Table 4 .... Refrigerant Line Capacities for Refrigerant 500 (Tons of Refrigeration Resulting in a Line Friction Drop Per 100 Ft Equiv. Pipe Length Corresponding to 2 F (ΔT) Change in Sat. Temp)[1]

Line Size Type L Copper, OD	Suction Lines* Suction Temp, F					Discharge Lines* $\Delta P = 4.59$ Saturated Suction Temp			Liquid Lines		
	−40 $\Delta P = 0.58$	−20 $\Delta P = 0.85$	0 $\Delta P = 1.19$	20 $\Delta P = 1.63$	40 $\Delta P = 2.17$	−40	0	40	Line Size Type L Copper, OD	Condenser to Receiver Velocity = 100 fpm	Receiver to System* $\Delta T = 1$ F $\Delta P = 2.3$
⅛						0.7	0.8	1.0			
¼	0.12	0.19	0.31	0.48	0.7	1.3	1.5	1.8	⅛	2.3	2.8
⅜	0.32	0.52	0.82	1.29	2.0	3.4	4.0	4.8	¼	3.0	5.1
½	0.65	1.07	1.67	2.64	4.1	7.1	8.3	10.0	⅜	6.3	13.6
⅝	1.17	1.72	3.02	4.77	7.4	12.1	14.1	17.0	½	10.8	28.0
⅞	1.83	2.99	4.69	7.42	11.5	20.0	23.3	28.0	⅝	16.4	50.0
1⅛	3.81	6.24	9.8	15.5	24.0	42.8	50.0	60.0	⅞	23.2	80.0
1⅜	6.82	11.16	17.5	27.7	43.0	75.0	87.6	105.0	1⅛	40.4	165.0
1⅝	11.11	18.2	28.6	45.1	70.0	121.4	141.5	170.0	1⅜	62.3	295.0
1⅞	16.2	26.5	41.6	65.8	102.0	177.2	206.5	248.0	1⅝	88.7	475.0
2⅛	23.6	38.7	60.9	96.2	149.0	257.0	300.0	360.0	1⅞	120.5	
2⅝	40.0	65.5	102.7	162.5	252.0				2⅛	156.5	

NOTES:

* (1) Basis of Table: 105 F Condensing Temp, 2 F ΔT per 100 ft Equivalent Length (except Liquid Lines).

(2) For other ΔT's and Equivalent Lengths, L_e Line Capacity (Tons)

$$= \text{Table Tons} \times \left(\frac{100}{L_e} \times \frac{\text{Actual } \Delta T \text{ Loss Desired}}{\text{Table } \Delta T \text{ Loss}}\right)^{0.55}$$

(3) For other Tons and Equivalent Lengths in a given pipe size

$$\Delta T = \text{Table } \Delta T \times \frac{L_e}{100} \times \left(\frac{\text{Actual Tons}}{\text{Table Tons}}\right)^{1.8}$$

(4) Values based on 105 F Condensing Temp. For capacities at other condensing temp, multiply table value by line capacity multiplier:

Line	Condensing Temperature, F					
	80	90	100	105	110	120
Suction Lines	1.16	1.09	1.03	1.00	0.97	0.91
Discharge Lines	0.84	0.90	0.96	1.00	1.04	1.12

(5) For the Equivalent Change in saturation temp for various line pressure drops in psi refer to Fig. 3.

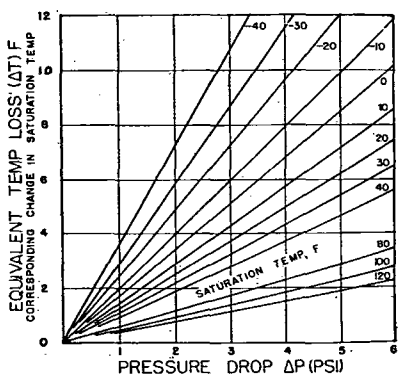

Fig. 3 .... Temp Equivalent (ΔT) of Pressure Drop (Refrigerant 500)

(Text continued from p. 727)

at −40 F suction with Refrigerant 12 the pressure drop equivalent to 2 F deg change in saturation temperature is about ½ psi. This means that low temperature lines must be sized for a very low pressure drop or accept the penalty of higher equivalent temperature losses, with resultant loss in equipment capacity.

Where a reduction in pipe size is necessary to provide sufficient gas velocity to entrain oil up vertical risers at partial loads, greater pressure drops will be imposed at full load. These can usually be compensated for by oversizing the horizontal and downcomer lines to keep the total pressure drop within the desired limit.

Discharge Lines. It is important to minimize the pressure loss in hot gas lines because losses in these lines increase the required compressor horsepower per ton of refrigeration and decrease the compressor capacity. It is usual practice not to exceed a pressure drop corresponding to one degree change in saturation temperature for ammonia and one or two degrees for other refrigerants. This is equal to about 3.3 psi for ammonia, 2 to 4 psi for Refrigerant 12 and 3 to 6 psi for Refrigerant 22.

The effect of excessive suction and hot gas line pressure drops on compressor capacity and horsepower is illustrated in Table 1, using Refrigerant 12.

