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Installation - Operation - Maintenance



ROTARY SCREW COMPRESSOR UNITS  
WITH  
MICROPROCESSOR CONTROL  
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.

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## PREFACE

This manual has been prepared to acquaint the owner and serviceman with the INSTALLATION, OPERATION, and MAINTENANCE procedures as recommended by Frick for RXB PLUS 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 his expert guidance in this determination.

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

**CORRECT INSTALLATION  
PROPER OPERATION  
REGULAR, SYSTEMATIC MAINTENANCE**

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

A refrigeration compressor is a VAPOR PUMP. To be certain that it is not being subjected to liquid refrigerant carryover, it is necessary that refrigerant controls are carefully selected and in good operating condition; 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. E70-100 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.**

**Frick**  
ROTARY SCREW COMPRESSOR  
MODEL/SERIAL NO. \_\_\_\_\_  
REFRIGERANT \_\_\_\_\_  
VOL. RATIO \_\_\_\_\_  
MAX. SPEED RPM \_\_\_\_\_  
DESIGN PRESSURE PSIG \_\_\_\_\_  
YEAR OF MFR \_\_\_\_\_  
COMPRESSOR MFGD. UNDER PATENTS LICENSED FROM SVENSKA ROTOR MASKINER AKTIEBOLAG, SWEDEN.  
WAYNESBORO, PA 17268

COMPRESSOR DATA PLATE

**Frick**  
ROTARY SCREW COMPRESSOR UNIT  
UNIT MODEL NO. \_\_\_\_\_  
UNIT SER. NO. \_\_\_\_\_  
FRICK SALES ORD. \_\_\_\_\_  
REFRIGERANT \_\_\_\_\_  
MAX. DESIGN PRESSURE PSIG \_\_\_\_\_  
kPa \_\_\_\_\_  
WAYNESBORO, PA 17268

UNIT DATA PLATE

## FOUNDATION

Each **RXB PLUS** Rotary Screw Compressor Unit is shipped mounted on a wood skid which must be removed prior to unit installation. **CAUTION: Allow space for servicing both ends of the unit. A minimum of 24 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 **HANDLING** and **MOVING**), 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 (in.)	MOMENTS (ft-lbf)			LOAD (lbf)		
	AXIAL	VERT.	LAT.	AXIAL	VERT.	LAT.
	M <sub>R</sub>	M <sub>C</sub>	M <sub>L</sub>	P	V <sub>C</sub>	V <sub>L</sub>
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.

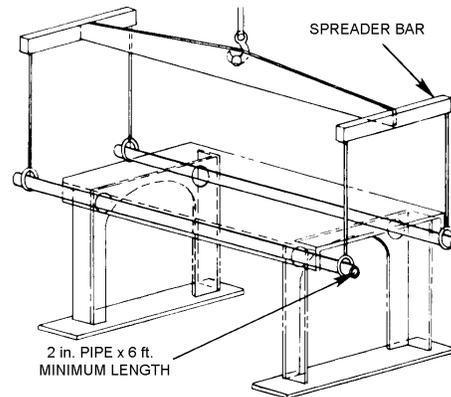


FIG. 1 - RECOMMENDED LIFTING METHOD

## HANDLING AND MOVING

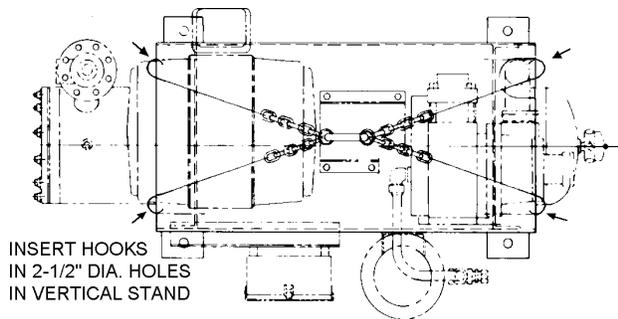


**THIS UNIT MAY BE TOP HEAVY. USE CARE WHILE HANDLING. Spreader bars should be used on**

**both the length and width of the package to prevent bending of oil lines and damage to the package.**

The unit can be moved with rigging, using a crane or forklift. The recommended method is to insert lengths of 2" pipe through the lifting holes in the vertical supports (see FIG. 1). Alternatively, hooks may be used in rigging, inserting them in the lifting holes (see FIG. 2).

Use **CAUTION** in locating the lifting ring. If no motor is mounted, the lifting ring should be moved off center to the compressor side 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.



**FIG. 2 - ALTERNATIVE LIFTING METHOD**

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.
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 that the shafts are properly spaced for the coupling being used. Refer to the coupling data table for the applicable dimension.

**COMPRESSOR/MOTOR COUPLING  
INSTALLATION**

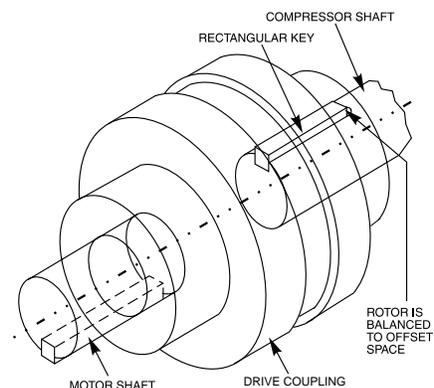
RXB PLUS units are arranged for direct motor drive and require a flexible drive coupling to connect the compressor to the motor. Before installing, perform the following:

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. 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:

**WARNING** **IT IS MANDATORY THAT THE COUPLING CENTER BE REMOVED AND THE DIRECTION OF MOTOR ROTATION BE CONFIRMED BEFORE RUNNING THE COMPRESSOR.** Proper rotation of the compressor shaft is clockwise looking at the end of the compressor shaft. **FAILURE TO FOLLOW THIS STEP COULD RESULT IN BACKWARD COMPRESSOR ROTATION WHICH CAN CAUSE COMPRESSOR FAILURE OR EXPLOSION OF THE SUCTION HOUSING.**

1. 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 onto 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 FIG. 3). 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.



**FIG. 3 - COUPLING/SHAFT KEYS INSTALLATION**

**CH COUPLING DATA TABLE**

CH COUPLING SIZE	BETWEEN SHAFT SPACING				COUPLING HUB						MAXIMUM TOTAL INDICATOR READING		CLAMP BOLT TORQUE		KEYWAY SETSCREW TORQUE	
	MIN *		MAX		SHAFT ENGAGEMENT				FACE SPACING							
	in.	mm	in.	mm	in.	mm	in.	mm								
									in.	mm	ft-lb	Nm	ft-lb	Nm		
6	3	76.2	3-1/4	101.6	3/4	19.0	15/16	23.8	7/8	22.2	.004	.104	10	13.6	13	17.6
7	3	76.2	3-7/16	138.1	1	25.4	1-3/8	34.9	1-1/16	27.0	.004	.104	20	27.1	13	17.6
8	3-13/16	96.8	4	161.9	1	25.4	1-13/16	46.0	1-1/8	28.6	.004	.104	35	47.5	13	17.6
9C	3-9/16	90.5	5-7/16	149.2	1-1/4	31.8	2-3/8	60.3	1-7/16	36.5	.004	.104	35	47.5	13	17.6

## 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.**

Use dial indicators 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. The following procedure is recommended.



**MISALIGNMENT MUST NOT EXCEED .004" FOR ALL CH COUPLINGS.**

### ANGULAR ALIGNMENT

1. To check angular alignment, as shown in Fig. 1., 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 Fig. 2.

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 Fig. 2.

4. Rotate both coupling hubs together 180° (6 o'clock position), as shown in Fig. 3. 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.

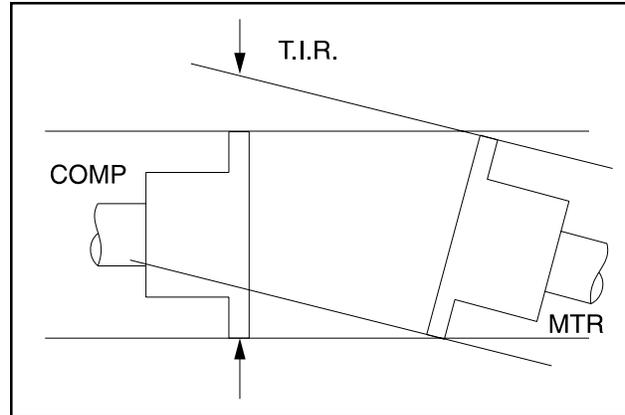


FIG. 1 - ANGULAR MISALIGNMENT

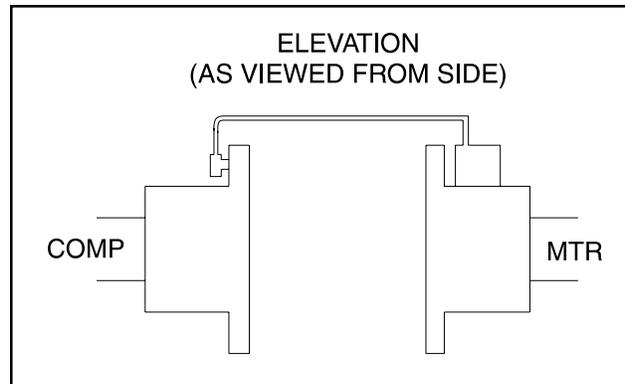


FIG. 2 - DIAL INDICATOR ATTACHED (AT 12 O'CLOCK)

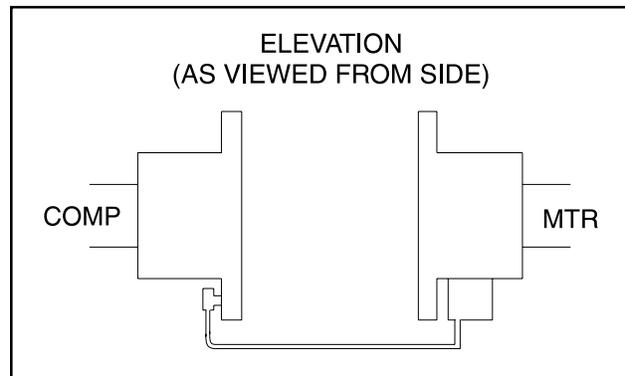


FIG. 3 - DIAL INDICATOR AT 6 O'CLOCK

**PARALLEL ALIGNMENT**

6. To check parallel alignment, as shown in Fig. 4, reposition dial indicator so the stem is in contact with the rim of the compressor hub, as shown in Fig. 5.

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 Fig. 6.

Set indicator at zero and rotate both coupling hubs together 180° (9 o'clock position), as shown in Fig. 5.

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

11. Recheck angular misalignment and realign if necessary.

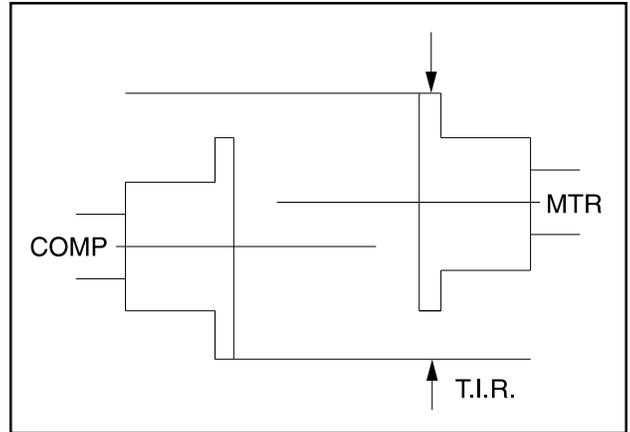
12. Tighten motor anchor bolts and rotate both coupling hubs together, checking the angular and parallel misalignment through the full 360° travel at 90° increments. If dial readings are in excess of specified tolerance, realign as required.

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.

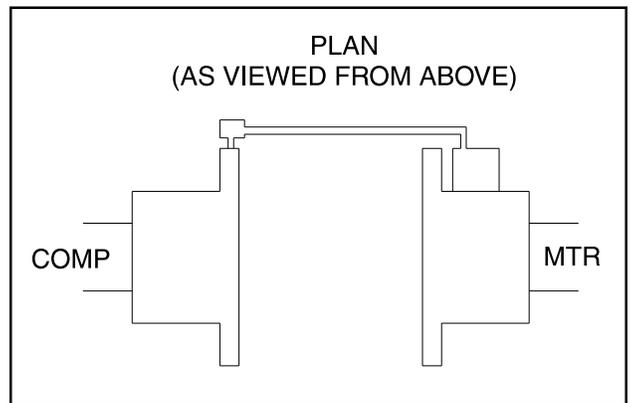
14. Bump the motor to check for correct compressor rotation. **COMPRESSOR ROTATION IS CLOCKWISE WHEN FACING COMPRESSOR SHAFT** (see "CHECKING MOTOR/COMPRESSOR ROTATION", page 8). After verification, install gear or disk drive spacer, as applicable.

15. Install the coupling guard before operating the compressor.

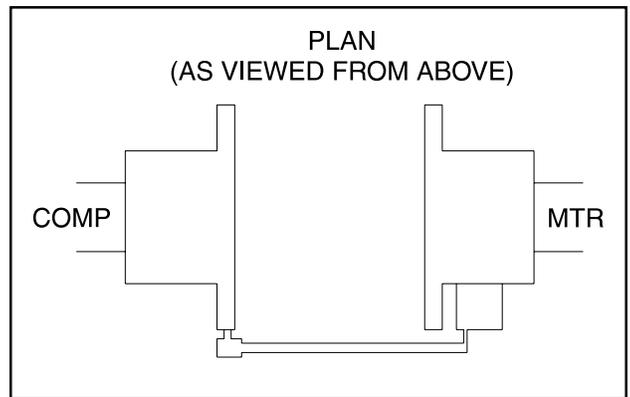
**CAUTION** When installing drive spacer, make sure that hub spacing is within limits shown on the Coupling Data Table applicable to the coupling being installed and that the clamping bolt(s) are properly torqued.



**FIG. 4 - PARALLEL MISALIGNMENT**



**FIG. 5 - DIAL INDICATOR ATTACHED (AT 9 O'CLOCK)**



**FIG. 6 - 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.

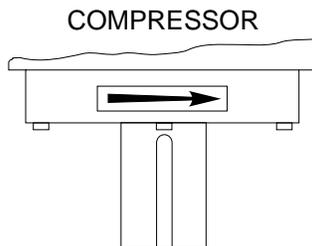
Shut down the unit and quickly affix dial indicator to coupling motor hub, then take readings of both the face and rim of the compressor hub. If these readings are within tolerance, record reading, attach coupling guard, and restart unit. However, if the reading is not within limits, compare the hot reading with the cold alignment and adjust for this difference; i.e. if the rim at 0° and 180° readings indicates that the motor rises .005" between its hot and cold state, .005" of shims should be removed from under the motor.

After the initial hot alignment adjustment is made, restart unit and bring to operating temperature. Shut down and recheck hot alignment. Repeat procedure unit hot alignment is within specified tolerance.

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

## CHECKING MOTOR/COMPRESSOR ROTATION

**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.



## HOLDING CHARGE AND STORAGE

Each 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.**

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 micro-processor. **Unit 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 must be approved in writing by Frick engineering or warranty claim may be denied.

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

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

## OIL CHARGE

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

**TABLE - BASIC OIL CHARGE (Gal)**

MODEL	BASIC CHARGE* (GAL.)
12	10
15	10
19	14
24	14
30	17
39	17
50	21

\* Add oil volume for external oil cooler, according to cooler size selected: 6 x 5 TSOC - 4 gal.; 6 x 5 WCOC - 5 gal.; 8 x 5 TSOC - 6-1/2 gal.; and 8 x 5 WCOC - 8 gal.

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 on the compressor end of the separator. Using a pressure-type pump and the recommended Frick oil, open the charging valve and pump oil into the separator.

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 near the bottom of the separator shell at the discharge end, should remain empty when the unit is in operation. The presence of oil in this end of the vessel during operation indicates liquid carryover or malfunction of the oil return.**

## OIL HEATER

Standard units are equipped with a 500 watt oil heater, 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 Company. The heater is energized only when the unit is not in operation.

**CAUTION** DO NOT ENERGIZE THE HEATER WHEN THERE IS NO OIL IN THE UNIT, OTHERWISE THE HEATER WILL BURN OUT. THE OIL HEATER WILL BE ENERGIZED WHENEVER 120 VOLT CONTROL POWER IS APPLIED TO THE UNIT AND THE COMPRESSOR IS NOT RUNNING UNLESS THE 10 AMP FUSE (1FU) IN THE CONTROL PANEL IS REMOVED.

**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 minimum 3/8" line connected into the solenoid valve provided. This gas is required by the expansion valve external port to control oil temperature.

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

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

The following table gives the condensing temperature(s) with the corresponding maximum evaporator temperature limit for liquid injection usage and the minimum evaporator temperature for a single-port application.

**TABLE - EVAPORATOR TEMPERATURE with SINGLE-PORT LIQUID INJECTION**

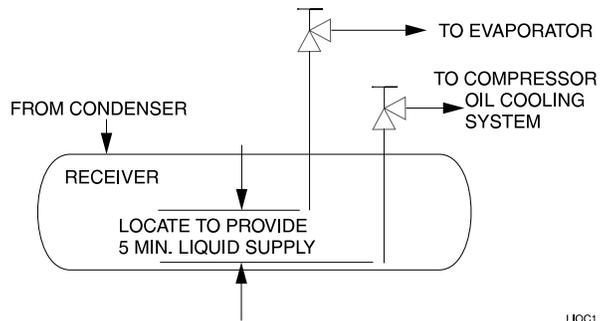
CONDENSING TEMP	MAXIMUM EVAPORATOR TEMPERATURE FOR LIQUID INJECTION USAGE		MINIMUM * EVAP TEMP FOR SINGLE PORT (LOW Vi)
	R-717	R-22	R-717 & R-22
75°F	+10°F	+5°F	-23°F
85°F	+25°F	+15°F	-17°F
95°F	+35°F	+25°F	-11°F
105°F	+40°F	+35°F	-4°F

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

Where low compression ratios (low condensing pressures) are anticipated, thermosyphon or water-cooled oil cooling should be used. It is **IMPERATIVE** that an uninterrupted supply of high pressure liquid refrigerant be provided to the injection system at all times. Two items 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.

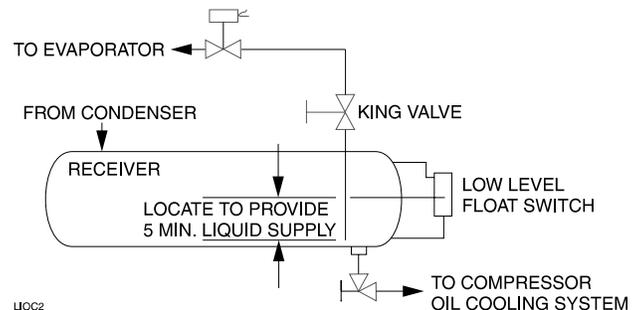
**DUAL DIP TUBE METHOD**

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



**LEVEL CONTROL METHOD**

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



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

REF	RXB MODEL	LIQ. LINE SIZE*		FLOW RATE (lb.) 5 MIN	LIQUID VOLUME CU.FT.
		PIPE SCH 80	TUBING OD		
HIGH STAGE R-717	12	1/2	—	10	.3
	15	1/2	—	12.5	.4
	19	1/2	—	15	.4
	24	1/2	—	20	.6
	30	1/2	—	25	.7
	39	1/2	—	30	.8
50	3/4	—	40	1.1	
HIGH STAGE R-22	12	3/4	5/8	30	.4
	15	3/4	5/8	37.5	.5
	19	3/4	5/8	45	.6
	24	3/4	7/8	60	.8
	30	3/4	7/8	75	1.0
	39	3/4	7/8	95	1.3
50	1	1	125	1.7	
BOOSTER R-717	12	1/2	—	2	.1
	15	1/2	—	2.5	.1
	19	1/2	—	3.5	.1
	24	1/2	—	4.5	.1
	30	1/2	—	5.5	.2
	39	1/2	—	6.5	.2
50	1/2	—	8.5	.3	
BOOSTER R-22	12	3/4	1/2	6	.1
	15	3/4	1/2	7	.1
	19	3/4	1/2	9	.1
	24	3/4	1/2	12	.2
	30	3/4	1/2	14.5	.2
	39	3/4	1/2	18	.3
50	3/4	5/8	24	.3	

\* 100 ft. liquid line. For longer runs, increase line size accordingly.

### WATER-COOLED OIL COOLING (OPTIONAL)

The shell and tube-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. It is recommended that (local codes permitting) 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 and water flow range (GPM). **The water supply must be sufficient to meet the required flow.**

It is imperative that the condition of cooling water and closed loop fluids be analyzed and maintained regularly and as necessary to prevent corrosion of heat exchanger surfaces. The oxygen content of river water and some other cooling water sources will oxidize steel tubes and cause premature failure. Careful attention to water treatment is essential to ensure adequate life of steel cooler tubes if cooling tower water is used. The condition of heat exchanger tubes should be checked semiannually to prevent hazard.

**OIL COOLER DATA TABLE**

SIZE - Inches		APPROX WATER FLOW RANGE (GPM)
COOLER	WATER CONN	
5 Foot Lengths		
6" DIA.	1 NPT	10 – 23
8" DIA.	1-1/4 NPT	35 – 60

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

### THERMOSYPHON OIL COOLING (OPTIONAL)

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 which is partially vaporized at the condenser temperature in a shell and tube- or plate-type 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:

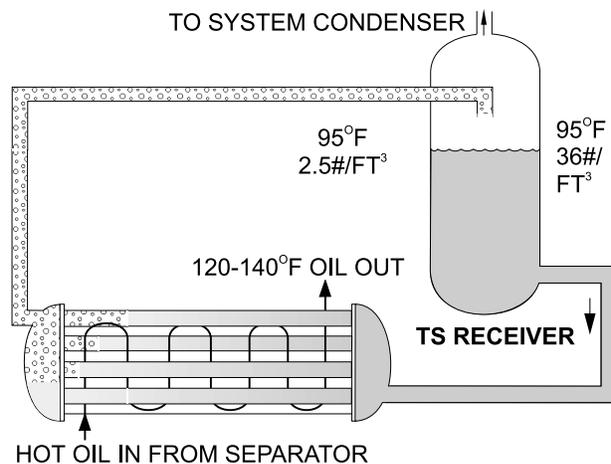
1. A source of liquid refrigerant at condensing pressure and temperature located in close proximity to the unit to minimize piping pressure drop. The liquid level in the refrigerant source must be 6 to 8 feet above the center of the oil cooler.
2. A shell and tube- or plate-type oil cooler with a 300 psi minimum design working pressure on both the oil and refrigerant sides.

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

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

Water or hot oil (above the liquid temperature) flowing through the cooler will cause some of the refrigerant to boil and vaporize in the tubes. 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 4:1 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.

**INSTALLATION** - The shell and tube-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 above the center of the oil cooler.
3. A safety valve should be installed if refrigerant isolation valves are used for the oil cooler.
4. Frick recommends the installation of an angle valve in the piping before the thermosyphon oil cooler to balance the thermosyphon system. Frick also recommends the installation of sight glasses at the TSOC inlet and outlet to aid in troubleshooting. The factory-mounted, plate-type thermosyphon oil cooler requires a refrigerant-side drain valve to be provided and installed by the customer.

**TSOC AND WCOC OPTIONAL OIL SIDE SAFETY RELIEF**

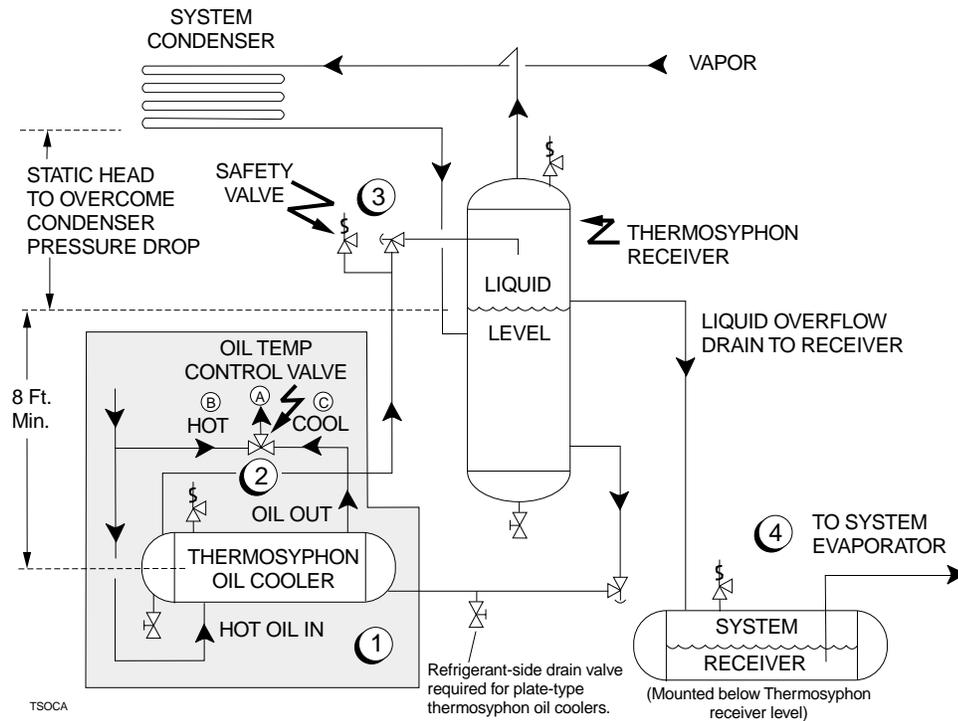
- Compressor units, which have valves in the oil piping to isolate the oil cooler from the oil separator for servicing, may have factory installed piping to relieve the shell side (oil side) safety valve directly into the oil separator, as shown in the P & I diagrams on pages 58 through 60.

