Type of Operation/Air Flow

Two important considerations in the selection and location of the unit cooler are uniform air distribution and air velocities which are compatible with the particular application.

The direction of the air and air throw should be such that there is movement of air where there is a heat gain; this applies to the room walls and ceiling as well as the product. The unit cooler(s) should be arranged to direct discharge air at any doors or openings, if at all possible. Avoid placing the unit cooler in a position close to a door where it may induce additional infiltration into the room; this can cause fan icing and a condition known as hoar-frost. Also, avoid placing a unit in the air stream of another unit because defrosting difficulties can result.

For general storage coolers and holding freezers, there are not criteria for air velocities within the room. The total supply of air is such that approximately 40 to 80 air changes occur each hour. This is an air conditioning term which is calculated as follows:

$$\text{Air Changes} = \frac{\text{(total CFM*) x 60}}{\text{internal room volume}}$$

*includes all unit coolers and auxiliary fans

This equation disregards the air motion which is induced by the discharge air from the unit cooler. For simplicity, the gross volume of the room is used unless the product and equipment occupy more than 10% of the volume. Specific applications such as cutting rooms and banana ripening rooms have desired limits. The table below indicates the minimum and maximum quantities of air for particular applications.

Recommended Air Changes/Hour

Type of Application	Recommended Number of Air Changes	
	Minimum	Maximum
Holding Freezer	40	80
Packaged Holding Cooler	40	80
Cutting Rooms	20	30
Meat Chill Room	80	120
Boxed Banana Ripening	120	200
Vegetable and Fruit Storage	30	60
Blast Freezer	150	300
Work Areas	20	30
Unpackaged Meat Storage	30	60

Derating Factors

A. Ambient
B. Altitude
C. Saturated Suction Temperature (S.S.T.)
D. 50 Cycle Power

In the selection of refrigeration equipment it should be noted that the manufacturer's equipment has ratings based on certain criteria. Care should be taken to determine actual job conditions and the proper derating factors should be applied. These factors may vary by manufacturer but can be used here as rule of thumb approximation.

A. Ambient
Condensing Unit Ambient is of concern as most equipment is generally cataloged at 90° to 95°F ambient.

Decrease condensing unit capacity 6% for each 10°F increase in operating ambient.

Increase condensing unit capacity 6% for each 10°F decrease in operating ambient.

B. Altitude
Most manufacturers rate their equipment at sea level conditions. An increase in altitude results in a decrease in air density. While the fans on direct drive equipment will deliver a constant cubic feet per minute of air regardless of density, the "thinness" of the air will affect capacity performance. Belt drive equipment can be speeded up to a certain extent without exceeding motor overloads to compensate for the decrease in air density.

Effects of Altitude on Air Cooled Equipment

Altitude Ft. Above	Absolute Pressure		Standard Air Density @70°F	Air Dens.	Capacity Multipliers Direct Drive Fans	
Sea Level	In. Hg	PSI	Lbs./Cu.Ft.	Ratio	Refrig.	Air Cooled
1000	31.02	15.27	.0778	1.04	1.03	1.005
500	30.47	14.97	.0763	1.02	1.02	1.002
0	29.92	14.70	.0749	1.00	1.00	1.00
500	29.38	14.43	.0735	0.98	0.98	0.995
1000	28.86	14.28	.0719	0.96	0.97	0.998
2000	27.82	13.67	.0697	0.93	0.94	0.985
3000	26.81	13.27	.0671	0.90	0.91	0.98
4000	25.84	12.70	.0647	0.86	0.875	0.975
5000	24.89	12.23	.0623	0.83	0.85	0.969
6000	23.98	17.78	.0600	0.80	0.82	0.960
7000	23.09	11.34	.0578	0.77	0.79	0.955
8000	22.22	10.92	.0556	0.74	0.76	0.946
9000	21.38	10.50	.0535	0.71	0.73	0.939
10,000	20.58	10.11	.0515	0.69	0.71	0.93
12,000	19.03	9.35	.0477	0.64	0.66	0.91
14,000	17.57	8.63	.0439	0.59	0.61	0.88

C. Suction Temperature Correction Factors
Care should be taken in the selection of unit coolers, especially freezer models. There is no set rating standard adopted by the industry for the ratings criteria. The model number of a low temperature unit cooler can be rated at -30° SST, -20° SST, -10° SST, 0° SST, or even + 10° SST. The capacity difference between the -30° SST and the +10° SST can be as much as 15% higher for lower rated unit cooler. Most manufacturers provide a suction temperature correction factor for their unit coolers and this should be noted in equipment selections.

D. 50 Cycle Power
Since we do live in a "global village" the opportunity to quote refrigeration equipment for export markets is one not to be ignored. Motors that are sized for 60 cycle operation run at 83% (50/60) speed on a 50 cycle operation. Compressors produce only 5/6 of their capacity. However, while fans are only running 83% speed, there is also a decrease in static pressure through the condenser or unit cooler coil and performance does not suffer the full 17% penalty. If it has been verified by the manufacturer that their equipment can be run on 50 cycle power then the following derating factors can be applied:

1. Unit Coolers and air-cooled condensers = capacity x .92.
2. Air-cooled condensing units = capacity x .85.

Systems capacity (unit cooler and air-cooled condensing unit) can be derated by .88.

To select refrigeration equipment after the load has been determined, divide the BTUH required by .88:

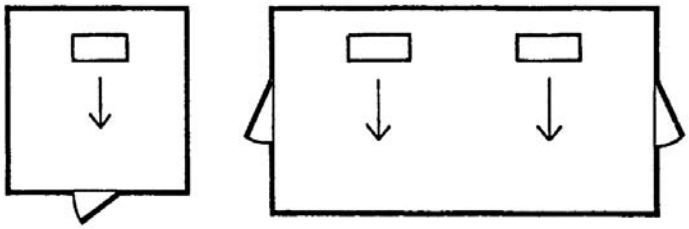
$\frac{\text{BTUH}}{.88}$ = Conversion to select 60 cycle equipment for 50 cycle load

This provides for larger equipment necessary to compensate for 50 cycle derating factor.

