Three-Way Valves

Figure 1:

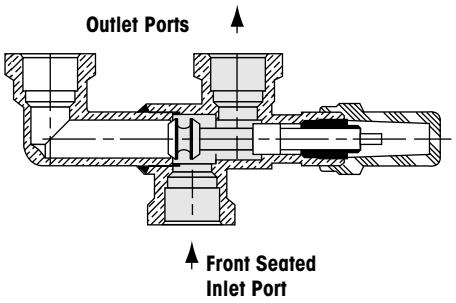


Figure 2:

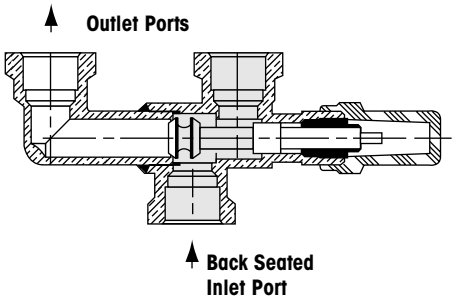
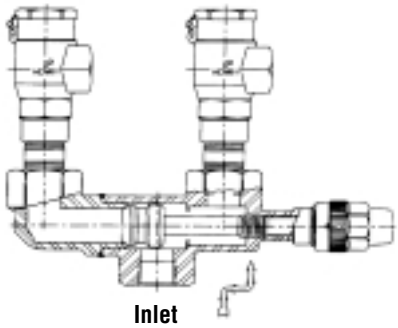


Figure 3:



As we enter an era of ecological awareness renewed industry efforts are being made to reduce refrigerant emissions to the atmosphere. These efforts are directed to reducing leaks through threaded and gasketed joints and at reducing refrigerant losses during servicing procedure. Adequate valving of the components insures serviceability without the loss of expensive refrigerants.

Relief devices by their very nature require special valving techniques. There is no question that a stop valve between the pressure relief device and the pressure vessel being protected would be invaluable to the service personnel. Local, national and international codes prohibit the use of a stop valve in this location. However, there is a device that when used in conjunction with dual relief devices is not considered a stop valve and is approved by various code organizations. That device is the three-way valve. By definition, a three-way valve is a service valve for dual pressure relief devices that allows using one device while isolating the other from the system.

The three-way valve is a unique valve consisting of two outlet ports connected to a common inlet. Figure 1 shows a three-way valve in the front seated position. The common inlet is at the bottom and the outlet ports are at the top. As shown, the front outlet port is closed directing all of the flow through the back port.

If we move the stem off the front seat and on to the backseat we simultaneously open the front port and block the back port. In the back seated position all of the flow is directed through the front port (figure 2). Because of the simultaneous opening and closing feature it is NEVER possible to close off both ports at the same time. If the valve stem is in the mid position, then the flow would be directed through both ports.

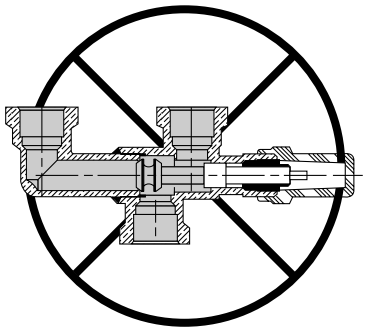
The three-way valve as mentioned is used in conjunction with two relief valves. When assembled as shown in figure 3, we have a Dual Relief Valve Assembly. Because of the three-way valve design, only

Table 1
Pressure Vessel Protection

Vessel Internal Gross Volume	Pressure Relief Valve Single	Pressure Relief Valve Dual	Rupture Member	Fusible Plug
Less then 3 Ft.^{3}	X		X	X
3 Ft.^{3} but less than 10 10Ft.^{3}	X		X	Not Allowed
More than 10Ft.^{3} Discharge to ATM		X	X	

*Special rules apply for vessels on low side of system. Consult applicable Code.

Figure 4



one relief valve can be isolated from the system at a time. With one relief valve in service, the other acts as a standby allowing for periodic checking or replacement of the relief valve while the system is operative. This eliminates the need for shutting down the system and removing the refrigerant for servicing.

The proper stem position for the three-way valve in service should be either fully front seated or fully back seated. The system should NEVER be operated with the stem in the mid position (figure 4). This insures that only one valve is in service at any given time. The second valve is on standby.

EACH RELIEF VALVE ON A DUAL RELIEF VALVE ASSEMBLY MUST HAVE SUFFICIENT CAPACITY TO PROTECT THE VESSEL. NO ADDED CAPACITY WOULD BE OBTAINED BY PLACING THE VALVE STEM IN THE MID POSITION, THUS EXPOSING BOTH RELIEF VALVES TO SYSTEM PRESSURE. SETTING THE THREE-SAY VALVE STEM IN THE MID POSITION CAN ACTUALLY REDUCE OVERALL RELIEVING CAPACITY.

The ports through the three-way valve are large enough to provide full, unrestricted flow to the relief valves when the valve is either front or back seated. With the stem in the mid position the open area to each relief valve is reduced. This reduced area is not large enough to provide full flow to either relief valve. Consequently, total discharge through the valves could actually be reduced due to neither valve opening completely. This condition could lead to excessive chattering and valve damage when the valves are discharging.

Refrigeration Codes require that all pressure vessels containing liquid refrigerant that can be isolated from the system by valving, must be provided with some means of over pressure protection. Table 1 provides an overview of allowable relief devices based on vessel internal volume. We recommend that this table be used as a guide, and that all local codes and regulatory agencies be consulted for the applicable regulations.

On all vessels 10 ft^3 and larger when relief valves are used as the over pressure protective device, a dual relief valve assembly is required. If the available pressure relief valves have insufficient capacity to meet the required capacity to protect the vessel, then two or more relief valves may be used to obtain the required capacity. If this is the case, it must be noted that the two pressure relief valves on a dual relief valve assembly (one dual relief valve assembly with the stem in the mid position, fig. 4), will not meet the code requirements. In order to comply with the current codes, two or more dual relief valve assemblies are required. REMEMBER, EACH DUAL RELIEF VALVE ASSEMBLY ONLY CONTRIBUTES THE RELIEVING CAPACITY OF ONE RELIEF VALVE TO THE TOTAL REQUIREMENT.

The dual relief valve assembly is required only on vessels of 10 ft^3 or larger discharging to atmosphere. However, a wise choice would be to install a dual relief valve assembly, along with a "SENTRY" rupture disc assembly on all systems.

We recommend that a periodic maintenance program be established for inspection of the pressure relief valves. The importance of a periodic maintenance program cannot be over emphasized. The frequency of inspection and maintenance should be established by the user based on his operating conditions.

There are a number of considerations to be made when specifying and installing relief devices.

1. When testing a system with a dual relief valve assembly, test the system with the three-way valve in the mid position. In this way system test pressure is applied to both relief valves. After checking for leaks, the three-way valve should be returned to either the front seated or back seated position, so only one relief valve is exposed to the variable system operating pressure.

2. Do not discharge the relief valve prior to installation or when pressure testing the system.

3. Select a relief valve for the type of refrigerant used.

4. Select a device having sufficient capacity for code requirements.

5. Consider using a dual relief valve assembly and "SENTRY" rupture disc assembly on all systems.