

Stock Code: 002158

**Quality Paradigm** 

Energy saving | High efficiency | Safety

# Fixed Screw Air Compressor (5.5~550KW) Operation Manual



### Acknowledgement

Thank you for choosing Hanbell Oil Injection Screw Air Compressors. This manual will help you better use the powerful aerodynamic compression system we provide for you. We welcome your valuable suggestions or comments at any time.

If you encounter any problems in using our machine, you may contact our Customer Service Department in the following ways. We will solve your problems as soon as possible.

- 1. 24 hour after-sale service hotline:
  - +86-400-770-2158
- 2. Welcome to our website:

  Http://www.hanbell.com.cn for online service
- 3. E-mail: hanbell-sales@hanbell.cn

We will try our best to ensure the completeness and accuracy of the manual. Hanbell will retain the right to continuously develop and improve the products without the obligation to modify and improve the products previously manufactured, and will not give notice when the product design changes.

Manufacturing License: XK06-010-01010

Model:

Serial Number:

Motor Type:

Motor Serial Number:















#### Introduction

This operation manual describes in detail the safety precautions of the screw air compressors designed and manufactured by Hanbell Company, the structure and function of each system and components, and the operation and maintenance methods.

Operators should read this operation manual carefully and be sure to operate and use the machine after well understanding the structure, function and safety precautions of each system and components. In addition to the instructions in this book, if the user does not operate and maintain according to the operation and maintenance rules in this book, or dismantles and modifies the machine by himself, or uses oil products and parts designated by Hanbell Company, you will lose the right to claim.

This manual does not provide you with a graphical catalogue of spare parts. If you need to order parts from our company, please refer to the relevant compressor Spare Part Manual. It is important to remind you that Hanbell is constantly developing and improving its products, so after a certain period of time, the contents of the Spare Part Manual may be different from the physical products. Please check with our Service Department before you order the parts.

This Operation Manual gives a general introduction to the motor and electrical system and maintenance, but before you use and maintain the compressor, if you have any questions, please contact the local distributor or the Service Department of Hanbell.

——Editor 2019/05

### **Warranty Terms**

Hanbell screw air compressor goes through strict quality management and performance test before delivery. Within the warranty period, any quality defects or faults caused by manufacturing, Hanbell will provide free products after being confirmed that the machines is under normal use, repair and maintenance.

Specific provisions are as follows:

HANBEL Screw Compressor: 18 months from the delivery date or 12 months from the date of the compressor's formal commissioning, whichever comes first.

Air-end: 6 months from the delivery date

Spare parts (exclude the oil filter, air filter, oil separator and lubricant): 9 months from the delivery date or 3 months from its trial operation whichever comes first.

For products not manufactured by Hanbell, the original manufacturer's warranty clause will be directly quoted under feasible conditions. Within the warranty period, you are required to notify Hanbell Company or its authorized distributor in writing form within 30 days when finding the defect, and attach all the detailed information for identification, including the factory serial number, model, purchase date, etc.

Hanbell will repair and replace any products or parts that has been proved to be defective according to judgment. If necessary, Hanbell Company may require the users to send defective products or parts back for inspection by prepaid freight

Under normal use, repair and maintenance, Hanbell's warranty period for the repaired products, parts or replaced parts (manufactured by its own) is 3 months or the remaining warranty period for repaired products u

Warranty terms do not apply to the following conditions, and Hanbell has no liability or obligation.

- A. Failure to operate or maintain according to this Operation Manual or fail to use consumables and oil labeled as Hanbell original.
- B. Faults caused by repairs by non-authorized personnel or designated distributor of Hanbell will not be included in the scope of product warranty.
- C. Damage caused by normal wear, abnormal operating conditions, negligent or improper use of equipment, improper storage or transportation.
- D. Not comply with the operation instructions, specifications or other special sales conditions.
- E. In any case, the seller's obligation to compensate is limited to not exceeding the selling price.

### **Legend of Warning Symbols**

In this manual, dangerous operations and matters related to safety are defined and classified according to the severity of the damage to the machine and the degree of personal injury that may be caused by the operation. The following symbols are used throughout the manual.

NOTE: unsafe factors that may cause general damage to the machine or injuries to personnel.

MARNING: unsafe factors that may cause property damage or personal injury or death.

WARNING DANGER: unsafe factors that may cause major accidents or personal casualties.

WARNING DANGER: the voltage beyond the safety level will cause serious personal casualties and unsafe factors. All electrical work must be performed by qualified electricians.

NOTE: hot surface may cause property damage or personal injury.

NOTE: important installation, operation and maintenance information.

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## **Chapter 1 Safety Rules**

#### 1. General Rules

Compressed air and compressed air system are dangerous! Before operating and maintaining compressors, you must read carefully and well understand this manual. Fail to comply with the operating procedures and safety precautions in this manual may result in accidents and casualties of yourself or other persons.

In the chapter of "Safety Rules", this manual gives a detailed description of the safety precautions to be followed and the dangerous areas during the operation of machines. Warning labels are applied to dangerous places and places before the machine leaves the factory.

Only trained and authorized personnel can operate the compressors. Before operation, you should read this manual carefully and fully understand its contents. Failure to follow the operation and maintenance rules and safety rules in the Operation Manual may result in accidents and casualties.

Never start the compressor under unsafe conditions; if the compressor has problems, do not attempt to start it, should cut off the power supply, make clear signs, so that the uninformed person will not misoperate.

Compressed air is dangerous. Repair and maintain the compressor after the compressed air in the whole compressor system has been released.

Do not change the compressor internal structure and control mode unless approved in writing by Hanbell Company

For routine maintenance, the compressor should be carefully checked every day to see if there is leakage, spare parts loose, damage, control failure or parts missing, and etc. Solve the problems in time.

#### 2. Notes

- 1) Before repairing the machine, all power supply must be cut off and locked and put a sign on it.
- 2) When the compressor shuts down, do not assume that it is safe, because the compressor with automatic starting and stopping devices, may start at any time.
- 3) This compressor is designed to compress general air. It is not allowed to compress other gases, vapors etc.
- 4) Without authorization or permission, the pressure setting of safety relief valve shall not be changed. Otherwise, it will lead to overpressure of compressor parts or systems, resulting in casualties and property losses.
- 5) When the compressor is running, do not remove any protective cover or sound insulation panel. It is forbidden to repair any part of the compressor while the machine is running.
- 6) When the compressor is running, observe the instrument and record it to ensure the normal operation of the compressor.
- 7) In accordance with the maintenance procedures, check all safety devices regularly to ensure that they are in good condition.
  - 8) The high temperature protection switch (probe) mustn't be shortened, blocked or removed.
  - 9) Follow the maintenance and repair procedures and use the correct lubricants.
  - 10) Do not open the hood when the unit is running, in order to avoid noise leakage or scald caused by

the high temperature surface.

#### 3. Pressure Release

- 1) Trial-trip the safety valve at least once a month to check for blockage or other damage. It is not allow to pull the safety valve handle when the compressor is under pressure. Once the safety valve is released when the compressor is working, because the pressure in the system is too high. The cause of the excessive pressure must be found out immediately.
- 2) Confirm that the pneumatic equipment, gas hose, fittings, valves, filters and other accessories are in good condition, and the working pressure is not higher than its rated pressure.
- 3) Before opening the oil cap of the oil-gas separator tank, shut down the compressor and ensure that there is no pressure in the tank.
- 4) Operators should not be working directly opposite to any exhaust outlet, no matter it is the outlet of the gas supply pipe or the exhaust outlet of the compressor or pneumatic equipment
- 5) High pressure fluid may exist in all components and pipes of the machine. Before disassembly and assembly, it should be confirmed that the pressure of the unit has been completely discharged. Avoid high-pressure fluid pointing to the human body.
- 6) When the machine is in operation, it is not allowed to dismantle the caps, install or dismantle any joints or devices. The high temperature liquid and compressed air contained in the machine will cause serious personal injury and even death.

### 4. Running Parts

- 1) Hands, arms and other parts of the body as well as clothes should not touch the running parts such as couplings and fans.
  - 2) Do not run the compressor if the protective cover of the fan, coupling or other parts is removed.
- 3) Wear tight clothes, tie up your long hair, wear a safety helmet, and do not wear too loose clothes to prevent accidents, especially near the high temperature surface or running parts.
  - 4) Be sure to close the doors on the compressors, exclude during repair.
  - 5) Do not fill lubricant when the compressor is working.
- 6) The capacity control valve or pressure switch may be need to be adjusted when the compressor is running, so do not touch other moving parts and electrified bodies. Other adjustments need to be done after compressor shuts down.
- 7)Don't open the soundproof shield before the compressor completely stop running to avoid accidents.
- 8) Before carrying out any disassembly and assembly work, it is necessary to wait until the motor and fan are completely stopped, and confirm that the power supply has been cut off.

### 5. High Temperature Surface, Sharp Corners and Sharp Edges

- 1)Do not touch hot oil, lubricants and high-temperature surfaces, and do not touch sharp corners.
- 2) Any part of your body should not be directed to the exhaust ports of compressor and cooling fan.
- 3) Protective equipments such as gloves and helmet should be worn when operating or maintaining inside the compressor or around it.
- 4) For some pipes or components which will produce high temperature (the machine has obvious warning signs). Don't touch until make sure that it has completely cooled.

### 6. Toxic and irritating substances

1) The compressed air provided by this machine is only for industrial use. It should not be directly

used for breathing or food processing without proper treatment. Otherwise, it will cause serious human injury, disease or death. Compressed air for breathing or food processing purposes must meet the requirements of OSHA 29 CFR 1910.134 or FDA 21XDE178.3570 standards.

2) Avoid skin contact and ingestion of lubricants. If it contacts with your skin, rinse it with soapy water. If accidentally swallowed, you should immediately seek medical treatment.

### 7. Handling

- 1) Before hoisting, the joints should be carefully checked to see if there are cracks around the chassis welding seams, whether the parts have cracks, deformation or corrosion, and whether the fasteners are loose or not.
- 2) Ensure that the hoisting equipment and lifting gear and rope used have good performance and can bear the weight of the compressor.
- 3) The lifting hook shall have a safety clasp, and the lifting lug or chain shall be firmly clamped when lifting.
- 4) Use a rope to hold the compressor in order to prevent the compressor from rotating or swaying during lifting.
  - 5) Do not hoist the compressor when the wind blows hard.
  - 6) Do not stand under the compressor when it is lifted.
  - 7) The lifting operation is not allowed to live when the compressor is lifted.
  - 8) Lift the compressor to a suitable height, not too high.
  - 9) Make sure the supporting surface is strength enough to hold the compressor when it is unloaded.
  - 10) Use iron nails or bolts to fixed the compressor base before transportation.

### 8. Electrical Safety Precautions

- 1)Once the air compressor is powered, only the electrician and electrical engineer who has obtained the certification of the National Examination will be allowed to install it. Operators must operate strictly accordance with the operating methods of this manual, as well as national regulations and safety standards.
- 2) Users and installers shall provide grounding and installation protection circuits for the compressor in accordance with national electrical standards.
- 3) Each compressor shall be equipped with a dedicated no fuse breaker (NFB). Select a NFB with suitable capacity to avoid danger.
- 4) Before any maintenance, make sure that the power is cut off, the switch is locked. Please hang a warning sign, saying "MAINENANCE! Don't switch on!" near the power switch. Make sure that the power switch is off to avoid accidents.
- 5) Personnel who is responsible for the installation of the machine must provide proper grounding for all electrical components, enough maintain space and lightning arresters.

## **Chapter 2 System Introduction**

#### 1. General

Hanbell AA/AE series screw compressor is a volumetric, single-stage or two-stage, oil-injection twin-screw compressor. It mainly include permanent magnet synchronous frequency conversion series (low pressure, atmospheric pressure, single-stage, two-stage, etc.), belt-connected, direct-connected, air-cooled, water-cooled, direct-integrated, mobile and other different types of products.

AA/AE series screw compressor motor is connected with the male rotor of the air end through belt, elastic coupling or embedded one-piece shaft direct connection structure to drive the compressor. The compressor uses Hanbell air end which is well processed, so the compressor has good power, economy and reliability.

This compressor has reasonable layout, complete functions, easy operation and maintenance, and beautiful appearance. It is composed of air, intake system, compressor discharge system, cooling and lubrication system, air volume control system, instrument control panel, electrical and automatic protection system, etc. In addition to the excellent sound absorption and insulation materials, the compressor adopts fully closed silent design, which can minimize the noise of the compressor. All instruments, indicators and control devices are centralized in the control panel, which is easy to operate. All components are mounted on a high-strength steel frame to ensure long time stable and reliable operation.

In this manual, we select one model to describe the system. The structure of rest models are similar or the same to this one. In order to keep the screw compressor you bought in the best operating condition, please read the sixth chapter of this operation manual for maintenance carefully. If you encounter any difficult questions which are not answered in this manual, please contact the local Hanbell agent or Hanbell After-sales Service Department.

### 2. Transmission System

The transmission system includes belt drive, direct drive. You can refer to Figure 2-1. Belt drive includes air end, motor, belt, pulley and other components. Direct drive includes air end, motor, coupling and other components.

Air end is a very important component for the screw compressor. Elaborately designed and manufactured screw compressor with oil injection cooling and lubrication can provide stable and non-pulsating compressed air. Compared with other types of air ends, the unique feature of Hanbell air end is its high mechanical reliability and durability. Its parts meet the requirements of "inspection-free" process, and it does not need regular maintenance and internal inspection.

In the air end casing, there is a pair of precision machined rotors with spiral grooves (male and female rotors), and there are inlet and outlet holes at the diagonal positions of the casing at both ends of the rotor. The grooves of the female rotor and the teeth of the male rotor meshes with each other and are driven by the male rotors. When working, air goes through the intake port and enters the casing. When the rotors rotate around the edge of the suction orifice on the casing, part of the inhaled air is enclosed in the enclosed screw groove composed of the male and female rotors and the casing. The enclosed volume of the screw groove varies with the meshing motion of the male and female rotors, thus realizing the continuous working cycle of suction, enclosure, compression and exhaust, and the compressed air is discharged into the oil-gas separator through the outlet port.

The transmission system of Hanbell compressor can be divided into direct connection, belt connection and integrated direct connection.

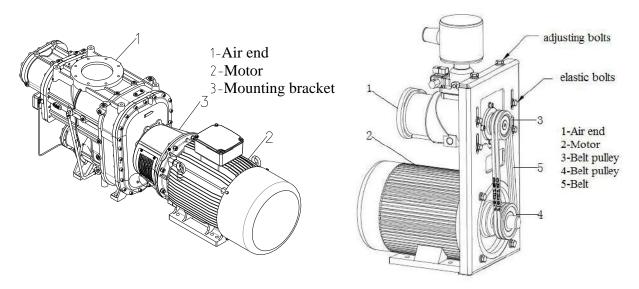


Figure 2-1 Transmission Assembly

### 3. Intake System

Refer to Figure 2-2. The function of the intake system is to provide clean air to the compressor. It includes an air filter, an intake valve and a connecting pipe. A vacuum pressure switch or vacuum indicator is installed at the outlet of the air filter.

The intake valve used in the compressor is butterfly valve or piston type. For the piston type, the air inlet is controlled by the air entering from the bottom of the piston. The more the air enters from the bottom of the piston, the greater the displacement of the piston will be, which makes the intake port become smaller and the less the intake volume. On the contrary, the intake volume increases.