This arrangement uses a special UV stamped safety valve rated for liquid and vapor relief. The safety valve is designed for 500 psi DWP and is set to relieve at 75 psi delta P. The safety valve piping contains flanged connections should the valve require maintenance or replacement.

**Extra caution should be used when servicing an oil separator with this arrangement. If the oil cooler is valved off from an oil separator which has been evacuated for servicing, then the oil cooler could relieve into the separator vessel if the 75 psi delta p setpoint is exceeded.**

Other units, which do not use this special safety valve arrangement, will have factory mounted safety valves on the shell side of the oil cooler which the installing contractor should pipe into house safety systems designated suitable for oil relief.

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



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 TSOC 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.

### ECONOMIZER - HIGH STAGE (OPTIONAL)

The economizer option provides an increase in system capacity and efficiency by subcooling liquid from the condenser through a heat exchanger or flash tank before it goes to the evaporator. The subcooling is provided by flashing liquid in the economizer cooler to an intermediate pressure level. The intermediate pressure is provided by a port located part way down the compression process on the screw compressor.

As the screw compressor unloads, the economizer port will drop in pressure level, eventually being fully open to suction. Because of this, an output from the microprocessor is generally used to turn off the supply of flashing liquid on a shell and coil or DX economizer when the capacity falls below approximately 45%-60% capacity (85%-90% slide valve position). This is done because the compressor will be more efficient operating at a higher slide valve position with the economizer turned off, than it will at a low slide valve position with the economizer turned on. Please note however that shell and coil and DX economizers can be used at low compressor capacities in cases where efficiency is not as important as ensuring that the liquid supply is subcooled. In such cases, the economizer liquid solenoid can be programmed to be left open whenever the compressor is running.

Due to the tendency of the port pressure to fall with decreasing compressor capacity, a back-pressure regulator valve (BPR) is generally required on a flash economizer system (FIG. 3) in order to maintain some preset pressure difference between the subcooled liquid in the flash vessel and the evaporators. If the back-pressure regulator valve is not used on a flash economizer, it is possible that no pressure difference will exist to drive liquid from the flash vessel to the evaporators, since the flash vessel will be at suction pressure. In cases where wide swings in pressure are anticipated in the flash economizer vessel, it may be necessary to add an outlet pressure regulator to the flash vessel outlet to avoid overpressurizing the economizer port, which could result in motor overload. Example: A system feeding liquid to the flash vessel in batches.

The recommended economizer systems are shown below. Notice that in all systems there should be a strainer (STR) and a check valve (VCK) between the economizer vessel and the economizer port on the compressor. The strainer prevents dirt from passing into the compressor and the check valve prevents oil from flowing from the compressor unit to the economizer vessel during shutdown.

**CAUTION** Other than the isolation valve needed for strainer cleaning, it is essential that the strainer be the last device in the economizer line before the compressor. Also, piston-type check valves are recommended for installation in the economizer line, as opposed to disc-type check valves. The latter are more prone to gas-pulsation-induced failure. The isolation and check valves and strainer should be located as closely as possible to the compressor, preferably within a few feet.

For refrigeration plants employing multiple compressors on a common economizing vessel, regardless of economizer type, each compressor must have a back-pressure regulating valve in order to balance the economizer load, or gas flow, between compressors. The problem of balancing load becomes most important when one or more compressors run at partial load, exposing the economizer port to suction pressure. In the case of a flash vessel, there is no need for the redundancy of a back-pressure regulating valve on the vessel and each of the multiple compressors. Omit the BPR valve on the flash economizer vessel and use one on each compressor, as shown in FIG. 4.

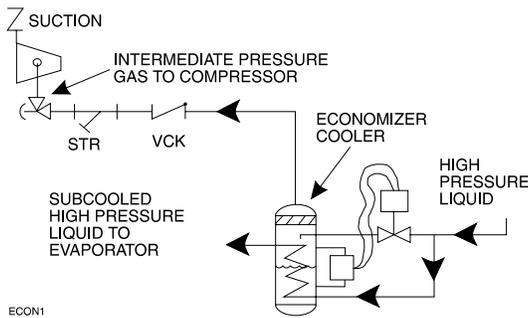


FIG. 1 - SHELL and COIL ECONOMIZER SYSTEM

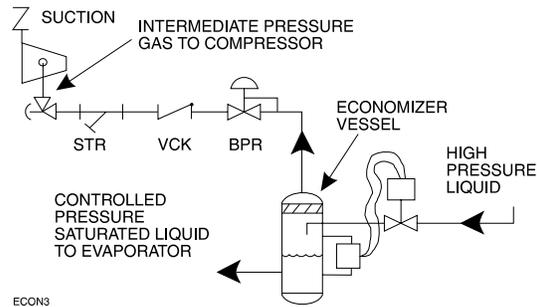


FIG. 3- FLASH ECONOMIZER SYSTEM

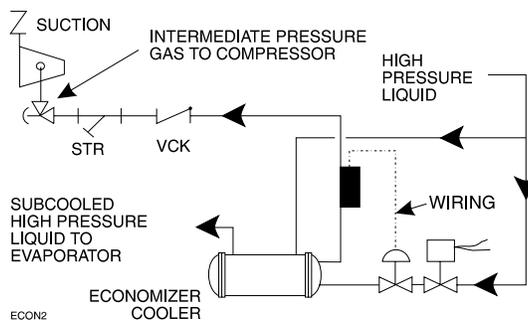


FIG. 2 - DIRECT EXPANSION ECONOMIZER SYSTEM

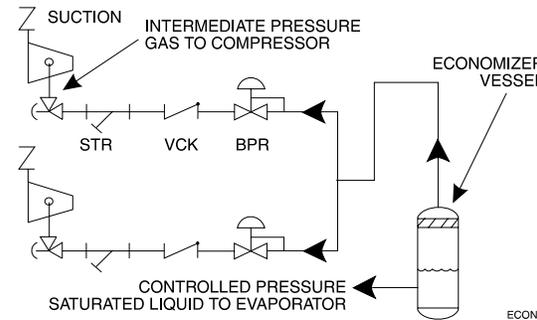


FIG. 4 - MULTIPLE COMPRESSOR ECONOMIZER SYSTEM

**ELECTRICAL**

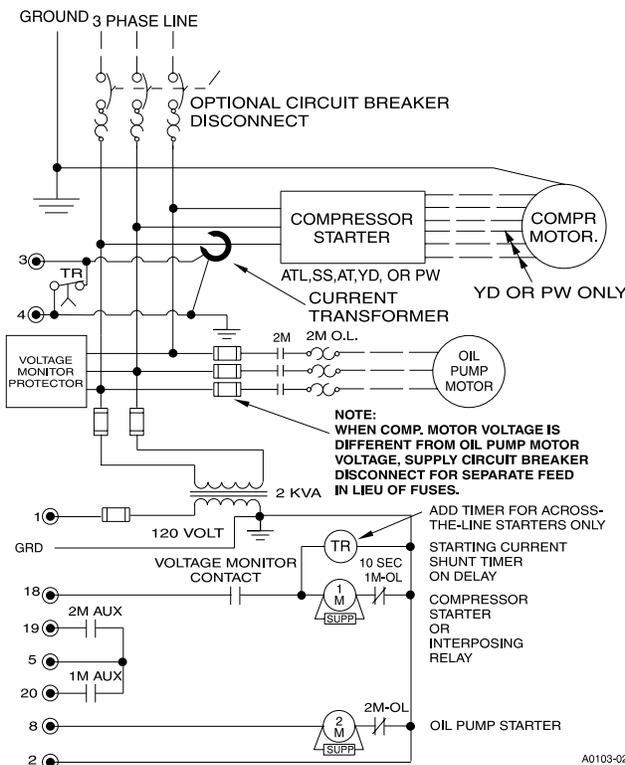
**NOTE: Before proceeding with electrical installation, read the instructions in the section "Proper Installation of Electronic Equipment in an Industrial Environment".**

RXB PLUS units are supplied with a SBC (single-board computer) microprocessor control system. Care must be taken that the controls are not exposed to physical damage during handling, storage, and installation. The microprocessor enclosure cover must be kept tightly closed to prevent entry of moisture and foreign matter.



**Customer-control power connections are made at the BOTTOM of the microprocessor enclosure.**

**Consult local ordinances before installation. Current transformer wiring should be kept separate. Extreme care should be taken that metal filings or other foreign material is not left in the microprocessor enclosure. Use seal-tight conduit fittings to prevent moisture entry into the microprocessor enclosure. This is the ONLY electrical enclosure that should be opened during installation and it should be kept tightly closed whenever work is not being performed in it.**



**NOTE: Customer ground required, see Micro Panel Assembly Wiring Diagram.**

**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:

**NOTE: When compressor motor voltage is different from oil pump motor voltage, supply a circuit breaker disconnect for separate feed in lieu of fuses.**

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 Company 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 supplied by others, usually as a part of an electrical power distribution board.

3. A 2.0 KVA control power transformer (CPT), to supply 120 volt control power to the control system and separator oil heaters, is included. If environmental conditions require more than a 500 watt oil heater, an appropriately oversized control transformer will be required.

4. One (1) normally open, compressor-motor-starter auxiliary contact and 1 normally open, oil-pump-motor-starter auxiliary contact (opt.) should be supplied and wired as shown on the starter package wiring diagram. In addition, the compressor and oil pump motor starter (opt.) coils and the CPT secondaries should be wired as shown on starter package wiring diagram.

5. The compressor motor Current Transformer (CT) can be installed on any one phase of the compressor leads. **NOTE: The CT must see all the current on any one phase; therefore in wye-delta applications, BOTH leads of any one phase must pass through the CT.**

6. Oil Pump Option: If the optional oil pump is specified, an oil pump starter must be a component of the unit starter package. The pump starter should be equipped with fuses or, in the case where the compressor motor is a different voltage from the oil pump motor, a circuit breaker disconnect suitable for separate power feed.

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

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### 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	100:5	100:5	100:5	-	-
25	100:5	100:5	100:5	100:5	100:5	-	-
30	200:5	100:5	100:5	100:5	100:5	-	-
40	200:5	200:5	100:5	100:5	100:5	-	-
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	500:5	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

### 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

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

1. Remote LOAD, UNLOAD, and RUN interlocks in case the customer desires to operate the unit from a remote control device.
2. Alarm Horn output.
3. Control solenoid valve for the economizer option.

For customer control options, consult FRICK Company.

**NOTE: The microprocessor will not operate without EPROM chips installed. When EPROM chips are not installed, the microprocessor display will typically indicate two dark lines across both the upper and lower display screens.**

### BATTERY BACKUP

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 illustration page 52) must be moved from OFF (pins 1-2) to ON (pins 2-3).

**NOTE: It is not necessary to disconnect the battery backup during extended downtime.**

**OPERATION and START-UP INSTRUCTIONS**

**GENERAL INFORMATION**

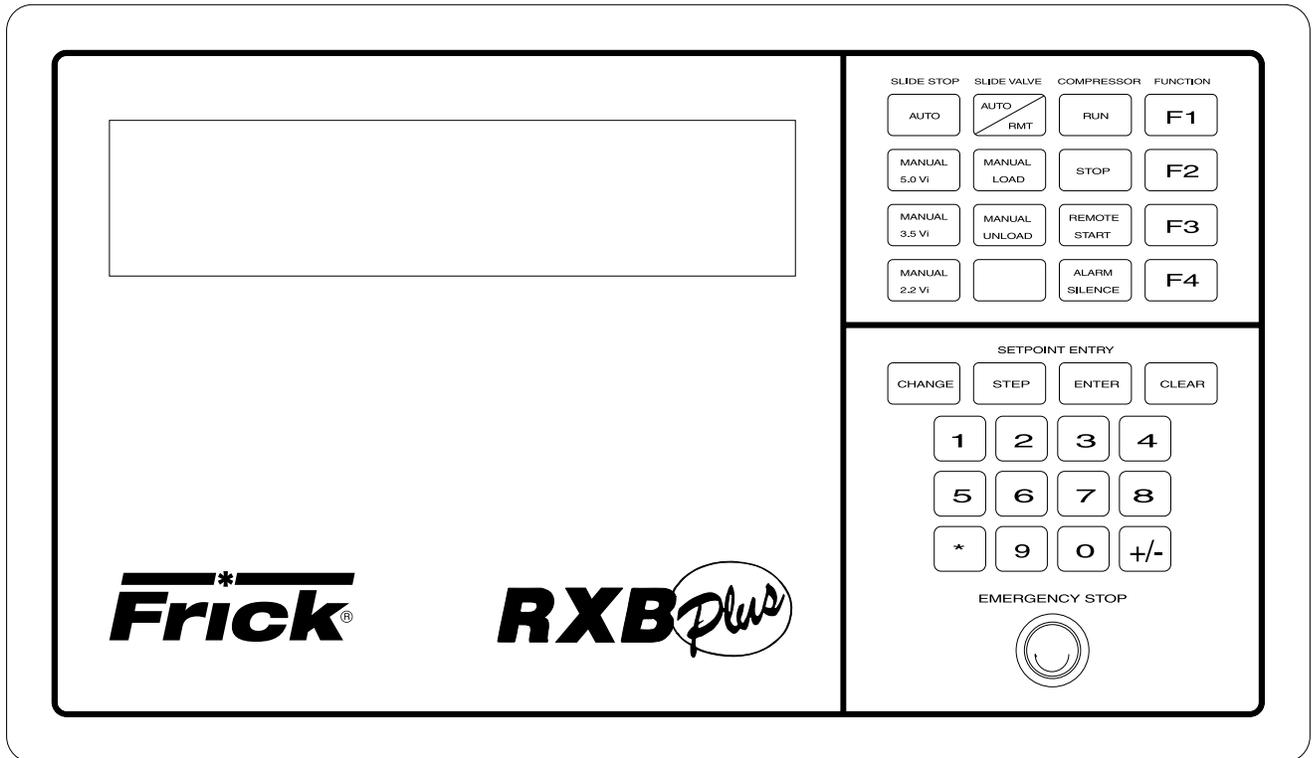
The Frick RXB PLUS Rotary Screw Compressor Unit is an integrated system consisting of six major subsystems:

1. Microprocessor Control 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 RXB PLUS Rotary Screw Compressor Unit.

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

**MICROPROCESSOR CONTROL PANEL**



RXBELD7

The RXB PLUS compressor is controlled by a state-of-the-art microprocessor control system. The microprocessor continuously monitors the compressor unit's condition and operation. The microprocessor also directs instructions to the various compressor unit subsystems.

The microprocessor has a membrane switch keyboard. Pressing the keyboard in the area outlined as a key will cause that function to be recognized by the microprocessor. The keyboard has 32 membrane-type keys.

In addition to the keyboard, there is an emergency stop button. Pushing the emergency stop will bypass the computer and remove all power from the outputs. This will shut down the compressor motor and all high voltage to the compres-

essor auxiliary systems such as the oil pump and liquid injection solenoid. **THE EMERGENCY STOP BUTTON IS FOR EMERGENCY SHUTDOWN SITUATIONS ONLY and MUST NOT BE USED TO ROUTINELY SHUT OFF THE COMPRESSOR.**

The microprocessor continuously monitors the state of the battery which maintains setpoints and various other data. If the battery voltage is low, the message "LOW BATT" will flash in the lower right hand corner of the bottom display (see page 14 for description of battery backup).

The microprocessor hardware contains an output watchdog circuit. If the microprocessor should fail, this circuit will disable (turn off) all outputs.

## KEYS AND KEY FUNCTIONS

**NOTE:** The microprocessor will automatically return to the main operating display after 60 seconds of keyboard nonactivity.

The **[CHANGE]** key rotates the dual display screen through six display modes. The **[CHANGE]** key is also used to change the status of various setpoints.

The **[STEP]** key steps or moves a set of flashing brackets through the variable setpoints on the Adjustable setpoints display, the Auto-cycle display, the Security display and the Setback display. The setpoint enclosed within the flashing brackets may be changed or updated. The **[STEP]** key is also used when the Annunciator display is selected to step through the annunciator's four information displays.

**NOTE:** The **[ \* ]** key is used to step or move the flashing brackets, described above, backwards.

The **[ENTER]** key is used to enter new setpoint limits.

The **[CLEAR]** key will reset an alarm or cutout indication on the annunciator screen and will clear the microprocessor to allow continued operation or restarting if all conditions have returned to normal and no other control lockouts are in force.

The **[NUMERIC KEYPAD]** is used to introduce new setpoint limits.

The **[+/-]** key is used to toggle between pounds per square inch gauge (g) and inches of mercury (hg).

The **[RUN]**, **[STOP]**, and **[REMOTE START]** keys control the starting and stopping of the compressor unit.

The **[ALARM SILENCE]** key will de-energize the alarm horn output.

The **[AUTO]**, **[REMOTE]**, and **[MANUAL]** keys control the operation of the compressor slide valve.

The **[AUTO]**, **[MANUAL 2.2]**, **[MANUAL 3.5]**, and **[MANUAL 5.0]** keys control the operation of the compressor slide stop.

The **[F1]** function key will return the operator to the main operating display. This function may be invoked at any time, even during setpoint entry.

The **[F2]** function key will call up the Security display. **NOTE:** Press the **[F2]** key, as prompted by the display, to return to the previously selected display.

The **[F3]** function key will call up the Setback display. **NOTE:** To exit the Setback display, press the **[F1]** key as prompted by the display.

The **[F4]** function key will call up the Auto Cycle display. **NOTE:** To exit the Auto Cycle display, press the **[F1]** key as prompted by the display.

The microprocessor has two liquid crystal displays in an 8 line by 40 character format, for a total of 320 characters. When power is first applied to the control panel, the unit will be in the Operating display mode. To change to a different display mode, press the **[CHANGE]** key. The display modes in their order of rotation are:

1. Operating displays
2. Setpoints displays
3. Annunciator displays
4. Shutdown Record displays
5. Freeze displays

- [F1]** Operating display
- [F2]** Security display
- [F3]** Setback display
- [F4]** Auto Cycle display

**NOTE:** On initial powering of the microprocessor, and any time power has been removed from the microprocessor, only the Operating, Setpoints, Annunciator, and Shutdown displays will display information. The Freeze display will appear as a dark screen. The Freeze display will only be present after a compressor unit cutout.

### OPERATING DISPLAY \*, Pages 1 and 2

OP.DISPLAY PAGE 1 Thu 03-01-89 15:33:36			
Suction	Disch	Oil	Compressor
14.3 hg	024 g	060 g	Man Mode
-040°F	135°F	135°F	Running

OP.DISPLAY PAGE 2 Thu 03-01-89 15:33:36				
V Ratio	S V Pos	Pump	%FLA	Sep 132°F
2.2	070%	on	096%	HTR off
Auto	Auto U			

### OPERATING DISPLAY, Page 1

The Operating display is continuously updated and provides a variety of information in regard to the current status of the compressor's condition and performance.

The information furnished by the Operating display is as follows:

The **DAY**, **DATE**, and **TIME** are displayed at the top right of the display.

**NOTE:** To set day, date, and time, see **TO CHANGE THE ADJUSTABLE SETPOINTS**.

**SUCTION** - Suction Pressure and Temperature are measured at the compressor inlet and are, respectively, displayed in pounds per square inch gauge (g) or inches of mercury (hg) and degrees Fahrenheit.

**DISCH** - Discharge Pressure and Temperature are measured at the compressor outlet and are, respectively, displayed in pounds per square inch gauge (g) and degrees Fahrenheit.

**OIL** - Oil Pressure and Temperature are measured prior to entering the compressor and are, respectively, displayed in pounds per square inch gauge (g) and degrees Fahrenheit.

**ALARM/CUTOUT** - An Alarm or Cutout message indicates an Alarm or Cutout setpoint has been reached, or exceeded. Rotate the display mode to the Annunciator display for details. In the event of a cutout, rotate to the Freeze display for further details.

**COMPRESSOR** - The compressor displays the status of the compressor unit. The mode of operation will be indicated as either manual (Man Mode) when the **[RUN]** key has been

\*Display for illustrative purposes only.

pressed, automatic (AUTO MODE) when Auto Cycle has been activated, remote (RMT MODE) when the [REMOTE] key has been pressed, or off (OFF MODE).

**RECYCLE DELAY** - A Recycle Delay message indicates that the compressor has started and has shut down within the time delay setpoint period. The Recycle Delay will prevent the compressor from starting until the delay time expires and is intended to prevent damage to the compressor motor from successive restarts. During Recycle Delay, the microprocessor will alternatively flash "RECYCLE DELAY" and the remaining delay time in minutes.

**NOTE: Consult Motor Manufacturer for the recommended duration of the Recycle Delay.**



**If the [RUN] key is pushed while the unit is in Recycle Delay, the compressor will start at the end of the delay period.**

**OPERATING DISPLAY, Page 2**

**V RATIO** - Volume Ratio is the ratio selected by the microprocessor to provide the highest efficiency at any given suction and discharge pressure condition. Immediately below this, an information space has been provided to indicate whether V ratio is in the automatic (AUTO) or the manual (MAN) mode.

**SV POS** - Slide valve position is displayed as a percentage. This percentage reflects the mechanical position of the slide valve and does not reflect the percentage of full load operation. Immediately below this information, space has been provided to indicate whether SV Pos is in the automatic (AUTO), manual (MAN), or remote (RMT) mode. The microprocessor will control this function in the automatic mode. To the right of the mode indicator, two other messages may appear:

- L** - Indicates Slide Valve loading.
- U** - Indicates Slide Valve unloading.

**PUMP (Optional)** - Pump displays the current status of the oil pump. The display will read ON or OFF whenever the HAND-OFF-AUTO switch is selected to AUTO and the compressor is running.

**% FLA** - Percent Full-Load Amps displays the percentage of the drive motor, full-load amperage rating that the motor is currently using.

**SEP** - Separator displays the oil separator temperature in degrees Fahrenheit.

**HTR** - Heater displays the condition of the oil separator heater(s), indicating ON or OFF.

**FORCED UNLD** - A Forced Unload message indicates that the percentage of motor, full-load amps has exceeded the maximum limit and the microprocessor is unloading the compressor until the percentage FLA falls back to normal limits.

**SETPOINTS DISPLAY \***

SETPOINTS PAGE 1A ID=[33] [03-01-89]  
 Cap. Control-----[14.3 hg] Thu [15:33:36]  
 Lo Suct Cutout - [20.0 hg] Baud----[ 2400]  
 Lo Suct Alarm -- [18.0 hg] Recy.Delay-[30]

\*Display for illustrative purposes only.

SETPOINTS PAGE 1B  
 Dead Band--[/./#]  
 Prop. Band--[/ / %]  
 Cycle Time--[/ / sec]  
 LOW % FLA---[/ / / %]

SETPOINTS PAGE 2 MLC Stop LD-[095%]  
 CT Factor-[078] MLC Force ULD[100%]  
 Aux1[Alarm] [NO] Hi Disch Cutout-[050 g ]  
 Aux2[Shutd] [NO] Hi Disch Alarm--[045 g ]

SETPOINTS PAGE 3 HIGH STAGE RXB NP-22  
 PB-[10% DB-[1.0 #]  
 Oil Heater----- [113F] Liq Inj Con ----- [122F]  
 Hi Disch Cut - [212F] Hi Disch Alarm - [194F]

SETPOINTS PAGE 4  
 Hi Oil Temp Cutout -- [167F] Alarm -- [158F]  
 Lo Oil Temp Cutout -- [49F] Alarm -- [58F]  
 Lo Oil Press. Cutout -- [005] Alarm -- [010]

The information furnished by these displays is as follows:

**SETPOINTS DISPLAY, Page 1A:**

**CAP CONTROL** - The Capacity Control setpoint, reported in pounds per square inch gauge (g) or inches of mercury (hg), controls the loading and unloading of the compressor when **Capacity** is in the automatic (AUTO) mode.

