



Screw air compressor User Manual

Dehaha Compressor Jiangsu Co.,Ltd.

Dear users:

First of all, thank you for choosing the DHH series screw air compressors of our Company.

All products have already passed strict inspection and tests before they go out. But in order to guarantee the machine's safety, reliability and durability, be sure to read the manual carefully before using the machine and fully grasp the screw air compressor's operating norm and skills. Then it can make the machine work steadily for a long time.

The clauses of this manual apply to the compressor products of our company. The manuals are also suitable for the components such as motor and electric apparatus.

Users should understand and observe the relevant local laws and regulations of compressors' installation and manipulation.

As for terms of this manual, the relevant local laws and regulations especially safety aspects are not the same, be sure to adopt the more secure one.

The operator has responsibility for ensuring the compressor runs safely. If unsafe hidden dangers are found, the machine should be overhauled in time.

From the day you buy the products of DHH Company, you will get DHH company's first-class after-sales service, our company's address and telephone numbers are as follows:

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Important information! Read and follow these instructions. Retain for reference.

The DHH Compressor Company has the right but not the obligation to revise or improve the products that had already left the factory.

Your compressor information as follows:

Model: _____ Series No.: _____

Motor power: _____ Cooling method: _____

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Safety Precautions

I. Installation

The installation of the compressor should observe the relevant local laws, regulations and the following rules strictly.

1. The compressor should be lifted by the hoisting equipment whose bearing power is bigger than the weight of the whole unit. The lift speed and the acceleration rate should be in the permit scope.
2. Locate the compressor in a cool, clean, well-ventilated place so as to provide it with cool, clean and dry air.
3. The air that the compressor takes in must not contain flammable gas and corrosive gas so as not to cause the explosion or inside corrosion.
4. The cooling water's quality of the water-cooled unit should conform to the requirements in page 11 and satisfy the following requirements: Inlet water temperature $\leq 89.6^{\circ}\text{F}$; The pressure should be between 29PSI and 203PSI.
5. The discharge of the compressor's sewage, waste oil should observe the local environmental protection laws and regulations.
6. The power of this compressor: The supply line of the compressor must match with it's power and should be installed with safety devices such as air switch, fuse, etc. In addition, the electrical equipments must be touched with the ground for the electrical machine's safety.

II. Debugging and running (Special attention)

1. The new machine must be debugged by debugging person who is appointed or approved by our company.
2. Remove the fixed transport trestles on the bottom of the compressor.
3. Water cooled unit: Please open the inlet/outlet valve, check the water temperature and the water pressure, make sure they meet the requirements.
4. Before starting the compressor, please make sure that there is nobody in the cabinet and no articles or tools are left in it. Close the door of the compressor. Inform the people near the compressor when starting the compressor in case any accidents would happen.
5. At the time of the test run, be sure to check the operation direction of the compressor. When the compressor is overturning, please shut down the compressor immediately, and disconnect the compressor from it's power source. Exchange any two three-phase electricity line and restart the machine, otherwise it will damage the compressor (Special attention when the factory overhauls the power supply).
6. Compressor can not work over the pressure specified on nameplate, otherwise it may cause the motor to be overloaded and burned out.
7. While the compressor is under remote control, the machine may be started at any time, please make eye-catching mark on it.
8. When there is something wrong with the compressor or some unsafe factors, do not start the machine, disconnect the compressor from it's power source immediately and make remarkable mark on it.
9. There are high-speed transmission equipment and high-temperature parts in the compressor. It's dangerous to open the door when the compressor is running.

III. Maintenance

The maintenance of the compressor must be done with the guidance of the qualified personnel.

1. Compressed air and electrical apparatus are dangerous, while overhauling or maintaining the compressor, be sure to disconnect the compressor from it's power source and hang the notice of "overhauling" or "No switching on" on the power source in case other person connect it from its power source and endanger the maintenance person.
2. Before maintaining the compressor, please wait till the whole compressor has already been cooled and compressed air

is discharged completely. The maintenance person should keep away from any compressed air outlets and close the related isolating valve.

3. While cleaning the spare parts, you should use the no-corrosive dissolvent. Inflammable, explosive and volatile cleaning agents are forbidden.

4. After the compressor has operated for some time, please examine the safety protection system regularly such as the safety valve. Make sure that they are sensitive and reliable. Generally speaking, you should examine them once a year.

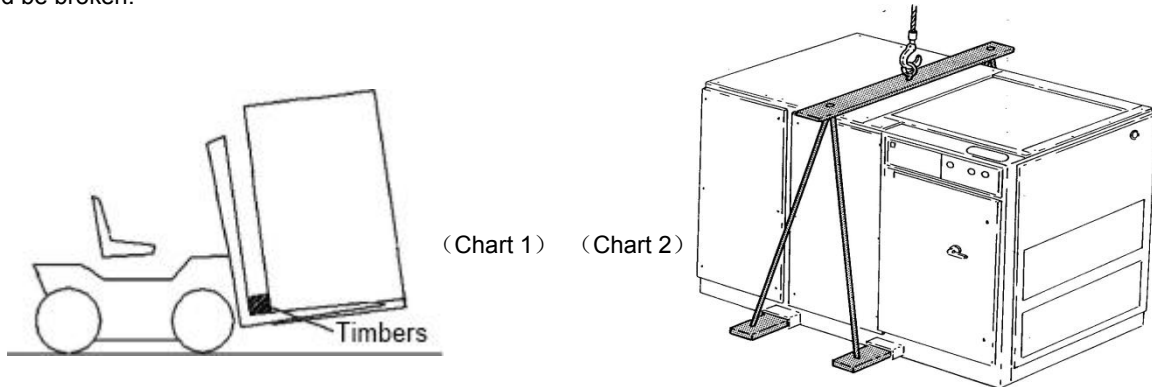
5. The accessories of the compressor must be offered by qualified factories, lubricant type must be exact the same as factory designated. The deterioration of lubricant caused by the mixed usage of different brands or different types may lead to a serious breakdown of the whole unit.

Notice: The compressor should be operated by someone well trained. The operator should read through and understand the contents of the manual, abide by the operating procedure of the operation manual, observe the safety precautions, and comply with the maintenance norms. Any operation action against the safety precautions may cause the serious consequence.

Installation Instruction

I. Transportation

The transportation and installation of the compressor units should be processed according to the instruction. While transporting the compressor, you should put two square timbers between the forklifts and compressor in case of the breach door panels (Chart 1). While using the slings, be sure to use the cross rods to counterbalance both sides (Chart 2). Attention: It's necessary to put some protection materials between the slings and the door panels. If not, the panels would be broken.



II. Foundation

- (1) The compressor should be installed on a horizontal and hard floor, and good joint must be ensured between the cabinet bottom and floor surface, a rubber mat could be placed in order to prevent vibrations and noise.
- (2) If the compressor is installed upstairs, the user must do well against vibration on account of the safety of the compressor and the building.
- (3) The screw compressor does not need fixed foundation because of the little vibration, but the ground must be smooth and firm. And it is better to spread a 0.39 in shock-proof cushion under the bottom of the compressor to avoid the vibration and noise.

III. Installation

The location which the compressor placed should be well selected. It is often located at a random place without planning in advance which is the main reason of the difficulty of maintenance and the poor quality of the compressed air. So selecting a good installation place is the prerequisite correctly using the compressor.

