# CORROSION PROTECTION

## Section 7A - All Models

## Table of Contents



7 A

# Specifications

## Special Tools

| Description | Part Number |
|---|---|
| MerCathode Reference Electrode Test | 91-76675T1 |
| Quicksilver VOA Meter* | 91-93572 |

*If you do not already have this meter, use a digital multi-meter (such as Radio Shack 22-191). DO NOT use a standard analog (Needle-Type) Meter as inaccurate readings will result.

**IMPORTANT: Quicksilver Volt/Ohm Meter 91-93572 and Multi-Meter DVA/Tester 91-99750 are no longer recommended for testing corrosion protection.**

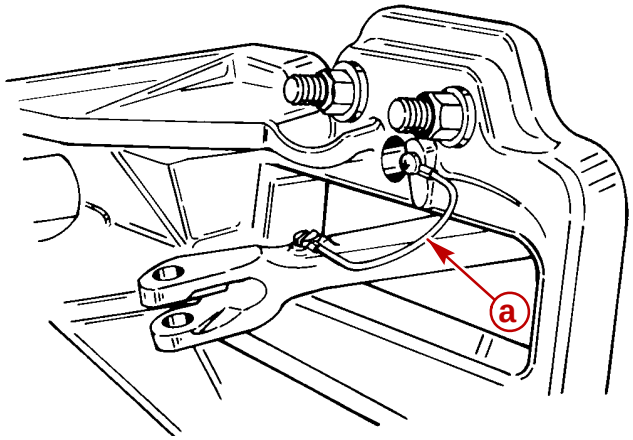
## Lubricants/Sealers/Adhesives

| Description | Part Number |
|---|---|
| Quicksilver Liquid Neoprene | 92-25711-3 |

# Continuity Circuit

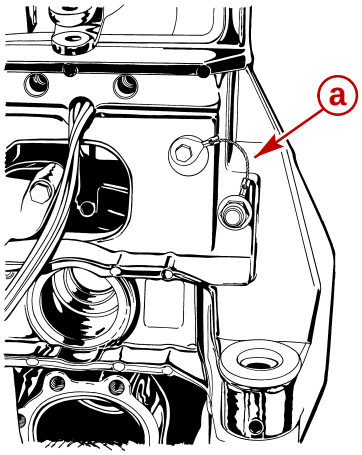
Transom assembly and sterndrive unit are equipped with ground circuit wires to ensure good electrical continuity between engine, transom assembly, and sterndrive components. Good continuity is essential for the zinc trim tab and MerCathode System to function effectively.

Inspect the following ground circuit components, at scheduled intervals (Section 1B), for loose connections, broken or fraying wires.

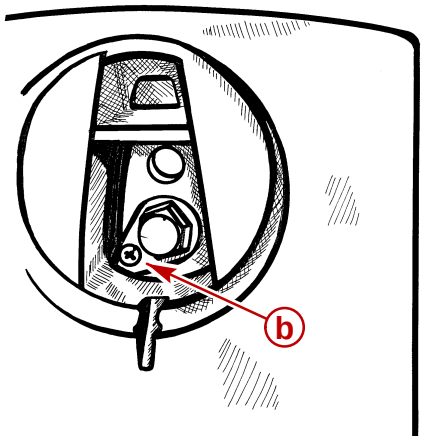



22028

**a** - Steering Lever Ground Wire

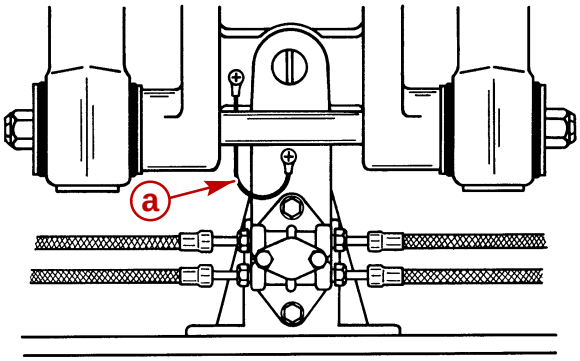



22650



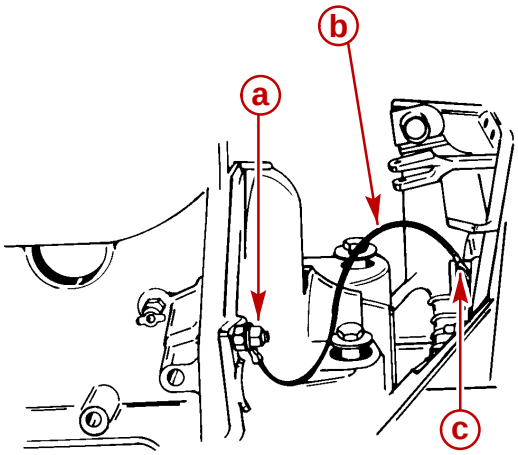

22754

**a** - Inner Transom Plate to Gimbal Housing Ground Wire
**b** - Driveshaft Housing to Gear Housing Ground Plate (Inside Trim Tab Cavity)




22230

**a** - Gimbal Housing to Gimbal Ring Ground Wire

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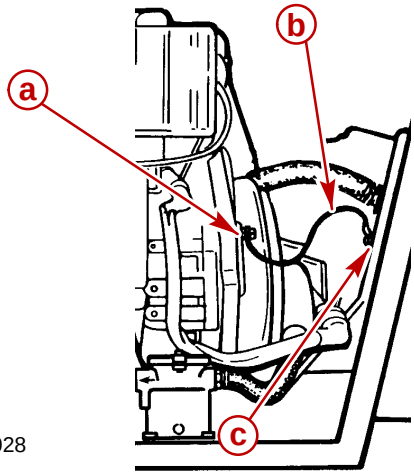
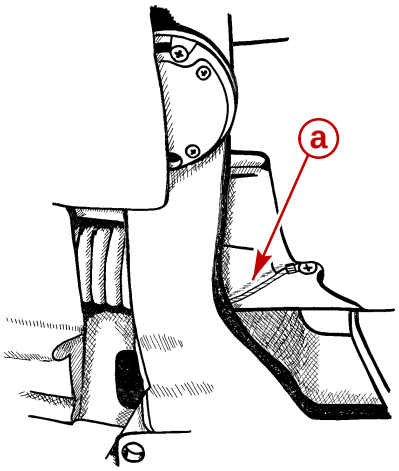



