Worksheet:

Given Values

Refrigerant _____

Suction Temperature _____ °F

BTUH _____

Liquid Temperature _____ °F

Calculations: _____ BTUH ÷ 12,000 = _____ Tons

Liquid Correction Factor:

_____ °F liquid = _____ Factor

_____ Tons ÷ _____ Factor = _____ Corrected Tons

Nozzle Selections (Table 3)

_____ Tons ÷ _____ Nozzle Capacity = _____ %

(If within 110% to 180%, it is acceptable)

Table 3. Distributor Nozzle Capacities in Tons of Refrigeration

Nozzle Orifice		Refrigerant & Evaporating Temperature °F											
		R22					R507, R502, HP80, R404A				R134a, R12, MP39		
No.	I.D.	40°	20°	0°	-20°	-40°	20°	0°	-20°	-40°	40°	20°	0°
1/4	0.052	0.33	0.26	0.21	0.18	0.15	0.17	0.13	0.11	0.09	0.18	0.14	0.11
1/3	0.060	0.44	0.34	0.28	0.23	0.20	0.23	0.17	0.14	0.12	0.24	0.18	0.14
1/2	0.070	0.61	0.48	0.37	0.28	0.25	0.31	0.22	0.17	0.13	0.35	0.28	0.22
3/4	0.086	0.91	0.74	0.60	0.48	0.35	0.46	0.38	0.29	0.19	0.53	0.44	0.34
1	0.099	1.20	0.96	0.78	0.62	0.50	0.67	0.49	0.35	0.26	0.71	0.56	0.47
1.5	0.120	1.80	1.50	1.20	0.90	0.75	0.93	0.71	0.52	0.39	1.00	0.80	0.69
2	0.140	2.40	2.00	1.60	1.20	1.00	1.30	0.98	0.75	0.58	1.40	1.10	0.95
2.5	0.157	3.00	2.40	1.90	1.50	1.20	1.60	1.20	0.93	0.71	1.80	1.40	1.15
3	0.172	3.60	3.00	2.30	1.80	1.50	2.00	1.40	1.10	0.84	2.20	1.70	1.40
4	0.199	4.90	4.00	3.10	2.50	2.00	2.60	2.00	1.50	1.20	2.80	2.20	1.80
5	0.221	6.10	4.80	3.90	3.00	2.50	3.20	2.40	1.80	1.40	3.60	2.80	2.20
6	0.242	7.20	5.60	4.60	3.60	2.90	3.80	2.80	2.20	1.70	4.30	3.40	2.70
8	0.265	9.50	7.40	6.00	4.60	3.70	5.20	3.80	3.00	2.30	5.70	4.40	3.40
10	0.281	11.40	9.10	7.30	5.20	4.30	6.20	4.40	3.50	2.60	7.10	5.60	4.30
12	0.312	14.10	10.90	8.70	6.60	5.50	7.70	5.40	4.10	3.20	8.50	6.70	5.20
14	0.348	17.50	13.50	10.60	8.10	6.50	9.30	7.10	5.20	4.50	10.60	8.00	6.40
17	0.368	19.80	14.70	12.00	9.00	7.50	11.00	7.60	6.40	5.20	12.10	9.20	7.30
20	0.404	23.60	18.30	14.30	10.90	9.00	13.00	9.30	7.50	5.80	14.20	10.80	8.60
25	0.453	29.60	23.50	18.00	13.80	11.00	16.50	12.00	9.30	7.70	—	—	—
30	0.484	34.20	27.00	20.20	15.70	13.00	18.50	13.50	10.50	9.50	—	—	—

NOTE: Based on 100°F liquid entering expansion valve.
(1 Ton = 12,000 BTUH)

Table 4. Liquid Temperature Correction Factor

Liquid Temperature °F	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Correction Factor	3.32	2.85	2.40	1.98	1.63	1.44	1.14	1.00	0.85	0.72

NOTE: Tons X Correction Factor = Nozzle Capacity Nozzle Capacity (Tons) X 12,000 = BTUH Rating

Table 5. Pressure Drop vs. Nozzle Loading.

		Actual Load at a Percent of Above Rating									
	Group	80%	90%	100%	110%	120%	130%	140%	150%	160%	170%
Nozzle PSI Drop	*M	10	12	15	18	20	22	24	27	29	31
	†H	16	20	25	30	35	38	40	43	46	49

* M Group = R12, MP39, R134a. † H Group = R22, R404A, R502, R507, HP80.

Unit Coolers

Recommended Unit Cooler Placement

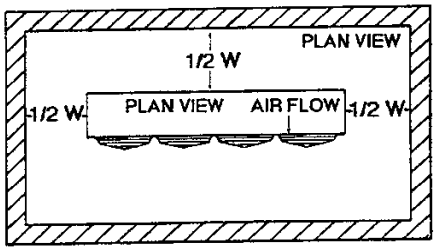
Some general rules for evaporator placement which must be followed are:

1. The air pattern must cover the entire room.
2. **NEVER** locate evaporators over doors.
3. Location of aisles, racks, etc. must be known.
4. Location relative to compressors for minimum pipe runs.
5. Location of condensate drains for minimum run.