The compressor equips with dry paper filter. It can handle dirty air in harsh working environment to ensure the normal operation of the compressor. In addition to the filter element, there is a cyclone separating blade ring outside the main filter element in the shell, which can pre-filter coarse dust particles. Operators should regularly remove dust particles accumulated in dust collection bags on the back cover of air filters. When the vacuum pressure switch on the air filter acts or the vacuum indicator turns red, it indicates that the flow resistance of the air filter is too large, and the main filter element should be maintained or replaced in time.

The connection elbow of the intake system adopts high quality moulded rubber pipes, which has good cold resistance, heat resistance and aging resistance. In order to ensure reliable sealing, stainless steel T-bolt clamps are used at all joints of the intake system of the unit

The filter effect directly affects the service life of the oil, oil filter, oil separator and air end bearings. If the air intake filter is blocked, the air intake will be reduced, and the air supply will be affected. Hanbell service staff will recommend the replacement of new air intake filters according to the situation of air intake dust in the field working environment and the use time displayed by the micro-controller. The micro-controller also sets the maximum using time. When the warning message on the micro-controller appears, the air intake filter must be replaced.

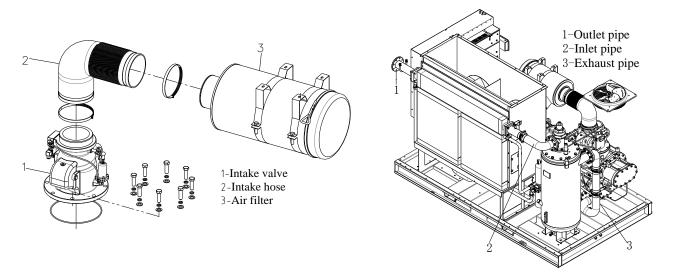


Figure 2-2 Air Inlet Assembly

Figure 2-3 Discharge Pipe

WARNING: Never tighten rubber fittings with wire, and do not use cracked rubber fittings.

### **Compressor Discharge Pipe System**

The discharge pipe system of compressor is mainly composed of exhaust pipe, oil-gas separator, minimum pressure valve, safety valve, post-cooler, etc. Please refer to Figure 2-3.

When the compressor works, the air in the groove closure volume is continuously compressed, and the heat generated in the process of compression is absorbed by the lubricant continuously injected into the groove closure volume. When the groove closure volume is reduced to a certain value (design value), the groove closure volume is connected to the outlet port, and the oil-gas mixture is discharged through the outlet port. Because a pair of rotors has several grooves, and the rotors rotate at very high speed, the compressed air continuously to be discharged.

The oil-gas mixture discharged from the air end enters the oil-gas separator. In the separator, most of the oil is separated from the air by interception, collision and direction change. The oil droplets fall into the bottom of the oil separator tank under the action of gravity. Only some very fine oil mist is left. When air flow passes through the filter element of the oil-gas separator, fine oil droplets are condensed on the filter core fiber through collision, dispersion and interception. Oil droplets condensed on the outer fibers of the filter core drop into the tank under the action of gravity; oil droplets condensed on the inner fibers eventually converge at the bottom of the filter core. A secondary oil return pipe is drawn from the bottom of the filter element and connected to the suction chamber of the compressor. Under the action of pressure difference, the oil gathered at the bottom of the filter element is returned to the suction chamber of the compressor. The oil return pipe is equipped with a throttle hole. After test, the throttle hole is confirmed to ensure the stability of oil return and the minimum gas loss. Therefore, it cannot be changed without the consent of Hanbell.

A minimum pressure valve is installed downstream of the outlet of the oil-gas separator tank. Its function is to ensure that the compressor establishes a minimum pressure in the tank at start-up to ensure the normal operation of the lubricating oil circuit, and to protect the oil-gas separator from damage due to big pressure difference, to achieve the best separation effect of oil and gas, to reduce the oil content of the exhaust, and to minimize the pressure valve when the unit stops or unloads. It is also a check valve to prevent the return of compressed air. For conventional models, the minimum opening pressure of the pressure valve is 4.0-4.5 bar, which has been pre-set before delivery.

The compressed air after oil-gas separation contains only a few lubricants of PPM (usually less than 3 ppm). The separated compressed air passes through the minimum pressure valve and enters the post-cooler for cooling and can be used by users.

The post-cooler is used to reduce the temperature of discarged compressed air, so that most of the moisture in compressed air condenses out and reduces the moisture content of compressed air, thus avoiding the problems caused by water content in downstream air.

Similarly, due to the different cooling modes, the post-cooler is divided into air-cooled and water-cooled. The air-cooled is divided into the post-cooler and oil cooler. The fan drives cooling air to blow over the surface of the cooler to play a cooling role.

Water-cooled post-coolers and oil coolers are generally arranged in series. Cooling water flows through the post-cooler first and then into the oil cooler.

A safety valve is installed on the cylinder of the oil-gas separator tank. The abnormal operation of the air compressor or the failure of the pressure sensor may cause the pressure in the oil-gas tank to rise continuously. When the gas pressure in the tank exceeds the set pressure of the safety valve, the safety valve will open automatically. The opening pressure of the safety valve has been set before delivery. In order to ensure the safety of the compressor and avoid accidents, users are not allowed to change without authorization. The exhaust pipe is also equipped with a temperature sensor. When the discharge temperature of the compressor is higher than  $105^{\circ}$ C, the compressor automatically alarms, and when the discharge temperature is higher than  $110^{\circ}$ C, the compressor automatically stops.

The screw plug at the filling port of the oil-gas separator has been specially designed to relieve the residual pressure in the tank during disassembly. The oil sight glass mounted on the cylinder is used to check the amount of lubricating oil in the tank. When the machine is not running, the normal oil level should be in the upper and middle part of the oil sight glass.

**WARNING:** Do not disassemble nuts, oil plugs and other parts when the compressor is running or under pressure. Stop the machine and release all internal pressure before maintenance operation. Don't replace or use other types of safety valves.

### 5. Compressor Cooling and Lubrication System

Under pressure, the lubricating oil flows from oil and gas separator, oil and gas barrel to cooler inlet and by-pass of the thermal control valve. Thermal control valve controls the discharge temperature of compressor to be above the dew point. At cold start, part of the lubricating oil bypasses the cooler. When the system temperature rises above the set value of the temperature control valve, the lubricant will flow through the cooler. When the compressor runs at high temperature, all the lubricants flow through the cooler. The outlet temperature of oil cooler of air compressor is controlled to eliminate the possibility of condensation of water vapor in oil-gas separator. By maintaining a sufficiently high oil outlet temperature, the temperature of the oil-gas mixture discharged from the compressor can be maintained above the dew point. Temperature-controlled lubricants are filtered through oil filters under constant pressure and then enter the air end.

There are three main functions of lubricating oil in the system:

- 1) As a coolant. The injected lubricating oil can absorb a large amount of heat generated in the compression process, thus effectively controlling the temperature of compressed air.
- 2) Fill the leakage gap between the rotor and the casing and between the rotor and the rotor to reduce the internal leakage of compressed air to improve the efficiency of the compressor.
  - 3) A lubricating oil film is formed between the rotors, which makes it easy for the male rotor to drive

the female rotor directly, and at the same time it absorbs part of the mechanical noise.

Please refer to Flow Chart 2-4, compressor cooling and lubrication system is composed of oil and gas separator, oil cooler, oil filter, temperature control valve (part of small-power models without temperature control valve) and oil pipeline etc.. For air cooling models, there are cooling fans and other components.

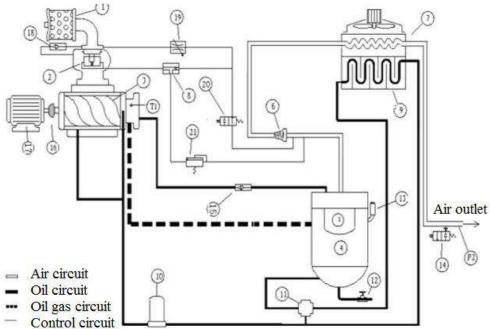


Figure 2-4 Compressor System Flow Chart

NO.	Description	NO.	Description
1	Intake filter	13	Safety valve
2	Intake valve	14	Magnetic drain valve (optional)
3	Air end	15	Check valve
4	Oil-gas tank	16	Coupling
5	Oil-gas separator	17	Motor
6	Minimum Pressure valve	18	Check valve
7	After cooler(air cooled or water cooled)	19	Throttle valve
8	Shuttle valve(optional)	20	Magnetic release valve (N.O.)
9	Oil cooler (air cooled or water cooled)	21	Proportioning valve (optional)
10	Oil filter	T1	Temperature sensor discharge temperature
11	Thermostatic valve	P2	System pressure sensor
12	Oil Drainage valve		

Table 2.1 System Components Description

Temperature control valve is a directional valve with temperature sensor. Before entering the cooler, the lubricating oil from the oil-gas separator passes through the temperature control valve. The valve will detect the temperature of the lubricating oil discharged from the oil-gas separator and automatically control the amount of lubricating oil flowing to the oil cooler. The specific working principle is that when the discharge temperature is too high, the amount of oil flowing to the cooler will be increased, and the amount of bypass oil will be reduced, so as to make the oil temperature entering the compression chamber lower to reduce the discharge temperature. On the contrary, if the discharge temperature is too low, the amount of oil flowing to the cooler will decrease and the amount of bypass oil will increase, which will increase the oil temperature entering the compression chamber and the discharge temperature. By this way the compressor can working in the normal temperature

range of 80~95°C (176~200°F) and ensure that the discharge temperature of the compressor is above the pressure dew point temperature, that avoids the condensation of water in the oil-gas separator, resulting in the emulsification and deterioration of lubricating oil.

The oil filter consists of a filter support and a replaceable rotary filter element (according to the size of the machine, the filter may have two or three elements). The oil filter element can remove impurities in the oil, improving the lubrication effect, and reducing the damage to the bearing and some parts of the compressor. Built-in bypass valve ensures smooth oil passage and normal operation of compressor when filters are dirty or oil viscosity is too high.

Hanbell after-sales staff will measure the pressure value before and after the oil filter, observe the quality of lubricant, recommend customers to replace new products after comprehensive judgment, and set the longest use time of the micro-controller. When the warning message of the micro-controller appears, the oil filter must be replaced. If the clogged filter is not replaced, it will lead to discharge temperature over high or insufficient lubrication of important parts, components and bearings, which will shorten the life of the compressor. If the filter is seriously clogged, it will lead to burning of the compressor.

Cooler is an important part of the cooling and lubrication system. It can be divided into air-cooled and water-cooled according to different cooling modes. The following is a brief description.

Air-cooled oil cooler: This cooler use aluminium plate-fin structure. The cooling fan forces air to flow through the fins of the cooler to cool the lubricating oil in the cooler pipeline. In order to maintain the normal operation of the compressor, the cooling fins of the cooler should be kept clean, and the maximum ambient temperature of the compressor should not exceed 41 °C. During routine maintenance, the surface of the cooler should be cleaned regularly, and if necessary, it can be washed with high temperature pressure water which pressure shall not exceed 3.5 Bar.

Water-cooled oil cooler: Water-cooled oil cooler uses shell-and-tube structure. Lubricating oil flowing in the shell transfers most of its heat to the cooling water flowing through the pipeline through the tube wall. Similar to the air-cooled machine, lubricating oil flows through the temperature control valve first and then enters the cooler to cool, so as to ensure that the compressor runs in the normal temperature range of 80-95°C (depending on the pressure of the compressor, etc.).

Or water-cooled post-cooler: Used to cool compressed air and control outlet temperature to avoid damage or ineffective of external dryer because of temperature over high. If the cooler is blocked or clogged, its efficiency will be reduced. Therefore, it is necessary to keep the cooler clean in daily maintenance to ensure good cooling effect.

### 6. Compressor Oil-gas Separation System

The oil-gas separation system consists of a specially designed oil-gas barrel, a two-stage aggregated separation core and a cooling oil recovery device. Refer to Figure 2-5. The basic working principle of oil and gas barrel: when the gas oil enters through the entrance, the oil droplets in the oil and gas mixture can be separated by impacting against the barrel wall. Oil and gas barrel uses centrifugal principle and relies on the gravity of the oil droplets themselves to separate larger diameter oil droplets from the gas. Oil droplets with diameter larger than 1um can be separated effectively by using centrifugal principle. When the oil-gas mixture acts by centrifugal force, the oil molecules are controlled in a certain range of velocity so that the oil droplets fall to the bottom of the oil-gas barrel during the discharge process. The oil contained in the discharged air can be reduced. In addition to storing lubricating oil, the oil-gas separator uses the principle of centrifugal force to separate the

oil-gas mixture initially. The separation effect will affect the separation effect of oil separator, and then affect the oil content in the air. The side of the barrel is equipped with oil level indication, which can directly see the oil level. There is an oil drain valve at the bottom to drain the condensate water in the oil and gas barrel before starting the air compressor and for regular maintenance and replacement of lubricating oil.

Oil separator consists of two layers of fine glass fibers, which can filter oil slick molecules in the compressed air. The filtered oil concentrates in the central groove and flows back to the compressor through a return tube to avoid being discharged with air. The oil content in air can be controlled below 3PPM under normal operation under rated pressure. Dust in working environment, quality of lubricating oil, filtering effect of oil filter and whether water in oil and gas barrel is removed before start-up have great influence on the service life and separation effect of oil separator. When blocked or separation effect is not good, the oil contained in the compressed air increases, resulting in oil throwing. Hanbell service personnel will recommend customers change new products or not basing on the working environment, the dust condition of air intake, the quality of lubricating oil and the total number of hours used by the micro-controller. The micro-controller also is set the maximum usage time. When the warning message of the micro-controller appears, the oil separator must be replaced.

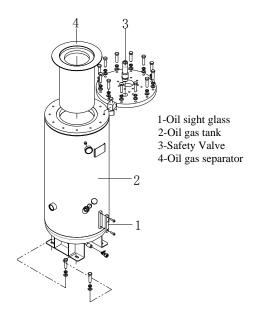


Figure 2-5 Oil Gas Separation System

### 7. Compressor Gas Regulation and Control System (Frequency Converter)

Below the frequency converter compressor with rated pressure 8 bar is taken as an example:

This series of compressors are equipped with standard automatic control system. When the compressor works continuously, and the speed of the motor is controlled by PID to match the demand for air. When the system pressure is lower than the rated pressure of 8 bar, the motor starts to accelerate. When the system reaches the rated pressure of 8 bar, the motor starts to decelerate. When the pressure continues to rise, the motor continues to decelerate until unloading, idling or immediately entering a dormant state. When the system pressure is lower than the loading pressure, the motor starts to speed up again or wakes up after dormancy to restart the compressor, so the system goes round and round.

Generally, the control system of compressor has been set up before delivery, so users don't need

to adjust it. If adjustment is necessary, please refer to the Operation Manual for controller.

The compressor uses the frequency control to regulate the air flow, that is, by controlling the speed of the motor to control the displacement of the compressor in order to achieve stable pressure and air flow. There are five working conditions of the compressor: A. starting condition; B. load operation condition; C. regulating operation condition; D. unloading condition; E. dormant condition. The working principle of the 8 bar rated pressure model is introduced as an example.

WANRING: Do not think that maintain the compressor when it is not running is safe. Compressor may be in "awake" state, and may start at any time. Please strictly follow all the relevant provisions in the "Repair and Maintenance Regulations".

