

富士豪



安装和启动说明

紧凑型双螺杆压缩机CX系列

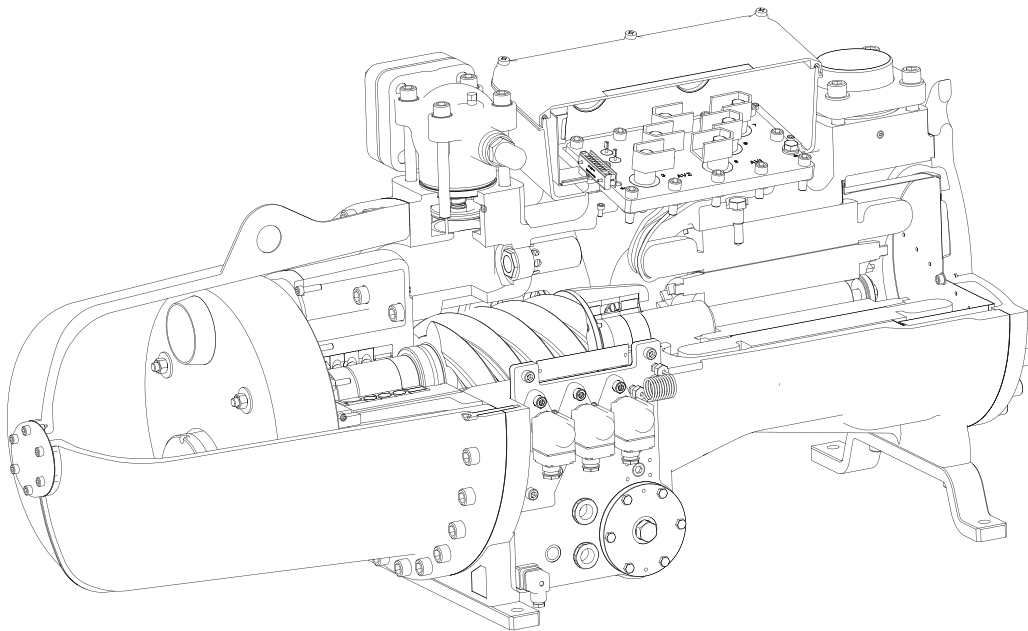
Installation and start-up instructions Compact twin screw compressors CX series

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标识信息



需遵守的一般警告或警示措施。严重危险。



触电危险



皮肤烫伤危险



禁止操作或行动

RECOGNISING TEXT INFORMATION



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



Danger of electrocution



Danger of skin burn



Forbidden maneuver or action

FTFC_027_04

制造商
Costruttore

压缩机型号
Modello compressore

频率/排气量/转速
Frequenza/ Volume spostato/ Velocità

三相交流电/冷冻油类型
Corrente alternata trifase

电机类型
Tipo motore

指定的电压和频率
Tensioni

Specified frequencies
Frequenze

标识条码
Codice d'identificazione a barre

标识码
Codice d'identificazione

产地
Luogo di produzione

序号
Numero di serie

最大允许排气压力
Pressione massima ammissibile

最大允许吸气静态压力
Massima pressione equalizzata

锁定转子电流
Corrente a rotore bloccato

Y 启动堵转电流
Corrente a rotore bloccato Y

Δ 启动堵转电流
Corrente a rotore bloccato Δ

最大工作电流
Corrente massima di esercizio

Frascold SPA Type **CXH91-280-1000Y**
Nr. **KP001002**

Hz	Displ. m³/h	RPM
50	1000	2900
60	1200	3500

Max. Operating Disch. Pressure bar 30
Max. Static Suct. Pressure bar 20,5

Oil type: POE170 3~

Volt		Hz	MRA		LRA	
Y/Δ			Y/Δ		Y	Δ
380-420		50	474		805	2520
440-480		60	474		805	2520

CE

Frascold S.p.A. **CX280000KLP001002** MADE IN ITALY

1. 交付状态说明



在将压缩机卸货到客户仓库时，请检查包装箱或包装盒是否有明显损坏，并确认其状态良好。

如果有任何物品受损，请立即与货运代理商联系，向货运公司发送声称遭受了损坏的挂号信件，并向富士豪发送一份副本，以确保富士豪了解相关情况。

根据包装清单和/或您的订单内容检查压缩机配件。如果缺少任何物品，请立即联系富士豪或当地经销商/代理商。

设备工厂安装

以下设备由工厂安装，属于标准供货的一部分：

- 3个线圈，230V，带电磁阀接头（参见第20页）
- 1个油箱加热器，230VAC，300W（参见第21页）

2. 开箱及操作

为防止水分或杂质渗入，压缩机出厂前已经用氮气填充压缩机。



通过轻轻压下任何针阀的气门芯或轻微打开排气截止阀，确保从卡车上卸货或从箱子中取出时，压缩机仍然处于氮气保压状态。

切勿把压缩机内的氮气完全释放完，并尽可能使压缩机长时间保持在氮气压力下，即使在组装过程中也是如此。如果出于任何原因，必须对压缩机进行释放氮气，请确保尽快恢复2bar的最小氮气压力，以避免水分、空气或灰尘进入。如果不能达到此要求，则会导致POE油被水解、过早生锈和压缩机加工内表面被异物损坏。

1. Delivery state condition



When the compressor is unloaded into your warehouse, inspect the crate or carton box for any visible damage and make sure it is in good condition.

In case any item is damaged, contact your forwarder immediately and send a registered letter to the shipping company, claiming the suffered damage, copy to Frascold for knowledge.

Check the compressor accessories against the packing list included and/or against your order. Contact Frascold or local distributor/agent immediately if there is any item missing.

EQUIPMENT FACTORY MOUNTED

The following equipment, part of the standard supply, is factory mounted:

- Nr. 3 Coils 230V w/ connectors for solenoid valves (see page 20)
- Nr. 1 Crankcase Heater 230VAC 300Watt (see page 21)

2. Unpacking and handling

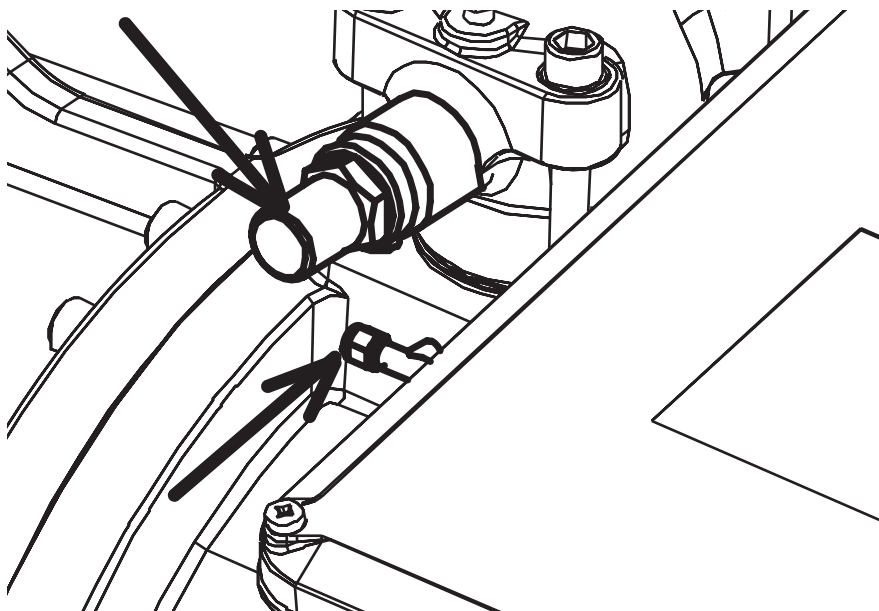
To prevent moisture or impurities penetration, the compressor is charged with nitrogen before shipment from our warehouse.



Please make sure the compressor still contains pressurized nitrogen when unloaded from the truck or taken out the crate, by slightly depressing any schrader valve or slightly opening the discharge shut off valve.

Do never depressurise the compressor completely, and keep it under nitrogen pressure for as long as possible, even during your assembly.

If, for any reason, the compressor must be depressurised, make sure to reinstate a minimum nitrogen pressure of 2 bar as soon as possible, to avoid moisture, air or dust ingress. Failure to accomplish this requirement will result in POE oil hydrolysis, premature rusting, and foreign body damage to the machined inner surfaces of the compressor.





即使氮气压力很低，也应缓慢地释放氮气。
操作人员应始终佩戴安全护目镜。



除了OFN（无氧氮气）之外，切勿给压缩机填充任何其他气体。切勿使用易燃或易爆的氧气或碳氢化合物，否则可能导致爆炸、受伤或死亡。
不要用HFC进行加压，因为这在您的国家可能是禁止的或非法的。



Release nitrogen slowly, even if the nitrogen pressure is low.
Always wear safety goggles.



Do not charge the compressor with anything else but OFN (oxygen free Nitrogen). Never use oxygen or hydrocarbons which are inflammable or explosive. Failure to comply may result in risk of explosion, injury or death.
Do not pressurize with HFCs either, as this may be forbidden or unlawful in your country.

起吊

使用钢链或钢丝绳和吊环螺栓（或可用的铸铁提升件）来起吊压缩机。

使用的任何绳索应能承受至少2000kg的重量，并且不小于压缩机重量的两倍，取高标准值为准。

如果没有钢链或钢丝绳，可以使用纤维绳索，前提是这些绳索能够承受至少4000kg的重量，并且不小于压缩机重量的四倍，取高标准值为准。

绳索必须有锁扣，无论是钢链还是纤维绳索。

如果没有锁扣，则绳索必须围绕在电机端和油分离器端周围。

LIFTING

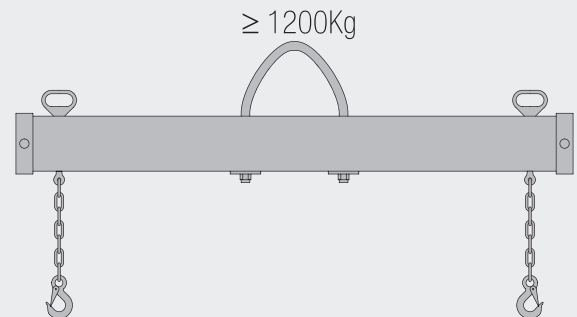
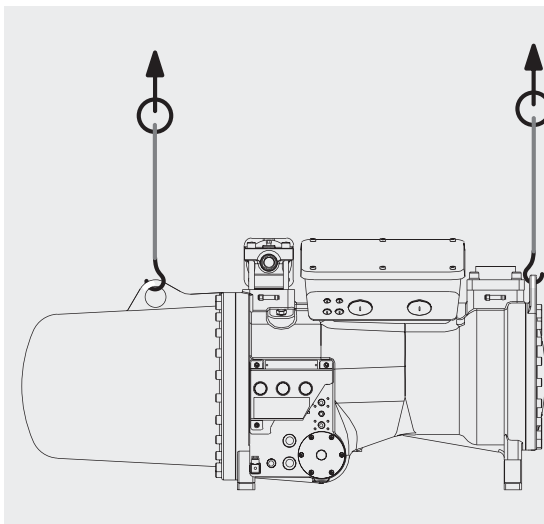
Use steel chain or steel ropes and eye bolts (or cast-iron lifting points, where available) to lift the compressor.

Any rope used should be capable to carry up the weight at least 2000 kg each, but not less than twice the weight of the compressor each, whichever is more.

If steel chains or ropes are not available, textile ropes can be used, provided they are capable to carry up the weight at least 4000 kg each, but not less than four times the weight of the compressor each, whichever is more.

Ropes must have shackled ends, unresponsive whether steel chains or textile.

If shackles are not available, than the rope must be encompassed around the motor end and the oil separator end.



确保钢链不接触电磁阀、油毛细管、油加热器、温度传感器或电源端子等，以防止任何损坏。



Make sure that the steel chain does not touch the Solenoid Valves, oil capillary, oil Heater, temperature sensor or power terminals, etc. for preventing any damage.



在没有证明其吊装能力的情况下，不要随意使用任何绳索。压缩机是重型设备，如果吊装装置失效可能会导致人员受伤或死亡。如果吊装压缩机的总重量超过1200Kg，建议在钢丝绳之间使用提升杆。



Don't try any rope arbitrarily without proof of its loading capability. Compressors are heavy equipments which may cause injury or death if lifting devices fail. In case the compressore to be lifted exceeds 1200Kg of total weight, it is recommended to use a lifting bar between ropes.



在提升压缩机时，避免绳索刮擦压缩机表面。
在提升时要保持压缩机处于水平状态。



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

3. 安全性说明

根据机器指令EC 98/37、EC 2006/42和以下适用法规，富士豪的压缩机专为机组或准机组而制造。只有在遵守相应条款的情况下才可以将压缩机投入使用。

“制造商声明”表明，只有严格遵守这些安全说明和用户手册，CX压缩机才是安全的。此声明可以从富士豪的网站下载。



本手册务必随附在压缩机上，并且必须完整地将这些说明书以及原理图和接线图一起纳入到使用机器（安装压缩机的机组）的用户手册中。

所有关于压缩机和制冷管路的工作只能由经过适当培训和指导的制冷人员执行。

钎焊设备和HFCs制冷剂的处理受法律管制，并且只能由具有认证合格及心理-生理能力齐全的人员执行。

专家人员拥有的资质和知识必须符合贵国现行有效的指导原则。

用户安全得到特别强调，用户安全与可持续发展、能源效率和环境意识一起构成了富士豪的企业社会责任。



残余危害。不可能完全消除与压缩机运行有关的所有危险。所有操作或维护必须由专业人员、获授权和知情人员执行，并遵守与特定应用相关的所有安全措施。

3. Safety

Frascold's compressors are built for and destined to machines or quasi-machines, according to the Machine Directive EC 98/37, EC 2006/42 and following applicable legislation. They may be put in operation only if the corresponding provisions have been followed by.

The Manufacturer Declaration can be downloaded from Frascold's website, declares that **CX** compressors are safe only if these safety instructions and user manual is strictly followed.



This manual shall always accompany the compressor and it is mandatory to incorporate completely these instructions into the user manual of the machines where the compressor is installed, together with principle scheme and wiring diagrams.

All work on compressor and refrigeration systems shall be carried out only by refrigeration personnel which has been properly trained and instructed.

Handling of brazing equipment and HFCs refrigerants is regulated by law and shall only be carried out by personnel having a proper certification and full psycho-physical capability.

The qualification and knowledge in possession by expert personnel must correspond to the respectively valid guidelines in force in your country.

Particular emphasis has been placed on the users' safety, that together with sustainable development, energy efficiency, and environmental awareness build up Frascold's Corporate Social Responsibility.



Residual hazards. It is not possible to completely eliminate all hazards related to the compressor operation. All maneuvers or maintenance must be carried out by expert, authorised and aware personnel, observing all safety measures, pertaining to the specific application.

4. 应用范围

被允许的制冷剂:

- HC、HFC、HCFC、HFO和混合物

被允许的油型:

- HC制冷剂使用PAG 150 cSt
- HFC、HCFC、HFO制冷剂或同等类型制冷剂使用 POE 170 cSt (见公告FTEC22)

压力范围:

- 高压侧的最大允许压力 30.0 Bar
- 吸气侧的最大允许压力 20.5 Bar
- 最大允许静态压力 20.5 Bar

运行范围:

- 请参阅FSS (富士豪选型软件) , 可从富士豪网站免费下载。

环境温度范围: - 20℃至+55℃

储存温度: - 30℃至60℃的干燥环境中

相对于标称额定值的电源电压:

- 稳定运行时, +/- 5%
- 在瞬态期间, +/- 10%

相对于标称额定值的电源频率:

- +/- 2%

对于超出这些范围或使用不同制冷剂或油类的任何其他用途, 都必须提前获得富士豪的同意。



在高于此处规定值的压力下使用会危害健康和生命安全, 可能导致人员伤亡并可能损坏财产。

如果系统不密封, 在蒸发压力低于1个大气压的情况下使用会导致吸入空气, 同时水分进入压缩机的制冷剂回路。

空气和水分是非常有害的, 因为它们都可以增加冷凝温度并因此促成吸热化学反应, 如氧化还原, 此外, 也可以促使聚酯油水解成其原始化合物 (酸和醇) 。此外, 由于存在氧化剂 (氧气) 即进入压缩机的制冷剂回路的空气可极易改变油 - 制冷剂混合物的闪点, 从而降低该闪点。

如果空气或水分可能被夹带在压缩机的制冷剂回路中时, 首先关闭压缩机阀门, 用密封罐中的新油换掉压缩机内的旧油, 再打开油箱加热器, 并抽真空。

根据制冷行业的标准, 剩余的制冷剂必须得到完全回收和清洁。

5. 安装说明

无论哪种应用, 必须水平地安装CX压缩机。

在海上应用的情况下, 以压缩机轴线必须仅与船的纵向轴线设置。海洋环境比通常的民用应用更具腐蚀性, 因此可能需要进行特殊处理, 或直接根据客户的要求进行特殊处理。

4. Application ranges

Authorised refrigerants:

- HC, HFC, HCFC, HFO and blends

Authorised oil type:

- PAG 150 cSt with HC refrigerants
- POE 170 cSt with HFC, HCFC, HFO refrigerants or equivalent (see bulletin FTEC22)

Pressure ranges:

- Maximum allowable pressure on high side 30.0 Bar
- Maximum allowable pressure on suction side 20.5 Bar
- Maximum allowable standstill pressure 20.5 Bar

Operating envelope:

- Refer to FSS (Fracold Selection Program), free download from Frascold website.

Ambient temperature range: -20℃ to +55℃

Storage temperature: -30℃ to +60℃ in dry ambient

Mains voltage respect to nominal rated value:

- +/- 5% in steady operation
- +/-10% during transient

Mains Frequency respect to nominal rated value:

- +/- 2%

Every other use, beyond these ranges, or with different refrigerants and oils, must be authorised in advance by Frascold.



The usage at higher pressures than hereby specified is a risk for health and safety, may cause injuries death and may damage property.

Usage at lower evaporating pressures than atmospheric can cause suction of air and moisture into the refrigerant circuit if this is not air tight.

Air and moisture are highly harmful because they can respectively increase the condensing temperature and therefore favouring endothermal chemical reactions, like redox, besides can favour polyester oil hydrolisis into its original compounds (acids and alcohols) furtherly favoured by high temperatures. Moreover, air ingress into refrigerant circuit can significantly shift the ignition point of the oil-refrigerant mixture, lowering it thanks to the presence of the oxidising agent: oxygen.

Whenever in doubt whether air or moisture could have entrained into the refrigerant circuit, first of all close the compressore valves, replace the oil with new equivalent oil from a sealed canister, and finally put it under triple vacuum with crankcase heaters ON.

Clearly, the remaining part of the refrigerant circuit must be subject to complete reclaim and cleaning, as per good refrigeration practice.

5. Mounting

CX compressors must be installed only horizontally, whichever the application.

In case of marine application, the compressor axis must be set along the ship longitudinal axis only. Marine environment can be much more aggressive than the usual civil applications, and for this reason a special treatment may be necessary, to be requested or to be directly applied.



压缩机不适合安装在有化学侵蚀、细菌污染、放射活性或潜在爆炸性的环境或大气环境中，除非富士豪以书面方式特别声明适用性。

不得将压缩机安装在环境温度超过上一章规定限值的房间或区域中。

固定

压缩机必须始终牢固地固定在合适的框架上，此框架可以承受压缩机产生的静态力和动态力。在启动过程中，压缩机会在支架上产生较高的反转矩，特别是在直接启动时，出于这个原因，并且为防止微小的振动，或者减少通过支撑梁传播的噪声，建议使用专用的高分子减震器。



不能将压缩机安装在任何其他不是专门设计用于承受压缩机本身所产生重量和加速度的支架上：例如，壳管式冷凝器与蒸发器等。

如果将压缩机安装在减震器上，螺栓螺母拧紧至通过螺栓牵引使减震器的安装厚度减少1 mm的状态下。



The compressors are not suitable for installation in chemically aggressive, bacteriologically contaminated, radiologically active or potentially explosive environments or atmospheres, unless Frascold specifically declared the suitability by written from. 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.

Fixing

Compressors must always be solidly fixed to a frame, suitable to withstand static and dynamic forces originated by the compressor. During starting, the compressor can originate a high counter torque on the bracketry, specifically when started with direct on-line procedure. For this reason, and also for preventing the little vibration, or reducing the noise transmitted through the support beams, it is advised to use the dedicated polymeric antivibration mountings.



The compressors cannot be installed on any other support, not specifically designed to withstand the weight and acceleration originated by the compressors themselves: e.g. shell-and-tube condensers and evaporators, etc. If the compressor is mounted on antivibration mountings, the nut tightening is concluded when the antivibration mounting thickness has been reduced 1mm by the bolt traction.

