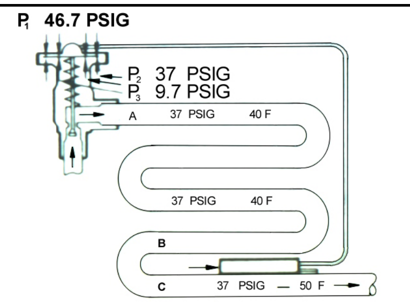
Mini Duct Heating and Air Conditioning
Indoor Air Quality Systems

Thermo Expansion Valves

Product Knowledge Base

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 (2) the pressure in the evaporator. This controlled flow prevents the return of the refrigerant liquid to the compressor. The Thermo Expansion Valve controls the flow of gas by maintaining a pre-determined super heat.

Three forces which govern the Thermo Valve's operation are
(1) the power element and remote bulb pressure (P1)
(2) the evaporator pressure (P2)
(3) the superheat spring equivalent pressure (P3 See Fig. 1).



THERMO EXPANSION VALVE with internal equalizer on evaporator with no pressure drop. Fig. 1

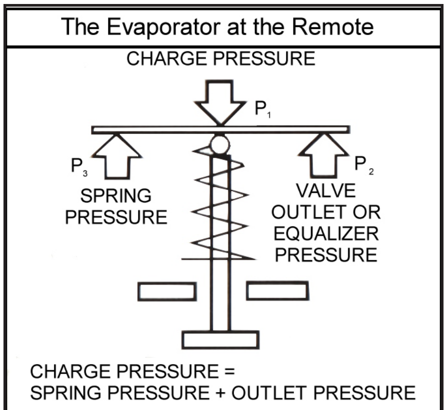
We are here concerned with the single outlet type of Thermo Valve and shall discuss it under two headings: (1) A valve with an internal equalizer, and (2) the use of the external equalizer feature.

Internal Equalizer

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 the following 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 (P1), 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 (P2) and

(2) that exerted by the superheat spring (P3). In the first condition, the valve will assume a stable control position when these three forces are in balance (See Fig.1A) (that is, when P1 = P2 + P3). 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 (P1 greater than P2 + P3) and causes the valve pin to move in an opening direction. 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 (P1 less than P2 + P3).



THERMO VALVE EQUILIBRIUM

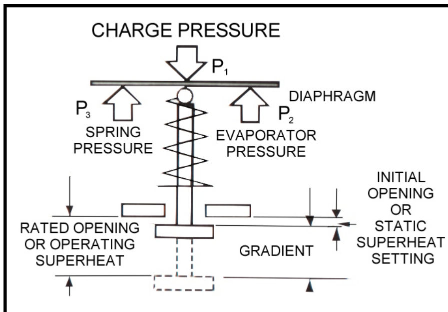
Fig. 1A

For example, when the evaporator is operating with R12 at a temperature of 40 degrees F. or a pressure of 37 psig and the refrigerant gas leaving the evaporator at the remote bulb location is 50 degrees F. a condition of 10 degrees F. superheat exists. Since the remote bulb and power assembly are charged with the same refrigerant as that used in the system, R-12, its pressure (P1) will follow its saturation pressure-temperature characteristics. With the liquid in the remote bulb at 50 degrees F. the pressure inside the remote bulb and power assembly will be 46.7 psig acting in an opening direction. Beneath the diaphragm and acting in a closing direction are the evaporator pressure (P2) of 37 psig and the spring pressure (P3) for a 10 degrees F. superheat setting of 9.7 psig (37 + 9.7 = 46.7) making a total of 46.7 psig above the diaphragm and 46.7 psig below the diaphragm. Changes in load, increasing the Expansion Valve pin to move in an opening direction. Conversely, a change, decreasing the superheat, will cause the Thermo Valve pin to move in a closing direction. Fig.1

Factory Setting of Valves

The factor superheat setting of Thermo Expansion Valves 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. Thermo Valves are so designed that an increase in superheat of the refrigerant gas leaving the evaporator, usually 4 to 8 degrees F., over and beyond the factor 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 factor static setting is 6 deg superheat, the operating superheat at the rated stroke or pin position (full load rating of valve) will be 10 to 14 degrees F. superheat (See Fig. 2). Manufacturers usually furnish the adjustable type Thermo Expansion Valves with a factor static superheat setting of 6 to 10 deg unless otherwise specified by the customer.

When using non-adjustable Thermo Expansion Valves, it is important that they be ordered with the correct factory superheat setting. For manufacture's production lines it is recommended that an adjustable Thermo Expansion Valve be used in a pilot model lab test to determine the correct factory superheat setting before ordering the non-adjustable type Thermo Expansion Valves.



