

Model # \_\_\_\_\_

Serial # \_\_\_\_\_

## The Marine Galvanic Isolator (GI)



## Installation and Testing Instructions

### Read entire document before installing

These installation instructions only apply when this product is installed on a boat for purposes of minimizing galvanic corrosion when the vessel is connected to an on-shore electric power source. Observe all safety grounding requirements and practices during installation and testing.

### GENERAL INFORMATION

DEI only manufactures fail-safe Galvanic Isolators which have been tested to standard A-28, July 2008 publication. DEI's extensive experience with solid-state grounding devices and "decouplers" dates back to 1983, manufacturing conservatively designed products for high power applications in the power utility, pipeline, and railroad markets. DEI manufactures isolators for other industries that have identical construction to the Galvanic Isolator line, and which have been fully tested and listed by Underwriters Laboratories to US and Canadian electrical codes (NEC, CSA, etc) for safety grounding and suitability for hazardous locations. The units were further tested by UL/Demko to meet European requirements. These electrical codes are much more demanding than the ABYC A-28 standard, where fail-safe construction is not optional, but required. Those products, identical to the Galvanic Isolator line, are routinely inspected by UL for compliance. No other isolator design has been subjected to such extensive testing and certification. All DEI Galvanic Isolators are considered "Fail-Safe Plus" or "Fail-Safe MAX," defined in the following sections.

### Fail-Safe Plus™

Fail-Safe Plus models not only meet the fail-safe test criteria in A-28, but also have considerably higher AC fault current ratings than are required and have substantial lightning current ratings which are not required by A-28; hence, the "Plus" version unique to DEI.

### Fail-Safe Max™

Fail-Safe Max models provide even higher performance than Fail-Safe Plus models, in that they have higher fault current ratings and will still be fully functional and meet all requirements of A-28 after being subject to the fail-safe test criteria (i.e. the energy required to melt the conductor).

### WARNING

To avoid injury or death from electrical shock when installing the Galvanic Isolator, the boat should not be connected to shore power and there should be no power to the AC panel.

### Mounting

The GI is to be installed in series with the ship-to-shore grounding conductor as illustrated in Figure 1, which is extracted from the ABYC standard A-28. Although Figure 1 shows a single-phase system, the GI can also be used on a three-phase system. Securely mount the GI in a location where it can easily be inserted in the grounding conductor as illustrated in Figure 1 and as described in the following section. For 30A and 50/60A models, use the washers provided under the head of the mounting bolts.

### Polarity

The standard GI has symmetrical voltage blocking characteristics; therefore polarity is not relevant. However, the terminals are marked "Boat Gnd" and "Shore Gnd" to avoid confusion or inadvertent by-passing of the device. Connect the terminal of the GI marked "Boat Gnd" to the boat grounding system. Connect the other terminal marked "Shore Gnd" to the grounding conductor in the shore power cable that goes to the shore power cable connector. When one 50/60A galvanic isolator is used for dual 30A services on a boat, the grounding conductor from each shore power cable will be connected to the terminal marked "Shore Gnd." There cannot be any other connections to the boat from the grounding conductor on the "Shore Gnd" side of the GI because this would by-pass the isolator.

### Lead Connections/ Torque Values

The GI is furnished with terminal pads for securing compression terminals crimped to insulated leads. Leads and ring type compression terminals appropriate for the current rating selected are user furnished. These ring terminals are secured by bolting, using the hardware supplied by DEI. The terminal should be sized for a 5/16" (or 8mm) diameter bolt for 30A and 50/60A models, and for a 1/2" (or 12mm) diameter bolt for the 100A and 200A models. Recommended torque values are 17 to 19 ft-lb (23 to 26 N-m) for the 5/16" bolt and 53 to 57 ft-lb (72 to 77 N-m) for the 1/2" bolt.

## Monitoring

The DEI Fail-Safe Plus and Fail-Safe Max line of Galvanic Isolators are not provided with a monitor because in A-28, July 2008 publication, monitoring has been eliminated as a requirement for galvanic isolators classified as Fail-Safe per A-28.

## Field Testing

Before and after installation, tests should be conducted to confirm that the boat electrical wiring is correct and that the GI is functioning properly. Tests should be performed by qualified personnel, using appropriate safety practices. For Test 3 the boat must be in the water. A multimeter with an ohms scale and a diode checking function is required.