IMPORTANT NOTICE:

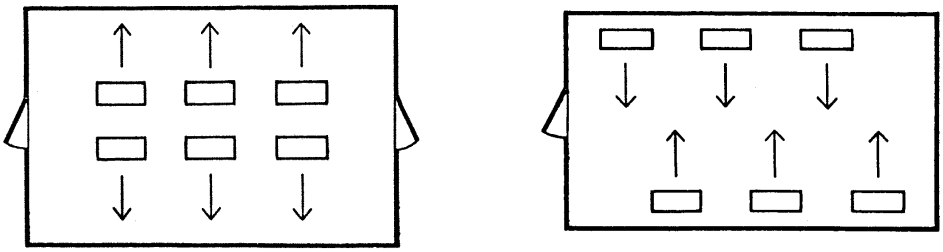
This information is for reference only. Read and follow all manufacturer's installation instructions. All installations shall be in accordance with all applicable codes, standards, rules and requirements. This information for use only by licensed, qualified technicians and HVAC/R professionals.

Unit Cooler Recommended Coil Replacement



Left
Large cooler or freezer

Right
Large cooler or freezer

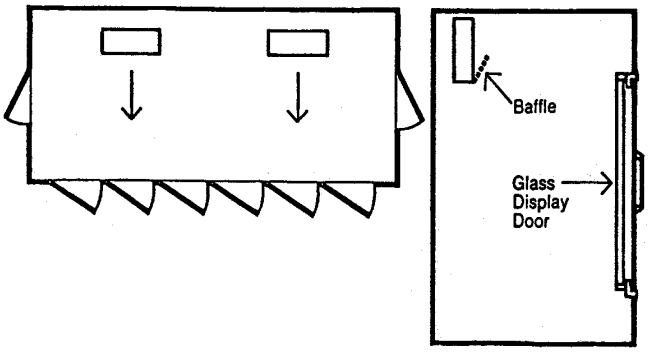


Large cooler or freezers where one wall will not accommodate all required evaporators or where air-throw distance must be considered.

Note: Always avoid placement of unit coolers directly above doors and door openings where low temperature is being maintained and wherever possible for normal temperature.

Allow sufficient space between rear of unit cooler and wall to permit free return of air. Refer to unit manufacturers' catalog for proper space.

Always trap drain lines individually to prevent vapor migration. Traps on low temperature units must be outside of refrigerated enclosures.



Left
Cooler or freezer with glass display doors

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

APPLICATION NOTE:
This information is provided for reference only. No guarantees are expressed or implied as to suitability or fitness for use, as all projects are subject to variations. Not for construction. Seek professional advice prior to application or use.

Glass Door Leads

Box Temperature	BTU per Door
+35	1060
+30	960
0	1730
-10	1730
-20	1730

Note: Adjusted for 16 to 18 hour run time. Multiply number of doors times door load above and add to box load.

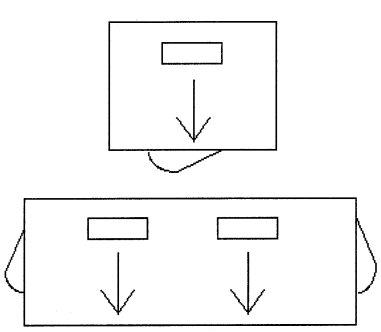
Unit Cooler Mounting

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 600 pounds and 5/8" for over 600 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.

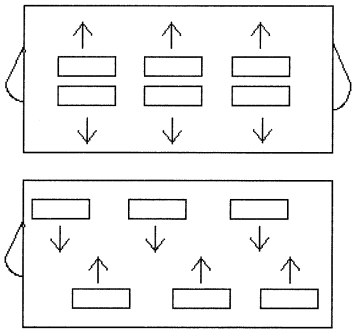
When using rod hangers, allow adequate space between the top of the unit and the ceiling for cleaning. To comply with NSF Standard 7, the area above the unit cooler must be sealed or exposed in such a way to facilitate hand cleaning without the use of tools. When lagging or bolting the unit flush to 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 cooler in a cooler or freezer, refer to Figure below for guidelines.

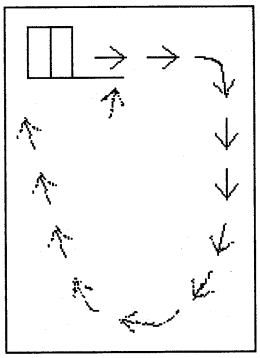
Large Cooler and Freezer Placement



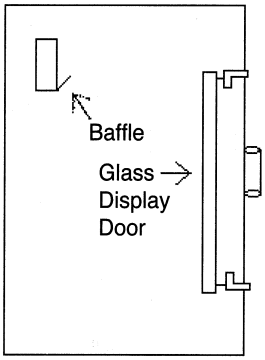
Where one wall evaporator mounting is satisfactory.



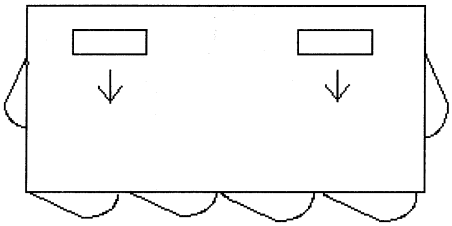
Cooler or freezers where one wall will not accommodate all required evaporators or where air throw distance must be considered.



Allow sufficient space between rear of Unit Cooler and wall to permit free return of air.



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.



Cooler or freezer with glass display doors.

NOTE: Always avoid placement of unit coolers directly above doors and door openings.

