



# Application Data

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## COMPRESSOR PHYSICAL DATA (Table 1)

Table 1 — Open-Drive Compressors

COMPRESSOR MODEL		5F20	5F30	5F40	5F60	5H40	5H46	5H60	5H66	5H80	5H86	5H120	5H126
Nominal Horsepower	R-12, R-134a	5	7 <sup>1</sup> / <sub>2</sub>	10	15	25	40	40	50	50	75	75	100
	R-22	10	15	20	25	40	60	60	75	75	100	125	150
	R-502, R-507/404A	10	15	20	25	40	60	60	75	75	100	125	150
Number of Cylinders		2	3	4	6	4	4	6	6	8	8	12	12
	Bore (in.)	2 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>4</sub>
	Stroke (in.)	2	2	2	2	2 <sup>3</sup> / <sub>4</sub>	3 <sup>7</sup> / <sub>16</sub>	2 <sup>3</sup> / <sub>4</sub>	3 <sup>7</sup> / <sub>16</sub>	2 <sup>3</sup> / <sub>4</sub>	3 <sup>7</sup> / <sub>16</sub>	2 <sup>3</sup> / <sub>4</sub>	3 <sup>7</sup> / <sub>16</sub>
Displacement Cfm at 1750 Rpm		19.8	29.8	39.8	59.6	92.4	115.5	138.4	173.0	184.7	231.0	276.8	346.0
Ratings in Tons*	R-12, R-134a	5.18	7.76	10.5	15.7	24.7	30.6	37.0	45.9	49.5	61.1	74.0	91.8
	R-22	8.46	12.7	16.8	25.3	39.6	49.1	59.4	73.8	79.2	98.2	119.0	145.0
	R-502	8.85	13.2	17.7	26.5	40.5	50.2	60.9	75.4	81.2	100.7	122.0	151.2
	R-507/404A	8.40	12.56	16.77	25.17	38.48	47.72	57.73	71.58	76.98	95.47	115.47	143.19
Max Speed (rpm)		1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Min Speed (rpm)	For Lubrication	400	400	400	400	400	400	400	400	400	400	400	400
	For Unloader Action	600	700	800	900	800	800	900	900	1100	1100	900	900
Net Oil Pressure (psig)†		45	45	45	45	45	45	45	45	45	45	45	45
Oil Charge (pt)		5	5 <sup>1</sup> / <sub>2</sub>	12	13	18	18	21	21	41	41	61	61
Normal Oil Level in Sight Glass		C.L.	C.L.	3 <sup>3</sup> / <sub>8</sub> " Above C.L.	3 <sup>3</sup> / <sub>8</sub> " Above C.L.	C.L.	C.L.	C.L.	C.L.	C.L.	C.L.	C.L.	C.L.
Min Oil Pressure for Unloader Action (psig)		22	28	35	35	35	35	35	35	35	35	35	35
Suction Line ODF (in.)		1 <sup>1</sup> / <sub>8</sub>	1 <sup>5</sup> / <sub>8</sub>	1 <sup>5</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>8</sub>	2 <sup>5</sup> / <sub>8</sub>	2 <sup>5</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	4 <sup>1</sup> / <sub>8</sub>	4 <sup>1</sup> / <sub>8</sub>
Discharge Line ODF (in.)		7 <sup>7</sup> / <sub>8</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>5</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	4 <sup>1</sup> / <sub>8</sub>	4 <sup>1</sup> / <sub>8</sub>
Bare Compressor Weight (lb)		175	215	355	400	610	610	795	795	1115	1115	1580	1580

LEGEND

C.L. — Center Line  
 ODF — Outside Diameter Female (in.)

\*40 F saturated suction, 105 F saturated discharge, 15 F superheat, 0° F subcooling.

†Net oil pressure = oil pressure gage reading – suction pressure. The above oil pressure is typical with mineral or alkylbenzene oils. A slight increase in oil pressure may result with the use of PolyolEster (POE) oil.

## OPEN-DRIVE COMPRESSORS

These compressors are designed to operate with Refrigerants 12, 22, 134a, 502, or 507/404A. See Table 1.

**Operating Requirements** — Satisfactory operation of a reciprocating compressor depends on 3 fundamental requirements:

1. Prevention of excess discharge temperature.
2. Adequate compressor lubrication.
3. A clean and dry system.

**Discharge Temperature** — The temperature at the discharge valves within the cylinders is a controlling factor. Some cooling of the discharge gas occurs before reaching the discharge stop valve, thus when water-cooled heads are used, this cooling is greater than it is without water cooling. To prevent excessive temperature at the compressor discharge valves, the following temperatures, when measured immediately following the discharge stop valve, must never be exceeded:

For nonwater-cooled heads . . . . . 275 F max  
 For water-cooled heads . . . . . 250 F max

The approximate discharge gas temperature can be found by using the following equation:

$$T_2 = T_1 \left( \frac{P_2}{P_1} \right)^{\frac{N-1}{N}}$$

Where:

- T<sub>2</sub> = Discharge temperature, F absolute
- T<sub>1</sub> = Suction temperature, F absolute (including superheat)
- P<sub>2</sub> = Discharge pressure, psia
- P<sub>1</sub> = Suction pressure, psia
- N = Compression exponent of the gas (see Table 2)

**Table 2 — Compression Exponent “N”**

COMPRESSION RATIO = Discharge Suction psia	WITHOUT WATER-COOLED HEADS*			WITH WATER-COOLED HEADS R-22
	R-12	R-22	R-502	
2	1.216	1.325	1.234	1.240
3	1.191	1.258	1.216	1.218
4	1.177	1.240	1.206	1.205
5	1.172	1.234	1.197	1.199
6	1.166	1.232	1.190	1.196
8	1.160	1.228	1.178	1.192
10	1.155	1.225	1.169	1.187
12	1.150	1.224	1.161	1.182

\*For R-134a and R-507/404A refer to the Carlyle Compressor Selection program (<http://www.carlylecompressor.com/TechnicalInfo/Carwin.htm>) to determine discharge temperature. The selection program can also be used for R-22 and R-502 in place of the discharge temperature formulas.

The value of compression exponent “N” depends upon the properties of gas compressed, degree of cooling in compressor jacket, leakages, etc.

To simplify discharge temperature calculations, the preceding formula may be stated in the following form:

$$T_2 = [(460 + T_1) \times C] - 460$$

Where:

- T<sub>2</sub> = Discharge temperature, F actual
- T<sub>1</sub> = Suction gas temperature, F actual (including superheat)

$$C = \left( \frac{P_2}{P_1} \right)^{\frac{N-1}{N}}$$

Values for “C” at various compression ratios are listed in Table 3.

**Table 3 — “C” Factors**

COMPRESSION RATIO = Discharge psia Suction psia	WITHOUT WATER-COOLED HEADS*			WITH WATER-COOLED HEADS R-22
	R-12	R-22	R-502	
2	1.14	1.17	1.13	1.15
3	1.19	1.25	1.22	1.22
4	1.23	1.31	1.27	1.27
5	1.26	1.36	1.30	1.31
6	1.29	1.40	1.33	1.34
8	1.33	1.47	1.37	1.40
10	1.36	1.53	1.40	1.44
12	1.38	1.57	1.41	1.47

\*For R-134a and R-507/404A refer to the Carlyle Compressor Selection program (<http://www.carlylecompressor.com/TechnicalInfo/Carwin.htm>) to determine discharge temperature. The selection program can also be used for R-22 and R-502 in place of the discharge temperature formulas.

Example:

Refrigerant 12

$$\text{Compression Ratio } \frac{P_2}{P_1} = 8$$

Factor C = 1.33

Suction Temperature, T<sub>1</sub> = 0° F saturated, superheated to 65 F

Solution:

$$\begin{aligned} T_2 &= [(460 + 65) \times 1.33] - 460 \\ &= 698 - 460 \\ &= 238 \text{ F} \end{aligned}$$

Although exponents are shown for high compression ratios, these are for information only. Rating tables define allowable selection and operation limits.

**High Compression Ratio** — Avoid compressor operation at compressor ratios exceeding those covered in the rating tables. For operating conditions outside the limits shown in these tables, use 2-stage compression. Care must be taken to prevent the compressor from pulling down to levels outside the rating tables.

**Suction Gas Superheat** — Excessive suction gas superheat will result in abnormally high discharge temperatures, which must be avoided. When using Refrigerants 12, 134a, 502, and 507/404A it is recommended that the actual suction gas temperature not exceed the values in Table 4.

**Table 4 — Actual Suction Gas Temperature Limits (F) Refrigerants 12, 134a, 502, and 507/404A\***

SATURATED SUCTION GAS TEMP		-60	-50	-40	-30	-20	-10	0 AND ABOVE
Actual Suction Gas Temp	R-12	—	—	35	45	55	65	65
	R-134a	—	—	—	—	—	—	65
	R-502 R-507/404A	25	35	45	55	65	65	65

\*With Refrigerant 22, the suction gas superheat should never exceed 25 F for continuous operation.

**Keeping Liquid Refrigerant Out of Compressor** — Liquid refrigerant, or excessive amounts of entrained liquid particles in suction gas must be kept out of the compressor by proper system design and compressor control. Under operating conditions, presence of unevaporated liquid refrigerant in the compressor tends to break down oil film on cylinder walls, resulting in increased wear and loss of machine capacity.

During compressor operation, proper adjustment of the expansion valve will prevent excessive amounts of liquid from entering the compressor.

During compressor shutdown, gravity, thermal action and refrigerant absorption can result in a refrigerant and oil mixture in compressor crankcase. Gravity flow can be prevented by the use of recommended loops, but thermal action and the absorption of refrigerant by lubricating oil cannot be prevented by piping design.

For the above reasons, the compressor must be controlled during idle times by one of the following methods.

**MINIMUM PROTECTION** — The minimum protection that Carrier will allow is shown in Fig. 1. Actuated control thermostat energizes crankcase heater and closes the liquid line solenoid valve simultaneously. With crankcase heaters energized, the crankcase temperature is always held above shutdown temperature in the evaporator coil and there will be no refrigerant migration to the crankcase.

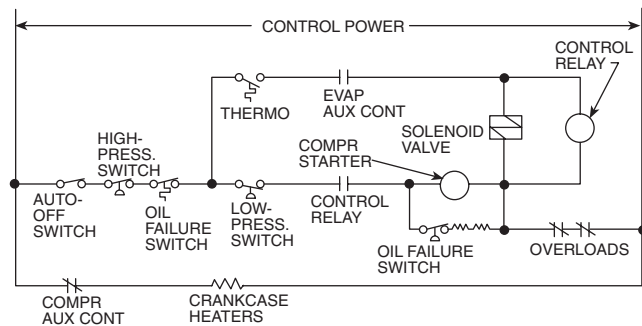
With this type of control, a control relay is required and crankcase heaters have to be energized when the compressor is not operating.

The control relay coil is located in parallel with the liquid line solenoid, and a normally open control relay contact is added in series with the compressor starter and other auxiliary safety devices.

When the thermostat calls for cooling, the solenoid valve opens and control relay is energized. This closes the relay contact and, if other safety devices are in their normal position, compressor will start. Simultaneously, the normally closed compressor auxiliary contact will open, removing crankcase heaters from the circuit.

When the thermostat is satisfied, the solenoid will close and control relay is deenergized. This opens relay contacts and compressor stops. This causes compressor auxiliary contacts to close, energizing crankcase heaters.

Specifications are sometimes written to call for a degree of protection greater than that afforded by the standard method. If this is the case, either single pumpout or automatic pumpdown control may be required.



**Fig. 1 — Minimum Protection**

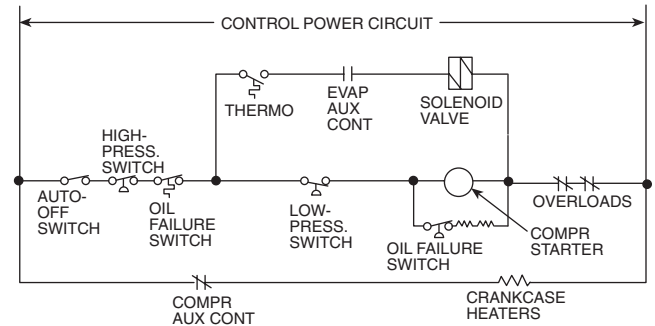
**AUTOMATIC PUMPDOWN CONTROL** (Fig. 2) — Pumpdown control is the most effective means of compressor control in keeping liquid refrigerant out of the crankcase on system shutdown.

In the basic pumpdown control sequence, the thermostat controls the liquid line solenoid valve to stop or start the flow of refrigerant to the evaporator as required.

The pumpdown control system permits compressor cycling if a system malfunction allows low side pressure to rise. Although this cycling is sometimes considered objectionable, it illustrates need for maintenance attention and provides positive

protection against liquid refrigerant accumulating in the compressor crankcase.

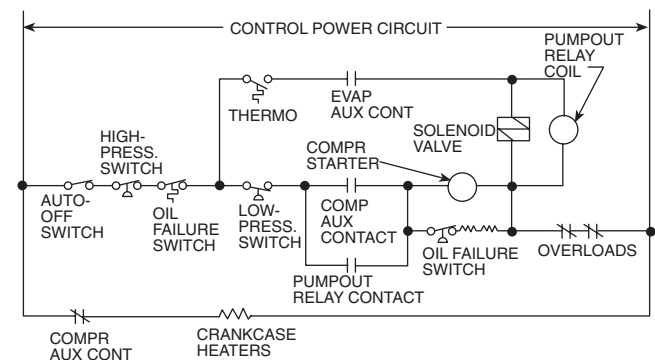
Do not use pumpdown control with dry expansion coolers as it may cause frost pinching or freeze-up. Do not use pumpdown control with dry expansion coolers if it is anticipated that there will be short bursts of system operation, as this will result in a gradual loss of oil.



**Fig. 2 — Automatic Pumpdown Control**

**SINGLE PUMPOUT CONTROL** (Fig. 3) — Pumpout control is not as effective as pumpdown control in keeping liquid refrigerant out of the crankcase. However, it is usually satisfactory when used with crankcase heaters if pumpdown is not acceptable.

Single pumpout control is similar to pumpdown control, except that a pumpout relay is added, a normally open compressor auxiliary contact is necessary, and energizing of crankcase heaters is required at end of each operating cycle.



**Fig. 3 — Single Pumpout Control**

With single pumpout control, when the thermostat is satisfied, the compressor pumps down once and stops. It starts again only when the thermostat calls for cooling. In pumpdown control, the compressor cycles only on the low-pressure switch, regardless of thermostat demands.

Do not use pumpout control with dry expansion coolers as it may cause frost pinching or freeze-up.

**MANUAL PUMPDOWN** — The compressor may be controlled manually without the use of pumpdown, or single pumpout control, and without crankcase heaters, provided the system is at all times under control of a qualified operator. The operator will pump down the system by use of manual valves and will keep liquid, suction and discharge valves closed when the machine is not operating.

## Compressor Capacity Notes

- Compressor capacities are based on 1750 rpm and 15 F subcooling for all unit sizes and refrigerants.
- Multiplying factors for other rpm:

RPM	1450	1160
Capacity	0.835	0.674
Bhp	0.798	0.602

See Multiplying Factors chart on page 31.

- Liquid subcooling greater than (less than) 15 F incorporated in ratings increases (decreases) system capacity by 1/2 of 1% for each degree of subcooling. When correcting for subcooling, brake horsepower does not change.
- Refrigerant temperatures shown in Table 5 are saturation temperatures corresponding to pressures indicated at compressor. Actual gas temperatures are higher because of superheat.
- Capacities are based on actual suction gas temperatures to compressor of 65 F for R-12, R-134a, R-502, and R-507/404A. (This assumes superheat is obtained from liquid suction interchanger or in evaporator.)**

Capacity corrections, other than for rated suction gas temperatures, may be obtained by using Rating Basis and Capacity Multipliers Tables 6 and 7. Refrigerant-22 suction gas superheat for ratings (15 F) normally occurs because of expansion valve operation and line losses. Therefore, R-22 ratings can be used without adjustment.

An alternate method for capacity correction is to run the Carlyle Selection program to obtain performance ratings at other than 65 F return gas temperature.

Compressor ratings and capacities are included in Tables 8-12.

## Compressor Features and Accessories

**WATER-COOLED HEADS AND OIL COOLERS** — Water cooled heads are typically not necessary for R-12 or R-134a applications within the range of compressor ratings shown in this publication. For R-502, or R-507/404A at the shaded conditions shown in the compressor ratings tables, water-cooled heads may be necessary, if the discharge temperature is greater than 275 F. The discharge temperature will increase with return gas temperature.

When operating conditions are such that suction gas becomes highly superheated and/or the compression ratio is high, it is recommended that an oil cooler be used on the compressor. An oil cooler is required on increased displacement compressors (5H46, 66, 86, and 126) on installations where compressor(s) can be subjected to extended periods of continuous, fully unloaded operation. These periods do not afford sufficient removal of compression and friction heat, and could result in overheating of the running gear, shaft seal and crankcase oil. The addition of an oil cooler removes excessive heat, ensuring increased life expectancy of compressor and components.

*Extended periods of continuous, fully unloaded operation will occur usually on variable-volume installations that use hot gas bypass to maintain conditions under all load situations. Without hot gas bypass, the compressor will usually cycle on the low-pressure switch (or temperature controlling device) giving time for seal, oil and crankcase to cool.*

On multiple-compressor installations where all units are manifolded into one refrigerant circuit, the controls should be designed to cycle off compressors at light loads to put maximum output on the still operative compressor. It is always desirable for the compressor to operate with as many cylinders as possible in loaded condition.

Water-cooled oil cooler package is available from the factory and is easily field installed on all 5 Series compressors. Refer to 5F,H Compressor Ratings to determine when oil coolers are required. These ratings, however, do not indicate oil cooler requirements during periods of extended continuous operation under fully unloaded operation. This should be determined on individual job basis.

Water flow through compressor heads (and water-cooled oil coolers, if used) must be shut off when the compressor is not running to prevent refrigerant vapors from condensing at the compressor during OFF cycles. For this purpose a solenoid valve is recommended in the water supply line to compressor heads.

Values listed in Table 13 assume a water temperature rise of 30 degrees. Oil cooler and water-cooled heads must be piped in series, with the oil cooler first. Leaving water temperature should be between 100 F and 120 F, with 120 F being maximum allowable temperature. Maximum working pressure for water-cooled heads is 125 psi.

**Table 5 — Total Heat Rejection Factors**  
**Total Heat Rejection (tons) = Compressor Capacity (tons) x Heat Rejection Factor\***

SAT. DISCHARGE TEMP (F)	SATURATED SUCTION TEMPERATURES (F)																					
	-60	-50	-40	-30	-20	-10	0	10	20	30	32	34	35	36	38	40	42	44	45	46	48	50
80	1.610	1.547	1.490	1.439	1.391	1.344	1.300	1.256	1.214	1.176	1.168	1.160	1.155	1.150	1.142	1.138	1.129	1.121	1.118	1.112	1.110	1.105
90	—	1.590	1.526	1.472	1.422	1.373	1.327	1.282	1.238	1.196	1.190	1.180	1.178	1.171	1.165	1.157	1.150	1.142	1.138	1.135	1.129	1.122
100	—	1.630	1.570	1.513	1.461	1.409	1.361	1.312	1.267	1.222	1.215	1.205	1.202	1.200	1.190	1.180	1.175	1.165	1.162	1.158	1.150	1.143
105	—	1.655	1.595	1.538	1.483	1.431	1.380	1.330	1.283	1.237	1.232	1.220	1.219	1.215	1.205	1.194	1.189	1.178	1.175	1.170	1.162	1.155
110	—	—	1.622	1.564	1.508	1.454	1.402	1.350	1.301	1.253	1.248	1.238	1.235	1.228	1.220	1.208	1.200	1.192	1.190	1.185	1.178	1.168
120	—	—	1.698	1.628	1.565	1.508	1.451	1.395	1.341	1.288	1.280	1.270	1.265	1.261	1.251	1.240	1.232	1.222	1.220	1.215	1.205	1.195
130	—	—	—	—	—	1.567	1.506	1.445	1.383	1.327	1.320	1.310	1.300	1.295	1.285	1.275	1.268	1.255	1.250	1.248	1.238	1.225
140	—	—	—	—	—	—	1.565	1.500	1.430	1.368	1.355	1.345	1.338	1.332	1.318	1.310	1.300	1.290	1.288	1.280	1.270	1.255
145	—	—	—	—	—	—	—	1.526	1.455	1.390	1.378	1.365	1.355	1.350	1.340	1.330	1.320	1.310	1.300	1.298	1.285	1.270

\*Complete capacity corrections before calculating for total heat rejection (refer to Compressor Capacity Note 5).

**Table 6 — Rating Basis and Capacity Multipliers for R-12 and R-134a\***

SST (F)	SDT (F)	RETURN GAS TEMPERATURE (F)										
		-30	-20	-10	0	10	20	30	40	50	60	65
-30	90	0.963	0.966	0.970	0.973	0.977	0.981	0.985	0.989	0.993	0.998	1.000
	100	0.951	0.956	0.960	0.965	0.970	0.976	0.981	0.986	0.992	0.997	1.000
	110	0.938	0.944	0.950	0.957	0.963	0.970	0.977	0.983	0.990	0.997	1.000
	120	0.923	0.931	0.939	0.947	0.955	0.964	0.972	0.980	0.988	0.996	1.000
	130	0.906	0.916	0.926	0.936	0.945	0.958	0.966	0.976	0.986	0.995	1.000
	140	0.887	0.899	0.912	0.924	0.936	0.949	0.960	0.972	0.983	0.994	1.000
	150	0.865	0.880	0.895	0.910	0.924	0.939	0.953	0.967	0.980	0.993	1.000
-20	90	—	0.968	0.971	0.974	0.978	0.982	0.985	0.989	0.994	0.998	1.000
	100	—	0.957	0.962	0.967	0.971	0.976	0.981	0.987	0.992	0.997	1.000
	110	—	0.946	0.952	0.953	0.964	0.971	0.977	0.984	0.990	0.997	1.000
	120	—	0.932	0.940	0.948	0.956	0.964	0.972	0.980	0.988	0.996	1.000
	130	—	0.917	0.927	0.937	0.947	0.957	0.967	0.976	0.986	0.995	1.000
	140	—	0.900	0.912	0.925	0.937	0.949	0.960	0.972	0.983	0.994	1.000
	150	—	0.880	0.895	0.910	0.925	0.939	0.953	0.967	0.980	0.993	1.000
-10	90	—	—	0.973	0.976	0.979	0.983	0.986	0.990	0.994	0.998	1.000
	100	—	—	0.964	0.968	0.973	0.977	0.982	0.987	0.992	0.997	1.000
	110	—	—	0.953	0.959	0.965	0.971	0.978	0.984	0.990	0.997	1.000
	120	—	—	0.940	0.949	0.957	0.965	0.973	0.981	0.988	0.996	1.000
	130	—	—	0.928	0.938	0.948	0.957	0.967	0.977	0.986	0.995	1.000
	140	—	—	0.913	0.925	0.937	0.949	0.961	0.972	0.983	0.994	1.000
	150	—	—	0.896	0.910	0.925	0.939	0.953	0.967	0.980	0.993	1.000
0	90	—	—	—	0.978	0.981	0.984	0.987	0.991	0.994	0.998	1.000
	100	—	—	—	0.970	0.974	0.979	0.983	0.988	0.993	0.998	1.000
	110	—	—	—	0.961	0.967	0.973	0.979	0.985	0.991	0.997	1.000
	120	—	—	—	0.951	0.958	0.965	0.973	0.981	0.989	0.996	1.000
	130	—	—	—	0.939	0.949	0.958	0.968	0.977	0.986	0.995	1.000
	140	—	—	—	0.926	0.938	0.950	0.961	0.972	0.983	0.995	1.000
	150	—	—	—	0.911	0.925	0.939	0.953	0.967	0.980	0.994	1.000
10	90	—	—	—	—	0.983	0.984	0.989	0.992	0.995	0.998	1.000
	100	—	—	—	—	0.976	0.980	0.984	0.989	0.993	0.998	1.000
	110	—	—	—	—	0.969	0.974	0.980	0.985	0.991	0.997	1.000
	120	—	—	—	—	0.960	0.967	0.974	0.982	0.989	0.996	1.000
	130	—	—	—	—	0.950	0.959	0.968	0.977	0.987	0.996	1.000
	140	—	—	—	—	0.939	0.950	0.962	0.973	0.984	0.995	1.000
	150	—	—	—	—	0.926	0.940	0.954	0.967	0.981	0.994	1.000
20	90	—	—	—	—	—	0.988	0.990	0.993	0.995	0.998	1.000
	100	—	—	—	—	—	0.982	0.986	0.990	0.994	0.998	1.000
	110	—	—	—	—	—	0.976	0.981	0.986	0.992	0.997	1.000
	120	—	—	—	—	—	0.969	0.975	0.982	0.989	0.996	1.000
	130	—	—	—	—	—	0.961	0.969	0.978	0.987	0.996	1.000
	140	—	—	—	—	—	0.951	0.962	0.973	0.984	0.995	1.000
	150	—	—	—	—	—	0.941	0.954	0.968	0.981	0.994	1.000
30	90	—	—	—	—	—	—	0.992	0.994	0.996	0.999	1.000
	100	—	—	—	—	—	—	0.988	0.991	0.994	0.998	1.000
	110	—	—	—	—	—	—	0.983	0.987	0.992	0.997	1.000
	120	—	—	—	—	—	—	0.977	0.983	0.990	0.997	1.000
	130	—	—	—	—	—	—	0.971	0.979	0.987	0.996	1.000
	140	—	—	—	—	—	—	0.963	0.974	0.984	0.995	1.000
	150	—	—	—	—	—	—	0.955	0.968	0.981	0.994	1.000
40	90	—	—	—	—	—	—	—	0.996	0.997	0.999	1.000
	100	—	—	—	—	—	—	—	0.992	0.995	0.998	1.000
	110	—	—	—	—	—	—	—	0.989	0.993	0.998	1.000
	120	—	—	—	—	—	—	—	0.985	0.991	0.997	1.000
	130	—	—	—	—	—	—	—	0.980	0.988	0.996	1.000
	140	—	—	—	—	—	—	—	0.975	0.985	0.995	1.000
	150	—	—	—	—	—	—	—	0.969	0.981	0.994	1.000
50	90	—	—	—	—	—	—	—	—	0.998	0.999	1.000
	100	—	—	—	—	—	—	—	—	0.996	0.999	1.000
	110	—	—	—	—	—	—	—	—	0.994	0.998	1.000
	120	—	—	—	—	—	—	—	—	0.992	0.997	1.000
	130	—	—	—	—	—	—	—	—	0.989	0.996	1.000
	140	—	—	—	—	—	—	—	—	0.986	0.995	1.000
	150	—	—	—	—	—	—	—	—	0.982	0.994	1.000

**LEGEND**

**SDT** — Saturated Discharge Temperature  
**SST** — Saturated Suction Temperature

\*R-134a capacity multipliers start at 0° F SST and above.

**Table 7 — Rating Basis and Capacity Multipliers for R-502 and R-507/404A**

SST (F)	SDT (F)	RETURN GAS TEMPERATURE (F)										
		-30	-20	-10	0	10	20	30	40	50	60	65
-30	90	0.913	0.922	0.931	0.941	0.950	0.959	0.968	0.977	0.986	0.995	1.000
	100	0.893	0.905	0.916	0.928	0.939	0.956	0.962	0.973	0.984	0.995	1.000
	110	0.870	0.884	0.899	0.913	0.927	0.941	0.954	0.967	0.981	0.994	1.000
	120	0.843	0.861	0.879	0.896	0.913	0.929	0.945	0.961	0.977	0.992	1.000
	130	0.812	0.834	0.855	0.876	0.896	0.916	0.935	0.954	0.973	0.991	1.000
	140	0.774	0.801	0.826	0.852	0.876	0.900	0.923	0.946	0.968	0.989	1.000
	150	0.728	0.760	0.792	0.822	0.851	0.880	0.908	0.935	0.961	0.987	1.000
-20	90	—	0.925	0.933	0.942	0.951	0.960	0.969	0.978	0.987	0.996	1.000
	100	—	0.906	0.918	0.929	0.940	0.951	0.962	0.973	0.984	0.995	1.000
	110	—	0.886	0.900	0.914	0.928	0.941	0.955	0.968	0.981	0.994	1.000
	120	—	0.862	0.879	0.896	0.913	0.930	0.946	0.962	0.977	0.992	1.000
	130	—	0.833	0.855	0.876	0.896	0.916	0.935	0.954	0.973	0.991	1.000
	140	—	0.800	0.826	0.851	0.876	0.899	0.923	0.945	0.968	0.989	1.000
	150	—	0.758	0.796	0.821	0.850	0.879	0.907	0.935	0.961	0.987	1.000
-10	90	—	—	0.936	0.944	0.953	0.961	0.970	0.978	0.987	0.996	1.000
	100	—	—	0.920	0.931	0.942	0.952	0.963	0.974	0.984	0.995	1.000
	110	—	—	0.901	0.915	0.927	0.942	0.955	0.968	0.981	0.994	1.000
	120	—	—	0.880	0.897	0.914	0.930	0.946	0.962	0.977	0.992	1.000
	130	—	—	0.855	0.876	0.896	0.916	0.935	0.954	0.973	0.991	1.000
	140	—	—	0.825	0.850	0.875	0.899	0.923	0.945	0.968	0.989	1.000
	150	—	—	0.788	0.819	0.849	0.878	0.907	0.934	0.961	0.987	1.000
0	90	—	—	—	0.947	0.955	0.963	0.971	0.979	0.988	0.996	1.000
	100	—	—	—	0.933	0.943	0.954	0.964	0.974	0.985	0.995	1.000
	110	—	—	—	0.917	0.930	0.943	0.956	0.969	0.981	0.994	1.000
	120	—	—	—	0.898	0.915	0.931	0.947	0.962	0.978	0.993	1.000
	130	—	—	—	0.876	0.896	0.916	0.936	0.955	0.973	0.991	1.000
	140	—	—	—	0.850	0.875	0.899	0.922	0.945	0.968	0.989	1.000
	150	—	—	—	0.817	0.848	0.877	0.906	0.934	0.961	0.987	1.000
10	90	—	—	—	—	0.958	0.965	0.973	0.980	0.988	0.996	1.000
	100	—	—	—	—	0.946	0.956	0.965	0.975	0.985	0.995	1.000
	110	—	—	—	—	0.932	0.945	0.957	0.970	0.982	0.994	1.000
	120	—	—	—	—	0.916	0.932	0.947	0.963	0.978	0.993	1.000
	130	—	—	—	—	0.897	0.917	0.936	0.955	0.973	0.991	1.000
	140	—	—	—	—	0.874	0.898	0.922	0.945	0.968	0.989	1.000
	150	—	—	—	—	0.846	0.876	0.905	0.933	0.961	0.987	1.000
20	90	—	—	—	—	—	0.968	0.975	0.982	0.988	0.996	1.000
	100	—	—	—	—	—	0.958	0.967	0.977	0.986	0.995	1.000
	110	—	—	—	—	—	0.947	0.959	0.971	0.982	0.994	1.000
	120	—	—	—	—	—	0.933	0.948	0.963	0.978	0.993	1.000
	130	—	—	—	—	—	0.917	0.936	0.955	0.973	0.991	1.000
	140	—	—	—	—	—	0.898	0.922	0.945	0.968	0.989	1.000
	150	—	—	—	—	—	0.875	0.904	0.933	0.960	0.987	1.000
30	90	—	—	—	—	—	—	0.978	0.984	0.990	0.997	1.000
	100	—	—	—	—	—	—	0.970	0.978	0.987	0.996	1.000
	110	—	—	—	—	—	—	0.961	0.972	0.983	0.994	1.000
	120	—	—	—	—	—	—	0.950	0.964	0.979	0.993	1.000
	130	—	—	—	—	—	—	0.937	0.956	0.974	0.991	1.000
	140	—	—	—	—	—	—	0.922	0.945	0.968	0.989	1.000
	150	—	—	—	—	—	—	0.903	0.932	0.960	0.987	1.000
40	90	—	—	—	—	—	—	—	0.986	0.991	0.997	1.000
	100	—	—	—	—	—	—	—	0.980	0.988	0.996	1.000
	110	—	—	—	—	—	—	—	0.974	0.984	0.995	1.000
	120	—	—	—	—	—	—	—	0.966	0.980	0.993	1.000
	130	—	—	—	—	—	—	—	0.956	0.974	0.991	1.000
	140	—	—	—	—	—	—	—	0.945	0.968	0.989	1.000
	150	—	—	—	—	—	—	—	0.931	0.959	0.987	1.000
50	90	—	—	—	—	—	—	—	—	0.994	0.998	1.000
	100	—	—	—	—	—	—	—	—	0.990	0.997	1.000
	110	—	—	—	—	—	—	—	—	0.985	0.995	1.000
	120	—	—	—	—	—	—	—	—	0.981	0.994	1.000
	130	—	—	—	—	—	—	—	—	0.975	0.992	1.000
	140	—	—	—	—	—	—	—	—	0.968	0.989	1.000
	150	—	—	—	—	—	—	—	—	0.959	0.987	1.000