THERMO VALVE STATIC SUPERHEAT AND GRADIENT

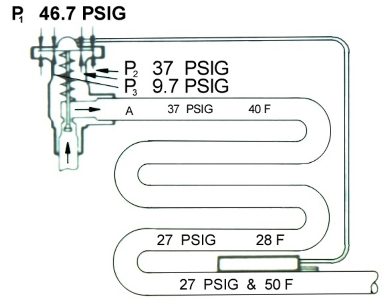
Fig. 2

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

External Equalizer

When the pressure drop through the evaporator is of any consequence, i.e., in general a pressure drop equivalent to 3 deg in the air conditioning range, 2 deg in the commercial temperature range, and 1 deg in the low temperature range, it will hold the Thermo Expansion Valve is a relatively "restricted: position and reduce the system capacity, unless a Thermo Expansion Valve with an external equalizer is used. The evaporator should be designed or selected for the operating conditions and the Thermo Expansion Valve selected and applied accordingly.

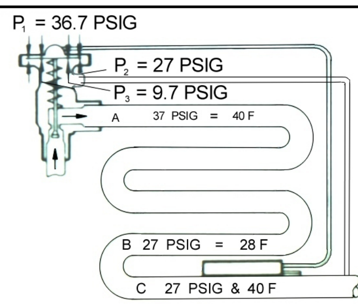


THERMO EXPANSION VALVE with internal equalizer on evaporator with 10 PSI drop. **Fig.** 3

For example, an evaporator is fed by a Thermo Expansion Valve with an internal equalizer, where a sizeable pressure drop of 10 psi is present (See Fig.3). The pressure at point "C" is 27 psig or 10 psi lower than at the valve outlet, point "A"; however, the pressure of 37 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 degrees F. superheat of a pressure of 9.7 psig, the required pressure above the diaphragm to equalize the forces is (37 + 9.7) or 46.7 psig. This pressure corresponds to a saturation temperature of 50 degrees F. It is evident that the refrigerant temperature at point "C" must be 50 degrees F. if the valve is to be in equilibrium. Since the pressure at this point is only 27 psig and the corresponding saturation temperature is 28 degrees F., a superheat of 50 degrees F. - 28 degrees F. or 22 deg is required to open the valve. This increase in superheat, from 10 to 22 deg 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 Thermo Valve capacity is greatest.

In order to compensate for an excessive pressure drop through an evaporator, the Thermo Expansion Valve 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 location. 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 Thermo Expansion Valve is used, with the equalizer line connected to the suction line, the true evaporator outlet pressure is exerted beneath the Thermo Valve diaphragm. The operating pressures on the valve diaphragm are now free from any effect of the pressure drop through the evaporator, and the Thermo Valve will respond to the superheat of the refrigerant gas leaving the evaporator.

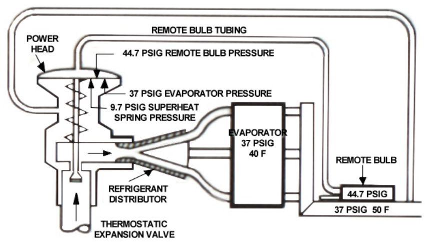


THERMO EXPANSION VALVE with internal equalizer on evaporator with 10 PSI drop. **Fig.** 4

When the same conditions of pressure drop exist in a system with a Thermo Expansion Valve which has the external equalizer feature (See Fig. 4), 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 27 psig. The required pressure above the diaphragm for equilibrium is 27 + 9.7 or 36.7 psig. This pressure, 36.7 psig, corresponds to a saturation temperature of 40 degrees F. and the superheat required is now (40 degrees F. - 28 degrees F.) 12 deg. The use of an external equalizer has reduced the superheat from 22 to 12 deg. *Thus, the capacity of a system, having an evaporator with a sizable pressure drop, will be increased by the use of a Thermo Expansion Valve 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 Thermo Expansion Valve must have the external equalizer feature for best performance.

The diagrams used in this Section thus far have shown the single outlet type of Thermo Expansion Valve. 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 Thermo Valve without external equalizer, because the distributor is installed between the valve outlet and the evaporator inlet. (See Fig. 5).



THERMOSTATIC EXPANSION VALVE, REFRIGERANT DISTRIBUTOR AND EVAPORATOR USED WITH REFRIGERANT 12

Fig. 5

Location of External Equalizer

As pointed out earlier the external equalizer line must be installed beyond the point of greatest pressure drop.*this change from 10 to 12 deg in the operating superheat is caused by the change in the pressure-temperature characteristics of R-12 at the lower suction pressure of 27 psig. 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 Fig. 4 & 5) 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 through the evaporator is known to be within the limits defined on page 2,k 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 Thermo Expansion Valve 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 Thermo Expansion Valve must always be connected on the evaporator side of such a control valve or regulator.

