Instructions of Industrial Oil Chiller

Nantong TOBEL Intelligent Controlling Equipment Co., Ltd.

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1. Overview

In the process of mechanical processing, the phenomenon of oil temperature rising is inevitable. When the oil temperature exceeds a certain temperature, it will cause a series of problems such as reduced machining accuracy, unstable action, reduced machining quality consistency, oil quality deterioration and even damage to working parts. The oil cooling temperature control device（hereinafter referred to as the oil chiller）can solve the above problems well, so that the working host can operate more reliably and efficiently.

The oil chillers are divided into two series: independent type ACO series and immersion type ACOS series. The independent type chiller has its own oil pump, which can independently cool the oil tank of the main equipment and is connected to the oil tank through the oil inlet/outlet. The immersion type chiller is not equipped with an oil pump and needs to be installed above the oil tank of the working main machine. The copper pipe under the chiller is immersed in the oil tank.

The function of the oil chiller is to cool the oil of the working main machine to keep it within the ideal working temperature.

2. Main Structure, Working Principle & Performance

The oil chiller is mainly composed of refrigeration system, oil circuit system and control system. The refrigeration system consists of one or two independent compressor refrigeration systems, each compressor refrigeration system includes compressor, condenser.,condensing fan, hermal expansion valve, evaporator and refrigeration pipeline. The oil circuit system includes circulating oil pump, evaporator and oil pipeline. The oil filter, pressure relay, indicator light,rotary switch and button switch are optional according to actual needs.

The oil chiller adopts environmental refrigerant forced cooling principle, with an independent circulating oil pump inside, which can suck out the oil in the oil tank and send it to the evaporator in the refrigeration system for cooling, and then send it back to the oil tank for continuous circulation. The working principle is that the oil pump runs first, the oil in the oil circuit system circulates continuously through the evaporator of the refrigeration system, at the same time, the temperature controller detects the temperature of the oil for cooling. When the detected oil temperature is higher than the current set temperature of the digital temperature controller, the refrigeration system starts to work. At this time, the low-temperature liquid refrigerant flowing into the evaporator in the refrigeration system exchanges heat with the high-temperature oil in the evaporator, thereby achieving the purpose

of cooling the oil. The cooled oil is sent back to the oil tank through the oil pump and mixed with the higher temperature oil in the oil tank to ensure that the temperature in the oil tank is controlled within an ideal range. When the detected oil temperature is lower than the current set temperature of the digital temperature controller, the refrigeration system stops working. Once the oil temperature is higher than the set temperature again, the refrigeration system starts working again.The evaporator of the refrigeration system adopts a corrugated metal plate structure and uses split and countercurrent methods to exchange heat between two different fluids, thereby greatly improving the heat exchange efficiency and making full use of the cooling capacity of the refrigeration system.

The oil chiller can also heat the oil according to customer needs, electric heating/heat pump heating can be selected.

The oil chiller uses a sensor to detect the oil temperature on the digital temperature display temperature controller, which compares the measured oil temperature with the set temperature to automatically control the operation of the refrigeration system.The cooling/heating temperature can be set by the user directly on the operation panel of the digital display temperature controller according to actual needs, which is simple and convenient to operate.

The oil chiller has high/low pressure protection, oil pump/compressor/fan/overload protection and short circuit protection/power phase sequence/phase loss protection, compressor delay protection, etc. In addition, oil filter, pressure relay, oil flow switch or oil temperature over-high protection can be added according to user needs. Above protection functions can provide corresponding fault display, which is convenient for users to judge and handle faults. The passive contact alarm output can be connected to the main equipment to ensure the reliable operation of the oil chiller.

3. Installation

- Installation location

(1) The oil chiller should be installed in a well-ventilated and clean environment. If installed outdoors, rain protection measures should be taken if conditions permit. The air inlet should be at least 1m away from the wall or other objects, and the air outlet should be at least 2m away from the wall or other objects. Adequate space around is needed for maintenance.

(2) There should be no corrosive gases, flammable and explosive dangerous goods around the oil chiller. There should also be no high temperature heat source or other heating matters near the installation location.