**LO SUCT CUTOUT** - The Low Suction Pressure Cutout, reported in pounds per square inch gauge (g) or inches of mercury (hg), will shut down the compressor if the suction pressure drops to this limit or lower, for 90 seconds or longer.

**LO SUCT ALARM** - The Low Suction Pressure Alarm, reported in pounds per square inch gauge (g) or inches of mercury (hg), will trigger a prealarm if the suction pressure drops to this limit or lower.

**ID** - The ID number is a programmable identification code used in telecommunications to access a specific compressor.

**DATE** - The Date displays the current date in the following format: Month - Day - Year.

**DAY** - Day will display the current day of the week.

**TIME** - The Time displays the current time in the following format: Hours - Minutes - Seconds. The time is in 24:00:00 hour clock format.

**BAUD** - Shows the baud rate of the RS422 communication port. Both ports are configured as follows: word = 8 bit, parity = none or even, stop = 1 bit. The communications port is programmable from 300 to 19200 baud.

**RECY. DELAY** - The Recycle Delay displays the current recycle delay setpoint in minutes. **NOTE: Consult the motor manufacturer for recommended setpoint.**

## SETPOINTS DISPLAY, Page 1B:

**Dead Band** - This is a + (plus) or - (minus) value above or below the setpoint at which the compressor will neither load nor unload. A dead band of 1 is the default value. It is adjustable between .5 lb to 5 lb in increments of .5. The **[Step]** key is used to select this setpoint; then press the **[Change]** key to toggle through the selections.

**Proportional Band** - This setpoint is used to determine the amount of time the load/unload solenoid is energized, according to how far from the setpoint the actual control pressure is. The smaller the number, the longer a load/unload signal will be sent; 10% is the default value. Selections are 2, 5, 10, 15, 20, or 25%. The **[Step]** key is used to select this setpoint; then press the **[Change]** key to toggle through the selections.

**Cycle Time** - Cycle time is the amount of time between the beginning of each load/unload response. Ten seconds is the default value. "Cycle Time" is adjustable between 5 and 30 seconds in 5 second intervals. The **[Step]** key is used to select a setpoint; then press the **[Change]** key to toggle through the selections.

**Low % FLA** - This setpoint is used to determine if the coupling has broken; 20% is the default value. It is adjustable from 0 to 100% FLA. Use the **[Step]** key to select a setpoint; then enter the desired setpoint and press the **[Enter]** key.

## SETPOINTS DISPLAY, Page 2:

**MLC STOP LD** - The Motor Load Control Stop Load, reported as a percentage of the motor, full-load amps (FLA), will prevent the compressor capacity control pistons from loading when the setpoint is equaled or exceeded. **NOTE: Consult motor manufacturer for recommended setpoint.**

**MLC FORCE ULD** - The motor Load Control Force Unload, reported as a percentage of the motor, full-load amps (FLA), will force the compressor to unload until the motor, full-load amps (FLA) fall within 1% of the setpoint or lower. **NOTE: Consult motor manufacturer for recommended setpoint.**

**HI DISCH CUTOUT** - The High Discharge Pressure Cutout, reported in pounds per square inch gauge (g), will shut down the compressor if the discharge pressure equals or exceeds this setpoint.

**HI DISCH ALARM** - The High Discharge Pressure Alarm, reported in pounds per square inch gauge (g) will trigger a prealarm if the discharge pressure equals or exceeds this setpoint.

**CT FACTOR** - The Current Transformer Factor records the proper current transformer factor to match the compressor motor FLA rating to the current transformer primary rating. The CTF factor is programmable and its correct value is determined by the following formula:

$$CTF = \frac{1024 \times FLA \text{ (Full Load Amps *)}}{10 \times CT \text{ (Current Transformer Primary Amps **)}}$$

\* See motor nameplate.

\*\* See CT located in starter panel.

EXAMPLE: FLA = 230 Amps  
CT = 300 (300:5)

$$CTF = \frac{1024 \times 230}{10 \times 300} = 78 \text{ (Round to whole number)}$$

**AUX 1** and **AUX 2** - May be configured for either an alarm or shutdown and with either a normally closed (**NC**) or normally open (**NO**) contact.

## TO CHANGE THE ADJUSTABLE SETPOINTS:

Adjustable Setpoints are stored in RAM (random access memory) and are easily changed in the field.



**Adjustable Setpoints are lost if power is interrupted and the battery is not fully charged. To facilitate reentry, we suggest that a list of Adjustable Setpoints be affixed to one end of the microprocessor cabinet for reference.**

**NOTE: The following procedure also applies to the changing of the Security, Setback, and Auto Cycle display setpoints.**

1. Press the **[CHANGE]** key to rotate the display to the Adjustable Setpoints display.

2. Press the **[STEP]** key to move or step a set of flashing brackets through the various setpoints. A setpoint is selected for change or update when it is enclosed by the flashing brackets.

**NOTE: The DAY indicator, itself, will flash when selected for change or update.**

3. Having selected the setpoint to be changed, the **[NUMERIC KEYPAD]** may be used to enter the new setpoint. **NOTE: All digits must be entered, including zeros. For example, (01.0).**

**NOTE: The DAY, AUX 1, and AUX 2 setpoints, once selected, are changed or updated by pressing the [CHANGE] key.**

**NOTE: Certain setpoints may be reported in either pounds per square inch gauge (g) or inches of mercury (hg). To toggle between (g) and (hg), having selected the setpoint, press the [+/-] key to toggle between (g) and (hg).**

4. In the event that an incorrect setpoint is keyed in completely or partially, press the **[CLEAR]** key to restore the original setpoint. Pressing the **[CLEAR]** key a second time will eliminate the flashing brackets.

5. Having keyed the desired setpoint, press the **[ENTER]** key. The new setpoint will be entered and the flashing brackets will move or step to the next setpoint.

**NOTE: A setpoint entry outside the parameters of the Adjustable Setpoint display will be refused and the original Adjustable setpoint will be restored.**

**NOTE: To clear any time values [STEP] to the desired setpoint, press [CHANGE] and then press [CLEAR].**

## HOW TO DETERMINE ADJUSTABLE SETPOINTS:

Adjustable Setpoints should reflect values compatible with normal system operation. Too high a Low Suction Pressure Alarm setpoint may cause nuisance prealarms. Similarly, cutout setpoints should not fall within what are considered normal plant operation. As a rule of thumb, set the Low Suction Pressure Alarm 5 PSIG lower than the lowest normal suction pressure. The Low Suction Pressure Cutout should be 5 to 10 PSIG lower than the Low Suction Pressure Alarm setpoint.

‡ The High Discharge Pressure Cutout should be set at 90% of the setting of the lowest high side relief valve. The High Discharge Pressure Alarm should be set 10 PSIG lower than the Cutout.

The Capacity Control setpoint should be the equivalent of the normal suction condition.

**FIXED SETPOINTS:**

Fixed setpoints define the limits of acceptable compressor operation. Fixed Setpoints are factory determined, stored in programmed memory (PROM), and will remain in memory if power to the microprocessor is interrupted.

**SETPOINTS DISPLAY, Page 3:**

**OIL HEATER** - The Oil Heater setpoint, reported in degrees Fahrenheit, turns on the oil separator heater(s) when the oil temperature equals or falls below this setpoint whenever the compressor is **NOT** running.

**LIQ INJ CON** - The Liquid Injection Control, reported in degrees Fahrenheit, will shut off the liquid refrigerant supply to the compressor if the oil temperature equals or falls below this setpoint.

**HI DISCH CUT** - The High Discharge Temperature Cutout, reported in degrees Fahrenheit, will shut down the compressor if the discharge temperature equals or exceeds this setpoint.

**HI DISCH ALARM** - The High Discharge Temperature Alarm, reported in degrees Fahrenheit, will trigger a prealarm if the discharge temperature equals or exceeds this setpoint.

**SETPOINTS DISPLAY, Fixed, Page 4:**

**HI OIL TEMP CUTOUT** - The High Oil Temperature Cutout, reported in degrees Fahrenheit, will shut down the compressor if the oil temperature equals or exceeds this setpoint.

**HI OIL TEMP ALARM** - The High Oil Temperature Alarm, reported in degrees Fahrenheit, will trigger a prealarm if the oil temperature equals or exceeds this setpoint.

**LOW OIL TEMP CUTOUT** - The Low Oil Temperature Cutout, reported in degrees Fahrenheit, will shut down the compressor if the oil temperature equals or falls below this setpoint.

**LOW OIL TEMP ALARM** - The Low Oil Temperature Alarm, reported in degrees Fahrenheit, will trigger a prealarm if the oil temperature equals or falls below this setpoint.

**LO OIL PRESS CUTOUT** - The Low Oil Cutout will shut down the compressor when the oil pressure equals or falls below this setpoint.

**LO OIL PRESS ALARM** - The Low Oil Alarm will trigger a prealarm when the oil pressure equals or falls below this setpoint.

When a prealarm or cutout occurs, a flashing **ALARM** or **CUTOUT** indicator will appear in the lower right hand corner of the Operating display. To determine the fault, rotate to the Annunciator display by pressing the **[CHANGE]** key.

The Annunciator display lists all key operative points on nine sequential displays. These displays can be rotated from page #1 thru page #9 by pressing the **[STEP]** key. When a prealarm or cutout is triggered, the pertinent point will flash and the time of the occurrence will be recorded to the right of the alarm.

**ANNUNCIATOR DISPLAY \***

ANNUNCIATOR: PG-01 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
High Press. Cutout \*\*\*\*\*  
High Press. Alarm \*\*\*\*\*

ANNUNCIATOR: PG-02 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Low Press. Cutout \*\*\*\*\*  
Low Press. Alarm \*\*\*\*\*

ANNUNCIATOR: PG-03 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Oil Press. Cutout \*\*\*\*\*  
Oil Press. Alarm \*\*\*\*\*

ANNUNCIATOR: PG-04 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Hi Oil Temp Cutout \*\*\*\*\*  
Hi Oil Temp Alarm \*\*\*\*\*

ANNUNCIATOR: PG-05 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Low Oil Temp Cutout \*\*\*\*\*  
Low Oil Temp Alarm \*\*\*\*\*

ANNUNCIATOR: PG-06 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Disch. Temp Cutout \*\*\*\*\*  
Disch. Temp Alarm \*\*\*\*\*

ANNUNCIATOR: PG-07 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Comp. Auxiliary \*\*\*\*\*  
Pump Aux. Not Used \*\*\*\*\*

ANNUNCIATOR: PG-08 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Oil Level \*\*\*\*\*  
Comp. Differential \*\*\*\*\*

ANNUNCIATOR: PG-09 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Superheat Cutout \*\*\*\*\*  
Superheat Alarm \*\*\*\*\*

ANNUNCIATOR: PG-10 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Aux. 1 (Alarm) \*\*\*\*\*  
Aux. 2 (Shutdown) \*\*\*\*\*

ANNUNCIATOR: PG-11 Thu 03-01-89 15:33:36  
(Use STEP key to advance PAGE)  
Low Motor Amps \*\*\*\*\*  
Sensor Fault \*\*\*\*\*

\*Displays for illustrative purposes only.

**Compressor Differential Cutout** - The differential cutout has been lowered from 55 lb to 25 lb. Cutout will occur after five minutes. To allow operation at low differential pressures, the micro will take the following steps:

**A.** Force unload the compressor to 50% and display an "F Unload" when the oil pressure is within 10 lb of the main oil injection port pressure and the slide valve position is greater than 50%.

**B.** Prohibit the compressor from loading and display a "Ld Inhib" message when the differential is within 15 lb of the main oil injection port pressure.

**Oil Pressure Alarm and cutout** - Prelube and Cycling Oil Pump version when pump is not running. Alarm will occur if oil pressure is 25 lb below discharge pressure or within 10 lb of suction pressure for 30 seconds. Cutout occurs if oil pressure is 30 lb below discharge pressure or if oil pressure is within 7 lb of suction pressure for 10 seconds and alarm has already been set.

Full Lube and Cycling Oil Pump version when oil pump is running. Alarm occurs if oil pressure is within 10 lb of discharge pressure for 30 seconds. Cutout occurs when oil pressure is within 5 lb of discharge pressure for 10 seconds and oil pressure alarm has been set.

**Cycling Oil Pump Control** - The oil pump will cut off when differential pressure between suction and discharge pressure is 55 lb or greater. Upon pump termination the above cutout logic (pump not running) is utilized. Pump cut-in occurs when the differential pressure between suction and discharge is 45 lb or less. Oil pressure alarm and cutout logic (pump running) begins after a 30 second delay which allows the oil pump to build pressure.

Prealarms are self-clearing. At this time the alarm will stop flashing, but the time of the first occurrence will still be recorded to the right of the alarm. Pressing the [CLEAR] key while at the Annunciator display will clear all alarms and/or cutouts.

In order to restore the Annunciator display and resume normal operation it will be necessary to go through the following steps:

1. Correct the conditions causing the alarm.
2. Press the [ALARM SILENCE] key. (This action may precede correcting the conditions causing the alarm).
3. To clear or reset the Annunciator pages, press the [CLEAR] key. This will also clear the ALARM or CUTOUT indicator from the Operating display.
4. Press [F1] to call up the Operating display. If the conditions causing the alarm have not been corrected or a new fault has occurred, a new **ALARM** or **CUTOUT** message will appear.

**NOTE: Use of the Emergency Stop Button may trip one or more alarm setpoints.**

**SHUTDOWN RECORD DISPLAY \***

```
SHUTDOWN RECORD P1 Thu 03-01-89 15:33:36
Hi Oil Temp Cutout *****
Hi Oil Temp Cutout *****
Low Temp Cutout *****
```

```
SHUTDOWN RECORD P2 Thu 03-01-89 15:33:36
Low Temp Cutout *****
Disch. Temp Cutout *****
Disch. Temp Cutout *****
```

The Shutdown Record display keeps a record of the last six shutdowns (cutouts). This information will help troubleshoot persistent operational problems. The most recent cutout will appear on the top line of page 1 of the display with the oldest appearing on the last or bottom line of page 2. When a cutout occurs, all information is moved down one line and the new cutout appears at the top of page 1. When the display is full, the oldest record is dropped off the display and is not retained in memory. The information presented is echoed from the Annunciator display, providing the type of cutout, the day, the date, and the time. **NOTE: This information will not be lost due to power failure.**

**FREEZE DISPLAY \***

```
FREEZE DISPLAY P1 Thu 03-01-89 15:33:36
Suction Disch Oil CUTOUT Compressor
14.3 hg 120 g 060 g OFF Mode
-040 F 135 F 135 F
```

```
FREEZE DISPLAY P2 Thu 03-01-89 15:33:36
V Ratio SV Pos Pump %FLA Sep 132°F
2.2 000% off 000% HTR off
Auto Auto L
```

The Freeze display has the same appearance and contains the same information as the Operating display. (For a description of the information presented by the Freeze display, refer to the Operating display.) The Freeze display freezes the information of the Operating display **AT THE MOMENT OF A COMPRESSOR CUTOUT**. The information on the Freeze display can help the operator to identify the cause of a fault which occurred when no one was present. The Freeze display will retain the information generated by a cutout until a new cutout occurs or power is removed from the microprocessor.



**Do not confuse the Freeze display with the Operating display. In order to avoid confusion remember**

**that the displayed information on the Operating display is constantly being updated and changed. The Freeze display is fixed and FREEZE DISPLAY appears in the upper left hand corner of the display.**

**NOTE: The Freeze display will appear as a blank screen when power is initially furnished to the unit, and it will return to a blank screen anytime power is removed from the microprocessor.**

**SECURITY DISPLAY \***

```
SECURITY DISPLAY Press F2 To Exit
Setpoints Access ---- [Enabled ] Keyboard
Enter Access Code - [*****]
```

\*Display for illustrative purposes only.

The [F2] function key will call up the Security display. The Security display allows the operator to either enable or disable the microprocessor's keyboard and, thereby, prevent unauthorized tampering with the various adjustable setpoints. When enabled, the microprocessor keyboard is fully operative and the security lockout is not in effect. When disabled, the keyboard is rendered partially nonfunctional. All displays will still be accessible through the keyboard. If any attempt is made to enter new adjustable setpoints, however, the microprocessor will default to the Security display.

**TO ENABLE THE KEYBOARD**, press the [STEP] key so that the brackets beside Enter Access Code flash; key the proper five digit access code and press [ENTER]. The Setpoints Access will toggle from disabled to enabled and adjustable setpoint entry is now possible.

**TO DISABLE THE KEYBOARD**, press the [F2] function key to call up the Security display; press the [STEP] key until the brackets beside Enter Access Code flash; key the proper five digit access code and press [ENTER]. Now press the [STEP] key until the brackets beside Setpoints Access flash; and press the [CHANGE] key to toggle from enabled to disabled.

**TO CHANGE THE ACCESS CODE**, press the [F2] function key to call up the Security display; press the [STEP] key until the brackets beside Enter Access Code flash; key the proper five digit access code and press [ENTER]. Now, select the Enter Access Code a second time by pressing the [STEP] key until the brackets beside Setpoints Access flash; key in the new five digit access code and press [ENTER].

**NOTE: Power loss will not effect the Security display.**

**NOTE: IF NO ACCESS CODE WAS ENTERED AND THE DISABLED COMMAND WAS SELECTED, THE ACCESS CODE IS [00000].**

**LOST OR FORGOTTEN ACCESS CODE:** Consult Frick Company for assistance.

**SETBACK DISPLAY \***

SETBACK DISPLAY	Thu 03-01-89 15:33:36
Setback Setpoint-[05.0 g ]	Active-[No ]
	Mon Start Time[- :- -]
F1 To Exit	Stop Time[- :- -]

The [F3] function key will call up the Setback display. The Setback feature enables automatic operation at two separate suction conditions on a preset time schedule. Having entered the desired Setback setpoint, enter the start and stop time or times and select Active: (Yes) or (No).

**NOTE: To change the Setback setpoints, refer to "TO CHANGE THE ADJUSTABLE SETPOINTS"**

**AUTO CYCLE DISPLAY \***

AUTO CYCLE	Compressor Start - [20.0 g ]
F1 To Exit	Compressor Stop -- [18.0 hg]
Suct.Press.	Min. Cap. Control -- [050%]
=[03.5 g ]	Auto Cycle Active -- [No ]

The Auto Cycle display is accessed by pressing [F4]. The Auto Cycle display provides for independently adjustable setpoints to turn the compressor on and off in response to the suction pressure or as an adjustable setpoint to limit the minimum slide valve position.

**NOTE: To change the Auto Cycle setpoints, refer to "TO CHANGE THE ADJUSTABLE SETPOINTS"**

**SUCT.PRESS.** - Constantly monitors and displays the suction pressure in pounds per square inch gauge (g) or inches of mercury (hg).

**COMPRESSOR START** - Compressor Start-up will bring the compressor back on line when the suction pressure rises to the displayed setpoint.

**COMPRESSOR STOP** - Compressor Stop will shut down the unit if the suction pressure drops to or below the displayed setpoint limit. **NOTE: This limit must be set higher than Low Suction Pressure Cutout and the Low Suction Pressure Alarm setpoints.**

**MIN. CAP. CONTROL** - Minimum Capacity Control, shown as a percentage, will limit the slide valve position to the displayed setpoint.

**AUTO CYCLE ACTIVE** - Indicates whether Auto Cycle is active (YES) or not active (NO). Press the [CHANGE] key while at this setpoint to change the status. Upon deactivation, the compressor will return to the previous mode of operation.

**ANALOG OFFSET DISPLAY\***

ANALOG OFFSET:							
	Suc	Disch	Oil	Sep	Filt	Spare	Econ
Temp	+0	+0	+0	+0		+0.0	
Pres	+0.0	+0	+0		+0		+0

The Analog Offset Display is accessed by pressing [+/-] key. All analog values can be offset + or - 3 to 9 units depending on which value is being adjusted. Use the [STEP] key to step through the desired setpoint. Press the [CHANGE] key to change the value of the offset by 1. The actual analog value will be displayed on the top line of the display. The "Econ" and channels 10, 12, and 13 are displayed but do not pertain to the program.

\*Display for illustrative purposes only.

## TEMPERATURE-PRESSURE CONTROL PROGRAM (OPTION)

**NOTE:** The following displays are provided only when the Temperature-Pressure Control Program option has been ordered with the RXB Plus Rotary Screw Compressor Unit.

### SETPOINTS DISPLAY, Page 1 \*

SETPOINTS PAGE 1	Capacity Control=Press					
	C.C.	CUTOUT	ALARM	PB	DB	CT
Press	25.3g	01.3g	05.3g	10	1.0	10
Temp	+40.0F	+32.0F	+33.0F	10	0.5	10

The Setpoints Display is accessed by pressing the [CHANGE] key.

**CONTROL** - This setpoint is used to select either Pressure Capacity Control or Temperature Capacity Control. **NOTE:** There are only two setpoints, press for pressure capacity control and temp for temperature capacity control.

**CC** - The capacity control setpoint is for normal operation, not setback.

**CUTOUT** - This setpoint will stop the compressor if the suction pressure drops below the pressure setpoint for 90 seconds or if the CC Temperature drops below the temperature setpoint. There is no time delay on the temperature cutout.

**ALARM** - An alarm will be activated if the suction pressure drops below the pressure setpoint or if the CC Temperature drops below the temperature setpoint. There is no time delay for either.

**NOTE:** Lo Temp Cutout and Alarm are active when operating in temperature capacity control mode only. These are failures based on the controlling temperature input. They precede the auxiliary failures on the annunciator display.

**PB** - The Proportional Band (PB) is used to determine the amount of time the load/unload solenoid is energized, according to how far away from the setpoint the actual control pressure or temperature is. The smaller the number, the more load/unload will be sent. A PB of 10% is default. It is adjustable to 2, 5, 10, 15, 20, or 25 percent.

**DB** - The Dead Band (DB) is a + (plus) or - (minus) value above or below the setpoint which the compressor will neither load nor unload. It is adjustable between .5 and 5.0 psig or degrees, in increments of .5 units.

**CT** - The Cycle Time (CT) setpoint is the amount of time between the beginning of each load/unload response. It is adjustable to 5, 10, 15, 20, 25, or 30 seconds.

Use the [STEP] key to step to the desired setpoint, then press the [CHANGE] key to change the CC, PB, DB, and CT values. Enter the desired value for the remaining setpoints and press [ENTER] when complete.

### SETPOINTS DISPLAY, Page 2

Refer to "SETPOINTS DISPLAY" (SETPOINTS PAGE 2) on page 17 and "SETPOINTS DISPLAY, Page 2:" on page 18.

\* Display for illustrative purposes only.

### SETPOINTS DISPLAY, Page 3\*

SETPOINTS PAGE 3	ID=[02] [04-09-90]
offset-act	Mon [01:00:18]
Sup Heat-Alarm-10F-no	Baud-[19200]
Sep Cond-Alarm-10F-no	Recycle--[30]

The new setpoints provided on this display allow monitoring of compressor superheat and condensing in the separator. The following setpoints apply to the monitoring of the superheat and condensing in the separator.

**ALARM/(SHUTDOWN)** - The Alarm/(shutdown) setpoints select the conditions for an alarm or shutdown. If alarm is selected, the alarm will occur after a 30 second delay. If shutdown is selected, the shutdown will occur 60 seconds after the alarm. **NOTE:** The Superheat Cutout and Alarm follow the auxiliary failures on the annunciator display of the TEMPERATURE-PRESSURE CONTROL PROGRAM option. The Sep Cond Alarm and Cutout are new failure features and are currently the last two listed in the Annunciator Display for the TEMPERATURE-PRESSURE CONTROL program option.

**OFFSET** - This setpoint is the degrees F above the saturation-point temperature where the alarm or shutdown will occur.

**ACT** - The function selects whether the alarm/shutdown is activated or not.

### SETPOINTS DISPLAY, Page 4\*

SETPOINTS PAGE 4	Active When Running in
	Temperature Cap. Cont.
Low Suction Press Stop Load	----- [05.0g]
Low Suction Press Force Unload	----- [00.0g]

Low-suction-pressure and motor-load-control features were added to the TEMPERATURE-PRESSURE CONTROL program and placed on this display. They are active only while the compressor is operating in Temperature Capacity Control Mode. The two new setpoints are Low Suction Press Stop Load and Low Suction Press Force Unload. Both are entered as a pressure in gauge or inches of mercury (HG). When suction pressure reaches the stop-load setpoint, loading of the compressor is inhibited. When the suction reaches the force-unload setpoint, the compressor will unload until the suction pressure is greater than the force-unload setpoint. Control will then be released to allow normal operation.

### SETPOINTS DISPLAY, Pages 5 and 6

Refer to "SETPOINTS DISPLAY" (FIXED PAGES 1 & 2) on page 17 and "SETPOINTS DISPLAY, Fixed, Pages 1 and 2:" on page 19.

