Charles Modular Cabinet
MC-1, MC-2, MC-3 and ME-1, ME-2, ME-3 Series
General Description and Installation

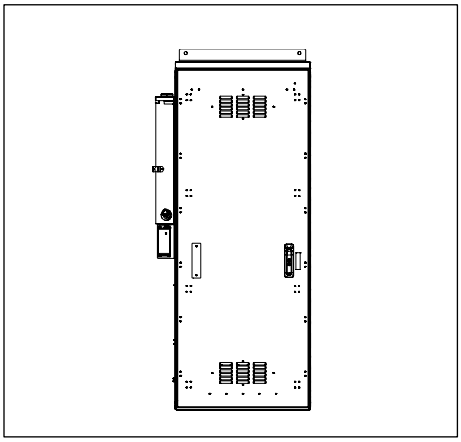


Figure 1 Front View of an MC-3 Bay

1. GENERAL INTRODUCTION

1.1. Document Purpose

This document provides general information for the MC-1, MC-2, and MC-3 series of the Charles Industries' Modular Cabinets, as well as the ME-x Modular Expansion units. Figure 1 shows an example of an MC-3 series cabinet.

-NOTE-

Hereafter, the Charles MC-1, MC-2, and MC-3 Series Modular Cabinets will be referred to as the "MC-x." The ME-1, ME-2, and ME-3 Modular Expansion units will be referred to collectively as the "ME-x."

1.2. Product Purpose

The MC-x/ME-x consists of a protective enclosure for an integrated system of electronic components and equipment that can serve fiber and copper interfaces. This series is part of Charles Industries' line of Modular Cabinets. The modular enclosures can combine multiple bays to support a variety of applications. Bays can be added in the factory or in the field, creating a versatile solution that can grow with changing applications. If purchasing units for field expansion, order the ME-x series.

1.3. Product Mounting and Location

This enclosure is suitable for outside plant-type (OSP) locations and those that may require NEC compliance. The outdoor, weather-resistant MC-x/ME-x is to be mounted on a concrete or composite pad (Charles CPAD). The installer connects the power, fiber, and copper connections. Detailed mounting and installation information is covered in Section 3.

ME-x cabinets are very similar to the MC-x bays, except that the ME-x bays do not have side panels. See Section 3.8.

2. PRODUCT DESCRIPTION

The MC-x can contain multiple bays. The series has multiple bay types, and these bays can have thermal and incoming power distribution units mounted on the cabinet exterior. See section 7.3 for a full description of the available options.

The MC-1, MC-2, and MC-3 differ in their external dimensions. Overall cabinet dimensions depend on the number and type(s) of bays ordered, as well as the size of any components mounted on the exterior (e.g. HVAC system, load center, etc.). Figures 2 through 5 show the dimensions for the different bay types. Figures 6 through 9 show the main components of the bays. The main components of each bay type are the same for all three sizes, however, if requested, bays may be equipped with shelves for customer equipment.

When combining bays, all bays must be of the same size (e.g. an MC-1 bay cannot be combined with an MC-3 bay). This is also true when adding an expansion unit (e.g. if adding a bay to an MC-1 installation, order an ME-1 expansion unit).

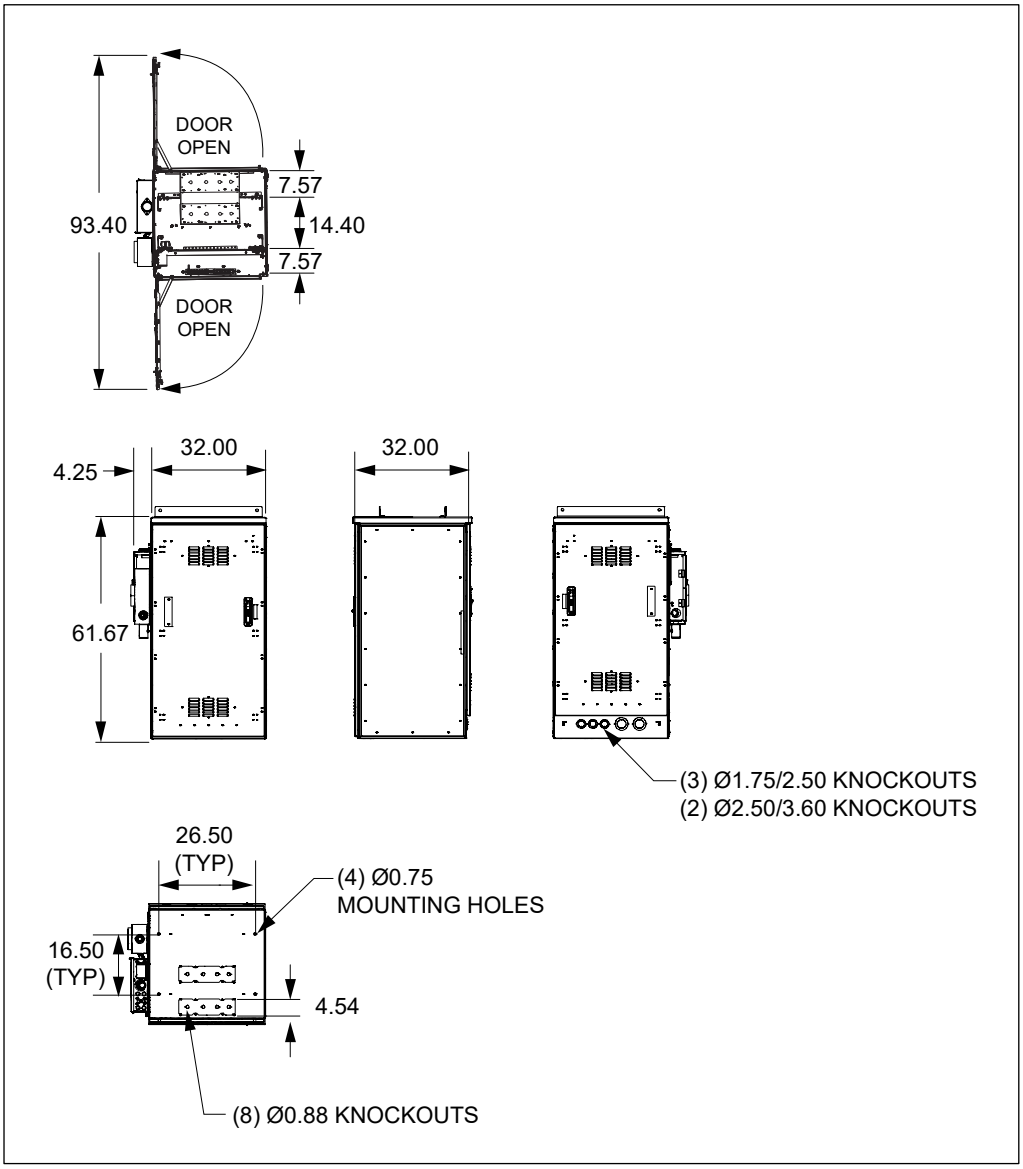


Figure 2 MC-1/ME-1 Equipment Bay, Single Bay Dimensions (in inches)
This example includes no thermal or incoming power distribution unit mounted on the exterior. This option has front and rear doors. A front door/rear panel option is also available.

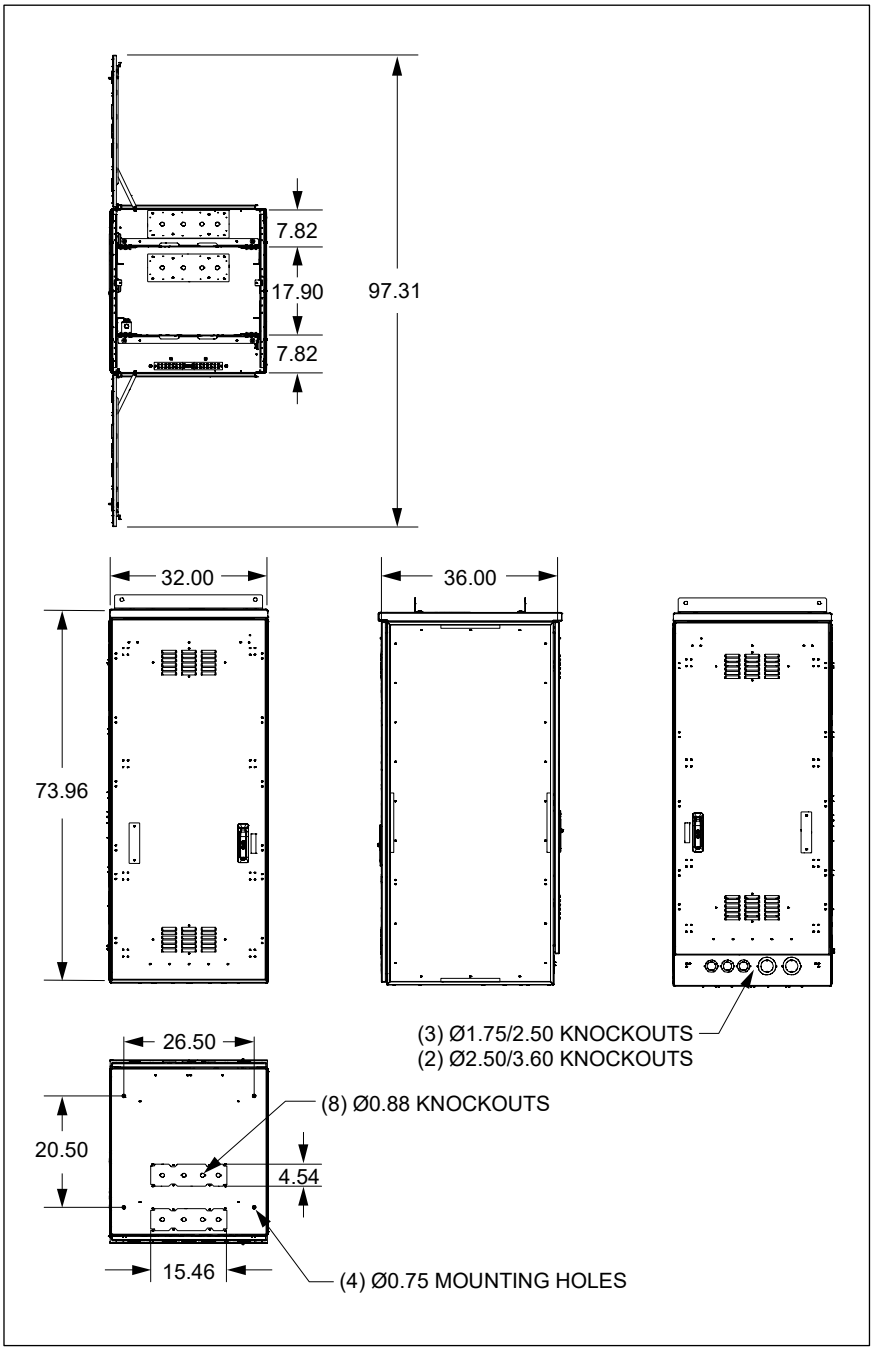


Figure 3 MC-2/ME-2 Equipment Bay, Single Bay Dimensions (in inches)
This example includes no thermal or incoming power distribution unit mounted on the exterior. This option has front and rear doors. A front door/rear panel option is also available.

