

Fig. 15 ... Evaporator Pressure Regulators in a Multiple System

est unit. With such a system, the compressor may be controlled by a low-pressure switch or by thermostats installed in the individual units.

The evaporator pressure regulator, with *internal pilot passage*, receives its source of pressure for pilot operation at the regulator inlet connection, whereas the regulator with the *external pilot connection* not only permits a choice of the pressure source for pilot operation, but also permits the use of a remote pressure pilot or pilot valves for other purposes.

If the regulator inlet pressure is unsteady and adversely affecting the regulator performance, a steadier source of pressure than that which is available at the regulator inlet may be obtained for the pilot by connecting the external pilot line to a surge drum or an enlarged section of suction line, upstream from the regulator.

The use of a *remote pressure pilot* installed in the external pilot line facilitates adjustment of the pressure setting when the regulator must be installed in an inaccessible location.

A *pressure pilot with a pneumatic connection* permits resetting and controlling of the evaporator pressure and temperature by a pneumatic control system.

In Fig. 15 a *pilot solenoid valve* installed in the external pilot line enables the regulator to function as a suction stop valve as well as an evaporator pressure regulator. This feature is particularly useful on a flooded evaporator to prevent *pumping-out* of the evaporator when the thermostat is satisfied and the compressor continues operating to cool other evaporators.

A *dual-pressure regulator* may be attained by using two pressure pilots; the lower pressure pilot is piped through a pilot solenoid valve, and, when energized, controls the lower pressure. The higher pressure, which occurs when the pilot solenoid valve is de-energized, is generally used for a warmer evaporator requirement, or for pressure above 32 F saturation, for defrosting.

Temperature-operated regulator. In some instances, it is desirable to control the air or liquid entering or leaving the evaporator at a constant temperature by modulating the evaporator pressure and temperature in accordance with the load demand in such a way that the evaporator temperature is decreased during heavy loads and is increased during lighter loads. This can be accomplished with an evaporator pressure regulator modified in one of the following ways:

1. By using a temperature-actuated pilot in the external pilot line in place of the pressure pilot, and having the bulb of the temperature pilot placed where it will respond to the temperature of the air or liquid being cooled. The temperature pilot will modulate the position of the regulator according to the load require-

ment, and thereby maintain the air or liquid being cooled at a constant temperature.

2. By using a pneumatic thermostat and a pressure pilot with a pneumatic connection so that the evaporator pressure and temperature are raised by an increase in air pressure supplied to the pressure pilot at reduced loads, and are lowered by a decrease in air pressure supplied to the pressure pilot at increased loads as required to maintain the temperature of the bulb of the pneumatic thermostat which is placed to respond to the temperature of the air or liquid being cooled. Thus, the air or liquid being cooled is maintained at a constant temperature.

3. By using a pressure pilot that is adaptable to a reversible electric motor drive which resets the pressure pilot and a potentiometer type thermostat to control the reversible electric motor. The evaporator pressure and temperature are raised at reduced loads and lowered at increased loads as required to maintain the temperature of the bulb (of the thermostat) which is placed to respond to the temperature of the air or liquid being cooled. The air or liquid being cooled is thus maintained at a constant temperature.

In addition to the normal applications, these regulators, when equipped with high pressure pilots and suitable valve seat material, or a higher range pressure spring such as in the direct acting regulator, are used in several methods of application in refrigeration systems, having air-cooled condensers. They are used for maintaining low-limit control of the compressor discharge, the liquid line pressure, or both, during cold weather operation.

SUCTION PRESSURE REGULATORS

The suction pressure regulator (hold-back valve or crank-case pressure regulator) limits the compressor suction pressure (regulator outlet pressure) to a maximum value. This type of regulator should be used in the suction line at the compressor on any refrigeration installation where the liquid expansion valve cannot limit the suction pressure, and where compressor motor overload would otherwise exist because of:

1. Excessive starting load.
2. Excessive suction pressure following the defrost cycle.
3. Prolonged operation at excessive suction pressure.
4. Low voltage and high suction pressure conditions.

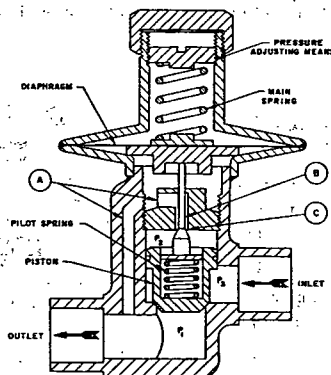


Fig. 16 ... Internally Pilot-Operated Suction Pressure Regulator

Operation

The *direct-acting suction pressure regulator* is designed with the same principle of operation as is used in the constant pressure expansion valve.

