Installation Instructions
06N Screw Compressors

SAFETY

Failure to follow these instructions could result in equipment damage, serious personal injury, or death.

- **WARNING:** **ELECTRIC SHOCK HAZARD!** Do not operate compressor or provide electric power to it unless the compressor terminal box is installed and the terminal box cover is in place and secured.
- **WARNING:** Do not provide power to unit or turn-on compressor unless suction and discharge service valves are open.
- **WARNING:** **ELECTRIC SHOCK HAZARD!** Do not remove the compressor terminal box cover until all electrical sources have been disconnected.
- **WARNING:** **CONTENTS UNDER PRESSURE!** Compressor contains oil and refrigerant under pressure. Pressure must be relieved before installation, servicing or opening any connections.
- **WARNING:** **RISK OF PERSONAL INJURY! HOT** and **COLD** surface temperatures can occur during operation and can result in severe burns or frostbite.
- **WARNING:** **RISK OF PERSONAL INJURY!** Only approved refrigerants and refrigeration oils may be used.
- **WARNING:** Use nitrogen or inert gas for tightness/pressure testing. **DO NOT USE** oxygen or other industrial gases.
- **WARNING:** System strength/tightness test pressure may not exceed the compressor maximum Proof Test pressure on the tag. Close shutoff valves to isolate compressor if necessary.
- **WARNING:** Charge only with refrigerant that conforms to AHRI Standard 700.
- Only qualified, authorized, and appropriately trained HVAC or refrigeration personnel, should install, commission, and maintain this equipment.
- Use appropriate personal safety equipment where required. Safety goggles, gloves, protective clothing, safety boots, and hard hats should be worn where necessary.

Safety Decals

Install label 2TB0713 on inside of terminal box cover. Install label 06DA502503 on outside of terminal box cover. Install one label 06DA508142 on outside of terminal box and the other label 06DA508142 on inside of terminal box.

Operating Limits

Maximum Proof Test Pressure: 450 psig
Refer to Figures 1 and 2

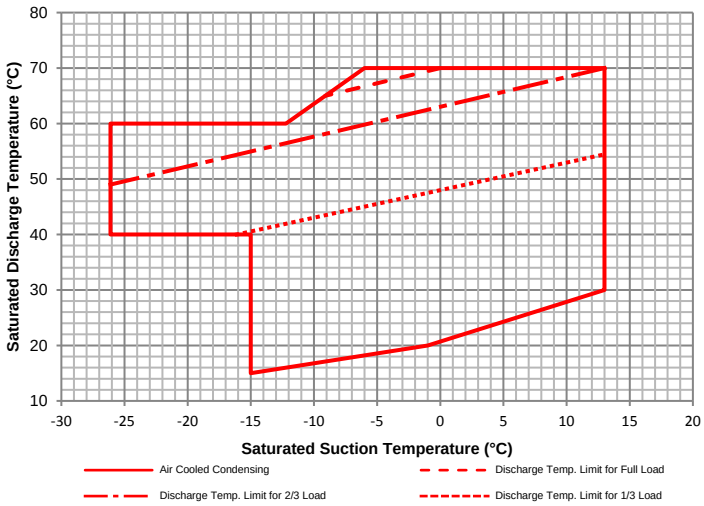

Figure 1 –Operating Envelope for Air Cooled Condensing

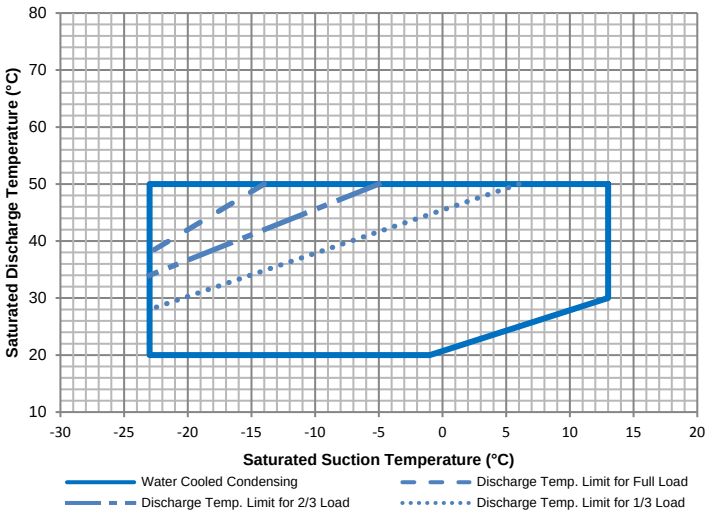

Figure 2 –Operating Envelope for Water Cooled Condensing

Application Drawings

Refer to Application Drawing 0TB0410

Approved Refrigerants

The 06N screw compressor is specifically designed for use in R-134a systems.

