



# MS-CEFB Filter Box



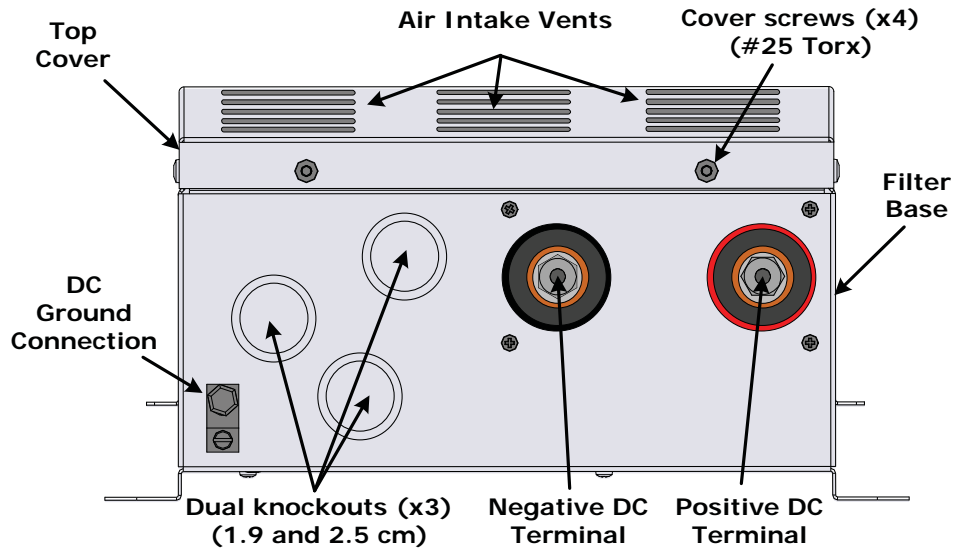
## Installation Guide

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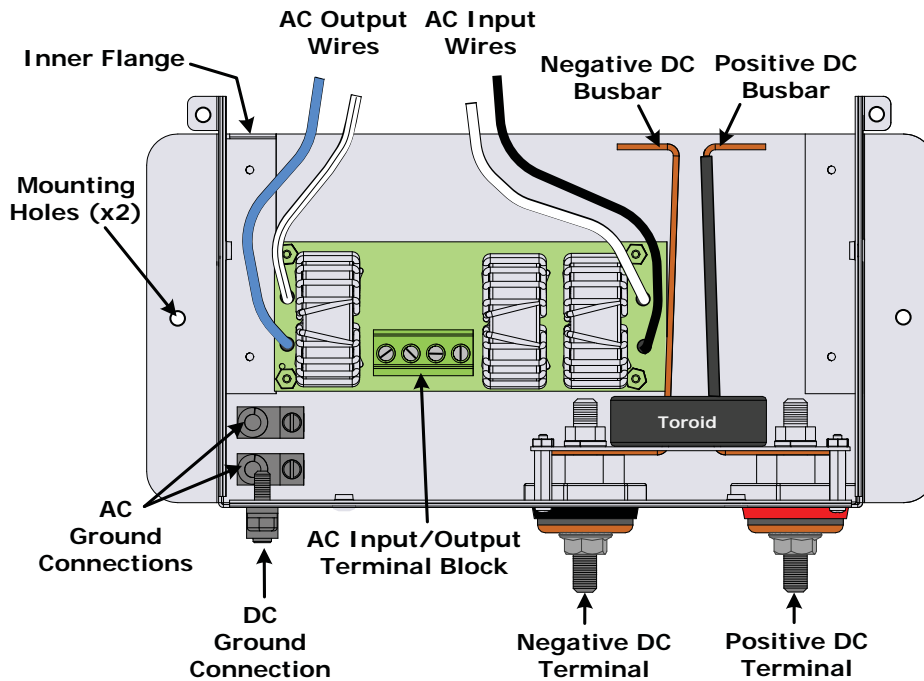
## Introduction

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The CE Filter Box (PN: MS-CEFB) is an EMI (electromagnetic interference) filter designed to control conducted emissions on the AC and DC side of Magnum Energy's MS-E and MS-PE Series inverters. It is used to ensure that stringent international standards for electromagnetic compatibility (EMC) are met. For specific EU directives and standards see info on the back page. Refer to Figures 1 & 2 below to identify the MS-CEFB filter box's features.



*Figure 1, MS-CEFB Front Side Features*



*Figure 2, MS-CEFB Inside Features*

**Knockouts and Dimensions**

The MS-CEFB provides knockouts for use with 3/4" and 1" trade size\* conduit, and adds just over 20 cm to the length of the inverter (see Figure 3).

\* - "Trade size" refers to standard North American conduit. Actual openings are approximately 2 cm and 2.7 cm.

