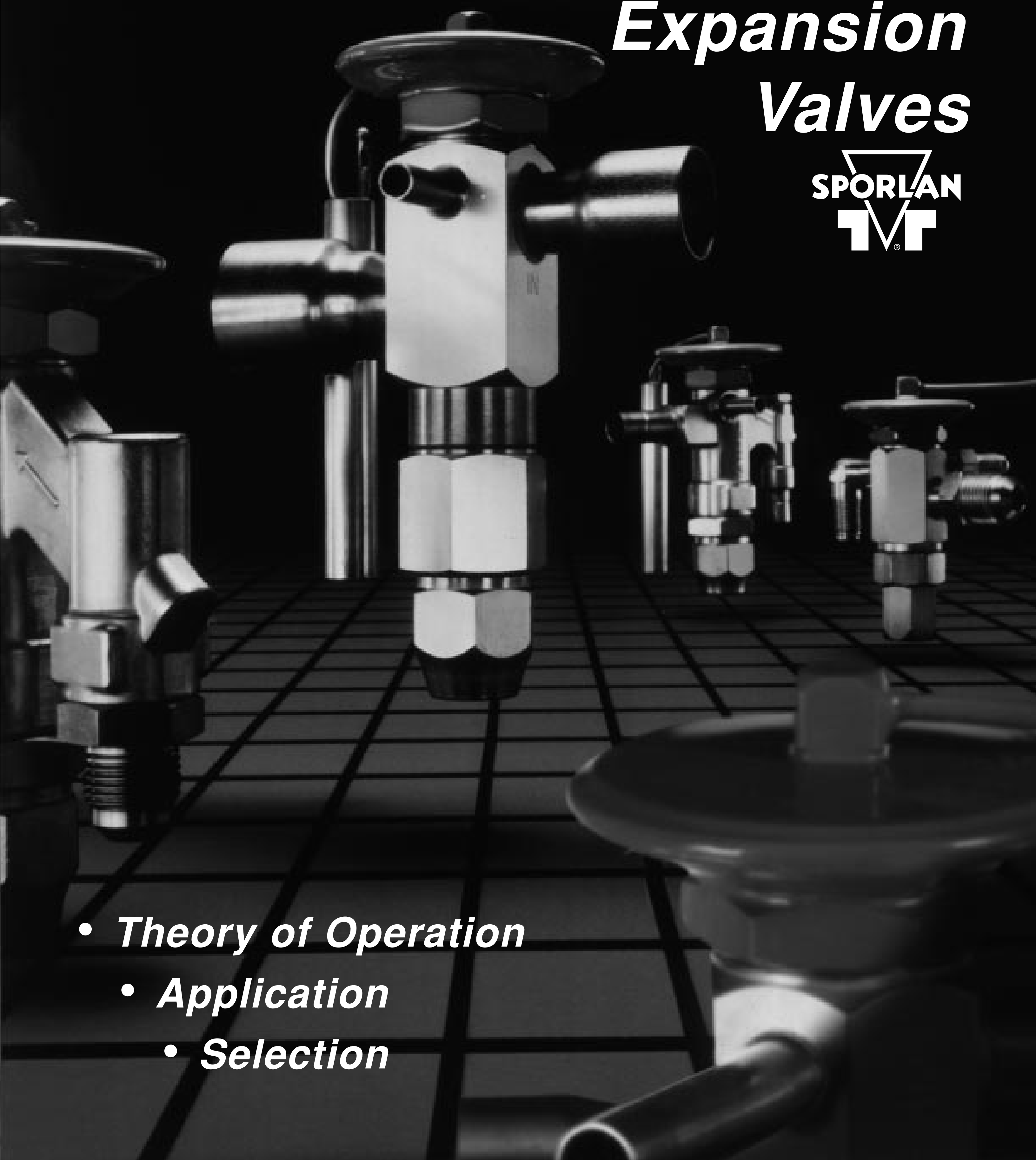
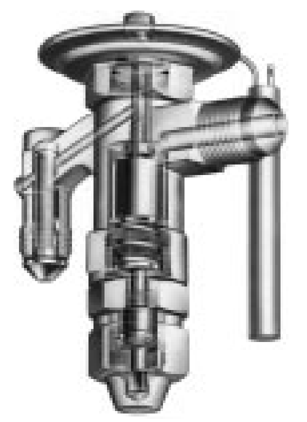
June 2001 / **BULLETIN 10-9**

Thermostatic Expansion Valves

SPORLAN



- *Theory of Operation*
- *Application*
- *Selection*



10
Outstanding Features & Benefits of Sporlan Thermostatic Expansion Valves

THERMOSTATIC EXPANSION VALVES

- **SELECTIVE THERMOSTATIC CHARGES**
  Designed to provide optimum performance for all applications—air conditioning and heat pump, medium and low temperature refrigeration.
- **THERMOSTATIC ELEMENT DESIGN**
  Long lasting and field proven stainless steel diaphragm and welded element construction.
- **DIAPHRAGM DESIGN**
  Large flat diaphragm permits precise valve control.
- **REPLACEABLE THERMOSTATIC ELEMENTS**
  Field replaceable elements on all standard valves.
- **BALANCED PORT DESIGN [TYPES (E)BF, EBS & O]**
  Provides perfect pin and port alignment, and prevents changes in pressure drop across the valve from influencing valve operation. Provides excellent control on applications having widely varying operating conditions.
- **PIN CARRIER DESIGN (CONVENTIONAL VALVES)**
  Provides precise pin and port alignment, and better seating.
- **ACCESSIBLE INTERNAL PARTS**
  Durable, leakproof body joint construction allows the valve to be disassembled, and the internal parts cleaned and inspected.
- **MATERIALS OF CONSTRUCTION**
  Pin and port materials offer maximum protection against corrosion and erosion.
- **SILVER SOLDERED CONNECTIONS**
  For leakproof, high strength connection-to-body joints.
- **ADJUSTABLE SUPERHEAT DESIGN**
  All standard valves are externally adjustable except the Type NI, which is internally adjustable through its outlet connection.

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Refer to Bulletin 10-10 for complete specifications of *Thermostatic Expansion Valves, with Selective Thermostatic Charges.*

Refer to Bulletin 10-11 for a complete discussion on *Installing and Servicing Thermostatic Expansion Valves.*

FOR USE ON REFRIGERATION and/or AIR CONDITIONING SYSTEMS ONLY

Bulletin 10-9, June 2001 supersedes Bulletin 10-9 dated October 1995 and all prior publications.

SPORLAN THERMOSTATIC EXPANSION VALVES

The thermostatic expansion valve (TEV) controls the flow of liquid refrigerant entering the direct expansion (DX) evaporator by maintaining a constant **superheat** of the refrigerant vapor at the outlet of the evaporator. **Superheat is the difference between the refrigerant vapor temperature and its saturation temperature**. To measure the superheat the TEV controls, the difference between the actual temperature at the sensing bulb and the saturation temperature corresponding to the suction pressure at the sensing bulb location is determined. By controlling superheat, the TEV keeps nearly the entire evaporator surface active while not permitting liquid refrigerant to return to the compressor. The ability of the TEV to match refrigerant flow to the rate at which refrigerant can be vaporized in the evaporator makes the TEV the ideal expansion device for most air conditioning and refrigeration applications.

THE REFRIGERATION SYSTEM

To understand the function of the thermostatic expansion valve, a short discussion of the refrigeration system is necessary. The refrigeration system can be defined as a closed system in which the process of absorbing and rejecting heat is performed by flowing a refrigerant in a vapor compression cycle. In its simplest form, the refrigeration system consists of five components: the compressor, condenser, evaporator, expansion device, and interconnecting piping.

The heart of the system is the compressor since it causes the refrigerant flow. Its function is simply to receive low pressure (and temperature) refrigerant vapor from the evaporator and compress it into high pressure (and temperature) refrigerant vapor. The high pressure vapor is then converted to a liquid phase in the condenser. The condenser performs this function by removing heat from the vapor and rejecting the heat to the air, or to water in the case of a water cooled condenser. The liquid, which remains at a high pressure, passes through the expansion device and becomes a low pressure two phase (liquid and vapor) mixture. This refrigerant mixture returns to its vapor phase in the evaporator by absorbing heat from the medium being cooled.

The selection of the expansion device is of particular importance to the operation of the refrigeration system because it regulates refrigerant flow into the evaporator. An expansion device which is misapplied or incorrectly sized will ordinarily result in operational difficulties and poor system performance. For example, an undersized expansion device will prevent sufficient refrigerant from flowing into the evaporator causing a reduction in the design cooling capability of the system. An oversized expansion device may allow too much refrigerant into the evaporator causing liquid refrigerant to flow back to the compressor. The latter condition is referred to as **floodback**. Both conditions will invariably result in compressor damage if not quickly remedied. Therefore, the expansion device requires attention to its selection and application.

TYPES OF EXPANSION DEVICES

Expansion devices can be divided into four general categories: the fixed area restrictor, the automatic (constant pressure) expansion valve, the thermostatic expansion valve, and the electric expansion valve. The fixed area restrictor expansion device is simply a precisely formed restriction through which liquid refrigerant flows. Two common examples of this type of device are the capillary tube, or *cap tube*, and the short tube restrictor, or plug orifice. These devices are typically used on certain small air conditioning and refrigeration systems where operating conditions permit moderately constant evaporator loading and constant condenser pressures. The drawback associated with these devices is their limited ability to efficiently regulate refrigerant flow in response to changes in system operating conditions, since they are sized based on one set of conditions.

Like the fixed area restrictor, the automatic expansion valve (AEV) is best suited for applications having moderately constant evaporator loading. The AEV regulates refrigerant flow by simply maintaining a constant evaporator or valve outlet pressure. As the heat load on the evaporator rises, the AEV decreases refrigerant flow to maintain evaporator pressure at the valve's setting. Conversely, the AEV increases refrigerant flow when the evaporator heat load decreases to maintain evaporator pressure at the valve's setting. As a result, the AEV starves the evaporator at high load conditions, and overfeeds it at low load conditions.

The thermostatic expansion valve provides an excellent solution to regulating refrigerant flow into a direct expansion type evaporator. The TEV regulates refrigerant flow by maintaining a nearly constant superheat at the evaporator outlet. As superheat at the evaporator outlet rises due to increased heat load on the evaporator, the TEV increases refrigerant flow until superheat returns to the valve's setting. Conversely, the TEV will decrease refrigerant flow when superheat lowers as a result of a decreased heat load on the evaporator. The effect of this type of regulation is it allows the evaporator to remain as nearly fully active as possible under all load conditions. The concept of superheat, and the proper method of measuring it is further explained on Page 14, *TEV Operation and Performance.*

The thermostatic expansion valve provides an additional benefit when charging the system with refrigerant. When a TEV is used, the system refrigerant charge is usually not as critical as with the other expansion devices. The proper operation of a fixed restriction and, to a lesser extent, an automatic expansion valve depends on having an exact amount of refrigerant in the system.

The electric expansion valve (EEV) provides a means by which applications can be designed with sophisticated system control functions. This type of valve is controlled by an electronic circuit which is often designed to allow the valve to control some aspect of system operation in addition to superheat at the outlet of the evaporator. For example, evaporator discharge air temperature or water temperature from a chiller could be monitored by the EEV's controller. See Bulletin 100-9 for details on electric valves for refrigerant control or contact Sporlan Valve Company for additional information.

HOW THE THERMOSTATIC EXPANSION VALVE WORKS

Basic Operation

In order to understand the principles of thermostatic expansion valve operation, a review of its major components is necessary. A **sensing bulb** is connected to the TEV by a length of capillary tubing which transmits bulb pressure to the top of the valve's **diaphragm**. The sensing bulb, capillary tubing, and diaphragm assembly is referred to as the **thermostatic element**. The thermostatic element on all standard Sporlan TEVs is replaceable.

The diaphragm is the actuating member of the valve. Its motion is transmitted to the **pin** and **pin carrier** assembly by means of one or two **pushrods**, allowing the pin to move in and out of the valve **port**. The **superheat spring** is located under the pin carrier, and a **spring guide** sets it in place. On externally adjustable valves, an external **valve adjustment** permits the spring pressure to be altered.

There are three fundamental pressures acting on the valve's diaphragm which affect its operation: sensing bulb pressure **P1**, equalizer pressure **P2**, and equivalent spring pressure **P3** (see Figure 1). The sensing bulb pressure is a function of the temperature of the **thermostatic charge**, i.e., the substance within the bulb. This pressure acts on the top of the valve diaphragm causing the valve to move to a more open position. The equalizer and spring pressures act together underneath the diaphragm causing the valve to move to a more closed position. During normal valve operation, the sensing bulb pressure must equal the equalizer pressure plus the spring pressure, i.e.:

P1 = P2 + P3

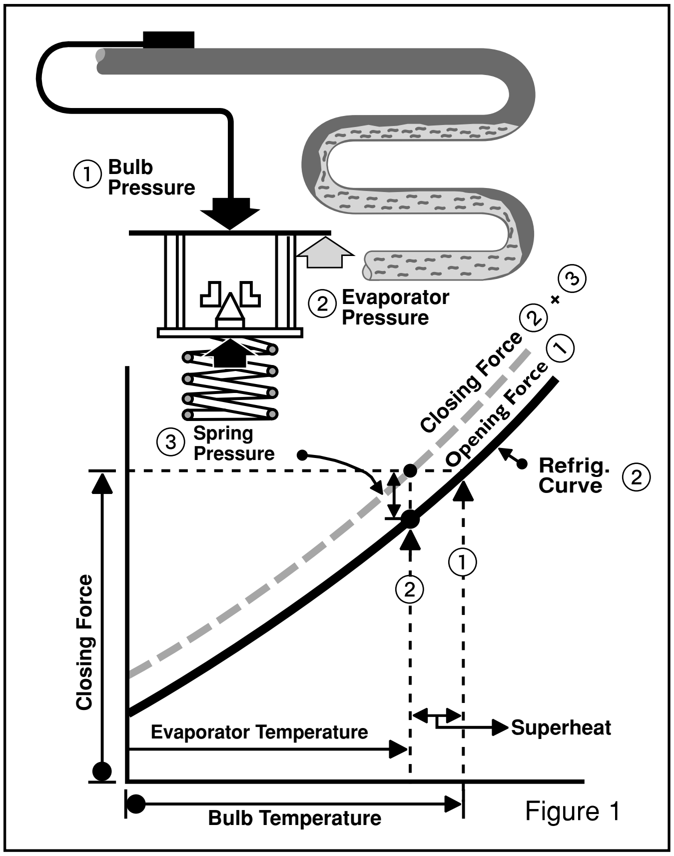


Figure 1

Equivalent spring pressure is defined as the spring force divided by the effective area of the diaphragm. The effective area of the diaphragm is simply the portion of the total diaphragm area which is effectively used by the bulb and equalizer pressures to provide their respective opening and closing forces. Equivalent spring pressure is essentially constant once the valve has been adjusted to the desired superheat. As a result, the TEV functions by controlling the difference between bulb and equalizer pressures by the amount of the spring pressure.

The function of the sensing bulb is to sense the temperature of the refrigerant vapor as it leaves the evaporator. Ideally, the bulb temperature will exactly match the refrigerant vapor temperature. As the bulb temperature increases, bulb pressure also increases causing the valve pin to move away from the valve port, allowing more refrigerant to flow into the evaporator. The valve continues in this opening direction until the equalizer pressure increases sufficiently such that the sum of the equalizer and spring pressures balance with the bulb pressure. Conversely, as the bulb temperature decreases, the bulb pressure decreases causing the valve pin to move toward the valve port, allowing less refrigerant to flow into the evaporator. The valve continues to close until the equalizer pressure decreases sufficiently such that the sum of the equalizer and spring pressures balance with the bulb pressure.

A change in refrigerant vapor temperature at the outlet of the evaporator is caused by one of two events: (1) the spring pressure is altered by means of the valve adjustment, and (2) the heat load on the evaporator changes. When spring pressure is increased by turning the valve adjustment clockwise, refrigerant flow into the evaporator is decreased. Vapor temperature at the evaporator outlet increases since the point where the refrigerant completely vaporizes moves further back within the evaporator, leaving more evaporator surface area to heat the refrigerant in its vapor form. The actual refrigerant vapor and bulb temperature will be controlled at the point where bulb pressure balances with the sum of the equalizer and spring pressures. Conversely, decreasing spring pressure by turning the valve adjustment counterclockwise increases refrigerant flow into the evaporator and decreases refrigerant vapor and bulb temperature. Spring pressure determines the superheat at which the valve controls. Increasing spring pressure increases superheat, decreasing spring pressure decreases superheat.

An increase in the heat load on the evaporator causes refrigerant to evaporate at a faster rate. As a result, the point of complete vaporization of the refrigerant flow is moved further back within the evaporator. Refrigerant vapor and bulb temperature increase, causing bulb pressure to rise and the valve to move in the opening direction until the three pressures are in balance. Conversely, a reduction in the heat load on the evaporator will cause the vapor and bulb temperature to fall and the valve to move in a closed direction until the three pressures are in balance. Unlike a change in the spring pressure due to valve adjustment, a change in the heat load on the evaporator does not appreciably affect the superheat at which the thermostatic expansion valve controls. This is due to the fact that the TEV is designed to maintain an essentially constant difference between bulb and equalizer pressures, thus controlling superheat regardless of the heat load.

Effect of Pressure Drop Across the Valve Port

An additional pressure affecting valve operation, which is not considered fundamental, arises from the actual pressure drop across the valve port. This pressure **P4** can be related to the three fundamental pressures as the product of pressure drop across the valve port and the ratio of the port area to the effective area of the diaphragm, i.e.:

P4 = Pressure Drop x (Port Area / Effective Diaphragm Area)

With Sporlan's conventional TEV design, this pressure is an opening influence since refrigerant flow tends to move the valve in an opening direction. As a result, our original equation is modified as follows:

P1 + P4 = P2 + P3

P4 becomes more significant to TEV operation the greater the port area to effective diaphragm area ratio, and the greater the pressure drop varies across the valve port.

Balanced Port TEVs

Sporlan introduced the concept of the **balanced port** thermostatic expansion valve in 1946 on large tonnage Types T and W valves. This concept provided the means to either largely reduce or eliminate the effect of pressure drop across the valve port. This design utilized a double seating piston operated by a single pushrod. The two port construction divided the refrigerant flow in opposite directions, thereby providing a semi-balanced pressure differential across the piston.

Improved balanced port designs resulted in a fully balanced Type O valve, and then the Types (E)BF, SBF, and EBS valves for smaller capacity applications. For additional information on the types and applications of balanced port TEVs, refer to Page 9, *Thermostatic Expansion Value Applications*.

Equalization Method

As previously discussed on Pages 3 and 4, the operation of the thermostatic expansion valve is determined by the relationship between three fundamental pressures: bulb pressure, equalizer pressure, and equivalent spring pressure. These pressures are illustrated in Figure 1. The equalizer pressure is the evaporator pressure the valve senses. The means used to transmit this pressure from the refrigeration system to the underside of the valve diaphragm is referred to as the equalization method.

Evaporator pressure is transmitted to the underside of the valve diaphragm by one of two methods. If the valve is **internally equalized**, the evaporator pressure at the valve outlet is transmitted to the diaphragm via a passageway within the valve body or through a clearance around the pushrods. If the valve is **externally equalized**, the underside of the valve diaphragm is isolated from the valve outlet pressure by the use of packing material around the pushrods or with pushrods which are closely fitted. Evaporator pressure is transmitted to the diaphragm by a tube connecting the suction line near the evaporator outlet to an external fitting on the valve. The external fitting is connected to a passageway which leads to the underside of the valve diaphragm. See Figure 2.

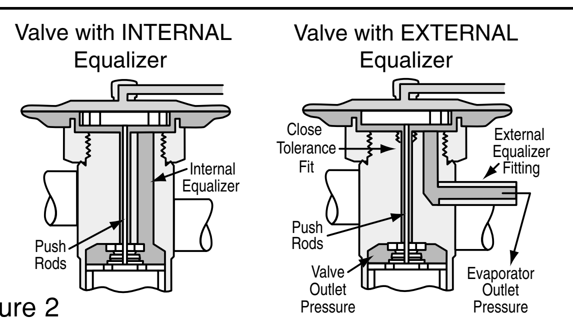


Figure 2

Internally equalized TEVs should be limited to single circuit evaporator coils having a pressure drop no greater than the equivalent of a 2°F saturated temperature change. Refer to Table 1 for recommended maximum allowable pressure drop values for internally equalized valves.

Externally equalized TEVs, however, are not affected by pressure drop across the evaporator, including pressure drop from refrigerant distributors employed by multi-circuited evaporator coils. An externally equalized TEV may be used for all refrigeration applications. It provides no operational disadvantages with respect to an internally equalized valve other than requiring an external equalizer line be connected. Figures 3, 4, and 5 illustrate the effects of evaporator pressure drop on an internally and externally equalized TEV.

TABLE 1

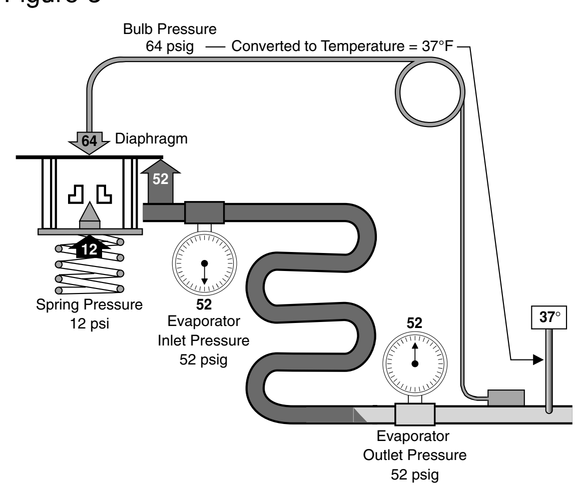
Refrigerant	Evaporating Temperature °F				
	40	20	0	–20	–40
	Pressure Drop —psi				
12, 134a	2.00	1.50	1.00	0.75	—
22	3.00	2.00	1.50	1.00	0.75
404A, 502, 507	3.00	2.50	1.75	1.25	1.00
717 (Ammonia)	3.00	2.00	1.50	1.00	—

IMPORTANT: The External Equalizer must be used on evaporators which employ a refrigerant distributor.

When an externally equalized TEV is used, the equalizer connection on the TEV must be connected to the outlet of the evaporator, and not capped!

Figure 3 shows an internally equalized valve feeding a single circuit evaporator which has no pressure drop. The system refrigerant is R-22 and, for the purpose of illustration, R-22 is also used as the thermostatic charge. The evaporator pressure at the valve outlet and at the sensing bulb location is 52 psig. The sum of this pressure and the 12 psi spring pressure produces a 64 psig pressure in the closing direction. For the valve to properly operate, a 64 psig opening bulb pressure is required to balance pressure. Since the sensing bulb consists of liquid R-22, its pressure-temperature characteristic is identical to the saturation curve of R-22, and a 37°F bulb temperature is required. The superheat at which the valve is controlling is calculated by subtracting the saturation temperature of the evaporator pressure at the sensing bulb location by the bulb temperature. In this case, the superheat is 9°F.

Figure 3



Closing Pressure.......................................= 52 + 12 = 64 psig
(Evaporator Inlet Pressure Plus Spring Pressure)

Bulb Pressure Necessary to Open Valve.......................................64 psig

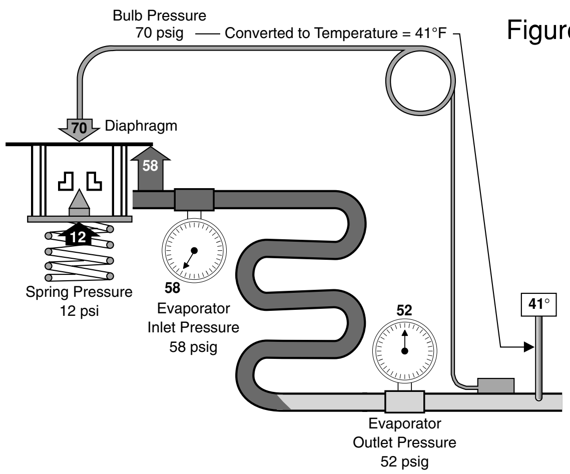
Bulb Pressure Equivalent to 64 psig.......................................37°F

Saturated Temperature Equivalent to Evaporator Outlet Pressure.......................................28°F

SUPERHEAT.......................................9°F
Bulb Temperature Minus Saturated Evaporator Temperature

Figure 4 shows the same internally equalized valve on a system having the same evaporator pressure at the sensing bulb location. The evaporator coil, however, now has a pressure drop of 6 psi. Since an internally equalized valve senses evaporator pressure at the valve outlet, the total pressure in the closing direction becomes 58 psig plus the 12 psi spring pressure, or 70 psig. A bulb pressure of 70 psig is now required for proper valve regulation, which translates to a 41°F bulb temperature. The superheat becomes 13°F, or 4°F higher than the superheat calculated in Figure 3. This rise in superheat is due to the pressure drop in the evaporator. Consequently, pressure drop between the valve outlet and the sensing bulb location causes an internally equalized TEV to operate at a higher than desired superheat.

Figure 4



Closing Pressure...= 58 + 12 = 70 psig
(Evaporator Inlet Pressure Plus Spring Pressure)

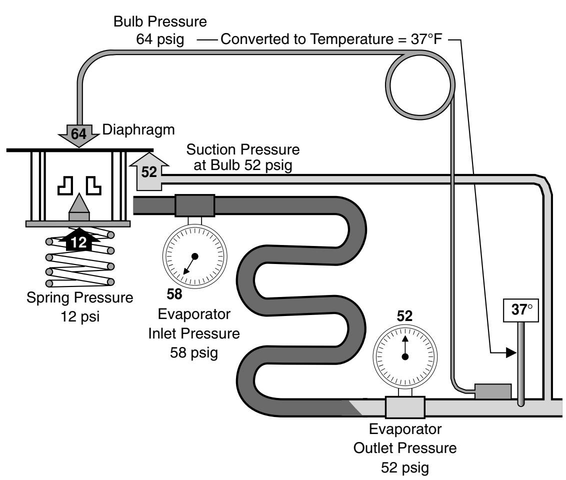
Bulb Pressure Necessary to Open Valve..70 psig

Bulb Temperature Equivalent to 70 psig...41°F

Saturated Temperature Equivalent to Evaporator Outlet Pressure..........................28°F

SUPERHEAT...13°F
Bulb Temperature Minus Saturated Evaporator Temperature

Figure 5



Closing Pressure...= 52 + 12 = 64 psig
(Suction Pressure at Bulb Plus Spring Pressure)

Bulb Pressure Necessary to Open Valve..64 psig

Bulb Temperature Equivalent to 64 psig...37°F

Saturated Temperature Equivalent to Evaporator Outlet Pressure..........................28°F

SUPERHEAT............. .... 9°F
Bulb Temperature Minus Saturated Evaporator Temperature

Figure 5 shows the same system as in Figure 4, but with an externally equalized TEV installed. Since an externally equalized TEV senses evaporator pressure at the evaporator outlet, it is not influenced by pressure drop through the evaporator. As a result, the TEV senses the correct pressure, and controls at the desired superheat.

These diagrams can be used to show the influence evaporator pressure drop has on internally equalized TEVs as evaporating temperatures fall. Table 1 provides general recommendations for maximum pressure drops that can be safely tolerated by internally equalized valves. These recommendations are suitable for most field installed systems. Use externally equalized TEVs when pressure drops exceed values shown in Table 1, or when pressure drops cannot be determined. **An externally equalized TEV should be used whenever a refrigerant distributor is used with the evaporator.**

Refer to Bulletin 10-11, TEV Installation, Field Service and Assembly, regarding recommendations for the location of the sensing bulb and external equalizer connection to the suction line.

Thermostatic Charges

As previously mentioned, the TEV's sensing bulb transmits pressure to the top of the diaphragm by a length of capillary tubing. The **thermostatic charge** is the substance in the TEV's sensing bulb which responds to suction line temperature to create the bulb pressure, and it is designed to allow the TEV to operate at a satisfactory level of superheat over a specific range of evaporating temperatures. The subject of thermostatic charges is best approached by describing the categories into which charges are classified. These categories are the following:

1. Liquid Charge
2. Gas Charge
3. Liquid-Cross Charge
4. Gas-Cross Charge
5. Adsorption Charge

The conventional liquid charge consists of the same refrigerant in the thermostatic element that is used in the refrigeration system, while the liquid-cross charge consists of a refrigerant mixture. The term **cross charge** arises from the fact that the pressure-temperature characteristic of the refrigerant mixture used within the sensing bulb will cross the saturation curve of the system refrigerant at some point.

Both the liquid and liquid-cross charges possess sufficient liquid such that the bulb, capillary tubing, and diaphragm chamber will contain some liquid under all temperature conditions. This characteristic prevents **charge migration** of the thermostatic charge away from the sensing bulb if the sensing bulb temperature becomes warmer than other parts of the thermostatic element. Charge migration will result in loss of valve control. An additional characteristic of these charges is their **lack of a maximum operating pressure (MOP)** feature. A thermostatic charge with an MOP feature causes the TEV to close above a predetermined evaporator pressure, thereby restricting flow to the evaporator and limiting the maximum evaporator pressure at which the system can operate.

Similarly, the gas charge consists of the same refrigerant in the thermostatic element that is used in the refrigeration system, while the gas-cross charge consists of a refrigerant mixture. Unlike the liquid type charges, both gas charges are distinguished by having a vapor charge in the thermostatic element which condenses to a minute quantity of liquid when the TEV is in its normal operating range. This characteristic provides an MOP for the valve at the bulb temperature of which the liquid component of the charge becomes vapor. Above this bulb temperature, a temperature increase does not significantly increase thermostatic charge pressure, limiting the maximum evaporator pressure at which the system can operate. A disadvantage of this type of thermostatic charge is the possibility of charge migration.

The adsorption charge consists of a noncondensable gas and an adsorbent material located in the sensing bulb. As the temperature of the bulb increases, gas is expelled (desorbed) from the adsorbent material increasing bulb pressure. Conversely, as the temperature of the bulb decreases, gas is adsorbed thus decreasing bulb pressure. Like the liquid and liquid-cross charges, the adsorption charge does not provide an MOP, and it will not migrate.

SPORLAN THERMOSTATIC EXPANSION VALVES

Sporlan manufactures thermostatic expansion valves for all air conditioning and refrigeration applications. For applications using refrigerants R-12, R-22, R-134a, R-404A, R-502, and R-507, Sporlan's standard line of TEVs are available with SAE flare, ODF solder, ODF solder flange, and FPT flange connections. For refrigerant R-717 (ammonia) applications, Sporlan TEVs are available with FPT flange connections. Socket weld flanges can also be obtained for selected valve types. Specifications for the standard line of Sporlan TEVs are provided on Pages 12 to 35, Bulletin 10-10. Materials and details of construction are provided on Page 36, Bulletin 10-10.

Valve capacity ratings for refrigerants R-12, R-22, R-134a, R-401A, R-402A, R-404A, R-407A, R-407C, R-408A, R-409A, R-502, R-507, and R-717 are provided on Pages 4 to 9, Bulletin 10-10. The capacity tables on these pages specify valve ratings at selected evaporator temperatures. Contact Sporlan Valve Company for applications not specifically listed in Bulletin 10-10.

In addition to the standard line of TEVs listed in this bulletin, Sporlan also manufactures special valve types to fill specific requirements for OEM customers. These OEM valve types include the Type BI, I, FB, and X TEVs. Special features such as bleed ports, nonadjustable construction, and extra length capillary tubing are available for many standard and OEM valves. Automatic expansion valves are also available on special order. If you have a special refrigerant flow control application, contact Sporlan Valve Company for assistance.

Alternative Refrigerants

Current efforts by refrigerant manufacturers to develop alternatives to chlorofluorocarbons (CFCs) are being closely followed by Sporlan Valve Company. At the time this bulletin is being published, hydrofluorocarbon (HFC) alternatives are available to replace R-12 and R-502. In addition, a number of hydrochlorofluorocarbons (HCFCs) have been developed as intermediate or service replacements for R-11, R-12, R-114, and R-502.

Several HFC alternative refrigerants are also being evaluated by manufacturers of air conditioning equipment to replace R-22, an HCFC refrigerant. These alternatives include R-407C and R-410A.

Sporlan has an ongoing program to evaluate alternative refrigerants and, when applicable, their associated refrigerant lubricants to assess compatibility with our materials of construction. For additional information on this subject, contact Sporlan Valve Company. The table below lists some of the major HFC and HCFC replacement refrigerants for R-11, R-12, R-114, and R-502.

CFC	Intermediate Alternatives (HCFC)	Long Term Alternatives (HFC)
R-11	R-123	–
R-12	R-401A (MP39) R-401B (MP66) R-409A (FX-56)	R-134a
R-114	R-124	–
R-502	R-402A (HP80) R-408A (FX-10)	R-404A (HP62) R-407A (KLEA*60) R-507 (AZ-50)

*KLEA is a trade name of ICI FLUOROCHEMICALS.

Sporlan Selective Charges

Sporlan introduced **Selective Charges** for TEVs over 50 years ago, recognizing that a single thermostatic charge cannot work effectively over the useful range of evaporating temperatures of many standard refrigerants. The present universal acceptance of Selective Charges is evidence of their many operational advantages. An explanation of their applications, design features, and advantages of each Selective Charge follows. Recommended Sporlan thermostatic charges for various applications are listed on Page 18.

The thermostatic expansion valve's **static superheat** versus evaporator temperature is referred to as the **superheat characteristic curve**. This curve is helpful in understanding TEV operation since its shape describes the valve's operation at a given setting over a range of evaporating temperatures. Figure 6 illustrates the superheat characteristic curves of standard Sporlan thermostatic charges. The concept of static superheat is described on Page 14, *Factors Affecting TEV Operation and Performance.*

Air Conditioning and Heat Pump Applications

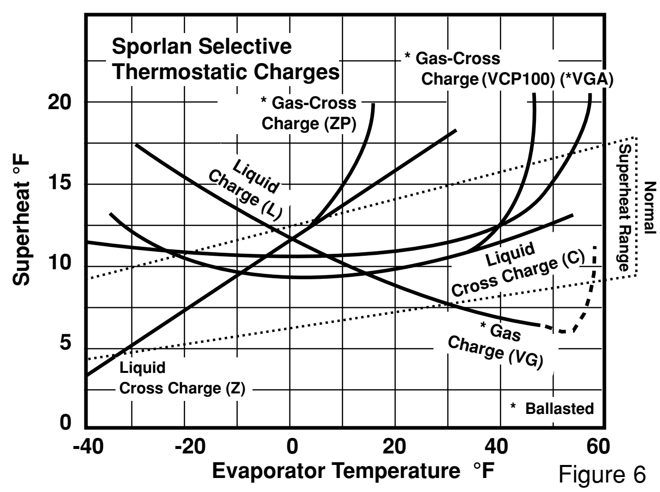


Figure 6

These applications usually require a pressure limiting (MOP type) thermostatic charge to limit compressor loading during system pulldown. The pressure limiting charge causes the TEV to remain closed until the system evaporator pressure is reduced below the MOP of the charge, permitting rapid pulldown.

The Sporlan thermostatic charges listed on Page 18 under the air conditioning and heat pump section are gas-cross charges.

Figure 6 illustrates the superheat characteristic curves of the Sporlan VCP100 and VG charges, a gas-cross charge and a gas charge respectively for R-22 applications. The VCP100 charge has a flatter operating range which allows the TEV to maintain a more constant superheat with changes in evaporating temperature. This characteristic is generally desired since many air conditioning and heat pump systems operate over a significant range of evaporating temperatures. The VG charge has limited application except for our WVE-180 valve. The vertical portion of the curves is the MOP region of both charges.

Sporlan pressure limiting charges also help reduce the problem of the TEV alternately overfeeding and underfeeding the evaporator, which is usually termed **hunting** or **cycling**. The amount of hunting in a system is influenced by the design of the evaporator coil, suction line piping at the valve's sensing bulb location, and the variability of the heat load on the evaporator. Hunting may cause a reduction in total system capacity, and a noticeable variation of evaporator pressure on systems having one evaporator. If hunting is severe, occasional floodback may result.

To help reduce or eliminate valve hunt, many Sporlan pressure limiting thermostatic charges feature the **FLOWMASTER** design introduced by Sporlan in 1948. This design incorporates a **thermal ballast** with the charge to help stabilize valve control.

Originally, it was felt that a highly temperature sensitive TEV would best be able to reduce hunting. This concept has proved to be incorrect for the majority of air conditioning and heat pump applications and, in fact, it was found to often aggravate hunting problems. A less temperature sensitive TEV using specifically designed pressure limiting thermostatic charges has been proven to be the best solution for these applications.

Type VGA Thermostatic Charge — The VGA charge is a specially designed pressure limiting charge for R-22 air conditioning and heat pump applications. The constituents and thermal ballast used with this thermostatic charge provide exceptional anti-hunt characteristics, which makes it the recommended charge for the majority of these applications. Due to its design, the MOP of the VGA charge is not as defined as the VCP100 charge, our alternate standard thermostatic charge for R-22 air conditioning and heat pump applications. **Therefore, if a defined MOP is not required, the VGA charge may be used in place of the VCP100 charge.**

TABLE 2

Refrigerant	Thermostatic Charge	MOP - psig	
		Factory Air Test	Nominal System
12	FCP60	60	50
	FCP	40	30
	FZP	20	12
22	VCP100	100	90
	VGA	*	*
	VCP	65	55
	VZP40	40	30
134a	JCP60	60	50
	JCP	40	30
404A	SCP115	115	105
	SCP	75	65
	SZP	45	35
502	RCP115	115	105
	RCP	75	65
	RZP	45	35
507	PZP	45	35

* Above normal operating conditions.

Maximum operating pressures for standard Sporlan pressure limiting charges are listed in Table 2. The factory air test pressure represents the valve MOP determined by a Sporlan air test fixture. The nominal system pressure is the actual system MOP. If an application requires a pressure limiting charge with an MOP not shown, contact Sporlan Valve Company for assistance.

Due to the design of pressure limiting charges, the valve diaphragm and capillary tubing must be kept at a temperature warmer than the bulb during system operation. Otherwise, migration of the charge away from the bulb will occur, and cause loss of valve control.

A properly selected and applied pressure drop type distributor is effective in preventing charge migration. Figure 7 illustrates how the pressure drop across this type of distributor keeps the TEV outlet pressure and temperature higher than the suction gas temperature.

Pressure drop at the refrigerant distributor does not affect system capacity. The refrigerant distributor simply lowers the pressure drop across the TEV by a small amount. If the TEV is properly sized, it will maintain desired superheat (and system capacity) with the remaining pressure drop available to the valve.

When applying a TEV and distributor, the two components perform together to provide stable system operation. Application of these components is much more critical on systems that operate at part-load conditions much of their operating time, e.g., variable air volume (VAV) systems and refrigeration systems with compressor unloading. See Bulletin 20-10 for complete information on refrigerant distributors.

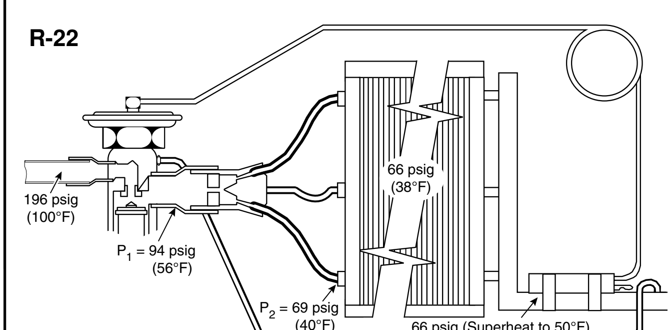


Figure 7

Refrigeration Applications

Ordinary refrigeration applications may be divided into the following three categories: commercial refrigeration, low temperature refrigeration, and extremely low temperature refrigeration. For each of these categories, Sporlan has developed a Selective Charge to provide optimum valve performance. These charges are described below.

Type C Charges — The charges listed under the commercial refrigeration section in the Recommended Thermostatic Charges table on Page 18 are collectively known as C Charges. These charges are liquid-cross charges and have an operating range from an evaporating temperature of 50°F to –10°F. Figure 6 illustrates a typical superheat characteristic curve of the C Charge. For comparison purposes, the superheat characteristic curve of a straight liquid charge is also shown. The flatter curve of the C Charge allows the valve to respond in a more stable manner to changes in evaporator pressure.

Types Z and ZP Charges — The charges listed under the low temperature refrigeration section are the Types Z and ZP Charges. The Z Charges (FZ, VZ, SZ, RZ, and PZ) are liquid-cross charges having an operating range from an evaporating temperature of 0°F to –40°F. A typical superheat characteristic curve of the Z Charge is illustrated in Figure 6. Since the curve slopes upward to the right, the valve will control at lower superheat values as evaporator temperature decreases, providing operational advantages for low temperature refrigeration. This characteristic prevents floodback during compressor startup, reduces the load on the compressor after startup, and permits rapid pulldown. Since the majority of low temperature systems operate at or near a specific evaporating temperature, the TEV can be set for optimum superheat at the design temperature permitting the system to operate as efficiently as possible.

The Types ZP Charges (FZP, VZP, SZP, RZP, and PZP) are gas-cross charges having the same operating range as the Type Z Charges. A typical superheat characteristic curve of the ZP Charge is illustrated in Figure 6. The Z and ZP Charges are essentially the same with the exception of the ZP Charge providing an MOP. **Type ZP Charges are not intended as replacements for Z Charges. Each should be selected for its unique purpose. A ZP Charge should only be used for low temperature refrigeration systems where it is necessary to limit evaporator pressure during pulldown**.

During and after a hot gas defrost cycle or after a shutdown period, evaporator pressure may rise to a level the compressor motor cannot handle. In such cases, a pressure limiting charge is often effective in limiting suction pressure at the compressor. For systems employing long suction lines, a crankcase pressure regulating (Sporlan CRO type) valve may be required to limit suction pressure at the compressor quickly. While a pressure limiting charge can be used with a CRO valve, pulldown time may be adversely affected if the charge MOP and the CRO valve setting are close to one another. Therefore, Sporlan does not recommend a CRO valve and a pressure limiting TEV be used on the same system.

Type X Charge — The charges listed under the extremely low temperature refrigeration are known as the X Charges. The X Charges are liquid-cross charges having an operating range from an evaporating temperature of –40°F to –100°F. This curve is similar to the Z Charge curve since the performance characteristics of the Z Charges previously discussed apply very well to extremely low temperature refrigeration. Contact Sporlan Valve Company for assistance in selecting TEVs for applications requiring the X Charge.

Special Selective Thermostatic Charges and Elements

Sporlan Valve Company manufactures a number of special thermostatic charges and elements designed for specific applications. A few of these are described below:

Type N Charge — This charge is an adsorption type charge which has a superheat characteristic curve similar to the C Charge but tends to be less responsive. The N Charge is a noncondensable charge, and it has no MOP feature. The N Charge is used on special medium and high temperature applications such as chillers which are located outdoors and must operate while exposed to cold temperatures.

Hydraulic Elements — These thermostatic elements are specially designed double diaphragm elements which provide a pressure limiting feature without the problems associated with charge migration from the bulb when the element becomes cooler than the bulb. The hydraulic element is often used on chillers which require a TEV with an MOP type charge, but experience problems with charge migration caused by cold ambient temperatures. For additional information on the hydraulic element, contact Sporlan Valve Company.

Mechanical Pressure Limit Elements — These thermostatic elements may use either liquid or liquid-cross charges, and they employ a mechanical means to limit suction pressure (PL-type). A collapsible member is used to limit evaporator pressure when it exceeds a specified value. This method of limiting evaporator pressure is currently considered obsolete, and replacement valves and thermostatic elements are no longer available. A cross reference is available from the obsolete PL element to the thermostatic element with the MOP charge, please refer to Bulletin 210-10-17.

Special Refrigerants — Thermostatic charges for use with special refrigerants are available. These refrigerants include: R-13, R-23, R-13B1, R-124, and R-503. Contact Sporlan Valve for assistance in valve selection for special refrigerant applications.

Desuperheating Charges — Special thermostatic charges have been developed for applications requiring suction gas desuperheating. The subject of hot gas bypass and desuperheating TEVs is discussed on Page 12.

THERMOSTATIC EXPANSION VALVE APPLICATIONS

Due to its superior operating characteristics, the TEV is currently used on a wide variety of applications. These applications include both large and small capacity air conditioning and heat pump systems; commercial refrigeration systems including refrigerated display cases, ice cubers, and soft drink dispensers; and low temperature refrigeration systems.

Most air conditioning and refrigeration systems use some method of capacity reduction to match the capacity of the system to a reduced heat load condition, commonly referred to as partload operation. The simplest method of capacity reduction is cycling the compressor, usually in response to a thermostat. Other methods of capacity reduction include using compressors equipped with cylinder unloaders, bypassing hot gas, or some combination of the above. A discussion on these capacity reduction methods and their effect on TEV operation is presented later in this section.

The thermostatic expansion valve is a modulating type flow control device with the capability to adjust to low load conditions and maintain reasonable refrigerant flow control. The range of effective TEV control, however, has limits and may not be capable of operating properly on a system requiring a high degree of capacity reduction. As a result, systems using capacity reduction methods require the use of proper design and installation practices.

System Design Factors

Predicting TEV performance at reduced system capacities is difficult due to the many influencing design factors present in any system. These factors include: TEV sizing, refrigerant distribution, TEV setting, evaporator coil design, suction line piping, and bulb location. General recommendations which address these factors are provided below. By observing these recommendations, a conventional

TEV can be expected to operate satisfactorily down to approximately 35 percent of its rated capacity. The Types (E)BF, SBF, EBS, and O valves, featuring the balanced port design, can be expected to operate satisfactorily down to approximately 25 percent of its rated capacity.

Valve Size — The TEV should be sized as close as possible to the system's maximum designed heat load condition. A valve with a capacity rating up to 10 percent below the full load conditions may be selected if the system is to operate at reduced loads for long periods of time, and if slightly higher than normal superheats can be tolerated at full load conditions.

Distributor Sizing — The proper sizing of the distributor is extremely important for systems using methods of capacity reduction. The function of the refrigerant distributor is to evenly distribute refrigerant to a multi-circuited evaporator. If the distributor cannot perform its function at all load conditions erratic TEV operation can be expected. For the pressure drop type distributor, the distributor nozzle and tubes must be checked for proper sizing at both minimum and maximum load conditions. See Bulletin 20-10 for further information.

Superheat Adjustment — The superheat setting of the TEV should be set at the highest possible superheat that can be tolerated at full load conditions. A high superheat setting will reduce problems associated with mild TEV hunting at low load conditions. High superheats are more acceptable on air conditioning systems where the wide temperature difference between the refrigerant and the air allows the TEV to operate at higher superheats without a significant loss in coil capacity.

Evaporator Coil Design — When the evaporator is circuited to provide counterflow of the refrigerant relative to the direction of the air flow, superheat will normally have the least effect on evaporator capacity and suction pressure fluctuations will be minimized.

Refrigerant velocity inside the evaporator should be high enough to prevent excessive trapping of liquid refrigerant and oil, which may cause TEV hunting. Multi-circuited coils should be designed in such a manner that each circuit is exposed to the same heat load. Air flow across the coil must be evenly distributed.

Large capacity air conditioning evaporator coils are often split into multiple sections so that one or more of these sections can be shut off for capacity control during part-load operation. Therefore, a TEV is required to feed each of these sections. The methods used to split these coils are referred to as: **row split, face split,** and **interlaced**. Generally, TEVs will operate best on interlaced coils.

Suction Line Piping — Approved methods of suction line piping including recommended bulb locations and use of traps are covered in Bulletin 10-11. Where system designers and manufacturers have tested and approved other methods of piping, these methods should be used when installing or servicing their systems.

Sensing Bulb Location — The TEV's sensing bulb should be located on a horizontal section of suction line near the evaporator outlet and, in the case of an externally equalized valve, upstream of the equalizer connection on the suction line. Refer to Bulletin 10-11 for additional information on bulb location and installation.

Vapor Free Liquid Refrigerant — Another important aspect in assuring proper TEV operation is providing vapor free liquid refrigerant to the inlet of the TEV. Vapor in the liquid line may severely reduce the capacity of the TEV hindering proper refrigerant flow to the evaporator. An adequately sized liquid-to-suction heat exchanger will help assure vapor free liquid by providing some amount of subcooling to the liquid. In addition, the heat exchanger provides an added advantage to the system by vaporizing small quantities of liquid refrigerant in the suction line before the liquid reaches the compressor. A Sporlan See•All Moisture-Liquid Indicator installed near the TEV inlet offers a visual check for vapor free refrigerant.

Balanced Port TEVs

One of the factors limiting a TEV's ability to operate at part-load conditions is a variation in pressure drop across the TEV during normal system operation due to changes in head pressure. As previously discussed on Page 3, *How The Thermostatic Expansion Valve Works*, pressure drop across the TEV influences valve operation, particularly with the larger capacity valves which possess larger port areas. To counteract the effects of this force Sporlan has incorporated balanced port design features into selected valve types.

Sporlan introduced this feature in 1946 using a double port construction on two large capacity valves: the Types T and W. The Type T valve later became our Type V valve when the valve design was modified. This double port construction features a piston which seats against two ports, and significantly reduces the effects of pressure drop across the valve.

The refrigerant flow entering these valve types is divided between the two ports, the force of the refrigerant flow being transmitted to the midsection of the piston. The force of the flow heading to the lower port is largely canceled out by the force of the flow heading to the upper port due to the design of the piston. A **semi-balanced** valve is achieved, allowing the valve to operate at a lower percentage of its rated capacity than a conventionally designed valve.

Sporlan introduced a patented discharge bypass valve with a **fully balanced** design in 1965, the Type ADRHE-6. This design was later used with the Type O TEV, which was introduced in 1971.

The Type O valve is designed to eliminate the effects of pressure drop across the valve. The Type O valve features a piston which seats against the valve's single port. See Figure 8. A passageway drilled through the piston allows liquid line pressure to be transmitted to the bottom side of the piston. A synthetic cup seal encircling the piston traps this pressure underneath the piston, which causes the force due to the liquid line pressure on top of the piston to be canceled. Satisfactory operation down to 25% or lower of rated capacity can be expected with the Type O valve provided that the aforementioned design recommendations are followed.

Recent efforts by system manufacturers to reduce operating costs of refrigeration systems by allowing condenser pressures to fall or float with lower ambient temperatures has created a need for a small capacity TEV with a balanced port design and superior modulating characteristics. This effort is particularly apparent with supermarket applications. Sporlan introduced the Types (E)BF and EBS valves in 1984 to meet this need.

The Types (E)BF and EBS valves feature a single pushrod which extends through the port of the valve. See Figure 8. The port and pushrod cross sectional areas are identical so that the opening force created by pressure drop across the port is canceled by the pressure drop across the pushrod. Furthermore, excellent pin and port alignment is provided by this design. Refer to the section, *Effect of Pressure Drop Across the Valve Port*, on Page 4 for additional information.

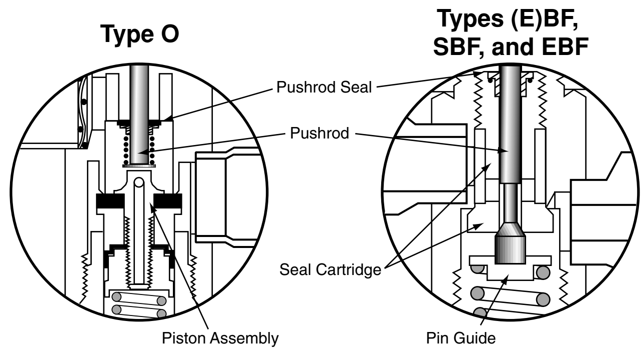


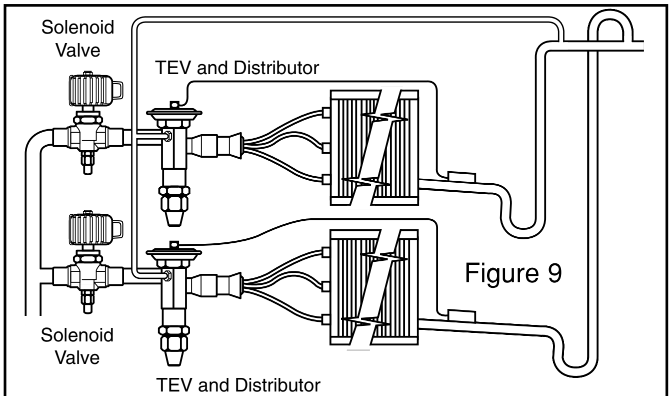
Figure 8

The Type (E)BF valve with the 'AA' port was developed by Sporlan in 1988. Its original design used a patented two pushrod construction (U.S. patent 4,750,334) similar to the conventional Type F valve, and the balanced design was achieved by the use of a third *floating rod* located above the valve port. As with the single rod balanced port construction, the *floating rod* causes the pressure drop across it to offset the opening force created by the pressure drop across the port.

The 'AA' port Type (E)BF valve was later redesigned in 1993 to a single pushrod construction like the other Type (E)BF valve sizes. All 'AA' port valves carrying a '3393' date code or later will have the single pushrod construction.

System Design For Part-Load Conditions

On systems where the compressor can unload to 50 percent of its rated capacity, care must be exercised when selecting expansion valves and refrigerant distributors. If the compressor can unload below 33 percent of its rated capacity, special design considerations may be necessary to assure proper TEV operation. Figures 9, 10, and 11 are piping schematics illustrating three possible methods of balancing the capacity of the TEV and distributor with the compressor during low load operation. Recognized piping references such as the equipment manufacturer's literature and the ASHRAE Handbooks should be consulted for further information on this subject. **Sporlan cannot be responsible for damages arising from improper piping practices or the improper use of its products.**



Capacity Reduction – 2 or more evaporator sections handling same load.

Two or More Evaporator Sections Handling the Same Load

Figure 9 illustrates two parallel evaporators each controlled by a separate TEV and refrigerant distributor. Each evaporator shares half of the total common load. The liquid line solenoid valve ahead of each TEV is electrically connected to the compressor capacity modulating system. When the compressor capacity is reduced to 50%, one of the two solenoid valves closes stopping refrigerant flow to one TEV. The TEV remaining in operation will then have a rated capacity approximately equal to the compressor capacity operating 50% unloaded.

This technique may be carried further by using additional evaporator sections, each controlled by a separate TEV and refrigerant distributor. Using multiple evaporator sections will let highly reduced loads to be properly controlled.

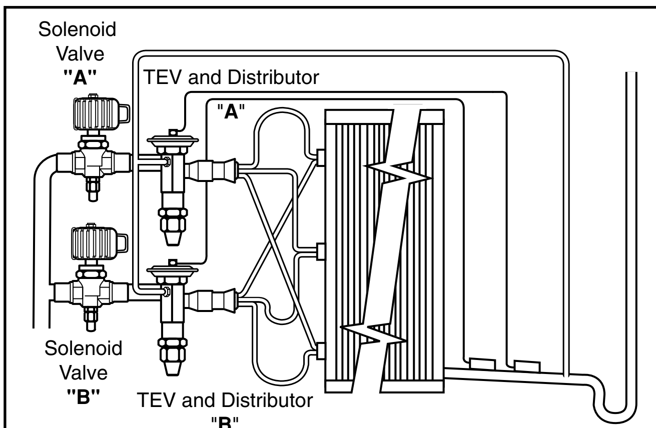
Single Evaporator Controlled by Two TEVs

For evaporator coils which are not split by design, i.e., row split, face split, or interlaced, the following techniques may be employed to improve part-load operation.

Figure 10 illustrates the use of two TEVs and two distributors feeding a single evaporator. Each evaporator circuit is fed by two distributor circuits, one from each distributor. The solenoid valves are connected to the compressor capacity modulating system as mentioned before. Using this configuration, TEV and distributor capacities can be reduced in three stages. As an example, assume that TEV and distributor combination **A** are sized to handle 67% of the load and combination **B** 33% of the load. The three stages of valve and distributor capacity reduction result from opening or closing the solenoid valves according to the following table:

Compressor Capacity Percent of Full Capacity	Position of Solenoid Valve "A"	Position of Solenoid Valve "B"	Total Valve and Distributing Loading Percent of Rated Capacity
100%	Open	Open	100%
83%			83%
67%		Closed	100%
50%			75%
33%	Closed	Open	100%
16%			50%

Another variation of this technique is to have each evaporator circuit fed by a single distributor circuit and size the TEVs and distributors on the expected load of the total number of circuits fed by each TEV. Reducing evaporator



Capacity Reduction – Single evaporator controlled with 2 TEVs and 2 Solenoid Valves.

capacity is accomplished by closing a solenoid valve which deactivates the circuits being fed by the TEV and distributor downstream of the solenoid valve. This method of capacity control, however, requires a degree of care since the heat load on the evaporator circuits will be affected in the manner in which circuits are deactivated.

Hot Gas Bypass and Desuperheating TEVs

Systems which are required to operate at load conditions below the unloading capabilities of their compressors present an additional design problem. To balance the system under these conditions, bypassing a controlled amount of hot gas to the suction side of the system provides a practical solution. Bypassing hot gas is accomplished with a modulating control valve known as a **discharge bypass valve**. Sporlan manufactures a complete line of these valves. For details, refer to Bulletin 90-40.

For close coupled systems, the preferred method of hot gas bypass is bypassing to the inlet of the evaporator. This method has three advantages: (1) the TEV will respond to the increased superheat of the vapor leaving the evaporator and will provide the liquid required for desuperheating; (2) the evaporator serves as an excellent mixing chamber for the bypassed hot gas and the liquid vapor mixture from the TEV; and (3) oil return from the evaporator is improved since the refrigerant velocity in the evaporator is kept high by the hot gas.

For multi-evaporator or remote systems, bypassing hot gas directly into the suction line in the manner illustrated in Figure 11 may be necessary. In addition to the discharge bypass valve, an auxiliary TEV known as a **desuperheating TEV** is required to supply the necessary liquid refrigerant to cool the discharge gas entering the suction line. Compressor manufacturers generally rate their air conditioning compressors for a 65°F return gas temperature, and this temperature is usually appropriate for selecting desuperheating TEVs. Many refrigeration and low temperature compressors, however, require lower suction gas temperatures to prevent discharge gas temperatures from rising too high and damaging compressor parts and carbonizing oil. Consult the compressor manufacturer if the maximum permissible suction gas temperature for a compressor is not known.

Sporlan has developed special desuperheating thermostatic charges. See table below. Each charge will allow the desuperheating TEV to control the listed suction gas superheat. For suction gas temperatures that require superheats other than those listed, contact Sporlan Valve or the compressor manufacturer for assistance.

*THERMOSTATIC CHARGES
For Desuperheating Thermostatic Expansion Valves

Refrigerant	Suction Gas Superheat* °F	Minimum Allowable Evaporating Temperature at Reduced Load Condition °F	
		40° thru – 15°	– 16° thru – 40°
12, 134a	25	L2	L1
	35		L2
	45	L3	
22	25	L1	L1
	35		
	45	L2	L2
404A, 502, 507	35	L1	L1
	45		

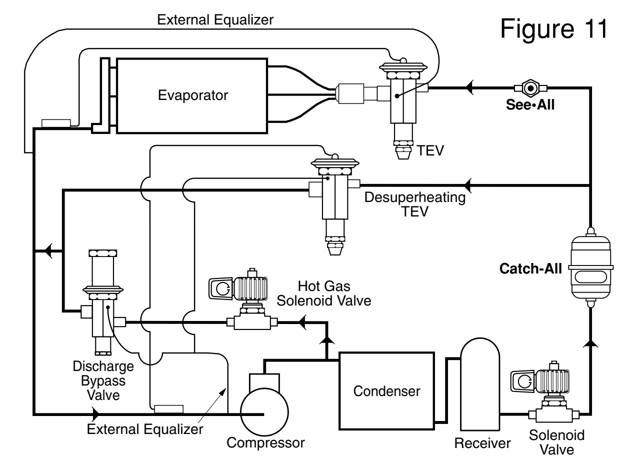
* For suction gas temperatures that require superheats other than those listed above, contact Sporlan Valve Company or the compressor manufacturer for assistance.

Sizing a desuperheating valve involves determining the amount of refrigerant liquid necessary to reduce the suction gas temperature to the proper level. For hot gas bypass applications, a desuperheating valve can be properly sized from the selection procedure provided in Bulletin 90-40.

An externally equalized TEV is recommended for most desuperheating applications. If the piping of the desuperheating TEV is close coupled, an internally equalized valve may be used. Figure 11 illustrates the use of an externally equalized desuperheating TEV. Refer to the section, *Equalization Method* on Page 5 for further information on this subject.

When piping the discharge bypass valve and the desuperheating TEV, remember that good mixing of the discharge gas and liquid must be obtained before the mixture reaches the sensing bulb of the desuperheating TEV. Improper mixing may produce unstable system operation causing the desuperheating TEV to hunt. Proper mixing can be accomplished in two ways: (1) install a suction line accumulator downstream of both valve outlet connections with the desuperheating TEV bulb downstream of the accumulator; or (2) tee the liquid vapor mixture from the desuperheating TEV and the hot gas from the bypass valve together before connecting a common line to the suction line. The latter method is illustrated in Figure 11.

Figure 11



Off-Cycle Pressure Equalization

Certain applications utilizing low starting torque single phase compressor motors (e.g., a permanent split capacitor motor) require some means of pressure equalization during system offcycle. Pressure equalization is necessary since low starting torque compressors are not capable of restarting against a large pressure differential. Typical applications requiring pressure equalization are small air conditioning and heat pump systems which frequently cycle on and off in response to a thermostat.

Permanent Bleed Port — Any Sporlan thermostatic expansion valve may be ordered with a **bleed port**. Standard bleed port sizes are: 5%, 10%, 15%, 20%, 30%, and 40%. Bleed ports are designated by the percentage they increase nominal valve capacity at 40°F evaporator temperature. For example, a 2 ton TEV with a 30% bleed will have the capacity of: 2 x 1.3 = 2.6 tons. Refer to Page 17 for *Ordering instructions*. Please contact Sporlan for assistance in selecting appropriate bleed port sizes.

The subject of pressure equalization during system off-cycle should not be confused with the external equalizer of the TEV. System pressure equalization is accomplished by allowing a certain amount of refrigerant to leak through a machined notch or hole in the valve seat during system off-cycle. The external equalizer of the TEV, however, simply allows the valve to sense evaporator pressure. The external equalizer does not provide pressure equalization during system off-cycle.

The Rapid Pressure Balancer (RPB) Feature — The thermostatic expansion valve with the Rapid Pressure Balancer (RPB) feature was developed by Sporlan in response to an industry demand for a TEV which would equalize system pressures during off-cycle more rapidly than a TEV with a permanent bleed port. In some cases, the bleed port has proved somewhat slow at equalizing system pressures creating restart problems for low starting torque compressor motors. The RPB feature, however, has been proven to reduce equalization times, normally to within two minutes after system off-cycle.

The RPB feature is actuated following system off-cycle. Immediately after compressor shutdown, the evaporator pressure rises forcing the valve's pin carrier to a more closed position. When the RPB feature is used, the pin carrier continues its motion and opens a secondary spring loaded bleed port allowing rapid pressure equalization to occur. Upon compressor restart, evaporator pressure falls closing the spring loaded bleed port. The bleed position and the normal operating position of the RPB are illustrated in Figure 12.

