

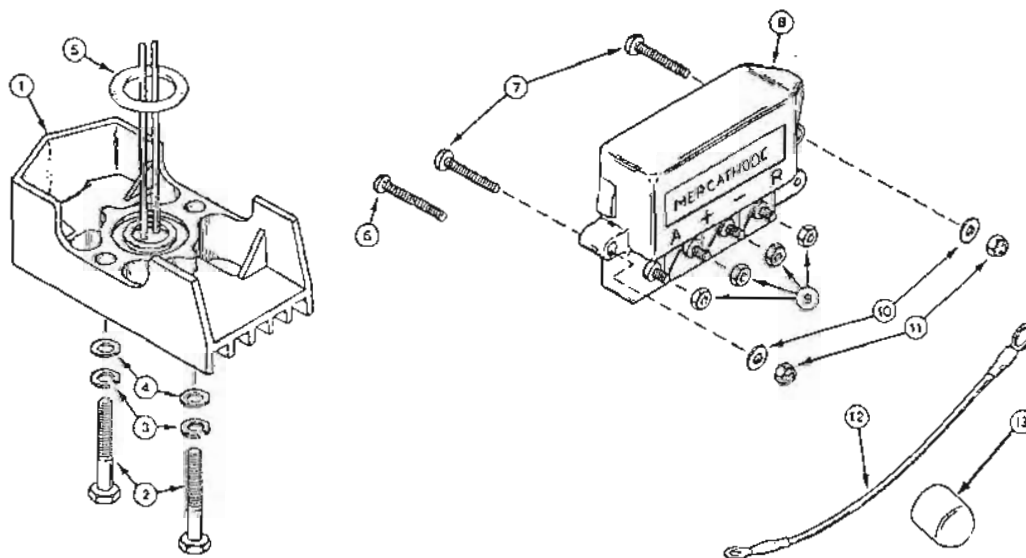
- A. New MerCathode System for MerCruiser 120-thru-260 R & MR Models
- B. Improved Corrosion Resistance On New Trim Cylinders
- C. Stern Drive Continuity Test
- D. Stainless Steel Propellers Corroding
- E. Anti-Fouling Paint Usage On MerCruiser Stern Drives
- F. Inactive Sacrificial Zinc Anodes
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CIRCULATE TO:
 SERVICE MANAGER
 PARTS MANAGER
 MECHANICS
 "Place in a Service Bulletin Binder"

A. NEW MERCATHODE SYSTEM FOR MERCUISER 120-thru-260 R & MR MODELS

A new MerCathode System is now available for MerCruiser 120-thru-260 R & MR models. (Figure 1) At this time, this system is available as a factory option only.

The new system features an electrode assembly with an integrated reference electrode and anode. The electrode assembly attaches directly to the bottom of the gimbal housing, thus eliminating the need to drill holes thru the transom as was required with the old system. A new controller attaches directly to the engine, providing a quick, convenient installation.



376-H

REF. NO.	PART NO.	DESCRIPTION	SIZE	QTY.
1	98869A3	Electrode Assembly	-----	1
2	10-69067	Screw	1/4"-20 x 1-3/8" (35mm) Long	2
3	13-26992	Lockwasher	1/4" ID	2
4	12-29245	Flat Washer	1/2" OD x 17/64" ID x 1/16" THK	2
5	25-88388	"O" Ring	-----	1
6	10-72202	Screw	10-32 x 1-1/4" (32mm) Long	1
7	10-24637	Screw	10-32 x 7/8" (22mm) Long	2
8	42600A1	Controller Assembly	-----	1
9	11-68219	Nut	10-32	4
10	12-20286	Flat Washer	7/16" OD x 13/64" ID x 1/16" THK	2
11	11-46438	Lock Nut	10-32	2
12	84-88543A3	Cable Assembly	-----	1
13	44574	Plastic Cap	-----	1

Figure 1. MerCruiser 120-thru-260 R & MR MerCathode System

To ensure proper operation of the new MerCathode System, the following information **MUST BE** observed.

- **DO NOT** paint electrode assembly as this will render the system inoperative.
- Do not replace plastic caps (Figure 2) with zinc anode heads, as this will affect the operation of the MerCathode System.

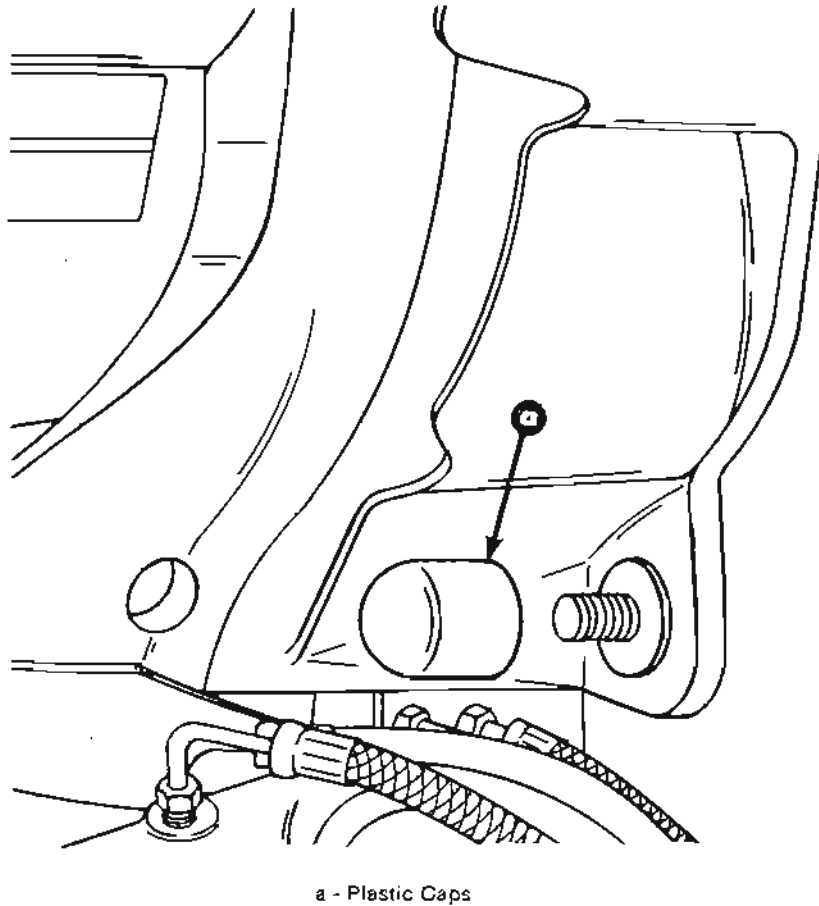


Figure 2. Gimbal Housing Plastic Caps

- Power supply for MerCathode System is provided by the engine wiring harness, therefore, if boat is equipped with a battery switch, switch **MUST BE** left in the "On" position when boat is moored in order for system to provide protection.

NOTE: To allow battery switch to be placed in the "Off" position while boat is moored, remove and discard red-purple power supply lead from "+" terminal of controller (Figure 1) and connect a separate wire between "+" terminal on controller and positive (+) battery terminal. This lead must be fitted with a 3 amp fuse, placed within 6 inches (15cm) of positive battery terminal.

- Do not substitute an older (black) controller for a new (blue) controller or vice-versa, as controllers have different internal circuitry and will not provide the proper protection if interchanged.
- It is recommended that MerCathode System be tested at least once each year to ensure that it is providing the proper corrosion protection. Refer to Subject H, following.