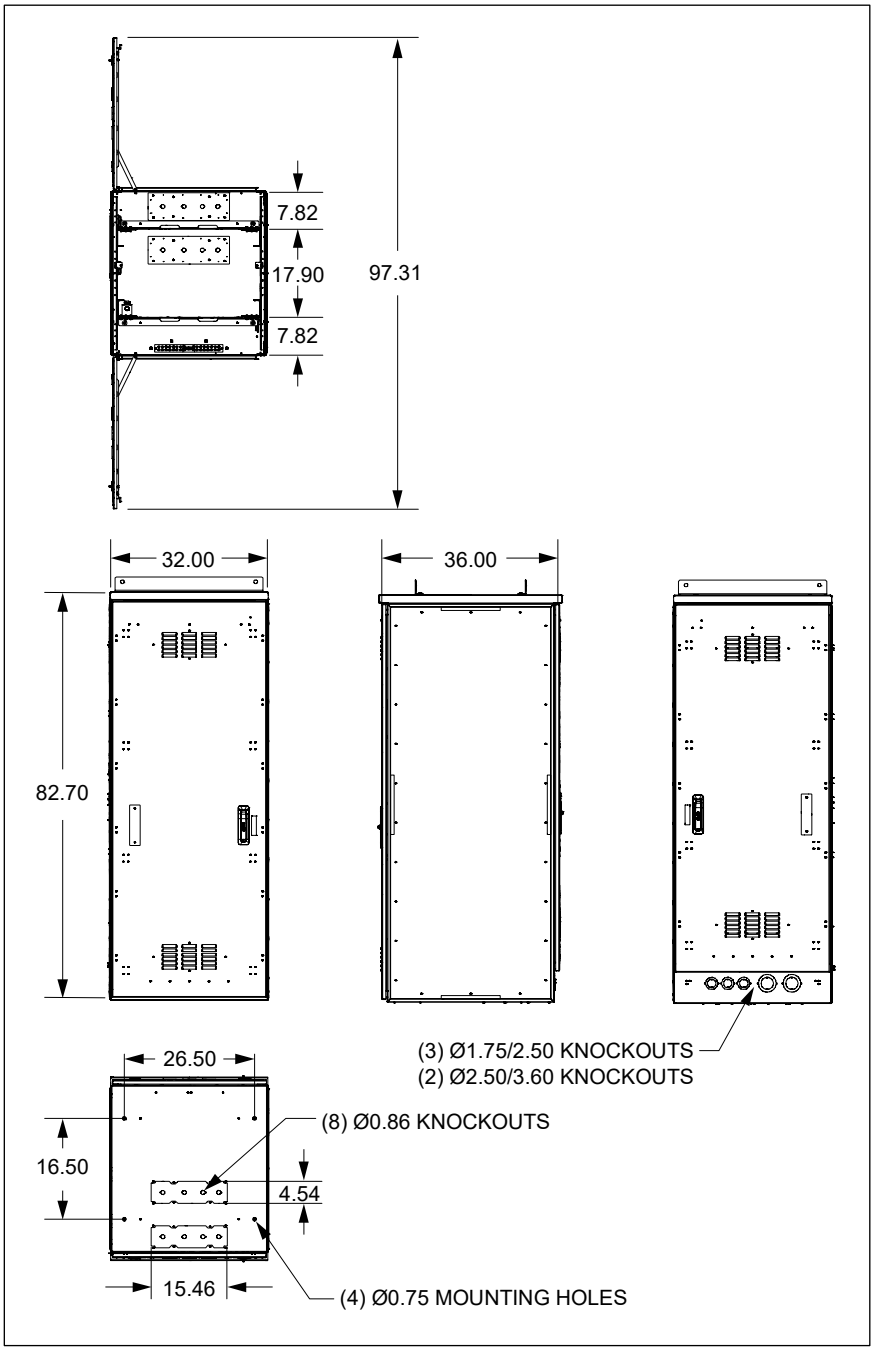
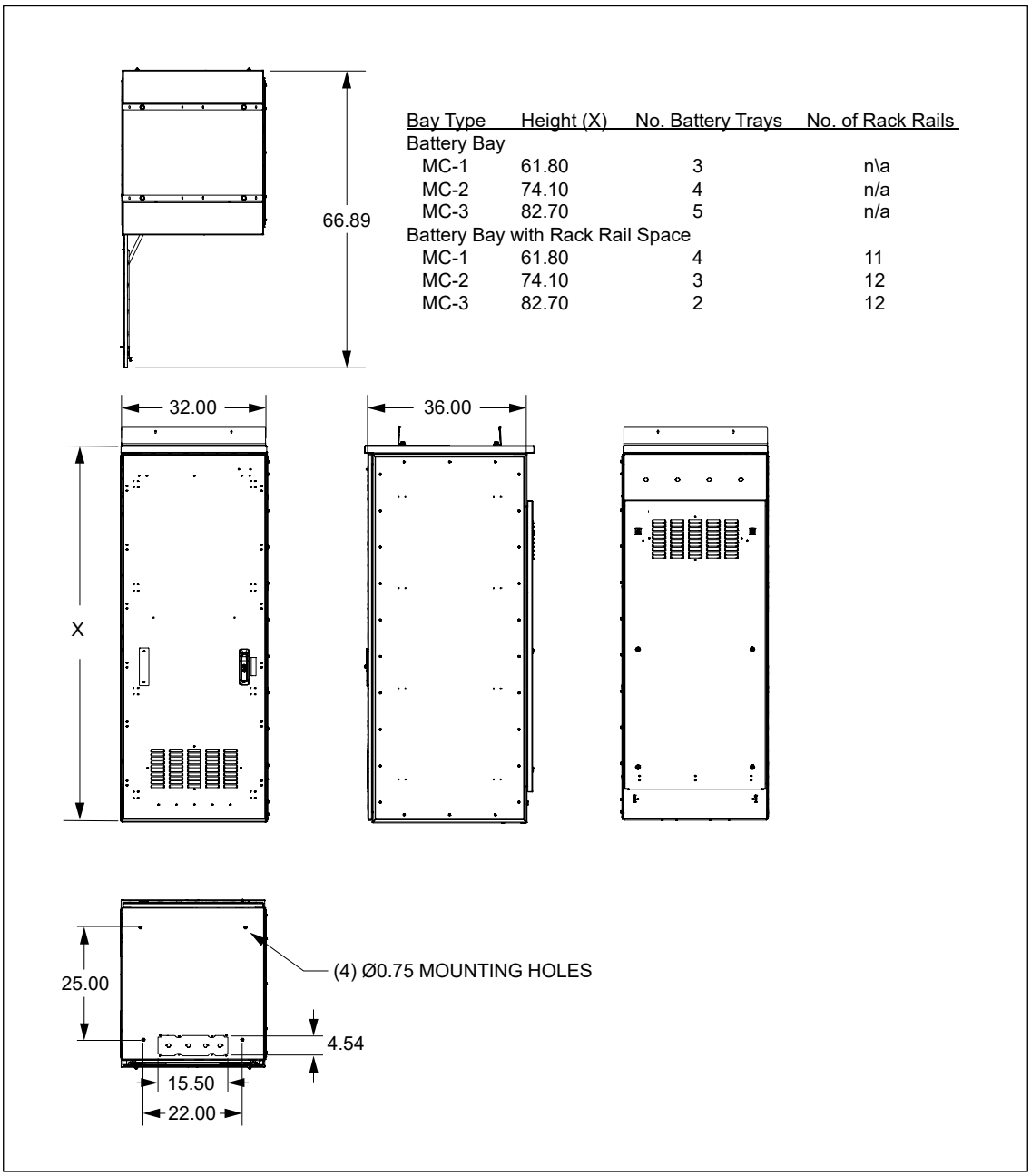


Figure 4 MC-3/ME-3 Equipment Bay, Single Bay Dimensions (in inches)
This example includes no thermal or incoming power distribution unit mounted on the exterior. This option has front and rear doors. A front door/rear panel option is also available.



Bay Type	Height (X)	No. Battery Trays	No. of Rack Rails
Battery Bay			
MC-1	61.80	3	n\a
MC-2	74.10	4	n/a
MC-3	82.70	5	n/a
Battery Bay with Rack Rail Space			
MC-1	61.80	4	11
MC-2	74.10	3	12
MC-3	82.70	2	12

Figure 5 MC-x Battery Bay and Battery Bay with Rack Rail Space, Single Bay Dimensions (in inches)

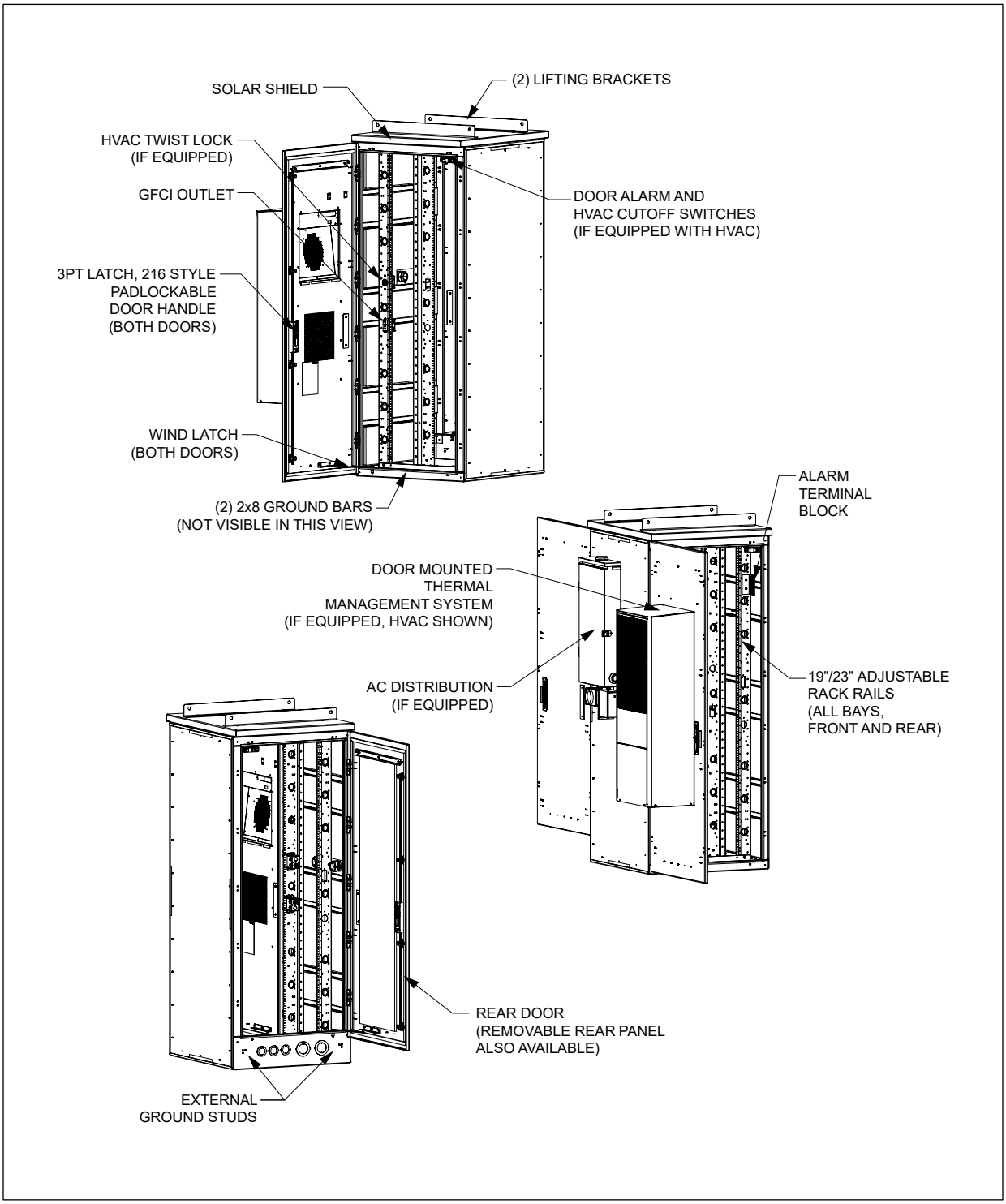


Figure 6 MC-x Equipment Bay Components
This is an example of a configured bay. Thermal and incoming AC distribution units shown here are optional. All other components are common to all equipment bays and all sizes.

