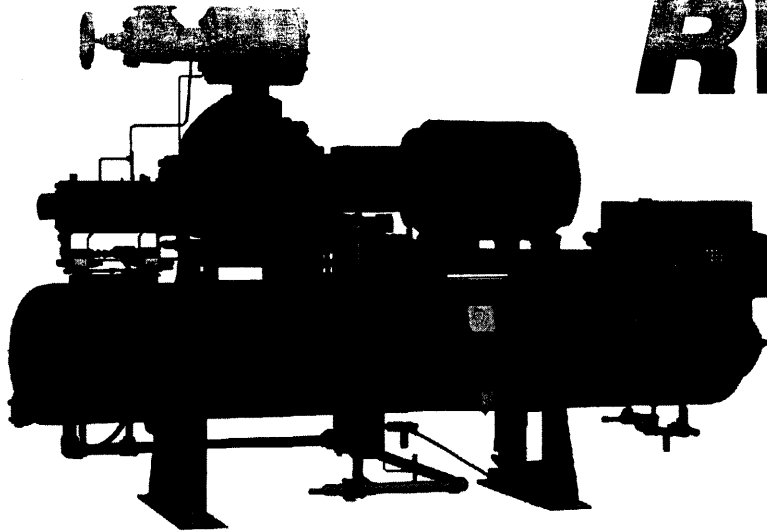




E70-200 SPC/DEC 97

File: EQUIPMENT MANUAL - Section 70
Replaces: E70-200 SPC/FEB 95
Dist: 1, 1a, 1b, 1c, 4, 4b, 4c



RWB II Plus

ROTARY SCREW COMPRESSOR UNITS Models: 60 - 480

SPECIFICATIONS

RWB II PLUS Rotary Screw Compressor Units are engineered and manufactured to meet the exacting requirements of the Industrial Refrigeration Market. All components have been designed and arranged to assure reliability, accessibility, and servicing convenience. Standard units are designed for use as boosters or high-stage machines on ammonia, halocarbon, or hydrocarbon refrigerants and are shipped completely assembled.

COMPRESSOR: The Frick manufactured RWB II compressor has been designed utilizing the latest technology to offer the most reliable and energy efficient unit currently available. All screw compressor casings are designed and tested in accordance with the requirements of ASHRAE 15 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 the bearings selected provide an L10 life in excess of 100,000 hours at design conditions.

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.

"VOLUMIZER®" VARIABLE VOLUME RATIO CONTROL: The RWB II 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 undercompression.

LUBRICATION SYSTEM: The RWB II 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 15 micron filter which is designed for vertical mounting and furnished with isolation stop valves and drain connections for ease of servicing. High-stage compressors are furnished with a close-coupled, positive-displacement prelube pump for start-up only. Booster and some low pressure differential, high-stage applications will require the full-time or cycling full-time-lube oil pump option.

OIL SEPARATOR/RESERVOIR: The oil separator is a horizontal, three-stage design with integral sump. The separator is designed and constructed in accordance with ASME Section VIII, Div. 1 for a maximum design working pressure of 300 psig. Replaceable coalescent separator elements are provided for final gas/oil separation of particles down to less than 1 micron.

OIL COOLING: Cooling the compressor oil may be achieved by either liquid-refrigerant-injection oil cooling, water-cooled oil cooling, or thermosyphon oil cooling. Water-cooled and thermosyphon oil-cooled systems are 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 4 single box control panel housing the microprocessor control panel and all electrical termination points. The microprocessor panel is supplied with 320 characters on two displays having a minimum rated life of 100,000 hours. Included in the microprocessor is time-proportioning capacity control, first-out annunciation, prealarms, volumizer control, real-time clock control, access code protection, and alternate suction pressure operation. All major operating conditions are continuously shown on the microprocessor display. All operating conditions prior to a compressor cutout are stored in memory and shown on a special **FREEZE** display mode providing the ultimate in service and troubleshooting convenience.

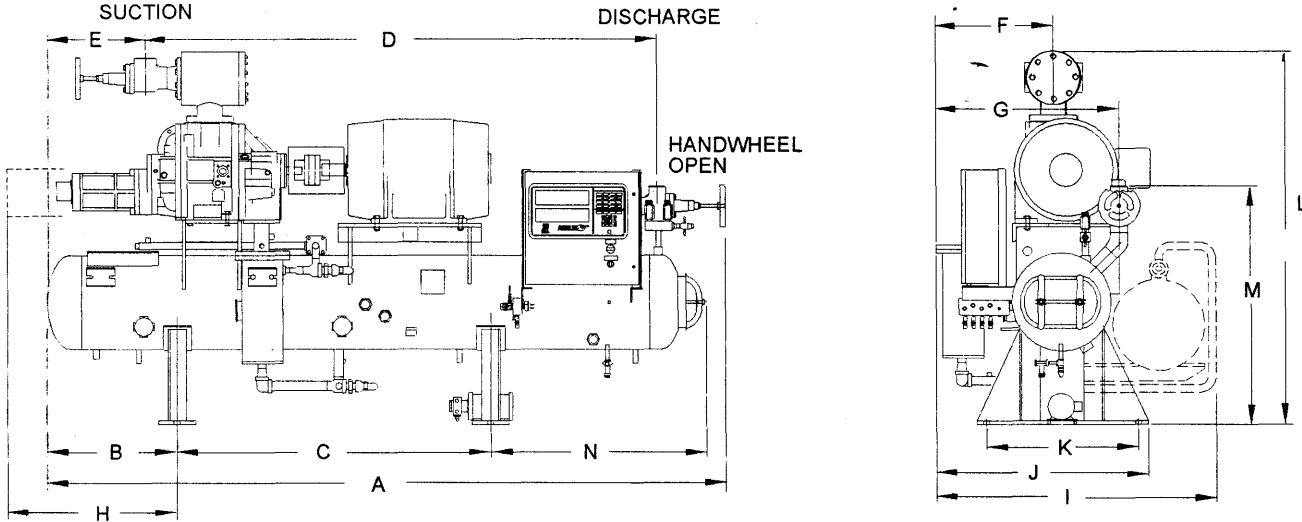
VALVES: The unit has a combination suction shutoff and check valve with strainer multivalve. The unit's discharge has a mounted combination check and shutoff valve.

OPTIONAL FEATURES: Full-Lube Oil Pump, Cycling Full-Lube Oil Pump, Dual Oil Filters, Economizer, Thermosyphon Oil Temperature Control Valve, Gauge Board, Motor, Motor Mounting, Starter Packages, and Microprocessor Service Kit, CLI, GPD, DIVII Microprocessor, Power-Regulating Control Transformer, Lead-lag sequencing, oversized Suction Valve, and Quantum Control Panel.