50242

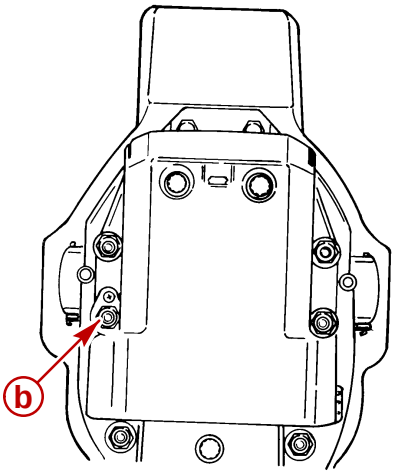
**Gasoline Models** **Diesel Models**

**a** - Flywheel Housing Grounding Stud
**b** - Ground Wire
**c** - Inner Transom Plate Grounding Screw

**IMPORTANT: Do Not Ground any accessories at the Transom Plate Grounding Screw.**

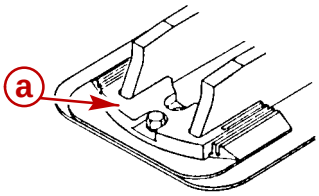


22755

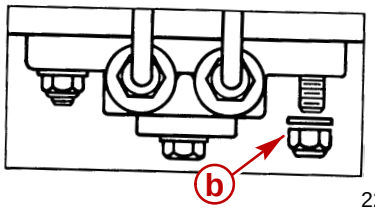


22031

**a** - Gimbal Ring To Bell Housing Ground Wire
**b** - Drive Unit To Bell Housing Ground Plate

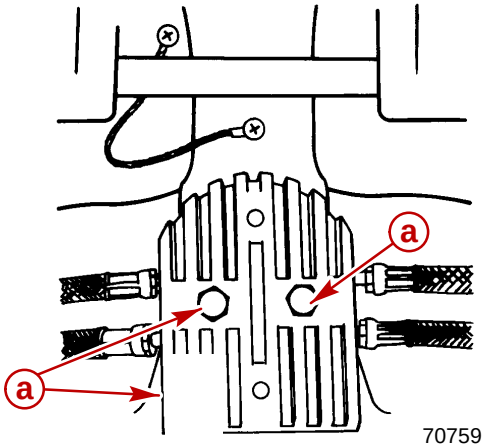


70575



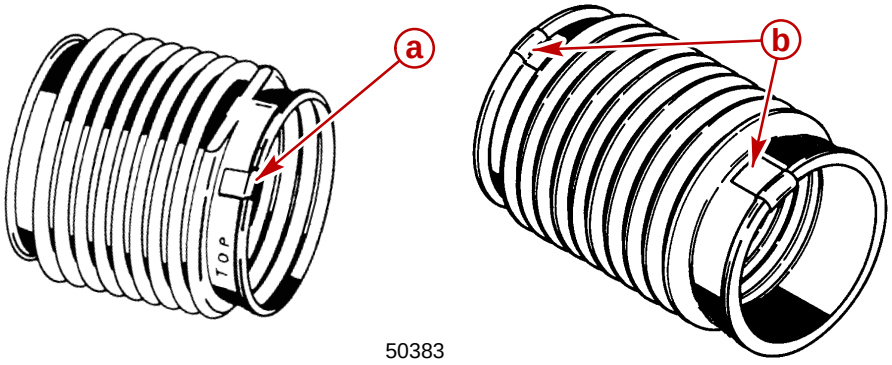
22230

**a** - Driveshaft Housing To Gear Housing Anodic Plate
**b** - Hydraulic Connector Block To Gimbal Housing Ground Washer



70759

**a** - Anodic Block To Hydraulic Manifold And Ground Washers (Beneath Screws).




50383 22079

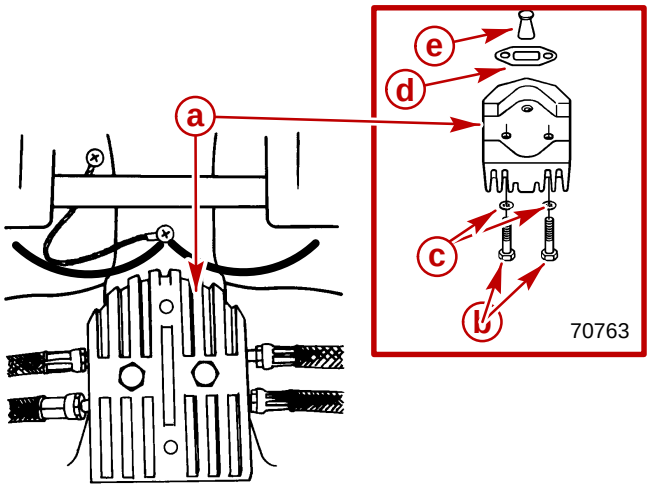
**a** - U-joint Bellows Ground Clip
**b** - Exhaust Bellows Ground Clips

# Anodic Block

**⚠ CAUTION**

**DO NOT paint new anodic block as this will render it ineffective as a galvanic corrosion inhibitor.**

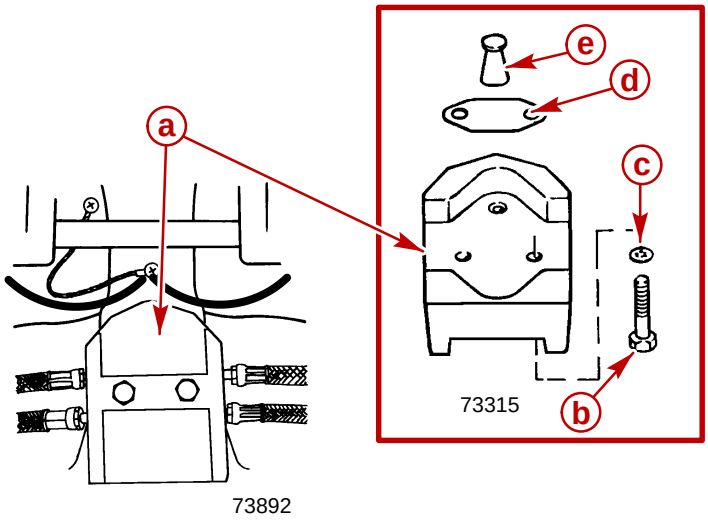
1. Remove screws, ground washers and gasket from anodic block. Remove anodic block to hydraulic manifold gasket and discard.




70759

**Earlier Style Anodic Block**

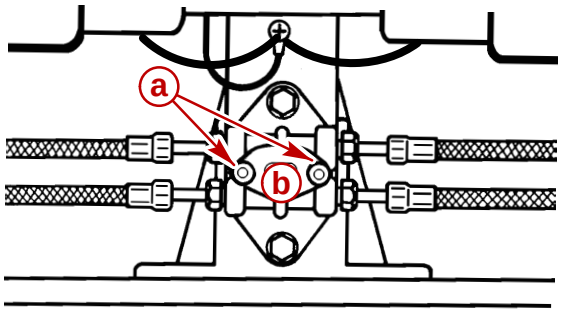
**a** - Anodic Block
**b** - Screws
**c** - Continuity Washers
**d** - Gasket
**e** - Seal




**Later Style Anodic Block**

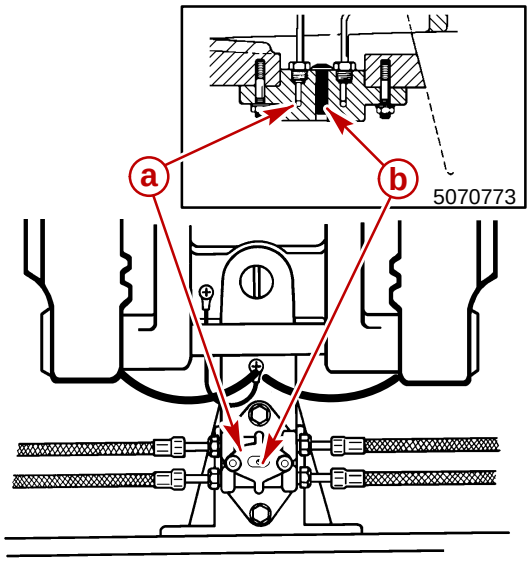
- **a** - Anodic Block
- **b** - Screw
- **c** - Continuity Washer
- **d** - Gasket
- **e** - Seal

