

AIR-COOLED DEHUMIDIFIER

MODEL : ADH12000



OPERATION & MAINTENANCE MANUAL



SPEEDO MARINE (PTE) LTD

No 11 Tuas Link 2 Singapore 638559 Tel : (65) 6863 1998 Fax : (65) 6863 1667

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| CONTENT |
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1. INTRODUCTION
2. PRECAUTIONS
3. SYSTEM FEATURES
4. PREPARATION FOR OPERATION
5. START-UP PROCEDURES (AUTO MODE)
6. OPERATION
7. POINT TO TAKE NOTED
8. TROUBLESHOOTING
9. TECHNICAL SPECIFICATION
10. WARRANTY



1. INTRODUCTION

The rate of corrosion or formation of iron oxide on a newly blasted steel plate is directly proportional to the rate of moisture condensing on its surface. Such condensation takes place when the surface temperature of a steel plate is within 3°C from dew point of the given climate.

Dew point is the temperature at which condensation of moisture in the air starts. When given normal ambient of 32°C, the relative humidity or RH of 90%, dew point reading from a psychometric chart is 30.5°C. An afloat tank where radiant heat from sunlight is less, couple with external sea water acting as a cooling media, could easily meet this dew point and traps condensate. This explains why blasted surface inside a tank oxidation faster than openly blasted steel plate

By lowering the RH of the tank below 45%, at room temperature of 27°C. Dew point is lowered to 13°C. Under such condition, a newly blasted surface can be kept away from microscopic oxidation due to condensation for as long as 2 weeks before coating is applied.

Such a process of lowering the RH in an enclosed blasting environment using a dehumidifier is widely practiced today. It cost not more than 4% of the total cost of corrosion control. In return, it allows blasting process to continue day and night without having to apply holding primer. The overall cost is reduced as the completion time is shortened. On top of that, coating quality has improve since there is no overlapping of old and new paint film

Besides controlling RH in a tank, dehumidifier also serves in the following purposes ;

- Promote solvent evaporation from the paint film to ensure proper curing.
- As a means of ventilation to lower-down solvent concentration within a tank to prevent explosion.
- Improve working environment thus increases working efficiency.
- Prevent corrosion due to contact of steel plate with human sweat. Shortening time of water drying after hydro jetting.

Air-cooled refrigerated type dehumidifier performs dehumidification by separating moisture from outside air through condensation. The air discharges is therefore low in temperature and absolute humidity.

The system incorporates a compressor, condenser, evaporator, expansion valves, blower, heaters, three condenser fans and an automatic control unit, assemble within a container structure.

R22, refrigerant agent is compressed by compressor and fed to condenser coil. As the condenser coil is cooled by condenser fan, refrigerant agent in condenser coil is thus liquefied. Liquefied refrigerant agent is then fed through to the evaporator coil via expansion valves. In passing through the expansion valve, the refrigerant drop in pressure, and absorb heat from evaporator coil, and gasified into vapors again. The vapours return back to the compressor to be compressed, and repeat the process itself.



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2. PRECAUTIONS

1. Operator **MUST** read through and understood the content of manual in order to operate the equipment.
2. The manufacturer will not hold any responsibilities for damages caused by not following the operating procedures or mishandling of the equipment.
3. The maintenance and troubleshooting of the equipment must handle by qualified personnel with knowledge on air-conditioning and electrical.
4. Due to the equipment in a highly dusty environment and long operating hours, the equipment requires regular maintenance and should not be left unattended while running.
5. The evaporator will get frozen up if the inlet air filter is choked and will cause liquid refrigerant agent to back-flow to compressor, thus causing severe damage to the equipment.
6. If equipment operates in a heavily dusty environment, cleaning of inlet filter has to be perform every 2 hours. Under normal usage, 2 cleaning session to be done per day.
7. If evaporator gets frozen, do not remove any ice with hammer or chisel. Shut down compressor, turn on air-blower or wash with fresh water.
8. Always ensure all motors supply voltage is sufficient. Motors operate under low voltage in long hours can easily damage.
9. All Motors's direction of rotation was factory set, protected by phase sequence relay. Server damage will cause to the motors if unauthorized wire connection is connected. Ensure motor cabling is earthed.
10. A qualified technician with air cool and refrigerating qualification to operate on the equipment during leakage repair, vacuuming and charging of refrigerant agent

WARNING : Must prevent evaporator from getting frozen at all time as it could caused serious damage to the compressor.