Typical Valve Cross Section

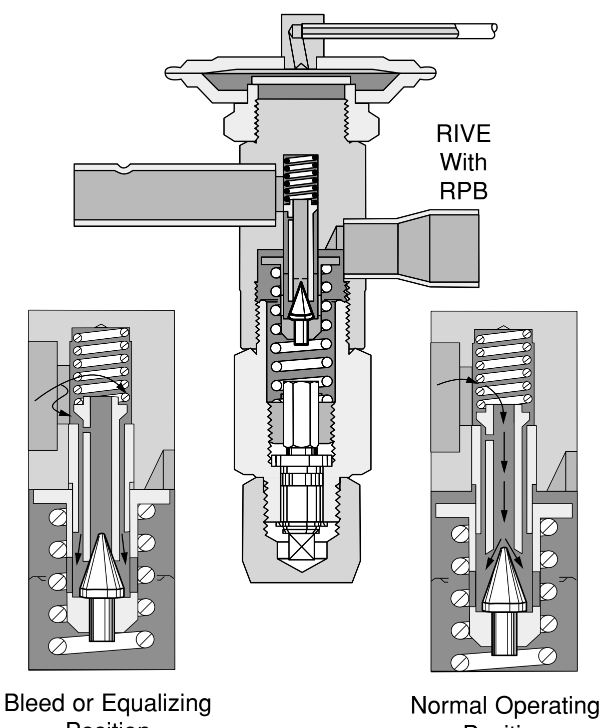


Figure 12

The RPB feature has a specific application. The feature should only be used on small air conditioning and heat pump systems which use a low starting torque single phase compressor motor. On heat pump applications, the RPB feature should only be used on the **indoor coil**. Since the outdoor coil may be exposed to cold ambient temperatures, there exists a possibility the evaporator pressure may fall too slowly upon compressor restart to reset the RPB feature. In addition, the RPB feature is not recommended nor is it required for any system employing electrical **hard start** components.

The RPB feature is available with the Type RI TEV, and it can be specified on a special order basis for Types C and S TEVs up to and including 4 tons R-22 nominal capacity. Refer to the valve specification sheets for further information. For OEM type TEVs, contact Sporlan Valve Company regarding the availability of the RPB feature. A **Catch-All Filter-Drier** should be installed near the inlet of a TEV having the RPB feature to assure proper valve operation.

The normal capacity of the valve is increased by 15% when the rapid pressure balancer is used. A cross drilling is part of the internal construction of the RPB feature and this drilling provides the additional refrigerant flow.

R-717 (Ammonia) Applications

Thermostatic expansion valves for ammonia applications require special design considerations due to the erosive effects of ammonia vapor. For this type of application, Sporlan has developed the Types D and A thermostatic expansion valves. Like other components of any ammonia system, the Types D and A valves are made from steel and steel alloys. The materials used in the manufacture of these valves are listed on Page 32, Bulletin 10-10.

With ammonia systems, the formation of flash vapor at the expansion valve port causes valve seat erosion or wire drawing to occur. This effect is further aggravated by high velocity ammonia mixed with dirt or scale passing through the port of the expansion valve. Fortunately, seat erosion can be minimized and valve life extended if the following steps are taken:

1. Maintain vapor-free liquid at the TEV inlet at all times.
2. Maintain clean ammonia through effective filtration.
3. Reduce the velocity of the ammonia through the TEV port by reducing the pressure drop across the port.

Step 1 can be accomplished through proper system design. Liquid line vapor is prevented by adequately sizing liquid lines and providing sufficient subcooling. Step 2 can be assured with the use of a Sporlan **Catch-All Filter-Drier**. This filter-drier is an effective scale trap when used on ammonia systems. For further information on the use of the **Catch-All Filter-Drier** with ammonia systems, refer to Bulletin 40-10 or Catalog 717.

Step 3 is accomplished through the use of a removable **discharge** tube located in the outlet of all Type D valves and the nominal 20, 30, and 50 ton Type A valves. This discharge tube represents the principal difference between Sporlan ammonia TEVs compared to TEVs used with other refrigerants. The discharge tube functions by removing a portion of the total pressure drop across the valve resulting in a lower pressure drop across the valve port. Liquid velocities and the formation of flash vapor at the valve port are reduced, extending the life of the valve. Discharge tube sizes are listed in the Types D and A valve specifications located on Pages 30 and 31, Bulletin 10-10.

The discharge tube should be removed and discarded when a Sporlan refrigerant distributor is used with the ammonia TEV since the function of the discharge tube is accomplished by the distributor nozzle. If the discharge tube is not removed from the valve, the combination of the discharge tube and distributor nozzle may create an excessive pressure drop resulting in a substantial loss of TEV capacity. Refer to Bulletin 20-10 for further information on ammonia distributors or Catalog 717.

The nominal 75 and 100 ton Type A valves do not employ a discharge tube since their valve outlets are designed to

Thermostatic Charge	Evaporator Temperature °F
C	40° to 0°
Z	0° to –30°

For applications at evaporator temperatures below minus 30° F, consult Sporlan Valve Company, Washington, MO.

serve as a secondary orifice to reduce pressure drop across the valve port.

Thermostatic Charges for Ammonia Valves

Thermostatic charges C, Z, and L are available for the Type D thermostatic expansion valve. The Type L thermostatic charge is the only charge available for the Type A valve.

The Types C and Z thermostatic charges provide operating advantages for systems that cycle in response to a suction pressure switch or thermostat. These charges are also recommended for systems using a small capacity compressor. The table below lists the recommended temperature range for each charge.

Cold storage plants will often have large centralized ammonia systems. These systems will consist of many evaporators connected to one or more large compressors. With many thermostatic expansion valves operating at a common evaporator pressure, a change in flow rate made by one valve will not have a significant effect on the evaporator pressure. This operating characteristic makes it more desirable for the thermostatic expansion valve to be more responsive to changes in bulb temperature. This is the feature of the Sporlan Type L charge. Therefore, for large ammonia systems consisting of multiple evaporators, the Type L charge is recommended.

FACTORS AFFECTING TEV OPERATION AND PERFORMANCE

There exists many factors which influence TEV operation and performance. The following discussion lists the major factors:

Superheat

Superheat is defined as the difference between the refrigerant vapor temperature and its saturation temperature. To properly measure the superheat the TEV is controlling, the **pressure-temperature method** is used. This method consists of measuring the suction pressure at the sensing bulb location, converting this pressure to its saturation temperature by using a pressure temperature (PT) chart, and subtracting the saturation temperature from the vapor temperature measured at the sensing bulb location. For example, the superheat of R-22 vapor at 50°F and 68.5 psig at the sensing bulb location is calculated as follows:

saturation temperature of R-22 vapor at 68.5 psig = 40°F
superheat = 50°F - 40°F = 10°F

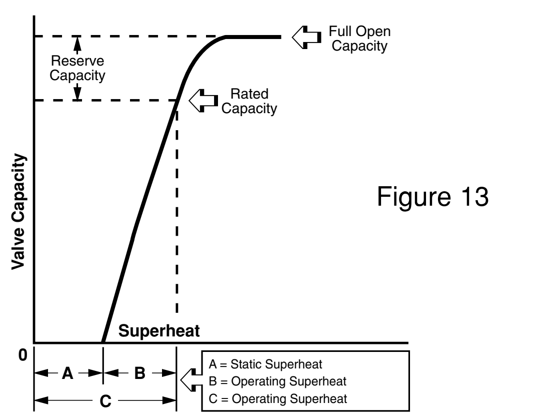


Figure 13

Another method of measuring superheat the TEV is controlling is the **two temperature method**. With this method, saturation temperature is measured directly by placing a temperature probe on the evaporator surface, normally at a location one-half to two-thirds the distance through the evaporator coil. Since this method can only approximate true saturation temperature, it is not as reliable as the pressure-temperature method, and it should be avoided whenever possible.

The TEV is designed to control superheat at a constant value at the location of its sensing bulb. The level of superheat determines to what extent the valve is open. A TEV controlling at a high superheat will be further open than a TEV controlling at a low superheat. Refer to the section, *How the Thermostatic Expansion Valve Works*, on Page 3 for additional information. Figure 13 shows a plot of valve capacity versus superheat for a typical TEV, illustrating the effect superheat has on valve capacity. For the purpose of understanding the relationship between superheat and valve capacity, superheat may be described as follows:

Static Superheat — static superheat is the amount of superheat necessary to overcome the spring and equalizer pressures so that any additional superheat will cause the valve to open.

Opening Superheat — opening superheat is the amount of superheat required to move the valve pin away from the seat after the spring and equalizer pressures have been overcome to permit refrigerant flow.

Operating Superheat — operating superheat is the superheat at which the TEV operates on a refrigeration system. Operating superheat is the sum of static and opening superheats. The valve capacity versus operating superheat curve is referred to as the **valve gradient.**

The most desirable operating superheat for a particular system largely depends on the **temperature difference (TD)** between the refrigerant and the medium being cooled. The basic definition of TD is the difference between evaporator temperature and the entering temperature of the medium being cooled, i.e., air or water. Systems with a high TD, such as air conditioning and heat pump systems, can tolerate higher superheats without appreciable loss in system capacity. Refrigeration and low temperature systems require low superheats due to their lower TDs. The table below provides general recommendations for superheat settings for different evaporator temperature ranges. **These settings are only estimates for typical system designs and should only be used if setting guidelines are unavailable from the system manufacturer:**

General Guidelines for Superheat Settings

Application ➧	Air Conditioning & Heat Pump	Commercial Refrigeration	Low Temperature Refrigeration
Evaporator Temperature °F	50° to 40°	40° to 0°	0° to –40°
Suggested Superheat Setting °F	8° to 12°	6° to 8°	4° to 6°

When a Sporlan TEV is properly selected and applied, the factory superheat setting will usually provide an operating superheat in the range of 8 to 12°F. A precise determination of the valve's operating superheat from a factory setting is not possible since factory settings are determined on the basis of static superheat, and opening superheat of the valve is influenced by several design factors within the system. Once the TEV has been placed on the system and set to the desired operating superheat, however, the valve's static superheat can be measured on a test fixture permitting the desired setting to be duplicated for production runs.

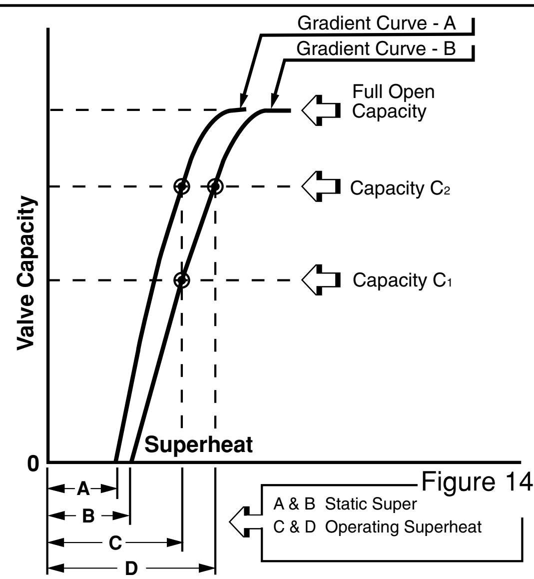


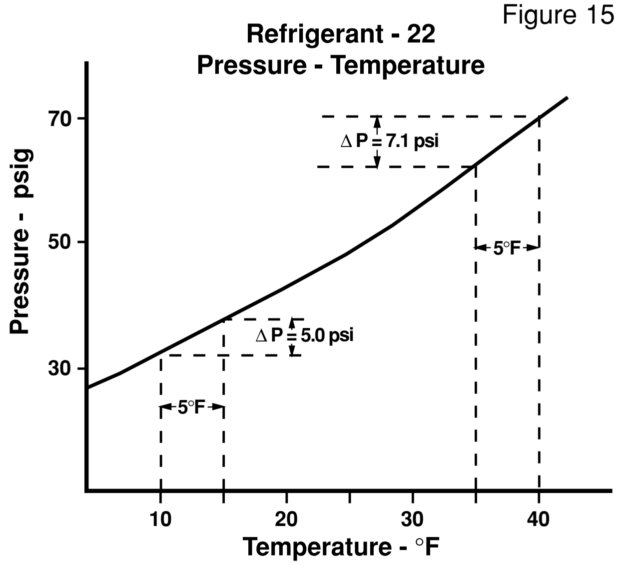
Figure 14

All Sporlan TEVs have reserve capacity in addition to the capacity shown in the rating tables on Pages 5 to 11, Bulletin 10-10. This reserve capacity should not be considered when selecting a valve and, in most cases, will not be utilized if the valve is properly selected and applied. Reserve capacity, however, is an important and necessary characteristic of any well designed TEV. Reserve capacity enables the valve to adjust for a temporary increase in load, periods of low condensing pressure, and moderate amounts of flash gas in the liquid line.

Valve Setting

All Sporlan TEVs will produce rated capacity at the standard factory setting. If the valve adjusting stem is turned clockwise, the additional spring pressure created will increase static superheat and decrease the valve's capacity

Figure 15



to a limited degree. Turning the adjusting stem counterclockwise will decrease static superheat and increase the valve's capacity to a limited degree. Figure 14 illustrates the effect setting has on valve capacity.

Referring to Gradient Curve **A** in Figure 14, Capacity **C2** is achieved with a static superheat setting of **A** and an operating superheat of **C**. Turning the adjusting stem clockwise will increase the static superheat and shift the curve to the right. This new curve, identified as Gradient Curve **B**, shows that valve capacity will decrease to capacity **C1** at the same operating superheat **C**. Capacity **C2** can only be achieved at the expense of a higher operating superheat designated as **D**.

On an operating system where a given valve capacity is required, any valve adjustment will merely change the superheat at which the valve is operating.

Evaporator Temperature

The pressure-temperature curves for all refrigerants have a flatter slope at lower temperatures. Figure 15 illustrates a P-T curve using R-22 as an example. The P-T curve for a thermostatic charge will also be flatter at lower temperatures. As a result, a given bulb temperature change causes a smaller bulb pressure change at lower evaporator temperatures. A given change in superheat will result in less pressure difference across the valve diaphragm at lower evaporating temperature causing a reduction in valve opening and valve capacity.

Subcooling

Subcooling is defined as the difference between the refrigerant liquid temperature and its saturation temperature. For example, the amount of subcooling of R-22 liquid at 85°F and 196 psig is calculated as follows:

saturation temperature of R-22 liquid at 196 psig = 100°F subcooling = 100°F - 85°F = 15°F

Adequate subcooling of the refrigerant liquid is necessary to prevent the formation of liquid line vapor due to pressure losses in the liquid line. Vapor in the liquid line, even in small quantities, will measurably reduce valve capacity. Several methods by which liquid line vapor can be prevented in spite of relatively high liquid line pressure losses are explained in Bulletin 10-11.

TABLE 3

Refrigerant	Vertical Lift – Feet				
	20	40	60	80	100
	Static Pressure Loss – psi				
12	11	22	33	44	55
22	10	20	30	39	49
134a, 502	10	20	30	40	50
404A	8	16	24	32	40
410A	9	17	26	34	43
507	8	17	25	34	42
717 (Ammonia)	5	10	15	20	25

TABLE 4

Refrigerant	*Average Pressure Drop Across Distributor
12, 134a	25 psi
22, 404A, 502, 507	35 psi
410A	45 psi
717 (Ammonia)	40 psi

*See Sporlan Bulletin 20-10 for pressure drop data as related to percent loading.

Pressure losses in the liquid line result from friction and static pressure losses. Minimizing these pressure losses as much as possible is necessary for proper system design. Friction losses may be minimized by properly sizing the liquid line and liquid line accessories such as a solenoid valve and filter-drier. Static pressure losses, however, are solely the result of the weight of the vertical height of refrigerant liquid. As a result, static pressure losses can only be minimized by reducing the upward vertical height refrigerant liquid must travel. Table 3 may be used to determine the static pressure loss of a liquid line. When the sum of the static pressure and friction losses are known, the amount of subcooling necessary to prevent vapor from forming in the liquid line can be determined. For example, if the sum of the static and friction losses is 14 psi for an R-22 system, and the condensing temperature is 100°F, the subcooling necessary is as follows:

saturation pressure of R-22 at 100°F condensing = 196
psig pressure at TEV inlet = 196 -14 = 182 psig
saturation temperature of R-22 liquid at 182 psig = 95°F
subcooling required = 100 - 95 = 5°F

Refrigerant Liquid Temperature and Pressure Drop Across TEV

The refrigerant liquid temperature entering the TEV and the pressure drop available across the TEV influence valve capacity. The valve capacity ratings displayed on Pages 4 to 9, Bulletin 10-10, are based on 100°F vapor free liquid entering the valve for R-12, R-22, R-134a, R-401A, R-402A, R-404A, R-407A, R-407C, R-408A, R-409A, R-502, and R-507. R-717 (ammonia) valve capacity ratings are based on 86°F vapor free liquid entering the valve. Liquid correction factors for other liquid temperatures are included in Bulletin 10-10 along with the ratings tables for each of the refrigerants listed above. The tables also provide valve capacities for typical pressure drops across the TEV.

Thermostatic Charge

The pressure-temperature curves of the various Sporlan Selective Charges have different characteristics. The same amount of superheat will not produce equal valve openings for each type of charge. The valve capacity ratings shown in this Bulletin specify the thermostatic charges which they are based on.

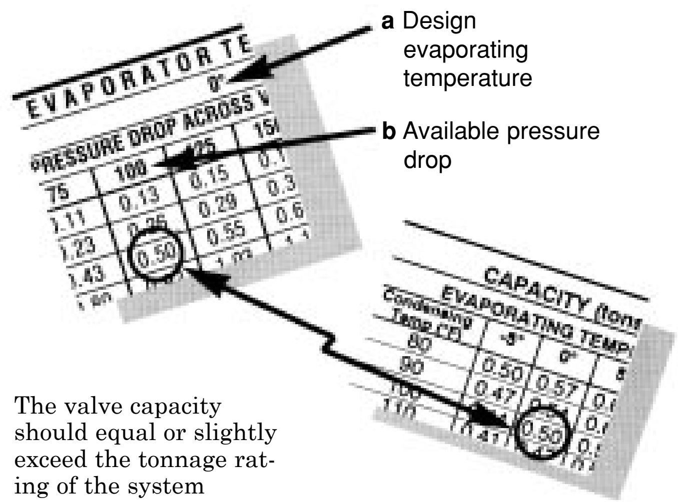
SELECTION PROCEDURE

The following procedure should be used when selecting a Sporlan TEV:

1. Determine pressure drop across valve — Subtract the evaporating pressure from the condensing pressure. The condensing pressure used in this calculation should be the minimum operating condensing pressure of the system. From this value, subtract all other pressure losses to obtain the net pressure drop across the valve. Be sure to consider all of the following possible sources of pressure drop: (1) friction losses through refrigeration lines including the evaporator and condenser; (2) pressure drop across liquid line accessories such as a solenoid valve and filter drier; (3) static pressure loss (gain) due to the vertical lift (drop) of the liquid line; and (4) pressure drop across a refrigerant distributor if used. Table 4 specifies typical pressure drops across Sporlan type refrigerant distributors at design load conditions. Refer to Bulletin 20-10 for further information on refrigerant distributors.

2. Determine the liquid temperature of the refrigerant entering the valve — The TEV capacity tables on Pages 5 to 11, Bulletin 10-10, are based on a liquid temperature of 100°F for R-12, R-22, R-134a, R-401A, R-402A, R-404A, R-407A, R-407C, R-408A, R-409A, R-502 and R-507. R-717 (ammonia) capacities are based on 86°F. For other liquid temperatures, apply the correction factor given in the tables for each refrigerant.

3. Select valve from the capacity tables — Select a valve based on the design evaporating temperature and the available pressure drop across the valve. If possible, the valve capacity should equal or slightly exceed the design rating of the system. Be sure to apply the appropriate liquid temperature correction factor to the valve ratings shown in the tables. Once the desired valve capacity has been located, determine the nominal capacity of the valve from the second column of the tables. On multiple evaporator systems, select each valve on the basis of individual evaporator capacity.



4. Determine if an external equalizer is required — The amount of pressure drop between the valve outlet and bulb location will determine if an external equalizer is required. Refer to the section, *Equalization Method*, on Page 5 for further information on this subject.

5. Select body type — Select the body type from Table 5 according to the style connections desired. For complete specifications on each TEV type including nominal ratings, refer to Bulletin 10-10 for valve's specifications.

6. Select the Sporlan Selective Thermostatic Charge — Select the charge according to the design evaporating temperature from the Table on Page 18. Refer to Pages 7 thru 9 for a complete discussion of the Sporlan Selective Thermostatic Charges available.

Selection Example

Refrigerant 22
Application: air conditioning

Design evaporator temperature . . . . .40°F
Design condenser temperature . . . . .105°F
Refrigerant liquid temperature . . . . .90°F
Design system capacity . . . . .2 tons

Available pressure drop across TEV:
Condensing pressure (psig) 211
Evaporating pressure (psig) 69
142
Liquid line and accessories loss (psi) 7
Distributor and tubes loss (psi)① 35
100

Refrigerant liquid correction factor 1.06

The SVE-2 has valve capacity of: 2.00 x 1.06 = 2.12 tons at 40°F evaporating temperature, 100 psi pressure drop, and 90°F liquid temperature.

Thermostatic charge (from Table on Page 18): VGA ②

Selection:

SVE-2-GA 1/2” x 5/8” ODF— 5’, 1/4” ODF equalizer

① An externally equalized valve must be used on evaporators employing a refrigerant distributor due to the pressure drop created by the distributor.

② Refer to the section, Sporlan Selective Charges, on Page 7 for information regarding the differences between the VGA and VCP100 charges. Please note that the refrigerant charge designation in the thermostatic charge ("V" in this case) is dropped when it is incorporated into the valve model designation.

Refrigerant Color Code Used on decals

R-12	—Yellow	R-402A	—Sand/Beige
R-13	—Blue	R-404A	—Orange
R-13B1	—Blue	R-407C	—Lt.Brown
R-22	—Green	R-410A	—Pink
R-23	—Blue	R-500	—Orange
R-114	—Blue	R-502	—Purple
R-124	—Blue	R-503	—Blue
R-134a	—Blue	R-507	—Teal
R-401A	—Pink	R-717	—White

For the complete valve specification, **also include all connection sizes and capillary tube length.**

TABLE 5

Body Type	Internal or External Equalizer	Connections	For Complete Specifications	Refrigerant
NI	Internal	SAE Flare	Bulletin 10-10	12, 22, 134a, 401A, 402A, 404A, 407A, 407C, 408A, 409A, 502, 507
RC	External	SAE Flare or ODF Solder	Bulletin 10-10-5	22
		ODF Solder		410A
RI (RPB only)		SAE Flare or ODF Solder	Bulletin 10-10	22
F	Either	SAE Flare		12, 22, 134a, 401A, 402A, 404A, 407A, 407C, 408A, 409A, 502, 507
EF		ODF Solder		
Q		SAE Flare		
EQ		ODF Solder		
SQ				
G		SAE Flare		
EG		ODF Solder		
C		SAE Flare		
BF				
EBF		ODF Solder		
SBF				
BQ		SAE Flare	Bulletin 10-10-6	
EBQ		ODF Solder		
SBQ				
S			Bulletin 10-10	
EBS	External			
O				
H	Either	ODF Solder-Flange		
M	External			
V				
W				12, 22, 134a, 401A, 407A, 407C, 409A
D	Either	FPT Pipe-Flange or Socket Weld-Flange		717 Only
A				

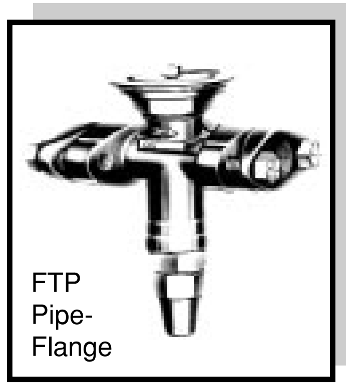
EXAMPLE

7. Ordering instructions — Combine the letters and numbers in the following manner to obtain the complete valve designation. Also include all connection sizes and the capillary tube length.

S	V	E	-	5	-	GA	3/8" SAE Flare	X	1/2" SAE Flare	X	1/4" SAE Flare Equalizer	X	5'
Body Type	Refrigerant Designation	“E” specifies external equalizer. Omission of letter "E" indicates valve with internal equalizer eg. GR-1-Z		Nominal Capacity in Tons		Thermostatic Charge	Inlet Connection Size and Style		Outlet Connection Size and Style		External Equalizer Connection Size and Style		Capillary Tubing Length

Refrigerant Designation

F	for	12	**S**	for	404A
E	for	13	**N**	for	407C
T	for	13B1	**R**	for	408A
V	for	22	**Z**	for	410A
G	for	23	**D**	for	500
B	for	114	**R**	for	502
Q	for	124	**W**	for	503
J	for	134a	**P**	for	507
X	for	401A	**A**	for	717
L	for	402A			



SPORLAN SELECTIVE CHARGES ENGINEERED for PEAK PERFORMANCE for EACH SPECIFIC APPLICATION

Recommended Thermostatic Charges*

Refrigerant	Air Conditioning or Heat Pump	Commercial Refrigerant 50°Fto –10°F	Low Temperature Refrigerant 0°Fto –40°F	Extreme Low Temperature Refrigerant –40°Fto –100°F
12	FCP60	FC	FZ & FZP	—
22	VCP100 and VGA	VC	VZ & VZP40	VX
134a	JCP60	JC	—	—
404A	SCP115	SC	SZ &SZP	SX
410A	ZN	—	—	—
502	RCP115	RC	RZ & RZP	RX
507	—	PC	PZ & PZP	PX
717	**Refer to the section on ammonia refrigeration on page 13.**			

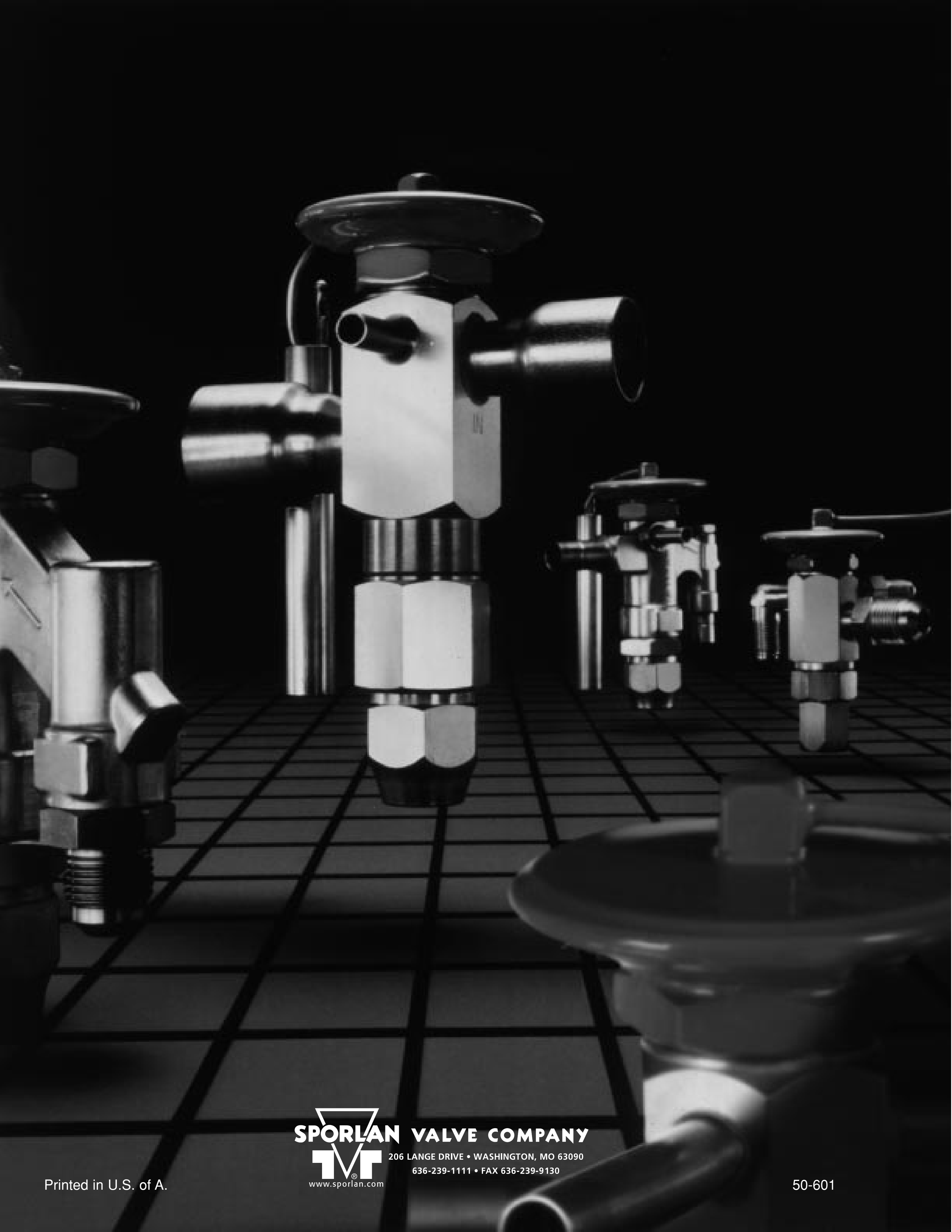
***Application Factors:**

1. The Type ZP charges have essentially the same characteristics as the Type Z charge with one exception: They produce a pressure limit (MOP). ZP charges are not intended as replacements for Z charges. Each should be selected for its own unique purpose. See Page 8 for additional application discussion.

2. All air conditioning and heat pump charges are intended for use with externally equalized valves. See Page 5 for complete discussion on when to use an external equalizer.

3. Type L Liquid charges are also available for most commonly used refrigerants in most element sizes.

4. If in doubt as to which charge to use, review discussion on Pages 7 and 8 or contact Sporlan Valve Company, Washington, MO with complete system data.



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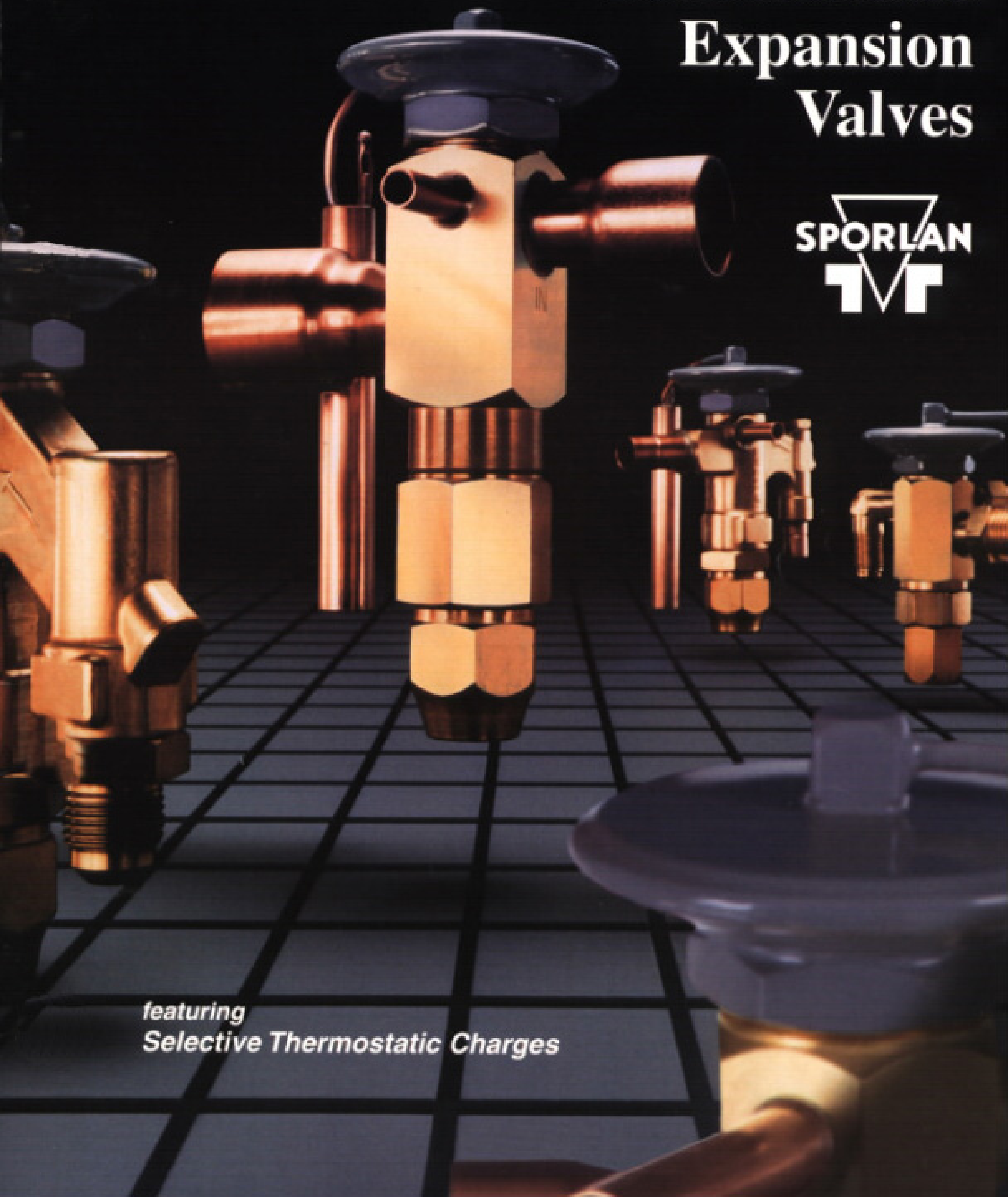
January 1998 / **BULLETIN 10-10**

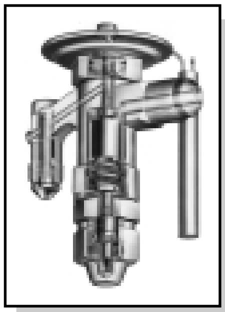
Thermostatic Expansion Valves

SPORLAN



featuring
Selective Thermostatic Charges

THERMOSTATIC EXPANSION VALVES



10
Outstanding Features & Benefits of Sporlan Thermostatic Expansion Valves

- **SELECTIVE THERMOSTATIC CHARGES** Designed to provide optimum performance for all applications — air conditioning and heat pump, medium and low temperature refrigeration.
- **THERMOSTATIC ELEMENT DESIGN** Long lasting and field proven stainless steel diaphragm and welded element construction.
- **DIAPHRAGM DESIGN** Large flat diaphragm permits precise valve control.
- **REPLACEABLE THERMOSTATIC ELEMENTS** Field replaceable elements on all standard valves.
- **BALANCED PORT DESIGN** Provides perfect pin and port alignment, and prevents changes in pressure drop across the valve from influencing valve operation. Provides excellent control on applications with widely varying operating conditions.
- **PIN CARRIER DESIGN (CONVENTIONAL VALVES)** Provides precise pin and port alignment, and tighter seating.
- **ACCESSIBLE INTERNAL PARTS** Durable, leakproof body joint construction allows the valve to be disassembled, and the internal parts cleaned and inspected.
- **MATERIALS OF CONSTRUCTION** Pin and port materials offer maximum protection against corrosion and erosion.
- **SILVER SOLDERED CONNECTIONS** For leakproof, high strength connection-to-body joints.
- **ADJUSTABLE SUPERHEAT DESIGN** All standard valves are externally adjustable except the Type NI, which is internally adjustable through its outlet connection.

TABLE OF CONTENTS

Refer to Bulletin 10-9 for a complete discussion on ***The Theory of Operation and Application of Thermostatic Expansion Valves.***
Refer to Bulletin 10-11 for a complete discussion on ***Installing and Servicing Thermostatic Expansion Valves.***

SPORLAN THERMOSTATIC EXPANSION VALVES

The thermostatic expansion valve (TEV) controls the flow of liquid refrigerant entering the direct expansion (DX) evaporator by maintaining a constant **superheat** of the refrigerant vapor at the outlet of the evaporator. The TEV controls the difference between the actual temperature and the saturation temperature of the refrigerant corresponding to the suction pressure at the sensing bulb location; this is superheat. By controlling superheat, the TEV keeps nearly the entire evaporator surface active, while preventing liquid refrigerant from returning to the compressor. The ability of the TEV to match refrigerant flow to the rate at which refrigerant can be vaporized in the evaporator makes the TEV the ideal expansion device for most air conditioning and refrigeration applications.

FOR USE ON REFRIGERATION and/or AIR CONDITIONING SYSTEMS ONLY

Bulletin 10-10, January 1998 supersedes Bulletin 10-10, December 1995; Bulletin 10-15, February 1994 and all prior publications.

SELECTION PROCEDURE

The following procedure should be used when selecting a Sporlan TEV:

1. Determine the liquid temperature of the refrigerant entering the valve — The TEV capacity tables on pages 5 to 9 are based on a liquid temperature of 100°F for R-12, R-22, R-134a, R401A, R-402A, R-404A, R-407A, R-407C, R-408A, R-409A, R-502, R-507; R-717 (ammonia) capacities are based on 86°F. For other liquid temperatures, apply the correction factor given in the tables for each refrigerant. For example see Table B.

2. Determine pressure drop across valve — The pressure drop correction factors are based on standard liquid temperature and pressure drop. The standard pressure drop is dependent on the evaporator temperature. To determine the pressure drop, subtract the saturated pressure equivalent to evaporator outlet temperature from the condensing pressure. The condensing pressure used in this calculation should be the minimum operating condensing pressure of the system. From this value, subtract all other pressure losses to obtain the net pressure drop across the valve. Use this value to determine the pressure drop correction factor. For example see Table C. Be sure to consider all of the following possible sources of pressure drop:

1. Friction losses through refrigeration lines including the evaporator and condenser.
2. Pressure drop across liquid line accessories such as a solenoid valve and filter-drier.
3. Static pressure loss (gain) due to the vertical lift (drop) of the liquid line.
4. Pressure drop across a refrigerant distributor if used.

Refer to Bulletin 20-10 for information on refrigerant distributors.

3. Select valve from the capacity tables — Select a valve based on the design evaporating temperature. If possible the valve capacity should be equal or slightly exceed the design rating of the system. Be sure to apply the appropriate correction factors for liquid temperature and pressure drop. Once the desired valve capacity has been located, determine the nominal capacity of the valve from the tables' second column. On multiple evaporator systems, select each valve on the basis of individual evaporator capacity. For example see Table A.

4. Determine if an external equalizer is required — The amount of pressure drop between the valve outlet and bulb location will determine if an external equalizer is required. Refer to Bulletin 10-9 for further information on this subject.

5. Select body type — Select the body type according to the style connections desired. For complete specifications on each TEV type including nominal ratings, refer to pages 9 to 11.

6. Select the Sporlan Selective Thermostatic Charge — Select the charge according to the design evaporating temperature from the Table on Page 4. Refer to Bulletin 10-9 for a complete discussion of the available Sporlan Selective Thermostatic Charges.

Selection Example – Refrigerant 22

Application: medium temperature refrigeration

Design evaporator temperature	20°F
Design condenser temperature	95°F
Refrigerant liquid temperature	70°F
Design system capacity	1 ton

Available pressure drop across TEV:

Condensing pressure (psig)	182
Evaporating pressure (psig)	43
	139
Liquid line and accessories loss (psi)	– 4
Distributor and tubes loss (psi) ①	– 35
	100

Refrigerant liquid correction factor	1.17
Pressure drop correction factor	0.89

Use the following formula to calculate TEV capacity:
TEV Capacity = TEV rating x CF liquid temperature x CF pressure drop

EGVE-1 Has valve capacity of: 1.09 x 1.17 x 0.89 = 1.13 Tons at 20°F evaporating temperature, 100 psi pressure drop and 70° liquid temperature.

Thermostatic charge (from Table on Page 4): VC ②

Selection:

EGVE-1-C 3/8" x 1/2" x 1/4" ODF x 5'

① An externally equalized valve must be used on evaporators employing a refrigerant distributor due to the pressure drop created by the distributor. In addition, an externally equalized valve should always be used with air conditioning thermostatic charges to reduce the possibility of thermostatic charge migration.

② Please note that the refrigerant charge designation in the thermostatic charge ("V" in this case) is dropped when it is incorporated into the valve model designation.

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS
TONS OF REFRIGERATION
AIR CONDITIONING, HEAT PUMP and

VALVE TYPES	NOMINAL CAPACITY	REFRIGERANT 22				
		RECOMMENDED THERMOST				
		VC, VCP100, VGA			VZ, VZP4	
		EVAPORATOR TEMPERATUR				
		40°	20°	0°	-10°	-20
F-EF-G-EG	1/5	0.20	0.22	0.19	0.17	0.1
NI	1/4	0.25	0.27	0.25	0.22	0.1
F-EF-G-EG	1/3	0.35	0.38	0.33	0.27	0.2
NI-F-EF-G-EG	1/2	0.45	0.49	0.43	0.35	0.3
G-EG	3/4	0.75	0.82	0.71	0.68	0.6
NI-F-EF-G-EG	1	1.00	1.09	0.95	0.86	0.7

Table A

The valve capacity should equal or slightly exceed the tonnage rating of the system. (For complete R-22 capacity tables, see page 6)

Design Evaporating Temperature

Liquid Temperature

REFRIGERANT	LIQUID TEMPERATURE EN								
	0°	10°	20°	30°	40°	50°	60°	70°	80
	CORRECTION FACTOR								
22	1.56	1.51	1.45	1.40	1.34	1.29	1.23	1.17	1.
407A	1.75	1.68	1.61	1.53	1.46	1.39	1.31	1.24	1.
407C	1.69	1.62	1.55	1.49	1.42	1.35	1.28	1.21	1.

Table B

TEV Pressure Drop

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)						
	30	50	75	100	125	150	175
	CORRECTION FACTOR, CF PRESSURE D						
40°	0.55	0.71	0.87	1.00	1.12	1.22	1.32
20° & 0°	0.49	0.63	0.77	0.89	1.00	1.10	1.18
– 10° & – 20°	0.45	0.58	0.71	0.82	0.91	1.00	1.08
– 40°	0.41	0.53	0.65	0.76	0.85	0.93	1.00

Table C

7. Valve Nomenclature / Ordering Instructions — Combine the letters and numbers in the following manner to obtain the complete valve designation. Also include all connection sizes and the capillary tube length.

EXAMPLE

EG	V	E	-	1	-	C	3/8" ODF Solder	X	1/2" ODF Solder	X	1/4" ODF Solder	X	5'
Body Type	Sporlan Code – REFRIGERANT – Element Label Color Code **F** - R-12 - Yellow **E** - R-13 - Blue **V** - R-22 - Green **G** - R-23 - Blue **M** - R-124 - Blue **J** - R-134a - Blue **X** - R-401A - Pink **L** - R-402A - Sand **S** - R-404A - Orange **V** - R-407A - Green **N** - R-407C - Lt. Brown **R** - R-408A - Purple **F** - R-409A - Yellow **R** - R-502 - Purple **W** - R-503 - Blue **P** - R-507 - Teal **W** - R-508B - Blue **A** - R-717 - White	"E" specifies external equalizer. Omission of letter "E" indicates valve with internal equalizer. eg. EGV-1-C		Nominal Capacity in Tons		Thermostatic Charge	Inlet Connection Size and Style		Outlet Connection Size and Style		External Equalizer Connection Size and Style		Capillary Tubing Length (Inches or Feet)

SPORLAN SELECTIVE CHARGES ENGINEERED for PEAK PERFORMANCE for EACH SPECIFIC APPLICATION

*** RECOMMENDED THERMOSTATIC CHARGES**

APPLICATION	REFRIGERANT 12 409A	22 407A	134a	401A	402A	404A	407C	502 408A	507	717	ACTUAL THERMOSTATIC CHARGES
AIR CONDITIONING	FCP60	–	JCP60	XCP60	–	–	–	–	–	–	FCP60
	–	VCP100	–	–	–	–	NCP100	–	–	–	VCP100
	–	VGA	–	–	–	–	NGA	–	–	–	VGA
	–	–	–	–	–	SCP115	–	RCP115	–	–	RCP115
COMMERCIAL REFRIGERATION 50°F to – 10°F	FC	–	JC	XC	–	–	–	–	–	–	FC
	–	VC	–	–	–	–	NC	–	–	–	VC
	–	–	–	–	–	SC	–	RC	–	–	RC
	–	–	–	–	LC	–	–	–	PC	–	PC
	–	–	–	–	–	–	–	–	–	AC, AL	AC, AL
LOW TEMPERATURE REFRIGERATION 0°F to – 40°F	FZ	–	–	–	–	–	–	–	–	–	FZ
	FZP	–	–	–	–	–	–	–	–	–	FZP
	–	VZ	–	–	–	–	–	–	–	–	VZ
	–	VZP40	–	–	–	–	–	–	–	–	VZP40
	–	–	–	–	LZ	SZ	–	RZ	PZ	–	RZ
	–	–	–	–	LZP	SZP	–	RZP	PZP	–	RZP
	–	–	–	–	–	–	–	–	–	AZ, AL	AZ, AL
EXTREME LOW TEMP. REFRIGERATION – 40°F to – 100°F	–	VX	–	–	–	–	–	–	–	–	VX
	–	–	–	–	LX	SX	–	RX	PX	–	RX

*** APPLICATION FACTORS:**

1. The Type ZP charges have essentially the same characteristics as the Type Z charge with one exception: they produce a pressure limit Maximum Operating Pressure (MOP). ZP charges are not intended as replacements for Z charges. Each should be selected for its own unique purpose. Refer to Bulletin 10-9 for additional application discussion.
2. All air conditioning and heat pump charges are intended for use with externally equalized valves. Refer to Bulletin 10-9 for complete discussion on when to use an external equalizer.
3. Type L Liquid charges are also available for most commonly used refrigerants in most element sizes.
4. Refer to Bulletin 10-9 for information regarding the differences between the VGA and VCP100 charges.
5. If in doubt as to which charge to use, review the section on thermostatic charges in Bulletin 10-9 or contact Sporlan Valve Company, Washington, Missouri with complete system data.

TEV CAPACITY RATINGS FOR REFRIGERANTS: 12, 22, 134a, 401A, 402A, 404A, 407A, 407C, 408A, 409A, 502, 507, 717

TEV capacity ratings for R-12, R-22, R-134a, R-401A, R-402A, R-404A, R-407A, R-407C, R-408A, R-409A, R-502, R-507 are based on vapor free 100°F liquid refrigerant entering the expansion valve, a maximum opening superheat of 7°F, and a standard factory air test superheat setting. A discussion of the relationship between valve capacities and superheat settings can be found in Bulletin 10-9.

The ratings for evaporator temperatures 40°F, 20°F, -10°F, -40°F in the capacity tables are in accordance with ANSI/ARI Standard Number 750. TEVs are tested in accordance with ANSI/ASHRAE 17.

TEV models featuring the mechanical pressure limit style thermostatic elements, i.e., the Types G(PL) and C(PL) TEVs, are now obsolete. Consult Bulletin 210-10-17 for additional information on this subject and replacement valves.

R-717 (ammonia) capacities for Types D and A TEVs are shown on Page 9. These ratings are based on vapor free 86°F liquid refrigerant entering the TEV, a maximum opening superheat of 7°F, and a standard factory air test setting.

For TEV capacity ratings at operating conditions not shown in the following tables, contact Sporlan Valve Company.

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS
TONS OF REFRIGERATION

12, 134a, 401A, 409A

AIR CONDITIONING, HEAT PUMP and COMMERCIAL REFRIGERATION APPLICATIONS

VALVE TYPES	NOMINAL CAPACITY	REFRIGERANT											
		12			134a			401A			409A		
		RECOMMENDED THERMOSTATIC CHARGES											
		FC, FCP60			JC, JCP60			XC, XCP60			FC, FCP60		
		EVAPORATOR TEMPERATURE (°F)											
		40°	20°	0°	40°	20°	0°	40°	20°	0°	40°	20°	0°
NI-F-EF-G-EG	1/8	0.13	0.12	0.11	0.15	0.15	0.14	0.16	0.16	0.15	0.15	0.15	0.14
F-EF-G-EG	1/6	0.21	0.23	0.22	0.25	0.28	0.26	0.27	0.30	0.29	0.25	0.28	0.27
NI-F-EF-G-EG	1/4	0.26	0.29	0.27	0.31	0.35	0.33	0.34	0.37	0.36	0.32	0.35	0.33
NI-F-EF-G-EG	1/2	0.50	0.50	0.46	0.60	0.60	0.55	0.65	0.65	0.60	0.61	0.60	0.56
NI-F-EF-G-EG	1	1.00	1.00	0.92	1.21	1.20	1.10	1.29	1.29	1.20	1.21	1.21	1.12
F-EF-G-EG	1-1/2	1.60	1.59	1.47	1.93	1.91	1.76	2.07	2.07	1.92	1.94	1.93	1.79
F&EF(Ext)-G&EG(Ext)-C(Int)-S	2	2.00	1.99	1.84	2.41	2.39	2.20	2.59	2.59	2.40	2.42	2.42	2.23
C-S	2-1/2	2.50	2.49	2.30	3.01	2.99	2.75	3.23	3.24	3.00	3.03	3.02	2.79
C-S	3	3.00	2.99	2.76	3.62	3.59	3.30	3.88	3.88	3.60	3.63	3.62	3.35
C&S(Ext)	5	5.00	4.15	3.49	6.03	4.98	4.17	6.47	5.39	4.56	6.05	5.03	4.24
S(Ext)	6	6.00	4.98	4.18	7.23	5.98	5.01	7.76	6.47	5.47	7.26	6.04	5.09
H	1-1/2	1.60	1.59	1.47	1.93	1.91	1.76	2.07	2.07	1.92	1.94	1.93	1.79
H	3	3.00	2.99	2.55	3.62	3.59	3.04	3.88	3.88	3.31	3.63	3.62	3.08
H	4	4.00	3.98	3.38	4.82	4.79	4.05	5.18	5.18	4.42	4.84	4.83	4.11
H	5	5.00	4.98	4.23	6.03	5.98	5.06	6.47	6.47	5.52	6.05	6.04	5.14
H	8	7.50	7.47	6.34	9.04	8.97	7.59	9.70	9.71	8.29	9.08	9.06	7.71
H	12	11.7	11.7	9.89	14.1	14.0	11.8	15.1	15.1	12.9	14.2	14.1	12.0
M	15	15.5	15.4	12.6	18.7	18.5	15.1	20.1	20.1	16.5	18.8	18.7	15.3
M	20	20.0	19.9	16.3	24.1	23.9	19.5	25.9	25.9	21.3	24.2	24.2	19.8
M	25	25.0	24.9	20.3	30.1	29.9	24.3	32.3	32.4	26.6	30.3	30.2	24.7
BALANCED PORT THERMOSTATIC EXPANSION VALVES													
BF-EBF-SBF	AAA	0.21	0.23	0.22	0.25	0.28	0.26	0.27	0.30	0.29	0.25	0.28	0.27
BF-EBF-SBF	AA	0.45	0.45	0.41	0.54	0.54	0.50	0.58	0.58	0.54	0.55	0.54	0.50
BF-EBF-SBF	A	1.00	1.00	0.92	1.21	1.20	1.10	1.29	1.29	1.20	1.21	1.21	1.12
BF-EBF-SBF	B	1.70	1.69	1.56	2.05	2.03	1.87	2.20	2.20	2.04	2.06	2.05	1.90
BF-EBF-SBF	C	3.00	2.99	2.76	3.62	3.59	3.30	3.88	3.88	3.60	3.63	3.62	3.35
EBS	5	5.10	4.68	4.04	6.12	5.60	4.82	6.57	6.06	5.26	6.15	5.66	4.89
EBS	7	7.00	6.43	5.55	8.44	7.72	6.64	9.06	8.36	7.25	8.47	7.80	6.74
O	9	9.00	8.96	7.80	10.8	10.8	9.33	11.6	11.7	10.2	10.9	10.9	9.48
O	12	11.7	11.7	10.1	14.1	14.0	12.1	15.1	15.1	13.2	14.2	14.1	12.3
O	16	15.5	15.4	13.4	18.7	18.5	16.1	20.1	20.1	17.6	18.8	18.7	16.3
O	23	23.0	24.9	20.7	27.7	30.0	24.7	29.8	32.4	27.0	27.8	30.2	25.1
O	32	32.0	34.7	28.7	38.6	41.7	34.4	41.4	45.1	37.6	38.7	42.1	34.9
O	40	40.0	43.4	35.9	48.2	52.1	43.0	51.8	56.4	47.0	48.4	52.6	43.7
V	35	35.0	34.9	27.7	42.2	41.9	33.2	45.3	45.3	36.3	42.4	42.3	33.7
V	45	45.0	44.8	35.7	54.2	53.8	42.7	58.2	58.3	46.6	54.5	54.3	43.3
V	55	55.0	54.8	43.6	66.3	65.8	52.2	71.2	71.2	57.0	66.6	66.4	53.0
W	80	85.0	84.6	62.9	102	102	75.3	110	110	82.2	103	103	76.4
W	110	114	–	–	137	–	–	148	–	–	138	–	–

VALVE TYPE	CARTRIDGE NO.	REPLACEABLE CARTRIDGE THERMOSTATIC EXPANSION VALVES												
Q-EQ-SQ	0	1/6	0.20	0.20	0.19	0.24	0.24	0.22	0.26	0.26	0.24	0.24	0.24	0.22
Q-EQ-SQ	1	1/4	0.45	0.45	0.42	0.54	0.54	0.50	0.58	0.58	0.54	0.55	0.54	0.50
Q-EQ-SQ	2	1/2	0.65	0.65	0.60	0.78	0.78	0.72	0.84	0.84	0.78	0.79	0.79	0.73
Q-EQ-SQ	3	1	1.00	1.00	0.92	1.21	1.20	1.10	1.29	1.29	1.20	1.21	1.21	1.12
Q-EQ-SQ	4	1-1/2	1.41	1.40	1.29	1.69	1.67	1.54	1.81	1.81	1.68	1.69	1.69	1.56
Q-EQ-SQ	5	2	2.01	2.00	1.85	2.41	2.39	2.20	2.59	2.59	2.40	2.42	2.42	2.23
Q-EQ-SQ	6	2-1/2	2.71	2.70	2.49	3.25	3.23	2.97	3.49	3.50	3.24	3.27	3.26	3.02

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)														
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE														
12	1.60	1.54	1.48	1.42	1.36	1.30	1.24	1.18	1.12	1.06	1.00	0.94	0.88	0.82	0.75
134a	1.70	1.63	1.56	1.49	1.42	1.36	1.29	1.21	1.14	1.07	1.00	0.93	0.85	0.78	0.71
401A	1.60	1.54	1.48	1.43	1.36	1.31	1.25	1.19	1.13	1.06	1.00	0.94	0.87	0.80	0.74
409A	1.55	1.50	1.45	1.39	1.34	1.28	1.23	1.17	1.12	1.06	1.00	0.94	0.88	0.82	0.76

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an evaporator temperature of 0°F. However, they may be used for any evaporator temperature from 0°F to 40°F since the variation in the actual factors across this range is insignificant.

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)							
	20	40	60	80	100	120	140	160
	CORRECTION FACTOR, CF PRESSURE DROP							
40°	0.58	0.82	1.00	1.15	1.29	1.41	1.53	1.63
20° & 0°	0.50	0.71	0.87	1.00	1.12	1.22	1.32	1.41

TEV capacity = TEV rating x CF liquid temperature x CF pressure drop — Example: Actual capacity of a nominal 1-1/2 ton R-134a Type EG valve at 20°F evaporator, 100 psi pressure drop across the TEV, and 60°F liquid temperature entering the TEV = 1.91 (from rating chart) x 1.29 (CF liquid temperature) x 1.12 (CF pressure drop) = 2.76 tons.

22, 407A, 407C

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS
TONS OF REFRIGERATION

AIR CONDITIONING, HEAT PUMP and COMMERCIAL REFRIGERATION APPLICATIONS

VALVE TYPES	NOMINAL CAPACITY	REFRIGERANT														
		22						407A						407C		
		RECOMMENDED THERMOSTATIC CHARGES														
		VC, VCP100, VGA			VZ, VZP40			VC, VCP100, VGA			VZ, VZP40			NC, NCP100, NGA		
		EVAPORATOR TEMPERATURE (°F)														
		40°	20°	0°	-10°	-20°	-40°	40°	20°	0°	-10°	-20°	-40°	40°	20°	0°
F-EF-G-EG	1/5	0.20	0.22	0.19	0.17	0.15	0.11	0.19	0.20	0.17	0.15	0.13	0.10	0.18	0.20	0.17
NI	1/4	0.25	0.27	0.25	0.22	0.19	0.14	0.23	0.25	0.23	0.24	0.22	0.16	0.23	0.25	0.23
F-EF-G-EG	1/3	0.35	0.38	0.33	0.27	0.24	0.18	0.33	0.35	0.30	0.24	0.21	0.15	0.32	0.35	0.30
NI-F-EF-G-EG	1/2	0.45	0.49	0.43	0.35	0.31	0.23	0.42	0.45	0.39	0.31	0.27	0.17	0.41	0.44	0.38
G-EG	3/4	0.75	0.82	0.71	0.68	0.61	0.45	0.70	0.75	0.64	0.60	0.53	0.39	0.69	0.74	0.64
NI-F-EF-G-EG	1	1.00	1.09	0.95	0.86	0.77	0.57	0.94	1.00	0.85	0.76	0.68	0.49	0.92	0.99	0.85
F-EF-G-EG	1-1/2	1.60	1.74	1.52	1.22	1.09	0.81	1.50	1.60	1.37	1.08	0.96	0.70	1.47	1.58	1.36
F&EF(Ext)-G&EG(Ext)-S	2	2.00	2.18	1.91	1.96	1.75	1.31	1.87	2.00	1.71	1.74	1.54	1.12	1.84	1.97	1.70
F&EF(Int)-G&EG(Int)	2-1/2	2.50	2.72	2.38	2.20	1.97	1.47	2.34	2.50	2.14	1.95	1.73	1.26	2.30	2.46	2.12
F&EF(Ext)-G&EG(Ext)-C(Int)-S	3	3.20	3.49	3.05	2.33	2.09	1.56	2.99	3.19	2.73	2.07	1.83	1.33	2.94	3.16	2.71
C-S	4	4.50	4.90	4.29	3.43	3.07	2.29	4.21	4.49	3.85	3.04	2.69	1.96	4.14	4.44	3.81
C-S	5	5.20	5.67	4.96	4.04	3.62	2.70	4.86	5.19	4.44	3.58	3.17	2.31	4.78	5.13	4.41
C&S(Ext)	8	8.00	8.72	7.04	5.82	4.87	3.59	7.48	7.99	6.30	5.16	4.27	3.07	7.35	7.89	6.25
S(Ext)	10	10.0	10.9	8.80	7.27	6.08	4.48	9.35	9.98	7.88	6.45	5.33	3.84	9.19	9.86	7.82
H	2-1/2	2.50	2.67	2.38	2.10	1.55	1.25	2.50	2.67	2.38	1.86	1.36	1.07	2.30	2.42	2.12
H	5-1/2	5.60	5.98	5.34	4.59	3.39	2.73	5.61	5.99	5.34	4.07	2.97	2.34	5.15	5.41	4.75
H	7	7.00	7.48	6.67	5.14	3.79	3.06	7.01	7.48	6.68	4.56	3.33	2.62	6.43	6.76	5.93
H	11	10.5	11.2	10.0	7.00	5.17	4.17	10.5	11.2	10.0	6.21	4.53	3.60	9.65	10.1	8.90
H	16	15.2	16.2	14.5	10.0	7.38	5.96	15.2	16.2	14.5	8.87	6.47	5.10	14.0	14.7	12.9
H	20	22.2	23.7	21.2	16.3	12.0	9.71	22.2	23.7	21.2	14.5	10.5	8.32	20.4	21.5	18.8
M	21	21.5	23.4	22.5	18.4	16.3	13.2	20.1	21.5	20.2	16.3	14.3	11.3	19.8	21.2	20.0
M	26	26.5	28.9	27.8	26.0	23.0	18.7	24.8	26.5	24.9	23.1	20.2	16.0	24.4	26.1	24.7
M	34	34.0	37.1	35.6	30.6	27.1	22.0	31.8	33.9	32.0	27.1	23.8	18.9	31.3	33.5	31.7
M	42	42.0	45.8	44.0	39.6	32.7	25.2	39.3	41.9	39.5	35.1	28.7	21.6	38.6	41.4	39.2
BALANCED PORT THERMOSTATIC EXPANSION VALVES																
BF-EBF-SBF	AAA	0.35	0.38	0.33	0.27	0.24	0.18	0.33	0.35	0.30	0.24	0.21	0.15	0.32	0.34	0.30
BF-EBF-SBF	AA	0.75	0.82	0.71	0.68	0.61	0.45	0.70	0.75	0.64	0.60	0.53	0.39	0.69	0.74	0.64
BF-EBF-SBF	A	1.60	1.74	1.52	1.22	1.09	0.81	1.50	1.60	1.37	1.08	0.96	0.70	1.47	1.58	1.36
BF-EBF-SBF	B	2.80	3.05	2.67	2.25	2.01	1.50	2.62	2.79	2.39	2.00	1.77	1.29	2.57	2.76	2.37
BF-EBF-SBF	C	5.20	5.67	4.96	4.04	3.62	2.70	4.86	5.19	4.44	3.58	3.17	2.31	4.78	5.13	4.41
EBS	8	8.51	8.81	7.30	6.15	5.15	3.79	7.95	8.06	6.54	5.45	4.51	3.25	7.81	7.96	6.48
EBS	11	11.5	11.9	9.86	8.32	6.96	5.13	10.8	10.9	8.84	7.38	6.10	4.39	10.6	10.8	8.77
O	15	15.0	15.5	13.0	9.20	8.15	6.14	14.0	14.2	11.7	8.20	7.14	5.26	13.8	14.1	11.6
O	20	22.2	23.0	19.3	16.3	12.0	9.71	20.8	21.1	17.3	14.5	10.5	8.32	20.4	20.8	17.1
O	30	30.5	31.6	26.5	19.4	17.1	14.4	28.5	28.9	23.7	17.2	15.0	12.3	28.0	28.6	23.6
O	40	40.3	43.5	32.0	29.5	26.1	21.8	37.7	39.8	28.7	26.2	22.9	18.7	37.0	39.3	28.5
O	55	55.0	59.3	43.7	39.4	29.9	24.3	51.4	54.4	39.2	34.9	26.2	20.8	50.6	53.7	38.9
O	70	73.0	78.8	58.0	51.5	34.0	26.4	68.3	72.1	52.0	45.7	29.8	22.7	67.1	71.3	51.6
V	52	52.0	56.1	54.0	52.2	37.0	29.5	48.6	51.4	48.4	46.3	32.4	25.3	47.8	50.8	48.0
V	70	73.0	78.8	75.8	71.6	50.7	40.4	68.3	72.1	67.9	63.5	44.5	34.7	67.1	71.3	67.4
V	100	100	108	104	92.2	65.3	52.1	93.5	98.8	93.0	81.8	57.3	44.6	91.9	97.6	92.3
W	135	143	154	148	132	93.5	74.5	134	141	133	117	82.0	63.9	131	140	132
W	180	180	–	–	–	–	–	168	–	–	–	–	–	165	–	–

VALVE TYPE	CARTRIDGE NO.	NOMINAL CAPACITY	22 40°	22 20°	22 0°	22 -10°	22 -20°	22 -40°	407A 40°	407A 20°	407A 0°	407A -10°	407A -20°	407A -40°	407C 40°	407C 20°	407C 0°
REPLACEABLE CARTRIDGE THERMOSTATIC EXPANSION VALVES																	
Q-EQ-SQ	0	1/3	0.35	0.38	0.33	0.27	0.24	0.18	0.33	0.35	0.30	0.24	0.21	0.15	0.32	0.35	0.30
Q-EQ-SQ	1	3/4	0.75	0.82	0.72	0.68	0.61	0.45	0.70	0.75	0.64	0.60	0.53	0.39	0.69	0.74	0.64
Q-EQ-SQ	2	1	1.00	1.09	0.95	0.86	0.77	0.57	0.94	1.00	0.85	0.76	0.68	0.49	0.92	0.99	0.85
Q-EQ-SQ	3	1-1/2	1.50	1.64	1.43	1.10	0.99	0.73	1.40	1.50	1.28	0.98	0.86	0.63	1.38	1.48	1.27
Q-EQ-SQ	4	2-1/2	2.50	2.73	2.38	2.20	1.97	1.47	2.34	2.50	2.14	1.95	1.73	1.26	2.30	2.46	2.12
Q-EQ-SQ	5	3-1/2	3.50	3.82	3.34	3.00	2.69	2.00	3.27	3.49	2.99	2.66	2.36	1.72	3.22	3.45	2.97
Q-EQ-SQ	6	5	4.80	5.24	4.58	3.65	3.27	2.44	4.49	4.79	4.10	3.24	2.87	2.09	4.41	4.73	4.07
-- VGA and NGA Thermostatic Charges Only --																	
RIVE		2	2.14	2.33	2.09	–	–	–	2.00	2.14	1.87	–	–	–	1.97	2.11	1.85
RIVE		3	3.40	3.71	3.31	–	–	–	3.18	3.39	2.97	–	–	–	3.13	3.35	2.95
RIVE		4	4.18	4.56	4.08	–	–	–	3.91	4.17	3.65	–	–	–	3.84	4.12	3.62
RIVE		5	4.52	4.93	4.41	–	–	–	4.23	4.51	3.95	–	–	–	4.15	4.46	3.92

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)														
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE														
22	1.56	1.51	1.45	1.40	1.34	1.29	1.23	1.17	1.12	1.06	1.00	0.94	0.88	0.82	0.76
407A	1.75	1.68	1.61	1.53	1.46	1.39	1.31	1.24	1.16	1.08	1.00	0.92	0.83	0.74	0.64
407C	1.69	1.62	1.55	1.49	1.42	1.35	1.28	1.21	1.14	1.07	1.00	0.93	0.85	0.77	0.69

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an evaporator temperature of 0°F. However, they may be used for any evaporator temperature from -40°F to 40°F since the variation in the actual factors across this range is insignificant.

