V-Cube Slim™ Split
Floor-by-Floor Cooling Systems

Installation, Operation & Maintenance Manual

Sizes: 830 and 840

Model: F-Series

MAMM-VCS-IOM-3FA (September 2013) PN 71144924

Contents

Nomenclature

F	830	S	H	F
Voltage	Size (BTUH Cooling)	Unit Type	Temperature Range	Design Series
F = 208-230/3/60	830 = 732,000	S = Split	H = Standard Range	
G = 460/3/60	840 = 732,000		L = Low Temperature	
J = 380/3/50				
K = 575/3/60				

Introduction

This manual provides guidelines for installation, startup, operation and maintenance of your Mammoth V-Cube Slim unit. Also provided with your unit are submittal documents that contain detailed specifications for your unit, including drawings and wiring schematics. If your system is equipped with EPiC™ controls from Mammoth, full documentation on their use is also provided.

Installation, startup and operation of this unit must follow accepted industry practices as described in the ASHRAE Handbook, the National Electric Code, and other applicable standards. Operate this equipment in accordance with regulations of authorities having jurisdiction and all applicable codes. Maintenance and service must be performed by qualified personnel familiar with applicable codes and regulations and experienced with this type of equipment.

If you have additional questions about the operation or maintenance of your Mammoth system, contact your local Mammoth representative, or the Mammoth Service department at (952) 358-6618 or info@mammoth-inc.com. For assistance in locating your Mammoth representative, call 952-358-6600 or send an email to info@mammoth-inc.com. Or, go to www.mammoth-inc.com and click on the Find a Rep link.

Warnings, Cautions and Notices

Warnings, cautions and notices appear at appropriate locations throughout this manual. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions. Read this manual thoroughly before operating or servicing this unit.

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. It could also be used to alert against unsafe practices.

General Warnings

WARNING! Electric shock and moving equipment hazard. Can cause severe injury or death. Lock and tag out all electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

CAUTION! Installation and servicing of this equipment should only be undertaken by a trained professional with experience working on commercial HVAC systems. Contact your Mammoth representative or the Mammoth Service Department for help in scheduling service.

CAUTION: Sharp edges on sheet metal, coil surfaces and fasteners can cause personal injury. Avoid contact and wear protective clothing and gloves.

Receiving Inspection and Storage

When receiving equipment, check the Bill of Lading to verify that all crates and cartons have been received. Compare shipped-loose items received against the list provided. Check for visible damage. If there is any evidence of rough handling, immediately check for concealed damage. If any damage is found, refuse delivery of the damaged item. Then contact your Mammoth Representative to place an order for a new unit or the repair and reshipment of the damaged unit. It is encouraged that detailed photos be taken for documentation.

This vertical unit must remain in an upright position at all times. If this unit must be positioned horizontally during transport or rigging, it must be returned to its normal upright position for at least 24 hours before operating.

IMPORTANT! Operating a unit after it has been stored or transported on its side can result in serious compressor damage which is not covered under the equipment warranty. Make sure the unit is first returned to its normal upright position for at least 24 hours before operating.

Temporary storage at the job site must be indoors, completely sheltered from rain, snow, etc. High or low temperatures naturally associated with weather patterns will not harm units. Excessively high temperatures, 140°F (60°C) and higher, may deteriorate certain plastic materials and cause permanent damage.

IMPORTANT! This product was carefully packed and thoroughly inspected before leaving the factory. Responsibility for its safe delivery was assumed by the carrier upon acceptance of the shipment. Claims for loss or damage sustained in transit must therefore be made upon the carrier as follows:

Visible Loss or Damage

If there is any external evidence of loss or damage, refuse delivery of the damaged item. Refusal of items must be noted on the freight bill or carrier's receipt, and signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier's refusal to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

Concealed Loss or Damage

Concealed loss or damage means loss or damage which does not become apparent until the product has been unpacked. The contents may be damaged in transit due to rough handling even though the carton may not show external damages. When the damage is discovered upon unpacking, make a written request for inspection by the carrier's agent within fifteen (15) days of the delivery date and file a claim with the carrier.

Disassembly and Assembly

General Guidelines

The Mammoth V Cube Slim Split is engineered to be disassembled in the field and moved through 36” doors into position then reassembled without breaking into the refrigeration circuits. Only qualified personel experienced in operation and maintenance of HVAC equipment should perform these procedures.

WARNING! This equipment presents hazards of electricity, rotating parts, sharp edges, heat and weight. Failure to read and follow these instructions can result in property damage, severe personal injury or death. This equipment must be installed by experienced, trained personnel only.

WARNING! A mechanical lift is required to move or lift all sections of a V-Cube Slim™ unit. Do not attempt to move or lift sections without a mechanical lift. Failure to do so can result in equipment damage, severe personal injury or death.

WARNING! Lifting the entire unit (blower section, coil section, etc.) using lifting lugs, eye bolts or straps attached to the top of the unit can result in serious damage to the unit, personal injury or death.Lifting the entire unit should only be done using a forklift or a strapping spreader bar mechanism attached to the base of the unit.

WARNING! All utilities (water, electric, and communication cables) must be removed prior to unit disassembly. Follow approved lockout/tagout procedures before any disassembly of the unit. Failure to do so can result in electric shock, equipment damage, severe personal injury, or death.

IMPORTANT! All blower wiring is correctly phased at the factory and must be re-wired correctly upon re-assembly for correct compressor and blower operation. Mark all wires and pull through knockouts using care not to scrape the insulation of the wiring when separating sections. If the wire insulation or wire jacket is torn during the disassembly/re-assembly procedure, replace the wire. Do not use wire that is missing insulation. Control and sensor wiring uses Molex plugs for proper polarity.

Figure 1 shows the unit as shipped from the factory. Figure 2 shows an exploded view of the unit, equipped with coil cabinets and 2” x 4 “ filter racks. Note that the coil cabinets and refrigeration sections are resting on welded steel bases. These bases are an integral part of the subassemblies and must not be removed.

IMPORTANT! The welded steel bases are integral to subassembly stability and mobility. Do not detach!

