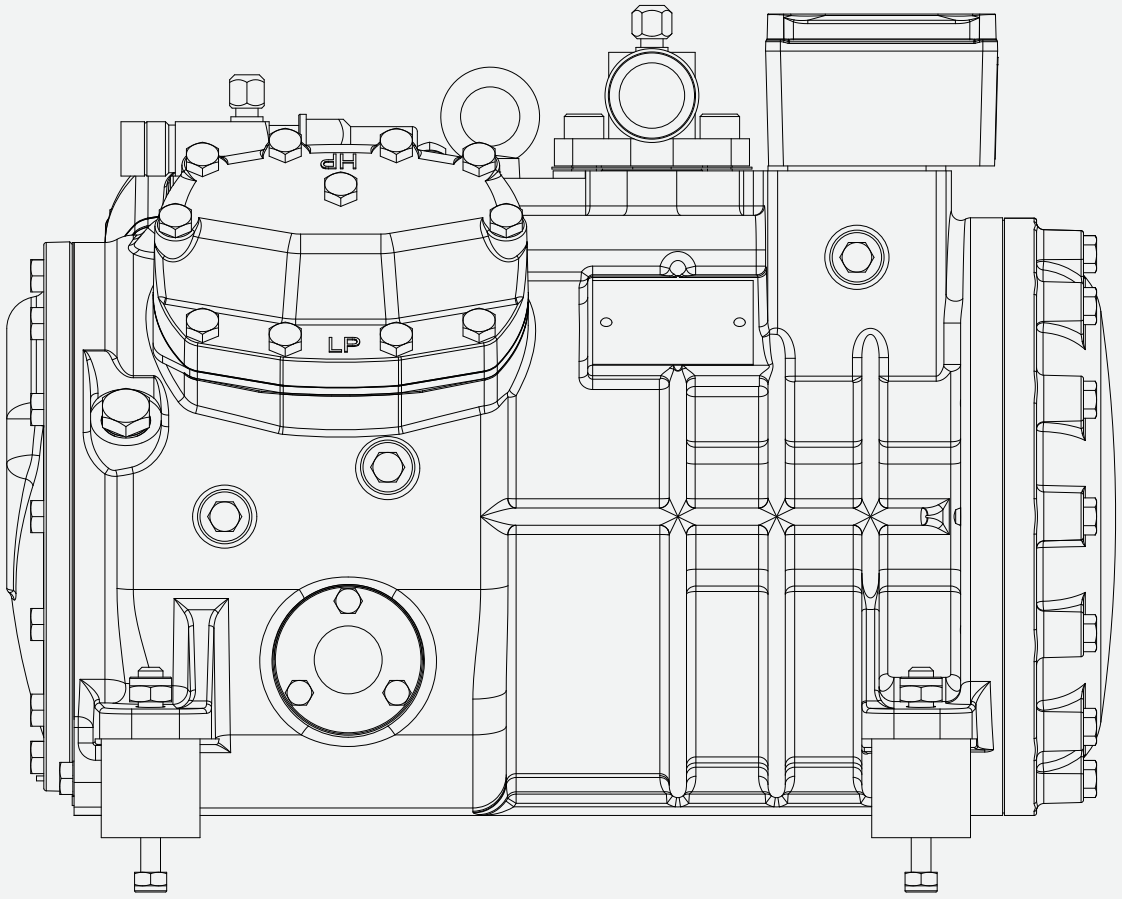
SEMI-HERMETIC RECIPROCATING COMPRESSORS

Installations and start-up instructions

安装和启动说明书

半封闭式往复式压缩机



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1. 目录

1. INDEX

说明

在装配和使用压缩机前，为了避免因错误安装而导致的压缩机严重损伤，请仔细阅读此手册。另外，请仔细参阅和遵守手册中的安全警示和规范。在压缩机从装配制造一直到最终使用，均须遵循此手册的规范要求。

INFORMATION

Before assembling and using the compressor, please read carefully these instructions. This will avoid improper use and incorrect assembly of the compressor that can result in serious or fatal injury. Observe the safety guidelines contained in these instructions. These instructions must always accompany the compressor from the manufacturer to the end-user.

安全标志说明

应遵守的一般警告或警示措施。严重危险。

触电危险

烧伤危险

禁止操作或擅动

Identification of safety instructions

General warning or cautionary measure to be observed. Serious hazard.

Electrocution hazard

Burn injury hazard

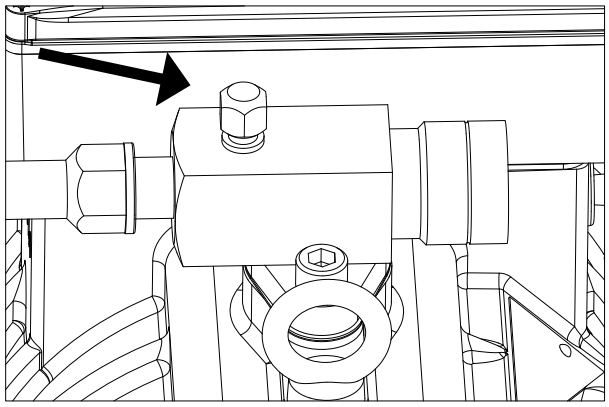
Forbidden maneuver or action

1. 开箱和处理

当压缩机送达您的仓库，请检查包装及任何可见的损坏，确定压缩机处于良好状态。
如果您发现任何损坏，请立即联系您的货运代理：发送一封挂号信给船公司对受损货物索赔，并抄送给富士豪。
然后，请按照装箱明细单核对包装内容。如果有任何问题，请即刻连络富士豪或当地经销商/代理商。

为了防止水汽、空气或者杂质渗漏，压缩机在离仓装运前已经充填了氮气。氮气压力大约1 bar / 14.5 PSI。

为确保压缩机仍然保有加压的氮气，从卡车上或木栈卸下压缩机时，可轻按任何充灌阀试压力。



阀门-螺栓拧紧扭矩

螺栓尺寸		M8	M10	M12	M16
拧紧力矩	lbf.ft	23.6	35.5	47.2	82.6
	Nm	32	48	64	112

不要对压缩机完全泄压, 即使在安装时也不要，使其在氮气压力下保持尽可能久的时间，使油位在视油镜的 1/4 和 3/4 之间。

为了避免大气腐蚀，压缩机交货前充入了比大气压高 0.5-1bar 的氮气。不正确的操作可能会导致眼睛或者皮肤受伤，请随时佩戴好护目镜。在压缩机内部压力没有完全释放前，请不要打开缩机阀门。

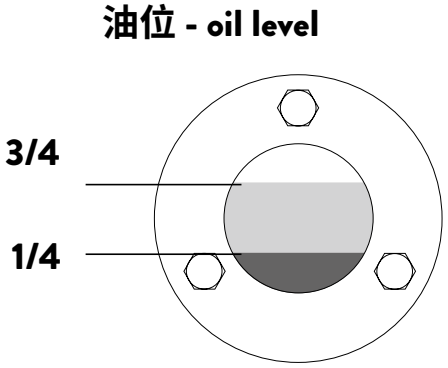
切勿将压缩机充注OFN (无氧氮气)以外的气体。切勿充注易燃或易爆的氧气或碳氢化合物。不遵守可能导致爆炸，人身伤害或死亡的风险。不要用 CFCs 加压，因为这可能在你的国家是禁止或非法的。

1. UNPACKING AND HANDLING

When the compressor reaches your warehouse, inspect the packing for any visible damage and make sure it is in good condition. In the event you detect any damage, please contact your forwarder immediately, send a registered letter to the shipping company claiming the suffered damage, a copy of which should be sent to Frascold. Next, check the contents of the packing against the packing list. Contact Frascold or the local distributor/agent immediately if any item is missing.

In order to prevent penetration of moisture, air, or impurities; the compressor has been charged with nitrogen before shipment from our warehouse. The compressor has been charged with about 1 bar / 14.5 PSI to nitrogen.

Please make sure the compressor still contains pressurized nitrogen when unloaded from the truck or taken out the crate by slightly depressing any schräder valve.



Valves - bolt tightening torque

Bolt dimensions		M8	M10	M12	M16
Tightening torque	lbf.ft	23.6	35.5	47.2	82.6
	Nm	32	48	64	112

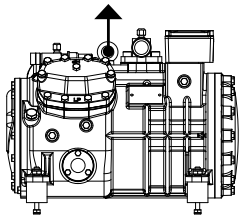
Never depressurize the compressor completely, and keep it under nitrogen pressure for as long as possible, even during the assembly. Verify that the oil level is between 1/4 and 3/4 of the sight glass.

The compressors are delivered with a holding charge of nitrogen of 0.5-1 bar above atmospheric pressure to avoid moisture contamination. Incorrect handling may cause injury to eyes and skin. Wear safety googles. Do not open the connections before the pressure has been totally released.

Never charge the compressor with anything else than OFN (oxygen-free nitrogen). Never use oxygen or hydrocarbons that are flammable or explosive. Failure to comply may result in the risk of explosion, injury, or death. Do not pressurize with CFCs either, as this may be prohibited by law in your country.

请使用钢链或钢缆绳和吊环螺栓（或铸铁起吊点，如果有的话）来起吊压缩机。

Always use steel chains or steel ropes and eye bolts (or cast-iron lifting points, where available) to lift the compressor.



每条钢链应当能够至少承受压缩机两倍的重量。如果没有钢链或缆绳，可以使用纺织绳索，它至少能承受压缩机4倍的重量。链条，纺织绳索和钢缆绳必须用钩环扣住(有封闭端)。如果不能用钩环扣住，此绳索必须绕过马达下方。

Each chain should be capable to bear a weight of at least twice the weight of the compressor. If steel chains or ropes are not available, textile ropes can be used, provided each is capable to bear a weight at least four times the weight of the compressor. Chains, textile, and steel ropes must have shackles (with closed ends). If shackles are not available, then the ropes must pass under the motor.

确保钢链不会碰到电磁阀，油毛细管，油加热器，温度传感器或电源端等，以防止任何可能的损伤。

Make sure that the steel chain does not touch the solenoid valves, oil capillaries, oil heaters, temperature sensors, power terminals, etc., to prevent any possible damage.

不知道它的负载能力的情况下，不要试图使用绳索。压缩机是重型机械，意外坠落可能造成受伤或死亡。

Do not attempt to use a rope without knowing its loading capacity. Compressors are heavy machines that may cause injury or death in the event of an accidental fall.

吊起压缩机时要避免压缩机表面被绳索划伤。当吊起压缩机时应保持水平。

Avoid the compressor surface to be scratched by the rope while lifting the compressor. Keep the compressor horizontally while lifting it.

2. 安全须知

根据欧盟机械指令2006/42/CE和相关法律法规，富士豪的压缩机是为机组或半成品的机组而制造的。只有遵守了相应的规定，机组才能被投入运行。制造商声明可从富士豪的网站下载，这展示了富士豪半封闭往复式压缩机是相当安全的，这些安全说明和用户手册无论何时何地都应该被严格遵守。

本手册应始终随附在压缩机一起，并且必须将这些说明与原理图和接线图一起整合到压缩机所在机组的用户手册中。只有经过相关培训和指导的人员才能对压缩机和制冷系统进行相关操作。钎焊设备和 HFCS 化合物制冷剂的处理受法律管制，只能由持有相关资质证书并具有完全身心能力的专业人员来操作。制冷人员的资格和知识必须符合贵国现行的要求。特别强调的是用户安全，与可持续发展，能源效率，环保意识，构成了富士豪的企业社会责任。

2. SAFETY

Frascold's compressors are built for and destined to machines or partly completed machines, according to the EC Machine Directive 2006/42/CE and following applicable legislation. They may be put in operation only if the corresponding provisions have been followed. The Manufacturer Declaration, which can be downloaded from Frascold's website, declares that *semi-hermetic* compressors are safe, wherever and whenever these safety instructions and the user manual is strictly followed.

This manual shall always accompany the compressor to which it was supplied with, and it is compulsory to integrally incorporate these instructions into the user manual of the machines into which the compressor is incorporated, together with the principle schemes and wiring diagrams. Any operation on the compressor and the refrigeration system shall be carried out only by personnel who has been properly trained and instructed. Handling of brazing equipment and HFCs refrigerants are regulated by law and shall only be carried out by personnel in possession with proper personal certification and in full psycho-physical capability. The qualification and knowledge of the refrigeration personnel must comply with the requirements in force in your country. Particular emphasis has been

placed on the users' safety which, together with sustainable development, energy efficiency, and environmental awareness, form Frascold's Corporate Social Responsibility.

残留的危害
不可能完全消除与压缩机运行相关的所有危险。因此，所有操作或维护都必须由专家、或授权给熟悉制冷系统的人员进行，他们应遵守与特定应用相关的所有安全规范和措施。

排气管温度可能达到 120°C，因此会造成皮肤灼伤。建议贴上适当的标示，以避免意外接触。压缩机有压力（比大气压力高 0.5-2 巴），不正确的操作可能会导致受伤，应穿戴安全装备，在压力未释放前不要打开压缩机阀门。

Residual hazards
It is not possible to completely eliminate all hazards connected to the operation of the compressor. It is, therefore, necessary that all maneuvers or maintenance is carried on by expert, authorized, and aware personnel, who shall observe all concerning safety measures pertaining to the specific application.

The discharge tube may reach 120°C and therefore cause skin burns. It is recommended to display the appropriate markings to avoid accidental contact. The compressor is under pressure (0.5-2 bar above atmospheric pressure); incorrect handling may causeinjuries; wear safety devices, and do not open connections before pressure has been released.

3. 适用范围

适用冷媒	HFC- HCFC
压力范围	高压最高压力 30 bar / 435 PSI 低压最高压力 20.5 bar / 297 PSI
操作限制	请参阅富矢豪 FSS3 选型软件，从网站上下载。
工作环境温度范围	-30°C a +70°C / -22°F a +158°F
仓储环境温度范围	-30°C a +60°C / -22°F a +140°F (避免水汽生成)

3. APPLICATION RANGES

Authorised refrigerants:	HFC- HCFC
Pressure ranges	30 bar / 435 PSI max on high side 20.5 bar / 297 PSI max on low side
Operating limits	See selection program Frascold FSS3, downloadable from website
Ambient temperature operation range	-30°C to +70°C / -22°F to +158°F
Warehouse temperature range	-30°C to +60°C / -22°F to +140°F (avoid moisture formation)

压缩机自带油的型号：

Oil table:

冷媒 / Refrig.	压缩机 / Compr.	编码 /code	黏度 /viscosity	类型 /type
HFC + R22	A-B-D-F-Q-S	T00ACD32	32 cSt	POE
	双级压缩机 / two stage			
	V-Z-W	T00ACD68	68 cSt	POE
R22 (按需提供/on request)	A-B-D-F-Q-S	T00FR32	32 cSt	MIN
	V-Z-W	T00FR68	68 cSt	MIN
	双级压缩机 / two stage	T00PX4542	46 cSt	AB

上述范围之外的任何其他用途，或使用不同的制冷剂和润滑油，必须事先获得富士豪的书面授权。更多信息请访问 FTEC 26.01。

Any other use outside the above ranges, or with different refrigerants and lubricants, must be authorized in advance by Frascold in written form. More information available on FTEC 26.01

压缩机在高于本手册规定的系统压力下使用会对人员健康和安全构成风险，并可能导致死亡或受伤以及财产损失。如果制冷回路不密封，在低于大气压的蒸发压力下使用可能会导致空气和水分进入制冷回路。

The usage at higher pressures than hereby specified is a risk for health and safety and may cause death or injuries and damage to properties. Usage at lower evaporating pressures than atmospheric may cause air and moisture to enter the refrigeration circuit, in the event it is not air-tight.

4. 安装

对于如何处理，请参阅第1章。半封闭压缩机必须水平安装。如果用于船用设备，请联系富士豪。

压缩机是不适合安装在具有化学侵蚀性、细菌污染、放射性活跃的或潜在爆炸性环境或空气中，除非取得富士豪特别的书面授权。绝不能将压缩机安装在会使压缩机表面温度超过温度限制的房间或场所，限制条件如前面章节所述。对于压缩机装在户外的情况，最好安装适当的挡雨罩，用来保护压缩机的元器件。在运行期间，压缩机的低温段最好用一些绝缘保温棉包起来，以防止结露结霜现象产生。

运输
用螺丝将压缩机锁在托盘上运送，或使用吊环螺栓来吊起压缩机。(见第 5 页)

安装
压缩机必须始终牢固地安装在可以承受压缩机产生的静态和动态力的钢架上。在启动过程中，压缩机可能会产生较高的反扭矩，特别是在直接启动时。因此，为了防止振动并减少通过钢架传递的噪音，建议使用压缩机附带的橡胶减震垫。

压缩机不能安装在非专门设计用于承受压缩机产生的重量和加速应力的其他支架上。

如果压缩机安装在橡胶减震垫上，当螺母达到推荐扭矩或螺栓牵引使减震垫厚度略有减少时，就表示螺母已经被拧紧了。

4. MOUNTING

For handling, please refer to chapter 1. Semi-hermetic compressors must be installed horizontally. In case of marine application, please contact Frascold.

The compressors are not suitable for installation in chemically aggressive, bacteriologically contaminated, radiologically active, or potentially explosive environments or atmospheres, unless specifically authorized by Frascold in written form. The compressors must never be installed in rooms or areas where the superficial temperature of the compressor can exceed the limits specified in the previous chapter. In case of outdoor installation, use suitable covers to protect the compressors from the elements. Thermal insulation of the compressors cold parts is recommended to avoid ice formation during operation.

Transport
Transport the compressor screwed on a pallet or lifted by using the eyebolts. (see pag.5)

Installation
Compressors must always be solidly fixed to a frame, suitable to withstand static and dynamic forces originated by the compressor. During start-up, the compressor can originate a high counter-torque, especially when started with a direct on-line connection. For this reason, and in order to prevent small vibrations and reduce the noise transmitted through the frame, it is advisable to use the rubber vibration dampers supplied with the compressor.

Compressors cannot be installed on other supports not specifically designed to withstand the weight and acceleration originated by the compressors.

If the compressor is mounted on vibration dampers, the nut tightening is concluded when the recommended torque is reached or when the antivibration mounting thickness has been slightly reduced by the bolt traction.

