File: EQUIPMENT MANUAL – Section 70
Replaces: E70–116 SED/FEB 84
Dist: 1, 1a, 1b, 1c, 4, 4b, 4c

E70–116SED/APR 85

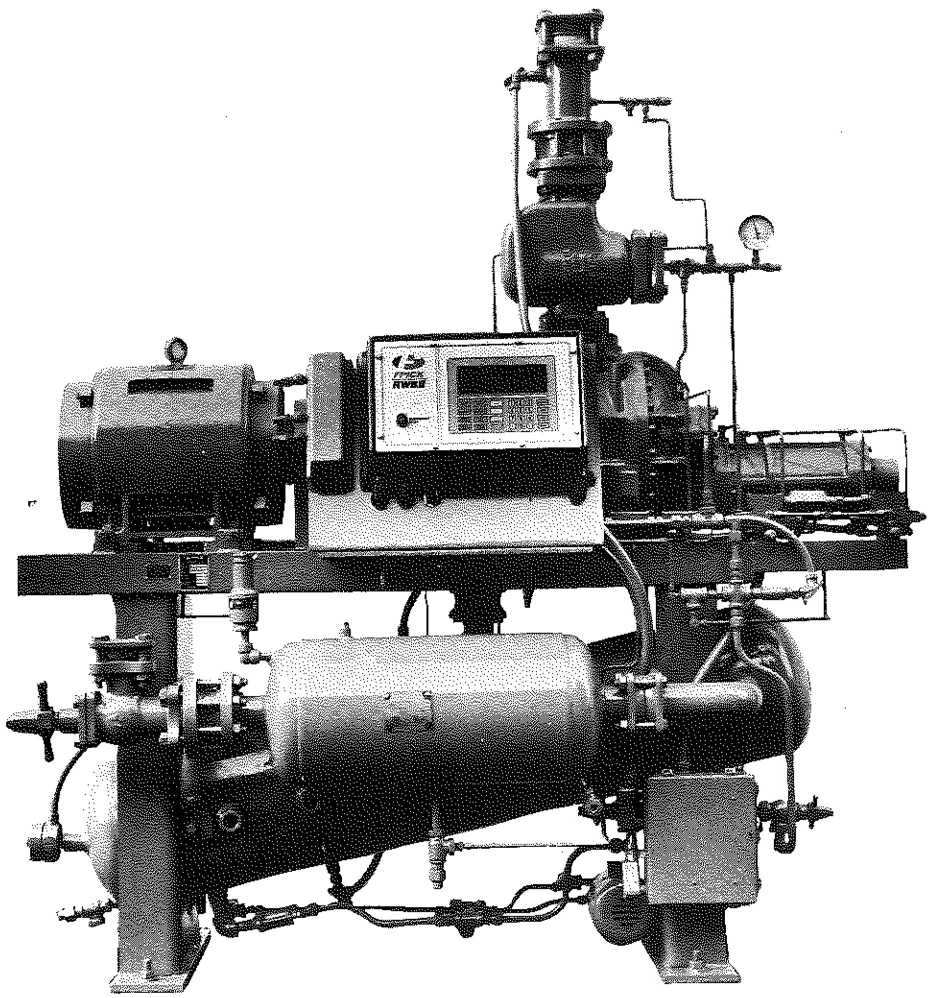
FRICK

SPECIFICATIONS – ENGINEERING DATA – DIMENSIONS

FRICK RWB II ROTARY SCREW COMPRESSOR UNIT

MODEL: RWB II–38 REFRIGERANTS: R-717 and R-22

HIGH STAGE and BOOSTER APPLICATIONS



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The RWB II-38 Rotary Screw Compressor Units are engineered and manufactured to meet the exacting requirements of the Industrial Refrigeration Market. All components have been selected and arranged to assure reliability, accessibility and ease of service.

Standard units are designed for use with ammonia, halocarbon and hydrocarbon refrigerants for single stage, high stage and booster duty. Single stage units are capable of operating with compression ratios as high as 26:1.

COMPRESSOR MODEL TDS – The Frick manufactured TDS compressor has been designed around the latest technology to offer the most reliable and energy efficient unit currently available. All screw compressor castings are designed and tested to meet the requirements of ASHRAE 15–78 safety code. The rotors are manufactured from forged steel and use the latest asymmetric profiles. The compressor incorporates a complete antifriction bearing design for reduced power consumption and superior rotor positioning which translates into improved efficiency especially at the higher compression ratios. The 1750 RPM operating speed means that the bearings selected provide an L10 life in excess of 200,000 hours at design conditions. The extra heavy, double wall casing and slow speed operation yield an exceptionally quiet screw compressor, typically 80 dBA at 1 meter. The TDS-1617 compressor used on the RWB II-38 unit has a displacement of 224 CFM (380 m^3h) at 1750 RPM with 163 mm diameter, 1.7 L/D rotors.

"VOLUMIZER" VARIABLE VOLUME RATIO – The TDS compressor includes a patented method of varying the internal volume ratio to match the system pressure ratio; eliminating the power penalty associated with over or under compression (2.2 to 5.0 Vi).

CAPACITY CONTROL – Capacity control is achieved by use of a slide valve which provides fully modulating capacity control from 100% to approximately 10% of full load capacity.

LUBRICATION SYSTEM – The TDS compressor is designed specifically for operation without an oil pump. All oil required for main oil injection and lubrication is provided by positive gas differential pressure. All oil passes through a 10 – 15 micron filter furnished with isolation stop valves and drain connections for ease of servicing.

The standard high stage unit is furnished with a close-coupled positive displacement pre-lube pump for start-up only. For some low pressure differential applications (refer to page 15) an optional full time or cycling full time lube pump will be required. The cycling full lube pump operates only when the suction – discharge differential is not sufficient to provide adequate lubrication and will shut off automatically to conserve pump motor power when not required.

The lubrication system on a unit designed for booster duty includes a full lube oil pump. The full lube pump is supplied as standard equipment due to the typical low differential pressure across the compressor in booster applications.

OIL SEPARATION SYSTEM – Three stage oil separation is achieved in a combination of two vessels. The primary separator/oil sump is tilted at a 15° angle providing a large cross-sectional area at the upper end for low gas separation velocity while at the same time providing a deep oil sump at the lower end for reliable lube oil supply. In essence combining the advantages of vertical and horizontal oil separators. Final separation of oil particles to less than 1 micron takes place in a separate, easily accessible coalescer vessel.

OIL COOLING – Choose between liquid refrigerant injection oil cooling and water cooled or thermosyphon oil coolers (supplied with ASME shell and tube heat exchangers mounted on the unit).

SBC MICROPROCESSOR CONTROL CENTER – The compressor control system is factory mounted and completely piped and wired with all the required safety and operating devices. The control system includes as standard a NEMA 4X microprocessor control panel and a separate NEMA 4 power supply and junction box. The microprocessor panel is supplied with a 240 character vacuum fluorescent display with a minimum rated life of 100,000 hours. Included in the microprocessor is time proportioning capacity control, first out annunciation, prealarms and volumizer control. All major operating conditions are continuously displayed on the microprocessor display. A special FREEZE DISPLAY mode provides the ultimate in service and troubleshooting ease by recalling past conditions from memory. Built-in telecommunications interface suitable for connection to standard modems is included.

VALVES – Suction and discharge check valves and service valves and a large capacity flanged mounted suction strainer are included with the unit.

OPTIONAL ACCESSORIES –
- Dual Oil Filter
- Economizer
- Motor
- Full Lube Oil Pump

EQUIPMENT SELECTION

SCREW COMPRESSOR UNIT

The following information is required for final unit selection:

Refrigerant	R-717, R-22, Other - Consult Frick Co.
Duty	Single Stage, High Stage, Booster, Other - Consult Frick Co.
Compressor RPM	1750 (60 Hz), 1450 (50Hz), (Std) Other - Consult Frick Co.
Lube Oil Pump: Single, High Stage	Prelube (Std)
Lube Oil Pump: Single, High Stage	Full or Cycling Full Lube (Opt)
Lube Oil Pump: Booster	Full Lube (Std)
Oil Filter	Single (Std), Dual (Opt)
Oil Cooling	Liquid Injection (Std)
Water Cooled Cooler (Inlet Water Temp °F, ΔT °F Req'd)	(Opt)
Thermosyphon	(Opt)
Saturated Suction Temperature	°F
Condensing Temperature	°F
Intermediate Temperature (Booster only)	°F
Suction Superheat	°F
Liquid Subcooling	°F
Economizer - Kit Only	(Opt)
Economizer - Mounted DX Cooler	(Opt)

Rating TR BHP (Including Liquid Subcooling, Suction Superheat, Liquid Injection and 50 Hz corrections as applicable)

COMPRESSOR DRIVER

The following information is required for proper coordination of the screw compressor unit and the compressor driver:

Driver Type	Electric Motor, Other - Consult Frick Co.
Motor Speed	RPM (1750 or 1450 ± 50 RPM)
Motor Specifications	HP, Frame Service Factor, Full Load Amps
Motor Power	Volts, 3 Phase, Hz (60 or 50 Hz)
Motor Supplied By	Frick, Others
Motor Mounted By	Frick, Others
Motor Enclosure	ODP, TEFC, Explosion Proof Class Group
Motor Starting Method	Across-the-line, Wye-delta, Autotransformer, Other - Consult Frick Co.

