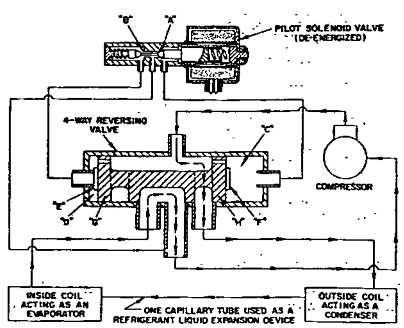


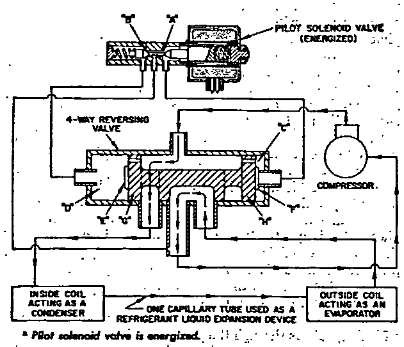
* *Pilot solenoid valve is de-energized.*

Fig. 24 .... Four-Way Slide-Type Refrigerant Reversing Valve Used in Cooling Cycle of Refrigeration System*

port B. The reversing valve will then reverse to the position shown in Fig. 24.

Reversing valves operate equally well with most fluorinated refrigerants, but the type of refrigerant used will affect the size of the valve selected for a given capacity. For a given refrigerant and capacity, the valve selected should have minimum pressure drops through the valve passages in both the discharge and suction gas paths, in order that the compressor capacity will not be reduced.

Other arrangements of refrigerant liquid expansion devices in reverse cycle systems include a multiple capillary tube system with a check valve to permit a greater refrigerant mass flow rate in one direction, or a single expansion valve system with four check valves arranged to cause the re-



* *Pilot solenoid valve is energized.*

Fig. 25 .... Four-Way Slide-Type Refrigerant Reversing Valve Used in Heating (Defrosting) Cycle of Refrigeration System*

frigerant to flow through the expansion valve in the same direction at all times.

In package units, the refrigerant receiver may be minimized in size or eliminated, provided consideration is given to a limited system refrigerant charge, and the internal volumes of the indoor and outdoor coils and their connecting lines.

In addition to providing the heat pump function, reversing valves may be used to defrost the evaporator of commercial refrigeration systems, which normally operate in the cooling cycle, in display cases and walk-in coolers.

Reversing valves are employed in refrigeration systems in motor trucks, trailers, and railway refrigerator cars for the transportation of perishable cargo. These systems can be arranged to operate automatically and provide cooling, heating, and defrosting as required. An optional arrangement provides manual control of the defrosting operation.

Regardless of the type of installation to which the reversing valve is added, e.g., window unit, residential unit, commercial unit, or customer built system, the system may be made to operate automatically. If a dual action thermostat is used, cooling will automatically occur when the temperature rises above a preset value, and heating will occur automatically when the temperature drops below a preset value.

CONDENSING WATER REGULATORS

Two-Way Regulators

The condensing water regulator modulates the quantity of water passing through a water-cooled refrigerant condenser in response to the condensing pressure. This regulator is used on a vapor cycle refrigeration system to maintain a condensing pressure level which will load but not overload the compressor motor. The regulator automatically modulates to correct for variations in temperature or pressure of the water supply, and for variations in the quantity of refrigerant gas which the compressor is sending to the condenser.

Operation

The condensing water regulator consists of a valve and an actuator which are linked together as shown in Fig. 26. The actuator commonly consists of a metallic bellows and adjustable spring combination which is connected to the system condensing pressure. For large water-flow capacities, a small condensing water regulator is used for pilot-operation of a diaphragm type main valve.

After a compressor starts, the condensing pressure begins to rise. When the opening pressure setting of the regulator spring is reached, the bellows move to gradually open the valve disc from its seat. The regulator continues to open as the condensing pressure rises, until a balance point is reached between the water flow and the heat rejection requirement, at which point the condensing pressure is stabilized. When the compressor stops, the continuing water flow through the regulator causes the condensing pressure to drop gradually, thereby closing the regulator, which becomes fully closed when the opening pressure setting of the regulator is reached.

Selection

Selection of a condensing water regulator depends upon the type of system refrigerant used, the water flow rate required, and the available water pressure drop across the regulator.