APPLICATION NOTE:

This information is provided for reference only. No guarantees are expressed or implied as to suitability or fitness for use, as all projects are subject to variations. Not for construction. Seek professional advice prior to application or use.

Defrost

Many types of control arrangements can be used. In some applications, it may not be necessary to have scheduled defrost periods. The normal "off cycle" of the compressor may be adequate to keep evaporator coil clear of frost. In other applications, a defrost timer may be necessary to help assure a clear coil. In a medium temperature environment, "air defrost" is initiated by the timer, but the evaporator fans continue to operate to facilitate the melting of frost on the fin surface. Other types of defrost schemes require that the fans on the evaporator shut off during the defrost period.

For most applications, two to four defrost cycles per day should be adequate. The defrost requirements will vary on each installation so the defrost settings should be determined by observing the system operation.

Defrost Thermostat

Adjustable (F25-209 Series)
The defrost duration is determined by the setting of the defrost termination thermostat. Initially, the thermostat should be set at mid-range. this will terminate the defrost at about a 60°F bulb temperature which will be satisfactory for most applications. A somewhat longer or shorter defrost can be obtained by adjusting the control clockwise for a shorter defrost and counterclockwise for a longer defrost. The fan delay temperature setting of the thermostat is factory set at 25°F. It can be adjusted upward by turning the adjusting screw next to the duration adjustment with a small screwdriver. Each complete clockwise rotation of this screw raises the setting approximately 3°F. this screw should not be adjusted more than four turns. Making this adjustment also raises the defrost termination temperature setting of the thermostat by a similar amount. For example, with the duration setting at midrange, the termination temperature would be approximately 60°F. Turning the adjusting screw one turn would raise the fan delay temperature to about 28°F as well as changing the termination temperature from 60°F to 63°F. On medium temperature applications it may be necessary to raise the setting to assure that the thermostat will reset after a defrost.

Adjustable (060-100-00 Series)
This control has an adjustable defrost termination setpoint and an adjustable differential for controlling the fan delay. A typical termination setting is 60°F with a 25°F differential. Termination setting may be adjusted to increase/decrease the length of defrost. The differential should be adjusted to turn on the fans at 30 to 35°F (fan temperature = termination temperature - differential). Actual coil temperature will be 5 to 10°F below this value. Some unit coolers are preset and labeled at the factory with special settings.

Note: Defrost controls are positioned as determined by engineering test. Job conditions may require the sensing device to be relocated for optimal defrosting.

Bimetal Disc
A bimetal disc type thermostat is wired to the control circuit to terminate the defrost cycle when the coil temperature reaches approximately 55°F. the bimetal disc thermostat provides a fan delay to allow moisture on the coil to freeze after defrost termination.

Note: On systems where the suction temperature is above approximately 25°F, the fans may not start for an extended period of time.

This can be corrected by jumping the fan switch contacts. This will allow the fans to start immediately after defrost termination. This will disable the fan delay.

If moisture blow-off is encountered without the fan delay, a higher temperature defrost thermostat can be ordered. This thermostat terminates defrost at 60°F and prevents the fans from running when the coil temperature is above 40°F. Refer to the replacement parts list for the correct number to order.