**LEGEND**

**SDT** — Saturated Discharge Temperature  
**SST** — Saturated Suction Temperature

**Table 8 — Compressor Ratings; R-12**

UNIT		5F20		5F30		5F40		5F60	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	80	0.6	1.7	1.0	2.7	1.3	3.4	2.0	5.3
	90	0.5	1.6	0.8	2.6	1.1	3.3	1.6	5.1
	100	0.4	1.5	0.6	2.4	0.9	3.1	1.3	4.7
-30	80	1.0	2.2	1.5	3.4	2.0	4.2	3.0	6.6
	90	0.8	2.2	1.3	3.3	1.8	4.3	2.6	6.6
	100	0.7	2.1	1.1	3.2	1.5	4.2	2.2	6.4
	105	0.6	2.1	1.0	3.2	1.4	4.2	2.0	6.3
	110	0.6	2.0	0.9	3.1	1.3	4.1	1.9	6.1
-20	80	1.4	2.6	2.2	4.0	2.9	5.1	4.3	8.0
	90	1.3	2.7	1.9	4.1	2.6	5.2	3.8	8.1
	100	1.1	2.7	1.7	4.1	2.3	5.3	3.4	8.1
	105	1.0	2.7	1.6	4.1	2.1	5.3	3.1	8.1
	110	0.9	2.7	1.5	4.0	2.0	5.3	2.9	8.0
-10	120	0.8	2.6	1.2	3.9	1.7	5.2	2.5	7.8
	80	2.0	3.1	3.0	4.6	3.9	5.9	5.9	9.2
-10	90	1.8	3.2	2.7	4.8	3.6	6.2	5.4	9.5
	100	1.6	3.3	2.4	4.9	3.2	6.4	4.8	9.8
	105	1.5	3.3	2.3	5.0	3.0	6.5	4.5	9.8
	110	1.4	3.3	2.1	5.0	2.8	6.5	4.3	9.9
	120	1.2	3.3	1.9	5.0	2.5	6.6	3.7	9.8
	130	1.0	3.2	1.6	4.9	2.2	6.6	3.2	9.7
	80	2.6	3.4	4.0	5.2	5.2	6.6	7.9	10.3
0	90	2.4	3.6	3.6	5.5	4.8	7.0	7.2	10.9
	100	2.2	3.8	3.3	5.7	4.4	7.4	6.6	11.3
	105	2.1	3.9	3.1	5.8	4.1	7.6	6.2	11.5
	110	1.9	3.9	3.0	5.9	3.9	7.7	5.9	11.7
	120	1.7	4.0	2.6	6.0	3.5	7.9	5.3	11.9
	130	1.5	4.0	2.3	6.0	3.1	8.1	4.7	12.0
	140	1.3	4.0	2.0	6.0	2.7	8.1	4.1	11.9
	145	1.2	4.0	1.9	5.9	2.5	8.1	3.8	11.8
10	80	3.4	3.7	5.1	5.6	6.8	7.1	10.3	11.1
	90	3.1	4.0	4.8	6.1	6.3	7.8	9.5	12.0
	100	2.9	4.3	4.4	6.4	5.8	8.3	8.7	12.8
	105	2.7	4.4	4.2	6.6	5.5	8.6	8.3	13.1
	110	2.6	4.5	4.0	6.8	5.3	8.8	7.9	13.4
	120	2.4	4.7	3.6	7.0	4.8	9.2	7.1	13.9
	130	2.1	4.8	3.2	7.2	4.3	9.5	6.4	14.2
	140	1.9	4.9	2.8	7.3	3.8	9.7	5.7	14.4
	145	1.7	4.9	2.7	7.3	3.6	9.8	5.3	14.4
	20	80	4.3	3.9	6.6	5.9	8.7	7.5	13.1
90		4.0	4.3	6.1	6.5	8.1	8.3	12.1	12.8
100		3.7	4.7	5.6	7.0	7.5	9.1	11.2	13.9
105		3.6	4.8	5.4	7.3	7.2	9.4	10.8	14.4
110		3.4	5.0	5.2	7.5	6.9	9.8	10.3	14.9
120		3.1	5.3	4.7	7.9	6.3	10.4	9.4	15.7
130		2.8	5.5	4.3	8.2	5.7	10.9	8.5	16.4
140		2.5	5.7	3.8	8.5	5.1	11.3	7.7	16.8
145		2.4	5.8	3.6	8.6	4.8	11.5	7.2	17.0
30		80	5.5	4.0	8.2	6.0	10.9	7.7	16.4
	90	5.1	4.5	7.7	6.8	10.2	8.7	15.3	13.3
	100	4.7	5.0	7.1	7.5	9.5	9.7	14.2	14.8
	105	4.5	5.2	6.9	7.8	9.1	10.1	13.7	15.5
	110	4.4	5.4	6.6	8.1	8.7	10.6	13.1	16.1
	120	4.0	5.8	6.1	8.7	8.0	11.4	12.1	17.3
	130	3.7	6.2	5.5	9.2	7.3	12.1	11.1	18.3
	140	3.3	6.4	5.0	9.6	6.7	12.8	10.0	19.1
	145	3.1	6.6	4.8	9.8	6.3	13.0	9.5	19.5
40	80	6.7	3.9	10.1	5.9	13.5	7.7	20.3	11.4
	90	6.3	4.5	9.5	6.9	12.7	8.9	19.0	13.4
	100	5.9	5.1	8.9	7.7	11.8	10.1	17.7	15.2
	105	5.7	5.4	8.6	8.2	11.4	10.6	17.1	16.1
	110	5.5	5.7	8.3	8.6	11.0	11.2	16.5	16.9
	120	5.1	6.2	7.6	9.3	10.1	12.2	15.3	18.5
	130	4.7	6.7	7.0	10.0	9.3	13.2	14.0	19.9
	140	4.2	7.1	6.4	10.6	8.5	14.0	12.8	21.1
145	4.0	7.3	6.1	10.9	8.1	14.4	12.2	21.7	

UNIT		5F20		5F30		5F40		5F60	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
42	80	7.0	3.8	10.5	5.9	14.1	7.6	21.1	11.2
	90	6.6	4.5	9.9	6.8	13.2	8.9	19.8	13.3
	100	6.2	5.2	9.3	7.8	12.3	10.1	18.5	15.3
	105	5.9	5.5	8.9	8.2	11.9	10.7	17.9	16.2
	110	5.7	5.8	8.6	8.6	11.5	11.3	17.2	17.1
	120	5.3	6.3	8.0	9.4	10.6	12.4	15.9	18.7
	130	4.9	6.8	7.4	10.2	9.8	13.4	14.7	20.2
	140	4.5	7.2	6.8	10.8	8.9	14.3	13.4	21.5
42	145	4.2	7.4	6.4	11.1	8.5	14.7	12.8	22.1
	80	7.3	3.8	11.0	5.8	14.7	7.5	22.0	11.0
44	90	6.9	4.5	10.3	6.8	13.8	8.9	20.6	13.2
	100	6.4	5.2	9.6	7.8	12.9	10.1	19.3	15.3
	105	6.2	5.5	9.3	8.2	12.4	10.8	18.6	16.2
	110	6.0	5.8	9.0	8.7	12.0	11.4	18.0	17.2
	120	5.5	6.4	8.3	9.5	11.1	12.5	16.7	18.9
	130	5.1	6.9	7.7	10.3	10.2	13.5	15.4	20.4
	140	4.7	7.4	7.1	11.0	9.4	14.5	14.1	21.8
	145	4.5	7.6	6.8	11.3	8.9	15.0	13.5	22.5
45	80	7.5	3.8	11.2	5.8	15.0	7.5	22.4	10.9
	90	7.0	4.5	10.5	6.8	14.0	8.9	21.1	13.2
	100	6.6	5.2	9.9	7.8	13.1	10.2	19.7	15.3
	105	6.3	5.5	9.5	8.3	12.7	10.8	19.0	16.3
	110	6.1	5.8	9.2	8.7	12.2	11.4	18.4	17.2
	120	5.7	6.4	8.5	9.6	11.3	12.5	17.0	19.0
	130	5.2	6.9	7.9	10.4	10.4	13.6	15.7	20.6
	140	4.8	7.4	7.2	11.1	9.6	14.6	14.4	22.0
45	145	4.6	7.6	6.9	11.4	9.2	15.1	13.8	22.6
	80	7.6	3.7	11.4	5.7	15.3	7.5	22.9	10.8
46	90	7.2	4.5	10.7	6.8	14.3	8.8	21.5	13.1
	100	6.7	5.2	10.1	7.8	13.4	10.2	20.9	15.3
	105	6.5	5.5	9.7	8.3	12.9	10.8	19.4	16.3
	110	6.2	5.8	9.4	8.7	12.5	11.4	18.8	17.2
	120	5.8	6.4	8.7	9.6	11.6	12.6	17.4	19.0
	130	5.3	7.0	8.1	10.4	10.7	13.7	16.1	20.7
	140	4.9	7.5	7.4	11.1	9.8	14.7	14.7	22.2
	145	4.7	7.7	7.1	11.5	9.4	15.2	14.1	22.8
48	80	7.9	3.7	11.9	5.6	15.9	7.4	23.8	10.6
	90	7.5	4.4	11.2	6.8	14.9	8.8	22.4	13.0
	100	7.0	5.2	10.5	7.8	14.0	10.2	21.0	15.2
	105	6.7	5.5	10.1	8.3	13.5	10.8	20.3	16.3
	110	6.5	5.8	9.8	8.8	13.0	11.5	19.6	17.3
	120	6.0	6.5	9.1	9.7	12.1	12.7	18.2	19.2
	130	5.6	7.1	8.4	10.5	11.2	13.9	16.8	20.9
	140	5.1	7.6	7.7	11.3	10.3	14.9	15.4	22.5
48	145	4.9	7.8	7.4	11.7	9.8	15.4	14.7	23.2
	80	8.2	3.6	12.3	5.6	16.5	7.3	24.8	10.4
50	90	7.8	4.4	11.6	6.6	15.5	8.8	23.3	12.8
	100	7.3	5.2	10.9	7.8	14.5	10.2	21.8	15.2
	105	7.0	5.5	10.5	8.3	14.1	10.9	21.1	16.3
	110	6.8	5.9	10.2	8.8	13.6	11.5	20.4	17.3
	120	6.3	6.5	9.5	9.8	12.6	12.8	18.9	19.3
	130	5.8	7.1	8.8	10.7	11.7	14.0	17.5	21.1
	140	5.3	7.7	8.1	11.5	10.7	15.1	16.1	22.8
	145	5.1	7.9	7.7	11.8	10.3	15.7	15.4	23.5

**LEGEND**

**Bhp** — Brake Horsepower  
**Cap.** — Capacity (Tons)  
**SDT** — Saturated Discharge Temperature (F)  
**SST** — Saturated Suction Temperature (F)

**NOTES:**

1.  Shaded ratings require an oil cooler when using a liquid-suction interchanger, or when 50 degrees of superheat is exceeded.
2. Refer to Table 5 for Total Heat Rejection.

Table 8 — Compressor Ratings; R-12 (cont)

UNIT		5H40		5H46		5H60		5H66	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	80	3.2	9.1	4.0	11.9	4.9	13.1	6.1	17.1
	90	2.7	8.8	3.4	11.5	4.1	12.7	5.2	16.6
	100	2.2	8.4	2.8	11.0	3.4	12.1	4.3	15.8
-30	80	4.9	11.1	6.0	14.4	7.3	16.0	9.1	20.8
	90	4.3	11.0	5.3	14.3	6.4	15.9	8.0	20.7
	100	3.7	10.7	4.6	13.9	5.6	15.5	6.9	20.3
	105	3.4	10.5	4.2	13.7	5.1	15.3	6.4	19.9
	110	3.1	10.3	3.9	13.4	4.7	15.0	5.9	19.5
-20	80	6.9	13.0	8.6	16.9	10.4	18.9	13.0	24.6
	90	6.2	13.1	7.7	17.1	9.4	19.2	11.6	24.9
	100	5.5	13.1	6.8	17.1	8.3	19.2	10.3	24.9
	105	5.1	13.0	6.4	17.0	7.8	19.1	9.7	24.8
	110	4.8	12.9	6.0	16.8	7.3	18.9	9.0	24.7
-10	80	9.5	14.9	11.7	19.3	14.2	21.7	17.7	28.3
	90	8.6	15.3	10.7	19.9	12.9	22.4	16.1	29.1
	100	7.8	15.5	9.6	20.2	11.7	22.8	14.5	29.7
	105	7.3	15.6	9.1	20.3	11.0	22.9	13.7	29.8
	110	6.9	15.6	8.6	20.3	10.4	23.0	13.0	29.9
	120	6.1	15.5	7.6	20.2	9.2	22.9	11.5	29.8
0	80	12.6	16.6	15.5	21.6	18.8	24.3	23.4	31.6
	90	11.6	17.3	14.3	22.5	17.3	25.5	21.5	33.1
	100	10.5	17.9	13.0	23.3	15.8	26.4	19.6	34.3
	105	10.0	18.1	12.4	23.6	15.1	26.7	18.7	34.8
	110	9.5	18.3	11.8	23.8	14.3	27.0	17.8	35.1
	120	8.5	18.5	10.6	24.1	12.9	27.4	16.0	35.6
	130	7.6	18.6	9.4	24.1	11.4	27.5	14.2	35.8
10	80	16.3	18.0	20.1	23.5	24.4	26.5	30.2	34.5
	90	15.1	19.2	18.6	24.9	22.6	28.2	28.0	36.7
	100	13.9	20.1	17.1	26.2	20.8	29.7	25.8	38.6
	105	13.3	20.5	16.4	26.7	19.9	30.3	24.7	39.4
	110	12.7	20.9	15.7	27.2	19.0	30.9	23.6	40.2
	120	11.5	21.5	14.2	27.9	17.3	31.8	21.4	41.4
	130	10.4	21.9	12.8	28.4	15.6	32.4	19.3	42.4
	140	9.2	22.0	11.4	28.7	13.9	32.7	17.3	42.6
20	80	20.7	19.1	25.5	24.9	30.9	28.1	38.3	36.6
	90	19.3	20.7	23.7	26.9	28.8	30.5	35.7	39.7
	100	17.9	22.1	22.0	28.7	26.7	32.7	33.1	42.5
	105	17.2	22.7	21.1	29.5	25.6	33.6	31.8	43.7
	110	16.5	23.3	20.3	30.3	24.6	34.5	30.5	44.8
	120	15.1	24.3	18.6	31.6	22.6	36.0	28.0	46.8
	130	13.7	25.1	16.9	32.6	20.5	37.2	25.5	48.4
	140	12.4	25.6	15.3	33.3	18.6	38.1	23.1	49.6
	145	11.7	25.8	14.5	33.6	17.6	38.4	21.9	50.1
30	80	25.9	19.7	31.8	25.7	38.6	29.1	47.9	37.8
	90	24.2	21.8	29.8	28.4	36.1	32.2	44.8	41.9
	100	22.6	23.7	27.8	30.8	33.7	35.0	41.8	45.6
	105	21.7	24.6	26.8	31.9	32.4	36.4	40.3	47.3
	110	20.9	25.4	25.8	33.0	31.2	37.6	38.8	48.9
	120	19.3	26.8	23.8	34.9	28.8	39.8	35.8	51.8
	130	17.7	28.1	21.8	36.5	26.5	41.7	32.8	54.3
	140	16.1	29.1	19.9	37.8	24.1	43.3	29.9	56.3
	145	15.3	29.5	18.9	38.3	23.0	44.0	28.5	57.2
40	80	31.9	19.7	39.2	25.6	47.5	29.0	58.9	37.8
	90	30.0	22.4	36.9	29.1	44.6	33.0	55.4	43.0
	100	28.0	24.8	34.5	32.2	41.8	36.7	51.9	47.7
	105	27.1	25.9	33.3	33.7	40.4	38.4	50.1	50.0
	110	26.1	27.0	32.2	35.1	39.0	40.1	48.4	52.1
	120	24.2	29.0	29.9	37.7	36.2	43.1	44.9	56.0
	130	22.4	30.8	27.6	40.0	33.4	45.8	41.5	59.5
	140	20.5	32.3	25.3	42.0	30.7	48.1	38.1	62.6
145	19.6	33.0	24.2	42.8	29.3	49.1	36.4	63.9	

UNIT		5H40		5H46		5H60		5H66	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
42	80	33.2	19.6	40.8	25.5	49.4	28.9	61.3	37.6
	90	31.2	22.4	38.4	29.1	46.5	33.1	57.7	43.0
	100	29.2	24.9	36.0	32.4	43.6	36.9	54.1	48.0
	105	28.3	26.1	34.8	34.0	42.1	38.7	52.3	50.4
	110	27.3	27.3	33.6	35.5	40.7	40.5	50.5	52.6
	120	25.3	29.4	31.2	38.2	37.8	43.6	46.9	56.8
	130	23.4	31.2	28.8	40.6	34.9	46.5	43.4	60.5
	140	21.5	32.9	26.5	42.7	32.1	49.0	39.8	63.7
44	80	34.6	19.5	42.5	25.3	51.4	28.7	63.8	37.4
	90	32.5	22.4	40.0	29.1	49.4	33.1	60.1	43.0
	100	30.5	25.1	37.5	32.6	45.4	37.1	56.4	48.3
	105	29.5	26.3	36.3	34.2	43.9	39.0	54.5	50.7
	110	28.5	27.5	35.0	35.8	42.4	40.8	52.7	53.1
	120	26.4	29.7	32.6	38.7	39.5	44.2	49.0	57.5
	130	24.4	31.7	30.1	41.2	36.5	47.2	45.3	61.4
	140	22.5	33.5	27.7	43.5	33.6	49.9	41.7	64.9
45	80	35.3	19.4	43.3	25.2	52.4	28.6	65.1	37.2
	90	33.2	22.4	40.8	29.1	49.4	33.1	61.3	43.0
	100	31.1	25.1	38.3	32.6	46.3	37.2	57.5	48.4
	105	30.1	26.4	37.0	34.3	44.8	39.1	55.6	50.9
	110	29.1	27.6	35.8	35.9	43.3	41.0	53.8	53.3
	120	27.0	29.9	33.3	38.9	40.3	44.4	50.0	57.8
	130	25.0	31.9	30.8	41.5	37.3	47.5	46.3	61.9
	140	23.0	33.7	28.3	43.9	34.3	50.3	42.6	65.4
46	80	36.0	19.3	44.2	25.1	53.5	28.5	66.4	37.1
	90	33.9	22.4	41.6	29.1	50.4	33.0	62.5	43.0
	100	31.8	25.2	39.1	32.7	47.3	37.3	58.7	48.5
	105	30.7	26.5	37.8	34.4	45.8	39.2	56.8	51.1
	110	29.7	27.7	36.5	36.1	44.2	41.1	54.9	53.5
	120	27.6	30.1	34.0	39.1	41.2	44.7	51.1	58.1
	130	25.5	32.2	31.5	41.8	38.1	47.9	47.3	62.3
	140	23.5	34.0	29.0	44.2	35.1	50.7	43.6	66.0
48	80	37.4	19.1	46.0	24.8	55.6	28.2	69.0	36.7
	90	35.2	22.3	43.3	29.0	52.4	32.9	65.1	42.9
	100	33.1	25.2	40.7	32.8	49.2	37.4	61.1	48.6
	105	32.0	26.6	39.4	34.6	47.7	39.4	59.1	51.3
	110	30.9	27.9	38.0	36.3	46.1	41.4	57.2	53.9
	120	28.8	30.4	35.4	39.5	42.9	45.2	53.3	58.8
	130	26.7	32.6	32.8	42.4	39.8	48.5	49.4	63.1
	140	24.6	34.6	30.3	44.9	36.7	51.5	45.5	67.1
50	80	38.9	18.9	47.8	24.5	57.8	27.9	71.7	36.3
	90	36.6	22.2	45.0	28.8	54.5	32.8	67.7	42.7
	100	34.4	25.3	42.3	32.8	51.2	37.4	63.6	48.7
	105	33.3	26.7	41.0	34.7	49.6	39.6	61.6	51.5
	110	32.2	28.1	39.6	36.5	48.0	41.7	59.5	54.2
	120	30.0	30.7	36.9	39.9	44.7	45.6	55.5	59.3
	130	27.8	33.0	34.3	42.9	41.5	49.1	51.5	63.9
	140	25.7	35.1	31.6	45.6	38.3	52.3	47.6	68.1
145	24.6	36.1	30.3	46.9	36.7	53.8	45.6	70.0	

LEGEND

- Bhp** — Brake Horsepower
- Cap.** — Capacity (Tons)
- SDT** — Saturated Discharge Temperature (F)
- SST** — Saturated Suction Temperature (F)

NOTES:

1. Shaded ratings require an oil cooler when using a liquid-suction interchanger, or when 50 degrees of superheat is exceeded.
2. An oil cooler is recommended for all long stroke compressors (5H46,66,86 and 126).
3. Refer to Table 5 for Total Heat Rejection.



**Table 8 — Compressor Ratings; R-12 (cont)**

UNIT		5H80		5H86		5H120		5H126	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	80	6.6	17.5	8.2	22.8	9.8	25.8	12.2	33.4
	90	5.6	17.0	7.0	22.1	8.3	24.9	10.3	32.4
	100	4.6	16.2	5.8	21.1	6.9	23.7	8.6	30.8
-30	80	9.8	21.3	12.2	27.7	14.7	31.5	18.3	40.9
	90	8.8	21.1	10.8	27.5	12.9	31.3	16.0	40.6
	100	7.5	20.7	9.3	27.0	11.2	30.6	13.9	39.7
	105	6.9	20.4	8.6	26.5	10.3	30.1	12.8	39.1
	110	6.4	20.0	8.0	26.0	9.5	29.5	11.8	38.3
-20	80	13.9	25.2	17.3	32.7	20.9	37.3	25.9	48.4
	90	12.5	25.4	15.5	33.1	18.7	37.8	23.3	49.0
	100	11.1	25.4	13.8	33.1	16.6	37.7	20.6	49.0
	105	10.4	25.3	13.0	33.0	15.6	37.6	19.3	48.8
	110	9.7	25.2	12.1	32.8	14.6	37.3	18.1	48.5
-10	80	19.0	28.9	23.6	37.6	28.5	43.0	35.4	55.7
	90	17.3	29.7	21.5	38.7	25.9	44.2	32.2	57.2
	100	15.6	30.3	19.4	39.4	23.4	45.0	29.0	58.5
	105	14.8	30.4	18.4	39.6	22.1	45.2	27.5	58.8
	110	13.9	30.5	17.3	39.7	20.9	45.3	25.9	58.9
0	80	25.1	32.3	31.2	42.0	37.7	48.1	46.8	62.4
	90	23.1	33.8	28.7	44.0	34.6	50.4	43.0	65.4
	100	21.1	35.0	26.2	45.5	31.6	52.1	39.2	67.7
	105	20.1	35.5	25.0	46.1	30.1	52.8	37.4	68.6
	110	19.1	35.8	23.7	46.6	28.7	53.4	35.6	69.4
10	80	32.5	35.3	40.3	45.8	48.8	52.5	60.5	68.1
	90	30.1	37.5	37.3	48.8	45.1	55.9	56.0	72.5
	100	27.7	39.4	34.4	51.3	41.6	58.8	51.6	76.3
	105	26.5	40.3	32.9	52.4	39.8	60.0	49.4	78.0
	110	25.3	41.0	31.5	53.3	38.0	61.1	47.2	79.4
20	80	41.2	37.5	51.1	48.7	61.8	55.8	76.7	72.3
	90	38.4	40.6	47.6	52.8	60.5	71.5	78.5	
	100	35.6	43.4	44.2	56.4	53.4	64.7	66.3	84.0
	105	34.2	44.6	42.4	58.0	51.3	66.6	63.7	86.4
	110	32.8	45.8	40.7	59.5	49.3	68.3	61.1	88.7
30	80	51.4	38.7	63.8	50.3	77.2	57.5	95.8	74.7
	90	48.1	42.8	59.7	55.7	72.3	63.8	89.7	82.8
	100	44.9	46.6	55.7	60.6	67.4	69.5	83.6	90.2
	105	43.2	48.3	53.7	62.9	64.9	72.1	80.6	93.6
	110	41.6	50.0	51.7	65.0	62.5	74.6	77.6	96.8
40	80	63.3	38.6	78.5	50.3	95.1	57.4	117.9	74.7
	90	59.5	43.9	73.8	57.2	89.4	65.4	110.9	85.0
	100	55.7	48.8	69.1	63.5	83.7	72.8	103.8	94.5
	105	53.8	51.1	66.8	66.5	80.8	76.2	100.3	99.0
	110	52.0	53.3	64.5	69.3	78.0	79.5	96.8	103.2

UNIT		5H80		5H86		5H120		5H126	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
42	80	65.9	38.5	81.8	50.0	99.0	57.1	122.8	74.3
	90	62.0	44.0	76.9	57.3	93.1	65.5	115.5	85.1
	100	58.1	49.1	72.1	63.9	87.2	73.2	108.2	95.1
	105	56.2	51.5	69.7	67.0	84.3	76.8	104.6	99.8
	110	54.2	53.8	67.3	70.0	81.4	80.3	101.0	104.2
	120	50.4	58.0	62.5	75.4	75.6	86.6	93.9	112.5
	130	46.6	61.8	57.8	80.3	69.9	92.3	86.8	119.9
	140	42.8	65.0	53.1	84.6	64.3	97.2	79.7	126.4
44	80	68.6	38.2	85.1	49.7	103.0	56.7	127.8	73.9
	90	64.6	44.0	80.1	57.3	96.9	65.5	120.3	85.2
	100	60.6	49.4	75.1	64.2	90.9	73.6	112.8	95.6
	105	58.0	51.9	72.6	67.5	87.9	77.4	109.1	100.5
	110	56.6	54.3	70.2	70.6	84.9	81.0	105.4	105.2
	120	52.6	58.7	65.3	76.4	79.0	87.7	98.0	113.9
	130	48.7	62.7	60.4	81.6	73.1	93.7	90.7	121.7
	140	44.8	66.2	55.6	86.1	67.2	99.0	83.4	128.6
45	80	70.0	38.1	86.8	49.5	105.0	56.5	130.3	73.6
	90	65.9	44.0	81.7	57.2	98.9	65.5	122.7	85.1
	100	61.8	49.5	76.7	64.4	92.8	73.7	115.1	95.8
	105	59.8	52.1	74.2	67.7	89.7	77.6	111.3	100.8
	110	57.8	54.5	71.7	70.9	86.7	81.3	107.6	105.6
	120	53.7	59.1	66.7	76.8	80.7	88.2	100.1	114.6
	130	49.7	63.2	61.7	82.2	74.7	94.4	92.7	122.6
	140	45.8	66.8	56.8	86.9	68.7	99.8	85.3	129.7
46	80	71.4	37.9	88.5	49.3	107.1	56.3	132.9	73.3
	90	67.2	44.0	83.4	57.2	100.9	65.4	125.2	85.1
	100	63.1	49.6	78.2	64.5	94.7	73.9	117.5	96.0
	105	61.0	52.2	75.7	67.9	91.6	77.8	113.7	101.1
	110	59.0	54.7	73.2	71.2	88.5	81.6	109.8	106.0
	120	54.9	59.4	68.1	77.3	82.4	88.7	102.2	115.2
	130	50.8	63.6	63.1	82.7	76.3	95.1	94.7	123.5
	140	46.8	67.3	58.1	87.6	70.3	100.7	87.2	130.8
48	80	74.2	37.5	92.0	48.8	111.4	55.7	138.1	72.6
	90	69.9	43.8	86.7	57.0	105.0	65.2	130.2	84.8
	100	65.7	49.7	81.5	64.7	98.6	74.1	122.3	96.3
	105	63.5	52.5	78.8	68.3	95.4	78.2	118.4	101.6
	110	61.4	55.1	76.2	71.7	92.2	82.2	114.4	106.8
	120	57.2	60.0	71.0	78.1	85.9	89.6	106.6	116.4
	130	53.1	64.5	65.8	83.9	79.7	96.4	98.8	125.2
	140	48.9	68.4	60.7	89.0	73.4	102.3	91.1	133.0
50	80	77.1	37.0	95.6	48.2	115.7	55.0	143.6	71.7
	90	72.7	43.6	90.2	56.8	109.1	64.9	135.4	84.5
	100	68.3	49.8	84.8	64.8	102.6	74.2	127.3	96.4
	105	66.2	52.7	82.1	68.5	99.3	78.5	123.2	102.0
	110	64.0	55.4	79.4	72.1	96.1	82.7	119.2	107.4
	120	59.6	60.6	74.0	78.8	89.6	90.5	111.1	117.6
	130	55.3	65.3	68.7	84.9	83.1	97.6	103.1	126.8
	140	51.1	69.5	63.4	90.4	76.7	103.9	95.2	135.0

**LEGEND**

- Bhp** — Brake Horsepower
- Cap.** — Capacity (Tons)
- SDT** — Saturated Discharge Temperature (F)
- SST** — Saturated Suction Temperature (F)

**NOTES:**

1. Shaded ratings require an oil cooler when using a liquid-suction interchanger, or when 50 degrees of superheat is exceeded.
2. An oil cooler is recommended for all long stroke compressors (5H46,66,86 and 126).
3. Refer to Table 5 for Total Heat Rejection.

**Table 9 — Compressor Ratings; R-22**

UNIT		5F20		5F30		5F40		5F60	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	80	1.0	2.6	1.5	4.0	2.1	5.3	3.0	7.9
-30	80	1.5	3.4	2.3	5.1	3.1	6.7	4.6	10.0
	90	1.3	3.3	2.0	5.0	2.7	6.7	4.1	10.0
-20	80	2.2	4.1	3.3	6.1	4.4	8.0	6.6	12.1
	90	1.9	4.2	3.0	6.2	4.0	8.3	6.0	12.4
	100	1.7	4.2	2.6	6.3	3.5	8.4	5.3	12.4
	105	1.6	4.2	2.5	6.2	3.3	8.4	4.9	12.4
	110	1.5	4.1	2.3	6.2	3.1	8.4	4.6	12.3
-10	80	3.0	4.7	4.6	7.1	6.1	9.3	9.2	14.1
	90	2.7	4.9	4.2	7.4	5.5	9.8	8.3	14.7
	100	2.5	5.1	3.8	7.6	5.0	10.1	7.5	15.1
	105	2.3	5.1	3.5	7.6	4.7	10.3	7.1	15.2
	110	2.2	5.1	3.3	7.7	4.5	10.4	6.7	15.3
0	80	4.0	5.3	6.1	7.9	8.1	10.4	12.2	15.8
	90	3.7	5.6	5.6	8.4	7.5	11.1	11.2	16.8
	100	3.4	5.9	5.1	8.8	6.8	11.7	10.2	17.6
	105	3.2	6.0	4.9	9.0	6.5	12.0	9.7	17.9
	110	3.0	6.1	4.6	9.1	6.2	12.2	9.3	18.1
10	80	5.3	5.8	8.0	8.6	10.6	11.3	15.9	17.1
	90	4.9	6.2	7.4	9.3	9.8	12.3	14.7	18.6
	100	4.5	6.7	6.8	10.0	9.0	13.2	13.6	19.8
	105	4.3	6.9	6.5	10.2	8.6	13.6	13.0	20.3
	110	4.1	7.0	6.2	10.5	8.3	13.9	12.4	20.8
20	80	6.8	6.0	10.2	9.1	13.6	11.9	20.4	17.9
	90	6.3	6.7	9.5	10.0	12.6	13.2	19.0	19.9
	100	5.8	7.3	8.8	10.9	11.7	14.4	17.6	21.6
	105	5.6	7.6	8.5	11.3	11.2	14.9	16.9	22.4
	110	5.4	7.8	8.1	11.6	10.8	15.5	16.2	23.2
30	80	8.5	6.1	12.8	9.2	17.1	12.1	25.6	18.1
	90	8.0	7.0	12.0	10.5	16.0	13.8	24.0	20.6
	100	7.4	7.8	11.2	11.6	14.9	15.3	22.3	23.0
	105	7.1	8.1	10.8	12.1	14.3	16.0	21.5	24.1
	110	6.9	8.5	10.4	12.6	13.8	16.7	20.7	25.1
40	80	10.6	6.0	15.9	9.1	21.2	12.0	31.8	17.4
	90	9.9	7.0	14.9	10.6	19.9	14.0	29.9	20.6
	100	9.3	8.0	14.0	12.0	18.6	15.9	28.0	23.6
	105	9.0	8.5	13.5	12.7	18.0	16.8	27.0	25.0
	110	8.7	8.9	13.0	13.3	17.3	17.7	26.1	26.4
50	80	13.0	5.6	19.4	8.5	26.1	11.4	39.0	15.8
	90	12.2	6.8	18.3	10.3	24.5	13.8	36.8	19.8
	100	11.5	8.0	17.2	12.0	23.0	16.0	34.5	23.5
	105	11.1	8.6	16.7	12.9	22.3	17.1	33.4	25.2
	110	10.7	9.2	16.2	13.7	21.5	18.2	32.3	26.9
60	80	16.0	4.5	24.0	6.5	32.0	8.5	48.0	11.5
	90	15.0	5.5	22.5	7.5	30.0	9.5	45.0	13.5
	100	14.0	6.5	21.0	8.5	28.0	10.5	42.0	15.5
	105	13.5	7.0	20.5	9.0	27.0	11.0	40.5	17.0
	110	13.0	7.5	20.0	9.5	26.0	11.5	39.0	18.5

UNIT		5F20		5F30		5F40		5F60	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
42	80	11.0	5.9	16.5	9.0	22.1	11.9	33.2	17.2
	90	10.4	7.0	15.6	10.5	20.8	14.0	31.2	20.5
	100	9.7	8.0	14.6	12.0	19.4	15.9	29.2	23.7
	105	9.4	8.5	14.1	12.7	18.8	16.9	28.2	25.1
	110	9.0	9.0	13.6	13.4	18.1	17.8	27.2	26.5
	120	8.4	9.9	12.7	14.7	16.8	19.5	25.3	29.2
	135	7.4	11.0	11.2	16.4	14.9	21.9	22.4	32.6
44	80	11.5	5.9	17.2	8.9	23.1	11.8	34.6	16.9
	90	10.8	7.0	16.2	10.5	21.7	14.0	32.5	20.4
	100	10.1	8.1	15.2	12.0	20.3	16.0	30.5	23.7
	105	9.8	8.6	14.7	12.8	19.6	17.0	29.5	25.2
	110	9.5	9.0	14.2	13.5	18.9	17.9	28.4	26.7
	120	8.8	10.0	13.2	14.8	17.6	19.7	26.4	29.4
	135	8.1	10.8	12.2	16.1	16.2	21.4	24.4	32.0
45	80	11.7	5.8	17.6	8.8	23.5	11.8	35.3	16.8
	90	11.1	7.0	16.6	10.5	22.1	13.9	33.2	20.3
	100	10.4	8.1	15.6	12.1	20.7	16.0	31.1	23.7
	105	10.0	8.6	15.0	12.8	20.0	17.0	30.1	25.2
	110	9.7	9.1	14.5	13.5	19.3	18.0	29.1	26.7
	120	9.0	10.0	13.5	14.9	18.0	19.8	27.0	29.6
	135	8.3	10.9	12.5	16.2	16.6	21.6	25.0	32.2
46	80	12.0	5.8	17.9	8.8	24.0	11.7	36.0	16.6
	90	11.3	7.0	16.9	10.5	22.6	13.9	33.9	20.2
	100	10.6	8.1	15.9	12.1	21.2	16.0	31.8	23.6
	105	10.2	8.6	15.4	12.8	20.5	17.0	30.7	25.2
	110	9.9	9.1	14.9	13.6	19.8	18.0	29.7	26.8
	120	9.2	10.1	13.8	15.0	18.4	19.9	27.6	29.7
	135	8.5	10.9	12.8	16.3	17.0	21.7	25.5	32.3
48	80	12.5	5.7	18.7	8.6	25.0	11.6	37.5	16.2
	90	11.8	6.9	17.6	10.4	23.5	13.9	35.3	20.0
	100	11.0	8.0	16.6	12.1	22.1	16.0	33.1	23.6
	105	10.7	8.6	16.0	12.9	21.3	17.1	32.1	25.2
	110	10.3	9.1	15.5	13.6	20.6	18.1	31.0	29.9
	120	9.6	10.1	14.4	15.1	19.2	20.1	28.8	29.9
	135	8.9	11.1	13.4	16.4	17.8	21.9	26.7	32.7
50	80	13.0	5.6	19.4	8.5	26.1	11.4	39.0	15.8
	90	12.2	6.8	18.3	10.3	24.5	13.8	36.8	19.8
	100	11.5	8.0	17.2	12.0	23.0	16.0	34.5	23.5
	105	11.1	8.6	16.7	12.9	22.3	17.1	33.4	25.2
	110	10.7	9.2	16.2	13.7	21.5	18.2	32.3	26.9
	120	10.0	10.2	15.1	15.2	20.0	20.2	30.1	30.1
	135	9.3	11.2	14.0	16.6	18.5	22.2	27.9	33.0