The size and shape of the storage will generally determine the type and number of evaporators to be used and their location. The following are some typical examples:

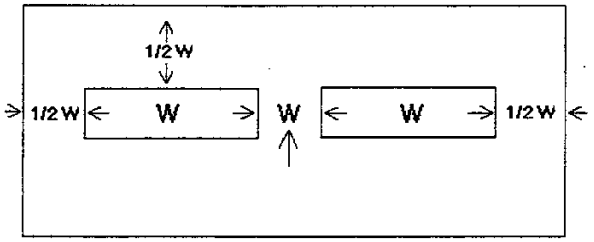
Minimum Unit Clearances

Figure 5 Intermediate and Large Unit Coolers



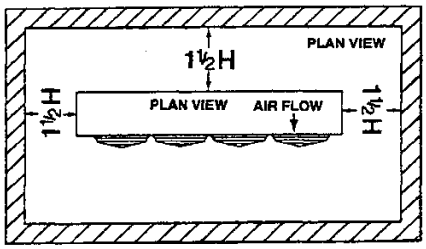
One evaporator

W = Total width of evaporator coil surface.



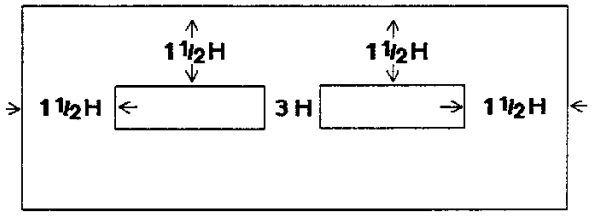
Two evaporators

Figure 6 Low Profile Unit Coolers



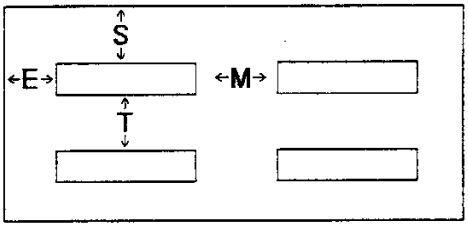
One evaporator

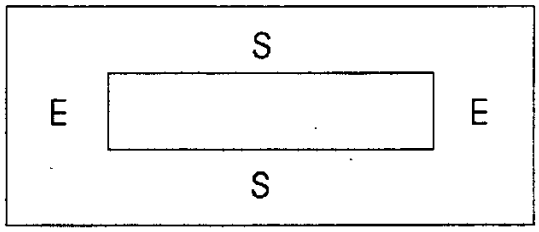
H = Total height evaporator coil surface.



Two evaporators

Figure 7 Center Mount Unit Coolers





Recommended Maximum - Minimum Dimensions for Center Mount Unit Cooler Installations.

E		S		M		T	
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
25'	2'	20'	3'	40'	3'	40'	6'

NOTE: Leave space equal to unit height between bottom of unit and product. Do not stack product in front of fans.

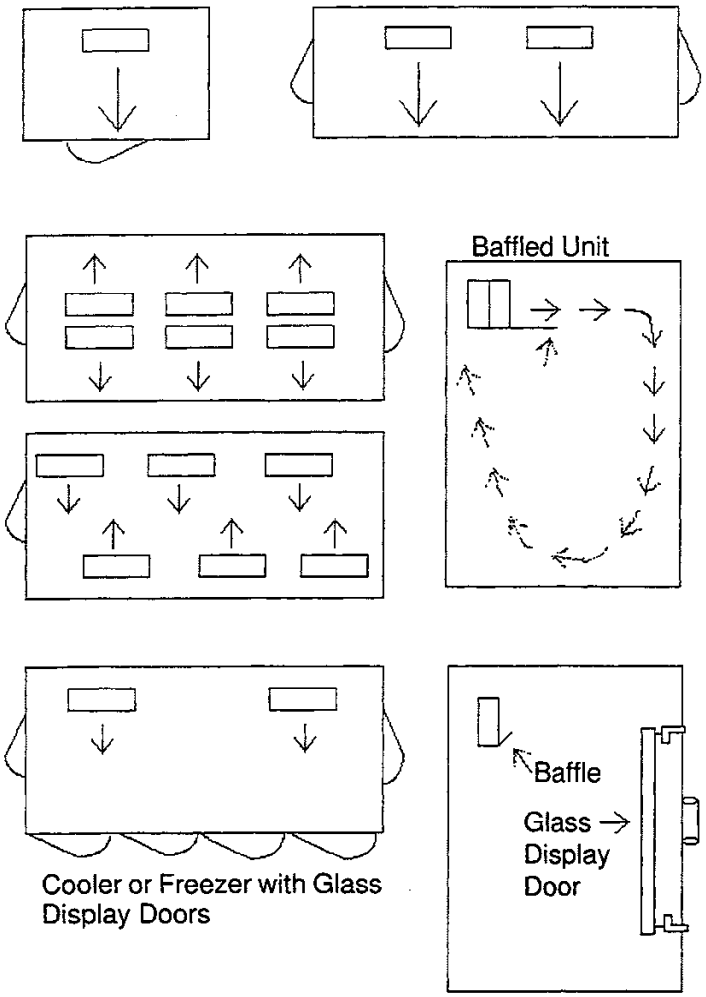
Unit Cooler Mounting

Most evaporators can be mounted with rod hangers, lag screws, or bolts. Use 5/16" bolt and washers or rod for up to 250 pounds, 3/8" for up to 500 pounds and 5/8" for over 500 pounds. Care should be taken to mount the units level so that condensate drains properly. Adequate support must be provided to hold the weight of the unit.

