Part # 457046

Installation, Operation and Maintenance Instructions

for MAKE UP AIR UNITS
with Electric Heaters *and* Steam, Water *and* DX Coils

WARNING:
Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and, maintenance instructions thoroughly before installing or servicing this equipment.

This manual is the property of the owner, and is required for future maintenance. Please leave it with the owner when you complete the job.

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Receiving and Handling

Upon receiving the equipment, check for both obvious and hidden damage. If damage is found, record all necessary information on the bill of lading and file a claim with the final carrier. Check also to be sure all parts of the shipment, including accessories, are accounted for.

Storage

When a fan is to be stored prior to installation (or for any long period of time) it must be protected from dirt and moisture. Covering the unit will aid in keeping it clean and dry. Plastic or vinyl sheeting should not be used, since they promote condensation. Improper storage which results in damage to the unit will void the warranty. The wheel and motor should be rotated periodically if the storage period is lengthy. Once every three months is recommended.

Unit Installation

This unit should be installed according to the GFC IOM:
 # 456856 for TSU's.

Warranty

Greenheck Fan Corporation warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove to be defective during the warranty period will be repaired or replaced at our option.

The motor is warranted by the motor manufacturer for a period of one year. Should the motor prove defective during this period, it should be returned to an authorized motor service station.

Greenheck Fan Corporation will not be responsible for any installation or removal costs.

Due to continuing research, Greenheck reserves the right to change specifications without notice.

Electric Heater Option

WARNING: Electrical Shock Hazard! Disconnect all Power sources before doing any work on the unit.

General:

The requirements and practices described below are based on the National Electric Code and The Space Heating Standard of the Underwriters Laboratories Inc. (UL). Although UL requirements are uniform throughout the country, local electrical codes may deviate from the National Electrical Code; therefore, local inspection authorities should be consulted regarding local requirements.

Electrical Wiring Instructions:

1. Use the wiring diagram supplied with the heater as a guide in correlating field wiring with the heater internal wiring.
2. All field wiring to the heater must meet the requirements of the National Electric Code (NEC) and any other applicable local or state codes.
3. Wiring to the heater must be rated for 75^{o}C minimum.
4. The fan is interlocked by the factory to the control circuit so the electric heater is not on unless the fan is on.
5. If heater does not have a built-in disconnect switch or main circuit breaker, install a remote disconnect (furnished by others) in accordance with the National Electric Code, Article 424-65.

Calculation of Line Currents:

(Amps) Single Phase Current = $\frac{\text{Watts}}{\text{Volts}}$

Example: Single Phase 5 KW, 208 Volt

$$\frac{5000 \text{ Watts}}{208 \text{ Volts}} = 24 \text{ Amps}$$

Three Phase Current = $\frac{\text{Watts}}{\text{Volts x 1.73}}$

Example: Three Phase 14.4 KW, 208 Volt

$$\frac{14400 \text{ Watts}}{208 \text{ Volts x 1.73}} = \frac{14400}{360} = 40 \text{ Amps}$$

Sizing of Supply Conductors:

The required minimum size of supply conductors is marked at the field wiring terminals within the heater control box; however, for reference the table on the following page is included. The wire gauges are calculated for 125% of the heater line current as required by the National Electric Code, Article 424-3 (b) based on conductor insulation rated for 75^{o} C (167^{o} F).

Supply Wire Size (Not More Than 6 Conductors in Single Conduit[1])			
AWG or MCM	Max. Heater Line Current[2] Copper[3]	AWG or MCM	Max. Heater Line Current[2] Copper[3]
14	12	0000	184
12	16	250	204
10	24	300	228
8	36	350	248
6	52	400	268
4	68	500	304
3	80	600	336
2	92	700	368
1	104	750	380
0	120	800	392
00	140	900	416
000	160	1000	436

[1] For 7-24 conductors in raceway or cable reduce allowable heater line currents to 87 1/2 % of those shown above.

[2] Based on 30° C (86° F) ambient temperature, for higher ambient temperature see N.E.C. table 310-16 and 310-18 Note 13.

[3] Based on 80% of ratings in table 310-16 N.E.C. for 75° C insulation.