**LEGEND**

- Bhp** — Brake Horsepower
- Cap.** — Capacity (Tons)
- SDT** — Saturated Discharge Temperature (F)
- SST** — Saturated Suction Temperature (F)

**NOTES:**

1. Shaded ratings require an oil cooler and water-cooled heads.
2. Refer to Table 5 for Total Heat Rejection.

**Table 9 — Compressor Ratings; R-22 (cont)**

UNIT		5H40		5H46		5H60		5H66	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	80	5.0	12.8	6.2	16.7	7.6	18.7	9.4	24.4
-30	80	7.5	15.9	9.3	20.6	11.4	23.3	14.1	30.4
	90	6.6	15.7	8.3	20.5	10.0	23.2	12.5	30.2
-20	80	10.7	18.9	13.3	24.6	16.1	28.0	20.0	36.4
	90	9.7	19.2	12.0	24.9	14.5	28.4	18.1	36.9
	100	8.6	19.2	20.7	24.9	13.0	28.4	16.1	37.0
	105	8.1	19.1	10.0	24.8	12.2	28.3	15.2	36.9
	110	7.5	18.9	9.4	24.6	11.4	28.1	14.2	36.6
-10	80	14.7	21.9	18.1	28.5	22.0	32.4	27.3	42.2
	90	13.4	22.6	16.5	29.4	20.1	33.5	25.0	43.6
	100	12.1	23.0	15.0	29.9	18.2	34.2	22.6	44.5
	105	11.5	23.2	14.2	30.1	17.3	34.4	21.5	44.8
	110	10.9	23.2	13.5	30.2	16.4	34.5	20.3	45.0
0	80	19.5	24.6	24.1	32.0	29.2	36.5	36.2	47.5
	90	18.0	25.8	22.2	33.6	26.9	38.4	33.4	49.9
	100	16.4	26.8	20.3	34.8	24.7	39.9	30.6	51.9
	105	15.7	27.2	19.4	35.3	23.5	40.4	29.2	52.6
	110	14.9	27.5	18.5	35.7	22.4	40.9	27.9	53.3
10	80	25.3	26.9	31.2	35.0	37.8	39.9	46.9	52.0
	90	23.5	28.8	29.0	37.4	35.1	42.7	43.6	55.6
	100	21.7	30.3	26.7	39.4	32.5	45.1	40.3	58.7
	105	20.8	31.0	25.6	40.3	31.1	46.1	38.6	60.0
	110	19.9	31.6	24.6	41.0	29.8	47.1	37.0	61.2
20	80	32.3	28.6	39.7	37.2	48.1	42.5	59.7	55.3
	90	30.1	31.2	37.1	40.5	44.9	46.4	55.8	60.3
	100	28.0	33.4	34.5	43.4	41.8	49.8	51.9	64.7
	105	26.9	34.4	33.2	44.7	40.2	51.3	49.9	66.7
	110	25.8	35.3	31.9	45.9	38.7	52.7	48.0	68.6
30	80	40.4	29.5	49.8	38.4	60.2	43.9	74.8	57.1
	90	37.9	32.9	46.7	42.7	56.5	48.9	70.2	63.7
	100	35.4	35.9	43.6	46.7	52.9	53.5	65.6	69.6
	105	34.2	37.3	42.1	48.5	51.0	55.6	63.3	72.4
	110	32.9	38.6	40.6	50.2	49.2	57.6	61.0	74.9
40	80	50.1	29.5	61.6	38.3	74.5	43.8	92.5	57.0
	90	47.1	33.7	58.0	43.8	70.2	50.2	87.1	65.3
	100	44.2	37.6	54.4	48.9	65.9	56.1	81.7	73.0
	105	42.7	39.4	52.6	51.2	63.7	58.8	79.1	76.5
	110	41.3	41.1	50.8	53.5	61.6	61.4	76.4	80.0
50	80	38.4	44.3	47.3	57.6	57.3	66.3	71.1	86.3
	90	35.5	47.2	43.7	61.3	53.0	70.6	65.8	91.9
	100	34.0	48.5	42.0	63.0	50.9	72.6	63.2	94.4

UNIT		5H40		5H46		5H60		5H66	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
42	80	52.2	29.3	64.1	38.1	77.6	43.6	96.3	56.7
	90	49.1	33.7	60.4	43.8	73.2	50.2	90.8	65.4
	100	46.1	37.8	56.7	49.2	68.7	56.4	85.3	73.4
	105	44.6	39.7	54.9	51.7	66.5	59.3	82.5	77.2
	110	43.1	41.6	53.1	54.0	64.3	62.1	79.8	80.8
	120	40.1	44.9	49.4	58.4	59.9	67.2	74.3	87.4
	130	37.1	47.9	45.7	62.3	55.5	71.8	68.8	93.4
44	80	54.3	29.1	66.8	37.8	80.8	43.3	100.3	56.3
	90	51.2	33.7	63.0	43.8	76.2	50.2	94.6	65.4
	100	48.1	38.0	59.2	49.4	71.7	56.7	88.9	73.8
	105	46.6	40.0	57.3	52.0	69.4	59.7	86.1	77.7
	110	45.0	41.9	55.4	54.5	67.1	62.6	83.3	81.5
	120	41.9	45.5	51.6	59.1	62.5	68.0	77.6	88.5
	130	38.8	48.7	47.8	63.3	58.0	72.9	72.0	94.8
45	80	55.4	29.0	68.2	37.6	82.5	43.1	102.4	56.1
	90	52.3	33.7	64.3	43.8	77.8	50.2	96.6	65.3
	100	49.1	38.1	60.4	49.5	73.2	56.8	90.8	73.9
	105	47.5	40.1	58.5	52.2	70.9	59.9	87.9	78.0
	110	46.0	42.1	56.6	54.7	68.5	62.9	85.0	81.8
	120	42.8	45.7	52.7	59.5	63.9	68.4	79.3	89.0
	130	39.7	49.0	48.9	63.7	59.3	73.4	73.6	95.5
46	80	56.6	28.8	69.5	37.4	84.1	42.9	104.5	55.8
	90	53.4	33.7	65.6	43.7	79.4	50.2	98.6	65.3
	100	50.2	38.1	61.7	49.6	74.7	56.9	92.7	74.1
	105	48.6	40.2	59.7	52.3	72.3	60.1	89.8	78.2
	110	47.0	42.3	57.8	54.9	70.0	63.1	86.9	82.1
	120	43.8	46.0	53.9	59.8	65.3	68.8	81.0	89.5
	130	40.6	49.4	50.0	64.2	60.6	73.9	75.2	96.2
48	80	58.9	28.5	72.4	37.0	87.6	42.4	108.7	55.3
	90	55.6	33.6	68.3	43.6	82.7	50.0	102.6	65.1
	100	52.3	38.2	64.3	49.7	77.8	57.0	96.6	74.3
	105	50.6	40.4	62.3	52.6	75.4	60.4	93.6	78.6
	110	49.0	42.5	60.2	55.3	73.0	63.6	90.6	82.7
	120	45.7	46.5	56.2	60.4	68.1	69.5	84.5	90.5
	130	42.4	50.1	52.2	65.1	63.3	74.9	78.5	97.5
50	80	61.3	28.2	75.3	36.5	91.1	41.9	113.1	54.6
	90	57.8	33.4	71.1	43.4	86.1	49.8	106.8	64.8
	100	54.4	38.3	67.0	49.8	81.1	57.1	100.6	74.4
	105	52.7	40.6	64.9	52.8	78.6	60.6	97.5	78.9
	110	51.0	42.8	62.8	55.6	76.0	63.9	94.4	83.2
	120	47.6	46.9	58.6	61.0	71.0	70.2	88.2	91.4
	130	44.3	50.7	54.5	65.9	66.1	75.9	82.0	98.8

**LEGEND**

- Bhp** — Brake Horsepower
- Cap.** — Capacity (Tons)
- SDT** — Saturated Discharge Temperature (F)
- SST** — Saturated Suction Temperature (F)

**NOTES:**

1. Shaded ratings require an oil cooler and water-cooled heads.
2. An oil cooler is recommended for all long stroke compressors (5H46,66,86 and 126).
3. Refer to Table 5 for Total Heat Rejection.

**Table 9 — Compressor Ratings; R-22 (cont)**

UNIT		5H80		5H86		5H120		5H126	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	80	10.2	24.9	12.7	32.5	15.2	36.9	18.9	48.0
	90	15.2	31.0	18.9	40.3	22.8	46.1	28.3	59.9
-30	80	13.5	30.8	16.8	40.1	20.1	45.7	25.0	59.5
	90	17.3	37.7	21.6	49.1	26.0	56.1	32.2	73.1
-20	80	21.5	37.1	26.8	48.3	32.3	55.3	40.1	71.9
	90	19.4	37.6	24.1	49.0	29.1	56.1	36.1	72.9
	100	17.3	37.7	21.6	49.1	26.0	56.1	32.2	73.1
	105	16.3	37.6	20.3	48.9	24.4	55.9	30.3	72.8
	110	15.3	37.3	19.1	48.6	22.9	55.5	28.4	72.3
-10	80	29.3	43.0	36.5	56.0	44.0	64.2	54.7	83.4
	90	26.8	44.4	33.3	57.8	40.2	66.3	49.9	86.2
	100	24.3	45.4	30.2	59.0	36.5	67.7	45.3	88.1
	105	23.1	45.6	28.7	59.4	34.6	68.1	42.9	88.6
	110	21.9	45.8	27.2	59.6	32.8	68.3	40.7	88.9
	120	19.5	45.7	24.2	59.5	29.1	68.1	36.2	88.7
0	80	38.9	48.5	48.3	63.0	58.4	72.4	72.4	93.9
	90	35.9	50.9	44.6	66.2	53.8	76.1	66.8	98.8
	100	32.9	52.9	40.9	68.8	49.3	79.0	61.2	102.7
	105	31.4	53.6	39.0	69.8	47.1	80.1	58.5	104.2
	110	29.9	54.3	37.2	70.6	44.9	81.0	55.7	105.4
	120	27.0	55.1	33.6	71.7	40.5	82.3	50.3	107.2
10	80	50.4	53.1	62.5	69.0	75.7	79.3	93.9	102.9
	90	46.8	56.8	58.1	73.8	70.3	84.8	87.2	110.1
	100	43.3	59.9	53.7	77.9	64.9	89.5	80.6	116.3
	105	41.5	61.2	51.5	79.6	62.3	91.5	77.3	119.0
	110	39.8	62.4	49.4	81.2	59.7	93.3	74.0	121.3
	120	36.3	64.4	45.1	83.8	54.4	96.2	67.6	125.2
20	80	64.1	56.5	79.6	73.5	96.3	84.4	119.4	109.6
	90	59.9	61.6	74.3	80.1	89.9	92.0	111.6	119.5
	100	55.7	66.1	69.1	86.0	83.6	98.8	103.8	128.3
	105	53.6	68.1	66.6	88.6	80.5	101.8	99.9	132.3
	110	51.5	70.0	64.0	91.0	77.4	104.6	96.0	136.0
	120	47.4	73.2	58.9	95.2	71.2	109.5	88.3	142.4
	130	43.3	75.8	53.9	98.7	65.1	113.4	80.7	147.6
135	41.3	76.9	51.4	100.0	62.0	115.0	77.0	149.7	
30	80	80.3	58.4	99.7	76.0	120.6	87.1	149.6	113.2
	90	75.4	65.1	93.5	84.7	113.2	97.2	140.4	126.3
	100	70.5	71.1	87.4	92.5	105.8	106.3	131.3	138.1
	105	68.0	73.9	84.4	96.1	102.1	110.5	126.7	143.5
	110	65.6	76.5	81.4	99.5	98.4	114.4	122.1	148.7
	120	60.7	81.2	75.3	105.7	91.1	121.5	113.1	158.0
	130	55.9	85.3	69.4	110.9	83.9	127.6	104.1	166.0
	135	53.5	87.0	66.4	113.2	80.3	130.3	99.6	169.5
40	80	99.4	58.2	123.2	75.8	149.2	86.8	185.1	113.0
	90	93.6	66.7	116.1	86.9	140.5	99.6	174.3	129.5
	100	87.8	74.6	109.0	97.0	131.9	111.4	163.6	144.8
	105	84.9	78.2	105.4	101.7	127.5	116.9	158.2	151.9
	110	82.1	81.7	101.8	106.2	123.2	122.1	152.9	158.7
	120	76.4	88.1	94.8	114.6	114.6	131.7	142.2	171.2
	130	70.7	93.7	87.7	121.9	106.1	140.3	131.6	182.4
	135	67.8	96.3	84.2	125.3	101.8	144.2	126.4	187.5

UNIT		5H80		5H86		5H120		5H126	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
42	80	103.5	57.9	128.4	75.4	155.4	86.3	192.8	112.5
	90	97.6	66.8	121.0	87.0	146.5	99.7	181.7	129.7
	100	91.6	75.0	113.7	97.6	137.6	112.0	170.7	145.7
	110	85.7	82.5	106.3	107.3	128.7	123.3	159.7	160.3
	120	79.8	89.3	99.0	116.1	119.8	133.5	148.7	173.5
	130	73.9	95.3	91.8	124.0	111.0	142.6	137.7	185.4
	135	71.0	98.0	88.1	127.5	106.6	146.7	132.3	190.8
	44	80	107.8	57.5	133.7	74.9	161.9	85.6	200.8
90		101.7	66.8	126.1	87.0	152.7	99.6	189.4	129.7
100		95.6	75.4	118.6	98.1	143.5	112.6	178.0	146.4
105		92.5	79.4	114.8	103.3	138.9	118.6	172.3	154.2
110		89.5	83.2	111.0	108.3	134.3	124.4	166.6	161.7
120		83.4	90.4	103.4	117.6	125.2	135.2	155.3	175.7
130		77.3	96.8	95.9	125.9	116.1	144.8	144.0	188.3
135		74.3	99.7	92.2	129.7	115.5	149.2	138.4	194.0
45	80	110.0	57.3	136.5	74.6	165.2	85.3	204.9	111.2
	90	103.8	66.8	128.7	86.9	155.8	99.6	193.3	129.6
	100	97.6	75.5	121.0	98.3	146.5	112.8	181.8	146.7
	105	94.5	79.7	117.2	103.6	141.8	119.0	176.0	154.7
	110	91.4	83.6	113.4	108.7	137.2	124.9	170.2	162.4
	120	85.2	90.9	105.7	118.3	127.9	136.0	158.7	176.7
	130	79.0	97.5	98.1	126.8	118.6	145.9	147.2	189.7
135	76.0	100.5	94.3	130.7	114.0	150.4	141.5	195.6	
46	80	112.3	57.0	139.2	74.3	168.5	84.8	209.1	110.7
	90	105.9	66.7	131.4	86.8	159.0	99.4	197.3	129.5
	100	99.6	75.7	123.6	98.5	149.6	113.0	185.6	147.0
	105	96.5	79.9	119.7	103.9	144.8	119.3	179.7	155.2
	110	93.3	83.9	115.8	109.2	140.1	125.4	173.8	163.1
	120	87.0	91.4	108.0	118.9	130.7	136.7	162.1	177.8
	130	80.8	98.2	100.2	127.7	121.3	146.9	150.5	191.0
	135	77.7	101.3	96.4	131.8	116.6	151.6	144.7	197.1
48	80	116.8	56.4	144.9	73.4	175.4	83.9	217.6	109.6
	90	110.3	66.5	136.8	86.6	165.6	99.1	205.4	129.1
	100	103.8	75.9	128.8	98.7	155.8	113.2	193.3	147.4
	105	100.5	80.3	124.7	104.5	151.0	119.9	187.3	156.0
	110	97.3	84.5	120.7	109.9	146.1	126.3	181.2	164.2
	120	90.8	92.4	112.7	120.2	136.4	138.2	169.2	179.6
	130	84.4	99.5	104.7	129.5	126.7	149.0	157.1	193.7
135	81.1	102.8	100.7	133.8	121.8	153.9	151.1	200.1	
50	80	121.5	55.6	150.7	72.5	182.4	82.7	226.3	108.2
	90	114.8	66.2	142.4	86.2	172.4	98.6	213.8	128.5
	100	108.1	76.0	134.1	98.9	162.3	113.4	201.3	147.6
	105	104.8	80.6	129.9	104.9	157.3	120.3	195.1	156.6
	110	101.4	85.0	125.8	110.6	152.2	127.0	188.9	165.2
	120	94.7	93.3	117.5	121.4	142.2	139.5	176.4	181.4
	130	88.1	100.8	109.3	131.2	132.2	150.9	164.0	196.1
135	84.7	104.3	105.2	135.7	127.2	156.1	157.8	203.8	

**LEGEND**

- Bhp** — Brake Horsepower
- Cap.** — Capacity (Tons)
- SDT** — Saturated Discharge Temperature (F)
- SST** — Saturated Suction Temperature (F)

**NOTES:**

1. Shaded ratings require an oil cooler and water-cooled heads.
2. An oil cooler is recommended for all long stroke compressors (5H46,66,86 and 126).
3. Refer to Table 5 for Total Heat Rejection.

**Table 10 — Compressor Ratings; R-502**

UNIT		5F20		5F30		5F40		5F60	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-60	80	0.4	1.6	0.6	2.5	0.9	3.4	1.3	5.1
-50	80	0.8	2.4	1.2	3.7	1.6	5.0	2.4	7.3
	90	0.6	2.2	0.9	3.4	1.3	4.7	1.9	6.8
	100	0.5	2.0	0.7	3.0	1.1	4.4	1.5	6.2
	105	0.4	1.8	0.6	2.8	0.9	4.1	1.3	5.8
-40	80	1.2	3.2	1.9	4.9	2.5	6.5	3.8	9.6
	90	1.0	3.1	1.6	4.7	2.2	6.4	3.2	9.4
	100	0.8	3.0	1.3	4.5	1.8	6.2	2.6	9.0
	105	0.7	2.9	1.2	4.3	1.6	6.1	2.4	8.7
	110	0.7	2.8	1.0	4.2	1.5	5.9	2.1	8.4
120	0.5	2.5	0.8	3.7	1.2	5.5	1.6	7.7	
-30	80	1.8	4.0	2.8	6.0	3.7	8.0	5.5	12.0
	90	1.6	4.0	2.4	6.0	3.2	8.1	4.8	12.0
	100	1.3	4.0	2.1	6.0	2.8	8.1	4.1	11.9
	105	1.2	3.9	1.9	5.9	2.6	8.1	3.8	11.7
	110	1.1	3.9	1.7	5.8	2.4	8.0	3.5	11.6
	120	0.9	3.7	1.4	5.5	2.0	7.8	2.9	11.0
-20	80	2.6	4.8	3.9	7.1	5.2	9.4	7.8	14.2
	90	2.3	4.9	3.4	7.3	4.6	9.8	6.9	14.6
	100	2.0	5.0	3.0	7.4	4.0	10.0	6.0	14.7
	105	1.8	5.0	2.8	7.4	3.8	10.1	5.6	14.8
	110	1.7	5.0	2.6	7.4	3.5	10.1	5.2	14.7
120	1.4	4.9	2.2	7.3	3.0	10.1	4.4	14.5	
-10	80	3.5	5.5	5.3	8.2	7.0	10.7	10.5	16.2
	90	3.1	5.7	4.7	8.5	6.3	11.3	9.4	17.0
	100	2.7	5.9	4.2	8.8	5.6	11.8	8.4	17.5
	105	2.6	6.0	3.9	8.9	5.2	12.0	7.8	17.7
	110	2.4	6.0	3.7	9.0	4.9	12.1	7.4	17.9
	120	2.1	6.1	3.2	9.1	4.3	12.4	6.4	18.0
0	80	4.6	6.0	6.9	9.0	9.1	11.8	13.8	17.9
	90	4.1	6.4	6.3	9.6	8.3	12.7	12.5	19.1
	100	3.7	6.8	5.6	10.1	7.5	13.4	11.2	20.1
	105	3.5	6.9	5.3	10.3	7.1	13.8	10.6	20.5
	110	3.3	7.1	5.0	10.5	6.7	14.1	10.0	20.9
	120	2.9	7.3	4.4	10.8	5.9	14.6	8.8	21.4
10	80	5.9	6.5	8.9	9.7	11.8	12.7	17.7	19.2
	90	5.4	7.0	8.1	10.5	10.7	13.8	16.2	20.9
	100	4.9	7.5	7.4	11.2	9.7	14.9	14.7	22.3
	105	4.6	7.8	7.0	11.6	9.3	15.4	13.9	23.0
	110	4.4	8.0	6.6	11.9	8.8	15.8	13.2	23.6
120	3.9	8.3	5.9	12.4	7.8	16.6	11.8	24.6	
20	80	7.4	6.7	11.2	10.1	14.9	13.3	22.4	19.9
	90	6.8	7.5	10.3	11.2	13.7	14.7	20.5	22.1
	100	6.2	8.2	9.4	12.1	12.5	16.1	18.8	24.1
	105	5.9	8.5	9.0	12.6	11.9	16.7	17.9	25.1
	110	5.6	8.8	8.5	13.0	11.3	17.3	17.0	25.9
120	5.1	9.3	7.7	13.8	10.2	18.5	15.3	27.5	
30	80	9.3	6.8	13.9	10.2	18.6	13.5	27.9	19.9
	90	8.5	7.7	12.9	11.5	17.1	15.3	25.7	22.7
	100	7.8	8.6	11.8	12.8	15.7	17.0	23.6	25.4
	105	7.5	9.0	11.3	13.4	15.0	17.8	22.6	26.6
	110	7.1	9.4	10.8	14.0	14.3	18.5	21.5	27.7
	120	6.5	10.1	9.8	15.0	13.0	20.0	19.5	29.9

UNIT		5F20		5F30		5F40		5F60	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
32	80	9.7	6.8	14.5	10.2	19.4	13.5	29.1	19.8
	90	8.9	7.7	13.4	11.6	17.9	15.3	26.8	22.8
	100	8.2	8.6	12.3	12.9	16.4	17.1	24.7	25.5
	105	7.8	9.1	11.8	13.5	15.7	17.9	23.6	26.8
	110	7.5	9.5	11.3	14.1	15.0	18.8	22.5	28.0
	120	6.8	10.3	10.2	15.2	13.6	20.3	20.4	30.3
34	80	10.1	6.7	15.1	10.1	20.2	13.4	30.3	19.6
	90	9.3	7.7	14.0	11.6	18.6	15.4	28.0	22.8
	100	8.6	8.7	12.9	13.0	17.1	17.2	25.8	25.6
	105	8.2	9.1	12.3	13.6	16.4	18.1	24.6	27.0
	110	7.8	9.6	11.8	14.2	15.7	18.9	23.5	28.3
	120	7.1	10.4	10.7	15.4	14.2	20.6	21.4	30.7
35	80	10.3	6.7	15.4	10.1	20.6	13.4	30.9	19.6
	90	9.5	7.7	14.3	11.6	19.0	15.4	28.6	22.7
	100	8.7	8.7	13.2	13.0	17.5	17.3	26.3	25.7
	105	8.4	9.2	12.6	13.7	16.8	18.2	25.2	27.1
	110	8.0	9.6	12.1	14.3	16.0	19.0	24.1	28.4
	120	7.3	10.4	11.0	15.5	14.5	20.7	21.8	30.9
36	80	10.5	6.7	15.7	10.1	21.0	13.4	31.6	19.5
	90	9.7	7.7	14.6	11.6	19.5	15.4	29.2	22.7
	100	8.9	8.7	13.5	13.0	17.9	17.3	26.9	25.7
	105	8.6	9.2	12.9	13.7	17.1	18.2	25.7	27.2
	110	8.2	9.7	12.3	14.4	16.4	19.1	24.6	28.5
	120	7.4	10.5	11.2	15.6	14.9	20.8	22.3	31.0
38	80	10.9	6.6	16.4	10.0	21.9	13.3	32.9	19.3
	90	10.1	7.7	15.2	11.6	20.3	15.4	30.5	22.7
	100	9.3	8.8	14.0	13.1	18.7	17.4	28.1	25.8
	105	8.9	9.3	13.4	13.8	17.9	18.4	26.9	27.3
	110	8.5	9.7	12.9	14.5	17.1	19.3	25.7	28.7
	120	7.8	10.6	11.7	15.8	15.5	21.0	23.4	31.4
40	80	11.4	6.6	17.1	9.9	22.8	13.3	34.2	19.0
	90	10.6	7.7	15.8	11.6	21.1	15.4	31.7	22.5
	100	9.7	8.8	14.6	13.1	19.5	17.5	29.3	25.8
	105	9.3	9.3	14.0	13.9	18.7	18.5	28.0	27.4
	110	8.9	9.8	13.4	14.6	17.8	19.4	26.8	28.9
	120	8.1	10.7	12.2	15.9	16.2	21.3	24.4	31.7
45	80	12.6	6.4	18.8	9.6	25.2	13.0	37.8	18.2
	90	11.7	7.6	17.5	11.4	23.4	15.3	35.1	22.1
	100	10.8	8.8	16.2	13.2	21.6	17.6	32.4	25.8
	105	10.3	9.4	15.5	14.0	20.7	18.6	31.1	27.5
	110	9.9	9.9	14.9	14.8	19.8	19.7	29.8	29.2
	120	9.0	11.0	13.6	16.3	18.1	21.7	27.2	32.3
50	80	13.9	6.1	20.7	9.2	27.8	12.5	41.6	17.1
	90	12.9	7.4	19.3	11.2	25.8	15.1	38.7	21.4
	100	11.9	8.7	17.9	13.1	23.9	17.5	35.8	25.4
	105	11.4	9.4	17.2	14.0	22.9	18.7	34.4	27.4
	110	11.0	10.0	16.5	14.9	22.0	19.9	33.0	29.2
	120	10.0	11.1	15.1	16.5	20.1	22.1	30.2	32.7

**LEGEND**

- Bhp** — Brake Horsepower
- Cap.** — Capacity (Tons)
- SDT** — Saturated Discharge Temperature (F)
- SST** — Saturated Suction Temperature (F)

**NOTES:**

1.  Shaded ratings require water-cooled heads, if the discharge temperature exceeds 275 F.
2. An oil cooler is required when SST is below -20 F.
3. Refer to Table 5 for Total Heat Rejection.

**Table 10 — Compressor Ratings; R-502 (cont)**

UNIT		5H40		5H46		5H60		5H66	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-60	80	2.2	8.9	2.8	11.6	3.4	12.9	4.3	16.8
-50	80	3.9	12.0	4.9	15.6	6.0	17.5	7.5	22.9
	90	3.2	11.3	4.0	14.8	4.9	16.6	6.2	21.7
	100	2.5	10.5	3.2	13.8	3.9	15.4	4.9	20.2
	105	2.2	10.0	2.8	13.2	3.4	14.7	4.3	19.3
-40	80	6.2	15.2	7.7	19.8	9.3	22.4	11.6	29.2
	90	5.3	14.9	6.5	19.4	8.0	22.0	9.9	28.6
	100	4.4	14.3	5.5	18.7	6.7	21.2	8.3	27.6
	105	4.0	14.0	5.0	18.2	6.1	20.6	7.6	27.0
	110	3.6	13.5	4.5	17.7	5.5	20.0	6.8	26.2
120	2.8	12.5	3.5	16.4	4.3	18.5	5.4	24.3	
-30	80	9.0	18.6	11.1	24.2	13.5	27.5	16.8	35.8
	90	7.9	18.6	9.7	24.2	11.9	27.5	14.7	35.8
	100	6.8	18.4	8.4	23.9	10.2	27.2	12.8	35.5
	105	6.3	18.2	7.8	23.6	9.5	26.9	11.8	35.1
	110	5.7	17.9	7.2	23.3	8.7	26.6	10.9	34.7
120	4.8	17.2	6.0	22.4	7.3	25.6	9.1	33.4	
-20	80	12.5	21.9	15.4	28.5	18.7	32.4	23.3	42.2
	90	11.1	22.3	13.7	29.0	16.7	33.1	20.7	43.1
	100	9.8	22.5	12.1	29.2	14.7	33.4	18.3	43.5
	105	9.1	22.5	11.3	29.2	13.8	33.4	17.1	43.6
	110	8.5	22.4	10.5	29.2	12.8	33.4	15.9	43.5
120	7.3	22.1	9.0	28.7	11.0	32.9	13.7	42.9	
-10	80	16.8	25.0	20.7	32.5	25.1	37.1	31.2	48.3
	90	15.1	25.9	18.6	33.7	22.6	38.5	28.1	50.1
	100	13.5	26.6	16.7	34.6	20.2	39.6	25.1	51.5
	105	12.7	26.8	15.7	34.9	19.1	39.9	23.7	52.0
	110	11.9	27.0	14.7	35.1	17.9	40.2	22.2	52.4
120	10.4	27.1	12.9	35.2	15.7	40.4	19.5	52.7	
0	80	21.9	27.8	27.0	36.2	32.8	41.3	40.7	53.8
	90	19.9	29.3	24.6	38.1	29.8	43.6	37.0	56.7
	100	18.0	30.5	22.2	39.7	26.9	45.5	33.4	59.2
	105	17.0	31.0	21.0	40.3	25.5	46.3	31.7	60.2
	110	16.1	31.4	19.9	40.9	24.1	46.9	29.9	61.1
120	14.2	32.1	17.6	41.7	21.4	47.9	26.6	62.4	
10	80	28.1	30.1	34.6	39.2	41.9	44.8	52.0	58.3
	90	25.7	32.3	31.7	42.0	38.4	48.1	47.7	62.5
	100	23.4	34.1	28.8	44.4	35.0	50.9	43.4	66.2
	105	22.2	34.9	27.4	45.4	33.3	52.1	41.3	67.8
	110	21.1	35.7	26.0	46.4	31.6	53.3	39.2	69.3
120	18.9	36.9	23.3	48.0	28.3	55.2	35.1	71.9	
20	80	35.4	31.8	43.5	41.3	52.7	47.2	65.5	61.5
	90	32.6	34.7	40.1	45.1	48.6	51.6	60.3	67.2
	100	29.8	37.2	36.7	48.4	44.5	55.5	55.3	72.3
	105	28.5	38.4	35.1	49.9	42.5	57.3	52.8	74.6
	110	27.1	39.5	33.4	51.3	40.5	59.0	50.3	76.8
120	24.4	41.4	30.1	53.8	36.6	62.0	45.4	80.6	
30	80	43.9	32.5	54.0	42.3	65.4	48.4	81.2	63.0
	90	40.6	36.3	50.0	47.1	60.5	54.0	75.1	70.3
	100	37.4	39.7	46.0	51.6	55.8	59.2	69.2	77.0
	105	35.8	41.2	44.0	53.6	53.4	61.6	66.2	80.1
	110	34.2	42.7	42.1	55.5	51.0	63.8	63.3	83.1
120	31.0	45.4	38.2	59.1	46.3	68.0	57.5	88.5	

UNIT		5H40		5H46		5H60		5H66	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
32	80	45.8	32.6	56.3	42.3	68.2	48.5	84.6	63.1
	90	42.4	36.5	52.2	47.4	63.2	54.4	78.4	70.7
	100	39.0	40.0	48.1	52.1	58.2	59.8	72.2	77.8
	105	37.4	41.7	46.0	54.2	55.8	62.3	69.2	81.0
	110	35.7	43.3	44.0	56.3	53.3	64.7	66.2	84.2
120	32.5	46.2	40.0	60.0	48.5	69.1	60.2	89.9	
34	80	47.7	32.5	58.7	42.3	71.0	48.4	88.1	63.1
	90	44.2	36.6	54.4	47.6	65.9	54.6	81.7	71.1
	100	40.7	40.4	50.2	52.5	60.8	60.3	75.4	78.5
	105	39.0	42.1	48.1	54.8	58.2	62.9	72.3	81.9
	110	37.3	43.8	46.0	56.9	55.7	65.5	69.1	85.2
120	34.0	46.9	41.8	60.9	50.7	70.1	62.9	91.2	
35	80	48.7	32.5	59.9	42.3	72.5	48.4	89.9	63.0
	90	45.1	36.7	55.5	47.7	67.2	54.7	83.4	71.2
	100	41.6	40.5	51.2	52.7	62.1	60.5	77.0	78.8
	105	39.9	42.3	49.1	55.0	59.5	63.2	73.8	82.3
	110	38.2	44.0	47.0	57.3	56.9	65.8	70.6	85.7
120	34.7	47.2	42.8	61.3	51.9	70.6	64.3	91.9	
36	80	49.7	32.5	61.1	42.2	73.9	48.4	91.8	63.0
	90	46.1	36.8	56.7	47.8	68.6	54.8	85.2	71.3
	100	42.5	40.7	52.3	52.9	63.4	60.8	78.6	79.1
	105	40.7	42.5	50.1	55.3	60.8	63.5	75.4	82.7
	110	39.0	44.3	48.0	57.6	58.2	66.2	72.2	86.1
120	35.5	47.5	43.7	61.8	53.0	71.1	65.8	92.5	
38	80	51.7	32.4	63.6	42.1	77.0	48.2	95.5	62.8
	90	48.0	36.8	59.1	47.9	71.5	54.9	88.7	71.5
	100	44.3	41.0	54.5	53.3	66.1	61.2	82.0	79.6
	105	42.5	42.9	52.3	55.8	63.4	64.1	78.6	83.4
	110	40.7	44.7	50.1	58.2	60.7	66.9	75.3	87.0
120	37.1	48.1	45.7	62.6	55.4	72.0	68.7	93.8	
40	80	53.8	32.2	66.2	41.8	80.1	48.0	99.4	62.5
	90	50.0	36.9	61.5	47.9	74.4	55.0	92.4	71.6
	100	46.2	41.2	56.8	53.5	68.8	61.5	85.4	80.1
	105	44.3	43.2	54.5	56.2	66.1	64.6	82.0	84.0
	110	42.4	45.1	52.2	58.7	63.3	67.5	78.5	87.8
120	38.7	48.7	47.7	63.4	57.8	72.9	71.7	94.9	
45	80	59.3	31.6	72.9	41.0	88.2	47.1	109.6	61.3
	90	55.2	36.8	67.9	47.8	82.2	54.8	102.0	71.4
	100	51.1	41.6	62.9	54.0	76.1	62.1	94.5	80.8
	105	49.1	43.8	60.4	57.0	73.1	65.5	90.8	85.3
	110	47.1	46.0	57.9	59.8	70.2	68.8	87.1	89.5
120	43.1	50.1	53.0	65.1	64.2	75.0	79.7	97.6	
50	80	65.3	30.6	80.2	39.7	97.0	45.6	120.4	59.4
	90	60.8	36.3	74.8	47.2	90.5	54.2	112.3	70.5
	100	56.4	41.6	69.4	54.1	84.0	62.2	104.3	81.0
	105	54.2	44.2	66.7	57.4	80.8	66.0	100.2	85.9
	110	52.0	46.6	64.0	60.6	77.5	69.7	96.2	90.7
120	47.7	51.2	58.7	66.5	71.1	76.6	88.3	99.7	

**LEGEND**

- Bhp** — Brake Horsepower  
**Cap.** — Capacity (Tons)  
**SDT** — Saturated Discharge Temperature (F)  
**SST** — Saturated Suction Temperature (F)

**NOTES:**

1. Shaded ratings require water-cooled heads, if the discharge temperature exceeds 275 F.
2. An oil cooler is recommended for all long stroke compressors (5H46,66,86 and 126).
3. An oil cooler is required when SST is below -20 F.
4. Refer to Table 5 for Total Heat Rejection.