压缩机 Compressor	振动阻尼器代码 Vibration dampers code	直径 [mm] Diameter [mm]	高度 [mm] Height [mm]	固定螺栓 Fixing	硬度 Shore +/-5
A-B-D	T00SSA1	30	30	M8	45
F-Q	T00SSA15	40	40	M8	45
S	T00SSA3	50	50	M10	55
V	T00SSA4	50	30	M10	55
Z	T00SSA9	50	40	M10	55
W	T00SSA5	50	40	M10	73

4.1 焊接

⚠ 压缩机处于氮气保压下；不正确的操作可能会导致人员受伤，请佩戴安全装置。在压缩机内部氮气未被释放之前，请不要打开压缩机阀门，始终避免空气进入压缩机内部。

管路连接用毫米或者英寸为单位的标准管，使用钎焊连接。根据阀门的大小，管路可以安装在不同的内部位置。在焊接过程中和焊接后，要注意冷却阀门，不要让阀门过热，保证最高温度不超过 700°C /1292°F。 请使用清洁、干燥的管路和零件，以及密封圈。 当焊接管路时，请确保吸排气阀门不能有拉伸变形。当管道完成后（如果是刚性的），在没有安装螺栓的情况下，截止阀须保持在正确的位置。一旦装配，请保护好焊接件和安装螺栓，如果有掉漆现象，用适量油漆自喷漆补好损坏的表面。

⚠ 应在液管强制安装干燥过滤器，并且建议在吸气端安装 25 目或更小的吸气过滤器。

4.2 马达保护 KRIWAN INT69® Diagnose

INT69 Diagnose 的马达保护器是已被认证的 KRIWAN 压缩机保护装置的升级版，多加了一个额外的排气传感器的输入。其灵活的反应保护功能可以延长冷冻系统的使用寿命。全面的诊断和数据存储功能可协助快速而可靠地判别可能的故障原因。马达的温度监测经由两个方式评估:

· 静态：如果在马达绕组的温度缓慢升高，当内置 PTC 传感器的额定反应温度到达时，马达立即切

4.1 Brazing

⚠ The compressor is under pressure; incorrect handling may cause injuries, wear safety devices, and do not open connections before pressure has been released. Always avoid the entry of air into the compressor.

The pipe connections are designed for standard tubes in millimeters or inches. Use solder connections. According to the size of the valve, the tube can be fitted in different internal positions. Do not overheat the valves. Cool them during and after brazing, guaranteeing a maximum brazing temperature of 700°C / 1292 °F. Use clean and dry tubes and components that are delivered with air-tight seals. When brazing the pipes, make sure that they do not generate tensions on the discharge and suction shut-off valve. When the pipe is completed (if rigid), the shut-off valve must remain in the correct position on the compressor without mounting screws on. Once assembled, protect the welded parts and the assembly screws of the shut-off valve with appropriate paint.

⚠ A filter drier should be mandatorily installed on the liquid line, and it is advisable to install a molecular sieve with a 25-micron mesh or less on the suction line.

4.2 Motor protection KRIWAN INT69® Diagnose

The INT69 Diagnose motor protector is an upgraded version of the proven KRIWAN compressor protection units with an additional input for a discharge gas sensor. Its additional flexible-response protective functions can extend the service life of a cooling system. The comprehensive diagnostics and data storage functions help to identify the causes of possible malfunctions quickly and reliably. The temperature monitoring of the motor is done with two evaluation methods:

• Static: If the temperature increases slowly in the motor winding, the motor is switched off immediately when the rated nominal response temperatures of the built-in PTC

断电源。
· 动态：如果马达绕组的温度不寻常的迅速增加时，马达会立即切断电源，就算如果温度仍然远低于内置 PTC 传感器的额定的反应温度，以免损坏电机。排气温度传感器的温度监测使用一个静态评估的过程。

以下的其他错误会造成马达停机：
· PTC 输入短路
· 接触器颤动(开关频率限制)

当马达冷却下来后或错误已修复，配合启动延迟后重新启动。
INT69 Diagnose 压缩机保护装置会自动保存操作上的(最近 7 天)和错误的数据(最后 20 个事件)在存储体中。此数据当有需要做分析时，可以在电脑上进行检索。

sensors are reached.
• Dynamic: If the temperature increases unusually quickly in the motor winding, the motor is switched off immediately, even if the temperature is still far below the rated nominal response temperatures of the built-in PTC sensors; this prevents damage to the motor.
The temperature monitoring of the discharge gas sensors uses a static evaluation process.
The following other errors result in a motor shut-down:
• Short circuit at the PTC inputs
• Contactor chatter (switching frequency limitation).

The motor is restarted with a restart delay after it has cooled down or the error has been repaired.
The INT69 Diagnose module automatically saves the operational data (last 7 days) and error data (last 20 events) in a non-volatile memory. This data can be retrieved on a PC as needed and analyzed for diagnosis.

端子接头 M5 用于 A-Q 系列压缩机，要连接到装置的扣件上(用于 S 系列压缩机是 M6) 。
Terminal connection M5 for compressors A-Q to be connected to the faston of the device (for S compressors is M6)

端子接头 M8 用于 V-W 系列压缩机，要连接到装置的扣件上。
Terminal connection M8 for compressors V-W to be connected to the faston of the device

4.2-1. 技术资料

供电压	- AC 50/60Hz 115-230V ±10% 3VA
允许的环境温度	-30°C ÷ +70°C / -22°F ÷ +158°F
温度测量回路	
- 类型	PTC, 依据 DIN 44081/082
- 传感器数量	1-7 串联
- 总阻抗	<1.8kΩ
- 跳脱，静态	4.5kΩ ±20%
- 复位	2.75kΩ ±20%
复位延迟	
- 跳脱，马达绕组	
静态	1min ±20%
动态	5min ±20%
- 跳脱，排气传感器	10min ±20%
- PTC 短路监控系统	通常情况 <30Ω
- 马达运转认可	20-90Hz,200-460V ±10%
- 接触器颤动停机	>30 秒内 2 次
- 复位延迟	5min ±20%

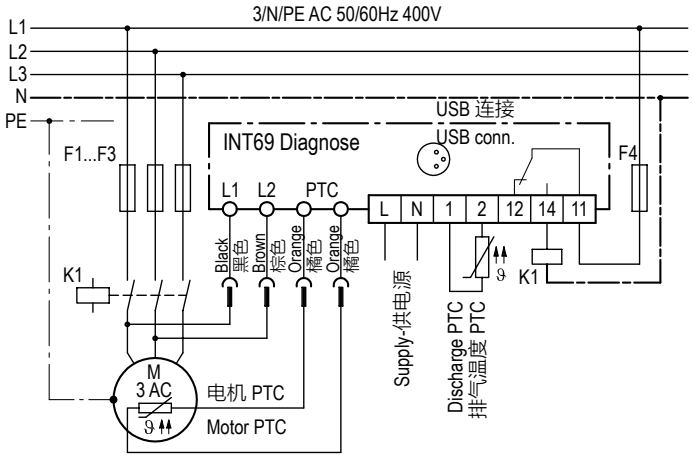
4.2-1. Technical data

Supply voltage	- AC 50/60Hz 115-230V ±10% 3VA
Permitted ambient temperature	-30°C ÷ +70°C / -22°F ÷ +158°F
Temperature measuring circuits	
- Type	PTC, according to DIN 44081/082
- Number of sensors	1-7 in series
- Rtotal @25°C	<1.8kΩ
- Rtrip, static	4.5kΩ ±20%
- Rreset	2.75kΩ ±20%
Reset delay	
- Ripping, motor winding:	
static	1min ±20%
dynamic	5min ±20%
- Tripping, discharge gas sensor	10min ±20%
- Short circuit monitoring system PTC	Typically <30Ω
- Operating recognition motor	20-90Hz, 200-460V ±10%
- Switch-off contactor chatter	>2 switchings in 30 s
- Reset delay	5min ±20%

继电器	
- 银镍 90/10	Max. AC 240V 2.5A C300 最大 Min. >AC/DC 24V, >20mA 最小
- 机械寿命	约百万开关周期
- 介面	KRIWAN 界面
- 保护等级依据 EN 60529	IP00
- 外壳材质	PA66/PA6, 增强尼龙玻璃纤维修复
- 重量	200g
- 检查依据	EN61000-6-2 / EN61000-6-3 / EN61010-1

Relay	
- AgNi 90/10	Max. AC 240V 2.5A C300 Min. >AC/DC 24V, >20mA
- Mechanical service life	Approx. 1 million switching cycles
- Interface	KRIWAN interface
- Protection class acc. to EN 60529	IP00
- Housing material	PA66/PA6, glass fiber reinforced
- Weight	200g
- Test according to	EN61000-6-2 / EN61000-6-3 / EN61010-1

4.2-2 接线图



每台压缩机皆有配备 Diagnose 装置且在出厂时皆经过条码纪录。在某些情况下，你需要安装 Diagnose 装置在另一台压缩机上时，请告知富士豪。

4.2-3 读取储存资料

读取储存资料有下列几种方法:

- USB 转接头，T00EC57，用 app INTelligence 可以连接到手机端.
- Dp-Modbus Gateway，T00EC59，此元件可将串口信号转换成 Modbus 通讯协议，此为标准控制器界面。
- Modbus LAN Gateway。在此情况下，INT69 必须连接 Dp-Modbus Gateway 再连接到 Modbus LAN Gateway，即可在 LAN 端网内读取数据。

4.3 KRIWAN INT69® TML Diagnose

前面 INT69 Diagnose 提到的信息，在 INT TML Diagnose 中一样适用。INT69 TML Diagnose 多了油泵的控制功能，所以适用于 V，Z，W 系列的压缩机。INT250FR 油压开关必须直接的连结到此装置上而不必接线至控制箱。装置上 LED 灯可帮助进一步了解压缩机的运转情形。

4.2-2 Wiring diagram

Legenda schemi elettrici - Wiring diagrams key		
F1-F3	fusibili compressore	compressor fuses
F4	fusibile ausiliario	auxiliary fuse
K1	contattore compressore	compressor contactor
M	motore del compressore	compressor electrical motor
L1-L2	controllo tensione	voltage control
PTC	collegamento PTC motore	motor PTC connection
L-N	alimentazione dispositivo	power supply
1-2	collegamento sonda di mandata (prima di collegarla rimuovere la resistenza installata)	
1-2	discharge sensor connection (before connecting remove the installed resistance)	

Each compressor has a Diagnose device associated with the factory through barcodes. In case you need to mount a Diagnose device from another compressor, please warn Frascold.

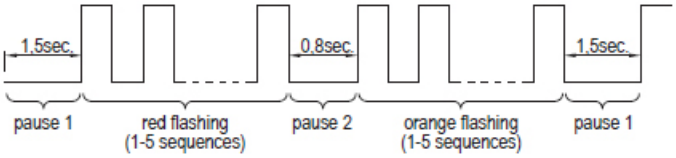
4.2-3 Stored data access

There are several ways to read the stored data:

- Using a USB adapter, T00EC57, connected to mobile using the app INTelligence
- Dp-Modbus Gateway, with code T00EC59, is a serial signal transducer to Modbus protocol, which can be interfaced with all standard controllers.
- Modbus LAN gateway. The INT69 Diagnose is connected to the Dp-Modbus Gateway and then connected to the Modbus LAN gateway, to have the data on the LAN net.

4.3 KRIWAN INT69® TML Diagnose

The information given for INT69 Diagnose in the previous section is all valid, even for the device INT69 TML Diagnose. The latter has the additional function of controlling the oil pump, and so it's suitable for compressors series V, Z, and W; the pressure switch INT250FR must be connected directly to the device and no longer at the cabinet. Further help to understand the operation of the compressor is given by the LED mounted on the device.



绿灯亮 Green lit: 压缩机待机 Compressor operational
绿灯闪烁 Green flashing:压缩机运行 Compressor running
红/橘灯闪烁 Red/Orange flashing:故障，压缩机停机，参见下表获取说明 Error, compressor is switched off

故障类别	红灯闪烁次数	橘灯闪烁次数	描述
电机温度	1	1	电机静态温度超温
		2	电机动态温度升温超限定标准
		3	电机静态温度超温复位延时
		4	电机温度传感器输入被检测到短路或开路
		5	电机动态升温超温复位延时
一般性	3	5	压缩机一般性故障复位延时

故障类别	红灯闪烁次数	橘灯闪烁次数	描述
油	4	1	油压差太低
		3	油故障复位延时
		4	油压差开关的传感器堵塞
		5	油压差开关传感器输入被检测到短路或开路
排气温度	5	1	排气温度超温
		2	排气温度超温复位延时
		3	排气温度传感器输入被检测到短路或开路

4.3-1. 技术资料

供电电压	- AC 50/60Hz 115-230V ±10% 3VA
允许的环境温度	-30°C ÷ +70°C / -22°F ÷ +158°F
温度测量回路	
- 类型	PTC, in accordo a DIN 44081/082
- 传感器编号	1-7 in serie
- 总电阻	<1.8kΩ
- 静态电阻	4.5kΩ ±20%
- 复位电阻	2.75kΩ ±20%
复位延迟	
- 跳脱，马达绕组： 静态 动态	5min ±20% 5min ±20%
- 跳脱，排气传感器	10min ±20%
- 油压差	90sec ±20%
- PTC 短路监控系统	通常情况 <30Ω
- 马达运转认可	20-90Hz, 175-690V ±10%
- 接触器颤动停机	>30 秒内 2 次
- 复位延迟	5min ±20%
继电器	
参考 INT69 Diagnose	详见 4.2-1
- 测试参考	EN61000-6-2 / EN61000-6-3 / EN61010-1

4.3-1. Technical data

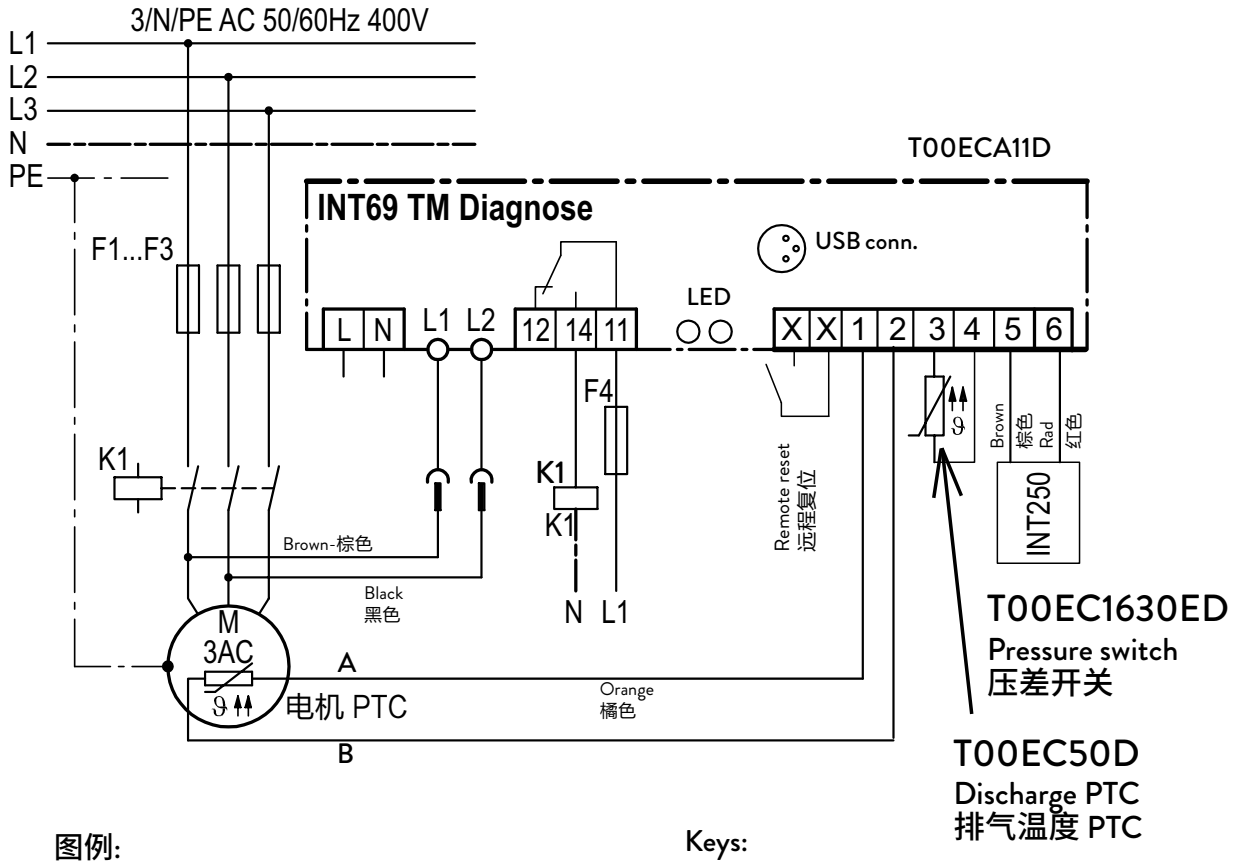
Supply voltage	- AC 50/60Hz 115-230V ±10% 3VA
Permitted ambient temperature	-30°C ÷ +70°C / -22°F ÷ +158°F
Temperature measuring circuits	
- Type	PTC, according to DIN 44081/082
- Number of sensors	1-7 in series
- Rtotal @25°C	<1.8kΩ
- Rtrip, static	4.5kΩ ±20%
- Rreset	2.75kΩ ±20%
Reset delay	
- Ripping, motor winding: static dynamic	5min ±20% 5min ±20%
- Tripping, discharge gas sensor	10min ±20%
- Oil differential pressure	90sec ±20%
- Short circuit monitoring system PTC	Typically <30Ω
- Operating recognition motor	20-90Hz, 175-690V ±10%
- Switch-off contactor chatter	>2 switchings in 30 s
- Reset delay	5min ±20%
Relay	
Identical to INT69 Diagnose	See section 4.2-1
- Test according to	EN61000-6-2 / EN61000-6-3 / EN61010-1

4.3-2. 接线图

DIAGNOSE 技术保护系统

4.3-2. Wiring Diagram

DIAGNOSE technology protection system



图例:

A-B	机温度 PTC 接口
F	保险丝
K1	接触器
L1-L2-L3	三相电
N	零线

更多信息请参考文件 FTEC239.01

Keys:

A-B	thermistor motor PTC terminals
F	fuse
K1	main contactor
L1-L2-L3	phase of electrical net
N	neutral

More infromation in our document FTEC239.01

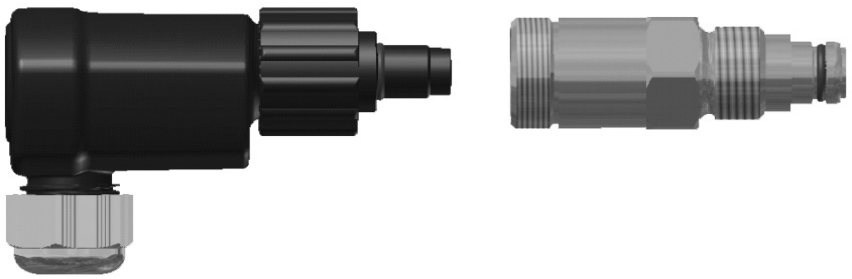
4.4 油压差开关 Olio INT 250

INT 250 油压差开关适用于润滑油压力控制，并作为 V，Z，Z-TK 和 W 系列半封闭压缩机的标准装备，其中包括(参考 fi.1):

4.4 INT 250 oil differential pressure switch

The INT 250 oil pressure switch is suitable for lubrication pressure control and is supplied as standard equipment with V, Z, Z-TK, and W semi-hermetic compressors and includes (see fig.1):

①



②

- fig. 1 -

① 控制回路:用螺钉安装固定即可。此元件放在压缩机的电气盒内。

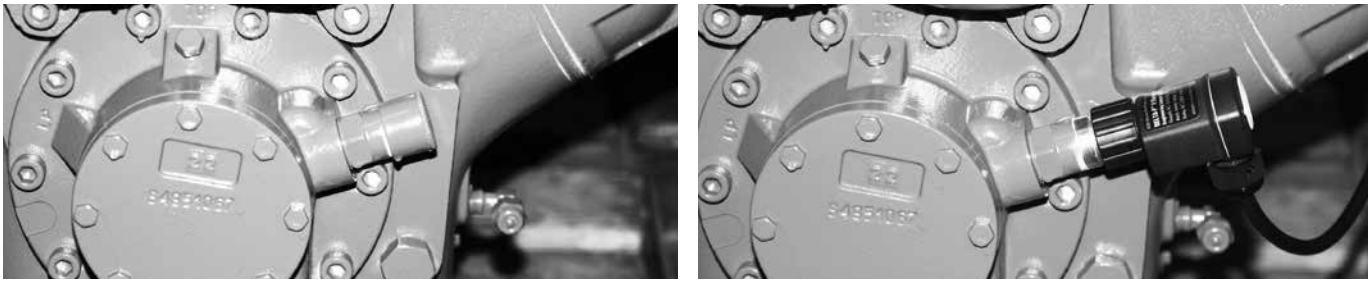
② 传感器: M20 x 1.5 公螺纹, 与油泵的压力测量口连接 (参考 fig.) . INT 250 安装容易快速, 无需安装支架, 进行维护操作时, 控制回路可以从传感器移除而且不会导致冷媒泄漏。

① control circuit; complete with fixing screw cap. This component is shipped in the compressor terminal box.