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3. SYSTEM FEATURES

1. There is a aluminum-alloyed filter screen installed on air inlet which has nine- folded staggered layer. The advantages of the filter screen is easy to dis-mantle for washing、 fireproofing and durable.
2. There is aluminum-alloyed pressure regulating valve installed on air inlet of process fan .This valve overcomes the pressure control problem of uncertain distance to the air-inlet.
3. A by-pass heat valve installed at Refrigeration control to allow outout temperature to operate at stable temperature of 12°C.
4. The unit installs many access holes which can make equipment's inspection and cleaning more convenient, to overcome problems of much dust accumulation and difficult cleanning.
4. Auto control adopts advanced temperature controller which has advantages of accurate data, convenient control, easy operation, safe and reliable.
5. The unit adopts RefComp, or Bitzer compressor.



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4. PREPARATION FOR OPERATION

1. The equipment should be placed on a flat, solid ground and provide wooden blocks or plank for level and sound footing.
2. Check the power source. Connect power supply cables to a **3-phase, 415V, 50Hz** AC power source through a circuit breaker. Check that incoming voltage is stable at 400V while standby and during start-up. The proper voltage balance is less than $\pm 6\%$ Check that no loose item example excess cable length ,air thunking, lift wire rope or tools are lying on the roof flaps
3. Check the phase of main power Check the main power lamp on the control panel. Check that "WRONG PHASE" light at switch panel is not lighted to ensure correct incoming phase sequence. Otherwise, reverse any two out of the three income phases.
4. Check the air inlet filter and evaporator. Check that suction air filters are clean and evaporator free from ice. Wash down with fresh water if necessary.
5. Check that access doors can be opened freely.
6. Check the motor can be running freely.
7. Check that condenser fan blades are free rotating and no foreign object or loose items are present within the container housing
8. Check the terminals fastening of each spare part regarding control box. You need to check it up because it might be damaged of all spare parts because of the terminals interval.
9. Position the unit as such that air discharge manifold faces no obstruction.
10. The equipment performance will be reduced because of dust accumulation during long operation, please perform air cleaning by using compressed air periodically.
And as dampness damages electric equipments, please strictly prohibit from washing the unit with water when getting rid of the dust.



5. START-UP PROCEDURES (AUTO MODE)

1. Connect power supply to QF1 circuit breaker from supply source, and inspect power source three-phase voltage is in phase or not and its tolerance is within 10%.
2. Switch on QF1 circuit breaker, check on the phase sequence indicator is ON and when phase-sequence indicator light (yellow) on phase sequence protector not on, It shown there is a wrong power source phase sequence.

Switch off QF1 circuit breaker incoming power source and interchange any two out of the three incoming phases cables to achieve correct phase sequence

3. Switch on power sources controlling circuit breaker QM-B, check white power source indicator is ON, to confirm the control voltage is 220V.

If it not light up, check on FU, fuse is faulty, replace when fuse is open circuit.

4. Inspect connections of motor, winding resistance of motor coils, and confirm resistance to ground is over 0.5MΩ.
5. Inspect connections of compressor, inspect winding resistance of compressor coils, and confirm resistance to ground is over 0.5MΩ.
6. Inspect winding resistance of condenser fan coils of 1 & 2, and confirm resistance to ground is over 0.5MΩ.
7. Inspect connections of after-heater and its three-phase resistance is stable.
8. Switch on ventilator air switch QM1.
9. Switch on condenser fan QM2、QM3.
10. Switch on compressor, QF2.
11. Switch on after-heater air switch QF3 、QF4 、QF5 、QF6.
12. If there is faulty light is on after power up, press SB3 to reset system. If faulty light still unable to reset, refer to circuit drawing for troubleshooting



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6. OPERATION

1. Blower system

Triggered SB1 to power on blower, when blower is trigger, after-heater system and refrigeration system can be operate. When SB2 is triggered, blower will delay shutdown after 3 minutes.

2. After-heater system

After Blower system trigger to operate, switch on SB4 to on after-heater system. After-heater loading will operate base on temperature controller TP3 specification.

Trigger SB5 to stop operation. Refer to Temperature control setting or circuit drawing.

3. Refrigeration system

After Blower system trigger to operate, switch on SB6 to on compressor after 10min delay, compressor system can be regulate reference to TP5 setting. Refer to Temperature control setting or circuit drawing.