Approved Lubricants

The following lubricants are approved for use with 06N Series screw compressors:

- Carrier Material Spec PP47-13, PP47-14, PP47-32, or PP47-34, Viscosity Grade ISO 220

Note that all POE oils are very hygroscopic (will readily pick up and retain moisture from the air). Damaging acids can form if moisture is present. Oil should only be used from a properly sealed container.

Electrical Connections

- Compressor user must provide properly sized motor over-current protection. Use the electrical data on drawing 0TB0659 or the compressor nameplate to size the contactor and overload relay or circuit breaker.
- When circuit breakers are used for motor protection, they must be permanently marked "Special Purpose - Not For General Use" and should indicate must trip current not exceeding 140% of compressor rated load current.
- Motor protection system must protect against primary single-phase failure.
- Motor over-current protection system must protect all three phases.
- An appropriate terminal box must be installed.
  WARNING: Terminal box must be in place, with its cover installed, before power can be applied.
- Connect the compressor in accordance with the Application Drawing and the wiring diagram located on the terminal box lid.
- Power wires are to be connected to the terminal pins using ring terminals and jam nuts.
- The compressor terminals are copper feed through pins. Torque nuts in accordance with the Application Drawing
- **WARNING:** Disturbing the factory installed nut will jeopardize the seal integrity of the terminal pin.
- The motor temperature thermistors and a separate grounding lug connection are located in the terminal pin area.
- The T-series compressors are approved for use with Across the Line and Open or Closed Transition Wye-Delta starting methods.
  There are two critical timing parameters associated with the open transition Wye-Delta starting method.
  - Duration of the Wye connection shall be 5 to 10 seconds.
    WARNING: Overheating of the motor can occur if duration is too long.

  - Duration of the power interruption during the transition from wye connection to delta connection shall not exceed 0.049 second.
- Screw compressors are designed to operate in one specific rotational direction. Any operation with reverse rotation will result in damage to the compressor and possibly hazardous situations. Steps should be taken to prevent this condition. Depending on the phase relationship of the supplied power, the motor can start and run in either direction. Improper rotation will cause the compressor to seize and the motor will overheat.
  Verification of proper rotation can be accomplished by temporarily installing a suitable pressure switch located before the discharge check valve. The switch is to be wired so that it will open the compressor control circuit if the pressure falls below 50 mm Hg (2 inches) of vacuum, indicating reversed rotation. The switch must be a manual reset type that can be reset after the pressure has once again risen above 1.7 bar (25 psig).
  To correct the rotation, disconnect the power and then switch any two power leads.

Oil System Requirements

Oil is required to lubricate the bearings and provide a seal between the screw rotors and their bores. System pressure is used to generate the oil pressure in normal operation but is supplemented with an oil pump during start-up and situations with low system pressure differential. Oil pressure is to be monitored continuously during compressor operation. The oil pressure, P_O, must meet two set points based on discharge, suction and economizer pressure (P_D, P_S, and P_E respectively) as shown in Table 1 below and referenced in the oil system schematic shown in Figure 1.

OPER. TIME "T" (SEC)		LIMIT/REQUIREMENT	OPERATING CONDITION	COMP'R	OIL PUMP	OIL SOL'N'D
0	-40	ALL SENSORS IN RANGE		0	0	0
1	-39 < T ≤ -20	$P_O < P_{O\ @\ T=-40} + 2.5$ PSI	PRE-START: OIL CONTROL SOLENOID CHECK	0	1	0
2	-19 < T ≤ 0	$P_O > P_{O\ @\ T=-20} + 2.5$ PSI	PRE START: OIL PUMP CHECK	0	1	1
3a	T < 5	OIL PRESSURE IGNORED	START-UP	1	1	1
3b	5 < T < 120	$P_O > 0.125 \times T + P_E$		1	1	1
4a	T > 120	$P_O > P_E + 10$ PSI	IF $P_S < 35$ PSIG	1	0❶	1
		$P_O > P_E + 12.5$ PSI	IF $35 \le P_S < 51$ PSIG			
		$P_O > P_E + 15$ PSI	IF $P_S \ge 51$ PSIG			
		- AND -				
4b		$P_O > 0.235 \times (P_D - P_S) + 0.588 + P_S$	IF $(P_D - P_S) < 125$ PSIG			
		$P_O > 2.0 \times (P_D - P_S) - 220 + P_S$	IF $125 \le (P_D - P_S) < 165$ PSIG			
		$P_O > 0.6364 \times (P_D - P_S) + 5.0 + P_S$	IF $(P_D - P_S) \ge 165$ PSIG			