STANDARD DESIGN DATA (with Metric equivalents) - NOMINAL @ 3550 RPM

RWB II MODEL NO.	COMPRESSOR DISPLACEMENT		RATINGS R-717 (1)				RATINGS R-22 (2)				UNIT WEIGHT LESS MOTOR	
			CAPACITY		POWER		CAPACITY		POWER			
	CFM	M3/hr	TR	kw	BHP	kw	TR	kw	BHP	kw	lb	kg
60	357	607	126	443	146	109	115	404	157	117	4900	2222
76	450	765	159	559	184	137	145	510	197	147	5200	2358
100	592	1005	213	749	235	175	194	682	261	195	6000	2721
134	790	1342	284	999	314	234	259	911	348	260	6300	2857
177	1042	1770	384	1351	410	306	345	1213	453	338	9800	4445
222	1311	2228	483	1699	517	386	434	1526	572	427	10,000	4536
270	1589	2700	598	2103	638	476	538	1892	705	526	12,700	5760
316	1865	3169	688	2420	736	549	617	2170	814	607	13,500	6124
399	2349	3992	866	3046	926	691	778	2736	1025	764	14,000	6350
480	2824	4798	1042	3664	1114	831	936	3291	1233	919	15,000	6804

1. Based on 20° F (-6.7° C) suction and 95° F (35° C) condensing with 10° F (5.5° C) liquid subcooling and 10° F (5.5° C) suction superheat.
2. Based on 20° F (-6.7° C) suction and 105° F (40.6° C) condensing with 10° F (5.5° C) liquid subcooling and 10° F (5.5° C) suction superheat.



RWB II MODEL NO.	APPROXIMATE DIMENSIONS INCHES/MILLIMETERS													
	A	B	C	D (4)	E (4)	F(3)	G (3)	H (2)	I (3)	J (3)	K	L (4)	M	N (1)
60	142/3607	28/711	66/1676	107/2717	23/584	26/661	40/1016	42/1067	56/1423	45/1143	32/813	80/2032	53/1347	46/1168
76	142/3607	28/711	66/1676	108/2743	22/558	26/661	40/1016	47/1194	56/1423	45/1143	32/813	79/2007	53/1347	46/1168
100	149/3785	30/762	66/1676	109/2768	25/635	28/711	42/1067	47/1194	59/1499	49/1245	32/813	89/2261	53/1347	48/1219
134	149/3785	30/762	66/1676	111/2819	23/584	28/711	41/1042	54/1372	59/1499	47/1194	32/813	87/2210	53/1347	48/1219
177	181/4598	46/1168	75/1905	133/3378	34/863	28/711	45/1143	61/1549	64/1626	52/1321	40/1016	99/2515	65/1651	55/1397
222	181/4598	46/1168	75/1905	134/3403	32/812	28/711	45/1143	68/1727	64/1626	52/1321	40/1016	100/2540	65/1651	55/1397
270	198/5030	51/1295	88/2235	150/3810	33/839	32/813	52/1321	75/1905	72/1829	64/1626	54/1372	111/2820	72/1829	56/1423
316	198/5030	51/1295	88/2235	163/4140	20/508	32/813	52/1321	60/1524	75/1905	64/1626	54/1372	112/2845	72/1829	56/1423
399	198/5030	51/1295	88/2235	167/4242	16/406	32/813	52/1321	70/1778	75/1905	64/1626	54/1372	118/2998	72/1829	56/1423
480	201/5105	53/1346	88/2235	174/4420	14/356	33/838	28/711	74/1880	78/1981	65/1651	54/1372	114/2896	80/2032	58/1473

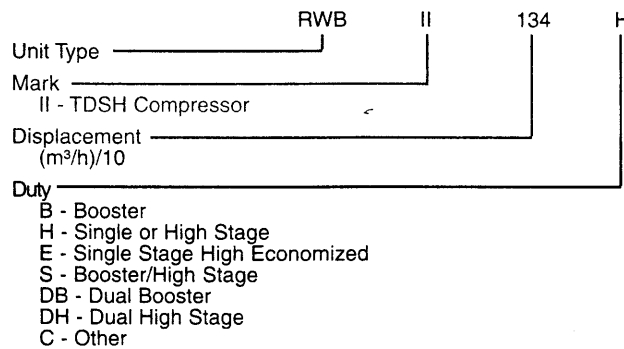
1. Allow additional 36 in./915 mm to pull coalescer element.
 2. Required clearance for removal of movable slide valve/slide stop assembly.
 3. Maximum dimension.
 4. Ammonia units only. For Halocarbon units, consult FRICK.
- NOTE: Drawing for reference only! Use certified drawing for erection.

RWB II MODEL NO.	STANDARD CONNECTIONS in./mm			
	R-717		R-22	
	SUCTION	DISCHARGE	SUCTION	DISCHARGE
60	4/101.6	3/76.2	4/101.6	3/76.2
76	4/101.6	3/76.2	4/101.6	3/76.2
100	5/127.0	4/101.6	5/127.0	4/101.6
134	6/152.4	4/101.6	6/152.4	4/101.6
177	6/152.4	5/127.0	6/152.4	5/127.0
222	6/152.4	5/127.0	8/203.2	5/127.0
270	8/203.2	6/152.4	10/254.0	6/152.4
316	8/203.2	6/152.4	10/254.0	6/152.4
399	8/203.2	6/152.4	10/254.0	6/152.4
480	8/203.2	6/152.4	10/254.0	8/203.2



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MODEL NUMBER EXPLANATION



DESCRIPTION

The RWB II Rotary Screw Compressor Unit line consists of 13 models ranging in capacity from 357 CFM (607 m³/h) through 5067 CFM (8609 m³/h) at 3550 RPM and 60 Hz. Standard units, models 60 – 480, are designed for use on ammonia, halocarbon, and hydrocarbon refrigerants for either high stage or booster service. Models 496 – 856 are covered in publication E70-210 SED.

Standard units consist of the following major components: Frick manufactured TDSH Rotary Screw Compressor with patented "VOLUMIZER®" variable volume ratio control; compressor/motor base; drive coupling and guard; SBC microprocessor control panel; prelube oil pump for start-up only; suction and discharge line stop valves; suction and discharge line check valves; suction scale trap with integral strainer; and a three-stage horizontal oil separator/reservoir. All components have been selected for maximum reliability and arranged to ensure accessibility for service. The units are factory packaged, complete with wiring and piping. All piping connecting the various elements of the compressor unit is done in accordance with ANSI B31.5.

MODEL TDSH COMPRESSOR

HOUSING: All screw compressor castings are designed and tested to meet the requirements of ASHRAE 15 safety code for 350 PSIG maximum discharge pressure. Castings are close grain, ASTM-A-48 Class 40 cast iron to ensure structural integrity and mechanical and thermal stability under all operating conditions.

ROTORS: The rotors are machined from AISI-1141 steel forgings to the exacting tolerances of the latest SRM asymmetric profile. The four-lobed male rotor is directly connected to the driver. The six-lobed female rotor is driven by the male rotor on a thin oil film.

BEARINGS: Antifriction bearings with an L10 rated bearing life in excess of 100,000 hours, at design conditions, are used for reduced frictional horsepower and superior rotor positioning, resulting in reduced power consumption, particularly at higher pressure ratios. Cylindrical roller bearings are provided to handle the radial loads and the thrust loads are absorbed by angular contact ball bearings. In addition, thrust balance pistons are provided to reduce the thrust load and improve bearing life.

SHAFT SEAL: The compressor shaft seal is a single-face type with a spring-loaded carbon stationary surface riding against a cast iron rotating seat. The seal is capable of sealing up to 350 PSIG, but is vented to low pressure to provide extended seal life.

