



BF系列/精威半封闭制冷压缩机 使用说明书

OPERATING INSTRUCTION FOR
JINGWEI BF SERIES SEMI-HERMETIC
REFRIGERATION COMPRESSOR

尊敬的用户：
在您使用精威半封闭制冷压缩机前，
请仔细阅读本说明书。

Dear users:
Please read this instruction carefully before your operation
of Jingwei Semi-Hermetic Refrigeration Compressor.

台州精威制冷电器有限公司
TAIZHOU JINGWEI REFRIGERATION EQUIPMENT CO., LTD.

中国·浙江·台州
TAIZHOU ZHEJIANG CHINA

注 意 ！

**本厂生产的压缩机及冷凝机组，
严禁用氧气等易燃易爆气体保压
或检漏。**

注：本说明书内容仅为参考，如有更改恕不另行通知。

Attention!

Flammable and explosive gases such as oxygen are strictly prohibited to be used for pressure maintaining or leak detection of the compressors and condensing units produced by our company.

Note: This instruction is for reference only, and subject to change without prior notice.

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一、结构简介

本系列半封闭八角压缩机的机体，由电机室和曲轴箱组成并连成一体，机体两端分别由压缩机端盖和电机端盖密封。

压缩机工作时，低温低压的制冷剂蒸汽从电机端盖的吸气截止阀吸入，流经电机通道进入气缸，在活塞的作用下被压缩成高温高压的气体，再经安装在机体上的排气截止阀排出。

由于低温的制冷剂蒸汽首先经过电机室，使电机得到良好的冷却，故电机过载能力大，可靠性好。电机定子绕组内还装有双金属片或热敏电阻，用于控制电机温度。因其原件体积小，对电机绕组温度变化非常灵敏，可有效防止压缩机过热运转，起到保护电机的作用。

本系列压缩机中有部分机型采用飞溅润滑。压缩机利用甩油盘将曲轴箱内的冷冻油溅起，甩向气缸和曲轴箱壁面；前后主轴承座顶部设有集油槽和油孔，用以贮集飞溅落下的冷冻油供主轴承润滑。连杆大、小头轴承也是通过飞溅油滴进入相应的油孔而得到润滑。冷冻机油流经运动零件的各个摩擦表面，起着润滑，冷却、清洗、密封的作用。

在曲轴箱底盖板上装有一块磁铁，用来吸附冷冻机油内的磁性金属颗粒，起到清洁冷冻机油的作用。

曲轴箱电加热是用来在开机前和停机间隙过程中对冷冻油加热，以防止启动压缩机时冷冻油沸腾起泡，避免产生“液击”。

曲轴箱加热器工作时，要注意以下几点：

1、用导线将曲轴箱电加热器和交流接触器的常闭触头连接起来，防止压缩机停机时曲轴箱电加热器通电加热。

2、为防止曲轴箱在缺少冷冻油时接通电加热器造成电加热器损坏，要注意曲轴箱内油面是否处在正常油位。

3、当启动长期停用的压缩机前，曲轴箱电加热器要通电加热2-4小时。

机体中间隔墙把曲轴箱和电机室分隔成两个空间，在隔墙上装有逆止阀（单向阀），它与机体上的喷射器组成特殊的自动回油机构，促使电机室内冷冻油通过逆止阀流向曲轴箱。当压缩机停机时，逆止阀能防止冷冻油从曲轴箱倒流到电机室，使电机室不会积油。在启动因长期停机的压缩机时，喷射器还能减轻冷冻油起泡现象的发生。

1. Structure description

Engine body of this series of semi-hermetic octagon compressor is composed of motor chamber and crankcase as a whole with both end sealed by end covers of compressor and motor respectively.

Low temperature and pressure refrigeration vapors are inducted from the suction line valve on the end cover of motor when compressor works, entering cylinder through motor channel, then the exhausted from discharge line valve, which is installed on engine body, after to be compressed into high temperature and pressure gases.

The electric motor is equipped with large overload capacity and good reliability because low temperature refrigeration vapors pass through motor chamber first to cool the motor well. There is bimetallic strip or thermistor, of which the components are small in size and extremely sensitive to temperature range of stator winding, installed in stator winding for controlling motor temperature, effectively preventing compressor from overheat movement and protect the motor.

Part models of this series of compressors adopt splash lubrication. The compressor splashes the refrigeration oil in crankcase to wall surface of cylinder and crankcase with oil thrower; there are oil collecting groove and oil hole set at the top of front and rear main bearing support to gather refrigeration oil splashed down for lubricating main bearing. Big and small end bearings get lubricated by splashed oil drops that entering corresponding oil holes. Refrigeration oil flows through all friction surfaces of moving parts with effect of lubrication, cooling, cleaning and sealing.

There is a magnet on the bottom cover of crankcase to adsorb magnetic metal particles in refrigeration oil for cleaning.

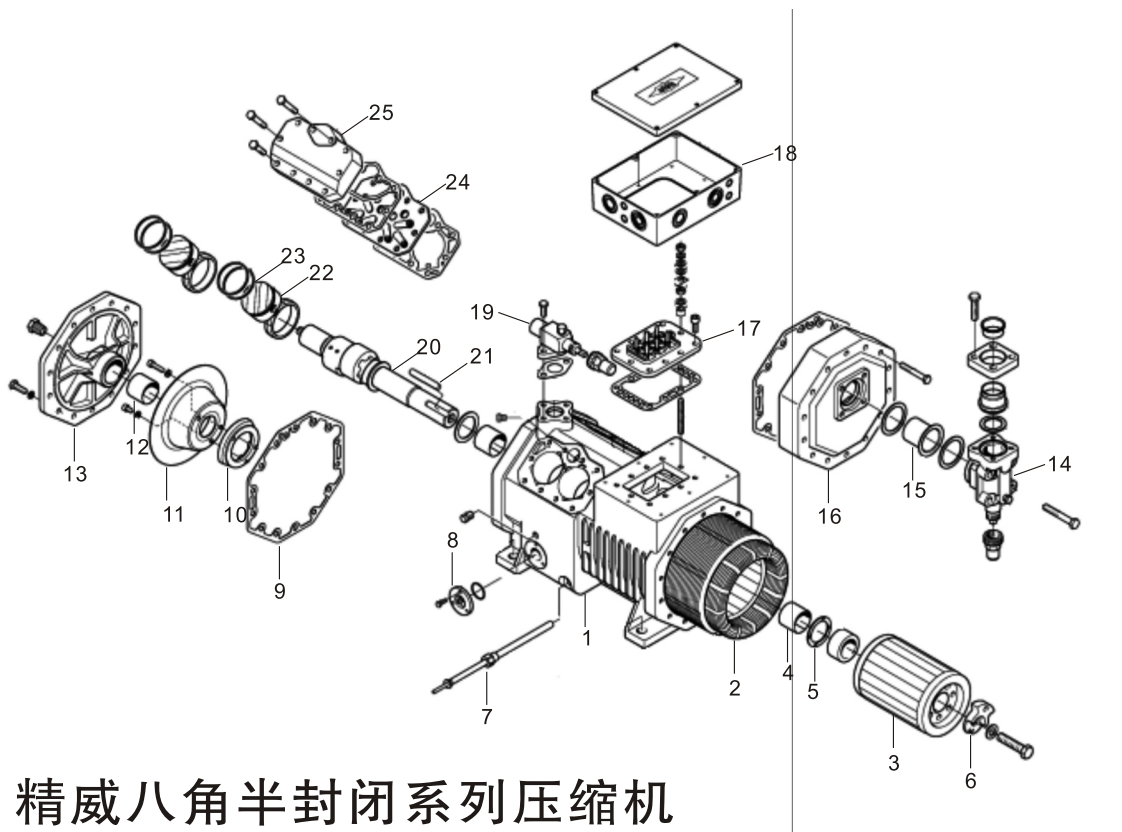
Electric crankcase heater is used to heat refrigeration oil before starting and shutdown interval to prevent refrigeration oil from bubbling when compressor starts, so as to avoid liquid impact.

Pay attention to the following points when crankcase heater is working:

1. Connect the normally closed contacts of crankcase heater and AC contactor with a wire to prevent ohmic heating of crankcase heater when compressor shuts down.
2. Pay attention that whether the oil level within crankcase is normal, so as to prevent damages to electric heater after connection under the circumstance of crankcase to be short of refrigeration oil.
3. Electrify electric crankcase heater for 2-4 hours before starting the compressor which is out of use for long time.

Separation wall of the body, with check valve (one-way valve) installed, constituting special automatic oil return structure together with the ejector on engine body to make refrigeration oil within motor chamber flow to crankcase through check valve, divides crankcase and the motor room into two spaces. When compressor shuts down, the check valve prevents refrigeration oil from back-flowing to motor room from crankcase, so as to avoid oil logging. Ejector can also reduce occurrence of oil foaming when start the compressor out of use for long time.

