



BY JOHNSON CONTROLS

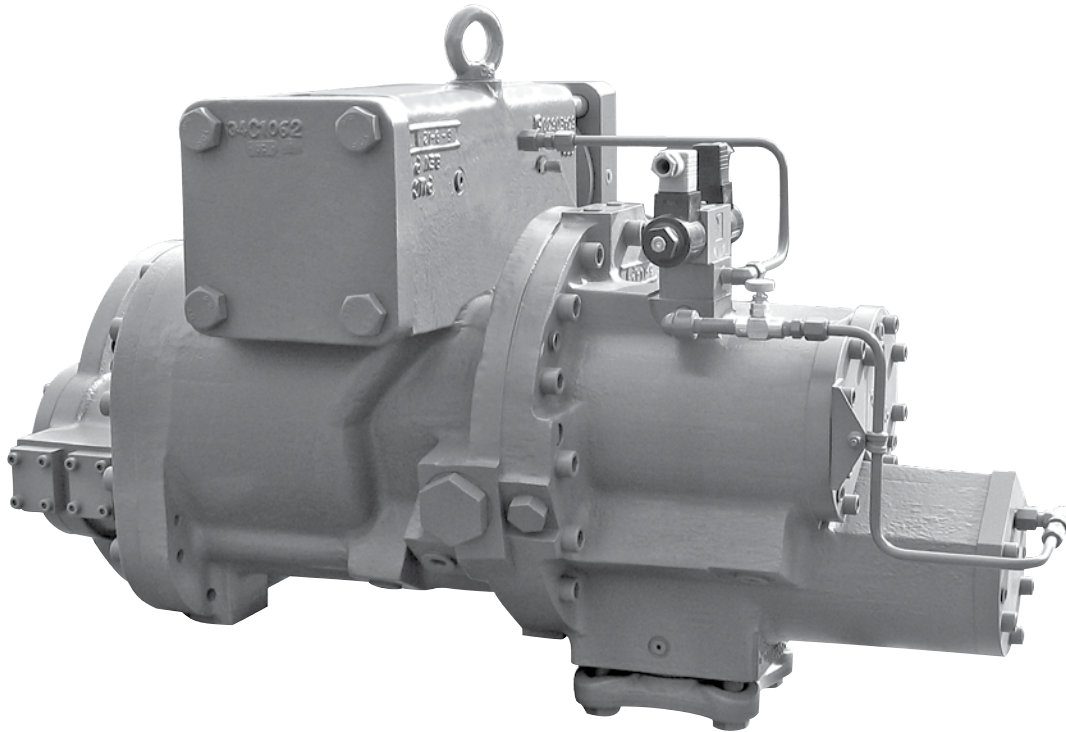
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INSTALLATION - OPERATION - MAINTENANCE

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XJF ROTARY SCREW COMPRESSOR

MODELS XJF 95, 120, 151



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

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SAFETY PRECAUTION DEFINITIONS

- 
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
- 
Indicates a potentially hazardous situation or practice which, if not avoided, will result in death or serious injury.
- 
Indicates a potentially hazardous situation or practice which, if not avoided, will result in damage to equipment and/or minor injury.
- 
Indicates an operating procedure, practice, etc., or portion thereof which is essential to highlight.

THE INFORMATION CONTAINED IN THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE

GENERAL INFORMATION

PREFACE

This manual has been prepared to acquaint the owner and serviceman with the INSTALLATION, OPERATION, and MAINTENANCE procedures as recommended by Johnson Controls-Frick for XJF Rotary Screw Compressors.

It is most important that these compressors be properly applied to an adequately controlled refrigerant or gas system. Your authorized Johnson Controls-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 screw compressor is a VAPOR PUMP. To be certain that it is not being subjected to pumping liquid, it is necessary that 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 are made for control; operating cycles and stand still periods are reasonable; and that high side components are sized within system and compressor design limits.

NOTICE

It is required that the discharge temperature be kept high enough to prevent condensation of any moisture in the compressor and oil separator.

DESIGN LIMITATIONS

XJF compressors are designed for operation within the pressure and temperature limits which are specified by Johnson Controls-Frick and the Johnson Controls-Frick selection software COOLWARE™. They are primarily used for compressing refrigerant gas and most hydrocarbon gasses.

If your application is for sour gas, there are special requirements to protect the compressor. Contact Johnson Controls - Frick Compressor Engineering for application details.

JOB INSPECTION

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

STANDARD BARE COMPRESSOR

Items not included with bare compressor that are available as sales order options: Motor Mount, Solenoid Valve Capacity, Tank Drain Tubing (T connection), Oil Feed Line (P connection), Connection Fittings, Coupling.

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 Johnson Controls-Frick Sales Administration Department, in Waynesboro, PA.

COMPRESSOR IDENTIFICATION

Each compressor has an identification data plate, containing compressor model and serial number mounted on the compressor body.

NOTICE

When inquiring about the compressor or unit, or ordering repair parts, provide the MODEL, SERIAL, and JOHNSON CONTROLS - FRICK SALES ORDER NUMBERS from the data plate. See Figure 1.

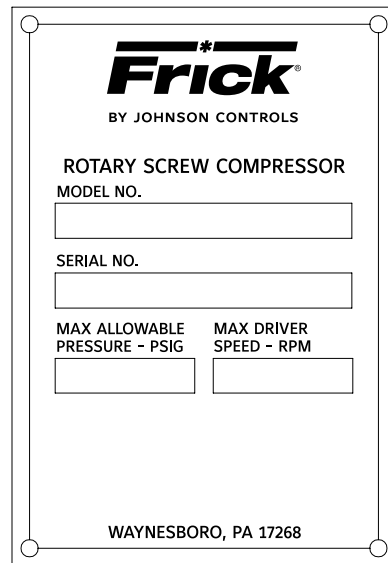


Figure 1 - Identification Data Plate

Rotary screw compressor serial numbers are defined by the following information:

EXAMPLE: 10240A90000015Z

PLANT	DECADE	MONTH	YEAR	GLOBAL SEQ NO.	ADDITIONAL REMARKS
1024	0	A	9	0000015	Z

Month: A = JAN, B = FEB, C = MAR, D = APR, E = MAY, F = JUN, G = JUL, H = AUG, K = SEP, L = OCT, M = NOV, N = DEC.

Additional Remarks: R = Remanufactured; Z = Deviation from Standard Configuration.

Geometrical swept volume table ...

Bare Compressors\General\Warranties\Screw Compressor Purchased for Long Term Storage).

The following guidelines must be followed to maintain the SCREW COMPRESSOR WARRANTY.

PREPARING COMPRESSOR FOR STORAGE

Evacuate compressor to remove moisture. Evacuation lines are to be connected to port SM1. Evacuation lines are to be connected to the three Schrader valves provided with the compressor. One valve is connected to compressor suction. The other two valves are located at the block on the cylinder.

Break vacuum with dry nitrogen and bring pressure to 0 psig.

Pump oil into the same ports mentioned in step 1. Johnson Controls-Frick recommends break-in oil P/N 111Q0831809 for storage purposes. The amounts of oil needed per compressor are:

- 95mm - 2Gal
- 120mm - 3Gal
- 151mm - 8Gal

After compressor is oil charged, pressurize compressor to 15 psig with nitrogen.

MAINTAINING COMPRESSOR

Ensure that the 5-15 psig nitrogen charge is maintained with 15 psig preferred.

Rotate the male rotor shaft every two weeks. Mark the shaft to ensure the rotor does not return to the original position.

The compressor must be stored inside a dry building environment.

Grease the male rotor shaft to prevent rust.

Record all information in a "Compressor Long Term Storage Log." See bottom of page 4.

Contact Johnson Controls-Frick Service with any questions regarding long term storage.

DESCRIPTION

XJF COMPRESSOR

The Frick XJF rotary screw compressor utilizes mating asymmetrical profile helical rotors to provide a continuous flow of 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 angular contact ball bearings to carry axial loads are mounted at the discharge end of compressor.
3. Moveable slide valve to provide fully modulating capacity control from 100% to 25% of full load capacity.
4. VOLUMIZER II volume ratio control adjusts the compressor volume ratio during operation to the most efficient of three possible volume ratios, 2.2, 3.5, 5.0, depending upon system requirements.

5. A hydraulic cylinder to operate the slide stop and slide valve.

6. Compressor housing suitable for 400 PSIG pressure.

7. Most bearing and control oil is vented to closed threads in the compressor instead of suction port to avoid performance penalties from superheating suction gas.

8. The shaft seal is designed to maintain operating pressure on the seal well below discharge pressure for increased seal life.

9. Oil is injected into the rotor threads to maintain good volumetric and adiabatic efficiency, even at high compression ratios.

10. Shaft rotation clockwise facing compressor, suitable for all types of drives. **SEE FOLLOWING WARNING.**

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.

COMPRESSOR LUBRICATION SYSTEM

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

The lubrication system on an XJF equipped 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.

OIL PUMP

The XJF screw compressor unit is designed to be self-lubricating. Oil being supplied to the compressor from the oil separator is at system head pressure. Within the compressor, oil porting to all parts of the compressor is vented back to a point in the compressor's body that is at a pressure lower than compressor discharge pressure. The compressor's normal operation makes the compressor unit operate essentially as its own oil pump. All oil entering the compressor is moved by the compressor rotors out the compressor outlet and back to the oil separator. For normal high-stage operation an oil pump is not required.

CONSTRUCTION DETAILS

HOUSING: All XJF screw compressor castings are close grain, pressure tight, grey cast iron, to ensure structural, mechanical, and thermal stability under all operating conditions. Ductile iron is also available for special applications. Contact Johnson Controls-Frick Sales for additional information.

ROTORS: The rotors are made from the highest quality rolled steel to exacting tolerances of the latest industry standard asymmetric profile. The five-lobed male rotor is directly connected to the internal gear. The seven-lobed female rotor is driven by the male on a thin oil film.

GEAR: The compressor has an internal gear to speed up the rotors. Each model has 3 or 4 gear ratios.

BEARINGS: Antifriction bearings with L₁₀ rated life in excess of 50,000 hours (using the Frick Superfilter™) at design conditions are used for reduced frictional horsepower and superior rotor positioning, resulting in reduced power consumption, particularly at higher pressure ratios. Cylindrical roller bearings are provided to handle the radial loads and the thrust loads are absorbed by four point contact or angular contact bearings. In addition, thrust balance pistons are provided to reduce the thrust load and improve bearing life.

SHAFT SEAL: The compressor shaft seal is a single-face type with a spring-loaded carbon stationary surface riding against a cast iron rotating seat. The seal is capable of withstanding static pressure up to 400 psig. During operation it is vented to low pressure to provide extended life.

VOLUMIZER II ADJUSTABLE VOLUME RATIO CONTROL: The Frick XJF compressor adjusts to the most efficient of three volume ratios (2.2, 3.5 or 5.0) depending upon system

requirements. Control of the internal volume ratio eliminates the power penalty associated with over- or under-compression. Volume ratio control is achieved by the use of a slide stop which is a movable portion of the rotor housing that moves axially with the rotors to control discharge port location. The slide stop is moved by hydraulic actuation of a control piston.

STEPLESS CAPACITY CONTROL: Capacity control is achieved by use of a movable slide valve. The slide valve moves axially under the rotors to provide fully modulated capacity control from 100% to 25% of full load capacity.

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

MOTOR MOUNT: The XJF series is designed with a drive end flange that mates with a cast iron motor mount (available as a sales order option). The motor mount is precision machined so that it ensures proper alignment of the compressor and motor coupling.

INSTALLATION

DESIGN LIMITS

General information for all of the models is provided below. **Please see CoolWare to determine the limits for a specific application.**

XJF compressors are primarily designed for connecting to an electric drive motor using a tunnel mount. If the application requires it, the compressor can also be driven with a foot-mounted motor. The tunnel mount ensures proper alignment of the compressor and motor so that the shaft seal and coupling will operate properly. The rotor and bearing design set limitations must not be exceeded (See Frick Selection Program, CoolWare). Pressure and temperature limits are shown in Frick publication 070.410-SED. Refer to Johnson Controls-Frick Compressor Control Panel instruction 090.040-O for additional information on setpoint limits.

OUTLINE DIMENSIONS

Drawings *for reference only* can be found on the following pages. Complete dimensions and access connections can be found on the outline drawings.

XJF 95	DWG# 534E0458
XJF 120	DWG# 534E0299
XJF 151	DWG# 534E0539

If you do not have these drawings, please request any you require by contacting Johnson Controls-Frick sales.

The **NOTES** below apply to the **Dimensions and Compressor Port Location** drawings on the following pages.

1. A metric rectangular parallel key is supplied with each XJF 95 and 120 compressor. Metric key conforms to din 6885A specification. A standard square parallel key is supplied with each XJF 151 compressor.
2. Standard voltage for solenoid coils is 110 VAC unless otherwise specified. Other voltages are available upon request.
3. Rotation of compressor jackshaft is clockwise when viewing the shaft end.
4. Solenoid control valves for Volume Ratio Slide Stop (SS) are included in delivery, including solenoids.
Solenoid control valves for Capacity Control Slide Valve (SV) are NOT included in delivery. Internal piping is included. A solenoid control valve kit with gasket can be ordered or specified separately on the sales order. The solenoid valve is a standard type D03/CETOP with O-rings suitable for application (either HNBR or Viton)
5. Motor support is not provided as part of the bare compressor. When required a motor support kit shall be specified on the sales order separately.