The *externally pilot-operated suction pressure regulator* employs a constant pressure expansion valve for the pilot valve.

In the *internally pilot-operated suction pressure regulator*, Fig. 16, the compressor suction pressure P_1 is transmitted through passage A to the space beneath the diaphragm, where it exerts its pressure against the main spring pressure on top of the diaphragm. When the compressor suction pressure drops below the value of the main spring pressure, the diaphragm moves downward, pressing pin B in an opening direction with respect to pilot port C, allowing the pressure P_2 in the space above the piston to be reduced toward the value of P_1 by flowing into passage A. Since the pressure P_2 on the upstream or evaporator side of the piston is greater than the compressor suction pressure P_1 , the differential pressure across the piston moves it in an opening direction.

When the compressor suction pressure P_1 exceeds the main spring pressure, the diaphragm is moved upward, allowing the pilot valve spring to move pin B in a closing direction. This reduces the escape of gas from on top of the piston. With the pilot port throttled, the pressure builds up on top of the piston through a bleed hole in the piston or through the clearance around the piston causing P_2 to approach the value of P_1 , thus, pressure differential across the piston moves it in a closing direction.

Selection

The suction pressure regulator should be selected for the required capacity and system refrigerant, at the required regulator inlet pressure, and the lowest pressure drop across the regulator for economical compressor operation.

Application

In addition to the normal applications, these regulators, when equipped with high-pressure pilots, suitable valve seat material or a higher range pressure spring such as in the direct acting regulator are used in several methods of application in refrigeration systems with air-cooled condensers. They are used for maintaining low-limit control of the compressor discharge or liquid line pressure, or both, during cold weather operation.

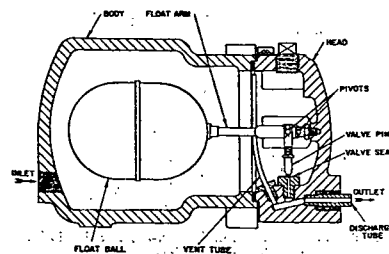


Fig. 17 ... High-Side Float Valve

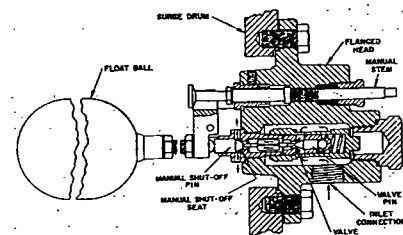


Fig. 18 ... Low-Side Float Valve

In addition, such modified regulators may be used to bypass compressor discharge gas in refrigeration systems as described in the Application Section for the Constant Pressure Expansion Valve.

CONDENSER PRESSURE REGULATORS

The condenser pressure regulating valves and condenser bypass valves, used for controlling cold weather operation of remote (roof mounted) air-cooled condensers, are constructed and operate similarly to evaporator pressure regulators and suction pressure regulators. (See Figs. 13, 14, and 16.) The valves are often identical except for the pressure spring, or high pressure pilot, and seat material if it is other than metal. These valves are responsive to compressor discharge pressure or condenser inlet or outlet pressure, depending on the location of the valve in the condenser circuit.

HIGH SIDE FLOAT VALVES

Operation

A high side float valve controls the mass flow rate of refrigerant liquid entering the evaporator so that it equals the rate at which the refrigerant gas is pumped from the evaporator by the compressor. A cross-section of a typical valve construction is shown in Fig. 17. The refrigerant liquid flows from the condenser into the high side float valve body where it raises the float and thereby moves the valve pin in an opening direction. Thus the refrigerant liquid is permitted to pass through the valve port, expand and flow into the evaporator. Most of the system refrigerant charge is contained in the evaporator at all times.

Selection

For acceptable performance, the high side float valve should be selected for the system refrigerant and a rated capacity that is neither excessively large nor too small. The orifice in the valve is sized for the maximum required capacity with the minimum pressure drop across the valve. The valve operated by the float may be a needle-and-seat construction, a butterfly valve, a balanced double-ported valve, or a sliding gate or spool valve. The internal bypass vent tube allows installation of the high side float valve near the evaporator and above the condenser, without danger of the float valve becoming gas bound. Some large capacity valves use a high side float valve for pilot operation of a diaphragm or piston type spring-