"VOLUMIZER®" VARIABLE VOLUME RATIO CONTROL:

The Frick compressor includes a patented method of varying the internal volume ratio to match the system pressure ratio. With control of the internal volume ratio, the power penalty associated with overcompression or undercompression is eliminated. The volume ratio control is achieved by the use of a slide stop which is a movable portion of the rotor housing that moves axially with the rotors to control discharge port location. The slide stop is moved by hydraulic actuation of a control piston based on signals from the microprocessor. The range of adjustability is from 2.2 to 5.0 Vi for 60 – 399 models and 2.2 to 4.2 Vi for the 480 model.

‡ **CAPACITY CONTROL:** Capacity control is achieved by use of a movable slide valve. The slide valve moves axially under the rotors to provide fully modulating capacity control from 100% to minimum load capacity. Minimum load capacity varies slightly with compressor model, pressure ratio, discharge pressure level and rotor speed. The approximate minimum capacity for RWB II models 270 and 480 is 20%. All other models from 60 through 399 are 10%.

The slide valve is positioned automatically by hydraulic movement of its control piston based on time-proportional signals from the microprocessor. When in the unloaded position, gas is bypassed back to suction through a recirculation slot before compression begins and any work is expended, providing the most efficient unloading method available for part-load operation of a screw compressor.

LUBRICATION SYSTEM

LUBRICATION SYSTEM: The TDSH compressor is designed specifically for operation without an oil pump under normal operating conditions. All oil required for main oil injection and lubrication is provided by positive gas differential pressure. All oil passes through a 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 prelube pump for start-up only. For some low pressure differential applications (see Prelube Oil Pump Limits - High Stage), 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 typically low differential pressure across the compressor in booster applications.

OIL SEPARATOR/RESERVOIR: RWB II models 60 through 480, high stage or booster have a horizontal design oil separator with integral sump. Two sight glasses are located in the reservoir section and one in the coalescing section. The separator is designed and constructed in accordance with ASME Section VIII, Div. 1 for a maximum design working pressure of 300 PSIG and supplied with dual relief valves. 500 watt heaters maintain oil temperature at an ambient temperature of 67°F minimum, with no wind factor, during compressor shutdown and are replaceable without shutting down the compressor.

Coalescent separator elements are provided for final gas/oil separation of particles down to less than 1 micron. Oil is drained from the coalescer section and returned to the compressor during operation.

On systems utilizing the standard prelube pump, a float switch is installed in the lower section of the oil separator to detect a low oil level. If a low level occurs, the float switch will shut down the compressor.

OIL FILTERS: All lubrication and injection oil passes through 15 micron filter(s). RWB II Plus Rotary Screw Compressor units have one filter. The filters are designed for vertical mounting and are furnished with isolation stop valves and drain connections for ease in servicing.

OIL COOLING

LIQUID INJECTION OIL COOLING: The compressor oil is cooled by direct contact with the refrigerant injected through one of two optimized port locations prior to the compressor discharge. Liquid feed arrangements include isolation valves, strainer, solenoid valve, sight glass, a thermal expansion temperature control valve, and a pressure differential control valve. The temperature control valve will maintain the temperature of the oil returning to the compressor between 110°F and 130°F for ammonia and between 120°F and 150°F for halocarbons.

WATER-COOLED OIL COOLING: The optional water-cooled oil cooler is a shell and tube design with oil on the shell side. The cooler is designed and constructed according to ASME Section VIII Div. 1 with a Maximum Allowable Working Pressure (MAWP) of 150 PSIG on the tube side and 400 PSIG on the shell side. The finned tubes are 5/8" O.D. to minimize water fouling and the oil temperature is maintained between 110°F and 130°F for ammonia and halocarbons with a thermally controlled water-regulating valve sensing outlet oil temperature. The oil cooler is mounted on the unit with the oil piping connected. Water connections and controls are field installed.

THERMOSYPHON OIL COOLING: The optional thermosyphon cooler is a shell and tube design constructed in accordance with ASME Div. 1 with a MAWP of 400 PSIG on the shell side and 400 PSIG on the tube side. The oil cooler is mounted on the unit with the oil piping connected. Refrigerant connections and controls are field installed.

MICROPROCESSOR CONTROL CENTER

The microprocessor compressor control system is factory mounted, completely piped and wired with all the required safety and operating devices. The single box NEMA 4, UL® listed* control panel houses both the microprocessor control and the junction box. All transducers are wired and piped into a common manifold. A built-in telecommunications interface suitable for connection to a remote computer, CRT, terminal printer, or standard modem is included.

Fixed and variable setpoints are displayed on individual screens for convenient definition. A combined total of 320 characters on 2 displays provide complete operating and monitoring conditions for full operator information. Displays have a minimum rated life of 100,000 hours. Continuous display indicates: suction pressure and temperature, discharge pressure and temperature, oil pressure and temperature, filter pressure drop, slide valve position and mode, volume ratio position and mode, pump on/off, percent of full-load motor amps, and compressor operating mode. The microprocessor continuous display will also indicate that an alarm condition exists or other messages as required.

The following adjustable and fixed control setpoints will be indicated by call-up through the microprocessor display: capacity control, low suction pressure alarm and cutout, motor recycle delay, current transformer factor, motor load control, high discharge pressure alarm and cutout, oil heater control, liquid injection oil cooling temperature control, oil heater temperature control, high discharge temperature alarm and cutout, high oil temperature alarm and cutout, low oil temperature alarm and cutout, and low oil pressure alarm and cutout.

An annunciator display stores the cause, day, date, and time of occurrence for an alarm or cutout, and in the event of a cutout, the operating conditions at the time of cutout are stored in a "Freeze display". This significantly reduces system downtime by providing valuable troubleshooting and maintenance information. A prealarm annunciator warns of potential shutdown conditions, displaying potential problems.

A time-proportioning capacity control resets at varying time intervals corresponding to deviations from compressor setpoints, providing stable operation under widely changing load conditions.

The microprocessor monitors operating conditions and controls the compressor at the most efficient volume ratio at both full-load and part-load conditions, with standard or economizer operation.

Provision is made for automatic start-up and shutdown on system suction pressure for individual unit operation. Changes can be made to alternate suction pressure operation at a preset day and time without reprogramming, making it ideal for swing duty service.

The real time clock control provides time determination of setpoints, shutdowns, and operating conditions for logging of system operation.

An access code protection permits authorized personnel only to vary adjustable setpoints. Setpoint display is available without the access code.

The microprocessor maintains memory storage of all setpoints and timing for up to one year with power shut off.

The keyboard on the microprocessor includes: auto, remote, and manual control of the slide stop and slide valve; compressor run, stop, remote start; alarm silence; and display control. An emergency stop button is clearly mounted on the microprocessor panel.

‡ QUANTUM CONTROL PANEL

HARDWARE: The Quantum control panel is factory mounted, completely piped and wired with all the required safety and operating devices. The single box NEMA 4, UL® listed* control panel houses both the Quantum control and the junction box. All transducers are wired and piped into a common manifold. A built-in telecommunications interface suitable for connection to a remote computer, CRT, terminal printer, or standard modem is included. A 486 computer chip provides speed and processing capability and the 10.4" Active Color VGA Graphics Display offers a high contrast, crisp clear display of compressor information and status. Additional I/O can be easily installed in the field. This feature provides flexibility for future engine room upgrades and

changes. Two field-selectable serial communication ports allow you to choose from a combination of RS-422, RS-485, or RS-232 port configurations for both interpanel and external communications.

