

**MERCURY**

# **MERCURY**

## *Service Manual*



**6/8/9.9/10/15**

**Starting Model Year 1986  
Serial Number 0A197112 and Up (USA)  
09503295 and Up (Belgium)**

**6/8/9.9/10/15**

**Starting Model Year 1986  
90-827242R02 February 2003**



## Notice

Throughout this publication, **Dangers**, **Warnings** and **Cautions** (accompanied by the International HAZARD Symbol ) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. **OBSERVE THEM CAREFULLY!**

These Safety Alerts alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus Common Sense operation, are major accident prevention measures.

### **DANGER**

**DANGER - Immediate hazards which WILL result in severe personal injury or death.**

### **WARNING**

**WARNING - Hazards or unsafe practices which COULD result in severe personal injury or death.**

### **CAUTION**

**Hazards or unsafe practices which could result in minor personal injury or product or property damage.**

## Notice to Users of This Manual

This service manual has been written and published by the Service Department of Mercury Marine to aid our dealers' mechanics and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures of these products, or like or similar products manufactured and marketed by Mercury Marine, that they have been trained in the recommended servicing procedures of these products which includes the use of mechanics' common hand tools and the special Mercury Marine or recommended tools from other suppliers.

We could not possibly know of and advise the service trade of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by the manufacturer, first must completely satisfy himself that neither his nor the products safety will be endangered by the service procedure selected.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. As required, revisions to this manual will be sent to all dealers contracted by us to sell and/or service these products.

It should be kept in mind, while working on the product, that the electrical system and ignition system are capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the battery cables should be disconnected at the battery.

Any time the intake or exhaust openings are exposed during service they should be covered to protect against accidental entrance of foreign material which could enter the cylinders and cause extensive internal damage when the engine is started.



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It is important to note, during any maintenance procedure replacement fasteners must have the same measurements and strength as those removed. Numbers on the heads of the metric bolts and on the surfaces of metric nuts indicate their strength. American bolts use radial lines for this purpose, while most American nuts do not have strength markings. Mismatched or incorrect fasteners can result in damage or malfunction, or possibly personal injury. Therefore, fasteners removed should be saved for reuse in the same locations whenever possible. Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that matches the original.

## **Cleanliness and Care of Outboard Motor**

A marine power product is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten thousands of an inch/mm. When any product component is serviced, care and cleanliness are important. Throughout this manual, it should be understood that proper cleaning, and protection of machined surfaces and friction areas is a part of the repair procedure. This is considered standard shop practice even if not specifically stated.

Whenever components are removed for service, they should be retained in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.

Personnel should not work on or under an outboard which is suspended. Outboards should be attached to work stands, or lowered to ground as soon as possible.

We reserve the right to make changes to this manual without prior notification.

Refer to dealer service bulletins for other pertinent information concerning the products described in this manual.



# Service Manual Outline

## Section 1 - General Information & Specifications

- A - Specifications
- B - Maintenance
- C - General Information
- D - Outboard Installation

## Section 2 - Electrical and Ignition

- A - Ignition System
- B - Charging & Starting System
- C - Timing/Synchronizing & Adjusting
- D - Wiring Diagrams

## Section 3 - Fuel System

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- B - Emissions

## Section 4 - Powerhead

## Section 5 - Mid-Section

- A - Clamp/Swivel Brackets and Driveshaft Housing
- B - Power Trim

## Section 6 - Lower Unit

## Section 7 - Attachments/Control Linkage

- A - Throttle/Shift Linkage (Tiller Handle Shift Models)
- B - Throttle/Shift Linkage (Side Shift Models)
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## Propeller Information

For in-depth information on marine propellers and boat performance – written by marine engineers – see your Authorized Dealer for the illustrated “**What You Should Know About Quicksilver Propellers... and Boat Performance Information**” (Part No. 90-86144 92).

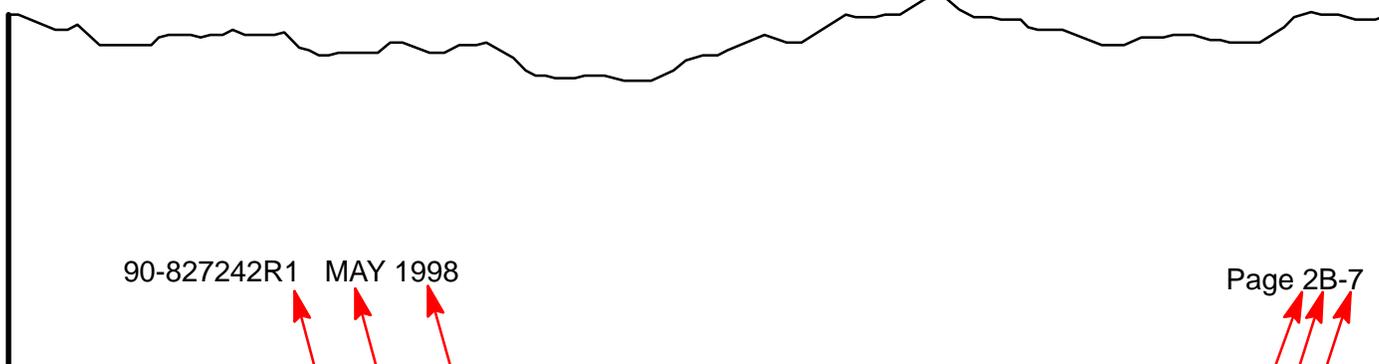
## How To Use This Manual

The manual is divided into SECTIONS which represents major components and systems. Some SECTIONS are further divided into PARTS. Each PART has a title page. A **Table of Contents** for the particular PART is printed on the back of the title page. SECTIONS and PARTS are listed on the **Service Manual Outline** sheet which immediately follows the cover of this book.

## Page Numbering

Two number groups appear at the bottom of each page. The example, below, is self-explanatory.

EXAMPLE:



Revision No. 1

Month of Printing

Year of Printing

Section Number

Part of Section Letter

Page Number



# GENERAL INFORMATION & SPECIFICATIONS

**1  
A**

## Section 1A – Specifications

### Table of Contents

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### General Specifications

<b>Models 6/8/9.9/10/15</b>		
<b>PERFORMANCE KW (HP)</b>	<b>Model 6</b> <b>Model 8</b> <b>Model 8 Sailmate</b> <b>Model 9.9</b> <b>Model 9.9 Sailpower</b> <b>XR/MAG/Viking10</b> <b>Model Sea Pro/Marathon 10</b> <b>Model 15</b> <b>Model Sea Pro/Marathon 15</b>	4.5 (6) 5.9 (8) 5.9 (8) 7.4 (9.9) 7.4 (9.9) 7.5 (10) 7.5 (10) 11.2 (15) 11.2 (15)
<b>OUTBOARD WEIGHT</b>	<b>Manual Start</b> <b>6</b> <b>8</b> <b>8 Sailmate</b> <b>9.9</b> <b>9.9 Sailpower</b> <b>XR/MAG/Viking10</b> <b>Sea Pro/Marathon 10</b> <b>15</b> <b>Sea Pro/Marathon 15</b> <b>Electric Start</b> <b>6</b> <b>8</b> <b>9.9</b> <b>9.9 Sailpower</b> <b>15</b>	33.1 kg (73.0 lb) 33.1 kg (73.0 lb) 33.8 kg (74.5 lb) 33.8 kg (74.5 lb) 34.2 kg (76.5 lb) 33.8 kg (74.5 lb) 33.8 kg (74.5 lb) 34.0 kg (75.0 lb) 34.0 kg (75.0 lb) 36.1 kg (79.5 lb) 36.1 kg (79.5 lb) 36.7 kg (81.0 lb) 37.7 kg (83.0 lb) 37.0 kg (81.5 lb)
<b>FUEL SYSTEM</b>	<b>Recommended Gasoline</b>  <b>Recommended Oil Ratio</b>  <b>Fuel Tank Capacity 6/8/9.9/Sailpower, XR/MAG10 10 Sea Pro Marathon/15</b>	Automotive Unleaded with a Minimum Pump Posted Octane Rating of 86 2 Cycle Outboard Oil 25:1 (During break-in) 50:1 (After break-in)  12.0 L, 2.7 Imp Gal., 3.2 U.S. Gal.  25.0 L, 5.5 Imp Gal., 6.6 U.S. Gal.



<b>CYLINDER BLOCK</b>	<b>Type</b> <b>Displacement (1994 Model)</b> 6 8 9.9 9.9 Sailpower 10 Sea Pro/Marathon XR10/MAG10 15 <b>Displacement (1995 and Newer)</b> 9.9 9.9 Sailpower 10 Sea Pro/Marathon XR/MAG/Viking 10 15 15 Sea Pro/Marathon	<b>Two-Stroke Cycle – Cross Flow</b>  209 cc (12.8 cu. in.) 209 cc (12.8 cu. in.) 209 cc (12.8 cu. in.) 209 cc (12.8 cu. in.) 262 cc (16.0 cu. in.) 262 cc (16.0 cu. in.) 262 cc (16.0 cu. in.)  262 cc (16.0 cu. in.) 262 cc (16.0 cu. in.)
<b>CYLINDER BORE</b>	<b>Diameter (Standard)(1994 Model)</b> 6 8 8 Sailmate 9.9 9.9 Sailpower 10 Sea Pro/Marathon XR/Mag 10 15 <b>Diameter (Standard)(1995 Model)</b> 9.9 9.9 Sailpower 10 Sea Pro/Marathon XR/Mag/Viking 10 15 15 Sea Pro/Marathon <b>Taper/Out of Round Maximum Bore Type</b>	53.975 mm (2.125 in.) 53.975 mm (2.125 in.) 53.975 mm (2.125 in.) 53.975 mm (2.125 in.) 53.975 mm (2.125 in.) 60.325 mm (2.375 in.) 60.325 mm (2.375 in.) 60.325 mm (2.375 in.)  60.325 mm (2.375 in.) 60.325 mm (2.375 in.) 0.1016 mm (0.004 in.) Cast Iron
<b>STROKE</b>	<b>Length</b>	45.7 mm (1.800 in.)
<b>CRANKSHAFT</b>	<b>Top Main Bearing Journal</b> <b>Center Main Bearing Journal</b> <b>Bottom Ball Bearing Journal</b> <b>Connecting Rod Journal</b> <b>Runout</b>	19.1 mm (0.7517 in.) 20.6 mm (0.8108 in.) 20.0 mm (0.7880 in.) 20.6 mm (0.8125 in.) 0.076 mm (0.003 in.)
<b>CONNECTING ROD</b>	<b>Piston Pin End (I.D.)</b> <b>Crankpin End (I.D.)</b>	20.8 mm (0.8195 in.) 27.0 mm (1.0635 in.)
<b>PISTON</b>	<b>Piston Type</b> <b>Ring End Gap</b>	Aluminum 0.25 mm - 0.46 mm (0.010 in. - 0.018 in.)
<b>REEDS</b>	<b>Reed Stand Open (Maximum)</b> <b>All Models</b> <b>Reed Stop Opening (Maximum)</b> <b>All Models</b>	0.178 mm (0.007 in.)  7.54 mm (0.296 in.)



<b>GEAR HOUSING</b>	<b>Gear Ratio</b> <b>Gearcase Capacity</b> <b>Lubricant Type</b> <b>Forward Gear - Tooth count - Type</b> <b>Pinion Gear - Tooth count - Type</b> <b>Pinion Height</b> <b>Forward Gear Backlash</b> <b>Reverse Gear Backlash</b> <b>Water Pressure</b> <b>With Thermostat</b> - @ W.O.T (5000 RPM) - @ Idle (750 RPM) <b>W/O Thermostat</b> - @ W.O.T (5000 RPM) - @ Idle (750 RPM)	2.0:1 200 ml (6.8 fl. oz.) Quicksilver Gear Lube Premium Blend 26 Spiral/Bevel 13 Spiral/Bevel Floating No Adjustment No Adjustment  34.5 - 48.3 kPa (5 - 7 PSI) 3.4 - 10.3 kPa (.5 - 1.5 PSI)  34.5 - 48.3 kPa (5 - 7 PSI) 0 - 7 kPa (0 - 1 PSI)
<b>MID SECTION</b>	<b>Transom Height</b> <b>Short Shaft</b> <b>Long Shaft</b> <b>Extra Long Shaft</b> <b>Steering Pivot Range</b> <b>Tilt Pin Positions</b> <b>Total Tilt Angle</b> <b>Allowable Transom Thickness</b>	38 cm (15 in.) 51 cm (20 in.) 63.5 cm (25 in.) 78° 3 + 3 Shallow Water 78° 60.3 mm (2-3/8 in.)
<b>FUEL SYSTEM</b>	<b>Fuel</b> <b>Recommended Gasoline</b> <b>Recommended Oil</b>  <b>Gasoline/Oil Ratio</b>  <b>Fuel Tank Capacity</b> <b>6/8/9.9/9.9 Sailpower</b> <b>XR/MAG/10 Sea Pro/</b> <b>Marathon/15</b>	Pre-Mixed Gasoline and Oil Automotive Lead-Free  2 Cycle Outboard Oil 25:1 (During Break-In) 50:1 (After Break-In)  12.0 L, 3.2 U.S. Gal.  25.0 L, 6.6 U.S. Gal.
<b>STARTING SYSTEM</b>	<b>Manual Start</b> <b>Electric Start</b> <b>Starter Draw (Under Load)</b> <b>(No Load)</b>	Recoil 12 Volt 55 Amperes 15 Amperes
<b>CHARGING SYSTEM</b>	<b>Alternator Output</b> <b>BLACK Stator - 2 Magnet Flywheel</b> <b>(8 Pole)(4 Pulses)</b>  <b>RED Stator - 4 Magnet Flywheel</b> <b>(10 Pole)(5 Pulses)</b>	4 Amp. (48 Watt) @ 6000 RPM  6 amp (72 Watt) @ 6000 RPM



BATTERY	Battery Rating	465 Marine Cranking Amps (MCA) or 350 Cold Cranking Amps (CCA)
<b>IGNITION SYSTEM</b>	<b>Type</b> <b>SPARK PLUG (1994)</b> 6/8/9.9 10/15	Capacitor Discharge  NGK BP8H-N-10 NGK BP8HS-15 NGK BPZ8H-N-10*
	<b>SPARK PLUG GAP (1994)</b> 6/8/9.9 10/15	1.0 mm (0.040 in.) 1.5 mm (0.060 in.)
	<b>SPARK PLUG (1995 AND NEWER)</b> 6/8 9.9/10/15	NGK BP8H-N-10 NGK BP8HS-15 NGK BPZ8H-N-10*
	<b>SPARK PLUG GAP (1995 AND NEWER)</b> 6/8 9.9/10/15	1.0 mm (0.040 in.) 1.5 mm (0.060 in.)
	<b>Firing Order</b>	1-2
	<b>Stator High Speed Winding</b>	120 - 180 Ω (BLACK/WHITE - GROUND)
	<b>Stator Low Speed Winding</b> <b>Diode Test</b>	3200 - 3800 Ω (BLACK/YELLOW - GROUND) 3100 - 3700 Ω (BLACK/YELLOW - BLACK/WHITE)
<b>Ignition Coil Resistance:</b> <b>Primary</b> <b>Secondary</b> <b>Trigger</b>	0.02 - 0.04 Ω 8000 - 11000 Ω 6500 - 8500 Ω	

**NOTE:** \*Use NGK-BPZ8H-N-10 where radio frequency interference (RFI) suppression is required.



<b>CARBURETOR SPECIFICATIONS</b>	<p><b>Type</b></p> <p><b>Idle RPM (In Gear)</b></p> <p>6 8 9.9/9.9 Sailpower 10 Sea Pro/Marathon XR/MAG/Viking 10 15</p> <p><b>Wide Open Throttle RPM</b></p> <p>6 8 9.9/9.9 Sailpower 10 Sea Pro/Marathon XR/MAG/Viking 10 15 15 Sea Pro/Marathon</p> <p><b>Idle Mixture Screw (Initial Setting)</b></p> <p><b>Float Setting (All Models)</b></p> <p><b>Main Jet –</b></p> <p><b>Thread size</b></p> <p>6 8 9.9/9.9 Sailpower 10 Sea Pro/Marathon XR/MAG 10 15</p> <p>6 8 9.9/9.9 Sailpower 10 Sea Pro/Marathon XR/MAG 10 15/Viking 10 15 Sea Pro/Marathon</p>	<p>Center Bowl, Integral Fuel Pump</p> <p>650 ± 75 725 ± 50 725 ± 50 850 ± 50 725 ± 50 725 ± 50</p> <p>4000 – 5000 4500 – 5500 5000 – 6000 5000 – 6000 5000 – 6000 5000 – 6000 5000 – 6000</p> <p>Refer to Section 3 for Specifics 25.4 mm (1 in.)</p> <p>10–32 1994 Model Year .042 .046 .052 .064 .052 .066</p> <p>1995 and Newer .042 .046 .048 .052 .052 .072 .072</p>
<b>TIMING SPECIFICATIONS</b>	<p><b>Idle</b></p> <p>6 8/8 Sailmate 9.9/9.9 Sailpower 10 Sea Pro/Marathon XR/MAG/Viking 10 15 15 Sea Pro/Marathon</p> <p><b>Maximum BTDC @ 4500 RPM – All Models</b></p>	<p>8° BTDC ± 1° 8° BTDC ± 1°</p> <p>36° BTDC</p>



## Propeller Information Chart - 6 HP

Wide Open Throttle RPM: 4000-5000

Recommended Transom Height: 15", 20", 25"

Right Hand Rotation Standard

Gear Reduction: 2:1

Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat WGT. (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
9"	9"	3	Alum.	Up To 1400	Up To 15'	10-19	48-828156A12
9"	8"	3	Alum.	1000 – 2200	12' - 16'	8-15	48-828154A12
9-1/4"	7"	3	Alum.	1200 – 2600	13' - 17'	5-12	48-828152A12
9-3/4"	6-1/2"	3	Alum.	1500+	High Reverse Thrust	3-10	48-828150A12
9-3/4"	5-1/2"	3	Alum.	1900+	Workboat	1-8	48-828148A12

Thrust Hub: 42630 1 (Forward)

Propeller Drive Hub: 827598T

Diffuser Ring: 42594 (Aluminum)

## Propeller Information Chart - 8 HP

Wide Open Throttle RPM: 4500-5500

Recommended Transom Height: 15", 20", 25"

Right Hand Rotation Standard

Gear Reduction: 2:1

Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat WGT. (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
9"	9"	3	Alum.	Up To 1200	Up To 16'	12-22	48-82815612
9"	8"	3	Alum.	1100 – 2000	14' - 17'	10-20	48-828154A12
9-1/4"	7"	3	Alum.	900 – 2400	14' - 18'	7-15	48-828152A12
9-3/4"	6-1/2"	3	Alum.	1400+	High Reverse Thrust	4-12	48-828150A12
9-3/4"	5-1/2"	3	Alum.	1700+	Workboat	1-10	48-828148A12

Thrust Hub: 42630 1 (Forward)

Propeller Drive Hub: 827598T

Diffuser Ring: 42594 (Aluminum)



## Propeller Information Chart -9.9/10 HP

Wide Open Throttle RPM: 5000-6000

Recommended Transom Height: 15", 20", 25"

Right Hand Rotation Standard

Gear Reduction: 2:1

Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat WGT. (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
9"	9"	3	Alum.	Up To 1200	Up To 16'	12-24	48-828156A12
9"	8"	3	Alum.	1100 – 2000	14' - 17'	12-22	48-828154A12
9-1/4"	7"	3	Alum.	900 – 2400	14' - 18'	8-18	48-828152A12
9-3/4"	6-1/2"	3	Alum.	1400+	High Reverse Thrust	5-15	48-828150A12
9-3/4"	5-1/2"	3	Alum.	1700+	Workboat	1-13	48-828148A12

Thrust Hub: 42630 1 (Forward)

Propeller Drive Hub: 827598T

Diffuser Ring: 42594 (Aluminum)

## Propeller Information Chart -15 HP

Wide Open Throttle RPM: 5000-6000

Recommended Transom Height: 15", 20", 25"

Right Hand Rotation Standard

Gear Reduction: 2:1

Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat WGT. (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
9"	10-1/2"	3	Alum.	Up To 1000	Up To 16'	18-28	48-828158A12
9"	9"	3	Alum.	600 – 1500	14' - 18'	14-24	48-828156A12
9"	8"	3	Alum.	800 – 2400	15' - 20'	15-25	48-828154A12
9-1/4"	7"	3	Alum.	1000 – 3400	16' - 22'	8-18	48-828152A12
9-3/4"	6-1/2"	3	Alum.	1800+	High Reverse Thrust	1-15	48-828150A12

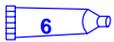
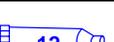
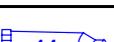
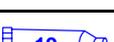
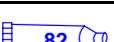
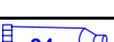
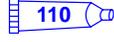
Thrust Hub: 42630 1 (Forward)

Propeller Drive Hub: 827598T

Diffuser Ring: 42594 (Aluminum)



# Mercury/Quicksilver Lubricants and Sealants

Tube Ref. No.	Description	Mercury Part Number	Quicksilver Part Number
 4	Needle Bearing Assembly Lubricant	92-802868A1	N/A
 6	Dielectric Grease	92-823506-1	92-823506-1
 7	Loctite 271 – Thread Locker	92-809819	92-809819
 9	Loctite 567 PST Pipe Sealant	92-809822	92-809822
 12	Loctite Master Gasket Kit	92-12564-2	92-12564-2
 14	2 Cycle Premium Outboard Oil	92-802813A1	92-802813Q1
 19	Perfect Seal	92-34227-1	92-34227-1
 25	Liquid Neoprene	92-25711-3	92-25711-3
 27	Bellows Adhesive	N/A	92-86166Q1
 33	Loctite 680 Retaining Compound	92-809833	92-809833
 34	Special Lubricant 101	92-802865A1	92-802865Q1
 42	U-Joint and Gimbal Bearing Grease	92-802870A1	92-802870Q1
 51	Loctite 222 Thread Locker	92-809818	92-809818
 66	Loctite 242 Thread Locker	92-809821	92-809821
 79	4 Cycle 25W40 Engine Oil	92-802837A1	92-802837Q1
 82	Premium Gear Lubricant	92-802846A1	92-802846Q1
 87	High Performance Gear Lube	92-802854A1	92-802854Q1
 91	Engine Coupler Spline Grease	92-802869A1	92-802869Q1
 94	Anti-Corrosion Grease	92-802867A1	92-802867Q1
 95	2-4-C with Teflon	92-802859A1	92-802859Q1
 110	4 Stroke 10W30 Outboard Oil	92-802833A1	92-802833Q1
 114	Power Trim & Steering Fluid	92-802880A1	92-802880Q1



Tube Ref. #	Description	Mercury Part Number	Quicksilver Part Number
115	Premium Plus 2 Cycle TC-W3 Outboard Oil	92-802824A1	92-802824Q1
116	RTV 587 Silicone Sealer	92-809825	92-809825
117	Loctite 7649 Primer N	92-809824	92-809824
119	Storage Seal Rust Inhibitor	92-802878-56	92-802878Q56
120	Corrosion Guard	92-802878 55	92-802878Q55
121	15W40 4-cycle Diesel Engine Oil	92-877695K1	92-877695Q1
122	Extended Life Anti-freeze/Coolant	92-877770K1	92-877770K1
123	Marine Engine Coolant	NA	92-813054A2
124	Fuel System Treatment and Stabilizer Concentrate	92-802876A1	92-802876Q1
125	Heat Transfer Compound	92-805701 1	
126	Liquid Gasket	92-808137	NA
127	T442 Sealant	92-862258	NA
128	Loctite 5900 Ultra Black RTV Silicone Sealant	92-809826	NA
129	Loctite Gasket Remover	92-809828 1	NA
130	Sealer Kit, Two Part Epoxy	NA	92-65150 1
131	Anti-seize Compound	92-881091K1	
132	Torco MTF Gear Oil	92-849864-1	
133	Optimol Longtime PD 2	92-848767	
134	Dexron III Automatic Transmission Fluid	Obtain Locally	Obtain Locally
135	Loctite 592	Obtain Locally	Obtain Locally
136	Loctite Quick Tite	Obtain Locally	Obtain Locally
137	Isopropyl Alcohol	Obtain Locally	Obtain Locally
138	Hot Glue	Obtain Locally	Obtain Locally
139	Loctite 609	Obtain Locally	Obtain Locally
140	Loctite 405	Obtain Locally	Obtain Locally



<b>Tube Ref. #</b>	<b>Description</b>	<b>Mercury Part Number</b>	<b>Quicksilver Part Number</b>
141	Cyanacrylate Adhesive	Obtain Locally	Obtain Locally
142	3M Permabond #3M08155	Obtain Locally	Obtain Locally
143	Loctite 262	Obtain Locally	Obtain Locally
144	Loctite 290	Obtain Locally	Obtain Locally
145	Loctite 598 RTV Sealant	Obtain Locally	Obtain Locally
146	Insulating Compound	92-41669-1	



# GENERAL INFORMATION & SPECIFICATIONS

## Section 1B – Maintenance

**1  
B**

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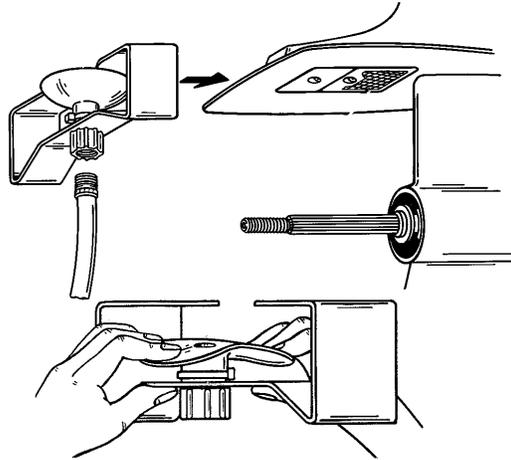


# Gearcase Lubricant Capacity

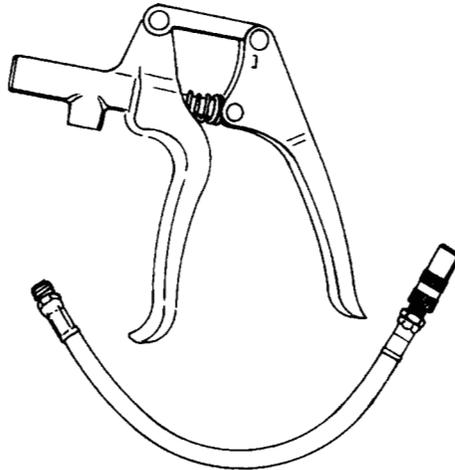
Gear Case Ratio	Capacity
2.00:1	200.0 ml (6.8 fl. oz.)

## Special Tools

1. Flushing attachment 12612Q2



2. Grease gun 91-37299Q2





# Inspection and Maintenance Schedule

## Before Each Use

1. Check that lanyard stop switch stops the engine.
2. Visually inspect the fuel system for deterioration or leaks.
3. Check outboard for tightness on transom.
4. Check steering system for binding or loose components.
5. Visually check steering link rod fasteners for proper tightness.
6. Check propeller blades for damage.

## After Each Use

1. Flush out the outboard cooling system if operating in salt or polluted water.
2. Wash off all salt deposits and flush out the exhaust outlet of the propeller and gearcase with fresh water if operating in salt water.

## Every 100 Hours of Use or Once Yearly, Whichever Occurs First

1. Lubricate all lubrication points. Lubricate more frequently when used in salt water.
2. Inspect and clean spark plugs.
3. Check fuel line filter for contaminants.
4. Check carburetor adjustments, if required.
5. Check corrosion control anodes. Check more frequently when used in salt water.
6. Drain and replace gearcase lubricant.
7. Lubricate splines on the drive shaft.\*
8. Electric start models – Inspect battery.
9. Remote control models – Check control cable adjustments. \*
10. Remove engine deposits with Power Tune Engine Cleaner.
11. Check tightness of bolts, nuts, and other fasteners.
12. Clean fuel tank pick up filter.

## Every 300 Hours of Use or Three Years

1. Replace water pump impeller (more often if overheating occurs or reduced water pressure is noted).\*

\* *These items should be serviced by an authorized dealer.*



## Flushing The Cooling System

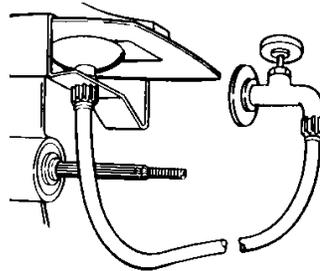
Flush the internal water passages of the outboard with fresh water after each use in salt, polluted, or muddy water. This will help prevent a buildup of deposits from clogging the internal water passages.

Use a Quicksilver accessory or equivalent flushing attachment.

### **⚠ WARNING**

**To avoid possible injury when flushing, remove the propeller. Refer to Propeller Replacement.**

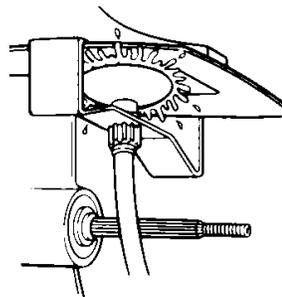
1. Remove propeller (refer to Propeller Replacement). Install the flushing attachment so the rubber cups fit tightly over the cooling water intake holes.



### **⚠ CAUTION**

**Never start or run your outboard (even momentarily) without water circulating through the cooling water intake in the gearcase to prevent damage to the water pump (running dry) or overheating of the engine.**

2. Attach a water hose to the flushing attachment. Turn on the water and adjust the flow so water is leaking around the rubber cups to ensure the engine receives an adequate supply of cooling water.
3. Start the engine and run it at idle speed in neutral shift position.
4. Adjust water flow if necessary so excess water continues leaking out from around the rubber cups to ensure the engine is receiving an adequate supply of cooling water.



5. Check for a steady stream of water flowing out of the water pump indicator hole. Continue flushing the outboard for 3 to 5 minutes, carefully monitoring water supply at all times.
6. Stop the engine, turn off the water, and remove the flushing attachment. Reinstall the propeller.



# Fuel System

## ⚠ WARNING

**Avoid serious injury or death from gasoline fire or explosion. Carefully follow all fuel system service instructions. Always stop the engine and DO NOT smoke or allow open flames or sparks in the area while servicing any part of the fuel system.**

Before servicing any part of the fuel system, stop engine and disconnect the battery. Drain the fuel system completely. Use an approved container to collect and store fuel. Wipe up any spillage immediately. Material used to contain spillage must be disposed of in an approved receptacle. Any fuel system service must be performed in a well ventilated area. Inspect any completed service work for sign of fuel leakage.