2. Check condition of hydraulic manifold and clean any debris from threaded holes.




- **a** - Threaded Holes
- **b** - Hydraulic Manifold

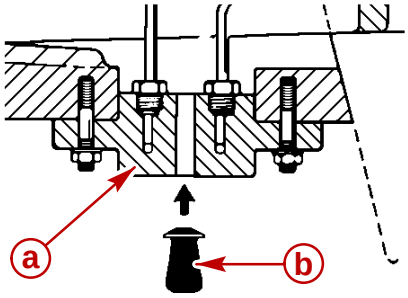
3. Examine rubber seal inside of hydraulic manifold block for signs of leakage or wear. Replace if necessary.




70748

**a** - Hydraulic Manifold
**b** - Rubber Seal

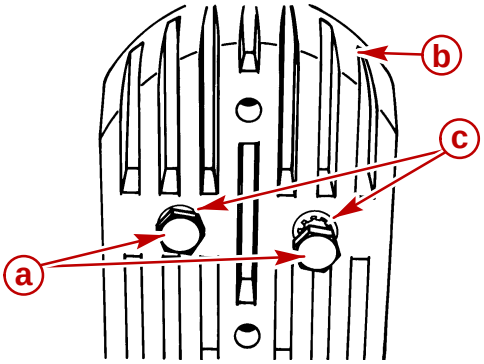
4. If rubber seal needs replacement, push old seal out of hydraulic manifold and install new seal as shown.




70774

**a** - Hydraulic Manifold
**b** - Rubber Seal

5. Install screws and washers into block as shown.



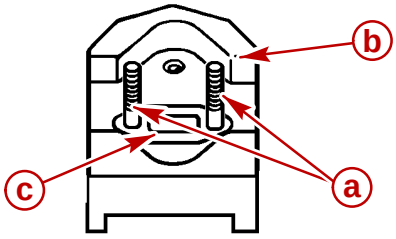

70760

**a** - Screws (2)
**b** - Anodic Block
**c** - Continuity Washers (2)

**⚠ CAUTION**

**To be effective, new anodic block MUST make good continuity contact with gimbal housing.**

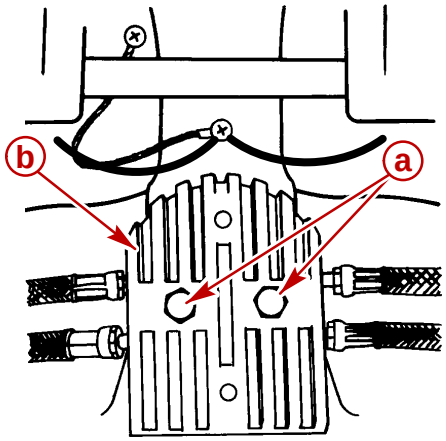
6. Be sure new gasket is in proper position between anodic block and hydraulic manifold. Apply Quicksilver Perfect Seal to threads of screw once they are through block.




70772

**a** - Screws (2)
**b** - Anodic Block
**c** - Gasket

7. Snug both screws evenly into hydraulic manifold, then torque to 100 lb-in. (11.5 Nm).




70759

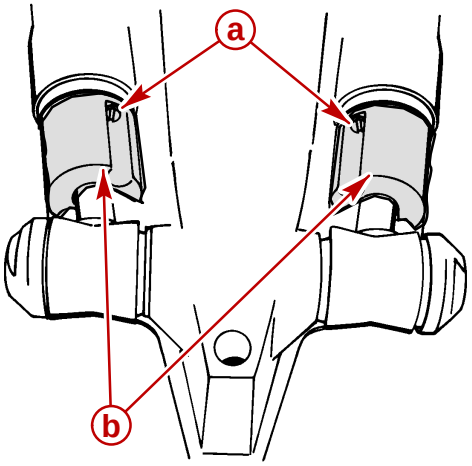
**a** - Screws and Washers
**b** - Anodic Block

# Trim Cylinder Anodes

**⚠ CAUTION**

**DO NOT paint new trim cylinder anodes, as this will render them ineffective as a galvanic corrosion inhibitor.**

1. Remove screws that secure anodes to trim cylinders. Remove anodes.



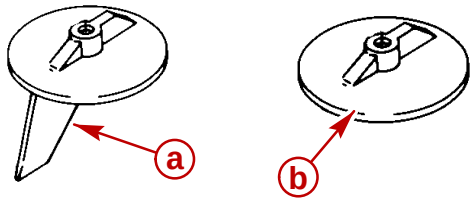

71966

**a** - Screws
**b** - Trim Cylinder Anodes

2. Scrape mounting surface on cylinder end-cap down to bare metal.
3. Install new anodes and tighten securely.

# Anodic Trim Tab or Plate

***NOTE:*** *Later models are equipped with an anodic plate instead of trim tab. Replacement procedure is the same.*




75251

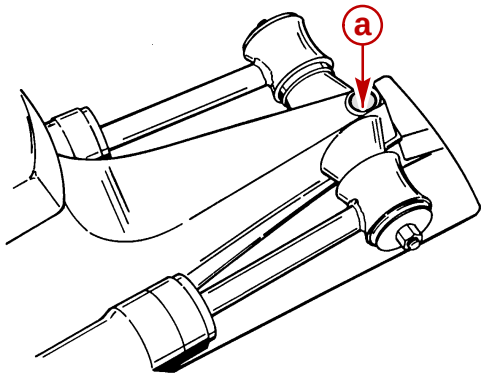
**a** - Trim Tab
**b** - Anodic Plate

**⚠ CAUTION**

**DO NOT paint new trim tab (or anodic plate), as this will render it ineffective as a galvanic corrosion inhibitor.**

## Replacement

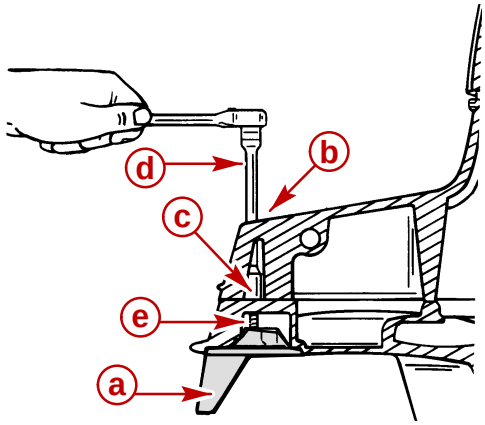
1. Remove plug from driveshaft housing to gain access to attaching screw.




