



LITERATURE & INSTRUCTIONS

MARINE GALVANIC ISOLATORS



INTRODUCTION

The Dairyland Galvanic Isolator (GI) is a fail-safe, solid-state DC isolation/ AC coupling device for marine applications with exceptional product performance and certifications to ABYC A-28. Galvanic isolators are a desirable addition whenever a boat is connected to AC shore power, due to the galvanic circuit created by the grounding conductor, which can cause corrosion of the boat and its drive system components. Due to the difference in the potential of the hull and drive system metal compared with the shore grounding system or other boats, a galvanic current, which causes corrosion, can flow. A galvanic isolator is installed in series with the shore power cable grounding conductor to prevent the flow of galvanic current thereby preventing the galvanic corrosion. A typical installation schematic is shown on the last page.

FAIL-SAFE CRITERIA

In the marine industry, the criteria for galvanic isolators is defined by the American Boat and Yacht Council (ABYC) recommended standard A-28. This standard defines “fail-safe” galvanic isolators, of which Dairyland is the leading manufacturer, as well as standard (non-fail-safe) isolators. To be considered “fail-safe,” an independent laboratory must confirm that the isolator will either remain fully functional or remain a permanent, effective grounding path if it fails, when subject to the ultimate current-carrying capability of the grounding conductor. This assures that safety grounding will be retained under all conditions.

Certified fail-safe units eliminate the need for a health monitoring system, which is no longer required for fail-safe units because the safety concerns of a product compromising the grounding conductor have been removed.

DID YOU KNOW?

All Dairyland products are certified and exceed ABYC A-28 requirements. In fact, Dairyland was responsible for introducing fail-safe design in galvanic isolators to the marine industry.

PRODUCT OVERVIEW

Dairyland is the leading manufacturer of fail-safe Galvanic Isolators, which have been independently tested and certified to ABYC A-28, by Imanna Laboratory, Inc.

Our 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. Dairyland manufactures isolators for other industries that have similar 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 to meet various international requirements. These electrical and safety codes are much more demanding than the ABYC A-28 standard, where fail-safe construction is not optional, but required.

Dairyland offers Galvanic Isolators rated for 30A, 50/60A, 100A, and 200A shore services. The scope of A-28 covers ratings through 100A, but the 200A model has similar construction to the certified models, with a full 200A continuous current rating (plus overload margin per ABYC).

GI-30A and GI-50/60A 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, and unique to Dairyland products.

GI-100A and GI-200A models provide even higher performance in that they 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).





KEY FEATURES

- Verified Fail-Safe construction
- Highest AC fault current ratings
- No monitoring system required per ABYC A-28
- Rated for lightning current. No other known galvanic isolators have published lightning current ratings.

ADDITIONAL UNIQUE FEATURES

- Ignition protected
- Longest warranties offered in the industry
- Compact design
- Designed for cool operation - no heat sinks needed
- Prevents the flow of galvanic current with super imposed AC current well above the 3A minimum required by A-28
- Designed to meet stringent NEC land-based grounding requirements (exceeds marine requirements)

PRODUCT CAPABILITIES

Blocking Voltage

Per ABYC A-28, the Dairyland model GI family has a DC blocking voltage of at least 1V. At a voltage below this value, the GI blocks the flow of DC current and allows AC current to pass. At voltages above the blocking voltage, such as could occur from an AC fault or lightning, the GI is a bi-directional conduction device that readily allows all current to flow, thereby safely limiting the voltage on the boat.

System Voltage

Dairyland Galvanic Isolators are strictly current rated and can be used on any voltage class system. Since A-28 requires a system voltage rating on the nameplate, all Dairyland Galvanic Isolators are name-plated for use on systems of 600Vac or less.

DC Leakage Current

For a given DC voltage across the GI, there will be a small DC leakage current. This value will be negligible (less than 1mA) at the worst-case galvanic voltage difference anticipated across the device, and well below the limits in ABYC A-28. The leakage current is a corrosion-causing current that is minimized with the Dairyland design.

Steady-State AC Current

Galvanic isolator models are rated to carry the steady state AC current for which the shore power cable is rated. The ratings offered by Dairyland are 30A (which has been certified and nameplated for 35A continuous to satisfy European requirements for a 32A rating), 50/60A (for a single 50A shore cord or two 30A shore cords), 100A (for a single 100A shore cord or two 50A shore cords), and 200A (for a single 200A shore cord or two 100A shore cords).