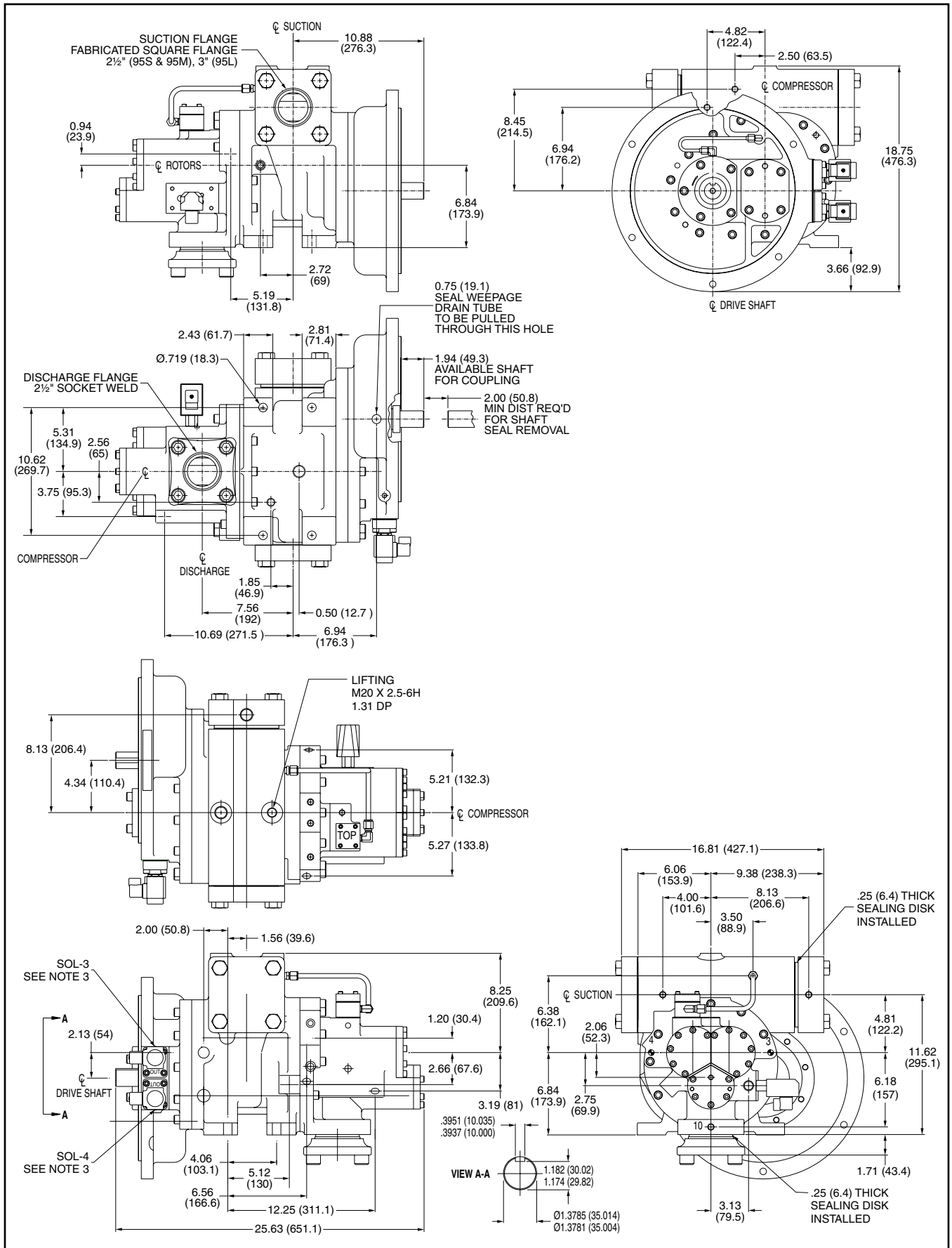
Approximate mass:

XJF 95: 600 lbm (272 kg)

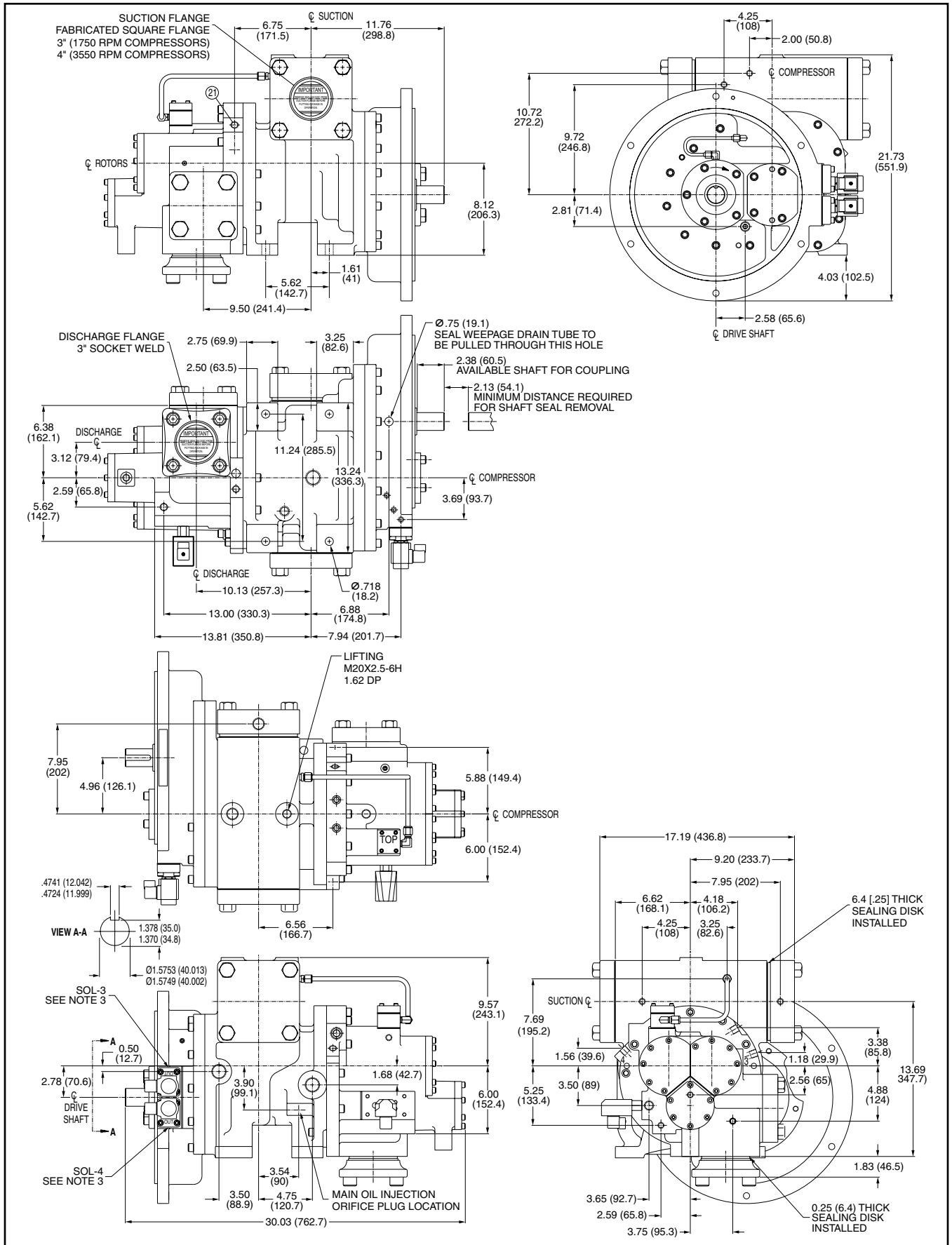
XJF 120: 845 lbm (383 kg)

XJF 151: 1210 lbm (550 kg)

