 | 4 23/32 | 7/16 | 4 1/8 | 3 11/16 | 2 |
| FLR05796 | ASF 45S7-VV | 7/8 ODF | 7 15/16 | 6 7/16 | 3/4 | 5 9/16 | 3 11/16 | 3 |
| FLR05797 | ASF 50S9-VV | 1 1/8 ODF | 8 27/32 | 7 1/32 | 29/32 | 6 1/8 | 5 | 3 1/2 |
| FLR05987 | ASF 64S17-V | 2 1/8 ODF | 11 3/4 | 91/16 | 1 5/16 | 7 5/8 | 5 | 6 1/2 |
| FLR06378 | ASF 75S11-VV | 1 3/8 ODF | 12 1/4 | 10 5/16 | 3 1/32 | 8 1/4 | 5 | 5 |

[1]Does not include weld bead

***Dimensional Data***



# Hermetic Moisture Indicator


## Type HMI Series

**Application**

- Alco's HMI was designed to provide an accurate method of determining the moisture content of a system's refrigerant.
- Premium Patented 3% High Accuracy Moisture Indicator for CFC, HCFC, and HFC refrigerants including R-410A.Features
- Dual access valves
- Solid copper fittings
- Corrosion resistant epoxy powder paint finish

**Features**

- 100% Hermetic Design
- 3% relative humidity indication compared to 10% paper indicators
- Single indicator for all common refrigerants
- Early moisture detection before acids form
- Accurate color calibration at low ppm levels and higher temperatures
- Wide angle viewing/high visibility window for ease of monitoring
- All brass corrosion resistant body
- Premium indicator withstands heat during brazing
- Solid copper fittings ensure ease of brazing
- Meets Copeland system protection standards
- 680 PSIG Maximum Working Pressure
- UL Approved

***HMI Ordering Information***

| HMI | 1 | MM | 2 |
|---|---|---|---|
| Hermetic Moisture Indicator Series | Design Series 1 = Standard Connection | Connection Style<br>MM = Male Flare x Male Flare<br>FM = Female Flare x Male Flare<br>MU = Male Flare x Female Flare Swivel Nut<br>FU = Female Flare x Female Flare Swivel Nut<br>TT = Sweat x Sweat (OD Female) | Connection Size (in 1/8") |

| ServiceFirst # | Mfg Model # | Series | Connection Size |
|---|---|---|---|
| GLS00878 | HMI-1MM2 | Male Flare x Male Flare | 1/4" |
| GLS00879 | HMI-1MM3 | | 3/8" |
| GLS00880 | HMI-1MM4 | | 1/2" |
| GLS00881 | HMI-1MM5 | | 5/8" |
| GLS00882 | HMI-1FM2 | Female Flare x Male Flare | 1/4" |
| GLS00883 | HMI-1FM3 | | 3/8" |
| GLS00884 | HMI-1FM4 | | 1/2" |
| GLS00885 | HMI-1MU2 | Male Flare x Female Flare Swivel Nut | 1/4" |
| GLS00886 | HMI-1MU3 | | 3/8" |
| GLS00887 | HMI-1MU4 | | 1/2" |
| GLS00888 | HMI-1FU4 | Female Flare x Female Flare Swivel Nut | 1/2" |
| GLS00889 | HMI-1TT2 | Sweat x Sweat (OD Female) | 1/4" |
| GLS00890 | HMI-1TT3 | | 3/8" |
| GLS00891 | HMI-1TT4 | | 1/2" |
| GLS00892 | HMI-1TT5 | | 5/8" |
| GLS00893 | HMI-1TT7 | | 7/8" |
| GLS00894 | HMI-1TT9 | | 1-1/8" |

# System Protectors

## AMI Moisture-Liquid Indicators

### Application

- Alco's AMI was designed to provide an accurate method of determining the moisture content of a system's refrigerant
- Premium Patented 3% High Accuracy Moisture Indicator for CFC, HCFC, and HFC refrigerants including R-410A
- AMI-2 Series for OEM T-Drill applications (through 1 1/8" sizes) - See page 79

### Features

- 3% relative humidity indication compared to 10% paper indicators
- Single indicator for all common refrigerants
- Accurate color calibration at low ppm levels and higher temperatures
- Wide angle viewing/high visibility window for ease of monitoring
- All brass corrosion resistant body
- Solid copper fittings

### Specifications

- 3% relative humidity sensitivity
- Maximum working pressure: 600 psig
- UL file number: SA 4876
- CSA file number: LR 32462

**Nomenclature** Example: AMI 1SS4

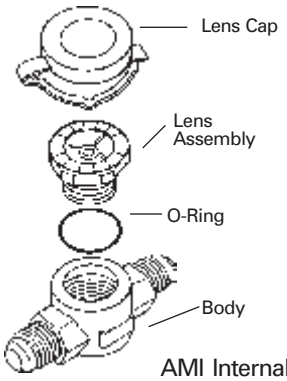
| AMI | 1 | SS | 4 |
|---|---|---|---|
| Moisture Liquid Indicator Series | Design Series 1 = standard connection 2 = bushing style | Connection Style SS - Sweat x Sweat | Connection Size (in 1/8") |

***Ordering Information For AMI***

| ServiceFirst Item # | Catalog Number | Connection Size |
|---|---|---|
| GLS00122 | AMI-1MU5 | 5/8 SAE |
| GLS00125 | AMI-1SS2 | 1/4 SAE |
| GLS00126 | AMI-1SS3 | 3/8 ODF |
| GLS00127 | AMI-1SS4 | 1/2 ODF |
| GLS00128 | AMI-1SS5 | 5/8 ODF |
| GLS00129 | AMI-1SS7 | 7/8 ODF |
| GLS00130 | AMI-1SS9 | 1 1/8 ODF |
| GLS00132 | AMI-1SU3 | 3/8 ODF x 3/8 SAE |
| GLS00133 | AMI-1SU4 | 1/3 ODF x 1/2 SAE |
| GLS00837 | AMI-1TT3 | 3/8 ODF |
| GLS00838 | AMI-1TT4 | 1/2 ODF |
| GLS00839 | AMI-1TT5 | 5/8 ODF |
| GLS00840 | AMI-1TT7 | 7/8 ODF |
| GLS00841 | AMI-1TT9 | 1 1/8 ODF |
| GLS00842 | AMI-1TT11 | 1 3/8 ODF |

***Replacement Parts For AMI***

| ServiceFirst Item # | Part | Number |
|---|---|---|
| KIT04996 | Lens Cap | 12740-1 |
| KIT06235 | "O" Ring | PS1525-2 |
| KIT05013 | Lens Assembly Kit (Consists of lens assembly, lens cap and "O" ring) | X12978-1 |



AMI Internals

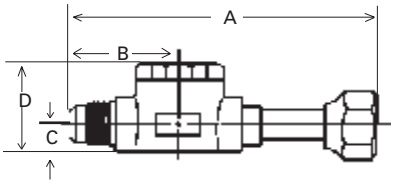
***Moisture Content Color Code (ppm $H_2O$)***

| Indication | Very Dry (Dark Blue) | | | Dry/Caution (Purple) | | | Caution/Wet (Pink) | | | Wet (Salmon) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Liquid Temperature | 75°F | 100°F | 125°F | 75°F | 100°F | 125°F | 75°F | 100°F | 125°F | 75°F | 100°F | 125°F |
| R-12 | 1.4 | 2.5 | 4 | 5 | 9 | 15 | 15 | 27 | 45 | 25 | 43 | 70 |
| R-134A | 20 | 35 | 60 | 35 | 55 | 85 | 90 | 120 | 150 | 130 | 160 | 190 |
| R-22 | 25 | 35 | 50 | 40 | 65 | 90 | 90 | 130 | 185 | 145 | 205 | 290 |
| R-407C | 26 | 40 | 64 | 42 | 68 | 109 | 94 | 144 | 230 | 150 | 230 | 370 |
| R-410A | 30 | 55 | 75 | 50 | 85 | 120 | 110 | 190 | 270 | 165 | 290 | 420 |
| R-404A/507 | 15 | 25 | 45 | 33 | 50 | 80 | 80 | 110 | 140 | 120 | 150 | 180 |
| R-502 | 2.6 | 5 | 8 | 10 | 18 | 30 | 30 | 54 | 90 | 50 | 90 | 150 |

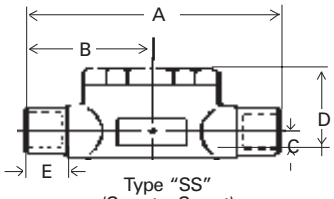
A minimum period of 12 hours is recommended after installation of the Moisture-Liquid Indicator before attempting to accurately determine system moisture content.

# System Protectors

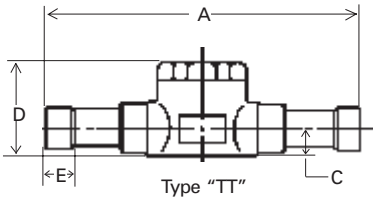
***Dimensional Data***




Type "MU"
(Male Flare x Female Flare Swivel Nut)




Type "SS"
(Sweat x Sweat)




Type "TT"

| Specifications | | | | | | |
|---|---|---|---|---|---|---|
| Type Number | Connection Size | A | B | C | D | E |
| AMI - 1MU5 | 5/8 SAE | 5 3/32 | 1 15/16 | 15/32 | 1 7/16 | |
| AMI - 1SS2 | 1/4 ODF | 2 1/4 | 1 1/8 | 11/32 | 1 3/16 | 5/16 |
| AMI - 1SS3 | 3/8 ODF | 2 1/4 | 1 1/8 | 11/32 | 1 3/16 | 5/16 |
| AMI - 1SS4 | 1/2 ODF | 2 5/8 | 1 5/16 | 15/32 | 1 7/16 | 3/8 |
| AMI - 1SS5 | 5/8 ODF | 2 5/8 | 1 5/16 | 15/32 | 1 7/16 | 1/2 |
| AMI - 1SS7 | 7/8 ODF | 3 1/8 | 1 9/16 | 39/64 | 1 3/4 | 3/4 |
| AMI - 1SS9 | 1 1/8 ODF | 3 3/8 | 1 11/16 | 43/64 | 1 59/64 | 7/8 |
| AMI - 1SU2 | 1/4 ODF x 1/4 SAE | 3 15/32 | 1 1/8 | 11/32 | 1 3/16 | 5/16 |
| AMI - 1SU3 | 3/8 ODF x 3/8 SAE | 3 9/16 | 1 1/8 | 11/32 | 1 3/16 | 5/16 |
| AMI - 1SU4 | 1/2 ODF x 1/2 SAE | 4 3/32 | 1 5/16 | 15/32 | 1 7/16 | 3/8 |
| AMI - 1SU5 | 5/8 ODF x 5/8 SAE | 4 7/32 | 1 5/16 | 15/32 | 1 7/16 | 1/2 |
| AMI - 1TT9 | 1 1/8 ODF | 6 19/64 | | 43/64 | 1 59/64 | 7/8 |

# System Protectors

## ALM Liquid Moisture Indicator

### Application

- Alco's economical hermetic moisture indicator utilizes a 10% relative humidity indicator
- Hermetic Moisture Indicator for CFC, HCFC, and HFC refrigerants

### Features

- Hermetically sealed to eliminate the potential of external leakage
- Color calibrated and easily read
- Solid copper fitting

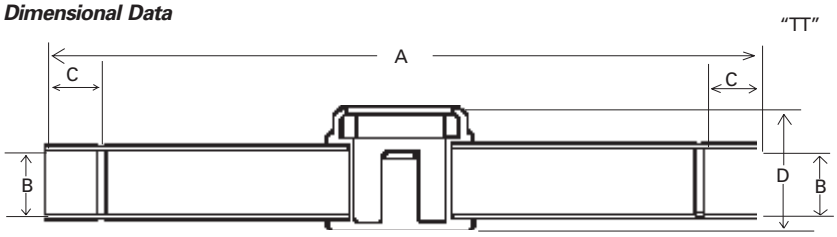
### Specifications

- 10% relative humidity sensitivity
- Maximum working pressure: 500 psig
- UL file number: SA 4876
- CSA file number: LR 32462

**Nomenclature** Example: ALM 1TT4

| ALM | 1 | TT | 4 |
|---|---|---|---|
| Liquid Moisture Indicator Series | Design Series 1 = standard connection | Connection Style TT = ODF extended ends | Connection Sizes (in 1/8") |

***Dimensional Data***




***Ordering Information For ALM***

| ServiceFirst Item # | Type | Connection | A | B | C | D |
|---|---|---|---|---|---|---|
| GLS00183 | ALM 1TT4 | 1/2 x 1/2 ODF | 4 63/64 | 1/2 | 3/8 | 1 1/8 |
| GLS00184 | ALM 1 TT5 | 5/8 x 5/8 ODF | 4 27/32 | 5/8 | 1/2 | 1 1/8 |

***Moisture Content Color Code (ppm $H_2O$)***

| Indication | Dry (Green) | | | Caution | | | Wet (Salmon) | | |
|---|---|---|---|---|---|---|---|---|---|
| Liquid Temperature | 75°F | 100°F | 125°F | 75°F | 100°F | 125°F | 75°F | 100°F | 125°F |
| R-12 | Below 7 | Below 13 | Below 22 | 7-12 | 13-18 | 22-28 | Above 12 | Above 18 | Above 28 |
| R-134A | Below 100 | Below 130 | Below 175 | 100-150 | 130-160 | 175-220 | Above 150 | Above 160 | Above 220 |
| R-22 | Below 100 | Below 140 | Below 175 | 100-150 | 140-200 | 175-220 | Above 150 | Above 200 | Above 220 |
| R-404A/507 | Below 75 | Below 90 | Below 100 | 75-110 | 90-120 | 100-130 | Above 110 | Above 120 | Above 130 |
| R-502 | Below 50 | Below 65 | Below 80 | 50-70 | 65-90 | 80-105 | Above 70 | Above 90 | Above 105 |

# HFC Refrigerants and POE Lubricants

The use of HFC refrigerants and Polyolester (POE) lubricants for air-conditioning and refrigeration have generated new system chemistry related problems. New and redesigned system protectors have been developed to counteract these problems and provide a long, reliable life for the operating refrigeration system.

Moisture is the major problem causing contaminate for HFC/POE oil systems just as it was for CFC and HCFC systems using Mineral oil. Many HFC's can hold much more water than their CFC counterparts but the oil differences are much worse than those of the refrigerant. POE oil can hold as much as 10 times more water than Mineral oils. In addition, evacuation has proven ineffective at removing this moisture so a filter-drier is required to perform this function.

Water poses a new problem for POE oils above and beyond those experienced with Mineral oil. POE oil will react with water to form organic acids at normal operating conditions in refrigerating and air-conditioning systems. This reaction starts at water levels as low as 75 ppm. These acids attack system components including motor insulation and metallic components reducing system life.

To combat the detrimental effects of water in HFC and POE oil systems it is imperative to hold moisture levels as low as possible. It is generally accepted that water level must be maintained less than 50 ppm in the refrigerant and the same for the oil. In order to monitor system water level a moisture indicator must be used that can sense changes in moisture in this ppm range.

Many commercial sightglasses cannot indicate a change at this level in liquid lines that exceed 100°F. This means that harmful organic acids may be attacking system components while the indicator is showing dry. The AMI has a unique element that has the ability to change color at low ppm levels so that proper action can be taken before any system components are damaged.

It was necessary to redesign standard filter-driers for increased water removal capacity to achieve these low moisture levels. However, since no system is entirely devoid of water upon startup some organic acids will be generated

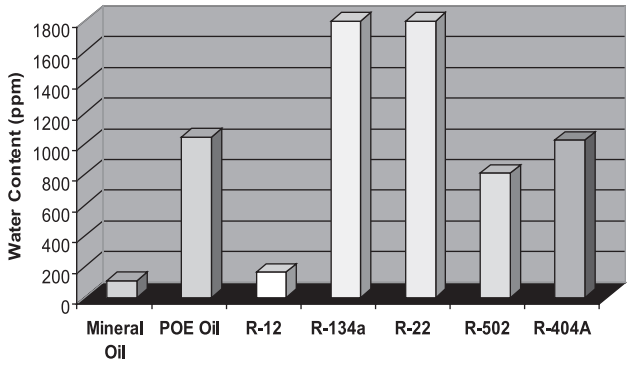



*Figure 1.*

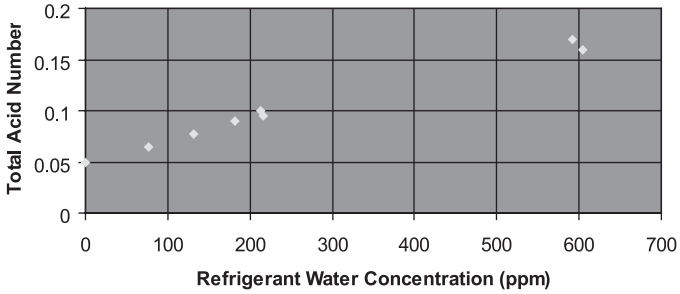



*Figure 2. Acid generation in a 1.5 ton R-134a air-conditioning system*

and must be removed. The desiccant formulation for the EK and UDK series of filter-driers was designed to provide the optimal mix of water capacity and acid capacity to ensure that both harmful contaminates are effectively removed. This desiccant mixture contains both molecular sieve and activated alumina. The molecular sieve is specifically designed to provide maximum drying in today's systems. The activated alumina is ideal for capturing the large organic acids that the molecular sieve cannot.

Another aspect of POE oil is the ability to keep more solid particles in suspension than Mineral oil. This is particularly important in retrofitted systems where pockets of solid contamination are now flushed from low flow areas and need to be removed before moving parts in the system are damaged. The filter-drier for POE oils needs to have increased solid particle holding capacity with minimal impact to refrigerant flow capacity or pressure drop.

The filter-drier should also have improved contaminate removal efficiency as well to ensure that all particles are captured the first time they enter the filter-drier. The ability to remove smaller particles is also advantageous. The EK series filter-driers provide a unique combination of these characteristics to provide outstanding filtration as shown in Figure 3.

The filter-driers for use in HFC and POE oil systems must maintain the system dry and free of any acids that may have been generated. However, since water capacity is of primary importance the filter-drier should contain a higher percentage of molecular sieve than was required for CFC and HCFC systems. But molecular sieve alone is insufficient since it has virtually no organic acid capacity. An organic acid removal desiccant must be used such as activated alumina to ensure low acid levels are maintained. In addition, the filter-drier should also have increased filtration capacity and efficiency. The EK series of filter-driers provides the optimal combination of these properties to ensure the long, trouble-free life of any air-conditioning or refrigeration system.

# HFC Refrigerants and POE Lubricants

The moisture indicating sightglass must also indicate moisture level in the range of less than 50 ppm moisture. Also, it must be able to perform this function at the temperature of the liquid line on which it is placed. Many sightglasses cannot perform this function at all liquid line temperatures. This low level indication ability is necessary to ensure that the system moisture never exceeds the level at which organic acid formation starts. The AMI moisture indicating sightglass provides this low level detection ability.

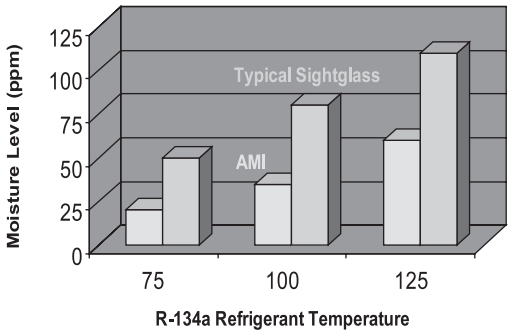



*Figure 3. Dry indication water level*

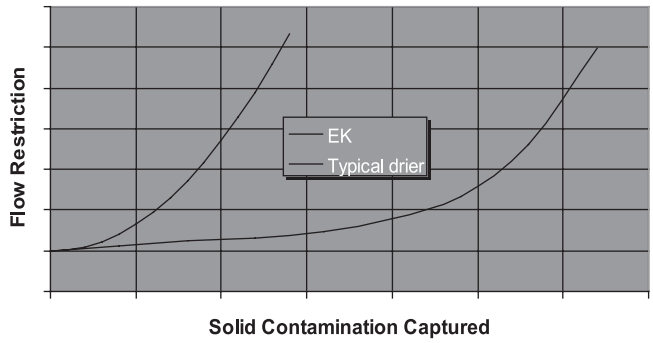



*Figure 4. Filtration capability of filter-driers*

## For use with both Mineral and POE Oils!


## Universal Acid Test Kit

### Application

The Universal Acid Alert Test Kit provides a positive indication of whether the acid level of the refrigeration oil is safe or unsafe.