Additional features include: circuit breaker protection for main power; UL, cUL, CE, and ISO 9001 certifications; flexible analog inputs, making it easy to change setup in the field to accept 0-5 volt, 1-5 volt, 4-20 mA or ICTD sensors and transmitters; long life, easily replaceable, lithium coin cell battery for power backup to the time/date clock; communication activity and diagnostic lamps simplify troubleshooting and provide visual indication of proper component operation; code readouts appear on the display if an internal component problem is detected; EEPROM setpoint memory - all setpoints are stored on an EEPROM chip which requires no battery backup and setpoints can be field programmed within Frick defined limits (a notice is displayed if you attempt to program setpoints outside of the defined ranges); replaceable input and output modules; built-in fuse tester.

SOFTWARE: Quantum control panel screens are user friendly, menu driven, and easy to use and understand. Help screens and prompts are available should you experience difficulties in setup or monitoring of system information. Operation instruction can be accessed on-screen via the Help key.

Numerous diagnostic features have been incorporated to ease troubleshooting and identify component malfunctions. They include: sensor short/open, setpoint input out of sensing range, DC and AC power monitoring, and memory error sensing.

Multiple capacity controllers provide application flexibility for auto setback control and control reset for changes in modes of operation. Override controls are provided to allow all safety and controller functions to be programmed to unload the compressor within maximum safety and control parameters.

On-screen calibrations for sensors, motor current, slide valve, and slide stop can be adjusted with easy to understand graphics. No potentiometer adjustment is required. Display backlight flashes on shutdown to attract attention in noisy engine rooms.

Other features include: selectable pressure and temperature units; industry standard communication protocols; real-time and historical X-Y trending - selected data and selected time periods can be viewed in either an X-Y trending chart or a tabular chart; ability to add analog and digital inputs.

ACCESSORIES and OPTIONAL ITEMS

DUAL OIL FILTERS: A second oil filter may be furnished mounted on the unit. Isolation valves are included to provide servicing of the primary filter set while the unit is running.

FULL-LUBE PUMP: Lubrication and oil injection may be achieved by using a positive-displacement, direct-driven gear-type oil pump capable of maintaining lube oil supply at low pressure differentials, operating independent of the compressor and controlled so that lubrication of the compressor begins prior to start-up.

A cycling option is available which will operate the full-lube pump only when required, due to low system differential pressure.



* UL® listing applies to standard panels. Micro-processor Control Panels with special components may also be certified. Contact Frick Company for confirmation.

ECONOMIZER: Increased refrigeration capacity with relatively low increase in brake horsepower can be achieved by the use of a Frick economizer system. The economizer consists of a shell and coil or shell and tube liquid subcooler with appropriate controls. Refrigerant vapor from the subcooler is piped to an optimized pressure port on the compressor.

MOTORS: The compressor drive motor can be supplied and mounted by Frick Company. In addition, a customer supplied motor can be factory mounted by Frick Company.

STARTERS: Starter packages complete with all accessories needed to interface with the RWB II, prewired to numbered terminal strips are available.

SPECIAL PACKAGES: For special refrigerant selection, special drivers, or any dual or two stage applications, consult Frick Company.

STANDARD DESIGN DATA

RWB II PLUS MODEL NO.	TDS COMPRESSOR			
	MODEL NO.	DIA mm	L/D	DISPLACEMENT CFM (m³/h)
60	163S	163.2	1.35	357 (607)
76	163L	163.2	1.70	450 (765)
100	193S	193.0	1.35	592 (1005)
134	193L	193.0	1.80	790 (1342)
177	233S	233.0	1.35	1042 (1770)
222	233L	233.0	1.70	1311 (2228)
270	233XL	233.0	2.10	1590 (2700)
316	283S	283.0	1.35	1865 (3169)
399	283L	283.0	1.70	2349 (3992)
480	283SX	283.0	2.10	2824(4798)

EQUIPMENT SELECTION SCREW COMPRESSOR UNIT

The following information is required for final unit selection:

Refrigerant _____ R-717, R-22
Other - Consult Frick Company

Duty _____ Single Stage, High Stage, Booster
Other - Consult Frick Company

Compressor RPM _____ 3550 (60 Hz) or 2950 (50 Hz)
Other - Consult Frick Company

Lube Oil Pump: Single, High Stage _____ Prelube (Std)
Full or Cycling Full Lube (Opt)

Lube Oil Pump: Booster _____ Full Lube (Std)

Oil Filters _____ Single (Std), Dual (Opt)

Oil Cooling _____ Liquid Injection (Std)

Water Cooled (Inlet/Outlet Water Temp Req'd) (Opt)
Thermosyphon _____ (Opt)

Saturated Suction Temperature _____ °F

Condensing Temperature _____ °F

Intermediate Temperature (Booster) _____ °F

Suction Superheat _____ °F

Liquid Subcooling _____ °F

Economizer - Kit Only _____ (Opt)

Economizer - Mounted Dx Cooler _____ (Opt)

Rating _____ TR _____ BHP _____ (Including Liquid Subcooling, Suction Superheat, and Liquid Injection 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 Company
Motor Speed _____ RPM (See Compressor RPM, above)
Motor Specifications _____ HP _____ Frame
_____ Service Factor _____ Full-Load Amps
_____ Bearings (Ball or Sleeve)
Motor Power _____ Volts, 3 Phase _____ 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, Solid State

* Motor Rotation _____
* **NOTE: Compressor rotation is clockwise when facing end of compressor shaft. MOTOR ROTATION MUST BE COUNTERCLOCKWISE WHEN FACING END OF MOTOR SHAFT.** Most motors have dual rotation, but some, such as the large TEFC motors, are single rotation only for purposes of fan cooling and must be ordered with the correct rotation.

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 see Compressor Speed/Torque Curve.

MOTOR STARTER PACKAGES

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 SBC Microprocessor.

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 single box microprocessor control. 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 application:

STARTING METHOD: Choose Across-the-line, Autotransformer, Wye-delta Open Transition, Wye-delta Closed Transition, or Solid State 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 80% 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 sync 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.

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, consult Frick Company for assistance.

OVERCURRENT PROTECTION: Choose either the Starter package or the Combination starter package with circuit breaker disconnect. For high voltage (2300V, 4160V) applications, specify High voltage fused draw-out starter package.

COMPRESSOR MOTOR DATA: Indicate the motor _____ HP, _____ voltage, _____ Hz, _____ FLA (full load amps), and _____ speed.

CURRENT TRANSFORMER RATIO: Select the appropriate current transformer ratio from the chart on the wiring diagram.

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

STANDARD CONDITIONS - HIGH STAGE

The RWB II high stage ratings for R-717 and R-22 are based on 3550 RPM (60 Hz), 10°F liquid subcooling (except no external liquid subcooling in economizer ratings), 10°F suction superheat (not contributing to the refrigeration effect) and thermosyphon or water-cooled oil cooling.