Expansion Valve Selection for 100 Lb. Head Pressure Valve

BTUH at about 10° TD	R-507/R404A				R-22			
	-20°F/-29°C		+25°F/-4°C Evap.		-20°F/-29°C Evap.		+25°F/-4°C Evap.	
	Sporlan	ALCO	Sporlan	ALCO	Sporlan	ALCO	Sporlan	ALCO
3000 to 5000	EGSE 1/2 ZP	HFESC-1/2-RZ	EGSE 1/2 C	HFESC-1/2-RC	EGVE 1/2 Z	HFESC-1-HZ	EGVE 1/2 C	HFESC-1/2-HC
5500 to 7000	EGSE 1/2 ZP	HFESC-1/2-RZ	EGSE 1 C	HFESC-1/2-RC	EGVE 1 ZP	HFESC-1-HZ	EGVE 1 C	HFESC-1-HC
7500 to 8000	EGSE 1 ZP	HFESC-1/2-RZ	EGSE 1 C	HFESC-1-RC	EGVE 1 ZP	HFESC-1-1/2-HZ	EGVE 1 C	HFESC-1-HC
8500 to 10,000	EGSE 1 ZP	HFESC-1-RZ	EGSE 1-1/2 C	HFESC-1-1/4-RC	EGVE 1-1/2ZP	HFESC-1-1/2-HZ	EGVE 1 C	HFESC-1-HC
10,500 to 11,000	EGSE 1 ZP	HFESC-1-1/4-RZ	EGSE 1-1/2 C	HFESC-1-1/4-RC	EGVE 1-1/2ZP	HFESC-2-HZ	EGVE 1-1/2 C	HFESC-1-HC
11,500 to 13,000	EGSE 1-1/2 ZP	HFESC-1-1/2-RZ	EGSE 1-1/2 C	HFESC-1-1/4-RC	EGVE 1-1/2ZP	HFESC-2-HZ	EGVE 1-1/2 C	HFESC-1-HC
13,500 to 15,000	EGSE 1-1/2 ZP	HFESC-2-RZ	EGSE 2 C	HFESC-1-1/2-RC	EGVE 2 ZP	HFESC-2-1/2-HZ	EGVE 1-1/2 C	HFESC-2-HC
15,500 to 17,000	EGSE 2 ZP	HFESC-2-RZ	EGSE 2 C	HFESC-2-RC	EGVE 2 ZP	HFESC-2-1/2-HZ	EGVE 2 C	HFESC-2-HC
17,500 to 20,000	EGSE 2 ZP	HFESC-3-1/2-RZ	SSE 3 C	HFESC-2-RC	EGVE 3 ZP	HFESC-3-HZ	EGVE 2 C	HFESC-2-1/2-HC
20,500 to 24,000	SSE 3 ZP	HFESC-3-1/2-RZ	SSE 3 C	HFESC-3-RC	SVE 3 ZP	HFESC-3-HZ	SVE 3 C	HFESC-3-HC
24,500 to 28,000	SSE 3 ZP	HFESC-3-1/2-RZ	SSE 4 C	HFESC-3-RC	SVE 4 ZP	HFESC-5-1/2-HZ	SVE 3 C	HFESC-3-HC
28,500 to 34,000	SSE 4 ZP	HFESC-5-RZ	SSE 4 C	HFESC-3-RC	SVE 5 ZP	HFESC-5-1/2-HZ	SVE 4 C	HFESC-5-1/2-HC
34,500 to 40,000	OSE 6 ZP	HFESC-5-RZ	SSE 6 C	HFESC-5-RC	SVE 8 ZP	HFESC-5-1/2-HZ	SVE 4 C	HFESC-5-1/2-HC
40,500 to 50,000	OSE 8 ZP	HFESC-7-RZ	OSE 8 C	HFESC-5-RC	SVE 10 ZP	HFESC-8-HZ	SVE 5 C	HFESC-5-1/2-HC
50,500 to 60,000	OSE 9 ZP	HFESC-10-RZ	OSE 9 C	HFESC-7-RC	SVE 10 ZP	HFESC-8-HZ	SVE 8 C	HFESC-8-HC
60,500 to 70,000	OSE 9 ZP	HFESC-10-RZ	OSE 9 C	HFESC-10-RC	OVE 15 ZP	HFESC-10-HZ	SVE 8 C	HFESC-8-HC
70,500 to 80,000	OSE 12 ZP	HFESC-10-RZ	OSE 12 C	HFESC-10-RC	OVE 15 ZP	HFESC-15-HZ	SVE 10 C	HFESC-10-HC
80,500 to 90,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-10-RC	OVE 15 ZP	HFESC-15-HZ	SVE 10 C	HFESC-10-HC
90,500 to 100,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-13-RC	OVE 15 ZP	HFESC-15-HZ	SVE 15 C	HFESC-15-HC
100,500 to 110,000	OSE 21 ZP	HFESC-20-RZ	OSE 21 C	HFESC-13-RC	OVE 20 ZP	HFESC-20-HZ	SVE 15 C	HFESC-15-HC
110,500 to 120,000	OSE 21 ZP	HFESC-20-RZ	OSE 21 C	HFESC-13-RC	OVE 20 ZP	HFESC-20-HZ	SVE 15 C	HFESC-15-HC
120,500 to 130,000	OSE 21 ZP	HFESC-20-RZ	OSE 21 C	TRAE-20-RC	OVE 20 ZP	HFESC-20-HZ	SVE 15 C	HFESC-15-HC

Note: Valve selections assume standard conditions and 100°F vapor-free liquid. Equivalent valve may be used in place of selection. For "Medium Temp. R-507," valve designation will use "P" for refrigerant code.

Kansas City
1104 Union Ave.
Kansas City, MO
64101

Lenexa
14021 W. 95th St.
Lenexa, KS
66215

Springfield
2215 W. Sunset Ste. A
Springfield, MO
65807

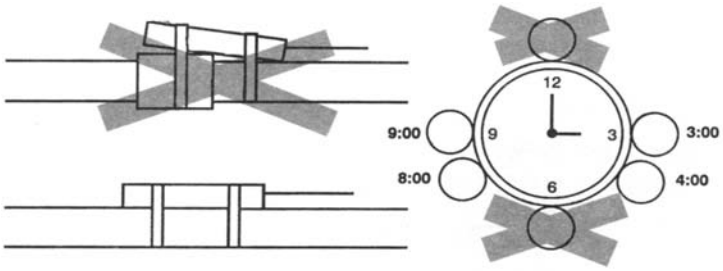
Des Moines
4137 109th St.
Urbandale, IA
50322

Wichita
212 S. Hydraulic
Wichita, KS
67211

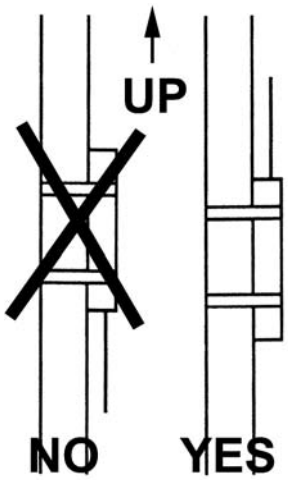
Expansion Valve Selection 180 Lb. Head Pressure Valve

