V-Cube Slim™
Air Handler

Installation, Operation and Maintenance Manual

Sizes: 180 to 840
Model: E Series

P/N 71144920

Table of Contents

Model Nomenclature

F	**-185-**	**V-**	**H-**	**E**
Voltage	**Model Size***	**Unit Type**	**Temperature Range**	**Design Series**
F = 208-230/60/3	180 = 180,000	V = Vertical	H = Standard Range	
G = 460/60/3	280 = 280,000			
J = 380-415/50/3	350 = 350,000			
K = 575/60/3	530 = 530,000			
	700 = 700,000			
	840 = 840,000			

*Packaged configurations available for all model sizes. See MAMM-VCS-IOM-1EB for units that include packaged refrigeration components.

Transportation and Storage

Upon receipt of the equipment, check for visible damage. Make a notation on the shipper's delivery ticket before signing. If there is any evidence of rough handling, immediately check for concealed damage. If any damage is found, notify the carrier within 48 hours to establish your claim and request their inspection and a report. Then contact the Mammoth Service department at (952) 358-6618 or info@mammoth-inc.com for a warranty claim number.

Do not stand or transport the unit on end.

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.

Installation

General

IMPORTANT:
Mammoth V-Cube Slim™ units should be installed only by qualified personnel, experienced in the installation of this equipment and related systems. Read these instructions carefully before unpacking, installing and operating this unit

1. To prevent damage, this equipment should not be operated for supplementary heating and cooling during the construction period.
2. Inspect the unit for any specific tagging numbers indicated by the factory per a request from the installing contractor.
3. 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.
4. Verify the installation location with the piping, sheet metal and electrical contractors prior to installation
5. Verify all clearances are available for the unit prior to installation.
6. Note the location and routing of water piping, condensate drain piping, and electrical wiring. The locations of these items are clearly marked on submittal drawings.
7. 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.

NOTE:
Check the unit name plate for correct voltage with the plans before installing the equipment. Make sure all electrical ground connections are made in accordance with local code.

Unit Location

Locate the unit in an area that allows for easy removal of the filter and access panels. Leave enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water, electrical and duct connections. Refer to submittal drawings for proper service clearance dimensions. Install unit in compliance with all state and local codes.

Disassembly and Assembly Instructions For V-Cube Slim™ Units

V-Cube Slim units are designed to allow for installation in new facilities and as a retrofit for older, obsolete equipment.

NOTE:
Please read all disassembly instructions completely before starting any disassembly

DANGER!
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.

DANGER!
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.

DANGER!
It is mandatory that all utilities (water, electric, and communication cables to the Building Management System) 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.

NOTE:
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 use Molex plugs for proper polarity.

Your new V-Cube Slim will come fully assembled. In the event building layout prohibits the unit to be moved to its final location as a whole assembly, it will be necessary to disassemble the unit into its basic sections and reassemble it at the final location.

The standard unit consists of three sections—the electrical control panel, the coil section and the blower section. Units with an optional waterside economizer or hot/chilled water coil will have an additional section for that coil.

The disassembly of sections requires removal of the 3/8" bolts holding them together while supporting each section as it is being removed with rigging equipment.

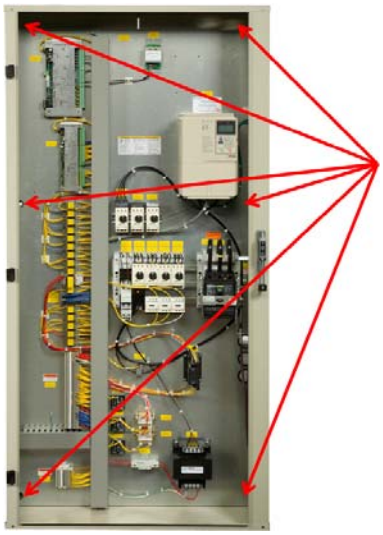
Step 1 – Remove the electrical panel
Unplug the wire harness that connects the EPiC™ keypad and reset buttons/selector switches from the panel door to the main electrical panel. Remove the panel door by lifting it from its hinges and carefully set aside, away from the unit to help prevent damage during the remaining disassembly process.

Unplug all control wiring harnesses that run from the main electrical panel to the main cabinet section. These plugs are labeled for correct re-installation. Finally, remove all high voltage wiring to the fan motors.

Once all electrical connections to other sections in the unit have been removed, make sure that the electrical panel is supported from above or below to prevent it from falling once the bolts that connect it to the main cabinet sections are loosened and removed.

Loosen and remove the section bolts that fasten the main electrical panel to the main cabinet sections (Figure 1). Set the main electrical panel aside, away from the unit to help prevent damage during the remaining disassembly process.