Use the [STEP] key to step to the desired setpoint, then press the [CHANGE] key to change it. Press [ENTER] when all desired setpoint changes have been made.

### SETBACK DISPLAY \*

SETBACK DISPLAY:	Mon 04-09-90 01:00:51
Press Setpt-[25.3g]	Temp Setpt[+50.0F]
Active-[No ]	Mon Start Time[- :- -]
F1 to Exit	Stop Time[- :- -]

The Setback Display is accessed by pressing the [F3] key.

**TEMPERATURE-PRESSURE CONTROL  
PROGRAM (OPTION) (continued)**

**PRESS SETPOINT** - The capacity-control setpoint is used when in the Setback mode and Pressure is selected as the capacity control desired.

**TEMP SETPOINT** - The capacity-control setpoint is used when in the Setback mode and Temperature is selected as the capacity control desired.

**NOTE:** To change the Setback setpoints, refer to "TO CHANGE THE ADJUSTABLE SETPOINTS".

**ANALOG OFFSET DISPLAY\***

ANALOG OFFSET:							
	Suc	Disch	Oil	Sep	Filt	Spare	Econ
Temp	+0	+0	0	+0		+0.0	
Pres	-1.0	+0	+0		+0		-3

The Analog Offset Display is accessed by pressing [+/-] key. All analog values can be offset + or - 3 to 10 units depending on which value is being adjusted. Use the [STEP] key to step to the desired setpoint. Press the [CHANGE] key to change the value of the offset by 1. The actual analog value will be displayed on the top line of the display. The "Filt" and "Econ" and channels are displayed but do not pertain to the standard program.

**AUTO CYCLE PRESS CONTROL DISPLAY \***

AUTO CYCLE	Start[40.0 g ]	Timer[01 min]
C.C.Press	Stop [25.0 g ]	Timer[01 min]
=[35.5 g ]	Min SV-[50%]	Active-[No ]
* for Temp Menu, F1 to Exit		

The Auto Cycle Pressure Control Display is accessed by pressing the [F4] key.

The Auto Cycle display provides for independently adjustable setpoints to turn the compressor on and off in response to the suction pressure or as an adjustable setpoint to limit the minimum slide valve position. The compressor can be started and stopped by the following pressure setpoints even if the capacity control is selected to temperature.

**START** - The suction pressure must be greater than or equal to the "START" setpoint in order to start the compressor. This setpoint works in conjunction with the "TIMER" setpoint located to the right of it on the display.

**(Start) TIMER** - This is a time delay used to start the compressor. The timer only accumulates time whenever the pressure rises to or above the "START" setpoint and will reset if the pressure drops below the "START" setpoint.

**STOP** - The suction pressure must be less than or equal to the displayed "STOP" setpoint limit in order to stop the compressor. This setpoint works in conjunction with the "TIMER" setpoint located to the right of it on the display. **NOTE: This limit must be set higher than Low Suction Pressure Cut-out and the Low Suction Pressure Alarm setpoints.**

**(Stop) TIMER** - The (stop) TIMER is a time delay used to stop the compressor. The timer only accumulates time whenever the pressure drops to or below the "STOP" setpoint and will reset if the pressure rises above the "STOP" setpoint.

**MIN SV** - Minimum Slide Valve Position, shown as a percentage, will limit the slide valve position to the displayed setpoint.

**ACTIVE** - Indicates whether Auto Cycle is active or not. Press the [CHANGE] key while at this setpoint to change the status. Upon deactivation, the compressor will return to the previous mode of operation.

**AUTO CYCLE TEMP CONTROL DISPLAY \***

AUTO CYCLE	Start[+50.0 F]	Timer[01 min]
C.C. Temp	Stop [=20.0 F]	Timer[01 min]
=[+44.3 F]	Min SV-[50%]	Active-[Yes]
* for Press Menu, F1 to Exit		

The Auto Cycle Temperature Control Display is accessed by pressing [F4] and then the [ \* ] keys.

The Auto Cycle display provides for independently adjustable setpoints to turn the compressor on and off in response to the suction temperature or as an adjustable setpoint to limit the minimum slide valve position. The compressor can be started and stopped by the following temperature setpoints, even if the capacity control is selected to pressure.

**START** - The CC (capacity control) Temperature must be greater than or equal to the "START" setpoint in order to start the compressor. This setpoint works in conjunction with the "TIMER" setpoint located to the right of it on the display.

**(Start) TIMER** - This is a time delay used to start the compressor. The timer only accumulates time whenever the CC Temperature rises to or above the "START" setpoint and will reset if the CC Temperature drops below the "START" setpoint.

**STOP** - The CC Temperature must be less than or equal to the "STOP" setpoint in order to stop the compressor. This setpoint works in conjunction with the "TIMER" setpoint located to the right of it on the display.

**(Stop) TIMER** - The (stop) TIMER is a time delay used to stop the compressor. The timer only accumulates time whenever the CC Temperature drops to or below the "STOP" setpoint and will reset if the CC Temperature rises above the "STOP" setpoint.

**MIN SV** - Minimum Slide Valve Position, shown as a percentage, will limit the slide valve position to the displayed setpoint.

**ACTIVE** - It indicates whether Auto Cycle is active or not. Press the [CHANGE] key while at this setpoint to change the status. Upon deactivation, the compressor will return to the previous mode of operation.

**TELECOMMUNICATIONS COMMANDS  
ADDED OR CHANGED:**

- Command:
- #01DS will send the Adjustable Setpoints pages 1 and 2.
  - #01D3 will send the Adjustable Setpoint page 3.
  - #01DC will send both Auto Cycle Displays.
  - #01D+ will send the Analog Offset Display.

\*Display for illustrative purposes only.

## LEAD-LAG OPTION

The lead-lag compressor sequencing option provides the controls for operating two RXB compressors in one system.

### AUTO CYCLE DISPLAY \*

AUTO CYCLE	Start[40.0 g ]	Timer[01 min]
F1 To Exit	Stop [25.0 g ]	Timer[01 min]
Suct Press	Min SV-[50%]	Lead [Yes]
=[35.5 g ]	Active-[No ]	

The software includes user adjustable setpoints on the Auto Cycle setpoints screen (F4 on Main Menu) for the following:

**START** - The suction pressure must be greater than or equal to the "START" setpoint in order to start the compressor. This setpoint works in conjunction with the "Timer" setpoint located to the right of it on the Auto Cycle setpoints screen.

**(Start) TIMER** - This is a time delay used to start the compressor. The timer only accumulates time whenever the pressure rises to or above the "START" setpoint and will reset if the pressure drops below the "START" setpoint.

**STOP** - The suction pressure must be less than or equal to the "STOP" setpoint in order to stop the compressor. This setpoint works in conjunction with the "Timer" setpoint located to the right of it on the Auto Cycle setpoints screen.

**(Stop) TIMER** - This is a time delay used to stop the compressor. The timer only accumulates time whenever the pressure drops to or below the "STOP" setpoint and will reset if the pressure rises above the "STOP" setpoint.

**MIN SV** -This setpoint is the minimum slide valve position and is shown as a percentage. It will limit the slide valve position to the displayed setpoint.

**LEAD** - This setpoint assigns the compressor as the lead or the lag unit. Press the [CHANGE] key while at this setpoint to change the status.

**ACTIVE** - This setpoint indicates whether the Auto Cycle Mode is active or not. Press the [CHANGE] key while at this setpoint to change the status.

## OPERATION

For operation of the LEAD-LAG sequence, both units must be in Auto Cycle compressor mode - one compressor micro selected as the LEAD compressor, the other compressor selected as the LAG compressor - and the slide valves must be in Auto mode.

### With NO Compressor Running

The lead will start when its "START" setpoint is reached for the amount of time selected for the "TIME" setpoint.

### With ONE Compressor Running

#### If the load rises:

The lag compressor will start when its "START" setpoint is reached for the amount of time selected for the "TIME" setpoint and the lead compressor is running at 100% slide valve or running with the motor load inhibit.

#### If the load falls:

The lead compressor will stop when its "STOP" setpoint is reached for the amount of time selected for the "TIME" setpoint.

### With TWO Compressors Running

#### If the load rises:

The lead and lag compressor will load independently.

#### If the load falls:

The lag compressor will unload to its "MIN SV" setpoint. Then the lead compressor will unload to its "MIN SV" setpoint. The lag compressor will stop when the suction pressure drops below the "STOP" setpoint for the amount of time selected for the "TIME" setpoint.

**NOTE: Be careful not to select both compressors as lead compressors or as lag compressors as improper operation will result.**

**NOTE: One compressor will operate as a normal auto cycle compressor when any one of the following occurs:**

- a. Power is removed from one of the two compressors,
- b. Either of the compressors is NOT selected to "AUTO", or
- c. If communication is lost between the compressors for any reason.

## COMMUNICATIONS TROUBLESHOOTING

### Troubleshooting the communications:

Go to the SETPOINTS DISPLAY FIXED Page 2 by using the [CHANGE] key and the [ \* ] key. The display will appear as:

### SETPOINTS DISPLAY \*

FIXED	PAGE 2	Comm. Activity-[ ]
Hi Oil Temp	Cutout --[167F]	Alarm --[158F]
Lo Oil Temp	Cutout --- [49F]	Alarm --- [58F]
Lo Oil Press. Cutout	--- [005]	Alarm --- [010]

If the microprocessor is receiving information in the communications port from the other compressor, a "1" will flash between the brackets. During normal operation a "1" will flash every 5 seconds.

At the same time information is displayed on the lower right hand corner of the Auto Cycle display concerning the lead-lag information:

### AUTO CYCLE DISPLAY \*

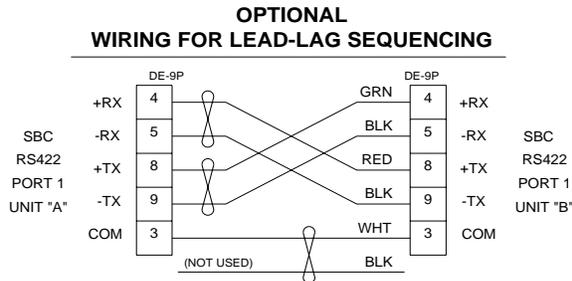
AUTO CYCLE	Start[20.0 g]	Timer[01 min]
F1 to Exit	Stop-[25.0 g]	Timer[01 min]
Suct Press	Min SV-[50%]	Lead-[Yes]
=[35.5 g ]	Active-[Yes]	0101

This information is either "0" or "1" and represents what is being sent from the other compressor. Consult Frick Company if additional information is required.

\*Display for illustrative purposes only.

**LEAD-LAG OPTION (continued)**

**TYPICAL LEAD-LAG WIRING**



USE BELDEN #8777 OR EQUAL (3 TWISTED PAIRS)  
COLOR CODING SHOWN IS BELDEN #8777  
RS 422 WIRING SHALL BE SEPARATE  
FROM ALL OTHER WIRING

CONNECTORS-#DE-9P MALE  
WITH DBCH-9 HOOD (2 THUS)  
JUMPER PIN 1 TO 6 AND 2 TO 7  
ON BOTH CONNECTORS

WIRED AT FRICK IF BOTH UNITS  
ARE ON THE SAME SKID

NOTE: WHEN USING THE RS422 PORTS FOR  
LEAD-LAG, THEY CANNOT BE USED FOR  
ANY OTHER COMMUNICATIONS

**HOW THE MICROPROCESSOR WORKS  
- SUMMARY -**

The Frick microprocessor has 4 major components and a variety of sensors. The major components are the SBC (single board computer), two display screens, and the keyboard.

The SBC can be considered the brain of the microprocessor control console. The SBC contains the logic center which provides the rules by which the microprocessor will operate, the integrated circuit chips which store the burned-in memory of how the compressor unit is to behave, an analog input to convert VDC from the various sensors into computer binary language, and RAM (random access memory) integrated circuit chips to store information which can be readily changed by the microprocessor or, as in the case of adjustable setpoints, by the operator. The SBC collects information, processes the information, and delivers instructions to the displays and to the output modules.

The SBC gathers information from several sources on the compressor unit. Pressure transducers sense changes in pressure and return a variable DC voltage of 1 to 5 VDC to the SBC. The signals are converted into binary code which the microprocessor understands. The microprocessor scans the incoming data many times per second and compares the information it receives with the instructions programmed in the PROM chips, information stored in the RAM chips, and instructions it has received from the console keyboard. As operating conditions change, the microprocessor also forwards the information it is receiving to the display screen. When an operating condition or conditions develop which the microprocessor program identifies as requiring a specific action, the microprocessor generates an instruction

which is forwarded to the output modules. The instruction triggers a solid state output device capable of handling control voltage and the instruction is executed. In some cases, such as load and unload instructions, the computer displays the instruction on the Operating display with an L (load) or U (unload) symbol at the same time as the appropriate output is energized.

If the microprocessor receives information that indicates an abnormal operating condition has been reached or is present, it will generate one or more of the following instructions:

1. If a subsystem on the compressor unit, such as the oil heater(s) or liquid injection, can correct the problem, the microprocessor will energize or de-energize this system.
2. If a prealarm setpoint has been reached the microprocessor will trigger the prealarm and display this information on the Operating display and the Annunciator display.
3. If a cutout setpoint has been reached, the microprocessor will shut down the compressor. The microprocessor will indicate **CUTOUT** on the Operating display and the information present on the Operating display at the moment of cutout will be stored and can be retrieved by rotating displays to the Freeze display. Additional information will be available through the Annunciator and Shutdown Record displays.

A typical example of how the microprocessor responds can be illustrated by the responses generated by the microprocessor as oil temperature increases. Assume that the ambient temperature and compressor unit temperature are 45°F and you have just pressed the **[RUN]** key to start the compressor unit:

**AT 45°F.**

The microprocessor receives information that the oil temperature is below 49°F, the Low Oil Temperature Cutout setpoint, and and shuts down the unit. The microprocessor will prevent the compressor package from running. The microprocessor also instructs the oil heater(s) output to energize the oil heater(s).

**AT 50°F.**

When the oil temperature reached 50°F the microprocessor would allow the Low Oil Temperature Cutout to be cleared and the compressor unit could now be started. (Assume that the **[RUN]** key has been pressed and that the compressor has now started.) The Low Oil Temperature Alarm would still be engaged and cannot be cleared until oil temperature exceeds 58°F. The oil heater(s) shut off on compressor start.

**AT 113°F**

The microprocessor instructs the liquid injection solenoid output to deenergize the liquid-injection solenoid.

**AT 122°F**

The microprocessor instructs the liquid injection solenoid output to energize.

**AT 110°F TO 150°F.**

Normal operating range. The microprocessor continues monitoring oil temperature and reporting this information on the Operating display.

**AT 158° F.**

The microprocessor triggers the High Oil Temperature Alarm and displays the alarm on the Operating display and the Annunciator display.

**AT 167° F.**

The microprocessor instructs the compressor motor to shut down and displays a **CUTOUT** indication on the Operating display. It stores the operating conditions at the moment of

cutout in the Freeze display. Information regarding the cut-out will also be retained by the Annunciator and the Shut-down Record displays.

**NOTE: If the operator makes an error by attempting to start the compressor under conditions outside safe normal operating conditions, the microprocessor will prevent start-up and advise the operator of the fault.**

**MULTIPLE COMPRESSOR SEQUENCING FOR RXB COMPRESSOR UNITS WITH MICROPROCESSOR CONTROLS**

**A -** The standard microprocessor panel includes:

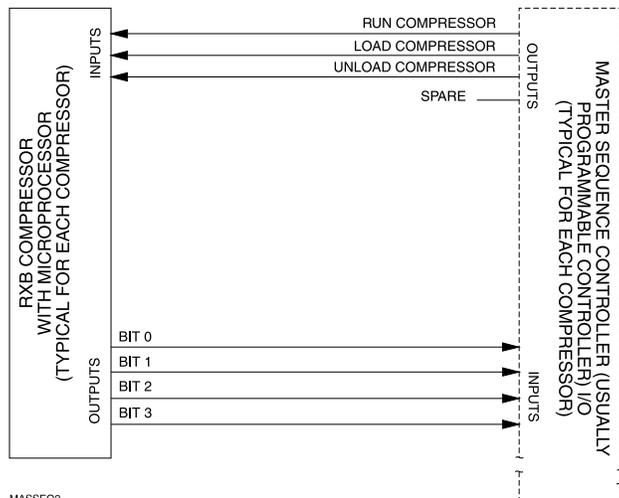
1. Remote Run Input
2. Remote Load Input
3. Remote Unload Input

The remote run input is only recognized when the remote run mode has been selected by pressing the **[REMOTE START]** key on the front panel of the microprocessor.

The remote load and unload inputs can only be recognized when the **[REMOTE]** key in the slide valve column on the front panel of the microprocessor has been pressed.

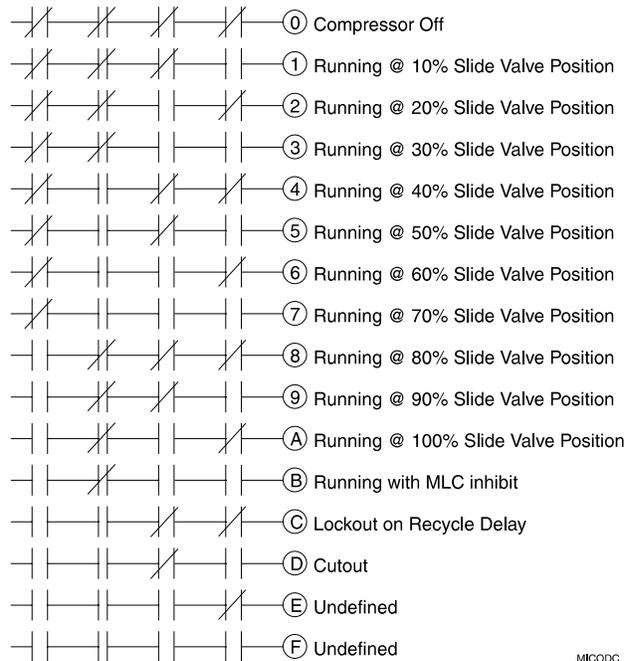
**B -** If master sequencing between multiple compressors in parallel on a common suction is desired. This output data will permit the compressor microprocessor to be interfaced with a master sequence controller. See electrical diagram for details.

**C -** A master sequence controller must be installed to provide the signals to remote start and stop the compressors and remote load and unload the compressors based on the common suction pressure or other parameter and the compressor status based on the optional microprocessor output data feedback. The customer may supply his own master sequencer panel (usually a programmable controller) or Frick, can supply this sequencer if desired (contact Frick Company for pricing).



MASSE02

**SUGGESTED PROGRAMMABLE CONTROLLER PROGRAM TO DECODE MICROPROCESSOR OUTPUT DATA CODES**

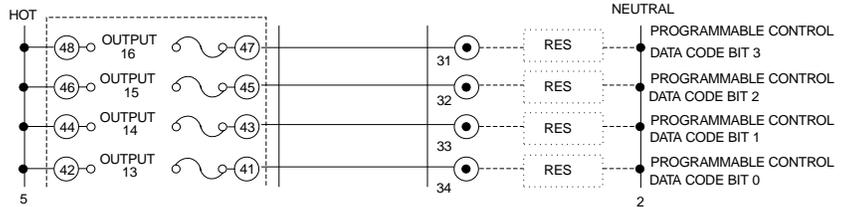


MICODC

OUTPUT NO.	16	15	14	13	HEX CODES
TERMINAL NO.	31	32	33	34	
MNEMONIC	BIT 3	BIT 2	BIT 1	BIT 0	
MEANING	OUTPUT DATA CODE				
Compressor Off	0	0	0	0	0
Running Slide Valve Position	10%	0	0	0	1
	20%	0	0	1	0
	30%	0	0	1	1
	40%	0	1	0	0
	50%	0	1	0	1
	60%	0	1	1	0
	70%	0	1	1	1
80%	1	0	0	0	8
90%	1	0	0	1	9
100%	1	0	1	0	A
Running with MLC Inhibit	1	0	1	1	B
Lockout on Recycle Delay	1	1	0	0	C
Cutout	1	1	0	1	D
Undefined	1	1	1	0	E
Undefined	1	1	1	1	F

**MICROPROCESSOR OUTPUT DATA CODE**

A 3.5 KOHM, 10 watt resistor (RES) must be field installed, as shown below, when the 120 VAC outputs of the RXB PLUS are driving 120 VAC solid state input devices such as programmable controllers.



**MICROPROCESSOR TELECOMMUNICATION**

The Frick **RXB PLUS** Microprocessor comes with an on-board telecommunication interface. The telecommunication feature permits interfacing the microprocessor with a modem, remote data communications terminal, or master computer via RS-422 protocol. In the case of a modem, telephone lines are used for the actual transmission of data, permitting communication from a remote location.

The components necessary to utilize the telecommunication feature will vary with the application. Information concerning these items may be obtained from Frick Company, Waynesboro, Pa.

**COMMUNICATIONS PROTOCOL SPECIFICATIONS:**

All commands must be in ASCII (CAPS) to be recognized. A compressor with an ID code of [00] is considered disabled. ID Codes from [01] thru [99] are valid and are recognized by the microprocessor.

The following is a complete list of available command types:

COMMAND CODE and DESCRIPTION
I = Returns compressor status information.
R = Compressor start command.
S = Compressor stop command.
V = Compressor capacity control command.
D = Compressor display screens command.
P = Return Pressures information.
T = Return Temperatures information.
A = Return full-load amps information.
C = Enter change setpoints mode.

The following is a detailed description of each command:

RETURN COMPRESSOR STATUS INFORMATION: #01I	
#	Start of command sequence.
01	Compressor ID code.
I	Return Status information command.
RETURNED ANSWER, ie: 090RRRN340	
Character Position	Description of returned data
1,2,3	Capacity control position.
4	Remote, Auto, Manual (Cap control)
5	Delay-recycle, Running, Off.
6	Rem, Man, Off, Auto (Compressor mode)
7	Cutout, Alarm, Normal.
8,9,10	Suction in PSIA. (Carriage return, line feed.)

COMPRESSOR START COMMAND: #01R01	
#	Start command sequence.
01	Compressor ID code.
R	Start compressor command.
01	ID code repeated for verification
NOTE: The compressor must be in the remote start mode for this command to be executed.	
Returned answer: A01	
Character Position	Description of returned data
1	Acknowledgement of command sent.
2,3	ID code of compressor. (Carriage return, line feed.)

COMPRESSOR STOP COMMAND: #01S01	
#	Start command sequence.
01	Compressor ID code.
S	Stop compressor command.
01	ID code repeated for verification
NOTE: The compressor must be in the remote start mode for this command to be executed.	
RETURNED ANSWER: A01	
Character Position	Description of returned data
1	Acknowledgement of command sent.
2,3	ID code of compressor. (Carriage return, line feed.)

COMPRESSOR SLIDE VALVE CONTROL COMMANDS: #01VLXX #01VUXX #01VS	
#	Start command sequence.
01	Compressor ID code.
V	Compressor control command.
L	Load slide valve command.
U	Unload slide valve command.
XX = 00	Turns selected output off.
XX = 01 to 15	Turns selected output on for XX seconds.
XX = 99	Turns selected output on.
S	Return slide valve position value.
If the command was #01VL00, then the load slide valve output on compressor #1 would be turned off. If the command was #01VL05, then the load slide valve output on compressor #1 would be turned on for 5 seconds, and would then automatically turn off. NOTE: the slide valve must be in the remote mode for this command to be executed.	
RETURNED ANSWER (for L or U commands): A01	
Character Position	Description of returned data
1	Acknowledgement of command sent.
2,3	ID code of compressor. (Carriage return, line feed.)
RETURNED ANSWER (for S command), ie: 090 1,2,3 Slide valve position.	



COMPRESSOR DISPLAY SCREENS COMMAND: #01DXNN

# Start command sequence.  
01 Compressor ID code.  
D Compressor control command.

X = O Operating display (Page 1 & 2).  
X = S Setpoints display (Page 1 & 2).  
X = X Setpoints display (Page 3 & 4).  
X = R Shutdown record display (Page 1 & 2).  
X = F Freeze display (Page 1 & 2).  
X = C Autocycle display.  
X = P Security display.  
X = B Setback display.  
X = + Analog offset display.  
X = ANN Annunciator display page "NN".

NOTE: "NN" parameter is used to access the annunciator display pages.

If the command was #01DA10, then the microprocessor would dump the annunciator display page number ten.

RETURN FULL LOAD AMPS COMMAND: #01A

# Start command sequence.  
01 Compressor ID code.  
A Return full load amps command.

If the command was #01A, then the microprocessor would dump the full-load amps value.

RETURNED ANSWER:

XXX = 3 characters followed by a carriage return, line feed.