② sensor; M20 x 1.5 male threaded, factory assembled to the pressure connection of the oil pump (see fig.2). INT 250 mounting is easy and fast; no mounting bracket is required and, for maintenance operations, the control circuit can be removed from the sensor without refrigerant leakage.

压力开关连接件 INT250
INT250 pressure switch connection

Pompa di lubrificazione con pressostato INT250
Oil pump with INT250 pressure switch



- fig. 2 -

4.4-1. 技术数据

断设定压力:	0.65±0.15 bar / 9.43±2.18 PSI
工作环境温度:	-30°C ÷ +70°C / -22°F ÷ +158°F
防护等级:	IP54
电缆线长度 2 x AWG18:	1m
重量:	290 g
力开关设定值	
启动延时:	3s
延时时间 (综合的) :	90±5 s
外部复位:	Manuale

4.4-1. Technical data

Cut-out set point:	0.65±0.15 bar / 9.43±2.18 PSI
Operating ambient Temperature:	-30°C ÷ +70°C / -22°F ÷ +158°F
Safety class:	IP54
Length of connecting cable, 2 x AWG18:	1m
Weight:	290 g
Motor module protection setup values	
Start-up delay:	3s
Delay time (integrated):	90±5 s
Reset by external contact:	Manual

4.4-2 安装说明

1. 固定在压缩机上的传感器接头位置上(见图 2)移除保护盖

2. 把控制回路 ① 置入传感器 ② 和以手拴紧环形螺母 (力矩最大10 Nm / 7.4 lbf·ft)

3. 依照接线图连接压力开关

4.4-2 Mounting instruction

1. Locate the position of the sensor connection on the compressor body (see fig. 2) and remove the protection cap

2. Put the control circuit ① into the sensor ② and tighten the ring-nut (torque max. 10 Nm / 7.4 lbf·ft)

3. Connect the pressure switch following the below wiring diagram

4.4-3 操作

当油压差开关 INT 250 连接到位后,开关会监控超过或者低于固定设定值（0.65 ± 0.15 bar / 9.43 ± 2.18 PSI）油压差，并发送数字信号到控制模块。由于输出触点会立即响应规定的差压变化，控制模块（电机保护模块）必须在启阶段延迟干预（固定预置延时为 3s）。在压缩机启动时，控制模块的黑色和棕色电缆会发出信号，并计算延时。在正常运行期间，如果 90s 内压差没有大于设定值，则报警，报警继电器打开红色 RD 和棕色 BN 电缆之间的接触器。当清除报警信号后，操作员可以在控制模块上闭合远程复位端子持续至少 1s 或者通过关闭模块持续至少 5s，以重启压缩机。

4.4-3 Operation

The differential pressure switch INT 250, when connected with its fixing screw cap, monitors the oil differential pressure from exceeding or dropping a fixed set threshold (0.65 ± 0.15 bar / 9.43 ± 2.18 PSI) and signals these occurrences to the motor protection module with a digital signal. Since the output contact reacts immediately to the given differential pressure change, the controller (motor protection module) has to intervene with a delay at start-up (fixed pre-set delay time of 3s). As the compressor starts, the black and brown cables of the motor protection module signal it and make the delay timing starts as well. If during normal operation the minimum differential pressure is not reached within 90 seconds, the alarm relay opens the contact between the red RD and brown BN cables. After removing the alarm cause, the operator may restart the compressor by closing, for at least 1 second, the remote reset terminals on the motor protection module or by powering down the same controller for at least 5 seconds.

4.5 马达保护

马达保护模块的内容参考如下文件:

M232 用于没有油泵的压缩机
M239 用于有油泵的压缩机

4.5 Motor protection

Information on the motor protection device, refer to the document:

M232 for compressors without oil pump
M239 for compressors with oil pump

4.6 制冷量调节: TESTA CC

CC 能调缸盖可以安装在任意 Q,S,V,Z 和 W 系列的压缩机上，降低的步骤如下:

4 缸压缩机 (Q, S 和 V 系列) **置 1 个能调缸盖,**
- 降低至名义排气量的 50%

6 缸压缩机 (Z 系列) **可配置 1 个或 2 个能调缸盖,**
- 降低至名义排气量的 66%
- 降低至名义排气量的 33%

8 缸压缩机 (W 系列) **配置 1 个或 2 个能调缸盖,**
- 降低至名义排气量的 75%
- 降低至名义排气量的 50%

必须注意到的是冷冻能力和输入功率的减少并非与排气量相同比率。

4.6 Reduction of cooling capacity: CC HEAD

CC head can be installed on any Q, S, V, Z and W series compressor; the steps of reduction are:

compressors with 4 cylinders (series Q, S and V) **with 1 head**
- have displacement reduced to 50% of the nominal value

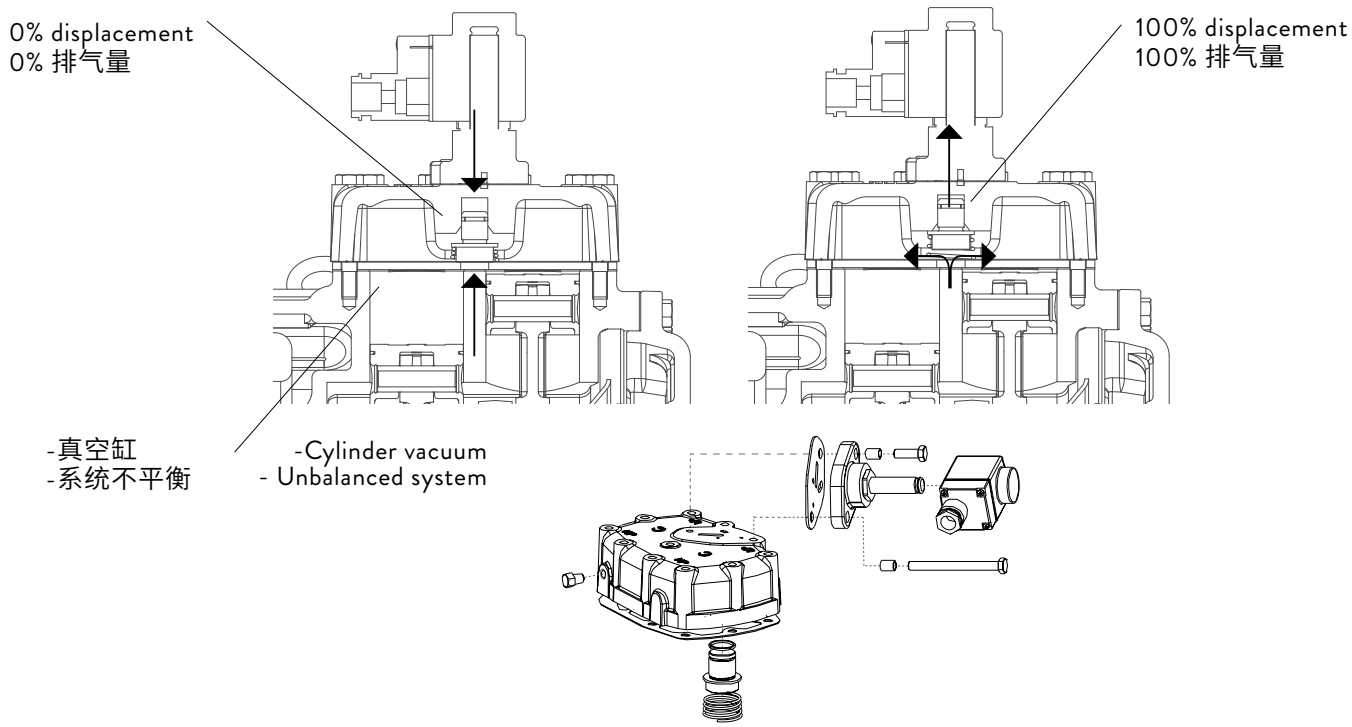
compressors with 6 cylinders (series Z) **with 1 or 2 heads**
- have displacement reduced to 66% of the nominal value
- have displacement reduced to 33% of the nominal value

compressors with 8 cylinders (series W) **with 1 or 2 heads**
- have displacement reduced to 75% of the nominal value
- have displacement reduced to 50% of the nominal value

It is important to notice that cooling capacity and input power are not reduced with the same ratio as displacement.

注意;
当压缩机 100% 运行时，至少保持运行 5 分钟后，方可首次打开 CC 能调，以后每次能调调节之间的时间间隔至少是系统稳定运行 5 分钟。

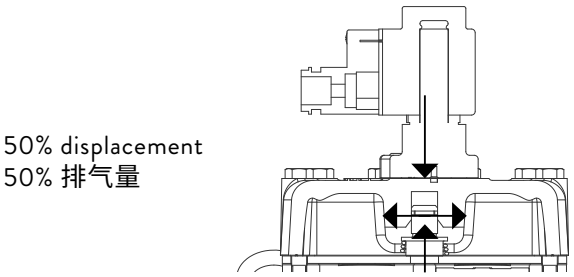
ATTENTION;
Please wait at least 5 minutes at 100% before switching ON the first CC head and again 5 minutes for every step of reduction to allow the stability of the system.



4.7 RSH 能调

D, Q, S, V, Z, W 系列可以安装 RSH 能调缸盖。RSH + CC 能调仅仅适用于 4 缸压缩机 (Q,S & V) 。适用于各种制冷剂以及整个应用领域。

如果所有 RSH 能调同步运行:
- 没有真空效应
- 非满载时振动等于或小于 100% 满载
- 75% 和 50% 能调 COP 相同
- 已安装压缩机也可翻新应用能调缸盖
- 运行期间可稳定曲轴箱内油位



- 所有活塞工作状态 (气缸非真空效应)
- 系统平衡

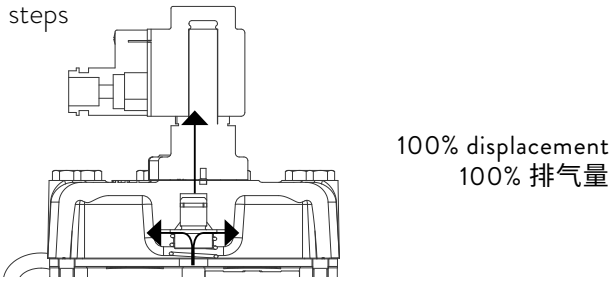
双缸压缩机 /2 cylinders compressors
50 % -100%

六缸压缩机 /6 cylinders compressors
1 x RSH: 83 % -100% 2 x RSH: 66% - 83% - 100% 3 x RSH: 50% - 66% - 83% - 100%

4.7 Capacity control RSH

Available for D, Q, S, V, Z, W. The RSH + CC configuration is valid only and exclusively for 4-cylinder compressors (Q, S & V) Suited to work with any gas and throughout the area of application.

If all the RSH are in simultaneous operation:
- No *vacuum effect*
- Vibrations in partial load equal to or less than 100% in
- COP to 75%, same as the one obtained at 50%
- Can be retrofit on compressors installed
- Stable oil level in the crankcase during operation of the steps



- All pistons keep working (no vacuum effect into the cylinders)
- Balanced system

四缸压缩机 /4 cylinders compressors
1 x RSH: 75 % -100% 2 x RSH: 50% - 75% - 100%

八缸压缩机 /8 cylinders compressors
1 x RSH: 87,5 % -100% 2 x RSH: 75% - 87,5 % - 100% 3 x RSH: 62,5% - 75% - 87,5 % - 100% 4 x RSH: 50% - 62,5% - 75% - 87,5 % - 100%

注意;
当压缩机 100% 运行时，至少保持运行 5 分钟后，方可首次打开 RSH 能调，以后每次能调调节之间的时间间隔至少是系统稳定运行 5 分钟。

ATTENTION;
Please wait at least 5 minutes at 100% before switching ON the first RSH head and again 5 minutes for every step of reduction to allow the stability of the system.

RSH D 系列		RSH Q/S/V 系列			RSH Z 系列				RSH W 系列				
	V1		V1	V2		V1	V2	V3		V1	V2	V3	V4
100%	○	100%	○	○	100%	○	○	○	100%	○	○	○	○
50%	●	75%	●	○	83%	●	○	○	88%	●	○	○	○
		50%	●	●	66%	●	●	○	75%	●	●	○	○
					50%	●	●	●	63%	●	●	●	○
									50%	●	●	●	●

○ 电磁阀不得电　● 电磁阀得电
V: 代表 RSH 电磁阀线圈

○ Valve de-energized ● Valve energized
V: coils of the RSH valves

对于选好的压缩机，如果贵司需要选用特别的制冷剂，或者需要选用其他比例的负载，以及可能产生的限制条件， 请通过富矢豪选型软件进行选择。

Please check on Frascold's selection software if for the selected compressors, with your specific refrigerant, if it is possible to use all the part load steps or if there are some limitations.

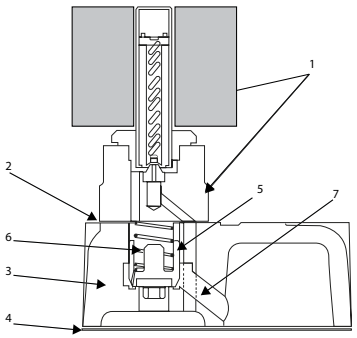
4.8 US 卸载启动汽缸盖

US head 卸载启动气缸盖让吸气压力和排气压力相当的接近；结果是导致一个比吸气压力高 0.5 bar 的通常压力。在这种方式下, 完成启动压缩机所需的启动转距以及输入电流都降低了。卸载启动模式可以在订购压缩机时在工厂装配上一个卸载启动气缸盖或是在安装现场再行安装此选配装置在压缩机上。

4.8 US head

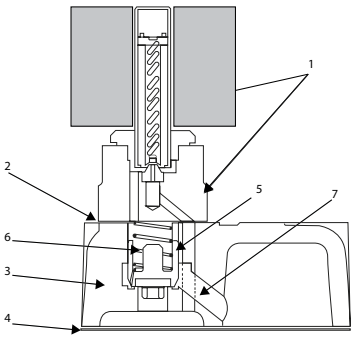
The US head allows the suction pressure and the discharge pressure to equalize nearly completely; the final result is a common pressure 0.5 bar higher than the suction pressure. In this way, the starting torque required to start the compressor completely is reduced as well as the input current. Unloaded start mode can be carried out by ordering a compressor equipped in the factory with a US head or mounting this option on the compressor after its field installation.

fig. A1



US 卸载启动汽缸盖 (图1) 基本包括:
- *带线圈的电磁阀(标注 1)*
- *垫片电磁阀/US 卸载启动汽缸盖(标注 2)*
- *汽缸盖(标注 3)*
- *垫片 US 卸载启动汽缸盖/阀板(标注 4)*
- *塞子(标注 5)*
- *弹簧(标注 6)*
- *吸气/排气通口(标注 7)*

fig. A1



The US head (see fig.A1) essentially includes:
- *1 solenoid valve with coil (ref.1)*
- *1 gasket solenoid valve/US head (ref.2)*
- *n°1 head (ref.3)*
- *n°1 gasket US head/valve plate (ref.4)*
- *n°1 stopper (ref.5)*
- *n°1 spring (ref.6)*
- *suction/discharge by-pass opening (ref.7)*

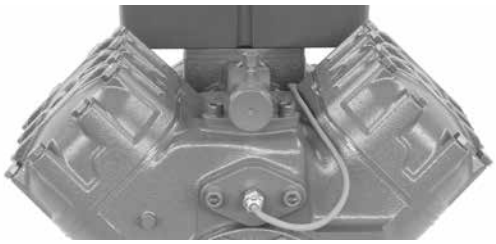
汽缸盖螺钉拧紧扭矩 - Head screw, tightening torque					
压缩机系列 - Compressors series	Q	S	V	Z	W
螺钉尺寸 - Screw dimensions	M8	M8	M10	M10	M10
拧紧扭矩 - Tightening torque (Nm)	40	40	80	80	80
拧紧扭矩 - Tightening torque (lbf.ft)	29.5	29.5	59	59	59

4.9 排气温度传感器

V, Z, W 系列压缩机均在排气端安装有一个温度传感器，用于监测压缩机的最大排气温度。

4.9 Discharge temperature sensor

The V, Z, and W series compressors are equipped with a sensor on the compressor discharge side to monitor maximum discharge temperature



一般信息

排气温度传感器可以与安全或者保护装置一起连接。

对于 Q, S, V, Z, W 系列以及 S(双级)系列压缩机，排气温度传感器可以与压缩机的保护模块连接，不管有无 diagnose 诊断。温度传感器可以通过线束供电，或者由两部分组成：金属部分通过螺纹装进压缩机内测温；电缆部分塞进金属内固定，然后与外界相连。

对于双级压缩机，2V和2Z系列，温度传感器能够连接到喷射装置，料号T00EC2252；此温度传感器由两部分组成：金属部分通过螺纹装进压缩机内测温；电缆部分塞进金属内固定，然后与外界相连。

General info

The discharge temperature sensor can be used in combination with a specific safety and protection device.

For compressors Q, S, V, Z, W series and S (two stages) series; can be connected to the module protection device with or without diagnose. Temperature probe can be supplied with integrated cable, or made up of two parts; a metal part to be screwed to the compressor and a cable to be inserted into the metal part simply by pressure.

For two stage compressors, 2V and 2Z series can be conneted to the INJECTION CONTROL CARD code T00EC2252; temperature proble is made up of two pats; a metal part to be screwed to the compressor and a cable to be inserted into the metal part simply by pressure.

供应

排气度传感器供应如下:

标准附件
V, Z, W 系列压缩机，排气温度传感器标配放在电气盒内。

可选附件
对于 Q 和 S 系列压缩机，排气温度传感器放在一个纸盒内供选配。

Supply

The discharge temperature sensor is supplied as follows:

Standard accessory
Supplied loose for compressors V, Z, and W. The temperature sensor is put inside the terminal box.