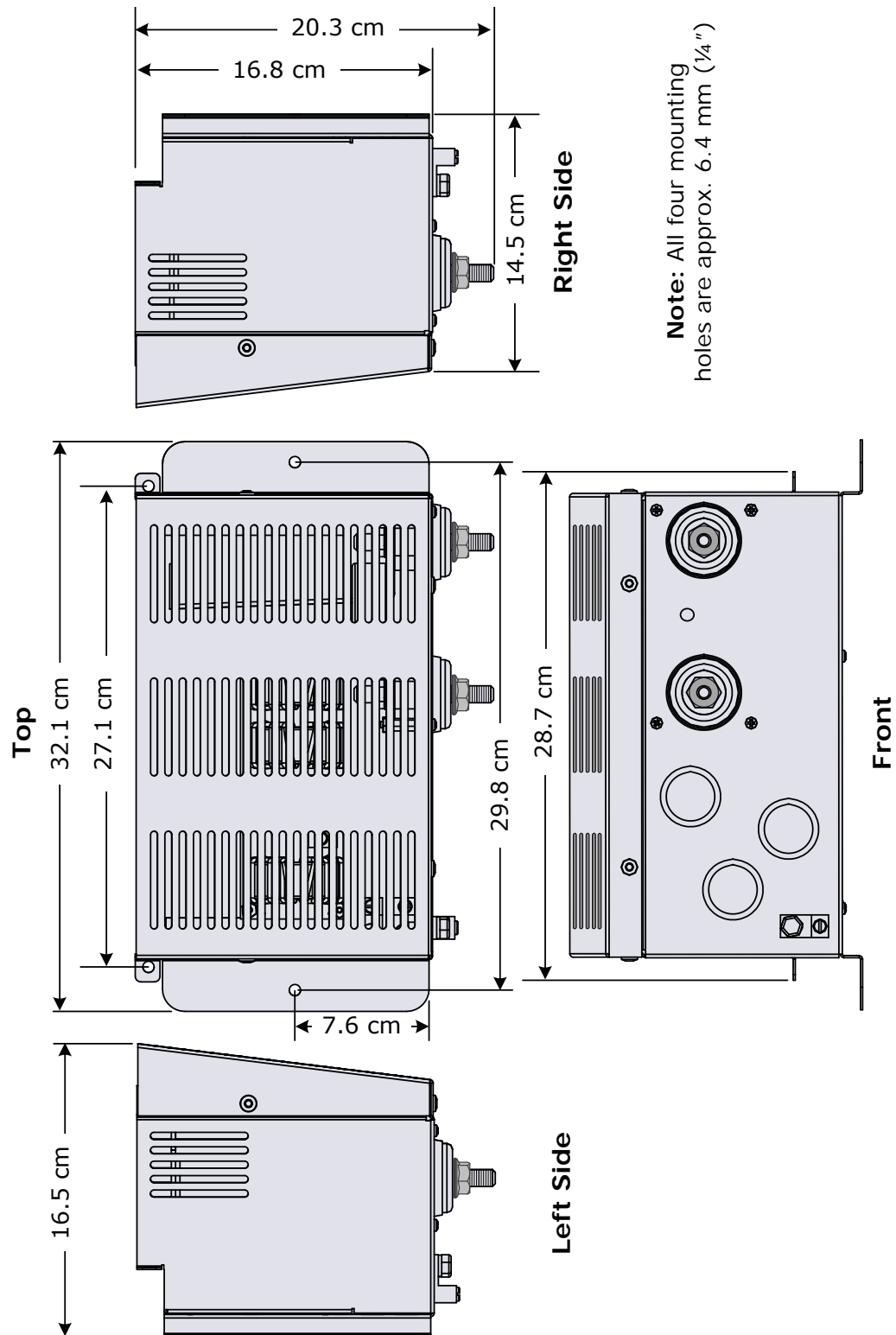


Figure 3, MS-CEFB Dimensions

# Installation

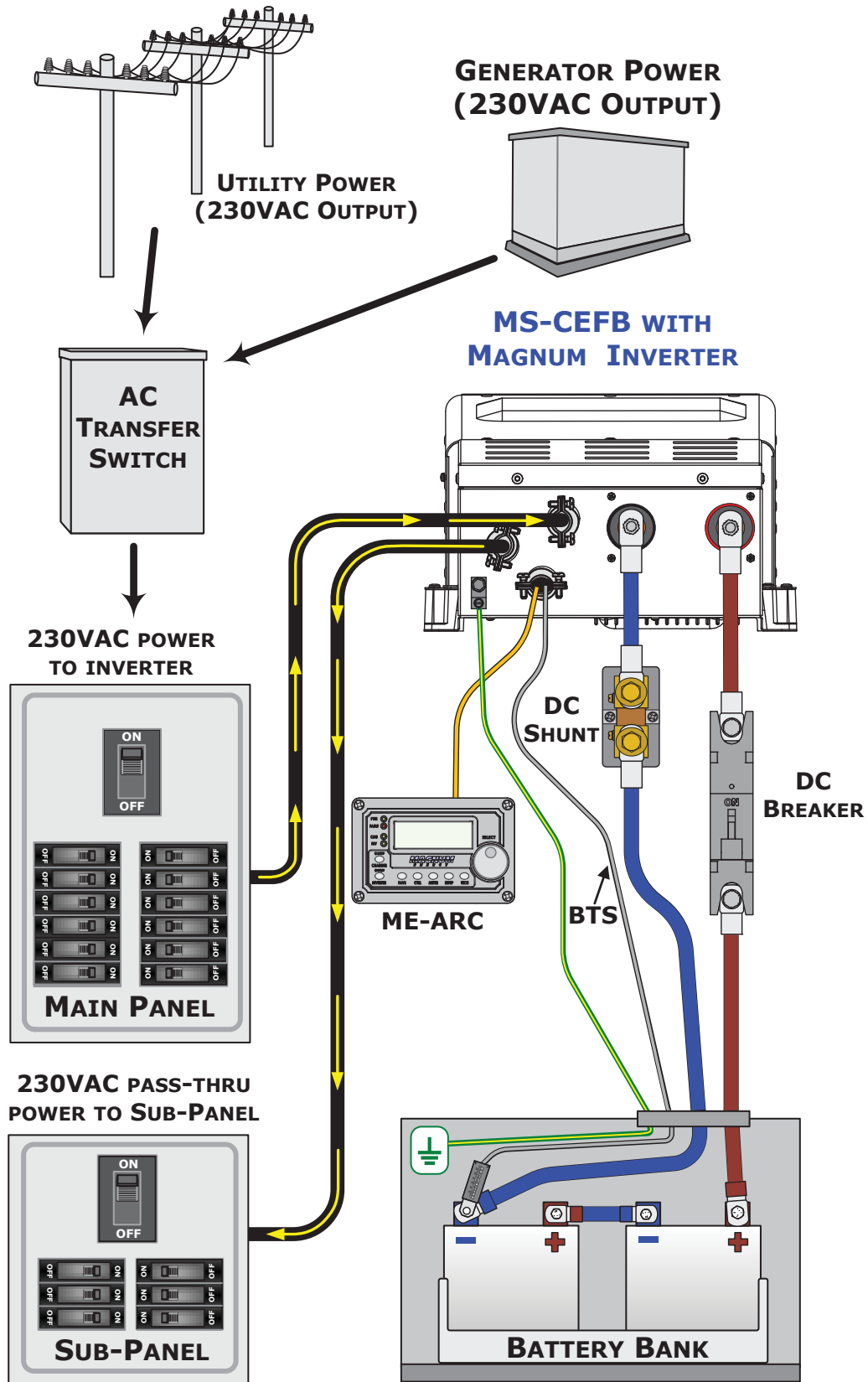


Figure 4, Simplified Installation Diagram

## Installation



**CAUTION:** Before installation, closely read and review all safety information and procedures in this guide and in your inverter owner's manual.



**WARNING:** The inverter uses power from both AC and DC sources. Before beginning the installation, ensure all AC power (utility/generator) and any negative/positive battery cables are safely disconnected from the inverter.

Review the simplified system diagram shown in Figure 4 to assist you in planning and designing your installation. This drawing is not intended to override or restrict any national or local electrical codes. This drawing should not be the determining factor as to whether the installation is compliant, that is the responsibility of the electrician and the on-site inspector.

### Safety Requirements

- The MS-CEFB should be reliably and permanently grounded (i.e., earthed) to the system's earth terminal. No plug or socket connection of the ground wire is allowed.
- The EMI (electromagnetic interference) filter should be grounded before connecting any power to the MS-CEFB. This bleeds relatively high leakage currents through the filter common-mode capacitors to safety ground, and removes hazardous voltage potentials from the filter body.

### Installation Considerations

- In all installations, the inverter and the MS-CEFB should be installed on the same metallic ground plane. Ensure all metal mating surfaces used for connecting the inverter to the MS-CEFB are clean of paint, oil or grease.
- It is recommended that equipment sensitive to EMI should be kept at least 25 cm away.
- Any communication cable (remote, network, stacking and BTS) should be separated from the AC IN and AC OUT power cables. Parallel runs of cables should be avoided when possible. Cross-over of all cables should be done at 90 degrees.