Figure 1—Electrical Control Panel Bolts



Remove the bolts used to mount the electrical cabinet to the main unit sections. There are 6 bolts on the side of the unit.

Step 2 – Remove optional heating coil section
This step only applies to units with an optional heating coil.

Remove the bolts that connect the welded base of the heating coil section to the welded base of the main cabinet section.

Remove the access panels on each side of the optional heating coil cabinet shown in Figure 2. Inside the optional heating coil section, disconnect wiring to any valves and/or air sensors that run to the other sections in the unit.

Once all electrical connections to the other sections in the unit have been removed, loosen and remove the section bolts that fasten the optional heating coil cabinet to the main cabinet. Set the optional heating coil section aside, away from the unit to help prevent damage during the remaining disassembly process.

Figure 2—Optional Heating Coil Section Removal

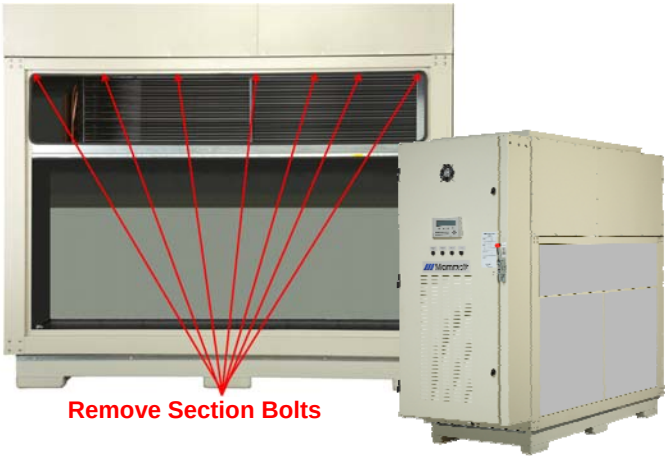
Remove Section Bolts

Step 3 – Removing the blower cabinet
Remove the main cabinet access panels (Figure 3).

Feed any wiring for the blower motors and/or air sensors passing through the coil section through the chase way into the blower cabinet.

Remove the section bolts that attach the blower cabinet to the coil section (Figure 3).

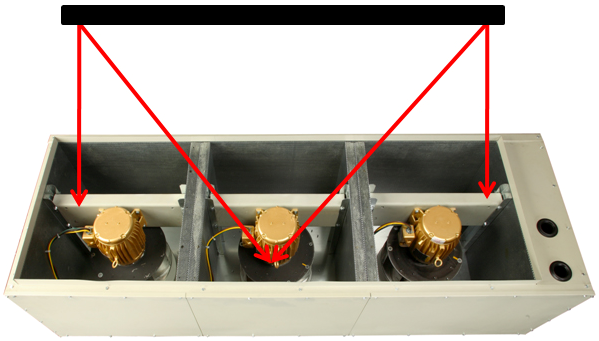
Figure 3—Removal of Blower Section Bolts



Remove Section Bolts

Remove the water pipe extensions at the Victaulic connection point inside the unit. Attach lifting straps to the motor mount plate as shown in Figure 4 and attach to a spreader bar or forklift fork. Also attach ropes or chains to the eye bolt on one of the motors and attach to each end of the spreader bar or fork to level the load of the blower section.

Figure 4—Lifting the Blower Section



CAUTION!
Lifting straps are to be used in lifting the blower section only. Do not attach eye bolts to the motor mount plate and attempt to lift the blower section. Failure to do so can result in equipment damage and personal injury.

Use these instructions in the reverse order for assembly. Replace any torn or damaged gasket with new material. Apply a bead of silicon caulking between sections while reassembling to minimize air leaks.

For further information or assistance with these procedures, contact the Mammoth Service department.

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 only 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.

The ductwork should be laid out so that there is no line of sight between the unit discharge and the distribution diffusers.

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. 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 typical to close off the ventilation air system 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

1. 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.
2. The piping may be steel, copper or PVC. Avoid dissimilar metal fittings as they may corrode. If the use of dissimilar metals cannot be avoided, use dielectric isolation at that connection point
3. Supply and return run outs usually join the unit via short lengths of high pressure flexible hose which are sound attenuators for both unit operating noise and hydraulic pumping noise. One end of the hose should have a swivel fitting to facilitate removal for service. Hard piping water connections is not recommended due to the possibility of vibration that can damage connections or pipe joints or noise attenuation. Any hard piped connections must contain a union to facilitate removal of the piping or unit.
4. Some flexible hose threaded fittings are supplied with sealant compound. If not, apply Teflon tape to provide a tight seal.
5. Supply and return shutoff valves are required at each unit. The return valve is used for balancing and should have a “memory stop” so that it can always be closed off but can only be reopened to the proper position for the flow required.
6. 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

1. Condensate piping can be steel, copper, or PVC. Each unit includes a condensate connection.
2. 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 1-1/4” male pipe fitting to accommodate the condensate drain connection.
3. Do not locate any point in the drain system above the drain connection of any unit.
4. The condensate piping system must be vented at its highest point.

