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Installation - Operation - Maintenance

RDB

BOOSTER ROTARY SCREW COMPRESSOR UNITS

ALL REFRIGERANTS

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

SAFETY PRECAUTION DEFINITIONS

DANGER — **Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

WARNING — **Indicates a potentially hazardous situation or practice which, if not avoided, will result in death or serious injury.**

CAUTION — **Indicates a potentially hazardous situation or practice which, if not avoided, will result in damage to equipment and/or minor injury.**

NOTE: — **Indicates an operating procedure, practice, etc., or portion thereof which is essential to highlight.**

PREFACE

This manual has been prepared to acquaint the owner and serviceman with the INSTALLATION, OPERATION, and MAINTENANCE procedures as recommended by Frick for RDB Booster Rotary Screw Compressor Units.

It is most important that these units be properly applied to an adequately controlled refrigeration system. Your authorized Frick representative should be consulted for 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; the piping is properly sized and traps, if necessary, are correctly arranged; the suction line has an accumulator or slugging protection; that load surges are known and provisions made for control; operating cycles and defrosting periods are reasonable; and that high side condensers are sized within system and compressor design limits.

It is recommended that the entering vapor temperature to the compressor be superheated to 10°F above the refrigerant saturation temperature. This ensures that all refrigerant at the compressor suction is in the vapor state.

DESIGN LIMITATIONS

The compressor units are designed for operation within the pressure and temperature limits as shown in Frick Pub. E70-300 SED.

JOB INSPECTION

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

TRANSIT DAMAGE CLAIMS

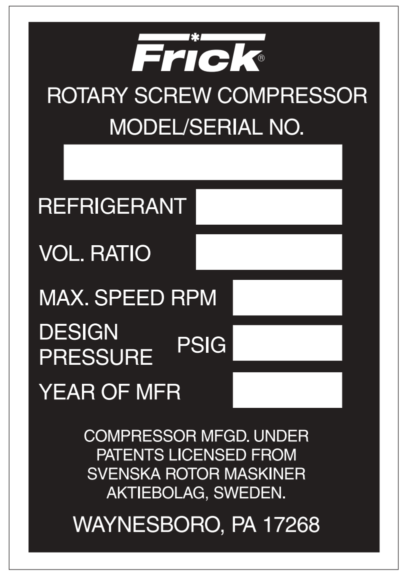
All claims must be made by consignee. This is an ICC requirement. Request immediate inspection by the agent of the carrier and be sure the proper claim forms are executed.

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

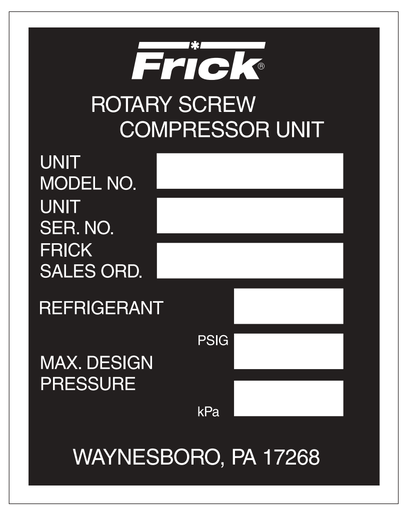
COMPRESSOR and UNIT IDENTIFICATION

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 motor 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

FOUNDATION

Each **RDB** Rotary Screw Compressor Unit is shipped mounted on a wood skid which must be removed prior to unit installation. **NOTE: Allow space for servicing both ends of the unit. A minimum of 36 inches is recommended.**

The first requirement of the compressor foundation is that it must be able to support the weight of the compressor package including coolers, 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 compressor package to a suitable foundation by proper application of grout and elimination of piping stress imposed on the compressor is the best insurance for a trouble free installation. Use only the certified general arrangement drawings from Frick to determine the mounting foot 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 should be a minimum of 6 inches of reinforced concrete and housekeeping pads are recommended. Anchor bolts are required to firmly tie the unit to the floor. Once the unit is rigged into place (See RIGGING and HANDLING), the feet must then be shimmed in order to level the unit. The shims should be placed to position the feet roughly one inch above the housekeeping pad to allow room for grouting. An expansion-type epoxy grout must be worked under all areas of the base with no voids and be allowed to settle with a slight outward slope so oil and water can run off of the base.

When installing on a steel base, the following guidelines should be implemented to properly design the system base:

1. Use I-beams in the skid where the screw compressor will be attached to the system base. They should run parallel to the package feet and support the feet for their full length.
2. The compressor unit feet should be continuously welded to the system base at all points of contact, or bolted.
3. The compressor unit should not be mounted on vibration isolators in order to hold down package vibration levels.
4. The customer's foundation for the system base should fully support the system base under all areas, but most certainly under the I-beams that support the compressor package.

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. The mounting and support of suction and discharge lines is also very important. Rubber or spring pipe supports may be required to avoid exciting the building structure at any pipe supports close to the compressor package. It is best to employ a vibration expert in the design of a proper mounting arrangement.

In any screw compressor installation, suction and discharge lines should be supported in pipe hangers (preferably within 2 ft of vertical pipe run) so that the lines won't move if disconnected from the compressor. See table for Allowable Flange Loads.

A licensed architect should be consulted to determine the proper foundation requirements for any large engine or turbine drive.

ALLOWABLE FLANGE LOADS

NOZ. SIZE NPS	MOMENTS (ft-lbf)			LOAD (lbf)		
	AXIAL M_R	VERT. M_C	LAT. M_L	AXIAL P	VERT. V_C	LAT. V_L
1	25	25	25	50	50	50
1.25	25	25	25	50	50	50
1.5	50	40	40	100	75	75
2	100	70	70	150	125	125
3	250	175	175	225	250	250
4	400	200	200	300	400	400
5	425	400	400	400	450	450
6	1000	750	750	650	650	650
8	1500	1000	1000	1500	900	900
10	1500	1200	1200	1500	1200	1200
12	1500	1500	1500	1500	1500	1500
14	2000	1800	1800	1700	2000	2000

When applying screw compressors at high pressures, the customer must be prepared for package vibration and noise higher than the values predicted for normal refrigeration duty. 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.

RIGGING and HANDLING

CAUTION

THIS SCREW COMPRESSOR PACKAGE MAY BE TOP-HEAVY. USE CAUTION IN RIGGING AND HANDLING.

The unit can be moved with rigging, using a crane or forklift, by hooking into the four lifting eyes on the compressor and motor bases. If no motor is mounted, the lifting ring should be moved to the compressor side of the center of the unit because 60 percent of the weight is toward the compressor end. If a motor is mounted appropriate adjustment in the lifting point should be made to compensate for motor weight. Adjustment of the lifting point must also be made for any additions to the standard package such as an external oil cooler, etc., as the center of balance will be affected.

The unit can be moved with a forklift by forking under the skid, or it can be skidded into place with pinch bars by pushing against the skid. **NEVER MOVE THE UNIT BY PUSHING OR FORKING AGAINST THE SEPARATOR SHELL OR ITS MOUNTING SUPPORTS.**

SKID REMOVAL

If the unit is rigged into place the skid can be removed by taking off the nuts and bolts that are fastening the unit mounting supports to the skid before lowering the unit onto the mounting surface.

If the unit is skidded into place remove the cross members from the skid and remove the nuts anchoring the unit to the skid. Using a 5 ton jack under the separator raise the unit at the compressor end until it clears the two mounting bolts. Spread the skid to clear the unit mounting support, then lower the unit to the surface. Repeat procedure on opposite end.

MOTOR MOUNTING

The following procedure is required only when the motor is mounted at the job site.

1. Thoroughly clean the motor feet and mounting pads of grease, burrs, and other foreign matter to ensure firm seating of the motor.

2. Attach the motor to the base using the bolts and motor raising blocks, if required. Bolt snugly through the base. The raising blocks, if 2 inches or higher, should be tack welded to the motor base support rails after being permanently located.

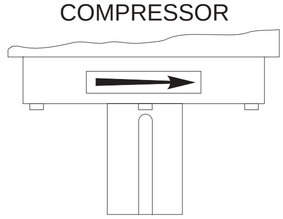
3. Weld the four kick bolts into place so that they are positioned to allow movement of the motor feet.

4. Now that the motor has been set, check to see that the shafts are properly spaced for the coupling being used. Refer to the coupling data tables for the applicable dimension.

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.



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. **COMPRESSOR ROTATION IS CLOCKWISE WHEN FACING COMPRESSOR SHAFT.** After verification, install gear or disk drive spacer, as applicable.

COMPRESSOR/MOTOR COUPLINGS INSTALLATION

RDB PLUS units are arranged for direct motor drive and require a flexible drive coupling to connect the compressor to the motor. Before installing, perform the following:

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.

CH COUPLING – The T.B. Woods Elastomeric CH Coupling is used in most applications up to 600 HP. It consists of two drive hubs and a loose, gear-type Hytrel 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. Install as follows:

1. 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.

2. Hold the elastomeric gear between the hubs and slide both hubs onto the gear to fully engage the mating teeth. Make sure that the keys on the compressor and motor halves of the coupling are offset 180° (see Figure 1). 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.

3. 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.**

4. Proceed to Coupling Alignment.

COUPLING/SHAFT KEYS ALIGNMENT

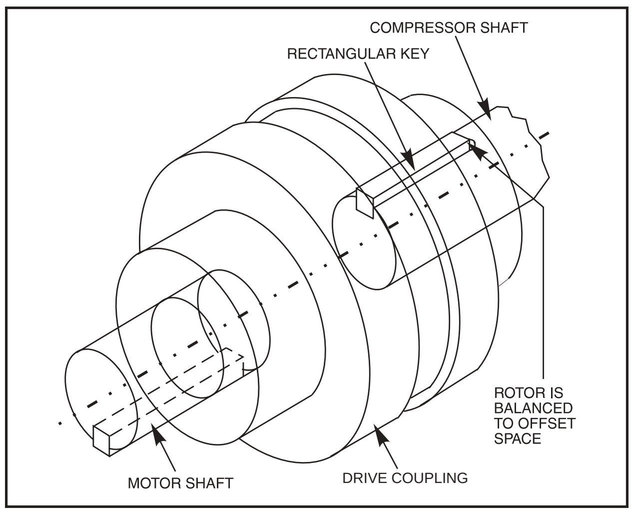


Figure 1

CH COUPLING DATA TABLE

CH COUPLING SIZE	BETWEEN SHAFT SPACING MIN*		BETWEEN SHAFT SPACING MAX		COUPLING HUB SHAFT ENGAGEMENT MIN		COUPLING HUB SHAFT ENGAGEMENT MAX		COUPLING HUB FACE SPACING		MAX TOTAL INDICATOR READING		CLAMP BOLT TORQUE (DRY)		CLAMP BOLT SIZE	KEYWAY SETSCREW TORQUE	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	ft-lb	Nm		ft-lb	Nm
8	3 13/16	96.8	4	101.6	1 1/16	27.0	1 13/16	46.0	1 1/8	28.6	.004	.104	55	74.6	3/8 - 24 UNF	13	17.6
9	4 5/16	109.5	5 7/16	138.1	1 7/16	36.5	2 3/16	61.9	1 7/16	36.5	.004	.104	55	74.6	3/8 - 24 UNF	13	17.6
10	4 5/16	109.5	6 3/8	161.9	1 11/16	42.9	2 9/16	65.1	1 11/16	42.9	.004	.104	130	176.4	1/2 - 20 UNF	13	17.6
11	4 7/8	123.8	5 7/8	149.2	2	50.8	2 7/8	73.0	1 7/8	47.6	.004	.104	130	176.4	1/2 - 20 UNF	13	17.6

* Required for shaft seal removal.

DBZ-B COUPLING – The Thomas DBZ-B coupling is used on applications above 600 HP and **MUST** be used with all sleeve bearing motors that do not have axial end float constraint. The DBZ-B coupling consists of two drive hubs and a flexible metal disc drive spacer that is bolted to both hubs. A flexible steel disc pack serves as the drive element. This disc pack is bolted to the coupling hubs and prevents axial end float between the compressor and motor shafts which may occur with sleeve bearing motors. On sleeve bearing motors, the magnetic center must be determined and maintained by securing the coupling to the motor shaft with the shaft properly located.

CAUTION

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

If the motor is coupled to the compressor using a fixed-end-play coupling, such as a DBZ-B coupling, and the motor is not properly centered, additional thrust loads will be transmitted to the compressor bearings that could result in premature bearing failure. Install as follows:

1. Remove the eight locknuts and long bolts attaching the center member to the disc pack.

2. Slide the disc pack and coupling hub assemblies onto their respective shafts.

3. Adjust the distance between hub faces as specified in the DBZ-B Data Table by sliding the hubs. Key and secure hubs to the shafts by tightening setscrews.

4. Reinstall the eight previously removed bolts and locknuts. Alternately tighten each locknut as you would the lug nuts on an automobile. **NOTE: ALWAYS TURN THE NUT - NEVER THE BOLT.**

5. Torque the locknuts to the value shown in the DBZ-B Data Table for the size coupling being installed.

CAUTION

Lubricated and/or plated bolts and locknuts develop higher bolt tension with less tightening than those that are dry and not plated.

Torques for lubricated and/or plated bolts and locknuts will generally fall in the lower range, while those that are dry or as received from the factory fall into the upper range. Torque readings should be observed while locknut is being turned.

6. Proceed to Coupling Alignment.

DBZ-B COUPLING DATA TABLE

DBZ-B COUPLING SIZE	HUB FACE				MAXIMUM TOTAL INDICATOR READING		CLAMP BOLT		
	SPACING		+/-				TORQUE (LUBE)		SIZE
	in.	mm	in.	mm	in.	mm	ft-lb	Nm	
226	3 13/16	96.8	1/64	.40	.003	.076	14	19.5	5/16 - 24 UNRF
263	4 5/16	109.5	1/32	.79	.004	.102	22	30.6	3/8 - 24 UNRF
301	4 7/8	123.8	1/32	.79	.004	.102	37	51.5	7/16 - 20 UNRF
351	5 7/8	149.2	1/32	.79	.004	.102	55	76.5	1/2 - 20 UNRF
401	6 11/16	169.9	1/32	.79	.004	.102	49	68.2	1/2 - 20 UNRF

WARNING

ALL ROTATING POWER TRANSMISSION EQUIPMENT IS POTENTIALLY DANGEROUS. ENSURE THAT THE COUPLINGS ARE PROPERLY GUARDED PRIOR TO TURNING ON THE POWER. COUPLING GUARDS ARE PROVIDED WITH THE EQUIPMENT AND MUST BE IN PLACE AND SECURED PROPERLY WHILE THE EQUIPMENT IS IN OPERATION.

COUPLING ALIGNMENT PROCEDURE

The life of the compressor shaft seal and bearings, as well as the life of the motor bearings, is dependent upon proper coupling alignment. Couplings may be aligned at the factory but realignment **MUST ALWAYS** be done on the job site after the unit is securely mounted on its foundation. Initial alignment must be made prior to start-up and rechecked after a few hours of operation. Final (HOT) field alignment can only be made when the unit is at operating temperature. After final (HOT) alignment has been made and found to be satisfactory for approximately one week, the motor may be dowelled to maintain alignment.

NOTE: Frick recommends cold aligning the motor .005" high. This cold misalignment compensates for thermal growth when the unit is at operating temperature.

The following procedure is applicable to both the CH and DBZ-B couplings. Dial indicators are to be used to measure the angular and parallel shaft misalignment. Coupling alignment is attained by alternately measuring angular and parallel misalignment and repositioning the motor until the misalignment is within specified tolerances.

⚠WARNING **ALWAYS LOCK OUT MAIN MOTOR DISCONNECT BEFORE TOUCHING MOTOR SHAFT. MISALIGNMENT MUST NOT EXCEED .004" FOR ALL CH AND DBZ-B COUPLINGS.**

ANGULAR ALIGNMENT

1. To check angular alignment, as shown in Figure 2, attach dial indicator rigidly to the motor hub. Move indicator stem so it is in contact with the outside face of compressor hub, as shown in Figure 3.

NOTE: When DBZ-B couplings are used on motors with sleeve bearings, it is necessary to secure the two coupling hubs with a bolt to prevent them from drifting apart when rotating.

2. Rotate both coupling hubs several revolutions until they seek their normal axial positions.

Check the dial indicator to be sure that the indicator stem is slightly loaded so as to allow movement in both directions.

3. Set the dial indicator at zero when viewed at the 12 o'clock position, as shown in Figure 3.

4. Rotate both coupling hubs together 180° (6 o'clock position), as shown in Figure 4. At this position the dial indicator will show TOTAL angular misalignment.

NOTE: The use of a mirror is helpful in reading the indicator dial as coupling hubs are rotated.

5. Loosen motor anchor bolts and move or shim motor to correct the angular misalignment.

After adjustments have been made for angular misalignment retighten anchor bolts to prevent inaccurate readings. Repeat Steps 3 through 5 to check corrections. Further adjustments and checks shall be made for angular misalignment until the total indicator reading is within the specified tolerance .004" total indicator runout (T.I.R.).

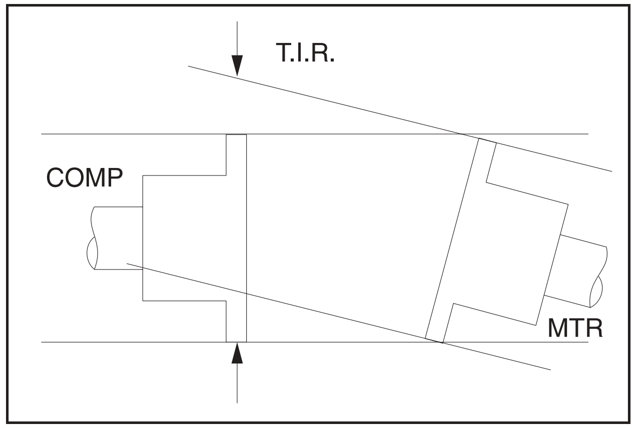


Figure 2 - Angular Misalignment

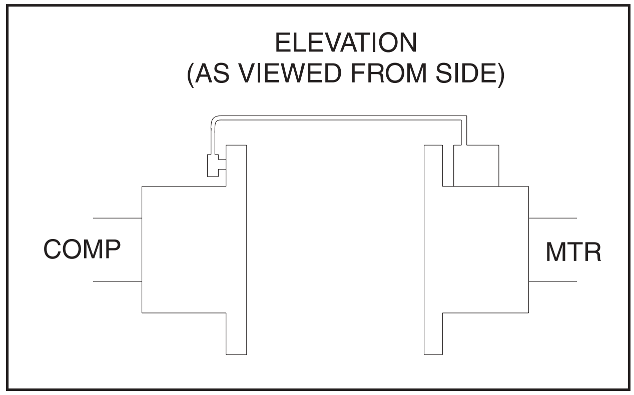


Figure 3 - Dial Indicator Attached (at 12 O'clock)

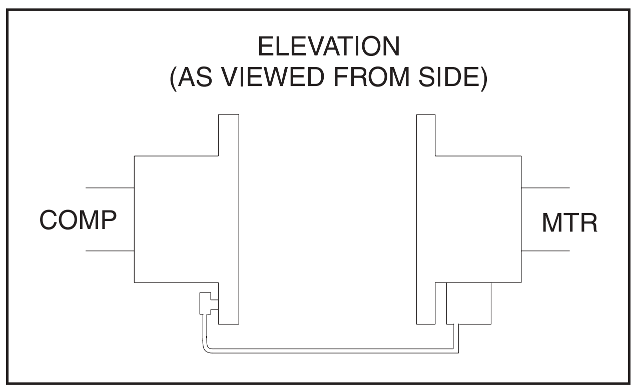


Figure 4 - Dial Indicator at 6 O'clock

PARALLEL ALIGNMENT

6. To check parallel alignment, as shown in Figure 5, reposition dial indicator so the stem is in contact with the rim of the compressor hub, as shown in Figure 6.

Check the dial indicator to be sure that the indicator stem is slightly loaded so as to allow movement in both directions.

7. Check parallel height misalignment by setting dial indicator at zero when viewed at the 12 o'clock position. Rotate both coupling hubs together 180° (6 o'clock position). At this position the dial indicator will show TWICE the amount of parallel height misalignment.