## Fuel Line Inspection

Visually inspect the fuel line and primer bulb for cracks, swelling, leaks, hardness or other signs of deterioration or damage. If any of these conditions are found, the fuel line or primer bulb must be replaced.

## Engine Fuel Filter

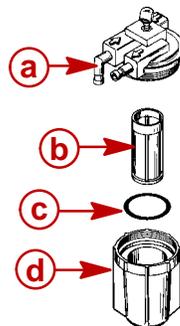
Inspect the sight bowl for water accumulation and inspect the filter element for sediment. Clean filter as follows.

### REMOVAL

1. Hold onto the filter cover cover to prevent it from turning.
2. Turn off the sight bowl.
3. Pull out the filter element and wash it with cleaning solvent.

### INSTALLATION

4. Push the open end of the filter element, into cover.
5. Place the O-ring seal into the sight bowl and screw the sight bowl hand tight into the cover.



- a** - Filter cover
- b** - Filter
- c** - O-ring
- d** - Sight bowl

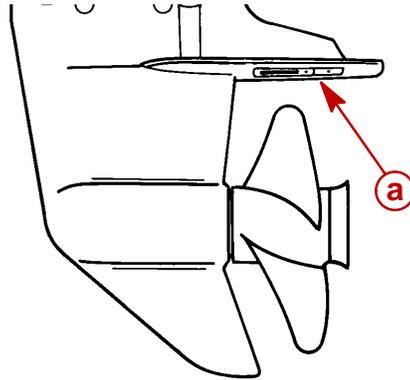
6. Visually inspect for fuel leakage around the sight bowl by squeezing the primer bulb until firm, forcing fuel into the sight bowl.



## Corrosion Control Anode

The outboard has a corrosion control anode installed to the gear case. An anode helps protect the outboard against galvanic corrosion by sacrificing its metal to be slowly eroded instead of the outboard metals.

1. The anode requires periodic inspection especially in salt water which will accelerate the erosion. To maintain this corrosion protection, always replace the anode before it is completely eroded. Never paint or apply a protective coating on the anode as this will reduce effectiveness of the anode.

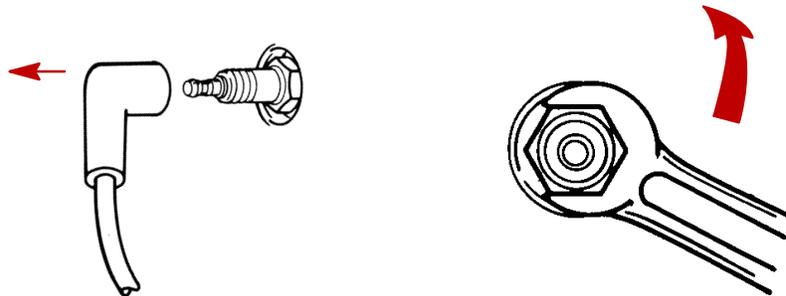


**a** - Anode

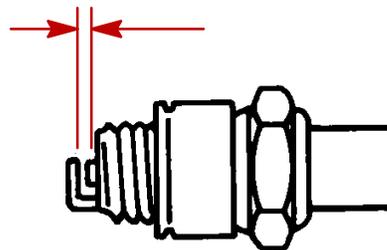
## Spark Plug Inspection

Inspect spark plugs at the recommended intervals.

1. Remove the spark plug leads by twisting the rubber boots slightly and pull off.
2. Remove the spark plugs to inspect and clean. Replace spark plug if electrode is worn or the insulator is rough, cracked, broken, blistered or fouled.



3. Set the spark plug gap. See Specification Chart in General Information Section.



4. Before reinstalling spark plugs, clean away dirt on the spark plug seats. Install plugs finger tight, and tighten 1/4 turn or torque to 27 N·m (20 lb. ft.).



## Battery Inspection

The battery should be inspected at periodic intervals to ensure proper engine starting capability.

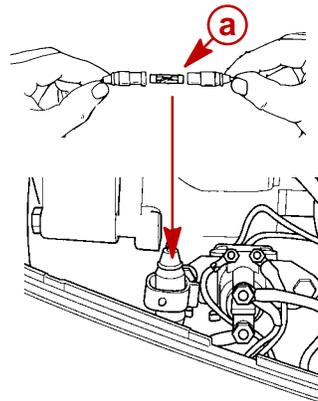
**IMPORTANT: Read the safety and maintenance instructions which accompany your battery.**

1. Turn off the engine before servicing the battery.
2. Add water as necessary to keep the battery full.
3. Make sure the battery is secure against movement.
4. Battery cable terminals should be clean, tight, and correctly installed. Positive to positive and negative to negative.
5. Make sure the battery is equipped with a nonconductive shield to prevent accidental shorting of battery terminals.

## Fuse Replacement – Electric Start Remote Control Models

The electric starting circuit is protected from overload by a SFE 20 AMP fuse. If the fuse is blown, the electric starter motor will not operate. Locate and correct the cause of the overload. If the cause is not found, the fuse may blow again. Replace the fuse with a fuse of the same rating.

1. Replace with a new SFE 20 AMP fuse.



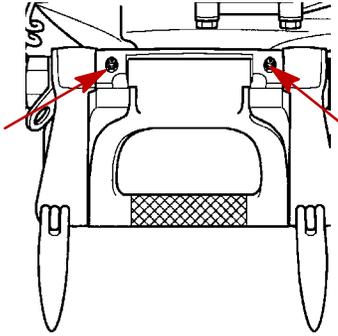
**a** - SFE 20 amp fuse



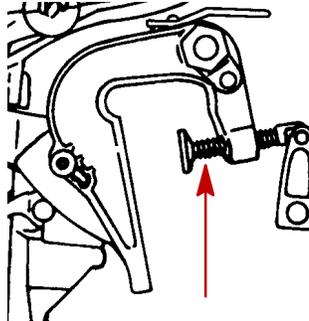
# Lubrication Points

1. Lubricate the following with 2-4-C with Teflon or Special Lubricant 101.

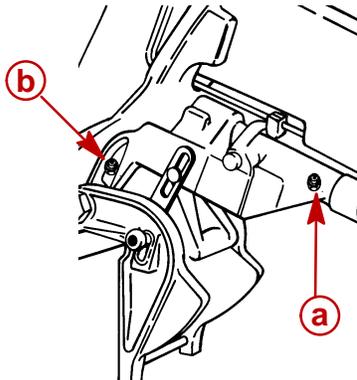
- Tilt tube.



- Transom clamp screws.



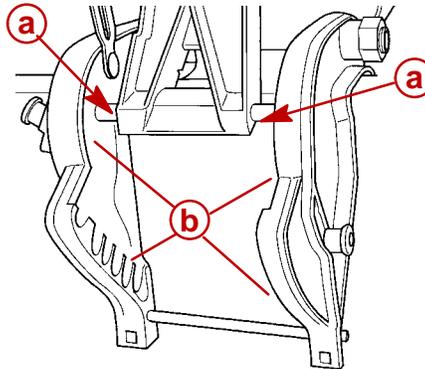
- Swivel bracket.
- Steering friction adjustment shaft (tiller handle models).



- a** - Swivel bracket
- b** - Steering friction adjustment shaft

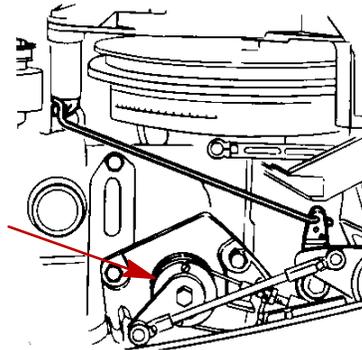


- Tilt lock pins (Make sure this pin is free to push in and out).
- Lubricate along the entire tilt pin track on both transom brackets.



- a** - Tilt lock pins
- b** - Tilt pin track

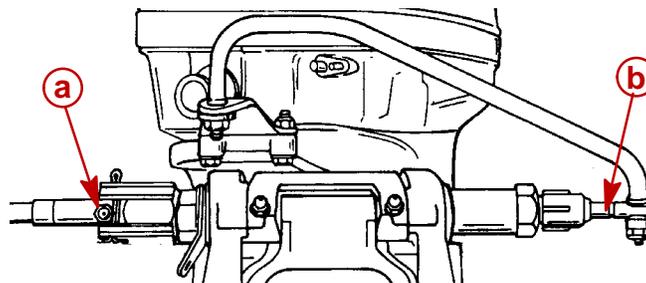
- Lubricate the throttle and shaft cables, moving components and pivot locations.



### **⚠ WARNING**

The end of the steering cable must be fully retracted into the outboard tilt tube before adding lubricant. Adding lubricant to steering cable when fully extended could cause steering cable to become hydraulically locked. An hydraulically locked steering cable will cause loss of steering control, possibly resulting in serious injury or death.

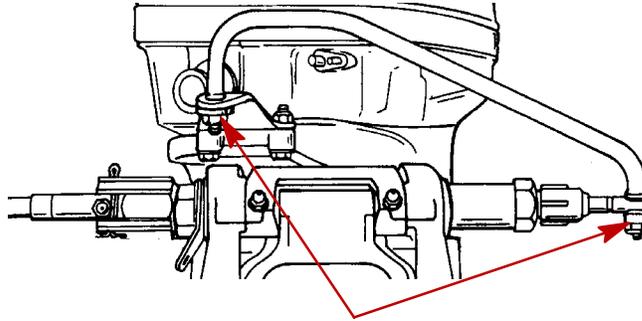
- Rotate steering wheel (if so equipped) to fully retract the steering cable end into the outboard tilt tube. Lubricate steering cable through grease fitting and cable end.



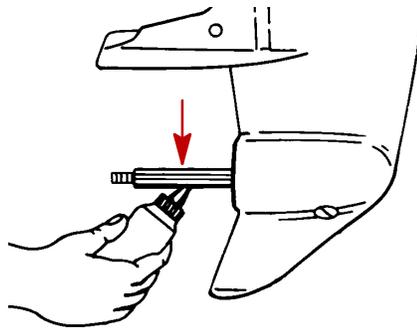
- a** - Grease fitting
- b** - Steering cable end



2. Lubricate the following with light weight oil.
  - Steering Link Rod Pivot Points.



3. Lubricate the following with anti-corrosion grease or 2-4-C with Teflon.
  - Coat the entire propeller shaft with lubricant to prevent the propeller hub from corroding to the shaft.



## Gearcase Lubrication

### Gearcase Lubricant Capacity

Gear Case Ratio	Capacity
2.00:1	200.0 ml (6.8 fl. oz.)

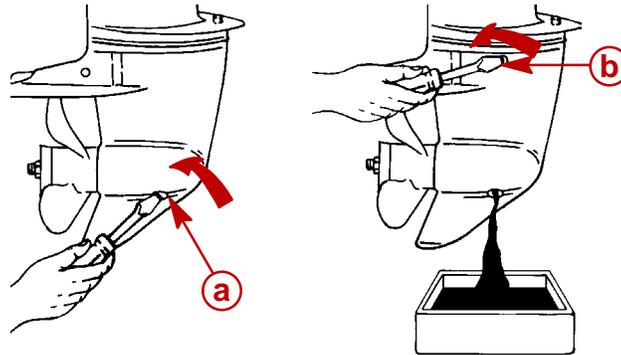
### Draining Gearcase

When adding or changing gearcase lubricant, visually check for the presence of water in the lubricant. If water is present, it may have settled to the bottom and will drain out prior to the lubricant, or it may be mixed with the lubricant, giving it a milky colored appearance. If water is noticed, have the gearcase checked by your dealer. Water in the lubricant may result in premature bearing failure or, in freezing temperatures, will turn to ice and damage the gearcase.

Whenever you remove the fill/drain plug, examine the magnetic end for metal particles. A small amount of metal filings or fine metal particles indicates normal gear wear. An excessive amount of metal filings or larger particles (chips) may indicate abnormal gear wear and should be checked by an authorized dealer.



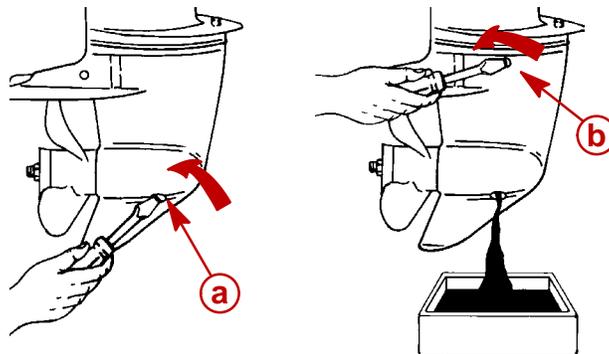
1. Place outboard in a vertical operating position.
2. Place drain pan below outboard.
3. Remove fill/drain plug and vent plug and drain lubricant.



- a** - Fill/Drain Plug  
**b** - Vent plug

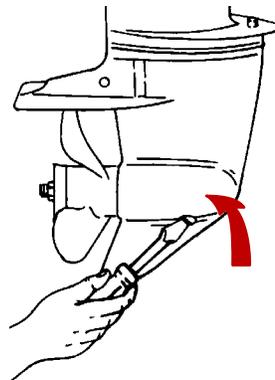
## Checking Lubricant Level and Refilling Gearcase

1. Place outboard in a vertical operating position.
2. Remove vent plug from vent hole.
3. Place lubricant tube into the fill hole and add lubricant until it appears at the vent hole.
4. Stop adding lubricant. Install the vent plug and sealing washer before removing the lubricant tube.



- a** - Fill/Drain plug  
**b** - Vent plug

5. Remove lubricant tube and reinstall cleaned fill/drain plug and sealing washer.





# Storage Preparations

## Fuel System

**IMPORTANT:** Gasoline containing alcohol (ethanol or methanol) can cause a formation of acid during storage and can damage the fuel system. If the gasoline being used contains alcohol, it is advisable to drain as much of the remaining gasoline as possible from the fuel tank, remote fuel line, and engine fuel system.

Fill the fuel system (tank, hoses, fuel pumps, and fuel injection systems) with treated (stabilized) fuel to help prevent formation of varnish and gum. Proceed with following instructions.

1. Portable fuel tank – Pour the required amount of fuel system/stabilizer concentrate (follow instructions on container) into fuel tank. Tip fuel tank back and forth to mix stabilizer with the fuel.
2. Permanently Installed Fuel Tank – Pour the required amount of fuel system/stabilizer concentrate (follow instructions on container) into a separate container and mix with approximately one liter (one quart) of gasoline. Pour mixture into fuel tank.
3. Place the outboard in water or connect flushing attachment. Run the engine for ten minutes to allow treated fuel to fill the fuel system.

## Protecting External Engine Components

1. Lubricate all outboard components listed in the **Inspection and Maintenance Schedule**.
2. Touch up any paint nicks.
3. Spray Corrosion Guard on external metal surfaces (except corrosion control anodes).

## Protecting Internal Engine Components

**NOTE:** Before performing Steps 1 and 2, make sure the fuel system has been prepared for storage.

1. Place the outboard in water or connect flushing attachment. Start the engine and let it run in neutral to warm up.
2. With engine running at fast idle, stop the fuel flow by disconnecting the remote fuel line. When engine begins to stall, quickly spray Storage Seal Rust Inhibitor into carburetor until engine stops from lack of fuel.
3. Remove the spark plugs and inject a five second spray of Storage Seal Rust Inhibitor around the inside of each cylinder.
4. Rotate the flywheel manually several times to distribute the Storage Seal in the cylinders. Reinstall spark plugs.

## Gearcase

Drain and refill the gearcase lubricant. Refer to **Refilling Gearcase**



## Positioning Outboard for Storage

Store outboard in an upright position to allow water to drain out of outboard.

### CAUTION

If outboard is stored tilted up in freezing temperature, trapped cooling water or rain water that may have entered the propeller exhaust outlet in the gearcase could freeze and cause damage to the outboard.

## Battery Storage

1. Follow the battery manufacturers instructions for storage and recharging.
2. Remove the battery from the boat and check water level. Recharge if necessary.
3. Store the battery in a cool, dry place.
4. Periodically check the water level and recharge the battery during storage.





# GENERAL INFORMATION & SPECIFICATIONS

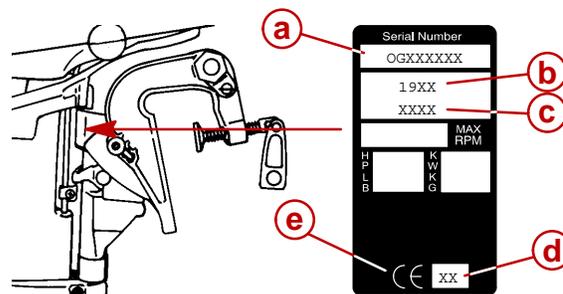
## Section 1C – General Information

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### Serial Number Location

The Outboard serial number is located on the lower starboard side of the engine block. A serial number is also located on the starboard side of the swivel bracket.

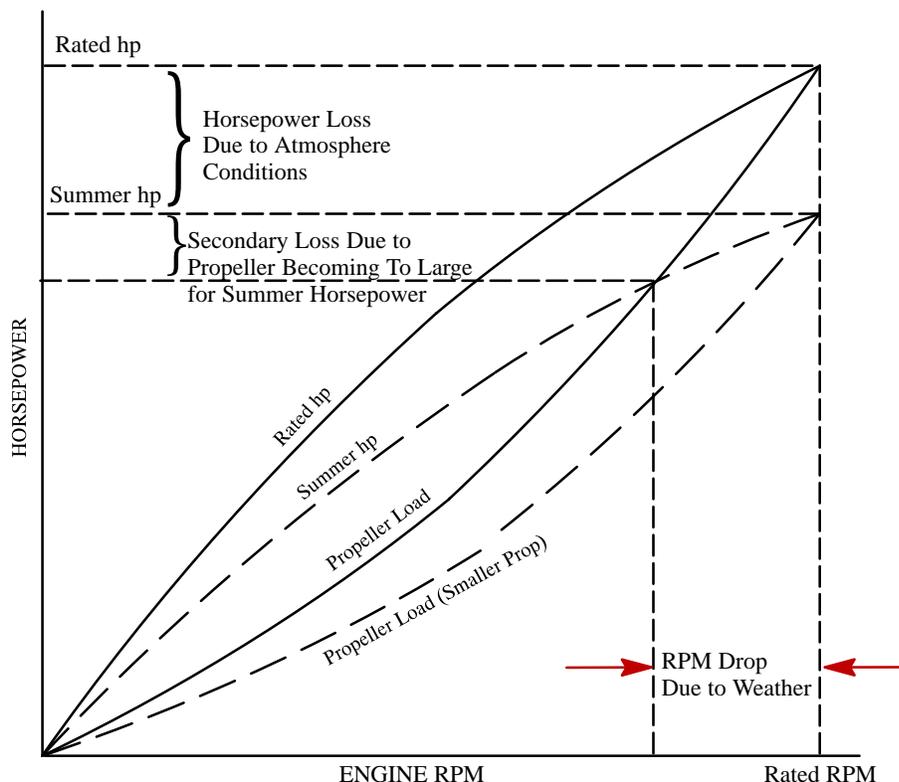


- a** - Serial number
- b** - Model year
- c** - Model description
- d** - Year manufactured
- e** - Certified Europe insignia



# Conditions Affecting Performance

## Weather



It is a known fact that weather conditions exert a profound effect on power output of internal combustion engines. Therefore, established horsepower ratings refer to the power that the engine will produce at its rated RPM under a specific combination of weather conditions.

Corporations internationally have settled on adoption of I.S.O. (International Standards Organization) engine test standards, as set forth in I.S.O. 3046 standardizing the computation of horsepower from data obtained on the dynamometer. All values are corrected to the power that the engine will produce at sea level, at 30% relative humidity, at 25° C (77° F) temperature and a barometric pressure of 29.61 inches of mercury.

Summer conditions of high temperature, low barometric pressure and high humidity all combine to reduce the engine power. This, in turn, is reflected in decreased boat speeds--as much as 3 or 5 Km per-hour (2 or 3 miles-per-hour) in some cases. (Refer to previous chart.) Nothing will regain this speed for the boater, but the coming of cool, dry weather.

In pointing out the practical consequences of weather effects, an engine--running on a hot, humid summer day--may encounter a loss of as much as 14% of the horsepower it would produce on a dry, brisk spring or fall day. The horsepower, that any internal combustion engine produces, depends upon the density of the air that it consumes, and in turn, this density is dependent upon the temperature of the air, its barometric pressure and water vapor (or humidity) content.

Accompanying this weather-inspired loss of power is a second but more subtle loss. At rigging time in early spring, the engine was equipped with a propeller that allowed the engine to turn within its recommended RPM range at full throttle. With the coming of the summer weather and the consequent drop in available horsepower, this propeller will, in effect, become too large. Consequently, the engine operates at less than its recommended RPM.



Due to the horsepower/RPM characteristics of an engine, this will result in further loss of horsepower at the propeller with another decrease in boat speed. This secondary loss, however, can be regained by switching to a smaller pitch propeller that allows the engine to again run at recommended RPM.

For boaters to realize optimum engine performance under changing weather conditions, it is essential that the engine have the proper propeller to allow it to operate at or near the top end of the recommended maximum RPM range at wide-open-throttle with a normal boat load.

Not only does this allow the engine to develop full power, but equally important is the fact that the engine also will be operating in an RPM range that discourages damaging detonation. This, of course, enhances overall reliability and durability of the engine.

## Boat

### WEIGHT DISTRIBUTION

1. Proper positioning of the weight inside the boat (persons and gear) has a significant effect on the boat's performance, for example:
  - a. Shifting weight to the rear (stern)
    - (1.) Generally increases top speed.
    - (2.) If in excess, can cause the boat to porpoise.
    - (3.) Can make the bow bounce excessively in choppy water.
    - (4.) Will increase the danger of the following - wave splashing into the boat when coming off plane.
  - b. Shifting weight to the front (bow)
    - (1.) Improves ease of planing off.
    - (2.) Generally improves rough water ride.
    - (3.) If excessive, can make the boat veer left and right (bow steer).

### BOTTOM

For maximum speed, a boat bottom should be nearly a flat plane where it contacts the water and particularly straight and smooth in fore-and-aft direction.

1. **Hook:** Exists when bottom is concave in fore-and-aft direction when viewed from the side. When boat is planing, hook causes more lift on bottom near transom and allows bow to drop, thus greatly increasing wetted surface and reducing boat speed. Hook frequently is caused by supporting boat too far ahead of transom while hauling on a trailer or during storage.
2. **Rocker:** The reverse of hook and much less common. Rocker exists if bottom is convex in fore-and-aft direction when viewed from the side, and boat has strong tendency to porpoise.
3. **Surface Roughness:** Moss, barnacles, etc., on boat or corrosion of outboard's gear housing increase skin friction and cause speed loss. Clean surfaces when necessary.

### WATER ABSORPTION

It is imperative that all through hull fasteners be coated with a quality marine sealer at time of installation. Water intrusion into the transom core and/or inner hull will result in additional boat weight (reduced boat performance), hull decay and eventual structural failure.



## CAVITATION

Cavitation is caused by water vapor bubbles forming either from a sharp edge or angle on the gear case or from an irregularity in the propeller blade itself. These vapor bubbles flow back and collapse when striking the surface of the propeller blade resulting in the erosion of the propeller blade surface. If allowed to continue, eventual blade failure (breakage) will occur.

## Engine

### DETONATION

Detonation in a 2-cycle engine resembles the pinging heard in an automobile engine. It can be otherwise described as a tin-like rattling or plinking sound.

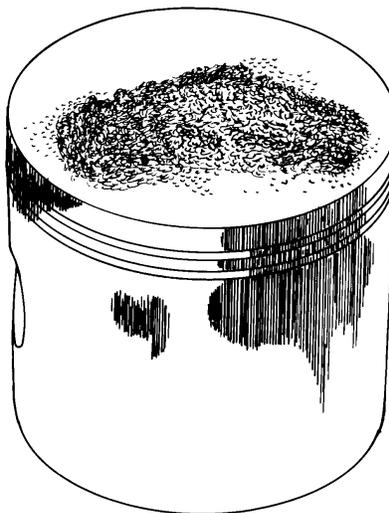
Detonation is an explosion of an unburned portion of the fuel/air charge after the spark plug has fired. Detonation creates severe shock waves in the engine, and these shock waves often find or create a weakness: The dome of a piston, cylinder head/gasket, piston rings or piston ring lands, piston pin and roller bearings.

A few of the most common causes of detonation in a marine 2-cycle application are as follows:

- Over-advanced ignition timing.
- Use of low octane gasoline.
- Propeller pitch too high (engine RPM below recommended maximum range).
- Lean fuel mixture at or near wide-open-throttle.
- Spark plugs (heat range too hot - incorrect reach - cross-firing).
- Inadequate engine cooling (deteriorated cooling system).
- Combustion chamber/piston deposits (result in higher compression ratio).

Detonation usually can be prevented if:

1. The engine is correctly set up.
2. Diligent maintenance is applied to combat the detonation causes.



51115

**Damaged Piston Resulting from Detonation**



## Following Complete Submersion

### Submerged While Running

When an engine is submerged while running, the possibility of internal engine damage is greatly increased. If, after engine is recovered and with spark plugs removed, engine fails to turn over freely when turning flywheel, the possibility of internal damage (bent connecting rod and/or bent crankshaft) exists. If this is the case, the powerhead must be disassembled.

### Fresh Water Submersion

1. Recover engine as quickly as possible.
2. Remove cowling.
3. Flush exterior of outboard with fresh water to remove mud, weeds, etc. DO NOT attempt to start engine if sand has entered powerhead, as powerhead will be severely damaged. Disassemble powerhead if necessary to clean components.
4. Remove spark plugs and get as much water as possible out of powerhead. Most water can be eliminated by placing engine in a horizontal position (with spark plug holes down) and rotating flywheel.
5. Pour alcohol into carburetor throats (alcohol will absorb water). Again rotate flywheel.
6. Turn engine over and pour alcohol into spark plug openings and rotate flywheel.
7. Turn engine over (place spark plug openings down) and pour engine oil into throat of carburetors while rotating flywheel to distribute oil throughout crankcase.
8. Again turn engine over and pour approximately one teaspoon of engine oil into each spark plug opening. Again rotate flywheel to distribute oil in cylinders.
9. Remove and clean carburetors and fuel pump assembly.
10. Dry all wiring and electrical components using compressed air.
11. Disassemble the engine starter motor and dry the brush contacts, armature and other corrodible parts.
12. Reinstall spark plugs, carburetors and fuel pump.
13. Attempt to start engine, using a fresh fuel source. If engine starts, it should be run for at least one hour to eliminate any water in engine.
14. If engine fails to start, determine cause (fuel, electrical or mechanical). Engine should be run within 2 hours after recovery of outboard from water, or serious internal damage may occur. If unable to start engine in this period, disassemble engine and clean all parts. Apply oil as soon as possible.

### Salt Water Submersion

Due to the corrosive effect of salt water on internal engine components, complete disassembly is necessary before any attempt is made to start the engine.



## Propeller Selection

For in-depth information on marine propellers and boat performance see your Authorized Dealer for the illustrated **What You Should Know About Quicksilver Propellers... and Boat Performance Information** (Part No. 90-86144 92).

For best all around performance from your outboard/boat combination, select a propeller that allows the engine to operate in the upper half of the recommended full throttle RPM range with the boat normally loaded (refer to **Section 1A - Specifications**). This RPM range allows for better acceleration while maintaining maximum boat speed.

If changing conditions cause the RPM to drop below the recommended range (such as warmer, more humid weather, operation at higher elevations, increased boat load or a dirty boat bottom/gear case) a propeller change or cleaning may be required to maintain performance and ensure the outboard's durability.

Check full-throttle RPM using an accurate tachometer with the engine trimmed out to a balanced-steering condition (steering effort equal in both directions) without causing the propeller to break loose.

Refer to **Mercury Precision Parts/Quicksilver Accessory Guide** for a complete list of available propellers.

1. Select a propeller that will allow the engine to operate at or near the top of the recommended full throttle RPM range (refer to **Section 1A - Specifications** preceding) with a normal load. Maximum engine speed (RPM) for propeller selection exists when boat speed is maximum and trim is minimum for that speed. (High RPM, caused by an excessive trim angle, should not be used in determining correct propeller.) Normally, there is a 150-350 RPM change between propeller pitches.
2. If full throttle operation is below the recommended range, the propeller must be changed to one with a lower pitch to prevent loss of performance and possible engine damage.
3. After initial propeller installation, the following common conditions may require that the propeller be changed to a lower pitch:
  - a. Warmer weather and great humidity will cause an RPM loss.
  - b. Operating in a higher elevation causes an RPM loss.
  - c. Operating with a damaged propeller or a dirty boat bottom or gear housing will cause an RPM loss.
  - d. Operation with an increased load (additional passengers, equipment, pulling skiers, etc.).

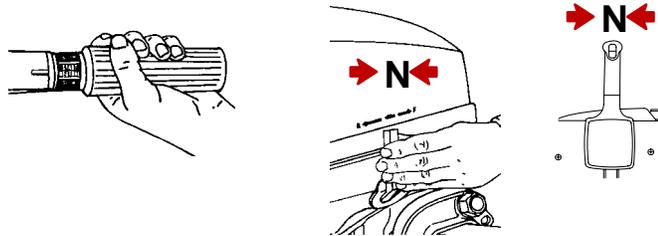


# Propeller Removal/Installation

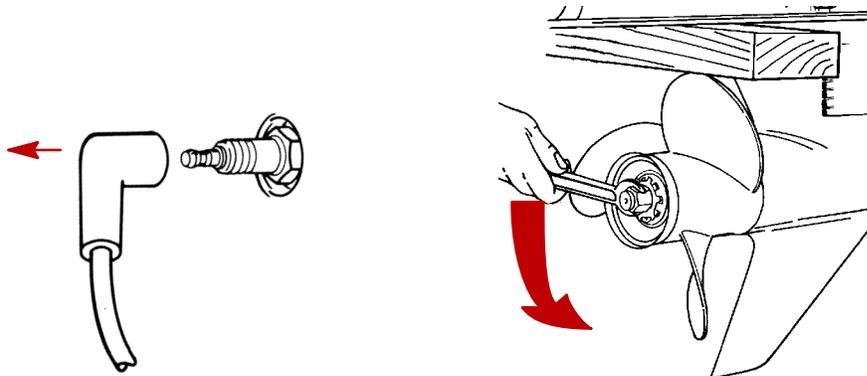
## ⚠ WARNING

If the propeller shaft is rotated while the engine is in gear, there is the possibility that the engine will crank over and start. To prevent this type of accidental engine starting and possible serious injury caused from being struck by a rotating propeller, always shift outboard to neutral position and remove spark plug leads when you are servicing the propeller.