二、产品结构解剖图



精威八角半封闭系列压缩机

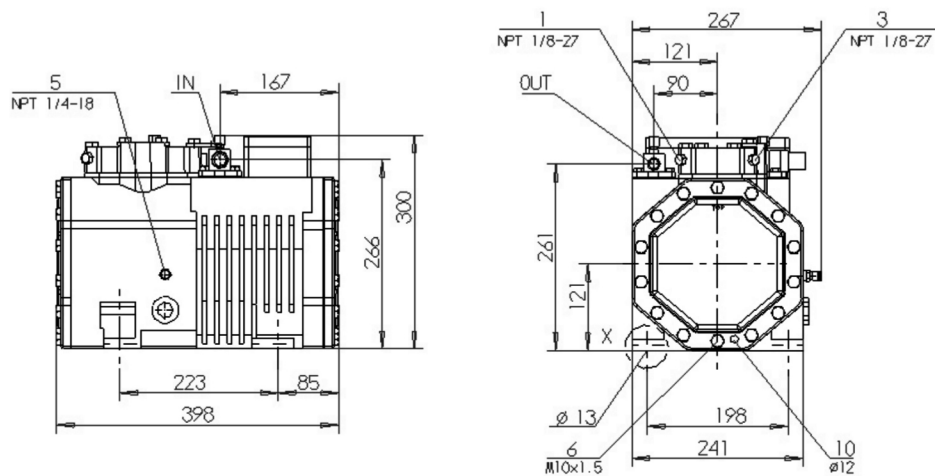
Jingwei Octagon Semi-Hermetic Compressor

BF-001\010

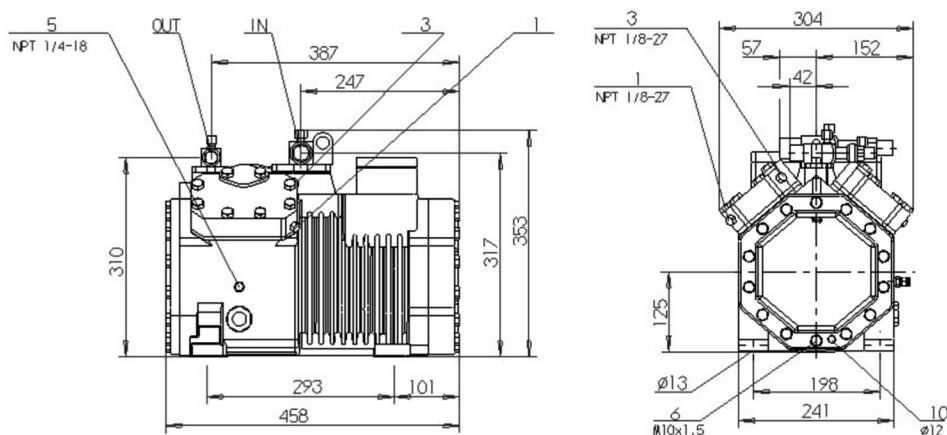
主要零部件说明

Descriptions of main parts

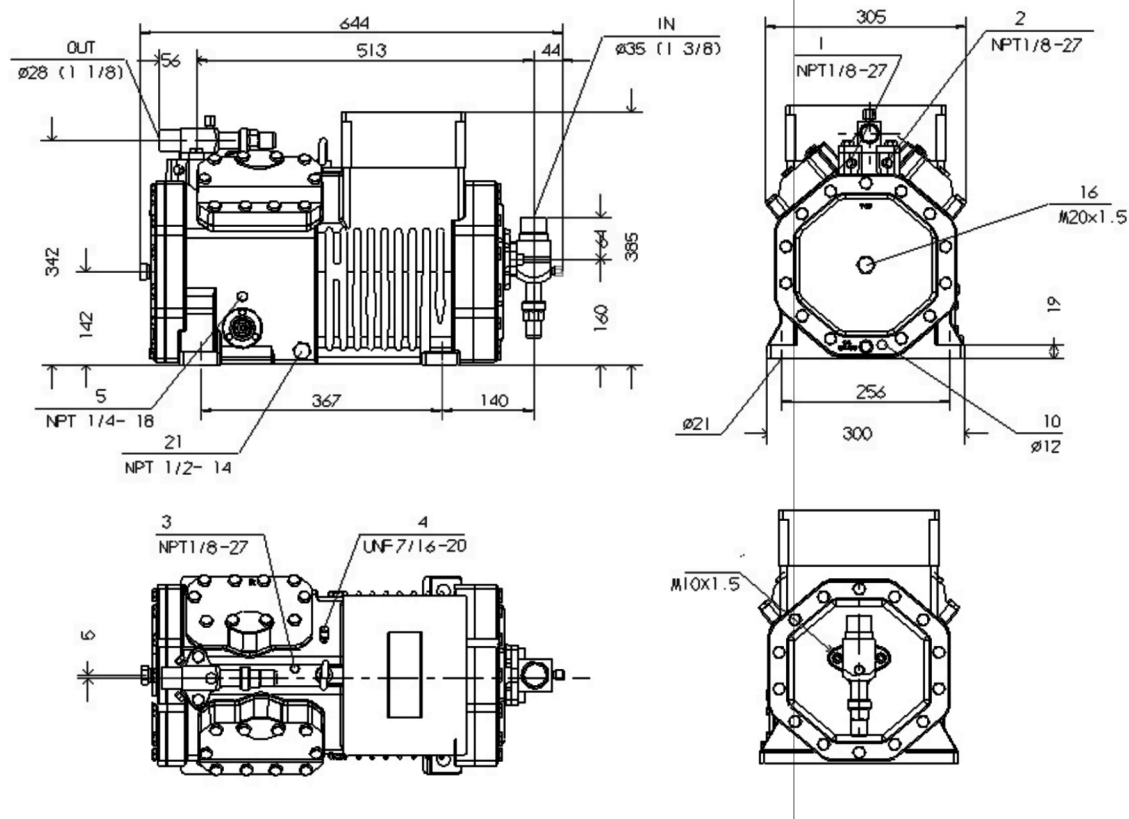
1、压缩机箱体	Compressor box	14、吸气阀门	Suction valve
2、电机线圈	Motor coil	15、吸气过滤网	Suction filter
3、电机转子	Motor rotor	16、电机端盖	Motor cover
4、中间轴套	Middle shaft sleeve	17、接线板	Terminal board
5、耐磨纸推垫	Wear resistant thrust pad	18、接线盒	Terminal box
6、轴平行圈	Axial parallel circle	19、排气阀门	Exhaust valve
7、加热管	Heating pipe	20、曲轴	Crankshaft
8、视液镜	Level glass	21、曲轴销子	Connecting rod pin
9、前端盖纸垫	Front cover paper pad	22、连杆活塞	Piston ring
10、轴平行圈	Axial parallel circle	23、活塞环	Valve plate
11、甩油盘	Oil thrower	24、阀板	Cylinder cover
12、前端盖轴套	Shaft sleeve of front end cover	25、缸盖	
13、前端盖	Front end cover		