### 7.1. Starting Condition

After electrified, the controller has 3-5 seconds of self-checking process during which the compressor won't start by pressing the button "ON". After self-inspection, press button "ON" to start it. The fixed frequency starting process is as follows: the controller output terminal is delayed to close, which is star triangle step-down starting. The controller sends start signal or terminal start or communication star. Then the frequency converter starts and the motor starts to run. The compressor intake valve opens and inhales a small amount of gas under the action of instantaneous vacuum. At this time, the loading solenoid valve belongs to normal open. At the same time, after inhaling a small amount of gas, the gas pushes the vent valve to open and the oil-gas separator is in the vent state. At this time, the initial inhaled gas pushes the vent valve to empty the gas and enters the valve chamber cylinder to push the cylinder to close the intake valve core. After the switching time and the loading delay time, the loading solenoid valve is loaded and operated electrically, the exhaust valve is closed, the intake valve chamber cylinder pneumatic pressure is released and the intake valve core is opened, and the compressor is loaded and operated. The system pressure rises rapidly to about 4.0 bar to 4.5 bar.

#### 7.2. Loading Condition

When the system pressure exceeds 4.0 bar to 4.5 bar, the minimum pressure valve opens and the compressor begins to discharge gas, which is the load. The solenoid valve is kept in normal closed state, the intake valve is in full open state, and the compressor is running during loading progress. Subsequently, the system pressure quickly reaches the rated pressure, and the unit enters the normal load operation condition.

#### 7.3. Condition during Adjustment

After the motor starts, the air compressor begins to load and the pressure in the gas tank begins to rise. When the pressure rise exceeds the set pressure value of 8 bar (variable frequency working pressure value), the controller controls the frequency converter to reduce the speed of the motor, thereby reducing the pressure. But if the pressure does not exceed the upper limit of the pressure, the PID analog output of the controller will drive the converter to reduce the lowest frequency and the corresponding lowest motor speed; When the pressure is lower than the set pressure value (variable frequency working pressure), The output analog of the controller PID increases, the frequency of the converter increases, and the speed of the motor increases, thus increasing the pressure, but the maximum value of the output of the controller is the upper limit of the frequency converter. When the pressure exceeds the set upper pressure limit, the controller controls the frequency converter to run directly at the lowest frequency or enter the dormant state. The load solenoid valve loses power. Only when the pressure is lower than the lower pressure limit, the controller will reload the increase frequency. If the idle running time exceeds the idle shutdown time, the controller controls the air

compressor to shutdown.

#### 7.4. Unloading at Automatic State

In the automatic state, the equipment is in the unloading state, click on "ON" or "M" to load the solenoid valve to get power. If the pressure is higher than the working pressure of the frequency conversion, the controller reduces the output frequency according to the control algorithm. If the pressure is lower than the working pressure of the frequency conversion, the controller increases the output frequency according to the control algorithm. When the pressure is near the working point, the controller automatically adjusts to the stable output. When the pressure continues to rise beyond the upper limit, the load solenoid valve loses power and the controller outputs the unloading frequency until the pressure is lower than the lower limit. In loading state, click "ON" or "M" to unload, load solenoid valve loses power, and the controller outputs unloading frequency until the pressure is below the lower limit.

### 7.5. Compressor Stop

When the controller receives the order to stop, the load solenoid valve loses power until the stop delay countdown is completed.

#### 7.6. Local manual control (start-stop mode: local; load mode: manual)

Start-stop control is the same as automatic control, but after the start-up of the equipment, it is in unloading operation. Press the load/unload button, the air compressor loads. When the supply pressure exceeds the unloading pressure, the equipment unloads automatically. In the unloading process, press the unload button, the machine unloads; in the loading process, press the unload button, the machine unloads.

## 8. Compressor Gas Regulation and Control System (Fixed Frequency

### Model)

This series of compressors are equipped with intelligent controllers and standard automatic control systems, which provide manual control and automatic control models. In the manual control mode, users can load or unload according to actual gas demand.

When the unit chooses the automatic control mode, the compressor works continuously and controls the activity of the intake valve through differential pressure to match the air demand. When the system reaches the unloading pressure (normally the rated pressure plus 0.6Bar), the solenoid valve acts to force the intake valve to close and the compressed air in the oil-gas separator is emptied. At this time, the compressor still works, but no compressed air is produced. At the same time, the machine enters the state of unloading/timing. After the end of the timing period, the compressor automatically stops and enters the state of "waiting". When the system pressure drops to the loading pressure (generally 0.7Bar lower than the rated pressure), the controller (pressure switch contact closed) sends out instructions, the timer is reset, and the unit is automatically restarted.

When the unit starts up, the delay period of the timer can be set, generally the minimum is 15 minutes.

Compressor air flow regulation and control system has different configurations according to different types, which can be mainly divided into the following two situations: 1. Simple on-Off control; 2. According to the actual air flow requied, the air intake can be automatically adjusted while maintaining the compressor's supply pressure unchanged. The system is mainly composed of the following components:

Intake control valve, pressure regulating valve, pressure switch, unloading valve, throttle hole,

muffler, solenoid valve and pressure relief valve, and fittings and joints connecting components

For the simple configuration machine, the operation of the machine has three main states: A. start-up condition; B. load operation condition; C. unloading and shutdown condition. See the following description for the specific meaning.

Generally, the air intake control and control system of the compressor unit has been set up at the time before delivery, so the user does not have to adjust it. If adjustments are necessary, please refer to the procedure for setting rated operating conditions in Section 7 of Chapter IV of this Operating Manual.

The compressor adopts air volume regulation mode of intake throttle, that is, by controlling the opening of the intake valve to control the air intake of the compressor, so as to achieve the purpose of air volume regulation. There are four working conditions of the compressor: A. starting condition; B. load operation condition; C. regulating operation condition; D. unload operation condition. The compressor model with 8 bar rated pressure model is introduced as an example to describe its working principle.

WARNING: Do not think that maintain the compressor when it is not running is safe. Compressor may be in "awake" state, and may start at any time. Please strictly follow all the relevant provisions in the "Repair and Maintenance Regulations".

### 8.1. Starting Condition

Press the start button, the motor starts in a star shape, and the compressor intake valve opens under the action of instantaneous vacuum to inhale a small amount of gas. At this time, the capacitive control valve closes, the 1 and 3 ports of the unloading solenoid valve remain connected, and the vent valve opens, which makes the oil-gas separation tank remain in the empty state. A small amount of gas inhaled at the instant of start-up enters the intake valve and forces it to close through the above-mentioned solenoid valve. A small amount of air through the small holes on the intake valve plate (or a small gap between the valve plate and the valve body) is allowed to enter the compressor, so that the starting pressure of the compressor can be basically maintained in the range of 2.0-3.5bar.The compressors of different specifications have different values, and the compressor has realized light load start-up. After setting time (usually 6-10 seconds), the motor is converted to delta operation. At this time, the unloading solenoid valve and the vent valve are closed. The intake valve is opened under the action of suction vacuum. The compressor is loaded, and the system pressure rises rapidly to 4.0 bar.

#### 8.2. Loading condition

When the system pressure exceeds 4.0 bar, the minimum pressure valve opens and the compressor begins to supply gas outward. At this time, the 1 and 2 ports of unloading solenoid valve remain open, and intake valve is in full open state, compressor loads. Subsequently, the system pressure quickly reaches the rated pressure, and the unit enters the normal operation condition. The unit operates continuously in this state unless the customer's gas consumption changes.

#### 8.3. Condition during Adjustment

When the customer's gas consumption is less than the rated discharge volume, the pressure in the system will increase. When the pressure exceeds the rated pressure of 0.6 Bar, the capacitive control valve acts to control the gas entering the intake valve and reduce the opening of the intake valve, thereby reducing the air intake volume of the compressor. The throttling effect of the intake valve is proportional to the pipeline pressure. The greater the pipeline pressure is, the smaller the opening of the intake valve will be and the throttling effect will be more obvious. The regulating range of the

volume control valve is 100%-20%, and the corresponding pipeline pressure is 8.0-8.6 bar.

If the demand for compressed air increases at this time, the pressure in the oil-gas separator will decrease. When the pressure drops below the pressure setting value of the volume control valve, the volume control valve will be closed, thus controlling the intake valve to open completely, so that the unit will run again at full load.

#### 8.4. Unload & Compressor Stop

When the customer's gas consumption continues to decrease to less than 20% of the compressor's rated air flow, the pipeline pressure will exceed the set value of the controller (pressure switch) 8.6 bar. At this time, the normal closed contact of the controller (pressure switch) will be disconnected, the unloading solenoid valve will be cut off, and the air will enter the intake valve, so that the intake valve will be closed. When the vent valve is opened, the compressed air in the oil and gas separator is released, and the compressor pressure is maintained in the range of 2.0-3.5 bar depending on a small amount of air intake from bypass pipe of the intake valve, which ensures the circulation of lubricating oil in the oil system. Within this pressure range, the minimum pressure valve closes, separating the user's pipeline from the compressor, and the unit will operate without load under a lower pressure, thus saving energy consumption.

If the gas consumption increases, the pipeline pressure decreases. When the pressure is lower than 7.3 bar, the contacts of the controller (pressure switch) are closed, the unloading solenoid valve gets electricity, the compressed air in the oil-gas separator stops releasing, the control gas in the piston chamber of the intake valve is discharged into the atmosphere from the throttle hole, and the intake valve is opened under the action of the suction vacuum, and the unit enters the load operation state.

For the simple configuration model, when the customer's gas consumption is less than the rated displacement, the pressure in the system will rise, but the compressor has no regulation function. When the pressure rapidly rises to the unloading pressure (8.6Bar), the controller (pressure switch) acts, and the unit will unload until shutdown.

### 9. Electrical System and Automatic Protection

Electrical system is a control system to realize compressor start-up, shutdown, parameter display and automatic protection. This system mainly includes motor, starting cabinet (frequency converter cabinet), instrument cabinet, contactor, transformer, wiring terminals and cables, as well as various protective switches.

**NOTE:** Relevant information is provided when the compressor before delivery. In order to avoid misoperation, please refer to the electrical schematic diagram when maintaining and repairing the electrical system.

The standard driving motor protection level is IP23/IP54/IP55, and the maximum ambient temperature used is  $41^{\circ}$ C. This standard motor is not suitable for saline, corrosive, dirty, damp and explosive occasions

The voltage of this series standard compressor is 380V/50HZ. The transformer in the control box reduces the power supply voltage to 220V for the secondary control circuit to work. The controller mainly includes overheating (current) relay, timer, high temperature switch, solenoid valve, indicator lamp, transformer, etc.

For air-cooled compressor, a special contactor (or fan converter) is used to start the cooling fan to drive the motor. The starter receives the instructions from the controller, controlling the start, stop (or speed) of the fan according to the program.

Automatic protection is an important part of the compressor. Its function is to ensure that the compressor cannot start or it will stop automatically in time under abnormal conditions, thus playing a role in the safety protection of compressor and its motor. This function mainly includes: compressor discharge temperature overhigh protection, current overload protection (thermal relay), voltage relay, safety valve and so on. When the compressoring is running, all the automatic protection devices except the safety valve can stop the unit. The control devices are described in detail below.

- $\bullet$  Compressor discharge temperature over high protection When the discharge temperature of the compressor reaches  $110^{\circ}$ C, the controller sends out instructions to cut off the power supply of the motor to stop the compressor.
- Current overload protection When the compressor is overloaded for some reason, and the current through the motor exceeds the set value, the controller gives instructions to cut off the power supply of the motor to stop the compressor.
- Overload Relay When the compressor unit is overloaded for some reason, the current flowing through the relay exceeds the set value, and the contacts in the relay will be disconnected due to the electric and thermal energy, and the power supply of the motor will be cut off to shut down.
- Phase sequence protector This series of compressors are equipped with phase sequence protector. Before delivery, the motor connection has been properly configured. If the user's power supply connection phase sequence is wrong, phase absence or over/under voltage, the machinet cannot start to ensure the safety of the compressor.

**WARNING:** High voltage will lead to serious casualties. Cut off the power supply before conducting electrical maintenance and opening the electronic control box.

Do not dismantle, jump over or damage the high temperature safety switch. Without this safety function, serious personal injury, casualties and property losses may occur. If the machine is shut down due to high temperature, please contact qualified service personnel immediately.

### 10. Panel Assembly

The outer panels of the compressor is elegant in design and has good ventilation. Its sealing performance is good, which can effectively prevent the infiltration of rainwater. Refer to Figure 2-6. The noise of the unit can be significantly reduced by the heat-resistant and flame-retardant sound-absorbing materials inside the panel. Nameplate and warning labels are pasted on the panels.

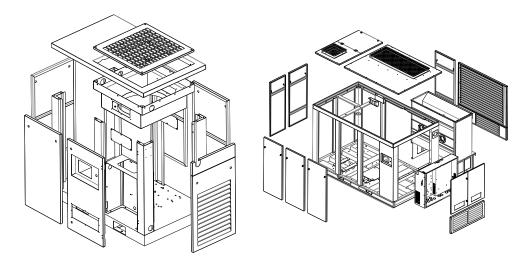


Figure 2-6 Panel Assembly

## **Chapter 3 Installation and Acceptance**

### 1. Installation, Acceptance and Storage

The proper transportation, installation and maintenance of machine determines the integrity and normal use of the equipment. Therefore, it is required to check if there are damage caused by transportation should be checked immediately after receiving the machine. If damage is found, the carrier is required to sign the shipping documents and make a damage report. If the damage was not found in time, but found afterwards, please inform the carrier within 7 days after receiving the goods, and ask the carrier to make a damage report. Detailed report is very important for the treatment of the loss (claim).

Please check if the specification on the nameplate of the air compressor is consistent with your purchase order. At the same time, check the oil and gas separator and safety valve to confirm whether the designed or set pressure is correct. For compressors that do not install temporarily or not operating for a long time, protection and maintenance schemes must be set up to ensure the normal operation of the compressor, especially the air end.

- o After opening the box, the handling and installation of the compressor should be carried out strictly according to the handling precautions. There are two forklift holes under the base of the compressor. During handling, pads should be placed to prevent the compressor panels from being damaged by the forklift (see Figure). If the sling is used, the cross bar must be used. The cross bar can offset the side pressure of the sling on the box. Note: It is not advisable to put some protective material between the sling and the unit noise shield, which will crush the upper door panels on both sides of the unit.
- 1.1. Please check if the specification on the nameplate (Figure 3-1) of the air compressor is consistent with your purchase order.

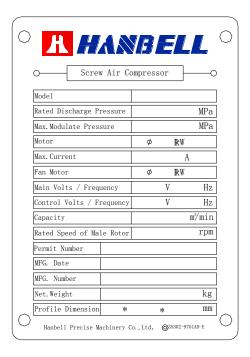


Figure 3-1

Note: The compressor model is compiled according to Hanbell coding principle; model specification is compiled according to national standard JB/T 2589-86

### 1.2. Accessories and Appearance Inspection

After receiving this air compressor, please check whether the attached spare parts are complete. If there are any fabrication defects, please contact us immediately. One Operation Manual, one Warranty Card, and two keys are provided as the accessories of the compressor.

#### 2. Installation location

In order to ensure the correct installation and reliable operation of this machine, it is necessary to read this chapter before installation.