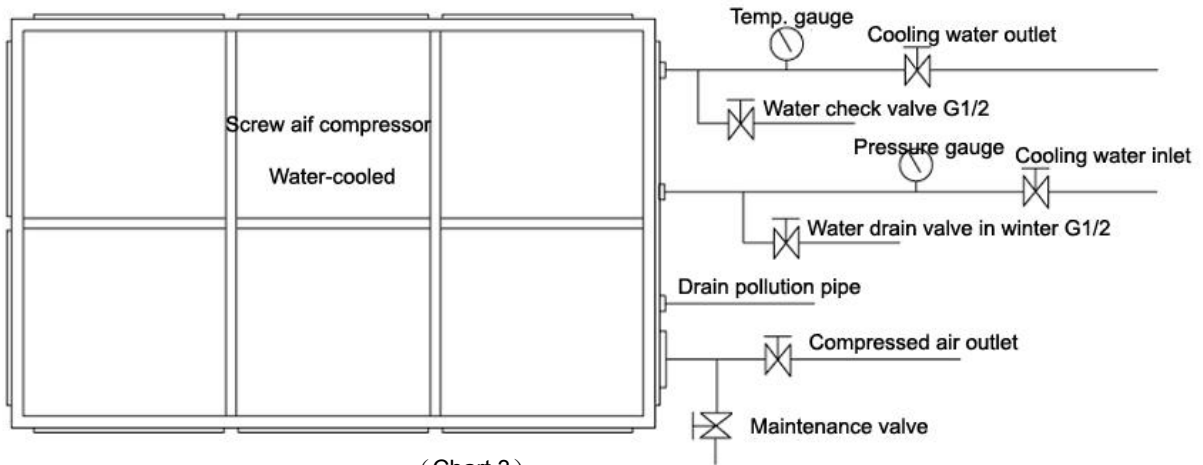
1. A spacious and bright place facilitates will simplify the maintenance and operation of the compressor.
2. Low humidity, less dust, clean air and good ventilation.
3. The temperature must be lower than 104°F. Because the higher temperature, the less exchange air.
4. The pre-filtering equipment is needed if the environment is not good and the air is too dusty.
5. Set aside some place for installation of the crane.
6. Set aside some place for maintenance (Chart 4): Models≤90kW: the distance between the compressor and the wall must be more than 27.5in, the distance between the top of compressor and the ceiling must be more than 59in; Models≥110kW: The distance between the compressor and the wall must be more than 59in, the distance between the top of compressor and the ceiling must be more than 118in.
7. For water-cooled compressor, the water pressure of the cooling water should be around 29-58PSI, both inlet & outlet valves should be installed. If there are any impurities, you should equip a filter. The requirements of the cooling water are follows:
 - a. The amount of the cooling water should meet the water flow connections of the cooler, if adopt the supply water directly whose quality conforms the requirements.

- b. When adopting the circle water, the amount of the supply water=24x water amount/ temperature of the cooler tower.
- c. If the quality of the cooling water can't meet the requirement, please enlarge the amount of the cooling water. Make sure the exhaust water temperature≤122°F.
- 8. As for air-cooled compressor, it's better to install a ventilating duct in order to drive the hot air out of the room. The exhaust pressure loss should be ≤0.23in water column, or you should add an exhaust fan, the volume of the exhaust air should not be less than the data in the following table.

When you choose air-cooled compressor, you should pay more attention to the following advice:

- a. You must take the ventilation environment into account. Do not install the compressor near the high temperature equipments in case high temperature air does harm to the unit.
- b. When the compressor must be installed in the tiny space, the ventilation equipment must be installed to quicken the air circulation. The capacity of ventilation equipment must be more than the exhaust volume of the cooling fan and the place of convulsion rim must suit the compressor's exhaust outlet.

The flow chart of the water-cooled compressor (for reference)

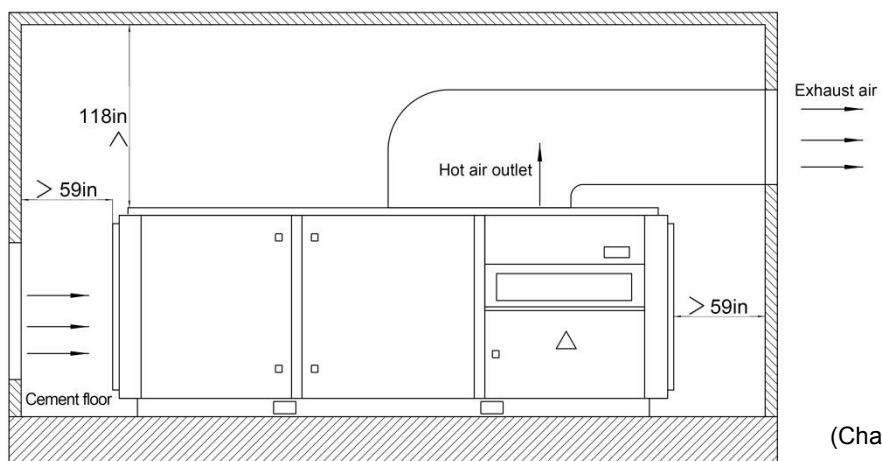


(Chart 3)

Cooling wind (Air cooled)

Motor power (kW)	Cooling air flow (CFM)
45-55	6650
65-75	9800
110-132	17150
160-180	21000
200-250	31500

The flow chart of the air-cooled compressor (for reference)



(Chart 4)

IV. Process piping

- (1) When processing the main pipe, the pipe must have an inclination pitch of 1°~2° which can help the discharge of condensed water.
- (2) The pressure of main pipeline must be lower than the 5% of the compressor's rated pressure, so if the length of the main pipeline is $\leq 1181\text{in}$, you should choose the pipe whose dimension is equal to the outlet of the compressor; if the length of the main pipeline $> 1181\text{in}$, you should choose the pipe with a bigger diameter. The longer of the pipeline is, the larger of the diameter to be.
- (3) The lateral pipeline must be joined with the top of the main pipeline. The diameter of the lateral pipeline should conform to the actual compressed air consumption.
- (4) Control valve should be installed in the outlet of the compressed air. A G1/2 bypass valve should be installed in the front of the control valve in order to exhaust the compressed air when maintaining the compressor.
- (5) If a few machines are installed in parallel and the main pipe is too long, A ball valve or automatic drain valve should be installed at the end of the main pipe to let the condensate drain out.
- (6) The main pipeline should not be reduced arbitrary. The user must use reducing pipe if the pipeline must be reduced or enlarge in case of pressure loss caused by mixed flow.
- (7) If there are buffer devices and purification devices such as compressed air receiver tank and air dryer, the ideal configuration is illustrated as (Chart 5). Then the air receiver tank can remove partly cooling water and decrease the temperature of compressed air. The air with lower temperature and less humidity can reduce the burden of air dryer and air filters.
- (8) If the user needs a lot of compressed air in a short time, the air receiver must be fixed. Air receiver with bigger capacity is a better choice (The capacity should be 30% bigger than the max instantaneous air capacity). This method can reduce the times of load and unload and keep the machine running stably. In general, the capacity of the air receiver is 20% of discharge air.
- (9) If the system pressure is less than 217.5PSI, the flow speed in the pipeline must be less than 525CFM/sec in case of the pressure loss.
- (10) All of the elbow and valve should meet the rated pressure and should be used as possible in the pipeline in case of the pressure loss.
- (11) The ideal pipeline is the main pipeline circling the whole workshop, so the user can use the compressed air in any places. Reduce pressure difference if the certain branch line increases air consumption greatly & suddenly. For examination and maintenance of the compressor, the circle pipeline must be equipped with valves.

The flow chart of the typical compressor station (For reference)

- ① Screw air compressor
- ② Air tank
- ③ Air dryer
- ④ C Line filter
- ⑤ T Line filter
- ⑥ A Line filter
- ⑦ H Line filter



(Chart5)

Working Principle

I. General introduction

DHH screw air compressor is oil-injected double screw compressor driven by belt or direct coupling. The air is compressed by the airend which is driven by an electric motor. The system will be cooled by the injection oil. The oil-air mixture flows through oil-air separator. The clean compressed air enters the cooler and then exhausts out. The cooler is used to cool compressed air and oil.

1. Working process (Chart 6)

The dust and Impurity in the air is removed by the air filter which installed at the intake valve. Then the air is compressed by rotor and stator inside of the airend which perfectly mesh with each other. When the pressure of the compressed air meets the rated pressure, the compressed air will be released to the exhaust side. Then the compressed air goes to the oil-air separator, most of the oil content in the compressed air will be separated by gravity & centrifugal force in the oil-air separator tank, after the separator tank, compressed air with quite less oil content continue goes through the cooler and the outlet.

2. Air process

Atmosphere → Air filter → Air intake valve → Airend → Oil-air separator → Min. pressure valve → Cooler → Compressed air.