8. Loosen motor anchor bolts and add or remove shims under the four motor feet until parallel height misalignment is within specified tolerance when anchor bolts are retightened.

CAUTION **Care must be used when correcting for parallel misalignment to ensure that the axial spacing and angular misalignment is not significantly disturbed.**

9. After the parallel height misalignment is within tolerance, repeat Steps 1 through 5 until angular misalignment is within specified tolerance.

10. Check parallel lateral misalignment by positioning dial indicator so the stem is in contact with the rim of the compressor hub at 3 o'clock, as shown in Figure 7.

Set indicator at zero and rotate both coupling hubs together 180° (9 o'clock position), as shown in Figure 6.

Adjust parallel lateral misalignment using the motor adjusting screws until reading is within specified tolerance.

11. Recheck angular misalignment and realign if necessary.

12. Tighten motor anchor bolts and rotate both coupling hubs together, checking the angular and parallel misalignment through the full 360° travel at 90° increments. If dial readings are in excess of specified tolerance realign as required.

13. When the coupling hubs have been aligned to within specified tolerance, a recording of the cold alignment must be made for unit records and usage during hot alignment.

CAUTION **Install the coupling guard before operating the compressor.**

CAUTION **When installing drive spacer, make sure that hub spacing is within limits shown on the Coupling Data Table applicable to the coupling being installed and that the clamping bolt(s) are properly torqued.**

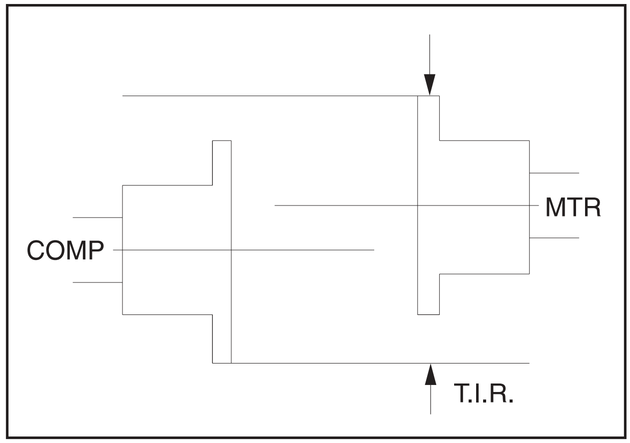


Figure 5 - Parallel Misalignment

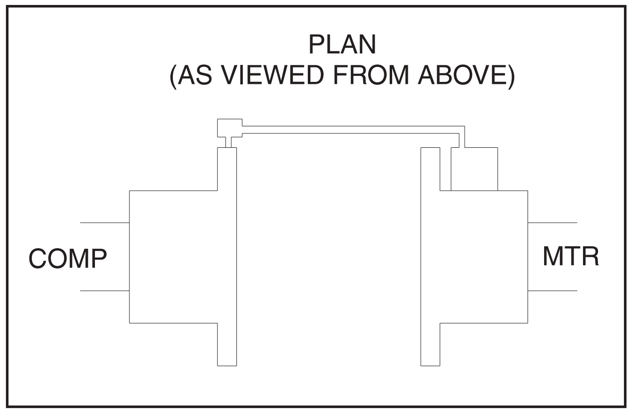


Figure 6 - Dial Indicator Attached (at 9 O'clock)

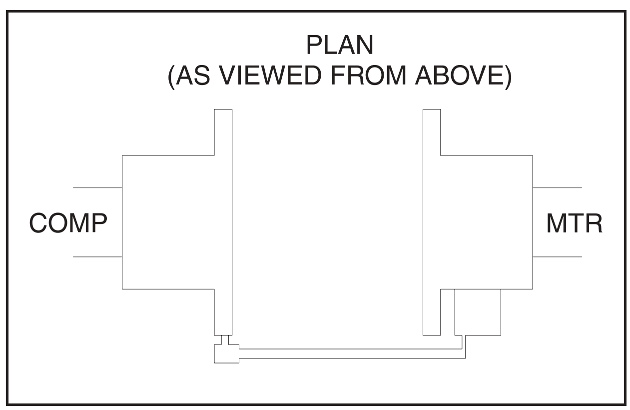


Figure 7 - Dial Indicator at 3 O'clock

HOT ALIGNMENT OF COMPRESSOR/MOTOR

Hot alignments can only be made after the unit has operated for several hours and all components are at operating temperatures.

Shut the unit down and quickly affix a dial indicator to the motor hub, then take readings on both the face and rim of the compressor hub. If these readings are within tolerance, record the readings, attach coupling guard and restart unit. Check again after 200 hours of run time while the unit is at operating temperature. If the readings are not within limits, compare the hot alignment readings with the cold alignment and adjust for the difference; i.e., if the rim readings at 0° and 180° indicate that the compressor rises .005" between the cold alignment check and the hot alignment check, .005" of shims should be added under the motor base. After the initial hot alignment adjustment is made, restart unit and bring to operating temperature. Shut down and recheck hot alignment. Repeat procedure until hot alignment is within specified tolerance.

NOTE: Liquid injection oil cooled units will typically experience less thermal growth of the compressor than units with external oil coolers due to the lower operating discharge temperatures, however hot alignment is always necessary.

⚠ CAUTION **INSTALL COUPLING GUARD BEFORE OPERATING COMPRESSOR.**

OIL PUMP COUPLING

RDB Booster units utilize full lube oil pumps which have the motor separate from the pump. These must be checked for alignment due to possible misalignment which may be caused by shipping and handling. Adjustments for parallel and angular alignment must be made to assure that maximum misalignment is less than 0.010 Total Indicator Runout (T.I.R.). Failure to align the coupling may cause serious damage to the pump, shaft seal, coupling, and motor bearings. Use the same procedure as compressor/motor coupling.

HOLDING CHARGE and STORAGE

Each RDB Booster compressor unit 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.

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 in Frick compressors 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 publication E160-802 SPC for guidance.

If the unit is to be installed in an existing system, contact FRICK to determine system oil compatability.

OIL CHARGE

The normal charging level is midway in the top sight glass located midway along the oil separator shell. Normal operating level is midway between the top sight glass and bottom sight glass. The following table gives the approximate oil charge quantity.

TABLE - BASIC OIL CHARGE (Gal)

RDB PLUS MODEL	BASIC* CHARGE (Gal)
100	40
134	40
177	65
222	65
316	110
399	140
546	170

* Includes total in oil separator and piping. Additional oil provided for oil cooler.

Add oil by attaching the end of a suitable pressure type hose to the oil charging valve, located on the top of the oil separator between the compressor and motor. Using a pressure-type pump and the recommended Frick oil, open the charging valve and pump oil into the separator. **NOTE: Fill slowly because oil will fill up in the separator faster than it shows in the sight glass.**

Oil distillers and similar equipment which act to trap oil must be filled prior to unit operation to normal design outlet levels. The same pump used to charge the unit may be used for filling these auxiliary oil reservoirs.

NOTE: The sight glass located in the coalescing end of the separator near the discharge connection should remain empty.

OIL FILTER(S)

CAUTION

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

The oil filter(s) and coalescer filter element(s) shipped with the unit are best suited to ensure proper filtration and operation of the system.

OIL HEATER(S)

Standard units are equipped with a 500 watt oil heater(s), providing sufficient heat to maintain the oil temperature for most indoor applications during shutdown cycles to permit safe start-up. Should additional heating capacity be required because of unusual environmental condition, contact Frick. The heater(s) is energized only when the unit is not in operation.

WARNING

Do not energize the heater(s) when there is no oil in the unit, otherwise the heater(s) will burn out. The oil heater(s) will be energized whenever 120 volt control power is applied to the unit and the compressor is not running unless the 15 amp circuit breaker in the junction box is first turned off.

LIQUID INJECTION OIL COOLING

The liquid injection system provided on the unit is self-contained but requires the connection of the liquid line sized as shown in the table and careful insertion of the expansion valve bulb into the thermowell provided in the separator. High pressure gas is connected through the regulator to the external port on the liquid injection valve to control oil temperature. Refer to the liquid injection piping diagram.

NOTE: For booster applications the high pressure gas connection must be taken from a high side source (high-stage compressor discharge). This should be a 3/8" line connected into the solenoid valve provided. This gas is required by the expansion valve external port to control oil temperature.

It is **IMPERATIVE** that an uninterrupted supply of high pressure liquid refrigerant be provided to the injection system at all times. Two items of **EXTREME IMPORTANCE** are the design of the receiver/liquid injection supply and the size of the liquid line.

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

The dual dip tube method (see Figure 8) uses two dip tubes in the receiver. The liquid injection tube is below the evaporator tube to assure continued oil cooling when the receiver level is low.

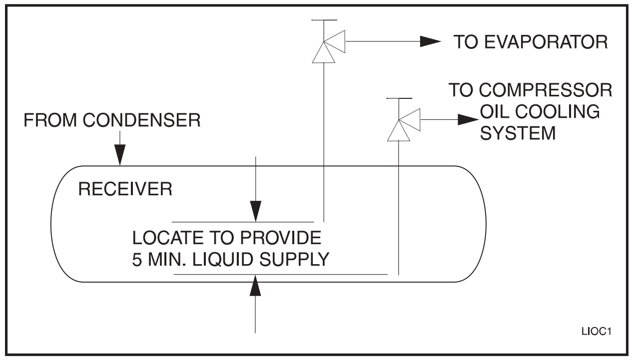


Figure 8

The level control method (see Figure 9) utilizes a float level control on the receiver to close a solenoid valve feeding the evaporator when the liquid falls below that amount necessary for 5 minutes of liquid injection oil cooling.

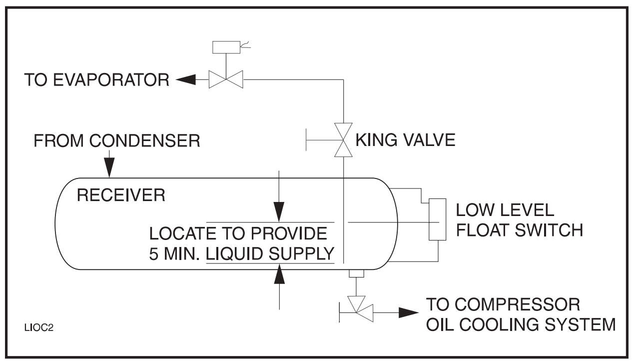


Figure 9

LIQUID LINE SIZES/RECEIVER VOLUME

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:

RDB MODEL	LINE SIZE * SCH 80 PIPE	LINE SIZE * OD TUBING	POUND PER 5 MIN.	LIQUID VOLUME CU FT
R-717				
100–134	1/2	—	20	0.5
177–222	3/4	—	30	1.0
316–399	1	—	40	1.5
546	1	—	60	2.0
R-22				
100–134	3/4	7/8	44	0.6
177–222	3/4	7/8	59	0.8
316–399	1	7/8	92	1.2
546	1	1-1/8	125	1.7

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

THERMOSYPHON OIL COOLING

Thermosyphon oil cooling is an economical, effective method for cooling oil on screw compressor units. Thermosyphon cooling utilizes liquid refrigerant at condenser pressure and temperature that is partially vaporized at the condenser temperature in a plate and shell vessel, cooling the oil to within 15°F of that temperature. The vapor, at condensing pressure, is vented to the condenser inlet and reliquified. This method is the most cost effective of all currently applied cooling systems since no compressor capacity is lost or compressor power penalties incurred. The vapor from the cooler need only be condensed, not compressed. Refrigerant flow to the cooler is automatic, driven by the thermosyphon principle and cooling flow increases as the oil inlet temperature rises.

EQUIPMENT - The basic equipment required for a thermosyphon system consists of:

1. A source of liquid refrigerant at condensing pressure and temperature, located in close proximity to the unit to minimize piping pressure drop. The liquid level in the refrigerant source must be 6 to 8 feet minimum above the center of the oil cooler.

2. A plate and shell oil cooler with:

Plate Side: Oil 400 psi design
Shell Side: Refrigerant 400 psi design

Due to the many variations in refrigeration system design and physical layout, several systems for assuring the above criteria are possible.

SYSTEM OPERATION - Liquid refrigerant fills the cooler shell side up to the Thermosyphon receiver liquid level.

Hot oil (above the liquid temperature) flowing through the cooler will cause some of the refrigerant to boil and vaporize. The vapor rises in the return line. The density of the refrigerant liquid/vapor mixture in the return line is considerably less than the density of the liquid in the supply line. This imbalance provides a differential pressure that sustains a flow condition to the oil cooler. This relationship involves:

1. Liquid height above the cooler.
2. Oil heat of rejection.
3. Cooler size and piping pressure drops.

Current thermosyphon systems are using two-pass oil coolers and flow rates based on 3:1 overfeed.

The liquid/vapor returned from the cooler is separated in the receiver. The vapor is vented to the condenser inlet and need only be reliquified since it is still at condenser pressure.

OIL TEMPERATURE CONTROL - Oil temperature will generally run about 15 - 35°F above condensing temperature. In many cases, an oil temperature control is not required if condensing temperature is above 65°F as oil temperature can be allowed to float with condenser temperature.

Condensing Temperature:	65°F - 105°F
Oil Temperature:	80°F - 140°F

INSTALLATION - The plate and shell type thermosyphon oil cooler with oil-side piping and a thermostatically controlled mixing valve (if ordered) are factory mounted and piped. The customer must supply and install all piping and equipment located outside of the shaded area on the piping diagram with consideration given to the following:

1. The refrigerant source, thermosyphon or system receiver, should be in close proximity to the unit to minimize piping pressure drop.

2. The liquid level in the refrigerant source must be **6** to **8 feet minimum** above the center of the oil cooler.

3. A safety valve should be installed if refrigerant isolation valves are used for the oil cooler.

The component and piping arrangement shown in Figure 10 is intended only to illustrate the operating principles of thermosyphon oil cooling. Other component layouts may be better suited to a specific installation. Refer to publication E70-900E for additional information on Thermosyphon Oil Cooling.

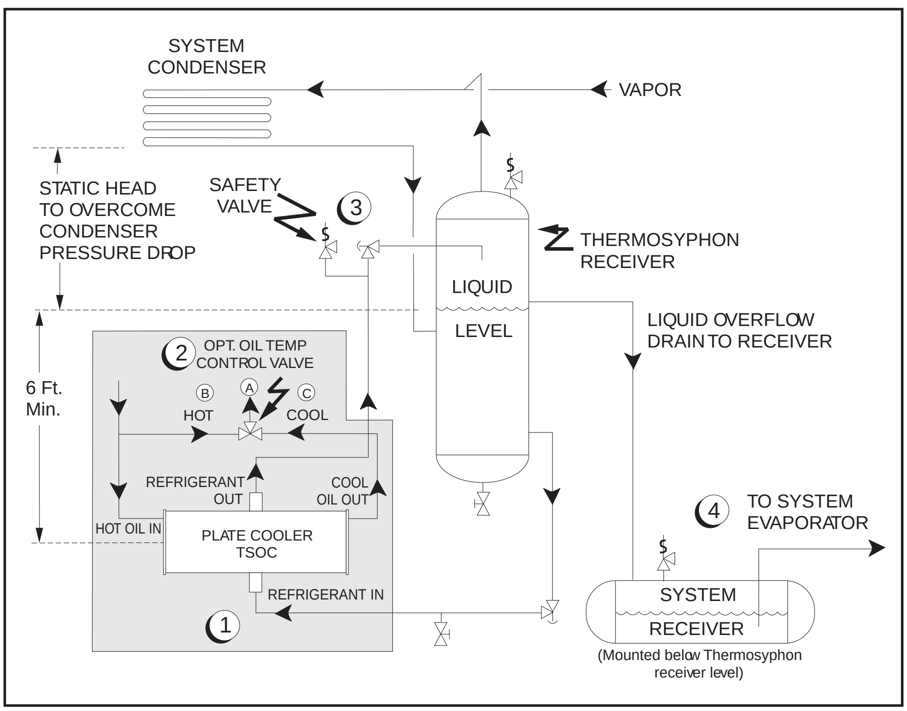


Figure 10

1. The thermosyphon oil cooler is supplied with the oil side piped to the compressor unit and stub ends supplied on the refrigerant side.
2. A three-way oil temperature control valve is 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. The system receiver must be below the thermosyphon receiver in this arrangement.

WATER-COOLED OIL COOLING (OPTIONAL)

The plate and shell type water-cooled oil cooler is mounted on the unit complete with all oil piping. The customer must supply adequate water connections and install the two-way water regulating valve if ordered in lieu of a three-way oil temperature valve. It is recommended (local codes permitting) that the water regulator be installed on the water outlet connection. Insert the water regulator valve bulb and well in the chamber provided on the oil outlet connection. Determine the size of the water-cooled oil cooler supplied with the unit, then refer to table for the water connection size. **The water supply must be sufficient to meet the required flow.**

Frick recommends a closed-loop system for the waterside of the oil cooler. Careful attention to water treatment is essential to ensure adequate life of the cooler if cooling tower water is used. **It is imperative that the condition of cooling water and closed-loop fluids be analyzed regularly and as necessary and maintained at a pH of 7.4, but not less than 6.0 for proper heat exchanger life.** After initial start-up of the compressor package, the strainer at the inlet of the oil cooler should be cleaned several times in the first 24 hours of operation.

In some applications, the plate and shell oil cooler may be subjected to severe water conditions, including high temperature and/or hard water conditions. This causes accelerated scaling rates which will penalize the performance of the heat exchanger. A chemical cleaning process will extend the life of the Plate and Shell heat exchanger. It is important to establish regular cleaning schedules.

Cleaning: A 3% solution of Phosphoric or Oxalic Acid is recommended. Other cleaning solutions can be obtained from your local distributor, but they must be suitable for stainless steel. The oil cooler may be cleaned in place by back flushing with recommended solution for approximately 30 minutes. After back flushing, rinse the heat exchanger with fresh water to remove any remaining cleaning solution.

NOTE: The water-regulating valve shipped with the unit will be sized to the specific flow for the unit.

OIL COOLER DATA TABLE

RDB MODEL	TYPICAL COOLER	INLET/OUTLET CONNECTION
100 - 222	66 Plates	2"
316	116 Plates	3"
399 - 546	190 Plates	3"

ELECTRICAL

NOTE: Before proceeding with electrical installation, read the instructions for "Proper Installation of Electronic Equipment in an Industrial Environment".

RDB Booster units are supplied with a *QUANTUM* control system. Care must be taken that the controls are not exposed to physical damage during handling, storage and installation. The single box control door must be kept tightly closed to prevent moisture and foreign matter from entry.

NOTE: All customer connections are made in the single box control mounted on the oil separator. This is the ONLY electrical enclosure and it should be kept tightly closed whenever work is not being done in it.

MOTOR STARTER PACKAGE

Motor starter and interlock wiring requirements are shown in the wiring diagram, above. All the equipment shown is supplied by the installer unless a starter package is purchased from Frick. Starter packages should consist of:

1. The compressor motor starter of the specified HP and voltage for the starting method specified (across-the-line, autotransformer, wye-delta, or solid state).

NOTE: If starting methods other than across-the-line are desired, a motor/compressor torque analysis must be done to ensure that sufficient starting torque is available, particularly in booster applications. Contact FRICK if assistance is required.

2. If specified, the starter package can be supplied as a combination starter with circuit breaker disconnect. However, the motor overcurrent protection/disconnection device can be applied by others, usually as a part of an electrical power distribution board.

3. The oil pump starter with fuses, or in the case where the compressor motor is a different voltage from the oil pump motor, with a circuit breaker disconnect suitable for separate power feed.

4. A 2.0 KVA control power transformer (CPT) to supply 120 volt control power to the microprocessor control system and separator oil heaters is included. If environmental conditions require more than the usual two 500 watt oil heaters, an appropriately oversized control transformer will be required. If frequent power fluctuations are anticipated or extremely noisy power lines are encountered, a regulating control transformer should be considered. Contact FRICK for assistance.

5. For customer-supplied across-the-line starters, a shunting devicemust be installed across the Current Transformer (terminals 3 & 4 as shown in Figure 11).