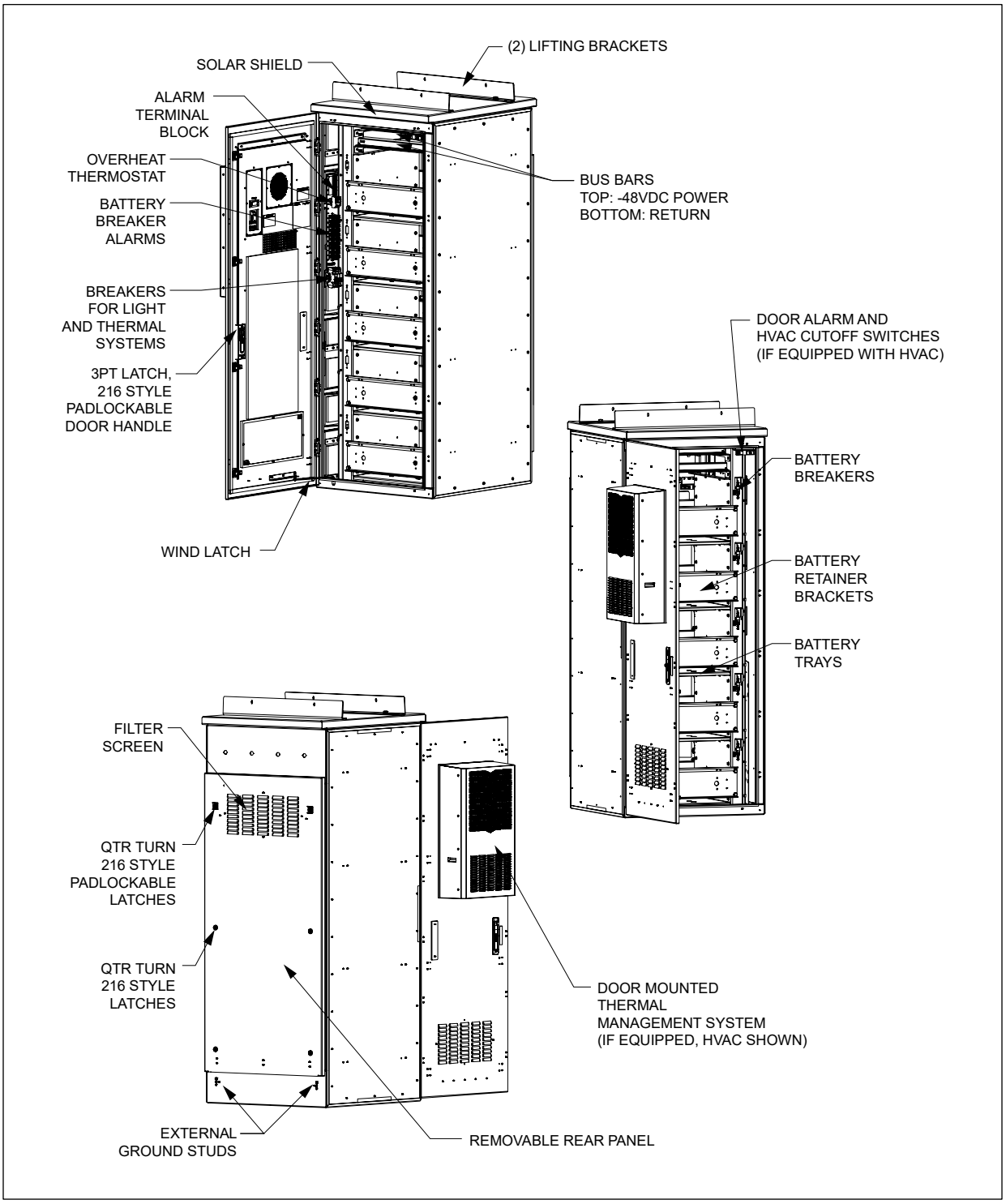


Figure 7 MC-x Battery Bay Components
This is an example of a configured bay. Thermal unit shown here is optional.
All other components are common to all battery bays and all sizes.

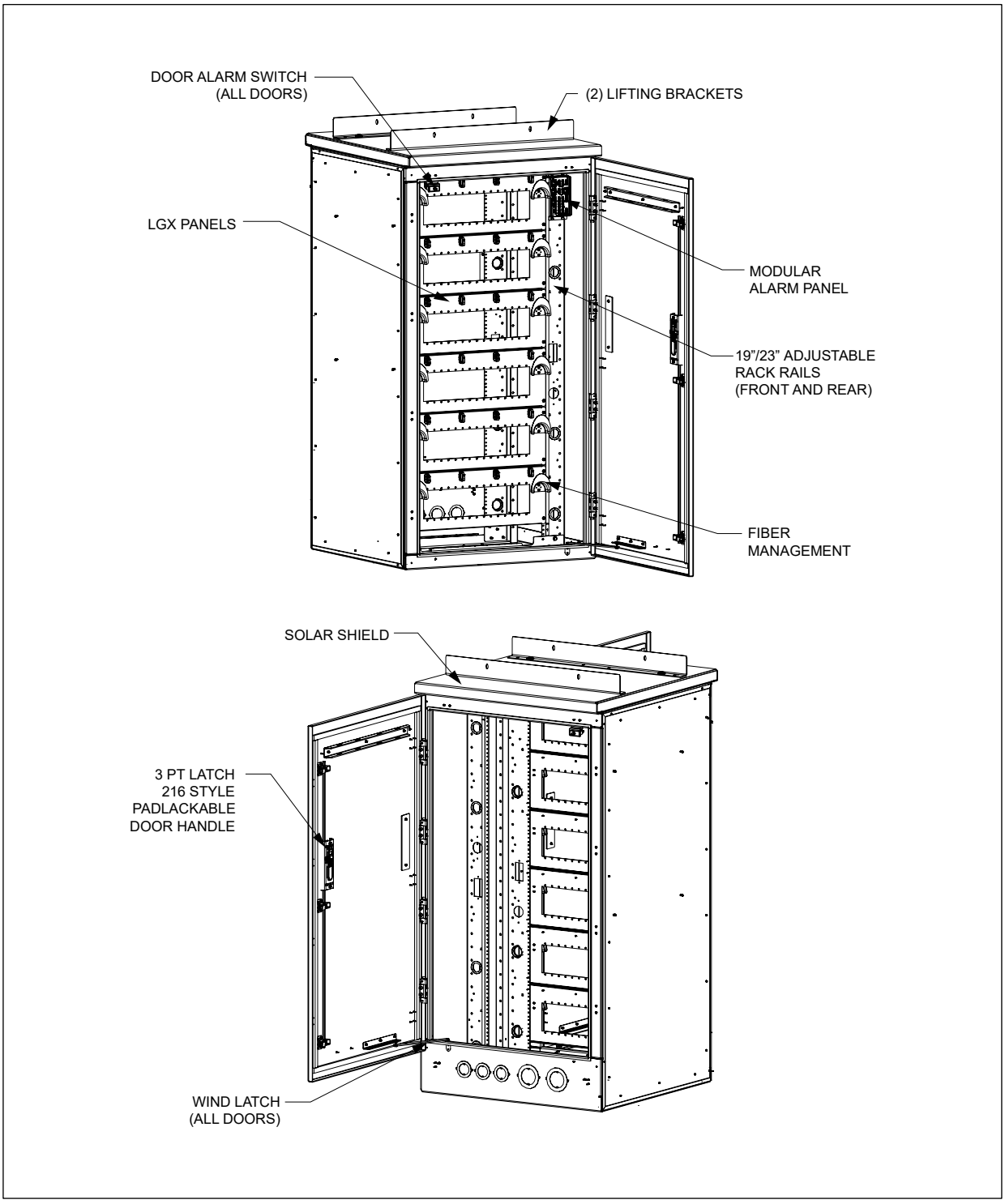


Figure 8 MC-x Fiber Bay Components
Front and rear doors shown. Rear panel option is also available.

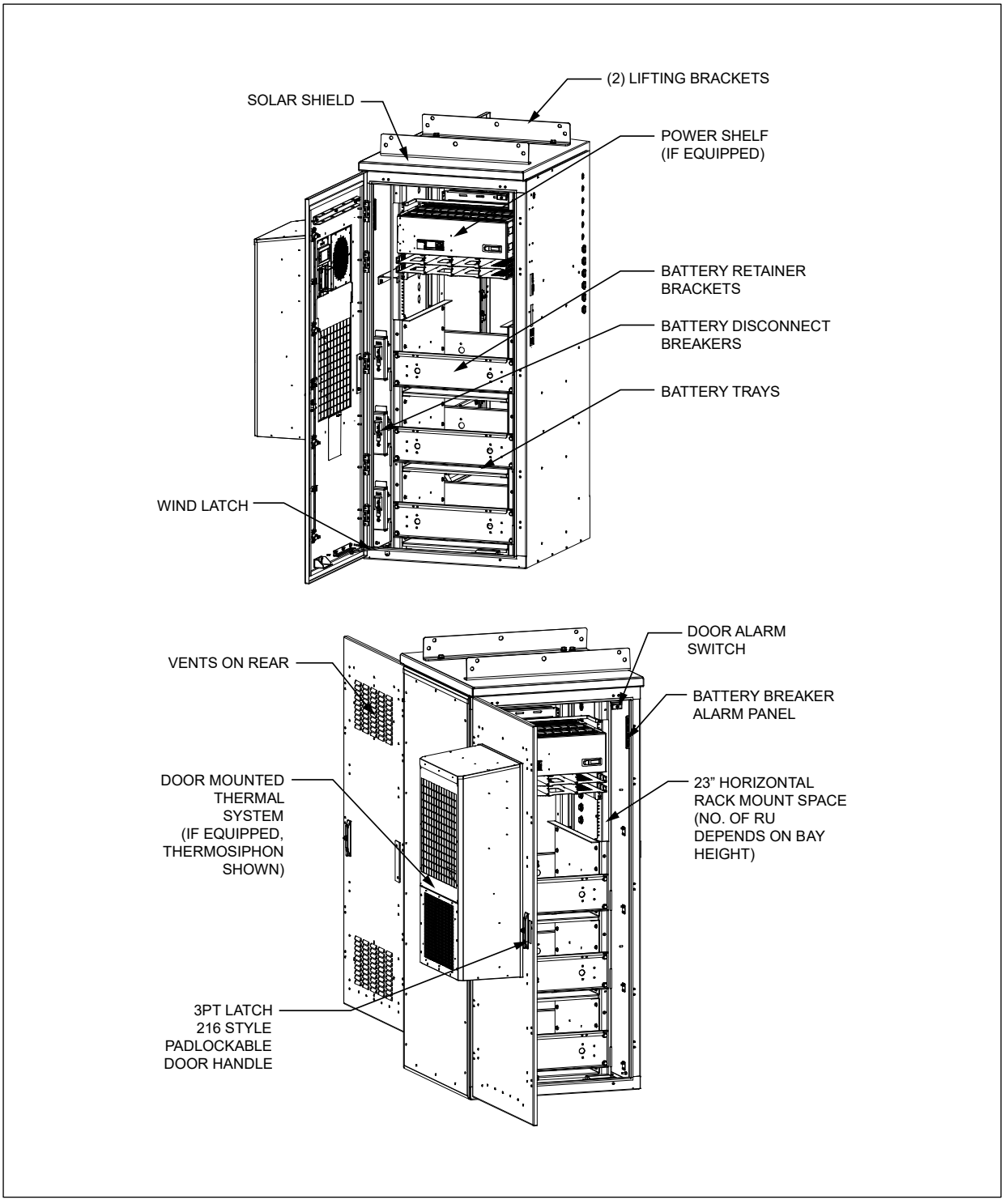


Figure 9 MC-x Battery Bay with Rack Rails Above
Front and rear doors shown. Rear panel option is also available.