Rotation Clockwise facing opposite the drive end of motor (facing compressor input shaft).

MOTOR SELECTION

Motors for high stage applications may be selected for the design operating condition, however motors for booster applications need to be sized for start-up and pull-down duty as well as for the design condition. For booster applications start-up and pull-down will quite often be the more demanding requirement.

For starting torque refer to page 16.

MOTOR STARTER PACKAGE

The following specifications describe a motor starter package, complete with all electrical accessories necessary to interface with the RWB II compressor unit. These starter packages are available from Frick Company with all necessary interlocks prewired to terminals numbered for direct connection to the RWB II unit junction box.

STARTER PACKAGE SPECIFICATIONS FOR RWB II COMPRESSOR UNITS WITH MICROPROCESSOR CONTROL

Specify starting method and overcurrent protection for HP Volt/3 Phase, Hz, FLA, RPM compressor motor, complete with overload heaters, 2KVA–120 volt control power transformer, :5 amp – 15 VA signal current transformer and normally open auxiliary contact. Starter package includes one across-the-line fused oil pump starter for HP, Volt/Phase, Hz, FLA, RPM motor complete with overload heaters and normally open auxiliary contact. All interlocks wired to terminals marked in accordance with the RWB II unit junction box. Specify NEMA rating for enclosure, NEMA 1 is standard. The maximum starter coil load on terminal 18 shall be (1) size 3 starter coil or (1) interposing relay.

The following information must be specified for each individual application:

STARTING METHOD – Choose Across-the-line, Autotransformer, Wye-delta open transition or Wye-delta closed transition starting.

ACROSS-THE-LINE STARTING – Yields full motor starting torque. However, power companies and/or in-house power distribution systems often require other starting methods to achieve reduced starting inrush current. Note: Reducing the inrush current also reduces the starting torque. A careful analysis of compressor torque requirements versus the available motor starting torque must be made. This can be accomplished by plotting the motor speed-torque curve (obtained from motor vendor) against the compressor speed-torque curve. The available motor torque should exceed the compressor torque requirement by a minimum of 20% at the worst portion of the curve. This usually occurs at approximately half-speed in the region known as the motor pull up torque (P.U.T.). When plotting these curves please remember that for starting methods other than across-the-line the motor torque values are reduced as follows:

AUTOTRANSFORMER – The Autotransformer starter has three voltage taps 50%, 65% and 80%. The starter, unless specified otherwise, is normally shipped connected to the 65% voltage tap. This can be changed in the field as required. The starting torque available is:

80% Tap – 64% of normal torque
65% Tap – 42% of normal torque
50% Tap – 25% of normal torque

WYE-DELTA (OPEN OR CLOSED TRANSITION) – Starting torque available is 33% of normal. While Wye-delta open transition starters exhibit the same torque characteristics as Wye-delta closed transition starters, closed transition is the more preferred method. This is because open transition allows the motor to get out of synch with the power line during transition. This can result in damaging power spikes that tend to nuisance trip circuit breakers and shorten motor and power distribution equipment life. This is especially true for screw compressors which represent relatively low inertia loads.

OVERCURRENT PROTECTION – Choose either the Starter package or the Combination starter package with circuit breaker disconnect. In the majority of cases the Starter package (without circuit breaker disconnect) is chosen and motor overcurrent protection is provided by the motor feeder circuit breaker in the electrical power panel. For high voltage (2300, 4160 V) applications only, specify High voltage fused draw-out starter package.

COMPRESSOR MOTOR DATA – Indicate the motor horsepower voltage, frequency (Hz), full load amps (FLA) and speed (1750 RPM or 1450 RPM).

CURRENT TRANSFORMER RATIO – Select the appropriate current transformer ratio from the chart on the wiring diagram on page 17.

OIL PUMP MOTOR DATA – The oil pump motor data is determined by Frick Company for each application. Standard units supplied with the prelube system will have a fractional horsepower oil pump. Units supplied with the optional full lube system will have an integral horsepower pump.

SOLID STATE – Solid state starters have complex current and torque relationships. In addition, solid state starters require careful coordination between the starter and other protective devices to prevent compressor failure due to shorted starter outputs. If a solid state starter is being considered, please contact Frick Company for assistance.

STANDARD CONDITIONS – HIGH STAGE

The RWB II-38 high stage ratings for R717 and R22 are given in the tables on pages 6 through 9. These ratings are based on 1750 RPM (60 Hz), 10°F liquid subcooling, 10°F suction superheat (not contributing to the refrigeration effect) and thermosyphon or water cooled oil cooling.

The final rating for an RWB II-38 unit at any condition is determined from the standard rating and all of the applicable correction factors.

Capacity (TR) = standard rating (or economizer rating) x subcooling correction factor x superheat correction factor x liquid injection correction factor if applicable (see page 12) x 0.81 (50 Hz only).

Brake horsepower (BHP) = standard rating (or economizer rating) x 1.01 (liquid injection correction factor if applicable) x 0.81 (50 Hz only).

LIQUID SUBCOOLING CORRECTION FACTORS – HIGH STAGE

For liquid subcooling other than 10°F, determine the liquid subcooling capacity correction factor (S.C.C.F.) in the following manner using the actual number of degrees of liquid subcooling (S.C.):

For R–717: $\text{S.C.C.F.} = 1 + (\text{S.C.} - 10°\text{F})\ (.0025)$

For R–22: $\text{S.C.C.F.} = 1 + (\text{S.C.} - 10°\text{F})\ (.005)$

No brake horsepower correction is required for liquid subcooling.

SUCTION SUPERHEAT CORRECTION FACTORS – HIGH STAGE

For suction superheat in excess of 10°F determine the suction superheat capacity correction factor (S.H.C.F.) in the following manner using the actual number of degrees of suction superheat (S.H.):

For R–717: $$\text{S.H.C.F.} = \frac{1}{1 + (\text{S.H.} - 10°\text{F})\ (.0027)}$$

For R–22: $$\text{S.H.C.F.} = \frac{1}{1 + (\text{S.H.} - 10°\text{F})\ (.0028)}$$

It is recommended that a minimum of 10°F of suction superheat be maintained to insure that all refrigerant entering the compressor is in the vapor state.

No brake horsepower correction is required for suction superheat.

STANDARD CONDITIONS – BOOSTER

The RWB II-38 booster ratings for R717 and R22 are given in the tables on pages 10 and 11. These ratings are based on 1750 RPM (60 Hz), liquid cooled to intermediate temperature, no suction superheat and thermosyphon or water cooled oil cooling.

The final rating for an RWB II-38 unit at any condition is determined from the standard rating and all of the applicable correction factors.

Capacity (TR) = standard rating x liquid temperature correction factor x superheat correction factor x 0.98 (liquid injection correction factor if applicable) x 0.81 (50 Hz only).

Brake Horsepower (BHP) = standard rating x 1.01 (liquid injection correction factor if applicable) x 0.81 (50 Hz only).

LIQUID TEMPERATURE CORRECTION FACTORS – BOOSTER

For liquid temperatures greater than the saturated intermediate temperature determine the liquid temperature correction factor (L.T.C.F.) in the following manner:

For R–717 $\text{L.T.C.F.} = 1 - (\text{TD})\ (.0025)$

For R–22 $\text{L.T.C.F.} = 1 - (\text{TD})\ (.005)$

Where TD is the temperature difference in degrees between the actual liquid temperature and the saturated intermediate temperature.

No brake horsepower correction is required for liquid temperature.

SUCTION SUPERHEAT CORRECTION FACTORS – BOOSTER

For suction superheat in excess of 0°F determine the suction superheat capacity correction factor (S.H.C.F.) in the following manner using the actual number of degrees of suction superheat (S.H.):

For R–717 $$\text{S.H.C.F.} = \frac{1}{1 + (\text{S.H.})\ (.0027)}$$

For R–22 $$\text{S.H.C.F.} = \frac{1}{1 + (\text{S.H.})\ (.0028)}$$

It is recommended that a minimum of 10°F of suction superheat be maintained to insure that all refrigerant entering the compressor is in the vapor state.

No brake horsepower correction is required for suction superheat.