22093

**a** - Plug

2. Use a 1/2 in. standard socket and extension, loosen screw, and remove trim tab (or anodic plate).



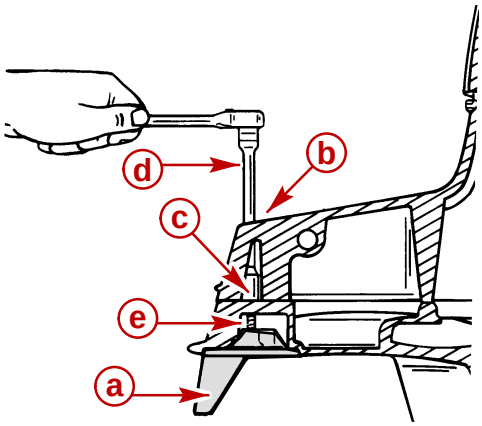

22258

**a** - Trim Tab (Or Anodic Plate, Depending Upon Model)
**b** - Plug - (Removed)
**c** - 1/2 in. Socket
**d** - Extension
**e** - Screw

**⚠ CAUTION**

**To be effective, new trim tab (or anodic plate) MUST make good electrical contact with gear housing.**

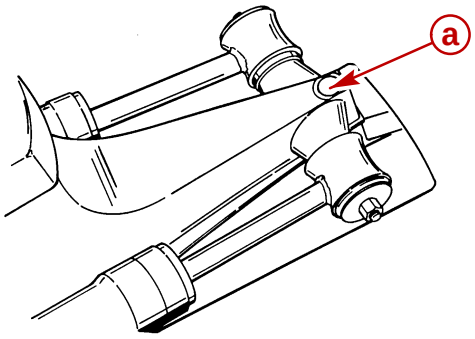
3. Scrape trim tab (or anodic plate) mounting surface on gear housing down to bare metal.
4. Install trim tab and align straight back. Torque screw to 30 lb-ft (40.5 Nm).




22258

**a** - Trim Tab (Or Anodic Plate, Depending Upon Model)
**b** - Plug - (Removed)
**c** - 1/2 in. Socket
**d** - Extension
**e** - Screw

5. Reinstall plug in driveshaft housing.

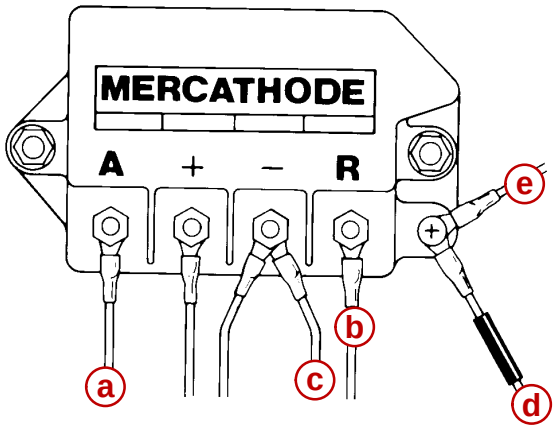



22093

# Integral MerCathode System

## Removing Electrode Assembly

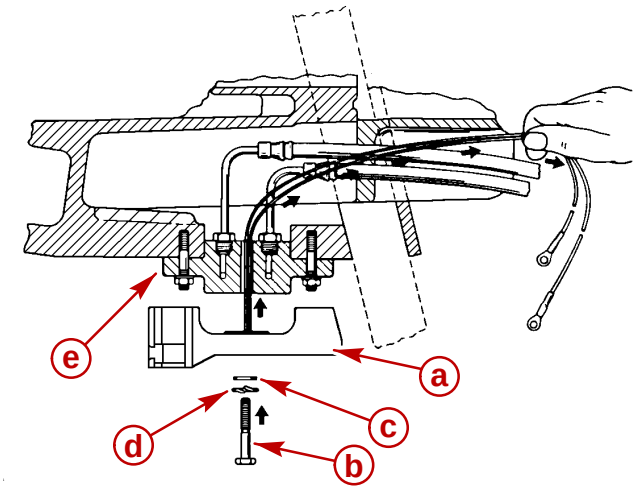
1. Disconnect electrode assembly wires from MerCathode Controller.




22032

**a** - Electrode Assembly Wire (Orange)
**b** - Electrode Assembly Wire (Brown)
**c** - Earlier Models - Trim Position Sender Wire (Black)
**d** - Earlier Models - Trim Position Sender Wire (Black)
**e** - Earlier Models - Wire to Trim Position Gauge (Brown/White)

2. Remove two screws, flat washers and lock washers; then remove electrode assembly.




70771

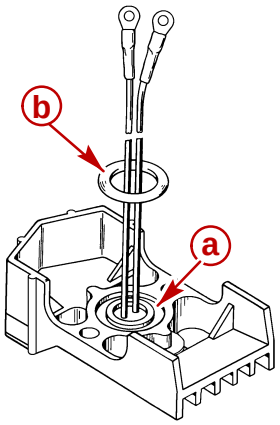
**a** - Electrode Assembly
**b** - Screw (2)
**c** - Flat Washer (2)
**d** - Lock Washer (2)
**e** - Hydraulic Connector Block

# Installing Electrode Assembly

**⚠ CAUTION**

**O-ring MUST BE properly seated in groove of electrode assembly or water leakage into boat will result.**

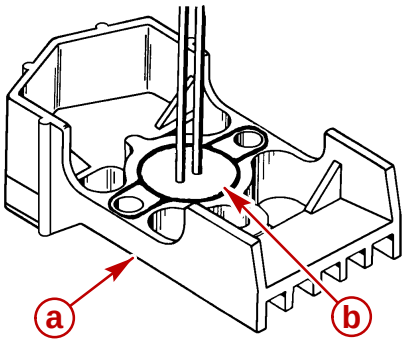
1. **Earlier Model Electrodes:** Install the O-ring over the orange and brown wires from the electrode assembly. Seat the O-ring in the groove. DO NOT use any type of sealer on the O-ring.




70756

**a** - O-ring Groove
**b** - O-ring

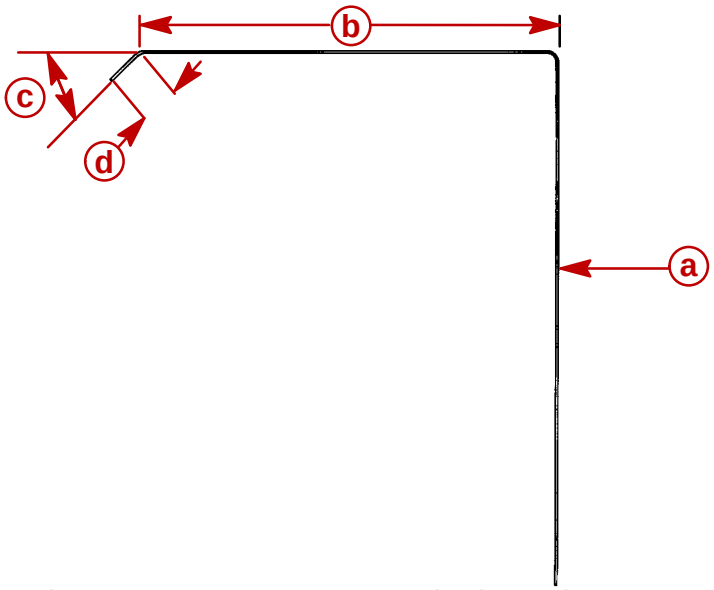
2. **Later Model Electrodes:** Later model electrodes have a factory installed rubber grommet and DO NOT require an O-ring.