Pressure drop is kept to a minimum by generously sizing the lines for low friction losses, but still making sure that refrigerant line velocities are sufficient to entrain and carry oil along at all loading conditions (except for ammonia systems).

Table 5 .... Refrigerant Line Capacities for Refrigerant 717 (Ammonia) (Single or High Stage Applications)

(Tons of Refrigeration Resulting in a Line Friction Drop per 100 ft Equivalent Pipe Length Corresponding to 1 F (ΔT) Change in Saturation Temp)

Line Size IPS	Line Size SCH	Suction Lines* Suction Temperature F −40 $\Delta P = 0.32$	−20 $\Delta P = 0.52$	0 $\Delta P = 0.78$	20 $\Delta P = 1.08$	40 $\Delta P = 1.48$	Discharge Lines* $\Delta P = 3.3$	Liquid Lines Line Size IPS	Line Size SCH	Condenser to Receiver Velocity = 100 fpm	Receiver to System* $\Delta P = 3.3$
¾	80						3.63	1¼	80	13.5	29.7
1	80				2.58	3.75	7.98	¾	80	24.9	66.7
1¼	80		2.11	3.46	5.14	7.50	15.9	1	80	41.5	130.0
1½	40	3.24	5.57	8.90	13.4	19.4	41.2	1¼	40	86.2	281.0
2	40	4.83	8.75	13.70	20.2	29.4	57.5	1½	40	117.2	439.0
2½	40	9.34	16.4	26.2	39.4	57.3	118.9	2	40	193.5	1004.0
3	40	15.0	26.0	42.2	62.5	91.2	187.2	2½	40	276.0	1599.0
4	40	26.9	46.0	73.9	111.0	162.0	338.2	3	40	425.0	2341.0
5	40	56.1	94.5	151.0	226.0	327.0	676.0	4	40	736.0	5750.0
6	40	102.0	172.0	272.0	408.0	592.0	1228.0	5	40		
8	40	160.0	280.0	445.0	662.0	958.0	1986.0	6	40		
10	40	338.0	570.0	908.0	1355.0	1960.0	4120.0	8	40		
12	40	605.0	1030.0	1640.0	2430.0	3555.0		10	40		
	ID	975.0	1660.0	2640.0	3940.0	5680.0		12	ID		

NOTES:

* (1) Basis of Table: 100 F Condensing Temperature, 1F ΔT per 100 ft Equivalent Length. Discharge and Liquid Lines based on 0 F Suction.

(2) For other ΔT's and Equivalent Lengths, L_e Line Capacity (Tons)

$$= \text{Table Tons} \times \left(\frac{100}{L_e} \times \frac{\text{Actual } \Delta T \text{ Loss Desired}}{\text{Table } \Delta T \text{ Loss}}\right)^{0.55}$$

(3) For other Tons and Equivalent Lengths in a given pipe size

$$\Delta T = \text{Table } \Delta T \times \frac{L_e}{100} \times \left(\frac{\text{Actual Tons}}{\text{Table Tons}}\right)^{1.8}$$

(4) Values based on 100 F condensing temp. For capacities at other condensing temp, multiply table value by line capacity multiplier:

Line	Condensing Temperature, F			
	70	80	90	100
Suction Lines	1.0	1.0	1.0	1.0
Discharge Lines	0.70	0.80	0.90	1.0

(5) For the Equivalent Change in saturation temp for various line pressure drops in psi, refer to Fig. 4.

(6) Tabulated data developed from ARI data.[1]

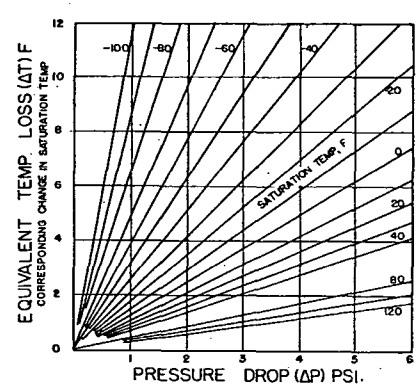

Fig. 4 .... Temperature Equivalent (ΔT) of Pressure Drop (Ammonia)

Basis of Refrigerant Line Capacity Tables

Tables 2 to 6 show capacities of refrigerant lines for ammonia and Refrigerants 12, 22 and 500 at specific pressure drops.

For ammonia, the tables are based on the tons of refrigeration capacity of a line resulting in a line friction drop per 100 ft of equivalent pipe length corresponding to 1 F deg (ΔT) change in saturation temperature. For the other refrigerants, the tables are based on a 2 F deg equivalent loss, except for liquid lines. Correction factors are provided for sizing lines at other losses. (See Table 7.)

Pressure drops have been given in terms of degrees because of the general acceptance of this convenient method of pipe sizing throughout the industry. The corresponding pressure drops in psi may be determined from Figs. 1 to 4, located below the capacity tables.

The refrigerant line capacity tables for ammonia, and Refrigerants 12 and 22 single or high stage applications are taken from data of the Air-Conditioning and Refrigeration Institute.[1] They are based on calculations using the Weisbach-Darcy formula and Darcy friction factors from a Moody chart. Capacity tables for