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)										
	30	50	75	100	125	150	175	200	225	250	275
	CORRECTION FACTOR, CF PRESSURE DROP										
40°	0.55	0.71	0.87	1.00	1.12	1.22	1.32	1.41	1.50	1.58	1.66
20° & 0°	0.49	0.63	0.77	0.89	1.00	1.10	1.18	1.26	1.34	1.41	1.48
– 10° & – 20°	0.45	0.58	0.71	0.82	0.91	1.00	1.08	1.15	1.22	1.29	1.35
– 40°	0.41	0.53	0.65	0.76	0.85	0.93	1.00	1.07	1.13	1.20	1.25

TEV capacity = TEV rating x CF liquid temperature x CF pressure drop — Example: Actual capacity of a nominal 2 ton R-22 Type S valve at 20°F evaporator, 100 psi pressure drop across the TEV, and 90°F liquid temperature entering the TEV = 2.18 (from rating chart) x 1.06 (CF liquid temperature) x 0.89 (CF pressure drop) = 2.06 tons.

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS
TONS OF REFRIGERATION

404A, 408A, 502

AIR CONDITIONING, HEAT PUMP and COMMERCIAL REFRIGERATION APPLICATIONS

VALVE TYPES	NOMINAL CAPACITY	REFRIGERANT																	
		404A						408A						502					
		RECOMMENDED THERMOSTATIC CHARGE																	
		SC, SCP115			SZ, SZP			RC, RCP115			RZ, RZP			RC, RCP115			RZ, RZP		
		EVAPORATOR TEMPERATURE (°F)																	
		40°	20°	0°	-10°	-20°	-40°	40°	20°	0°	-10°	-20°	-40°	40°	20°	0°	-10°	-20°	-40°
NI-F-EF-G-EG	1/8	0.15	0.16	0.15	0.15	0.13	0.11	0.20	0.21	0.20	0.22	0.19	0.16	0.14	0.15	0.15	0.16	0.13	0.11
F-EF-G-EG	1/6	0.23	0.24	0.23	0.24	0.21	0.17	0.31	0.33	0.32	0.34	0.30	0.25	0.23	0.24	0.23	0.24	0.21	0.18
NI-F-EF-G-EG	1/4	0.29	0.31	0.29	0.31	0.27	0.22	0.39	0.42	0.41	0.43	0.38	0.32	0.29	0.31	0.29	0.31	0.27	0.23
NI-F-EF-G-EG	1/2	0.56	0.59	0.56	0.59	0.51	0.42	0.75	0.81	0.77	0.83	0.72	0.61	0.55	0.58	0.55	0.59	0.51	0.43
NI-F-EF-G-EG	1	1.02	1.10	1.04	1.10	0.94	0.79	1.37	1.50	1.44	1.54	1.34	1.14	1.00	1.09	1.03	1.10	0.95	0.80
F-EF-G-EG	1-1/2	1.53	1.60	1.39	1.47	1.26	1.05	2.05	2.19	1.92	2.06	1.79	1.53	1.50	1.58	1.38	1.47	1.27	1.07
F&EF(Ext)-G&EG(Ext)-C(Int)-S	2	2.04	2.14	1.83	1.96	1.68	1.40	2.74	2.92	2.54	2.74	2.38	2.04	2.00	2.11	1.82	1.96	1.69	1.43
C-S	3	2.86	3.00	2.50	2.45	2.10	1.75	3.83	4.08	3.48	3.43	2.98	2.54	2.80	2.96	2.50	2.45	2.12	1.78
C-S	4	4.08	4.28	3.58	3.42	2.94	2.45	5.48	5.83	4.97	4.80	4.17	3.56	4.00	4.23	3.57	3.43	2.96	2.50
C&S(Ext)	6	5.61	5.11	4.25	4.52	3.84	2.97	7.53	6.97	5.90	6.34	5.45	4.32	5.50	5.05	4.23	4.53	3.87	3.03
S(Ext)	7	7.14	6.51	5.41	5.76	4.90	3.79	9.58	8.87	7.50	8.08	6.94	5.51	7.00	6.42	5.39	5.77	4.93	3.86
H	1-1/2	1.53	1.46	1.39	1.47	1.25	0.99	2.05	1.99	1.92	2.06	1.77	1.44	1.50	1.44	1.38	1.47	1.26	1.01
H	3	2.85	2.72	2.31	2.45	2.08	1.65	3.83	3.71	3.20	3.43	2.95	2.41	2.80	2.69	2.30	2.45	2.09	1.69
H	4	4.08	3.89	3.13	3.42	2.91	2.32	5.48	5.30	4.34	4.80	4.13	3.37	4.00	3.84	3.12	3.43	2.93	2.36
H	6-1/2	6.63	6.32	5.09	5.32	4.52	3.60	8.90	8.61	7.06	7.46	6.41	5.24	6.50	6.24	5.07	5.33	4.55	3.67
H	9	9.69	9.24	7.44	6.11	5.19	4.13	13.0	12.6	10.3	8.57	7.36	6.01	9.50	9.12	7.41	6.12	5.23	4.22
H	12	13.3	12.6	10.2	9.79	8.31	6.62	17.8	17.2	14.1	13.7	11.8	9.60	13.0	12.5	10.1	9.80	8.37	6.75
M	15	16.1	17.1	13.0	13.8	12.4	10.0	21.6	23.3	18.0	19.3	17.5	14.5	15.8	16.9	13.0	13.8	12.5	10.2
M	20	21.0	22.3	16.3	17.3	15.5	12.5	28.2	30.3	22.7	24.2	22.0	18.2	20.6	22.0	16.3	17.3	15.6	12.8
M	25	26.2	27.8	20.4	20.3	18.2	14.7	35.2	37.8	28.3	28.4	25.8	21.4	25.7	27.4	20.3	20.3	18.3	15.0
M	30	31.6	33.5	24.6	23.5	21.1	17.0	42.4	45.7	34.1	32.9	29.9	24.7	31.0	33.1	24.5	23.5	21.2	17.3
BALANCED PORT THERMOSTATIC EXPANSION VALVES																			
BF-EBF-SBF	AAA	0.23	0.24	0.23	0.24	0.21	0.17	0.31	0.33	0.32	0.34	0.30	0.25	0.23	0.24	0.23	0.24	0.21	0.18
BF-EBF-SBF	AA	0.46	0.49	0.46	0.45	0.39	0.32	0.62	0.66	0.64	0.63	0.55	0.47	0.45	0.48	0.46	0.45	0.39	0.33
BF-EBF-SBF	A	1.02	1.10	1.04	1.10	0.94	0.79	1.37	1.50	1.44	1.54	1.34	1.14	1.00	1.09	1.03	1.10	0.95	0.80
BF-EBF-SBF	B	1.89	1.98	1.66	1.60	1.37	1.14	2.53	2.70	2.30	2.24	1.95	1.66	1.85	1.95	1.65	1.60	1.38	1.17
BF-EBF-SBF	C	2.86	3.00	2.50	2.45	2.10	1.75	3.83	4.08	3.48	3.43	2.98	2.54	2.80	2.96	2.50	2.45	2.12	1.78
EBS	6	5.71	5.63	4.61	4.15	3.28	2.97	7.67	7.66	6.40	5.82	4.66	4.32	5.60	5.56	4.59	4.15	3.31	3.02
EBS	7-1/2	7.75	7.64	6.26	5.28	4.18	3.78	10.4	10.4	8.68	7.41	5.93	5.49	7.60	7.54	6.24	5.29	4.21	3.85
O	9	9.69	9.24	7.24	6.11	5.31	4.43	13.0	12.6	10.1	8.57	7.53	6.44	9.50	9.12	7.22	6.12	5.35	4.52
O	12	13.3	12.6	9.91	9.74	8.46	7.06	17.8	17.2	13.8	13.6	12.0	10.3	13.0	12.5	9.88	9.75	8.52	7.20
O	21	21.4	20.4	14.3	11.7	10.1	8.46	28.8	27.8	19.8	16.4	14.4	12.3	21.0	20.2	14.3	11.7	10.2	8.62
O	30	30.8	32.3	23.0	17.5	15.2	12.7	41.4	44.0	32.0	24.5	21.5	18.4	30.2	31.9	22.9	17.5	15.3	12.9
O	35	35.7	37.4	26.7	19.0	16.5	13.8	47.9	51.0	37.0	26.6	23.4	20.0	35.0	37.0	26.6	19.0	16.6	14.0
O	45	45.9	48.1	34.3	21.9	19.0	15.9	61.6	65.6	47.6	30.7	26.9	23.1	45.0	47.5	34.2	21.9	19.1	16.2
V	38	38.7	39.4	33.6	33.2	30.5	24.1	52.0	53.7	46.6	46.6	43.2	35.1	38.0	38.9	33.5	33.3	30.7	24.6
V	50	52.0	52.9	45.1	47.4	43.5	34.4	69.8	72.1	62.6	66.5	61.7	50.0	51.0	52.2	44.9	47.5	43.8	35.1
V	70	71.4	72.6	62.7	66.4	60.9	48.1	95.8	99.0	87.0	93.1	86.4	70.0	70.0	71.7	62.4	66.5	61.3	49.1

VALVE TYPE	CARTRIDGE NO.	REPLACEABLE CARTRIDGE THERMOSTATIC EXPANSION VALVES																		
Q-EQ-SQ	0	1/6	0.20	0.22	0.20	0.20	0.17	0.14	0.27	0.30	0.28	0.28	0.24	0.21	0.20	0.21	0.20	0.20	0.17	0.15
Q-EQ-SQ	1	1/4	0.46	0.49	0.46	0.45	0.39	0.32	0.62	0.66	0.64	0.63	0.55	0.47	0.45	0.48	0.46	0.45	0.39	0.33
Q-EQ-SQ	2	1/2	0.66	0.72	0.67	0.59	0.51	0.42	0.89	0.98	0.94	0.83	0.72	0.61	0.65	0.71	0.67	0.59	0.51	0.43
Q-EQ-SQ	3	1	1.02	1.07	0.89	0.85	0.73	0.61	1.37	1.46	1.24	1.19	1.03	0.88	1.00	1.06	0.89	0.85	0.73	0.62
Q-EQ-SQ	4	1-1/2	1.63	1.71	1.44	1.47	1.26	1.05	2.19	2.33	1.99	2.06	1.79	1.53	1.60	1.69	1.43	1.47	1.27	1.07
Q-EQ-SQ	5	2	2.14	2.25	1.88	1.96	1.68	1.40	2.88	3.06	2.61	2.74	2.38	2.04	2.10	2.22	1.87	1.96	1.69	1.43
Q-EQ-SQ	6	3	2.86	3.00	2.51	2.45	2.11	1.75	3.83	4.08	3.48	3.43	2.98	2.54	2.80	2.96	2.50	2.45	2.12	1.78

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)														
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE														
404A	2.04	1.94	1.84	1.74	1.64	1.54	1.43	1.33	1.22	1.11	1.00	0.89	0.77	0.65	0.53
408A	1.66	1.60	1.54	1.47	1.40	1.34	1.27	1.21	1.14	1.07	1.00	0.93	0.86	0.79	0.71
502	1.86	1.78	1.69	1.61	1.52	1.44	1.35	1.26	1.18	1.09	1.00	0.91	0.82	0.73	0.64

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an evaporator temperature of 0°F. However, they may be used for any evaporator temperature from -40°F to 40°F since the variation in the actual factors across this range is insignificant.

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)										
	30	50	75	100	125	150	175	200	225	250	275
	CORRECTION FACTOR, CF PRESSURE DROP										
40°	0.55	0.71	0.87	1.00	1.12	1.22	1.32	1.41	1.50	1.58	1.66
20° & 0°	0.49	0.63	0.77	0.89	1.00	1.10	1.18	1.26	1.34	1.41	1.48
– 10° & – 20°	0.45	0.58	0.71	0.82	0.91	1.00	1.08	1.15	1.22	1.29	1.35
– 40°	0.41	0.53	0.65	0.76	0.85	0.93	1.00	1.07	1.13	1.20	1.25

TEV capacity = TEV rating x CF liquid temperature x CF pressure drop — Example: Actual capacity of a nominal 1-1/2 ton R-404A Type EG valve at -20°F evaporator, 125 psi pressure drop across the TEV, and 60°F liquid temperature entering the TEV = 1.26 (from rating chart) x 1.43 (CF liquid temperature) x 0.91 (CF pressure drop) = 1.64 tons.

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS

TONS OF REFRIGERATION

402A & 507

COMMERCIAL and LOW TEMPERATURE REFRIGERATION APPLICATIONS

VALVE TYPES	NOMINAL CAPACITY	REFRIGERANT											
		402A						507					
		RECOMMENDED THERMOSTATIC CHARGE											
		LC			LZ, LZP			PC			PZ, PZP		
		EVAPORATOR TEMPERATURE (°F)											
		40°	20°	0°	-10°	-20°	-40°	40°	20°	0°	-10°	-20°	-40°
NI-F-EF-G-EG	1/8	0.15	0.16	0.15	0.16	0.13	0.11	0.14	0.15	0.14	0.15	0.13	0.11
F-EF-G-EG	1/6	0.23	0.24	0.23	0.24	0.21	0.18	0.22	0.24	0.22	0.24	0.20	0.17
NI-F-EF-G-EG	1/4	0.29	0.31	0.29	0.31	0.27	0.23	0.29	0.30	0.29	0.30	0.26	0.22
NI-F-EF-G-EG	1/2	0.56	0.59	0.56	0.59	0.51	0.43	0.55	0.58	0.54	0.58	0.50	0.41
NI-F-EF-G-EG	1	1.02	1.10	1.04	1.11	0.95	0.80	1.00	1.08	1.01	1.08	0.93	0.77
F-EF-G-EG	1-1/2	1.52	1.61	1.39	1.48	1.27	1.07	1.50	1.57	1.36	1.44	1.24	1.03
F&EF(Ext)-G&EG(Ext)-C(Int)-S	2	2.03	2.14	1.84	1.97	1.70	1.42	2.00	2.09	1.79	1.92	1.65	1.38
C-S	3	2.85	3.00	2.52	2.47	2.12	1.78	2.79	2.93	2.45	2.40	2.06	1.72
C-S	4	4.07	4.28	3.60	3.45	2.97	2.49	3.99	4.19	3.50	3.36	2.89	2.41
C&S(Ext)	6	5.59	5.12	4.27	4.56	3.88	3.02	5.49	5.00	4.16	4.43	3.77	2.93
S(Ext)	7	7.12	6.51	5.44	5.81	4.95	3.85	6.99	6.36	5.30	5.65	4.80	3.73
H	1-1/2	1.52	1.46	1.39	1.48	1.26	1.01	1.50	1.43	1.36	1.44	1.22	0.98
H	3	2.85	2.72	2.32	2.46	2.10	1.68	2.79	2.66	2.26	2.40	2.04	1.63
H	4	4.07	3.89	3.15	3.45	2.94	2.36	3.99	3.81	3.07	3.36	2.86	2.28
H	6-1/2	6.61	6.33	5.12	5.36	4.57	3.66	6.49	6.18	4.98	5.22	4.44	3.54
H	9	9.66	9.25	7.48	6.16	5.25	4.20	9.48	9.04	7.28	5.99	5.09	4.07
H	12	13.2	12.7	10.2	9.86	8.40	6.73	13.0	12.4	10.0	9.59	8.16	6.52
M	15	16.1	17.1	13.1	13.9	12.5	10.2	15.8	16.7	12.7	13.5	12.1	9.83
M	20	20.9	22.3	16.4	17.4	15.7	12.7	20.6	21.8	16.0	16.9	15.2	12.3
M	25	26.1	27.8	20.5	20.4	18.4	14.9	25.6	27.2	20.0	19.9	17.9	14.5
M	30	31.5	33.5	24.7	23.6	21.3	17.3	30.9	32.8	24.1	23.0	20.7	16.7
BALANCED PORT THERMOSTATIC EXPANSION VALVES													
BF-EBF-SBF	AAA	0.23	0.24	0.23	0.24	0.21	0.18	0.23	0.24	0.22	0.24	0.21	0.17
BF-EBF-SBF	AA	0.46	0.49	0.46	0.45	0.39	0.33	0.45	0.48	0.45	0.44	0.38	0.32
BF-EBF-SBF	A	1.02	1.10	1.04	1.11	0.95	0.80	1.00	1.08	1.01	1.08	0.93	0.77
BF-EBF-SBF	B	1.88	1.98	1.66	1.61	1.39	1.16	1.85	1.94	1.62	1.57	1.35	1.12
BF-EBF-SBF	C	2.85	3.00	2.52	2.47	2.12	1.78	2.79	2.93	2.45	2.40	2.06	1.72
EBS	6	5.69	5.63	4.63	4.18	3.32	3.01	5.59	5.50	4.52	4.06	3.22	2.92
EBS	7-1/2	7.73	7.64	6.29	5.32	4.23	3.84	7.59	7.47	6.13	5.18	4.10	3.72
O	9	9.66	9.25	7.28	6.16	5.37	4.50	9.48	9.04	7.09	5.99	5.21	4.36
O	12	13.2	12.7	9.96	9.81	8.55	7.17	13.0	12.4	9.71	9.54	8.30	6.95
O	21	21.3	20.4	14.4	11.8	10.2	8.60	21.0	20.0	14.0	11.4	9.95	8.32
O	30	30.7	32.3	23.1	17.6	15.3	12.9	30.1	31.6	22.5	17.1	14.9	12.5
O	35	35.6	37.5	26.8	19.1	16.7	14.0	34.9	36.6	26.1	18.6	16.2	13.5
O	45	45.7	48.2	34.5	22.0	19.2	16.1	44.9	47.1	33.6	21.4	18.6	15.6
V	38	38.6	39.5	33.8	33.5	30.8	24.5	37.9	38.6	32.9	32.6	29.9	23.7
V	50	51.8	52.9	45.3	47.8	44.0	34.9	50.9	51.8	44.2	46.5	42.7	33.8
V	70	71.2	72.7	63.0	66.9	61.5	48.9	69.9	71.0	61.4	65.1	59.8	47.4

VALVE TYPE	CARTRIDGE NO.	REPLACEABLE CARTRIDGE THERMOSTATIC EXPANSION VALVES												
Q-SQ-EQ	0	1/6	0.20	0.22	0.20	0.20	0.17	0.15	0.20	0.21	0.20	0.20	0.17	0.14
Q-SQ-EQ	1	1/4	0.46	0.49	0.46	0.45	0.39	0.33	0.45	0.48	0.45	0.44	0.38	0.32
Q-SQ-EQ	2	1/2	0.66	0.72	0.67	0.59	0.51	0.43	0.65	0.70	0.66	0.58	0.50	0.42
Q-SQ-EQ	3	1	1.02	1.07	0.89	0.86	0.74	0.62	1.00	1.05	0.88	0.83	0.72	0.60
Q-SQ-EQ	4	1-1/2	1.63	1.71	1.44	1.48	1.27	1.07	1.60	1.67	1.41	1.44	1.24	1.03
Q-SQ-EQ	5	2	2.13	2.25	1.88	1.97	1.70	1.43	2.10	2.20	1.84	1.92	1.65	1.38
Q-SQ-EQ	6	3	2.85	3.00	2.51	2.47	2.13	1.77	2.79	2.93	2.46	2.40	2.07	1.72

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)														
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE														
402A	2.01	1.91	1.82	1.72	1.62	1.52	1.42	1.32	1.22	1.11	1.00	0.89	0.77	0.65	0.53
507	1.99	1.89	1.79	1.69	1.59	1.50	1.40	1.30	1.20	1.10	1.00	0.89	0.78	0.66	0.51

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an evaporator temperature of 0°F. However, they may be used for any evaporator temperature from -40°F to 40°F since the variation in the actual factors across this range is insignificant.

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)											
	30	50	75	100	125	150	175	200	225	250	275	300
	CORRECTION FACTOR, CF PRESSURE DROP											
40°	0.55	0.71	0.87	1.00	1.12	1.22	1.32	1.41	1.50	1.58	1.66	1.73
20° & 0°	0.49	0.63	0.77	0.89	1.00	1.10	1.18	1.26	1.34	1.41	1.48	1.55
– 10° & – 20°	0.45	0.58	0.71	0.82	0.91	1.00	1.08	1.15	1.22	1.29	1.35	1.41
– 40°	0.41	0.53	0.65	0.76	0.85	0.93	1.00	1.07	1.13	1.20	1.25	1.31

TEV capacity = TEV rating x CF liquid temperature x CF pressure drop — Example: Actual capacity of a nominal 1-1/2 ton R-402A Type EG valve at -20°F evaporator, 125 psi pressure drop across the TEV, and 60°F liquid temperature entering the TEV = 1.27 (from rating chart) x 1.42 (CF liquid temperature) x 0.91 (CF pressure drop) = 1.64 tons.

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS
TONS OF REFRIGERATION

717 (Ammonia)

COMMERCIAL REFRIGERATION APPLICATIONS

VALVE TYPE	NOMINAL CAPACITY	REFRIGERANT 717 — RECOMMENDED THERMOSTATIC CHARGE — EVAPORATOR TEMPERATURE (°F)				
		AC, AL			AZ, AL	AZ
		40°	20°	5°	-10°	-20°
D	1	1.21	1.12	1.00	0.66	0.60
	2	2.41	2.24	2.00	1.14	1.03
	5	6.03	5.61	5.00	2.68	2.42
	10	12.1	11.2	10.0	5.66	5.11
	15	18.1	16.8	15.0	7.85	7.08

VALVE TYPE	NOMINAL CAPACITY	REFRIGERANT 717 — RECOMMENDED THERMOSTATIC CHARGE — EVAPORATOR TEMPERATURE (°F)			
		AL			
		40°	20°	5°	-10°
A	20	21.6	20.6	20.0	17.2
	30	32.3	30.8	30.0	25.8
	50	53.9	51.4	50.0	43.1
	75	80.8	77.1	75.0	64.6
	100	108	103	100	86.1

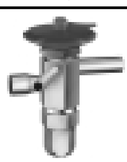
REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)											
	0°	10°	20°	30°	40°	50°	60°	70°	80°	86°	90°	100°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE											
717	1.27	1.24	1.20	1.17	1.14	1.11	1.08	1.05	1.02	1.00	0.99	0.96

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an average evaporator temperature of 0°F. However, they may be used for any evaporator temperature from -20°F to 40°F since the variation in the actual factors across this range is insignificant.

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)								
	40	60	80	100	120	140	160	180	200
	CORRECTION FACTOR, CF PRESSURE DROP								
40°	0.63	0.77	0.89	1.00	1.10	1.18	1.26	1.34	1.41
20°	0.58	0.71	0.82	0.91	1.00	1.08	1.15	1.22	1.29
5° & – 10°	0.53	0.65	0.76	0.85	0.93	1.00	1.07	1.13	1.20
– 20°	0.50	0.61	0.71	0.79	0.87	0.94	1.00	1.06	1.12

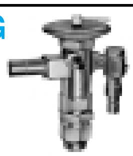
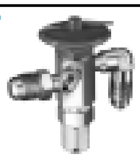
TEV capacity = TEV rating x CF liquid temperature x CF pressure drop — Example: Actual capacity of a nominal 2 ton R-717 Type D valve at 5°F evaporator, 100 psi pressure drop across the TEV, and 70°F liquid temperature entering the TEV = 2.00 (from rating chart) x 1.05 (CF liquid temperature) x 0.85 (CF pressure drop) = 1.79 tons.

TEV Quick Reference Guide

VALVE TYPE	NOMINAL CAPACITY RANGE (tons) R-22	R-134a	R-404A & R-507	CONNECTION TYPES	VALVE DESCRIPTION AND APPLICATION
NI  Specs on Page 12	1/4 thru 1	1/8 thru 1	1/8 thru 1	SAE Flare	Small brass body, angle style valve which is adjustable through its outlet fitting. Inlet connection has a removable 100 mesh strainer. Suitable for small capacity refrigeration applications in which an external adjustment is not required. Typical application: Drink dispensers, ice cubers.
RI  Specs on Page 13	2 thru 5	–	–	SAE Flare or ODF Solder	Small brass body, externally adjustable valve available only for R-22 air conditioning or heat pump applications. This valve is available with the Rapid Pressure Balancer (RPB) feature for off-cycle pressure equalization if desired. Suitable for replacing OEM type TEVs used on these applications.
F  Specs on Page 14 & 15	1/5 thru 3	1/8 thru 2	1/8 thru 2	SAE Flare	Small brass bar body, externally adjustable valve for small capacity refrigeration systems. SAE flare inlet connection has a removable 100 mesh strainer. Typical applications: Refrigerated cases, coolers, freezers.
EF  Specs on Page 14 & 15	1/5 thru 3	1/8 thru 2	1/8 thru 2	ODF Solder	Same as the Type F valve except it features ODF solder connections. The inlet connection has a 100 mesh insert type strainer. Typical applications: Refrigerated cases, coolers, freezers.

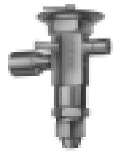
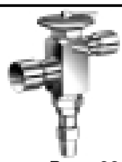
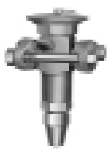
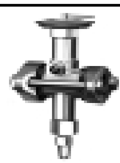
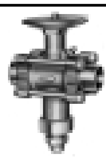
FOR OEM TYPE VALVES, REFER TO PAGE 37.

TEV Quick Reference Guide

VALVE TYPE	NOMINAL CAPACITY RANGE (tons)			CONNECTION TYPES	VALVE DESCRIPTION AND APPLICATION
	R-22	R-134a	R-404A & R-507		
Q  Specs on Page 16-19	1/3 thru 5	1/6 thru 2-1/2	1/6 thru 3	SAE Flare	The brass body Q valve is externally adjustable. The valve body has a removable cartridge or orifice. The valve body, cartridge and thermostatic element can be supplied as independent components. This allows body, cartridge and element to be assembled and matched to specific system requirements. Inlet connection has a 100 mesh removable strainer screen. Typical applications: Refrigeration applications and external equalized versions may be used on air conditioning.
EQ  Specs on Page 16-19	1/3 thru 5	1/6 thru 2-1/2	1/6 thru 3	Extended ODF Solder	Same as the Type Q valve except it features extended ODF connections. A 100 mesh insert strainer is provided with the valve.
SQ  Specs on Page 16-19	1/3 thru 5	1/6 thru 2-1/2	1/6 thru 3	Extended ODF Solder	Same as the Type Q valve except it features ODF solder connections and a forged brass inlet fitting with a removable 100 mesh strainer screen which can be cleaned and/or replaced without removing the valve from the line.
G  Specs on Page 20	1/5 thru 3	1/8 thru 2	1/8 thru 2	SAE Flare	Forged brass body, externally adjustable valve for small capacity refrigeration systems. Inlet connection has a removable 100 mesh strainer. Typical applications: Refrigerated cases, coolers, freezers, small capacity air conditioners.
EG  Specs on Page 21	1/5 thru 3	1/8 thru 2	1/8 thru 2	ODF Solder	Same as the Type G valve except it features ODF solder connections and a forged brass inlet fitting with a removable 100 mesh strainer which can be cleaned and/or replaced without removing the valve from the line.
C  Specs on Page 22	3 thru 8	2 thru 5	2 thru 6	SAE Flare	Forged brass body, externally adjustable valve. Inlet connection has a removable 80 mesh strainer. This valve is a larger capacity version of the Type G valve. Typical applications: Refrigerated cases, coolers, freezers, air conditioners.
BF  Specs on Page 23	AAA thru C	AAA thru C	AAA thru C	SAE Flare	Same physical size as the Type F valve with SAE flare connections except it features a balanced port construction. Inlet connection has a removable 100 mesh strainer. Typical applications: Small capacity refrigeration that operates over widely varying operating conditions.
SBF  Specs on Page 24 & 25	AAA thru C	AAA thru C	AAA thru C	Extended ODF Solder	Same as the Type BF valve except it features ODF solder connections and a forged brass inlet fitting with a removable 100 mesh strainer which can be cleaned and/or replaced without removing the valve from the line.
EBF  Specs on Page 24 & 25	AAA thru C	AAA thru C	AAA thru C	Extended ODF Solder	Same as the Type BF valve except it features extended ODF connections. A 100 mesh insert strainer is provided with the valve.

FOR OEM TYPE VALVES, REFER TO PAGE 37.

TEV Quick Reference Guide

VALVE TYPE	NOMINAL CAPACITY RANGE (tons)			CONNECTION TYPES	VALVE DESCRIPTION AND APPLICATION
	R-22	R-134a	R-404A & R-507		
S  Specs on Page 26	2 thru 10	2 thru 6	2 thru 7	ODF Solder	Brass bar body, externally adjustable valve. Inlet has a permanent 12 mesh strainer. General purpose valve for air conditioning and refrigeration applications.
EBS  Specs on Page 27	8 & 11	5 & 7	6 & 7-1/2	Extended ODF Solder	Same physical size as the Type S valve except it features extended ODF connections and a balanced port construction.
O  Specs on Page 28 & 29	15 thru 70	9 thru 40	9 thru 45	ODF Solder	Brass bar body, externally adjustable valve. Inlet has a permanent 12 mesh strainer. This valve features a balanced port construction, and it is suitable for both air conditioning and refrigeration applications.
H  Specs on Page 30	2-1/2 thru 20	1-1/2 thru 12	1-1/2 thru 12	ODF Solder or FPT Flange	Brass bar body, externally adjustable valve with flange connections. Inlet flange bushing has a permanent 16 mesh strainer. The FPT flange connection requires the K-1178 adapter kit. This valve provides the smallest capacity TEVs with flange connections and it is suitable for both air conditioning and refrigeration applications.
M  Specs on Page 31	21 thru 42	15 thru 25	15 thru 30	ODF Solder or FPT Flange	Cast bronze body, externally adjustable valve with flange connections. Inlet has a 12 mesh strainer. This valve type provides valve capacities greater than the Type H and it is suitable for air conditioning and refrigeration applications. Flanges for the Type M valve are interchangeable with the Type V valve.
V  Specs on Page 32	52 thru 100	35 thru 55	38 thru 70	ODF Solder or FPT Flange	Cast bronze body, externally adjustable valve with flange connections. Inlet has a 12 mesh strainer. This valve type features a dual port semi-balanced design. This valve type provides valve capacities greater than the Type M, and is suitable for air conditioning and refrigeration applications. Flanges for the Type V are interchangeable with the Type M.
W  Specs on Page 33	135 & 180	80 & 110	–	ODF Solder Flange	Cast bronze body, externally adjustable valve with flange connections. Inlet has a 12 mesh strainer. This valve type features a dual port semi-balanced design and it is primarily for large capacity chillers. This valve type provides the largest valve capacities available for flange connection TEVs.
D  Specs on Page 34	R-717 1 thru 15			FPT or Socket Weld Flange	Gray cast iron body, externally adjustable valve for small capacity ammonia service. Optional XD-074 100 mesh external strainer may be ordered with this valve.
A  Specs on Page 35	R-717 20 thru 100			FPT or Socket Weld Flange	Gray cast iron body, externally adjustable valve for large capacity ammonia service. Optional 8004 (1/2 FPT) or 8006 (3/4 FPT) 80 mesh external strainer may be ordered with this valve.

FOR OEM TYPE VALVES, REFER TO PAGE 37.

TYPE NI

for Refrigerants 22-134a-404A-507 — SAE Flare Connections

Sporlan Type NI valve is a small brass bar body, angle style (bottom outlet) valve with SAE flare connections. The thermostatic element is replaceable, and the inlet connection has a removable 100 mesh strainer. An internal adjustment is provided in the outlet fitting, and adjustments can be made with a 7/32'' hex wrench when the outlet is not connected. This valve is designed for small refrigeration systems such as drink dispensers and ice cubers where space is limited and an external superheat adjustment is not necessary.

for complete details of construction, see page 36

SPECIFICATIONS — ELEMENT SIZE NO. 43, KNIFE EDGE JOINT

REFRIGERANT (Sporlan Code)	TYPE Internal Equalizer Only	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Inches	CONNECTIONS – Inches SAE Flare (Blue figures are standard and will be furnished unless otherwise specified.) INLET	OUTLET	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	NIV-1/4	1/4	C Z ZP40	30	1/4 or 3/8 ①	3/8 or 1/2 ②	1	1-1/2
	NIV-1/2	1/2						
	NIV-1	1						
134a (J) 12 (F) 401A (X) 409A (F)	NIJ-1/8	1/8	C		1/4 or 3/8 ①			
	NIJ-1/4	1/4						
	NIJ-1/2	1/2						
	NIJ-1	1			1/4 or 3/8 ①			
404A (S) 502 (R) 408A (R)	NIS-1/8	1/8	C Z ZP		1/4 or 3/8 ①			
	NIS-1/4	1/4						
	NIS-1/2	1/2						
	NIS-1	1			1/4 or 3/8 ①			
507 (P) 402A (L)	NIP-1/8	1/8	C Z ZP		1/4 or 3/8 ①			
	NIP-1/4	1/4						
	NIP-1/2	1/2						
	NIP-1	1			1/4 or 3/8 ①			

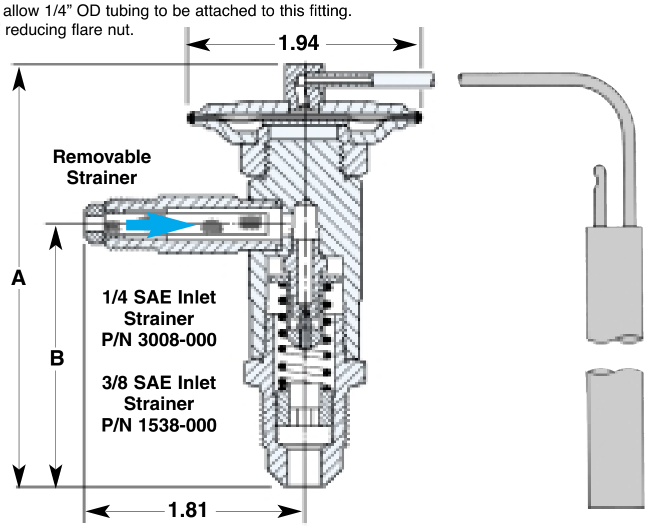
① The 3/8" SAE inlet fitting has a long taper on the flare surface. A 3/8" x 1/4" reducing flare nut will allow 1/4" OD tubing to be attached to this fitting.
② The 1/2" SAE outlet fitting has a long taper. 3/8" OD tubing can be connected by using 1/2" x 3/8" reducing flare nut.

DIMENSIONS – Inches Connections - SAE Flare

OUTLET FITTING SIZE	A	B
3/8	4.07	2.72
1/2	3.63	2.29

BULB SIZES – Inches

STANDARD CHARGES	REFRIGERANT 22	134a	404	507
C	0.50 OD x 3.00			
Z & ZP Series	0.50 OD x 3.00	–	0.50 OD x 3.00	



NOTE: The cross-sectional views on the following valve specification pages illustrate the internal construction differently depending on whether one or two pushrod construction is used. Types NI, RIVE, F, EF, Q, EQ, SQ, G, EG, C, S, H, M, D, and A utilize two pushrods to operate the valve. The pushrods are not shown to avoid confusing details in the cross-sectional view.

The element diaphragm assembly deflects in response to temperature changes at the sensing bulb. This moves the pin carrier which opens the valve port. The pushrods transmit the diaphragm motion to the pin carrier. Valve types BF, EBF, SBF, EBS, O, V, and W utilize only one pushrod. The pushrods are shown in the proper position.

for Refrigerant 22 — SAE Flare & ODF Solder Connections

for complete details of construction, see page 36

Sporlan Type RI valve is a small brass bar body, externally adjustable valve available with either SAE flare or ODF solder connections. This valve has a replaceable thermostatic element, and it is designed for small R-22 air conditioning and heat pump units where space is limited. This valve is also ideal for replacement of OEM type Sporlan TEVs such as the Type I and BI when used on the above applications.

This valve is available with the Rapid Pressure Balancer (RPB) feature for off-cycle pressure equalization if desired. Refer to Sporlan Bulletin 10-9 for additional information on this subject.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections	*Distributors*
1/2" SAE	1603, 1605, 1606, 1608, 1650(R)
1/2" ODF	1613, 1616
5/8" ODF	1620, 1622, 1651(R)

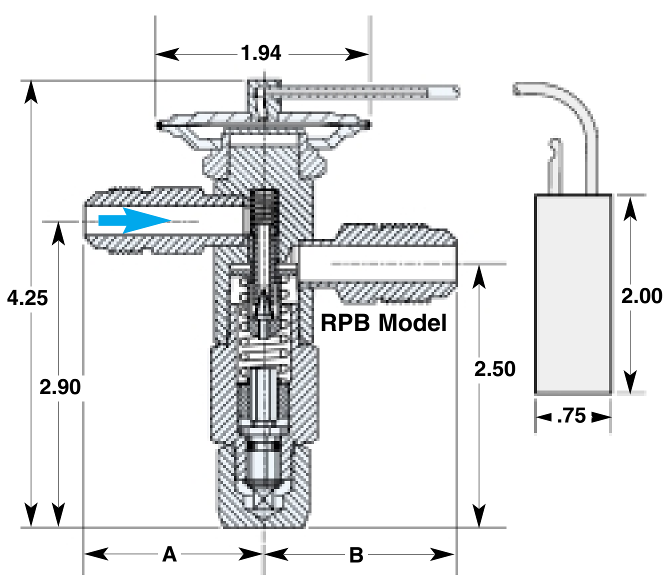
TYPE RIVE

SPECIFICATIONS — ELEMENT SIZE NO. 43, KNIFE EDGE JOINT

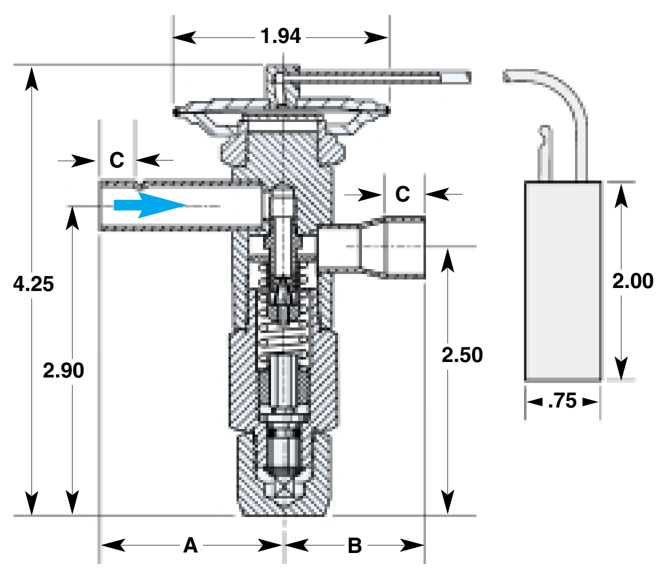
REFRIGERANT (Sporlan Code)	TYPE External Equalizer Only	④ NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Inches	CONNECTIONS – Inches (Blue figures are standard and will be furnished unless otherwise specified.) SAE Flare INLET	SAE Flare OUTLET	③ ODF Solder INLET	③ ODF Solder OUTLET	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	RIVE-2	2	GA only	30	3/8	1/2	**3/8**	**1/2**	1	1-1/2
	RIVE-3	3								
	RIVE-4	4			1/2	1/2	**1/2**	**1/2,** 5/8		
	RIVE-5	5								

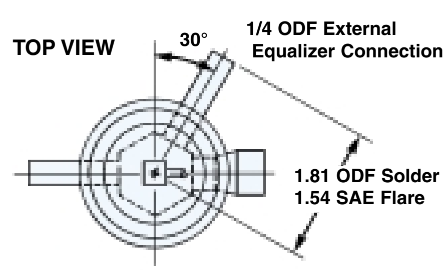
③ ODF Solder indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus 1/2" ODF will receive 1/2" OD tubing.
④ The Nominal Capacity of the valve is increased by 15% when the Rapid Pressure Balancer (RPB) feature is used. A cross drilling is part of the internal construction of the RPB feature and this drilling provides the additional refrigerant flow.

SAE Flare



ODF Solder





DIMENSIONS – Inches			
FITTING SIZE	**A**	**B**	**C**
3/8 SAE	1.69	–	–
1/2 SAE	1.66	1.80	–
3/8 ODF	1.69	–	.37
1/2 ODF	1.75	1.33	.44
5/8 ODF	–	1.41	.50

TYPE F & EF

for Refrigerants 22-134a-404A-507 — SAE Flare & ODF Solder Connections

Sporlan Type F with SAE flare connections or Type EF with ODF solder connections are small brass bar body valves with identical internal construction and replaceable thermostatic elements. The Type F valve has a removable 100 mesh strainer as a standard feature. The Type EF has a 60x50 mesh insert strainer. These valves are designed for small refrigeration systems such as refrigerated cases, coolers, and freezers where space is limited and an external adjustment is desired.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections	*Distributors*
1/2" SAE	1603, 1605, 1606, 1608, 1650(R)
1/2" ODF	1613, 1616

F

EF

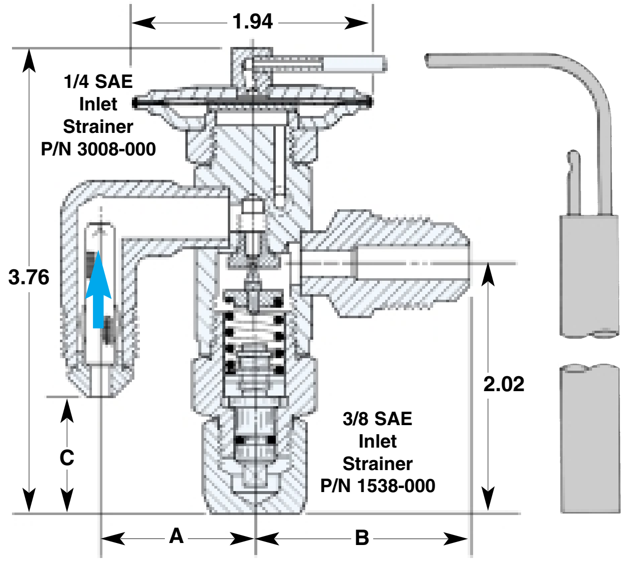
for complete details of construction, see page 36

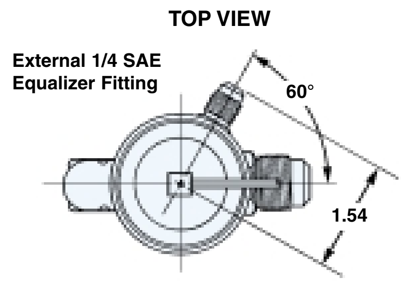
SPECIFICATIONS ELEMENT SIZE NO. 43, KNIFE EDGE JOINT

REFRIGERANT (Sporlan Code)	TYPE F SAE Flare Internal Equalizer	TYPE F SAE Flare External Equalizer	TYPE EF ODF Solder Internal Equalizer	TYPE EF ODF Solder External Equalizer	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Inches	CONNECTIONS – Inches SAE Flare / ③ ODF Solder (Blue figures are standard and will be furnished unless otherwise specified.) INLET	OUTLET	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	FV-1/5	FVE-1/5	EFV-1/5	EFVE-1/5	1/5	C Z ZP40	30	1/4 or 3/8 ①	3/8 or 1/2	1	1-1/2
	FV-1/3	FVE-1/3	EFV-1/3	EFVE-1/3	1/3						
	FV-1/2	FVE-1/2	EFV-1/2	EFVE-1/2	1/2						
	FV-1	FVE-1	EFV-1	EFVE-1	1						
	FV-1-1/2	FVE-1-1/2	EFV-1-1/2	EFVE-1-1/2	1-1/2			3/8 ⑮	1/2		
	–	FVE-2	–	EFVE-2	2						
	FV-2-1/2	–	EFV-2-1/2	–	2-1/2						
	–	FVE-3	–	EFVE-3	3						
134a (J) 12 (F) 401A (X) 409A (F)	FJ-1/8	FJE-1/8	EFJ-1/8	EFJE-1/8	1/8	C		1/4 or 3/8 ①	3/8 or 1/2		
	FJ-1/6	FJE-1/6	EFJ-1/6	EFJE-1/6	1/6						
	FJ-1/4	FJE-1/4	EFJ-1/4	EFJE-1/4	1/4						
	FJ-1/2	FJE-1/2	EFJ-1/2	EFJE-1/2	1/2						
	FJ-1	FJE-1	EFJ-1	EFJE-1	1			3/8 ⑮	1/2		
	FJ-1-1/2	FJE-1-1/2	EFJ-1-1/2	EFJE-1-1/2	1-1/2						
	–	FJE-2	–	EFJE-2	2						
404A (S) 502 (R) 408A (R)	FS-1/8	FSE-1/8	EFS-1/8	EFSE-1/8	1/8	C Z ZP		1/4 or 3/8 ①	3/8 or 1/2		
	FS-1/6	FSE-1/6	EFS-1/6	EFSE-1/6	1/6						
	FS-1/4	FSE-1/4	EFS-1/4	EFSE-1/4	1/4						
	FS-1/2	FSE-1/2	EFS-1/2	EFSE-1/2	1/2						
	FS-1	FSE-1	EFS-1	EFSE-1	1			3/8 ⑮	1/2		
	FS-1-1/2	FSE-1-1/2	EFS-1-1/2	EFSE-1-1/2	1-1/2						
	–	FSE-2	–	EFSE-2	2						
507 (P) 402A (L)	FP-1/8	FPE-1/8	EFP-1/8	EFPE-1/8	1/8	C Z ZP		1/4 or 3/8 ①	3/8 or 1/2		
	FP-1/6	FPE-1/6	EFP-1/6	EFPE-1/6	1/6						
	FP-1/4	FPE-1/4	EFP-1/4	EFPE-1/4	1/4						
	FP-1/2	FPE-1/2	EFP-1/2	EFPE-1/2	1/2						
	FP-1	FPE-1	EFP-1	EFPE-1	1			3/8 ⑮	1/2		
	FP-1-1/2	FPE-1-1/2	EFP-1-1/2	EFPE-1-1/2	1-1/2						
	–	FPE-2	–	EFPE-2	2						

① The 3/8" SAE inlet fitting has a long taper on the flare surface. A 3/8" x 1/4" reducing flare nut will allow 1/4" OD tubing to be attached to this fitting.
③ ODF Solder on Type EF valves indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus 1/2" ODF will receive 1/2" OD tubing.
⑮ Nominal 1 ton and larger F valves for R-134a, R-404A and R-507 type refrigerants, and nominal 1-1/2 ton and larger for R-22 refrigerant require 3/8" SAE Flare or 3/8" ODF inlet, minimum.

SAE Flare

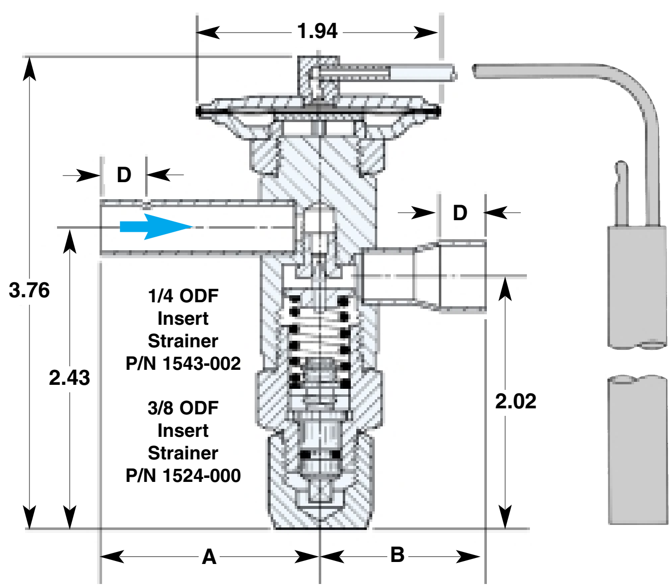


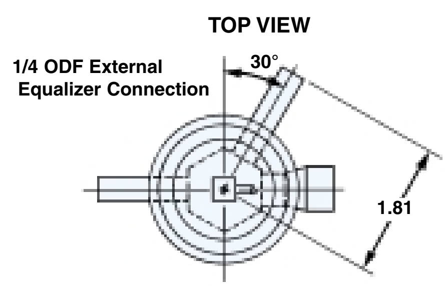


BULB SIZES – Inches				
STANDARD CHARGES	22	134a	404	507
C	0.50 OD x 3.00			
Z & ZP Series	0.50 OD x 3.00	–	0.50 OD x 3.00	

DIMENSIONS – Inches SAE			
FITTING SIZE	A	B	C
1/4 Elbow	1.05	–	1.34
3/8 Elbow	1.27	–	.98
3/8 SAE	–	1.61	–
1/2 SAE	–	1.80	–

ODF Solder



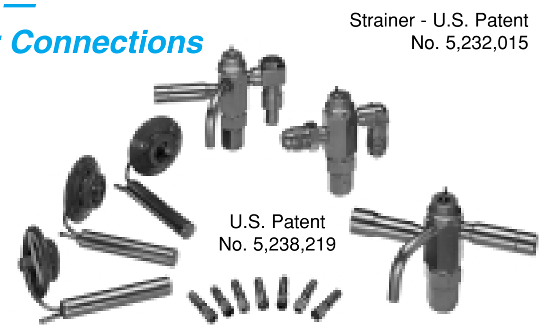


BULB SIZES – Inches				
STANDARD CHARGES	22	134a	404	507
C	0.50 OD x 3.00			
Z & ZP Series	0.50 OD x 3.00	–	0.50 OD x 3.00	

DIMENSIONS – Inches ODF			
FITTING SIZE	A	B	D
1/4 ODF	1.69	–	.31
3/8 ODF	1.69	1.33	.31
1/2 ODF	–	1.33	.38

TYPE Q EQ SQ

for Refrigerants 22-134a-404A-507 — SAE Flare & Extended ODF Solder Connections



for complete details of construction, see page 36

The brass body type Q, EQ, and SQ are replaceable cartridge style valves, whereby a cartridge can be selected to match the system capacity and installed in the valve body. All share identical internal construction with external adjustments. The identification of the three valve body styles available is now unique. The Q body is supplied with the traditional SAE flare connections. The EQ body is supplied with extended ODF solder connections and the "877" series strainer. The SQ body features ODF solder connections with the forged inlet and replaceable strainer. These valves are all designed for small refrigeration systems, such as refrigerated cases, coolers, and freezers. The externally equalized version of these valves may be used on air conditioning and heat pump systems, the EQ body is specifically targeted for this application. This is the first cartridge type valve to be designed and marketed by Sporlan Valve Company, and it can be supplied as a complete valve or as three component parts: the thermostatic element, the valve body, and the replaceable cartridge or orifice. The thermostatic element to valve body joint is the Sporlan traditional knife edge, metal-to-metal, joint which insures leak-proof construction.

SELECTIVE THERMOSTATIC CHARGES — Since the valve body and thermostatic elements can be supplied as independent components, the installer can select the best possible thermostatic charge for the application. Sporlan selective thermostatic charges are specifically designed for low temperature, medium temperature and air conditioning applications. The element is manufactured with a large flat diaphragm to yield maximum power for best control performance.

INTERNAL PORT DESIGN — The flow of refrigerant through the valve port opposes the pin movement in all type Q, EQ and SQ valves. This design concept improves valve control stability when light loads occur and the pin modulates to a position close to the port. This design also reduces or eliminates the risk of charge migration in the thermostatic element which is inherent with other cartridge style valves. By design, the Sporlan thermostatic element is warmed by the entering liquid which flows through the top of the valve body.

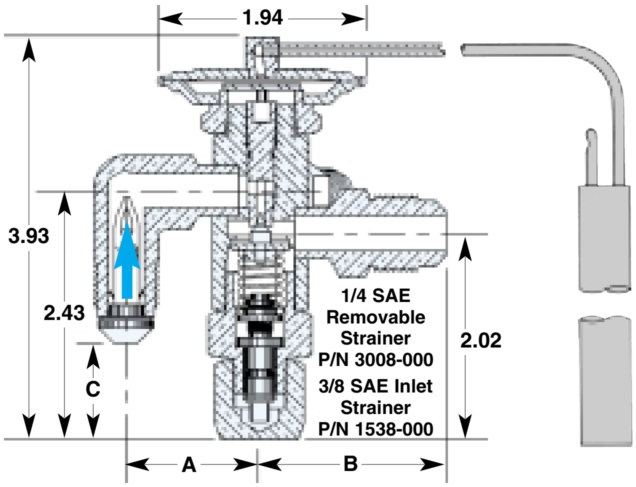
SPECIFICATIONS ELEMENT SIZE NO. 43, KNIFE EDGE JOINT

REFRIGERANT (Sporlan Code)	BODY TYPE-CARTRIDGE						CARTRIDGE	NOMINAL CAPACITY-Tons	Thermostatic Charges Available	Standard Tubing Length-Feet	CONNECTIONS Inches **BOLD** figures are standard and will be funished unless otherwise specified	Net Weight-Lbs.	Shipping Weight-Lbs.
	SAE Flare		Extended ODF Solder										
	Internal Equalizer ⑥	External Equalizer ⑯	Internal Equalizer ⑥	External Equalizer ⑯	Internal Equalizer ⑥	External Equalizer ⑯					Inlet x Outlet		
22 (V) 407C (N) 407A (V)	Q-0	QE-0	EQ-0	EQE-0	SQ-0	SQE-0	0	1/3	Refer to Recommended Thermostatic Elements on Page 18	5	*Q & QE Only* 1/4 x 3/8 SAE 90° Angle Inlet or 1/4 x 1/2 SAE 90° Angle Inlet or **3/8 x 1/2 SAE 90° Angle Inlet** *EQ Only* **3/8 x 1/2 ODF Straight Thru** *EQE Only* **3/8 x 1/2 ODF Straight Thru** or 3/8 x 5/8 ODF Straight Thru or 1/2 x 5/8 ODF Straight Thru or 1/2 x 7/8 ODF Straight Thru *SQ & SQE Only* **3/8 x 1/2 ODF 90° Angle Inlet**	1	1-1/2
	Q-1	QE-1	EQ-1	EQE-1	SQ-1	SQE-1	1	3/4					
	Q-2	QE-2	EQ-2	EQE-2	SQ-2	SQE-2	2	1					
	Q-3	QE-3	EQ-3	EQE-3	SQ-3	SQE-3	3	1-1/2					
	Q-4	QE-4	EQ-4	EQE-4	SQ-4	SQE-4	4	2-1/2					
	Q-5	QE-5	EQ-5	EQE-5	SQ-5	SQE-5	5	3-1/2					
	Q-6	QE-6	EQ-6	EQE-6	SQ-6	SQE-6	6	5					
134a (J) 12 (F) 401A (X) 409A (F)	Q-0	QE-0	EQ-0	EQE-0	SQ-0	SQE-0	0	1/6					
	Q-1	QE-1	EQ-1	EQE-1	SQ-1	SQE-1	1	1/4					
	Q-2	QE-2	EQ-2	EQE-2	SQ-2	SQE-2	2	1/2					
	Q-3	QE-3	EQ-3	EQE-3	SQ-3	SQE-3	3	1					
	Q-4	QE-4	EQ-4	EQE-4	SQ-4	SQE-4	4	1-1/2					
	Q-5	QE-5	EQ-5	EQE-5	SQ-5	SQE-5	5	2					
	Q-6	QE-6	EQ-6	EQE-6	SQ-6	SQE-6	6	2-1/2					
404A (S) 502 (R) 408A (R)	Q-0	QE-0	EQ-0	EQE-0	SQ-0	SQE-0	0	1/6					
	Q-1	QE-1	EQ-1	EQE-1	SQ-1	SQE-1	1	1/4					
	Q-2	QE-2	EQ-2	EQE-2	SQ-2	SQE-2	2	1/2					
	Q-3	QE-3	EQ-3	EQE-3	SQ-3	SQE-3	3	1					
	Q-4	QE-4	EQ-4	EQE-4	SQ-4	SQE-4	4	1-1/2					
	Q-5	QE-5	EQ-5	EQE-5	SQ-5	SQE-5	5	2					
	Q-6	QE-6	EQ-6	EQE-6	SQ-6	SQE-6	6	3					
507 (P) 402A (L)	Q-0	QE-0	EQ-0	EQE-0	SQ-0	SQE-0	0	1/6					
	Q-1	QE-1	EQ-1	EQE-1	SQ-1	SQE-1	1	1/4					
	Q-2	QE-2	EQ-2	EQE-2	SQ-2	SQE-2	2	1/2					
	Q-3	QE-3	EQ-3	EQE-3	SQ-3	SQE-3	3	1					
	Q-4	QE-4	EQ-4	EQE-4	SQ-4	SQE-4	4	1-1/2					
	Q-5	QE-5	EQ-5	EQE-5	SQ-5	SQE-5	5	2					
	Q-6	QE-6	EQ-6	EQE-6	SQ-6	SQE-6	6	3					

⑥ Valves listed in this column NOT AVAILABLE with MOP Type air conditioning charges.
⑯ Standard External Equalizer 1/4" SAE (Q Body), 1/4" ODF (SQ and EQ Body).

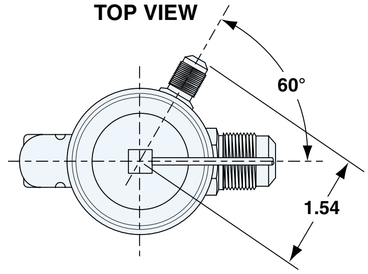
TYPE Q EQ SQ

TYPE QE



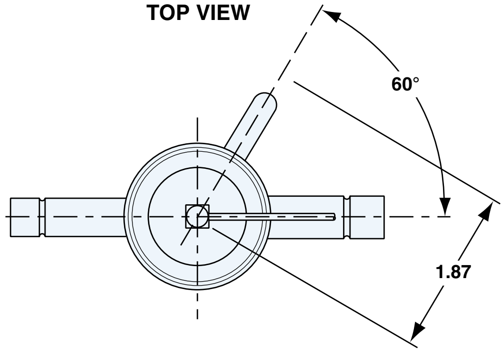
QE DIMENSIONS – Inches			
FITTING SIZE	A	B	C
1/4 SAE, 90° Angle	1.19	–	1.34
3/8 SAE, 90° Angle	1.35	–	0.98
3/8 SAE	–	1.61	–
1/2 SAE	–	1.80	–

TOP VIEW

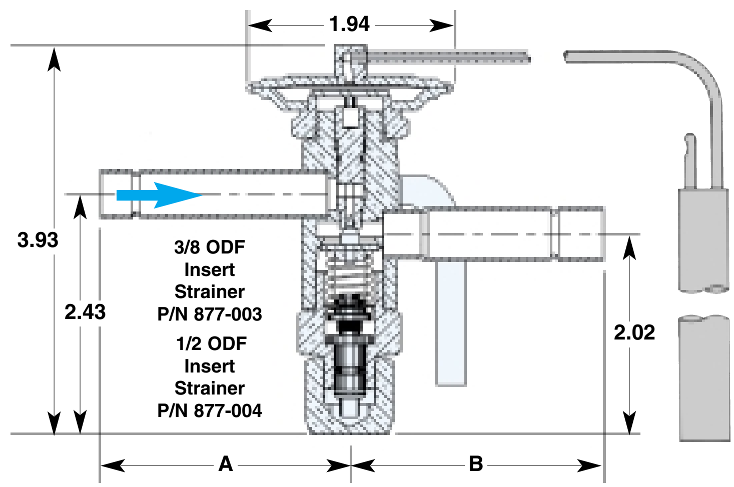


EQE DIMENSIONS – Inches		
FITTING SIZE	A	B
3/8	2.50	–
1/2	2.42	2.48
5/8	–	2.48
7/8	–	2.39

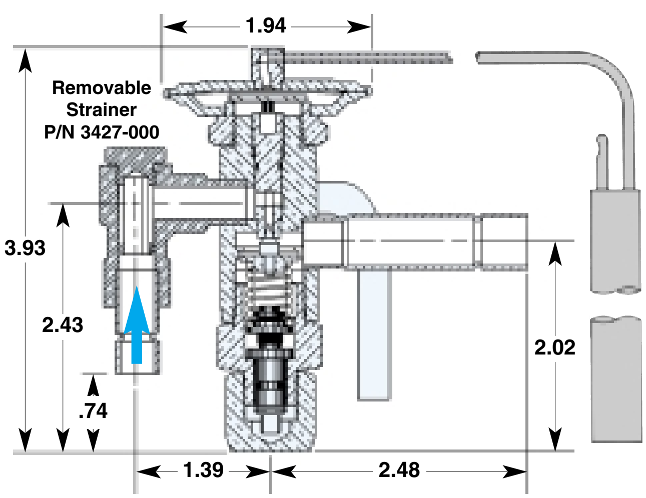
TOP VIEW



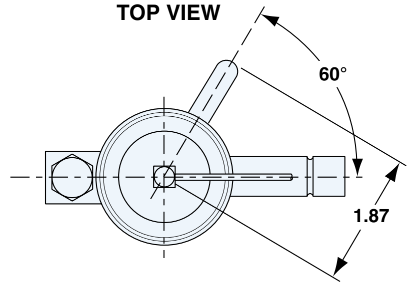
TYPE EQE



TYPE SQE



TOP VIEW



QE, EQE, SQE BULB SIZES – Inches				
STANDARD CHARGES	REFRIGERANT			
	22	134a	404A	507
C	0.50 OD x 3.00			
Z & ZP Series	0.50 OD x 3.00	–	0.50 OD x 3.00	
CP Series	0.50 OD x 3.00			–
VGA	0.75 OD x 2.00	–		

TYPE Q EQ SQ

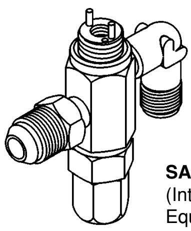
ORDERING INSTRUCTIONS

QE – 0 (1/3T) – VC – 5' – 3/8 x 1/2 x 1/4 SAE

- QE: Valve Type — Q, EQ, SQ = Internally Equalized; QE, EQE, SQE = Externally Equalized
- 0: Cartridge Size
- (1/3T): Nominal Capacity (tons)
- V: Refrigerant Code (See page 4)
- C: Thermostatic Charge
- 5': Capillary Tube Length
- 3/8 x 1/2 x 1/4 SAE: Connection Size and Style: in x out x ext. eq.