### Features

- Quick and easy test kit
- Universal acid test kit for use with all refrigeration lubricants
- By changing the percentage of oil sample taken, the acid number of the oil can be accurately determined
- Phase separation of the chemicals in the kit provide a positive color change regardless of the color and condition of the oil

***Ordering Information***

| ServiceFirst Item # | Description |
|---|---|
| KIT06815 | AA Kit Universal |

# Storage Devices

## A-AS Suction Accumulators

### Application

- Alco's A-AS suction line accumulators are available for systems through 28.5 tons nominal capacity
- Suction line accumulator for CFC, HCFC, HFC refrigerants

### Features

- Designed to operate in a range of +40°F to -40°F evaporator temperature
- Fusible plug on larger diameter units
- Solid copper fittings
- Corrosion resistant epoxy powder paint finish
- Inlet deflector that blends refrigerant flow to prevent internal splashing and aid in the collection of refrigerant oil in the bottom connection of the accumulator

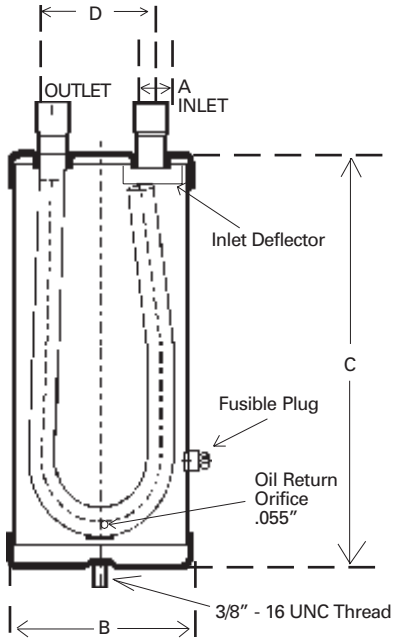
### Specifications

- Maximum working pressure:
  3-4" diameter: 300 psig
  5-6" diameter: 575 psig
- UL file number: SA 7973
- CSA file number: LR 100624
- Fusible Plug 430°F

### Nomenclature

| A | AS | 3 | 12 | 5 |
|---|---|---|---|---|
| Alco | Accumulator Suction | Diameter (in inches) | Height (in inches) | Fitting Size in 1/8" |
| Above Example: A-AS 3 125 | | | | |

***Dimensional Data***




***Ordering Information for A-AS***

| ServiceFirst Item # | Model Number | A Fltting Size Nominal | B Unit Weight (Lbs.) | C Diameter In Inches | D Height In Inches | Fitting Separation (In.) | Tons R-22 (+40°F) | Holding Capacity (Lbs.) 50%Full 40°F LIQUID R22/R134a | Holding Capacity (Lbs.) 50%Full 40°F Liquid R404A/R507 |
|---|---|---|---|---|---|---|---|---|---|
| ACC00120 | A-AS 3 84[1] | 1/2 | 2.0 | 3 | 8 | 1.63 | 2 | 1.5 | 1.5 |
| ACC00121 | A-AS 3 105[1] | 5/8 | 2.4 | 3 | 10 | 1.63 | 3 | 2 | 2 |
| ACC00122 | A-AS 3 125[1] | 5/8 | 2.9 | 3 | 12 | 1.63 | 3 | 3 | 2.5 |
| ACC00123 | A-AS 3 126[1] | 3/4 | 2.9 | 3 | 12 | 1.63 | 4 | 3 | 2.5 |
| ACC00124 | A-AS 3 145[1] | 5/8 | 3.3 | 3 | 1 5 | 1.63 | 3 | 3.5 | 3 |
| ACC00125 | A-AS 3 146[1] | 3/4 | 3.3 | 3 | 14 | 1.63 | 4 | 3.5 | 2.75 |
| ACC00126 | A-AS 4 64 | 1/2 | 2.8 | 4 | 6 | 2.5 | 2 | 2.5 | 2 |
| ACC00127 | A-AS 4 65 | 5/8 | 2.8 | 4 | 6 | 2.5 | 3 | 2.5 | 2 |
| ACC00128 | A-AS 4 105 | 5/8 | 4.6 | 4 | 10 | 2.5 | 3 | 4 | 3.5 |
| ACC00129 | A-AS 4 106 | 3/4 | 4.6 | 4 | 10 | 2.5 | 4 | 4 | 3.5 |
| ACC00130 | A-AS 5 96 | 3/4 | 5.1 | 5 | 9 | 2.75 | 4 | 6 | 5.5 |
| ACC00131 | A-AS 5 97 | 7/8 | 5.1 | 5 | 9 | 2.75 | 7.3 | 6 | 5.5 |
| ACC00132 | A-AS 5 126 | 3/4 | 6.6 | 5 | 12 | 2.75 | 4 | 8 | 7.5 |
| ACC00133 | A-AS 5 127 | 7/8 | 6.6 | 5 | 12 | 2.75 | 7.3 | 8 | 7.5 |
| ACC00135 | A-AS 5 137 | 7/8 | 7.1 | 5 | 13 | 2.75 | 7.3 | 8.5 | 8 |
| ACC00134 | A-AS 5 139 | 1 1/8 | 7.1 | 5 | 13 | 2.75 | 11.8 | 8.5 | 8 |
| ACC00136 | A-AS 5 179 | 1 1/8 | 8.4 | 5 | 17 | 2.75 | 11.8 | 12 | 10 |
| ACC00137 | A-AS 5 1711 | 1 3/8 | 8.4 | 5 | 17 | 2.75 | 18.8 | 12 | 10 |
| ACC00138 | A-AS 6 117 | 7/8 | 10.0 | 6 | 1 1 | 2.94 | 7.3 | 10 | 9 |
| ACC00139 | A-AS 6 137 | 7/8 | 11.7 | 6 | 13 | 2.94 | 7.3 | 12 | 1 1 |
| ACC00140 | A-AS 6 139 | 1 1/8 | 11.7 | 6 | 13 | 2.94 | 11.8 | 12 | 1 1 |
| ACC00141 | A-AS 6 1411 | 1 3/8 | 12.1 | 6 | 14 | 2.94 | 18.8 | 1 5 | 12 |
| ACC00142 | A-AS 6 1713 | 1 5/8 | 15.4 | 6 | 17 | 2.94 | 28.5 | 1 6 | 1 5 |
| ACC00143 | A-AS 6 2013 | 1 5/8 | 18.1 | 6 | 20 | 2.94 | 28.5 | 20 | 1 6 |
| ACC00144 | A-AS 6 2513 | 1 5/8 | 22.6 | 6 | 25 | 2.94 | 28.5 | 25 | 20 |

[1]Not supplied with a fusible plug

# Storage Devices

***Accumulator Capacity Tables in Tons of Refrigeration***

| | | | R-22 | | |
|---|---|---|---|---|---|
| Model Number | -40°F | -20°F | 0°F | +20°F | +40°F |
| A-AS 3 84 | .4 | .6 | 0.9 | 1.4 | 2.0 |
| A-AS 3 105 | .5 | .8 | 1.4 | 2.1 | 3.0 |
| A-AS 3 125 | .5 | .8 | 1.4 | 2.1 | 3.0 |
| A-AS 3 126 | .72 | 1.1 | 1.8 | 2.8 | 4.0 |
| A-AS 3 145 | .5 | .8 | 1.4 | 2.1 | 3.0 |
| A-AS 3 146 | .72 | 1.1 | 1.8 | 2.8 | 4.0 |
| A-AS 4 64 | .4 | .6 | 0.9 | 1.4 | 2.0 |
| A-AS 4 65 | .5 | .8 | 1.4 | 2.1 | 3.0 |
| A-AS 4 105 | .5 | .8 | 1.4 | 2.1 | 3.0 |
| A-AS 4 106 | .72 | 1.1 | 1.8 | 2.8 | 4.0 |
| A-AS 5 96 | .72 | 1.1 | 1.8 | 2.8 | 4.0 |
| A-AS 5 97 | 1.3 | 2.0 | 3.3 | 5.1 | 7.3 |
| A-AS 5 126 | .72 | 1.1 | 1.8 | 2.8 | 4.0 |
| A-AS 5 127 | 1.3 | 2.0 | 3.3 | 5.1 | 7.3 |
| A-AS 5 137 | 1.3 | 2.0 | 3.3 | 5.1 | 7.3 |
| A-AS 5 139 | 2.1 | 3.3 | 5.3 | 8.3 | 11.8 |
| A-AS 5 179 | 2.1 | 3.3 | 5.3 | 8.3 | 11.8 |
| A-AS 5 1711 | 3.4 | 5.3 | 8.5 | 13.2 | 18.8 |
| A-AS 6 117 | 1.3 | 2.0 | 3.3 | 5.1 | 7.3 |
| A-AS 6 137 | 1.3 | 2.0 | 3.3 | 5.1 | 7.3 |
| A-AS 6 139 | 2.1 | 3.3 | 5.3 | 8.3 | 11.8 |
| A-AS 6 1411 | 3.4 | 5.3 | 8.5 | 13.2 | 18.8 |
| A-AS 6 1713 | 5.1 | 8.0 | 12.8 | 20.0 | 28.5 |
| A-AS 6 2013 | 5.1 | 8.0 | 12.8 | 20.0 | 28.5 |
| A-AS 6 2513 | | | 12.8 | 20.8 | 28.5 |

The maximum capacity in tons recommended is based on a pressure drop through the accumulator equivalent to 1.0°F.

Note: 1. The minimum capacity in tons must be no less that 15% of the recommended capacity in order to ensure a positive return of oil.

2. All of the data is based on tons of refrigeration and is not related to horsepower.

3. **Minimum evaporator temperature** of **-40°F**. **Minimum temperature** of the **suction gas** through the accumulator is **12°F**. For operation under conditions that are not within the recommended range, please contact ALCO Controls' Applications Department before proceeding with the installation.

# Storage Devices

## AVR Liquid Refrigerant Receivers

### Application

- Alco's AVR liquid refrigerant receivers provide a reservoir for refrigerant during normal system operation
- Receivers are selected based on the operating charge for all system components and liquid lines
- Receivers should be sized to hold no more than 90% of the total internal volume of the receiver is used
- Direct replacement of popular competitive models

### Features

- Corrosion resistant epoxy powder paint finish

### Specifications

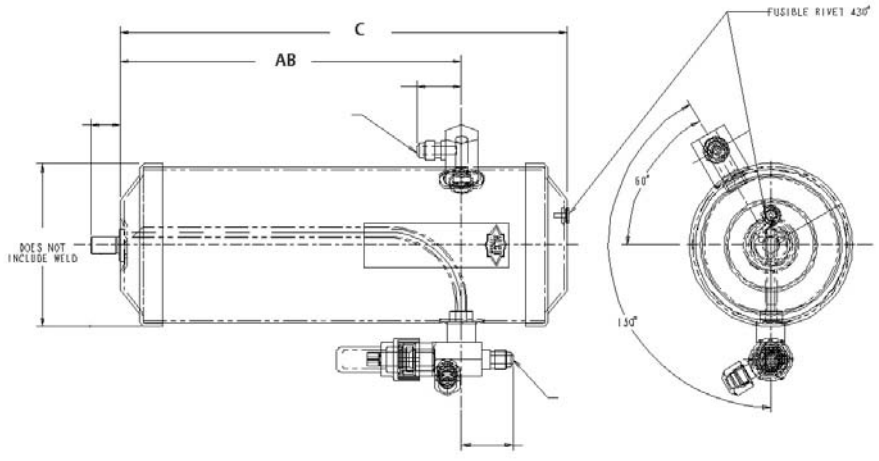
- Maximum working pressure: 450 psig
- UL/CUL: SA 9447

**Nomenclature** Example: AVR 03 10 2 MXP

| A | V | R | 03 | 10 | 2 | M | X | P |
|---|---|---|---|---|---|---|---|---|
| Alco | V = Vertical<br>H = Horizontal | Receiver | Diameter (in inches) | Length (in inches) | Fitting size in 1/8" inches | M = SAE<br>S = ODF | Service Value | Fusible Plug |

| ServiceFirst Item # | Catalog Number | Diameter in inches | A | B | Connections Inlet | Connections Outlet | Cross Reference AC&R | Cross Reference REF. RES. | Pump Down Capacity (lbs.) 90% of Volume at 90°F R22/R134a | Pump Down Capacity (lbs.) 90% of Volume at 90°F R404A/R507 |
|---|---|---|---|---|---|---|---|---|---|---|
| REC00847 | AVR 03 10 2 MX | 3 | 10 | 7.63 | 1/4 SAE | 1/4 SAE | S-8060 | 5774 | 2 | 1.8 |
| | AVR 03 10 2 SX | 3 | 10 | 7.63 | 1/4 ODF | 1/4 ODF | -- | -- | 2 | 1.8 |
| | AVR 05 10 2 MXP | 5 | 10 | 6.75 | 1/4 SAE | 1/4 SAE | S-8064 | 1918 | 6 | 5.4 |
| | AVR 05 10 3 MXP | 5 | 10 | 6.75 | 3/8 SAE | 3/8 SAE | -- | 5315 | 6 | 5.4 |
| | AVR 06 12 3 MXP | 6 | 12 | 7.75 | 3/8 SAE | 3/8 SAE | S-8065 | 1911 | 10 | 9.0 |
| | AVR 06 18 4 MXP | 6 | 18 | 14.50 | 1/2 SAE | 1/2 SAE | -- | 3212 | 16 | 14.4 |
| | AVR 35 10 2 MXP | 3.50 | 10 | 7.63 | 1/4 SAE | 1/4 SAE | S-8062 | 1917 | 3 | 2.7 |
| | AVR 35 75 2 MXP | 3.50 | 7.50 | 5.13 | 1/4 SAE | 1/4 SAE | S-8061 | 1920 | 2 | 1/8 |

***Dimensional Data***



# Oil Controls


## A-W Oil Separators

### Application

- Multiple compressor racks for supermarkets and air conditioning
- Systems with long refrigerant lines
- Systems with inherent oil return problems
- Ultra-low temperature systems
- For use with HCFCs, HFCs and their lubricants

### Features

- Hermetic welded or accessible bolted flange construction
- Solid copper connections
- Corrosion resistant paint

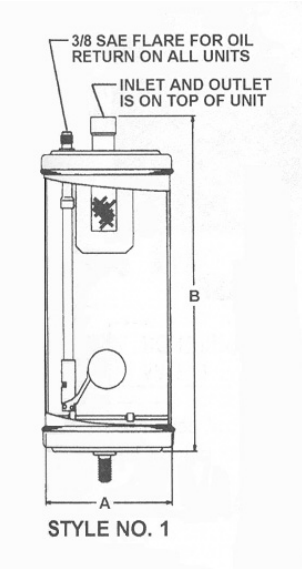
### Specifications

- Maximum working pressure: 450 psig
- UL file number: 5168
- CSA file number: LR 100624

***Sealed Units: A-W***

| Model Number | Connection Size | Dimensions (inches) A | B |
|---|---|---|---|
| A-W 55824 | 1/2 ODF | 4.00 | 10.75 |
| A-W 55855 | 5/8 ODF | 4.00 | 14.25 |
| A-W 55877 | 7/8 ODF | 4.00 | 17.75 |
| A-W 55889 | 1 1/8 ODF | 4.00 | 21.00 |
| A-W 559011 | 1 3/8 ODF | 4.00 | 21.25 |
| A-W 569011 | 1 3/8 ODF | 6.00 | 15.75 |
| A-W 569213 | 1 5/8 ODF | 6.00 | 19.00 |
| A-W 569417 | 2 1/8 ODF | 6.00 | 19.50 |

***Dimensional Data***




**Nomenclature** Example: AW 5582 4

| A | W | 5582 | 4 |
|---|---|---|---|
| Alco | W = Welded<br>F = Flanged | Competitive Cross Reference | Connection Size (in 1/8") |

***Ordering Information and Capacity Table***

| ServiceFirst Item # | Model Number | R12 -40F/C Tons | R12 -40F/C kW | R12 40F (14C) Tons | R12 40F (14C) kW | R22/R407C -40F/C Tons | R22/R407C -40F/C kW | R22/R407C 40F (14C) Tons | R22/R407C 40F (14C) kW | R502 -40F/C Tons | R502 -40F/C kW | R502 40F (14C) Tons | R502 40F (14C) kW | R134a -40F/C Tons | R134a -40F/C kW | R134a 40F (14C) Tons | R134a 40F (14C) kW | R-404A/R-507 -40F/C Tons | R-404A/R-507 -40F/C kW | R-404A/R-507 40F (14C) Tons | R-404A/R-507 40F (14C) kW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CNT04656 | A-W 55824 | 1 | 3.54 | 1.5 | 5.31 | 1.5 | 5.31 | 2 | 7.08 | 1.5 | 5.31 | 2 | 7.08 | 1 | 3.54 | 1.75 | 6.2 | 1.5 | 5.31 | 2 | 7.0 |
| | A-W 55855 | 3 | 10.62 | 4 | 14.2 | 4.5 | 15.9 | 5.5 | 19.5 | 4.75 | 16.8 | 5.75 | 20.36 | 3.25 | 11.5 | 4.5 | 15.9 | 4 | 14.16 | 5.5 | 19.0 |
| | A-W 55877 | 4.5 | 15.93 | 5.5 | 19.5 | 7 | 24.8 | 8 | 28.3 | 7.5 | 26.6 | 8.5 | 30.09 | 4.75 | 16.8 | 6.5 | 23 | 6.5 | 23.01 | 8.5 | 30.0 |
| | A-W 55889 | 6 | 21.24 | 7.5 | 26.6 | 9 | 31.9 | 11 | 37.2 | 9.5 | 33.6 | 11.5 | 40.71 | 6.5 | 23 | 8.5 | 30.1 | 8.5 | 30.09 | 11 | 38.0 |
| | A-W 559011 | 7.5 | 26.55 | 10 | 35.4 | 11.5 | 40.7 | 14 | 47.8 | 12 | 42.5 | 14.5 | 51.33 | 8 | 28.3 | 11.5 | 40.7 | 10.5 | 37.17 | 14 | 49.0 |
| | A-W 559213 | 9 | 31.86 | 11.5 | 40.7 | 14 | 49.6 | 18 | 62 | 16 | 56.6 | 17.5 | 61.95 | 9.5 | 33.6 | 13.25 | 46.9 | 14 | 49.56 | 17 | 60.0 |
| CNT03773 | A-W 569213 | 11 | 38.94 | 14 | 49.6 | 16 | 56.6 | 18 | 63.7 | 20 | 70.8 | 24 | 84.96 | 11.8 | 41.6 | 16 | 56.6 | 17.5 | 61.95 | 23 | 81 |
| | A-W 569417 | 17 | 60.18 | 22 | 77.9 | 25 | 88.5 | 30 | 106 | 30 | 106 | 35 | 123.9 | 18 | 63.7 | 25.25 | 89.4 | 26 | 92.04 | 34 | 121.0 |

# Oil Controls

***Highly Recommended for Scroll Compressors!***

## AOF High Efficiency Oil Filter

**Application**

- Specifically designed to protect the compressor from dirt and all solid contaminants including metallic magnetic particles

**Features**

- Corrosion resistant epoxy powder paint finish
- 3/8" SAE connections for easy installation on oil lines
- 98% efficient to 4 micron particles
- Compatible with all oils

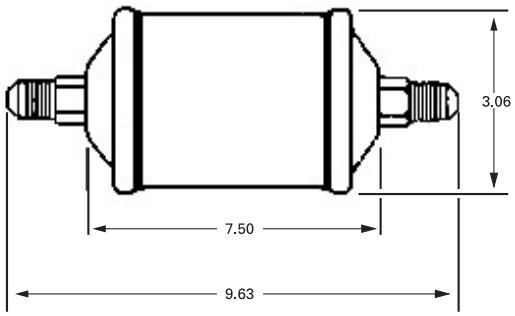
**Specifications**

- Maximum working pressure: 500 psig
- UL/CUL: SA 3124

***Ordering Information***

| ServiceFirst Item # | Description |
|---|---|
| FLR05984 | AOF 303 |

***Dimensional Data***



# Regulators

## Fundamentals of HeadMaster Head Pressure Controls

The application of air-cooled condensers for year-round operation, or during periods of low ambient temperatures, requires some means of control to maintain adequate condensing pressures that ensure proper system performance. It is essential that proper liquid refrigerant pressure be controlled to:

1. Maintain liquid subcooling and prevent liquid line flash gas.
2. Provide adequate pressure at the inlet side of the Thermo Valve to obtain sufficient pressure drop across the valve port.
3. Properly operate systems with hot gas defrost or hot gas bypass.
4. Provide adequate temperature for operation of heat reclaim systems.