BF-001A安装尺寸
BF-001A Installation size

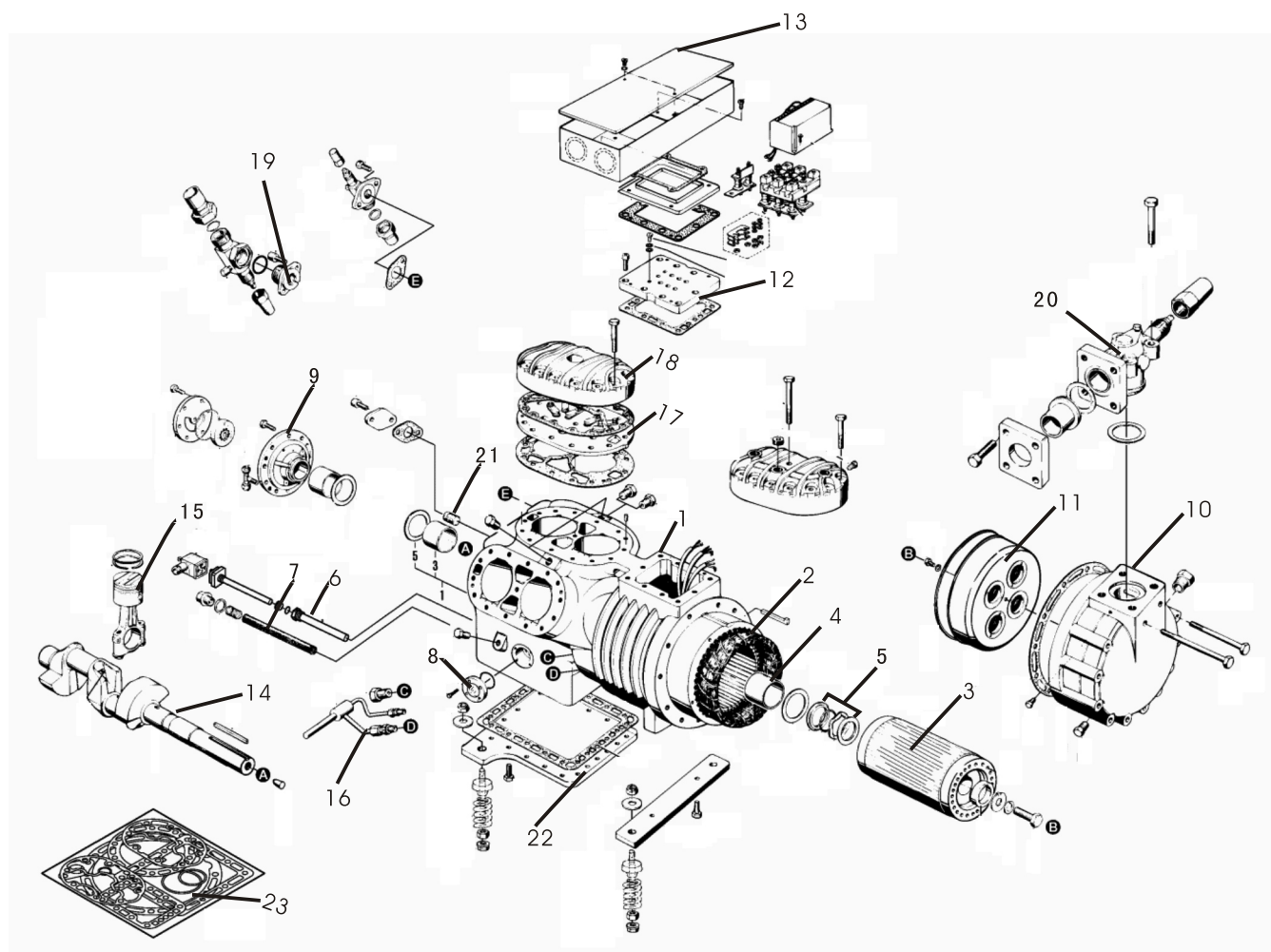


BF-001B/001/002/003/004 安装尺寸
BF-001B/001/002/003/004 Installation size



BF-005A/005B/005/006/007/008/009/010安装尺寸

BF-005A/005B/005/006/007/008/009/010 Installation size



精威四六缸半封闭系列压缩机

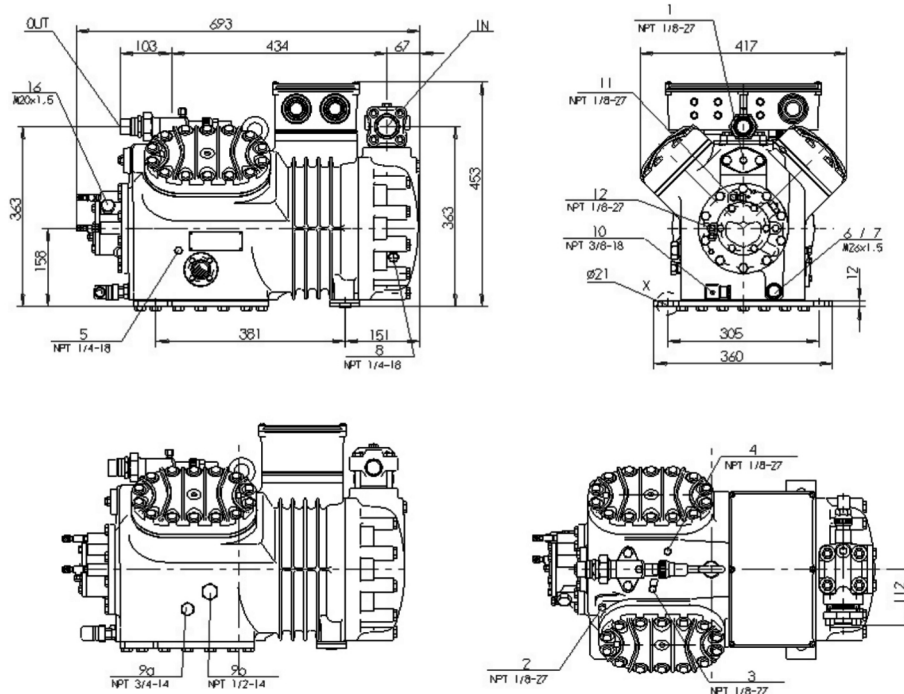
Jingwei Four six cylinder Semi-Hermetic Compressor

BF-011\025

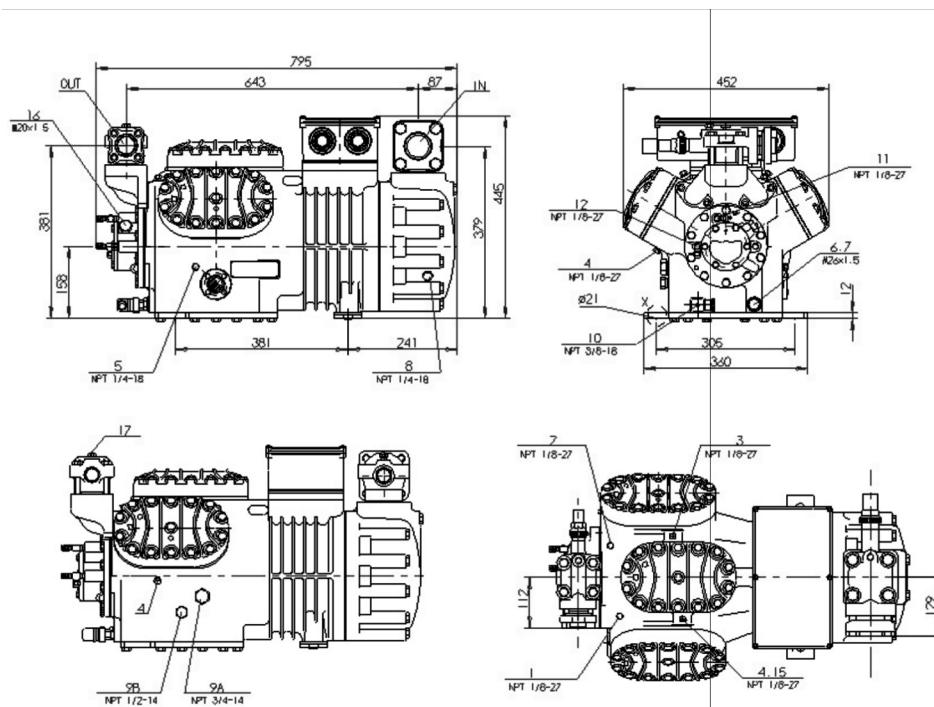
主要零部件说明

Descriptions of main parts

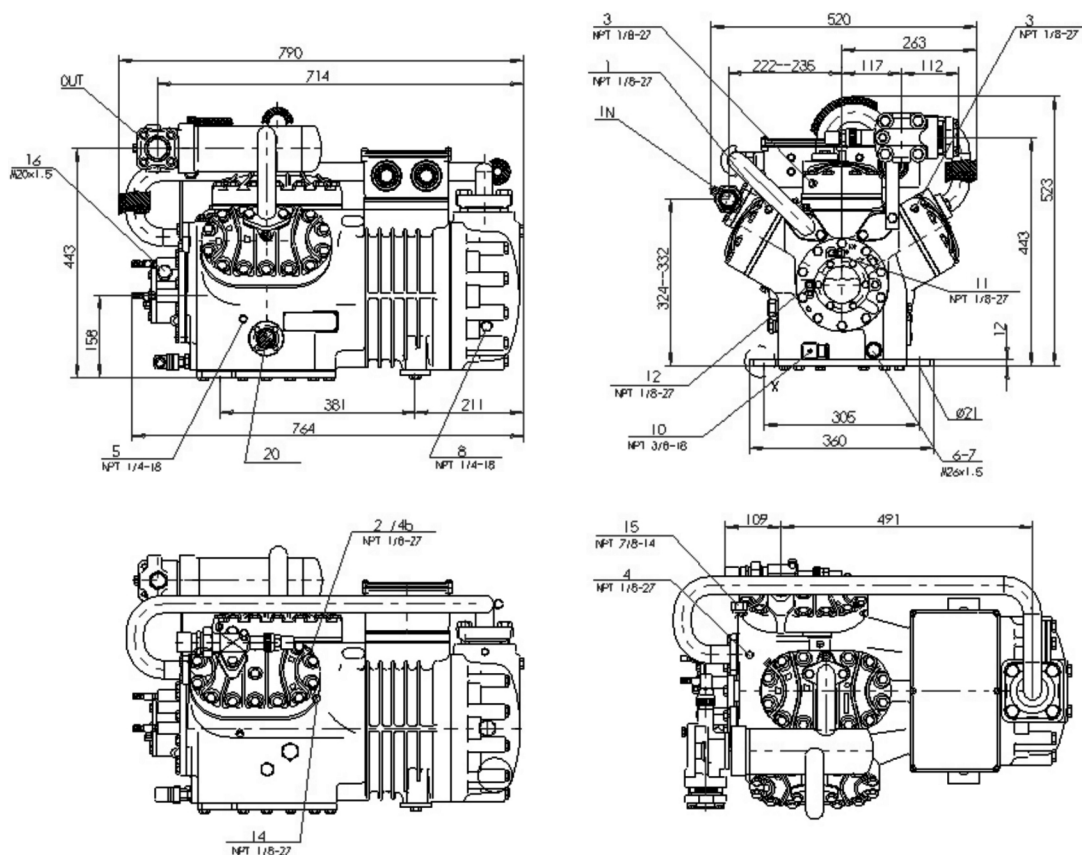
1、压缩机箱体	Compressor box	13、接线盒	Terminal box
2、电机线圈	Motor coil	14、曲轴	Crankshaft
3、电机转子	Motor rotor	15、连杆活塞	Connecting rod piston
4、中间轴套	Middle shaft sleeve	16、回油管	Oil return pipe
5、油封组件	Oil seal assembly	17、阀板	Valve plate
6、加热管	Heating pipe	18、钢盖	Cylinder cover
7、机油滤网	Oil strainer	19、排气阀门	Exhaust valve
8、视液镜	Level glass	20、吸气阀门	Suction valve
9、油泵	Oil pump	21、安全阀	Safety valve
10、电机端盖	Motor cover	22、油底板	Oil base
11、吸气过滤网	Suction filter	23、整机纸垫	The whole paper pad
12、接线板	Terminal board		