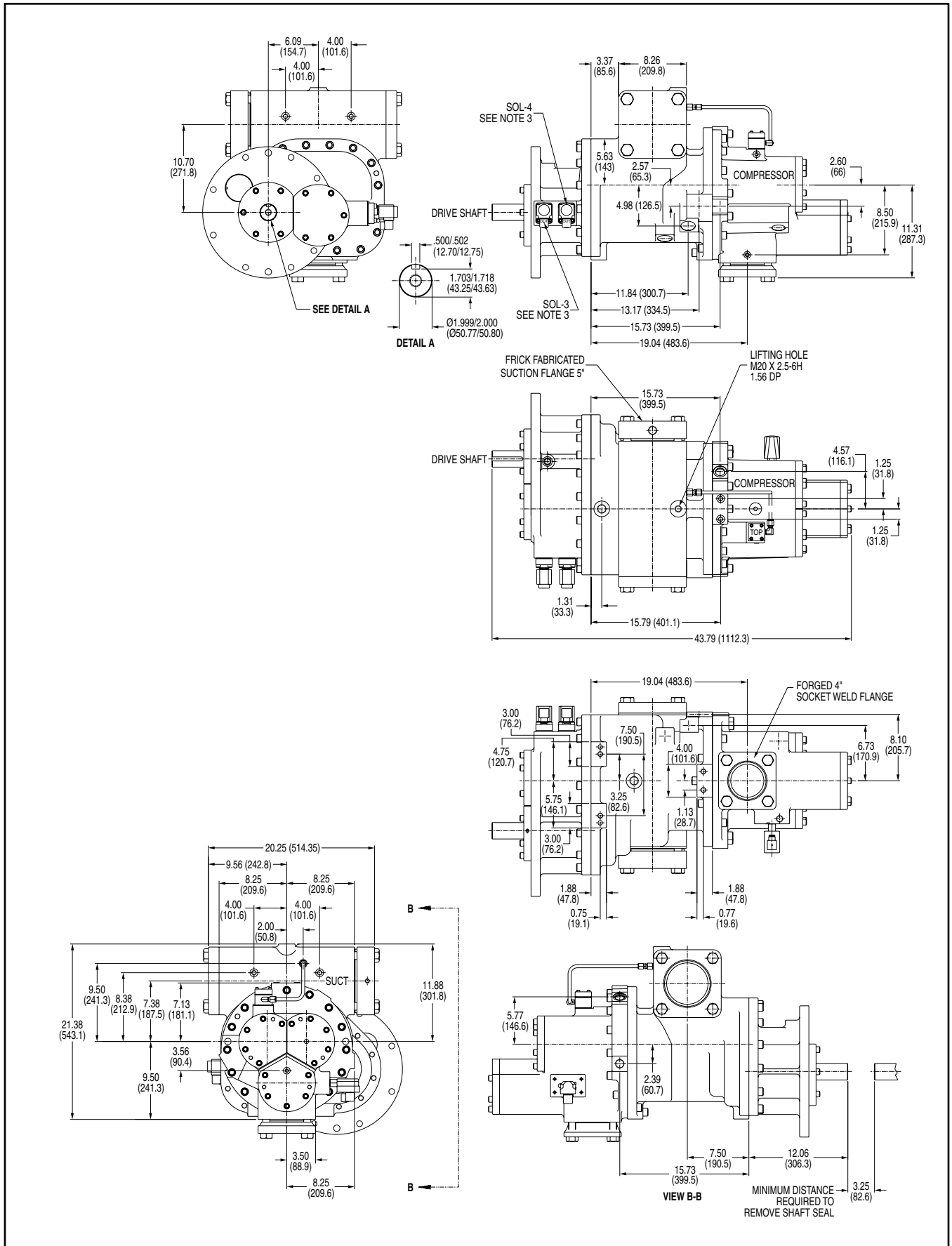
XJF 95 DIMENSIONS



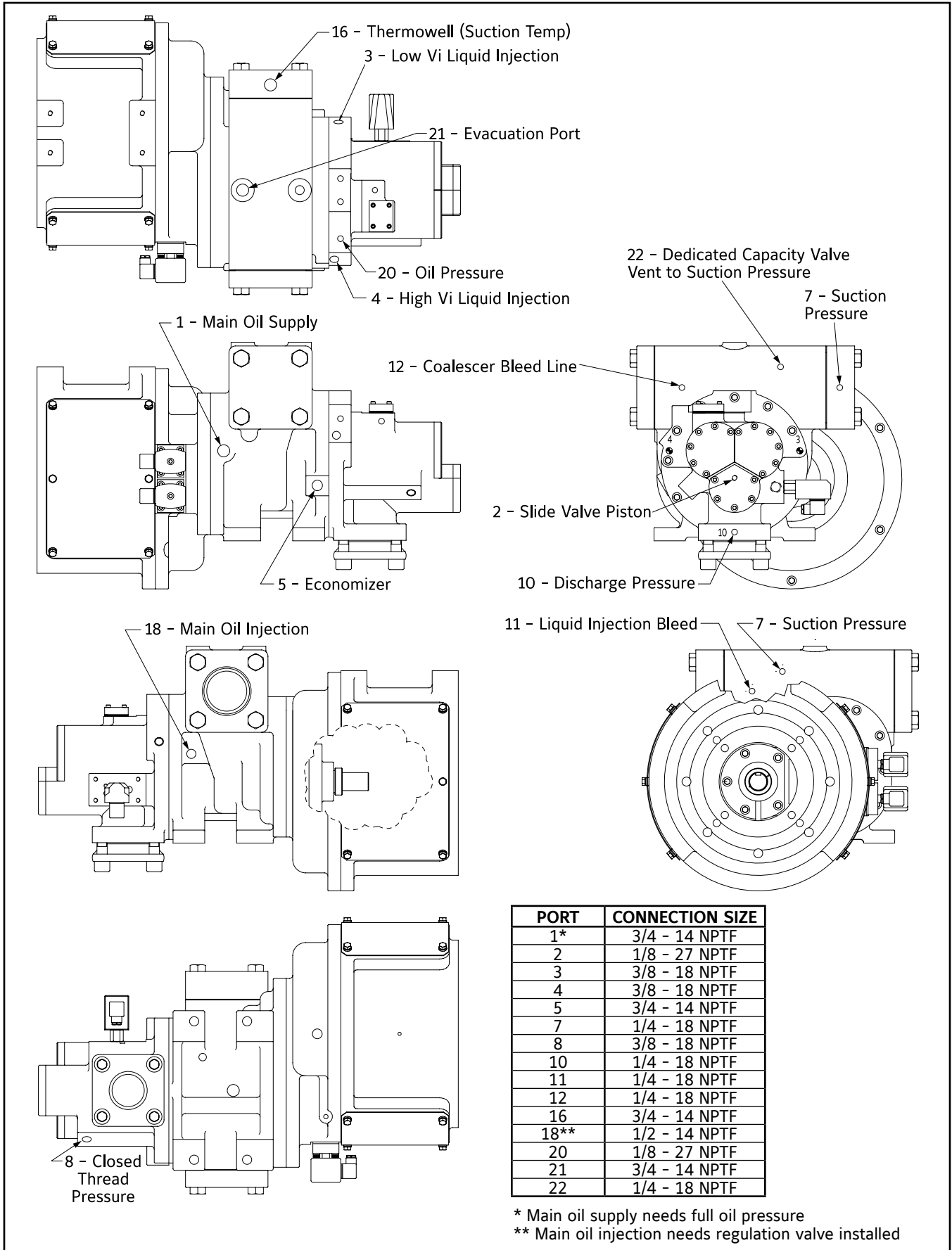
XJF 120 DIMENSIONS



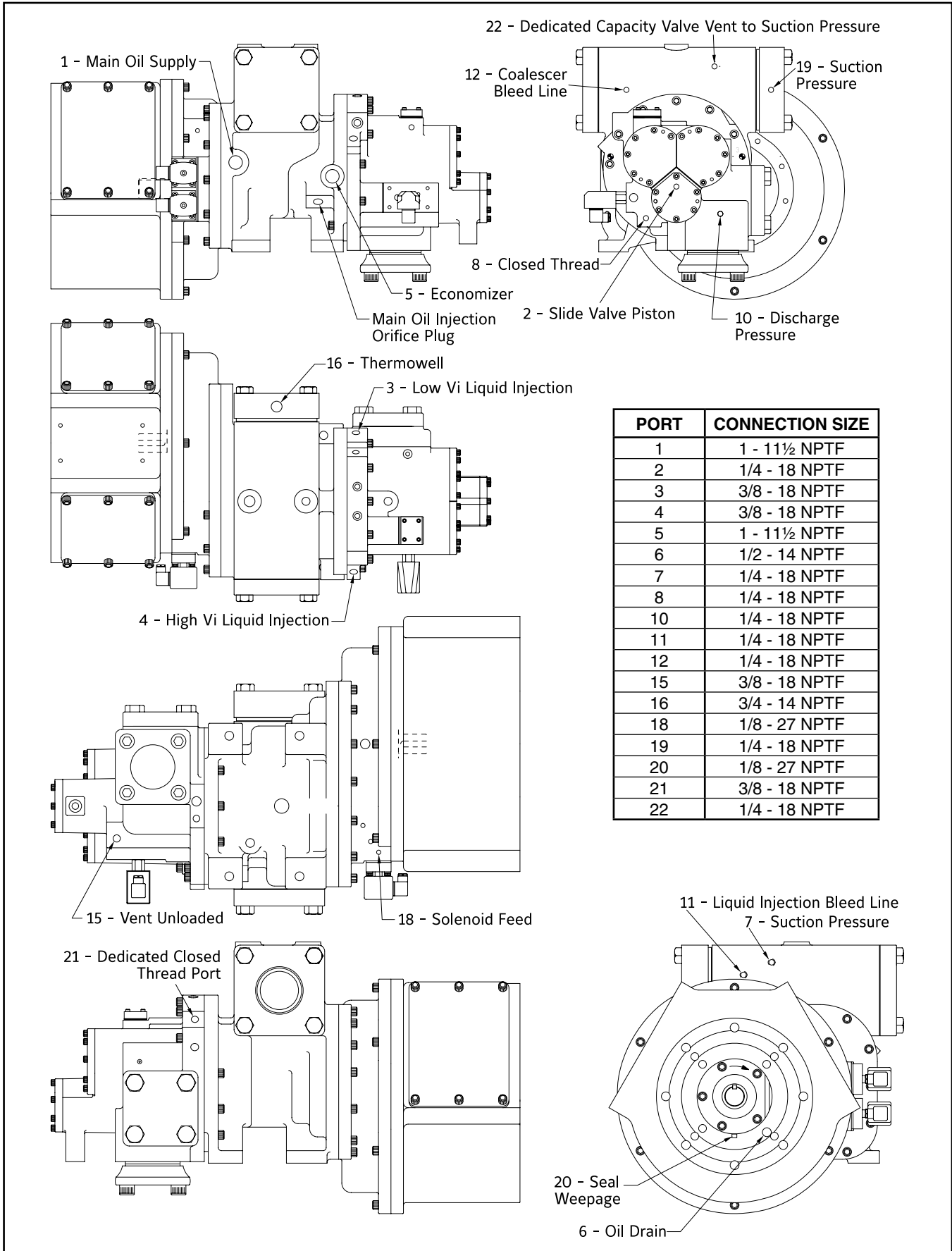
XJF 151 DIMENSIONS



XJF 95 COMPRESSOR PORT LOCATIONS

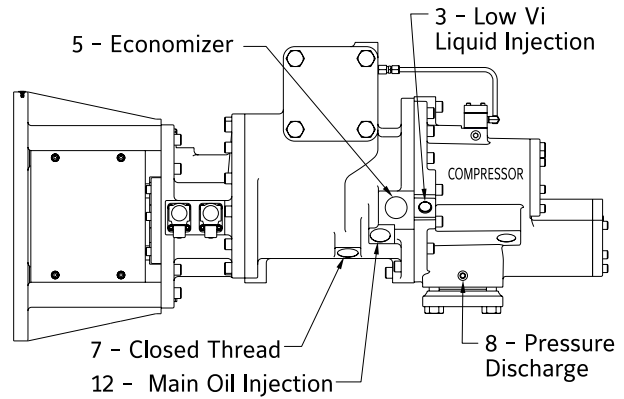
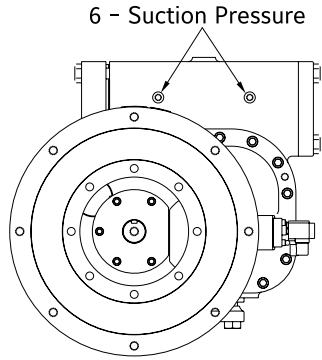


XJF 120 COMPRESSOR PORT LOCATIONS

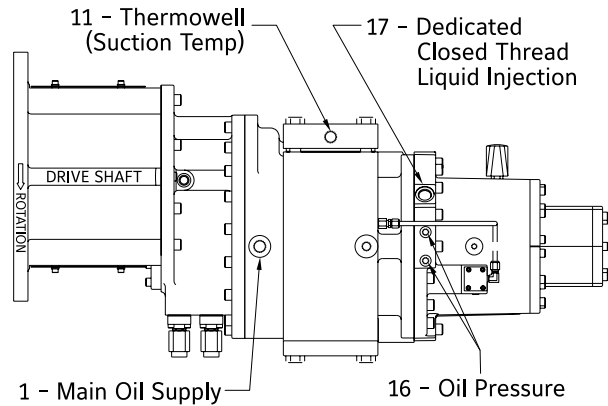


PORT	CONNECTION SIZE
1	1 - 11½ NPTF
2	1/4 - 18 NPTF
3	3/8 - 18 NPTF
4	3/8 - 18 NPTF
5	1 - 11½ NPTF
6	1/2 - 14 NPTF
7	1/4 - 18 NPTF
8	1/4 - 18 NPTF
10	1/4 - 18 NPTF
11	1/4 - 18 NPTF
12	1/4 - 18 NPTF
15	3/8 - 18 NPTF
16	3/4 - 14 NPTF
18	1/8 - 27 NPTF
19	1/4 - 18 NPTF
20	1/8 - 27 NPTF
21	3/8 - 18 NPTF
22	1/4 - 18 NPTF

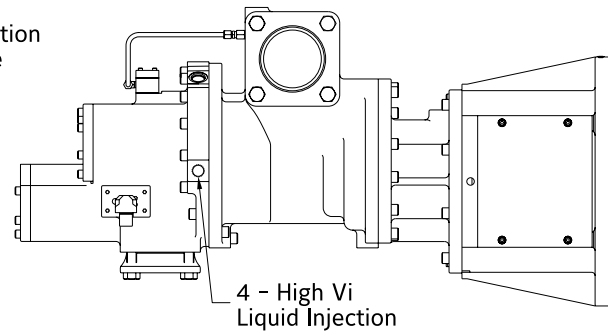
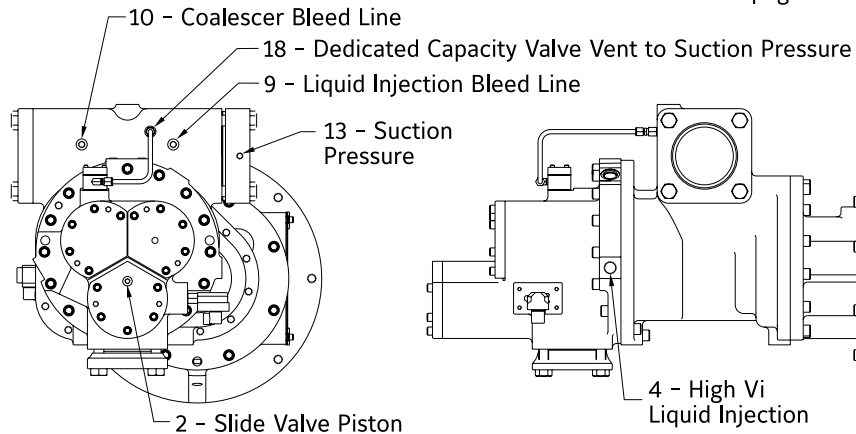
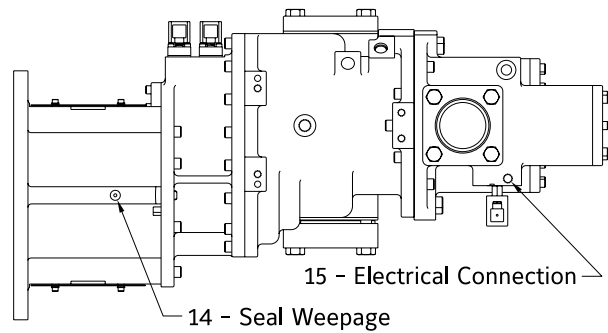
XJF 151 COMPRESSOR PORT LOCATIONS



PORT	CONNECTION SIZE	O-RING
1*	1 1/16 - 12 UN-2B	980A0012K66
2	7/16 - 20 UNF-2B	980A0012K58
3	1 1/16 - 12 UN-2B	980A0012K66
4	1 1/16 - 12 UN-2B	980A0012K66
5	1 7/8 - 12 UN-2B	980A0012K72
6	9/16 - 18 UNF-2B	980A0012K60
7	1 1/16 - 12 UN-2B	980A0012K66
8	7/16 - 20 UNF-2B	980A0012K58
9	9/16 - 18 UNF-2B	980A0012K60
10	9/16 - 18 UNF-2B	980A0012K60
11	3/4 - 14 NPTF	N/A
12**	1 1/16 - 12 UN-2B	980A0012K66
13	1/4 - 18 NPTF	N/A
14	1/8 - 27 NPTF	N/A
15	1/2 - 14 NPTF	N/A
16	9/16 - 18 UNF-2B	980A0012K60
17	1 1/16 - 12 UN-2B	980A0012K66
18	9/16 - 18 UNF-2B	980A0012K60



* Main oil supply needs full oil pressure
** Main oil injection needs regulation valve installed



SAE STRAIGHT THREAD O-RING FITTINGS - ASSEMBLY PROCEDURE FOR RXF 58 - 101

When performing maintenance or replacing the compressor, the hydraulic tubing may need to be removed and re-installed. The following procedure outlines the proper installation of SAE straight thread fittings to SAE straight thread ports.

The male and female ends of SAE straight thread O-ring ports have UN/UNF straight threads. An elastomeric O-ring is fitted to the male end. On assembly, the O-ring is firmly sandwiched between the angular sealing surface of the female port and the shoulder of the male end. Sealing is thus affected and maintained by the O-ring compression which results from the clamping force generated by the tightening action. The straight threads do not offer sealing action; they provide the resistance (holding power) for service pressure.

1. Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks and scratches or any foreign material.
2. If the O-ring is not pre-installed to the fitting on the male end, install the proper size O-ring.
3. Lubricate the O-ring with a light coating of system oil or petroleum jelly.
4. Screw the fitting into the female port until the hex flat contacts the port face. Light wrenching may be necessary.
5. Tighten to the appropriate torque value shown in the Assembly Torque Table.

ASSEMBLY TORQUE TABLE

Straight and Adjustable Fittings or Plugs (steel)			
Fitting Size	SAE Port Thread Size	Assembly Torque	
		Inch lb	Foot lb
2	5/16 - 24	65 ± 5	5.5 ± 0.5
3	3/8 - 24	130 ± 10	11 ± 1.0
4	7/16 - 20	170 ± 10	14 ± 1.0
5	1/2 - 20	260 ± 15	22 ± 1.0
6	9/16 - 18	320 ± 20	27 ± 2.0
8	3/4 - 16	500 ± 25	42 ± 2.0
10	7/8 - 14	720 ± 30	60 ± 2.5
12	1 1/16 - 12	960 ± 50	80 ± 5.0
16	1 5/16 - 12	1380 ± 75	115 ± 6.0
20	1 7/8 - 12	2700 ± 150	225 ± 12.0
24	1 7/8 - 12	3000 ± 160	250 ± 12.0

HOLDING CHARGE AND STORAGE

Every XJF compressor is pressure and leak tested at the Johnson Controls-Frick factory and then thoroughly evacuated and charged with dry nitrogen to ensure its integrity during shipping and short term storage prior to installation.

All compressors must be kept in a clean, dry location to prevent corrosion damage. Compressors that will be stored for more than two months must have their nitrogen charge checked periodically (see pages in GENERAL INFORMATION for complete instructions).

⚠ WARNING

Holding-charge shipping gauges (if mounted) are rated for 30 psig and are for checking the shipping charge only. They must be removed before pressure testing and operating the system. Failure to remove these gauges may result in catastrophic failure of the gauge resulting in serious injury or death.

Access valves are bronze and they must be replaced with steel plugs when package is assembled.

⚠ WARNING

THIS EQUIPMENT HAS BEEN PRESSURIZED WITH NITROGEN GAS. TEMPORARY VALVES AND GAUGES HAVE BEEN INSTALLED.