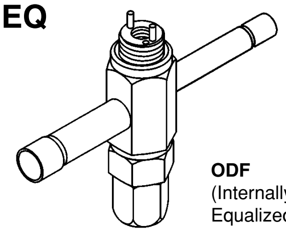
SELECTING BODY TYPE

Q



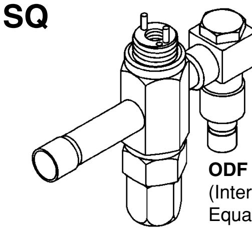
SAE (Internally Equalized)

EQ



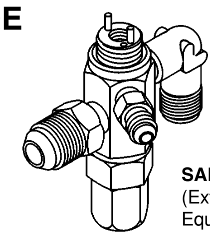
ODF (Internally Equalized)

SQ



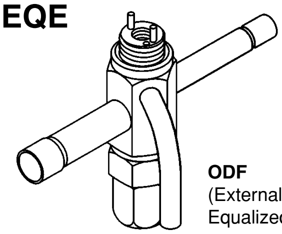
ODF (Internally Equalized)

QE



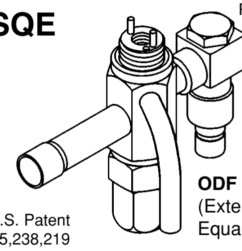
SAE (Externally Equalized)

EQE



ODF (Externally Equalized)

SQE

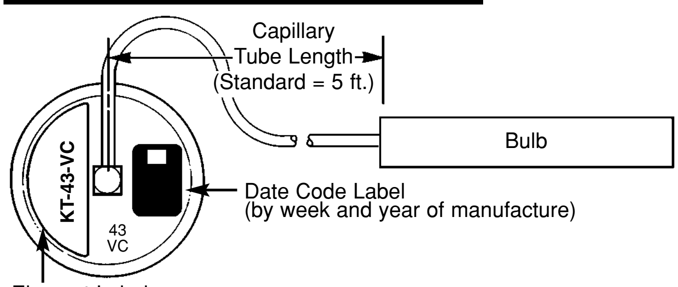


Replaceable Strainer
- U.S. Patent No. 5,232,015
- P/N 3427-000

U.S. Patent No. 5,238,219

ODF (Externally Equalized)

SELECTING THE ELEMENT



KT	-	43	-	V	C
Abbreviation for "Kit"		Element Size Number		*Refrigerant Code See Page 4	Thermostatic Charge

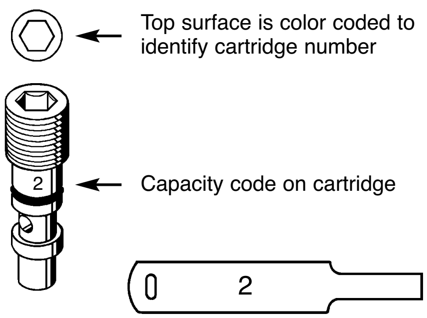
* While many new refrigerants and refrigerant blends have a unique letter code, many use the same thermostatic element as the traditional refrigerant they replace. Refer to the table below to select the correct thermostatic element.

RECOMMENDED THERMOSTATIC ELEMENTS

APPLICATION	REFRIGERANT 12	22	134a	401A	402A	404A	407A	407C	408A	409A	502	507	THERMOSTATIC ELEMENT	SYSTEM MOP psig
AIR CONDITIONING	X	–	X	X	–	–	–	–	–	X	–	–	KT-43-FCP60	50
	–	X	–	–	–	–	X	X	–	–	–	–		90
	–	X	–	–	–	–	X	X	–	–	–	–	KT-43-VGA	–
	–	–	–	–	–	X	–	–	X	–	X	–		105
COMMERCIAL REFRIGERATION 50°F to – 10°F	X	–	X	X	–	–	–	–	–	X	–	–		–
	–	X	–	–	–	–	X	X	–	–	–	–		–
	–	–	–	–	–	X	–	–	X	–	X	–		–
	–	–	–	–	X	–	–	–	–	–	–	X		–
LOW TEMPERATURE REFRIGERATION 0°F to – 40°F	X	–	–	–	–	–	–	–	–	–	–	–	KT-43-FZ	–
	X	–	–	–	–	–	–	–	–	–	–	–	KT-43-FZP	12
	–	X	–	–	–	–	X	–	–	–	–	–	KT-43-VZ	–
	–	X	–	–	–	–	X	–	–	–	–	–		30
	–	–	–	–	X	X	–	–	X	–	X	X		–
	–	–	–	–	X	X	–	–	X	–	X	X		35

The Sporlan type ZP thermostatic charges have essentially the same characteristics as the conventional Z cross charges with one exception: they produce a pressure limit or MOP. The ZP charges are not intended as replacements for the Z charges - they should only be used where a definite pressure limit is required to prevent motor overloading.

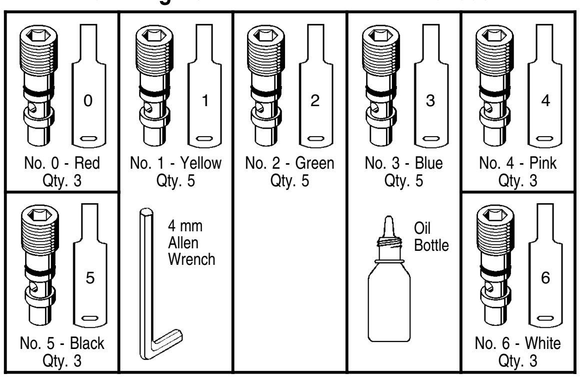
SELECTING THE CARTRIDGE



Identification tag with cartridge number (bends around capillary tubing)

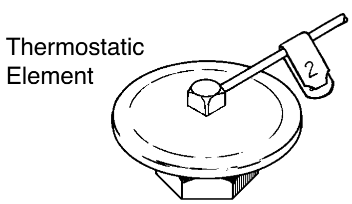
INDIVIDUAL REPLACEMENT PARTS		
PART NUMBER	**SIZE**	**COLOR CODE**
CARTRIDGE AND I.D. TAG		
QC-0	0	RED
QC-1	1	YELLOW
QC-2	2	GREEN
QC-3	3	BLUE
QC-4	4	PINK
QC-5	5	BLACK
QC-6	6	WHITE
MISCELLANEOUS PARTS		
OB-1	Oil Bottle (With Oil)	
AW-1	4 mm Allen Wrench	
CSK-1	Cartridge Service Kit (Empty)	
184000	Cartridge Service Kit (Complete as noted below)	

Cartridge Service Kit – Part No. 184000

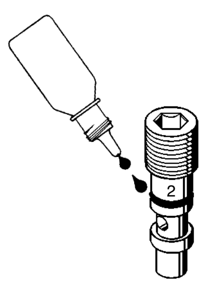


NOMINAL CAPACITY (tons) of SPORLAN VALVE to be REPLACED								Q VALVE CARTRIDGE	
R-12	**R-22**	**R-134a**	**R-401A**	**R-402A**	**R-404A**	**R-502**	**R-507**	**SIZE**	**COLOR CODE**
1/8	1/4	1/8	1/8	1/8	1/8	1/8	1/8	0	RED
1/6	1/3	1/6	1/6	1/6	1/6	1/6	1/6		
1/4	1/2	1/4	1/4	1/4	1/4	1/4	1/4	1	YELLOW
	3/4								
1/2	1	1/2	1/2	1/2	1/2	1/2	1/2	2	GREEN
1	1-1/2	1	1	1	1	1	1	3	BLUE
1-1/2	2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	4	PINK
	2-1/2								
2	3	2	2	2	2	2	2	5	BLACK
2-1/2	4	2-1/2	2-1/2	3	3	3	3	6	WHITE
3	5	3	3						

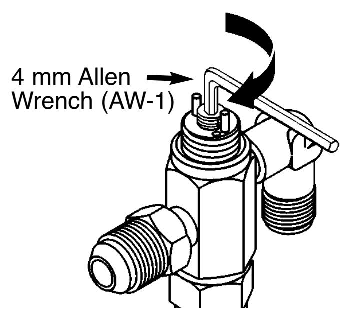
COMPONENT ASSEMBLY



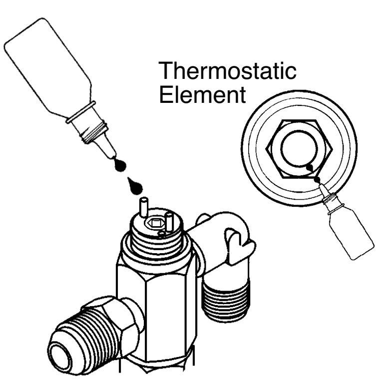
1 Attach cartridge identification tag to element capillary tube.



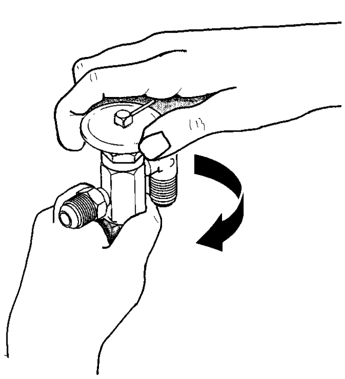
2 (Oil) Lubricate O-ring.



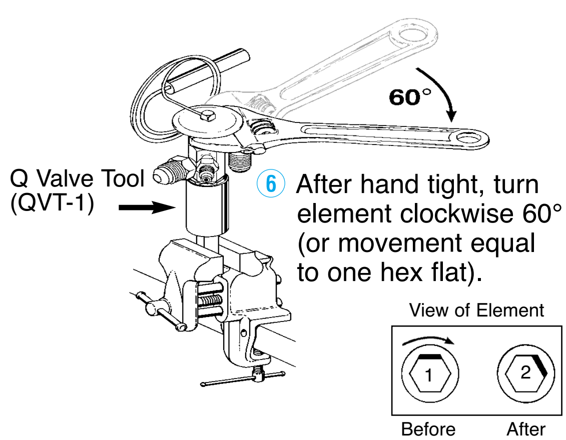
3 Turn clockwise until seated (do not over tighten).



4 (Oil) Lubricate lock ring surface and top of push rods.



5 Hand tighten element.



6 After hand tight, turn element clockwise 60° (or movement equal to one hex flat).

TYPE G

for Refrigerants 22-134a-404A-507 — SAE Flare Connections

Sporlan Type G valve is a forged brass body, externally adjustable valve with SAE flare connections. The thermostatic element is replaceable, and the inlet connection has a removable 100 mesh strainer. This valve is designed for small refrigeration systems such as refrigerated cases, coolers and freezers. In addition to refrigeration applications, the externally equalized Type G valve may be used for small capacity air conditioning and heat pump units.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections	*Distributors*
1/2" SAE	1603, 1605, 1606, 1608, 1650(R)

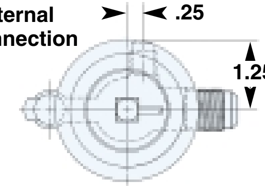
for complete details of construction, see page 36

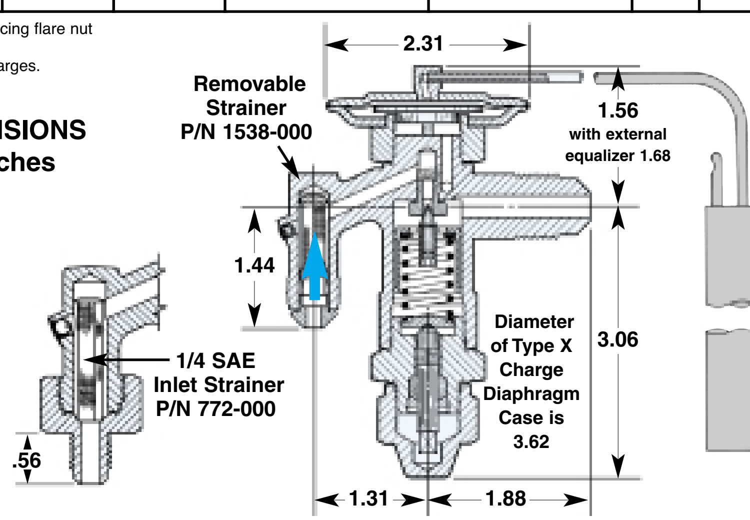
SPECIFICATIONS ELEMENT SIZE NO. 53, KNIFE EDGE JOINT

REFRIGERANT (Sporlan Code)	TYPE: Internal Equalizer ⑥	TYPE: External Equalizer 1/4" SAE Flare	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Feet	CONNECTIONS – Inches SAE Flare (**Blue** figures are standard and will be furnished unless otherwise specified.) INLET	OUTLET	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	GV-1/5	GVE-1/5	1/5	Refer to Recommended Thermostatic Charges on Page 4	5	**1/4** or 3/8 ①	**1/2**	2	3
	GV-1/3	GVE-1/3	1/3						
	GV-1/2	GVE-1/2	1/2			1/4 or **3/8** ①			
	GV-3/4	GVE-3/4	3/4						
	GV-1	GVE-1	1						
	GV-1-1/2	GVE-1-1/2	1-1/2			**3/8** ①			
	–	GVE-2	2						
	GV-2-1/2	–	2-1/2						
	–	GVE-3	3						
134a (J) 12 (F) 401A (X) 409A (F)	GJ-1/8	GJE-1/8	1/8			**1/4** or 3/8 ①			
	GJ-1/6	GJE-1/6	1/6						
	GJ-1/4	GJE-1/4	1/4						
	GJ-1/2	GJE-1/2	1/2			1/4 or **3/8** ①			
	GJ-1	GJE-1	1						
	GJ-1-1/2	GJE-1-1/2	1-1/2			**3/8** ①			
	–	GJE-2	2						
404A (S) 502 (R) 408A (R)	GS-1/8	GSE-1/8	1/8			**1/4** or 3/8 ①			
	GS-1/6	GSE-1/6	1/6						
	GS-1/4	GSE-1/4	1/4						
	GS-1/2	GSE-1/2	1/2			1/4 or **3/8** ①			
	GS-1	GSE-1	1						
	GS-1-1/2	GSE-1-1/2	1-1/2			**3/8** ①			
	–	GSE-2	2						
507 (P) 402A (L)	GP-1/8	GPE-1/8	1/8			**1/4** or 3/8 ①			
	GP-1/6	GPE-1/6	1/6						
	GP-1/4	GPE-1/4	1/4						
	GP-1/2	GPE-1/2	1/2			1/4 or **3/8** ①			
	GP-1	GPE-1	1						
	GP-1-1/2	GPE-1-1/2	1-1/2			**3/8** ①			
	–	GPE-2	2						

① The 3/8" SAE inlet fitting has a long taper on the flare surface. A 3/8" x 1/4" reducing flare nut will allow 1/4" OD tubing to be attached to this fitting.
⑥ Valves listed in this column NOT AVAILABLE with MOP Type air conditioning charges.

DIMENSIONS – Inches





BULB SIZES – Inches

STANDARD CHARGES	REFRIGERANT: 22	134a	404A	507
C	0.50 OD x 3.50			
Z & ZP Series	0.50 OD x 3.50	–	0.50 OD x 3.50	
X	0.75 OD x 4.00	–	0.75 OD x 4.00	
CP Series	0.50 OD x 3.50			–
VGA	0.75 OD x 2.00	–		

for Refrigerants 22-134a-404A-507 — SAE Flare & ODF Solder Connections

for complete details of construction, see page 36

Sporlan Type EG valve is a forged brass body, externally adjustable valve with ODF solder connections. The thermostatic element is replaceable, and the inlet connection has a removable 100 mesh strainer which can be cleaned and/or replaced without removing the valve from the line. This valve is designed for small refrigeration systems such as refrigerated cases, coolers and freezers. In addition to refrigeration applications, the externally equalized Type EG valve may be used for small capacity air conditioning and heat pump units.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections 1/2" ODF

Distributors 1613, 1616

TYPE EG

Replaceable Strainer
U.S. Patent
No. 5,232,015

SPECIFICATIONS — ELEMENT SIZE NO. 53, KNIFE EDGE JOINT

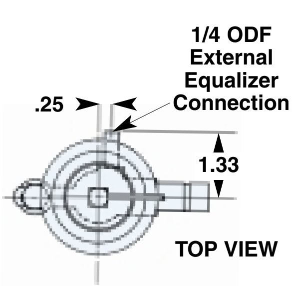
REFRIGERANT (Sporlan Code)	TYPE: Internal Equalizer ⑥	TYPE: External Equalizer 1/4" ODF Solder	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Feet	CONNECTIONS – Inches ③ ODF Solder (Blue figures are standard and will be furnished unless otherwise specified.) INLET	OUTLET	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	EGV-1/5	EGVE-1/5	1/5	Refer to Recommended Thermostatic Charges on Page 4	5	3/8	1/2	2	3
	EGV-1/3	EGVE-1/3	1/3						
	EGV-1/2	EGVE-1/2	1/2						
	EGV-3/4	EGVE-3/4	3/4						
	EGV-1	EGVE-1	1						
	EGV-1-1/2	EGVE-1-1/2	1-1/2						
	–	EGVE-2	2						
	EGV-2-1/2	–	2-1/2						
	–	EGVE-3	3						
134a (J) 12 (F) 401A (X) 409A (F)	EGJ-1/8	EGJE-1/8	1/8						
	EGJ-1/6	EGJE-1/6	1/6						
	EGJ-1/4	EGJE-1/4	1/4						
	EGJ-1/2	EGJE-1/2	1/2						
	EGJ-1	EGJE-1	1						
	EGJ-1-1/2	EGJE-1-1/2	1-1/2						
	–	EGJE-2	2						
404A (S) 502 (R) 408A (R)	EGS-1/8	EGSE-1/8	1/8						
	EGS-1/6	EGSE-1/6	1/6						
	EGS-1/4	EGSE-1/4	1/4						
	EGS-1/2	EGSE-1/2	1/2						
	EGS-1	EGSE-1	1						
	EGS-1-1/2	EGSE-1-1/2	1-1/2						
	–	EGSE-2	2						
507 (P) 402 (L)	EGP-1/8	EGPE-1/8	1/8						
	EGP-1/6	EGPE-1/6	1/6						
	EGP-1/4	EGPE-1/4	1/4						
	EGP-1/2	EGPE-1/2	1/2						
	EGP-1	EGPE-1	1						
	EGP-1-1/2	EGPE-1-1/2	1-1/2						
	–	EGPE-2	2						

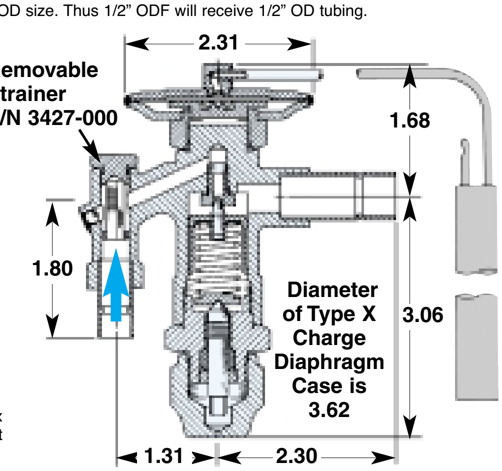
③ ODF Solder indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus 1/2" ODF will receive 1/2" OD tubing.
⑥ Valves listed in this column NOT AVAILABLE with MOP Type air conditioning charges.

BULB SIZES – Inches

STANDARD CHARGES	REFRIGERANT: 22	134a	404A	507
C	0.50 OD x 3.50			
Z & ZP Series	0.50 OD x 3.50	–	0.50 OD x 3.50	
X	0.75 OD x 4.00	–	0.75 OD x 4.00	
CP Series	0.50 OD x 3.50			–
VGA	0.75 OD x 2.00	–		

DIMENSIONS – Inches





* Type EG valves manufactured prior to June 1994 use a smaller inlet strainer, P/N 1935-000, which has a 1/2" brass hex head. Current Type EG valves use inlet strainer P/N 3247-000 which has a 5/8" brass hex head. These strainers are not interchangeable, but both are available as replacement parts.

TYPE C

for Refrigerants 22-134a-404A-507 — SAE Flare Connections

Sporlan Type C valve is a forged brass body, externally adjustable valve with SAE flare connections. The thermostatic element is replaceable, and the inlet connection has a removable 80 mesh strainer. This valve is designed for refrigerated cases, coolers and freezers. In addition to refrigeration applications, the externally equalized Type C valve may be used for small capacity air conditioning and heat pump units.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

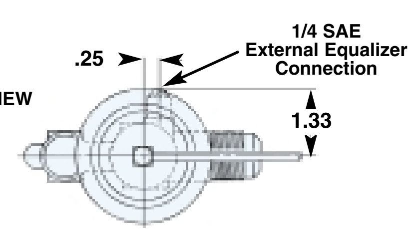
Outlet Connections	*Distributors*
1/2" SAE	1603, 1605, 1606, 1608, 1650(R)
5/8" SAE	1104, 1147, 1652(R), 1654(R), 1656(R)

for complete details of construction, see page 36

SPECIFICATIONS — ELEMENT SIZE NO. 83, KNIFE EDGE JOINT

REFRIGERANT (Sporlan Code)	TYPE: Internal Equalizer ⑥	TYPE: External Equalizer 1/4" SAE Flare Only	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Feet	CONNECTIONS – Inches SAE Flare (Blue figures are standard and will be furnished unless otherwise specified.) INLET	OUTLET	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	CV-3	–	3	Refer to Recommended Thermostatic Charges on Page 4	5	3/8 ① or 1/2	1/2 or 5/8	2	3
	CV-4	CVE-4	4						
	CV-5	CVE-5	5						
	–	CVE-8	8			1/2	5/8		
134a (J) 12 (F) 401A (X) 409A (F)	CJ-2	–	2			3/8 ① or 1/2	1/2 or 5/8		
	CJ-2-1/2	CJE-2-1/2	2-1/2						
	CJ-3	CJE-3	3						
	–	CJE-5	5			1/2	5/8		
404A (S) 502 (R) 408A (R)	CS-2	–	2			3/8 ① or 1/2	1/2 or 5/8		
	CS-3	CSE-3	3						
	CS-4	CSE-4	4						
	–	CSE-6	6			1/2	5/8		
507 (P) 402A (L)	CP-2	–	2			3/8 ① or 1/2	1/2 or 5/8		
	CP-3	CPE-3	3						
	CP-4	CPE-4	4						
	–	CPE-6	6			1/2	5/8		

① The 3/8" SAE inlet fitting has a long taper on the flare surface. A 3/8" x 1/4" reducing flare nut will allow 1/4" OD tubing to be attached to this fitting.
⑥ Valves listed in this column NOT AVAILABLE with MOP Type air conditioning charges.

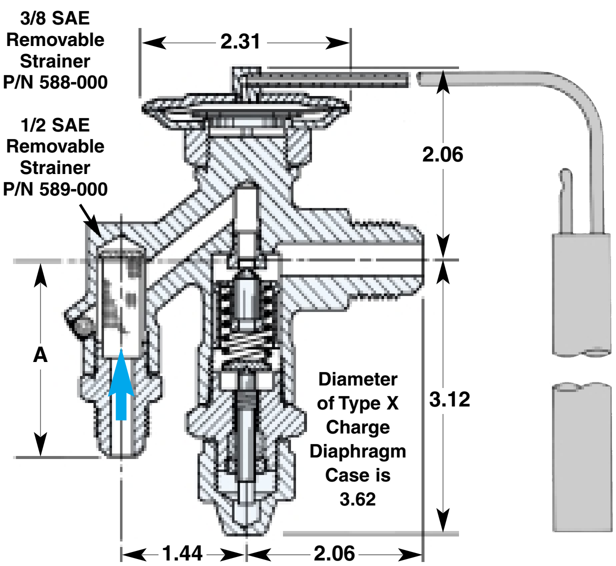


DIMENSIONS – Inches Connections - SAE Flare

FITTING SIZE	A
3/8	2.25
1/2	2.38

BULB SIZES – Inches

STANDARD CHARGES	REFRIGERANT 22	134a	404A	507
C	0.50 OD x 3.50			
Z & ZP Series	0.50 OD x 3.50	–	0.50 OD x 3.50	
X	0.75 OD x 4.00	–	0.75 OD x 4.00	
CP Series	0.50 OD x 3.50			–
VGA	0.75 OD x 2.00	–		



for Refrigerants 22-134a-404A-507 — SAE Flare Connections

TYPE BF

for complete details of construction, see page 36

Sporlan Type BF valve is a small brass bar body valve with SAE flare connections and balanced port construction. This valve has the same exterior dimensions as the Type F valve. The thermostatic element is replaceable, and the inlet connection has a removable 100 mesh strainer. The balanced port construction makes this valve ideally suited for small capacity refrigeration applications which operate over widely varying operating conditions.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections	*Distributors*
1/2" SAE	1603, 1605, 1606, 1608, 1650(R)

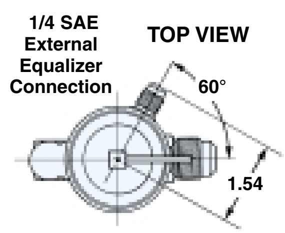
SPECIFICATIONS — ELEMENT SIZE NO. 43, KNIFE EDGE JOINT

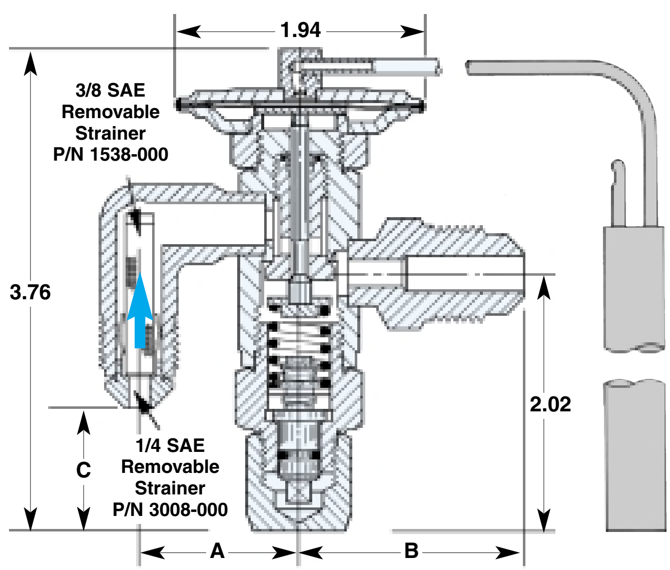
REFRIGERANT (Sporlan Code)	TYPE – SAE Flare – Internal Equalizer	TYPE – SAE Flare – External Equalizer	Port Size	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Inches	CONNECTIONS – Inches (Blue figures are standard and will be furnished unless otherwise specified.) SAE Flare – INLET	OUTLET	External Equalizer	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	BFV-AAA	BFVE-AAA	AAA	1/8 thru 1/3	C Z ZP40	30	1/4 or 3/8 Elbow ①	3/8 or 1/2	1/4	1	1-1/2
	BFV-AA	BFVE-AA	AA	1/2 thru 2/3							
	BFV-A	BFVE-A	A	3/4 thru 1-1/2			1/4 or 3/8 Elbow ①				
	BFV-B	BFVE-B	B	1-3/4 thru 3			3/8 Elbow				
	BFV-C	BFVE-C	C	3-1/4 thru 5-1/2							
134a (J) 12 (F) 401A (X) 409A (F)	BFJ-AAA	BFJE-AAA	AAA	1/8 thru 1/5	C		1/4 or 3/8 Elbow ①				
	BFJ-AA	BFJE-AA	AA	1/4 thru 1/3							
	BFJ-A	BFJE-A	A	1/2 thru 1			1/4 or 3/8 Elbow ①				
	BFJ-B	BFJE-B	B	1-1/4 thru 1-3/4			3/8 Elbow				
	BFJ-C	BFJE-C	C	2 thru 3							
404A (S) 502 (R) 408A (R)	BFS-AAA	BFSE-AAA	AAA	1/8 thru 1/5	C Z ZP		1/4 or 3/8 Elbow ①				
	BFS-AA	BFSE-AA	AA	1/4 thru 1/3							
	BFS-A	BFSE-A	A	1/2 thru 1			1/4 or 3/8 Elbow ①				
	BFS-B	BFSE-B	B	1-1/4 thru 2			3/8 Elbow				
	BFS-C	BFSE-C	C	2-1/4 thru 3							
507 (P) 402A (L)	BFP-AAA	BFPE-AAA	AAA	1/8 thru 1/5	C Z ZP		1/4 or 3/8 Elbow ①				
	BFP-AA	BFPE-AA	AA	1/4 thru 1/3							
	BFP-A	BFPE-A	A	1/2 thru 1			1/4 or 3/8 Elbow ①				
	BFP-B	BFPE-B	B	1-1/4 thru 2			3/8 Elbow				
	BFP-C	BFPE-C	C	2-1/4 thru 3							

① The 3/8" SAE inlet fitting has a long taper on the flare surface. A 3/8" x 1/4" reducing flare nut will allow 1/4" OD tubing to be attached to this fitting.

DIMENSIONS – Inches Connections - SAE Flare

FITTINGS SIZE	A	B	C
1/4 Elbow	1.19	–	1.34
3/8 Elbow	1.35	–	.98
3/8 SAE	–	1.61	–
1/2 SAE	–	1.80	–





BULB SIZES – Inches

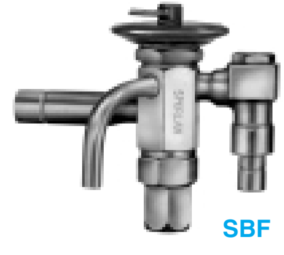
STANDARD CHARGES	REFRIGERANT – 22	REFRIGERANT – 134a	REFRIGERANT – 404A	REFRIGERANT – 507
C	0.50 OD x 3.00			
Z & ZP Series	0.50 OD x 3.00	–	0.50 OD x 3.00	

TYPE SBF & EBF

for Refrigerants 22-134a-404A-507 — Extended Solder Connections

Sporlan Types SBF & EBF are small brass bar body valves with Extended ODF solder connections and the same balanced port construction as the Type BF valve. Both valves have replaceable thermostatic elements. The Type EBF has a 100 mesh insert strainer. The Type SBF has a 100 mesh removable strainer that can be cleaned and/or replaced while the valve is still soldered to the system tubing. The balanced port construction makes these valves ideally suited for small capacity refrigeration applications which operate over widely varying conditions.

Refrigerant distributors that will mate directly to these valves are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.



SBF

EBF

Replaceable Strainer
U.S. Patent
No. 5,232,015

Outlet Connections	*Distributors*
1/2" ODF	1613, 1616
5/8" ODF	1620, 1622, 1651(R)

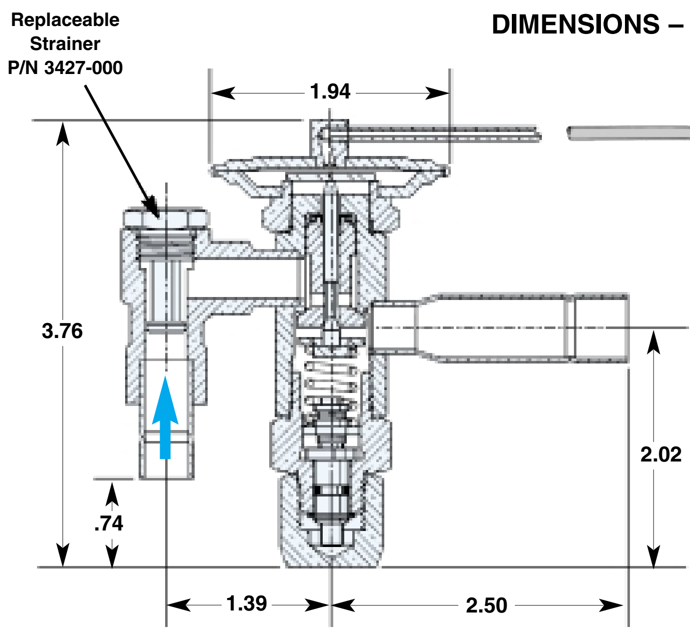
for complete details of construction, see page 36

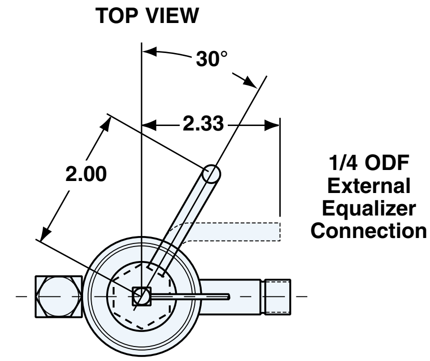
SPECIFICATIONS — ELEMENT SIZE NO. 43, KNIFE EDGE JOINT

REFRIGERANT (Sporlan Code)	TYPE SBF Extended ODF Solder (with replaceable strainer) Internal Equalizer	TYPE SBF Extended ODF Solder (with replaceable strainer) External Equalizer	TYPE EBF Extended ODF Solder Internal Equalizer	TYPE EBF Extended ODF Solder External Equalizer	Port Size	NOMINAL CAPACITY RANGE Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Inches	CONNECTIONS – Inches (Blue figures are standard and will be furnished unless otherwise specified.) Extended ODF Solder INLET	OUTLET	External Equalizer	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	SBFV-AAA	SBFVE-AAA	EBFV-AAA	EBFVE-AAA	AAA	1/8 thru 1/3	C Z ZP40	30	3/8	1/2 or 5/8	1/4 Pointed Toward Bottom Cap or Parallel to Outlet Connection	1	1-1/2
	SBFV-AA	SBFVE-AA	EBFV-AA	EBFVE-AA	AA	1/2 thru 2/3							
	SBFV-A	SBFVE-A	EBFV-A	EBFVE-A	A	3/4 thru 1-1/2							
	SBFV-B	SBFVE-B	EBFV-B	EBFVE-B	B	1-3/4 thru 3							
	SBFV-C	SBFVE-C	EBFV-C	EBFVE-C	C	3-1/4 thru 5-1/2							
134a (J) 12 (F) 401A (X) 409A (F)	SBFJ-AAA	SBFJE-AAA	EBFJ-AAA	EBFJE-AAA	AAA	1/8 thru 1/5	C						
	SBFJ-AA	SBFJE-AA	EBFJ-AA	EBFJE-AA	AA	1/4 thru 1/3							
	SBFJ-A	SBFJE-A	EBFJ-A	EBFJE-A	A	1/2 thru 1							
	SBFJ-B	SBFJE-B	EBFJ-B	EBFJE-B	B	1-1/4 thru 1-3/4							
	SBFJ-C	SBFJE-C	EBFJ-C	EBFJE-C	C	2 thru 3							
404A (S) 502 (R) 408A (R)	SBFS-AAA	SBFSE-AAA	EBFS-AAA	EBFSE-AAA	AAA	1/8 thru 1/5	C Z ZP						
	SBFS-AA	SBFSE-AA	EBFS-AA	EBFSE-AA	AA	1/4 thru 1/3							
	SBFS-A	SBFSE-A	EBFS-A	EBFSE-A	A	1/2 thru 1							
	SBFS-B	SBFSE-B	EBFS-B	EBFSE-B	B	1-1/4 thru 2							
	SBFS-C	SBFSE-C	EBFS-C	EBFSE-C	C	2-1/4 thru 3							
507 (P) 402A (L)	SBFP-AAA	SBFPE-AAA	EBFP-AAA	EBFPE-AAA	AAA	1/8 thru 1/5	C Z ZP						
	SBFP-AA	SBFPE-AA	EBFP-AA	EBFPE-AA	AA	1/4 thru 1/3							
	SBFP-A	SBFPE-A	EBFP-A	EBFPE-A	A	1/2 thru 1							
	SBFP-B	SBFPE-B	EBFP-B	EBFPE-B	B	1-1/4 thru 2							
	SBFP-C	SBFPE-C	EBFP-C	EBFPE-C	C	2-1/4 thru 3							

SBF

DIMENSIONS – Inches

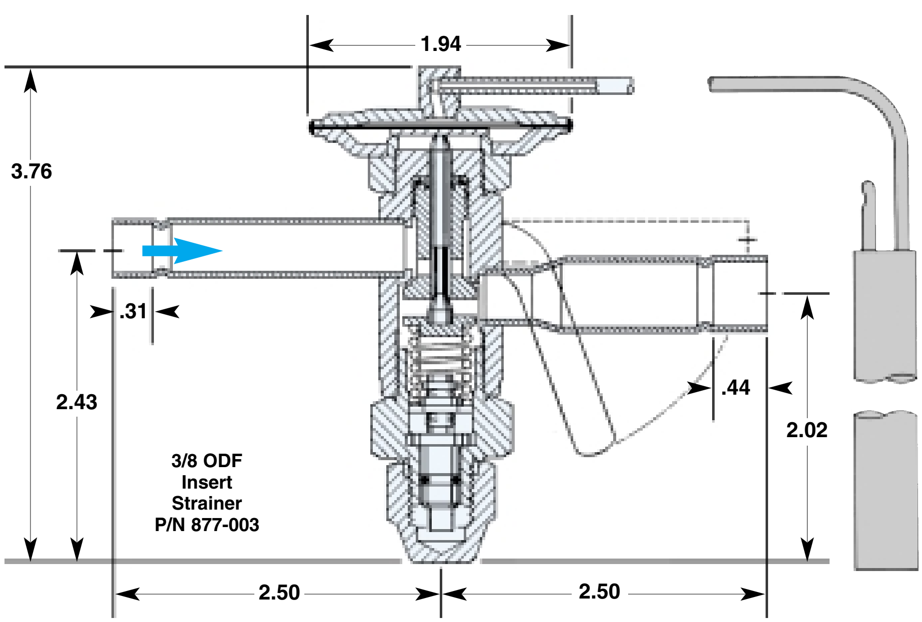


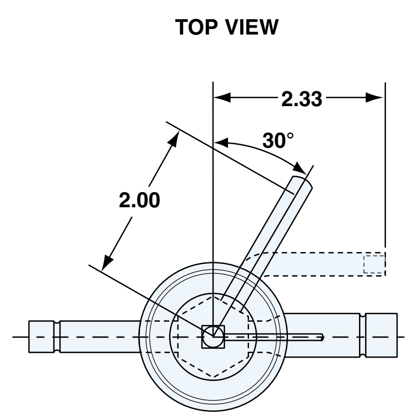


BULB SIZES – Inches				
STANDARD CHARGES	REFRIGERANT			
	22	134a	404A	507
C	0.50 OD x 3.00			
Z & ZP Series	0.50 OD x 3.00	–	0.50 OD x 3.00	

EBF

DIMENSIONS – Inches





BULB SIZES – Inches				
STANDARD CHARGES	REFRIGERANT			
	22	134a	404A	507
C	0.50 OD x 3.00			
Z & ZP Series	0.50 OD x 3.00	–	0.50 OD x 3.00	

TYPE S

for Refrigerants 22-134a-404A-507 — ODF Solder Connections

Sporlan Type S valve is a brass bar body, externally adjustable valve with ODF solder connections. The thermostatic element is replaceable, and the inlet connection has a permanent 12 mesh strainer. This valve is designed for both air conditioning and refrigeration applications.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections	*Distributors*
5/8" ODF	1620, 1622, 1651(R)
7/8" ODF	1112, 1113, 1653(R)
1-1/8" ODF	1115, 1116, 1655(R)

for complete details of construction, see page 36

SPECIFICATIONS ELEMENT SIZE NO. 83, KNIFE EDGE JOINT

REFRIGERANT (Sporlan Code)	TYPE: Internal Equalizer ⑥	TYPE: External Equalizer ⑦	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Feet	CONNECTIONS – Inches ⑧ ODF Solder: INLET	CONNECTIONS – Inches ⑧ ODF Solder: OUTLET	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	SV-2	SVE-2	2	Refer to Recommended Thermostatic Charges on Page 4	5	3/8 or 1/2	5/8, 7/8 or 1-1/8	2	3
	SV-3	SVE-3	3						
	SV-4	SVE-4	4			1/2	5/8, 7/8 or 1-1/8		
	SV-5	SVE-5	5						
	–	SVE-8	8			5/8	7/8 or 1-1/8		
	–	SVE-10	10						
134a (J) 12 (F) 401A (X) 409A (F)	SJ-2	SJE-2	2			3/8 or 1/2	5/8, 7/8 or 1-1/8		
	SJ-2-1/2	SJE-2-1/2	2-1/2			1/2	5/8, 7/8 or 1-1/8		
	SJ-3	SJE-3	3						
	–	SJE-5	5			5/8	7/8 or 1-1/8		
	–	SJE-6	6						
404A (S) 502 (R) 408A (R)	SS-2	SSE-2	2			3/8 or 1/2	5/8, 7/8 or 1-1/8		
	SS-3	SSE-3	3			1/2	5/8, 7/8 or 1-1/8		
	SS-4	SSE-4	4						
	–	SSE-6	6			5/8	7/8 or 1-1/8		
	–	SSE-7	7						
507 (P) 402A (L)	SP-2	SPE-2	2			3/8 or 1/2	5/8, 7/8 or 1-1/8		
	SP-3	SPE-3	3			1/2	5/8, 7/8 or 1-1/8		
	SP-4	SPE-4	4						
	–	SPE-6	6			5/8	7/8 or 1-1/8		
	–	SPE-7	7						

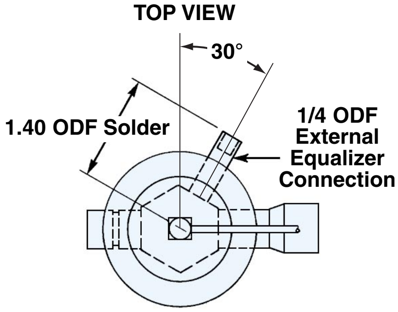
Blue figures are standard and will be furnished unless otherwise specified.

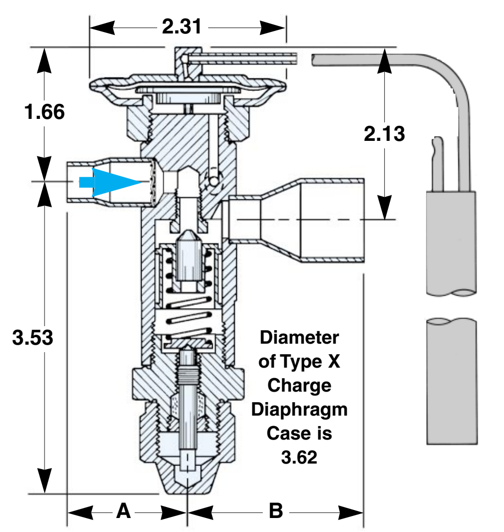
⑥ Valves listed in this column NOT AVAILABLE with MOP Type air conditioning charges.
⑦ Standard External Equalizer Connection 1/4" ODF Solder, 1/4" SAE flare connection available on request.
⑧ ODF Solder indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus 5/8" ODF will receive 5/8" OD tubing.

DIMENSIONS – Inches

FITTING SIZE	A	B
3/8	1.34	–
1/2	1.29	1.36
5/8	1.50	1.57
7/8	–	2.13
1-1/8	–	2.19

TOP VIEW





BULB SIZES – Inches

STANDARD CHARGES	REFRIGERANT: 22	REFRIGERANT: 134a	REFRIGERANT: 404A	REFRIGERANT: 507
C	0.50 OD x 3.50			
Z & ZP Series	0.50 OD x 3.50	–	0.50 OD x 3.50	
X	0.75 OD x 4.00	–	0.75 OD x 4.00	
CP Series	0.50 OD x 3.50			–
VGA	0.75 OD x 2.00	–		

TYPE EBS

for Refrigerants 22-134a-404A-507 — Extended ODF Solder Connections

for complete details of construction, see page 36

Sporlan Type EBS valve is a brass bar body valve having the same physical size as the Type S valve except the Type EBS features a balanced port construction and extended ODF connections. The thermostatic element is replaceable. The balanced port construction makes this valve ideally suited for refrigeration and air conditioning applications which operate over widely varying conditions.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections	*Distributors*
7/8” ODF	1112, 1113, 1653(R)
1-1/8” ODF	1115, 1116, 1655(R)
1-3/8” ODF	1117, 1126, 1128, 1657(R)

SPECIFICATIONS — ELEMENT SIZE NO. 83, KNIFE EDGE JOINT

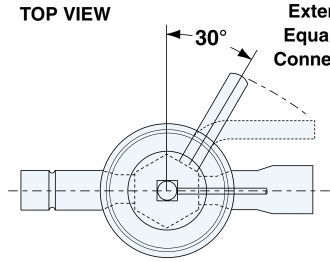
REFRIGERANT (Sporlan Code)	TYPE External Equalizer	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Feet	CONNECTIONS – Inches Blue figures are standard and will be furnished unless otherwise specified. ⑧ Extended ODF Solder INLET	OUTLET	External Equalizer	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	EBSVE-8	8	* Refer to Recommended Thermostatic Charges on Page 4	5	1/2 or 5/8	7/8 or 1-1/8	1/4 Pointed Toward Bottom Cap or Parallel to Connection	2	3
	EBSVE-11	11			1/2, 5/8 or 7/8	7/8, 1-1/8 or 1-3/8			
134a (J) 12 (F) 401A (X) 409A (F)	EBSJE-5	5			1/2 or 5/8	7/8 or 1-1/8			
	EBSJE-7	7			1/2, 5/8 or 7/8	7/8, 1-1/8 or 1-3/8			
404A (S) 502 (R) 408A (R)	EBSSE-6	6			1/2 or 5/8	7/8 or 1-1/8			
	EBSSE-7-1/2	7-1/2			1/2, 5/8 or 7/8	7/8, 1-1/8 or 1-3/8			
507 (P) 402A (L)	EBSPE-6	6			1/2 or 5/8	7/8 or 1-1/8			
	EBSPE-7-/12	7-1/2			1/2, 5/8 or 7/8	7/8, 1-1/8 or 1-3/8			

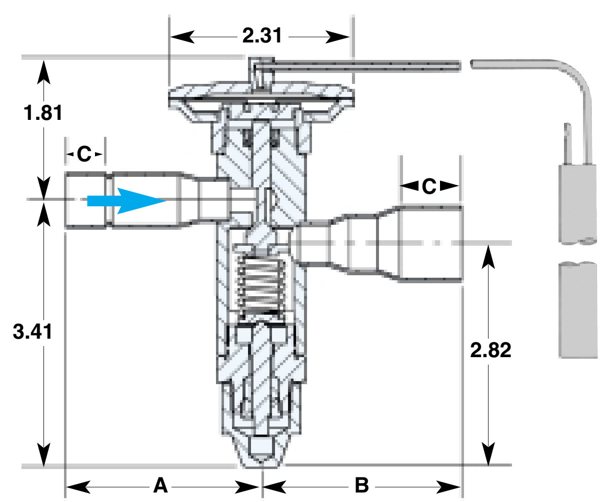
⑧ ODF Solder indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus 5/8” ODF will receive 5/8” OD tubing.

* X - Charge Not Available

DIMENSIONS – Inches

FITTING SIZE	A	B	C
1/2	2.49	–	.37
5/8	2.46	–	.50
7/8	2.46	2.53	.75
1-1/8	–	2.53	.81
1-3/8	–	3.04	.97





BULB SIZES – Inches

STANDARD CHARGES	REFRIGERANT 22	134a	404A	507
C	0.50 OD x 3.50			
Z & ZP Series	0.50 OD x 3.50	–	0.50 OD x 3.50	
CP Series	0.50 OD x 3.50			–
VGA	0.75 OD x 2.00	–		

TYPE O

for Refrigerants 22-134a-404A-507 — ODF Solder Connections

U.S. Patent Number 3,742,722

Sporlan Type O valve is a brass bar body, externally adjustable valve with ODF solder connections. The thermostatic element is replaceable, and the inlet connection has a permanent 12 mesh strainer. This valve type features a balanced port construction, and it is designed for both air conditioning and refrigeration applications. A synthetic seating surface provides tight shut-off during system off periods.

This valve type has two body styles: a small body which provides capacities up to 30 tons R-22, and a large body which extends capacities to 70 tons R-22.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

for complete details of construction, see page 36

Outlet Connections	*Distributors*
1-1/8” ODF	1115, 1116, 1655(R)
1-3/8” ODF	1117, 1126, 1128, 1657(R)
1-5/8” ODF	1125, 1127, 1143, 1659(R)

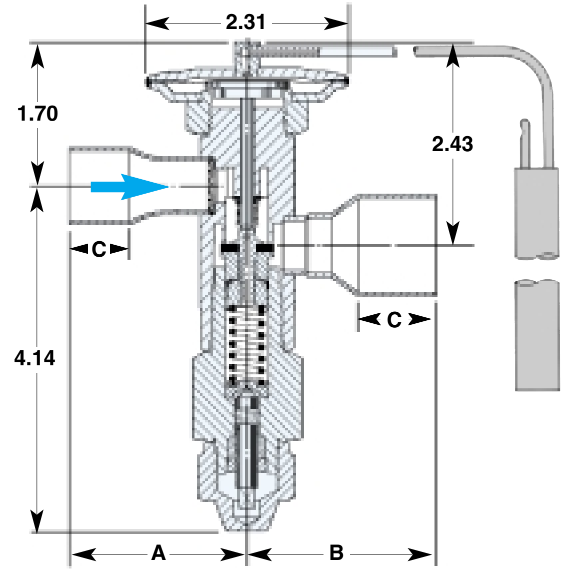
SPECIFICATIONS ELEMENT SIZE NO.'s 83 and 33, KNIFE EDGE JOINT

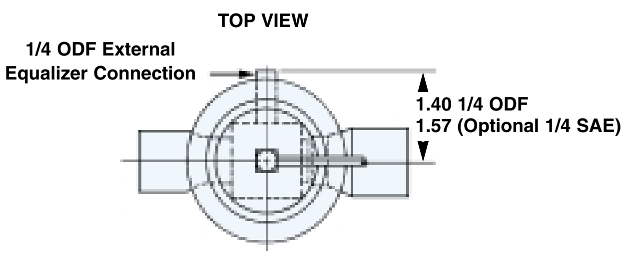
REFRIGERANT (Sporlan Code)	TYPE External Equalizer ⑦	NOMINAL CAPACITY Tons of Refrigeration	Element Size No.	Thermostatic Charges Available	Standard Tubing Length-Feet	CONNECTIONS – Inches ⑧ ODF Solder (Blue figures are standard and will be furnished unless otherwise specified.) INLET	OUTLET	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	OVE-15	**15**	83	* Refer to Recommended Thermostatic Charges on Page 4	**5**	7/8	1-1/8	2	3
	OVE-20	**20**					1-3/8		
	OVE-30	**30**				1-1/8			
	OVE-40	**40**	33				1-3/8 or 1-5/8	4	5
	OVE-55	**55**							
	OVE-70	**70**							
134a (J) 12 (F) 401A (X) 409A (F)	OJE-9	**9**	83			7/8	1-1/8	2	3
	OJE-12	**12**					1-3/8		
	OJE-16	**16**				1-1/8			
	OJE-23	**23**	33				1-3/8 or 1-5/8	4	5
	OJE-32	**32**							
	OJE-40	**40**							
404A (S) 502 (R) 408A (R)	OSE-9	**9**	83			7/8	1-1/8	2	3
	OSE-12	**12**					1-3/8		
	OSE-21	**21**				1-1/8			
	OSE-30	**30**	33				1-3/8 or 1-5/8	4	5
	OSE-35	**35**							
	OSE-45	**45**							
507 (P) 402A (L)	OPE-9	**9**	83			7/8	1-1/8	2	3
	OPE-12	**12**					1-3/8		
	OPE-21	**21**				1-1/8			
	OPE-30	**30**	33				1-3/8 or 1-5/8	4	5
	OPE-35	**35**							
	OPE-45	**45**							

⑦ Standard External Equalizer Connection 1/4” ODF Solder, 1/4” SAE flare connection available on request.
⑧ ODF Solder indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus 5/8” ODF will receive 5/8” OD tubing.

* X - Charge Not Available

TYPE O WITH NUMBER 83 ELEMENT

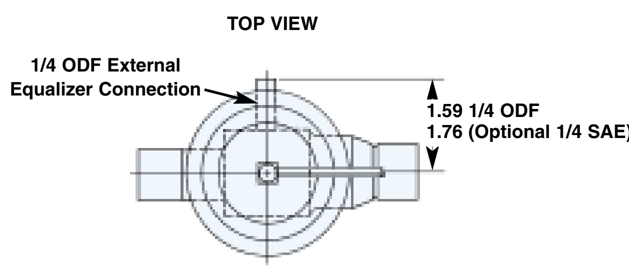


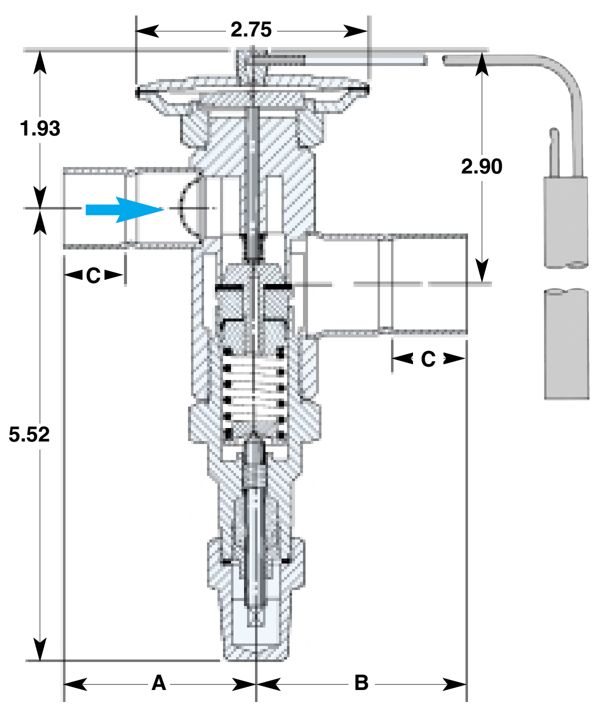


DIMENSIONS – Inches			
STRAIGHT THRU ODF SOLDER	A	B	C
7/8	2.09	2.08	0.75
1-1/8	2.21	2.23	0.91
1-3/8	–	2.39	0.97

BULB SIZES – Inches				
STANDARD CHARGES	REFRIGERANT			
	22	134a	404A	507
C	0.50 OD x 3.50			
Z & ZP Series	0.50 OD x 3.50	–	0.50 OD x 3.50	
CP Series	0.50 OD x 3.50			–
VGA	0.75 OD x 2.00	–		

TYPE O WITH NUMBER 33 ELEMENT





DIMENSIONS – Inches			
STRAIGHT THRU ODF SOLDER	A	B	C
1-1/8	2.69	–	0.91
1-3/8	–	2.84	0.97
1-5/8	–	3.12	1.09

BULB SIZES – Inches				
STANDARD CHARGES	REFRIGERANT			
	22	134a	404A	507
C	0.75 OD x 4.00	0.50 OD x 5.00	0.75 OD x 4.00	
Z & ZP Series	0.75 OD x 4.00	–	0.75 OD x 4.00	
CP Series	0.75 OD x 4.00			–
VGA	0.75 OD x 4.00	–		

TYPE H

for Refrigerants 22-134a-404A-507 — ODF Solder-Flange Connections

Sporlan Type H valve is a brass bar body, externally adjustable valve available with either ODF solder or FPT flange connections. The thermostatic element is replaceable, and the inlet connection has a permanent 16 mesh strainer. The FPT flange connection requires the Sporlan K-1178 adapter kit. This valve type provides the smallest capacity TEVs with flange connections, and it is designed for both air conditioning and refrigeration applications.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections	*Distributors*
5/8" ODF	1620, 1622, 1651(R)
7/8" ODF	1112, 1113, 1653(R)
1-1/8" ODF	1115, 1116, 1655(R)
"H" flange type	1109, 1110, 1124, 1192 (aluminum)

for complete details of construction, see page 36

SPECIFICATIONS ELEMENT SIZE NO. 33, KNIFE EDGE JOINT

REFRIGERANT (Sporlan Code)	TYPE Internal Equalizer ⑥	TYPE External Equalizer ⑦	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Feet	CONNECTIONS – Inches ⑧ ODF Solder Flange INLET	CONNECTIONS – Inches OUTLET	Flange Ring Size OD x ID Inches ⑨	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	HV-2-1/2	HVE-2-1/2	**2-1/2**	Refer to Recommended Thermostatic Charges on Page 4	5	1/2 or 5/8	5/8 or 7/8	1.25 x 1.00	5	6
	HV-5-1/2	HVE-5-1/2	**5-1/2**			5/8 or 7/8	7/8 or 1-1/8			
	–	HVE-7	**7**							
	–	HVE-11	**11**							
	–	HVE-16	**16**			7/8	7/8 or 1-1/8			
	–	HVE-20	**20**							
134a (J) 12 (F) 401A (X) 409A (F)	HJ-1-1/2	HJE-1-1/2	**1-1/2**			1/2 or 5/8	5/8 or 7/8			
	HJ-3	HJE-3	**3**			5/8 or 7/8	7/8 or 1-1/8			
	HJ-4	HJE-4	**4**							
	HJ-5	HJE-5	**5**							
	–	HJE-8	**8**							
	–	HJE-12	**12**			7/8	7/8 or 1-1/8			
404A (S) 502 (R) 408A (R)	HS-1-1/2	HSE-1-1/2	**1-1/2**			1/2 or 5/8	5/8 or 7/8			
	HS-3	HSE-3	**3**			5/8 or 7/8	7/8 or 1-1/8			
	HS-4	HSE-4	**4**							
	–	HSE-6-1/2	**6-1/2**							
	–	HSE-9	**9**							
	–	HSE-12	**12**			7/8	7/8 or 1-1/8			
507 (P) 402A (L)	HP-1-1/2	HPE-1-1/2	**1-1/2**			1/2 or 5/8	5/8 or 7/8			
	HP-3	HPE-3	**3**			5/8 or 7/8	7/8 or 1-1/8			
	HP-4	HPE-4	**4**							
	–	HPE-6-1/2	**6-1/2**							
	–	HPE-9	**9**							
	–	HPE-12	**12**			7/8	7/8 or 1-1/8			

Blue figures are standard and will be furnished unless otherwise specified.

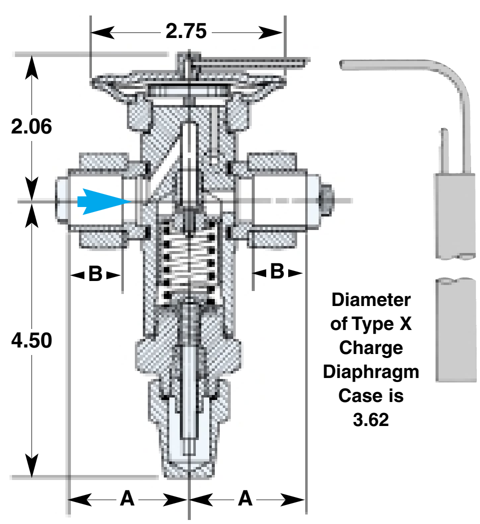
⑥ Valves listed in this column NOT AVAILABLE with MOP Type air conditioning charges.
⑦ Standard External Equalizer Connection 1/4" SAE Flare, 1/4" ODF Solder connection available on request.
⑧ ODF Solder indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus, 5/8" ODF will receive 5/8" OD tubing.
⑨ Kit K-1178 with two brass bushings is available for two purposes: 1) To allow the current Type H valve to replace obsolete Types T and H with 1.125" x 0.75" flange rings by mating with the smaller flange ring bushings and/or distributors. 2) To allow the Type H to use 1/2" FPT connections — Part number 225-002 and 1/2" socket weld connections — Part number 580-000. Order the appropriate 1/2" connections and one K-1178 per valve.

DIMENSIONS – Inches

SOLDER BUSHING	A	B
1/2, 5/8, 7/8	2.00	0.88
1-1/8	2.06	0.94

BULB SIZES – Inches

STANDARD CHARGES	REFRIGERANT 22	134a	404A	507
C	0.75 OD x 4.00	0.50 OD x 5.00	0.75 OD x 4.00	
Z & ZP Series	0.75 OD x 4.00	–	0.75 OD x 4.00	
X	0.75 OD x 4.00	–	0.75 OD x 4.00	
CP Series	0.75 OD x 4.00			–
VGA	0.75 OD x 4.00	–		



for Refrigerants 22-134a-404A-507 — ODF Solder-Flange Connections

for complete details of construction, see page 36

Sporlan Type M valve is a cast bronze body, externally adjustable valve with either ODF solder or FPT flange connections. The thermostatic element is replaceable, and the inlet connection has a permanent 12 mesh strainer. This valve type provides capacities greater than the Type H, and it is designed for both air conditioning and refrigeration applications. Flanges for the Type M valve are interchangeable with the Type V.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections	*Distributors*
1-1/8" ODF	1115, 1116, 1655(R)
1-3/8" ODF	1117, 1126, 1128, 1657(R)
1-5/8" ODF	1125, 1127, 1143, 1659(R)
"M/V" flange	1119, 1121, 1193 (aluminum)

SPECIFICATIONS ELEMENT SIZE NO. 63, GASKET JOINT

Blue figures are standard and will be furnished unless otherwise specified.

REFRIGERANT (Sporlan Code)	TYPE External Equalizer ⑦	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Feet	⑩ CONNECTIONS – INCHES ⑪ ODF Solder Flange INLET	⑩ CONNECTIONS – INCHES ⑪ ODF Solder Flange OUTLET	Flange Ring Size OD x ID Inches	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	MVE-21	21	Refer to Recommended Thermostatic Charges on Page 4	5 10	7/8 or 1-1/8	1-1/8 1-3/8 or 1-5/8	1.75 x 1.25	8	9
	MVE-26	26							
	MVE-34	34							
	MVE-42	42			7/8 or 1-1/8				
134a (J) 12 (F) 401A (X) 409A (F)	MJE-15	15			7/8 or 1-1/8				
	MJE-20	20							
	MJE-25	25			7/8 or 1-1/8				
404A (S) 502 (R) 408A (R)	MSE-15	15			7/8 or 1-1/8				
	MSE-20	20							
	MSE-25	25							
	MSE-30	30			7/8 or 1-1/8				
507 (P) 402A (L)	MPE-15	15			7/8 or 1-1/8				
	MPE-20	20							
	MPE-25	25							
	MPE-30	30			7/8 or 1-1/8				

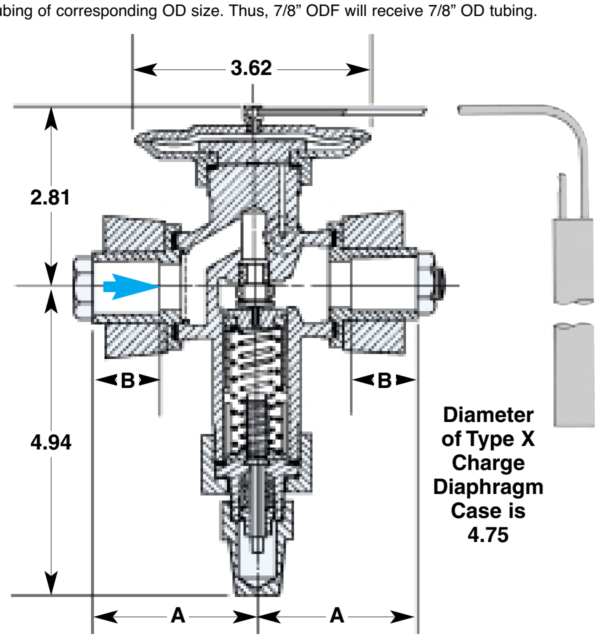
⑦ Standard External Equalizer Connection 1/4" SAE Flare. 1/4" ODF Solder connection available on request.
⑩ FPT connections also available on request; 1/2" FPT - Part Number 360-000, 3/4" FPT - Part Number 360-001, 1" FPT - Part Number 362-000.
⑪ ODF Solder indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus, 7/8" ODF will receive 7/8" OD tubing.