When using rod hangers, allow adequate space between the top of the unit and the ceiling for cleaning. To comply with NSF Standard 7, the area above the unit cooler must be sealed or exposed in such a way to facilitate hand cleaning without the use of tools. When lagging or bolting the unit flush to the ceiling, seal the joint between the top and the ceiling with an NSF listed sealant and ends of open hanger channels must be sealed to prevent accumulation of foreign matter.

When locating unit coolers in a cooler or freezer, refer to Figures 5 through 8 for guidelines.

Figure 8. Large Coolers and Freezers Placement.



Where one wall evaporator mounting is satisfactory.

Cooler or Freezers where one wall will not accommodate all required evaporators or where air throw distance must be considered.

NOTE: Always avoid placement of Unit Coolers directly above doors and door openings where low temperature is being maintained and wherever possible for medium temperature.

Allow sufficient space between rear of Unit Cooler and wall to permit free return of air. Refer to Figures 5 through 7 for proper space.

NOTE: Always trap drain lines individually to prevent vapor migration.

Traps on low temperature units must be outside of refrigerated enclosures. Traps subject to freezing temperatures must be wrapped with heat tape and insulated.

Elevation view of glass display door cooler or freezer. Be sure air discharge blows above, not directly at doors. Provide baffle if door extends above blower level.

Condensing Unit Rigging and Mounting

Rigging holes are provided on all units. Caution should be exercised when moving these units. To prevent damage to the unit housing during rigging, cables or chains used must be held apart by spacer bars. The mounting platform or base should be level and located so as to permit free access of supply air.

Ground Mounting

Concrete slab raised six inches above ground level provides a suitable base. Raising the base above ground level provides some protection from ground water and wind blown matter. Before tightening mounting bolts, recheck level of unit. The unit should in all cases be located with a clear space in all directions that is at a minimum, equal to the height of the unit above the mounting surface. A condensing unit mounted in a corner formed by two walls, may result in discharge air recirculation with resulting loss of capacity.

Roof Mounting

Due to the weight of the units, a structural analysis by a qualified engineer may be required before mounting. Roof mounted units should be installed level on steel channels or an I-beam frame capable of supporting the weight of the unit. Vibration absorbing pads or springs should be installed between the condensing unit legs or frame and the roof mounting assembly.

Access

Provide adequate space at the compressor end of the unit for servicing. Provide adequate space on the connection side to permit service of components.

Spring Mounted Compressor

Compressors are secured rigidly to make sure there is no transit damage. Before operating the unit, it is necessary to follow these steps:

a. Remove the upper nuts and washers.
b. Discard the shipping spacers.
c. Install the neoprene spacers. (Spacers located in the electrical panel or tied to compressor.)
d. Replace the upper mounting nuts and washers.
e. Allow 1/16 inch space between the mounting nut/ washer and the neoprene spacer. See Figures 9 and 11 on page 10.

Rigid Mounted Compressor

Some products use rigid mounted compressors. Check the compressor mounting bolts to insure they have not vibrated loose during shipment. See Figure 10 on page 10.

Figure 9. Spring Mount

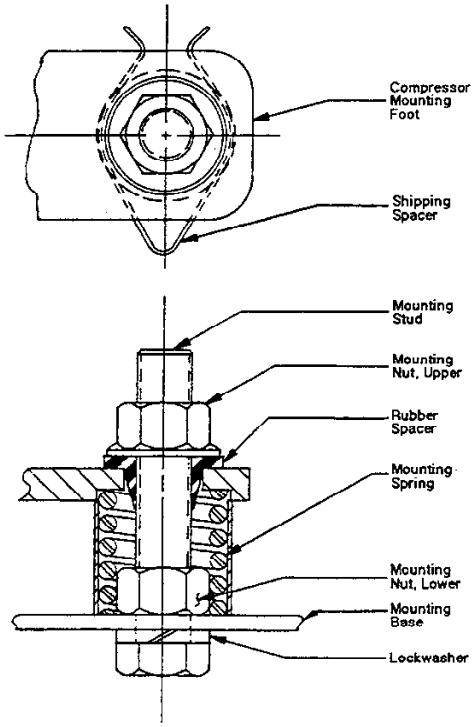


Figure 10. Solid Mount for Mobile or Deep Sump Application.

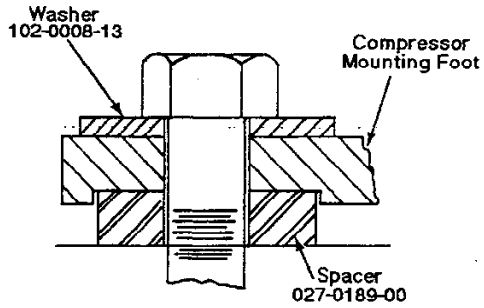
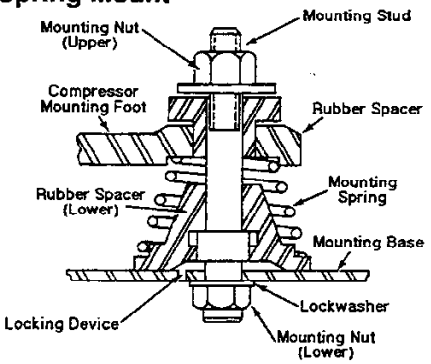


Figure 11. Spring Mount



Mount is shown in properly adjusted position.

Copeland Demand Cooling for L2 Models

R-22, when used in a properly designed and controlled refrigeration system, is a realistic low temperature refrigerant alternative to R-502, which must be phased out due to its high ozone depletion potential. However, experience has shown R-22 can present problems as a low temperature refrigerant because under some conditions the internal compressor discharge temperature exceeds the safe temperature limit for long term stability of refrigeration oil. For this reason suction to liquid heat exchangers are not recommended unless they are necessary to prevent another potential problem.