### Unpacking and Inspection

Carefully remove the MS-CEFB filter box from the shipping container and inspect all contents. Verify the following are included:

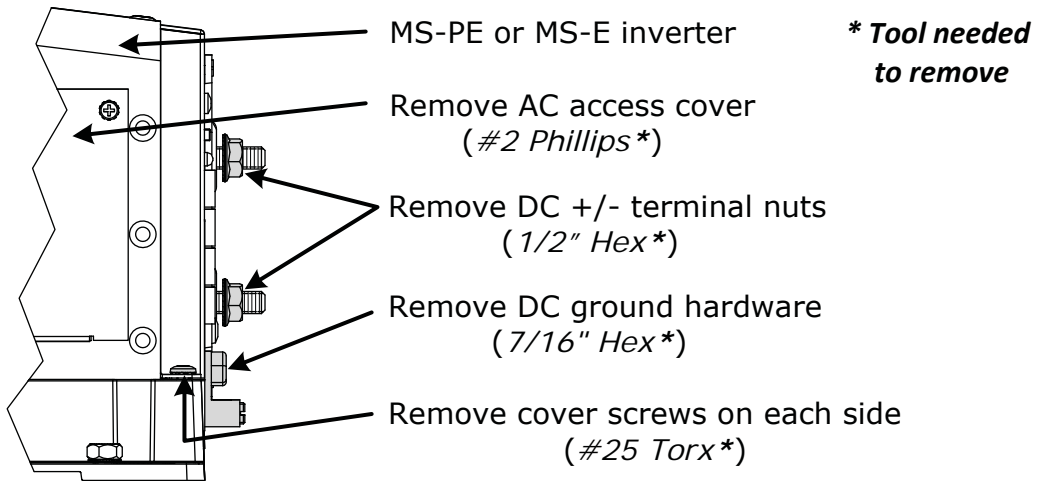
- MS-CEFB filter box
- Ferrite core
- DC terminal insulators (one black, one red)
- MS-CEFB Owner's Manual

If items appear to be missing or damaged, contact your authorized Magnum dealer or Magnum Energy. Save your proof-of-purchase as a record of ownership; it will be needed if the unit should require in-warranty service.

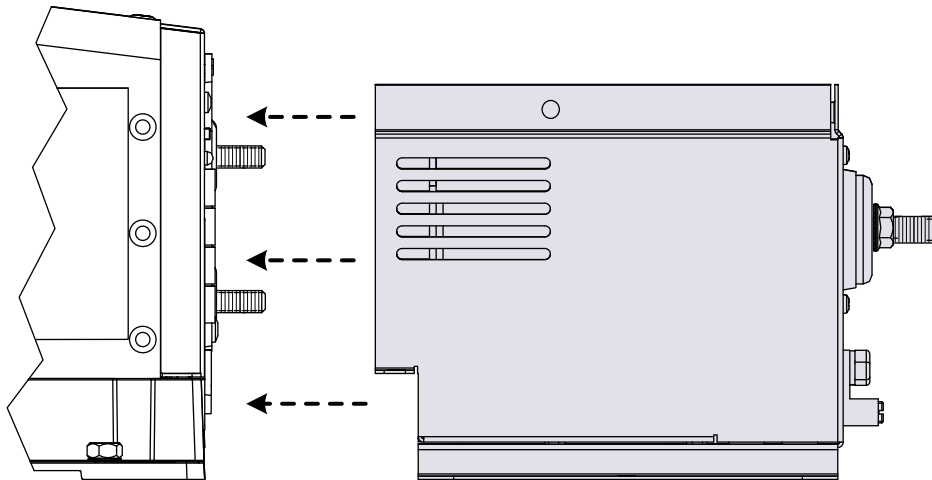
### Tools Needed

- #2 Phillips screwdriver
- 3/16" ( $\leq 4.8$  mm) flat-bladed screwdriver
- 7/16" wrench/socket
- 1/2" wrench/socket
- 11/16" wrench/socket

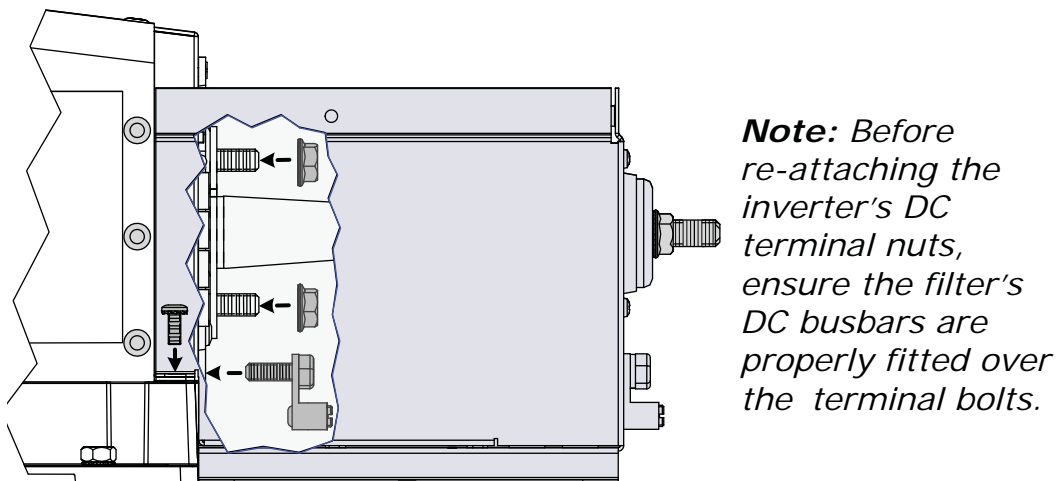
## Installation



### Stage I – Prepare Inverter



### Stage II – Connect Filter Box to Inverter



### Stage III – Attach & Tighten Hardware

Figure 5, Attaching the MS-CEFB to the Inverter

## Installing the MS-CEFB

Prior to installation of the filter box, the inverter/charger must be prepared.