BF-011/012/013/014安装尺寸
BF-011/012/013/014 Installation size



BF-015/016/017/018/019/020安装尺寸
BF-015/016/017/018/019/020 Installation size



BF-023/024/025安装尺寸
BF-023/024/025 Installation size

图示接管位置说明

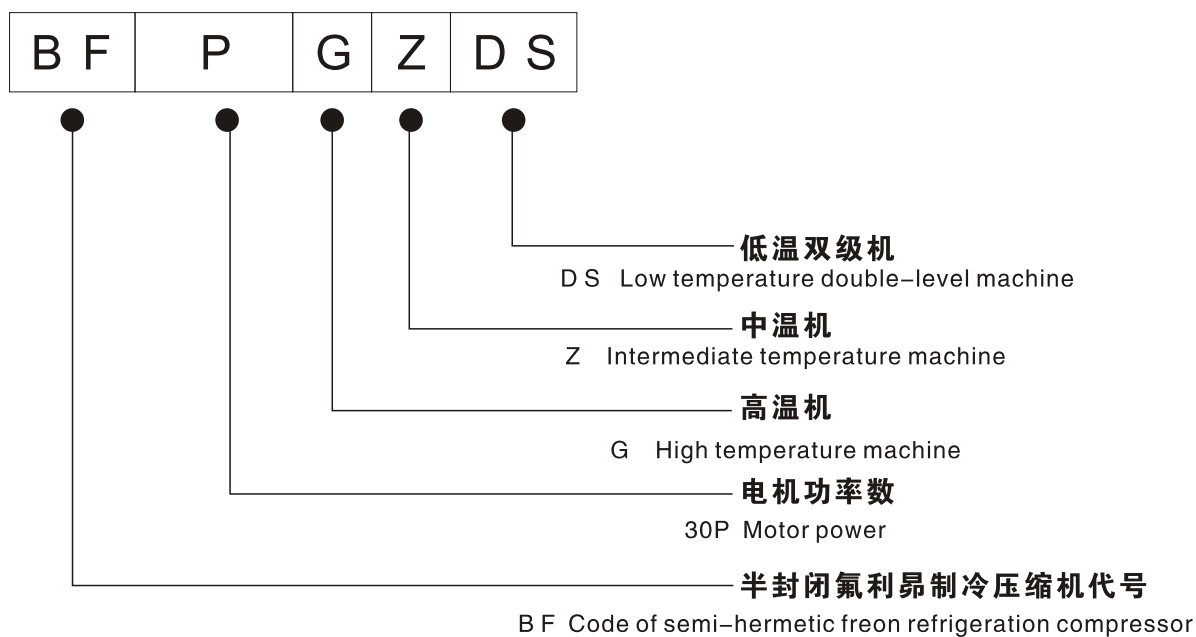
- 1 高压接口
 - 2 排气温度探头接口
 - 3 低压接口
 - 4 CIC系统：喷嘴接口（不带液体过冷器运行）
 - 5 加油堵
 - 6 放油口
 - 7 油过滤器（带磁螺栓）
 - 8 回油口（接油分离器）
 - 9 气平衡接口（并联运行）
 - 10 油平衡接口（并联运行）
 - 11 曲轴箱加热器
 - 12 油压高压接口 +
 - 13 油压低压接口 -
 - 14 中间压力接口
 - 15 喷液口（不带液体过冷器、热力膨胀阀运行）
 - 16 油压差开关"Delta-P"连接
 - 17 液体过冷器制冷入口
 - 18 液体过冷器制冷出口
 - 19 热力膨胀阀外平衡管接口（带液体过冷器运行）
- OUT 排气阀接口
IN 吸气阀接口

Explanation of pipes location in the drawing

- High pressure connection
Discharge gas temperature sensor
Low pressure connection
CIC system: spray nozzle (operation without liquid subcooler)
Oil fill plug
Oil drain
Oil filter (magnetic screw)
Oil return (oil separator)
Gas equalization (parallel operation)
Oil equalization (parallel operation)
Crankcase heater
Oil pressure high connection +
Oil pressure low connection -
Intermediate pressure connection
Liquid injection (operation without liquid subcooler and with thermostatic expansion valve)
Connection for differential oil pressure switch "Delta-P"
Refrigerant inlet at liquid subcooler
Refrigerant outlet at liquid subcooler
OUT. Discharge valve connection
IN. Suction valve connection

三、半封闭系列压缩机型号编号说明

3. Code specifications of semi-hermetic compressor model



注意：如国外销售产品，电压等标准参数另做说明。

Notice: For product sold in foreign countries, standard parameters such as the voltage should be specified otherwise.

四、半封闭系列压缩机主要技术参数

4.Main technical parameters of semi-hermetic compressor

压缩机 型号 MODEL	电机名义 功率 POWER HP/KW	1450 转/分 排气量 m³/h		缸数X直径X行程 NUMBER OF CYLINDER X DIAMETER X STROKE MM	油注 入量 OIL INJECTION VOLUME L	电源 POWER SUPPLY V/φ/HZ	电器参数 ELECTRICAL PARAMETER		曲轴箱 加热器 CRANKCASE HEATER (220V) W	供油 方式 OIL SUPPLY METHOD	重量 含冷冻油 WEIGHT INCLUDING FREEZING OIL KG
		低压 LOW PRESSURE	高压 HIGH PRESSURE				最大工作 电流 MAX OPERATING CURRENT A	启动/堵转 电流 STARTING CURRENT/ ROTOR LOCKED CURRENT A			
BF-3PZ-001A	3/2.2		16.24	2 X φ55 X39.3	1.5	380 ~ 420/Y/3/50 440 ~ 480/Y/3/60	8.5	37	110	离心润滑 Centrifugal lubrication	70
BF-4PZ-001B	4/3.0		22.72	4 X φ46 X39.3	2.0		10.7	53	115		84
BF-5PZ-001	5/3.7		26.84	4 X φ50 X39.3	2.0		13.5	62.2	115		84.5
BF-7.5PG-002	7.5/5.5		26.84	4 X φ50 X39.3	2.0		15.9	82.4	115		88.5
BF-6PZ-003	6/4.4		32.48	4 X φ55 X39.3	2.0		15.9	82.4	115		90.5
BF-9PG-004	9/6.6		32.48	4 X φ55 X39.3	2.0		20	82.4	115		90.5
BF-6PZ-005A	6.2/4.4		34.73	4 X φ55 X39.3	2.6	380 ~ 420/YY/3/50 440 ~ 480/YY/3/60	14	39/68	140	离心润滑 Centrifugal lubrication	129
BF-10PG-005B	10/7.5		34.73	4 X φ55 X42	2.6		21	59/99	140		139
BF-8PZ-005	8/5.5		41.33	4 X φ60 X42	2.6		17	49/81	140		134
BF-12PG-006	12/8.8		41.33	4 X φ60 X42	2.6		24	69/113	140		141
BF-10PZ-007	10/7.5		48.5	4 X φ65 X42	2.6		21	59/99	140		139
BF-15PG-008	15/10.5		48.5	4 X φ65 X42	2.6		31	81/132	140		142
BF-12PZ-009	12/8.8		56.25	4 X φ70 X42	2.6		24	69/113	140		141
BF-20PG-010	20/15		56.25	4 X φ70 X42	2.6		37	97/158	140		150
BF-15PZ-011	15/10.5		73.6	4 X φ70 X55	4.5	380 ~ 420/YY/3/50 440 ~ 480/YY/3/60	31	81/132	140	油泵润滑 Forced- lubrication	197
BF-25PG-012	25/18.5		73.6	4 X φ70 X55	4.5		45	116/193	140		205
BF-20PZ-013	20/15		84.5	4 X φ75 X55	4.5		37	97/158	140		200
BF-30PG-014	30/22		84.5	4 X φ75 X55	4.5		53	135/220	140		209
BF-25PZ-015	25/18.5		110.5	6 X φ70 X55	4.25	380 ~ 420/YY/3/50 440 ~ 480/YY/3/60	45	116/193	140	油泵润滑 Forced- lubrication	237
BF-35PG-016	35/25.5		110.5	6 X φ70 X55	4.25		61	147/262	140		248
BF-30PZ-017	30/22		126.8	6 X φ75 X55	4.75		53	135/220	140		241
BF-40PG-018	40/30		126.8	6 X φ75 X55	4.75		78	180/323	140		247
BF-40PZ-019	40/30		151.6	6 X φ82 X55	4.75		78	180/323	140		243
BF-50PG-020	50/37		151.6	6 X φ82 X55	4.75		92	226/404	140		248
BF-20PGDS-023	20/15	73.6	36.8	6 X φ70/70X55	4.75	380 ~ 420/YY/3/50 440 ~ 480/YY/3/60	37	97/158	140	油泵润滑 Forced- lubrication	235
BF-25PZDS-024	25/18.5	84.5	42.3	6 X φ75/75X55	4.75		45	116/193	140		248
BF-30PGDS-025	30/22	101.1	50.5	6 X φ82/82X55	4.75		53	135/220	140		249

五、半封闭系列压缩机使用范围

5. Range of application for semi-hermetic compressor

制 冷 剂 REFRIGERANT		R22	R134a	R404a	R407a	R407b	R407c
项 目 ITEM							
蒸发温度※ EVAPORATING TEMPERATURE		-40 ~ +12.5℃	-20 ~ +12.5℃	-40 ~ +10℃	-40 ~ -10℃	-40 ~ -10℃	-30 ~ +10℃
冷凝温度 CONDENSING TEMPERATURE		30 ~ 45℃ (水冷) 30 ~ 45℃ (WARET COOLED) 30 ~ 50℃ (风冷) 30 ~ 50℃ (AIR COOLED)					
最大压力差 MAX.PRESSURE DIFFERENCE		1.83MPa					
最大压缩比 MAX.COPRESSION RATIO		18					
最高排气温度 MAX.DISSCHARGE TEMPERATURE		135℃(排气管表面) (DISCHARGE PIPE SURFACE)					
吸气过热度 SUCTION SUPERHEAT		最小: 10度 最大: 保证排气温度小于135℃时的最大过热度 MIN:10K MAX:Value which maintains the discharge temperraature below 135℃					
最高油温 MAX.OIL TEMPERATEUE		80℃					
电源 POWER SUPPLY		3Ph 380/440V 50/60Hz					
电机温度 MOTOR TEMPERATURE		105℃ 以下 BELOW 105℃					
冷冻机油 REFRIGERATION OIL		SUNINISO 3GS	SUNISO SL32S				
最高环境温度 MAX.AMBIENT TEMPERATURE		43℃					

※ 蒸发温度范围详见制冷量表 ※ See the table of refrigerating capacity for the range of evaporation temperature.

注：

①蒸发温度低于 -20°C 时，系统应安装油分离器和气液分离器，电路设计成负压(抽真空)停机，以保证系统回油，防止产生“液击”及损坏压缩机吸、排气阀片等故障。另外必须更换机内的冷冻机油，可以选用絮凝点较低的L-DRB/A32或进口太阳牌3GS等品种的冷冻机油；对于水冷压缩冷凝机组在气缸盖上要加装冷却风扇，以降低排气温度，防止过热造成冷冻机油结碳及制冷剂分解。

②表中压力均为表压

③冷凝温度在 45°C 以上时，缸盖需附加冷却风扇。如是风冷压缩冷凝机组，压缩机可安装在风冷冷凝器的气流中，起到冷却缸盖的作用。

Note:

1. Oil separator and gas-liquid separator should be installed in the system while the circuit should be designed to negative pressure (evacuation) halting when the evaporating temperature is lower than -20°C to ensure oil return of system and prevent occurrence of failures as liquid impact as well as damages to suction and exhaust valve plates of compressor. In addition, the refrigeration oil within the machine shall be replaced by L-DRB/A32 or imported SUNISO 3GS refrigeration oil with lower flocculation point; for water-cooled compression condensing units, cooling fan should be installed on cylinder cover to decrease exhaust temperature, so as to prevent the carbonization of refrigeration oil and degradation of refrigerant resulted from overheating.