Figure 1: Unit As Shipped

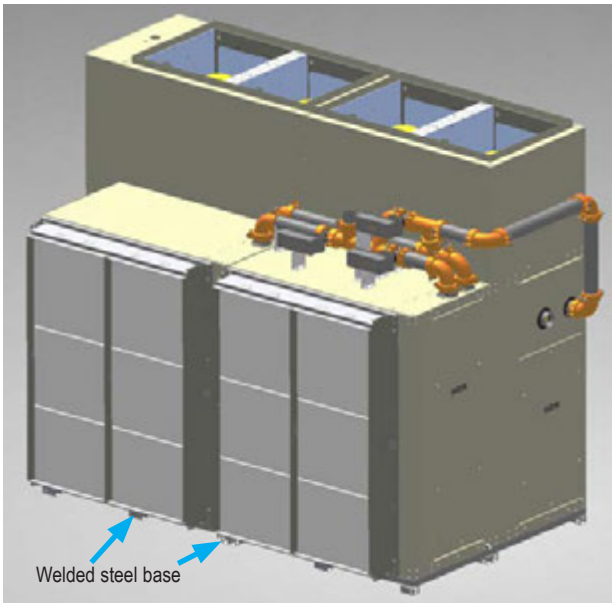
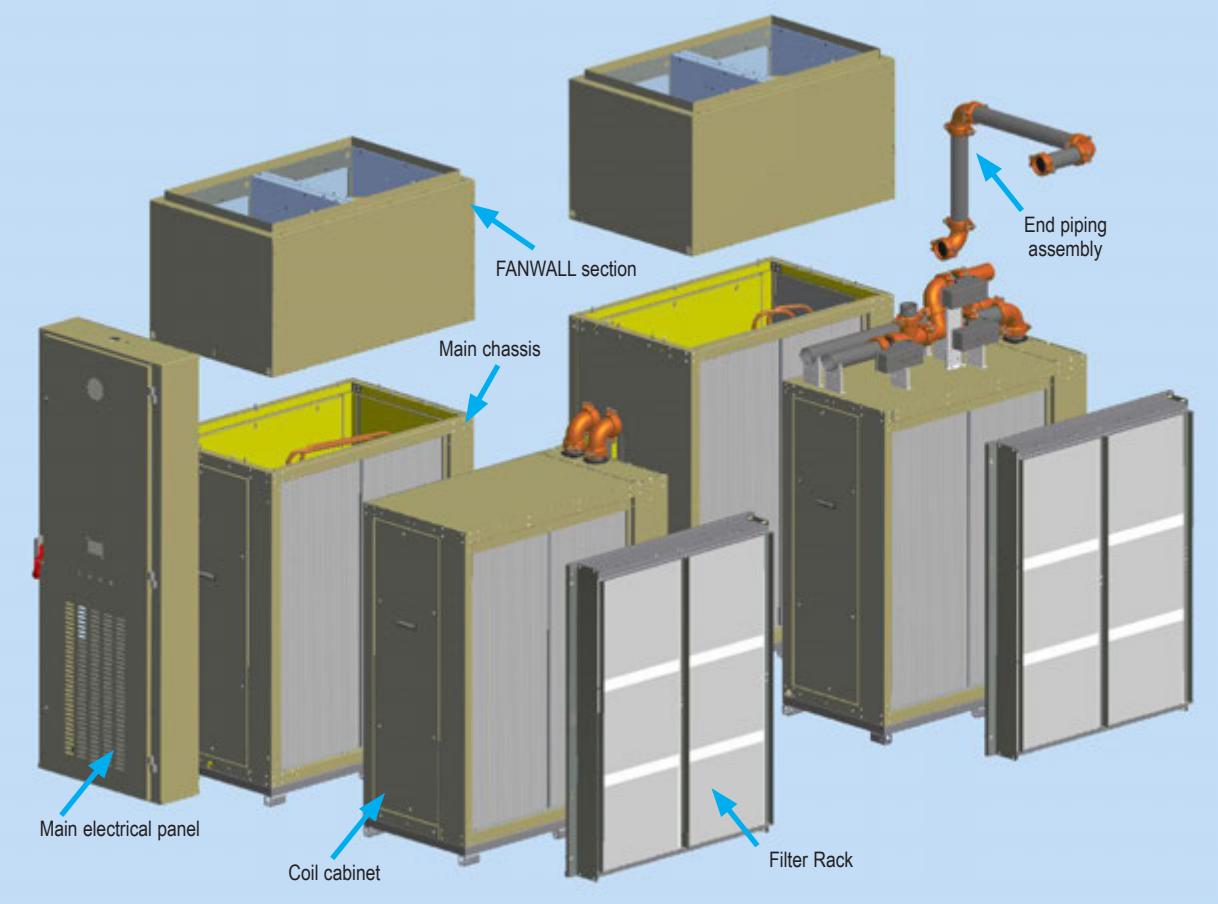


Figure 2: Exploded View



Mechanical lifting equipment is necessary to dismantle and relocate the V Cube Slim Split. This unit will weigh between 4000 and 5800 pounds depending on options and features built into the unit at the factory.

Mechanical lifting equipment is also required to remove the sub assemblies from the main chassis. Subassemblies weigh a minimum of 205 pounds and as much as 1500 pounds each.

Wiring

NEMA does not allow quick-connect plugs for power (high voltage) wiring. For this reason, all power wires have raw ends and are 'hardwired' to terminal blocks in the unit and require handtools for removal. These power wires must be labeled prior to removal to avoid problems.

All low voltage wires are connected using quick-connect plugs.

Piping

All water piping is iron with grooved (Victualic®) connections.

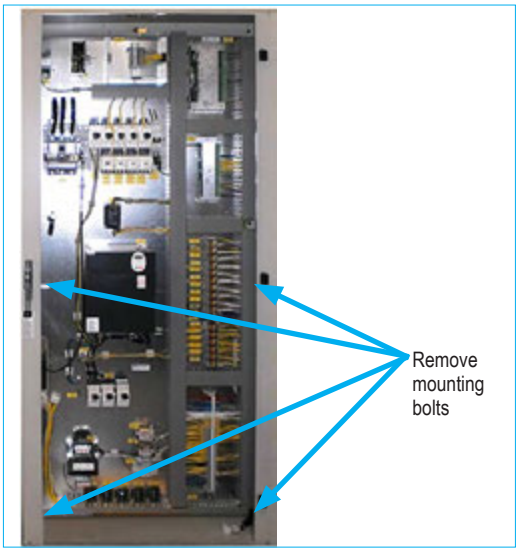
Refrigeration circuits are copper pipe and do not require any disassembly and reassembly.

Main Electrical Panel Removal

The main electrical panel is removed as follows.

1. Unplug the wiring harness that connects the EPiC™ keypad, reset buttons and selector switches from the panel door to the main electrical panel.
2. Remove the panel door by lifting it from its hinges. Carefully set it away from the unit to help prevent damage during the remaining disassembly process.
3. Unplug all control wiring harnesses that run from the main electrical panel to the main cabinet section. All wiring connecting the main electrical panel to the unit passes through knockouts on the left inside corner. These plugs are labeled for correct re-installation.
4. Disconnect all high voltage wiring to the fan motors.
5. Verify that all electrical connections to the unit from the control panel have been disconnected.
6. Support the electrical panel from above or below to prevent it from falling once the connecting bolts have been removed.
7. Loosen and remove the section bolts that fasten the main electrical panel to the main cabinet sections, as shown in Figure 3.
8. Set the main electrical panel aside, away from the unit to help prevent damage during the remaining disassembly process.

Figure 3: Main Electrical Panel Removal

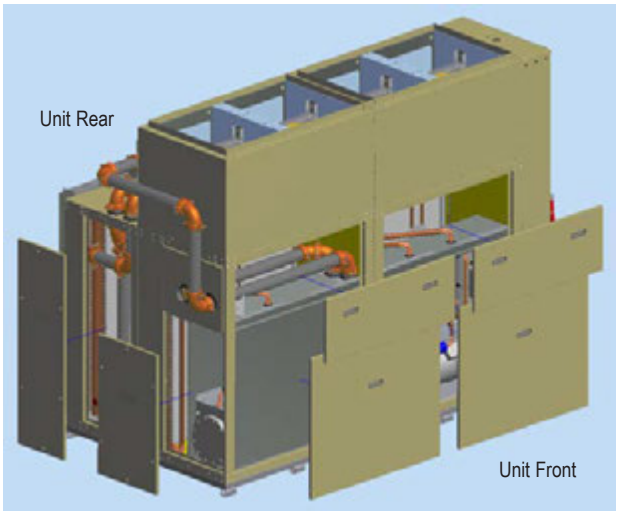


Splitting Apart The Main Sections

To disassemble the unit's two main sections into separate halves, carry out the following procedures. To reassemble, follow these procedures in reverse.

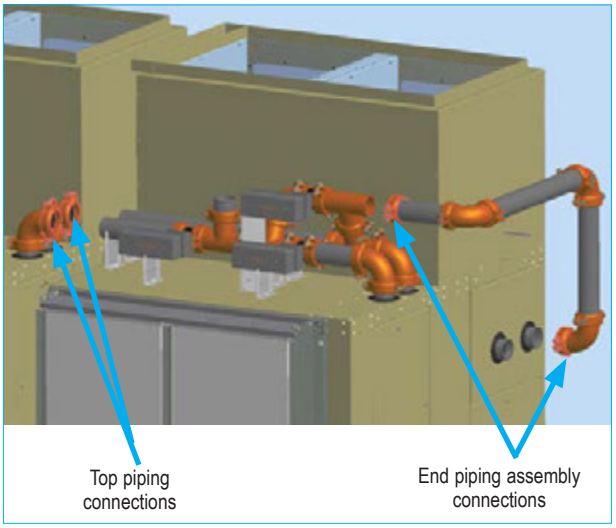
1. Remove all access panels and set them aside. See Figure 4. Quarter turn, twist lock fasteners secure most access panels.