While one standard bellows operator can sometimes handle any of several refrigerants, special springs or bellows may be required for very high- or low-pressure refrigerants, as in the

case of Refrigerant 717 (ammonia), where a stainless steel bellows must be used in lieu of a brass bellows.

The water flow rate required depends upon condenser performance data, the temperature of available water, the quantity of heat which must be rejected to this water, and the allowable leaving water temperature.

For a given opening of the valve seat, which corresponds to a given pressure rise above the regulator opening point, the flow rate handled by a given size water regulator is a function of the available water pressure drop across the valve seat. Available water pressure drop is determined for the required flow rate by deducting condenser water pressure drop, pipe line pressure drop, and static head losses from the pressure of the water at its supply point.

The condensing water regulator should be selected from the manufacturer's data on the basis of maximum required flow rate and minimum available pressure drop.

Application

Oversizing of a regulator should be avoided because this encourages *hunting*.

When two-way condensing water regulators (see Fig. 26) are used on recirculating cooling tower systems, the throttling action of the valves during cold weather causes a reduction in pump and tower circulation which is undesirable for that equipment.

Three-Way Regulators

On tower systems requiring individual condensing pressure control, it is advisable to use three-way condensing water regulators (see Fig. 27). These are similar in construction to two-way regulators, but they have an additional port which opens to bypass water around the condenser as the port controlling water flow to the condenser closes. Thus the tower decking or sprays and the circulating pump receive a constant supply of water, although the water supply to individual condensers is modulated for control.

Three-way condensing water regulators must be supplemented by other means where cooling tower systems are to be

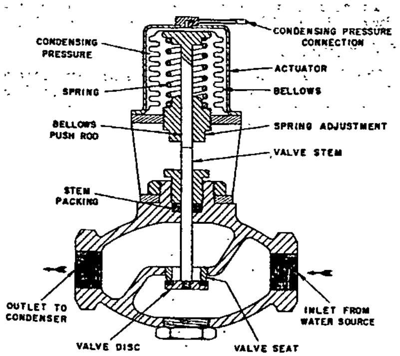


Fig. 26 .... Two-Way Condensing Water Regulator

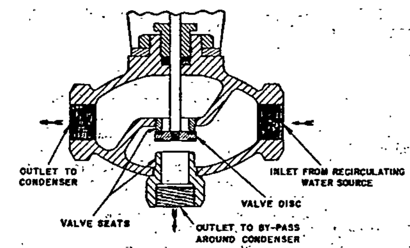


Fig. 27 .... Three-Way Condensing Water Regulator

operated in freezing weather. An indoor sump is usually required and a temperature actuated three-way water control valve is used to periodically divert all of the condenser leaving water directly to the sump whenever the water becomes too cold.

Unlike the recommended and accepted practice pertaining to the application of refrigerant control valves, a strainer is not ordinarily used with a water regulator, because a strainer usually requires more cleaning and servicing than a regulator without a strainer.

CHECK VALVES

Refrigerant check valves are normally used in refrigerant lines where pressure reversals could cause undesirable reverse flows. A check valve is usually opened by a portion of the pressure drop which causes flow in the pipe line. Closing usually occurs when a reversal of pressure takes place, or when the pressure drop across the check valve is less than the minimum opening pressure drop in the normal flow direction.

Conventional check valve designs frequently use the *piston type* construction, and employ the globe pattern in large sizes, while *in-line* designs are commonly smaller than the 2-in. size. Either design may be used with closing springs; the heavier springs give more reliable and tight closing, but require greater pressure drop for the check to open. The in-line check design does not permit a manual opening stem. Although conventional check valves may be designed to open at less than 1 psi drop, they may not be reliable at temperatures below − 25 F because the light closing springs may not overcome the viscous oil.

Special refrigeration check valves are available, such as *excess flow checks*, which close only when flow exceeds the maximum desired rate; *electrically lifted checks*, which require no pressure drop to remain open; *remote pressure operated checks*, which are normally open but close when supplied with a higher pressure source of refrigerant, are available.

Seat Materials

Although precision metal seats may be manufactured nearly bubble-tight, they are not economically practicable, for refrigerant check valves. Seats made of synthetic rubbers provide excellent tightness at medium and high temperatures, but may leak at low temperatures, due to lack of resilience. Since high temperatures deteriorate most rubbers suitable for refrigerants, the use of plastic seat materials has become in-