Exceptions: If the shore power steady-state current rating is different from the above values, choose a GI rating that exceeds the shore power rating. When in doubt about ratings, contact Dairyland.

AC Fault Current

All Dairyland Galvanic Isolators are designed to exceed the ABYC A-28 ratings for AC fault current. When a boat is connected to shore power, if a fault on the boat occurs, the isolator will be exposed to fault current until the appropriate breaker operates. Dairyland offers models that have assured fail-safe operation, based on testing to the equivalent failure level of the shore power cable grounding conductor required for a given current rating. Following are the fault ratings of all Dairyland models, in amperes rms symmetrical. For comparison, per the A-28 standard, non-fail-safe galvanic isolators are only required to be tested for one cycle at the fault current ratings shown below, for three consecutive times. Dairyland marine products greatly exceed all requirements.

AC Fault Current Ratings	
Amps AC-RMS Symmetrical	
Model	Fault Rating
GI-30A-FSP	3kA for 13 Cycles
GI-50/60A-FSP	5kA for 10 Cycles
GI-100A-FSM	5kA for 198 Cycles
GI-200A-FSM	5kA for 198 Cycles

LIGHTNING SURGE CURRENT

Although not a requirement of A-28, Dairyland has established substantial lightning current ratings for all Galvanic Isolators. The lightning surge current rating should not be confused with the AC fault current rating. Lightning has a very different waveform, with a faster rise time, a shorter duration, and much less energy than for an AC current waveform of the same peak current. However, lightning develops much larger voltage differences along the current flow path than AC, resulting in arcing, equipment damage, or personnel risks. Lightning current ratings for Dairyland Galvanic Isolators were established by subjecting the galvanic isolator to representative lightning current in a high-power test laboratory per the requirements of ANSI C62.11.

The waveform used for Dairyland testing is described as an industry standard 4x10 μ s waveform. This describes a lightning waveform where the rise time is 4 microseconds to peak value, followed by decay to one-half of peak in 10 microseconds. Similar construction products by Dairyland have been tested to 8x20 waveforms successfully, although the GI product line has not yet been formally certified to claim compliance to this waveform. The following models have the peak current rating stated.



Lightning Surge Current Rating	
Model	Fault Rating
GI-30A-FSP	75A Peak
GI-50/60A-FSP	100kA Peak
GI-100A-FSM	100kA Peak
GI-200A-FSM	100kA Peak

FEATURES AND CHARACTERISTICS

Certification

The Dairyland line of Galvanic Isolators was tested and certified by Imanna Laboratory, Inc of Rockledge, FL to the ABYC A-28 standard, July 2008 publication, and Dairyland complies with all subsequent standard editions. As defined in the standard, all Dairyland products are “Ignition Protected” and “Fail-Safe,” or beyond the requirements of fail-safe as previously described.

Note: While ABYC A-28 standards do not specify requirements for a 200A device, Dairyland’s 200A Galvanic Isolator was tested to the criteria that would apply if the requirements of A-28 were extended to this rating.

Solid-State Design

The Dairyland Galvanic Isolator utilizes solid-state components in proven designs supplied to the energy industries since 1983. The design has an instantaneous response to voltage, initiating voltage clamping immediately when the voltage attempts to exceed the blocking level. The design includes a non-polarized capacitor. All Dairyland products are fail-safe by design.

Warranty

Due to the conservative design, Dairyland offers long term warranties. The warranty for GI-30A and GI-50/60A is 7 years, and for GI-100A and GI-200A models the warranty is 10 years. During the warranty period, any model will be repaired or replaced due to failure for any cause.

Field Testing/Maintenance

The Galvanic Isolator can be field tested with a multi-meter and clamp on DC ammeter. Testing procedures are included in the installation instructions. The Galvanic Isolator is completely maintenance-free.

Enclosure

The 30A and 50/60A models are packaged in a molded, non-metallic enclosure rated IP68. See Figures 1 and 2. The 100A and 200A models are packaged in a molded, non-metallic fiberglass enclosure rated NEMA 4X. See Figures 3 and 4.

Polarity/Electrical Connection

The Galvanic Isolator terminals do not include polarity marks because it is bi-directional and symmetrical in design.