Figure 4: Panel Removal



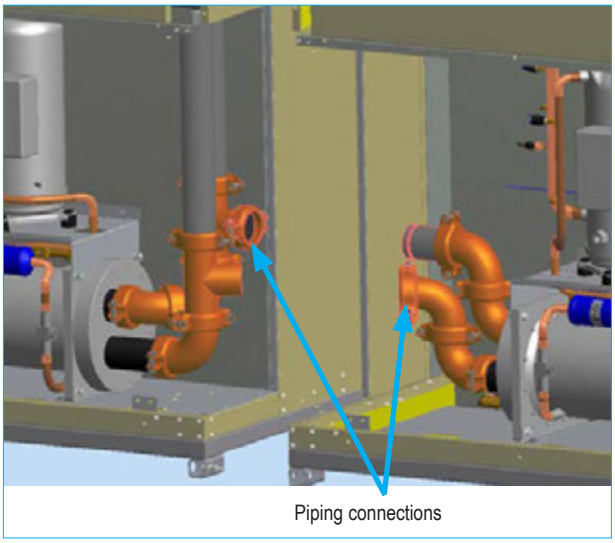
2. Facing the rear side of the unit, loosen the top piping connections between the two main sections as shown in Figure 5. The pipes will separate as cabinet halves are separated.

Figure 5: Rear Side Piping Disconnects



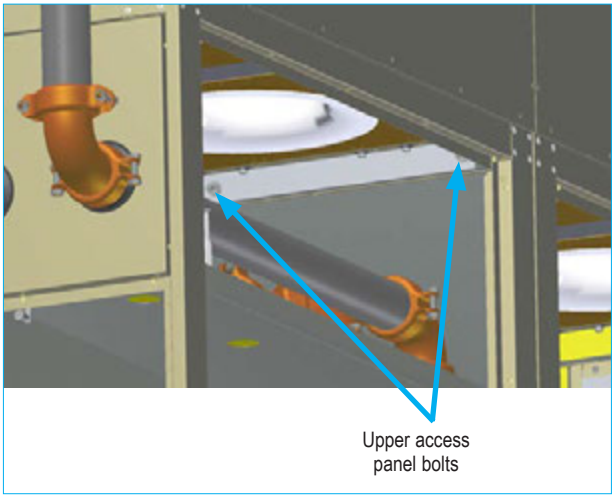
3. Loosen the piping connections on either end of the end piping assembly, as shown in Figure 5. Then remove the end piping assembly and set it aside. (If the end piping assembly is not already installed, it is packed inside the unit for field assembly.)
4. Facing the front of the unit, loosen the piping connections between the two main sections as shown in Figure 6. The pipe connections will separate as cabinet halves are separated.

Figure 6: Front Side Piping Disconnects



5. Remove the nuts and bolts connecting the two main sections at the welded steel base.
6. Remove the connecting bolts from the upper access panel location as shown in Figure 7.
7. The unit should now come apart in two halves. Each side will weigh at least 1000 pounds.

Figure 7: Upper Access Panel Conecting Bolts



Filter Rack and Coil Cabinet Removal

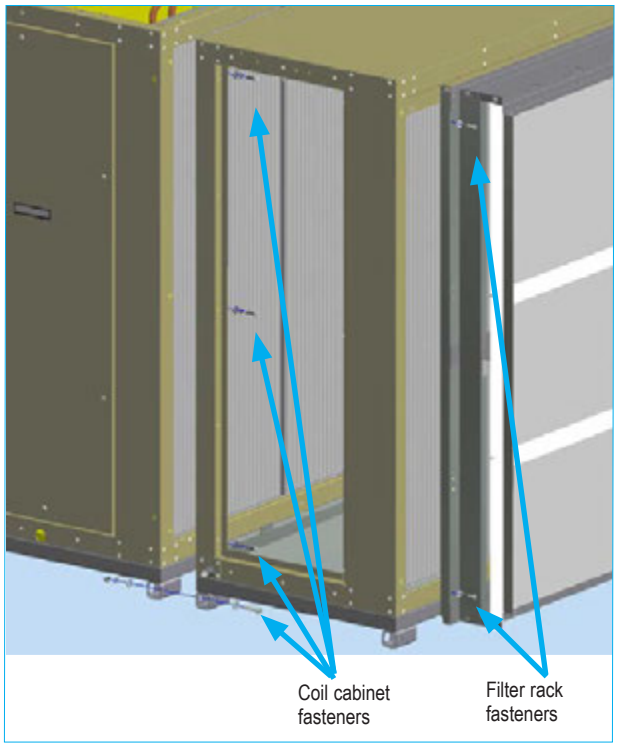
Once the unit has been split apart into separate halves, the coil cabinet and filter rack can be removed from the main chassis, as follows. See Figure 8 for fastener locations.

1. Remove the filter rack from the coil cabinet by screwing out the fasteners from the four corners of the rack.

IMPORTANT! Filter rack mounting bolts are a specific length so as to not contact the coil behind the bulkhead. If any are lost, replacement bolts must be the same length.

2. If still in place, remove the coil cabinet inner access panel from the side of the cabinet.
3. Remove the six fasteners (three on each side) connecting the sides of the coil cabinet to the main chassis.
4. Remove the nuts and bolts (two sets, one on each end) connecting the coil cabinet to the main chassis at the welded steel base.
5. The coil cabinet can now be separated from the main chassis. Each coil cabinet will weigh at least 300 pounds.

Figure 8: Filter Rack and Coil Cabinet Removal



FANWALL Section Removal

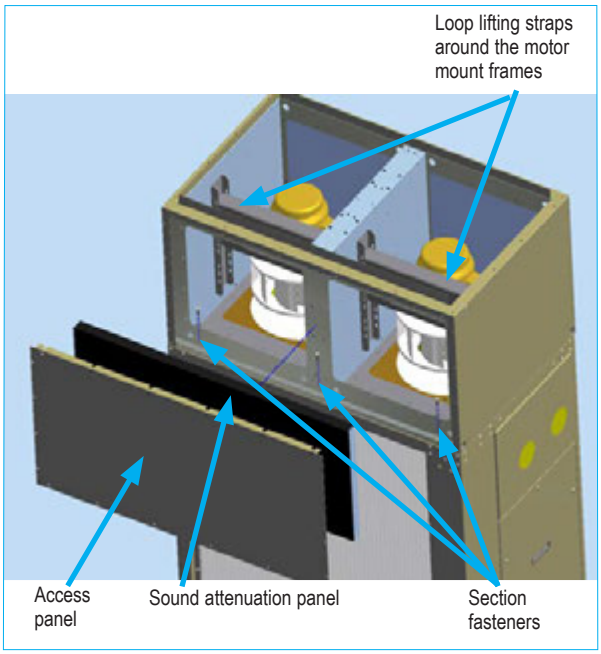
The FANWALL cells come off in pairs; each pair weighing roughly 600 pounds. They are removed as follows.

1. Loop lifting straps around both motor mount frames as shown in Figure 9 and then to a spreader bar or to two forklift forks.

CAUTION! DO NOT lift the fan cells by the motor eye bolts or by attaching eye bolts to the motor mount plates. This may result in personal injury, equipment damage or motor/ wheel misalignment.

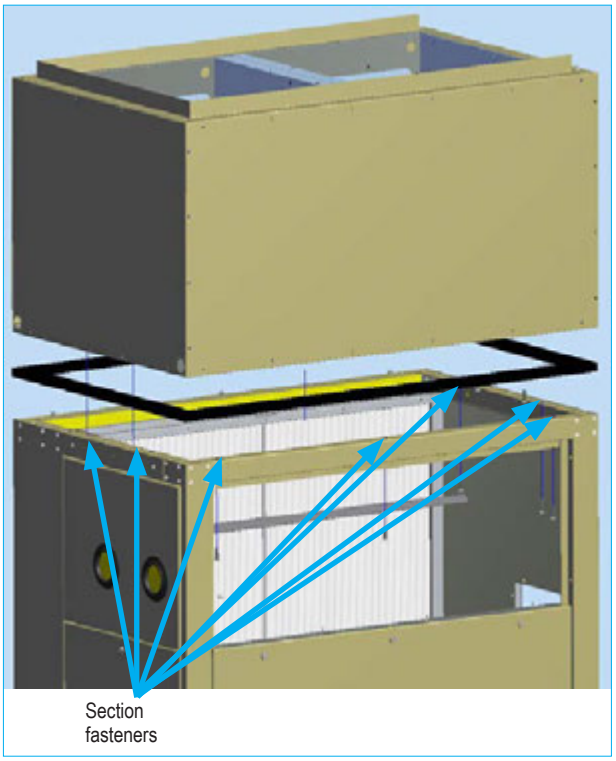
2. As a safety precaution, take up the slack in the lifting straps before removing any connecting bolts from the section.
3. Remove the screws from the access panel on the front of the FANWALL section, then remove the panel. See Figure 9.
4. Remove the screws from the sound attenuation panel, then remove the panel. See Figure 10.
5. Remove the three fasteners that attach the front, coil side of the FANWALL section to the base as shown in Figure 9.