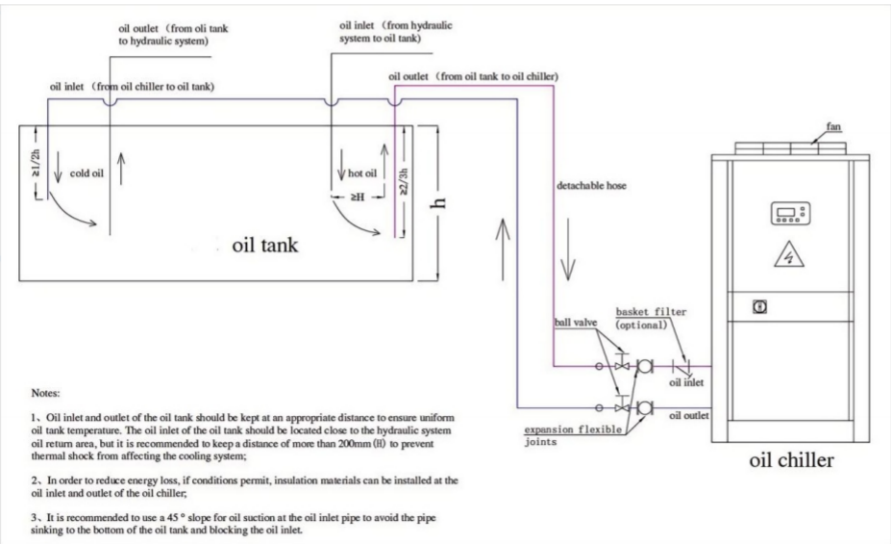
(3) The foundation structure at the installation location should be able to fully withstand the total weight of the unit and the vibration transmitted during operation.
The chiller should be protected from damage due to external impact or excessive vibration during transportation or installation. It is strictly prohibited to tilt or invert the chiller. It should be hoisted smoothly to avoid sudden rise and fall.

● Wiring

(1) Pay attention to the current and phase number specified on the nameplate. The working range of the power supply voltage is AC380±10%.
(2) Install an air switch of appropriate capacity on the main power supply circuit.
(3) The wire diameter of the main power supply should be selected according to the current value on the nameplate. Do not use thin wires to avoid danger.
(4) The chiller must be reliably grounded.
Note: The instruction manual contains the electrical schematic and wiring diagram.

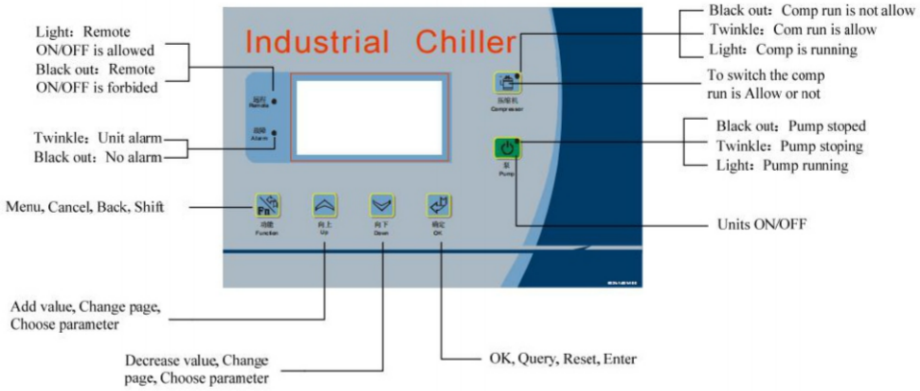
● Pipe

(1) The pipe diameter should be greater than or equal to the inlet and outlet of oil chiller, and the pipe elbows should be minimized. In order to reduce the length of the pipe section and reduce the pressure drop, the oil inlet should be as close to the oil tank as possible, and the oil chiller should be as close to the working main equipment as possible.
(2) In order to reduce the vibration of the working pipeline, it is recommended to use a plastic hose reinforced with steel wire as the oil inlet and outlet, or install a shock-absorbing hose between the hard pipeline and the oil forced cooling device inlet and outlet, or install an oil filter in the oil system. In order to facilitate the cleaning of the oil filter, it is recommended to install a valve at each end of the filter.