The Copeland Demand Cooling System

Copeland's demand cooling system uses modern electronics to provide a reliable, cost-effective solution to this problem. It is required for all single stage R-22 applications with saturated suction temperatures below -10°F.

The Demand Cooling module uses the signal of a discharge head temperature sensor to monitor discharge gas temperature. If a critical temperature is reached, the module energizes a long life injection valve which meters a controlled amount of saturated refrigerant into the compressor suction cavity to cool the suction gas. Refer to Figure 13.

This process controls the discharge temperature to a safe level. If, for some reason, the discharge temperature rises above a preset maximum level, the Demand Cooling module will turn the compressor off (requiring a manual reset) and actuate its alarm contact. To minimize the amount of refrigerant which must be injected, the suction gas cooling process is performed after the gas has passed around and through the motor.

Operating Range

Demand Cooling is designed to protect the compressor from high discharge temperatures over the evaporating and condensing temperature ranges shown in Figure 12 at a maximum return gas temperature of 65°F.

Demand Cooling System Design

When Demand Cooling operates, it "diverts" refrigeration capacity in the form of injected saturated refrigerant from the evaporator to the compressor. The effect of this diversion on evaporator capacity is minimal because the diverted capacity is used to cool the gas entering the compressor. As the gas is cooled, it naturally becomes more dense, increasing the mass flow through the compressor, which partly compensates for the capacity diverted from the evaporator.

1. Compressor Return Gas Temperature: Suction lines should be well insulated to reduce suction line heat gain. Return gas superheat should be as low as possible consistent with safe compressor operation. Minimum 20°F superheat at the compressor is required.
2. Condensing Temperatures: It is important when using R-22 as a low temperature refrigerant that condensing temperatures be minimized to reduce compression ratios and compressor discharge temperature.
3. Suction Pressure: Evaporator design and system control settings should provide the maximum suction pressure consistent with the application in order to have as low a compression ratio as possible.

In most cases, with floating head systems where condensing temperatures are low during most of the year, Demand Cooling will operate primarily as a compressor protection control much as the oil failure control protects the compressor during periods of low oil pressure. Demand Cooling will be allowed to operate only during those periods when condensing temperatures and return gas temperatures are high or in periods where a system failure (such as an iced evaporator, an expansion valve which does not control superheat, blocked condenser, or a failed condenser fan) raises condensing temperatures or return gas temperatures to abnormally high levels or lowers suction pressure to abnormally low levels.

Figure 12. Demand Cooling Injection

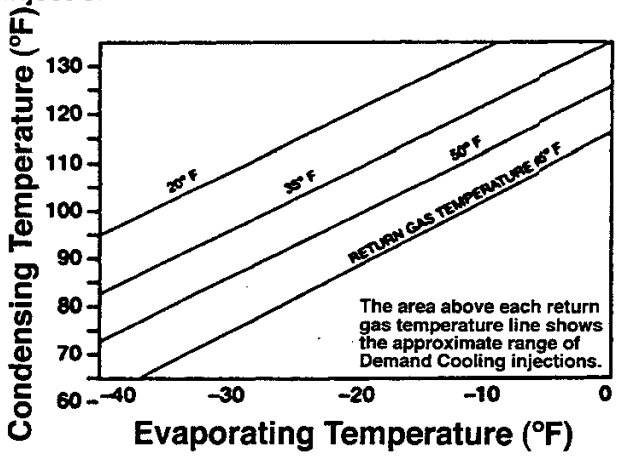
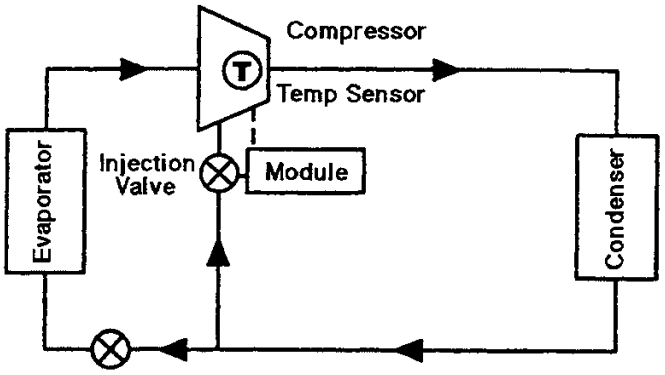


Figure 13. Single Stage Internal Refrigerant Injection



Line Sizing

The following Tables 10A through 13B on pages 14 through 21 indicate liquid lines and suction lines for all condensing units for R22, R502, R404A, R134a, R12 and R507.

When determining the refrigerant line length, be sure to add an allowance for fittings. See Table 7 below. Total equivalent length of refrigerant lines is the sum of the actual linear footage and the allowance for fittings.

Table 6. Pressure Loss of Liquid Refrigerants in Liquid Line Risers (Expressed in Pressure Drop, PSIG, and Subcooling Loss, °F).