⚠ CAUTION **If the shunting device is not installed, the SBC board may be severly damaged at start-up.**

6. One each normally open compressor motor and oil pump motor starter auxiliary contact should be supplied and in addition to the compressor and oil pump motor starter coils, the CT and CPT secondaries wired as shown on the starter package wiring diagram. The load on the control panel for the compressor motor starter coil should not exceed 1 Nema size 3 starter. For larger starters, an interposing relay must be used to switch the compressor motor starter coil(s).

NOTE: Do not install a compressor HAND/OFF/AUTO switch in the starter package as this would bypass the compressor safety devices.

7. The compressor motor Current Transformer (CT) is installed on any one phase of the compressor leads.

NOTE: The CT must see all the current of any one phase, therefore in wye-delta applications BOTH leads of any one phase must pass through the CT.

In addition to the starter package interlocks shown on the starter package diagram, the following optional interlocks are on the typical RDB Booster Screw Compressor unit with the SBC Microprocessor Control System wiring diagram:

Remote LOAD, UNLOAD, and RUN interlocks in case the customer desire to operate the unit from a remote control device.

Alarm Horn output.

Control solenoid valve for the economizer option.

For customer control options, consult FRICK.

NOTE: The *QUANTUM* microprocessor will not operate without U24 and U35 EPROM chips installed. When U24 and U35 EPROM chips are not installed, the screen will display:

System Board Initialized
No boot device available,
Press Enter to continue

NOTE: The PLUS Panel microprocessor will not operate without EPROM chips installed. When EPROM chips are not installed, the microprocessor display will only indicate a dash in the upper left hand corner of the display.

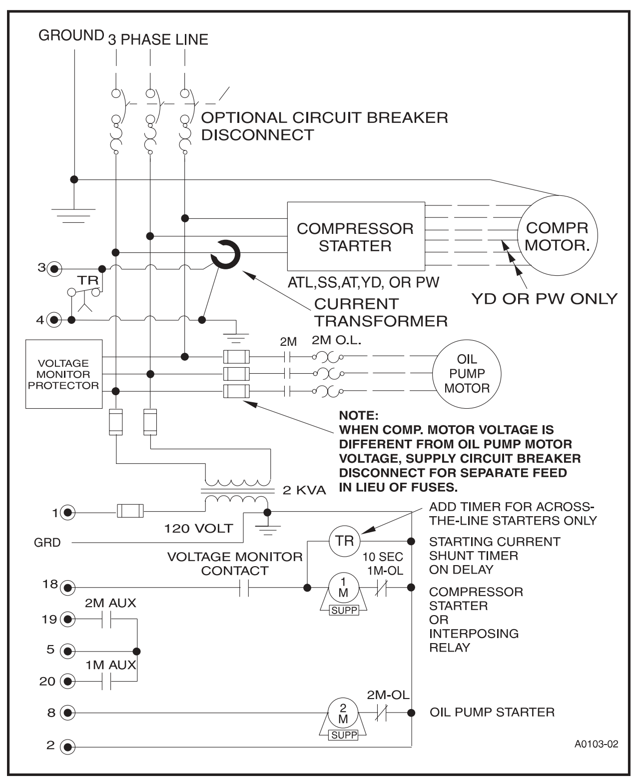


Figure 11

NOTE: Customer ground required, see wiring diagram.

CURRENT TRANSFORMER (CT) RATIOS

The CT ratio for various motor sizes (with a 5 amp secondary) is given in the following table:

HP	VOLTAGE 200	230	380	460	575	2300	4160
20	100:5	100:5	50:5	50:5	50:5	-	-
25	100:5	100:5	50:5	50:5	50:5	-	-
30	200:5	100:5	100:5	50:5	50:5	-	-
40	200:5	200:5	100:5	100:5	50:5	-	-
50	200:5	200:5	100:5	100:5	100:5	-	-
60	300:5	200:5	200:5	100:5	100:5	-	-
75	300:5	300:5	200:5	200:5	100:5	-	-
100	400:5	300:5	200:5	200:5	200:5	-	-
125	500:5	400:5	300:5	200:5	200:5	-	-
150	600:5	500:5	300:5	300:5	200:5	-	-
200	800:5	600:5	400:5	300:5	300:5	100:5	50:5
250	800:5	800:5	500:5	400:5	300:5	100:5	50:5
300	1000:5	1000:5	600:5	500:5	400:5	100:5	50:5
350	-	1000:5	800:5	500:5	500:5	100:5	100:5
400	-	-	800:5	600:5	500:5	200:5	100:5
450	-	-	1000:5	800:5	600:5	200:5	100:5
500	-	-	1000:5	800:5	600:5	200:5	100:5
600	-	-	1200:5	1000:5	800:5	200:5	100:5
700	-	-	-	1200:5	1000:5	200:5	200:5
800	-	-	-	-	1000:5	300:5	200:5
900	-	-	-	-	1200:5	300:5	200:5
1000	-	-	-	-	-	300:5	200:5
1250	-	-	-	-	-	400:5	200:5
1500	-	-	-	-	-	500:5	300:5

MINIMUM BURDEN RATINGS

The following table gives the minimum CT burden ratings. This is a function of the distance between the motor starting package and the compressor unit.

BURDEN RATING		MAXIMUM DISTANCE FROM FRICK PANEL		
ANSI	VA	USING # 14 AWG	USING # 12 AWG	USING # 10 AWG
B-0.1	2.5	15 ft	25 ft	40 ft
B-0.2	5	35 ft	55 ft	88 ft
B-0.5	12.5	93 ft	148 ft	236 ft

BATTERY BACKUP

For the Quantum panel the battery backup is used only for date and time retention during power interruption. All setpoints and other critical information are saved on EEPROM chips.

For the PLUS Panel, the battery backup prevents data loss during power interruption. It will maintain the adjustable setpoints stored in RAM (Random Access Memory) for up to 1 year after power loss. Expected battery life is 10 years. A trickle charge maintains the battery backup at peak charge when control voltage is present.

To prevent power loss, the battery backup is shipped disabled. To enable the battery backup, a jumper pin located near the top of the microprocessor circuit board (see Figure 12) must be moved from OFF (pins 1-2) to ON (pins 2-3).

NOTE: On either panel, it is not necessary to disconnect the battery backup during extended downtime.

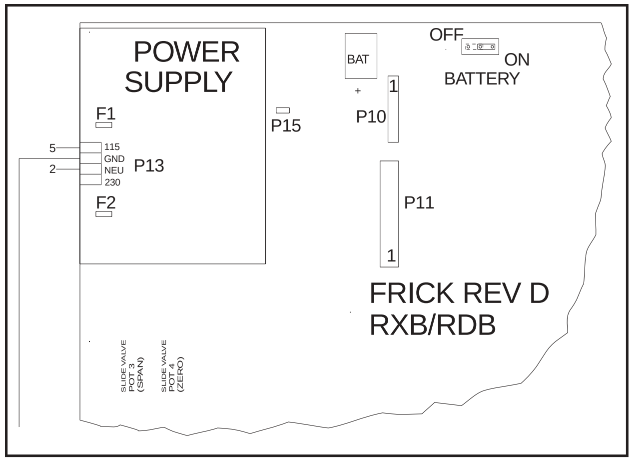


Figure 12

OPERATION and START-UP INSTRUCTIONS

The Frick RDB BOOSTER Rotary Screw Compressor Unit is an integrated system consisting of six major subsystems:

1. Control Panel (see publications S90-010 O, M, & CS for Quantum panel or S70-301 OM for the Plus panel).
2. Compressor
3. Compressor Lubrication System
4. Compressor Oil Separation System
5. Compressor Hydraulic System
6. Compressor Oil Cooling System

The information in this section of the manual provides the logical step-by-step instructions to properly start up and operate the RDB BOOSTER Rotary Screw Compressor Unit.

WARNING **THE SUBSECTIONS ON THE FOLLOWING PAGES MUST BE READ AND UNDERSTOOD BEFORE ATTEMPTING TO START OR OPERATE THE UNIT.**

TDSL COMPRESSOR

The Frick RDB Booster rotary screw compressor utilizes mating asymmetrical profile helical rotors to provide a continuous flow of refrigerant vapor and is designed for both high pressure and low pressure applications. The compressor incorporates the following features:

1. High-capacity roller bearings to carry radial loads at both the inlet and outlet ends of the compressor.

2. Heavy-duty four point angular contact ball bearings to carry axial loads are mounted at the discharge end of compressor.

3. Balance pistons located in the inlet end of the compressor to reduce axial loads on the axial load bearings and increase bearing life.

4. Two oil pressure activated bypass ports provide capacity control at 100%, 75%, 50%, and 25% of full load capacity. The compressor will start at a minimum capacity of 25%.

5. Bearing and casing design for 350 PSI discharge pressure. **This PSI rating applies only to the compressor and does not reflect the design pressure of the various system components.**

6. All bearing and control oil vented to closed thread in the compressor instead of suction port to avoid performance penalties from superheating suction gas.

7. Shaft seal design to maintain operating pressure on seal well below discharge pressure, for increased seal life.

8. Oil injected into the rotors to maintain good volumetric and adiabatic efficiency even at very high compression ratios.

9. Shaft rotation clockwise facing compressor, suitable for all types of drives. SEE NOTE BELOW.

WARNING **COMPRESSOR ROTATION IS CLOCKWISE WHEN FACING THE COMPRESSOR DRIVE SHAFT (see Figure 13). THE COMPRESSOR SHOULD NEVER BE OPERATED IN REVERSE ROTATION AS BEARING DAMAGE COULD RESULT AND EXPLOSION OF THE SUCTION HOUSING IS POSSIBLE.**

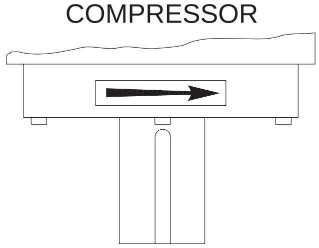


Figure 13

10. Dual compressor casing design for very low airborne noise transmission.

COMPRESSOR LUBRICATION SYSTEM

The lubrication system on an RDB Booster screw compressor unit performs several functions:

1. Provides lubrication to bearings and seal.

2. Provides a cushion between the rotors to minimize noise and vibrations.

3. Helps keep the compressor cool and prevents overheating.

4. Provides oil pressure to the balance pistons to help increase bearing life.

5. Provides an oil seal between the rotors to prevent rotor contact or gas bypassing.

DEMAND PUMP OIL SYSTEM

This system is designed to provide adequate compressor lubrication for all booster applications.

During the period from start-up to normal operation the oil pressure alarm and oil pressure cutout setpoints will vary according to formulas built into the microprocessor control program.

NOTE: For alarm descriptions and shutdown or cutout parameters, see publication S90-010 O.

COMPRESSOR HYDRAULIC SYSTEM CAPACITY CONTROL

Oil pressure is used to hydraulically actuate the capacity control piston assemblies to load and unload the compressor in response to unit load requirements.

A three-way solenoid valve is connected to the capacity control pistons and either supplies oil pressure to the piston (solenoid energized) to load the compressor by closing a bypass port, or vents the oil pressure from the piston to a low pressure area (solenoid deenergized) to permit the return spring to open the bypass port, unloading the compressor.

Three solenoids provide stepped capacity control at a nominal 25%, 50%, and 75% of full load capacity (see Figures 14 and 15). At start-up the solenoids are deenergized for minimum start-up torque at the 25% position.

For optimum part-load performance it is necessary that the solenoids be controlled in the sequence noted in the CAPACITY CONTROL SEQUENCE table.

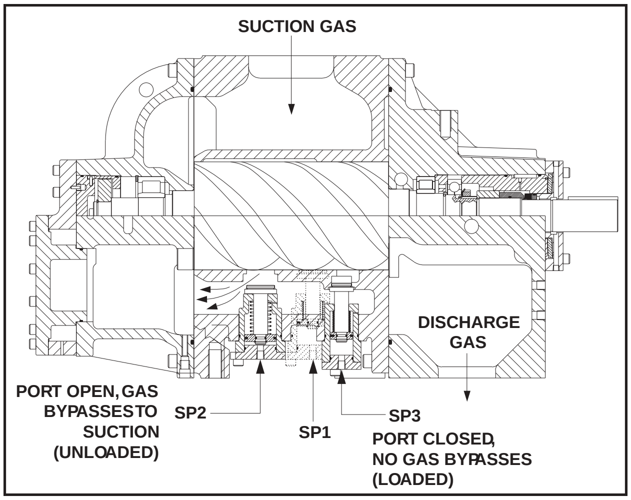


Figure 14 - COMPRESOR AT 75% LOAD

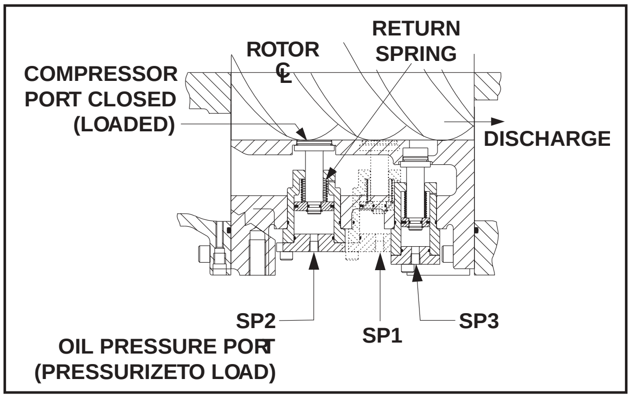


Figure 15 - COMPRESOR AT 100% LOAD

CAPACITY CONTROL SEQUENCE				
PORT	% FULL LOAD CAPACITY			
	25%*	50%	75%	100%
Sol. - YY1	Deenergized	Deenergized	Energized	Energized
Port SP-1**	Open	Open	Closed	Closed
Sol. - YY2	Deenergized	Deenergized	Deenergized	Energized
Port SP-2**	Open	Open	Open	Closed
Sol. - YY3	Deenergized	Energized	Energized	Energized
Port SP-3**	Open	Closed	Closed	Closed

*Condition at start-up.
**RDB 546 unit has two capacity control piston assemblies per step of control.

When loading from minimum capacity (25% to 50% to 75% to 100%), solenoid YY1 must be energized before YY2.

When unloading from full load (100% to 75% to 50% to 25%), YY2 must be deenergized before YY1or YY3.

COMPRESSOR OIL SEPARATION SYSTEM

The RDB Booster is an oil flooded screw compressor. Most of the oil discharged by the compressor separates from the gas flow in the oil charge reservoir. Some oil, however, is discharged as a mist which does not separate readily from the gas flow and is carried past the oil charge reservoir. One or more coalescer filter elements then COALESCE the oil mist into droplets, the droplets of oil fall to the bottom of the coalescer section of the oil separator (see Figure 16). The return of this oil to the compressor is controlled by a needle valve. **NOTE: Open needle valve only enough to keep coalescer end of separator free of oil.**

The sight glass located near the bottom of the coalescer section of the oil separator should remain empty during normal operation. If an oil level develops and remains in the sight glass, a problem in the oil return separation system or compressor operation has developed. Refer to Maintenance for information on how to correct the problem.

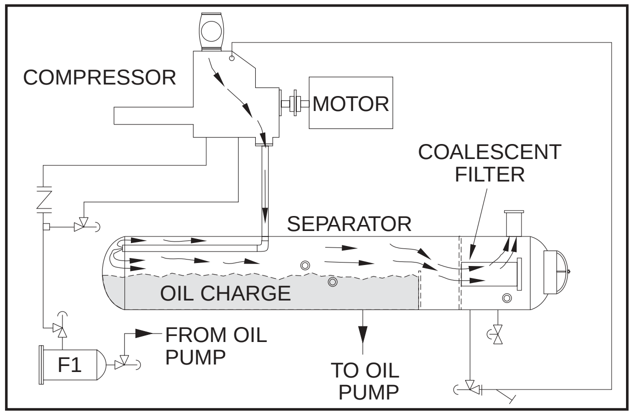


Figure 16 - OIL SEPARATION SYSTEM

COMPRESSOR OIL COOLING SYSTEMS

The RDB Booster unit can be equipped with one of several systems for controlling the compressor oil temperature. They are liquid injection, or thermosyphon and water-cooled oil coolers. Each system is automatically controlled, independent of compressor loading or unloading.

Oil cooling systems should maintain oil temperature within the following ranges:

Liquid Injection Oil Cooling	External* Oil Cooling
130 - 170°F - R-717	120 - 140°F

* Thermosyphon oil cooling (TSOC) or water-cooled oil cooling (WCOC).

LIQUID INJECTION

The liquid injection system is designed to permit liquid refrigerant injection into one port on the compressor at any given moment and operates as outlined.

Solenoid valve YY5 is energized by the microprocessor when the temperature sensor installed in the oil manifold exceeds the LICO set point. High pressure liquid refrigerant is then supplied to the temperature control valve (TCV). The temperature control valve is equalized to a constant back pressure by the differential pressure control valve (PDCV). The differential pressure control valve uses discharge gas to maintain downstream pressure. The gas downstream of the differential pressure control valve is bled off to the compressor suction to ensure steady and constant operation of the valve.

A unit with liquid injection oil cooling will need to be adjusted to ensure that the oil is at the proper temperature. When the adjustments have been made correctly, the oil temperature, the discharge temperature, and the temperature of the oil in the separator should all be approximately the same.

The bulb from the thermal expansion valve (TXV) needs to be carefully inserted into the well in the discharge pipe between the compressor and the oil separator. The valve to the oil separator highpressure connection needs to be opened. The refrigerant supply valve needs to be opened. The cap on the pressure regulating valve (PCV) has to be removed. The adjusting valve needs to be closed at this time.

For low-temperature oil - 125 to 135 degrees
After the unit has been started, wait for the oil temperature to reach 122 degrees. This is the preprogrammed temperature to open the liquid feed solenoid in the liquid injection supply line. At this time, start to open the adjusting valve (a very small amount of movement) only until the needle on the gauge begins to move. When this has been done, adjust the pressure-regulating valve to approximately 80 psig by turning the adjustment ring inside the top of the valve with a 5/16" Allen wrench. Turn the wrench clockwise to raise the oil temperature and counter-clockwise to lower the oil temperature. After the adjustment has been made, wait until the oil and discharge temperatures have had a chance to stabilize before readjusting. The end result should be between 135 and 140 degrees.

For high-temperature oil - 160 to 170 degrees
After the unit has been started, wait for the oil temperature to reach 122 degrees. This is the preprogrammed temperature to open the liquid feed solenoid in the liquid injection supply line. At this time, start to open the adjusting valve (a very small amount of movement) only until the needle on the gauge begins to move. When this has been done, adjust the pressure-regulating valve to approximately 30 psig by turning the adjustment ring inside the top of the valve with a 5/16” Allen wrench. Turn the wrench clockwise to raise the oil temperature, and counterclockwise to lower the oil temperature. After the adjustment has been made, wait until the oil and discharge temperatures have had a chance to stabilize before readjusting. The end result should be between 160 and 170 degrees.

Liquid Injection - Ammonia
To tell if the unit you are starting has a low- or high-temperature liquid injection valve, look at the powerhead of the Thermal Expansion Valve.

If the unit is using Ammonia as a refrigerant and is for low temperature, the Sporlan number on the power head should be Y764 or Y830. Set the oil temperature for 135.

If the unit is using Ammonia as a refrigerant and is for high temperature, the Sporlan number on the power head should be Y1199 or Y1201. Set the oil temperature for 160.

Liquid Injection - Halocarbon
To tell if the unit you are starting has a low- or high-temperature liquid injection valve, look at the powerhead of the Thermal Expansion Valve.

If the unit is using Halocarbon as a refrigerant and is for low temperature, the Sporlan number on the power head should be L3. Set the oil temperature for 135.

If the unit is using Halocarbon as a refrigerant and is for high temperature, the Sporlan number on the power head should be Y1200 or Y1202. Set the oil temperature for 160.

Liquid Injection

When the unit has high-temperature liquid injection oil ooling, set the oil temperature alarm for 170 degrees.

Set the oil temperature cutout for 180 degrees.

When the unit has low-temperature liquid injection oil cooling, set the oil temperature alarm and cutout at the default values set in the microprocessor.