Effect of Low Voltage on Wattage and B.T.U.:

The heating elements may be used on voltages lower than the design voltage of the heater; however, the wattage and B.T.U. output will be reduced to the percentages listed in the table below.

De-rated Wattage For Low Voltage					
Heater Voltage	Line Voltage	% of Heater Wattage and BTU	Heater Voltage	Line Voltage	% of Heater Wattage and BTU
480	460	92	208	200	92
	440	84		190	83
277	265	92	120	115	92
	254	84		110	84
240	230	92			
	220	84			
	208	75			
	200	69			

Electric Heater Sequence of Operation:

1. 120 Volt power from the control center (when supplied) or by others with out a control center, is delivered to the electric heater for the step controller. This power must be interlocked with the supply fan, so when the fan is off, the heater control power is off.

2. A thermostat with a duct stat is supplied. The duct stat is placed in the blower discharge and monitors the heated air.

3. Electric Heaters are divided in to equally sized steps. For example, a 100 KW heater with 5 steps will have 20 KW per step. The thermostat and step controller will control these steps.

4. A temperature and time delay of 0.7^{o} F and 2 seconds, respectively, is standard for the controller. This is designed to prevent unncecessary cycling.

5. With the thermostat set to 70^{o} F the heater will be off with a temperature sensing above 70^{o} F. As the temperature varies the steps turn on and off to hold the setpoint discharge temperature. The colder the discharge temperature becomes the more steps the controller will energize.

6. In addition to the fan interlock mentioned in step 1, the heater has an airflow switch to prove that air flow is established before energizing the steps. The heater also has an automatic resetting highlimit switch and manual resetting highlimit switch set above the automatic switch to protect from overheating.

Troubleshooting:

Check-out Procedure:

1. Equipment Needed:
   a. Digital Voltmeter (0 - 20 VDC range) DVM.
   Input for intended use. May be Thermostat (HCC - 10K) or other input such as 0 - 13 ohm, 0 - 20 VDC, 0 - 20
   b. MA, 6 - 9 VDC, or 8 - 16 VDC.
   c. Output relays (loads) for output stages or 200 ohm, 5 watt resistor.

2. Wiring:
   a. Plug in the required number of 2 stage PC boards for application. **(Stage boards always include two stages.)**
   b. Connect output relays or 200 ohm, 5 watt resistor to provide output load.
   c. Program Input Switch to ON or OFF for seven positions provided.

Steam Coils

Application Recommendations:

Satisfactory operation and service life are best ensured when coils are installed with proper piping, trap, and support arrangement. The following notes and figure 1 (page 7) are recommended for the coil unit installation and operation.

General:

1. Provide separate supports and hangers for the unit and the piping.
2. Be certain that adequate piping flexibility is provided. Stresses resulting form expansion of closely coupled piping and coil arrangement can cause serious damage.
3. Standard steam coils are pitched in the casings when installed for horizontal air flow. The CASING MUST BE LEVEL after the unit is installed for proper condensate drainage. If condensate is not removed the coil will suffer from water hammering and will have a shortened life. On vertical air flow applications, the coils must be pitched when installed.
4. Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to the trap.
5. It is recommended that vacuum breakers be installed on all applications to prevent retaining condensate in the coil. Generally, the vacuum breaker is to be connected between the coil inlet and the return main. The vacuum breaker should be open to the atmosphere and the trap design should allow venting of large quantities of air.
6. Do not drip supply mains through the coil.
7. Do not attempt to lift condensate when using modulating or on-off control.
8. Do not reduce the pipe size leaving the coil.

Traps:

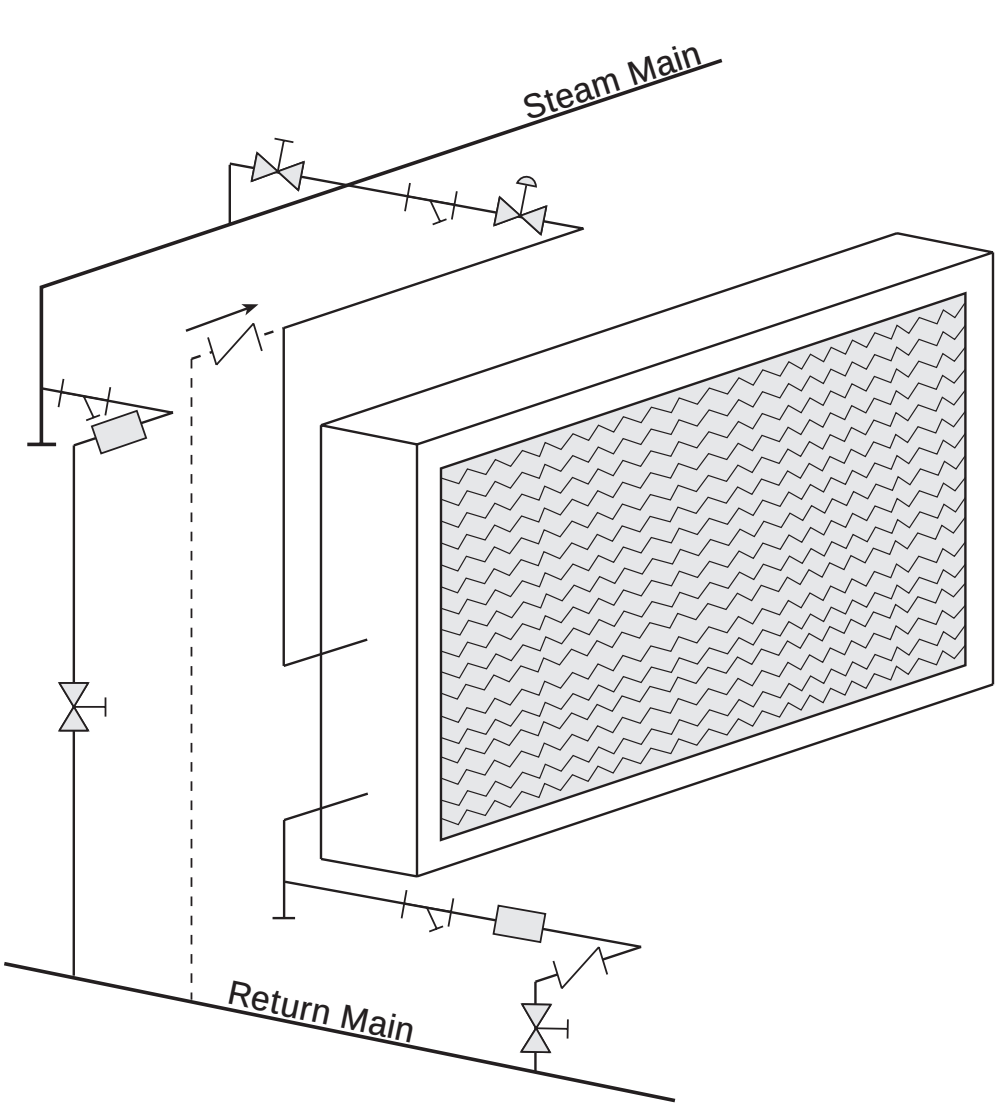
1. Size traps in accordance with the manufacturer's recommendations. Be certain that the required pressure differential will always be available. DO NOT UNDERSIZE.
2. Float and thermostatic or bucket traps are recommended for low pressure steam. On high pressure systems, bucket traps are normally recommended. The thermostatic traps should be used only for air venting.
3. Bucket traps are recommended for use with on-off control only.
4. Locate traps at least 12 inches below the coil return connection.

Controls:

1. On high pressure installations, a two-position steam valve with a face and bypass arrangement is preferred where modulating control is required.
2. Modulating valves must be size properly. DO NOT UNDERSIZE.

Freezing Conditions (Entering air below 35ºF):

1. 5 PSI steam must be supplied to the coil at all times.
2. Modulating valves are not recommended. Control should be by means of face and bypass dampers.
3. Provision should always be made to thoroughly mix fresh air and return air before it enters the coil on return air units. Also, temperature control elements must be properly located to obtain true air mixture temperatures.
4. As additional protection against freeze-up, the trap should be installed sufficiently far below the coil to provide an adequate hydrostatic head to ensure removal of condensate during an interruption in the steam pressure. Estimate 3 feet for each 1 PSI of trap differential required.
5. On start up, admit steam to coil ten minutes before admitting outdoor air.
6. Provision must be made to close fresh air dampers if steam supply pressure falls below minimum specified.