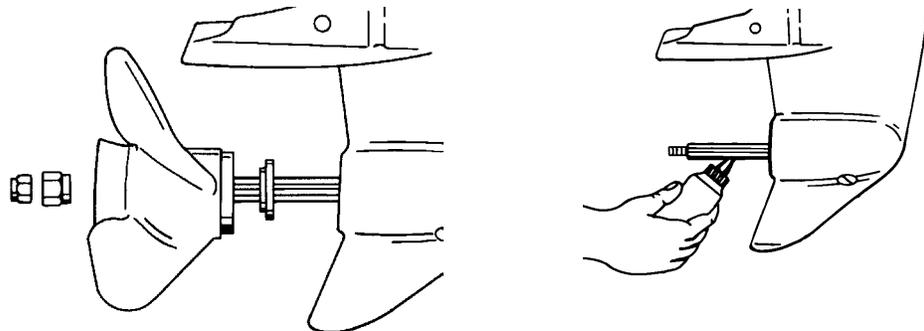
1. Shift outboard to neutral position.



2. Remove the spark plug leads to prevent engine from starting.
3. Place a block of wood between gear case and propeller to hold propeller and remove propeller nut.



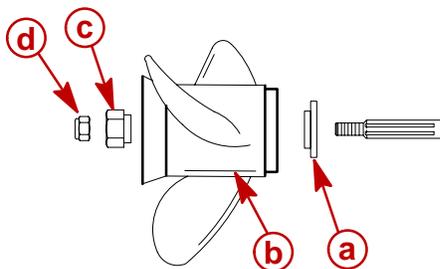
4. Pull propeller straight off shaft. If propeller is seized to the shaft and cannot be removed, have the propeller removed by an authorized dealer.
5. Coat the propeller shaft with Anti-Corrosion Grease or 2-4-C with Teflon.



**IMPORTANT:** To prevent the propeller hub from corroding and seizing to the propeller shaft, especially in salt water, always apply a coat of the recommended lubricant to the entire propeller shaft at the recommended maintenance intervals and also each time the propeller is removed.

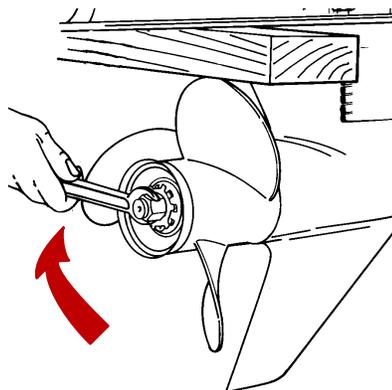


6. Install forward thrust hub, propeller, rear thrust hub and propeller nut onto the shaft.



- a** - Forward thrust hub
- b** - Propeller
- c** - Rear thrust hub
- d** - Propeller nut

7. Place a block of wood between gear case and propeller and tighten propeller nut.





## Compression Check

<b>Normal Compression (All Models)</b>	<b>787 – 856 kPa (115 – 125 psi)</b>
--	--------------------------------------

1. Remove spark plugs.
2. Install compression gauge in spark plug hole.
3. Hold throttle plate at W.O.T.
4. Crank the engine over until the compression reading peaks.
5. Check and record compression of each cylinder. The difference in compression readings between each cylinder should not vary more than 15%. If compression varies by more than 15% or compression for both cylinders is less than 685kPa (100psi), the powerhead should be disassembled and inspected.
6. Compression check is important because an engine with low or uneven compression cannot be tuned successfully to give peak performance. It is essential, therefore, that improper compression be corrected before proceeding with an engine tuneup.
7. Cylinder scoring: If powerhead shows any indication of overheating, such as discolored or scorched paint, visually inspect cylinders for scoring or other damage. Refer to **Section 4 Powerhead**.

## Painting Procedures

### Cleaning & Painting Aluminum Propellers & Gear Housings

<b>⚠ WARNING</b>
------------------

<b>Avoid serious injury from flying debris. Avoid serious injury from airborne particles. Use eye and breathing protection with proper ventilation.</b>
---

#### PROPELLERS

1. Sand the entire area to be painted with 3M 120 Regalite Polycut or coarse Scotch-Brite, disc or belts.
2. Feather edges of all broken paint edges. Try not to sand through the primer.
3. Clean the surface to be painted using PPG Industries DX330 Wax and Grease Remover or equivalent (Xylene or M.E.K.).
4. If bare metal has been exposed, use Mercury/Quicksilver's Light Gray Primer.
5. Allow a minimum of 1 hour dry time and no more than 1 week before applying the finish coat.
6. Apply the finish coat using Mercury/Quicksilver's EDP Propeller Black.



## GEAR HOUSINGS

The following procedures should be used in refinishing gear housings. This procedure will provide the most durable paint system available in the field. The materials recommended are of high quality and approximate marine requirements. The following procedure will provide a repaint job that compares with a properly applied factory paint finish. It is recommended that the listed materials be purchased from a local Ditzler Automotive Finish Supply Outlet. The minimum package quantity of each material shown following is sufficient to refinish several gear housings.

Procedure:

1. Wash gear housing with a muriatic acid base cleaner to remove any type of marine growth, and rinse with water, if necessary.
2. Wash gear housing with soap and water, then rinse.
3. Sand blistered area with 3M 180 grit sandpaper or P180 Gold Film Disc to remove paint blisters only. Feather edge all broken paint edges.
4. Clean gear housing thoroughly with (DX-330) wax and grease remover.
5. Spot repair surfaces where bare metal is exposed with (DX-503) alodine treatment.

**IMPORTANT: Do not use any type of aerosol spray paints as the paint will not properly adhere to the surface nor will the coating be sufficiently thick to resist future paint blistering.**

6. Mix epoxy chromate primer (DP-90LF) with equal part catalyst (DP-402LF) per manufacturers instructions, allowing proper induction period for permeation of the epoxy primer and catalyst.
7. Allow a minimum of one hour drying time and no more than one week before top coating assemblies.
8. Use Ditzler Urethane DU9300 for Mercury Black, DU34334 for Mariner Grey, and DU35466 for Force Charcoal, and DU33414 for Sea Ray White. Catalyze all three colors with Ditzler DU5 catalyst mixed 1:1 ratio. Reduce with solvents per Ditzler label.

### CAUTION

**Be sure to comply with instructions on the label for ventilation and respirators. Using a spray gun, apply one half to one mil even film thickness. Let dry, flash off for five minutes and apply another even coat of one half to one mil film thickness. This urethane paint will dry to the touch in a matter of hours, but will remain sensitive to scratches and abrasions for a few days.**

9. The type of spray gun used will determine the proper reduction ratio of the paint.

**IMPORTANT: Do not paint sacrificial zinc trim tab or zinc anode.**

10. Cut out a cardboard plug for trim tab pocket to keep paint off of mating surface to maintain good continuity circuitry between trim tab and gear housing.



# Decal Application

## Decal Removal

1. Mark decal location before removal to assure proper alignment of new decal.
2. Carefully soften decal and decal adhesive with a heat gun or heat blower while removing old decal.
3. Clean decal contact area with a 1:1 mixture of isopropyl alcohol and water.
4. Thoroughly dry decal contact area and check for a completely cleaned surface.

## Instructions for Wet Application

**NOTE:** The following decal installation instructions are provided for a wet installation. **All** decals should be applied wet.

## TOOLS REQUIRED

1. Plastic Squeegee\*
2. Stick Pin
3. Dish Washing liquid detergent without ammonia. Do not use a soap that contains petroleum based solvents.

\* Automotive body filler squeegee.

**SERVICE TIP:** Placement of decals using the wet application will allow time to position decal. Read entire installation instructions on this technique before proceeding.

## TEMPERATURE

**IMPORTANT:** Installation of vinyl decals should not be attempted while in direct sunlight. Air and surface temperature should be between 15°C (60°F) and 38°C (100°F) for best application.

## SURFACE PREPARATION

**IMPORTANT:** Do not use a soap or any petroleum based solvents to clean application surface.

Clean entire application surface with mild dish washing liquid and water. Rinse surface thoroughly with clean water.



## DECAL APPLICATION

1. Mix 16 ml ( $\frac{1}{2}$  ounce) of dish washing liquid in 4 literes (1 gallon) of cool water to use as wetting solution.

**NOTE:** Leave protective masking, if present, on the face of decal until final steps of decal installation. This will ensure that the vinyl decal keeps it's shape during installation.

2. Place the decal face down on a clean work surface and remove the paper backing from adhesive side of decal.
3. Using a spray bottle, flood the entire adhesive side of the decal with the pre-mixed wetting solution.
4. Flood area where the decal will be positioned with wetting solution.
5. Position pre-wetted decal on wetted surface and slide into position.
6. Starting at the center of the decal, lightly squeegee out the air bubbles and wetting solution with overlapping strokes to the outer edge of the decal. Continue going over the decal surface until all wrinkles are gone and adhesive bonds to the cowl surface.
7. Wipe decal surface with soft paper towel or cloth.
8. Wait 10 - 15 minutes.
9. Starting at one corner, carefully and slowly pull the masking off the decal surface at a 180° angle.

**NOTE:** To remove any remaining bubbles, pierce the decal at one end of the bubble with stick pin and press out the entrapped air or wetting solution with your thumb (moving toward the puncture).



# GENERAL INFORMATION & SPECIFICATIONS

# 1 D

## Section 1D – Outboard Installation

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### Notice to Installer and Owner

This manual as well as safety labels posted on the outboard use the following safety alerts to draw your attention to special safety instructions that should be followed.

**⚠ DANGER**

**DANGER – Immediate hazards which will result in severe personal injury or death.**

**⚠ WARNING**

**WARNING – Hazards or unsafe practices which could result in severe personal injury or death.**

**⚠ CAUTION**

**CAUTION – Hazards or unsafe practices which could result in minor injury or product or property damage.**

### Boat Horsepower Capacity

U.S. COAST GUARD CAPACITY	
MAXIMUM HORSEPOWER	XXX
MAXIMUM PERSON CAPACITY (POUNDS)	XXX
MAXIMUM WEIGHT CAPACITY	XXX

Do not overpower or overload your boat. Most boats will carry a required capacity plate indicating the maximum acceptable power and load as determined by the manufacturer following certain federal guidelines. If in doubt, contact your dealer or the boat manufacturer.

**⚠ WARNING**

Using an outboard that exceeds the maximum horsepower limit of a boat can: 1) cause loss of boat control 2) place too much weight at the transom altering the designed flotation characteristics of the boat or 3) cause the boat to break apart particularly around the transom area. Overpowering a boat can result in serious injury, death, or boat damage.

## Outboard Remote Control

The remote control connected to your outboard must be equipped with a start in gear protection device. This prevents the engine from starting when the outboard is in gear.

**⚠ WARNING**

Avoid serious injury or death from a sudden unexpected acceleration when starting your engine. The design of this outboard requires that the remote control used with it must have a built in start in gear protection device.

## Selecting Accessories For The Outboard

Mercury Marine Quicksilver Accessories have been specifically designed and tested for your outboard.

Mercury Marine Quicksilver accessories are available from Mercury Marine dealers.

Some accessories not manufactured or sold by Mercury Marine are not designed to be safely used with your outboard or outboard operating system. Acquire and read the installation, operation, and maintenance manuals for all your selected accessories.

## Selecting Steering Cables and Remote Control Cables

Install steering mount and steering wheel in accordance with installation instructions that accompany each.

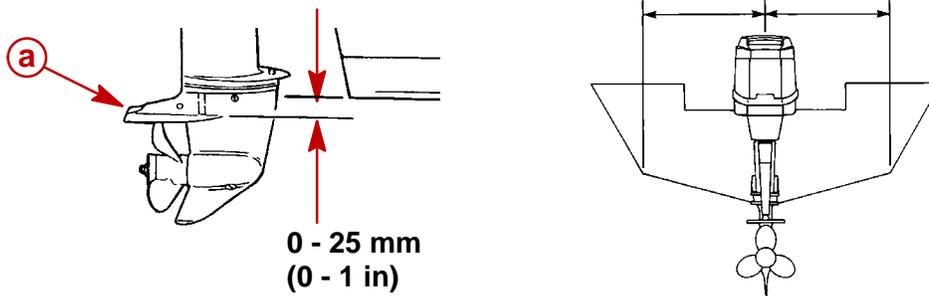
**IMPORTANT: Steering cable must be correct length. Sharp bends on too-short of a cable result in kinks; too-long of a cable require unnecessary bends and/or loops. Both conditions place extra stress on the cable.**

Refer to **Mercury Precision Parts/Quicksilver Accessories Guide** to determine correct length of steering cable.



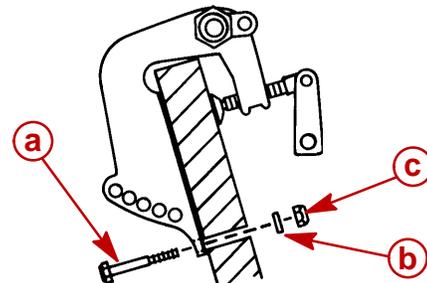
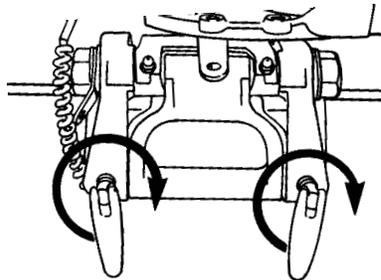
## Installing Outboard

1. Measure the transom height of your boat. The boat bottom should be aligned or be within 25 mm (1 in.) above the anti-ventilation plate of the outboard.
2. Place outboard on center line of transom.



**a** - Anti-Ventilation Plate

3. Tighten transom clamp handles.
4. To prevent loss of outboard overboard, fasten outboard by drilling two 7.9 mm (5/16 in.) holes through the transom using transom clamp holes as a template. Fasten with two bolts, flat washers and locknuts. Use a marine waterproofing sealer in holes and around bolts to make the installation water tight.



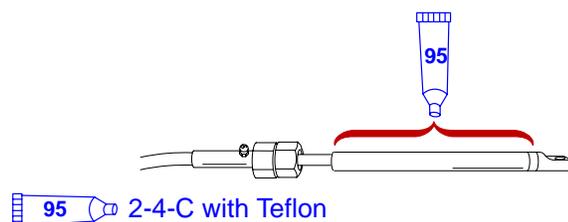
- a** - Bolts (2)  
**b** - Flat washers (2)  
**c** - Locknuts (2)

## Steering Cable and Steering Link Rod Installation

### Installing Ride Guide Steering Cable to the Outboard

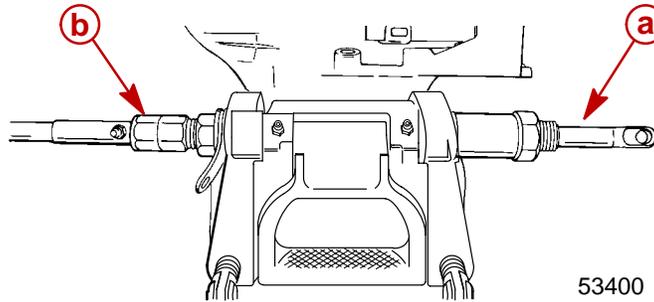
**IMPORTANT:** Before installing steering cable into tilt tube, lubricate entire cable end with 2-4-C with Teflon.

1. Lubricate the entire cable end.





2. Insert steering cable end through outboard tilt tube and secure steering cable to tilt tube with steering cable attaching nut as shown. Tighten to specified torque.

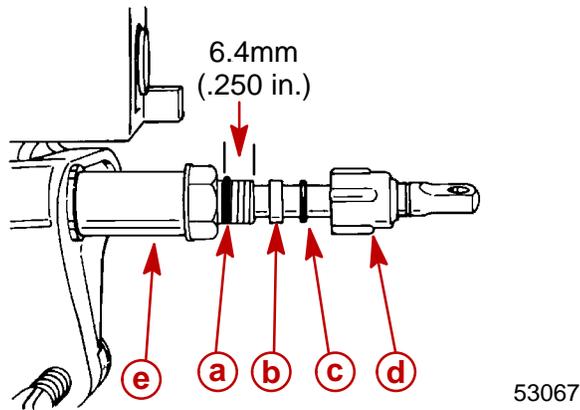


- a** - Cable end
- b** - Attaching nut

<b>Steering Cable Attaching Nut Torque</b>
47.5 Nm (35 lb-ft)

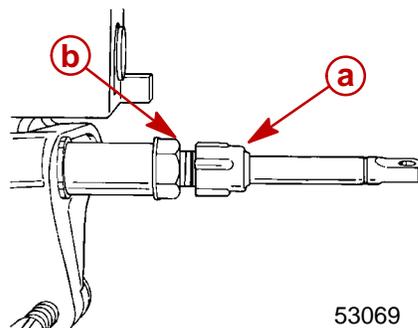
### Steering Cable Seal

1. Place a mark on tilt tube 6.4 mm (.250 in.) from port end of tube. Slide plastic spacer, O-ring and cap over steering cable end, to tilt tube on engine.



- a** - Mark
- b** - Spacer
- c** - O-ring
- d** - Cap
- e** - Spacer

2. Thread cap up to the 6.4 mm (1/4 in.) mark.



- a** - Cap
- b** - 6.4 mm (.250 in.) mark



## Steering Link Rod Installation

**IMPORTANT:** The steering link rod that connects the steering cable to the engine must be fastened using special self locking nuts. These locknuts must never be replaced with common nuts (non-locking) as they will work loose and vibrate off freeing the link rod to disengage.

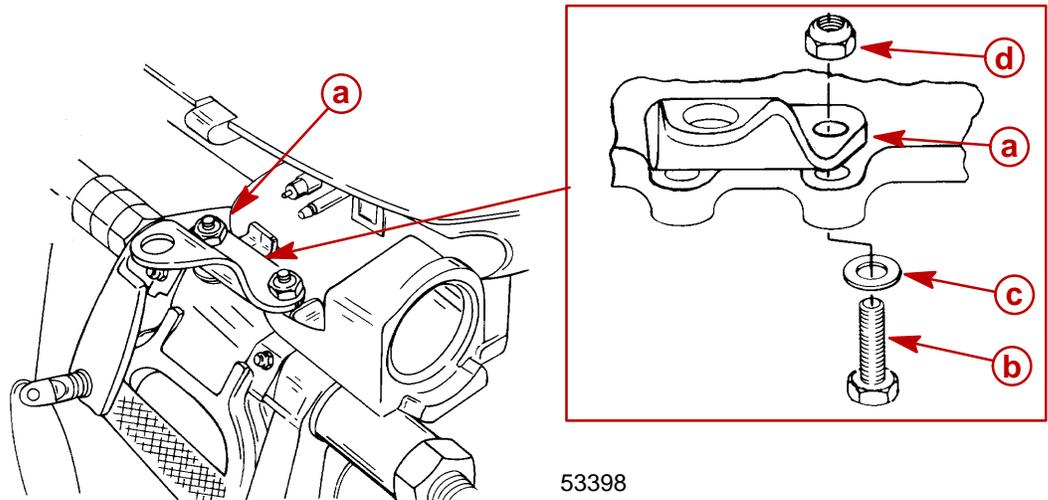
### ⚠ WARNING

Disengagement of a steering link rod can result in the boat taking a full, sudden, sharp turn. This potentially violent action can cause occupants to be thrown overboard exposing them to serious injury or death.

### ⚠ WARNING

After installation is complete (and before operating outboard), check that boat will turn right when steering wheel is turned right and that boat will turn left when steering wheel is turned left. Check steering through full range (left and right) and at all tilt angles to assure interference-free movement.

1. Secure steering bracket to engine. Tighten nut to specified torque.



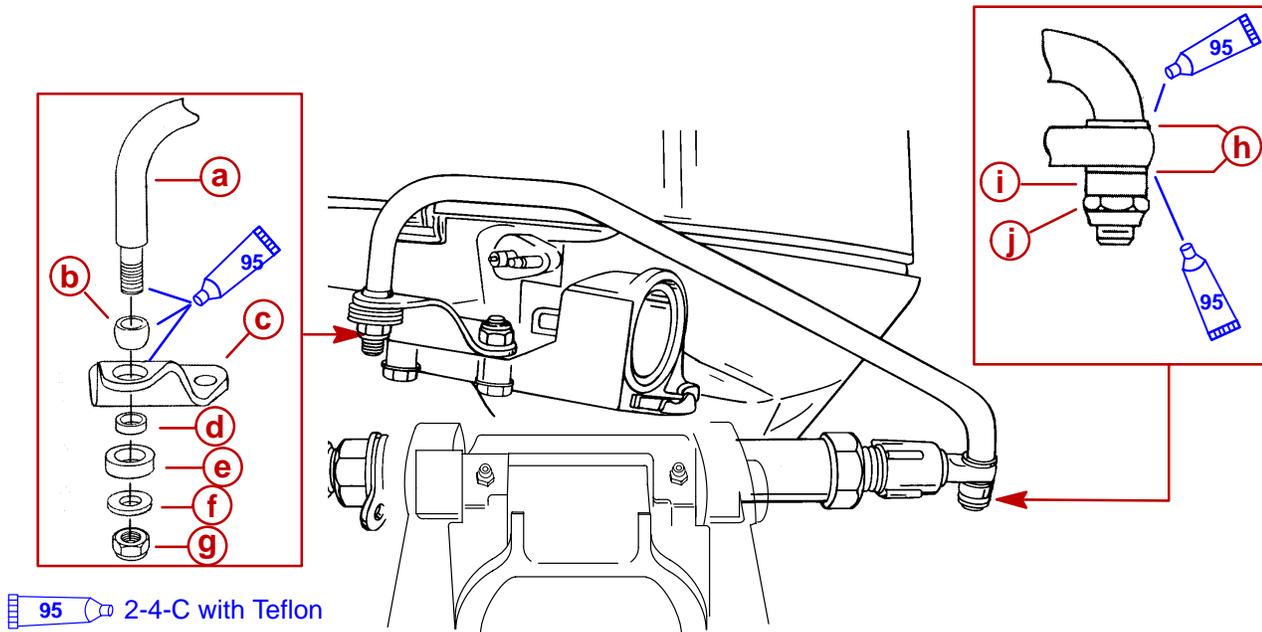
- a** - Steering bracket
- b** - Bolt (2)
- c** - Flat washer (2)
- d** - Locknut (2)

#### Steering Bracket Nut Torque

15.8 Nm (140 lb-in.)



2. Secure steering link rod between engine steering bracket and steering cable end.



95 2-4-C with Teflon

- a** - Steering link arm
- b** - Ball joint (flat end facing up)
- c** - Steering bracket
- d** - Spacer - 9.5 mm (3/8 in.)
- e** - Rubber spacer
- f** - Flat washer 20.6 mm (13/16 in.)
- g** - Locknut. Tighten to specified torque.
- h** - Flat washer [15.9 mm (5/8 in.)] (2)
- i** - Spacer
- j** - Locknut. Tighten until nut seats, then back off 1/4-turn

Locknut Torque
27 Nm (20 lb-ft)



## Remote Control Installation

Refer to **Mercury Precision Parts/Quicksilver Accessory Guide** for appropriate electric or manual remote control. Use instructions provided with control for proper installation.

## Shift and Throttle Cable Installation to the Outboard

**IMPORTANT:** Install control cables to remote control and mount control before attaching control cables to outboard.

Install throttle and shift cables to remote control and mount control as outlined in installation instructions which accompany the remote control.

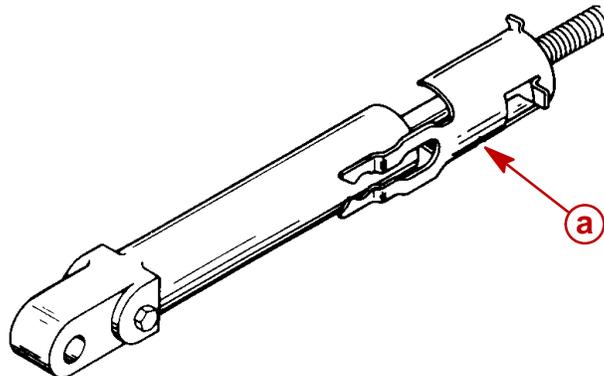
**NOTE:** Attach shift cable to outboard first. Shift cable is the first cable to move when remote control handle is advanced from NEUTRAL position toward in-gear position.

Refer to the **Mercury Precision Parts/Quicksilver Accessory Guide** to determine correct length of remote control cables.

**IMPORTANT:** Remote control cables must be the correct length. Sharp bends on too-short cables result in kinks. Too-long cables require unnecessary bends and/or loops. Both conditions place extra stress on the cables and control.

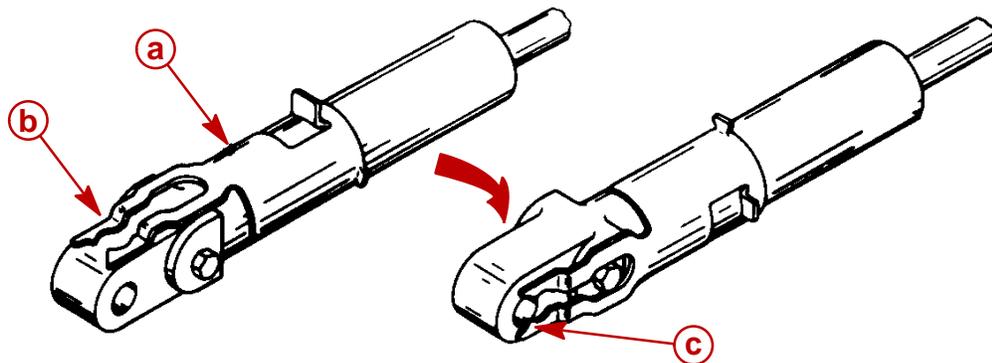
### INSTALLING CABLE RETAINERS ON CABLES

1. Slip cable retainer over the threaded metal end of control cables.



**a** - Retainer

2. Push cable retainer onto control cables so that the pointed ends are on the top side of hole.
3. Rotate cable retainer 90° to position end of retainer over hole.



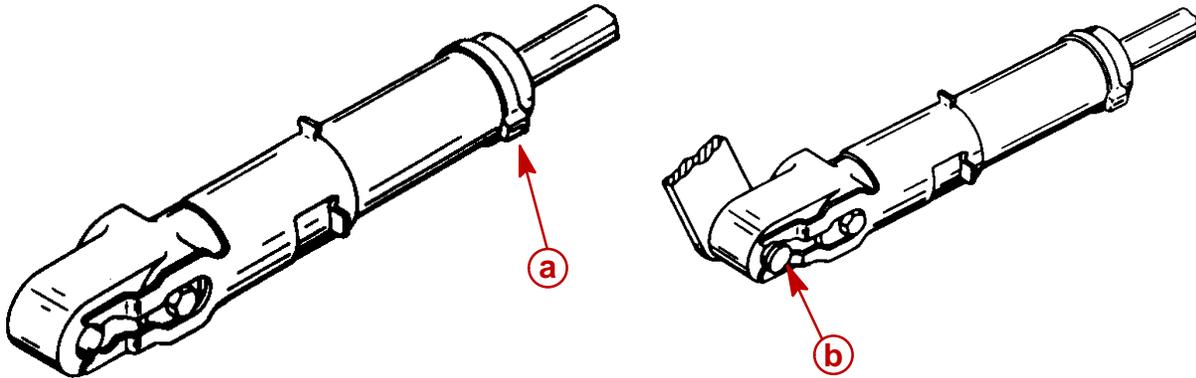
**a** - Retainer  
**b** - Pointed ends  
**c** - Hole



4. Install cable ties on control cables.

**NOTE:** Cable ties will prevent retainers from slipping off cables whenever cables are removed from engine.

5. Place end of control cables on anchor pins and lock in place with retainers.



**a** - Cable tie

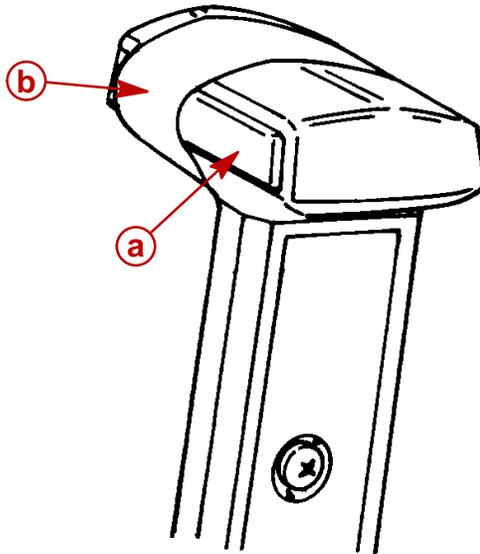
**b** - Pin

### SHIFT CABLE INSTALLATION

1. If remote control has a NEUTRAL lock release, secure the release in the depressed position using a piece of tape. The true NEUTRAL detent can now be located.

### **⚠ WARNING**

To avoid accidental starting which could result in personal injury, remove and isolate high tension spark leads BEFORE working near propeller.



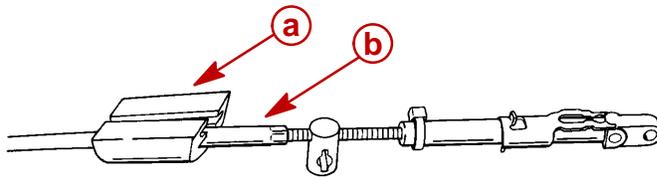
53258

**a** - Neutral lock release

**b** - Tape



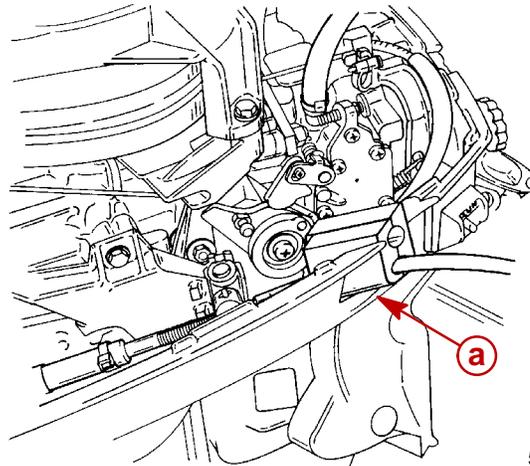
2. Wrap rubber control cable grommet around shift cable.