LIQUID INJECTION ADJUSTMENT PROCEDURE

1. Open back pressure valve (V4) approximately one quarter turn.

2. Set pressure regulator valve (PDCV) for approximately 75 psig (R-717), 100 psig (R-22).

3. Monitor the oil temperature of the compressor. If the oil temperature rises above 180°F (R-717), open back pressure valve (V4) a very small amount. This will reduce pressure on the equalizer and allow more refrigerant to flow to compressor. If the oil temperature drops below 160°F, increase pressure on back pressure (V4) valve and allow less refrigerant to flow to compressor, thus raising the oil temperature. The ideal condition is to maintain an oil temperature as stable as possible. An incorrectly tuned liquid injection system will cause extreme swings in the discharge temperature and the oil temperature.

SUCTION CHECK VALVE POWER ASSIST KIT

Low temperature booster compressor operations require a more positive suction check valve closure. This is accomplished by allowing the high pressure discharge gas to assist the spring tension and intermediate pressure closing force. The power assist kit (Figure 17) is factory installed with the discharge gas pressure being supplied from a connection on the dry end of the oil separator. It may be necessary to provide high pressure gas from a high stage compressor discharge for booster applications in which the operating pressure differential on the booster compressor is insufficient to close the suction check valve.

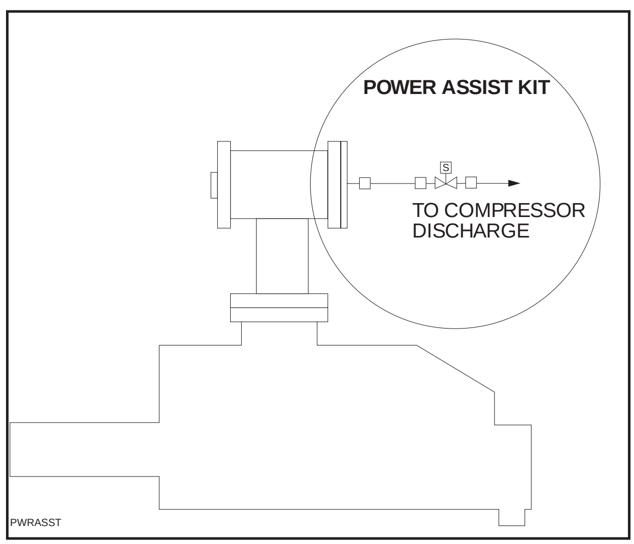


Figure 17 - Power Assist Kit

FRICK provides a power assist kit consisting of a mounted and wired solenoid valve and timer on all RDB booster compressors. Introduction of high discharge pressure gas is made to the check valve. A timer limits the high pressure gas to only thirty seconds duration since intermediate gas pressure and spring tension are sufficient to maintain closure on unit shutdown. A metering valve is also provided for use as a service valve and to allow discharge gas flow regulation to prevent excessive force and resulting closure “hammering”.

SUCTION CHECK VALVE BYPASS

NOTE: HV-1 and associated tubing factory installed on 8" valves and larger. HV-2 is factory installed on all units. During normal operation, valve HV-1 is closed. This is a pump-out connection to allow refrigerant removal to the system suction prior to evacuation for servicing. Valve HV-2 must be open in most systems at all times. It should normally be left 2 turns open to allow the oil separator to slowly bleed down to system suction pressure when the unit is stopped. If the separator oil level foams excessively on shutdown, HV-2 should be closed slightly. If the separator takes more than 20 – 30 minutes to equalize to suction pressure after shutdown, HV-2 can be opened slightly. See Figure 18.

NOTE: HV-2 should be closed on systems with suction pressures below atmospheric pressure, to avoid the possibility of air leakage into the system during shutdown. On systems with check valve, HV-2 can remain open.

HV-2 also should be closed on systems that utilize autocycle to restart the compressor, based on increase in system suction pressure during shutdown, if slowly bleeding the oil separator gas to suction will raise the suction pressure enough to cause short cycling of the compressor.

Also it is important to close HV-2, if the oil pump is to be run for long periods of time with the compressor stopped, to avoid oil being pumped up the suction line.

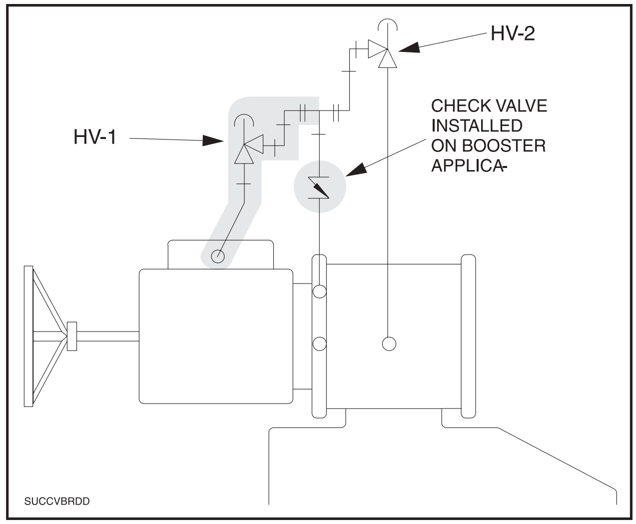


Figure 18 - Suction Check Valve Bypass

INITIAL START-UP

Initial start-up must be performed under the supervision of a FRICK authorized start-up representative to prevent voiding the compressor warranty. Prior to the start-up, the prestart check must be accomplished.

INITIAL START-UP PROCEDURE

Having performed the checkpoints on the prestart check list the compressor unit is ready for start-up. It is important that an adequate refrigerant load be available to load test the unit at normal operating conditions. The following points should be kept in mind during initial start-up.

1. For proper and safe operation the compressor must be run at the proper speed and discharge pressure. Exceeding design conditions creates a potential hazard.

2. Rotate and lubricate motor bearings according to manufacturer's recommendations PRIOR to start-up as required.

3. After running the unit for approximately 3 hours adjust liquid injection oil cooling if applicable. If unit has thermosyphon or water cooled oil cooling, adjust water control valve to cooler.

4. Stop the unit, open the motor main disconnect, check the hot alignment and adjust as necessary.

NORMAL START-UP PROCEDURE

1. Confirm system conditions permit starting the compressor.

2. Press the **[RUN]** key.

3. Allow the compressor to start-up and stabilize. Press the **[AUTO]** key immediately below the V ratio label on the operating display screen. Press the **[AUTO]** key immediately below the SV POS label on the operating display. The compressor is now operating in the automatic mode.

4. Observe the compressor unit for mechanical tightness of the external piping, bolts and valves. Ensure that the machine is clean from oil and refrigerant leaks. If any of these occur, shut down the compressor and correct the problem, as necessary, using good safety precautions.

5. RETIGHTEN MANWAY BOLTS at condenser design pressure (while system is running).

RESTARTING COMPRESSOR UNIT AFTER CONTROL POWER INTERRUPTION (PLANT POWER FAILURE)

1. Check variable setpoints.

2. Follow normal start-up procedure.

GENERAL INFORMATION

This section provides instructions for normal maintenance, a recommended maintenance program, troubleshooting and correction guides, typical wiring diagrams and typical P and I diagrams.

WARNING **THIS SECTION MUST BE READ AND UNDERSTOOD BEFORE ATTEMPTING TO PERFORM ANY MAINTENANCE OR SERVICE TO THE UNIT.**

NORMAL MAINTENANCE OPERATIONS

When performing maintenance you must take several precautions to ensure your safety:

CAUTION

1. **IF UNIT IS RUNNING, PRESS STOP KEY.**
2. **DISCONNECT POWER FROM UNIT BEFORE PERFORMING ANY MAINTENANCE.**
3. **WEAR PROPER SAFETY EQUIPMENT WHEN COMPRESSOR UNIT IS OPENED TO ATMOSPHERE.**
4. **ENSURE ADEQUATE VENTILATION.**
5. **TAKE NECESSARY SAFETY PRECAUTIONS REQUIRED FOR THE REFRIGERANT BEING USED.**

WARNING **CLOSE ALL COMPRESSOR PACKAGE ISOLATION VALVES PRIOR TO SERVICING THE UNIT. FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY.**

GENERAL MAINTENANCE

Proper maintenance is important in order to ensure long and trouble-free service from your screw compressor unit. Some areas critical to good compressor operation are:

1. Keep refrigerant and oil clean and dry, avoid moisture contamination. After servicing any portion of the refrigeration system, evacuate to remove moisture before returning to service. Water vapor condensing in the compressor while running, or more likely while shut down, can cause rusting of critical components and reduce life.

2. Keep suction strainer clean. Check periodically, particularly on new systems where welding slag or pipe scale could finds it way to the compressor suction. Excessive dirt in the suction strainer could cause it to collapse, dumping particles into the compressor.

3. Keep oil filters clean. If filters show increasing pressure drop, indicating dirt or water, stop the compressor and change filters. Running a compressor for long periods with high filter pressure drop can starve the compressor for oil and lead to premature bearing failure.

4. Avoid slugging compressor with liquid refrigerant. While screw compressors are probably the most tolerant to ingestion of some refrigerant liquid of any compressor type available today, they are not liquid pumps. Make certain to maintain adequate superheat and properly size suction accumulators to avoid dumping liquid refrigerant into compressor suction.

Keep liquid injection valves properly adjusted and in good condition to avoid flooding compressor with liquid. Liquid can cause a reduction in compressor life and, in extreme cases, cause complete failure.

5. Protect the compressor during long periods of shut down. If the compressor will be setting for long periods without running, it is advisable to evacuate to low pressure and charge with dry nitrogen or oil, particularly on systems known to contain water vapor.

6. Preventive maintenance inspection is recommended any time a compressor exhibits a noticeable change in vibration level, noise, or performance.

COMPRESSOR SHUTDOWN and START-UP

For seasonal or prolonged shutdowns, use the following procedure:

1. Reduce the system pressure to the desired condition.

2. Press **[STOP]** key to cease operation of the compressor.

3. Open disconnect switches for compressor motor and oil pump starters.

4. Turn off oil heater circuit breaker.

5. Close suction and discharge service valves, also liquid injection and economizer service valves, if applicable. **Attach CLOSED TAGS.**

6. Shut off cooling water supply valve to oil cooler, if applicable. **Attach CLOSED TAG.**

7. Protect oil cooler from ambient temperatures below freezing or remove water heads.

8. Rotate the coupling with center intact every two weeks. Mark the spot so that you don't stop at the same point. This will prevent brunelling of the compressor and motor bearings.

To start up after a seasonal or prolonged shutdown, use the following procedure:

1. Any water necessary for the operation of the system that may have been drained or shut off should be restored and turned on. If oil cooler heads were removed, reinstall and remove tags.

2. Open suction and discharge service valves, also liquid injection and economizer service valves, if applicable. Remove tags.

3. Close disconnect switches for compressor, motor, and oil pump starters.

4. Turn on oil heater circuit breaker.

5. Perform checkpoints on prestart check list, then start unit.

GENERAL INSTRUCTIONS FOR REPLACING COMPRESSOR UNIT COMPONENTS.

When replacing or repairing components which are exposed to refrigerant pressure, proceed as follows:

1. Push **[STOP]** key on control panel to shut down unit.

2. Open and lock out disconnect switches for compressor and pump motor starters.

3. Close suction and discharge service valves, also liquid injection and economizer service valves, if applicable. Attach closed tags.

4. SLOWLY vent separator to low-side system pressure using the bypass line on the suction trap. **NOTE: Recover or transfer all refrigerant vapor, in accordance with local ordinances, before opening to atmosphere.** The separator **MUST** be equalized to atmospheric pressure.

⚠ CAUTION

Oil entrained refrigerant may vaporize, causing a separator pressure increase. Repeat venting and recovery procedure, if necessary.

5. Make replacement or repair.

6. Isolate the low pressure transducer, PE-4, to prevent damage during pressurization and leak test.

7. Pressurize unit and leak test.

8. Evacuate unit.

9. Open suction and discharge service valves and the low pressure transducer. Also open the liquid injection and economizer service valves, if applicable.

10. Close disconnect switches for compressor and oil pump motor starters.

11. Unit is ready to put into operation.

12. Perform checkpoints on prestart check list, then start unit.

OIL FILTER (F-1) MAIN SINGLE/DUAL

⚠ CAUTION

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

RDB Booster compressor 100 through 546 units are furnished with one main oil filter (F-1). A second oil filter (F-2) is installed as optional equipment to facilitate the changing of the filter cartridge(s) without unit shut down.

The procedure to change filter cartridge(s) is as follows:

1. If a single oil filter is installed push **[STOP]** key on microprocessor panel to shut down unit, then open disconnect switches for compressor and oil pump motor starters.

If dual (2) oil filters are installed, open the outlet, then inlet service valves of the standby filter.

⚠ CAUTION

Open inlet service valve slowly to prevent a sudden pressure drop which could cause an oil filter differential alarm.

2. Close outlet then inlet service valves of filter being serviced.

3. Open bleed valve and purge pressure from the oil filter cartridge. **NOTE: Recover or transfer all refrigerant vapor, in accordance with local ordinances, before opening to atmosphere.**

4. Remove the plug from the bottom of the filter canister and drain the oil. Remove the canister cover and discard the gasket. Remove the screws securing the filter assembly. Pull the filter assembly from the canister and discard the gasket and the element.

5. Flush the canister with clean Frick refrigeration oil; wipe dry with a clean, lint-free cloth; and replace the plug.

6. Install a new element and tighten the nut on the end plate to 10 ft-lb torque. Then, while holding the nut with a wrench, apply a second nut to act as a lock nut. Replace the gasket and reinstall the filter assembly into canister, securing with screws tightened to 7 ft-lb torque. Fill the canister with new Frick refrigeration oil. Replace the gasket and reinstall the canister cover. Torque cover bolts first to finger tight, then 65 ft-lb, then 130 ft-lb.

7. Close purge valve.

8. Open outlet service valve and leak test.

9. Filter is ready to place in service.

STRAINER - DEMAND OIL PUMP

To clean the demand oil pump strainer, the unit must be shut down. The procedure is as follows:

1. Push **[STOP]** key on microprocessor panel to shutdown unit, then open disconnect switches for compressor and oil pump motor starters.

2. Close strainer inlet service valve.

3. Open drain valve located in the strainer cover and drain oil into a container.

4. Remove capscrews securing strainer cover, strainer cover, gasket and element. Retain gasket.

5. Wash element in solvent and blow clean with air.

6. Wipe strainer body cavity clean with a lint free clean cloth.

7. Replace cleaned element, gasket and reattach cover using retained capscrews.

8. Close drain valve and open strainer inlet service valve.

9. Check for leakage.

10. Close disconnect switches for compressor and oil pump motor starters.

11. Start unit.

STRAINER - LIQUID INJECTION

To clean the liquid injection strainer the unit must be shut down. The procedure is as follows:

1. Push **[STOP]** key on microprocessor panel to shut down unit, then open disconnect switches for compressor and oil pump motor starters.

2. Close liquid supply service valve located before liquid solenoid.

3. IMMEDIATELY SCREW IN THE MANUAL SOLENOID VALVE STEM TO RELIEVE LIQUID REFRIGERANT PRESSURE TRAPPED BETWEEN THE SOLENOID AND THE SERVICE VALVE.

4. Close service valve located between the compressor and the liquid injection thermovalve.

5. Carefully loosen capscrews securing the strainer cover to the strainer. Allow pressure to relieve slowly.

6. When all entrapped refrigerant has been relieved, carefully remove loosened capscrews (as liquid refrigerant is sometimes caught in the strainer), strainer cover, and strainer basket.

7. Wash the strainer basket and cover in solvent and blow clean with air.

8. Reassemble strainer.

9. Open service valve between compressor and liquid injection thermovalve and check for leakage.

10. Screw out manual solenoid valve stem.

11. Carefully open liquid supply service valve.

12. Leak test.

13. Close disconnect switches for compressor and oil pump motor starters.

14. Start unit.

COALESCER FILTER ELEMENT(S)

CAUTION **Use of filter elements other than Frick must be approved in writing by Frick engineering or warranty claim may be denied.**

When changing the coalescer filter element(s), it is recommended that the oil be changed, cartridge(s) in oil filters F-1, F-2, and F-3 if applicable be changed, and the following applicable strainer elements be removed and cleaned.

1. Refer to oil changing Steps 1 through 8.

2. Loosen manway cover retainer bolts, remove retainers, manway cover and cover gasket. Discard cover gasket.

3. Remove and retain nut securing coalescer filter retainer.

4. Remove retainer, coalescer filter element and 2 O-rings. Discard filter elements.

5. Install new coalescer filter element(s).

CAUTION **Seat element in center of locating tabs on separator bulkhead.**

6. Replace coalescer filter retainer and nut. Torque nut to 21 ft-lb. **DO NOT OVERTIGHTEN NUT.**

7. Install a new manway gasket and replace manway cover.

8. Tighten manway bolts. **NOTE: WHEN THE COMPRESSOR UNIT IS REPRESSURIZED RETIGHTEN SINCE MANWAY BOLTS WILL LOOSEN.**

9. Refer to CHANGING OIL, Steps 9 through 14.

CHANGING 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 in Frick compressors must be approved in writing by Frick engineering or warranty claim may be denied.**

Shut down the unit when changing oil. At the same time all oil filter cartridges must be changed and all oil strainer elements removed and cleaned. The procedure is as follows:

1. Press **[STOP]** key on microprocessor panel to stop compressor unit.

2. Open disconnect switch for compressor motor starter.

3. Close suction and discharge service valves, also liquid injection.

4. SLOWLY vent separator to low-side system pressure using the bypass line on the suction trap. **NOTE: Recover or transfer all refrigerant vapor, in accordance with local ordinances, before opening to atmosphere.** The separator **MUST** be equalized to atmospheric pressure.

CAUTION **Oil entrained refrigerant may vaporize, causing a separator pressure increase. Repeat venting and recovery procedure, if necessary.**

5. Open drain valve(s) located on the underside of the separator and drain oil.

6. Drain oil filter(s) F-1 and, if applicable, oil coolers and filter F-2.

7. Remove and install new filter cartridges.

8. Remove, clean, and reinstall strainer elements in strainers.

9. Open suction service valve and pressurize unit to system suction pressure. Close suction valve and leak test.

10. Evacuate unit to 28″ Hg vacuum.

11. Add oil by attaching suitable pressure type hose to oil charging valve located on top of the separator. Using a pressure type oil pump and recommended Frick oil, open charging valve and fill separator until oil level is midway in the top sight glass. **NOTE: Fill slowly because oil will fill up in the separator faster than it shows in he sight glass.** See table in the OIL CHARGE section for approximate oil charge quantities.

12. Open suction and discharge service valves, also liquid injection and economizer service valves, if applicable.

13. Close disconnect switch for compressor motor starter.

14. Start unit.

DEMAND PUMP DISASSEMBLY

DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, JACKET, ETC.) ENSURE:

1. THAT ANY PRESSURE IN THE CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.

2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON THE PUMP.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

1. Mark head and casing before disassembly to ensure proper reassembly. The idler pin, which is offset in the pump head, must be positioned up and equal distance between port connections to allow for proper flow of liquid through the pump.

2. Remove the head capscrews.

3. Tilt top of head back when removing to prevent idler from falling off idler pin.

4. Remove idler and bushing assembly. If idler bushing needs replacing, see **INSTALLATION OF CARBON GRAPHITE BUSHINGS**.

5. Insert a brass bar or piece of hardwood in the port opening and between rotor teeth to keep shaft from turning. Turn the locknut counterclockwise and remove locknut. See Figure 20 or 21.

6. Loosen two setscrews in face of bearing housing and turn thrust bearing assembly counterclockwise and remove from casing. See Figure 20 or 21.

7. GG, HJ, HL: Remove snap ring from shaft. See Figure 20. **AS, AK, AL:** Remove bearing spacer from shaft. See Figure 21.

8. Remove brass bar or piece of hardwood from port opening.

9. The rotor and shaft can now be removed by tapping on end of shaft with a lead hammer or, if using a regular hammer, use a piece of hardwood between shaft and hammer.

The rotary member of the seal will come out with rotor and shaft.

10. AS, AK, AL: Remove bearing retainer washer. The washer may have stayed with rotor and shaft when removed or is against ball bearing. See Figure 21.