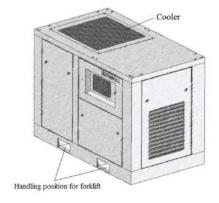
#### 2.1. Requirement for Environment Condition

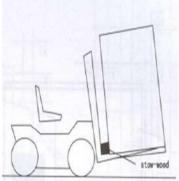
- 1) It is better to install the air compressor in a room with good ventilation and lighting. Avoid installing it in places with much dust, high humidity, erosive gas, metalline dust, direct sunlight or direct rain shower.
  - 2) Environmental temperature:  $0^{\circ}$ C~41°C.
- 3) When installing the air compressor outdoors, keep it away from boilers and any equipment that may produce huge amount of heat. Flashing shed should be arranged, and attention should also be paid to the effect of environment ventilation.
- 4) At least 1500 mm maintenance room must be set aside in the surrounding air compressor and the upper ventilating fans (Fig. 3.1).
  - 5) Altitude shall not be higher than 1000 meters. Relative humidity shall be below 95%.

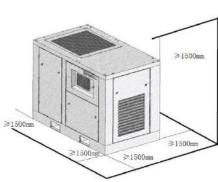
#### 2.2. Inspection and Handling

The contents in this chapter should be read in detail to protect the rights of customers. When handling, please follow the way described in Figure 3.2 to prevent accidents and unit damage.

Things need to pay attention during handling: Please select the appropriate stacker or crane according to the weight of the air compressor. During the lifting process, it is strictly prohibited to stand under the air compressor and keep the safe distance as far as possible. The compressor can be moved by hydraulic vehicle or by stacker in the direction of the following sketch. It can also be lifted by traveling crane.







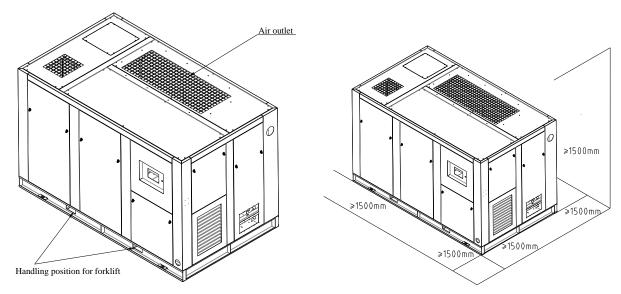


Figure 3-2

#### 2.3. Requirement for Installation Site

The screw air compressor can be positioned into any floor slab that can bear the weight of the compressor without special base as long as the ground is even and horizontal. But when installed on steel frame, moving ships or vehicles, the air compressor must be fixed with anchor screws, and at the same time, using damping pad to buffer vibration of the machine sets.

#### 2.4. Requirement for Ventilation and Cooling

Ventilating condition should be kept well when installing indoors or outdoors to avoid short cycle of hot gas or interactions of thermal exhaust of machine. Thus the location of ventilation pipe, ventilator and air compressor should be taken into consideration carefully (in general there are three arrangement methods, see Fig. 3.3).

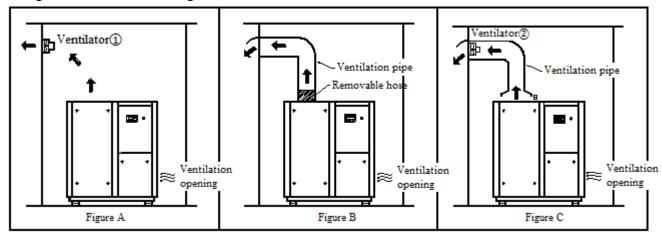


Figure 3-3

#### Note:

- 1) Figure A: When ventilation pipe is not used for ventilation, please refer to Air Flow (1) written in Table 3.1 for recommended external ventilation, and please install the ventilator as high as possible.
- 2) Figure B: When ventilation pipe is used but ventilator is not installed, it's necessary to calculate the air flow of the air compressor and the pressure loss in the ventilation pipe. When pressure loss is less than 20Pa, the ventilator doesn't need to be installed, but please install removable ventilation hose directly at the ventilation hole. (Ventilation design indicated in Figure. A and C are recommended)
- 3) Figure C: When pressure loss inside the ventilation pipe is more than 20 Pa, ventilator needs to be installed, and the distance between ventilation pipe and ventilation hole of the air compressor shall be

from 200mm to 300mm. The Air Flow (2) written in Table 3.1 is recommended. The ventilation amount needs to be considered when the ventilator is selected. Also pressure loss & temperature increase of the discharge air shall be taken into account.

NOTE: Don't put anything on the cooler above the sheet metal. Covering is strictly prohibited to avoid high temperature jump of the unit.

### 2.5. Air Flow Requirement of the Ventilator

Air Compressor Cooling Method	Air cooled					
Motor Power kW	55	75	90	110	132	
Air Flow(1) m <sup>3</sup> /min	540	900	1125	1350	1650	
Air Flow (2) m <sup>3</sup> /min	240	340	470	500	500	
Air Compressor Cooling Method	Air cooled					
Motor Power kW	160	185	200	250		
Air Flow (1) m <sup>3</sup> /min	2000	2300	2500	3125		
Air Flow (2) m <sup>3</sup> /min	750	750	750	1100		

Table 3-1

**WARNING:** Do not run the compressor above the maximum operating temperature limit.

Do not place the compressor in the environment with high temperature waste gas that is exhausted by other compressors or heat load equipments. Do not hinder the exhaust of air-cooled compressors. It should be directed outdoors, so as to avoid causing high ambient temperature in the compressor room. If the compressor room is poorly ventilated, it may cause high temperature shutdown of the machine. Do not place compressor in basement or in the place with bad ventilation. Considering the possibility of oil contamination by water, it is necessary to control the operating temperature of the compressor and monitor the lubricating oil of the compressor.

**NOTE:** The normal operation of compressors requires sufficient clean air.

**NOTE:** Removal or alteration of the noise shield will produce high noise and endanger human health.

Screw compressor runs smoothly, basically without vibration, so it can be placed naturally without the need for foot connection. However, if the user needs, the compressor can be bolted to prevent the machine from being displaced by collision, resulting in pipeline damage or electrical connection damage. At this time, please be careful not to tighten the bolts too tightly, so as to avoid the distortion of the machine chassis caused by the bolts too tightly, resulting in the cracking of oil coolers, pipes and gas storage tanks.

WARNING: Do not install or expose compressors to toxic, volatile or corrosive gases or store similar substances near them, otherwise serious casualties and property losses will be caused.

If the working condition is poor and the dust is heavy, a special heavy duty air filter must be installed to maintain the service life of the air compressor system parts.

For the design, installation and use of compressor station, please refer to GBJ29-90 Code for Design of Compressed Air Station.

### 3. Storage and Maintenance

The screw compressor, especially its air end, which has been specially designed and precisely processed, so it must be strictly maintained and maintained in accordance with the manufacturer's operating specifications and requirements, otherwise it may cause property losses and personal injury accidents. When the compressor is to be put in place for a long time or stop running for a long time, it must ensure that the place is clean, dry. Empty the water accumulated at the bottom of oil and gas storage tank, cooler (especially water cooler), steam-water separator, pipeline water filter and other parts. Regularly inspect the main parts and joints of the compressor to ensure that there is no leakage and rust. at least every month start-up. Let the compressor run at least 60 minutes every month to ensure the good lubrication of the air end. Check carefully before starting, change the lubricating oil if necessary, and carry out 2 hours full load operation test of the compressor, record data, and ask qualified professional service engineers for guidance.

### 4. Piping

Air cooler in the machine will reduce the temperature of discharge air to a point that is far below dew point (for most environment condition), so a great amount of water will be condensed. Therefore, a drain valve for condensation water needs to be installed near the air outlet of the air compressor and a drain pipe shall be connected to the drainage device on the bottom frame.

NOTE: A piece of transparent drainpipe shall be installed in the exhaust pipe system in order to ease the check of the working status of the automatic drain valve. If the rear pipe system further cools down the air, condensate water may be produced again, so another drain valve need to be installed at the lower position of the pipe system.

NOTE: The diameter of the air outlet pipes shall be at least the same size as that of the air compressor exhaust piping. All pipes and joints must be compatible with the maximum working temperature of the machine sets, and its rated pressure shall be at least the same as that in the air-oil tank of the air compressor.

It is necessary to check the joint size of the air compressor. Proper length and diameter of the pipes, quantities and types of the joints as well as the valves should all be taken into account to maximize the efficiency of the air compressor. To ensure the safety of the whole system, it is important to review the air system of the factory when a air compressor is installed.

Condensate water is due to be produced in the air line during air compression. The water vapor in the environmental condenses when pressed, and to be cooled down then turned into water in the following air line. The water in the compressed air needs to be eliminated in almost all the air compressor overall pipe system. Thus it needs to be paid more attention to by every customer when the air compressor is used, also during the design of the air lines and normal maintenance.

Problems caused sue to moisture:

- 1) The inner system of the air compressor has water, which will make the lubricant emulsification, air compressor fouling and even stuck.
- 2) The pipes of the outer system of the air compressor has water, which will make the system rust, fouling and including the following conditions
- 3) Instrument stuck
- 4) Control valve stuck
- 5) Risk of outdoor air pipe frozen when the temperature is low

Any problem mentioned above may cause the factory to stop production partially or completely. The dryer in the post treatment devices can reduce the density of the water vapor, and prevent

forming water in the air line. The combination use of dryer, filter, after cooler and automatic drain valve can improve the air quality of the air system. To solve the problem of water containing in the outer air system of the compressor, two dryers can be used, i.e. refrigeration dryer and regenerating dryer. When the dew point requirement of the compressed air system is 1-4°C, the refrigeration dryer is generally used, while the dew point requirement is below 1°C, the regenerating dryer shall be used. Please contact Hanbell's local branch office or authorized dealer to help you choose the proper dryer.

NOTE: If there is no pulse isolation device (e.g. shared air storage tank), the screw air compressor cannot be connected to a reciprocating compression system. We recommend you to connect two types of air compressors to a shared air storage tank by using individual air line.

When several air compressors are installed in parallel (optional), it is necessary to install a stop valve and a drain valve on each air compressor before the shared air storage tank.

### **⚠** NOTE:

- 1) When several air compressors are installed in parallel, a drainage device must be installed after end of the air exhaust.
- 2) Before starting up the machine, please open the drain valves of the air-oil tank and that of the gas storage tank to completely drain the condensate water. This prevents emulsifying of the lubricant of the machine sets so that the air compressor won't be stuck due to oil deterioration.
- 3) Be sure to periodically check the drainage performance of the drainage device of the post treatment device of the outer system to ensure the normal operation of the outer and inner system of the air compressor.

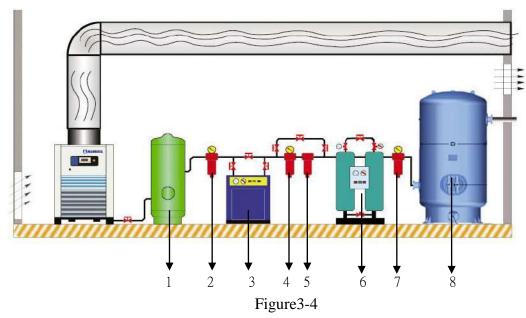
### 5. Air pipes Piping Suggestions

- 1) Depending on the diameter of the air compressor outlet pipe, the pipes with same or larger diameter can be used to connect to the air tank to avoid pressure decrease. The pressure drop of piping shall not exceed 5% of the set pressure of the air compressor.
- 2) For convenient maintenance and repair in the future, compressor air outlet pipe shall be connected to the air tank via flange. A stop valve (close to the air tank) needs to be installed to help isolate the air system without releasing the pressurized air which is precious in the future maintenance.
- 3) During piping, the flexibility of the pipeline shall be considered and resonance of the pipe lines shall be avoided. The air line shall have an angle with at least 1-2 degree so that the water in the air line can be smoothly drained.
- 4) To avoid too much water condensed in the pipeline to affect the function of the equipment, generally a dryer is to be installed after the air tank to removing the moisture.
- 5) In order to avoid the influence of thermal expansion and contraction of pipelines on the system, flexible expansion joints or hoses are installed in the pipeline system when necessary. Pipelines should be supported and fixed independently to reduce vibration and prevent expansion and deformation. In any case, the pipe size shall not be smaller than the connecting size of the discharge pipe of the compressor.
- 6) The branch line must be connected from the top of the main line to avoid condensation water flowing into the working machine or back to the air compressor.
- 7) After the air compressor, if there are purification buffer facilities such as gas storage tank and dryer, the ideal piping should be air compressor + gas storage tank + dryer. In this way, the gas storage tank can filter part of the condensate water, and the gas storage tank also has the function of reducing the gas exhaust temperature. Air with lower temperature and less water contained can reduce the load of the dryer when the air enters it.

- 8) The flow rate of the compressed air whose system pressure is less than 1.5 MPa in the conveyor pipe should be less than 15 mm/sec to avoid excessive pressure drop.
- 9) The ideal piping is that the main line surrounds the entire plant, so that compressed air can be obtained on both sides at any location. If the gas consumption of a branch line suddenly increases, the pressure drop can be reduced. And in the ring trunk line with appropriate valves, in order to facilitate repair and cut off.

Please refer to framework below for standard arrangement of air system.

please contact Hanbell for special arrangement of air with different quality requirement or application.



NO.	Description	NO.	Description
1	Air storage tank	5	Oil filter
2	Prefliter	6	Adsorption dryer
3	Refrigerant dryer	7	Fine filter
4	Fine filter	8	Air storage tank

Table 3-2 System Components Description

#### 6. Foundation

- 1) Foundation should be built on hard soil. Make sure the ground is flat before installation to avoid vibration of air compressor.
- 2) If the air compressor is installed upstairs, it should be well treated to prevent vibration from spreading downstairs or generating resonance. There are safety concerns about the air compressor and the building itself.
- 3) The vibration produced by the screw air compressor is very small, so it does not need foundation, but the ground should be flat, and the ground should not be soft soil.

### 7. Cooling System

1) The cooling water of water-cooled air compressor must conform to the general industrial water standard, refer to Table 1. When the compressor shuts down for a long time, especially in cold weather conditions, the cooling water in the cooler, gas storage tank and other containers must be discharged completely to avoid parts damage.

Item	UOM	Cooling water	Supplementary water
PH (25°)	μ S/cm	6.5-8.0	6.5-8.0
Conductivity (25°)	mg/l	< 800	<200
Total hardness (CaCO <sub>3</sub> )	mg/l	<200	<50
Acid consumption (CaCO <sub>3</sub> )	mg/l	<100	< 50
Chloride ion (CI)	mg/l	<200	< 50
Sulfate ion (SO <sub>4</sub> <sup>2-</sup> )	mg/l	<200	< 50
Iron (Fe)	mg/l	<1.0	<0.3
Ionic silica (SiO <sub>2</sub> )	mg/l	< 50	<30
Sulfide ion (S <sup>2-</sup> )	mg/l	0	0
Ammonia ion (NH <sub>4</sub> <sup>+</sup> )	mg/l	<1.0	< 0.2

Table 3-3 Quality Standard of Cooling Water

- 2) The automatic replenishment system of cooling water circulating system should be improved, otherwise, after several hours of operation, the insufficient cooling water will cause the air compressor to jump out due to high temperature. Cooling water towers should be placed with easy heat dissipation, good ventilation, and support and fix to prevent dumping.
- 3) The water pressure of cooling water should generally be maintained between 0.3 and 0.6 MPa.
- 4) If it is an air-cooled air compressor, the ventilation environment should be paid special attention to. The air compressor should not be placed near the high temperature machinery or in the confined space with bad ventilation, so as not to cause compressor jumping out because of the high exhaust temperature. If it is used in a closed system, it is necessary to install pumping and ventilation equipment to facilitate air circulation. Generally speaking, the single air volume of pumping and ventilation equipment should be larger than that of the air compressor.