B. IMPROVED CORROSION RESISTANCE ON NEW TRIM CYLINDERS

The MerCruiser 120-thru-260 R & MR models and later TR and TRS models are equipped with 1½" (38mm) ID external return line trim cylinders. These cylinders are equipped with an internal continuity ring (Figure 3) to maintain continuity between the piston rod and outer tube. To further improve the corrosion resistance of these cylinders, a new procedure is being used when manufacturing the end cap and outer tube to ensure good continuity between these components.

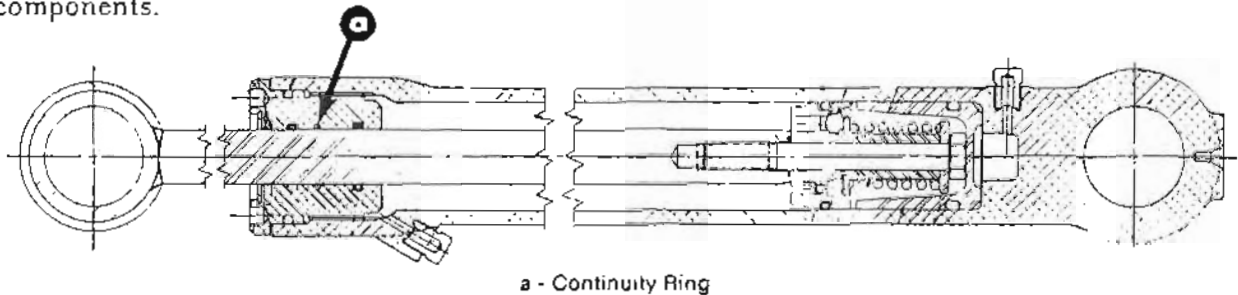
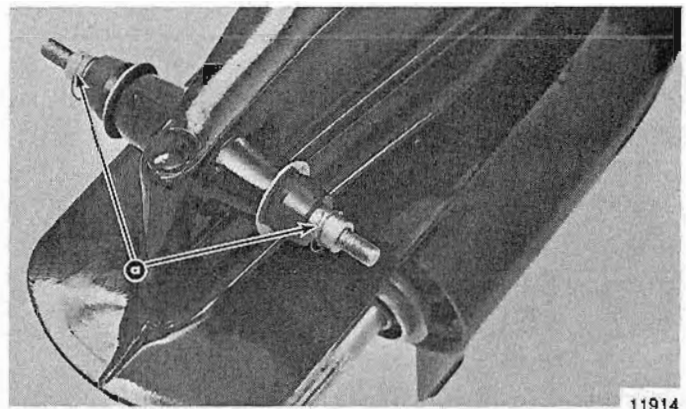


Figure 3. 1½" I.D., External Return Line Trim Cylinder

The new trim cylinders do not require the use of spiral springs (Figure 4) as was required on the trim cylinders in the past.

a - Spiral Grounding Springs

**Figure 4. Trim Cylinder
Spiral Grounding Springs**



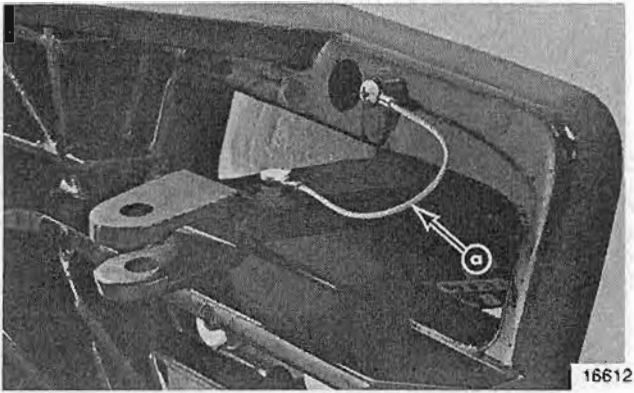
C. STERN DRIVE CONTINUITY TEST

Electrical continuity must be maintained between all underwater components on the stern drive for MerCathode System and/or zinc anodes to effectively protect these parts. If unit is equipped with a MerCathode System it also is essential that all underwater components be electrically grounded to the negative (-) battery terminal.

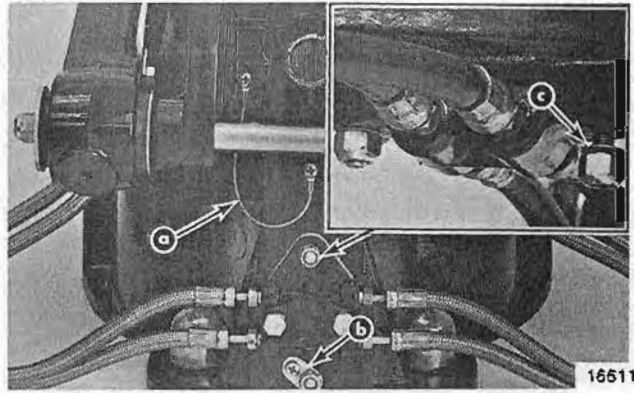
To help ensure proper grounding of underwater components, current production MerCruiser 120-thru-260 R & MR and TR/TRS models are now equipped with a continuity circuit. (Figures 5 and 6) A Continuity Circuit Kit (99940A1) also is available to retrofit older MC I, TR and TRS models with this system. Continuity circuit should be inspected periodically to ensure that there are no loose connections or damaged wires. Isolated corrosion on only one or two components on the stern drive could indicate improper grounding.

The following test can be used to check if the stern drive is properly grounded.

1. Boat must be in the water when performing this test.
2. Set D.C. voltmeter on 0-2 volt (0-2000 millivolt) scale.
3. Connect negative (black) meter lead to negative (-) battery terminal.
4. Suspend end of positive (red) meter lead in the water within 6" (15cm) of drive unit. Do not allow it to contact drive unit. Reading should be above 3 millivolts.
5. Connect end of positive meter lead to each metallic component on stern drive. Reading should drop below 2 millivolts.
6. A reading higher than specified indicates improper grounding.

