



# **Rotary Screw Air Compressor**

Installation, maintenance, and use manuals

# I . Safety Caution

1. The new machine must be debugged by the professional.
2. The power supply line to the compressor must be installed air switch, fuses and other safety devices. To ensure the reliability of the equipment, must follow the relevant safety regulations, connect a grounding wire, and install lightning protection devices if necessary. When installing, consider to leave a certain space for maintenance around the compressor.
3. For the first time to start or have a change in the power line, must make sure the rotation direction of motor is correct. The method is to turn on the compressor for a very short time (about 1 second) before starting, check the direction of rotation.It is very important, otherwise a few seconds may lead to damage to the air compressor screw rotors.
4. The machine can not be operated above the discharge pressure specified on the nameplate, otherwise the motor may be overloaded, resulting in the motor and compressor being stopped.
5. Both the electricity and compressed air are dangerous, when overhauling or maintaining, make sure that the power supply is turned off and the compressed air is completely released in the entire system. When repairing, the electric box should be locked, and place a maintenance sign to prevent others from switching it on.
6. Only use safe solutions to clean compressors and auxiliary equipment.
7. Before maintenance, the following preparations must be done.
  - a. Shuts down the unit and cooling down.
  - b. Turn off the power supply
  - c. Make sure the compressed air is completely released
8. The safety valve and shutdown protection system must be regularly checked to ensure that it is sensitive and reliable.Generally once a year.
9. Fire extinguishers should be provided near the machine.

## II. Inverter precautions

1. Do not touch cooling fin and inverter in the hot state.
2. Do not change the inverter's factory setting parameters, otherwise it will damage the inverter.
3. Do not touch the inverter terminals. They have high voltage, may cause electric shock.
4. Cut off the power before inspections or maintenance, make sure the charge indicator turn off. If the inverter has a residual voltage on the capacitance, any work is dangerous.
5. Only qualified personnel can do the inspections. Don't carry watches, bracelets or other metal objects when repairing or replacing parts. The tools must be insulation to prevent electric shock.
6. The inverter is equipped with a DC reactor. When there are radio or other electronic devices nearby, place a wave filter near the input power supply.
7. It may cause electric shock if don't obey these rules

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# Chapter 1 General information and specifications of screw compressor

## 1-1. Brief introduction of screw air compressor

The screw compressor has the characteristics of reliable operation, few wearing parts, low vibration, low noise, and high efficiency.

During the compression process, the compressor continuously injects lubricating oil into the compression chamber and bearings by its pressure difference. The lubricating oil has four main functions:

- a. Lubricate: The lubricating oil can form an oil film between the rotors, avoiding the contact between the rotors and reduce friction.
- b. Seal: The oil film can seal the compressed air and increase the volumetric efficiency of the compressor.
- c. Cool: The lubricating oil absorbs a large amount of compression heat, can reduce the specific power of the compressor.
- d. Protect: Reduce the noise created by high-frequency compression.

## 1-2. Structure of screw air compressor

### 1. Basic structure

Our product is a two shaft positive displacement rotary screw air compressor. Air inlet is at the top of the air end casing, and outlet at the bottom, with high-precision male and female rotors inside, horizontally and parallelly mounted inside the air end. The male rotor has 5 lobes and female with 6 lobes, the male rotor has a larger diameter. The teeth have a screw shape outside the pitch circle and mesh with each other. Both ends of the rotors are supported by bearings each of the inlet ends has a roller bearing and exhaust end with two symmetrically mounted tapered roller bearings. There are two types for oil injection screw air compressors, direct driven and belt driven. Direct driven is connect the motor and air end by a coupling, increase the speed of male rotor by a set of high-precision gears. Belt driven don't have speed increasing gears, it transfer the power by belts.

### 2. Meshing

The motor drive the male rotor by the coupling, increasing gear or by belts. The two rotors mesh with each other, male rotor drives the female rotor to rotate together. The lubricating oil inject into the meshing space, mix with air to remove the heat generated by the compressor and achieve cooling effect. The oil can form an oil film, avoiding direct contact between two rotors, meanwhile seal clearance between rotors, clearance between rotors and casing. The oil can also reduce the noise created by high-frequency compression. Due to the difference in exhaust pressure, the weight of the injected oil is about 5-10 times the weight of the air.

### 1-3. Principle of screw compressor

#### 1. Suction process

The suction port must be designed to make the compression chamber can fully inhale. While the screw compressor does not have the intake and exhaust valve group, the suction is adjusted by the regulating valve. The groove space is largest when it rotate to the inlet port and connect with the air outside, it is in a vacuum state and the air outside get sucked in. After the air fills the entire tooth groove, the groove space rotate away from the inlet port and the space is sealed. It is "suction process"

#### 2. Sealing and delivery process

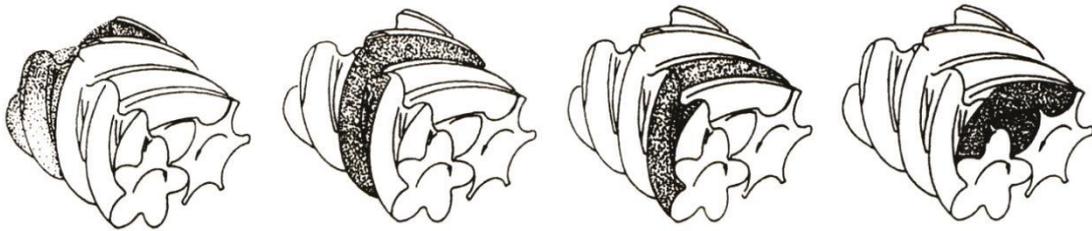
After suction, the tooth peaks of male and female rotor will be closed with the casing and the air in the groove space is sealed, it is "sealing process". The rotors continue to rotate, and groove space moves toward the exhaust port, it is called "delivery process"

#### 3. Compression and oil injection process

During the delivery process, the meshing surface moves toward the exhaust port, the groove space get smaller, the air is compressed and pressure is increased, it is "compression process". Meanwhile the lubricating oil is injected into the compression chamber and mixed with air due to the pressure difference.

#### 4. Exhaust process

When the meshing surface moves to the exhaust port, the compressed air(air pressure is the highest at this time) starts to discharge until the the tooth peak moves to the end. At this time, no space between the meshing surface of the two rotors, it is "exhaust process". At the same time, the groove space is the largest at inlet port, and another suction process is in progress.



1.Suction process

2. Sealing and delivery process

3.Compression and oil injection process

4. Exhaust process

#### 1-4. Technical parameters of screw compressor

Model Parameter		SY10A	SY15A	SY20A	SY25A	SY30A	SY40A	SY50A	SY60A	SY75A	SY100A
		Air Delivery/ Discharge Pressure (m <sup>3</sup> /min)/Mpa	1.2/0.7 1.1/0.8 0.95/1.0 0.8/1.2	1.65/0.7 1.5/0.8 1.3/1.0 1.1/1.2	2.5/0.7 2.3/0.8 2.1/1.0 1.9/1.2	3.2/0.7 3.0/0.8 2.7/1.0 2.4/1.2	3.8/0.7 3.6/0.8 3.2/1.0 2.7/1.2	5.3/0.7 5.0/0.8 4.5/1.0 4.0/1.2	6.8/0.7 6.2/0.8 5.6/1.0 5.0/1.2	7.4/0.7 7.0/0.8 6.2/1.0 5.6/1.2	10.0/0.7 9.6/0.8 8.5/1.0 7.6/1.2
Lubricating Oil Capacity L	10	18				30			65		
Noise dB(A)	66±2	68±2						72±2			
Driving Mode	Direct driven										
Power kw/hp	7.5/10	11/15	15/20	18.5/25	22/30	30/40	37/50	45/60	55/75	75/100	
Startup Mode	Y-Δ start										
Size	L mm	900	1080		1380			1500		1900	
	W mm	700	750		850			1000		1250	
	H mm	920	1000		1160			1330		1570	
Weight kg	220	450	500		540		750	1300	1400		
Outlet Pipe Diameter	G½	G¾		G1			G1-½		G2		