### 8. Installation of Safety Facilities

#### 8.1. Safety Valve (relief valve)

Safety valve is a pressure relief device for protecting the system. It has been set up before delivery. You cannot change its pressure setting or block the valve at will. Only the safety valve manufacturer or qualified agent can do this work.

Safety valves should be located before the potential blockage points, including globe valves, heat exchangers and exhaust mufflers (but not limited to that). In theory, safety valves should be directly connected to pressure-bearing pipes or containers, rather than connecting them with pipes. The gas discharged from safety valves should be directed to safety place, away from the crowd.

"WARNING": Pressure vessels specified in GB (or ASME) shall not be altered, welded, repaired or reprocessed, nor shall they be allowed to be used beyond the nameplate rating. Otherwise, warranty clauses will be affected and serious casualties and property losses will be caused.

#### 8.2. Protective shield

All mechanical movements are dangerous to some extent, so protective shields should be installed. This series of compressors are equipped with necessary protective facilities in accordance with national and industrial standards. Users should check regularly and maintain them. They cannot be changed or dismantled at will.

#### 8.3. Manual Relief Valves and Globe Valves

It is recommended to install a manual vent valve in the customer's air system. The purpose of

installing the manual vent valve is to discharge air from the compressor and its exhaust pipe into the atmosphere. When the system storage tank is only used with a single compressor, the vent valve can be installed on the storage tank. If the system has a globe valve installed, the manual vent valve should be installed upstream of the globe valve. This configuration ensures that personnel and equipment are in a safe state during maintenance and repair.

If only to isolate the compressor from the system for maintenance, be careful not to replace the globe valve with a check valve

**WARNING:** Manual vent valve, compressor and system pressure must be opened before repairing the machine. The negligence in system pressure reduction may lead to serious personal injury, death and property loss.

#### 9. Electrical installation

Before installing electrical appliances, we recommend that you review the safety precautions written in the previous of this manual and find the nameplate of the compressor or motor. The nameplate lists the working pressure, the maximum discharge pressure, and the characteristics and power of the motor. Make sure that the circuit voltage is consistent with the voltage specified in the nameplate of the air compressor. Open the door of the control box and make sure that all electrical appliances are connected correctly and firmly. Be sure that the supply voltage of the control transformer is correct. Check whether the motor and control circuit are firmly connected. Check whether the power supply, power cord and transformer capacity are in line. Appropriate fuses or circuit breakers should be equipped. When installing motors, connecting wires, cables and all electrical components, they must comply with relevant national electrical standards and local specifications. The compressor must be well grounded and the door of the control box should be closed. Qualified electricians can undertake the above work. Refer to the electrical wiring diagram of the compressor.

Please refer to JB6213.5-92 National Standard and the following list of specifications to select appropriate specifications of air compressor main power cord, grounding wire and switch (NFB) to ensure the safety of electrical appliances. The safe current of power line is set under the conditions of 35 °C, operating temperature below 55 °C, line length less than 20 meters and PVC line of 600 V. When the power line cannot meet the above setting conditions, the specification of power line should be increased to avoid the overrun of voltage drop and the failure to start the air compressor, and even to cause electrical hazards.

- 1) It is better to use separate power system for air compressor, especially to avoid parallel connection with other different power consumption systems. Using parallel connection may cause the overload of air compressor due to excessive voltage drop or unbalanced three-phase current and cause the protection device to jump. Please pay special attention to high-power air compressor should this requirement.
- 2) The correctness of the voltage of the air compressor must be confirmed when it is distributed. The grounding wire of air compressor should be erected, and the grounding wire should not be directly on the air conveyor pipe or cooling water pipe.
- 3) The air compressor must pull a grounding wire to the ground to prevent danger caused by leakage of electricity.
- 4) Limited to the size of the control box, a single cable should not be too thick. If the cross-section area of the power line is large, please use two or more power lines to replace it. When using multiple power lines, each power line must be balanced in three phases. Otherwise, it will cause cable overheating and unbalanced synthetic voltage. The input power

supply voltage shall be kept within the rated voltage (+10%) and the three-phase voltage difference shall be within 3%. The air compressor must have the correct grounding wire, otherwise the noise may be connected to any control system in series, and cause interference. If the grounding problem cannot be improved, the controller may have fluctuations in temperature, current and pressure values.

5) When the grounding wire and the power line are placed together in a hose or cable, the movable electrical appliance shall have the same diameter as the power line.

		Current under	Customer Power Wire	User's NFB	
Rated power	Current	Service	Diameter	Specification	
(kW)	(A)	Coefficient	Calculation of Carrier	Not less than the	
		(A)	Flow at 40°C	following current(A)	
5.5	11.0	12.7	4*6m <sup>2</sup>	19	
7.5	14.7	17.6	4*6m <sup>2</sup>	26	
11	21.0	25.2	4*6m <sup>2</sup>	38	
15	28.4	34.1	4*6m <sup>2</sup>	51	
18.5	34.4	39.6	4*8m <sup>2</sup>	59	
22	40.6	48.7	4*8m <sup>2</sup>	73	
30	55.1	66.1	4*10m <sup>2</sup>	99	
37	67.5	81.0	4*10m <sup>2</sup>	122	
45	81.8	98.2	3*16m <sup>2</sup> +10m <sup>2</sup>	147	
55	99.5	119.4	3*25m <sup>2</sup> +16m <sup>2</sup>	179	
75	135.0	162.0	3*50m <sup>2</sup> +25m <sup>2</sup>	243	
90	166.7	200.0	3*70m <sup>2</sup> +35m <sup>2</sup>	300	
110	195.0	234.0	3*70m <sup>2</sup> +50m <sup>2</sup>	351	
132	233.0	279.6	3*95m <sup>2</sup> +50m <sup>2</sup>	419	
160	288.6	346.3	3*120m <sup>2</sup> +70m <sup>2</sup>	519	
185	326.0	391.2	3*150m <sup>2</sup> +70m <sup>2</sup>	587	
200	352.0	422.4	3*180m <sup>2</sup> +95m <sup>2</sup>	634	
220	390.0	468.0	3*180m <sup>2</sup> +95m <sup>2</sup>	702	
250	443.2	531.8	3*120m <sup>2</sup> +70m <sup>2</sup> , Qty:2	798	
			Parallel connection		
290	496.4	595.7	3*150m <sup>2</sup> +70m <sup>2</sup> , Qty:2	904	
280			Parallel connection	894	
315	545.0	654.0	3*150m <sup>2</sup> +70m <sup>2</sup> , Qty:2	981	
400	707.0	848.4	3*180m <sup>2</sup> +95m <sup>2</sup> , Qty:2	1273	

Table 3-4 Selection of User Power Wire and Air Switch

Note: Voltage specification is 380V, 50/60Hz. For other voltages, it depends on the current withstanding capacity of the cable.

### 10. Water Supply and Drainage (water-cooled)

Ensure the smooth connection of water supply and drainage pipelines. The user's water pipelines shall have at least the same diameter as that of the compressor. Drainage equipment should be easy to

install and connect. And it should meet the local drainage standards and the requirements of the compressor itself. Ensure the correct connection of water supply and drainage pipelines.

**WARNING:** Removal or erasure safety signs can result in a state of no prompt information, which may lead to personal injury or property damage. Warning signs should be highlighted and placed in a well-lighted eye-catching position, with clear handwriting, and do not move warning signs and other incidental instructions.

### 11. Adjustment and Calibration of Belt

- 1) Use a ruler (accuracy < 0.5mm) to measure the perpendicularity of two pulleys with the same datum, and the allowable error is less than 0.5mm.
- 2) If the verticality error is more than 0.5mm, use gasket to adjust the mounting foot of the air end or oil and gas tank to ensure that the vertical error of the same base level does not exceed 0.5 mm.
- 3) Air end and oil and gas tank shall be secured with bolts.
- 4) Assemble the belt to the pulley.
- 5) Based on the small pulley, the plane straightness of the two pulleys is measured with a ruler or a laser measuring instrument. The allowable error is less than 0.5mm.
- 6) Tighten the belt with motor adjusting screw. The tightening requirements are shown in the attached table.
- 7) Conversely, the plane straightness of the two pulleys is checked again based on the large pulley, and the allowable error is less than 0.5mm.
- 8) Lock the screws and nuts.

### 12. Coupling Correction

It is recommended to re-check the alignment of the coupling after the installation of the user's compressor, so as to ensure that the coupling connection deviation is corrected within the allowable range before the machine starts. If the machine is moved, this work must be carried out every time to avoid efficiency reducing, the coupling lifetime shorten and noise increasing caused by the alignment problem of the coupling. The correction method of coupling is detailed in the company's specific manual.

## **Chapter 4 Operation Procedures**

#### 1. General

This series of screw compressor units are equipped with a series of control components and display/indication components. In order to ensure the normal operation of the compressor, it is necessary for the operator to operate the machine correctly. It is also necessary for the operator to make a correct judgment according to the display/indication value or condition. Before starting the compressor, the operator should be familiar with the position, function and usage of control/control components and display/indication components.

#### Compressor Start

- 1) Remove debris and tools around the compressor
- 2) Remove bolts or fixtures for transportation.
- 3) Check oil level to ensure it is in normal position (see Lubricating Oil Chapter).
- 4) Check the alignment of belt or coupling when necessary.
- 5) Check the fan to ensure that it is firmly installed.
- 6) Manual turning to ensure no mechanical interference.
- 7) Check that all pressure pipe joints are firm and no loosen.
- 8) Open the air supply valve.
- 9) Check and ensure that the safety valve is well installed.
- 10) Check that all shields and protective devices are safe and secure.
- 11) Check whether the specifications of fuses, circuit breakers and thermal overload protection devices or the current settings of controllers are suitable and correct.
- 12) Check the intake and drainage pipes of water-cooled compressor to ensure that the connection is correct and reliable, and the cooling water has been opened.
- 13) Check whether the air filter is installed reliably.
- 14) Turn on the power switch and turn on the power indicator. Click start button, check the compressor steering to ensure that the compressor steering is consistent with the specified steering.

### 2. Normal Starting Steps

- 1) Open the cut-off valve to the air supply system
- 2) Preset the control parameters and press the start button.
- 3) Observe whether the compressor after starting has abnormal vibration, noise and gas/oil leakage. If problems are found, please stop immediately and correct them.
- 4) Close all the doors to control the noise of the compressor and ensure the normal flow of cooling air.
- 5) Slowly close the gas supply stop valve and check whether the unit is unloaded according to the setting. See Chapter VI for setting and adjusting the operating parameters.
- 6) Check whether the indicative values of each state parameter are normal.
- 7) For water-cooled compressors, please check the inlet water pressure and adjust the water path ball valve to keep the discharge temperature within the normal range.
- 8) In the first hour of compressor operation, please observe the operation carefully. In the next seven hours, observe at any time. If there is any abnormality, please stop and repair.
- 9) After the initial operation, stop the compressor, check whether the oil tank needs to be filled with

lubricant, and check whether the connections are loose.



- 1) In order to prevent lubricant foaming which leads to the system oil filtering efficiency lose, and in order to protect the motor, the time interval between two start-ups of the compressor should be no less than 5 minutes.
- 2) Condensate water at the bottom of the oil-gas separator should be released regularly. The operation of releasing condensate water should be carried out before starting the compressor.
- 3) Regular (weekly) discharge the condensate water at the bottom of the control line filter. The operation of releasing condensate should be carried out before compressor starting.

#### 3. Downtime Procedures

- 1) Press the stop button.
- 2) Close the shutoff valve to the air supply system.
- 3) Cut off power supply.

NOTE: Closing the shutoff valve during shutdown can avoid leakage and damage of the parts caused by the back flow of compressed air to the compressor of the air supply system due to the damage of the check valve.

4) Emergency stop: under abnormal circumstances, press the emergency stop/reset switch to shut down and cut off the power.

**WARNING:** In the non-emergency state, it is not allowed to press the emergency stop button, otherwise it will affect the life of the shaft seal and other negative effects.

# Chapter 5 Setting and Adjustment of Working Condition Parameters

Refer to the manual for the intelligent controller operation (model: power frequency or frequency conversion) attached randomly.

# **Chapter 6 Maintenance**

# 1. Preparation Before Maintenance

In order to ensure the normal operation and long service life of the compressor, good maintenance is very important. Therefore, the maintenance of screw compressor must be carefully implemented. Before proceeding with the maintenance, please read the first chapter of this manual carefully and make the following preparations at least:

- 1) Before carrying out any disassembly and assembly work, it is necessary to wait until the motor and fan are completely stopped, and confirm that the power supply has been cut off. During air compressor repairing or maintenance, a warning sign should be placed on the starting device, which says "WARNING: MAINTENANCE, DO NOT START THE COMPRESSOR". When repairing the compressed parts, the internal compressed air should be completely discharged before construction.
- 2) Close the shutoff valve to the air supply system to prevent the compressed air from flowing back to the repaired part.
- 3) Open the manual vent valve to completely discharged the system pressure, and keep the vent valve open.
- 4) Regarding water-cooled compressors, the water supply system must be shut down and release the pressure of the water pipeline.
- 5) Ensure that the compressor has been cooled to prevent scalds and burns.
- 6) Clean the oil and water marks on the ground to prevent slipping.
- 7) Maintenance schedule for oil filter, air filter and oil separator

No	Running Time	Maintenance	Note
1	First time 500 hours for new compressor, then	Change the lubricant or depend	
	every 3000hours, depend on the oil	on the condition of the oil	
2	Every 3000 hours or once a year	Change oil separator	
3	First time 500 hours for new compressors, then	Change oil filter element	
	every 3000hours		
4	Every 3000hours or once a year	Change air filter element	

NOTE: Under bad working conditions, the maintenance period should be shortened appropriately.

**A"WARNING":** The compressor's automatic control system may start the compressor at any time, so do not think it is allowed to maintain the compressor when it is stop.

Poor maintenance not only affects the normal operation of the compressor, but also may affect the safety of operators

Do not disassemble nuts, filling plugs and other parts when the compressor is running or under pressure.

Flammable solvents, such as gasoline or kerosene, should not be used to clean air filters or other components. Safe solvents should be used according to instructions

# 2. Maintenance Schedule for Screw Compressor

NOTE: Only trained and qualified maintenance personnel are qualified to maintain the machine.

#### 2.1. Compressor Lubricant

The screw air compressor designed and manufactured by Hanbell can use the synthetic lubricating oil listed in the table below. Each compressor manufactured by Hanbell has a lubricating oil label indicating the type of lubricating oil added to the compressor. Different types of lubricants can adapt to different ambient temperatures and load conditions, and oil change schedule is also different. Only by using the special synthetic lubricant of Hanbell can have the corresponding quality assurance service.

Lubricant Model		Period(Hours)	Operation Temperature °C
HBA-C05		3000	≤105°C
HBA-C01		6000	≤110°C
HBA-B03		6000	≤110°C

For standard compressor, HBA lubricant is usually added before delivery. The lubricant is a special screw compressor oil supplied by the manufacturer. It runs reliably and has a long replacement period.

Do not mix oils of different types or trademarks. Otherwise, it will cause operational failures such as foaming of lubricating oil, blockage of filters, blockage of throttle holes or pipelines, and reduce the life of compressors and lubricating oil.