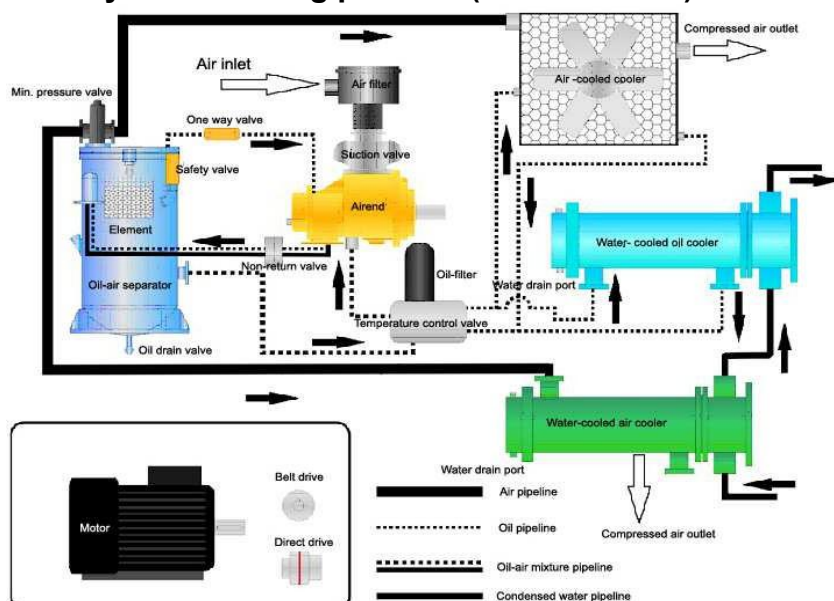
3. Lubricant process

Lubricant → Oil-air separator → Temperature control valve → Cooler (or bypass) → Oil-filter → Airend → Separation → Circle.

The hot lubricant in the oil-air separator flows into the temperature control valve. The temperature control valve control the proportion of lubricant which flow into the cooler or the bypass according to the temperature of the lubricant. So can guarantees the temperature not too low. (The water in the compressed air will be condensed in the oil-air separator if the temperature is too low and lubricant will be emulsified and reduce its useful life). The lubricant will be injected into the airend after being filtered in the oil-filter.

The circle of the lubricant will be maintained by the pressure difference between the oil-air separator and the low pressure chamber of airend. To keep the cycle lubricant, make sure the pressure in the oil-air separator is 29-43.5PSI. This is the function of min. pressure valve (the opening pressure is 58-65.2PSI).

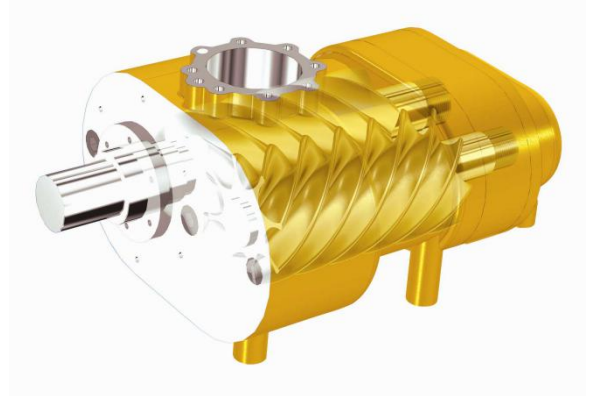
II. The chart of system working process (For reference)



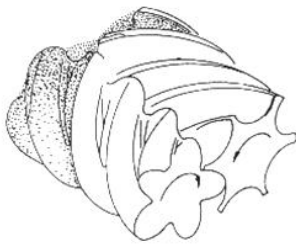
Main Functional Components

I. Airend

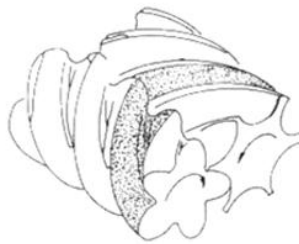
The compressor Airend (Chart 7) consists of machine parts, male rotor and female rotor, bearing and bearing seal, etc. Airend is the most important part in the unit. All the parts are precise components, so be sure to keep the dust away from the compressor. In addition, in order to ensure the efficiency of the compressor, you should ensure the appropriate environment, normal oil system and appropriate oil level. Screw air compressor is one of the displacement compressors. The air is compressed by female rotor and male rotor which perfectly mesh with each other. The rotation of the rotors in the compressor make the volume of the air change periodically and the whole process of air suction, air compressing and air exhausting are finished along the axis of the rotor from the suction side to the exhaust side.



(chart 7)



Sucking



Compressing

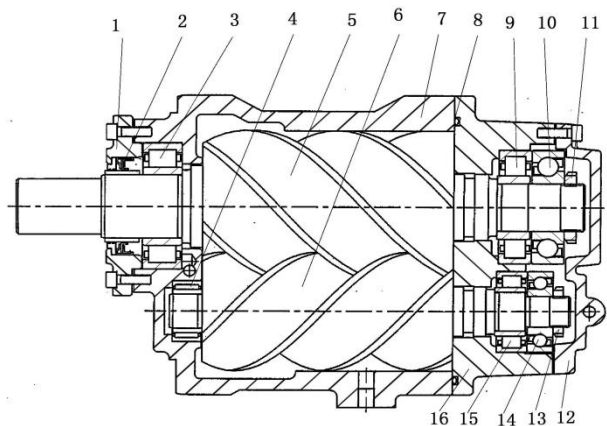


Exhausting

Three working processes of compressor

Structural Chart (Chart 8)

No.	Name	No.	Name
1	Bearing housing cover	9	Bearing
2	Bearing seal	10	Bearing
3	Bearing	11	Locknut
4	Bearing	12	End cover
5	Male rotor	13	Locknut
6	Female rotor	14	Bearing
7	Rotor housing	15	Bearing
8	Sealing ring	16	Exhaust cover



(Chart 8)

II. Air filter (Chart 9)

The air filter consists of paper-making filter element and cover. When the air was taken into the compressor, the dust was blocked outside of the filtering element and the clean air flow into the compressor. Thus, it can reduce the abrasion of parts and oxidation of lubricant. The users should clean or replace the filter element according to the time of use and its environment (Refer to the 19th page of this manual "Replace the air filter"). Clean the air filter according to the following method: Take out of the filtering element, knock on the upper/downer surface softly. Blow off the dust on the surface of the filtering element. Don't clean it with oil or water. Replace it when the filter paper is badly blocked or broken.



III. Air intake valve (Chart 10)

The air intake valve mainly consists of valve body, valve, cylinder, proportional control valve, solenoid valve, etc (The components are different according to the motor power). And there is a control unit in the lateral aspect of the compressor. The cylinder is connected to proportional control valve and solenoid valve. It has the function of proportional adjustment of air suction, on/off adjusting, noise reduction, pressure reduction and air discharge, etc. It's the air intake valve that controls the amount of the air which is sucked into the compressor. When starting the compressor, the air intake valve is closed so as to reduce the start-up burden of the compressor. When receiving the load signal, the solenoid valve will begin to work. It supplies air to the cylinder and open the valve, then the compressor is state of load. When the exhaust pressure rise up to the system rated pressure (about 7.2PSI, can be adjusted by the proportional control valve), the proportional control valve starts to work. The valve of the air intake valve becomes smaller when the pressure is higher. The displacement of compressed air becomes smaller too. We called this process "proportional adjusting process"; when the pressure rises up to the rated exhaust pressure, the PLC controller send a signal which power off the solenoid valve. Then the air intake valve will also be closed. When the pressure drops down to the rated value, the valve will be open again. Then the compressor will be running normally. This process is called on/off adjustment. When the compressor is in state of unload, a little amount of the air will enter through the gap or eyelet, which keeps the pressure of the air receiver maintaining between 29PSI and 43.5PSI and the normal operation of lubricant circle.

The function of air intake valve is auto-controlled by the system controller and the proportional valve. Then the sensitivity of the air intake valve is very important for the normal operation of the compressor. Thus, the air intake valve should be maintained on schedule. When undertaking the maintenance work, be sure to dismantle all the components. And check whether there are abrasions on the surface of the components. Pay special attention to the compressor with the cylinder; check whether there is any failure on the diaphragm in the cylinder. Before reassembling the compressor, clean all the components and lubricate all the metal parts.

The function of the solenoid valve: When unloading the compressor, supplies the pressure of separator tank for the compressor to balance the pressure between the pressure between the oil-air separator and airtend, and reduces the energy consumption and noise.