Model Parameter		SY125A	SY150A	SY175A	SY200A	SY250A	SY300A	SY350A	SY430A	SY480A	SY540A
		Air Delivery/ Discharge Pressure (m <sup>3</sup> /min)/Mpa	16.2/0.7 15.0/0.8 13.8/1.0 12.3/1.2	21.0/0.7 19.8/0.8 17.4/1.0 14.8/1.2	24.5/0.7 32.2/0.8 20.5/1.0 17.4/1.2	28.7/0.7 27.6/0.8 24.6/1.0 21.5/1.2	32.0/0.7 30.4/0.8 27.4/1.0 24.8/1.2	36.0/0.7 34.3/0.8 30.2/1.0 27.7/1.2	42.0/0.7 40.5/0.8 38.2/1.0 34.5/1.2	51.0/0.7 50.2/0.8 44.5/1.0 39.5/1.2	64.0/0.7 61.0/0.8 56.5/1.0 49.0/1.2
Lubricating Oil Capacity L	72	90		110		125	150			180	
Noise dB(A)	72±2		75±2			82±2			84±2		
Driving Mode	Direct driven										
Power kw/hp	90/125	110/150	132/175	160/200	185/250	220/300	250/350	315/430	355/480	400/540	
Startup Mode	Y-Δ start										
Size	L mm	1900	2500			3150					
	W mm	1250	1470			1980					
	H mm	1570	1840			2150					
Weight kg	1650	2300	2600	3200	3500	4000	4500	6000	6500	7200	
Outlet Pipe Diameter	G2	G2-½			DN85				DN100		

## Chapter 2 Air compressor receipt and installation

### 2-1. Receipt and installation

#### 1. Receipt

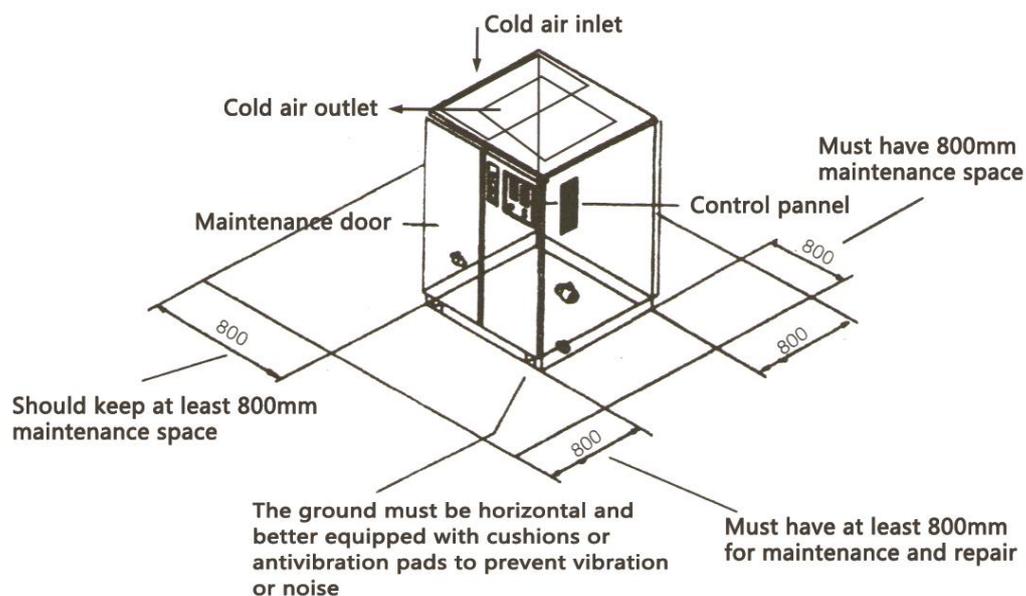
- a. When you receive the air compressor, please count the quantity, type, specification and attached information according to the items listed on the packing list.
- b. Visually check whether the air compressor and parts are damaged during transportation.
- c. If there is any shortage or damage, please indicate the situation and notify the seller.

#### 2. Installation

Selection of installation sites:

It is always neglected for the selection of air compressor installation site. They find any place after purchase a air compressor and use it immediately after the pipe is installed. There is no plan beforehand, resulting in poor quality of compressed air and some difficulties in the maintenance of the machine. Therefore, a proper installation site is a prerequisite for the correct use of the air pressure system.

- a. Should be a wide and well lighted place for operation and maintenance.
- b. The relative humidity of the air should be low, dust-less, air is clean and well ventilated.
- c. The ambient temperature should be lower than 40 °C . The higher ambient temperature, the less air output of the air compressor.
- d. If the factory environment is poor and there is a lot of dust, pre-filtering equipment should be installed to ensure the lifespan of the air compressor system.
- e. Reserve passageway and cranes (especially the high-power compressor) for maintance.
- f. Reserve space for maintenance. There should be at least 80cm distance between the air compressor and the wall.
- g. If the air compressor is placed in a closed room, an exhaust fan should be installed to maintain the temperature. The air volume of exhaust fan should be larger than cooling fans and the inlet area of the cold air must be sufficient. It is also possible to install a diversion pipe at the outlet of the cooling fan to deliver hot air to the outside and maintain room temperature.



## 2-2. Piping, base, and cooling system attentions

### 1. Attentions for piping in air line

- (1). The pipeline must have a gradient of 1-2 degrees, to drain the condensate.
- (2). The pressure drop of pipeline shall not exceed 5% of the set pressure, therefore, it is better to use a larger diameter pipe than designed.
- (3).The branch line should be connected from the top of the main pipe line, to prevent condensation from flowing to the working machine or back to the air compressor.
- (4). Tool to be lubricated should be combined (water filter, pressure regulator, oil feeder), to ensure the service life of the tool.
- (5). The main pipeline should not be arbitrarily reduced. If necessary, use reducing pipe. Otherwise, there will be mixed flow at the joint, which will lead to large pressure loss, and it will have a great impact on the life of the pipeline.
- (6).If there are purification and buffer facilities after the compressor, the ideal order should be air compressor→air tank→dryer. In this way, the air tank can filter out some of the condensed water, and also has the function of reducing the gas temperature. Air with lower temperature and less water can reduce the load of the dryer.
- (7).If the system need a large air volume in a short time, it is better to install an air tank as a buffer. This can make it run stable, which is of great help to air compressors.
- (8).For air pressure under 15Mpa, the flow rate in the pipe should be below 15m/s to avoid excessive pressure drop.
- (9).Minimize the use of elbows and valves in the pipeline to reduce pressure loss.
- (10).The ideal piping is that the main line surrounds the entire plant, so that any position can get compressed air from both sides. It can reduce pressure drop if there is a suddenly increase air demand from branch line. And it should configure some appropriate valves for maintenance.

### 2. Base

- (1). The base should be built on hard soil, it should be horizontal to avoid vibration.
- (2). If the compressor is installed on the upper floors, it need anti vibration treatment to prevent vibrations from passing downstairs or generate resonances. This has security concerns for the air compressor and the building.
- (3). Our screw air compressor has a low vibration, there is no need to build a foundation. But the ground on which it is placed must be flat and can not be soft soil.

### 3. Cooling system

(1). Water cooling type air compressor should use soft water to avoid chemical reaction of calcium and magnesium plasma due to high temperature, it will form scale in the cooler and affect the heat transfer effect of the cooler. If use circulating water cooling system, it should be regularly filled with softeners to keep the water clean.

(2). Automatic water recharge system must be perfected for circulating water cooling system, otherwise after a period of operation, the cooling water will be insufficient, which will cause the air compressor shut down due to high temperature.

(3). The water cooling system should use independently, avoid sharing with other systems, in case of short for water and influence cooling effect.

(4). Cooling towers must meet the demand of cooling water requirement by the air compressor, and the power of pumps must be correct.

(5). The place for cooling tower should be easy to dissipate heat, well ventilated, and be supported to prevent it from toppling over.

(6). Cooling water outlet temperature should be below 40 ° C

(7). For air cooling type, must pay attention to its ventilation environment. Don't install the air compressor near high-temperature machinery or in poor ventilation space to avoid it shut down due to the high temperature. If it is used in a closed system, must be equipped with exhaust equipment for air circulation. In general, the air volume of exhaust facility should be larger than cooling fans.

### **2-3. General electrical specifications and safety specifications**

1. Choose the right electric wire diameter according to the power of air compressor. The wire diameter should not be too small, it may easily get burned due to high temperature.

2. The air compressor should have independent power systems, especially avoid sharing power with other systems, otherwise it will shut down due to the excessive voltage drop or the current imbalance, especially the high-power air compressor.