**Table 10 — Compressor Ratings; R-502 (cont)**

UNIT		5H80		5H86		5H120		5H126	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-60	80	4.7	17.3	5.9	22.6	6.9	25.3	8.6	32.9
-50	80	8.1	23.4	10.1	30.5	12.1	34.5	15.0	44.9
	90	6.7	22.2	8.3	29.0	9.9	32.7	12.3	42.6
	100	5.3	20.7	6.7	27.0	7.9	30.4	9.8	39.5
	105	4.7	19.8	5.9	25.9	6.9	28.9	8.6	37.7
-40	80	12.5	29.8	15.5	38.8	18.7	44.3	23.2	57.6
	90	10.7	29.2	13.3	38.1	16.0	43.3	19.9	56.4
	100	9.0	28.2	11.2	36.8	13.4	41.7	16.7	54.4
	105	8.2	27.5	10.2	35.9	12.2	40.7	15.1	53.0
	110	7.4	26.8	9.3	34.9	11.0	39.5	13.7	51.5
	120	5.9	24.9	7.4	32.6	8.7	36.6	10.8	47.8
-30	80	18.1	36.4	22.5	47.4	27.1	54.3	33.6	70.6
	90	15.9	36.5	19.7	47.5	23.7	54.3	29.5	70.7
	100	13.7	36.1	17.1	47.1	20.5	53.7	25.5	70.0
	105	12.7	35.8	15.8	46.6	19.0	53.2	23.6	69.3
	110	11.7	35.3	14.6	46.1	17.5	52.5	21.7	68.4
	120	9.8	34.1	12.2	44.4	14.6	50.5	18.1	65.8
-20	80	25.0	43.0	31.1	56.0	37.5	64.2	46.5	83.4
	90	22.3	43.9	27.7	57.1	33.4	65.5	41.5	85.2
	100	19.7	44.3	24.5	57.7	29.5	66.1	36.6	86.0
	105	18.4	44.3	22.9	57.7	27.6	66.1	34.2	86.1
	110	17.2	44.3	21.4	57.6	25.7	65.9	31.9	85.9
	120	14.7	43.7	18.4	57.0	22.1	65.0	27.4	84.8
-10	80	33.5	49.3	41.6	64.1	50.2	73.6	62.3	95.6
	90	30.2	51.1	37.5	66.5	45.3	76.3	56.2	99.3
	100	27.0	52.5	33.6	68.3	40.5	78.4	50.3	102.0
	105	25.4	53.0	31.6	68.9	38.2	79.1	47.4	102.9
	110	23.9	53.3	29.7	69.4	35.9	79.6	44.5	103.6
	120	20.9	53.6	26.0	69.8	31.4	80.0	38.9	104.3
0	80	43.7	54.9	54.2	71.4	65.6	82.0	81.4	106.5
	90	39.8	57.9	49.4	75.3	59.7	86.5	74.1	112.4
	100	35.9	60.3	44.6	78.5	53.9	90.2	66.9	117.2
	105	34.0	61.3	42.3	79.8	51.1	91.7	63.4	119.3
	110	32.2	62.2	40.0	81.0	48.3	93.0	59.9	121.0
	120	28.5	63.6	35.5	82.7	42.8	95.0	53.1	123.7
10	80	55.9	59.5	69.4	77.4	83.9	88.9	104.1	115.5
	90	51.2	63.8	63.6	83.0	76.9	95.4	95.4	123.9
	100	46.6	67.5	57.9	87.9	70.0	101.0	86.9	131.3
	105	44.4	69.2	55.1	90.0	66.6	103.5	82.7	134.5
	110	42.1	70.7	52.3	91.9	63.3	105.7	78.5	137.4
	120	37.7	73.2	46.9	95.2	56.6	109.5	70.3	142.5
20	80	70.3	62.8	87.2	81.7	105.6	93.8	131.0	121.9
	90	64.8	68.6	80.4	89.3	97.3	102.5	120.7	133.2
	100	59.4	73.8	73.7	96.0	89.1	110.3	110.6	143.4
	105	56.7	76.1	70.3	99.0	85.1	113.9	105.6	148.0
	110	54.0	78.3	67.0	101.9	81.1	117.2	100.6	152.3
	120	48.7	82.2	60.5	107.0	73.2	123.0	90.8	160.0
30	80	87.2	64.4	108.2	83.8	130.9	96.1	162.4	125.0
	90	80.7	71.9	100.2	93.5	121.2	107.3	150.4	139.5
	100	74.3	78.7	92.2	102.3	111.6	117.6	138.5	152.8
	105	71.2	81.8	88.3	106.4	106.8	122.3	132.6	159.0
	110	68.0	84.8	84.4	110.3	102.1	126.8	126.7	164.9
	120	61.8	90.3	76.7	117.4	92.7	135.1	115.1	175.6

UNIT		5H80		5H86		5H120		5H126	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
32	80	90.9	64.5	112.7	83.9	136.5	96.1	169.3	125.1
	90	84.2	72.3	104.5	94.1	126.5	108.0	156.9	140.4
	100	77.6	79.4	96.3	103.4	116.5	118.7	144.6	154.3
	105	74.3	82.8	92.2	107.7	111.6	123.8	138.5	160.8
	110	71.1	85.9	88.2	111.8	106.7	128.5	132.4	167.0
	120	64.6	91.7	80.2	119.3	97.1	137.2	120.4	178.4
34	80	94.7	64.4	117.5	83.9	142.2	96.1	176.4	125.1
	90	87.8	72.6	108.9	94.5	131.9	108.4	163.6	141.0
	100	81.0	80.2	100.5	104.3	121.6	119.8	150.9	155.7
	105	77.6	83.7	96.3	108.8	116.5	125.1	144.6	162.6
	110	74.3	87.0	92.1	113.1	111.5	130.1	138.3	169.1
	120	67.6	93.1	83.9	121.1	101.5	139.3	125.9	181.1
35	80	96.7	64.4	119.9	83.8	145.1	96.0	180.0	125.0
	90	89.7	72.8	111.2	94.7	134.6	108.6	167.0	141.3
	100	82.7	80.5	102.6	104.7	124.2	120.3	154.1	156.3
	105	79.3	84.1	98.4	109.4	119.1	125.7	147.7	163.4
	110	75.9	87.5	94.2	113.8	113.9	130.8	141.4	170.0
	120	69.1	93.8	85.8	122.0	103.8	140.3	128.8	182.4
36	80	98.6	64.3	122.3	83.7	148.1	95.9	183.7	124.9
	90	91.5	72.9	113.5	94.9	137.4	108.8	170.5	141.6
	100	84.5	80.8	104.8	105.1	126.9	120.7	157.4	156.9
	105	81.0	84.5	100.5	109.9	121.6	126.3	150.9	164.1
	110	77.5	88.0	96.2	114.4	116.4	131.5	144.4	171.0
	120	70.7	94.4	87.7	122.9	106.1	141.3	131.6	183.7
38	80	102.7	64.1	127.3	83.5	154.1	95.5	191.2	124.5
	90	95.3	73.1	118.3	95.1	143.1	109.1	177.6	141.9
	100	88.1	81.3	109.3	105.8	132.3	121.5	164.1	158.0
	105	84.5	85.2	104.8	110.8	126.9	127.3	157.4	165.5
	110	80.9	88.9	100.4	115.6	121.5	132.9	150.7	172.8
	120	73.8	95.7	91.6	124.5	110.8	143.2	137.5	186.2
40	80	106.8	63.8	132.5	83.1	160.3	95.0	198.9	123.9
	90	99.3	73.1	123.1	95.2	149.0	109.1	184.9	142.1
	100	91.8	81.8	113.9	106.4	137.8	122.2	171.0	158.9
	105	88.1	85.8	109.3	111.7	132.2	128.3	164.1	166.8
	110	84.4	89.7	104.7	116.7	126.7	134.1	157.2	174.4
	120	77.1	96.9	95.6	126.1	115.7	145.0	143.5	188.5
45	80	117.7	62.5	146.0	81.5	176.7	93.1	219.3	121.6
	90	109.6	72.9	136.0	94.9	164.6	108.7	204.2	141.7
	100	101.5	82.6	126.0	107.4	152.5	123.3	189.1	160.4
	105	97.5	87.1	121.0	113.3	146.4	130.1	181.7	169.3
	110	93.5	91.5	116.1	119.0	140.4	136.7	174.2	177.8
	120	85.6	99.6	106.2	129.6	128.6	149.0	159.5	193.7
50	80	129.5	60.6	160.5	78.9	194.3	90.1	241.1	117.9
	90	120.7	72.0	149.7	93.8	181.2	107.3	224.8	140.0
	100	112.0	82.7	139.0	107.7	168.2	123.5	208.7	160.8
	105	107.7	87.8	133.6	114.2	161.7	131.1	200.6	170.6
	110	103.4	92.6	128.3	120.6	155.2	138.4	192.6	180.1
	120	94.8	101.8	117.7	132.5	142.4	152.3	176.7	198.0

**LEGEND**

- Bhp** — Brake Horsepower  
**Cap.** — Capacity (Tons)  
**SDT** — Saturated Discharge Temperature (F)  
**SST** — Saturated Suction Temperature (F)

**NOTES:**

1. [Shaded] Shaded ratings require water-cooled heads, if the discharge temperature exceeds 275 F.
2. An oil cooler is recommended for all long stroke compressors (5H46,66,86 and 126).
3. An oil cooler is required when SST is below -20 F.
4. Refer to Table 5 for Total Heat Rejection.

**Table 11 — Compressor Ratings; R-134a**

UNIT		5F20		5F30		5F40		5F60	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
10	90	2.9	4.0	4.4	6.0	5.8	7.9	8.7	11.7
	100	2.7	4.2	4.0	6.3	5.3	8.3	8.0	12.3
	105	2.5	4.3	3.8	6.4	5.1	8.5	7.6	12.6
	110	2.4	4.4	3.6	6.5	4.8	8.6	7.2	12.8
	120	2.1	4.5	3.2	6.7	4.3	8.8	6.5	13.1
	135	1.8	4.5	2.7	6.7	3.6	8.9	5.4	13.2
20	90	3.9	4.5	5.8	6.6	7.7	8.7	11.6	13.0
	100	3.6	4.8	5.4	7.1	7.1	9.4	10.6	14.0
	105	3.4	4.9	5.1	7.3	6.8	9.6	10.2	14.4
	110	3.2	5.0	4.9	7.5	0.7	9.9	9.7	14.7
	120	2.9	5.2	4.4	7.8	5.9	10.3	8.8	15.4
	135	2.5	5.4	3.7	8.1	5.0	10.7	7.5	16.0
30	90	5.0	4.8	7.5	7.1	10.0	9.4	15.0	14.0
	100	4.6	5.2	6.9	7.8	9.3	10.3	13.9	15.3
	105	4.4	5.4	6.7	8.1	8.9	10.7	13.3	15.9
	110	4.3	5.6	6.4	8.4	8.5	11.0	12.8	16.5
	120	3.9	6.0	5.8	8.9	7.8	11.7	11.7	17.5
	135	3.3	6.3	4.9	9.5	6.7	12.5	10.0	18.7
40	90	6.4	5.0	9.5	7.4	12.7	9.8	19.2	14.5
	100	5.9	5.6	8.9	8.3	11.9	10.9	17.8	16.3
	105	5.7	5.8	8.5	8.7	11.4	11.5	17.1	17.1
	110	5.5	6.1	8.2	9.1	11.0	12.0	16.4	17.9
	120	5.0	6.6	7.5	9.8	10.1	13.0	15.1	19.3
	135	4.4	7.2	6.5	10.7	8.8	14.2	13.2	21.2

UNIT		5H80		5H86		5H120		5H126	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
10	90	27.5	36.8	34.1	47.9	41.3	54.7	51.2	74.0
	100	25.0	39.0	31.1	50.6	37.6	57.9	46.7	77.6
	105	23.8	39.8	29.6	51.8	35.8	59.3	44.4	78.6
	110	22.6	40.5	28.1	52.8	34.0	60.4	42.2	79.2
	120	20.2	41.5	25.1	54.3	30.4	62.2	37.8	80.1
	135	16.8	42.1	20.9	55.2	25.2	63.4	31.4	81.9
20	90	36.5	41.1	45.3	53.2	54.8	60.7	68.0	80.6
	100	33.5	44.3	41.6	57.3	50.3	65.5	62.5	85.9
	105	32.0	45.6	39.7	59.2	48.1	67.7	59.7	87.8
	110	30.5	46.8	37.9	60.9	45.9	69.6	57.0	89.4
	120	27.6	48.9	34.3	63.7	41.5	73.0	51.5	92.1
	135	24.1	51.0	29.1	66.7	35.1	76.6	43.6	97.2
30	90	47.5	44.4	59.0	57.1	71.4	65.2	88.6	84.5
	100	43.8	48.8	54.4	62.9	65.9	71.8	81.8	91.8
	105	42.0	50.8	52.2	65.5	63.2	74.9	78.4	94.7
	110	40.2	52.6	49.9	68.0	60.5	77.8	75.1	97.4
	120	36.7	55.8	45.5	72.5	55.1	83.0	68.4	102.5
	135	31.5	59.7	39.1	77.7	47.3	89.2	58.7	111.4
40	90	60.9	46.1	75.6	59.3	91.3	67.9	113.3	87.5
	100	56.4	52.0	70.0	66.9	84.7	76.5	105.1	97.2
	105	54.2	54.6	67.3	70.5	81.4	80.6	101.0	101.4
	110	52.0	57.1	64.6	73.8	78.1	84.4	97.0	105.4
	120	47.7	61.7	59.2	80.0	71.6	91.6	88.9	113.2
	135	41.3	67.5	51.3	87.9	62.1	100.8	77.1	126.3

UNIT		5H40		5H46		5H60		5H66	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
10	90	13.7	18.7	17.1	24.3	20.6	27.8	25.6	36.2
	100	12.5	19.5	15.5	25.7	18.7	29.4	23.4	38.3
	105	11.9	19.7	14.7	26.3	17.8	30.1	22.2	39.2
	110	11.3	19.8	13.9	26.8	16.9	30.6	21.1	39.9
	120	10.1	19.8	12.5	27.6	15.2	31.5	18.9	41.1
	135	8.3	20.1	10.3	28.1	12.6	32.1	15.8	41.8
20	90	18.3	20.7	22.7	26.8	27.4	30.8	34.0	40.1
	100	16.8	22.0	20.8	28.9	25.1	33.2	31.2	43.3
	105	16.0	22.5	19.8	29.9	24.0	34.3	29.9	44.6
	110	15.3	22.8	18.9	30.7	22.9	35.3	28.5	45.9
	120	13.8	23.4	17.1	32.3	20.7	36.9	25.8	48.1
	135	11.6	24.4	14.4	33.8	17.5	38.7	21.9	50.4
30	90	23.8	22.6	29.5	28.8	35.7	33.0	44.3	43.1
	100	21.9	24.5	27.2	31.6	32.9	36.4	40.9	47.4
	105	21.0	25.3	26.1	32.9	31.5	37.9	39.2	49.4
	110	20.1	26.0	24.9	34.2	30.2	39.3	37.5	51.3
	120	18.3	27.1	22.7	36.5	27.5	41.9	34.2	54.6
	135	15.7	29.1	19.5	39.2	23.6	45.0	29.4	58.7
40	90	30.4	23.6	37.7	30.0	45.7	34.4	56.7	44.8
	100	28.2	26.4	34.9	33.6	42.3	38.7	52.5	50.4
	105	27.1	27.5	33.6	35.3	40.7	40.7	50.5	53.1
	110	26.0	28.6	32.2	37.0	39.0	42.7	48.5	55.6
	120	23.9	30.5	29.6	40.1	35.8	46.3	44.5	60.3
	135	20.7	33.5	25.6	44.2	31.0	50.9	38.5	66.3

**LEGEND**

- Bhp** — Brake Horsepower
- Cap.** — Capacity (Tons)
- SDT** — Saturated Discharge Temperature (F)
- SST** — Saturated Suction Temperature (F)

**NOTES:**

1. An oil cooler is recommended for all long stroke compressors (5H46, 66, 86, 126).
2. Refer to Table 5 for Total Heat Rejection.



**Table 12 — Compressor Ratings;  
R-507/404A**

UNIT		5F20		5F30		5F40		5F60	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	90	1.0	3.5	1.5	5.1	2.1	6.8	3.1	10.2
	100	0.8	3.3	1.3	4.9	1.7	6.5	2.5	9.7
	105	0.7	3.2	1.1	4.8	1.5	6.3	2.2	9.4
	110	0.6	3.1	0.9	4.7	1.3	6.2	1.9	9.2
-20	90	2.1	5.0	3.2	7.5	4.3	10.0	6.5	14.9
	100	1.9	5.1	2.9	7.5	3.9	10.0	5.8	14.9
	105	1.8	5.1	2.7	7.5	3.6	10.0	5.5	14.9
	110	1.7	5.1	2.5	7.5	3.4	10.0	5.2	14.9
0	90	3.9	6.3	5.8	9.4	7.8	12.5	11.7	18.7
	100	3.5	6.6	5.3	9.8	7.1	13.0	10.7	19.4
	105	3.4	6.7	5.1	9.9	6.8	13.2	10.2	19.8
	110	3.2	6.8	4.8	10.1	6.4	13.4	9.7	20.1
20	90	6.6	7.4	9.9	11.0	13.3	14.6	19.9	21.8
	100	6.0	7.9	9.1	11.7	12.2	15.6	18.2	23.3
	105	5.8	8.1	8.7	12.1	11.6	16.1	17.4	24.1
	110	5.5	8.4	8.3	12.4	11.0	16.5	16.6	24.8

UNIT		5H80		5H86		5H120		5H126	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	90	10.1	29.2	12.6	37.9	15.2	43.3	18.9	56.4
	100	8.3	28.1	10.3	36.5	12.5	41.6	15.6	54.3
	105	7.3	27.6	9.1	35.8	11.1	41.0	13.8	53.2
	110	6.3	27.1	7.9	35.2	9.6	40.2	11.9	52.3
-20	90	20.7	43.8	25.9	57.0	31.1	65.3	38.6	85.0
	100	18.7	44.1	23.3	57.4	28.1	65.8	34.9	85.5
	105	17.7	44.2	22.0	57.6	26.5	65.9	33.0	85.7
	110	16.6	44.2	20.6	57.7	24.9	66.0	31.0	85.9
0	90	37.0	56.5	46.0	73.5	55.5	84.3	68.9	109.7
	100	33.9	58.7	42.2	76.5	50.9	87.7	63.2	114.1
	105	32.4	59.7	40.2	77.9	48.6	89.2	60.3	116.1
	110	30.8	60.7	38.2	79.2	46.2	90.7	57.3	118.0
20	90	61.8	66.6	76.7	86.7	92.7	99.5	114.9	129.3
	100	56.8	71.4	70.5	93.0	85.2	106.7	105.8	138.7
	105	54.3	73.6	67.4	95.9	81.5	110.0	101.1	143.1
	110	51.8	75.7	64.3	98.6	77.7	113.2	96.4	147.2

UNIT		5H40		5H46		5H60		5H66	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	90	5.0	14.9	6.2	19.4	7.6	22.1	9.4	28.7
	100	4.1	14.4	5.1	18.7	6.2	21.3	7.8	27.7
	105	3.6	14.1	4.5	18.3	5.5	20.9	6.9	27.2
	110	3.1	13.9	3.9	18.0	4.7	20.5	6.0	26.7
-20	90	10.3	22.2	12.8	28.9	15.5	33.1	19.3	43.0
	100	9.3	22.4	11.6	29.1	14.0	33.3	17.5	43.3
	105	8.8	22.4	10.9	29.1	13.2	33.4	16.5	43.4
	110	8.2	22.5	10.2	29.2	12.4	33.4	15.5	43.5
0	90	18.5	28.6	22.9	37.1	27.7	42.6	34.5	55.5
	100	16.9	29.7	21.0	38.6	25.4	44.3	31.6	57.7
	105	16.2	30.2	20.0	39.2	24.3	45.0	30.2	58.7
	110	15.4	30.7	19.0	39.9	23.1	45.8	28.7	59.6
20	90	30.9	33.6	38.3	43.7	46.3	50.2	57.5	65.3
	100	28.4	36.0	35.2	46.8	42.6	53.8	52.9	70.0
	105	27.1	37.1	33.7	48.2	40.7	55.4	50.6	72.2
	110	25.9	38.2	32.1	49.6	38.8	57.0	48.2	74.2

**LEGEND**

- Bhp** — Brake Horsepower  
**Cap.** — Capacity (Tons)  
**SDT** — Saturated Discharge Temperature (F)  
**SST** — Saturated Suction Temperature (F)

**NOTES:**

1. Shaded ratings require water-cooled heads, if the discharge temperature exceeds 275 F.
2. An oil cooler is recommended for all long stroke compressors (5H46, 66, 86, 126).
3. Oil cooler required when SST is below -20 F.
4. Refer to Table 5 for Total Heat Rejection.

**Table 13 — Minimum Gpm Required for Water-Cooled Heads and/or Oil Cooler (Based on 30° F Rise)**

COMPRESSOR	GPM
5F	2-3
5H (4, 6 and 8 Cylinders)	6
5H (12 Cylinders)	8

**SAFETY RELIEF VALVES** — All 5H compressors are equipped with built-in safety relief valves that are factory set to relieve from discharge to suction side of the compressor at a pressure differential of 350 psi.

Safety relief valves that relieve at a 400 psi pressure differential are factory installed on the 5F60 compressor but are not available with smaller 5F compressors.

**SUCTION STRAINERS** — Each 5F,H compressor is equipped with one or 2 suction strainers located in the suction manifold. On new installations, felt filters should be used in suction strainers to trap foreign material left after installation. After 50 hours of use, these felt filters must be removed. See 5F,H Installation Instructions for further details.

**OIL SAFETY SWITCH** — An oil safety switch is provided as standard with all compressors except 5F20 and 5F30. This switch is optional equipment on 5F20 and 5F30 compressors. This switch will shut off the compressor before high oil temperatures or lack of oil causes loss of oil pressure which can result in compressor failure. As a safety feature, this switch must be reset manually after cutout.

**OIL SEPARATORS** — Oil separators in the hot gas discharge line are not recommended for general use. However, there are systems where protection afforded by a separator is desirable, notably systems employing flooded evaporators or refrigeration systems with long system piping. For a more complete discussion see Carrier's System Design Manual.

**CRANKCASE OIL HEATERS** — Crankcase oil heaters are available for all 5F,H compressors. Heaters keep the crankcase warm during off cycles and thus minimize refrigerant absorption in the oil. Crankcase heaters are recommended for CFC or HCFC refrigerant applications and are required for HFC refrigerant applications with POE lubricants. Refer to the 5F,H Installation Instructions for installation and wiring.

**INTERCONNECTION OF COMPRESSORS** — All 5F,H compressors are furnished with removable handhole cover plates on each crankcase. When field interconnection is desired on 5F40 through 5H86 compressors, cover plates can be removed and replaced by special cover plates with tapped openings. These tapped cover plates have connections for both oil and gas equalizing lines. For interconnection of 5F20 and 5F30 compressors, use the opening for the oil sight glass (see 5F,H Installation Instructions). Cover plates for interconnection are standard equipment on 5F120 and 126 compressors.

Many refrigeration systems utilize oil management components such as an oil separator, oil reservoir and floats. The oil level control float can be installed in the sight glass connection in the 5F,H handhole cover plate.

**VIBRATION ISOLATORS** — A standard vibration isolation package is available for each 5F,H compressor. This consists of a standard rubber-in-shear and compression type mounting that gives an average static deflection of approximately 1/8 in. and provides reasonably good vibration isolation at 1750 rpm.

The use of vibration isolators is recommended for all compressor and condensing units because:

1. Transfer of vibration to structure is reduced when the units are installed on upper floors.
2. They limit drive shaft misalignment on installations where units are bolted to an uneven concrete floor.

Vibration isolators giving approximately 3/8-in. deflection are available for superior isolation or if the compressor is run at slower speeds. Tables 14 and 15 provide an estimated weight distribution on legs of a compressor or condensing unit when used with a normal horsepower motor.

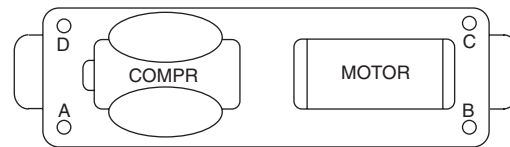
**MUFFLERS** — Four standard mufflers cover the entire model range of 5F,H compressors. It is recommended that these mufflers be installed when compressors are used with remotely located water-cooled or evaporative condensers.

Mufflers are not usually necessary with smaller 5F compressors and their use is recommended only when quiet operation is required.

Each piping package to convert 5H compressor units to condensing units includes a standard muffler of appropriate size.

Pressure drop through mufflers is about 1/2 psi at 40 F suction and 105 F discharge with following loadings: 5 tons with 5F20 muffler, 15 tons with 5F40 muffler, 35 tons with 5H40 muffler and 100 tons with 5H120 muffler.

**Table 14 — Weight Distribution, Condensing Units**



COMPR	COND SIZE	WEIGHT DISTRIBUTION (lb)			
		Belt Drive		Direct Drive	
		A or D	B or C	A or D	B or C
5F20	20	138	115	—	—
	30	148	125	—	—
5F30	20	163	135	—	—
	30	170	148	—	—
5F40	30	280	220	—	—
	40	325	263	305	240
	60	345	285	325	265
5F60	40	365	305	—	—
	60	406	345	360	305
	027	—	—	470	430
5H40	60	525	423	—	—
	027	585	478	555	450
	043	665	603	580	505
5H46	043	—	—	580	505
	054	—	—	610	535
	070	—	—	625	550
5H60	027	693	570	—	—
	043	745	625	710	590
	054	825	818	755	635
	054*	915	823	—	—
	070	930	833	765	645
	084	—	—	960	865
5H66	054	—	—	755	635
	070	—	—	765	645
	084	—	—	690	865
	097	—	—	1030	935
5H80	043	1023	803	—	—
	054	1065	848	985	900
	070	1075	858	995	910
	084	1163	943	1080	995
	097	1185	1018	1150	1065
5H86	070	—	—	995	910
	084	—	—	1030	995
	097	—	—	1150	1065
	127	—	—	1300	1215
5H120	054	1335	1008	—	—
	070	1350	1023	1280	1080
	084	1425	1098	1340	1140
	097	1493	1163	1385	1185
	127	—	—	1535	1335
5H126	097	—	—	1325	1185
	127	—	—	1535	1335

\*Oversize frame.

**Table 15 — Weight Distribution, Compressor Units (See drawing, Table 14)**

COMPR	WT DISTR (lb)		NEMA FRAME SIZE
	A or D	B or C	
<b>Belt Drive</b>			
5F20	115	100	182T, 184T, 213T, 215T
5F30	140	118	184T, 213T, 215T, 254T
5F30*	168	145	184T, 213T, 215T, 254T
5F40	228	165	213T, 215T, 254T, 256T
5F60	280	210	215T, 254T, 256T, 284T
5H40	410	305	256T, 284T, 286T, 324T, 326T
5H60	515	395	286T, 324T, 326T
5H60*	630	533	324T, 326T, 364T, 365T
5H80	685	558	324T, 326T, 364T, 365T, 404T
5H120	1050	728	364T, 365T, 404T
<b>Direct Drive</b>			
5F40	210	145	213T, 215T, 254T, 256T
5F60	245	185	215T, 254T, 256T, 284T, 286T
5F60*	290	255	256T, 284T, 286T
5H40	380	275	256T, 284T, 286T, 324TS, 326TS
5H46	380	275	324TS, 326TS, 364TS, 365TS
5H80	480	360	286T, 324TS, 326TS, 364TS
5H60	480	360	365TS, 404TS
5H66	480	360	286T, 324TS, 326TS, 364TS, 365TS, 404TS
5H80	690	605	324TS, 326TS, 364TS, 365TS, 404TS
5H86	690	605	365TS, 404TS, 405TS
5H120	890	690	364TS, 365TS, 404TS, 405TS, 444TS
5H126	890	690	405TS, 444TS, 445TS

**LEGEND**

**NEMA** — National Electrical Manufacturers Association

\*Oversize frame.

**Capacity Control** — For all 5F,H compressors, a pressure-type cylinder unloader is used. On 5F20 and 5F30 compressors, the capacity control valve is external and on 5F40 through 5H126 compressors the valve is located internally. On all 5F,H compressors, capacity reduction is in response to suction pressure.

The cylinder unloading mechanism is powered by a compressor force-feed lubricating system. This feature assures unloading of all controlled cylinders at starting regardless of

the position of the capacity control valve, since suction valves will be held in open position until the lubricating oil pressure reaches its normal operating level. Refer to Fig. 4 for cylinder unloading sequence.

An external adjusting stem is provided to set control point and maintain desired suction pressure. The control point is adjustable from 0 to 85 psig suction pressure. Differential over the complete range at any temperature level is 10.7 psig with Refrigerant 22 and Refrigerant 502. A 7-lb spring (for use on 5F40 and larger units) is furnished with the compressor which, when used, results in an adjustable control point from 0 to 50 psig with a 6.8 psig range. Insert a spring in the capacity control valve when R-12 is used. See Fig. 5.

With this arrangement, suction pressure will not drop below the control set point minus the differential within range of capacity steps since the compressor will unload to balance its capacity with evaporator load.

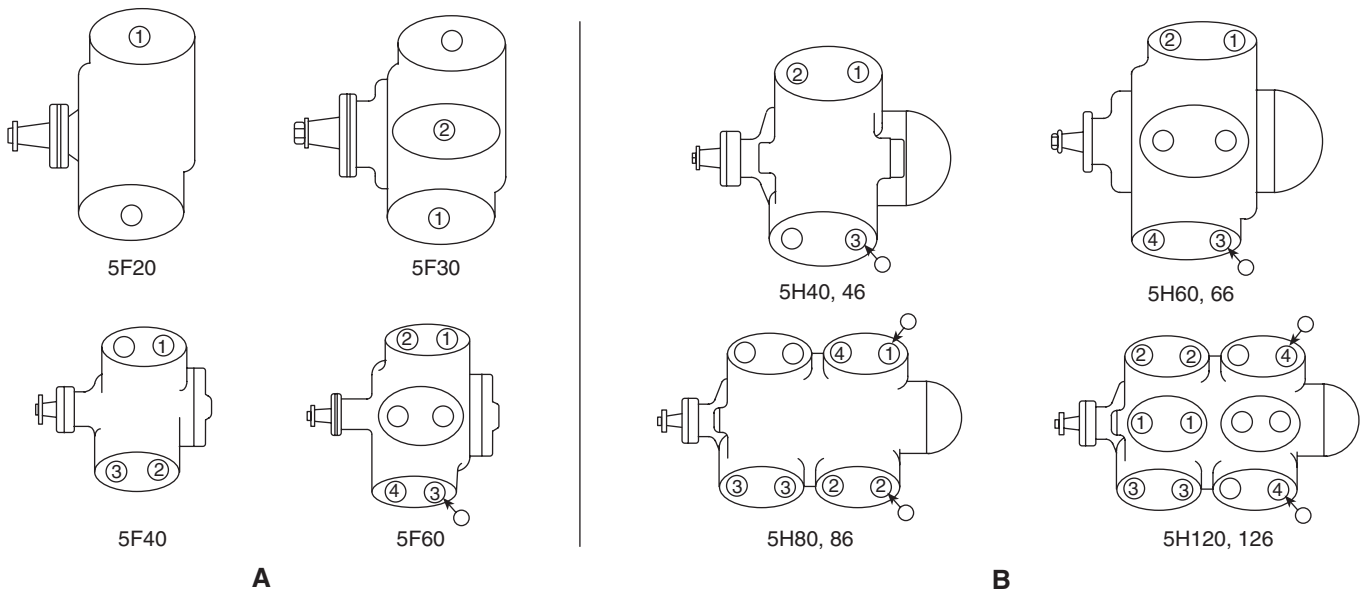
Power elements and valve lifting mechanisms are identical on all 5F,H compressors. However, when using capacity control, various methods are used to activate the power elements.

See Table 16 for unloading steps and power requirements at each step.

5F20 AND 5F30 (Fig. 6)

**Major Elements of Control Systems:**

1. **Capacity Control Valve:** Function is to raise or lower oil pressure from oil pump in response to refrigerant suction pressure.
2. **Power Elements:** Function is to supply power necessary to operate valve lifting mechanism. It is modulated by the capacity control valve.
3. **Valve Lifting Mechanism:** Consists of a sleeve and push pin assembly around each controlled cylinder, designed to hold the suction valve open, or to permit the valve to remain in a normal operating position depending on its actuation by the power element.



○ — Cylinders recommended for permanently unloaded operation.