Without proper control of condensing pressure, serious consequences in the way of poor refrigeration and component damage can occur. ALCO's HeadMaster Control offers an efficient and economical approach to this common industry problem on air cooled condensers.

The HeadMaster 3-Way Head Pressure Control eliminates the need for special piping or multiple control valves. As a single unit it simplifies piping and reduces installation costs.

**HeadMaster HP Operation**

The HP control is a three-way modulating valve controlled by the discharge pressure. The charged dome exerts a constant pressure on top of the diaphragm. At high ambient air temperature, bypass gas entering Port B is allowed under the diaphragm where it counteracts the pressure of the dome charge. This upward push on the diaphragm allows the seat disc to seal against the top seat, preventing flow from Port B (discharge gas) while flow from Port C is unrestricted (see Figure 1).

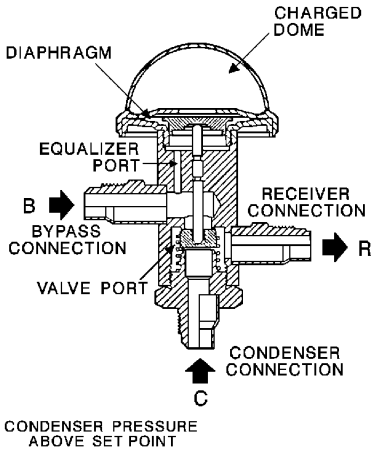



***Figure 1: HeadMaster HP Valve CutAway View***

As ambient air temperature falls, an uncontrolled air cooled condenser will exhibit a corresponding decrease in head pressure. As the discharge (bypass) pressure falls, it no longer counteracts the dome charge pressure and the diaphragm moves downward, moving the pushrod and seat disc towards the bottom seat. NOTE: This allows discharge (bypass) gas to be metered into the receiver, creating a higher pressure at the condenser outlet. The higher pressure at the condenser outlet reduces the flow from Port C and causes the level of condensed liquid to rise in the condenser.

# Regulators

The flooding of the condenser with liquid reduces the available condensing surface. The result is to increase the pressure in the condenser and maintain an adequate high side pressure. Figure 2 illustrates a typical application of the 3-way control valve. This system is perhaps the most economical and reliable means to accomplish discharge pressure control. The three-way valve as shown in figure 1 is a fixed, non-adjustable valve. The wholesaler replacement setting is normally furnished for a pressure corresponding to 95° to 98°F condensing temperature for the given system refrigerant.

As with all head pressure control applications, additional liquid receiver capacity is required to prevent loss of a liquid seal in the receiver when the condenser is flooded. The receiver must be large enough to hold the total system charge. The total system charge consists of the following:

A. An operating charge which is the necessary pounds of refrigerant to operate the system during summer (high ambient temperature) conditions.

B. An additional charge equaling the number of pounds of refrigerant required to flood the condenser with liquid. The condenser must be filled with liquid to point where a minimum head pressure is created for cold weather (low ambient temperature) conditions.

**NOTE**: Should the outdoor temperature fall below design conditions, additional refrigerant will be required.

The total of A and B is the total charge necessary for satisfactory system performance during the lowest expected ambient air temperature conditions. During summer operation the receiver must be sized to safely hold the total system charge. Good refrigeration practice states that the total system charge should not exceed 75% of the receiver capacity.

**CAUTION:**

1. The HP control should not be used on a system which does not have a liquid receiver or on one with a receiver which is too small. If the receiver does not have adequate storage space, the refrigerant will back up in the condenser to produce excessively high discharge pressures during high ambient air temperatures, with resulting system damage and/or personal injury.
2. The HP control should be used only on systems which employ a Thermostatic Expansion Valve.

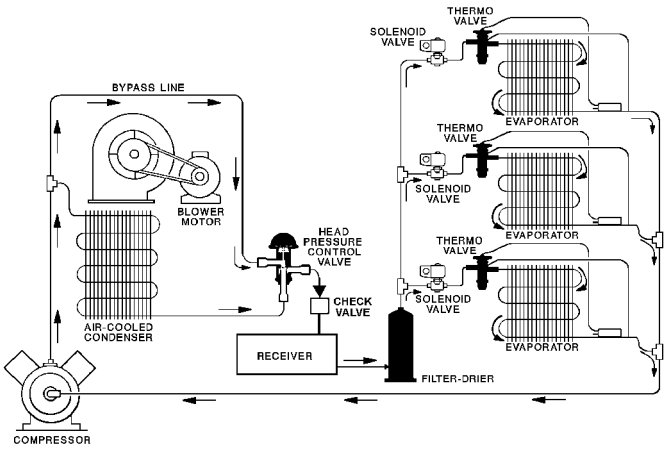



*Figure 2: Typical 3-Way Valve Head Pressure Control Application*

| Service Reference Code | | Charge Type | | |
|---|---|---|---|---|
| | | A | | B C |
| | | To Be Used With Refrigerant Type | | |
| | | R-134a | R-22 | R-404A/R-507 |
| | | System Condensing Pressure Set Point* (PSIG) | | |
| Valve | HP5, HP8 | 110 | 185 | 215 |
| Type | HP14 | 120 | 175 | 215 |

* For Corresponding Condensing Temperature, see P-T Chart.

# Regulators

## Fundamentals of Head Pressure Controls

**Installation of HeadMaster HP Series**
In general, head pressure control systems of this type are used on refrigeration systems that are temperature operated. This means that the compressor is started by a thermostat or the system operates on a pump down cycle, where the thermostat controls the liquid line solenoid valve and the compressor starts on a rise in suction pressure with a low pressure switch.

On systems that are pressure operated, migration of the refrigerant to the cold condenser on the "off" cycle should be prevented. If the system does not operate on a pump down cycle, migration can take place through some compressors, from the suction line to the condenser. The use of crankcase heaters will prevent liquid from condensing in the crankcase, but will not eliminate migration to the cold condenser. If the system is properly charged, the filled condenser will permit the excess to remain in the receiver and low side.

Under certain conditions where the receiver is located in a warm ambient, a check valve in the liquid drain line between the HeadMaster control and the receiver may be required to prevent the liquid receiver pressure from equalizing to that of the condenser during the "off" cycle. This enables the system to start on a pressure switch. Some systems may require a time delay on the low pressure switch. ***Condenser fans should not be cycled when using the HeadMaster control. The sudden changes in high side pressure caused by fan cycling will result in erratic Thermostatic Expansion Valve performance, and shortened head pressure control life.***

**HP Series Capacity and Selection**
The nominal HP control capacity in tons for various refrigerants is shown in Table 1 (see page XX) for R134a, R22 and R404A/R507. The nominal capacity is based on 100°F liquid, 40°F evaporator and the pressure drop shown. To obtain capacities in tons at other liquid and evaporator conditions, multiply the nominal capacity at the desired pressure drop by the factor in Table 2 (page XX) given for the existing liquid temperature and evaporator temperature.

NOTE: Do not select a valve for a capacity rating exceeding 5 psi pressure drop from Port C to Port B or for a system with more than 20 psi pressure drop across the condenser.

During normal ambient conditions, the available liquid sub-cooling in the condenser will be adequate to cover the existing pressure drop through the HeadMaster control.

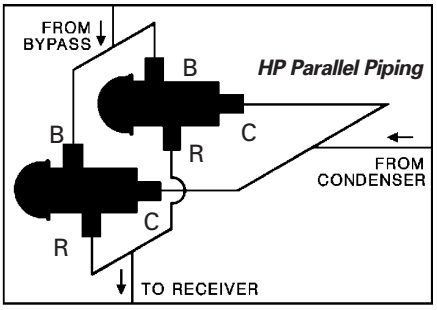
If a valve is selected for a given flow rate, the resulting pressure drop must not cause the liquid pressure to drop below saturation and produce flash gas.

If sufficient sub-cooling is not available to cover this pressure drop, it is suggested that more than one valve be installed in parallel to reduce the pressure drop to tolerable limits. **Do not parallel valves of different capacities.** Liquid drain lines from the condenser to receiver are generally sized for a velocity of 150 ft./min.

**Additional Refrigerant**
On most systems, an additional amount of refrigerant will be required. It is essential to have enough to completely fill the condenser for the lowest ambient condition.

**Factory Setting**
The HeadMaster Control is factory-set to provide an average condensing temperature consistent with good system performance. The complete type number includes the service reference code, port size, connection size and style. When ordering, be sure to specify the complete type number.

**UL File No. SA5312**
**CSA File No. LR44005**



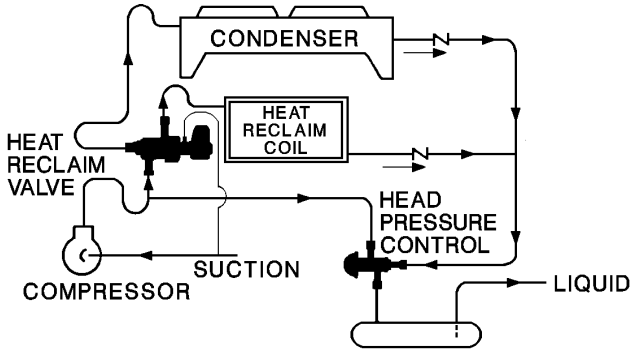
# Regulators

**HeadMaster Service Hints (during low ambient operation)**

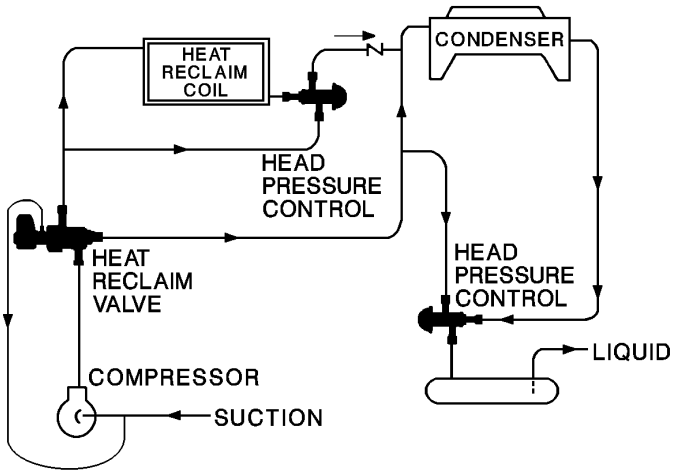
| Complaint | Possible Cause | Remedy |
|---|---|---|
| Low head pressure during operation. | Valve unable to throttle 'C' port: | |
| | a) foreign material wedged between 'C' port seat & seat disc. | a) Artificially raise head pressure & tap valve body to dislodge foreign material. |
| | b) power element lost its charge. | b) Change valve. |
| | c) insufficient wintertime system charge. | c) Add refrigerant per table 3. |
| | Wrong charge pressure in valve for system refrigerant. | Change valve. |
| | Receiver exposed to low ambient conditions is acting as condenser. | Insulate the receiver. |
| | Hot gas bypass line restricted or shut off. | Clear obstruction or open valve. |
| System runs high head pressure or cycles on high pressure cut-out. | Compressor not pumping or restriction in liquid line, or low side causing very low suction pressure. | Change or repair compressor or clear obstruction or other reason for low suction pressure. |
| | Condenser fan or fans not running or turning in the wrong direction. | Replace or repair fan motor, belts, wiring or controls as required. |
| | Fan cycling. | Run condenser fans continuously while the system is running. |
| | Pressure drop through condenser exceeds allowable 20 psi forcing 'B' port partially open. | Repipe, recircuit, or change condenser as required to reduce condenser pressure drop to less than 20 psi. |
| | Condenser unersized or air flow restricted or short circuiting. | Increase size of condenser or remove air flow restriction or short circuit as required. |
| | 'B' port wedged open due to foreign material between seat and seat disc. | Artificially reduce head pressure below valve set point and tap valve body with system running to dislodge foreign material. |
| | 'B' port seat damaged due to foreign material. | Change valve. |
| | Wrong charge pressure in valve for system refrigerant. | Change valve. |
| | Excess system charge or air in system. | Purge or bleed off refrigerant or noncondensables as system requires. |
| | Obstruction or valve closed in discharge or condenser drain line. | Clear obstruction or open valve. |
| | Liquid line solenoid fails to open. | Check solenoid. |

# Regulators

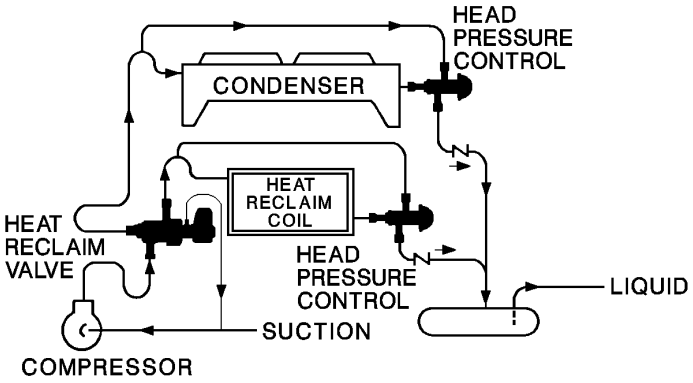
## Head Pressure Control



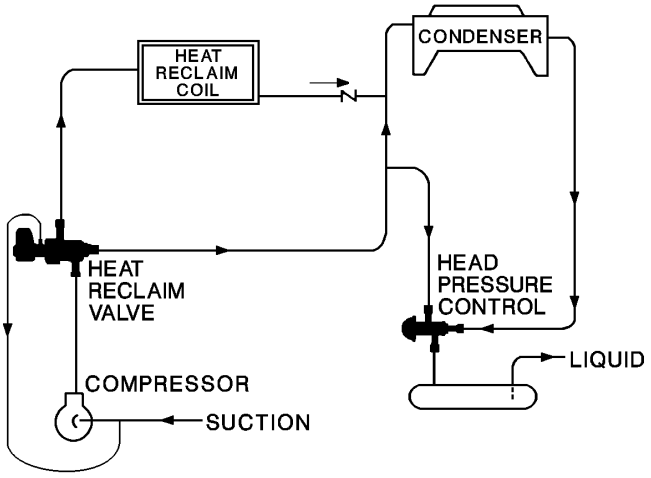

**Coils in Parallel**
One HP Series Valve controlling both coils.



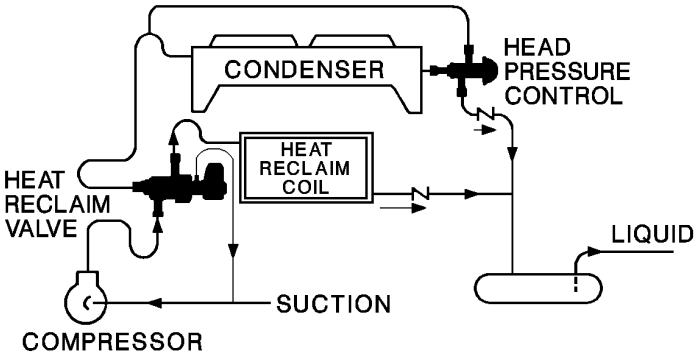

**Coils in Series**
Two HP Series Valves – one on each coil.




**Coils in Parallel**
One HP Series Valve controlling each coil.




**Coils in Series**
One HP Series Valve for both coils.




**Coils in Parallel**
One HP Series Valve controlling outdoor coil only.

# Regulators

## Fundamentals of Hot Gas Bypass

Demand continues to mount for improved comfort conditioning combined with lower operating costs. New architectural designs have created real problems for contractors and engineers to maintain humidity control at reduced loads, and to control load variations. Refrigeration and air conditioning systems are usually designed to provide a given capacity at maximum conditions. These operate with little fluctuation throughout a narrow load range. However, only the larger size machines make any provisions for operation at reduced capacity. In some systems, integral cylinder unloading, the installation of a gas engine drive with variable speed control, or even multiple smaller systems, provide a logical solution.

**Function — Hot Gas Bypass Method**
Many manufacturers now recommend use of a modulating control valve to provide a metered flow of compressor discharge gas to the system low side, in a proportion that will balance the system capacity to the load demand. This is commonly known as the hot gas bypass method. It permits full modulation of capacity on all types of reciprocating compressors, and extends capacity reduction below the last step of cylinder unloading.

Basically, the system must provide a means of bypassing high pressure refrigerant to the system low pressure side, in order to maintain operation at a given minimum suction pressure. Proper bypass control can be accomplished by a modulating type pressure regulator, which opens on a decrease in valve outlet pressure.

**Operation of Bypass Valves**
Bypass pressure regulators are grouped into the following categories:
1. Direct acting unbalanced port valves (figure 3).
2. Direct acting balanced port valves (figure 4)
3. Pilot operated valves (figure 5)

Any of these regulators are available with either an adjustable setting, or a fixed, non-adjustable setting.

*Figure 3. DGRE adjustable hot gas bypass regulator.*

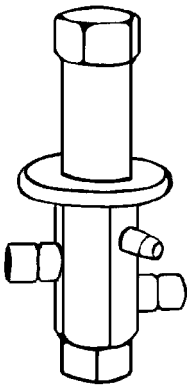


*Figure 4. Balance port CPHE adjustable field-serviceable hot gas bypass regulator.*

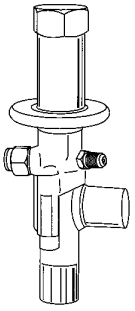
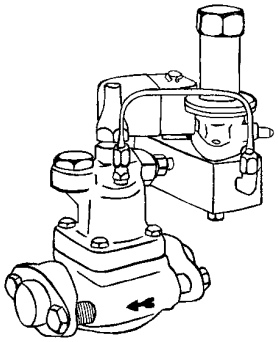


*Figure 5. FA8 pilot operated hot gas bypass regulator.*



# Regulators

*Figure 6. Hot gas bypass from discharge through FA8 regulator to suction.*

*Note: Bypass flows against suction to create a good mix.*

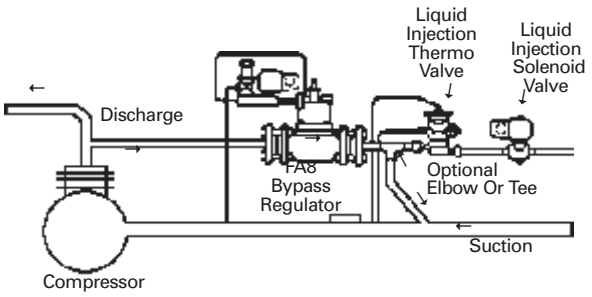
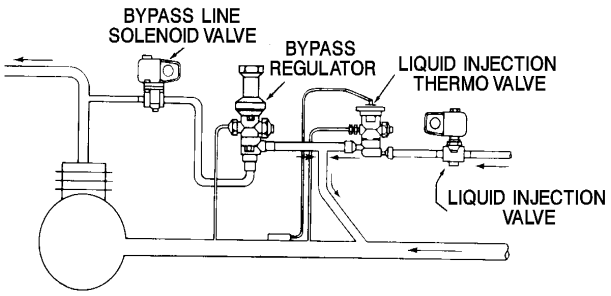



*Figure 7. Hot gas bypass using type LCL liquid injection valve.*




## Applications

**Hot Gas Bypass to Compressor Suction Line**

Figure 6 shows what is possibly the most common hot gas bypass system. In this system, the bypass line is taken directly from the compressor discharge line, through a bypass regulator, and into the suction line at the compressor. While the hot gas bypass regulator is considered a downstream control, there is a big difference in function between a Crankcase Regulator (FA5) and a hot gas regulator (FA8).

Pilot operated bypass valve main regulators have a long stroke stem with a restrictor plug characterized by either a parabolic or vee port restrictor plug design. This prevents the valve from operating close to the seat where pressure differential unbalance may occur, eliminating the need for a balanced port design.

The characterized port will provide smooth bypass flow modulation. Pilot operated valves usually have the extra features of a manual opening stem for testing or emergency operation, flanged connections, synthetic tight seating seats, and replaceable parts. Hot gas bypass valves can be applied to a system in several general ways, differing only in the point to which the hot gas is to be bypassed. Several mixing methods are available. The one generally recommended is piped so that discharge gas is admitted to the suction line to flow against the direction of the suction gas as in figure 6.

# Regulators

## Applications

**Bypass to Evaporator Inlet**
Another method is to bypass the hot discharge gas to the evaporator inlet, usually between the Thermo Valve and the refrigerant distributor (see figures 9 and 10). This provides distinct advantages. The artificial load imposed on the evaporator causes the Thermo Valve to respond to the increase in superheat, eliminating the need for the liquid injection valve. The evaporator serves as an excellent chamber to provide homogeneous mixing of the gases before reaching the compressor. It is essential that this type system be equipped with a Venturi flow type refrigerant distributor (i.e., no restrictor orifice).