Optional accessory
Inside a cartoon box for compressors Q and S.

技术参数

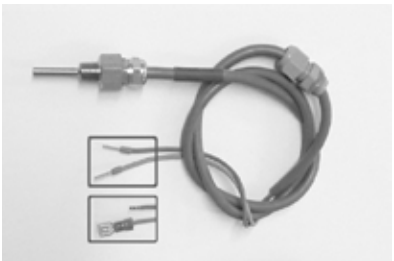
M17 六边形本体配 1/8" NPT 螺纹
80 cm 长电缆线，电缆端子接头如下:
- 针脚端子
- 针脚+铲形端子

PG7 电缆格兰头
- 温度设定 140°C (160°C for TK) / 284°F (320°F for TK)
- 防护等级 IP67

Technical data

M17 HEX shape body with male 1/8" NPT thread
80 cm cable with following terminals:
- pin lags
- pin lag+faston

PG7 cable gland
- Temp. set 140°C (160°C for TK) / 284°F (320°F for TK)
- Protection class IP67



温度探头和电缆线 / TEMPERATURE PROBE WITH INTEGRATED CABLE

温度探头、电缆线各自结构 / TWO PARTS TEMPERATURE PROBE

安装步骤

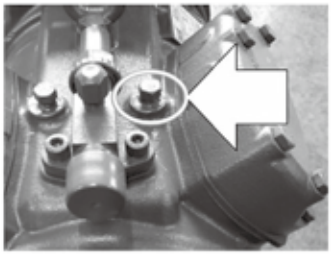
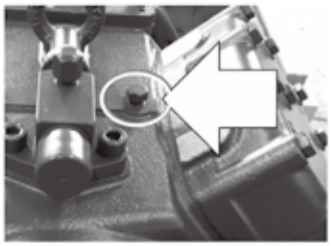
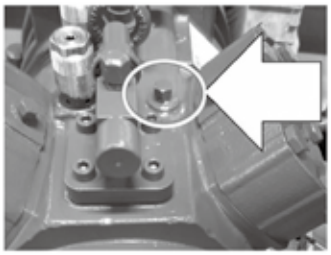
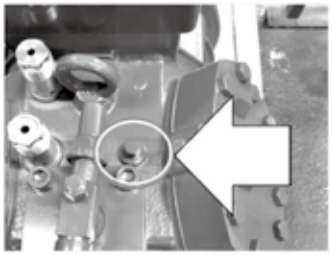
• 压缩机泄压.

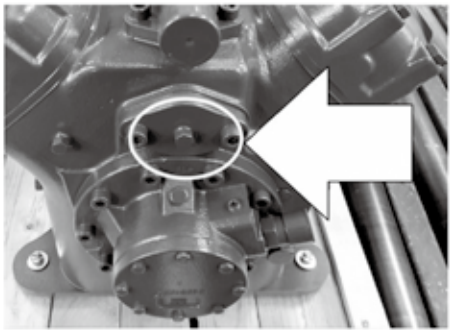
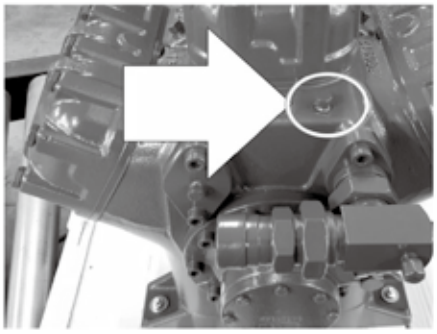
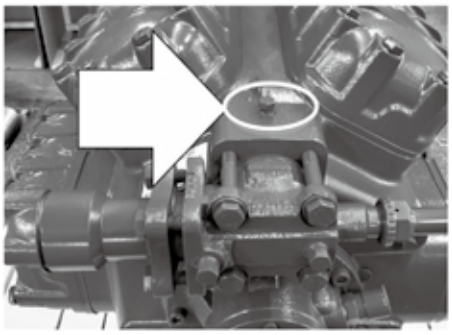
• 移走 1/8”NPT 铜接头 (位置参考下面的示意图).

Installation procedure

• Depressurize the compressor.

• Remove the 1/8”NPT brass plug (see positions).

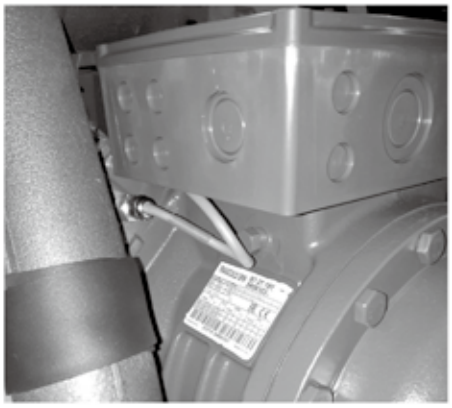
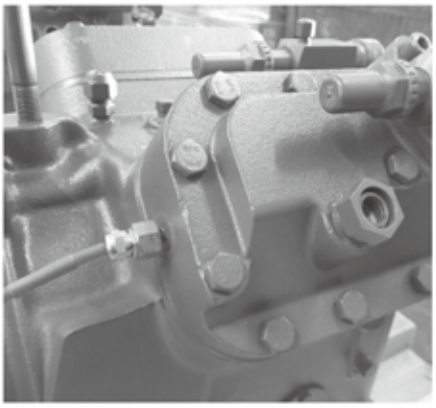
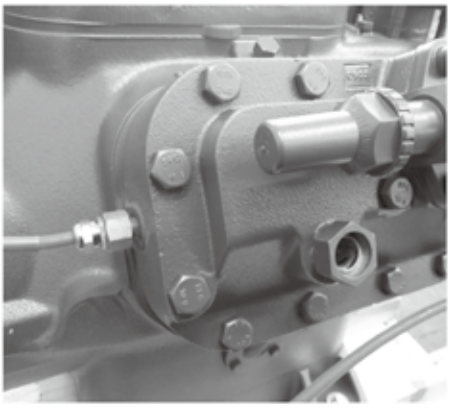





V **Z** **W**

双级压缩机 - Two-stage compressors

传感器位置参考下面的示意图 - here below the correct position of the sensor

S **2V** **2Z**

Istruzioni - instructions

Step 1 清洁螺纹周围的油漆。

Step 2 螺纹上涂点螺纹胶。

Step 3 拧紧传感器上的螺纹，扭矩 15 Nm (11 lbf.ft)。

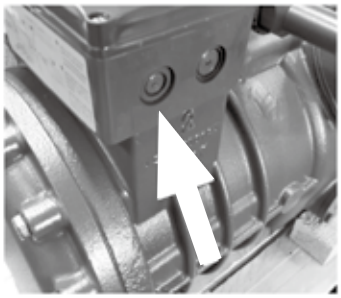
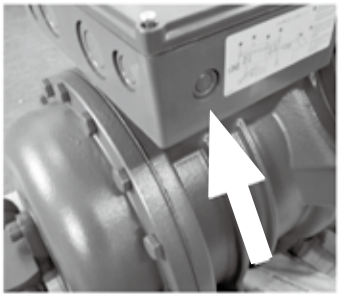
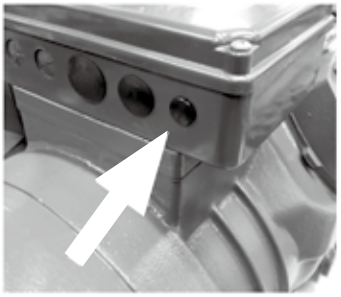
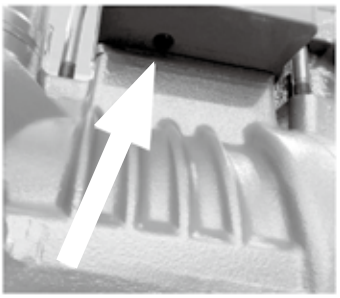
Step 4 移除电气盒盖盒传感器上的塑料盖，固定格兰头里面的电缆，以便给传感器供电。

Step 1 Remove any scrap of paint around the thread.

Step 2 Apply some thread sealing anaerobic adhesive.

Step 3 Screw and tight the sensor, and apply 15 Nm (11 lbf.ft) torque.

Step 4 Remove the plastic cap or the block-off from the terminal box and fix the cable gland supplied with the sensor.

Q - Q TK **S** **S TK** **V - Z - W - 2V - 2Z**

Step 5 电缆的接线端子与控制模块连接。关于电缆的正确连接方式，请参考手册中压缩机安装和启动的部分的接线图:

- Atex 压缩机 FTEC 232A (ATEX)
- 双级压缩机 FTEC 432
- TK (CO2) 压缩机 FTEC 037

备注: 对于TK压缩机: 电缆连接时，注意电缆不要卷曲，要消除应力.

Step 6 将格兰头拧紧.

Step 5 Connect the cable terminals to the control module. For the correct connection, refer to the electric diagram shown in the Installation and Start-up Manual of your compressor:

- Atex compressors FTEC 232A (ATEX)
- Two-stage compressors FTEC 432
- TK compressors (CO2) FTEC 037

NOTE: for TK compressors: to wire the cable, eliminate the faston.

Step 6 Tight the cable gland.

5. 电气连接

控制或电源接线只允许受过适当的专业训练或经过合法认证的专业人员来进行操作。半密闭压缩机是具有高能量的机械，任何电气接线上的错误可能会造成财务的损失，严重的伤害或死亡。压缩机电气接线、电源或控制都必须严格的依照本手册规范执行。

安全的装备、标签、电缆线的颜色与尺寸与电气控制面板的安装必须严格遵守“低电压”欧盟指令 2006/95/CE 与任何其他适用的国家或国际标准。任何其他在服务指令上未说明的装备或接线，必须事先经富士豪以书面形式授权。为管理冷冻能力与马达线圈的启动时间，建议压缩机连接到高效能的微处理器上。

A、B、D、F、Q、S 系列配置的是 IP65 接线盒，V、Z、W 系列配置的是 IP65 接线盒。在运转中，过低的吸气温度可导致水气凝结或冻结，进而可能导致配电盒内短路。这就是为什么强制安装 IP65 或更高防护等级的电缆密封套以防止空气或湿气进入配电盒。

5.1 保护的选型

接触器必须选择 AC3 类别。如果使用 PWS 启动，每一个接触器的规格，必须是至少 MRA 60% 的电流。如果是星/三角启动，每线和角接触器的规格最小是 MRA 的 60%，星接触器的规格最小是MRA的 50% 保险丝必须是 aM 类型(马达等级)。我们强烈建议主要的生产厂商使用磁热开关。

5. ELECTRICAL CONNECTIONS

Control or power electrical connections can only be carried out by properly trained professionals, having proper certification required by law. Semi-hermetic compressors are machines with high specific capacity. Any mistake in the electric connections may cause damage to property, serious injuries, or death. Electrical connections, either power or control, of a compressor must be performed in strict accordance with what is specified in this manual.

Safety devices, labels, color and size of cables and installation of the electrical control panel must be performed in strict observance of the 2006/95/CE European Directive and any other applicable national and international norms. Any other device or connection not described in the service instructions must be authorized in advance by Frascold in written form. For managing the cooling capacity and the startup timing of the motor windings, it is recommended to connect the compressor to a microprocessor with a high elaboration capacity.

The terminal box is IP56 for compressors series A, B D, F, Q, S, and IP65 for series V, Z, and W. During operation, low suction temperature can cause moisture to condensate or freeze, thus causing short circuits in the terminal box. It is compulsory to install cable glands with protection grade IP65 or higher in order to prevent air or humidity enter the terminal box.

5.1 Sizing of protections

Contactors must be chosen in the AC3 category if the startup is by PWS, each of the contactors must be sized for a minimum current of at least 60% of MRA. If the startup is by star/delta, each of the line and delta contactors must be sized for a minimum current of at least 60% of the MRA, while the star center contactor shall be sized for 50% of the MRA. Fuses must be type aM (motor rated). It is highly recommended to use magnetothermal switches from major producers.

建议检查在压缩机名牌上的电压与频率是否符合你安装上的需要。当已达到平均故障间隔时间，或超过由生产厂指定的时间间隔的建议时，请更换接触器与开关。

It is recommended to check for voltage and frequency on the compressor plate, and compare them with the requirement of your installation. Replace contactors and switches when the mean time between failures has been reached or at the recommended interval specified by the manufacturers.

5.2 电源线

两个马达绕组的旋转方向(在PWS启动的情况下) 必须是同相位 (同旋转顺序)。

反向的绕组运转，甚至只几秒钟，可造成压缩机的损坏与无法修复。

PWS: 绕组“同相位”的旋转不仅是必须的且要连接到同一接触器上。因此建议连接L1相位到端线1和7 , L2相位到端线2和8 , L3相位到端线3和9。建议两个绕组互锁，切换时间不会低于0.5秒且不高于1秒。(对于PWS的接线)。

SDS: 对于星/三角启动，星型不能超过1秒启用，其次是星/三角切换时间不小于0.05s，不大于0.20s。在任何情况下，准确的切换时间，必须在设备现场做出选择，在切换的过程中通过切换时间让转子的放缓最小化，相容与接触器的切换的速度。

请记住，压缩机运转在星连接的时间越长，排气压力抗拒转子惯性便越高。将压缩机连接到标示符号做接地 ⏚，并确保该接地连接的交流阻抗是在所选用的电磁开关可接受的范围之内。

5.2 Power cables

The rotation of the two windings (in case of PWS start) must be “in phase” (same rotation sequence).

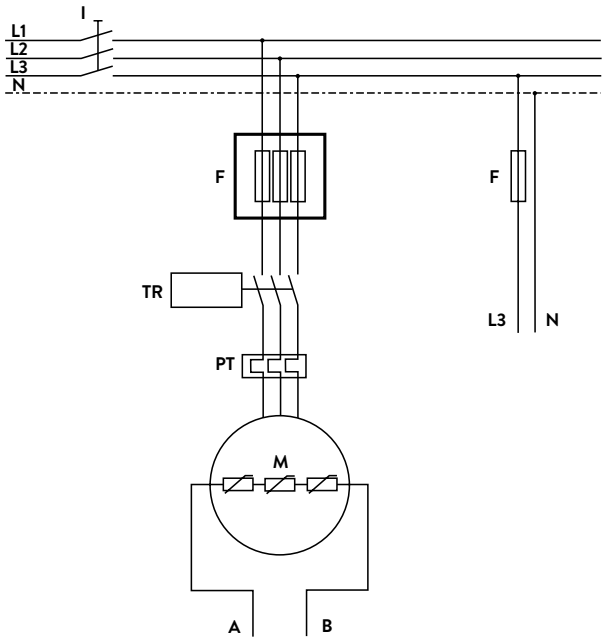
Operation of counter rotating windings, even for few seconds, can damage the compressor beyond repair.

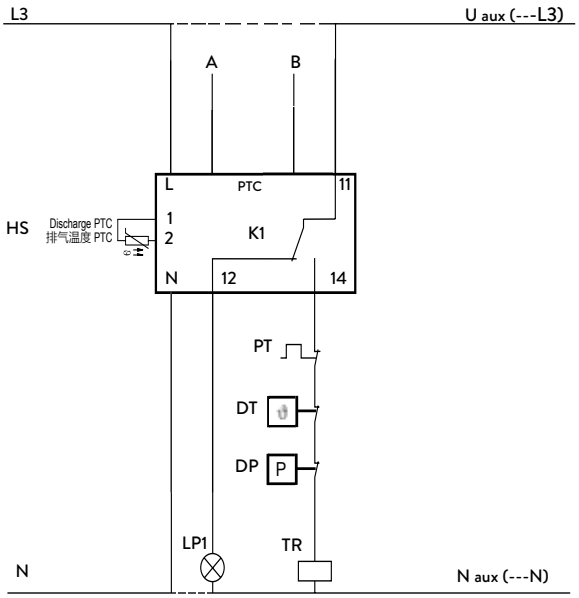
PWS: it is not only necessary that windings are rotating “in phase”, but the respective terminals must be connected to the same conductor. It is, therefore, recommended to connect phase L1 to terminals 1 and 7, phase L2 to terminals 2 and 8, and phase L3 to terminals 3 and 9. It is recommended to interlock the two windings with a switching time not lower than 0.5 seconds and not higher than 1 second (for PWS connections).

SDS: For star/delta start, star connection must not be enabled for longer than 1 second, followed by a star/delta switching time not shorter than 0.05s and not longer than 0.20s. In any case, the exact switching time must be selected on the field by choosing the time, minimizing the slow down of the rotors during the switching, compatibly with the switching speed of the contactors.

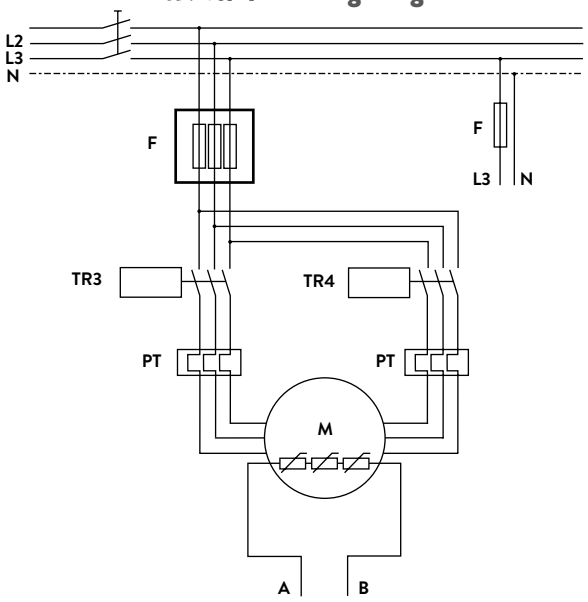
Remember that the longer the compressor runs at star connections, the higher will be the discharge pressure which opposes the rotor inertia. Connect the compressor to the earth grounding identified by the symbol ⏚ and make sure that the earth connection impedance is within the acceptable range for the selected differential magnetic switch.