**NOTE:** The numerals indicate the unloading sequence and the number of cylinders that unload with each step.

SHORT-STROKE COMPRESSORS ONLY

**Fig. 4 — Cylinder Unloading Sequence**

**Table 16 — Capacity Control Reduction Steps**

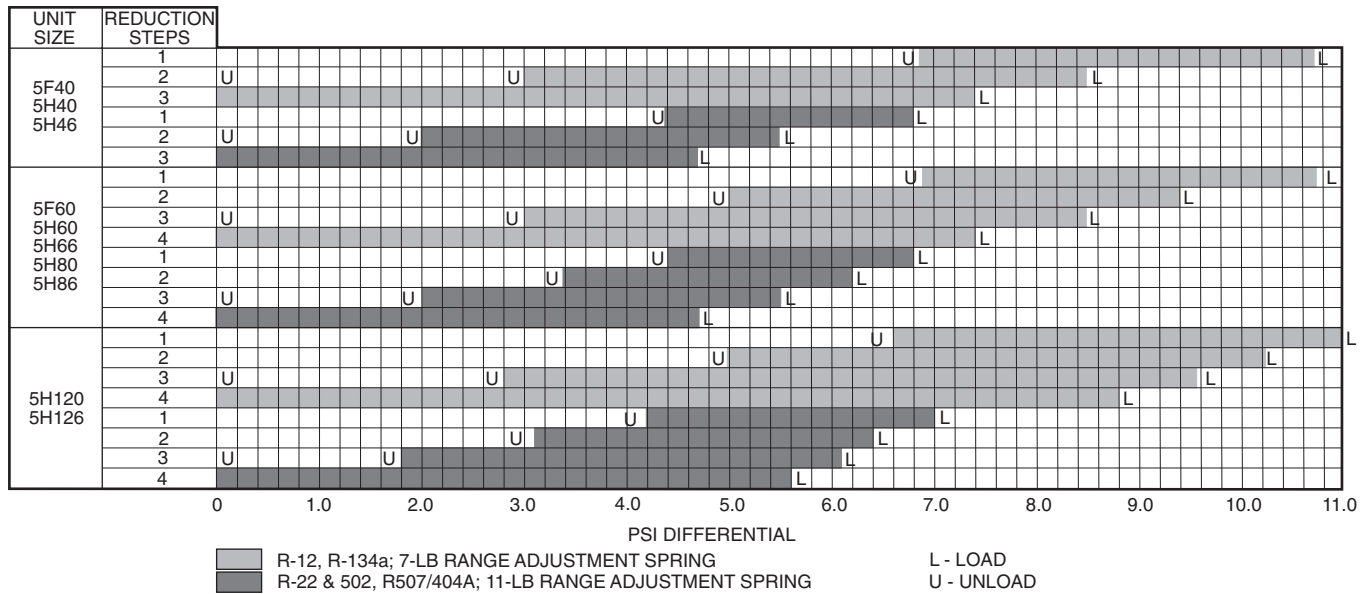
COMPR MODEL	CONTR CYL	CAP. STEPS (% Full Load Cap.)									
		100	87½	83⅓	75	66⅔	62½	50	37½	33⅓	25
		% Full Load Bhp									
		100	90	86	80	74	71	60	50	45	38
Number of Active Cylinders											
5F20	1	2	—	—	—	—	—	1	—	—	—
5F30*	1	3	—	—	—	2	—	—	—	—	—
5F40	3	4	—	—	3	—	—	2	—	—	1
5F60	4	6	—	5	—	4	—	3	—	2	—
5H40	3	4	—	—	3	—	—	2	—	—	1
5H46	3	4	—	—	3	—	—	2	—	—	1
5H60	4	6	—	5	—	4	—	3	—	2	—
5H66	4	6	—	5	—	4	—	3	—	2	—
5H80	6	8	7	—	—	5	—	3	—	—	2
5H86	6	8	7	—	—	5	—	3	—	—	2
5H120	8	12	—	10	—	8	—	6	—	4	—
5H126	8	12	—	10	—	8	—	6	—	4	—

\*Two controlled cylinders (to 33⅓%) available on request for 5F30.

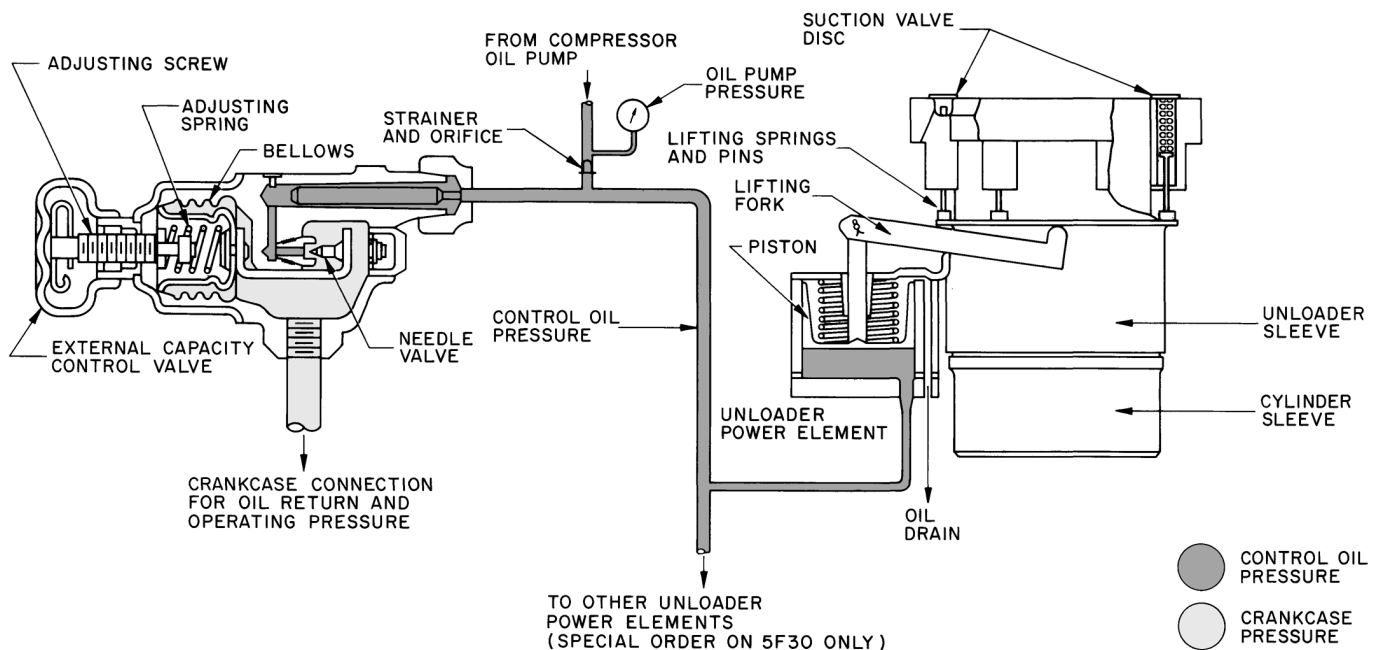
**Principle of Operation of the System** — An increase in suction gas pressure, which requires increased compressor capacity, causes the needle valve to close. Therefore, lubrication oil pressure in power element increases. Increased oil pressure in power element moves the power piston upward and the suction valve discs are allowed to seat.

Table 17 indicates control oil pressure at which controlled cylinders start to and completely unload.

Different points of control pressure on 5F30 are obtained by using springs with different loading rates in the power element.



**Fig. 5 — Operating Sequence of Capacity Reduction Steps**



**Fig. 6 — Capacity Control — 5F20, 5F30**

**Table 17 — Initial and Final Unloading Oil Pressures — 5F20, 5F30**

COMPR	NO. OF CONTROLLED CYLINDERS	START TO UNLOAD OIL PRESS. (psi)	COMPLETELY UNLOADED OIL PRESS. (psi)
5F20	1	19.8	13.0
5F30	1	30.0	20.2
	2	19.8	13.0

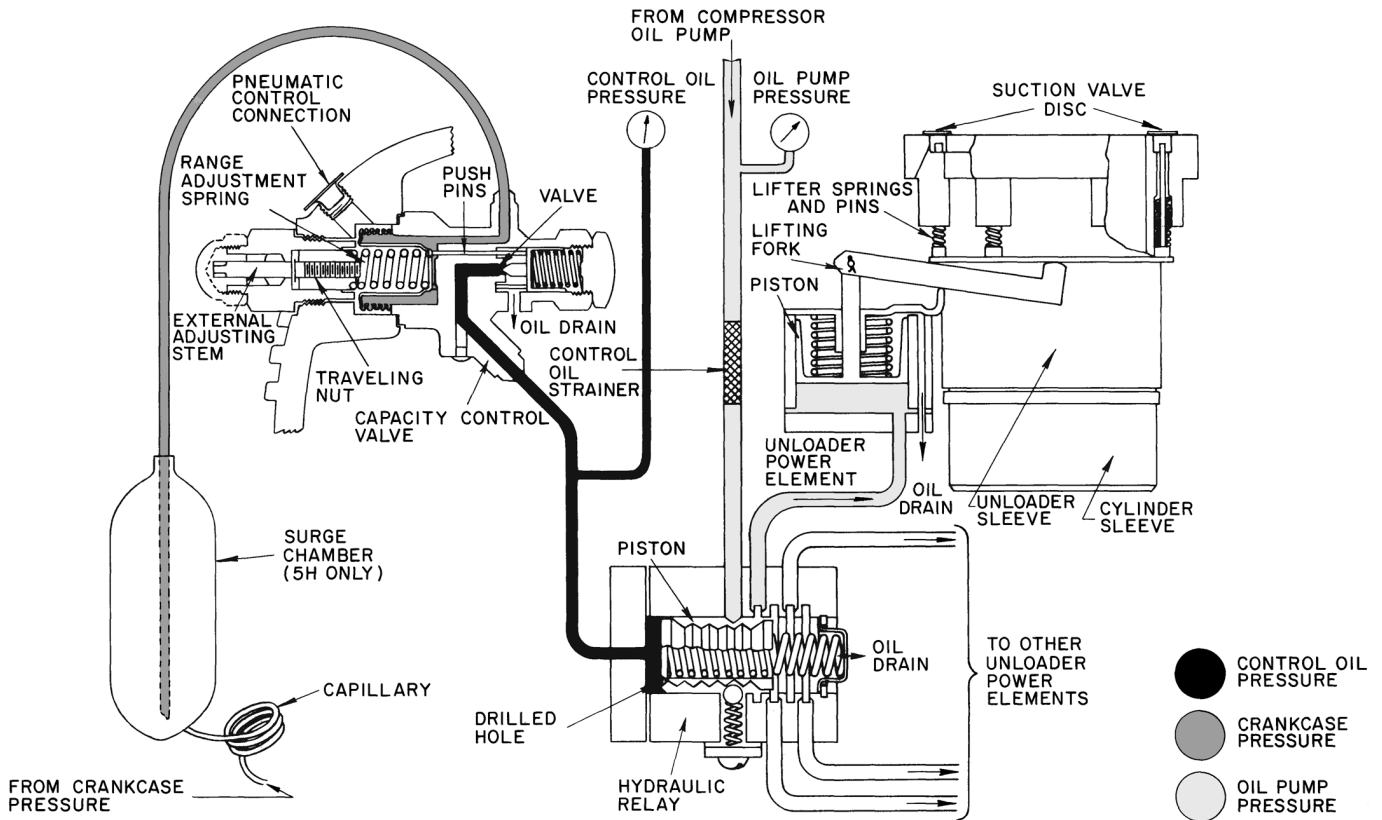
5F40 THROUGH 5H86 (Fig. 7)

Major Elements of Capacity Control Systems:

1. *Capacity Control Valve:* Function is to raise or lower the control oil pressure to the hydraulic relay piston in response to refrigerant suction pressure. Increase in suction pressure increases control oil pressure in the hydraulic relay.
2. *Hydraulic Relay:* Function is to feed lubrication oil from the oil pump at full pressure in sequence to one or more power elements. Relay is activated by control oil pressure from the capacity control valve.

3. *Power Element:* Supplies power to operate the valve lifting mechanism.
4. *Valve Lifting Mechanism:* Consists of a sleeve and push pin assembly around each controlled cylinder, designed to hold the suction valve open, or to permit the valve to remain in a normal operating position depending on its actuation by the power element.

Principle of Operation of the System — A decrease in suction gas pressure, which necessitates a decrease in compressor capacity, causes the range spring to open the capacity control modulating valve. This allows control oil to relieve from the hydraulic relay and thus reduces control oil pressure in the relay. With reduced control oil pressure, the spring in the hydraulic relay moves a piston and thus lubrication oil from the oil pump is prevented from flowing to a particular deactivated power element. This relieves oil pressure from the power element allowing the spring in the power element to move the lifting fork and unload the cylinder. An increase in suction pressure reverses action and loads cylinders.



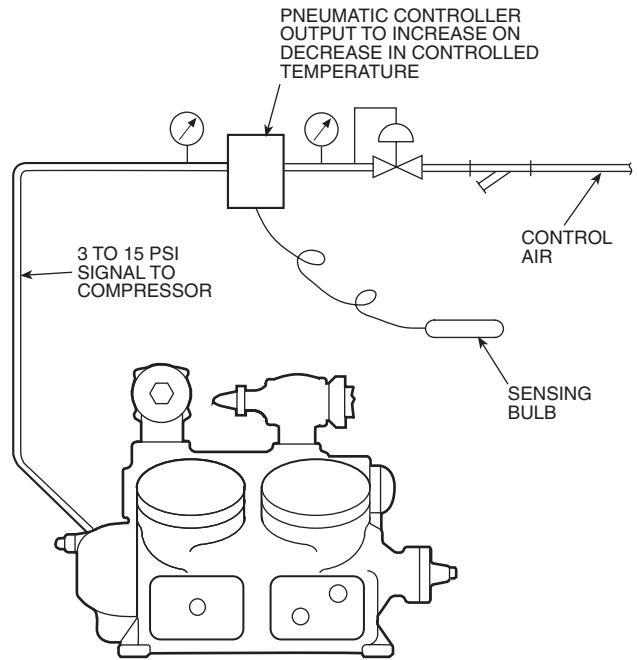
**Fig. 7 — Capacity Control — 5F40, 60; 5H40, 46, 60, 66, 80 and 86**

5H120, 5H126 CAPACITY CONTROL (Fig. 8) — This capacity control system is slightly different from the system on 5F40 through 5H86 compressors. Unloaded starting and capacity reduction is obtained by holding open the suction valves of a number of cylinders. For capacity control purposes, a suction-pressure-actuated capacity control valve pilots a hydraulic relay that loads or unloads cylinders in pairs.

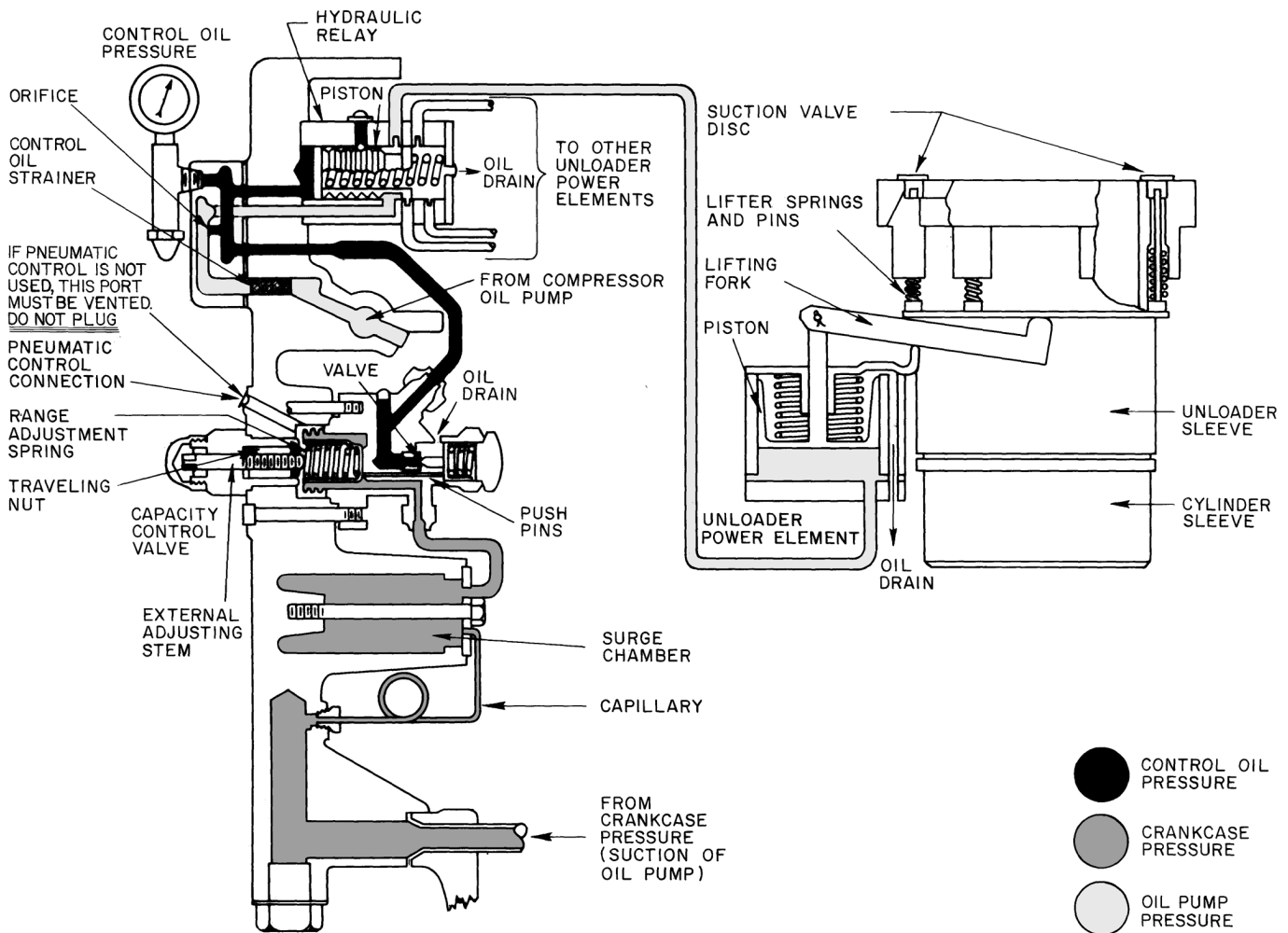
Major Difference from the 5F40 through 5H86 Capacity Control:

1. The hydraulic relay design provides a wider pressure differential between cylinder cut-in and cutout points. The relay is a small, easily removed cartridge rather than an integral part of pump end cover.
2. The surge chamber on 5H120 and 5H126 is an integral part of the bearing head casting.

**PNEUMATIC COMPENSATION OF COMPRESSOR CAPACITY CONTROL** — Adding a control air line to the external pneumatic control connection permits pneumatic resetting of the control point in accordance with changes in operating conditions. Each pound of change in air pressure resets the control one pound in the same direction. Thus, a one-pound rise in air pressure will cause unloading to begin at a suction pressure one pound higher than the original control point, etc. Figure 9 shows a typical pneumatic control arrangement. All components and installation instructions are field supplied.



**Fig. 9 — Pneumatic Compensation**



**Fig. 8 — Capacity Control — 5H120, 5H126**

**Control Pressurestats** — Dual pressurestats are furnished with all 5F,H compressors. They are often referred to as high- and low-pressure cutouts. Their function is to cut the circuit to the holding coil of the compressor motor starter when pressure setting limits are exceeded.

The high pressurestat has an operating range from 50 to 450 psig with a differential range from 170 to 235 psig (adj). The low pressurestat has an operating range from 20 in. Hg to 60 psig and a differential range from 60 to 90 psig (adj).

Pressurestat settings should be adjusted on the job to meet particular operating conditions for which the compressor(s) have been selected. Directions for setting these pressurestats are in the 5F,H Installation Instructions.

**Permanently Unloaded Cylinders** — Operation of an open-drive compressor with its cylinders permanently unloaded requires field modification. The 5F60, 5H40 and 5H60 compressors can operate with one cylinder unloaded; 5H80 and 5H120 compressors can operate with 2 cylinders unloaded. Compressors are modified by removing the suction valve and suction valve springs from the cylinder(s) shown in Fig. 4.

**ELECTRIC SOLENOID VALVE CAPACITY CONTROL** — Closer control of a conditioned space or medium can be realized by activating the cylinder unloaders directly in response to an external step controller activated by solenoid valves. A temperature sensing controller activates the electric solenoid valves. Refer to Fig. 10 for an operating concept using an external electric solenoid-type capacity control. All components external to the compressor must be field supplied. Modifications required for standard sequence are as follows:

**5F20 and 5F30 Compressors** — Modifications are not required to the 5F20 and 5F30 compressors. See Fig. 4 and 11. Securely attach a ported solenoid valve to compressor to minimize line vibration. Connect a 1/4-in. steel tubing or high-pressure flexible hose, KA73RR025, between the compressor and solenoid valve.

**5F40 and 5F60 Compressors**

1. Remove the capacity control handhole cover. Remove the hydraulic relay and all tubing. As shown on Fig. 12, drill and tap 3 holes on the bottom side of the cover and 2 on the front. No hole is required at point A on 5F40 compressors. Plug 5 cover holes that connected cover to the relay. Plugs are 1/8 NPT.
2. Install cover with a new cover gasket 5F40-1042.
3. Mount solenoid valves on a sturdy bracket attached to the handhole cover using stud bolts on the compressor.
4. Connect external oil lines as shown in Fig. 12 and 13. Steel tubing and compression fittings are recommended.

**5H40 Through 5H86 Compressors** — Standard compressors 5H40 through 5H86 built after Serial No. G103460 (July 1971) may be modified for electric solenoid unloading without additional machining. Proceed as follows: (See Fig. 4, 13, 14, and 15).

1. Remove pump end cover *only* from the compressor.
2. Using the pump end cover gasket (Part No. 5H40-1423) as a guide, make a blank metal disc (1/32 to 1/16-in. thick), making holes for bolts only.
3. Reinstall the pump end cover using 2 new 5H40-1423 gaskets, one on each side of the blank disc. This isolates the capacity control cover.
4. Mount solenoid valves and run oil lines.
5. To minimize vibration, mount the valves on a bracket attached to the compressor.

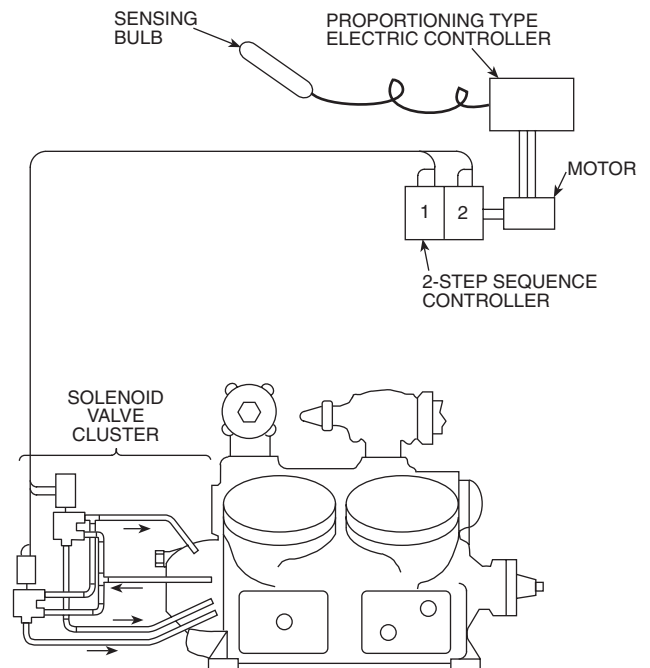
**5H120, 126 Compressors** — Following modifications are required to electrically unload 5H120, 126 compressors.

1. After closing the compressor service valves and reducing refrigerant pressure to the atmosphere, remove pump end bearing head.

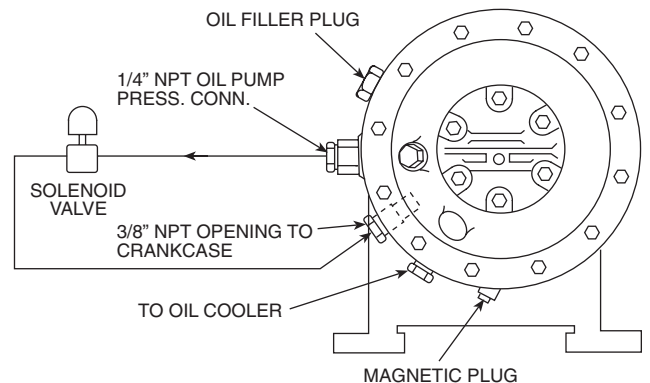
2. Remove hydraulic relay assembly by removal of two 5/16-in.-18 socket head screws. Make a blank metal disc using a hydraulic relay gasket (5H120-3351) as a guide. Using 1/32 to 1/16-in. thick metal, cut holes in the disc for dowel pins *only*. (Do not cut five 9/32-in. diameter holes.) Reinstall relay assembly using 2 new 5H120-3351 gaskets, one on each side of the metal disc. Torque 5/16-in. socket head screws evenly to 16 to 20 lb-ft.
3. Reinstall the bearing head using extreme care not to damage the oil pump tang. Align with recess in the end of the crankshaft. Do not force on.
4. Mount solenoid valves and run oil lines. See Fig. 4, 13, and 16.
5. To minimize vibration, mount the valves on a bracket attached to the compressor.

**Valves** — The following 3-way valves have been used in the field and are listed as a guide:

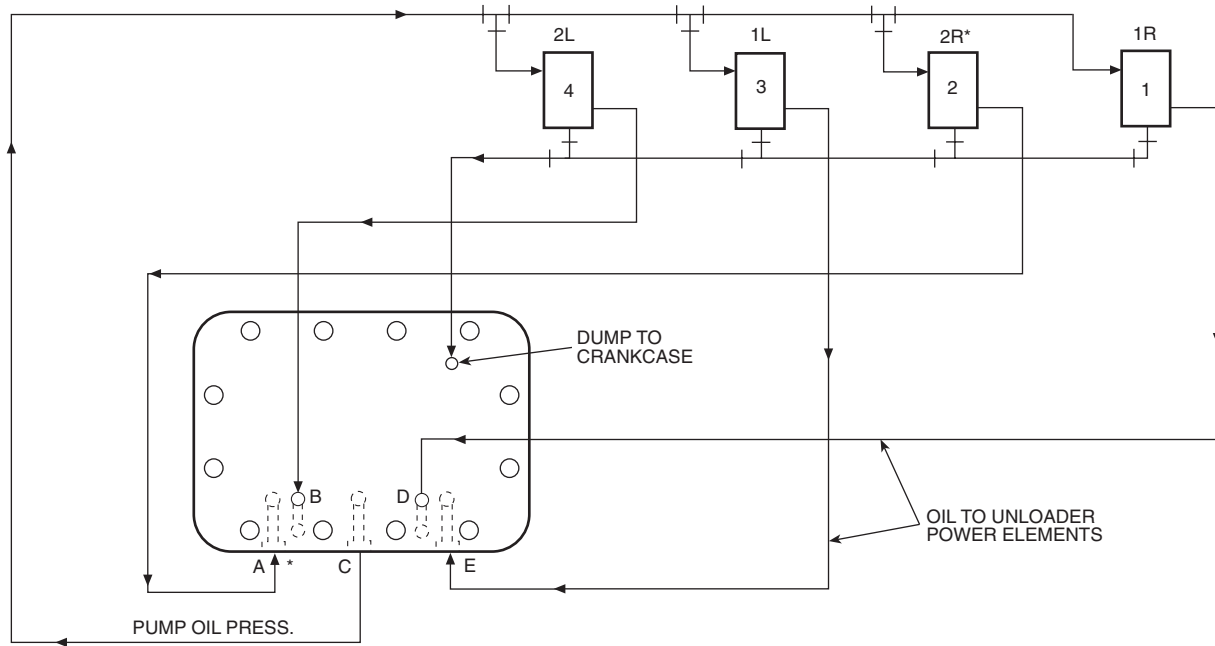
- Alco Controls No. 702RA001.
- Alco Controls No. S608-1.
- Sporlan Type 180.



**Fig. 10 — External Solenoid-Type Capacity Control**



**Fig. 11 — 5F20 and 5F30 Compressor**



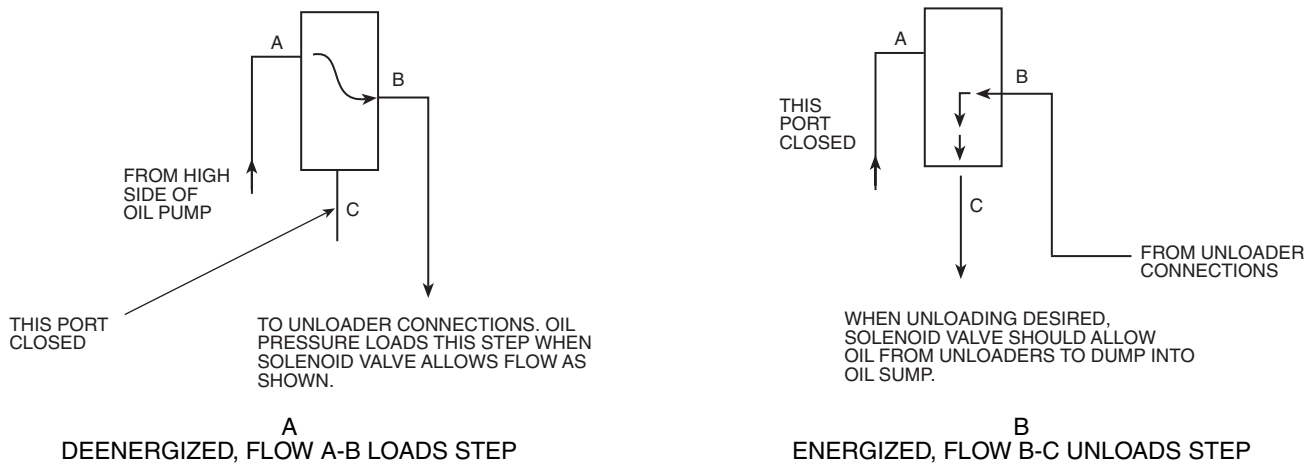
FRONT VIEW

\*STEP 2R DOES NOT EXIST ON A 5F40 COMPRESSOR. NO HOLE IS REQUIRED AT POINT A



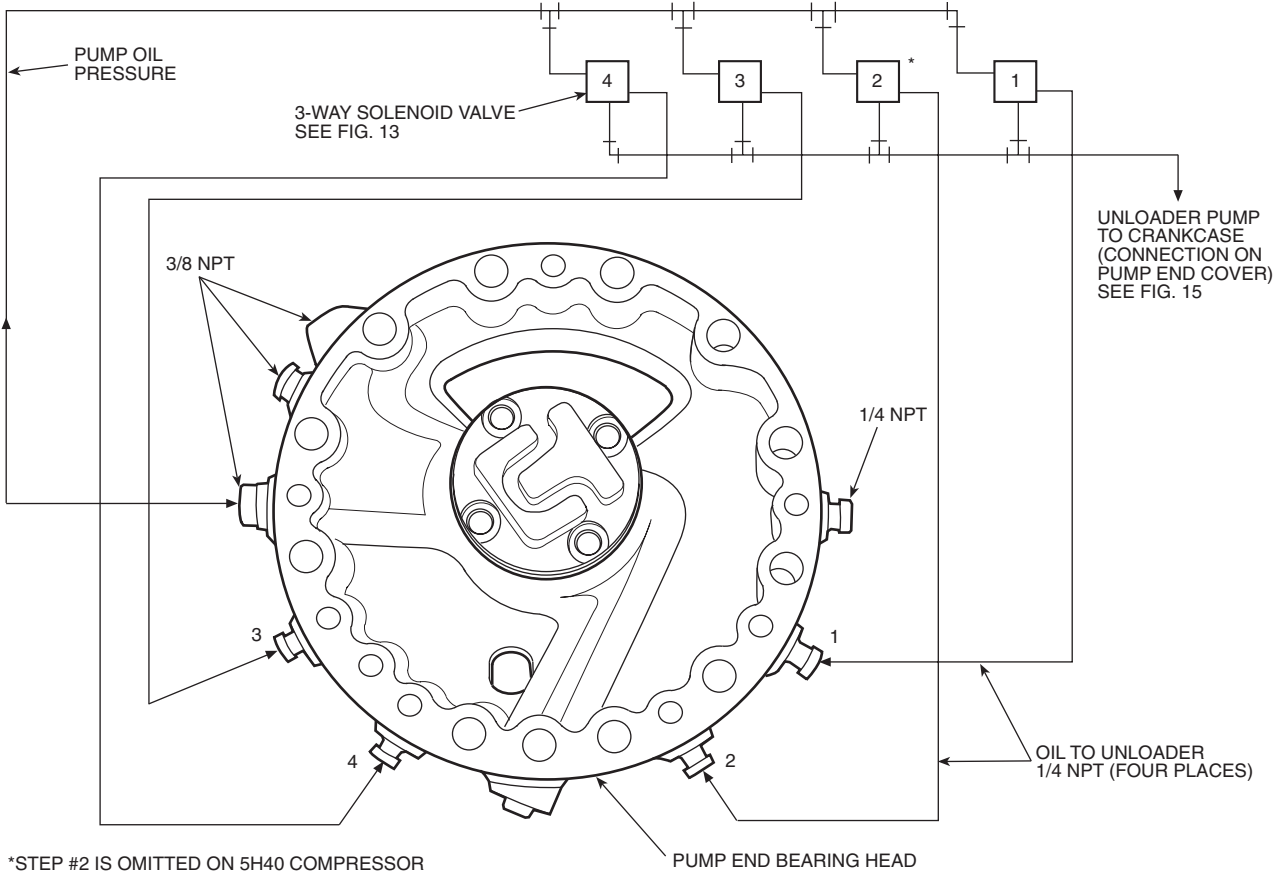
BOTTOM VIEW HANDHOLE COVER (ALL PIPE PLUGS 1/8 NPT)

**Fig. 12 — 5F40 and 5F60 Compressors**

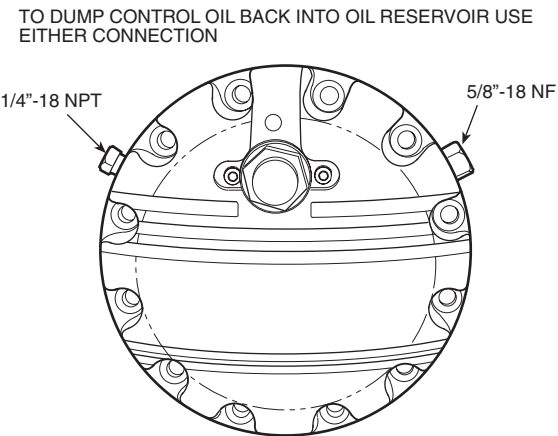


**Fig. 13 — Recommended Solenoid Valve Operation**





**Fig. 14 — 5H40, 46, 60, 66, 80, 86 Bearing Head**

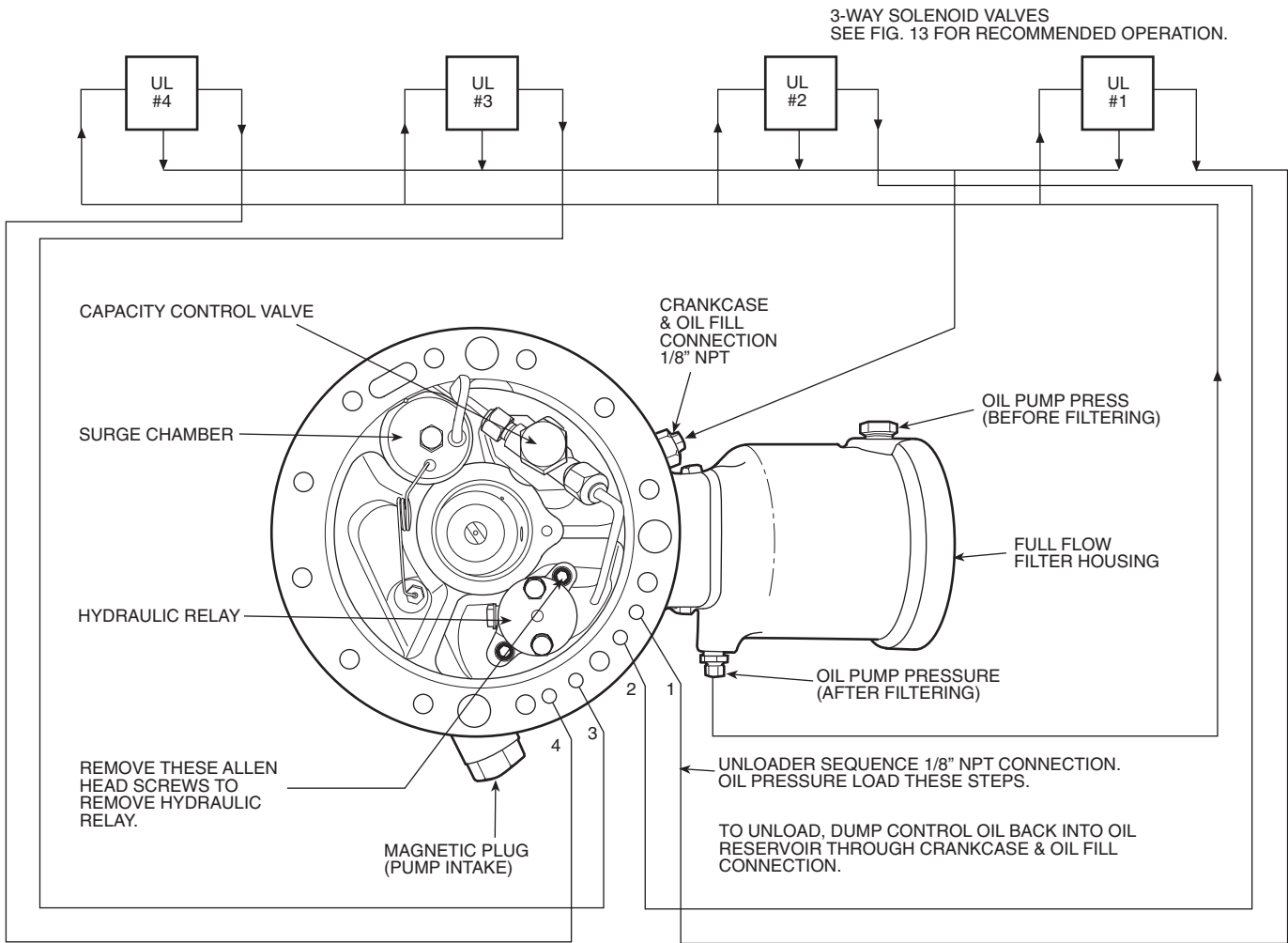


**Fig. 15 — 5H40, 46, 60, 66, 80, 86 Pump End Cover Assembly**

**CAPACITY CONTROL MODIFICATIONS FOR HEAT PUMP APPLICATION** — Where 5F40, 5F60, and 5H compressors are used in refrigerant cycle reversing heat pump applications, it is usually necessary to modify the standard capacity control arrangement to satisfy unloading requirements. On summer cycle, the compressor is required to unload as circulating water or air temperature drops. During winter cycle, the control works in reverse, so that the compressor unloads as the circulating water or air temperature increases. It is necessary for the compressor to unload in response to either a summer or winter temperature-sensing device, depending on the particular cycle in operation.