Before proceeding with installation of the galvanic isolator, disconnect the shore cord (or shore cords where dual shore cords are on a boat) so there is no AC power to the panel and close all AC circuit breakers. The shore cord (or cords) should be disconnected through Test 2. Also check for and de-energize any inverters that could supply AC power to the panel.

1. Measure the resistance between the boat ground and neutral. Confirm that this resistance value is 25,000 ohms or greater per ABYC E-11, after which the GI can be installed following the guidelines provided earlier in this document. If the resistance is less than 25,000 ohms there is a ground-neutral by-pass that must be corrected or the isolator will not isolate the vessel.

2. To confirm that the GI is installed without any by-pass connection, momentarily short the terminals of the GI to remove any residual charge that may be on the internal capacitor. Using a multimeter set to the lowest ohms scale, connect a meter lead to each GI terminal while observing the meter. If the resistance reading starts at zero ohms and slowly begins increasing, the GI is not by-passed.

If the resistance reading remains fixed at near zero ohms, the GI may be by-passed or it may be internally shorted.

To determine which condition exists, disconnect all leads to the GI "Shore Gnd" terminal and repeat the above ohmmeter test. If the resistance now slowly increases, the GI was by-passed. Find and eliminate the by-pass connection and retest to confirm. If the meter reading remains fixed and near zero ohms, the GI is internally shorted and must be replaced.

3. Following boating industry accepted procedures, connect the shore power cord (or cords) to the dock AC power source.

Measure the DC voltage across the GI terminals to determine if there is any galvanic voltage present. This voltage should be well below the +/- 1.1 volt blocking level of the GI, and could, but would not normally be, zero.

4. This is a definitive test to determine whether the GI is fully functional and is recommended for a new installation, as an annual test, or whenever the operation of the GI may be in question. This test uses a multimeter and will take about 15 minutes to conduct, however Test 5 is an equivalent test that can be conducted in about one minute, but requires an auxiliary 1.5Vdc battery (one AA suitable) with clip leads for connection to the GI terminals. (This battery tester is provided by the user, or upon request DEI can suggest a source for a suitable battery tester. E-mail [contact@dairyland.com](mailto:contact@dairyland.com) and ask for "Info on GI Battery Tester".)

Disconnect the boat completely from shore power (including both shore power cords where one galvanic isolator is used for dual services).

Momentarily short the terminals of the GI together to completely remove any residual charge that may be on the internal capacitor.

Using a multimeter set to the diode checking function, connect the positive lead to the terminal labeled "Boat Gnd" and the negative lead to the terminal labeled "Shore Gnd." The meter should show a voltage reading that very slowly increases from zero at a rate on the order

of one to several millivolts per second, depending on the characteristics of the multimeter. This test will take about 5 to 10 minutes since a multimeter is very current limited and DEI GIs utilize a higher capacitance value than other GIs.

- If the voltage instantly increases to the 0.8 to 0.9 volt range, the capacitor is defective (i.e. open circuit).

- When the test time is extended until there is no further appreciable increase in voltage, the voltage reading will increase to about 0.80 to 0.90 volts. (Once the voltage increases to a value greater than 0.55 volts, then both diodes in the GI are almost certainly functional, but it is suggested that the test be taken to its limit. If the voltage increases above 0.90 volts, the diodes may be open circuit, a condition that should never be encountered with any DEI marine galvanic isolator.)

- If the voltage only increases to about 0.45 volts or slightly less, then one diode is shorted.

- If the voltage does not increase at all, then both diodes are shorted, or the capacitor is shorted, or the GI is by-passed. To determine whether the GI is by-passed, go to Test 3. If the GI was not by-passed, it is failed.

Assuming that the above test was successful, remove the meter leads, momentarily short the GI terminals to remove any residual charge on the capacitor, then connect the meter leads to the GI in the reverse direction (positive lead to "Shore Gnd" and negative lead to "Boat Gnd") and repeat the above test to confirm that all components are functional for the alternate polarity.

5. This is an equivalent to Test 4 that requires a 1.5Vdc battery (one AA suitable) with clip leads. Connect a multimeter, set for dc volts, across the GI terminals. Then connect the 1.5V battery source across the GI terminals, first with one polarity and then the opposite polarity, and only long enough to take a reading (several seconds) or the battery will rapidly deplete. Follow-

ing is a summary of typical results for a functional GI and for a defective GI. Replace any GI that does not meet the requirements of a “Functional GI.”