3. INSTALLATION

3.1. Inspecting the Product

The MC-x/ME-x is shipped mounted upright on a skid. Remove the bolts, unpack the unit, and dispose of the packaging material.

-INSPECTION NOTE-

Visually inspect the unit for damages prior to installation. If the equipment was damaged in transit, immediately report the extent of the damage to the transportation company.

3.2. Following and Using Safety Precautions

Read the following site and safety tips, cautions, and warnings, then proceed with the paragraphs that follow.

- For installation, follow all National Electrical Codes (NEC) ANSI/NFPA 70, local, environmental, workplace, and company codes, safety procedures, and practices.
- Minimum spacing between the accessories and components and the housing for ITE equipment shall be maintained for safe operation of the equipment when installed in accordance with NEC ANSI/NFPA 70.
- Read all instructions, warnings and cautions on the equipment and in the documentation shipped with the product.
- Always connect ground connections first.
- Do not place this product on weak or unstable surfaces which may allow the product to fall, resulting in potentially serious damage(s) to persons or product.
- Only authorized trained personnel shall install the MC-x/ME-x.
- In windy conditions, be sure to engage the door latches to secure the door in a stationary position.

3.3. Obtaining Tools and Equipment

Obtain the following recommended or needed items for installing the MC-x/ME-x.

- Sufficient length and quantities of fiber cable (or pigtails)
- Cable scoring, opening, and cutting tools for cable sheathing, shields, wrappings, strength members and buffer tubes
- Wire strippers
- Crimpers
- Cable, tube, wire, and fiber cleaning materials
- Protective and/or insulated work gloves
- Safety glasses
- Tape measure
- Marking utensil
- #6 ground wire or rod and earth ground materials
- Bond strap (optional, from cable bond clamp to bond post)
- Any exterior cable strain relief, per company practice
- Slotted, hex, and Phillips screwdrivers
- Torque wrench
- Assorted cable ties, clips, or fasteners (optional)
- Can wrench (216 type tool)
- Derrick for lifting
- Level

3.4. Preparing the Installation Site

Observe the following site preparation recommendations.

- Leave adequate horizontal and vertical space between multiple installations to allow for proper cable access, as well as enough room around the enclosure to open the door(s).
- The site must meet minimal personnel and equipment safety requirements.
- The distance from the cable entry point should be consistent with local installation practices.
- The pad must be able to support the weight of the MC-x/ME-x.
- Run all fiber and copper facilities to the site.

3.5. Lifting the MC-x/ME-x

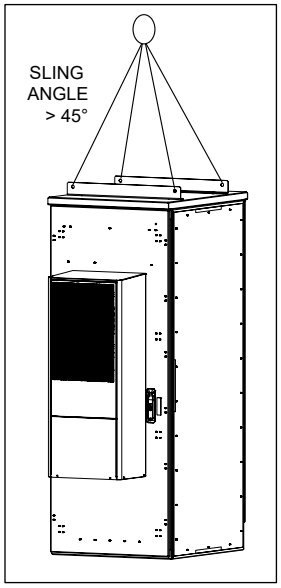


Figure 10
Lifting the MC-x/ME-x

See section 7.3.1 for MC-x/ME-x weights. Use the formula in section 7.3.1 to calculate the maximum weight of customer supplied equipment that can be added to the MC-x/ME-x prior to lifting. Charles recommends the following procedure for lifting the MC-x/ME-x.

3.5.1. Required Equipment

- One derrick (crane) capable of lifting the MC-x/ME-x
- Minimum 16-foot lifting slings or chains with each having a 2,500 lbs. capacity
- Connecting links/U-shackles to attach slings to the MC-x/ME-x's lifting brackets
- 75-ft. long tagline rope

Insert the lifting sling connecting links securely through each of the holes on the lifting brackets as shown in Figure 10. A 1-bay example is shown here. If multiple bays are ordered, additional slings may be needed. Use one sling in each hole on the lifting brackets to fully support the MC-x/ME-x weight.

3.5.2. Warnings and Specific Safety Precautions

⚠	**WARNING**	**Improper hoisting equipment and unsafe lifting procedures can result in serious injury or death.** **Because of the added risk of injury or damage, do not lift enclosures with batteries installed.**

Observe the following local safety procedures when performing the tasks in this section.

- Keep the MC-x/ME-x away from any power lines.
- Keep bystanders away from the work operations at all times.
- Only trained operators shall operate the crane for lifting and setting the MC-x/ME-x.
- Do not suspend loads over people or equipment.
- All persons working with hoisting equipment shall wear standard safety gear according to local practices including safety helmets and steel-toed shoes.
- Do not operate the hoisting equipment until all stabilizers are extended and in firm contact with the ground or adequate support structure.
- Do not attempt to retract or extend the stabilizers while a load is suspended.

3.6. Mounting the MC-x/ME-x

The MC-x/ME-x can be mounted on a new or existing concrete pad. One gasket is provided for each bay ordered for use when placing the MC-x/ME-x on a concrete pad. If a gasket becomes damaged during installation, order a replacement (80-004770-A for MC1 cabinets or 80-005819-A for MC-2 and MC-3 cabinets). Ensure that the unit is level. If multiple bays are being installed, then place the gaskets side-by-side. Ensure that the mounting holes are horizontally aligned across all mounting gaskets.

The MC-x/ME-x can also be mounted on a Charles CPAD composite mounting pad. The gaskets are not needed if mounting on a CPAD. See the list below for CPAD part numbers.

1-bay cabinet	CPAD-M1BUNI4036
2-bay cabinet	CPAD-M2BUNI7836 with CPAD-M2EUNI7836 extension
3-bay cabinet	CPAD-M2BUNI7836 pad with CPAD-M1EUNI4036 extension
4-bay cabinet	CPAD-M2BUNI7836 pad with CPAD-M1EUNI7836 extension

3.6.1. Torque Requirements

Torque all hardware as shown below (unless otherwise noted). These values apply to SAE Grade 1 & 2 Low Carbon Steel, ASTM A307 Low Carbon Steel, and Stainless Steel Grade 18-8.

Thread Size	In-lbs	Ft-lbs
4-40	4±10%	
6-32	8±10%	
8-32	16±10%	
10-32	26±10%	
12-24	50±10%	
1/4-20/M6	60±5%	5±5%
5/16-18	125±5%	10.4±5%
3/8-16	180±5%	15.0±5%
1/2-13	500±2%	41.7±2%
5/8-11	1000±1%	83.3±1%

3.6.2. Constructing a New Pad

- Use only concrete for new pad construction. Do not use substitute materials since they lack the rigidity for MC-x/ME-x placement.
- Observe local building practices for pad construction. Charles recommends that the pad should extend a minimum of 8" beyond the MC-x/ME-x base on all sides.
- Use a minimum of 6" of sand or gravel as a base for the pad for leveling purposes.
- Figures 11 through 14 show the required conduit openings and mounting hole dimensions for entering/mounting the bottom of the bays. Use these dimensions when designing the pad. A 2-bay mounting example is shown in all figures.

⚠	**WARNING**	**When pad mounting, the compression strength of the pad must be at least 4000 psi as determined by ASTM C39 test of compression strength of concrete cylinders.** **The slump of the concrete shall be 2" to 4" as determined by ASTM C143 test method.**

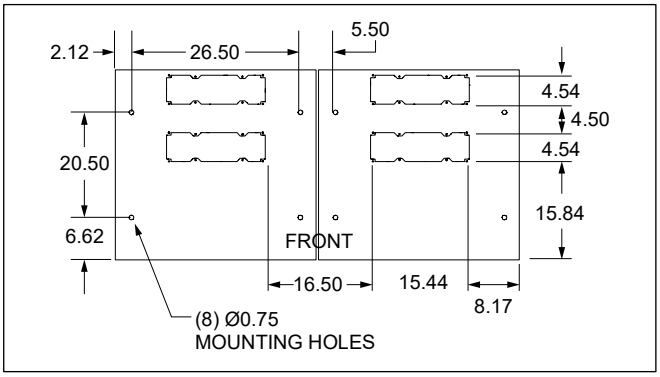


Figure 11
MC-1 Equipment Bay
Mounting Hole Dimensions (in inches), Top View

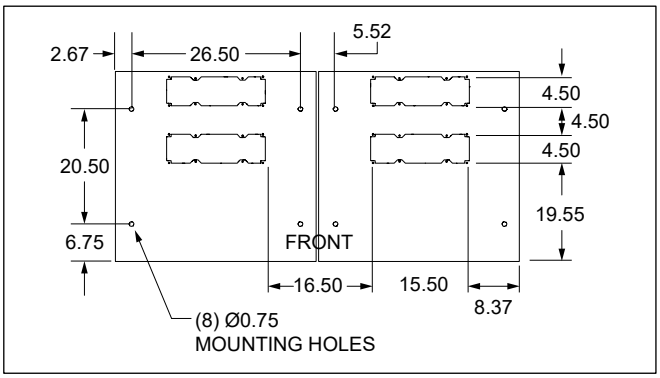


Figure 12
MC-2 and MC-3 Equipment Bay
Mounting Hole Dimensions (in inches), Top View

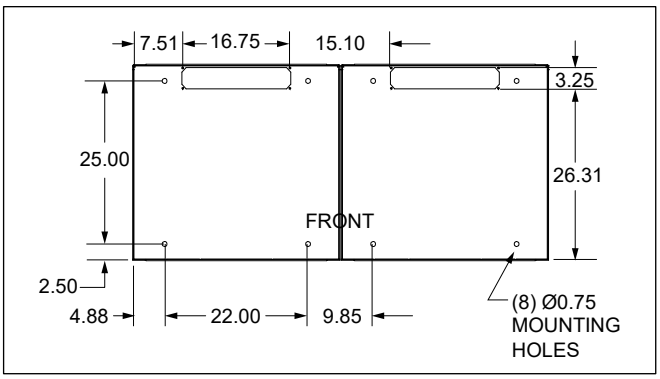


Figure 13
MC-1 Battery Bay
Mounting Hole Dimensions (in inches), Top View

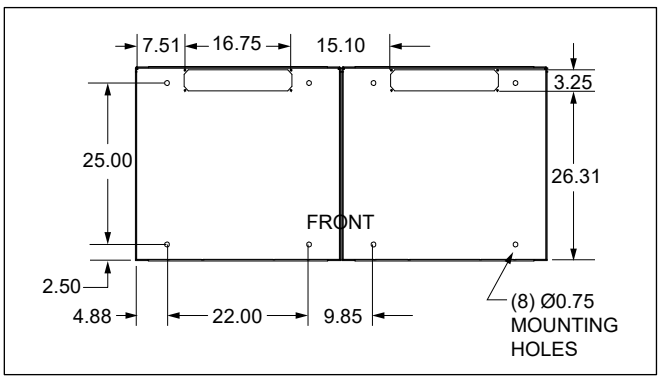


Figure 14
MC-2 and MC-3 Battery Bay and
Battery Bay with Rack Rails
Mounting Hole Dimensions (in inches), Top View

3.6.3. Mounting the MC-x/ME-x on a Pad

Four customer supplied, corrosion resistant, 1/2”-13 hex head bolts with anchors are required for mounting each MC-x/ME-x bay to the concrete pad.