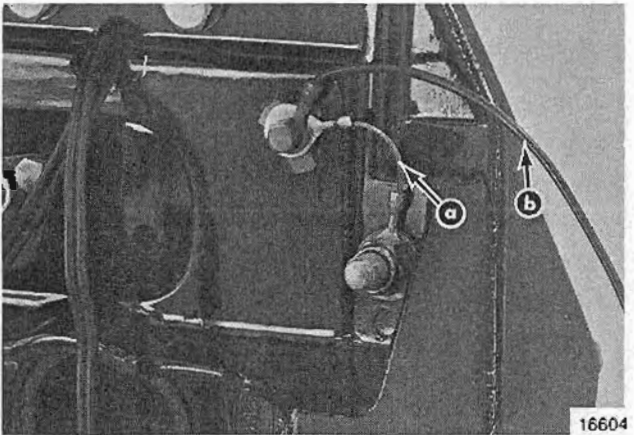


a - Steering Lever Ground Wire

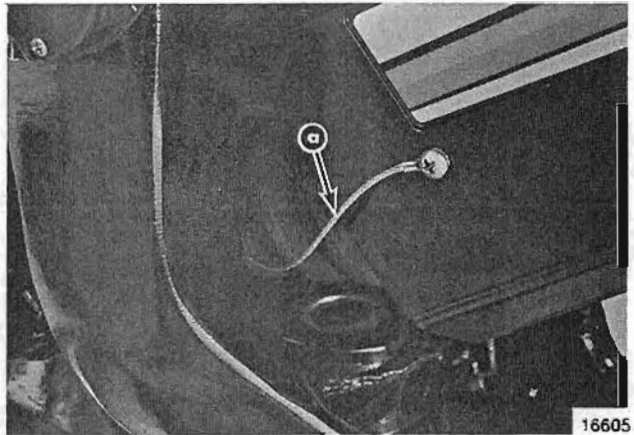


a - Gimbal Ring Ground Wire c - Star Washer
b - Hydraulic Connector Ground Plate

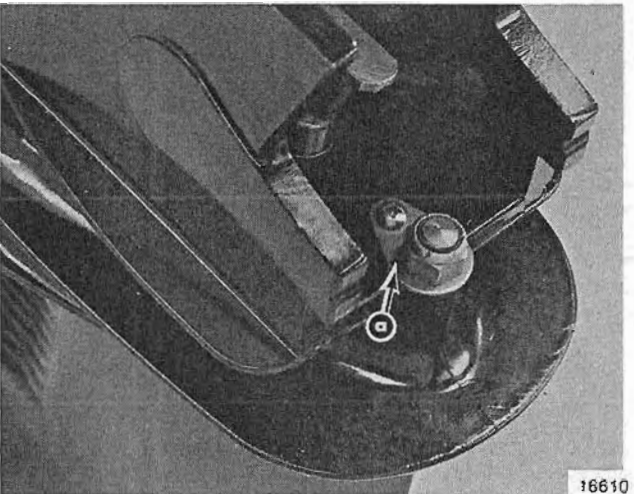
*NOTE: Ground Plate Has Been Replaced With Star Washers
(Under Each Nut) On Later Production Models.*



a - Inner Transom Plate Ground Wire
b - Engine Ground Wire



a - Bell Housing Ground Wire

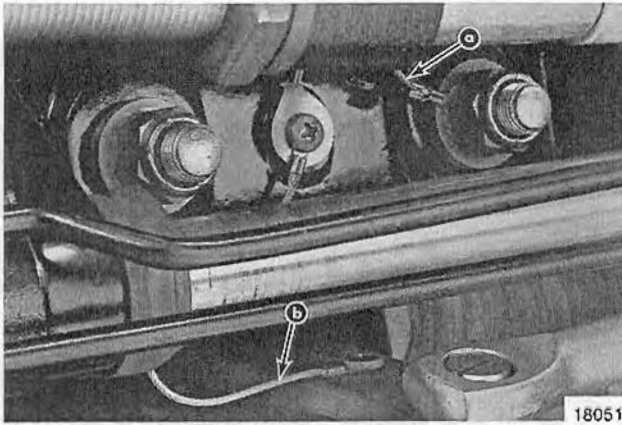


a - Gear Housing to Drive Shaft Housing Ground Plate

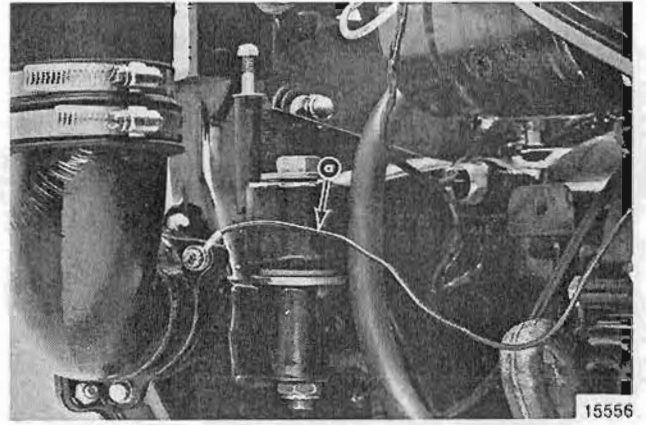


a - Drive Shaft Housing to Bell Housing Ground Plate

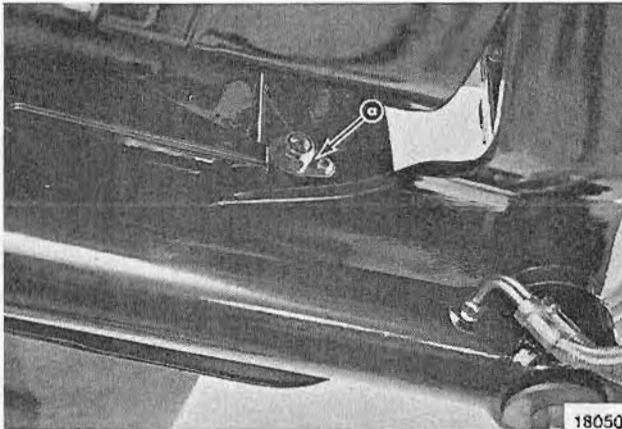
Figure 5. MerCruiser 120-thru-260 R & MR Continuity Circuit



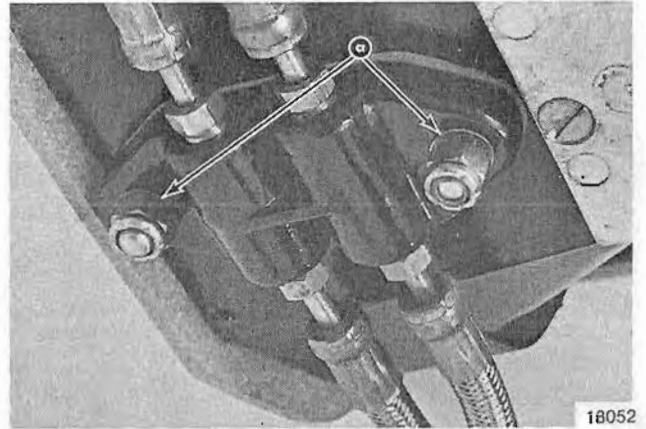
a - Inner Transom Plate Ground Wire
b - Steering Lever Ground Wire



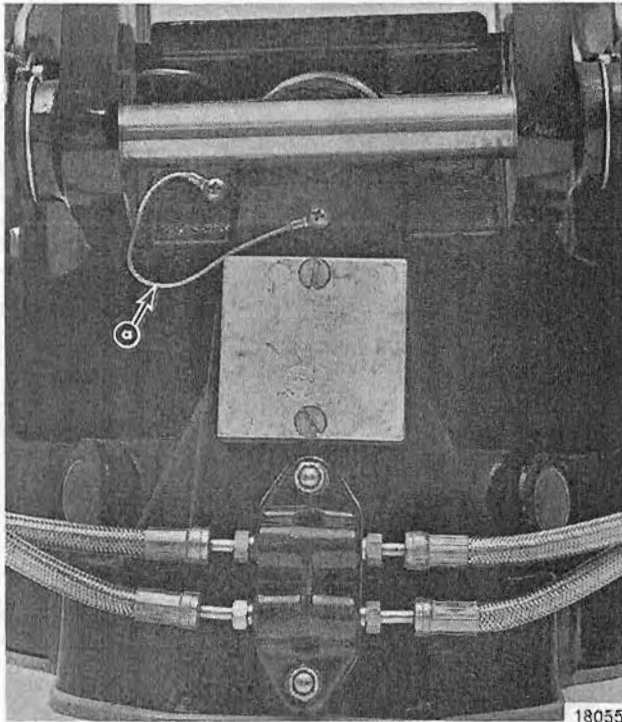
a - Engine to Inner Transom Plate Ground Wire