❶ OIL PUMP CAN BE USED TO INCREASE OIL PRESSURE AT LOW LIFT CONDITIONS

Table 1 – Oil Pressure Limits

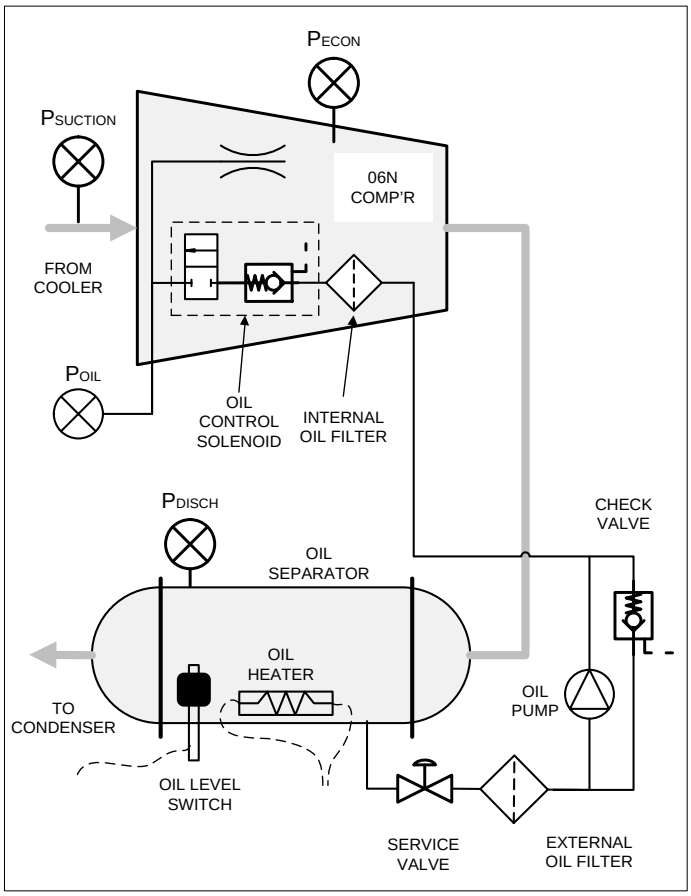

Figure 1 – Oil System Schematic

Table 1 shows the oil pressure limits base on the operating time "T" in seconds, where zero equals compressor start. The unit control system must monitor the oil pressure differential, as well as the operating condition so that the compressor can be shut down if the minimum requirements are not met for a duration exceeding 15 seconds.

Oil system capacity depends on the unit and circuit where the compressor is being installed. Most applications run between 4.5 and 8 gallons (17- 30 Liters). Refer to Carrier's 30GX, 30HXA, 30HXC Controls Start-Up, Operation Service and Troubleshooting for proper oil charge.

Installation Instructions
06N Screw Compressors

Unpacking and Pre-Installation Checks

- ☐ Unpack the compressor and check for damage.
  Note: It is common to have a small amount of oil that accumulates at the bottom of the discharge housing to rotor housing connection. This is the result of oil getting trapped in the o-ring groove during assembly. This does not indicate a refrigerant leak and will disappear after a start.
- ☐ Verify that a holding charge is still present. Compressors are shipped with a 0.5-1.4 bar (7-20 psig) nitrogen holding charge. The holding charge does not have to be removed until it is time to make connections to the compressor. The pressure can be released using the High Discharge Pressure Cut-out Port located on the discharge housing of the compressor.
- ☐ Perform a functional test on the capacity control solenoid valves & the oil control solenoid valve. Using a permanent magnet or a solenoid coil, activate each solenoid valve. There should be a distinctive "click" when the solenoid is energized & de-energized. The valve may have been damaged if there is no sound. Examine the valve stem to determine if it is bent or damaged.
- ☐ Inspect the terminal pins. Make sure that they are not bent or damaged. Winding continuity may also be checked using an ohmmeter. Resistances between pins 1 & 4 should be 0 to 0.3 ohms. The same resistances should be obtained between pins 2 & 5, and between 3 & 6. There should be infinite resistance between any pin and the compressor housing (ground).
- ☐ Refer to the Application Drawings for the correct method of lifting the compressor.

