

ESC-SERIES

Formerly *SPEC-AIR*

Evaporative Cooling TECHNICAL MANUAL

⚠ 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.



LIMITED WARRANTY

Cambridge Engineering's Limited Warranty is included with the Terms and Conditions that are sent with every Order Acknowledgement. For questions regarding the Limited Warranty, contact Cambridge Engineering's Customer Service Group at 1-800-473-4569 during the hours of 8:00 a.m. to 5:00 p.m. Central Time, Monday through Friday.

ESC-SERIES

Evaporative Cooling

TECHNICAL MANUAL

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SAFETY CONSIDERATIONS

Throughout this manual are Warnings, Cautions and Notes to alert the installing contractors, service and maintenance personnel of potential hazards that could result in personal injury, death or serious damage to property or equipment.

Your personal safety and the proper operation of this machinery depend on the careful observance of all Warnings, Cautions and Notes.

WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or to alert against unsafe practices.

NOTE: Indicates a situation that could result in equipment or property damage, or provides important information on installation considerations.

WARNING: Proper Field Wiring and Grounding Required! All field wiring **MUST** be performed by qualified personnel. Ensure all field wiring and grounding is accomplished in full accordance with National Electrical Code (NEC) and local/state electrical codes. Failure to do so may pose **FIRE** or **ELECTROCUTION** hazards resulting in death or serious injury.

WARNING: Personal Protective Equipment (PPE) Required! Installing/servicing this unit could result in exposure to electrical, mechanical and chemical hazards.

- Before installing/servicing this unit, technicians **MUST** wear all recommended Personal Protective Equipment (PPE) for the specific work being undertaken. **ALWAYS** refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.
- When working with or around hazardous chemicals, **ALWAYS** review appropriate Safety Data Sheets (SDS) and OSHA guidelines to ensure compliance with safety standards for personal exposure levels, proper respiratory protection and handling recommendations.
- If there is a risk of arc or flash, technicians **MUST** put on all Personal Protective Equipment (PPE) in accordance with NFPA 70E or other country-specific requirements for arc flash protection, **PRIOR** to servicing the unit.

Failure to follow recommendations could result in death or serious injury.

OVERVIEW OF MANUAL

Cambridge Engineering ESC-Series units are custom fabricated air handlers that use evaporative cooling to meet specific usage and dimensional requirements. These models come with various options including service access location, utility connections, airflow arrangement and accessories. Use this manual to install, start-up, operate, and maintain the Cambridge Engineering ESC-Series models. A careful review of this manual will help minimize installation, startup, and maintenance difficulties.

NOTE: For more detailed information on individual evaporative cooling, heating, and control components refer to individual manufacturer's technical manuals.

Unit Description

The ESC-Series air handler is a semi-custom designed for a variety of applications. The basic unit consists of an evaporative cooling section, fan, heating and/or cooling coils, filters, and dampers. The unit ships as a complete assembly whenever possible and in sections based upon customer request or shipping requirements. Units shipped split will require field connection by the installing contractor.

RECEIVING, OFFLOADING, AND RIGGING INSTRUCTIONS

Upon receipt of the air handler(s), a thorough inspection should be performed to note any shipping damage that may have occurred and that the shipment is complete. Factory shipping protection should be removed immediately to allow complete access for the inspection. The shipping protection provided by the factory is for transit protection only and should not be used as a jobsite storage cover.

Receiving Checklist

- Check all access doors to confirm that the latches and hinges are not damaged.
- Inspect the interior of each section for any internal damage.

NOTE: Concealed damage must be reported within 5 days of receipt.

- Inspect the coils for damage to the fin surface and/or coil connections.
- If the unit was ordered with factory-mounted controls, locate all sensors.

