had a temperature below zero. The temperature differential between the inlet brine and the return brine is an indication of the amount of heat being absorbed by the brine and thus the refrigeration load was computed.

The shaft was about 1100 ft deep, 16 ft in diameter inside the concrete lining. According to the formation, the lining varied from 16 in. at the top to possibly 30 in. in the wet zone at 750 ft. Below 750 ft it was about 12 in. thick.

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CHAPTER 69

REFRIGERANT PIPING SYSTEMS—GENERAL

Refrigerant Line Sizing, Basis of Refrigerant Line Capacity Tables, Equivalent Lengths for Valves and Fittings, Refrigerant Line Velocities and Flow Rates, General Piping Practice

THIS chapter deals with the following general piping information applicable to all refrigerants, although certain specific data covers only the commonly used refrigerants, Refrigerants 12, 22, 500 and 717 (ammonia):

1. Refrigerant line sizing data.
2. Equivalent lengths of valves and fittings.
3. Refrigerant flow data.
4. General piping practice.

Information concerning the physical arrangements of piping at and between the various system components can be found in Chapters 70 to 73.

For information on piping materials and methods of pipe assembly, refer to Chapter 50 of the 1961 Guide And Data Book.

REFRIGERANT LINE SIZING

In sizing refrigerant lines it is necessary to consider the optimum sizes with respect to economics, friction losses and oil return.

It is desirable to have line sizes as small as possible from the cost standpoint. On the other hand, suction and discharge line pressure drops cause loss of compressor capacity, and excessive liquid line pressure drops may cause flashing of the liquid refrigerant with consequent faulty expansion valve operation.

Oil return is not considered in ammonia system design. Therefore lines are usually sized for very low pressure drops. For other refrigerants, however, it is necessary to consider the requirements for oil return up vertical risers (see Chapter 70). Oversizing of horizontal or vertical downward lines will have no detrimental effect on system operation.

Pressure Drop Considerations

Liquid Lines. Pressure drop in liquid lines is not as critical as with suction and discharge lines. The important things to remember are that the pressure drop should not be so excessive as to cause gas formation in the liquid line, insufficient liquid pressure at the liquid feed device, or both.

A system should normally be designed so that the pressure drop in the liquid line, due to friction, is not greater than that corresponding to about 1 F deg change in saturation temperature for ammonia, and 1 to 2 F deg for other refrigerants. A change of 1 F deg in saturation temperature, in terms of pressure loss at 100 F condensing temperature corresponds to approximately:

3.3 psi for Ammonia
1.8 psi for Refrigerant 12
2.9 psi for Refrigerant 22
2.2 psi for Refrigerant 500

Friction pressure drops in the liquid line include accessories such as solenoid valve, strainer-drier, hand valves, etc., as well as the actual pipe and fittings, from the receiver outlet to the refrigerant feed device at the evaporator.

Suction Lines. Pressure drop in the suction line means a loss in system capacity because it forces the compressor to operate at a lower suction pressure to maintain desired evaporating temperature in the coil.

It is usually standard practice to size the suction line to have a pressure drop due to friction not any greater than the equivalent of about 1 F deg change in saturation temperature for ammonia, and 2 F deg for other refrigerants. In terms of pressure loss at 40 F suction temperature, this corresponds to about:

1.48 psi for Ammonia
1.81 psi for Refrigerant 12
2.94 psi for Refrigerant 22
2.17 psi for Refrigerant 500

At suction temperatures lower than 40 F, the pressure drop equivalent to a given degree change becomes less. For example,

(*Text continued on p. 730*)

Table 1 .... Approximate Effect of Gas Line Pressure Drops on Compressor Capacity and Horsepower

Line Pressure Loss	Compressor	
	Capacity	hp/Ton
No Line Loss	100%	100%
2 F Suction Line Loss	96.2%	103.1%
2 F Hot Gas Line Loss	98.2%	103.1%
4 F Suction Line Loss	92.2%	106.9%
4 F Hot Gas Line Loss	96.7%	106.3%