Figure 9: FANWALL Removal From Front



6. Remove the access panel from the back of the base cabinet section as shown in Figure 9.
7. Remove the seven fasteners (three on the front, two on each end) connecting the FANWALL section to the main chassis as shown in Figure 10.

Figure 10: FANWALL Removal from Rear



8. Carefully lift the FANWALL section off the base with the attached lifting straps.

CAUTION! This method of lifting may be imbalanced. Use care to avoid personal injury or damage to the FANWALL section.

IMPORTANT! The gasket between the FANWALL section and the main chassis must be replaced before reassembling the section. Failure to do so may cause air leakage and poor unit performance.

Installation

WARNING! The installer must determine and follow all applicable codes and regulations. This equipment presents hazards of electricity, rotating parts, sharp edges, heat and weight. Failure to read and follow these instructions can result in property damage, severe personal injury or death. This equipment must be installed by experienced, trained personnel only.

General

To prevent damage, this equipment should not be operated for supplementary heating and cooling during the construction period.

Inspect the unit for any specific tagging numbers indicated by the factory per a request from the installing contractor.

Check the unit nameplate for the size and voltage rating and confirm against the plans that the unit is being installed in the correct location.

Verify the installation location with the piping, sheet metal and electrical contractors prior to installation

Verify all clearances are available for the unit prior to installation.

Note the location and routing of water piping, condensate drain piping, and electrical wiring. The locations of these items are clearly marked on the unit submittal drawings.

Mammoth recommends the unit be covered during construction to protect components from dust and other harmful material. This is critical while spraying fireproofing material on bar joists, sandblasting, spray painting and plastering.

IMPORTANT! Check the unit name plate for correct voltage with the plans before installing the equipment. Make sure all electrical connections are made in accordance with national (NEC) and local codes.

Location and Clearances

This equipment is designed for indoor installation only. Sheltered locations such as attics, garages, etc., generally will not provide sufficient protection against extremes in temperature and/or humidity, and equipment performance, reliability, and service life may be adversely affected.

Units should be mounted on a flat, level floor or on a code-compliant housekeeping pad. An antivibration pad or mat is recommended between the bottom of the unit and the surface beneath it.

Figure 11 and Figure 12 show recommended minimum clearances. Local building and/or electrical codes may require additional clearance. Refer to local codes.

If the unit has an open or non-ducted return, provide adequate clearance to the return air opening to ensure proper air flow.

Figure 11: Clearances - Unit With Waterside Economizer

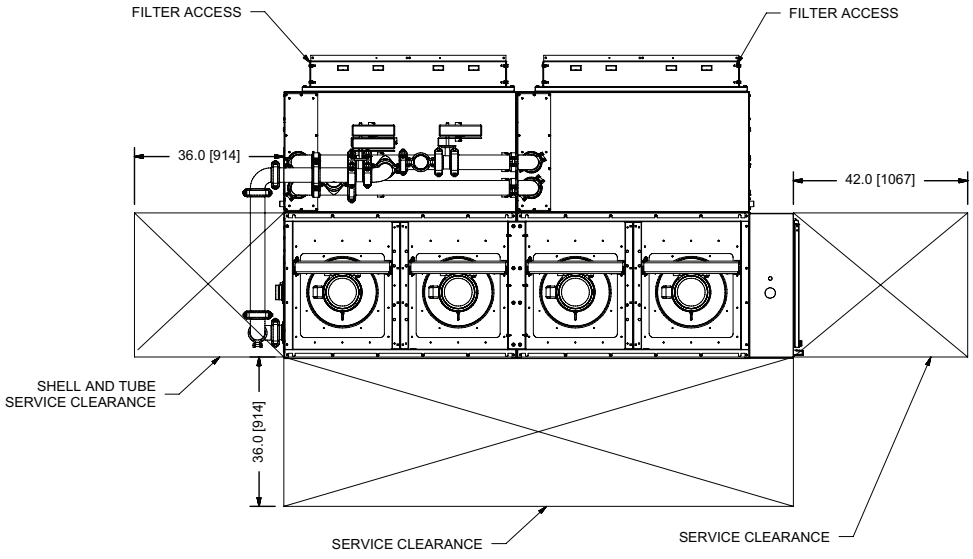
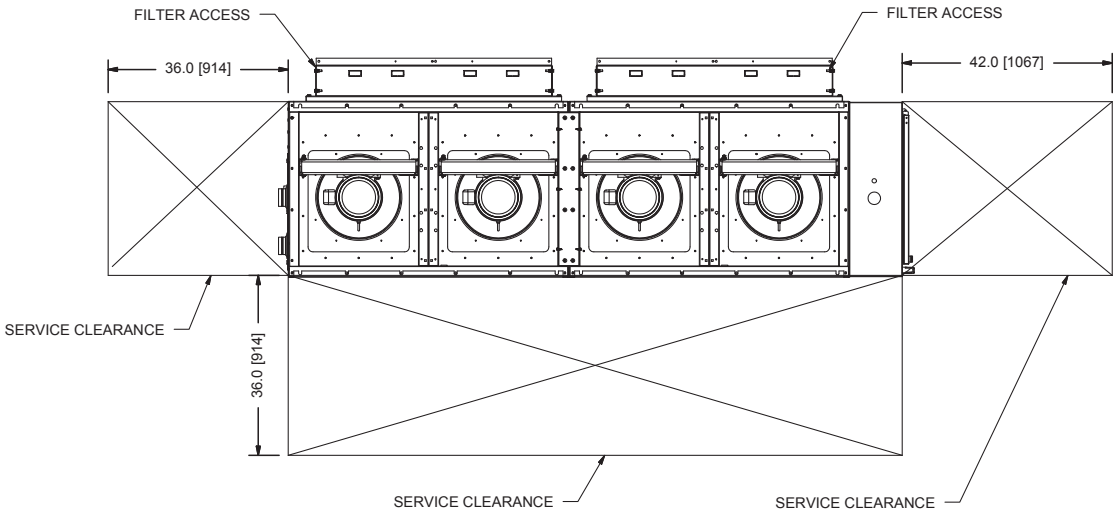


Figure 12: Clearances - Units Without Waterside Economizer



Ductwork and Attenuation

Discharge ductwork is normally used with the V-Cube Slim™. Return air ductwork may also be required.

All ductwork should conform to industry standards of good practice as described in the ASHRAE Systems Guide.

The discharge duct system will normally consist of a flexible connector at the unit connection, a transition piece to the full duct size, a short run of duct, and elbow with vanes, and a trunk duct teeing into a branch duct with discharge diffuses. The transition piece must not have angles totaling more than 30° or severe reduction in airflow performance can result.

Do not connect the full duct size to the unit. Use a transition piece sized according to the discharge collar on the unit to get to the full duct size. With metal duct material, the sides of the elbow and entire branch duct should be internally lined with acoustic fibrous insulation for sound attenuation. Glass fiber duct board material is more absorbing and may permit omission of the canvas connector.

Return air ductwork (if used) should be connected to the unit using the filter section flange.

Ventilation Air

Outside air may be required for ventilation. Refer to local codes. The temperature of the ventilation air must be controlled so that the mixture of outside air and return air entering the unit is within application limits. It is recommended that the ventilation air inlet be closed during unoccupied periods (i.e. night setback).

The ventilation air system is typically a separate building subsystem with distribution ductwork. Simple introduction of the outside air into each return air plenum chamber reasonably close to the unit air inlet is recommended. Do not duct outside air directly to the unit inlet. Provide sufficient distance for the thorough mixing of outside and return air.