SELECTION PROCEDURE - HIGH STAGE

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

Capacity (TR) = standard rating (or economized rating) x subcooling correction factor x superheat correction factor x liquid injection correction factor if applicable (see Liquid Injection Oil Cooling) x 0.83 (50 Hz only).

Brake Horsepower (BHP) = standard rating (or economized rating) x 1.01 (liquid injection correction factor if applicable) x 0.83 (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.):

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

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

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.):

$$\text{FOR R-717: S.H.C.F.} = \frac{1}{1 + (\text{S.H.} - 10^\circ\text{F})(.0027)}$$

$$\text{FOR R-22: S.H.C.F.} = \frac{1}{1 + (\text{S.H.} - 10^\circ\text{F})(.0028)}$$

It is recommended that a minimum of 10°F of suction superheat be maintained to ensure 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 booster ratings for R-717 and R-22 are based on 3550 RPM (60 Hz), liquid cooled to intermediate temperature, no suction superheat, and thermosyphon or water-cooled oil cooling.

SELECTION PROCEDURE - BOOSTER

The final rating for a RWB II 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, if applicable, x 0.83 (50 Hz only).

Brake Horsepower (BHP) = standard rating x 1.01 (liquid injection correction factor, if applicable) x 0.83 (50 Hz only).

LIQUID TEMPERATURE CORRECTION FACTORS BOOSTER

For liquid temperatures greater than the saturated intermediate temperature, determine the liquid temperature de-rating factor (L.T.D.F.) in the following manner:

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

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

Where TD is the temperature difference in degrees between the actual liquid temperature and the saturated intermediate temperature. No brake horsepower correction is required.

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.):

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

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

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

No brake horsepower correction is required for suction superheat.

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

REF.	RWB II MODEL	LIQUID LINE SIZES - Inches (1)		5 MINUTE LIQUID SUPPLY	
		PIPE	TUBING OD	MASS LB(5 MIN)	VOL CU FT
HIGH STAGE	R 60,76	3/4	-	50	1.5
	7 100,134	3/4	-	80	2.0
	1 177,222	1	-	140	4.0
	7 270	1-1/4	-	180	5.0
	316,399	1-1/4	-	250	7.0
BOOSTER	R 60,76	1	1-1/8	170	2.5
	2 100,134	1-1/4	1-1/8	290	4.0
	2 177,222	1-1/2	1-3/8	570	8.0
	7 270	2	2-1/8	700	10.0
	316,399	2	2-1/8	1050	14.0
BOOSTER	R 60,76	1/2	-	10	0.5
	7 100,134	1/2	-	20	0.5
	1 177,222	3/4	-	30	1.0
	7 270	1	-	40	1.5
	316,399	1	-	40	1.5
	R 60,76	3/4	5/8	33	0.4
	2 100,134	3/4	5/8	44	0.6
	2 177,222	3/4	7/8	59	0.8
	7 270	3/4	7/8	92	1.2
	316,399	3/4	7/8	92	1.2

1. Lines are sized for a maximum 100 foot liquid line. For longer runs, increase line size accordingly.

THERMOSYPHON OIL COOLING

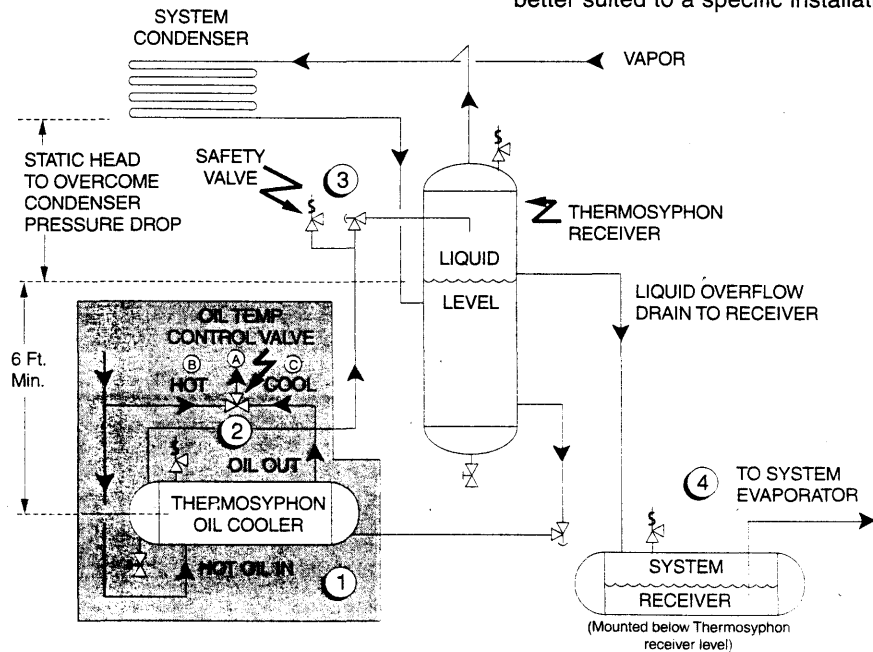
Thermosyphon oil coolers, like water (or glycol)-cooled oil coolers, eliminate the capacity and power penalties associated with liquid injection oil cooling. Thermosyphon oil coolers have the further advantages of eliminating water (or glycol) pump power consumption and maintenance, tube fouling, and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

PIPING ARRANGEMENT FOR THERMOSYPHON OIL COOLING SYSTEMS

The components and piping of a thermosyphon oil cooling system include a liquid source at condensing pressure, adequate static heads to provide fluid flow, appropriate control valves, safety relief valves, service valves and pump-out connections. The arrangement of component placement and fluid flow requirements must be designed to suit the individual refrigeration system layout with consideration given to piping safety practices.

The component and piping arrangement shown below is intended only to illustrate the operating principles of thermosyphon oil cooling. Other component layouts may be better suited to a specific installation.



1. Thermosyphon oil cooler is supplied with the oil side piped to the compressor unit and stub ends supplied on the refrigerant side.
2. Three-way oil temperature control valve required where condensing temperature is expected to go below 65°F.
3. A refrigerant-side safety valve is required in this location only when refrigerant isolation valves are installed between the cooler and thermosyphon receiver. If no valves are used between the cooler and TSOC receiver, the safety valve on the TSOC receiver must be sized to handle the volume of both vessels. Then, the safety valve on the cooler vent (liquid refrigerant side) can be eliminated.
4. System receiver must be mounted below thermosyphon receiver level in this arrangement.

WATER-COOLED OIL COOLER SELECTION

Required cooling water flow, GPM, is determined from the following formula.