When the machine is running, please check the lubricating oil level regularly. Every Hanbell compressor is equipped with oil sight glass on the oil-gas separator. The normal oil level should be between the upper and lower lines of the oil sight glass. If the oil level of the oil separator drops below the downline of the oil sight glass after shutdown, the compressor needs refueling, but make sure to do it only when the compressor is shut down and completely discharged. When replacing the new oil, the old oil in the system must be completely released, otherwise the service life of the new oil will be shortened. Usually when changing oil, oil filter and oil separator should be replaced at the same time.

The method of oil change is as follows: confirm that the compressor power switch is turned off, release the pressure in oil-gas separator. Open the oil drain valve of oil-gas barrel and the cooler, and put a container under it to hold the old oil in the oil-gas barrel and cooler. Turn off the oil drain valve once the oil is completely drained—and turn on the power to restart the air compressor and let it run for about 3 seconds, then cut off the power supply. Make sure that the oil-gas barrel has no pressure, then open the drain valve again under pressure-free state to release the residual oil. Tighten the drain valve when refueling the oil and put a container under the oil and gas barrels and coolers to hold the oil. For the first time, the oil and gas barrel is full, please restart the compressor and check if the oil level in the middle of the oil sight glass. If it is lower than half of the it, stop the compressor and refill the oil. Make sure the oil should not be too full.

- 2.1.1. Factors Affecting Lubricant Life
- 1) Abnormal high temperature operation
- 2) Pollution
  - a) Other types or brands of lubricants
  - b)Strong oxidizing substances, such as

- Acid
- Sulfur
- Chloride
- Nitrogen oxide
- Welding waste gas
- Ozone
- c) Ammonia
- d)Solvent-based soot
- e) Air dust

Place the compressor in a cool place with good ventilation to ensure that it runs in the normal temperature range, otherwise the oil consumption and oil contained in the oil will increase, and when the operating temperature exceeds 95°C (generally refers to compressors under 10 bar pressure), the service life of lubricating oil will be halved when the discharge temperature increases by 10°C, so the above lubricating oil operating temperature should not exceed 95°C.

#### 2.1.2. Lubricant Analysis Plan

Hannell provides oil analysis service for all customers. The oil analysis detects the total acid value (TAN), viscosity and other indicators of compressor lubricants, providing users with the best oil change cycle, maximizing the protection of customers' compressor. The general oil product analysis plan is recommended as follows. For details, you can ask the agent or the service department of Hanbell.

NOTE: Oil samples must be collected when compressor stops operation, preferably from the oil filter interface, which can accurately reflect the current quality of lubricating oil.

- Fist time lubricant change:500hours
- Every 3000 hours
- Abnormal situations such as high fuel consumption, oil leakage of shaft seal, lock of nose and so on.
  - Whenever necessary.

**WARNING:** Lubricants under high temperature and high pressure can cause serious burns and even casualties. It is forbidden to unscrew the injection plug during operation or when there is pressure in the machine. If you want to refuel, first confirm that the equipment is turned off, and the power supply of the equipment has been cut off, and the equipment has not been able to start automatically.

#### 2.1.3. Drainage and Replacement of Lubricating Oil

Condensate water at the bottom of oil and gas separator tank should be drained regularly. When the water in lubricating oil exceeds 200 PPM, the lubricating oil will be seriously emulsified, which will cause damage to the air end and bearing, so it is necessary to replace the lubricating oil. When changing oil, it is forbidden to mix different kinds or brands of lubricants. Otherwise, the warranty clause of compressor will be invalid. If you really need to use other kinds of lubricants due to special circumstances, please contact Hanbell dealers or Hanbell Service Department.

For HANBEL lubricant, under normal maintenance and working conditions, it shall be replaced when the compressor works for 3000 hours or after a year, no matter which comes first; regarding other suitable lubricants, please refer to the oil change periodic table in this section or contact the Hanbell dealer.

Stop the compressor before replacing the oil filter element, and carefully wipe the dirt and oil to prevent impurities from entering the lubrication system. According to the maintenance instructions,

the service life of the filter is about 2000~3000Hrs. The use time of the filter may be lengthened or shortened according to the environmental conditions, dust, the efficiency of the intake filter, and the degree of daily cleaning and maintenance of the unit. However, when the oil filtration effect is poor, it must be replaced so as to avoid damage to the air end.

The oil filter element of a new compressor shall be changed after 500 hours. The oil filter should be replaced whichever the following conditions occurs.

- The filter (pressure differential) alarms under normal operating temperature, at this time the pressure differential of the filter exceeds 1.7 Bar (25psi).
  - Every 2000 hours
  - When it's time to change the lubricant
  - When the oil sample is tested unqualified.

NOTE: Air compressor controller alarms in the cold morning after the start, showing "filter resistance large", which is due to the high pressure difference caused by the low fluidity of lubricating oil. Please monitor the indicator after the compressor operating temperature is normal. If there are signs that insoluble deposits have formed on the filter element of the oil filter, indicating that the compressor lubricating oil cannot work properly, it must be replaced immediately.

The steps for oil filter element replacement and adjustment:

- 1) Apply a thin layer of lubricant to the surface of the new gasket before disassembly
- 2) Place an container under the filter procedure to hold the spilled oil.
- 3) Use special disassembly tools for oil filters to disassemble the old filter elements and gaskets.
- 4) Tighten the filter element by hand for 1/2-3/4 turns.
- 5) Restart the compressor and check for leakage.

MARNING: In order to minimize the possibility of filter core breakage, only products provided by Hanbell can be used, because other substitutes may not match the pressure of the unit.

#### 2.2. Safety Valve

If dirty blockage occurs in the safety valve, it will cause the safety valve cannot be opened or closed automatically after opening. Failure to open the safety valve will deprive its function of protecting the pressure system and make the safety of the compressor not guaranteed. If the safety valve cannot be automatically closed, there will be a large number of oil ejection accidents in the oil-gas separator, resulting in property losses.

- 1) The safety valve has been adjusted by Hanbell before delivery. Do not make any further adjustment.
- 2) Safety valve should be tested regularly for its effectiveness, and the air compressor pressure should be applied to the corresponding safety valve opening pressure to confirm that the normal blow-off is not blocked.

#### 2.3. Secondary Return Pipeline

The function of the secondary oil return pipeline is to bring the oil accumulated in the filter element of the oil-gas separator back to the low pressure chamber of the compressor, where the throttle hole is used to ensure the stability of the oil return. If the secondary return pipeline is seriously blocked (mainly in throttle holes and filters), it will cause excessive oil during discharge. The secondary oil return pipeline should be inspected at the prescribed time, throttle holes and filters should be cleaned.

In daily maintenance, throttle holes should be cleaned in the following cases:

• Fail to see the lubricant flowing through the oil return observation window.

- Oil contained in the gas is too high
- When change the lubricant
- Once every half year

#### 2.4. Cooler

When oil, grease, dust and dirt accumulate on the surface of the cooler, the heat transfer effect of the cooler will be weakened and the discharge temperature will eventually be too high. For air-cooled coolers every two months, vacuum cleaner, cleaning fluid or low pressure (generally not higher than 3.5 bar) compressed air should be used to clean the external surface of the cooler. For water-cooled coolers, discharge temperature should be monitored in real time. Under normal operating conditions, every 8000 hours or a year, no matter which appears first, the internal cleaning of the cooler should be carried out.

#### Air-cooled cooler

After using air-cooled cooler for a period of time, due to dirt and dust adhering to the surface, it causes bad heat dissipation, which makes the discharge temperature rise. Clean it regularly, and blows dust away with high-pressure gas. It is necessary and important to strengthen the heat transfer effect. The quality of ambient air and the quality of cooling water will affect the length of maintenance period.

Water-cooled cooler

- 1) For water-cooled coolers, please confirm the following items before starting to use:
- a) Is there any leakage among the connecting parts before starting the hydraulic system.
- b) Has the valve for two fluids through the oil temperature cooler been opened?
- c) Are there any leakage among the sealing parts of flanges?
- d) Is there any leakage at the outlet and plug?
- e) Water treatment equipment is recommended for cooling water. Otherwise, after a period of use, the cooler should be regularly disassembled and cleaned up according to the following instructions.
  - 2) After the above items being checked, it can be started. At this time, full attention should be paid to the vibration, and pressure. Daily cleaning and regular inspection should be done well. When installing outside the house, there should have a shelter, and attention should be paid to the influence of environmental ventilation.
- a) Regular checks must be carried out at least once every six months or carry out overall inspection once a year.
  - b)Remove the backwater cap to clearly inspect the cooler tube.
- c) In winter, when the temperature is below zero, the cooling water may freeze, which may cause the internal cracking of the cooler. Therefore, discharging the cooling water must be implemented every time when the compressor finish working.
  - 3) In order to control corrosion and prevent leakage, regular cleaning and repair, disassembly, assembly and inspection should be carried out.
    - a) Disassembly method

Close the inlet and outlet of the two fluids completely and stop the flow. The two fluids are discharged from the nozzle and the oil cooler. For ease of reassembly, please mark on the parts. Disassemble the external parts to make the oil cooler in a decomposable monomer state. Unscrew the nuts on the bracket, remove the fastening rings, and take off the oil cooler and move it to a place where is easy to do the maintenance (if it cannot be removed, cleaning and checking can also be carried out). Remove the water caps on the backwater side and the inlet side, take out the sealing parts and the sealing pressure ring (steel parts), set the cooling core and the cylinder upright, and pull the outer cylinder upward. When pulling out, it should be vertical upward so as not to scratch the seal surface of the tubesheet. When the outer cylinder is pulled out, the disassembly work is completed.

Then, please fully clean the inside and outside of the cooling tube, the inner side of the tube, the connections and the oil inlets and outlets. According to the pollution degree, you can use cleaning oil, steam, hot kerosene, cleaning agent and so on to clean. If there are more pollutants in the cooling pipe, it can be cleaned by nylon brush or iron bar one by one. When cleaning, make sure don't damage the surface of the sealing parts. When cleaning with liquid containing water, it should be fully dried afterwards to remove water. (Note: If it is not necessary, do not remove the cooling core.)

- b) The assembly method is in a sequence completely opposite to the disassembly operation, during which the sealing ring should be replaced. The assembled oil cooler is shall be moved back to its original position and fixed on the support frame with a fastening ring.
- c) Pressure inspection must be carried out after assembly. The order is as follows: fill the tube with oil and seal the oil outlet on one side. Add pressure, 10 Kg/cm2G for 5 minutes, then 15 Kg/cm2G, keep 20-30 minutes. After confirming that the indicator on the pressure gauge is 15Kg/cm2G, discharge the oil and assemble.
  - 4) Regional qualified service personnel will conduct regular inspection and cleaning services.

#### 2.5. Air Filter

Air filters should be checked every day.

Clean the dust bag (for heavy air filtration) every day, clean the dust cover or the intake muffler. In dusty environment, cleaning should be more frequent. If the environment is dirty, it is recommended that the compressor intake should be directed to the place where there is clean air source outdoors.

When the vacuum switch of the air filter works, the pressure loss reaches 25"water column, and the indicator is lightened, the air filter needs to be maintained. After working for 500 hours or three months, the air filter should be checked to find out whether the air filter is damaged and the intake system is well sealed. Under normal operating conditions, the air filter core should be replaced when it works for every 2000 hours or once every year. If the environment is poor, there is much dust (such as ceramics, cement, etc.), the maintenance period should be properly shortened. When replacing the main filter element for heavy duty filter, the safety filter element should be replaced at the same time.

Every time the air filter is maintained, check whether the downstream side of the filter core is dirty. If it's dirty, we must find out the reasons and solve them. To ensure the air tightness between air filter and compressor suction port, threaded connection, flanged connection and leather pipe connection is absolutely reliable.

When the maintenance indicator flashes, it must be replaced. Its service life is about 3000hr depending on the ambient air quality. The quality of the intake filter will directly affect the service life of the oil filter and oil separator. The replacement method is as follows: remove the fixed bolt of the intake filter, replace the new product. Pay attention to the sealing pad of the intake filter must effectively close to its support.

Maintenance or replacement steps of filter element:

- 1) Remove the back cover and remove the dust.
- 2) Carefully remove the main filter element and check the filter paper for damage. Check whether the rubber seal is firmly bonded, whether the metal end cap is firmly bonded to the filter paper, and whether the metal end cap is cracked.
- 3) Clean the inside of the shell with a clean wet cloth, and be sure not to use compressed air.
- 4) After tapping the filter element gently on the flat plate, the dry compressed air with pressure no more than 35 bar is used to blow from the inside to the outside along the 45 degree to remove the dust in each fold of the main filter element.
  - 5) Re-install the cleaned filter element or new filter element. Make sure the sealing ring under the

fixed nut of the filter element shall not be too loose or too tight. The nut should be tightened appropriately. Too loose cannot ensure that the sealing washer is close to the end of the shell. Too tight can easily deform and degum the end cover of the filter element

6) Install dust collecting tray and back cover, pay attention to the opening direction is correct.

NOTE: When the compressor is working, it is forbidden to dismantle and replace the filter element of the air filter. It is forbidden to clean the filter element with compressed air containing oil, water or water. If the filter paper or sealing ring of the filter is damaged, the filter element must be replaced immediately. Each time the filter element is installed, apply a small amount of grease along the end face of the filter element seal ring to prevent the seal ring from adhering to the air filter shell. If the air filter core has been damaged or has been cleaned five times, it must be replaced.

#### 2.6. Oil Gas Separator

The oil as separator is an integral structure, which can condense the oil mist into oil droplets on its surface, then drip into the bottom of the separator, and be recycled by the return tubing and flowed back into the compression chamber. The separator must be handled carefully to avoid damage. If the separator core is impacted and deformed, even a little indentation will affect the separation efficiency, resulting in excessive oil content in the discharged air.

Normally, if the air filter and oil filter are maintained properly, the filter element of the oil-gas separator does not need to be replaced periodically.

When the following conditions occur on the machine, the oil-gas separator core needs to be replaced:

- The pressure difference switch of separator energized, and the pressure difference is more than 1.0 bar.
- The oil contained in compressed air is too high when the oil level is normal, the loading and unloading are normal and the oil return system is normal.
  - Once every 3000 hours

If the gas supply is obviously oily, but the return tubing filter, one-way valve, throttle hole and vent valve diaphragm are in normal condition after inspection, the filter element of the oil-gas separator should be replaced.

- 1) Remove all pipes (return pipes, supply pipes, etc.) connected to the flat cover.
- 2) Remove the return tubing (stainless steel tubing) from the joint of the flat cover.
- 3) Remove the bolts and gaskets on the flat cover and remove the flat cover.
- 4) Remove the filter element.
- 5) Clean the sealing surface between the flat cover and the cylinder, and take care not to let debris and dust fall into the cylinder.
  - 6) Replace the new filter element and take care not to remove the staple on the gasket.
- 7) Install the flat cover, tighten the bolt by hand, and then cross and tighten the bolt in 4-5 steps. The tightening moment refers to Hanbell Standard
- 8) Re-connect all pipelines. Stainless steel oil return pipe should extend to 1.5mm from the bottom of filter element of oil-gas separator to ensure smooth oil return.
  - 9) Clean the return pipe filter, throttle hole and one-way valve before starting again.
  - 10) After 24 hours of re-operation, tighten the bolts on the flat cover as required in step 7.