减振器套件T00SK205200 (CX 0和CX5系列)

- 数量: 4 方形垫90SH 50x50x14 mm
- 数量: 4 圆形垫90SH ϕ 31x5 mm
- 数量: 4 螺栓M16x90 8.8 UNI – 5739 I.F.ZB (*)
- 数量: 4 垫圈16x30x3 UNI – 6592
- 数量: 4 锁紧螺母M16 UNI – 7474 (*)

减振器套件T00SK205201 (CX 9系列)

- 数量: 4 方形垫90SH 50x60x14 mm
- 数量: 4 圆形垫90SH ϕ 38x5 mm
- 数量: 4 螺栓M20x90 8.8 UNI – 5739 I.F.ZB (*)
- 数量: 4 垫圈20x37x3 UNI – 6592
- 数量: 4 锁紧螺母 M20 UNI – 7474 (*)

(*) 紧固:
直到橡胶垫厚度减少约1 mm



钎焊

截止阀或衬套适用于英制或公制的钎焊管道。有关直径的更多信息，请查阅目录。
保持阀门始终被关闭状态，如果没有吸气截止阀，则必须使用一个合适的装置来接触压缩机的腔体，如通过盲法兰、临时阀门或任何其他合适装置来保持压缩机的气密性，直到制冷剂回路完全抽真空为止。

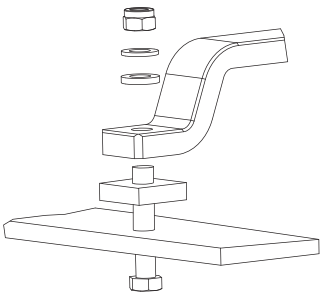
Kit Vibration absorbers T00SK205200 (CX 0 & 5 series)

- n.4 Square Pad 90SH 50x50x14mm
- n.4 Round Pad 90SH ϕ 31x5mm
- n.4 Bolt M16x90 8.8 UNI-5739 I.F. ZB (*)
- n.4 Washer 16x30x3 UNI-6592
- n.4 Locknut M16 UNI-7474 (*)

Kit Vibration absorbers T00SK205201 (CX 9 series)

- n.4 Square Pad 90SH 50x60x14mm
- n.4 Round Pad 90SH ϕ 38x5mm
- n.4 Bolt M20x90 8.8 UNI-5739 I.F. ZB (*)
- n.4 Washer 20x37x3 UNI-6592
- n.4 Locknut M20 UNI-7474 (*)

(*) Tightening:
untill the rubber pad thickness has been reduce about 1mm



Brazing

Shut-off valves or bushes are suitable for brazing Inches or Metric pipings. Please consult the catalogues for more information concerning the diameters.
Keep the valves always shut. If you don't have a suction port valve, then you must provide a suitable mean to seal the exposed cavity of the compressor, by using a blind flange, a temporary valve or any other suitable mean to hermetically seal the compressor, for all the time it will take until ready to evacuate the refrigerant circuit.

不要使用抹布、纸张或其他不合适的材料。

从压缩机上取下衬套，在远离压缩机的位置对管道进行钎焊。

推荐在惰性或抗氧化剂的情况下使用低温、高银含量的钎焊。

只有当衬套完全冷却时，才能将其重新安装在压缩机或阀体上。事实上，必须在相同温度下完成所有组件的螺栓拧紧。需要使用独立供应的新垫圈。

使用内部已清洁并带有端盖的铜管。如果必须切割铜管，请使用专业的切管机。切勿使用电动切割机、锯、磨床或其他会留下铜屑的任何工具。

铜管必须是最近生产的铜管，并且不得有明显的氧化或灰尘。铜管的相关标准必须在铜管上清楚标出。

如果使用钢管或不锈钢管，以上规定同样则适用。

必须在液体管路上安装大尺寸的干燥过滤器，同时最好在吸气管路上安装一个小于或者等于25微米的过滤器。

滤芯必须在回路抽真空前几分钟安装，且滤芯必须来自密封罐。

制冷剂管道连接件

吸气管必须放平，以防止压缩机停机期间大量的油或液体制冷剂回流。



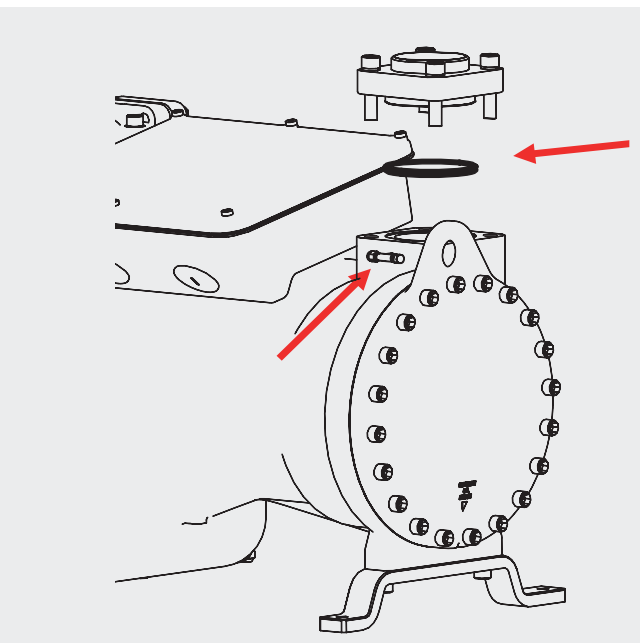
在一年中的任何季节，当制冷循环停止时，压缩机的温度必须始终高于回路中任何其他组件的温度。

带有内置恒温器的油箱加热器必须始终有电力供应，以便在油温低于70℃时对油进行加热。

有关油箱加热器的位置，请参阅第21页。



没有吸气阀的压缩机有一块安装在衬套下的密封钢板。在运行前，确保已移除圆盘（见图片）。



Do not use rags, paper or other unsuitable materials.

Remove the bushing from the compressor and braze the pipe away from the compressor.

A light brazing is recommended, at low temperature, high silver content, in inert atmosphere or with antioxidant.

Only when the bushing cold, remount it on the compressor or on the valve body. In fact, bolts tightening must be completed with all components at the same temperature. Use only new gaskets supplied loose.

Use copper pipes already internally cleaned, with capped ends. In case the pipes must be cut, please just use professional pipe cutters. Do never use electric cutters, saws, grinders or any other tool that leaves copper debris behind.

Tubes must have been produced at recent times, and must not be visibly oxidised or dusty. The relevant norm pertaining to refrigeration copper must be clearly stamped on the copper pipe.

Same prescriptions apply in case of steel or stainless steel pipes are used.

It is mandatory to install a generously sized drier filter on the liquid line, but it is also good practice to have one on the suction line, with molecular sieve of 25 micron Mesh or less.

Drier cartridges must be installed just few minutes before the circuit is evacuated, and must come from hermetically sealed cans.

Refrigerant piping connections

The suction line must be layed down so that return of great quantities of oil or liquid refrigerant is prevented during compressor standstill.

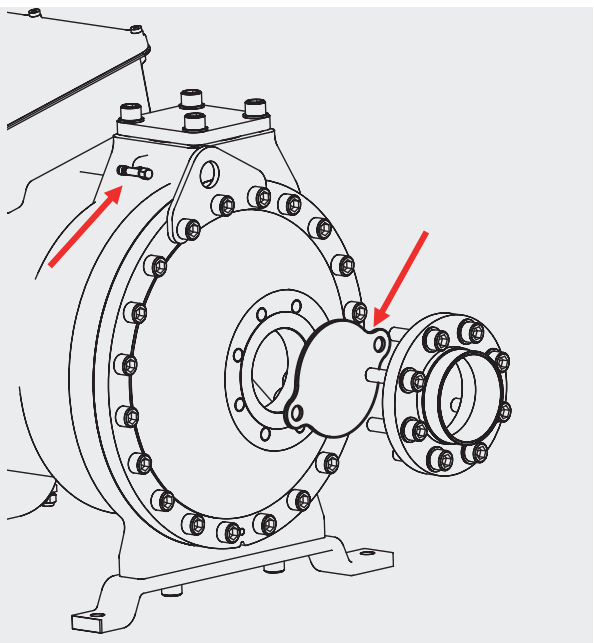


When the refrigerant circuit is off, the compressor must always be at a temperature higher than any other component in the circuit, **in any season of the year**. The Oil crankcase heater with built in thermostat, must be always power supplied in order to warm-up the oil when its temperature is below 70°C.

Refer to page 21 for the position of the crankcase heater.



The compressors supplied without suction valve, have a steel sealing disk installed under teh bushing. Before proceeding, make sure that the disk has been removed (see figure).



建议使用P型管或尺寸合适的虹吸管来满足各个运行条件。

相同的建议适用于油分离器、油冷却器、液体喷射器和ECO管道。建议对从膨胀阀到压缩机吸气的回路进行热绝缘。如果在低温环境下使用时，建议热绝缘至压缩机的转子壳体法兰。

需防止排气管被意外接触，但必须能够自由散热。铺设排气管的区域必须通风良好。

为了减少管路的压降，尽可能减少排气和吸气管道的弯道及弯头数量。高制冷剂流量会导致高压降和相关的效率下降。



排气管可以达到120℃的高温，在接触时会导致皮肤灼伤。建议在排气管上使用适当的警告标志，以避免意外接触。

在排气和吸气阀或衬套的正下方，有高压和低压三通连接件或没有气门芯的针阀。在三通的另一侧机体上，可以通过拆下内六角螺丝获得另一个压力连接点。在一些型号上，也可以在截止阀上配备压力塞（注意吸气阀是可选件）。实际可用性取决于阀门尺寸。只能使用带有合适气门销的压力软管，接在压缩机上的某个已安装好的有气门芯的针阀来抽真空。

It is recommended to use *P-shaped* pipes or appropriate syphons, correctly sized for any working operating condition.

Same recommendations must be used for piping to and from the oil separator, oil cooler, liquid injection and economiser. It is recommended to thermally insulate the suction pipe line, from thermostatic valve to the compressor suction connection. In case of application at low temperatures, it is recommended to insulate also the compressor until the rotor body flange.

Discharge pipe line must be protected against accidental touch, but must be free to dissipate heat. The area where the discharge pipe is layed down must be properly ventilated.

Minimize the number of curves/elbows as much as possible, on both discharge and suction pipes, in order to reduce the pressure drop of the pipe lines. High refrigerant flow rates can cause high pressure drops and related efficiency drop.



The discharge pipe can be as warm as 120°C and cause skin burns when touched. It is recommended to apply appropriate warning signs on discharge pipe to avoid accidental contact.

Right below the discharge and suction valves or bushings, there are the high pressure and low pressure Tee connections, **without schröder valve**. On the opposite side of the Tees, an other connection point is available by removing the hex socket screw.

On some models, pressure plugs can be available on the shut off valves as well (note that the suction valve is optional). The actual availability depends on the valve size.

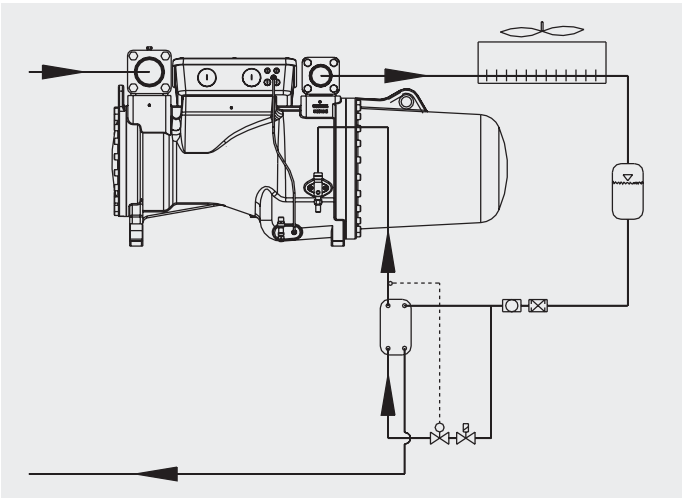
Use one of these plugs, having previously taken care of installing the schröder valve stopper, to evacuate the compressor. Use pressure manifolds having hoses with appropriate schröder valve pin only.

经济器组件（可选）

CX压缩机配备了用于经济器运行的额外连接件。在ECO模式下，制冷量和整体效率被提高，输入功率略有增加。ECO循环在热力学上类似于具有中间冷却器的双级循环。

Economizer (optional)

CX compressors are provided with an extra connection for Economizer operation. In ECO mode, the cooling capacity and the overall efficiency are increased, with a slight increase of power input. ECO cycle is thermodynamically behaving like a double stage circuit with an interstage cooling.

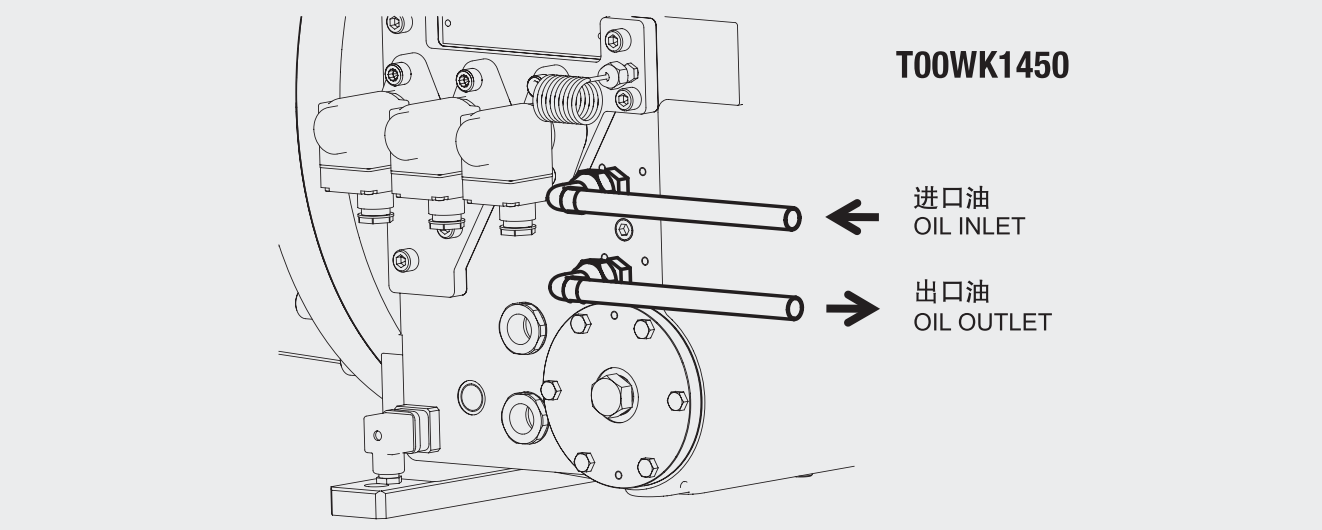


外部油路循环连接件（可选）

CX压缩机有两个用于连接外部油冷却器或外置油分离器的连接件。

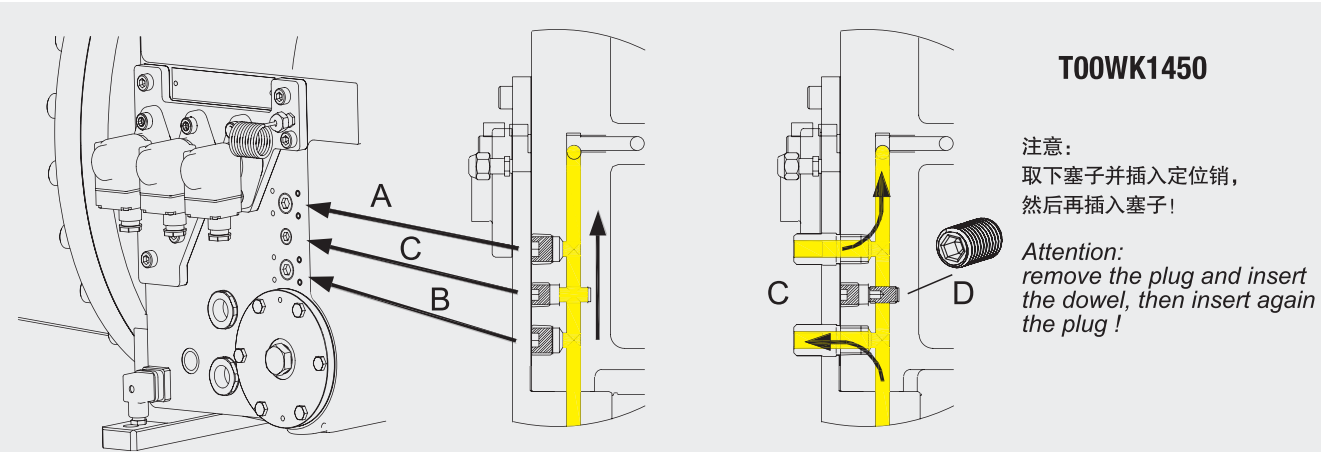
Connections for external oil circuit (optional)

CX compressors have two connections for the connection to the external oil cooler piping or to the additional oil separator.



可选套件T00WK1450包括两个1/2"NPT接头，用于替换图中位置A和B所示的塞子。
该套件含有油路阻断销D，3/8"NPT，必须拧在中央那个塞子C的里面。
此销用来阻断内部油路并使油从外部回路中循环（见图片）。
取下塞子C并拧入油路阻断销D，直至其拧到位，然后拧入塞子C。

The optional Kit T00WK1450 includes two Half union joints 1/2" NPT that will replace the plugs in position A and B shown in figure.
The kit includes the dowel D, 3/8"NPT, that must be inserted underneath the central plug C.
The dowel allows to close the internal oil channel and deviate the oil flow to the external piping (see figure).
Remove the plug C and insert the dowel till it stops, then, insert the plug C.



套件T00WK1450组件

- 数量：2 纳子螺母 5/8" SAE - Ø16 ODS
- 数量：2 转换接头 1/2"NPT - 5/8"SAE
- 数量：2 铜帽 5/8"
- 数量：1 销（公制） M12x20 UNI 5923 (*)

(*) 紧固力矩 15 – 20 Nm

Kit T00WK1450 components

- n.2 Flare nut 5/8" SAE - Ø16 ODS
- n.2 Half Union joint 1/2"NPT - 5/8"SAE
- n.2 Copper plug 5/8"
- n.1 Dowel (metric) M12x20 UNI 5923 (*)

(*) Tightening Torque 15-20 Nm



油流量开关（可选件）

用于外部油路的连接件也可连接流量开关T00WK1400或T00WK1460。
流量开关报警串联在警报输出链中，可确保压缩机运行的高度安全性。
为避免在压缩机启动和运行期间出现错误警报，延时继电器（不是由富士豪提供）是必要的。

在固定连接油流量开关电气盒时，请参见下一页的图。
流量开关触点是一种磁性簧片开关：
- 此触点在无油流动的情况下是开路
- 此触点在有油流动的情况下是闭合的

套件T00WK1400

流量开关的连接口1/2"NPT位于滤油器上方，如下图所示的A和B。
清除A-B-C周围的所有油漆，然后取下两个塞子A和B，；取下中间那个塞子C，3/8"NPT；拧入阻断销D（M12x20），然后重新安装3/8"NPT塞子C。
按照图中的顺序安装流量开关，在密封面上垫好O型圈，并拧紧螺丝。

套件T00WK1400组件

- 数量：1 集成的油流量开关
- 数量：2 矩形垫片30x50x36 mm
- 数量：4 O型圈3100 HNBR
- 数量：8 螺栓 M6x90 8.8 UNI – 5737 P.F.AISI 304 (*)
- 数量：1 电气连接件
- 数量：1 销M12x20 UNI 5923 (*)

(*) 紧固力矩 15 – 20 Nm

Flowswitch (optional)

The same connections for the external oil circuit, can be used for the installation of flowswitch T00WK1400 or T00WK1460.
Connected in series in the chain of alarms, this device ensures a high level of safety for the compressor operation.
Delay relays (not supplied by Frascold) are necessary to avoid false alarms at the compressor start-up and during operation.

In case of connection inside the electrical box of the flowswitch, see the wiring diagrams in the next pages.
The flowswitch contact is a magnetic Reed switch:
- the contact is open without flow
- the contact is closed with flow.