71862

**a** - Electrode
**b** - Rubber Grommet

3. Form a 2 ft. (610mm) long piece of approximately .032 in. diameter wire to the dimensions shown.

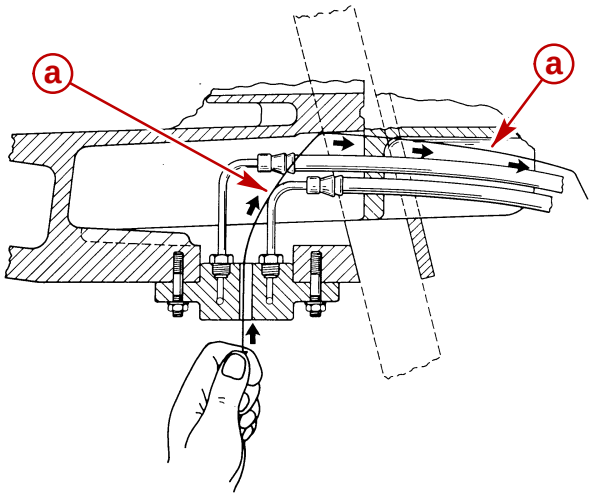



74106

**a** - 2 ft. (610 mm) OF APPROXIMATELY .032 in. (.8 mm) DIA. WIRE
**b** - 5 in. (123 mm)
**c** - 45° Angle
**d** - 1/2 in. (13 mm)

4. Insert 45° angle end of wire through center hole in hydraulic connector block.

5. Guide wire through hole until wire protrudes through cavity on the bottom of exhaust pipe.



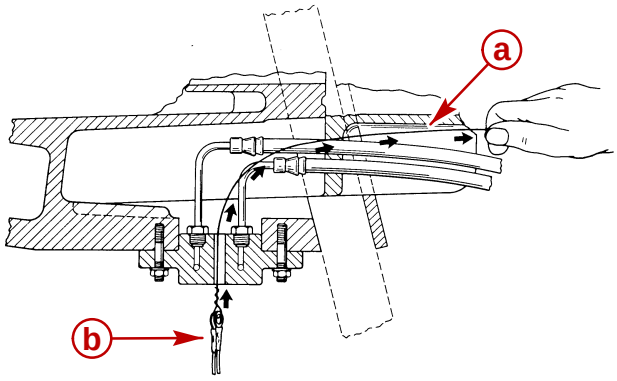

22235

**a** - Wire

6. Secure ring terminals to tracer wire.
7. Guide leads through center hole in connector block.

**IMPORTANT: Orange lead is approximately 6 in. (150 mm) longer than the brown lead.**

8. Pull leads ALL the way into the boat.



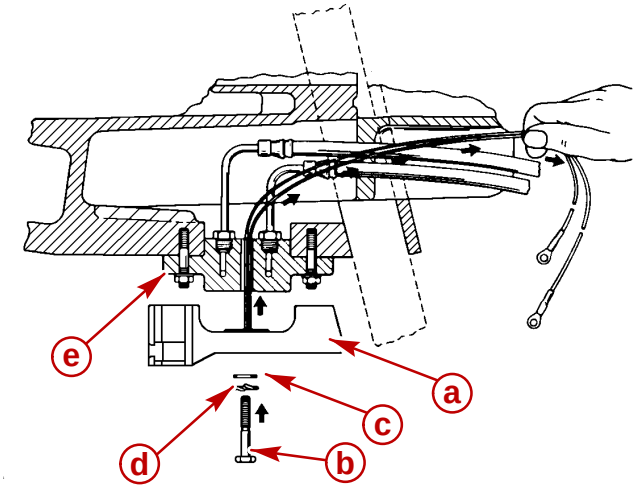

22234

**a** - Wire
**b** - Leads

**⚠ CAUTION**

**DO NOT paint sacrificial anodes or MerCathode System electrode assembly, as this will render them ineffective as galvanic corrosion inhibitors.**

9. Position and secure electrode assembly to gimbal housing using two 1-3/8 in. (35mm) long screws, flat washers and lockwashers. Torque to 25 lb-in. (2.8 Nm). DO NOT OVERTIGHTEN.




70771

**a** - Electrode Assembly
**b** - Screw (2)
**c** - Flat Washer (2)
**d** - Lock Washer (2)
**e** - Hydraulic Connector Block

## Connect Electrical Leads to Controller Assembly

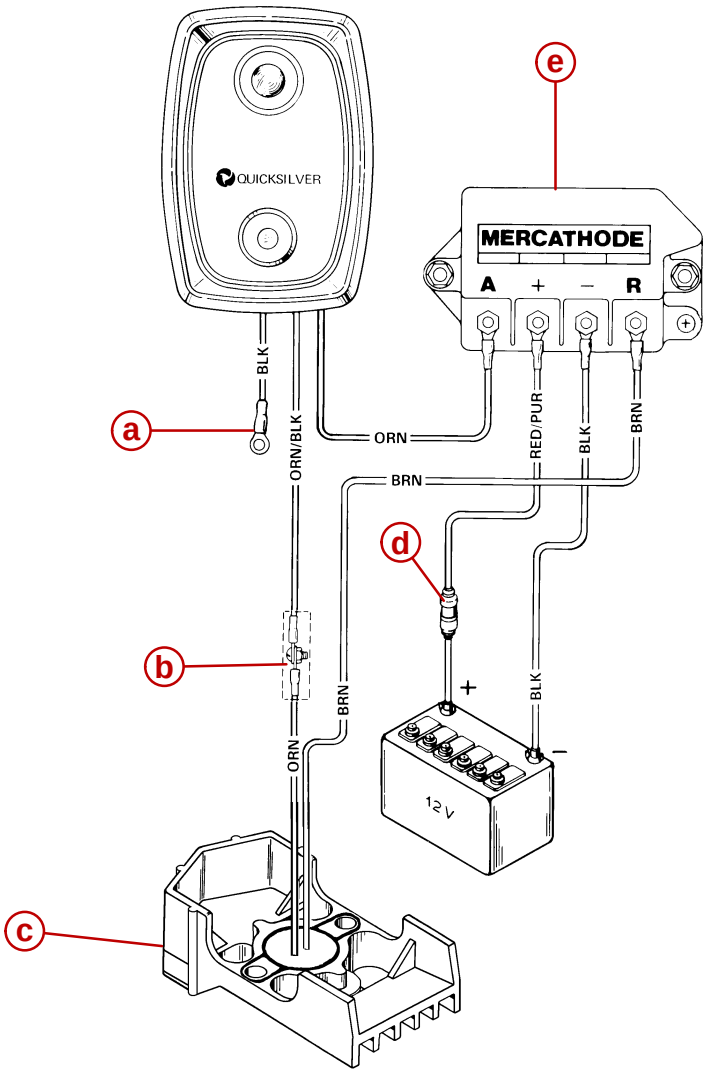
***NOTE:*** *If black (ground) wire is not available at terminal block or from wire harness, install a separate lead between controller negative (–) terminal and negative (–) battery cable attaching point on engine.*

1. Connect electrical leads to controller assembly, securely. (See applicable Wiring Diagrams, following.)
2. Apply a thin coat of Quicksilver Liquid Neoprene (92-25711) to ALL electrical connections.