4. Operation instructions

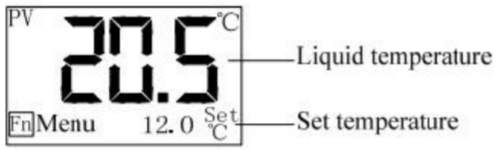
- Control panel settings and operations

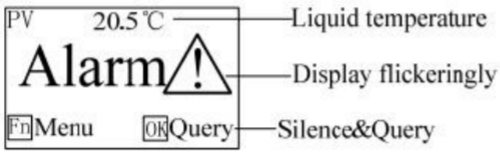


- Main Screen

(1) The system enters main screen after countdown, which displays as follows: picture 1.

(2) In case of unit failure, the alarm screen is as follows: picture 2.



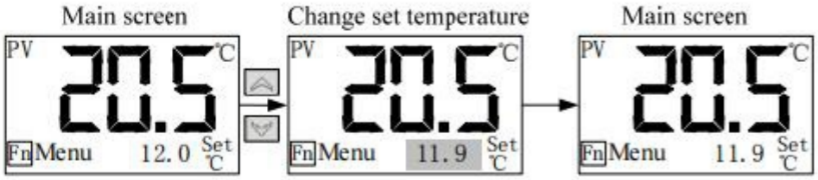


Picture 1 Picture 2

- Common Operation

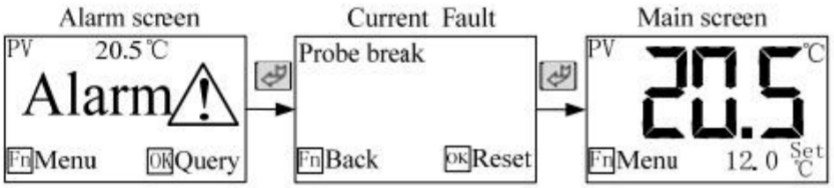
(1) Quick Modification of Setting Temperature

If the user parameter [Locked T.set] is set to "No", the setting temperature can be modified directly in the main screen, with operation details as follows:



(2) Query/Reset Fault

In case of fault, the alarm screen will automatically pop up. The operation details of query and reset faults are as follows:



(3) Cut over the Chinese-English quickly

Press below function keys at the same time 3 seconds in the main screen to cut over the Chinese-English quickly.

Note: The language establishes can also be modified in the user parameters.

(4) Function Menu

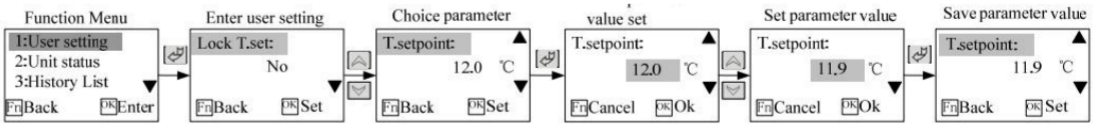
Press the function key 

on the main screen to enter the Function Menu, which includes five items as the table below:

Menu Item	Funtion	Remark
User Settings	To display user parameters	For number of user parameters and their implications, please refer to: User Parameters Table.
Unit Status	To display the current operating status of the unit	Current value is not displayed when current module is not used.
History List	Allowing the query of the last 10 faults	Press  2s to clear the fault history.
Comp Run Time	To display the cumulative operation time of the compressor	
Version	To check the current software version	

(5) Parameter Operation

For the modification operation of parameter value, the user's modification of setting temperature will be described as an example.



- Operation Instructions for the oil chiller

(1) The oil chiller is equipped with a special power switch. After turning on the power, the PV displays the actual temperature value after a few seconds of self-test.Press the PUMP button to start the pump, the pump indicator light is on, and the compressor indicator flashes. When the oil temperature is detected to be higher than set temperature, the refrigeration system starts to work, and the oil temperature gradually decreases until it reaches the set temperature, and then the refrigeration system stops working. The compressor indicator flashes, indicating that the compressor is waiting for work.