DIMENSIONS – Inches

SOLDER BUSHING	A	B
7/8	2.38	0.88
1-1/8, 1-3/8	2.75	0.94
1-5/8	3.22	1.22

BULB SIZES – Inches

STANDARD CHARGES	REFRIGERANT 22	REFRIGERANT 134a	REFRIGERANT 404A	REFRIGERANT 507
C	0.88 OD x 6.00			
Z & ZP Series	0.88 OD x 6.00	–	0.88 OD x 6.00	
X	0.88 OD x 6.00	–	0.88 OD x 6.00	
CP Series	0.75 OD x 4.00			–
VGA	0.75 OD x 4.00	–		



TYPE V

for Refrigerants 22-134a-404A-507 — ODF Solder-Flange Connections

Sporlan Type V valve is a cast bronze body, externally adjustable valve available with either ODF solder or FPT flange connections. The thermostatic element is replaceable, and the inlet connection has a permanent 12 mesh strainer. This valve features a dual port semi-balanced design, and it is designed for both air conditioning and refrigeration applications. A synthetic seating surface provides tight shut-off during system off periods. This valve provides greater capacities than the Type M. Flanges for the Type V valve are interchangeable with the Type M.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

Outlet Connections	*Distributors*
1-3/8" ODF	1117, 1126, 1128, 1657(R)
1-5/8" ODF	1125, 1127, 1143, 1659(R)
"M/V" flange	1119, 1121, 1193 (aluminum)

for complete details of construction, see page 36

SPECIFICATIONS ELEMENT SIZE NO. 63, GASKET JOINT

REFRIGERANT (Sporlan Code)	TYPE External Equalizer ⑦	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Std. Tubing Lgth.-Ft.	⑩ CONNECTIONS – Inches ⑪ ODF Solder Flange INLET	⑩ CONNECTIONS – Inches ⑪ ODF Solder Flange OUTLET	Flange Ring Size OD x ID Inches	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	VVE-52	**52**	Refer to Recommended Thermostatic Charges on Page 4	**5** 10	1-1/8 or **1-3/8**	1-1/8 or **1-3/8** 1-5/8	1.75 x 1.25	9	10
	VVE-70	**70**							
	VVE-100	**100**							
134a (J) 12 (F) 401A (X) 409A (F)	VJE-35	**35**							
	VJE-45	**45**							
	VJE-55	**55**							
404A (S) 502 (R) 408A (R)	VSE-38	**38**							
	VSE-50	**50**							
	VSE-70	**70**							
507 (P) 402A (L)	VPE-38	**38**							
	VPE-50	**50**							
	VPE-70	**70**							

Blue figures are standard and will be furnished unless otherwise specified.

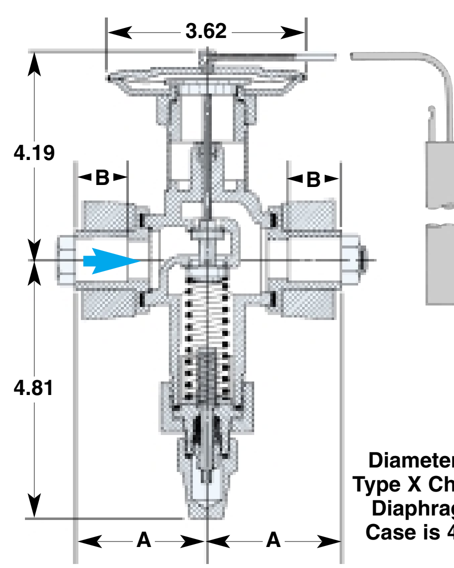
⑦ Standard External Equalizer Connection 1/4" SAE Flare. 1/4" ODF Solder connection available on request.
⑩ FPT connections also available on request; 1/2" FPT - Part Number 360-000, 3/4" FPT - Part Number 360-001, 1" FPT - Part Number 362-000.
⑪ ODF Solder indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus, 7/8" ODF will receive 7/8" OD tubing.

DIMENSIONS – Inches

SOLDER BUSHING	A	B
7/8	2.38	0.88
1-1/8, 1-3/8	2.75	0.94
1-5/8	3.22	1.22

BULB SIZES – Inches

STANDARD CHARGES	REFRIGERANT 22	REFRIGERANT 134a	REFRIGERANT 404A	REFRIGERANT 507
C	0.88 OD x 6.00			
Z & ZP Series	0.88 OD x 6.00	–	0.88 OD x 6.00	
X	0.88 OD x 6.00	–	0.88 OD x 6.00	
CP Series	0.75 OD x 4.00			–
VGA	0.75 OD x 4.00	–		



Diameter of Type X Charge Diaphragm Case is 4.75

for Refrigerants 22-134a — ODF Solder-Flange Connections

for complete details of construction, see page 36

Sporlan Type W valve is a cast bronze body, externally adjustable valve available with ODF solder flange connections. The thermostatic element is replaceable, and the inlet connection has a permanent 12 mesh strainer. This valve features a dual port semi-balanced design, and it is designed primarily for large capacity chillers. A synthetic seating surface provides tight shut-off during system off periods. This valve provides the largest capacities available for flange connection TEVs.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

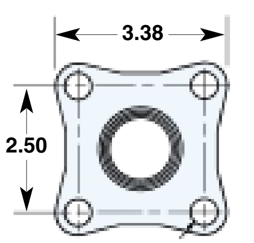
Outlet Connections	*Distributors*
1-3/8" ODF	1117, 1126, 1128, 1657(R)
1-5/8" ODF	1125, 1127, 1143, 1659(R)

SPECIFICATIONS — ELEMENT SIZE NO.'s 63 and 7, GASKET JOINT

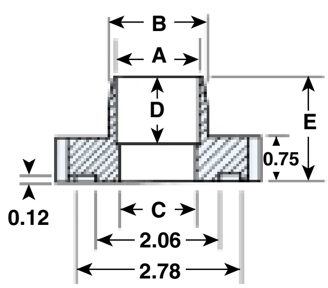
REFRIGERANT (Sporlan Code)	TYPE External Equalizer ⑦	NOMINAL CAPACITY Tons of Refrigeration	Thermostatic Charges Available	Element Size No.	Std. Tubing Lgth.-Ft.	CONNECTIONS – Inches ⑫ ODF Solder Flange INLET	CONNECTIONS – Inches ⑫ ODF Solder Flange OUTLET	Flange Ring Size OD x ID Inches ⑮	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	WVE-135	**135**	⑬	63	**10**	1-1/8 1-3/8 **1-5/8** or 2-1/8	1-1/8 1-3/8 1-5/8 or **2-1/8**	2.75 x 2.19	10	11
	WVE-180	**180**	G only	7						
134a (J) 12 (F) 401A (X) 409A (F)	WJE-80	**80**	⑬	63						
	WJE-110	**110**	G only	7						

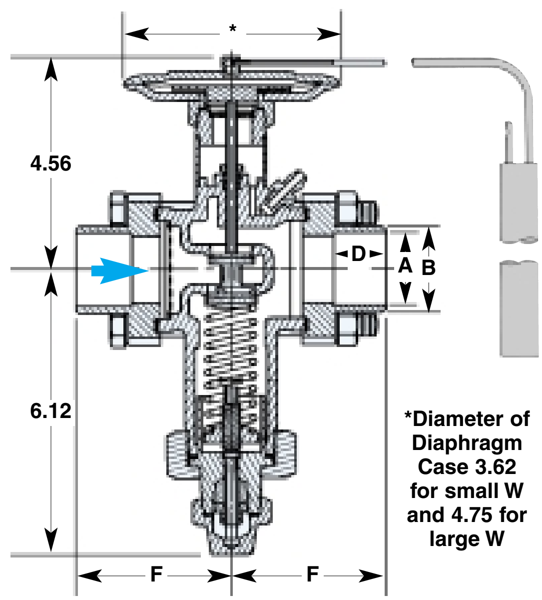
Blue figures are standard and will be furnished unless otherwise specified.

⑦ Standard External Equalizer Connection 1/4" SAE Flare, 1/4" ODF Solder connection available on request.
⑫ ODF Solder indicates a female connection on the valve of proper diameter to receive copper tubing of corresponding OD size. Thus, 1-1/8" ODF will receive 1-1/8" OD tubing.
⑬ Refer to Recommended Thermostatic Charges, Page 4.
⑮ For 1-1/2" NPT connections, order flanges separately for MA42 solenoid eg P/N 933-1. The customer must supply 5/8" diameter x 6" long bolts and 5/8" diameter nuts.



0.53 – Diameter Bolt Holes





DIMENSIONS – Inches

CONNECTIONS	A	B	C	D	E	F
1-1/8	1.12	1.27	1.06	0.91	1.56	3.09
1-3/8	1.38	1.53	1.28	0.97	1.62	3.16
1-5/8	1.62	1.78	1.50	1.09	1.75	3.28
2-1/8	2.12	2.44	1.94	1.34	1.53	3.25

BULB SIZES – Inches

ELEMENT SIZE NO.	STANDARD CHARGES	REFRIGERANT 22	REFRIGERANT 134a
63	C	0.88 OD x 6.00	0.88 OD x 6.00
	Z & ZP Series	0.88 OD x 6.00	–
	X	0.88 OD x 6.00	–
	CP Series	0.75 OD x 4.00	0.75 OD x 4.00
	VGA	0.75 OD x 4.00	–
7	G	0.75 OD x 4.00	–

TYPE D

for Refrigerant 717 Ammonia — FPT Flange Connections

Sporlan Type D valve is a gray cast iron body, externally adjustable valve available with either FPT or socket weld flange connections. The thermostatic element is replaceable, and all internal parts are serviceable. An optional XD-074 (1/2'' FPT) external inlet strainer may be ordered with this valve. This valve type provides the smallest capacity TEVs for ammonia service. The nominal 1 and 2 ton Type D valves are identical with the exception of their discharge tubes. One of these valves can be converted to the other by exchanging the discharge tubes. The nominal 10 and 15 ton Type D valves are also identical with the exception of their discharge tubes, and may be converted to each other by exchanging discharge tubes.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject. Note: The discharge tubes must be removed when a refrigerant distributor is applied to the valves.

Outlet Connections	*Distributors*
"D" flange	1130, 1132, 1133, 1180 (aluminum) 1182 (aluminum)

Refer to Sporlan Catalog 717 for complete information on Sporlan's line of products for ammonia refrigeration systems.

for complete details of construction, see page 36

SPECIFICATIONS ELEMENT SIZE NO. 23, GASKET JOINT

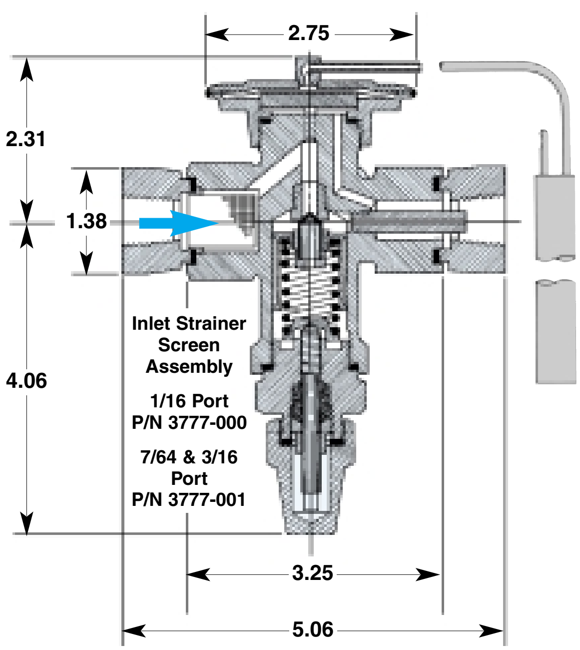
TYPE: Internal Equalizer	TYPE: External Equalizer 1/8" FPT	NOMINAL CAPACITY Tons of Refrigeration	Port Size Inches	Discharge Tube Orifice Inches	⑬ Thermostatic Charges Available	Std. Tubing Lgth.-Ft.	CONNECTIONS – Inches ⑭ FPT: INLET	CONNECTIONS – Inches ⑭ FPT: OUTLET	Flange Ring Size OD X ID Inches	Net Weight-Lbs.	Shipping Weight-Lbs.
DA-1	DAE-1	**1**	1/16	1/32							
DA-2	DAE-2	**2**	1/16	1/16							
DA-5	DAE-5	**5**	7/64	5/64	**C-Z-L**	5 10 15	1/4, 3/8 or 1/2		1.12 x 0.75	8	9
DA-10	DAE-10	**10**	3/16	7/64							
DA-15	DAE-15	**15**	3/16	5/32							

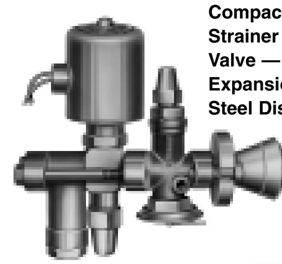
Blue figures are standard and will be furnished unless otherwise specified. (Standard: 10 ft. tubing; 1/2 connection.)

⑬ Refer to Page 4 for Application Recommendations.
⑭ Socket weld connections available upon request.

BULB SIZES – Inches

CHARGES	REFRIGERANT 717 - Ammonia
C - Z - L	0.75 x 4.00





Compact combination of XD Strainer — MA5A3 Solenoid Valve — DA Thermostatic Expansion Valve & 1130 Steel Distributor

Types XD Strainer — DA Thermostatic Expansion Valve & 1132 Steel Distributor

for Refrigerant 717 – Ammonia — FPT Flange Connections

Sporlan Type A valve is a gray cast iron body, externally adjustable valve with either FPT or socket weld flange connections. The thermostatic element is replaceable. An optional 8004 (1/2'' FPT) or 8006 (3/4'' FPT) strainer may be ordered with this valve. This valve provides the largest capacity TEVs for ammonia service.

The nominal 20 and 30 ton Type A valves are identical with the exception of their discharge tubes. One of these valves can be converted to the other by exchanging their discharge tubes. The nominal 75 and 100 ton Type A valves do not employ a discharge tube, nor are their outlets tapped to receive one.

Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject. Note that the discharge tube must be removed from the nominal 20, 30, and 50 ton Type A valves when a refrigerant distributor is applied.

Refer to Sporlan Catalog 717 for complete information on Sporlan's line of products for ammonia refrigeration systems.

for complete details of construction, see page 36

Outlet Connections
"A" flange

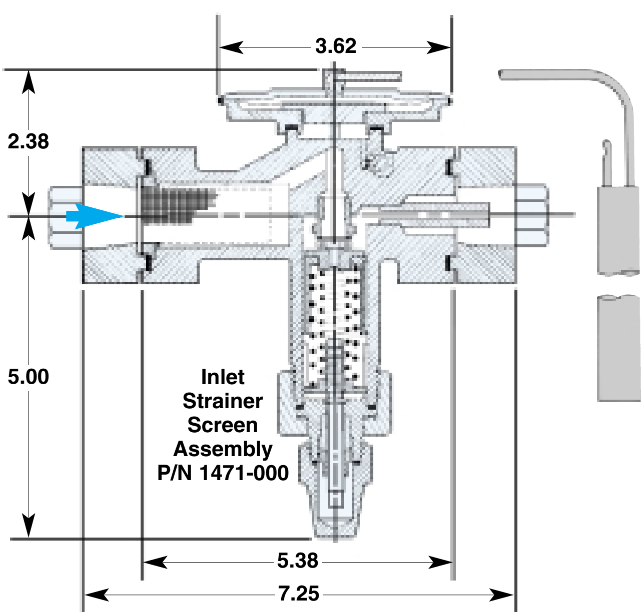
Distributors
1138, 1185 (aluminum)

SPECIFICATIONS — ELEMENT SIZE NO. 12, GASKET JOINT

TYPE: Internal Equalizer	TYPE: External Equalizer 1/8" FPT	NOMINAL CAPACITY Tons of Refrigeration	Port Size Inches	Discharge Tube Orifice Inches	Thermostatic Charges Available	Std. Tubing Lgth.-Ft.	CONNECTIONS – Inches ⑭ FPT: INLET	CONNECTIONS – Inches ⑭ FPT: OUTLET	Flange Ring Size OD x ID Inches	Net Weight-Lbs.	Shipping Weight-Lbs.
AA-20	AAE-20	**20**	5/16	1/8	L Only	10, 15	1/2, 3/4 or 1		1.75 x 1.25	10	11
AA-30	AAE-30	**30**	5/16	5/32							
AA-50	AAE-50	**50**	3/8	3/16							
AA-75	AAE-75	**75**	3/8	–			3/4 or 1				
AA-100	AAE-100	**100**	7/16	–							

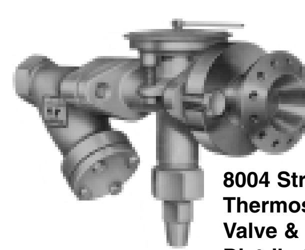
Blue figures are standard and will be furnished unless otherwise specified.

⑭ Socket weld connections available upon request.



BULB SIZES – Inches

CHARGE	REFRIGERANT 717 - Ammonia
L - Only	0.88 OD x 6.00



8004 Strainer – AA Thermostatic Expansion Valve & 1185 Aluminum Distributor

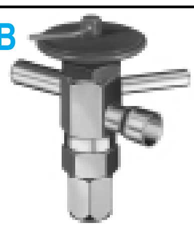
MATERIALS & DETAILS OF CONSTRUCTION

<table>
<tr><th>VALVE TYPE</th><th>BODY</th><th>SEAT</th><th>PIN</th><th>PIN CARRIER</th><th>PUSHROD(S)</th><th>TYPE OF JOINTS</th><th>CONNECTIONS</th><th>INLET STRAINER</th></tr>
<tr><td>NI</td><td rowspan="7">Machined Brass Bar</td><td rowspan="2">Monel</td><td rowspan="15">Stainless Steel</td><td rowspan="11">Brass</td><td>Triangular Stainless Steel</td><td rowspan="16">Knife Edge, Metal to Metal</td><td>SAE Flare, Inlet Fitting Silver Soldered to Body</td><td>Removable Strainer Screen</td></tr>
<tr><td>RI</td><td rowspan="6">Stainless Steel</td><td rowspan="2">SAE Flare Fittings Silver Soldered to Body</td><td>No Strainer</td></tr>
<tr><td>F</td><td rowspan="5">Brass</td><td>Removable Strainer Screen</td></tr>
<tr><td>EF</td><td>Extended Copper Fittings Silver Soldered to Body</td><td>Insert Strainer</td></tr>
<tr><td>Q</td><td>SAE Flare Fittings Silver Soldered to Body</td><td rowspan="2">Removable Strainer Screen</td></tr>
<tr><td>SQ</td><td rowspan="2">Extended Copper Fittings Silver Soldered to Body</td></tr>
<tr><td>EQ</td><td>Insert Strainer</td></tr>
<tr><td>G</td><td rowspan="3">Brass Forging</td><td rowspan="4">Monel</td><td rowspan="4">Internally Equalized: Triangular Stainless Steel
Externally Equalized: Round Stainless Steel</td><td>SAE Flare, Integral Part of Brass Forged Body</td><td rowspan="3">Removable Strainer Screen</td></tr>
<tr><td>EG</td><td>Extended Copper Fittings Silver Soldered to Body</td></tr>
<tr><td>C</td><td>SAE Flare, Integral Part of Brass Forged Body</td></tr>
<tr><td>S</td><td rowspan="8">Machined Brass Bar</td><td>Wrought Copper Fittings Silver Soldered to Body</td><td>Coarse Mesh Strainer Disc</td></tr>
<tr><td>BF</td><td rowspan="3">Brass</td><td rowspan="6">—</td><td rowspan="12">Stainless Steel</td><td>SAE Flare Fittings Silver Soldered to Body</td><td rowspan="2">Removable Strainer Screen</td></tr>
<tr><td>SBF</td><td rowspan="3">Extended Copper Fittings Silver Soldered to Body</td></tr>
<tr><td>EBF</td><td>Insert Strainer</td></tr>
<tr><td>EBS</td><td rowspan="3">Brass Port Machined In Body</td><td rowspan="7">Coarse Mesh Strainer Disc</td></tr>
<tr><td>SMALL O</td><td rowspan="2">Brass Piston With Synthetic Seating Surface</td><td rowspan="2">Wrought Copper Fittings Silver Soldered to Body</td></tr>
<tr><td>LARGE O</td><td rowspan="2">Knife Edge At Element and Bottom Cap Gasket At Seal Cap</td></tr>
<tr><td>H</td><td rowspan="2">Stainless Steel or Brass</td><td rowspan="2">Stainless Steel</td><td rowspan="2">Brass</td><td rowspan="4">Solder-Flange, Pipe Flange</td></tr>
<tr><td>M</td><td rowspan="3">Bronze Casting</td><td rowspan="5">Gasket</td></tr>
<tr><td>V</td><td rowspan="2">Dual Port, Seats Machined In Valve Body</td><td rowspan="2">Bronze Piston With Synthetic Seating Surface</td><td rowspan="2">—</td></tr>
<tr><td>W</td></tr>
<tr><td>D</td><td rowspan="2">Gray Iron Casting</td><td>Stainless Steel or Steel Alloy</td><td>Tungsten Carbide</td><td rowspan="2">Stainless Steel</td><td rowspan="2">Pipe Flange, Socket Weld</td><td rowspan="2">Removable Strainer Screen</td></tr>
<tr><td>A</td><td>Stainless Steel</td><td>20 & 30 Ton: Tungsten Carbide
50, 75, & 100 Ton: Stainless Steel</td></tr>
</table>

NOTE: Materials and Construction specifications listed on this page may change without notice. Contact Sporlan Valve Company for current specifications on materials and other details of construction.

OEM TYPE THERMOSTATIC EXPANSION VALVES

In addition to the standard line of Thermostatic Expansion Valves listed in this bulletin, special valve types are also available to fill manufacturers' specific requirements. Listed below are examples of valves that are supplied for quantity orders.

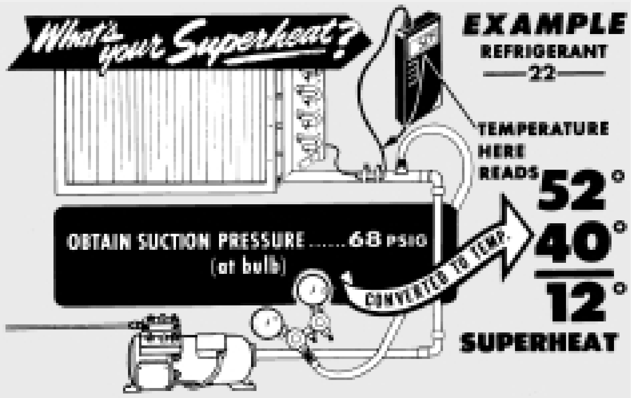
VALVE TYPE	CONNECTION TYPE	VALVE DESCRIPTION and APPLICATION	TYPICAL REPLACEMENT TEVs
BI/BBI 	SAE Flare or ODF Solder	Small brass body valve available with either angle style or straight through connections. Type BI valves with straight through connections are normally supplied non-adjustable. The Type BBI is a Type BI valve modified to incorporate balanced port construction. The thermostatic element is not replaceable on valves manufactured prior to 1994. Current models use a replaceable No. 43 element. Typical applications: small capacity R-22 air conditioning and heat pump systems.	RI, G, EG, C, S, Q, SQ, EQ
Y997-BI 	SAE Flare or ODF Solder	Type BI valve modified to incorporate an internal check valve and bypass tube to allow for *reverse* flow with heat pump applications. The valve is not adjustable. The thermostatic element is not replaceable on valves manufactured prior to 1994. Current models use a replaceable No. 43 element. Typical applications: small capacity R-22 heat pump systems.	RI, G, EG, C, S, Q, SQ, EQ Note: A check valve must be installed around the TEV to allow flow in the reverse direction.
I 	SAE Flare or ODF Solder	Small brass body valve available with either angle style or straight through connections. Type I valves with straight through connections are normally supplied non-adjustable. Current models use a replaceable No. 43 element. This valve is available with the Rapid Pressure Balancer (RPB) feature for off-cycle pressure equalization. Typical applications: small capacity R-22 air conditioning and heat pump systems.	RI, G, EG, C, S, Q, SQ, EQ
CBI/CBBI 	SAE Flare or ODF Solder	Type BI/BBI valves modified to incorporate an internal check valve to allow for *reverse* flow with heat pump applications. Type CBI/CBBI valves with straight through connections are normally supplied non-adjustable. The valve uses a replaceable No. 43 element. Typical applications: small capacity R-22 heat pump systems.	RI, G, EG, C, S, Q, SQ, EQ Note: A check valve must be installed around the TEV to allow flow in the reverse direction.
FB 	SAE Flare or ODF Solder	Small brass body valve available only with straight through connections and external adjustment. The thermostatic element is not replaceable on valves manufactured prior to 1994. Current models use a replaceable No. 43 element. Typical applications: small capacity air conditioning and refrigeration applications where an external adjustment is desired.	RI, G, EG, C, S, Q, SQ, EQ
X 	SAE Flare or ODF Solder	Brass body valve available with either angle style or straight through connections. Angle style valve is available only with SAE flare connections. Type X valves with straight through connections are normally supplied non-adjustable. The thermostatic element is a replaceable type, size number 53. This valve is available with the Rapid Pressure Balancer (RPB) feature in certain nominal capacities for off-cycle pressure equalization. Typical applications: R-22 air conditioning and heat pump systems.	RI, G, EG, C, S, Q, SQ, EQ

FEATURES NOT INCLUDED IN THIS BULLETIN

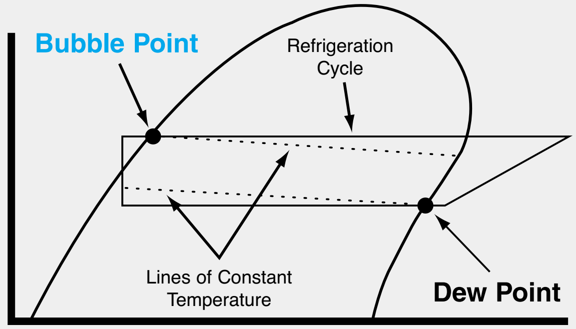
Special features such as non-adjustable construction or similar modifications are also available for both standard and special valves when ordered in reasonable quantities.

Automatic (constant pressure) expansion valves are also available on special order.

If you have a special valve application, contact your Sporlan Sales Engineer or Sporlan Valve Company, 206 Lange Drive, Washington, Missouri 63090, 636-239-1111.



P-H DIAGRAM — BLENDS



To determine superheat, use **Dew Point** values.
To determine subcooling, use **Bubble Point** values.

PRESSURE TEMPERATURE CHART

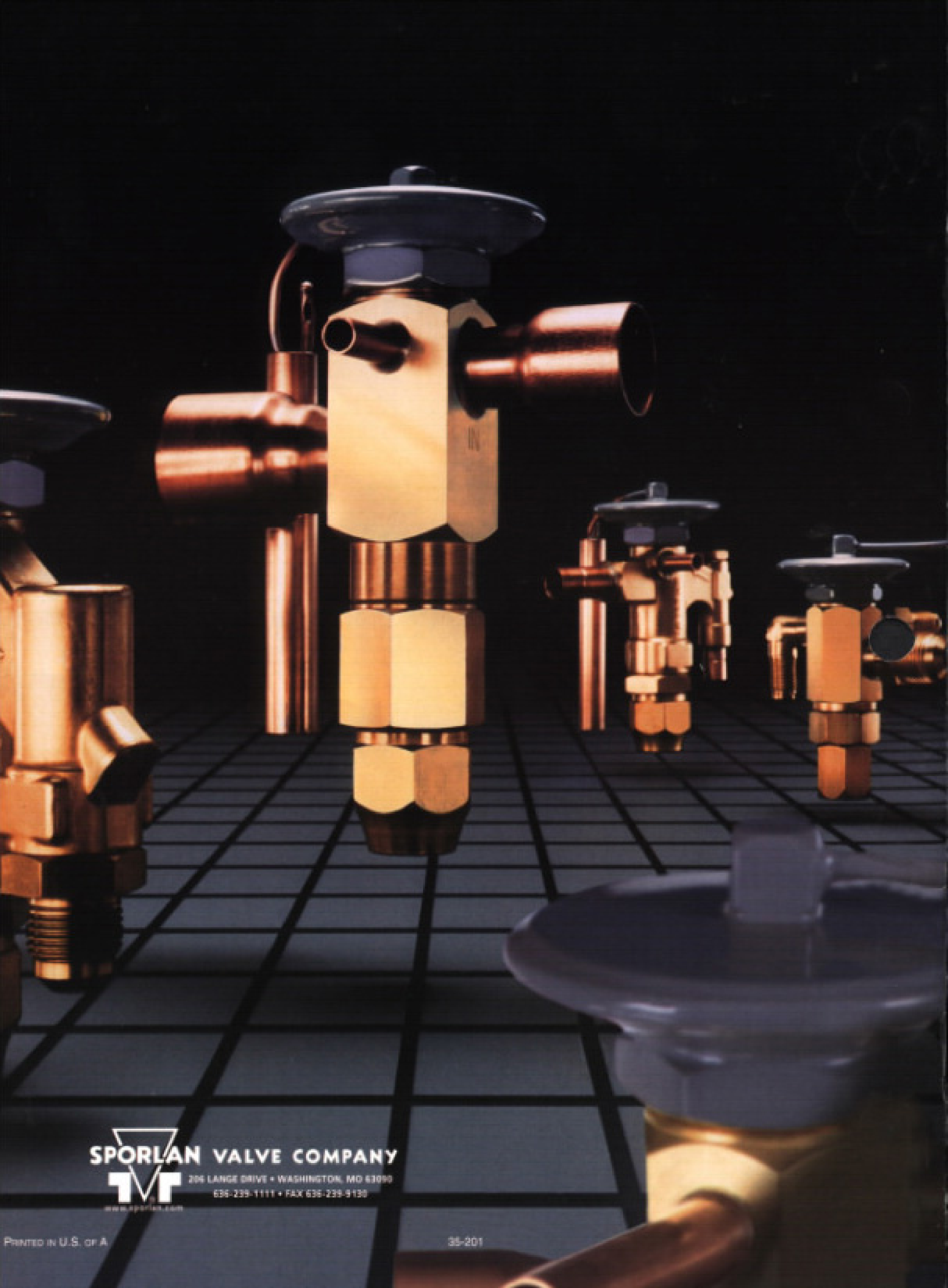
PSIG	Temperature, °F												
	Yellow	Green	Blue	Pink	Sand	Orange	Green	Lt. Brown	Purple	Yellow	Purple	Teal	White
	REFRIGERANT (Sporlan Code)												
	12(F)	22(V)	134a(J)	MP39 401A(X)	HP80 402A(L)	HP62 404A(S)	KLEA 60 407A(V)	9000 KLEA 66 407C(N)	FX-10 408A(R)	FX-56 409A(F)	502(R)	507(P)	717(A)
5*	-38	-56	-31	-32	-67	-65	-52	-48	-62	-30	-65	-66	-42
4*	-34	-53	-27	-28	-64	-62	-49	-45	-58	-27	-61	-63	-39
3*	-31	-50	-24	-25	-61	-59	-46	-42	-55	-23	-58	-60	-36
2*	-28	-47	-21	-22	-58	-56	-43	-39	-52	-20	-55	-57	-33
1*	-24	-44	-18	-19	-55	-53	-41	-36	-49	-17	-52	-55	-30
0	-22	-41	-15	-16	-53	-51	-38	-34	-47	-15	-50	-52	-28
1	-19	-39	-12	-13	-50	-48	-36	-31	-44	-12	-47	-50	-26
2	-16	-36	-10	-11	-48	-46	-33	-29	-42	-9	-45	-47	-23
3	-14	-34	-8	-9	-45	-43	-31	-27	-39	-7	-42	-45	-21
4	-11	-32	-5	-6	-43	-41	-29	-24	-37	-5	-40	-43	-19
5	-9	-30	-3	-4	-41	-39	-27	-22	-35	-2	-38	-41	-17
6	-7	-28	-1	-2	-39	-37	-25	-20	-33	0	-36	-39	-15
7	-4	-26	1	0	-37	-35	-23	-18	-31	2	-34	-37	-13
8	-2	-24	3	2	-36	-33	-21	-17	-29	4	-32	-35	-12
9	0	-22	5	4	-34	-32	-20	-15	-27	6	-30	-34	-10
10	2	-20	7	6	-32	-30	-18	-13	-26	8	-29	-32	-8
11	4	-19	8	8	-30	-28	-16	-12	-24	9	-27	-30	-7
12	5	-17	10	9	-29	-27	-15	-10	-22	11	-25	-29	-5
13	7	-15	12	11	-27	-25	-13	-8	-21	13	-24	-27	-4
14	9	-14	13	13	-26	-23	-12	-7	-19	14	-22	-25	-2
15	11	-12	15	14	-24	-22	-10	-5	-18	16	-20	-24	-1
16	12	-11	16	16	-23	-20	-9	-4	-16	18	-19	-23	1
17	14	-9	18	17	-21	-19	-8	-3	-15	19	-18	-21	2
18	16	-8	19	19	-20	-18	-6	-1	-13	21	-16	-20	3
19	17	-7	21	20	-19	-16	-5	0	-12	22	-15	-18	4
20	19	-5	22	21	-17	-15	-4	1	-11	23	-13	-17	6
21	20	-4	24	23	-16	-14	-2	3	-9	25	-12	-16	7
22	21	-3	25	24	-15	-12	-1	4	-8	26	-11	-15	8
23	23	-1	26	25	-14	-11	0	5	-7	27	-9	-13	9
24	24	0	27	27	-12	-10	1	6	-5	29	-8	-12	10
25	26	1	29	28	-11	-9	2	8	-4	30	-7	-11	11
26	27	2	30	29	-10	-8	4	9	-3	31	-6	-10	13
27	28	4	31	30	-9	-6	5	10	-2	32	-5	-9	14
28	30	5	32	32	-8	-5	6	11	-1	34	-3	-8	15
29	31	6	33	33	-7	-4	7	12	0	35	-2	-6	16
30	32	7	35	34	-6	-3	8	13	1	36	-1	-5	17
31	33	8	36	35	-5	-2	9	14	3	37	0	-4	18
32	34	9	37	36	-4	-1	10	15	4	38	1	-3	19
33	36	10	38	37	-2	0	11	16	5	39	2	-2	20
34	37	11	39	38	-1	1	12	17	6	40	3	-1	21
				BUBBLE POINT ↓	BUBBLE POINT ↓	BUBBLE POINT ↓	BUBBLE POINT ↓	BUBBLE POINT ↓	BUBBLE POINT ↓	BUBBLE POINT ↓			
35	38	12	40	39	0	2	13	18	7	41	4	0	22
36	39	13	41	40 30	0	3	14	19	8	42	5	1	22
37	40	14	42	41 31	1	4	15	20	9	44	6	2	23
38	41	15	43	43 32	2	5	16	21	10	45 30	7	3	24
39	42	16	44	44 33	3	6	17	22	11	46 31	8	4	25

*Inches mercury below one atmosphere

PRESSURE TEMPERATURE CHART

PSIG	Temperature, °F																			
	Yellow	Green	Blue	Pink		Sand		Orange		Green		Lt. Brown		Purple		Yellow		Purple	Teal	White
	REFRIGERANT (Sporlan Code)																			
	12(F)	22(V)	134a(J)	MP39 401A(X)		HP80 402A(L)		HP62 404A(S)		KLEA 60 407A(V)		9000 KLEA 66 407C(N)		FX-10 408A(R)		FX-56 409A(F)		502(R)	507(P)	717(A)
				DEW POINT	BUBBLE POINT	DEW POINT	BUBBLE POINT	DEW POINT	BUBBLE POINT	DEW POINT	BUBBLE POINT	DEW POINT	BUBBLE POINT	DEW POINT	BUBBLE POINT	DEW POINT	BUBBLE POINT			
40	43	17	45	44	34	4		7		18		23		12		47	32	9	5	26
42	45	19	47	46	36	6		9		19		25		13		48	34	11	6	28
44	47	21	49	48	38	8		10		21		26		15		50	36	13	8	29
46	49	23	51	50	40	10		12		23		28		17			38	15	10	31
48	51	24	52		42	11		14		24		30		19			39	16	12	32
50	53	26	54		44	13		16		26		31		20			41	18	13	34
52	55	28	56		45	14		17		28		33		22			43	20	15	35
54	57	29	57		47	16		19		29		34		24			45	21	16	37
56	59	31	59		49	18		20		31		36		25			46	23	18	38
58	60	32	60		50	19		22		32		37		27			48	24	19	40
60	62	34	62		52	20		23		33		39		28			50	26	21	41
62	64	35	64		53	22		25		35		40		30			51	27	22	42
64	65	37	65		55	23		26		36		42		31			53	29	24	44
66	67	38	66		56	25		27		38		43	32	32	32		54	30	25	45
68	68	40	68		58	26		29		39		44	33	34	33		56	32	27	46
70	70	41	69		59	27		30		40		46	34	35	34		57	33	28	47
72	71	42	71		61	29		32	31	41	31	47	36	37	36		58	34	29	49
74	73	44	72		62	30		33	32	43	32	48	37	38	37		60	36	30	50
76	74	45	73		64	31		34	33	44	34	49	38	39	38		61	37	32	51
78	76	46	75		65	32		35	34	45	35	51	39	40	40		63	38	33	52
80	77	47	76		66	34	31	37	36	46	36		41	42	41		64	40	34	53
85	81	51	79		69	37	34	40	39	49	39		44	45	44		67	43	37	56
90	84	53	82		73	40	37	42	42	52	42		46	48	47		70	46	40	59
95	87	56	85		76	42	40	45	44		45		49	50	50		73	49	43	61
100	90	59	88		78	45	43	48	47		47		52		52		76	51	46	64
105	93	62	90		81	48	45	51	50		50		54		55		79	54	48	66
110	96	64	93		84	50	48		52		53		57		57		82	57	51	68
115	99	67	96		87		50		55		55		59		60		84	59	53	71
120	102	69	98		89		53		57		57		62		62		87	62	56	73
125	104	72	100		92		55		59		60		64		65		89	64	58	75
130	107	74	103		94		57		62		62		66		67		92	67	60	77
135	109	76	105		96		60		64		64		69		69		94	69	62	79
140	112	78	107		99		62		66		66		71		71		96	71	64	81
145	114	81	109		101		64		68		68		73		73		99	73	67	83
150	117	83	112		103		66		70		70		75		76		101	75	69	85
155	119	85	114		105		68		72		72		77		78		103	77	71	86
160	121	87	116		108		70		74		74		79		80		105	80	73	88
165	123	89	118		110		72		76		76		81		81		107	82	74	90
170	126	91	120		112		74		78		78		82		83		109	83	76	92
175	128	92	121		114		75		80		80		84		85		111	85	78	93
180	130	94	123		116		77		82		81		86		87		113	87	80	95
185	132	96	125		117		79		83		83		88		89		115	89	82	96
190	134	98	127		119		81		85		85		90		91		117	91	83	98
195	136	100	129		121		82		87		87		91		92		119	93	85	99
200	138	101	130		123		84		88		88		93		94		121	95	87	101
205	140	103	132		125		86		90		90		95		96		123	96	88	102
210	141	105	134		126		87		92		91		96		97		124	98	90	104
220	145	108	137		130		91		95		94		99		100		128	101	93	107
230	149	111	140		133		94		98		97		102		104		131	104	96	110
240	152	114	143		136		97		101		100		105		106		134	108	99	112
250	155	117	146		139		99		104		103		108		109		137	111	102	115
260	159	120	149		143		102		107		106		111		112		141	114	105	117
275	163	124	153		147		106		111		110		115		116		145	118	109	121
290	168	128	157		151		110		115		114		119		120		149	122	112	124
305	172	132	161		155		114		118		117		123		124		153	126	116	128
320	176	136	165		159		118		122		121		126		128		157	130	120	131
335	181	139	169		163		121		125		124		130		131		161	133	123	134
350	184	143	172		167		124		129		128		133		135		165	137	126	137
365	188	146	176		170		128		132		131		137		138		169	141	129	140

*Inches mercury below one atmosphere



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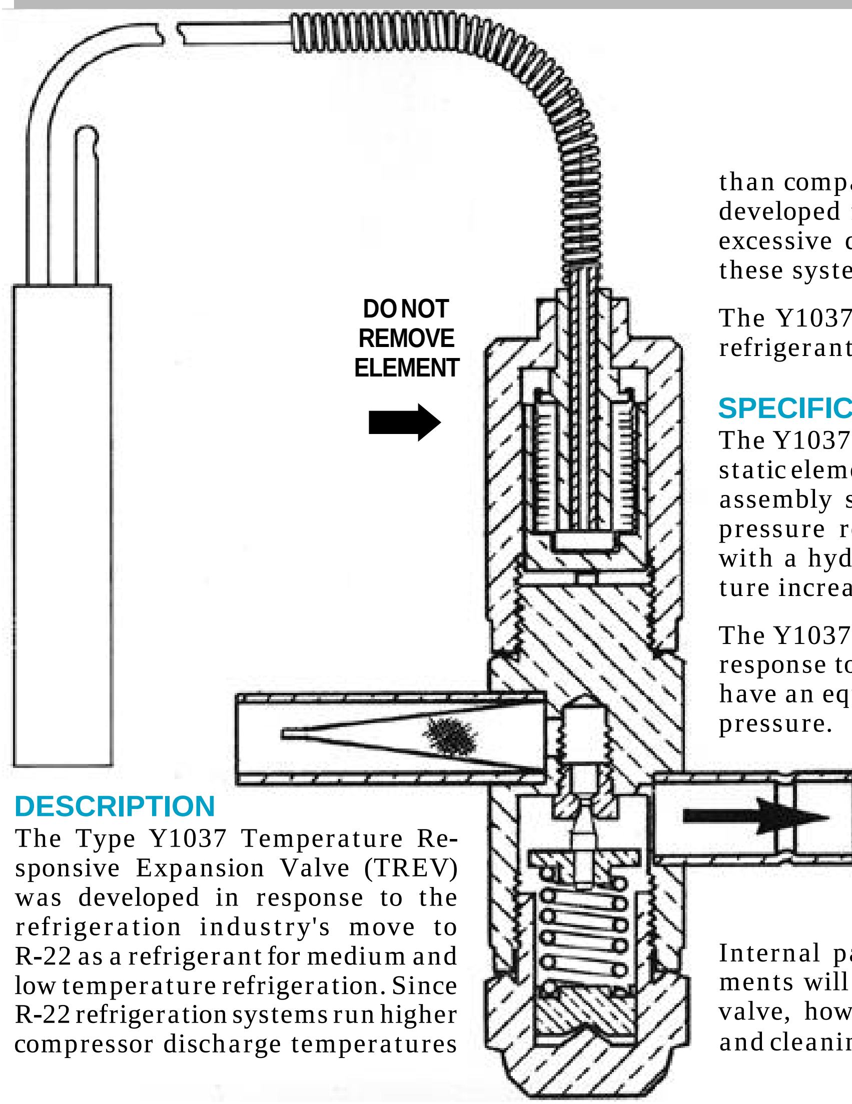
Bulletin 10-10-2
February 1994

Y1037
Temperature Responsive Expansion Valve



DESCRIPTION

The Type Y1037 Temperature Responsive Expansion Valve (TREV) was developed in response to the refrigeration industry's move to R-22 as a refrigerant for medium and low temperature refrigeration. Since R-22 refrigeration systems run higher compressor discharge temperatures than comparable R-12 and R-502 systems, a need has developed for an expansion valve which will prevent excessive discharge temperatures from occurring on these systems.

The Y1037 TREV solves this problem by modulating refrigerant flow in response to bulb temperature only.

SPECIFICATIONS & OPERATION

The Y1037 TREV uses the Type F body and a thermostatic element consisting of a sensing bulb and a bellows assembly similar to the direct acting ORI and CRO pressure regulating valves. The element is charged with a hydraulic fluid which expands as its temperature increases.

The Y1037 TREV modulates the flow of refrigerant in response to bulb temperature only. The valve does not have an equalizer connection, and is not influenced by pressure.

INSTALLATION AND SERVICE

When brazing solder type connections, it is recommended that a wet rag, chill block, or some other means be used to prevent excessive heating of the valve body.

Internal parts kits or replacement thermostatic elements will not be available for the Y1037 TREV. The valve, however, may be disassembled for inspection and cleaning when necessary. **Do not remove element.**

Y1037 QUICK SELECTION CHART*

Nominal Valve Capacity - Tons

COMPRESSOR H P	EVAPORATOR TEMPERATURE (°F)						
	- 40				- 20		
	SUCTION VAPOR TEMPERATURE ENTERING COMPRESSOR (°F)						
	0	20	40	65	20	40	65
2	1/3	1/3	1/3	1/3	1/3	1/3	1/3
3	1/3	1/3	1/3	1/2	1/3	1/3	1/3
5	1/3	1/3	1/2	1/2	1/3	1/3	1/2
7-1/2	1/3	1/2	1/2	1	1/3	1/3	1/2
10	1/2	1/2	1	1	1/3	1/2	1/2
15	1/2	1	1	1-1/2	1/3	1/2	1
20	1/2	1	1-1/2	1-1/2	1/2	1/2	1
30	1	1-1/2	1-1/2	2	1/2	1	1-1/2

Selection based on R22, 100°F liquid and 10°F bulb temperature change
*For selections at conditions other than listed above see reverse side.

TYPICAL DESIGNATION

Y1037-FV-1-230° 3/8 ODF x 3/8 ODF

CAPACITY RATINGS AND SELECTION PROCEDURES

Ratings for R-22 are listed below. Ratings are in tons of refrigeration, and they are based on 100°F liquid refrigerant entering the valve, and an opening bulb temperature change of 10°F.

EVAPORATOR TEMPERATURE - 0°F to - 40°F							
PRESSURE DROP - psi >		125	150	175	200	225	250
NOMINAL CAPACITY (tons)	1/3	0.25	0.27	0.30	0.32	0.34	0.35
	1/2	0.35	0.39	0.42	0.44	0.47	0.50
	1	0.56	0.62	0.67	0.71	0.76	0.80
	1-1/2	0.88	0.97	1.04	1.12	1.18	1.25
	2	1.23	1.35	1.46	1.56	1.65	1.74
	3	1.76	1.93	2.08	2.23	2.36	2.49
	5	2.74	3.01	3.25	3.47	3.68	3.88

LIQUID TEMPERATURE CORRECTION FACTORS							
TEMP (0°F)	0°	20°	40°	60°	80°	100°	120°
FACTOR	1.56	1.45	1.34	1.23	1.12	1.00	0.88

The valve's setting is the bulb temperature at which the valve will begin to open. Rated valve capacity occurs at 10°F above the bulb temperature at which the valve begins to open. The ambient temperature in which the valve operates may have a small influence on the valve's opening point.

Selection Example:
- R-22, 2 tons
- Condensing temp: 110°F
- Liquid temp: 110°F
- Evaporator temp: - 20°F

At these operating conditions, a suction vapor temperature of 40°F (60°F superheat) is expected, and a maximum temperature of 240°F at the TREV bulb is desired.

Capacity required from the TREV may be determined from the chart shown below. This chart lists the percentage of system capacity to maintain a 240°F bulb temperature given evaporator temperature and expected suction vapor temperature.

Evaporator Temperature (°F)	Suction Vapor Temperature (°F)				
	- 20	0	20	40	65
- 20	0	0	3	8	14
- 40	2	7	12	17	23

Values assume:
- 110°F condensing temperature
- discharge temp = isentropic compression + 80°F
- TREV bulb temp = isentropic compression + 30°F

In this case, 8 percent of the system capacity is required, or 2 x 0.08 = 0.16 tons.

Pressure drop across TREV:
- Condensing pressure (psig) 226
- Evaporator pressure (psig) 10
- 216 psi

Liquid correction factor: 0.94

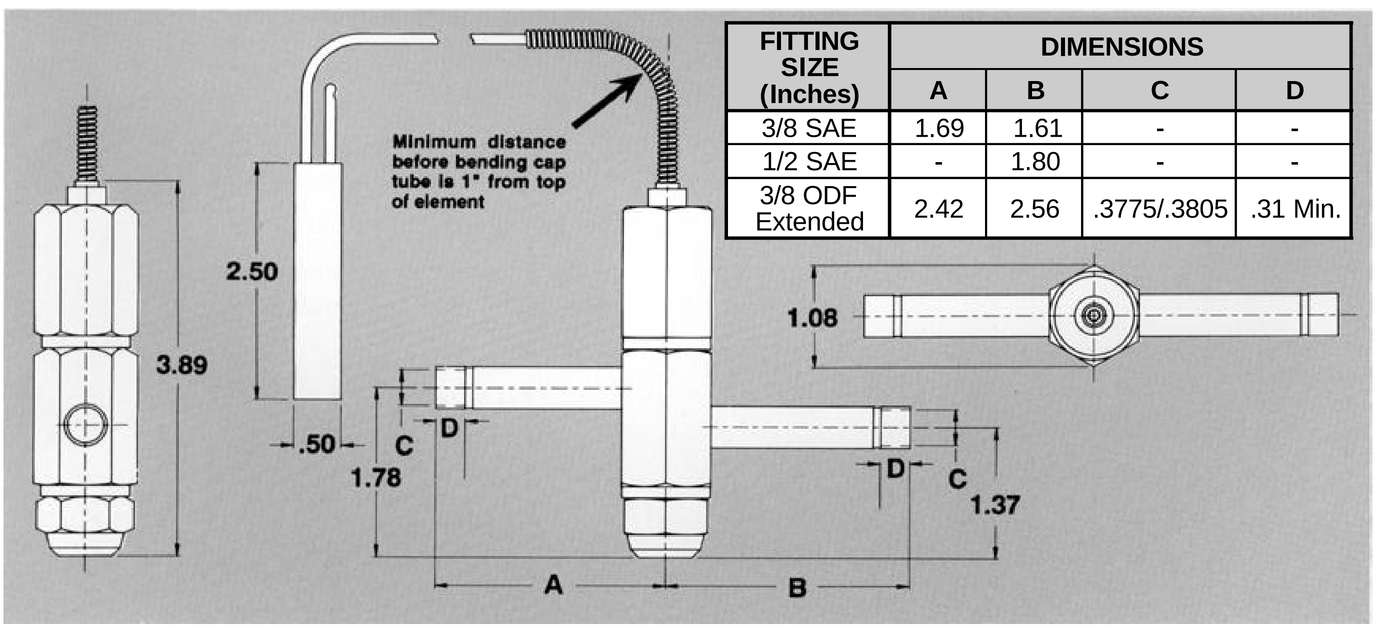
$$\frac{0.16 \text{ tons}}{0.94} = 0.17 \text{ tons corrected to } 100°\text{F liquid}$$

Y1037-FV-1/3 = 0.33 tons at 216 psi

$$\% \text{ loading} = \frac{0.17 \text{ tons}}{0.33 \text{ tons}} = .52 \text{ or } 52\%$$

The actual TREV bulb temperature can be estimated as follows: 10°F x 0.52 = 5.2°F, or approximately 5°F. Therefore, a 240°F valve setting would control at approximately: 240°F + 5°F = 245°F. The control temperature may actually be slightly higher due to cooling effects of ambient temperature on the valve body. As a result, **actual tests must be performed to verify the valve controls at the desired bulb temperature.**

DIMENSIONS



FITTING SIZE (Inches)	DIMENSIONS			
	A	B	C	D
3/8 SAE	1.69	1.61	-	-
1/2 SAE	-	1.80	-	-
3/8 ODF Extended	2.42	2.56	.3775/.3805	.31 Min.

BULLETIN 10-10-4
June 1995

TYPE EMC

Thermostatic Expansion Valve

with ODF Solder or SAE Flare Connections

for Refrigerants 12, 22, 134a, 404A, 502 & 507

U.S. Patent Numbers
5,277,364 and 5,232,015

The Sporlan Type EMC thermostatic expansion valve (TEV) is a patented two port valve designed to perform effectively over the range of load conditions inherent with most refrigeration systems.

On any refrigerated fixture, e.g., display case, freezer, walk-in cooler, the load on the evaporator will be greatest during a startup, following a defrost, or when warm product is being added to the fixture. The refrigeration system must then operate in a 'pulldown' mode until the fixture reaches its design temperature. Once design temperature has been reached, the evaporator will be at its minimum load condition, i.e., its 'holding' load. A typical load profile for a refrigerated fixture is shown in Figure 1 below.

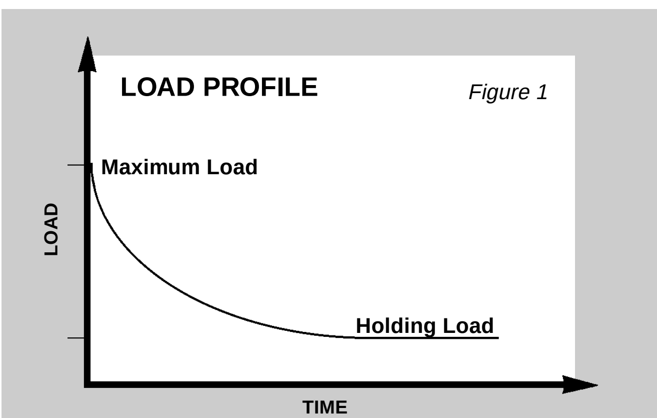
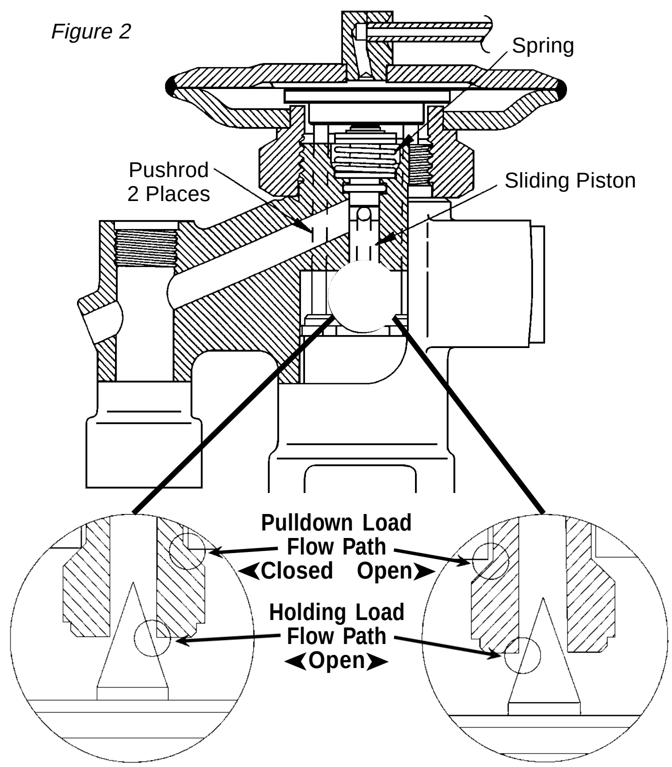


Figure 1

Maximum pulldown load can be as high as 2 to 3 times greater than the holding load. As a result, consideration must be given to the pulldown load when sizing a TEV. For many refrigerated fixtures, the desired pulldown time is typically less than one hour. To minimize this time, the TEV must be oversized somewhat with respect to the holding load, or the valve will starve the coil during pulldown. But the more oversized the valve, the less capable the valve becomes operating at the low load conditions, particularly when variations in condensing pressure from summertime to wintertime operation are considered.

The Type EMC valve solves this problem by providing two independent capacities: a large port for pulldown loads and a smaller port to control holding loads. See Figure 2. During holding load operation, the large capacity port remains closed and the valve regulates with the small capacity port in the same manner as a conventional TEV. During pulldown, the valve diaphragm moves far enough in the opening direction to contact the top of the sliding piston, opening the large capacity port. With the large capacity port opened, valve capacity is effectively doubled. This design allows the Type EMC valve to be sized based on the ***holding load*** without concern for the pulldown load.

Figure 2



The Type EMC valve is available with a ***resealable*** bleed feature. The purpose of this bleed is to allow the valve to operate with a flatter flow rate versus superheat curve. See Figure 3. The flatter flow rate curve allows the valve to respond to changes in superheat in a more stable manner.

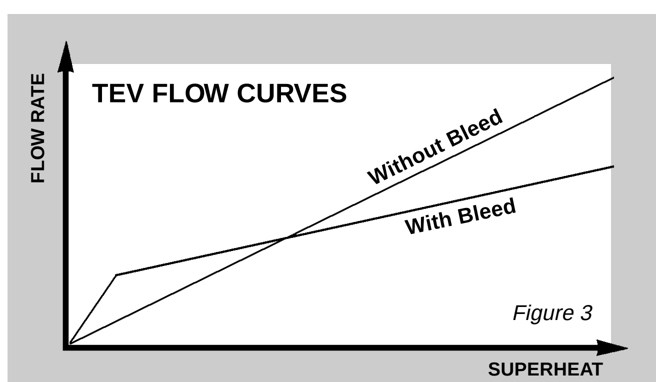


Figure 3

Figure 4

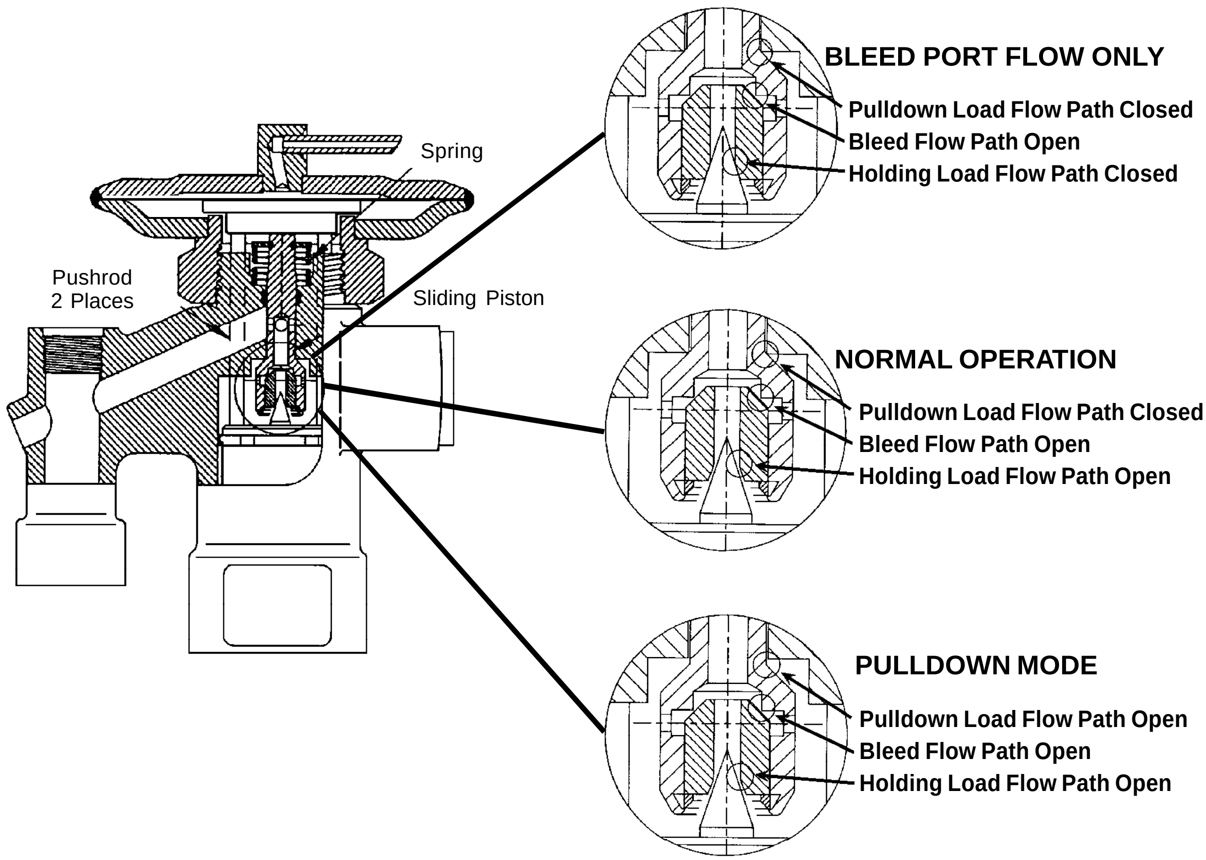


Figure 4 shows the bleed port which opens as the valve begins to operate. As the stroke of the bleed port is reached, the small capacity port begins to open. At this point, the valve regulates in the same manner as a conventional TEV. During pulldown, all three ports will be open.

The resealable bleed is suggested for all medium temperature (above 0° F evaporator) applications, provided the flow through the bleed does not represent more than approximately 70 percent of the holding load requirements. See valve selection examples.

On low temperature (below 0° F evaporator) applications, the resealable bleed does not have as significant an influence on valve performance. As a result, the non-bleed style valve is recommended.

Selection examples:

R-22

Evaporator temperature .... –20°F
Condenser temperature (maximum) .... 110°F
(minimum) .... 70°F

Liquid temperature (entering TEV) .... 60°F
Evap coil rating or holding load .... 3000 Btu/hr (0.25 ton)

Available pressure drop across TEV:	max	min
Condensing pressure (psig)	226	122
Evaporator pressure (psig)	–10	–10
	216	112
High side pressure loss (psi)	–7	–7
Distributor and tubes loss (psi)	–35	–35
	174	70

Refrigerant liquid correction factor: 1.23

The EMCE-10-VZ valve has the following ratings and percentage loadings at minimum and maximum condensing pressures:

PRESSURE DROP (psi)	RATING (tons)	PERCENTAGE LOADING
70*	0.25 x 1.23 = 0.31	0.25 / 0.31 = 0.81 or 81%
174	0.39 x 1.23 = 0.48	0.25 / 0.48 = 0.52 or 52%

R-404A

Evaporator temperature .... 20°F
Condenser temperature (maximum) .... 110°F
(minimum) .... 70°F
Liquid temperature (entering TEV) .... 60°F
Evap coil rating or holding load .. 12,000 Btu/hr (1.00 ton)

Available pressure drop across TEV:	max	min
Condensing pressure (psig)	273	150
Evaporator pressure (psig)	–56	–56
	217	94
High side pressure loss (psi)	–7	–7
Distributor and tubes loss (psi)	–35	–35
	175	52

Refrigerant liquid correction factor: 1.40

The EMCE-22-SC valve has the following ratings and percentage loadings at minimum and maximum condensing pressures:

PRESSURE DROP (psi)	RATING (tons)	PERCENTAGE LOADING
52*	0.75 x 1.40 = 1.05	1.00 / 1.05 = 0.95 or 95%
175	1.38 x 1.40 = 1.93	1.00 / 1.93 = 0.52 or 52%

PRESSURE DROP (psi)	BLEED (tons)	% LOAD HANDLED BY BLEED
52*	(0.75 —0.55) x 1.40 = 0.28	0.28 / 1.00 = 0.28 or 28%
175	(1.38 —1.02) x 1.40 = 0.50	0.50 / 1.00 = 0.50 or 50%

Bleed capacity can be calculated by subtracting the valve's rating without the bleed from its rating with the bleed. In the above case, the EMCE-12-SC rating was subtracted from the EMCE-22-SC rating.

R-134a

Evaporator temperature .... 20°F
Condenser temperature (maximum) .... 110°F
(minimum) .... 70°F
Liquid temperature (entering TEV) .... 60°F
Evap coil rating or holding load .... 6,000 Btu/hr (0.50 ton)

Available pressure drop across TEV:	max	min
Condensing pressure (psig)	146	71
Evaporator pressure (psig)	–18	–18
	128	53
High side pressure loss (psi)	–7	–7
Distributor and tubes loss (psi)	–0	–0
	121	46

Refrigerant liquid correction factor: 1.29

The EMC-20-JC valve has the following ratings and percentage loadings at minimum and maximum condensing pressures:

PRESSURE DROP (psi)	BLEED (tons)	% LOAD HANDLED BY BLEED
46*	(0.39 0.20) x 1.29 = 0.26	0.26 / 0.50 = 0.52 or 52%
121	(0.63 0.31) x 1.29 = 0.41	0.41 / 0.50 = 0.82 or 82%

PRESSURE DROP (psi)	BLEED (tons)	% LOAD HANDLED BY BLEED
46*	(0.39 0.20) x 1.29 = 0.26	0.26 / 0.50 = 0.52 or 52%
121	(0.63 0.31) x 1.29 = 0.41	0.41 / 0.50 = 0.82 or 82%

Since 82% of the load will be handled by the resealable bleed at the maximum condenser temperature condition, it would be safer to choose a valve without the resealable bleed. The EMC-11-JC has the following ratings:

PRESSURE DROP (psi)	RATING (tons)	PERCENTAGE LOADING
46*	0.47 x 1.29 = 0.61	0.50 / 0.61 = 0.82 or 82%
121	0.77 x 1.29 = 0.99	0.50 / 0.99 = 0.51 or 51%

* Ratings at these pressure drops can be determined by extrapolating ratings published in the rating tables or by using the Sporlan Selection program.