However, the terminals are marked as “Boat Ground” and “Shore Ground” to avoid confusion or inadvertent bypassing of the device. Conductors are to be terminated with one-hole cable lead connectors (user furnished) by bolting, using the hardware supplied. The connector should be sized for a 5/16” diameter bolt for 30A and 50/60A models, and for a 1/2” diameter bolt for the 100A and 200A models. Torque values are included in the installation instructions.

Number of Operations

The number of times that the Galvanic Isolator can be subject to its rated lightning or AC fault current rating is virtually unlimited, provided the operations are not immediately repetitive.

Energy Requirements

None. The device is completely passive.

Ambient Operating Temperature

-45°C to +65°C

DID YOU KNOW?

The fail-safe characteristics of Dairyland Galvanic Isolators remove the safety concern of a galvanic isolator compromising the grounding conductor, eliminating the need for monitoring, per ABYC A-28. Monitoring will still be required for isolators made by others that are not certified as fail-safe.



INSTALLATION INSTRUCTIONS

Pre-Installation Tests

Before proceeding with installation of the galvanic isolator, disconnect the shore cord (or shore cords where dual shore cords are installed) so there is no AC power to the panel. Also check for and de-energize any sources that could supply AC power to the panel. Assure that any shore power breaker between the shore cord and boat shore panel is closed to establish continuity for testing. 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 as described in the next sections. If the resistance is less than 25,000 ohms there may be a ground-neutral by-pass that must be corrected, or the isolator will not isolate the boat. If assistance is needed in clearing such a condition, please contact a marine electrician.

Mounting

The GI is to be installed in series with the ship-to-shore grounding conductor as illustrated on the final page, which is extracted from the ABYC standard A-28. Although this illustration shows a single-phase system, the GI can also be used on a three-phase system that includes a grounding conductor. Securely mount the GI in a location where it can easily be inserted in the grounding conductor as illustrated and as described in the following section.

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" and a new short insulated conductor of adequate ampacity for both shore cords (by user) should connect the "Boat Gnd" terminal to the boat grounding bus. A similar action would be taken for any Dairyland GI rating being used to connect two shore cord grounds to a single GI. 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.

Conductor Connections/ Torque Values

The GI is furnished with terminal pads for securing compression terminals crimped to insulated conductors. Conductors 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 Dairyland. 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 Dairyland Galvanic Isolators are not provided with a monitor because in A-28 monitoring has been eliminated as a requirement for galvanic isolators classified as Fail-Safe.

Testing After Installation

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 2 the boat must be in the water. A multimeter with an ohms scale and a diode checking function is required.

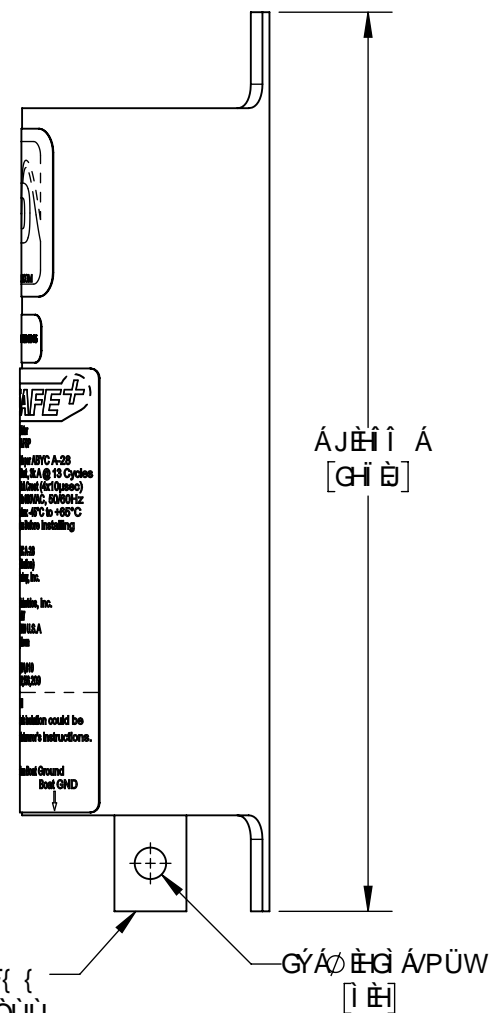
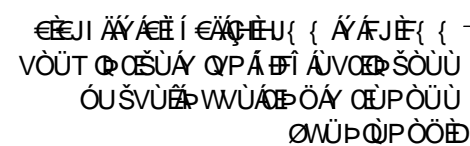
- 1) **Functional Test:** To confirm that the GI is installed without any by-pass connection, with the shore cord unplugged, momentarily short the terminals of the GI to remove any residual charge that may be on the internal capacitor. Using a multimeter set to the lowest ohms scale, connect a meter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