- Functional GI: Voltage quickly rises to slightly over 1.3V. When source is removed, voltage decays to about 0.85V in about 30 seconds, then further decays very slowly after that. (If a GI does not meet the Functional GI test, change the battery and retest in the event the battery is depleted.)
- One Diode Shorted: Voltage quickly rises to the 0.7V to 0.85V range.
- Two Diodes Shorted: Voltage increase minimal or zero.
- Capacitor Open: Voltage quickly rises to slightly over 1.3V. When source is removed, voltage immediately drops to zero (no gradual decay as for a Functional GI).
- Capacitor Shorted: Minimal, if any, voltage increase (less than 1V). When source is removed, voltage immediately drops to zero.
- Open Circuited Diodes: Voltage quickly rises to 1.5V (battery voltage) and then slowly decays. This condition should never be encountered due to the fail-safe design.

If any results are not as expected or if a GI appears to be failed, contact DEI.

**FIGURE 1** Typical Installation of a Galvanic Isolator for Marine Vessel Application

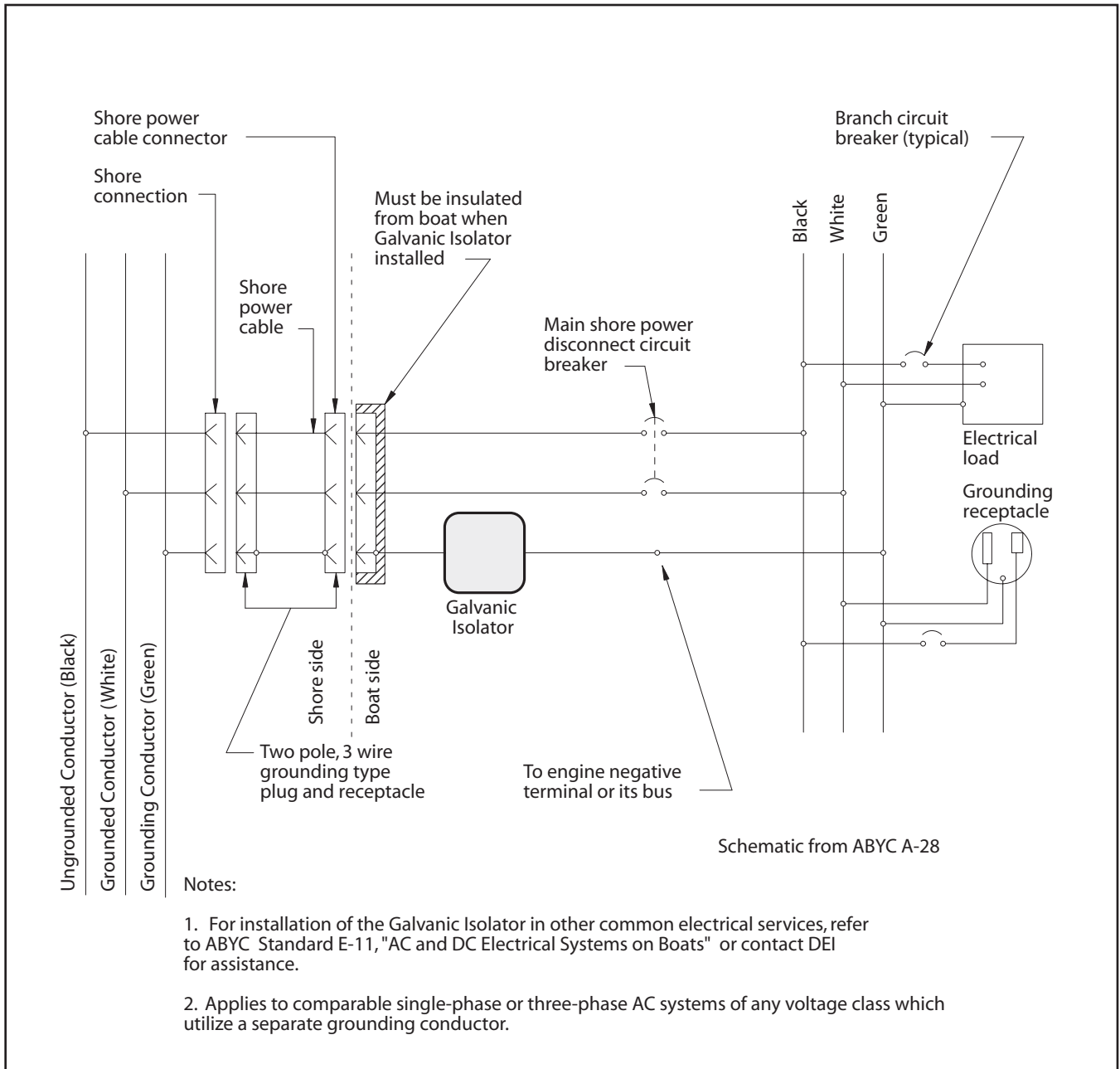


Figure 2 Galvanic Isolator Outline Drawing for 30A Model

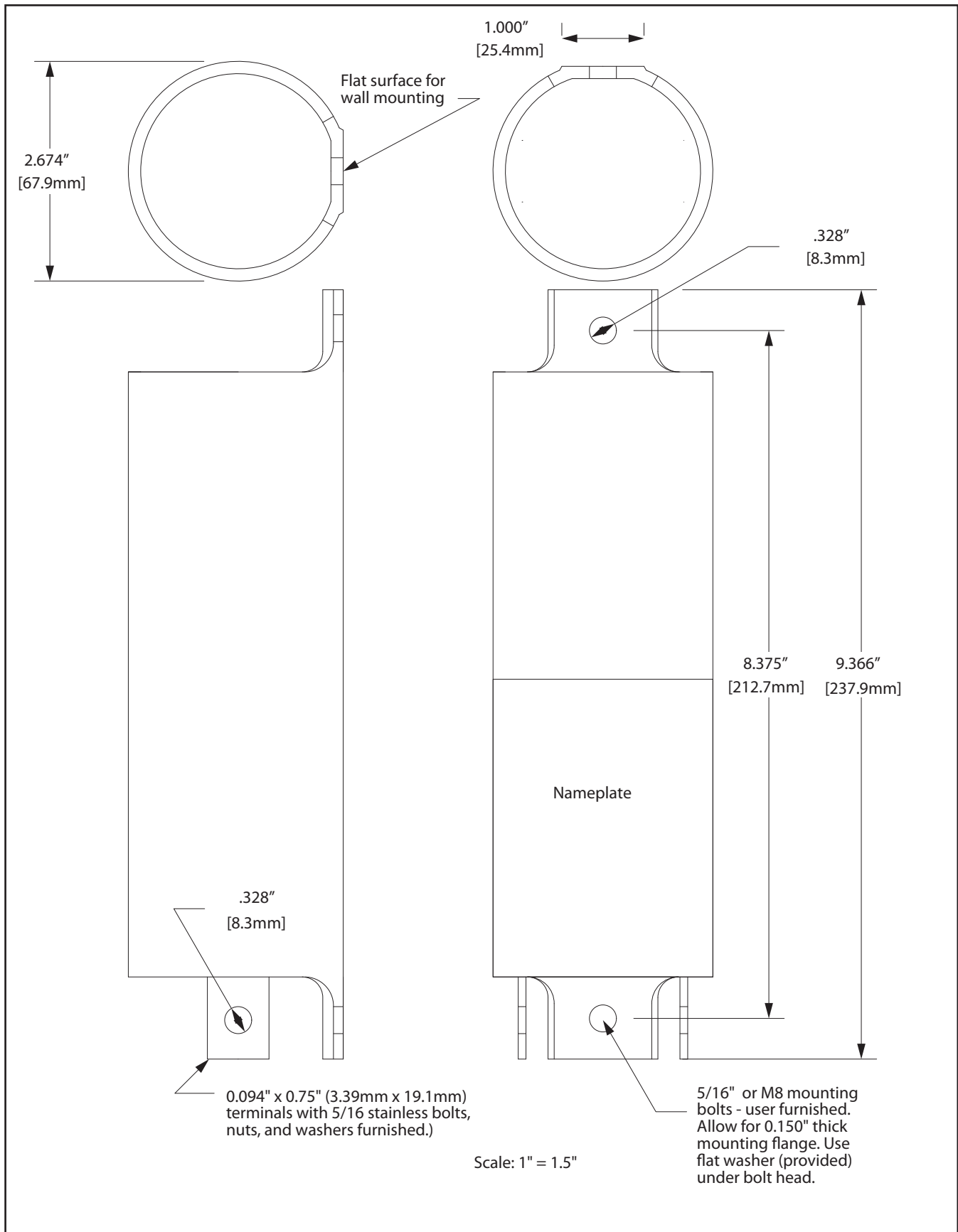


Figure 3 Galvanic Isolator Outline Drawing for 50/60A Models

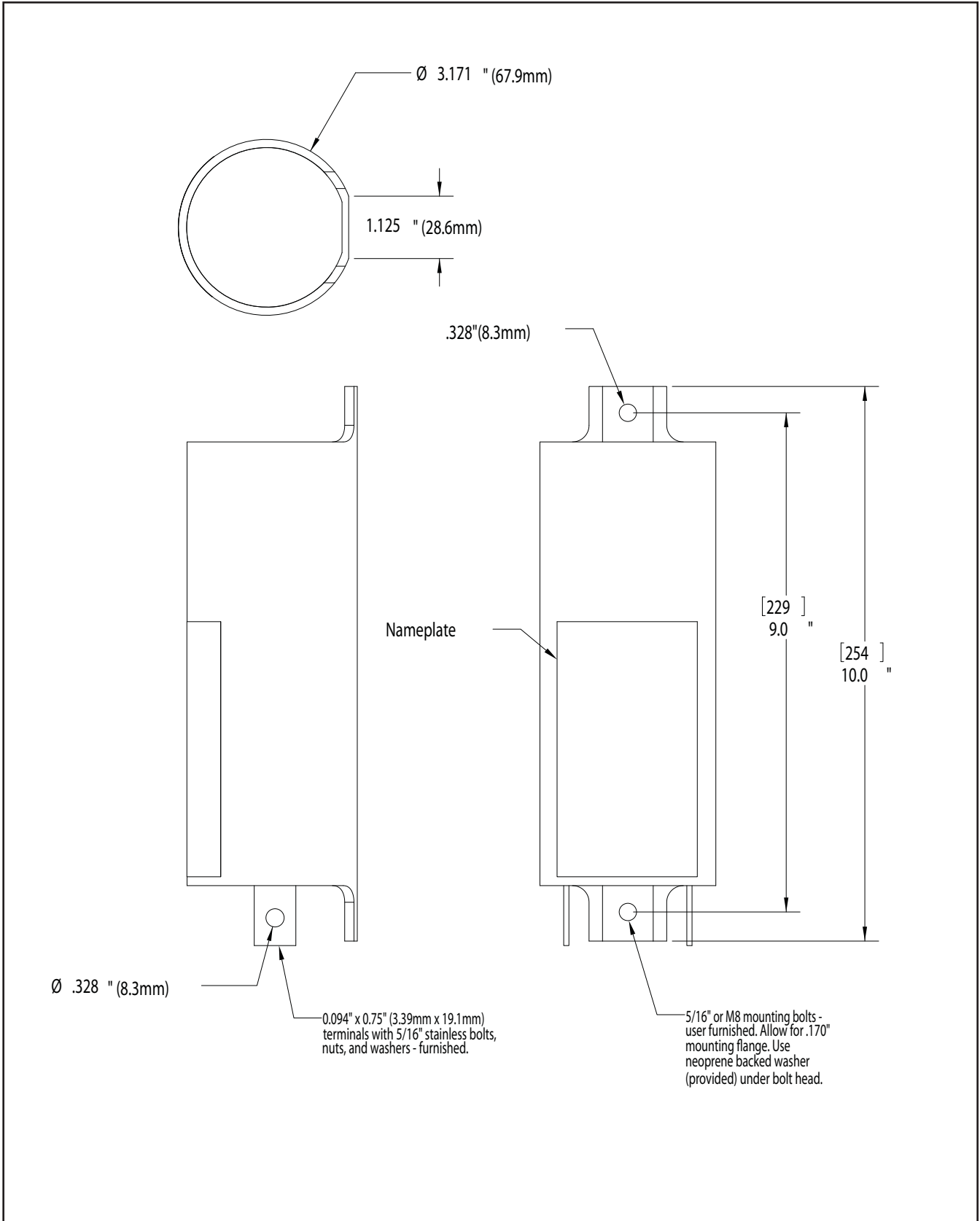
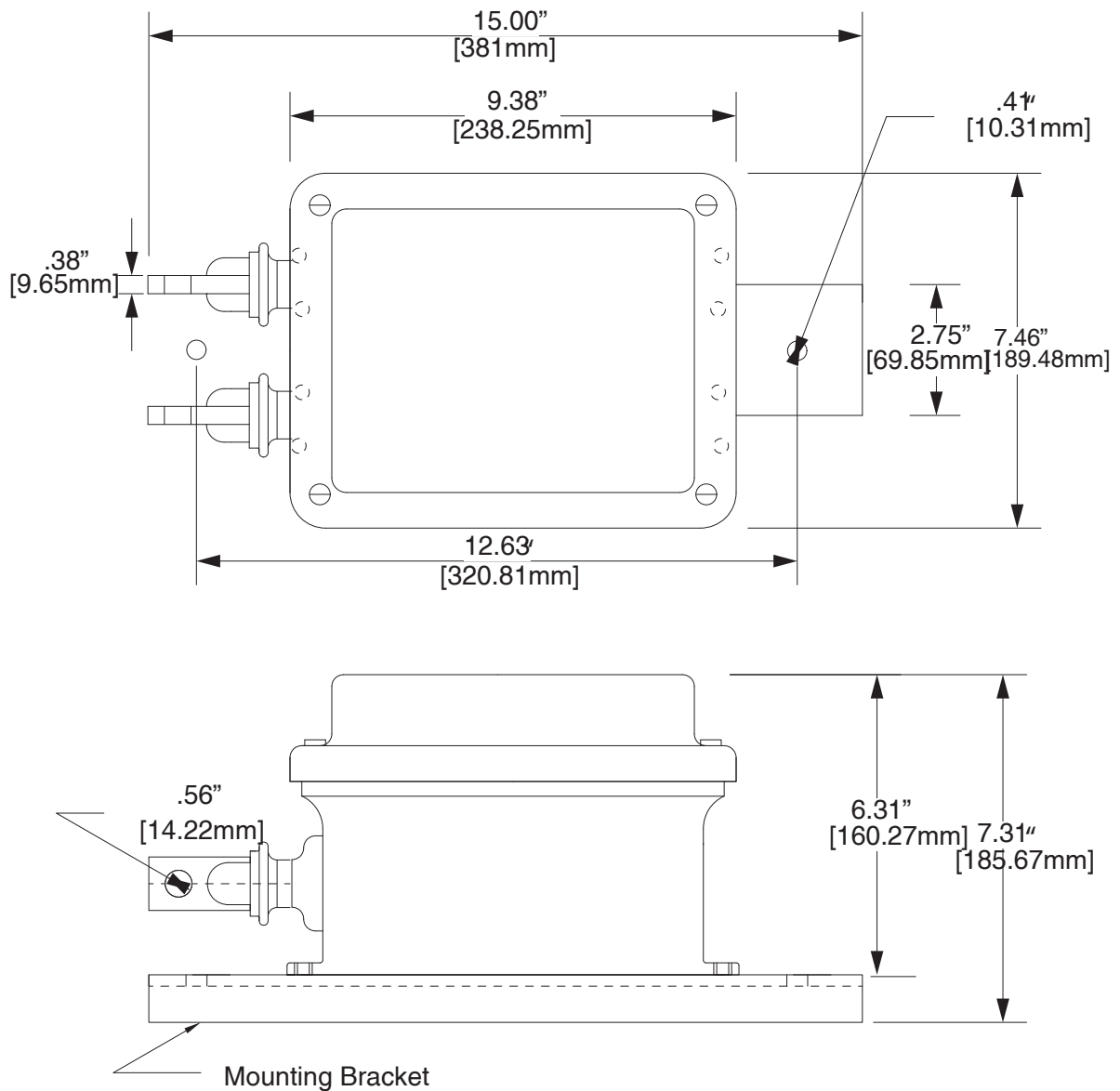