11. Remove the mechanical seal rotary member and spring from rotor and shaft assembly.

12. GG, HJ, HL: Remove inner snap ring and single-row ball bearing from casing.

AS, AK, AL: Remove single-row ball bearing from casing.

13. Remove seal seat or stationary part of seal from casing.

14. Disassemble thrust-bearing assembly.

GG, HJ, HL: Remove outer snap ring from bearing housing and remove ball bearing. See Figure 20.

AS, AK, AL: Loosen two set screws in flange outside diameter. Rotate end cap and lip seal counterclockwise and remove. Remove ball bearing. See Figure 21.

The casing should be examined for wear, particularly in the area between ports. All parts should be checked for wear before pump is put together.

When making major repairs, such as replacing a rotor and shaft, it is advisable to also install a new mechanical seal, head and idler pin, idler, and bushing. See **INSTALLATION OF CARBON GRAPHITE BUSHINGS**.

Clean all parts thoroughly and examine for wear or damage. Check lip seals, ball bearings, bushing, and idler pin and replace if necessary. Check all other parts for nicks, burrs, excessive wear and replace if necessary.

Wash bearings in clean solvent. Blow out bearings with compressed air. Do not allow bearings to spin; turn them slowly by hand. Spinning bearings will damage race and balls. Make sure bearings are clean, then lubricate with refrigeration oil and check for roughness. Roughness can be determined by turning outer race by hand. Replace bearings if bearings have roughness.

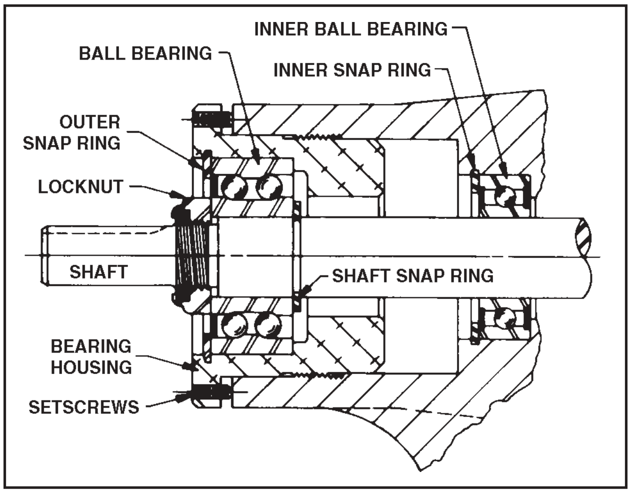


Figure 20 - Thrust-Bearing assembly (GG, HJ, HL)

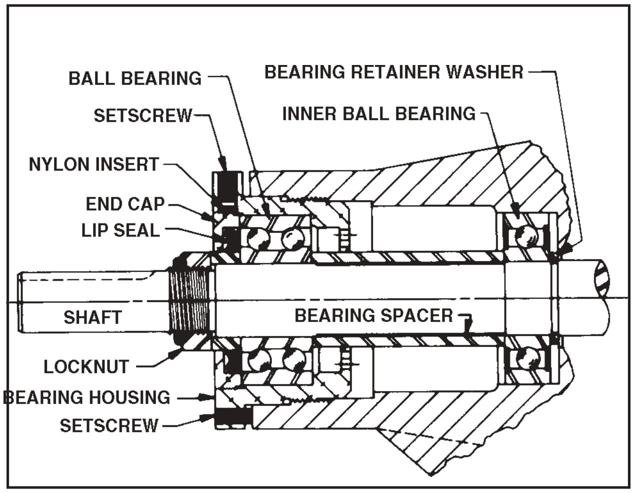


Figure 21 - Thrust-Bearing assembly (AS, AK, AL)

Be sure shaft is free from nicks, burrs and foreign particles that might damage mechanical seal. Scratches on shaft in seal area will provide leakage paths under mechanical seal. Use fine emery cloth to remove scratches or sharp edges.

DEMAND PUMP ASSEMBLY

Assembly Notes On Standard Mechanical Seal (Synthetic Rubber Bellows Type)

NOTE: Read carefully before reassembling pump

The seal used in this pump is simple to install and good performance will result if care is taken during installation.

The principle of mechanical seal is contact between the rotary and stationary members. These parts are lapped to a high finish and their sealing effectiveness depends on complete contact.

Prior to installing rotary portion of mechanical seal, prepare and organize rotor shaft, head and idler assemblies and appropriate gaskets for quick assembly

Once rotary portion of mechanical seal is installed on rotor shaft, it is necessary to assemble parts as quickly as possible to ensure that the seal does not stick to shaft in wrong axial position. The seal will stick to the shaft after several minutes setting time.

Never touch sealing faces with anything except clean hands or clean cloth. Minute particles can scratch the seal faces and cause leakage.

1. Coat idler pin with refrigeration oil and place idler and bushing on idler pin in head. If replacing a carbon-graphite bushing, refer to "Installation of Carbon Graphite Bushings".

2. Clean rotor hub and casing seal housing bore. Make sure both are free from dirt and grit. Coat outer diameter of seal seat and inner diameter of seal housing bore with refrigeration oil.

3. Start seal seat in seal housing bore. If force is necessary, protect seal face with a clean cardboard disc and gently tap it in place with a piece of wood. Be sure seal seat is completely seated in the bore.

4. Place tapered installation sleeve on shaft. Refer to Figure 22. Sleeve is furnished with GG, AS, AK, and AL replacement mechanical seals. Coat rotor shaft, tapered installation sleeve, and inner diameter of mechanical seal rotary member with a generous amount of refrigeration oil. Petrolatum may be used but grease is not recommended.

5. Place seal spring on shaft against rotor hub. Refer to Figure 23.

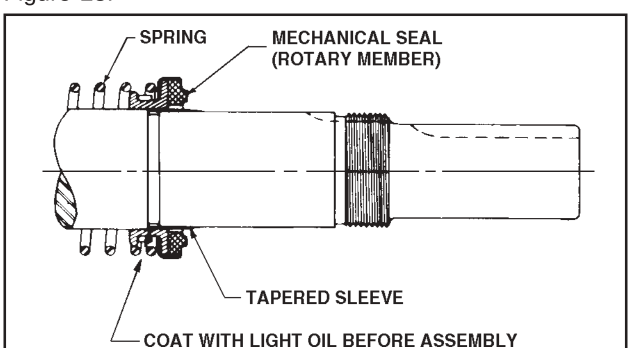


Figure 22

6. Slide rotary member, with lapped contact surface facing away from spring, over installation sleeve on shaft until just contacting the spring. Do not compress spring. Remove installation sleeve.

7. Coat rotor shaft with refrigeration oil. Install shaft slowly pushing until the ends of rotor teeth are just below the face of the casing.

8. Leave the rotor in this position. Withdrawal of rotor and shaft may displace the carbon seal rotating face and result in damage to the seal.

9. Place O-ring gasket on head and install head and idler assembly on pump. Pump head and casing were marked before disassembly to ensure proper reassembly. If not, be sure idler pin, which is offset in pump head, is positioned up and equal distance between port connections to allow for proper flow of liquid through pump.

10. Tighten head capscrews evenly

11. Pack inner ball bearing with multipurpose grease, NLGI #2.

GG, HJ, HL: Install bearing in casing with sealed side towards head end of pump. Drive the bearing into the bore. Tap the inner race with a brass bar and lead hammer to position bearing. Install inner snap ring.

AS, AK, AL: Install bearing retainer washer over the shaft before installing ball bearing. Install ball bearing in casing with sealed side towards head end of pump. Drive the bearing into the bore. Tap the inner race with a brass bar and lead hammer to position bearing.

12. GG, HJ, HL: Install shaft snap ring in groove in the shaft. See Figure 1.

AS, AK, AL: Install bearing spacer over shaft and against single row ball bearing. See Figure 21.

13. Pack lubrication chamber between inner ball bearing and double-row ball bearing in the thrust-bearing assembly approximately one-half full of multipurpose grease, NLGI #2. The thrust-bearing assembly will take the remaining space. See Figures 20 and 21.

14. Pack double-row ball bearing with multipurpose grease, NLGI #2.

GG, HJ, HL: Install ball bearing into bearing housing with shield side toward coupling end of shaft. See Figure 20. Install snap ring into bearing housing to retain ball bearing.

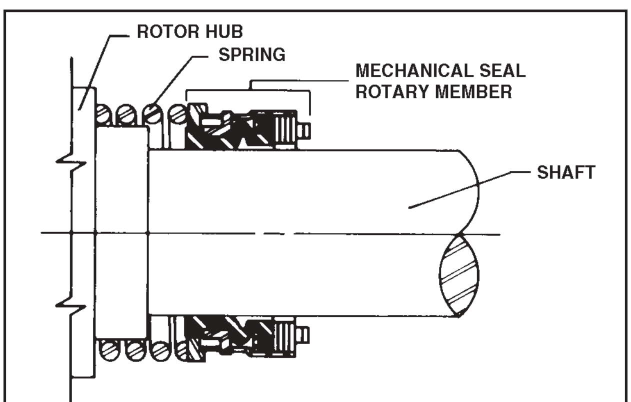


Figure 23

This snap ring has a tapered edge to fit tapered groove in bearing housing. The tapered edge is located away from ball bearing.

AS, AK, AL: Install ball bearing into bearing housing. Install lip seal in bearing housing end cap. The lip should face towards end of shaft. Put bearing spacer collar in lip seal and install in bearing housing and tighten setscrews securely. See Figure 21.

15. Insert brass bar or hardwood through port opening between rotor teeth to keep shaft from turning.

16. Start thrust-bearing assembly into casing. Turn by hand until tight. This forces rotor against head. Replace and tighten locknut or shaft.

17. Remove brass bar or hardwood from port opening.

18. Adjust pump end clearance.

DANGER

BEFORE STARTING PUMP, ENSURE THAT ALL DRIVE EQUIPMENT GUARDS ARE IN PLACE. FAILURE TO PROPERLY MOUNT GUARDS MAY RESULT IN SERIOUS INJURY OR DEATH.

THRUST BEARING ADJUSTMENT

See Figures 20 and 21.

Loosen two screws in face of thrust-bearing assembly.

If shaft cannot be rotated freely, turn thrust-bearing assembly counterclockwise until shaft can be turned easily.

1. While turning rotor shaft, rotate thrust-bearing assembly clockwise until noticeable drag occurs. This is zero end clearance.

2. Mark position of bearing housing with respect to the casing.

3. Rotate thrust-bearing assembly counterclockwise the distance listed below as measured on outside of bearing housing.

4. Tighten two setscrews in face of bearing housing after adjustment is made to secure thrust-bearing assembly position.

For viscosities above 2500 SSU, add additional end clearance (0.004" for GG, HJ and HL size pumps and 0.005" for AS, AK and AL size pumps).

Pump Size	Distance (in.) on O.D. of Bearing Housing	End Clearance (in.)
GG	7/16	.003
HJ, HL	9/16	.003
AS, AK, AL	1/2	.003

INSTALLATION OF CARBON GRAPHITE BUSHINGS

When installing carbon graphite bushings, extreme care must be taken to prevent breaking. Carbon graphite is a brittle material and easily cracked. If cracked, the bushing will quickly disintegrate. Using a lubricant and adding a chamfer on the bushing and the mating part will help in installation. The additional precautions listed below must be followed for proper installation:

1. A press must be used for installation.

2. Be certain bushing is started straight.

3. Do not stop pressing operation until bushing is in proper position. Starting and stopping will result in a cracked bushing.

4. Check bushing for cracks after installation.

TROUBLESHOOTING THE DEMAND PUMP

DANGER

BEFORE OPENING ANY PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, JACKET ETC.) ENSURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.

2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.

3. THE PUMP HAS BEEN ALLOWED TO COOL DOWN TO THE POINT THAT THERE IS NO CHANCE OF ANYONE BEING BURNED.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

Mark valve and head before disassembly to ensure proper reassembly.

If trouble does develop, one of the first steps toward finding the difficulty is to *install a vacuum gauge in the suction port and a pressure gauge in the discharge port*. Readings on these gauges often will give a clue as to where to start looking for the trouble.

Vacuum Gauge—Suction Port

1. High reading would indicate:
  a. Suction line blocked - foot valve stuck, gate valve closed, strainer plugged.
  b. Liquid too viscous to flow through the piping.
  c. Lift too high.
  d. Line too small.

2. Low reading would indicate -
  a. Air leak in suction line.
  b. End of pipe not in liquid.
  c. Pump is worn.
  d. Pump is dry - should be primed.

3. Fluttering, jumping, or erratic reading:
  a. Liquid vaporizing.
  b. Liquid coming to pump in slugs - possibly an air leak or insufficient liquid above the end of the suction pipe.
  c. Vibrating from cavitation, misalignment, or damaged parts.

Pressure Gauge - Discharge Port

1. High reading would indicate:
  a. High viscosity and small and/or long discharge line.
  b. Gate valve partially closed.
  c. Filter plugged.

d. Vertical head did not consider a high specific gravity liquid.
e. Line partially plugged from buildup on inside of pipe.
f. Liquid in pipe not up to temperature.
g. Liquid in pipe has undergone a chemical reaction and has solidified.
h. Relief valve set too high.

2. Low reading would indicate:
a. Relief valve set too low
b. Relief valve poppet not seating properly.
c. Too much extra clearance.
d. Pump worn.

3. Fluttering, jumping, or erratic reading:
a. Cavitation.
b. Liquid coming to pump in slugs.
c. Air leak in suction line.
d. Vibrating from misalignment or mechanical problems.

Some of the following may also help pinpoint the problem:

1. Pump does not pump.
a. Lost its prime - air leak, low level in tank**.**
b. Rotating in wrong direction.
c. Motor does not come up to speed.
d. Suction and discharge valves not open.
e. Strainer clogged.
f. Relief valve set too low, relief valve poppet stuck open.
g. Pump worn out.
h. Any changes in the liquid system, or operation that would help explain the trouble, e.g. new source of supply, added more lines, inexperienced operators, etc.
i. Tighten end clearance.
j. Head position incorrect.

2. Pump starts, then loses its prime.
a. Low level in tank.
b. Liquid vaporizing in the suction line.
c. Air leaks or air pockets in the suction line; leaking air through packing or mechanical seal.
d. Worn out.

3. Pump is noisy
a. Pump is being starved (heavy liquid cannot get to pump fast enough). Increase suction pipe size or reduce length.
b. Pump is cavitating (liquid vaporizing in the suction line). Increase suction pipe size or reduce length; if pump is above the liquid, raise the liquid level closer to the pump; if the liquid is above the pump, increase the head of liquid.
c. Check alignment.
d. May have a bent shaft or rotor tooth. Straighten or replace.
e. May be a foreign object trying to get into the pump through the suction port.

4. Pump not up to capacity
a. Starving or cavitating - increase suction pipe size or reduce length.
b. Strainer partially clogged - clean.
c. Air leak in suction piping or along pump shaft.
d. Running too slowly - is motor the correct speed and is it wired up correctly
e. Relief valve set too low or stuck open.
f. Pump worn out.
g. Tighten end clearance.
h. Head position incorrect.

5. Pump takes too much power.
a. Running too fast - is correct motor speed, reducer ratio, sheave size, etc. being used.
b. Liquid more viscous than unit sized to handle - heat the liquid, increase the pipe size, slow the pump down, or get a bigger motor.
c. Discharge pressure higher than calculated - check with pressure gauge. Increase size or reduce length of pipe, reduce speed (capacity), or get bigger motor.
d. Pump misaligned.
e. Extra clearance on pumping elements may not be sufficient for operating conditions. Check parts for evidence of drag or contact in pump and increase clearance where necessary

6. Rapid Wear.
Examination of a pump that has gradually lost its ability to deliver capacity or pressure would show a smooth wear pattern on all parts. Rapid wear shows up as heavy grooving, galling, twisting, breaking, or similar severe signs of trouble.

PREVENTATIVE MAINTENANCE

Performing a few preventative maintenance procedures will extend the life of your pump and reduce the cost per gallon pumped.

1. Lubrication - Grease all zerks after every 500 hours of operation or after 60 days, whichever occurs first. If service is severe, grease more often. Do it gently with a hand gun. Use #2 ball bearing grease for normal applications. For hot or cold applications, use appropriate grease.

2. Packing Adjustment - Occasional packing adjustment may be required to keep leakage to a slight weep; if impossible to reduce leakage by gentle tightening, replace packing or use different type. See Technical Service Manual on particular model series for details on repacking.

3. End Clearance Adjustment - After long service the running clearance between the end of the rotor teeth and the head may have increased through wear to the point where the pump is losing capacity or pressure. Resetting end clearance will normally improve pump performance. See Technical Service Manual on particular model series for procedure on adjusting end clearance for the pump involved.

RECOMMENDED MAINTENANCE PROGRAM

In order to obtain maximum compressor unit performance and ensure reliable operation, a regular maintenance program should be followed.

The compressor unit should be checked daily for leaks, abnormal vibration, noise, and proper operation and a log maintained. There should be a continuing monitoring of oil quality and oil analysis testing. In addition, an analysis of the unit's vibration should be periodically made.

VIBRATION ANALYSIS

Periodic vibration analysis can be useful in detecting bearing wear and other mechanical failures. If vibration analysis is used as a part of your preventive maintenance program, take the following guidelines into consideration.

1. Always take vibration readings from exactly the same places, at exactly the same percent of load.

2. Use vibration readings taken from the new unit at start-up as the base line reference.

3. Evaluate vibration readings carefully as the instrument range and function used can vary. Findings can be easily misinterpreted.

4. Vibration readings can be influenced by other equipment operating in the vicinity or connected to the same piping as the unit.

MOTOR BEARINGS

Follow the motor manufacturer's maintenance recommendations for lubrication. See Figure 24, schedule for standard motor.

CAUTION **Make sure motor bearings are properly lubricated before start-up as required by motor manufacturer.**

OIL QUALITY and ANALYSIS

High quality refrigeration oil is necessary to ensure compressor longevity and reliability. Oil quality will rapidly deteriorate in refrigeration systems containing moisture and air or other contaminants. In order to ensure the quality of the refrigeration oil in the compressor unit:

1. Only use Frick refrigeration oil or high quality refrigeration oils approved by Frick for your application.

2. Only use Frick filter elements must be approved in writing by Frick engineering or warranty claim may be denied.

3. Participate in a regular, periodic oil analysis program to maintain oil and system integrity.

LUBRICATION SCHEDULE / INSTRUCTIONS

SYNC. RPM	FRAME SERIES	SERVICE CYCLE* - BALL BEARING** 8 HR/DAY OPERATION	SERVICE CYCLE* - BALL BEARING** 24 HR/DAY OPERATION
3600	360-5800	150 DAYS (1200 HRS)	50 DAYS (1200 HRS)
1800	360	390 DAYS (3120 HRS)	130 DAYS (3120 HRS)
	400-440	270 DAYS (2160 HRS)	90 DAYS (2160 HRS)
	5000-5800	210 DAYS (1680 HRS)	70 DAYS (1680 HRS)
1200	360-440	390 DAYS (3120 HRS)	130 DAYS (3120 HRS)
	5000-5800	270 DAYS (2160 HRS)	90 DAYS (2160 HRS)

* LUBRICATION SCHEDULE FOR SEVERE SERVICE (VIBRATION, SHOCK AND/OR ENVIRONMENTAL EXTREME) = 1/3 OF THE ABOVE INTERVALS.

** LUBRICATION SCHEDULE FOR ROLLER BEARINGS = 1/3 OF THE ABOVE INTERVALS.

- LUBRICATE BEARINGS WITH POWER IN THE OFF CONDITION.
- CLEAR AND CLEAN THE GREASE FITTINGS AND SURROUNDING AREA.
- REMOVE THE PIPE PLUG FROM THE VENTING PORT OPPOSITE THE GREASE FITTING.
- USING A LOW PRESSURE GREASE GUN APPLY 2 OZS. (60 GRAMS) OF GREASE AT EACH FITTING. DO NOT OVER GREASE.
- WITH THE VENT PORTS OPEN, OPERATE THE MOTOR FOR A MINIMUM OF 15 MINUTES AND UNTIL ANY GREASE FLOW HAS CEASED AT THE VENTING PORTS.
- REMOVE POWER.
- REPLACE THE VENT PIPE PLUGS
- REPLACE ANY AND ALL GUARDS AND COVERS THAT MAY HAVE BEEN REMOVED TO ACCESS THE MOTOR.