If the resistance reading remains fixed at or near zero ohms, the GI may be by-passed, or it may be internally shorted. To determine which condition exists, with the shore cord unplugged, disconnect all leads to the "Shore Gnd" terminal and repeat the above ohmmeter test. If the resistance now slowly increases, the GI was externally 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.

- 2) **Threshold vs. Galvanic Voltage Present:** This test applies when the boat is in the water. The GI and all shore grounding connections must be solidly reconnected first. Following boating industry accepted procedures, connect the shore power cord (or cords) to the dock AC power source and close the main shore power breaker.

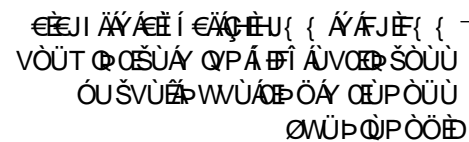
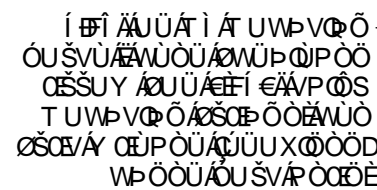
Measure the DC voltage across the GI terminals to determine the level of galvanic voltage present. This voltage should be well below the +/- 1.1 volt blocking level of the GI, and could, but would not normally be, zero. A voltage reading of approximately 1V or higher may allow excessive galvanic current to flow. If this occurs, contact Dairyland for assistance. The voltage present may vary as the boat is docked at different locations, due to the variation in marina grounding materials and potentials on other boats connected to the marina that do not have galvanic isolation. Excessive readings may be caused by wiring problems on adjacent boats in the marina. Contact the marina or a marine electrician for assistance.



For technical support, contact us via the phone number below or techsupport@dairyland.com for a prompt response during business hours.

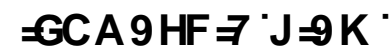
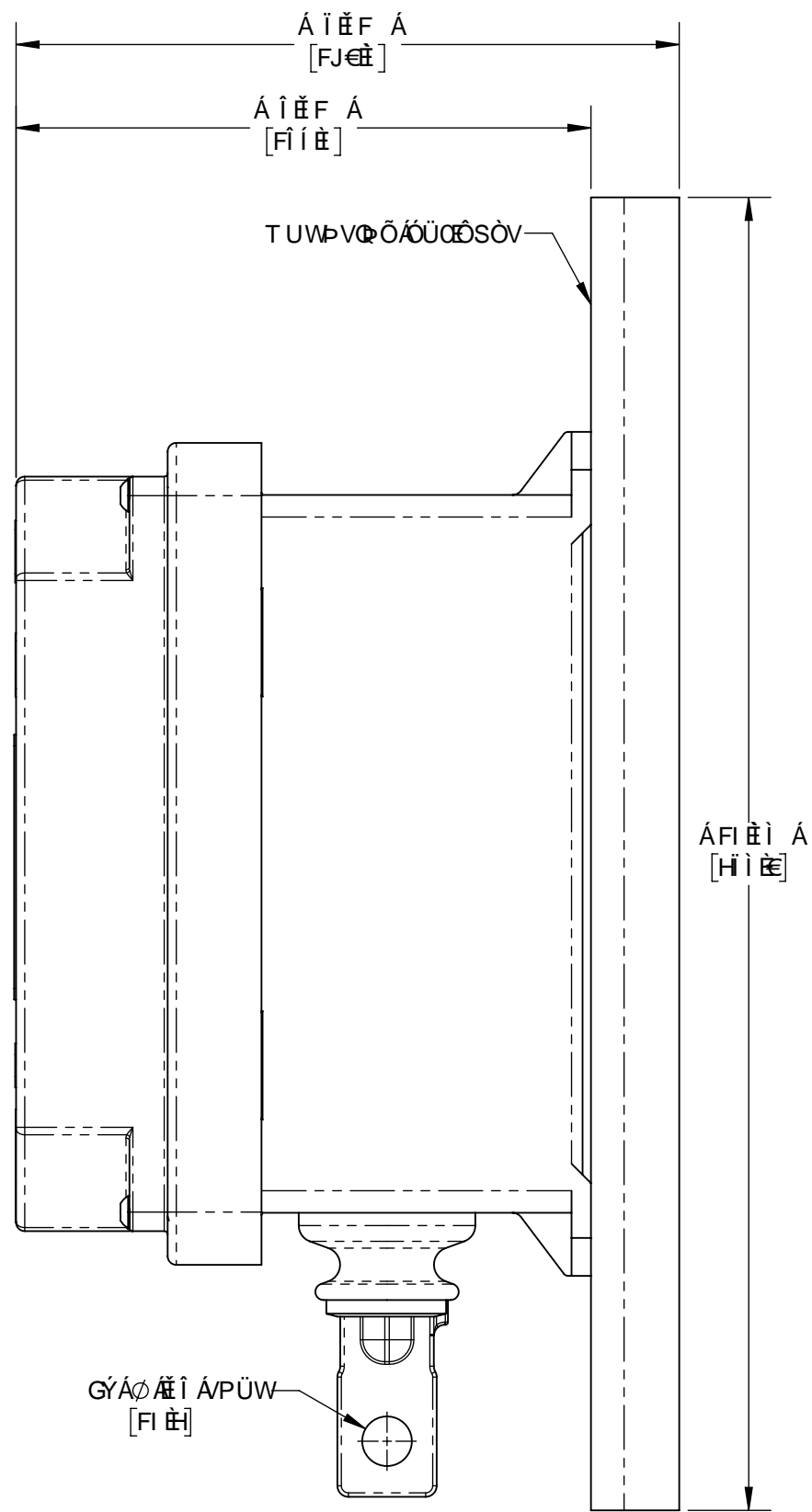