RETURN TEMPERATURES COMMAND: #01TX

# Start command sequence.  
01 Compressor ID code.  
T Return temperature command.

X = S Return suction temperature.  
X = D Return discharge temperature.  
X = O Return oil temperature.  
X = P Return separator temperature.  
X = A Return all temperatures as a string of data.

If the command was #01TS, then the microprocessor would dump the suction temperature.

RETURNED ANSWER:

XXXX = 4 characters followed by a carriage return, line feed if suction temperature is requested. The first character is "+" or "-" followed by 3 digits.

XXX = 3 characters followed by a carriage return, line feed for all other temperatures.

If using the "A" command, then the returned data would be:

XXXXXXXXXXXX = 13 characters followed by a carriage return, line feed. The first 4 characters are Suction Temp, the next 3 are Discharge Temp, the next 3 are Oil, and the last 3 are Separator.

CHANGE SETPOINTS COMMAND: #01C

# Start command sequence.  
01 Compressor ID code.  
C Change setpoint command.  
xxx New setpoint.  
xx New setpoint.  
y g or h for gauge or inches.

The following is the complete list of the setpoints that may be changed while in the change setpoints command:

01xxx Capacity Control Setpoint.  
02xxx Change Low Pressure Cutout Setpoint.  
03xxx Change Low Pressure Alarm Setpoint.  
04xxx Change High Pressure Cutout Setpoint.  
05xxx Change High Pressure Alarm Setpoint.  
06xxx Change MLC Stop Load Setpoint.  
07xxx Change MLC Force Unload Setpoint.  
08xx Change Recycle Delay Setpoint.  
09xxx Change CTF Setpoint.

01 Compressor ID code.

RETURNED ANSWER:

Axxxx The new setpoint which was sent, followed by a carriage return, line feed.

If the command was sent #01C01300g01, the capacity control setpoint would be changed to 30.0g and the returned answer is A300g followed by a carriage return, line feed.  
If the command sent was #01C0711001, the MLC force unload setpoint would be changed to 110% and the returned answer is A110 followed by a carriage return, line feed.  
If the command sent was #01C0520002, the returned answer is "BAD" followed by the ID number and a carriage return, line feed.

RETURN PRESSURES COMMAND: #01PX

# Start command sequence.  
01 Compressor ID code.  
P Return pressures command.

X = S Return suction pressure (PSIA).  
X = D Return discharge pressure (g/hg).  
X = O Return oil pressure (g).  
X = F Return filter differential pressure.  
X = A Return all pressures.

If the command was #01PS, then the microprocessor would dump the suction pressure.

RETURNED ANSWER:

XXX = 3 characters followed by a carriage return, line feed.

If using the "A" command, then the returned data would be:

XXXXXXXXXXXX = 12 characters followed by a carriage return, line feed.

g or h : must be lower case - exception to "All commands must be caps" statement at beginning of section.

**READ INPUT/OUTPUT COMMAND**

#01X  
# Start command sequence.  
01 Compressor ID Code.  
X Read Input/Output(s) command.

Returned Answer:  
  
A10000011000000000100000001

Character Position	Description
1	Acknowledge of command sent.
2	Oil Level Input 1
3	Remote Run Input 2
4	Remote Load Input 3
5	Remote Unload Input 4
6	Compressor Aux Input 5
7	Oil Pump Aux 6
8	Aux 1 Input 7
9	Aux 2 Input 8
10	Compressor Run Output 1
11	Slide Valve Load Output 2
12	Slide Valve Unload Output 3
13	Slide Stop Increase Output 4
14	Slide Stop Decrease Output 5
15	Liquid Injection Output 6
16	High Vi Liquid Injection Output 7
17	Economizer Output 8
18	Alarm Output 9
19	Oil Heater Output 10
20	Oil Pump Start Output 11
21	Spare Output 12
22	Programmable Control Data Bit 0 Output 13
23	Programmable Control Data Bit 1 Output 14
24	Programmable Control Data Bit 2 Output 15
25	Programmable Control Data Bit 3 Output 16
26,27	Compressor ID Code

Example:  
If the answer returned was  
  
A10000011000000000100000001,  
  
the inputs/outputs on compressor #1  
which are energized are:  
  
Oil level input 1  
Aux 1 Input 7  
Aux 2 Input 8  
Oil Heater Output 10

**READ FAILURES COMMAND: #01F**

# Start command sequence.  
01 Compressor ID Code.  
F Read Failures command.

Returned Answer:  
  
A000000000000000000000000000002

Character Position	Description
1	Acknowledge of command sent.
2	High Press Cutout
3	High Press Alarm
4	Low Press Cutout
5	Low Press Alarm
6	Oil Press Cutout
7	Oil Press Alarm
8	Hi Oil Temp Cutout
9	Hi Oil Temp Alarm
10	Lo Oil Temp Cutout
11	Lo Oil Temp Alarm
12	Disch Temp Cutout
13	Disch Temp Alarm
14	Comp Auxiliary
15	Pump Auxiliary
16	Oil Level
17	Comp Differential
18	Dirty Filter
19	Spare
20	Aux 1 Alarm or Cutout
21	Aux 2 Alarm or Cutout
22	Spare
23	Spare
24	Spare
25,26	Compressor ID Code

Example:  
If the answer returned was  
  
A00000100000000000000000000002,  
  
compressor #2 has an Oil Press Alarm.

## RXB COMPRESSOR

The Frick **RXB** rotary screw compressor utilizes mating, asymmetrical-profile helical rotors to provide a continuous pulse-free 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. Moveable slide valve to provide infinite step capacity control from 100 to 25% of full load.
4. VOLUMIZER<sup>®</sup> adjusts to the most efficient of three volume ratios (2.2, 3.5 or 5.0) depending upon system requirements.
5. A hydraulic unloader cylinder to operate the slide stop and slide valve.
6. Compressor housing suitable for 350 PSI pressure. Dual-compressor casing design for very low airborne noise transmission.
7. Most bearing and control oil vented to closed thread in the compressor instead of suction port to avoid performance penalties from superheating suction gas.
8. Shaft seal design to maintain operating pressure on seal well below discharge pressure for increased seal life.
9. Oil injected into the rotors to maintain good volumetric and adiabatic efficiency even at very high compression ratios.



**IT IS MANDATORY THAT THE COUPLING CENTER BE REMOVED AND THE DIRECTION OF MOTOR**

**ROTATION BE CONFIRMED BEFORE RUNNING THE COMPRESSOR. Proper rotation of the compressor shaft is clockwise looking at the end of the compressor shaft. FAILURE TO FOLLOW THIS STEP COULD RESULT IN BACKWARD COMPRESSOR ROTATION WHICH CAN CAUSE COMPRESSOR FAILURE OR EXPLOSION OF THE SUCTION HOUSING.**

## COMPRESSOR LUBRICATION SYSTEM

The **RXB** compressor is designed specifically for operation without an oil pump for high stage service. Boosters and some low-differential-pressure applications will require the full-lube pump option.

The lubrication system on an **RXB** screw compressor unit performs several functions:

1. Lubricates the rotor contact area, allowing the male rotor to drive the female rotor on a cushioning film of oil.
2. Provides lubrication of the bearings and shaft seal.

3. Serves to remove the heat of compression from the gas, keeping discharge temperatures low and minimizing refrigerant or oil breakdown.

4. Fills gas leakage paths between or around the rotors with oil, thus greatly reducing gas leakage and maintaining good compressor performance even at high compression ratios.

5. Provides oil pressure for development of balance load on the balance pistons to reduce bearing loading and increase bearing life.

## FULL-LUBE OIL SYSTEM

**RXB PLUS** booster compressors and high-stage compressors, that operate with very low differential pressures across the compressor suction and compressor discharge, require a full-time oil pump to produce the oil flow and pressures required. Oil is pumped from the oil separator through the oil filter to the main oil injection feed and the compressor. An oil pressure regulating valve downstream of the pump is used to regulate oil pressure at the compressor by returning excess oil to the separator.

Oil pressure on **RXB PLUS** compressors with full-time oil pumps should be adjusted to provide 20 – 25 PSI (high stage) or 30 – 35 PSI (booster) pounds of oil pressure at the highest normal head pressure or intermediate pressure expected with the compressor fully loaded. The compressor will require maximum oil flow under these conditions.

## COMPRESSOR OIL SEPARATION SYSTEM

The **RXB PLUS** 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. The return of this oil to the compressor is controlled by a needle valve on both high-stage and booster applications.

**NOTE: Open needle the valve only enough to keep the coalescer end of the 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.

**COMPRESSOR HYDRAULIC SYSTEM**

The compressor hydraulic system moves the movable slide valve (MSV) to load and unload the compressor. It also moves the movable slide stop (MSS) to increase or decrease the compressor's volume ratio (Vi).

**CAPACITY CONTROL**

**COMPRESSOR LOADING:** If the capacity control valve is mounted on the base, the compressor loads when MSV solenoid coil SV1 is energized. If the capacity control valve is mounted on the compressor, the compressor loads when MSV solenoid coil SV2 is energized. Oil flows from the solenoid valve through the needle valve (NV2) to compressor port 2, where it enters the load side of the slide valve piston. This equalizes the force on the slide valve piston and discharge pressure on the slide valve area loads the compressor.

**COMPRESSOR UNLOADING:** If the capacity control valve is mounted on the base, the compressor unloads when MSV solenoid SV2 is energized. If the capacity control valve is mounted on the compressor, the compressor unloads when MSV solenoid coil SV2 is energized. Oil is allowed to flow from compressor port 2 through the needle valve to the MSV solenoid. This allows discharge pressure on the slide valve piston to unload the slide valve as the piston moves outward.

**ADJUSTMENT (Capacity Control):** A needle valve (NV2) is provided to adjust slide valve travel time, preventing excessive slide valve "hunting". NV2 should be adjusted to restrict oil flow to compressor port so that slide valve travel time from full load to full unload, or vice versa is a minimum of 30 seconds.

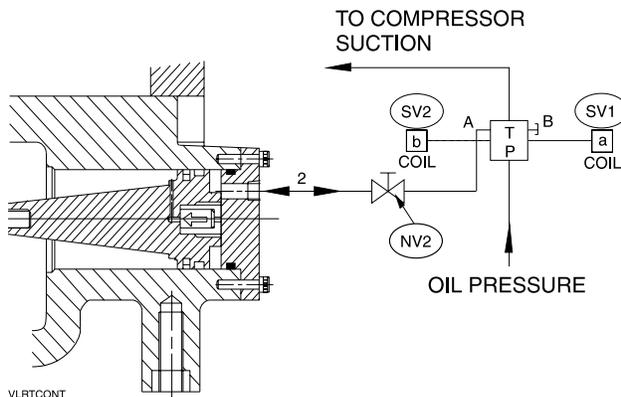
**NOTE:** A change in operating conditions may require readjustment of Slide Valve travel time (NV).

**VOLUMIZER® II Vi CONTROL**

Solenoid valves 3 and 4 control the Vi Ratio. Oil is internally ported to move the Movable Slide Stop.

Vi	SOL-3 (TOP)	SOL-4 (BOTTOM)
2.2	Energized	Energized
3.5	De-energized	Energized
5.0	De-energized	De-energized

**CAPACITY CONTROL VALVE MOUNTED ON BASE**



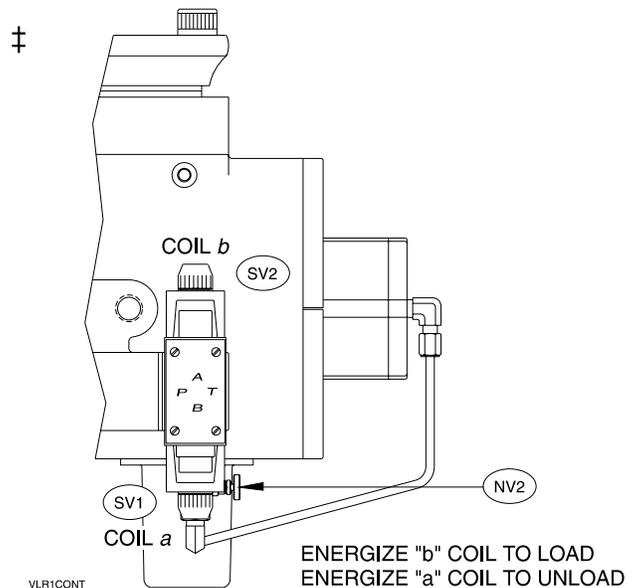
**FUNCTIONAL CHECK OF THE COMPRESSOR VOLUME RATIO CONTROL (Vi) OPERATION**

1. Remove the slide valve potentiometer cover located on the outlet end of the compressor and secured by 4 cap screws.
2. Push the Slide Stop Manual 2.2 Vi key on the micro keypad.
3. Push Manual Load on the Slide Valve Control and hold in the depressed position until the compressor is fully loaded.
4. Remove the Capacity Position Potentiometer which is secured by 2 bolts. This will expose the indicator rod which protrudes from the indicator rod guide.
5. In the 2.2 Vi position, the rod should extend from the guide the amount shown in the Indicator Rod Extension table.
6. With the slide valve fully loaded, depress the manual 3.5 Vi key. Movement of the indicator rod should occur as the Vi is changed so that the rod extension corresponds to the table.
7. Reassemble the parts if the functional check is satisfactory.

If the indicator rod does not move to the proper position as the table indicates, then the compressor is not changing Vi in either manual or optional automatic operation. This would result in higher compressor motor horsepower consumption and possibly high oil temperature. The problem would be caused by a malfunction of either solenoid valve 3SOL or 4SOL, or the solenoid coil. Replace as required.

INDICATOR ROD EXTENSION (in.)		
Vi POSITION	RXB 12, 15, & 19	RXB 24, 30, 39, & 50
2.2	.412 / .454	.434 / .474
3.5	.297 / .339	.319 / .359
5.0	.235 / .277	.258 / .298

**CAPACITY CONTROL VALVE ON COMPRESSOR**

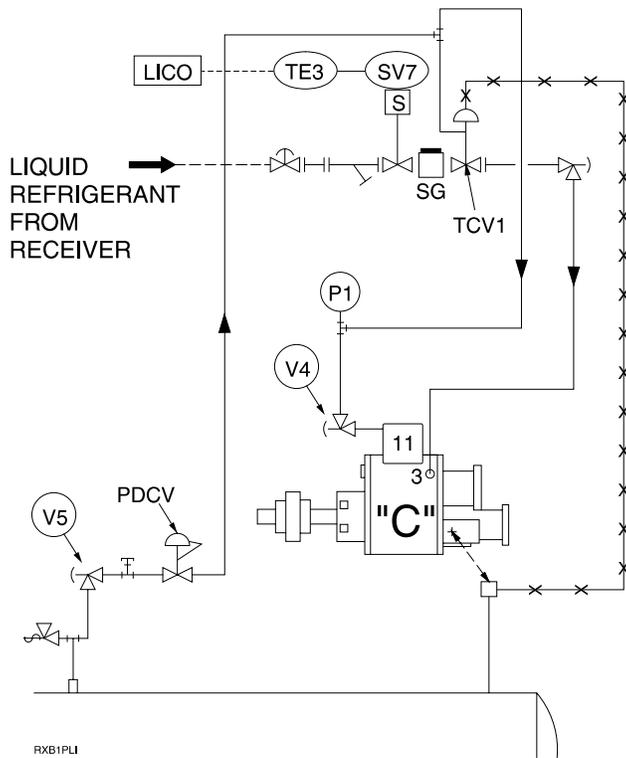


### COMPRESSOR OIL COOLING SYSTEMS

The **RXB PLUS** unit can be equipped with one of several systems for controlling the compressor oil temperature. They are single or dual-port liquid injection, thermosyphon or water-cooled oil coolers. Each system is automatically controlled, independent of compressor loading or unloading. Oil cooling systems maintain oil temperature within the following ranges:

LIQUID INJECTION OIL COOLING	EXTERNAL* OIL COOLING
R-717 110 - 130°F.	110 - 130°F
R-22 130 - 150°F.	110 - 130°F

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



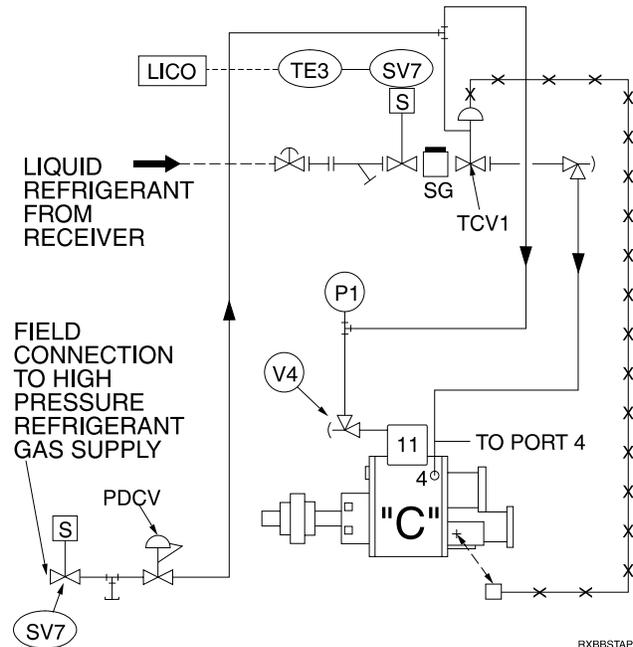
### SINGLE-PORT LIQUID INJECTION

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

Solenoid valve SV7 is energized by the microprocessor when the temperature element (TE3), installed in the piping after the oil filter, exceeds the LICO setpoint. High pressure liquid refrigerant is then supplied to the temperature control valve TCV1. The temperature control valve is equalized to a constant back pressure by the differential pressure control valve PDCV (see **LIQUID INJECTION ADJUSTMENT PROCEDURE**). 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.

**BOOSTER APPLICATION** - Discharge gas from the high-stage compressor is required to assist the differential pressure control valve (PDCV) in providing the temperature control valve (TCV) with a constant back pressure.

A solenoid valve SV6 is installed before the differential pressure control valve (PDCV) to prevent migration of high pressure gas during shut down.



**DUAL-PORT LIQUID INJECTION**

The dual-port liquid injection system is designed to obtain the most efficient compressor performance at high and low compression ratios by permitting injection of liquid refrigerant into one of two ports on the compressor.

The dual-port system contains all the components of the single-port system with the addition of a double-acting solenoid valve SV9 and operates as outlined.

Solenoid valve SV7 is energized by the microprocessor when the temperature element (TE3), installed in the oil piping after the oil filter, exceeds the LICO setpoint. Liquid refrigerant is then passed through the temperature control valve TCV1 to the double-acting solenoid valve SV9. Depending on the compressor's operating volume ratio  $V_i$ , the microprocessor will select the flow of the liquid refrigerant to either compressor port 3 or port 4.

When the compressor operates at 3.5 or 2.2,  $V_i$  compressor port 3 (low  $V_i$ ) supplies the liquid cooling. At 5.0  $V_i$ , port 4 (high  $V_i$ ) supplies the liquid cooling.

The temperature control valve TCV1 is equalized to a constant back pressure by the differential pressure control valve PDCV.

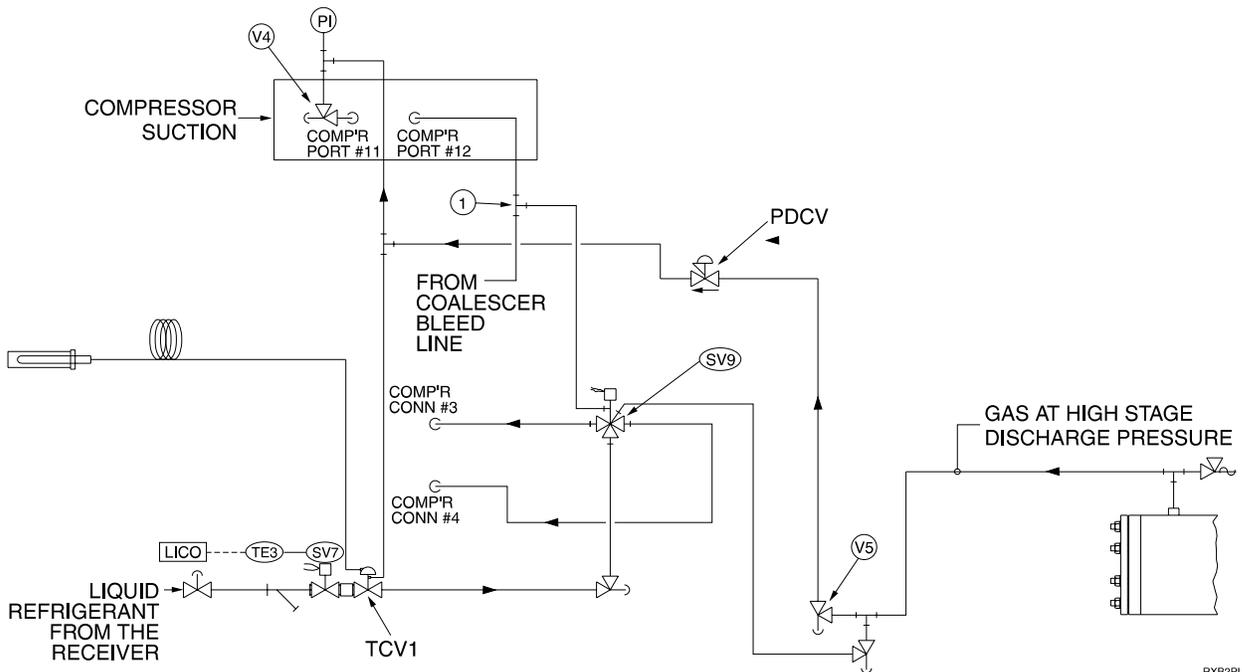
Both the differential pressure control valve PDCV and the double-acting solenoid valve SV9 use discharge gas to maintain downstream pressure. The gas downstream of both valves is bled off to the compressor suction to ensure steady and constant operation of the valves.

**LIQUID INJECTION  
ADJUSTMENT PROCEDURE**

1. Close vent valve (V4).
2. Open service valve (V5) until approximately 80 PSIG is registered at the Pressure Indicator (PI).
3. Open vent valve (V4) until 75 PSIG is registered at the Pressure Indicator (PI).
4. Monitor the oil temperature of the compressor. If the oil temperature rises above 130°F (R-717) or 150°F (R-22), open vent valve (V4) a very small amount. This will reduce pressure on the equalizer and allow more refrigerant to flow to the compressor. If the oil temperature drops below 110°F (R-717) or 130°F (R-22), close vent valve (V4) a very small amount. This will increase pressure on the equalizer. 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.



**The vent valve (V4) MUST be open at least 1/4 turn during normal operation. A higher initial pressure (step 2) may be required.**



RXB2PLI

### PRESTART CHECKLIST

All check points in the following list must be completed before placing the compressor unit in operation. Only when the checklist is completed will the unit be ready for initial start-up.

	CHECKPOINT
	Ammonia Units: Only refrigerant grade Ammonia as specified by International Institute of Ammonia Refrigeration (IAR) Bulletin # 110, Section 3.3 should be used with FRICK equipment.
	Unit pressure test. Close suction and discharge service valves, and isolation valve to low pressure transducer. Introduce pressure to unit and check for leaks. <b>CAUTION: Do NOT exceed 80% of relief valve and/or 100% of the vessel's design working pressure.</b>
	Charge unit with proper amount and grade of oil. Oil level should be between the two sight glasses on the oil separator.
	Evacuate unit and system to 29.88" Hg. vacuum (1000 microns) to ensure that the system is free of moisture and noncondensable gases. Additional information regarding evacuation is detailed in the following publications: AMMONIA - International Institute Of Ammonia Refrigeration (IAR) Bulletin # 110, Section 5.4. HALOCARBONS - Refrigeration Service Engineering Society (RSES) Service Application Manual, Section 83, Forms 610-57 and 630-46.
	Confirm that all field wiring is complete.
	With coupling center removed, check for proper compressor motor rotation. COMPRESSOR ROTATION IS CLOCKWISE WHEN FACING COMPRESSOR SHAFT. Check for proper alignment. OPEN compressor motor disconnect. Replace coupling center.
	If applicable, check Full-Time Oil Pump for correct rotation. OPEN oil pump motor disconnect.
	Confirm that motor overload and CT is properly sized.
	With ALL motor disconnects OPEN, turn control power ON and check ALL voltages.
	Check that oil heater circuit is on. <b>CAUTION: The oil heater should be on 24 hours before initial start-up is attempted.</b>
	Confirm that the Emergency Stop Button is not depressed. Disengage by gently twisting to the left.
	Confirm Microprocessor function. Rotate through displays.
	Rotate to the ADJUSTABLE setpoints display (2 pages) and enter setpoints including DAY, DATE, and TIME. Return to the Operating display, then rotate back to the ADJUSTABLE setpoints display to confirm that the proper setpoints have registered. Press [F1] to return to the Operating display.
	Rotate to the ANNUNCIATOR display. Confirm that all setpoints are normal and that no alarm or cutout indications are present. Press [F1] to return to the Operating display.
	Open all oil circuit service valves to allow normal oil flow.
	If applicable, start the oil pump by turning the oil pump switch to HAND. Confirm oil pressure buildup pump rotation. Separator oil level may drop as oil filter(s) and oil cooler fills up. Add oil as required. Allow oil pump to operate 10 minutes to flush the lubricating circuit. Shut down oil pump. Place the oil pump switch in the AUTO mode.
	Open discharge and suction service valves.
	Open the oil return needle valve located at the bottom of the coalescer section of the oil separator.
	Open all hydraulic control valves for the slide valve (compressor loading and unloading) and the slide stop (volumizer).
	Open all required oil cooling valves. LIQUID INJECTION: service valves should be fully open with the exception of the bleed valve which should be opened 1/4 turn. WATER-COOLED OIL COOLER: confirm adequate water supply is present and adjust water-regulating valve to midrange.
	Close economizer service valves, if applicable. The economizer can be put into service once normal operation is established.
	Confirm that the entire refrigeration system is ready for compressor operation and that sufficient load is available for compressor start-up.
	Close compressor motor main disconnect.