### To prepare the inverter (Figure 5, Stage I):

1. Remove the inverter's AC access cover (will need access to inside the inverter to remove the DC ground connection and to wire AC connections).
2. Remove the inverter's DC positive and negative terminal nuts/washers.
3. Remove the DC ground connection from the bottom left corner on the front side of the inverter (reach into the AC terminal block compartment to secure the hex nut while unscrewing the bolt on the outside of the inverter using a 7/16" wrench/nut driver). Refer to Figure 6.
4. Remove the two #25 Torx screws that hold the inverter cover to the base—located on each side of the inverter's front.

### To prepare the MS-CEFB filter box:

5. Detach the top cover of the filter box by removing the four #25 Torx screws that secure the cover to the base.
6. Determine the AC and DC wiring through the filter box, and then remove the appropriate knockouts (Figure 3).

**Note:** Magnum does not provide additional strain reliefs or conduit for the knockout holes; to add either, you must supply the hardware.

### To attach the MS-CEFB to the inverter (Figure 5, Stages II & III):

7. Attach the filter box to the inverter using the two #25 Torx screws that were removed from the inverter cover in Step 4. Ensure the filter box's DC busbars align over the inverter's positive and negative DC terminals.
8. Secure the filter box's mounting flanges—preferably to the same mounting surface used for the inverter.
9. Re-attach the DC ground connection removed in Step 3—the ground's Hex screw fits through the inner flange on the filter box (Figure 6).
10. Re-attach and tighten the inverter's DC positive and negative terminal nuts/washers that were removed in Step 2—securing the filter box's DC busbars to their respective DC terminals on the inverter. Torque to between 13.6 and 16.3 N-m (10 to 12 ft lbf).

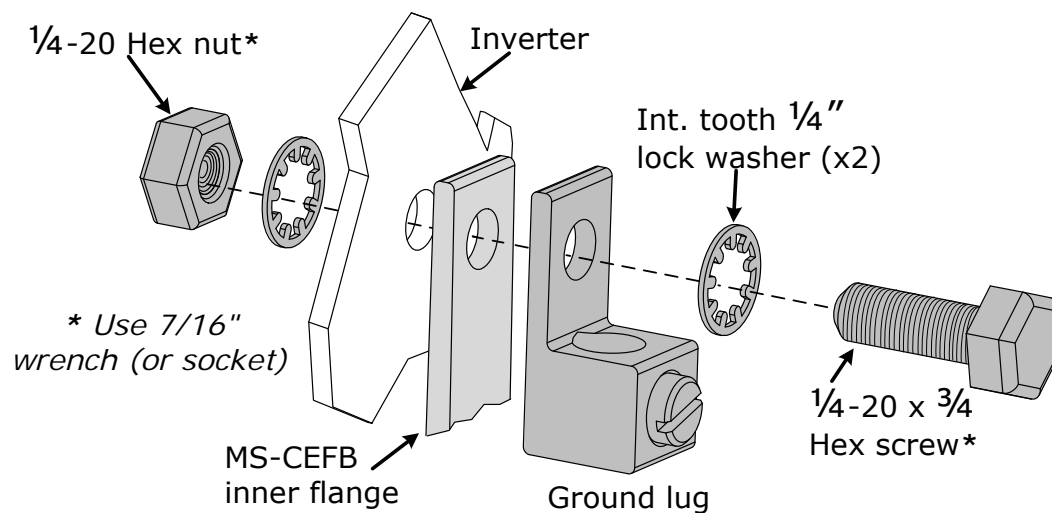


Figure 6, Re-Attaching the DC Ground Hardware

## Installation

### ***To wire the inverter's AC terminal block (top of Figure 7):***

11. Route the filter box's AC input/output wiring through the appropriate knockouts/strain reliefs on the inverter, and then connect to the inverter's AC terminal block.
  - Connect wire A (white w/ black stripe) to Terminal #1 (AC NEUT OUT).
  - Connect wire B (blue) to Terminal #2 (AC HOT OUT).
  - Connect wire C (black) to Terminal #3 (AC HOT IN).
  - Connect wire D (white) to Terminal #4 (AC NEUT IN).Tighten all to a maximum torque of 3.6 N-m (32 in lbf).

### ***To wire the filter box's AC terminal block (bottom of Figure 7):***

12. Route the AC input source/output load wiring through the appropriate knockouts/strain reliefs on the filter box, and then connect to the filter box's AC terminal block.
  - Connect wire F (brown) to Terminal #1 (INV HOT OUT), and then route and connect to the sub-panel.
  - Connect wire G (blue) to Terminal #2 (INV NEUT OUT), and then route and connect to the sub-panel.
  - Connect wire H (blue) to Terminal #3 (INV NEUT IN), and then route and connect to the main panel.
  - Connect wire I (brown) to Terminal #4 (INV HOT IN), and then route and connect to the main panel.