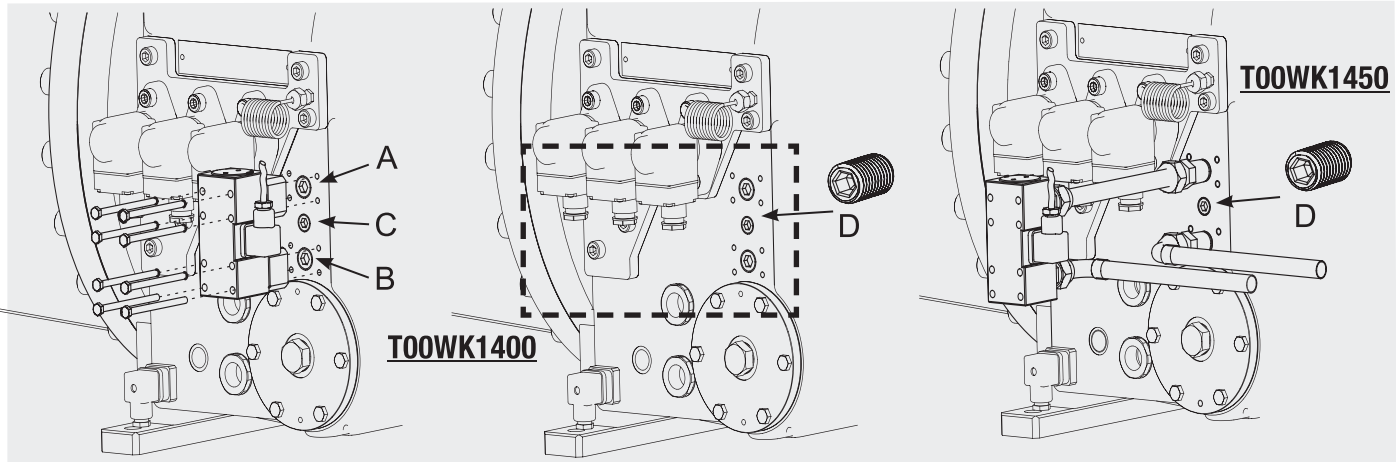
Kit T00WK1400

The connections 1/2"NPT for the flowswitch are located above the oil filter, indicated in figure here below as A and B.
Before removing the two plugs A and B, eliminate all paint around; remove the central plug C, 3/8" NPT; insert the dowel D (M12x20), then re-mount the 3/8" NPT plug C.
Install the flowswitch following the sequence in figure, apply the O-rings on the spacers, tight the screws.

Kit T00WK1400 components

- n.1 Integrated flowswitch
- n.2 Rectangular spacer 30x50x36mm
- n.4 O-ring 3100 HNBR
- n.8 Screw M6x90 8.8 UNI-5737 P.F. AISI 304 (*)
- n.1 Electrical connector
- n.1 Dowel M12x20 UNI 5923 (*)

(*) Tightening Torque 15-20 Nm



流量开关技术数据

操作原理	带活塞的磁性流量开关
壳体材料	阳极氧化铝
活塞材料	应用在Iglidur H导轨上的楔形黄铜
名义流量	4,6 l/min (在70℃下) ± 15%
电接触状态	无油流动情况下开路
最大工作压力/温度	40Bar/130°C
防护等级	IP65
簧片触点（电气和磁测数据）	
吸合	最小20 – 最大60 AT
断开	最小6 AT
接触电阻	100 mΩ
击穿电压	500 V DC
绝缘电阻	10 ¹⁰ Ω
电容	0,5 pF
最大直流/交流功率	50 W / 70 VA
最大直流/交流电压	300V / 350V
最大直流/交流电流	0,7 A / 0,5 A
最大载荷	2,5 A

Flowswitch Technical data

Principle of operation	Magnetic flowswitch with piston
Body material	Anodized aluminum
Piston material	Wedged brass on Iglidur H rails
Nominal calibration	4,6 l/min a 70°C ±15%
Electric contact state	Open without flow
Max. working pressure/ temperature	40Bar / 130°C
Level of protection	IP65
Reed contact (electric and magnetic data)	
Pull-in	min 20 - max 60 AT
Drop-out	min 6 AT
Contact resistance	100 mΩ
Breakdown voltage	500 V DC
Insulation resistance	10 ¹⁰ Ω
Capacitance	0,5 pF
Max. DC/AC power	50 W / 70 VA
Max. DC/AC voltage	300 V / 350 V
Max. DC / AC current	0,7 A / 0,5 A
Max. load	2,5 A

带流量开关的外部油路连接件（可选件）

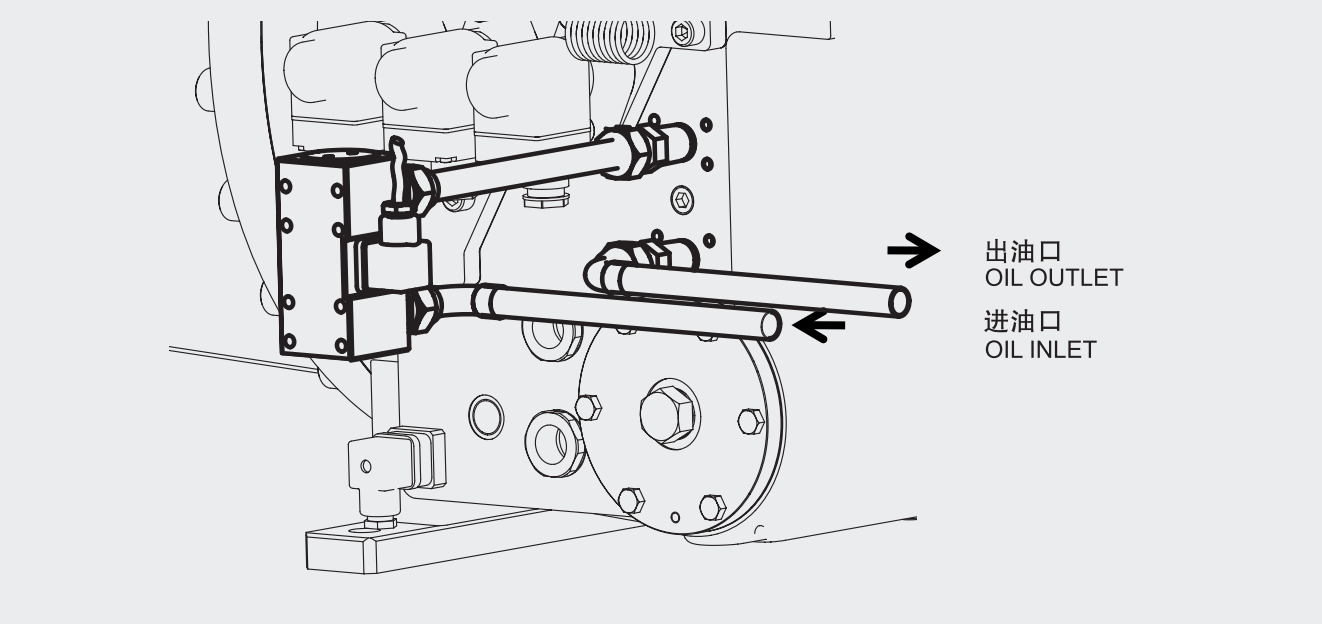
套件T00WK1450 + T00WK1460

当流量开关与连接油冷却器或外置油分的外部油路共同使用时，必须使用两个套件。

Connections for external oil circuit with flowswitch (optional)

Kit T00WK1450 + T00WK1460

These two kits are necessary when the flow switch is used together with the external oil circuit piped to the oil-cooler or to the oil separator.



流量开关的1/2"NPT连接口位于滤油器上方，如第11页的图所示的A和B。

The connections 1/2"NPT for the flowswitch are located above the oil filter, indicated in figure on page 11 as A and B.

取下两个塞子A和B，以及中间那个塞子C，3/8"NPT；拧入阻断销D（M12x20），然后重新安装3/8"NPT塞子C（见第10页，T00WK1450组件）。

Remove the two plugs A and B, and the central plug C, 3/8"NPT; insert the dowel D (M12x20), then re-mount the 3/8"NPT plug C (see page 10, Kit T00WK1450).

套件T00WK1460组件

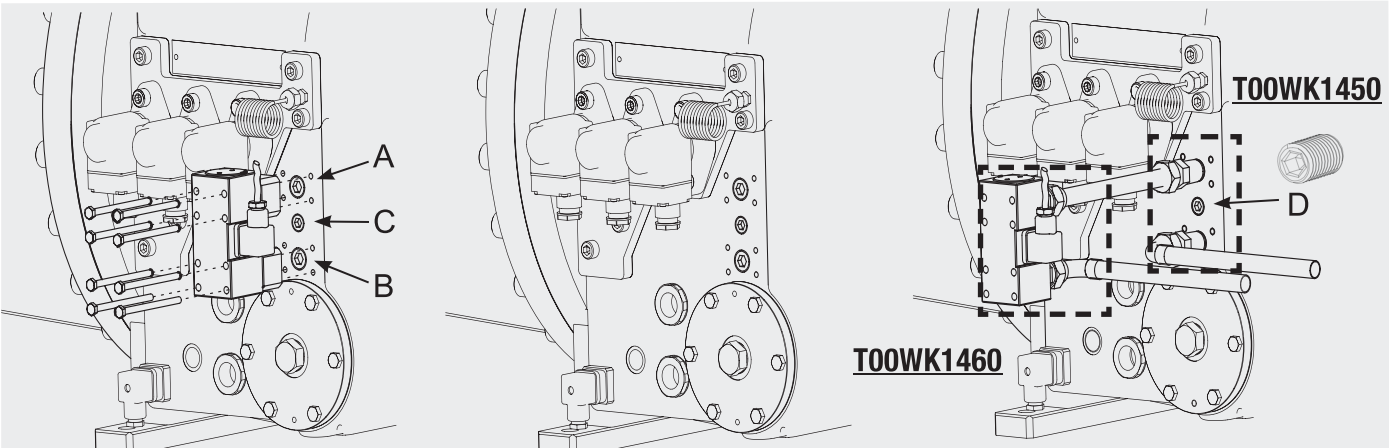
- 数量: 1 集成的流量开关
- 数量: 1 电气连接器
- 数量: 1 销M12x20 UNI 5923 (*)
- 数量: 2 纳子螺母5/8"SAE - Ø16 ODS
- 数量: 2 转换接头1/2"NPT - 5/8"SAE
- 数量: 2 铜垫圈5/8"

(*) 紧固力矩 15 - 20 Nm

Kit T00WK1460 components

- n.1 Integrated flowswitch
- n.1 Electrical connector
- n.1 Dowel M12x20 UNI 5923 (*)
- n.2 Flare nut 5/8" SAE - Ø16 ODS
- n.2 Half Union joint 1/2"NPT - 5/8"SAE
- n.2 Cooper washer 5/8"

(*) Tightening Torque 15-20 Nm



油位开关（可选件）

用于螺杆压缩机的光电油位开关（图1）（代码T00WP253（230V））包括一个传感器，其装有红外线发射器和光学接收器，它们均通过透明棱镜提供保护。红外线来自发射器，会产生不同的效果：

- a) 如果棱镜周围有油，则红外线主要被润滑油吸收，只有少数被反射到接收器，在这种情况下，压缩机平稳运行。
- b) 如果保护棱镜周围没有油，所有红外线都会被棱镜反射到接收器上。

如果在压缩机运行期间，油位低于参考点超过3秒钟，则延时继电器将停止压缩机运行。
图2展示了为安装油位开关所需移除的盖子的位置。
油位开关动作所需的棱镜是已经安装在所有CX系列压缩机上的标准部件（工厂安装），通过这种方式，即使在已经运行的压缩机上，也可以安装T00WP253，而不会损失润滑油或制冷剂。

以下红色LED的故障闪烁代码，显示油位开关的运行状态：

- ● ● ● ● 完好无误，油位正常
- ● ● ● ● 内部故障
- ● ● ● ● 油位过低故障



图1：油位开关
Fig.1: Oil level switch

Oil level switch (optional)

The electro-optical oil level switch for screw compressors (fig.1), code T00WP253 (230V), includes one sensor in which there are fitted both a infra-red rays emitter and an optical receiver, both protected by means of a transparent prism.

Infra-red rays come from the emitter and different effects occur:

- a) if oil is around the prism, infra-red rays are mainly absorbed by the lubricant and only fews are reflected to the receiver.
In this case compressor runs regularly.
- b) if no oil is around the protecting prism, all the infra-red rays are reflected to the receiver by the prism.

If, during compressor running, the oil level stays below the reference for more than 3 seconds, the relay time delay will act to stop the compressor.
In figure 2 is shown the position of the plug to be removed for deviice installation.
The prism, needed for the operation of the oil level switch, is a standard part factory mounted on all compressors CX series. In this way, the T00WP253 can be always mounted, even on already functioning installation, without any loss of oil or refrigerant.

A red LED displays the operating status of the Oil level switch with a fault blink code shown here below:

- ● ● ● ● Ok, no error, oil level correct
- ● ● ● ● Internal fault
- ● ● ● ● Oil level too low fault

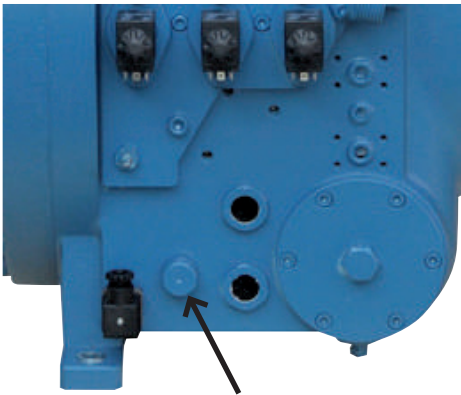


图2：油开关安装处
Fig.2: Oil switch connection

技术数据

电源	230V 50–60Hz
环境温度范围	–30至+60°C
棱镜处的最高允许温度	+120°C
运行中延时	3秒
继电器 – 开关电压	240V
继电器 – 开关电流	2.5A
连接电缆	5 x 0.75mm ² L=1m
壳体材料	PA66
棱镜材料	强化玻璃
防护等级	IP54
重量	160g
适用制冷剂	HFO混合物 – HFC – HCFC – CFC

注：不允许使用NH₃和碳氢化合物

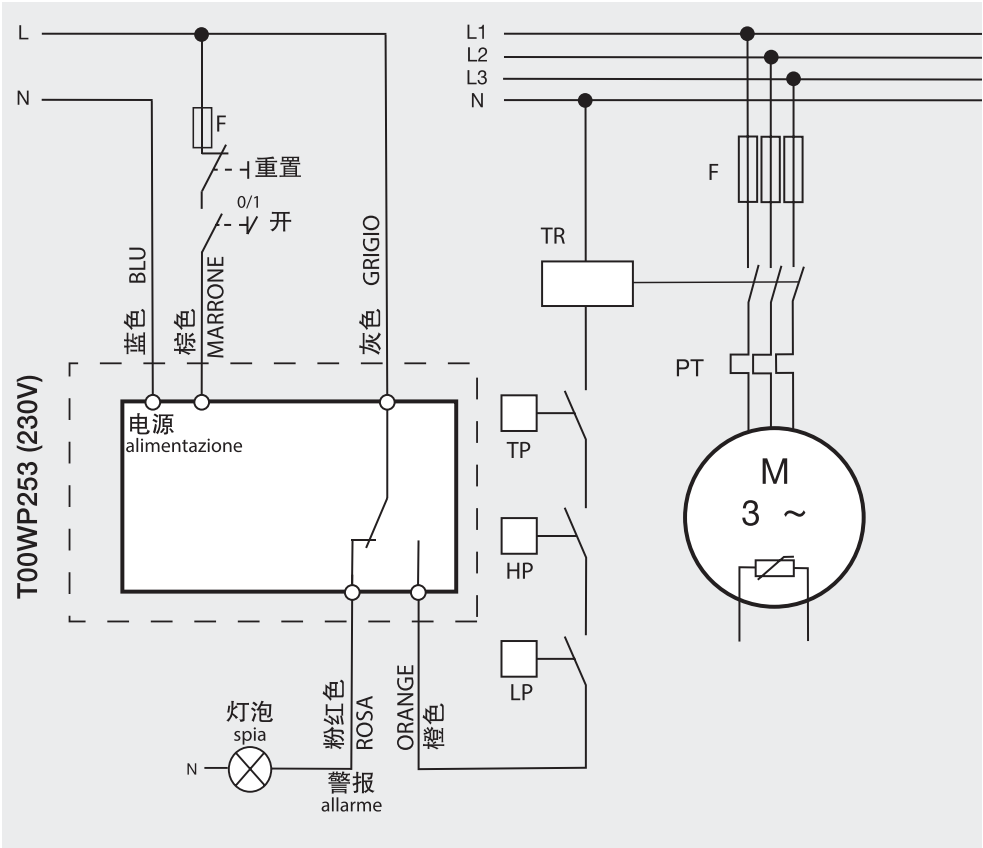
Technical data

power supply	230V 50-60Hz
ambient temperature	-30 + +60°C
maximum temperature at prism	+120°C
delay in operation	3 seconds
relay - switching voltage	240V
relay - switching current	2.5A
connecting cables	5 x 0.75mm ² L=1m
housing material	PA66
prism material	glass
protection class	IP54
weight	160g
refrigerants	HFO Blends-HFC-HCFC-CFC

NOTE: not admitted to NH₃, and hydrocarbons

接线图

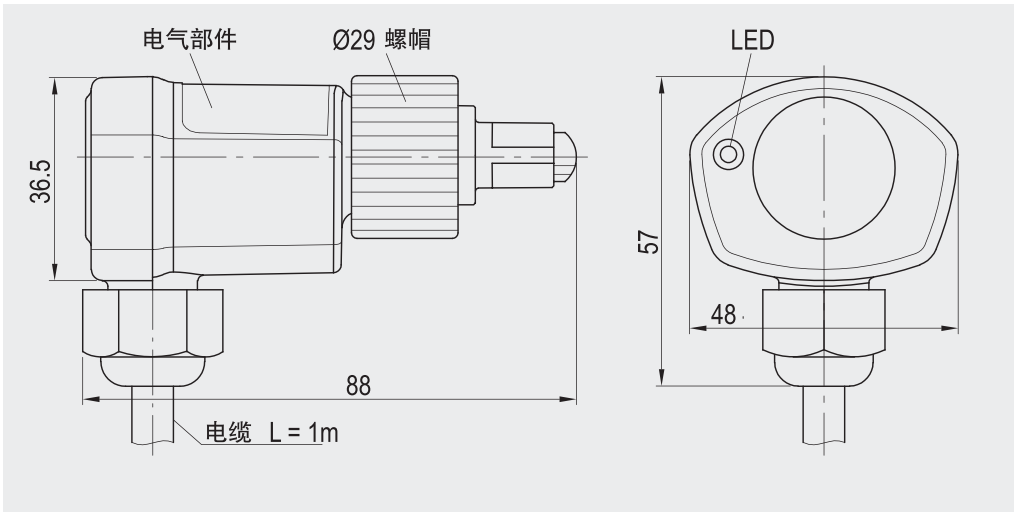
Wiring diagram



F	保险丝	F	fuses
HP	高压开关	HP	high pressure switch
LP	低压开关	LP	low pressure switch
M	压缩机电机	M	compressor motor
TP	温度开关	TP	thermostat
TR	压缩机接触器	TR	compressor contactor
L1 L2 L3	三相线	L1 L2 L3	phases of electrical net
N	中性线	N	neutral

尺寸图

Dimensional drawing



FTFC_027_04

滤油器堵塞压差开关（可选件）

Oil filter clogging pressure switch (optional)

用于螺杆压缩机的滤油器堵塞压力开关（图1）（代码T00W3501122）是一个2bar的预设压差开关。它配有三极防护电缆（长度为1m）和电缆压盖。

如果在压缩机运行期间，滤油器压降高于设定值，则延时继电器将停止压缩机运行。

图2展示出了安装该压差开关而需移除的塞子的位置。

此装置可通过两种方式进行电气连接：

并确保压缩机运行的高度安全性。

- 1. 报警串联在警报输出链中，（参见接线图中的FCS），连接到压缩机接线盒内的电机保护模块T00EC45AD。
- 2. 直接连接到PLC控制器。

电缆按照接线图进行接线：棕色（公共点）、蓝色（过滤器正常工作时常闭）、绿黄色（接地）。

The Oil Filter clogging pressure switch for screw compressors (fig.1), code T00W3501122, is a 2 bar pre-set differential pressure switch. It is supplied with tripolar cable, 1m length, and cable gland.

If, during compressor running, the oil filter pressure drop is above the set value, the relay time delay will act to stop the compressor.

In figure 2 is shown the position of the plug to be removed for device installation.

This device can be connected in two ways:

- 1. in series in the chain of alarms (see FCS in the wiring diagrams) to the motor protection module, T00EC45AD, inside the compressor's terminal box.
- 2. Directly to the PLC controller.

The cables are being wired as in the wiring diagram: the brown (common), the blue (normally closed in case of correct functioning of the filter), the green-yellow (ground).