(Chart 10)

IV.Oil-air separator (Chart 11)

The Oil-air separator consists of oil-air separator tank and oil-air separator element. When the oil-air mixture discharged from the compressor airtight flow through the air-oil separation tank, the oil is separated by the air-oil separating device and flow into the oil-air separator element. Then the oil separated from the oil tank was used in the lubricating system. The little oil in the oil-air separator will be drained via the oil return pipe which is inserted in the bottom of the air-oil separator element. Then the oil will flow back into the low pressure cavity of the airtight via a one-way valve. The function of the one way valve is ensures that the oil at the bottom of the oil-air separator element is drained timely and little compressed air is discharged. The air-oil separator element will be filled with oil if the orifice is blocked. The other function of the one-way valve is to prevent the oil in the airtight from flowing back into the air-oil separator element when the compressor is stop.

There is a safety valve equipped on the oil-air separator. The compressed air will be discharged through this safety valve when the pressure in the compressor is too high. This can ensure that the compressor run safely. There is oil port and oil level detector on the side of the tank, the oil level should be kept in the middle of the oil level detector.

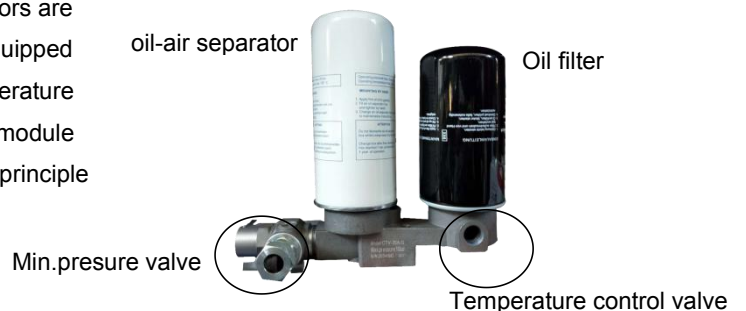
There is a differential pressure indicator on the side of the tank of the compressor, whose power is above the 185kW. The function is to check whether the oil-air separator element is blocked. The differential pressure indicator will be running when oil -air separator element is blocked. The PLC controller will warn you that the oil-air separator element should be replaced in time. In addition, please check the oil-extracting pipeline and one-way valve whether they are blocked when there is too much oil mixed into the compressed air. If not, take out of the air-oil separator element to check, if it is blocked, replace a new one.



(Chart 11)

There will be condensed water at the bottom of the oil-air separator tank when the compressor has been running for a long time. Thus, in order to prolong the useful life of the lubricant, please drain the condensed water through the oil discharge valve at the bottom of the oil-air separator tank.

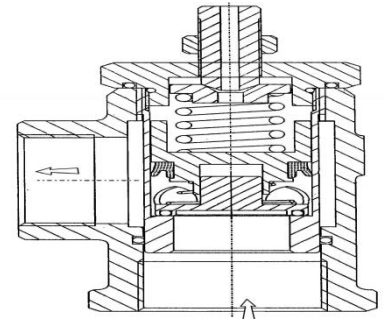
Combined screw air compressor series, the oil-air separators are external ones. The oil-air separator and the oil filter are equipped in an integrated module (Chart 12) which consists of temperature control valve and the min. pressure valve. The integrated module is equipped on the horizontal oil-air separator. Its working principle is familiar with the ones mentioned above.



(Chart 12)

V. Min. pressure valve (Chart 13、14)

The min. pressure valve equipped on the outlet of the air-oil separator tank consists of valve body, valve core, spring, seal ring, adjusting screw, etc. Its function is to be keeping the pressure in the tank not less than 36.2PSI. Then, it can guarantee that the oil-air mixture can be separated finely and the consumption of the lubricant can be reduced. Meanwhile, it can guarantee the air pressure for the circle of the lubricant. It also has the function like the one-way valve which can prevent the back flow of the compressed air. The pressure of the min. pressure valve has been preset before leaving the factory. Adjust the pressure with the professional's guidance when it has been used for a long time.



(Chart 13)



(Chart 14 Min. pressure valve)

VI. Temperature control valve (Chart 15)

The function of the temperature control valve is to control the lowest oil injection temperature. If the oil injection temperature is too low, the discharge air pressure will also be too low. Then there will be condensed water in the oil-air separator tank, the quality of the lubricant will be deteriorated gradually and its useful life will be reduced. When the oil injected temperature is higher than a certain temperature, the temperature of oil-air mixture will be higher than the dew point temperature.

The working principle is as follows: When the temperature is below 159.8°F, all the oil will flow into the airend via the oil filter by the bypass pipeline; when the temperature is above 159.8°F, the temperature control devices will expand and push the piston. Then the bypass pipeline will be closed gradually and the pipeline to the cooler will be open gradually. The ratio of flow areas of the two pipelines is controlled by the inlet oil temperature. When the oil flowing into the cooler pipeline is cooled, it will converge with the oil flowing into the bypass pipeline and then flows into the airend. The entire bypass pipeline will be closed if the inlet oil temperature is much too high. Then all the oil will enter the cooler and be cooled.



(Chart 15 all kinds of temperature control valves)

VII. Oil filter (Chart 16)

The oil filter is a paper-element one. Its function is to eliminate the impurities of the lubricant. Then it is good for the running of the bearings and rotors in the airend. The users should replace the filter element according to the time of use and whether the filter element is blocked (Refer to the 18th page of this manual “Replace the oil filter”).

It is better to equip a differential pressure indicator at the bottom of oil filter which the compressor’s power is above the 110kW. The differential pressure indicator will remind you that it is time to replace the oil filter when it is blocked.

When the oil filter is blocked seriously, it will result in the lack of oil in the airend and high discharge temperature, these will do harm to all the components of air compressor.



(Chart 16) All kinds of Oil-filters

VIII. Cooler

1. Air-cooled cooler (Chart 17)

The air-cooled unit adopts the plate-fin cooler (the air pipeline and the oil pipeline are combined together). All the materials are welded with aluminum alloys. The cooler is equipped on the top of the cooling fan, and the function is to cool the compressed air and the lubricant discharged from the air compressor. Most of the heat will be transferred by the lubricant and the forced air convection. The thermal resistance plays a leading part in the process of the heat exchange in the air-cooled unit. Thus, please clean the air-cooling fin regularly for good cooling effect. (Refer to the 20nd of this manual “Clean the air-cooled cooler”)



(Chart 17)



2. Water-cooled cooler (Chart 18)

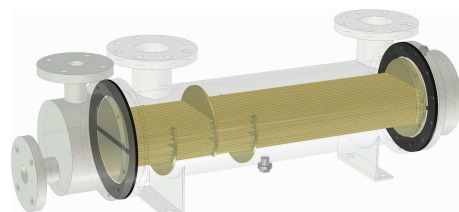
The element of the cooler consists of the high efficiency plate-fin copper tube. Most of the heat generated in the compressor is transferred by the lubricant and the forced air convection. In the process of the hot exchange, be sure to use clean cooling water in order to keep good effect of hot exchange and prolong the useful life of the cooler. And the inlet water temperature should be lower than 89.6°F. Clean the cooler at regular intervals when there is some water scale after using for a long time. (Refer to the 21nd of this manual “Clean the water-cooled cooler”)

The quality requirements of the cooling water are as follows:

1. The cooling water should be nearly the neutral, that is the concentration of hydrogen ion should be 6.5-9.5;
2. Both the organic substances and suspended mechanical impurities should be less than 2×10^{-4} LB /gal, the oil-content should be less than 2×10^{-5} LB /gal;
3. Temporary hardness shouldn't be more than 10° (Temporary hardness 1° means there are 10mg CaO and 7.19 mg MgO per liter water) .



(Chart 18)
11



Capacity control, safety device, electrical principal

I. Principle of capacity control of compressed air

The control system can control the discharge compressed air automatically according to the consumption of the compressed air and make the compressor work on the pressure between the preset max. pressure and the min. pressure. In addition, the control system is based on the pressure change of the compressed air. This system mainly consists of pressure sensor, solenoid valve, air intake valve, etc.