BTUH at about 10° TD	R-507/R404A				R-22			
	-20°F/-29°C		+25°F/-4°C Evap.		-20°F/-29°C Evap.		+25°F/-4°C Evap.	
	Sporlan	ALCO	Sporlan	ALCO	Sporlan	ALCO	Sporlan	ALCO
3000 to 5000	EGSE 1/2 ZP	HFESC-1/2-RZ	EGSE 1/2 C	HFESC-1/2-RC	EGVE 1/2 Z	HFESC-1/2-HZ	EGVE 1/2 C	HFESC-1/2-HC
5500 to 7000	EGSE 1/2 ZP	HFESC-1-RZ	EGSE 1 C	HFESC-1/2-RC	EGVE 1 ZP	HFESC-1-HZ	EGVE 1/2 C	HFESC-1-HC
7500 to 8500	EGSE 1 ZP	HFESC-1-RZ	EGSE 1 C	HFESC-1/2-RC	EGVE 1 ZP	HFESC-1-HZ	EGVE 1 C	HFESC-1-HC
8500 to 10,000	EGSE 1 ZP	HFESC-1-RZ	EGSE 1 C	HFESC-1-RC	EGVE 1-1/2 ZP	HFESC-1-1/2-HZ	EGVE 1 C	HFESC-1-HC
10,500 to 11,000	EGSE 1 ZP	HFESC-1-1/4-RZ	EGSE 1-1/2 C	HFESC-1-RC	EGVE 1-1/2 ZP	HFESC-1-1/2-HZ	EGVE 1 C	HFESC-1-HC
11,500 to 13,000	EGSE 1-1/2 ZP	HFESC-1-1/4-RZ	EGSE 1-1/2 C	HFESC-1-1/4-RC	EGVE 1-1/2 ZP	HFESC-2-HZ	EGVE 1 C	HFESC-1-1/2-HC
13,500 to 15,000	EGSE 2 ZP	HFESC-1-1/2-RZ	EGSE 1-1/2 C	HFESC-1-1/4-RC	EGVE 2 ZP	HFESC-2-HZ	EGVE 1-1/2 C	HFESC-1-1/2-HC
15,500 to 17,000	EGSE 2 ZP	HFESC-2-RZ	EGSE 2 C	HFESC-1-1/2-RC	EGVE 2 ZP	HFESC-2-1/2-HZ	EGVE 1-1/2 C	HFESC-1-1/2-HC
17,500 to 20,000	EGSE 2 ZP	HFESC-2-RZ	EGSE 2 C	HFESC-1-1/2-RC	EGVE 3 ZP	HFESC-2-1/2-HZ	EGVE 1-1/2 C	HFESC-2-HC
20,500 to 24,000	SSE 3 ZP	HFESC-3-RZ	SSE 3 C	HFESC-2-RC	SVE 3 ZP	HFESC-3-HZ	SVE 2 C	HFESC-2-HC
24,500 to 28,000	SSE 4 ZP	HFESC-3-RZ	SSE 3 C	HFESC-2-RC	SVE 4 ZP	HFESC-3-HZ	SVE 3 C	HFESC-2-1/2-HC
28,500 to 34,000	SSE 4 ZP	HFESC-5-RZ	SSE 4 C	HFESC-3-1/2-RC	SVE 4 ZP	HFESC-5-1/2-HZ	SVE 3 C	HFESC-3-HC
34,500 to 40,000	OSE 6 ZP	HFESC-5-RZ	SSE 6 C	HFESC-3-1/2-RC	SVE 5 ZP	HFESC-5-1/2-HZ	SVE 3 C	HFESC-3-HC
40,500 to 50,000	OSE 9 ZP	HFESC-7-RZ	SSE 6 C	HFESC-3-1/2-RC	SVE 8 ZP	HFESC-5-1/2-HZ	SVE 4 C	HFESC-5-1/2-HC
50,500 to 60,000	OSE 9 ZP	HFESC-7-RZ	OSE 9 C	HFESC-5-RC	SVE 10 ZP	HFESC-8-HZ	SVE 5 C	HFESC-5-1/2-HC
60,500 to 70,000	OSE 9 ZP	HFESC-10-RZ	OSE 9 C	HFESC-7-RC	OVE 15 ZP	HFESC-8-HZ	SVE 5 C	HFESC-5-1/2-HC
70,500 to 80,000	OSE 12 ZP	HFESC-10-RZ	OSE 12 C	HFESC-7-RC	OVE 15 ZP	HFESC-10-HZ	SVE 8 C	HFESC-8-HC
80,500 to 90,000	OSE 12 ZP	HFESC-10-RZ	OSE 12 C	HFESC-10-RC	OVE 15 ZP	HFESC-10-HZ	SVE 8 C	HFESC-8-HC
90,500 to 100,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-10-RC	OVE 15 ZP	HFESC-15-HZ	SVE 10 C	HFESC-8-HC
100,500 to 110,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-10-RC	OVE 20 ZP	HFESC-15-HZ	SVE 10 C	HFESC-10-HC
110,500 to 120,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-10-RC	OVE 20 ZP	HFESC-15-HZ	SVE 10 C	HFESC-10-HC
120,500 to 130,000	OSE 21 ZP	HFESC-13-RZ	OSE 12 C	HFESC-13-RC	OVE 20 ZP	HFESC-15-HZ	OVE 15 C	HFESC-10-HC