HIGH STAGE – CAPACITY and BRAKE HORSEPOWER RATING @ 1750 RPM

RWB II-38

R717 HIGH STAGE

R-717

SATURATED SUCTION TEMPERATURE, °F/CORRESPONDING PRESSURE, PSIG (*in Hg)		SATURATED CONDENSING TEMPERATURE, °F / CORRESPONDING PRESSURE, PSIG: 75 / 125.8	85 / 151.7	95 / 181.1	105 / 214.2	115 / 251.5
–40	TR	15.7	15.0	14.2	13.4	12.5
8.7*	BHP	49.4	55.4	62.1	69.9	79.2
–35	TR	18.5	17.6	16.8	15.9	15.0
5.4*	BHP	51.9	58.0	64.8	72.3	81.1
–30	TR	21.5	20.6	19.7	18.7	17.7
1.6*	BHP	54.4	60.8	67.7	75.3	83.8
–25	TR	24.9	24.0	22.9	21.9	20.8
1.3	BHP	56.8	63.7	70.9	78.7	87.1
–20	TR	28.7	27.6	26.6	25.4	24.3
3.6	BHP	58.7	66.6	74.2	82.2	90.8
–15	TR	32.9	31.7	30.6	29.3	28.1
6.2	BHP	60.3	68.8	77.5	85.9	94.8
–10	TR	37.5	36.2	35.0	33.6	32.3
9.0	BHP	61.4	70.9	80.2	89.7	99.0
–5	TR	42.6	41.2	39.8	38.4	36.9
12.2	BHP	62.4	72.2	82.6	92.9	103.2
0	TR	48.2	46.7	45.2	43.6	42.0
15.7	BHP	63.5	73.4	84.3	95.7	107.2
5	TR	54.3	52.7	51.0	49.3	47.6
19.6	BHP	64.3	74.6	85.8	97.9	110.2
10	TR	61.1	59.3	57.5	55.6	53.7
23.8	BHP	65.0	75.7	87.1	99.6	113.1
15	TR	68.4	66.5	64.5	62.5	60.4
28.4	BHP	65.4	76.5	88.4	101.1	115.0
20	TR	76.4	74.3	72.1	69.9	67.7
33.5	BHP	65.4	77.2	89.5	102.7	116.8
25	TR	85.1	82.8	80.5	78.1	75.6
39.0	BHP	65.0	77.5	90.4	104.0	118.5
30	TR	94.5	92.0	89.5	86.9	84.2
45.0	BHP	64.1	77.3	91.0	105.1	120.2
35	TR	104.7	102.0	99.3	96.4	93.5
51.6	BHP	62.7	76.6	91.0	106.0	121.4
40	TR	115.7	112.8	109.8	106.8	103.6
58.6	BHP	60.4	75.3	90.6	106.4	122.7

NOTE: Capacities Based on 10° Liquid Subcooling, 10° Suction Superheat with the Superheat not contributing to the refrigeration effect.

RWB II-38E

HIGH STAGE – CAPACITY and BRAKE HORSEPOWER RATING @1750 RPM W/ECONOMIZER

R-717: SATURATED SUCTION TEMPERATURE, °F/CORRESPONDING PRESSURE, PSIG (*in Hg)		SATURATED CONDENSING TEMPERATURE, °F / CORRESPONDING PRESSURE, PSIG: 75 / 125.8	85 / 151.7	95 / 181.1	105 / 214.2	115 / 251.5	DX (*) ECONOMIZER
−40	TR	18.3	17.8	17.3	16.7	16.1	
8.7*	BHP	51.4	58.0	65.4	74.1	84.5	
−35	TR	21.3	20.8	20.3	19.7	19.1	6″ x 3′
5.4*	BHP	54.0	60.8	68.3	76.7	86.5	
−30	TR	24.5	24.1	23.5	23.0	22.3	
1.6*	BHP	56.6	63.7	71.4	79.9	89.5	
−25	TR	28.1	27.6	27.1	26.6	25.9	
1.3	BHP	59.1	66.8	74.8	83.6	93.2	
−20	TR	32.0	31.5	31.0	30.5	29.8	6″ x 4′
3.6	BHP	61.1	69.8	78.3	87.4	97.2	
−15	TR	36.3	35.8	35.4	34.8	34.2	
6.2	BHP	62.8	72.2	81.9	91.4	101.6	
−10	TR	40.9	40.5	40.0	39.5	38.9	
9.0	BHP	64.0	74.4	84.8	95.4	106.1	
−5	TR	46.0	45.6	45.1	44.6	44.0	6″ x 6′
12.2	BHP	65.1	75.8	87.3	99.0	110.7	
0	TR	51.4	51.0	50.5	50.0	49.4	
15.7	BHP	66.2	77.2	89.3	102.0	115.1	
5	TR	57.3	56.9	56.5	55.9	55.4	
19.6	BHP	67.1	78.4	90.9	104.5	118.5	
10	TR		63.2	62.8	62.3	61.7	
23.8	BHP		79.6	92.3	106.4	121.7	
15	TR			69.6	69.1	68.5	
28.4	BHP			93.8	108.1	123.9	
20	TR			76.9	76.4	75.8	8″ x 4′
33.5	BHP			94.9	109.8	125.9	
25	TR	CONSULT FRICK COMPANY			84.1	83.6	
39.0	BHP				111.3	127.8	
30	TR					91.9	
45.0	BHP					129.7	
35	TR						
51.6	BHP						
40	TR						
58.6	BHP						

R 717 HIGH STAGE

NOTE: Capacities Based on Economizer, 10° Suction Superheat with the Superheat not contributing to the refrigeration effect.

(*) Suggested DX shell and coil economizer vessel size. No allowance for vapor line pressure drop or liquid temperature split is included in the selections.

HIGH STAGE – CAPACITY and BRAKE HORSEPOWER RATING @ 1750 RPM

RWB II-38

R22 HIGH STAGE

R-22		SATURATED CONDENSING TEMPERATURE, °F / CORRESPONDING PRESSURE, PSIG					
SATURATED SUCTION TEMPERATURE, °F/CORRESPONDING PRESSURE, PSIG		75 132.2	85 155.7	95 181.8	105 210.8	115 242.7	120.0 259.9
−40 .5	TR BHP	19.0 54.8	17.6 60.9	16.2 67.3	14.9 74.2	13.5 81.6	12.8 86.0
−35 2.6	TR BHP	21.8 56.6	20.3 63.6	18.8 70.3	17.3 77.5	15.8 84.9	15.0 89.2
−30 4.9	TR BHP	25.0 58.1	23.4 65.5	21.7 73.4	20.0 80.9	18.4 88.5	17.5 92.8
−25 7.4	TR BHP	28.5 59.3	26.7 67.2	24.9 75.4	23.0 84.2	21.2 92.7	20.3 96.8
−20 10.2	TR BHP	32.4 60.6	30.4 68.6	28.4 77.4	26.4 86.5	24.3 96.3	23.3 100.9
−15 13.2	TR BHP	36.6 61.7	34.4 70.0	32.2 78.8	30.0 88.6	27.8 98.9	26.7 104.6
−10 16.5	TR BHP	41.2 62.7	38.8 71.2	36.4 80.4	33.9 90.3	31.5 101.1	30.3 106.8
−5 20.1	TR BHP	46.3 63.5	43.6 72.3	41.0 81.8	38.3 91.9	35.6 102.9	34.3 109.0
0 24.0	TR BHP	51.8 64.0	48.9 73.3	45.9 83.0	43.0 93.5	40.1 104.6	38.6 110.7
5 28.2	TR BHP	57.8 64.1	54.5 74.0	51.3 84.0	48.2 94.7	45.0 106.4	43.4 112.5
10 32.8	TR BHP	64.3 63.9	60.7 74.3	57.2 84.8	53.7 95.9	50.2 107.7	48.5 114.1
15 37.7	TR BHP	71.4 63.8	67.5 74.2	63.6 85.3	59.8 96.9	56.0 109.0	54.0 115.5
20 43.0	TR BHP	79.0 63.3	74.8 73.9	70.5 85.4	66.3 97.6	62.2 110.2	60.1 116.8
25 48.8	TR BHP	87.1 62.2	82.7 73.6	78.0 85.2	73.4 97.9	68.8 111.1	66.6 117.9
30 54.9	TR BHP	96.0 60.6	91.1 72.8	86.1 84.9	81.1 97.8	76.1 111.5	73.6 118.6
35 61.5	TR BHP	105.6 58.3	100.1 71.3	94.8 84.2	89.4 97.3	83.9 111.5	81.2 118.9
40 68.5	TR BHP	115.9 55.2	110.0 69.3	104.1 82.9	98.3 96.8	92.3 111.1	89.4 118.8

NOTE: Capacities Based on 10° Liquid Subcooling, 10° Suction Superheat with the Superheat not contributing to the refrigeration effect.