When the compressor starts up, it is in the state of unload and its air intake valve is closed. The air inlet will be completely open when the compressor is in the normal state. The pressure of the oil-air separator will rise gradually, the compressed air will be discharged when the working pressure bigger than the rated pressure of the min. pressure valve. The compressor is operating under full load.

The system pressure will rise when the air consumption is smaller than the rated consumption. The proportional control valve starts working when the system pressure approaches the rated pressure (rated exhaust pressure is 7.25PSI) and the air intake valve will be closed gradually. When the air consumption reduces continually, the working pressure of the compressor will rise up to maximum level. Then the microcomputer will send a signal to the solenoid valve, and the power supply of the solenoid on the air inlet will be closed. the compressor will be in a unload state. If the pressure fall down to the min. level (the max. or the min. level can be set, 0.1-0.15 in general), the solenoid valve will be power on, and the air inlet will be open, the compressor will be in a full load state.

II. Safety device

1. Safety valve

The safety valve is equipped in the oil-air separator. When there is any breakdown, the exhaust pressure will rise up to the opening pressure of safety valve. The compressed air will go through the valve core and be ejected to the atmosphere. The pressure in the oil-air separator will go down. When the pressure drops to the blow-down pressure of safety valve, the safety valve will close automatically. In general, the open pressure of the safety valve will higher than the rated pressure of the compressor by 14.5-29PSI.

2. Overpressure protection

When the actual exhaust pressure is higher than the rated exhaust pressure, pressure sensor will send a signal to the PLC controller. Then the power source will be cut down, the compressor will be stopped, the PLC will display the message of "overpressure broken"

3. High temperature protection

When the exhaust temperature is higher than the rated temperature or the motor temperature is higher than the rated temperature, the temperature sensor equipped in the exhaust hole and the temperature examination place will send a signal to the PLC controller. Then the power source will be cut down, the compressor will be stopped immediately, PLC will display the related broken information.

As for the above 250kW model there are temperature sensors in the exhaust hole and the temperature examination place, the temperature sensors are collected to with two adjustable temperature switches in the electric box. When the temperature is higher than the rated temperature and the main sensor is out of service, the sensor will send a signal to the temperature switches. Then the power will be turned off and the compressor will be stopped.

4. Blocked alarm of air intake valve, Oil filter and oil-air separator

When the useful life of air filter element, oil filter, oil-air separator achieve the rated figure set by the PLC controller, PLC will display the replace information. As for the model which power is above 185kW, it should be equipped with a differential pressure indicator, when the differential pressure is up to 14.5-21.8PSI, the differential pressure indicator send a signal to the PLC controller, the PLC will display the rated information but the compressor doesn't stop.

III. Electrical principle

The electrical principle could be seen in the “Electrical principal diagram” in the electrical box or the material bag.

Adopt Y- Δ start method. The eclectic protection functions are as follows: phase protection (Prevents the compressor from reverse-rotation), phase-lacking protection and overload protection.

Pre-operational preparations

I. Preparation before starting the machine (Refer to the PLC user manual)

1. Remove the red mark transportation fixed bolt.
2. As for the water-cooled compressor: Make sure open the inlet and outlet valve, check whether the water pipe is unimpeded and the water pressure is 29-58PSI.
3. Check all the components, if loose, fasten it in case of the oil leakage, air leakage and other accidents.
4. Check the lubricant through the view oil mirror, at the running state, keep the normal oil level according the requirement (In the middle of the red mark), and add it if not enough. When adding the lubricant, Please use our synthetic lubricant. The deteriorating of lubricant caused by the mixed usage of different brands or different type's lubricants may lead to a serious breakdown of the whole unit.
5. Rotary the compressor according to the direction of the arrow.
6. Input the copper core flexible cord with the powerful compressor into the electrical control cabinet and connect to the ground, test the voltage and the three-phase power source. Check the lines in the electrical control cabinet in case of accidents caused by the loose lines.
7. Clear away all the irrelevant components.

II. Start

1. Connect from the power source.
2. Open the air outlet valve.
3. As for the water-cooled: Examine the water pipe and the water pressure whether it is 29-58PSI.
4. Turn the red emergence stop button 90° in clockwise, the compressor will be in load state, examine whether the PLC display "normal state" or not. You can hear a sound and the PLC will display the "phase default" when the phase-sequence is wrong. Before resolving the problem, please press the red emergence stop button, disconnect from the power source. Change any two in three-phase lines, make sure there is not any default, and then can go to the next operation.
5. Start the compressor instantly; Check the direction of the compressor again. If the direction is wrong, stop the compressor and check it.
6. After normal start, make sure that the PLC display normally and there is no noise. If there is any problem, stop the compressor and resolve it immediately. If everything is ok, the pressure of the compressor will raise from 0 to rated pressure gradually. Examine the PLC display information again, if there is any problem of noise, vibration, oil leakage and air leakage, stop the compressor immediately.

7. When the compressor in normal operation, examine the controller parameter, record the running information for reference.



For the first start the atmosphere temperature is $\leq 41^{\circ}\text{F}$. Set the PLC to manual method. Stop the compressor 5 minutes after preheating compressor to change the control mode back to automatic model.

III. Matters should be paid attention to

1. Pay attention to the oil level, if the oil level drops fast and there is too much oil content in the compressed air. Resolve the problem according to the troubleshooting table(refer to page 23rd)
2. Pay attention to all the measuring appliance data whether they are in the normal range or not, the pressure of compressed air should in the rated range. The exhaust temperature should be $176\text{-}203^{\circ}\text{F}$ (As for water-cooled compressor, the exhaust temperature can be adjusted through the open degree of the water inlet valve.)
3. When the pressure difference between the oil-air separator, oil filter and the air filter is too high, the PLC will alarm. Please replace new ones even if the compressor can still run in case of the accident caused by the lack of oil.
4. When the temperature is too high, the PLC will alarm and the compressor will stop automatically. Please resolve the problems before restarting the compressor.
5. Avoid the start/stop frequently except on special occasions such as debugging/using conditions, especially starting in high pressure. The interval of the start and stop should be 5 minutes.

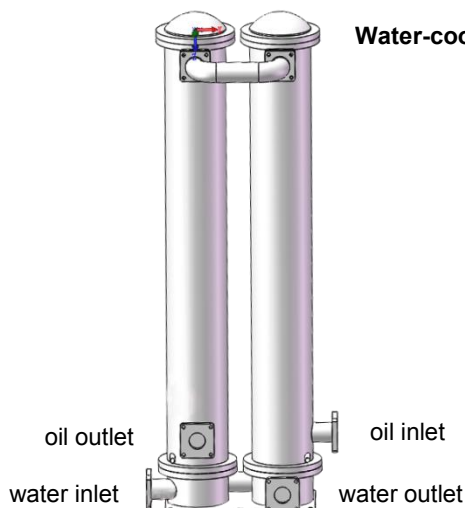
IV. Stop

Press the OFF button on the PLC controller panel if it is necessary to stop the compressor, the compressor should be stopped according to the rated procedures (Red emergence button can be used only in the emergence condition!). The blowdown valve in the air intake valve and solenoid valve on oil-air separator will discharge the compressed air after stopping the compressor,disconnect from the power source after releasing all the compressed air. Close the cooling water valve in water-cooled unit.

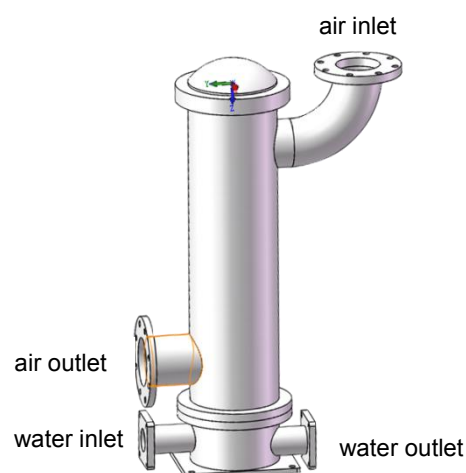


Attention:

1. Disconnect from the power source 4-5 minutes only after stopping the compressor. Then the compressed air in the compressor could be discharged completely through the solenoid valve and the compressor will be in a unload state.
2. In winter, if the temperature is below 32°F , the water inlet valve of the water-cooled unit should be closed after stopping the compressor (see the following chart) in case of the broken of cooler caused by freezing.
3. As for water-cooled unit with the power 55-200kW, the coolers are vertical-type (Chart 19), the others are horizontal-type (Chart 20), drain the water drain according to following drawing.