3. Equip with non fuse switch according to the power of the compressor, to protect the power system and ensure safety.

4. Confirm the voltage before power distribution.

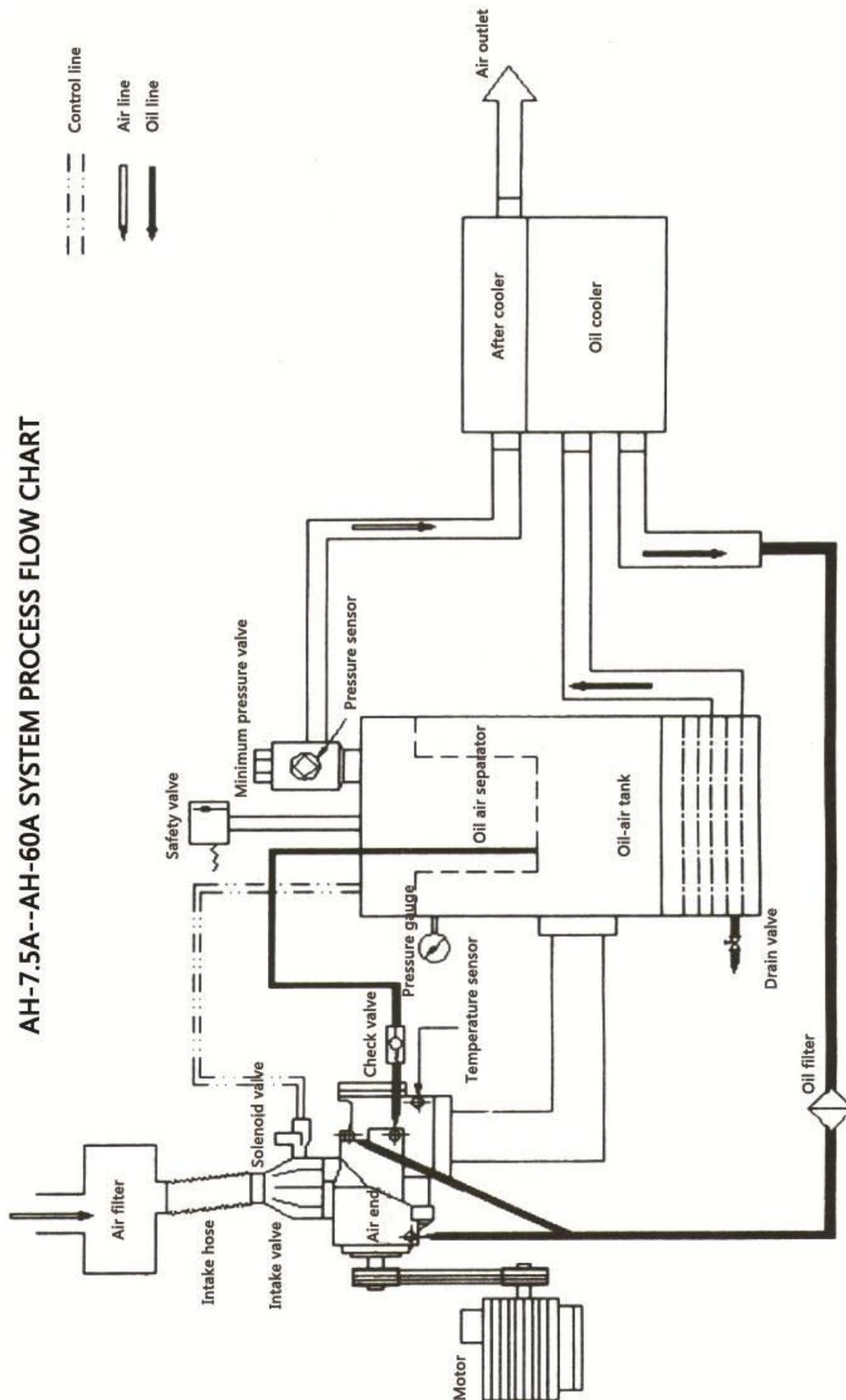
5. The ground wire of the motor or system should be set up and can not just connect to the air delivery pipe or water cooling pipe.

6. General provisions, the current may not exceed 3% of the rated current when three-phase AC motor overload operate. If the three-phase current is imbalance, the difference between the lowest phase current and the highest phase current must not exceed 5%. If there is a voltage drop, the voltage drop can't higher than 5% of the stable voltage.

7. The air compressor must set up a ground wire to prevent danger of electric leakage.

# Chapter 3 System process flow chart

## 3-1. System process and part name



## 3-2. System process

1. Air flow process (refer to the system process chart for each model)

① The air get into the compression chamber after filtered by the air filter and mix with lubricating oil, the compressed air enters into oil-gas separator through check valve, and be sent to the system via the oil separator, minimum pressure valve and after cooler.

② Components in the main air line.

### A. Air filter

Air filter is a paper filter with 10 micron pore size, the dust on the surface should be removed every 1000 hours. The method of removal is using low-pressure air to blow dust from the inside out. A pressure differential detector is installed inside the air filter. If the  $\Delta P$  indicator on the control panel is on, the air filter must be cleaned or replaced.

### B. Suction valve

Load and off load control:

The intake valve is controlled by a piston valve, utilize the action of up and down of the piston to achieve load and off load control. When starting, stopping or idling, control the inlet valve to close by solenoid valve and use throttle valve to provide pressure for the system circulation.

When the motor runs at full load, the solenoid valve is energized, at this time, the piston in the intake valve is sucked down into the intake state due to the different pressure. If the air pressure reaches the limit of the pressure switch, the solenoid valve start bleeding, and the intake valve piston is pushed upwards to close the valve and become off load state.

a. Capacity control: When the system pressure rises (have not reach the set pressure of pressure switch), if reach the set pressure of capacity control valve, there will be a little air passing through, pushing the intake valve piston upward, and the intake volume will gradually decrease, at this point the system has started capacity control. If the pressure continues to rise then the intake piston continues moving upwards, but if the system pressure decreases, the intake piston opens and intake more air. The capacity control operation stops until the pressure is below the setting value.

b. Guide rod type capacity control valve: This intake valve has two brakes, left one is air intake brake, and right one is the capacity control brake. When heavy loading, the pressure from the solenoid valve enters the left cylinder, the valve stem is pushed to the right side, at this time the inlet valve opens to reach loading operation. There is a branch tube that connect with pressure control valve at right side and enter capacity control room. When the system pressure rises due to a decrease in usage and reaches the set pressure of capacity control, the pressure starts to enter the capacity control room. There is a relief hole in the volume control room. If the air intake volume is larger than the relief volume, the pressure is gradually built up in the volume control room, then the diaphragm push the stem to left to limit the intake air volume. If the air usage increases at this time, the system pressure drops slightly and the capacity control valve is closed or turned down, the pressure of capacity control room decrease, the stem pushes back to right side to increase the volume of intake air. This is the process of capacity control.

If the usage of air reduce to much, the pressure increase to fast exceed the response capacity of the capacity control valve, the solenoid valve will lose power, the air intake brake chamber at left side lose pressure, the stem is pushed back by the spring, and cut off the air intake. The compressor is idling, and relief valve release the compressed air to intake port form oil-gas separator. When it drop to the set pressure, the solenoid valve get energized and back to loading program.

### ③ Temperature sensor

In the case of loss of water, loss of oil, lack of water, lack of oil, etc., it may cause the exhaust gas temperature to be too high. When it reach the set temperature, the controller will shut down the machine. The temperature is generally set at 100 ° C. There is a thermometer on the instrument panel to show the exhaust gas temperature.

### ④ Check valve

Prevent the backflow of compressed air from oil-gas separator to cause the reversal of the rotor when shut down.

Eliminate internal stress caused by heat expansion, and the vibration of the unit.

### ⑤ Oil-air tank

There is an oil level gauge on the separator, the oil should at high oil level line when in static state. A hole is opened on the separator for adding oil. There is a drain valve at the bottom of the separator, condensed water should be drain out before start.

The separator has a large sectional area, could reduce the flow rate of the compressed air, and separate the oil, this is the first stage for oil separation.

### ⑥ Oil air separator

For details, please refer to the following section

### ⑦ Safety Valve

When the pressure switch is misregulation or malfunctions and the pressure in the oil gas separator is 0.1 Mpa higher than set pressure, the safety valve opens, and the pressure will drop below the set pressure. The safety valve has been adjusted before leaving the factory. Do not change.

### ⑧ Relief solenoid valve

The relief valve is a normally open solenoid valve. When the machine is stopped or idling, the valve is opened and relief the pressure in the separator, to ensure the compressor can be started without load or off load running.