Note: if mounting a battery bay, then use 5/8” Grade 8 bolts and washers with the mounting hardware. Torque to 159ft-lb.

1. Layout, drill, and set the 1/2” anchors per manufacturer’s recommendations. The embedment depth is not to exceed 3.5”. Use the gasket as a mounting hole location template.
2. Clean any debris from the concrete pad.
3. Install the gaskets by positioning them on the pad so that they are underneath the bottom of the MC-x/ME-x when the cabinet is installed. Line up the gaskets so that the cutouts are in proper position around the conduit openings and the bolt holes as shown in Figure 15. Use the adhesive strips on the underside of each gasket to secure them to the concrete pad to prevent them from shifting as the cabinet is lowered.
4. Open the door(s) to allow access to mounting holes.
5. Ensure that the cabinet is parallel to the pad surface as it is placed onto the pad and that it aligns with the holes in the pad and the gaskets. Dress the cable/conduit so that it aligns with the MC-x/ME-x openings as it is lowered onto the pad.
6. Place the cabinet on the pad. Loosen the slings so that all the weight is on the pad. Check that the MC-x/ME-x is properly aligned.
7. Secure the MC-x/ME-x to the pad using the 1/2”-13 hex head bolts. Tighten all bolts securely.
8. Once the MC-x/ME-x is secured, remove the slings and tagline. Close the doors.
9. The lifting brackets can be removed after the MC-x/ME-x is installed.

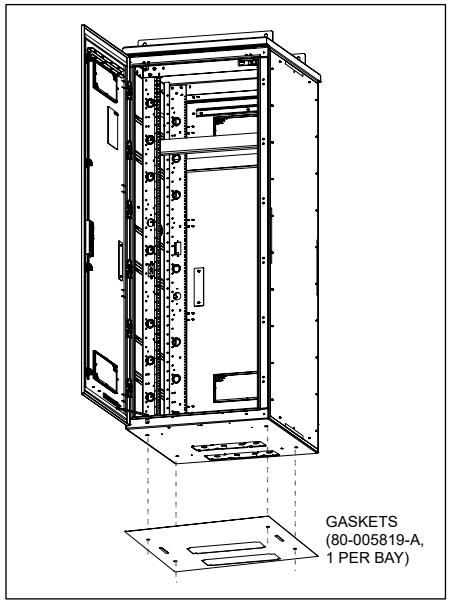


Figure 15 Gasket Installation

3.6.4. Mounting the MC-x/ME-x on a CPAD

First, follow the instructions that ship with the CPAD to ensure that the CPAD is securely installed in the ground. Then proceed to mount the MC-x/ME-x on the CPAD. Four customer supplied, corrosion resistant, 1/2”-13, 2” long fully threaded hex head bolts with flat and lock washers are required for mounting the each bay to the CPAD. Use the following steps to mount the MC-x/ME-x to a CPAD.

Note: if mounting a battery bay, then use 5/8” Grade 8 bolts and washers with the mounting hardware. Torque to 159ft-lb.

1. Clean any debris from the CPAD.
2. Open the doors to allow access to mounting holes.
3. Ensure that the cabinet is parallel to the CPAD surface as it is placed onto the CPAD and that it aligns with the holes in the CPAD. Dress the cable/conduit so that it aligns with the MC-x/ME-x openings as it is lowered onto the CPAD.
4. Place the cabinet on the CPAD. Loosen the slings so that all the weight is on the CPAD. Check that the MC-x/ME-x is properly aligned and level.
5. Secure the MC-x/ME-x to the CPAD using the 1/2”-13 hardware. Tighten all bolts securely.
6. Once the MC-x/ME-x is secured, remove the slings and tagline. Close the doors.
7. The lifting brackets can be removed after the MC-x/ME-x is installed.

3.7. MC-x/ME-x Wiring and Equipment

After the MC-x/ME-x is properly mounted in the desired location, apply No-Ox where bus bar and other 2-hole lug connections will be made. Install ground and power connections. Always ground the equipment first, before making any other connections.

⚠	**WARNING**	**Perform all bonding and grounding connections prior to any electrical and communications connections.**

In order to prevent condensation prior to being placed in service, do not remove the desiccant until the MC-x is sealed and power is applied (desiccant is not present in ME-x bays or in MC-x bays with vented doors).

Basic electrical diagrams are shown on the inside of the MC-x/ME-x front door.

3.7.1. Ground Connection

Use two 2x8 position ground bar provided in each equipment bay for all grounding of internal equipment. Stack hardware as shown in Figure 16. External ground studs are available on the rear of each bay for connecting a site ground wire.

If using a single site ground wire on only one bay, then the ground bars in each of the other bays must have a ground wire that runs to the ground bar in the site grounded bay.

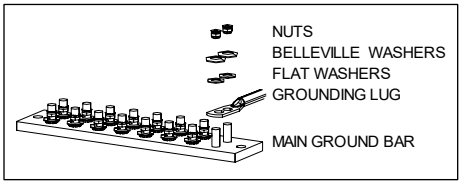


Figure 16
Ground Bar Hardware Stack

3.7.2. AC Voltage Connection

The MC-x equipment bay is available with an AC load center (multiple position options available). If a load center is selected, then incoming 208/240A voltage is connected to the main circuit breaker. The maximum wire size is 2/0AWG (or 250kcmil for 200A load centers). The installer connects the two hot (line) wires to the breaker, the neutral wire to the neutral bus and the ground wire to the ground bus. Use wire that is sized per National Electrical Code NFPA70 table 310.16.

The AC load center is configured as a sub panel with separate neutral and ground busses. If the load center needs to be configured as a main panel, the green bonding screw inside the load center must be screwed down to connect the busses.

The MC-x equipment bay may be equipped with a generator inlet. In the event of a power outage, an external generator can be connected to the generator inlet. The generator inlet uses the 2-pole breaker in the load center. When power from the main utility is off, slide the main breaker to the "OFF" position. If necessary, reposition the manual transfer switch in the load center into the generator position, and turn on the generator breaker. When power from the main utility is restored, slide the generator breaker into the "OFF" position, slide the manual transfer switch back to the normal position, and turn the main breaker back on.

3.7.3. Battery Connections

All batteries are customer supplied.

⚠	**WARNING**	**Always turn off battery breakers prior to servicing batteries.** **If using VRLA batteries, ensure that the power system is set up for VRLA batteries with temperature compensation enabled.**

Verify the polarity of the cables prior to terminating them to the batteries. Ensure the battery terminations are properly insulated to avoid shorting prior to terminating to the batteries.

1. Switch off the battery breakers on the sides of the battery trays.
2. Remove the battery retainer bracket by removing the hardware. Save the hardware for reinstallation.
3. If replacing batteries, disconnect battery cables from terminals.
4. Remove the battery temperature probe(s).
5. Remove batteries.
6. Carefully position the new batteries on the battery tray. Connect the interconnecting straps to each battery string.
7. Replace battery temperature probe(s) to the closest battery.
8. Reinstall the battery retainer brackets using hardware from step 2. The MC-2/ME-2 and MC-3/ME2 bays use Grade 8 hardware for the retainer brackets, so torque hardware to 33 lb-ft. For MC-1/ME-1 retainer brackets, see the torque table in section 3.6.2.
9. Connect the battery cables to the appropriate terminals.
10. Secure the battery cables to the front of the retainer bracket.
    - Use lacing cord or cable ties suitable for battery cable size.
    - Ensure that the bend radius is at least 5x the cable diameter (e.g. 4/0 battery cable = 4 inch bend radius).
    - Use as few bends as possible between the two termination points.
    - Do not bend the cable at the termination points.
    - Isolate the lug and insulation by at least ¼" from all metal surfaces.
11. Switch on the battery breakers.

Notes:

- All battery strings are terminated to the bus bars at the top of the battery bay. The top bus bar is the power bus and the bottom bus bar is used for the return voltage. The bus bars have covers and use 1/4"-20 hex nuts for securing connections.
- Ensure temperature compensation probes are installed per power system guidelines.
- Ensure back up battery amperage is inputted into the power system controller per power system guidelines.
- Ensure float voltage is set per power system and battery guidelines.
- Ensure all battery terminations and bus bars have No-Ox applied.
- Refer to the battery manufacturer's documentation for proper battery installation and maintenance information.

3.7.4. Battery Breaker Alarm Switches

The CUBE has a switchboard on the left side of the bay that is connected to the battery breakers. The default switch setting is to the bottom, indicating that a battery string is present, and the battery breaker is turned on. If any battery breaker is turned off or tripped, it will cause a normally open alarm connection on the alarm block "BAT BRKR" position. If no battery string is present, then move the switch for that shelf into the top position to bypass the breaker alarm.

3.7.5. Available Thermal Systems

These are listed in section 7.3 under Item D, Bay Thermal. In that configuration matrix, each thermal unit is given a code. Codes from the configuration matrix are shown here for reference.

A. Code 2: 2000BTU 48VDC HVAC

The 2000BTU DC powered HVAC compressor and fans are PID (proportional integral derivative) controlled. The compressor turns on at 25°C at low speed and will increase speed as needed to maintain that temperature. The compressor turns off at 22°C. The internal fan is always on at low speed to continually circulate heat within the cabinet. The heating cycle turns on at 8°C and off at 13°C. The MC-x/ME-x is equipped with a cutoff switch that shuts off the HVAC compressor when a door is opened to minimize condensation buildup on the coils. See the label on the HVAC for firmware information. For further information, refer to the HVAC documentation that ships with the unit.

-NOTE-
Changing the cooling or heating cycles' default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, compressor or fan failure caused by excessive runtimes and vibration. Avoid placing items in front of the HVAC's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

B. Code 5: 6000W Thermosiphon (CTMS)

The 6000W DC powered CTMS in the equipment compartment has a fan speed controller and includes two internal and two external fans. The fans' speed increases with increasing ambient temperature. Default fan settings are defined below and can be modified if necessary.

Fan Setting	Internal	External
Turn-on Setting	-8°C	32°C
Medium Temp Setting	35°C	35°C
High Temp Setting	45°C	45°C

For more information, refer to the CTMS documentation found inside the CUBE.

-NOTE-
Changing the speed controller default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, fan failure caused by excessive runtimes and vibration. Avoid placing items in front of the CTMS's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

C. Code 6: 6000BTU 48VDC HVAC

The 6000BTU DC-powered HVAC compressor and fans are PID (proportional integral derivative) controlled. The compressor turns on at 33°C at low speed and will increase/decrease speed as needed to maintain this temperature. The compressor turns off when the internal temperature reaches 28°C. The internal fan is always on at low speed (30%) to continually circulate heat within the cabinet. The external fan turns on/off with the compressor. Both fans' speed increase as needed with increasing internal cabinet temperature. In addition, the HVAC includes a built-in 500W heater for cold temperature operation. HVAC settings for the compressor, fans, heater, and temperature alarms are defined below and are based off the cabinet's interior temperature. The CUBE is equipped with a cutoff switch that shuts off the HVAC compressor when a door is opened to minimize condensation buildup on the coils. The maximum airflow amount supplied to the equipment by the HVAC is 441CFM.

HVAC Compressor/Fans/Heater/Alarms Setting	Internal	External
Compressor Turn-on Setting	33°C	N/A
Compressor Turn-off Setting	28°C	N/A
Fan Turn-on Setting	-40°C	33°C
Heater ON Setting (50% Fan Speed)	8°C	N/A
Heater OFF Setting	13°C	N/A
High Temp Alarm Setting	65°C	N/A
Low Temp Alarm Setting	0°C	N/A

For further information, refer to the HVAC documentation that ships with the CUBE.