VALVE NOMENCLATURE:

E MC E - 1 0 - S C

Thermostatic Charge
Refrigerant Code
Port Code (0, 1, 2 or 3)
1= No Bleed, 2= Resealable Bleed
External Equalizer Omit if Internally Equalized
Valve Type
Extended ODF Connections Omit for SAE Flare Connections

REFRIGERANT LETTER & COLOR CODES

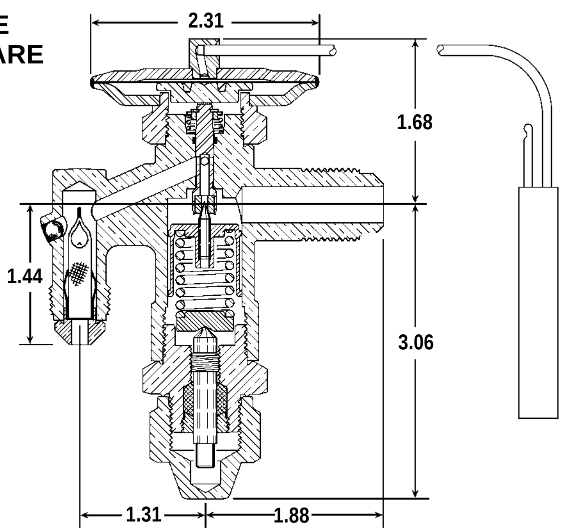
REFRIGERANT	SVC LETTER CODE	SVC COLOR CODE
12	F	Yellow
22	V	Green
134a	J	Sky Blue
401A (MP39)	X	Coral (Pink)
402A (HP80)	L	Light Brown
404A (HP62)	S	Orange
502	R	Violet
507 (AZ-50)	P	Teal (Green-Blue)

SPECIFICATIONS Element Size No. 53, Knife Edge Joint

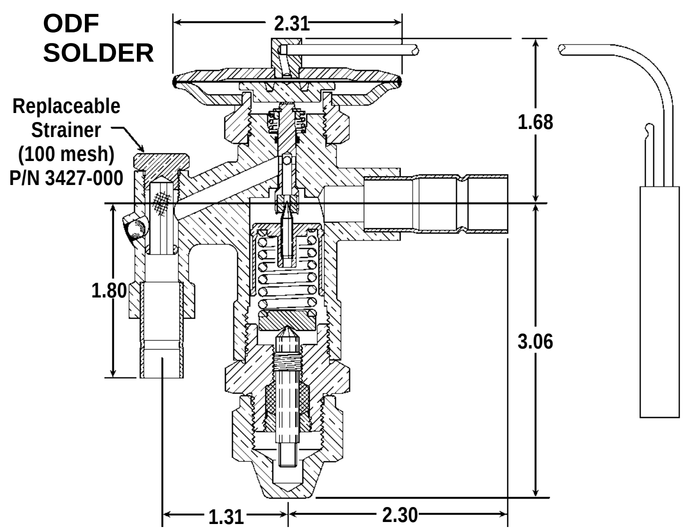
Refrigerant	Type: No Bleed, Internal Equalizer	Type: No Bleed, External Equalizer	Type: With Bleed, Internal Equalizer	Type: With Bleed, External Equalizer	Port Code	Nominal Capacity (tons of refrigeration): No Bleed	Nominal Capacity (tons of refrigeration): With Bleed	Thermostatic Charges Available ①	Standard Tubing Length (feet)	Connections (inches) ② ODF Solder or SAE Flare: Inlet	Connections (inches) ② ODF Solder or SAE Flare: Outlet	Net Weight (lbs)	Shipping Weight (lbs)
12	EMC-10-F	EMCE-10-F	EMC-20-F	EMCE-20-F	0	0.19	0.39	C, Z	5	3/8	1/2	2	3
	EMC-11-F	EMCE-11-F	EMC-21-F	EMCE-21-F	1	0.47	0.67						
	EMC-12-F	EMCE-12-F	EMC-22-F	EMCE-22-F	2	0.74	1.00						
	EMC-13-F	EMCE-13-F	EMC-23-F	EMCE-23-F	3	1.02	1.41						
22	EMC-10-V	EMCE-10-V	EMC-20-V	EMCE-20-V	0	0.32	0.64	C, Z					
	EMC-11-V	EMCE-11-V	EMC-21-V	EMCE-21-V	1	0.79	1.11						
	EMC-12-V	EMCE-12-V	EMC-22-V	EMCE-22-V	2	1.22	1.67						
	EMC-13-V	EMCE-13-V	EMC-23-V	EMCE-23-V	3	1.69	2.34						
134a	EMC-10-J	EMCE-10-J	EMC-20-J	EMCE-20-J	0	0.23	0.46	C					
	EMC-11-J	EMCE-11-J	EMC-21-J	EMCE-21-J	1	0.57	0.80						
	EMC-12-J	EMCE-12-J	EMC-22-J	EMCE-22-J	2	0.89	1.20						
	EMC-13-J	EMCE-13-J	EMC-23-J	EMCE-23-J	3	1.22	1.69						
404A	EMC-10-S	EMCE-10-S	EMC-20-S	EMCE-20-S	0	0.21	0.43	C, Z					
	EMC-11-S	EMCE-11-S	EMC-21-S	EMCE-21-S	1	0.52	0.73						
	EMC-12-S	EMCE-12-S	EMC-22-S	EMCE-22-S	2	0.81	1.11						
	EMC-13-S	EMCE-13-S	EMC-23-S	EMCE-23-S	3	1.12	1.55						
502	EMC-10-R	EMCE-10-R	EMC-20-R	EMCE-20-R	0	0.21	0.42	C, Z					
	EMC-11-R	EMCE-11-R	EMC-21-R	EMCE-21-R	1	0.51	0.72						
	EMC-12-R	EMCE-12-R	EMC-22-R	EMCE-22-R	2	0.80	1.08						
	EMC-13-R	EMCE-13-R	EMC-23-R	EMCE-23-R	3	1.10	1.51						
507	EMC-10-P	EMCE-10-P	EMC-20-P	EMCE-20-P	0	0.21	0.42	C, Z					
	EMC-11-P	EMCE-11-P	EMC-21-P	EMCE-21-P	1	0.51	0.72						
	EMC-12-P	EMCE-12-P	EMC-22-P	EMCE-22-P	2	0.79	1.08						
	EMC-13-P	EMCE-13-P	EMC-23-P	EMCE-23-P	3	1.10	1.51						

Contact Sporlan Valve Company for application information not shown on this specification sheet.
① The "MOP" charge is not recommended as it may limit the opening of the pulldown port.
② To specify SAE flare connection, omit the "E" prefix from the valve model number, e.g., MCE-10-SC.

SAE FLARE



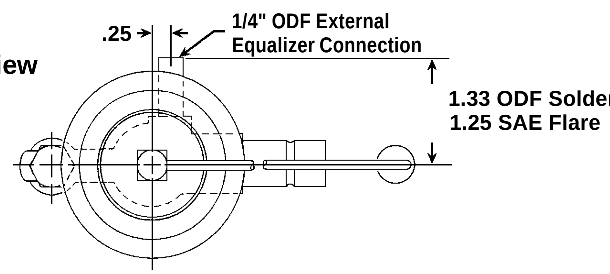
ODF SOLDER



BULB SIZES - Inches

STANDARD CHARGES	REFRIGERANT: 12	REFRIGERANT: 22	REFRIGERANT: 404A, 502, 507	REFRIGERANT: 134a
C	0.50 OD x 3.50			
Z	0.38 OD x 4.50	0.50 OD x 3.50		

Top View



CAPACITIES FOR TYPE EMC THERMOSTATIC EXPANSION VALVE

Refrigerant 12

PORT CODE	EVAPORATOR TEMPERATURE (°F)																	
	40°						20°						0°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	40	60	80	100	120	140	60	80	100	120	140	160	60	80	100	120	140	160
10	0.16	0.19	0.22	0.25	0.27	0.30	0.19	0.21	0.24	0.26	0.26	0.30	0.18	0.20	0.23	0.25	0.27	0.29
11	0.39	0.47	0.55	0.61	0.67	0.73	0.45	0.53	0.59	0.64	0.64	0.74	0.43	0.50	0.56	0.61	0.66	0.71
12	0.60	0.74	1.85	0.95	1.04	1.13	0.70	0.81	0.91	1.00	1.00	1.15	0.68	0.78	0.88	0.96	1.04	1.11
13	0.83	1.02	1.18	1.32	1.44	1.56	0.97	1.13	1.26	1.38	1.38	1.59	0.93	1.08	1.21	1.32	1.43	1.53
20	0.32	0.39	0.45	0.50	0.55	0.59	0.37	0.43	0.48	0.52	0.52	0.61	0.35	0.41	0.46	0.50	0.54	0.58
21	0.55	0.67	1.78	0.87	0.95	1.03	0.64	0.74	0.83	0.91	0.91	1.05	0.61	0.71	0.79	0.86	0.93	1.00
22	0.82	1.00	1.16	1.29	1.42	1.53	0.96	1.11	1.24	1.36	1.36	1.57	0.92	1.06	1.18	1.29	1.40	1.49
23	1.15	1.41	1.63	1.82	1.99	2.15	1.35	1.56	1.74	1.91	1.91	2.20	1.28	1.48	1.66	1.82	1.96	2.10

Refrigerant 22

PORT CODE	EVAPORATOR TEMPERATURE (°F)																	
	40°						20°						0°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	75	100	125	150	175	200	75	100	125	150	175	200	75	100	125	150	175	200
10	0.28	0.32	0.36	0.39	0.43	0.45	0.27	0.31	0.35	0.38	0.41	0.44	0.26	0.30	0.34	0.37	0.40	0.43
11	0.68	0.79	0.88	0.97	1.04	1.12	0.67	0.77	0.86	0.94	1.02	1.09	0.65	0.75	0.84	0.92	0.99	1.06
12	1.06	1.22	1.37	1.50	1.62	1.73	1.04	1.20	1.34	1.47	1.59	1.69	1.01	1.16	1.30	1.43	1.54	1.65
13	1.46	1.69	1.89	2.07	2.24	2.39	1.43	1.65	1.84	2.02	2.18	2.33	1.39	1.61	1.80	1.97	2.13	2.27
20	0.56	0.64	0.72	0.79	0.85	0.91	0.54	0.63	0.70	0.77	0.83	0.89	0.53	0.61	0.68	0.75	0.81	0.86
21	0.96	1.11	1.24	1.36	1.47	1.57	0.93	1.08	1.21	1.32	1.43	1.53	0.91	1.05	1.18	1.29	1.39	1.49
22	1.44	1.67	1.86	2.04	2.20	2.36	1.41	1.62	1.82	1.99	2.15	2.30	1.37	1.58	1.77	1.94	2.09	2.24
23	2.02	2.34	2.61	2.86	3.09	3.31	1.97	2.28	2.55	2.79	3.01	3.22	1.91	2.21	2.47	2.71	2.92	3.13

PORT CODE	EVAPORATOR TEMPERATURE (°F)																	
	-10°						-20°						-40°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	100	125	150	175	200	225	125	150	175	200	225	250	125	150	175	200	225	250
10	0.30	0.34	0.37	0.40	0.42	0.45	0.33	0.36	0.39	0.42	0.44	0.47	0.32	.035	0.38	0.40	0.43	0.45
11	0.74	0.82	0.90	0.97	1.04	1.10	0.81	0.89	0.96	1.02	1.09	1.14	0.78	0.86	0.92	0.99	1.05	1.10
12	1.15	1.28	1.41	1.52	1.62	1.72	1.25	1.37	1.48	1.59	1.68	1.77	1.22	1.33	1.44	1.54	1.63	1.72
13	1.58	1.77	1.94	2.09	2.24	2.37	1.74	1.91	2.06	2.20	2.33	2.46	1.68	1.84	1.99	2.13	2.26	2.38
20	0.60	0.67	0.73	0.79	0.85	0.90	0.66	0.72	0.78	0.83	0.88	0.93	0.64	0.70	0.75	0.81	0.85	0.90
21	1.04	1.16	1.27	1.37	1.47	1.56	1.14	1.25	1.35	1.44	1.53	1.61	1.10	1.21	1.30	1.39	1.48	1.56
22	1.56	1.74	1.91	2.06	2.20	2.33	1.71	1.87	2.02	2.16	2.30	2.42	1.65	1.81	1.96	2.09	2.22	2.34
23	2.18	2.43	2.67	2.88	3.08	3.26	2.39	2.62	2.83	3.03	3.21	3.39	2.32	2.54	2.74	2.93	3.11	3.28

Refrigerant 134a

PORT CODE	EVAPORATOR TEMPERATURE (°F)																	
	40°						20°						0°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	40	60	80	100	120	140	60	80	100	120	140	160	60	80	100	120	140	160
10	0.19	0.23	0.27	0.30	0.33	0.36	0.22	0.26	0.29	0.31	0.34	0.36	0.21	0.24	0.27	0.30	0.32	0.34
11	0.47	0.57	0.66	0.74	0.81	0.87	0.54	0.63	0.70	0.77	0.83	0.89	0.52	0.60	0.67	0.73	0.79	0.85
12	0.73	0.89	1.03	1.15	1.26	1.36	0.85	0.98	1.10	1.20	1.30	1.39	0.80	0.93	1.04	1.14	1.23	1.31
13	1.00	1.22	1.41	1.58	1.73	1.87	1.17	1.35	1.51	1.66	1.79	1.91	1.11	1.28	1.44	1.57	1.70	1.82
20	0.38	0.46	0.54	0.60	0.66	0.71	0.44	0.51	0.57	0.63	0.68	0.72	0.42	0.49	0.54	0.60	0.64	0.69
21	0.66	0.80	0.93	1.04	1.14	1.23	0.76	0.88	0.99	1.08	1.17	1.25	0.73	0.84	0.94	1.03	1.12	1.19
22	0.98	1.20	1.39	1.56	1.70	1.84	1.15	1.33	1.49	1.63	1.76	1.88	1.09	1.26	1.41	1.55	1.67	1.78
23	1.38	1.69	1.95	2.18	2.38	2.57	1.61	1.86	2.08	2.28	2.46	2.63	1.53	1.77	1.98	2.17	2.34	2.51

REFRIGERANT LIQUID TEMPERATURE CORRECTION FACTORS

Refrigerant	Refrigerant Liquid Temp °F	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	Example
12	Correction Factor	1.60	1.54	1.48	1.42	1.36	1.30	1.24	1.18	1.12	1.06	1.00	0.94	0.88	0.82	0.75	Actual capacity of an EMCE-11-J valve at 20°F evaporator, 100 psi pressure drop and 60°F liquid temperature = 0.70 tons x 1.29 = 0.90 tons.
22		1.56	1.51	1.45	1.40	1.34	1.29	1.23	1.17	1.12	1.06	1.00	0.94	0.88	0.82	0.76	
134a		1.70	1.63	1.56	1.49	1.42	1.36	1.29	1.21	1.14	1.07	1.00	0.93	0.85	0.78	0.71	

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an average evaporator temperature of 0°F. However they may be used for any evaporator temperature from –40°F to 40°F since the variation in the actual factors across this range is insignificant.

CAPACITIES FOR TYPE EMC THERMOSTATIC EXPANSION VALVE (continued)

Refrigerant 404a

PORT CODE	EVAPORATOR TEMPERATURE (F)																	
	40°						20°						0°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	75	100	125	150	175	200	75	100	125	150	175	200	75	100	125	150	175	200
10	0.18	0.21	0.24	0.26	0.28	0.30	0.17	0.20	0.23	0.25	0.27	0.28	0.16	0.19	0.21	0.23	0.25	0.27
11	0.45	0.52	0.58	0.64	0.69	0.74	0.43	0.49	0.55	0.61	0.65	0.70	0.40	0.46	0.52	0.57	0.62	0.66
12	0.70	0.81	0.91	0.99	1.07	1.15	0.67	0.77	0.86	0.94	1.02	1.09	0.63	0.72	0.81	0.89	0.96	1.02
13	0.97	1.12	1.25	1.37	1.48	1.59	0.92	1.06	1.19	1.30	1.41	1.50	0.87	1.00	1.12	1.23	1.33	1.42
20	0.37	0.43	0.48	0.52	0.56	0.60	0.35	0.40	0.45	0.49	0.53	0.57	0.33	0.38	0.42	0.46	0.50	0.54
21	0.64	0.73	0.82	0.90	0.97	1.04	0.60	0.70	0.78	0.85	0.92	0.98	0.57	0.65	0.73	0.80	0.87	0.93
22	0.96	1.11	1.24	1.35	1.46	1.56	0.91	1.05	1.17	1.28	1.38	1.48	0.85	0.99	1.10	1.21	1.30	1.39
23	1.34	1.55	1.73	1.89	2.05	2.19	1.27	1.46	1.63	1.79	1.93	2.07	1.19	1.38	1.54	1.69	1.82	1.95

PORT CODE	EVAPORATOR TEMPERATURE (F)																	
	-10°						-20°						-40°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	100	125	150	175	200	225	125	150	175	200	225	250	125	150	175	200	225	250
10	0.18	0.21	0.22	0.24	0.26	0.28	0.20	0.22	0.23	0.25	0.27	0.28	0.18	0.20	0.22	0.23	0.25	0.26
11	0.45	0.50	0.55	0.60	0.64	0.68	0.49	0.53	0.57	0.61	0.65	0.69	0.45	0.49	0.53	0.57	0.60	0.64
12	0.70	0.78	0.86	0.93	0.99	1.05	0.76	0.83	0.89	0.96	1.01	1.07	0.70	0.77	0.83	0.89	0.94	0.99
13	0.97	1.08	1.19	1.28	1.37	1.45	1.05	1.15	1.24	1.32	1.40	1.48	0.97	1.06	1.15	1.23	1.30	1.37
20	0.37	0.41	0.45	0.48	0.52	0.55	0.40	0.43	0.47	0.50	0.53	0.56	0.37	0.40	0.43	0.46	0.49	0.52
21	0.63	0.71	0.78	0.84	0.90	0.95	0.68	0.75	0.81	0.87	0.92	0.97	0.63	0.69	0.75	0.80	0.85	0.90
22	0.95	1.06	1.17	1.26	1.35	1.43	1.03	1.12	1.21	1.30	1.38	1.45	0.95	1.04	1.12	1.20	1.28	1.34
23	1.33	1.49	1.63	1.77	1.89	2.00	1.43	1.57	1.70	1.82	1.93	2.03	1.33	1.46	1.57	1.68	1.79	1.88

Refrigerant 502

PORT CODE	EVAPORATOR TEMPERATURE (F)																	
	40°						20°						0°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	75	100	125	150	175	200	75	100	125	150	175	200	75	100	125	150	175	200
10	0.18	0.21	0.23	0.26	0.28	0.29	0.17	0.20	0.22	0.24	0.26	0.28	0.16	0.19	0.21	0.23	0.25	0.27
11	0.44	0.51	0.57	0.63	0.68	0.72	0.42	0.49	0.55	0.60	0.65	0.69	0.40	0.46	0.52	0.57	0.61	0.66
12	1.69	0.80	0.89	0.98	1.05	1.13	0.66	0.76	0.85	0.93	1.01	1.07	0.62	0.72	0.81	0.88	0.95	1.02
13	0.95	1.10	1.23	1.34	1.45	1.55	0.91	1.05	1.17	1.28	1.38	1.48	0.86	0.99	1.11	1.22	1.32	1.41
20	0.36	0.42	0.47	0.51	0.55	0.59	0.34	0.40	0.44	0.49	0.53	0.56	0.33	0.38	0.42	0.46	0.50	0.53
21	0.62	0.72	0.80	0.88	0.95	1.02	0.60	0.69	0.77	0.84	0.91	0.97	0.57	0.65	0.73	0.80	0.86	0.92
22	0.93	1.08	1.21	1.32	1.43	1.53	0.89	1.03	1.15	1.26	1.36	1.45	0.85	0.98	1.09	1.20	1.29	1.38
23	1.31	1.51	1.69	1.85	2.00	2.14	1.25	1.45	1.62	1.77	1.91	2.04	1.19	1.38	1.54	1.69	1.82	1.95

PORT CODE	EVAPORATOR TEMPERATURE (F)																	
	-10°						-20°						-40°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	100	125	150	175	200	225	125	150	175	200	225	250	125	150	175	200	225	250
10	0.18	0.21	0.22	0.24	0.26	0.28	0.20	0.22	0.24	0.25	0.27	0.28	0.19	0.21	0.22	0.24	0.25	0.26
11	0.45	0.50	0.55	0.60	0.64	0.68	0.49	0.54	0.58	0.62	0.66	0.69	0.46	0.50	0.54	0.58	0.62	0.65
12	0.70	0.78	0.86	0.93	0.99	1.05	0.76	0.83	0.90	0.96	1.02	1.08	0.71	0.78	0.85	0.90	0.96	1.01
13	0.97	1.08	1.19	1.28	1.37	1.45	1.05	1.16	1.25	1.33	1.42	1.49	0.99	1.08	1.17	1.25	1.33	1.40
20	0.37	0.41	0.45	0.49	0.52	0.55	0.40	0.44	0.47	0.50	0.54	0.56	0.37	0.41	0.44	0.47	0.50	0.53
21	0.63	0.71	0.78	0.84	0.90	0.95	0.69	0.75	0.82	0.87	0.92	0.97	0.65	0.71	0.76	0.82	0.87	0.91
22	0.95	1.06	1.17	1.26	1.35	1.43	1.04	1.13	1.23	1.31	1.39	1.46	0.97	1.06	1.15	1.23	1.30	1.37
23	1.33	1.49	1.63	1.77	1.89	2.00	1.45	1.59	1.72	1.84	1.95	2.06	1.36	1.49	1.61	1.72	1.82	1.92

REFRIGERANT LIQUID TEMPERATURE CORRECTION FACTORS

Refrigerant	Refrigerant Liquid Temp F	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	Example
404A	Correction Factor	2.04	1.94	1.84	1.74	1.64	1.54	1.43	1.33	1.22	1.11	1.00	0.89	0.77	0.65	0.53	Actual capacity of an EMCE-11-J valve at 20°F evaporator, 100 psi pressure drop and 60°F liquid temperature = 0.70 tons x 1.29 = 0.90 tons.
502		1.86	1.78	1.69	1.61	1.52	1.44	1.35	1.26	1.18	1.09	1.00	0.91	0.82	0.73	0.64	

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an average evaporator temperature of 0°F. However they may be used for any evaporator temperature from –40°F to 40°F since the variation in the actual factors across this range is insignificant.

CAPACITIES FOR TYPE EMC THERMOSTATIC EXPANSION VALVE (continued)

Refrigerant 507

PORT CODE	EVAPORATOR TEMPERATURE (F°)																	
	40°						20°						0°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	75	100	125	150	175	200	75	100	125	150	175	200	75	100	125	150	175	200
10	0.18	0.21	0.23	0.26	0.28	0.29	0.17	0.20	0.22	0.24	0.26	0.28	0.16	0.19	0.21	0.23	0.25	0.26
11	0.44	0.51	0.57	0.63	0.68	0.72	0.42	0.48	0.54	0.59	0.64	0.68	0.39	0.46	0.51	0.56	0.60	0.64
12	0.69	0.79	0.89	0.97	1.05	1.12	0.65	0.75	0.84	0.92	1.00	1.07	0.61	0.71	0.79	0.87	0.94	1.00
13	0.95	1.10	1.23	1.34	1.45	1.55	0.90	1.04	1.16	1.27	1.37	1.47	0.85	0.98	1.09	1.20	1.29	1.38
20	0.36	0.42	0.47	0.51	0.55	0.59	0.34	0.39	0.44	0.48	0.52	0.56	0.32	0.37	0.42	0.45	0.49	0.53
21	0.62	0.72	0.80	0.88	0.95	1.02	0.59	0.68	0.76	0.83	0.90	0.96	0.56	0.64	0.72	0.78	0.85	0.91
22	0.93	1.08	1.21	1.32	1.43	1.53	0.88	1.02	1.14	1.25	1.35	1.44	0.83	0.96	1.07	1.18	1.27	1.36
23	1.31	1.51	1.69	1.85	2.00	2.14	1.24	1.44	1.61	1.76	1.90	2.03	1.17	1.35	1.51	1.66	1.79	1.91
PORT CODE	EVAPORATOR TEMPERATURE (F°)																	
	-10°						-20°						-40°					
	PRESSURE DROP ACROSS VALVE (PSI)																	
	100	125	150	175	200	225	125	150	175	200	225	250	125	150	175	200	225	250
10	0.18	0.20	0.22	0.24	0.25	0.27	0.19	0.21	0.23	0.25	0.26	0.27	0.18	0.20	0.21	0.23	0.24	0.26
11	0.44	0.49	0.54	0.58	0.62	0.66	0.48	0.52	0.56	0.60	0.64	0.67	0.44	0.49	0.52	0.56	0.59	0.63
12	0.69	0.77	0.84	0.91	0.97	1.03	0.74	0.81	0.88	0.94	0.99	1.05	0.69	0.76	0.82	0.87	0.93	0.98
13	0.94	1.05	1.16	1.25	1.33	1.42	1.03	1.12	1.21	1.30	1.38	1.45	0.95	1.04	1.12	1.20	1.28	1.34
20	0.36	0.40	0.44	0.48	0.51	0.54	0.39	0.43	0.46	0.49	0.52	0.55	0.36	0.40	0.43	0.46	0.48	0.51
21	0.62	0.69	0.76	0.82	0.88	0.93	0.67	0.73	0.79	0.85	0.90	0.95	0.62	0.68	0.74	0.79	0.84	0.88
22	0.94	1.05	1.15	1.24	1.32	1.40	1.01	1.10	1.19	1.27	1.35	1.42	0.94	1.03	1.11	1.18	1.26	1.32
23	1.31	1.46	1.60	1.73	1.85	1.96	1.42	1.55	1.68	1.79	1.90	2.00	1.31	1.44	1.55	1.66	1.76	1.85

REFRIGERANT LIQUID TEMPERATURE CORRECTION FACTORS

Refrigerant	Refrigerant Liquid Temp °F	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	Example
507	Correction Factor	1.99	1.89	1.79	1.69	1.59	1.50	1.40	1.30	1.20	1.10	1.00	0.89	0.78	0.66	0.51	Actual capacity of an EMCE-11-J valve at 20°F evaporator, 100 psi pressure drop and 60°F liquid temperature = 0.70 tons x 1.29 = 0.90 tons.

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an average evaporator temperature of 0°F. However they may be used for any evaporator temperature from –40°F to 40°F since the variation in the actual factors across this range is insignificant.

BULLETIN 10-10-5
September 2001

SPORLAN

TYPE RC

COMPACT and ADJUSTABLE THERMOSTATIC EXPANSION VALVE with an INTERNAL CHECK VALVE

for REPLACEMENT of CBI AND CBBI valves on AIR CONDITIONING and HEAT PUMP SYSTEMS

Type RC valves are available for replacement of types CBI and CBBI valves. These valves contain internal check valves to allow reverse flow on heat pump applications. This eliminates the need for an external check valve piped around the TEV for reverse flow. The RC valve can be used on Heat Pump and Air Conditioning (cooling only) applications. This allows you to reduce inventory by using the same valve to replace the I and BI valves. The RC valve can even be used to replace the RI valve (non-RPB versions only).

The small physical size of the Type RC valve makes replacement of the CBI, CBBI, BI, and I valves easier when compared to the larger size models (Type G, C, or S).

Exact replacement valves for the CBI, CBBI, BI, and I valves are available from the OEM and should be ordered from the OEM during the warranty period of the equipment, or when special features such as specific bleed ports, connections, configurations, capillary tube lengths, etc., are required.

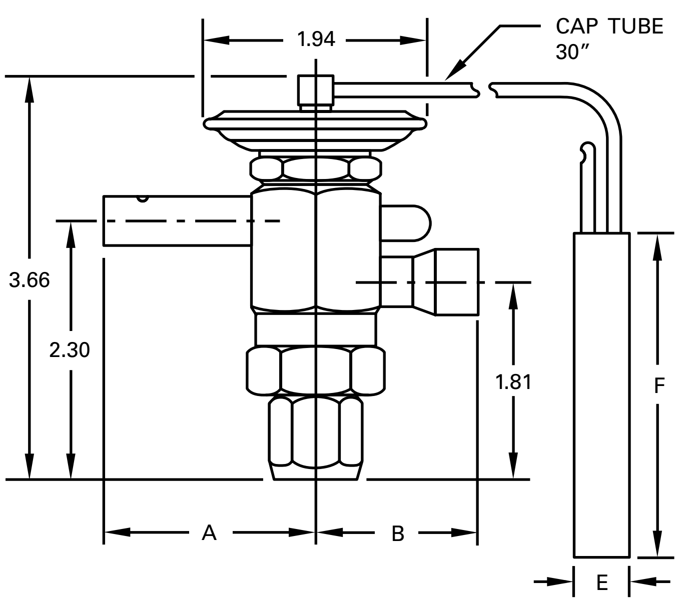
Replaceable elements available for these valves are the following: Refrigerant 22, Element Kit Number KT-43-VGA-30", and Refrigerant 410A, Element Kit Number KT-45-ZGA-30".

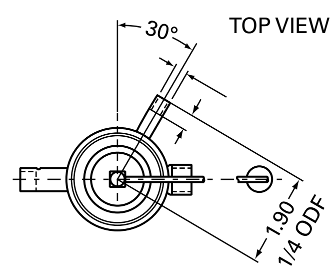
SPECIFICATIONS – The Type RC thermostatic expansion valves are only available with the specifications shown below.

SPECIFICATIONS

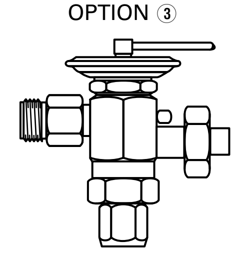
Valve Type	Connections - Inches ① Bold figures are standard and will be furnished unless otherwise directed.		Refrigerant	External Equalizer ②,③	Capillary Tube Length - Inches
	Inlet	Oulet			
RCVE-2-GA	**3/8** SAE	**1/2** SAE	22	1/4 SAE 1/4 ODF	30 ONLY
RCVE-3-GA	3/8 ODF	1/2 ODF			
RCVE-4-GA	**1/2** ODF	**1/2** ODF			
RCVE-5-GA	1/2 SAE	1/2 SAE			
RCVE-6-GA	1/2 ODF	5/8 ODF			
RCZE-2-GA	**3/8** ODF	**1/2** ODF	410A	1/4 ODF	30 ONLY
RCZE-3-GA					
RCZE-4-GA	**1/2** ODF	**1/2** ODF			
RCZE-5-GA	**1/2** ODF	**5/8** ODF			
RCZE-6-GA					

① Valves are also available as special order with Chatleff connections.
② Valves with SAE inlet and outlet fittings are available only with the 1/4" SAE flare external equalizer; valves with ODF fittings are available only with the 1/4" ODF external equalizer.
③ Valves with Chatleff fittings are available only with the 1/8" OD X 24" long tube with flare and nut external equalizer.





CHATLEFF FITTINGS
OPTION ③



DIMENSIONS - Inches

Capacity Tons	Fitting Size	A	B
2 & 3	3/8 SAE	1.92	---
	1/2 SAE	---	1.92
	3/8 ODF	1.92	---
	1/2 ODF	---	1.45
4, 5 & 6	1/2 SAE	1.89	1.92
	1/2 ODF	1.98	1.45
	5/8 ODF	---	1.53
Chatleff Fittings		1.89	1.71

BULB SIZE - Inches

Thermostatic Charge	Dim. "E"	Dim. "F"
ZGA	.75	2.00
VGA	.75	2.00

SELECTION – The selection of the proper RC valve is simplified if complete system operating conditions are available. This includes evaporator and condensing temperatures, to calculate the pressure drop across the valve, liquid temperature at the valve inlet, and evaporator load in tons.

When operating conditions are **not** readily available, the RC can be selected for the same capacity as the CBI, CBBI, BBI, BI, and I it is replacing. Since valves have different superheat settings, the RC valve can be adjusted for peak performance.

CAPACITY RATINGS – The capacity ratings for the Type RC thermostatic expansion valves are identical to the ratings for our Type BBI and CBBI models. The tables are based on 100°F vapor free liquid at the valve inlet. For liquid temperatures other than 100°F multiply the capacity from the table at the available pressure drop for the valve in question by the correction factor in the Refrigerant Liquid Temperature Correction Factor Table.

Valve Type	Nominal Capacity	Evaporator Temperature (°F)								
		40			20			0		
		Pressure Drop Across Valve (psi)								
		100	125	150	100	125	150	100	125	150
RCVE-2-GA	2	2.30	2.57	2.82	2.24	2.51	2.75	2.01	2.24	2.46
RCVE-3-GA	3	3.20	3.58	3.92	3.12	3.49	3.82	2.79	3.12	3.42
RCVE-4-GA	4	4.20	4.70	5.15	4.10	4.58	5.02	3.66	4.09	4.49
RCVE-5-GA	5	5.00	5.60	6.13	4.88	5.45	5.97	4.36	4.87	5.34
RCVE-6-GA	6	6.01	6.71	7.36	5.85	6.54	7.17	4.72	5.28	5.78
Valve Type	**Nominal Capacity**	**Pressure Drop Across Valve (psi)**								
		150	175	200	150	175	200	150	175	200
RCZE-2-GA	2	2.67	2.89	3.09	2.60	2.81	3.01	2.33	2.51	2.69
RCZE-3-GA	3	3.71	4.01	4.29	3.62	3.91	4.18	3.24	3.50	3.74
RCZE-4-GA	4	4.88	5.26	5.63	4.76	5.14	5.49	4.25	4.59	4.91
RCZE-5-GA	5	5.80	6.27	6.70	5.66	6.11	6.54	5.06	5.46	5.84
RCZE-6-GA	6	6.96	7.52	8.04	6.79	7.34	7.84	5.48	5.92	6.32

Liquid Correction Factor R-22									
Temperature (°F)	**60°**	**70°**	**80°**	**90°**	**100°**	**110°**	**120°**	**130°**	**140°**
Correction Factor	1.23	1.17	1.12	1.06	1.00	0.94	0.88	0.82	0.76

Liquid Correction Factor R-410A									
Temperature (°F)	**60°**	**70°**	**80°**	**90°**	**100°**	**110°**	**120°**	**130°**	**140°**
Correction Factor	1.32	1.24	1.16	1.08	1.00	0.92	0.83	0.73	0.62

ORDERING INSTRUCTIONS – When ordering this thermostatic expansion valve, specify completely as follows:

RCVE - 2 - GA, 3/8 SAE X 1/2 SAE

- **R** – BODY TYPE
- **C** – REFRIGERANT DESIGNATION R-22(V), R-410A(Z)
- **V** – EXTERNAL EQUALIZER
- **E** – NOMINAL CAPACITY in TONS
- **2** – THERMOSTATIC CHARGE (V)GA for R-22 (Z)GA for R-410A
- **GA** – INLET CONNECTION ODF or SAE
- **3/8 SAE** – OUTLET CONNECTION ODF OR SAE
- **1/2 SAE**

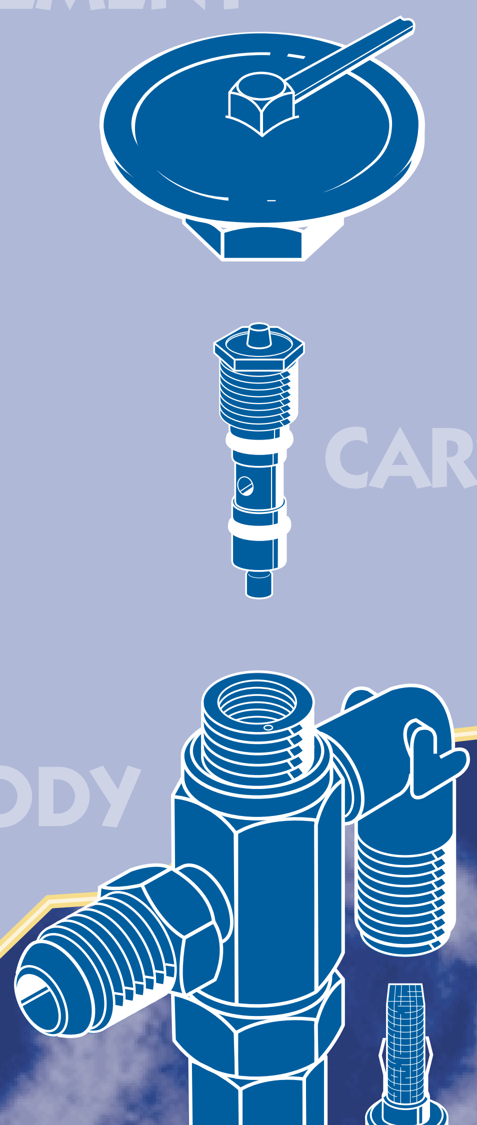
DISTRIBUTION: W & C

SPORLAN VALVE COMPANY
206 LANGE DRIVE • WASHINGTON, MO 63090
636-239-1111 • FAX 636-239-9130
www.sporlan.com

SPORLAN

March 2001 / BULLETIN 10-10-6

BALANCED PORT Q-VALVE



Introducing the Balanced Port Q-Valve

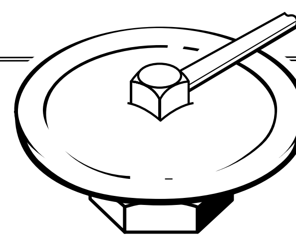
The BQ combines the flexibility of the replaceable cartridge style Q valve with the proven performance of the Balanced Port BF, SBF and EBF valve types . . . a first for the industry!

Like the Q valve, the BQ can be supplied as a complete valve or as three component parts: the valve body, the cartridge assembly and the thermostatic element.

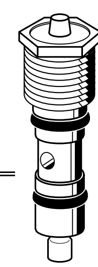
Since Sporlan's introduction of the Q-Valve in 1994, the family of conventional port interchangeable cartridge valves have become increasingly popular. Q-Valves are ideal for reducing inventory while increasing valve options — So, the right valve is always on hand.

Now, with the introduction of the Balanced Port Q-Valve (BQ), designed especially for systems with a wide range of operating conditions, the Q-Valve line satisfies over 2,900 TEV applications. And, like the conventional Q-Valve, the BQ reduces your inventory and increases your options.

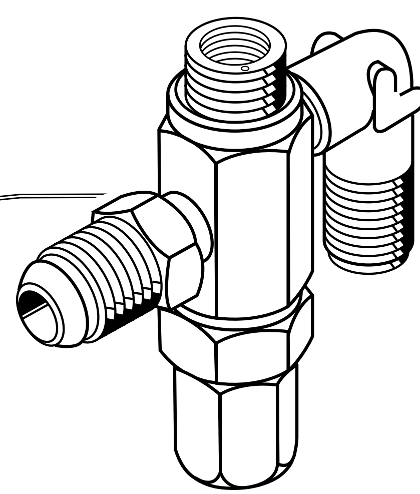
ELEMENT

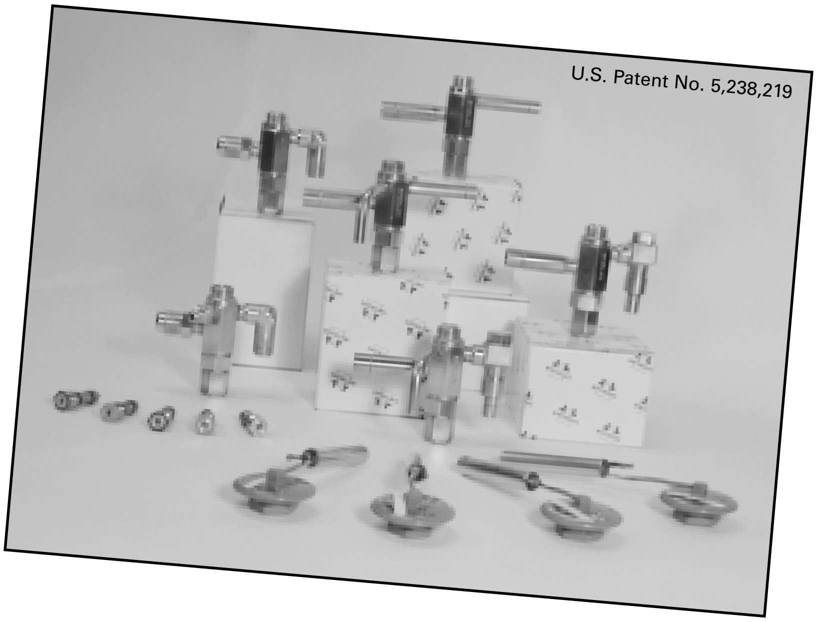


CARTRIDGE



BODY





For Refrigerants: 12-22-134a-402A-404A-407A-407C-408A-409A-502-507

SAE Flare & Extended ODF Solder Connections

Sporlan selective charges are specifically designed for low temperature, medium temperature and air conditioning applications. Since the valve body and thermostatic element are supplied as independent components, you select the best possible thermostatic charge for the application. The element is manufactured with a large, flat diaphragm to yield maximum power and performance. The thermostatic element to body is Sporlan's proven knife edge, metal-to-metal joint, insuring leak-proof construction.

Five cartridges are available with capacities that duplicate the balanced port BF, SBF, and EBF valve types. The cartridges are color-coded and metal stamped for identification. Like other Sporlan TEVs, flow through the BQ valve opposes the pin movement for improved stability at light loads. This design minimizes the risk of charge migration in the thermostatic element, a problem inherent in other cartridge style valves. By design, the Sporlan thermostatic element is warmed by the liquid flow entering through the top of the valve body.

The brass body type valve is available with three body styles, the BQ(E), the EBQ(E) and the SBQ(E). While the nomenclature may appear to be unique at first glance, it is patterned after Sporlan's BF and Q valves. The BQ(E) version is designed with the traditional SAE flare connections, the EBQ(E) and SBQ(E) are supplied with ODF connections. All BQ valves have a removable strainer, and share identical internal construction details with external adjustment assemblies.

These valves are designed for small refrigeration systems, including refrigerated cases, coolers and freezers. The externally equalized versions are well suited for air conditioning and heat pump duty.

12, 134a, 401A, 409A

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS
TONS OF REFRIGERATION

AIR CONDITIONING, HEAT PUMP and COMMERCIAL REFRIGERATION APPLICATIONS

VALVE TYPES	CARTRIDGE CODE (PORT SIZE)	REFRIGERANT											
		12			134a			401A			409A		
		RECOMMENDED THERMOSTATIC CHARGES											
		FC, FCP60			JC, JCP60			XC, XCP60			FC, FCP60		
		EVAPORATOR TEMPERATURE (°F)											
		40°	20°	0°	40°	20°	0°	40°	20°	0°	40°	20°	0°
BQ-EBQ-SBQ	AAA	0.21	0.23	0.22	0.25	0.28	0.26	0.27	0.30	0.29	0.25	0.28	0.27
	AA	0.45	0.45	0.41	0.54	0.54	0.50	0.58	0.58	0.54	0.55	0.54	0.50
	A	1.00	1.00	0.92	1.21	1.20	1.10	1.29	1.29	1.20	1.21	1.21	1.12
	B	1.70	1.69	1.56	2.05	2.03	1.87	2.20	2.20	2.04	2.06	2.05	1.90
	C	3.00	2.99	2.76	3.62	3.59	3.30	3.88	3.88	3.60	3.63	3.62	3.35

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)														
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE														
12	1.60	1.54	1.48	1.42	1.36	1.30	1.24	1.18	1.12	1.06	1.00	0.94	0.88	0.82	0.75
134a	1.70	1.63	1.56	1.49	1.42	1.36	1.29	1.21	1.14	1.07	1.00	0.93	0.85	0.78	0.71
401A	1.60	1.54	1.48	1.43	1.36	1.31	1.25	1.19	1.13	1.06	1.00	0.94	0.87	0.80	0.74
409A	1.55	1.50	1.45	1.39	1.34	1.28	1.23	1.17	1.12	1.06	1.00	0.94	0.88	0.82	0.76

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an evaporator temperature of 0°F. However, they may be used for any evaporator temperature from 0°F to 40°F since the variation in the actual factors across this range is insignificant.

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)							
	20	40	60	80	100	120	140	160
	CORRECTION FACTOR, CF PRESSURE DROP							
40°	0.58	0.82	1.00	1.15	1.29	1.41	1.53	1.63
20° & 0°	0.50	0.71	0.87	1.00	1.12	1.22	1.32	1.41

TEV capacity = TEV rating x CF liquid temperature x CF pressure drop — Example: Actual capacity of an A port in a Type BQ valve with R-134a at 20°F evaporator, 100 psi pressure drop across the TEV, and 60°F liquid temperature entering the TEV = 1.20 (from rating chart) x 1.29 (CF liquid temperature) x 1.12 (CF pressure drop) = 1.73 tons.

22, 407A, 407C

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS
TONS OF REFRIGERATION

AIR CONDITIONING, HEAT PUMP and COMMERCIAL REFRIGERATION APPLICATIONS

VALVE TYPES	CARTRIDGE CODE (PORT SIZE)	REFRIGERANT														
		22						407A						407C		
		RECOMMENDED THERMOSTATIC CHARGES														
		VC, VCP100, VGA			VZ, VZP40			VC, VCP100, VGA			VZ, VZP40			NC, NCP100, NGA		
		EVAPORATOR TEMPERATURE (°F)														
		40°	20°	0°	-10°	-20°	-40°	40°	20°	0°	-10°	-20°	-40°	40°	20°	0°
BQ-EBQ-SBQ	AAA	0.35	0.38	0.33	0.27	0.24	0.18	0.33	0.35	0.30	0.24	0.21	0.15	0.32	0.34	0.30
	AA	0.75	0.82	0.71	0.68	0.61	0.45	0.70	0.75	0.64	0.60	0.53	0.39	0.69	0.74	0.64
	A	1.60	1.74	1.52	1.22	1.09	0.81	1.50	1.60	1.37	1.08	0.96	0.70	1.47	1.58	1.36
	B	2.80	3.05	2.67	2.25	2.01	1.50	2.62	2.79	2.39	2.00	1.77	1.29	2.57	2.76	2.37
	C	5.20	5.67	4.96	4.04	3.62	2.70	4.86	5.19	4.44	3.58	3.17	2.31	4.78	5.13	4.41

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)														
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE														
22	1.56	1.51	1.45	1.40	1.34	1.29	1.23	1.17	1.12	1.06	1.00	0.94	0.88	0.82	0.76
407A	1.75	1.68	1.61	1.53	1.46	1.39	1.31	1.24	1.16	1.08	1.00	0.92	0.83	0.74	0.64
407C	1.69	1.62	1.55	1.49	1.42	1.35	1.28	1.21	1.14	1.07	1.00	0.93	0.85	0.77	0.69

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an evaporator temperature of 0°F. However, they may be used for any evaporator temperature from -40°F to 40°F since the variation in the actual factors across this range is insignificant.

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)										
	30	50	75	100	125	150	175	200	225	250	275
	CORRECTION FACTOR, CF PRESSURE DROP										
40°	0.55	0.71	0.87	1.00	1.12	1.22	1.32	1.41	1.50	1.58	1.66
20° & 0°	0.49	0.63	0.77	0.89	1.00	1.10	1.18	1.26	1.34	1.41	1.48
– 10° & – 20°	0.45	0.58	0.71	0.82	0.91	1.00	1.08	1.15	1.22	1.29	1.35
– 40°	0.41	0.53	0.65	0.76	0.85	0.93	1.00	1.07	1.13	1.20	1.25

TEV capacity = TEV rating x CF liquid temperature x CF pressure drop — Example: Actual capacity of an A port in a Type EBQ valve with R-22 at 20°F evaporator, 100 psi pressure drop across the TEV, and 90°F liquid temperature entering the TEV = 1.74 (from rating chart) x 1.06 (CF liquid temperature) x 0.89 (CF pressure drop) = 1.64 tons.

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS
TONS OF REFRIGERATION

404A, 408A, 502

AIR CONDITIONING, HEAT PUMP and COMMERCIAL REFRIGERATION APPLICATIONS

VALVE TYPES	CARTRIDGE CODE (PORT SIZE)	REFRIGERANT																	
		404A						408A						502					
		RECOMMENDED THERMOSTATIC CHARGE																	
		SC, SCP115			SZ, SZP			RC, RCP115			RZ, RZP			RC, RCP115			RZ, RZP		
		EVAPORATOR TEMPERATURE (°F)																	
		40°	20°	0°	-10°	-20°	-40°	40°	20°	0°	-10°	-20°	-40°	40°	20°	0°	-10°	-20°	-40°
BQ-EBQ-SBQ	AAA	0.23	0.24	0.23	0.24	0.21	0.17	0.31	0.33	0.32	0.34	0.30	0.25	0.23	0.24	0.23	0.24	0.21	0.18
	AA	0.46	0.49	0.46	0.45	0.39	0.32	0.62	0.66	0.64	0.63	0.55	0.47	0.45	0.48	0.46	0.45	0.39	0.33
	A	1.02	1.10	1.04	1.10	0.94	0.79	1.37	1.50	1.44	1.54	1.34	1.14	1.00	1.09	1.03	1.10	0.95	0.80
	B	1.89	1.98	1.66	1.60	1.37	1.14	2.53	2.70	2.30	2.24	1.95	1.66	1.85	1.95	1.65	1.60	1.38	1.17
	C	2.86	3.00	2.50	2.45	2.10	1.75	3.83	4.08	3.48	3.43	2.98	2.54	2.80	2.96	2.50	2.45	2.12	1.78

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)														
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE														
404A	2.04	1.94	1.84	1.74	1.64	1.54	1.43	1.33	1.22	1.11	1.00	0.89	0.77	0.65	0.53
408A	1.66	1.60	1.54	1.47	1.40	1.34	1.27	1.21	1.14	1.07	1.00	0.93	0.86	0.79	0.71
502	1.86	1.78	1.69	1.61	1.52	1.44	1.35	1.26	1.18	1.09	1.00	0.91	0.82	0.73	0.64

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an evaporator temperature of 0°F. However, they may be used for any evaporator temperature from -40°F to 40°F since the variation in the actual factors across this range is insignificant.

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)										
	30	50	75	100	125	150	175	200	225	250	275
	CORRECTION FACTOR, CF PRESSURE DROP										
40°	0.55	0.71	0.87	1.00	1.12	1.22	1.32	1.41	1.50	1.58	1.66
20° & 0°	0.49	0.63	0.77	0.89	1.00	1.10	1.18	1.26	1.34	1.41	1.48
– 10° & – 20°	0.45	0.58	0.71	0.82	0.91	1.00	1.08	1.15	1.22	1.29	1.35
– 40°	0.41	0.53	0.65	0.76	0.85	0.93	1.00	1.07	1.13	1.20	1.25

TEV capacity = TEV rating x CF liquid temperature x CF pressure drop — Example: Actual capacity of an A port in a Type SBQ valve with R-404A at -20°F evaporator, 125 psi pressure drop across the TEV, and 60°F liquid temperature entering the TEV = 0.94 (from rating chart) x 1.43 (CF liquid temperature) x 0.91 (CF pressure drop) = 1.22 tons.

THERMOSTATIC EXPANSION VALVE CAPACITIES for REFRIGERANTS
TONS OF REFRIGERATION

402A & 507

COMMERCIAL and LOW TEMPERATURE REFRIGERATION APPLICATIONS

VALVE TYPES	CARTRIDGE CODE (PORT SIZE)	REFRIGERANT											
		402A						507					
		RECOMMENDED THERMOSTATIC CHARGE											
		LC			LZ, LZP			PC			PZ, PZP		
		EVAPORATOR TEMPERATURE (°F)											
		40°	20°	0°	-10°	-20°	-40°	40°	20°	0°	-10°	-20°	-40°
BQ-EBQ-SBQ	AAA	0.23	0.24	0.23	0.24	0.21	0.18	0.23	0.24	0.22	0.24	0.21	0.17
	AA	0.46	0.49	0.46	0.45	0.39	0.33	0.45	0.48	0.45	0.44	0.38	0.32
	A	1.02	1.10	1.04	1.11	0.95	0.80	1.00	1.08	1.01	1.08	0.93	0.77
	B	1.88	1.98	1.66	1.61	1.39	1.16	1.85	1.94	1.62	1.57	1.35	1.12
	C	2.85	3.00	2.52	2.47	2.12	1.78	2.79	2.93	2.45	2.40	2.06	1.72

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV (°F)														
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE														
402A	2.01	1.91	1.82	1.72	1.62	1.52	1.42	1.32	1.22	1.11	1.00	0.89	0.77	0.65	0.53
507	1.99	1.89	1.79	1.69	1.59	1.50	1.40	1.30	1.20	1.10	1.00	0.89	0.78	0.66	0.51

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an evaporator temperature of 0°F. However, they may be used for any evaporator temperature from -40°F to 40°F since the variation in the actual factors across this range is insignificant.

EVAPORATOR TEMPERATURE (°F)	PRESSURE DROP ACROSS TEV (PSI)											
	30	50	75	100	125	150	175	200	225	250	275	300
	CORRECTION FACTOR, CF PRESSURE DROP											
40°	0.55	0.71	0.87	1.00	1.12	1.22	1.32	1.41	1.50	1.58	1.66	1.73
20° & 0°	0.49	0.63	0.77	0.89	1.00	1.10	1.18	1.26	1.34	1.41	1.48	1.55
– 10° & – 20°	0.45	0.58	0.71	0.82	0.91	1.00	1.08	1.15	1.22	1.29	1.35	1.41
– 40°	0.41	0.53	0.65	0.76	0.85	0.93	1.00	1.07	1.13	1.20	1.25	1.31

TEV capacity = TEV rating x CF liquid temperature x CF pressure drop — Example: Actual capacity of an A port in a Type BQ valve with R-402A at -20°F evaporator, 125 psi pressure drop across the TEV, and 60°F liquid temperature entering the TEV = 0.95 (from rating chart) x 1.42 (CF liquid temperature) x 0.91 (CF pressure drop) = 1.23 tons.

SPECIFICATIONS — ELEMENT SIZE NO. 43, KNIFE EDGE JOINT

REFRIGERANT (Sporlan Code)	TYPE BQ SAE Flare ① Internal Equalizer	TYPE BQ SAE Flare ② External Equalizer	CARTRIDGE CODE (Port Size)	NOMINAL CAPACITY RANGE Tons of Refrigeration	Thermostatic Charges Available	Standard Tubing Length-Inches	CONNECTIONS – Inches (Blue figures are standard and will be furnished unless otherwise specified.) SAE Flare INLET x OUTLET	CONNECTIONS SAE Flare External Equalizer	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	BQ-AAA	BQE-AAA	**AAA**	1/8 thru 1/3	**C Z ZP40**	60	*BQ & BQE* 1/4 x 3/8 SAE 1/4 x 1/2 SAE **3/8 x 1/2 SAE** ③ 90° Angle Inlet	**1/4 SAE**	1	1-1/2
	BQ-AA	BQE-AA	**AA**	1/2 thru 2/3						
	BQ-A	BQE-A	**A**	3/4 thru 1-1/2						
	BQ-B	BQE-B	**B**	1-3/4 thru 3						
	BQ-C	BQE-C	**C**	3-1/4 thru 5-1/2						
134a (J) 12 (F) 401A (X) 409A (F)	BQ-AAA	BQE-AAA	**AAA**	1/8 thru 1/5	**C**					
	BQ-AA	BQE-AA	**AA**	1/4 thru 1/3						
	BQ-A	BQE-A	**A**	1/2 thru 1						
	BQ-B	BQE-B	**B**	1-1/4 thru 1-3/4						
	BQ-C	BQE-C	**C**	2 thru 3						
404A (S) 502 (R) 408A (R)	BQ-AAA	BQE-AAA	**AAA**	1/8 thru 1/5	**C Z ZP**					
	BQ-AA	BQE-AA	**AA**	1/4 thru 1/3						
	BQ-A	BQE-A	**A**	1/2 thru 1						
	BQ-B	BQE-B	**B**	1-1/4 thru 2						
	BQ-C	BQE-C	**C**	2-1/4 thru 3						
507 (P) 402A (L)	BQ-AAA	BQE-AAA	**AAA**	1/8 thru 1/5	**C Z ZP**					
	BQ-AA	BQE-AA	**AA**	1/4 thru 1/3						
	BQ-A	BQE-A	**A**	1/2 thru 1						
	BQ-B	BQE-B	**B**	1-1/4 thru 2						
	BQ-C	BQE-C	**C**	2-1/4 thru 3						

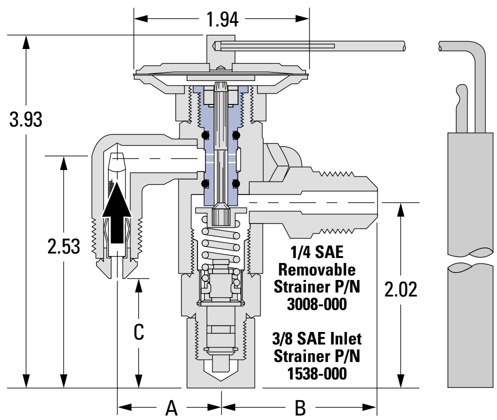
① Valves listed in this column should not be assembled with MOP Type air conditioning charges.
② Standard External Equalizer 1/4" SAE (BQ Body), 1/4" ODF (SBQ and EBQ Body).
③ The 3/8" SAE inlet fitting has a long taper on the flare surface. A 3/8" x 1/4" reducing flare nut will allow 1/4" OD tubing to be attached to this fitting.

SPECIFICATIONS — ELEMENT SIZE NO. 43, KNIFE EDGE JOINT

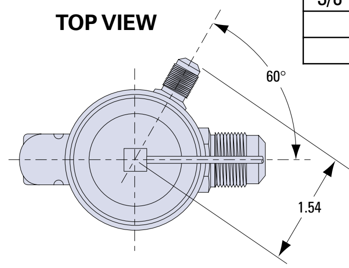
REFRIGERANT (Sporlan Code)	TYPE SBQ Extended ODF Solder (with replaceable strainer) ① Internal Equalizer	TYPE SBQ Extended ODF Solder (with replaceable strainer) ② External Equalizer	TYPE EBQ Extended ODF Solder Internal Equalizer	TYPE EBQ Extended ODF Solder ② External Equalizer	CARTRIDGE CODE (Port Size)	NOMINAL CAPACITY RANGE Tons of Refrigeration	Thermostatic Charges Available	Std. Tubing Lgth.-In.	CONNECTIONS – Inches (Blue figures are standard and will be furnished unless otherwise specified.) Extended ODF Solder INLET x OUTLET	CONNECTIONS Extended ODF Solder External Equalizer	Net Weight-Lbs.	Shipping Weight-Lbs.
22 (V) 407C (N) 407A (V)	SBQ-AAA	SBQE-AAA	EBQ-AAA	EBQE-AAA	**AAA**	1/8 thru 1/3	**C Z ZP40**	60	*SBQ & SBQE Only* **3/8 x 1/2 ODF** 90° Angle Inlet *EBQ Only* **3/8 x 1/2 ODF** Straight Thru *EBQE* **3/8 x 1/2 ODF** 1/2 x 5/8 ODF 1/2 x 7/8 ODF Straight Thru	**1/4 ODF Pointed Toward Bottom Cap**	1	1-1/2
	SBQ-AA	SBQE-AA	EBQ-AA	EBQE-AA	**AA**	1/2 thru 2/3						
	SBQ-A	SBQE-A	EBQ-A	EBQE-A	**A**	3/4 thru 1-1/2						
	SBQ-B	SBQE-B	EBQ-B	EBQE-B	**B**	1-3/4 thru 3						
	SBQ-C	SBQE-C	EBQ-C	EBQE-C	**C**	3-1/4 thru 5-1/2						
134a (J) 12 (F) 401A (X) 409A (F)	SBQ-AAA	SBQE-AAA	EBQ-AAA	EBQE-AAA	**AAA**	1/8 thru 1/5	**C**					
	SBQ-AA	SBQE-AA	EBQ-AA	EBQE-AA	**AA**	1/4 thru 1/3						
	SBQ-A	SBQE-A	EBQ-A	EBQE-A	**A**	1/2 thru 1						
	SBQ-B	SBQE-B	EBQ-B	EBQE-B	**B**	1-1/4 thru 1-3/4						
	SBQ-C	SBQE-C	EBQ-C	EBQE-C	**C**	2 thru 3						
404A (S) 502 (R) 408A (R)	SBQ-AAA	SBQE-AAA	EBQ-AAA	EBQE-AAA	**AAA**	1/8 thru 1/5	**C Z ZP**					
	SBQ-AA	SBQE-AA	EBQ-AA	EBQE-AA	**AA**	1/4 thru 1/3						
	SBQ-A	SBQE-A	EBQ-A	EBQE-A	**A**	1/2 thru 1						
	SBQ-B	SBQE-B	EBQ-B	EBQE-B	**B**	1-1/4 thru 2						
	SBQ-C	SBQE-C	EBQ-C	EBQE-C	**C**	2-1/4 thru 3						
507 (P) 402A (L)	SBQ-AAA	SBQE-AAA	EBQ-AAA	EBQE-AAA	**AAA**	1/8 thru 1/5	**C Z ZP**					
	SBQ-AA	SBQE-AA	EBQ-AA	EBQE-AA	**AA**	1/4 thru 1/3						
	SBQ-A	SBQE-A	EBQ-A	EBQE-A	**A**	1/2 thru 1						
	SBQ-B	SBQE-B	EBQ-B	EBQE-B	**B**	1-1/4 thru 2						
	SBQ-C	SBQE-C	EBQ-C	EBQE-C	**C**	2-1/4 thru 3						

① Valves listed in this column should not be assembled with MOP Type air conditioning charges.
② Standard External Equalizer 1/4" SAE (BQ Body), 1/4" ODF (SBQ and EBQ Body).