2. Pressures listed in the table are gauge pressures.

3. Cooling fan needs to be installed on cylinder cover for higher than 45°C of condensing temperature. In the case of wind compression condensing units, the compressor may be installed in air flow of air-cooled condenser to cool cylinder cover.

六、安装使用要求

- 1、焊接压缩机吸、排气截止阀上的连接管路时，尽可能将阀卸下，以避免截止阀法兰密封垫片损坏，并用湿布包裹，以防止阀内密封件受热损坏，影响密封性能。
- 2、制冷系统的其它设备（如冷凝器、储液器、油分离器、干燥过滤器、蒸发器等）及其连接管道必须严格清理和干燥处理，系统内不得残留焊渣、锈斑、氧化皮、水分等杂质。
- 3、压缩机出厂前已充入0.05–0.1MPa干燥氮气，启封后应尽快安装于制冷系统中，以免造成压缩机内部零件锈蚀。
- 4、系统安装结束后，应进行压力、真空和制冷剂三种方法检漏，真空检验应用真空泵抽空到1.3KPa（10mmHg）以下，严禁用压缩机自行抽空。
- 5、压缩机出厂时已注入定量的合格冷冻机油，系统运行后，部分冷冻机油会带入系统造成油位下降，因此需要进行补充。不应使用长久暴露在大气中的冷冻机油，不要将压缩机内倒出的冷冻机油继续回用。
- 6、压缩机电机接线盒接好线后，要用704防水胶密封接线座，以防止系统运行时接线座处产生凝露和结霜，影响电机的绝缘性能。
- 7、压缩机应可靠接地，以确保安全。若要打开电机接线盒，必须切断电源。不允许接线盒未装好前接通电源进行操作。
- 8、风冷冷凝器在接通风机电源时，应注意其转向，使风机产生气流朝压缩机。

6. Installation and operation requirements

- a. Get the valve off as possible as you can in welding connecting pipelines on suction and exhaust valves of compressor, so as to avoid damages to flange seals of cut-off valve, then wrap the valve with damp cloth to protect seals from damages caused by heating, which may affect sealing performance.
- b. Other equipments (such as condenser, liquid receiver, oil separator, drier filter and evaporator etc.) as well as their connection pipelines of refrigerating system must be treated in strict cleaning and drying process without any residual welding slag, rust, oxide, water and other impurities in the system.
- c. Dry nitrogen of 0.05–0.1Mpa has been filled in the compressor, which should be installed in refrigerating system as soon as possible after opening so as not to result in internal parts corrosion, before leaving factory.
- d. Leak detection should be carried out in three methods as pressure, vacuum and refrigerant after completing system installation. For vacuum test, evacuate the system to 1.3Kpa (10mmHg) below with vacuum pump rather than compressor, which is strictly prohibited.
- e. Quantitative qualified refrigeration oil has been injected into the compressor in factory, which need to be supplemented because part of the oil may be taken into the system after starting to result in decline of oil level. Refrigeration oil exposed in the air for long time should not be employed; furthermore, do not reuse refrigeration oil poured out from the compressor.
- f. Seal up the connector base with 704 waterproof glue to prevent condensation and frost, which may affect the insulation performance of motor, after completing wiring in terminal box of compressor motor.
- g. The compressor should be grounded reliably to ensure safety. Power supply must be cut off if there is need to open the terminal box of motor. There is no power allowed for operation before completing terminal box installation.
- h. Pay attention to the rotation direction of air-cooled condenser before switching on draught fan, enable the fan to generate airflow toward the compressor.

七、注意事项

- 1、为了确保压缩机安全可靠地运行，请遵照使用说明书中要求进行安装，并将制冷系统保持在使用范围内运行。建议在吸气截止阀前安装吸气过滤器，并定期检查和清洗，以保护压缩机和电机受到伤害。
- 2、主电源必须用交流接触器或继电器启动。
- 3、制冷系统中必须安装保护装置：如高、低压继电器、温度继电器、热过载继电器、油压差继电器、电机保护器和排气超温保护器。
- 4、严禁压缩机吸、排气阀未打开前接通电源启动压缩机，否则会对压缩机及人员造成机械、电气损伤。
- 5、压缩机应在排气压力和吸气压力平衡的情况下启动，停机后吸、排气压力尚达到平衡时不要急于启动。压缩机应避免频繁启动。1小时内开停次数应少于6次，每次停车间隙时间不应少于5分钟。
- 6、不准用压缩机自行抽真空，以免损坏压缩机。严禁在真空状态下给压缩机通电。
- 7、发现冷冻机油油位下降或变脏时，需及时添加或更换。不能加入牌号不对和长期暴露在空气中致使含水量多的不合格冷冻机油，否则会引起高温碳化、低温析蜡、电机绝缘受损、系统回油困难等故障。
- 8、严禁使用氧气、压缩空气及其它可燃可爆性气体对压缩机及制冷系统进行试压检漏。

7. Precautions

- a. Please conduct installation in accordance with the requirements from operating instruction to ensure safe and reliable running of compressor, meanwhile keep the refrigerating system running within serviceable range. It is suggested that install the suction filter in front of suction line valve with checking and cleaning regularly to protect compressor and motor from damages.
- b. Main supply must be started by AC contactor or relay.
- c. There must be protector installed in refrigerating system: such as high-voltage and low-voltage relays, thermal overload relay, oil pressure differential relay, motor protector and exhaust overheating protector.
- d. Suction valve and exhaust valve of compressor are strictly prohibited to open before switching on compressor, or it will cause mechanical or electrical damages to compressor and personnel.
- e. The compressor should be started under the circumstance of balanced exhaust pressure and suction pressure. Do not rush to start the machine until exhaust and suction pressures are balanced after shutdown. Frequent starting of compressor should be avoided to be less than 6 times in one hour with more than 5 minutes for each shutdown interval.
- f. Do not evacuate on compressor own so as to avoid damage to the compressor. In addition, it is strictly prohibited to electrify the compressor in vacuum state.
- g. There is need to add or replace once refrigeration oil happens to be lower oil level or dirty. Unqualified refrigeration oil of wrong trademark and with rich moisture content caused by long-term exposure to the air shall not be filled in, otherwise it would result in high-temperature carbonization, low-temperature wax, damages to motor insulation, and fault in system oil return.
- h. Oxygen, compressed air and other flammable and explosive gases are strictly prohibited for pressure test and leak detection of the compressor and refrigerating system.

八、压缩机的运转

1、压缩机开机前

- (1)检查压缩机油面高度在视油镜的1/2~2/3高度范围内，若油面在视油镜的1/4位置以下，应及时补充。
- (2)检查排气截止阀和系统中应开启的阀是否都打开。
- (3)检查电源电压、环境温度是否在规定范围内。
- (4)装有曲轴箱电加热器的压缩机，开机前应预热冷冻油，时间不少于2小时，以避免启动时起泡奔油和“液击”等不良现象。

2、压缩机运转中

- (1)压缩机的吸气压力及排气压力要维持在正常使用范围内，发现问题及时调整。
- (2)倾听压缩机运转声音，除吸、排气阀片有清晰的起落声外，其它零部件不应有不正常的异响，一旦发现异常应立即停机检查。
- (3)经常观察视油镜油面，检查油分离器的工作是否正常，发现油面骤变必须立即停机检查。
- (4)随时注意电机外壳、机身及气缸盖处温度的变化，以判断压缩机运行是否正常。

- 3、压缩机长期停用时，应将制冷剂收到贮液器内，当系统抽空到低压压力稍高于大气压力时，停机关闭吸、排气截止阀。

8. Running of compressor

1. Before starting the compressor

- (1) Check the oil level of compressor to ensure it within the height range as 1/2~2/3 of oil sight glass, and supplement oil promptly if the oil level is in 1/4 position below of oil sight glass.
- (2) Check whether the exhaust line valve and other valves in the system required are opened.
- (3) Check whether the supply voltage and ambient temperature are within specified scope.
- (4) For compressor equipped with electric crankcase heater, refrigerant oil should be warmed up before starting for more than 2 hours, so as to avoid undesirable phenomena of blistering oil and liquid impact.

2. In running of the compressor

- (1) Suction pressure and exhaust pressure of compressor should be maintained within the range of normal serviceable range, and carry out adjustment timely once problems identified.
- (2) Listen to operation sound of compressor. There should be no abnormal sound from other components except as clear sound of ups and downs from suction and exhaust valve plates. Stop the machine immediately for inspection once find any exception.
- (3) Observe the oil level of oil sight glass frequently, and check whether the oil separator works properly. Stop the machine immediately for inspection once find sudden change of oil level.
- (4) Pay attention to the change of motor shell, body and the temperature of cylinder cover to determine whether the compressor is running properly.

3. Refrigerant should be recovered to liquid receiver when compressor is out of use for long time. Stop the machine and close suction and exhaust line valves when the system is evacuated to low pressure that slightly higher than atmospheric pressure.