-NOTE-
Changing the cooling or heating cycles' default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, compressor or fan failure caused by excessive runtimes and vibration. Avoid placing items in front of the HVAC's return and supply vents. Maintain a minimum of 6" clearance to enable proper airflow.

D. Code C: 12000BTU 48VDC HVAC

The 12000BTU DC powered HVAC compressor and fans are PID (proportional integral derivative) controlled. The compressor turns on at 33°C at low speed and will increase/decrease speed as needed to maintain this temperature. The compressor turns off when the internal temperature reaches 28°C. The internal fan is always on at low speed (30%) to continually circulate heat within the cabinet. The external fan turns on/off with the compressor. Both fans' speed increase as needed with increasing internal cabinet temperature. In addition, the HVAC includes a built-in 1000W heater for cold temperature operation. HVAC settings for the compressor, fans, heater, and temperature alarms are defined below and are based off the cabinet's interior temperature. The CUBE is equipped with a cutoff switch that shuts off the HVAC compressor when a door is opened to minimize condensation buildup on the coils.

The maximum airflow amount supplied to the equipment by the HVAC is 500CFM. For further information, refer to the HVAC documentation that ships with the CUBE

-NOTE-

Changing the cooling or heating cycles' default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, compressor or fan failure caused by excessive runtimes and vibration. Avoid placing items in front of the HVAC's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

HVAC Compressor/Fans/Heater/Alarms Setting	Internal	External
Compressor Turn-on Setting	33°C	N/A
Compressor Turn-off Setting	28°C	N/A
Fan Turn-on Setting	-40°C	33°C
Heater ON Setting (70% Fan Speed)	8°C	N/A
Heater OFF Setting	13°C	N/A
High Temp Alarm Setting	65°C	N/A
Low Temp Alarm Setting	0°C	N/A

E. Code D: 750W 48VDC Heat Exchanger

The 750W DC powered heat exchanger in the equipment compartment has a fan speed controller and includes an internal and an external fan. Both fans' speed increases with increasing internal cabinet temperature. Fans and heat exchanger settings are defined below, and are based off of the cabinet interior temperature. The maximum airflow amount supplied to the equipment by the heat exchanger is 147CFM.

Setting	Internal	External
Turn-on Setting (5°C Differential)	0°C	30°C
Medium Temp Setting	30°C	35°C
High Temp Setting	45°C	50°C
High Temp Alarm Setting	70°C	N/A
Low Temp Alarm Setting	-40°C	N/A

For more information, refer to the heat exchanger documentation found inside the CUBE.

-NOTE-

Changing the speed controller default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, fan failure caused by excessive runtimes and vibration. Avoid placing items in front of the heat exchanger's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

F. Code F: Direct Air Cooler (DAC)

The AC powered DAC system consists of filtered louvers and a shroud with dual fans. The fans are connected to a control thermostat and power. The fan wiring is routed to the equipment bay and connected to a circuit breaker on the power system. The control thermostat is factory set at 30°C (±4°C). The thermostat turns the cooling fans on at the set point and turns them off when the temperature drops by 7°C.

-NOTE-

Changing the thermostat set point from its factory default setting can lead to system performance issues, such as reduced battery life, condensation buildup, excessive runtimes, premature fan failure, and filter clogging, in addition to unnecessary power use, noise, and vibration.

G. Code J: 4000BTU 120VAC HVAC and Code U/Code Y: 10000BTU 240VAC HVAC

The 4000 and 10000 BTU AC powered HVAC is driven by a built-in controller and temperature sensor. The factory cooling cycle turns on at 30°C and off at 27°C. The heating cycle turns on at 10°C and turns off at 15°C. The CUBE is equipped with a cutoff switch that shuts off power to the HVAC compressor when a door is opened to minimize condensation buildup on the coils. See the label on the HVAC for firmware information. For further information, refer to the HVAC documentation that ships with the CUBE.

-NOTE-

Changing the cooling or heating cycles' default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, compressor or fan failure caused by excessive runtimes and vibration. Avoid placing items in front of the HVAC's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

H. Code K: 4000BTU 48VDC HVAC

The 4000BTU DC powered HVAC compressor and fans are speed controlled. The compressor turns on at 30°C, reaches its high speed at 35°C, and turns off at 27°C. The internal fan is always on to continually circulate heat within the cabinet. The heating cycle turns on at 10°C and off at 15°C. The MC-x/ME-x is equipped with a cutoff switch that shuts off the HVAC compressor when a door is opened to minimize condensation buildup on the coils. See the label on the HVAC for firmware information. For further information, refer to the HVAC documentation that ships with the unit.

-NOTE-

Changing the cooling or heating cycles' default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, compressor or fan failure caused by excessive runtimes and vibration. Avoid placing items in front of the HVAC's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

I. Code L/Code V: 1000BTU 48VDC HVAC

The 10000BTU DC powered HVAC compressor and fans are speed controlled. The compressor turns on at 30°C, reaches its high speed at 42°C, and turns off at 27°C. The internal fan is always on to continually circulate heat within the cabinet. The heating cycle turns on at 10°C and off at 15°C. The MC-x/ME-x is equipped with a cutoff switch that shuts off the HVAC compressor when a door is opened to minimize condensation buildup on the coils. See the label on the HVAC for firmware information. For further information, refer to the HVAC documentation that ships with the unit.

-NOTE-

Changing the cooling or heating cycles' default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, compressor or fan failure caused by excessive runtimes and vibration. Avoid placing items in front of the HVAC's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

J. Code M and Code T: 1880W and 3500W 48VDC Heat Exchanger

The 1880W and 3500W DC powered heat exchanger in the equipment compartment has a fan speed controller and includes an internal and an external fan. The fans' speed increases with increasing ambient temperature. Fan settings are defined below.

Fan Setting	Internal	External
Turn-on Setting	-40°C	30°C
Medium Temp Setting	30°C	40°C
High Temp Setting	45°C	55°C

-NOTE-

Changing the speed controller default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, fan failure caused by excessive runtimes and vibration. Avoid placing items in front of the heat exchanger's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

K. Code P: 3500W Thermosiphon

The DC powered thermosiphon in the equipment compartment has a speed controller and includes an internal and an external fan. The fans' speed increases with increasing ambient temperature. Fan settings are defined below.

Fan Setting	Internal	External
Turn-on Setting	-40°C	35°C
Medium Temp Setting	35°C	35°C
High Temp Setting	45°C	45°C

For more information, refer to the thermosiphon documentation found inside the CUBE.

-NOTE-

Changing the speed controller default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, fan failure caused by excessive runtimes and vibration.

Avoid placing items in front of the thermosiphon's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

3.7.6. Alarm Block Connections

A 10-position, labeled alarm block monitors components in the equipment compartment. See the electrical diagram on the inside of the MC-x/ME-x front door for information about alarm connections. Unless otherwise indicated on the electrical diagram, all connections are normally closed and will open upon alarm. See the electrical diagram on the inside of the door.

3.7.7. Rack Rail Adjustment

The rack rails in the equipment bay can be placed at either 19" or 23" horizontal spacing. To adjust the position, remove hardware that holds the rail uprights in position (top and bottom of upright) and move the rail to the left or right as needed (Figure 17). Then secure in the new position using the hardware removed previously. Both the left and right rails must be in the correct positions.

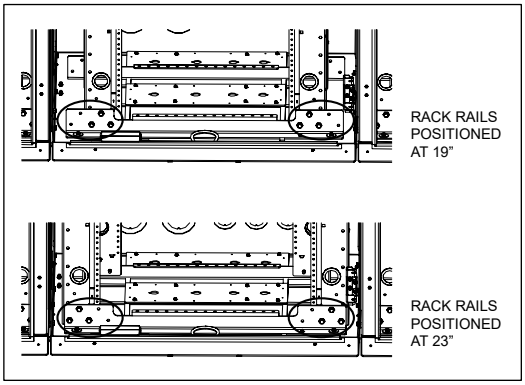


Figure 17 Adjusting the Rack Rails

3.7.8. Fiber and Copper Entry

The equipment bay has Ø1.75/2.50" and Ø2.50/3.60" knockouts on the rear that accommodate Ø1.25/2.00" and Ø2.00/3.00" conduit fittings, respectively. Additionally, the bottom of the bay has two knockout panels with four Ø0.88" pilot hole knockouts per panel. These pilot holes are intended to be enlarged using a Greenlee tool to accommodate the desired conduit sizes.

The battery bay has one knockout panel on the bottom with four Ø0.88" pilot hole knockouts. Additional Ø0.88" enlargeable pilot holes are available on the rear of the bay.

3.8. Modular Expansion Units

The ME-x bays ship with the same size and type of gasket as the MC-x. An ME-x bay can only be installed with the same size MC-x bays (e.g. if the existing installation is an MC-1, then only ME-1 bays can be added).

If the MC-x installation is mounted on a plinth, then mount the expansion bay on the same plinth.

3.8.1. Modifying the Mounting Area

If the MC-x installation was mounted on a CPAD, then mount the ME-x bay on an CPAD expansion (purchased separately).

If the MC-x installation was mounted on a concrete pad, then the pad might need to be enlarged/modified to support the ME-x bay.

1. Drill holes into the side of the existing pad in order to secure two or three rods into the pad. The rods ensure that the extension is firmly secured to the original pad.

   Ensure that the rods will not interfere with the mounting holes that will be drilled into the new pad for the ME-x. Consult the mounting hole diagrams in the Mounting section of this document.

2. Pour new concrete to extend the pad, following the guidelines in the Mounting section of this document.
3. Ensure that the pad extension is perfectly level with the existing pad. Otherwise, the ME-x bay will not be level with the rest of the bays, and the holes for mounting hardware will not be aligned correctly.

Figure 18 illustrates the pad extension with the rods in place.

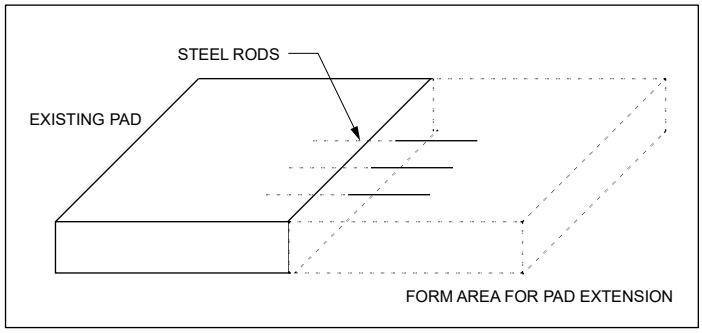


Figure 18 Concrete Pad Extension

3.8.2. Mounting the ME-x Bay

Views in this section have all doors hidden for clarity.

1. The side panel on the MC-x installation is held in place by nuts on the inside of the cabinet. Remove the side panel from the MC-x bay by removing these nuts (Figure 19). Save this panel and its mounting nuts for re-installation.

   Note: If the far left bay has a load center mounted on the left side, then the ME-x expansion bay can only be mounted on the far right side of the MC-x installation.

2. Locate the two sets of cross braces and hardware that ship with the ME-x. Use the Keps nuts to mount one set of cross braces to the open side of the MC-x installation (two nuts per cross brace, Figure 20). Mount the second set to the side of the ME-x bay that will face the MC-x installation.