- 1. RELIEVE PRESSURE PRIOR TO OPENING LINES OR MAKING FIELD CONNECTIONS.**
- 2. REMOVE CHARGING VALVES OR GAUGES PRIOR TO PRESSURIZING SYSTEM.**
- 3. REFER TO THIS MANUAL FOR ADDITIONAL INFORMATION.**

ESCAPING GAS MAY CAUSE INJURY !

RIGGING AND HANDLING

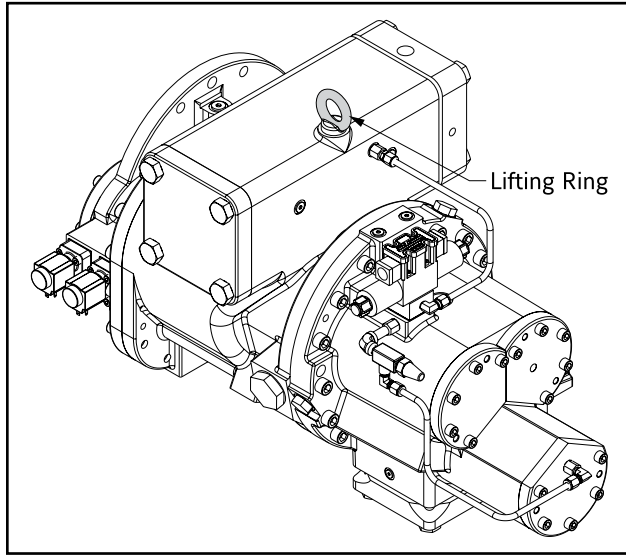


Figure 3 - Lifting Ring

The compressor can be moved with rigging, using a crane or forklift, by hooking into the two lifting rings at each end of the main housings. The compressor lifting rings shall only be used to lift the compressor itself. See Figures 3 and 4.

FOUNDATION

Each XJF Rotary Screw Compressor is shipped mounted on a wooden skid, which must be removed prior to unit installation.

⚠ CAUTION
Allow proper spacing for servicing (see Dimensional Outline Drawing).

The first requirement of the compressor foundation is that it must be able to support the weight.

XJF 95	600 lb
XJF 120	845 lb
XJF 151	1,210 lb

Screw compressors are capable of converting large quantities of shaft power into gas compression in a relatively small space. The compression process creates relatively high frequency vibrations that require sufficient mass in the base to effectively dampen them.

The best insurance for a trouble-free installation is to firmly anchor the compressor to a suitable foundation using proper bolting and by preventing piping stress from being imposed on the compressor. Once the compressor is rigged into place, its feet must be shimmed to level it. There must be absolutely no stresses introduced into the compressor body due to bolting of the feet and flanges.

The compressor motor mount is not designed to carry the unsupported weight of the motor. The full motor weight must be supported using the motor lifting point during the motor installation process. After the necessary bracket to support the motor have been welded into place on the

package and the rear motor feet and the motor mount have been bolted into place, the weight of the motor can rest on the support bracket and the motor mount.

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

NOZ. SIZE NPS	ALLOWABLE FLANGE LOADS					
	MOMENTS (ft-lbf)			LOAD (lbf)		
	AXIAL	VERT.	LAT.	AXIAL	VERT.	LAT.
	M _R	M _C	M _L	P	V _C	V _L
1	25	25	25	50	50	50
1.25	25	25	25	50	50	50
1.5	50	40	40	100	75	75
2	100	70	70	150	125	125
3	250	175	175	225	250	250
4	400	200	200	300	400	400
5	425	400	400	400	450	450
6	1,000	750	750	650	650	650
8	1,500	1,000	1,000	1,500	900	900
10	1,500	1,200	1,200	1,500	1,200	1,200
14	2,000	1,800	1,800	1,700	2,000	2,000

CUSTOMER CONNECTIONS

As a minimum you must make oil connections to the locations shown on the compressor port location drawings in addition to suction and discharge.

Other connections are available for instrumentation and service as noted on the Dimensional Outline drawing. The electrical connections for the slide stop and the slide valve transmitters and the solenoid valve coils must be connected to your control system .

The oil supply system for the compressor must be designed for a total pressure drop of no more than 15 psi with a new oil filter element. Excessive pressure drop in the oil circuit can prevent proper operation of the slide valve and slide stop pistons.

COMPRESSOR OIL

⚠ WARNING
DO NOT MIX OILS of different brands, manufacturers, or types. Mixing of oils can cause excessive oil foaming, nuisance oil level cutouts, oil pressure loss, gas or oil leakage and catastrophic compressor failure. CoolWare will select a specific Frick oil for the refrigerant being used. Depending on the application, a different oil can be selected provided it is of the proper viscosity and is compatible with the refrigerant and compressor elastomers.

OIL PUMP

If your XJF compressor application requires an oil pump, it is recommended that a strainer be mounted upstream to protect it. Frick supplied pumps are a positive displacement gear type that must have a safety relief valve to ensure the oil pressure will not be more than 50 psi above compressor discharge pressure for all models.

COMPRESSOR

MOUNTING

⚠ CAUTION

To prevent injury or damage to components, and for complete details regarding pressurized refrigerant vapor transfer and recovery, see the current Installation-Operation-Maintenance Manual for your unit.

1. Place a new gasket on the oil separator flange. (**Contact the Baltimore Parts Center for replacement gaskets, Ph: 800-336-7264**). Assemble the new compressor to the tunnel and hand tighten the bolts in a star pattern. Then torque to 1/3 of table value in star pattern increasing by 1/3's to full torque. Refer to Table 3 for torque specifications.
2. Set the compressor and motor assembly on the separator flange and align the oil separator flange bolt holes to the compressor discharge flange bolt holes while supporting the assembly with a hydraulic piston underneath the motor. The hydraulic piston must support the motor weight, motor support / tunnel weight, plus 1/2 the compressor weight. Reference Table 2 for compressor weights.

TABLE 2 - COMPRESSOR WEIGHT

XJS/XJF	Compressor Weight - Approximate	
	lb	kg
95	600	272
120	845	383
151	1,210	549

3. Insert the bolts through the oil separator flange and into the compressor discharge flange. Tighten bolts using a star pattern. Lube bolts then finger tight on all bolts, then torque to 1/3 of table value in star pattern increasing by 1/3's to full torque. Reference Table 3.
4. The motor feet should rise above the support base. If not, remove the compressor, add another gasket on top of the oil separator flange and repeat steps 4 & 5.
5. While the assembly is still supported, measure the clearance between the motor feet and base plate with a feeler gage. Shim the motor feet to gage reading plus .002" gap between each motor foot and the support base. Then, bolt the motor to the mounting base and torque the motor mounting bolts to 250 ft-lb.
6. Connect all tubing and pipe connections to the compressor and all wiring to the motor.

7. Remove the lifting assembly.

TABLE 3 - BOLT TORQUE VALUE

Compressor Model	Screw Size	Torque	
		ft-lb	NM
XJF 95	1/2 or 5/8	58	79
XJF 120	1/2 or 5/8	58	79
XJF 151	5/8 or 3/4	144	195

COMPRESSOR/MOTOR COUPLING REQUIREMENTS.

XJF compressors are arranged for direct motor drive and require a flexible drive coupling to connect the compressor to the motor.

If you are using the Johnson Controls – Frick motor mount, the mount is machined to ensure that motor to compressor alignment is in specification (see the above "MOTOR MOUNTING" section for mounting details).

If you are using a foot mounted motor, it is essential that the coupling be properly aligned to ensure proper bearing and seal performance.

1. Coupling must be selected and installed so that it doesn't transmit any axial load to the compressor shaft.
2. Set up the minimum distance between compressor shaft and motor shaft to allow for seal removal (see Outline drawings).
3. Coupling must be able to take up any misalignment between motor and compressor. It is critical to the life of the shaft seal that misalignment is kept to the minimum possible value. Be sure to follow the coupling manufacturer's guidelines for checking and correcting any misalignment. See the next section for Johnson Controls-Frick requirements.

COUPLING ALIGNMENT REQUIREMENTS (FOOT MOUNTED ONLY)

Coupling alignment must be performed prior to start-up. After the compressor has been installed on the job site, alignment must be checked again and if necessary corrected prior to start-up. After a few hours operation, the alignment must be checked while the package is still hot. Correct hot alignment is critical to ensure the life of the shaft seal and compressor bearings.

Maximum radial runout is .004" total indicator reading.
Maximum axial runout is .004" total indicator reading.

A dial indicator or another appropriate measuring device is to be used to determine the Total Indicator Runout.

Indicator bracket sag must be checked as all brackets have some flexibility. The best way to measure this is to attach the dial indicator and bracket on a pipe at the coupling span distance. Zero the indicator in the 12:00 position, and rotate the pipe so the indicator is in the 6:00 position. The reading on the indicator in the 6:00 position is the bracket sag. This value must be included in the dial indicator readings when affixed to the coupling for an accurate alignment.

OIL HEATER(S)

Your package must be equipped with oil heaters that provide sufficient heat to prevent condensation from occurring during shutdown cycles.

OIL FILTER(S)

Your package must be equipped with full-flow oil filtration. Typical oil filter specification $\beta_5 = 75$ according to ISO 4572 is required to obtain the recommended oil cleanliness class 16/14/11 according to ISO 4406. Frick SuperFilters™ can be ordered separately.

OIL COOLING REQUIREMENTS

Compressor oil needs to be cooled to control the discharge temperature, maintain proper oil viscosity and to preserve the life of the oil. Normally the discharge temperature will be in the 170° - 180°F range (see CoolWare™).

One application that typically requires higher discharge temperatures (as high as 250°F) is natural gas gathering at the wellhead¹. Moisture is normally present in the gas and it is imperative that the discharge temperature be at least 30°F higher than the discharge dew point temperature for the gas. Run Coolware with the "Water Saturated" block checked to get the discharge dew point temperature for your application. Oil temperatures as high as 170°F can be used to achieve the necessary discharge temperature to prevent moisture from condensing in the oil separator.
¹ Contact Johnson Controls-Frick for additional information for natural gas compression - availability of bearings for high temperature applications - standard bearings have limitations per Coolware that must be observed.

The main oil injection line must have a regulating valve to permit adjustment of the oil flow to maintain the desired discharge temperature at all times.

The use of a three-way mixing valve is recommended to keep the oil temperature in the normal range of 120° - 140°F. The valve will provide warm oil to the compressor quickly, reducing the pressure drop caused by cold, viscous oil. This ensures proper oil flow and temperature over the full range of operating conditions.

ECONOMIZER - HIGH STAGE

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 60%-70% (85%-90% slide valve position). This is done to improve compressor operating efficiency. 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 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 (Figure 6) 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 in Figures 4 - 7. Notice that in all systems there must be a strainer and a check valve 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.

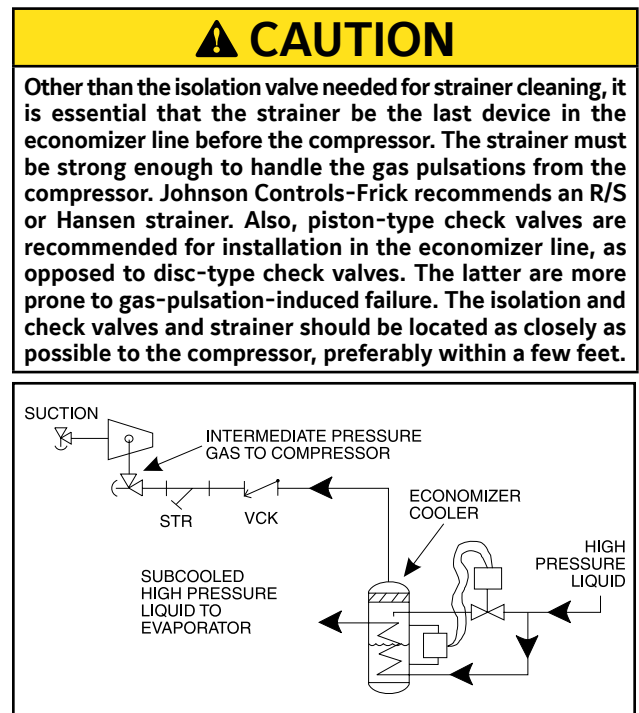


Figure 4 - Shell And Coil Economizer System

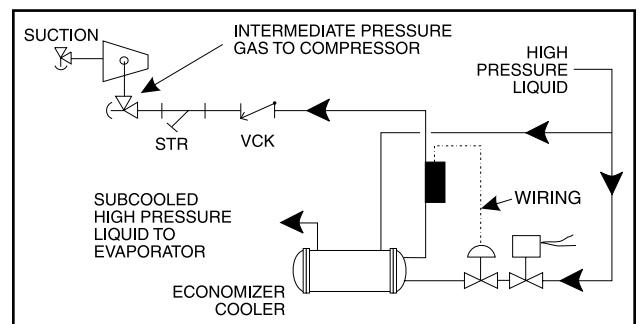


Figure 5 - Direct Expansion Economizer System

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 Figure 7.

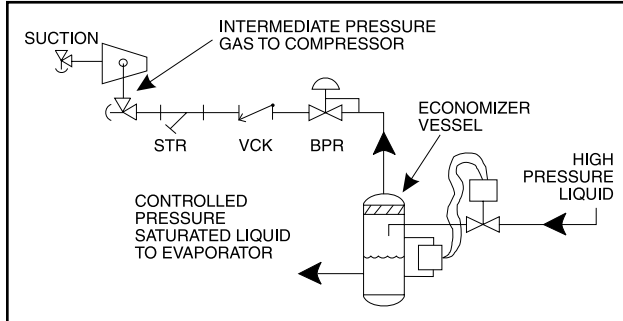


Figure 6 - Flash Economizer System

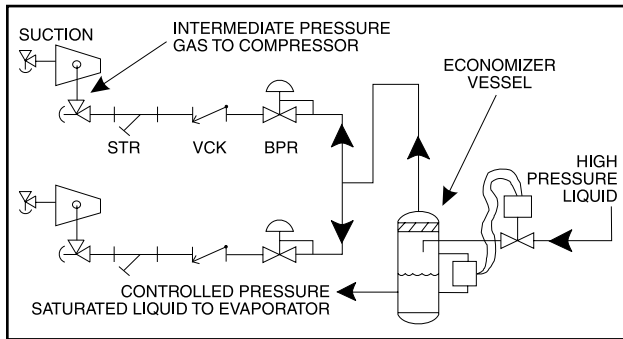


Figure 7 - Multiple Compressor Flash Economizer System

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.