Hot gas bypass into the evaporator is suggested when the evaporator elevation is below the compressor, to prevent oil trapping due to low velocity at low loads. This assures proper oil return. Although there are many advantages to this system, it is not generally used on a multiple coil system, or where the evaporator sections may be located a distance from the compressor. The coil should be a free draining circuiting design to prevent the increase in velocity, due to forcing a large quantity of trapped liquid out of the low side, which in some cases may have enough volume to flood the compressor crankcase. NOTE: Separate regulators must be used for each evaporator when bypassing to multiple evaporators located below the compressor to facilitate oil return.

Bypass to flooded evaporators and suction line accumulators also present special cases. Contact the equipment manufacturer or the bypass control valve manufacturer for specific, detailed information.

**Solenoid Valve for Positive Shut-off & Pump-down Cycle**
It is recommended that a solenoid valve be installed ahead of the bypass regulator. This permits the system to operate on an automatic pump-down cycle. Applications which use the pilot operated FA8 series valve are factory assembled with integral solenoid and need no separate solenoid installed in the discharge line.

## Liquid Injection Applications

**Thermo Valves for Liquid Injection**
When hot gas is bypassed directly into the suction line, it is necessary to make some provision for desuper-heating the gas returning to the compressor. Without a small Thermo valve to reduce suction gas temperature to tolerable limits, compressor damage may occur. Standard Thermo Valves cannot be adjusted for control in excess of 20°F superheat and, therefore, are not generally recommended. Liquid Injection Thermo Valves with special adjustment ranges are used to conform with compressor manufacturer temperature recommendations.

To simplify selection, ALCO has developed Liquid Injection Thermo Valves with four basic adjustment ranges. These are designated as models A, B, C and D. The adjustable superheat range chart (Table 5, page 97) shows the proper power assembly charge symbol suffix for a given saturated suction temperature and a given superheated suction gas temperature entering the compressor.

Nearly all Thermo valves for liquid injection may be internally equalized. However, if pressure drop occurs at the valve outlet due to a distributor, spray nozzle or other restrictive device, externally equalized valves may be necessary.

Model LER and LIR valves are furnished with a 1/4" SAE male flare external equalizer as standard. Other models must include the code letter "E" to specify the 1/4" SAE male flare external equalizer connection. Example: LCLE and LJLE.

*Figure 8. Bullhead the Hot Gas and Liquid Injection in a tee to permit good mixing.*

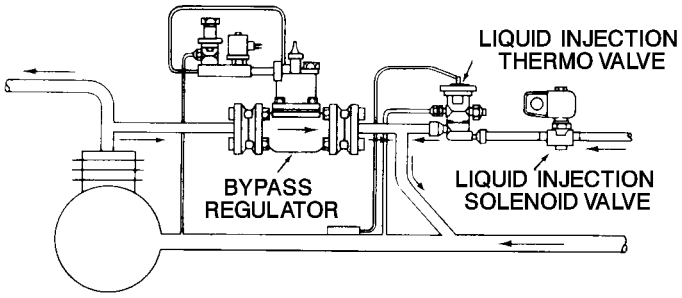
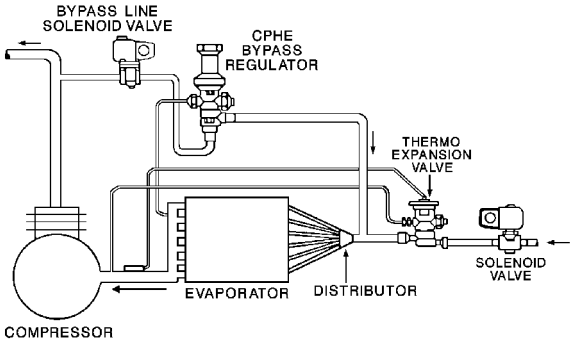
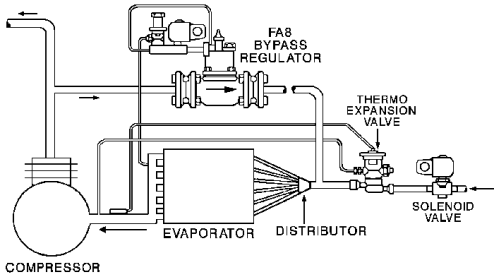



*Figure 9. Direct acting hot gas regulator admitting flow between TEV and venturi distributor.*



# Regulators

*Figure 10. Hot gas bypass using type LCL liquid injection valve.*




**Application and Installation**
Liquid injected into a gas to be desuperheated should be injected in a manner which provides a homogeneous mixing of the liquid and superheated gas. Desuperheating hot gas bypass in the suction line may be accomplished in several ways.

The preferred method is to bullhead the hot gas and liquid injection in a tee to permit good mixing before it enters the suction line. A good mix with the suction gas may be gained by injecting the liquid/hot gas mixture into the suction line at approximately a 45° angle against the flow of suction gas to the compressor. See figures 7 and 8.

For suction lines 7/8" OD and smaller, the bypass mixture may be introduced into a tee rather than an angle connection. For lines larger than 2-5/8" OD, introduce the desuperheated bypass mixture into a 90° ell inserted against the flow of suction gas to the compressor.

Arranging a bypass directly into a suction accumulator is often a convenient way to obtain proper desuperheating of suction gas.

Introducing the hot gas and liquid into the suction line with separate connections is not generally recommended.

**Note:** Excessive suction gas superheat can cause serious damage to the compressor. As a safety precaution, the bypass line solenoid valve should be wired in series with a discharge line thermostat.

# Regulators

## Liquid Injection Applications

**Special Applications**

On systems where evaporator pressure regulators are used, better control can be achieved by locating the bypass regulator equalizer line on the downstream (outlet) side of the EPR so it responds to compressor suction pressure, not evaporator pressure. This results in nearly constant evaporator load balance (see figure 11).

Extremely close control can be obtained with pneumatic compensation. Any pneumatic controller may be applied to CPH and FA8 regulators with external air connection. Controllers that respond to: leaving water or air temperature, or entering water or air temperature, as well as humidity, pressure, etc., are often used to reset the hot gas bypass regulator to a setting appropriate for the desired condition (see figure 12).

***Solenoid Connection Size Chart***

| Valve Type | Connection Size (in inches) |
|---|---|
| 100RB 2T2 | 1/4 ODF |
| 200RB 3 | 3/8 ODF |
| 200RB 4T4 | 1/2 ODF |
| 200RB 5T5 | 5/8 ODF |
| 200RB 6T5 | 5/8 ODF |
| 240RA 8T5 | 5/8 ODF |
| 240RA 9T7 | 7/8 ODF |
| 240RA 12T7 | 7/8 ODF |
| 240RA 16T9 | 1-1/8 ODF |

***Standard Voltage & Frequency Table***

| **FA8 Series Regulators** | |
|---|---|
| Voltage | Frequency |
| 24, 120, 208-240, 480 | 50/60 Hz. AC |
| **100RB, 200RB, 240RA Series Solenoid Valves** | |
| Voltage | Frequency |
| 24, 120, 120/240, 208-240, 480 | 50/60 Hz. AC |

*Figure 11.*

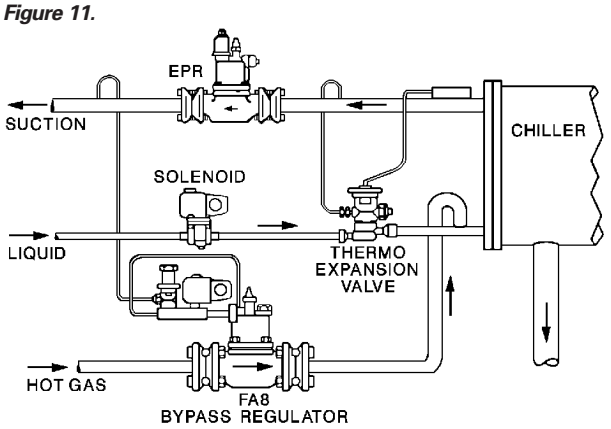
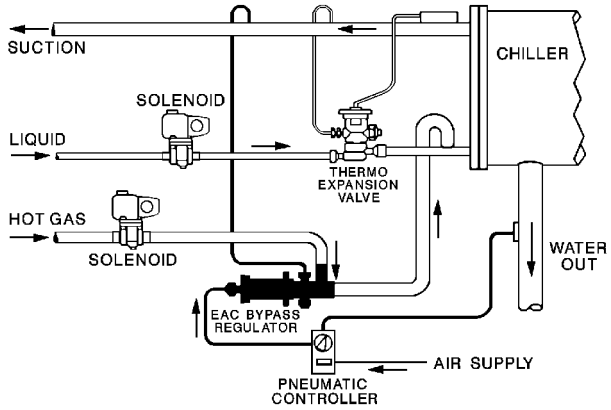



*Figure 12.*



# Regulators

**Ordering Instructions Pressure Regulators**

**A. Direct Operated – CPH Series**
When ordering, specify:
1. The complete valve type number.
2. Size and style of connections.
3. Type of equalizer.
4. Pressure adjustment range.

**B. Pilot Operated – FA8 Series**
When ordering, specify:
1. The complete valve type number.
2. Size connections.
   Flanges are sold separately.
3. Solenoid coil voltage & frequency.

**Example**: FA8-15F, 120/50-60, 1-3/8" ODF.

For 1/4" male SAE external air connection for FA8 regulators, order X10227-2 EAC conversion kit.

Discharge Gas Solenoids

**A. Companion Discharge Line Solenoid with CPH Series**
When ordering, specify:
1. The complete solenoid type number.
2. Solenoid coil voltage & frequency.
3. Size line connections.

Liquid Injection Valves & Solenoids

**A. Liquid Injection Valve**
When ordering, specify:
1. The complete valve type number, including type equalizer (external or internal) and charge symbol.
2. Remote bulb tubing length.
3. Line connection size & style.

**Example**: LJLE12B, 5 ft. tubing, 5/8" x 7/8" ODF angle

***Flange Interchangeability Table Style & Connections***

| Valve Type | Size & Style Connections Inlet | Outlet | Body Flange Part Number | Cap Screw Part Number |
|---|---|---|---|---|
| **Angle Configuration** | | | | |
| TCL, TCLE, LCL, LCLE | 3/8 SAE | 1/2 SAE | C500-4 | PS286-5 |
| | 3/8 SAE | 5/8 SAE | C500-5 | |
| | 1/2 SAE | 5/8 SAE | C500-6 | |
| | 1/4 ODF | 3/8 ODF | C501-1 | |
| | 3/8 ODF | 1/2 ODF | C501-4 | |
| | 3/8 ODF | 5/8 ODF | C501-5 | |
| | 1/2 ODF | 5/8 ODF | C501-7 | |
| **Straight-thru Configuration** | | | | |
| TCL, TCLE, LCL, LCLE | 3/8 SAE | 1/2 SAE | X6669-4 | PS286-5 |
| | 3/8 SAE | 5/8 SAE | X6669-1 | |
| | 1/2 SAE | 1/2 SAE | X6669-5 | |
| | 1/2 SAE | 5/8 SAE | X6669-2 | |
| | 3/8 ODF | 1/2 ODF | 9761-5 | |
| | 3/8 ODF | 5/8 ODF | 9761-3 | |
| | 1/2 ODF | 1/2 ODF | 9761-6 | |
| | 1/2 ODF | 5/8 ODF | 9761-4 | |
| | 1/2 ODF | 7/8 ODF | 9761-2 | |
| | 5/8 ODF | 5/8 ODF | X6346-16 | |
| | 5/8 ODF | 7/8 ODF | X6346-17 | |
| | 5/8 ODF | 1-1/8 ODF | X6346-18 | |
| | 7/8 ODF | 1-1/8 ODF | X6346-34 | |

# Regulators

## Ordering Instructions

### Liquid Injection Valves & Solenoids (cont.)

**B. Companion Liquid Line Solenoid Valve**

When ordering, specify:

1. The complete solenoid type number.
2. Solenoid coil voltage & frequency (see chart on p. 95-96).
3. Size line connections (see chart on page 95-96).

**Hot Gas Bypass Valve**

When ordering, determine each item below & specify:

1. System Refrigerant.
2. Capacity to be bypassed in tons (compressor capacity minus system load equals tons to be bypassed).
3. Evaporator temperature at which regulator is to operate.
4. Select the appropriate Hot Gas Bypass valve from Quick Selection Charts that begin on page 304 for tons, and page 322 for kW.

**Example:** A refrigerant 134a system operating at 30°F evaporator has a compressor capacity of 20 tons against a system load of 15 tons. To balance the load between compressor and system, 5 tons must be bypassed (20 – 15 = 5 tons). Referring to the R134a quick selection chart for 30°F evaporator and 5 tons to be bypassed, we find the FA8-12M has the proper capacity for this installation. If the hot gas is to be bypassed into the suction line, a liquid injection valve may be needed to desuperheat this discharge gas in order to protect the compressor. The proper liquid injection valve is shown with each regulator selection.

**Note:**

1. Selection of regulators is based on a 6° gradient. i.e.: Rated capacity of regulator will be attained when the suction pressure falls 6° below the pilot set point.
2. Applications which vary from normal system conditions will not affect selection of the regulator, as selections are based on average conditions at 65°F superheated suction gas entering the compressor with isentropic compression to 100°F saturation plus 50°.

***Table 4. Selection of liquid injection thermo® & solenoid valves to assist hot gas bypass systems***

| Liquid Injection Valve★ Number | All-purpose Cage Part Number | Power Assembly Part Number | Companion Solenoid For Liquid Injection Valve | | |
|---|---|---|---|---|---|
| | | | R134a | R22 | R404A/R507 |
| LCL❶1❷ | X22440-1❸ | | 100RB2 | 100RB2 | 100RB2 |
| LCL❶2❷ | X22440-2❸ | | 100RB2 | 100RB2 | 100RB2 |
| LCL❶3❷ | X22440-3❸ | | 100RB2 | 200RB4 | 100RB2 |
| LCL❶4❷ | X22440-4❸ | | 200RB4 | 200RB4 | 200RB4 |
| LCL❶6❷ | X22440-5❸ | XB1019-❷ 1❸ | 200RB4 | 200RB5 | 200RB4 |
| LCL❶7❷ | X22440-6❸ | | 200RB5 | 200RB6 | 200RB5 |
| LCL❶8❷ | X22440-7❸ | | 200RB6 | 240RA8 | 200RB6 |
| LCL❶10❷ | X22440-8❸ | | 200RB6 | 240RA8 | 240RA8 |
| LJL❶11❷ | XC724-B4❸ | | 200RB6 | 240RA8 | 240RA8 |
| LJL❶12❷ | XC724-B5❸ | | 240RA8 | 240RA9 | 240RA8 |
| LERE13❷ | X9117-B6B | | 240RA9 | 240RA12 | 240RA9 |
| LERE14❷ | X9117-B7B | | 240RA9 | 240RA12 | 240RA9 |
| LERE15❷ | X9117-B8B | XC726-❷2B | 240RA12 | 240RA12 | 240RA12 |
| LERE16❷ | X9117-B9B | | 240RA16 | 240RA16 | 240RA16 |
| LIRE17❷ | X9166-B10B | | 240RA16 | 240RA16 | 240RA16 |

★ Type **LA(E)** Valves are also available for liquid injection valve applications.
❶ Add letter "E" for external equalizer. Example: LCLE3.
❷ Add charge designation A, B, C, or D. (See table below.)
❸ Add letter "A" for internal equalizer or "B" for 1/4" SAE male flare external equalizer.
*Nominal capacity based on 40°F evaporator and 100°F condensing.

***Table 5. LCL (LA) charge codes***

| Sat'd Suction Temp. | Refrigerant | | | | | |
|---|---|---|---|---|---|---|
| | R-134a | | R-22 | | R-404A/R-507 | |
| | Required Suction Gas Temp | | Required Suction Gas | | Required Suction Gas | |
| | 45°F | 65°F | 45°F | 65°F | 45°F | 65°F |
| 40°F | — | B (GL) | — | A (CL) | — | — |
| 30°F | B (GL) | B (GL) | — | A (CL) | — | A (CL) |
| 20°F | B (GL) | C (UL) | A (CL) | B (GL) | — | A (CL) |
| 10°F | B (GL) | C (UL) | B (GL) | B (GL) | A (CL) | B (GL) |
| 0°F | C (UL) | C (UL) | B (GL) | B (GL) | A (CL) | B (GL) |
| – 10°F | C (UL) | C (UL) | B (GL) | C (UL) | B (GL) | B (GL) |
| – 20°F | C (UL) | C (UL) | B (GL) | C (UL) | B (GL) | C (UL) |
| – 30°F | C (UL) | C (UL) | C (UL) | C (UL) | B (GL) | C (UL) |
| – 40°F | C (UL) | C (UL) | C (UL) | C (UL) | B (GL) | C (UL) |

( ) Denotes la series valve charge code

# Regulators

## EGR(E) Direct Acting Hot Gas Bypass Regulator

EGRE Series Direct Acting Hot Gas Bypass Regulators are designed for use on light commercial systems. They provide precision system capacity balance at an economical price. The EGRE is an adjustable valve.

The adjustable EGR Regulators are supplied with a factory set point of 50 psig (point at which the regulator starts to open), which can be changed by adjustment. Capacity of these regulators is based on 6° gradient. Rated capacity will be attained when the suction pressure falls 6° below the corresponding set point saturation temperature. This lower temperature, at which the regulator is rated, is termed "evaporator temperature" in the selection tables (on page 102).

When the suction pressure decreases below the set point, the regulator opens and allows discharge gas to be bypassed. The discharge gas may be bypassed into the evaporator or the suction line. When bypassed to the suction line, a liquid injection Thermo Valve must be installed to properly desuperheat the suction gas returning to the compressor.

**Features**
- Compact hermetic construction.
- Contoured power assembly for long life.
- ODF line connections.
- Balanced port design.

**Options**
- External or internal equalizer.
- Sizes available: 4 thru 8.

**Specifications**
- Safe working pressure: 440 psig
- Adjustment range: 0-80 psig (factory setting 50 psig)
- UL file number SA5312
- CSA file number LR44005

| Catalog Number | Line Connections Code | Line Connections Size & Style | Standard Equalizer [2] | Adjustment Range | Shipping Weight |
|---|---|---|---|---|---|
| EGRE-4 [1] | S3 | 3/8 ODF | 1/4 SAE or | | |
| EGRE-6 [1] | S4 | 1/2 ODF | 1/4 ODF | 0-80 psig | 2-1/2 lbs. |
| EGRE-8 [1] | S5 | 5/8 ODF | External | | |

[1]Add connection code to complete catalog number. Example: EGRE-4S4.
[2]Internal equalized style available. To order, omit "E" from catalog number. Example: EGR-4S3.

***Ordering Information***

| ServiceFirst Item # | Description | ServiceFirst Item # | Description |
|---|---|---|---|
| REG00435 | EGRE 4 S 4 B SAE EE | VAL06394 | EGRE 6 S 4 C ODF EE |
| REG00436 | EGRE 4 S 5 B SAE EE | REG00438 | EGRE 6 S 5 B SAE EE |
| REG00437 | EGRE 6 S 4 B SAE EE | REG00429 | EGRE 8 S 4 B SAE EE |
| | | VAL07515 | EGRE 8 S 5 B SAE EE |

**Nomenclature** Example: EGRE 6S4 B SAE EE

| EGR | E | 6 | S | 4 | B | SAE EE |
|---|---|---|---|---|---|---|
| Valve Series | External Equalizer (omit for internal equalizer) | Size | Connection S = ODF connections | Connection (in 1/8") | External Equalizer Connection A = NONE, B = 1/4" SAE C = 1/4" ODF | External Equalizer Type |

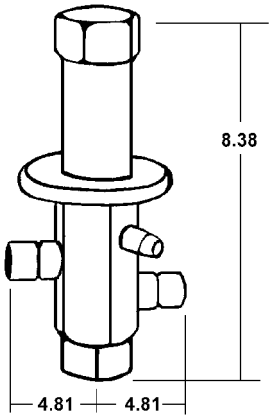
***Nominal Capacity Table in Tons (kW)***

| Valve | R-12 | R-134a | R-22 | R-407C | R-507/R-404A | R-502 |
|---|---|---|---|---|---|---|
| EGR(E)-4 | 1.6 (5.6) | 1.8 (6.2) | 2.9 (10.1) | 2.9 (10.1) | 2.8 (9.7) | 2.6 (9.0) |
| EGR(E)-6 | 2.0 (6.9) | 2.4 (8.3) | 3.8 (13.2) | 3.8 (13.2) | 3.5 (12.1) | 2.9 (10.1) |
| EGR(E)-8 | 3.6 (12.5) | 4.2 (14.6) | 6.7 (23.2) | 6.7 (23.2) | 6.3 (21.9) | 5.9 (20.5) |

See EGRE Extended Capacity Tables (page 107 in tons) before completing selection.

