Frick®

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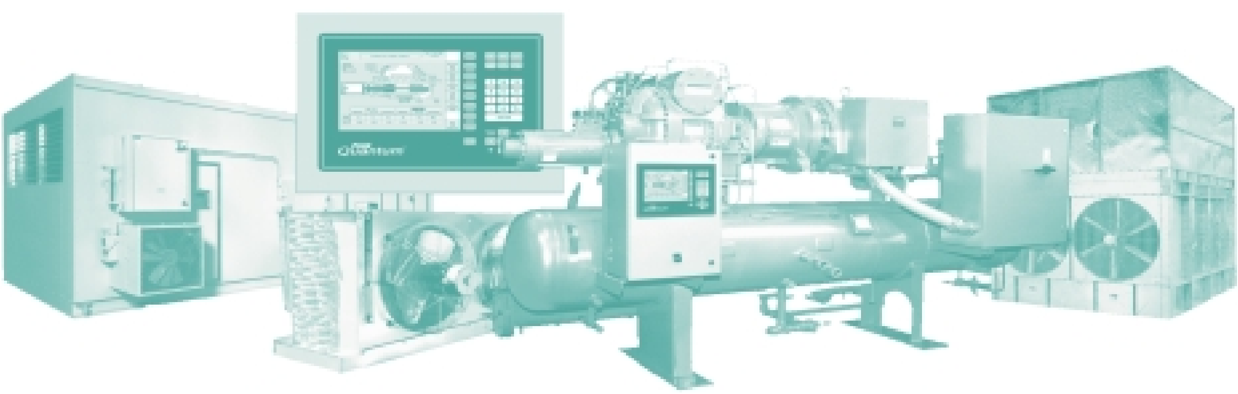
Installation - Operation - Maintenance

powerPAC™

PACKAGED CHILLER UNITS



THIS MANUAL CONTAINS RIGGING, ASSEMBLY, START-UP, AND MAINTENANCE INSTRUCTIONS. READ THOROUGHLY BEFORE BEGINNING INSTALLATION. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN DAMAGE OR IMPROPER OPERATION OF THE UNIT.

Contents

PREFACE

This manual has been prepared to acquaint the owner and serviceman with the INSTALLATION, OPERATION, and MAINTENANCE procedures as recommended by Frick for powerPAC™ Chiller Units.

For information about the functions of the Quantum ™ control panel, communications, specifications, and wiring diagrams, see publication series S90-010 O, M, CS, and E90-010 SPC. For information about the functions of the compressor packages, see publications S70-400 IOM and S70-600 IOM.

It is most important that these units be properly applied to an adequately controlled refrigeration system. Your authorized Frick representative should be consulted for his expert guidance in this determination.

Proper performance and continued satisfaction with these units is dependent upon:

CORRECT INSTALLATION
PROPER OPERATION
REGULAR, SYSTEMATIC MAINTENANCE

To ensure correct installation and application, the equipment must be properly selected and connected to a properly designed and installed system. The Engineering plans, piping layouts, etc. must be detailed in accordance with the best practices and local codes, such as those outlined in ASHRAE literature.

A refrigeration compressor is a VAPOR PUMP. To be certain that it is not being subjected to liquid refrigerant carryover it is necessary that refrigerant controls are carefully selected and in good operating condition; that load surges are known and provisions made for control; and that operating cycles and defrosting periods are reasonable.

JOB INSPECTION

Immediately upon delivery examine all crates, boxes and exposed compressor and component surfaces for damage. Unpack all items and check against shipping lists for any discrepancy. Examine all items for damage in transit.

TRANSIT DAMAGE CLAIMS

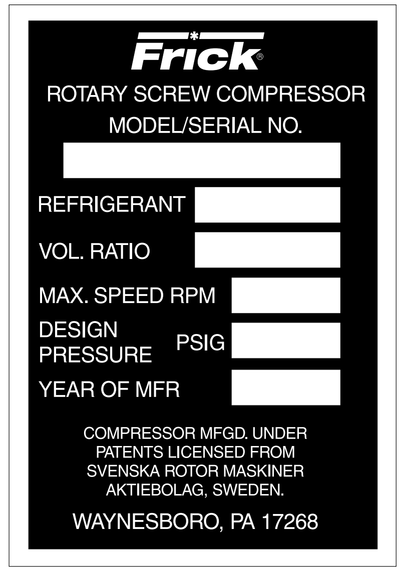
All claims must be made by consignee. This is an ICC requirement. Request immediate inspection by the agent of the carrier and be sure the proper claim forms are executed.

Report damage or shortage claims immediately to YORK Refrigeration, **Frick** Sales Administration Department, in Waynesboro, PA.

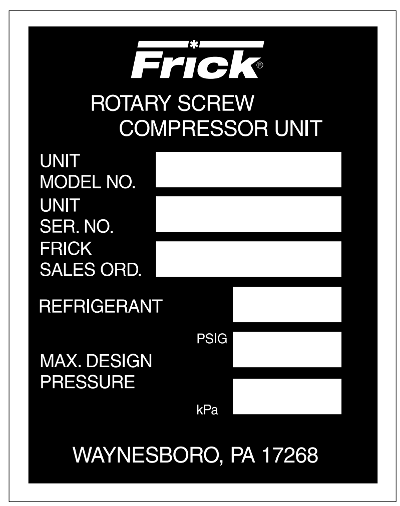
COMPRESSOR and UNIT IDENTIFICATION

Each compressor unit has 2 identification data plates. The **compressor data plate** containing compressor model and serial number is mounted on the compressor body. The **unit data plate** containing unit model, serial number and **Frick** sales order number is mounted on the side of the compressor base.

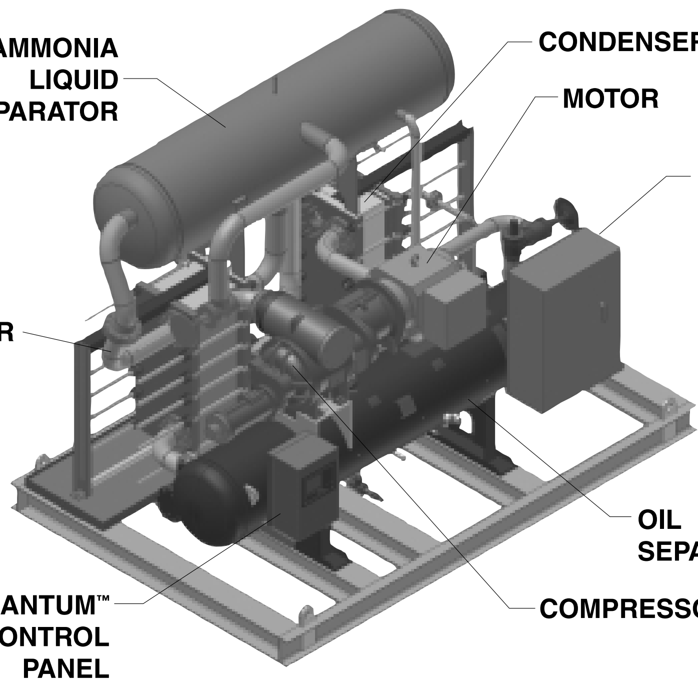
NOTE: When inquiring about the compressor or unit, or ordering repair parts, provide the MODEL, SERIAL, and FRICK SALES ORDER NUMBERS from these data plates.



COMPRESSOR DATA PLATE



UNIT DATA PLATE



PACKAGED AMMONIA CHILLER UNITS

powerPAC™ 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 ease of service. Units are completely assembled with all interconnecting refrigerant piping and internal wiring. The powerPAC™ is equipped with these optional features: Dual Oil Filters and Unit-Mounted Solid-State Starter Packages are offered on powerPAC™ 101 and larger. Contact **Frick** for details.