High-stage compressor units may be supplied with single-port (low Vi, side, or closed thread) 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 (High Vi), 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.

Where low compression ratios (low condensing pressures) are anticipated, thermosyphon or water-cooled oil cooling should be used.

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:

CONDITIONS: High Stage at 0°F Evap, and 95°F Cond, 10°F suction superheat; Booster at -40°F Evap, 95°F Cond, 20°F Intermediate, and 10°F suction superheat; R-507 unloaded slide valve.

REFRIG	XJF MODEL	LIQ. LINE SIZE*		5 MIN SUPPLY POUNDS	LIQUID VOLUME CU. FT
		PIPE SCH 80	TUBING OD		
R-717 HIGH STAGE	95	3/8	—	12	0.3
	120	1/2	—	33	0.9
	151	3/4	—	65	1.8
R-507 HIGH STAGE	95	3/8	1/2	24	0.4
	120	3/8	1/2	60	1.0
	151	1/2	5/8	99	1.6
R-717 BOOSTER	95	3/8	—	3	0.1
	120	3/8	—	8	0.2
	151	3/8	—	14	0.4
R-507 BOOSTER	95	No oil heat of rejection at this condition			
	120				
	151				

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

CAUTION

It is imperative that an uninterrupted 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. Failure to follow these requirements causes wire draw which can result in damage to the expansion valve, loss of oil cooling, and intermittent oil cooling. One method of accomplishing this is described below.

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 assure continued oil cooling when the receiver level is low. See Figure 8.

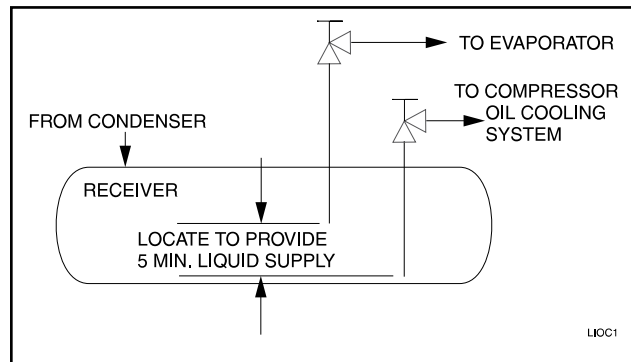


Figure 8

DEHYDRATION / EVACUATION TEST

Evacuate the system to 1000 microns. Valve off the vacuum pump and hold vacuum for one hour.

Pass – Vacuum cannot rise more than 500 microns during one hour hold period.

Fail – Vacuum rise is more than 500 microns during one hour hold period. Identify and repair any system leaks. Repeat vacuum test until requirements are met.

ELECTRICAL INSTALLATION

CAPACITY SLIDE VALVE TRANSMITTER

The slide valve transmitter (Figure 9) measures the position of the slide valve (SV) and sends a 4 to 20mA signal to your control system. See Figure 10. The controller will adjust the position of the SV according to the motor load set point. The correct position is important to properly load the compressor and motor. It is important not to overload the compressor and motor. Observe the maximum power input and ensure design limitations are not exceeded. Connect to +/- and signal as shown in the wiring diagram, Figure 10. Refer to Frick compressor panel instructions for calibration procedure 090.040-O.

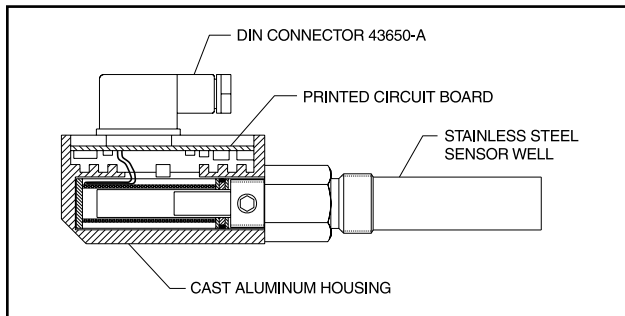


Figure 9 - Slide Valve Transmitter

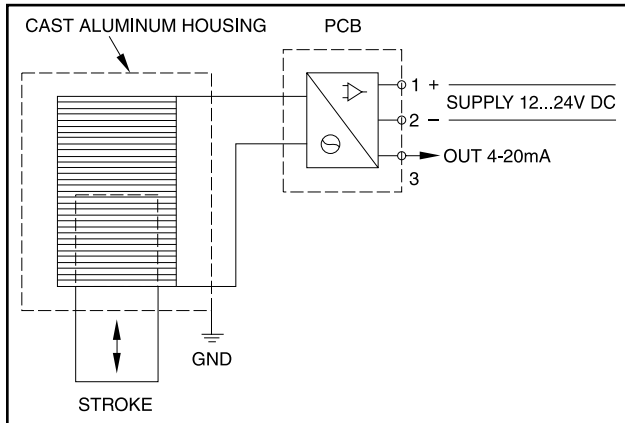


Figure 10 - Wiring Diagram for Slide Valve Transmitter

COMPRESSOR HYDRAULIC SYSTEM

The hydraulic system of the XJF compressor utilizes oil pressure from internally drilled passages in the compressor casing to selectively load and unload the compressor by applying this pressure to the actuating hydraulic piston of the movable slide valve (MSV). It also uses oil pressure to actuate a hydraulic piston that moves the movable slide stop, Volumizer II. This allows adjustment of the compressor volume ratio, (Vi) while the compressor is running.

CAPACITY CONTROL

COMPRESSOR LOADING: The compressor loads when MSV solenoid coil YY2 is energized and oil flows from the solenoid valve through the needle valve (HV2) 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. See Figure 11.

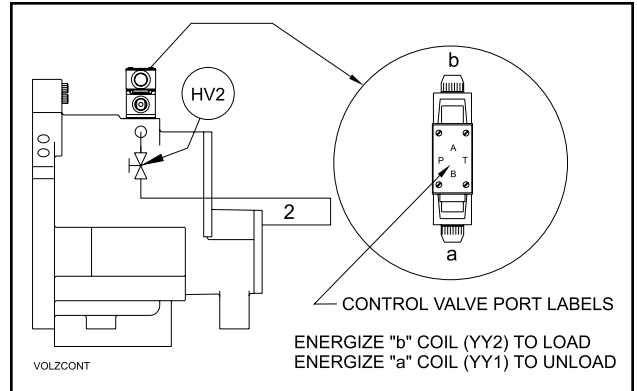


Figure 11 - Hydraulic Schematic

COMPRESSOR UNLOADING: The compressor unloads when MSV solenoid YY1 is energized and oil is allowed to flow from compressor port 2 thru 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 (HV2) is provided to adjust slide valve travel time, preventing excessive slide valve "hunting". HV2 should be adjusted to restrict oil flow to the compressor port so that slide valve travel time from full load to full unload, or vice versa, is a minimum of 30 seconds.

NOTICE

A change in operating conditions, such as winter-to-summer operation, may require readjustment of slide valve travel time.

VOLUMIZER II Vi CONTROL

The XJF compressor is equipped with a special internal control that automatically adjusts the compressor volume ratio to the most efficient of three available steps, (2.2, 3.5, or 5.0 volume ratio). This gives the compressor the ability to operate at varying operating conditions while minimizing power consumption by avoiding over or undercompression.

Solenoid valves 3 and 4 (See Figures 12 - 14 and location on P & I diagram represented by YY3 and YY4) control the Volumizer II volume ratio control. Oil is internally ported to apply hydraulic pressure to two stepping pistons in order to move the moveable slide stop to the optimum position. The following chart shows the logic of solenoid operation to adjust the volume ratio.

Vi	SOLENOID 3 / YY3	SOLENOID 4 / YY4
2.2	Energized	Energized
3.5	Deenergized	Energized
5.0	Deenergized	Deenergized

Proper operation of the Volumizer II control can be checked as follows.

1. Confirm that the slide valve travel number in Factory Setup is set at 190 degrees. If necessary, adjust the setting to 190 degrees before proceeding further.
2. Set the compressor Vi to 2.2, then record the voltage that is shown on the Slide Valve calibration screen for the current Slide Valve and 0% Slide Valve positions. The difference between these voltages must be in the 1.35 - 1.65 Vdc range.

3. Set the compressor V_i to 3.5, then record the voltage that is shown on the Slide Valve calibration screen for the current Slide Valve and 0% Slide Valve positions. The difference between these voltages must be in the 0.95 - 1.15 Vdc range.
4. Set the compressor V_i to 5.0, then record the voltage that is shown on the Slide Valve calibration screen for the current Slide Valve and 0% Slide Valve positions. The difference between these voltages must be in the 0.73 - 0.93 Vdc range.
5. If the above voltage measurements are all in range, the Volumizer II is working properly. If any of the voltages are out of range, go to the troubleshooting section.

Proper installation of the V_i control valves and gaskets is essential to the operation of this equipment. Incorrectly installed parts may cause the compressor to operate at the wrong V_i , or to load or unload improperly. Operation at the wrong compressor V_i can cause excessive power consumption, noise, vibration, or excessive oil foaming. See Figures 12 - 14 for correct installation of gaskets and location of solenoids.

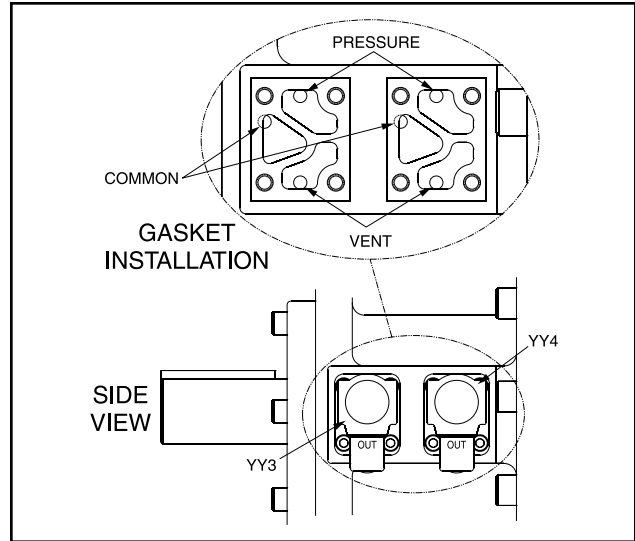


Figure 14 - XJF 151 V_i Control

LOW AMBIENT OPERATION

It is recommended that package oil separators be insulated as a minimum requirement to preserve the heat generated by the oil heaters, to prevent condensation and secure lubrication at start-up.

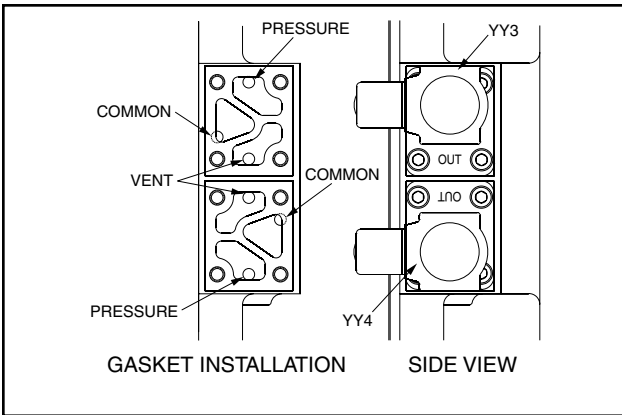


Figure 12 - XJF 95 V_i Control

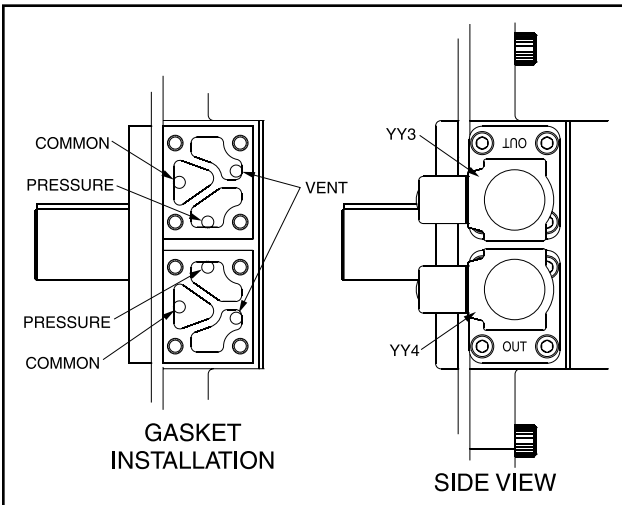


Figure 13 - XJF 120 V_i Control

OPERATION

OPERATION AND START-UP INSTRUCTIONS

The Frick XJF Rotary Screw Compressor will be a component in an integrated system. As such the compressor requires some specific operation and conditions to ensure trouble-free running.

The information in this section of the manual provides the logical step-by-step instructions to properly start up and operate the XJF Rotary Screw Compressor in your Unit. Only matters which may influence the proper operation of the XJF compressor are included.

NOTICE

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

INITIAL START-UP

Prior to the start-up, the prestart check must be accomplished. See Prestart Checklist in FORMS section of this manual.

INITIAL START-UP PROCEDURE

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

1. For proper and safe operation, the compressor must be run at the proper speed and discharge pressure. Exceeding design conditions creates a potential hazard.
2. After 1 to 3 hours of operation adjust oil cooling system.
3. Pull and clean suction strainer after 24 hours of operation. If it is excessively dirty, repeat every 24 hours until system is clean. Otherwise, follow the normal maintenance schedule.
4. Perform vibration analysis if equipment is available.

NORMAL START-UP PROCEDURE

1. Confirm system conditions permit starting the compressor.
2. Start.
3. Observe the compressor unit for mechanical tightness of the external piping, bolts and valves. Ensure that the machine has no oil and vapor leaks. If any of these occur, shut down the compressor and correct the problem as necessary using good safety precautions.