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

OCHR - Oil Cooler Heat Rejection (BTU/HR)
See Tables

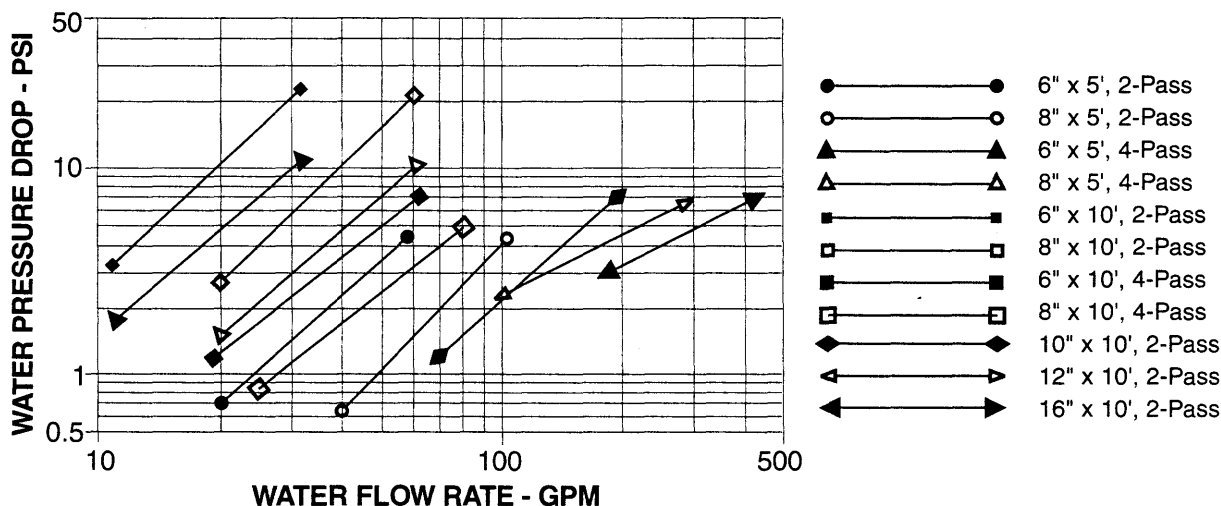
T_o - Cooling Water Outlet Temperature
(Not to exceed 110°F based upon 120°F oil out)

T_i - Cooling Water Inlet Temperature (°F)

OIL COOLER DATA TABLE

SIZE - Inches		APPROX WATER FLOW RANGE (GPM)
COOLER	WATER CONN	
5 Feet and 10 Feet Lengths		
6"	1-1/2 NPT	22 - 57
6"(1)	1-1/2 NPT	11 - 29
8"	2-1/2 NPT	40 - 108
8"(1)	2-1/2 NPT	20 - 54
10 Feet Length		
10"	3 NPT	70 - 187
12"	4 NPT	100 - 279
16"	5 NPT	180 - 480

1. 4-pass design.



OIL COOLER HEAT REJECTION (OCHR) - 1,000 BTU/HR

Based on 10°F superheat, 10°F subcooling, superheat enthalpy not contributing to refrigeration effect. For applications having greater than 10°F superheat, consult Frick Co.

OIL COOLER HEAT REJECTION (OCHR) - 1000 BTU/HR (10°F Superheat, 120°F oil into compressor)

COND TEMP. °F	EVAP TEMP. °F	RWB II PLUS SCREW COMPRESSOR MODELS - HIGH STAGE R-717									
		60	76	100	134	177	222	270	316	399	480
75	-40	136	168	211	273	353	439	564	629	787	947
	-35	136	168	212	272	353	438	566	628	786	946
	-30	137	168	211	271	351	436	566	625	781	940
	-25	137	167	211	268	348	431	563	619	773	930
	-20	136	166	209	264	343	423	557	608	759	913
	-15	134	163	205	258	334	412	546	592	738	888
	-10	131	158	200	250	323	397	530	570	710	854
	-5	126	152	193	239	308	377	509	543	675	812
	0	120	144	183	226	290	354	482	510	633	762
	5	113	135	172	210	269	327	449	471	584	703
	10	104	123	158	192	244	296	410	425	527	634
	15	94	110	142	171	216	261	365	376	464	558
	20	94	112	146	178	221	269	373	390	484	582
	25	83	98	130	157	191	232	324	336	416	500
	30	72	84	112	134	161	195	275	282	349	420
35	61	71	93	110	131	158	226	230	283	340	
40	52	61	73	86	103	123	178	179	220	265	

OIL COOLER HEAT REJECTION (OCHR) - 1000 BTU/HR (10°F Superheat, 120°F oil into compressor)

COND TEMP. °F	EVAP TEMP. °F	RWB II PLUS SCREW COMPRESSOR MODELS - HIGH STAGE R-717									
		60	76	100	134	177	222	270	316	399	480
85	-40	163	202	256	333	427	532	680	763	957	1151
	-35	164	203	257	332	429	535	687	767	961	1156
	-30	166	204	258	333	431	536	692	770	964	1160
	-25	167	205	259	332	431	536	696	770	963	1158
	-20	167	205	259	331	430	533	697	767	959	1154
	-15	167	204	259	328	426	527	694	759	948	1140
	-10	166	202	256	323	419	518	687	746	931	1120
	-5	164	198	252	316	409	504	673	727	906	1090
	0	160	193	246	306	395	486	654	701	873	1050
	5	154	185	237	293	378	463	629	669	832	1001
	10	147	176	226	277	356	435	597	630	782	941
	15	139	165	213	259	331	403	558	584	724	871
	20	128	151	197	237	302	367	513	531	658	792
	25	116	136	179	214	271	327	462	474	586	705
	30	104	121	161	190	237	285	408	413	510	614
35	92	106	141	165	205	245	354	355	437	526	
40	93	109	146	173	212	257	367	374	462	556	
95	-40	194	241	309	402	510	637	811	913	1146	1379
	-35	195	242	309	401	514	642	821	920	1154	1388
	-30	198	244	310	401	518	646	831	928	1163	1399
	-25	200	246	313	403	522	650	841	935	1171	1409
	-20	202	248	315	404	525	653	848	939	1176	1415
	-15	203	249	317	404	526	653	854	941	1177	1416
	-10	204	249	317	403	524	649	855	937	1172	1410
	-5	204	248	316	400	519	642	852	928	1159	1394
	0	202	245	314	394	511	630	843	912	1138	1369
	5	199	240	309	385	498	614	827	889	1108	1333
	10	194	233	301	373	482	592	804	858	1069	1286
	15	188	224	291	357	461	565	774	820	1020	1227
	20	179	213	278	339	436	533	737	775	962	1157
	25	169	200	262	317	407	495	692	721	895	1077
	30	157	185	243	292	374	454	640	661	818	984
35	144	168	224	266	337	408	582	595	736	885	
40	130	151	203	240	300	362	521	528	652	784	
105	-40	232	288	374	489	605	757	961	1086	1363	1640
	-35	231	286	369	480	608	761	970	1092	1370	1648
	-30	233	289	370	480	615	768	983	1103	1384	1665
	-25	236	292	372	481	622	776	998	1116	1399	1683
	-20	239	295	376	485	628	783	1013	1128	1413	1700
	-15	243	298	380	488	634	789	1027	1138	1424	1713
	-10	245	300	384	490	637	792	1037	1144	1431	1722
	-5	247	301	386	490	639	792	1044	1146	1433	1724
	0	247	301	387	489	636	788	1046	1141	1426	1715
	5	247	299	386	484	630	779	1042	1130	1411	1697
	10	245	295	382	477	619	764	1030	1111	1385	1666
	15	241	290	376	466	604	744	1011	1083	1349	1623
	20	235	281	367	452	585	718	985	1047	1303	1568
	25	227	271	354	434	561	687	950	1003	1247	1500
	30	217	258	339	412	531	649	906	949	1179	1418
35	205	242	321	387	497	606	854	887	1100	1323	
40	191	224	300	358	459	558	794	817	1013	1219	
115	-40	279	348	456	596	719	901	1140	1291	1622	1951
	-35	274	340	444	579	717	897	1140	1287	1617	1945
	-30	273	339	438	570	722	903	1153	1298	1629	1960
	-25	276	342	440	571	732	914	1172	1315	1650	1985
	-20	281	346	444	574	742	926	1193	1333	1672	2011
	-15	285	351	450	579	752	937	1214	1352	1694	2038
	-10	289	355	456	585	760	947	1234	1368	1714	2062
	-5	293	359	461	589	767	954	1251	1380	1728	2079
	0	296	362	466	592	772	958	1265	1389	1737	2090
	5	298	363	469	592	772	958	1273	1391	1739	2092
	10	299	362	470	590	769	952	1275	1385	1730	2081
	15	298	360	468	585	761	941	1269	1371	1711	2058
	20	295	355	464	576	748	923	1255	1347	1680	2021
	25	291	348	456	563	730	899	1232	1314	1638	1971
	30	283	338	445	546	707	869	1202	1272	1584	1906
35	274	325	431	524	679	832	1161	1221	1518	1826	
40	262	310	413	499	645	788	1110	1158	1438	1730	