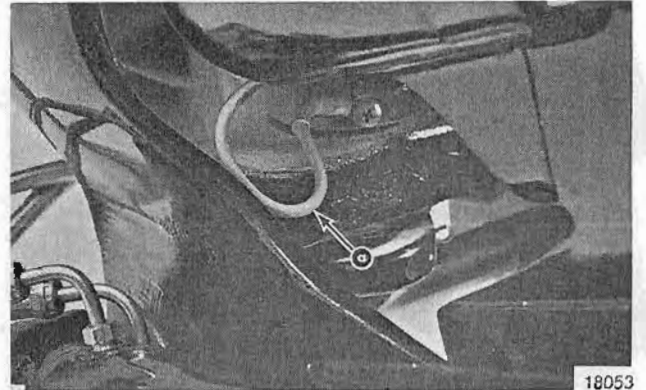
a - Drive Shaft Housing to Gear Housing Ground Plate



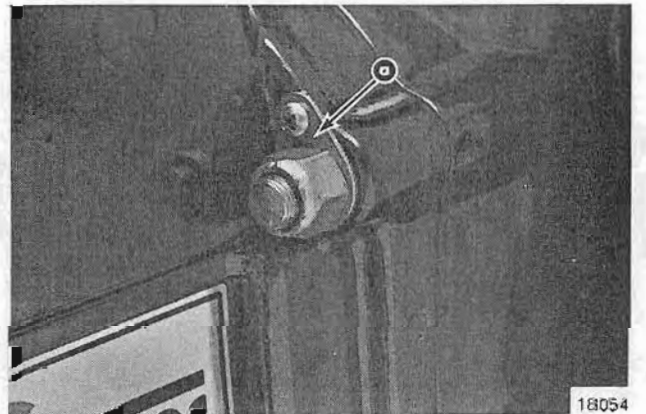
a - Hydraulic Connector Continuity Washer



a - Gimbal Ring Ground Wire



a - Bell Housing Ground Wire



Drive Shaft Housing to Bell Housing Ground Plate

Figure 6. MerCruiser TR and TRS Continuity Circuit

D. STAINLESS STEEL PROPELLERS CORRODING

Good continuity must be maintained between a stainless steel propeller and propeller shaft or corrosion damage to propeller will result. The corrosion damage will appear in the form of deep pits or holes in the metal. (Figure 7) Loss of continuity to the propeller also will contribute to surface rust forming on the metal.

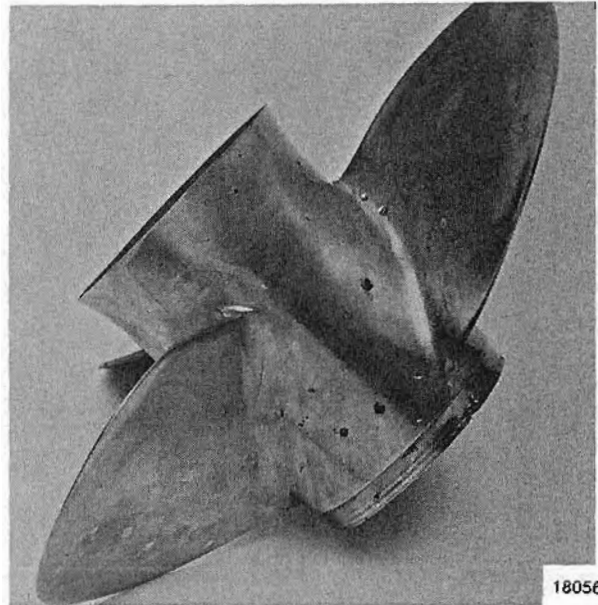
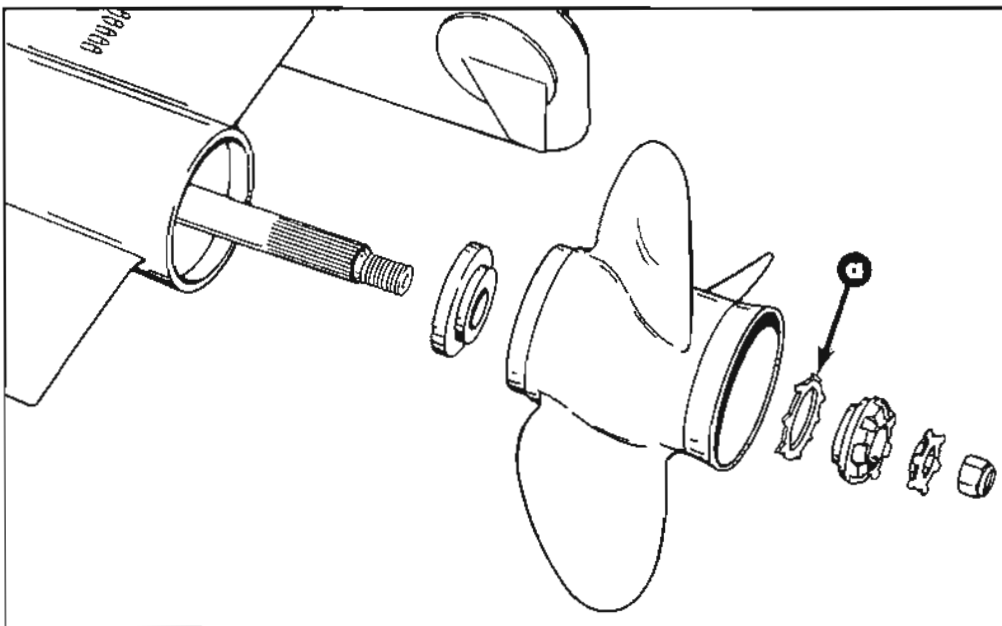


Figure 7. Propeller Corrosion from Loss of Continuity

To help ensure good continuity, propeller should be removed periodically and all mating surfaces on propeller, propeller attaching parts and propeller shaft should be cleaned. A liberal coat of Quicksilver Special Lubricant 101, 2-4-C Multi-Lube or Perfect Seal should be applied to propeller shaft before reinstalling propeller. Be sure to retorque propeller nut to 55 lbs. ft. (75 N.m).

On MC-I, Black Max and TRS Cleaver Propellers (with square rubber drive hub), a continuity washer (13-42351) can be installed between the spline washer and the propeller to help ensure continuity. (Figure 8) In the future, this washer will be included as standard equipment with these propellers. MerCruiser 120MR-thru-260MR models also will be equipped with this washer.



a - Continuity Washer 13-42351

Figure 8. Continuity Washer Installation

E. ANTI-FOULING PAINT USAGE ON MERCUISER STERN DRIVES

NEVER use anti-fouling paints which contain copper or mercury on stern drive or boat. Use of these paints will increase the potential for galvanic corrosion of the stern drive. Even the MerCathode System (or several systems) may be unable to handle the increased corrosion potential.

ONLY ANTI-FOULING PAINTS WHICH HAVE A TRI-BUTYL-TIN-ADIPATE BASE (TBTA) SHOULD BE USED ON MERCUISER STERN DRIVE INSTALLATIONS. We cannot begin to list all of the paints on the market which comply with this specification, therefore, we suggest that you contact the paint manufacturer directly if there is any question as to whether their paint complies. Paint contents are usually listed on the can.