Installation Checks

- ☐ If the shipping blank-offs have not been removed, relieve the holding pressure as outlined above.
- ☐ Verify that the suction screen is installed.
- ☐ Torque the fasteners in a "criss-cross" pattern. Make sure the collar of a two piece discharge flange is not "cocked" or misaligned.
- ☐ Install appropriate terminal box.
- ☐ Install motor leads as shown on the application drawing and the terminal box label. Torque nuts to values given on the Application Drawing. Do not over-tighten nuts. Both the copper terminal pins and brass nuts can be easily damaged by over-tightening (refer to the Applications Drawing and the "Electrical Connections" section**)**.
- ☐ Connect grounding lead to grounding terminal.
- ☐ Connect a continuity meter to the oil level switch located on the oil separator. Gradually fill the oil separator with approved oil and note when the oil level switch is activated (closed). Record the amount of oil added at this point and the observed level in the sight glass. Continue to fill the oil separator until the proper amount of oil has been added. This will depend on the oil separator used. Make sure all the oil line connections have been properly made. Double check that the solenoid activation line is connected to the proper port on the bottom of the compressor and not to the rotor housing drain port.

Pre-Start and Initial Operation

- ☐ Verify that the oil separator has been properly charged. The oil level should be above the sight glass.
- ☐ Verify that the oil level protection circuit is working correctly by disconnecting the level switch to generate an alarm.
- ☐ Ensure that the system is properly charged with refrigerant.
- ☐ If an oil separator is used which does not allow liquid refrigerant to drain freely from the compressor, ensure that compressor is not filled with refrigerant by:
  Applying a supplemental crankcase heater on the compressor for at least 2 hours prior to starting.
  OR
  running chiller water that is a minimum of 20°F (11°C) below ambient temperature for a minimum of 3 hours.
- ☐ Verify the oil heater, located on the oil separator, has been activated for at least 4 hours prior to start.
- ☐ Ensure all temperature and pressure transducers are calibrated and working properly.
- ☐ Ensure all safety cutout switches are working correctly.
- ☐ Ensure all the safety limits pertaining to the Design/Operating Pressures and the oil system have been addressed.
- ☐ Check solenoid coil activation for the capacity control and oil control solenoid valves.
- ☐ Ensure that all service valves are open:
  Suction Service Valve (if equipped)
  Discharge Service Valve (if equipped)
  Liquid Line Service Valve
  Oil Filter Service Valve
  Economizer Valve
  Liquid Injection Valve
- ☐ Verify that the rotation and wiring of the compressor are correct before the compressor is operated. If operated in the reverse direction, the compressor may seize. Refer to the "Electrical Connections" section above.
- ☐ If wye-delta starting is used, verify that the duration in the wye configuration does not exceed the values outlined in the "Electrical Connections" section above. If a solid state soft-starter is used, make sure it is properly set to the manufacturer's recommendations.
- ☐ Verify that the oil pump is activated prior to compressor starting
- ☐ START COMPRESSOR
- ☐ Verify that the oil control solenoid energizes as soon as the compressor starts. If it does not, shut the compressor down immediately and make the appropriate corrections.
- ☐ Monitor the sight glass in the oil line to ensure that it is clear during operation.
- ☐ Check the oil level in the oil separator sight glass. The oil level should be above the sight glass during operation.
- ☐ Verify that the oil heater on the separator (and the compressor crankcase, if equipped) is off when the compressor is operating.
- ☐ After conditions have stabilized, load the compressor. The operating current should be compared to the expected current draw for the particular model and operating condition. Current values can be obtained from Carrier Compression Application Engineering.
- ☐ Record the suction, discharge, and oil pressures. Calculate the pressure drop across the oil filter ($P_{DISCHARGE}$ -P_{OIL}). Calculate the compressor operating differential ($P_{DISCHARGE}$ - $P_{SUCTION}$). Repeat this check after approximately 20 hours of operation to determine if there is a significant change. If a significant change is observed, the system may have been contaminated.
- ☐ Manually unload the compressor. Observe conditions and current draw to verify that a corresponding change occurs.
- ☐ SHUTDOWN COMPRESSOR
- ☐ If the compressor is operating correctly and does not shutdown on a fault or safety, it is recommend that the following are verified during the first few shutdowns.
  - Ensure that the compressor fully unloads before shutting down.
  - Ensure the compressor does not rotate backwards for more than two (2) seconds after shutting down.