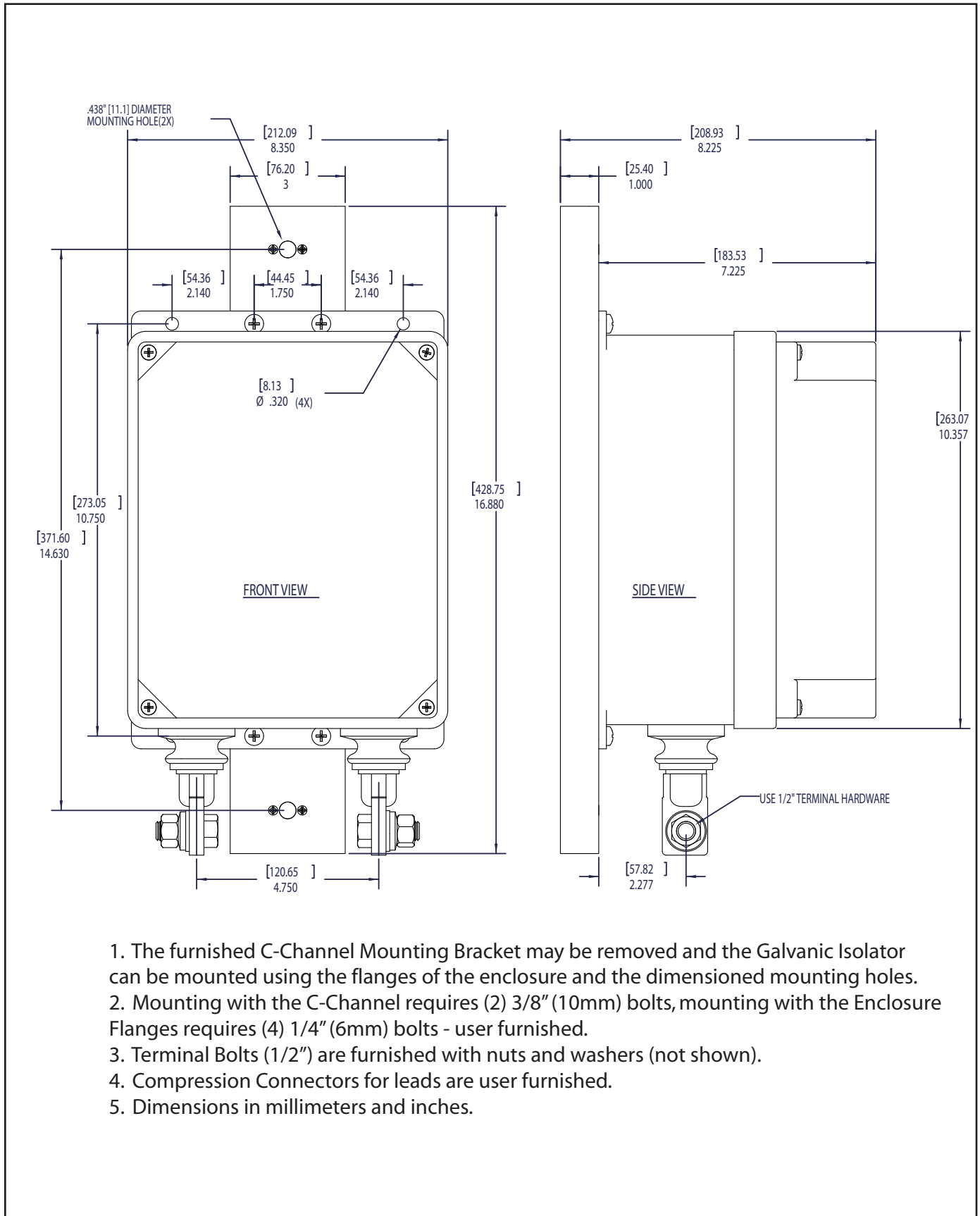
Figure 4 Galvanic Isolator Outline Drawing for 100A Model



Note:

1. If desired, the mounting bracket furnished can be removed and the galvanic isolator can be mounted using the flanges on the enclosure. Four inner mounting holes are located on 1.75" x 8.75" centers and four outer mounting holes are located on 4" x 8.88" centers.
2. Mounting with the bracket provided requires (2) 3/8" (10mm) bolts and mounting by using the enclosure flange requires (4) 1/4" (6mm) bolts - user furnished.
3. Terminal bolts (1/2" diameter) are furnished with nuts and washers, not shown.
4. Compression connectors for leads - user furnished.
5. Dimensions in inches and millimeters.

Figure 5 Galvanic Isolator Outline Drawing for 200A Model



1. The furnished C-Channel Mounting Bracket may be removed and the Galvanic Isolator can be mounted using the flanges of the enclosure and the dimensioned mounting holes.
2. Mounting with the C-Channel requires (2) 3/8" (10mm) bolts, mounting with the Enclosure Flanges requires (4) 1/4" (6mm) bolts - user furnished.
3. Terminal Bolts (1/2") are furnished with nuts and washers (not shown).
4. Compression Connectors for leads are user furnished.
5. Dimensions in millimeters and inches.