### ⑨ Minimum pressure valve

Located at the top of the separator, the opening pressure is set at around 0.45 MPa, The function of the minimum pressure valve is:

- a. When start, provide the pressure for lubricating system and ensure the lubrication of the machine.
- b. It opens when the pressure over 0.45Mpa, can reduce the air flow through the oil separator element, not only ensures the effect of the oil separator, but also protects the oil separator from damage due to the pressure difference.

### ⑩ After cooler

a. For air cooling cooler, the cooling fan blows cold air through the chiller to cool the compressed air, the exhaust temperature is generally below ambient temperature + 15 ° C. Air-cooled air compressors are sensitive to ambient temperature conditions. When choosing the position, pay attention to the ventilation conditions of the environment.

b. For water cooling type, use shell cooler, cool the compressed air by water. Its exhaust temperature is below 40 ° C (cooling water inlet temperature can not exceed 35 ° C). Water-cooling type are less sensitive to ambient temperature conditions, and easier to control the exhaust temperature. If the cooling water quality is poor, the cooler will easily form scale and plug the pipe, if the PH value of water is low (ie high acidity) should usde copper material to avoid corrosion.

## 2. Lubricating oil flow process (refer to the system process chart for each model)

### ① Oil injection process description

Because of the pressure in the oil-gas separator, the lubricating oil is pressed into the oil cooler, then go through an oil filter to remove impurities, and then divided into two routes. One to the compression chamber from the bottom of the air end for cooling compressed air; the other one to the two ends of the air end to lubricate the bearing assembly and the transmission gears, then gather at the outlet port and exhaust with compressed air.

The compressed air mix with oil exhaust into oil gas separator and separate a large part of the oil, the rest of the oil separated by oil separator and it can be sent to the system for usage through after cooler.

## ② Oil injection control

The oil injected into the screw compressor is mainly used to take away the heat generated by the compression process, the amount of oil injected directly affects the performance of the compressor. The amount has been set by our technician before leaving the factory, do not change it. If need adjustment, please contact our customer service first to avoid damaging the air compressor.

## ③ Components on oil system

### A. Oil cooler

The oil cooler has air cooling and water cooling two types.

If the environmental conditions are not good, the dust will cover the fin of cooler and affect cooling effect, result to shut down of the machine due to high temperature. Therefore, blow off the dust on the fin by low pressure compressed air regularly. If cannot be cleaned, it must be cleaned with solvents. Be sure to keep the cooling surface clean.

When the shell-type cooler is blocked, it must be soaked with special liquid, and the fouling plugged in the pipe must be removed mechanically. Be sure to clean it completely.

### B. Oil filter

The oil filter is a paper filter whose function is to remove the impurities such as metal particles, oil deterioration, etc. The filtration accuracy is between 10-15 microns, have perfect protection to bearings and rotors. Whether the oil filter should be replaced can be judged by its pressure difference indicator. If the indicator is on, the oil filter is blocked and must be replaced. For a new compressor, it is necessary to change the oil and oil filter after 500 hours' operation. After that, replace according to the differential pressure indicator. If the pressure different is high but have not replace the filter, may lead to insufficient of oil intake and shut down duo to high exhaust temperature, and also affect the life of the bearings.

### C. Oil air separator

The oil air separator element is made of multiple layers of hibiscus glass fiber, the mist oil is almost completely filtered out by the oil separator, and the oil particle size can be controlled at 1 $\mu$ m, oil content can be less than 5ppm. The quality of the lubricating oil and ambient enviroment have great impact on the lubricating system. If the environmental is poor, can install a pre-air filter. As for the choice of lubricating oil, it is necessary to use the brand recommended by us, and avoid using fake oil or reproduction oil. The outlet of the oil separator is equipped with a safety valve, a relief valve and a minimum pressure valve, the compressed air pass through it to the cooler.

The oil filtered by the oil separator is concentrated in the central small round groove, and then returned to the inlet side of the air end by a return pipe to prevent the oil from being discharged with the air.

In general, whether the oil separator is damaged can be judged by the following methods:

- a. The air line contains more oil.
- b. The pressure difference switch between the separator and oil filter alerts, its set pressure difference is 0.15Mpa. When the pressure difference exceeds the set value, the indicator on and indicate that the oil separator is blocked and should be replaced immediately.
- c. Check if the oil pressure is high.
- d. Does the current increase.

### D. Thermostatic valve

A thermostatic valve is installed in front of the oil cooler. It is to maintain the exhaust temperature above the pressure dew point temperature. When the machine is turned on, the temperature of the lubricating oil is low. The thermostatic valve will automatically open the return circuit and the oil will enter the air end without passing through the oil cooler. If the oil temperature rises above 67 $^{\circ}$  C, the valve will open slowly and fully open at 72 $^{\circ}$  C, at which time the oil will pass through the oil cooler and enter the air end.

### 3. Cooling system

#### ① Air cooling type

The cold air is sucked by cooling fan, and exchanges heat with the compressed air and the lubricating oil to achieve the cooling effect. The maximum ambient temperature allowed for this cooling system is 40 ° C. If the ambient temperature exceeds 40 ° C, the system may shut down.

#### ② Water cooling type

The design temperature of cooling water temperature is 32 ° C. Water cooling circulation system design must pay special attention to the quality of the cooling water, must reach industrial water standards, try to avoid the use of groundwater. If the water quality is poor, the water tower must be periodically cleaned with detergent to avoid affecting the efficiency and life of the cooler. In winter, the cooling temperature is usually above the freezing point. After the unit shuts down, the cooling water in the cooler must be drained. In winter, if the ambient temperature is below the freezing point, the condensate must be drained after the unit is shut down.

## 3-3. Safety protection system and warning device

### (1). Overload protection of motor

There are two motors in the air compressor system. One motor for driving the compressor and the other is fan motor. Under normal conditions, the operating current of the motor will not exceed 3% of the rated current (eg due to voltage drop, three-phase imbalance, etc.) When the running current exceeds the limit set by the over-current protection device, the device will automatically cut off the main power supply, and the compressor stops. At this point, the air compressor cannot start unless it is reset. In general, the reason for motor overload is:

- a. Error of operation: such as change the exhaust pressure, improper adjustment of the system, etc.
- b. Mechanical failure: such as internal damage of motor, short for phase, safety valve broken, system settings fail, oil separator is blocked, etc.

If found the motor overloaded during operation, contact the customer service immediately. Send someone to do the inspection and find out the reasons to prevent the motor from burning down.

### (2). High temperature protection

The highest exhaust temperature set is 100 ° C, the system will alarm immediately and cut off the power if the temperature exceeds 100 ° C. There are many reasons for high exhaust temperature, the most common cause is oil cooler failure. If the fins of air cooler oil cooler are covered by dust, the cold air can not pass through the cooler freely, the temperature of the oil will gradually increase, causing shutdown of the machine. Therefore, blow off the dust on the fin by low pressure compressed air regularly. If cannot be cleaned, use leaning liquid or solvents. For water cooling air compressor, it will cause high temperature if it form scale in the cooler and make it blocked. The maximum ambient temperature for the air compressor is 40 ° C. The higher the ambient temperature, the higher the exhaust temperature. Therefore, it is necessary to select a place with a low ambient temperature and good ventilation to place the air compressor. When the exhaust temperature exceeds the set value, the system startup circuit is shut off and it cannot be restarted again unless it is reset.

## 3-4. Control system and electrical circuit

### (1). Control system of screw air compressor

#### ①. Motor startup (low voltage startup or Y startup)

During this time, the intake valve is fully closed, the relief valve is fully open and the solenoid valve is closed. The inlet side has a high degree of vacuum. It suck lubricating oil to compression chamber and bearing by the vacuum.

#### ②. Motor full pressure rotation ( full voltage or $\Delta$ operation)

When the controller turn to full pressure operation, the solenoid valve is opened after being energized, the relief valve is closed, the

intake valve gradually opens, so the pressure in the oil separator rapidly increases, resulting in the inlet valve is fully open and the compressor starts to loading. When the pressure rises to 0.45Mpa, the minimum pressure valve is open and discharge air.

#### ③. Heavy-duty/off load operation

When the discharge pressure reaches the limit set by the pressure switch, the power supply is turned off and the solenoid valve is closed, and the intake valve is also closed, the relief valve is fully opened, and the air in the separator is discharged to the atmosphere, the compressor is running under no load. The required lubricating oil pressure is ensured by the difference between vacuum and atmospheric pressure. When the pressure of the pipeline system is reduced to the lower limit of the pressure switch, the switch is turned on again, the solenoid valve opens again and the intake valve is fully opened, and the relief valve is closed, and the compressor is loading again.