Supply Piping

NOTE: Read all Supply Piping instructions before proceeding.

All units should be connected to supply and return piping in a two-pipe, reverse-return configuration. A reverse-return system is inherently self-balancing and requires only trim balancing where multiple quantities of heat pumps with different flow and pressure drop characteristics exist in the same loop. Check for proper water balance by measuring differential temperature reading across the water connections.

Avoid dissimilar metal fittings as they may corrode. If the use of dissimilar metals cannot be avoided, use dielectric isolation at that connection point

Supply and return shutoff valves are recommended at each unit. A flow control device to limit fluid flow through the unit should be connected to the water outlet.

No unit should be connected to the supply and return piping until the water system has been cleaned and flushed completely. After the cleaning and flushing has taken place, the initial connection should have all valves wide open in preparation for the water system flushing.

Condensate Piping

Condensate piping can be steel, copper, or PVC. Each unit includes a minimum of two stainless steel condensate connections; one in each coil cabinet section.

The condensate disposal piping must be trapped. The piping must be pitched away from the heat pump not less than ¼” per foot. The unit is supplied with a 1-¼” male

pipe fitting to accommodate the condensate drain connection.

Do not locate any point in the drain system above the drain connection of any unit.

The condensate piping system must be vented at its highest point.

Cleaning and Flushing

Before building water is connected to the unit, the building water system must be flushed clean of particulate contaminants. Follow the procedures described in this section.

IMPORTANT! Performance of WSHP units relies upon a building water supply filtered of any particulate and chemical contaminants. Before building water is connected to the unit, the building water system must be flushed clean of particulate contaminants. The building water system is also required to have a neutral PH balance.

Failure to bring the building water system into compliance with these requirements, verifiable by recorded documentation, will void unit warranties.

1. Open all air vents.
2. Fill the system at the city water makeup connection.
3. After filling, close all air vents.
4. Open the pressure reducing valve.
5. Check air vents in sequence to bleed off any trapped air, providing circulation through all components of the system.
6. Check and repair any leaks in the piping.
7. Start the main circulator with the pressure reducing valve open.
8. Open the drains at the lowest point(s) in the system for the initial flush and blow down, making sure city water fill valves are set to make up water at the same rate.
9. Check the pressure gauge at the pump suction and manually adjust the makeup to hold the same positive steady pressure both before and after opening the drain valves.
10. Flush the system for at least two hours, or longer if required, until the drain water is clear and clean.
11. Shut off the supplemental heater (if applicable) and the circulator pump.
12. Open all drains and vents to completely drain down the system. .
13. Refill the system with clean water.
14. Test the water using litmus paper for acidity and treat as required to leave the water slightly alkaline (pH 7.5 to 8.5).
15. The specified percentage of antifreeze may also be added at this time. Use commercial grade antifreeze designed for HVAC systems only. Do not use automotive grade antifreeze.
16. Once the system has been filled with clean water and antifreeze (if used), precaution should be taken to protect the system from dirty water conditions.

IMPORTANT! Dirty water will result in system-wide performance degradation and solids may clog valves, strainers, flow regulators, etc. Additionally, the heat exchangers may become clogged which reduces compressor service life or causes premature failure.

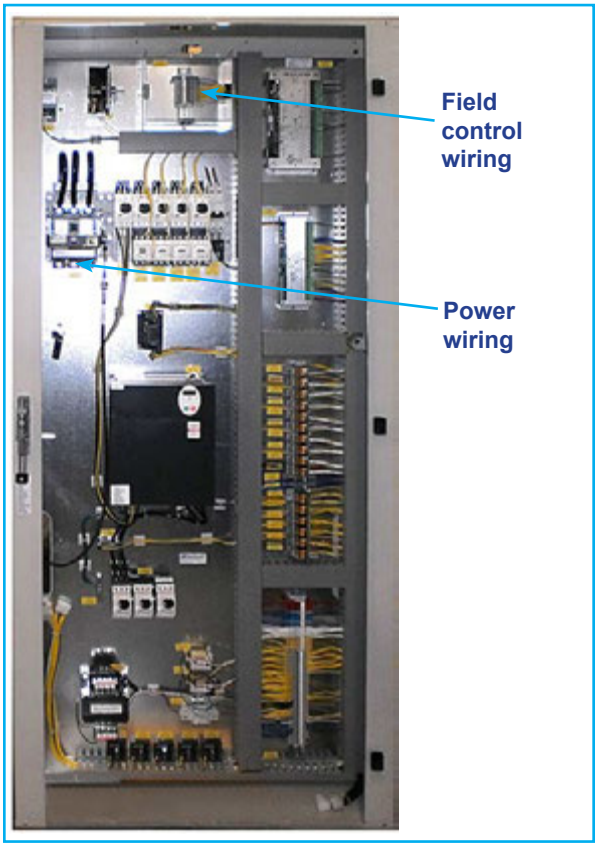
17. Supply power to all motors and start the circulation pumps.
18. After full flow has been established through all components, including the heat exchanger (regardless of season), and after air has been vented and loop temperatures stabilized, each of the units will be ready for check, test, startup, and water balancing.

Electrical Connections

CAUTION! Verify that the unit label voltage matches building power before connecting power wires to the unit. Do not apply power to the unit until all installation work is completed.

Wiring to the unit is routed through the electrical knockout in the top of the main electrical panel. See . The incoming power connection is made at the power voltage terminal block and the ground wire is connected to the unit's grounding lug. Control wiring enters the unit through the small knockout on top of the main electrical panel.

Figure 13: Electrical Connection Points



Operating Voltage

Incoming power supply must comply with the data in Table 1. Unit operation outside of the Min/Max range is not recommended and will result in premature component failure.

Table 1: Operating voltages

	Minimum	Maximum
208-230/60/3	197 volts	253 volts
460/60/3	414 volts	506 volts
380-415/50/3	342 volts	418 volts
575/60/3	515 volts	632 volts

.

IMPORTANT! Units operating with over- or under-voltage conditions for extended periods of time will experience premature component failure. Three-phase system imbalance should not exceed 2%.

Startup

The following should be used as a guide for a comprehensive commissioning and startup procedure which is required before placing your Mammoth unit into service.

IMPORTANT! The commissioning and startup procedures described in this document must be carried out prior to placing this unit into service. Failure to follow these procedures could result in improper or dangerous operation and/or void the equipment warranty.

CAUTION! Installation, startup and servicing of this equipment should only be undertaken by trained professionals with experience working on commercial HVAC systems. Contact your Mammoth representative or the Mammoth Service Department for help in scheduling service.

Startup Report Form

A startup report form is zip-tied to the inside of the main control panel. In addition to carrying out the procedures described in this guide, it should be filled out, signed and returned to Mammoth as part of the warranty process for your system. See the warranty documents included with your unit for additional information.

Prior to Startup

Before requesting unit startup, please verify all of the following.

- The main power supply is connected to the unit disconnect and electrical power is available to run the unit.
- Drain lines are connected to the condensate connections. See “Condensate drain” on page 17.
- The controls contractor has been notified of the requested start-up date and is confirmed to attend.
- The duct system is complete enough to allow for operation.
- All air filters have been installed.
- All water systems, if applicable, have been fully installed, tested and will be operable.

Startup: Power Off

Verify that the system on/off and/or standby switch is in the off or standby position. Then carry out the following procedures.

WARNING! Electric shock and moving equipment hazard. Can cause severe injury or death. Lock and tag out all electric power before carrying out these procedures. More than one disconnect may be required to de-energize the unit..

Electrical

Electrical Terminals

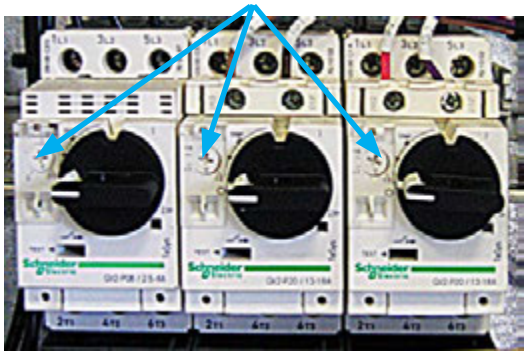
Tighten all electrical terminals per the torque value listed on the connector. Electrical terminals are located within the main unit control panel. Where no torque value is given, use the tightening torques provided in this manual. See “Electrical Terminal Tightening Torques” on page 19.