THE FACTORY INSTALLED, RECOMMENDED LUBRICANT IS LISTED ON THE MOTOR DATA PLATE. THE FOLLOWING PRODUCTS ARE DEEMED SUITABLE LUBRICANTS UNDER NORMAL SERVICE CONDITIONS BUT MAY NOT BE CHEMICALLY COMPATIBLE OR INTERCHANGEABLE ONE TO THE OTHER OR CORRECT FOR ALL AMBIENT OR SERVICE CONDITIONS. FOLLOW ALL MANUFACTURER'S GUIDELINES WHEN INTRODUCING ALTERNATES - WHEN DOUBT EXISTS, PURGE THE BEARINGS AS DESCRIBED IN THE INSTRUCTION MANUAL.

CHEVRON OIL CO. - SRI#2
EXXON CORP. - POLYREX
SHELL OIL CO. - DOLIUM R
EXXON CORP. - UNIREX#2
MOBIL OIL CO. - MOBILUX#2

Figure 24

OPERATING LOG

The use of an operating log as shown below permits thorough analysis of the operation of a refrigeration system by those responsible for its maintenance and servicing. Continual recording of gauge pressures, temperatures, and other pertinent information, enables the observer and serviceman to be constantly familiar with the operation of the system and to recognize immediately any deviations from normal operating conditions. The operating log below suggests listing conditions twice each 8 hour shift.

MACHINE ROOM NO. or SYSTEM DESIGNATION ______________________________ DATE ____________

CHECK LIST	NORMAL RANGE		HOURLY RECORDINGS					
	FROM	TO	4 AM	8 AM	12 AM	4 PM	8 PM	12 PM
Suction Pressure								
Suction Temperature								
Suction Superheat								
Discharge Pressure								
Discharge Temperature								
Oil Pressure - Compressor								
Oil Filter Pressure Drop								
Oil Temperature - Separator								
Oil Temperature								
Oil Level								
Oil Added (gals.)								
Running Time (hrs.)								
Motor FLA								
CC %								
Cooling Water Temp IN - OUT								
Receiver Liquid Level								
Machine Room Temperature								
Outside Ambient Temperature								

MAINTENANCE SCHEDULE

This schedule should be followed to ensure trouble-free operation of the compressor unit.

MAINTENANCE	HOURS OPERATION (MAXIMUM)																					
	200	1000	5000	8000	10000	15000	20000	25000	30000	35000	40000	45000	50000	55000	60000	65000	70000	75000	80000	85000	90000	95000
CHANGE OIL	As directed by oil analysis																					
OIL ANALYSIS		■	Then every 6 months																			
CHANGE FILTERS	■		■		■		■		■		■		■		■		■		■		■	
CLEAN OIL STRAINERS	■		■		■		■		■		■		■		■		■		■		■	
CLEAN LIQUID STRAINERS	■		■		■		■		■		■		■		■		■		■		■	
CHANGE COALESCERS									■						■						■	
CHECK AND CLEAN SUCTION SCREEN	■	■	■		■		■		■		■		■		■		■		■		■	
CHECK ALIGNMENT	■		■		■		■		■		■		■		■		■		■		■	
CHECK COUPLING	■		■		■		■		■		■		■		■		■		■		■	
VIBRATION ANALYSIS	Every 6 months, more frequently if levels increase																					
REPLACE SEAL	When leak rate exceeds 7 - 8 drops per minute																					

TROUBLESHOOTING GUIDE

NOTE: Refer to Frick publication S90-010 M for troubleshooting the Quantum panel or S70-301 OM for the Plus panel. Successful problem solving requires an organized approach to define the problem, identify the cause, and make the proper correction. Sometimes it is possible that two relatively obvious problems combine to provide a set of symptoms that can mislead the troubleshooter. Be aware of this possibility and avoid solving the "wrong problem".

ABNORMAL OPERATION ANALYSIS and CORRECTION

Four logical steps are required to analyze an operational problem effectively and make the necessary corrections:

1. Define the problem and its limits.

2. Identify all possible causes.

3. Test each cause until the source of the problem is found.

4. Make the necessary corrections.

The first step in effective problem solving is to define the limits of the problem. If, for example, the compressor periodically experiences high oil temperatures, do not rely on this observation alone to help identify the problem. On the basis of this information, the apparent corrective measure would appear to be a readjustment of the liquid injection system. Lowering the equalizing pressure on the thermal expansion valve would increase the refrigerant feed and the oil temperature should drop.

If the high oil temperature was the result of high suction superheat, however, and not just a matter of improper liquid injection adjustment, increasing the liquid feed could lead to other problems. Under low load conditions, the liquid injection system may have a tendency to overfeed. The high suction superheat condition, moreover, may only be temporary. When system conditions return to normal the unit's liquid injection will overfeed and oil temperature will drop. In solving the wrong problem a new problem was created.

When an operating problem develops, compare all operating information on the OPERATING DISPLAY with normal operating conditions. If an Operating Log has been maintained, the log can help determine what constitutes normal operation for the compressor unit in that particular system.

The following list of abnormal system conditions can cause abnormal operation of the RDB Booster compressor unit:

1. Insufficient or excessive refrigeration load.

2. Excessively high suction pressure.

3. Excessively high suction superheat.

4. Excessively high discharge pressure.

5. Inadequate refrigerant charge or low receiver level.

6. Excessively high or low temperature coolant to the oil cooler.

7. Liquid return from system (slugging).

8. Refrigerant underfeed or overfeed to evaporators.

9. Blocked tubes in water cooled oil cooler from high mineral content of water.

10. Insufficient evaporator or condenser sizing.

11. Incorrect refrigerant line sizing.

12. Improper system piping.

13. Problems in electrical service to compressor unit.

14. Air and moisture present in the system.

Make a list of all deviations from normal plant operation and normal compressor unit operation. Delete any items which do not relate to the symptom and separately list those items that might relate to the symptom. Use the list as a guide to further investigate the problem.

The second step in problem solving is to decide which items on the list are possible causes and which items are additional symptoms. High discharge temperature and high oil temperature readings on a display may both be symptoms of a problem and not casually related. High suction superheat or a low receiver level, however, could cause both symptoms.

The third step is to identify the most likely cause and take action to correct the problem. If the symptoms are not relieved, move to the next item on the list and repeat the procedure until you have identified the cause of the problem. Once the cause has been identified and confirmed, make the necessary corrections.

SERVICING THE COLD-START VALVE

WARNING **DO NOT ATTEMPT TO SERVICE THE COLD START VALVE. PLEASE CONTACT THE FRICK SERVICE DEPARTMENT.**

PRESSURE TRANSDUCER TESTING

1. Shut compressor down and allow pressures to equalize.

2. Isolate suction transducer PE-4 (see Figure 25 for location) from unit and depressurize using valves provided at the transducer manifold. **NOTE: Recover or transfer all refrigerant vapor, in accordance with local ordinances, before opening to atmosphere.**

3. Measure the voltage of PE-4 on connector P4 (terminals WHT and BLK) on the SBC with a digital voltmeter.

4. The voltage reading should be between 1.48 VDC and 1.72 VDC at standard atmospheric pressure (14.7 PSIA or 0 PSIG). When checking transducers at higher elevations, an allowance in the readings must be made by subtracting approximately 0.02 VDC per 1000 feet of elevation above sea level. Barometric pressure can generally be ignored but in extreme cases may be compensated for by adding/subtracting 0.002 VDC for each 0.1 inch of barometric pressure (adjusted to sea level) above/below 0 PSIG. Therefore, if PE-4 is measured at 5000 feet elevation under relatively normal weather conditions, the output voltage should differ by 0.10 VDC to read between 1.38 VDC and 1.62 VDC.

5. Divide voltage reading by .00488

6. Subtract 205 from the result.

7. Multiply the result by 10.

8. Divide the result by 82.

9. This result is the absolute suction pressure (PSIA). The Operating display will indicate PSIG (14.7 PSIA = 0.0 PSIG).

10. Isolate the oil pressure transducer PE-1 from the package and depressurize. **NOTE: Recover or transfer all refrigerant vapor, in accordance with local ordinances, before opening to atmosphere.**

11. Measure the voltage of PE-1 on connector P4 (terminals WHT and BLK) on the SBC.

12. The voltage reading should be between 1.1 VDC and 1.29 VDC at standard atmospheric pressure. PE-1, PE-2, and PE-3 all have a span of 300 PSI as compared to PE-4 with a span of 100 PSI. Therefore, atmospheric pressure changes have a lesser effect which is 0.0067 VDC per 1000 feet of elevation and 0.00067 VDC per 0.1 inch Hg barometric deviation.

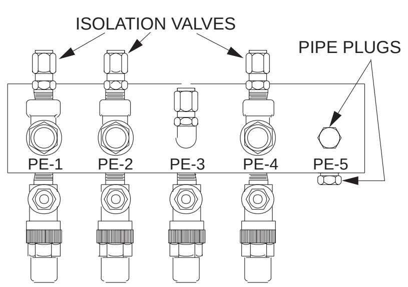


Figure 25

13. Isolate transducer PE-2 from the package and depressurize. **NOTE: Recover or transfer all refrigerant vapor, in accordance with local ordinances, before opening to atmosphere.**

14. Measure the voltage of PE-2 on connector P4 (terminals WHT and BLK) on the SBC.

15. The voltage reading should be between 1.1 VDC and 1.29 VDC at standard atmospheric pressure (see Step 12).

16. Since the discharge pressure, PE-3, cannot be closed off from its sensing point (code requirements), close all transducers from atmosphere and open them to their sensing points so all transducers can equalize to separator pressure.

17. Measure the voltage of PE-3 on connector P4 (terminals WHT and BLK) on the SBC.

18. Measure the voltage of PE-1 on connector P4 (terminals WHT and BLK) on the SBC.

19. These two voltages should be within .04 VDC of one another.

20. Test complete.

PRESSURE TRANSDUCER REPLACEMENT

1. Shut off control power.

2. Close the applicable transducer isolation valve. **NOTE: To change the discharge pressure transducer (PE-3), it will be necessary to depressurize the entire compressor package. Follow the "General Instructions For Replacing Compressor Unit Components" section before going to step 3.**

3. Remove the microprocessor console cover.

4. Use the chart to identify transducer terminals of the SBC.

TRANSDUCER	MANIFOLD CONNECTION
Oil Pressure	PE-1
Oil Before Filter (PSID)	PE-2
Discharge Pressure	PE-3
Suction Pressure	PE-4

5. Disconnect transducer leads by loosening the terminal screws for the transducer to be changed.

6. Tape a 3 foot length of pull wire to the leads of the transducer to be removed.

7. Pull the transducer leads through the conduit until pull wire extends out of the conduit hole in the transducer manifold. Separate the transducer leads from the pull wire.

8. Unscrew the transducer using a wrench on the metal hex at the base of the transducer. **DO NOT ATTEMPT TO LOOSEN OR TIGHTEN TRANSDUCERS BY THEIR TOP CASING.**

9. Install new transducer and tape leads to the pull wire.

10. Pull new transducer leads into the microprocessor console and reconnect them to the terminal strip.

11. Replace the microprocessor console cover and transducer manifold cover.

12. Reopen the transducer isolation valve.

13. Turn on control power.

PRESSURE TRANSDUCER CONVERSION DATA				
	200 psi		500 psi	
Sensor	Range - PSI		Range - PSIG*	
Voltage	low	high	low	high
1.0	29.92"	9.57"	29.92"	4.10
1.1	29.92"	0.30	29.92"	16.60
1.2	29.92"	5.30	17.10"	29.10
1.3	19.74"	10.30	4.10	41.60
1.4	9.57"	15.30	16.60	54.10
1.5	0.30	20.30	29.10	66.60
1.6	5.30	25.30	41.60	79.10
1.7	10.30	30.30	54.10	91.60
1.8	15.30	35.30	66.60	104.10
1.9	20.30	40.30	79.10	116.60
2.0	25.30	45.30	91.60	129.10
2.1	30.30	50.30	104.10	141.60
2.2	35.30	55.30	116.60	154.10
2.3	40.30	60.30	129.10	166.60
2.4	45.30	65.30	141.60	179.10
2.5	50.30	70.30	154.10	191.60
2.6	55.30	75.30	166.60	204.10
2.7	60.30	80.30	179.10	216.60
2.8	65.30	85.30	191.60	229.10
2.9	70.30	90.30	204.10	241.60
3.0	75.30	95.30	216.60	254.10
3.1	80.30	100.30	229.10	266.60
3.2	85.30	105.30	241.60	279.10
3.3	90.30	110.30	254.10	291.60
3.4	95.30	115.30	266.60	304.10
3.5	100.30	120.30	279.10	316.60
3.6	105.30	125.30	291.60	329.10
3.7	110.30	130.30	304.10	341.60
3.8	115.30	135.30	316.60	354.10
3.9	120.30	140.30	329.10	366.60
4.0	125.30	145.30	341.60	379.10
4.1	130.30	150.30	354.10	391.60
4.2	135.30	155.30	366.60	404.10
4.3	140.30	160.30	379.10	416.60
4.4	145.30	165.30	391.60	429.10
4.5	150.30	170.30	404.10	441.60
4.6	155.30	175.30	416.60	454.10
4.7	160.30	180.30	429.10	466.60
4.8	165.30	185.30	441.60	479.10
4.9	170.30	190.30	454.10	491.60
5.0	175.30	195.30	466.60	504.10
At 0 psig	**1.094 V**	**1.494 V**	**0.968 V**	**1.268 V**

* Below 0 PSIG measured in inches of mercury.

TEMPERATURE and/or PRESSURE ADJUSTMENT

All temperature and pressure sensors are factory set, calibration is not required.

TROUBLESHOOTING THE RDB BOOSTER COMPRESSOR

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
EXCESSIVE NOISE and VIBRATION	Bearing damage or excessive wear. CONTACT Frick Factor or Frick. Coupling loose on shaft. Tighten coupling. Replace if damaged. Misalignment between motor and compressor. Realign motor and compressor. Refrigerant flood back. Correct system problem.

Troubleshooting the compressor is limited to identifying the probable cause. If a mechanical problem is suspected contact the Frick Service Department. DO NOT ATTEMPT TO DISASSEMBLE COMPRESSOR.

TROUBLESHOOTING THE OIL SEPARATION SYSTEM

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
GRADUAL OIL LOSS WITH AN OIL LEVEL IN THE COALESCER SECTION SIGHT GLASS	Maintaining too high an oil level. Lower level. Refrigerant carryover or liquid injection overfeeding. Correct operation. Loss of suction superheat. Adjust evaporator feeds. Contaminated oil, damaged or not seated coalescer filter elements. Replace oil charge and coalescers. Oil float return valve closed. Open return valve. Float equalizing valve closed. Open valve. Coalescing oil return line strainer blocked. Clean Clean and check needle valve.
RAPID LOSS WITH NO OIL LEVEL IN THE COALESCER SECTION SIGHT GLASS	On shutdown, compressor unit suction check valve did not close. Repair valve. Suction check valve by pass valve open. Close valve. Coalescers loose or not seated properly. Correct or replace.

TROUBLESHOOTING THE DEMAND PUMP SYSTEM

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
PUMP WILL NOT PRODUCE ENOUGH OIL PRESSURE TO START COMPRESSOR	Check pump rotation. Check that service valves are open. Filter cartridges may be blocked. Check PSID across filters. Strainer may be blocked. Clean. Oil pressure regulator set too low or stuck open. Readjust or repair. Pump worn out. Repair or replace.
OIL PRESSURE RAPIDLY DROPS OFF WHEN COMPRESSOR STARTS RESULTS IN COMPRESSOR DIFFERENTIAL ALARM	Main oil injection throttling valve too wide open or oil pressure regulating valve improperly adjusted. Readjust both valves.
OIL PRESSURE FLUCTUATES	Liquid injection overfeeding or refrigerant flood back from system. Make necessary adjustments or corrections
NOISE and VIBRATION	Pump strainer blocked. Clean. Liquid refrigerant overfeed. Adjust liquid injection. Pump worn out. Repair or replace.
GREASE LEAKS FROM VENT PORT IN THE SIDE OF THE PUMP BODY	Normal leakage which will cease after initial operation. Black oil leaking from this vent indicates oil seal wear or failure. If leakage exceeds normal allowable rate of 7 drops per minute, replace seal.
OIL PRESSURE DROPS AS HEAD PRESSURE INCREASES	Normal behavior. Set main oil injection and oil pressure for maximum head pressure condition.
MAIN FILTER PSID IS TOO HIGH	Filters clogged with dirt. Replace. Oil is too cold. Allow oil to warm up and check again. Service valve on filter outlet is partially closed. Open valves fully.

TROUBLESHOOTING THE LIQUID INJECTION OIL COOLING SYSTEM

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
HIGH OIL TEMPERATURE	Insufficient liquid supply. Check receiver level and pressure drop at injection solenoid. Equalizer pressure too high. Lower. Suction superheat too high. Correct system problem. Thermal valve power head lost charge. Replace. Liquid strainer blocked. Clean. Liquid solenoid coil failed. Replace. Excessive load. Thermovalve undersized. Reduce load or install larger thermovalve.
LOW OIL TEMPERATURE	Equalizing pressure too low. Raise. Suction superheat too low or liquid coming back on compressor. Correct system problem. Low load conditions. Valve oversized, increase load or use smaller thermovalve.
OIL TEMPERATURE FLUCTUATES	System conditions rapidly fluctuate causing liquid injection system to over respond. Stabilize system operation.

THERMAL EXPANSION VALVES

In situations where system load conditions increase or decrease over extended periods of time and the liquid injection thermal expansion valve is not adequate for the new conditions, an improvement in valve performance may be achieved by increasing or decreasing discharge tube size.

NOTE: DO NOT ATTEMPT TO ADJUST SUPERHEAT ADJUSTMENT STEM ON BOTTOM OF VALVE IN AN EFFORT TO CHANGE THE VALVE'S PERFORMANCE. THIS ADJUSTMENT IS PRESET AT THE FACTORY. ONLY ADJUST 1/4" BLEED VALVE.

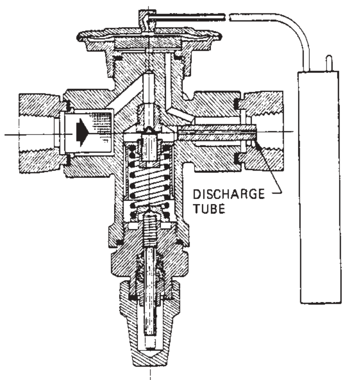


Figure 26 - TYPE D (1-15 TONS) R-717

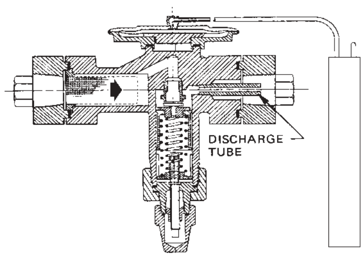


Figure 27 - TYPE A (20-100 TONS) R-717

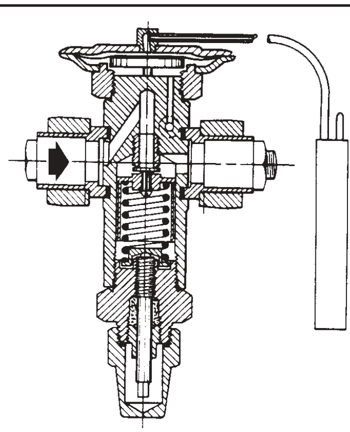


Figure 28 - TYPE H (2-1/2 TO 16 TONS) R-22

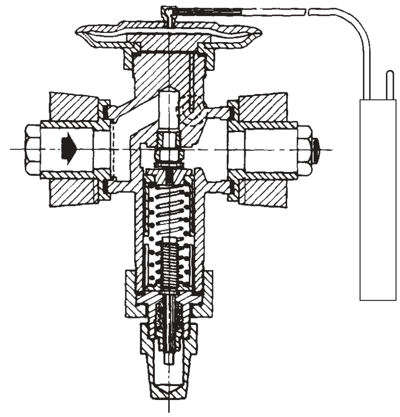


Figure 29 - TYPE M (12 TO 34 TONS) R-22

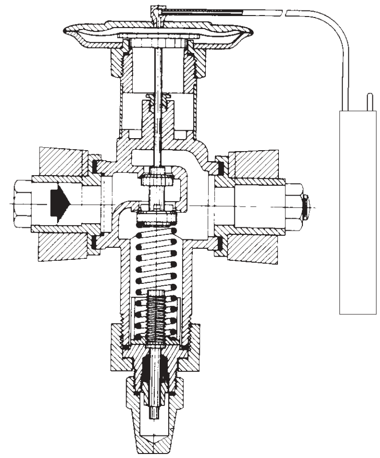


Figure 30 - TYPE V (52 TO 100 TONS) R-22

R-717 TX VALVE SIZES

TX VALVE MODE	PORT SIZE	DISCHARGE TUBE SIZE
DAE - 1	1/16	1/32
DAE - 2	1/16	1/16
DAE - 5	7/64	5/64
DAE - 10	3/16	7/64
DAE - 15	3/16	5/32
AAE - 20	5/16	1/8
AAE - 30	5/16	5/32
AAE - 50	3/8	3/16
AAE - 75	3/8	NONE
AAE - 100	7/16	NONE

R-22 TX VALVE SIZES

TX VALVE MODE	FPT CONNECTION
HVE - 2-/1/2	1/2
HVE - 5-1/2	1/2
HVE - 11	1/2
HVE - 16	1/2
MVE - 12	1
MVE - 21	1
MVE - 34	1
VVE - 52	1
VVE - 70	1
VVE - 100	1

BARE COMPRESSOR MOUNTING

The following procedure is required only when a bare compressor is replaced in the field.