Tighten all to within a minimum/maximum torque of 1.2 N-m (10.6 in lbf)/1.5 N-m (13.3 in lbf) – using a 3/16" (4.8 mm or less) flat-bladed screwdriver.

**Note:** *The AC input source, output load, and grounds (i.e., brown, blue, and green with yellow stripe wires) are field wires and must be provided by the installer.*



**Info:** Approved wire sizes for the MS-CEFB's AC terminal block are 0.5-16 mm<sup>2</sup> (#20-6 AWG).

### ***To wire the AC input/output grounds (bottom left of Figure 7):***

13. Connect an AC ground wire from one of the filter box's ground terminals to the main panel's ground busbar.
14. Connect another AC ground wire from the filter box's other ground terminal to the sub-panel's ground busbar. Tighten both grounds to a maximum torque of 5.1 N-m (45 in lbf).



**Info:** Approved wire sizes for the MS-CEFB's ground terminals are 2 -33.6 mm<sup>2</sup> (#14-2 AWG) copper stranded.

### ***To inspect the AC wiring:***

1. Verify all wire runs are secured.
2. Verify strain reliefs or grommets are in place to prevent damage to the wiring or conduit where it passes through walls or other openings.
3. Verify that all AC connections are correct, and all inverter and filter box AC terminal screws are properly torqued.
4. Replace the inverter's AC wiring access cover.