图1

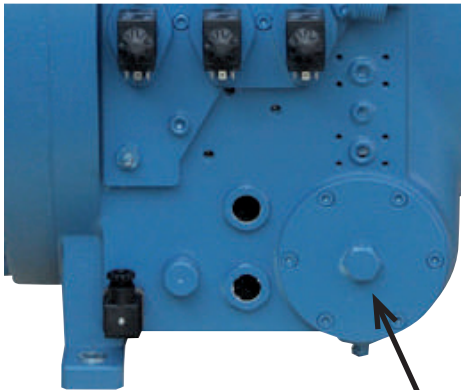


图2

技术数据

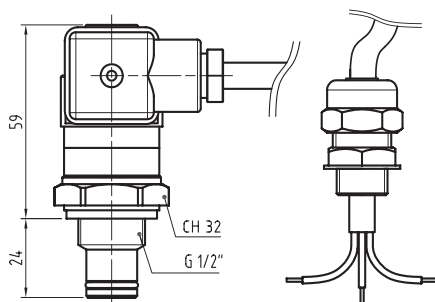
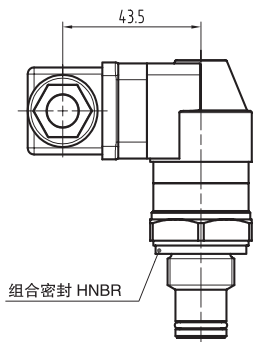
Technical data

操作原理	过滤器进出压差
主体材料	黄铜
动作压力	2 bar ± 10%
磁滞	<10%的动作压力
工作温度	-25℃至 +110℃
机械使用寿命	约100万次开关周期
兼容性	矿物油/合成油
最大接触负载	5A / 250V
垫圈	HNBR
电缆	(3x1) , 长1米
电缆压盖	尼龙M16x1.5
防护等级	IP65
制冷剂	HFO混合物 – HFC – HCFC – CFC

Principle of operation	Filter pressure difference in-out
Body material	Brass
Switch pressure	2 bar ±10%
Hysteresis	< 10% switch pressure
Working temperature	-25 °C +110 °C
Mechanical service life	Approx. 1 million switching cycles
Compatibility	mineral oil / synthetic fluids
Max. contact load	5A / 250V
Gasket	HNBR
Cable	(3x1), lenght 1 meter
Cable glands	Nylon M16x1.5
protection class	IP65
refrigerants	HFO Blends-HFC-HCFC-CFC

注：不允许使用NH₃和碳氢化合物

NOTE: not admitted to NH₃, and hydrocarbons



外置油分离器的管理

外置油分离器可以通过可选件T00WK1455进行管理。

套件T00WK1455组件

- 数量: 2 纳子螺母 5/8" SAE – Ø16 ODS
 - 数量: 2 转换接头 1/2" NPT – 5/8" SAE
 - 数量: 1 销 (公制) M12x20 UNI 5923 (*)
 - 数量: 2 NC电磁阀5/8"钎焊接头, 230V线圈, 连接器
 - 数量: 1 用于控制电磁阀的油位开关T00WP253, 带棱镜的M20塞子和垫圈
 - 数量: 1 M20 x 1"1/8适配器
- (*) 紧固力矩 15 – 20 Nm



电子油位监控开关将直接与电磁阀线圈相连 (参见下图)。

重要提示: 在压缩机启动前5秒给油位开关通电, 并在压缩机运行期间保持通电。通过这种方式, 油位开关将在启动之前检查压缩机内的油位, 并只打开相应的电磁阀。

External Oil separator managing

The additional oil separator can be managed by means of the optional kit T00WK1455.

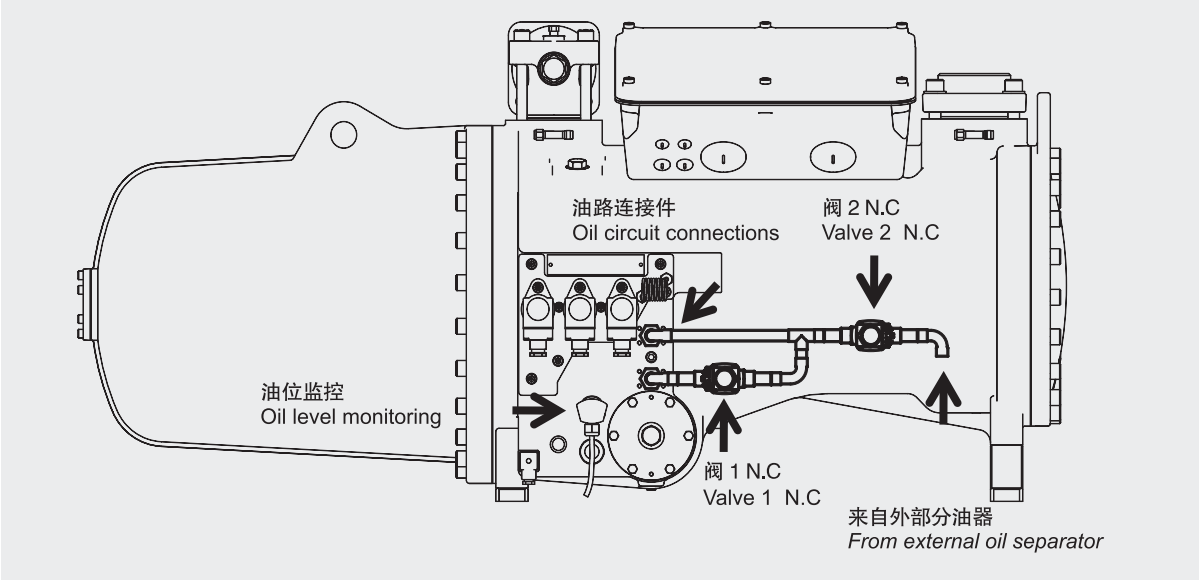
Kit T00WK1455 components

- n.2 Flare nut 5/8" SAE - Ø16 ODS
 - n.2 Half Union joint 1/2"NPT - 5/8"SAE
 - n.1 Dowel (metric) M12x20 UNI 5923 (*)
 - n.2 NC Solenoid valve 5/8" braze joint, 230V Coil, Connector
 - n.1 Oil level switch T00WP253 for solenoid valves managing, M20 Plug with prism and gasket
 - n.1 M20 x 1"1/8 adapter
- (*) Tightening Torque 15-20 Nm



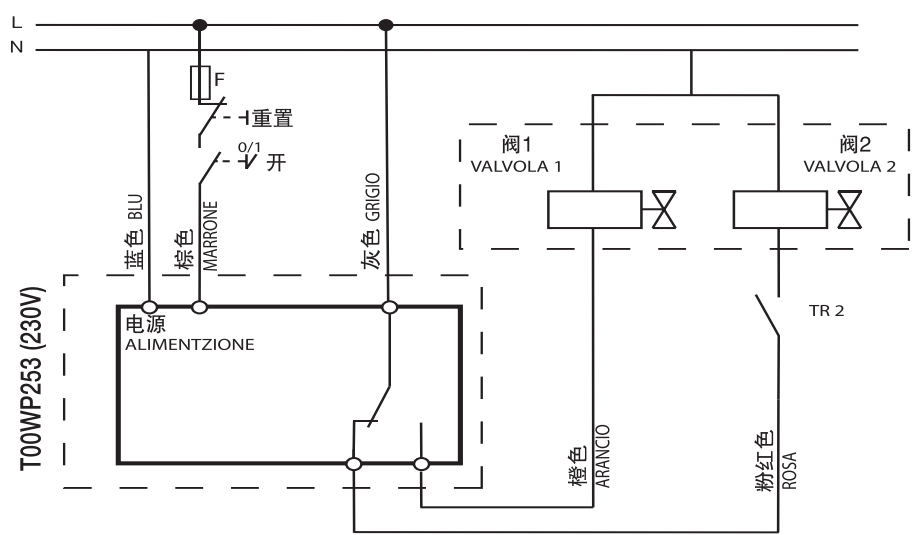
The Electronic oil level regulator will be directly connected to the solenoid valves coils (see diagram below).

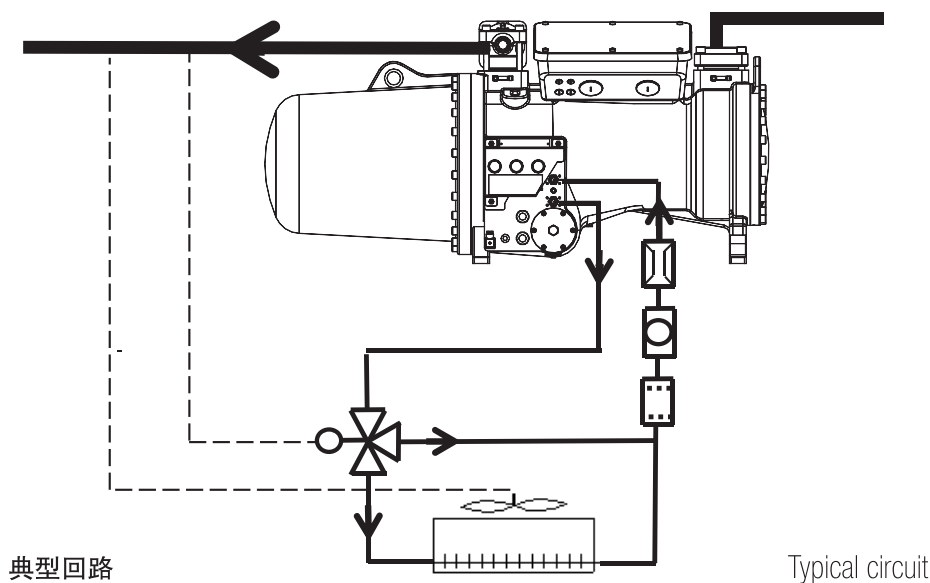
IMPORTANT: switch on the Oil level switch 5 sec before compressor star-up and keep energized during compressor operation. In this way the Oil level switch will check the oil level inside the compressor before start-up and will open only the appropriate solenoid valve.



接线图

Wiring diagram

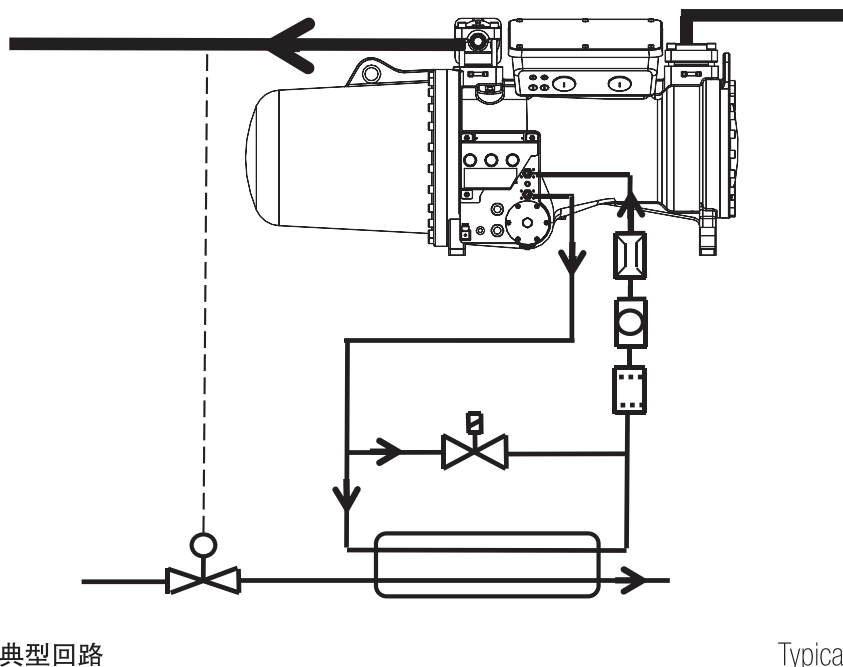




油管路布置必须防止压缩机停机时油倒流至压缩机。油冷却器必须低于或同于的压缩机位置。



Piping arrangement must avoid oil drainage during stand still. The Oil cooler must be below or at the same compressor level.



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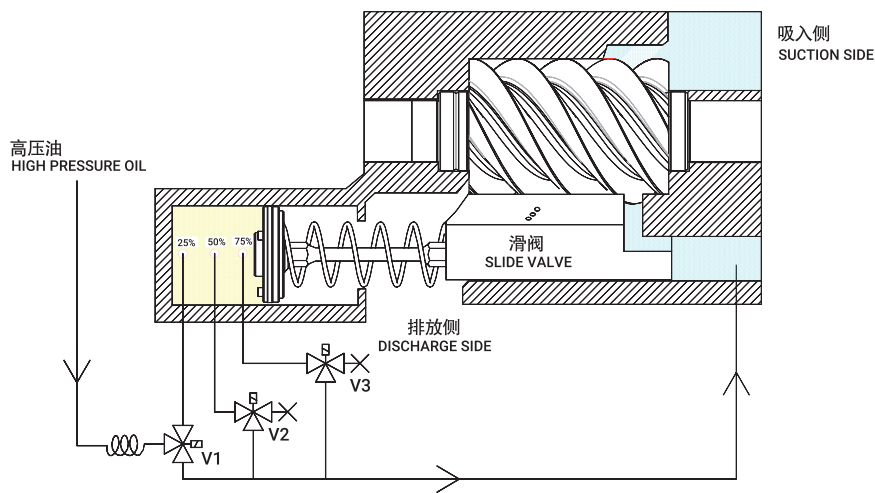
Piping arrangement must avoid oil drainage during stand still. The Oil cooler must be below or at the same compressor level.

有级能调控制

CX压缩机配置了一个有级能量调节的步进系统，或根据要求可提供无级能调控制（见下文）。此系统允许4级能量调节，对应于25%（仅用于启动）、50%、75%、100%或目标制冷量。能量调节通过三个电磁阀的组合来实现。在此显示操作顺序和工作原理。

Step capacity control

CX compressors are supplied with a partialisation system with step capacity control, or stepless on request (see below). This system allows 4 steps of capacity reduction, corresponding to 25% (only for start up), 50%, 75%, 100% or the project cooling capacity. The capacity control is made through combinations of three solenoid valves. The sequence of operation and the working principle is hereby shown.



	V3	V2	V1
25%	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
50%	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
75 %	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
100%	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

☒ 电磁阀通电 Solenoid valve energized ☐ 电磁阀断电 Solenoid valve de-energized

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无级能调控制

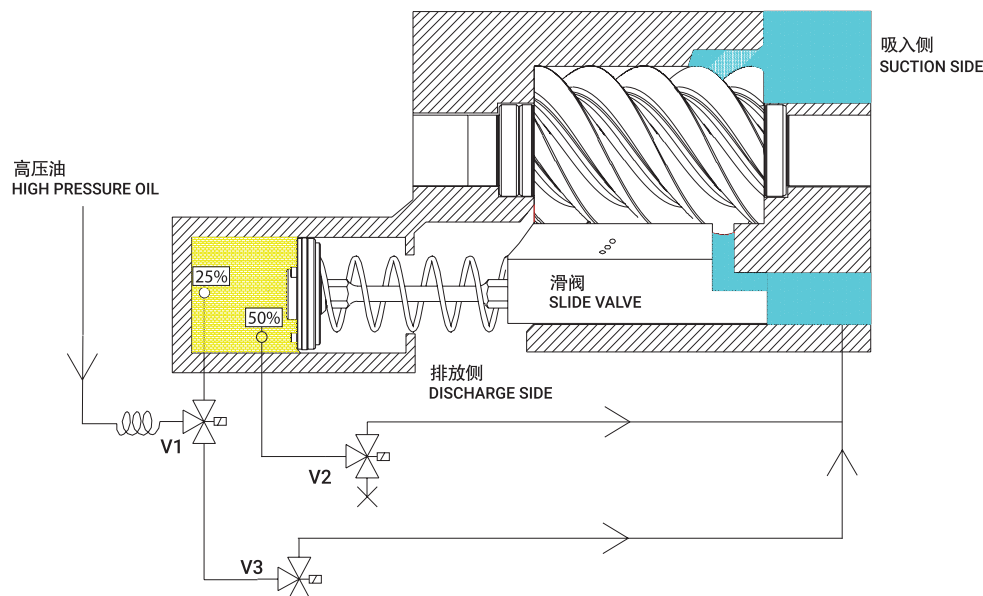
通过简单地使用特定的套件，CX压缩机可以转变为无级能调（50~100%），此特定套件包含板材和垫圈（代码T00WK1603对应CX0系列；或代码T00WK1602对应CX 5和CX9系列）。

无级能调通过使用三个电磁阀（V1、V2和V3）来实现，如下所示。

Stepless capacity control

CX compressors can be turned into a stepless capacity control regulation (50-100%), by simply using a specific kit, containing a plate and a gasket (code T00WK1603 for compressors size 0 or T00WK1602 for compressors size 5 and 9).

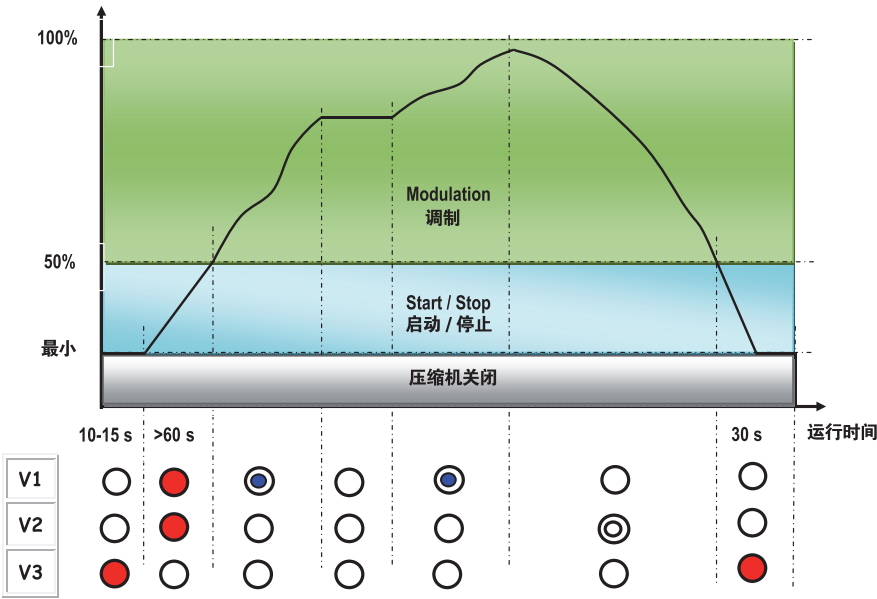
The stepless capacity control is made by using three solenoid valves (V1, V2 and V3) as show below.