1. Thoroughly clean the compressor feet and mounting pads of burrs and other foreign matter to ensure firm seating of the compressor.

2. Clean the discharge flange surfaces on the compressor and separator.

3. Install a gasket on the compressor discharge connection of the separator.

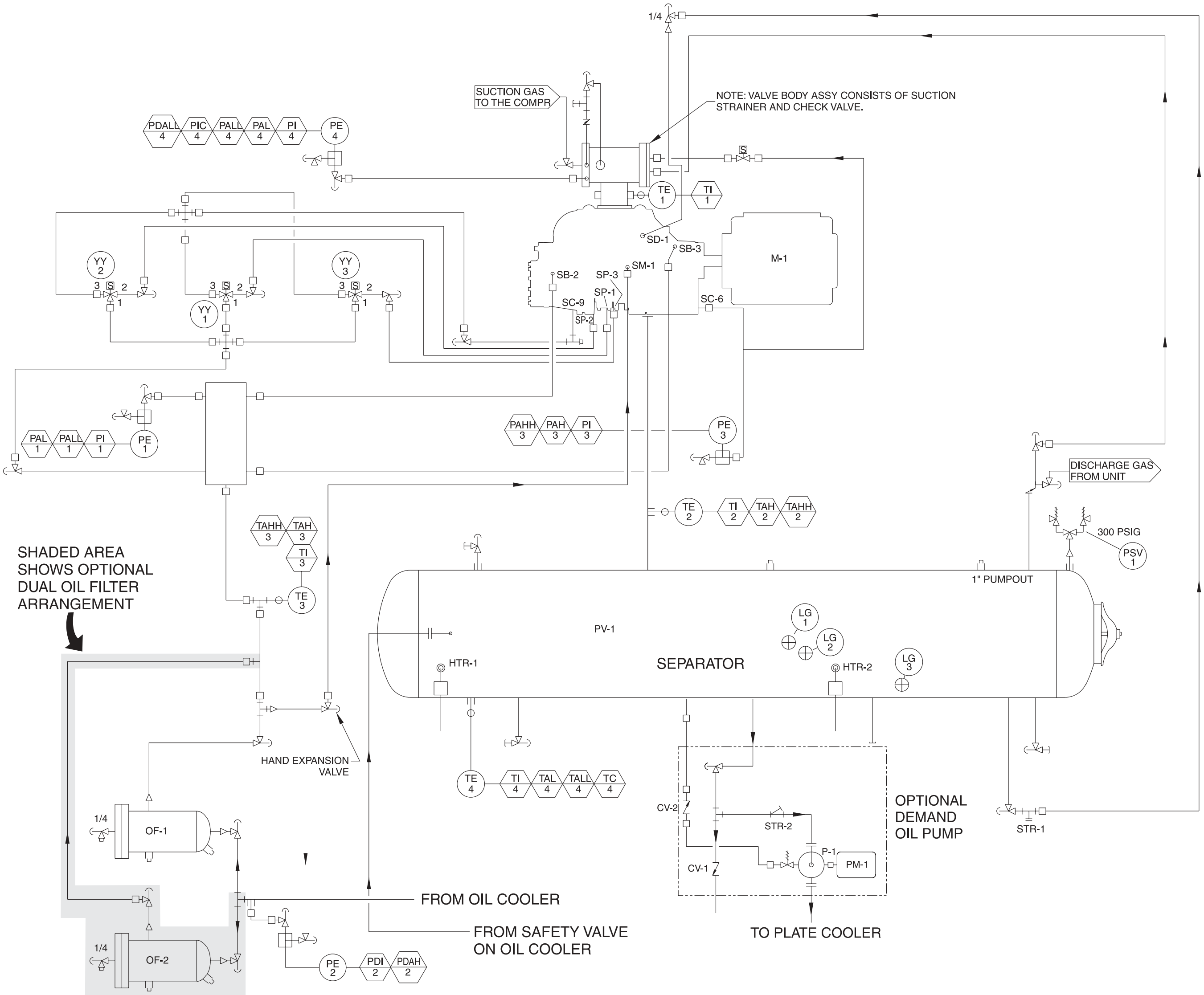
4. Set the compressor on its base and tighten the discharge flange bolts. **The feet of the compressor should lift off the mounting base. If the compressor feet do not raise off the mounting base install a thicker discharge gasket and reinstall the discharge flange bolts.** Check the clearance between the feet and the base with a feeler gauge. Shim the compressor feet (gauge reading plus .002").

5. Tighten compressor hold down bolts.

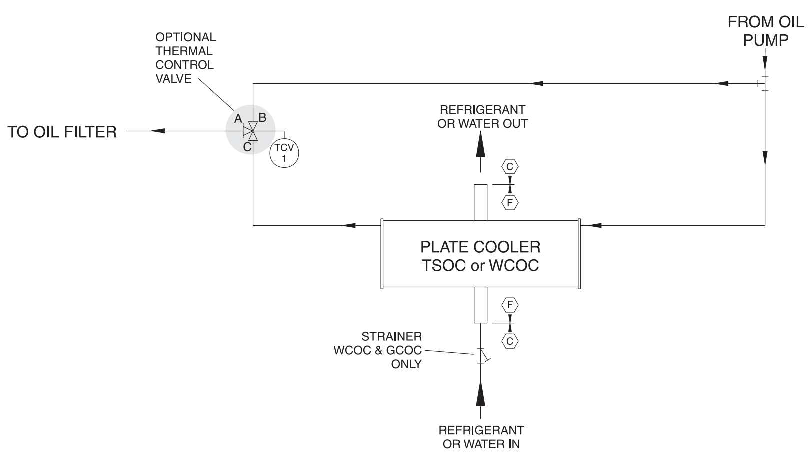
6. Complete compressor/motor coupling alignment (see INSTALLATION section).

7. Complete tubing, piping and wiring per the P & I and wiring diagrams.

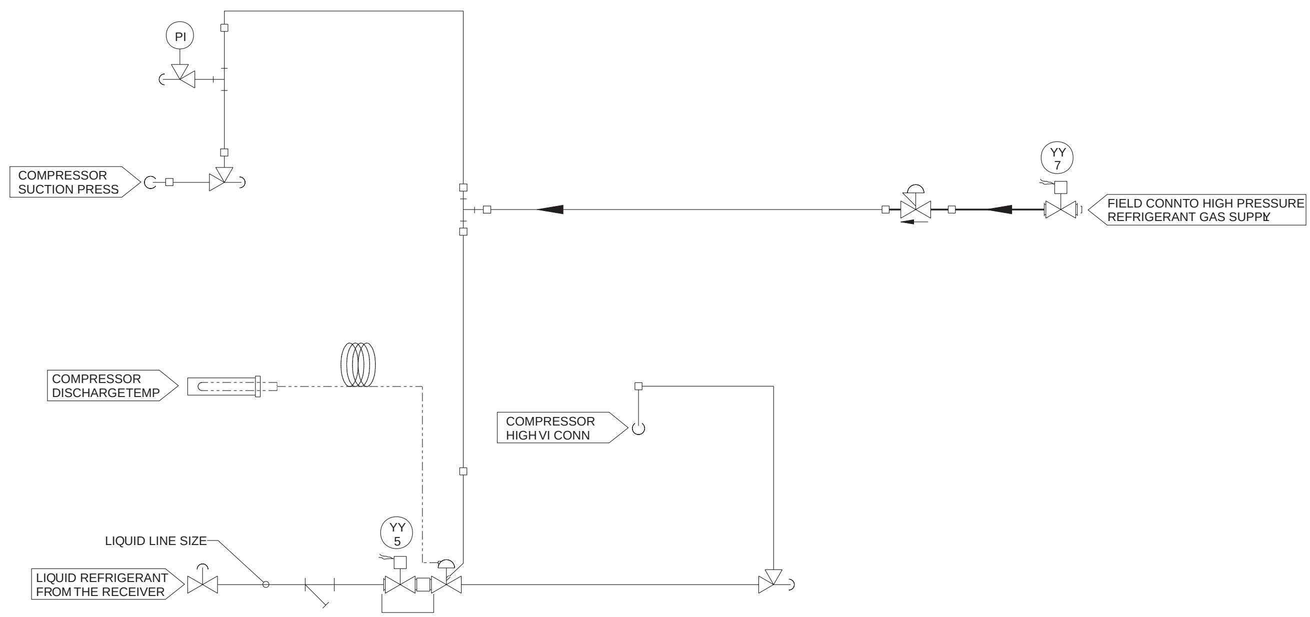
P & I DIAGRAM



OIL COOLER OPTIONS



LIQUID INJECTION OIL COOLING



LEGEND (Covers all P & I diagrams in this manual)

C	COMPRESSOR
CV	CHECK VALVE
DP	DISCHARGE PRESSURE
FG	FLOW GLASS
HV	HAND VALVE
HTR	HEATER
LG	LEVEL GLASS
LSLL	SEPARATOR LOW OIL LEVEL SHUTDOWN
M	MOTOR
1MC	MOTOR CONTROL CENTER
2MC	MOTOR CONTROL CENTER
NOS	NO OIL SWITCH
OF	OIL FILTER
OP	OIL PRESSURE
P	DEMAND PUMP
PAH	HIGH DISCHARGE PRESSURE ALARM
PAHH	HIGH DISCHARGE PRESSURE SHUTDOWN
PAL	LOW PRESSURE ALARM
PALL	LOW PRESSURE SHUTDOWN
PDAH	HIGH PRESSURE DIFFERENTIAL ALARM
PDI	PRESSURE DIFFERENTIAL INDICATOR
PDSLL	COMPRESSOR LOW DIFFERENTIAL PRESSURE CUTOUT
PE	PRESSURE TRANSDUCERS
PI	PRESSURE INDICATOR
PIC	PRESSURE INDICATION CONTROLLER
PM	PUMP MOTOR
PS	PRESSURE SWITCH CONTROL
PSV	HIGH PRESSURE SAFETY VALVE
SP	SUCTION PRESSURE
STR	STRAINER
TAH	HIGH TEMPERATURE ALARM
TAHH	HIGH TEMPERATURE SHUTDOWN
TAL	LOW OIL TEMPERATURE ALARM
TALL	LOW OIL TEMPERATURE SHUTDOWN
TC	TEMPERATURE CONTROLLER
TCV	THERMAL CONTROL VALVE
TE	TEMPERATURE ELEMENT
TI	TEMPERATURE INDICATOR
TS	TEMPERATURE SWITCH

TSH	TEMPERATURE SWITCH HIGH ALARM
TW	THERMOWELL
VI	VI CONTROL
SB-2	INLET BEARING & BALANCE PISTON
SB-3	DISCHARGE BEARINGS & SEAL
SC-1	SLIDE VALVE - UNLOAD
SC-2	SLIDE VALVE - LOAD
SC-3	MOVEABLE SLIDE STOP
SC-4	MOVEABLE SLIDE STOP
SC-5	INLET PRESSURE
SC-6	DISCHARGE PRESSURE
SC-7	SEAL WEEPAGE
SC-8	OIL DRAIN CONNECTION
SC-9	INLET HOUSING OIL DRAIN
SC-13	OIL DRAIN CYLINDER
SE-1	ELECTRICAL CONNECTION
SE-2	ELECTRICAL CONNECTION
SL-1	LIQUID INJECTION LOW VI
SL-2	LIQUID INJECTION HIGH VI
SM-1	MAIN OIL INJECTION
SV-1	VAPOR INJECTION TONGUE & GROOVE
SD-1	COALESCER BLEED STR THD O-RING PORT
TW-1	THERMOWELL

PRESSURE TRANSDUCERS INDICATE:
- PE-1 OIL PRESSURE (MANIFOLD)
- PE-2 OIL PRESSURE BEFORE FILTER
- PE-3 DISCHARGE PRESSURE
- PE-4 SUCTION PRESSURE

TEMPERATURE PROBES INDICATE:
- TE-1 SUCTION GAS TEMPERATURE
- TE-2 DISCHARGE GAS TEMPERATURE
- TE-3 LUBE OIL TEMPERATURE
- TE-4 SEPARATOR OIL TEMPERATURE

SOLENOID VALVE FUNCTION:
- YY-1 ENERGIZE UNLOAD SLIDE VALVE
- YY-2 ENERGIZE LOAD SLIDE VALVE
- YY-3 ENERGIZE INCREASE VOLUME RATIO
- YY-4 ENERGIZE DECREASE VOLUME RATIO

PROPER INSTALLATION OF ELECTRONIC EQUIPMENT IN AN INDUSTRIAL ENVIRONMENT

In today's refrigeration plants, electronic controls have found their way into almost every aspect of refrigeration control. Electronic controls have brought to the industry more precise control, improved energy savings and operator conveniences. Electronic control devices have revolutionized the way refrigeration plants operate today.

The earlier relay systems were virtually immune to radio frequency interference (RFI), electromagnetic interference (EMI), and ground loop currents. Therefore installation and wiring were of little consequence and the wiring job consisted of hooking up the point-to-point wiring and sizing the wire properly. In an electronic system, improper installation will cause problems that outweigh the benefits of electronic control. Electronic equipment is susceptible to RFI, EMI, and ground loop currents which can cause equipment shutdowns, processor memory and program loss, erratic behavior, and false readings. Manufacturers of industrial electronic equipment take into consideration the effects of RFI, EMI, and ground loop currents and incorporate protection of the electronics in their designs. These manufacturers require that certain installation precautions be taken to protect the electronics from these effects. All electronic equipment must be viewed as sensitive instrumentation and therefore requires careful attention to installation procedures. These procedures are well known to instrument engineers, but are usually not followed by general electricians.

There are a few basics, that if followed, will result in a trouble-free installation. The National Electric Code (NEC) is a guideline for safe wiring practices, but it does not deal with procedures used for electronic control installation. **Use the following procedures for electronic equipment installation.** These procedures do not override any rules by the NEC, but are to be used in conjunction with the NEC code.

WIRE SIZING

Size supply wires one size larger than required for amperage draw to reduce instantaneous voltage dips caused by large loads such as heaters and contactors and solenoids. These sudden dips in voltage can cause the processor, whether it be a microprocessor, a computer, or a PLC to malfunction momentarily or cause a complete reset of the control system. If the wire is loaded to its maximum capacity, the voltage dips are much larger, and the potential of a malfunction is very high. If the wire is sized one size larger than required, the voltage dips are smaller than in a fully loaded supply wire, and the potential for malfunction is much lower. The NEC code book calls for specific wire sizes to be used based on current draw. An example of this would be to use #14 gauge wire for circuits up to 15 amp or #12 gauge wire for circuits of up to 20 amp. Therefore, when connecting the power feed circuit to an electronic industrial control, use #12 gauge wire for a maximum current draw of 15 amp and #10 wire for a maximum current draw of 20 amp. Use this rule of thumb to minimize voltage dips at the electronic control.

VOLTAGE SOURCE

Selecting the voltage source is extremely important for proper operation of electronic equipment in an industrial environment. Standard procedure for electronic instrumentation is to provide a "clean" separate source voltage in order to prevent EMI, from other equipment in the plant, from interfering with the operation of the electronic equipment. Connecting electronic equipment to a breaker panel (also known as lighting panels and fuse panels) subjects the electronic equipment to noise generated by other devices connected to the breaker panel. This noise is known as electromagnetic interference (EMI). EMI flows on the wires that are common to a circuit. EMI cannot travel easily through transformers and therefore can be isolated from selected circuits. **Use a control transformer to isolate the electronic control panel from other equipment in the plant that generate EMI. See Figure 31.**

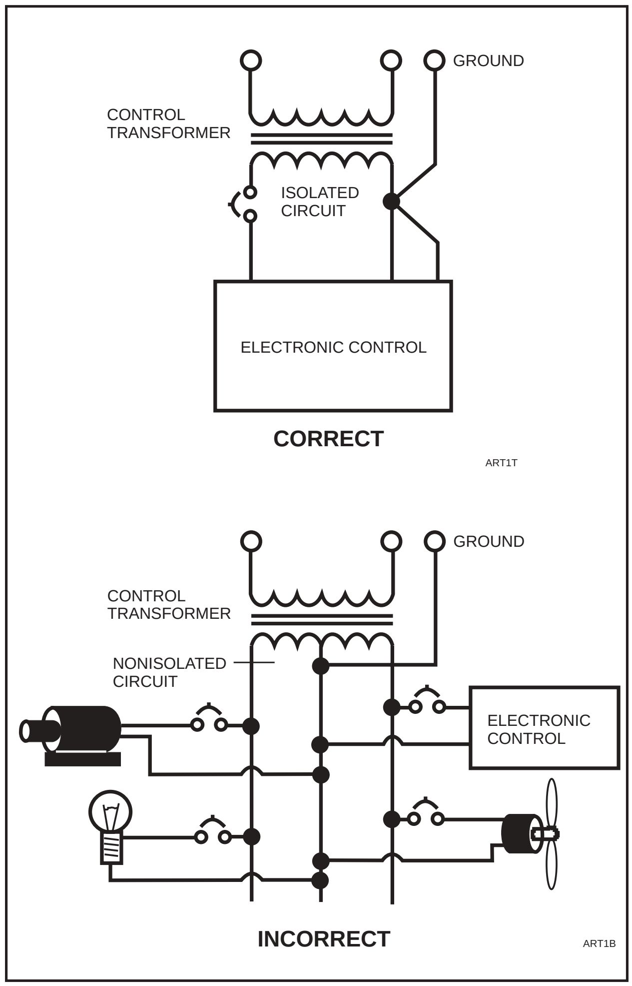


Figure 31

GROUNDING

Grounding is the most important factor for successful operation and is also the most overlooked. The NEC states that control equipment may be grounded by using the rigid conduit as a conductor. This worked for the earlier relay systems, but it is not acceptable for electronic control equipment. Conduit is made of steel and is a poor conductor relative to a copper wire. Electronic equipment reacts to very small currents and must have a good ground in order to operate properly; therefore, **copper grounds are required for proper operation. Note: aluminum may be used for the large three-phase ground wire.**

The ground wire must be sized the same size as the supply wires or one size smaller as a minimum. The three phase power brought into the plant must also have a ground wire, making a total of four wires. In many installations that are having electronic control problems, this essential wire is usually missing. A good ground circuit must be continuous from the plant source transformer to the electronic control panel for proper operation (Figure 32). Driving a ground stake at the electronic control will cause additional problems since other equipment in the plant on the same circuits will ground themselves to the ground stake causing large ground flow at the electronic equipment.