(Chart 20 Horizontal-type separated water-cooled cooler)



(Chart 19 Vertical-type combined water-cooled cooler)

Maintenance

I. Drain condensed water (at the bottom of the oil-air separator)

The water in the air may be condensed in the oil-air separator tank, especially in moist weather. There is a lot of condensed water if the exhaust temperature is lower than the dew point of the air or the compressor is stopped of cooling. Too much water in the oil may lead to the emulsion of the lubricant, and affect the machines' normal operation. Such as:

- Bad lubricant effect of the airend;
- Oil/air separation effect gets worse, bigger differential pressure of the oil-air separator element;
- Erosion of the components..

Therefore, please set condensed water discharging timetable according to the temperature conditions.

II. Methods of draining the condensed water:

Before draining the condensate, stop the compressor and release the pressure in the compressor. In addition, the temperature of the compressor should be appropriate and the condensate should be fully deposited. The best time to drain the condensate is before starting the compressor in the morning.

1. Twist out of the front screw plug of the ball valve (Chart 21);
2. Open the ball valve slowly till there is oil drain out, then close the ball valve;
3. Twist the front screw plug.

III. Replace the lubricant

Replace the lubricant after stopping the compressor, and make sure that the compressed air in the compressor is released completely.

Following the steps for replacing the lubricant:

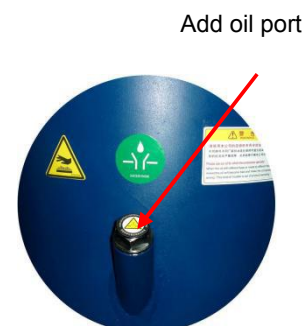
1. Run the compressor, makes the exhaust temperature up to 140-176 °C and the lubricant has been full preheated. Then stop the compressor and release the pressure in the compressor;
2. Get ready for the container for the oil, twist out of the screw plug of the oil drain ball valve;
3. Open the ball valve slowly to drain the oil (Chart 21);
4. As for the water-cooled units, twist out of the screw plug at the bottom of the cooler, in order to drain all the oil;
5. Close the ball valve, twist the screw plug;
6. Deal with the waste oil properly.

Following the steps for adding the lubricant:

1. Open the oiling port on the oil-air separator (Chart 22), add the lubricant to the oil-air separator tank;
2. As for the water-cooled units, remember to twist the screw plug at the bottom of the oil cooler;
3. Twist the screw plug and examine the oil level after starting the compressor, the oil mark should be kept in the middle of the red mark;
4. Make the record of the replacement.

Lubricant quantity of all kinds of models

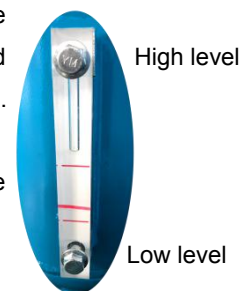
Motor power	Lubricant consumption	No.	Motor power	Lubricant consumption	No.
5.5-7.5 kW	1.85-2.1gal	2#	110-132kW	23.2-24.3gal	3#
11-15 kW	2.38-2.64gal	2#	160-185 kW	26.4-31.7gal	3#
18-30 kW	4.22-4.75gal	2#	200-250 kW	31.7-39.6gal	3#
37-45 kW	5.81-6.6 gal	2#	280-315kW	42.2-47.5gal	3#
55kW	9.51-10.5gal	2#	355-400KW	63.4-68.1gal	3#
75-90 kW	13.7-14.5gall	2#			



III. Add the lubricant

At the running state, the oil level should be kept between the min. and max. oil level(Chart 23). The separating effect may be affected if there is a lot of lubricant. The cooling performance may be affected if there is little lubricant. In the oil replace period, add the lubricant if the oil level is lower than the min. oil level. The operating steps are as follows:

1. Stop the compressor and make sure that the pressure is released completely, disconnect from the power source.
2. Open the oiling port on the oil-air separator tank; add lubricant in the tank.



(Chart 23)

IV.Lubricant (Means cooling oil)

You must use the lubricant and replace the lubricant according to the requirements strictly. The lubricant with poor quality may cause the following sequences:

-Carbon deposition or oil emulsification, oil pipeline be blocked, the valves out of services, system breakdown and burn down of the airend.

-Bad separating effect, shorten the useful life of the oil filter and the oil-air separator element.

-Shorten the useful life of the running components.

So, please use the specified lubricant for the screw compressor. Add or replace the lubricant of the same factory and same No., The lubricant of different No. and different factory can't be mixed.

- Must be the specified lubricant for the screwcompressor.

Replace period of lubricant:

The replace period of the lubricant is decided by the atmosphere, temperature, dustiness and the Acid and alkali gas in the air. The replacement should be extended or shortened according to lubricant No. and the actual environment (Refer to the page 22nd "Maintenance table"). The unused compressor should also should replace the lubricant every year.


Lubricant no. and the Replace period for reference

Lubricant No.	2#(Mineral lubricant)	3#(Mineral lubricant)
Replacement Period	Replace it every 3000 hours	Replace it every 4000 hours

Please use our specified environmental protection lubricant special for the screw compressor (Chart 24) or the lubricant authorized by us.



(Chart 24)



Attention: Some companies which replace special lubricant for screw compressor with the normal lubricant. This may cause badly sequence. So, please purchase it carefully!

DHH compressor specified original environmental protection cooling lubricant

V. Replace the oil filter

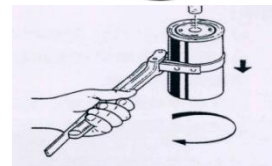
The oil-filter equipped on one side of the airend (Chart 25). Replace it every 300-500 hours after the first running, replace every 2000 hours later (refer to page 22nd "Maintenance table").

Operating steps:

1. Stop the compressor and make sure that the pressure is released completely, disconnect from the power source.
2. Pull out of the oil filter in counterclockwise(Chart 26); take care of the remained oil.
3. Check the new oil filter and the integrity of the sealing circle.
4. Fasten the oil filter in clockwise manually.
5. Check whether the oil filter is in a normal state or not.
6. Keep the replacement records.



(Chart 25)



(Chart 26)

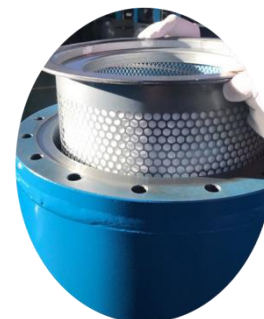
VI. Replace the oil-air separator element

The performance of the oil-air separator element is the main factor that affects the oil content of the compressed air.

The oil-air separator element is equipped in the oil-air separator tank (Chart 27), you should replace it every 3000-3500 hours(refer to the 22nd "Maintenance table") or replace it when the differential pressure indicator alarm (differential pressure is $> 14.5\text{PSI}$); or replace it once a year even if the total running hours are less than 3000 hours a year. When the quality of the compressed air or the quality of the lubricant is not good enough, the oil-air separator will be blocked easily and the differential pressure indicator will alarm ahead of time.

Operating steps:

1. Stop the compressor and make sure that the pressure is released completely, disconnect from the power source;
2. Dismantle the connecting pipelines of the min. pressure valve;
3. Dismantle oil-extracting pipeline and others control pipelines;
4. Dismantle the cover of the oil-air separator;
5. Pull out of the oil-air separator ;
6. Replace a new oil-air separator;
7. Keep the replacement records.



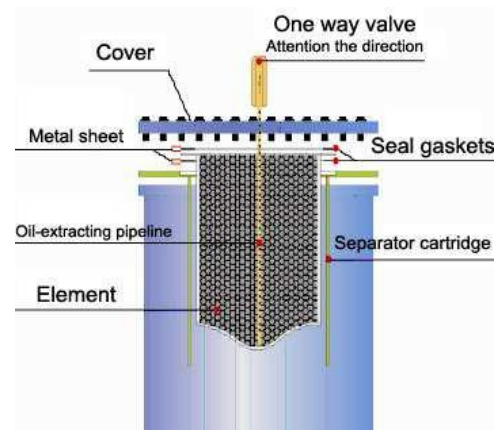
(Chart 27)



Special attention for changing the oil-air separator element

(Chart 28)

1. Make sure that the oil-extracting pipeline is inserted into the bottom of the oil-air separator element to ensure that the waste oil is drained completely.
2. Pay special attention to the two sealing washers; make sure that they are equipped with the metallic needle or metal copper fin. Please add them if not. Make sure the cover, oil-air separator element and the oil-air separator are connected with them. The function of the sheet metal is to ensure that the oil-air separator element is connected to atmosphere and prevent the oil-air separator element from collecting static which should lead to oil air explosion.