WARNING! Loose electrical terminals can lead to erratic unit operation and arcing which may cause fires. Tighten all electrical terminals before unit startup. Be careful not to over-tighten to avoid stripping out threads..

Motor Protector Settings

Before startup, adjust the overload setting on all motor protectors as follows. They are located within the unit electrical panel. See Figure 14.

Figure 14: Motor Protectors



1. Switch to the off position all motor protectors.
2. For motors and pumps, adjust the setting to match the amps (FLA) listed on the motor nameplate.
3. For compressors and VFDs, adjust the setting as indicated on the electrical wiring diagram provided with your unit.

Control Settings

- Verify that all control jumper positions, time delay relay settings, baud rates and control temperatures and/or pressure settings match those indicated on the electrical wiring diagram, as applicable. Refer to the wiring schematics provided with your unit for locations and settings.

Verify that high and low static pressure safety settings match those indicated on the electrical wiring diagram. They are typically set at 3.5 inches w.c. each. Record the values on the Startup Report form.

Refrigerant Piping

Mammoth V-Cube Slim units with DX cooling are shipped fully charged with refrigerant from the factory. No piping connections are needed and no field charging is required prior to operation of the system. Check the following prior to startup:

- Verify that all pressure lines are free from the compressors – i.e., not contacting or rubbing against them – to prevent damage from vibration and friction. Pressure line coils should have a distance between each coil of at least one inch.
- Verify that all pipe clamps have the rubber lining intact and are secure.
- Verify that all compressor service valves are open.

Startup: Power On

With the main power control panel door closed, switch on the main power to the unit. Then carry out the following procedures.

WARNING! Electric shock and moving equipment hazard. Can cause severe injury or death. Use extreme caution when inspecting or servicing equipment with electrical power supplied to the unit. Per OSHA 29 CFR 1910.333 (c)(2): “Only qualified persons may work on electric circuit parts or equipment that have not been de-energized. Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.”

Electrical

Supply Power

- Verify that the measured supply voltage matches the rated voltage on the unit nameplate. The nameplate is located on the electrical panel door. Record voltages on the startup form.

Motor Rotation

- Verify that all fans, blowers and pumps are rotating in the correct direction. This can be accomplished by shutting off the motors individually, using each motor’s overload protector shut-off switch, then observing the direction of rotation as you start them back up.
- Check for proper rotation of each compressor using a phase rotation meter. Also verify that the unit phase monitor is set correctly as indicated on the electrical wiring diagram provided with your unit.

Blowers and Fans

Switch the motor protectors for the supply air fans to the On position (see page 6 for motor protector locations). Turn the system switch to the On position, then carry out the following checks:

- Verify that the unit controller is calling for the unit to operate. Consult the controls documentation provided with your unit to trouble shoot any problems.
- Measure the amp draw of all blowers and fan motors and record them on the startup report form. Verify that they do not exceed the FLA listed on the motor nameplate. Amp draw can be checked using an amp draw meter clamped around the motor wires leading into the motor protectors for each motor. See Figure 15.

Figure 15: Amp Draw Check

- Verify that the parameter settings are correct on the supply and return/exhaust fan VFDs, as applicable. Refer to the parameter settings that are detailed on the wiring diagrams provided with your Mammoth unit. Refer to the instruction manual for the VFD for information on how to navigate through the parameter menus.

DX Cooling Startup

A reasonable cooling load must be available to perform a proper cooling startup. With a cooling load available, carry out the following procedure on each circuit:

1. Install refrigeration gauges on the compressor circuit to be started.
2. Turn the unit system switch to the on position.
3. Verify that the liquid sub-cooling is between 10 and 12 degrees F (8 to 10 degrees F for shell and tube or flat plate condensers).
4. Verify that the super heat is within 12 to 18 degrees F at the compressor.

Repeat each step above for all additional compressor circuits to be started.

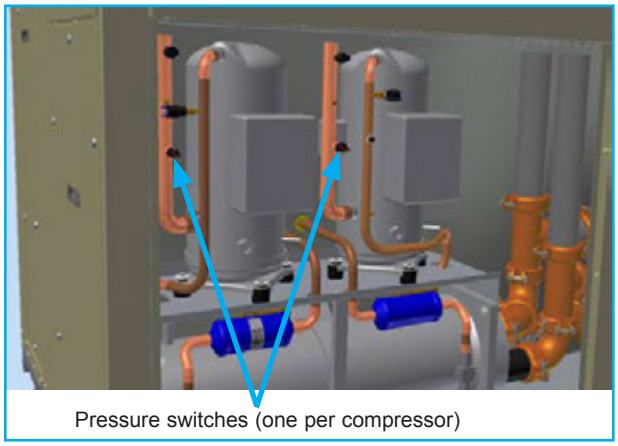
Geothermal Units Only

For geothermal units only, verify that the low-pressure switches installed on the suction line of each compores-sor are all labeled “40 to 50 PSI.” This is accomplished as follows:

1. Remove the front cover from the main chassis on both halves of the V-Cube Slim Split unit.
2. The low pressure switches are inserted into the compressor suction piping about halfway up the overall height of each compressor. See Figure 16
3. Do not attempt to turn or rotate the switch.
4. View the label on each of the switches. It should read “40 to 50 PSI.” If it does not, contact your Mammoth representative to replace the switch.

Note: Due to tight quarters, an inspection mirror or smart phone photo may be necessary to view the pressure range label on the switch.

Figure 16: Pressure Switches



Chilled Water, Hot Water and Steam Coils Startup

Visually check the coils and system piping for proper installation and any signs of leakage. Repair as needed.

Check motorized valves and linkages for the following points of operation.

- The motor should be free to run through its complete stroke.
- The linkage should work freely without binding.
- The valve must close off tightly at the bottom of its stroke.

Controls Startup

For controls startup procedures, see the EPIC® Sequence of Controls documentation that is included in the packet of information that is zip-tied to the inside of the main control panel.

Final System Check

- Verify that controller read out values are equal to actual gauge or temperature readings, as applicable.
- Install all refrigeration fitting caps, etc., that were removed during the startup procedure.
- Check the refrigeration system for leaks.
- Clean up all debris.

General Maintenance

Normal maintenance on any V-Cube Slim™ unit includes but may not be limited to the following:

Air filter changes

Air filters must be replaced a minimum of two times per year. A good standard to follow is at the beginning of the cooling season and the beginning of the heating season. In certain environments, more frequent filter changes may be required. For new installations, it is recommended that the air filters be checked every 60 days and changed as required until a regular interval can be established. An air filter needs to be replaced if no light can be seen through it when it is held up to a light.

Condensate drain

The condensate drain and drain pan should be checked on an annual basis to verify positive drainage and cleaned or flushed as necessary.

Electrical

Check the tightness of all electrical terminals twice each year. Retighten as needed.

WARNING! Loose electrical terminals can lead to erratic unit operation and arcing which may cause fires.

WARNING! Electric shock and moving equipment hazard. Can cause severe injury or death. Lock and tag out all electric power before carrying out these procedures. More than one disconnect may be required to de-energize the unit.

Electrical terminals are located within the main unit control panel. Tighten all terminals per the torque value listed on the connector. Where no torque value is given, use the tightening torques provided in this manual. See “Electrical Terminal Tightening Torques” on page 19.

On all units with electric heat, check the condition of contactors and wiring at the beginning of each heating season.

Data recording

Recording current draw of blower motors at regular intervals is recommended to verify their condition. Recording differences in water temperature and air temperature at regular intervals can help identify any performance degradation. Annual comparison of the data will aid in determining the overall condition and operation of the unit.

Nuisance trips and/or lockouts

Occasional trips and/or lockouts are generally caused by water or airflow restrictions. When a trip or lockout occurs, check the water flow rate, incoming water temperature, airflow rates and incoming air temperature. Take corrective action necessary to enable unit operation.