安全性

如果不按照说明操作可能会导致设备损坏, 严重的人身伤害, 或死亡.

- **警告:** **触电危险!** 不要操作压缩机或给其供电，除非压缩机接线盒已经安装并且接线盒盖已经安全盖好.
- **警告:** 吸排气管路截止阀没有打开时，禁止给压缩机供电或者启动压缩机.
- **警告:** **触电危险!** 不要拿开压缩机接线盒盖，除非已经断开电源.
- **警告:** **内有压力!** 压缩机内有带有一定压力的冷冻油和制冷剂，在压缩机安装、维修或者打开连接处时必须先释放压力.
- **警告:** **人身伤害风险!** 压缩机运行时表面有高温和低温，可能导致严重的烧伤或冻伤.
- **警告:** **人身伤害风险!** 只可使用许可的制冷剂和冷冻油.
- **警告:** 用氮气或惰性气体做密封性/压力测试. **不要使用**氧气或其它工业气体.
- **警告:** 系统强度/气密性压力试验不得超过压缩机铭牌上的最大验证压力，必要时可以用阀门把压缩机与待测系统隔离开.
- **警告:** 充注的制冷剂必须符合 AHRI 700 标准.
- 只有合格的，经过认可的，和适当训练的暖通空调或制冷专业人士才可以安装、调试和维护该设备.
- 在需要时使用适当的个人安全设备.防护眼镜、手套、防护服、安全鞋和安全帽是必须穿戴的.