## **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. On start-up, the unit should be operated at as high a load as possible for 3 hours. During this period, adjust liquid injection oil cooling if applicable. If the unit has water-cooled oil cooling, adjust the water control valve to the cooler. No adjustment is required for thermosyphon oil cooling.
2. The compressor slide valve potentiometer should be calibrated.
3. After three hours, stop the unit and open the motor's main disconnect. Check hot alignment and adjust as necessary.
4. Pull and clean the suction strainer after 24 hours of operation. Repeat every 24 hours until the system is clean.

## **NORMAL START-UP PROCEDURE**

1. Confirm that system conditions permit starting the compressor.
2. Press the **[RUN]** key.
3. Allow the compressor to start up and stabilize. At start-up the slide stop (volumizer) and the slide valve (capacity control) are in the **AUTO** mode.

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

1. Check **ADJUSTABLE** setpoints.
2. Follow normal start-up procedure.

## MAINTENANCE

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.

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

### NORMAL MAINTENANCE OPERATIONS

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

1. If the unit is running, push [STOP] key to shut down the unit.
2. Disconnect power from unit before performing any maintenance.
3. Wear proper safety equipment when the compressor unit is opened to the atmosphere.
4. Ensure adequate ventilation.
5. Take necessary safety precautions required for the refrigerant being used.

### COMPRESSOR SHUTDOWN and START-UP

For seasonal or prolonged shutdown, the following procedure should be used:

1. Push [STOP] key to shutdown the unit.
2. Open the disconnect switch for the compressor motor starter and oil pump motor starter (if applicable).
3. Turn off power.
4. Close suction, discharge, suction check valve bypass, and liquid injection service valves. Attach CLOSED TAGS.
5. Shut off cooling water supply valve to the oil cooler, if applicable. Attach CLOSED TAG.
6. Protect the oil cooler from ambient temperatures below freezing or remove the water heads.

**NOTE: The unit should be inspected weekly during shutdown. Check for leaks or abnormal pressure. Manually rotate the compressor. Consult motor manufacturer for recommendations.**

To start up after a seasonal or prolonged shutdown, the following procedure should be used:

1. Perform routine maintenance. Change oil and replace filters. Check strainers.
2. Any water necessary for the operation of the system that may have been drained or shut off should be restored or turned on. If the oil cooler heads were removed, reinstall and remove tags.

3. Open suction, discharge, and liquid injection service valves and remove tags.

4. Compressor unit is ready for prestart checks. Refer to **PRESTART CHECKLIST**.

### GENERAL INSTRUCTIONS FOR REPLACING COMPRESSOR UNIT COMPONENTS

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

1. Push [STOP] key to shutdown the unit.
2. Open disconnect switches for the compressor motor starter and the oil pump motor starter (if applicable).
3. Close discharge service valve.
4. SLOWLY vent the component to low-side system pressure using suction check valve bypass. Then close suction service valve and suction bypass valve. **NOTE: Recover or transfer all refrigerant vapor, in accordance with local ordinances, before opening to atmosphere. The component MUST be equalized to atmospheric pressure before opening.**

**CAUTION** Oil-entrained refrigerant may vaporize, causing a 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 the unit and leak test.
8. Evacuate the unit to 29.88" Hg (1000 microns).
9. Open suction and discharge service valves, and the low pressure transducer. Readjust suction bypass valve.
10. Close disconnect switches for the compressor motor starter and the oil pump motor starter, if applicable.
11. The unit is ready to put into operation.

### SUCTION CHECK VALVE BYPASS

A 1/4" angle valve (HV-1 on P & I diagram) is installed between the compressor and suction flange that can be used as a suction valve bypass. This feature has several uses including reducing starting torque, improving oil quality, and relieving the refrigerant to low side for servicing.

In most cases, the valve should be left open approximately 1/4 to 1/2 turn at all times. If the compressor back-spins or too much oil foaming is experienced while venting, partially close valve to slow speed of equalization. If system is on AUTO CYCLE and short cycling occurs, the valve must be closed.

To relieve refrigerant to low side, close separator discharge service valve. Slowly open bypass valve (if closed) and wait for pressure to equalize. Close bypass and suction service valves before evacuating the unit.

### OIL FILTER - SINGLE

To change the filter cartridge proceed as follows:

1. If a single oil filter is installed, push **[STOP]** key to shut-down the unit. Open disconnect switches for the compressor and (if applicable) oil pump motor starters.
2. Close discharge service valve. SLOWLY vent the separator to low-side system pressure using the suction check valve bypass. Close suction valve and suction check valve bypass. **NOTE: Recover or transfer all refrigerant vapor, in accordance with local ordinances, before opening to atmosphere. The oil filter cartridge MUST be equalized to atmospheric pressure before opening.**



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

3. 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.
4. Flush the canister with clean Frick refrigeration oil; wipe dry with a clean, lint-free cloth; and replace the plug.
5. 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.
6. Isolate the low pressure transducer, PE-4, to prevent damage during pressurization and leak test.
7. Pressurize and leak test. Evacuate the unit to 29.88" hg (1000 microns).
8. Open suction and discharge the service valves, and the low pressure transducer. Readjust suction check valve bypass. Close disconnect switches for the compressor and (if applicable) the oil pump motor starters. Start the unit.

### OIL FILTER(s) - DUAL

RXB compressor units are furnished with one main oil filter.



A second filter is installed as optional equipment to minimize down time and reduce refrigerant loss.

1. If dual oil filters are furnished, open the inlet and then the outlet service valves of the standby filter.
- Open outlet and inlet service valves SLOWLY to prevent a sudden pressure drop which could cause an oil filter differential cutout.**
2. Close the outlet and then the inlet service valves of the filter being serviced. Open the bleed valve on the filter canister and **SLOWLY** purge to atmospheric pressure.
  3. Follow instructions 3, 4, and 5 under "OIL FILTER - SINGLE"
  4. Place the unit back into service.

### OIL RETURN STRAINER

The unit must be shut down and equalized to atmospheric pressure. **NOTE: Recover or transfer all refrigerant vapor in accordance with local ordinances before opening to atmosphere.**

1. Remove the large plug from the bottom of the strainer, remove the element from the strainer.
2. Wash the element in solvent and blow it clean with air.
3. Replace the element and the large plug.
4. Open the valves closed in Step 1 and check for leakage.

### OIL PUMP STRAINER (Optional)

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

1. Shut down the unit and open the disconnect switches for the compressor and (if applicable) the oil pump motor starters. Isolate and equalize unit to atmospheric pressure (See General Instructions for Replacing Compressor Unit Components).
2. Close the inlet service valve.
3. Open the drain valve located in the strainer cover and drain the oil into a container.
4. Remove the capscrews securing the strainer cover, strainer cover gasket, and element. Retain the gasket.
5. Wash the element in solvent and blow it clean with air.
6. Wipe the strainer body cavity clean with a lint-free clean cloth.
7. Replace the cleaned element and gasket, then reattach the cover using the retained capscrews.
8. Close the drain valve and open the strainer inlet service valve.
9. Check for leakage.
10. Open suction and discharge valves and readjust suction check valve bypass (if required). Close the disconnect switches for the compressor and (if applicable) the oil pump motor starters.
11. Start the unit.

### LIQUID INJECTION STRAINER

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

1. Shut down unit and open the disconnect switches for the compressor and (if applicable) oil pump motor starters. Isolate and equalize unit to atmospheric pressure (See General Instructions for Replacing Compressor Unit Components).
2. Close the liquid supply service valve located before the 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 the service valve located between the compressor and the liquid injection, thermal expansion valve.
5. Carefully loosen the capscrews securing the strainer cover to the strainer. Allow pressure to relieve slowly.
6. When all entrapped refrigerant has been relieved, carefully remove the 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 them clean with air.
8. Reassemble the strainer.
9. Open the service valve between the compressor and the liquid injection thermal expansion valve and check for leakage.
10. Screw out the manual solenoid valve stem.
11. Carefully open the liquid supply service valve.
12. Leak test.
13. Open suction and discharge valves and readjust suction check valve bypass (if required). Close the disconnect switches for the compressor and (if applicable) oil pump motor starters.
14. Start the unit.

### COALESCER FILTER ELEMENT

When changing the coalescer filter element, it is recommended that the oil and oil filter(s) be changed. Applicable strainer elements should be removed and cleaned.

1. Refer to **CHANGING OIL**, Steps 1 thru 8.
  2. Remove the coalescer head and gasket. Discard the gasket.
  3. Remove and retain the nut securing the coalescer filter retainer.
  4. Remove the retainer, coalescer filter element, and 2 O-rings. Discard the filter element.
  5. Install the new coalescer filter element.
- CAUTION** Seat the element in center of locating tabs on separator bulkhead.
6. Replace the coalescer filter retainer and nut. **DO NOT OVERTIGHTEN THE NUT.** Torque values for nut are: 15 ft-lb for models 12 and 15; 17 ft-lb for 19 and 24; and 21 ft-lb for 30–50. Install jam nut.
  7. Install a new head gasket and replace the coalescer head.
  8. Tighten the head bolts. **NOTE: WHEN THE COMPRESSOR UNIT IS REPRESSURIZED, RETIGHTEN THE HEAD BOLTS TO PREVENT THEM FROM LOOSENING.**
  9. Refer to **CHANGING OIL**, Steps 9 thru 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 ap-

**proved 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. Push **[STOP]** key to shut down the unit.
2. Open the disconnect switch for the compressor motor starter and (if applicable) oil pump motor starter.
3. Close the discharge, and liquid injection (if applicable) service valves.
4. **SLOWLY** vent the separator to low-side system pressure using the suction check valve bypass. Close suction valve and suction check valve bypass. **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 the drain valve(s) located on the underside of the separator and drain the oil.
6. Drain the oil filter, strainers, and oil cooler, if applicable.
7. Remove and install new oil filter cartridge(s). Inspect check valve in the bottom of the filter housing to ensure that the parts are in good condition.
8. Remove, clean, and reinstall strainer elements in strainers.
9. Evacuate the unit to 29.88" Hg (1000 microns).
10. Open the suction service valve and pressurize the unit to system suction pressure. Close the suction valve and leak test.
11. Add oil by attaching suitable pressure-type hose to the oil-charging valve located on top of the separator. Using a pressure-type oil pump and recommended Frick oil, open the charging valve and fill separator until oil level is midway in the top sight glass. The following table gives approximate oil charge quantities.

TABLE BASIC OIL CHARGE	
RXB MODEL	BASIC CHARGE*(Gal.)
12 & 15	10
19 & 24	14
30 & 39	17
50	21

\* Add oil volume for external oil cooler, according to cooler size selected: 6 x 5 TSOC - 4 gal.; 6 x 5 WCOC - 5 gal.; 8 x 5 TSOC - 6-1/2 gal.; and 8 x 5 WCOC - 8 gal.

12. Open the suction, discharge, and liquid injection service valves. Readjust suction check valve bypass.
13. Close the disconnect switch for the compressor motor starter and (if applicable) oil pump motor starter.
14. Start the unit.

**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. A daily log should also be maintained. There should be a continued monitoring of oil quality and oil analysis testing. In addition, an analysis of the unit's vibration should be made periodically.

**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 the vibration reading from exactly the same places and at exactly the same percentage 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.

**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, follow these recommendations:

1. Only use Frick refrigeration oil as recommended by Frick Company for your application.
2. Participate in a regular, periodic, oil analysis program to help maintain oil and system integrity.

**MOTOR BEARINGS**

Follow the motor manufacturer's maintenance recommendations.



**Lubricate the motor bearings properly before start-up. Maintain subsequent lubrication as recommended by the motor manufacturer.**

**LUBRICATION SCHEDULE / INSTRUCTIONS**

SYNC. RPM	FRAME SERIES	SERVICE CYCLE* - BALL BEARING**	
		8 HR/DAY OPERATION	24 HR/DAY OPERATION
3600	360-5800	150 DAYS (1200 HRS)	50 DAYS (1200 HRS)
	360	390 DAYS (3120 HRS)	130 DAYS (3120 HRS)
1800	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)

- 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.

\* 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.

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

**OPERATING LOG:** The use of an operating log, as shown on the inside back cover, 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. It is recommended that readings be taken at least every four hours.



**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

Successful problem solving requires an organized approach to define the problem, identify the cause, and make the proper correction.

### 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.

The following list of abnormal system conditions can cause abnormal operation of the **RXB** 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 the system (carryover).
8. Refrigerant underfeed or overfeed to the evaporators.
9. Blocked tubes in the water-cooled oil cooler from high mineral content of the water.
10. Insufficient evaporator or condenser sizing.
11. Incorrect refrigerant line sizing.
12. Improper system piping.
13. Problems in electrical service to the 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 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.

## TROUBLESHOOTING THE RXB PLUS MICROPROCESSOR

This section contains information on troubleshooting and making corrections to the microprocessor and control circuits of the **RXB PLUS** unit. The section is composed of four parts: a general information section, a troubleshooting guide, a repair procedure guide, and a section with illustrative schematics and data.

### GENERAL INFORMATION

**CAUTION** THE COMPONENTS WITHIN THE MICROPROCESSOR CONSOLE CAN BE INADVERTENTLY DAMAGED BY STATIC ELECTRICITY OR MISHANDLING. ONLY QUALIFIED TECHNICIANS SHOULD DIRECTLY HANDLE THESE COMPONENTS.

**1. DO NOT REMOVE** the microprocessor console cover or attempt to make corrections to the microprocessor power supply without shutting off the control power. Accidental shorts can irreparably damage the SBC (single board computer) or the display screen.

**2. DO NOT HANDLE** the SBC or the display screen board when their cables are disconnected without first attaching a ground strap to prevent static electrical discharge from your body.

Most problems encountered with the microprocessor and control circuits will be the result of a wiring fault, blown fuse, or failure of a peripheral control such as a solenoid coil or a pressure transducer. Faults in the computer, while possible, are unlikely. If a fault develops in the computer, the probability is that all functions will cease and the display screen will go blank.

The control system of the **RXB PLUS** compressor consists of a 120 volt AC (high voltage) side and a DC (low voltage) side. The 120 volt side actuates solenoids, relays, alarms, and other electromechanical functions. The DC side operates the computer and its various sensors. The microprocessor console contains the SBC (single board computer) and one display screen.



**When working within the microprocessor console, 120 VOLTS CAN CAUSE INJURY OR DEATH.**

To troubleshoot the low-voltage side of the **RXB PLUS** control circuits, it is necessary to have the following tools:

1. Accurate digital multimeter.\*
2. Small wire stripper.
3. Small screwdriver.
4. Small snip nose pliers.
5. 15 watt soldering iron (no larger).
6. .032,60/40 rosin core solder.
7. IC chip extraction and insertion tools.\*
8. Grounding strap.\*
9. Static free grounded work surface.

\* Available from Frick. Order kit no. 111Q0451862

## TROUBLESHOOTING FRICK SBC MICROPROCESSOR SYSTEM (REFER TO WIRING DIAGRAMS)

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
DISPLAY IS INOPERATIVE	<p>Check the 10 amp fuse (2FU) which controls all voltage going to the microprocessor.</p> <p>Shut off power to the microprocessor and confirm that all cable and wire connections are made.</p>
COMPRESSOR AUXILIARY SHUTDOWN	<p>Output 1 controls the Compressor Start Relay (2CR). If the compressor does not start and the LED for Output 1 is on, check the fuse FU1 (1.5 amp). If the problem persists, check the interposing relay (2CR).</p> <p>The Compressor Starter Auxiliary Contacts turn on Input 5 when they are closed. These contacts are located on the Compressor Starter.</p>
OIL HEATERS DO NOT OPERATE	<p>The oil heaters should operate only when the compressor is NOT running and the oil in the separator sump is cold.</p> <p>If the oil heaters do not work, check fuse 1FU (10 amp). If the fuse is not blown, check between Wires 25 and 2. If 120VAC is not found, check between wires 26 and 2. If 120VAC is found between wires 26 and 2, the Oil Heater Relay is defective. Next, check the voltage between Wires 11 and 2. If 120 VAC is present, the Oil Heater Relay is defective.</p> <p>If you do not read 120VAC between Wires 9 and 2 when the LED for output 10 is on, check the fuse (FU10).</p>

**TROUBLESHOOTING FRICK SBC MICROPROCESSOR SYSTEM (Continued)**

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
SLIDE VALVE DOES NOT LOAD and/or UNLOAD	<p>Verify that the Slide Valve is in the AUTO mode and that capacity control is calling for loading or unloading (AUTO L or AUTO U will appear on the Operating display).</p> <p>Output 2 controls the Slide Valve Load Solenoid. If 120VAC is found across Wires 17 and 2, the Slide Valve Load Solenoid should be energized. If not, the solenoid is defective. If 120VAC is not found when the LED for Output 2 is on, check the fuse (FU2).</p> <p>Output 3 controls the Slide Valve Unload Solenoid. If 120VAC is found across Wires 16 and 2, the Slide Valve Unload Solenoid should be energized. If not, the solenoid is defective. If 120VAC is not found across Wires 16 and 2 when the LED for Output 3 is on, check the fuse (FU3).</p> <p><b>NOTE: Verify that the proper setpoint has been programmed into C.C. (Capacity Control) on the Adjustable Setpoints display.</b></p>
SLIDE STOP DOES NOT INCREASE and/or DECREASE	<p>Output 4 controls the Slide Stop 3.5 Vi Solenoid. If 120VAC is found across Wires 15 and 2, the Slide Stop 3.5 Vi Solenoid should be energized. If not, the solenoid is defective. If 120VAC is not found across Wires 15 and 2 when the LED for Output 4 is on, check the fuse (FU4).</p> <p>Outputs 4 and 5 control the Slide Stop 2.2 Vi Solenoid. If 120VAC is found across Wires 14 and 2, the Slide Stop 2.2 Vi Solenoid should be energized. If not, the solenoid is defective. If 120VAC is not found across Wires 14 and 2 when the LED for Output 5 is on, check the fuse (FU5).</p>
LIQUID INJECTION SOLENOID DOES NOT ENERGIZE (LICO ONLY)	<p>Verify that the Liquid Injection TXV is modulating properly and not feeding excessive liquid to the compressor. When oil temperature drops too low, the microprocessor SHOULD de-energize this solenoid.</p> <p>Output 6 controls the Liquid Injection Solenoid. If 120VAC is found across Wires 13 and 2, the Liquid Injection Solenoid should be energized. If not, the solenoid is defective. If 120VAC is not found when the LED for Output 6 is on, check the fuse (FU6).</p>
HI Vi LIQUID INJECTION PORT	<p>Output 7 controls the Hi Vi Liquid Injection Port solenoid. If 120VAC is found across Wires 12 and 2, the Hi Vi Liquid Injection Port Solenoid should be energized. If not, the solenoid is defective. If 120VAC is not found when the LED for output 7 is on, check the fuse (FU7).</p> <p><b>NOTE: This output should only be on when the Vi is at 5.0.</b></p>
ECONOMIZER (OPTIONAL) SOLENOID DOES NOT ENERGIZE	<p>Output 8 controls the Economizer Solenoid Valve. If 120VAC is found across Wires 11 and 2, the Economizer Solenoid should be energized. If not, the solenoid is defective. If 120VAC is not found when the LED for Output 8 is on, check the fuse (FU8).</p> <p><b>NOTE: The economizer output should only lbe on when the slide valve is at or above the 90% position.</b></p>
ALARM CIRCUIT DOES NOT ENERGIZE	<p>Output 9 controls the Alarm Circuit. The Alarm should turn on only when there is a prealarm or shutdown. If the Alarm does not sound when these conditions are found, check for 120VAC across Wires 10 and 2. If 120VAC is not found, check the fuse (FU9).</p>
CONTROL PANEL DOES NOT RESPOND TO REMOTE CONTROL SIGNALS	<p>Inputs 2 through 4 can be used to operate the compressor from a remote location.</p> <p><b>NOTE: Check the Operating display to verify that the compressor and the Slide Valve are in the REMOTE MODE.</b></p> <p>If 120VAC is found (across Wires 21 and 2, 22 and 2, and 23 and 2) and the input does not turn on, consult Frick Company.</p>
MOTOR LOAD CONTROL (FORCED UNLOAD) OCCURS AT HIGH MOTOR AMPS	<p>The current transducer is used to convert the AC motor amps to a DC voltage signal for the microprocessor. If the %FLA reading from the Operating display is incorrect, consult Frick Co.</p>
PRESSURES ON THE OPERATING DISPLAY DO NOT APPEAR CORRECT	<p>TEST 1 - Shut down the compressor and allow pressures to equalize. Discharge pressure and oil pressure should have the same reading.</p> <p>TEST 2 - If either oil pressure or discharge pressure read different pressures, one or both transducers are at fault. Valve off the suction transducer from the unit and open the vent valve on transducer manifold to atmosphere. If the suction transducer reads atmospheric pressure, then the suction transducer is correct.</p> <p><b>NOTE: A 1% tolerance is allowed for all transducers.</b></p>
COMPRESSOR DOES NOT AUTOMATICALLY LOAD OR UNLOAD	<p>Verify that the [AUTO] key has been pressed and AUTO appears under SV Pos on the Operating display #4.</p> <p>If the problem persists, see the Troubleshooting section SLIDE VALVE DOES NOT LOAD and/or UNLOAD.</p>

**TROUBLESHOOTING FRICK SBC MICROPROCESSOR SYSTEM (Continued)**

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
<p>DISPLAY SCREENS DISPLAY SCRAMBLED PATTERN OR LIST ALPHABET</p>	<p>A loose or improper connection between the displays and the SBC is indicated. Remove fuse (2FU, 10 amp) for 15 seconds, then restore to reset the displays.</p>
<p>OIL PUMP DOES NOT START (Optional)</p>	<p>Verify that the Oil Pump HAND-OFF-AUTO switch (1SS) is in the AUTO position and that the Emergency Stop Button is not depressed.</p> <p>Output 11 controls the Oil Pump Starter Relay (3CR) when in the AUTO mode. If HAND is selected on 1SS, Output 11 will not have any effect on the operation of the oil pump starter.</p> <p>If AUTO has been selected and the oil pump does not start, check for 120VAC between Wires 39 and 2. If 120VAC is not found when the LED for Output 11 is on, check the fuse (FU11). If the problem persists, check the control relay (3CR).</p> <p>The Oil Pump Starter Auxiliary Contact switches voltage to Input 6 (Wires 28 and 2) when the auxiliary contacts are closed and the AUTO mode is selected on 1SS. If the Input does not turn on and voltage is present at Input 6, consult Frick Company.</p>
<p>OIL PUMP IS RUNNING BUT COMPRESSOR DOES NOT START (Optional)</p>	<p>The (HAND-OFF-AUTO) Oil Pump Selector Switch (1SS) controls oil pump operation and must be in the AUTO position before the compressor can be started.</p> <p>Verify that the Slide Valve has unloaded to 5% or less. If the Slide Valve has not unloaded, troubleshoot the hydraulic system. The compressor will not start until the Slide Valve is unloaded.</p> <p>Output 1 controls the motor starter. Check between terminals 38 and 2 for 120VAC. If 120VAC is not found when the LED for Output 1 is on, check the fuse (FU1).</p>

**EPROM MEMORY I/C CHIP REPLACEMENT**

Microprocessor EPROM memory I/C chips are located inside the microprocessor console on the SBC board. A special tool is required to remove these chips to lessen the chance of damaging them (See Troubleshooting The Microprocessor). The procedure to replace EPROM memory chips is outlined below:

1. Shut off control power.
2. Remove the microprocessor console cover.
3. Using a chip extraction tool, remove the old EPROM chips from the SBC board. Pay particular attention to the orientation of the notch on the end of the chip; then install new chip with the notch in the same position. **NOTE: The chip labeled 4 must be inserted into socket U4 and the chip labeled 5 must be inserted into socket U5.**

**SBC BOARD REPLACEMENT**

The procedure to replace SBC boards is outlined below:

1. Shut off control power.
2. Remove the old board from the machine and the new board from its packing and place both on an antistatic surface.
3. Remove the program chip(s) from the defective board and install them in the replacement board.