COMPRESSOR

The **Frick** XJF or SGC rotary screw compressor has been designed utilizing the latest technology to offer the most reliable and energy efficient unit currently available. Compressor casings are designed and tested in accordance with the requirements of ANSI/ASHRAE 15 safety code and are designed for 365 psig working pressure. 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, improved efficiency, and reduced maintenance. The bearings provide an L10 life in excess of 100,000 hours at design conditions.

The XJF compressor incorporates a simple mechanism that adjusts the compressor volume ratio during operation to the most efficient of three possible volume ratios, depending on system requirements. The SGC Compressor includes a patented method of varying the internal volume ratio to match the system pressure ratio. Either compressor reduces the power penalty associated with over/under compression.

COMPRESSOR CAPACITY CONTROL

Effective capacity control is achieved by use of a slide valve which provides infinite adjustment from 100% down to 25% of full load for an XJF compressor and down to 10% of full load on an SGC Compressor.

LUBRICATION SYSTEM

The compressor oil is superior quality semisynthetic, hydrotreated oil for ammonia applications. The oil provides high thermal stability for improved breakdown characteristics and extended service intervals. The 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 compressor oil passes through our new Frick® SuperFilter™, specifically designed for increased particle capture, cleaner oil, and compressor operation. SuperFilter™ allows less than 1/2% of 15 micron particles to pass through, yielding 35 X better performance than today's industry standard of 50% efficiency (nominal) captured in one pass. It is also designed for horizontal mounting and furnished with isolation stop valves and drain connections for ease of servicing. Booster and some low-pressure differential high-stage applications will require the demand oil pump option.

OIL SEPARATOR/RESERVOIR

The oil separator is 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

The compressor oil is cooled using a semi-welded plate heat exchanger that is integral with the refrigerant condenser. The heat exchanger plates are AISI 316 stainless steel construction. Design working pressure is 300 psig.

MOTOR

A factory mounted flange motor is close-coupled to the compressor. The compressor/motor assembly requires no field coupling alignment. Standard motors are open drip proof (ODP) and have class B insulation and 1.15 service factor.

EVAPORATOR/CONDENSER

Semiwelded plate heat exchangers that have plates constructed of AISI 316 Stainless Steel. Gaskets are a two-piece construction for excellent compatibility with refrigerant and cooling media. Design working pressure is 300 psig. The plate heat exchangers can be disassembled for easy cleaning and capacity modification.

QUANTUM™ CONTROL CENTER

The control system is factory mounted and completely wired with all required safety and operating devices. The control system includes as standard a NEMA 4 single box control panel housing, microprocessor control, and electrical termination points. Included in the microprocessor is time-proportioning capacity control, first-out annunciation, pre-alarms, VOLUMIZER® controls, real-time clock control, access code protection, lead-lag sequencing, alternate suction pressure operation, trending, and more. The operating conditions at the time of the compressor's last ten alarms or shutdowns are stored in memory, providing the ultimate in service and troubleshooting convenience. A built-in telecommunications interface is standard that enables connection to a remote computer or control device.

AMMONIA LIQUID SEPARATOR

A horizontal liquid separator is specifically designed for units with small ammonia charges and small variations in liquid level. This level must not be more than 2.5 inches (64 mm) above the bottom of the liquid separator. The separation of liquid from gas is achieved efficiently by leading the return lines to both ends of the liquid separator. This reduces the gas velocity in the liquid separator and allows time for the liquid to collect before the gas travels to the compressor.

INSTALLING YOUR POWERPAC™

FOUNDATION

NOTE: Allow space for servicing both ends of the unit. A minimum of 24 inches (610 mm) is recommended.

The first requirement of the package chiller foundation is that it must be able to support the weight of the package including oil and refrigerant charge. Screw compressors are capable of converting large quantities of shaft power into gas compression in a relatively small space and a mass is required to effectively dampen these relatively high frequency vibrations.

Firmly anchoring the chiller package to a suitable foundation by proper application of grout and elimination of piping stress imposed on the package is the best insurance for a trouble free installation. Use only the certified general arrangement drawings from Frick® to determine the mounting locations and to allow for recommended clearances around the unit for ease of operation and servicing. Foundations must be in compliance with local building codes and materials should be of industrial quality.

The floor shall be a minimum of 6 inches (152 mm) of reinforced concrete. Housekeeping pads are recommended. Anchor bolts are required to tie the unit firmly to the floor. Once the package is rigged into place (See HANDLING and MOVING), it must be shimmed in order to level the unit. The shims should be placed to position the package rails one inch (25.4 mm) above the housekeeping pad to allow space for grouting. An expansion-type epoxy grout must be worked under all areas of the base with no voids. It should be allowed to settle with a slight outward slope so oil and water can run off of the base.

When installing on the upper floors of buildings, extra precautions should be taken to prevent normal package vibration from being transferred to the building structure. It may be necessary to use rubber or spring isolators, or a combination of both, to prevent the transmission of compressor vibration directly to the structure. However, this may increase package vibration levels because the compressor is not in contact with any damping mass. Rubber or spring pipe supports may be required to avoid exciting the building structure at any pipe supports close to the chiller package. It is best to employ a vibration expert in the design of a proper mounting arrangement.

Proper foundations and proper installation methods are vital; and even then, sound attenuation or noise curtains may be required to reduce noise to desired levels.

For more detailed information on Screw Compressor Foundations, please request Frick® publication S70-210 IB.

HANDLING and MOVING

Use a crane and rigging whenever the unit is moved. **DO NOT USE A FORKLIFT. Refer to charts located in TECHNICAL DATA section for shipping weight.**

⚠ CAUTION **Spreader bars should be used on both the length and width of the package to prevent damage to the package. CAUTION must also be used in locating the lifting ring. Appropriate adjustment in the lifting point should be made to compensate for the center of gravity.**

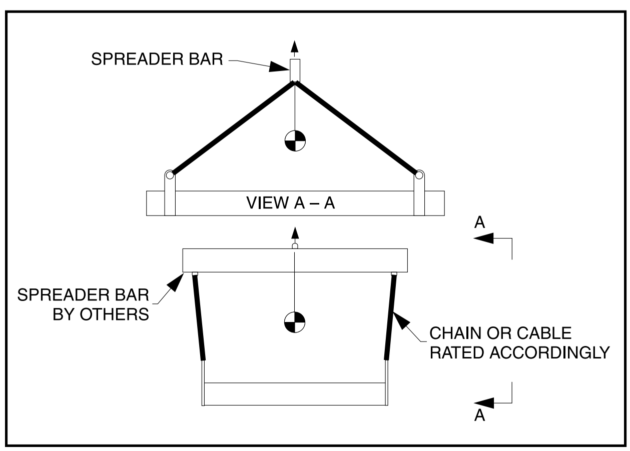


Figure 1

WARNING **Unit may be top heavy**. Lifting operators must use **extreme care** to check the level and stability of the load before lifting the load more than a few inches. Impose an imbalance by sequentially adding weight to each corner and carefully observing the load reaction to make sure the load does not shift. Balancing chains, cables or straps are essential in both directions to prevent load shift and instability during rigging. Call **Frick** Engineering for an estimate of the location of the center of gravity of the package if one is not given**. The center of gravity may NOT be located in the center of the package.**

NOTES:

1. Reference OSHA Safety And Health Standards (29 CFR 1910), sections 1910.179 and 1910.184.
2. Hooks, chains, cables and spreader bars shall meet manufacturer's recommendations and shall not be overloaded.
3. This unit shall be lifted using the four lifting lugs welded to the base as shown above. Shackles and screw pins shall be provided (by others) as shown in Figure 2 as minimum.
4. Spreader bars and balancing chains must be used to prevent instability and damaging or straining system piping, instrumentation or shells.
5. Adjust cables or chains to ensure that the package (skid) is stable and lifted level.
6. Lifting must be done by a qualified operator.