TYPE BQE

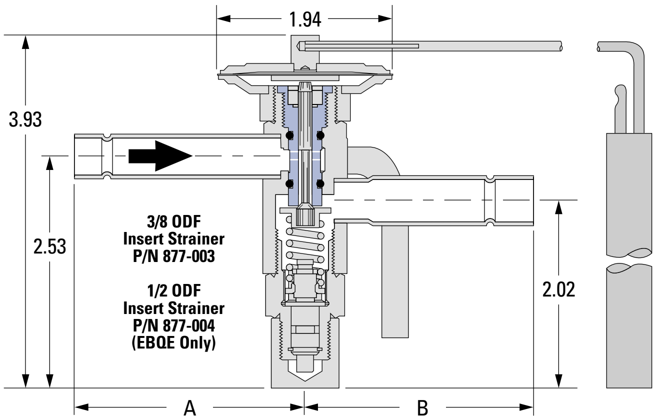


TOP VIEW

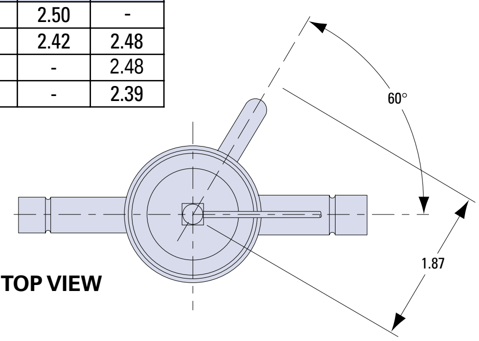


BQE DIMENSIONS – Inches			
FITTING SIZE	A	B	C
1/4 SAE, 90° Angle	1.19	-	1.44
3/8 SAE, 90° Angle	1.35	-	1.08
3/8 SAE	-	1.61	-
1/2 SAE	-	1.80	-

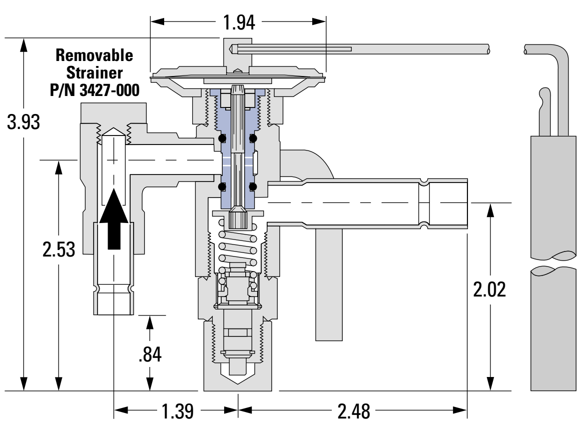
TYPE EBQE



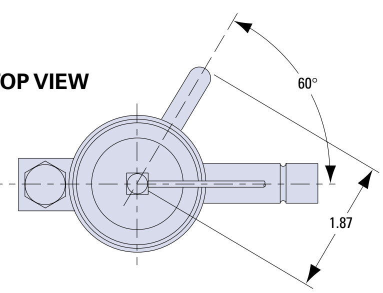
EBQE DIMENSIONS – Inches		
FITTING SIZE	A	B
3/8	2.50	-
1/2	2.42	2.48
5/8	-	2.48
7/8	-	2.39



TOP VIEW



TOP VIEW



BQE, EBQE, SBQE BULB SIZES – Inches				
STANDARD CHARGES	REFRIGERANT			
	22	134a	404A	507
C	0.50 OD x 3.00			
Z & ZP Series	0.50 OD x 3.00	–	0.50 OD x 3.00	
CP Series	0.50 OD x 3.00			–
VGA	0.75 OD x 2.00	–		

COMPLETE VALVE NOMENCLATURE

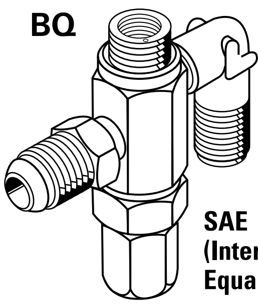
BQE	- AAA -	V	C	- 5'	- 3/8 x 1/2 x 1/4 SAE
Valve Type BQ, EBQ, SBQ = Internally Equalized BQE, EBQE, SBQE = Externally Equalized	Cartridge Size	Refrigerant Code (See page 9)	Thermostatic Charge	Capillary Tube Length	Connection Size and Style: In x Out x Ext. Eq.

(See page 9)

SELECTING COMPONENTS

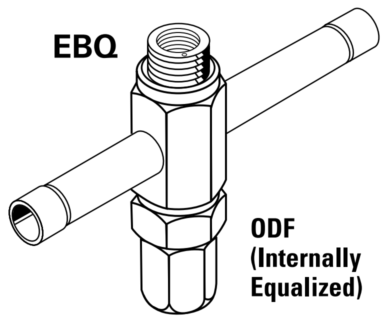
1 BODY

BQ



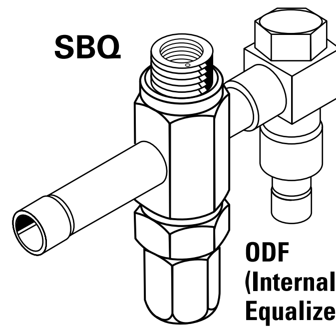
SAE (Internally Equalized)

EBQ



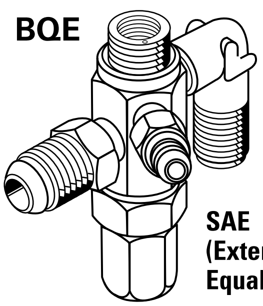
ODF (Internally Equalized)

SBQ



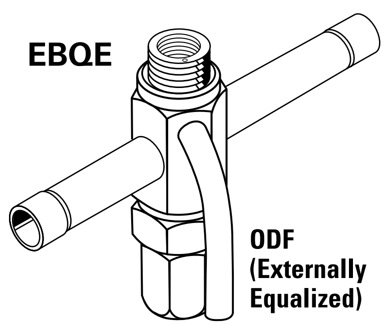
ODF (Internally Equalized)

BQE



SAE (Externally Equalized)

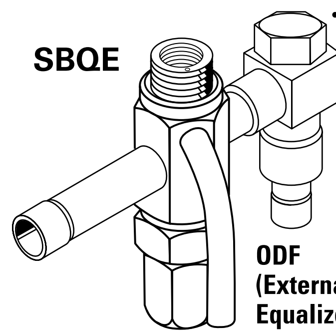
EBQE



ODF (Externally Equalized)

Replaceable Strainer
• U.S. Patent No. 5,232,015
• P/N 3427-000

SBQE

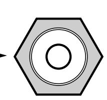


ODF (Externally Equalized)

2 CARTRIDGE

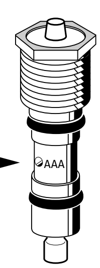
U.S. Patent No. 5,238,219

Top surface is color coded to identify cartridge capacity



Identification tag with cartridge code (bends around capillary tubing)

Capacity code on cartridge

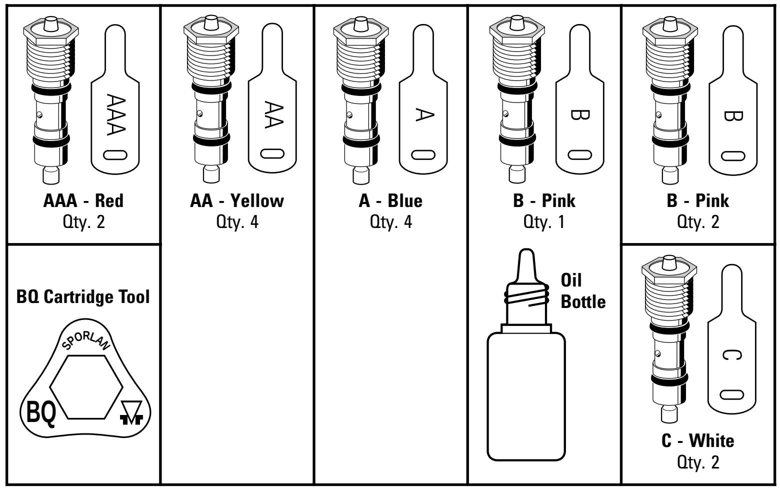


INDIVIDUAL REPLACEMENT PARTS

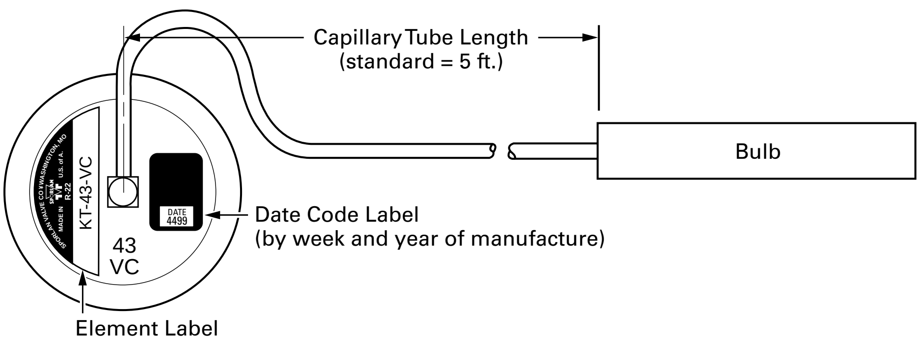
PART NUMBER	SIZE	COLOR CODE
CARTRIDGE AND I.D. TAG		
BQC-AAA	AAA	RED
BQC-AA	AA	YELLOW
BQC-A	A	BLUE
BQC-B	B	PINK
BQC-C	C	WHITE
MISCELLANEOUS PARTS		
OB-1	Oil Bottle (With Oil)	
4444-000	BQ Cartridge Tool	
184007	Cartridge Service Kit (Complete as noted on page 9)	

NOMINAL CAPACITY (tons) of the VALVE to be REPLACED								BQ VALVE CARTRIDGE	
R-12	R-22	R-134a	R-401A	R-402A	R-404A	R-502	R-507	SIZE	COLOR CODE
1/8 thru 1/5	1/8 thru 1/3	1/8 thru 1/5	1/8 thru 1/5	1/8 thru 1/5	1/8 thru 1/5	1/8 thru 1/5	1/8 thru 1/5	**AAA**	**RED**
1/4 thru 1/3	1/2 thru 2/3	1/4 thru 1/3	1/4 thru 1/3	1/4 thru 1/3	1/4 thru 1/3	1/4 thru 1/3	1/4 thru 1/3	**AA**	**YELLOW**
1/2 thru 1	3/4 thru 1-1/2	1/2 thru 1	1/2 thru 1	1/2 thru 1	1/2 thru 1	1/2 thru 1	1/2 thru 1	**A**	**BLUE**
1-1/4 thru 1-3/4	1-3/4 thru 3	1-1/4 thru 1-3/4	1-1/4 thru 1-3/4	1-1/4 thru 2	1-1/4 thru 2	1-1/4 thru 2	1-1/4 thru 2	**B**	**PINK**
2 thru 3	3-1/4 thru 5-1/2	2 thru 3	2 thru 3	2-1/4 thru 3	2-1/4 thru 3	2-1/4 thru 3	2-1/4 thru 3	**C**	**WHITE**

CARTRIDGE SERVICE KIT – Part No. 184007



3 ELEMENT



KT	-	43	-	V	C
Abbreviation for "Kit"		Element Size Number		*Refrigerant Code	Thermostatic Charge

SPORLAN CODE - REFRIGERANT - Element Label Color Code
F - R-12 - Yellow
V - R-22 - Green
J - R-134a - Blue
X - R-401A - Pink
L - R-402A - Sand
S - R-404A - Orange
V - R-407A - Green
N - R-407C - Light Brown
R - R-408A - Purple
F - R-409A - Yellow
R - R-502 - Purple
P - R-507 - Teal

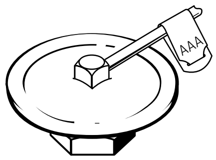
*While many new refrigerants and refrigerant blends have a unique letter code, many use the same thermostatic element as the traditional refrigerant they replace. Refer to the table below to select the correct thermostatic element.

RECOMMENDED THERMOSTATIC ELEMENTS

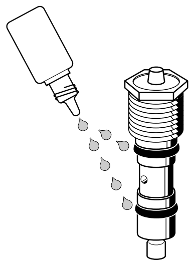
APPLICATION	REFRIGERANT												THERMOSTATIC ELEMENT	SYSTEM MOP psig
	12	22	134a	401A	402A	404A	407A	407C	408A	409A	502	507		
AIR CONDITIONING	X	–	X	X	–	–	–	–	–	X	–	–	KT-43-FCP60	50
	–	X	–	–	–	–	X	X	–	–	–	–	KT-43-VCP100	90
	–	X	–	–	–	–	X	X	–	–	–	–	KT-43-VGA	–
	–	–	–	–	–	X	–	–	X	–	X	–	KT-43-SCP115	105
COMMERCIAL REFRIGERATION 50°F to – 10°F	X	–	X	X	–	–	–	–	–	X	–	–	KT-43-FC	–
	–	X	–	–	–	–	X	X	–	–	–	–	KT-43-VC	–
	–	–	–	–	–	X	–	–	X	–	X	–	KT-43-SC	–
	–	–	–	–	X	–	–	–	–	–	–	X	KT-43-PC	–
LOW TEMPERATURE REFRIGERATION 0°F to – 40°F	X	–	–	–	–	–	–	–	–	–	–	–	KT-43-FZ	–
	X	–	–	–	–	–	–	–	–	–	–	–	KT-43-FZP	12
	–	X	–	–	–	–	X	–	–	–	–	–	KT-43-VZ	–
	–	X	–	–	–	–	X	–	–	–	–	–	KT-43-VZP40	30
	–	–	–	–	X	X	–	–	X	–	X	X	KT-43-SZ	–
	–	–	–	–	X	X	–	–	X	–	X	X	KT-43-SZP	35

The Sporlan type ZP thermostatic charges have essentially the same characteristics as the conventional Z cross charges with one exception: they produce a pressure limit or MOP. The ZP charges are not intended as replacements for the Z charges - they should only be used where a definite pressure limit is required to prevent overloading the motor.

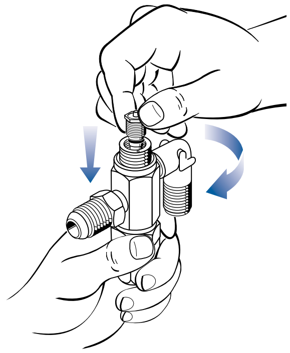
COMPONENT ASSEMBLY



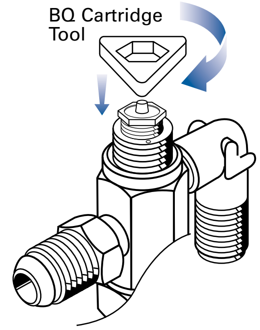
1 Attach cartridge identification tag to element capillary tube.



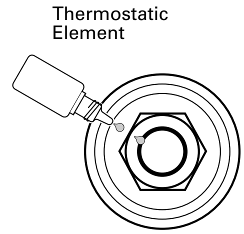
2 (Oil) Lubricate O-rings.



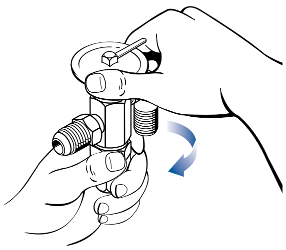
3 Turn clockwise while applying downward force.



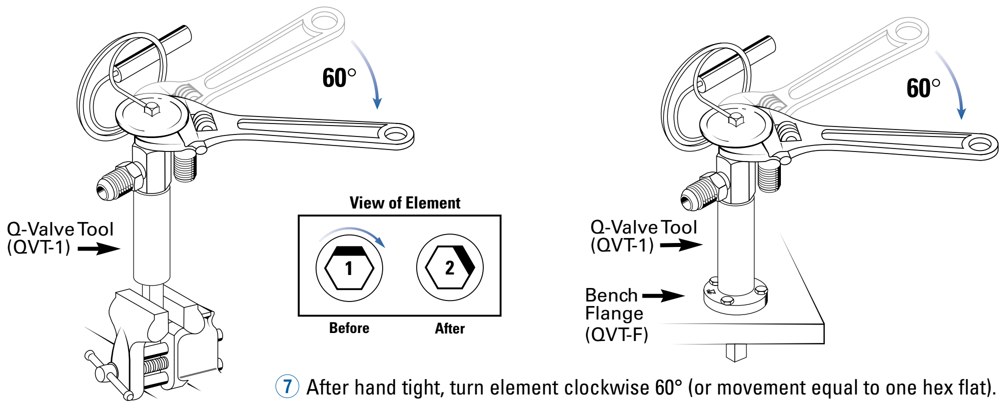
4 Once threads are engaged, Turn clockwise until seated (do not over tighten).



5 (Oil) Lubricate lock ring surface.

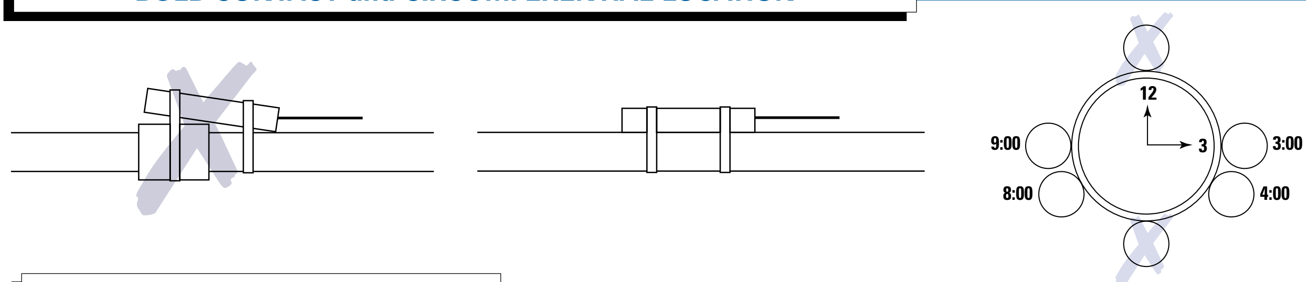


6 Hand tighten element.

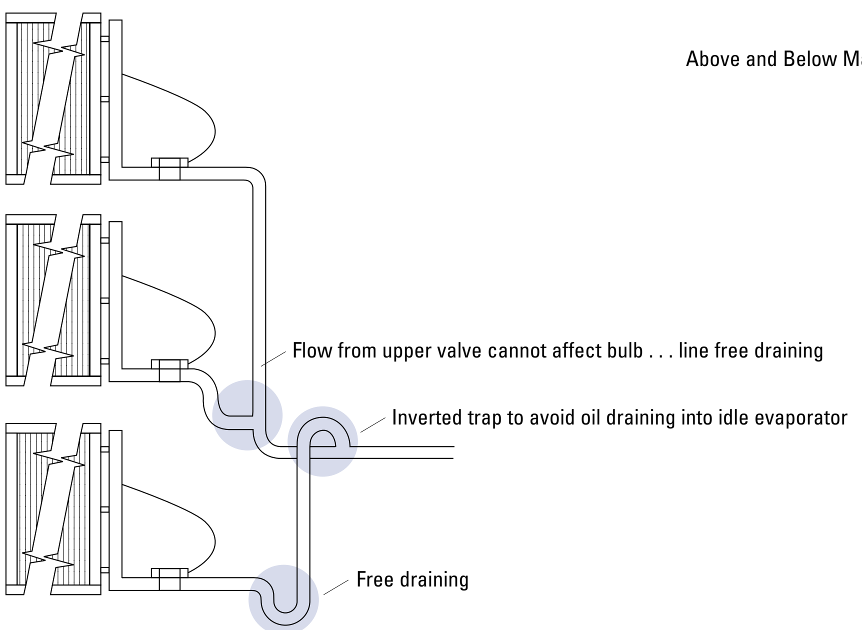


7 After hand tight, turn element clockwise 60° (or movement equal to one hex flat).

BULB CONTACT and CIRCUMFERENTIAL LOCATION



MULTIPLE EVAPORATORS



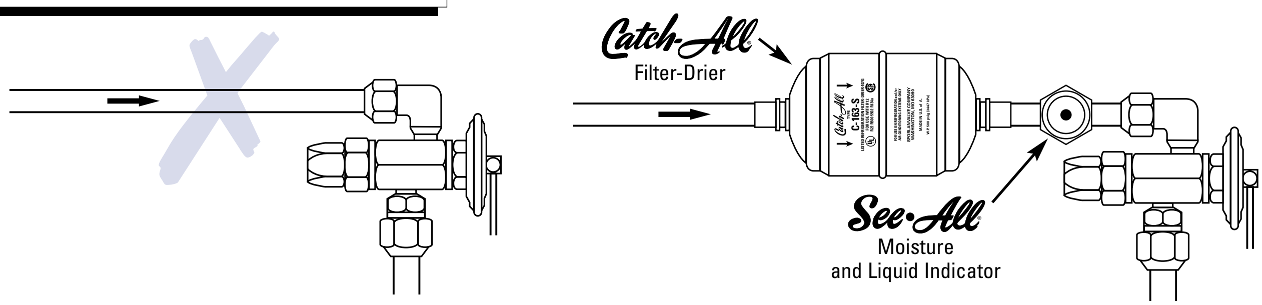
MAXIMUM TEST CONDITIONS

MAXIMUM DEHYDRATION TEMPERATURES °F					
REFRIGERANT	THERMOSTATIC CHARGE				
	VGA	C	Z	P Air Conditioning Charge	ZP
12	250	190	250	250	250
134a		190	250		
22		160	185		
502		150	170		

MAXIMUM LOW SIDE TEST PRESSURES	
VALVE TYPE	psig
BQ(E), EBQ(E), SBQ(E)	450

If elevated temperatures are used to assist in dehydrating the system, the thermostatic expansion valve should not be exposed to temperatures exceeding those shown in the table above.

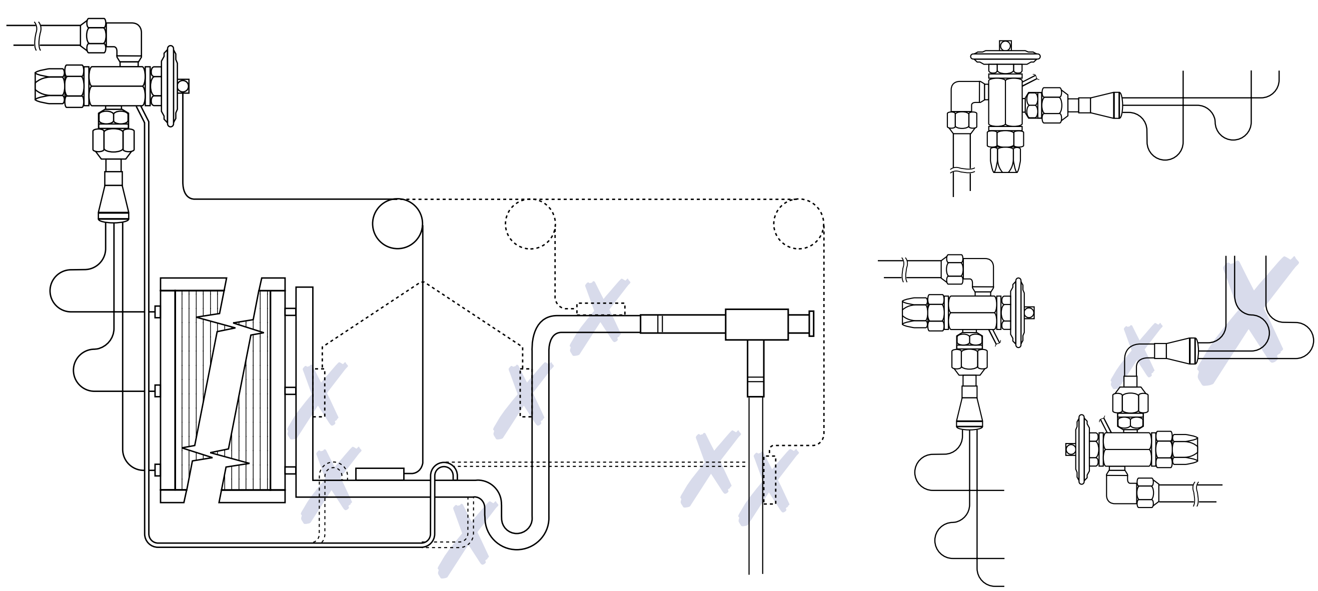
SYSTEM INSURANCE

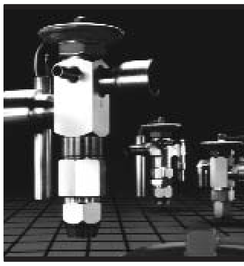


SOLDER TECHNIQUES

Direct torch tip away from valve body and wrap body with wet rag.

VALVE, EXTERNAL EQUALIZER, and BULB LOCATIONS





Thermostatic Expansion Valves

Installation, Field Service, and Assembly

SPORLAN

Table of Contents

Installation

For peak performance, it is important to select a Sporlan Thermostatic Expansion Valve (TEV) with correct capacity, selective charge, external or internal equalizer, etc. See Bulletins 10-9 and 10-10 for complete application information. Equally important is the proper installation, which can determine the success or failure of the entire system.

Valve Location

TEVs may be mounted in any position, but they should be installed as close to the evaporator as possible. If a refrigerant distributor is used with the expansion valve, best performance is obtained if the distributor is mounted directly to the valve outlet. If the distributor cannot be mounted directly to the valve outlet, the distance between the valve outlet and distributor should not exceed 24 inches or refrigerant distribution problems may occur. Also, the tube connecting the valve outlet and distributor can be sized smaller to maintain refrigerant velocity and better distribution. Elbows located between the expansion valve and distributor will hinder proper distribution and therefore, are not recommended.

Best distribution is usually obtained if the expansion valve feeds vertically up or down into the distributor. System manufacturers, however, have successfully applied distributors in other orientations. See Bulletin 20-10 for application and selection information on refrigerant distributors.

While not always convenient or possible, valve Types BI, F, FB, and O are easier to service if mounted in a vertical and upright position. If mounted in a horizontal position, the internal parts must be carefully reassembled to prevent damage to them. Also, some consideration should be taken in mounting larger sized expansion valves. They must be adequately supported since system vibration and the weight of the valve may cause valve connections to fracture.

If a hand valve is located on the outlet side of the TEV it should have a full sized port. No restrictions should appear between the TEV and the evaporator, except a refrigerant distributor if one is used.

Sporlan TEVs having Selective Charges C, Z, L, or X may be installed and operated in most locations. The amount of thermostatic charge and the bulb size are such that the bulb retains control despite a colder valve body or diaphragm case. The exception is when the element is subjected to sub-zero temperatures for extended periods of time during an off-cycle. In this case, start-up may be prolonged until the bulb and element are warmed sufficiently to open the valve.

To minimize the possibility of charge migration, the Sporlan MOP type charges (CP series, ZP series, and VGA) should be installed so the diaphragm case is warmer than the bulb. Special non-condensable charges without MOP and double diaphragm hydraulic elements with MOP are available for system manufacturers to overcome this potential problem.

Occasionally, TEVs are located in corrosive atmospheric conditions that can damage the valve and/or the element assembly. Due to this possibility, the valve must be protected with appropriate materials to prevent premature failure. Consult specialists in protective coatings.

Precautions:

When the evaporator and TEV are located above the receiver, there is a static pressure loss in the liquid line. This is due to the weight of the column of liquid refrigerant, and this weight may be interpreted in terms of pressure loss in pounds per square inch as shown in Table 3, Bulletin 10-9. If the vertical lift is great enough, vapor or ***flash gas*** will form in the liquid line causing a serious reduction in the capacity of the TEV.

When an appreciable vertical lift is unavoidable, precautions should be taken to prevent the accompanying pressure loss from producing liquid line vapor. This can be accomplished by providing enough subcooling to the liquid refrigerant, either in the condenser or after the liquid leaves the receiver. Subcooling is determined by subtracting the actual liquid temperature from the condensing temperature (corresponding to the condensing pressure). A subcooling calculation example is provided in the "subcooling" section of Bulletin 10-9.

Bulletin 10-11, October 2003 Supersedes Bulletin 10-11, September 1996 and all prior publications.

Liquid subcooling is provided by the following methods:

1. In the condenser

2. Suction – liquid heat exchanger

3. Special devices

Method 1 – will provide sufficient subcooling for the simple short-coupled system that has only moderate liquid line pressure drop.

Method 2 – will usually not provide more than 20°F subcooling on air conditioning systems operating at normal head pressures. The amount of subcooling will depend on the design and size of the heat exchanger and on the operating suction and discharge pressures.

Method 3 – may be used to provide considerable subcooling required for systems with excessive vertical lift. The following special devices are the most commonly used methods:

- Water coils in heat exchange relationship with the liquid line.
- Separate refrigeration system.
- Special heat exchanger which uses a portion of the refrigerant to cool the main body of liquid. See Figure 1.

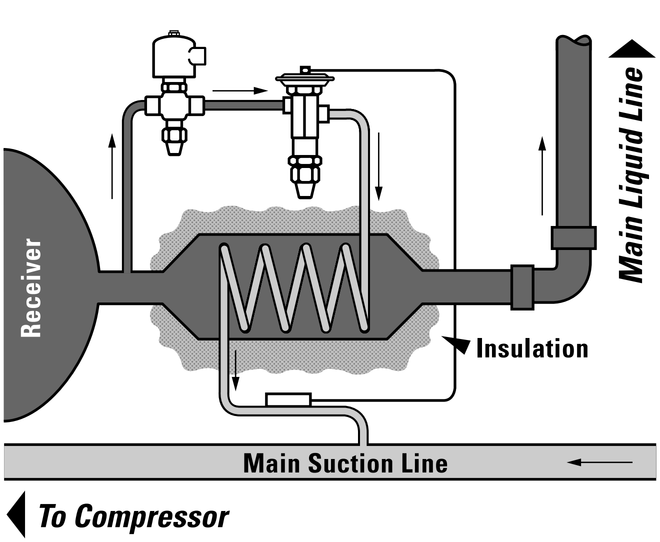


Figure 1

Ordinarily the conventional suction-liquid heat exchanger is installed near the evaporator, where the suction vapor is the coldest, to re-condense any vapor in the liquid line. When the primary purpose of the heat exchanger is to prevent the formation of flash gas – particularly on systems that have a long liquid line or excessive vertical lift – install the heat exchanger near the receiver ***before the vertical lift occurs***. (This also applies to the special devices described in Method 3). Because vapor in the liquid line considerably increases friction losses, the total pressure drop available across the expansion device on these types of systems is reduced. Also, the suction line and liquid line should be carefully insulated to minimize heat gain if subcooled below ambient temperature.

Important

Preventing the formation of vapor in liquid lines having high pressure losses does not eliminate the requirement that an adequate pressure drop must be available across the TEV. The capacity tables show valve capacities at pressure drops lower than normal. For TEV application data and capacities at pressure drops below those listed, ***consult Sporlan Valve Company***.

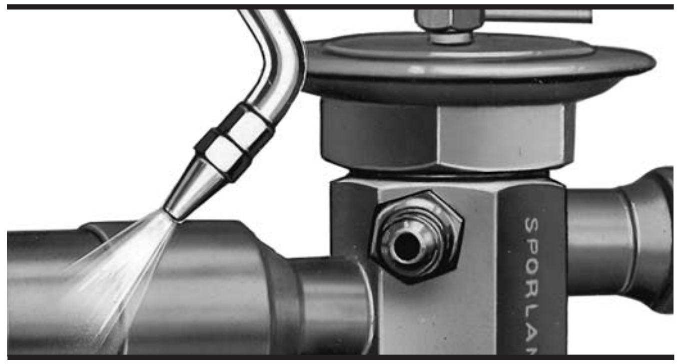


Figure 2

Solder Techniques

It is not necessary to disassemble solder type valves when soldering to the connecting lines. Any of the commonly used types of solders, e.g., 95-5, Sil-Fos, Easy-Flo, Phos-Copper, Stay Brite 8 or equivalents may be used for copper to copper connections. When soldering a brass refrigerant distributor to the valve, appropriate solders for these connections, such as 95-5, Easy-Flo, Stay Brite 8 or equivalents must be used. It is important however, regardless of the solder used, to direct the flame away from the valve body and avoid excessive heat on the diaphragm, Figure 2. As an extra precaution, a wet cloth may be wrapped around the body and element during the soldering operation.

This precaution will prevent overheating the valve body which could damage the superheat spring and result in flood back problems. In addition, the Type O, EBF/SBF, and EBS valve contain synthetic parts which can be damaged due to overheating, resulting in poor valve performance.

Bulb Location and Installation

The location and installation of the bulb is extremely important to the proper performance of the system and care should be taken with its final location.

Accepted principles of good suction line piping should be followed to provide a bulb location that will give the best possible valve control. When system manufacturers have piping recommendations that differ from the general industry recommendations and Sporlan's suggestions shown in this section, those recommendations should be used. When specific recommendations are not available, the suggestions below should be used.

The bulb should be attached to a horizontal suction line at the evaporator outlet (See Figures 3, 4, and 5) If the bulb cannot be located in that manner, it may be located on a ***descending*** vertical line only (as shown in Figure 5 for "pumpdown control"). The bulb should never be located in a trap or downstream of a trap in the suction line. Liquid refrigerant or mixture of liquid refrigerant and oil boiling out of the trap will falsely influence the temperature of the bulb and result in poor valve control.

On suction lines 7/8" OD and larger, the surface temperature may vary slightly around the circumference of the line. On these lines, it is generally recommended that the bulb be installed at 4 or 8 o'clock on the side of the horizontal line, and parallel with respect to the direction of flow. On smaller lines the bulb may be mounted at any point around the circumference, however locating the bulb on the bottom of the line is not recommended as an oil-refrigerant mixture is generally present at that point. Certain conditions peculiar to a particular system may require a different bulb location than normally

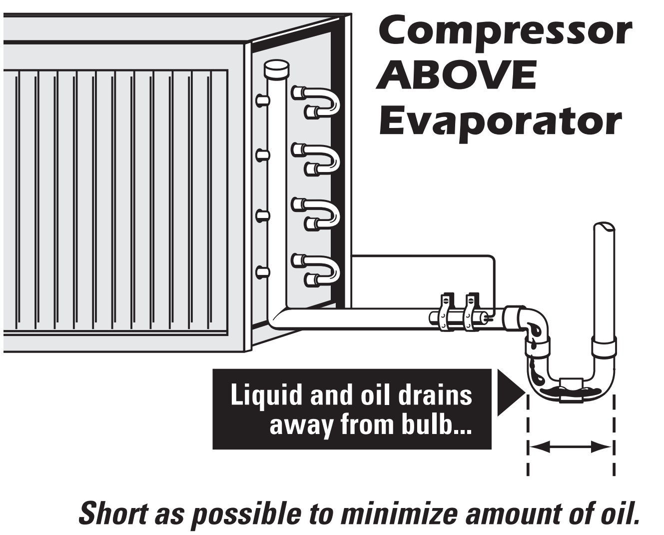


Figure 3

recommended. In these cases the proper bulb location may be determined by trial.

For satisfactory expansion valve control, ***good thermal contact*** between the bulb and suction line is essential. The bulb should be securely fastened with two bulb straps, supplied with each expansion valve, to a clean straight section of the suction line.

Recommended suction line piping usually includes a horizontal line leaving the evaporator to which the TEV bulb is attached. This line is pitched slightly downward, and when a vertical riser follows, a short trap is placed immediately ahead of the vertical line, see Figure 3. The trap will collect any liquid refrigerant or oil passing through the suction line and prevent it from influencing the bulb temperature.

On multiple evaporator installations the piping should be arranged so that the flow from any valve cannot affect the bulb of another. Approved piping practices including the proper use of traps

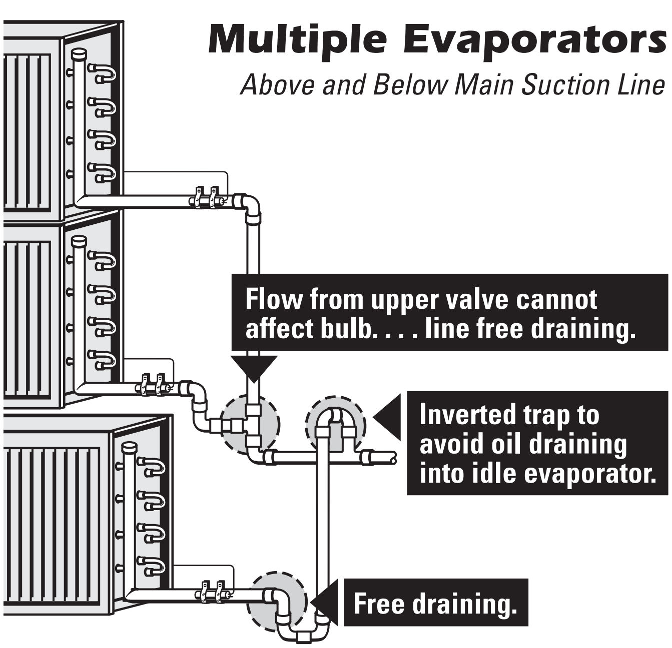


Figure 4

insures individual control for each valve without the influence of refrigerant and oil flow from other evaporators.

For recommended suction line piping when the compressor is located below the evaporator see Figure 5. The vertical riser extending to the height of the evaporator prevents refrigerant from draining by gravity into the compressor during the off-cycle. When a pumpdown control is used the suction line may turn immediately down without a trap.

On commercial and low temperature applications requiring Sporlan Selective Charges C, Z, or X the bulb should be clamped on the suction line at a point where the bulb temperature will be the same as the evaporator temperature during the off-cycle. This will insure tight closing of the valve when the compressor stops. If bulb insulation is used on lines operating below 32°F, use non-water absorbing insulation to prevent water from freezing around the bulb.

On brine tanks and water coolers, the bulb should be below the liquid surface where it will be at the same temperature as the evaporator during the off-cycle. When locating the bulb in a brine tank, paint it and the capillary tubing with pitch or other corrosion resistant paint.

If, for practical reasons, the bulb must be located where its temperature will be higher than the evaporator during the off-cycle, a solenoid valve must be used ahead of the TEV.

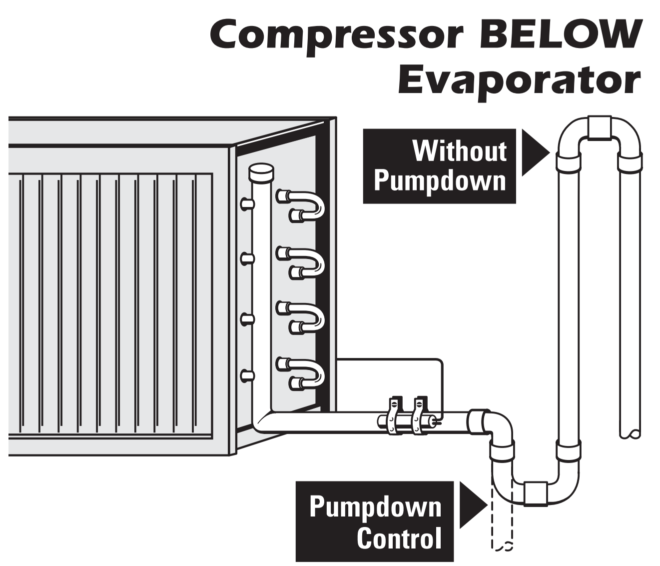


Figure 5

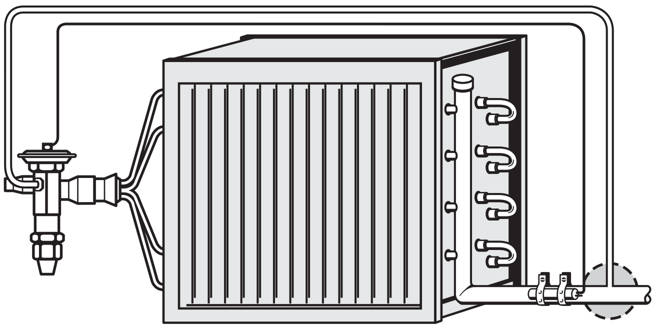
On air conditioning applications having TEVs equipped with VCP100 or VGA elements, the bulb may be located inside or outside the cooled space or duct. The valve body should not be located in the air stream leaving the evaporator. Avoid locating the bulb in the return air stream unless it is well insulated.

External Equalizer Connection

For a complete explanation of when an externally equalized valve should be used, refer to "equalization method," Bulletin 10-9. Valves supplied with an external equalizer ***will not operate*** unless this connection is made.

The equalizer connection should be made at a point that will most accurately reflect the pressure existing in the suction line at the bulb location. See Figure 6. Generally, the connection is immediately downstream of the bulb. However, equipment manufacturers sometimes locate them in return bends or suction headers that are

External Equalizer Connection



It must be connected - NEVER CAPPED! Must be free of crimps, solder, etc.

Figure 6

compatible with their specific design requirements. The difference between the pressure at the equalizer connection and the suction pressure at the bulb location should not exceed reasonable pressure drop values. The values shown in Table 1 of Bulletin 10-9 can be used as a guide in determining the value.

If any evaporator pressure or temperature control valves are located in the suction line at or near the evaporator outlet, the equalizer must be connected on the evaporator side of these valves.

Driers, Strainers, and Accessories

Most Sporlan TEVs are equipped with built-in screens of varying mesh sizes depending on the valve size and type. These strainers are effective only in removing particles of scale, solder, etc. which could obstruct the closure of the pin and seat.

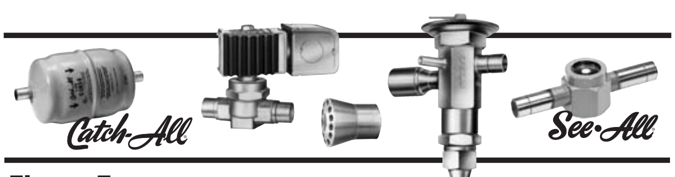


Figure 7

Moisture and smaller particles of foreign materials are equally harmful to the system and must be removed for peak system performance. Field experience has proven that, without a doubt, most expansion valve failures are due to the presence of dirt, sludge, and moisture in the system. Furthermore, the performance and life of other system components are also seriously affected by these foreign materials. The Sporlan **Catch-All Filter-Drier®** removes dirt, moisture, acids, and sludge, and insures the circulation of clean, dry refrigerant through the system at all times.

For all refrigeration and air conditioning applications we recommend that a Sporlan Catch-All Filter-Drier be installed in the liquid line ahead of the TEV. See Bulletin 40-10 for complete Catch-All Filter-Drier specifications.

Further system protection is easily and inexpensively provided with the installation of a Sporlan **See-All®**. The See-All is a combination liquid and moisture indicator that visually indicates if there is a shortage of refrigerant in the liquid line, or if the moisture content of the refrigerant is at a dangerous level. See Bulletin 70-10 for complete See-All specifications.

Test Pressures and Dehydration Temperatures

Inert dry gases such as nitrogen, helium or CO_2 are often used for leak detection.

CAUTION: Inert gases must be added to the system carefully through a pressure regulator. Unregulated gas pressure can seriously damage the system and endanger human life. Never use oxygen or explosive gases.

Excessive test pressures can shorten the life of the TEV diaphragm. Table 1 lists the maximum pressure that can safely be applied with the expansion valve connected to the evaporator. These maximum pressures are well above the minimum field leak test pressures for low sides, listed by the ANSI/ASHRAE Standard 15-2001 or latest revision.

The external equalizer line should be disconnected if there is any possibility of exceeding the recommended maximum pressures listed below.

If elevated temperatures are used to assist in dehydrating the system, the TEV should not be exposed to temperatures exceeding those shown in Table 2.

Table 2 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.

Table 1
Maximum Low Side Test Pressures

Valve Type	psig
(B)I, X, NI, F, FB, (E)BF/SBF, RI, G, EG, C, S, EBS, Small O	450
D, P, H, Large O	425
A, M, V, W	400

Table 2
Maximum Dehydration Temperatures – Degrees F

Refrigerant	Thermostatic Charge					
	L	C	Z	X	VGA	P Type, ZP Series
12, 134a	190	190	250		---	
22	160	160	185	210	250	250
404A, 502, 507	150	150	170		---	
717 (Ammonia)	150	190	235	---	---	---

Expansion Valve Adjustment

Each Sporlan TEV is thoroughly tested and set at the factory before shipment. This factory superheat setting will be correct and no further adjustment is required for the majority of applications. However, there are many factors which can affect the performance of a TEV. These factors are independently variable and all of them cannot be compensated for in the design of a valve. When the application or operating conditions require a different valve setting due to one or more of the factors listed below, the valve may be adjusted to obtain the required operating superheat. Therefore, an adjusting stem is provided on all standard valves. The valve should be set with the system as near as possible to design conditions.

Factors which affect valve performance and may make it necessary to adjust the valve are:

1. Low temperature difference (TDs) between the refrigerant and the air
2. TEV bulb location
3. Balance between compressor and evaporator
4. Ratio of load to TEV capacity
5. Condenser capacity
6. Operation of several fixtures on multiple installation
7. Seasonal variation in head pressure caused by extreme changes in ambient air temperature.

Note: Valve Types F, (E)BF/SBF, Q, A, M, V, K, and W have non-rising adjusting stems and a change in adjustment does not change the stem position.

When setting valves on multi-evaporator refrigeration systems with pressure or temperature sensitive evaporator control valves, the following procedure is recommended:

1. Evaporator Pressure Regulating Valve (ORI Type): the ORI valve is set first at the minimum load condition. Then, if necessary, the expansion valve is adjusted to the desired superheat setting while under the normal operating load condition.
2. Temperature Sensitive Evaporator Regulating Valves (CDS Type): The CDS valve is forced into a fully open position first. Then the expansion valve is adjusted to the desired superheat setting at full load condition. Finally, the controller for the CDS is set to the desired temperature. Contact Sporlan Valve Company, or the case manufacturer, for additional details on setting the CDS controller.

When the adjustment is completed on the TEV, always tighten the adjusting stem packing nut and replace the seal cap tightly.

Many expansion valves are made ***non-adjustable*** for use on Original Equipment Manufacturer's units, particularly those valves used on residential air conditioning and heat pump systems. These valves are set at a superheat predetermined by the manufacturer's laboratory tests and cannot be adjusted in the field.

Some ***non-adjustable*** models are modifications of standard adjustable type valves. This is done by using a solid bottom cap instead of one equipped with an adjusting stem and seal cap. These valves can be identified by an **N** preceding the standard valve designation. Adjustable bottom cap assemblies are available for converting most non-adjustable valves to the adjustable type. However, this is rarely required. If symptoms indicate that a valve adjustment is needed, carefully check the other possible causes of incorrect superheat, pages 6 through 10, before attempting an adjustment.

How to Determine Superheat Correctly

1. Measure the temperature of the suction line at the bulb location.
2. Obtain the suction pressure that exists in the suction line at the bulb location by **either** of the following methods:
   a. If the valve is externally equalized, a gauge in the external equalizer line will indicate the desired pressure directly and accurately.
   b. Read the gauge pressure at the suction valve of the compressor. To the pressure add the estimated pressure drop through the suction line between bulb location and compressor suction valve. The sum of the gauge reading and the estimated pressure drop will equal the approximate suction line pressure at the bulb.
3. Convert the pressure obtained in **2a** or **2b** above to saturated evaporator temperature by using a temperature-pressure chart.
4. Subtract the two temperatures obtained in **1** and **3** – the difference is superheat.

Figure 8 illustrates a typical example of superheat measurement on an air conditioning system using Refrigerant 22. The temperature of the suction line at the bulb location is read at 52°F. The suction pressure at the compressor is 66 psig and the estimated suction line pressure drop is 2 psi …66 psig + 2 psig = 68 psig at the bulb, which is equivalent to a 40°F saturation temperature. (Use dew point temperature for refrigerant blends.) 40°F subtracted from 52°F = 12°F superheat.

Note: Refrigerated case manufacturers frequently use a "temperature difference" method to approximate superheat. This procedure consists of measuring the temperature of a location on the evaporator which is representative of saturated vapor temperature; and, then subtracting that temperature from the outlet evaporator temperature which is measured at the bulb location.

While this method of reading "superheat" is acceptable on those manufacturer's cases where the pressure drop through the evaporator is low, Sporlan does not recommend the "temperature difference" method for other types of systems.

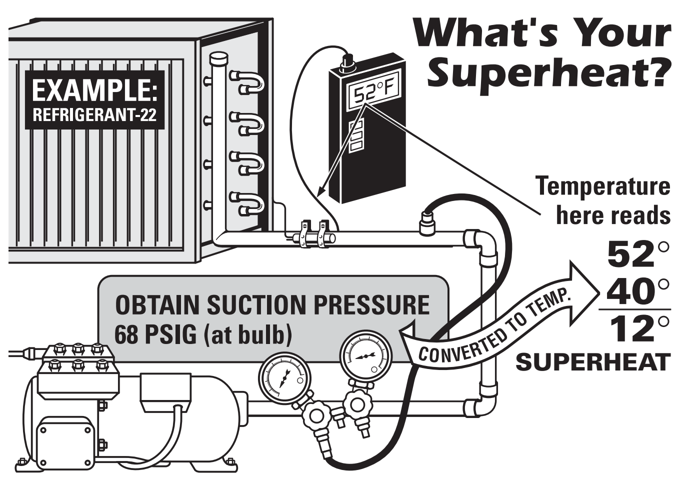


Figure 8

How to Change the Superheat Setting

Note: There are some valve bodies (G, EG, C, S, EBS and EMC) that have a packing nut around the adjustment stem. It may be necessary to loosen the packing nut slightly to turn the adjusting stem. Do not forget to retighten the nut after the superheat is set.

To reduce the superheat, turn the adjusting stem **counter-clockwise**. To increase the superheat, turn the adjusting stem **clockwise**. When adjusting the valve, make no more than one turn of the stem at a time and observe the change in superheat closely to prevent ***over-shooting*** the desired setting. As much as 30 minutes may be required for the new balance to take place after an adjustment is made.

If in doubt about the correct superheat setting for a particular system, consult the equipment manufacturer. As a general rule, the proper superheat setting will depend on the amount of temperature difference **(TD)** between refrigerant temperature and the temperature of the air or other substance being cooled. Where high **TD's** exist, such as on air conditioning applications, the superheat setting can be made as high as 15°F without noticeable loss in evaporator capacity. Where low **TD's** exist, such as in low temperature blower coil applications, a superheat setting of 10°F or below is usually recommended for maximum evaporator capacity. It is these applications that the TEV will more than likely need to be adjusted.

For the correct valve setting on factory built equipment, manufacturers' recommendations should be followed. Some manufacturers specify the superheat directly; others may recommend valve adjustment to a given suction pressure at certain operating conditions, or until a certain frost line is observed. Such recommendations, however they are stated, represent the results of extensive laboratory testing to determine the best possible operation.

■ Field Servicing

The TEV is erroneously considered by some to be a mysterious and complex device. As a result, many valves are needlessly replaced when the cause of the system malfunction is not immediately recognized.

Actually the TEV performs only one very simple function – **it keeps the evaporator supplied with enough refrigerant to satisfy all load conditions**. It is not a temperature control, suction pressure control, a control to vary the compressor's running time, or a humidity control.

How effective the valve performs is easily determined by measuring the superheat as outlined in Figure 8. Observing the frost on the suction line, or considering only the suction pressure may be misleading. **Checking the superheat is the first step in a simple and systematic analysis of TEV performance.**

- **If not enough refrigerant is being fed to the evaporator— the superheat will be high.**
- **If too much refrigerant is being fed to the evaporator — the superheat will be low.**

Although these symptoms may be attributed to improper TEV control, more frequently the origin of the trouble lies elsewhere.

Note: TEVs with permanent bleed ports **(BP)** or Rapid Pressure Balancer **(RPB)** construction are applied on many air conditioning and refrigeration systems by original equipment manufacturers. Each application is tested and approved by the manufacturer. The primary function of these devices is to equalize high-to-low side pressures during the off cycle on systems equipped with low starting torque compressors.

However, some BP type valves are applied to allow small amounts of liquid refrigerant to pass for compressor motor cooling. The specific function of the feature on a given unit must be determined from the system manufacturer. Once that is determined, it is easier to troubleshoot the system.

The primary cause of difficulty with either the BP or RPB feature is dirt and other foreign materials that restrict or plug them. And if the system purpose intended for either feature is not being satisfied, the valve probably needs cleaning or replacing.

As stated in Bulletin 10-9, the RPB type valve is not to be applied on systems using high starting torque compressors or "hard-start" electrical components, on outdoor coils of heat pumps, or on any refrigeration system, and it should ***not*** be used to replace BP type valves that are applied on those types of systems. On systems other than those described above, the RPB type valve can replace the BP type valve when necessary. Usually it is advisable to replace a valve with one of the same specification unless advised differently. Consult with the system manufacturer for assistance.

Complaint "A"

"Valve does not feed enough refrigerant."

SYMPTOMS:

- ***Load temperature (air or water leaving evaporator) too high.***
- ***Superheat too high.***
- ***Suction pressure lower than normal with compressor unloaders locked out or hot gas bypass shut off.****

THE CAUSE MAY BE:

1. ***Moisture*** — Water or a mixture of water and oil frozen in the valve port or working parts of the valve will prevent proper operation. This is a common source of trouble on expansion valves. Since the valve is the first cold spot in the system, moisture will freeze and block the valve open, closed, or any position in between. If the valve is frozen in the intermediate position so that flow is restricted, the superheat will be high.

   Remedy — Install a Sporlan Catch-All Filter-Drier in the liquid line for removal of moisture from the refrigerant and oil. See Bulletin 40-10.

   To determine a safe level of moisture in the system, install a Sporlan See•All Moisture and Liquid Indicator. See Bulletin 70-10.

   Excessive moisture has a damaging effect on all system components regardless of the evaporating temperature. Moisture must be removed for trouble-free performance.

2. ***Dirt or foreign material*** — Contaminants such as copper oxide scale, metal chips, oil breakdown sludge, etc. will restrict the flow of refrigerant when it collects in strainers or other liquid line accessories. This produces a shortage of refrigerant at the TEV port. Conventional strainers frequently allow the material to pass through the screen and obstruct the flow at the valve port. If a See•All is installed downstream of the restriction, bubbles will be visible. This should not be confused, however, with a refrigerant shortage or excessive liquid line pressure loss which are also indicated by bubbles in the See•All.

   Remedy — Locate and remove the foreign material creating the restriction. Install a Sporlan Catch-All Filter-Drier to provide effective filtration of the refrigerant. See Bulletin 40-10.

* When system has some form of capacity reduction — cylinder unloaders or hot gas bypass, a low suction pressure will not exist. Therefore, when checking TEV performance, a better analysis is possible when these devices are locked out or shut off so the suction pressure will respond to variations in load or valve feed.

3. ***Wax*** — Certain systems are contaminated with small amounts of wax which will precipitate at low temperatures in systems with Refrigerants 22 or 502. Since the TEV represents the first cold point in the refrigeration cycle, wax is most likely to form at the valve port.

   It is sometimes difficult to observe the wax in a valve because it may exist in solid form only at very low temperatures. By the time the valve has been taken apart, the temperature has increased enough to cause the wax to melt and thus become difficult to detect. When wax is suspected, it can usually be detected on the pin and seat by packing the valve in dry ice while disassembling.

   Remedy — Clean the valve with solvent before reassembling the valve. The Sporlan HH style Catch-All Filter-Driers have a special activated charcoal desiccant that is designed to remove wax in the liquid line before it causes trouble. Therefore, to prevent wax problems, use these HH style driers (e.g., C-415-S-HH) on all low temperature systems using Refrigerants 22 or 502.

4. ***Refrigerant shortage*** — See•All or sight glass in the liquid line will show bubbles when the system is short of refrigerant charge. Before adding more refrigerant however, be sure the bubbles are not produced by other causes (See Paragraphs **A-2** and **A-5**).

   A lack of refrigerant charge may also be detected by a hissing sound at the TEV. Some systems not equipped with a liquid line sight glass will have test cocks or other devices for checking the refrigerant level in the receiver.

   Remedy — Add enough refrigerant to obtain desired result.

5. ***Gas in the liquid line*** — As explained in Paragraphs **A-2** and **A-4**, liquid line vapor can be produced by a partially plugged strainer or drier and by a shortage of refrigerant charge. In addition, gas in the liquid line can be caused by air or other non-condensable gases in the system or by excessive pressure losses in the liquid line as a result of:

   - Long or undersized line.
   - Liquid line vertical lift.

   Remedy — Verify the correct liquid line size for the equivalent length and system tonnage. Consult liquid line sizing data published in many manufacturers' catalogs and in textbooks. If undersized, repipe with the correct size.

   Determine amount of vertical lift, and obtain the resulting pressure loss from Table 3, Bulletin 10-9. Using the subcooling calculation example provided in the "subcooling" section of Bulletin 10-9, find required subcooling necessary to prevent gasification with the existing pressure losses. Provide the necessary subcooling by using one of the methods described on Page 1.

6. ***Misapplication of internally equalized valve or incorrect location of external equalizer*** — If the pressure drop through the evaporator exceeds the predetermined values shown in Table 1, Bulletin 10-9, an externally equalized valve must be used. When an externally equalized valve is used, the equalizer connection should be made at a point in the suction line that will reflect the pressure existing in the line at the bulb location.

   Remedy — Replace internally equalized valve with one having an external equalizer.

   If external equalizer is installed incorrectly, change to correct location. See Page 3.

7. ***Insufficient pressure drop across valve*** — One of the factors that influence expansion valve capacity is the pressure drop that exists between the inlet and outlet. Anything contributing to a reduction in this pressure drop will reduce valve capacity. Abnormally low condensing pressures, excessive liquid line pressure losses (even with adequate subcooling), undersized distributor nozzle or distributor tubes may also be responsible for a very low net pressure drop across the valve port.

   Remedy — Remove source of pressure loss, or install valve with adequate capacity at the reduced pressure drop. If inlet pressure to valve is low due to low condensing pressure, raise pressure.

   If the refrigerant distributor nozzle is undersized replace with correct size. See Bulletin 20-10.

8. ***Dead thermostatic element or wrong thermostatic charge*** — If the element has partially or completely lost its thermostatic charge, the valve will be unable to feed sufficient refrigerant or will remain closed. A wrong charge may cause insufficient feed also.

   Remedy — Replace the element if it is dead. If charge is incorrect, replace with proper selective charge. See Bulletin 10-9.

9. ***Charge migration (CP series, ZP series, and VGA charges only)*** — In order for valves with these charges to maintain control at the bulb, the bulb must be kept at a lower temperature than the element (diaphragm case). If the thermostatic charge does migrate to the element because of a lower element temperature, the valve will throttle.

   Detection — Warm the element with a cloth saturated with hot water. If this produces more refrigerant feed and reduces the superheat to normal, charge migration is responsible for the starved evaporator.

   Causes —
   - Insufficient pressure drop between the valve outlet and bulb location, possibly due to an oversized distributor nozzle or no nozzle at all.
   - Excessive pushrod leakage, which allows the leaking refrigerant to cool the diaphragm case before passing into the equalizer line. This is a rare occurrence and should be carefully checked before arriving at this conclusion.
   - Cold location of TEV, or condensate drippage on the diaphragm case.

   Remedies —
   - Install distributor nozzle correctly sized in accordance with nozzle sizing procedure given in Sporlan Bulletin 20-10.
   - On valves with packed pushrod construction, remove element and tighten the pushrod packing nuts.
   - Relocate the TEV away from cold outlet air, or condensate drippage.

10. ***Undersized valve***

    Remedy — Install valve sized in accordance with procedure given in Bulletin 10-9, or Bulletin 10-10.

11. ***High Superheat adjustment***

    Remedy — Turn the adjusting stem counter clockwise until the correct superheat is indicated.

12. ***Feed-back from another valve*** — Review instructions for Bulb Location and Installation, Page 2.

    Remedy — Check the bulb temperature and calculate the superheat. If superheat is normal but too little refrigerant is flowing through the evaporator, check the piping for possible refrigerant flow from another evaporator affecting the bulb. Re-pipe if necessary. See Figure 4.

13. *High pressure drop through evaporator*

Remedy — Check the pressure at the evaporator inlet and outlet with gauges. If pressure difference is greater than the values shown in Table 1, Bulletin 10-9, use an externally equalized valve.

14. *Restricted, plugged, or capped external equalizer* — If the pressure under the diaphragm builds up due to pushrod leakage and cannot escape through the external equalizer line, the valve will remain closed.

Remedy — Check the external equalizer line to be sure it is open or not capped.

Complaint "B"

"Valve feeds too much refrigerant."

SYMPTOMS:

- ***Liquid returns to compressor.***
- ***Superheat is low.***
- ***Suction pressure is normal or higher than normal.***

THE CAUSE MAY BE:

1. Moisture — Water or a mixture of water and oil frozen in the valve port or working parts of the valve will prevent proper operation. This is the most common source of trouble on TEVs. Since the valve is the first cold spot in the system, moisture will freeze and block the valve open, closed, or any position in between. If the valve is held in the open position by ice, liquid flood-back will occur.

Remedy — Install a Sporlan Catch-All Filter-Drier in the liquid line for removal of moisture from the refrigerant and oil. See Bulletin 40-10.

For additional protection, install a Sporlan See•All Moisture and Liquid Indicator for a positive indication of when a safe moisture level is reached. See Bulletin 70-10.

2. Dirt or foreign material — Contaminants such as copper oxide scale, metal chips, oil breakdown sludge, etc. may pass through ordinary strainers and lodge at the TEV port and prevent the valve from closing.

Remedy — Disassemble the valve and remove all foreign material from the internal parts. Install a Sporlan Catch-All Filter-Drier in the liquid line. The Catch-All filters out the smallest particles of foreign material that might interfere with the operation of any system component.

3. Expansion valve seat leak — When the valve port does not seat tightly, refrigerant will pass through during the off-cycle and fill the evaporator with refrigerant. If the seat leak is severe, the valve will feed too much refrigerant during the operating cycle as well. (Not applicable to valves with permanent bleed ports or RPB feature.)

Remedy — If the valve seat is leaking, a gurgling or hissing sound can usually be heard during the off-cycle. Also, a sight glass or See•All in the liquid line may indicate continued refrigerant flow for a long period after the compressor has stopped. Make certain however, that the bubbles are not the result of ***back-flow*** through a vertical liquid line.

Disassemble the valve to be certain that dirt or foreign material is not responsible (see **B-2**). If the pin and seat are worn or damaged and an internal parts kit is available, replace the parts. When parts are not available, the valve must be replaced.

4. Oversized valve — Check valve ratings considering all the factors which affect its capacity. See Page 16, Bulletin 10-9, or Page 3, Bulletin 10-10.

Remedy — Install correctly sized valve.

5. Incorrect bulb installation — The bulb should be securely fastened to a straight, clean, section of the suction line using two bulb straps for good thermal contact. Also, the temperature of the bulb should not be influenced by ambient temperature — an external heat source such as a steam pipe or heating coil.

Remedy — Install bulb correctly. See Bulb Location and Installation, Page 2.

6. Low superheat adjustment

Remedy — Turn the adjusting stem clockwise until the correct superheat is indicated. See Page 4.

7. Incorrect thermostatic charge

Remedy — Select and install the correct selective charge. See Bulletin 10-9.

8. Incorrectly located external equalizer

Remedy — Relocate external equalizer or the connection between evaporator and any other temperature or pressure sensitive evaporator control valve near bulb location. See Page 3 for recommendations.

9. Inefficient compressor — If the compressor is inefficient or for some other reason lacks capacity, the suction pressure will operate higher than normal. This may or may not be accompanied by low superheats.

Remedy — Consult with compressor manufacturer.

Complaint "C"

"Valve feeds too much refrigerant <u>at start-up only</u>."

SYMPTOMS:

- ***Liquid returns to compressor.***
- ***No superheat.***
- ***Suction pressure higher than normal.***

THE CAUSE MAY BE:

1. Refrigerant drainage — Drainage of refrigerant from the evaporator (during the off-cycle) when installed at a higher level than the compressor.

Remedy — Install a trap-riser to top of evaporator or use pump-down control. See Figure 5.

2. Compressor or suction line in cold location — During the period when the system is not in operation, liquid refrigerant will condense at the coldest point in the system. Liquid will condense in the compressor or suction line, if they are located in an ambient temperature below that of the evaporator during the off-cycle. Upon re-starting, this liquid will slug the compressor.

Remedy — Keep compressor or suction line warm during the off-cycle. Some compressors are equipped with crankcase heaters for this purpose. Another corrective measure is to install a suction line solenoid valve that is de-energized during the off-cycle.

3. ***Restricted or plugged external equalizer*** — A momentary flood can occur when the load increases suddenly, such as at start-up because the higher suction pressure cannot reach the underside of the diaphragm and help close the valve. If the pressure under the diaphragm increases due to any pressure leakage around the pushrods, the valve will eventually throttle.

   Remedy — Remove the restriction or plugged portion of the external equalizer.

4. ***Liquid line solenoid valve seat leak or interrupted pumpdown*** — Liquid refrigerant can continue to feed the TEV and/or remain in evaporator upon shut-down causing flood-back to the compressor upon start-up.

   Remedy — Disassemble and clean solenoid valve and/or replace damaged internal parts if seat leakage is the problem. If the pumpdown cycle isn't completed before the compressor cycles off, or the thermostat calls for cooling and reopens the liquid line solenoid before the evaporator has been properly evacuated, check the low pressure cut-off setting or the electrical controls for possible causes.

Complaint "D"

"Valve doesn't feed properly."

SYMPTOMS:

- ***Poor system performance.***
- ***Superheat normal or lower than normal.***
- ***Suction pressure lower than normal with compressor unloaders locked out or hot gas bypass shut off.****

THE CAUSE MAY BE:

1. ***Unequal circuit loading (Multi-circuit evaporators and parallel evaporators connected to a single refrigerant distributor)*** — When each circuit is not subjected to the same heat load, the lightly loaded circuits will allow unevaporated refrigerant or low temperature vapor to enter the suction line and throttle the valve. This will cause normally loaded circuits to be deprived of their share of refrigerant. The net result is a loss of refrigerated evaporator surface.