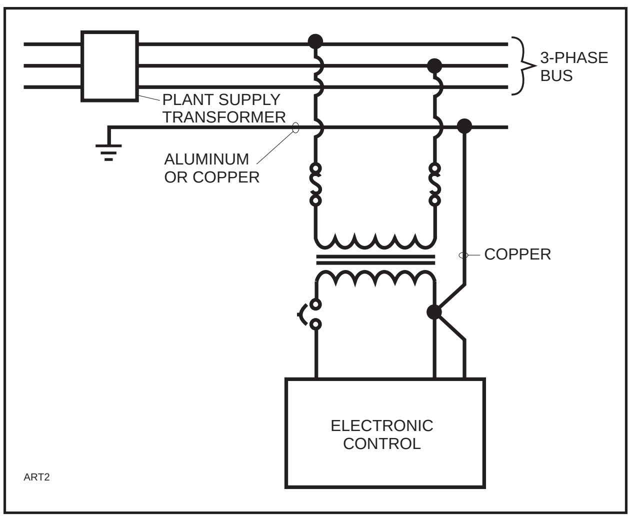


Figure 32

WIRING PRACTICES

Do not mix wires of different voltages in conduit. An example of this would be the installation of a screw compressor package. The motor voltage is 480 volts and the panel control power is 120 volts. **The 480 volt circuit must be run from the motor starter to the motor in its own conduit. The 120 volt circuit must be run from the motor starter control transformer to the control panel in its own separate conduit.** If the two circuits are run in the same conduit, transients on the 480 volt circuit will be inducted into the 120 volt circuit causing functional problems with the electronic control. Dividers must be used in wire way systems (conduit trays) to separate unlike voltages. The same rule applies for 120 volt wires and 220 volt wires. **Also, never run low voltage wires in the same conduit with 120 volt wires. See Figure 33.**

Never run any wires through an electronic control panel that do not relate to the function of the panel. Electronic control panels should never be used as a junction box. These wires may be carrying large transients that will interfere with the operation of the control. An extreme example of this would be to run the 480 volts from a motor starter through the control panel to the motor.

When running conduit to an electronic control panel, take notice of the access holes (knockouts) provided by the manufacturer. These holes are strategically placed so that the field wiring does not interfere with the electronics in the panel. **Never allow field wiring to come in close proximity with the controller boards since this will almost always cause problems.**

Do not drill a control panel to locate conduit connections. You are probably not entering the panel where the manufacturer would like you to since most manufacturers recommend or provide prepunched conduit connections. Drilling can cause metal chips to land in the electronics and create a short circuit. **If you must drill the panel, take the following precautions:** First cover the electronics with plastic and tape it to the board with masking or electrical tape. Second, place masking tape or duct tape on the inside of the panel where you are going to drill. The tape will catch most of the chips. Then clean all of the remaining chips from the panel before removing the protective plastic. It would be a good idea to call the manufacturer before drilling the panel to be sure you are entering the panel at the right place.

When routing conduit to the top of an electronic control panel, condensation must be taken into consideration. Water can condense in the conduit and run into the panel causing catastrophic failure. **Route the conduit to the sides or bottom of the panel and use a conduit drain.** If the conduit must be routed to the top of the panel, use a sealable conduit fitting which is poured with a sealer after the wires have been pulled, terminated and the control functions have been checked. **A conduit entering the top of the enclosure must have an O-ring-type fitting between the conduit and the enclosure** so that if water gets on top of the enclosure it cannot run in between the conduit and the enclosure. This is extremely important in outdoor applications.

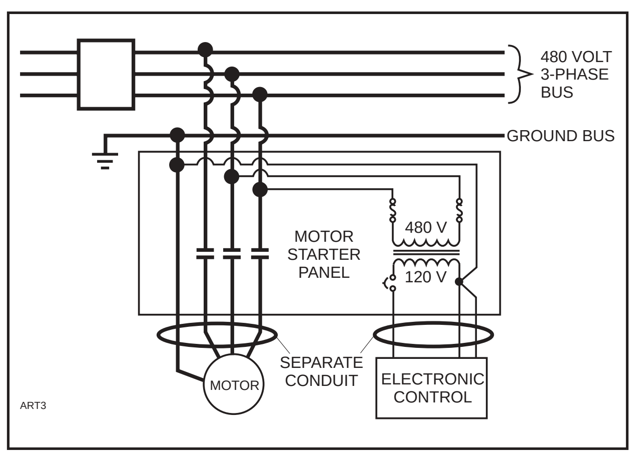


Figure 33

Never add relays, starters, timers, transformers, etc. inside an electronic control panel without first contacting the manufacturer. Contact arcing and EMI emitted from these devices can interfere with the electronics. Relays and timers are routinely added to electronic control panels by the manufacturer, but the manufacturer knows the acceptable device types and proper placement in the panel that will keep interference to a minimum. If you need to add these devices contact the manufacturer for the proper device types and placement.

Never run refrigerant tubing inside an electronic control panel. If the refrigerant is ammonia, a leak will totally destroy the electronics.

If the electronic control panel has a starter built into the same panel, be sure to run the higher voltage wires where indicated by the manufacturer. EMI from the wires can interfere with the electronics if run too close to the circuitry.

Never daisy-chain or parallel-connect power or ground wires to electronic control panels. Each electronic control panel must have its own supply wires back to the power source. Multiple electronic control panels on the same power wires create current surges in the supply wires which can cause controller malfunctions. Daisy-chaining ground wires allows ground loop currents to flow between electronic control panels which also causes malfunctions. See Figure 34.

It is very important to read the installation instructions thoroughly before beginning the project. Make sure you have drawings and instructions with your equipment. If not, call the manufacturer and have them send you the proper instructions. Every manufacturer of electronic equipment should have a knowledgeable staff, willing to answer your questions or fax additional information. Following correct wiring procedures will ensure proper installation of your electronic equipment.

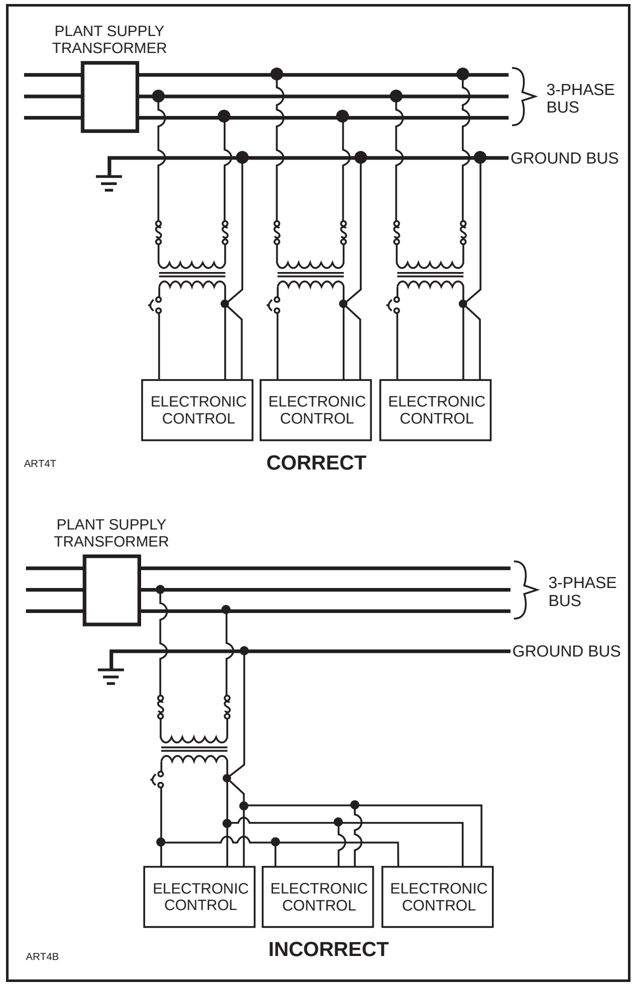


Figure 34

OPERATING LOG SHEET

SCREW COMPRESSOR
Operating Log Sheet

Frick Order No. ____________
Compr. Ser. No. ____________
Unit Location ____________

Date												
Time												
Hour Meter Reading												
Equipment Room Temp./Outdoor Temp.			/	/	/	/	/	/	/	/	/	/
Compressor		Suction Pressure										
		Suction Temperature										
		Suction Superheat										
		Discharge Pressure										
		Corresponding Temperature										
		Actual Discharge Temperature										
		Oil Pressure										
		Oil Temperature										
		Oil Filter Press. Drop - DP										
		Slide Valve Position %										
		Volume Ratio (V.I.)										
		FLA %										
		Seal Leakage (drops/min)										
Capacity Control Setpoint												
Oil Sep.		Separator Temperature										
		Oil Level (example ◒ ●)	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○
		Oil Added (gallons)										
Evap.	Brine	Inlet Temperature										
		Outlet Temperature										
		Pressure Drop - DP										
		Flow Rate - GPM										
Condenser	Air	Air On Temperature										
		Air Off Temperature										
	Water	Inlet Temperature										
		Outlet Temperature										
		Pressure Drop - DP										
		Flow Rate - GPM										
	Leaving Liquid Refrigerant Temperature											
Rcvr/Econ		Level										
		Pressure										

Remarks:

NOTE: Temperature and Pressure Units in °F and PSIG respectively, unless otherwise indicated.

COMPRESSOR 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 the IOM. 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 compressor drive coupling guard
__ Check compressor and driver shaft alignment
__ 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 alignment) 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 S90-010 OM (Quantum panel) or S70-301 OM (Plus panel)

Sign this form & fax to 717-762-2422 as confirmation of 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

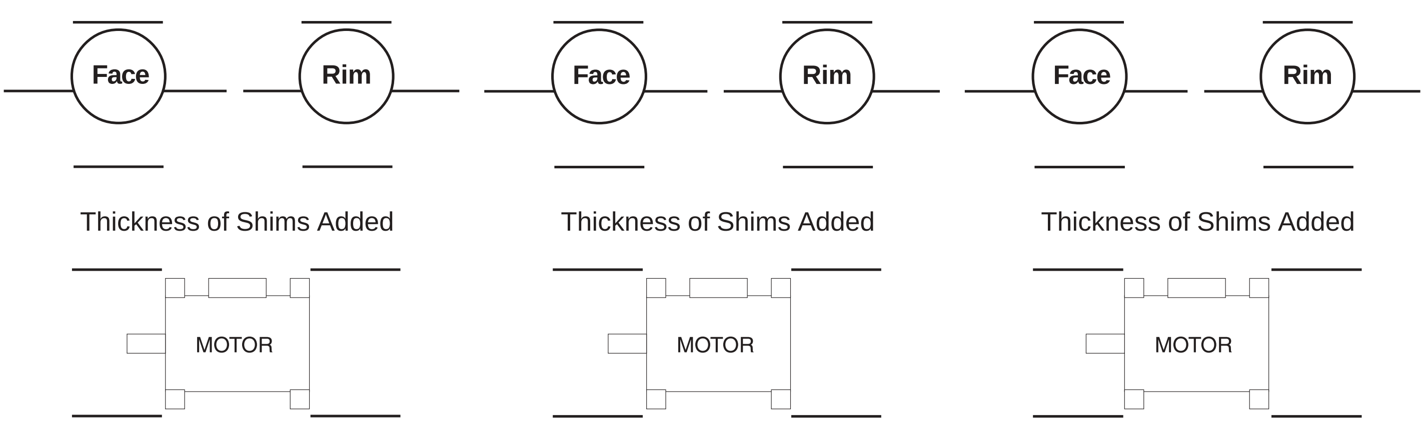
Adjustable Safety Setpoints

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.)							

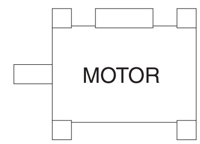
VIBRATION DATA SHEET

Date: ____ Sales Order Number: ____________________________
End User: ____________________________________ Installing Contractor: ____________________________
Address: _____________________________________ Service Technician: _____________________________

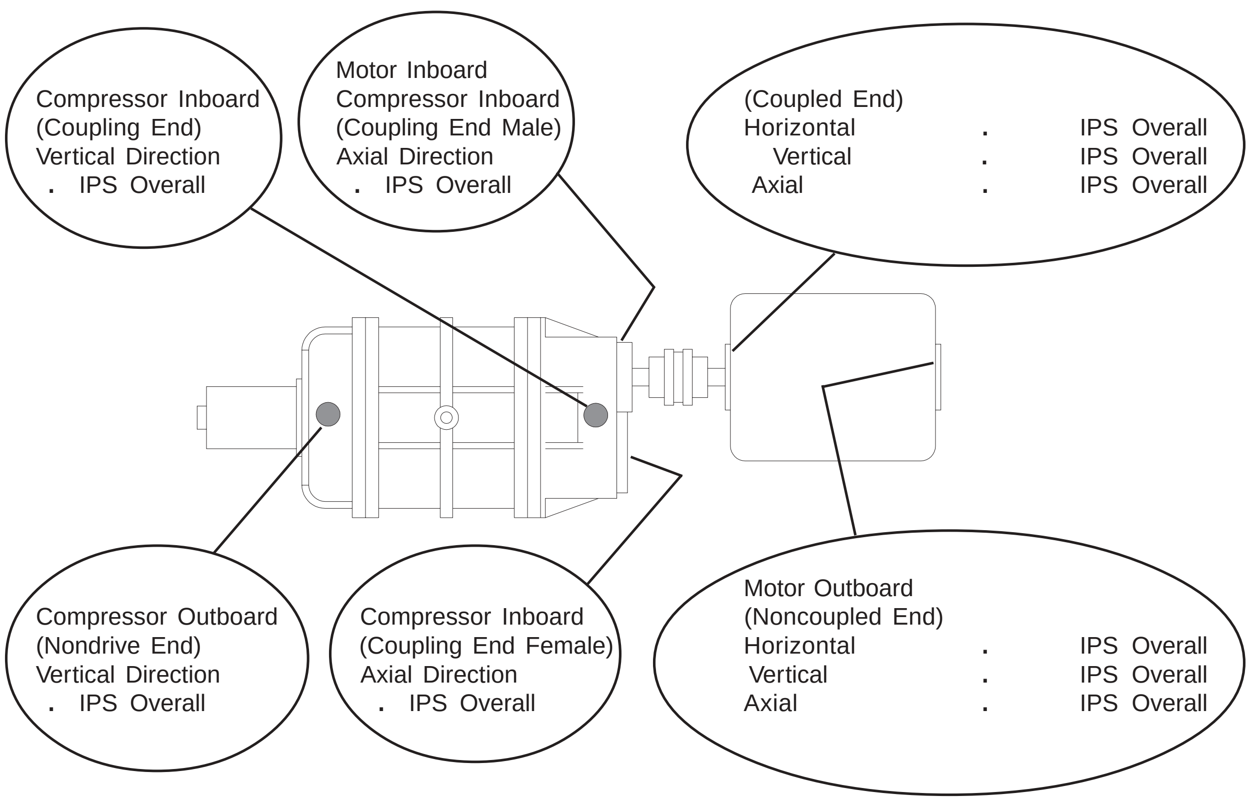
Equipment ID (As in Micrologo): ____________________
Compressor Serial Number: ____________________
Unit Serial Number: ____________________________
National Board Number: _____________________
Running Hours: _____________________________
Manufacturer and Size of Coupling: _______________
Motor Manufacturer: RAM ________________________
Motor Serial Number: ___________________________
RPM: ______ Frame Size: _________ H.P. ________
Refrigerant:
Ambient Room Temperature: __________°F
Operating Conditions:

Final Hot Alignment

Total Thickness of Shims Added



SUCTION	DISCHARGE	OIL	SEPARATOR	Slide Valve Position %
Press #	Press #	Press #	Temp °F	V.I. Ratio
Temp °F	Temp °F	Temp °F		F.L.A. %



RECOMMENDED SPARE PARTS - CURRENT DESIGN

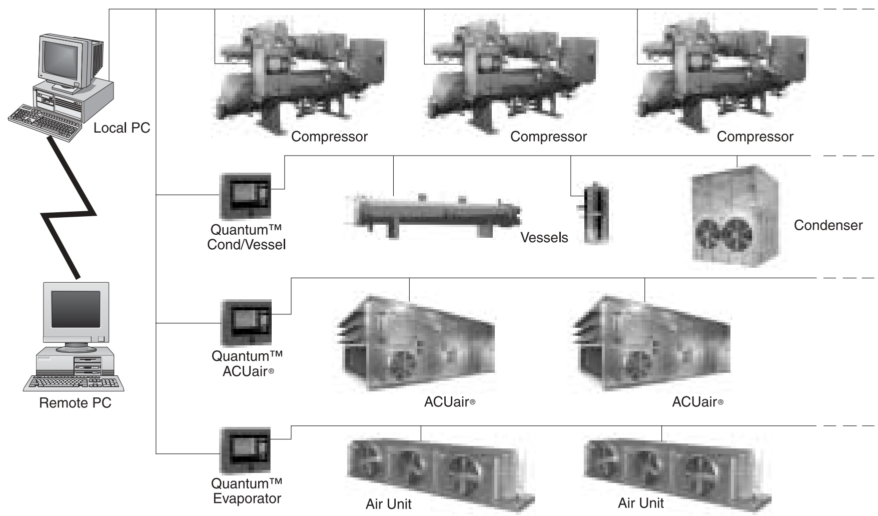
ITEM DESCRIPTION	QTY	MODELS	ITEM NO.
QUANTUM:			
Assembly, VGA Display, Phillips (Display only, 649C1078H01)	1	ALL	640C0052G01
Assembly, VGA Display, Sharp (Display only, 333Q0001581)	1	ALL	640C0021G01
Inverter (part of 640C0052G01 & 640C0021G01 above)	1	ALL	333Q0001582
Power Supply	1	ALL	640C0022G01
Battery, 3V	1	ALL	333Q0001786
Switch, Power	1	ALL	333Q0001194
Block, Contact, Power Switch	1	ALL	333Q0001195
Circuit Breaker, 10 Amp	1	ALL	649A0883H10
Circuit Breaker, 16 Amp	1	ALL	649A0883H16
Cable, Key Pad	1	ALL	640B0031H01
Cable, CCFT Backlight Inverter (for Phillips & Sharp Display)	1	ALL	640B0032H01
Cable, LCD Display (for Phillips Display)	1	ALL	640B0065H01
Cable, LCD Display (for Sharp Display)	1	ALL	640B0045H01
Cable Harness, Power	1	ALL	640B0038H01
Cable Harness, Digital Board 1	1	ALL	640B0041H01
Keypad, Overlay	1	ALL	640D0060H01
Circuit Board, Main (Arcom, Quantum IV)	1	ALL	649C1084G01
Board, Analog 1	1	ALL	640C0026G01
Board, Digital 1	1	ALL	640C0024G01
Module, Output, 280V (For 115/230V)	2	ALL	111Q0281061
Module, Input, 90-140V (For 115V)	1	ALL	333Q0000116
Fuse, 5 Amp, 250V, Digital Board	4	ALL	333Q0001326
Relay, 3PDT, 115V	1	ALL	333Q0000206
UNIT:			
Temperature Sensor (TE-1—4)	1	ALL	913A0101H01
Transducer, Pressure, 0—200 PSIA	1	ALL	913A0110H01
Transducer, Pressure, 0—500 PSIA	1	ALL	913A0110H02
Heater, Oil, 500W, 120V	1	ALL	913A0047H01
Heater, Oil, 500W, 240V	1	ALL	913A0047H03
Filter, Coalescing, Convoluted	A/R	ALL	531B0065H01
Gasket, Manway For Coalescer	1	100 & 134	531A0105H03
Gasket, Manway For Coalescer	1	177—546	531A0105H04
Element, Filter, Oil, SuperFilter™	A/R	ALL	531A0218H01
Gasket, End Cover, For 531A0028H01 Above	1	ALL	959A0082H01
Gasket, Clamping Plate, For 531A0028H01 Above	1	ALL	959A0053H01
Shaft Seal Kit, TDSL193	1	100 & 134	534M0163G06
Shaft Seal Kit, TDSL233	1	177—222	534M0163G07
Shaft Seal Kit, TDSL283	1	316—546	534M0163G04

* Order and replace gaskets when filter elements are inspected or replaced.

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

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