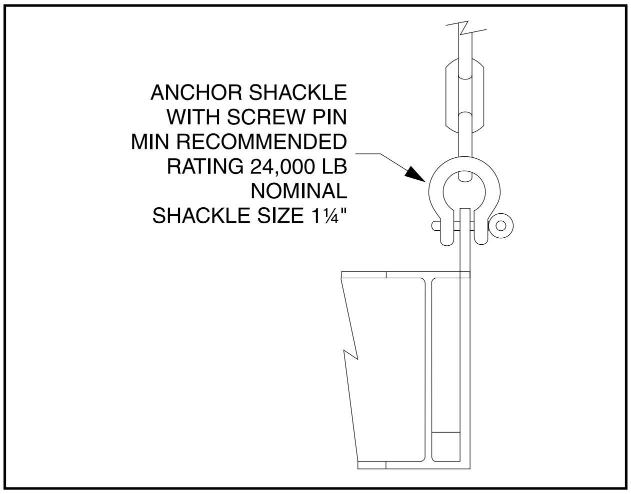
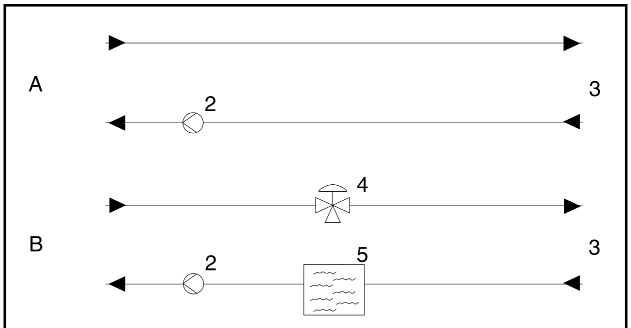


Figure 2

LIFTING LUG CAPACITY, LB/LUG		
NOMINAL BEAM MEMBER SIZE	**CABLE ANGLE**	
	VERTICAL	**45°**
W8	**15,200**	**14,990**
W8	**15,200**	**14,990**
W10	**19,400**	**14,990**

BRINE–/WATER SYSTEMS

For the most efficient operation of the evaporator, ensure a full flow of either water or brine through the unit. Full flow is achieved by using one of the following systems.



1. Brine/water to/from powerPAC™
2. Circulating pump
3. Brine/water to/from the system
4. Modulating 3-way valve
5. Buffer tank

Figure 3

A: Continuously Loaded System: The cooling media circulates continually through the system and the evaporator.

B: System with load variations: (Example: air conditioning system with several adjustable cabinets in which the cooling media flow can be varied.) The modulating 3-way valve will maintain a constant cooling media flow throughout the evaporator. Installation of a buffer tank is recommended, as shown in Position 5.

NOTE: Install vent valves (Pos. 1, Fig. 1 A and Fig.1B) at the highest point in the system as well as at the drainage valves (Pos. 2), which are located at the lowest point.

Connections and valves for chemical cleaning should be installed.

All cold pipes should be insulated in order to avoid condensation.

Water treatment

Often, brine and water for industrial refrigeration plants contain impurities that can create a coating on the heat conducting surfaces. This reduces the heat transmission. In some cases, this coating can cause corrosion of the heat conducting surfaces.

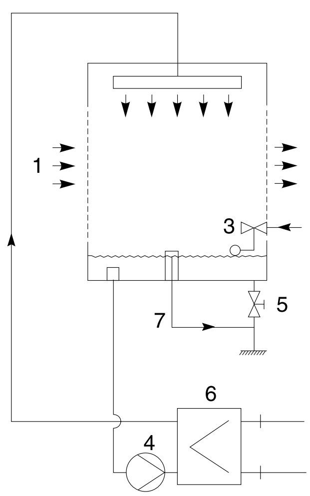
This makes it **important** to monitor brine and water quality. Consult a water expert concerning additives to the system before installing the system.

Warranty does not include any damage that may occur due to harmful impurities in the system.

Attention is drawn to the fact that all cooling towers experience a constant loss of water due to evaporation. This makes impurities remain in the refrigeration system in an ever-increasing concentration, also increasing their harmful effects.

Using a drainage system can minimize the concentration of impurities. This drains off a minor part of the polluted cooling tower water and replaces it with fresh water.

This drainage system consists of a hand-operated adjusting valve (Pos. 5), shown in Fig. 4, that is opened sufficiently to drain the polluted cooling tower water to the sewage system. Fresh water is provided through the float valve shown at position 3.



COOLING TOWER

1. Air in
2. Air out
3. Float valve
4. Pump
5. Adjusting valve with outlet to sewer
6. Condenser
7. Overflow pipe

Figure 4

ELECTRIC WIRING

All electric wiring inside the powerPAC™ unit has been connected at the factory on units ordered with solid-state, package-mount starters.

External wiring connections that must be established once the powerPAC™ unit is installed are:

1. Mounting of main cable to the control panel
2. Mounting of control line for starting of the condenser pump
3. Mounting of control line for starting of the evaporator pump
4. Mounting of flow switch, if any
5. Mounting of outside thermostat, if any

HOLDING CHARGE AND STORAGE

Each powerPAC™ chiller is pressure and leak tested at the Frick factory and then thoroughly evacuated and charged with dry nitrogen to ensure the integrity of the unit during shipping and short term storage prior to installation.

NOTE: Care must be taken when entering the unit to ensure that the nitrogen charge is safely released.

WARNING **Holding-charge shipping gauges on separator and external oil cooler are rated for 30 PSIG and are for checking the shipping charge only. They must be removed before pressure testing the system and before charging the system with refrigerant. Failure to remove these gauges may result in catastrophic failure of the gauge and uncontrolled release of refrigerant resulting in serious injury or death.**

All units must be kept in a clean, dry location to prevent corrosion damage. Reasonable consideration must be given to proper care for the solid state components of the microprocessor.

Units which will be stored for more than two months must have the nitrogen charge checked periodically.

TECHNICAL DATA

Shipping weights, dimensions, and R-717 charges.

Model**	PAC 50	PAC 101	PAC 222
Cooling Capacity (tons)	75	150	350
Power (bhp)	121	238	489
Dimensions (W x L x H)	96" x 112" x 102"	96" x 170" x 108"	126" x 214" x 144"
Weight (lbs.)	10,890	16,940	34,760
Ammonia Charge	57	107	293
Fluid IN (F)	22	22	22
Fluid OUT (F)	12	12	12
Water PD (psi)	8.3	9.0	5.4
Connection Size	4"	4"	6"
Fluid IN (F)	75	75	75
Fluid OUT (F)	85	85	85
Water PD (psi)	12.0	13.3	
Connection Size	4"	4"	6"

* 40% Ethylene Glycol
** R-717 Condensing Temp. = 95°F, Evap. Temp.= 5°F

Model**	PAC 50	PAC 101	PAC 222
Cooling Capacity (tons)	75	150	350
Power (bhp)	121	238	489
Dimensions (W x L x H)	96" x 112" x 102"	96" x 170" x 108"	126" x 214" x 144"
Weight (lbs.)	10,835	16,803	33,770
Ammonia Charge	50	95	230
Evaporator Fluid IN (F)	25	25	25
Fluid OUT (F)	15	15	15
Water PD (psi)	4.6	5.3	8.7
Connection Size	4"	4"	6"
CondenserFluid IN (F)	75	75	75
Fluid OUT (F)	85	85	85
Water PD (psi)	10	10.6	10.7
Connection Size	4"	4"	6"

* 40% Ethylene Glycol
** R-717 Condensing Temp. = 95F, Evap. Temp.= 5F

• The weight is exclusive of refrigerant, oil, and water. The weight is the average weight because motor size and number of cassettes in the plate heat exchangers may vary.

•• The R-717 charge is an estimated amount. Maximum charge corresponds to a level of 2.5 inches (64 mm) in the ammonia liquid separator.