#### ④. Stop

After pressing the OFF button, the solenoid valve is shut off and the relief valve is fully opened, the air in the separator is discharged to the atmosphere. When the pressure falls to a certain value, the motor stops.

#### ⑤. Emergency shutdown

When the exhaust temperature exceeds 100 °C or the motor overload, the power will be cut off immediately and stop the motor, while the solenoid valve, the intake valve is also closed and the relief valve is fully open. Only when there is an abnormal situation, we can press the emergency stop button, otherwise it will cause the system to malfunction.

#### ⑥. No-load automatic shutdown system

If the air usage is reduced, the compressor is kept running under no load. If the no-load running time exceeds the set time, the air compressor will automatically stop. When the usage of air increases, the system pressure will decrease, and the air compressor will automatically start to supply air. The no-load automatic shutdown should operate less than 2 time per hour, customers can set according to their own situation, should not cause the motor burned due to start too often.

### (2). Frequency conversion screw air compressor control and protection system

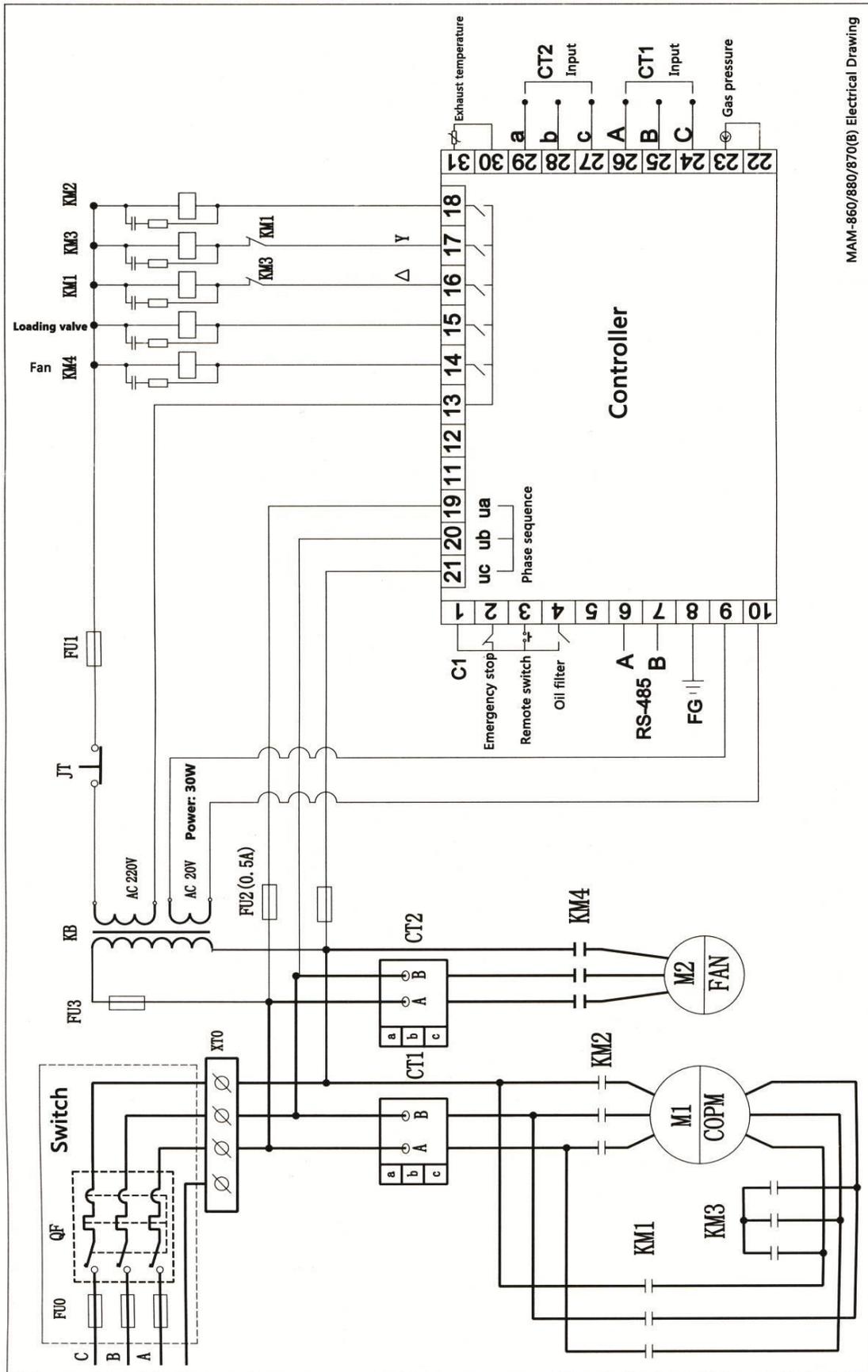
When don't have air usage or the usage is small, the intake valve is closed, the compressor is idling, to achieve energy saving. When have gas consumption, the microcomputer controller re-opens the main intake valve, the compressor start loading. And the microcomputer controller also monitors the unit and automatically shuts down in the event of abnormal conditions (such as motor overload, exhaust over-temperature, etc.) to protect the compressor from damage. A safety valve is equipped on the separator. When the pressure in the separator exceeds the set value, the safety valve will be automatically opened; the pressure will be quickly relieved to ensure the safety of the unit. The machine has a perfect pressure relief function, so under normal circumstances, the safety valve will not open.

### (3). Electrical circuit of screw air compressor

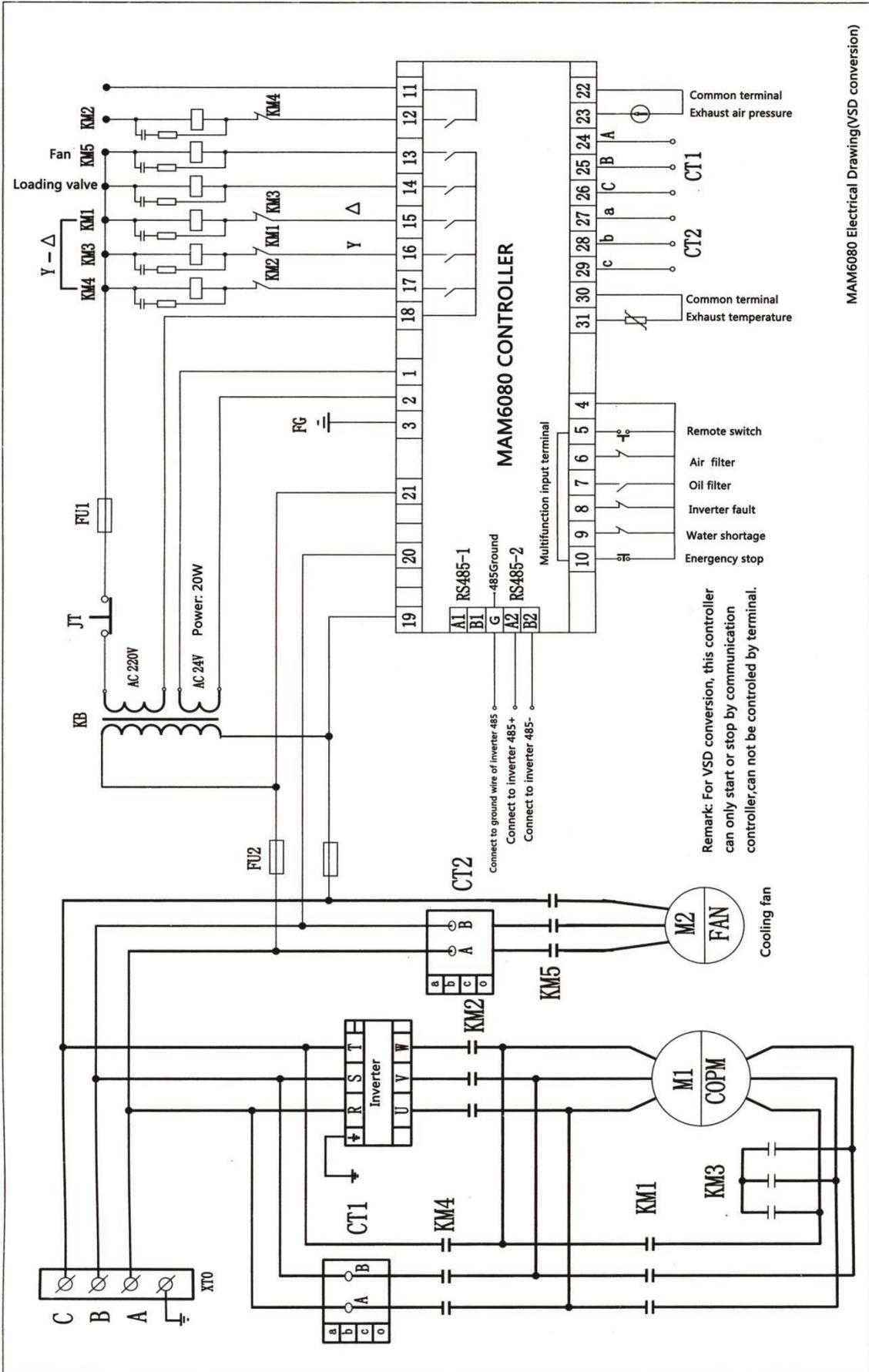
The electrical control of the air compressor have two systems, one is the internal control system and the other is the starter disk portion. The starter disk is the commonly used Y- $\Delta$  starter control of general machinery. The control part is electronically controlled.