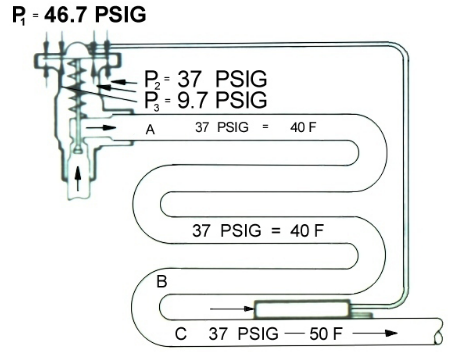
On a multi-evaporator system including two or more evaporators each fed by a separate Thermo Expansion Valve, the external equalizer lines must be located so that they will be free from the effect of pressure changes in the evaporators fed by the other Thermo Expansion Valves. At no time should the equalizer 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 circumstance cap or plug the external equalizer connection on a Thermo Expansion Valve, as it will not operate. If the Thermo Expansion Valve is furnished with the external equalizer feature, the external equalizer line must be installed.

Super Heat

A vapor is said to be 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 12 at 37 psig suction pressure (See Fig. 6). The Refrigerant 12-saturation temperature at 37 psig is 40 degrees F. As long as any liquid exists at this pressure, the refrigerant temperature will remain 40 degrees 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 (37 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, (See Point C) its temperature is 50 degrees F. This refrigerant gas is now superheated and the amount of superheat is 10 degrees F. (50 degrees - 40 degrees). The degree to which the refrigerant gas is superheated depends on (1) the amount of refrigerant being fed to the evaporator by the Thermo Valve and (2) the heat load to which the evaporator is exposed.



THERMO EXPANSION VALVE with internal equalizer on evaporator with no pressure drop **Fig.** 6

Adjustment of Super Heat

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

A Thermo Valve, 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 Thermo Valve performance. It is important that this function is measured, as accurately as possible, or in the absence of accuracy, to be aware of the magnitude and direction of whatever error is present.

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 Thermo Valve 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; a tee installed in the Thermo Valve 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).

The temperature element from your Temperature Meter should be taped 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 an 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 finitely 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 lover 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 packaged equipment and close-coupled installations, 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 above, **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 Thermo Valve 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 trouble shooting in mountain areas i.e. 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 Control's 5000-foot correction pocket chart.

FACTORS INVOLVED IN VALVE SELECTION

The BTU/HR or tons load requirement, the pressure drop determines proper Thermo Valve size across the valve, and the evaporator temperature.

It should not be assumed that the pressure drop across the Thermo Valve is equal to the difference between discharge and suction pressure at the compressor. This assumption will lead to incorrect sizing of the valve.

The pressure at the Thermo Valve outlet will be higher than the suction pressure indicated at the compressor, due to frictional losses through the distribution header, evaporator tubes, suction line fittings, and hand valves.

The pressure at the Thermo Valve inlet will be lower than the discharge pressure indicated at the compressor, due to frictional losses created by length of liquid line, valves and fittings, and possible vertical lift. The only exception to this is where the valve is located considerably below the receiver and the static head built up is more than enough to offset frictional losses. The liquid line should be properly sized giving due consideration to its length plus the additional equivalent length of line due to the use of fittings and hand valves. When a vertical lift in the liquid line is necessary, an additional pressure drop, due to loss in static head, must be included.

The pressure drop across the Thermo Expansion Valve will be the difference between the discharge and suction pressures at the compressor less the pressure drops in the liquid line, through the distributor, evaporator, and suction line. ASHRAE*tables should be consulted for determining pressure drop in liquid and suction lines.

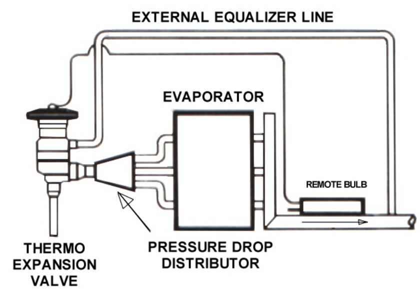
Since the capacity and the performance of the Thermo Valve is based on solid liquid entering the valve, careful consideration must be given to the total pressure drop in the liquid line to determine if there will be sufficient subcooling of the liquid refrigerant to prevent the formation of flash gas. 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 Thermo Valve at all times!!

Alco Controls has prepared extended capacity tables for use with the above mentioned conditions in mind. These extended tables can be found in the catalog section of each type of Alco Thermo Expansion Valve.

Therefore - where possible always select Thermo Valves for actual operating conditions rather than nominal valve capacities.

Applications

In general, for best evaporator performance, the Thermo Expansion Valve 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 7.)



THERMO EXPANSION VALVE and PRESSURE DROP TYPE DISTRUBUTOR feeding an EVAPORATOR

Fig. 7

The “T” Series 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 charge 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 Thermo Valve 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 Thermo Valve 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 less than 7/8” OD the remote bulb may be installed on top of the line. With 7/8” OD and over, the remote bulb should be installed at the position of about 4 or 8 o’clock. (See Figure 8.)