~~GCA9HF~~ 7 'J 9 K'

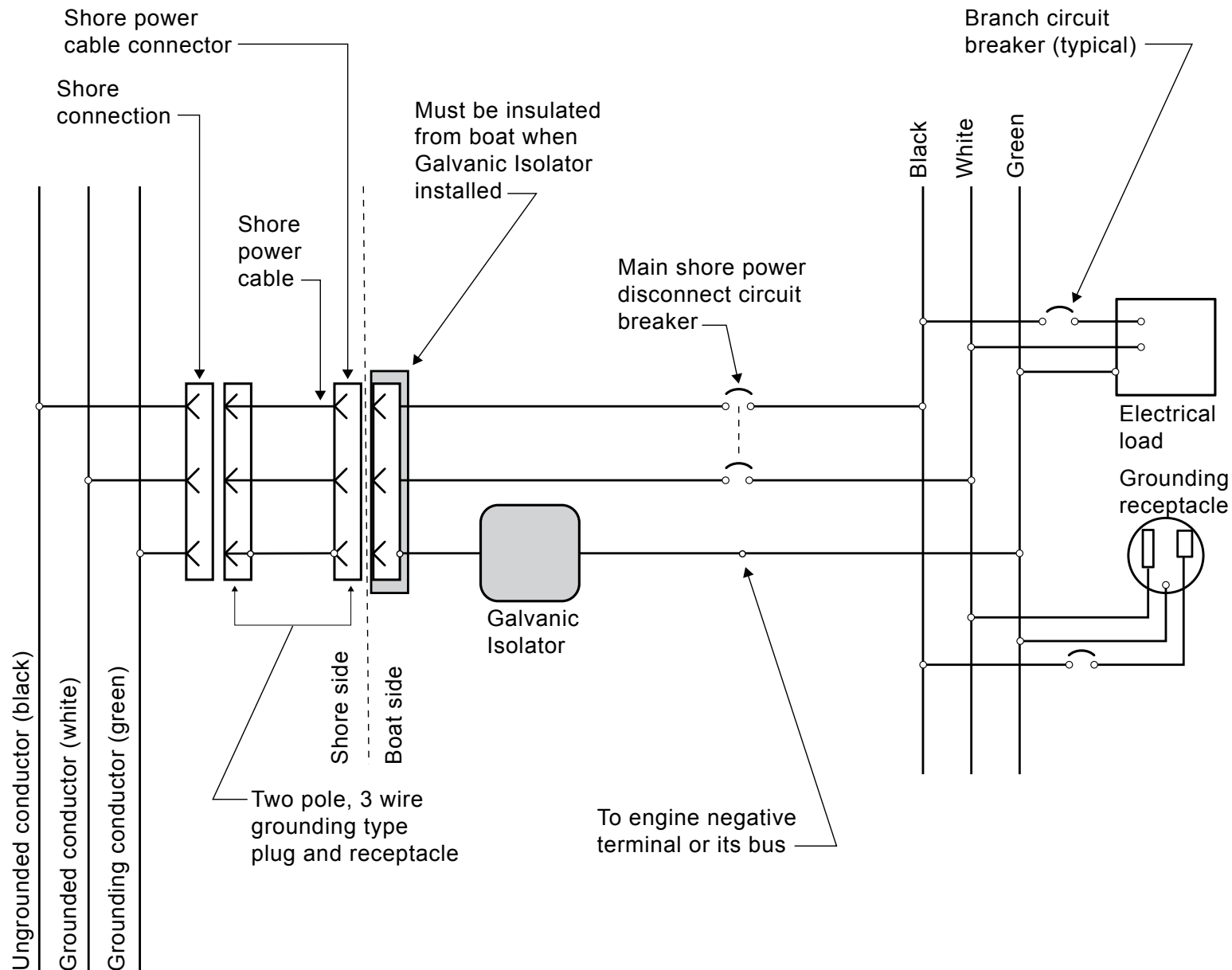
[illegible]