九、半封闭系列压缩机电路图

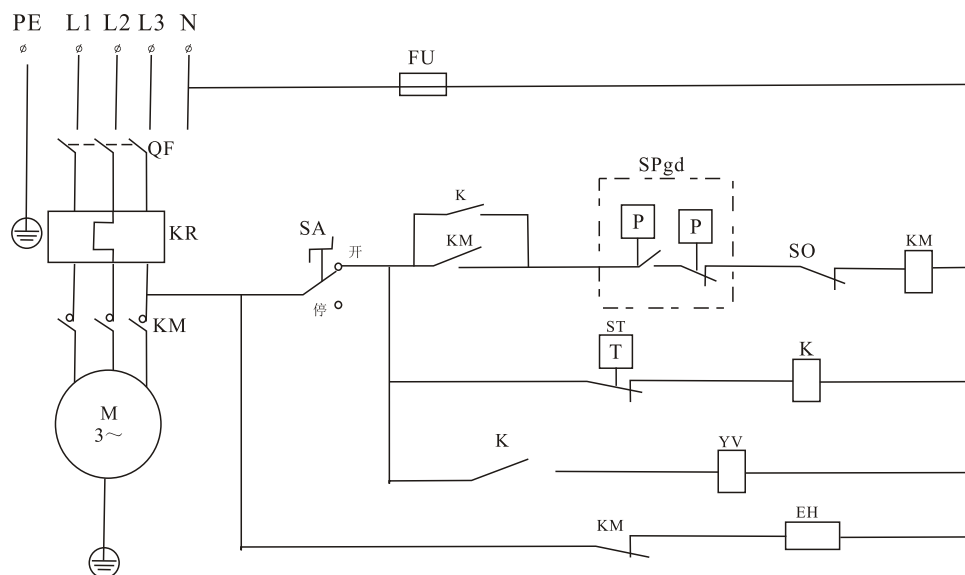
9. Circuit diagram of semi-hermetic compressor

电气控制原理图（下面的电气原理图供用户设计时参考）

Electrical control diagram (the electrical diagram below is for user reference in design)

(1) 采用双金属片电机保护的电路

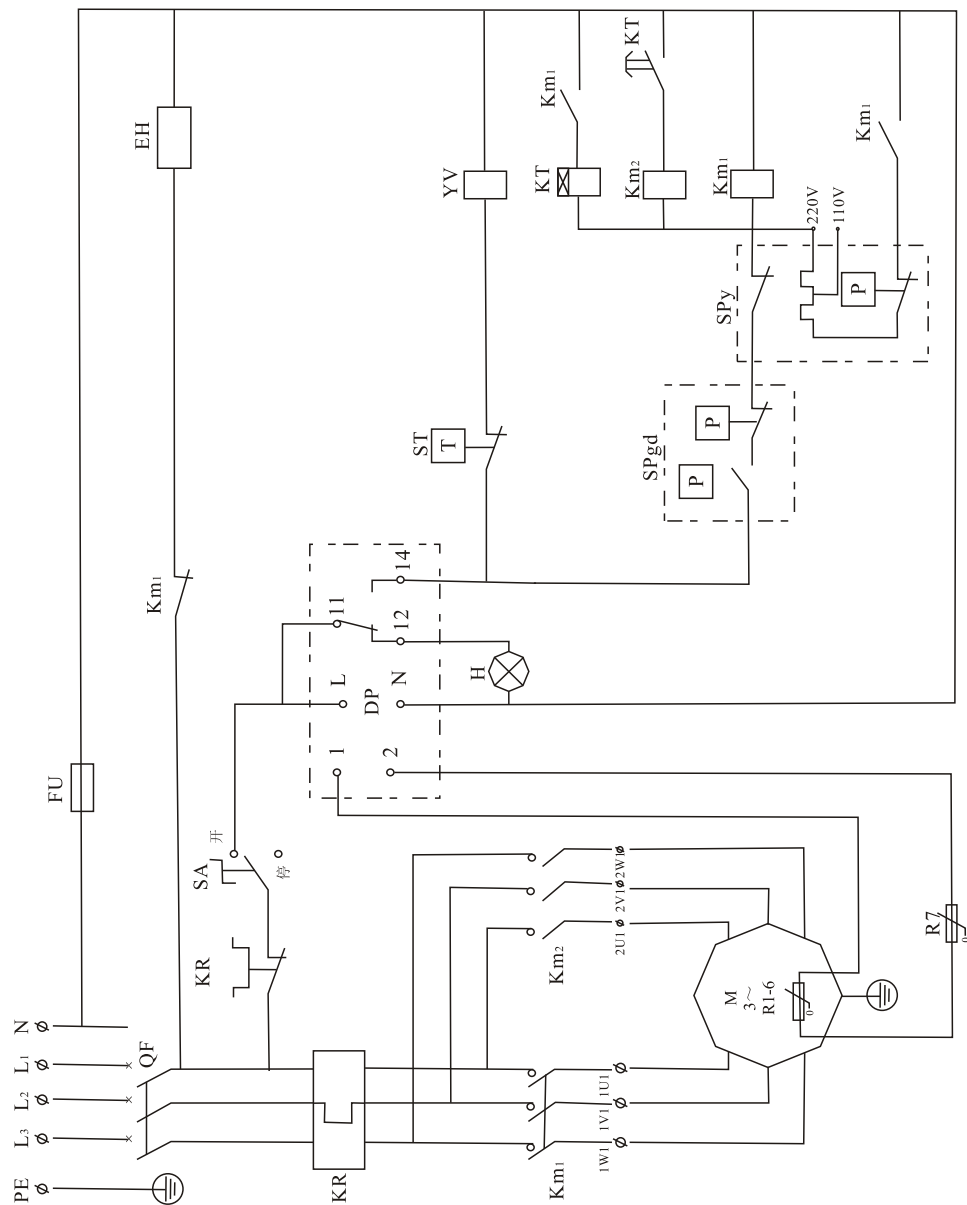
(1) Control circuit for adoption of bimetallic motor protector



符 号 Symbol	名 称	Name
QF	空气开关	Air switch
KM	交流接触器	AC contactor
M	压缩机电机	Compressor motor
R U	熔断器	Fuse
SA	旋钮开关	Rotary switch
Spgd	高低压继电器	High and low pressure relay
KR	热继电器	Thermal relay
ST	温度继电器	Temperature relay
S0	双金属片电机保护器	Bimetallic motor protector
YV	电磁阀线圈	Magnetic valve coil
EH	曲轴箱电加热器	Electric crankcase heater
K	继电器	Relay

(2) 采用电机保护的控制电路 (1)

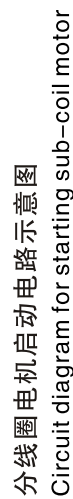
(2) Control circuit for motor protection (1)



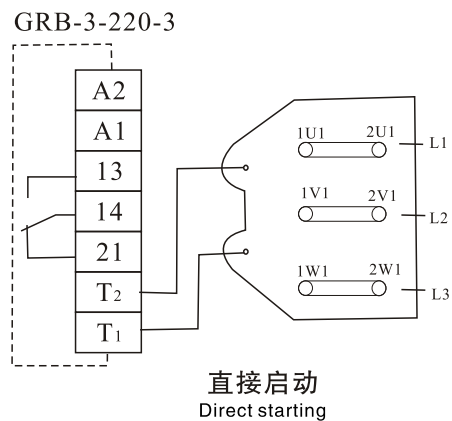
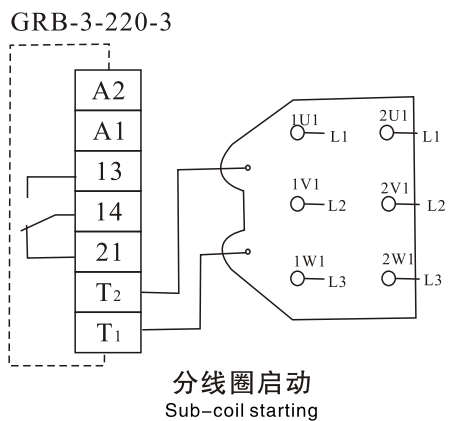
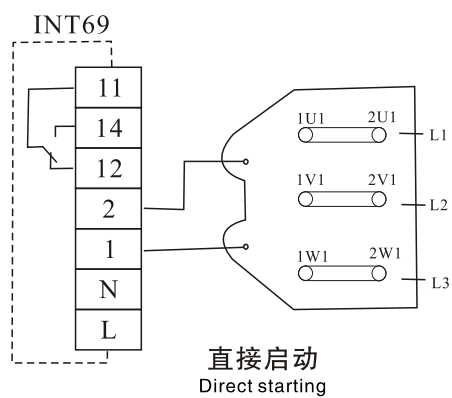
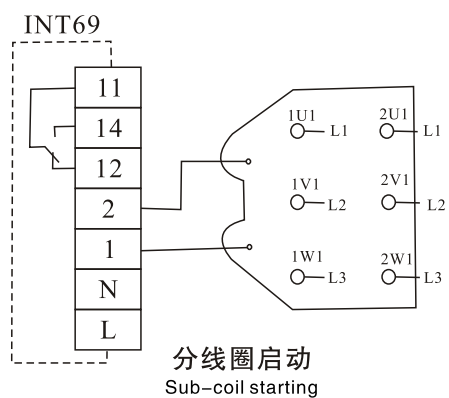
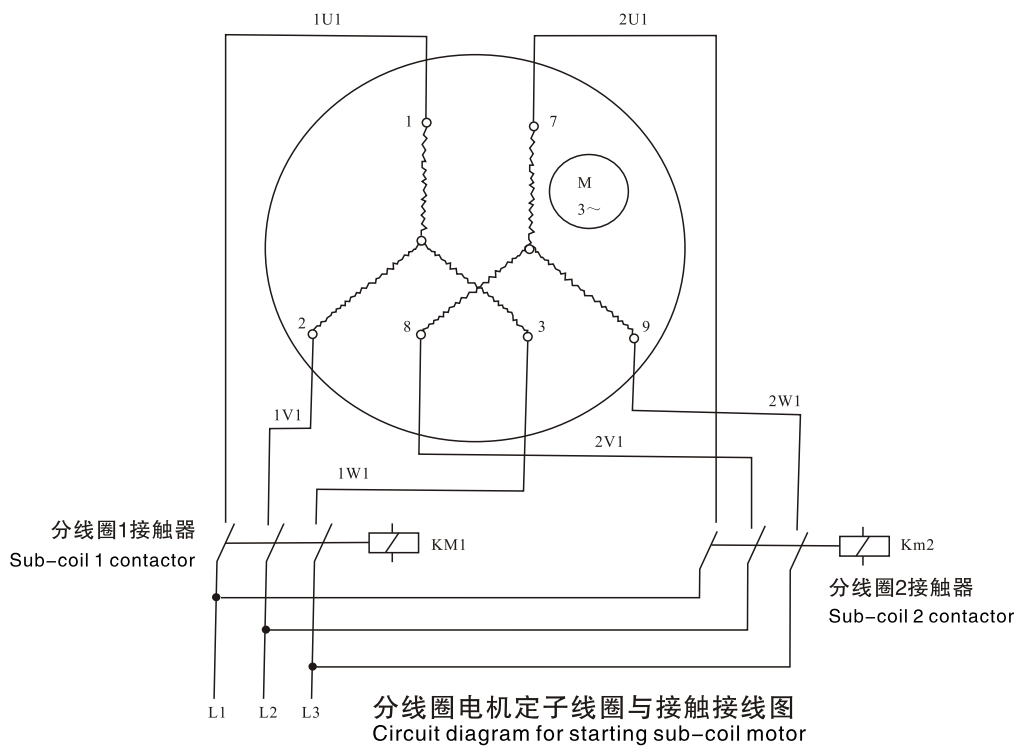
符 号 Symbol	名 称 Name
QF	空气开关 Air switch
EH	曲轴箱电加热器 Electric crankcase heater
FU	熔断器 Fuse
SA	旋钮开关 Rotary switch
DP	电机保护器 Motor protector
H	超温指示灯 Overheat indicator
ST	温度继电器 Temperature relay
YV	电磁阀 Magnetic valve
KT	时间继电器 Time relay
Km ₁	接触器1 Contactor 1
Km ₂	接触器2 Contactor 2
SPgd	高低压继电器 High and low pressure relay
SPy	油压差继电器 Oil pressure differential relay
M	压缩机 Compressor
R1-6	电机温度传感器 Motor temperature sensor
R7	排气温度传感器 Exhaust temperature sensor
KR	热继电器 Thermal relay