安全标贴

标贴 2TB0713 贴在接线盒盖内侧

标贴 06DA502503 贴在接线盒盖外侧

标贴 06DA508142 贴在接线盒盖外侧，另一张标贴 06DA508142 贴在接线盒内侧

运行范围

最大验证试验压力:450 psig
参见图 1 和图 2

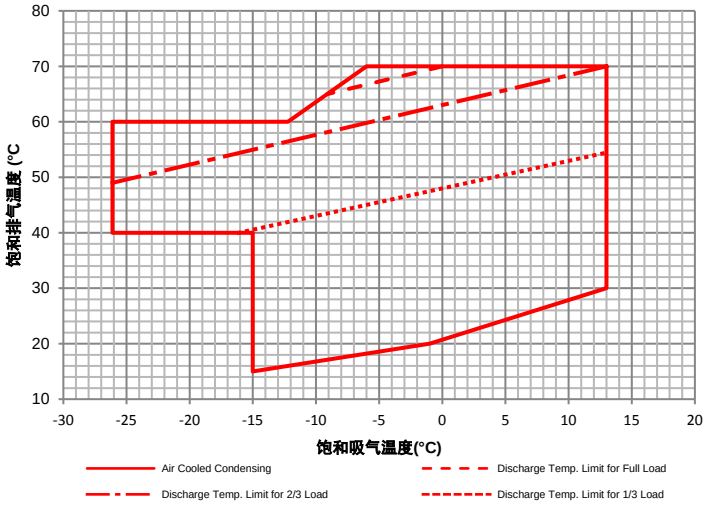

图 1-风冷冷凝运行范围

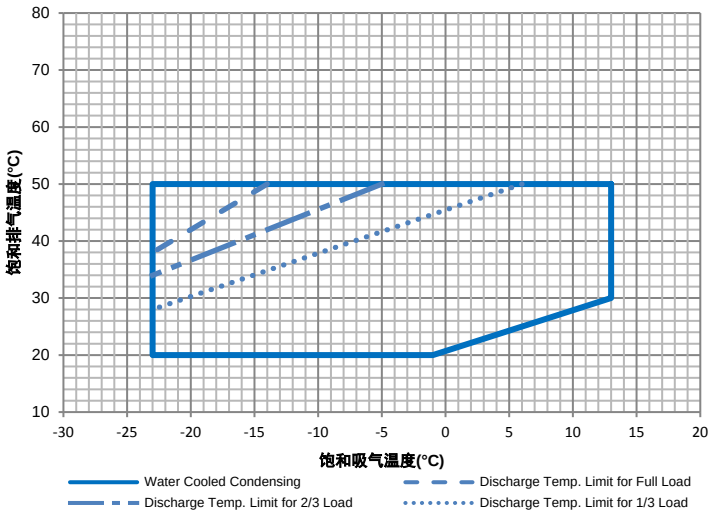

图 2-水冷冷凝运行范围

应用图纸

参考应用图纸 0TB0410

认可的制冷剂

06N 螺杆压缩机是专门为 R-134a 系统设计的

认可的冷冻油

下列冷冻油是批准使用在 06N 螺杆压缩机上的:
开利物料规范 PP47-13, PP47-14, PP47-32,或者 PP47-34, 粘度等级 ISO 220.
注意所有 POE 油很易受潮(很易吸收空气中的水分). 油在含水的情况下可能会形成有害的酸类. 冷冻 油应该来自密封良好的容器.

电气连接

- 压缩机用户必须提供跟电机大小匹配的过流保护装置。 使用图纸或压缩机铭牌上的电气数据来确定接触器和过载继电器或断路器的规格。
- 使用断路器保护电机时，断路器上必须永久表示“特殊用途-不通用”并应指明跳闸电流不可超过压缩机额定负载电流的 140%。
- 电机保护系统必须能够实现单相故障保护。
- 电机过流保护系统必须能够保护所有三相。
- 必须安装合适的接线盒。

警告:在接通电源前，接线盒必须安装到位，并安装有盒盖。

- 按照应用图纸连接压缩机并且将接线图布置在端子盒盖上.
- 用环形接线端子和锁紧螺母将电源线连接到接线柱上.
- 压缩机接线柱为铜质材料，按应用图纸规定的力矩拧紧螺母.
- **警告： 随意拧动出厂前安装的螺母将破坏接线柱的密封性。**
- 电机温度的热敏电阻和一个独立的接地接头布置在接线柱区域.
- T-系列压缩机允许使用跨线和开式或闭式转换星-三角启动方式.
  开式转换星-三角启动方式有两个关键的时间参数。
  - 星形连接的持续时间应为 5 到 10 秒。
    警告:如果持续时间过长电机可能会过热。
  - 从星形连接转换到三角形连接时电源中断的时间不能超过 0.049 秒。
- 螺杆压缩机被设计成在一个特定的旋向下工作。 任何导致反向旋转的操作都将对压缩机造成损坏和出现其他危险情况。 应该采取措施防止出现这种情况.。根据供电的相位关系，电机会在任意旋向启动和运行.。不正确的旋向会导致压缩机卡死和电机过热。
  在排气止回阀前安装合适的压力开关可以实现压缩机反转保护。这个开关需要连接，当压力低于绝对压力 50 mm Hg (2 inches)即表明压缩机反转，能开启压缩机保护控制电路。 这个压力开关必须是手动复位的，当压力再次超过 1.7 bar (25 psig)时能够复位。
  如果要更正旋转方向，可以再断开电源后互换任意两个电源线。

油系统要求

轴承的润滑需要油，并在螺旋转子及其孔之间提供密封。系统压力用于正常运行时形成一定的油压，但在启动和系统压力较差的情况下由用泵补充油压。压缩机运行时油压需不间断地监测。油压，Po，必须达到两个设定值，取决于排气、吸气和经济器压力（PD, PS, and PE），见下图所示表格 1 并参考图 1 所示的油系统原理图。