F. INACTIVE SACRIFICIAL ZINC ANODES

If the underwater portion of the stern drive shows signs of corrosion, but the zinc anodes are not being consumed, the problem may be due to the following:

- Zinc anodes may not be making good electrical contact with stern drive. Scrape anode mounting surfaces down to bare metal and reinstall anodes.
- Zinc anodes may have a protective coating of a very dense oxide film on their surface, (which usually has a charcoal gray appearance). This condition usually occurs in fresh water; however, it also can happen in salt water areas if the boat is left out of the water for substantial periods of time.

To confirm this condition, test for continuity between anode and stern drive, using an ohmmeter set on Rx1 scale. If anode must be scraped with a knife in order to get a conductive reading, the anode is oxidized and should be replaced. Sanding the surface with coarse sandpaper provides a temporary fix, but it is very likely that the oxide will form again.

IMPORTANT: The latest replacement Quicksilver zinc anodes are manufactured out of a new material that prevents the formation of an oxide coating. These parts will have the letters "MS" cast into the mounting surface. Older parts were identified with the letter "Z".

G. MERCATHODE MONITOR OPERATION AND TESTING

When a MerCathode System and a MerCathode Monitor both are installed on a boat equipped with a new stern drive, the Monitor initially may indicate that protective current is not being supplied thru the MerCathode anode. This condition is normal and, in such a case, the green light will not illuminate when the red button is depressed. This is only temporary, however, and results from the sacrificial zincs and/or new paint on the drive unit that are providing complete protection.

After the boat has been in the water for a period of time, surface scratches and abrasions expose the aluminum housings. Also, water can work its way into direct contact with the aluminum. At some time in this process, the MerCathode is called upon to start protecting the drive and, at this time, the green light on the Monitor begins to glow when the red button is pushed. During this transition period, the green light, on occasion, will only flicker, but a steady green light will appear as soon as the MerCathode takes over and provides its continuous automatic protection. If the stern drive is equipped with a stainless propeller, the MerCathode System usually will be called upon immediately to provide protective current and therefore, there will be no "waiting period" before the Monitor light begins to illuminate.

The following test can be used to check MerCathode Monitor for proper operation. (Refer to Figure 9)

1. Connect a jumper wire between the "R" and "-" terminals on MerCathode controller.
2. If Monitor light illuminates, Monitor is in good condition, but MerCathode System is not providing protective current.
3. If light does not lite, disconnect Monitor lead from the "A" terminal on MerCathode controller and connect lead to a 12 volt source.
 - **If light now illuminates**, Monitor is operating properly, but MerCathode System is not providing protection current.
 - **If light does not illuminate**, check Monitor wiring for damage or loose connections. If wiring is good, Monitor is faulty and must be replaced.
4. Disconnect Monitor lead from 12 volt source immediately after performing test to prevent corrosion damage.

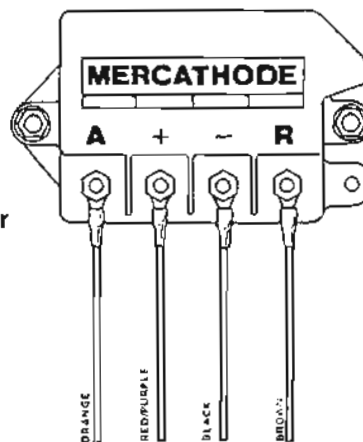


Figure 9. MerCathode Controller

H. 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, and with either the old or the new MerCathode System.

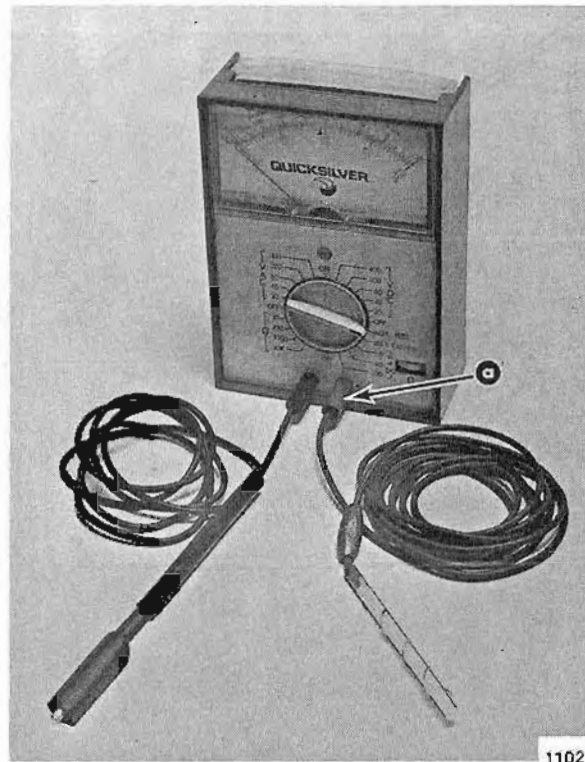
Use the following test to determine if stern drive is being afforded adequate corrosion protection, or if additional corrosion protection is required. If the unit is equipped with a MerCathode System, it is recommended that this test be performed at least once each year (where the boat is moored) to ensure that the system is functioning properly.

Test requires the use of MerCathode Reference Electrode Tester 76675A1 and Quicksilver VOA Meter 91-62562A1. (Figure 10) This meter is no longer available from Mercury Marine. If you do not already have this meter, a digital multimeter (such as a Fluke 8012A-01 or a Radio Shack 22-191) must be used. A STANDARD ANALOG (Needle Type) 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 Quicksilver VOA Meter 91-62562A1. Previously, we stated that this plug could be removed to allow tester to be used with

other analog type meters. Further testing has revealed that this could result in inaccurate readings and; therefore, we no longer recommend the removal of this plug and the use of other analog meters. Resistor jack can be left in place when using digital meters.



a - Special Resistor Jack

Figure 10. Quicksilver VOA Meter 91-62562A1 and
MerCathode Reference Electrode Tester 76675A1

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

- If unit is equipped with a MerCathode System, make sure that battery is fully charged (12.6 volts or above).
 - New boats just placed in service usually will produce a reading higher than normal. This is due to the drive unit being protected by a good finish and new sacrificial zinc 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, which will result 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 zinc anodes to polarize the surrounding water. Be careful not to rock the boat excessively while boarding to perform 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. If using Quicksilver VOA Meter 91-62562A1, set meter on "AUX TEST" position. If using a digital meter, set meter on scale required to read 0-2000 millivolts (0-2 volts).
 1. Immerse Electrode Tester in the water within 6" (15cm) of the aft end of the drive unit. (Figure 11)