(Chart 28)

VII. Replace the air filter (Chart 29)

The useful life of the air filter is decided by the atmosphere humidity, dustiness in the air. (Refer to 22nd "Maintenance table"). Generally speaking, you should replace it every 2000-3000 hours or replace it when the differential pressure indicator alarms(differential pressure is $> 0.72\text{PSI}$). And be sure to clean the surface of the element during the period. When the quality of the atmosphere is not good enough, the air filter will be blocked easily and the differential pressure indicator will alarm ahead of time.



When maintaining or replacing the air filter, please make sure that no matters are left in the airend and cover the inlet hole of the airend. Rotary the airend several times according to the mark direction, start the compressor if there is not any trouble.

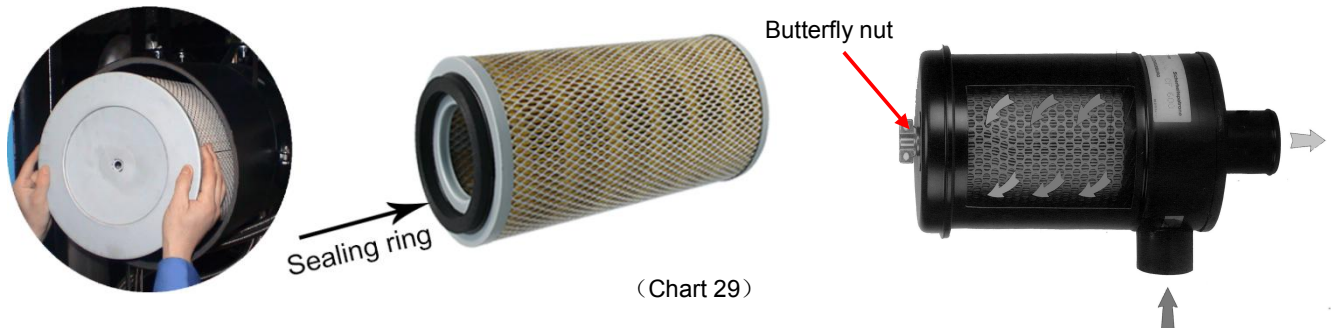
Maintenance steps of the air filter:

1. Stop the compressor and make sure the pressure is released completely and disconnect from the power source;
2. Screw off the butterfly nut, takes down the cover;
3. Screw off compression nut, takes out of air filter element;
4. Clean the filter element or replace a new one.

Clean method:

a) Knock method: Knock the upper and downer of the element gently in case break the filter element; this can remove the dust impurities on the surface of the element.

- b) Blow method: Blow up the impurities by the compressed air, but the pressure of the compressed air should be less than 58PSI.
5. Clean the impurities in the body.
 6. Equip according to the counter order. Attention: Check the end face and the head face of the element for leak test.
 7. Keep the replacement records.



(Chart 29)


VIII. Check/Adjust the automatic belt tensioning device

As for the belt drive model, please check the degree of tightness every 2000 hours. If the belt is too loose, please adjust the nut ① (Chart 30) till the belt tighten and the spring can runs. For protecting the useful life of the belt, avoid the rejection of the belt caused by the oil pollution of the oil lubricant.




(Chart 30)

⚠ CAUTION



- Before you start the compressor for the first time, make sure to move screw nut ③ and ④ back to the bottom and lock them.
- Check the tightness of the belts, adjust the screw nut ② in order to tighten the belt and spring, and then lock the screw nut ① and ②.
- You must check the tightness of the belts when the compressor running for about 2000 hours. You'd better adjust screw nut ② if the belts are too loose.
- If you relocate the compressor, rotate up the screw nut ① and ② in order to loosen the spring. Then rotate up the screw ③ and ④ to the bottom of the motor baseboard, at last lock the screw nut ③ and ④.

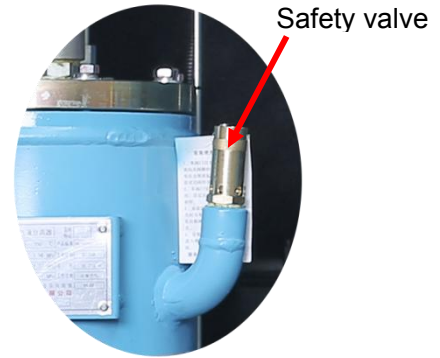
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IX. Maintenance of safety valve

The safety valve is equipped on the oil-air separator tank (Chart 31), check once a year or according to the local labor department's stipulation.

Operating steps:

1. Stop the compressor and make sure that the pressure is released completely, disconnect from the power source;
2. Screw off the safety valve;
3. Examine the sensitivity by the special testing equipment. Dismantle the seal, if necessary. Screw off locking nut. Then you can adjust the opening pressure; turn up the opening pressure in clockwise, vice versa.
4. Send the adjusted safety valve to the local labor safety department for examination, seal it when pass the examination. Then you can equip it again.



(Chart 31)

Safety valve opening pressure for reference:

Compressor working pressure PSI	101.5	116	145	188.5
Safety valve opening pressure PSI	116	130.5	159.5	207.4



Attention: The safety valve opening pressure should be less than the design pressure of the oil tank.

Customer had better not adjust the safety valve privately. If necessary, make sure that it passes the examination of the local labor safety department, or we won't take responsibility for all the sequences.

X. Maintenance of cooler

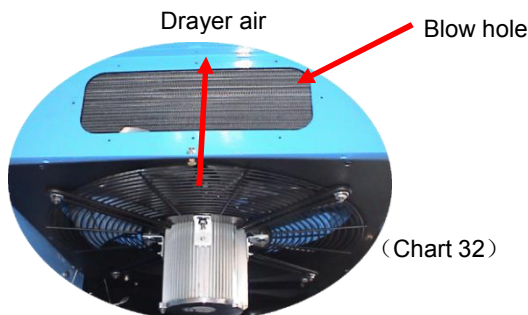
Clean the cooler in schedule according to using condition, make sure that the compressor work in the normal temperature. This can guarantee long useful life of the cooler. The exhaust temperature of the compressor will rise up if the cooler is blocked.

Therefore, clean the cooler regularly can guarantee the compressor working temperature less than 203°F. This will be good to the function and useful life of the compressor.

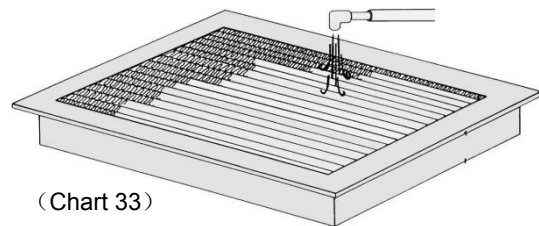
You can remove dirties by using the cleaning liquid. The clean working will be quite boring if the scales are too thick. You may have to dismantle the cooler to clean it.

1. Clean the air-cooled cooler (Chart 32、33)

Clean the surface of the radiator every 2000 hours. Open the blow hole on the side of the fan (Chart 32). Blow the dust on the surface of the cooler by the blows dust air-gun till the dust has been removed clearly. Dismantle the cooler, pure the oil into the cooler and seal the inlets/outlets in case of the entering of the impurities. Then blow up the dust by the compressed air or rush it by water (Chart 33), blow the water up on the surface, equip it again.



(Chart 32)



(Chart 33)

Attention! Don't remove the dirty by the iron brushes or other hard things in case of damaging the cooler.



Attention: The material of the air-cooled cooler is Aluminum alloy, as for the water-cooled cooler is copper. Be sure not to use the cleaning liquid which may react with the cooler.