**Pay particular attention to the orientation of the notch(es) on the end of the chip(s). Install the chip(s) on the replacement board in exactly the same position as they were on the defective board.**

4. **IMPORTANT:** Before installing the new board, determine if there are gray/yellow wires from P15 (see page 14 for location) on the old board. If they are present, the display is the old style and the new board can be installed without modification.
5. If the gray/yellow wires are not present on the old SBC, the machine is equipped with a new style display. Resistor R6 must be removed from the new board by cutting the wire leads on either side of the resistor.
6. Then install the modified replacement board in the panel.

**MICROPROCESSOR DISPLAY REPLACEMENT**

The procedure to replace the microprocessor display is outlined below:

1. Shut off control power.
2. Remove the defective display(s).
3. Install the new display(s).
4. If present, remove the grey/yellow wires from P15 (on the SBC, see page 14 for location) to the display(s) as they are no longer needed.
5. If resistor R6 is present on the SBC, cut off the wire leads on both sides (see page 14 for location) and remove it. This resistor is no longer needed.

**OUTPUT FUSE REPLACEMENT**

1. Shut off control power.
2. Remove the microprocessor console cover.
3. Identify the faulty fuse.
4. Use a voltmeter to verify that no voltage is present on either side of the fuse.
5. Remove the faulty fuse using a fuse puller or screwdriver.
6. Install a new plug-type fuse.

**PRESSURE TRANSDUCERS - TESTING**

Pressure transducers are located below the microprocessor console.

**Test Procedure**

1. Shut down the compressor and allow pressures to equalize.

PRESSURE TRANSDUCER CONVERSION DATA				
PROBE VOLT.	0-100 Transducer		0-300 Transducer	
	1.388V**	1.788V**	1.046V**	1.346V**
	Range - PSIG*		Range - PSIG*	
	Low	High	Low	High
1.0	29.92"	19.74"	29.92"	7.00"
1.1	29.92"	14.65"	29.92"	4.10
1.2	29.92"	9.57"	22.30"	11.60
1.3	24.83"	4.48"	7.00"	19.10
1.4	19.74"	0.30	4.10	26.60
1.5	14.65"	2.80	11.60	34.10
1.6	9.57"	5.30	19.10	41.60
1.7	4.48"	7.80	26.60	49.10
1.8	0.30	10.30	34.10	56.60
1.9	2.80	12.80	41.60	64.10
2.0	5.30	15.30	49.10	71.60
2.1	7.80	17.80	56.60	79.10
2.2	10.30	20.30	64.10	86.60
2.3	12.80	22.80	71.60	94.10
2.4	15.30	25.30	79.10	101.60
2.5	17.80	27.80	86.60	109.10
2.6	20.30	30.30	94.10	116.60
2.7	22.80	32.80	101.60	124.10
2.8	25.30	35.30	109.10	131.60
2.9	27.80	37.80	116.60	139.10
3.0	30.30	40.30	124.10	146.60
3.1	32.80	42.80	131.60	154.10
3.2	35.30	45.30	139.10	161.60
3.3	37.80	47.80	146.60	169.10
3.4	40.30	50.30	154.10	176.60
3.5	42.80	52.80	161.60	184.10
3.6	45.30	55.30	169.10	191.60
3.7	47.80	57.80	176.60	199.10
3.8	50.30	60.30	184.10	206.60
3.9	52.80	62.80	191.60	214.10
4.0	55.30	65.30	199.10	221.60
4.1	57.80	67.80	206.60	229.10
4.2	60.30	70.30	214.10	236.60
4.3	62.80	72.80	221.60	244.10
4.4	65.30	75.30	229.10	251.60
4.5	67.80	77.80	236.60	259.10
4.6	70.30	80.30	244.10	266.60
4.7	72.80	82.80	251.60	274.10
4.8	75.30	85.30	259.10	281.60
4.9	77.80	87.80	266.60	289.10
5.0	80.30	90.30	274.10	296.60

\* Below 0 PSIG measured in inches of mercury.  
\*\* At zero psig.

2. Isolate suction transducer PE-4 from the unit and open it to atmosphere using valves provided at the transducer manifold. 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 "General Instructions For Replacing Compressor Unit Components" (p. 36) before going to step 3.**

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 1.48 VDC to 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. 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. Subtract 1 from the voltage.

6. Multiply by 25.

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

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

9. The voltage reading should be between 1.1 VDC and 1.29 VDC at standard atmospheric pressure. PE-1 and PE-3 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.

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

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

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

13. Test complete.

## PRESSURE TRANSDUCERS - REPLACEMENT

1. Shut off control power.
2. Close the applicable transducer isolation valve. **NOTE: To change the discharge pressure transducers, it will be necessary to depressurize the entire compressor package. Follow "General Instructions For Replacing Compressor Unit Components" (p. 36) before going to step 3.**
3. Open the microprocessor console door.
4. Use the chart to identify transducer terminals of the SBC.

TRANSDUCER	P & I CONNECTION
Oil Pressure	PE-1
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 ft. 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. Close the microprocessor console door.

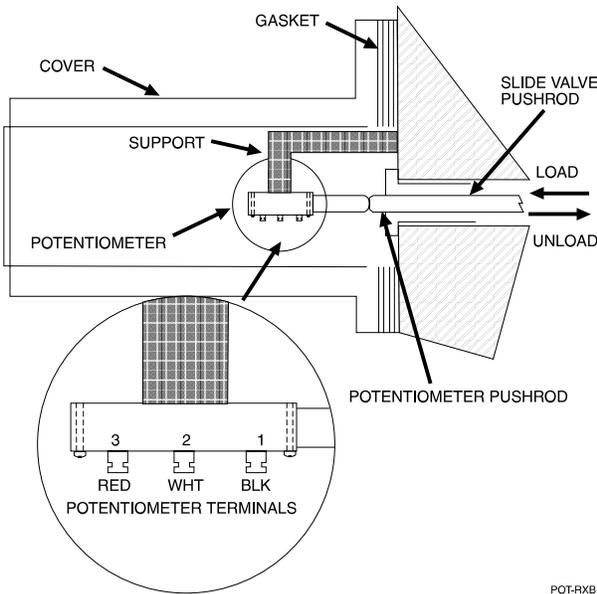
12. Reopen the transducer isolation valve.

13. Turn on control power.

**SLIDE VALVE POSITION POTENTIOMETER  
REPLACEMENT AND ADJUSTMENT**

The slide valve potentiometer is located under a cover on the right side of the compressor (facing shaft) at the inlet end.

1. Shut off control power.
2. Remove the potentiometer cover and gasket.
3. Remove the potentiometer and mounting bracket.
4. Install new potentiometer and bracket.



**5. ADJUSTMENT** must be made with the slide valve fully unloaded and the compressor running. The Operating display at this time should indicate a slide valve position of 0%. If the display is greater than 0%, adjust potentiometer POT #4 on the SBC until 0% is indicated. If 0% is not attainable, get as close as possible and then proceed to the next step. The adjustments of POT #4 and POT #3 are interactive and POT #3 may require adjustment to allow POT #4 to come into range.

Completely load the slide valve at 2.2 Vi. The display at this time should indicate 100%. If the display is less than 100%, adjust potentiometer POT #3 on the SBC until 100% is indicated.

Repeat this sequence until the slide valve indicates 0% fully unloaded and 100% fully loaded.

**TEMPERATURE and/or PRESSURE  
ADJUSTMENT**

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

**NOTE: Refer to page 22 for description on microprocessor offset adjustment for temperature and/or pressure.**

**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.

### TROUBLESHOOTING THE RWB II PLUS COMPRESSOR

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
EXCESSIVE NOISE and VIBRATION	Bearing damage or excessive wear. CONTACT Frick Factor or Frick Co. 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 OIL SEPARATOR

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. Contaminated oil, damaged or not seated coalescer filter elements. Replace oil charge and coalescers. Oil return valve closed. Open return valve. Return oil strainer blocked. Clean strainer.
RAPID LOSS WITH NO OIL LEVEL IN THE COALESCER SECTION SIGHT GLASS	Compressor unit suction check valve did not close on shutdown. Repair valve. Bypass open around check valve (if field installed). Close bypass. Economizer check valve (if applicable) failed. Coalescer not seated. Reseal.

### TROUBLESHOOTING THE HYDRAULIC SYSTEM

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
SLIDE VALVE WILL NOT LOAD OR UNLOAD	Solenoid coil may be burned out. Replace. Hydraulic service valve may be closed. Open valve. Solenoid spool may be stuck or centering spring broken. Free spool or replace spring. Solenoid may be mechanically actuated by inserting a piece of 3/16" rod against armature pin and pushing spool to opposite end. If valve is mounted on compressor, push "A" side to confirm unload capability. If valve is mounted on base, push "B" side to confirm unload capability. If valve works, problem is electrical.
SLIDE VALVE WILL LOAD BUT WILL NOT UNLOAD	Solenoid coil may be burned out ("A" side if mounted on compressor, "B" side if mounted on base). Replace coil. Dirt inside solenoid valve preventing valve from operating both ways. Clean valve. Solenoid may be mechanically actuated by inserting a piece of 3/16" rod against armature pin and pushing spool to opposite end. If valve is mounted on compressor, push "A" side to confirm unload capability. If valve is mounted on base, push "B" side to confirm unload capability. If valve works, problem is electrical.
SLIDE VALVE WILL UNLOAD BUT WILL NOT LOAD	Solenoid coil may be burned out ("B" side if mounted on compressor, "A" side if mounted on base). Replace coil. Dirt inside solenoid valve preventing valve from operating both ways. Clean valve. Solenoid may be mechanically actuated by inserting a piece of 3/16" rod against armature pin and pushing spool to opposite end. If valve works, problem is electrical.
SLIDE STOP WILL NOT FUNCTION EITHER DIRECTION	Solenoid coil may be burned out. Replace. Check solenoid coils (see Vi Control table, page 31).
SLIDE VALVE WILL NOT MOVE	Slipper seals worn out or damaged. Unloader spindle or slide valve jammed. Internal check valve bad. Clean, repair, or replace. Check needle valve adjustment.

**TROUBLESHOOTING THE OIL PUMP SYSTEM**

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
PUMP WILL NOT PRODUCE ENOUGH OIL PRESSURE TO START COMPRESSOR	Filter cartridge may be blocked. Check PSID across filter. Replace filter. Strainer may be blocked. Clean. Oil pressure regulator set too low or stuck open. Readjust or repair. Low oil level. Add oil. Excessive refrigerant in oil. Equalize separator to a lower pressure.
OIL PRESSURE RAPIDLY DROPS OFF WHEN COMPRESSOR STARTS	Oil pressure regulating valve improperly adjusted. Readjust valve. Check manual system. Regulator defective. Replace. Excessive refrigerant in oil. Check heaters.
OIL PRESSURE FLUCTUATES	Liquid injection overfeeding or refrigerant carryover. Make necessary adjustments or corrections. Dirty oil filter. Replace Low oil level. Add oil.
NOISE and VIBRATION	Pump strainer blocked. Clean. Liquid injection overfeeding. 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. Replace seal.
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 valve fully.

**TROUBLESHOOTING THE LIQUID INJECTION OIL COOLING SYSTEM**

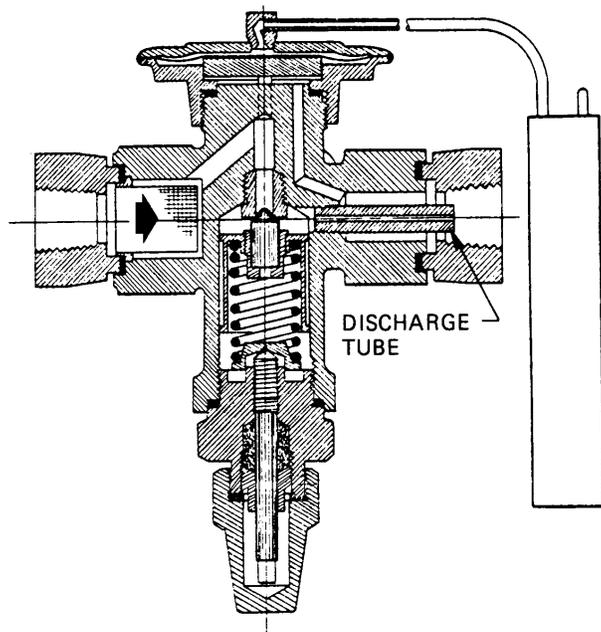
SYMPTOM	PROBABLE CAUSES and CORRECTIONS
HIGH OIL TEMPERATURE	Insufficient liquid supply. Check receiver level. Check strainer. Equalizer pressure too high. Lower pressure. Suction superheat too high. Correct system problem. Thermal valve power head lost charge. Replace. Liquid strainer blocked. Clean. Liquid supply line not sized properly. Install larger line. Operating conditions significantly different from design.
LOW OIL TEMPERATURE	Equalizing pressure too low. Raise. Suction superheat too low or refrigerant flood-back on compressor. Correct system problem. Low load conditions. Valve oversized, increase load or use smaller thermostatic valve. Operating conditions significantly different from design.
OIL TEMPERATURE FLUCTUATES	System conditions rapidly fluctuate causing liquid injection system to overrespond. Stabilize system operation.

### THERMAL EXPANSION VALVES

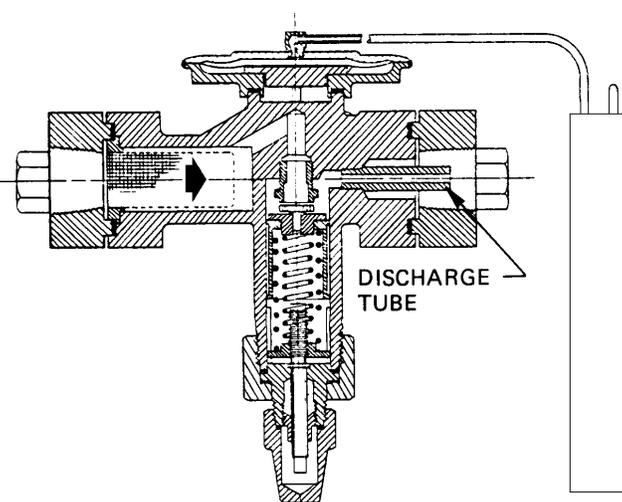
In situations where system load conditions increase or decrease over extended periods of time and the liquid injection thermal expansion valve is not adequate for the new conditions, an improvement in valve performance may be achieved by increasing or decreasing discharge tube size.

**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 ON EQUALIZING LINE.**

**TYPE D THERMAL EXPANSION VALVE (1-15 TONS)  
R-717**



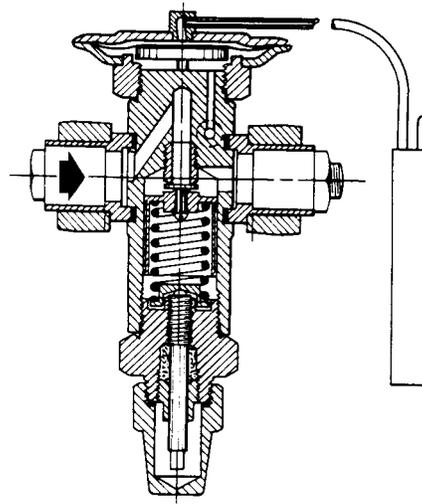
**TYPE A THERMAL EXPANSION VALVE (20-100 TONS)  
R-717**



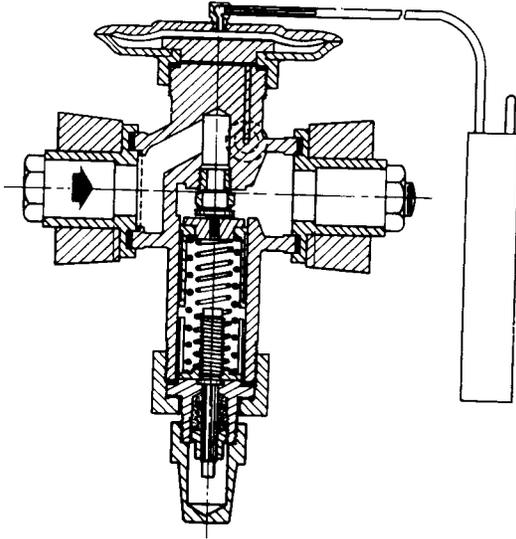
**JORDAN TEMPERATURE REGULATOR VALVE  
(For low differential pressure applications)**



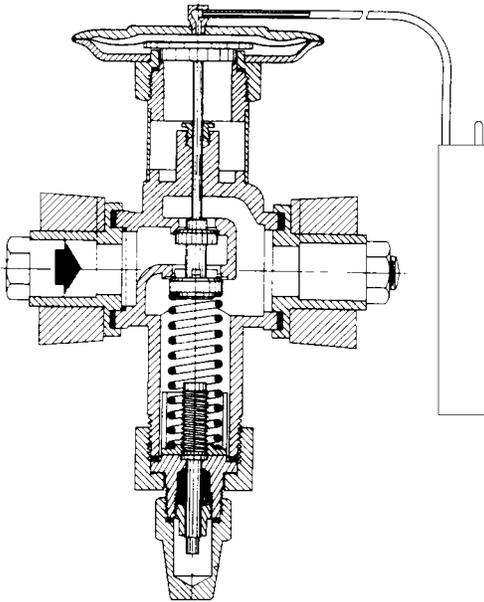
**TYPE H THERMAL EXPANSION VALVE (2-1/2 TO 16  
TONS) R-22**



**TYPE M THERMAL EXPANSION VALVE (12 TO 34 TONS)  
R-22**



**TYPE V THERMAL EXPANSION VALVE (52 TO 100 TONS)  
R-22**



**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

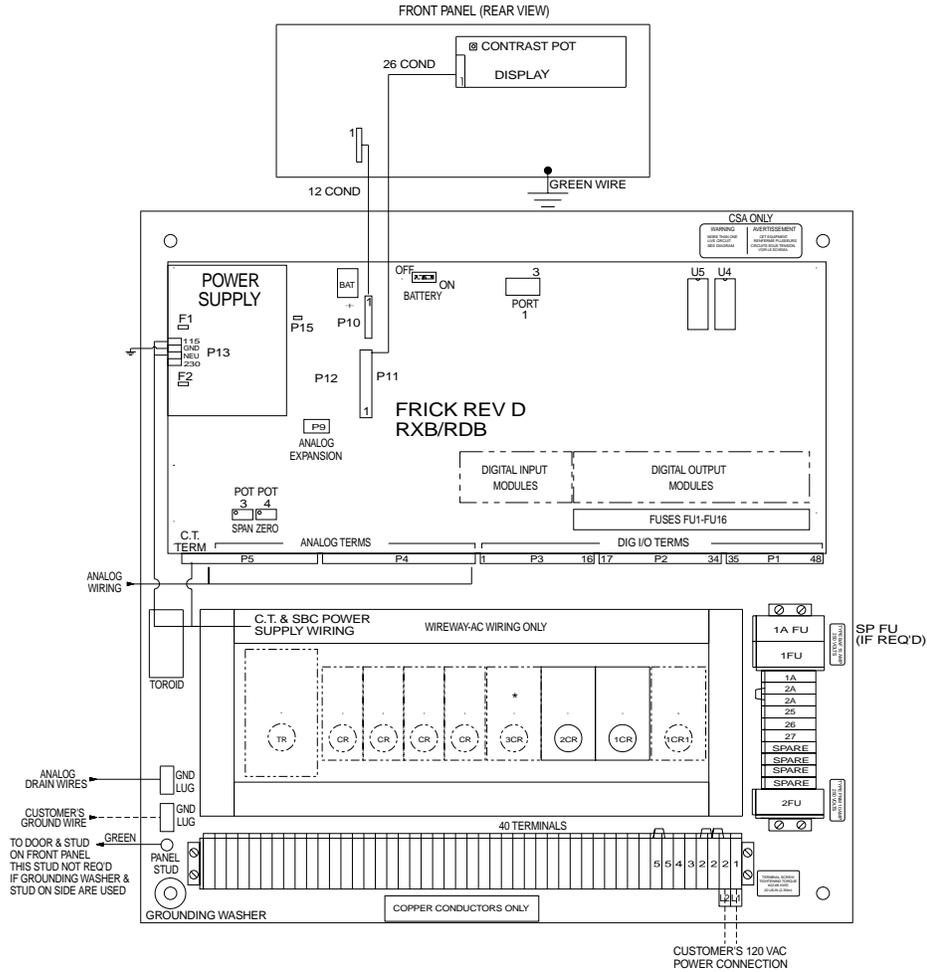
**JORDAN TEMPERATURE REGULATOR  
VALVE**

To increase or decrease the discharge temperature/oil temperature, adjust the knurled nut located on the actuator stem of the Jordan Temperature regulator valve. The temperature is allowed to increase as the nut is turned higher on the stem and decreases as the nut is turned lower.