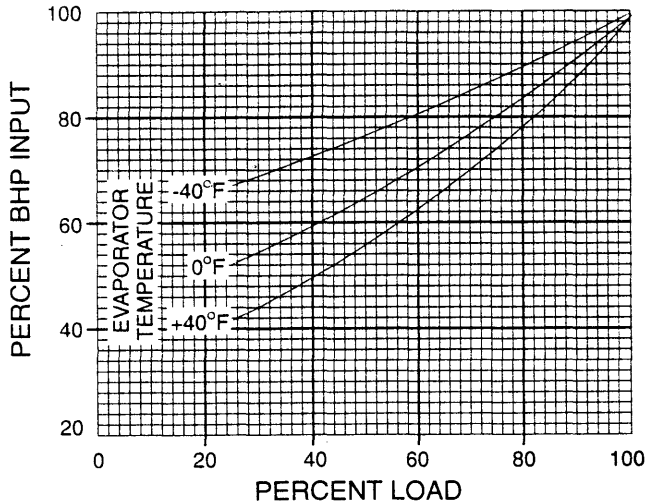
OIL COOLER HEAT REJECTION (OCHR) - 1000 BTU/HR (10°F Superheat, 120°F oil into compressor)

COND TEMP. °F	EVAP TEMP. °F	RWB II PLUS SCREW COMPRESSOR MODELS - ECONOMIZED R-717									
		60	76	100	134	177	222	270	316	399	480
75	-40	136	168	211	271	350	435	562	624	781	940
	-35	137	168	211	270	349	433	563	621	777	935
	-30	137	167	210	268	347	430	562	617	771	928
	-25	136	166	209	265	343	424	558	609	761	915
	-20	135	164	207	260	337	416	551	598	745	896
	-15	133	161	203	254	328	404	539	581	723	870
	-10	129	156	197	245	316	388	522	558	695	836
	-5	125	150	190	234	301	368	499	530	659	793
	0	119	142	180	221	283	345	471	497	616	741
	5	111	132	168	205	261	318	438	457	567	682
	10	102	120	154	186	237	286	399	413	511	615
	15	91	107	139	166	209	252	355	363	449	540
	20	92	109	142	173	214	261	362	378	469	564
	25	81	95	126	151	184	224	314	325	402	484
	30	70	83	109	130	157	189	268	275	340	409
35	60	70	92	109	131	157	225	228	282	339	
40	52	61	73	86	103	123	178	179	220	265	
85	-40	165	204	258	334	428	533	685	764	957	1151
	-35	166	204	258	332	429	533	689	766	959	1154
	-30	167	205	259	332	430	533	693	767	959	1154
	-25	168	205	259	331	429	532	695	765	956	1150
	-20	168	205	259	328	426	528	695	760	949	1142
	-15	167	203	257	325	422	521	690	751	937	1127
	-10	165	200	255	319	414	510	681	736	917	1103
	-5	163	196	250	311	403	495	666	715	890	1071
	0	158	190	243	301	388	476	645	688	855	1029
	5	152	182	234	287	370	452	618	654	813	978
	10	145	173	222	271	348	424	585	614	763	918
	15	136	161	208	252	323	392	546	568	704	847
	20	125	148	192	231	294	356	500	516	639	769
	25	113	133	174	208	263	317	450	460	568	683
	30	101	118	156	185	230	276	395	400	494	594
35	89	103	137	160	198	237	343	343	423	509	
40	92	107	144	170	208	252	360	367	454	546	
95	-40	198	245	314	407	515	643	824	923	1158	1393
	-35	199	246	313	404	518	646	832	928	1163	1399
	-30	201	247	314	404	521	649	840	933	1169	1406
	-25	202	249	316	404	524	651	848	938	1174	1412
	-20	204	250	317	404	525	651	853	939	1175	1414
	-15	205	250	318	403	524	649	856	938	1172	1410
	-10	205	249	318	401	521	644	855	932	1163	1399
	-5	204	247	316	396	515	635	850	920	1148	1381
	0	202	243	312	389	505	622	838	901	1124	1352
	5	198	238	306	380	491	604	819	876	1091	1312
	10	193	231	298	367	474	581	795	844	1050	1263
	15	186	221	287	351	452	553	763	805	1000	1203
	20	177	210	273	332	427	521	725	758	941	1132
	25	166	196	257	310	398	484	679	705	874	1051
	30	154	181	239	286	365	443	627	645	799	961
35	141	165	219	260	330	398	570	581	718	864	
40	128	149	200	235	294	354	511	516	637	766	

OIL COOLER HEAT REJECTION (OCHR) - 1000 BTU/HR (10°F Superheat, 120°F oil into compressor)