# Regulators

***DGRE Dimensional Data***




DIMENSIONS SHOWN ARE IN INCHES.

## DGR(E) Direct Acting Hot Gas Bypass Regulator

DGRE Series Direct Acting Hot Gas Bypass Regulators are designed for use on residential and light commercial systems. They provide precision system capacity balance at an economical price. The DGRE is an adjustable valve.

The adjustable DGR Regulators are supplied with a factory set point of 50 psig (point at which the regulator starts to open), which can be changed by adjustment. Capacity of these regulators is based on 6° gradient. Rated capacity will be attained when the suction pressure falls 6° below the corresponding set point saturation temperature. This lower temperature, at which the regulator is rated, is termed "evaporator temperature" in the selection tables (on page 102).

When the suction pressure decreases below the set point, the regulator opens and allows discharge gas to be bypassed. The discharge gas may be bypassed into the evaporator or the suction line. When bypassed to the suction line, a liquid injection Thermo Valve must be installed to properly desuperheat the suction gas returning to the compressor.

**Features**
- Compact hermetic construction
- Contoured power assembly for long life

**Options**
- External or internal equalizer

**Specifications**
- Maximum working pressure: 440 psig
- Adjustment range: 0-80 psig (factory setting 50 psig)
- UL file number SA5312, CSA file number 44005

***Ordering Information for DGRE Valves***

| ServiceFirst Item # | Description |
|---|---|
| REG00253 | DGRE 12 S 7 B SAE EE |
| REG00254 | DGRE 12 S 9 B SAE EE |

***Nomenclature example: DGRE 12S7 B SAE EE***

| DGR | E | 12 | S | 7 | B | SAE EE |
|---|---|---|---|---|---|---|
| Valve Series | External Equalizer (omit for internal equalizer) | Size | Connection S = ODF connections | Connection (in 1/8") | EE Connection A = NONE, B = 1/4" SAE C = 1/4" ODF | External Equalizer Type |

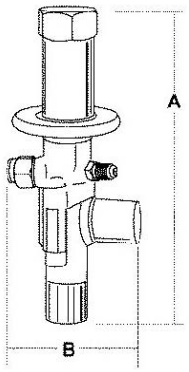
***Nominal Capacity Table in Tons (kW)***

| VALVE | R-12 | R-134a | R-22 | R-407C | R-507/R-404A | R-502 |
|---|---|---|---|---|---|---|
| DGR(E)-12 | 8.3 (29.4) | 9.7 (34.2) | 15.4 (54.6) | 15.4 (54.6) | 14.5 (51.3) | 13.6 (48.0) |

All capacities shown are based on 40°F Evaporator Temperature, 100°F Condensing Temperature, Valve Full Open, Compressor Discharge Temperature is 50°F higher than Isentropic Compression and 25°F Superheat at the compressor inlet.

See page 107 for DGRE Extended Capacity Tables in tons before completing selection.

# Regulators




## CPH(E) Direct Operated Hot Gas Bypass Regulator

CPHE Series Direct Operated Regulators are furnished with an adjustment range of 0-80 psig. Other features include: Take-A-Part construction for service ease without removing the body flange from the line; stainless steel diaphragm; contoured power element; and the "U" gland packing material which eliminates stem friction and packing leaks. Vacuum service is possible by counterclockwise adjustment of the side-mounted adjusting screw. Chart below shows breakdown of parts by number and connection sizes.

A 1/4" SAE male flare external equalizer is standard. Types 1 and 2 can be furnished with internal equalizer—omit "E" from the type number (i.e. CPH1 or CPH2). Types CPHE3 thru CPHE6 use a balanced double-ported cage assembly.

**Features**
- SAE external equalizer standard

**Options**
- Sizes available: 1 thru 6
- ODF and ODF x ODM connections are available
- External air connection available for pneumatic compensation (add EAC prefix – example: EAC CPHE)

**Specifications**
- Adjustment Range: 0-80 psig (factory setting 20 psig)
- UL file #SA5312, CSA file #LR44005

***CPH(E) Dimensional Data***

| VALVE | A | B |
|---|---|---|
| CPH(E)1 | 6.81 | 2.75 |
| CPH(E)2 | 2.94 | |
| CPH(E)3 | 8.25 | |
| CPH(E)4 | 8.25 | |
| CPH(E)5 | 8.75 | |
| CPH(E)6 | 8.75 | |

The above dimensions are maximum height and width variations, dependent on flange selection.

DIMENSIONS SHOWN ARE IN INCHES.

See CPHE Extended Capacity Tables (in tons page 107) before completing selection.

***Nomenclature example: CPHE 3 SAE EE 7/8 x 1 1/8 ODF ANG***

| CPH | E | 3 | SAE EE | 7/8 x 1-1/8 | | ODF | ANG |
|---|---|---|---|---|---|---|---|
| Valve Series | External Equalizer (omit on CPHE1 & 2 for internal equalizer) | Size | 1/4" SAE male External Equalizer | Inlet Connection Size | Outlet Connection Size | Connection Type | Connection Style |

***Ordering Information for CPH(E) Valves***

| ServiceFirst Item # | Description | ServiceFirst Item # | Description |
|---|---|---|---|
| VAL05757 | CPHE 1 SAE EE 3/8 x 5/8 ODF ANG | VAL05763 | CPHE 4 SAE EE 7/8 ODF/1-1/8 ODM ANG |
| VAL05758 | CPHE 1 SAE EE 3/8 x 5/8 ODF S/T | VAL05764 | CPHE 4 SAE EE 7/8 ODF/1-1/8 ODM S/T |
| VAL05759 | CPHE 2 SAE EE 1/2 x 5/8 ODF ANG | VAL05765 | CPHE 5 SAE EE 7/8 ODF/1-1/8 ODM ANG |
| VAL05760 | CPHE 2 SAE EE 1/2 x 5/8 ODF S/T | VAL05766 | CPHE 5 SAE EE 7/8 ODF/1-1/8 ODM S/T |
| VAL05761 | CPHE 3 SAE EE 7/8 x 1-1/8 ODF ANG | VAL05767 | CPHE 6 SAE EE 1-1/8X1-1/8 ODM ANG |
| VAL05762 | CPHE 3 SAE EE 7/8 ODF/1-1/8 ODM S/T | VAL05768 | CPHE 6 SAE EE 1-1/8X1-1/8 ODM S/T |

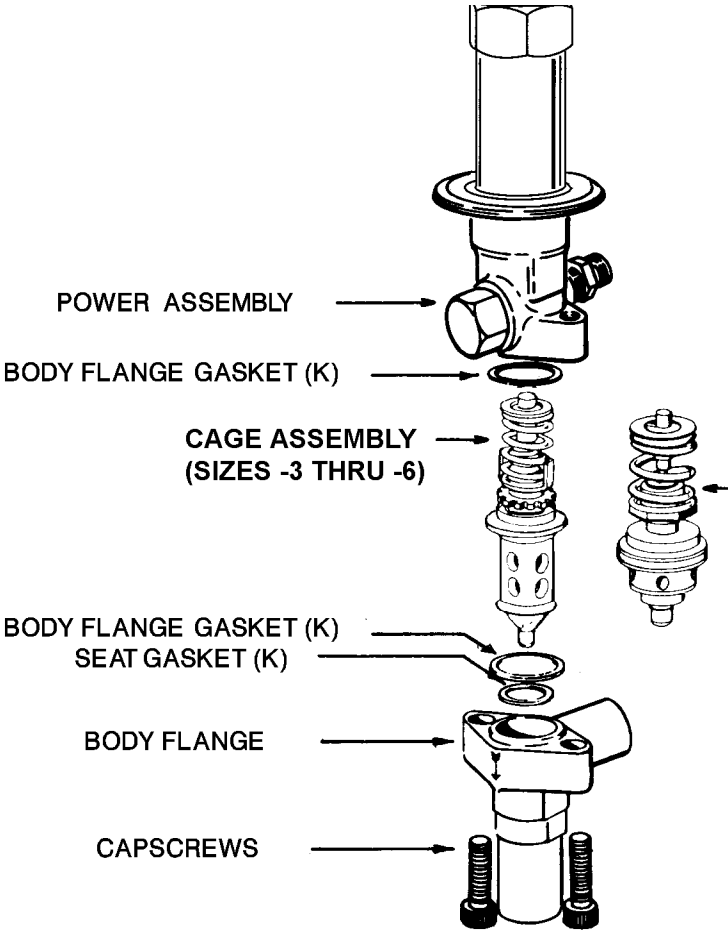
***Nominal Capacity Table in Tons***

| VALVE | R-12 | R-134a | R-22 | R-407C | R-507/R-404A | R-502 |
|---|---|---|---|---|---|---|
| CPH(E)-1 | 0.4 | 0.5 | 0.7 | 0.7 | 0.7 | 0.6 |
| CPH(E)-2 | 0.7 | 0.8 | 1.2 | 1.2 | 1.2 | 1.0 |
| CPH(E)-3 | 1.2 | 1.6 | 2.3 | 2.3 | 2.2 | 2.0 |
| CPH(E)-4 | 3.0 | 3.8 | 5.5 | 5.5 | 5.3 | 4.8 |
| CPH(E)-5 | 3.6 | 4.5 | 6.7 | 6.7 | 6.4 | 5.8 |
| CPH(E)-6 | 4.6 | 5.8 | 8.5 | 8.5 | 8.2 | 7.4 |

All capacities shown are based on 40°F Evaporator Temperature, 100°F Condensing Temperature, Valve Full Open, Compressor Discharge Temperature is 50°F higher than Isentropic Compression and 25°F Superheat at the compressor inlet

# Regulators

## CPH(E) Replacement Parts And Exploded View




***Cage Assembly***

| Valve | Part # | ServiceFirst Item # |
|---|---|---|
| CPH(E)1 | X22440-B5B | CAG00049 |
| CPH(E)2 | X22440-B8B | CAG00052 |
| CPH(E)3 | X11873-B5B | CAG00054 |
| CPH(E)4 | X9117-B9B | CAG00058 |
| CPH(E)5 | X9166-B10B | CAG00059 |
| CPH(E)6 | X9144-B13B | CAG00061 |

Consists of cage assembly and gaskets.

***Power Assembly***

| Valve | Part # | ServiceFirst Item # |
|---|---|---|
| CPH(E)1, 2, 3 | X7118-4 | HED00645 |
| CPH(E)4, 5, 6 | X7428-2 | KIT05340 |

Consists of power assembly and body flange gasket.

***Body Flange***

| Angle Style | Part # | ServiceFirst Item # |
|---|---|---|
| 3/8 x 5/8 ODF | C501-5 | FLG00245 |
| 1/2 x 5/8 ODF | C501-7 | FLG00246 |
| 7/8 ODF x 1-1/8 ODM | 10331 | FLG00261 |
| 7/8 ODF x 1-1/8 ODM | 9153 | FLG00263 |
| 7/8 ODF x 1-1/8 ODM | 9151 | FLG00265 |
| 1-1/8 x 1-1/8 ODM | 9149 | FLG00267 |
| **Straight-thru Style** | **Part #** | **ServiceFirst Item #** |
| 3/8 x 5/8 ODF | 9761-3 | FLG00253 |
| 1/2 x 5/8 ODF | 9761-4 | FLG00255 |
| 7/8 ODF x 1-1/8 ODM | 10332 | FLG00262 |
| 7/8 ODF x 1-1/8 ODM | 9152 | FLG00264 |
| 7/8 ODF x 1-1/8 ODM | 9150 | FLG00266 |
| 1-1/8 x 1-1/8 ODM | 9148 | FLG00268 |

Consists of body flange.

# Regulators

***Extended Capacities Table***

***DGR(E) & EGR(E) Valves for R22 in Tons***

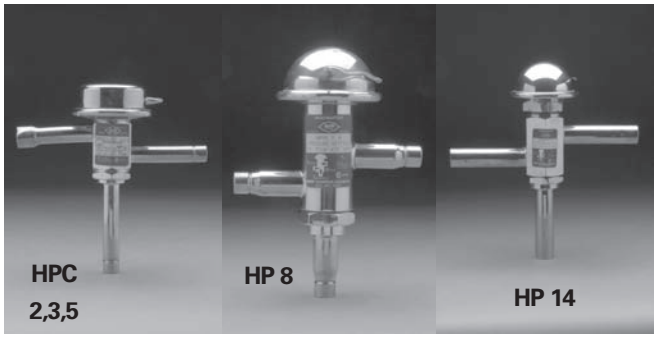
| Total Tons Bypassed | Component Type | Evaporator Temperature °F | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 40° | 30° | 20° | 10° | 0° | –10° | –20° | –30° | –40° |
| 1/2 | Bypass Regulator | EGRE4 | EGRE4 | EGRE6 | EGRE6 | EGRE6 | EGRE6 | EGRE6 | EGRE6 | EGRE8 |
| | Hot Gas Sol. | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 |
| | Liq. Inj. Valve | LCL1A | LCL1A | LCL1B | LCL1B | LCL1B | LCL1C | LCL1C | LCL1C | LCL1C |
| 1 | Bypass Regulator | EGRE4 | EGRE6 | EGRE6 | EGRE6 | EGRE8 | EGRE8 | EGRE8 | EGRE8 | EGRE8 |
| | Hot Gas Sol. | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 |
| | Liq. Inj. Valve | LCL1A | LCL1A | LCL1B | LCL1B | LCL1B | LCL1C | LCL1C | LCL1C | LCL1C |
| 2 | Bypass Regulator | EGRE8 | EGRE8 | EGRE8 | EGRE8 | EGRE8 | EGRE8 | DGRE12 | DGRE12 | DGRE12 |
| | Hot Gas Sol. | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 |
| | Liq. Inj. Valve | LCL1A | LCL1A | LCL1B | LCL1B | LCL1B | LCL1C | LCL1C | LCL1C | LCL1C |
| 3 | Bypass Regulator | EGRE8 | EGRE8 | EGRE8 | DGRE12 | DGRE12 | DGRE12 | DGRE12 | DGRE12 | – |
| | Hot Gas Sol. | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | – |
| | Liq. Inj. Valve | LCL1A | LCL1A | LCL1B | LCL1B | LCL1B | LCL2C | LCL2C | LCL2C | – |
| 4 | Bypass Regulator | EGRE8 | EGRE8 | DGRE12 | DGRE12 | DGRE12 | DGRE12 | DGRE12 | – | – |
| | Hot Gas Sol. | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | – | – |
| | Liq. Inj. Valve | LCL2A | LCL2A | LCL2B | LCL2B | LCL2B | LCL2C | LCL3C | – | – |
| 5 | Bypass Regulator | DGRE12 | DGRE12 | DGRE12 | DGRE12 | DGRE12 | DGRE12 | – | – | – |
| | Hot Gas Sol. | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | – | – | – |
| | Liq. Inj. Valve | LCL2A | LCL2A | LCL2B | LCL2B | LCL2B | LCL2C | – | – | – |
| 6 | Bypass Regulator | DGRE12 | DGRE12 | DGRE12 | DGRE12 | DGRE12 | – | – | – | – |
| | Hot Gas Sol. | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | – | – | – | – |
| | Liq. Inj. Valve | LCL2A | LCL2A | LCL2B | LCL2B | LCL2B | – | – | – | – |
| 7 | Bypass Regulator | DGRE12 | DGRE12 | DGRE12 | DGRE12 | – | – | – | – | – |
| | Hot Gas Sol. | 240RA8 | 240RA8 | 240RA8 | 240RA8 | – | – | – | – | – |
| | Liq. Inj. Valve | LCL2A | LCL2A | LCL2B | LCL3B | – | – | – | – | – |
| 8 | Bypass Regulator | DGRE12 | DGRE12 | DGRE12 | – | – | – | – | – | – |
| | Hot Gas Sol. | 240RA8 | 240RA8 | 240RA8 | – | – | – | – | – | – |
| | Liq. Inj. Valve | LCL3A | LCL3A | LCL3B | – | – | – | – | – | – |
| 9 | Bypass Regulator | DGRE12 | DGRE12 | – | – | – | – | – | – | – |
| | Hot Gas Sol. | 240RA8 | 240RA8 | – | – | – | – | – | – | – |
| | Liq. Inj. Valve | LCL3A | LCL3A | – | – | – | – | – | – | – |
| 10 | Bypass Regulator | DGRE12 | – | – | – | – | – | – | – | – |
| | Hot Gas Sol. | 240RA8 | – | – | – | – | – | – | – | – |
| | Liq. Inj. Valve | LCL3A | – | – | – | – | – | – | – | – |

***CPH(E) & FA8 Valves for R22 in Tons***

| Total Tons Bypassed | Component Type | Evaporator Temperature °F | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 40° | 30° | 20° | 10° | 0° | –10° | –20° | –30° | –40° |
| 1/2 | Bypass Regulator | CPHE-1 | CPHE-1 | CPHE-1 | CPHE-1 | CPHE-1 | CPHE-1 | CPHE-1 | CPHE-1 | CPHE-1 |
| | Hot Gas Sol. | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 | 100RB2 |
| | Liq. Inj. Valve | LCL1A | LCL1A | LCL1B | LCL1B | LCL1B | LCL1C | LCL1C | LCL1C | LCL1C |
| 1 | Bypass Regulator | CPHE-3 | CPHE-3 | CPHE-3 | CPHE-3 | CPHE-3 | CPHE-3 | CPHE-3 | CPHE-2 | CPHE-2 |
| | Hot Gas Sol. | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 | 200RB3 |
| | Liq. Inj. Valve | LCL1A | LCL1A | LCL1B | LCL1B | LCL1B | LCL1C | LCL1C | LCL1C | LCL1C |
| 2 | Bypass Regulator | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 |
| | Hot Gas Sol. | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 | 200RB4 |
| | Liq. Inj. Valve | LCL1A | LCL1A | LCL1B | LCL1B | LCL1B | LCL1C | LCL1C | LCL1C | LCL1C |
| 3 | Bypass Regulator | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 | CPHE-4 |
| | Hot Gas Sol. | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 |
| | Liq. Inj. Valve | LCL1A | LCL1A | LCL1B | LCL1B | LCL1B | LCL1C | LCL2C | LCL2C | LCL2C |
| 4 | Bypass Regulator | CPHE-5 | CPHE-5 | CPHE-5 | CPHE-5 | CPHE-5 | CPHE-5 | CPHE-4 | CPHE-4 | CPHE-4 |
| | Hot Gas Sol. | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 | 200RB5 |
| | Liq. Inj. Valve | LCL2A | LCL2A | LCL2B | LCL2B | LCL2B | LCL2C | LCL3C | LCL3C | LCL3C |
| 5 | Bypass Regulator | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-5 | CPHE-5 | CPHE-5 | CPHE-5 |
| | Hot Gas Sol. | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 |
| | Liq. Inj. Valve | LCL2A | LCL2A | LCL2B | LCL2B | LCL2B | LCL2C | LCL2C | LCL2C | LCL2C |
| 6 | Bypass Regulator | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-5 |
| | Hot Gas Sol. | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 | 200RB6 |
| | Liq. Inj. Valve | LCL2A | LCL2A | LCL2B | LCL2B | LCL2B | LCL3C | LCL3C | LCL3C | LCL3C |
| 7 | Bypass Regulator | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 | CPHE-6 |
| | Hot Gas Sol. | 240RA8 | 240RA8 | 240RA8 | 240RA8 | 240RA8 | 240RA8 | 240RA8 | 240RA8 | 240RA8 |
| | Liq. Inj. Valve | LCL2A | LCL2A | LCL2B | LCL3B | LCL3B | LCL3C | LCL3C | LCL3C | LCL3C |

# Regulators

## HP/HPC HeadMaster® Head Pressure Controls




HeadMaster HP/HPC Series 3-Way Head Pressure Control Valves are controlled by the system discharge pressure. Adequate head pressure, the system pressure imposed by the compressor, is necessary for optimum system performance. When ambient air temperature flowing thru air-cooled condensers is warm enough, there is no problem maintaining head pressure. However, when ambient temperature falls, there is a corresponding head pressure drop and a method of controlling this situation is necessary. The HP/HPC is designed specifically to maintain proper air-cooled condenser pressures during periods of low ambient conditions. The HP/HPC eliminates the need for special piping or multiple control valves. As a single unit, the HP/HPC simplifies piping and reduces installation costs.