Parts and Service Support

Mammoth brand products are serviced by Authorized Service Providers. For service support, contact your Mammoth representative. Parts for Mammoth brand products are also available by contacting your local representative. For assistance locating your Mammoth representative, visit www.mammoth-inc.com.

Troubleshooting

The charts in this section provide general guidelines on troubleshooting problems with your V-Cube Slim unit. If Service assistance is required contact Mammoth Service at (952) 358-6618. For additional help diagnosing problems or servicing the unit, contact your local Mammoth representative. For assistance locating your Mammoth representative, call 952-358-6600 or e-mail info@mammoth-inc.com.

*Table 2: Refrigeration system troubleshooting**

Symptom	Head Pressure	Suction Pressure	Compressor Amp Draw	Super Heat	Subcooling	Air Temp Differential	Water Loop Temp Differential	Safety Lockout
Undercharged system	Low	Low	Low	High	Low	Low	Low	Low Pressure
Overcharged system pressure	High	High	High	Normal	Low	Normal	Normal	High Pressure
Low air flow in cooling	Low	Low	Low	Low or Normal	Low	Low	Low	Low Temp
Low water flow in cooling	High	High	High	High	Low	Low	High	High Pressure
High air flow incooling	Low	High	Normal	High	Low	Low	Normal	High Pressure
High water flow in cooling	Low	Low	Low	Low	HIgh	Normal	Low	Low Temp
TVX restricted	High	Low	Normal or low	High	High	Low	Low	

* Referenced values for your unit are recorded on the factory run test sheet. This sheet is part of the unit documents provided with your unit. They are located within the main electrical panel.

Figure 17: Performance troubleshooting

Problem	Heating	Cooling	Possible Cause	Solution
Insufficient Capacity	X	X	Dirty Filter	Replace or clean
Not cooling or heating properly	X	X	Reduced or no air flow	Check for dirty air filter and clean or replace, Check fan motor operation and airflow restriction. External static too high? Check static vs. blower table
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers: If significantly different, duct leaks are present
Unit doesn't operate in cooling	X	X	Low refrigerant charge	Check superheat and subcooling
	X	X	Restricted metering device	Check superheat and subcooling– replace
		X	Defective reversing valve	Perform RV touch test
	X	X	Thermostat improperly located	Check location and for air drafts behind stat
	X	X	Unit undersized	Recheck loads & sizing. Check sensible, cooling load and heat pump capacity
	X	X	Scaling in waterside heat exchanger	Perform scaling check and clean if necessary
	X	X	Inlet water to hot or cold	Check load, loop sizing, loop backfill, ground moisture
High head pressure	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high? Check static vs. blower table
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting. Check water flow; adjust to proper flow rate
		X	Inlet water to hot	Check load, loop sizing, loop backfill, ground moisture
	X		Air temperature out of range in heating	Bring return air temp within design parameters
		X	Scaling in waterside heat exchanger	Perform scaling check and clean if necessary
	X	X	Unit overcharged	Check superheat and subcooling
	X	X	Non-condensable in system	Vacuum system, reweigh in charge
Low suction pressure	X		Reduced water flow in heating	Check pump operation or valve operation/setting. Check water flow adjust to proper flow rate
	X		Water temperature out of range	Bring water temp within design parameters
		X	Reduced air flow in cooling	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high? Check static vs. blower table
		X	Air temperature out of range	Too much cold vent air? Bring entering air temp within design parameters
	X	X	Insufficient charge	Check for refrigerant leaks
Low discharge air temperature in heating	X		Too high of air flow	Check fan motor speed selection and airflow
	X		Poor performance	See insufficient capacity

Electrical Terminal Tightening Torques

The following tables provide tightening torques, as recommended by the component manufacturer, for many of the electrical components provided on Mammoth units. If a torque value is provided on the component, use that value instead. Where no torque value is given or provided here, use the torques provided in the tables at the end of this section, which are taken from UL Standard 486A.

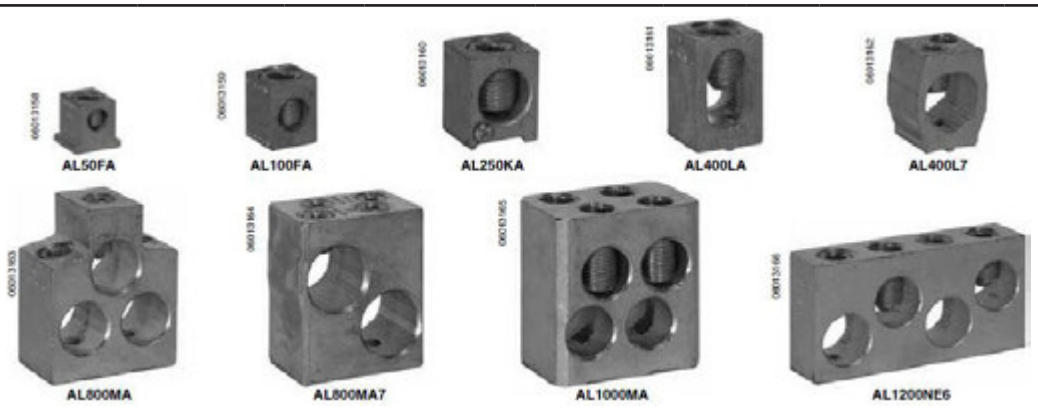
Table 3: Telemecanique manual motor starters, controllers, and protectors

Device	Model	Tightening Torque
Motor Starter	GV2ME	15 lb-in (1.7 N•m)
Motor Starter	GV2P	15 lb-in (1.7 N•m)
Motor Starter	LS1D30, LS1D303	15 lb-in (1.7 N•m)
Motor Starter	LS1D32, LS1DT32, LS1D323	15 lb-in (1.7 N•m)
Motor Starter	GV3ME06 through ME20	15 lb-in (1.7 N•m)
Motor Starter	GV3ME25 through ME63	44 lb-in (5 N•m)
Trip Module GV2AU	12 lb-in	(1.4 N•m) max
Trip Module GV2AS	12 lb-in	(1.4 N•m) max
Auxiliary Contact	GVAN, GVAD	12 lb-in (1.4 N•m) max
Auxiliary Contact	GV2AD, GV2 AM11	12 lb-in (1.4 N•m) max
Auxiliary Contact	GV2AE	12 lb-in (1.4 N•m) max
Terminal Block	GV2G05 and GV1G09	Connector: 20 lb-in (2.2 N•m) Screw clamp: 15 lb-in (1.7 N•m)

Table 4: Altivar 212 variable speed drives

Maximum Wire Size		Tightening Torque	
mm^2	AWG	N-m	lb-in
6	10	1.3	11.5
16	6	2.5	22
25	3	4.5	40
50	1/0	24	212
150	300 kcmils	41	363

Table 5: Square D Molded Case Circuit Breakers – Mechanical lug kit wire ranges and torques