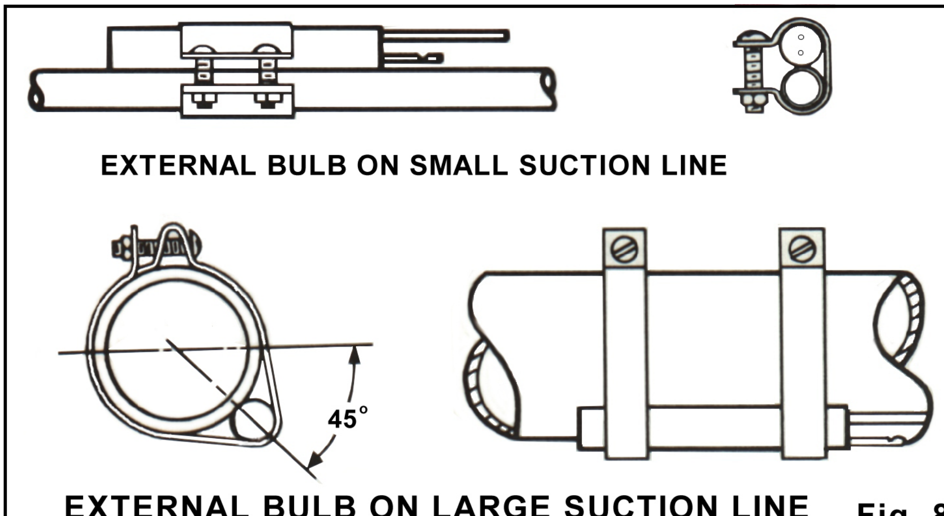


Fig. 8

If it is necessary to protect the remote bulb from the effect of an air stream, after it is claimed to the line, use material that will not absorb water with evaporator temperatures above 32 degrees F. Below 32 degrees 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 water or brine level of a submerged coil, use a water proofing material or pitch, that does not require heating above 12 degrees 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 superheats are desired and (2) where convected heat from a warm room can influence the remote bulb. (See Figure 9.)

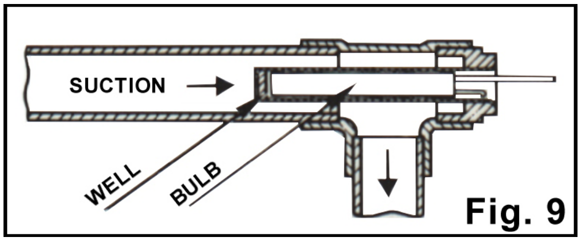


Fig. 9

Do not under any circumstances locate either type of remote bulb in a location where the suction line is trapped. (See Figure 10.) If the liquid refrigerant collects at the point of remote bulb location, the Thermos Expansion Valve 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.

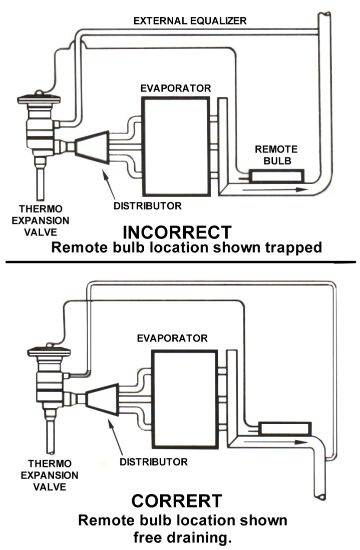


Fig. 10

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 REMOTE BULB LOCATION WITHOUT FIRST REMOVING THE REMOTE BULB.**

HUNTING

"Hunting" of the Thermo Expansion Valve3 can be defined as the alternate over-feeding 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 (TD) under which the evaporator is operated, arrangement of suction piping and application of the Thermo Valve remote bulb. "Hunting" can be minimized or eliminated by the correct rearrangement of this 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 Thermo Valve is a self-contained direct operated regulator, which does not have any built in anticipating or compensating factors. As such it 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 Thermo Valve 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 over-shooting the control point due to inertia (compensation). With these features a Thermo Valve would be in phase with the system demand at all times and “hunting” would not occur.

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

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 over-feed the coil. Thus, when the valve does move in the closing direction, it will gain 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 Thermo Valve 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 Thermo Valve 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 large single ported Thermo Valves as the force due to the pressure differential is magnified by the larger port area.

We have seen that a Thermo Valve 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 Thermo Valve, when intelligently selected and applied, will overcome these factors and operate with virtually no “hunt” over a fairly wide load range.

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

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

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 affects of moisture, sludge and acids a filter-drier should be installed on every system.