### (4). Electrical circuit of frequency conversion screw air compressor

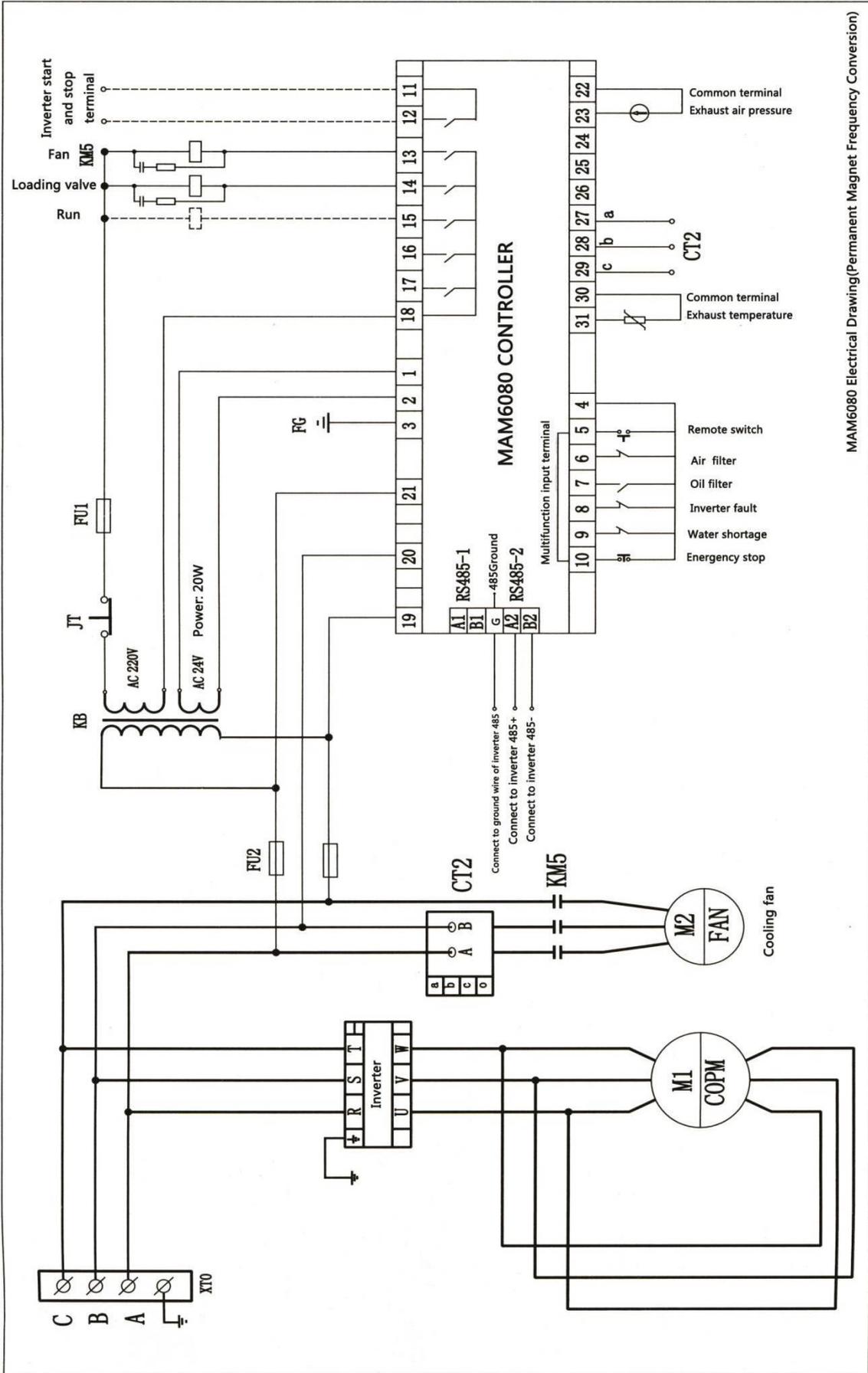
The electrical system consists of frequency converter, main motor, fan motor, electrical cabinet assemble, solenoid valve, temperature sensor, pressure transmitter, microcomputer controller, and control panel. The settings and operation of frequency conversion screw air compressor are described in the "User Manual".



MAM-860/880/870(B) Electrical Drawing



MAM6080 Electrical Drawing(VSD conversion)



MAM6080 Electrical Drawing(Permanent Magnet Frequency Conversion)

# Chapter 4 Operations

## 4-1. Test run, start and stop

- (1). Connect the power cable and grounding cable to test whether the voltage and the three-phase power supply is correct.
- (2). Check whether the oil level in the separator is between the high oil level line H and the low oil level line L.
- (3). If it is a long time after receiving the machine, add about 0.5 liters of lubricating oil from the intake valve and turn the air compressor by hand to prevent the compressor from burning down before test run. Please pay special attention to foreign objects falling into the valve, do damage the aircend.
- (4). Check the cooling system
- (5). Press "ON" to start and immediately press the "Emergency Stop" button in few seconds to check the rotation of motor is correct (as in the direction of the arrow), If incorrect, swap any two of the three wires.
- (6). Press the "ON" button again to start the compressor.
- (7). Check the instruments and indicators are working properly. If there is any abnormal sound, vibration or oil leakage, press the "emergency stop" immediately, shut down and check the unit.
- (8). Pay attention whether each indicator is normal.
- (9). The exhaust temperature is maintained between 75-85°C.
- (10). After pressing the "OFF" button for 10-15 seconds, the timing relay action, the motor stop, this is to avoid the air compressor directly stop under the heavy load.
- (11). The relief valve automatically exhausts when the "OFF" button is pressed.

## 4-2. Inspection before starting up

The inspection before start of is to avoid failure of the compressor and improve the use efficiency.

- (1). Open the manual drain valve of the separator and drain the condensed water. If don't do this, the service life of the oil will be shortened and the bearings will be easily damaged.
- (2). Check if the oil level is between H and L. Lubricant must not be too much, nor too little. It is forbidden to mix different brands of lubricating oil. When replenishing lubricating oil, make sure no pressure in the system and then open the filler cap.
- (3). Observe the oil level should be ten minutes after the shutdown, the oil level may be slightly lower when running than the oil level when shutdown.

## 4-3. Precautions during operation

- (1). When there is abnormal noise and abnormal vibration during operation, it should be stopped immediately.
- (2). There is pressure in the pipeline and in the container during operation. Do not release the pipeline or plug, or open valves.
- (3). If the oil on the oil level gauge is not found during long-term operation and the indicator is on. Should stop immediately, observe the oil level after stopping for 10 minutes, if the oil is insufficient, add oil when there is no pressure inside the system.
- (4). There will be condensation in the after cooler and oil gas separator, should be drained every

day or install automatic drain device. Otherwise, moisture will be carried into the system.

(5). Every 2 hours during the operation check the instrument and record the voltage, current, pressure exhaust temperature, oil level, etc. For future reference.

#### **4-4. Processing method for long-term shutdown**

For long-term shutdown, it should be carefully handled according to the following processing, especially high humidity seasons or regions.

(1). Shutdown for more than 3 weeks

①. Wrap the electrical equipment such as motor control panel with plastic paper or oil paper, to prevent moisture intrusion.