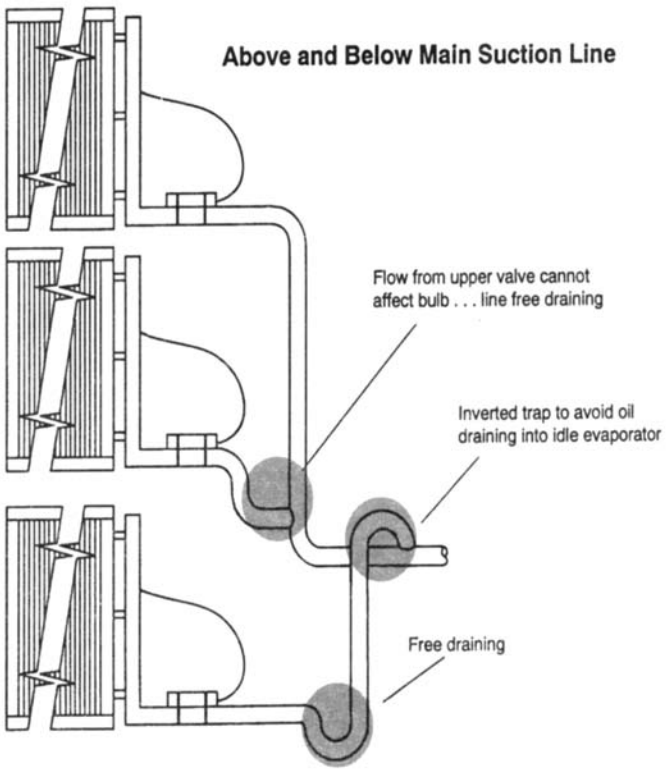
Bulb and Contact Location



Vertical Bulb Mounting



Multiple Evaporators



Condensate Drain Lines

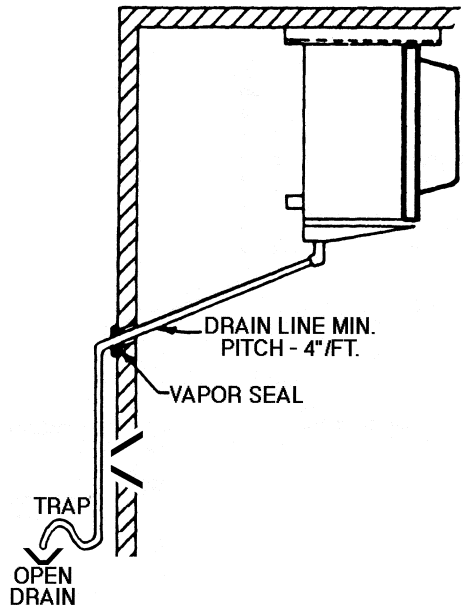
Either copper or steel drain lines should be used and properly protected from freezing. In running drain lines, provide a minimum 4 inches per foot pitch for proper drainage. Drain lines should be at least as large as the evaporator drain connection. All plumbing connections should be made in accordance with local plumbing codes. All condensate drain lines must be located in a warm ambient. We recommend a trap on all evaporators. Traps located outside, or extensive outside runs of drain line must be wrapped with a drain line heater. The heater should be connected so that it operates continuously. It is recommended that the drain line be insulated to prevent heat loss. A heat input of 20 watts per linear foot of drain line for 0°F (-18°C) room applications and 30 watts per linear foot for -20°F (-19°C) rooms is satisfactory.

Inspect drain pan periodically to insure free drainage of condensate. If drain pan contains standing water, check for proper installation. The drain pan should be cleaned regularly with warm soapy water.

Warning: All power must be disconnected before cleaning. Drain pan also serves as cover of hazardous moving parts. Operation of unit without drain pan constitutes a hazard.

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

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



Condensing Unit Accessories

Suction Filters, Driers, Sight Glasses

There are two types of suction and liquid filter/driers used on Heatcraft Refrigeration Products units. Replaceable core and/or sealed units are used, dependent upon the option package ordered.

Suction filters, regardless of type, are always installed upstream of the compressor suction service valve, and any accumulators or other options that may be installed. Suction filters are equipped with "Schrader" type access valves to allow field measurement of pressure drop across the device. This allows plugged filters and elements to be identified very quickly and easily so they can be replaced when the pressure drop is excessive. Refer to the specific manufacturers' recommendation on servicing these units by make and model.

Liquid filter/driers, regardless of type, are always installed downstream of the receiver outlet service valve, and upstream of the liquid line solenoid valve (if supplied). Liquid line driers may or may not have an access valve, dependent on the size and application. The basic servicing of these units is similar to suction filters. Liquid line driers should be replaced whenever there is evidence of excessive pressure drop across the filter, or the system becomes contaminated due to system leaks, compressor burnouts, acid formation, or moisture accumulation as indicated by the liquid line sight glass.

The sight glass is installed in the main liquid line assembly, downstream from the receiver outlet service valve, and immediately after the liquid line drier. The sight glass is designed to give a visual indication of moisture content in the system. Generally, it requires no field service. However, in cases of extreme acid formation in a system after a compressor burnout, the acid may damage the sensing element or etch the glass. This would require that the sight glass be replaced, along with liquid line drier after any compressor motor burnout.

Recommended Low Pressure Control Settings for Outdoor Air Cooled Condensing Units

	R-22		R-404A/R-507		R-134a	
Minimum Temp. °F*	Cut-In PSI	Cut-Out PSI	Cut-In PSI	Cut-Out PSI	Cut-In PSI	Cut-Out PSI
50	70	20	90	35	45	15
40	55	20	70	35	35	10
30	40	20	55	35	25	10
10	30	10	45	25	13	0
0	15	0	25	7	8	0
-10	15	0	20	1	–	–
-20	10	0	12	1	–	–
-30	6	0	8	1" Hg	–	–

* Minimum ambient or box temperature anticipated, high pressure control setting: R-22, 360 PSI; R-404A, R-507, 400 PSI; R-134a, 225 PSI.

Thermostat Settings

	Design	Thermostat Settings		
Models	TD	T1	T2	T3
2-fan units:	30	60		
	25	65		
4-fan units:	20	70		
	15	75		
3-fan units:	30	60	40	
	25	65	55	
6-fan units:	20	70	60	
	15	75	65	
8-fan units:	30	60	50	30
	25	65	55	40
	20	70	65	50
	15	75	70	60

Note: Cycles pairs of fans on double wide units.

Caution: Fans closest to the headers should not be cycled on standard temperature or pressure controls. Dramatic temperature and pressure changes at the headers as a result of fan action can result in possible tube failure. Fan motors are designed for continuous duty operation.

Fan cycling controls should be adjusted to maintain a minimum of five minutes on and five minutes off. Short cycling of fans may result in a premature failure of motor and/or fan blade.

Compressors operating below +10°F SST must have air flowing over the compressor at all times when compressor is running.

APPLICATION NOTE:

This information is provided for reference only. No guarantees are expressed or implied as to suitability or fitness for use, as all projects are subject to variations. Not for construction. Seek professional advice prior to application or use.

Kansas City
1104 Union Ave.
Kansas City, MO
64101

Lenexa
14021 W. 95th St.
Lenexa, KS
66215

Springfield
2215 W. Sunset Ste. A
Springfield, MO
65807

Des Moines
4137 109th St.
Urbandale, IA
50322

Wichita
212 S. Hydraulic
Wichita, KS
67211

Suction Lines

Horizontal suction lines should slope away from the evaporator toward the compressor at the rate of 1/4" per 10 ft. for good oil return. When multiple evaporators are connected in series using a common suction line, the branch suction lines must enter the top of the common suction line.