HIGH STAGE – CAPACITY and BRAKE HORSEPOWER RATING @1750 RPM W/ECONOMIZER

RWB II-38E

R-22		SATURATED CONDENSING TEMPERATURE, °F / CORRESPONDING PRESSURE, PSIG						
SATURATED SUCTION TEMPERATURE, °F/CORRESPONDING PRESSURE, PSIG		75 132.2	85 155.7	95 181.8	105 210.8	115 242.7	120.0 259.9	DX (*) ECONOMIZER
–40 .5	TR BHP	24.1 60.3	23.3 67.3	22.5 74.6	21.6 82.5	20.6 91.0	19.9 96.1	6″ x 6′
–35 2.6	TR BHP	27.5 62.3	26.7 70.3	25.8 78.0	24.9 86.2	23.9 94.9	23.2 99.8	
–30 4.9	TR BHP	31.0 63.9	30.2 72.3	29.3 81.4	28.4 90.1	27.4 99.0	26.6 104.0	8″ x 4′
–25 7.4	TR BHP	34.9 65.3	34.0 74.2	33.1 83.7	32.2 93.8	31.1 103.7	30.3 108.5	
–20 10.2	TR BHP	39.0 66.7	38.1 75.8	37.1 85.9	36.1 96.4	35.1 107.9	34.3 113.3	8″ x 6′
–15 13.2	TR BHP	43.3 67.9	42.4 77.3	41.4 87.5	40.3 98.9	39.3 110.8	38.4 117.6	
–10 16.5	TR BHP	47.8 68.9	46.9 78.7	45.9 89.3	44.8 100.7	43.7 113.4	42.8 120.1	
–5 20.1	TR BHP	52.5 69.8	51.5 79.9	50.5 90.9	49.4 102.6	48.2 115.5	47.3 122.7	
0 24.0	TR BHP	57.6 70.3	56.5 80.9	55.4 92.2	54.3 104.5	53.1 117.6	52.1 124.7	10″ x 6′
5 28.2	TR BHP		61.8 81.7	60.7 93.4	59.5 105.9	58.3 119.7	57.3 126.9	
10 32.8	TR BHP			66.2 94.3	65.0 107.3	63.8 121.2	62.7 128.8	
15 37.7	TR BHP			72.0 94.9	70.8 108.5	69.4 122.8	68.4 130.6	
20 43.0	TR BHP				76.8 109.3	75.5 124.2	74.4 132.2	
25 48.8	TR BHP	CONSULT FRICK COMPANY			83.3 109.7	81.8 125.3	80.7 133.5	
30 54.9	TR BHP					88.6 125.9	87.4 134.4	
35 61.5	TR BHP					95.7 126.1	94.5 134.9	
40 68.5	TR BHP						101.9 134.9	

R22 HIGH STAGE

NOTE: Capacities Based on Economizer, 10° Suction Superheat with the Superheat not contributing to the refrigeration effect.
(*) Suggested DX shell and coil economizer vessel size. No allowance for vapor line pressure drop or liquid temperature split is included in the selections.

R717 BOOSTER

BOOSTER – CAPACITY and BRAKE HORSEPOWER RATING @ 1750 RPM

R-717		SATURATED CONDENSING TEMPERATURE, °F/CORRESPONDING PRESSURE, PSIG						
SATURATED SUCTION TEMPERATURE, °F/CORRESPONDING PRESSURE, PSIG (* in Hg)		–20.0 3.6	–10.0 9.1	0.0 15.7	10.0 23.8	20.0 33.5	30.0 45.1	40.0 58.6
–80. 24.3*	TR BHP	5.5 14.1	5.3 15.9				CONSULT FRICK COMPANY	
–75. 23.2*	TR BHP	6.7 14.2	6.5 16.2	6.3 18.1				
–70. 21.9*	TR BHP	8.0 14.0	7.8 16.3	7.6 18.6	7.3 20.6			
–65. 20.4*	TR BHP	9.6 14.2	9.3 16.5	9.0 18.9	8.7 21.3	8.4 23.9		
–60. 18.6*	TR BHP	11.4 14.3	11.1 16.4	10.8 19.1	10.4 21.8	10.1 24.6	9.7 27.7	
–55. 16.6*	TR BHP	13.4 14.3	13.1 16.7	12.7 19.1	12.4 22.1	12.0 25.1	11.6 28.4	
–50. 14.3*	TR BHP	15.7 14.4	15.4 16.8	15.0 19.4	14.5 22.4	14.1 25.6	13.7 29.2	13.3 32.7
–45. 11.7*	TR BHP	18.3 14.6	18.0 16.8	17.6 19.6	17.1 22.4	16.5 25.9	16.1 29.6	15.6 33.5
–40. 8.7*	TR BHP	21.2 13.8	20.8 17.0	20.4 19.7	20.0 22.8	19.4 25.9	18.8 29.8	18.3 34.1
–35. 5.4*	TR BHP		24.0 16.9	23.6 19.7	23.1 22.9	22.5 26.3	21.8 30.2	21.2 34.2
–30. 1.6*	TR BHP		27.6 15.6	27.2 20.0	26.6 23.0	26.1 26.6	25.3 30.2	24.5 34.6
–25. 1.3	TR BHP			31.1 19.4	30.6 23.1	29.9 26.7	29.2 30.7	28.3 34.5
–20. 3.6	TR BHP				34.9 23.4	34.2 26.7	33.4 31.0	32.5 35.1
–15. 6.2	TR BHP	CONSULT FRICK COMPANY			39.7 22.0	38.9 26.7	38.1 30.9	37.2 35.6
–10. 9.0	TR BHP					44.2 26.6	43.2 30.8	42.3 35.8
–5. 12.2	TR BHP					50.0 25.1	48.9 30.8	47.9 35.5
0. 15.7	TR BHP						55.2 30.2	54.0 35.3

NOTE: Capacities based on liquid at intermediate saturation temperature and no suction superheat.

BOOSTER – CAPACITY and BRAKE HORSEPOWER RATING @ 1750 RPM

RWB II-38

R-22		SATURATED CONDENSING TEMPERATURE, °F/CORRESPONDING PRESSURE, PSIG						
SATURATED SUCTION TEMPERATURE, °F/CORRESPONDING PRESSURE, PSIG (* in Hg)		–20.0 10.2	–10.0 16.5	0.0 24.0	10.0 32.8	20.0 43.0	30.0 54.9	40.0 68.5
–80.	TR	8.3	8.0	7.8				
20.2*	BHP	19.6	21.8	24.4			CONSULT FRICK COMPANY	
–75.	TR	9.8	9.5	9.2	8.9			
18.5*	BHP	19.9	22.1	24.6	27.4			
–70.	TR	11.4	11.1	10.8	10.4	10.2		
16.6*	BHP	20.1	22.4	24.9	27.7	31.5		
–65.	TR	13.3	12.9	12.5	12.2	11.9		
14.4*	BHP	20.0	22.7	25.3	28.1	31.8		
–60.	TR	15.4	15.0	14.6	14.1	13.8	13.4	
12.0*	BHP	19.9	22.8	25.7	28.5	32.2	36.4	
–55.	TR	17.8	17.3	16.9	16.4	16.0	15.5	15.1
9.2*	BHP	19.8	22.6	25.9	28.9	32.6	36.8	41.5
–50.	TR	20.5	19.9	19.4	18.9	18.4	17.9	17.4
6.2*	BHP	20.1	22.5	25.8	29.2	33.0	37.2	41.9
–45.	TR	23.5	22.9	22.3	21.6	21.2	20.6	20.0
2.7*	BHP	19.7	22.4	25.6	29.3	33.4	37.6	42.3
–40.	TR	26.9	26.1	25.4	24.7	24.2	23.6	22.9
0.5	BHP	18.5	22.5	25.3	29.1	33.6	38.1	42.8
–35.	TR		29.7	29.0	28.2	27.6	27.0	26.2
2.6	BHP		22.1	25.2	28.7	33.4	38.4	43.3
–30.	TR		33.7	32.8	32.0	31.4	30.7	29.9
4.9	BHP		20.7	25.2	28.4	33.0	38.2	43.7
–25.	TR			37.1	36.1	35.5	34.8	33.9
7.4	BHP			24.7	28.3	32.6	37.8	43.6
–20.	TR			41.8	40.7	40.1	39.3	38.4
10.1	BHP			23.2	28.3	32.2	37.2	43.2
–15	TR				45.7	45.1	44.2	43.3
13.2	BHP	CONSULT FRICK COMPANY			27.7	32.1	36.7	42.6
–10.	TR				51.2	50.5	49.7	48.6
16.5	BHP				25.8	32.0	36.3	42.0
–5.	TR					56.4	55.5	54.5
20.1	BHP					31.2	36.2	41.6
0.	TR						61.9	60.9
24.0	BHP						36.0	40.9

NOTE: Capacities based on liquid at intermediate saturation temperature and no suction superheat.

R22 BOOSTER

LIQUID INJECTION OIL COOLING

High stage compressor units may be supplied with single port (low Vi) or dual port (low Vi and high Vi) liquid injection oil cooling. Single port will be furnished for low compression ratio operation and dual port for high compression ratio operation. Booster compressor units use single port liquid injection oil cooling due to the typically lower compression ratios.

The control system on high stage units with dual port liquid injection oil cooling automatically switches the liquid refrigerant supply to the high port when the compressor is operating at higher compression ratios (above 3.5 Vi) for best efficiency.

The following table gives the evaporator temperature limits for liquid injection use and single port application.