After a period of time, the filter will be gradually blocked, resulting in a certain pressure drop. The cleanliness of the oil separator will affect the quality of the filter oil. Excessive blockage will increase the oil contained in outlet air, the normal supplement of lubricating oil and the power consumption. The service life of general oil separators ranges from 3000 hrs to 6000 hrs, depending on factors such

as environmental quality dust, frequent cleaning and regular replacement of intake filters, use of oil filters and lubricants, etc.

#### 2.7. Intake Valve

See Figure 6-1. Remove the intake valve piston regularly to remove fouling, and re-grease or replace the piston ring to ensure the sensitivity of the piston to control air flow. Follow the following steps in maintenance:

- 1)Remove all pipes connected to the intake valve
- 2)Remove the four bolts and cushions connecting the intake valve body with the compressor, and remove the intake valve from the compressor.
  - 3)Remove retaining ring and O-ring from intake valve body;
  - 4)Remove the check valve assembly and spring from the valve body;
  - 5)Remove piston spring and piston assembly;
- 6)Clean the valve body to ensure that the internal tunnel is clean, and remove the old sealing ring on the flange of the intake valve;
  - 7) Replace old parts with new parts and install them into intake valves;
- 8)Put an O-ring on the piston sleeve, put some oil on the outside and install it into the valve body.
  - 9)Install new piston spring;
  - 10) A new check valve spring is inserted into the piston, and then install a check valve.
- 11) Insert a new PTFE O-ring on the valve body and lock the nut. At this time, the bolt needs to be taken out and tapped gently on the head. When disassembling, pay attention to the installation sequence of components.
  - 12) Clean the inlet flange surface of compressor before installing new flange gasket;
  - 13) Tighten 4 bolts and lock expansion washers

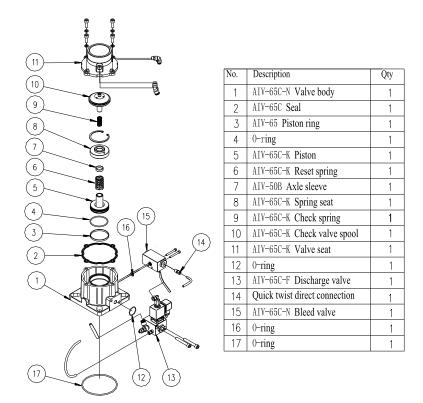
#### 2.8. Discharge Solenoid Valve

- 1) If the air compressor frequently switching from loading and unloading, , the user or service personnel should set the load and unload pressure reasonably according to the gas consumption, otherwise the life of the discharge solenoid valve will be reduced by half.
- 2) The bad action of discharge solenoid valve will directly affect the normal use of users, so regular inspection is very important.
  - 3) Discharge solenoid valve should be inspected regularly.
  - 4) Is there any particulate matter in solenoid valve (disassemble for inspection)
- 5) Whether the coil rod of the electrified solenoid valve is sucked properly (can be detected by using a pen-like tool on the coil rod)
- 6) Whether the action of the load and unload is normal (sound during the switching of load and unload)

# **M**WARNING

- Do not remove screw, plug and other parts when the compressor is working or under pressure.
  - Turn off the compressor before disassembly and release all internal pressure.
  - NOTE: Oil the parts to ensure good sealing.
- NOTE: Use the same type of compressor oil to coat the flange seal ring to enhance the

sealing effect.



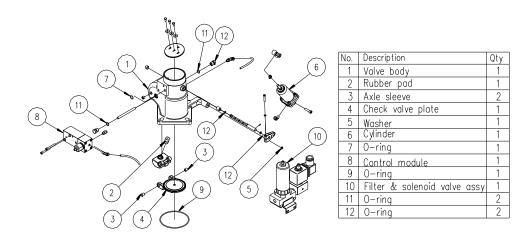


Figure 6-1 Intake Valve

Regular inspection of intake valves (usually 500 hours or two months), vent valves and load solenoid valves to ensure that good sealing effect.

#### 2.9. Maintenance of Minimum Pressure Valve

Refer to Figure 6-2. Maintenance can only be carried out after the pressure of the compressor is completely released. Refer to Figure. 19

- 1) Take off the valve from the top of the oil-gas separation tank;
- 2)Unscrew the top cover and take out the main spring
- 3)Turn the valve upside down and tap the check valve assembly with a screwdriver until the piston and check valve assembly come out.

- 4)Clean valve body and undamaged parts;
- 5)Apply a layer of oil to the new check valve, put it into the body lightly, and assemble the new check spring.
  - 6)Oil the new O-ring, install the piston, new piston spring and reassemble the top cover.

Pressure maintenance valves should be removed regularly to remove fouling then re-grease. O-rings or disc seals should be replaced if they are damaged. Regular testing of disc sealability can reduce leakage.

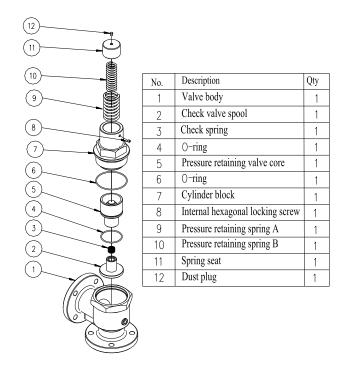


Figure 6-2 Minimum Pressure Valve

#### 2.10. Belt and Pulley

In normal operation, the driving wheel and driven wheel must ensure good alignment. Under the appropriate belt tension, the efficiency of belt transmission, belt life and the safe operation of the air end can be ensured. When the following conditions occur on the machine, the pulley alignment and belt tension need to be checked, adjusted or replaced.

500 hours from the machine first start

Every 1000 hours after the initial inspection

Every time the seal is repaired or replaced

Abnormal run out and wear of the belt:

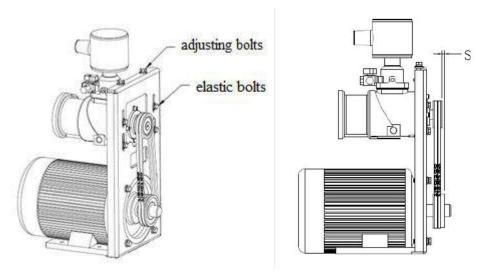
Air end abnormal noise and vibration

Requirements for the alignment of pulleys: Place the machine on a level and solid foundation, and the circular run out of the outer end of the two pulleys should not be greater than 0.5mm relative to the horizontal base. The horizontal ruler can be used for inspection.

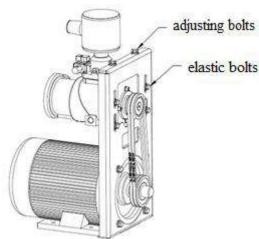
#### 2.10.1. Adjustment of Belt and Pulley

After 48 working hours from the compressor initial starting, the belt must be re-tightened. By loosening the elastic bolt, the tension of the belt can be adjusted up and down by adjusting the bolt. When the working pressure or volume flow requirement changes, it is convenient and easy to change the belt pulley. The calibration method is to stick to the end face of the belt pulley with a ruler or a horizontal ruler and measure the distance "S" between the outer edge of the other belt pulley and the

ruler. The value of S shall be less than 1mm. Four tightening bolts are required to be retightened after adjustment.



#### 2.10.2. The Replacement of Belt



If the service life of the belt is reached, or if the belt has cracked or worn seriously, the belt needs to be replaced. First, loose four elastic bolts to 2-3 teeth, and then use the adjusting bolts to reduce the air end height until the belt can be easily removed. At the same time, replace the new belt, adjust the tension of the belt by the adjusting bolt after installation, tighten four elastic bolts after adjustment without readjust the level of the pulley, so as to bring convenience to the work.

#### 2.11. Maintenance and Replacement of Temperature Control Valves

Temperature control valve is used to control and regulate the operating temperature of the compressor to ensure that the operating temperature is not lower than the air pressure leakage point temperature, so as to protect the safety and long-term life of the air end and the compressor. The temperature control valve consists of a four-way valve body, temperature control core (temperature-sensing component) and corresponding sealing element (O-ring). During the use of the compressor, attention should be paid to observation. When the following conditions are found, the temperature control valve should be checked and maintained.

The operating temperature of the compressor is too low. Especially in the cold season, the discharge temperature of the compressor is lower than  $70^{\circ}$ C.

The operating temperature of the compressor is too high. Especially under normal environment, the discharge temperature of the it is higher than  $95^{\circ}$ C.

Under normal conditions, when oil temperature is high, the thermal control valve bypass is

closed. When the oil temperature is low, the bypass of the thermal control valve is open. This way can be used to check whether the thermal control valve is normal.

## 2.12. Inspection of Hoses and Pipe Joints

Every 500 working hours or half a year, the intake hose, lubricating oil pipeline, flexible hose and control pipeline must be inspected to check whether the oil return pipeline of the air end is smooth or not and the temperature of the oil return pipeline during operation is higher than normal or not. If the surface of the pipeline is not warm when the pipe is blocked, or if there is too much oil in the condensed water discharged, the pipeline must be cleaned, or changed if necessary. Check whether the oil separator, return tubing, connector, check valve and return oil orifice are blocked. Regularly inspect all pipeline joints for leakage, hose aging and cracking. Replace gaskets, O-rings, hoses, or re-sealant according to the problem. If parts are found loosen during maintenance, re-secure and re-seal if necessary. Hanbell service personnel will advise customers to purchase repair kits depending on the inspection situation.

#### 2.13. Installation of Shaft Seals

The compressor shaft seal belongs to wear parts, which must be replaced sooner or later. Only equipped with special tools and a complete understanding of the installation process and operation procedures can the successful replacement of shaft seals. If you decide to do it yourself, please ask Hanbell dealer or Hanbell Company for complete illustrations, operation techniques and maintenance considerations.

**NOTE:** When disassembling a defective shaft seal part, do not destroy it. Pay attention to observe the damaged part of the seal, in order to understand the reasons for the damage of the seal.

A return pipe system of Hanbell compressor device cooperates with the shaft seal assembly, so that the whole shaft seal has triple sealing function. When repairing and replacing shaft seals, the oil return pipe system should be inspected to ensure the following points:

- a) Check the connection between the oil returnpipe and the sealing chamber of the shaft seal.
- b)Ensure that the return pipe itself (inside) is not blocked.

The wear degree or service life of the shaft seal varies according to the operating state and mode of the screw air compressor, such as speed, final pressure, oil pressure and working temperature. Therefore, customers must strictly use the machine according to the requirements in the manual to ensure the normal service life of the shaft seal. Installation steps of shaft seal are as follows:

- 1)Stop the compressor and make sure that it will not re-start.
- 2) Dismantle the driving parts (such as pulleys, couplings, etc.);
- 3) First remove the key from the keyway and then from the spindle;
- 4)Remove the inner hexagonal screw and the front cover;
- 5) Remove the inner ring from the spindle using a removal tool or a hot removal tool;
- 6)Clean compressor spindle and remove grease;
- 7) A layer of silica gel is coated on the outer and inner ring of the bearing.
- 8)Heat the new inner ring to  $100^{\circ}$ C, then slide tightly into the spindle until it touches the limiting edge.
- 9)Before installing the shaft seal, thoroughly clean the spindle and inner ring, press out the old shaft seal from the front cover, clean the front cover and coat it with a layer of silica gel;
- 10) Press the seal into the front cover at the right angle, clean the silica gel inside the seal, and replace the new O-ring.
  - 11) Slide the guide ring of the shaft seal installation into the spindle until it touches the limiting

edge;

- 12) Carefully press the prepared front cover, including the shaft seal and O-ring, into the shaft seal of the spindle to install the guide ring, and keep it concentric with the compressor shell. Be sure not to damage the lip of the shaft seal. Fixed front cover with tightened internal hexagonal screw
  - 13) Press the key into the keyway;
- 14) After the silica gel solidifies (about 30 minutes), the driving parts are reloaded. Check the oil level in the tank and test the compressor in a short time.
  - 15) Perform leakage testing and check the function of components;
  - 16) Fill the replacement record form.
- 2.14. Compressor Bearings

Compressor bearings are consumables (recommended to be replaced once in 30,000 working hours). Their service life will be reduced due to normal or abnormal wear and intake quality (dust condition, etc.), lubricant quality, oil filtration effect and other comprehensive conditions, which will lead to greater noise and vibration during operation. In this case, Hanbell service personnel will judge whether to return to the factory to replace bearings.

#### 3. Maintenance of Motor

3.1. Conditions for use of special motor of Hanbell compressor (taking fixed frequency compressor as an example):

Ambient temperature  $\leq 45 \,^{\circ}\text{C}$ Frequency 50Hz Voltage 380V Working standard S1

Protection grade/insulation grade IP54/IP55/F

- 3.2. The Operation of Hanbell Compressor Motor
- 3.2.1. The motor shall be properly grounded. The grounding wires of the special motor for compressor are generally directed to the inside of the cabinet and connected to the cabinet body. Connect the user's grounding wires to the point.
- **3.2.2.** The special motor for Hanbell compressor shall be connected according to the connection and connection marks on the nameplate or instruction, and the leading-out line shall be clearly marked.
- 3.2.3. When the voltage and frequency of the motor for compressor are same as the values specified on the nameplate, the motor can operate continuously at rated power multiplied by the power of the coefficient of use. When the frequency deviation of the power supply exceeds 1% of the nameplate value or the voltage deviation exceeds 5%, the motor cannot guarantee the continuous output of this power.
- 3.2.4. When the three-phase unbalance of power supply does not exceed 1%, the special motor for Hanbell compressor can run well
- 3.2.5. There should be no intermittent or abnormal sound or vibration during unload or load operation of the motor.
- 3.2.6. Maintenance and Repair of Hanball Compressor Motor
- 3.2.7. Keep the environment dry; the motor surface should be kept clean, and the air intake should not be hindered by dust, fibers and so on.
- 3.2.8. If the working environment is wet or after a long downtime, it should be heated to remove the moisture when restarting.
- 3.2.9. When the controller or thermal relay is energized, please check the cause, and the fault

should be eliminated before it can be put into operation.

- 3.2.10. After motor failure, please contact the service department or dealer of Hanbell.
- 3.2.11. The motor should be maintained periodically and handled promptly after failure is found. Generally, a monthly maintenance and a yearly maintenance shall be carried out.

#### 3.2.11.1. Monthly Maintenance:

- 1)Clean the dust on the motor surface;
- 2) Measuring the insulation resistance of the motor;
- 3) Fasten the fixed bolts and grounding bolts, as well as various connecting bolts;
- 4)Clean starter and insulating terminals;
- 5)Clean dust and carbon deposits in slip rings and brushes of winding rotor (YP series) motors;
- 6)Clean the mesh holes of the motor hood to ensure that the air intake and outlet are unimpeded.

#### 3.2.11.2. Yearly Maintenance

- 1)All the monthly maintenance items
- 2)Clean the inner part of the motor, so that the stator rake group of the motor can be neat, oil-free and copper not visible;
- 3)Whether the motor bearings are in good condition; if they have been damaged, they should be replaced immediately;
- 4)If the bearing does not need to be replaced, the bearing should be cleaned and the grease should be replaced.
  - 5)Cleaning or replacement of other parts of the motor.

#### 3.2.12. Lubrication of motors

The correct lubrication of motor will directly affect the life of the bearing and the motor. It is very important to add lubricating grease (oil) to electric bearings correctly and regularly.

- 1)For small motors, our company has fully adopted double-sealed bearings (bearing type is "ZZ"), which are pre-oiled and not need to be oiled again.
- 2)Bigger motors (usually H180 and above) and motors with special requirements, with oil injection and drainage devices, these motors have been oiled before delivery, but they need to be replaced regularly. The period of grease replacement depends on the size and use of the motor.