For dual or multiple evaporator systems, the branch lines to each evaporator should be sized for the evaporator capacity. The main common line should be sized for the total system capacity.

Suction lines that are outside of refrigerated space must be insulated. See the Line Insulation section for more information.

Note: If the suction line must rise to a point higher than the suction connection on the evaporator, a suction line trap at the outlet of the evaporator must be provided.

Suction Line Risers

Prefabricated wrought copper traps are available, or a trap can be made by using two street "L"s and one regular "L". The suction trap must be the same size as the suction line. For long vertical risers, additional traps may be necessary. Generally, one trap is recommended for each length of pipe (approximately 20 feet) to insure proper oil movement. See graphic for methods of constructing proper suction line P-traps.

Liquid Lines

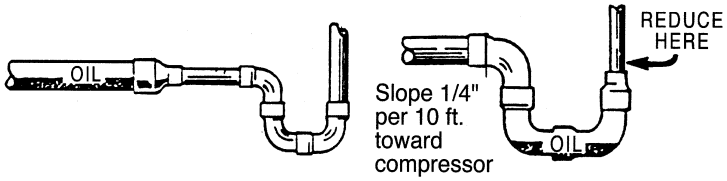
Liquid lines should be sized for a minimum pressure drop to prevent "flashing". Flashing in the liquid lines would create additional pressure drop and poor expansion valve operation. If a system requires long liquid lines from the receiver to the evaporator or if the liquid has to rise vertically upward any distance, the losses should be calculated to determine whether or not a heat exchanger is required. the use of a suction to liquid heat exchanger may be used to subcool the liquid to prevent flashing. This method of subcooling will normally provide no more than 20°F subcooling on high pressure systems. The amount of subcooling will depend on the design and the size of the heat exchanger and on the operating suction and discharge pressures. An additional benefit from the use of the suction to liquid type heat exchanger is that it can help raise the superheat in the suction line to prevent liquid return to the compressor via the suction line. Generally, heat exchangers are not recommended on R-22 low temperature systems. However, they have proved necessary on short, well insulated suction line runs to provide superheat at the compressor.

APPLICATION NOTE:

This information is provided for reference only. No guarantees are expressed or implied as to suitability or fitness for use, as all projects are subject to variations. Not for construction. Seek professional advice prior to application or use.

Need help with specifications? Our knowledgeable staff will be happy to assist you!

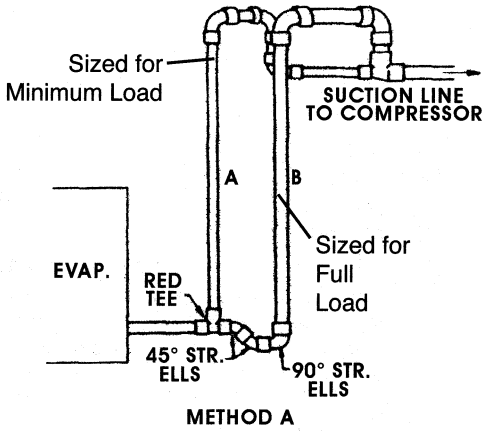
Pipe Size Reduction with Suction P-Traps



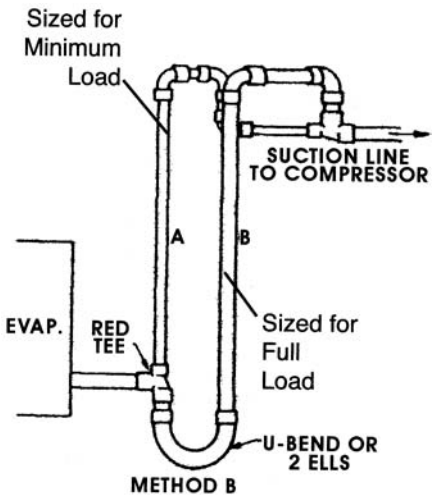
"INCORRECT" "CORRECT"

Traps Oil – BAD!