分线圈电机启动电路示意图

Circuit diagram for starting sub-coil motor



符号 Symbol	名称 Name
QF	空气开关 Air switch
EH	曲轴箱电加热器 Electric crankcase heater
FU	熔断器 Fuse
SA	旋钮开关 Rotary switch
DP	电机保护器 Motor protector
H	超温指示灯 Overheat indicator
ST	温度继电器 Temperature relay
YV	电磁阀 Magnetic valve
KT	时间继电器 Time relay
Km1	接触器1 Contactor 1
Km2	接触器2 Contactor 2
SFGd	高低压继电器 High and low pressure relay
SPy	油压差继电器 Oil pressure differential relay
M	压缩机 Compressor
R1~6	电机温度传感器 Motor temperature sensor
R7	排气温度传感器 Exhaust temperature sensor
KR	热继电器 Thermal relay



不同启动方法在接线盒内的连接方式
Connection methods in terminal box for different starting methods

特别注意事项:

- 1、分线圈电机与直接启动电机结构有所不同，接线需特别注意！请按照分线圈电机接线图准确连接，不得有任何差错！不正确的电气连接会使电机旋转磁场方向相反或磁场错位，从而造成堵转和烧坏电机的危险。
- 2、两个交流接触器KM1和KM2的额定工作电流可选用电机最大运行电流的60%容量。
- 3、延时继电器KT的延时时间为2至4秒。
- 4、绝不允许电机单个绕组通电运行，否则压缩机电机会烧坏。
- 5、采用直接启动时，可将接线柱1U1与2U2，1V1与2V1，1W1与2W1分别短接，直接启动与分线圈启动相比，直接启动电机的启动电流较大。

Special notice:

1. Wiring of sub-coil motor should be paid particular attention because the structure of which is different from direct-starting motor. Please carry out accurate connection in accordance with sub-coil motor wiring diagram. Incorrect electrical connection may result in reverse field direction or field dislocation of motor rotation, thus lead to risks of locked rotor and damages to the motor.
2. Rated working current of two AC contactors as KM1 and KM2 may adopt 60% capacity of the maximum running current of motor.
3. Delay time of timing relay KT is 2 to 4 seconds.
4. No energization for running of single motor winding is allowed, otherwise the compressor motor will be damaged.
5. Terminals 1U1 and 2U2, 1V1 and 2V1, 1W1 and 2W1 may be shorted respectively for adoption of direct starting. Compare direct starting to sub-coil starting, starting current of the former motor is larger.

十、故障及排除方法

高压压力过高	系统内混入空气或其它不凝性气体	将制冷剂收回至冷凝器或贮液器内并在高处排出空气
	冷凝器散热不好	冷凝面积不足必须更换冷凝器 水冷冷凝器要清除水垢及污垢，检查进出口水温及水流量 风冷冷凝器要检查翅片清洁度，进出口通道是否畅通， 风扇风量和转向是否正确
	排气管路部分阻塞	检查排气管路上阀件是否全开
	吸气压力过高	见故障吸气压力过高
	冷凝器中积油过多	检查油分离器工作是否正常，回油管路设计是否合理
	制冷剂充注过量	回收多余制冷剂
高压压力过低	制冷剂不足或泄漏	消除泄漏点并适当添加制冷剂
	冷凝器换热太强	调整水冷冷凝器水流量不能过大
	吸、排气阀片密封不好	检修或更换吸、排气阀片或阀板
	压缩机活塞环和气缸磨损严重，使气体泄漏	修理和更换相应零件
	环境温度太低	减小风量增加气流阻力
	吸气压力过低	参看吸气压力过低内容叙述
低压压力过高	负荷过大蒸发器传热面积不足或压缩机制冷量偏小	根据负荷计算蒸发器传热面积和选择能量都是的压缩机
	膨胀阀选型不对或供液太多	更换膨胀阀或减小开启度
	膨胀阀感温包放置位置不正确或保温不好	固定感温包至正确位置并将感温包用绝热材料包扎好
	制冷剂充注过量	回收多余制冷剂
	进气阀片不工作或进、排气阀片泄漏，气缸与活塞环磨损过大	更换或修理有关零件
	蒸发压力调节阀调节不当	根据低压表读数进行调节

故障	分 析 原 因	排 除 方 法
低压压力过低	制冷剂充注不足或泄漏	消除泄漏点并适当添加制冷剂
	管路部分阻塞	检查管路中的阀门是否开足，干燥过滤器是否脏堵
	膨胀阀配置或开度过小	更换膨胀阀或增大开启度
	膨胀阀感温包充注剂泄漏	更换膨胀阀
排气温度过高	排气压力过高	参看高压压力过高的内容叙述
	吸气压力过低，压力比太大	参看低压压力过低的内容叙述
	排气阀片碎裂或汽缸盖密封垫损坏，高低压腔穿通	更换相关零件
	压缩机冷却不足	气缸头未装冷却风扇（特别是水冷机组）
	吸气管过长和未进行绝热	加强吸气管的绝热措施
	电机故障绕组异常温升	检查电机发热原因，属电机毛病应更换
气缸内有敲击声	排气阀片螺钉松脱	紧固螺钉并加装防松装置
	吸、排气阀片损坏	拆下气缸盖更换损坏零件
	活塞销与配合的活塞销孔及连杆小头孔磨损，间隙增大	更换有关零件
	制冷装置停机期间，液态制冷剂积蓄到曲轴箱内，由于启动时压力急剧降低而起泡，在压缩过程中将冷冻油和液态制冷剂的混合液压缩产生“液击”	加装气液分离器和曲轴箱加热器，在启动压缩机前接通曲轴箱加热器约2小时，同时关小吸气截止阀，在启动过程中再逐渐将阀开大直至开足
曲轴箱内有敲击声	主轴承与轴套磨损过大	更换曲轴及轴套
	连杆轴承与轴瓦磨损过大	更换曲轴及轴瓦
	甩油盘松动或损坏	紧固或更换甩油盘

故 障	分 析 原 因	排 除 方 法
油压下降	调压弹簧弹力降低或断裂	更换调压弹簧
	油过滤网堵塞	拆洗过滤网
	油泵零件磨损	更换磨损零件
	冷冻油油面下降，油量不足	添加冷冻油到规定油面
	主轴承和连杆轴承配合零件因磨损过度而跑油严重	根据配合间隙要求对有关零件进行更换和修理
	低压压力过低	检查系统是否脏堵
油耗增大，油面下降过快	油分离器故障	针对不回油原因进行修理或更换
	冷冻机窜油严重	调整气缸与活塞配合间隙，更换磨损的活塞环，控制油面高度，且检查逆止阀是否损坏
	管路集油，回油不畅	检查管路设计造成回油不畅的原因，进行调整
	管路泄漏	找到泄漏处予以处理，再补充油量
电机温度过高	电源电压太低或太高	检查电源，使电压控制在额定电压的±5%以内
	缺相运转	检查线路接头、接触器触头是否烧坏，熔断器是否断开
	三相电压不平衡	三相之间电压不平衡不能超过5%
	电机绕组匝间短路	更换电机绕组
	电机过载	检查运动零件是否润滑不良或冷冻油太脏引起负荷加大以及吸气压力是否过高
	压缩机停开频繁	检查故障是否来自温度继电器差值太小或油压差继电器、高压继电器或电机保护器起作用
压缩机不能启动	安全保护装置是否动作及损坏	排除其中的保护器的故障或更换
	电机损坏	更换电机
	缺油抱轴	更换有关配件