②. Completely drain the water in the oil cooler and after cooler.

③. If there is any fault, it should be eliminated first for future use.

④. After a few days, drain the condensate from the separator, oil cooler and after cooler again.

(2). Shutdown for more than 2 months

In addition to the above procedures, the following additional processing is required:

① . Close all doors to prevent moisture and dust from entering.

② . Pack safety valve, control panel, etc. with oil paper or similar paper to prevent corrosion

③ . Replace the lubricating oil and run 30 minutes, and 2-3 day's later, drain the water in the oil cooler and after cooler.

④ . Drain the condensation completely.

⑤ . Move the machine to low dust and dry places if possible.

(3). Restart processing

① . Remove the plastic or oil paper on the machine.

② . Measure the insulation of the motor, it should be above  $1M\Omega$ .

③ . Other procedures as the operation steps.

## Chapter 5 Maintenance and inspection

### 5-1. The specification and maintenance of lubricating oil

(1). Please use special oil for screw compressor

(2). The process of replace lubricating oil

①. Run the air compressor and raise the oil temperature to discharge. Then press the OFF button and stop running.

②. If there are pressure in the system, oil drain very fast, but it is easy to be ejected, slowly opened, so as to avoid splash lubricating oil.

③. Close the drain valve if all drained out, open the filler cap. The lubricating oil in system must be completely drained out, such as pipeline, cooler/separator etc..

④. Add new oil.

(3). Use precautions of lubricating oil

①. For a new screw air compressor, the first time to replace oil could be 500 hours of use. Send the oil sample back to the oil supplier for oil testing to determine the quality of the lubricant. Repeat every 1000 hours. After that, the oil change cycle of the air compressor can be determined.

②. Never allow the lubricating oil exceed its service life, the oil should be replaced on time, otherwise the quality will declined, easily to cause shutdown due to high temperature. Furthermore, the burning point of oil will decrease and cause autoignition to the compressor

③. After 2 years' usage, it is best to do a "system cleaning" by lubricating oil. The method is to replace new oil, and make the air compressor run for 6-8 hours, then replace the oil again to clean the impurity in the system.

Advice:

In order to ensure the operation of the machine, please use special oil and consumables for screw compressors. Otherwise, you will not get the normal warranty service.

### 5-2. Conventional maintenance

After 500 hours of operation

① Replace the lubricating oil    ② Replace the oil filter    ③ Clean the air filter

After 2000 hours of operation

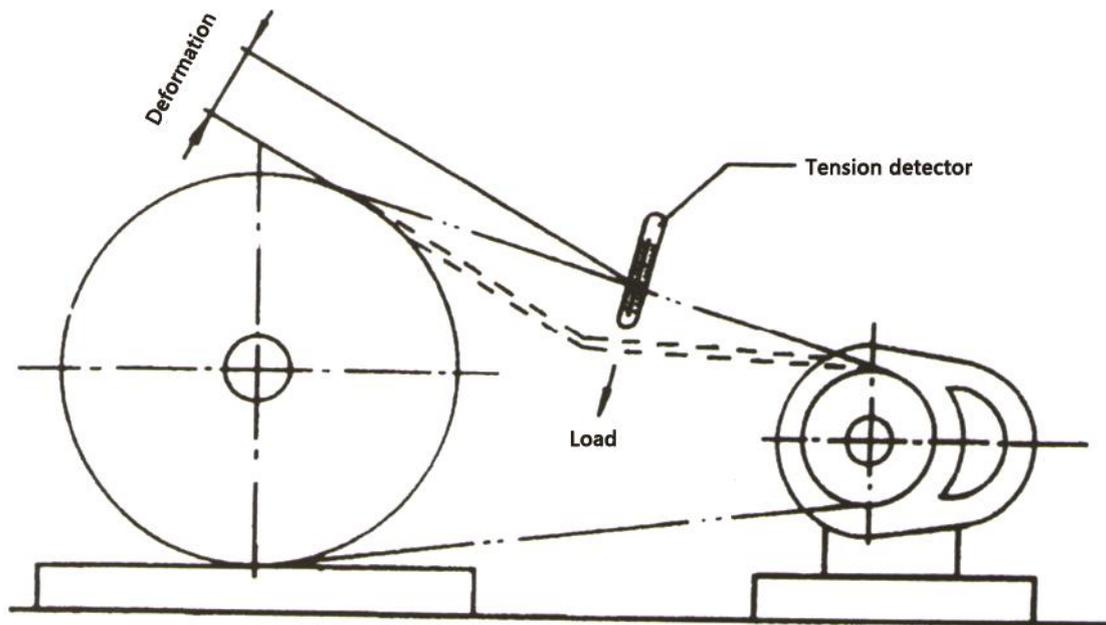
① Replace the lubricating oil    ② Replace the oil filter    ③ Clean the air filter    ④ Replace oil separator element

Advice:

If the environment is poor and the dust is large, the maintenance time should be shortened appropriately.

### 5-3. Belt adjustment

For belt driven type, check the belt after the 30 hours of operation of the new machine. If it is too loose, adjust it immediately and adjust it every 1500 hours.



Item	Load(kg)	Deformation(mm)
22kW	3.4	8-10
37kW	3.0	8-10
55-100kW	3.0	9-12

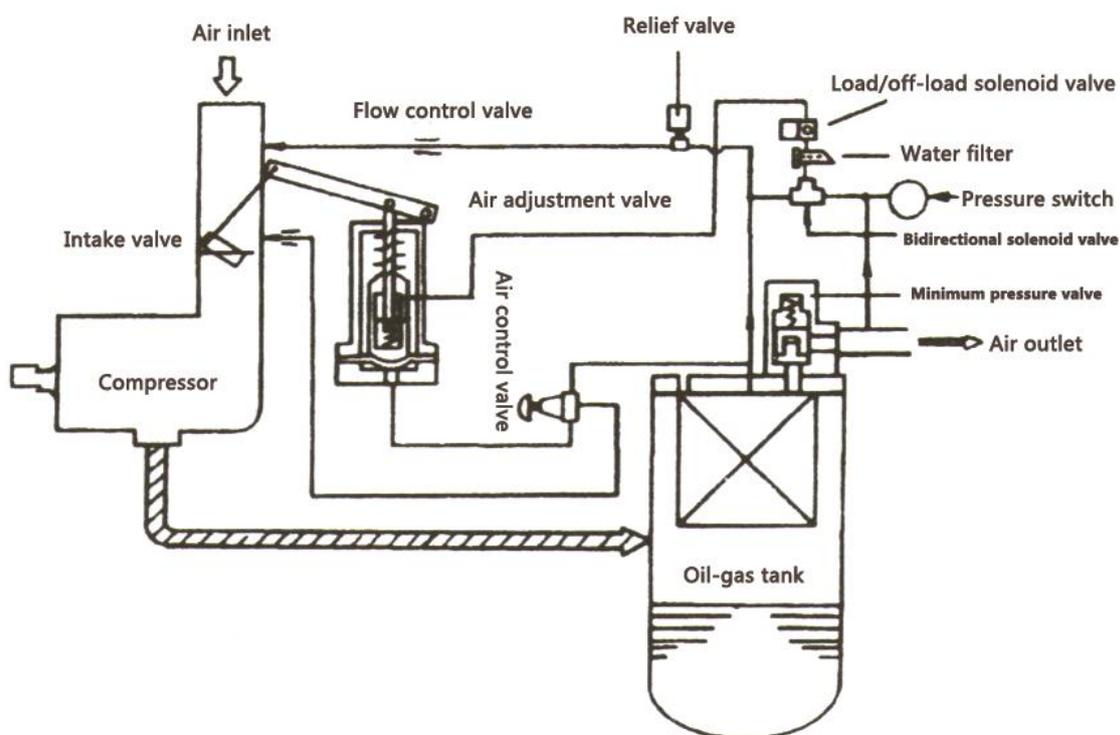
- (1). As the figure shows, using a tensiometer to measure the amount of deformation. If it is within the standard value, don't need adjustment. If exceeds the standard value, adjust the tension of the belt.
- (2). When adjusting the belt tension, loosen the four fixing screws of the motor seat slightly, then use the adjustment screw to adjust the belt, measure with a tension gauge, and then tighten the fixing screws of the motor.
- (3). To replace the belt, all the belts must be replaced, do not only replace one belt, otherwise the tension will be unbalanced.
- (4). When adjusting or replace, do not splash lubricant on the belt or pulley.