**Features**
- Accurate head pressure control, even at low ambient temperatures
- Precise control in maintaining optimum pressure
- Maintains liquid subcooling and prevents liquid line flash gas
- Eliminates the need for special piping or multiple control valves
- Superior operation at low ambients

**Options**
- ODF or SAE connections available – HP Series
- 3/8" or 1/2" ODF connections – HPC Series

**Specifications**
- Maximum working pressure:
  HP5,8 – 500 psig
  HP14 – 440 psig
- Shipping weights:
  HP5 & HP8 = 2-1/2 lbs
  HP14 = 5 lbs
- UL file #SA5312, CSA file #LR44005

***Nomenclature Example: HP 8T4 180 1/2 x 1/2 x 1/2 ODF***

| HP | 8 | T | 4 | 180 | | 1/2 x 1/2 x 1/2 | | ODF |
|---|---|---|---|---|---|---|---|---|
| Valve Series HP or HPC | Size | Connection Style T = ODF F = SAE | Connection Size (in 1/8") | Condensing Pressure Set Point (for corresponding Condensing Temp. see P-T Chart) | Bypass Connection Size | Receiver Connection Size | Condenser Connection Size | Connection Type |

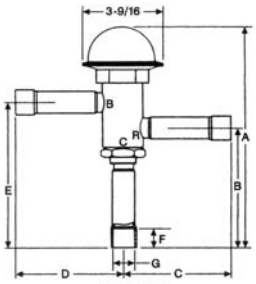
***Ordering Information for HP/HPC Valves***

| ServiceFirst Item # | HP Valve | Connections |
|---|---|---|
| REG00294 | HP 5 T 3-110 | 3/8 x 3/8 x 3/8 ODF |
| REG00295 | HP 5 T 3-185 | 3/8 x 3/8 x 3/8 ODF |
| REG00296 | HP 5 T 4-110 | 1/2 x 1/2 x 1/2 ODF |
| REG00297 | HP 5 T 4-185 | 1/2 x 1/2 x 1/2 ODF |
| REG00298 | HP 8 T 4-110 | 1/2 x 1/2 x 1/2 ODF |
| REG00299 | HP 8 T 4-185 | 1/2 x 1/2 x 1/2 ODF |
| REG00313 | HP 8 T 5-110 | 5/8 x 5/8 x 5/8 ODF |
| REG00300 | HP 8 T 5-185 | 5/8 x 5/8 x 5/8 ODF |

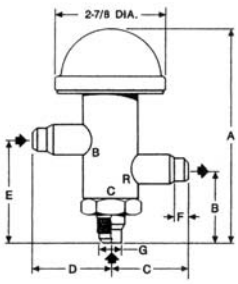
| ServiceFirst Item # | HP Valve | Connections |
|---|---|---|
| REG00457 | HPC 5 T 3-180 | 3/8 x 3/8 x 3/8 ODF |
| REG00314 | HP 8 T 7-110 | 7/8 x 7/8 x 7/8 ODF |
| REG00301 | HP 8 T 7-185 | 7/8 x 7/8 x 7/8 ODF |
| REG00451 | HP 8 T 7-215 | 7/8 x 7/8 x 7/8 ODF |
| REG00311 | HP 14 T 7-120 | 7/8 x 7/8 x 7/8 ODF |
| REG00390 | HP 14 T 7-175 | 7/8 x 7/8 x 7/8 ODF |
| REG00312 | HP 14 T 9-120 | 1-1/8 x 1-1/8 x 1-1/8 ODF |
| REG00291 | HP 14 T 9-175 | 1-1/8 x 1-1/8 x 1-1/8 ODF |
| REG00292 | HP 14 T11-120 | 1-3/8 x 1-3/8 x 1-3/8 ODF |
| REG00293 | HP 14 T11-175 | 1-3/8 x 1-3/8 x 1-3/8 ODF |

# Regulators

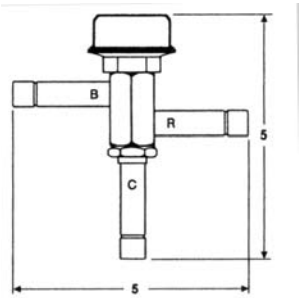
## HP Dimensional Data



HP14



HP5 & HP8



HPC

***HP Dimensions***

| Valve | Size and Style Conn. | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| HP 5F3-* | 3/8 SAE | 5.31 | 1.31 | 1.81 | 1.81 | 2.44 | | |
| HP 5F4-* | 1/2 SAE | 5.75 | 2.06 | 2.00 | 2.00 | 2.81 | | |
| **HP 5T3-*** | 3/8 ODF | 6.81 | 3.81 | 2.56 | 2.56 | 3.94 | .38 | .31 |
| HP 5T4-* | 1/2 ODF | 6.81 | 3.19 | 2.56 | 2.56 | 3.94 | .50 | .38 |
| HP 8F4-* | 1/2 SAE | 5.75 | 2.06 | 2.00 | 2.00 | 2.81 | | |
| HP 8F5-* | 5/8 ODF | 5.84 | 2.16 | 2.19 | 2.19 | 2.91 | | |
| HP 8T4-* | 1/2 ODF | 6.81 | 3.17 | 2.56 | 2.56 | 3.94 | .50 | .38 |
| HP 8T5-* | 5/8 SAE | 6.81 | 3.17 | 2.56 | 2.56 | 3.94 | .63 | .50 |
| **HP 8T7-*** | 7/8 ODF | 6.81 | 3.17 | 2.56 | 2.56 | 3.94 | .88 | .75 |
| HP 14T7-* | 7/8 ODF | | | | | | .38 | .88 |
| HP 14T9-* | 1 1/8 ODF | 10.31 | 5.44 | 4.75 | 4.75 | 6.56 | .94 | 1.13 |
| HP 14T11-* | 1 3/8 ODF | | | | | | 1.00 | 1.38 |

Bold Type Valves are the standard models, other sizes may require longer leadtimes.
Dimensions are shown in inches
* Add Charge Code

| Service Reference Code | | Charge Type A | Charge Type B | Charge Type C |
|---|---|---|---|---|
| | | To be used with refrigerant type | | |
| | | **R-134a** | **R-22** | **R-404A/R-507** |
| | | System condensing pressure set point* (psig) | | |
| Valve | **HP5, HP8** | 110 | 185 | 215 |
| Type | **HP14** | 120 | 175 | 215 |

* For Corresponding Condensing Temperature, see P-T Chart.

# Regulators

## HP/HPC Sizing Selection

Consideration must be given to the system design requirements, such as: equivalent line length (vertical lift or unusual pressure drop), equipment location, etc., to determine if the minimum control range meets design requirements. There are numerous alternatives involving head pressure control applications worth considering.

For engineering assistance, consult your ALCO field engineer or ALCO Technical Services Department, Alco Controls, St.Louis.

**Note**: Be sure the HP valve is not required to operate at conditions exceeding the maximum working pressure.

**Note**: Not recommended for systems utilizing patented subcooling coils in conjunction with low head pressure systems or on systems where the condensate line bypasses the receiver in order to maintain subcooling effect in the liquid line.

***Table 1 – Nominal Capacity Table in Tons***

| | | Pressure Drop – psi (kPa) | | | | |
|---|---|---|---|---|---|---|
| 1 (7) | 2 (14) | 3 (21) | 4 (28) | 5 (35) | | |
| Refrigerant | Valve | Tons | Tons | Tons | Tons | Tons |
| R-134a | HPC-2 | 1.0 | 1.4 | 1.8 | 2.0 | 2.3 |
| | HPC-3 | 1.7 | 2.4 | 3.0 | 3.5 | 3.9 |
| | HPC-5 | 2.2 | 3.2 | 3.9 | 4.5 | 5.0 |
| | HP-5 | 2.0 | 2.9 | 3.6 | 4.1 | 4.6 |
| | HP-8 | 5.5 | 7.8 | 9.6 | 11.0 | 12.4 |
| R-22/ R-407C | HP-14 | 14.0 | 19.8 | 24.2 | 28.3 | 31.7 |
| | HPC-2 | 1.1 | 1.6 | 1.9 | 2.2 | 2.5 |
| | HPC-3 | 1.9 | 2.7 | 3.3 | 3.8 | 4.2 |
| | HPC-5 | 2.4 | 3.4 | 4.2 | 4.9 | 5.4 |
| | HP-5 | 2.2 | 3.2 | 3.9 | 4.5 | 5.0 |
| | HP-8 | 6.0 | 8.5 | 10.5 | 12.0 | 13.5 |
| | HP-14 | 14.7 | 20.8 | 25.6 | 29.7 | 33.8 |
| R-404A/ R-507 | HPC-2 | 0.7 | 1.0 | 1.3 | 1.5 | 1.7 |
| | HPC-3 | 1.3 | 1.8 | 2.2 | 2.5 | 2.8 |
| | HPC-5 | 1.6 | 2.3 | 2.8 | 3.3 | 3.6 |
| | HP-5 | 1.5 | 2.1 | 2.6 | 3.0 | 3.3 |
| | HP-8 | 3.9 | 5.5 | 6.7 | 7.8 | 8.7 |
| | HP-14 | 10.1 | 14.3 | 17.6 | 20.5 | 23.0 |
| R-12 | HPC-2 | 0.9 | 1.2 | 1.5 | 1.7 | 1.9 |
| | HPC-3 | 1.5 | 2.1 | 2.6 | 3.0 | 3.4 |
| | HPC-5 | 1.8 | 2.5 | 3.1 | 3.6 | 4.0 |
| | HP-5 | 1.7 | 2.4 | 3.0 | 3.4 | 3.8 |
| | HP-8 | 4.6 | 6.5 | 8.0 | 9.2 | 10.3 |
| | HP-14 | 11.7 | 16.5 | 20.2 | 23.6 | 26.4 |
| R-502 | HPC-2 | 0.7 | 1.0 | 1.3 | 1.5 | 1.6 |
| | HPC-3 | 1.3 | 1.8 | 2.3 | 2.6 | 2.9 |
| | HPC-5 | 1.6 | 2.3 | 2.8 | 3.2 | 3.6 |
| | HP-5 | 1.5 | 2.1 | 2.6 | 3.0 | 3.3 |
| | HP-8 | 3.9 | 5.5 | 6.7 | 7.8 | 8.7 |
| | HP-14 | 10.1 | 14.3 | 17.6 | 20.5 | 23.0 |

All capacities shown are based on 40°F Evaporator Temperature and 100°F liquid.

***Table 2 – Multiplier Factors for Capacities at Conditions Other Than Nominal Ratings***

| | Evaporator Temperature °F | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Liquid | R-134a/R-12 | | | | | R-22/R-407C | | | | | R-404A/R-507/R-502 | | | | |
| Temp. °F | 40° | 20° | 0° | -20° | -40° | 40° | 20° | 0° | -20° | -40° | 40° | 20° | 0° | -20° | -40° |
| 120° | 0.87 | 0.82 | 0.78 | 0.71 | 0.69 | 0.89 | 0.86 | 0.84 | 0.82 | 0.78 | 0.84 | 0.79 | 0.74 | 0.69 | 0.63 |
| 100° | 1.00 | 0.96 | 0.91 | 0.86 | 0.82 | 1.00 | 0.98 | 0.95 | 0.93 | 0.89 | 1.00 | 0.96 | 0.90 | 0.85 | 0.79 |
| 80° | 1.13 | 1.08 | 1.04 | 0.99 | 0.95 | 1.12 | 1.09 | 1.06 | 1.03 | 1.00 | 1.14 | 1.09 | 1.04 | 0.99 | 0.93 |
| 60° | 1.27 | 1.22 | 1.17 | 1.12 | 1.07 | 1.22 | 1.20 | 1.17 | 1.14 | 1.10 | 1.32 | 1.27 | 1.21 | 1.16 | 1.09 |
| 40° | – | 1.34 | 1.29 | 1.24 | 1.19 | – | 1.30 | 1.27 | 1.24 | 1.21 | – | 1.42 | 1.37 | 1.31 | 1.26 |
| 20° | – | – | 1.42 | 1.38 | 1.32 | – | – | 1.39 | 1.35 | 1.32 | – | – | 1.51 | 1.46 | 1.41 |

# Temperature-Pressure Controls

## Fundamentals of Temperature Pressure Controls

### Introduction

Pressure controls serve various functions, which may be divided into control and protection functions. Examples for control functions are compressor cycling, pump-down or defrost control. Protection functions include, pressure limiting and cut out against excessive pressures, against loss of charge or for freeze protection.

ALCO pressure controls are equipped with display scale and pointers to indicate the approximate settings. The display scales are printed in relative pressure units “bar” and “psi”. For precise setting of the controls, external gauges must be used.

### Pressure sensing

All pressures are understood as gauge pressures. PS1/PS2 and TS1 controls sense pressure by means of bellows which expand or contract when exposed to medium pressure. PS3 controls use a diaphragm rather than a bellows.

High pressure limiters and pressure cut outs with type approval according to DIN 32733 feature a double bellows design. The inner bellows serves as the operating bellows and is enclosed by the outer bellows featuring a larger surface area.

Should the inner bellows leak, then the larger surface area of the outer bellows creates a larger force and causes the pressure control to a pre-empted cut out. This represents a fail-safe function.

***Bellows Diagram***

Standard controls for refrigeration applications are equipped with a bronze bellows and can be used with all common HFC, HCFC and CFC refrigerants. For ammonia applications controls with stainless steel bellows are available on request.

### Pressure connectors

A variety of pressure connectors, including male and female flare type connectors, capillary and solder connectors are available. The standard connector is a 7-16”-20 UNF male flare connector, which, in its high pressure versions, is equipped with a snubber to protect against pressure pulsations.

Refer to the Nomenclature Section for a complete listing of available connector types.

### Electrical contacts

PS1/PS2/PS3 and TS1 controls are equipped with high rated double snap action contacts for chatter-free and reliable operation. All contacts throughout this range of controls are designed as Single Pole Double Throw (SPDT) contacts. One contact may be used for control and the other contact for alarm/status indication or auxilliary control. In addition, Dual Pressure Controls PS2 come with two independently actuated SPDT contacts, providing for even further application flexibility by allowing for a variety of wiring options.

Gold plated contacts are available on request for low electrical loads, for example in electronic signalling D.C. applications.

***Electrical Ratings***

| | | |
|---|---|---|
| Maximum Load | 120VAC | 240VAC |
| Full Load Amps | 24 FLA | 24 FLA |
| Locked Rotor Amps | 144 LRA | 144 LRA |
| Horsepower | 2 HP | 3 HP |
| Pilot Duty | 720VA | 720VA |
| NonInductive | 24 amps | 24 amps |

### Setpoints

PS1/PS2 and TS1 are adjustable controls with either internal or external adjustment spindles for range and differential[1]. By turning the range spindle, the *upper setpoint* is defined and by adjusting the differential spindle, the differential and hence the *lower setpoint* is changed (upper setpoint does not change).

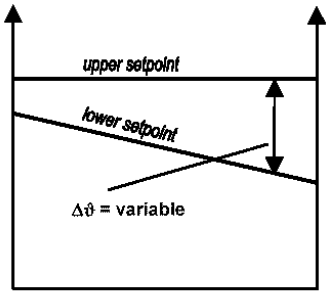
The dependency between upper and lower setpoint is always as follows:

**lower setpoint = upper setpoint – differential**

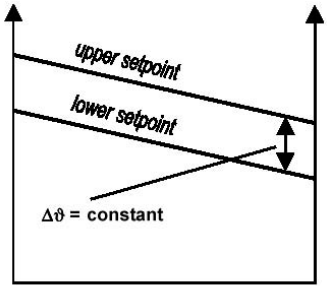
The following two rules should be kept in mind:

- An adjustment of the range spindle always affects both, upper and lower setpoint.
- An adjustment of the differential spindle affects the lower setpoint, only.

The following diagrams depict this dependency:




***Effect of turning differential spindle***




***Effect of turning range spindle***

[1] Manual reset controls have a fixed differential and no differential spindle

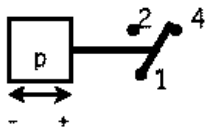
### Contact Function

All PS1, PS2 and TS1 Controls have contacts labelled 1-2-4 where ‘1’ refers to the common pole, ‘2’ refers to the lower setpoint and ‘4’ refers to the upper setpoint.

The contact function for automatic and manual reset versions is as described below.

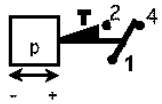
# Temperature-Pressure Controls

**Automatic Reset**
On temperature/pressure rise above the upper setpoint, contacts 1-2 open and contacts 1-4 close. On decreasing temperature/pressure lower setpoint contacts 1-4 open and contacts 1-2 close



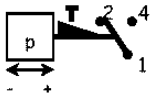

Automatic reset contact function

**Manual Reset–Low Temperature or Pressure**
On decreasing temperature or pressure below the lower setpoint, contacts 1-4 open, contacts 1-2 close and latch. Only on pressure rise above upper setpoint and after pressing the manual reset button contacts 1-2 will open and contacts 1-4 will close again.




Manual reset low pressure contact function

**Manual Reset–High Temperature or Pressure**
On increasing temperature or pressure above the upper setpoint, contacts 1-2 open, contacts 1-4 close and latch. Only on falling temperature or pressure below lower setpoint and after pressing the manual reset button, contacts 1-4 will open and contacts 1-2 will close again.




Manual reset high pressure contact function

For operational safety, all PS1/PS2 with manual reset are designed as trip-free controls, i.e. pressing the manual reset button while the pressure has not reached its reset treshold will not operate the electrical contacts.

The contact function for controls with internal and external manual reset is alike. The only difference between the two is that for internal manual reset the cover has to be undone, whereas the external reset controls can be reset without removing the cover.

As Dual Pressure Controls, PS2 have two complete sets of contacts, their function is the same as on Single Pressure Controls PS1 with the only difference that the contact labels are preceded by an additional index. One side of the control is labeled 11-12-14 whereas the second side is 21-22-24.

The contact function of controls with convertible reset is as described above but depends on the actual position of the convertible reset toggle, i.e. automatic or manual reset position.

**Installation and maintenance**
Controls come with a lockplate which may be used to protect the settings by wire-seal if desired. Range and differential spindle may be sealed independent from each other.

A front access manual toggle is provided for checking out control operation. On low pressure controls this toggle may be used to override the low pressure signal during system evacuation, avoiding the need to undo the electrical wiring for this purpose.

All PS1 / PS2 controls come with heavy duty terminal blocks which are finger-proof and feature wire clamps plus non-loosening terminal screws for ease of wiring.

Available accessories include mounting brackets of various types, including flat and angle brackets. A universal mounting bracket which matches the most common whole patterns encounted in the field is also available.

The standard mounting holes for mounting brackets are equipped with a universal thread to fit both, M4 and UNC 8-32 screws. The standard wholesale package includes two mounting screws. Several hole patterns for surface mounting are provided.

# Temperature-Pressure Controls

## TF115 Replacement

*See page 109 for Old to New Cross Reference (TF115 to TS1)*

## TS1 Series Temperature Controls

The TS1 Series is ALCO's range of adjustable thermostats for application in refrigeration and heat pump systems. In these systems, thermostats serve control and monitoring functions, such as space temperature control, high/low temperature alarming or defrost termination. By operating a set of electrical contacts, a temperature value is kept inside a certain limit.

Several housing variants and sensors are provided in order to suit a control to a specific application.