53212

- a** - Grommet
- b** - Cable

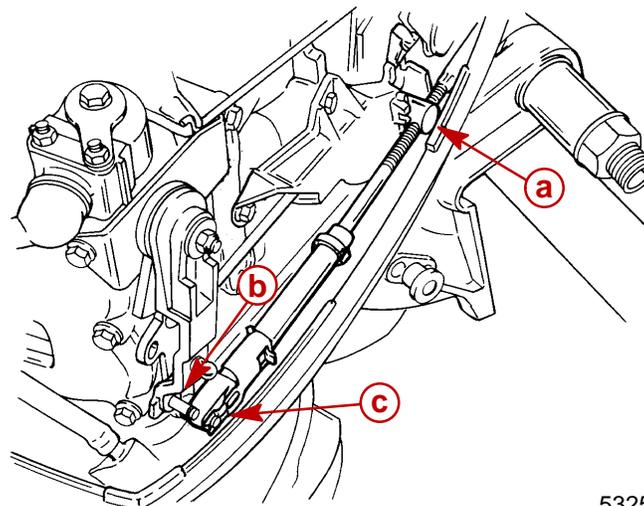
3. Push grommet with cable into opening in starboard bottom cowl.



53249

- a** - Grommet

4. Manually shift outboard into **neutral** position (propeller will rotate freely in both directions).
5. Adjust barrel on shift cable to attain the same distance between barrel and hole in end of shift cable as exists between barrel recess of control cable anchor bracket and shift lever pin.
6. Slip barrel into barrel recess. Place end of shift cable on shift lever pin and lock in place with cable retainer. Secure barrel after throttle cable is installed.



53253

- a** - Barrel
- b** - Pin
- c** - Retainer

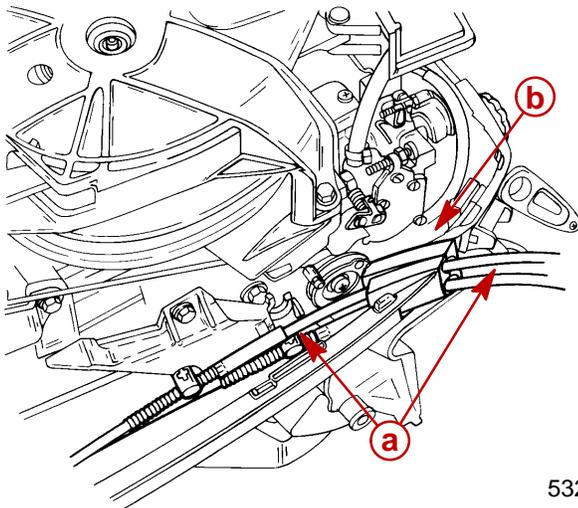


7. Check shift cable adjustment as follows:
  - a. Shift remote control into **forward** gear. The propeller should not be able to rotate in a counterclockwise direction. If propeller does rotate counterclockwise, adjust barrel closer to end of cable and recheck.
  - b. Shift remote control into **neutral**. Propeller should turn freely without drag. If not, adjust barrel away from end of cable and repeat steps a and b.
  - c. While rotating propeller shaft, shift remote control into **reverse** gear. If propeller can be rotated, adjust barrel away from end of cable and repeat steps a through c.
  - d. Shift remote control into **neutral**. Propeller should turn freely without drag. If not, adjust barrel closer to end of cable and repeat steps a through d.

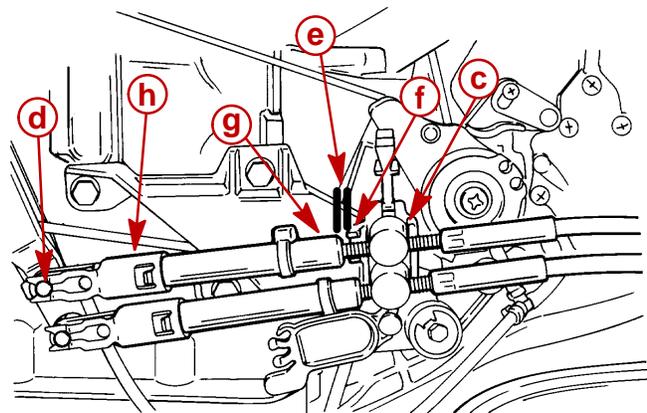
### THROTTLE CABLE INSTALLATION

**NOTE:** For easier installation of throttle cable into control cable grommet, apply a soap and water solution to top and inside of grommet.

1. Install throttle cable into control cable grommet.
2. Move remote control handle **forward** to wide open throttle position.
3. Slide barrel of throttle cable into barrel recess of control cable anchor bracket. Place end of cable on throttle lever pin.
4. With remote control in the wide open throttle position, a 1.6 mm (1/16 in.) gap must exist between guide of anchor bracket and control cable end. Adjust throttle barrel as required.
5. Secure throttle cable end to throttle lever pin with retainer.



53252



53254

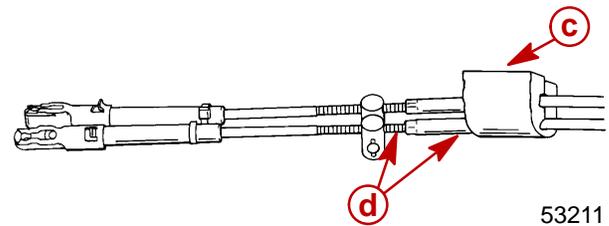
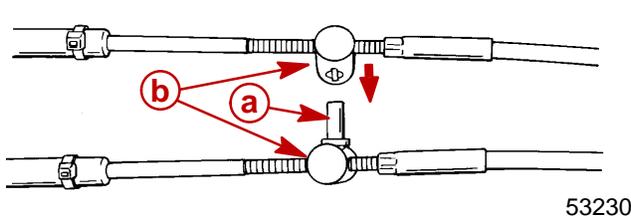
- a** - Throttle cable
- b** - Grommet
- c** - Barrel
- d** - Throttle lever pin
- e** - 1.6mm (1/16 in.) gap
- f** - Guide
- g** - Cable end
- h** - Retainer



## SPECIAL INSTRUCTIONS

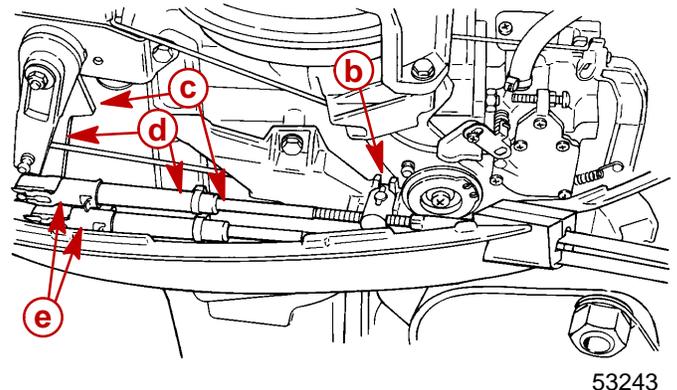
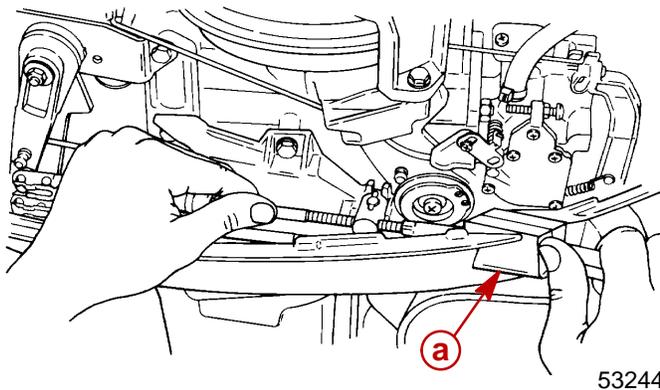
On installations where control cables will frequently be removed and reinstalled after the initial installation (i.e. inflatable boats), a barrel retaining plug has been supplied as an aid for installation. Using this plug allows the control cables to be installed as a set without further cable adjustment. Install barrel retaining plug as follows:

1. Without allowing barrels of control cables to rotate, remove cables with cable grommet from outboard.
2. Install barrel retainer plug between control cable barrels.
3. Wrap cable grommet around control cables.



- a - Barrel retainer plug
- b - Control cable barrels
- c - Grommet
- d - Control cables

4. Push grommet with control cables into opening in starboard bottom cowl.
5. Place remote control in **neutral** position.
6. Manually shift outboard into **neutral** position.
7. Slide control cable barrels into barrel recess of anchor bracket.
8. Place ends of control cables onto pins of shift/throttle levers and lock in place with cable retainers.

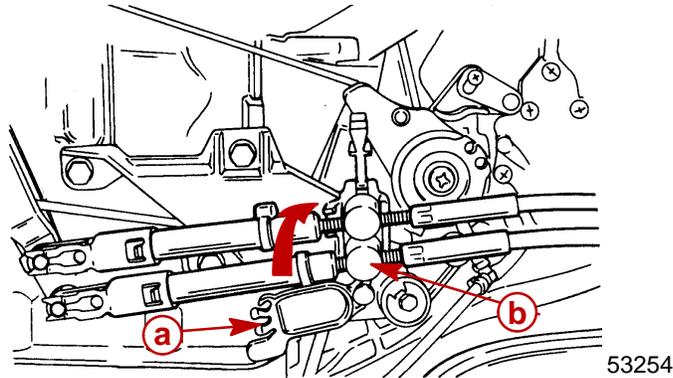


- a - Grommet
- b - Control cable barrels (2)
- c - Shift cable/lever
- d - Throttle cable/lever
- e - Cable retainers



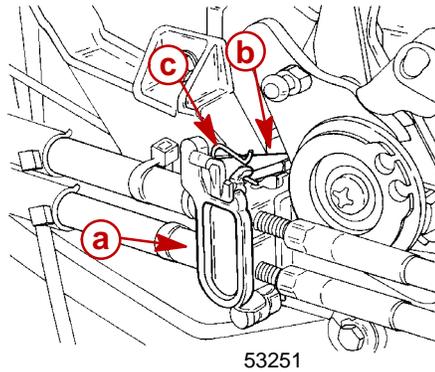
## SECURING CABLES TO ANCHOR BRACKET

1. Position barrel retainer over barrels of control cables.



- a** - Retainer
- b** - Barrels

2. Secure barrel retainer with latch. Latch must snap onto barrel retainer.
3. Align hole in latch with hooks of barrel retainer and secure with latch pin.

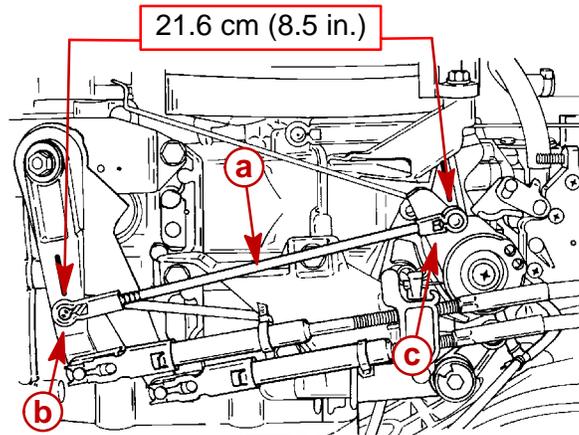


- a** - Retainer
- b** - Latch
- c** - Pin



## THROTTLE LINK ROD INSTALLATION

1. Adjust throttle link rod to a length of 21.6 cm (8.5 in.) as measured between ball joint centerlines.
2. Install throttle link rod between ball joint of throttle control lever and ball joint of actuating lever.

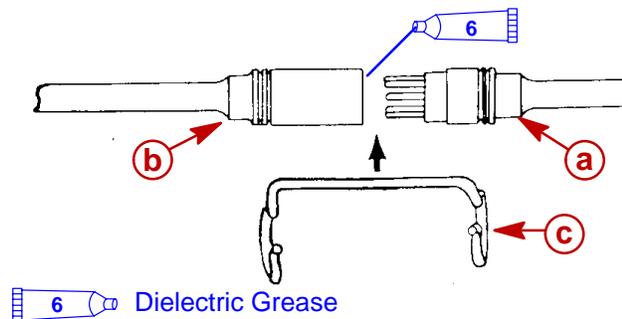


53236

- a** - Throttle link rod [21.6 cm (8.5 in.)]
- b** - Throttle control lever
- c** - Actuating lever

## Remote Wiring Harness Connection to Engine

1. Apply Dielectric Grease inside the connection.
2. Plug the remote wiring connector into the outboard wiring harness connector. Secure the connection together with retainer, as shown.

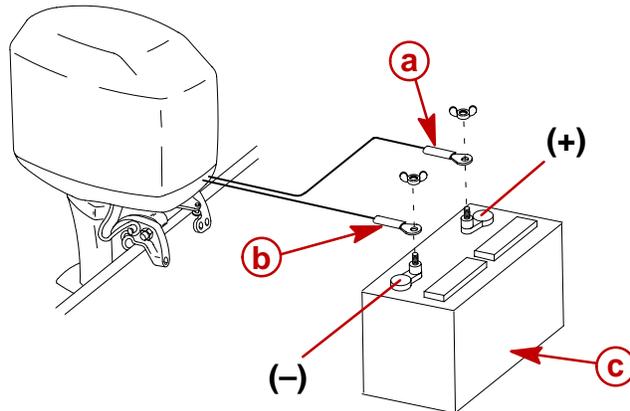


- a** - Remote wiring connector
- b** - Outboard wiring harness connector
- c** - Retainer



# Battery Cable Connections

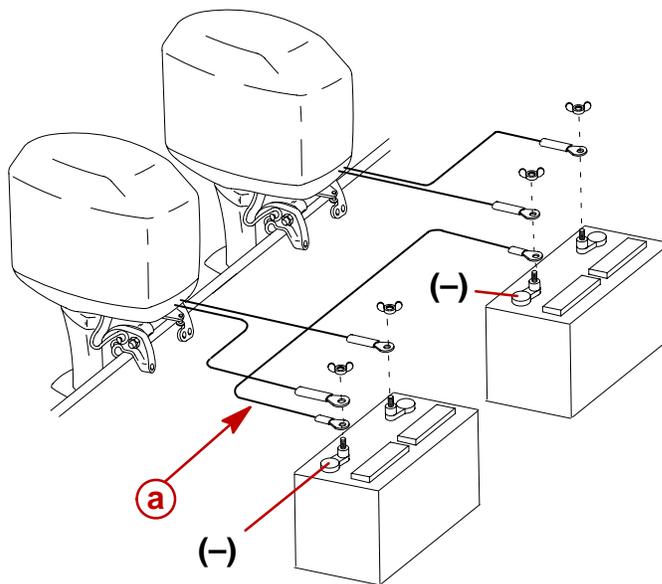
## SINGLE OUTBOARD



- a** - Red sleeve (positive)
- b** - Black sleeve (negative)
- c** - Starting battery

## DUAL OUTBOARD

1. Connect a common ground cable (wire size same as engine battery cables) between negative terminals on starting batteries.

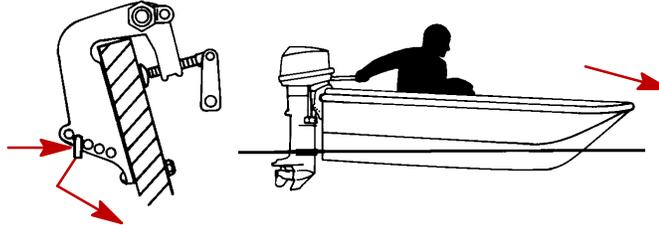


- a** - Ground cable (same wire size as engine battery cable) - connect between negative Terminals



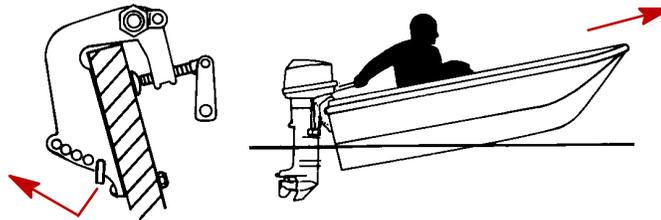
## Tilt Pin Adjustment

### Placing Tilt Pin in Lower Holes



1. Lower the bow.
2. Result in quicker planing off, especially with a heavy load or a stern heavy boat.
3. Generally improve the ride in choppy water.
4. Increase steering torque or pull to the right (with the normal right hand rotation propeller).
5. In excess, lower the bow of some boats to a point at which they begin to plow with their bow in the water while on plane. This can result in an unexpected turn in either direction called bow steering or over-steering if any turn is attempted or if a significant wave is encountered.

### Placing Tilt Pin in Upper Holes



1. Lift the bow out of the water.
2. Generally increase top speed.
3. Increase clearance over submerged objects or a shallow bottom.
4. Increase steering torque or pull to the left at a normal installation height (with the normal right hand rotation propeller).
5. In excess, cause boat porpoising (bouncing) or propeller ventilation.





# ELECTRICAL AND IGNITION

## Section 2A – Ignition System

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**2  
A**

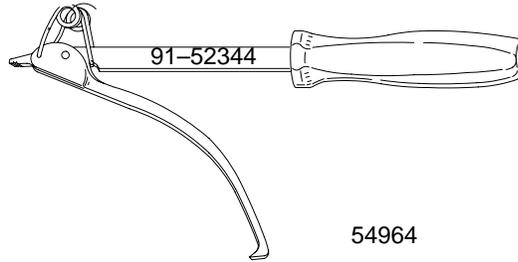
### Specifications

<b>IGNITION SYSTEM</b> Readings taken @ 68°F (20°C).	<b>BLACK Stator</b> <b>Stator High Speed Winding</b> <b>Stator Low Speed Winding</b>	120 - 180 Ω (BLACK/WHITE- GROUND) 3000 - 3600 Ω (BLACK/YELLOW - GROUND) 3100 – 3700 Ω (BLACK/YELLOW - BLACK/WHITE)
	<b>Ignition Coil Resistance:</b> <b>Primary</b> <b>Secondary</b> <b>Trigger</b>	0.02 - 0.04 Ω 8000 - 11000 Ω 6500 - 8500 Ω
	<b>RED Stator</b> <b>Stator Capacitor Charging Winding</b>	370 – 445 Ω (GREEN/WHITE - WHITE/ GROUND)
	<b>Ignition Coil Resistance:</b> <b>Primary</b> <b>Secondary</b> <b>Trigger</b>	0.02 - 0.04 Ω 8000 - 11000 Ω 6500 - 8500 Ω

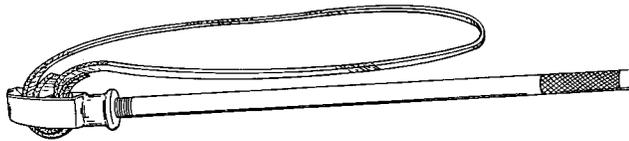


# Special Tools Required

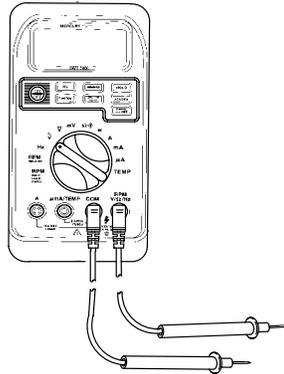
1. Flywheel Holder 91-52344



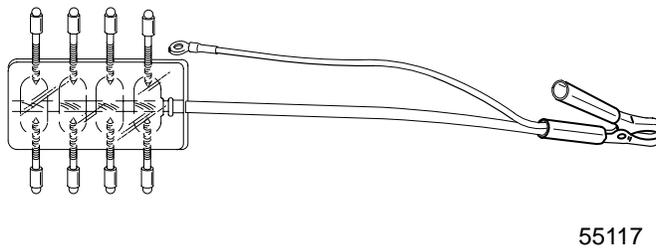
2. Flywheel Holder 91-24937A1



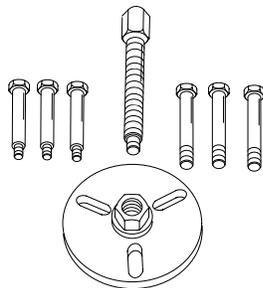
3. DMT 2000 Digital Multimeter 91-854009A1



4. Spark Gap Board 91-850439



5. Flywheel Puller 91-83164M

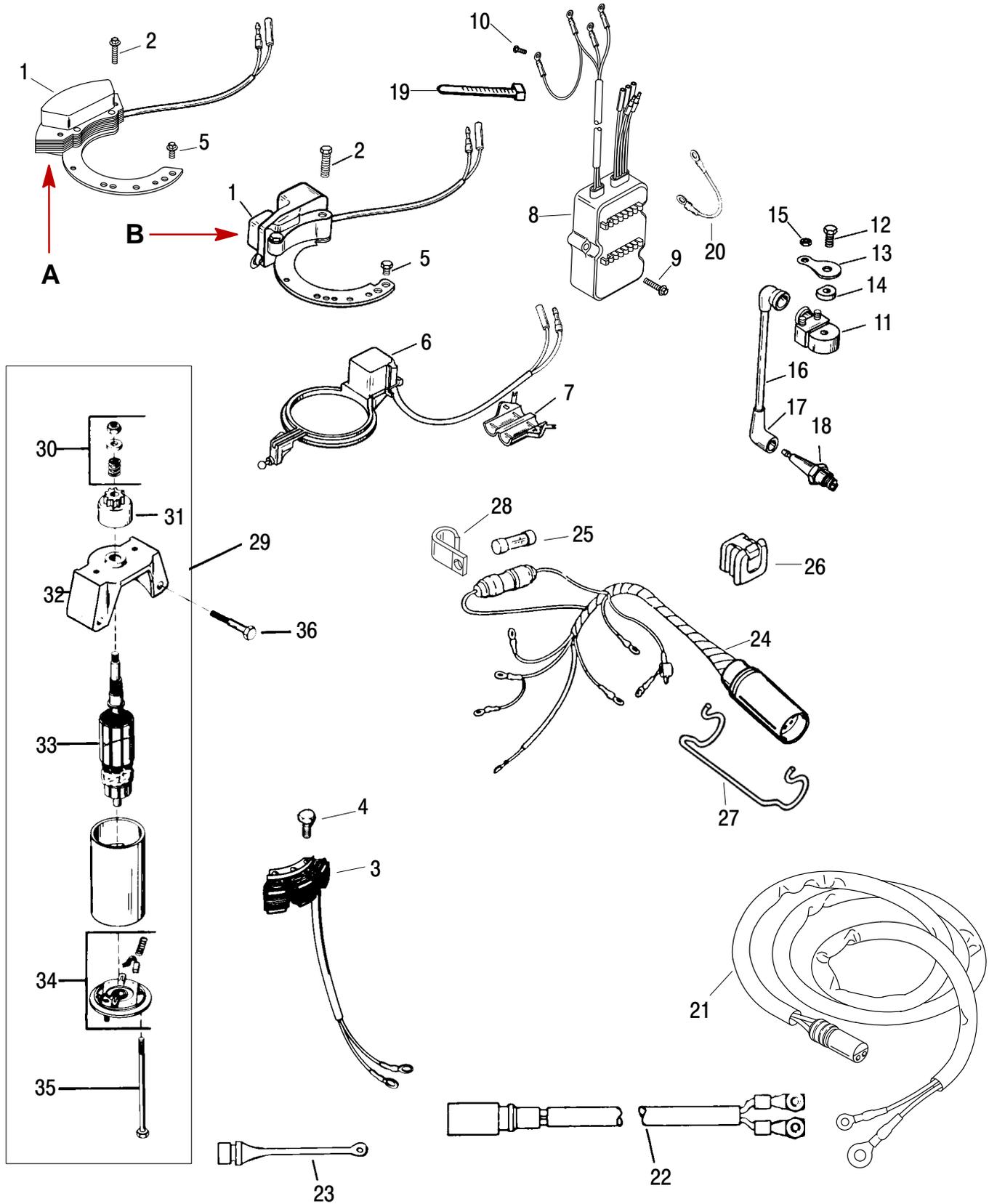




## Notes:



# Electrical Components



**A** – RED Stator  
**B** – BLACK Stator



## Electrical Components (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N-m
1	1	STATOR ASSEMBLY			
2	2	SCREW (M5 x 30)	40		4.5
3	1	STATOR AUXILIARY ( <b>ELECTRIC/ALTERNATOR MODELS</b> )			
4	3	SCREW (M5 x 30)	40		4.5
5	1	SCREW (M5 x 10) ( <b>MANUAL</b> )	40		4.5
6	1	TRIGGER ASSEMBLY			
7	1	CLIP–trigger lead			
8	1	SWITCH BOX			
9	3	SCREW–switch box to block (M5 x 35)			Drive Tight
10	2	SCREW–ground wire (10-16 x 1/2)			Drive Tight
11	2	IGNITION COIL ASSEMBLY			
12	2	SCREW–ignition coil	35		3.9
13	2	TAB WASHER			
14	2	BUSHING–coil			
15	4	NUT–coil terminal	20		2.2
16	1	LEAD ASSEMBLY–high tension			
17	2	BOOT ASSEMBLY–spark plug			
18	2	SPARK PLUG (NGK#BP8H-N-10) <b>6/8</b>			
	2	SPARK PLUG (NGK#BPZ-8H-N-10)			
	2	SPARK PLUG (NGK#BP8HS-15) <b>9.9/15</b>			
	2	SPARK PLUG (NGK#BPZ8HS-15)			
19	AR	STA-STRAP ( <b>8 IN.</b> )			
	AR	STA-STRAP ( <b>5-1/2 IN.</b> )			
20	1	CABLE–grounding			
21	1	HARNESS (62 IN. - BLACK/RED)			
22	1	HARNESS (20 IN. - BLACK/RED) <b>SAILPOWER/SAILMATE</b>			
23	1	PLUG			
24	1	ENGINE WIRING HARNESS			
25	1	FUSE			
26	1	RETAINER <b>REMOTE CONTROL</b>			
27	1	RETAINER			
28	1	J-CLAMP			
29	1	STARTER MOTOR			
30	1	DRIVE KIT			
31	1	DRIVE			
32	1	END CAP			
33	1	ARMATURE			
34	1	END CAP			
35	2	THRU BOLT			
36	2	SCREW (M8 x 55)			



## Description

The ignition system is an alternator driven capacitor discharge system. Major components of the ignition system are the flywheel, stator, trigger coil, switch box, 2 ignition coils and 2 spark plugs.

The flywheel has permanent magnets mounted in both the outer rim and the center hub.

The BLACK stator assembly is mounted below the flywheel and has a low speed (LS) and a high speed (HS) capacitor charging coil. Low speed coil provides primary voltage to the switch box from idle to approximately 2500 RPM. The high speed coil provides primary voltage from 2000 RPM to the maximum RPM the outboard is capable of achieving.

The RED stator assembly is mounted below the flywheel and has only one capacitor charging coil.

As the flywheel rotates, the magnets mounted in the flywheel outer rim pass the charging coils creating voltage. This voltage is rectified to DC and charges the capacitor located in the switch box.

As the flywheel continues to rotate, the magnets in the center hub pass the trigger coil creating voltage pulses. These pulses turn on one of the two electronic switches (SCR) in the switch box. A positive voltage pulse turns on the SCR switch associated with cylinder #1; a negative voltage pulse turns on the SCR switch associated with cylinder #2.

The SCR switch discharges the stored capacitor voltage into the primary side of the respective ignition coil. The ignition coil multiplies this voltage to a value high enough to jump the spark plug gap – 34000 volts for standard coils; 40000 volts for high energy coils.

This sequence occurs once per engine revolution for each cylinder.

Spark timing is changed (advanced/retarded) by rotating the trigger coil on mechanically advanced models which changes the trigger coil position in relation to the magnets in the center hub of the flywheel.

Spark timing on electronically advanced models is controlled internally by the switch box with a fixed trigger.

The stop switch (or ignition switch) shorts the output of the stator to ground to stop the engine on all models.

## Test Procedures

### WARNING

**When testing or servicing the outboard ignition system, high voltage is present. Be extremely cautious. DO NOT touch or disconnect any ignition components while engine is running or while battery cables are connected on electric start models.**

It is recommended that the switch box and ignition coils be tested with a Quicksilver Multi-Meter/DVA, or a voltmeter capable of measuring 400 volts DC or higher, in conjunction with Quicksilver Direct Voltage Adaptor.

All other components can be tested with an ohmmeter.

Before troubleshooting the ignition system, check the following:

1. On electric models, verify that the electric harness and ignition switch are not the source of the problem. Check that plug-in connectors are fully engaged and that plug terminals are free of corrosion.
2. Verify that wire connections are tight and free of corrosion.
3. Inspect all electrical components that are grounded directly to the engine and all ground wires that they are properly grounded to engine.
4. Inspect for disconnected wires and short and open circuits.



# Ignition Troubleshooting (BLACK Stator)

TOOL : MULTIMETER/DVA

Tested Part	Multimeter Wires	Connected To	Scale	Resistance (ohms)
Stator (BLACK/ YELLOW and BLACK/WHITE wires disconnected from switch box)	RED	BLACK/WHITE	R x 1	120 - 180
	BLACK	GROUND		
	RED	BLACK/YELLOW	R x 100	32 - 38
	BLACK	GROUND		
	RED	BLACK/YELLOW	R x 100	31 - 37
	BLACK	BLACK/WHITE		
Trigger (BROWN/ YELLOW and BROWN/WHITE wires disconnected from switch box)	RED	BROWN/YELLOW	R x 100	6.5 - 8.5
	BLACK	BROWN/WHITE		

Tested Part	Multimeter	Connected To	Scale	Resistance (ohms)
Ignition Coils (all wires dis- connected)	RED	+ Terminal	R x 1	0.02 - 0.04
	BLACK	- Terminal		
	RED	Spark Plug Tower	R x 1000	8 - 11
	BLACK	- Terminal		

Tested Part	Multimeter Wires	Connected To	Selector Position	Reading At 300 - 1000 RPM	Reading At 1000 - 4000 RPM
Switch Box Primary Coil	RED	- Terminal	400 VDC	125 -260	200 - 360
	BLACK	+ Terminal			
Switch Box Stop Circuit Stator Low Speed	RED	GROUND	400 VDC	150 - 300	250 - 360
	BLACK	BLACK/YELLOW			
Stator High Speed	RED	GROUND	400 VDC	10 - 75	50 - 300
	BLACK	BLACK/WHITE			

**NOTE:** Copper is an excellent conductor, but resistance may notably vary between low and high temperature. Therefore, reasonable differences can be accepted between resistance readings and specifications.