MAINTENANCE

GENERAL INFORMATION

This section provides instructions for normal maintenance, a recommended maintenance program, and troubleshooting and correction guides.

⚠ WARNING

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

⚠ CAUTION

Cylinder assembly under high spring load. Consult manual before disassembly. Improper disassembly may cause injury due to spring tension release.

NORMAL MAINTENANCE OPERATIONS

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

1. IF UNIT IS RUNNING, PRESS [STOP] KEY.
2. STOP MOTOR AND LOCK OUT STARTER BEFORE PERFORMING ANY MAINTENANCE.
3. WEAR PROPER SAFETY EQUIPMENT WHEN COMPRESSOR UNIT IS OPENED TO ATMOSPHERE.
4. ENSURE ADEQUATE VENTILATION.
5. TAKE NECESSARY SAFETY PRECAUTIONS REQUIRED FOR THE GAS BEING USED.

GENERAL MAINTENANCE

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

- 1. Keep oil clean and dry, avoid moisture contamination.** After servicing any portion of the refrigeration system, evacuate to remove moisture before returning to service. Water vapor condensing in the compressor while running or more likely while shut down, can cause rusting of critical components and reduce life.
- 2. Keep suction strainer clean.** Check periodically, particularly on new systems where welding slag or pipe scale could find its way to the compressor suction. Excessive dirt in the suction strainer could cause it to collapse, dumping particles into the compressor.
- 3. Keep oil filters clean.** If filters show increasing pressure drop, indicating dirt or water, stop the compressor and change filters. Running a compressor for long periods with high filter pressure drop can starve the compressor of oil and lead to premature bearing failure. Dual oil filters are recommended so that the filters can be changed without shutting down the package.
- 4. Avoid slugging the compressor with liquids (oil).** While screw compressors are probably the most tolerant of any compressor type available today about ingestion of some liquid, they are not liquid pumps. Make certain a properly sized suction accumulator is used to avoid dumping liquid into compressor suction.

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

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

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.

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. Stop the compressor unit.
2. Lock out the motor starter.

3. Close the suction and discharge service valves
4. Using appropriate equipment, lower the compressor pressure to 0 psig.
5. Open the drain valve(s) and drain oil into a suitable container.
6. Drain the oil filter(s) and the oil coolers.
7. Remove the old filter cartridges, and install new ones.
8. Remove, clean, and reinstall elements in the strainers.
9. Evacuate the unit.
10. Open the suction service valve and pressurize the unit to system suction pressure. Close the suction valve and leak test.
11. Add oil.
12. Open the suction and discharge service valves
13. Remove the lockout from the motor starter.
14. Start the unit

RECOMMENDED MAINTENANCE PROGRAM

In order to obtain maximum compressor performance and ensure reliable operation, a regular maintenance program should be followed. The compressor unit should be checked regularly for leaks, abnormal vibration, noise, and proper operation. A log should also be maintained. Oil analysis

MAINTENANCE SCHEDULE

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

MAINTENANCE	FREQUENCY OR HOURS OF OPERATION (MAXIMUM)																					
	200	1000	5000	8000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000	70,000	75,000	80,000	85,000	90,000	95,000
Change Oil	As Directed By Oil Analysis																					
Oil Analysis		■	Every 6 Months																			
Replace Filters	■		■		■		■		■		■		■		■		■		■		■	
Clean Oil Strainers	■		■		■		■		■		■		■		■		■		■		■	
Clean Liquid Strainers	■		■		■		■		■		■		■		■		■		■		■	
Replace Coalescers									■						■						■	
Check and Clean Suction Strainer	■		■		■		■		■		■		■		■		■		■		■	
Check Coupling (a)	■	Annually Regardless of Operating Hours																				
Suction & Disch Flange Bolts (d)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
VFD Units Check Skip Freq. (f)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Check Electrical Connections (b)	■		■		■		■		■		■		■		■		■		■		■	
Check Sensor Calibration (c)	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Vibration Analysis (e)	■	Every 6 Months, More Frequently If Levels Increase																				
Replace Shaft Seal	When Leak Rate Exceeds 7 - 8 Drops Per Minute																					

- a. Check bolts, shim packs, center inserts, keys, and all bolt torques.
- b. Check and torque all terminals in the processor and starter panel per the specification posted in the enclosure.
- c. Check calibration of Slide Valve, Slide Stop, pressures and temperatures. Calibration should be conducted with NIST certified devices.
- d. Verify tightness of bolts on suction and discharge flanges. See table below for torque requirements.
- e. Vibration measurement must be carried out continuously to obtain optimum preventative control on bearings. If not continuously controlled, then every 6 months, more frequently if levels increase.
- f. Units with variable speed drives - check for excess vibration and skip frequencies any time unit operating conditions change.

Compressor Model	Motor Flange to Compressor Tunnel ⁽¹⁾		Compressor Flange to Separator Flange ⁽²⁾	
	Bolt Size (in.)	Torque (ft-lb)	Bolt Size	Torque (ft-lb)
XJF 95S,M,L	1/2 or 5/8	58	M20 X 2.5	107
XJF 120S,M,L	1/2 or 5/8	58	M20 X 2.5	150
XJF 151A,M,L,N	5/8 or 3/4	144	M22 X 2.5	167

1. Based on metal to metal contact.
2. Based on: Gaskets: Garlock® Blue-Gard® 3300; Bolts: class 8.8 or stronger hex head bolts, lightly oiled and clean

should be performed on a regular basis. It is a valuable tool that can identify the presence of moisture, acid, metallics and other contaminants that will shorten compressor life if not corrected. In addition, an analysis of the compressor 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 vibration readings 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 baseline 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 and suitable oil is necessary to ensure compressor longevity and reliability. Oil quality will rapidly deteriorate in systems containing moisture and air or other contaminants. In order to ensure the quality of the oil in the compressor unit:

1. Only use Frick oil or high quality oils approved by Johnson Controls - Frick for your application.
2. Only use Frick filter elements. Substitutions must be approved in writing by Johnson Controls - Frick engineering or warranty claim may be denied.
3. Participate in a regular, periodic oil analysis program to maintain oil and system integrity.

OPERATING LOG

The use of an operating log as included in this manual permits thorough analysis of the operation of a 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 daily.

MAINTENANCE SCHEDULE

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

TROUBLESHOOTING GUIDE

Successful problem solving requires an organized approach to define the problem, identify the cause, and make the proper correction. Sometimes it is possible that two relatively obvious problems combine to provide a set of symptoms that can mislead the troubleshooter. Be aware of this possibility and avoid solving the "wrong problem".

ABNORMAL OPERATION ANALYSIS AND CORRECTION

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

1. Define the problem and its limits.
2. Identify all possible causes.
3. Test each cause until the source of the problem is found.
4. Make the necessary corrections.

The first step in effective problem solving is to define the limits of the problem. The following list of abnormal system conditions can cause abnormal operation of the XJF compressor:

1. Insufficient or excessive refrigerant or gas load.
2. Excessively high suction pressure.
3. Excessively high discharge pressure.
4. Excessively high or low temperature coolant to the oil cooler.
5. Excessive liquid entering the compressor (slugging).
6. Insufficient oil cooling.
7. Excessive oil cooling
8. Incorrect gas line sizing.
9. Improper system piping.
10. Wrong operation of hydraulic operated slide valve.
11. Problems in electrical service to compressor.
12. Moisture present in the system.

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

The second step in problem solving is to decide which items on the list are possible causes and which items are additional symptoms. High discharge temperature and high oil temperature readings on a display may both be symptoms of a problem and not causally related.

The third step is to identify the most likely cause and take action to correct the problem. If the symptoms are not relieved, move on 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.

SLIDE VALVE TRANSMITTER REPLACEMENT

The Slide Valve Transmitter (Figure 15) is located on the right side of the compressor (facing shaft) at the inlet end.

The linear transmitter with hermetic enclosure is based on the inductive measuring principle. It features removable electronics (from the sensor well) eliminating the need to evacuate the compressor for replacement. This type of transmitter is dedicated to volume ratio control and has no user adjustments.

1. Shut off control power.
2. Remove DIN connector plug from transmitter.
3. Loosen set screws.
4. Remove transmitter unit.
5. Install new transmitter unit.
6. Tighten set screws.
7. Apply DIN connector plug to transmitter.
8. Turn on control power.

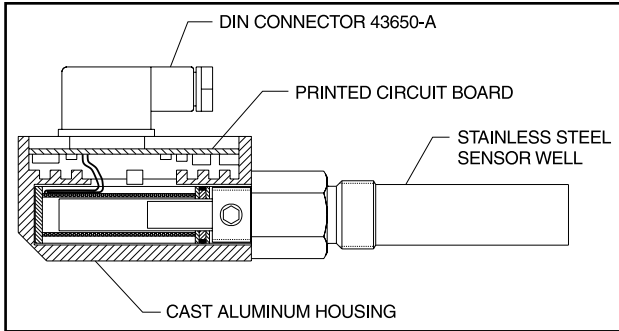


Figure 15 - Slide Valve Transmitter

NOTICE

For calibration of the Slide Valve unit, refer to the Analog Calibration instructions in publication 090.040-O.

BARE COMPRESSOR MOUNTING

Refer to publication 070.660-SM.

TROUBLESHOOTING THE COMPRESSOR

SYMPTON	PROBABLE CAUSES and CORRECTIONS
EXCESSIVE NOISE and VIBRATION	Loose bolts on compressor mounting. Tighten bolts. No oil getting to compressor. Check oil level, oil filter and oil pressure. Bearing damage or excessive wear. Coupling loose on shaft. Tighten coupling. Replace if damaged. Volumizer not adjusted correctly. Readjust. Refrigerant flood-back. Correct system problem.

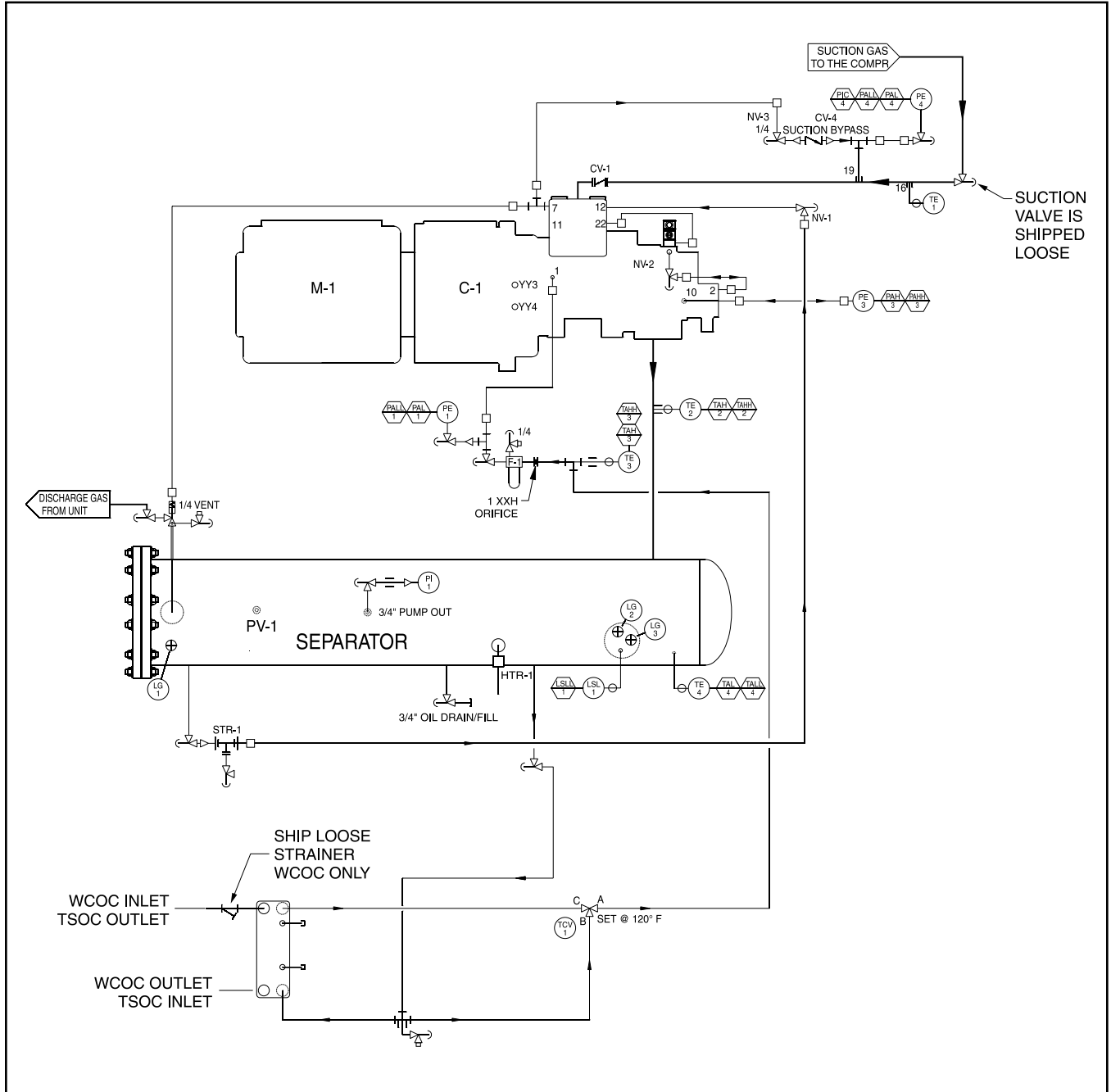
NOTICE

Unless the Service Technician has been certified by Johnson Controls – Frick to rebuild our compressors, troubleshooting the compressor is limited to identifying the probable cause. If a mechanical problem is suspected contact Johnson Controls – Frick Service. DO NOT ATTEMPT TO DISASSEMBLE COMPRESSOR.