	Liquid Line Rise in Feet																	
	10'		15'		20'		25'		30'		40'		50'		75'		100'	
Refrigerant	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F
R12	5.4	2.8	8.1	4.2	10.7	5.4	13.4	6.9	16.1	8.3	21.5	11.3	26.9	14.3	40.3	22.4	53.7	31.0
R22	4.8	1.6	7.3	2.3	9.7	3.1	12.1	3.8	14.5	4.7	19.4	6.2	24.2	8.0	36.3	12.1	48.4	16.5
R502	4.9	1.5	7.3	2.2	9.7	3.0	12.1	3.7	14.6	4.5	19.5	6.0	24.3	7.6	36.4	11.5	48.6	14.8
R134a	4.9	2.0	7.4	2.9	9.8	4.1	12.3	5.2	14.7	6.3	19.7	8.8	24.6	11.0	36.8	17.0	49.1	23.7
R507, R404A	4.1	1.1	6.1	1.6	8.2	2.1	10.2	2.7	12.2	3.3	16.3	4.1	20.4	5.6	30.6	8.3	40.8	11.8

Based on 110°F liquid temperature at bottom of riser.

Table 7. Equivalent Feet of Pipe Due to Valve and Fitting Friction

Copper Tuber, O.D., Type "L"	1/2	5/8	7/8	1 1/8	1 3/8	1 5/8	2 1/8	2 5/8	3 1/8	3 5/8	4 1/8	5 1/8	6 1/8
Globe Valve (Open)	14	16	22	28	36	42	57	69	83	99	118	138	168
Angle Valve (Open)	7	9	12	15	18	21	28	34	42	49	57	70	83
90° Turn Through Tee	3	4	5	6	8	9	12	14	17	20	22	28	34
Tee (Straight Through) or Sweep Below	.75	1	1.5	2	2.5	3	3.5	4	5	6	7	9	11
90° Elbow or Reducing Tee (Straight Through	1	2	2	3	4	4	5	7	8	10	12	14	16

Table 8. Weight of Refrigerants in Copper Lines During Operation (Pounds per 100 lineal feet of type "L" tubing).

Line Size O.D. in Inches	Refrigerant	Liquid Line	Hot Gas Line	Suction Line at Suction Temperature				
				-40°F	-20°F	0°F	+20°F	+40°F
3/8	12, 134a	4.0	.15	.01	.01	.02	.04	.06
	22	3.9	.22	.02	.03	.04	.06	.08
	R507, 502, 404A	3.4	.31	.03	.04	.06	.09	.13
1/2	12, 134a	7.4	.30	.01	.03	.04	.07	.11
	22	7.4	.41	.03	.05	.07	.11	.15
	R507, 502, 404A	6.4	.58	.04	.07	.13	.16	.24
5/8	12, 134a	11.9	.47	.02	.05	.07	.12	.17
	22	11.8	.65	.05	.08	.12	.17	.25
	R507, 502, 404A	10.3	.93	.07	.11	.17	.25	.35
7/8	12,134a	24.7	.99	.05	.10	.15	.24	.36
	22	24.4	1.35	.10	.16	.24	.36	.51
	R507, 502, 404A	21.2	1.92	.15	.23	.37	.51	.72
1 1/8	12,134a	42.2	1.70	.08	.17	.26	.41	.60
	22	41.6	2.30	.17	.28	.42	.61	.87
	R507, 502, 404A	36.1	3.27	.26	.39	.63	.86	1.24
1 3/8	12,134a	64.2	2.57	.14	.26	.40	.61	1.91
	22	63.5	3.50	.27	.42	.64	.93	1.33
	R507, 502, 404A	55.0	4.98	.40	.58	.95	1.32	1.87
1 5/8	12,134a	90.9	3.65	.20	.37	.57	.87	1.30
	22	90.0	4.96	.37	.59	.90	1.33	1.88
	R507, 502, 404A	78.0	7.07	.56	.82	1.35	1.86	2.64
2 1/8	12,134a	158	6.34	.34	.64	.98	1.51	2.24
	22	156	8.61	.65	1.03	1.57	2.30	3.26
	R507, 502, 404A	134	12.25	.98	1.43	2.35	3.23	4.58
2 5/8	12,134a	244	9.78	.52	.99	1.51	2.32	3.47
	22	241	13.70	1.01	1.59	2.42	3.54	5.03
	R507, 502, 404A	209	18.92	1.51	2.21	3.62	5.00	7.07
3 1/8	12, 134a	348	13.97	.75	1.41	2.16	3.31	4.96
	22	344	18.95	1.44	2.28	3.45	5.05	7.18
	R507, 502, 404A	298	27.05	2.16	3.15	5.17	7.14	9.95
3 5/8	12, 134a	471	18.90	.99	1.91	2.92	4.48	6.69
	22	465	25.60	1.94	3.08	4.67	6.83	9.74
	R507, 502, 404A	403	36.50	2.92	4.25	6.97	19.65	13.67
4 1/8	12,134a	612	24.56	1.29	2.49	3.81	5.84	8.75
	22	605	33.40	2.53	4.01	6.08	8.90	12.70
	R507, 502, 404A	526	47.57	3.80	5.55	9.09	12.58	17.80