Lug Kit	Lugs Per Kit	Circuit Breaker	Wires Per Lug and Wire Ranges			Lug Mounting Screw Torque		Wire Binding Screw Torque		
			Wires	Domestic	Metric	Lb-in.	N•m	Wire*	Lb-in.	N•m
AL50FA	3	FA, FH, FI	1	#14–#4 Cu or #12–#4 Al	2.5–25 mm^2 4–25 mm^2	40	4.5	Cu #14–#4 STR/ SOL Al #12–#4 STR Al #12–#10 SOL	35 35 15	4.0 4.0 1.7
AL100FA4	3	FC	1	#14–#3 Cu or #12–#1 Al		65	7.3	Cu #14–#3 STR Cu #14–#8 SOL Al #8–#1 STR Al #12–#10 SOL	65 65 65 65	7.3 7.3 7.3 7.3
AL100FA	3	FA, FH, FI	1	#14–1/0 Cu or #12–1/0 Al	2.5–50 mm^2 4–50 mm^2	40	4.5	Cu #14–1/0 STR Al #12–1/0 STR Al #12–#10 SOL	80 80 40	9.0 9.0 4.5
AL100TF	3	FA, FH	1	#12–#3 Cu		50	5.7	Cu #12–#3 STR Cu #12–#10 SOL	50 50	5.6 5.6
AL250KA	3	KA, KH, KC, KI	1	#6–#350 kcmil	25–185 mm^2	80	9.0		250	28.2
AL250KI	3	KC, KI	1	1/0–#350 kcmil	50–185 mm^2	80	9.0		250	28.2
AL400LA	1	Q4, LA, LH	1 2	#0–#600 kcmil or #1–#250 kcmil»	50–300 mm^2 50–120 mm^2	180	20.0		300	33.9
AL800MA7	1	MA, MH	2	#500–#750 kcmil	240–300 mm^2	180	20.0		300	33.9
AL900MA	1	MA, MH	3	3/0–#500 kcmil	95–240 mm^2	180	20.0		300	33.9
AL1000MA	1	MA, MH	4	1/0–#350 kcmil	50–185 mm^2	180	20.0		300	33.9
AL1200NE6	1	NA, NC	4	3/0–#600 kcmil	95–300 mm^2	250	28.2		330	37.3
AL2500PA	2	PAF, PHF, PCF	1	3/0–#750 kcmil	95–300 mm^2	840			550	
CU30FA4	3	FC	1	#14–#10 Cu		N/A	N/A	#14–#10 STR/SOL	35	4.0
CU100FA	3	FA, FH, FI	1	#14–#1 Cu	2.5–50 mm^2	50	5.7	Cu #3–#1 STR Cu #6–#4 STR Cu #8 STR/SOL Cu #14–#10 STR/ SOL	50 45 40 35	5.7 5.1 4.5 4.0
CU100TF	3	FA, FH	1	#12–#3 Cu		50	5.7	Cu #12–#3 STR Cu #12–#10 SOL	50 50	5.7 5.7
CU250KA	3	KA, KH, KC, KI	1	#6–#250 MCM Cu	16–20 mm^2	80	9.0		250	22.6
CU400LA	1	Q4, LA, LH	2	#1–#600 MCM Cu #1–#250 MCM Cu	50–300 mm^2 50–120 mm^2	180	20.0		300	33.9
CU1000MA	1	MA, MH	3	3/0–#500 MCM Cu	95–240 mm^2	300	33.9		300	33.9
CU1200NE6	1	NA, NC	4	3/0–#600 MCM Cu	95–300 mm^2	250	28.2	330		37.3

* STR = Stranded, SOL = Solid

Table 6: UL 486A tightening torques for electrical terminals, pound-inch (N-m)

Conductor size installed in connector		Slotted head No. 10 or larger*		Hexagonal head - external drive socket wrench	
AWG or kcmil	(mm^2)	Slot width to 3/64 inch (1.2 mm) or slot length to 1/4 inch	Slot width – over 3/4 inch (1.2 mm) or slot length over 1/4 inch	Split-bolt connectors	Other connectors
30 – 10	(0.05 – 5.3)	20 (2.3)	35 (4.0)	80 (9.0)	75 (8.5)
8	-8.4	25 (2.8)	40 (4.5)	80 (9.0)	75 (8.5)
6 – 4	(13.3 – 21.2)	35 (4.0)	45 (5.1)	165 (18.6)	110 (12.4)
3	-26.7	35 (4.0)	50 (5.6)	275 (31.1)	150 (16.9)
2	-33.6	40 (4.5)	50 (5.6)	275 (31.1)	150 (16.9)
1	-42.4	–	50 (5.6)	275 (31.1)	150 (16.9)
1/0 – 2/0	(53.5 – 67.4)	–	50 (5.6)	385 (43.5)	180 (20.3)
3/0 – 4/0	(85.0 – 107.2)	–	50 (5.6)	500 (56.5)	250 (28.2)
250 – 350	(127 – 177)	–	50 (5.6)	650 (73.4)	325 (36.7)
400	-203	–	50 (5.6)	825 (93.2)	325 (36.7)
500	-253	–	50 (5.6)	825 (93.2)	375 (42.4)
600 – 750	(304 – 380)	–	50 (5.6)	1000 (113.0)	375 (42.4)
800 – 1000	(406 – 508)	–	50 (5.6)	1100 (124.3)	500 (56.5)
1250 – 2000	(635 – 1016)	–	–	1100 (124.3)	600 (67.8)

*For values of slot width or length not corresponding to those specified, select the largest torque value associated with the conductor size. Slot width is the nominal design value. Slot length is measured at the bottom of the slot.

Table 7: UL 486A tightening torques for slotted head screws smaller than No. 10 intended for use with No. 8 AWG or smaller conductors

Slot length of screw[b]		Slot width of screw[a]			
		Smaller than 3/64 inch (1.2 mm)		3/64 inch (1.2 mm) and larger	
Inch	(mm)	pound-inch	(N-m)	pound-inch	(N-m)
Less than 5/32	(4)	7	(0.79)	9	(1.0)
5/32	(4)	7	(0.79)	12	(1.4)
3/16	(4.8)	7	(0.79)	12	(1.4)
7/32	(5.6)	7	(0.79)	12	(1.4)
1/4	(6.4)	9	(1.0)	12	(1.4)
9/32	(7.1)			15	(1.7)
Above 9/32	(7.1)			20	(2.3)

a Slot width is the nominal design value.

b For slot lengths of intermediate values, select torques pertaining to next shorter slot length. Also see note to Table 7.4 for screws with multiple tightening means. Slot length is to be measured at the bottom of the slot.

Table 8: UL 486A tightening torques for socket head screws

Socket Size Across Flats -- Inches	Tightening Torque, Pound Inches
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

Unit Checkout Sheet

Customer Data

Customer Name _____ Date _____
Address _____
Phone _____ Unit Number_____

Unit Nameplate Data

Make _____ Model Number _____ Serial Number _____
Compressor(s):
1: RLA_____ LRA _____ Refrig, Charge (oz.) _____ # 2: RLA_____ LRA _____ Refrig, Charge (oz.) _____
3: RLA_____ LRA _____ Refrig, Charge (oz.) _____ # 4: RLA_____ LRA _____ Refrig, Charge (oz.) _____
Blower Motor(s):
1: FLA (or NPA)_____ HP _____ # 2: FLA (or NPA)_____ HP _____
3: FLA (or NPA)_____ HP _____ # 4: FLA (or NPA)_____ HP _____
Maximum Fuse Size (Amps) _____ _____ Minimum Circuit Ampacity (Amps) _____

Operating Conditions

Unit Conditions	**Cooling Mode**	**Heating Mode**	**Measured At:**
Entering Air Temperature	_____	_____	_____
Leaving Air Temperature	_____	_____	_____
Entering Fluid Temperature	_____	_____	n/a
Leaving Fluid Temperature	_____	_____	n/a
Fluid Flow (gpm)	_____	_____	n/a
Fluid Side Pressure Drop	_____	_____	n/a

Compressor	**# 1**		**# 2**		**# 3**		**# 4**	
Mode	**Cooling**	**Heating**	**Cooling**	**Heating**	**Cooling**	**Heating**	**Cooling**	**Heating**
Suction Pressure (psig)	_____	_____	_____	_____	_____	_____	_____	_____
Discharge Pressure (psig)	_____	_____	_____	_____	_____	_____	_____	_____
Suction Temp (at compressor)	_____	_____	_____	_____	_____	_____	_____	_____
Discharge Temp (at compressor)	_____	_____	_____	_____	_____	_____	_____	_____
Suction Superheat (at compressor)	_____	_____	_____	_____	_____	_____	_____	_____
Liquid Line Leaving Condenser Temp	_____	_____	_____	_____	_____	_____	_____	_____
Liquid Subcooling	_____	_____	_____	_____	_____	_____	_____	_____

Volts/Amps	**# 1**			**# 2**			**# 3**			**# 4**		
Phase	**L1**	**L2**	**L3**	**L1**	**L2**	**L3**	**L1**	**L2**	**L3**	**L1**	**L2**	**L3**
Compressor Volts	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Compressor Amps	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Blower Volts	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Blower Amps	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

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Mammoth, Inc. has a policy of continuous improvement and reserves the right to change design and specifications without notice.

MAMM-SVC-IOM-3FA
September 2013