Operating Environment

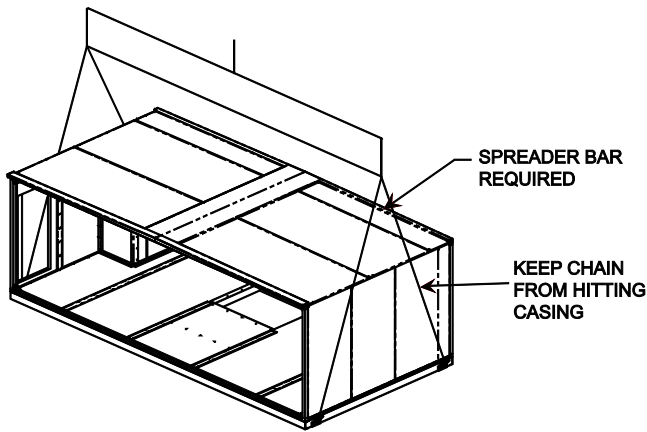
Unit can be designed for both indoor or outdoor applications. When considering the placement of the air handler, it is important to consider the operating environment. The acceptable ambient temperature range for unit operation is -10 to 115° F.

CAUTION: Do not subject E2 Pak to temperatures over 140°F/ 60°C.

NOTE: Careful consideration is also required if the air handler(s) will be installed within a coastal temperate zone. Additional protective coatings may be necessary to prevent corrosion.

NOTE: Items that are shipped loose will be located inside the unit and identified.

- Check all control devices attached to the unit exterior and confirm that they are not damaged.
- Manually rotate the fan wheel to ensure free movement of the shaft, bearings, and drive.
- Inspect the fan housing for any foreign objects.
- If the unit is shipped in sections, locate the assembly hardware, which should be packaged and shipped inside a section of the unit.
- Inspect and test all piping for possible shipping damage. Nipples may be installed on coils at the factory but should always be tightened and tested before any connections are made. Rough handling during shipping, in addition to other factors can cause pipe connections to become loose.



Resolving Shipping Damage

NOTE: Cambridge Engineering is not responsible for shipping damage.

Cambridge Engineering air handlers ship freight-on-board (FOB).

Ownership of the units transfers to the customer the moment the delivery truck leaves the Cambridge Engineering factory. If damage has occurred to the unit during shipment, follow these instructions:

1. Make specific notation, describing the damage, on the freight bill. Take photos of the damaged material if possible.
2. Report all claims of shipping damage to the delivering carrier immediately and coordinate carrier inspection if necessary.
3. Contact Cambridge Engineering immediately for replacement of damaged parts or components.

NOTE: Do not attempt to repair the unit without consulting the delivering carrier and Cambridge Engineering.

Forklifting Considerations

WARNING: Refer to unit submittals for weight and forklift limitations before attempting to use a forklift for offloading.

A forklift may be used to lift a single section provided the forks extend under both ends of the base frame. The forks should not contact the bottom of the air handler. Units should only be lifted from the proper end identified by the lifting label on the unit. A lifting crane or other means should be used for larger units where forks cannot extend under both base rails.

Preparing the Unit Site

Ensure the installation site can support the total weight of the unit and curb. Refer to the unit submittals for actual weights. Preparation of roof curb or mounting pad should be completed before hoisting/rigging unit to roof. Refer to submittals for specific Cambridge Engineering minimum requirements.

General Notes:

- Allow room for all piping, ductwork, and electrical connections, and fan and coil removal.
- Ensure there is adequate height for condensate drain requirements.

NOTE: If unit is installed in a mechanical room on a pad, inadequate height may necessitate core-drilling the floor to attain proper trap height. Insufficient height could inhibit condensate drainage and result in flooding the unit and/or equipment room.

- Confirm the roof curb or foundation of the mounting platform is level and large enough to accommodate the unit. Refer to the unit submittals for specific dimensions.
- Provide adequate lighting for maintenance personnel to perform maintenance duties.
- Provide permanent power outlets in close proximity to the unit for installation and maintenance.

Rooftop curb-mounted units must be sealed tightly to the curb. Use proper sealants and roof-to-curb sealing techniques to prevent water and air leakage prior to air handler installation.

Offloading and Rigging Instructions

Field rigging procedures will vary. Lifting brackets are built into the unit. Additional lifting brackets/clips may be provided with the unit when required. Use a spreader bar and proper rigging and lifting procedures to avoid equipment damage and personal injury.