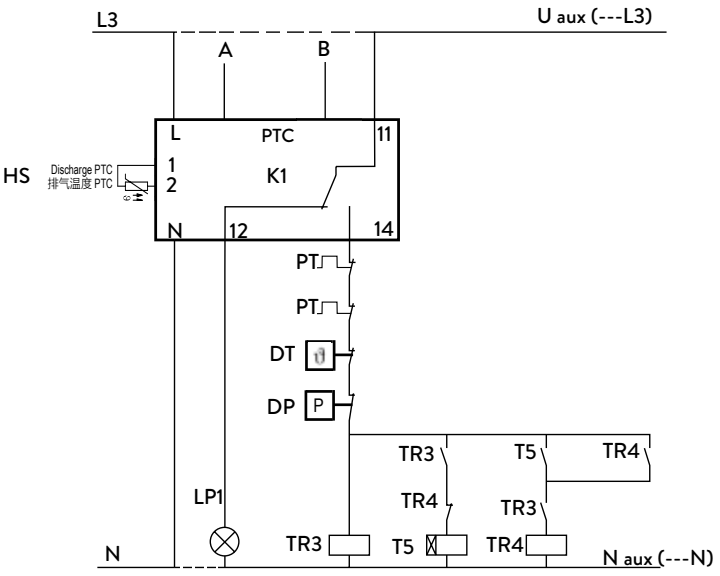
3 PH D.O.L. 接线图 - Wiring Diagram





3 PH P.W.S. 接线图 - Wiring Diagram





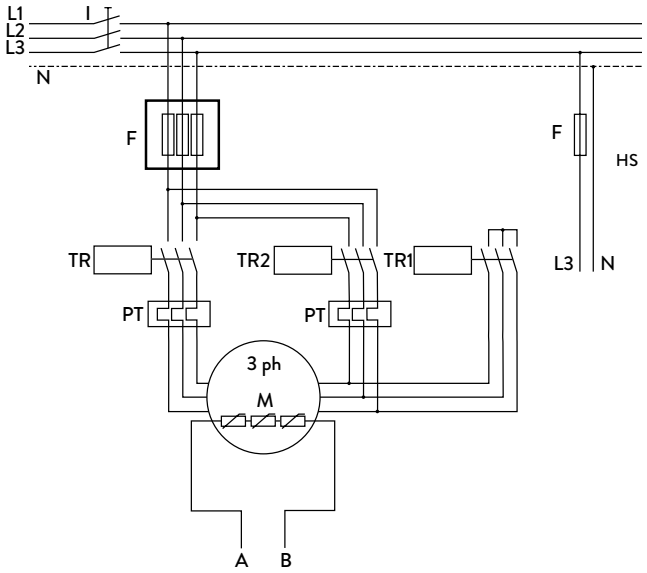
热敏电阻的 A - B终端不要直接接在接线端板上 Do not feed directly terminals A - B of the thermistors

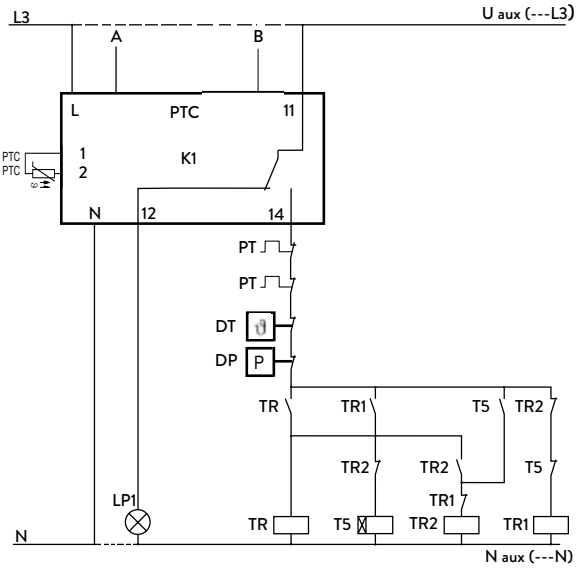
* 接触器功率 > 最大输入功率
Contactor power > maximum input power
** 保险丝容量(aM类型)= 1.1 ÷ 1.3 x MRA (请查看压缩机的铭牌)
Fuses capacity (aM type) = 1.1 ÷ 1.3 x MRA (see name plate on the compressor)

接线图图例 - Wiring diagrams key

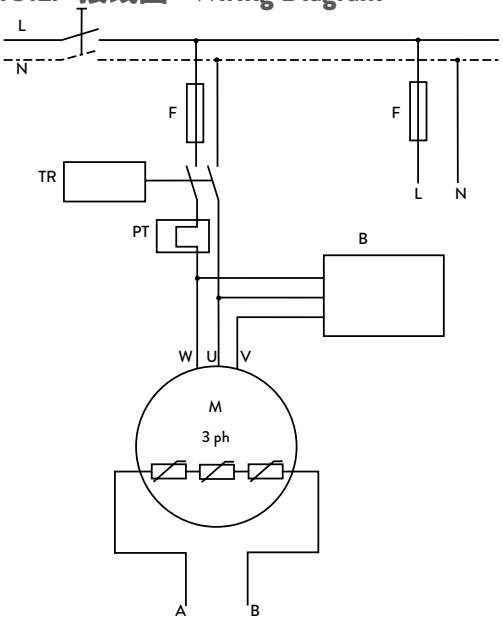
A-B	热敏电阻终端 - thermistor terminals
DP	压力开关 - pressure switch
DT	温度开关 - temperature switch
F	保险丝 - ** fuse **
HS	最高排气温度传感器 - max discharge temp. sensor
L1	电路相位 - phase of electrical net
L2	电路相位 - phase of electrical net
L3	电路相位 - phase of electrical net
N	中性线 - neutral
I	主开关 - main switch
K	接线端板 - terminal board
K1	电子模组 - electronic module protection
LP1	热敏电阻警告灯 - thermistor alarm light
PT	过载保护器 - overload protector
TR	主接触器 - * main contactor *
TR3	50%启动接触器 - * starting contactor 50%*
TR4	100%启动接触器 - * starting contactor 100%*
T5	0.8-1 se c时间继电器 - timer relay 0.8-1 sec

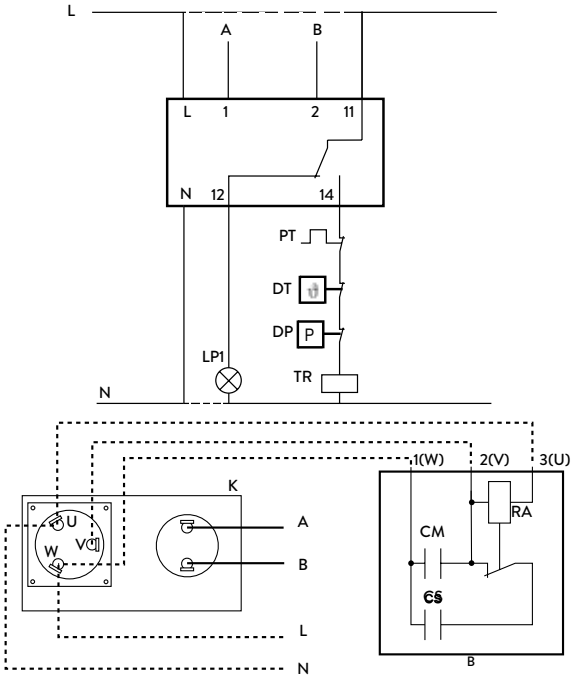
3 PH S.D.S. 接线图 - Wiring Diagram





1 PH D.O.L. 接线图 - Wiring Diagram





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接线图图例 - Wiring diagrams key

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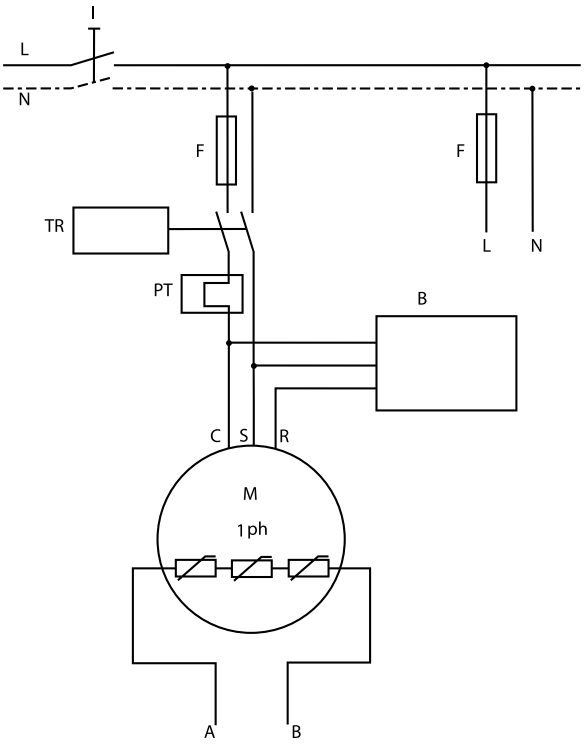
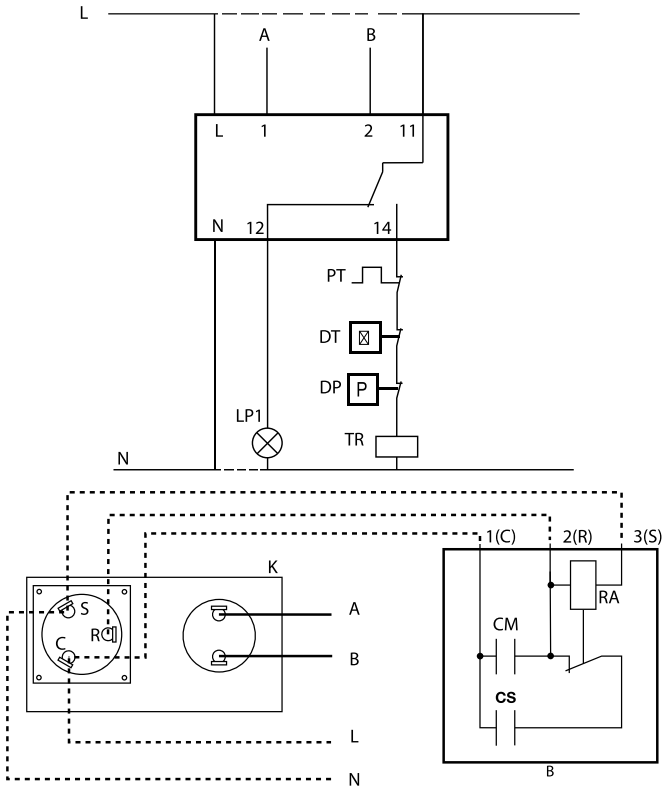
F	保险丝 ** - fuse **
HS	最高排气温度传感器 - max discharge temp. sensor
L1	电路相位 - phase of electrical net
L2	电路相位 - phase of electrical net
L3	电路相位 - phase of electrical net
N	中性线 - neutral
I	主开关 - main switch

K	接线端板 - terminal board
K1	接线端板 - electronic module protection
LP1	热敏电阻 - thermistor alarm light
PT	过载保护器 - overload protector
TR	主接触器 - * main contactor *
TR1	人 启动接触器* - 人 starting contactor*
TR2	△ 启动接触器* - △ starting contactor*
T5	0.8-1秒时间继电器 - timer relay 0.8-1 sec
B	电容盒 - capacitors box
CS	启动电容 - start capacitor
CM	运行电器 - run capacitor
RA	启动继电器 - start relay

1 PH UL 接线图 - Wiring Diagram





热敏电阻的 A - B终端不要直接接在接线端板上 - Do not feed directly terminals A - B of the thermistors

* 接触器功率 > 最大输入功率
接触器需符合IEC60947-1和IEC60947-5-1,动作次数须达到10000次
Contactor power > maximum input power
Contactor according to IEC60947-1 e IEC60947-5-1, switching cycles number 10000

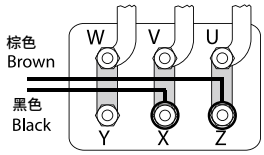
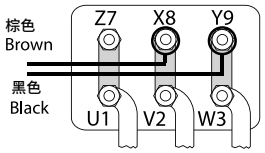
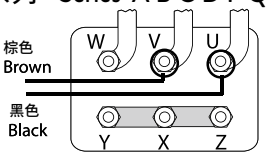
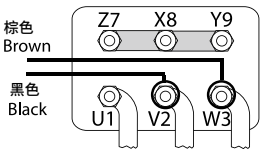
** 保险丝容量(aM类型)= 1.1 ÷ 1.3 x MRA (请查看压缩机的铭牌)
Fuses capacity (aM type) = 1.1 ÷ 1.3 x MRA (see name plate on the compressor)

*** 保险丝容量(aM类型)= 1.1 ÷ 1.3 x MRA (请查看压缩机的铭牌)
ATTENTION: C, R, S are indicated on the insulator (black block)

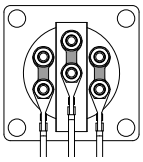
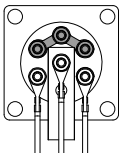
接线图图例 - Wiring diagrams key

A-B	热敏电阻终端 - thermistor terminals
DP	压力开关 - pressure switch
DT	温度开关 - temperature switch
F	保险丝** - fuse **
HS	最高排气温度传感器 - max discharge temp. sensor
L1	电路相位 - phase of electrical net
L2	电路相位 - phase of electrical net
L3	电路相位 - phase of electrical net
N	中性线 - neutral
I	主开关 - main switch
K	接线端板 - terminal board
K1	KRIWAN模块 - KRIWAN electronic module
LP1	热敏电阻告警灯 - thermistor warning lamp
PT	过载保护器 - overload protector
TR	主接触器* - main contactor *
B	电容盒 - capacitors box
CS	启动电容 - start capacitor
CM	运行电容 - run capacitor
RA	启动继电器 - start relay

3 PH D.O.L. (Direct on line) 直接启动

220-240/3/50 Δ • 208-230/3/6 Δ • 265-290/3/60 • Δ 200/3/50 Δ • 200/3/60		380-420/3/50 人• 380-420/3/60 人• 440-480/3/60 人	
系列 - Series A B C D F Q	系列 - Series S V Z W	系列 - Series A B C D F Q	系列 - Series S V Z W
			

可选接线方式 Alternatively

220-240/3/50 Δ • 208-230/3/6 Δ • 265-290/3/60 • Δ 200/3/50 Δ • 200/3/60		380-420/3/50 人• 380-420/3/60 人• 440-480/3/60	
系列 - Series A B C D F Q		系列 - Series A B C D F Q	
			

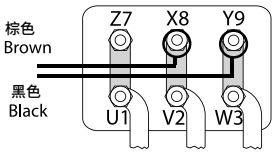
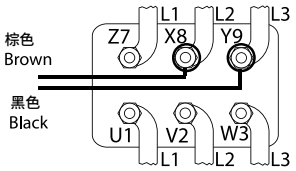
端子连接

如果压缩机有控制保护模块，模块会有黑色和棕色电缆线引出，这两根线如图所示接到压缩机的接线柱上。

Terminal connections

Black and brown cables are related to a module protection device. If the compressor has got this device, the connection of the two cables must be done as indicated in the drawings

3 PH P.W.S (Part winding start) 分绕组启动

直接启动 • Direct On line start 380-420/3/50 • 380-420/3/60 • 440-480/3/60	分绕组启动 • Part winding start 380-420/3/50 • 380-420/3/60 • 440-480/3/60
Serie - Series S V Z W	Serie - Series S V Z W
	

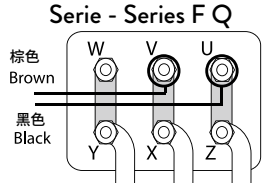
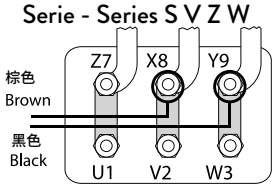
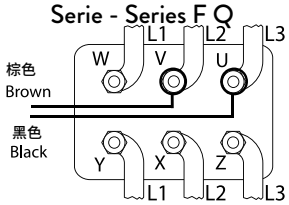
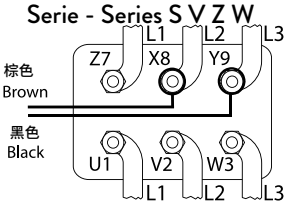
端子连接

如果压缩机有控制保护模块，模块会有黑色和棕色电缆线引出，这两根线如图所示接到压缩机的接线柱上。

Terminal connections

Black and brown cables are related to a module protection device. If the compressor has got this device, the connection of the two cables must be done as indicated in the drawings

3 PH S.D.S. (Star delta star) 星三角启动

直接启动 Δ • Δ Direct On line start 380-420/3/50 Δ • 380-420/3/60 Δ • 440-480/3/60 Δ		分绕组启动 Δ - 人 • Star/Delta start Δ - 人 380-420/3/50 • 380-420/3/60 • 440-480/3/60	
Serie - Series F Q	Serie - Series S V Z W	Serie - Series F Q	Serie - Series S V Z W
			

端子连接

如果压缩机有控制保护模块，模块会有黑色和棕色电缆线引出，这两根线如图所示接到压缩机的接线柱上。

Terminal connections

Black and brown cables are related to a module protection device. If the compressor has got this device, the connection of the two cables must be done as indicated in the drawings

3 PH 直接启动无 UL
A-B-D-F-Q 系列

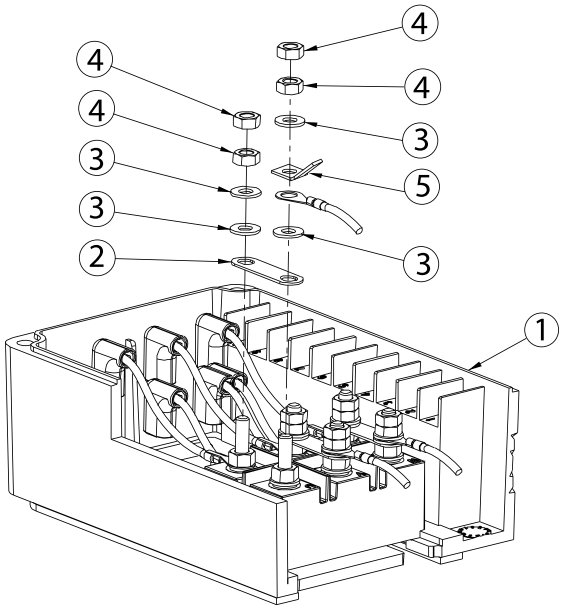


fig.1

Δ - 接线
Δ - connection D.O.L.