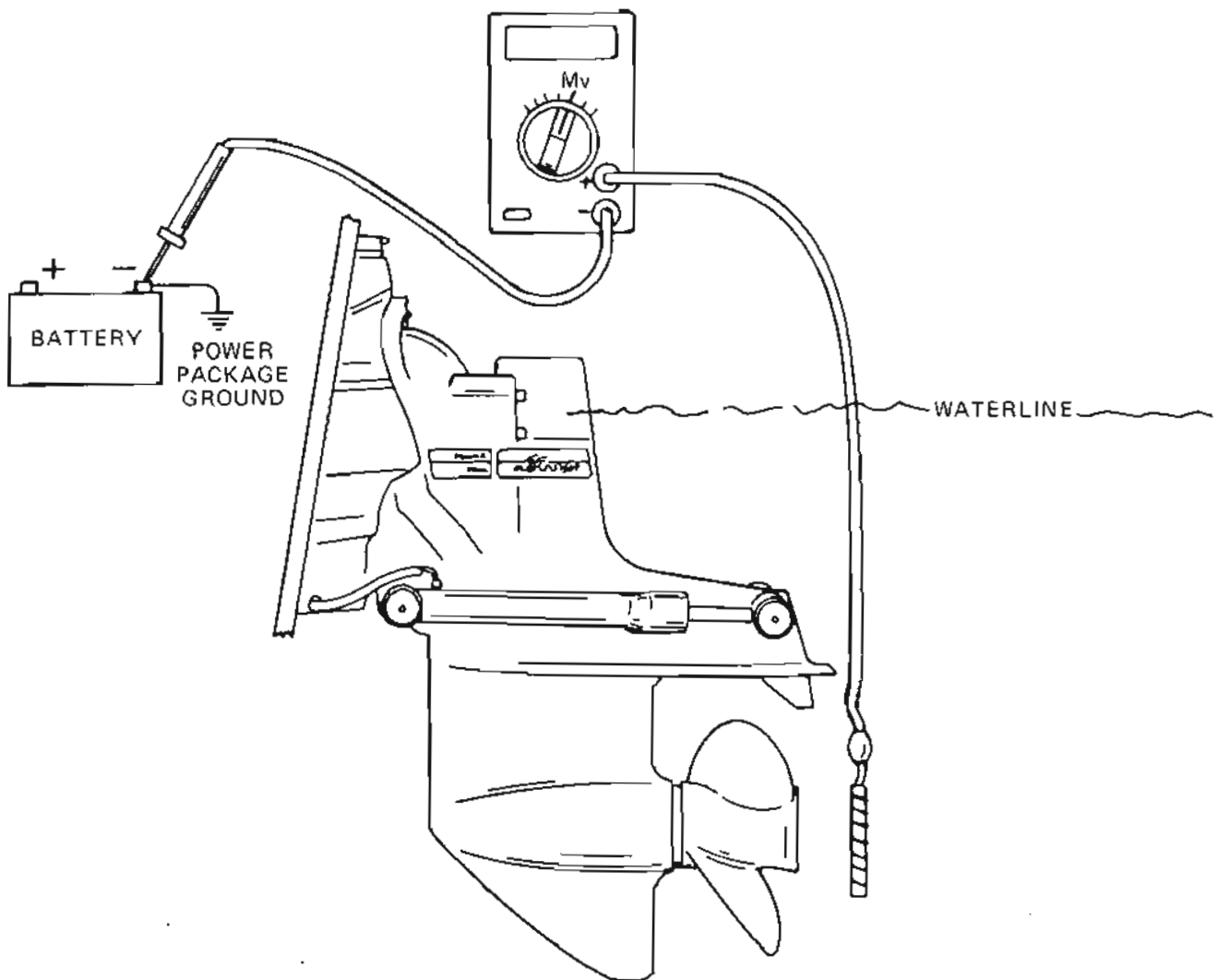


Figure 11. Reference Electrode Tester Positioned Properly

5. The following readings indicate that stern drive is adequately protected:

Fresh Water Areas --

7.5 - 10.5 with Quicksilver VOA Meter

750-1050 Millivolts with Digital Meter

Salt, Polluted or Mineral Laden Water Areas --

8.8 - 10.5 with Quicksilver VOA Meter

880-1050 Millivolts with Digital Meter

6. If the reading is not within specified limits, or if reading is within specifications, but there is evidence of corrosion on stern drive, refer to the appropriate troubleshooting chart, following to aid in diagnosis and correcting the problem.

LOW READING

Possible Cause	Remedy
1. Loss of continuity between stern drive components and negative (-) battery terminal.	1. Check that grounding lead between engine and inner transom plate is not missing or damaged and that connections are clean and tight. If unit is equipped with continuity circuit, test circuit as explained under Subject C, preceding.
2. BOATS EQUIPPED WITH SHORE POWER ONLY: Shore power green safety grounding lead not isolated from power package ground.	2. Disconnect shore power and notice if reading increases. If so, a Quicksilver Isolator 7664A1 or an isolation transformer should be installed.
3. Underwater metal parts on stern drive and/or boat unpainted or paint is in poor condition. More exposed metal than zinc anodes and/or MerCathode System can protect.	3. Prime and paint underwater metal parts. This will reduce the load on the zinc anodes and/or MerCathode System.
4. Zinc anodes painted. Anodes will not provide protection if painted.	4. Remove paint or replace anodes.
5. Zinc anodes improperly grounded or inactive.	5. Clean anode mounting surface or replace zinc anodes if they have oxidized. (Refer to Subject F, preceding)
6. Zinc anodes consumed (no longer affording protection).	6. Replace anodes if eroded 50% or more.
7. Drive unit and/or boat bottom painted with anti-fouling paint containing copper or mercury.	7. Only Tri-Butyl-Tin-Adipate (TBTA) base anti-fouling paint should be used. (Refer to Subject E, preceding.)
8. *MerCathode reference electrode or anode painted.	8. Remove paint.
9. *Zinc anode heads used instead of plastic caps (MerCruiser 120-thru-260 R & MR MerCathode System Only)	9. Reinstall plastic caps. (Refer to Subject A, preceding.)
10. *No power to MerCathode controller.	10. Connect positive (+) lead of volt meter (set on 0-20 volt scale) to "+" terminal on controller and negative (-) volt meter lead to "-" terminal. Meter should indicate battery voltage. Check for blown fuse (if so equipped) on Standard MerCathode System. Clean connection or repair wiring as required.
11. *Poor connection between reference electrode (brown) lead or anode (orange) lead and MerCathode controller.	11. Clean and/or tighten connection. Repair wiring as required.
12. *Faulty MerCathode reference electrode.	12. Disconnect reference electrode (brown) lead from controller "R" terminal. Connect lead to positive (+) terminal of a digital multi-meter (set on 0-2000 millivolt scale). Connect negative (-) meter lead to negative (-) battery terminal. Note meter reading; then repeat test using MerCathode Reference Electrode Tester 76675A1. The same reading should be obtained in both cases. If not, replace reference electrode.

* Applicable to units with a MerCathode System only.

Possible Cause	Remedy
13. *Faulty MerCathode Controller.	13. With anode and reference electrode leads connected to controller, connect a jumper wire between "R" and "-" terminals on controller. Connect positive (+) lead of volt meter (set on 0-20 scale) to "A" terminal on controller. Connect negative (-) meter lead to negative "-" controller terminal. Reading should be as follows: <ul style="list-style-type: none"> • Fresh Water Areas - 11.5 volts minimum • Seawater Areas - 3.55 volts minimum If reading is low, replace controller.
14. Additional corrosion protection required. Boats which are equipped with a sizeable 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.	14. Install additional zinc anodes or a MerCathode System 88334A2. If unit is already equipped with a MerCathode System, a second system may be required.

* Applicable to units with a MerCathode System only.