ENGLISH	METRIC
1 HP	.747 kW
1 in.	25.4 mm
1 lb	.454 kg
°F	9/5°C + 32
1 psi	.069 bar
1 TR	3.52 kW

OPERATING YOUR POWERPAC™

PRESTART CHECKLIST

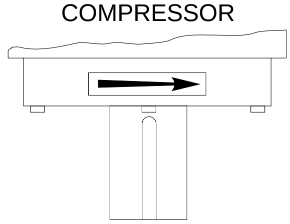
After the powerPAC™ has been installed and all connections for refrigerant, water and electricity, instruments and safety switches have been connected, proceed as follows:
Check the rotation direction of the motor, with the coupling dismantled, to be certain it is correct. **An arrow on the compressor end-cover marks the proper direction of rotation. (See PRESTART CHECKLIST in FORMS section)**

CHECKING MOTOR/COMPRESSOR ROTATION

⚠WARNING **Make sure coupling hubs are tightened to the shaft before rotating the motor to prevent them from flying off and possibly causing serious injury or death.**

⚠ CAUTION **Injury may occur if loose clothing, etc, becomes entangled on the spinning motor shaft.**

COMPRESSOR



COMPRESSOR ROTATION IS CLOCKWISE WHEN FACING THE END OF THE COMPRESSOR SHAFT. Under **NO** conditions should the motor rotation be checked with the coupling center installed as damage to the compressor may result. Bump the motor to check for correct compressor rotation. After verification, install disk drive spacer, as applicable.

COMPRESSOR/MOTOR COUPLING INSTALLATION

The powerPAC™ chiller has compressor to motor alignment through the use of a machined cast iron tunnel. This tunnel is factory set through machining tolerances ensuring motor compressor alignment. No alignment is required in the field. For replacement motors, the shaft alignment should be checked and tolerances verified with the **Frick** service department.

CH COUPLING

The T. B. Woods Elastomeric Type CH Coupling is used in most applications. This coupling consists of two drive hubs and a gear-type Hytrel or EDPM and neoprene drive spacer. The split hub is clamped to the shaft by tightening the clamp screws.

Torque is transmitted from the motor through the elastomeric gear which floats freely between the hubs. Because of the use of the motor/compressor adapter housing on the RXF, no field alignment is necessary.

It is mandatory that the coupling center be removed and the direction of motor rotation be confirmed *before* running the compressor. Proper rotation of the compressor shaft is clockwise looking at the end of the compressor shaft. Failure to follow this step could result in backward compressor rotation which can cause compressor failure or explosion of the suction housing.

1. Inspect the shaft of the motor and compressor to ensure that no nicks, grease, or foreign matter is present.

2. Inspect the bores in the coupling hubs to make sure that they are free of burrs, dirt, and grit.

3. Check that the keys fit the hubs and shafts properly.

4. Slide one hub onto each shaft as far as possible. It may be necessary to use a screwdriver as a wedge in the slot to open the bore before the hubs will slide on the shafts.

5. Hold the elastomeric gear between the hubs and slide both hubs onto the gear to fully engage the mating teeth. Center the gear and hub assembly so there is equal engagement on both shafts. Adjust the space between hubs as specified in the CH Coupling Data Table below.

6. Torque the clamping bolts in both hubs to the torque value given in the CH Data Table. **DO NOT USE ANY LUBRICANT ON THESE BOLTS.**

CH COUPLING DATA TABLE

CH COUPLING SIZE	BETWEEN SHAFT SPACING				COUPLING HUB						CLAMP BOLT			KEYWAY SETSCREW TORQUE	
					SHAFT ENGAGEMENT				FACE SPACING		TORQUE DRY		SIZE		
	MIN*		MAX		MIN		MAX								
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	ft-lb	Nm		ft-lb	Nm
6	2	50.8	2 3/4	69.9	1	25.4	1 15/16	49.2	7/8	22.2	15	20.3	1/4 - 20 UNC	13	17.6
7	2 5/16	58.7	3 7/16	87.3	1	25.4	2 3/16	55.6	1 1/16	27.0	30	40.7	5/16 - 24 UNF	13	17.6
8	2 9/16	65.1	4	101.6	1 1/16	27.0	2 1/2	63.5	1 1/8	28.6	55	74.6	3/8 - 24 UNF	13	17.6
9	3 1/16	77.8	4 5/8	117.5	1 7/16	36.5	3	76.2	1 7/16	36.5	55	74.6	3/8 - 24 UNF	13	17.6
10	3 9/16	90.5	5 1/4	133.4	1 11/16	42.9	3 1/2	88.9	1 11/16	42.9	130	176.3	1/2 - 20 UNF	13	17.6

powerPAC™ 100, 134, 177, 222, 270

TORSIONAL DATA				
COUPLING PART NO.	MOTOR HUB	WEIGHT (lb)	INERTIA lb x in.^{2}	TORSIONAL in. x lb/RADIAN
720C0044H01	2.377	32.4	152	2.89×10^6
720C0044H02	2.127	33.1	153	2.89×10^6
720C0044H03	1.877	33.8	154	2.89×10^6
720C0045H01	2.377	52.6	334	4.58×10^6
720C0045H02	2.127	53.5	335	4.33×10^6
720C0045H03	2.877	50.7	330	5.06×10^6

OPERATING DATA - 60 Hz		
SPECIFICATION	COUPLING PART NO.	
(Maximum)	720C0044H0_	720C0045H0_
Power (hp)	424	740
Speed (rpm)	3,600	3,600
Torque* (in.-lb)	11,130	19,425

*Includes 1.5 service factor.

powerPAC™ Models 100, 134, 177, 222, 270

ALTERNATE OPERATING DATA - 50 Hz		
	COUPLING PART NO.	
SPECIFICATION	720C0044H0_	720C0045H0_
Power (hp)	424	740
Speed (rpm)	3,000	3,000
Torque* (in.-lb)	13,356	23,310

*Includes 1.5 service factor.

COUPLING TORQUE RATINGS		
	COUPLING PART NO.	
TORQUE	720C0044H0_	720C0045H0_
Max continuous	17,500 in.-lb	24,300 in.-lb
Peak overload	35,000 in.-lb	48,600 in.-lb

COMPRESSOR UNIT OIL

⚠WARNING

DO NOT MIX OILS of different brands, manufacturers, or types. Mixing of oils may cause excessive oil foaming, nuisance oil level cutouts, oil pressure loss, gas or oil leakage and catastrophic compressor failure.

⚠ CAUTION

Use of oils other than Frick Oil must be approved in writing by Frick engineering or warranty claim may be denied.

The oil charge shipped with the unit is the best suited lubricant for the conditions specified at the time of purchase. If there is any doubt due to the refrigerant, operating pressures, or temperatures; refer to Frick Pub. E160-802 SPC for guidance.

For standard powerPAC™ units only use semisynthetic hydrotreated oil oils, as provided by **Frick**.

Semisynthetic hydrotreated oil is synthetic oil with a low vapor pressure. This greatly reduces the amount of oil that is passed with the R-717 discharge gas from the compressor to the separator compressor during operation. The result is noticeably lower oil consumption.

Because semisynthetic hydrotreated oils do not mix well with R-717, there is a considerable reduction of any content of this oil taken from the compressor into the refrigeration system. The high viscosity index of semisynthetic hydrotreated oils makes the oil slide off the evaporator plates more easily and gather on the bottom of the evaporator. Then, the oil is returned to the compressor via the automatic oil return system.

CHARGING REFRIGERANT

The refrigerant charge for the powerPAC™ units is very small, compared to their large cooling capacity. Keeping refrigerant liquid solely in the evaporator because of the high pressure float system. The total amount of refrigerant is indicated in the table found in **TECHNICAL DATA**.

