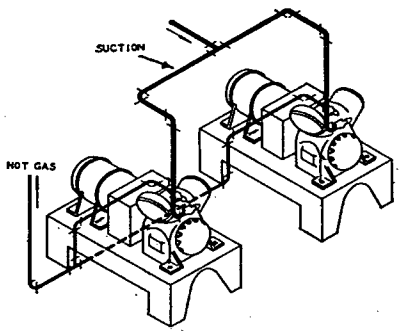


Fig. 20 .... Suction and Hot Gas Headers for Multiple Compressors[3]

to form crosses with the branch suction lines to the compressors.

The suction header should be run full size along its entire length. The horizontal take-offs to the various compressors should be the same size as the suction header. No reduction should be made in the branch suction lines to the compressors until the vertical drop is reached.

Fig. 20 shows suction and hot gas header arrangements for two compressors operating in parallel. Fig. 21 shows pyramidal or yoke type suction header for maximum equalization of pressure at each of three compressor suction inlets, piped in parallel. An acceptable alternate, although not as good with regard to equal pressure drops to all compressors, is to have the suction line from the evaporators enter at one end of the header instead of using the yoke arrangement, as shown by the broken line.

Take-offs to each compressor from the common suction header should be horizontally from the side, to assure equal distribution of oil and to prevent accumulating liquid refrigerant in an idle compressor in case of slop-over.

Discharge Piping

Hot gas piping at paralleled compressors should be arranged to prevent excessive vibration and to prevent oil and liquid refrigerant from draining back to the head of any of the compressors. The branch hot gas lines from the compressors should be connected into a common header run at some level below that of the compressor discharge connections. For convenience, it is often at the floor. This is equivalent to the hot gas loop for the single compressor.

The hot gas loop accomplishes two functions:

1. It prevents gas which may condense in the hot gas line, during the off cycles, from draining back onto the heads of the compressors, eliminating compressor damage from this potential hazard.
2. It prevents oil which leaves one compressor from draining down onto the head of an idle machine.

The solid lines in Fig. 22 show correct hot gas piping from two paralleled compressors. Each branch line has a muffler for reducing hot gas pulsations and drops down into the hot gas header at the floor, before rising up and going to the condenser.

Piping shown by the broken lines in Fig. 22 is incorrect and can result in three kinds of trouble.

1. The use of a *bull-headed* tee at the junction of the two branches and the main will greatly increase the gas turbulence and pressure drop at this point. Hammering in the line may also result.
2. Any gas condensed in the discharge riser, during an off cycle, can run down and accumulate on the heads of the compressors, causing possible valve breakage on start-up.
3. Oil leaving one operating compressor will be thrown into branch line of the other compressor which may be idle, and drain down onto the head of that machine.

Interconnecting Piping

In addition to properly designing the suction and hot gas piping at paralleled compressors, there are also certain other piping connections required between compressors and condensing units for proper parallel operation.

Interconnection of Crankcases

When two or more compressors are to be interconnected, they should be placed on foundations such that all oil equalizer tappings are exactly level.

An interconnecting oil equalization line should connect all of the crankcases in order to maintain uniform oil levels and adequate lubrication in all compressors. The oil equalizer may be run level with the tappings, or, for convenient access to the compressors, it may be run at the floor. Under no conditions should it be run at a level higher than that of the tappings.

For the oil equalizer line to work successfully, it is necessary to equalize the crankcase pressures. This is accomplished through the use of a gas equalizer line which is installed above the oil level. This line may be run (Fig. 23) to provide head room or run level with the tappings on the compressors. It should be piped so that oil or condensed vapor will not be trapped.

Both lines should be the same size as the tappings on the largest compressor and should be valved so that any one machine can be taken out for repair without shutting down the entire system. Neither line should be run directly from one crankcase into another without forming some sort of U-bend, or hairpin, to absorb vibration.

Condensing Pressure Equalization

When multiple condensing units are interconnected as shown in Fig. 23, it is also necessary to equalize the pressure

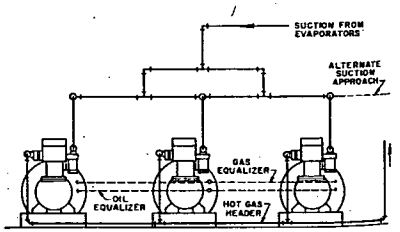


Fig. 21 .... Suction and Hot Gas Headers for Multiple Compressors[3]

in the condensers to prevent hot gas from blowing through one of the condensers and into the liquid line. To do this, install a condensing pressure equalizer line as shown. If the piping is looped as shown, vibration should not be a problem. The bottoms of all condensers should be at the same level to prevent backing liquid into the lowest one.