Table 9. Recommended Remote Condenser Line Sizes

Net Evaporator Capacity	Total Equiv. Length	R-12 & R-134a		R-22		R-502		R507 & R-404A	
		Discharge Line (O.D.)	Liquid Line Cond. to Receiver (O.D.)	Discharge Line (O.D.)	Liquid Line Cond. to Receiver (O.D.)	Discharge Line (O.D.)	Liquid Line Cond. to Receiver (O.D.)	Discharge Line (O.D.)	Liquid Line Cond. to Receiver (O.D.)
3,000	50	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	100	1/2	3/8	3/8	3/8	3/8	3/8	3/8	3/8
6,000	50	1/2	3/8	3/8	3/8	3/8	3/8	1/2	3/8
	100	1/2	3/8	1/2	3/8	1/2	3/8	1/2	3/8
9,000	50	5/8	3/8	1/2	3/8	1/2	3/8	1/2	3/8
	100	5/8	3/8	1/2	3/8	1/2	3/8	5/8	3/8
12,000	50	5/8	1/2	1/2	3/8	1/2	3/8	1/2	3/8
	100	7/8	1/2	5/8	3/8	5/8	3/8	5/8	3/8
18,000	50	7/8	1/2	1/2	3/8	5/8	1/2	5/8	1/2
	100	7/8	1/2	5/8	3/8	5/8	1/2	5/8	1/2
24,000	50	7/8	5/8	5/8	1/2	5/8	5/8	7/8	5/8
	100	7/8	5/8	5/8	1/2	7/8	5/8	7/8	5/8
36,000	50	7/8	5/8	7/8	5/8	7/8	5/8	7/8	5/8
	100	1 1/8	5/8	7/8	5/8	7/8	5/8	7/8	5/8
48,000	50	1 1/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8
	100	1 1/8	7/8	7/8	5/8	7/8	7/8	1 1/8	7/8
60,000	50	1 1/8	7/8	7/8	7/8	1 1/8	7/8	7/8	7/8
	100	1 3/8	7/8	7/8	7/8	1 1/8	7/8	1 1/8	7/8
72,000	50	1 1/8	7/8	7/8	7/8	1 1/8	7/8	1 1/8	7/8
	100	1 3/8	7/8	1 1/8	7/8	1 1/8	7/8	1 1/8	7/8
90,000	50	1 3/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8
	100	1 3/8	7/8	1 1/8	7/8	1 1/8	1 1/8	1 3/8	1 1/8
120,000	50	1 3/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 1/8	1 1/8
	100	1 5/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8
180,000	50	1 5/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8
	100	2 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 3/8	1 5/8	1 3/8
240,000	50	1 5/8	1 5/8	1 5/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8
	100	2 1/8	1 5/8	1 5/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8
300,000	50	2 1/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8
	100	2 1/8	1 5/8	1 5/8	1 5/8	2 1/8	1 5/8	2 1/8	2 1/8
360,000	50	2 1/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8
	100	2 5/8	1 5/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8
480,000	50	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
	100	2 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
600,000	50	2 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	2 1/8	2 1/8
	100	3 1/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8
720,000	50	2 5/8	2 5/8	2 1/8	2 5/8	2 1/8	3 1/8	2 1/8	2 5/8
	100	3 1/8	2 5/8	2 5/8	2 5/8	2 5/8	3 1/8	2 5/8	2 5/8
840,000	50	2 5/8	2 5/8	2 1/8	2 5/8	2 5/8	3 1/8	2 5/8	3 1/8
	100	3 1/8	2 5/8	2 5/8	2 5/8	2 5/8	3 1/8	2 5/8	3 1/8
960,000	50	3 1/8	3 1/8	2 5/8	3 1/8	2 5/8	3 1/8	2 5/8	3 1/8
	100	3 1/8	3 1/8	2 5/8	3 1/8	2 5/8	3 1/8	3 1/8	3 1/8
1,080,000	50	3 1/8	3 1/8	2 5/8	3 1/8	2 5/8	3 5/8	2 5/8	3 1/8
	100	3 5/8	3 1/8	2 5/8	3 1/8	3 1/8	3 5/8	3 1/8	3 1/8
1,200,000	50	3 1/8	3 5/8	2 5/8	3 1/8	2 5/8	3 5/8	2 5/8	3 5/8
	100	3 5/8	3 5/8	3 1/8	3 1/8	3 1/8	3 5/8	3 1/8	3 5/8
1,440,000	50	3 1/8	3 5/8	2 5/8	3 5/8	3 1/8	4 1/8	3 1/8	3 5/8
	100	3 5/8	3 5/8	3 1/8	3 5/8	3 1/8	4 1/8	3 5/8	3 5/8
1,680,000	50	3 5/8	4 1/8	2 5/8	3 5/8	3 1/8	4 1/8	3 1/8	4 1/8
	100	4 1/8	4 1/8	3 1/8	3 5/8	3 5/8	4 1/8	3 5/8	4 1/8

Table 10A. Recommended Line Sizes for R-134a *†#

SYSTEM CAPACITY BTU/H	SUCTION LINE SIZE																	
	SUCTION TEMPERATURE																	
	+40°F Equivalent Lengths						+30°F Equivalent Lengths						+20°F Equivalent Lengths					
	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'
1,000	3/8	3/8	3/8	3/8	3/8	1/2	3/8	3/8	3/8	3/8	1/2	1/2	3/8	1/2	1/2	1/2	1/2	5/8
3,000	3/8	1/2	1/2	1/2	5/8	5/8	1/2	1/2	1/2	5/8	5/8	5/8	1/2	5/8	5/8	7/8	7/8	7/8
4,000	1/2	1/2	5/8	5/8	5/8	5/8	1/2	1/2	5/8	5/8	5/8	7/8	5/8	5/8	7/8	7/8	7/8	7/8
6,000	1/2	5/8	5/8	5/8	7/8	7/8	1/2	5/8	5/8	7/8	7/8	7/8	5/8	5/8	7/8	7/8	7/8	7/8
9,000	5/8	5/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	1 1/8
12,000	5/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8
15,000	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8
18,000	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8
24,000	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8
30,000	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8
36,000	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8
42,000	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8
48,000	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8	1 5/8
54,000	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8
60,000	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8
66,000	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8
72,000	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8
78,000	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8
84,000	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8
90,000	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8
120,000	1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8
150,000	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 5/8
180,000	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8
210,000	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8
240,000	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8
300,000	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8
360,000	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	2 5/8	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8
480,000	2 5/8	2 5/8	3 1/8	3 18	3 1/8	3 5/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	3 5/8	3 1/8	3 5/8	3 5/8	4 1/8	5 1/8	5 1/8
600,000	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	3 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8	3 1/8	3 5/8	4 1/8	4 1/8	5 1/8	5 1/8

* Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return.
All sizes shown are for O.D. Type L copper tubing.
† Recommended line sizes for R-12 also.
# Suction line sizes selected at pressure drop equivalent to 2°F. Reduce estimate of system capacity accordingly.
NOTE: Consult factory for R-134a, R-12 operation at winter conditions below 0° ambient.
Heated and insulated receiver required below 0° ambient.
If system load drops below 40% of design, consideration to installing double suction risers should be made.

Table 10B. Recommended Line Sizes for R-134a (continued) *†#

SUCTION LINE SIZE												LIQUID LINE SIZE						
SUCTION TEMPERATURE												Receiver to Expansion Valve Equivalent Lengths						SYSTEM CAPACITY
+10°F Equivalent Lengths						0°F Equivalent Lengths												
25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	BTU/H
3/8	1/2	1/2	1/2	1/2	5/8	3/8	1/2	1/2	1/2	1/2	5/8	3/8	3/8	3/8	3/8	3/8	3/8	1,000
1/2	5/8	5/8	7/8	7/8	7/8	1/2	5/8	5/8	7/8	7/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8	3,000
5/8	5/8	7/8	7/8	7/8	7/8	5/8	5/8	7/8	7/8	7/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8	4,000
5/8	7/8	7/8	7/8	1 1/8	1 1/8	5/8	7/8	7/8	7/8	7/8	1 1/8	3/8	3/8	3/8	3/8	3/8	3/8	6,000
7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	3/8	3/8	3/8	3/8	3/8	1/2	9,000
7/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	3/8	3/8	3/8	3/8	1/2	1/2	12,000
7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	3/8	3/8	3/8	1/2	1/2	1/2	15,000
1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	3/8	3/8	1/2	1/2	1/2	1/2	18,000
1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	3/8	1/2	1/2	1/2	1/2	5/8	24,000
1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1/2	1/2	1/2	1/2	5/8	5/8	30,000
1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1/2	1/2	1/2	5/8	5/8	5/8	36,000
1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1/2	1/2	5/8	5/8	5/8	5/8	42,000
1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 3/8	1 5/8	1/58	2 1/8	21/8	2 1/8	1/2	5/8	5/8	5/8	5/8	7/8	48,000
1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 18	2 1/8	1/2	5/8	5/8	5/8	7/8	7/8	54,000
1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1 3/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	5/8	5/8	5/8	5/8	7/8	7/8	60,000
1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	5/8	5/8	5/8	7/8	7/8	7/8	66,000
1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	5/8	5/8	7/8	7/8	7/8	7/8	72,000
1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	5/8	5/8	7/8	7/8	7/8	7/8	78,000
1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	5/8	7/8	7/8	7/8	7/8	7/8	84,000
1 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	5/8	7/8	7/8	7/8	7/8	7/8	90,000
2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	7/8	7/8	7/8	7/8	7/8	1 1/8	120,000
2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	150,000
2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	180,000
2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	210,000
2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	240,000
2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	300,000
2 5/8	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8	2 5/8	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	360,000
3 1/8	3 5/8	3 5/8	4 1/8	5 1/8	5 1/8	3 1/8	3 5/8	3 5/8	4 1/8	5 1/8	5 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	480,000
3 1/8	3 5/8	4 1/8	5 1/8	5 1/8	5 1/8	3 1/8	3 5/8	4 1/8	4 1/8	5 1/8	5 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	600,000

* Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return.
All sizes shown are for O.D. Type L copper tubing.
† Recommended line sizes for R-12 also.
# Suction line sizes selected at pressure drop equivalent to 2°F. Reduce estimate of system capacity accordingly.
NOTE: Consult factory for R-134a, R-12 operation at winter conditions below 0° ambient.
Heated and insulated receiver required below 0° ambient.
If system load drops below 40% of design, consideration to installing double suction risers should be made.