1. Connect refrigerant cylinder to the charge valve. Purge the charge hose with refrigerant before tightening the union nut on the valve.
2. Open the charge valve. Refer to Start-up procedure, outlined above, to initiate compressor operation.
3. Start the compressor as described in the Control Panel manual.
4. Check the compressor for any abnormal noises and make sure that the compressor is building a differential pressure.
5. Charge the amount of ammonia gradually as indicated in the table in *Technical Data*. Check the amount by weighing the refrigerant cylinders on a scale. The liquid level in the ammonia liquid separator 2.5 inches (64 mm).
6. Close the charge valve and slowly increase capacity to 100%.

NOTE: Never leave the unit during the first 60 minutes following start-up or during operation.

DRAINING AMMONIA

Use the following procedure to drain refrigerant from the unit:
• Run the system normally. Manually reduce the chiller package capacity to a minimum.
• Connect drainage valve to a refrigerant vessel approved for this purpose. The connection must be made with an approved refrigerant hose.

IMPORTANT: Check that the vessel is large enough to hold the entire charge without being overfilled and that it is made for the particular refrigerant used. Only charge the vessel up to 90%.

Before connecting the vessel, place it in chilled water or cool it by some other means.

- **Open** the drainage valve and stop valve on the refrigerant vessel.
- Close valves that supply liquid refrigerant to the evaporator.
- Using this procedure, the evaporator is pumped down and the condensed liquid transferred to the refrigerant vessel. After dismantling, the refrigerant vessel and protecting cap must both be weighed to ensure that the vessel is not overfilled. Net and gross weights stamped into the vessel include the weight of the protecting cap.

REFRIGERANT PUMPDOWN

After pressure testing, discharge the refrigeration system to remove any atmospheric air or moisture.

The boiling point of a liquid is defined as the temperature at which the vapor pressure is equal to atmospheric pressure.

The boiling point of water is 212°F (100°C). If the pressure is lowered, so is the water's boiling point.

The table indicates the boiling point of water at very low pressures:

BOILING POINT of WATER °F (°C)	AT PRESSURE IN. H_2O (mm HG)
41 (5)	3.6 (6.63)
50 (10)	4.9 (9.14)
59 (15)	6.8 (12.73)
68 (20)	9.5 (17.80)

For pumpdown, use a vacuum pump that empties the package of both air and water vapor.

The vacuum pump must be able to lower the pressure to approximately 0.05 in. H_2O (0.1-mm Hg), and it must be equipped with a gas ballast valve. Use this valve as much as possible in order to prevent the condensation of water vapor in the vacuum pump.

IMPORTANT: NEVER use the refrigeration compressor to pumpdown a system.

For pumpdown to be satisfactory, the final pressure must be lower than 2.7 in. H_2O (5 mm Hg).

NOTE: There is a risk that any water still present in the refrigeration system may freeze if the ambient temperatures drops below 50°F (10°C). If this occurs, add heat to the environment of the components because ice does not evaporate easily.

OPERATING LOG

Monitor the condition of the package. Log data manually using History and Trending capabilities of Frick® Quantum™. See Quantum™ Operating Manual shipped with the package.

This operating log should be maintained at regular intervals, providing important information about the cause of any undesired changes in the operating state.

The operating log should also contain data about the compressor's cooling system functions, and whether there are unusual noises or vibrations.

HIGH PRESSURE REGULATING SYSTEM

The powerPAC™ unit is equipped with either a mechanical high pressure float valve or an electrical on/off regulator. Both systems are mounted at the inlet of the condenser and regulate the liquid level in the condenser. At the same time, it controls the expansion between the low pressure and high pressure sides of the chiller unit.

Mechanical Float Valve

The mechanical float valve (Fig. 5) is mounted on the condenser liquid outlet, resulting in a compact design and a very low liquid charge.

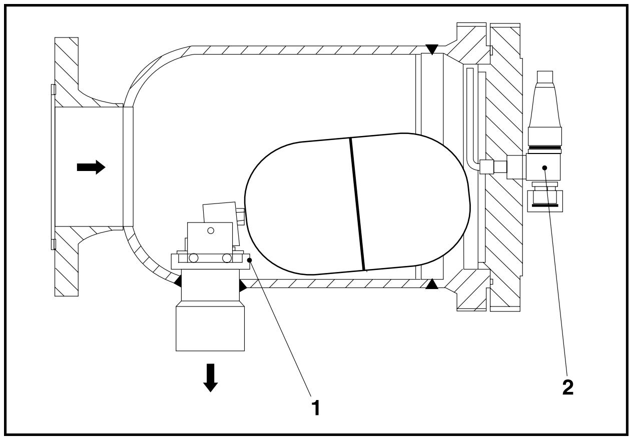


Figure 5

The float valve has a bypass boring (Pos. 1). This ensures that a pressure equalization occurs at standstill between the high and low pressure sides, with a subsequent emptying of liquid from the float housing. The hole is placed below liquid level but note that a small amount of liquid may be left when dismantling the float vessel .

The vent valve (Pos. 2) is located in the middle of the end cover of the float housing and allows access to the top of the float housing through a tube.

Electrical On/Off Regulation

The electrical on/off regulation (Fig. 6) consists of the following 3 main components:

- Electrical expansion valve (Pos. 1)
- Level sensor (Pos. 2)
- Control box (Pos. 3)

To regulate the liquid level in the condenser, let the level sensor, located in the reservoir, register whether there is refrigerant vapor or liquid around the sensor element. If liquid registers (a sign of a rising liquid level in the condenser), the level sensor sends out a signal from the control box (Pos. 3) to the solenoid valve (Pos. 1), telling it to open. The solenoid valve works as an expansion valve with a built-in time constant function. This prevents it from opening or closing too frequently during its on/off function. This system requires no adjustment. A vent valve (Pos. 4) is located on the discharge pipe of the condenser.

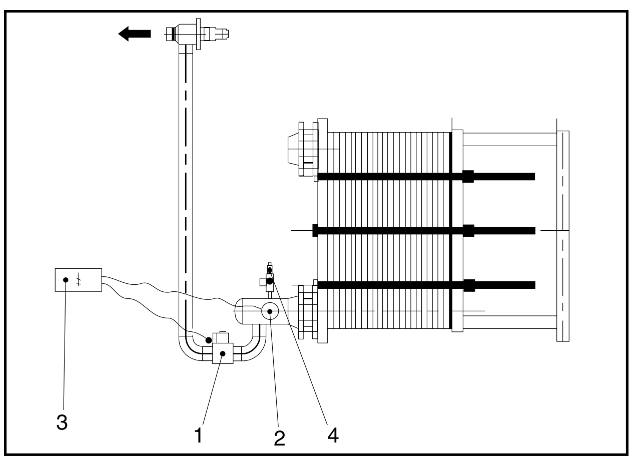


Figure 6

PURGING powerPAC™

If the chiller is filled with air, it tends to gather at the high pressure regulating system. Consequently, both the mechanical high pressure float and the electrical on/off regulation are provided with a vent valve (Pos. 2 and 4 in Figs. 5 and 6.)

During purging, the vent valve is connected to an open vessel with water passing through a refrigerant hose. The air will leave the water in bubbles whereas the R-717 gas is absorbed by the water.

NOTE: The R-717 filled water must be eliminated at an authorized incineration plant. Purging should only be performed by properly trained staff.

AUTOMATIC OIL RETURN SYSTEM

The small amount of oil leaving the compressor unit with the discharge gas is eventually collected at the bottom of the evaporator. A reservoir is mounted in this location. Then the oil is automatically returned to the compressor.

The float switch controls solenoid valves M1 and M2 (shown in Fig. 7). With a rising oil level, the built-in reed switch will activate the solenoid valves. The oil is conveyed to the compressor suction line by means of the hot gas ejector E1. With a falling oil level, the solenoid valves will close.