Gate Valve

Control Valve, Modulating Two-Position

Check Valve-Vacuum Breaker

Float and Thermostat Trap

Strainer

Greenheck does not supply coil controls, all control elements shown are supplied by others.

Figure 1
Recommended Steam Coil Piping

Direct Expansion Coils

Application Recommendations:

1. Piping should be in accordance with accepted industry standards.
2. The condensate drain pipe should be sized adequately to ensure the condensate drains properly. The bottom of the drain pan should be twice the distance of the internal static pressure water column above the exit of the trap.
3. When connecting suction and liquid connections make sure the coil is free from all foreign material. Make sure all joints are tight and free of leakage.
4. Greenheck does not supply compressor or condensing units, for further instruction on DX coil installation and operation contact your compressor and/or condenser manufacturer.

Water Coils

Application Recommendations:

1. Piping should be in accordance with accepted industry standards.
2. Connect the WATER SUPPLY TO THE BOTTOM CONNECTION on the air leaving side and the WATER RETURN TO THE TOP CONNECTION on the air entering side. The extra bottom connection can be used for an auxiliary manual drain connection, and the extra top connection can be used for an automatic air vent or the extra connections can be capped. Connecting the supply and/or return in any other manner will result in very poor performance.
3. The air vent at the uppermost point should be temporarily opened during system start-up to release all of the air from the coil. To maintain heat transfer capacity, periodically vent any air in coil.
4. Water coils are not normally recommended for use with entering air temperatures below 40ºF; however, special high pressure water coils have been used successfully on high temperature hot water jobs with low entering air temperatures when correctly controlled. No control system can be depended on to be 100% safe against freeze-up with water coils. Glycol solutions or brines are the only safe media for operation of water coils with low entering air conditions.
5. When fresh and return air are to be heated by a hot water coil, care should be used in the design of the duct work to ensure thorough mixing before the air enters the coil. The return air should always enter the bottom of the duct and the fresh air should enter the top of the duct. The greater the distance between the mixing point and the entrance to the coil, the better the application. Temperature control elements should be located to sense the lowest temperature air that will enter the coil. Always install gasketed fresh air dampers which are automatically controlled to close whenever the water leaving the coil is too cool, or the fan stops. Care should be used in designing fresh air intake to prevent stack effect (or wind) from forcing cold air through the coils when the fan is shut down. Two sets of dampers are frequently required. CONTINUOUS WATER CIRCULATION THROUGH THE COIL AT ALL TIMES IS HIGHLY RECOMMENDED.
6. Pipe sizes for the system must be selected on the basis of the head (pressure) available from the circulation pump. The velocity should not exceed 8 feet per second and the friction loss should be approximately 3 feet of water column per 100 feet of pipe.
7. For chilled water coils, the condensate drain pipe should be sized adequately to ensure the condensate drains properly.

Coil Maintenance

Filters:

Filters upstream of the coil should be checked regularly for dirtiness and clogging. If the filters are dirty, they should be cleaned or replaced. It is important that the coils stay clean to maintain maximum heat transfer capability.

WARNING: Biological Hazard! All drain pans and coils should be cleaned on a regular schedule by qualified personnel to prevent the growth of bacteria.

Cleaning:

1. Coils must be clean to obtain maximum performance. Soiled fins reduce the capacity of the coil, demand more energy from the fan, and create a medium for order and bacteria to grow and spread through the conditioned zone. High pressure water (700 Psi or less) may be used to clean coils with fin thickness over .0095 inches thick. TEST THE SPRAY PRESSURE over a small corner of the coil to determine if the fins will withstand the spray pressure. For coils with fragile fins or high fin density, foaming chemical sprays and washes air available. Many coil cleaners contain harsh chemicals, so they must be used with caution by qualified personnel only. Care must be taken not to damage the coils. FINS ARE SHARP! Use caution when working with coils.
2. Drain pans in any air conditioning unit will contain moisture; therefore, algae and other organisms will grow due to airborne spores and bacteria. Scheduled cleaning is necessary to prevent build-up from clogging the drain. The drain pans should also be kept clean to prevent growth of bacteria and the spread of disease.

Winterizing Coils:

During any extended down time, all water should be drained from the coil. The coil should then be thoroughly flushed with a glycol solution to prevent freeze damage.