Here are the recommended values for motor refueling (excessive or over frequent refueling may also damage the motor)

Rated Power	Motor speed	Time For Refilling						
(KW)	(RPM)	Normal working	Severe working	Harsh working				
		condition	condition	consition				
<18.5	3000/1500	5 Year	3 Year	1 Year				
18.5~90	3000/1500	1 Year	6 Month	3 Month				
90~200	3000/1500	3 Month	3 Month	1 Month				
200~630	3000/1500	3 Month	1 Month	15 Day				

#### **NOTE:**

Normal working condition: In clean environment, use at rated or below rated power, 8 hours a day.

Severe working conditions: use at rated or below rated power, 24 hours a day. Or in a dirty and

dusty environment. Or the motors withstand vibration or light impact.

Harsh working conditions: In very dirty and dusty environment, or with heavy impact load and large vibration.

Refueling method:

- 1)Open the dustproof cap of the injection nozzle and the discharge nozzle, make sure that the injection nozzle is clean. Use the manual oil gun or the pneumatic oil gun to connect the injection nozzle and pour in the grease until the new grease is discharged from the discharge nozzle.
- 2)Remove the oil gun and let the motor run for 10-20 minutes. Make sure that the excess oil has been discharged. Cover the oil injection nozzle and the dust-proof cover of the oil discharge nozzle, and finish the refueling.

The brand of grease is specified in the nameplate on the motor or grease instructions.

- 3)The initial filling quantity is the new filling quantity after decomposing the clean bearing. About 1/3 of the bearing is filled in, and the rest is filled in the inner bearing cover (It is filled before the motor is delivered).
- 4)The amount of lubricating grease injected into bearings at each replenishment interval should be replenished in accordance with the number of operating hours of the compressor.
- 5)If the grease is accumulated in the "discharging grease storage area", bearing will be overheated due to stirring resistance and grease leakage, please open the discharging cover in time (about 2-3 times after injection) and discharging the grease.
- 6)Please note that filling more at a time will not prolong the supply period. The refueling amount must be in accordance with the standard value. Too much fuel will also cause damage to the motor.
- 7)The period of grease replacement depends on the size of the motor, the use and the working environment. It is suggested that the period of grease replacement and the amount of grease replacement should be carried out according to the requirements of the oil-filling label on the motor.

#### 4. Maintenance Schedule

- 1)Daily Maintenance
- a) Make a good record of the daily operation of the machine. For the specific contents to be recorded, see Table 6-1.
- b)Clean the dust collection bag or intake muffler of air filter. It is absolutely not allowed to open the machine without air filter. When the differential pressure switch of air filter acts as an alarm, the filter element needs to be maintained.
  - c) Observe whether the oil level is within the specified range.
  - d)Check the oil filter pressure differential switch.
  - e) When the intelligent controller alarms, showing the oil filter clogged, please replace the oil filter.
    - 2) Weekly Maintenance (50hours)
  - a) Check whether the safety valve is blocked or damaged.
- b) Check the oil filter for the first 50 hours after the new machine is in operation and replace the filter element if necessary.
- c) Clean throttle holes and filters if have on the secondary oil return pipeline in the first 50 hours after the new machine is in operation.
  - d)Check the control line filter and remove the water from the cup.
    - 3) Monthly Maintenance (500 hours)
  - a) Clean the dust of the machine air intake.
  - b)Remove the air filter and check the filter element, and do a good job in the maintenance of the

filter element.

- c) Remove breathing pipes, clean and dry them.
- d) For the first time, replace the oil filter.
- e) For the first time, collect oil samples and send them to Hanbell After Sales Department for analysis.
  - f) Check the tension of the belt and adjust it if necessary.
    - 4)Half a year (1000 hours)
  - a) Maintenance and replacement of oil filter core.
  - b)Inspection and cleaning of throttle holes and filters (if have)in secondary oil return pipelines 5)One year (2000 hours)
  - a) Replace air filter element
  - b)Remove the gas-water separator and clean its interior.
- c) Check the spring valve plate inside the check valve to check whether it works properly and replace it if necessary.
  - d)Collect oil samples and send to Hanbell for routine analysis.
  - e) Check and verify pressure gauges and sensors.
- f) Check the capacitive adjustment (loading) solenoid valve and replace the internal sealing ring if necessary.
- g)Check the running status of the machine to determine whether the inside of the cooler needs cleaning. If necessary, it is better to clean the inside of the cooler with chemical reagents.
  - h)Inspection of cooling water quality

Description	Reference valve				
Discharge temperature	xx bar				
Ambient (intake)	<45℃				
temperature	<u>_43</u> C				
Discharge pressure	≤95℃				
Oil level	Allowable oil				
Oli level	level area				
Drainage Time of	1-2 seconds				
Electronic Drainage Valve					

Table 6-1Daily Checklist

#### 6)Preparations for long-term downtime

If there is a long interval between shutdown and restart, please open the manual switch of drainage (electronic) valve before shutdown, and keep drainage time not less than 5 minutes to ensure that the water in the system is totally drained. After shutdown, drain the water in the cooler, gas tank and other parts.

- a) Downtime of less than one month
  - It is necessary to start the machine once a week and let it run for 10 minutes unloading.
  - Turn the coupling by hand once a week.
- b)Downtime of over one month
  - 1 Shutdown preparation
  - Continuous loading for 10 minutes to exhaust the air inside the pipeline.

NOTE: Drain water inside the two gas-water separators

# Fixed Screw Air Compressor (5.5~550KW)

- Turn the coupling by hand after shutdown
- Discharge the water accumulated in the parts of cooler, gas storage tank, etc.
- 2 Downtime
- Repeat every three months (A)
- ③ Before rebooting
- Replace the oil in tank
- Open drain valve of gas-water separator
- Rotate the connecting parts (coupling) between the motor and the air end by hand to ensure easy rotation.

# **Chapter 7 Trouble Shooting**

FAULTS	CAUSE	SOLUTION
	Malfunction of control circuit	Check control voltage, fuse and connection of the control circuit
	Emergency switch actuates	Check if the emergency switch actuated or contact is loosed
Start-up Failure	Power is not switched on	Check if power switch has been switched on Check power supply of motor and controller
	Voltage is too low	Wire diameter is too small-> Modify the wire.  Voltage of power is too low-> Adjust to correct voltage.
	Air consumption is much higher than the capacity of compressor	More air compressors are required
	Suction control valve malfunctions	Check and repair.
	Leakage in the system	Check the pipe and repair it.
System	Air filter is too dirty	Change the air filter.
Pressure is	Pressure setting value in the controller is too low	Check the setting value and pressure sensor.
too low	Unloading solenoid valve (N.O) is unable to close	Check if the solenoid valve has been energized, or the valve is stuck. Signal output from the controller also needs to be checked.
	Pipe is blocked or valve is not opened completely	Check pressure of each part of the air compressor
	Installation of drain pipe in the system is incorrect	Modify the incorrect arrangement of drain pipe
Too much moisture in	Heat exchange efficiency of cooler is not good	Cooler is too dirty. Clean the cooler.
the System	No dryer installed or dryer is not working properly.	Install dryer or check the dryer.
Fluctuation of Pressure	Air consumption changes too much in a short time	Increase volume of the gas storage tank
is too Large	The pressure range between load and unload is too large	Revise setting value of the pressure.

Oil content in the air is too high. Oil consumption is too much  Vibration and noise  Level are too high  I consecution of correct.  Level are too high  Check if oil pipe and sealing part is leaking fix them.  Check the fine separator.  Check the fine separator.  Check all elements in oil return pipe.  Check all elements in oil return pipe.  Abnormal transmission  Alignment between motor and air end is not good.  Coupling is loose. Change new rubber ring.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Tighten the parts.  Tighten the installation base or supporter. the connection of the piping.  Compressor runs abnormal and shaft seal is damaged  Pressure setting in controller is not correct.  The real pressure is higher than the p	oressor I.			
Oil content in the air is too high. Oil consumption is too much  Vibration and noise  Level are too high  Installation of compressor or piping is not good.  Compressor runs abnormal and shaft seal is damaged  Polic for the separator is blocked  Change fine separator.  Check the fine separator.  Check all elements in oil return pipe.  Check all elements in oil return pipe.  Decrease air consumption, or let the compoperate at rated pressure.  Alignment between motor and air end is not good.  Coupling is loose. Change new rubber ring.  Change the bearing and find out the root capearing deterioration.  Change the bearing and find out the root capearing deterioration.  Change the bearing and find out the root capearing deterioration.  Change the bearing and find out the root capearing deterioration.  Change the bearing and find out the root capearing deterioration.  Change the bearing and find out the root capearing deterioration.  Change the bearing and find out the root capearing deterioration.  Change the bearing and find out the root capearing deterioration.  Change the bearing and find out the root capearing deterioration.  Change the bearing and find out the root capearing deterioration.  Tighten the parts.  Eliminate the factors casues loss of oil of the piping.  Pressure setting in controller is not correct.  The real pressure is higher than the possible of the	oressor I.			
Fine separator is leaking  Check the fine separator.  Oil return pipe is blocked  Air compressor works under rated pressure  Abnormal transmission  Vibration and noise  Level are too high  Installation of compressor or piping is not good.  Compressor runs abnormal and shaft seal is damaged  Pressure setting in controller is not correct.  Fine separator is leaking  Check the fine separator.  Check all elements in oil return pipe.  Decrease air consumption, or let the compoperate at rated pressure.  Alignment between motor and air end is not good.  Coupling is loose. Change new rubber ring.  Change the bearing and find out the root can be a searing deterioration.  Connection of certain parts are  Tighten the parts.  Strengthen the installation base or supporter. the connection of the piping.  Compressor runs abnormal and shaft seal is damaged  Pressure setting in controller is not correct.  The real pressure is higher than the p	l.			
Consumption is too much  Oil return pipe is blocked  Air compressor works under rated pressure  Abnormal transmission  Coupling is loose. Change new rubber ring.  Change the bearing and find out the root cabearing deterioration.  Bearings in the motor are deteriorated  Connection of certain parts are  Level are too high  Installation of compressor or piping is not good.  Compressor runs abnormal and shaft seal is damaged  Pressure setting in controller is not correct.  Oil return pipe is blocked  Check all elements in oil return pipe.  Coupling is not sumption, or let the components in oil good.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Change the bearing and find out the root cabearing deterioration.  Research the component and should the root cabearing deterioration.  The real pressure is highe	l.			
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The real pressure is higher than the p	r high			
D 1' C 1	-			
actuated Pressure sensor malfunctions detected by the sensor. Check or clean the pressure sensor.				
Controller malfunctions Correct the I/O signal in controller.				
Relief valve malfunctions Change a new relief valve.				
Mix with other brand of lubricant Remove the oil in the system complete charge new oil.	y and			
Old oil in the system is not removed Remove the oil in the system complete	y and			
completely in maintenance. charge new oil.				
Short service Compressor runs at high Find out the root cause of high temperature	re and			
life of lubricant temperature adjust it too reasonable value.				
Compressor runs at low temperature When runs below dew point, condensation which deteriorates the oil will be generated.				
Class of oil is different Use suitable oil.				

# **Appendix 1: Maintenance Schedule**

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_				500 hours	1500 hour s	3000 hours	6000 hours	12000 hours	18000 hours	30000 hours	Note
Item	Description	Daily	Weekly	Month	Quar ter	Half Year	Year	Every Two Year	Every Three Year	Every Five Year	
Light & signal on panel	Check if there is abnormal light or signal	0									
Discharge temperature	Check (70~95°C)	0									
Condensing water in oil-gas tank	Drain	0									
Oil level	Check	0									
Transparent hose	Check/Replace	0					•				
Intake hose	Check/Replace					0	•				
Pipe(Rubber)	Check/Replace	0					•				
Pipe(Metal)	Check/Replace	0						•			
Pipe joint	Check/Leakage testing		0								
Cooler	Clean/Check		0						0		
Cooling fan	Clean		0								
Intake filter	Clean/Check/Replace		0	New●		•					
Prefilter	Clean		0								
Check valve	Clean/Check/Replace			0	0	0	0	0	0	0	
Coupling/Elastomer	Replace									•	
Oil filter	Replace			New●		•					
Lubricant	Refill/Replace			New●		•					
Oil separator	Check/Replace			New●		•					
Electrical insulation	Check all the phases and grounding						0				
Thermal control valve	Check/Replace						0				
Intake valve	Check/Replace						0				
MPV	Check/Replace						0				
Relief valve	Check/Replace						0				
Unloading solenoid valve	Check/Replace					0					
Pressure sensor	Check/Replace						0				
Temperature sensor	Check/Replace						0				
Compressor bearing	Check/Replace							0		•	

NOTE: The suggested maintenance schedule should be modified according to environment and working conditions.

Please pay attention to the following points:

- 1) All models use Hanbell special oil products and when using 3000 hours or half a year, it is recommended to replace the oil. If the compressor runs at high temperature, the service life of lubricant is half.
- 2) Under normal working condition(no dust, using Hanbell lubricant, environment temperature  $\leq$  45 °C), the oil filter, air filter could be used for 3000 hours. Fine separator could be used for 3000 hours..
- 3) Service life of oil filter, air filter, and fine separator would be only 60% of original schedule when compressor runs at harsh working environment without using Hanbell original lubricant.
- 4) Hanbell is not responsible for the after service or maintenance and exempt from warranty if the compressor is used in harsh working condition without using original Hanbell lubricant.
- 5) The first maintenance and replacement time of oil products air filter, oil filter and fine seperator is 500 hours.
- 6) Some compressors are equipped with cold dryer. For maintenance of cold dryer, please refer to the its operating manual.

# - www.hanbell.com.cn

Shanghai Hanbell Precise Machinery Co., Ltd. keeps the right of design change for continuous improving the products. No further notice will be given for any change.

## Shanghai Hanbell Precise Machinery CO., Ltd.

Add: No.8289, Tingfeng Road, Fengjing Area, Jinshan District, Shanghai

Tel: 021-57350280

Fax: 021-31106889/57352004

# Shanghai Hanbell Precise Machinery CO., Ltd. Fengjing Factory NO.1

Add: No.108, Jiangong Road, Fengjing Area, Jinshan District, Shanghai

TEL: 021-57350280 FAX: 021-31106805

## Shanghai Hanbell Precise Machinery CO., Ltd. Jinan Branch Office

Add: No.4 Building, Liandong Ugu Enterprise Port, No.2222, South Section Of Yuqing Road, Changqing District, Jinan City

TEL: 0531-55616898 FAX: 0531-55616800

## Shanghai Hanbell Precise Machinery Co., Ltd. Nanjing Branch Office

Add: No.6 Building, Liandong U Valley, 1001fuying Road, Jiangning District, Nanjing

TEL: 025-52078091/92/93

FAX: 025-52078090

#### Shanghai Hanbell Precise Machinery Co., Ltd. Chongqing Branch Office

Add: F-1-1, Building A10, Dongben Industrial Park, No.18 Yuma Road, Chayuan New District, Nan'an District, Chongqing

TEL: 023-62611069 FAX: 023-62611069

### Shanghai Hanbell Precise Machinery Co., Ltd. Guangzhou Branch Office

Add: No.15 Lianwang Industrial Park, Wenbian Village, Shiji Town, Panyu District, Guangzhou, Guangdong Province

TEL: 020-34721075 FAX: 020-34723325



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