HIGH READING

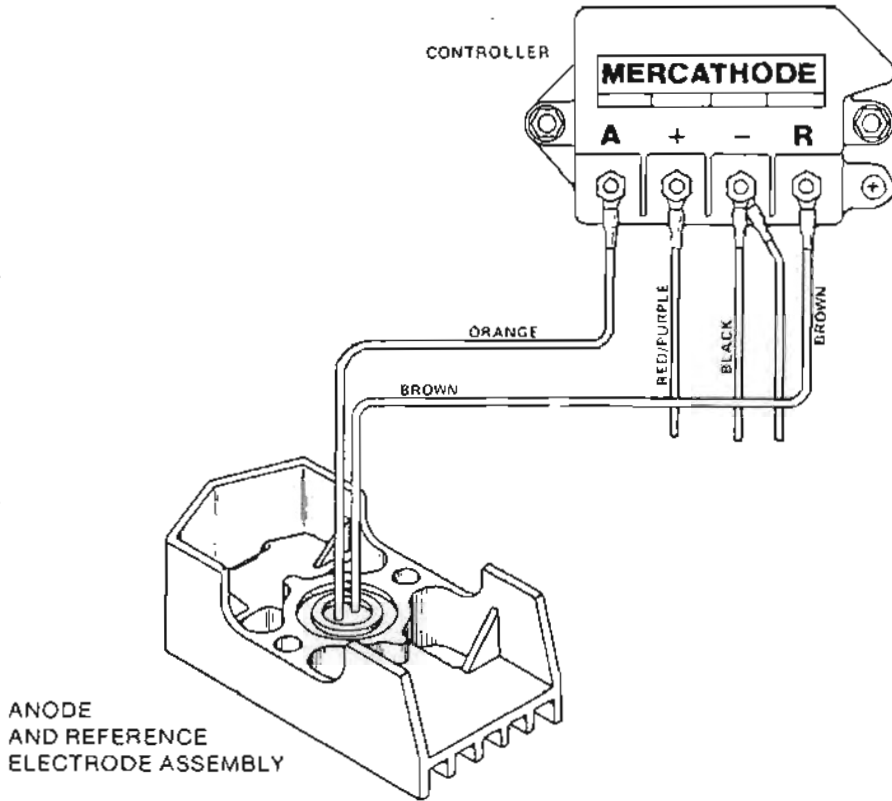
Possible Cause	Remedy
1. Stray current corrosion. If an electrical current flowing along a metal conductor leaves the metal for a water path, it will cause ionization of the metal, and an area of rapid corrosion.	1. Observe reading while disconnecting electrical components (one at a time) until high reading is eliminated. Correct source of stray current.
2. *Poor connection between MerCathode reference electrode (brown) lead and "R" terminal on controller.	2. Clean and/or tighten connection. Repair wiring as required.
3. *Faulty MerCathode reference electrode.	3. Disconnect reference electrode (brown) lead from "R" terminal on controller. Connect lead to positive (+) terminal of digital multi-meter (set on 0-2000 millivolt scale). Connect negative (-) meter lead to negative (-) battery terminal. Note meter reading; then, repeat test using MerCathode Reference Electrode Tester (76675A1). The same reading should be obtained in both cases. If not, replace reference electrode.
4. *Faulty MerCathode controller.	4. Replace controller.

* Applicable to units with a MerCathode System only.