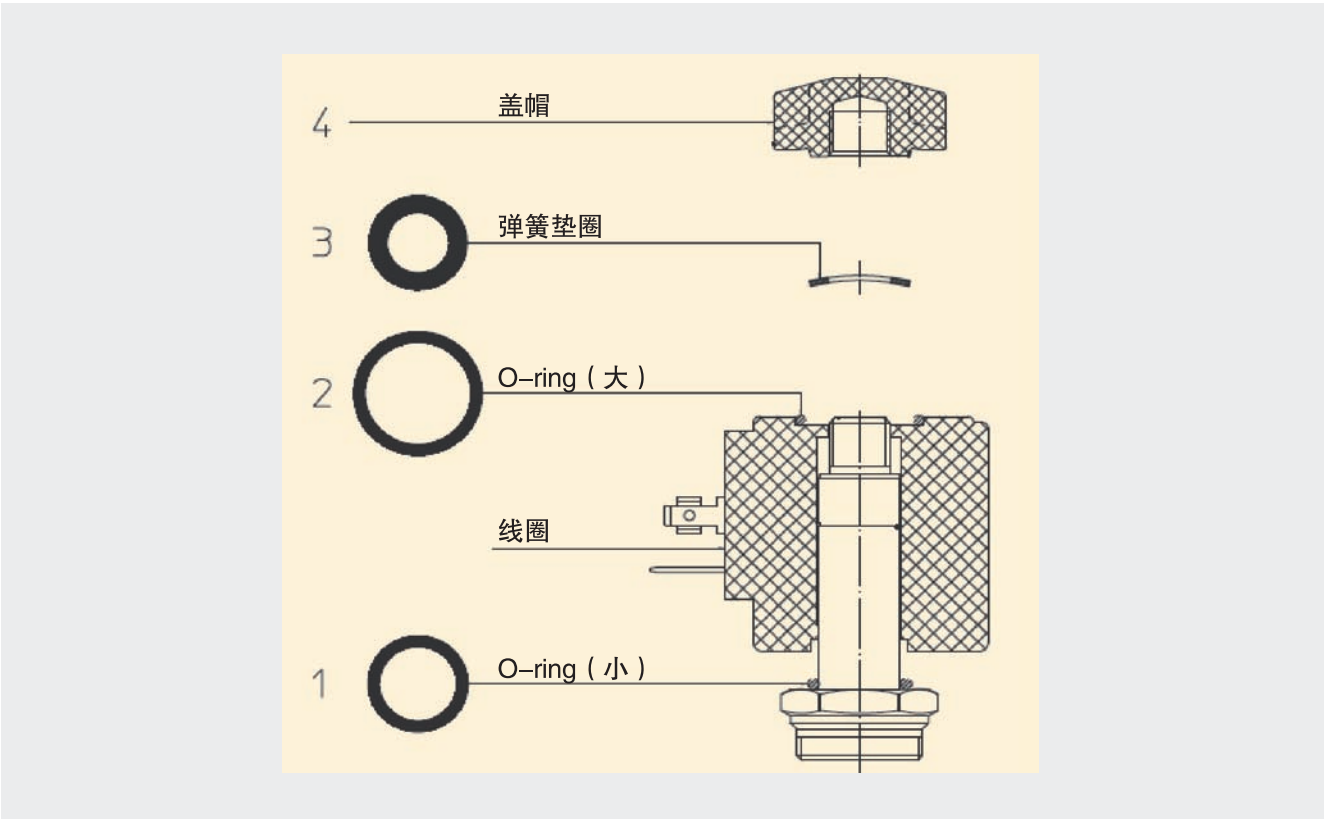
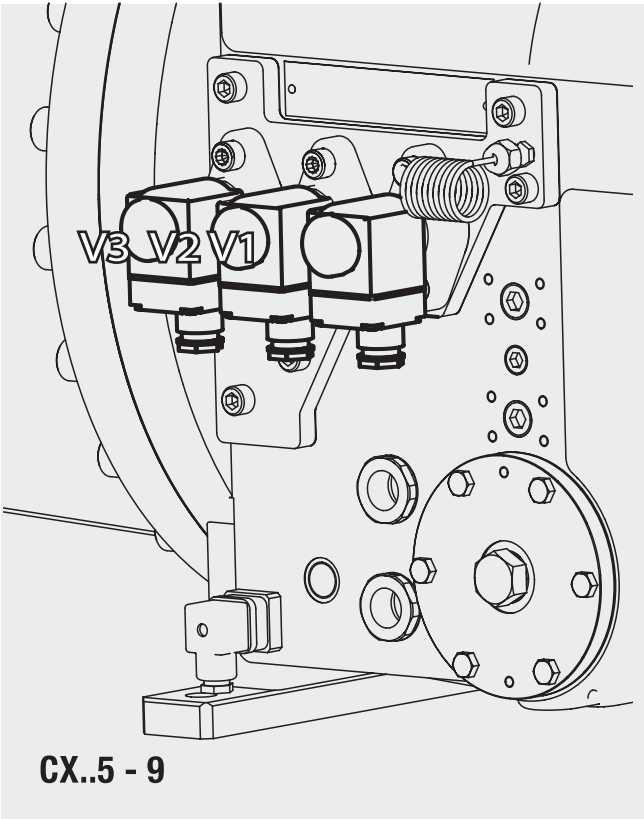
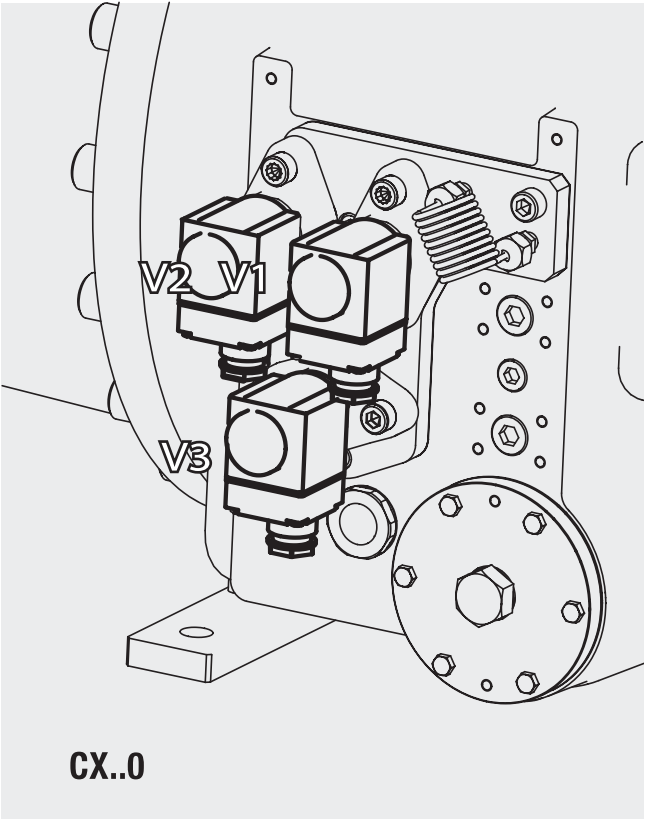


冷却能力	V3	V2	V1
启动/停止	●	○	○
增加50%	○	●	●
增加 (>50% - - <100%)	○	○	⊙
常量	○	○	○
减少 (<100% - - >50%)	○	⊙	○
停止前的减少	●	○	○

● 电磁阀通电 Solenoid valve energized ○ 电磁阀断电 Solenoid valve de-energized ⊙ 电磁阀间断* Solenoid valve intermittent* ⊗ 电磁阀脉冲** Solenoid valve pulsing**

*时间应设为约5秒打开/5秒关闭。 **脉冲时间约为1 – 2秒
但是，正确的时间安排取决于系统的工作条件，建议使用可调的时间继电器。





油箱加热器

油箱加热器是工厂安装的标准组件。位置如下所示。

将加热器连接正确的电压。加热器已经配置内置恒温开关，不需要与压缩机接触器连接。



在一年中的任何季节，当制冷循环停止时，压缩机的温度必须始终高于回路中任何其他组件的温度。

带有内置恒温器的油箱加热器必须始终通电。

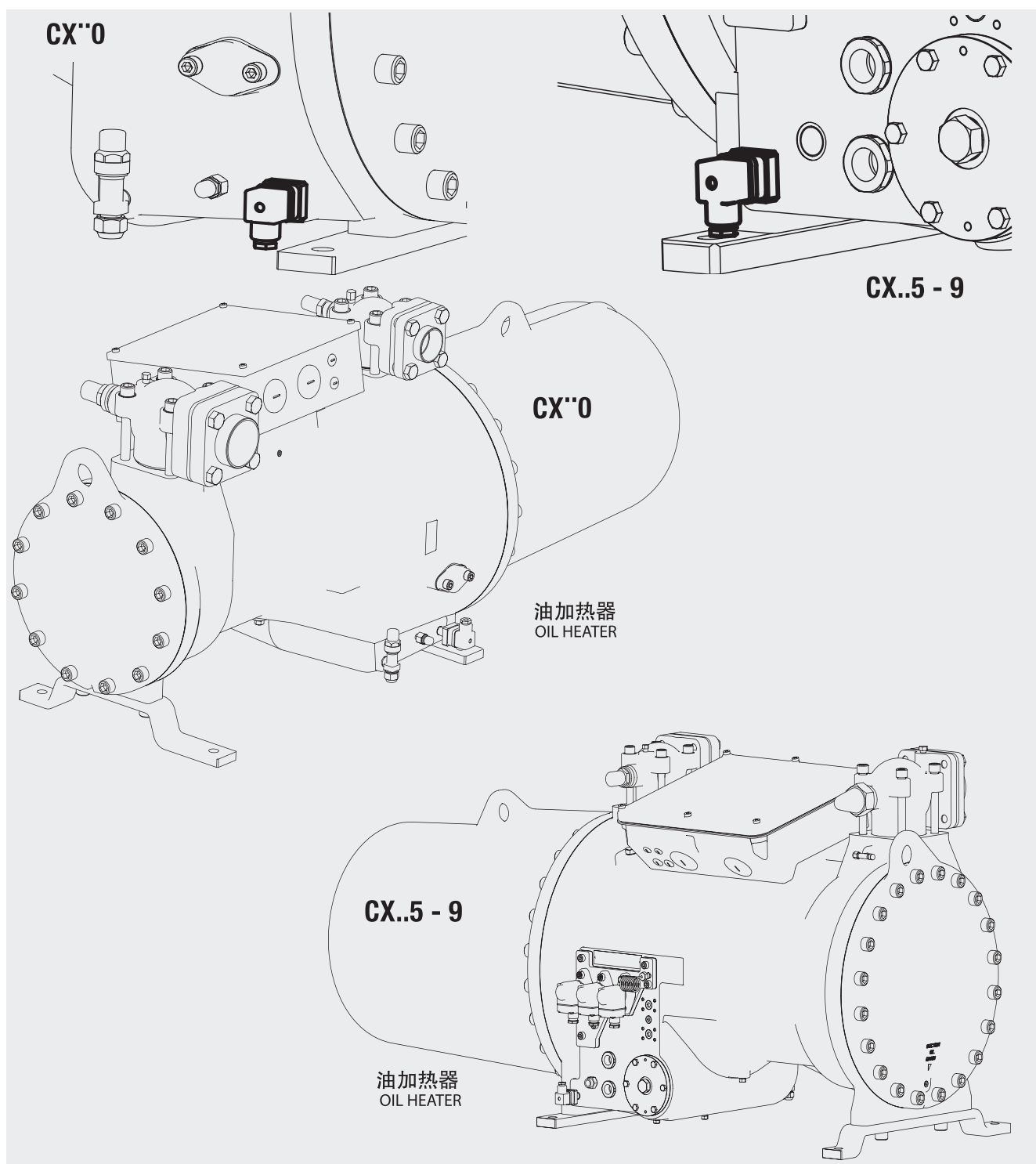
Oil crankcase heater

The crankcase heater is a standard component factory installed. The position is shown here below.

Connect the oil heater to the appropriate power supply. The heater is already thermally switched and doesn't require to be interfaced with the compressor contactor.



When the refrigerant circuit is *off*, **in any season of the year**, the compressor must always be at a temperature higher than any other component in the circuit. The oil crankcase heater, with built-in thermostat, must be always energized.



6. 电气连接



主电源和控制电源只能由经过完整培训且具有完整法规认证的人员来完成。

CX压缩机系列的电气连接（无论是主电源还是控制电源）必须严格按照本章节的规定进行。



安全装置、标签、颜色和电缆尺寸以及电箱中的控制装置必须严格符合当地法规和标准。

使用说明中未预见的任何其他装置或连接都必须事先获得富士豪的书面授权。为了监控马达绕组温度和启动时间，要将压缩机电气连接到由富士豪授权的微电脑处理器（模块）上。



在运行过程中，低吸气温度会导致水分凝结或结霜，从而导致接线盒内电气短路。为防止空气进入接线盒，必须安装IP65或更高防护等级的电缆密封套。

保护器的规格

选择的接触器必须为AC3类别。

在PWS启动时，每个接触器的尺寸需选择不小于MRA的60%（MRA指最大运行电流）。

在星/三角启动时，电缆规格和三角形接触器的规格需选择不小于MRA的60%；星形接触器的尺寸需选择不小于MRA的35%。

保险丝必须是M型（电机启动器）。

强烈建议使用主流品牌的磁热开关。



检查压缩机铭牌上的电压和频率需与供给电制相匹配。

当达到平均故障时间周期时，或达到相应生产商指定的建议时间周期时，更换接触器和电气开关。

电缆接线

PWS启动：绕组需要“同相”旋转，此外，相应的端子必须连接到相同的相位：将L1相连接到端子1和7，将L2相连接到端子2和8，将L3相连接到端子3和9。

建议互锁两个绕组，切换时间不低于0.5秒，不高于1秒（PWS连接）。

SDS启动：对于星/三角启动，星形连接的启用不得超过1秒，星/三角切换时间不得短于0.05s且不得超过0.20s。

必须在现场选择准确的切换时间，方法是在切换期间选择尽量减少转子减速的时间，以便与接触器的切换速度兼容。

注：压缩机在星形连接处运行的时间越长，排气压力越高，将产生更大的阻力对抗转子惯性。

6. Electrical connections



Power and control wirings, can only be done by properly trained personnel, having proper law-abiding certification.

Electrical connections, either power or control, of the CX compressor range, must be performed in strict conformity to what specified in this paragraph.



Safety devices, labels, colours and cable sizes and control devices in the electric box, must be performed in strict observance with the local regulations and standards.

Any other device or connection not foreseen on the service instruction must be authorised in advance by Frascold on written form. For managing the cooling capacity and the startup timing of the motor windings, it is recommended to connect the compressor to a highly capable microprocessor, brand and model of which shall be approved by Frascold.



During operation, low suction temperature can cause moisture condensate or frost, in turn 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 ingress in the terminal box.

Sizing of protections

Contactors must be chosen in AC3 category.

With PWS starting, each contactors must be sized for a minimal current of at least 60% of MRA.

With Star/Delta starting, the line and delta contactors must be sized for a minimum current of at least 60% of the MRA; the star-center contactor shall be sized for 35% of the MRA.

Fuses must be of aM type (motor starter).

It is highly recommended to use magnetothermal switches of primary brand.



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 respective producers.

Power cables wiring


PWS starting: it is necessary that windings are rotating “in phase”, besides, the respective terminals must be connected to the same conductor: 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 starting: 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.

The exact switching time must be selected on the field, by choosing the time minimising the slow down of the rotors during the switching, compatibly with the switching speed of the contactors.

Note: the more time the compressor runs at star connection, the higher is the discharge pressure, and more force will oppose the rotor inertia.

重要提示：当启动压缩机时(无论是PWS或SDS的启动方法)，都必须激活最小能调(25%)至少5-10秒。
将压缩机连接到标记  所确定的接地线，并确保所选电气开关的接地线阻抗可接受。



反向旋转绕组的操作（甚至几秒钟）会导致损坏压缩机，而且无法修复。

绝缘测试

绝缘测试已在工厂进行。如果需要重复此测试，用氮气或制冷剂气体对压缩机进行填充，然后在1000Vac的最大电压下进行测试。



切勿在有带电电压的情况下对压缩机的绝缘进行测试，以及不要在真空下对压缩机进行测试。真空是一种良导体！

保护装置

标准压缩机配备INT69FRY®保护模块（T00EC45B）。此模块位于接线盒内部，并已连接至电机PTC、端子排和排温传感器。

作为可选配件（可单独供应），可提供保护装置INT69 FRYL®（T00EC45AD）；在此模块中应用诊断工具以记录不同的压缩机工作参数和警报。请参阅公告FBUL0033（www.frascold.net）以了解所有信息和接线，并参阅后续页面的电气图。

通过此模块，下面列出每个保护装置都有其专用连接端口：

- 电机PTC热敏电阻（1，2）
- 油（排气）温度传感器（3，4）
- 油位传感器（5，6）
- 滤油器堵塞传感器（7，8）
- 油流量开关（9，10）



切勿将带电电压施加到热敏电阻端子上。几伏电压足以烧毁热敏电阻的保护链。

高压和低压开关

高压和低压开关可安装在吸气和排气法兰的三通接头上，并与接触器线圈（使用机电控制时）或数字输入（在微处理器逻辑情况下）串联。




严禁在截止阀上安装压力开关（存在时），因为这些塞子可能会被滑杆阻断，所以其功能会受到抑制。



安全装置使用时被阻碍会导致爆炸、财产损失、伤害或甚至死亡。

油箱加热器

将油加热器连接到相应的电源。加热器已经配置内置恒温开关，不需要与压缩机接触器连接。

IMPORTANTE: when the compressor is switched on, whatever is the starting method, PWS or SDS, it is mandatory to keep the minimum step (25%) activated for at least 5-10 seconds. Connect the compressor to the earth grounding identified by the  mark and make sure that the grounding circuit impedance is acceptable for the selected differential magnetic switch.



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

Isolation test

Isolation test has been factory performed. If it is necessary to repeat it, charge the compressor with nitrogen or refrigerant gas and test at a **max voltage of 1000Vac**.



Do never test insulation on the compressor with live voltage and compressor under vacuum. Vacuum is a good conductor !

Protection devices

The compressors are equipped as standard with an INT69 FRY® protection module (T00EC45B). The module is inside the terminal box, already wired to motor PTC, terminal pins and discharge temperature probe.

As optional accessory, supplied loose, it's available the protection INT69 FRYL® (T00EC45AD); in this module diagnostic tools are implemented in order to record different compressor working parameters and alarms. Refer to bulletin FBUL0033 (www.frascold.it) for all information and wirings and to the electrical diagrams on next pages.

With this module, each protection device listed here below has its dedicated connection port:

- Motor PTC thermistors (1, 2)
- Oil (discharge) temperature sensor (3, 4)
- Oil filter clogging sensor (7, 8)
- Oil flow switch (9, 10)



Never apply live voltage to thermistor terminals. Few volts are enough to burn the protection chain of thermistors.

High and low pressure switches

High and low pressure switches can be installed on the Tee joints of the suction and discharge flanges, and connected in series with the contactor coils (when electromechanical control is used) or to the digital inputs (in case of microprocessor logic).



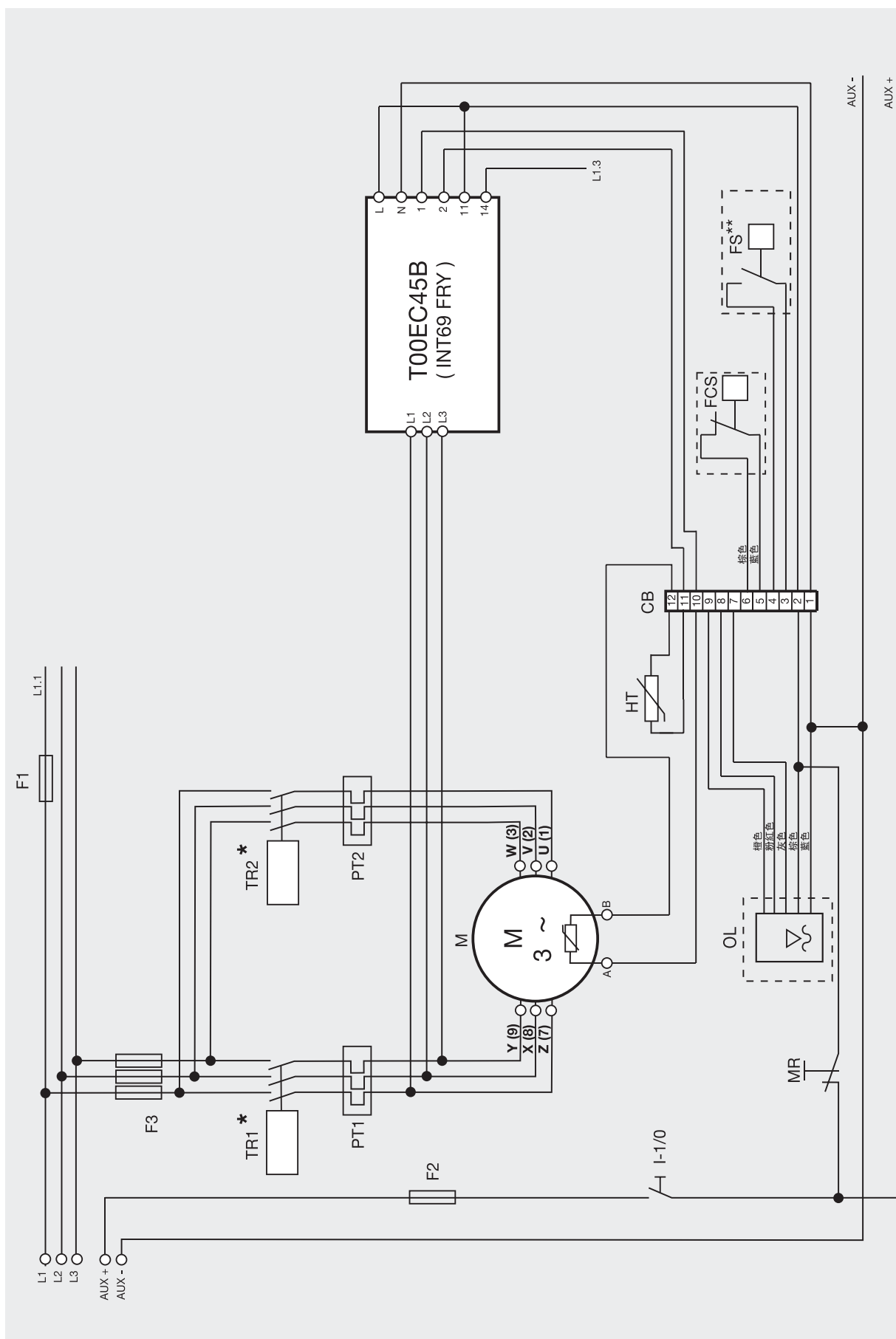
It is strictly forbidden to install pressure switches on the shut off valves (when available) because those plugs can be intercepted by the sliding vane and therefore their function inhibited.