Where summer and winter design suction temperatures are within design range of either electric or pneumatic compensation devices, capacity control may be external. However, another means is normally required.

Usually modification to the compressor capacity control system is required. The compressor can be modified in 2 ways: (1) for applications requiring 50% capacity reduction; (2) for applications requiring more than one step of capacity reduction. See Fig. 10 for a typical 2-step external capacity control arrangement.



**Fig. 16 — 5H120 and 126 Bearing Head Assembly**

**Application Requiring 50% Capacity Reductions** — This is the usual specification for heat pump applications and should cover majority of cases. The necessary modifications to compressor capacity control can be accomplished by ordering the compressor with factory modifications and then completing modification at the jobsite with field-supplied components.

**Factory Modifications** — The compressor order should state that compressor is to be special for heat pump application, and is to include only enough unloader power elements to unload the compressor down to 50% displacement. The unloaded cylinders will be those closest to pump end of the compressor.

**Field Completion** — Install a 1/4-in. or 3/8-in. bypass line between the control oil pressure connection and the crankcase and install a solenoid valve in this line.

The cylinders set up for unloading may be loaded or unloaded by operation of this solenoid valve. When the solenoid valve is closed, full oil pressure is available to the controlled cylinders and these will be loaded so that compressor will be operating on 100% capacity. When the solenoid valve is open, oil pressure will be bled from the controlled cylinders and they will be unloaded, so that compressor will then be operating at 50% capacity. A 2-step thermostat controlling the compressor can thus utilize 2 capacity steps by operating the compressor starter and solenoid bypass valve.

**Application Requiring More Than One Step of Capacity Reduction** — This can be furnished on special order for compressors having 6, 8, or 12 cylinders. Arrangement consists of

furnishing a compressor with external solenoid unloading type capacity control. The control can be furnished with or without 3-way valves (Table 18).

**Table 18 — Capacity Control Steps and Heat Pump Modification**

COMPRESSOR	EXTERNAL 3-WAY SOLENOID VALVES	AVAILABLE CAPACITY STEPS (%)
5F40, 5H40, 5H46	3	100, 75, 50, 25
5F60, 5H60, 5H66	4	100, 83.3, 66.7, 50, 33.3
5H80	4	100, 87.5, 62.5, 37.5, 25
5H120, 5H126	4	100, 83.3, 66.7, 50, 33.3

**Hot Gas Bypass** — Hot gas bypass may be required on some systems for one of the following reasons:

1. Frequent operation at loads below minimum capacity (compressor fully unloaded).
2. To avoid low-load compressor cycling on the low-pressure switch. *Excessive cycling can reduce equipment life and increase demand charges.*
3. Specifications call for hot gas bypass (better humidity control, etc.).

The variety of systems using 5F,H compressors make it impractical to cover all aspects of hot gas bypass operation. The following guidelines will aid in determining the proper application.

The hot gas bypass valve is basically a pressure regulating valve installed to hold a constant compressor suction pressure. It should operate over as small a pressure range as possible. The normal set point of the valve should be coordinated with cylinder unloaders so that the bypass valve starts to open at a pressure where the last cylinder bank unloads, and is fully open at a slightly lower pressure. Types, ratings and published application guides for various available valves must be evaluated to determine the proper valve and installation practice for each application.

If a compressor system is to operate down to zero load, the valve capacity should equal compressor capacity when fully unloaded. For systems using multiple evaporators, it may be necessary to use multiple hot gas valves.

Hot gas should be taken from a point as close as possible to compressor discharge and fed through a hot gas solenoid valve and then through a hot gas valve. The hot gas solenoid valve can be controlled by a pressure switch or temperature switch. On compressors equipped with an electrically actuated cylinder unloader, the hot gas solenoid should be wired in parallel with the solenoid that unloads the final cylinder bank so that bypassing starts immediately when all cylinders are unloaded.

**HOT GAS INJECTION INTO LIQUID LINE** — When amount of bypass is small and the evaporator has a low pressure drop distribution system and existing system piping does not present problems, hot gas is frequently injected into the liquid line between the thermostatic expansion valve (TXV) and the evaporator. The ideal point for hot gas injection is into the side inlet of a side connection distributor, where inlet is downstream of distributor orifice. If too much hot gas is injected upstream of a distributor orifice, gas binding and erratic expansion valve operation will result. Injection into liquid line is recommended whenever practical, since agitation in the evaporator and normal operation of the TXV will tend to thoroughly desuperheat injected hot gas and prevent compressor overheating.

**HOT GAS INJECTION INTO COMPRESSOR SUCTION** — Hot gas injection into compressor suction is sometimes necessary but must be done with caution to ensure sufficient desuperheating of hot gas and to prevent liquid slugging in the compressor. Following guidelines should be observed:

1. Inject hot gas as close as possible to the evaporator outlet.
2. Install a TXV bulb at least 3 or 4 ft (further if possible) downstream from the hot gas injection point to ensure good gas mixing before the bulb.

3. Install a separate small TXV to inject liquid refrigerant into the suction line along with bypass gas. This valve should have capacity approximately 25% of hot gas valve capacity since hot gas must be superheated but not condensed.
4. Install a suction (knockout) drum in the suction line immediately before the compressor and downstream of the hot gas inlet and liquid injection inlet. Only larger industrial systems or systems with many remote evaporators can normally justify the extra expense of injecting hot gas into the compressor suction.

**Motor Selection Data** — Motor selection data based on brake horsepower occurring at design operating condition is usually satisfactory for applications in air conditioning suction temperature range.

Required compressor starting torque is dependent on discharge pressure as well as pressure differential occurring during start-up and is the same for any compressor speed. Values shown in Table 19 indicate maximum starting torque for R-12, R-134a, R-22, R-502, and R-507/404A. In most cases, a standard torque motor can be selected because of the partially unloaded starting feature of the 5F and 5H compressors.

In selection of a motor, the required motor starting torque must exceed the compressor starting torque only when the compressor is operating at same speed as the motor. If compressor speed is less than motor speed, as on some belt drive units, the motor starting torque requirements are reduced in proportion to the speed ratio between the compressor and motor because of mechanical advantage available to the motor.

In special applications or systems where there is a large pulldown requirement, the bhp requirement during pulldown may significantly exceed bhp at design conditions. The motor must not be overloaded during pulldown operation. If the motor is sized for pulldown, it will be only partially loaded during design operation and will run inefficiently. Therefore, select a motor that will be optimized for system design requirements and not for pulldown requirements. Two ways for handling this are:

1. Install a crankcase pressure regulator in the system to maintain a given saturated suction temperature, thereby controlling bhp requirement, or
2. Install a current sensing device so that the motor current draw does not exceed the maximum rated motor current.

**Drive Packages** — Table 20 indicates drive package components for 5F,H standard belt drive packages. Figure 17 and Tables 21 and 22 indicate data for the flywheel used in each of these packages.

**Table 19 — Compressor Starting Torques**

COMPRESSOR SIZE	% UNLOADING DURING STARTING	SATURATED DISCHARGE TEMPERATURE (F)								
		80 F			100 F			120 F		
		R-12, R-134a	R-22	R-502, R-507/404A	R-12, R-134a	R-22	R-502, R-507/404A	R-12, R-134a	R-22	R-502, R-507/404A
Maximum Starting Torque (lb-ft)										
5F20	None	19	30	32	27	42	45	34	53	57
5F30	None	22	34	37	30	47	50	39	61	65
5F40	75	18	28	30	25	39	42	32	50	53
5F60	66 <sup>2</sup> / <sub>3</sub>	22	34	37	30	47	50	39	61	65
5H40	75	42	65	70	57	89	95	74	115	123
5H46	75	53	81	87	71	111	119	92	144	154
5H60	66 <sup>2</sup> / <sub>3</sub>	51	79	85	69	107	115	90	140	149
5H66	66 <sup>2</sup> / <sub>3</sub>	64	99	106	86	134	144	113	175	186
5H80	75	58	90	96	79	123	130	102	158	169
5H86	75	73	113	120	99	154	162	127	197	212
5H120	66 <sup>2</sup> / <sub>3</sub>	91	141	151	123	191	204	160	249	266
5H126	66 <sup>2</sup> / <sub>3</sub>	114	176	189	154	239	255	200	311	332

**Table 20 — Belt Drive Packages**

DRIVE PACKAGE PART NUMBER	COMPR SIZE	HP	FRAME	SHAFT DIAM (in.)	COMPR RPM	CENTER TO CENTER (in.)	FLYWHEEL		PULLEY		BELTS	
							Pkg No.	OD	Pkg No.	PD	Pkg No.	No. of Belts
5F20-A181	5F20	3	182T	1 1/8	1750	19.3	5F20-394	7.5	5F20-861	7.4	5F20-851	2
	5F20	5	184T	1 1/8	1750	19.3	5F20-394	7.5	5F20-861	7.4	5F20-851	2
	5F30	5	184T	1 1/8	1750	19.3	5F20-394	7.5	5F20-861	7.4	5F20-851	2
5F20-A191	5F20	3	182T	1 1/8	1450	20.2	5F20-394	7.5	5F20-881	6.2	5F20-851	2
	5F30	5	184T	1 1/8	1450	20.2	5F20-394	7.5	5F20-881	6.2	5F20-851	2
5F20-A201	5F20	7.5	213T	1 3/8	1750	19.3	5F20-394	7.5	5F20-891	7.4	5F20-851	2
	5F20	10	215T	1 3/8	1750	19.3	5F20-394	7.5	5F20-891	7.4	5F20-851	2
	5F30	7.5	213T	1 3/8	1750	19.3	5F20-394	7.5	5F20-891	7.4	5F20-851	2
	5F30	10	215T	1 3/8	1750	19.3	5F20-394	7.5	5F20-891	7.4	5F20-851	2
5F20-A211	5F20	7.5	213T	1 3/8	1450	20.2	5F20-394	7.5	5F20-901	6.2	5F20-851	2
	5F30	7.5	213T	1 3/8	1450	20.2	5F20-394	7.5	5F20-901	6.2	5F20-851	2
	5F30	10	215T	1 3/8	1450	20.2	5F20-394	7.5	5F20-901	6.2	5F20-851	2
5F30-A201	5F30	15	254T	1 5/8	1750	19.3	5F30-394	7.5	5F30-921	7.4	5F30-831	3
5F40-A181	5F40	7.5	213T	1 5/8	1750	26.6	5F40-394	9.5	5F30-881	9.4	5F40-841	3
	5F40	10	215T	1 5/8	1750	26.6	5F40-394	9.5	5F30-881	9.4	5F40-841	3
	5F60	10	215T	1 5/8	1750	26.6	5F40-394	9.5	5F30-881	9.4	5F40-841	3
5F40-A191	5F40	7.5	213T	1 3/8	1450	25.5	5F40-394	9.5	5F40-891	8.0	5F30-841	3
	5F40	10	215T	1 3/8	1450	25.5	5F40-394	9.5	5F30-891	8.0	5F30-841	3
	5F60	10	215T	1 3/8	1450	25.5	5F40-394	9.5	5F30-891	8.0	5F30-841	3
5F40-A201	5F40	15	254T	1 5/8	1750	26.6	5F40-394	9.5	5F40-871	9.4	5F40-841	3
	5F40	20	256T	1 5/8	1750	26.6	5F40-394	9.5	5F40-871	9.4	5F40-841	3
	5F60	15	254T	1 5/8	1750	26.6	5F40-394	9.5	5F40-871	9.4	5F40-841	3
	5F60	20	256T	1 5/8	1750	26.6	5F40-394	9.5	5F40-871	9.4	5F40-841	3
5F40-A211	5F40	15	254T	1 5/8	1450	25.5	5F40-394	9.5	5F30-901	8.0	5F30-841	3
	5F60	15	254T	1 5/8	1450	25.5	5F40-394	9.5	5F30-901	8.0	5F30-841	3
	5F60	20	256T	1 5/8	1450	25.5	5F40-394	9.5	5F30-901	8.0	5F30-841	3
5F60-A191	5F60	25	284T	1 7/8	1750	26.6	5F40-394	9.5	5F40-881	9.4	5F40-841	3
5F60-A211	5F60	25	284T	1 7/8	1450	25.5	5F40-394	9.5	5F40-891	8.0	5F30-841	3
5H40-911	5H40	20	256T	1 5/8	1750	32.2	5H40-394	11.0	5H40-811	11.0	5H40-861	3
5H40-921	5H40	20	256T	1 5/8	1450	30.7	5H40-394	11.0	5H60-811	9.0	5H60-861	3
5H40-931	5H40	25	284T	1 7/8	1750	32.2	5H40-394	11.0	5H80-811	11.0	5H40-861	3
	5H40	30	286T	1 7/8	1750	32.2	5H40-394	11.0	5H80-811	11.0	5H40-861	3
	5H60	30	286T	1 7/8	1750	32.2	5H40-394	11.0	5H80-811	11.0	5H40-861	3
5H40-941	5H40	25	284T	1 7/8	1450	30.7	5H40-394	11.0	5H120-811	9.0	5H60-861	3
	5H40	30	286T	1 7/8	1450	30.7	5H40-394	11.0	5H120-811	9.0	5H60-861	3
	5H60	30	286T	1 7/8	1450	30.7	5H40-394	11.0	5H120-811	9.0	5H60-861	3
5H40-951	5H40	40	324T	2 1/8	1750	32.2	5H40-394	11.0	5H40-821	11.0	5H40-861	3
	5H40	50	326T	2 1/8	1750	32.2	5H40-394	11.0	5H40-821	11.0	5H40-861	3
	5H60	40	324T	2 1/8	1750	32.2	5H40-394	11.0	5H40-821	11.0	5H40-861	3
5H40-961	5H40	40	324T	2 1/8	1450	30.7	5H60-394	11.0	5H60-821	9.0	5H80-861	5
	5H40	50	326T	2 1/8	1450	30.7	5H60-394	11.0	5H60-821	9.0	5H80-861	5
	5H60	40	324T	2 1/8	1450	30.7	5H60-394	11.0	5H60-821	9.0	5H80-861	5
	5H60	50	326T	2 1/8	1450	30.7	5H60-394	11.0	5H60-821	9.0	5H80-861	5
5H60-921	5H60	50	326T	2 3/8	1750	32.2	5H60-394	11.0	5H80-821	11.0	5H120-861	5
	5H80	60	364T	2 3/8	1750	36.7	5H60-394	11.0	5H120-821	11.0	5H40-871	5
5H60-931	5H80	75	365T	2 3/8	1750	36.7	5H60-394	11.0	5H120-821	11.0	5H40-871	5
	5H120	60	364T	2 3/8	1750	36.7	5H60-394	11.0	5H120-821	11.0	5H40-871	5
	5H120	75	365T	2 3/8	1750	36.7	5H60-394	11.0	5H120-821	11.0	5H40-871	5
	5H120	75	365T	2 3/8	1750	36.7	5H60-394	11.0	5H120-821	11.0	5H40-871	5
5H60-941	5H60	60	364T	2 3/8	1750	32.8	5H60-394	11.0	5H120-821	11.0	5H120-861	5
	5H60	75	365T	2 3/8	1750	32.8	5H60-394	11.0	5H120-821	11.0	5H120-861	5
5H80-911	5H80	40	324T	2 1/8	1750	36.7	5H60-394	11.0	5H80-821	11.0	5H40-871	5
	5H80	50	326T	2 1/8	1750	36.7	5H60-394	11.0	5H80-821	11.0	5H40-871	5
5H80-921	5H80	40	324T	2 1/8	1450	38.2	5H60-394	11.0	5H60-821	9.0	5H40-871	5
	5H80	50	326T	2 1/8	1450	38.2	5H60-394	11.0	5H60-821	9.0	5H40-871	5
5H80-931	5H80	60	364T	2 3/8	1450	38.2	5H60-394	11.0	5H60-831	9.0	5H40-871	5
	5H120	60	364T	2 3/8	1450	38.2	5H60-394	11.0	5H60-831	9.0	5H40-871	5
5H80-941	5H80	75	365T	2 3/8	1450	38.2	5H80-394	11.0	5H80-831	9.0	5H80-871	6
5H120-941	5H120	75	365T	2 3/8	1450	38.2	5H120-394	11.0	5H80-831	9.0	5H80-871	6
5H80-951	5H80	100	404T	2 7/8	1750	36.7	5H120-394	11.0	5H120-831	11.0	5H120-871	9
	5H120	100	404T	2 7/8	1750	36.7	5H120-394	11.0	5H120-831	11.0	5H120-871	9
5H120-911	5H120	100	404T	2 7/8	1450	38.2	5H120-394	11.0	5H40-841	9.0	5H120-871	9

**LEGEND**

**PD** — Pitch Diameter (in.)

NOTE: Compressor shaft diameter before taper begins:

5F20, 30 = 1.0 in.  
 5F40, 60 = 1.5 in.  
 All 5H = 2.0

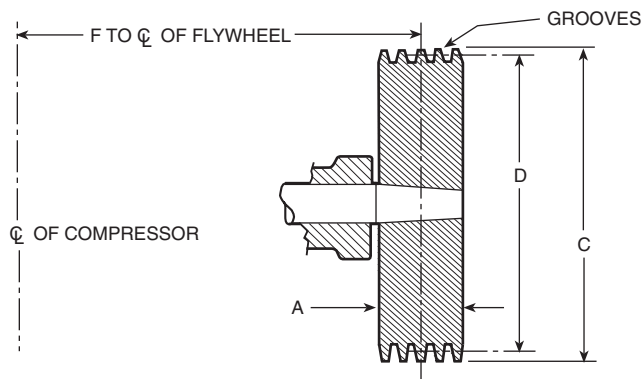


Fig. 17 — Flywheel

Table 21 — Flywheel Data

FLYWHEEL PACKAGE NUMBER	FLYWHEEL MODEL	WIDTH A (in.)*	OD C (in.)*	PITCH DIAM D (in.)*	GROOVES (No. and Type)
5F20-394	5F20-1053	1 <sup>3</sup> / <sub>4</sub>	8.0	7.5	2-B
5F30-394	5F30-1053	2 <sup>1</sup> / <sub>2</sub>	8.0	7.5	3-B
5F40-394	5F40-1054	2 <sup>1</sup> / <sub>2</sub>	10.0	9.5	3-B
5F60-394	5F60-1054	3 <sup>1</sup> / <sub>8</sub>	10.0	9.5	4-B
5H40-394	5H40-1104	3 <sup>3</sup> / <sub>8</sub>	11.75	11.0	3-C
5H60-394	5H60-1104	5 <sup>3</sup> / <sub>8</sub>	11.75	11.0	5-C
5H80-394	5H80-1104	6 <sup>3</sup> / <sub>8</sub>	11.75	11.0	6-C
5H120-394	5H120-1104	9 <sup>3</sup> / <sub>8</sub>	11.75	11.0	9-C

\*Refer to Fig. 17.

Table 22 — Flywheel — Compressor Dimensions

COMPRESSOR MODEL	FLYWHEEL MODEL	DIMENSIONS F (in.)*
5F20	5F20-1053	6 <sup>7</sup> / <sub>8</sub>
5F30	5F20-1053	8 <sup>5</sup> / <sub>8</sub>
	5F30-1053	8 <sup>3</sup> / <sub>4</sub>
5F40	5F40-1054	10 <sup>5</sup> / <sub>8</sub>
5F60	5F40-1054	11 <sup>5</sup> / <sub>8</sub>
	5F60-1054	11 <sup>3</sup> / <sub>4</sub>
5H40	5H40-1104	13 <sup>1</sup> / <sub>4</sub>
	5H60-1104	13 <sup>11</sup> / <sub>16</sub>
5H60	5H40-1104	14
	5H60-1104	14 <sup>7</sup> / <sub>16</sub>
5H80	5H40-1104	20
	5H60-1104	20 <sup>7</sup> / <sub>16</sub>
	5H80-1104	18 <sup>9</sup> / <sub>16</sub>
	5H120-1104	21 <sup>5</sup> / <sub>16</sub>
5H120	5H60-1104	20 <sup>11</sup> / <sub>16</sub>
	5H120-1104	21 <sup>9</sup> / <sub>16</sub>

\*Refer to Fig. 17.

## BOOSTER COMPRESSORS FOR REFRIGERANT 12, 22, 502, AND 507/404A

**Booster Application Data** — The following data supplements the single-stage compressor application data, and adds information pertaining to booster application only. Refer to the single-stage compressor data for all other information.

**Rating Basis** — All booster ratings\* are given in refrigeration effect and are based on:

1. Use of a liquid-suction heat interchanger. All liquid-suction interchangers should have a bypass connection on the liquid side so that adjustment can be made in event that too much superheating of suction gas causes excessive heating of compressor. This is especially true for Refrigerant 22, which has a higher compression exponent than Refrigerant 12.

2. The liquid refrigerant at Point A (Fig. 18) at saturation temperature corresponds to booster discharge pressure. This is often referred to as saturated intermediate temperature.

This occurs when booster discharge gas is condensed in a cascade (refrigerant-cooled) condenser, or when using an open flash-type intercooler in a direct staged system. When subcooling of liquid takes place in a closed-type intercooler, it is not possible to bring liquid temperature down to saturated intermediate temperature because of temperature difference required for heat transfer through the liquid coil. In this case, the compressor rating must be decreased 3% for each 10 degrees that liquid temperature at Point A is above the saturated intermediate temperature.

3. Use of only half of the standard number of suction valve springs per cylinder. All 5F,H compressors are factory assembled with the standard number of suction valve springs; therefore, one-half of the springs per cylinder must be removed in the field for booster applications.
4. Booster ratings are based on a 1750 rpm compressor speed.

\*R-507/404A ratings are similar to R-502.

**“R” Factors** — In a multistage compression system, the intermediate or high-stage compressor must have sufficient capacity to handle the low-stage (booster) compressor load plus heat added to refrigerant gas by a low-stage machine during compression. Likewise, if an intermediate stage compressor should be used, the high-stage compressor must have sufficient capacity to handle the intermediate stage compressor load plus heat added to the refrigerant gas by an intermediate stage machine during compression.

To assist in the selection of higher stage compressors, Table 23 presents “R” factors that depict approximate required relationship between stages at various saturated temperature conditions.

To determine the required capacity of a higher stage compressor, multiply lower stage compressor capacity by the proper “R” factor from Table 23. Any additional loads handled at intermediate pressure must be added to this figure to arrive at the total higher stage load.

**Multistage System Pointers** — A staged system is essentially a combination of 2 or more simple refrigerant cycles. In combining 2 or more simple flow cycles to form a staged system for low temperature refrigeration, 2 basic types of combinations are common (Fig. 18).

**DIRECT STAGING** — Involves use of compressors, in series, compressing a single refrigerant.

**CASCADE STAGING** — Usually employs 2 or more refrigerants of progressively lower boiling points. Compressed refrigerant of low stage is condensed in an exchanger (cascade condenser) that is cooled by evaporation of another lower pressured refrigerant in the next higher stage.

**Safety Factors** — Use of capacity safety factors in selecting booster compressors must be a matter of judgment when making selection.

Factors that have a bearing on satisfactory compressor selections are: accuracy of load estimate, amount of safety factor included in the total load, degree of importance of meeting specified capacity at given condition, temperature level of operation and magnitude of refrigeration load. All of the factors must be recognized when considering the use of a capacity safety factor in selecting a booster compressor.

Figure 19 presents reasonable safety factors for use in selection of booster compressors. These can be employed when it is not desired to establish a factor based on selector’s judgment.

When a capacity safety factor is used, the compressor is selected at its maximum speed to handle design load plus safety factor. Multiplying factors for non-standard speeds are shown in Fig. 20.

Whether or not added capacity offered by the safety factor is incorporated at once is a matter of judgment. If it is, then the compressor will be operated at maximum speed at the start and any excess capacity achieved will be reflected in faster

pulldowns or lower temperatures. It is also a good practice to drive the machine at a speed that will provide slightly more rated capacity than is required by design load. Additional speed-up available will then constitute reserve capacity in the event it is needed. Motors should be sized to run the compressor at maximum speed to forestall any motor changes, should this maximum compressor speed be required in the future.

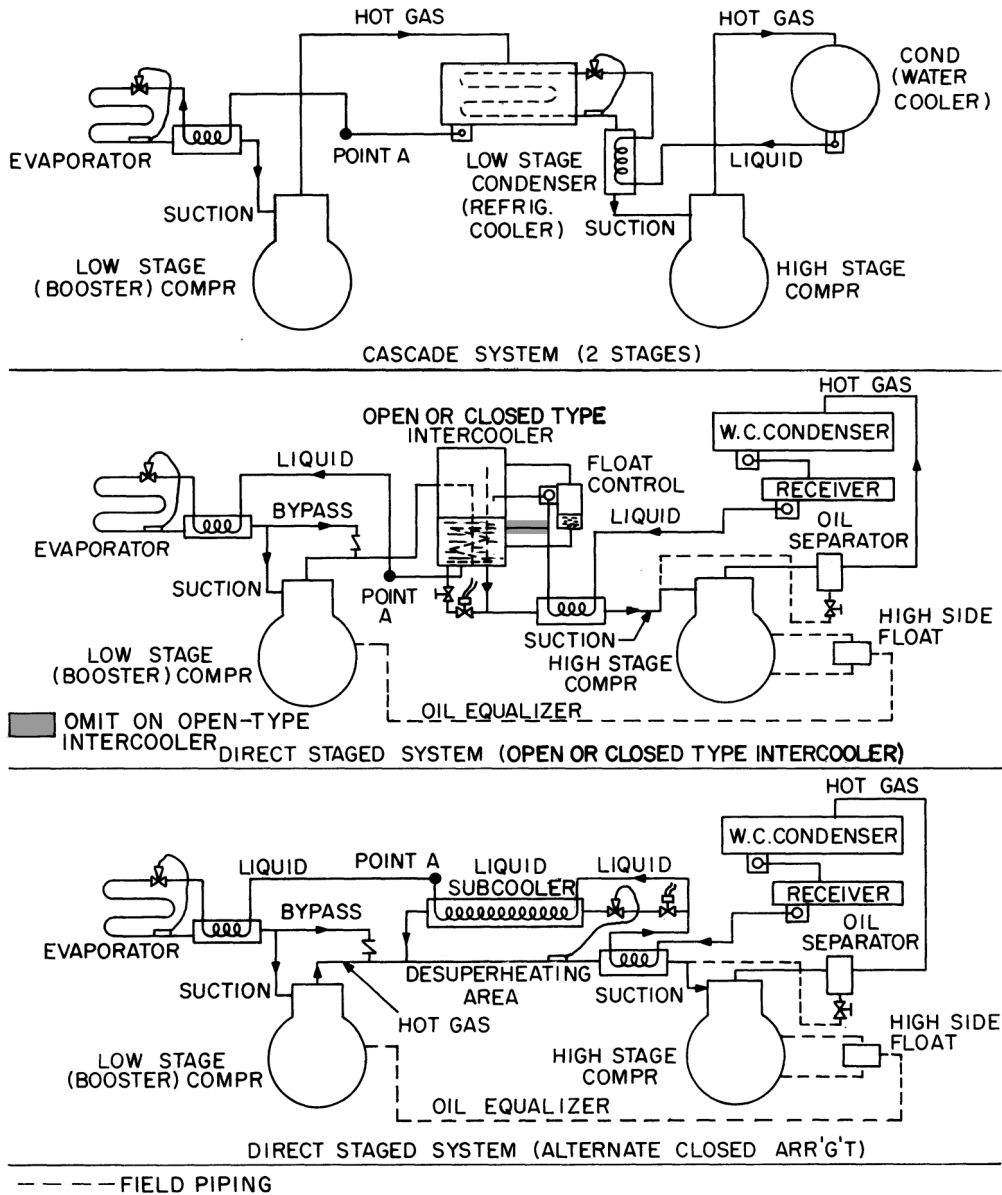


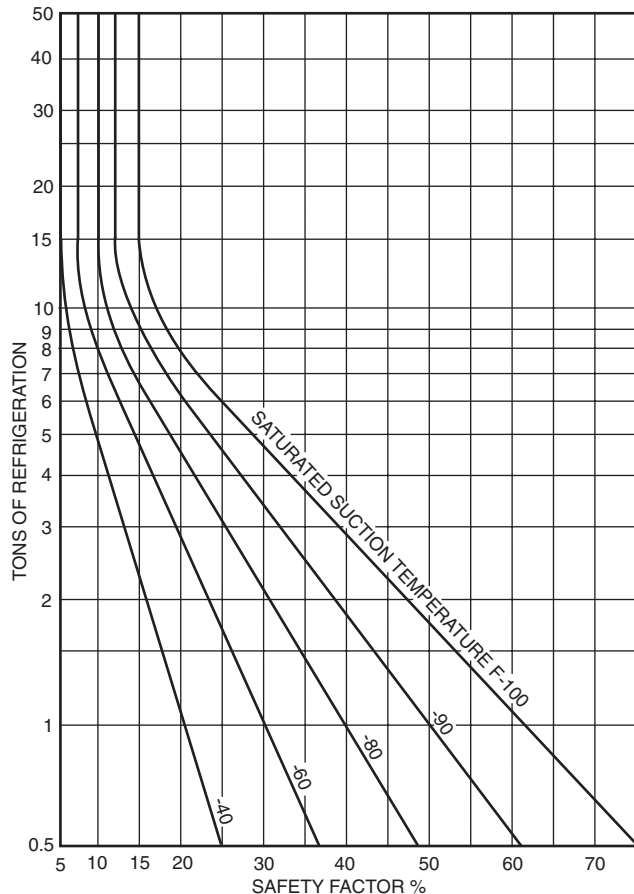
Fig. 18 — Flow Diagrams for Common Multistage Systems (Not to be used as Piping Diagrams)

**Table 23 — Booster “R” Factors**

SUCTION TEMP (F)	DISCHARGE TEMPERATURE (F)								
	-50	-40	-30	-20	-10	0	10	20	30
	R-12								
-80	—	1.230	1.276	1.328	1.377	1.429	1.470	—	—
-70	—	1.186	1.230	1.280	1.330	1.380	1.421	1.458	1.489
-60	—	—	1.183	1.233	1.284	1.334	1.375	1.410	1.441
-50	—	—	—	1.189	1.238	1.287	1.328	1.363	1.397
-40	—	—	—	—	1.190	1.240	1.280	1.318	1.350
-30	—	—	—	—	—	1.291	1.234	1.270	1.307
	R-22								
-100	1.261	1.310	1.360	1.410	1.453	—	—	—	—
	1.221	1.271	1.319	1.371	1.414	—	—	—	—
-90	1.214	1.263	1.313	1.361	1.407	1.448	—	—	—
	1.175	1.221	1.270	1.321	1.368	1.408	—	—	—
-80	1.170	1.218	1.269	1.315	1.360	1.400	1.434	—	—
	1.129	1.172	1.221	1.271	1.319	1.359	1.394	—	—
-70	—	1.172	1.221	1.269	1.313	1.351	1.388	1.424	—
	—	1.125	1.173	1.221	1.270	1.311	1.348	1.382	—
-60	—	—	1.178	1.220	1.267	1.303	1.340	1.377	1.406
	—	—	1.125	1.172	1.221	1.263	1.300	1.337	1.367
-50	—	—	—	1.175	1.219	1.256	1.291	1.329	1.360
	—	—	—	1.123	1.173	1.217	1.252	1.289	1.319
-40	—	—	—	—	1.171	1.209	1.245	1.281	1.311
	—	—	—	—	1.126	1.169	1.205	1.241	1.261
-30	—	—	—	—	—	1.160	1.199	1.233	1.265
	—	—	—	—	—	1.121	1.159	1.196	1.227

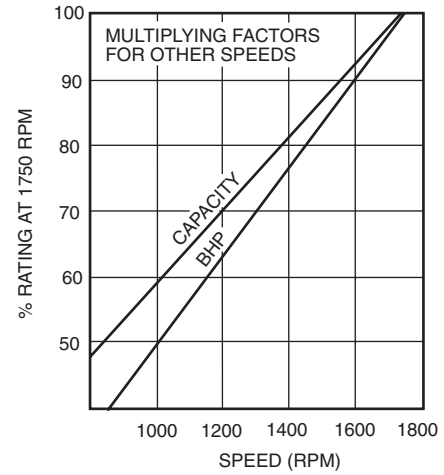
□ Air-cooled (R-12 and R-22)    ■ Water-cooled (R-22 only)

NOTE: For R-502, “R” Factor =  $1 + \frac{[0.212 \times \text{low stage bhp}]}{\text{low stage capacity (tons)}}$



**Fig. 19 — Booster Compressor Selection Safety Factors**

**Determining Intermediate Pressure —** In application of commercial compressors to staged systems, the lowest total bhp per ton and most economical equipment selection results when using approximately equal compression ratios for each stage. It is also economical to juggle assigned compression ratios to fit available sizes of machines.