# Wiring Diagrams

## MerCathode Monitor

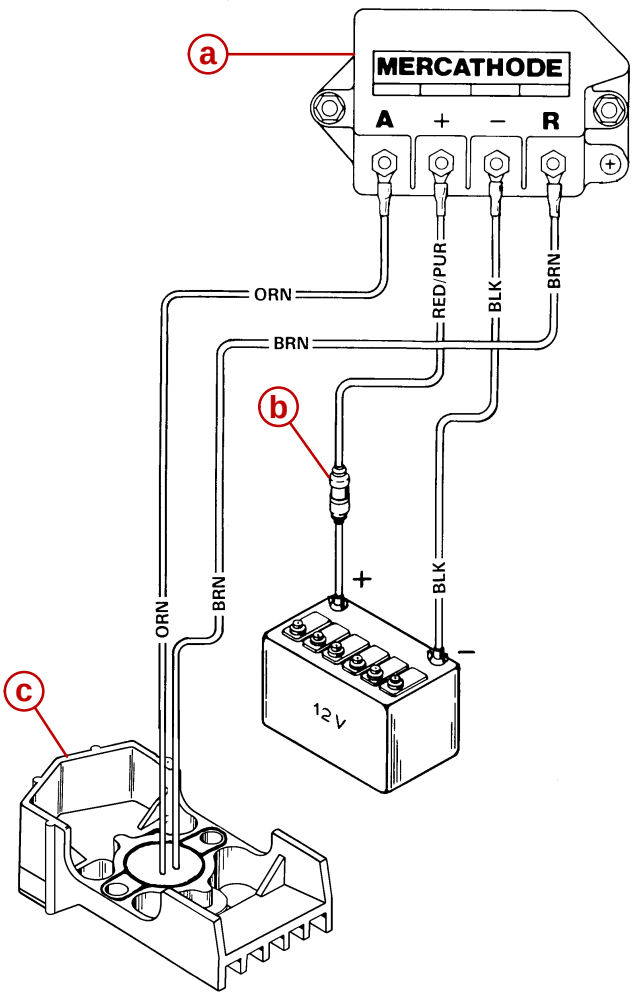
BLK = Black
BLU = Blue
BRN = Brown
GRY = Gray
GRN = Green
ORN = Orange
PNK = Pink
PUR = Purple
RED = Red
TAN = Tan
WHT = White
YEL = Yellow
LIT = Light
DRK = Dark




74251

**a** - Ground to a Suitable Ground on the Instrument Panel
**b** - Screw, Nut and Sleeve
**c** - Electrode
**d** - 20 Amp Fuse
**e** - Controller

# MerCathode Controller

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LIT = Light
DRK = Dark

73596

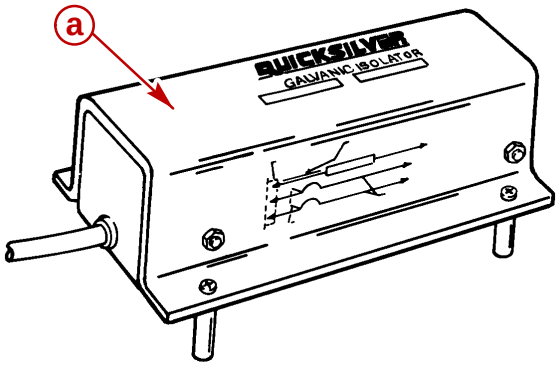
**a** - Controller
**b** - 20 Amp Fuse
**c** - Electrode

# Quicksilver Isolator

Boats, which are connected to A.C. shore power require additional protection, to prevent destructive low voltage galvanic currents from passing thru the shore power ground wire. A Quicksilver Isolator (18478A2) can be installed to block the passage of these currents, while still providing a path to ground for dangerous fault (shock) currents.

**⚠ CAUTION**

**If A.C. shore power is not isolated from boat ground, the MerCathode System and sacrificial anodes may be unable to handle the increased galvanic corrosion potential.**




70972

**a -** Quicksilver Isolator

# Corrosion Protection Testing and Troubleshooting

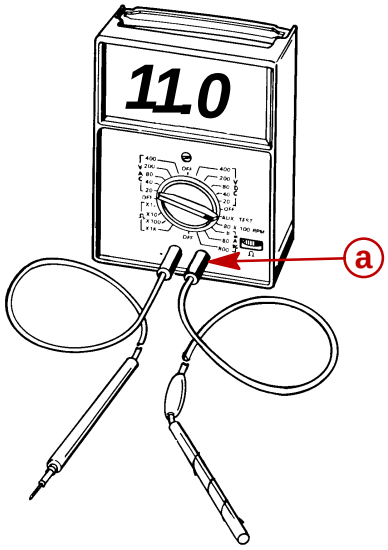
***NOTE:*** *The following corrosion protection test supersedes all previously issued tests. This test can be used on applications with or without a MerCathode System.*

If the unit is equipped with a MerCathode System, this test should be performed annually where the boat is moored to ensure that the system is functioning properly.

Test requires the us of MerCathode Reference Electrode Test 76675A1 and Quicksilver VOA meter 91-62562A1. This meter is no longer available from Mercury Marine. If you do not already have this meter, a digital multi-meter must be used. A STANDARD ANALOG METER CANNOT BE USED, AS AN INACCURATE READING WILL RESULT.

**IMPORTANT: Quicksilver Volt/Ohm Meter 91–93572 and Multi-Meter DVA/Tester 91-99750 are no longer recommended for testing corrosion protection.**

The MerCathode Reference Electrode Tester 76675A1 is equipped with a special jack containing a resistor to provide the proper scale reading when used with a digital multimeter. **Do NOT remove this plug or use analog meters.** Resistor jack can be left in place when using digital meters.




76834

**Digital Multimeter and MerCathode Reference Tester 76675A1**

**a -** Special Resistor Jack

***NOTE:*** *Set-up test equipment as shown on page 7A-21.*

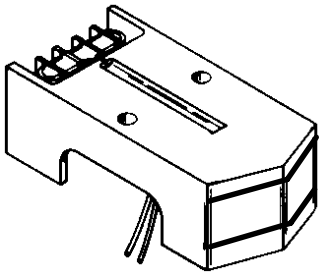
**IMPORTANT: Be sure to observe the following when performing test:**

- If equipped with MerCathode System, ensure battery is fully charged (12.6 Volts or above).
- Boats recently placed in service usually will produce a reading higher than normal because the sterndrive unit is protected by a good finish and new sacrificial anodes. To obtain an accurate diagnosis, the test should be performed after the boat has been in service at least one or two weeks. This will give the paint a chance to soak and minor abrasions and scratches will have appeared resulting in a more accurate reading.
- Boats should be moored, without being operated, for at least 8 hours before performing tests. This is necessary to allow the MerCathode System and/or sacrificial anodes to polarize the surrounding water. Be careful not to rock the boat excessively while boarding to perform a test as this will alter the test reading.