# Ignition Troubleshooting (RED Stator)

TOOL : MULTIMETER/DVA

Tested Part	Multimeter Wires	Connected To	Scale	Resistance (ohms)
Stator (GREEN/WHITE and WHITE/GREEN wires disconnected from switch boxes)	RED	GREEN/WHITE	R x 1	370 - 445
	BLACK	WHITE/GREEN		
Trigger (BROWN/YELLOW and BROWN/WHITE wires disconnected from switch boxes)	RED	BROWN/YELLOW	R x 100	6.5 - 8.5
	BLACK	BROWN/WHITE		

Tested Part	Multimeter	Connected To	Scale	Resistance (ohms)
Ignition Coils (all wires disconnected)	RED	+ Terminal	R x 1	0.02 - 0.04
	BLACK	- Terminal		
	RED	Spark Plug Tower	R x 1000	8 - 11
	BLACK	- Terminal		

Tested Part	Multimeter Wires	Connected To	Selector Position	Reading At 300 - 1000 RPM	Reading At 1000 - 4000 RPM
Switch Box Primary Coil	RED	- Terminal	400 VDC	125 - 320	200 - 320
	BLACK	+ Terminal			
Switch Box Stop Circuit	RED	BLACK/YELLOW	400 VDC	150 - 330	250 - 330
	BLACK	GROUND			
Stator Voltage	RED	GREEN/WHITE	400 VDC	150 - 330	250 - 330
	BLACK	GROUND			
	RED	WHITE/GREEN	400 VDC	150 - 330	250 - 330
	BLACK	GROUND			

**NOTE:** Copper is an excellent conductor, but resistance may notably vary between low and high temperature. Therefore, reasonable differences can be accepted between resistance readings and specifications.



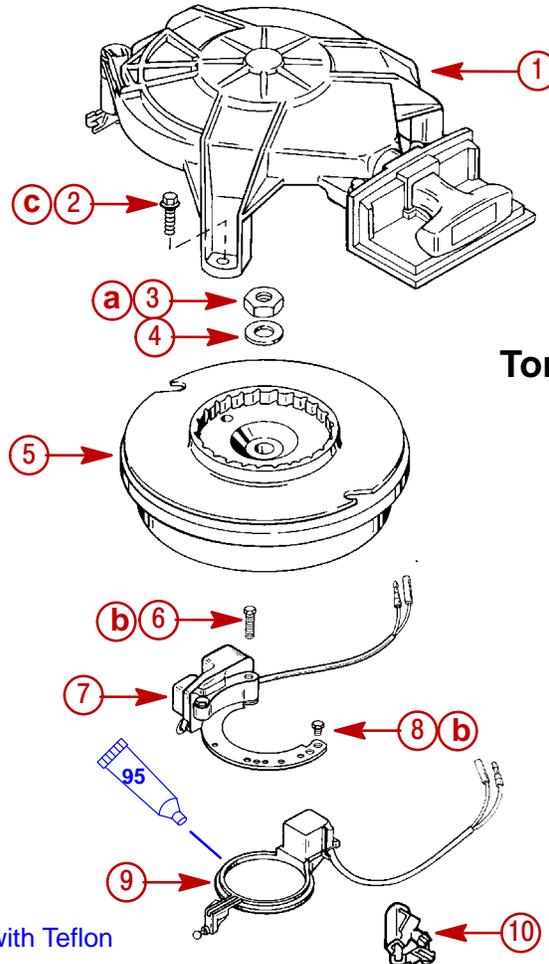
# Ignition Components Removal and Installation

## CAUTION

Do not strike flywheel with a hard object as flywheel damage could occur. Inspect flywheel magnets for clinging debris before installation.

## WARNING

Engine could possibly start when turning flywheel during removal and installation. Disconnect (and isolate) spark plug leads.



## Torque Specifications

- a** 67.8 Nm (50 lb-ft)
- b** 4.5 Nm (40 lb-in.)
- c** 7.9 Nm (70 lb-in.)

95 2-4-C with Teflon

53053

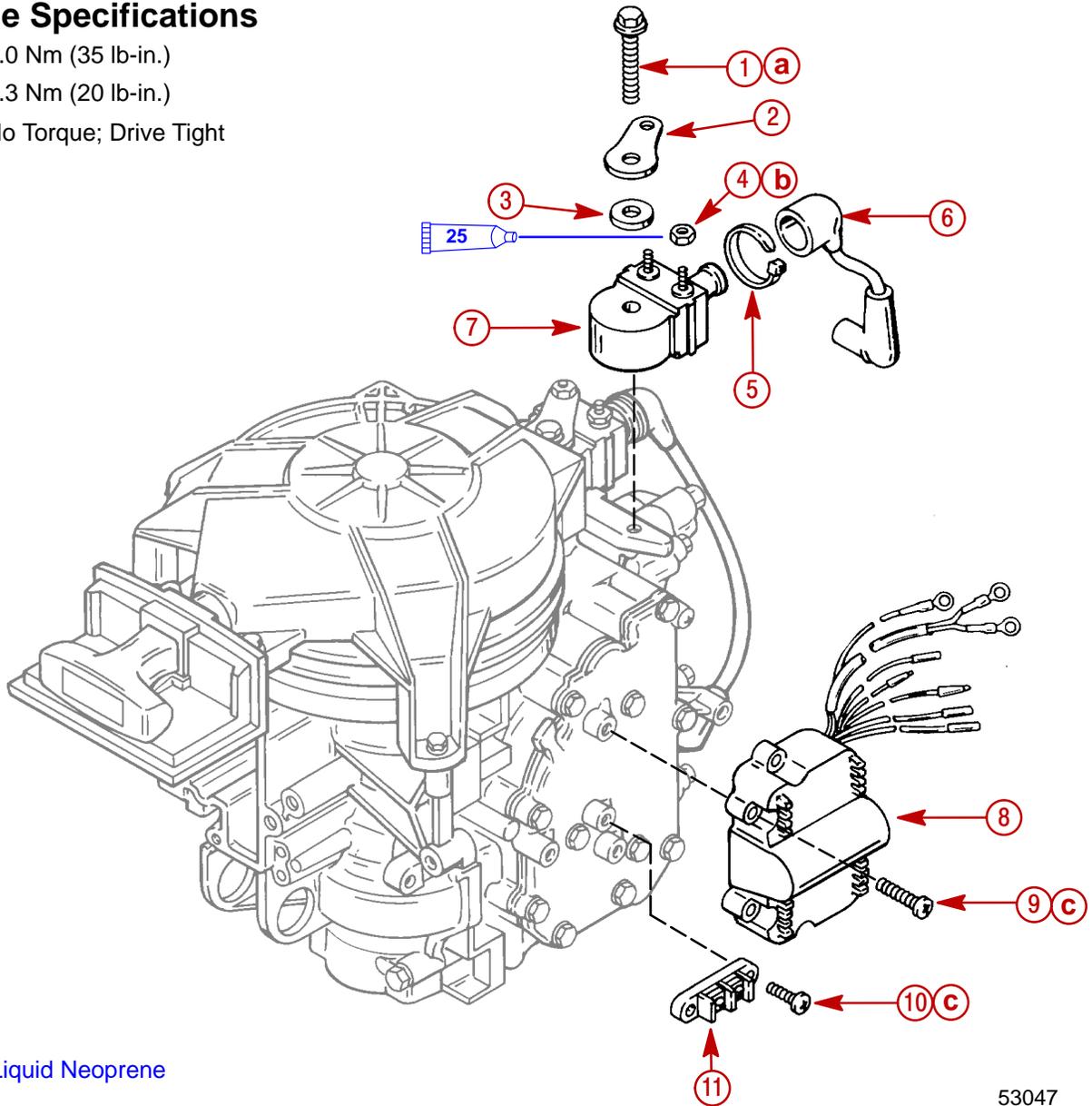
- 1** - Recoil assembly
- 2** - Bolt (3)
- 3** - Flywheel nut
- 4** - Washer
- 5** - Flywheel
- 6** - Screw (2)
- 7** - Stator
- 8** - Screw (manual)
- 9** - Trigger
- 10** - Retainer (trigger)



# Ignition Components Removal and Installation (continued)

## Torque Specifications

- a** 4.0 Nm (35 lb-in.)
- b** 2.3 Nm (20 lb-in.)
- c** No Torque; Drive Tight



25 Liquid Neoprene

53047

- 1** - Bolt (2)
- 2** - Retainer (2)
- 3** - Washer (2)
- 4** - Nut (4)
- 5** - Sta-strap (2)
- 6** - Spark plug lead
- 7** - Ignition coil
- 8** - Switch box
- 9** - Screw (3)
- 10** - Screw (2)
- 11** - Terminal block



# ELECTRICAL AND IGNITION

## Section 2B – Charging and Starting System

### Table of Contents

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B**

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### Specifications

<b>STARTING SYSTEM</b>	<b>Manual Start Electric Start Starter Draw (Under Load) (No Load)</b>	Recoil 12 Volt 55 Amperes 15 Amperes
<b>CHARGING SYSTEM</b>	<b>Alternator Output 2 Magnet Flywheel (8 Pole)(4 Pulses)  4 Magnet Flywheel (10 Pole)(5 Pulses)</b>	4 Amp. (48 Watt) @ 6000 RPM  6 amp (72 Watt) @ 6000 RPM
<b>BATTERY</b>	<b>Battery Rating</b>	465 Marine Cranking Amps (MCA) or 350 Cold Cranking Amps (CCA)



## Recommended Battery

A 12 volt battery with a Marine Cranking Amperage rating minimum of 465 amperes or a Cold Cranking Amperage of 400.

## Battery

### Precautions

When charging batteries, an explosive gas mixture forms in each cell. A portion of this gas escapes through holes in vent plugs and may form an explosive atmosphere around battery if ventilation is poor. This explosive gas may remain in or around battery for several hours after it has been charged. Sparks or flames can ignite this gas and cause an internal explosion which may shatter the battery.

The following precautions should be observed to prevent an explosion.

1. DO NOT smoke near batteries being charged or which have been charged very recently.
2. DO NOT break live circuits at terminals of batteries because a spark usually occurs at the point where a live circuit is broken. Always be careful when connecting or disconnecting cable clamps on chargers. Poor connections are a common cause of electrical arcs which cause explosions.
3. DO NOT reverse polarity of battery cables on battery terminals.

#### CAUTION

If battery acid comes into contact with skin or eyes, wash skin immediately with a mild soap. Flush eyes with water immediately and consult a physician.

## Operating Engine Without Battery

In an emergency, engines equipped with an alternator can be started and operated without a battery, if the **WARNING** below is followed.

#### WARNING

Before operating engine with battery leads disconnected from battery, disconnect stator leads from rectifier and insulate leads from touching ground.



## Battery Charging System Troubleshooting

A fault in the battery charging system usually will cause the battery to become undercharged. Check battery electrolyte level, and charge battery. See **Electrolyte Level**, and **Charging a Discharged Battery**.

If battery will NOT accept a satisfactory charge, replace battery.

If battery accepts a satisfactory charge, determine the cause of the charging system problem as follows.

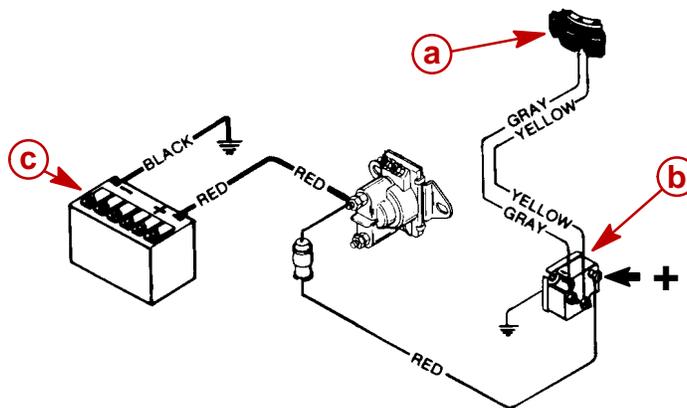
1. Check for correct battery polarity [RED cable to POSITIVE (+) battery terminal]. If polarity was incorrect, check for damaged rectifier. Refer to RECTIFIER, RECTIFIER/REGULATOR TEST.
2. Check for loose or corroded battery connections.
3. Visually inspect wiring between stator and battery for cuts, chafing; and disconnected, loose or corroded connection.
4. Excessive electrical load (too many accessories) will cause battery to run down.

If visual inspection determines that battery connections and wiring are OK, perform the following stator and rectifier tests.

## Battery Charging System

### (1998 And Prior)

The battery charging system components are the alternator, rectifier and battery. Alternating current flows to the rectifier which changes alternating current (AC) current to direct current (DC) for charging the battery.



- a - Alternator
- b - Rectifier
- c - Battery

The charging system may be damaged by:

1. Reversed battery cables.
2. Running the engine with battery cables disconnected and alternator leads connected to rectifier.
3. An open circuit, such as a broken wire or loose connection.



## Alternator Amperes Output 1998 And Prior (Stator - 8 Pole/4 Pulse)

Amperage output can be measured by installing a amp meter a (10 amp minimum) in series between the rectifier and the battery or by clamping an inductive type amp meter (10 amp minimum) over the RED output lead from the rectifier to the battery.

**NOTE:** Acceptable alternator amperage output should be within  $\pm 10\%$  of the amperes listed below.

RPM	AMPERES
Idle	0
1000	0
2000	.9
3000	2.5
4000	3.5
5000	4.0
6000	4.3

## Alternator Test (1998 And Prior)

**NOTE:** Alternator can be tested without removing from engine.

1. Disconnect GRAY and YELLOW alternator leads from terminals on either rectifier, voltage regulator or isolator block.
2. Use an ohmmeter and perform tests as shown in following chart.
3. If meter readings are other than specified, replace alternator assembly.

Test Leads	Resistance	Scale
RED to YELLOW BLACK to GRAY	0.65*	R x 1
RED to either GRAY or YELLOW BLACK to GROUND	NO CONTINUITY	R x 1000

**NOTE:** DC resistance of these windings generally is less than 1 ohm. A reading that resembles a short is acceptable.

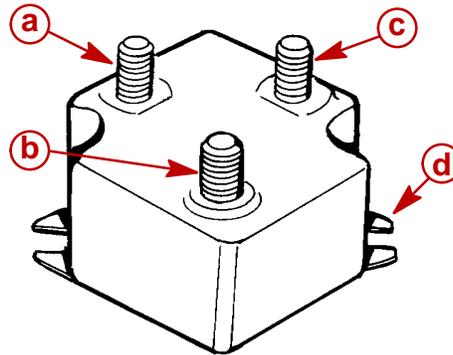
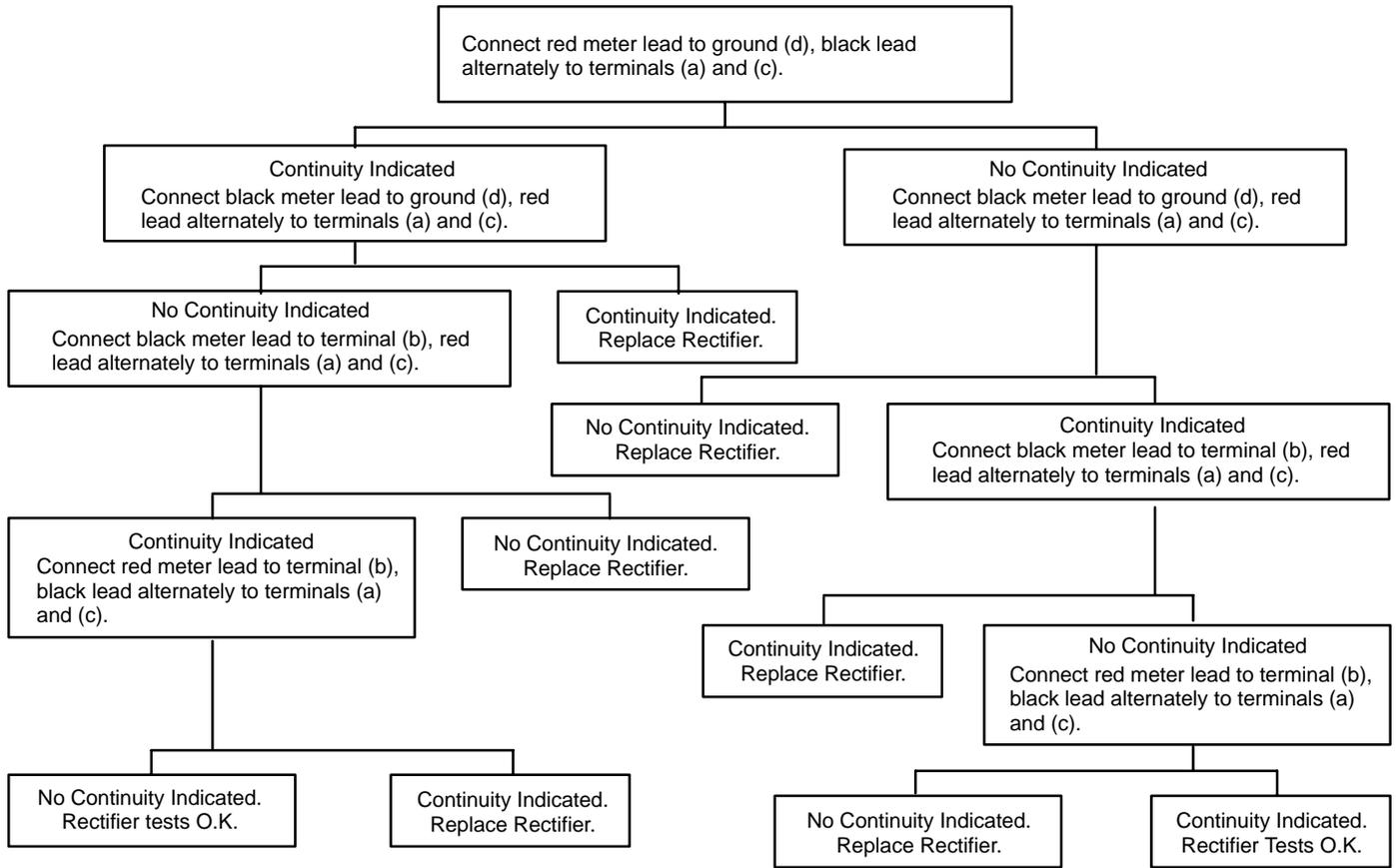
## Rectifier Test (1998 And Prior)

### **⚠ WARNING**

**Disconnect battery leads from battery before testing rectifier.**

**NOTE:** Rectifier can be tested without removing from engine.

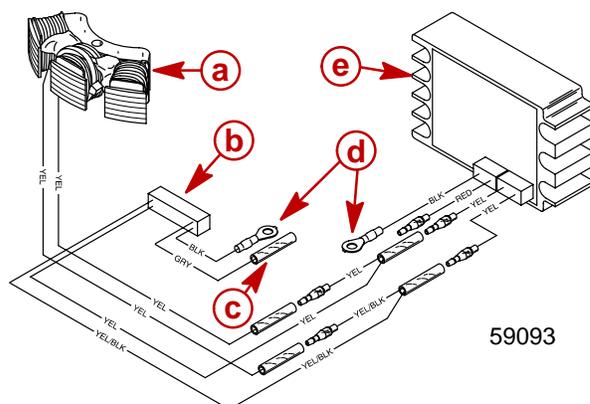
1. Disconnect all wires from terminals on rectifier.
2. Use an ohmmeter (R x 1000 scale) and perform the following test. Refer to drawing for rectifier terminal identification.



07300

**(1999 And Newer)**

The battery charging system components are the alternator, rectifier/regulator and the battery. Alternating current (generated in the alternator/stator coils) flows to the rectifier/regulator, which changes the alternating current to direct current for charging the battery.



59093

- a** - Alternator
- b** - Tachometer module
- c** - Tachometer lead
- d** - Ground leads
- e** - Rectifier/Regulator

The charging system may be damaged by:

- a. Reversed battery cables.
- b. Running the engine with battery cables disconnected and alternator leads connected to rectifier.
- c. An open circuit, such as a broken wire or loose connection.

**Alternator Amperes Output 1999 And Newer (Stator - 10 Pole/5 Pulse)**

Amperage output can be measured by installing a amp meter (10 amp minimum) in series between the rectifier and the battery or by clamping an inductive type amp meter (10 amp minimum) over the RED output lead from the rectifier to the battery.

**NOTE:** Acceptable alternator amperage output should be within  $\pm 10\%$  of the amperes listed below.

RPM	AMPERES
Idle	0
1000	0.75
2000	3.5
3000	4.5
4000	5.0
5000	5.5
6000	6.0

Test Leads	Resistance	Scale
RED to YELLOW, BLACK to YELLOW	0.5*	R x 1
RED to either YELLOW, BLACK to GROUND	NO CONTINUITY	R x 1000

\*DC resistance of these windings generally is less than 1 ohm. A reading that resembles a short is acceptable.

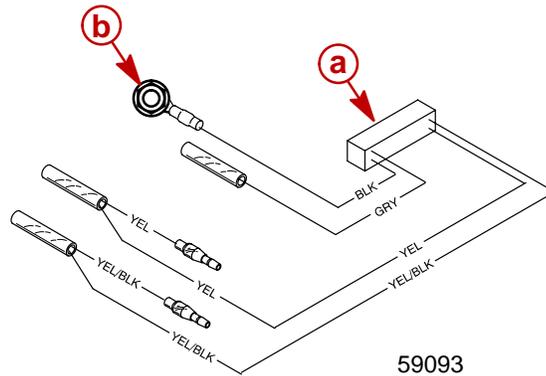
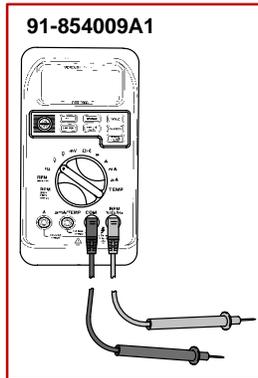


## Tachometer Module Static Test

1. Disconnect GRAY, YELLOW, and YELLOW/BLACK tachometer module leads.
2. Set meter to  $\rightarrow$ .

**NOTE:**  $\rightarrow$  uses the battery voltage within the meter.

3. Connect the multi-meter black lead to engine ground or BLACK harness wire. Connect the RED multi-meter lead to the GRAY tachometer module engine bullet connector.
4. Measure voltage.



YEL = Yellow  
 BLK = Black  
 GRY = Gray  
 YEL/BLK = Yellow with Black Stripe

- a** - Tachometer module  
**b** - Engine ground

METER TEST LEADS		METER SCALE	READING
RED	BLACK	DIODE	Open, OUCH, or OL
TACHOMETER MODULE LEADS			
GRAY	BLACK OR GROUND		

5. Connect the multi-meter RED lead to engine ground or BLACK harness wire. Connect the BLACK multi-meter lead to the GRAY tachometer module bullet connector.
6. Measure voltage.

METER TEST LEADS		METER SCALE	READING (V)
RED	BLACK	DIODE	0.5 - 0.9 Volts
TACHOMETER MODULE LEADS			
BLACK OR GROUND	GRAY		

7. Set meter to  $\Omega$ .
8. Measure resistance.

METER TEST LEADS		METER SCALE	READING ( $\Omega$ )
RED	BLACK	$\Omega$	4 - 8 Mega Ohms
TACHOMETER MODULE LEADS			
BLACK OR GROUND	GRAY		



## CHARGING AND STARTING SYSTEM

9. Connect GRAY, YELLOW, and YELLOW/BLACK tachometer module leads to engine harness.
10. Measure resistance.

METER TEST LEADS		METER SCALE	READING ( $\Omega$ )
RED	BLACK	$\Omega$	1 - 3 Mega Ohms
TACHOMETER MODULE LEADS			
BLACK OR GROUND	GRAY		

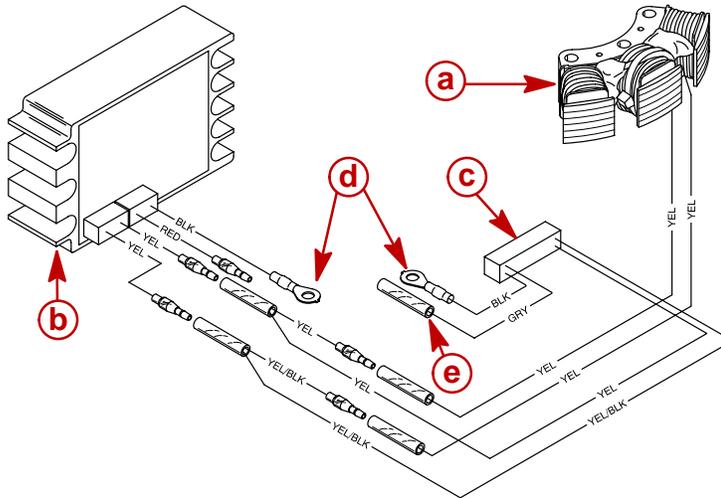
11. Connect the multi-meter RED lead to the YELLOW tachometer module wire. Connect the BLACK multi-meter lead to engine ground or to the BLACK tachometer module bullet connector.

METER TEST LEADS		METER SCALE	READING ( $\Omega$ )
RED	BLACK	$\Omega$	5.5 - 8 k Ohms
TACHOMETER MODULE LEADS			
YELLOW	BLACK OR GROUND		

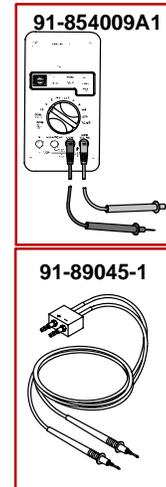


## Tachometer Module Running or Cranking Test

### OUTPUT VOLTAGE TEST



59093



- a** - Alternator, stator
- b** - Voltage regulator/rectifier
- c** - Tachometer module
- d** - Engine ground leads
- e** - Gray tachometer lead

1. Disconnect the GRAY tachometer lead.
2. Set meter to Voltage scale.
3. Connect Direct Voltage Adapter to DMT 2000 multi-meter. Connect the multi-meter RED lead to the GRAY tachometer module wire. Connect the BLACK multi-meter lead to engine ground or to the BLACK tachometer module bullet connector.
4. Crank or start engine.
5. Measure voltage.

METER TEST LEADS		METER SCALE	READING
RED	BLACK	<b>V</b>	<b>9 - 14 Volts</b>
<b>TACHOMETER MODULE LEAD</b>			
GRAY	BLACK OR GROUND		



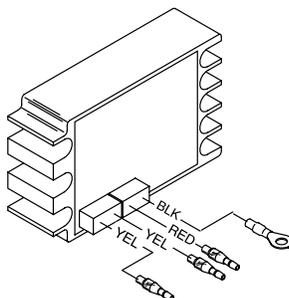
## Rectifier/Regulator (P/N 853358T1) Diode Test

### ⚠ WARNING

Disconnect battery leads from battery before testing rectifier.

### Digital Meter (DMT 2000 or Equivalent)

**NOTE:** Voltage regulator/rectifier specifications are given for informational purposes only. Use the appropriate troubleshooting techniques previously mentioned to find the faulty component in the charging system.



BLK = Black  
RED = Red  
YEL = Yellow

1. Set meter to  $\Omega$ .
2. Connect BLACK (–) meter lead to regulator case.
3. Connect RED (+) meter lead to BLACK lead.

<b>Resistance Specification</b>
---------------------------------

0.0 OHMS
----------

4. Connect BLACK (–) meter lead to regulator case.
5. Connect RED (+) meter lead to RED lead.

<b>Resistance Specification</b>
---------------------------------

4.28 K OHMS
-------------

### RESISTANCE TEST - SCR

1. Set meter to  $\Omega$ .
2. Connect RED (+) meter lead to regulator case.
3. Connect BLACK (–) meter lead to either YELLOW regulator lead. Test.
4. Connect BLACK (–) meter lead to YELLOW/BLACK regulator lead.

<b>Resistance Specification (Both Tests)</b>
--

900 K OHMS Minimum
--------------------



## VOLTAGE SPIKE SUPPRESSER

1. Set meter to  $\rightarrow \blacktriangleleft$ .
2. Connect RED (+) meter lead to regulator case.
3. Connect BLACK (-) meter lead to RED regulator lead.

<b>Voltage Specification</b>
0.4 - 0.7 VOLTS

## VOLTAGE SPIKE SUPPRESSER DIODE TEST

1. Set meter to  $\rightarrow \blacktriangleleft$ .
2. Connect BLACK (-) meter lead to RED regulator lead.
3. Connect RED (+) meter lead to either YELLOW regulator lead. Test.
4. Connect RED (+) meter lead to the other YELLOW regulator lead.

<b>Diode Test Specification (Both Tests)</b>
0.4 - 0.8 VOLTS

## DIODE TEST

1. Set meter to  $\rightarrow \blacktriangleleft$ .
2. Connect RED (+) meter lead to RED regulator lead.
3. Connect BLACK (-) meter lead to either YELLOW regulator lead. Test.
4. Connect BLACK (-) meter lead to the other YELLOW regulator lead.

<b>Diode Test Specification (Both Tests)</b>
No Continuity - Ouch - OL or $\infty$

## SCR TEST

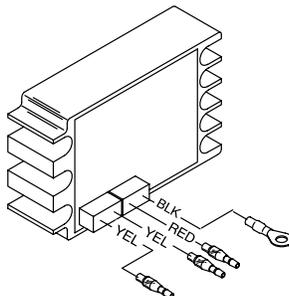
1. Set meter to  $\rightarrow \blacktriangleleft$ .
2. Connect BLACK (-) meter lead to regulator case.
3. Connect RED (+) meter lead to either YELLOW regulator lead. Test.
4. Connect RED (+) meter lead to other YELLOW regulator lead.

<b>SCR Test Specification (Both Tests)</b>
1.5 Volts - No Continuity - Ouch - OL or $\infty$



## Analog Meter

**NOTE:** Voltage regulator/rectifier specifications are given for informational purposes only. Use the appropriate troubleshooting techniques previously mentioned to find the faulty component in the charging system.



BLK = Black  
RED = Red  
YEL = Yellow

### DIODE TEST

1. Set Ohm meter to R X 10 scale.
2. Connect RED(+) meter lead to RED regulator lead.
3. Connect BLACK (-) meter lead to either YELLOW or YELLOW/BLACK regulator lead.

Resistance Specification
100 - 400 OHMS

### DIODE TEST

1. Set Ohm meter to R X 1K scale.
2. Connect Black (-) meter lead to RED regulator lead.
3. Connect RED (+) meter lead to YELLOW regulator lead. Test.
4. Connect RED (+) meter lead to the other YELLOW regulator lead.

Test Specification (Both Tests)
40,000 to $\infty$ OHMS (40 K)

### SCR TEST

1. Set Ohm meter to R X 1K scale.
2. Connect RED (+) meter lead to regulator case.
3. Connect BLACK (-) meter lead to the YELLOW regulator lead. Test.
4. Connect BLACK (-) meter lead to the other YELLOW lead.

SCR Test Specification (Both Tests)
10,000 OHMS (10K)



# Starting System

## STARTER MOTOR AMPERES DRAW

STARTER MOTOR PART NO.	NO LOAD AMP. DRAW	NORMAL AMP. DRAW
50-90983A1	15 AMPS	55 AMPS
Starter Motor Teeth	10	

## STARTING SYSTEM COMPONENTS

The starting system consists of the following components.