General Lifting Considerations

Before preparing the unit for lifting, estimate the approximate center of gravity for lifting safety. Because of placement of internal components, the unit weight may be unevenly distributed, with more weight in the coil and fan areas. Refer to the unit submittals for actual section weights. Test the unit for proper balance before lifting.

For outdoor air handlers, preparation of the roof curbs or pier mounts and roof openings must be completed before lifting to the roof.

- Always rig sections as they ship from the factory.
- Never bolt sections together before rigging.
- Use all lifting lugs provided. The air handler is not designed to be lifted or rigged from the top of the unit.
- Never stack the inlet hood on the unit as it is being lifted.
- Do not attach the intake hood (if shipped loose) to the unit prior to lifting the unit. Doing so may damage the equipment. Attach the hoods to the unit only after all sections are in place.
- For outdoor air handlers, all shipping supports and crating on the face of the sections must be removed to permit proper fit-up and sealing of the surfaces. Dispose of properly.

Unit Placement and Assembly

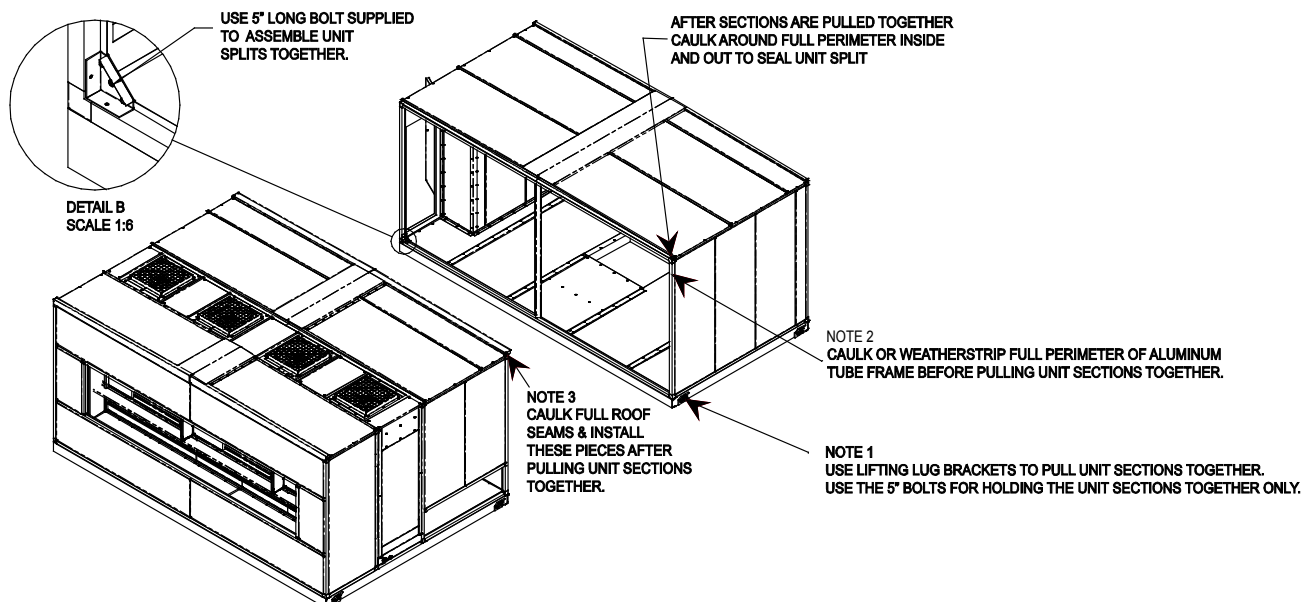
After assembling and hoisting the unit, mount it on its roof curb or rail mount. Make sure that the gasket around the base channel provides an airtight and watertight seal. The unit should be supported by its base channel, around the entire perimeter of the unit. Check that the unit is level to ensure proper operation. For vertical discharge units, allow space for duct connections under the unit.