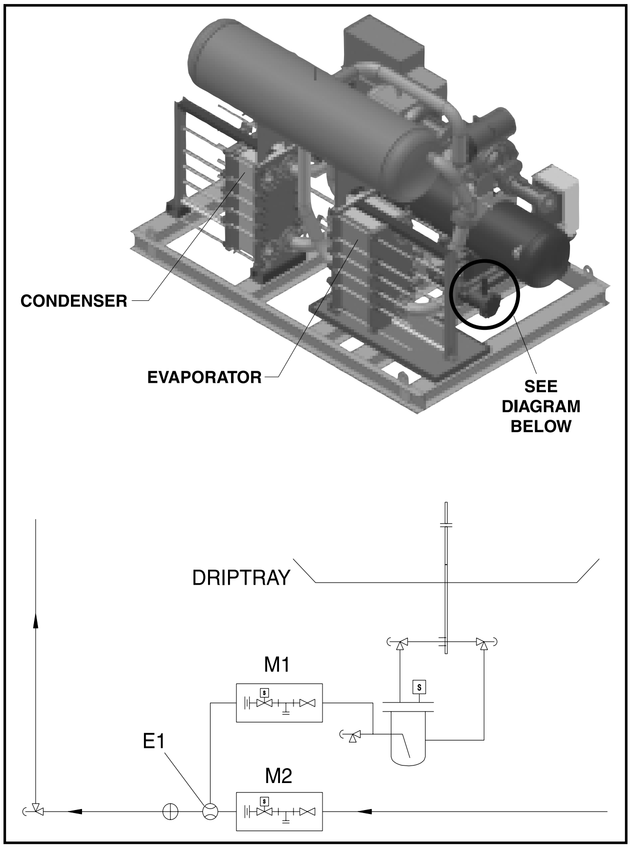


Figure 7

MAINTAINING YOUR POWERPAC™

The operator must be familiar with the unit and this instruction manual to service and maintain the powerPAC™ unit correctly.

Before dismantling any portion of the unit, it is important to make sure that the pressure in the unit or its components has been equalized to atmospheric pressure.

Parts to be dismantled must not contain refrigerant.

Operator safety is improved by using gloves and face protection. It is suggested that a suitable gas mask be at hand.

It is useful to have spare gaskets available for replacement use.

Only use **synthetic oil based on polyalphaolefine** for your powerPAC™ unit. When handling refrigerants, oils, brines etc., personal safety and protection of the environment should have a very high priority.

Only R-717 (ammonia) may be used as refrigerant in powerPAC™ Chiller Units.

TROUBLESHOOTING AND CAPACITY MEASUREMENT

OPERATING CONDITIONS

Variations in pressures and temperatures within the cooling cycle can provide information about the operating state of the chiller package.

Suction and condensing pressures, as well as the temperatures of suction and pressure gas, can provide important information.

Small changes in the variable pressures and temperatures are sufficient to create considerable changes in the operating conditions.

These issues highlight the importance of using the Operating Log.

TROUBLESHOOTING

An error in the system often leads to changes in operating conditions, but not to a total shutdown. For that reason, check the operating state of your powerPAC™ at regular intervals.

Refer to compressor manuals for further detail.

CAPACITY MEASUREMENT

If the system does not produce the capacity indicated, check for possible sources of error. Refer to the troubleshooting table in *Section 2* of the instruction book. Before taking any action, check the possible causes indicated in Tables 1 and 2 below.

INCORRECT CAPACITY MEASURING

The powerPAC™ chiller is equipped with a Frick® Quantum™ control system for control and regulation of the package capacity according to the brine temperature. Quantum™ has a display to read the operating conditions. The pressures and temperatures indicated are not exact. They can only be used to perform approximate capacity calculations. Exact measurements should be calculated in accordance with ASHRAE.

TABLE 1 - EXCESSIVE CONDENSING PRESSURE

Cause	Remedies
Insufficient water flow through the condenser	Adjust water supply or clean the condenser
Fouling in the condenser	Clean the condenser
Overheated cooling water	Get hold of colder cooling water or reduce compressor capacity
The plant is overcharged	Drain R-717 into an empty vessel
Air or noncondensable gases in the system	Remove air from the condenser
A condensing temperature 1°K lower results in a 1% higher cooling performance.	

TABLE 2 - EVAPORATING TEMPERATURE TOO LOW

Causes	Remedies
Fouling in the evaporator	Clean the evaporator
Oil in the evaporator	Inspect the oil return system
Insufficient R-717 charge	Charge more R-717 to the plant.
Overheating should be approximately 32.9 to 35.6°F (0.5 to 2°C) (Quantum™)	
An evaporating temperature 1°K higher results in a 4% higher cooling performance.	

First Aid in case of Ammonia accidents (Chemical formula: NH_3 – refrigerant no. R-717)

GENERAL

Ammonia is easy to identify. It has a strong, distinctive odor that is noticed by most people, even at very low, harmless concentrations. Ammonia serves as its own warning agent so that no one will voluntarily remain in a room in which concentrations have become hazardous. Because ammonia is lighter than air, adequate ventilation is the best means of preventing a concentration.

Experience has shown that ammonia is difficult to ignite and, under normal conditions, it is a very stable compound.

NOTE: In concentrations greater than 15%, ammonia can form ignitable mixtures with air and oxygen. It should always be treated with respect.

Basic rules of First Aid

1. **Call a doctor immediately.**
2. **Be prepared**: Keep an irrigation bottle available, containing a sterile isotonic (0.9%) NaCl–solution (salt water).
3. A shower bath or water tank should be available near all major ammonia installations.
4. Individuals applying first aid should be properly protected to avoid further injury.

INHALATION

1. Move affected personnel into fresh air immediately, and loosen clothing to facilitate breathing.
2. **Call a doctor/ambulance with oxygen equipment immediately**
3. Keep the patient still and warmly wrapped in blankets.
4. If mouth and throat are burnt (freeze or acid burn), let the conscious patient drink water, a little at a time.
5. If the patient is conscious and the mouth is **not** burnt, give hot, sweet tea or coffee (never force feed an unconscious person).
6. Oxygen may be administered, but **only** when authorized by a doctor.
7. If breathing fails, apply artificial respiration.

EYE INJURIES FROM LIQUID SPLASHES OR CONCENTRATED VAPOR

1. Force the eyelids open and rinse eyes immediately for at least 30 minutes with the salt water solution.
2. **Call a doctor immediately.**

SKIN BURNS FROM LIQUID SPLASHES OR CONCENTRATED VAPOR

1. Wash immediately with large quantities of water and continue for at least 15 minutes. Remove contaminated clothing carefully while washing.
2. **Call a doctor immediately.**
3. After washing, apply wet compresses (saturated with a sterile isotonic (0.9%) NaCl solution (salt water)) to affected areas until medical assistance is available.

FOLLOW YOUR COMPANY GUIDELINES FOR PROCESS SAFETY MANAGEMENT (PSM).

PROTECTING THE ENVIRONMENT

Many countries have passed legislation in an effort to reduce pollution and preserve the environment.

Be especially careful with the following substances:

- refrigerants
- cooling media (brines etc)
- lubricating oils

Refrigerants usually have a natural boiling point which lies a good deal below 32° (0°C). This means that liquid refrigerants can be extremely harmful if they come into contact with skin or eyes.

When halocarbon gasses come into contact with open flame or hot surfaces **over approximately 572°F (300°C**) they decompose to produce poisonous chemicals. They have a very strong odor warning us of their presence.

In high concentrations, R-717 causes respiratory problems. When ammonia vapor and air mix 15 to 28 volume %, the combination is explosive and can be ignited by an electric spark or open flame.

Oil vapor in the ammonia vapor increases this risk significantly as the point of ignition falls below that of the mixture ratio stated.

Usually the strong smell of ammonia will give ample warning of its presence before concentrations become dangerous.

The following table shows the values for refrigerant content in air. It is measured in volume %.