3 PH D.O.L. Not UL
A-B-D-F-Q Series

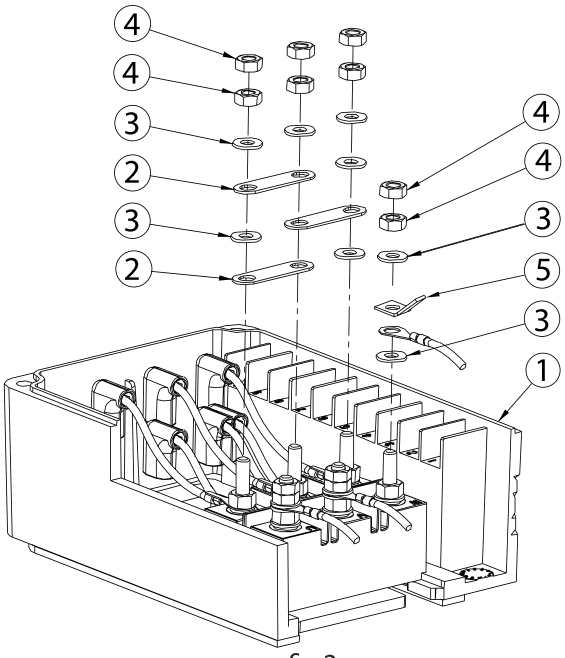
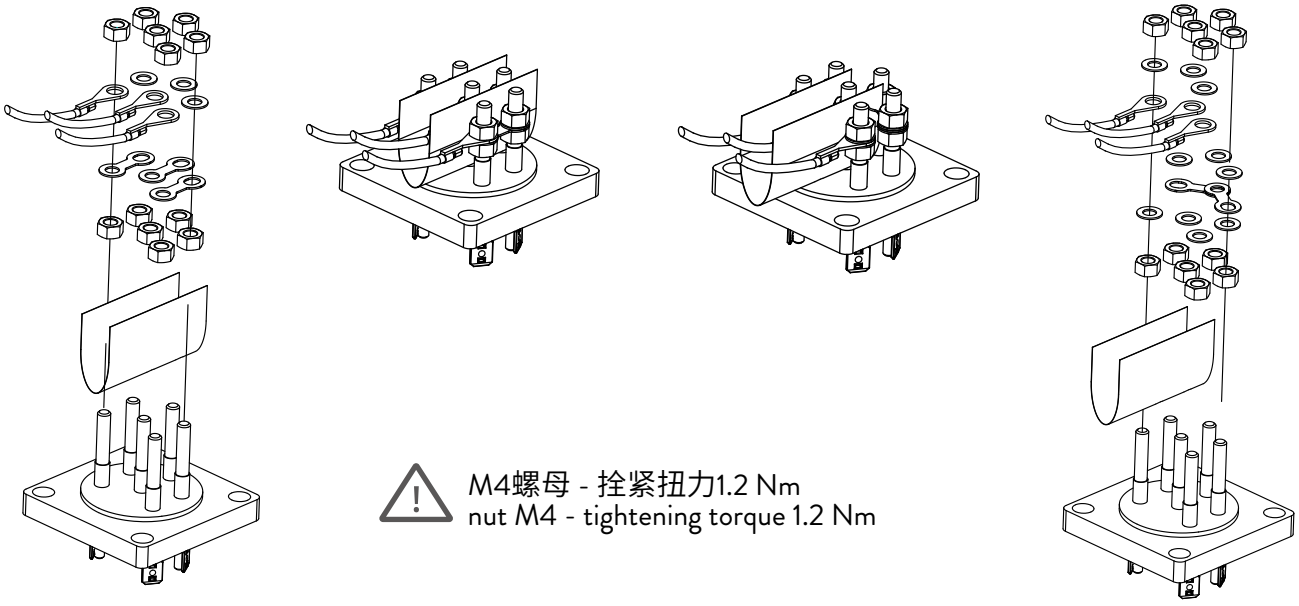


fig.2

人 - 接线
人 - connection D.O.L.

可选接线

Alternatively



M4螺母 - 拴紧扭力1.2 Nm
nut M4 - tightening torque 1.2 Nm

A, B, D, F, Q 三相半封闭压缩机配备的T00S2491039配电盒(参阅图1,图 2)包含完整的电气接线T00SK261100。

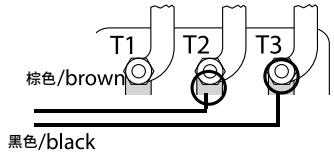
套件套件包括:
- 3 铜搭片 (rif.2) T00S1251085
- 12 M4铜垫片 (rif.3) T00R01104009
- 12 M4铜螺丝 (rif.4) T00DE3004004
- 2INT69 Diagnose扣件 (rif.5) T00EC60

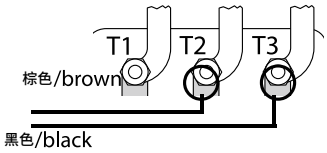
A, B, D, F, and Q three-phase semi-hermetic compressors are equipped with the terminal box T00S2491039 (see fig. 1 and fig.2) that is complete with a kit for electric connection model T00SK261100.

Connection kit includes:
- 3 bridge bars (ref.2) T00S1251085
- 12 washers M4, brass (ref.3) T00R01104009
- 12 bolts M4 x 0.7 x 4 brass UNI5587 (ref.4) T00DE3004004
- 2 faston for module protection device (ref.5) T00EC60

3 ph D.O.L. (直接启动) 终端接线 • Terminal connections

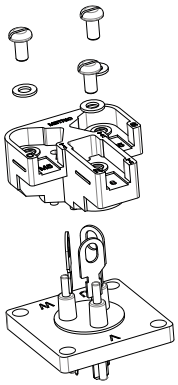
208-230/3/60	系列 - Series A B C D F Q	460/3/60 - 575/3/60

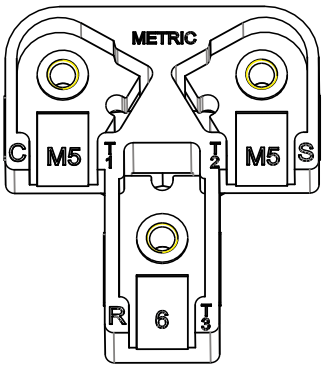




如果压缩机有控制保护模块，模块会有黑色和棕色电缆线引出，这两根线如图所示接到压缩机的接线柱上。

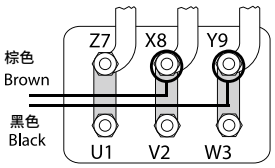
Black and brown cables are related to the Diagnose module. If the compressor has got this device, the connection of the two cables must be done as indicated in the drawings.

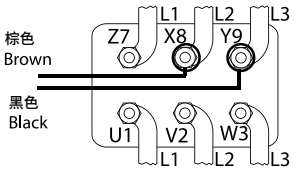




终端接线 • Terminal connections

直接启动 • Direct On Line start 460/3/60 – 575/3/60	分绕组启动 – Part winding start 460/3/60 – 575/3/60
系列 - Series S V Z W	系列 - Series S V Z W





如果压缩机有控制保护模块，模块会有黑色和棕色电缆线引出，这两根线如图所示接到压缩机的接线柱上。

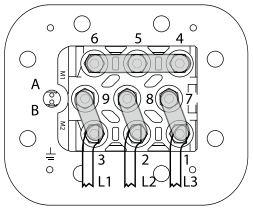
Black and brown cables are related to the Diagnose module. If the compressor has got this device, the connection of the two cables must be done as indicated in the drawings.

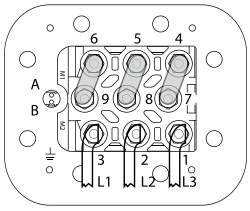
3 ph 双电压 • Dual voltage

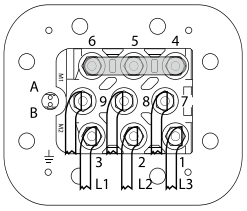
终端接线 - Terminal connections

208-230/3/60 - 460/3/60

直接启动 • Direct On Line start 208-230/3/60	直接启动 • Direct On Line start 460/3/60	分绕组启动 • Part Winding Start 208-230/3/60
系列 - Series S V Z W	系列 - Series S V Z W	系列 - Series S V Z W







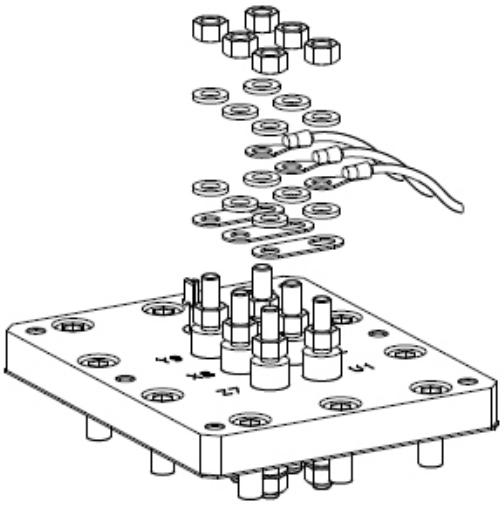
如果压缩机有控制保护模块，模块会有黑色和棕色电缆线引出，这两根线如图所示，棕色线接到压缩机的接线柱L2 上，黑色线接到L3上。

Black and brown cables are related to the Diagnose module. If the compressor has got this device, connect brown cables to the L2 phase and black cables to the L3 phase.

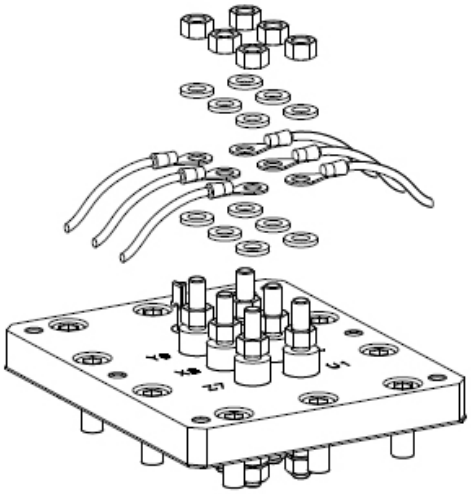
为了压缩机的接线准确，操作人员必须遵循图示正确的安装顺序；接线柱位置基于供电电源的特征和位置。S系列压缩机有一个电气盒，与本页显示的类似，但是其电机是PWS类型，因此，请参考前面或下页同类型的接线示意图。

For a proper electric connection of the compressor, the operator has to comply with the correct assembling sequence as shown; the staple bars' positioning depends on the electric supply characteristics. S compressors have a terminal box similar to the one shown on this page, but the standard motor is PWS, so please refer to the previous and the next page for connections.

3 PH P.W.S
S 系列 - S Series

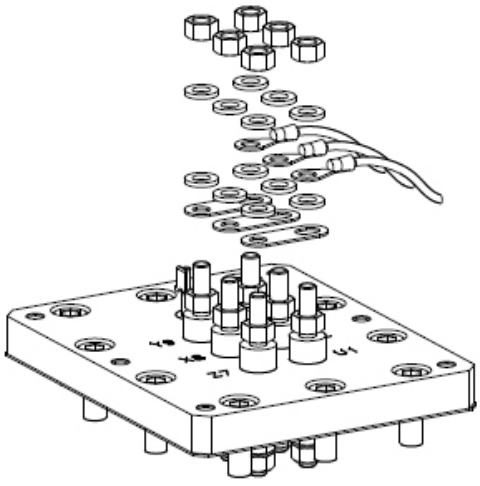


PWS 马达 - 联动 人 直接跨线启动
PWS motor - linkage 人 for Direct On Line start

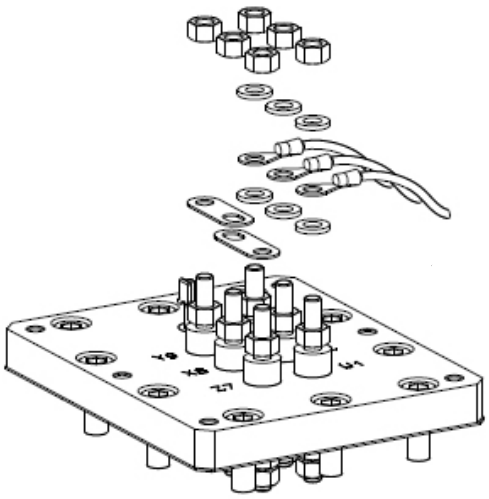


PWS 马达 - 联动 人/人 分绕组启动
PWS motor - linkage 人 / 人 for part winding start

3 PH D.O.L.
S 系列 - S Series



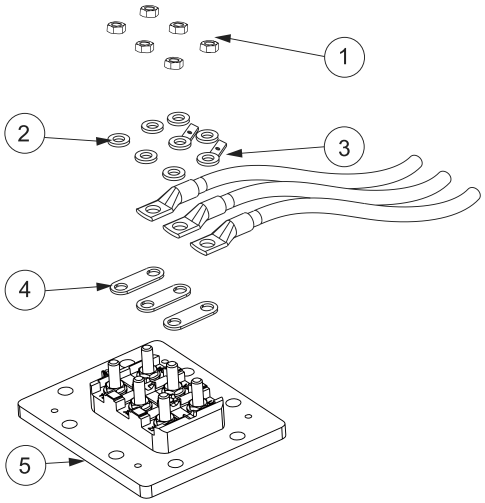
PWS 马达 - 联动 Δ 直接跨线启动
D.O.L. motor - linkage Δ for direct on line start



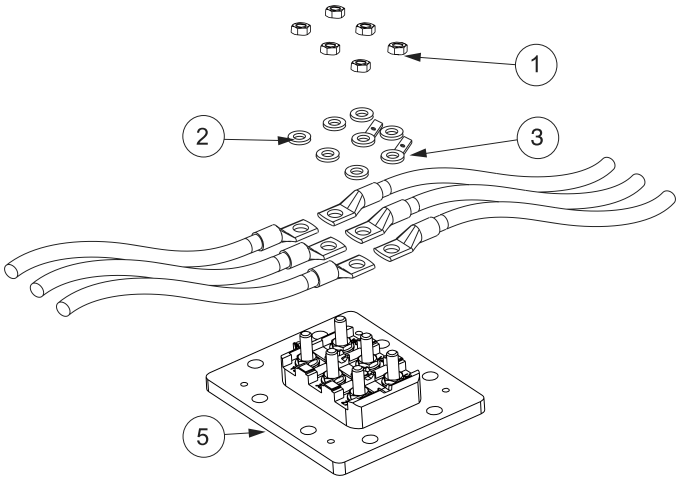
PWS 马达 - 联动 人 分绕组启动
D.O.L. motor - linkage 人 for direct on line start

M6螺母 - 扭矩 10 Nm
nut M6 - tightening torque 10 Nm

3 PH P.W.S
V, Z, W 系列 - V, Z, W Series

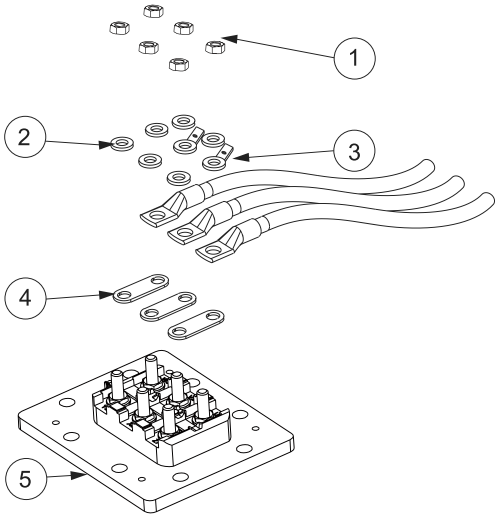


PWS 电机 - 连接 人 直接启动
PWS motor - connection 人 for Direct On Line start

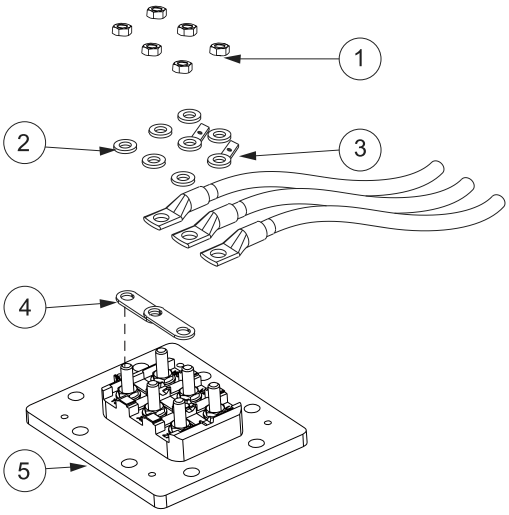


PWS 电机 - 连接 人/人 分绕组启动
PWS motor - connection 人/人 for part winding start

3 PH D.O.L.
V, Z, W 系列 - V, Z, W Series



D.O.L 电机 - 连接 Δ 直接启动
D.O.L. motor - connection Δ for direct on line start

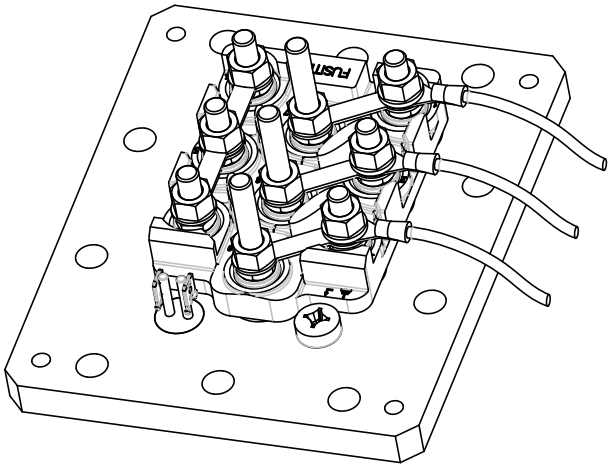


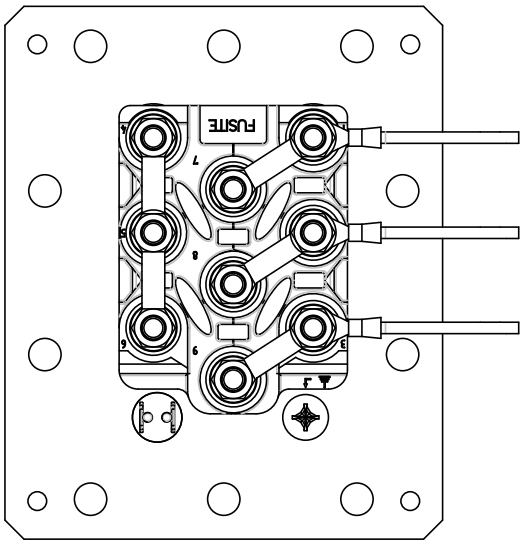
D.O.L 电机 - 连接 人 直接启动
D.O.L. motor - connection 人 for direct on line start

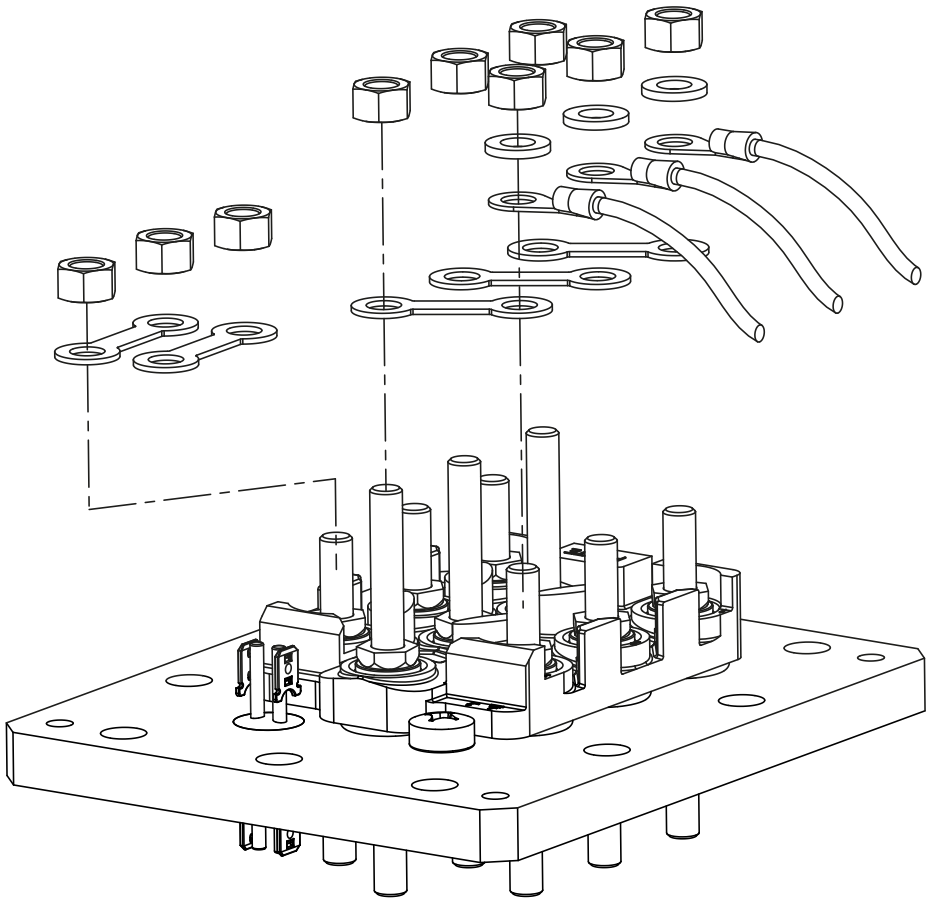
M8 螺母 - 拴紧扭力 15 Nm
nut M8 - tightening torque 15 Nm