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

Oil Crankcase Heater

Connect the oil heater to the appropriate power supply. The heater is already thermally switched and doesn't require to be interfaced with the compressor contactor.

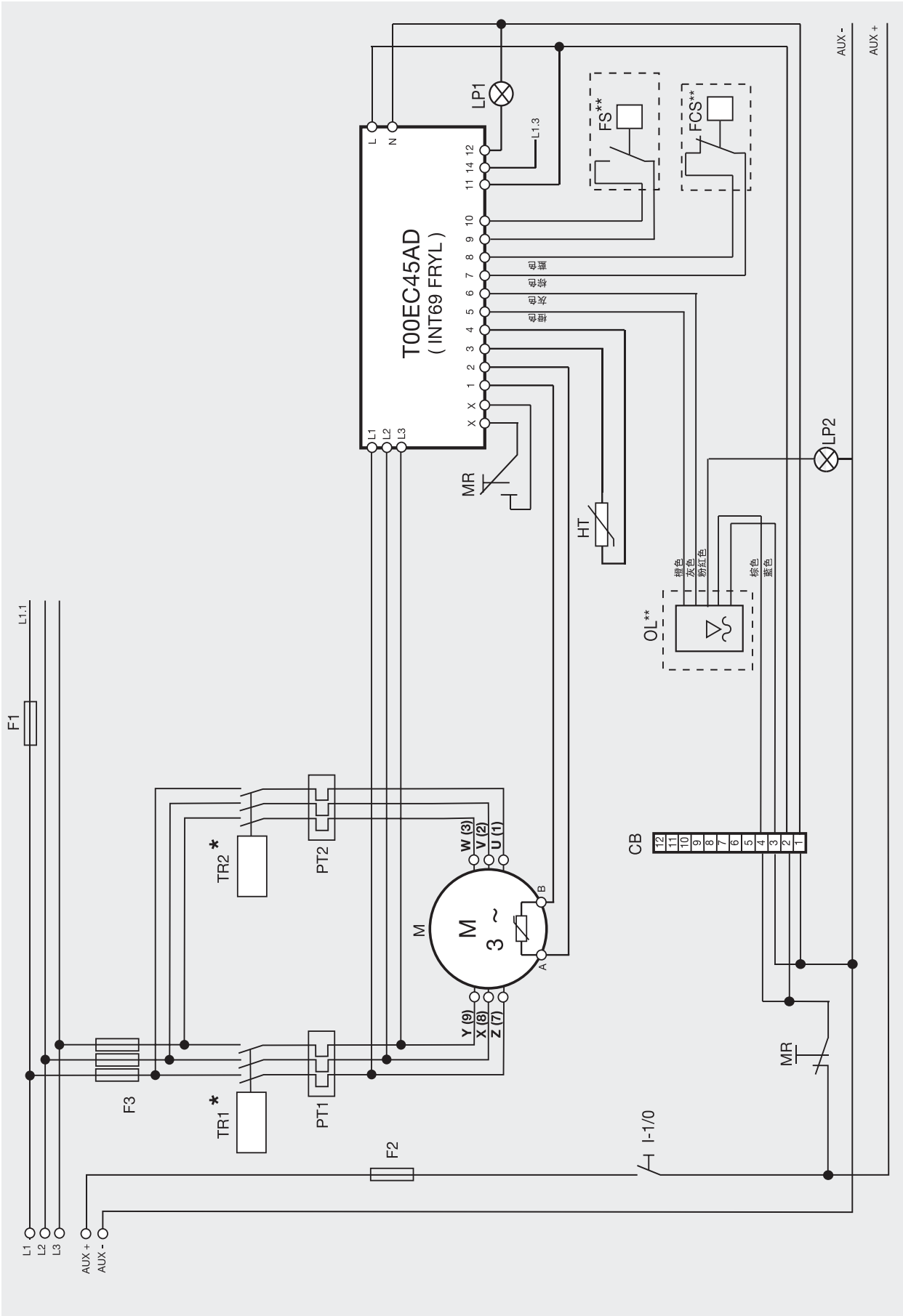


流量开关(FS)需要延时继电器(不是由富士豪提供); 见第27页的图解。
The flowswitch (FS) needs the delay relays (not supplied by Frascold); see diagram pag. 27

遵守接线顺序: TR1-YXZ-TR2-WVU
Comply with the wiring sequence TR1 - YXZ and TR2 - WVU

可选设备
Optional equipment

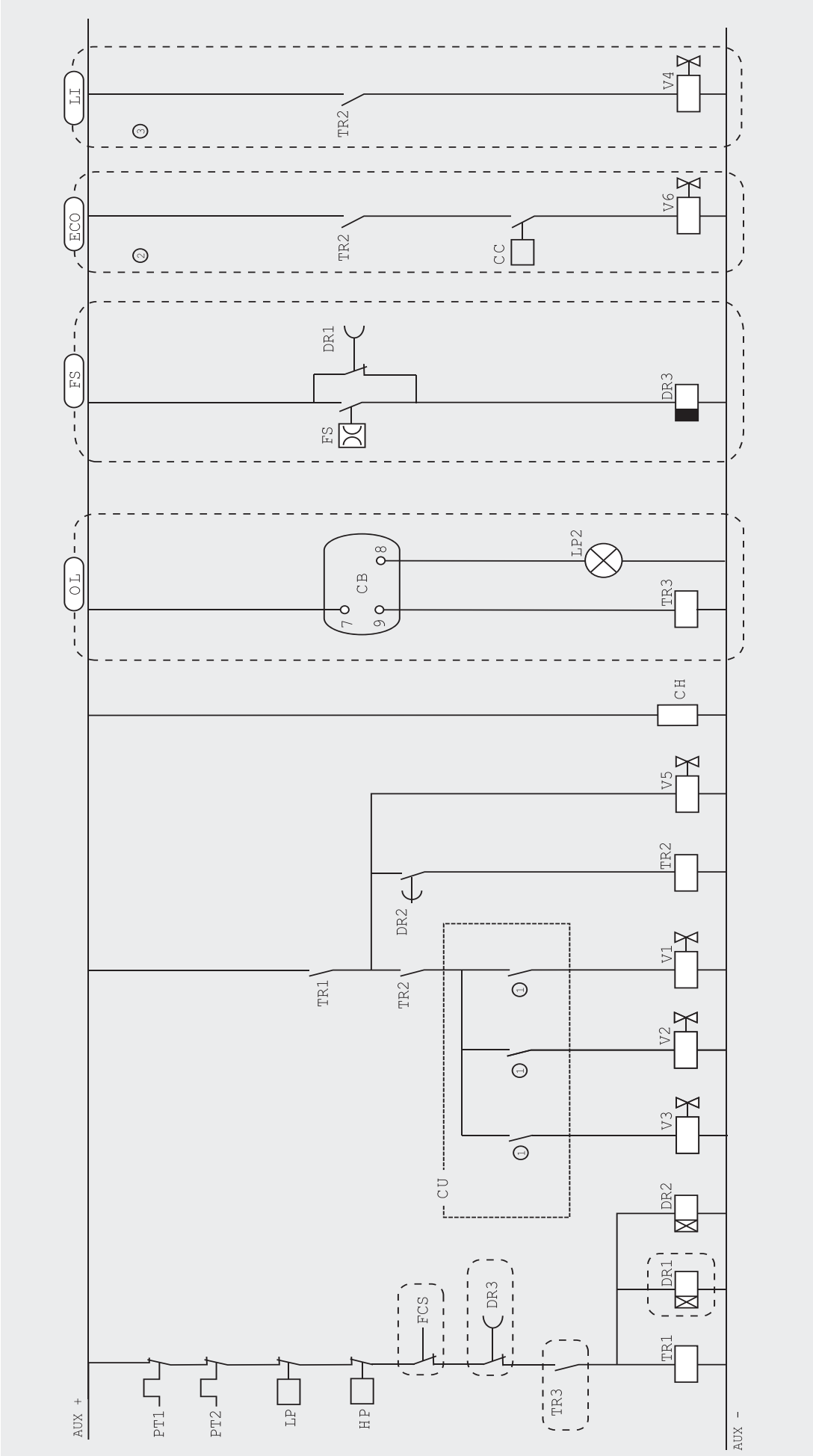
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** 可与压缩机一起发送可选设备。在移除桥接器后，T00EC45AD可直接接上油位保护、油流保护、油压差保护。
(FS) 油流量开关的延时逻辑是：启动10秒，运行3秒。
** Optional equipments sent with the compressor. Can be wired directly to the T00EC45AD after the removal of the bridges, (FS) Oil flow switch the logic of the delays is: 10 seconds at startup, 3 seconds at running.

* 遵守接线顺序
TR1-YXZ-TR2-WVU
* Comply with the wiring sequence
TR1 - YXZ and TR2 - WVU

可选设备
Optional equipment



③ 查阅公告 “液体注入”
③ Consult the bulletin “Liquid injection”

② Eco模式仅在50-100%下打开
② Eco ON only at 50-100%

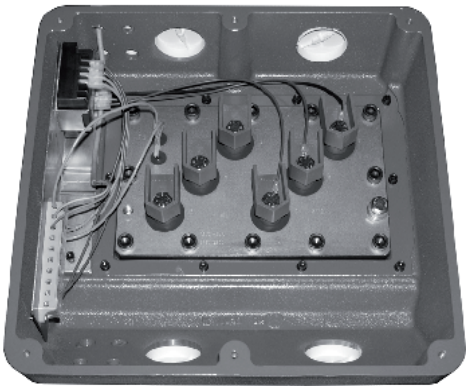
① 查阅公告 “无级容量控制”
① Consult the bulletin “Stepless capacity control”

可选设备
Optional equipments

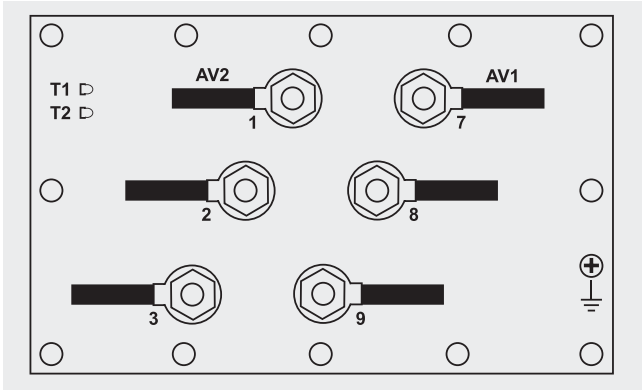
图例

Legenda

CB	压缩机的接线板	CB	electric board of the compressor
CC	条件控制	CC	condition control
CH	油箱加热器	CH	oil crankcase heater
CU	控制装置	CU	control unit
DR1	油流量控制延时继电器（10 ~ 120秒）	DR1	oil flow control time delay relay (10 ÷ 120 sec.)
DR2	PWS延时继电器（0.5 ~ 1秒）	DR2	PWS time delay relay (0.5 ÷ 1 sec.)
DR3	油流量控制报警延时继电器（5秒）	DR3	oil flow control alarm time delay relay (5 sec.)
F1	控制电路保险丝	F1	control circuit fuse
F2	控制电路保险丝	F2	control circuit fuse
F3	压缩机保险丝	F3	compressor fuses
FCS	油过滤器堵塞的传感器	FCS	sensor for oil filter clogging
FS	油流量开关	FS	oil flow switch
HP	高压开关	HP	high pressure switch
HT	最高油/排温传感器	HT	max oil temperature sensor
I-1/0	“通/断”开关	I-1/0	ON / OFF switch
LP1	“可选报警”指示灯	LP1	“optional alarm” lamp
LP2	“油位报警”指示灯	LP2	“oil level alarm” lamp
LP	低压开关	LP	low pressure switch
TR1	第一个PWS启动接触器	TR1	1st PWS start contactor
TR2	第二个PWS启动接触器	TR2	2nd PWS start contactor
TR3	油位控制接触器	TR3	oil level control contactor
PT1	过载保护，一次绕组	PT1	overload protection, 1st windind
PT2	过载保护，二次绕组	PT2	overload protection, 2nd winding
M	电机	M	electric motor
MR	故障复位	MR	fault reset
OL	油位开关（可选配件）	OL	oil level switch (optional accessory)
V1	能调控制电磁阀	V1	capacity control solenoid valve
V2	能调控制电磁阀	V2	capacity control solenoid valve
V3	能调控制电磁阀	V3	capacity control solenoid valve
V4	液体管路电磁阀	V4	liquid line solenoid valve
V5	注油电磁阀	V5	oil injection solenoid valve
V6	经济器电磁阀	V6	economizer solenoid valve



电气盒和端子板



Electrical box and terminal plate

低蒸发温度和高湿高温环境下使用压缩机时可能会导致在接线盒内产生凝结水。为避免水分进入接线盒内，必须安装IP65（或更高保护等级）的电缆密封套。可能需要在接线盒中使用加热元件或在端子上涂抹绝缘脂。



切勿将带电电压施加到热敏电阻端子上。几伏电压足以烧毁热敏电阻的保护链。



水在接线盒中的凝结可能会导致短路。请勿移除或损坏已提供的针形绝缘体！

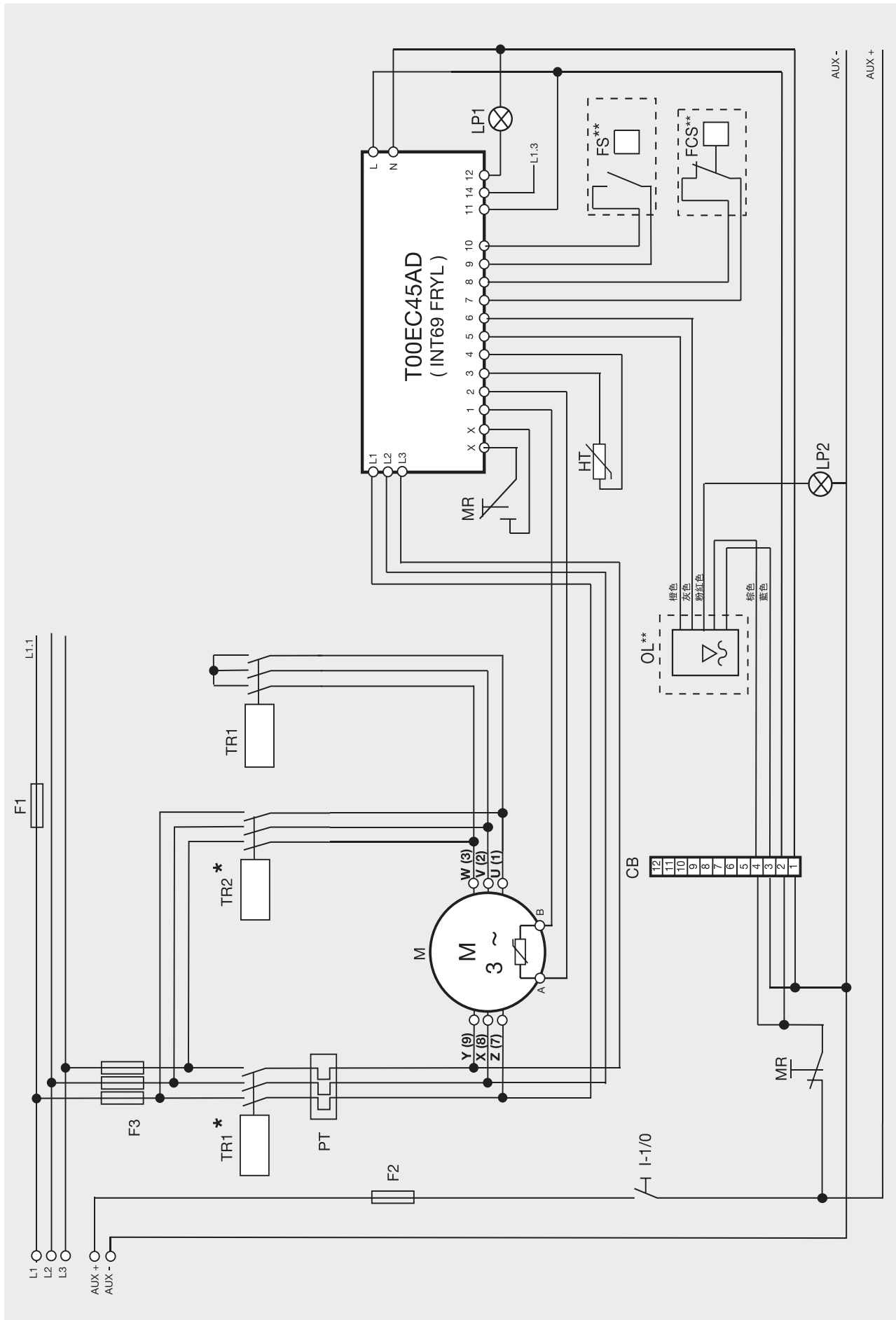
The use in low evaporating temperatures and/or high ambient humidity may produce water condensation inside the terminal box. Installation of IP65 (or higher protection) cable glands is mandatory in order to avoid the moisture to enter inside the terminal box. The use of heating element in the terminal box or contact grease on the terminals may become necessary.



Never apply live voltage to thermistor terminals. Few volts are enough to burn the protection chain of thermistors.



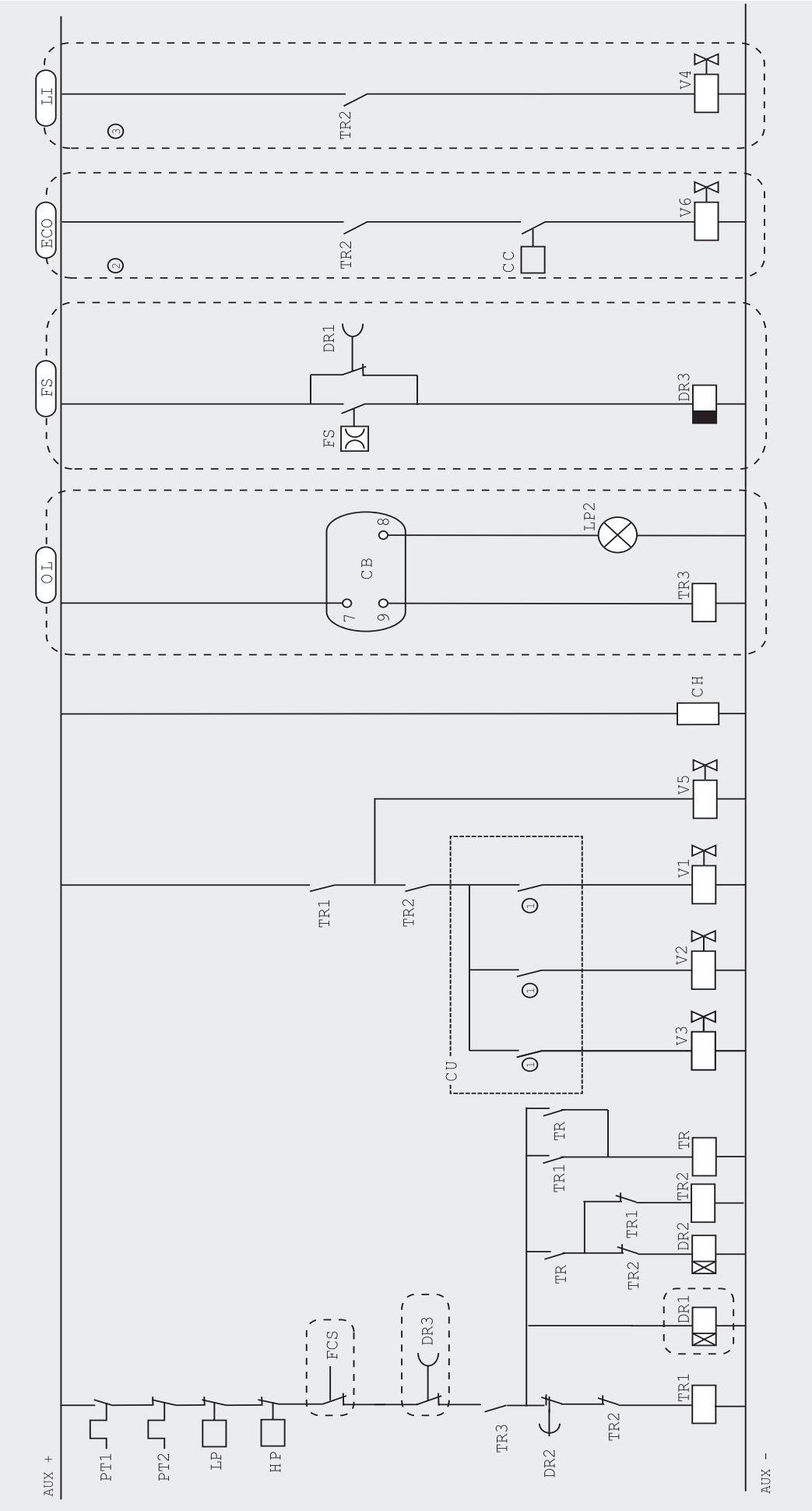
Risk of short circuit due to condensing water into the terminal box. Do not remove or damage the pins insulator supplied!