1. Plug negative meter lead into negative (–) receptacle of meter. Connect other end of lead to negative (–) battery terminal or other convenient engine ground.
2. Plug Reference Electrode Tester lead into positive (+) receptacle of meter.
3. Set meter on scale required to read 0-2000 millivolts (0-2 volts).

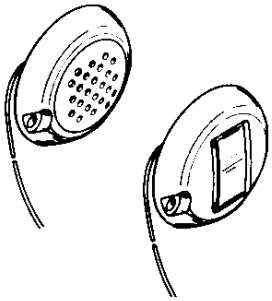
4. Immerse Electrode Tester in the water within 6 in. (150 mm) of aft end of sterndrive unit.

**IMPORTANT: There will be different voltage readings depending on the type of Mer-Cathode System you are testing.**



76868

**Electrode Mounted on Bottom of Transom Assembly**



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**Electrodes Mounted on Boat Transom**

5. The following readings indicate that the sterndrive unit is adequately protected:

   a. **MODELS WITH ELECTRODE MOUNTED ON BOAT TRANSOM**

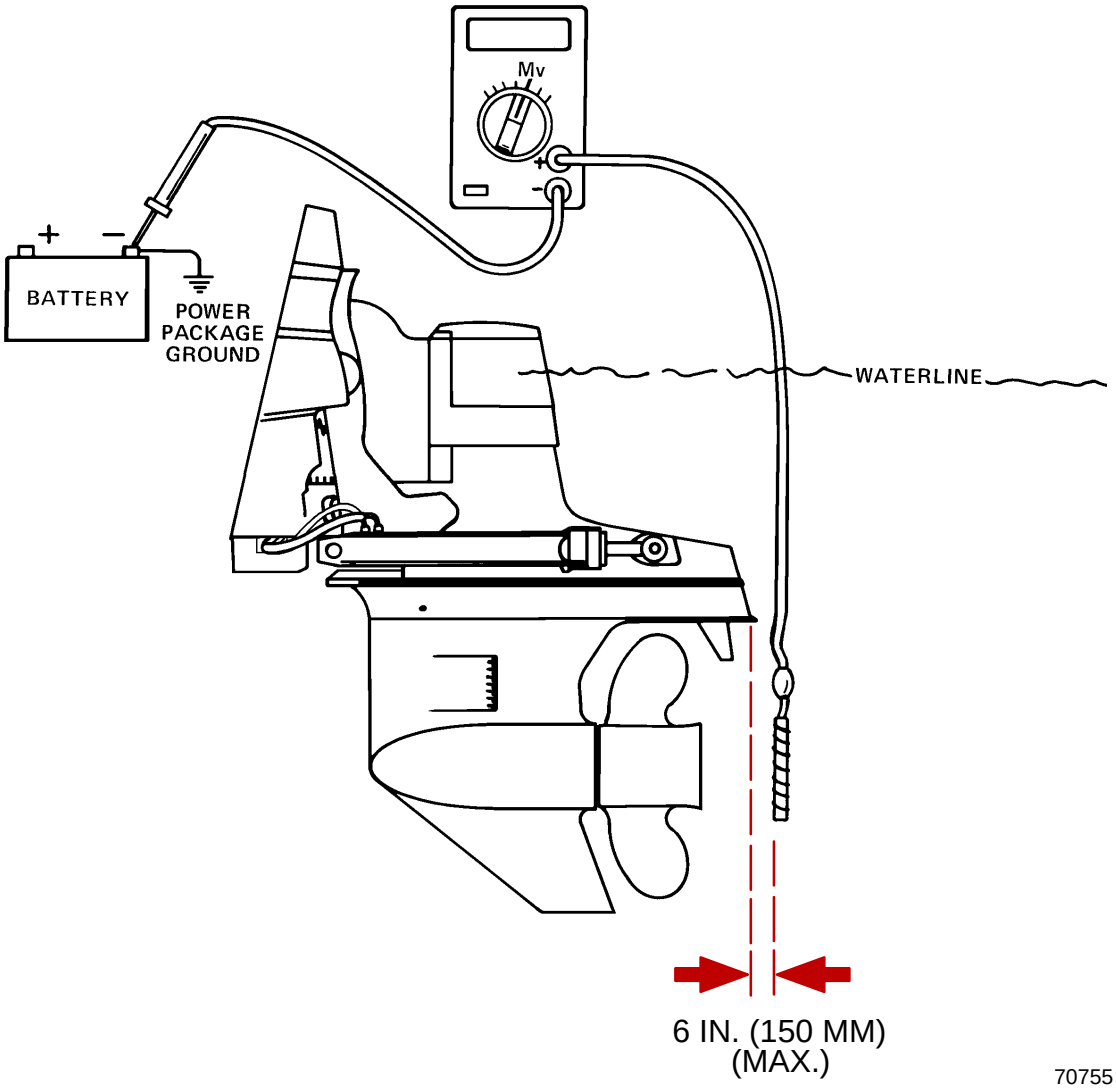
| | Fresh Water Areas | Salt, Polluted or Mineral Laden Water Areas |
|---|---|---|
| **Quicksilver VOA Meter** | 7.5 - 10.5 millivolts | 8.8 - 10.5 millivolts |
| **Digital Meter** | 750 - 1050 millivolts | 880 - 1050 millivolts |

   b. **MODELS WITH ELECTRODE MOUNTED ON BOTTOM OF TRANSOM ASSEMBLY**

| | Fresh Water Areas | Salt, Polluted or Mineral Laden Water Areas |
|---|---|---|
| **Quicksilver VOA Meter** | 6.2 - 11.8 millivolts | 7.5 - 11.8 millivolts |
| **Digital Meter** | 620 - 1180 millivolts | 750 - 1180 millivolts |

6. If the reading is not within specified limits, or if reading is within specifications but there is evidence of corrosion on sterndrive, refer to the following troubleshooting charts to aid in diagnosis.