Trigger SB7 to stop operation.

4. Shut down procedure

Shut down after-heater system and refrigeration system, then shut down blower system.

The blower system will come to complete shutdown after 3 min delay.

5. Emergency switch

The EA switch is for emergency stop/shutdown



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7. Points to take noted...Important

1. Please reassure correct rotation of condenser fan direction(impeller rotates clockwise) for safety under correct phase sequence.
2. Only ventilation system to be switch on prior to other subsystems (refrigeration system、after-heater system)can be started.
3. The Red emergency switch is for emergency situation, and it is not allowed to use for normal shutdown.
4. Connected 220V to preheat oil heater for 24 hours prior to operate the refrigeration system.
Oil temperature is set to be 40°C
5. Compressor has time delay protection during operation (Factory setting for startup is 10 minutes、and normal shutdown is 20sec).
Compressor is not allowed to start within 10 minutes after power supplied, and compressor should not to restart within 10 minutes after its shutdown.
6. When system is in operation mode, compressor will not be started below 12°C and compressor will not start when evaporator temperature is under 2°C
7. When compressor's HIGH pressure reading is over 1.6Mpa, condenser fan 2 can be operated; when compressor's HIGH pressure reading is less than 1.4Mpa, condenser fan 2 will not operate. (adjustable,on high pressure switch HP2).
8. Fan has shutdown time delay and heat protection feature (factory setting is 3 minutes).
9. OT1 is after-heater ultra-temperature protection.It has been preset to OT1 is 80°C, and there is no need to regulate without special requirements.
10. TP6-1 is compressor's liquid spreading valve temperature controller. When exhaust temperature >100°C, the electromagnetic valve is opened And when temperature < 95°C, the electromagnetic valve will be closed.
11. TP6-2 is compressor's temperature exhaust protection. When exhaust temperature >110°C, the compressor stopped its temperature protection and when temperature < 100°C, the electromagnetic valve will be closed.
12. Temperature control consists of relay output operation or non operation indicator.



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13. Power Capacity :

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| Ambient Temperature | 40°C~27°C | 26°C~16°C | 15°C~5°C | 4°C~10°C |
| Compressor power capacity | 45kW | 34kw~45 kW | 0kw~22.5 kW | 0kW |
| Blower power capacity | 15 kW | | | |
| Condenser Axial Flow Fan power capacity | 8kW | 4kw~8 kW | 4 kW | 0kW |
| After Heater power capacity | 6.75kW | 13.5 kW | 13.5kW~20.25W | 27kW |
| Operating Power < or = | < or = 74.8k W | < or = 81.5k W | < or = 61.75k W | < or = 42k W |
| Total Power | 95.0kW | | | |

The above data are for reference only, and specific use method is determined by users subject to environmental condition and requirements.

Attention: Only trained personnel are allow to operate on the equipment.

Notes: Please do not press the monitor with hard objects such as pen etc, for longer life span.



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8. TROUBLESHOOTING

| Faults | Possible Cause | Possible Symptom | Possible Remedy |
|-----------------------------------|--|---|---|
| System fail to start | Cable | Power source isn't well connected | Reconnect three-phase power source. |
| | Phase sequence | Wrong power source phase sequence. Phase sequence is wrong and light R in phase sequence protector isn't lit up, motion is preserved now and unit won't start | Inter-change any two phases of power source till light R is lit up. |
| | Emergency STOP switch | Emergency stop button is pressed | Reset |
| | Abnormal Power Source | Light V is lit up when power voltage is over or sub 10%, motion is preserved and unit won't start. | supply power with a stable voltage till light V went off |
| | power source controlling switch | the power source controlling switch is not energize. | Switch on the power source switch. If the switch trip immediately after switching on, do not force to switch on, check for any electricity leakage or short circuit occurs. |
| | Ventilator | Ventilator is normal or not | Inspect ventilator's resistance. When ventilator's static resistance is unbalanced, resistance to ground is $<0.5M\Omega$, motor may be burnt, and ventilator's power source must be switch on after it is repaired. |
| Refrigeration System not working. | Condenser fan | Condenser fan not working | Check condenser fan resistance, make sure it is normal and start condenser fan. |
| | Compressor | Compressor not working | Switch on power source after assuring compressor's static resistance is normal, and inspect if high pressure protector is out, set back manually if moves. |
| | Ambient temperature and evaporator temperature display | Display not working. | Inspect ambient temperature and evaporator temperature display are normal. Replace if not working |