TROUBLESHOOTING THE HYDRAULIC SYSTEM

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
SLIDE VALVE WILL NOT LOAD OR UNLOAD	Solenoid coil burned out. Replace coil. HV2 needle valve 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. Push "A" side to confirm unload capability. If valve works, problem is electrical. Solenoid valve piston hung in bore or bolt loose. Check piston or tighten bolt.
SLIDE VALVE WILL LOAD BUT WILL NOT UNLOAD	YY1 solenoid coil burned out. Replace coil. Check valve in solenoid valve piston bad. Replace or repair. 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. Push YY1 valve to confirm unload capability. If valve works, problem is electrical. Slipper seals worn out or damaged. Replace. Check valve in slide valve piston sticking. Remove and clean check valve.
SLIDE VALVE WILL UNLOAD BUT WILL NOT LOAD	YY2 solenoid coil burned out. 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, the problem is electrical.
SLIDE STOP WILL NOT FUNCTION IN EITHER DIRECTION	Solenoid coil burned out. Replace coils. Solenoid valve sticking. Replace valve.
SLIDE VALVE and/or SLIDE STOP WILL NOT MOVE	Slipper seals worn out or damaged. Unloader spindle or slide valve jammed. Slide stop indicator rod jammed.

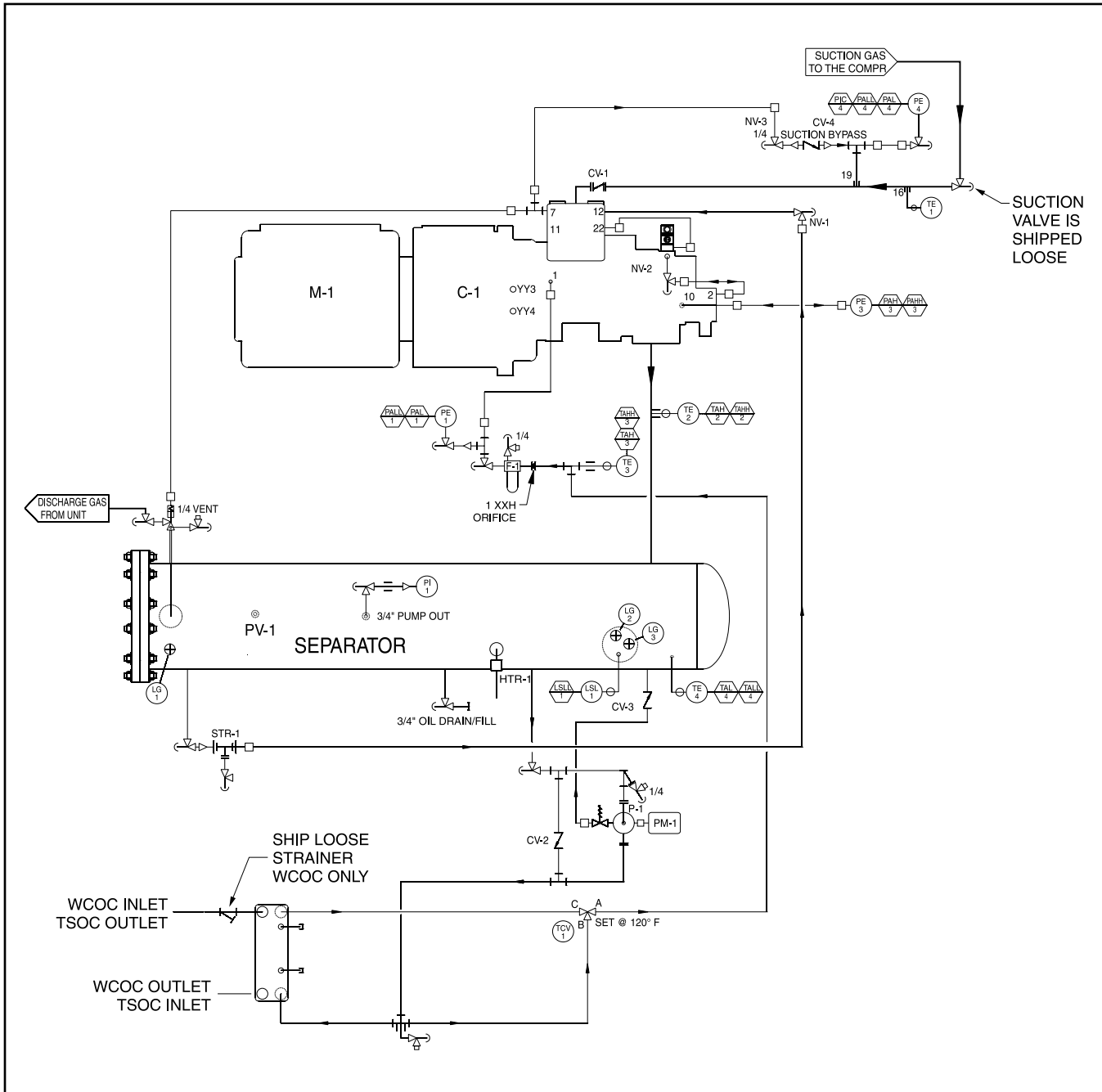
XJF MODELS 95 and 120 without OIL PUMP (See OIL COOLING ADDITIONS)



LEGEND*					
AS	AIR SUPPLY	P	PUMP	TAH	HIGH TEMPERATURE ALARM
C	COMPRESSOR	PAH	HIGH PRESSURE ALARM	TAHH	HIGH TEMP. SHUTDOWN
CV	CHECK VALVE	PAHH	HIGH PRESSURE SHUTDOWN	TAL	LOW TEMPERATURE ALARM
DP	DISCHARGE PRESSURE	PAL	LOW PRESSURE ALARM	TALL	LOW TEMPERATURE SHUTDOWN
F	FILTER OR FILTER DRIER	PALL	LOW PRESSURE SHUTDOWN	TCV	TEMPERATURE CONTROL VALVE
FG	FLOW GLASS	PCV	PRESSURE CONTROL VALVE	TE	TEMPERATURE ELEMENT
HTR	HEATER	PDSLL	LOW DIFFERENTIAL PRESS. SHUTDOWN	TI	TEMPERATURE INDICATOR
HV	HAND ACTUATED VALVE	PE	PRESSURE ELEMENT	TS	TEMPERATURE SWITCH
LG	SIGHT OR LEVEL GLASS	PI	PRESSURE INDICATOR	TSH	TEMP. SWITCH HIGH ALARM
LSL	OIL LEVEL SWITCH LOW	PIC/TIC	PRESS./TEMP. INDICATING CONTROLLER	TSLL	LIQUID INJECTION SHUTOFF
LSLL	LOW OIL LEVEL SHUTDOWN	PM	PUMP MOTOR	TW	THERMOWELL
M	MOTOR	PS	AUTO CYCLE/PRESSURE SWITCH	VI	VI CONTROL
1MC	MOTOR CONTROL CENTER	PSV	PRESSURE SAFETY VALVE	WS	WATER SUPPLY
2MC	MOTOR CONTROL CENTER	SP	SUCTION PRESSURE	YY	SOLENOID VALVE/EVENT VALVE
OP	OIL PRESSURE	STR	STRAINER		

* See additional Legend items on opposite page.

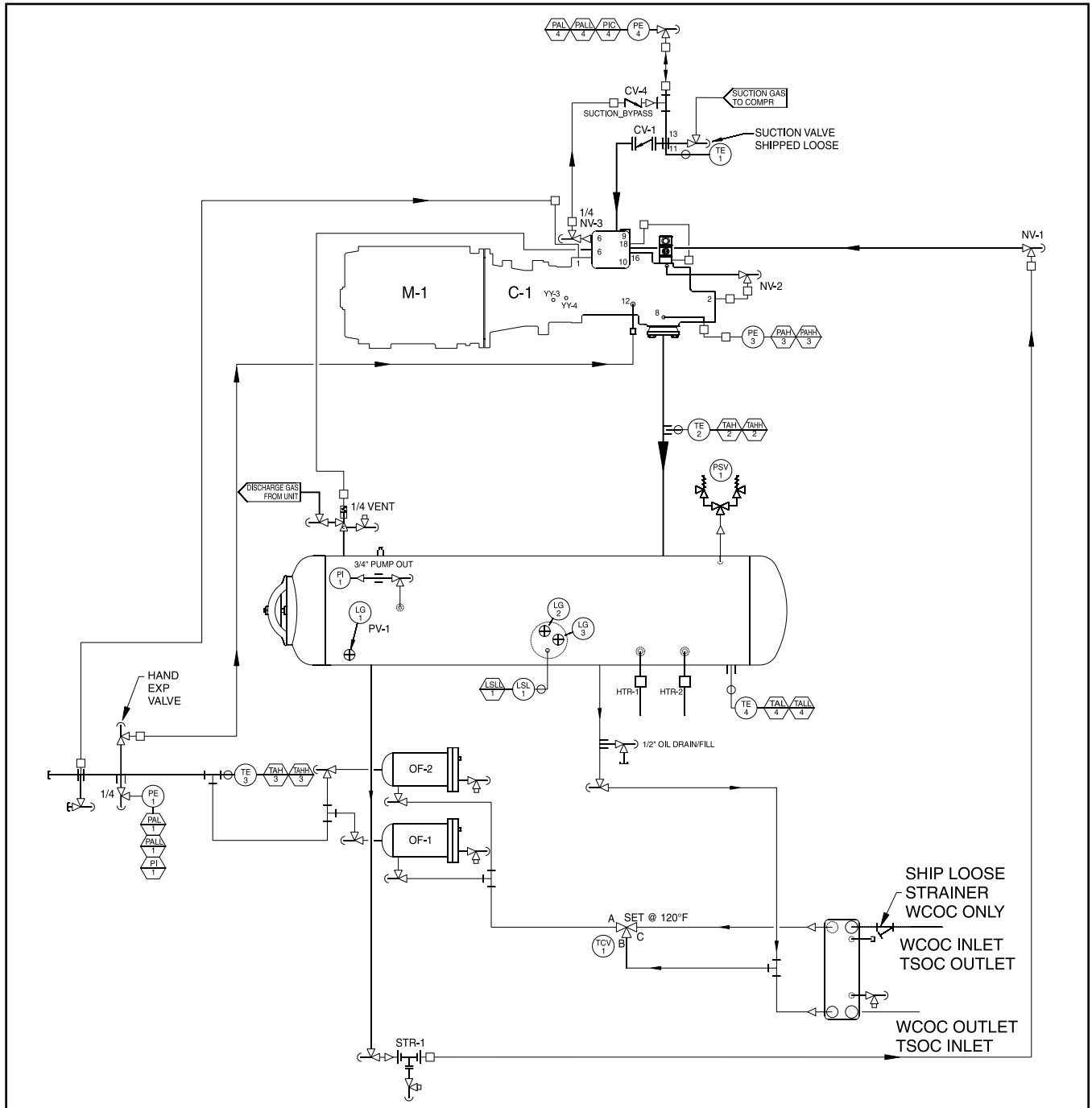
XJF MODELS 95 and 120 with OIL PUMP (See OIL COOLING ADDITIONS)



LEGEND (Cont.)

<p>CONNECTIONS</p> <p>1 MAIN OIL SUPPLY 2 SLIDE VALVE PISTON 3 LOW VI LIQUID INJECTION 4 HIGH VI LIQUID INJECTION 5 ECONOMIZER 6 OIL DRAIN 7 SUCTION PRESSURE 8 CLOSED THREAD 10 DISCHARGE PRESSURE 11 LIQ. INJ. BLEED LINE 12 COALESCER BLEED LINE</p>	<p>15 VENT - UNLOADING 16 THERMOWELL 19 SUCTION PRESSURE</p>	<p>NOTES:</p> <p>1. PRESSURE TRANSDUCERS INDICATE: PE-1 OIL PRESSURE PE-3 DISCHARGE PRESSURE PE-4 SUCTION PRESSURE</p> <p>2. TEMPERATURE PROBES INDICATE: TE-1 SUCTION GAS TEMPERATURE TE-2 DISCHARGE GAS TEMPERATURE TE-3 LUBE OIL TEMPERATURE TE-4 SEPARATOR OIL TEMPERATURE</p> <p>3. TERMINATIONS "A" THROUGH "C" REFER TO CONNECTION POINTS FOR VARIOUS OPTIONS.</p>
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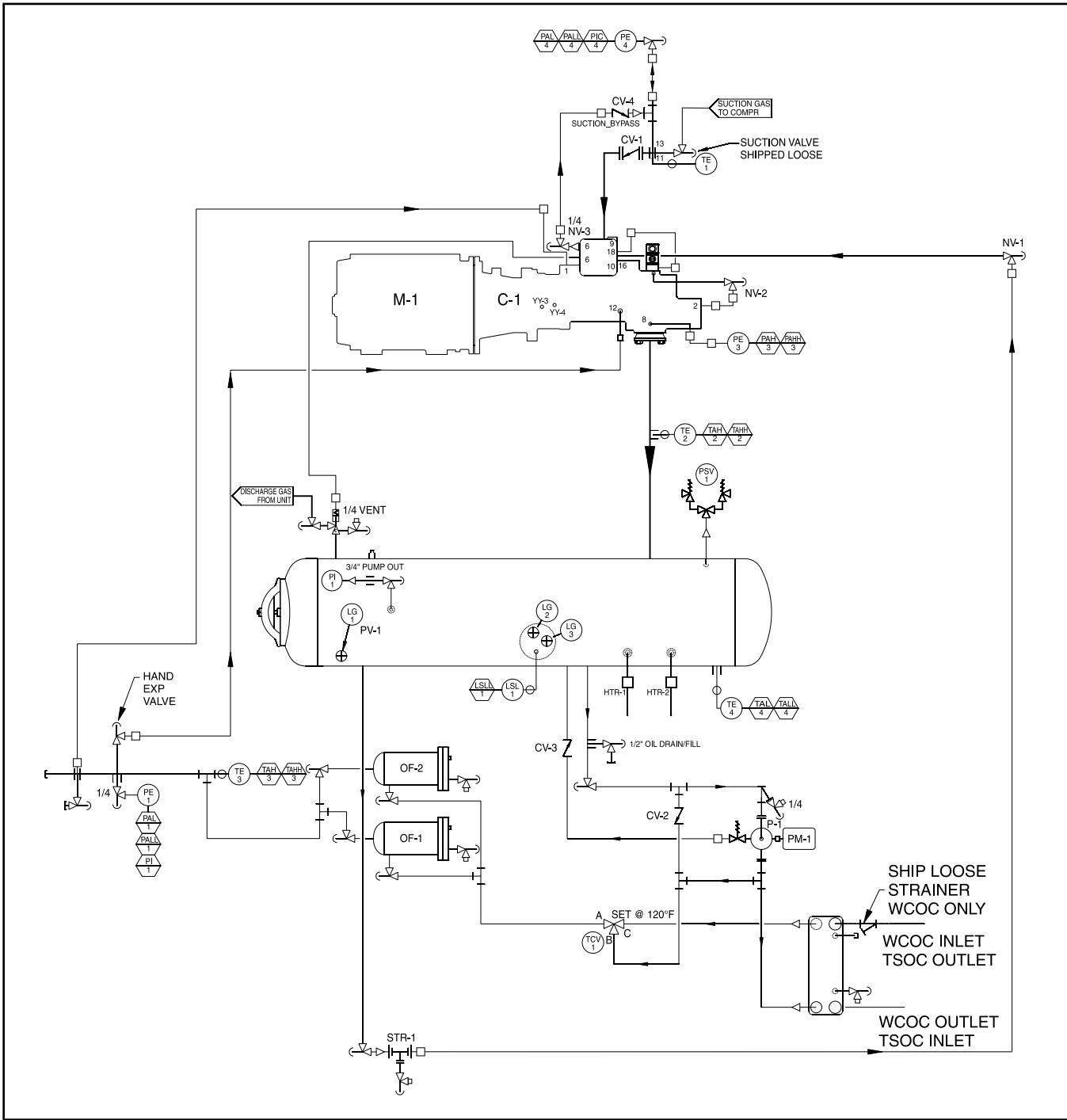
XJF MODEL 151 without OIL PUMP (See OIL COOLING ADDITIONS)