6 pz. M8 铜螺丝
6 pz. 8 x 17 铜垫片
2 pz. INT69 扣件
3pz. 铜搭片
1pz. 新接线板

6 pz. brass bolt M8
6 pz. brass washer 8 x 17
2 pz. faston for INT69 Diagnose
3pz. bridge bars
1pz. new terminal plate



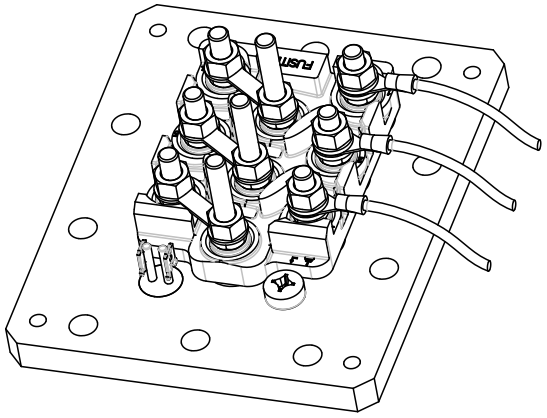

FUSITE

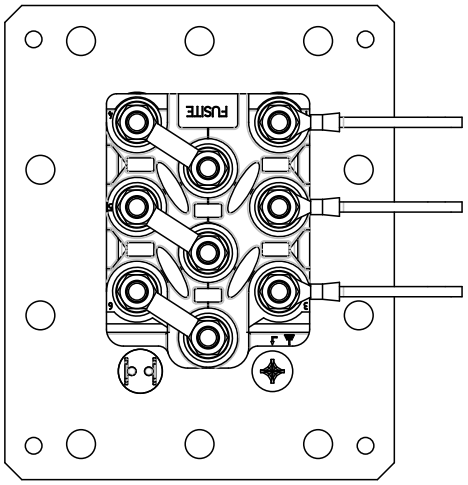


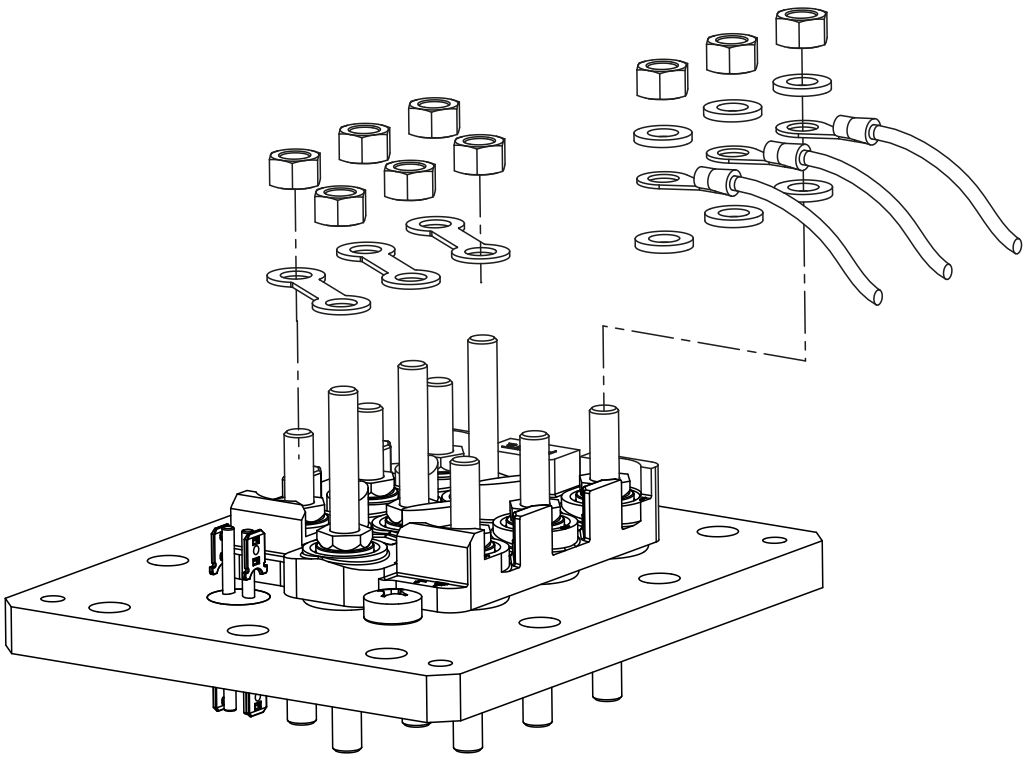
3 ph 双电压 • Dual voltage

直接启动- Direct On Line start

460/3/60



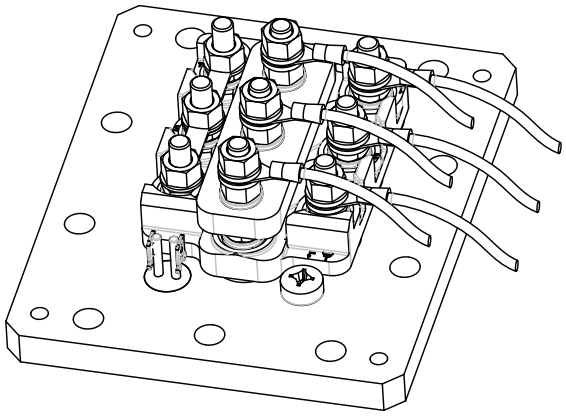


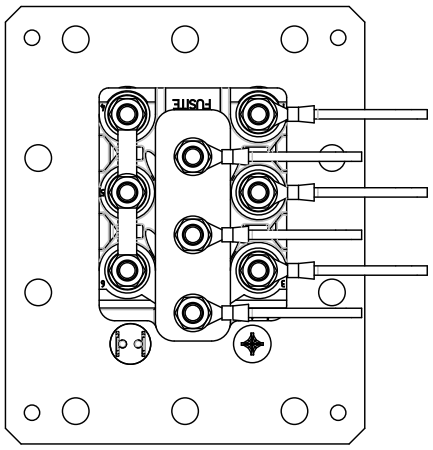


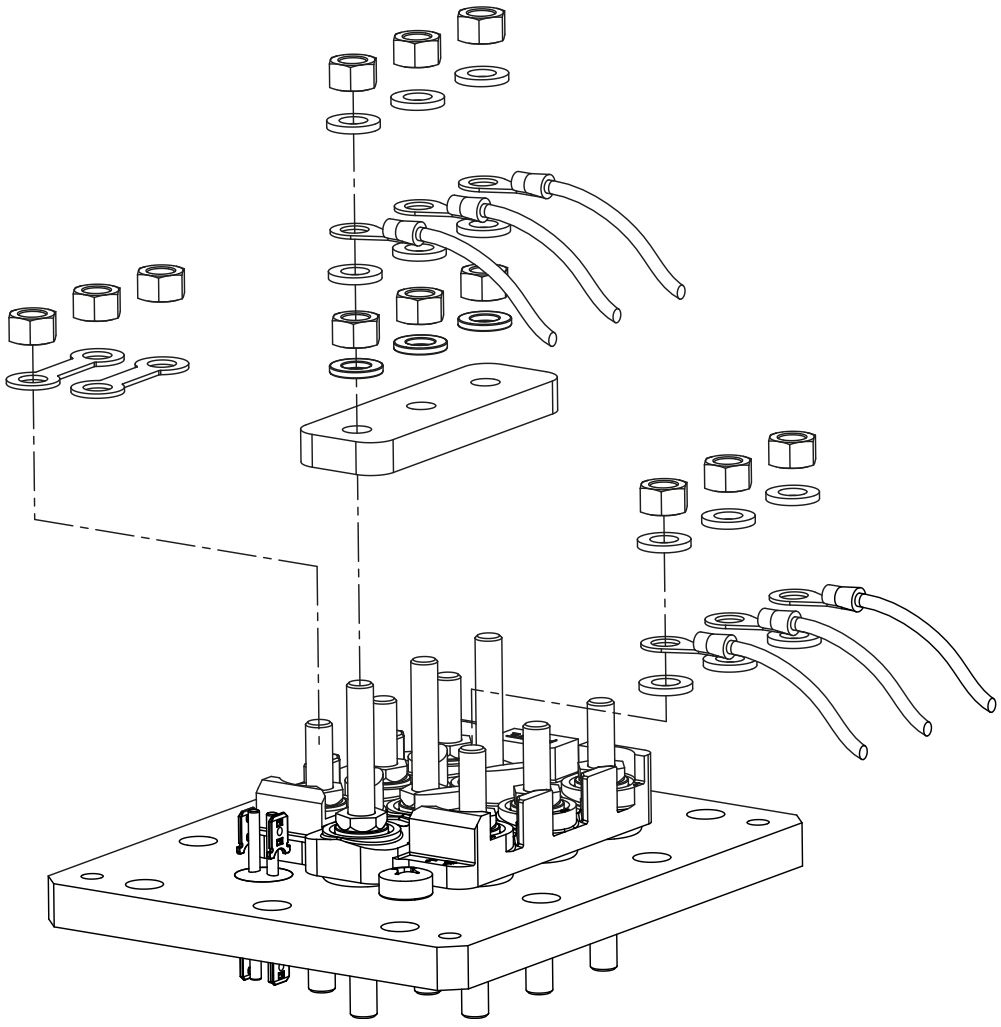
3 ph 双电压 • Dual voltage

分绕组启动- Part Winding Start

230/3/60







5.3 绝缘测试

绝缘测试已经在我们的工厂执行了，没有必要重复做。请在电压最大在 1000 Vac下，填充氮气。

千万不要在压缩机真空状态时测试绝缘，因为真空是良导体!

5.3 Insulation test

An insulation test has already been performed in our factory, and it is not necessary to repeat it. If you need to repeat it anyway, please charge the compressor with nitrogen or refrigerant gas and use a maximum voltage of 1000 Vac.

Never test insulation on the compressor by applying voltage to a compressor under vacuum: vacuum is a good conductor!

5.4 保护装置

在安装手册 5.1、5.3 中，你可以找到保护装置正确接线的所有信息。

千万不要在温度传感器上输入电压，因为只要少许电压就会导致烧毁。

5.4 Protection devices

In this Manual, in paragraphs 5.1 and 5.3, you can find all information on correct connection of protection devices.

Never apply live voltage to thermistor terminals. Even a few volts are enough to burn the thermistor chain.

5.5 高低压开关

高低压力开关可安装在吸气和排气侧的腔体的栓塞上,和接触器线圈串接(当使用机电控制时)，或连接在专用的数位控制的输入点(在微处理器逻辑的情况下)。

严格禁止安装压力开关在关断阀上（如可用时），因为这些栓塞通路会被滑杆阻挡，因此功能会被抑制。

未使用适当的安全装置可能发生爆炸，财产的损失，伤害甚至死亡。

5.5 High and low pressure switch

High and low pressure switches can be installed on the plugs of the suction and discharge flanges and connected in series with the contactor coils (when electromechanical controls are used) or to the digital input dedicated (in case of microprocessor logic).

It is strictly forbidden to install pressure switches on the shut-off valves (when available) because those plugs can be intercepted by the sliding vane and therefore their function is inhibited.

To inhibit a safety device can cause explosions, damage to property, injuries, or even death.

5.6 压缩机附加冷却装置

富士豪所有的半封闭压缩机都是吸气式冷却。当过热吸入蒸汽经过压缩机和电机时，使绕组冷却；通过这种方法它吸收热量，使焓含量和温度增加。

接着，压缩制冷剂将热量传递给气体（排出热量）的能量，使温度进一步增加。在正常情况下，在压缩终点气体温度不得超过+130°C / 266°F。

工作时的温度对压缩机的寿命起着决定性的作用，因为在压缩机里它是一种具有高温度下创造安全的风险情，并可以在在强制执行的条件下验证高温。

5.6 Devices for compressor additional cooling

All FRASCOLD compressors are cooled by refrigerant in superheated gas conditions from a suction. As the superheated suction vapor passes through the compressor and over the electrical motor, it cools the windings; in this way, it absorbs heat which produces an increase in both enthalpic content and its temperature.

Successively, the energy used to compress the refrigerant transfers heat to the gas (discharge heat), causing a further temperature increase. In normal conditions, gas temperature at the compression end must never exceed +130°C / 266°F.

The temperature during working has a determinant role in compressor life, because it is with high temperatures that, in the compressor, risk situations for its safety create. These high temperatures can occur under particularly forced operative conditions.

在制冷量表里，富士豪压缩机目录中明确指出，操作条件对压缩机有额外的冷却要求和对设备的使用有具体的工作条件。

对于额外的冷却，设备可以:

• 液态喷射(见 FTEC03)

• 缸头风扇(见 FTEC181)

• 水冷缸盖

验证这个设备的必要性后，这些设备可以直接在工厂安装(订购压缩机时同时订购设备)。

The refrigerating capacity tables on FRASCOLD compressor catalogs indicate, in an unequivocal way, when the operative conditions are such to request the compressor additional cooling and also what is the device to use with respect to specific working conditions. For additional cooling of FRASCOLD compressors, the devices available are:

• liquid injection (see FTEC03)

• head fan motor (see FTEC181)

• water-cooled heads

After verifying these devices' needs, these may be assembled on the compressor directly in the factory (by ordering the device together with the compressor).

5.7 油加热器

连接油加热器到合适的电源。加热器必须与压缩机接触器连接。为了使压缩机运行时可以被断开。

5.7 Oil heater

Connect the oil heater to the appropriate power supply. The heater is required to be interfaced with the compressor contactor in order to be switched off when the compressor is running.

压缩机 Compressor	加热器代码/Heater code	加热器代码/Voltage and power
A-B-D	T00CH13	230V / 50W
F-Q-S	T00CH01	230V / 70 W
V-Z-W	T00CH09	230V / 150 W

5.8 外部转换器

原始数据的设定需要外部转换器与富矢豪压缩机相连:

· 转换器额定输出电流至少等于压缩机MRA乘以1.1或者更高
· 启动阶段的最大电流（峰值电流）:
  考虑到一个正确的比例因子，此电流与压缩机的缸数有关
  o 双缸: 2 X 额定电流
  o 四缸: 1,6 X 额定电流
  o 六缸: 1,5 X 额定电流
  o 八缸: 1,3 X 额定电流
· 控制方式: V/f
· 最小频率 = 30 Hz 适用于双缸压缩机和其他带油泵压缩机；25 Hz 适用于四缸以及其他不带油泵压缩机；在一些特别情形或者应用中(常见低温应用)，对于双缸压缩机，最小频率应提高到40 Hz因为高的振动。

5.8 External inverter

Fundamental parameters to be set for an external inverter with Frascold compressors:

· Nominal output current of the inverter at least equal to compressor MRA multiplied 1.1 or higher
· Maximum current (peak current) during the starting: consider a correction factor, connected to the number of cylinders
  o 2 cylinders: 2 X Inominal
  o 4 cylinders: 1,6 X Inominal
  o 6 cylinders: 1,5 X Inominal
  o 8 cylinders: 1,3 X Inominal
· Way to control: V/f
· Minimum frequency = 30 Hz for 2 cylinders compressors and all compressors with oil pump; 25 Hz for 4 cylinders compressors without oil pump; in some condition/application/implantation (usually LT, not really compact machine) for 2 cylinders compressors the minimum frequency should be put at 40 Hz due to high vibrations

· 最大频率= 87 Hz 适用于所有不带油泵压缩机；
70 Hz 适用于所有带油泵压缩机；

· 从0 Hz 升到最小频率的最大时间间隔 = 1 秒
· 从最小频率升到最大频率的最短时间 = 15 秒
· 频率转换= 4 kHz (或者更多); 请验证转换器的降低马力启动输出电流；
· 如果要监控 PTC，请直接与转换器连接；否则，用标准的压缩机保护器；

· 用刚性支撑来固定压缩机，用刚性管路与压缩机连接；在装好后的机器下面安装减震阻尼器。

· Maximum frequency= 87 Hz for all compressors without oil pump; 70 Hz for all compressors with oil pump

· Maximum time from 0 Hz to minimum frequency= 1 second
· Minimum time from minimum frequency to maximum frequency and vice versa = 15 seconds
· Frequency switching= 4 kHz (or more); please verify the derating of the continuous output current of the inverter
· Connect PTC directly to the inverter if it is able to monitor PTC; otherwise, use standard compressor protectors

· Use rigid supports for the compressor and rigid pipelines; put absorber under the skid of the complete machine

在一些带有变频器的系统（例如重启动环境），US (卸载软起动）缸头可能会变得有必要。对于更进一步的信息，请阅读 ASERCOM 指导书，其定义了多种变频器去减小压缩机启动冲击的内容，在网站 www.asercom.org 下“Guides”单元可查。

With a frequency inverter on some system design (e.g. heavy starting condition) also US (unloading start) head might become necessary.
For further information, please read the “ASERCOM guidelines for the design of multiple compressor racks using frequency inverters” available on the website www.asercom.org under the section “Guides”

6. 试运转

没有必要对压缩机做压力测试，如果您的测试过程包括制冷回路的压力试验，必须保持关断阀关闭，除非进行压力测试的压力在高压端不超过 30 bar / 435PSI 和在低压端不超过 20.5 bar / 297 PSI 。
在泄漏测试方面，也可按 EN378-2 准则进行，充填的压力须保持在压缩机可接受的范围内。确保用一个具有减压器和安全阀的密封钢瓶所提供的无氧氮气(OFN)进行测试。

禁止使用 HFCs 冷媒做隙漏测试，HFCs 冷媒不是追踪用气体，释放HFCs到大气中是一项重罪。在无氧氮气 (OFN) 接触 HFCs 冷媒情况下，就不可以释放到大气中，它必须回收和进行热破坏，处理 HFCs 冷媒的抛弃瓶也按同样的规定。

6. COMMISSIONING

It is not necessary to submit the compressor to a pressure test. If your testing procedure includes a pressure test for the refrigeration circuit, it is compulsory to keep the shut-off valves close, unless the pressure test is performed with pressures not exceeding 30 bar / 435 PSI on the high side and 20.5 bar / 297 PSI on the low side. The leak test, on the other hand, can be performed by following the guidelines of EN378-2, provided the pressures are kept within the acceptable range of the compressor. Make sure the test is performed with oxygen-free nitrogen (OFN) from a sealed cylinder, and having a pressure reducer and safety valve.