** 可与压缩机一起发送可选设备。在移除桥接器后，T00EC45AD可直接上油位保护、油流保护、油压差保护。(FS) 油流量开关的延时逻辑是：启动10秒，运行3秒。10 seconds at startup, 3 seconds at running.

* 遵守接线顺序：
TR1 - YXZ e TR2 - WVU
Comply with the wiring sequence:
TR1 - YXZ and TR2 - WVU

可选设备
Optional equipments



③ 查阅公告 “液体注入”
③ Consult the bulletin “Liquid injection”

②/Eco模式仅在50 - 100% 下打开
② Eco ON only at 50-100%

① 查阅公告 “无级容量控制”
① Consult the bulletin “Stepless capacity control”

可选设备
Optional equipments

图例

Legenda

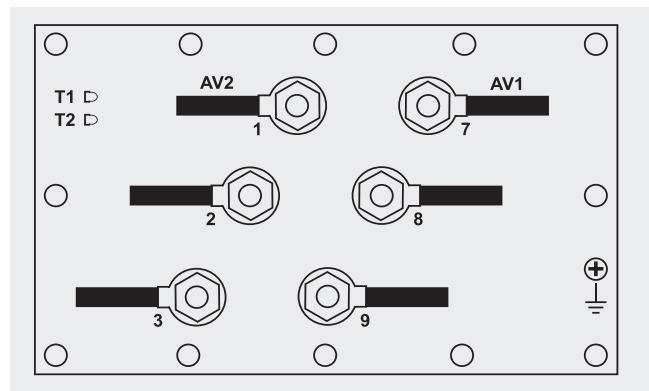
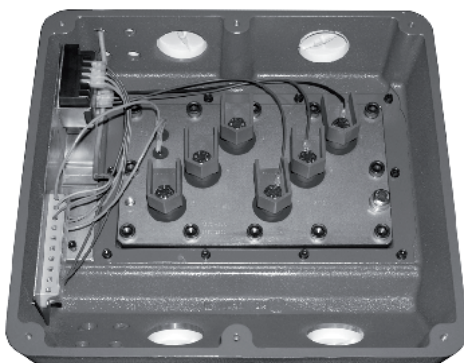
CB	压缩机的接线板	CB	electric board of the compressor
CC	控制条件	CC	condition control
CH	油箱加热器	CH	oil crankcase heater
CU	控制装置	CU	control unit
DR1	油流量控制延时继电器 (10 ~ 120秒)	DR1	oil flow control time delay relay (10 ÷ 120 sec.)
DR2	Y/△ 延时继电器 (0.5 ~ 1秒)	DR2	Y/D time delay relay (0.5 ÷ 1 sec.)
DR3	油流量控制报警延时继电器 (5秒)	DR3	oil flow control alarm time delay relay (5 sec.)
F1	控制电路保险丝	F1	control circuit fuse
F2	控制电路保险丝	F2	control circuit fuse
F3	压缩机保险丝**	F3	compressor fuses **
FCS	用于滤油器堵塞的传感器	FCS	sensor for oil filter clogging
FS	油流量开关	FS	oil flow switch
HP	高压开关	HP	high pressure switch
HT	最高油/排温传感器	HT	max oil temperature sensor
I-1/O	“通/断” 开关	I-1/O	ON / OFF switch
LP1	“可选报警” 指示灯	LP1	“optional alarm” lamp
LP2	“油位报警” 指示灯	LP2	“oil level alarm” lamp
LP	低压开关	LP	low pressure switch
TR	主要接触器*	TR	main contactor *
TR1	Y启动接触器	TR1	Y start contactor
TR2	△ 启动接触器	TR2	△ start contactor
TR3	油位控制接触器	TR3	oil level control contactor
PT	过载保护	PT	overload protection
M	电机	M	electric motor
MR	故障复位	MR	fault reset
OL	油位开关 (可选配件)	OL	oil level switch (optional accessory)
V1	25%能量控制电磁阀	V1	25% capacity control solenoid valve
V2	50%能量控制电磁阀	V2	50% capacity control solenoid valve
V3	75%能量控制电磁阀	V3	75% capacity control solenoid valve
V4	液体管电磁阀	V4	liquid line solenoid valve
V5	注油电磁阀	V5	oil injection solenoid valve
V6	经济器电磁阀	V6	economizer solenoid valve

*接触器功率 > 0.56 x 最大功率输入

* Contactor power > 0.56 x maximum power input

**GL型保险丝容量 = 1.3 x LRA (见压缩机铭牌)

** Fuses capacity GL type = 1.3 x LRA (see name plate of compressor)



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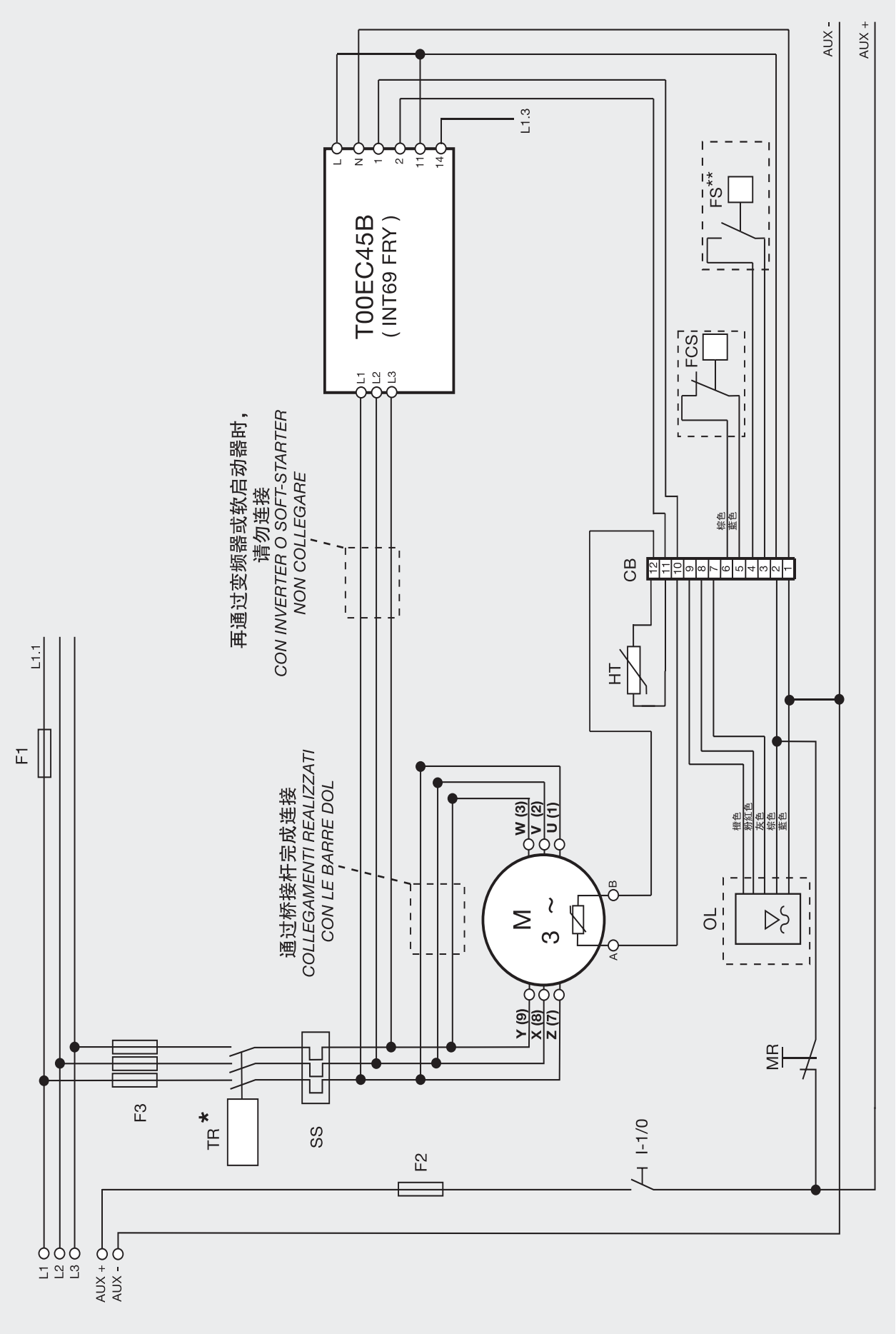


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Risk of short circuit due to condensing water into the terminal box. Do not remove the insulators supplied !

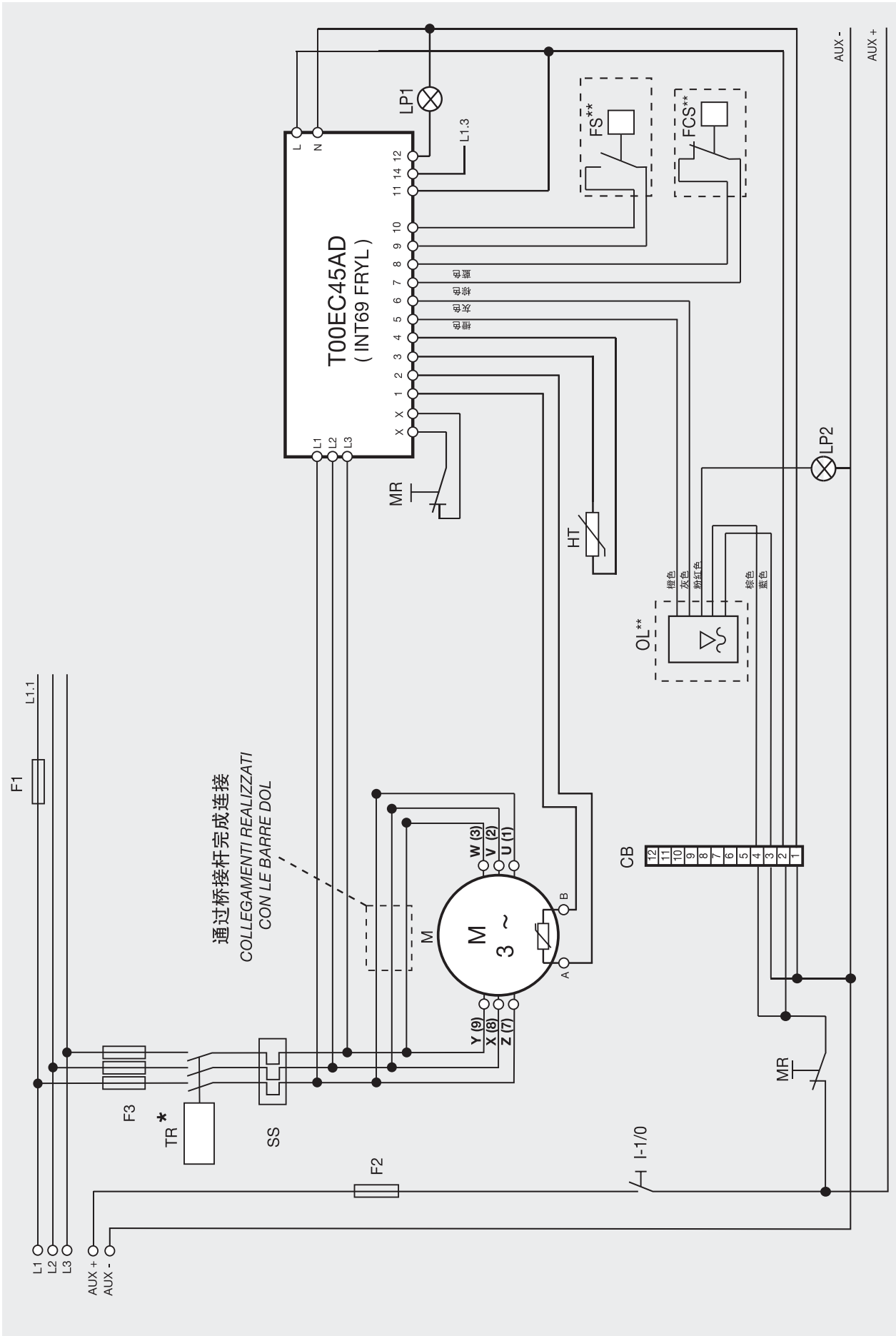


软启动器/变频器启动
(可选诊断设备)

辅助电源230V

SOFT Starter / Inverter Starting
(optional Diagnose setting)

Auxiliary Power Supply 230V

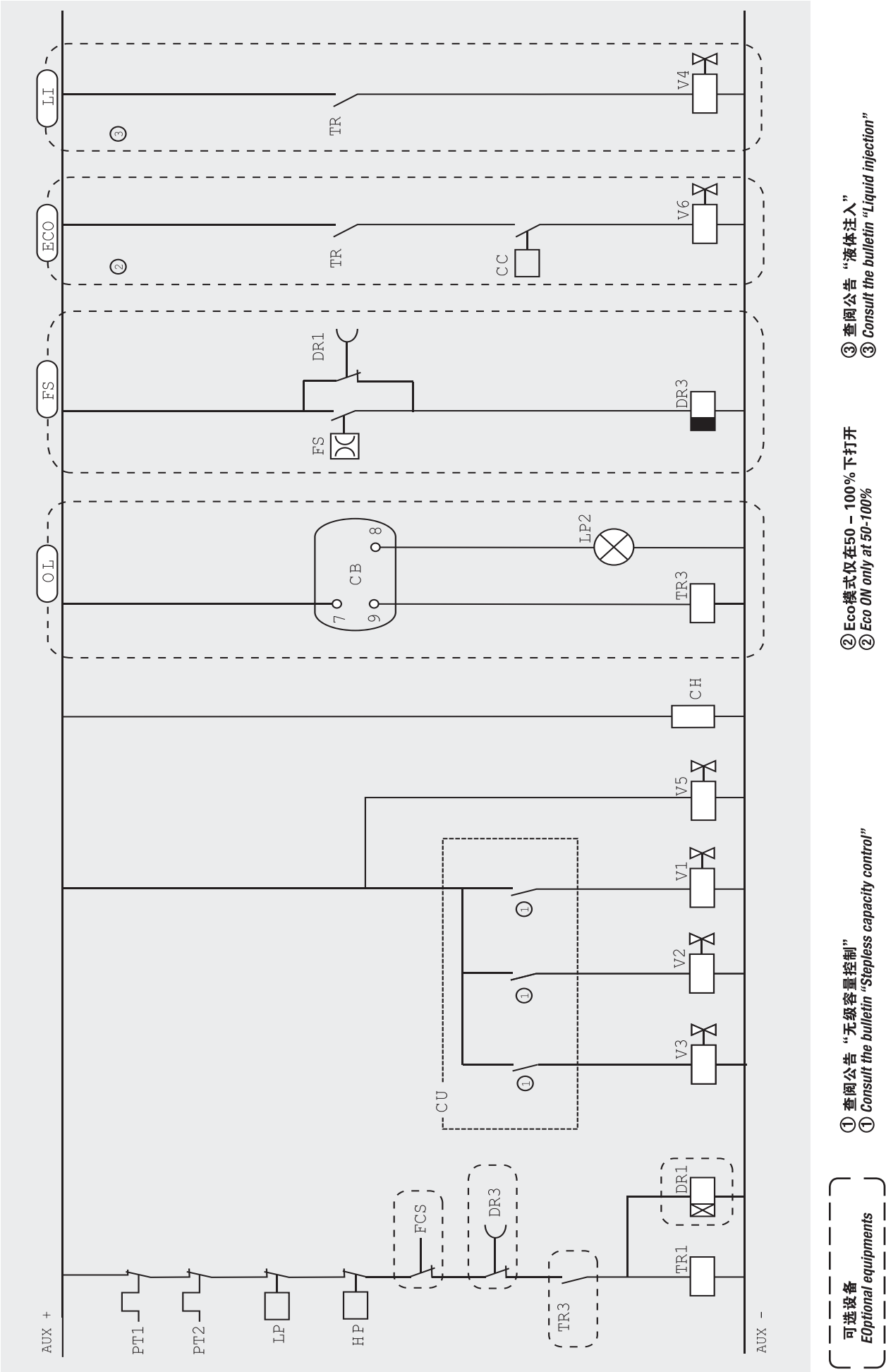


** Optional equipments sent with the compressor. They can be wired directly to the T00EC45AD after the removal of the bridges. (FS) oil flow switch the logic of the delays is: 10 seconds at startup, 3 seconds at running.

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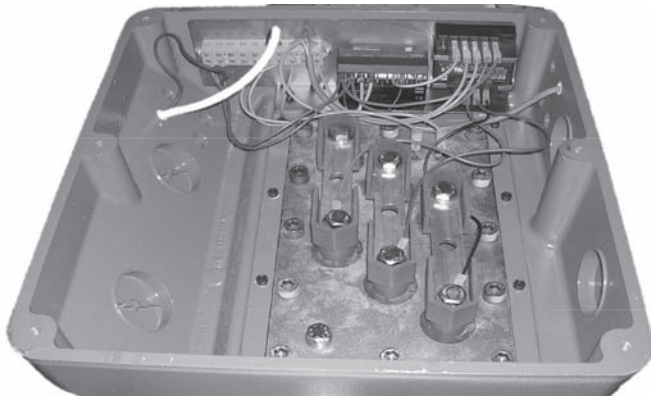
可选设备
Optional equipments



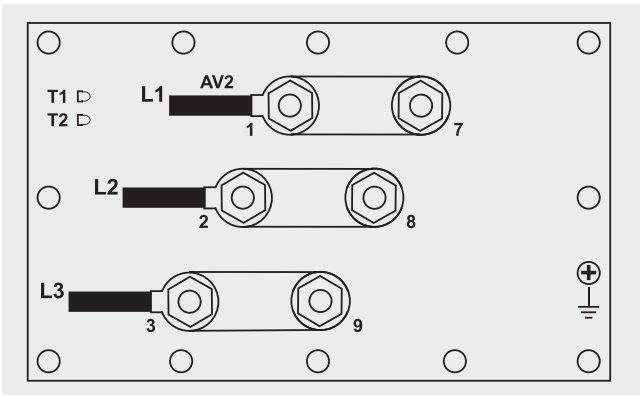
图例

Legenda

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TR3	油位控制接触器	TR3	oil level control contactor
SS	软启动器/变频器	SS	Soft starter / Inverter
M	电机	M	electric motor
MR	故障复位	MR	fault reset
OL	油位开关（可选配件）	OL	oil level switch (optional accessory)
V1	能调控制电磁阀	V1	capacity control solenoid valve
V2	能调控制电磁阀	V2	capacity control solenoid valve
V3	能调控制电磁阀	V3	capacity control solenoid valve
V4	液体管路电磁阀	V4	liquid line solenoid valve
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7. 试运转

如果您需要测试制冷回路的压力，则必须保持压缩机截止阀处于关闭状态，除非在执行压力测试时，高压侧的压力不超过30bar，低压侧的压力不超过20.5bar。

根据EN378-2的要求，对压缩机进行允许的最大压力下执行泄漏测试。必须使用具有减压阀和安全阀的密封钢瓶里的无氧氮气（OFN）执行该测试。



禁止使用HFCs进行泄漏测试，因为HFCs制冷剂属于不环保气体。向大气中释放HFCs是一项重罪。如果OFN与HFCs接触，则不能再释放到大气中，而是必须将其回收并进行热分解，而且必须遵循与处理HFCs气瓶相同的规定。

抽真空

制冷剂管路的抽真空必须严格遵守行业标准。

如果管路仍处于氮气压力下，请释放氮气至大气。

连接足够数量的软管，以便有效地到达制冷剂管路的任何点，事先打开所有截止阀，然后打开所有电磁阀，并保证回路的密封性。

将所有软管连接到一个表组上，再连接到双级真空泵。

根据EN378-2，实现深度真空，至少达到270Pa这个最小值。

富士豪建议达到不超过一半的最大真空度时，将加热器对油进行加热，油温需要高于室温20K。如果真空泵在更短的时间内达到所需的真空度，则保持真空泵运行，直到油温比室温高20K。

当真空泵停止运行时，真空度不应超过泵运行时真空度的 $\pm 20\%$ 。否则，请重复抽真空程序，或检查整个制冷剂管路是否存在泄漏。



一些制冷剂气体（如R134a）在室温下与POE油具有很好的互溶性。如果油与R134a意外接触，则可能无法再达到真空。



在深度真空状态下，严禁运行压缩机。这种情况下的任何电气操纵都可能对电动机的定子造成不可逆转的损坏，并引起润滑剂的脱酯化或水解。

制冷剂充注。

打开所有电磁阀，断开真空泵的所有软管，并将仪表组的软管分别连接到冷凝器的高压侧和节流阀之后的低压侧。

切勿连接排气口上的歧管。

7. Commissioning

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 30,0 Bar on the high side and 20,5 Bar on the low side.