LEGEND*			
AS	AIR SUPPLY	P	PUMP
C	COMPRESSOR	PAH	HIGH PRESSURE ALARM
CV	CHECK VALVE	PAHH	HIGH PRESSURE SHUTDOWN
DP	DISCHARGE PRESSURE	PAL	LOW PRESSURE ALARM
F	FILTER OR FILTER DRIER	PALL	LOW PRESSURE SHUTDOWN
FG	FLOW GLASS	PCV	PRESSURE CONTROL VALVE
HTR	HEATER	PDSLL	LOW DIFFERENTIAL PRESS. SHUTDOWN
HV	HAND ACTUATED VALVE	PE	PRESSURE ELEMENT
LG	SIGHT OR LEVEL GLASS	PI	PRESSURE INDICATOR
LSL	OIL LEVEL SWITCH LOW	PIC/TIC	PRESS./TEMP. INDICATING CONTROLLER
LSLL	LOW OIL LEVEL SHUTDOWN	PM	PUMP MOTOR
M	MOTOR	PS	AUTO CYCLE/PRESSURE SWITCH
1MC	MOTOR CONTROL CENTER	PSV	PRESSURE SAFETY VALVE
2MC	MOTOR CONTROL CENTER	SP	SUCTION PRESSURE
OP	OIL PRESSURE	STR	STRAINER
		TAH	HIGH TEMPERATURE ALARM
		TAHH	HIGH TEMP. SHUTDOWN
		TAL	LOW TEMPERATURE ALARM
		TALL	LOW TEMPERATURE SHUTDOWN
		TCV	TEMPERATURE CONTROL VALVE
		TE	TEMPERATURE ELEMENT
		TI	TEMPERATURE INDICATOR
		TS	TEMPERATURE SWITCH
		TSH	TEMP. SWITCH HIGH ALARM
		TSLL	LIQUID INJECTION SHUTOFF
		TW	THERMOWELL
		VI	VI CONTROL
		WS	WATER SUPPLY
		YY	SOLENOID VALVE/EVENT VALVE

* See additional Legend items on opposite page.

XJF MODEL 151 with OIL PUMP and DUAL OIL FILTERS (See OIL COOLING ADDITIONS)



LEGEND (Cont.)

CONNECTIONS		NOTES:	
1	MAIN OIL SUPPLY	12	MAIN OIL INJECTION
2	SLIDE VALVE PISTON	13	SUCTION PRESSURE
3	LOW VI LIQUID INJECTION	14	SEAL WEEPAGE
4	HIGH VI LIQUID INJECTION	15	ELECTRICAL CONNECTION
5	ECONOMIZER	16	OIL PRESSURE
6	SUCTION PRESSURE		
7	CLOSED THREAD		
8	DISCHARGE PRESSURE		
9	LIQ. INJ. BLEED LINE		
10	COALESCER BLEED LINE		
11	THERMOWELL (SUCT. TEMP.)		

1. PRESSURE TRANSDUCERS INDICATE:
PE-1 OIL PRESSURE
PE-3 DISCHARGE PRESSURE
PE-4 SUCTION PRESSURE

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

3. TERMINATIONS "A" THROUGH "C" REFER TO CONNECTION POINTS FOR VARIOUS OPTIONS.

READ THIS FIRST: COMPRESSOR PRESTART CHECKLIST

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

Mechanical Checks

- Package installed according to Frick publication 070.210-IB, Screw Compressor Foundations.
- Confirm that motor disconnect is open
- Isolate suction pressure transducer
- Pressure test and leak check unit
- Evacuate unit
- Remove compressor drive coupling guard
- Remove coupling center and **DO NOT reinstall** (motor rotation must be checked without center)
- Check for correct position of all hand, stop, and check valves **PRIOR** to charging unit with **OIL** or **REFRIGERANT**
- Charge unit with correct type and quantity of oil
- Lubricate electric drive motor bearings **PRIOR** to checking motor rotation
- Check oil pump alignment (if applicable)
- Check for correct economizer piping (if applicable)
- Check separate source of liquid refrigerant supply (if applicable, liquid injection oil cooling)
- Check water supply for water-cooled oil cooler (if applicable, water cooled oil cooling)
- Check thermosyphon receiver refrigerant level (if applicable, thermosyphon oil cooling)
- Check for **PROPER PIPE SUPPORTS** and correct foundation
- Check to ensure **ALL** piping **INCLUDING RELIEF VALVES** is completed

Electrical Checks

- Package installed according to Frick publication 090.400-SB, Proper Installation of Electrical Equipment In An Industrial Environment.
- Confirm that main disconnect to motor starter and micro is open
- Confirm that electrical contractor has seen this sheet, **ALL PERTINENT WIRING** information, and drawings
- Confirm proper power supply to the starter package
- Confirm proper motor protection (breaker sizing)
- Confirm that all wiring used is stranded copper and is 14 AWG or larger (sized properly)
- Confirm all 120 volt control wiring is run in a separate conduit from all high voltage wiring
- Confirm all 120 volt control wiring is run in a separate conduit from oil pump and compressor motor wiring
- Confirm no high voltage wiring enters the micro panel at any point
- Check current transformer for correct sizing and installation
- Check all point-to-point wiring between the micro and motor starter
- Confirm all interconnections between micro, motor starter, and the system are made and are correct
- Ensure all electrical panels are free from installation debris, **METAL PARTICLES**, and moisture

After the above items have been checked and verified:

- Close the main disconnect from the main power supply to the motor starter
- Close the motor starter disconnect to energize the micro
- Manually energize oil pump and check oil pump motor rotation
- Leave micro energized to ensure oil heaters are on and oil temperature is correct for start-up
- DO NOT energize compressor drive motor!** This should only be done by authorized Factory Field Service Technicians.

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

The Start-up Supervisor will:

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

NOTE: Customer connections are to be made per the electrical diagram for the motor starter listed under the installation section and per the wiring diagram listed under the maintenance section of the IOM.

Please complete and sign this form & fax to 717-762-8624 as confirmation of completion.

Frick Sales Order Number: _____
 Compressor Model Number: _____
 Unit Serial Number: _____
 End User Name: _____
 Address of Facility: _____
 City, State, Zip: _____

Print Name: _____
 Company: _____
 Job Site Contact: _____
 Contact Phone Number: _____
 Signed: _____

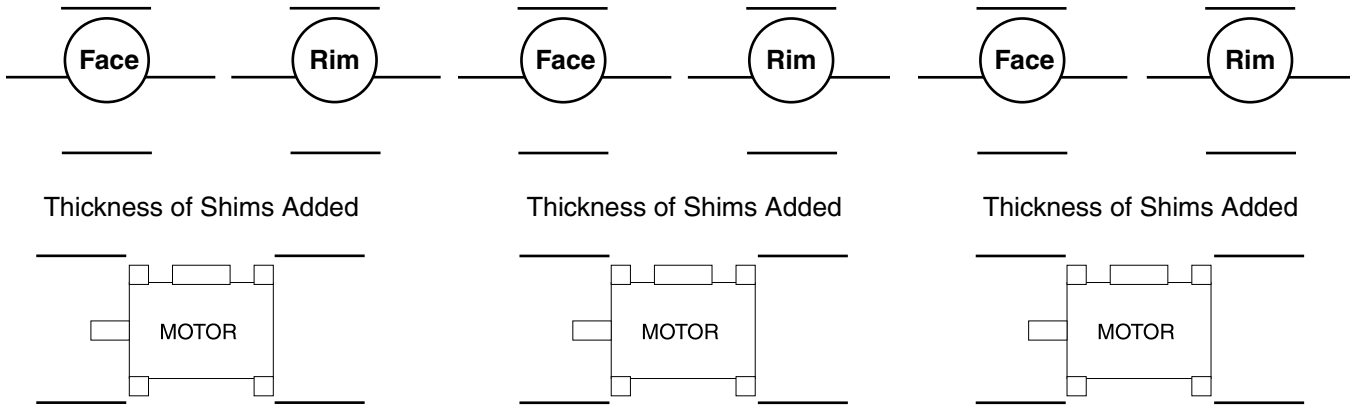
DRIVE TRAIN ALIGNMENT

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

Initial Cold Alignment

Initial Hot Alignment

Final Hot Alignment



OPERATING LOG SHEET

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

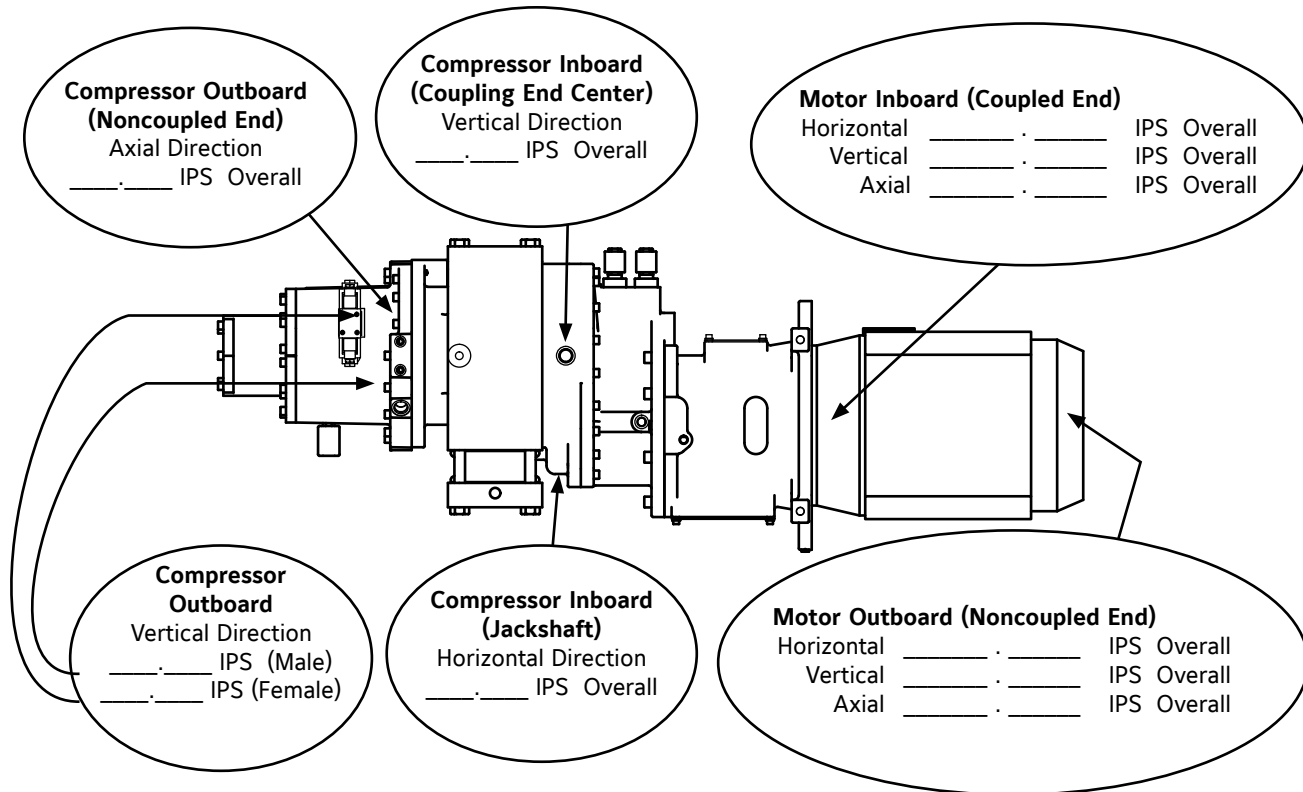
VIBRATION DATA SHEET

Date: _____
End User: _____
Address: _____

Sales Order Number: _____
Installing Contractor: _____
Service Technician: _____

Equipment ID (As in Microlog): _____
Compressor Serial Number: _____
Unit Serial Number: _____
National Board Number: _____
Running Hours: _____
Manufacturer and Size of Coupling: _____
Motor Manufacturer: _____
Motor Serial Number: _____
RPM: _____ Frame Size: _____ H.P. _____
Refrigerant: _____
Ambient Room Temperature: _____ °F
Operating Conditions: _____

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



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