# Test Equipment Set-Up



## Low Readings

| Cause | Special Instructions |
|---|---|
| Loss of continuity between sterndrive unit components and negative (-) battery terminal. | Ensure that continuity devices are not missing or damaged and that connections are clean and tight. |
| Shore power green safety grounding lead not isolated from the power package ground on boats equipped with shore power. | Disconnect shore power and verify if reading increases. If so, install a Quicksilver Isolator P/N 18478A2 or an isolation transformer. |
| Underwater metal parts on the sterndrive unit and/or boat are unpainted or the paint is in poor condition. The boat has more exposed metal than the anodes and/or MerCathode system can protect. | Prime and paint underwater metal parts. This will reduce the load on the anodes and/or MerCathode system. |
| Anodes painted. | Remove paint or replace anodes. |
| The anodes are improperly grounded or inactive. | Clean anode mounting surface or replace anodes if they have oxidized. |
| Anodes consumed (no longer protect). | Replace anodes if eroded 50% or more. |
| Sterndrive unit and/or boat bottom painted with anti-fouling paint containing copper or tin. | Avoid any electrical interconnection between the MerCruiser product, anodic blocks, or MerCathode system and the paint by allowing a minimum of 1-1/2 in. (40 mm) of UNPAINTED area around these items on the transom of the boat. |
| MerCathode reference electrode or anode painted. | Remove paint. |
| Anodic heads used instead of plastic caps. | Reinstall the plastic caps. |
| No power to MerCathode controller. | Connect the positive (+) volt meter lead (set on 0-20 volt scale) to the positive (+) controller terminal and the negative (–) volt meter lead to the negative (–) terminal. The meter should indicate battery voltage. Check for a blown fuse (if equipped) on the starboard MerCathode system. Clean the connection or repair wiring as required. |
| Poor connection between reference electrode lead (brown) or anode lead (orange) and MerCathode controller. | Clean and/or tighten the connection. Repair the wiring. |

## Low Readings (continued)

| Cause | Special Instructions |
|---|---|
| Faulty MerCathode reference electrode. | Disconnect the reference electrode lead(brown) from the controller “R” terminal. Connect the lead to the positive (+) terminal of a digital multimeter (set on 0-2000 millivolt scale). Connect the negative (–) meter lead to the negative (–) battery terminal. Note the meter reading; then repeat the test using a MerCathode Reference Electrode Tester 76675A1. You should obtain the same reading in both cases. If not, replace the reference electrode. |
| Faulty MerCathode Controller. | With anode and reference electrode leads connected to the controller, connect the jumper wire between “R” and negative (-) terminals on the controller. Connect the positive (+) lead of the volt meter (set on 0-20 scale) to terminal “A” on the controller. Connect the negative (-) meter lead to the negative (-) controller terminal. Reading should be as follows:<br>● **Freshwater Areas -**<br>Electrodes Mounted on boat transom: 7.5 - 10.5 Millivolts<br>Electrode mounted on bottom transom assembly: 6.2 - 11.8 Millivolts<br>● **Saltwater Areas -**<br>Electrodes mounted on boat transom: 8.8 - 10.5 Millivolts<br>Electrode mounted on bottom of transom assembly: 7.5 - 11.8 Millivolts<br>If the reading is low, replace the controller. |
| Additional corrosion protection required. Boats equipped with a sizable amount of underwater metal (stainless steel prop, after planes, etc.), or that are moored in an area with warm or rapid flowing water may require additional protection. | Install additional anodes or MerCathode system 88334A2. If the unit is already equipped with a MerCathode system, a second system may be required. |

## High Reading

| Cause | Special Instructions |
|---|---|
| Stray current corrosion. If an electrical current flowing along a metal conductor leaves the metal for a water path, it will cause ionization of the metal, and an area of rapid corrosion. | Observe the reading while disconnecting the electrical components one at a time until you eliminate the high reading. Correct the course of stray current. |
| Poor connection between MerCathode reference electrode lead (brown) and “R” terminal on controller. | Clean and /or tighten connection. Repair wiring as required. |
| Faulty MerCathode reference electrode. | Disconnect the reference electrode lead (brown) from “R” terminal on the controller. Connect the lead to the positive (+) terminal of a digital multi-meter (set on 0-2000 millivolt scale). Connect the negative (–) meter lead to the negative (–) battery terminal. Note the meter reading; then, repeat the test using MerCathode Reference Electrode Tester 76675A1. Both tools should produce the same reading. If not, replace the reference electrode. |
| Faulty MerCathode controller. | Replace the controller. |

## Normal Reading But Corrosion is Evident

### CORROSION ON THE ENTIRE STERNDRIVE UNIT

| Cause | Special Instructions |
|---|---|
| The sterndrive unit is raised so that the sacrificial anodic trim tab is out of the water. | Leave the sterndrive unit in the IN/DOWN position when the boat is moored to ensure the trim tab is in the water, providing protection. |

### CORROSION PROBLEM DEVELOPED AFTER REFINISHING THE DRIVE UNIT

| Cause | Special Instructions |
|---|---|
| A steel wire brush was used to clean the aluminum casting. Steel particles became en-trapped and set up a small galvanic cell. | Use only a nylon or bristle brush. |

### PAINT BLISTERING ON DRIVE UNIT

| Cause | Special Instructions |
|---|---|
| Battery charger, using 110 volt shore power improperly connected to the battery. | Ensure the charger is connected correctly. |

## TRIM CYLINDER CORRODING

| Cause | Special Instructions |
|---|---|
| Continuity lost between trim cylinder and drive unit. | Install proper continuity devices. |

## ONLY ONE OR TWO COMPONENTS CORRODING

| Cause | Special Instructions |
|---|---|
| Continuity lost between drive unit and components. | If not already done, install Continuity Circuit Kit 99940A1. |

## CORROSION IN THE EXHAUST OUTLET AREA

| Cause | Special Instructions |
|---|---|
| Exhaust gas deposits accumulating on the drive exterior can result in paint blistering and corrosion. | Remove deposits with marine or automotive wax. |

## CORROSION OCCURS AFTER THE UNIT IS REMOVED FROM THE WATER

| Cause | Special Instructions |
|---|---|
| Salt crystals remaining on the surface of the drive components combine with high humidity to cause electrolyte formation, resulting in corrosion. | Wash drive exterior and flush drive interior with fresh water. |

## CORROSION BETWEEN SURFACES

| Cause | Special Instructions |
|---|---|
| Salt buildup between surfaces. | Protect mating parts with Quicksilver Special Lubricant 101, Perfect Seal or Quicksilver 2-4-C Marine Lubricant. |

## ALUMINUM CORRODING IN LUBRICATED AREAS

| Cause | Special Instructions |
|---|---|
| Graphite in the lubricant. | Never use lubricants containing graphite because they accelerate corrosion. Use specially formulated Quicksilver marine lubricants. |

## STAINLESS STEEL COMPONENTS CORRODING

| Cause | Special Instructions |
|---|---|
| Foreign matter (fishing line, marine growth, etc.) covering the steel and starving it of oxygen. This causes a breakdown of the protective oxide film and subsequent corrosion (known as oxygen starvation corrosion). Burying stainless steel in sand or silt can also cause this problem. | Remove foreign matter and prevent surfaces from being covered by sand or silt. |

## STAINLESS STEEL PROPELLER CORRODING

| Cause | Special Instructions |
|---|---|
| Continuity lost between propeller and propeller shaft. | Clean the mating surfaces on the propeller, propeller shaft and attaching parts. If applicable, install a continuity washer. |

## PAINT BLISTERING - THE METAL UNDER THE BLISTERED PAINT IS NOT PITTED

| Cause | Special Instructions |
|---|---|
| The surface was not properly prepared before paint was applied. | Sand the surface down to bare metal, prime and repaint with Quicksilver Spray Paint. |

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