Cleaning and Flushing

1. Prior to first operation of the V-Cube Slim™, the water circulation system must be cleaned and flushed of all construction dirt and debris.
2. If the unit is equipped with water shutoff valves, either electric or pressure operated, the supply and return run-outs must be connected at each unit location. This will prevent the introduction of dirt into the unit.
3. Fill the system with water with all air vents open. When the unit is filled with water, close all air vents to remove all air..
4. Start the main circulator with the pressure reducing valve open. Check vents in sequence to bleed off any trapped air to provide circulation through all components of the system.
5. While circulating water, check for and repair any leaks in the piping. Drains at the lowest point(s) in the system should be opened for the initial flush and blow down, making sure city water fill valves are set to make up water at the same rate. 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. Flush should continue for approximately two hours, or until the drain water is clear and clean.
6. Shut off supplemental heater (if applicable) and circulator pump and open all drains and vents to completely drain down the system. Short circuited supply and return run-outs should now be connected to the unit supply and return connections.
7. Refill the system with clean water. Test the water using litmus paper for acidity, and treat as required to leave the water slightly alkaline (pH 7.5 to 8.5). 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.
8. 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. Dirty water will result in system wide degradation of performance and solids may clog valves, strainers, flow regulators, etc.
9. Set the loop water controller heat add setpoint to 70°F and the heat rejection setpoint to 85°F. Supply power to all motors and start the circulation pumps. After full flow has been established through all components including the heat rejecter (regardless of season) and air vented and loop temperatures stabilized, each of the units will be ready for check, test and start-up, and water balancing.

Start-up

1. Open all valves to the full open position and turn on power to the V-Cube Slim™.
2. Set room temperature sensor for “Fan Only” operation by selecting “Off” at the system switch and “On” at the fan switch. If “Auto” fan operation is selected, the fan will cycle. Check for proper air delivery.
3. Measure the temperature difference between entering and leaving water. The difference in water temperature should be approximately 1 ½ times greater in the cooling mode as compared to the heating mode . Adjust the combination shutoff/ balancing valve in the return line to a water flow rate which will result in the temperature difference.
4. In the heating mode, with the entering water temperature in the range of 60°F to 80°F, the temperature difference between the entering water and leaving water should be between 6°F to 12°F. In the cooling mode, if the leaving air temperature falls below 35°F, adjust water flow to the unit to >3 gpm/ton to avoid freeze damage to the unit.
5. To verify proper drainage of condensate, slowly add water to the condensate pan until proper drainage is accomplished.
6. If the unit fails to operate, check the following:
   a. Verify that the incoming power to the unit matches the nameplate and that the main disconnect is turned on.
   b. Verify a call for heating or cooling is present.
7. If the unit starts but after a short time trips on high or low head pressure, check the following:
   a. Verify that airflow is not impeded by a dirty air filter, improper fan rotation or improper duct sizing.
   b. Verify that the water flow rate is within limits. Check the water flow balance and back flush if necessary.

Additional Information For Initial Start-up Only

Operating voltages

208-230/60/3 . . .. 197 volts min.; 253 volts max.
460/60/3 . . . . . 414 volts min.; 506 volts max.
380-415/50/3. . . . . ..342 volts min.; 418 volts max
575/60/3. . . . . .515 volts min.; 632 volts max.

Note:
Voltages listed are to show voltage range. However, 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%.

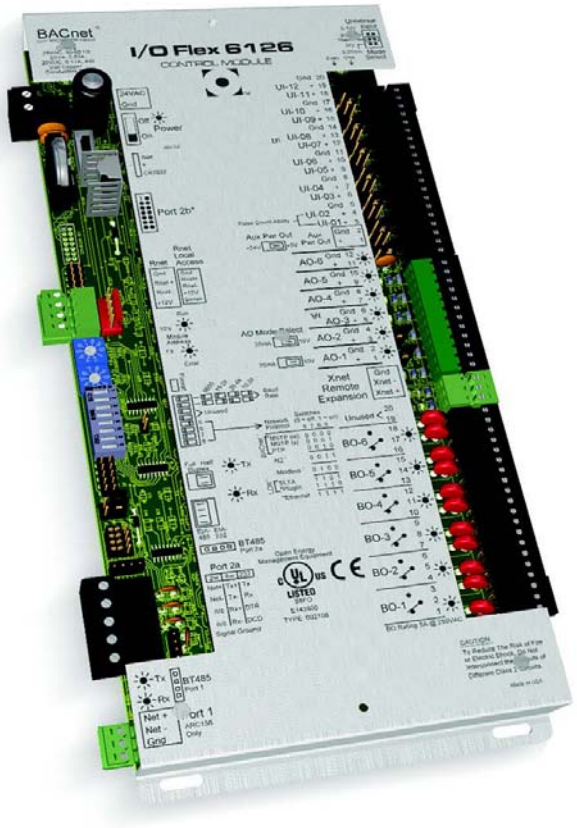
Operating Limits

Environment

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.