(2) When an alarm appears on the main screen, just press the OK button to query the current fault. After the fault is eliminated, turn the rotary switch to re-power to eliminate the alarm state, the main screen will show the actual temperature at the same time.

(3) The oil chiller reserves remote control and alarm output interfaces. If the user needs to apply these functions, just open the electrical control box and refer to the electrical schematic diagram on the back of the electrical box.

(4) Oil temperature setting of the heating temperature controller

a. The oil chiller with heating function has a dedicated hot/cold conversion switch. Under normal conditions, the display panel of the thermostat displays the return oil temperature value measured by the temperature sensor.

b. Put the hot/cold shift switch in the closed position, the controller will automatically enter the heating state. The temperature setting operation is the same as the cooling setting.

5. Electrical control principle

The control circuit of the chiller is mainly composed of an air switch, an LCD temperature integrated controller, a temperature sensor, an AC contactor, a thermal relay, an intermediate relay, a high and low voltage protector and a rotary switch.

- QF—Air switch, used to control the main power supply and control circuit of the oil pump/compressor/fan. When a short circuit occurs,the air switch will trip.
- KM—AC contactor of the oil pump/compressor/electric heater.

- ST—The control rotary switch, used to control the start and stop of the oil chiller.
- TC—The output contact of the digital temperature controller, used to control the start and stop of the heating/cooling system. In order to make the refrigeration system work reasonably and reliably and achieve economical operation, the two refrigeration systems are staggered to ensure that only one refrigeration system is turned on when the heat load is low.
- HP, LP—High/low pressure switch of refrigeration system, used to detect high/low pressure of refrigeration system. When the working pressure is too high or too low, the switch will work. After high/low pressure protection occurs, please refer to "Common faults and troubleshooting".
- HLP—Condensation pressure switch, used to detect high pressure of refrigeration system. When the high pressure of refrigeration system is too low, condensation pressure switch will work and fan will stop working to ensure that high pressure can work normally at any ambient temperature.
- CUR—used to detect the current of oil pump and compressor in real time. It can be directly displayed on the screen.

6. Precautions and daily maintenance

(1) Before start-up, check whether the power supply voltage is within the range specified on the nameplate. If not, please wait until the power supply voltage is normal.
(2) After the main equipment is powered on, the oil chiller should be turned on at the same time to avoid the chiller working in possible adverse conditions and extend its service life.
(3) The operating temperature of the circulating oil of the oil chiller cannot be lower than 20℃. If the oil temperature is too low, the oil viscosity will increase, resulting in increased oil pump working current and increased oil pump noise.
(4) Maintenance should be performed by professionals.
(5) Be sure to disconnect the power supply during daily maintenance and inspection.
Please follow safety precautions before any maintenance. To maintain the cooling efficiency of the chiller and extend its service life, the chiller requires regular maintenance. To keep the chiller running properly, a well-ventilated and unobstructed working environment is required.

- Cleaning

Do not clean or maintain the oil chiller while it is running. Removing any parts while the oil chiller is running may cause personal injury or machine damage. The parts that need to be cleaned regularly include the following:
* Machine body
* Condenser

* Air filter
* Oil tank
* Oil suction filter

(a) Frame

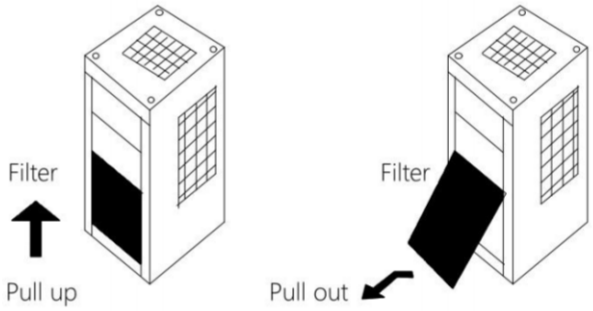
- Use a neutral detergent to remove dirt from the surface of the chiller. Do not use alkali, acid,steel brush, hot water, etc. to clean and keep the paint intact.
- Don't let water splash electrical components when cleaning the frame of the chiller.
- Use a wrung out rag to wipe electrical components.