2. Clean the water-cooled cooler (Chart 34)

The water-cooled cooler adopts the high-efficiency plate-fin cooler; Most of the heat will be transferred by the lubricant and be taken out by the convection of the water. Generally speaking, clean the water-cooled cooler every 3500 hours for the water-cooled unit.

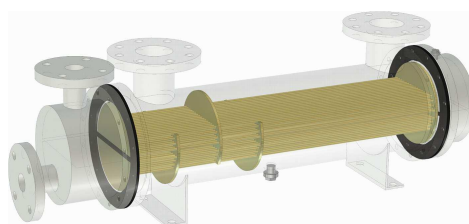
Operating steps:

1. Stop the compressor and make sure that the pressure is released completely and disconnect from the power source;
2. Disassemble the cooling water inlet/outlet water pipes;
3. Pours into the clean solution and wash out with pumps (wash in the counter direction will get a better effect).
4. Equip the inlet/outlet water pipes again;

The clean effect couldn't be good if there are a lot of scales, you can disassemble the oil cooler separately, open the covers, and remove the dirty by the steel wire or other tools.



(Chart 34)

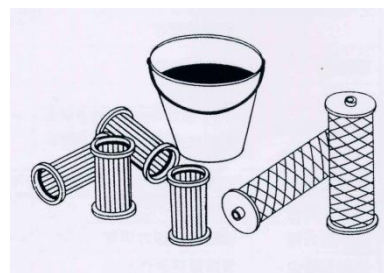


XI. Add lubricant to bearings (refer to the Motor user's manual)

Be sure that the motor bearings have been well lubricated during the running period. Replace or add the No.3 general lithium bases grease every 2000 hours. Replace the grease if the bearings are too hot or grease degeneration, the add grease take up 2/3 place of the bearing house. The oiling ports of the motor are on the covers, add the grease by the oil gung.

XII. Waste disposal

Disposal the used lubricant, oil filter, air filter and oil-air separator element should according to the related local laws and regulations.



XIII. Maintenance attention

1. Before maintaining the compressor, disconnect from the power source, release the compressed air in the compressor and make a notice board "Don't connect the power source."
2. Please use original components from our company; otherwise we will not take responsibility for them.
3. The airend is a precise component; you must send it to us for maintenance or turn to help from our designated maintenance personnel if there is anything wrong.

XIV. Sealing

1. Drain all the lubricant out and replace the new lubricant of same brand when you want to keep the compressor for a long time. Drain the water in the cooler.
2. Lay the compressor in a dry and closed place. Maintenance should be reinforced especially in the hot or humidity place.
3. The oil sealing period is 12 months (from the date of out of factory), please replace it after 12 months.

Maintenance Table

Item	Content	Check or Replace period (h)						Note
		500	1000	2000	3000	5000	8000	
Air filter element	Clear dust and impurity on the surface	△			□			Shorten or prolong maintenance cycle according to situation of dust content
Belt	Check, adjust			△				Belt-drive type
	Replace					□		
Lubricant volume check	Whether it is enough	△						
	Add lubricant				□			
Replace new lubricant	Mineral lubricant	□			□			Replace 300-500 hours for the first time
Oil-filter	Replace a new one	□			□			Replace 300-500 hours for the first time
Oil-air separator element	Replace a new one				□			
Min. pressure valve	Check/Maintain Pressure adjusting					△	△	
Dust removal of cooler	Clear dust on the surface	△						Air-cooled type
Dirty stuff removal of cooler	Remove the oil stain and water scale (Water cooled: on the water side)				△		△	Water cooled: Shorten or prolong maintenance cycle according to the quality of the water
Solenoid valve	Check				△			
Pressure gauge	Check			△				
Safety valve	Check					△	△	
Drain water	Drain the condensed water from the Oil tank							Evacuate the condensate in the gas tank and the oil-air separator tank before starting the machine every day
Dump valve	Check whether the valve is blocked			△				
Motor	Add lubricant			□				Refer to the Motor User's Manual

Check: △ Replace: □

Troubleshooting

When there is abnormal phenomenon in the function process of the compressor, find out the reasons immediately and eliminate these factors timely. Don't use the machine until they are repaired, or it would cause some uncertain loss. You can find troubleshooting procedures in the following table.

Reference table

Problem	Possible cause	Possible solution
Compressor will not start	<ol style="list-style-type: none"> 1. Fuse blown 2. Start electric appliance breakdown 3. Start button contact problem 4. Electric circuit contact problem 5. Under-voltage 6. Loss-of -phase 7. Fan motor overload 8. Problem of motor 9. Problem of airend (Unusual sound, Partial hot) 	Ask the electrical person to check or replace.
High Running Current, Compressor stops automatically. (Motor over temperature alarm)	<ol style="list-style-type: none"> 1. Voltage is too low 2. High discharge pressure 3. Oil-air separator element gets blocked. 4. Problem of airend 5. Problem of circuit 	<ol style="list-style-type: none"> 1. Ask the electrical person to check 2. Check/adjust pressure parameters 3. Replace a new one 4. Open the Compressor for examining (Inform us) 5. Ask the electrical person to check
Discharge temperature is too low	<ol style="list-style-type: none"> 1. Temperature control valve out of control 2. Unload for a long time 3. Exhaust temperature sensor out of control 4. Air intake valve out of control, the suction hole is not completely open 5. Inlet water is too big or water temperature is too low(Water-cooled type) 	<ol style="list-style-type: none"> 1. Maintenance 2. Add air consumption or shutdown the compressor 3. Check or replace it 4. Clean or replace it 5. Check or adjust the inlet water system
Discharge temperature is too high, compressor stop automatically (High discharge temperature alarm)	<ol style="list-style-type: none"> 1. The quantity of the lubricant is too low 2. Wrong lubricant spec./model 3. Oil filter gets blocked 4. Oil cooler gets blocked 5. Problem of temperature sensor 6. Temperature control valve is out of control 7. The exhaust fan does not run 8. The inlet water is too little and inlet temperature is too high 	<ol style="list-style-type: none"> 1. Check and add lubricant 2. Replace the lubricant according to the requirements 3. Check and replace a new one 4. Check and clean 5. Replace a new one 6. Check, clean or replace a new one 7. Check or replace the fan 8. Check or adjust the inlet water system
Compressed air content too much oil	<ol style="list-style-type: none"> 1. The oil-air separator element is destroyed 2. One-way valve and oil return pipe gets blocked 3. Too much lubricant 	<ol style="list-style-type: none"> 1. Replace a new one 2. Clean the one-way valve or oil return pipe 3. Drain part of lubricant

Continued from previous page

Problem	Possible cause	Possible solution
Discharge capacity is lower than normal requirement	1. Air filter gets blocked 2. Oil-air separator gets blocked 3. Leak of the solenoid valve 4. Leak of pipeline 5. Belt creep 6. Air intake valve can't completely open	1.Remove the dust or replace a new one 2.Replace a new one 3. Replace a new one 4. Replace and maintenance 5. Replace a new one or tie the belt 6. Clean or replace the damaged one
Oil Injection from the air filter after stopping the compressor	Some problems about the spring of one-way valve and the sealing ring in the one-way valve	Replace the damaged components
Movement of Safety valve	1. Used for a long time, spring is damaged. 2. Pressure control is out of service, Working pressure is too high. 3. Oil-air separator element gets blocked.	1. Replace or re-adjusting 2. Replace or re-adjusting 3. Replace the oil-air separator element

Parts and Accessories

The table is for reference only, The Parts and Accessories should be same as per the ones in the material bag.

No.	Name	Requirement	Note
1	Air filter element	*	
2	Oil filter	*	
3	Oil-air separator element	*	
4	Cooling lubricant	*	
5	Air intake valve diaphragm	*	In the cylinder of air intake valve
6	Temperature sensor	*	PT100
7	Belt	*	According to the models marked on the belt
8	Air filter tube		Air filter-Air intake valve
9	Inverse proportioning valve		
10	Pressure sensor		
11	High pressure oil pipe		

Attention: 1. Be sure to purchase the original accessories from our company. Otherwise we will not take responsibilities for any consequences caused by these factors.

2. The requirement row marked "*" is a must, you should keep at least a spare set.

3. When you purchase the accessories, Please note: a. Model and DefaultNo.

b. Accessories No., Name and Quantities.