Double Suction Riser Construction



METHOD A



METHOD B

Kansas City
1104 Union Ave.
Kansas City, MO
64101

Lenexa
14021 W. 95th St.
Lenexa, KS
66215

Springfield
2215 W. Sunset Ste. A
Springfield, MO
65807

Des Moines
4137 109th St.
Urbandale, IA
50322

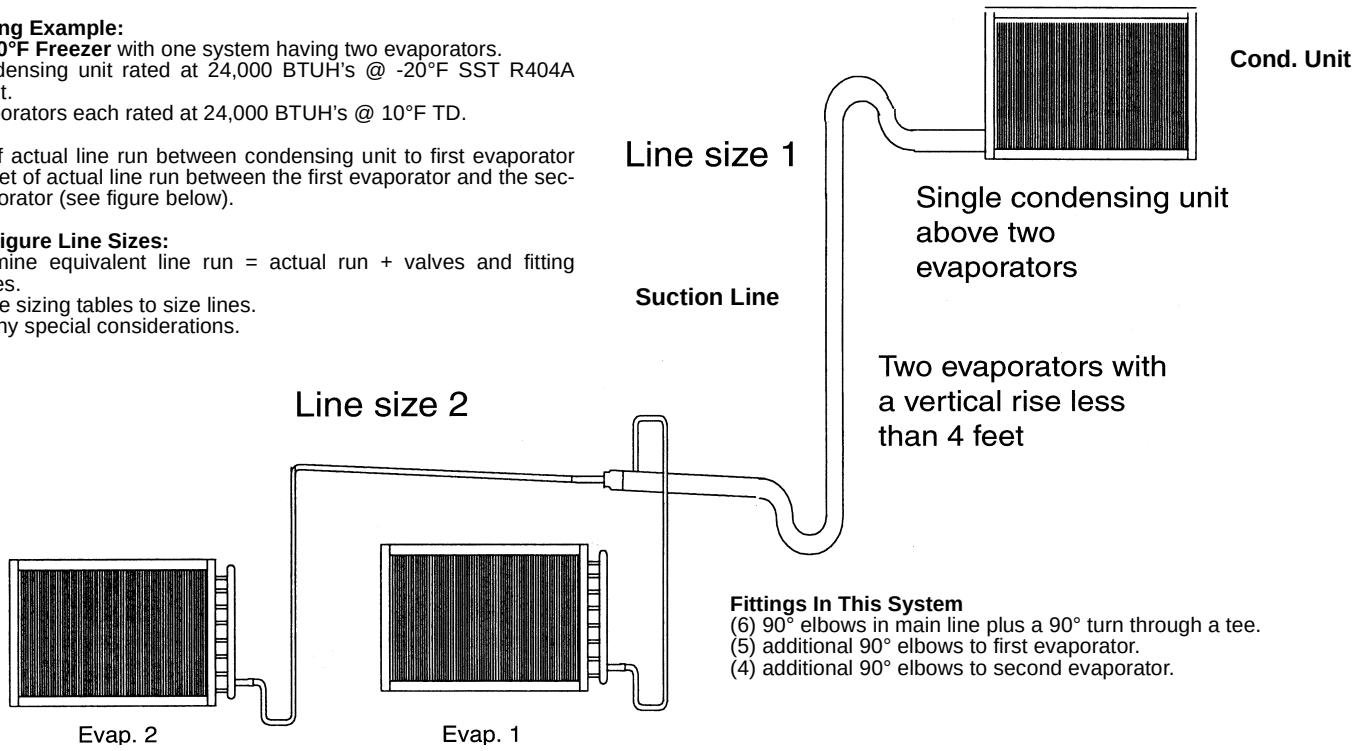
Wichita
212 S. Hydraulic
Wichita, KS
67211

Unit Cooler Piping

Pipe Sizing Example:
Given: **-10°F Freezer** with one system having two evaporators.
One condensing unit rated at 24,000 BTUH's @ -20°F SST R404A refrigerant.
Two evaporators each rated at 24,000 BTUH's @ 10°F TD.

75 feet of actual line run between condensing unit to first evaporator and 20 feet of actual line run between the first evaporator and the second evaporator (see figure below).

How to Figure Line Sizes:
1. Determine equivalent line run = actual run + valves and fitting allowances.
2. Use line sizing tables to size lines.
3. Note any special considerations.



Fittings In This System
(6) 90° elbows in main line plus a 90° turn through a tee.
(5) additional 90° elbows to first evaporator.
(4) additional 90° elbows to second evaporator.

Determine Line Size One (Main Line From Condensing Unit):
1. Main line from the condensing unit to be sized for the total capacity (balance of the whole system of 24,000 BTUH (see "Recommended Lines Sizes for R-404A and R507" tables).
2. Refer to 24,000 @ 75 ft. at -20°F SST R404A on the chart. You will find the suction line to be 1-1/8" and 1/2" liquid line.
3. Refer to "Equivalent Feet of Pipe Due to Valve and Fitting Friction" table. For every 1-1/8" 90° elbow you must add 3 equivalent feet of pipe and 2 equivalent feet of pipe for each 1-1/8" tee.
Therefore, total equivalent line run =

Actual line run	75 feet
+ (6) 1-1/8" elbows @ 3 ft.	18 feet
+ (1) 1-1/8" tee @ 2 ft.	2 feet
Total equivalent line run	**107 feet**

4. Refer to Table "Recommended Lines Sizes for R-404A and R507". For 100 total equivalent feet, the suction line size should be 1-3/8" and the liquid line stays at 1/2" line. Note the gray shaded areas on the table. For 24,000 BTUH's, the maximum suction riser is 1-1/8" to insure proper oil return and pressure drop from the bottom P-trap to the top P-trap.

Determine Line Size Two (Evaporators)
1. Line sizing to each evaporator is based on 12,000 BTUH and equivalent run from condensing unit. First evaporator has an 80-ft. run and the second evaporator has a 95-ft. run.
2. The "Recommended Lines Sizes for R-404A and R507" table indicates 7/8" for the first evaporator and 1-1/8" for the second evaporator.
3. Refer to "Equivalent Feet of Pipe Due to Valve and Fitting Friction" table. Each 7/8" 90° elbow adds 2 equivalent feet of pipe. Each 1-1/8 90° elbow adds 3 equivalent feet and a 90° turn through a 1-1/8" tee adds 6 equivalent feet.
4.

Actual line run (evap. 1)	80 feet
+ (5) 7/8" elbows @ 2 ft.	10 feet
+ (1) 90° turn through tee @ 6 ft.	6 feet
Total equivalent line run	**96 feet**

Actual line run (evap. 2)	95 feet
(4) 1-1/8 elbows @ 3 ft.	12 feet
Total equivalent line run	**107 feet**

5. The "Recommended Lines Sizes for R-404A and R507" table indicates 1-1/8" suction line and 3/8" liquid line from main line to both evaporators.

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

Liquid Line Rise in Feet

	10		15		20		25		30		40		50		75		100	
Refrigerant	**PSI**	**°F**	**PSI**	**°F**	**PSI**	**°F**	**PSI**	**°F**	**PSI**	**°F**	**PSI**	**°F**	**PSI**	**°F**	**PSI**	**°F**	**PSI**	**°F**
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
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

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

Equivalent Feet of Pipe Due to Valve and Fitting Friction

Copper Tube, OD, 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