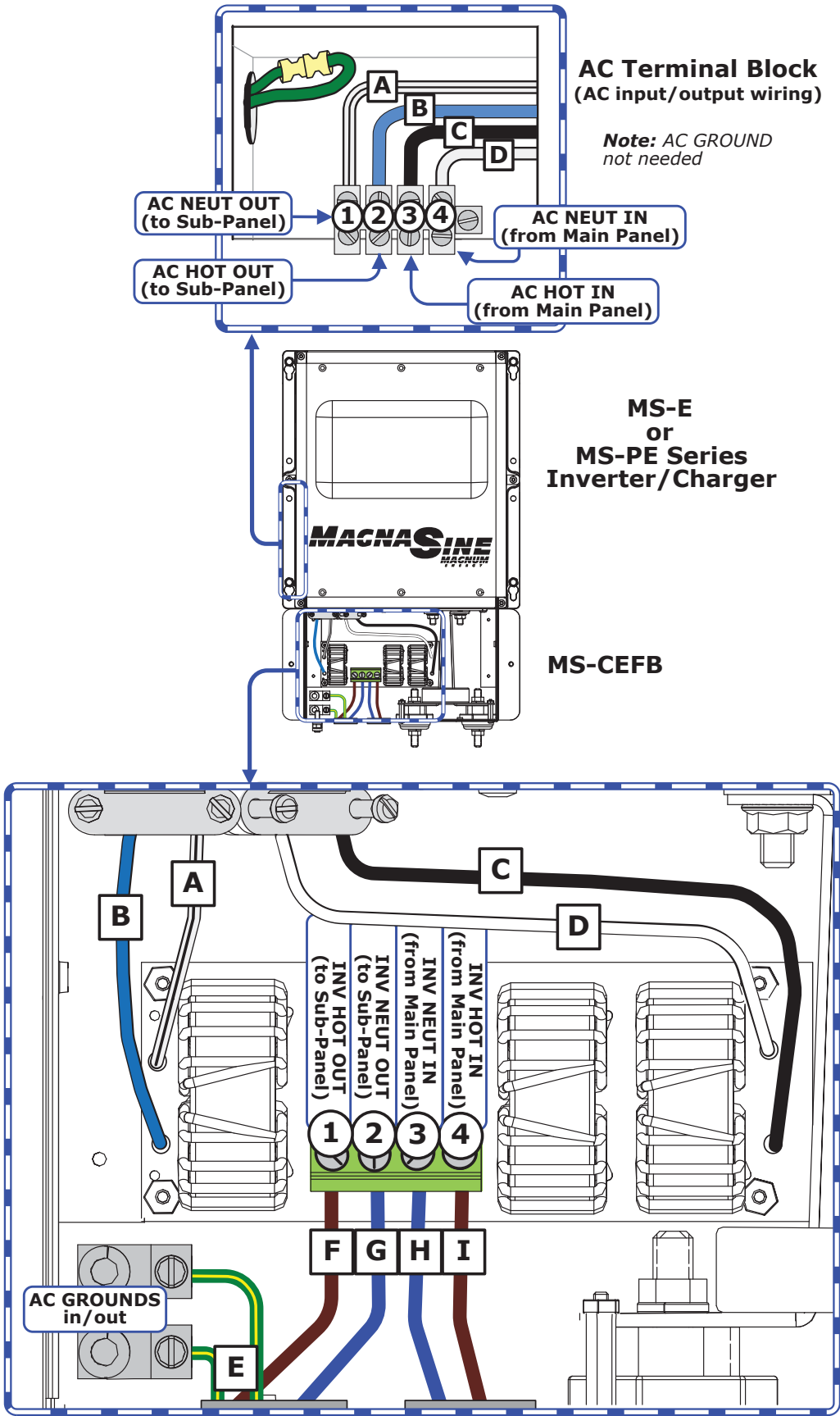


Figure 7, AC Wiring

## Installation

### To wire the MS-CEFB filter box to the battery bank:

1. Route the end of the positive DC battery cable from the battery bank through the supplied red DC terminal insulator (do the same for the negative DC cable – using the black DC terminal insulator). The insulators protect the MS-CEFB's DC terminals and can help prevent accidental shorts.



**WARNING:** Before connecting the DC cables from the battery bank to the MS-CEFB, ensure DC overcurrent protection has been installed and the correct DC voltage and polarity have been verified.

2. Connect the positive and negative battery cables to their respective terminal posts on the front of the filter box. When connecting the battery cables to the filter's DC terminals, the cable's ring lug should be placed directly against the filter terminal (Figure 8). Torque to 20.4 N-m (15 ft lbf).
3. Fit the red and black DC terminal insulators (that were routed over the DC battery cables in Step 1) over their respective terminal posts.



**WARNING:** DO NOT close the DC circuit breaker or connect the fuse to bring battery power to the inverter at this time. This will occur in the Functional Test after the installation is complete.



**Info:** Refer to your inverter owner's manual for the required DC wiring sizes and overcurrent protection.

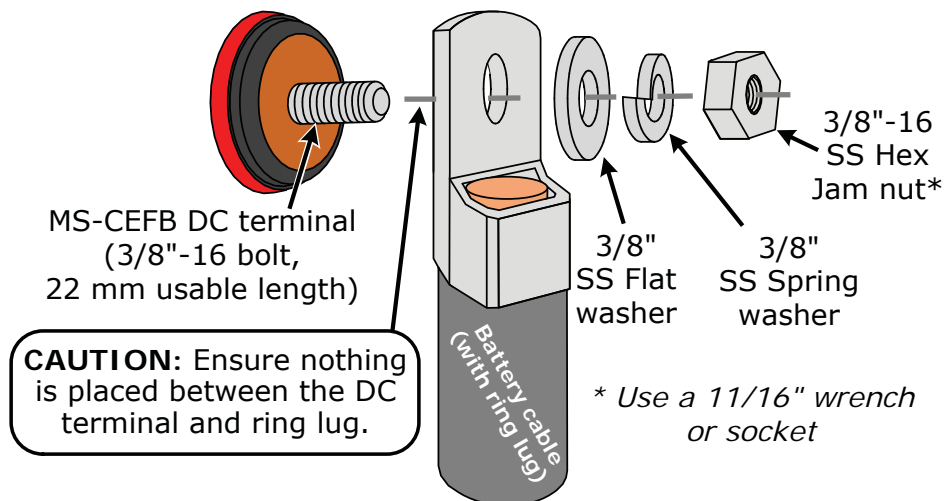


Figure 8, MS-CEFB DC Hardware Installation

### Communication Cables

When connecting a communication cable (remote, network, stacking or BTS) to the inverter, a ferrite core must be connected to one end of the cable. A ferrite core is shaped like a metal doughnut and is a passive electronic component used to suppress high frequency noise in electronic circuits. It is used to reduce EMI that may be transmitting, and prevents the cable from acting as an antenna and receiving interference from other devices.

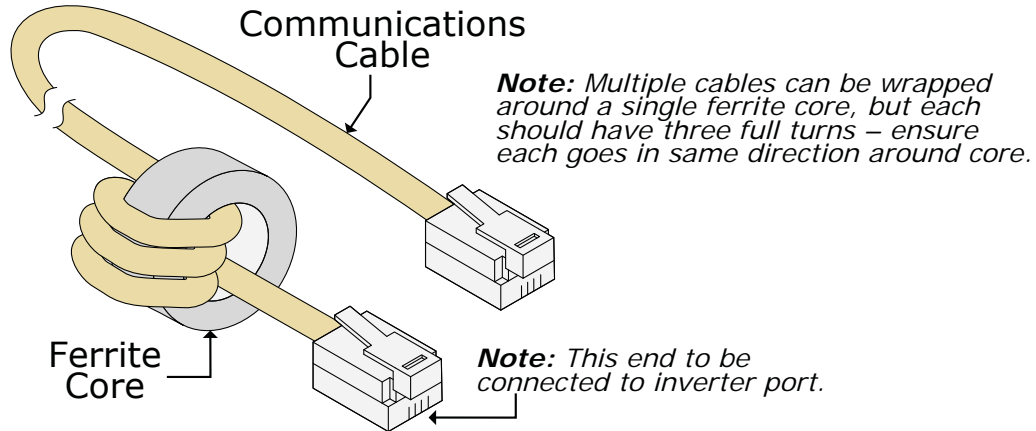


**Info:** The BTS cable and another communication cable (e.g., remote cable) can both fit and be separately wrapped three times into a single ferrite core. However, if using more than one cable with a single ferrite, all must go in the same direction around the core.