	工作时间 "T"（秒）	限制/要求	运行状况	压缩机	油泵	油电磁阀
0	-40	范围内所有传感器		0	0	0
1	-39 < T ≤ -20	$P_O < P_{O\ @\ T=-40} + 2.5$ PSI	预先启动：油控制电磁阀检查	0	1	0
2	-19 < T ≤ 0	$P_O > P_{O\ @\ T=-20} + 2.5$ PSI	预先启动：油泵检查	0	1	1
3a	T < 5	忽略油压	启动	1	1	1
3b	5 < T < 120	$P_O > 0.125 \times T + P_E$		1	1	1
4a	T > 120	$P_O > P_E + 10$ PSI	IF $P_S < 35$ PSIG	1	0●	1
		$P_O > P_E + 12.5$ PSI	IF $35 \le P_S < 51$ PSIG			
		$P_O > P_E + 15$ PSI	IF $P_S \ge 51$ PSIG			
		- 并且 -				
4b		$P_O > 0.235 \times (P_D - P_S) + 0.588 + P_S$	IF $(P_D - P_S) < 125$ PSIG			
		$P_O > 2.0 \times (P_D - P_S) - 220 + P_S$	IF $125 \le (P_D - P_S) < 165$ PSIG			
		$P_O > 0.6364 \times (P_D - P_S) + 5.0 + P_S$	IF $(P_D - P_S) \ge 165$ PSIG			

● 油泵可用于在低压状况下升高油压。

表 1-油压范围

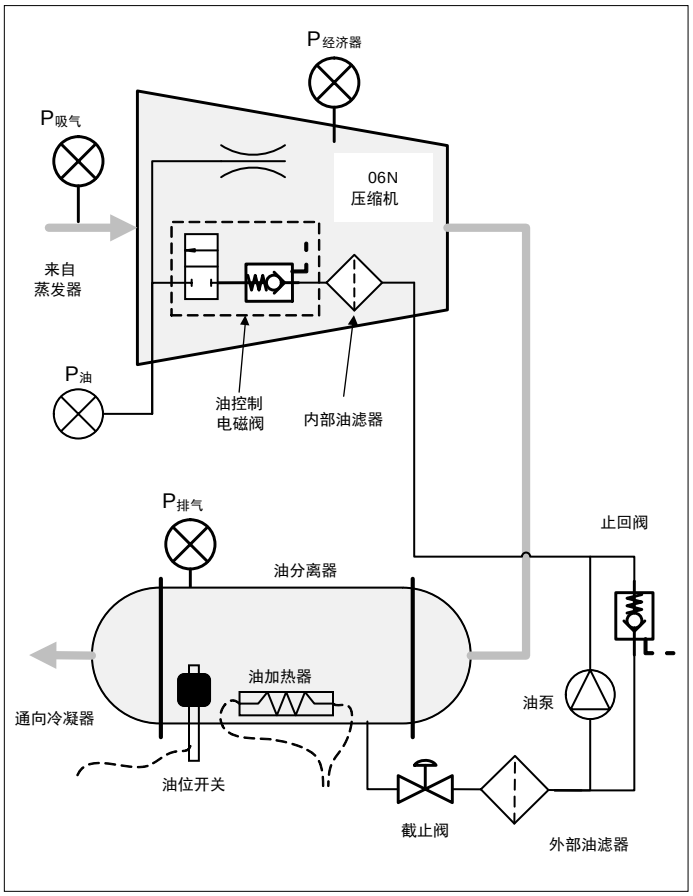

图 1-油系统原理图

表 1 显示了在基于工作时间“T”（秒）的油压范围, 其中零等同于压缩机启动压力。 机组控制系统必须监测油的压差，以及工作状态，以便在超过 15 秒的时间内不满足最低要求时压缩机可以关闭。

油系统的容量取决于安装在压缩机上的机构和循环路径。大多数应用下运行在 4.5 到 8 加仑（17-30 升）之间。参考开利的 30GX, 30HXA, 30HXC 控制启动，运行服务和故障排除，为适当的回油。

箱和安装前检查

- ☐ 开箱检查压缩机是否损坏。
- ☐ 注意: 在排气座和转子座连接处底部积有少量油是正常的。 这是由装配时 O 圈槽内积的油造成的。 这并不能表明有制冷剂泄漏且在开机后积油会消失。
- ☐ 校验保护气体是否还在。 压缩机船运时会充注 0.5-1.4 bar (7-20 psig) 的氮气作为保护气体。 不到连接压缩机的时候不需要放掉保护气体。 用压缩机排气座上的高压排气切断端口释放压力。
- ☐ 进行上下载电磁阀和供油电磁阀的性能测试。 用永磁铁或电磁线圈激活每个电磁阀。 当电磁阀通电和断电时需有响声。 如果没有声响，则该电磁阀阀可能已经损坏。 检查阀杆以确定是否弯曲或损坏。
- ☐ 检查接线柱。 确认它们没有弯曲或损坏。 也可以用电阻表检查绕组导通性。 接线柱 1 & 4 间的电阻为 0 至 0.3 欧姆。 在接线柱 2 & 5 和 3 & 6 之间的电阻应该与之相同。 任意接线柱和压缩机壳体(接地)之间的阻值应为无穷大。
- ☐ 正确的压缩机吊装方法参见应用图纸。