**Fig. 20 — Multiplying Factors — Nonstandard Speeds**

The use of Fig. 21 (page 32), will allow direct determination of proper intermediate pressure that will result in equal compression ratios per stage for a direct 2-stage system. Information in Fig. 21 is given in terms of saturated temperature instead of pressures, for easier use with compressor ratings.

Existence of a second appreciable load, at some higher suction pressure level, will often dictate the most convenient intermediate pressure.

**Gas Desuperheating —** Operation of a direct staged system requires cooling of the gas between stages; otherwise, highly superheated discharge gas from low-stage machine would be taken directly into the suction of higher stage compressor and further compression would result in excessive heating of this compressor.

**Liquid Cooling —** It is also necessary to employ liquid cooling between stages and increase refrigeration effect of liquid delivered to evaporator to realize rated capacity of booster compressor. Amount of refrigeration expended in cooling liquid between stages is accomplished more economically at the level of high-stage compressor suction than at the level of low-stage suction.

Three common methods of gas desuperheating and liquid cooling for direct stage systems are illustrated in Fig. 18. In open-type systems, refrigerant liquid is cooled down to the saturation temperature corresponding to intermediate pressure. In closed-type systems, good intercooler design usually results in refrigerant liquid being cooled down to 10 to 20 degrees above saturation temperature corresponding to intermediate pressure.

**Oil Separators and Lubrication —** In cascade-type systems, where evaporators and suction lines are properly designed for oil return to the compressor, oil separators are usually not used.

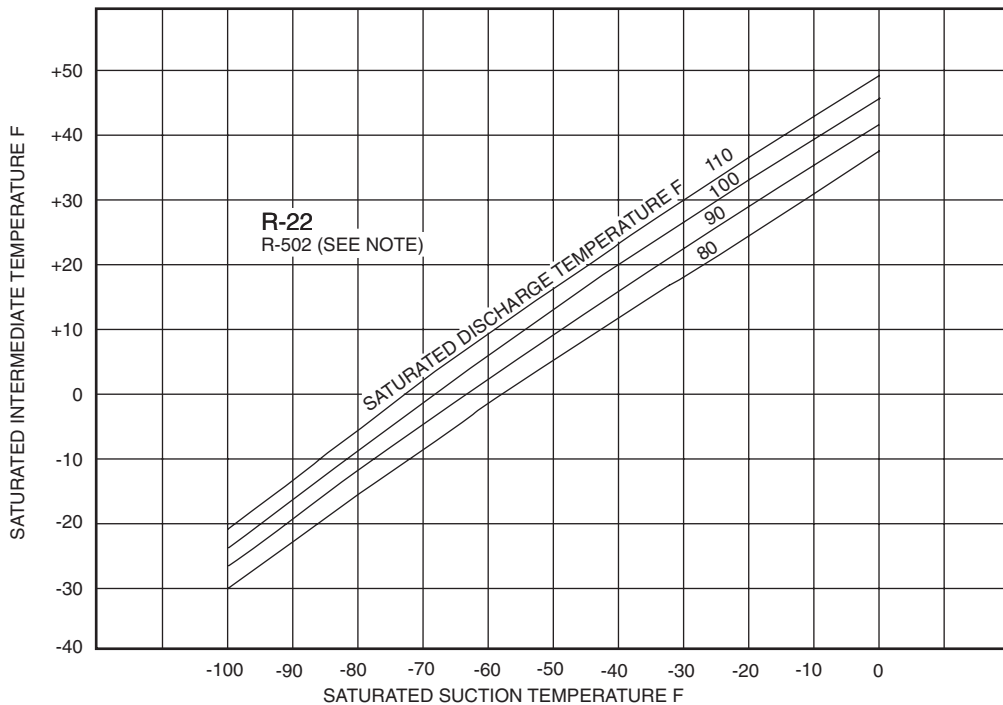
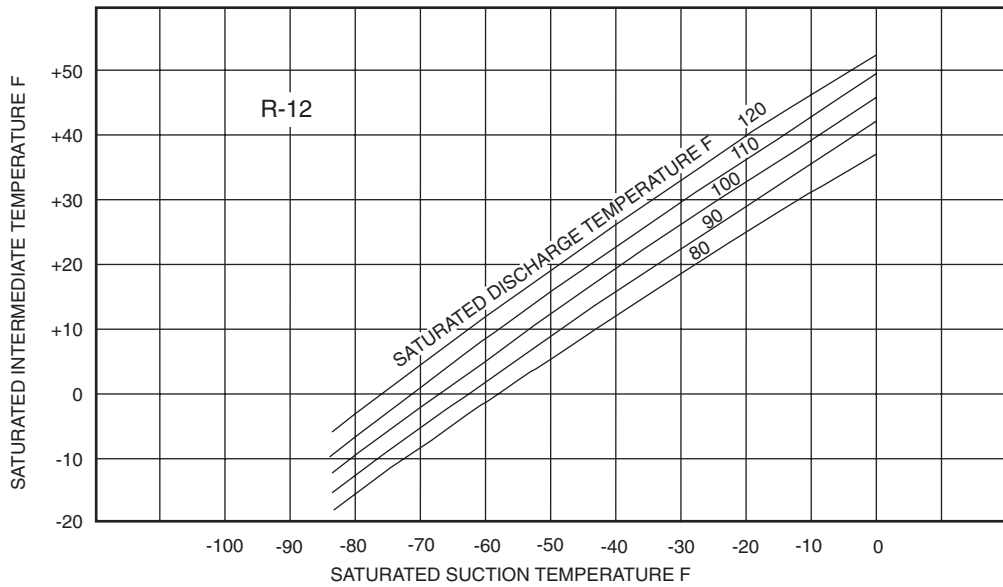
In direct stage systems, however, oil may tend to accumulate in one of the stages and thus result in lack of lubrication in other machine. By use of oil transfer lines, equalization of oil level between crankcases can be achieved by manual operation at periodic intervals. Automatic control of proper oil return to both compressors is effected by use of a high stage discharge line oil separator, returning oil to high stage machine, and a high side float, connected to high stage machine crankcase, which continually drains excess oil from this crankcase down to the next lower stage compressor (Fig. 18).

For booster application, factory oil charge should be drained and replaced with a suitable viscosity oil for low temperature application.

**Control Pressurestat for Booster Application** — The standard dual pressure switch furnished with the 5F,H compressor cannot be used for booster application. Replace it with an appropriate low temperature dual pressurestat that can operate at values shown in Table 24. Any commercial pressure switch is acceptable; for example, an Allen-Bradley Bulletin 836, type L33 for R-12 or type 1 for R-22.

**Table 24 — Control Pressurestats for Low Stage Application**

CHARACTERISTICS	R-12	R-22, R-502, OR R-507/404A
Switch Action — High — Low	Open on pressure rise Open on pressure fall	Open on pressure rise Open on pressure fall
Range — High — Low	20" Vac to 65 psig 30" Vac to 20 psig	30" Vac to 110 psig 30" Vac to 25 psig
Differential — High — Low	8 to 30 psi adjust. 5 to 15 psi adjust.	12 to 30 psi adjust. 9 to 30 psi adjust.
Max Pressure — High — Low	200 psig 120 psig	300 psig 300 psig



NOTE: For R-502, lower saturated intermediate temperature is approximately 5 F.

**Fig. 21 — Optimum Intermediate Temperature for 2-Stage Compression (Incorporating Equal Compression Ratios per Stage)**



**Discharge Valve Springs** — When 5H compressors are used for booster applications where discharge pressure is below 10 psig, the standard discharge valve springs furnished with the machine should be replaced with an equal number of lighter weight springs, Part Number 5H41-1801.

No change in discharge valve springs is recommended for 5F compressors.

**Water-Cooled Heads** — Standard 5F,H compressors are not equipped with water-cooled heads but they are available on special order. Water cooling of heads is generally not necessary in R-12 or R-502 booster applications. For applications with R-22 involving high compression ratios, 5 or above, 5F,H booster compressors should be equipped with water-cooled heads.

**Motor Selection Data** — In staged refrigeration systems, the high stage compressor starts first and runs until low stage pressure has been reduced to a predetermined level before the low stage machine starts. With direct staged arrangements, the high stage machine draws gas from the evaporator through low stage machine bypass during this initial period. Size of the selected motor must be related to the maximum condition at which booster compressor can operate.

Compressor may run under heavy loads during periods of high suction pressure, especially on starting when system is warm. To handle these situations the motor must be sized larger than the actual balanced operation brake horsepower indicates, or special attention must be paid to operation of the system when starting initially. Tables 25-27 give balanced brake horsepower values at 1750 rpm.

If the system is to operate only at a fixed low temperature, it is possible to avoid oversizing of motors providing careful operation is followed when the system is first put in operation.

On applications requiring reduction from ambient conditions to some extremely low temperature, the compression system will be operated at high suction pressures for considerable periods of time. General practice is to drive the high stage compressor with a motor that will operate compressor at the highest expected evaporator temperature. This is generally the “air conditioning” rating of unit. For intermediate or low stage compressors, it is generally sufficient to size motor to take care of double the balance load indicated horsepower plus friction horsepower.

Also consider compressor starting torque requirements when selecting motor for a booster compressor. Starting torque of a motor only large enough to provide required normal operating bhp for booster applications may not be large enough to start the compressor. Recommended minimum motor sizes shown in Table 28 have been selected to assure adequate starting torque. Actual motor size selected is usually larger, depending on the maximum bhp conditions under which the compressor will run during pulldown or other abnormal operating periods.

It is good practice to select motors with allowance for 10% voltage reduction unless there is a certainty that this cannot occur.

**Compressor Starting Torque** — Required compressor starting torque is dependent on the discharge pressure as well as the pressure differential occurring during start-up. Maximum expected torque required during the starting period for 5F,H compressors, used as boosters, is shown in Table 28 at 2 saturated discharge temperatures.

**Selection Procedure** — Selection of a 5F,H booster compressor requires that the load, saturated suction temperature, saturated discharge temperature, type of system and refrigerant are known.

After the saturated intermediate temperature is determined from Fig. 21, the booster rating (Tables 25-27) can be entered and the compressor selected. Low stage load is then multiplied by the “R” factor from Table 23 to obtain high stage compressor load. With this information, the Compressor Ratings tables on pages 7-15, and page 17 can be entered and the high-stage compressor selected.

SELECTED EXAMPLE:

Given:

Refrigeration Load . . . . . 5.7 tons  
Saturated Suction Temperature . . . . . -60 F  
Saturated Condensing Temperature . . . . . 80 F  
Open-Type Intercooler  
Refrigerant 22

Find: Compressor size and motor size.

Solution:

- Figure 21 indicates an optimum saturated intermediate temperature of -2 F. Allow a 1 degree or 2 degree drop from the booster compressor to intercooler and from the intercooler to the high stage compressor.

Booster Saturated Suction Temperature = -60 F  
Booster Saturated Discharge Temperature = 0° F

- At -60 F suction and 0° F discharge, the 5H60 booster compressor has a capacity of 6.8 tons with 12.1 bhp input at 1750 rpm.

The safety factor at 1750 rpm:

$$\left( \frac{6.8}{5.7} \right) \times 100 - 100 = 19.3 \text{ or } 20\%$$

This is satisfactory from Fig. 19 and a 5H60 compressor is selected.

- Indicated hp (ihp) = bhp - Friction hp (fhp)

Where bhp is given in Table 26 and fhp is given in Table 28.

Indicated hp (ihp) = 12.1 - 3.07 = 9.03

Recommended minimum hp

$$= (2 \times \text{ihp}) + \text{fhp}$$

$$= (2 \times 9.03) + 3.07 = 21.13$$

Tentatively select a 25-hp motor. Assume that low stage will never start against a saturated discharge higher than 30 F. At 30 F discharge, Table 28 indicates a starting torque of 54 lb-ft. Therefore, a normal starting torque 25-hp motor is selected.

- With -60 F suction and 0° F discharge, Table 23 indicates an “R” value of 1.303. Therefore, the high stage load is:

$$1.303 \times 6.8 = 8.86 \text{ tons (actual load)}$$

- Allowing a 1 degree drop from the intercooler, the high stage saturation suction temperature is -3 F.

Allowing a 2 degree drop between the compressor and condenser, the high stage saturated discharge temperature = 80 + 2 = 82 F.

- Referring to the 5F,H Compressor Ratings table, 5F60 at 1450 rpm (using multiplier in compressor capacity notes) has a capacity of 9.21 tons at -3 F suction and 82 F discharge (through interpolation). The 5F60 is selected and requires 13.0 bhp at 1450 rpm.

- Assume that maximum load during pulldown occurs at 50 F suction and 90 F discharge. For this condition, the rating tables (using the multiplier in Step 6) indicate 15.8 bhp, thus a 20-hp motor is selected.

Table 25 — 5F,H Booster Ratings; R-12

SST	SDT*	5F20		5F30		5F40		5F60	
		Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-85	-50	0.28	0.93	0.42	1.30	0.57	1.67	0.85	2.42
	-40	0.27	0.94	0.40	1.31	0.54	1.68	0.80	2.43
	-30	0.25	0.94	0.38	1.31	0.50	1.69	0.76	2.45
	-20	0.24	0.95	0.36	1.33	0.47	1.70	0.71	2.46
	-10	0.20	0.95	0.31	1.34	0.40	1.71	0.63	2.49
	0	0.18	0.95	0.27	1.35	0.36	1.73	0.55	2.51
	10	0.18	0.95	0.27	1.35	0.36	1.73	0.55	2.51
-80	-50	0.34	0.97	0.51	1.36	0.63	1.75	1.00	2.54
	-40	0.33	1.00	0.49	1.40	0.65	1.80	0.98	2.61
	-30	0.31	1.00	0.47	1.40	0.62	1.80	0.93	2.62
	-20	0.30	1.00	0.45	1.41	0.59	1.81	0.89	2.63
	-10	0.27	1.00	0.40	1.42	0.54	1.82	0.80	2.64
	0	0.24	1.01	0.36	1.42	0.48	1.76	0.72	2.66
	10	0.21	1.01	0.31	1.43	0.42	1.84	0.63	2.67
-70	-40	0.48	1.11	0.72	1.57	0.95	2.03	1.40	2.96
	-30	0.46	1.13	0.70	1.60	0.93	2.07	1.40	3.02
	-20	0.45	1.14	0.68	1.62	0.90	2.09	1.40	3.05
	-10	0.42	1.14	0.63	1.63	0.84	2.10	1.30	3.07
	0	0.39	1.15	0.58	1.63	0.77	2.11	1.20	3.08
	10	0.35	1.15	0.53	1.64	0.70	2.12	1.10	3.09
	20	0.31	1.16	0.46	1.65	0.60	2.13	0.93	3.11
30	0.27	1.17	0.40	1.66	0.53	2.15	0.80	3.14	
-60	-30	0.66	1.27	0.98	1.81	1.30	2.35	2.00	3.44
	-20	0.64	1.31	0.96	1.87	1.30	2.43	1.90	3.56
	-10	0.61	1.32	0.92	1.89	1.20	2.45	1.80	3.59
	0	0.58	1.33	0.86	1.90	1.20	2.47	1.70	3.62
	10	0.54	1.39	0.82	1.99	1.10	2.59	1.60	3.80
	20	0.50	1.45	0.75	2.08	1.00	2.71	1.50	3.98
	30	0.45	1.35	0.68	1.94	0.90	2.52	1.40	3.69
-50	-20	0.89	1.51	1.30	2.17	1.80	2.83	2.70	4.16
	-10	0.86	1.53	1.30	2.20	1.70	2.87	2.60	4.22
	0	0.83	1.56	1.20	2.25	1.70	2.93	2.50	4.31
	10	0.79	1.58	1.20	2.28	1.60	2.97	2.40	4.37
	20	0.74	1.60	1.10	2.30	1.50	3.01	2.20	4.43
	30	0.69	1.61	1.00	2.32	1.40	3.03	2.10	4.46
	30	0.69	1.61	1.00	2.32	1.40	3.03	2.10	4.46
-40	-10	1.20	1.77	1.80	2.56	2.40	3.35	3.50	4.94
	0	1.10	1.83	1.70	2.65	2.30	3.47	3.40	5.12
	10	1.10	1.90	1.70	2.76	2.20	3.61	3.30	5.33
	20	1.10	1.90	1.60	2.78	2.10	3.64	3.20	5.38
	30	1.00	1.93	1.50	2.80	2.00	3.67	3.00	5.42
	30	1.00	1.93	1.50	2.80	2.00	3.67	3.00	5.42
	30	1.00	1.93	1.50	2.80	2.00	3.67	3.00	5.42
-30	0	1.50	2.17	2.30	3.16	3.10	4.15	4.60	6.14
	10	1.50	2.23	2.30	3.25	3.00	4.27	4.50	6.32
	20	1.40	2.29	2.20	3.34	2.90	4.39	4.40	6.50
	30	1.40	2.34	2.10	3.41	2.80	4.49	4.20	6.65
	30	1.40	2.34	2.10	3.41	2.80	4.49	4.20	6.65
	30	1.40	2.34	2.10	3.41	2.80	4.49	4.20	6.65
	30	1.40	2.34	2.10	3.41	2.80	4.49	4.20	6.65

SST	SDT*	5H80		5H86		5H120		5H126	
		Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-85	-50	2.60	7.37	3.20	9.58	4.00	9.50	5.00	12.35
	-40	2.50	7.44	3.20	9.66	3.80	9.70	4.70	12.60
	-30	2.40	7.51	3.00	9.76	3.60	9.80	4.50	12.73
	-20	2.20	7.58	2.70	9.85	3.40	9.90	4.20	12.88
	-10	2.00	7.67	2.50	9.96	3.00	10.00	3.70	13.00
	0	1.80	7.76	2.20	10.99	2.70	10.10	3.30	13.93
	0	1.80	7.76	2.20	10.99	2.70	10.10	3.30	13.93
-80	-50	3.20	7.69	4.00	10.00	4.80	10.20	5.90	13.28
	-40	3.10	7.90	3.80	10.28	4.60	10.20	5.70	13.28
	-30	2.90	8.01	3.60	10.41	4.40	10.50	5.40	13.66
	-20	2.80	8.12	3.50	10.54	4.20	10.70	5.20	13.91
	-10	2.60	8.19	3.10	10.64	3.90	10.80	4.80	14.03
	0	2.30	8.27	2.80	10.74	3.50	10.90	4.30	14.18
	10	2.00	8.42	2.50	10.94	3.00	11.10	3.70	14.42
-70	-40	4.50	9.05	5.60	11.77	6.70	12.10	8.30	15.72
	-30	4.30	9.22	5.30	11.98	6.50	11.30	8.10	14.70
	-20	4.20	9.40	5.20	12.21	6.30	12.60	7.80	16.39
	-10	4.00	9.47	5.00	12.31	5.90	12.70	7.30	16.50
	0	3.70	9.55	4.60	12.41	5.60	12.70	7.90	16.50
	10	3.40	9.66	4.20	12.56	4.30	13.00	5.30	16.90
	20	3.00	9.79	3.70	12.71	4.50	13.20	5.60	17.18
30	2.60	9.92	3.20	12.89	3.90	13.40	4.80	17.42	
-60	-30	6.20	10.74	7.70	13.98	9.30	14.60	11.50	18.99
	-20	6.10	11.00	7.60	14.30	9.10	15.00	11.30	14.50
	-10	5.80	11.13	7.20	14.48	8.70	15.20	10.80	19.77
	0	5.60	11.26	6.90	14.62	8.30	15.40	10.30	20.02
	10	5.20	11.36	6.40	14.77	7.80	15.50	9.70	20.15
	20	4.80	11.47	5.90	14.90	7.20	15.70	8.90	20.40
	30	4.30	11.58	5.30	15.06	6.50	15.90	8.10	20.70
-50	-20	8.30	12.80	10.30	16.63	12.50	17.70	15.50	23.00
	-10	8.10	13.10	10.10	17.02	12.10	18.20	15.10	23.65
	0	7.80	13.41	9.70	17.42	11.70	18.60	14.50	24.19
	10	7.40	13.65	9.20	17.73	11.20	19.00	13.90	24.70
	20	7.00	13.74	8.70	17.87	10.50	19.10	13.00	24.80
	30	6.50	13.84	8.10	18.00	9.80	19.30	12.10	25.10
	30	6.50	13.84	8.10	18.00	9.80	19.30	12.10	25.10
-40	-10	11.10	15.37	13.80	19.98	16.60	21.60	20.60	28.07
	0	10.80	15.98	13.40	20.77	16.20	22.50	20.10	29.21
	10	10.40	16.41	12.90	21.36	15.60	23.10	19.30	25.10
	20	9.90	16.58	12.30	21.55	14.80	23.40	18.30	30.40
	30	10.70	16.76	13.30	21.79	14.10	23.60	17.50	30.70
	30	10.70	16.76	13.30	21.79	14.10	23.60	17.50	30.70
	30	10.70	16.76	13.30	21.79	14.10	23.60	17.50	30.70
-30	0	14.60	19.33	18.10	25.16	21.90	27.50	27.10	35.74
	10	14.10	19.79	17.50	25.71	21.20	28.20	26.20	34.05
	20	13.60	20.26	16.90	26.25	20.50	28.90	25.40	37.55
	30	13.00	20.72	16.10	26.94	19.60	29.60	24.30	38.43
	30	13.00	20.72	16.10	26.94	19.60	29.60	24.30	38.43
	30	13.00	20.72	16.10	26.94	19.60	29.60	24.30	38.43
	30	13.00	20.72	16.10	26.94	19.60	29.60	24.30	38.43

SST	SDT*	5H40		5H46		5H60		5H66	
		Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-85	-50	1.30	3.43	1.60	4.46	2.00	5.52	2.50	7.17
	-40	1.20	3.46	1.50	4.50	1.90	5.58	2.40	7.25
	-30	1.20	3.50	1.50	4.54	1.80	5.63	2.20	7.31
	-20	1.10	3.53	1.30	4.59	1.70	5.68	2.10	7.38
	-10	1.00	3.58	1.20	4.65	1.50	5.75	1.90	7.47
	0	0.88	3.63	1.10	4.72	1.30	5.82	1.60	7.56
	0	0.88	3.63	1.10	4.72	1.30	5.82	1.60	7.56
-80	-50	1.60	3.64	2.00	4.73	2.40	5.85	3.00	7.60
	-40	1.50	3.70	1.80	4.81	2.30	5.93	2.90	7.70
	-30	1.50	3.75	1.80	4.87	2.20	6.01	2.70	7.81
	-20	1.40	3.81	1.70	4.95	2.10	6.09	2.60	7.91
	-10	1.30	3.85	1.60	5.00	1.90	6.15	2.40	7.99
	0	1.20	3.88	1.50	5.04	1.70	6.20	2.10	8.06
	10	1.00	3.96	1.20	5.15	1.50	6.31	1.90	8.20
-70	-40	2.20	4.27	2.70	5.55	3.40	6.79	4.20	8.82
	-30	2.20	4.36	2.70	5.66	3.30	6.92	4.10	8.98
	-20	2.10	4.45	2.60	5.78	3.20	7.05	4.00	9.15
	-10	2.00	4.49	2.40	5.84	3.00	7.11	3.70	9.23
	0	1.90	4.52	2.30	5.87	2.80	7.12	3.50	9.25
	10	1							

**Table 26 — 5F,H Booster Ratings; R-22**

SST	SDT*	5F20		5F30		5F40		5F60	
		Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-100	-50	0.27	0.95	0.40	1.35	0.54	1.75	0.80	2.25
	-40	0.22†	1.00	0.33†	1.36	0.43†	1.75	0.65†	2.45
	-30	0.18†	1.05	0.28†	1.38	0.37†	1.80	0.55†	2.50
	-20	0.15†	1.10	0.23†	1.38	0.30†	1.80	0.45†	2.60
	-10	0.10†	1.15	0.15†	1.40	0.20†	1.85	0.30†	2.70
-90	-50	0.42	1.05	0.62	1.53	0.83	1.95	1.40	2.65
	-40	0.38	1.11	0.56	1.55	0.75	1.95	1.10	2.75
	-30	0.35†	1.14	0.53†	1.58	0.70†	2.00	1.10†	2.80
	-20	0.29†	1.19	0.44†	1.59	0.58†	2.00	0.88†	2.81
	-10	0.27†	1.24	0.40†	1.61	0.54†	2.05	0.80†	2.90
0	0.24†	1.23	0.36†	1.62	0.48†	2.10	0.73†	3.00	
-80	-50	0.63	1.25	0.94	1.80	1.30	2.20	1.90	3.20
	-40	0.57	1.25	0.85	1.81	1.10	2.20	1.70	3.25
	-30	0.54	1.28	0.81	1.82	1.10	2.25	1.60	3.30
	-20	0.50	1.30	0.75	1.85	1.10	2.25	1.50	3.35
	-10	0.46†	1.33	0.69†	1.86	0.92†	2.30	1.40†	3.40
0	0.43†	1.36	0.65†	1.90	0.87†	2.30	1.30†	3.50	
10	0.36†	1.39	0.53†	1.91	0.71†	2.40	1.10†	3.50	
-70	-40	0.83	1.45	1.20	2.11	1.70	2.70	2.50	3.94
	-30	0.79	1.48	1.20	2.15	1.60	2.72	2.40	4.00
	-20	0.75	1.50	1.10	2.18	1.50	2.72	2.20	4.05
	-10	0.71	1.53	1.10	2.19	1.40	2.80	2.10	4.10
	0	0.67†	1.59	1.00†	2.20	1.30†	2.85	2.00†	4.17
10	0.59†	1.50	0.89†	2.21	1.20†	3.00	1.80†	4.20	
20	0.51†	1.55	0.75†	2.22	1.00†	3.00	1.60†	4.42	
-60	-30	1.10	1.75	1.70	2.45	2.40†	3.30	3.40	4.78
	-20	1.10	1.79	1.60	2.48	2.10	3.30	3.20	4.80
	-10	1.00	1.82	1.60	2.60	2.10	3.40	3.10	5.00
	0	0.99	1.88	1.50	2.62	2.00	3.50	3.00	5.08
	10	0.91†	1.81	1.40†	2.65	1.80†	3.60	2.70†	5.25
20	0.82†	1.82	1.20†	2.68	1.60†	3.57	2.50†	5.29	
30	0.73†	1.84	1.10†	2.70	1.50†	3.50	2.20†	5.40	
-50	-20	1.50	2.12	2.30	3.05	3.00	4.00	4.60	5.50
	-10	1.40	2.16	2.20	3.10	2.90	4.10	4.30	6.00
	0	1.40	2.10	2.20	3.15	2.90	4.15	4.30	6.19
	10	1.30	2.23	2.00	3.25	2.60	4.25	4.00	6.28
	20	1.20	2.22	1.90	3.30	2.50	4.30	3.70	6.40
30	1.20†	2.28	1.70†	3.31	2.30†	4.20	3.50†	6.50	
-40	-10	1.90	2.60	2.90	3.50	3.90	4.88	5.80	7.50
	0	1.90	2.50	2.80	3.88	3.80	5.08	5.60	7.68
	10	1.80	2.78	2.70	4.17	3.60	5.40	5.40	7.96
	20	1.70	2.82	2.60	4.08	3.50	5.40	5.20	8.09
	30	1.70	2.85	2.50	4.17	3.30	5.50	5.00	8.19
-30	0	2.40	2.85	3.60	5.19	4.80	7.40	7.30	9.78
	10	2.30	3.60	3.50	5.34	4.60	7.58	7.00	10.00
	20	2.30	3.62	3.40	5.44	4.50	7.00	6.80	10.10
	20	2.20	3.70	3.30	5.47	4.40	7.87	6.60	10.20

SST	SDT*	5H40		5H46		5H60		5H66	
		Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-100	-50	1.30	3.10	1.60	4.03	1.90	5.50	2.40	7.15
	-40	1.10†	3.50	1.30†	4.55	1.60†	5.58	2.00†	7.25
	-30	0.92†	3.50	1.10†	4.55	1.40†	5.78	1.70†	7.50
	-20	0.79†	3.68	0.97†	4.78	1.20†	6.00	1.50†	7.80
	-10	0.67†	3.75	0.83†	4.87	1.00†	6.08	1.20†	7.90
-90	-50	1.90	3.70	2.30	4.80	2.90†	6.18	3.60	8.03
	-40	1.70	3.98	2.10	5.17	2.60	6.40	3.20	8.31
	-30	1.60†	4.04	2.00†	5.25	2.40†	6.58	3.00†	8.55
	-20	1.04†	4.09	1.70†	5.31	2.10†	6.58	2.60†	8.55
	-10	1.30†	4.14	1.60†	5.38	2.00†	6.65	2.50†	8.64
0	1.20†	4.19	1.50†	5.44	1.80†	6.75	2.20†	8.77	
-80	-50	2.80	4.49	3.50	5.84	4.30	7.30	5.30	9.48
	-40	2.60	4.79	3.20	6.22	3.90	7.50	4.80	9.74
	-30	2.40	4.89	3.00	6.35	3.60	7.68	4.50	9.97
	-20	2.30	4.94	2.80	6.41	3.40	7.78	4.20	10.10
	-10	2.20†	5.00	2.70†	6.50	3.30†	7.88	4.10†	10.20
0	1.90†	5.12	2.30†	6.65	2.90†	7.99	3.60†	10.40	
10	1.70†	5.25	2.10†	6.82	2.50†	8.00	3.10†	10.40	
-70	-40	3.80	5.90	4.70†	7.66	5.80	9.18	7.20	11.90
	-30	3.60	5.98	4.40	7.77	5.40	9.28	6.70	12.10
	-20	3.30	5.97	4.10	7.75	5.00	9.28	6.20	12.10
	-10	3.30	6.08	4.10	7.90	4.90	9.50	6.10	12.40
	0	3.10†	6.19	3.80	8.04	4.60†	9.75	5.70†	12.70
10	2.70†	6.25	3.30†	8.42	4.10†	10.00	5.10†	13.00	
20	2.40†	6.25	2.90†	8.12	3.60†	10.10	4.50†	13.10	
-60	-30	5.20	7.08	6.40†	9.19	7.80	11.30	9.70	14.70
	-20	4.90	7.28	6.10	9.45	7.40	11.60	9.20	15.10
	-10	4.80	7.34	5.90	9.53	7.20	11.80	8.90	15.40
	0	4.50	7.70	5.60	10.00	6.80	12.10	8.40	15.70
	10	4.10†	7.75	5.10†	10.05	6.20†	12.30	7.70†	16.00
20	3.80†	7.75	4.70†	10.05	5.60†	12.30	6.90†	16.00	
30	3.50†	7.87	4.30†	10.20	5.20†	12.50	6.40†	16.30	
-50	-20	6.90	8.88	8.50	11.50	10.30	14.00	12.80	18.20
	-10	6.80	9.00	8.40	11.70	10.20	14.50	12.60	18.90
	0	6.40	9.25	7.90	12.00	9.60	14.60	11.90	19.00
	10	6.00	9.50	7.40	12.30	9.30	14.70	11.50	19.10
	20	5.60	9.66	6.90	12.60	8.50	15.00	10.50	19.50
30	5.30†	9.75	6.60†	12.70	7.90†	15.10	9.80†	19.60	
-40	-10	9.00	10.30	11.20	13.40	13.60	17.20	16.90	22.40
	0	8.70	11.60	10.50	15.10	13.00	17.70	16.10	23.00
	10	8.20	12.00	10.20	15.60	12.30	18.20	15.30	23.60
	20	7.90	12.30	9.80	16.00	11.90	18.60	14.80	24.20
	30	7.70	12.40	9.50	16.10	11.50	18.90	14.30	24.20
-30	0	11.50	15.10	14.30	19.60	17.20	22.50	21.20	29.20
	10	11.10	15.50	13.70	20.10	16.70	23.20	20.70	30.10
	20	10.90	15.80	13.50	20.50	16.30	24.00	20.00	31.20
	20	10.60	16.10	13.10	20.90	15.90	24.60	19.70	32.00

SST	SDT*	5H80		5H86		5H120		5H126	
		Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-100	-50	2.50	7.00	3.10	9.10	3.80	9.50	4.70	12.40
	-40	2.20†	7.25	2.70†	9.40	3.30†	9.60	4.10†	12.50
	-30	1.80†	7.50	2.20†	9.70	2.80†	10.10	3.50†	13.10
	-20	1.60†	7.75	2.00†	10.10	2.40†	10.50	3.00†	13.70
	-10	1.30†	8.12	1.60†	10.00	2.00†	10.60	2.50†	13.80
-90	-50	3.80	8.00	4.70	10.40	5.80	10.90	7.20	14.20
	-40	3.40	8.25	4.20	10.70	5.10	11.30	6.30	14.70
	-30	3.20†	8.50	4.00†	11.00	4.80†	11.60	5.90†	15.10
	-20	2.80†	8.87	3.50†	11.50	4.30†	11.60	5.30†	15.10
	-10	2.70†	9.00	3.30†	11.70	4.00†	11.80	5.00†	15.40
0	2.30†	9.00	2.80†	11.70	3.50†	12.00	4.30†	15.60	
-80	-50	5.70†	9.50	7.10	12.40	8.50†	13.10	10.50	17.10
	-40	5.20	10.00	6.40	13.00	7.80	13.50	9.70	17.50
	-30	4.80	10.30	5.90	13.40	7.30	13.90	9.00	18.10
	-20	4.50	10.50	5.60	13.70	6.80	14.10	8.40	18.30
	-10	4.30†	10.60	5.30†	13.80	6.50†	14.30	8.10†	18.60
0	3.80†	10.60	4.70†	13.80	5.80†	14.50	7.20†	18.90	
10	3.30†	10.80	4.10†	14.00	5.00†	14.50	6.20†	18.90	
-70	-40	7.70	12.10	9.50	15.70	11.50	16.90	14.30	22.00
	-30	7.20	12.50	8.90	16.20	10.80	17.10	13.40	22.00
	-20	6.70	12.70	8.30	16.50	10.00	17.10	12.40	22.20
	-10	6.50	12.70	8.00	16.50	9.80	17.50	12.20	22.80
	0	6.20†	13.00	7.70†	16.90	9.30†	18.00	11.50	23.40