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|----------------------------------|---|---|---|
| After-heating System Not Working | Heater | Heater's static resistance is abnormal, the heater may be damaged. | Check & replace. |
| | Connection | Check for heater's loose cable connections are secure | Secure & tighten |
| | Heater switch | Check for heater's switch is on, if it is off, | Switch on breaker. |
| | Heater's ultra-temperature switch OT1 | Check heater's ultra-temperature switch OT1 is damage. | Check & replace. |
| | Air outlet temperature and humidity display | Not working | Check & replace. |
| Faulty light display ON | Process Fan Power Source | Process Fan Power Source Fault Handling: Inspect QM1 is on,if it is on,inspect connections. | Check & rectify |
| | Refrigeration Power Source | Refrigeration Power Source Fault Handling:Inspect QF2、QM2、QM3 is on, if it is on,inspect connections. | Check & rectify |
| | Compressor High Pressure Protection | Compressor High Pressure Protection Handling:Inspect compressor is over ultra-pressure(HP1). | Check & rectify |
| | Compressor Low Pressure Protection | Compressor Low Pressure Protection Handling:Inspect compressor is under low-pressure(LP), check refriferant is low & pressure side filter screen is blocked. | Check & rectify |
| | Compressor Heat Protection | Compressor Heat Protection Handling: check compressor has heat protection (FR1). | Check & rectify |
| | Compressor Inner Protection | Compressor Inner Protection Handling: Check compressor has inner protection(ST), if it is protected,break QM-B and close it. | Check & rectify, switch on after 30 sec |
| | After-heater high temperature | After-heater Power Source Fault Handling: Check after-heater is protected by ultra-temperature(OT1), if it is protected, protector will reset automatically after it has cooled down. | Check & rectify |
| | Phase - sequence wrong phase | Wrong phase sequence connection | Interchange any 2 of the 3 power cable till green indicator light is on |



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| | Compressor oil level faulty | Compressor oil level being protector(YW) being triggered | Check and rectify QM-B, shut down and switch on after 30 sec. |
| | Compressor exhaust temperature protection | Compressor exhaust temperature overheated (TP6-2) | Check and rectify, manual reset |



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9. TECHNICAL SPECIFICATION

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|--|---|
| Model No: | ADH 12000 |
| Air Flow Capacity | 12000 m ³ /hr |
| Cooling Capacity | 155000 Kcal/hr |
| Static Pressure | 2400 Pa |
| Cooling Media | Air Cool |
| Refrigerant | R22 |
| Inlet Air Temperature | 20°C to 40°C ± 5°C |
| Discharge Air Temp & Relative Humidity | 25°C ± 5°C, RH=45% & below |
| Dew Point | 10°C |
| Evaporator Coil | Copper tube / Copper fin with stainless Steel Casing |
| Condenser Coil | Copper tube / Aluminium fin with Stainless Steel Casing |
| Control Panel | Traditional Relay Control (IP55 Enclosure) |
| Compressor Capacity | 60HP, 45 KW 【RefComp】 |
| Condenser Fan Motor | 2 × 4.0 kw |
| Blower Motor | 15 kw |
| Electric Heater | 27 kw |
| Total Power Consumption | 95.0 kw |
| Power Supply | 380~415 V / 50Hz / 3 phase |
| Machine Structure | Containerized |
| Outlet Connection | 4 × Φ280mm |
| External Dimension | 3600 × 2100 × 2500mm(L×W×H) |
| Weight | 4.3 Ton |



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10. WARRANTY

Coverage

This system is subjected to a 12 months warranty which includes service and repair with exclusion to replacement of wear and tear parts and replacement of:

1. Evaporator suction filter net
2. Air filter net

Exclusion

The manufacturer will not responsible for any damages caused for the following reasons.

1. Physical damage to the container housing or any component due to improper lifting, loading or unloading.
2. System damage due to vibration arises from poor positioning of the machine on an uneven ground.
3. Damages to any component, fan blower rotation cause by any foreign object
4. Damages causes by wrong electrical power connection
5. Damages causes by missing of earth connection
6. Damages to motors due to wrong phase connection
7. Damages to motors due to improper positioning
8. Damages to system due to loose electrical cables to power source or broken cable insulation
9. System damages due to unauthorized adjustment made on all electrical components

NOTE: The manufacturer reserves the right to make changes in technical and product specification without prior notice.