⚠ CAUTION **Check official limits in the location of your installation. They may differ from those stated.**

ADDITIONAL FACTS ABOUT R-717:

- Ammonia is easily absorbed by water: At 59°F (15°C), 1.06 qt (1 liter) of water can absorb approximately 1.1 lb (.05-kg) liquid ammonia (or approximately 185 gal. (700 liters) ammonia vapor.
- Even small amounts of ammonia in water are enough to destroy marine life if allowed to pollute waterways and lakes
- Because ammonia is alkaline it will damage plant life if released into the atmosphere in large quantities

Refrigerant evacuated from a refrigeration plant must be charged into refrigerant cylinders intended for this specific refrigerant.

If the refrigerant is not to be reused, **return** it to the supplier or to an authorized incineration plant.

Never mix R-717 with halocarbon refrigerants.

VENTILATING A REFRIGERATION PLANT

If it is necessary to ventilate a refrigeration plant, make sure you observe the following:

- **Never** release refrigerants directly into the atmosphere.

- When ventilating an R-717 plant, you must use an approved air ventilator. **Released air must pass through an open water** container in which the remnants of R-717 refrigerant will be absorbed. Send the water containing R-717 to an authorized incineration plant.

COOLING AGENTS

Standard powerPAC™ units are designed to use glycol as the cooling agent. Other cooling agents include: Salt solutions (brines) of calcium chloride ($CaCl_2$) or sodium chloride (NaCl).

In general, all brines must be considered harmful to nature. Use caution when charging or purging a refrigeration plant.

Never empty brines down a sewer or into the environment.

The brine must be collected in suitable containers, clearly marked with the contents, and sent to an approved incineration plant.

OILS

To lubricate screw compressors included in the powerPAC™ units, use only:

Semisynthetic hydrotreated oil

When changing the oil in the compressors and when emptying the vessels, the used oil must be charged into containers marked ”waste oil” and sent to an approved incineration plant.

NOTE: The owner of the refrigeration plant is responsible for ensuring compliance with all Federal, state, and local regulations. PSM procedures should be routinely followed.

POWERPAC™ PRESTART CHECKLIST

The following items MUST be checked and completed by the installer prior to the arrival of the Frick Field Service Supervisor. Details on the checklist can be found in this manual. Certain items on this checklist will be reverified by the Frick Field Service Supervisor prior to the actual start-up.

Mechanical Checks

__ Confirm that motor disconnect is open
__ Isolate suction pressure transducer
__ Pressure test and leak check unit
__ Evacuate unit
__ Remove motor tunnel cover
__ Remove coupling center and **do not reinstall**
__ Check for correct position of all hand, stop, and check valves prior to charging unit with oil or refrigerant
__ Charge unit with correct type and quantity of oil
__ Lubricate motor bearings (if applicable)
__ Check oil pump alignment (if applicable)
__ Check for correct economizer piping (if applicable)
__ Check separate source of liquid refrigerant supply (if applicable, liquid injection oil cooling)
__ Check water supply for water-cooled oil cooler (if applicable, water cooled oil cooling)
__ Check thermosyphon receiver refrigerant level (if applicable, thermosyphon oil cooling)

Electrical Checks

__ Confirm that main disconnect to motor starter and micro is open
__ Confirm that electrical contractor has seen this sheet, all pertinent wiring information, and drawings
__ Confirm proper power supply to the starter package
__ Confirm proper motor protection (breaker sizing)
__ Confirm that all wiring used is stranded copper and is 14 AWG or larger (sized properly)
__ Confirm all 120 volt control wiring is run in a separate conduit from all high voltage wiring
__ Confirm all 120 volt control wiring is run in a separate conduit from oil pump and compressor motor wiring
__ Confirm no high voltage wiring enters the micro panel at any point
__ Check current transformer for correct sizing and installation
__ Check all point-to-point wiring between the micro and motor starter
__ Confirm all interconnections between micro, motor starter, and the system are made and are correct

After the above items have been checked and verified:

__ Close the main disconnect from the main power supply to the motor starter
__ Close the motor starter disconnect to energize the micro
__ Manually energize oil pump and check oil pump motor rotation
__ Manually energize compressor drive motor and check motor rotation
__ Leave micro energized to ensure oil heaters are on and oil temperature is correct for start-up

Summary: The Frick Field Service Supervisor should arrive to find the above items completed. He should find an uncoupled compressor drive unit (to verify motor rotation) and energized oil heaters with the oil at the proper standby temperatures. Full compliance with the above items will contribute to a quick, efficient and smooth start-up.

The Start-up Supervisor will:

1. Verify position of all valves
2. Verify all wiring connections
3. Verify compressor driver rotation
4. Verify oil pump motor rotation
5. Verify the % of FLA on the micro display
6. Verify and finalize alignment
7. Calibrate slide valve and slide stop
8. Calibrate temperature and pressure readings
9. Correct any problem in the package
10. Instruct operation personnel

Note: Customer connections are to be made per the electrical diagram for the motor starter listed under the installation section and per the wiring diagram found in Frick publication S90-010 M.

Sign this form & fax to 717-762-2422 to confirm completion.

Signed: ______________________________
Print Name: ______________________________
Company: ______________________________

Start-up Report

Sold To: ____________________ Contact Name: ____________________ Date: ____________
End User: ____________________ Contact Name: ____________________ Phone: ____________
End User Address: ____________________ Fax No: ____________
City, State, Zip: ____________________ Start-up Rep. ____________________

Unit General Information

Unit Model # ____________________ Customer Package Identification # ____________________
Compressor Serial # ____________________ Separator National Board # ____________________
Unit Serial # ____________________ Oil Cooler National Board # ____________________
Refrigerant ☐ R-717 ☐ R-22 ☐ R-290 ☐ Other ____________
Lube Oil Type ☐ 2A ☐ 3 ☐ 4 ☐ 9 ☐ Other _______ Design Operating Conditions
Lube System ☐ None ☐ Prelube ☐ Cycling ☐ Full ☐ Demand ______ °Suct./ _____ °Disch.
Oil Cooling ☐ TSOC ☐ WCOC ☐ S-LIOC ☐ D-LIOC ☐ GCOC
Oil Filters ☐ Single ☐ Dual Micro Log I.D. ____________

Micro Information

Micro Type ☐ Quantum ☐ Plus ☐ Standard ☐ Electromechanical U3, U4, U5 Program ________
SBC / CPU Serial # ________ Rev. ___ U24/U35 Program ID/OS Ver # ________ and Date ________
U36 Bios Ver # ______ and Date ________ U42 Keyboard Ver # ________ and Date ________
Digital I/O Board #1 Serial # ________ Rev. ______ U8 Digital I/O Ver # ________ and Date ________
Digital I/O Board #2 Serial # ________ Rev. ______ U8 Digital I/O Ver # ________ and Date ________
Analog Board #1 Serial # ________ Rev. _____ U13 Analog Ver # ________ and Date ________
Analog Board #2 Serial # ________ Rev. _____ U13 Analog Ver # ________ and Date ________

Compressor Motor Information

Manufacturer ____________________ Frame Size ________ H.P. ________ RPM ________
Serial # ____________________ Service Factor ________ Voltage ________ Hz ______ FLA ________
Design ________ Code ________ Bearing Type ☐ Antifriction ☐ Sleeve

Compressor Motor Starter Information

Manufacturer ____________________ Serial # ____________________
Starter Type ☐ WDCT ☐ ATL ☐ Auto-Trans ☐ Solid State ☐ Digital DBS ☐ Standalone DBS
CT Location Checked ☐ CT Phase _____ CT Ratio ______ Transition Time ________ DBS Ver. # ________

Oil Pump Information

Pump Manufacturer ____________ Model # ____________ Serial # ____________
Motor Manufacturer ____________ H.P. ________ RPM ________ Serial # ____________
Service Factor ______ Voltage ______ Hz ________ FLA ________ Design ______ Code _____ Starter Size ____