It is forbidden to test for leakage by using HFCs. HFCs refrigerants are not tracing gases. Releasing HFCs into the atmosphere is a felony. In case OFN comes in contact with HFCs, it cannot be released into the atmosphere any longer, but it must be recovered and carried to thermodestruction, with the same regulations for handling HFCs disposing of cylinders.

6.1 抽真空

冷媒回路进行抽真空必须严格遵守有效的操作。特别是如果回路仍然有压力，须释放内部氮气，直至与大气压平衡。
连接足够数量的软管，就可以有效的达到冷媒回路的任何点，先打开所有的关断阀，并且把回路中所有的电磁阀都打开。
连接所有的软管到一个表组上，转连接到两段式真空泵。
执行高真空度，推荐至少达到欧洲 EN378-2 标准，富士豪建议达到 20 Pa 的最低真空等级，加热时间不能短于将油加热温度升高至室温 20K。如果真空泵在一个较短的时间内达到所需的真空度，须保持运转直到油的温度高过室温 20K。当泵停止时，真空度不得变动超过泵运转时的水平 ±20%。如果不是这样的情况，重复抽真空程序，或者检查整个冷媒回路是否隙漏。

一些如 R134a 的冷媒气体，在室温下与 POE 油有很好的混溶性。在油意外的与 R134a 接触的情况下，或许就不会有可能达到一个良好的真空度。

严格禁止在深度真空下启动压缩机。在此条件下的任何电机操作可能造成电动机的定子永久性损坏，并导致润滑油的脱酯化或水解。

6.2 冷媒充填

打开所有的电磁阀，拆掉所有接真空泵的软管并接上表组，一条接低压端，另一条接在冷凝器和热力膨胀阀之间的高压端。
切勿连接表组在排气端上。使用正确的保证未拆封的专用密封钢瓶，只用液态冷媒管路充填液态冷媒，充填的冷媒可能进入液体储液器内。如果蒸发器是满液式类型，冷媒液可以被转移到这里。

不要在吸气管路中充填液态冷媒。如果因任何原因发生这种情况，请使用冷媒回收机回收所有冷媒入空罐。如果冷媒是非共沸的，它就不能再使用，并且必须进行热破坏和当作危险特殊废弃物处理。

6.1 Vacuum

Refrigerant circuit vacuum must be performed with strict observance of the good practice and regulations in the place of installation. Specifically, if the circuit is still under pressure, release nitrogen down to atmospheric pressure. Connect a sufficient number of hoses, so as to reach efficiently any point of the refrigerant circuit, having previously opened all of the shut-off valves and eventually having engaged all solenoid valves intercepting any part of the circuit remaining otherwise closed. Connect all hoses to a single manifold, which in turn is connected to a double-stage vacuum pump. Perform a very deep vacuum, reaching at least the value recommended in the European standard EN378-2 (or the regulations in the place of installation). Frascold recommends reaching a minimum vacuum level of 20 Pa, for a time not shorter than the time the heater takes to warm the oil to a temperature 20K higher than room temperature. If the vacuum pump reaches the desired vacuum level in a shorter time, keep it running until the oil temperature is 20K higher than the room. When the pump is stopped, the vacuum level shall not change for more than ±20% of the level when the pump was running. If that's not the case, repeat the evacuation procedure, or check the whole refrigerant circuit for leakages.

Some refrigerant gases, like R134a, have a great miscibility with POE oil, already at room temperature. In case the oil came in accidental contact with R134a, it might not be possible to reach a good vacuum any longer.

It is strictly forbidden to switch the compressor on when it is under a deep vacuum. Any electrical maneuver in this condition may cause permanent damage to the stator of the electric motor and cause de-esterification or hydrolysis of the lubricant.

6.2 Refrigerant charge

Disengage all solenoid valves. Disconnect all hoses of the vacuum pump and connect the hoses of the manifold gauges, one to the low side and one on the high side between the condenser and the thermostatic expansion valve. Never connect the manifold gauge on the discharge. Charge liquid refrigerant, coming exclusively from a sealed cylinder, still with the proper warranty seal untouched, only in the liquid refrigerant pipeline, possibly into the liquid receiver. If the evaporator is of a flooded type, liquid can be transferred into it as well.

Never charge liquid refrigerant in the suction line. If this happened for any reason, please reclaim all refrigerant into empty canisters with a reclaiming unit suitable for the case. If the refrigerant is zeotropic, it cannot be used any longer and must be disposed and treated as dangerous special waste.

当液态冷媒停止流入储液器，关闭表组的关断阀或软管阀，并充填气态冷媒进入冷媒回路的其余部分，包括压缩机。
在所有的充填过程中，保持油加热器通电，随时注意油视窗，看是否改变颜色，也注意油的密度和外观，看有没有开始发泡。如果出现这种情形，这可能意味着，油已经接触到液态冷媒，在这种状况下，必须重新开始整个程序。在这一点上充填量已足以允许压缩机启动。

When liquid refrigerant stops flowing into the liquid receiver, close the shut-off valves of the manifold gauge or the hose valve, and charge vapor into the rest of the refrigerant circuit, including the compressor. During all of the charging procedure, keep the oil heater ON and keep an eye on the oil sight glass, so that it doesn't change color, density, or appearance and it doesn't start foaming. If that happens, it probably means that it came in contact with liquid refrigerant, and in this case, the whole procedure must be repeated from the beginning. At this point, the charge is sufficient to allow the compressor to be started up.

6.3 试运转结束

按您的正常程序充填，直到达到所需的冷媒充填量，小量添加冷媒，当确定排气温度比冷凝温度高约 30K。每充注 5 分钟时等待 1 分钟，以让运转状况稳定。
保持油位在严格的控制下。如果油位低于视窗面，它可能需要添加一些，主要的原因是冷媒回路较长或较多的U弯管。在这种情况下，停止压缩机，关闭关断阀，回收一些在压缩机内的冷媒，通过加油口倒入润滑油。在添加后，密封加油口，压缩机抽真空和重新打开关断阀。
除了油分离器以外，请不要在冷媒回路的任何其他部分添加润滑油(如果有安装)。
如果再次加注不成功，可能是管路里面有东西阻挡或者尺寸不正确的零件不允许油进入压缩机。压缩机加油不能过量，这也可能导致阀门损坏。为了避免过量注油，检查一些管路设计里面是否有障碍物，并且油位不能超过视油镜的 3/4 (参考第 4 页)。

6.3 End of commissioning

Go on charging as per your normal procedure, until reaching the desired refrigerant charge by adding refrigerant in small quantities while making sure the discharge temperature is around 30K over the condensing temperature. Wait 1 minute every 5 minutes of charging to allow stabilization of operating conditions. Keep the oil level under strict control. If the oil level drops below the sight glass, it may be necessary to add more, mainly when the refrigerant circuit is long or with a high number of oil traps. In this case, stop the compressor, close the shut-off valves, reclaim some of the refrigerant in the compressor, and pour oil through the oil port. After refilling, seal the oil port, evacuate the compressor, and reopen the shut-off valves. Do not add oil up in any other part of the refrigerant circuit, exception made for oil separators (if installed). If the refilling procedure is not effective, there may be an obstruction or some improperly sized siphons that do not allow the correct oil return to the compressor. The compressor must not work with excessive oil charge, as this may cause the valves to break. To avoid excessive oil charge, check if there are some oil obstructions on the piping design. The oil level must not exceed 3/4 of the oil sight glass (see page 4).

请注意: 这是一个非常危险的状况，因为油可以在任何时间返回，出乎意料的也可能是任何数量，并可能导致直接的，暴力的，致命的压缩机故障。当制冷达到预定效果时，冷媒填充就完成了。

Attention: this is a very dangerous condition because oil can return at any time, unexpectedly, and in any amount, and can cause compressor seizing or valve breaking. The charge is complete when subcooling reaches the project value.

不要从液管视窗判断冷媒充填是否完成。它可能会误导你!

Don't judge the refrigerant charge by the liquid sight glass. It may mislead you!

完成所有测量并将数值存进机器的日记簿中。
这些测量应至少包括:
- 冷媒液温
- 吸气温度
- 空气温度
- 蒸发压力
- 冷凝压力
- 排气温度
- 油温
- 三相电流
- 三相电压

Make all measurements and file them into the machine logbook. Those measurements shall at least include:
- Liquid temperature
- Suction temperature
- Air temperature
- Evaporating pressure
- Condensing pressure
- Discharge temperature
- Oil temperature
- Current on the three phases
- Voltage on the three phases

打印或填入微处理器的参数表中，并连同上述的测量资料一起保留在日志里面。在整个压缩机的使用期间，所有这些数据都可以传输到富士豪成为知识，和用以谘询，解决问题和援助。关于问题的更多信息，请联系我们的售后服务部门。

Print or fill the parameter list of the microprocessor and keep it together with the measurements above in the logbook. All of these data can be transmitted to Frascold for knowledge and used in order to have advising, problem-solving, and assistance during the entire compressor life. Contact Frascold's post-sales service for more information.

重要提示:
最大循环启动: 6 次每小时
最小运行时间: 5 分钟

Important note
Maximum cycling rate: 6 starts per hour
Minimum running time: 5 minutes

6.4 故障排除

造成故障的原因是不可能列出所有可能的状况，但它仍然是可以帮助用户防止某些最常见造成故障的原因，例如:

A 膨胀阀感温管的正确安装位置。它必须频繁地控制和收紧。没有任何理由可以安装于吸气过热器位置之后，只可以在靠近蒸发器出口处。

B 在任何运转条件、季节变换或热负荷变动，吸气过热度必须总是被控制在可接受的范围之内。它决不可低于 5K 或高于 20K。

C 在任何运转条件、季节变换或热负荷变动，冷媒必须总是避免任何闪蒸气体，如果安装了经济器，视镜必须位于经济器入口之前。

D 油加热器必须维持通电。必须总是联锁油温控制器提供启动信号。对于长期不开机，压缩机可切开电源，关断阀处于可以关闭状态，用以防止冷媒迁移到壳体或油分离器。

E 压缩机必须总是比回路内其他零件温暖，即使在回路因为季节性停止而关闭。

F在蒸发器的热负荷有强烈的波动情况下，建议安装的液气分离器在吸气管路。

G 为了方便故障排除和做故障分析，任何冷媒回路提供足够和适当的仪器是必要的，例如容易取得的压力计，温度计，探针，感测器……等。

H为了避免在长期不用或者运输的情况下，液体进入到曲轴箱，建议在此期间关闭吸排气阀门。

6.4 Troubleshooting

It is impossible to list all possible conditions which might be a cause of a malfunction, but it is nevertheless possible to help the user prevent some of the most frequent causes of fault, e.g.:

A Correct positioning of the thermostatic valve sensing bulb. It must be frequently controlled and tightened. For no reason at all can it be located after the suction superheater, but only immediately after the evaporator.

B The suction superheat must always be controlled within the acceptable range at any operating condition, season, or heat load. It shall never be lower than 5K or higher than 20K.

C Refrigerant must always be void of any flash gas at any operating condition, season, or heat load. If an economizer is installed, the sight glass must be located just before the economizer inlet port.

D Oil heater must always be ON. The start enables signal shall always be interlocked with an oil thermostat. For long out of service periods, it may be possible to switch it OFF, provided the shut-off valves are closed in order to prevent the refrigerant to migrate into the casing or into the oil separator.

E Compressor must always be warmer than any other component in the circuit, even if the circuit is switched off for seasonal stop.

F In case the thermal load at the evaporator has strong fluctuations, it is recommended to install a liquid separator in the suction line.

G In order to ease the troubleshooting and fault analysis, it is necessary that any refrigerant circuit is provided with sufficient and proper instrumentation, e.g., readily accessible manometers, thermometers, probes, transducers, etc.

H In order to avoid liquid migrating into the compressor crankcase during a long shut-off period and/or transport it is suggested closing suction and discharge valves.

如需要任何进一步的讯息，请联系售后服务部门。

Contact the Post-Sales service for more information.

7. 操作与维护

介绍最常见的维护操作如下:

1. 温度和压力，在试运转时要检查机器的历史日志上的报告。
2. 油位和温度
3. 安全和控制装置(压力开关、安全开关、电磁阀)
4. 电源线和控制线: 螺丝栓紧和目视检查电缆绝缘
5. 冷媒充填量
6. 泄漏测试
7. 润滑油更换

冷水机组和单元机换油不是必需的。

“现场安装”和靠近运转极限的应用，第一次换油建议约在 100 个工作小时后。

之后约每 10000...12000 工作小时换油一次，参考 FTEC 26。如果对压缩机的操作有疑虑，请仔细收集的所有技术数据，联系富士豪售后服务部门。

7. OPERATION AND MAINTENANCE

The most common must-do maintenance operations are hereby described:

1. Temperatures and pressures to be checked against what reported on the machine history logbook, and at commissioning
2. Oil level and temperature
3. Safety and control devices (pressure switches, safety switches, solenoids)
4. Power and control connections: bolts tightening and visual inspection of insulation cables.
5. Refrigerant charge
6. Leak testing
7. Oil changes

Oil changing is not normally necessary for the chiller and package unit.

For “field installation“ and for applications near the operating limit, a first oil change is recommended after approx. 100 operating hours.

After that, oil has to be replaced approx. every 10000... 12000 operating hours. See our FTEC26 for more information. In case of doubts on the compressor operation, please contact the after-sales department of Frascold, after having carefully collected all the technical data available. having carefully collected all the technical data available.

8. 拆卸

⚠ 在拆卸压缩机时，必须有冷媒回路和高功率电路操作的授权。确保受过适当培训和资格的人员进行此相关的技术活动。

关闭压缩机的关断阀并拴紧阀门的密封。保持油加热器通电，移除保险丝或打开电磁开关。压缩机连接到一个合适的冷媒回收机进行内部的冷媒回收和分离。

只要有轻微的真空度，就以略高于大气压力的氮气加压。

连接卸油阀到一个管子，预先插入适用于容纳排出的润滑油罐内，并在外面标示适当的警告标志和危险符号。

油罐的容量必须大于压缩机内的油含量至少 30%-50%，因为 POE 油只要暴露到较低的压力时就开始起泡。一旦油已完全排出，关闭加热器，关闭卸油阀。

⚠ 油罐含有排出的冷媒气体和油必须被运送到能够正确地处置它们的工厂。

8. DECOMMISSIONING

⚠ For decommissioning the compressor, it is necessary to have all the necessary authorizations for operation on the refrigerant circuit and high power electrical circuits. Make sure the personnel is properly trained and qualified for the respective technical activities. Close the compressor shut-off valves, and tighten the valve seal. While keeping the oil heater ON, remove the fuses or open the magnetic switch. Connect the compressor to a suitable reclaim unit for reclaiming and segregating the refrigerant contained inside of it. Once a slight vacuum is obtained, pressurize with nitrogen at a pressure slightly above the atmospheric one. Connect the oil drain valve to a pipe, previously inserted into a canister, suitable for containing exhausted lubricants and having the appropriate warning signs and danger symbols on the outside. The canister volume must be at least 30%-50% larger than the volume of oil contained in the compressor because the POE oil will start to foam as soon as it is exposed to a lower pressure. Once the oil is completely drained, switch the heater OFF and close the drain valve.

⚠ The cylinder containing the exhaust refrigerant gas and the exhausted oil must be transported to a plant, capable of correctly disposing of them.

这两种流体被视为特殊和危险的，适用现行法令，因此它们必须处理。

拆开电气接线端子。
切勿拆卸接线端板，以避免污染冷媒或让气体留在机壳内。
将压缩机从冷媒回路中拆开，留下衬套和法兰在回路上。如果压缩机不具备两边的关断阀，关闭法兰空腔或以任何适当装置密封排气和吸气端。
抬起压缩机如第1章的说明，并送回富士豪拆卸或运送到工厂，以使能够正确的处理。

9. 测试报告的依据

所有的 A-B-D-F-Q-S-V-Z-W 系列单级或双级压缩机，有以下规范:

设计压力
吸气端的最大允许静态压力，显示在压缩机的铭牌: 20.5 bar / 297 PSI (适用于所有的冷媒)排气端最大允许压力，显示在压缩机的铭牌:30 bar / 435 PSI(适用于所有的冷媒)。

设计温度
最大允许排气温度: 140°C / 284°F（适用于所有的冷媒）

液压试验
上述压缩机符合下列要求:
低压侧外壳须能承受 61.5 bar/ 89.1 PSI 压力的液压试验而不会破裂-为压缩机在铭牌上显示的最大允许静态压力的至少 3 倍。高压侧外壳须能够承受 90 bar / 1305 PSI 的压力的液压试验而不会破裂-为压缩机铭牌显示的最大允许压力的至少 3 倍。此测试是至少每年一次由每个机型范围提供两个样品来进行。

气压测试压力
上述压缩机已经过33 bar / 478 PSI的压力测试。

泄漏测试
泄漏测试在生产线上已按最大容许压力的 1,1 倍的压力使用干燥空气和氦的混合气完成测试，为在压缩机铭牌上所显示的 30 X 1.1= 33 bar / 478 PSI。

外壳材质
外壳材料为 EN-GJL-250 铸铁

Those two fluids are to be considered special and dangerous, by the present Law in force, and they must be treated as such.

Disconnect the electric terminals. Never disassemble the terminal plate in order to avoid pollutant gases or vapors leaving the casing. Disconnect the compressor from the refrigerant circuit, leaving the bushes and flanges with the circuit. If the compressor doesn't possess one or both shut-off valves, close the cavities with blind flanges or any device suitable to hermetically seal the discharge and suction. Lift the compressor as explained in chapter 1 and return it to Frascold for disassembly or transport it to a plant capable of correctly disposing of it.

9. TEST REPORT CERTIFICATE

All compressors of the A-B-D-F-Q-S-V-Z-W series, one stage or two-stage, have the following specifications:

Design pressure
Suction side maximum allowable standstill pressure, indicated in the compressor label: 20.5 bar / 297 PSI (for all refrigerants) Discharge side maximum allowable pressure, indicated in the compressor label: 30 bar / 435 PSI (for all refrigerants)

Design temperature
Maximum allowable discharge temperature: 140 °C / 284 °F (for all refrigerants)

Hydraulic test
The above-mentioned compressors meet the following requirements: Low-pressure side enclosure is able to withstand, without rupture, a hydraulic test with 61.5 bar / 89.1 PSI pressure - at least 3 times the specified max allowable standstill pressure indicated in the compressor label. High-pressure side enclosure is able to withstand, without rupture, a hydraulic test with 90 bar / 1305 PSI pressure - at least 3 times the max allowable pressure indicated in the compressor label. This test is made at least once a year on two samples for each model range.

Pneumatic test pressure
The above-mentioned compressors have been tested at 33 bar / 478 PSI

Leak test
The leak test is done in line with a mixture of dry air and helium with a pressure of 1,1 times the maximum allowable pressure indicated on the compressor label:
30 X 1.1= 33 bar / 478 PSI

Housing Material
The housing material is cast iron type EN-GJL-250

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