Adequate clearance must be provided around unit for service access and free air passage. Allow sufficient room to pull coils and fans if necessary. If unit is enclosed by walls or other obstructions on all four sides, allow a minimum of 72" clearance on all four sides.

NOTE: Cambridge Engineering air handling units typically ship complete. Based on unit size and customer requirements, units may ship in sections and need to be field assembled.

If a unit arrives in sections, then each section must be individually hoisted, set on the housekeeping pad, roof curb, or rail and then assembled. Refer to the unit submittals and unit tagging for correct placement of all sections. If there are any discrepancies between the submittals and the unit tagging, contact your local Cambridge Engineering representative before proceeding. Following the order of the sections on the unit submittals and tagging, individually place each unassembled section in the appropriate installation location.

Section to Section Assembly



Assembly Hardware

Cambridge Engineering air handlers ship with all necessary assembly hardware and gasket material located inside the unit. If there is not enough space inside a section, then a crate or pallet will be loaded onto the bed of the truck.

Check all sections thoroughly before contacting your Cambridge Engineering Sales Representative to report missing items.

NOTE: Do not proceed with unit assembly until verification that all materials are present.

Sections are joined with a gasket applied to one of the mating surfaces and hardware to bolt the sections together. 1” wide closed cell foam gasket with adhesive backing is used for section-to-section joints.

INSTALLATION — MECHANICAL

NOTE: All work to conform to local, state, and national codes and ordinances and per approved submittals.

INTERNAL ASSEMBLY

Component Installation Requirements

NOTE: The components in the air handler may have installation requirements that could affect the unit’s performance.

Typical components include, but are not limited to, Inlet Hoods or Louvers, Dampers, Filters, Evaporative Cooling Sections, Fans and Isolation, Control and Electric Panels, Gas Heaters, Coils and Valves.

Additional information to install and/or adjust components can be referenced from the manufacturer’s technical manuals and are attached for your reference.

EXTERNAL CONNECTIONS

NOTE: Air handlers often include factory provided casing penetration (entry points) for field provided piping and wiring. Consider overall unit serviceability and accessibility, mentioned previously, before mounting and installing any permanent connections to the cabinet.

Duct Connections

All duct connections to the air handlers should be installed in accordance with the standards of the National Fire Protection Association (NFPA) and all other local, state, and national codes and ordinances, including:

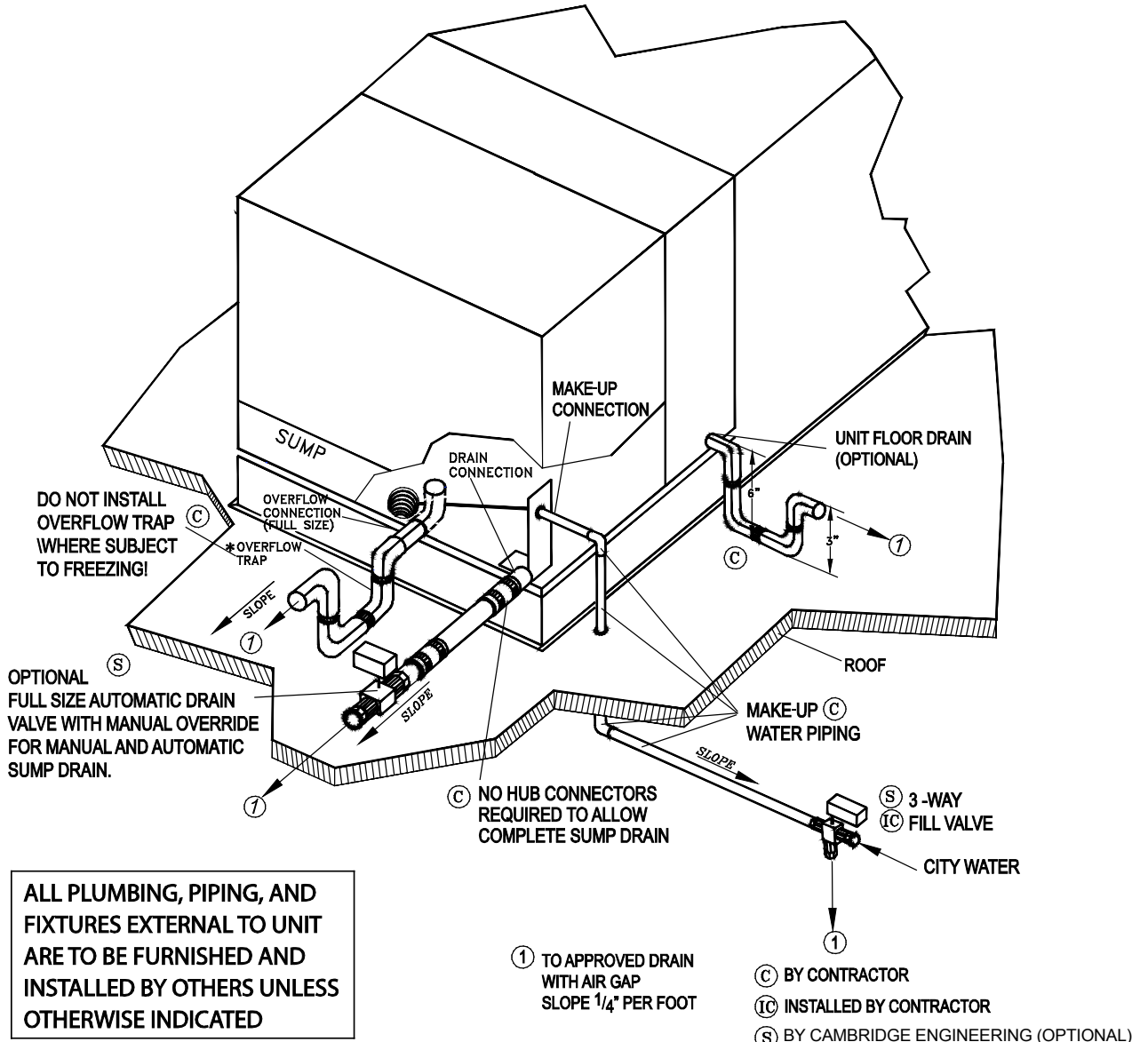
- NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems for installing air conditioning and ventilating systems other than residence type.
- NFPA 90B Standard for the Installation of Warm Air Heating & Air-Conditioning Systems.
- See unit submittal documentation & specifications for any additional duct mounting information.

Fan Discharge Connections

To ensure the highest fan efficiency, duct turns and transitions must be made carefully, minimizing air friction losses and turbulence. Proper ductwork installation, as outlined by such organizations as Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), should be followed closely.

FILL AND DRAIN VALVE SCHEMATIC

DRAIN, OVERFLOW AND MAKE-UP WATER PIPING FOR AUTODRAIN WITH FREEZE PROTECTION



Coil Piping Recommendations

1. Proper installation, piping and trapping is necessary to insure satisfactory coil operation and to prevent operational damage.
2. Support all piping independently of the coils.
3. Provide swing joints or flexible fittings in all connections that are adjacent to heating coils in order to absorb thermal expansion and contraction strains.
4. Check that the coils are installed correctly, with airflow in the same direction as indicated on the nameplate or coil casing.
5. For best results, Cambridge Engineering recommends that a short pipe nipple be used on coil headers prior to making up any welded flange or welded elbow type connections. This allows the use of a back-up pipe wrench which prevents over-tightening when it is necessary to rotate the welded flange or elbow until the bolt holes line up with the mating flange on the pre-fabricated piping.

NOTE: Use a “Back-Up Wrench” when attaching piping to coils with copper headers. Do not use brass fittings or brass pipe connectors. Brass distorts easily and causes connection leaks.

6. When attaching the piping to the coil header make the connection only tight enough to prevent leaks. Maximum recommended torque is 200 foot-pounds. Use pipe sealer on all threads.
7. Connect supply and return coil piping. Verify the coil's water lines are correctly installed for counter flow operation.
8. After completing the piping connections, seal around pipe from inner panel to outer panel.
9. Provisions must be made to drain coils that are not in use when subjected to freezing temperatures.