Mammoth EPiC™ Systems

I/O Flex 6126



The standard factory-integrated DDC controller provides control flexibility that can be easily customized to meet any sequence of operation needs. It is fully capable of operating in a 100% stand-alone mode or can connect to a Building Automation System (BAS) using any of today's four leading protocols: BACnet, Modbus, N2, and Lontalk. The base controller provides 12 inputs and 12 outputs plus supports the 8160 expander module if additional inputs/outputs are required.

Key Features and Benefits

- 6160 I/O points: 6 digital outputs, 12 universal inputs, and 6 analog outputs.
- 8160 I/O points: 16 universal inputs, 8 digital outputs.
- Optional built-in protocol support: BACnet® (ARCNET, MS/TP, and PTP modes), Modbus® (RTU and ASCII modes supported), N2, or Lontalk®.
- Powerful, high-speed 16-bit microprocessor with 1 MB Flash memory and 1 MB of battery-backed RAM
- Built-in support through an Rnet port for control's custom configurable keypad/display unit, BACview6 (4-line by 40 character per line display) for intelligent sensors.
- For variable air volume (VAV), constant volume (CAV), and make-up air (MAU) applications.

Examples of I/O's

INPUTS				
Point	**Description**			
UD #1	**+Pulse**	BMS Supply Air, Duct Static Reset or Room Air Temperature Setpoint		
UD #2		Room Air Temperature		
UD #3	**RTD/Therm/Dry**	System Switch	Emergency Shut Down	Remote Start
UD #4	**Contact, 0-10VDC,**	High Static	Low Static	VFD in Bypass
UD #5	**0-20MA**	Economizer Lockout	Cooling Lockout	Heating Lockout
UD #6		Supply Fan Status	Compressor Fault	Condensate Overflow
UD #7		Duct Static Pressure or Airflow Switch		
UD #8		Filter Static Pressure or Dirty Filter Switch #1		
UD #9		Outside Air Temperature (AiSE Only)		
UD #10		Condenser Water Temperature		
UD #11		Entering Air Temperature or Return Air Temperature (AiSE)		
UD #12		Supply Air Temperature		
OUTPUTS				
Point	**Description**			
UO #1	**4-20mA, 0-10Vdc**	Spare		
UO #2		Heating Source Control Signal		
UO #3	**0-10 Vdc**	Economizer Valve (WiSE)/Damper Control Signal (AiSE)		
UO #4		WiSE Bypass Valve Signal		
UO #5		Spare		
UO#6		Supply Fan VFD Control Signal		
DO #1	**120 VAC**	Start Supply Fan		
DO #2	**FORM C**	Start Condenser Pump or Switch Reversing Valve		
DO #3		Field-Lin (MWU or Open Min OA)		
DO #4		Common Alarm		
DO #5		Compressor Call #2		
DO #6		Compressor Call #1		

Mammoth EPiC™ Systems

Keypad

Locally access controllers and operational properties with the easy-to-use BACview6 keypad/display. It plugs into an Rnet connection on a 6126 controller and allows you to display and modify properties. The BACview6 features a numeric keypad, directional keys, and four programmable function keys. A large 4-line by 40-character backlit LCD display is provided for easy reading even in poor lighting conditions. The device also includes an alarm indicator light.

Key Features and Benefits

- Compatible with all EPiC system controllers.
- Flexible design allows panel or wall mounting; can be located up to 500 feet from the controller.
- Hand-held version can be plugged into RS room temperature sensors.
- Backlit LCD display enhances reading even in poor lighting conditions.
- Customized menus for each product.
- Password protection provides security.
- One keypad can be used on different units/programs since the menus are part of the control program.

General Maintenance

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

- **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 heating 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.

- **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.

Performance Troubleshooting

Performance Troubleshooting	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 in heating	Check for dirty air filter and clean or replace, Check fan motor operation and airflow restriction. Too high of external static? Check static vs. blower table
	X	X	Leaky ductwork	Check supply and return air temperatures at the unit and at distant duct registers: If significantly different, duct leaks are present

UNIT CHECK-OUT SHEET

Customer Data

Customer Name _____ Date _____
Address _____
Phone _____ Unit Number_____

Unit Nameplate Data

Make _____ Model Number _____ Serial Number _____
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

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

info@mammoth-inc.com
www.mammoth-inc.com

MAMM-VCS-IOM-2EB
October 2011