CONDENSING TEMPERATURE	MAXIMUM EVAP TEMP		MINIMUM * EVAP TEMP
	LIQUID INJ. USE		SINGLE PORT (LOW Vi)
	R717	R22	R717 & R22
75°F	+10°F	+ 5°F	– 5°F
85°F	+25°F	+15°F	+ 5°F
95°F	+35°F	+25°F	+ 10°F
105°F	+40°F	+35°F	+ 15°F

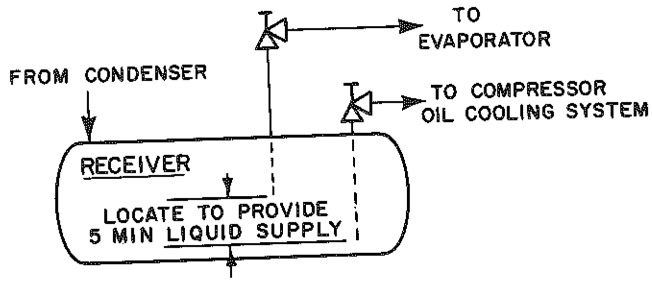
* Dual Injection Kit will be shipped by Frick below these temperatures.

Where low compression ratios are anticipated, thermosyphon or water cooled oil cooling should be used.

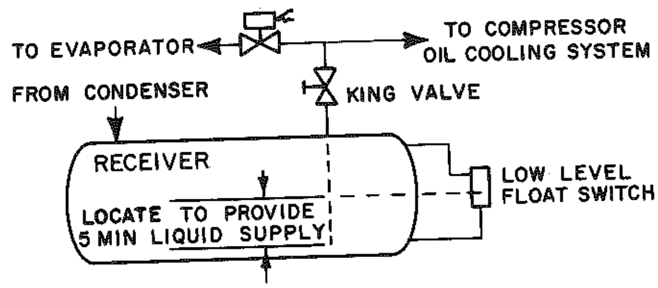
It is imperative that an uninterrupted supply of high pressure liquid refrigerant be provided to the injection system at all times. Two items are of extreme importance, the design of the receiver/liquid injection supply and the size of the liquid line.

It is recommended that the receiver be oversized sufficiently to retain a five (5) minute supply of refrigerant for oil cooling. The evaporator supply must be secondary to this consideration. Two methods of accomplishing this are shown.

The dual dip tube method uses two dip tubes in the receiver. The liquid injection tube is below the evaporator tube to assure continued oil cooling when the receiver level is low.



The level control method utilizes a float level control on the receiver to close a solenoid valve feeding the evaporator when the liquid falls below that amount necessary for five (5) minutes of liquid injection oil cooling.

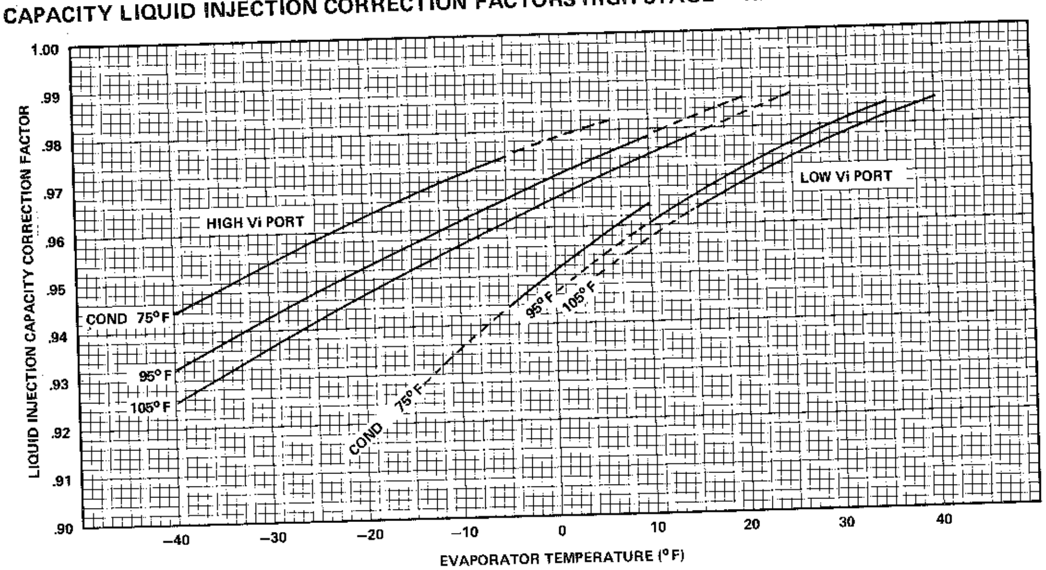


Liquid line sizes and the additional receiver volume (quantity of refrigerant required for five (5) minutes of liquid injection oil cooling) are given in the following table.

REF	LIQUID LINE SIZE (*)		FLOW RATE (LB) 5 MIN	LIQUID VOLUME CU FT
	PIPE SCH 80	TUBING OD		
HIGH STAGE				
R–717	3/4	–	25	.75
R–22	1	1–1/8	85	1.25
BOOSTER				
R–717	1/2	–	5	.50
R–22	3/4	5/8	25	.30

* 100 foot liquid line. For longer runs increase line size accordingly.

CAPACITY LIQUID INJECTION CORRECTION FACTORS HIGH STAGE – R717 and R22

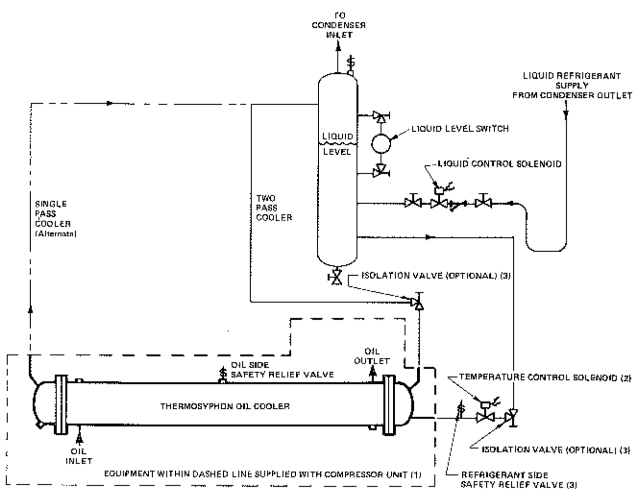


THERMOSYPHON OIL COOLING

Thermosyphon oil coolers, like water (or glycol) cooled oil coolers, eliminate the capacity and power penalties associated with liquid injection oil cooling. Thermosyphon oil coolers have the further advantages of eliminating water (or glycol) pump power consumption and maintenance, tube fouling and potential system contamination.

The principle of operation is as follows (see diagram). A supply of high pressure liquid is maintained in a receiver at a predetermined minimum head above the oil cooler. Gravity causes the liquid refrigerant to flow to the oil cooler where a portion of the liquid is boiled off, thereby cooling the hot oil. New liquid from the receiver displaces the lighter refrigerant liquid/vapor mixture which rises to the receiver dropping out the remaining liquid before allowing the vapor to return to the condenser completing the cycle.

TYPICAL PIPING ARRANGEMENT FOR THERMOSYPHON OIL COOLER SYSTEM — Pressure vessels, valves, fittings, piping and controls shown outside of dashed line are dependent upon the application. Consult Frick Company for selection and pricing of these items.



1. Thermosyphon oil cooler is supplied with the oil side piped to the compressor unit and stub ends supplied on the refrigerant side.
2. Output from microprocessor is supplied for control of this solenoid valve.
3. Refrigerant side safety relief valve is required in this location only when refrigerant isolation valves are installed.

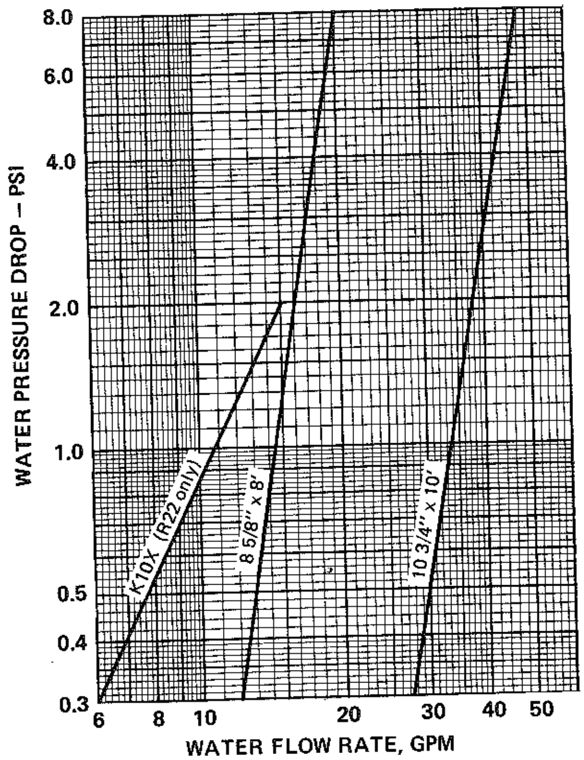
WATER COOLED OIL COOLER SELECTION

Use the following formula, OCHR tables and graph to determine the cooling water flow (GPM), standard water cooled oil cooler selection and the resulting cooling water pressure drop.