CAUTION: Failure to properly drain and vent coils when not in use during freezing temperatures may result in coil freeze-up damage. In all steam coil installations, the condensate return connections must be at the low point of the coil.

10. Install air vents for piping per plans, specifications and submittals and per local, state, and national codes and ordinances.
11. Check for coil fin damage and straighten if necessary.

CAUTION: Do not throttle or modulate the water flow for coils that are exposed to freezing air. Coil damage may result from freeze-up.

NOTE: Cambridge Engineering recommends the following if not already included:

12. Install a strainer ahead of the control valve when used.
13. Install a drain line with a shutoff valve near the coil.

Condensate Drain Connections

A condensate drain connection is provided on the door side of the fan/coil section drain pan. Check the openings for obstruction to flow. Install drain and trap per local, state, national codes, and ordinances and approved submittals.

Gas Piping

NOTE: All unit installations must be in accordance with NFPA 54/ANSI Z223.1: National Fuel Gas Code in the United States and CSA B149.1, Natural gas and propane installation code in Canada, and all other applicable local, state, and national codes and ordinances.

Refer to gas heater manufacturer's technical manual for specific requirements.

All internal gas piping is factory installed and pressure/leak tested before shipment. Once the unit is set into place, the gas supply line must be field connected inside the gas heat control compartment.

Electrical Connections

NOTE: All field installed wiring must comply with NEC and applicable codes. Properly ground the unit. The unit, when installed must be electrically grounded in accordance with the National Electrical Code, ANSI/NFPA No. 70E

Refer to the Cambridge Engineering wiring diagrams furnished with the unit, regarding factory wired and field installed wiring requirements. Actual wiring diagrams will differ according to the options used. The outdoor conduits leading into the unit should be installed to prevent rain from wetting any high voltage wire.

Install all power wiring and controls per drawings, specifications, and applicable codes.

- Verify that power supply electrical characteristics comply with unit nameplate specifications.
- Inspect all control panel components: tighten any loose connections.
- Connect properly sized and fused power supply wiring to a field supplied/installed disconnect and unit power terminal block or to an optional unit mounted disconnect switch.
- Complete field wiring for the controls, as applicable.

START-UP

Pre-Startup Checklist

Once the air handler has been assembled, installed, and piped attention must be directed to individual components for proper operation. Before operating the unit, complete the Pre-Startup checklist. Sign and send copy to Cambridge Engineering.

NOTE: Follow all manufacturer's guides for Pre-Start Up. The following is a guide only.

- Remove any debris from the unit interior.
- Remove all foreign material from the drain pan.
- Check drain pan opening and condensate line for obstructions.
- Ensure the unit has been installed level.
- Ensure damper operator motor and connecting linkage have been installed.

- Verify damper operation and linkage alignment.
- Check that air filters are in place and positioned properly.
- Close and secure all unit access doors.
- If differential pressure switch is provided on filter rack, adjust per system requirements.
- Inspect electrical connections to the unit and unit controllers.
 - Connections should be clean and secure.
 - Compare the actual wiring with the unit diagrams.
 - Reference the appropriate controller manual for more details about starting units with factory-mounted controls.
- Check all items in Cambridge Engineering direct and indirect evaporative cooling modules Start-Up Checklist.
- Ensure supply and return air ducts have been connected properly.
- Ensure all piping, connections, vents and drains have been connected properly.
- Ensure all gas piping, connections, drains and flue vent piping have been connected properly.
- Check piping and valves for leaks. Open or close the valves to check for proper operation. Drain lines should be open.
- Leave this manual with the unit.

Start-Up Checklist

NOTE: The following are guidelines:

After completing the Pre-Startup Checklist the unit may be operated. The following checks and adjustments should be made during the initial start-up:

- Measure the motor voltage and amperage on all phases to ensure proper operation. The readings should fall within the range given on the motor nameplate.
- Check fan rotation and correct if necessary.
- Check all interlocks to be sure that connected components work per plans and specifications.
- Sign and send copy of Start-Up Checklist to Cambridge Engineering.