Table 27 — 5F,H Booster Ratings; R-502

SST	SDT*	5F20		5F30		5F40		5F60	
		Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-90	-30	0.6	1.0	0.9	1.6	1.1	1.7	1.7	3.2
	-20	0.5	1.0	0.7	1.7	1.0	1.8	1.5	3.3
	-10	0.4	1.1	0.6	1.7	0.9	1.9	1.3	3.3
	0	0.3	1.0	0.5	1.7	0.7	1.9	1.1	3.3
	10	0.3	1.0	0.4	1.5	0.6	1.8	0.9	3.1
	20	0.2	0.9	0.3	1.5	0.5	1.7	0.7	2.9
	30	0.1	0.8	—	—	0.3	1.5	0.5	2.6
-80	-30	0.9	1.1	1.3	1.8	1.7	1.9	2.6	3.5
	-20	0.8	1.2	1.2	2.0	1.5	2.1	2.3	3.8
	-10	0.7	1.3	1.0	2.1	1.4	2.3	2.0	4.0
	0	0.6	1.3	0.9	2.1	1.2	2.4	1.8	4.1
	10	0.5	1.3	0.8	2.1	1.0	2.4	1.5	4.1
	20	0.4	1.3	0.6	2.0	0.9	2.4	1.3	4.0
	30	0.3	1.2	0.5	1.9	0.7	2.3	1.0	3.8
-70	-30	1.2	1.2	1.9	2.0	2.5	2.1	3.7	3.8
	-20	1.1	1.4	1.7	2.2	2.3	2.4	3.4	3.2
	-10	1.0	1.5	1.5	2.3	2.1	2.7	3.1	4.6
	0	0.9	1.6	1.4	2.5	1.8	2.9	2.8	4.8
	10	0.8	1.6	1.2	2.6	1.6	3.0	2.4	5.0
	20	0.7	1.7	1.1	2.6	1.4	3.1	2.1	5.1
	30	0.6	1.6	0.9	2.6	1.2	3.1	1.8	5.0
-60	-30	1.7	1.2	2.6	2.0	3.5	2.2	5.2	3.8
	-20	1.6	1.4	2.4	2.3	3.2	2.6	4.8	4.4
	-10	1.5	1.6	2.2	2.6	3.0	3.0	4.4	5.0
	0	1.3	1.8	2.0	2.8	2.7	3.3	4.0	5.5
	10	1.2	1.9	1.8	3.0	2.4	3.6	3.6	5.9
	20	1.1	2.0	1.6	3.1	2.1	3.8	3.2	6.2
	30	0.9	2.1	1.4	3.2	1.9	4.0	2.8	6.3
-50	-20	2.2	1.4	3.3	2.3	4.4	2.6	6.7	4.4
	-10	2.1	1.7	3.1	2.7	4.1	3.1	6.2	5.2
	0	1.9	2.0	2.8	3.1	3.8	3.6	5.7	6.0
	10	1.7	2.2	2.6	3.4	3.4	4.1	5.2	6.6
	20	1.5	2.4	2.3	3.6	3.1	4.4	4.7	7.1
	30	1.4	2.5	2.1	3.8	2.8	4.7	4.2	7.5
	-40	-20	3.0	1.3	4.5	2.2	6.0	2.5	9.0
-10		2.8	1.7	4.2	2.7	5.6	3.2	8.4	5.1
0		2.6	2.0	3.9	3.2	5.2	3.8	7.7	6.2
10		2.4	2.3	3.6	3.6	4.7	4.4	7.1	7.1
20		2.2	2.6	3.3	4.0	4.3	4.9	6.5	7.9
30		2.0	2.8	3.0	4.3	3.9	5.4	5.9	8.6
-30		-10	3.7	1.6	5.5	2.5	7.4	3.0	11.1
	0	3.4	2.0	5.2	3.1	6.9	3.8	10.3	6.0
	10	3.2	2.4	4.8	3.7	6.4	4.6	9.6	7.2
	20	2.9	2.8	4.4	4.3	5.9	5.3	8.8	8.4
	30	2.7	3.1	4.1	4.8	5.4	6.0	8.1	9.4

SST	SDT*	5H40		5H46		5H60		5H66	
		Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-90	-30	2.7	6.3	3.4	8.2	4.1	8.7	5.1	11.3
	-20	2.4	6.4	3.0	8.3	3.6	8.9	4.5	11.5
	-10	2.1	6.4	2.6	8.4	3.1	9.0	3.9	11.6
	0	1.8	6.4	2.2	8.3	2.7	8.9	3.3	11.5
	10	1.4	6.2	1.8	8.1	2.2	8.6	2.7	11.2
	20	1.1	5.9	1.4	7.7	1.7	8.2	2.2	10.7
	30	—	—	—	—	—	—	—	—
-80	-30	4.1	6.9	5.1	8.9	6.1	9.6	7.6	12.4
	-20	3.7	7.2	4.6	9.4	5.6	10.1	6.9	13.1
	-10	3.3	7.4	4.1	9.6	5.0	10.4	6.2	13.5
	0	2.9	7.5	3.6	9.8	4.4	10.6	5.4	13.8
	10	2.5	7.5	3.1	9.8	3.8	10.6	4.7	13.8
	20	2.1	7.4	2.6	9.6	3.2	10.4	4.0	13.5
	30	1.7	7.1	2.1	9.3	2.6	10.0	3.2	13.0
-70	-30	5.9	7.3	7.3	9.5	8.8	10.3	11.0	13.3
	-20	5.4	7.9	6.7	10.3	8.1	11.1	10.1	14.4
	-10	4.9	8.3	6.1	10.8	7.4	11.8	9.2	15.3
	0	4.4	8.7	5.5	11.3	6.6	12.3	8.2	16.0
	10	3.9	8.9	4.9	11.5	5.9	12.6	7.3	16.4
	20	3.4	8.9	4.2	11.6	5.2	12.8	6.4	16.6
	30	2.9	8.8	3.6	11.5	4.4	12.7	5.5	16.5
-60	-30	8.3	7.5	10.2	9.8	12.3	10.6	15.3	13.7
	-20	7.7	8.4	9.4	10.9	11.4	11.9	14.2	15.4
	-10	7.0	9.1	8.7	11.8	10.5	13.0	13.1	16.8
	0	6.4	9.7	7.9	12.6	9.6	13.9	11.9	18.0
	10	5.8	10.2	7.2	13.2	8.7	14.6	10.8	19.0
	20	5.2	10.5	6.4	13.7	7.8	15.1	9.7	19.6
	30	4.6	10.7	5.7	13.9	6.9	15.4	8.6	20.0
-50	-20	10.5	8.3	12.9	11.1	15.6	12.1	19.4	15.7
	-10	9.8	9.6	12.0	12.5	14.5	13.7	18.0	17.8
	0	9.0	10.6	11.1	13.7	13.4	15.2	16.7	19.7
	10	8.2	11.4	10.1	14.8	12.3	16.4	15.3	21.3
	20	7.5	12.0	9.2	15.6	11.2	17.4	13.9	22.6
	30	6.7	12.5	8.3	16.2	10.1	18.1	12.5	23.5
	-40	-20	14.1	8.2	17.3	10.7	20.9	11.7	26.0
-10		13.2	9.7	16.2	12.7	19.6	13.9	24.3	18.1
0		12.2	11.1	15.1	14.4	18.2	16.0	22.6	20.7
10		11.3	12.3	13.9	16.0	16.9	17.8	20.9	23.1
20		10.4	13.3	12.8	17.3	15.5	19.3	19.2	25.1
30		9.4	14.1	11.7	18.4	14.1	20.6	17.5	26.8
-30		-10	17.4	9.3	21.3	12.1	25.8	13.3	32.1
	0	16.3	11.1	20.0	14.5	24.2	16.0	30.0	20.8
	10	15.1	12.8	18.6	16.6	22.5	18.5	28.0	24.1
	20	14.0	14.2	17.2	18.5	20.9	20.7	25.9	27.0
	30	12.9	15.5	15.9	20.2	19.2	22.7	23.9	29.5

SST	SDT*	5H80		5H86		5H120		5H126	
		Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-90	-30	5.4	11.6	6.8	15.1	8.2	17.0	10.1	21.8
	-20	4.8	11.9	6.0	15.4	7.2	17.4	9.0	22.4
	-10	4.2	12.0	5.2	15.5	6.3	17.5	7.8	22.6
	0	3.6	11.8	4.4	15.4	5.3	17.3	6.6	22.3
	10	2.9	11.5	3.7	15.0	4.4	16.8	5.4	21.7
	20	2.3	11.0	2.9	14.3	3.5	16.0	4.3	20.6
	30	—	—	—	—	—	—	—	—
-80	-30	8.2	12.8	10.2	16.6	12.3	18.8	15.2	24.2
	-20	7.4	13.5	9.2	17.5	11.1	19.8	13.8	25.5
	-10	6.6	13.9	8.2	18.1	9.9	20.5	12.3	26.4
	0	5.8	14.1	7.2	18.4	8.7	20.8	10.8	26.8
	10	5.0	14.1	6.3	18.4	7.5	20.8	9.4	26.8
	20	4.3	13.9	5.3	18.1	6.4	20.4	7.9	26.3
	30	3.5	13.4	4.4	17.4	5.2	19.6	6.5	25.4
-70	-30	11.8	13.7	14.6	17.8	17.7	20.1	21.9	25.9
	-20	10.8	14.8	13.4	19.3	16.2	21.9	20.1	28.2
	-10	9.8	15.7	12.2	20.4	14.8	23.2	18.3	29.9
	0	8.9	16.4	11.0	21.3	13.3	24.2	16.5	31.3
	10	7.9	16.8	9.8	21.9	11.8	24.8	14.7	32.1
	20	6.9	17.0	8.6	22.1	10.3	25.1	12.8	32.4
	30	6.0	16.9	7.4	21.9	8.9	24.9	11.1	32.2
-60	-30	16.4	14.1	—	—	—	—	—	—
	-20	15.2	15.8	18.9	20.5	22.9	23.2	28.4	30.1
	-10	14.0	17.3	17.4	22.5	21.1	25.5	26.1	32.9
	0	12.8	18.5	15.9	24.0	19.2	27.4	23.9	35.3
	10	11.6	19.4	14.4	25.3	17.4	28.8	21.6	37.2
	20	10.4	20.1	12.9	26.1	15.6	29.8	19.4	38.5
	30	9.2	20.5	11.4	26.6	13.8	30.3	17.1	39.2
-50	-20	20.9	16.2	25.9	21.0	31.3	23.8	38.9	30.7
	-10	19.4	18.3	24.1	23.8	29.1	27.1	36.1	35.0
	0	17.9	20.2	22.2	26.3	26.9	29.9	33.3	38.6
	10	16.4	21.8	20.4	28.3	24.6	32.3	30.6	41.8
	20	14.9	23.1	18.5	30.0	22.4	34.2	27.8	44.3
	30	13.4	24.0	16.7	31.3	20.2	35.7	25.0	46.2
	-40	-20	27.9	15.6	34.6	20.2	41.9	22.9	52.0
-10		26.1	18.6	32.4	24.1	39.2	27.4	48.6	35.5
0		24.3	21.3	30.2	27.6	36.5	31.5	45.3	40.7
10		22.5	23.6	27.9	30.7	33.8	35.1	41.9	45.3
20		20.7	25.7	25.6	33.4	31.0	38.1	38.5	49.3
30		18.8	27.4	23.4	35.6	28.3	40.7	35.1	52.7
-30		-10	34.5	17.7	42.7	23.1	51.7	26.1	64.2
	0	32.3	21.4	40.0	27.8	48.4	31.6	60.1	40.9
	10	30.0	24.7	37.3	32.1	45.1	36.6	56.0	47.4
	20	27.8	27.6	34.5	35.9	41.8	41.0	51.8	53.1
	30	25.6	30.2	31.8	39.2	38.5	44.9	47.7	58.1

LEGEND

- Bhp — Brake Horsepower
  - Cap. — Capacity (Tons)
  - SDT — Saturated Discharge Temperature (F)
  - SST — Saturated Suction Temperature (F)
- \*Also referred to as Saturated Intermediate Temperature.

**Table 28 — Booster Compressor Starting Data**

COMPR SIZE	UNLOADING DURING STARTING	MAX COMPR STARTING TORQUE (lb-ft)				RECOMMENDED MIN MOTOR SIZE HP				FRICTION HP* (fhp)
		R-12		R-22 or R-502		R-12		R-22 or R-502		
		Saturated Discharge Temperature (F)				High Torque	Normal Torque	High Torque	Normal Torque	
		10 F	30 F	10 F	30 F					
5F20	None	9	13	15	21	—	2	3	3	.67
5F30	None	10	15	16	24	3	3	5	5	.91
5F40	75%	8	12	13	19	3	3	5	5	1.15
5F60	66 <sup>2</sup> / <sub>3</sub> %	10	15	16	24	3	5	5	7 <sup>1</sup> / <sub>2</sub>	1.64
5H40	75%	19	28	30	45	5	7 <sup>1</sup> / <sub>2</sub>	7 <sup>1</sup> / <sub>2</sub>	10	2.25
5H46	75%	24	35	38	56	7 <sup>1</sup> / <sub>2</sub>	10	10	15	2.25
5H60	66 <sup>2</sup> / <sub>3</sub> %	23	34	37	54	7 <sup>1</sup> / <sub>2</sub>	10	10	15	3.07
5H66	66 <sup>2</sup> / <sub>3</sub> %	29	43	46	68	10	15	15	20	3.07
5H80	75%	26	38	41	60	10	15	20	20	3.82
5H86	75%	33	48	51	75	15	20	20	30	3.82
5H120	66 <sup>2</sup> / <sub>3</sub> %	41	60	65	94	15	20	20	30	5.25
5H126	66 <sup>2</sup> / <sub>3</sub> %	51	75	81	118	20	30	30	40	5.25

\*Based on 1750 rpm with 5F,H compressors. Will vary directly with rpm at other speeds.

## CONDENSERS

**Condenser Physical Data** — Refer to Table 29. Refer to 5F,H Product Data for information on the current P701 water-cooled condensers used with the 5F,H water-cooled condensing units.

**Condenser Selection Considerations** — On most installations the condenser is selected within recommended conditions specified in ARI Standards. Main considerations are:

1. The water velocity is within a range of 1 to 12 ft per second (to minimize corrosion and erosion).
2. It is good practice to select condensers on a leaving temperature difference between 6 and 12 degrees. In general, higher temperature differences are used only where condensing water temperature is quite low or where special conditions make it economical to do so. A high temperature difference not only makes effect of fouling more pronounced but since the condenser volume is likely to be small, the effect on noncondensable gases will be greater.

Table 30 lists maximum water velocities from Carrier System Design Manual. Limits are above ARI recommended values but are generally accepted where ARI conformance is not specified. See Part 5 of the Carrier System Design Manual for further details.

Table 31 lists condenser water quantities (gpm) for water velocities from 3 to 12 fps. For higher velocities, use formulas below Table 31.

**Condenser Duty** — The capacity of a given compressor is greatest at high saturated suction temperatures. Because of this, the compressor normally requires the largest condenser at these conditions or for air conditioning duty.

On refrigeration or low temperature applications, the same compressor displacement results in a lower refrigeration capacity and, consequently, less heat rejection. Thus, condenser size is smaller than would normally be required with the same compressor on air conditioning duty.

Condenser size is also affected by refrigerant used, since compressor capacities (and thus heat rejection) differ with Refrigerants 12, 22, and 502.

**Pulldown** — Condensers for systems subject to pulldown periods, especially low temperature or multistage systems, should be oversized beyond the capacity required at the final balanced load condition. The condenser must adequately

handle load during the first stages of pulldown, when system capacity is substantially greater than at final condition.

If pulldown load is sizable, as in most water or brine cooling applications, check the condenser performance when it is handling total heat rejection at maximum rated suction temperature (50 F for most compressors). Condenser size and water quantity must be adequate to handle this start-up load without resulting in excessive head pressure or excessive water pressure drop. As a rough guide, the selected condenser should have a maximum total heat rejection rating that is equal to or greater than the compressor heat rejection at pulldown conditions.

If this pulldown occurs infrequently, it may be possible to select a condenser for design conditions and on each start-up limit compressor capacity by manually throttling suction gas flow. This can be done by partially closing suction valve but this will extend time required to reach design conditions.

If the pulldown is of short duration, such as on a direct expansion coil, suction temperature will drop very rapidly and more than likely design conditions will be reached before the compressor would cut out on high pressure. No oversizing of the condenser would be required.

Whenever possible, the selected condenser should never be of a larger size than the largest condenser that will match the compressor used and still be a standard combination. This should be considered especially when the condensers are to be used with 5F,H series open reciprocating compressors.

**Fouling and Fouling Factors** — Fouling in condenser tubes is result of a build-up of scale within tubes because of impurities in water. As a result, heat transfer is adversely affected. Fouling factors are a means of identifying degree of fouling.

Condensers should not be selected for less than 0.0005 fouling factor, even when high quality water is available. For lower quality water, use larger fouling factors from the condenser ratings, but temper factor according to operating conditions.

The following affect magnitude of fouling factor selected:

- Percentage of yearly operating time.
- Frequency of tube cleaning.
- Condensing temperature.
- Type of water treatment.

For instance, reduce fouling factor when the operating time is less than 4000 hours per year, when frequent cleaning of tubes takes place, or when low condensing temperatures exist.

**Table 29 — Condenser Physical Data**

CONDENSER SIZE		5F20	5F30	5F40	5F60	09RH 027	09RH 043	09RH 054	09RH 070	09RH 084	09RH 097	09RH 127	
NOMINAL CAPACITY (Tons)		9.8	14.3	22.1	27.3	47.0	71.0	87	103	120	135	198	
CONDENSER TYPE		Shell and Coil			Shell and Tube								
Net Weight (lb)		77	114	246	340	493	686	807	863	1028	1360	1635	
SHELL													
Outside Diameter (in.)		8 <sup>3</sup> / <sub>8</sub>	8 <sup>3</sup> / <sub>8</sub>	8 <sup>5</sup> / <sub>8</sub>	8 <sup>5</sup> / <sub>8</sub>	10 <sup>3</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	12 <sup>3</sup> / <sub>4</sub>	14	14	18	
Length (in.)		28 <sup>5</sup> / <sub>8</sub>	39 <sup>5</sup> / <sub>8</sub>	63	74	77 <sup>1</sup> / <sub>8</sub>	79 <sup>1</sup> / <sub>4</sub>	95 <sup>1</sup> / <sub>4</sub>	95 <sup>1</sup> / <sub>4</sub>	99 <sup>3</sup> / <sub>8</sub>	123 <sup>1</sup> / <sub>8</sub>	100 <sup>1</sup> / <sub>2</sub>	
TUBES OR COIL													
Number (Total)		Coil			Tubes; Integral Fin; 40 Fins per Inch								
Length (in.)		2	2	26	30	44	66	66	80	94	94	156	
No. of Water Circuits		295 <sup>1</sup> / <sub>4</sub>	387 <sup>5</sup> / <sub>8</sub>	56 <sup>5</sup> / <sub>8</sub>	67 <sup>5</sup> / <sub>8</sub>	70 <sup>5</sup> / <sub>32</sub>	70 <sup>5</sup> / <sub>32</sub>	86 <sup>5</sup> / <sub>32</sub>	86 <sup>5</sup> / <sub>32</sub>	86 <sup>5</sup> / <sub>32</sub>	109 <sup>7</sup> / <sub>8</sub>	86 <sup>5</sup> / <sub>32</sub>	
No. of Water Passes		2 or 1	2 or 1	2 or 1	2 or 1	2 or 1	2 or 1	2 or 1	2 or 1	2 or 1	2 or 1	2 or 1	
CIRCUIT LENGTH (ft)													
Single Circuit		49.2	64.6	—	—	—	—	—	—	—	—	—	
Double Circuit (each)		24.6	32.3	—	—	—	—	—	—	—	—	—	
Minimum (4 or 3 Pass)		—	—	18.0	21.6	17.0	16.9	20.9	20.9	20.8	26.7	20.8	
Maximum (8 or 6 Pass)		—	—	36.0	43.3	34.0	33.8	41.8	41.8	41.6	53.4	41.6	
SURFACE AREA (sq ft)													
Water Side		8.6	13.4	20.5	30.7	48.8	70.8	87.7	108.4	130.3	165.2	207.7	
Refrig Side		43.6	65.8	66.4	99.5	158.0	229.0	284.0	352.0	422.5	536.3	672.4	
MAX WORK. PRESS. (psig)		150					385			250			
MAX REFRIG STORAGE CAP. (lb)													
R-12		30	41	80	94	163	217	268	239	309	397	527	
R-22		27	37	74	86	148	197	243	226	280	360	478	
R-502		28	38	75	87	150	200	247	229	284	366	485	
MIN REFRIG OPERATING CHARGE (lb)													
R-12		2.0	3.0	14.0	16.0	37.0	41.0	51.0	51.0	78.0	100	126	
R-22		1.8	2.7	12.7	14.5	33.0	37.0	46.0	46.0	71.0	91	114	
R-502		1.9	2.9	13.1	15.0	34.4	38.2	47.3	47.3	73.0	94	118	
WATER CONN (in.)													
Single Ckt or Min Pass		Inlet	1/2 FPT	3/4 FPT	(2) 1 1/4 FPT	(2) 1 1/4 FPT	(2) FPT	(2) 2 FPT	(2) 2 FPT	(2) 2 FPT	(2) 2 1/2 IPS	(2) 2 1/2 IPS	(2) 3 IPS
Outlet		1/2 FPT	3/4 FPT	1 1/2 FPT	1 1/2 FPT	2 1/2 FPT	3 FPT	3 FPT	3 FPT	4 IPS	4 IPS	5 IPS	
Double Ckt or Max Pass		Inlet	(2) 1/2 FPT	(2) 3/4 FPT	1 1/4 FPT	1 1/4 FPT	2 FPT	2 FPT	2 FPT	2 FPT	2 1/2 IPS	2 1/2 IPS	3 IPS
Outlet		(2) 1 MPT	(2) 1 MPT	1 1/4 FPT	1 1/4 MPT	2 FPT	2 FPT	2 FPT	2 FPT	2 1/2 IPS	2 1/2 IPS	3 IPS	
REFRIG CONN													
Gas Inlet		Type	Female-Solder										
ODF (in.)		1 1/8	1 3/8	1 3/8	1 5/8	2 1/8	2 5/8	3 1/8	3 1/8	3 1/8	3 5/8	3 5/8	
Liquid Outlet		Type	Female-Solder			2-Bolt Valve			4-Bolt Valve				
ODF (in.)		1/2	1/2	7/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	
RELIEF VALVE (in.)		3/8 MPT	3/8 MPT	1/2 FPT	1/2 FPT	5/8 FL	5/8 FL	5/8 FL	5/8 FL	3/4 FL	3/4 FPT	(2) 3/4 FPT	
WATER DRAIN & VENT PLUG (in.)		—	—	1/4	1/4	3/8	3/8	3/8	3/8	3/8	3/8	3/8	
WATER REG CONN (in.)		1/4											

**LEGEND**

- FL — Flare
- FPT — Female Pipe Thread (in.)
- IPS — Iron Pipe Size (Butt-welded connection)
- MPT — Male Pipe Thread (in.)
- ODF — Outside Diameter Female (in.)
- Psig — Pounds Per Square Inch Gage

**NOTES:**

1. Based on R-22 at 105 F condensing, 85 F entering water temperature, 10 F rise. The 09RH097 is rated at 10.6 F rise in order to stay within the recommended water velocity range.
2. 90 F liquid, 80% filled.
3. Purge and liquid test cocks furnished on all condensers.
4. 5F40 and larger condensers have cleanable and renewable tubes.

**Table 30 — Max Condenser Tube Water Velocity**

OPERATING HOURS PER HOUR	MAXIMUM TUBE WATER VELOCITY (fps)
Up to 1500	15.0
2000	14.0
3000	13.0
4000	12.0
6000	10.0
8000	8.0

**Table 31 — Condenser Gpm at Various Water Velocities\***

CONDENSER	MINIMUM PASS†						MAXIMUM PASS**					
	Water Velocity (fps)											
	3	5	7	9	10	12	3	5	7	9	10	12
5F20	6	11	15	20	22	24	3	5	8	10	11	12
5F30	8	15	22	29	32	32	4	7	11	14	16	16
5F40	16	27	39	50	56	64	8	14	19	25	28	32
5F60	20	35	50	65	72	80	10	17	25	32	36	40
09RH027	42	70	98	126	140	168	21	35	49	63	70	84
09RH043	63	105	147	189	210	252	31.5	52.5	73.5	94.5	105	126
09RH054	63	105	147	189	210	252	31.5	52.5	73.5	94.5	105	126
09RH070	79	131	183	236	262	316	39.5	65.5	91.5	118	131	158
09RH084	93	155	216	279	310	372	46.5	77.5	108	139.5	155	186
09RH097	93	155	216	279	310	372	46.5	77.5	108	139.5	155	186
09RH127	148	247	346	445	494	592	74.0	123.5	173	222.5	247	296

**LEGEND**

ARI — Air Conditioning and Refrigeration Institute

\*Within ARI Standard recommendations.

†Double circuit for 5F20 and 30.

\*\*Single circuit for 5F20 and 30.

Water velocity formulas: (Use for velocities above 12 fps.)

$$5F20 \text{ Condenser: } V = \frac{\text{gpm} \times 0.92}{\text{no. of circuits}}$$

$$5F40 \text{ through } 09RH127: V = \frac{\text{gpm} \times \text{passes} \times 1.06}{\text{total tubes}}$$

$$5F30 \text{ Condenser: } V = \frac{\text{gpm} \times 0.65}{\text{no. of circuits}}$$

**Water Circuiting Arrangements** — The water circuiting arrangement selected for 5F and 09RH condensers depends on available condenser water pressure, temperature, quantity and source. Refer to Table 32.

Refer to the Carrier System Design Manual for specific information and recommendations for refrigerant and water piping.

**Economics** — Selection of a condenser requires balancing of certain economic variables, including:

1. First cost of compressor-condenser combination.
2. Operating costs.
3. Ratio between power costs and water costs.

Where first cost is the most important consideration, the best combination of compressor and condensers has the lowest total equipment cost.

If owning and operating costs are important, combination must be selected on basis of both considerations.

A condenser selection that permits operation of the system at a low condensing temperature, results in the lowest compressor motor brake horsepower and consequently, lowest operating cost. A condenser selection that is heavily loaded requires the compressor to operate at a higher condensing temperature and results in higher compressor motor brake horsepower and operating cost.

For a given compressor-condenser combination, selection of a condensing temperature may depend on a ratio between power costs and water costs, on quantity of water available, on condensing temperature required to achieve compressor capacity, or a requirement to remain within allowable loading on a given motor size.

**Condenser Performance with Ethylene Glycol** — Increased use of closed circuit cooling towers has led to a corresponding increase in the need for shell and tube condenser ratings for use with ethylene glycol. When towers are installed outdoors, a brine solution is required for freeze protection during winter operations.

In most outdoor installations, specifications will call for a percentage of concentration of ethylene glycol or other brine solution. If concentration is not specified, it may be the choice of the contractor to determine a percentage of glycol concentration to ensure against freeze-up during winter minimum design ambients.

To perform simplified selection, use Fig. 22 to convert a condenser water rating to a brine rating.

EXAMPLE:

Assume that a building with a year-round cooling load has a cooling requirement of 120 tons during summer design conditions. Chilled water design temperatures are 54 F entering to 44 F leaving, and for summer duty, the condenser water is based on 85 F and a 10 degree rise.

From product literature, selected unit will deliver 121 tons at 105.8 F saturated discharge temperature (SDT) and has 153 tons of heat rejection.

Determine condenser loading factor by use of following formula:

$$LF = \frac{THR}{SDT - 1.5 \text{ line loss} - EWT}$$

$$= \frac{153}{(105.8 - 1.5) - 85}$$

$$= \frac{153}{19.3} = 7.9$$

Where: EWT — Entering Water Temperature  
 LF — Loading Factor  
 THR — Total Heat Rejection

The 85 F value is return water temperature from closed circuit cooler.

Entering condenser rating data at loading factor of 7.9, 300 gpm are required to maintain design condensing temperature. Next, determine the rise by:

$$\text{Rise} = \frac{THR \times 24}{\text{Gpm}}$$

$$= \frac{153 \times 24}{300} = 12.2 \text{ degrees}$$

If a more precise rise is desired, go back and assume a slightly different condensing temperature, recalculate the loading factor and rise and repeat the procedure until a final balance is found.

For this example, condenser water pressure drop is approximately 9.4 ft for the design 300 gpm flow rate. Using Fig. 22, flow rate correction can be determined for any glycol concentration versus water in shell and tube condensers.

Continuing with example, assume specifications required protection against freeze-up at an ambient of 0° F. (A glycol concentration that provides protection between 10 and 15 degrees below expected minimum ambient has been the design criteria for many years.)

In a condenser system, the use of proper ethylene glycol brine concentration is important because of the phenomenon that commonly published freeze points are not freeze points but are the point of crystallization where the first crystals begin to form. Actual freezing into a solid occurs at much lower temperatures. For example, freeze point of 20% ethylene glycol is given as +16 F but does not become a solid until it reaches -50 F; 35% ethylene glycol with a freeze point of -6 F does not become solid until it reaches -120 F. Consequently, 20% glycol solution will take care of most domestic applications and 35% brine should satisfy the rest. The lowest concentration of brine will be the most efficient and result in considerable energy conservation.

Entering Fig. 22 at 0° F crystallization point, necessary concentration of glycol is either 32.5% by weight or 30% by volume. Next, determine glycol flow rate:

$$\text{Glycol Flow Rate} = \frac{THR (\text{tons}) \times \text{Glycol Factor (GF)}}{\text{Rise}}$$

**Table 32 — Condenser Water Circuiting**

WATER CIRCUITING ARRANGEMENTS	CONDENSER SIZE	CONDENSER CHARACTERISTICS	NORMAL USE
Double Circuit 4 Passes 3 Passes	5F20, 5F30 5F40, 5F60 All 09RH	High Water Quantity Low Pressure Drop	Cooling Tower
Single Circuit 8 Passes 6 Passes	5F20, 5F30 5F40, 5F60 All 09RH	Low Water Quantity High Pressure Drop	City or Well Water

Determine glycol factor (GF) by entering Fig. 22 at proper glycol concentration and reading left from glycol factor line — in this case a glycol gpm factor of 33.5.

$$\text{Glycol Flow Rate} = \frac{153 \times 33.5}{10} = 513 \text{ Gpm}$$

Therefore, at 32.5% by weight ethylene glycol specified and used to satisfy design conditions, a flow rate of 513 gpm of brine solution would be required and this value used to select a closed circuit cooler. Closed circuit cooler selection can be made from the manufacturer's literature or by contacting the local representative.

With the increase in brine flow rate, the rise will now be:

$$\begin{aligned} \text{Rise} &= \frac{\text{THR} \times 24}{\text{Gpm}} \\ &= \frac{153 \times 33.5}{513} \\ &= 10 \text{ degrees} \end{aligned}$$

Next determine the glycol pressure drop.

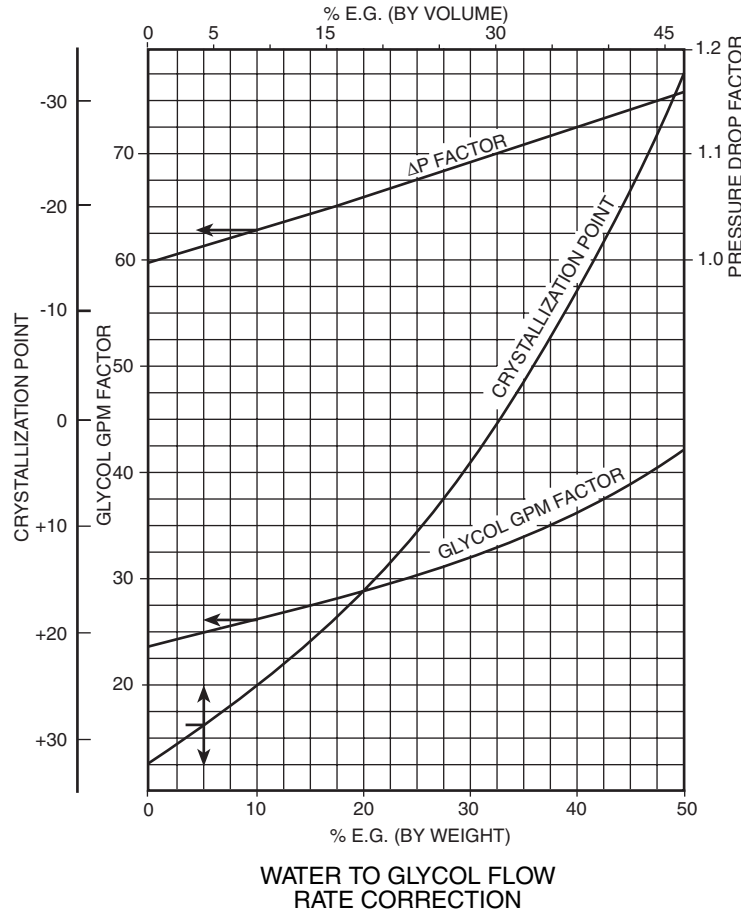
$$\text{Equiv Water Flow} = \text{Glycol Flow} \times \text{Press. Drop Factor}$$

Pressure drop factor can be determined by entering Fig. 22 at the proper concentration of glycol solution (30% by volume), going to the pressure drop factor line and reading right to the pressure drop factor. For this example the factor is 1.1.

$$\begin{aligned} \text{Equiv Water Flow} &= 513 \times 1.1 \\ &= 564 \text{ Gpm} \end{aligned}$$

Entering condenser water pressure drop curve in product literature at 564 gpm, the brine pressure drop can be determined. Note there will be an increase in flow rate and pressure drop with ethylene glycol as compared to a straight water cooling system.

In conclusion, add a glycol solution to a condenser system only when conditions warrant. Do not add more than is required. When glycol is used, proper control of inhibitor concentration is necessary to maintain design properties of solution and prevent corrosion.



**NOTES:**

1. Determine % concentration at required crystallization point.
2. Determine glycol flow rate (gpm).

$$\text{Glycol Flow} = \frac{\text{THR (tons)} \times \text{Glycol Factor}}{\text{Rise}}$$

3. Determine glycol pressure drop.

$$\text{Equivalent Water Flow} = \text{Glycol Flow} \times \Delta p \text{ Factor}$$

Enter condenser water Δp curves at equivalent water flow rate. Result equals glycol Δp.

**Fig. 22 — Water to Glycol Flow Rate Correction**