1. Battery
2. Starter Solenoid
3. Neutral Start Switch
4. Starter Motor
5. Ignition Switch

## Description

The function of the starting system is to crank the engine. The battery supplies electrical energy to crank the starter motor. When the ignition switch is turned to "START" position, the starter solenoid is activated and completes the starting circuit between the battery and starter.

The neutral start switch opens the start circuit when the shift control lever is not in neutral. This prevents accidental starting when engine is in gear.

### ⚠ CAUTION

**The starter motor may be damaged if operated continuously. DO NOT operate continuously for more than 30 seconds. Allow a 2 minute cooling period between starting attempts.**

## Troubleshooting the Starting Circuit

Before beginning the starting circuit troubleshooting flow chart, following, check first for the following conditions:

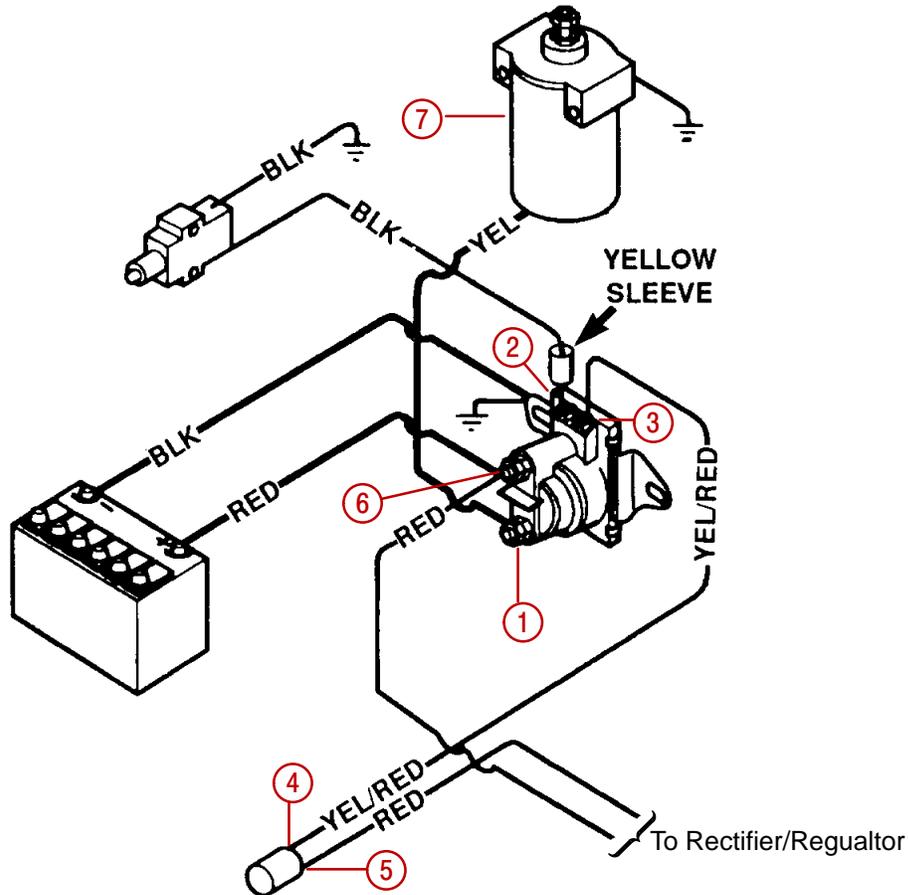
1. Make sure that battery is fully charged.
2. Check that control lever is in NEUTRAL position.
3. Check terminals for corrosion and loose connections.
4. Check cables and wiring for frayed and worn insulation.
5. Check in-line fuse in RED wire. Refer to wire diagram **SECTION 2D**.

The following STARTING CIRCUIT TROUBLESHOOTING FLOW CHART is designed as an aid to troubleshooting the starting circuit. This flow chart will accurately locate any existing malfunction. Location of TEST POINTS are numbered in diagram below.

**IMPORTANT: Remote Control Electric Start Models have a 20 Ampere fuse located under the cowl next to the starter solenoid. This fuse protects the remote control harness. If this fuse is open, the starter will be inoperative. The cause of the blown fuse (a short) should be found and corrected.**

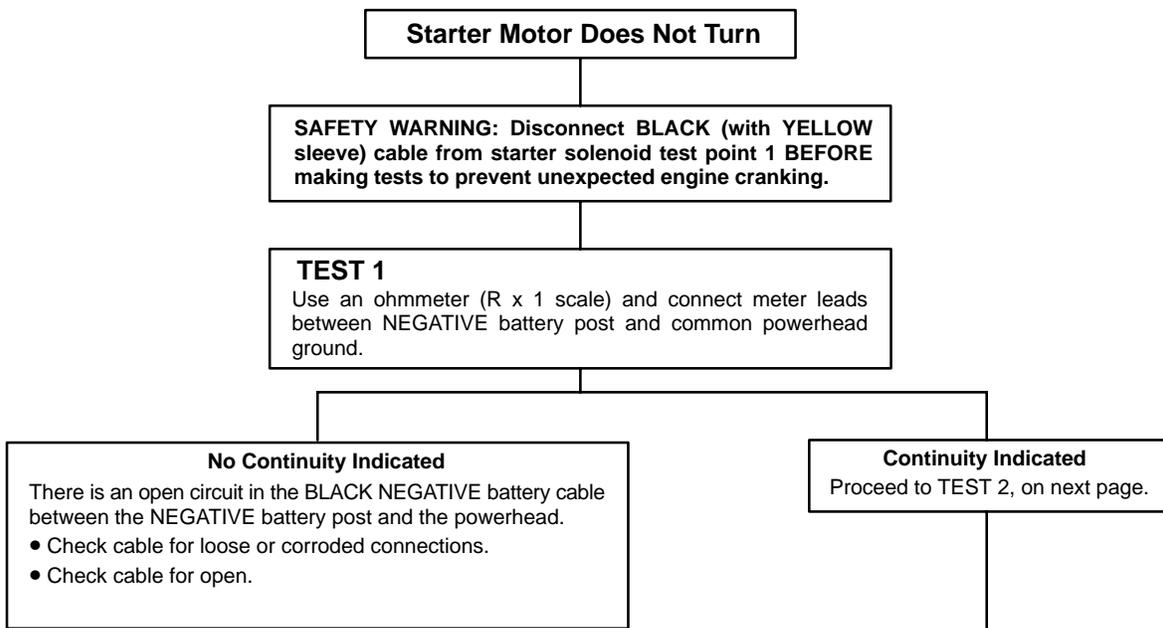


# Starting Circuit Troubleshooting Flow Chart



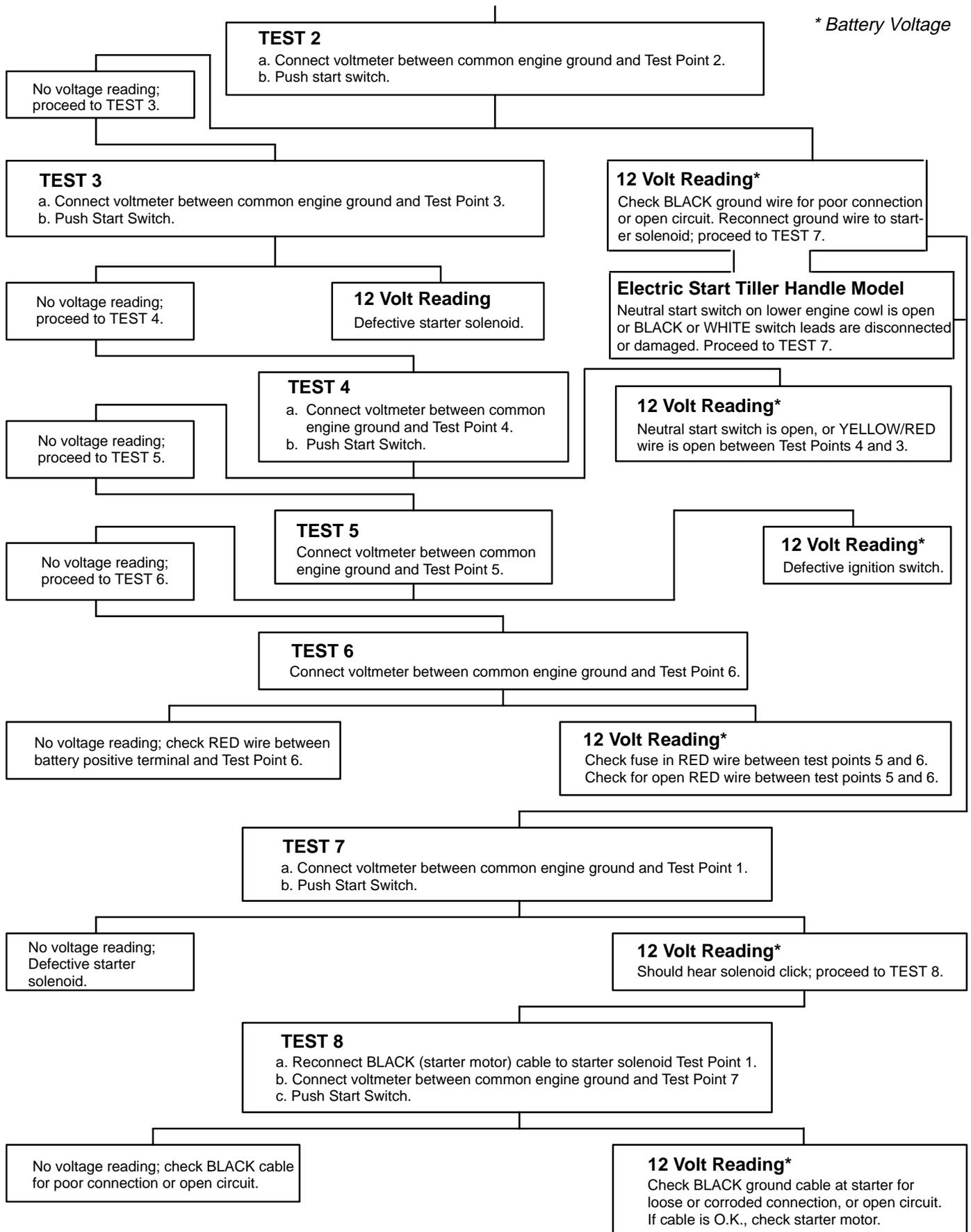
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## Starting Circuit Troubleshooting Flow Chart





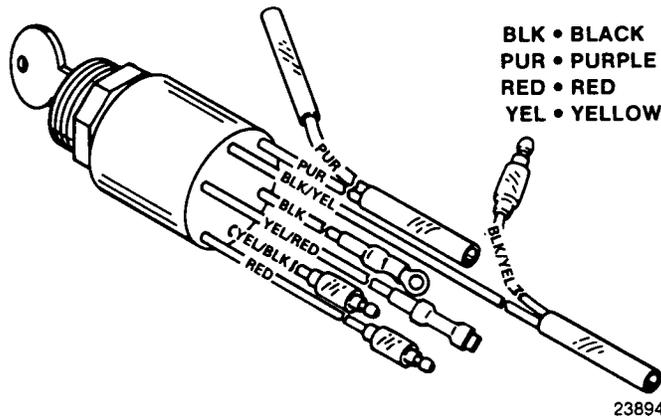
\* Battery Voltage





## COMMANDER 2000 Key Switch Test

1. Disconnect remote control wiring harness and instrument panel connector.
2. Set ohmmeter on R x 1 scale for the following tests:



KEY POSITION	CONTINUITY SHOULD BE INDICATED AT THE FOLLOWING POINTS:					
	BLK	BLK/YEL	RED	YEL/RED	PUR	YEL/BLK
OFF	○ — — — ○					
RUN			○ — — — ○			
START			○ — — — ○	○ — — — ○		
CHOKE*			○ — — — ○		○ — — — ○	○ — — — ○

\*Key switch must be positioned to “RUN” or “START” and key pushed in to actuate choke for this test.

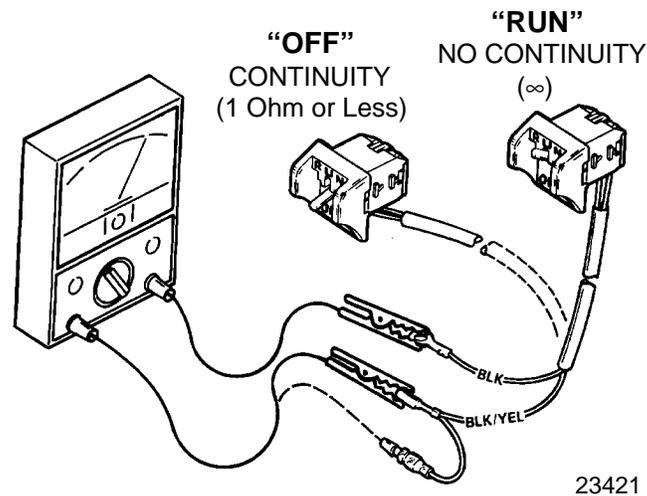
3. If meter readings are other than specified in the preceding tests, verify that switch and not wiring is faulty. If wiring checks ok, replace switch.



## Emergency Stop Switch (Lanyard Type)

**IMPORTANT: Refer to Section 2D-Wiring Diagrams for wiring connections.**

1. Disconnect emergency stop switch leads from engine wiring.
2. Use an ohmmeter and perform the following tests.

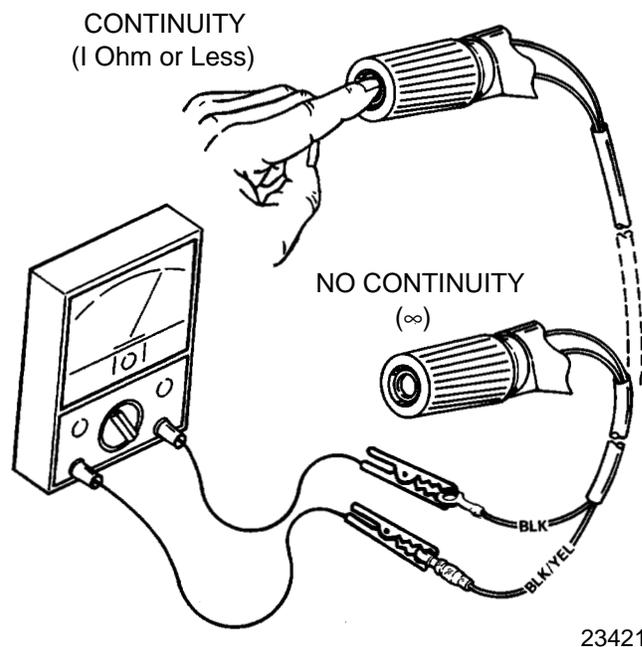


3. If meter readings are other than specified, replace emergency stop switch.

## Push Button Stop Switch

**IMPORTANT: Refer to Section 2D-Wiring Diagrams for wiring connections.**

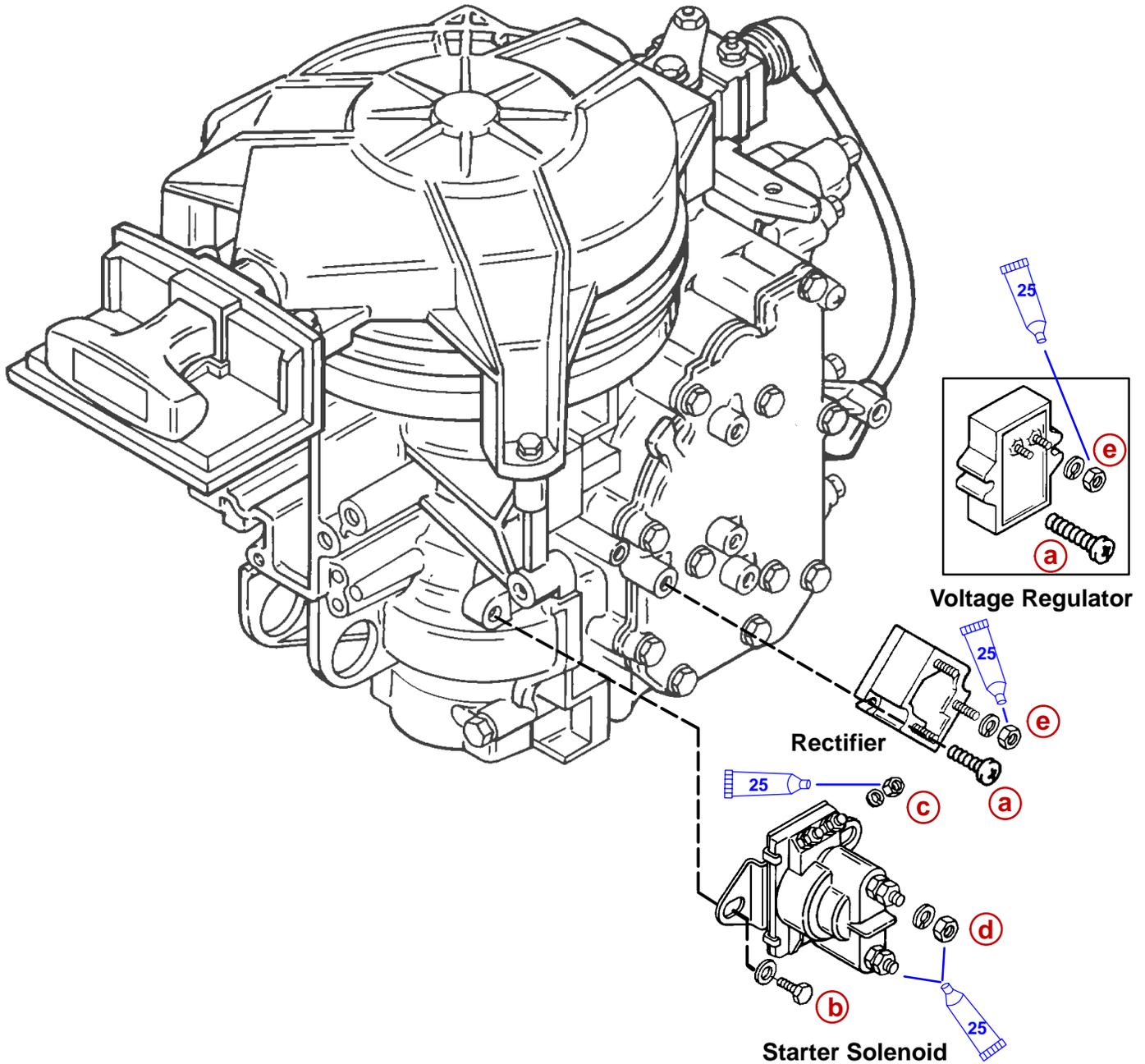
1. Disconnect push button stop switch leads from engine wiring.
2. Use an ohmmeter and perform the following tests.



3. If meter readings are other than specified, replace push button stop switch.



# Electrical Component Removal and Installation



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## Torque Specifications

- (a) Tighten Securely
- (b) 70 lb. in. (7.9 N·m)
- (c) 15 lb. in. (1.7 N·m)
- (d) 30 lb. in. (3.4 N·m)
- (e) 25 lb. in. (2.8 N·m)

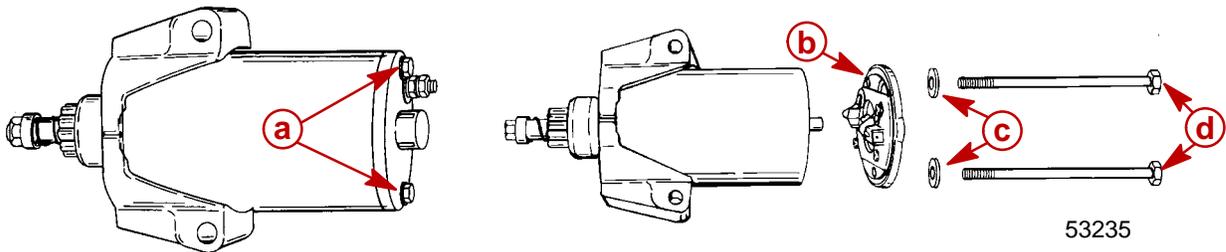
Liquid Neoprene



# Starter Motor

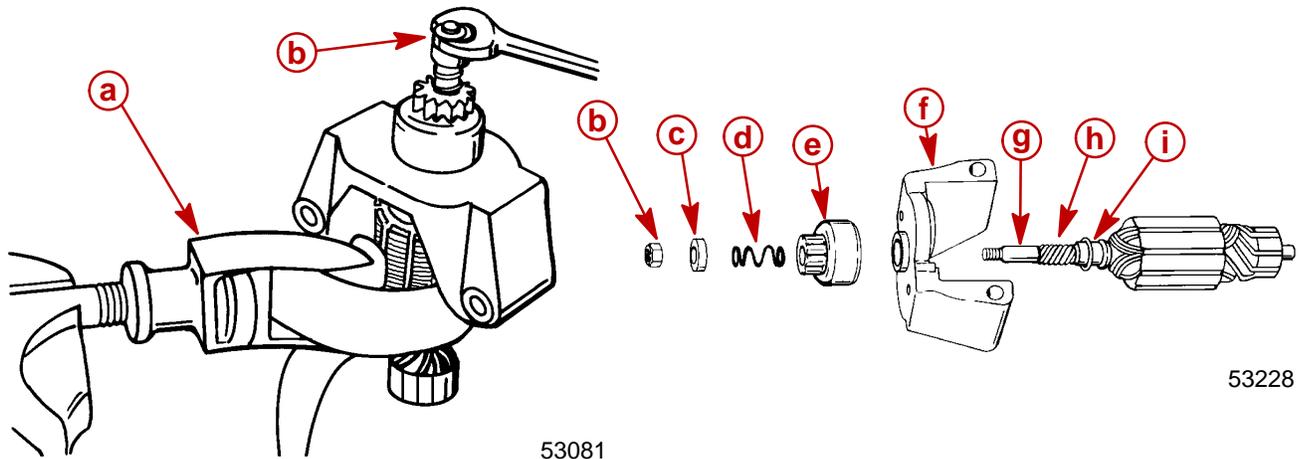
## Disassembly

1. Remove 2 thru-bolts from starter.
2. Lightly tap on end of shaft and lower end cap with rubber mallet. Do not lose brush springs.



- a** - Bolts
- b** - Lower end cap
- c** - Washers
- d** - Bolts

3. Tap on drive end cap to loosen. Remove end cap and armature from starter housing.
4. If removal of parts that are installed on armature is necessary, hold armature with Strap Wrench and remove locknut from end of shaft and discard.
5. Remove parts from shaft.



- a** - Strap Wrench (91-24937A1)
- b** - Locknut (discard)
- c** - Spacer
- d** - Spring
- e** - Drive Assembly
- f** - Drive end cap
- g** - Armature shaft
- h** - Helix threads
- i** - Washer



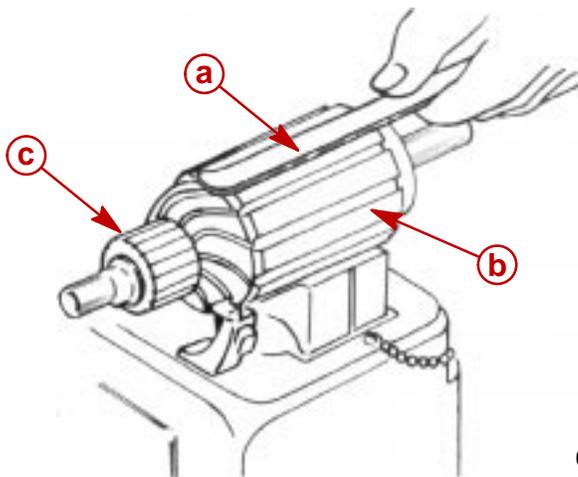
## Cleaning and Inspection

1. If brushes are pitted, chipped or worn to less than 4.8mm (3/16 in.), replace brushes.  
**IMPORTANT: DO NOT clean the starter drive assembly or armature shaft while starter motor is installed on outboard. The cleaning solution will drain dirt into motor housing.**
2. If the motor drive assembly does not fully engage with flywheel, the drive assembly may be binding on the helix threads on the armature shaft due to dirt or wear. Locate cause of binding and correct before reassembling.
3. Clean drive components with cleaning solution and inspect parts for wear.
4. Clean commutator with No. 00 sandpaper. Remove any oil from commutator. If commutator surface is pitted, rough or worn unevenly, resurface on a lathe.
5. Resurface commutator on a lathe as follows:
  - a. Use a lathe to turn down the commutator surface. DO NOT turn down the commutator surface excessively.
  - b. Clean copper particles from slots between commutator bars.
  - c. Sand the commutator lightly with No. 00 sandpaper to remove burrs. Thoroughly clean the armature after resurfacing and sanding.

## Testing Motor Armature

### TESTING ARMATURE FOR SHORTS

1. Place armature in a growler and switch growler on.
2. Hold hack saw blade over armature core while rotating armature.
3. If saw blade vibrates, armature is shorted. Retest after cleaning between commutator bars. If saw blade still vibrates, replace armature.



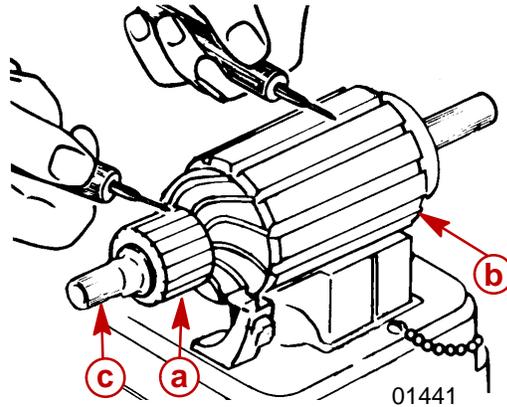
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- a** - Hack saw blade
- b** - Armature core
- c** - Commutator



### TESTING ARMATURE FOR GROUND

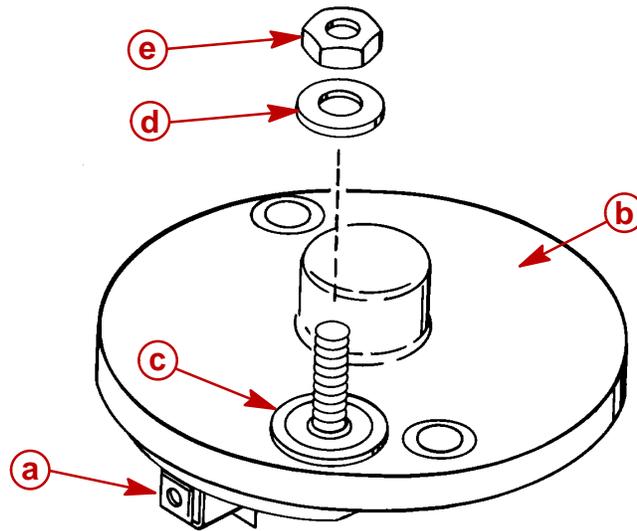
1. Use an ohmmeter (R x 100) to check for no continuity between commutator and armature core or commutator and shaft.
2. If continuity exists, armature is grounded and must be replaced.



- a - Commutator
- b - Core
- c - Shaft

### Starter Motor Reassembly

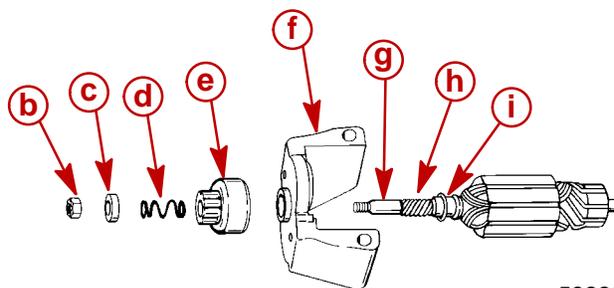
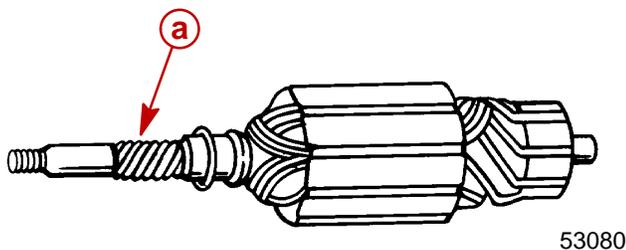
1. Reinstall brush assembly.



- a - Brush
- b - End cap
- c - Fiber washer
- d - Metal washer
- e - Nut

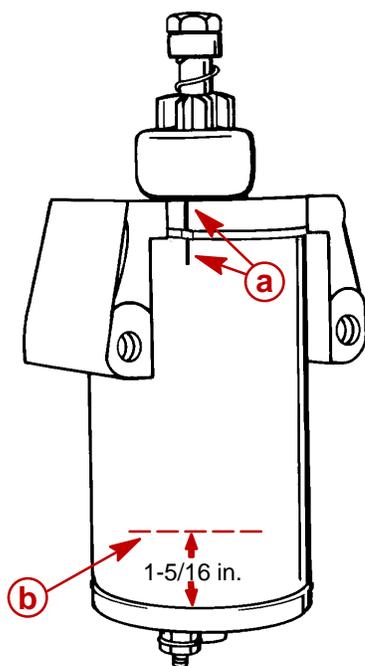


2. Apply a drop of SAE 10W oil to to helix threads on armature shaft. DO NOT over lubricate.
3. Apply a drop of SAE 10W oil to bushings in drive end cap and lower end cap. DO NOT over lubricate.
4. Reinstall components on armature shaft. Use a new locknut and tighten securely.



- a** - Helix threads
- b** - Locknut
- c** - Spacer
- d** - Spring
- e** - Drive assembly
- f** - Drive end cap
- g** - Armature shaft
- h** - Helix threads
- i** - Washer

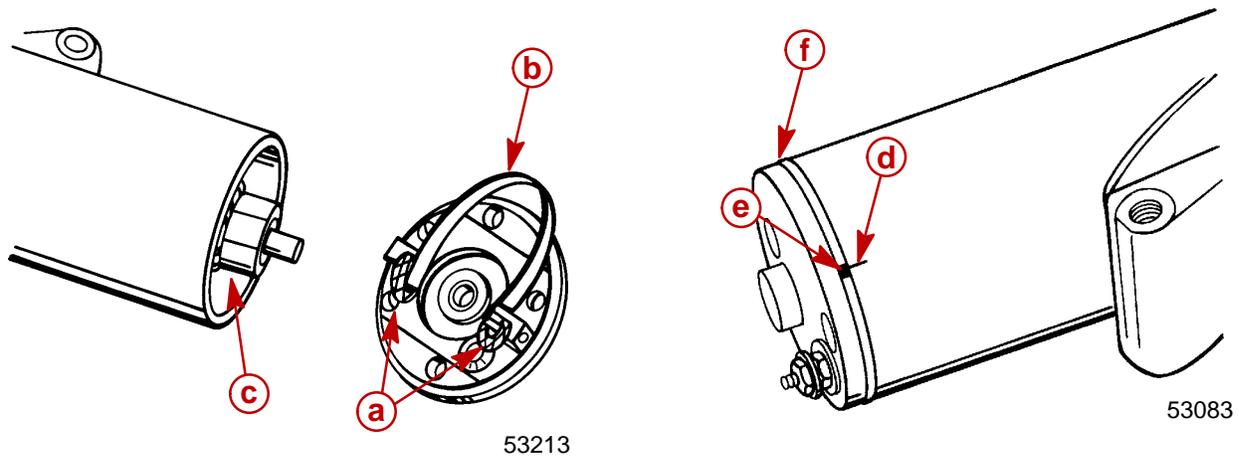
5. Position armature into starter frame so that commutator end of armature is at end of starter frame where permanent magnets are recessed 33.3mm (1-5/16 in.). Align marks as shown.