(b) Condenser

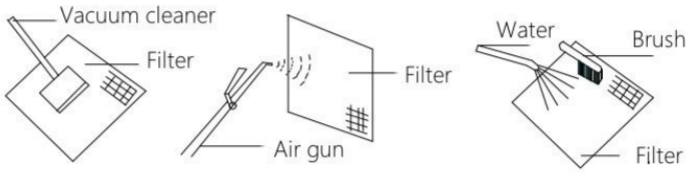
Check whether the condenser is blocked by dirt. Use air gun or air conditioning special detergent to remove dust from the condenser.

(c) Air filter

The air filter can be removed by pulling it up and pulling it out.



Use a vacuum cleaner, air spray gun, water pipe and long-bristled brush to remove the dust on the filter. After cleaning, dry the filter before reinstalling it. Please clean the filter regularly. If there is serious fouling, use a neutral detergent to clean it irregularly.



(d) Oil tank

If the chiller is installed in a humid place, water will condense at the bottom of the oil tank. Please drain the water regularly.

(e) Oil suction filter

Clean it once every quarter after normal operation.

- Storage

When the chiller is not in use for a long time, please protect the inside of the chiller and the condenser from dust and moisture.

(1)Please place the chiller in a place away from dust.
(2)Wipe the power cord clean.
(3)Please store the chiller in a flat,dry and fresh-air place.
(4)If the chiller is equipped with casters, make sure the casters are fixed or locked to prevent the casters from slipping and causing personal injury.

7. Common Faults & troubleshooting

Any inspection, maintenance and troubleshooting should be performed by experienced professionals.When fault or abnormal condition occurs, the chiller will stop running and displaying alarm, please refer to the following information to eliminate the fault and restart the chiller.

- Leakage

When oil leaks from the oil pipe, tighten the tube bundle or hose lock nut, or replace the tube bundle.
When welding tools are required for maintenance:
(1) Please discharge the refrigerant in a well-ventilated place to prevent suffocation.
(2) Please drain the oil in the oil pipeline and oil tank, remove the oil pipe between the main machine and the chiller to prevent fire.
(3) Please discharge and dispose of the refrigerant in accordance with national environmental protection requirements and regulations.

- Abnormal alarm and troubleshooting

(1) The chiller suddenly stops running and displays fault signal.

Probe short circuit or open circuit	Possible causes	Broken or bad contact probe
		Controller failure
	Inspection method	Check whether the probe is broken
		If above is normal, it's controller failure
	Troubleshooting	Rewiring
		Replace faulty parts
Compressor pressure high or low	Possible causes	Overmuch or insufficient refrigerant
		Refrigeration system blockage or leakage
		Condenser or air filter blockage
		Poor heat dissipation
		Cooling fan failure
	Inspection method	Copper tube on the low pressure side of the compressor is not cold

		Fin of condenser fails to pass heat
		Low temperature of the surface of dry filter
		Check whether fan motor is broken
	Troubleshooting	Please contact professional maintenance personnel
		Clean the condenser or air filter regularly
		Replace faulty fan motor
Compressor current high or low	Possible causes	Improper rated current setting
		Incorrect wiring or loose connector
		Overmuch refrigerant
		Refrigeration system blockage
		Condenser or air filter blockage
		Poor heat dissipation
		Fan failure
	Inspection method	Check the compressor current setting
		Check whether the compressor wiring is correct and firm
		Fin of condenser is not hot
		Check whether fan motor is broken
	Troubleshooting	Reset the current according to compressor rating
		Reconnect compressor power cord or tighten the wire
		Please contact professional maintenance personnel
		Clean the condenser or air filter regularly
		Replace faulty fan motor
Low Temp. alarm,Over Temp. alarm	Possible causes	Excessive low ambient temperature
		Oil temperature exceeds 50℃
		Cooling capacity of the chiller is insufficient
		Temperature sensing contact failure
		Refrigeration system failure or refrigerant blocked or leaked
	Inspection method	Check if the startup temperature is too low
		Check if the oil temperature exceeds 50℃
		Recalculate if the required cooling capacity exceeds the load of the chiller
		Check if the temperature sensing contact is normal
		Copper tube on the low pressure side of the compressor is not cold
		Fin of condenser is not hot
		Low temperature of the surface of dry filter
	Troubleshooting	Keep the oil temperature above 1℃ before starting