### To attach the ferrite core to a communication cable (Figure 9):

1. For each communication cable, route one end through the ferrite core and wrap it several times around/through the core. There needs to be at least three full turns around the ferrite core.
2. While wrapping the cable around the core, ensure the core is located as close as possible to one end of the cable [within 2.5 to 5 cm (1-2 inches) from the end]. The result should look something like Figure 9 below.

**Note:** Once the core is attached to the cable, plug the core-connected end of the cable into the appropriate RJ11 port (Stack/Accessories, Remote, Network, or BTS) on the inverter.



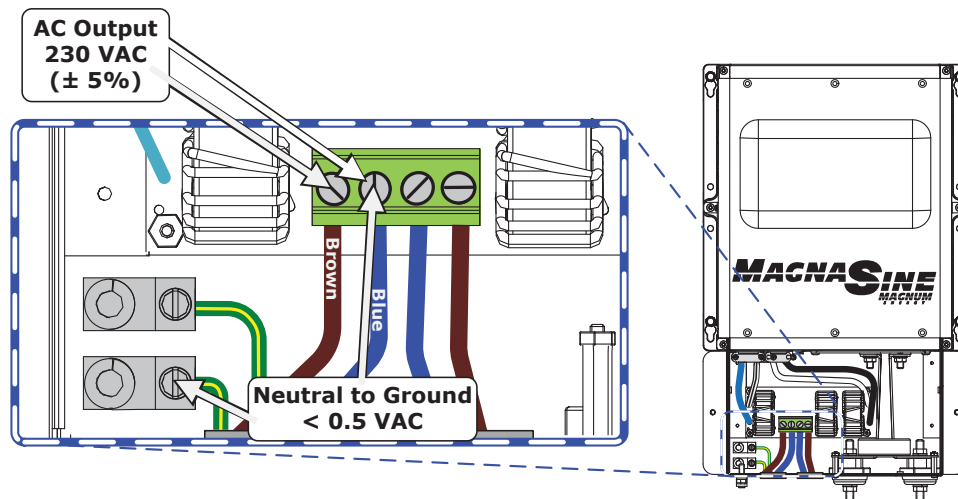
**Figure 9, Ferrite Core Attached to a Communication Cable**

### Final Inspection

After all electrical connections to the inverter, batteries, AC source, and sub-panel have been completed, follow the steps for the Functional Test as directed in your inverter owner's manual.

**Note:** When verifying the correct DC voltage, check the filter box's positive and negative DC terminals with a multimeter. When verifying the correct AC output voltage, check the filter box's AC terminal block NEUT OUT, HOT OUT, and GROUND poles with a voltmeter (Figure 10 below).

Once your system passes all the steps, attach and secure the filter box's cover.



**Figure 10, AC Voltage Checks**

## EU Standards/Limited Warranty

### EU Directives and Standards

A MS-CEFB (CE Filter Box) connected to a MS-E or MS-PE Series inverter/charger conforms to the provisions of EMC Directive 1999/5/EEC, per:

- **EN 55014-1 (2006) +A1, +A2, (> 1000W)** Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission
- **EN 55014-2 (1997) +A1, +A2**, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard
- **EN 61000-3-2 (2006) +A1, +A2**, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤16 amps per phase)

Additionally, these products conform to the C-Tick Mark requirements based on the provisions in standard AS/NZS CISPR 14-1:2005.

### Limited Warranty

Magnum Energy, Inc. warrants the CE Filter box for a maximum of 12 months from the product's original date of purchase according to the following terms and conditions:

1. The limited warranty extends to the original purchaser of the product and is not assignable or transferable to any subsequent purchaser.
2. During the limited warranty period, Magnum Energy will repair or replace at Magnum Energy's option any defective parts, or any parts that will not properly operate for their intended use with factory new or remanufactured replacement items—if such repair or replacement is needed because of product malfunction or failure during normal usage. The limited warranty does not cover defects in cosmetic appearance, or any decorative, structural, or non-operative parts. Magnum Energy's limit of liability under the warranty shall be the actual cash value of the product at the time the original purchaser returns the product for repair—determined by the price paid by the original purchaser. Magnum Energy shall not be liable for any other losses or damages.
3. Upon request from Magnum Energy, the original purchaser must prove the product's original date of purchase by providing a dated bill of sale or itemized receipt.
4. This limited warranty is voided if:
  - the product has been modified without authorization;
  - the product has been damaged through abuse, neglect, accident, or corrosion;
  - the product was not installed according to this installation guide.