To find the required cooling water flow (GPM) use the following formula:

$$GPM = \frac{OCHR}{500\,(T_o - T_i)}$$

OCHR – Oil cooler heat rejections (1,000 BTU/HR)
T_o – Cooling water outlet temp (not to exceed 110°F)
T_i – Cooling water inlet temp (°F)



HIGH STAGE
OIL COOLER HEAT REJECTION (OCHR) – 1000 BTU/HR

	Et	CONDENSING TEMPERATURE °F					
REF	°F	75	85	95	105	115	125
	–40	97	113	132	154	180	–
	–35	99	116	135	157	182	–
	–30	101	119	139	161	185	–
	–25	102	122	143	165	190	–
	–20	102	125	146	170	196	–
	–15	101	125	150	175	202	–
	–10	99	125	152	180	208	–
	– 5	97	123	153	183	214	–
R717	0	94	121	152	184	219	–
	5	89	118	150	185	222	–
	10	85	115	147	184	223	–
	15	81	111	145	182	223	–
	20	75	106	141	179	222	–
	25	68	101	137	177	220	–
	30	60	94	131	173	219	–
	35	52	87	125	169	215	–
	40	43	79	118	162	212	–
	–40	72	91	111	135	159	188
	–35	70	91	112	136	161	190
	–30	67	88	113	138	164	193
	–25	62	86	111	139	167	197
	–20	58	82	108	138	170	201
	–15	53	78	105	135	169	204
	–10	48	73	101	132	168	206
	– 5	43	69	98	129	166	206
R22	0	37	64	93	126	162	204
	5	32	59	89	122	160	203
	10	25	52	83	118	157	200
	15	19	47	78	114	153	198
	20	13	41	72	109	150	195
	25	7	35	66	103	146	192
	30	–	28	60	97	141	189
	35	–	22	54	91	135	185
	40	–	15	47	85	129	180

Based on 10°F compressor suction superheat and 120°F oil temperature.

BOOSTER
OIL COOLER HEAT REJECTION (OCHR) – 1000 BTU/HR

REF	EVAP T °F	INTERMEDIATE TEMPERATURE °F –20	–10	0	10	20	30	40
R717	–80	23	28	–	–	–	–	–
	–75	22	27	32	–	–	–	–
	–70	19	23	31	36	–	–	–
	–65	16	19	29	35	42	–	–
	–60	14	17	27	33	41	49	–
	–55	11	14	23	31	39	47	–
	–50	8	10	20	28	37	46	55
	–45	5	7	17	24	33	43	53
	–40	–	3	13	21	29	40	50
	–35	–	–	9	17	26	36	46
	–30	–	–	6	13	22	31	42
	–25	–	–	–	9	17	28	37
	–20	–	–	–	4	13	20	33
	–15	–	–	–	–	8	18	30
	–10	–	–	–	–	3	12	25
	– 5	–	–	–	–	–	7	19
	0	–	–	–	–	–	1	13
R22	–80	16	23	29	–	–	–	–
	–75	13	19	25	32	–	–	–
	–70	9	15	21	28	37	–	–
	–65	4	10	17	24	33	–	–
	–60	–	5	12	19	28	37	–
	–55	–	–	7	14	23	32	44
	–50	–	–	1	9	18	26	38
	–45	–	–	–	3	12	21	32
	–40	–	–	–	–	6	16	26
	–35	–	–	–	–	–	9	20
	–30	–	–	–	–	–	2	13
	–25	–	–	–	–	–	–	6

Based on 10° F compressor suction superheat and 120° F oil temperature.

ECONOMIZER OPTION – HIGH STAGE

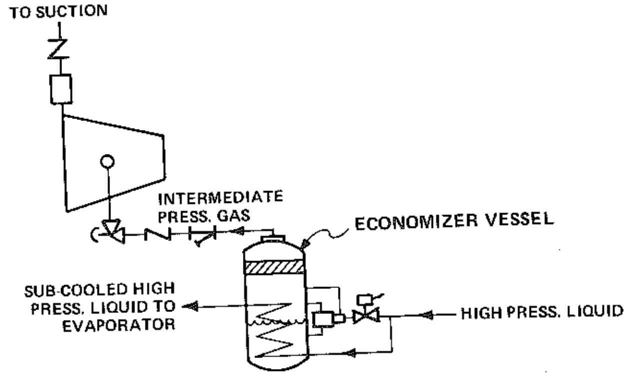
Compressor ratings with the economizer effect included are given in the ratings tables with the "E" suffix. No allowance for vapor line pressure drop or closed type economizer vessel temperature differential have been included.

The economizer option requires a liquid subcooler which is usually a shell and coil heat exchanger, similar to an intercooler, or a direct expansion refrigerant chiller.

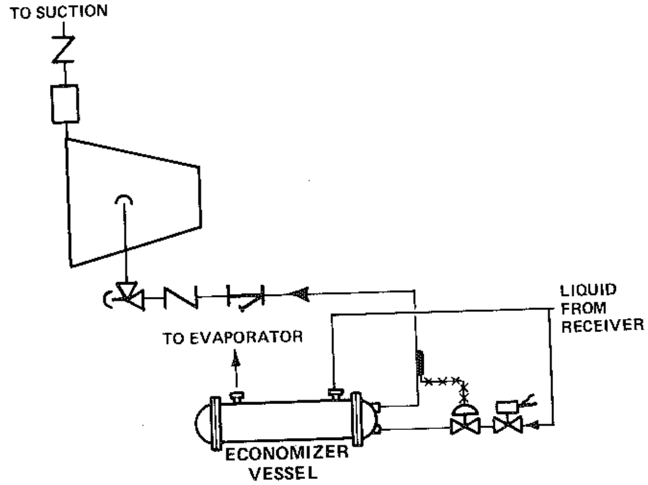
Notice that in both systems there is a strainer and a check valve between the economizer vessel and the economizer port in the compressor. The check valve prevents oil flow from the compressor unit to the economizer during shutdown.

A flash-type subcooler can be used but care should be taken because of the low pressure differential between the flash tank and the evaporators. If a flash tank is used, a back pressure regulator between the flash tank and the economizer must be installed to keep the pressure differential from approaching zero during part load operation.

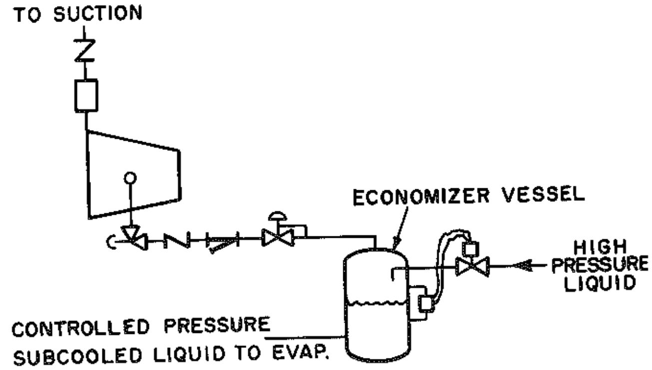
SHELL and COIL ECONOMIZER SYSTEM



DIRECT EXPANSION ECONOMIZER SYSTEM

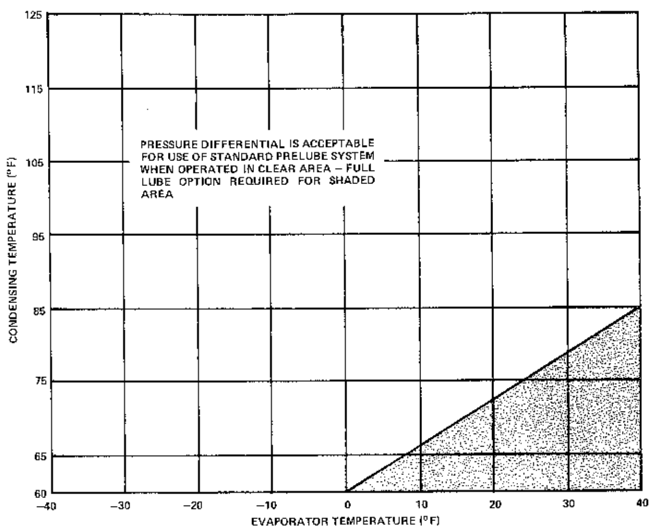


FLASH ECONOMIZER SYSTEM

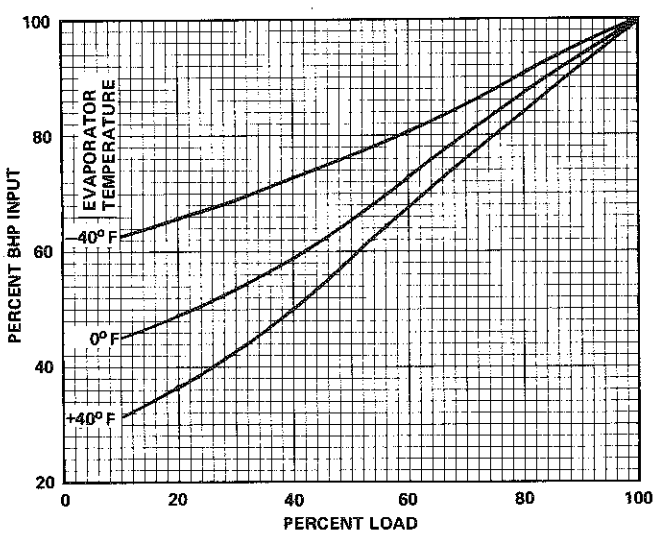


PRELUBE OIL PUMP LIMITS – HIGH STAGE

The standard prelube pump system for compressor operation without a lube oil pump may be used on high stage applications shown in the clear area of graph. The optional full lube oil pump is required only on low differential pressure applications shown in the shaded area of graph. Where condensing temperatures fluctuate into the shaded area only on an occasional basis in the winter, the full lube pump with cycling option avoids unnecessary consumption of pump horsepower.