安装检查

- ☐ 如果运输板没被移除，请先按上文所述释放压缩机内气体。
- ☐ 验证吸入滤网已经安装。
- ☐ 连接压缩机和油分时，安装前将垫片浸入油中。 在安装前擦拭掉多余的油。 用十字扳手拧紧紧固件。 确认两片排气法兰边缘没有翘起或不重合。
- ☐ 安装合适的接线盒。
- ☐ 按应用图纸和接线盒标签所示的方法安装电机引线。 把螺母拧至应用图纸中给出的力矩值。 不要把螺母拧的过紧。 铜接线柱和黄铜螺母在过紧时都容易被损坏(参见应用图纸和“电气连接”章节)。
- ☐ 连接接地线和接地端子。
- ☐ 连接一个连续性测试器到油分上的油位开关上。 用认可的油逐渐的注满油分并注意油位开关已经触发(闭合)。 记录此时注入的油的量并通过视镜观察液位。 继续往油分中注入油直至油量适当。 油量取决于所用的油分。确认油管路已经适当的连接。 再次检查上下载电磁阀供油管路连接到了压缩机底部的正确端口上，而不是转子座底部的排油口。

开机和初始化操作

- ☐ 验证油分已经正确的加注。 油位应超过视镜。
- ☐ 断开液位开关发出警报声以验证油位保护电路是否工作正常。
- ☐ 确保系统正确的注入制冷剂。
- ☐ 如果使用不能让液态制冷剂自由的从压缩机中排出的油分，确保在下列情况之前压缩机没有注入制冷剂:
  开机 2 小时前激活压缩机上辅助曲轴箱加热器。
  或者
  在机组冷凝器中循环运行至少低于环境温度 20°F (11°C)的水至少 3 小时。
- ☐ 验证油分上的油加热器在开机前已经工作至少 4 小时。
- ☐ 确保所有温度和压力传感器都已经校准并工作正常。
- ☐ 确保所有安全保护开关都工作正常。
- ☐ 确保所有安全限值都符合设计/运行压力且油系统已得到处理。
- ☐ 检查上下载控制和油控制的电磁阀是否动作。
- ☐ 确保所有的备用阀门都已打开:
  吸气截止阀 (如果配备)
  排气截止阀 (如果配备)
  液体管路截止阀
  油过滤器截止阀
  经济器阀
  引射器阀
- ☐ 压缩机运转前验证旋向和布线是否正确。 如果反向运转，压缩机可能会卡死。 参见上述“电气连接”章节。
- ☐ 如果使用星-三角启动方式，确保星形连接方式的持续时间不超过上述“电气连接”章节中的值。 如果使用固定软启动方式，确保使用符合制造商建议的设置。
- ☐ 压缩机启动前确认油泵已启动。
- ☐ 启动压缩机
- ☐ 压缩机一启动验证油控制电磁线圈是否通电。 如果没有，立即关闭压缩机并做出正确的修正。
- ☐ 用视镜监测油管路中的油在运行期间是否清洁。
- ☐ 从油分上的视镜检查油位。 运行期间油位应在视镜之上。
- ☐ 验证油分上的油加热器(压缩机曲轴箱，如果配备)在运行期间是否关闭。
- ☐ 在工况稳定后，给压缩机加载。 对比实际运行电流和对应型号压缩机相应工况下的电流值。电流值可以从开利应用工程部门获得。
- ☐ 记录吸气，排气和油压力。 计算通过油过滤器的压降($P_{排气} - P_{油}$)。 计算压缩机运行压差($P_{排气} - P_{吸气}$)。 在运行大约 20 小时后重新检查以判定是否有显著变化。 如果观测到显著变化，系统可能有垃圾。
- ☐ 手动卸载压缩机。 观测工况和电流值以验证是否有相应的变化发生。
- ☐ 关闭压缩机
- ☐ 如果压缩机运行正常不要用故障或安全关机，建议在前几次关机时验证下列 2 条。
  - 确保压缩机在关机前完全卸载。
  - 确保在关机超过两(2)秒后压缩机不反转。