0UT 0A'F1 E' T A' F1 A' U' S' O' U' 		T 0E/0U'0E\$K B5		0U'0E' P'K A58		0E'0A'0U'0E' P'K %8#B8#B\$8\$			85-F M5B8 '9@97HF =75@ -B8I GHF -9GZ-B7"		
W'F S' O' U' A' U' P' O' U' W' O' A' U' O' O' O' O' A' O' F' O' P' U' W' P' U' A' U' O' A' O' P' O' U' E' O' U' T' U' W' U' O' E' O' P' O' U' O' O' A' U' O' U' E' P' O' U' A' U' A' O' O' A' P' O' W' A' S' S' Y' E'		0E/0U'0E\$K A58		0E'0A'0U'0E' P'K \$8#B8#B\$8%		D'C"6 CL"%+ GHCI ; <HCBZK =>') , - * \$, I , + , - \$ \$85 F M5B8 '7 CA					
'LLL'1'±'\$\$)'"" 'LL'1'±'\$\$% 'L'1'±'\$' " 5B; @G'1'±%		B5		A5F-B9'; 5 @J5B7' -GC @ HCF							
V'P' O' E' O' U' T' O' E' P' A' O' U' P' O' E' O' O' A' P' O' U' E' P' O' A' U' A' P' O' U' S' O' A' U' U' O' U' V' A' I' U' P' O' E' U' S' O' A' S' O' S' O' U' V' O' E' A' O' U' U' U' U' U' O' E' P' O' E' P' A' I' O' U' U' U' U' O' W' O' N' U' E' P' A' A' U' A' I' U' A' U' A' P' U' S' O' E' Y' O' P' U' W' A' P' O' A' Y' U' Q' U' O' P' A' J' O' U' T' W' I' U' A' P' A' I' O' U' E' U' S' O' A' S' O' S' O' U' U' O' E' P' O' E' O' W' U' U' U' U' U' U' O' E' O' R' A' U' A' U' U' P' O' O' E'				U' P' O' O' V' I' A' U' O' & (6 %& 5		O' Y' O' A' J' O' K' U' O' O' S' O' K' U' O' X' K' %\$\$\$% %			U' C' E' J' V' A' K'		

[illegible][illegible]

SHIP-TO-SHORE GROUND ISOLATION



Notes:

1. For installation of the Galvanic Isolator in other common electrical services, refer to ABYC Standard E-11, "AC and DC Electrical Systems on Boats" or contact Dairyland for assistance.
2. Applies to comparable single-phase or three-phase AC systems of any voltage class which utilize a separate grounding conductor.

Schematic from ABYC A-28



DAIRYLAND ELECTRICAL INDUSTRIES
Dairyland.com | marketing@dairyland.com | 608.877.9900