- a** - Alignment marks
- b** - Bottom edge of permanent magnets



6. Install springs and brushes into brush holders. Spread brushes and hold in place with a strip of spring steel.
7. Push in on drive end of shaft so that commutator will extend out of starter frame.
8. Install lower end cap onto starter frame.

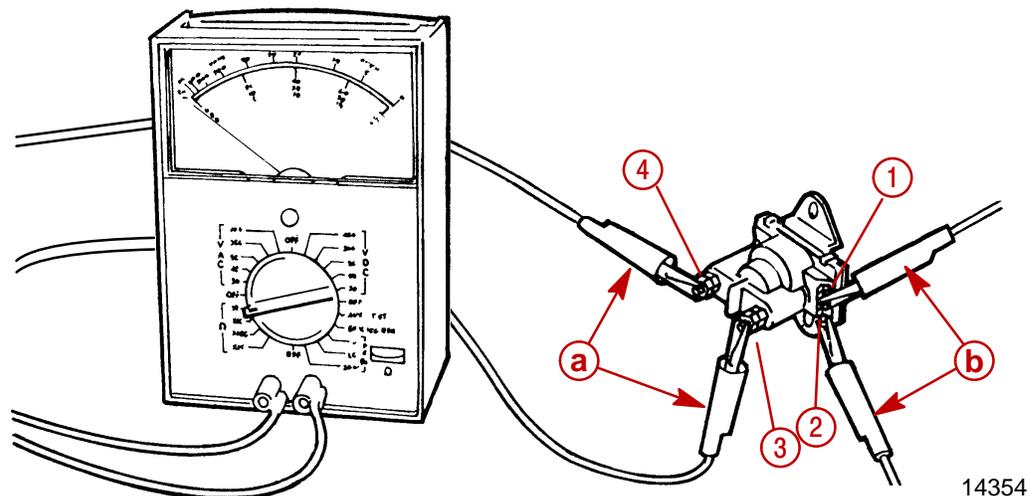


- a** - Brushes
- b** - Spring steel
- c** - Commutator
- d** - Alignment mark; must align with slot
- e** - Slot
- f** - Lower end cap

## Starter Solenoid Test

Test starter solenoid as follows:

1. Disconnect all leads from solenoid terminals.
2. Use an ohmmeter, set to R x 1 scale and connect between solenoid terminals 3 and 4.
3. Connect a 12-volt supply between solenoid terminals 1 and 2. Solenoid should click and meter should read zero ohms.
4. If meter does not read zero ohms (full continuity), replace solenoid.



- a** - Ohmmeter leads
- b** - 12-volt supply

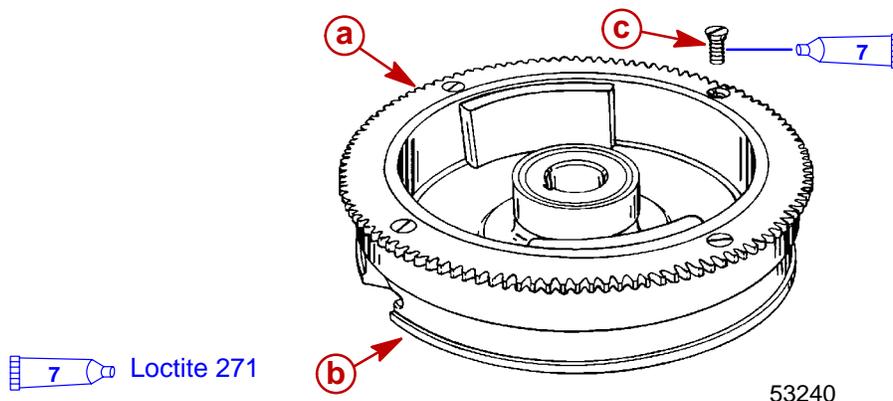


# Flywheel Ring Gear

## Installation

**IMPORTANT:** Before installing ring gear on flywheel, inspect gear and flywheel for paint runs which will prevent ring gear from laying flat against flywheel.

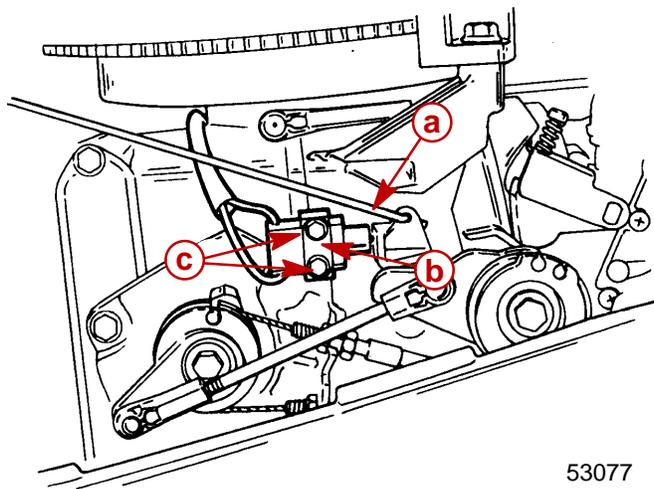
1. Inspect (and remove) any paint runs on ring gear and/or mounting surface on flywheel.
2. Place gear on flywheel with countersink side of mounting holes toward the outside.
3. Apply Loctite 271 to threads of 4 gear mounting screws and secure gear to flywheel. Torque screws to 11.3 Nm (100 lb. in.).



- a - Ring gear
- b - Flywheel
- c - Screws [Torque to 11.3 Nm (100 lb. in.)]

## Neutral Start Switch (Electric Start Tiller Handle Shift Models)

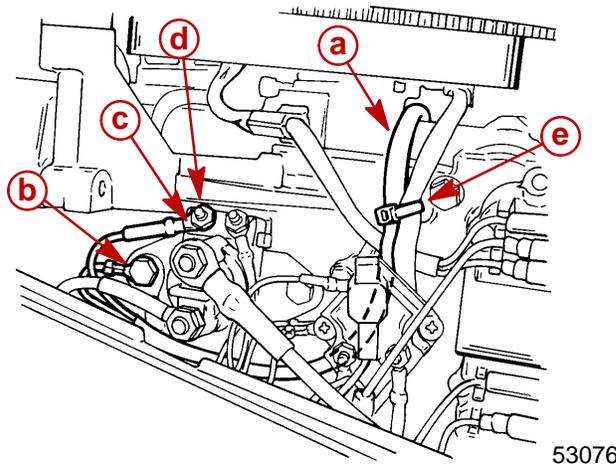
1. Mount neutral start switch onto control platform with 2 bolts and plate.
2. Torque mounting bolts to 0.6 Nm (5 lb. in.).



- a - Neutral start switch
- b - Plate
- c - Bolts [Torque to 0.6 Nm (5 lb. in.)]



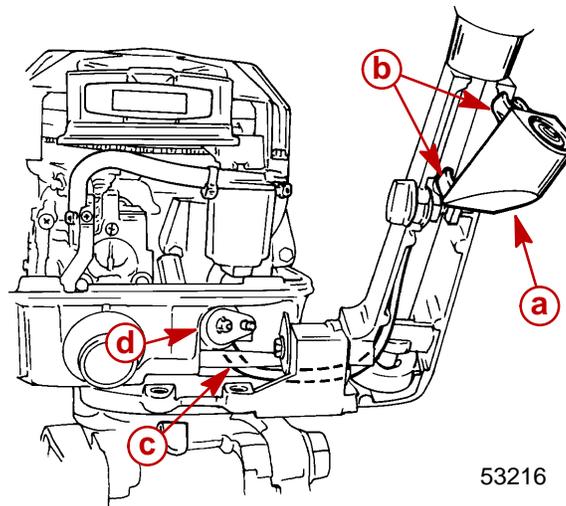
3. Route switch harness over block. Secure harness to stator harness with cable-tie.
4. Route harness behind rectifier. Attach BLACK lead to solenoid mount bolt. Attach BLACK lead with YELLOW sleeve to terminal 1 of starter solenoid.



- a - Switch harness
- b - BLACK lead
- c - BLACK lead with YELLOW sleeve
- d - Terminal 1
- e - Cable-tie

## Tiller Handle Start Button

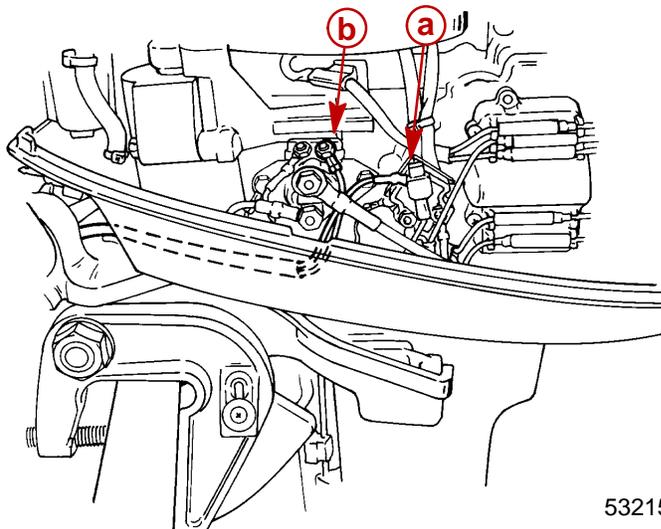
1. The tiller handle start button assembly is secured to the tiller handle by 2 semi-loops which snap fit onto the tiller throttle shaft. To remove the button assembly, pry the assembly away from the tiller handle with a flat tip screwdriver.
2. The starter button harness is routed into the lower cowl through the fuel connector access hole.



- a - Start button assembly
- b - Semi-loops
- c - Harness
- d - Fuel connector



3. The starter button harness is routed down the PORT side of lower engine to cowl.
4. The RED harness lead is connected to the POSITIVE terminal of the rectifier. Torque attaching nut to 2.8 Nm (25 lb. in.).
5. The YELLOW/RED harness lead attaches to the #2 terminal of the starter terminal. Torque attaching nut to 1.7 Nm (15 lb. in.).



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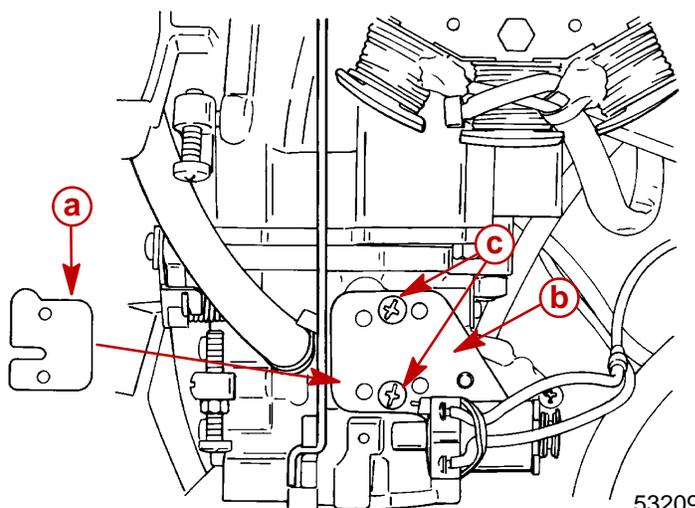
- a** - RED Lead [Torque nut to 2.8 Nm (25 lb. in.)]
- b** - YELLOW/RED Lead [Torque nut to 1.7 Nm (15 lb. in.)]

## Choke Solenoid

### Installation

**IMPORTANT: New gasket MUST be positioned as shown when being installed.**

1. Install new gasket with solenoid plate assembly.
2. Secure assembly with 2 screws. Torque screws to 2.0 Nm (18 lb. in.).



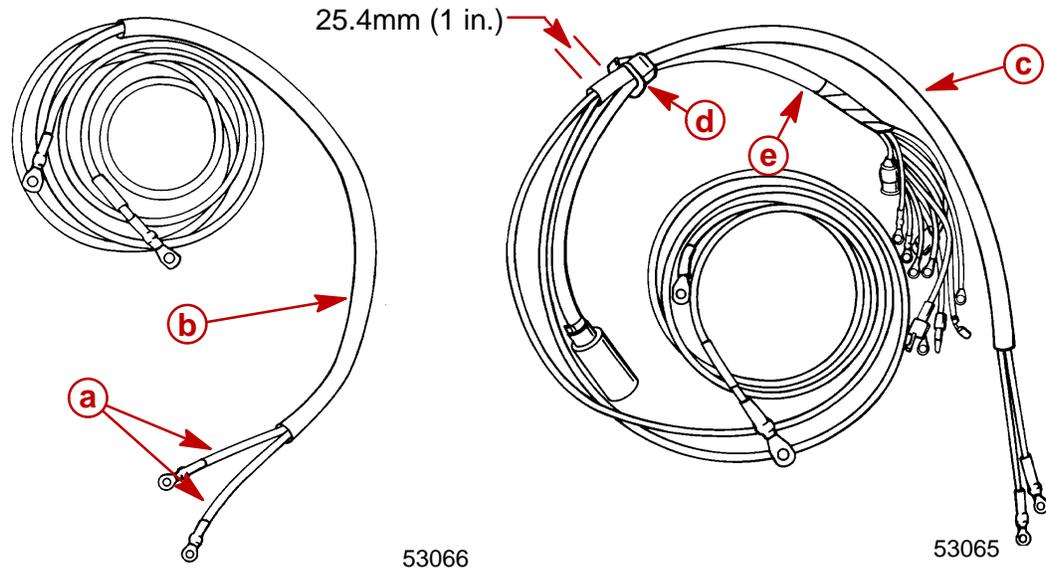
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- a** - Gasket
- b** - Solenoid plate
- c** - Screws [Torque to 2.0 Nm (18 lb. in.)]



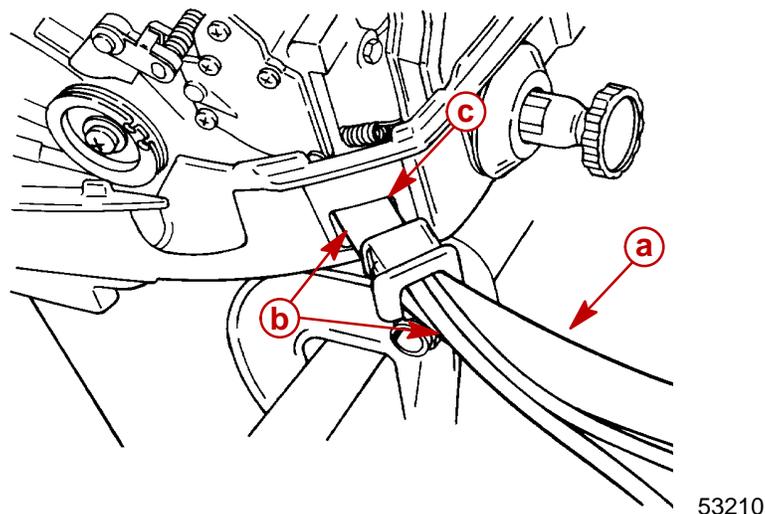
## Battery Cables/Engine Wiring Harness (Remote Electric Start Models)

1. Slide battery cables through sleeve.
2. Thread battery cable/sleeve through wire retainer of engine wiring harness. Verify 25.4mm (1 in.) of sleeve remains to the outside of wire retainer.



- a - Battery cables
- b - Sleeve
- c - Sleeve
- d - Retainer
- e - Harness

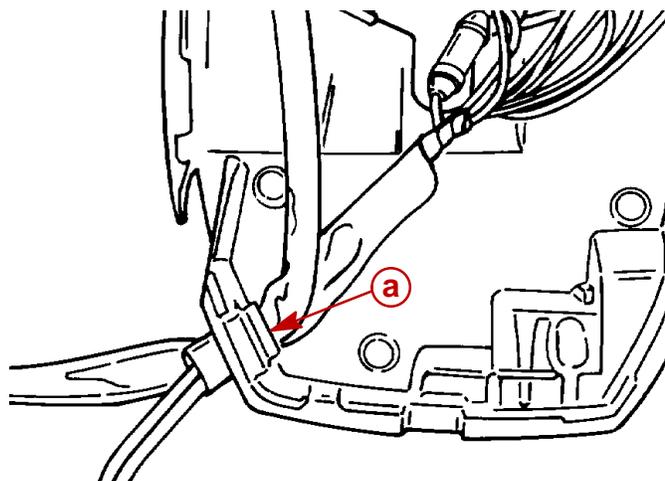
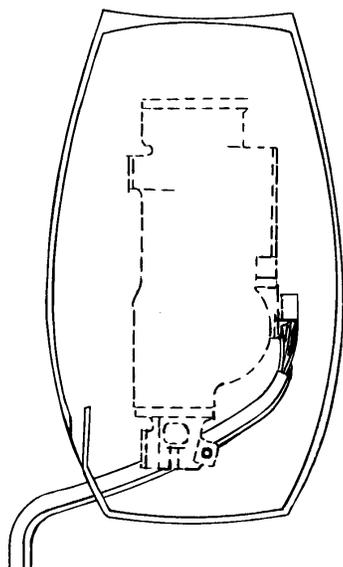
3. Remove carburetor as outlined in **Section 3**.
4. Thread engine wiring harness first and then battery cable/sleeve through opening in bottom cowl.



- a - Harness
- b - Battery cable/sleeve
- c - Opening



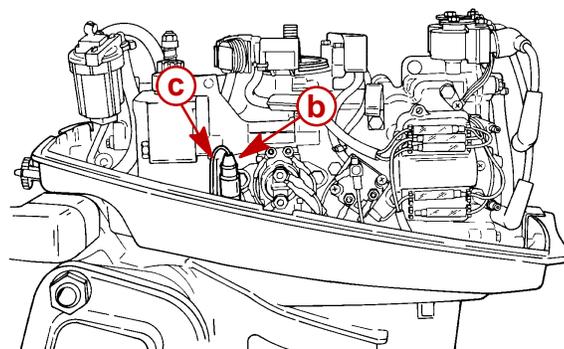
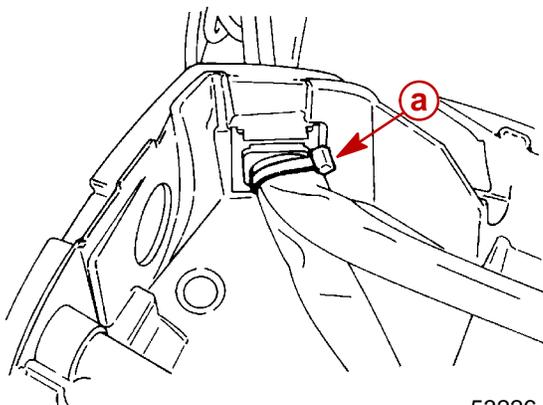
5. Route engine wiring harness and battery cable/sleeve (under carburetor location) around to PORT side of cylinder block.
6. Push wire retainer into opening of bottom cowl and secure with clip.



53068

**a** - Clip

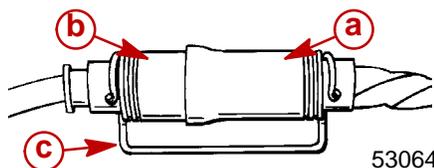
7. Secure harness and battery cable/sleeve with cable-tie just inside bottom cowl.
8. Reinstall carburetor. Refer to **Section 3A**.
9. Secure fuse holder in J-clip.



53226

**a** - Cable-tie  
**b** - Fuse holder  
**c** - J-clip

10. Plug remote control harness connector into engine wiring harness connector and secure with harness connector retainer.



53064

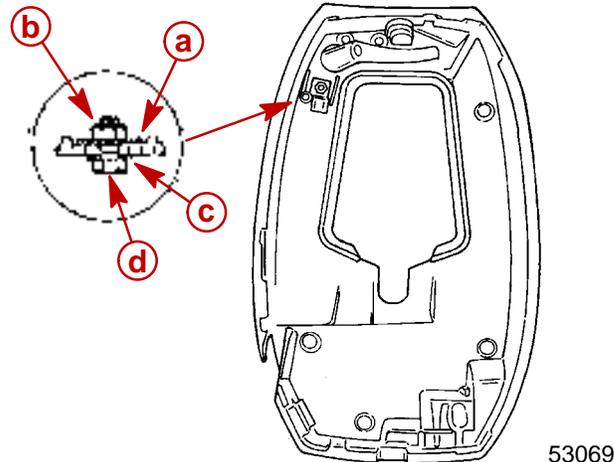
**a** - Remote control harness  
**b** - Engine harness  
**c** - Retainer



# Battery Cables (Tiller Handle Push Button Electric Start Models)

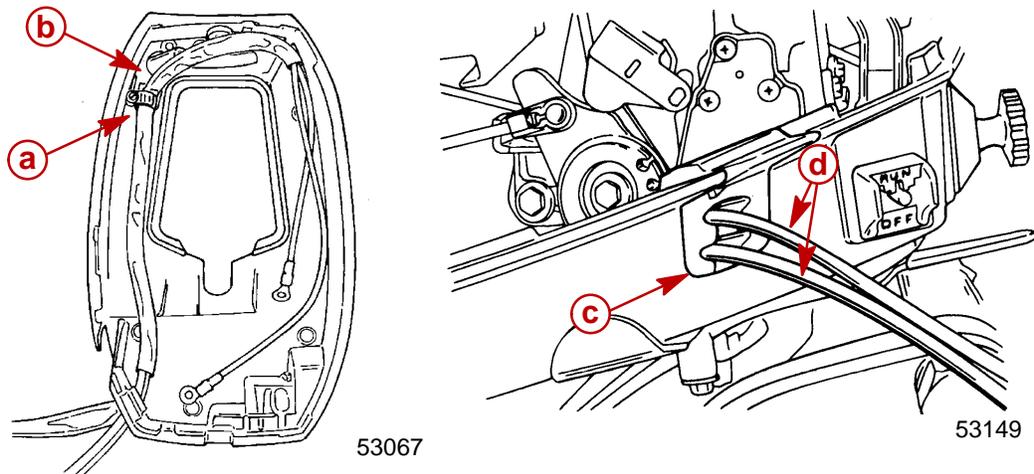
## Installation

1. Fasten harness clamp to bottom cowl with nut, washer and bolt.



- a - Clamp
- b - Nut
- c - Washer
- d - Bolt

2. Slide battery cables through sleeve.
3. Slide harness clamp over battery cable sleeve and position cables into bottom cowl.
4. Position harness clamp onto clamp bracket in bottom cowl. Tighten clamp securely.
5. Slide battery cable grommet over battery cables and install grommet into opening in starboard bottom cowl.



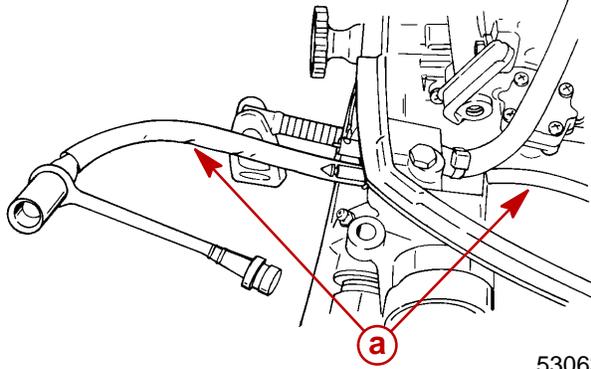
- a - Clamp
- b - Bracket
- c - Grommet
- d - Cables



## Plug Harness (Battery Charging Kit)

### Installation

1. Install plug harness through fuel fitting opening in bottom cowl.
2. Route harness along PORT side of engine to rectifier.



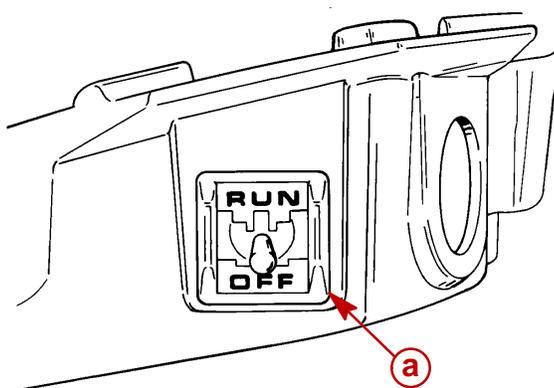
**a** - Harness

3. Refer to **Section 2D** for wiring connections.

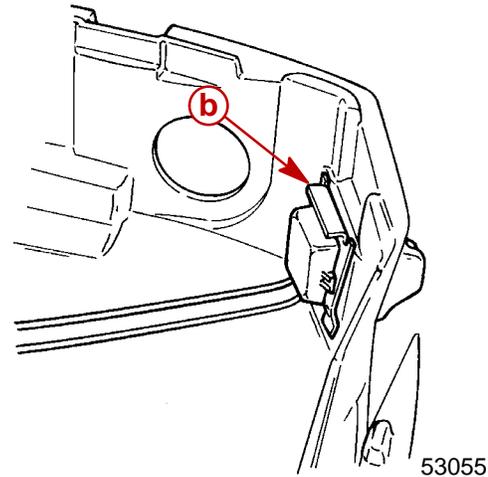
## Emergency Stop Switch (Lanyard Type)

### Installation

1. Route emergency stop switch wiring through opening in STARBOARD bottom cowl.
2. Secure stop switch into opening in bottom cowl using clip.



**a** - Stop Switch  
**b** - Clip



3. Refer to **Section 2D** for wiring connections.



# ELECTRICAL AND IGNITION

## Section 2C – Timing, Synchronizing & Adjusting

### Table of Contents

Specifications .....	2C-1	Tiller Handle Shift Models .....	2C-3
Special Tools .....	2C-2	Maximum Timing Adjustment .....	2C-4
Adjustments .....	2C-2	Idle Timing Adjustment .....	2C-4
Side Shift Models .....	2C-2	Fast Idle Adjustment .....	2C-5

**2  
C**

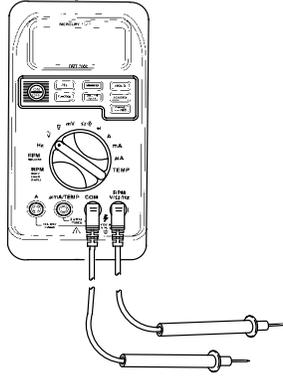
### Specifications

<b>MAXIMUM TIMING</b>	36° BTDC
<b>IDLE TIMING</b> 6/8/9.9/10/15	8° BTDC ± 1°
<b>IDLE RPM IN FORWARD GEAR –</b>  6 8/9.9/15 10 SEA PRO MARATHON XR/MAG/VIKING 10 15 SEA PRO MARATHON	650 ± 75 725 ± 50 850 ± 50 850 ± 50 725 ± 50  725 ± 50
<b>FULL THROTTLE RPM</b> 6 8 9.9/10/15	4000 – 5000 4500 – 5500 5000 – 6000
<b>SPARK PLUG (1994)</b> 6/8/9.9 10/15  <b>SPARK PLUG GAP</b> 6/8/9.9 10/15	NGK BP8H-N-10 NGK BP8HS-15  1.0mm (0.040 in.) 1.5mm (0.060 in.)
<b>SPARK PLUG (1995 AND NEW-ER)</b> 6/8 9.9/10/15 <b>SPARK PLUG GAP</b> 6/8 9.9/10/15	NGK BP8H-N-10 NGK BP8HS-15  1.0mm (0.040 in.) 1.5mm (0.060 in.)
<b>NEUTRAL FAST IDLE</b>	1500 – 2000 RPM

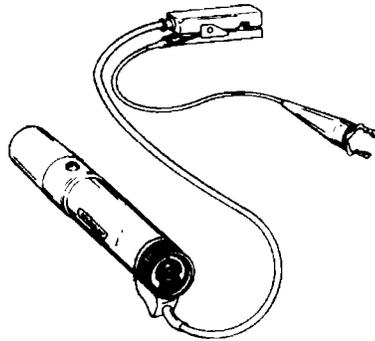


## Special Tools

1. DMT 2000 Service Tachometer 91-854009A1



2. Timing Light 91-99379

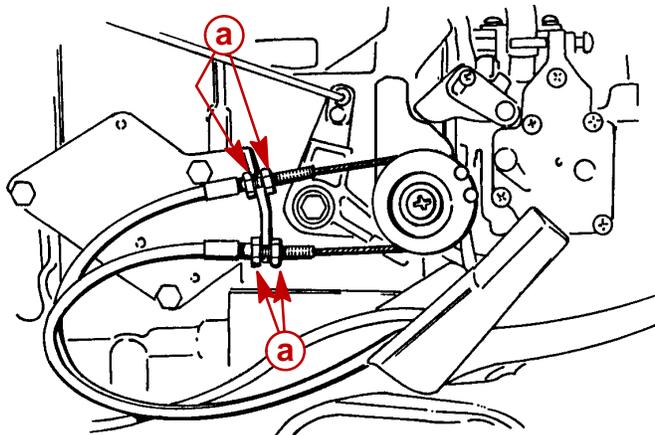


## Adjustments

1. Place engine in water.

### Side Shift Models

1. Check tiller handle cable adjustment for full throttle movement in both **Forward** and **Reverse** gears.
2. Adjust jam nuts for proper travel and to eliminate any slack.