**Features**

- Adjustable temperatures and differentials
- Range and differential pointer in units °C and °F
- Range and differential individually lockable by wire seal
- Captive terminal and cover screws
- Manual toggle for system checkout and override
- Bellows heater for thermostats with vapour charge
- Room thermostats with insulation console
- Standard accessories include mounting brackets and knob with lockplate on all individually packed controls
- Non-ambient sensitive
- Heavy-duty SPDT switch allows handling of most loads directly without the use of relays

**Specifications**

- Ambient temperature ranges -50°C to +70°C (-58°F to 158°F)
- SPDT switch rated for 120VAC/240VAC at 24FLA and 144LRA
- Agency approvals include: UL/CUL file #E85974, VDE 0631/0660, TÜV, CE 73/23/EWG, CE 93/68/EWG

**Options**

- Housing variants for top and front operation
- Flush mounted version
- Vapor, liquid and cross-ambient charges
- Sensor shapes for various applications
- Versions with and without manual override
- Factory set to customer specification
- Different types of mounting brackets
- Sensor bulb wells and capillary tube holders
- Special approvals

***Nomenclature – Example TS! BIE***

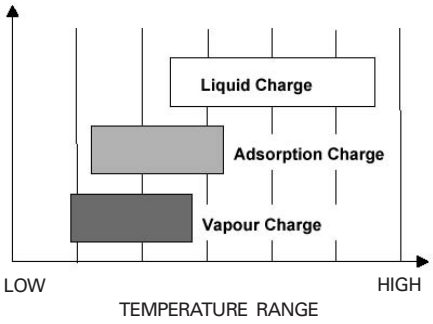
| TS1 | B | 1 | E |
|---|---|---|---|
| **Product Name** | **Housing Variant/function** | **Temperature Range** | **Sensor Type** |
| TS1 = Adjustable thermostat<br>TSA = Customer specials | A = Wall mount design, top adjustment<br>B = Wall mount design, top adjustment, off-switch<br>C = Frost monitor, auto reset<br>D = Frost monitor, manual reset<br>E = Wall mount design, front adjustment<br>F = Wall mount design, front adjustment, off-switch<br>G = Flush mount design, front adjustment<br>H = Flush mount design, front adjustment, off switch<br>R = Wall mounting, top adjustment, manual reset<br>X = Wall mount design, top adjustment<br>Y = Frost monitor, manual reset | 0 = +40 to +68°F (+4.5 to +20°C)<br>1 = -50 to +14°F (-45 to -10°C)<br>2*=-22 to +50°F (-30 to +10°C)<br>-22 to +59°F (-30 to +15°C)<br>3*=+14 to +77°F (-10 to +25°C)<br>+14 to +95°F (-10 to +35°C)<br>4*=-13 to +86°F (-25 to +30°C)<br>-22 to +95°F (-30 to +35°C)<br>5*=+68 to +140°F (+20 to +60°C)<br>+77 to +167°F (+25 to +75°C)<br>6 = +122 to +212°F (+50 to +100°C)<br>7 = +32 to +50°F (0 to +10°C)<br>8 = +194 to +284°F (+90 to +140°C)<br>9 = +266 to +356°F (+130 to +180°C)<br>NOTES<br>Temp ranges 0-4:<br>manual reset for falling temperature off-switch<br>Temp ranges 5-9:<br>manual reset for rising temperature<br>*First line is range for controls with housing variant/function A, B, C, D, R, X or Y. Second temperature range applies to controls with housing variant/function E, F, G or H. | A = Vapor Charge, 2 m. capillary<br>C = Liquid Charge, 2 m. bulb<br>E = Vapor Charge, 0 m. coil<br>F = Adsorption Charge, 2 m. bulb<br>P = Vapor Charge, 2 m. capillary for housing variant A/B/E/F/G/H/R.<br>6 m. capillary for housing variant C/D/X/Y. |

# Temperature-Pressure Controls

## Temperature Sensors

TS1 thermostats sense temperature by means of a thermal system, consisting of temperature charge, bulb, capillary and bellows. The temperature charge changes its pressure based on the refrigerant temperature to be sensed. The sensor is the portion of the system which is in thermal contact with the refrigerant, the capillary connects the sensor with the bellows and the bellows contracts or expands depending on the pressure, causing the thermostat to operate the electrical contacts. An exception are capillary type of sensors, which do not have a bulb, instead, their capillary serves as the bulb directly. Charges and sensor types are matched to temperature ranges and other application specific characteristics.

TS1 thermostats come with one of three charge types: vapor charges, adsorption charges or liquid charges. The application temperature range covered by each charge type is shown in the chart below.




**Vapor Charge–Sensor Type A, E, P**
These sensing elements always sense from the coldest point on the capillary, coil, bulb or power element head. For proper operation it must be ensured that this coldest point is at the sensor portion which is exposed to the temperature to be sensed. The sensing location should be at least 4°F (2 K) colder than the other parts of the thermal system.

In order to avoid unwanted effects of heat transfer, e.g. from a cold wall, ALCO vapour charged thermostats come with an integrated bellows heater, which is rated for 230 V applications. For other applications the heater must be disabled, alternatively, a bellows heater with a different rating may be available.

In addition to the bellows heater, room thermostats are supplied with an insulation console for the same reason.

Sensor type 'A' is a coiled bulb sensor with two meter capillary, which may be used with or without a bulb well. Style 'E' is a coil sensor for space temperature sensing, and type 'P' is a capillary type of sensor which can be wrapped around a heat exchanger's surface in order to sense the coldest point on the heat exchanger for frost protection applications.

Vapor charges respond faster to temperature changes than adsorption and liquid charges.

**Adsorption Charge–Sensor Type F**
Adsorption charged sensor types operate on the basis of a temperature dependent adsorption material, which is located inside the bulb only. Therefore these sensor types always respond to temperature changes at the bulb only. This makes them suitable to applications where it is not always defined which part of the thermal system the coldest point is (cross ambient applications). An example for such applications is defrost control.

Adsorption charges are slower in response to temperature changes than vapour charges.

**Liquid Charge–Sensor Type C**
Liquid charge sensors of type 'C' always sense from the warmest point of the thermal system. This condition must always be ensured. The sensing location should always be warmer than 4°F (2 K) than other parts of the thermal system.

## Housing Variants

TS1 controls can be delivered in three main housing variants, top operated, front operated and flush mounted. All three variants are available either with or without off-switch, which cuts off power supply to the thermostat in off position.

**Top operated controls–Function/ Housing Variant A,B,C,D,R,X,Y**
Have adjustment spindles at the top and a display scale, indicating temperature setpoint and differential, at the front. A knob which may be permanently plugged onto one of the adjustment spindles comes with every control. Frost monitors and room thermostats are derivatives of top operated thermostats. They differ by their sensors and other features to suit their particular target applications.

**Front operated controls–Function/ Housing Variant E,F**
Have an adjustment knob at the front for the temperature setpoint with an approximate scale imprinted on the knob. In order to adjust the temperature differential, the cover of the control must be removed.

**Flush Mounted controls–Function/ Housing Variant G,H**
Designed in a way that they can be integrated into a panel or housing, for example into display cases.

# Temperature-Pressure Controls

***Ordering Information for TS1 Temperature Controls***

| Type | ServiceFirst Item # | Adjustment Range Upper Setpoint °F (°C) | Adjustment Range Differ. Setpoint °F (°K) | Factory Setting °F (°C) | Temperature Sensor Charge | Temperature Sensor Type |
|---|---|---|---|---|---|---|
| **Top Operated Thermostats Without Off-switch (Capillary Type Sensor)** | | | | | | |
| TS1-X1A | CNT02201 | -49 to 14 (-45...-10) | 3 to 29 (2 to 16) | 0/-4 (-18/-20) | Vapor | 6 Ft. (2 m.) capillary |
| TS1-X2A | CNT02202 | -22 to 59 (-30...+15) | 3 to 29 (2 to 16) | 30/21 (-1/-6) | Vapor | 6 Ft. (2 m.) capillary |
| TS1-X4F | CNT02200 | -22 to 95 (-30...+35) | 5 to 36 (3...20) | 41/32 (+5/0) | Adsorption | 6 Ft. (2 m.) cap. & bulb |
| **Room Thermostats Top Operated Without Off-switch (Includes Insulation Console And Coil Type Sensor)** | | | | | | |
| TS1-X2E | CNT02203 | -22 to 59 (-30...+15) | 3 to 29 (2 to 16) | 39/35 (+4/+2) | Vapor | Coil |
| TS1-X3E | CNT02204 | 14 to 95 (-10...+35) | 3 to 29 (2 to 16) | 68/64 (+20/+18) | Vapor | Coil |
| **Freeze-Stat, Top Operated Without Off-switch (Capillary Type Sensor)** | | | | | | |
| TS1-C0P | CNT04019 | 40 to 68 (+45...+20) | 5 (3) fix | 40/36 (4.5/+2) | Vapor | 20 Ft. (6 m.) capillary |
| TS1-Y0P | CNT03258 | 40 to 68 (+45...+20) | Man Reset Ca .5 (3) fix | 36 (+2) | Vapor | 20 Ft. (6 m.) capillary |

1 Low Temperature Cut Out
2 Defrost & Universal Thermostat

**Old To New Cross Reference (TF115 To TS1)**

| Old Model | New Model | ServiceFirst Item # | Replaces The Competition Ranco | Penn | White-Rodgers | Honeywell |
|---|---|---|---|---|---|---|
| TF115-S2-AA10 | TS1-X2A 21/30 | CNT02202 | 010-1408, 010-1409 | | 1609-90 | T4031A1008 |
| | | | 010-1410, 010-104 | | | |
| TF115-S4-AF10 | TS1-X4F 32/41 | CNT02200 | 060-100 | A19ABC-24 | 1609-101, 1609-102 | T6031A1029 |
| | | | F25-107 | A19ZBC-2 | 1609-103 | |
| TF115-S2-AE00 | TS1-X2E 36/40 | CNT02203 | 010-1418, 016-594 | A19BBC-2 | 201-20 | T605 |
| | | | 010-1072 | | | |
| TF115-S3-AE00 | TS1-X3E 64/68 | CNT02204 | 010-301, 016-165 | A19BAB-3, A19BAC-1 | 201-8 | T6054B |
| TF115-S1-AA10 | TS1-X1A -4/0 | CNT02201 | 010-1433 | | 1609-100 | |
| TF115-S0-DP20 | TS1-Y0P-36 | CNT03258 | | | | |
| TF115-S0-AP20 | TS1-C0P | CNT04019 | | | | |

# Temperature-Pressure Controls

## FF115 Replacement

See page 111 for Old to New Cross Reference (FF115 to PS1)

## PS1 Series Single Pressure Controls

PS1 Single Pressure Controls are designed for use on high and low pressure applications in refrigeration and heat pump systems. By operating a set of electrical contacts, a pressure is kept inside a certain limit.

### Features

- Adjustable pressures and differentials
- Narrow adjustable differential depending on model
- Range and differential pointer in units bar and psig
- Range and differential individually lockable by wire seal
- High rated SPDT contacts for all versions
- Captive terminal and cover screws
- Manual toggle for system checkout and override
- Factory installed wire bridge for reduced installation effort

### Options

- Different pressure connections
- Automatic and manual reset versions
- Factory set to customer specification
- Different types of mounting brackets

### Specifications

- SPDT switch rated for 120VAC/240VAC at 24FLA and 144LRA
- Agency approvals include: UL/CUL file #E85974, VDE 0631/0660, TÜV, CE 73/23/EWG, CE 93/68/EWG
- Low pressure and high pressure versions available with TÜV approval according to EN 12263 (supercedes DIN 32733) to meet requirements of DIN 8901 and EN378 (supercedes DIN 8975)

***Nomenclature – Example PS1-A5K***

| PS1 | A | 5 | K |
|---|---|---|---|
| **Product Name** | **Function** | **Pressure Range** | **Pressure Connector Type** |
| TS1 = Adjustable thermostat<br>PS1 = Adjustable single Pressure Control<br><br>PSA = Customer specials | A = Wall mount design, top adjustment<br>A = Pressure control, automatic reset, internal range & differential adjustments<br>B = Pressure cut out, external manual reset, DIN/TUV approved, internal range and differential adjustments[A,Á]<br>R = Pressure cut out, external manual reset, internal range and differential adjustments[A,Á]<br>S = Safety pressure cut out, internal manual reset, DIN/TUV approved, internal range & differential adjustments[A,Á]<br>U = Convertible from R to A<br>W = Pressure control, automatic reset, DIN/TUV approved, internal range and differential adjustments<br>X = Pressure control, automatic reset, external range and differential adjustments<br>Y = Pressure cut out, external manual reset, external range and differential adjustments<br><br>[1] Function types B, R, S in combination with Pressure Range 1 or 3 have a low pressure manual reset function. (15 psi differential)<br>[2] Function types B, R, S in combination with Pressure Range 4 or 5 have a high pressure manual reset function. (60 psi diff.) | 0 = +40 to +68°F (+4.5 to +20°C)<br>1 = 24"Hg to 42 psi (-0.75 to 3 bar)<br>2 = 26"Hg to 21 psi (-0.8 to 1.5 bar)<br>3 = 15"Hg to 100 psi (-0.5 to 7 bar)<br>4 = 15 to 290 psi (1 to 20 bar)<br>5 = 90 to 450 psi (6 to 31 bar) | A = Vapor Charge, 2 m. capillary<br>A = 7/16"-20 UNF male for 1/4" SAE male flare<br>C = R 1/4" stainless steel with steel bellows<br>F = 1/4"-18 NPTF stainless steel with steel bellows<br>K* = 7/16"-20 UNF flare nut with 1 meter (3 ft.) cap tube<br>L = 1/4" ODF solder with 1 meter (3 ft.) cap tube<br>R = R 1/4"<br>U = 6 mm ODF solder, 80 mm tube length<br>X = 1/4" ODF solder, 80 mm tube length<br><br>* Controls with housing variant X/Y have extended copper ends, without schrader valve depressor. All other housing variants have schrader valve depressor and brass end fitting with copper gasket. |

# Temperature-Pressure Controls

***Ordering Information for PS1 Single Pressure Controls***

| Single Pressure Control | ServiceFirst. Item # | Upper Setpoint PSI (BAR) | Adjustment Range Diff. Setpoint PSI (BAR) | Factory Setting PSI (BAR) | Pressure Connection |
|---|---|---|---|---|---|
| **Low Pressure Controls** | | | | | |
| PS1-X1K | CNT02198 | 24" Hg to 42 (-.75 to 3) | 4 to 29 (.25 to 2) | 7/15 (.5/1) | Capillary/ nut |
| PS1-X3A | CNT02187 | 15" Hg to 100 (-0.5 ... +7) | 7 to 73 (0.5 ... 5) | 50/65 (3.5/4.5) | 7/16"-20 UNF, 1/4" SAE male |
| PS1-X3K | CNT02188 | 15" Hg to 100 (-0.5 ... +7) | 7 to 73 (0.5 ... 5) | 50/65 (3.5/4.5) | Capillary/ nut |
| **High Pressure Controls** | | | | | |
| PS1-X4K | CNT02189 | 15 to 290 (1 to 20) | 15 to 100 (1 to 7) | 145/115 (10/8) | Capillary/ nut |
| PS1-X5A | CNT02190 | 90 to 450 (6 ... 31) | 29 to 217 (2 ... 15) | 190/280 (10/19) | 7/16"-20 UNF |
| PS1-X5K | CNT02192 | 90 to 450 (6 ... 31) | 29 to 217 (2 ... 15) | 230/290 (16/20) | Capillary/ nut |
| PS1-Y5A | CNT02191 | 90 to 450 (6 ... 31) | External Manual Reset High Pressure 60 psi (4 bar) fixed | 390 (27) | 7/16"-20 UNF, 1/4" SAE male |
| PS1-Y5K | CNT02193 | 90 to 450 (6 ... 31) | External Manual Reset High Pressure 60 psi (4 bar) fixed | 290 (20) | Capillary/ nut |

| **Old To New Cross Reference (TF115 to TS1)** | | | **Replaces The Competition** | | | | |
|---|---|---|---|---|---|---|---|
| Old Model | New Model | ServiceFirst Item # | Copeland ① | Ranco | Penn | Danfoss | Saginomiya |
| FF115-S1-BAK | PS1-X1K 7/15 | CNT02198 | 085-0098-21<br>985-CP1A-1K | 010-1402<br>016-557 | P70AB-12 | | |
| FF115-S4-BAK | PS1-X4K 115/145 | CNT02189 | 085-0098-33 | 010-2000<br>016-593 | P70AA-2 | | |
| FF115-S3-BAK | PS1-X3K 50/65 | CNT02188 | 085-0098-00<br>985-CP1A-3K | 010-1483, 011-3099<br>016-527 | P70AB-12, P70AB-2<br>P70CA-2 | | |
| FF115-S5-BAK | PS1-X5K 230/290 | CNT02192 | 085-0098-08<br>985-CP1A-5K | 010-2054, 011-1711<br>016-108, 020-7006 | P70AA-118<br>P70CA-3 | | |
| FF115-S5-BRK | PS1-Y5K 230/290 | CNT02193 | | 016-200 | P70DA-1 | P70KA-1 | |
| FF115-S3-BAA | PS1-X3A 50/65 | CNT02187 | 985-CP1A-3A | 010-1401, 010-1831<br>011-1799, 016-106<br>016-107 | P170AB-12<br>P170AB-2 | KP1 60-1101 | SNS-C106X |
| FF115-S5-BAA | PS1-X5A 140/280 | CNT02190 | 985-CP1A-5A | 010-1894, 011-1713<br>016-503, 016-570<br>016-106 | P170AA-118, P170CA-3<br>P77AAA-9350<br>P77AAA-9370 | KP5 60-1171 | SNS-C130X, SNS-C135X |
| F115-S5-BRA | PS1-Y5A 330/390 | CNT02191 | | 016-209, 016-106 | P170DA-1, P77BEA-9350<br>P77BEA-9370 | KP5 60-1173 | |
| | PS1-U5A 385 | | 985-CP1U-5A | | | | |
| | PS1-U5K 385 | | 985-CP1U-5K | | | | |

① The Alco control may be used with bracket (PCN 097221) to allow replacement of the Copeland control with the same mounting configuration.

# Temperature-Pressure Controls

## FF215 Replacement

See page 114 for Old to New Cross Reference (FF215 to PS2)

## PS2 Series Dual Pressure Controls

PS2 Dual Pressure Controls are designed for use on high and low pressure applications in refrigeration and heat pump systems. By operating a set of electrical contacts, a pressure is kept inside certain limits.

**Features**

- Adjustable pressures and differentials
- Narrow adjustable differential depending on model
- Range and differential pointer in units bar and psig
- Range and differential individually lockable by wire seal
- High rated SPDT contacts for all versions
- Captive terminal and cover screws
- Manual toggle for system checkout and override
- Factory installed wire bridge for reduced installation effort

**Options**

- Different pressure connections
- Automatic and manual reset versions
- Factory set to customer specification
- Different types of mounting brackets

**Specifications**

- SPDT switch rated for 120VAC/240VAC at 24FLA and 144LRA
- Agency approvals include: UL/CUL file #E85974, VDE 0631/0660, TÜV, CE 73/23/EWG, CE 93/68/EWG
- Low pressure and high pressure versions available with TÜV approval according to DIN 32733 to meet requirements of DIN 8901 and DIN 8975

# Temperature-Pressure Controls

## PS2 Series Dual Pressure Controls

***Nomenclature – Example PS2-G8A***

| PS2 | G | B | A |
|---|---|---|---|
| **Product Name** | **Function** | **Pressure Range** | **Pressure Connector Type** |
| PS2 = Adjustable Dual Pressostat | A = Both sides: Pressure controls, Automatic reset, Internal range and differential adjustments. | 7 = Left side: 15"Hg to 100 psi (-0.5 to 7 bar) Right side: 90 to 450 psi (6 to 31 bar) | A = 7/16"-20 UNF male for 1/4" SAE flare fitting |
| PSB = Customer special Version | B = Both sides: Pressure cut out, External manual reset, DIN/TÜV approved, internal range and differential adjustments. | 8 = Left side: 90 to 450 psi (6 to 31 bar) Right side: 90 to 450 psi (6 to 31 bar) | C = R 1/4" stainless steel with steel bellows |
| | C = Left side: Pressure control, Automatic reset, DIN/TÜV approved, Internal range and differential adjustments. Right side: Safety cut out, External manual reset, DIN/TÜV approved, Internal range & differential adjustments. | 9 = Left side: 24"Hg to 45 psi (-0.75 to 3 bar) Right side: 90 to 450 psi (6 to 31 bar) | F = 1/4"-18 NPTF stainless steel with steel bellows |
| | G = Left side: Pressure control, Automatic reset, DIN/TÜV approved, Internal range and differential adjustments. Right Side: Safety limiter, internal manual reset, DIN/TÜV approved, Internal range & differential adjustments. | | K* = 7/16"-20 UNF flare nut with 1 meter (3 ft.) cap tube |
| | L = Left side: Pressure control, Automatic reset, Internal range and differential adjustments. Right side: Pressure cut out, External manual reset, Internal range and differential adjustments. | | L = 1/4" ODM solder with 1 meter (3 ft.) cap tube |
| | M = Left side: Pressure control, Automatic reset, Internal range and differential adjustments. Right side: Convertible reset from R to A, Internal range and differential adjustments. | | R = R 1/4" |
| | R = Both sides: Pressure cut out, External manual reset, Internal range and differential adjustments. | | U = 6 mm ODF solder, 80 mm tube length |
| | S = Both sides: Pressure safety cut out, Internal manual reset, DIN/TÜV approved, Internal range and differential adjustments. | | X = 1/4" ODF solder, 80 mm tube length |
| | T = Left side: Pressure control, Automatic reset, DIN/TÜV approved, Internal range and differential adjustments. Right Side: Safety limiter, internal manual reset, DIN/TÜV approved, Internal range & differential adjustments. | | * Controls with housing variants X/Y/Z have extended copper ends, without schrader valve depressor. All other housing variants have schrader valve depressor and brass end fitting with copper gasket. |
| | U = Both sides: Convertible from R to A. | | |
| | W = Both sides: Pressure control, Automatic reset, TÜV approved, Internal range and differential adjustments. | | |
| | X = Both sides: Pressure controls, Automatic reset, External range and differential adjustments. | | |
| | Y = Left side: Pressure control, Automatic reset, External range and differential adjustments. Right side: Convertible from external manual reset to automatic reset, External range and differential adjustments. | | |
| | Z = Both sides: Convertible from External manual reset to automatic reset, External range and differential adjustments. | | |
| | LOW PRESSURE MANUAL RESET: Cut outs with manual reset function and in combination with the low pressure side of Pressure Ranges 7 & 9 have a low pressure manual reset function (15 psi differential). HIGH PRESSURE MANUAL RESET: Cut outs with manual reset function and in combination with the high pressure side of Pressure Ranges 7 & 9 have a high pressure manual reset function (60 psi differential). | | |