**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

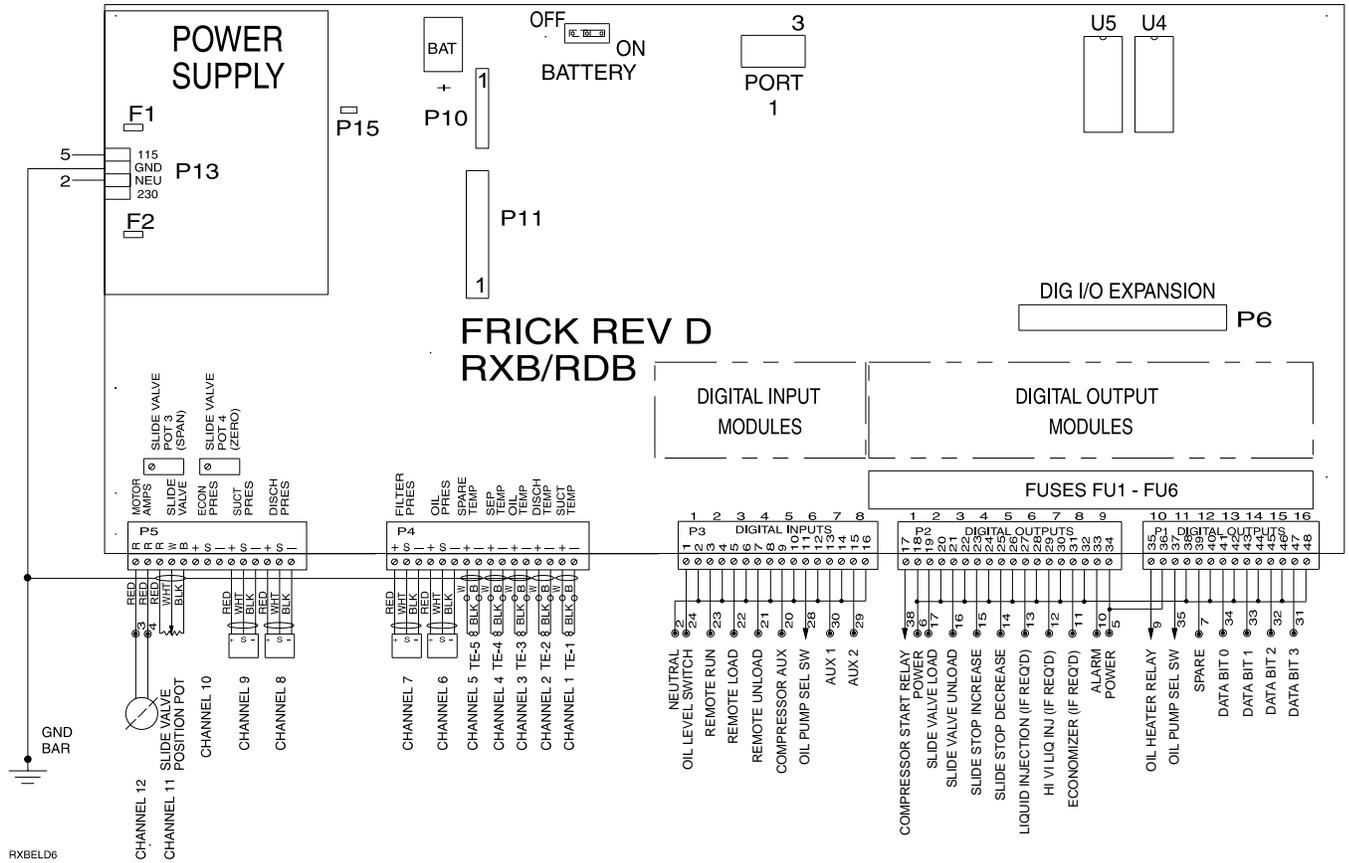
MICRO COMPONENT PLACEMENT DIAGRAM



--- INDICATES DEVICES SUPPLIED ONLY WHEN OPTIONAL OR REQUIRED  
\* INDICATES SUPPLIED ONLY WHEN OIL PUMP IS REQUIRED

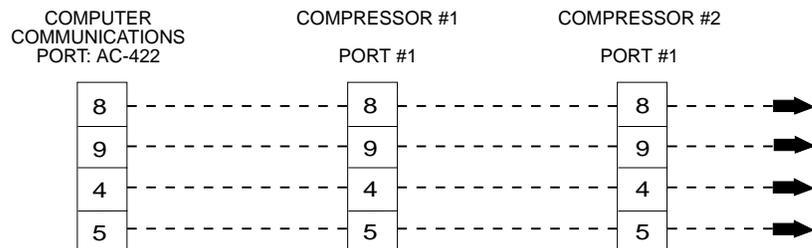
RXBELD5

**SBC WIRING DIAGRAM**

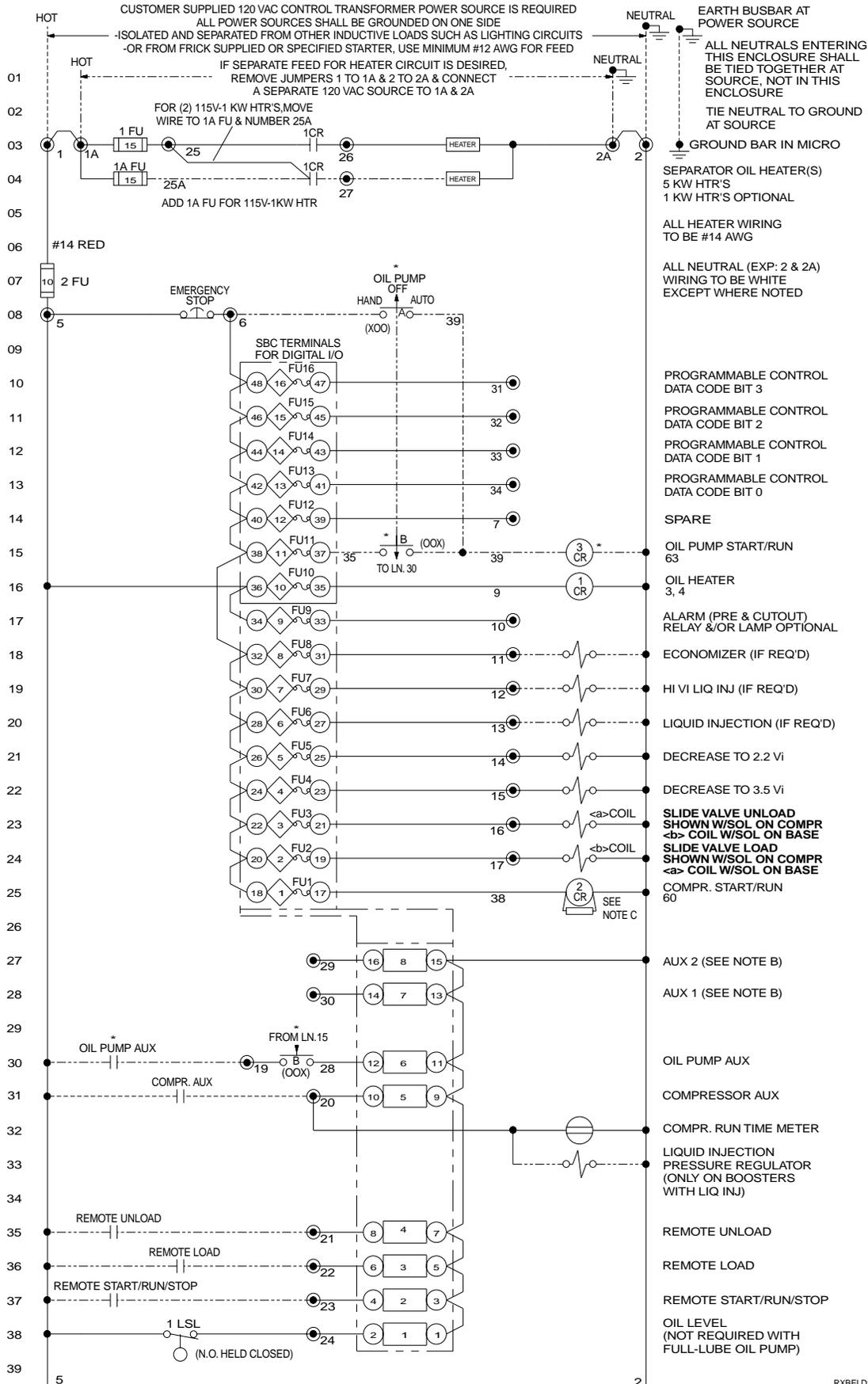


**RXB PLUS TELECOMMUNICATIONS**

**COMPUTER TO MICROPROCESSOR WIRING DIAGRAM**



MICRO PANEL ASSEMBLY WIRING DIAGRAM







**MICRO PANEL ASSEMBLY WIRING DIAGRAM**

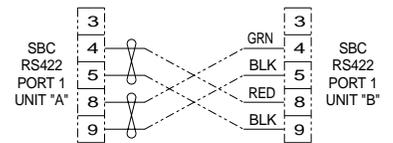
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2

TEMPERATURE SENSOR WIRING TO BE #8760 BELDEN CABLE OR EQUAL. GROUND DRAIN WIRE AT PANEL GROUND ONLY. INSULATE AT PROBE END

NOTE 2A:  
SPECIFICATIONS FOR TEMP. CAPACITY CONTROL  
-SETPOINT RANGE: -50<sup>OF</sup> TO 1000<sup>OF</sup>  
-TEMP PROBE SIZE- .188 DIA x 4" LONG  
304 S.S. WITH (2) 24" LEADS  
-MOUNTING IN WELL IS DESIRABLE  
USE HEAT TRANSFER COMPOUND  
-WIRE AS SHOWN IN SEPARATE CONDUIT  
FROM ALL OTHER WIRING  
USE BELDEN #8761 CABLE OR EQUAL  
TEMP PROBE-FRICK P/N - 111Q0280982  
WELL FOR ABOVE, 3/4" MPT WELL CONNECTION, 1/2" FPT FOR CONNECTION BOX- P/N - 990A0014H01  
HEAT TRANSFER COMPOUND-P/N - 111Q0831807

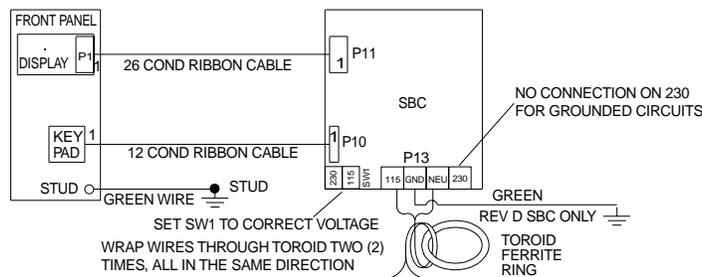
OPTIONAL  
WIRING FOR LEAD-LAG SEQUENCING



USE BELDEN #8777 OR EQUAL (3 TWISTED PAIRS)  
COLOR CODING SHOWN IS BELDEN #8777  
RS 422 WIRING SHALL BE SEPARATE  
FROM ALL OTHER WIRING

WIRED AT FRICK IF BOTH UNITS  
ARE ON THE SAME SKID

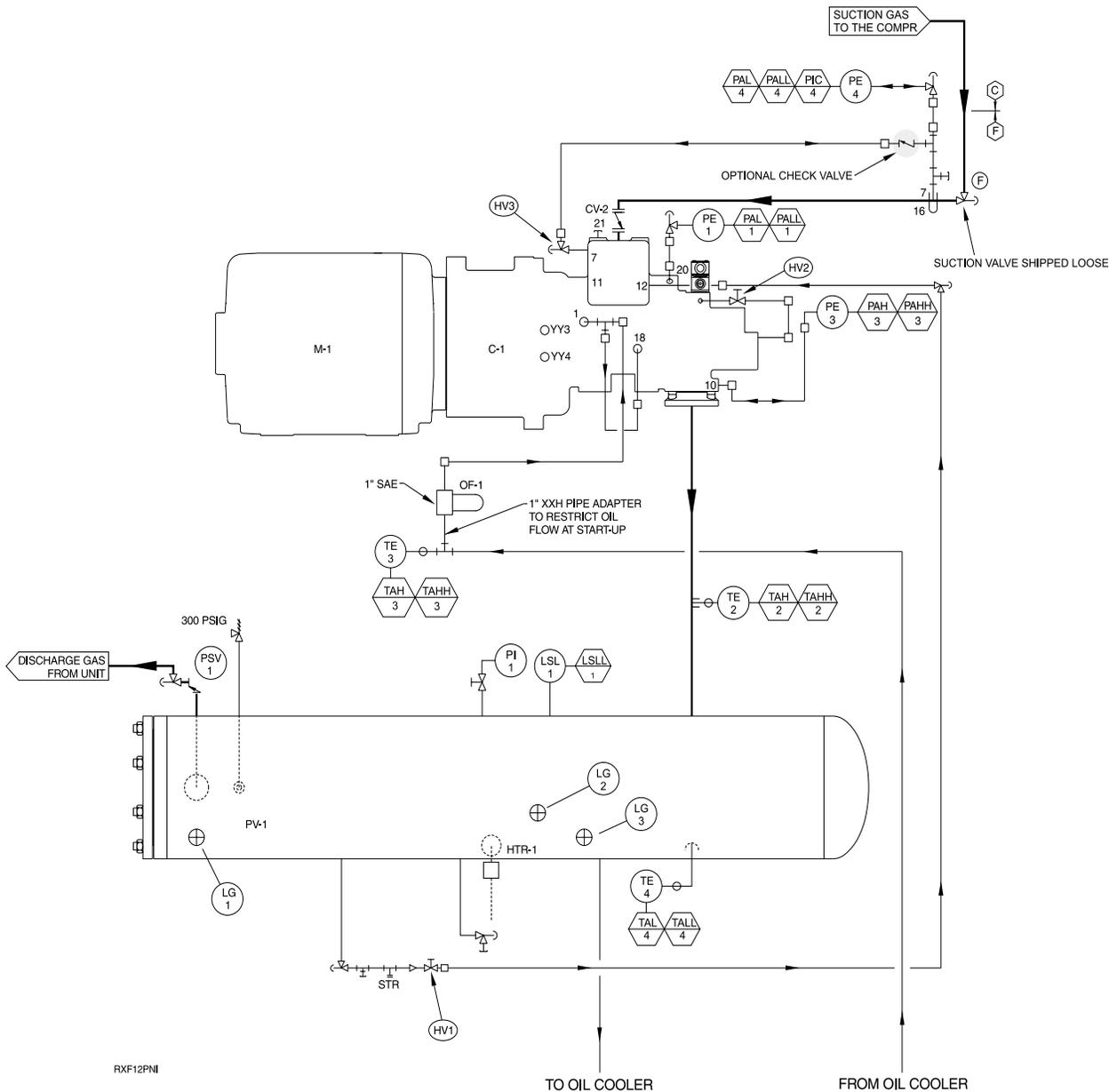
NOTE: WHEN USING THE RS422 PORTS FOR  
LEAD-LAG, THEY CANNOT BE USED FOR  
ANY OTHER COMMUNICATIONS



5

2

P & I DIAGRAM, Models 12, 15, & 19 w/Full-Lube Oil Pump



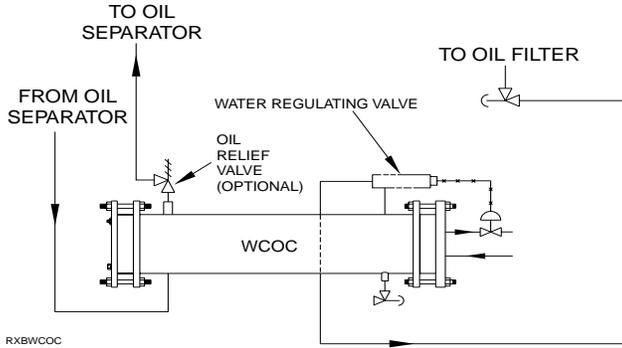
**LEGEND (Covers P & I diagrams pages 58 – 60) See page 59 for additional notes**

AC	AUTO CYCLE	LTCO	LOW OIL TEMPERATURE CUTOUT
C	COMPRESSOR	M	MOTOR
CC	CAPACITY CONTROL	MLC	MOTOR LOAD CONTROLLER
DTA	HIGH DISCHARGE TEMPERATURE ALARM	NV	NEEDLE VALVE
DTCO	HIGH DISCHARGE TEMPERATURE CUTOUT	OF	OIL FILTER
F	FILTER	OHTR	OIL HEATER TEMPERATURE SWITCH
HPA	HIGH DISCHARGE PRESSURE ALARM	OPA	LOW OIL PRESSURE ALARM
HPCO	HIGH DISCHARGE PRESSURE CUTOUT	OPCO	LOW OIL PRESSURE CUTOUT
HTA	HIGH OIL TEMPERATURE ALARM	P	PUMP
HTCO	HIGH OIL TEMPERATURE CUTOUT	PE	PRESSURE INDICATOR
HTR	HEATER	PM	PUMP MOTOR
HV	HAND VALVE	PSV	HIGH PRESSURE SAFETY VALVE
LICO	LIQUID INJECTION REFRIGERANT CUTOUT	SG	SIGHT GLASS
LLCO	LOW OIL SEPARATOR LEVEL CUTOUT	STR	STRAINER
LPA	LOW SUCTION PRESSURE ALARM	SV	SOLENOID VALVE
LPCO	LOW SUCTION PRESSURE CUTOUT	TE	TEMPERATURE ELEMENT
LSL	LEVEL SWITCH	TW	THERMOWELL
LTA	LOW OIL TEMPERATURE ALARM	V	VESSEL

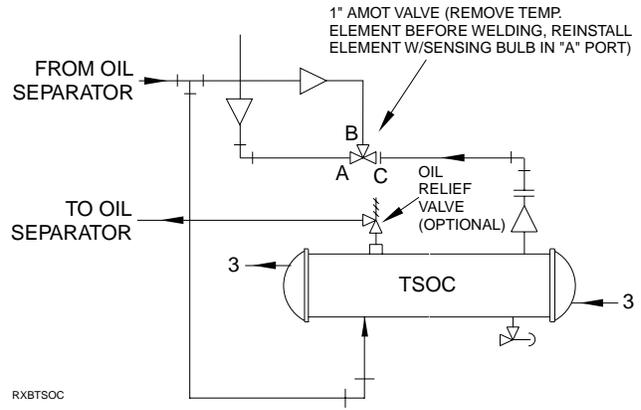


P & I DIAGRAM, All Models

WATER-COOLED OIL COOLER



THERMOSYPHON OIL COOLER



**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 shut-downs, 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. (Figure 1)**

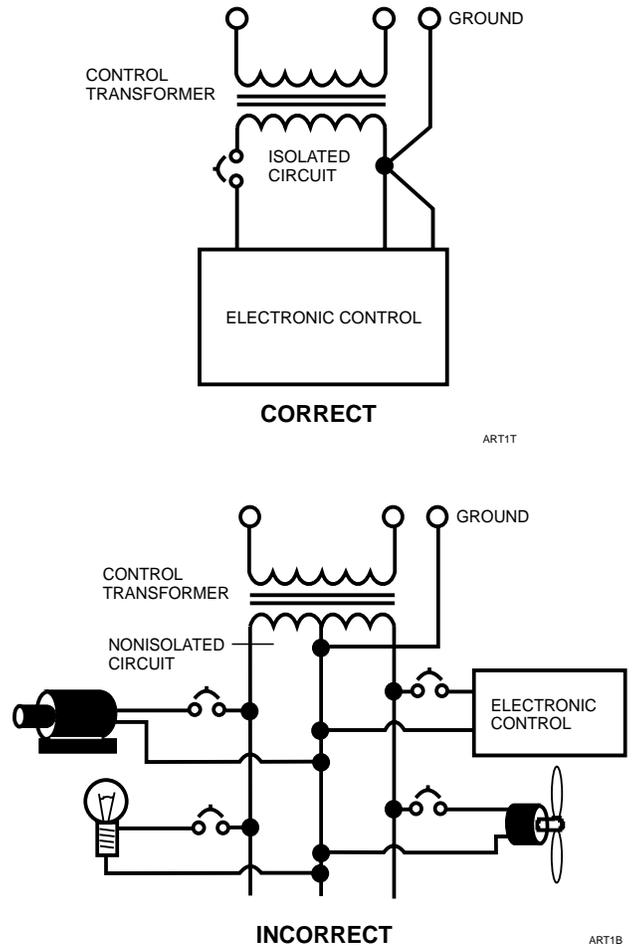


Figure 1

## 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 2) 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.

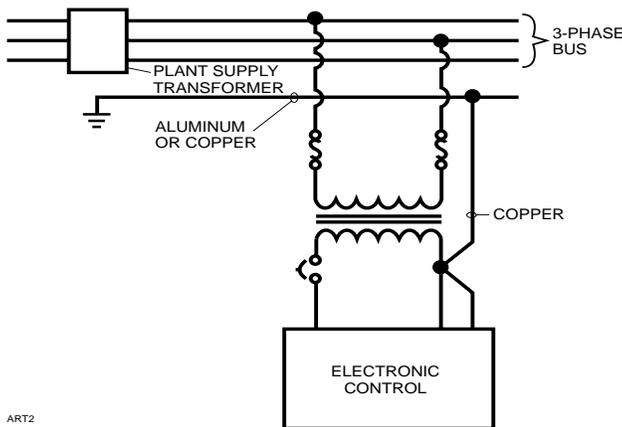


Figure 2

## 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.** (Figure 3)

**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.

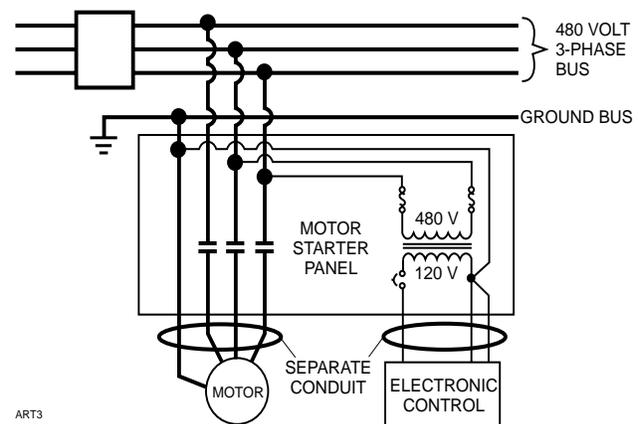


Figure 3

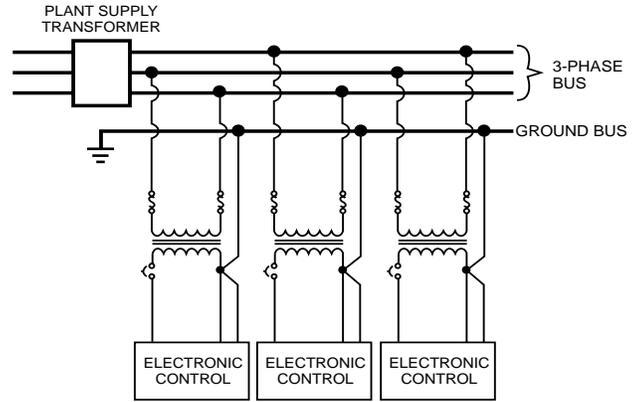
**Never add relays, starters, timers, transformers, etc. inside an electronic control panel without first contacting the manufacturer.** Contact arcing and EMI emitted from these devices can interfere with the electronics. Relays and timers are routinely added to electronic control panels by the manufacturer, 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.

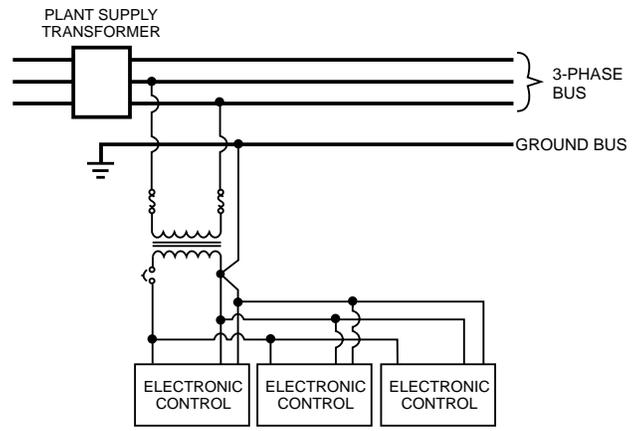
**Never daisy-chain or parallel-connect power or ground wires to electronic control panels.** Each electronic control panel must have its own supply wires back to the power source. Multiple electronic control panels on the same power wires create current surges in the supply wires which can cause controller malfunctions. Daisy-chaining ground wires allows ground loop currents to flow between electronic control panels which also causes malfunctions. (Figure 4)

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.



ART4T

**CORRECT**



ART4B

**INCORRECT**

Figure 4

**RECOMMENDED SPARE PARTS (Current Design)**

DESCRIPTION	QTY	MODELS	ITEM NUMBER
Fuse - 10 AMP	2	ALL	111Q0280687
Shaft Seal Assy. Kit	1	12 – 19	111Q0043229
Shaft Seal Assy. Kit	1	24 – 50	111Q0043231
Oil Heater, 500 Watt, 110 Volt	1	ALL	913A0047H01
Oil Heater, 500 Watt, 240 Volt	1	ALL	913A0047H03
Oil Filter Cartridge	1	ALL	531A0028H01
Oil Filter Gasket, End Cover	1	ALL	959A0082H01
Oil Filter Gasket, Clamping Plate	1	ALL	959A0053H01
Cap. Control Sol. Valve & Coil (120/110 Volt)	1	ALL	951A0056H02
Coil Only for C.C. Sol. Valve (120/110 Volt)	1	ALL	951A0056H03
Cap. Control Sol. Valve & Coil (240/220 Volt)	1	ALL	951A0056H41
Coil Only for C.C. Sol. Valve (240/220 Volt)	1	ALL	951A0056H42
Slide Valve Potentiometer	1	ALL	534B0293H01
Slide Valve Potentiometer Bracket	1	ALL	534C0625H01
Vi Control Sol. Valve Less Coil	1	ALL	951A0056H39
Coil Only for Vi Solenoid	1	ALL	951A0056H40
Microprocessor Cover and Keypad	1	ALL	640D0012H01
Gasket for 640D0012H01	1	ALL	649D0979H01
Display	1	ALL	333Q0000068
Output Module	2	ALL	111Q0281061
Input Module	1	ALL	333Q0000116
SBC Board	1	ALL	333Q0000548
2 PDT Relay (IDEC Type)	1	ALL	333Q0000194
Base for 333Q0000194	1	ALL	333Q0000195
3 PDT Relay (IDEC Type)	1	ALL	333Q0000206
Base for 333Q0000206	1	ALL	333Q0000207
Fuse - 5 AMP	5	ALL	333Q0000117
Cable Assy. - 26 Conductor, SBC to Display	1	ALL	111Q0280930
Cable Assy. - 12 Conductor, SBC to Keypad	1	ALL	640B0019H01
Suppressor	3	ALL	111Q0280958
Fuse 2 AMP (For F-1 & F-2)	2	ALL	333Q0000573
Temperature Probe (TE-1-4)	1	ALL	111Q0280818
Pressure Transducer 0-100 PSIA (PE-4)	1	ALL	333Q0000426
Pressure Transducer 0-300 PSIA (PE-1-3)	1	ALL	333Q0000427
Float Switch	1	ALL	913A0086H01
Emergency Stop Button	1	ALL	111Q0280832
Contact Block for 111Q0280832 Above	1	ALL	111Q0280833
Fuse - 15 AMP	2	ALL	111Q0281053
Battery Backup Kit	1	ALL	640A0020G01
Coalescing Filter Element	1	12 & 15	531B0065H04
	1	19 & 24	531B0065H06
	1	30 & 39	531B0065H05
	1	50	531B0065H03
Separator Head Gasket	1	12 & 15	959A0090H03
	1	19 & 24	959A0090H02
	1	30 – 50	959A0090H01
Microprocessor Service Tool Kit Includes: CMOS Extractor Tool CMOS Insertion Tool Digital Multimeter Wrist Grounding Strap Antistatic Pad	1	ALL	111Q0451862





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