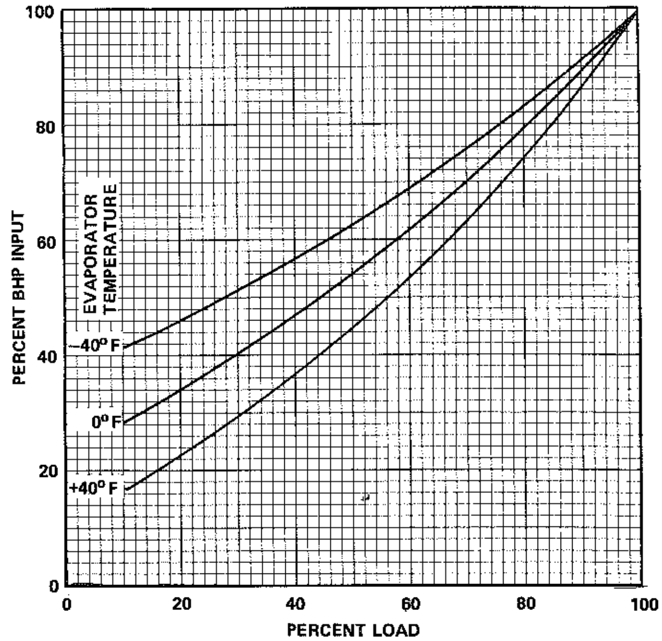


TYPICAL PART LOAD POWER INPUT WITH CONSTANT CONDENSING TEMPERATURE – HIGH STAGE



This curve is applicable for R717 (85°F to 105°F full load condensing temperature) and R22 (95°F to 115°F full load condensing temperature).

TYPICAL PART LOAD POWER INPUT WITH FALLING CONDENSING TEMPERATURE – HIGH STAGE



The above curve is based on a 20°F linear drop in condensing temperature from full load to 10% of full load. This curve is applicable for R717 (85°F to 105°F full load condensing temperature) and R22 (95°F to 115°F full load condensing temperature). It is not applicable if condensing temperature does not drop with compressor unloading as in the following examples:

1. Water cooled condensing temperatures cannot fall below entering water temperature.
2. Single compressor unloading on a multiple compressor system will have negligible effect on system condensing temperature.
3. No condensing temperature drop will occur if condenser fans are cycled off as the load decreases.

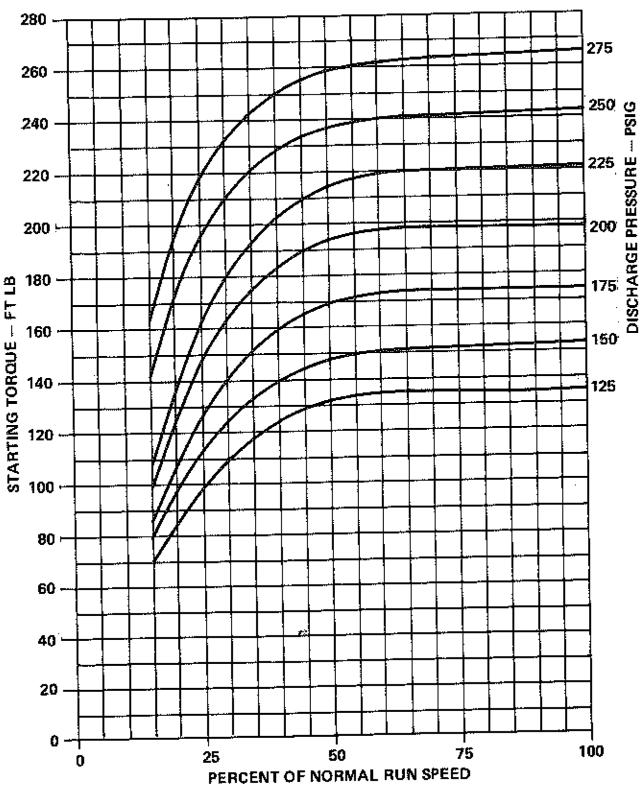
MOTOR SELECTION and STARTING TORQUE

Motors must be sized adequate for all expected operating conditions since start-up, pull down and load variations quite often require significantly more horsepower than nominal design.

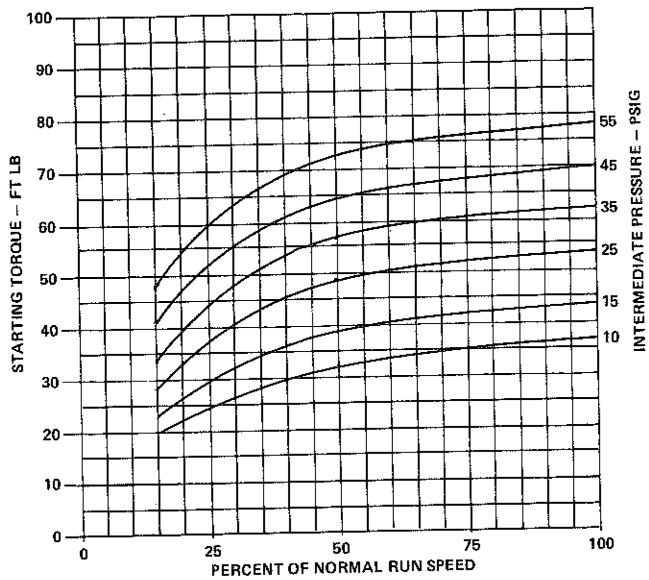
Motor starting torque capacity must also be considered, especially when other than across-the-line start is employed. Motor starting and pull-up-torque must be at least 20% greater than compressor requirements at maximum expected start-up conditions. Refer to the torque data.

NOTE: Motor starting torque varies considerably with various manufacturers – obtain specific torque data for the motor being used.

SCREW COMPRESSOR SPEED Vs TORQUE CURVE – FULLY UNLOADED – HIGH STAGE



SCREW COMPRESSOR SPEED Vs TORQUE CURVE – FULLY UNLOADED – BOOSTER

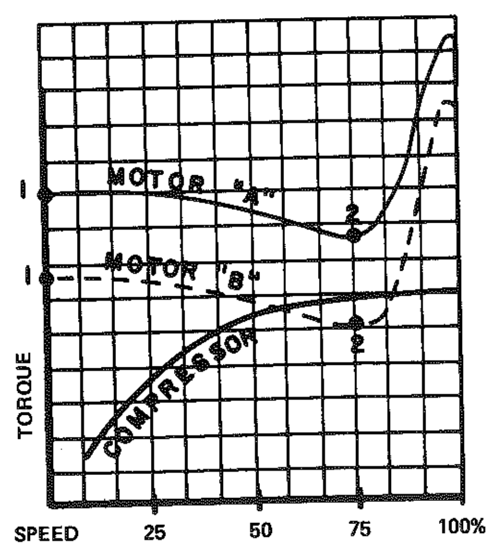


MOTOR/COMPRESSOR TORQUE

Assure that the motor STARTING and MINIMUM PULL–UP TORQUE capabilities will exceed the compressor requirements at the anticipated condition that will be experienced during normal starting.

NOTE: Wye-delta and auto transformer (reduced voltage) motor starting methods drastically affect the starting torque available from motors as indicated:

Across-the-line	100% Torque
Auto Transformer	25 - 64% Torque
Wye-delta	33% Torque