# Temperature-Pressure Controls

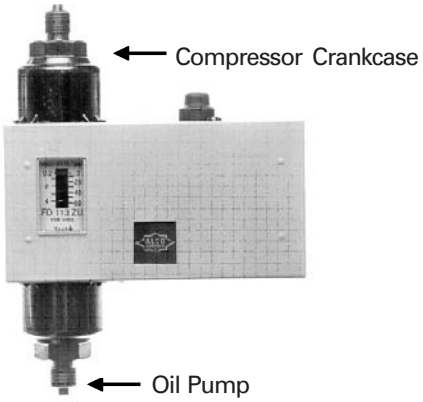
***Ordering Information for PS2 Dual Pressure Controls***

| Single Pressure Control | ServiceFirst Item # | Adjustment Range: Upper Setpoint Left PSI (Bar) | Upper Setpoint Right PSI (Bar) | Differential Left PSI (Bar) | Differential Right PSI (Bar) | Factory Setting Left PSI (Bar) | Factory Setting Right PSI (Bar) | Pressure Connection |
|---|---|---|---|---|---|---|---|---|
| PS2-Y7A | CNT02194 | 15" Hg. to 100 (-0.5...7) | 90 to 450 (6...31) | 7 to 72 (0.5...5) | Convertible Auto/Man Reset | 50/65 (3.5/4.5) | 290 (20) | 7/16"-20 UNF |
| PS2-Y7K | CNT02195 | | | | | | | Capillary/ nut |
| PS2-Y9K | CNT02199 | 24" Hg to 45 ( -0.8...3) | 90 to 450 (6...31) | 4 to 29 (.25...2) | | 7/15 | | Capillary/ nut |

| Old To New Cross Reference (TF215 to TS1) | | | Replaces The Competition | | |
|---|---|---|---|---|---|
| Old Model | New Model | ServiceFirst Item # | Copeland ① | Ranco | Penn |
| FF215-S7-BAUK | PS2-Y7K 50/65* 230/290 | CNT02195 | 085-0098-02, 085-7000-00 985-CP2M-7K | 012-1549 012-4834 | P70LB-1, P70LB-6 P70MA-1, P70MA-18 |
| FF215-S9-BAUK | PS2-Y9K 7/15* 230/290 | CNT02199 | 085-0098-22, 085-0098-23 | 012-1502, 012-1506 012-1554, 012-4833 | P70LB-1, P70LB-6 P70MA-1, P70MA-18 |
| FF215-S7-BAUA | PS2-Y7A 50/65* 230/290 | CNT02194 | 985-CP2M-7A | 012-1550 | P170LB-1 P170MA-1 |

① The Alco Control may be used with bracket (PCN 097221) to allow replacement of the Copeland control with the same mounting configuration.

# Temperature–Pressure Controls




## FD113-ZU(K) Oil Pressure Safety Controls

The FD113 Oil Pressure Safety Control senses the effective oil pressure on pressure lubricate compressors. If inadequate oil pressure exists, a time delay is energized. If the oil pressure does not recover to safe levels within the time delay setting, the compressor is shut down. The time delay allows the compressor adequate time to establish oil pressure on start up and avoids nuisance shutdowns on pressure drop of short duration during the run cycle.

Maximum application flexibility is assured by providing an adjustable differential pressure switch which can be adjusted to the compressor's minimum required oil pressure needs and an adjustable electronic time delay which allows you to select the length of time the compressor runs below the minimum pressure before shutdown. The minimum pressure setting and time delay values specified by the compressor manufacturer should be used when installing the FD113 control.

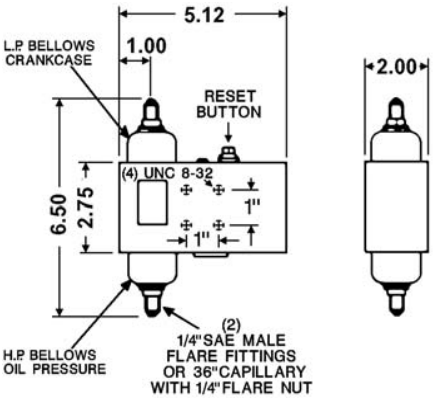
**Features**

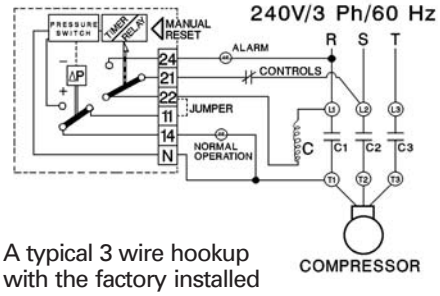
- Pressure Range adjustable from 4 to 65 PSID; Timer start pressure–timer stop pressure is 3 PSID above timer start pressure
- A SPDT switch is used in the pressure portion of the control which allows the addition of a "safe light" if desired
- Electronic Timer is Time-Adjustable from 20 to 150 seconds
  Supply voltage—24 to 240 Volt AC/DC; Timing unaffected by voltage or ambient temperature variations
- A SPDT Manual Reset Switch is used in the Timer Module; Upon time-out, the compressor is stopped and an alarm circuit is energized; To restart the compressor and de-energize the alarm circuit, the reset button is pushed
- A factory installed Jumper allows the FD113 to be powered from a single power source; Should separate circuits be desired for the timer and "Lockout" switch, the Jumper can be removed

**Specifications**

- Agency approvals include: UL/CUL file #E85974, VDE 0631/0660, TÜV, CE 73/23/EWG, CE 93/68/EWG

**FD113 Dimensional Data**




A typical 3 wire hookup with the factory installed jumper.

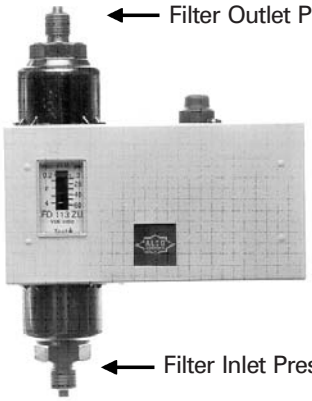
Dimensions shown are in inches.

***Ordering Information for FD113-ZU(K) Oil Pressure Safety Controls***

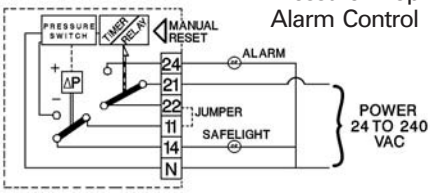
| ServiceFirst Item # | ALCO Part Number | Adjustable Pressure Range | Adjustable Time Delay | Supply Voltage | Pressure Connection | Penn | Replaces Copeland | Ranco |
|---|---|---|---|---|---|---|---|---|
| CNT02197 | FD113–ZUK | 4-65 PSID | 20 to 150 second | 24 to 240V AC/DC | (2) 36" capillary with 1/4" flare nut | P45NCA-12<br>P45NCA-82<br>P28AA-1,-2<br>P28AA-17,-18<br>P28DA-1<br>P28GA-2<br>P28NA-5 | 085-0062-00 | P30-5826<br>P30-3601<br>P30-3701<br>P30-3801 |
| CNT02196 | FD113–ZU | | Factory-set at 120 seconds | | (2) 1/4" male flare[1] | P128AA-1,-2,-3<br>P145NCA-12,-82<br>P145NCB-12,-82 | | P30-5827 |

[1] For applications where the condensing unit/control is exposed to temperatures below 20°F, 1/4" lines are recommended.

# Temperature-Pressure Controls




Wiring for Pressure Drop Alarm Control



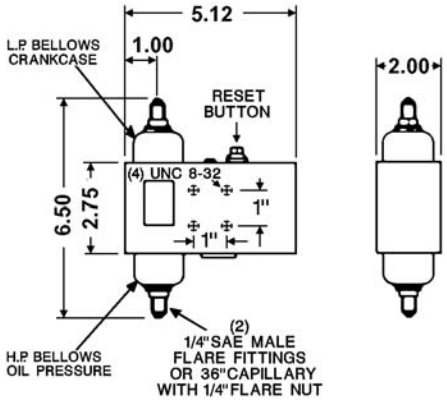

## FD113-ZU-S Pressure Drop Alarm Control

The FD113 Filter Alarm Control senses the differential pressure across a filter and if the pressure drop exceeds the setpoint value, the timer is energized. If the pressure drop does not decrease 4 PSI below the setpoint during the time delay period, the manual reset timer relay trips and the alarm circuit is energized.

**Typical Pressure Drop Monitoring Applications**

- Liquid Line Filters/Driers
- Suction Line Filters
- Oil Line Filters

## FD113 Dimensional Data




Dimensions shown are in inches.

**Features**

- Wide Adjustable Pressure Range: 4 to 60 PSID
- Narrow Cut-in/Cut-out Differential at PSID setpoint 4 PSI
- Wide reference pressure capabilities 10" to 300 PSIG with minimum change in setpoint or differential settings
- Electronic Time Delay–Manual Reset
  Adjustable from 20 to 150 seconds
  Supply voltage–24 to 240 VAC
  Timing unaffected by voltage or ambient temperature variations
- Prevents nuisance alarms from temporary surges in pressure changes during start-up
- Output: SPDT Isolated Manual Reset Relay–times out on increasing pressure differential above setpoint.
- Rating: 360 VA Max. 120/240 VAC.

**Specifications**

- Ambient Temperature Range
  - Operating –10°F to +120°F.
- Agency approvals include: UL/CUL file #E85974, VDE 0631/0660, TÜV, CE 73/23/EWG, CE 93/68/EWG

***Ordering Information for FD113-ZU-S Pressure Drop Alarm Controls***

| ServiceFirst Item # | ALCO Part Number | Adjustable Pressure Range | Adjustable Time Delay | Supply Voltage | Pressure Connection | Application |
|---|---|---|---|---|---|---|
| | 4-65 psid<br>FD113–ZU–S | factory set at 50 psid | 20 to 150 seconds factory set at 120 sec. | 24 to 240V AC/DC | (2) 1/4" male flare fittings | Oil filter pressure drop alarm on HVAC chiller |
| | FD113–ZU–S | 4-65 psid factory set at 25 psid | | | | |

Standard Product Offering
* Product Code Number

# Temperature-Pressure Controls

## PS3 Mini-Pressure Controls

The PS3 Mini-Pressure Control provides the ultimate in reliability and flexibility in a commercial grade mini-pressure control. A standard plug connectable design simplifies installation and service. The SPDT switch allows the addition of alarm circuits on high or low pressure applications. The PS3 makes your application and selection easy. Models with high temperature diaphragms and built-in pressure pulsation snubbers make the PS3 ideally suited for compressor head mounting high pressure limit control applications—automatic or manual reset versions are available.

Pressure Ranges/Differential also make the PS3 controls ideally suited for condenser fan cycling applications. Field Trimable Low Pressure versions with standard or narrow differential switches make these controls ideally suited low pressure limit or back-up safety controls on electronically controlled systems. Numerous options, such as panel mount or capillary connections are available on high volume applications. Standard on all models are worldwide agency approvals.

**Typical Applications**
- High Pressure Limit/Alarm
- Condenser Fan Cycling
- Low Pressure Limit/Alarm
- Low Pressure Cycling (Back-Up)
- Defrost Termination/Fan Delay
- Rupture Guard Alarm

**Specifications**
- Worldwide Approvals: UL/CUL/VDE/TUV
- UL file #E85974

**Features**
- Commercial Grade High/Low/Condenser Fan Cycling Pressure Controls for use on Refrigeration/AC Applications
- Mini-Size 2" x 1-1/2" x 2-3/4"
- Standard SPDT Switch Action
- Automatic or Manual Reset
- Models available with high temperature double diaphragms and built-in pressure pulsation snubber for direct head mount high pressure sensing/limit applications
- Plug Connectable with hub for 1/2" flexible conduit or Compression Fitting for cable
- Factory preset to customer's desired pressure specifications
- Selected Models Field "Trimable" to match application pressure requirements
- Precise, repeatable settings
- Narrow differential "Micro" switch available on low pressure models
- Panel Mount configurations with fitting or capillary available on special order
- Terminal Covers available for protecting individual wire connections when 1/4" QC's used on Panel Mount configurations

***Nomenclature – Example PS3-AF1HNB***

| PS3 | A | F | 1 | H | N | B |
|---|---|---|---|---|---|---|
| Product Name | Function | Mounting | Pressure Range | Electrical Connection | Contact Type | Pressure Connection |
| | A = Automatic Reset, High Pressure with Single Bronze Diaphragm Material<br>W = Automatic Reset, High Pressure with safety cut-out with Double Bronze Diaphragm Material, DIN/TUV approved<br>X = Automatic Reset, High Pressure with Double Nickel Beryllium Diaphragm Material (High Temp), DIN/TUV approved<br>B = Manual Reset, High Pressure Safety Limiter with Double Bronze Diaphragm Material, DIN/TUV approved<br>C = Manual Reset, High Pressure Safety Limiter with Double Nickel Beryllium Diaphragm Material (High Temp), DIN/TUV approved<br>D = Manual Reset, Low Pressure with Single Bronze Diaphragm Material<br>R = Manual Reset, High Pressure with Single Bronze Diaphragm Material<br>S = Manual Reset (only with special reset tool), High Pressure Safety Limiter with Double Bronze Diaphragm Material, DIN/TUV approved<br>T = Manual Reset (only with special reset tool), High Pressure Safety Limiter with Double Nickel Beryllium Diaphragm Material (High Temp), DIN/TUV approved | F = Free Standing<br>P = Panel Mount design with mounting flange | 1 = 15" Hg to 90 psig (-0.6 to 6 bar)<br>3 = 2 to 230 psig (0.1 to 16 bar)<br>5 = 100 to 465 psig (6 to 32 bar) | H = Spade for DIN connector<br>T = 1/4" x .032" Spade connections | N = Standard<br>M = MicroSwitch<br>G = MicroSwitch with Gold plated contacts<br>O = Standard switch with Gold plated contacts | S = 1/4" SAE Female (7/16"-20 UNF) with Schrader valve depressor<br>A = 1/4"SAE Male (7/16"-20 UNF)<br>B = 1/4" SAE Female (7/16"-20 UNF) with Snubber orifice and Schrader valve depressor for High Temp/Pressure Application<br>L = 1/4" ODM Solder with 36" capillary tube<br>K = 1/4" SAE Female Flare Nut (7/16"-20 UNF) with 36"capillary tube |

# Temperature-Pressure Controls

## Specifications

### Electrical Ratings–SPDT Switch
- Standard Switch – High/Low Pressure
  Load Contact
  6 FLA – 36 LRA – 120/240 VAC
  Pilot Duty: 240VA @ 120
  480VA @ 240 VAC
  Back Contact
  0.5 Amp 120/240 VAC Pilot Duty

### Micro Switch – Low Pressure
- 2.5 FLA – 15 LRA – 120/240 VAC
  Pilot Duty: 120VA @ 120
  240VA @ 240 VAC
- Back Contact
  0.5 Amp 120/240 VAC Pilot Duty

### Ambient Temperature
- Storage: –30° to +160°F
  Operating: –20° to +140°F

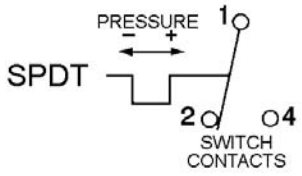
### Protection
- Protect from rain, direct sunlight and exterior damage.

### Weight
- Approximately 0.25 pound, depending upon configuration.

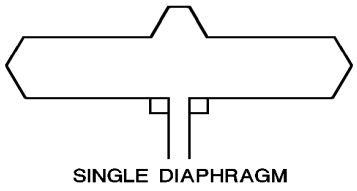
### Compatibility
- HFC, HCFC, CFC

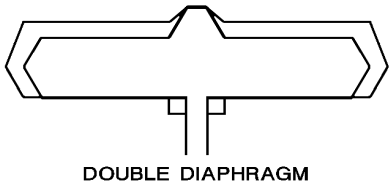
### Agency Approvals
- UL/CUL/DIN/TUV, depending upon configuration.

### Switch Action
- SPDT Standard
  1–2 Open on Rise
  Close on Fall
  1–4 Close on Rise
  Open on Fall




### Construction




- Low Pressure
  Single Diaphragm
  Maximum Media Temp. 150°F.
- High Pressure
  Double Diaphragm
  Maximum Media Temp. 300°F.
- Internal Pressure Pulsation Snubber available for direct head mount.

NOTE: Single Diaphragm High Pressure Configurations are also available.

***PS3 Mini-Pressure Control Specifications Selection Table***

| ServiceFirst Item # | Type & PCN | High Event Range PSIG | Differential Range PSID | Settings | Reset | Pressure Conn. | Electrical Conn. | Electrical Ratings [2] | Maximum Overpressure | Mounting |
|---|---|---|---|---|---|---|---|---|---|---|
| LOW PRESSURE CONTROLS | | | | | | | | | | |
| | PS3-AF1 HMS 1 1.5/6 | | 4 | | | | DIN Plug | | | |
| | | Low End | | 1.5/6 | | 1/4" SAE | with 1/2" NPTF | 2.5 FLA | | Free |
| | PS3-AF1 HMS 1 24/30 | 15"-90 | 7 | | | Female | Hub for Flex | 15 LRA | 360 PSIG | Standing |
| | | | High End | 24/30 | AUTO | with Valve | Conduit | | | Direct |
| | PS3-AF1 HNS 5/15 | | 9 Low End | | | Depressor | Connection | 6 FLA | | Mount |
| | | | 15 High End | 5/15 | | | 36" Cable | 36 LRA | | |
| HIGH PRESSURE CONTROLS | | | | | | | | | | |
| | PS3-XF5 HNB 285/350 | | | 285/350 | | | | | | |
| | | | 45 | | | | | | | |
| | PS3-XF5 HNB 300/370 | | Low End | 300/370 | AUTO | 1/4" SAE | | | | |
| | | | 80 | | | Female | DIN Plug | | | |
| CNT03269 | PS3-XF5 HNB 320/395 | | High End | 320/395 | | with Valve | with 1/2" NPTF | | | Free |
| | | | | | | Depressor | Hub for Flex | | | Standing |
| | PS3-CF5 HNB 350 | | | 350 | | & High Temp | Conduit | | | Direct |
| | | | | | | Double | Connection | 6 FLA | 520 PSIG | Mount |
| CNT03640 | PS3-CF5 HNB 370 | 100-465 | | 370 | | Diaphragm | 36" Cable | 36 LRA | | |
| | | | | | | & Snubber | | | | |
| | PS3-CF5 HNB 395 | | Manual | 395 | Manual | | | | | |
| | | | Reset | | | | | | | |
| | PS3-BP5 TNLM0 | | | 340 | | 36" capillary | 1/4" Quick | | | Panel |
| | | | | | | with 1/4" | Connects | | | Mount |
| | PS3-BP5 TNL 440 | | | 440 | | ODM sweat | w/terminal | | | (Flange) |
| | | | | | | connection | | | | |

[1]Micro-Switch Construction.
[2]All switches SPDT ratings stated are 1 side only 120/240 VAC. Opposite switch side – 1/2 amp pilot duty 120/240.
*Product Code Number

SERVICEFIRST™

| | |
|---|---|
| Literature Order Number | RSP-PRC022-EN |
| Filing Hierarchy | Service Products/Refrigeration Components |
| Date | June 2005 |
| Supersedes | RSP-PRC022-EN 0804 |
| Stocking Location | Inland |