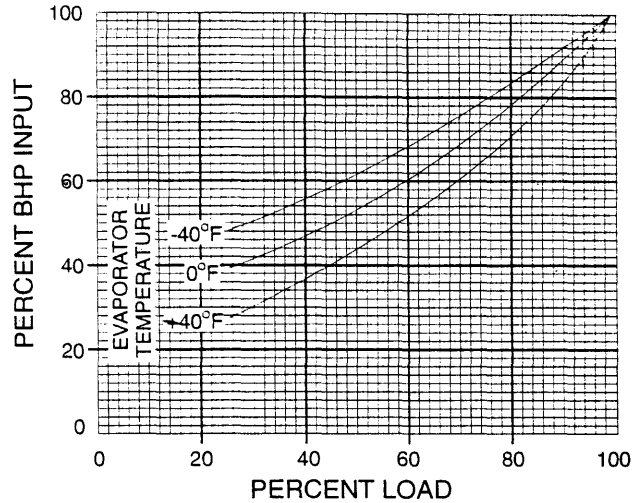
COND TEMP. °F	EVAP TEMP. °F	RWB II PLUS SCREW COMPRESSOR MODELS - ECONOMIZED R-717									
		60	76	100	134	177	222	270	316	399	480
105	-40	239	296	384	499	618	773	987	1109	1392	1675
	-35	237	293	377	489	620	774	993	1112	1395	1678
	-30	239	295	377	487	624	779	1004	1120	1404	1689
	-25	241	297	379	487	629	784	1017	1130	1415	1702
	-20	244	299	382	489	634	789	1029	1138	1425	1714
	-15	246	301	385	491	638	792	1039	1145	1432	1723
	-10	248	303	387	491	639	793	1047	1147	1434	1725
	-5	249	303	388	490	638	790	1051	1146	1431	1722
	0	249	302	388	487	634	784	1049	1138	1420	1708
	5	248	299	386	482	626	772	1042	1123	1401	1685
	10	245	294	381	473	614	756	1027	1100	1371	1649
	15	240	288	374	461	597	734	1005	1070	1332	1602
	20	234	279	364	446	576	707	976	1032	1284	1545
	25	225	267	351	427	551	674	939	986	1225	1474
	30	215	254	335	405	521	636	894	931	1156	1391
	35	203	238	316	379	487	593	841	869	1078	1297
40	188	220	295	351	450	546	781	801	992	1193	
115	-40	290	360	472	615	742	929	1183	1333	1674	2014
	-35	284	352	458	595	737	922	1180	1325	1663	2001
	-30	283	349	451	584	741	925	1189	1332	1670	2009
	-25	285	351	452	583	748	933	1206	1345	1686	2028
	-20	288	355	455	585	756	942	1224	1359	1703	2049
	-15	292	358	460	588	763	950	1242	1374	1720	2069
	-10	296	362	465	592	770	957	1258	1386	1734	2086
	-5	299	364	469	594	774	961	1271	1393	1743	2097
	0	301	366	472	595	776	962	1281	1397	1747	2102
	5	302	365	473	594	774	958	1286	1395	1742	2096
	10	302	364	473	590	769	950	1283	1385	1728	2079
	15	300	360	470	583	758	935	1273	1366	1703	2049
	20	296	354	464	572	743	915	1255	1339	1668	2007
	25	290	346	455	558	723	889	1229	1302	1621	1950
	30	282	335	443	540	699	857	1195	1258	1564	1882
	35	273	322	427	517	669	819	1152	1204	1496	1800
40	260	306	409	491	635	775	1099	1140	1416	1703	

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



This curve is applicable for R-717 (85°F to 105°F) full-load condensing temperature) and R-22 (95°F to 115°F) full-load condensing temperature).

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

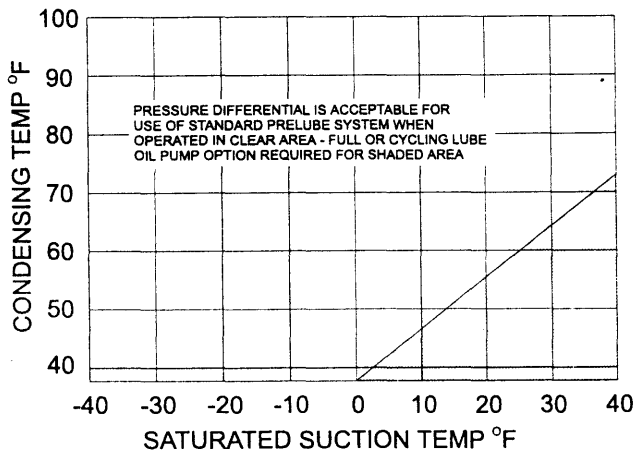


The curve, above, is based on a 20°F linear drop in condensing temperature from full load to 10% of full load. This curve is applicable for R-717 (85°F to 105°F) full-load condensing temperature) and R-22 (95°F to 115°F) full-load condensing temperature). It is not applicable if condensing temperature does not drop with compressor unloading as in the following examples:

‡ STANDARD LUBRICATION SYSTEM LIMITS - HIGH STAGE

The standard prelube system for compressor operation without a lube oil pump may be used on high stage applications shown in the clear area of the graph. The optional **full-lube oil pump** is required only on low differential pressure applications shown in the shaded area of the 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.

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



‡ MINIMUM COMPRESSOR FLOW

The minimum flow capacity for each compressor varies depending upon its geometry and its operating conditions. Typical minimum flow for each of our compressor models is listed below. This table represents minimum suction flow with the slide valve fully unloaded.

UNIT	MINIMUM FLOW*	
	CFM	m ³ /hr
60	43	73
76	54	92
100	71	121
134	95	161
177	125	212
222	157	267
270	365	621
316	224	380
399	282	479
480	650	1,104

*@ 3550 rpm

**MOTOR SELECTION
and
STARTING TORQUE**

Motors must be sized adequately 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.

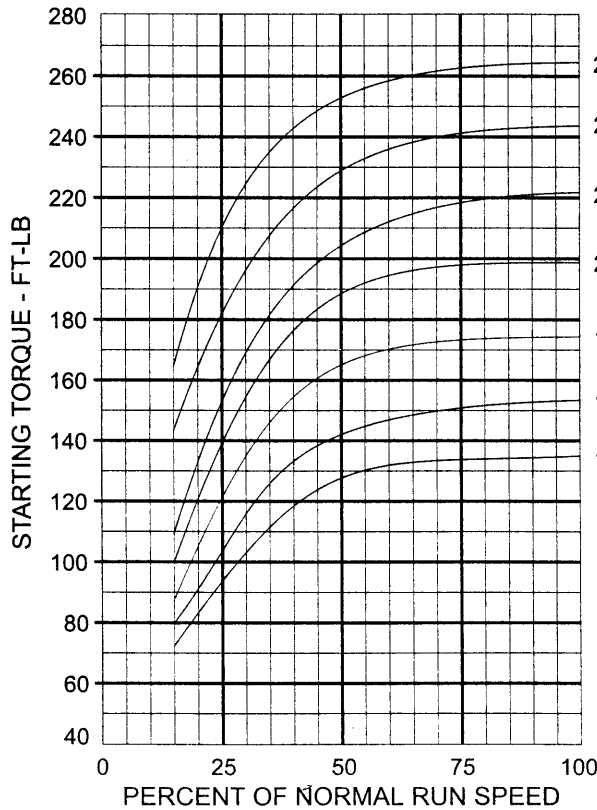
NOTE: Motor starting torque varies considerably with various manufacturers - obtain specific torque data for the motor being used.

RWB MODEL	STARTING TORQUE (1) MULTIPLIER	BREAKAWAY TORQUE (ft-lb)	(2)(3) MASS MOMENT OF INERTIA (lb-ft ²)
60	0.46	7	3
76	0.58	7	3.5
100	0.75	10	7
134	1.00	10	8
177	1.32	14	14
222	1.66	14	17
270	2.24	14	27
316	2.36	20	35
399	2.98	20	43
480	3.91	20	50

1. High Stage or Booster Application.
2. Including standard compressor coupling half.
3. Inertia resolved to drive shaft.

**RWB II SCREW COMPRESSOR
SPEED vs STARTING TORQUE CURVE
- FULLY UNLOADED -
HIGH STAGE and BOOSTER**

HIGH STAGE



BOOSTER