Special Options

☐ DX Economizer ☐ Frick Supplied Starter ☐ PC Control System ☐ Other

Prestart Checks

☐ Position of all valves ☐ All wiring connections ☐ Motor rotation ☐ Oil pump motor rotation
☐ All micro settings ☐ Cold alignment ☐ Proper oil charge ☐ Installation, Foundation

Factory Setup Options (Quantum™)

☐ RWB II ☐ RWF ☐ RXF ☐ RDB 3-Step ☐ RDB 4-Step ☐ Other ☐ GSV II ☐ GST ☐ GSF ☐ GSB
☐ No Pump ☐ Prelube ☐ Cycling ☐ Full Time ☐ Dual ☐ Oil Filter Transducer ☐ Yes ☐ No
Refrigerant ________ K-Factor for User Defined Refrigerant ________ Slide Valve Travel ________
Dual Dischaarge Control ☐ Enabled ☐ Disabled Liquid Injection Cooling ☐ Enabled ☐ Disabled
Main Oil Injection Control ☐ Enabled ☐ Disabled Balance Piston Setup ☐ Enabled ☐ Disabled
Oil Log Setup ☐ Enabled ☐ Disabled Enable Aux 1 & 2 ☐ None ☐ 1 ☐ 2 ☐ Both

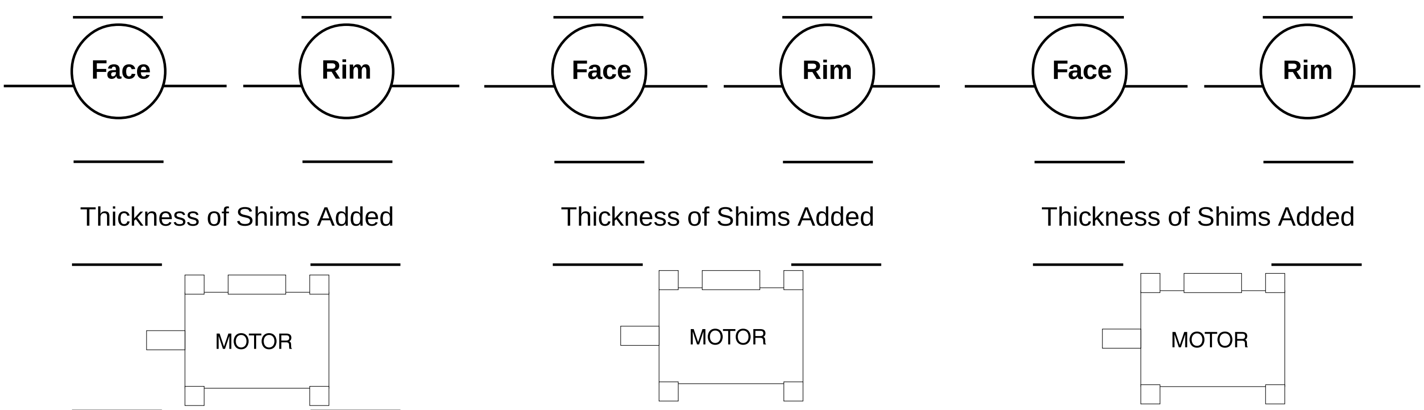
Adjustable Safety Setpoints

High Discharge Pressure Stop Load _____ Force Unload _____ Alarm ______ Delay _____ Shutdown ____ Delay ____
High Discharge Temp. Stop Load _____ Force Unload _____ Alarm ______ Delay _____ Shutdown ____ Delay ____
Motor Amps_____ Volts _____ Service Factor _______ Horsepower _______ CT Factor ______ Recycle Delay ______
Low Motor Amps Shutdown _____ Delay ______ Force Unload Inhibit Delay _______
High Motor Amps Stop Load _____ Force Unload _____ Alarm ______ Delay _____ Shutdown ____ Delay ____
High Oil Temperature Alarm _______ Delay ______ Shutdown ______ Delay ______
Low Oil Temperature Alarm _______ Delay ______ Shutdown ______ Delay ______ High Level Shutdown Delay _____
Low Separator Oil Temp. Alarm _______ Delay ______ Shutdown ______ Delay ______

Drive Train Alignment

Ambient Temperature at Time of Alignment _______ Oil Separator Temperature at Time of Alignment ________
Motor Coupling Type ___________ Size ___________ Distance Between Coupling Hub Faces __________
Soft Foot Check ☐ OK as Found ☐ Shimming Required Amount of Shims used to Correct__________
Indicator Readings in ☐ in./1000 ☐ mm Indicator Clamped to ☐ Motor ☐ Compressor
Indicator Readings Facing ☐ Compressor ☐ Motor Magnetic Center Checked ☐ Marked ☐ N/A
Compressor Coupling Hub Runout___________ Motor Coupling Hub Runout ____________

Initial Cold Alignment | **Initial Hot Alignment** | **Final Hot Alignment**



Operating Log Sheet

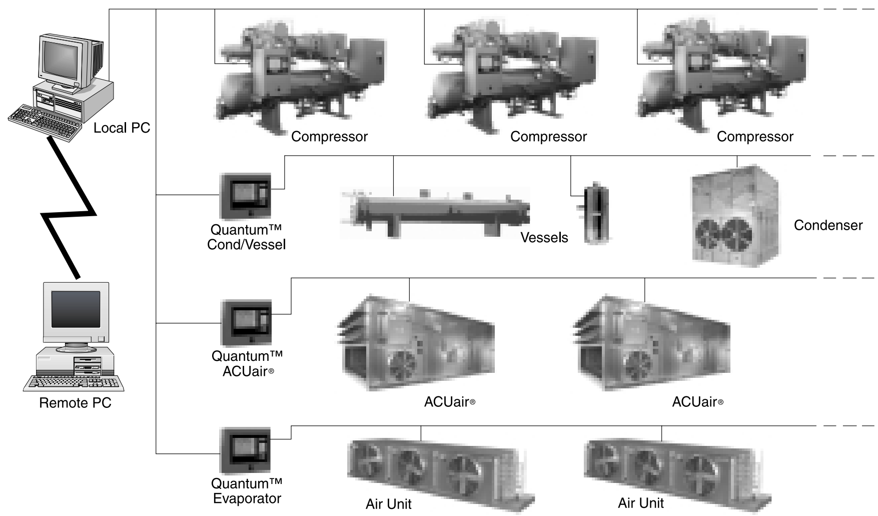
Date							
Time							
Hour Meter Reading							
Equip. Room Temp.							
Suction Pressure							
Suction Temperature							
Suction Superheat							
Discharge Pressure							
Discharge Temperature							
Corresponding Temperature							
Oil Pressure							
Oil Temperature							
Oil Filter Pressure Drop							
Separator Temperature							
Slide Valve Position							
Volume Ratio (VI)							
Motor Amps / FLA %							
Capacity Control Setpoint							
Oil Level							
Oil Added							
Seal Leakage (Drops/Min.)							

INDEX

Q-NET™ network technology...

make the connection with QUANTUM™!

Preengineering = Lower Cost
Totally distributed units means remote control using single cable
Upgradeable



- System integration is what we do…
  - **Q-NET™** supports open-protocols for your SCADA system (i.e. Allen Bradley DF1 and Modbus ASCII)
  - **Q-NET™** connects for local or remote access
  - **Q-NET™** can be applied to both new and existing systems
- **Q-NET™** means precise control 24 hours a day, seven days a week
- **Q-NET™** distributed architecture means faster, easier, economical installations
- **Q-NET™** delivers increased operating efficiency and lowers energy costs

Now available on Frick's ACUair® hygienic air handlers, PowerFlow™ condensers, screw compressors, evaporators, and refrigerant vessels, too.

For more information on how Q-NET™ Network Technology can enhance the performance of your job site, contact Frick® Controls at 717-762-2121 or visit our website (www.frickcold.com) for a complete listing of Frick sales offices and Frick Factor Distributors.

Take full advantage of Q-NET™ technology with all Frick® products!

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