The leak test, can be performed at the max allowable pressures recall on the compressor plate according to EN378-2 requirements. The test must be performed with oxygen-free nitrogen (OFN), the bottle must be equipped with 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 cylinders.

Evacuation

Refrigerant circuit evacuation must be performed with strict observance of the good practice in force.

Specifically, if the circuit is still under pressure, release nitrogen down to atmospheric pressure.

Connect a sufficient number of hoses, so to reach efficiently any point of the refrigerant circuit, having previously opened all of the shut off valves and eventually having engaged all solenoid valve intercepting any part of the circuit remaining otherwise closed.

Connect all hoses to a single manifold, in turn connected to a double-stage vacuum pump.

Perform a very deep vacuum, reaching at least **the minimum value** of 270Pa according to EN378-2.

Frascold recommends to reach a maximum vacuum level no more than half than that, for a time not shorter than the time the heater takes to warm the oil at 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 room.

When the pump is stop, the vacuum level shall not change for more than $\pm 20\%$ of the level when pump is 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 may not be possible to reach vacuum any longer.



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

Refrigerant charge.

De-energize 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 condenser and thermostatic expansion valve.

使用正确的密封完好无损的专用密封钢瓶装液体制冷剂，然后将其充入制冷循环液体管路中，也可以充入储液器中。如果蒸发器为满溢式的，也可以将液体转移到蒸发器中。



切勿将液体制冷剂充入吸气管路中。如果出于任何原因出现此情况，请将所有制冷剂回收到有合适回收装置的空罐中。如果制冷剂为非共沸混合物，则不能再使用，并且必须对制冷剂进行热分解，将其作为危险特殊废物处理。



当液体制冷剂停止流入储液器时，关闭仪表组截止阀或软管阀，并将气态制冷剂充入回路的其余部分，包括压缩机。

在所有充注过程中，请保持油加热器处于开启状态，并注意观察油观察窗，以免颜色、密度、形状发生变化，并且是否开始起泡。如果出现以上的非正常情况，可能意味着它与液态制冷剂接触，在该情况下，必须从头开始重复整个过程。

此时，充注完成，可以启动压缩机。

使用设备上的压力计或仪表组，确保压缩机以正确的相序连接。如果启动时，吸气压力在1秒内不会降低，请迅速关断主开关或热磁开关的电源（如果有两个，则同时断开两个开关的电源）。



切勿按下微处理器调节器的“OFF”（关闭）按钮：切断时间可能会延迟，长延迟时间会导致压缩机损坏。
检查螺杆旋转方向：查看接线图并进行相序分析。



确保您经过合适的培训，并具备相关的认证。不要只是切换电线，而要认真地思考正在做的事情。

试运转结束

按照正常程序继续充注制冷剂，直至达到所需的制冷剂充注量，通过少量添加制冷剂，同时确保排气温度在冷凝温度约30K以上。此时每5分钟充注一次，期间等待1分钟，以使运行稳定。

严格监控油位。如果油位低于视油镜，则需要及时添加润滑油。在这种情况下，停止压缩机运行，关闭压缩机截止阀，回收压缩机中的制冷剂，并将油从注油口注入。在充注完成后，关闭注油口，对压缩机抽真空并重新打开截止阀。

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 flooded type, liquid can be transferred into it as well.



Never charge liquid refrigerant in the suction line. If it 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 carried to thermodestruction and treated as dangerous special waste.



When liquid refrigerant stops flowing into the liquid receiver, close the shut off valves of the manifold gauge or the hose valve, and charge vapour into the rest of the refrigerant circuit, including the compressor.

During all of the charge procedure, keep the oil heater ON and keep an eye on the oil sight glass, so that it doesn't change colour, density, shape 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 scratch.

At this point the charge is completed to allow the compressor to be started up.

Use the manometer on board the unit or the gauges on the manifold, to make sure the compressor was connected with the right phase sequence. If at start-up, the suction pressure does not reduce within 1 second, act quickly and disconnect the power from the main switch or the magnetic switch (if two, from both at the same time).



Do not press OFF button of the microprocessor regulation: there may be delays from cut out, long enough to damage the compressor. Check the rotation of the magnetic field: look at the wiring diagram and use of a phase sequence analyser.



Make sure you have the appropriate training and certification to do it. Don't just switch the wires without pondering heavily on what you are doing.

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 minute of charging, for allowing stabilisation of the operating conditions.

Keep the oil level under strict control. If the oil level drops below the lower sight glass, it may be necessary to add more, mainly when the refrigerant circuit is long or with a high number of syphons and P-curves. In this case, stop the compressor, close the shut off valves, reclaim some of the refrigerant in the compressor, and pour oil into the dedicated hole. At the of refilling, seal the plug, evacuate the compressor and reopen the shut off valves.

除油分器（内置或外置）外，切勿在制冷剂管路的任何其他部分加入油。
如果出现多次重复充注的现象，则可能出现阻塞或不合理的回油弯。



注意：这是一种非常危险的情况，因为油可能任何时候出乎意料地回流，并且会导致即时、剧烈及不可挽回的压缩机堵塞。



当制冷达到设计时预测的值时，充注完成。切勿通过视液镜来判断制冷剂充注量。它可能会误导你！

进行所有测量并将测量结果存档到机器日志中。测量应至少包括：

- 液体温度
- 吸气温度
- 环境温度
- 蒸发压力
- 冷凝压力
- 排气温度
- 油温
- 三相电流
- 三相电压

最大开停机次数： 每小时6次启动
建议的最短运行时间： 5分钟

打印或填写机组微处理器的参数列表，并将其与上述测量结果一起保存到日志中。
所有这些数据都可以传输给富士豪，并用于在整个压缩机使用寿命期间提供建议和协助以及解决问题，甚至可以获得更长的保修期限。
有关该主题的更多信息，请联系我们的售后服务部门。

故障排除

不可能预测所有可能的情况并排除未来故障的所有原因，但仍然可以帮助用户防止一些最常见的失效或故障原因，例如：

- 正确放置膨胀阀感温包的位置，其不得位于吸气过热（如有）后面，尽量靠近蒸发器出口。
- 在任何工作条件、季节或热负荷下，必须始终将吸气过热度控制在可接受的范围内。其温度不得低于3K或高于20K。
- 在安装经济器时，注意观察经济器前面的试液镜。在任何工作条件、季节或热负荷下，制冷剂必须始终不含任何闪蒸气体。

Do not add oil up in any other part of the refrigerant circuit, exception made for oil separators (either built-in or remote, if installed).
Should the refilling procedure be repeated more and more times, there may be an obstruction or a syphon not properly sized.



Beware: this is a very dangerous condition, because oil can return at any time, unexpectedly, and in any amount, and can cause an immediate, violent and unrepairable compressore seizure.
The charge is complete when subcooling reaches the value forecasted at design time.



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

Make all measurements and archive them into the machine logbook. The 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 thre three phases

Maximum cycling rate : 6 starts per hour
Advised minimum running time: 5 minutes

Print or fill the parameter list of the microprocessor and keep it together with the measurements above into 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 whole compressore life, or even being able to obtain longer warranty terms.
Contact our After Sales for more information on the subject.

Troubleshooting

It is impossible to forecast all possible conditions and exclude all causes of a future malfunction, but it is nevertheless possible to help the user preventing some of the most frequent causes of fault or malfunction, e.g.:

- Correct positioning of the thermostatic valve sensing bulb. It must be frequently controlled and tightened. For no reason it can be located after the suction superheater, if any at all, but just only after the evaporator.
- 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 3K or higher than 20K.
- Refrigerant must always be void of any flash gas, at any operating condition, season or heat load. If an economiser is installed, the sight glass must be located just before the economiser inlet port.

- 油箱加热器必须是常通电。压缩机启动信号必须始终与油恒温器互锁。
对于长时间的不运行时段，允许关闭油箱加热器；在这种情况下，为防止液体制冷剂移至壳体内或油分离器中，建议关闭压缩机的阀门。
- 泵集停机增加了压缩机停机时的反转时间。反转使得过热气体回流到吸气管路中；这会导致泵集压力开关的复位，因此不推荐使用此程序。
- 即使在季节性停止时关闭电路，压缩机的温度也必须始终比制冷剂回路其他部分的温度高。
- 如果蒸发器的热负荷在运行时间内发生很大变化，建议在冷凝器后面的液体管路中安装储液器。
- 为简化故障排除和故障分析，必须为任何制冷剂管路提供足够和适当的检测仪器，例如容易实现的压力计、温度计、探头、传感器等。
- 检查油滤器清洁状况。如果在运行开始计算的前100个小时内，压缩机未能达到其制冷量调节的100%，这可能是由于产生高压降的油滤器堵塞引起的。
- 油滤器堵塞报警:对于配备油滤器堵塞传感器（可选件）的压缩机，会发出表明油滤脏堵的报警信号。需检查过滤器的清洁情况。
- 油流量报警:对于配备油流量开关（可选件）的压缩机，会发出表明油流量不足的报警信号。需检查过滤器的清洁情况。
- Oil crankcase heater must always be ON. The compressor start-up signal must always be interlocked with the oil thermostat.
For long out-of-order periods, it is allowed to switch OFF the crankcase heater; in such a case, it is recommended to close the compressor's valves in order to prevent the liquid refrigerant migration into the casing or into the oil separator.
- The pump-down procedure increases the counter-rotation time at compressor shut-down. The counter-rotation makes flowing back the superheated gas into the suction pipeline; this is causing the reset of the pump-down pressure switch. It is therefore not recommended.
- Compressor must always be warmer than any other part of the refrigerant circuit, even if the circuit is switched off for seasonal stop.
- In case the thermal load at the evaporator changes greatly during the operating time, it is recommended to install a liquid separator in the liquid line after the condenser.
- 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. manometers, thermometers, probes, transducers, etc. readily accessible.
- Checking the oil filter cleaning. If during the first 100 hours of operation the compressor fails to reach 100% of its capacity, it can be caused by clogging of the oil filter which generates a high pressure drop.
- Oil filter clogging alarm. For compressors equipped with the oil filter clogging sensor (optional), an alarm signal warns that the oil pressure is too low. Check the filter cleaning.
- Oil flow alarm. For compressors equipped with the oil flow switch (optional), an alarm signal warns that the oil flow is insufficient. Check the filter cleaning.

有关更多信息，请联系售后服务部门。

Contact the After Sales service for any further information.

8. 维护操作

下面描述了最常见的维护操作和相关的频率：

- 滤油器堵塞检查（见第7章）
第一个100小时后
- 干燥过滤器更换
第一个100小时后以及每10000小时
- 工作温度和压力，与试运转期间压缩机日志的报告值进行比较
每月
- 油位和温度
每月
- 安全和控制装置（压力开关、安全开关、电磁阀）
三个月一次
- 止回阀
三个月一次
- 电力和控制连接：拧紧螺栓和目视检查电缆绝缘状态。
每月
- 压缩机固定在支撑架上，阀门螺栓、法兰螺栓和阀体螺栓均拧紧。
三个月一次
- 制冷剂充注量
每年
- 油质检查
每5000个小时或每年

对于带油过滤-干燥器的冷水机组和成套设备，通常不需要换油。如果在油品分析中发现其性质有不足的方面，则需要更换。在电机烧坏后，必须进行换油。

- 检查是否存在泄漏
当地法律规定的时间
- 滤油器堵塞检查（见第7章）
每5000个小时或每年

如果对压缩机运行有任何疑问，请注意事先收集所有技术数据，并联系富士豪的售后服务部门。

8. Operation and maintenance

Most common maintenance operations and the associated frequency are hereby following described:

- Oil filter clogging check (see chapter 7)
after first 100 hours
- Drier filter change
after first 100 hours and every 10000 hours
- Operating temperatures and pressures, to be compared with the reported values of compressor's logbook during the commissioning
monthly
- Oil level and temperature
monthly
- Safety and control devices (pressure switches, safety switches, solenoids)
three-monthly
- Check valve
three-monthly
- Electric power and control connections: bolts tightening and visual inspection of the status of cables insulation.
monthly
- Compressor fixing to the supporting frame, valve bolts, flanges bolts and body bolts.
three-monthly
- Refrigerant charge
yearly
- Oil quality check
every 5000 hours or yearly

Oil changing is not normally necessary for chiller and package unit with oil filter-driers. The replacement is necessary in case of lack in its properties found with the oil analysis. Oil changing is surely necessary after a motor burn out.

- Check for leakages
periods set by law
- Oil filter clogging check (see chapter 7)
every 5000 hours or yearly

In case of doubts on the compressor operation, please contact the After Sales Service of Frascold, being careful about gathering all technical data preliminarily.

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9. 停用拆机



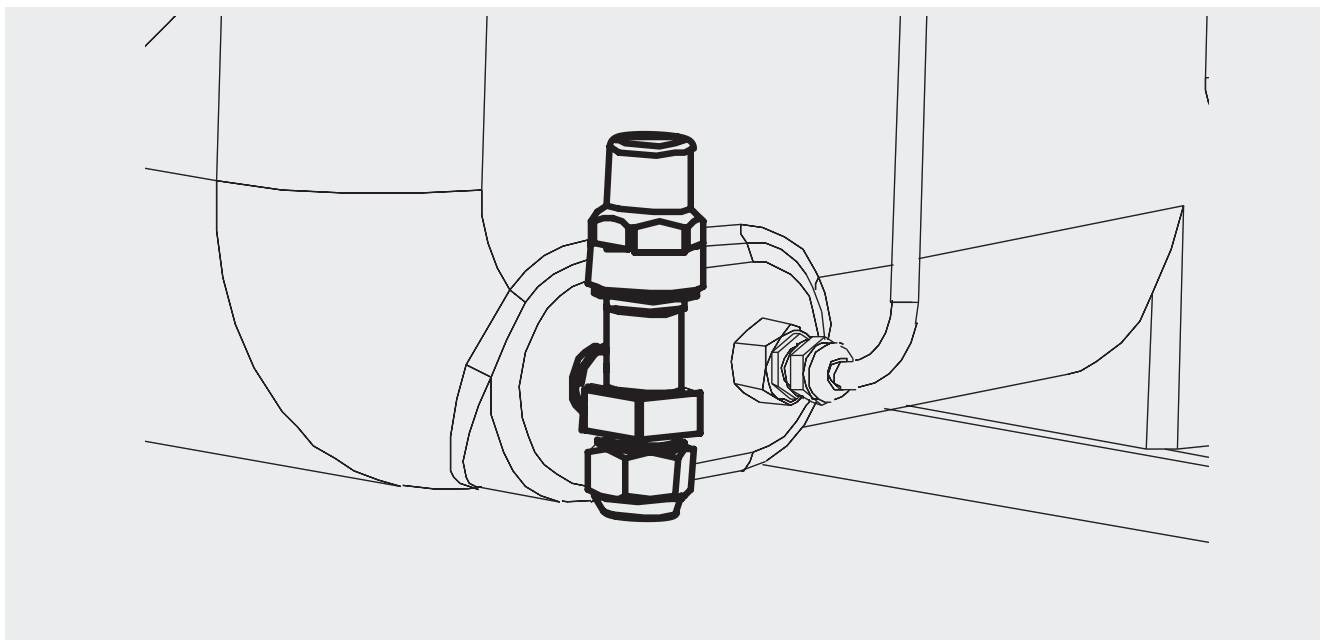
如果需要正式停用并拆除压缩机，必须获得有关制冷剂回路和高功率电路操作的所有必要条件允许。确保人员经过适当的培训并有资格参加相应的技术操作。

关闭压缩机截止阀并拧紧密封螺母。在保持油加热器处于打开状态时，取下保险丝或使热磁开关开路。将压缩机的制冷剂回路连接到标准的装置，回收和分离其内部包含的制冷剂。

获得纯粹的真空后，在略高于大气压力的压力下用氮气进行加压。

将排油阀连接到事先布置好的适当容器中的管道，此容器适用于容纳和密封用过的润滑油，并且其外部具有适当的警告标志和危险图标。

容器体积必须比压缩机中所包含油的体积至少大30%-50%，因为当承受较低的压力时，POE油就会开始起泡。一旦将油完全排出，关闭加热器和排油阀。



必须将回收的制冷剂气体和用过的POE油用密封的圆桶运送到能够进行正确处理的工厂。



根据现行法律，这两种液体被视为特殊和危险物质，因此必须对其进行处理。

拆卸电气接线端子。不要出于任何原因拆卸接线板，以避免污染气体或空气留在壳体中。

断开压缩机与制冷回路的连接，将衬套和法兰留在回路上。如果压缩机未配备一个或两个截止阀，则应使用盲法兰或合适的方法关闭压缩机腔体，同时对制冷回路进行密封。

按照第1章的说明提升压缩机，并将其退返给富士豪以进行拆检。

9. Decommissioning



For decommissioning the compressor, it is necessary to be in possession of all the necessary authorisation for operation on 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 counter-nut. While keeping the oil heater ON, remove the fuses or open the the magnetic switch. Connect the compressor to a suitable reclaim unit for reclaiming and segregating the refrigerant contained inside of it.

Once a mere 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 proper canister, suitable for containing and sealing exhausted lubricants, and having the appropriate warning signs and danger icons on the outside.

The canister content volume must be at least 30%-50% larger than the volume of oil contained into the compressor, because the POE oil will start to foam as soon as exposed to a lower pressure. Once the oil is completely drained, switch the heater OFF and close the drain tap valve.



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



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

Disconnect the electric terminals. Do never, for any reason, disassemble the terminal plate, in order to avoid pollutant gases or vapours to leave the casing.

Disconnect the compressor from the refrigerant circuit, leaving the receptacles and flanges with the circuit. If the compressor doesn't possess one or both shut off valves, close the cavities with blind flanges or suitable mean to hermetically seal the discharge and suction.

Lift the compressor as explained in chapter 1 and return it to Frascold for disassembly.

报告证书

所有压缩机CX系列都遵循以下规范：

1. 设计压力
压缩机铭牌中指示的吸气侧最大允许静止压力：20.5 bar（适用于所有制冷剂）
压缩机铭牌中指示的排气侧最大允许压力：30bar（适用于所有制冷剂）
2. 设计温度
最大允许排气温度：120℃（适用于所有制冷剂）
3. 液压试验
上述压缩机符合以下要求：
低压侧外壳能够承受61.5bar压力（压缩机铭牌中指定的最大允许静止压力的至少3倍）下的液压测试而不会破裂。
高压侧外壳能够承受90bar压力（压缩机标签中指定的最大允许压力的至少3倍）下的液压测试而不会破裂。每年必须至少对每个型号范围的两个样品进行一次这种测试。
4. 气密试验压力
已在33bar的压力下对上述压缩机进行了测试。
5. 泄漏试验
在指定压力下使用干燥空气和氦气的混合气体进行泄漏测试，该指定压力为压缩机铭牌上所示最大允许压力的1.1倍，即 $30 \times 1.1 = 33\text{bar}$
6. 壳体材料
外壳材料为G25型铸铁。
机器主体排气侧的材料为GS600型铸铁

Report certificate

All compressors CX series, have the following specifications:

1. Design pressure
Suction side maximum allowable standstill pressure, indicated in the compressor label: 20,5 bar (for all refrigerants)
Discharge side maximum allowable pressure, indicated in the compressor label : 30 bar (for all refrigerants)
2. Design temperature
Maximum allowable discharge temperature : 120°C (for all refrigerants)
3. Hydraulic test
The above mentioned compressors meet the following requirements :
Low pressure side enclosure is able to withstand, without rupture an hydraulic test with 61,5 bar 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 an hydraulic test with 90 bar 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.
4. Pneumatic test pressure
The above mentioned compressors have been tested at 33 bar
5. Leak test
Leak test 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 $30 \times 1.1 = 33 \text{ bar}$
6. Housing Material
The housing material is cast iron type G25.
All body discharge side is cast iron type GS600

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信息

如需获取符合机器指令2006/42 EC的“公司声明”，
请访问网站www.frascold.net

Information

The Declaration of Incorporation according to
Machines Directive 2006/42 EC are available
on web site www.frascold.it

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