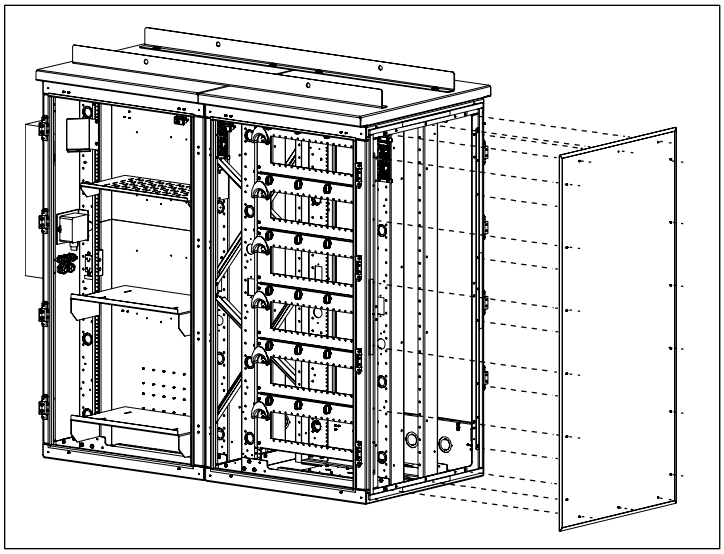


Figure 19 Remove Side Panel

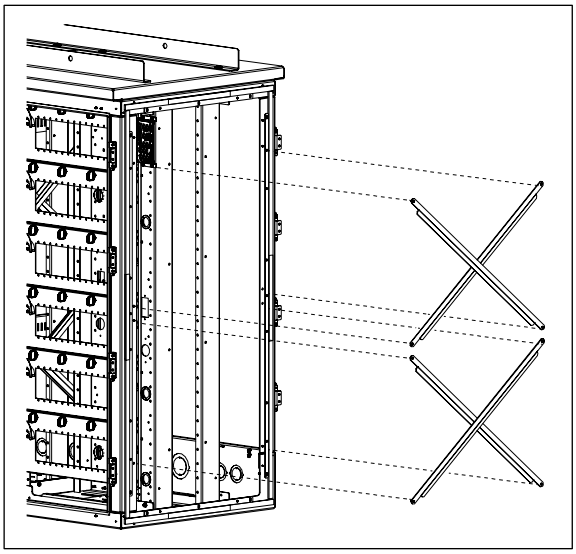


Figure 20 Attach Cross Braces

3. Mount the ME-x bay as described in the Mounting section of this document. Use the (18) 1/4-20 hex screws, washers, and nuts that ship with the ME-x bay to secure the two bays together (Figure 21). Position hardware so that the screws and washers are inside the ME-x bay and the nuts are inside the MC-x bay.
4. Mount the side panel removed previously onto the side of the ME-x bay (Figure 22).

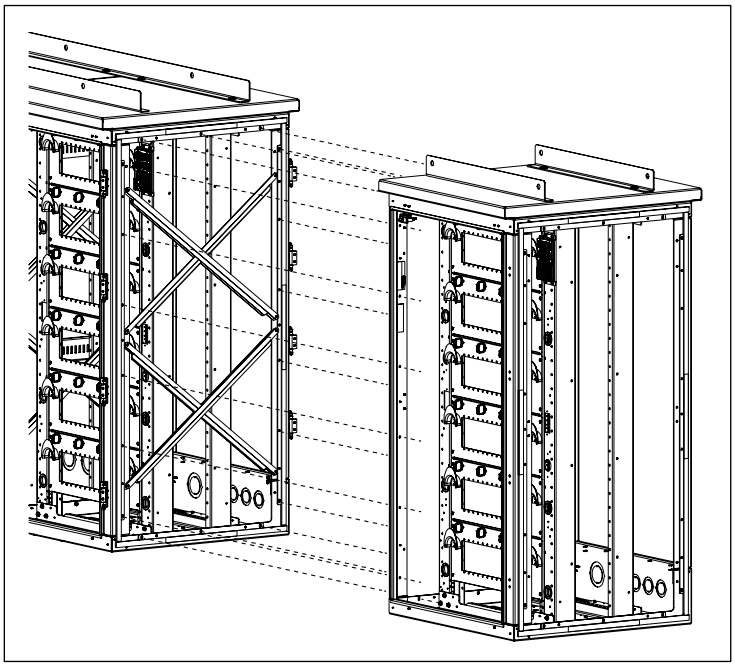


Figure 21 Connect ME-x Extension Bay to MC-x

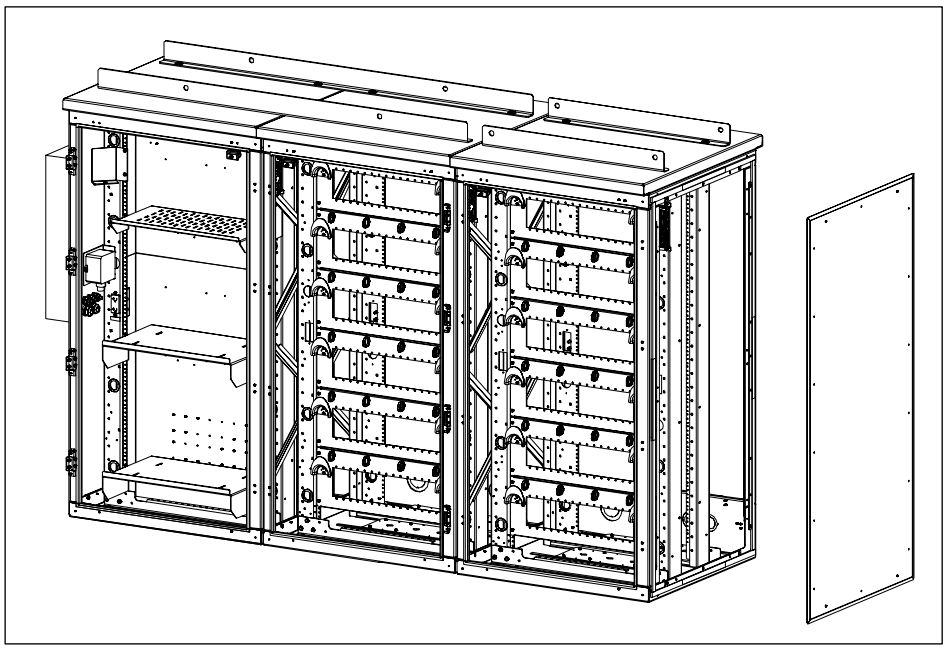


Figure 22 Mount Side Panel

3.9. Add-on Battery Chamber Kits

An add-on battery chamber kit can be ordered with the MC-x/ME-x cabinets. The battery kit is a chamber with a single battery tray, removable front and rear access panels, and a 100W, thermostat-controlled heater pad. All chambers also include a 100A battery disconnect breaker.

The kit is installed underneath an equipment bay at the factory. The 96-MC1BBCHAMx-A is compatible with MC-1 and ME-1 bays, while the 96-MC3BBCHAMx-A is installed with the MC-2/ME-2 and MC-3/ME-3 bays. Figure 23 shows the dimensions of the battery kits, and Figure 24 shows a kit installed with an equipment bay (MC-1 and 96-MC1BBCHAM1-A shown; other sizes are similar in appearance).

Note: If a battery add-on kit is ordered, then it must be added to all bays in the configuration to keep all bays the same height. Battery add-on kits cannot be ordered with battery bays due to difference in the mounting dimensions. See section 3.6 for mounting dimensions and information.

The kits and corresponding configurations are listed below.

- 96-MC1BBCHAM1-A – Compatible with MC-1/ME-1 when one bay is ordered
- 96-MC1BBCHAM2-A – Compatible with MC-1/ME-1 when two bays are ordered
- 96-MC1BBCHAM3-A – Compatible with MC-1/ME-1 when three bays are ordered
- 96-MC1BBCHAM4-A – Compatible with MC-1/ME-1 when four bays are ordered
- 96-MC3BBCHAM1-A – Compatible with MC-2/ME-2 and MC-3/ME-3 when one bay is ordered
- 96-MC3BBCHAM2-A – Compatible with MC-2/ME-2 and MC-3/ME-3 when two bays are ordered
- 96-MC3BBCHAM3-A – Compatible with MC-2/ME-2 and MC-3/ME-3 when three bays are ordered
- 96-MC3BBCHAM4-A – Compatible with MC-2/ME-2 and MC-3/ME-3 when four bays are ordered

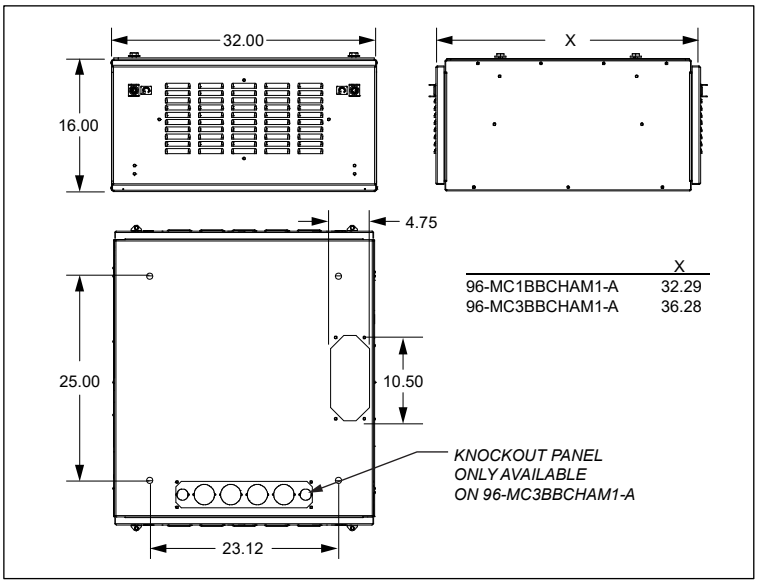


Figure 23 Battery Chamber Dimensions (in inches)

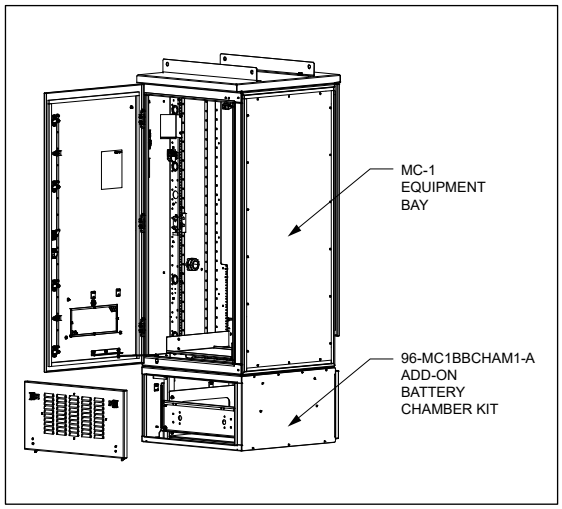


Figure 24
Example Cabinet with Battery Chamber Kit

3.10. Conduit Seals

All internal and external conduit openings on the MC-x/ME-x must be completely sealed with a duct seal compound to prevent moisture from entering enclosure. Battery bays (if present) must be internally sealed from the equipment bays to prevent outgassing from the batteries into the equipment bays. Use a moldable, flame-retardant putty style duct seal material. Do not use an expanding foam seal. Mold the putty so that the open space around the wire or conduit is completely sealed, as shown in Figure 25. If the openings must be accessed at any time, remove the putty and set it aside. When work is complete, re-mold the putty to re-seal the opening.

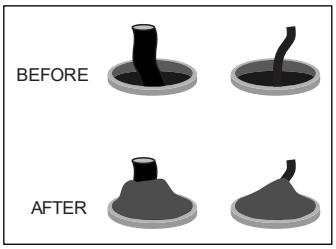


Figure 25 Applying Putty Seal

3.11. Verifying the Installation

Verify that earth ground and all grounding and bonding is complete and functional. After verifying that all installer connections are secure and complete, apply voltage.