10. Troubleshooting

High pressure of excessive high	Air or other non-condensable gases enter the system	Recover refrigerant to condenser or liquid receiver and exhaust air on high
	Poor heat emission of condenser	Condenser must be replaced in the case of inadequate condensation area Scale and dirt in water-cooled condenser need to be cleaned, check the water temperature and flow at inlet and outlet Check the cleanliness of fin for air-cooled condenser, whether inlet and outlet channels are smooth, air volume and rotation direction of fan are correct
	Part of exhaust line is blocked up	To check whether the valves on exhaust line are fully opened
	Over high suction pressure	See faulted over high suction pressure
	Too much oil accumulation within condenser	To check whether the oil separator works properly, and oil return line design is reasonable
	Over much refrigerant charge	Recover spare refrigerant
Low pressure of excessive low	Short or leakage of refrigerant	Remove leaking point and add refrigerant properly
	Too strong heat exchange of condenser	Adjust the water flow of water-cooled condenser as not to be over much
	Bad sealing of suction and exhaust valve plates	Overhaul or replace the suction, exhaust valve sheets or plates
	Gas leakage resulted from severe abrasion of piston ring and cylinder of compressor	Maintain and replace corresponding parts
	Too low ambient temperature	Reduce air volume and increase airflow resistance
	Too low suction pressure	Refer to the descriptions of too low suction pressure
Low pressure of excessive high	over load, inadequate heat transfer area of evaporator or small refrigerating capacity of compressor	Calculate heat transfer area of evaporator according to the load and select the compressor with proper energy
	Incorrect type selection of expansion valve or feed too much liquid	Replace expansion valve or reduce opening
	Incorrect location of thermal bulb of expansion valve or poor heat preservation	Fix thermal bulb at correct place and wrap heat insulating material with thermal bulb
	Over much refrigerant charge	Recover spare refrigerant
	Suction valve sheet is out of work or leakage of suction and exhaust valve sheets, over abrasion between cylinder and piston ring	Replace or maintain relevant spare parts
	Improper adjustment to evaporating pressure regulating valve	Regulate the reading according to low pressure gauge

Failure	Cause analysis	Elimination method
Low pressure of excessive low	Insufficient refrigerant charge or leakage	Remove leaking point and add refrigerant properly
	Part of pipeline is blocked up	To check whether the valves on pipeline are fully opened, and drier filter is dirty and blocked
	Expansion valve configuration or undersize opening	Replace expansion valve or enlarge opening
	Leakage of charging refrigerant from thermal bulb of expansion valve	Replace expansion valve
Over high exhaust temperature	Over high exhaust pressure	Refer to the descriptions of high pressure of excessive high
	Over low suction pressure, and too big pressure ratio	Refer to the descriptions of low pressure of excessive low
	Exhaust valve plate is broken or seal gasket of cylinder cover damaged, high and low pressure cavity is punched through	Replace relevant parts
	Inadequate cooling of compressor	Cooling fan (especially water-cooled units) is not installed on cylinder head
	Overlong suction pipe, no heat insulation	Strengthen thermal insulation measures of air suction pipe
	Motor failure, abnormal temperature rise of winding	To check the cause of motor fever. Replace the motor in the case of motor problem
Knock in cylinder	Loose screw of exhaust valve plate	Fasten bolt and install locking device
	Damages to suction and exhaust valve plates	Dismantle cylinder cover to replace damaged parts
	Piston pin and pin bore coupled as well as small end hole are worn, clearance increases	Replace relevant parts
	Liquid refrigerants are saved in crankcase, during shutdown of refrigerating equipment, and foaming because of sharp reduction of pressure at starting; mixed liquor of refrigeration oil and liquid refrigerant are compressed during compression process to result in liquid impact	Install gas-liquid separator and crankcase heater, connect crankcase heater for about 2 hours before starting compressor, meanwhile turn suction line valve down, which shall be opened widely to full gradually during starting process
Knock in crankcase	Excessive abrasion between main bearing and bearing cover	Replace crankcase and bearing cover
	Excessive abrasion between connecting rod bearing and bearing bush	Replace crankcase and bearing bush
	Oil thrower is loose or damaged	Fasten or replace oil thrower

Failure	Cause analysis	Elimination method
Drop in oil pressure	Pressure adjusting spring has been with elastic force reduction or broken	Replace pressure adjusting spring
	Oil filter is blocked	Remove and clean the filter
	Part of oil pump is wearing	Replace wearing parts
	Drop in refrigeration oil level, be short of oil mass	Add refrigeration oil to specified oil level
	Fittings of main bearing and connecting rod bearing are excessively wearing, which result in serious oil run	Replace and maintain relevant parts according to the requirements of fit clearance
	Low pressure of excessive low	To check whether the system is dirty and blocked
Increase in oil consumption, drop	Failure of oil separator	Maintain or replace on the cause of failure in oil return
	serious oil pumping of refrigerating machine	Adjust fit clearance between cylinder and piston, replace wearing piston ring, control oil level and inspect whether the check valve is damaged
	Pipeline collects oil, bad oil return	To check piping design, find the cause of poor oil return out, and carry out adjustment
	Pipeline leakage	Find leaking point for processing, then refuel oil mass
Over high motor temperature	Supply voltage is too low or too high	To check power supply, control the voltage to be 5% within rated voltage
	Default phase running	To check whether the wiring connector and contact terminal of contactor has burnt out, fuse is cut off
	There-phase voltage imbalance	No more than 5% of three phase voltage imbalance
	Turn to turn short circuit of motor winding	Replace motor winding
	Motor overload	To check whether there is poor lubrication of moving parts or refrigeration oil is such dirty that cause load increasing, and suction pressure is over high
	Compressor has been shut down and started frequently	To check whether the failure is resulted from too small D-value of temperature relay or oil pressure differential relay, high pressure relay or motor protector is working
Compressor fails to start	Whether the safety protection device has taken action and damaged	Remove the failure of protector therein or replace it
	Motor damages	Replace motor
	Oil starvation and bearing suspension	Replace relevant parts

十一、关于半封闭系列压缩机有偿或无偿服务的有关规定

1、产品使用保证

本设备的安装、调试及维修应经过专业技术培训的技工进行，在设备安装使用前，需认真阅读本压缩机的使用说明书。产品自发货即日起本厂负责保修壹年（但不包括易损件）。

凡用户在安装过程中系统存在问题和未根据使用说明书规定进行操作所造成的设备损坏，均不属无偿保修的范围。

2、属于下列情况时则有偿服务

- (1)设备安装不符合要求所带来的一切故障。
- (2)电源电压超过额定值的 $\pm 5\%$ 造成的电机的损坏。
- (3)由于交流接触器吸合及接触不良或某相熔丝损坏的情况下缺相起动或缺相运转以及三相不平衡所造成的电机损坏。
- (4)由于压缩机频繁起动（每小时起动次数超过6次，每次停机间隙时间不足5分钟），所造成的电机损坏。
- (5)系统中因不清洁、水分过多以及抽空不到位等造成电机的损坏及其故障。
- (6)系统中进入过多空气造成排气压力过高，负荷过大所引起的故障。
- (7)系统中管路设计及安装不合理，致使冷冻油难以返回压缩机，造成压缩机缺油下运转而引起的故障。
- (8)利用压缩机自身对系统抽真空，造成缺油、零件磨损严重和电机烧毁等事故。
- (9)未根据规定的使用范围运行，如蒸发温度和蒸发压力过低，最大压力比太大，水冷机组打低温时气缸盖未装冷却风扇等等，所造成压缩机的故障及损坏。
- (10)由于下述原因造成压缩机液击（带液压缩）引起压缩机及电机损坏。
 - a.制冷剂充注量过多。
 - b.制冷剂充注方法不对。
 - c.电磁阀失灵。
 - d.系统管路设计不正确。
 - e.开机前未按规定将曲轴箱电加热器通电，预热冷冻机油（因冷冻机油内溶解了大量的制冷剂液体）。
- (11)系统未安装和接入保护装置，（如电机的温度保护装置、温度继电器、高低压继电器、油压差继电器和曲轴箱加油器等）所造成的故障。
- (12)压缩机接线柱部位未灌注密封胶，导致周围结霜或凝露造成接线柱击穿，短路，从而使电机烧坏。

11. Relevant regulations on paid or free service of semi-hermetic compressor

1. Product use assurance

Installation, debugging and maintenance of this equipment should be conducted by technician through professional technical trainings. Read the operating instruction of this compressor carefully before installation and use. Our factory takes charge of product warranty for one year since delivery date (whereas excluding wearing parts).

Damages to the equipment caused by system problems during installation process and operations fail in accordance with rules in the instruction are not covered under free warranty.

2. Paid service for situations below

- (1) All failures resulted from undesirable equipment installation.
- (2) Damages to motor caused by supply voltage $\pm 5\%$ more than rated value.
- (3) Damages to motor caused by default phase starting or running as well as three-phase unbalance under the circumstances of bad pull-in and contact of AC contactor or damage of fuse wire of certain phase.
- (4) Damages to motor caused by frequent starting of compressor (more than 6 times of starting per hour with less than 5 minutes of shutdown interval).
- (5) Damages to motor as well as failures caused by uncleanness, over much moisture and incomplete evacuation of system.
- (6) Failure caused by over high exhaust pressure and excessive load resulted from too much air in system.
- (7) Failure caused by compressor operation in short of oil, which arises from unreasonable piping design and installation in the system that make it difficult for refrigerant oil return to compressor.
- (8) Accidents such as oil starvation, seriously part abrasion and motor burnout resulted from evacuation of system by compressor itself.
- (9) Failure and damage of compressor resulted from running fails in accordance with specified range of application such as too low evaporating temperature and pressure, too large maximum pressure ratio, no cooling fan installed on cylinder cover for water-cooled units at low temperature.
- (10) Damages to compressor and motor caused by the liquid impact (with liquid compression) caused by the following reasons.
 - a. Too much refrigerant charge
 - b. Wrong refrigerant charge method
 - c. Magnetic valve failure
 - d. Incorrect piping design of system
 - e. Energize the electric crankcase heater before starting, which does not comply with regulations, to warm up refrigeration oil (because there is a lot of liquid dissolved in refrigeration oil).
- (11) Failure caused by no installation and access of protective device, (such as temperature protector, temperature relay, high and low voltage relay, oil pressure differential relay and crankcase oiler for motor), in the system.
- (12) Motor burns out as the wiring terminal of compressor is not filled with sealant, which results in frosting or condensation around, leading to puncture and short circuit of wiring terminal.



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