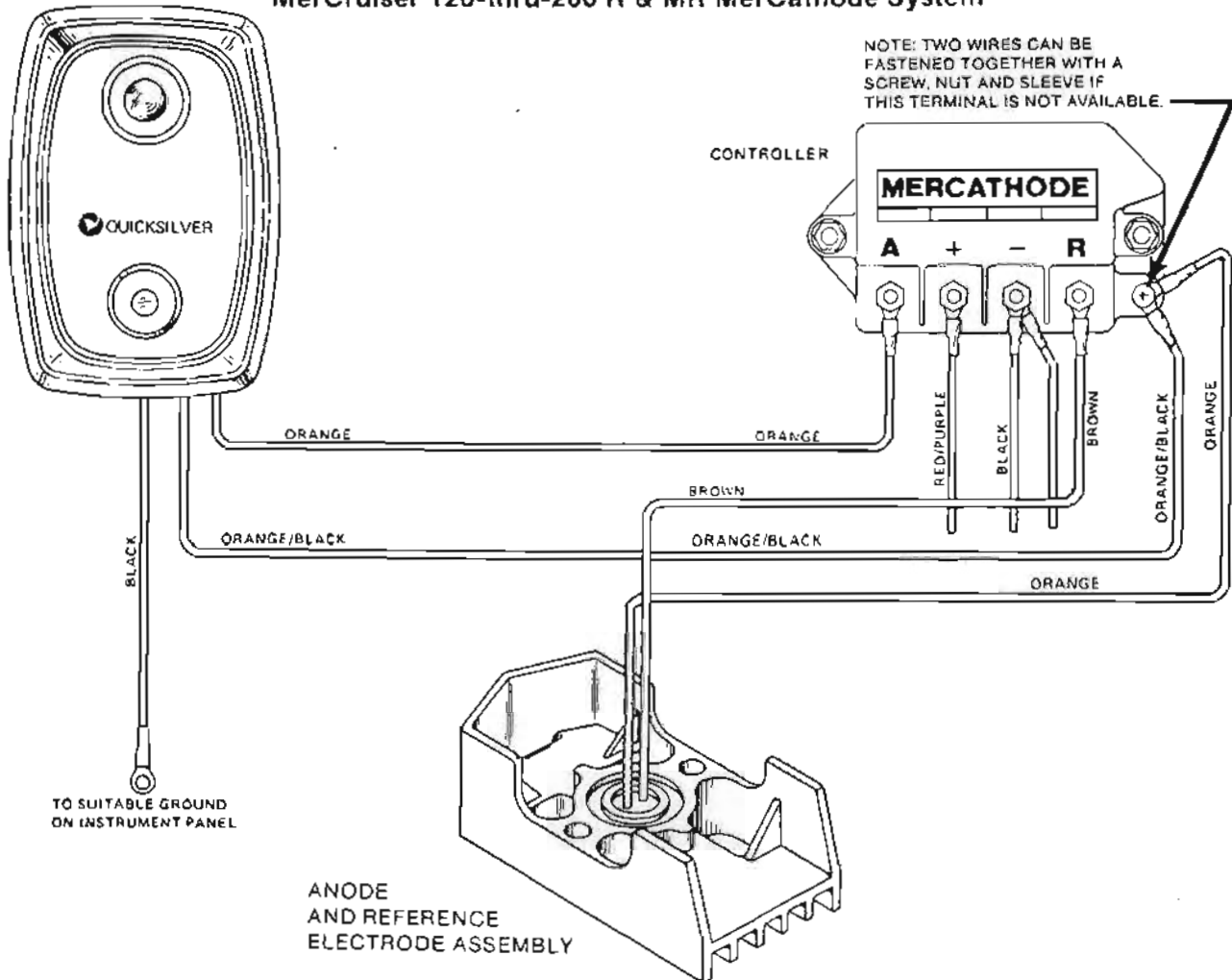
NORMAL READING BUT CORROSION IS EVIDENT

Problem	Possible Cause	Remedy
Corrosion on Entire Drive Unit	Drive Unit raised so far that sacrificial zinc trim tab is out of the water.	Drive unit must be left "In" ("Down") position when boat is moored for trim tab to provide protection.
Corrosion Problem Developed after Stern Drive was Refinished	Steel wire brush used to clean aluminum casting. Steel particles become entrapped and set up a small galvanic cell.	Use a nylon or bristle brush only.
Paint Blistering on Stern Drive	Battery charger, which uses 110 volt shore power, improperly connected to battery.	Make sure charger is connected correctly.
Trim Cylinder Corroding	Loss of continuity between trim cylinders and stern drive.	Install proper continuity devices.
Corrosion isolated to one or two components (bell housing, gimbal ring, etc.)	Loss of continuity between stern drive components.	If not already done, install Continuity Circuit Kit 99940A1. If unit is already equipped with continuity circuit, test circuit as outlined under Subject C, preceding.
Corrosion in Area of Exhaust Outlets	Accumulation of exhaust gas deposits on the drive exterior may result in paint blistering and corrosion.	Deposits can be removed with marine or automotive wax which also will help protect finish.
Corrosion Occurs After Unit is Removed From the Water	Salt crystals remain on the surface of drive components and high humidity causes electrolyte to form with subsequent corrosion resulting.	Wash exterior and flush interior with fresh water.
Corrosion Between Surfaces	Salt buildup between surfaces.	Exclude moisture from between mating parts with Quicksilver Special Lubricant 101, 2-4-C Multi-Lube or Perfect Seal.
Aluminum Corroding in Areas Where Lubricant Was Applied.	Lubricant used contained graphite.	Never use lubricants which contain graphite as they will accelerate corrosion.
Stainless Steel Components Corroding	Foreign matter (fish line, marine growth, etc.) covering 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 also can cause this problem.	Remove foreign matter and prevent surfaces from being covered by sand and silt.
Stainless Steel Propeller Corroding	Loss of continuity between propeller and prop shaft	Clean mating surfaces on propeller, propeller shaft and attaching parts. If applicable, install continuity washer (refer to Subject D, preceding). Torque propeller nut to 55 lbs. ft. (75 N.m).
Paint blistering - metal under blistered paint is not pitted.	Surface was not properly prepared before paint was applied.	Sand surface down to bare metal, prime and repaint with Quicksilver Phantom Black Spray Paint.

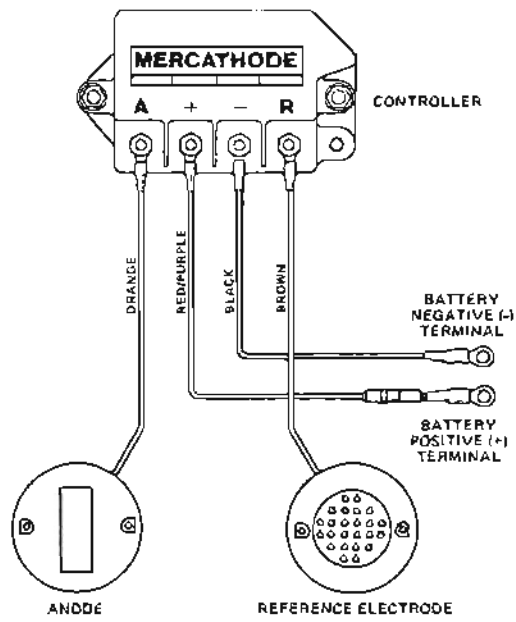
I. MERCATHODE SYSTEM and MONITOR WIRING DIAGRAMS



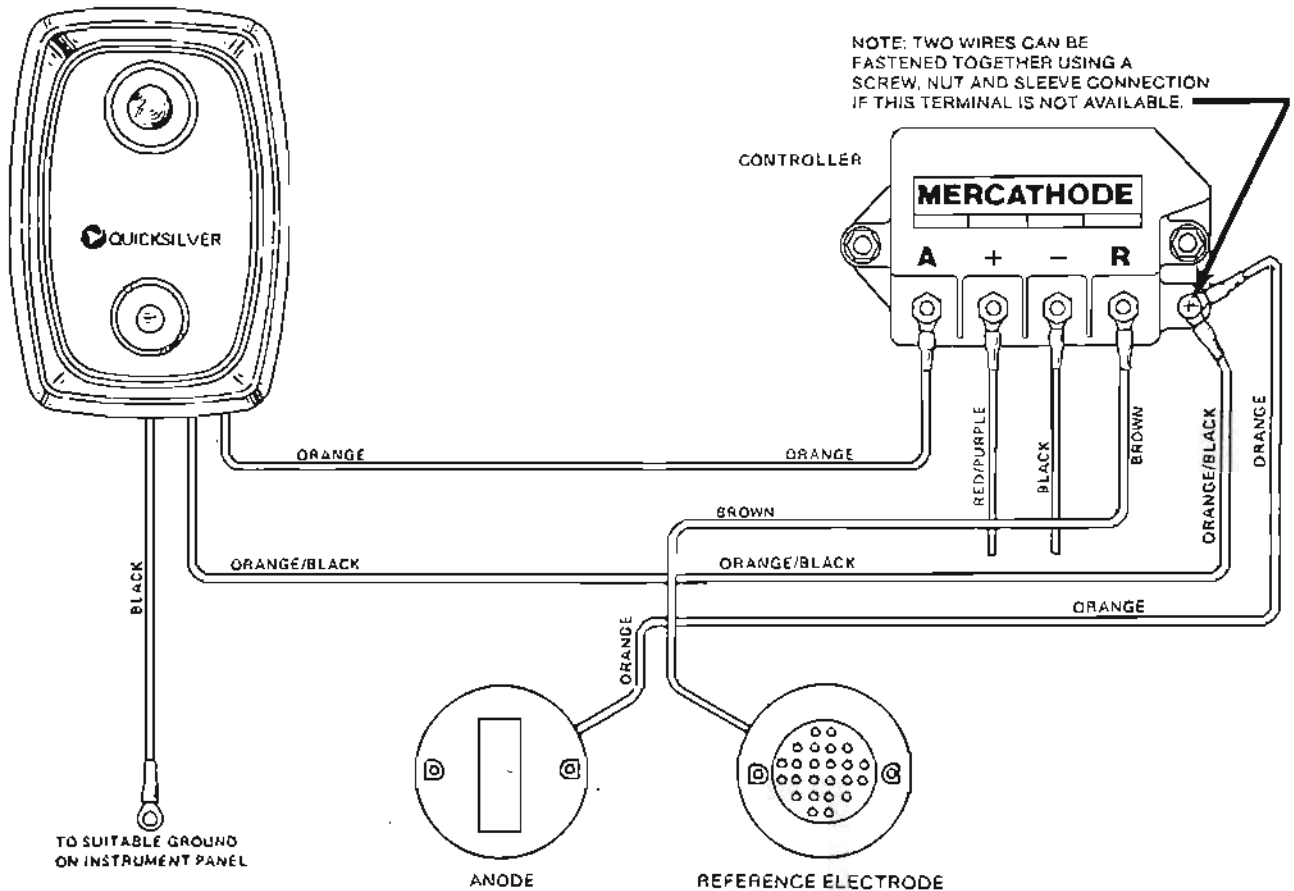
MerCruiser 120-thru-260 R & MR MerCathode System



MerCruiser 120-thru-260 R & MR MerCathode System With Monitor



Standard MerCathode System



Standard MerCathode System With Monitor