4. PERIODIC MAINTENANCE

In the event that the enclosure must be opened in freezing conditions, use a narrow, pointed metallic object such as a screwdriver or chisel, along with a non-metallic device like a rubber mallet, to remove excessive ice buildup around the door and locking mechanism. A commercial aerosol de-icer spray can be used to free up locks and latches if needed. Use protective gloves and safety glasses when applying de-icer sprays.

Reset the GFCI duplex receptacle periodically to ensure it is working. The unit meets UL-943, which requires an auto-monitoring (self-testing) feature. A flashing or solid red LED indicates a fault. If the unit continues to show a fault after resetting, replace the unit.

The heat exchanger (if equipped) requires no scheduled maintenance other than cleaning the fans and heat exchanger core if they become contaminated with dust or residue. Remove the cover by removing the screws on the outside. Examine periodically to determine the required cleaning periods based on the installed environmental conditions.

Refer to the thermal system manual supplied with the cabinet (if equipped) for periodic maintenance requirements.

5. TECHNICAL ASSISTANCE AND REPAIR SERVICE

For questions on product repair or if technical assistance is required, contact Charles Technical Support.

847-806-8500
techserv@charlesindustries.com (email)
http://www.charlesindustries.com/techserv.htm

6. WARRANTY & CUSTOMER SERVICE

Charles Industries LLC offers a one-year warranty on the MC-x/ME-x product. The Charles warranty is limited to the operation of the MC-x/ME-x hardware as described in this documentation and does not cover equipment which may be integrated by a third party. The terms and conditions applicable to any specific sale of product shall be defined in the resulting sales contract. For questions on warranty or other customer service assistance, contact your Charles Customer Service Representative.

847-806-6300
mktserv@charlesindustries.com (email)
http://www.charlesindustries.com/main/telecom_sales_support.htm

7. SPECIFICATIONS

7.1. Regulatory Specifications

- Designed to meet GR-487
- GFCI: UL-943 Listed

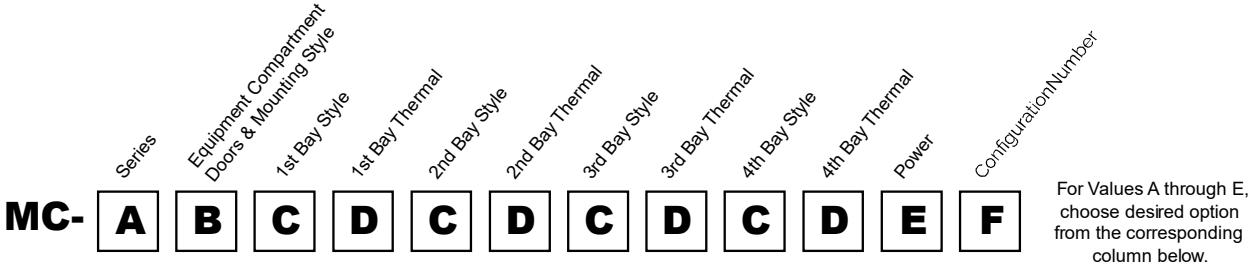
If the MC-x/ME-x is field-modified, a customer provided ETL field evaluation of the modified components may be required to re-establish ETL certification to UL standards. Consult local jurisdictions for guidance on a site-by-site basis.

7.2. Product Specifications

Physical	
Dimensions	MC-1/ME-1: 62”Hx32”Wx32”D (single bay) MC-2/ME-2: 74”Hx32”Wx36”D (single bay) MC-3/ME-3: 84”Hx32”Wx36”D (single bay)
19”/23” Equipment Rack Space and Hole Spacing (Adjustable)	MC-1: 54.25” (31RU) rack spacing MC-2: 64.75” (37RU) rack spacing MC-3: 75.25” (43RU) rack spacing All with tapped EIA #12-24 mounting holes on front and rear rails
Maximum Supported Weight	Equipment Bays: 11 lbs. per RU (max. depends on bay size selected) Battery Bays: 600 lbs. per battery tray (max. depends on bay size selected)
Materials	Enclosure: 0.125” aluminum Battery trays and retaining brackets: steel
Color	Off-white
Electrical	
Bonding and Grounding	Equipment bay: Two 2x8 position ground bars inside All bays: two sets of external ground studs on rear
Cable Entry	See Figures 2, 3, 4, and 5 and section 3.7.8
Thermal Options	
2000BTU DC Powered HVAC	Vikinor VAK-600
6000W CTMS	Charles CTMS-320WK-1000
6000BTU DC Powered HVAC	Vikinor VAK-1800
12000BTU DC Powered HVAC	Vikinor VAK-3000-DC
750W DC Powered Heat Exchanger	Vikinor VHC-040
4000BTU AC Powered HVAC	Dantherm 708341
4000BTU DC Powered HVAC	Dantherm 708143
10000BTU DC Powered HVAC	Dantherm 708349
1880W Heat Exchanger	Dantherm 705882
3500W Thermosiphon	Vikinor VHT-180-DC
3500W Thermosiphon	Vikinor VHC-325-DC
10000BTU AC Powered HVAC	Dantherm 708347
Environmental	
Operating Temp. Range, Outside Enclosure	-40° to +115°F, -40° to 46°C
Operating Temp Range, Inside Enclosure	-40° to +149°F, -40° to 65°C
Humidity	0 to 95% (non-condensing)
Altitude	Up to 2,000 meters (6560 feet)
Kits and Replacement Parts	
Touch-up Paint	02-000290-0
216 Type Security Tool	07-002070-0
Single-tray Battery Chamber Add-on Kit (Installed at factory)	MC-1/ME-1: 96-MC1BBCHAMx-A MC-2/ME-2 and MC-3/ME3: 96-MC3BBCHAMx-A Battery tray maximum weight capacity: 600lbs
Plinth Mounting Kit	MC-1/ME-1: 97-MC1PLINTH6-A MC-2/ME-2 and MC-3/ME3: 97-MC3PLINTH6-A
Replacement Gasket	MC-1/ME-1: 80-004470-A MC-2/ME-2 and MC-3/ME3: 80-005819-A Add-on Battery Chamber Kit Gaskets: MC-1: 80-000185-0; MC-2: 80-000211-A
Shim Kit for Leveling	97-000010-0
Swing Handle	39-000148-0
1/4 Turn Latch	39-000269-0
1/4 Turn Latch with Padlock Hasp	39-000311-0
4-Wire Door Alarm Switch (Black)	17-400319-0
2-Wire Door Alarm Switch (White)	17-400314-0
HVAC Cutoff Switch (Black with White Button)	17-400322-0 (if equipped with HVAC)
15A GFCI Outlet	04-100207-0

Table 1 MC-x/ME-x Specifications

7.3. Available Options



A. Series
1 = 62”H x 32”W x 32”D
2 = 74”H x 32”W x 36”D
3 = 84”H x 32”W x 36”D

B. Equip Compartment Doors & Mounting Styles
2 = Front and Rear Door
5 = Front Door, Rear Panel

C. Bay Styles
A = Modular Equipment Bay w/ (2) Rack Mount Battery Trays
B = Modular Battery Bay
C = Shelf for Power Supply, (2) Shelves for Batteries, (2) Rear Strands for Mounting Outdoor Nodes
D = Battery trays with Rack Space Above, Vented
E = Modular Equipment Bay
F = Modular Passive Fiber w/ LGX Panels

D. Bay Thermal
2 = 2000 BTU 48VDC HVAC
5 = 6000W Thermosiphon (CTMS)
6 = 6000 BTU 48VDC HVAC
7 = 17000 BTU 48VDC HVAC
C = 12000 BTU 48VDC HVAC
D = 750W 48VDC Heat Exchanger
F = Direct Air Cooler (DAC)
G = Vented Only
H = Vented w/ Fans
J = 4000 BTU 120VAC HVAC
K = 4000 BTU 48VDC HVAC
L = 10000 BTU 48VDC HVAC
M = 1880W 48VDC Heat Exchanger
N = None
R = 24000 BTU 48VDC HVAC
T = 3500W 48VDC Heat Exchanger
U = 10000 BTU 240VAC HVAC
V = (2) 10000 BTU 48VDC HVAC
Y = (2) 10000 BTU 240VAC HVAC

E. Power
C = 12 Position AC Load Center
D = 30 Position AC Load Center, 50A Generator Receptacle
E = 8 Position AC Load Center, 30A Generator Receptacle
F = 12 Position AC Load Center, 30A Generator Receptacle
J = 20 Position AC Load Center
K = 16 Position AC Load Center
M = 8 Position AC Load Center, 30A Generator Receptacle, 150A Ringless Meter Socket
N = No power
P = 16 Position AC Load Center, 50A Generator Receptacle
T = 30 Position AC Load Center
U = 16 Position AC Load Center, 50A Generator Receptacle, 150A Ringless Meter Socket
V = 14 Position AC Load Center / 100A Ring Type Meter Socket Combo
Y = 24 Position AC Load Center

F. Configuration #
Charles will assign the configuration #, use “1” as default

Sample Part Numbers:

MC-25BHEHN1
Modular Cabinet, Medium (74”H x 32”W x 36”D), Front Door and Rear Panel, No Power
• 1st Bay: Modular Battery Bay, Vented with Fan
• 2nd Bay: Modular Equipment Bay, Vented with Fan

MC-12BJBJEJFNK1
Modular Cabinet, Small (62”H x 32”W x 32”D), Front and Rear Doors, 16 Position AC Load Center
• 1st Bay: Modular Battery Bay with 4000 BTU HVAC 120VAC
• 2nd Bay: Modular Battery Bay with 4000 BTU HVAC 120VAC
• 3rd Bay: Modular Equipment Bay with 4000 BTU HVAC 120VAC
• 4th Bay: Modular Passive Fiber with no power

7.4. Configuration Weights

To calculate the approximate weight of a configuration, use the individual component weights shown below.

Component	Weight (lbs.)
Bay Styles	
E, MC-1 Equipment Bay	255
E, MC-2 Equipment Bay	338
E, MC-3 Equipment Bay	377
B, MC-1 Battery Bay	415
B, MC-2 Battery Bay	520
B, MC-3 Battery Bay	600
D, MC-2 Battery Trays with Rack Space Above	440
Thermal Systems	
2: 2000BTU DC Powered HVAC	58
5: 6000W CTMS	102
6: 6000BTU DC Powered HVAC	97
C: 12000BTU DC Powered HVAC	126
D: 750W DC Powered Heat Exchanger	23
J: 4000BTU AC Powered HVAC	75
K: 4000BTU DC Powered HVAC	75
L: 10000BTU DC Powered HVAC	115
M: 1880W Heat Exchanger	70
P: 3500W Thermosiphon	88
T: 3500W Heat Exchanger	135
U: 10000BTU AC Powered HVAC	115
F: DAC	10
Incoming AC Distribution Systems	
16-position AC Load Center, AC Surge Suppressor, Meter Socket	13
20-position AC Load Center, AC Surge Suppressor, Meter Socket	20
30-position AC Load Center, AC Surge Suppressor, Meter Socket	36
Add-on Battery Chamber Kits	
96-MC1CHAM1-A	201 lbs. (tray supports 600 lbs.)
96-MC3CHAM1-A	208 lbs. (tray supports 600 lbs.)

Table 2 Component Weights

If adding customer equipment prior to moving and lifting the MC-x/ME-x, then care must be taken to avoid overloading the bays. Use the formula below to determine the maximum allowed weight of customer equipment that can be installed prior to moving and lifting the cabinet.

(Number of bays) x 895 lbs. – (total MC-x/ME-x weight) = maximum allowed weight for added equipment