		Keep the oil temperature below 50℃
		Replace the temperature sensing contact
		Replace a larger cooling capacity chiller
		Please contact professional maintenance personnel
High or Low current	Possible causes	Incorrect wiring or loose connector for fan
		Condenser or air filter blockage
		Inappropriate rated current setting for fan
		Fan failure
	Inspection method	Check the current setting for fan
		Check whether the fan wiring is correct and firm
		Check whether the condenser or air filter is dirty
		Check whether fan motor is broken
	Troubleshooting	Reset the current according to the rated value of fan
		Reconnect the power cord of fan or tighten the wires
		Clean the condenser or air filter regularly
		Replace faulty fan motor
Pump.I high or low	Possible causes	Incorrect oil pump motor rating setting
		Loose or incorrect oil pump motor wiring
		Oil circuit system blockage
		No oil in oil circuit system
		Oil pump motor failure
	Inspection method	Check the current setting value of the oil pump motor
		Check whether the oil pump motor wiring is correct and firm
		Check whether foreign matter exists in oil tank or pipeline
		Check whether there is oil in the oil system
		Check whether the oil pump motor is damaged
	Troubleshooting	Reset the current according to the oil pump motor rating
		Reconnect the oil pump motor power cord or tighten the wires
		Replace new oil and add an oil filter if necessary
		Add oil to the oil system
		Replace the faulty parts
Power failure	Possible causes	Input power reverse phase or phase loss
		Temperature controller failure
	Inspection method	Check whether the main power supply and three phases are connected correctly
		If the power supply is correctly connected, the temperature controller is faulty

	Troubleshooting	Replace any two of the three phases of the main power supply
		Replace the temperature controller

(2) The chiller stops suddenly without showing any fault signal.

Power input,switch on, no display on the temp. controller panel	Possible causes	Main power connection is bad or circuit breaker is disconnected
		Temperature controller failure
	Inspection method	Check if the power supply is normal
		Check if the electrical wiring is normal
		Check if the circuit breaker is turned on
		If all of the above are normal, the temperature controller may be faulty
	Troubleshooting	Reconnect the wiring
		Replace the faulty parts
Temperature controller panel displays normal, pump and refrigeration do not work	Possible causes	Faulty remote control connection or no remote action
		The pump or compressor wiring is correct or not firmly connected
	Inspection method	Check whether the remote wiring is correct or firm, the main equipment outputs remote signals
		Check whether the pump or compressor wiring is correct and firm
	Troubleshooting	Reconnect or tighten the wiring
		Re-output the main equipment remote signal
Refrigeration system does not work	Possible causes	The oil temperature reaches setting temperature, the compressor stops working.
		Poor heat dissipation
	Inspection method	Check if the oil temperature reaches the set value
		Check the internal temperature of the chiller
	Troubleshooting	If oil temperature reaches setting temperature, it's normal for the compressor to stop working.
		Improve the working environment and create a well-ventilated place

Oil temperature does not reach the set temperature but the refrigeration system stops working	Possible causes	Load exceeds the cooling capacity
		Poor heat dissipation
		Refrigerant leakage
		Temperature controller failure
	Inspection method	Check if the required cooling capacity exceeds the load of the chiller
		Check the internal temperature of the chiller
		Copper tube on the low-pressure side of the compressor is not cold
		If all of the above are normal, the temperature controller may be faulty
	Troubleshooting	Replace a larger cooling capacity chiller
		Improve the working environment and create a well-ventilated place
		Please contact professional maintenance personnel
		Replace the temperature controller

8. Electrical diagram

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