MAINTENANCE

The following are general maintenance procedures and guidelines and should be used for reference purposes only. Refer to manufacturer's technical manuals for specific procedures and frequency.

Maintenance Checklist

Frequency of Maintenance

After 48 hours of operation

- For belt-drive fans, the belts have acquired their permanent set. Readjust but do not overtighten.

Every week

- Observe unit weekly for any change in running condition and unusual noise.

Every month

- Clean or replace air filters if clogged or dirty; coat permanent filters with oil after cleaning; filters per manufacturer's recommendations.
- Belt-drive fans: Re-lubricate fan bearings if necessary. Check and adjust fan belt tension.

Every three to six months

- Belt-drive fans - check fan bearing grease line connections. Lines should be tight to the bearings.
- Check motor bracket torque.
- Belt drive fans: check bearing bolt torque and bearing setscrew torque.
- Belt-drive fans: align fan and motor sheaves.
- Inspect and clean drain pans.
- Tighten electrical connections.
- Inspect coils for dirt build-up.

Every year

- Inspect the unit casing for corrosion. If damage is found, clean and repaint.
- Clean fan wheels and shaft.
- Inspect and clean drain pans.
- Check damper linkages, set screws, and blade adjustment. Clean, but do not lubricate, the nylon damper rod bushings.
- Check door handles for proper fit and operation, adjust if necessary.
- Check condition of gasket and insulation around unit, door and dampers.
- Inspect electrical components and insulation.
- Inspect wiring for damage.
- Rotate the fan wheel and check for obstructions. The wheel should not rub. Re-center the wheel, if necessary.
- Lubricate motor bearings in accordance with motor manufacturer's recommendations.
- Examine flex connections for cracks or leaks. Repair or replace damaged material.

NOTE: If ESC-Series units have evaporative cooling modules please refer to their individual maintenance procedures.

Cambridge Engineering Direct and Indirect Evaporative Cooling Modules Maintenance Procedure:

Spring Start-Up

1. Clean any scale or debris in pump and sump area.
2. Remove distribution header and clean out distribution holes that supply water flow to media pads.
3. Inspect all wire connections for discolored and/or burned wires. Replace where necessary.
4. Check unit for proper grounding.
5. Check and adjust the following items:
 - a. Open make-up water valve allowing sump to fill with water and check for leaks.
 - b. Check float for operation and adjust to maintain water level at 3-1/4" depth.
 - c. Check the sump water level is 1/2" below the overflow level and the low water level switch is closed. Clean any debris around the overflow intake.
 - d. Fully close bleed valve, then fully open it counting the revolutions. Set to 50% open. Check after the first month of operation and adjust if necessary to prevent solids from forming on the exchanger.
 - e. Direct evaporative module - Inspect media pads and replace per manufacturer's recommendations.
 - 1) Inspect at bottom of heat exchanger for complete water coverage. Should see a steady flow of water across the complete exchanger.
 - f. Indirect evaporative module - Inspect fan for vibration.
 - 1) Inspect at bottom of heat exchanger for complete water coverage. Should see a steady flow of water across the complete exchanger.
 - g. Follow 'Initial Start-Up' procedures. See attached.

Annual Shutdown for Winterizing

1. Disconnect power to unit.
2. Shut off manual water make-up valve to unit.
3. Drain sump (Pump removal is not necessary). Unplug pump. Use garden hose to flush out the sump and clean any debris or algae. For freeze protection, be sure that supply water is shut off inside and that the water line is sloped to allow complete draining of the line.
4. Indirect evaporative module - Wash primary heat exchanger passages with hot water and mild detergent if dirty. Clean the heat exchanger from the inside to outside direction to prevent water accumulation inside the unit.
5. Visually check wetted plates of exchanger on top (Vaporizer Exhaust Air Flow) and bottom for excess build-up of solids from evaporating water. If plates have more than 1/32" of white solids (calcium-lime), use vinegar or muriatic acid diluted to 10% to wash plates. Pour non-diluted vinegar over the top of the plates until solids dissolve, circulate and flush. Use a synthetic bristle brush to remove any scale at bottom of the plates.