   Remedy — Make necessary modifications which will allow each evaporator circuit to receive the same percentage of the total load. See Bulletin 20-10 for application information on multi-circuit evaporators using a refrigerant distributor.

2. ***Poor refrigerant distribution (Multi-circuit evaporators and parallel evaporators connected to a single refrigerant distributor)*** — If the refrigerant distribution is faulty, the circuits receiving the largest portion of refrigerant will have the controlling influence on the TEV. The result is the same as in paragraph 1 above.

   Remedy — Correct refrigerant distribution. See Bulletin 20-10 for complete information on Refrigerant Distributors.

3. ***Low load*** — Low evaporator load may be caused by insufficient air over the coil as a result of an undersized blower, dirty air filters, or an obstruction in the air stream. In addition, frost formation on the coil or low entering air temperatures will reduce the evaporator load.

   Remedy — Correct the condition responsible.

4. ***Flow from one coil affecting TEV bulb of another (Multiple evaporator systems only)*** — The temperature of the bulb may be falsely influenced by flow from another evaporator usually because of incorrect piping.

   Remedy — Correct the piping. See Figure 4, Page 3.

5. ***Improper compressor-evaporator balance*** — If the compressor is too large for the load and evaporator capacity, the low suction pressure which results will cause poor system performance.

   Remedy — Consult with the manufacturer or consulting engineer, or the ASHRAE Handbook on component balancing. If necessary, change or correct the improperly sized component. Hot gas bypass may be used to balance properly.

6. ***Evaporator oil-logged*** — Poor heat transfer occurs and unpredictable performance takes place. If erratic performance is observed over a period of time, and other causes are omitted from consideration, review the amount of oil in the system. Turbulent compressor oil level with little or no return to the compressor sump indicates oil problems.

   Remedy — Remove excessive oil from evaporator and connecting piping. Many times the evaporator temperature will be too low for the oil to be removed. Therefore, the system must be allowed to warm sufficiently to get cold oil to drain. Analyze system components for possible causes of oil problem before restarting the system. Consult with the compressor manufacturer for specific details on their compressor.

Complaint "E"

"System hunts or cycles."

SYMPTOMS:

- ***Suction pressure fluctuates****
- ***Superheat fluctuates.***
- ***Valve does not feed enough, and then too much refrigerant.***

THE CAUSE MAY BE:

1. ***System characteristics*** — Certain design characteristics of the system may have an effect on the system's tendency to hunt or cycle. As an example, after the valve admits refrigerant to the evaporator inlet, there is a time delay before the bulb senses the effect at the evaporator outlet. This time delay is dependent on evaporator length, tube size, and load. Generally, there is more likelihood for hunting to occur when this time interval is long. Other influencing factors are circuit arrangement, load per circuit, and temperature difference.

   Remedy — When hunting is moderate particularly with no floodback, the effect on the system is insignificant and correc-

* When system has some form of capacity reduction — cylinder unloaders or hot gas bypass, a low suction pressure will not exist. Therefore, when checking TEV performance, a better analysis is possible when these devices are locked out or shut off so the suction pressure will respond to variations in load or valve feed.

tions are not necessary. If hunting is severe with floodback to the compressor, check the possible remedies shown in paragraphs below.

2. ***Valve size*** — An over-sized valve usually aggravates hunting. Carefully check the valve rating considering all the factors affecting its capacity. See Bulletin 10-9, or Bulletin 10-10.

   Remedy — Replace valve with one correctly sized. On multiple circuit evaporators using a refrigerant distributor, the capacity of the valve can be reduced, within certain limits, by installing a smaller distributor nozzle. See Bulletin 20-10.

3. **Bulb location** — If the bulb is located in a suction line trap, its temperature will be affected by liquid oil and refrigerant alternately collecting and evaporating at this point. This condition frequently results in severe hunting.

   Remedy — As a temporary measure relocate the bulb away from the trap, and any turbulent areas created by elbows, tees, etc. Also remove the bulb from the air stream or insulate. Re-pipe if necessary. Sometimes another position around the circumference of the suction line will minimize hunting. Follow the Bulb Location and Installation instructions given on Page 2 for the best TEV control.

4. ***Refrigerant and load distribution*** — In addition to the effects of poor distribution explained in paragraphs **D-1** and **D-2**, hunting also frequently results. This is caused by liquid refrigerant from the overfed circuits occasionally reaching the bulb of the valve.

   Remedy — Correct the faulty distribution.

5. ***Superheat adjustment*** — All Sporlan TEVs are preset at the factory to give the best performance on the average system. A valve should not be adjusted unnecessarily, but occasionally another setting may prove to be better.

   Remedy — Turn the adjusting stem clockwise a turn at a time. If the hunting stops or is reduced, turn the adjusting stem counter clockwise a turn at a time to obtain the lowest superheat with stable operation.

6. **Moisture** — As ice forms in a TEV from excessive moisture, a very erratic hunt may result.

   Remedy — Remove the moisture with the installation of a Sporlan Catch-All Filter-Drier. A safe moisture level can be determined by installing a Sporlan See•All.

Complaint "F"

"System won't perform properly."

SYMPTOM:

- ***Cannot get valve to react or regulate at all.***

THE CAUSE MAY BE:

1. ***No refrigerant being fed to evaporator***. See Section **A** on Pages 6 & 7.

2. ***Too much refrigerant being fed to evaporator***. See Section **B** on Page 8.

3. ***Too much refrigerant being fed to evaporator at start-up only***. See Section **C** on Page 8.

4. ***Refrigerant control is erratic***. See Section **D** on Page 9.

5. ***System is hunting or cycling***. See Section **E** on Page 9.

6. ***The TEV has been physically abused in an effort to make the valve work properly.*** This is usually the result of a mistaken analysis. It is frequently assumed that if a valve does not feed properly, it is stuck (either opened or closed). Beating the valve body with a hammer will only distort the body and make it impossible for the valve to work once the real cause is determined.

   If a valve "sticks," it is usually due to moisture freezing in the port, dirt and other foreign material restricting or plugging the internal parts, wax forming on the internal parts at low temperatures, or the valve has been physically abused so it **cannot** function.

   Remedy — Inspect the valve and its internal parts, including the inlet strainer. If plugged or restricted in any way, clean the parts thoroughly, oil the parts with a good grade of refrigerant oil, and reassemble the parts. Complete details on this subject are found on Pages 10 through 12.

   If the valve is beyond normal cleaning processes, or if it is physically damaged in any way, replace the valve with its proper replacement model.

■ Field Assembly Instructions

Sporlan valves my be opened easily for inspection.

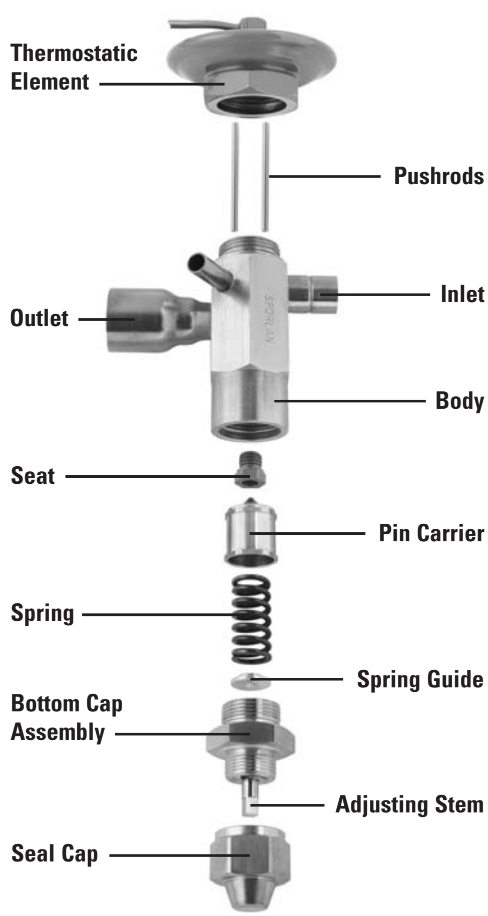


Figure 9

Note: These Field Assembly Instructions apply in part to all Sporlan TEVs. See Figure 9 for an "exploded" view of those models that can be completely disassembled. When a TEV is to be disassembled for inspection and cleaning, or for replacement of the thermostatic element or the internal parts, the following information should be reviewed for assistance.

Types F dated approximately C84 or earlier and Types I, BI, NI, RI, FB manufactured prior to 1994 do not have replaceable elements nor internal parts kits, but can be disassembled for inspection and cleaning. Type F dated D84 or later, Type S valves dated B69 or later, Type C valves dated C70 or later, and **ALL** Type G, X, (E)BF/SBF and EBS valves employ packless pushrod construction and internal parts are NOT available for use with them. However, their elements can be replaced and they can be disassembled for inspection and cleaning. Due to the single pushrod construction of the Type (E)BF/SBF and EBS valves, only the bottom cap assembly, pin guide, and superheat spring may be removed for inspection and cleaning.

Early production of the Type F valve with the replaceable element requires a 15/16" **thin jaw**, open end type element wrench such as a Bonney 1230. Subsequent production of the Type F valve and all Types (E)BF/SBF, I, BI, NI, RI, and FB valves require a 1" **thin jaw**, open end type element wrench such as the one available from Sporlan wholesalers. An open end wrench is necessary because of limited space between the body and element of these valves. Precautions must be taken in removing the KT-43 element (F) so the element, body, or connections are not damaged by the wrenches.

While standard open end or adjustable wrenches fit the other element sizes, the **thin jaw** type wrenches are also available for the other element sizes: Bonney 1236 (1-1/8") for KT-53 elements, Bonney 1240 (1-1/4") for KT-83 elements, Bonney 1248 for KT-33 elements, and Bonney 1252 for KT-63 and 7 elements.

Replaceable elements and internal parts kits are available for current valves with ***packed*** pushrod construction:
Types P, H, M, D, and A.

Replaceable elements for Types O, V, W, and U are also available. However, special field assembly instructions are included with their internal parts kits.

Assembling Instructions

The following steps are necessary in properly disassembling, inspecting, cleaning, and reassembling a TEV whether the valve is in or out of the refrigerant piping.

1. Before disassembling the valve, be sure the refrigerant pressure in the system has been reduced to a safe level **(0 psig)**.

2. Remove the seal cap and turn the adjustment stem counter-clockwise to relieve the spring force. Count and record the number of turns so adjustment can be returned to its original position.

3. Using appropriate wrenches or a vise to properly support the valve body, remove the element (if a replaceable type), the bottom cap assembly, and the internal parts. (Only remove the bottom cap, pin guide, and superheat spring on Type (E)BF/SBF and EBS valves. **DO NOT** remove the single pushrod from these valves.)

Caution: Regardless of whether the valve is in the system or in a vise, care must be taken to prevent distorting the body by exerting too much pressure in tightening the element or in clamping the body in the vise. Also, do not use a wrench on the outer welded edge of the element.

4. Inspect parts, element, and body for any foreign materials or physical damage.

5. On valves with replaceable elements and/or internal parts, replace any items that appear damaged.

6. Clean all parts with solvent, preferably by applying and then blowing off with clean dry compressed air.

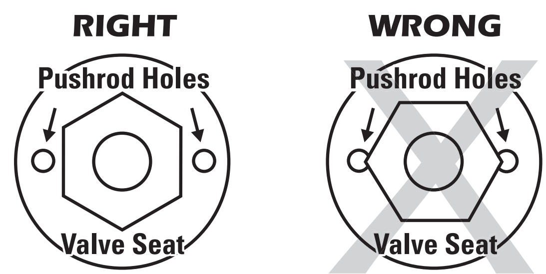


Figure 10

7. To reassemble valves with replaceable seats, screw seat into body with a fairly light pressure since it does not require a heavy pressure to make this small knife-edge joint.

Caution: Be sure hexagon corners of seat do not protrude into pushrod holes (see Figure 10).

For valves that do not have replaceable elements or for Type O valves, place the pushrod(s) into the body now.

8. Next, slip the pin and carrier (which have been pressed together at the factory) into the body and tap the pin into the seat to form a true seating surface. It is generally advisable, before tapping these parts together, to check the concentricity of both the pin and seat by engaging the parts by pressing them lightly together with one finger and noting that there is no tendency to stick together. This should be repeated several times after rotating the pin carrier a quarter of a turn. In assembling valves with port sizes of 1/4" and larger which use the flat disc instead of the tapered pin, **DO NOT TAP THE DISC AGAINST THE SEAT.**

9. Now place the spring guide stamping (when used), and spring, in the pin carrier, place the lower spring guide on the opposite end of the spring and screw the bottom cap in place. (Replace the pin guide, spring, and bottom cap assembly together on Type (E)BF/SBF and EBS valves.) After screwing bottom cap assembly in place, carefully tighten, preferable with two 10" wrenches, to seal the metal-to-metal knife edge joint. The sealing surfaces should be free of any foreign material or nicks that might prevent a leak-tight joint.

10. On valves with replaceable elements (except Types O, (E)BF/SBF and EBS), place the pushrods into the body and open the valve several times by pressing down on the pins with a flat metal surface. This will help seat the pin properly.

11. Check the height of the pushrod(s) above the element sealing surface with the pushrod gauge (see Figure 11). The gauge is supplied with internal parts kits or can be obtained at no charge

Table 3

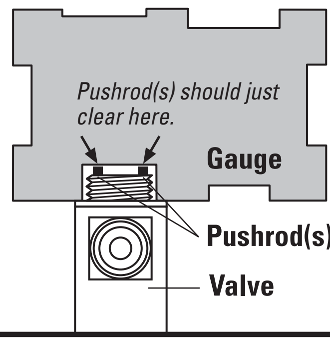
Valve Type[1] Current	Obsolete	Gauge Number
AA(E), LMC-AA(E)	---	1
DA(E), LMC-DA(E)	---	2
PFE or HFE-1½, 3, 4, 5, 8, 12	PFE or HFE-6, 7½, 10, 11	3
PVE or HVE-2½, 5½, 7, 11, 16, 20	PVE or HVE-2, 5, 8, 10, 12, 15, 17, 18	
PDE or HDE-5, 8, 14	PDE or HDE-6, 7½, 9, 12, 13	
PRE or HRE-1½, 4, 6½, 9, 12	PRE or HRE-6, 7½, 11, 13	
---	UFE-12, 17	
	UVE-22, 30	
	UDE-15, 21	
	URE-16, 22	
OFE-23, 32, 40	UFE-23	3A
OVE-40, 55, 70	UVE-40	
ODE-28, 40, 50	UDE-28	
ORE-30, 35, 45	URE-30	
All F Models[2] except FF(E)-⅛, FV(E)-¼, FD(E)-⅛, FR(E)-⅛	---	4
All G Models except GF(E)-⅛, GV(E)-¼, GR(E)-⅛	All small K models	5
All X Models	---	
MFE-5, 7½, 11, 13, 15, 20	MFE-12, 17	6
MVE-8, 12, 18, 21, 26, 34	MVE-30	
MDE-6, 9, 13, 15, 18, 25	MDE-14, 20	
MRE-9, 15, 20, 25	---	
KFE or VFE-45, KVE or VVE-70		
KDE or VDE-55, KRE or VRE-50		
MFE-25	MFE-22	6A
MVE-42	MVE-40	
MDE-30	MDE-26	
MRE-30	---	
KFE or VFE-35, 55	VFE-50	
KVE or VVE-52, 100	VVE-90	
KDE or VDE-40, 65	VDE-42, 60	
KRE or VRE-38, 70	---	
WFE-80, 110	WFE-75, 100	7
WVE-135, 180	---	
WDE-95, 130	WDE-90, 120	
WRE-100, 130	---	
CF(E) or SF(E)-¼, ½, 1, 1½, 2, 2½, 3	R and T Models with 83 elements	8
CV(E) or SV(E)-½, 1, 1½, 2, 3, 4, 5		
CD(E) or SD(E)-¼, ½, 1, 1½, 2, 2½, 3, 3½		
CR(E) or SR(E)-¼, ½, 1, 1½, 2, 3, 4		
CFE-5, SFE-5, 6	---	8A
CVE-8, SVE-8, 10		
CDE-6, SDE-6, 7		
CRE-6, SRE-6, 7		
OFE-6, 9, 12		
OVE-10, 15, 20		
ODE-7, 11, 14		
ORE-6, 9, 12		
OFE-16, OVE-30 ODE-20, ORE-21[3]	---	8B

upon request. (Since the internal parts of the Type (E)BF/SBF and EBS valves cannot be replaced, it is not necessary to check the pushrod height of these valves.)

The appropriate gauge numbers for the various TEV's are given in Table 3.

Caution: If the element-to-body joint utilizes a gasket, the gasket must be removed before checking pushrod height.

If the pushrod(s) are too long, they must be carefully ground off to the proper length. Clean the pushrod(s) of all dirt and grindings and place them into the body.



Check Height of Pushrod(s) with Gauge

Figure 11

12. *Element Replacement* — If the element is damaged or has lost its thermostatic charge, replace it with the same type.

To properly replace the element without damaging the element or the valve body on valves which utilize a gasketed joint, be sure only one gasket is used before assembling the element. In assembling gasketed elements held in place by two cap screws, be sure to pull up the cap screws evenly.

On valves which utilize the threaded type of element with metal-to-metal knife edge joints, always use an appropriate wrench (10") on the wrench flats. **DO NOT** use a wrench on the outer welded edge of the element. The sealing surfaces should be free of any foreign materials or nicks that might prevent a leak-tight joint. A few drops of refrigerant oil on the element threads will facilitate easy assembling and removal.

13. Return the superheat spring adjustment to its original position. Replace the seal cap tightly.

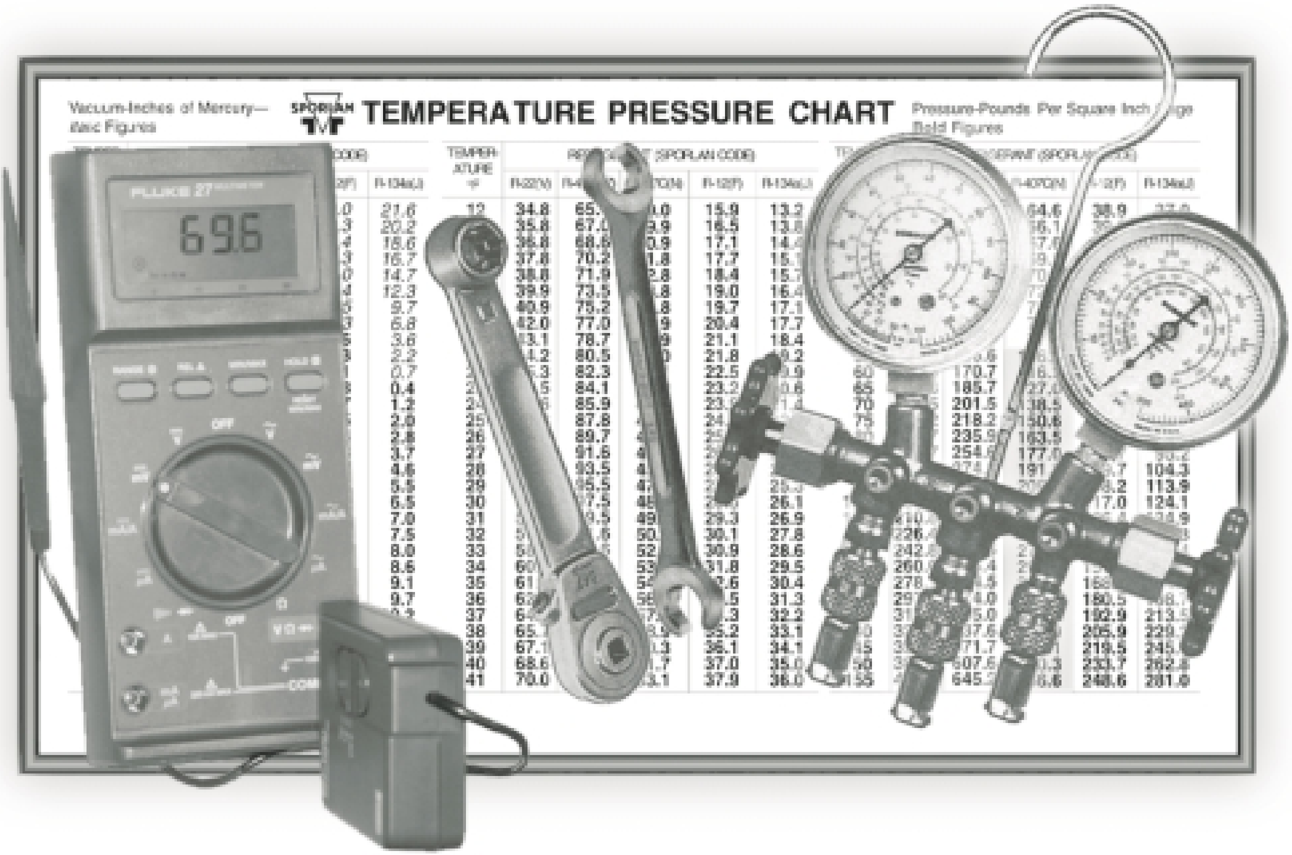
① Type F (internally and externally equalized) valves dated D84 or later, Type S valves dated B69 or later, Type C valves dated C70 or later, and all Type G (externally equalized only) and X valves have packless pushrod construction and internal parts kits are not available for use with them.

② Applies only to Type F valves with a replaceable element.

③ Formerly used the KT-33-8 element and gauge number 33-8 (redesignated 8B). The KT-33-8 element has been replaced by the KT-83.

FORM 10-135

Using the P-T Card as a Service Tool



Manufacturers of refrigerants, controls, and other suppliers distribute hundreds of thousands of pressure-temperature charts to the trade every year. It would be rare indeed to find a service technician who could not put their hands on a pressure-temperature card at a minute's notice.

In spite of the widespread availability and apparent reference to the pressure-temperature relationship, the number of service technicians who use the P-T chart properly in diagnosing service problems are very few.

The purpose of this Form is to not only demonstrate the proper use of the pressure-temperature relationship, but to also illustrate how it can be used to thoroughly analyze a refrigeration or air conditioning system.

REFRIGERANT IN THREE FORMS:

Before getting into the proper use of the P-T card, let's review briefly the refrigeration system and examine exactly how the pressure-temperature relationship can be applied.

The refrigerant in a refrigeration system will exist in one of the following forms:

1. All liquid
2. All vapor
3. A mixture of liquid and vapor.

Figure 1

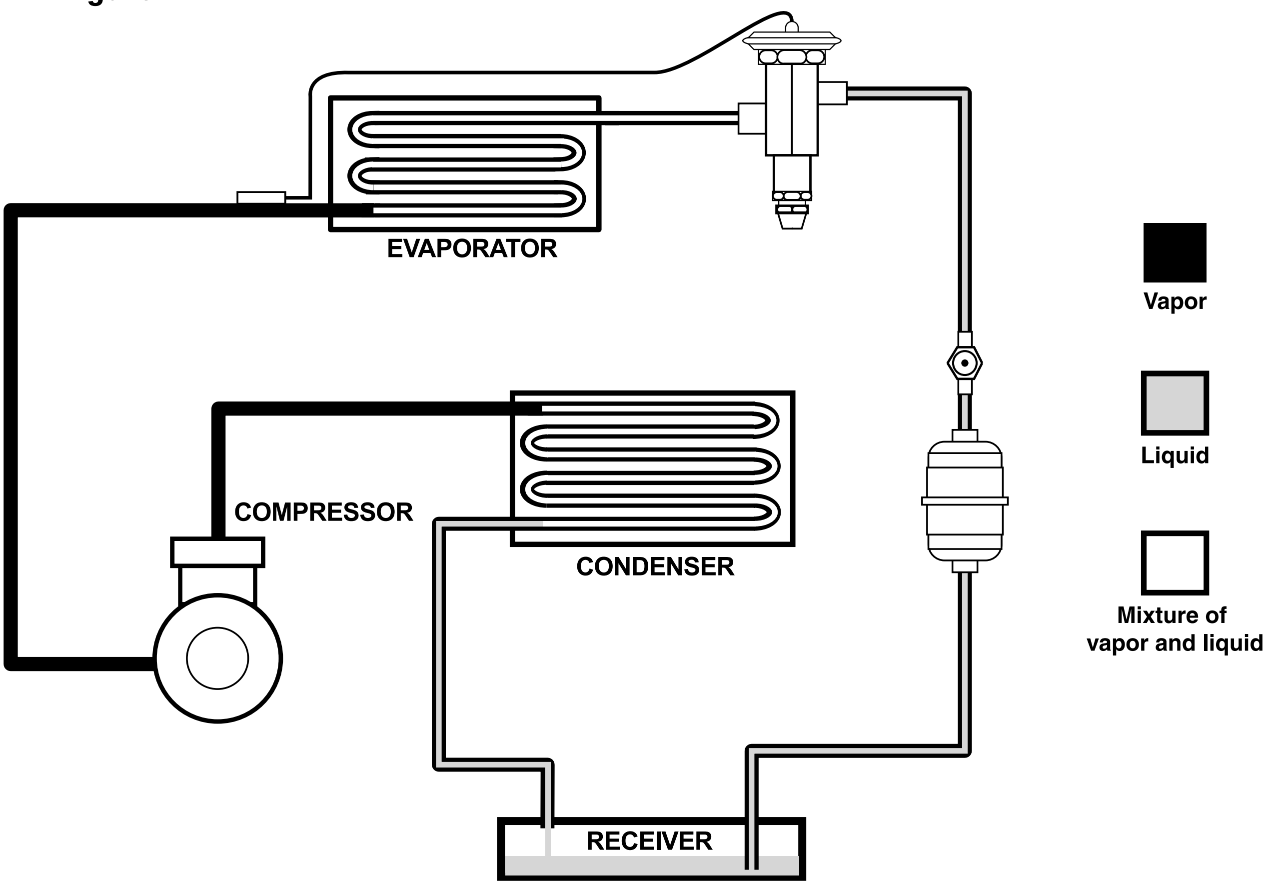


Figure 1 Illustrates the form in which refrigerant is found at various points in a normal operating refrigeration system.

Notice that the high side contains refrigerant in all of the three conditions listed above. The discharge line contains all vapor. The condenser where the vapor condenses into a liquid contains a mixture of liquid and vapor. The line between the condenser and the receiver usually contains all liquid although it would not be abnormal for this line to also have some vapor mixed with the liquid. Since the receiver has a liquid level at some point, it must be thought of as having a mixture of liquid and vapor. The liquid line leading from the receiver to the thermostatic expansion valve should contain all liquid. A sight glass or liquid indicator is frequently installed in the liquid line to assist in determining if the liquid refrigerant is completely vapor-free.

The low side of the system will usually contain refrigerant in only two of the three forms that were listed previously. That is, the low side will contain all vapor in the suction line and a mixture of liquid and vapor from the outlet of the thermostatic expansion valve to nearly the outlet of the evaporator.

WHEN P-T RELATIONSHIP HOLDS TRUE, REFRIGERANT IS “SATURATED”

The important thing to remember is that the pressure-temperature relationship as shown by a P-T card is only valid when there is a mixture of refrigerant liquid and vapor.

Therefore, there are only three places in the normally operating refrigeration system where the P-T relationship can be guaranteed with certainty. That is the evaporator, the condenser, and the receiver — places where a mixture of refrigerant liquid and vapor are known to exist. When refrigerant liquid and vapor exist together, the condition is known as “saturated”.

This means that if we are able to determine the pressure at any of these points, we can easily determine the temperature by merely finding the pressure on a P-T card and reading the corresponding temperature. Conversely, if we can accurately measure the temperature at these three locations, we can also determine the pressure from the P-T relationship by finding the pressure corresponding to the temperature that we have measured.

WHEN P-T RELATIONSHIP IS NOT TRUE, SUPERHEAT OR SUBCOOLING IS INDICATED

At the points in the system where only vapor is present, the actual temperature will be above the temperature that is indicated by the P-T relationship for the pressure we are measuring. The temperature of the vapor can be the same as the pressure-temperature relationship but in actual practice, it is always above. In this case, the difference between the measured temperature and the temperature corresponding to the pressure that exists at the point in question is a measure of superheat.

Where it is known that all liquid is present such as in the liquid line, the measured temperature will be somewhere below the temperature corresponding to the pressure. In this case, the difference between the measured temperature and the temperature corresponding to the P-T relationship is a measure of liquid subcooling. Again, it is possible to find that the actual measured temperature is equivalent to the P-T relationship, in which case the amount of subcooling would be indicated as zero.

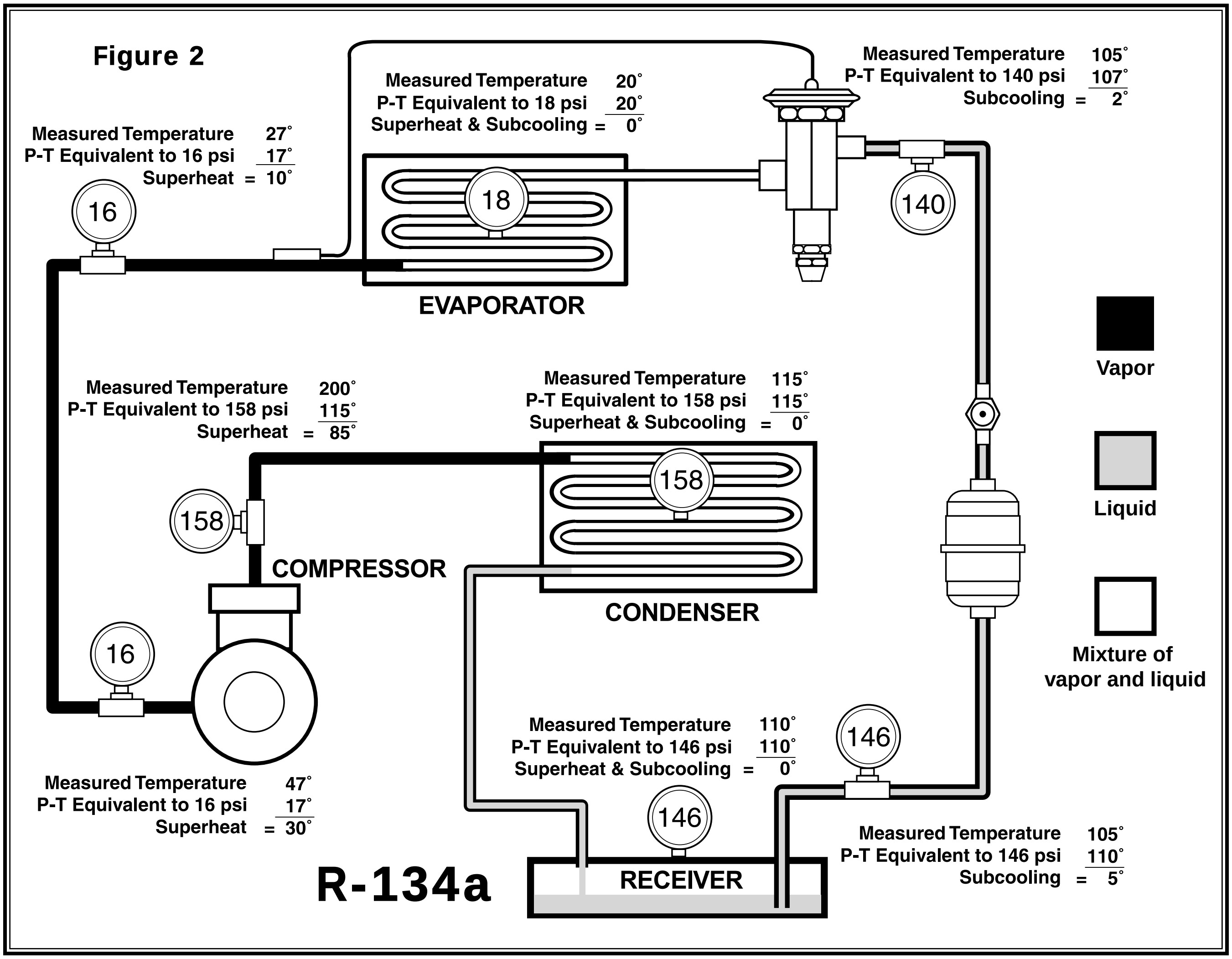
ANALYZING ACTUAL SYSTEM FOR SATURATED, SUBCOOLED, OR SUPERHEATED REFRIGERANT

Figure 2 shows some actual pressure-temperature measurements throughout a normally operating system using Refrigerant 134a which may give a better insight into the condition of the refrigerant at the various points. The measured temperature at the evaporator inlet is 20°F. A gauge installed at this point indicates a pressure of 18 psi. 18 psi on the P-T card indicates a temperature of 20°F — the same as was measured. This is what we should expect since, when refrigerant liquid and vapor are present together, the P-T relationship will hold true.

A gauge installed in the suction line measures 16 psi. If there were a mixture of liquid and vapor at this point, the measured temperature would be the same as the P-T relationship or 17°F. However, our actual measured temperature in this case is 27°F. The amount of superheat in the vapor, therefore, at this point is the difference between the measured temperature of 27°F and the indicated temperature (according to the P-T chart) of 17°F. The superheat therefore is 10°F.

If we also measure 16 psi at the compressor inlet with the measured temperature of 47°F, our superheat in this case would be 30°F, calculated by subtracting the temperature equivalent to 16 psi (17°F) from the measured temperature of 47°F.

Let’s now examine the gauge we have installed midway in the condenser which reads 158 psi. According to the P-T relationship, the temperature will be 115°F



and this is the temperature that we would be able to measure if we placed a thermocouple in the refrigerant at this point, where it is changing from a vapor to a liquid. In other words, there is no difference between the measured temperature and the indicated temperature using the P-T card. It might also be said that the superheat is zero and the subcooling is zero. This condition is also referred to as “saturation”.

In our example we also measure 158 psi at a discharge line of the compressor. The measured temperature here is 200°F. Calculating the superheat in the same way as it was done on the suction line, (difference between measured temperature and temperature corresponding to the P-T relationship), it is determined that the superheat is 85°F.

When a system employs the use of a liquid receiver, there can be no subcooling at the surface of the liquid in the receiver. The reason for this is that when liquid refrigerant and vapor exist together, they must obey the P-T relationship or the refrigerant must be “saturated”. In our example the measured pressure in the receiver is 146 psi, the refrigerant in the receiver must therefore be at 110°F.

Once a solid column of liquid is formed, subcooling of the refrigerant can take place by lowering its temperature with the use of liquid-suction heat exchangers, subcoolers, or from lower ambient temperatures surrounding the line.

Subcooling is a lowering of a temperature below the P-T relationship. In our illustration in Figure 2, subcooling of 5°F and 2°F have been determined as illustrated at two points.

Of course, it is important to maintain some liquid subcooling in the liquid line to prevent flash gas from forming in the liquid line and entering the thermostatic expansion valve.

With the use of a P-T card, we should be able to determine the condition of the refrigerant at any point in the system by measuring both the pressure and the temperature and observing the following rules:

A. Liquid and vapor are present together when the measured temperature corresponds to the P-T relationship (it is theoretically possible to have "saturated liquid" or "saturated vapor" under these conditions but practically speaking in an operating system, it should be assumed that some liquid and some vapor are present under these conditions).

B. Superheated vapor is present when the measured temperature is above the temperature corresponding to the P-T relationship. The amount of superheat is indicated by the difference.

C. Subcooled liquid is present when the measured temperature is below the P-T relationship. The amount of subcooling is represented by the difference.

PRACTICAL LIMITATION TO GAUGE LOCATIONS

In our illustration we have located gauges at points in the system where it is not always feasible to do so on an actual installation. Because of this, we must oftentimes make deductions and assumptions when dealing with an actual system.

As an example, we would normally assume that the 158 psi read on the gauge installed at the compressor discharge line is also the pressure that exists in the condenser. That is, we assume that there is no pressure loss of any consequence between the compressor discharge and the condenser. With this reasoning, we arrive at a condensing temperature of 115°F. If an undersized discharge line or other restrictions are suspected, we cannot make this assumption and other pressure taps may be necessary to locate the troublesome area.

It is also common practice to assume that the pressure measured at the suction service valve of the compressor is the same pressure that exists at the outlet of the evaporator at the expansion valve bulb location. This is particularly true on close-coupled systems where it has been determined that the suction line is of the proper size. By making this assumption, we can determine the expansion valve superheat without installing an additional pressure tap at the bulb location. However, to eliminate any doubt as to the amount of suction line pressure drop and to be absolutely precise in measuring superheat, a gauge must be installed in the suction line at the bulb location.

Care must be taken to make a reasonable allowance for pressure drops within the system. Excessive pressure drops can be detected by applying the principles of the P-T relationship. As an example, in Figure 2, with gauges installed only at the suction and discharge of the compressor and reading as indicated, a significant pressure drop through the evaporator would be indicated by a high temperature of, say, 50°F measured at the evaporator inlet which would correspond to a pressure at that point of approximately 45 psi for a pressure drop of 29 psi from the evaporator inlet to the compressor inlet (45 minus 16). While this would be considered excessive on a single-circuit evaporator, it should be remembered that on multi-circuit evaporators using a refrigerant distributor that a pressure drop through the distributor on Refrigerant 134a may be in the vicinity of 25 psi. This means that with the use of a refrigerant distributor, a measured temperature between the outlet of the thermostatic expansion valve and the inlet of the distributor of approximately 50°F would not be abnormal in the system illustrated in Figure 2.

CHECKING ON NON-CONDENSABLES

The proper use of the P-T relationship can be helpful in discovering the presence of air or other non-condensable gases in the system. This would be revealed by the measured temperature in the condenser or the leaving temperature of the cooling medium being much lower than that indicated by the P-T relationship.

TEST YOUR P-T KNOW-HOW!

Figure 3 is an exercise to test your knowledge and use of the P-T relationship. The pressure and temperature are shown at various points in the system. Check the square that indicates the condition of the refrigerant at each point. In the case of superheated vapor and subcooled liquid, indicate the amount in the blank shown.

Vacuum-Inches of Mercury—*Italic* Figures

SPORLAN

TEMPERATURE PRESSURE CHART

Pressure-Pounds Per Square Inch Gage **Bold** Figures

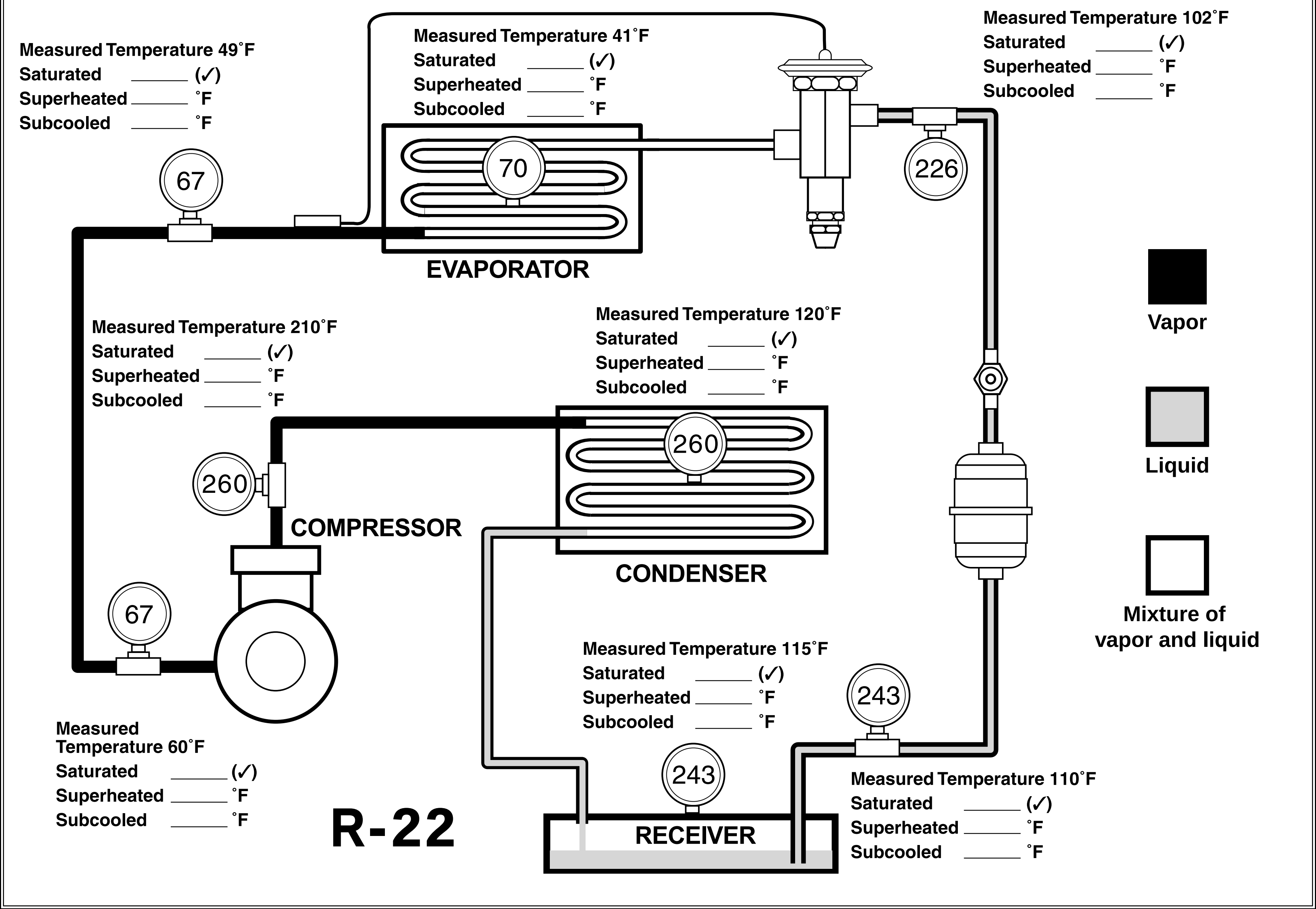
TEMPERATURE °F	REFRIGERANT (SPORLAN CODE)				
	R-22(V)	R-410A(Z)	R-407C(N)	R-12(F)	R-134a(J)
-60	*11.9*	*0.9*	*16.0*	*19.0*	*21.6*
-55	*9.2*	1.8	*13.7*	*17.3*	*20.2*
-50	*6.1*	4.3	*11.1*	*15.4*	*18.6*
-45	*2.7*	7.0	*8.1*	*13.3*	*16.7*
-40	0.6	10.1	*4.8*	*11.0*	*14.7*
-35	2.6	13.5	*1.1*	*8.4*	*12.3*
-30	4.9	17.2	1.5	*5.5*	*9.7*
-25	7.5	21.4	3.7	*2.3*	*6.8*
-20	10.2	25.9	6.2	0.6	*3.6*
-18	11.4	27.8	7.2	1.3	*2.2*
-16	12.6	29.7	8.4	2.1	*0.7*
-14	13.9	31.8	9.5	2.8	0.4
-12	15.2	33.9	10.7	3.7	1.2
-10	16.5	36.1	11.9	4.5	2.0
-8	17.9	38.4	13.2	5.4	2.8
-6	19.4	40.7	14.6	6.3	3.7
-4	20.9	43.1	15.9	7.2	4.6
-2	22.4	45.6	17.4	8.2	5.5
0	24.0	48.2	18.9	9.2	6.5
1	24.8	49.5	19.6	9.7	7.0
2	25.7	50.9	20.4	10.2	7.5
3	26.5	52.2	21.2	10.7	8.0
4	27.4	53.6	22.0	11.3	8.6
5	28.3	55.0	22.8	11.8	9.1
6	29.1	56.4	23.7	12.4	9.7
7	30.0	57.9	24.5	12.9	10.2
8	31.0	59.3	25.4	13.5	10.8
9	31.9	60.8	26.2	14.1	11.4
10	32.8	62.3	27.1	14.7	12.0
11	33.8	63.9	28.0	15.3	12.6

TEMPERATURE °F	REFRIGERANT (SPORLAN CODE)				
	R-22(V)	R-410A(Z)	R-407C(N)	R-12(F)	R-134a(J)
12	34.8	65.4	29.0	15.9	13.2
13	35.8	67.0	29.9	16.5	13.8
14	36.8	68.6	30.9	17.1	14.4
15	37.8	70.2	31.8	17.7	15.1
16	38.8	71.9	32.8	18.4	15.7
17	39.9	73.5	33.8	19.0	16.4
18	40.9	75.2	34.8	19.7	17.1
19	42.0	77.0	35.9	20.4	17.7
20	43.1	78.7	36.9	21.1	18.4
21	44.2	80.5	38.0	21.8	19.2
22	45.3	82.3	39.1	22.5	19.9
23	46.5	84.1	40.2	23.2	20.6
24	47.6	85.9	41.3	23.9	21.4
25	48.8	87.8	42.4	24.6	22.1
26	50.0	89.7	43.6	25.4	22.9
27	51.2	91.6	44.7	26.1	23.7
28	52.4	93.5	45.9	26.9	24.5
29	53.7	95.5	47.1	27.7	25.3
30	54.9	97.5	48.4	28.5	26.1
31	56.2	99.5	49.6	29.3	26.9
32	57.5	101.6	50.9	30.1	27.8
33	58.8	103.6	52.1	30.9	28.6
34	60.2	105.7	53.4	31.8	29.5
35	61.5	107.9	54.8	32.6	30.4
36	62.9	110.0	56.1	33.5	31.3
37	64.3	112.2	57.5	34.3	32.2
38	65.7	114.4	58.9	35.2	33.1
39	67.1	116.7	60.3	36.1	34.1
40	68.6	118.9	61.7	37.0	35.0
41	70.0	121.2	63.1	37.9	36.0

TEMPERATURE °F	REFRIGERANT (SPORLAN CODE)				
	R-22(V)	R-410A(Z)	R-407C(N)	R-12(F)	R-134a(J)
42	71.5	123.6	64.6	38.9	37.0
43	73.0	125.9	66.1	39.8	38.0
44	74.5	128.3	67.6	40.8	39.0
45	76.1	130.7	69.1	41.7	40.0
46	77.6	133.2	70.6	42.7	41.1
47	79.2	135.6	72.2	43.7	42.2
48	80.8	138.2	73.8	44.7	43.2
49	82.4	140.7	75.4	45.7	44.3
50	84.1	143.3	77.1	46.7	45.4
55	92.6	156.6	106.0	52.1	51.2
60	101.6	170.7	116.2	57.8	57.4
65	111.3	185.7	127.0	63.8	64.0
70	121.5	201.5	138.5	70.2	71.1
75	132.2	218.2	150.6	77.0	78.6
80	143.7	235.9	163.5	84.2	86.7
85	155.7	254.6	177.0	91.7	95.2
90	168.4	274.3	191.3	99.7	104.3
95	181.9	295.0	206.4	108.2	113.9
100	196.0	316.9	222.3	117.0	124.1
105	210.8	339.9	239.0	126.4	134.9
110	226.4	364.1	256.5	136.2	146.3
115	242.8	389.6	274.9	146.5	158.4
120	260.0	416.4	294.2	157.3	171.1
125	278.1	444.5	314.5	168.6	184.5
130	297.0	474.0	335.7	180.5	198.7
135	316.7	505.0	357.8	192.9	213.5
140	337.4	537.6	380.9	205.9	229.2
145	359.1	571.7	405.1	219.5	245.6
150	381.7	607.6	430.3	233.7	262.8
155	405.4	645.2	456.6	248.6	281.0

To determine ***subcooling*** for refrigerant R-407C use BUBBLE POINT values (Temperatures above 50°F — Gray Background); to determine ***superheat*** R-407C, use DEW POINT values (Temperatures 50°F and below).

Figure 3


Measured Temperature 49˚F
Saturated ______ (✓)
Superheated ______ ˚F
Subcooled ______ ˚F
Measured Temperature 41˚F
Saturated ______ (✓)
Superheated ______ ˚F
Subcooled ______ ˚F
Measured Temperature 102˚F
Saturated ______ (✓)
Superheated ______ ˚F
Subcooled ______ ˚F
67
70
226
EVAPORATOR
Vapor
Measured Temperature 210˚F
Saturated ______ (✓)
Superheated ______ ˚F
Subcooled ______ ˚F
Measured Temperature 120˚F
Saturated ______ (✓)
Superheated ______ ˚F
Subcooled ______ ˚F
260
260
COMPRESSOR
Liquid
CONDENSER
67
Mixture of vapor and liquid
Measured Temperature 115˚F
Saturated ______ (✓)
Superheated ______ ˚F
Subcooled ______ ˚F
243
Measured Temperature 60˚F
Saturated ______ (✓)
Superheated ______ ˚F
Subcooled ______ ˚F
243
R-22
RECEIVER
Measured Temperature 110˚F
Saturated ______ (✓)
Superheated ______ ˚F
Subcooled ______ ˚F

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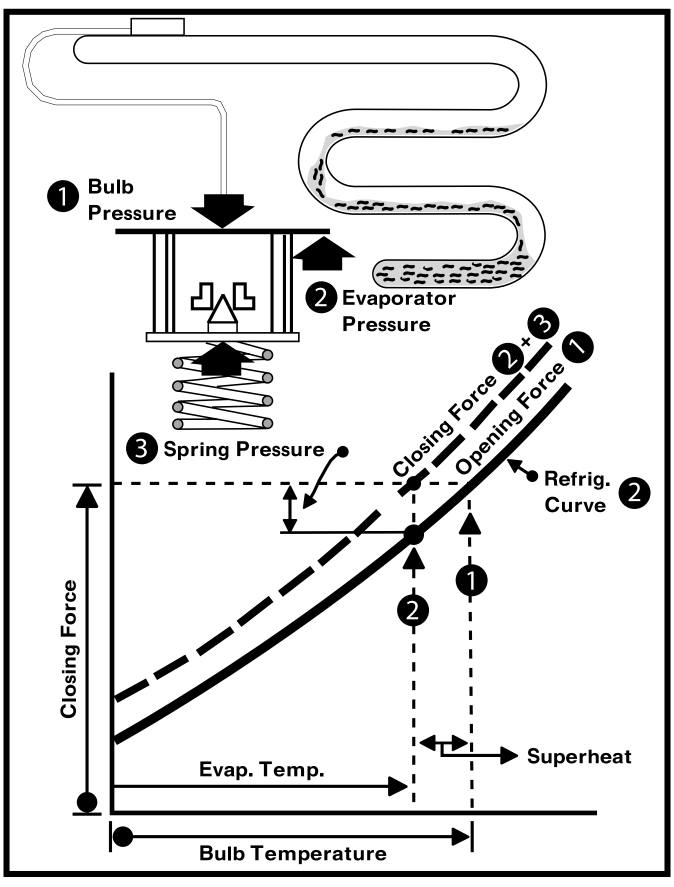
12 Solutions for Fixing Common TEV Problems

By Steve Esslinger — Senior Application Engineer of Supermarket Refrigeration

When responding to a refrigeration service call at a supermarket, the refrigeration technician immediately plays "problem percentages" upon entering the store. Most refrigeration equipment breakdowns are repeat problems to some degree. Playing the "percentages" when responding to a service call enables the Technician to get to the root source of a problem as quickly as possible to prevent perishable product loss.

The purpose of this form is to cover the higher percentage problems and repair procedures of TEVs in supermarket applications.

A brief review of basic TEV operation is in order. The diaphragm is the actuating member of the TEV. There are three fundamental pressures acting on it: Sensing bulb pressure P1, equalizer pressure P2, and the equivalent spring pressure P3. The sensing bulb pressure is a function of temperature and acts on the top of the diaphragm causing the TEV to move in a opening direction. The equalizer and spring pressure act together underneath the diaphragm causing the valve to move in a closed position. Under normal operation (disregarding the pressure differential required across the diaphragm to move it), sensing bulb pressure equals equalizer pressure plus spring pressure, i.e: P1 = P2 + P3. It is important to note that spring pressure is essentially constant once the valve is set. As a result, the TEV is actually controlling the difference between the bulb and the equalizer pressures, which is the amount of the spring pressure. The spring pressure represents the superheat the valve is controlling at the bulb location. Now with TEV basics aside, lets review some of the higher percentage TEV problems when servicing a supermarket. The subject valves had previously been operating at the correct superheat setting.

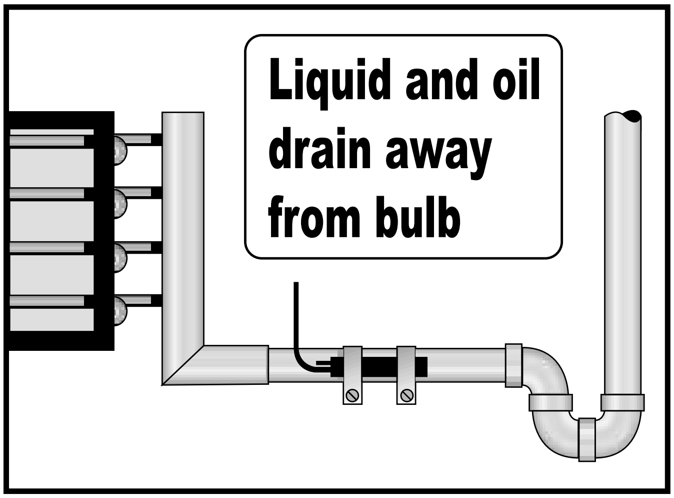


The Valve Will Not Feed Enough Refrigerant

1 — Check the TEV Adjustment: The factory setting of a Sporlan TEV is close to center stem. Count the total number of turns front seat to back seat, then front seat the adjustment stem to 50% of the total turns counted.

Turn the adjusting stem counter clockwise in increments of 1/2 to 1 full turn every 15-minutes until the correct superheat is reached.

2 — Check the Sensing Bulb Location: The sensing bulb should be securely fastened to a clean, straight section of the suction line. The bulb should not be influenced by ambient air temperature. The bulb should be attached to a horizontal suction line at the evaporator outlet. If the bulb cannot be located in this manner it may be located on a descending vertical line only. On suction lines 7/8" and larger, it should be installed at 4 or 8 o'clock on the

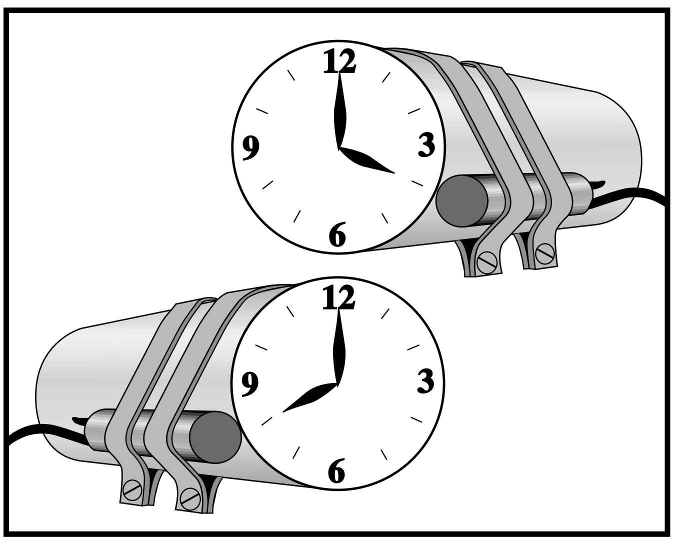


The sensing bulb should be securely fastened to a clean, horizontal section of the suction line at the evaporator outlet.

side of the horizontal line. On smaller lines the bulb may be mounted at any point around the circumference except the bottom of the line where oil may influence the sensitivity. On multiple evaporators, the piping should be arranged so that the flow from any one valve cannot affect the sensing bulb of another. The equalizer connection should be made at a point several inches downstream of the bulb.

Verify the sensing bulb is correctly installed.

Note: This check is also valid when the TEV is flooding the evaporator.



On suction lines 7/8" and larger, the sensing bulb should be installed at 4 or 8 o'clock on the side of the horizontal line.

3 — Check For Moisture: Water or a mixture of water and oil frozen in the valve port (or working parts of the valve) prevent proper operation. Since the valve is the first cold spot in the system, moisture will freeze restricting flow. The fact that the system has not been opened for years does not eliminate the potential for this problem. Elevating the temperature of a liquid line drier (already at maximum water retention) beyond its normal operating temperature can cause it to release moisture into the system. Liquid lines increase in temperature during a slow refrigerant leak, dirty condenser coil, failed condenser fan motor etc.

Pour a cup of hot water on the valve body to melt the suspected internal ice formation. A telltale audible surge in refrigerant flow will indicate system moisture. Install a new Catch-All filter-drier.

Note: This check is also valid when the TEV is flooding the evaporator, the valve may freeze in a "too open" position.

4 — Check for Contaminants in the Valve Body: Restrictive dirt or foreign material such as copper oxide scale, metal chips, oil breakdown, sludge, etc. Conventional strainers allow some types of these materials through ultimately obstructing the port of the TEV.

Pump the system down, disassemble and clean the TEV. Install a Catch-All filter-drier directly ahead of the TEV if additional contaminants are suspected between the main liquid line filter and the restricted TEV. If no contaminants are found, install a sight glass ahead of the TEV and go to step #5.

Note: This check is also valid when the TEV is flooding the evaporator, the foreign material may prevent the valve from closing.

5 — Check for a Solid Liquid Column to the TEV: Install a liquid line sight glass directly ahead of the TEV during step #4 while the system is pumped down. If flash-gas is present, check for a liquid line restriction or pressure drop caused by incorrect pipe size or poor piping practices.

Correct the pressure drop as required. If the pressure drop is because of the length of the piping run or liquid lift, install a heat exchanger to sub-cool the refrigerant to the required temperature for elimination of the flash-gas.

6 — Check Design Pressure Drop for Required TEV Capacity: The capacity of the TEV is a variable dependent on the pressure differential across the valve. Greater pressure drop across the TEV = greater TEV capacity.

Remove the source of the pressure loss on the inlet, or pressure increase at the outlet. If the inlet pressure to the valve is due to low condensing pressure, install the appropriate head pressure controls. Installing a larger TEV is the last resort.

7 — Check for Element Charge Migration: Pressure limiting type elements P, VGA and G charges have a limited volume of constituents. The bulb temperature must be lower than the element or the bulb constituents will migrate into the element causing the valve to throttle and or close.

Warm the element with a heat gun (not a rosebud torch) returning the superheat to normal. Relocate the valve body to a location with a higher temperature than the sensing bulb.

TEV Continuously or Cyclically Floods the Evaporator

A TEV is a modulating type valve with the ability to modulate the refrigerant flow rate much lower than its full load design rating. The more oversized the TEV, the larger the valve superheat swings. The "superheat swing" references the number of degree's change from high to low at the evaporator outlet as the TEV modulates. The superheat swings are also referred to as "hunting".

A conventional non-balanced port TEV can modulate down to about 30% of its maximum loading. The TEV hunting (or swings) at this minimal percent are large enough that liquid refrigerant can spill past the sensing bulb before the valve throttles. A balanced port TEV can modulate down to approximately 25% of its maximum load rating before spillover occurs (the loading is lower with the balanced port valve because it is not influenced by inlet pressure).

Note: Increased pressure drop or decreased entering liquid temperature beyond design conditions increases the TEVs capacity.

8 — Check the TEV Adjustment: The factory setting of a Sporlan TEV is close to center stem. Count the total number of turns from front seat to back seat, then front seat the adjustment stem 50% of the total turns counted.

Turn the adjusting stem clockwise in incriments of 1/2 to 1 full turn every 15-minutes until the correct superheat is reached.

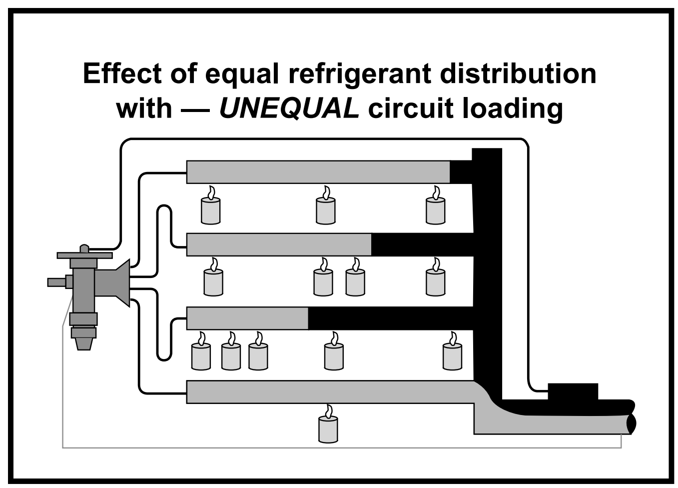
9 — Check for a Solid Liquid Column to the TEV: The TEV adjustment stem may be opened far enough to offset less than a solid column of liquid in some applications. Should the condensing temperature drop, resulting in sub-cooled refrigerant, (a solid head of refrigerant) the TEV may flood. A lighter evaporator load may also result in a solid head of refrigerant to the TEV, leading to a flooded evaporator condition that did not formerly exist.

Install a liquid line sight glass directly ahead of the TEV and verify a solid head of refrigerant during the adjustment procedure.

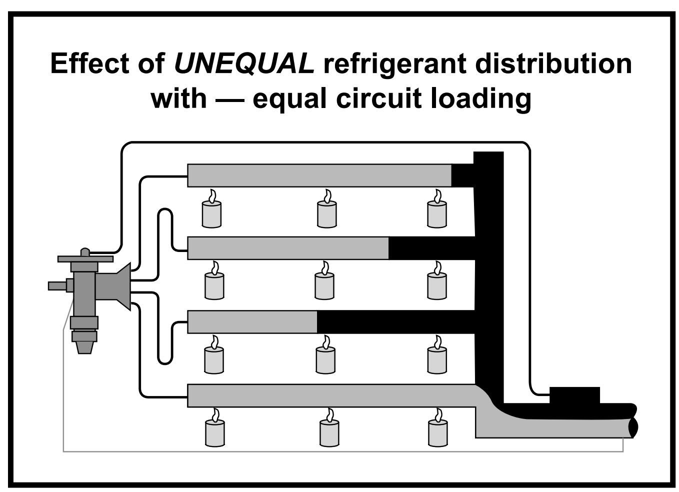
10 — Time Study the Flooding Cycles: A TEV with a severe "hunt" will go to zero degrees of superheat before the valve throttles closed. It may take up to several minutes for the liquid refrigerant in the flooded evaporator to boil off (exhibiting zero degrees superheat). The evaporator superheat may then conversely rise ten or more degrees for an additional minute or two before starting the cycle over.

A TEV that is exhibiting this type of cyclical flooding condition should slowly be adjusted OPEN. Not only will the higher superheat value get lower, the zero degrees at the bottom of the TEV swing will increase to a superheated value. Reducing the adjustment spring pressure results in a higher volume, less erratic evaporator feed, in most applications.

11 — Check the Evaporator for Air Side Heat Loading: The number of air turns in a walk-in cooler or feet per minute air flow in a refrigerated



These illustrations depict conditions that result in a loss of heat transfer due to either (top) unequal circuit loading or (bottom) unequal refrigerant distribution.



fixture should not be reduced. A loss of air movement because of dirt, ice, missing sheet metal panels or incorrect product load levels results in a loss of heat transfer. The TEV may hunt and flood if loaded too lightly.

Verify air movement is at design conditions.

12 — Check the Evaporator for Unequal Circuit Loading: Multi-circuit evaporators and parallel evaporators connected to a single refrigerant distributor must receive an equal percentage of the total load. When each circuit is not subjected to the same heat load, the lightly loaded circuits will allow liquid refrigerant or low temperature vapor to enter the suction line and throttle the TEV. This will cause normally loaded circuits to be deprived of their share of the refrigerant. The net result is a loss of refrigerated evaporator surface and a potentially oversized TEV. Check the temperature of the suction outlets of each distributor circuit before the suction header. Unequal temperatures at these locations are the result of unequal loading.

Check with the equipment manufacturer for the correct distributor and nozzle assembly if poor distribution is diagnosed.

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