The condensing pressure equalizer line between units should be the same size as the largest hot gas line that it connects into.

PIPING AT VARIOUS SYSTEM COMPONENTS

Flooded Fluid Coolers

Flooded cooler design usually involves a refrigerant shell containing bundles of water tubes. Refrigerant surrounds the tubes in the shell and water or other fluid flows through the tubes in one or more passes through the cooler, depending upon the baffling arrangement in the heads.

The fluid tube bundles fill up the lower portion only of the cooler shell, leaving the upper volume to serve as a gas-liquid separation space so that the suction gas taken off the top of the cooler will not contain refrigerant in liquid form. The separation space in the top of the cooler is most efficient when eliminators are used in this space, allowing higher loading of the cooler without liquid carryover into the suction line.

The design of flooded coolers to prevent liquid carryover into the suction line creates the problem of getting trapped oil out of the cooler. This is handled with a continuous liquid bleed line from some point in the cooler shell, below the liquid level, into the suction line. This continuous bleed of refrigerant liquid and oil prevents the oil concentration in the cooler from getting too high. The location of the liquid bleed connection on the shell depends on the refrigerant used. With Refrigerant 12 the connection can be anywhere below the liquid level, because of the high miscibility of the oil and refrigerant. Refrigerant 22 is less miscible with oil, however, and there is a tendency toward stratification, with the oil concentration being the richest toward the top of the refrigerant bath. This becomes more noticeable as the evaporating temperature drops. With Refrigerant 22 coolers, therefore, the bleed line is usually taken off the shell just slightly below the liquid level. Sometimes there is more than one valved bleed connection at slightly different levels so that the optimum point can be selected during operation.

This bleed of refrigerant and oil out of the cooler is by gravity. It is usually drained into the suction line so that the oil can be returned to the cooler with the suction gas, after vaporising the accompanying liquid refrigerant in a liquid-suction heat interchanger.

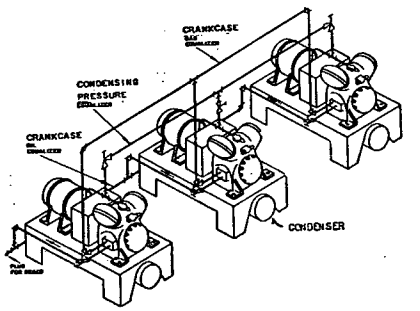


Fig. 23 .... Interconnecting Piping for Multiple Condensing Units[2]

Sometimes the refrigerant-oil bleed is not drained into the suction line but into an electrically heated receiver where the refrigerant is boiled off to the suction line and the oil drained back to the compressor.

Flooded coolers can have several different types of refrigerant feed, such as:

1. Low pressure float valve, direct acting.
2. Low pressure float switch and solenoid valve.
3. Low pressure pilot operated valve (Fig. 24).
4. High pressure float valve.

For further information on these valves, see Chapter 36 of the 1961 Guide And Data Book.

The *low pressure float valve* controls the flow of refrigerant in direct response to the liquid level in a flooded evaporator. It is called *low pressure* because the pressure existing in the float chamber is substantially the same as that in the evaporator. Because of its greater flexibility, the low pressure float is very widely used. It is not critical with respect to the refrigerant charge or number of evaporators in the system.

The application of a *low pressure float switch* is similar to that for the low pressure float valve except that the refrigerant

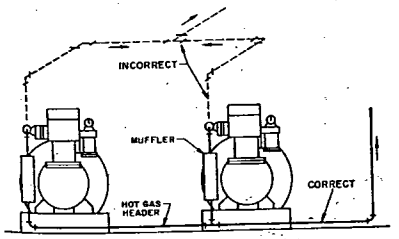


Fig. 22 .... Hot Gas Connections from Parallel Compressors (Correct and Incorrect Methods)[3]

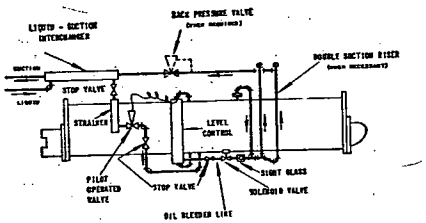


Fig. 24 .... Typical Piping at Flooded Fluid Cooler[2]