#### 5-4. Adjustment of the pressure system

##### (1). System pressure adjustment

- ① The pressure adjustment is operated by the keyboard on the microcomputer controller. The two pressure points are displayed (the value of the pressure point can be set via the keypad). An unloading pressure, which is the upper pressure limit, unload when the pressure rises to this value.
- ② Another pressure point is the loading pressure, which is the lower pressure limit. When the system pressure drops below this value, the machine will automatically load and increase the pressure.
- ③ Within the maximum pressure range allowed by the model designed, both pressure points can be adjusted depending on the conditions of use in the site.

(2) . Air volume adjust system



If the air volume used by the customer is smaller than the discharge volume of air compressor, the system can automatically adjust the air supply volume of the air compressor.

- ① Set the pressure of air volume adjust regulator, so that a small amount of air can enter the regulator before the system pressure rise to no-load set pressure, and push the piston up, start the air adjustment. The setting pressure of the regulator can be determined according to the air usage.
- ② Properly adjust the relief volume of flow control valve to stabilize the pressure of the air regulator.
- ③ If there is no need for air volume adjustment, the air volume adjustment regulator can be locked.

### 5-5. The adjustment of safety valve

The discharge pressure of the safety valve is generally set to be .1Mpa higher than the discharge pressure, so there is no need to adjust it by yourself. If need to change the pressure of safety valve, loosen the lock nut above the safety valve, and then adjust the adjustment screw. Turn clockwise to increase the discharge pressure, and counterclockwise to decrease the pressure setting. After setting the discharge pressure, tighten the lock nut.

## Chapter 6 Faults and Troubleshooting

### 6.1 Troubleshooting table

ITEM	Fault situation	Possible causes	Method
1	Unable to start (No fault display) Show -20°C, remote control	data wire failure or loose	electrical person overhaul and replace
2	Unable to start (Electrical fault light on)	<ol style="list-style-type: none"> <li>1. The fuse is blown</li> <li>2. Protection electric relay action</li> <li>3. Start relay failure</li> <li>4. Poor contact of start button</li> <li>5. The voltage is too low</li> <li>6. Motor failure</li> <li>7. Air end failure</li> <li>8. lost-phase protection relay action</li> </ol>	<ol style="list-style-type: none"> <li>1. electrical person overhaul and replace</li> <li>2. electrical person overhaul and replace</li> <li>3. electrical person overhaul and replace</li> <li>4. electrical person overhaul and replace</li> <li>5. electrical person overhaul and replace</li> <li>6. electrical person overhaul and replace</li> <li>7. Turn the body by hand. If cannot turn it, please contact the company for service.</li> <li>8. Check the power cord and contacts.</li> </ol>
3	Show Y-△ start, but the unit does not operate	<ol style="list-style-type: none"> <li>1. Emergency switch failure</li> <li>2. Control line failure or wire loose</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace new parts</li> <li>2. electrical person overhaul and replace</li> </ol>
4	High operating current, compressor shut down (electrical fault light is on)	<ol style="list-style-type: none"> <li>1. The voltage is too low</li> <li>2. Exhaust pressure is too high</li> <li>3. Wrong lubricating oil</li> <li>4. Belt loose</li> <li>5. Oil gas separators blocked (high lubricant pressure)</li> <li>6. Failure of the air end</li> </ol>	<ol style="list-style-type: none"> <li>1. electrical person overhaul and replace</li> <li>2. Check the pressure gauge, if it exceeds the set pressure, adjust the pressure switch</li> <li>3. Check the oil, replace oil, see 5-1</li> <li>4. Check and adjust</li> <li>5. Replace oil separator</li> <li>6. Turn the body by hand. If cannot turn it, please contact the company for service.</li> </ol>
5	Current is lower than normal	<ol style="list-style-type: none"> <li>1. Air consumption is too high</li> <li>2. Air filter plugged</li> <li>3. Intake valve fault (butterfly valve stuck, no action)</li> <li>4. Intake adjustment valve fault</li> </ol>	<ol style="list-style-type: none"> <li>1. Check consumption, increase compressor if necessary</li> <li>2. Clean or replace</li> <li>3. Disassemble, clean and add oil</li> <li>4. Reset</li> </ol>
6	Exhaust temperature too low (below 75°C)	<ol style="list-style-type: none"> <li>1. The amount of cooling water is too large</li> <li>2. Low ambient temperature</li> <li>3. No load for too long</li> <li>4. The exhaust temperature gauge is incorrect</li> <li>5. Thermostatic valve failure</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the outlet valve of the cooling water. If it is an air-cooled cooler, the cooling area of the cooler can be reduced.</li> <li>2. Adjust the cooling water outlet valve. If it is an air-cooled cooler, reduce the cooling area of the cooler</li> <li>3. Increase air consumption</li> <li>4. Replace the exhaust temperature gauge</li> <li>5. Replace the thermostatic valve</li> </ol>

7	Exhaust temperature too high, air compressor shut down, and the exhaust temperature indicator lights on (exceeding the set temperature value --100°C)	<ol style="list-style-type: none"> <li>1. Insufficient of lubricant</li> <li>2. Insufficient cooling water</li> <li>3. The cooling water temperature is high</li> <li>4. High ambient temperature</li> <li>5. Oil cooler blocked</li> <li>6. Oil filter blocked</li> <li>7. Cooling fan failure</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the oil level. If it is lower than "L", please stop and add oil to "H"</li> <li>2. Check the temperature difference between inlet and outlet pipes</li> <li>3. Check the water temperature</li> <li>4. Increase ventilation and reduce room temperature</li> <li>5. Check the temperature difference between inlet and outlet water, if higher than 5°C, disassemble and clean the cooler</li> <li>6. Replace the oil filter</li> <li>7. Check and repair cooling fan</li> </ol>
8	High oil content in discharge air, shortened oil add cycle, filter smoke when no load	<ol style="list-style-type: none"> <li>1. The oil level is too high</li> <li>2. Oil return pipe blocked</li> <li>3. Low exhaust pressure</li> <li>4. Minimum pressure valve spring fatigue</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the oil level and drain it between "H" and "L".</li> <li>2. Removal and cleaning</li> <li>3. Increase the discharge pressure (adjust the pressure switch to the set point).</li> <li>4. Update spring</li> </ol>
9	Can't load	<ol style="list-style-type: none"> <li>1. Pressure sensor failure</li> <li>2. Solenoid valve failure</li> <li>3. Delay relay failure</li> <li>4. Intake valve failure</li> <li>5. Minimum pressure valve failure</li> <li>6. Control line leakage</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace</li> <li>2. Replace</li> <li>3. Electrical person overhaul and replace</li> <li>4. Cleaning, add oil</li> <li>5. Disassemble and check, replace if worn.</li> <li>6. Check the leak location and lock</li> </ol>
10	Unable to idling. When idling, pressure is maintained or continues to rise, the safety valve opens	<ol style="list-style-type: none"> <li>1. Pressure sensor failure</li> <li>2. Intake valve malfunction</li> <li>3. Bleeding solenoid valve failure (coil burning)</li> <li>4. Air volume adjustment diaphragm breakage</li> <li>5. The discharge restriction hole is too small</li> </ol>	<ol style="list-style-type: none"> <li>1. Overhaul, replace if necessary</li> <li>2. Add lubricating grease after cleaning</li> <li>3. Overhaul, replace if necessary</li> <li>4. Overhaul and replace</li> <li>5. Increase the hole</li> </ol>
11	Air discharge lower than normal	<ol style="list-style-type: none"> <li>1. Intake air filter plugged</li> <li>2. Intake valve malfunction</li> <li>3. Minimum pressure valve failure</li> <li>4. Oil separator plugged</li> <li>5. Relief solenoid valve leak</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean or replace</li> <li>2. Disassemble, clean and add oil</li> <li>3. Check whether the valve seat and check valve are worn after dismantling. Replace if worn out.</li> <li>4. Overhaul. Replace if necessary</li> <li>5. Overhaul. Replace if necessary</li> </ol>
12	Frequent load and off load	<ol style="list-style-type: none"> <li>1. Leakage of pipe</li> <li>2. Unstable air consumption</li> <li>3. Minimum pressure valve failure</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the leak location and lock</li> <li>2. Increase the capacity of the air tank</li> <li>3. Replacement pressure maintenance valve</li> </ol>



Date	Maintenance content	Signature