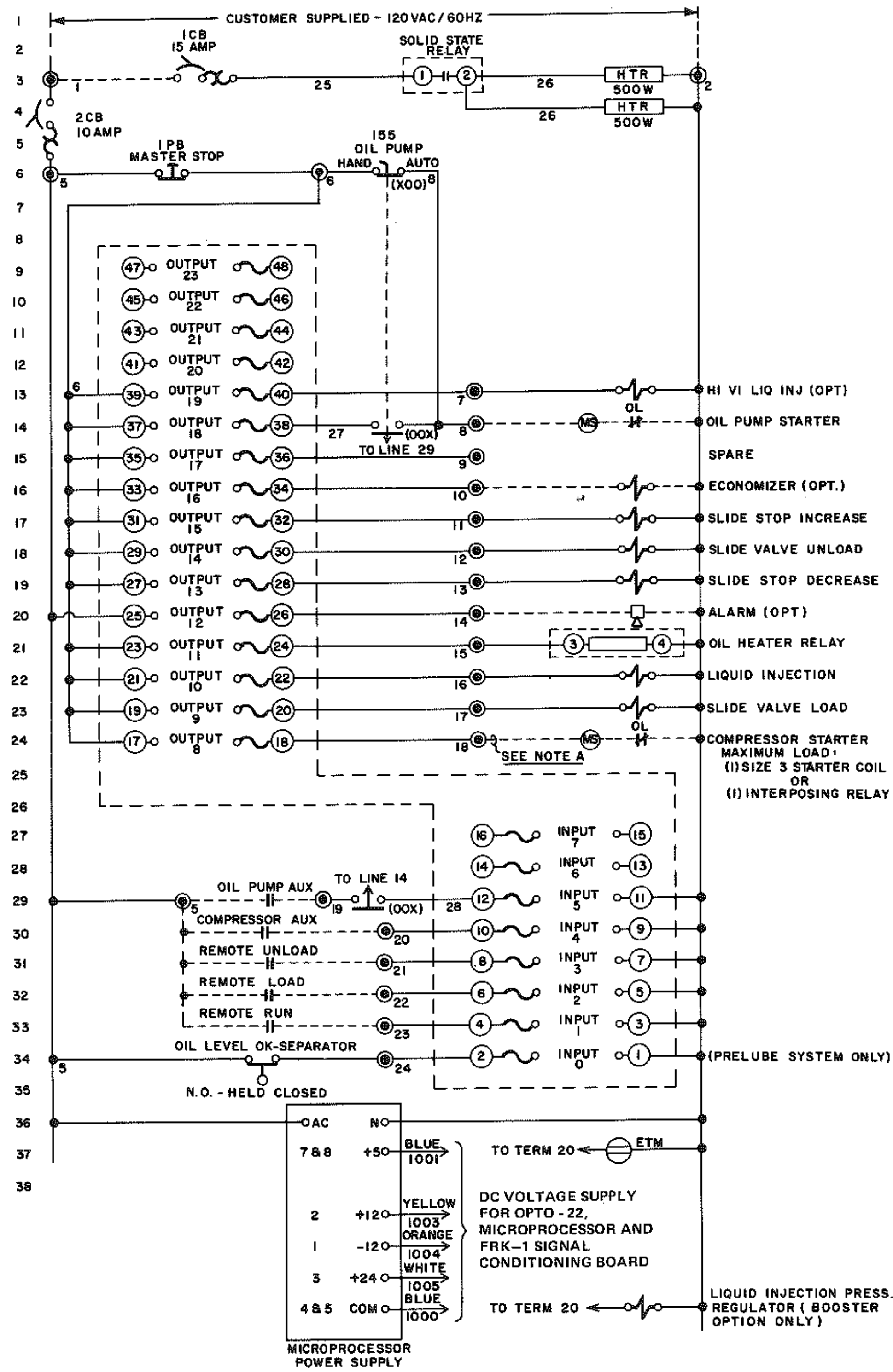


Motor "A": Adequate to start the compressor

Motor "B": Will not start the compressor

NOTE: Starting torque of both motors (1) is above compressor torque. However, the Pull-Up-Torque (2) of motor "B" is below the compressor torque curve and motor "B" will not accelerate the compressor to 100% speed.

RWB II-38 SCREW COMPRESSOR UNIT w/ SBC MICROPROCESSOR CONTROL SYSTEM TYPICAL WIRING DIAGRAM



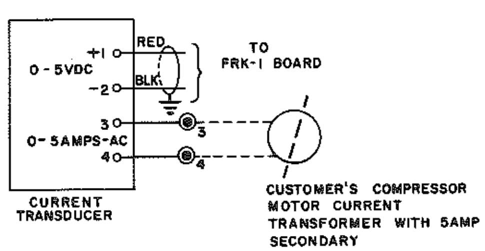
CUSTOMER CONNECTIONS TO CONTROL CIRCUIT		
LINE NO.	TERM NO.	CIRCUIT DESCRIPTION
3	1,2	CONTROL POWER
49,50	3,4	CURRENT TRANSFORMER
14	8,2	OIL PUMP STARTER
20	14,2	ALARM
29	5,19	OIL PUMP AUX
30	5,20	COMPRESSOR AUX
31	5,21	REMOTE UNLOAD
32	5,22	REMOTE LOAD
33	5,23	REMOTE RUN

NOTE A:
ADDITIONAL SHUTDOWN INTERLOCKS (HIGH LEVEL CUTOUT ETC.) MAY BE INSTALLED IN SERIES WITH THE MOTOR STARTER COIL.

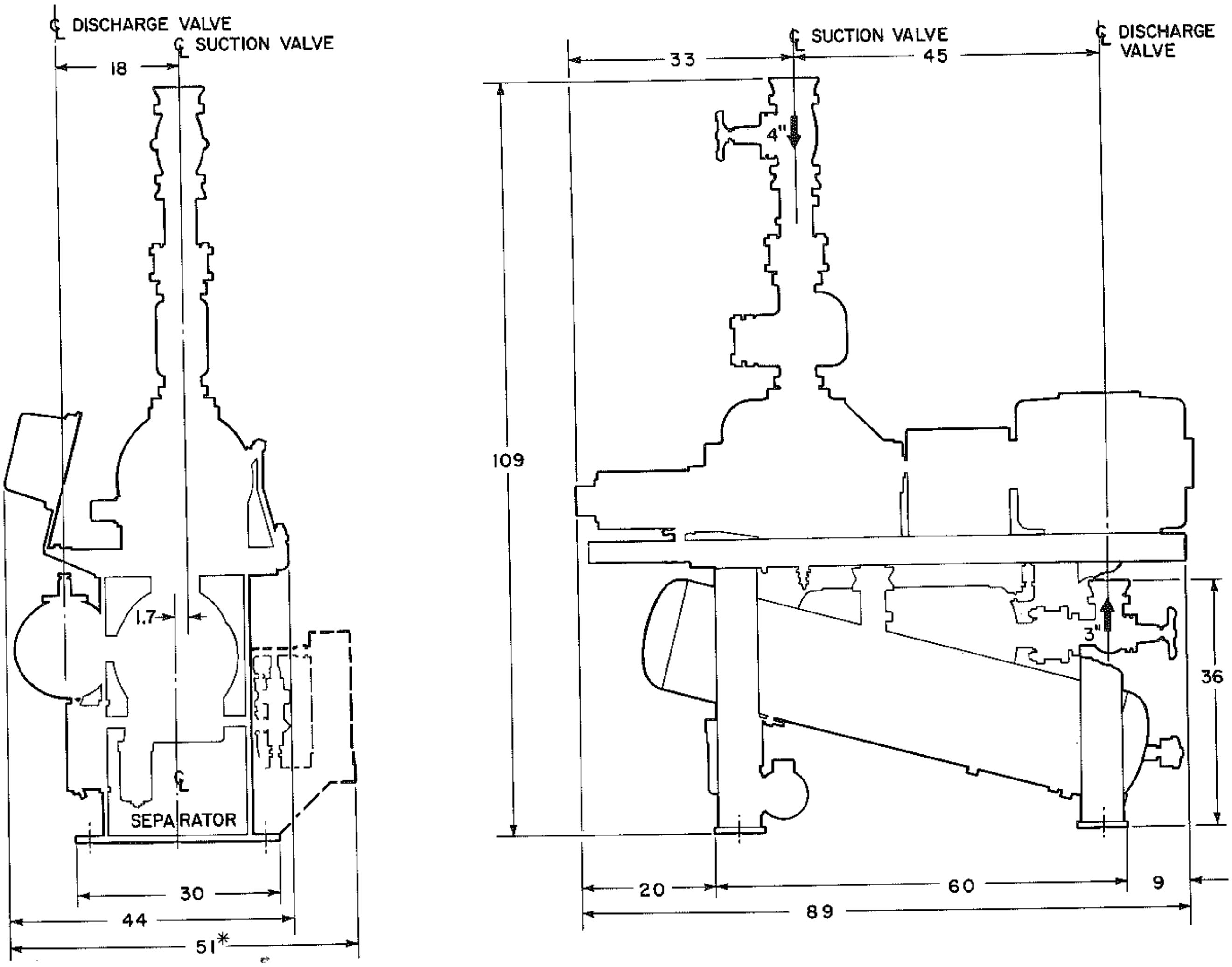
◉ TERMINALS IN JUNCTION BOX
---- WIRING BY OTHERS

CURRENT TRANSFORMER RATIOS

HORSEPOWER	200	230	380	460	575
25	100:5	100:5	50:5	50:5	50:5
30	200:5	100:5	100:5	50:5	50:5
40	200:5	200:5	100:5	100:5	50:5
50	200:5	200:5	100:5	100:5	100:5
60	300:5	200:5	200:5	100:5	100:5
75	300:5	300:5	200:5	200:5	100:5
100	400:5	300:5	200:5	200:5	200:5
125	500:5	400:5	300:5	200:5	200:5



DIMENSIONS IN INCHES



* With Water Cooled Oil Cooler

NOTE: REFERENCE ONLY – USE CERTIFIED DRAWINGS FOR INSTALLATION

SHIPPING WEIGHT – 4600 lb

MOTOR SIZES

HP	FRAME
125	405T, TS
100	404T, TS
75	365T, TS
60	364T, TS
50	326T, TS
40	324T
30	286T
25	284T

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