WARNING: If module is equipped with direct evaporative section, shut water balancing valve or sump pump to direct media.

WARNING: Do not put vinegar or acid on direct media.

WARNING: Do not operate vaporizer or supply fan when cleaning. Completely flush sump two times with clean water after cleaning. Obtain professional water treatment advice and increase bleed rate to reduce solids plating.

NOTE: A damaged or fouled Indirect Heat Exchanger can be replaced in most cases. Contact Cambridge Engineering for a replacement heat exchanger. See Troubleshooting section for instructions on media replacement.
6. Clean strainer.
7. Provide maintenance as recommended by the manufacturer of vaporizer fan and motor.
8. Refer to direct evaporative module IOM for direct evaporative section maintenance.

TROUBLESHOOTING

Water Carry Over Causes for Cambridge Engineering Direct and Indirect Evaporative Modules

The following items should be checked if there is water carryover in the Cambridge Engineering Evaporative Cooler modules of the unit. For detailed repair procedures, contact your local Sales Representative and refer to the manufacturer's literature.

- Distribution media (direct) or Mist Eliminator (indirect), both located on top of the heat exchanger, not properly installed or removed causing excessive splashing.
- Incorrect sprinkler or nozzle orientation.
- Too high flow rate through water distribution header.
- Media installed backwards.
- Fan CFM (velocity across pads) is too high.
- Improperly installed media allowing air to bypass media and entraining water on edges.
- Dirty/clogged media.
- Sagging media due to media breakdown from using deionized or distilled water or excessive mineral deposits creating breaches and allowing water carryover.
- Damaged plates (indirect) that leak water into the primary side of air flow. Leaks can be repaired with high quality non-silicone caulk (available from Cambridge Engineering).

SERVICES AVAILABLE

Factory trained technicians are available for start-ups.

Technical service support: Call 1-800-473-4569.

ORDERING

For prompt and accurate handling of your order, always include the following:

1. Owner and property location.
2. Date installed.
3. Cambridge Engineering Unit Model number.
4. Unit Serial number.
5. Part name or description.
6. Part number if available
7. Voltage of unit or part

ORDER NOTES

1. Photos of units/ sections or parts above will facilitate the identification and availability of the part(s).
2. Shipment may be delayed without proper information. If unit is still under warranty, replacement part(s) will be billed and shipped. Credit will be issued for both parts and shipping when the part(s) are returned, inspected, and found to be defective from normal usage.

Taxes: Any taxes or other government charges upon production, sale and /or shipment of merchandise sold hereunder, not imposed by Federal, State, or Municipal authorities, or hereafter becoming effective, shall be added to price herein provided, and shall be paid by the buyer.

PARTS LIST (COMMON PARTS USED):

Part #	Description
1. 9094-0004	Stainless steel sump pump
2. 9469-0002	Low water level switch
3. 9070-2004-05	½” Roberts float valve assembly
4. 9070-3003-05	Bleed valve
5. 9070-0006-08	Water balancing valve
6. 9401-4004	½ inch 3-way water fill valve
7. 9401-4003	2 inch 2-way water drain valve
8. 9401-4000	Fill and drain valve covers
9. 9477-0001-01	24 hour timer
10. 9477-0010	Time delay relay with base
11. 9470-0005	GFCI
12. 9506-0100	1 HP TEAO motor
13. 9506-0150	1.5 HP TEAO motor
14. 9506-0200	2 HP TEAO motor
15. 9506-0300	3 HP TEAO motor
16. 9250-0033	Multi-wing axial fan (2- Blade)
17. 9250-0031	Multi-wing axial fan (4- Blade)

Cambridge Engineering, Inc. reserves the right to change specifications, modify the design and/or substitute equivalent materials without notice as the result of code requirements, product enhancements, ongoing research/development and vendor changes beyond our control.



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