Table 11A. Recommended Line Sizes for R-22 *#

SYSTEM CAPACITY	SUCTION LINE SIZE																				
	SUCTION TEMPERATURE																				
	+40°F						+20°F						+10°F						0°F		
	Equivalent Lengths						Equivalent Lengths						Equivalent Lengths						Equivalent		
BTU/H	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'
1,000	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	3/8	3/8	3/8
3,000	3/8	3/8	3/8	1/2	1/2	1/2	3/8	1/2	1/2	1/2	5/8	5/8	3/8	1/2	1/2	1/2	5/8	5/8	1/2	1/2	1/2
4,000	3/8	3/8	1/2	1/2	1/2	1/2	3/8	1/2	1/2	1/2	5/8	5/8	1/2	1/2	1/2	5/8	5/8	5/8	1/2	1/2	5/8
6,000	1/2	1/2	1/2	5/8	5/8	5/8	1/2	1/2	5/8	5/8	5/8	5/8	1/2	5/8	5/8	5/8	7/8	7/8	5/8	5/8	5/8
9,000	1/2	5/8	5/8	5/8	7/8	7/8	1/2	5/8	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8
12,000	5/8	5/8	5/8	7/8	7/8	7/8	5/8	5/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8
15,000	5/8	5/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8
18,000	5/8	7/8	7/8	7/8	7/8	1 1/8	5/8	7/8	7/8	7/8	7/8	1 1/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	1 1/8
24,000	5/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8
30,000	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8
36,000	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8
42,000	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8
48,000	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8
54,000	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8
60,000	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8
66,000	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 5/8
72,000	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8
78,000	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8
84,000	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 5/8	1 5/8
90,000	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8
120,000	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 5/8	1 5/8	2 1/8
150,000	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1 5/8	1 5/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8
180,000	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8
210,000	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 1/8
240,000	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8
300,000	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 5/8	2 5/8
360,000	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/9	2 5/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8
480,000	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	2 5/8	2 5/8	3 1/8
600,000	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	2 5/8	3 1/8	3 1/8

* Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return.
All sizes shown are for O.D. Type L copper tubing.

\# Suction line sizes selected at pressure drop equivalent to 2°F. reduce estimate of system capacity accordingly.
If system load drops below 40% of design, consideration to installing double suction risers should be made.

Table 11B. Recommended Line Sizes for R-22 (continued) *#

SUCTION LINE SIZE															LIQUID LINE SIZE						
SUCTION TEMPERATURE															Receiver to						
0°F			-10°F						-20°F						Expansion Valve						SYSTEM
Lengths			Equivalent Lengths						Equivalent Lengths						Equivalent Lengths						CAPACITY
100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	25'	50'	75'	100'	150'	200'	BTU/H
3/8	1/2	1/2	3/8	3/8	3/8	3/8	1/2	1/2	3/8	3/8	3/8	1/2	1/2	1/2	3/8	3/8	3/8	3/8	3/8	3/8	1,000
5/8	5/8	5/8	1/2	1/2	1/2	5/8	5/8	5/8	1/2	1/2	5/8	5/8	5/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8	3,000
5/8	5/8	7/8	1/2	1/2	5/8	5/8	5/8	7/8	1/2	5/8	5/8	5/8	7/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8	4,000
5/8	7/8	7/8	1/2	5/8	5/8	7/8	7/8	7/8	5/8	5/8	7/8	7/8	7/8	7/8	3/8	3/8	3/8	3/8	3/8	3/8	6,000
7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	1 1/8	1 1/8	3/8	3/8	3/8	3/8	3/8	3/8	9,000
7/8	7/8	1 1/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	3/8	3/8	3/8	3/8	3/8	3/8	12,000
7/8	1 1/8	1 1/8	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	3/8	3/8	3/8	3/8	3/8	1/2	15,000
1 1/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	3/8	3/8	3/8	3/8	1/2	1/2	18,000
1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	3/8	3/8	1/2	1/2	1/2	1/2	24,000
1 1/8	1 3/8	1 3/8	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	3/8	3/8	1/2	1/2	1/2	1/2	30,000
1 3/8	1 3/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	3/8	1/2	1/2	1/2	1/2	1/2	36,000
1 3/8	1 3/8	1 5/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	3/8	1/2	1/2	1/2	1/2	5/8	42,000
1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	1/2	1/2	1/2	1/2	1/2	5/8	48,000
1 3/8	1 5/8	1 5/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1/2	1/2	1/2	1/2	5/8	5/8	54,000
1 5/8	1 5/8	2 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1/2	1/2	1/2	5/8	5/8	5/8	60,000
1 5/8	1 5/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	1/2	1/2	5/8	5/8	5/8	5/8	66,000
1 5/8	2 1/8	2 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1/2	1/2	5/8	5/8	5/8	5/8	72,000
1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1/2	1/2	5/8	5/8	5/8	7/8	78,000
1 5/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1/2	5/8	5/8	5/8	5/8	7/8	84,000
2 1/8	2 1/8	2 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	1 3/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	1/2	5/8	5/8	5/8	7/8	7/8	90,000
2 1/8	2 1/8	2 1/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	5/8	5/8	5/8	7/8	7/8	7/8	120,000
2 1/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	5/8	7/8	7/8	7/8	7/8	7/8	150,000
2 1/8	2 5/8	2 5/8	1 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	5/8	7/8	7/8	7/8	7/8	1 1/8	180,000
2 5/8	2 5/8	2 5/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	2 5/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	7/8	7/8	7/8	7/8	7/8	1 1/8	210,000
2 5/8	2 5/8	3 1/8	2 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	240,000
2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	2 5/8	3 1/8	3 1/8	2 1/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	300,000
3 1/8	3 1/8	3 1/8	2 1/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	2 5/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	360,000
3 1/8	3 5/8	3 5/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	3 5/8	2 5/8	3 1/8	3 5/8	3 5/8	3 5/8	4 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	480,000
3 5/8	3 5/8	4 1/8	2 5/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8	3 1/8	3 1/8	3 5/8	3 5/8	4 1/8	4 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	600,000

* Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return.
All sizes shown are for O.D. Type L copper tubing.

Suction line sizes selected at pressure drop equivalent to 2°F. reduce estimate of system capacity accordingly.
If system load drops below 40% of design, consideration to installing double suction risers should be made.