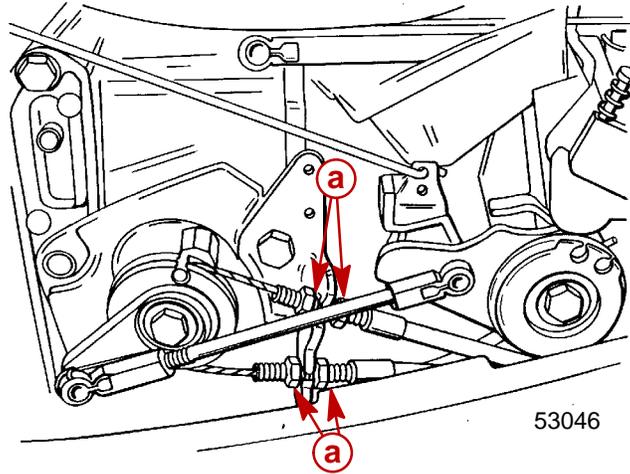


**a** - Jam nuts



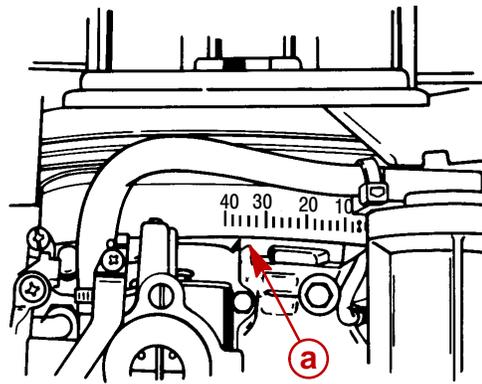
## Tiller Handle Shift Models

1. Rotate tiller handle twist grip to NEUTRAL.
2. Adjust jam nuts to remove slack from control cables while allowing full travel of throttle/shift linkage.



**a** - Jam nuts

## TIMING POINTER LOCATION

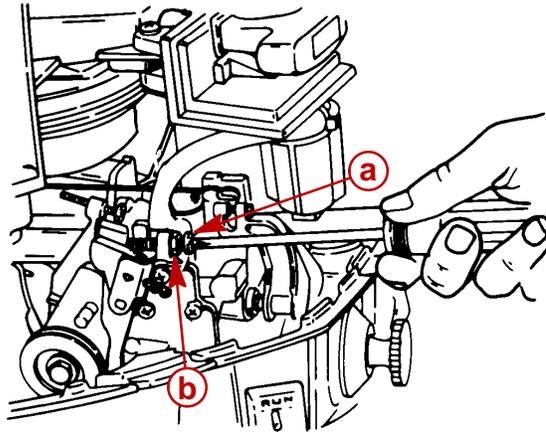


**a** - Timing pointer



## Maximum Timing Adjustment

1. Connect timing light to No. 1 (top) spark plug lead.
2. With engine in **Forward** gear, fully advance throttle to WOT (Wide Open Throttle) position.
3. Adjust maximum spark advance screw to align the 36° BTDC (Before Top Dead Center) timing mark on flywheel with timing pointer. Tighten jam nut if so equipped.
4. Adjust low speed mixture screw. Refer to **Section 3A-Carburetor Adjustments**.



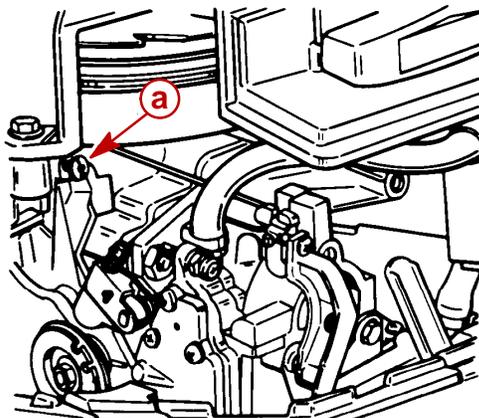
- a** - Maximum spark advance screw  
**b** - Jam nut

## Idle Timing Adjustment

1. Push primer/fast idle knob completely in and rotate knob fully counterclockwise.
2. With engine running in **Forward** gear, reduce engine speed to idle.

**IMPORTANT: It may be necessary to adjust idle speed screw to obtain a reasonably stabilized idle.**

3. Adjust idle timing adjustment screw to align the specified idle timing mark on flywheel with timing pointer.
4. Shift to **Neutral** gear and stop engine.

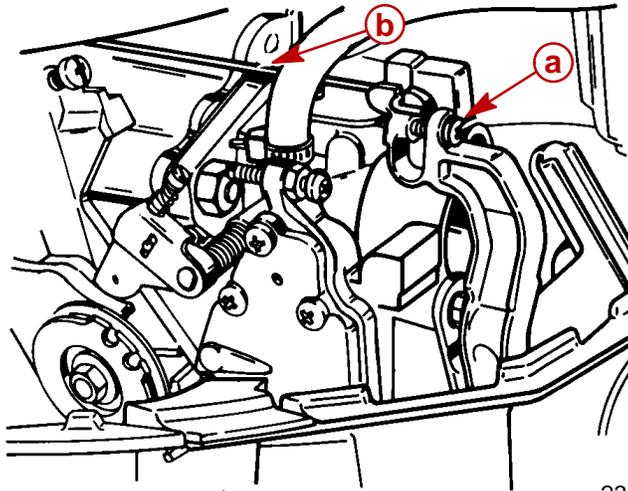


- a** - Idle timing adjustment screw



## Fast Idle Adjustment

1. Push primer/fast idle knob completely in and rotate knob fully COUNTERCLOCKWISE.
2. Shift outboard to NEUTRAL.
3. Adjust screw to remove all clearance between idle wire and trigger.



23970

- a** - Fast idle screw  
**b** - Idle wire

4. Check fast idle by turning primer knob to full CLOCKWISE position. Fast idle speed should be 1500 – 2000 RPM.



# ELECTRICAL AND IGNITION

## Section 2D – Wiring Diagrams

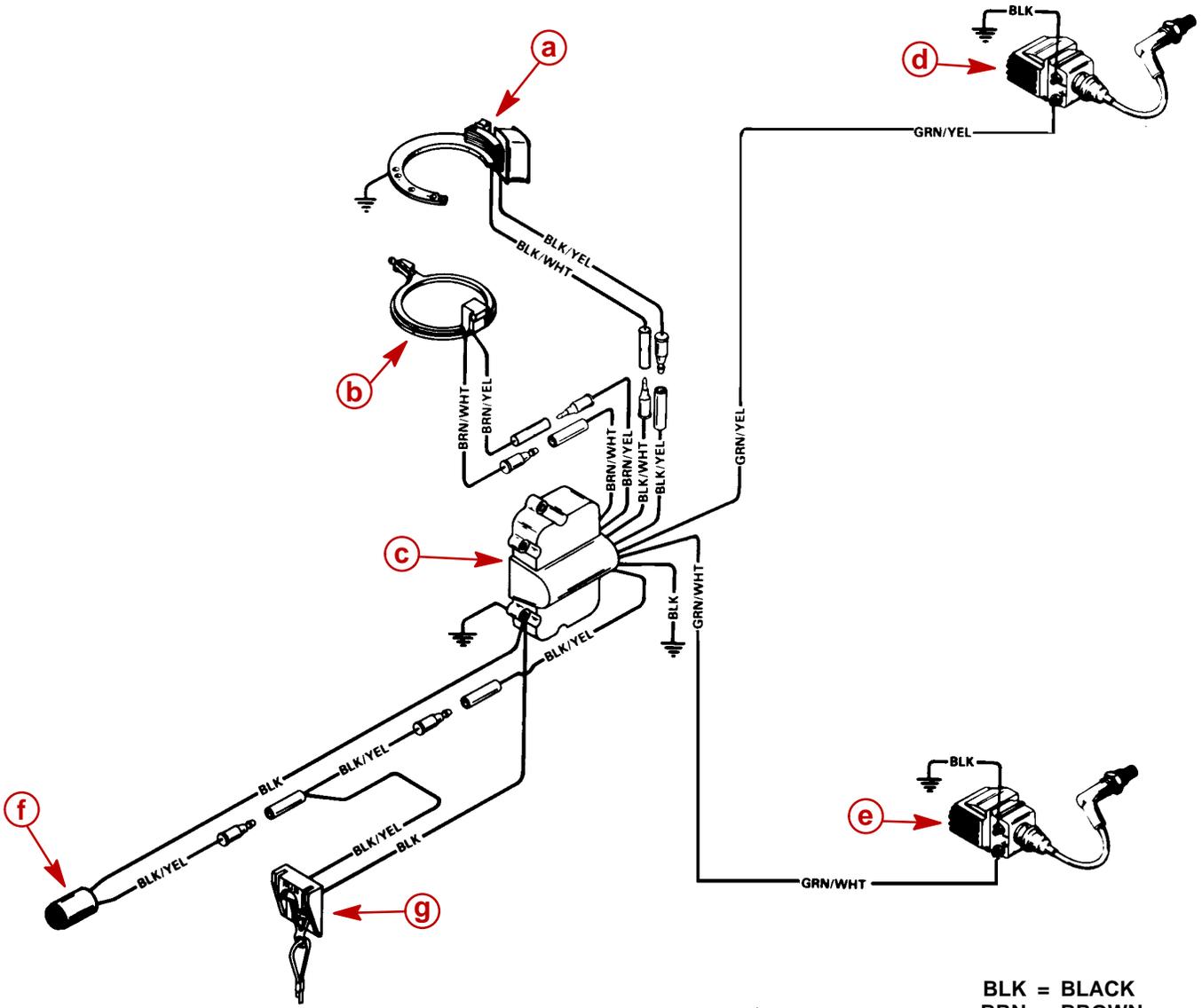
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Electric Start Models with Tiller Handle Start Button (1998 And Prior) . . . . .	2D-3	Electric Start Models with Tiller Handle Start Button (1999 And Newer, Design II) . . . . .	2D-9
Electric Models Equipped with Remote Control (1998 And Prior) . . . . .	2D-4	Electric Models Equipped with Remote Control (1999 And Newer, Design II) . . . . .	2D-10
Manual Start Ignition Wiring Diagram (1999 And Newer) . . . . .	2D-5	Optional Electrical Accessories Wiring Diagrams . . . . .	2D-11
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		Commander 3000 Panel Mount Control . . . . .	2D-14



# Manual Start Ignition Wiring Diagram (1998 And Prior)

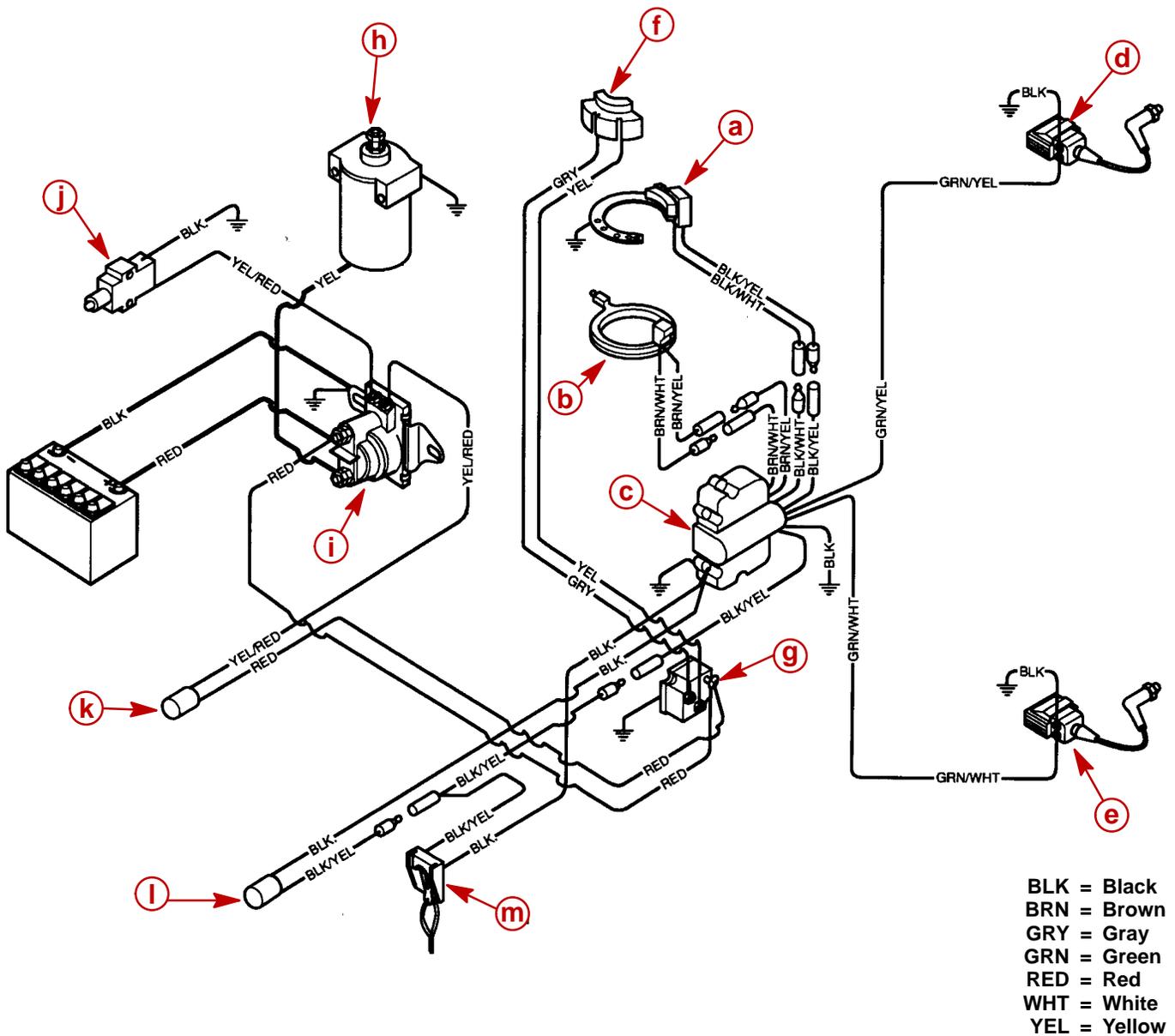


BLK = BLACK  
 BRN = BROWN  
 GRY = GRAY  
 GRN = GREEN  
 RED = RED  
 WHT = WHITE  
 YEL = YELLOW

- a** - Stator
- b** - Trigger
- c** - Switch box
- d** - Ignition coil top cylinder
- e** - Ignition coil bottom cylinder
- f** - Stop switch
- g** - Emergency stop switch



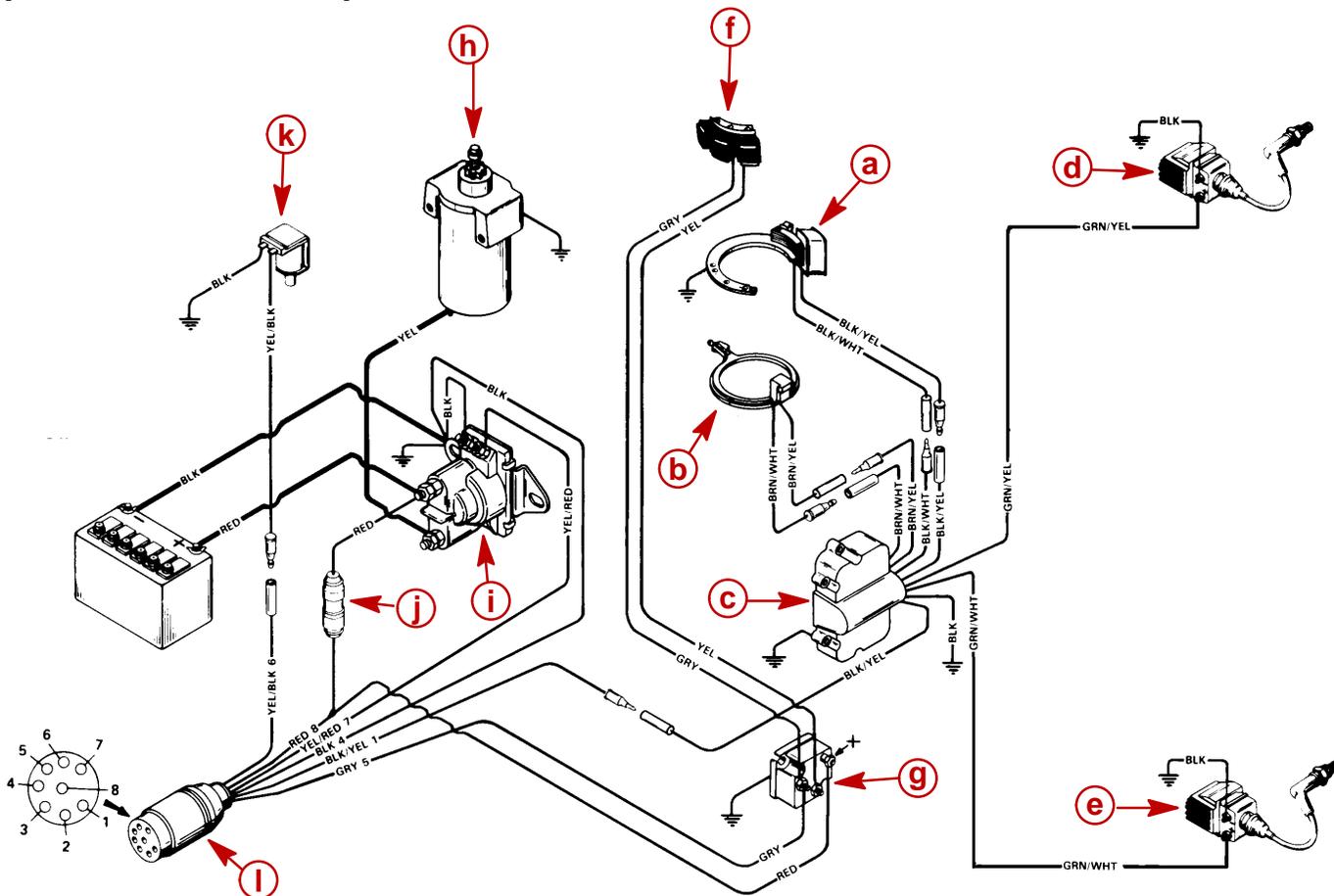
# Electric Start Models with Tiller Handle Start Button (1998 And Prior)



- a** - Stator
- b** - Trigger
- c** - Switch box
- d** - Ignition coil top cylinder
- e** - Ignition coil bottom cylinder
- f** - Alternator stator
- g** - Rectifier
- h** - Starter motor
- i** - Starter solenoid
- j** - Neutral start switch
- k** - Start switch
- l** - Stop switch
- m** - Emergency stop switch



# Electric Models Equipped with Remote Control (1998 And Prior)

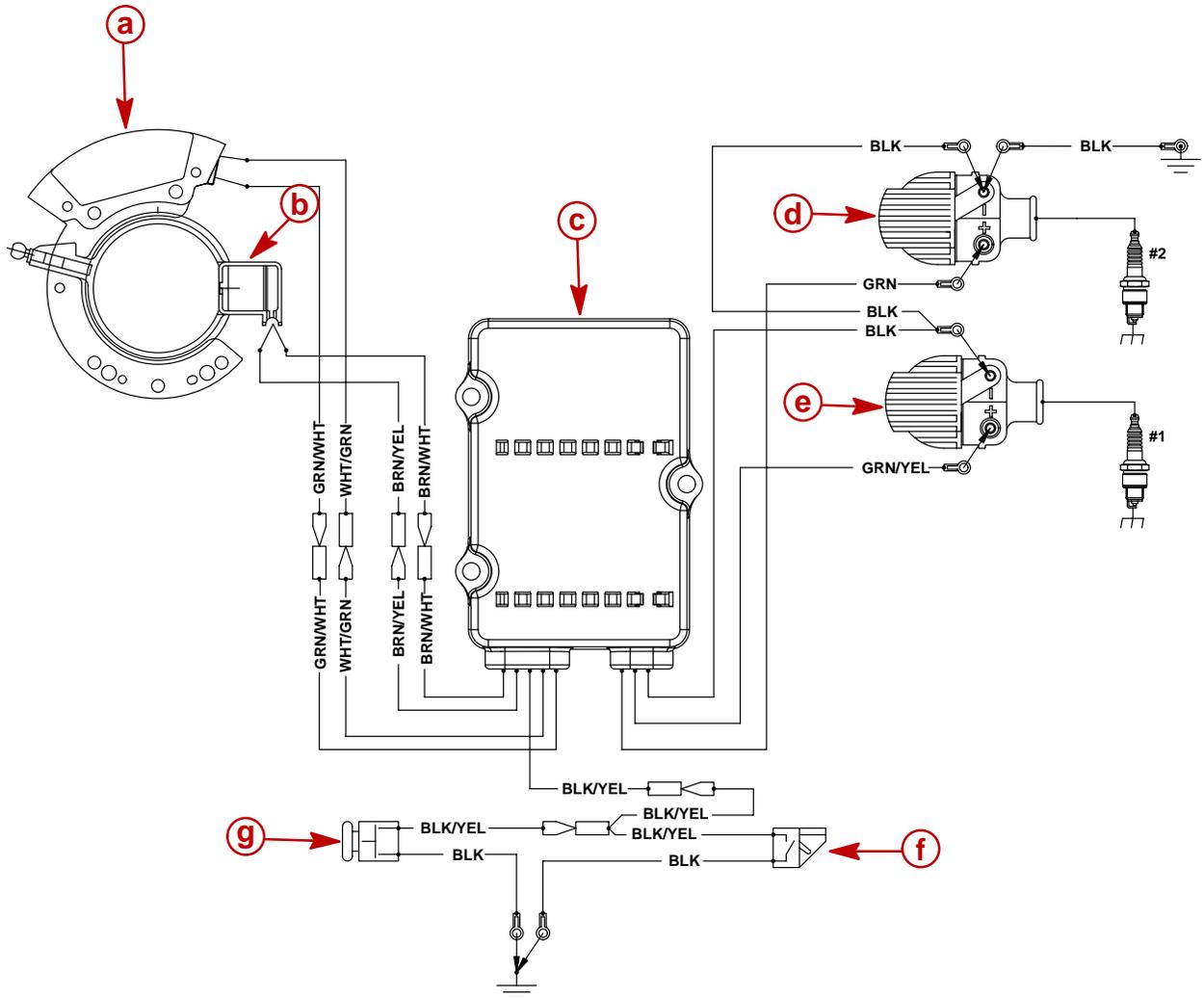


BLK = BLACK  
 BRN = BROWN  
 GRY = GRAY  
 GRN = GREEN  
 RED = RED  
 WHT = WHITE  
 YEL = YELLOW

- a** - Stator
- b** - Trigger
- c** - Switch box
- d** - Ignition coil top cylinder
- e** - Ignition coil bottom cylinder
- f** - Alternator stator
- g** - Rectifier
- h** - Starter motor
- i** - Starter solenoid
- j** - Fuse holder (20 ampere fuse)
- k** - Choke solenoid
- l** - Wiring harness



# Manual Start Ignition Wiring Diagram (1999 And Newer)

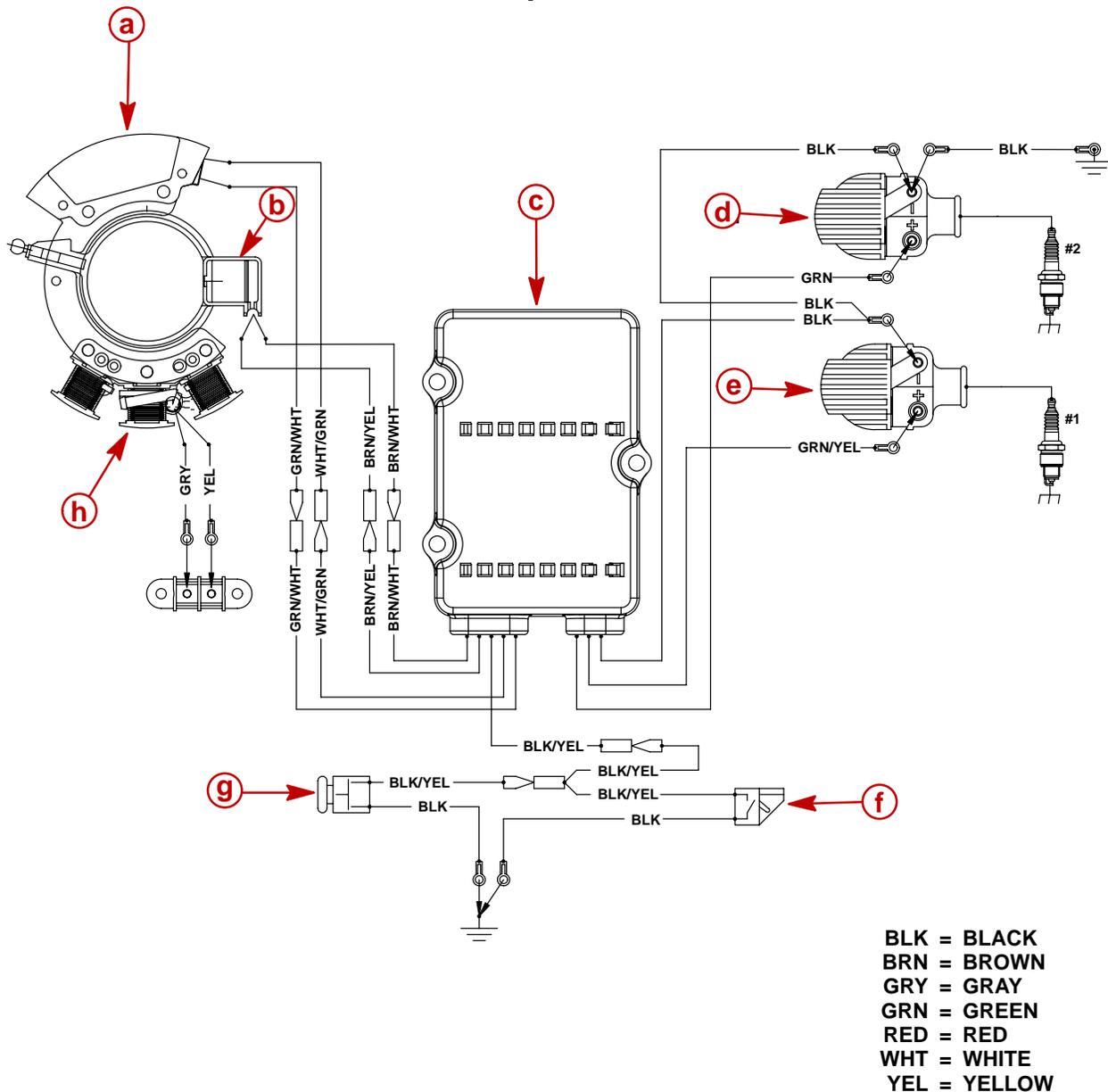


BLK = BLACK  
 BRN = BROWN  
 GRY = GRAY  
 GRN = GREEN  
 RED = RED  
 WHT = WHITE  
 YEL = YELLOW

- a** - Stator
- b** - Trigger
- c** - Switch box
- d** - Ignition coil bottom cylinder
- e** - Ignition coil top cylinder
- f** - Emergency stop switch
- g** - Stop switch



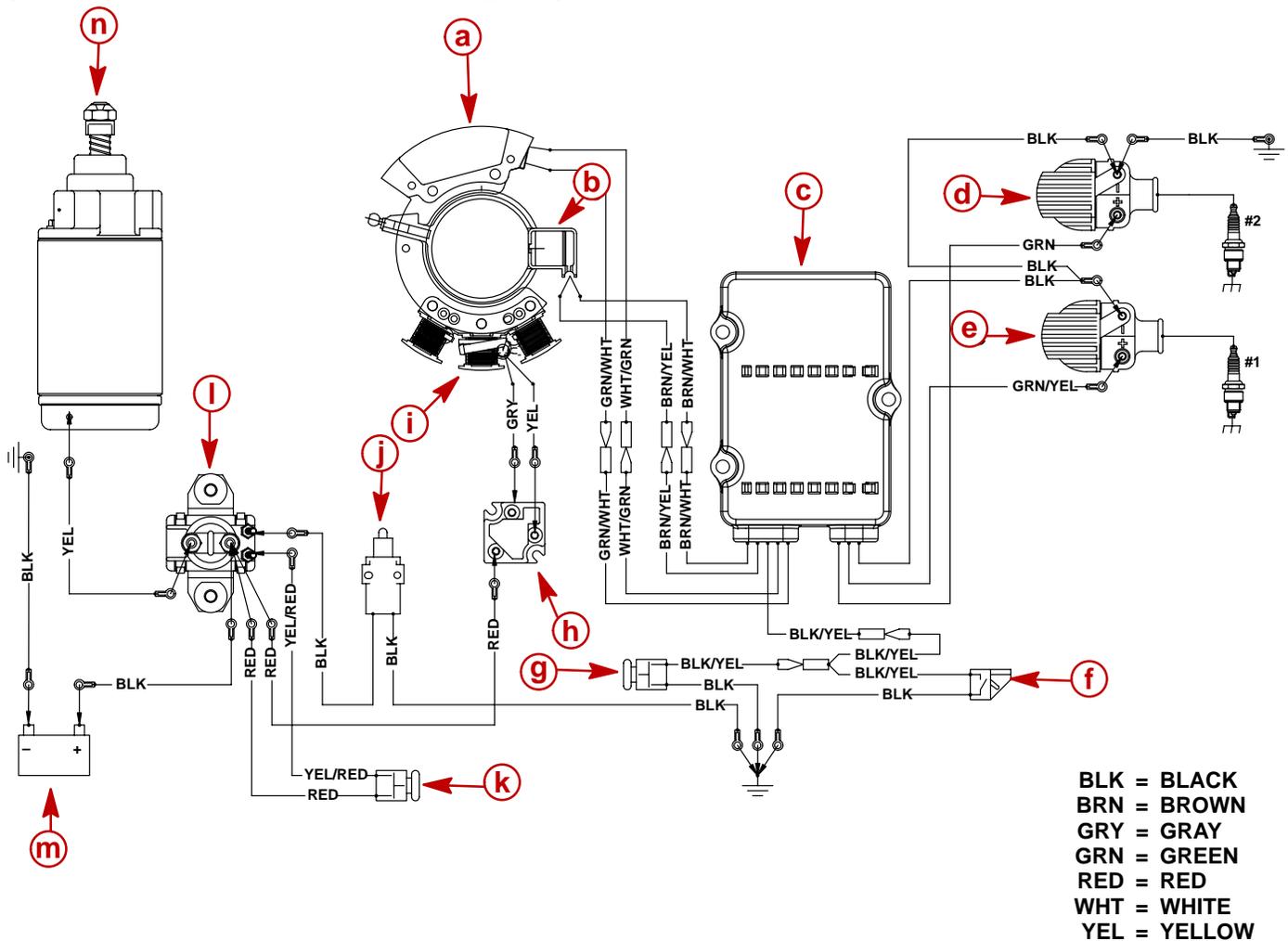
# Manual Start Ignition Wiring Diagram (1999 And Newer) (Marathon and Sea Pro Models)



- a** - Stator
- b** - Trigger
- c** - Switch box
- d** - Ignition coil bottom cylinder
- e** - Ignition coil top cylinder
- f** - Stop switch
- g** - Emergency stop switch
- h** - Alternator stator



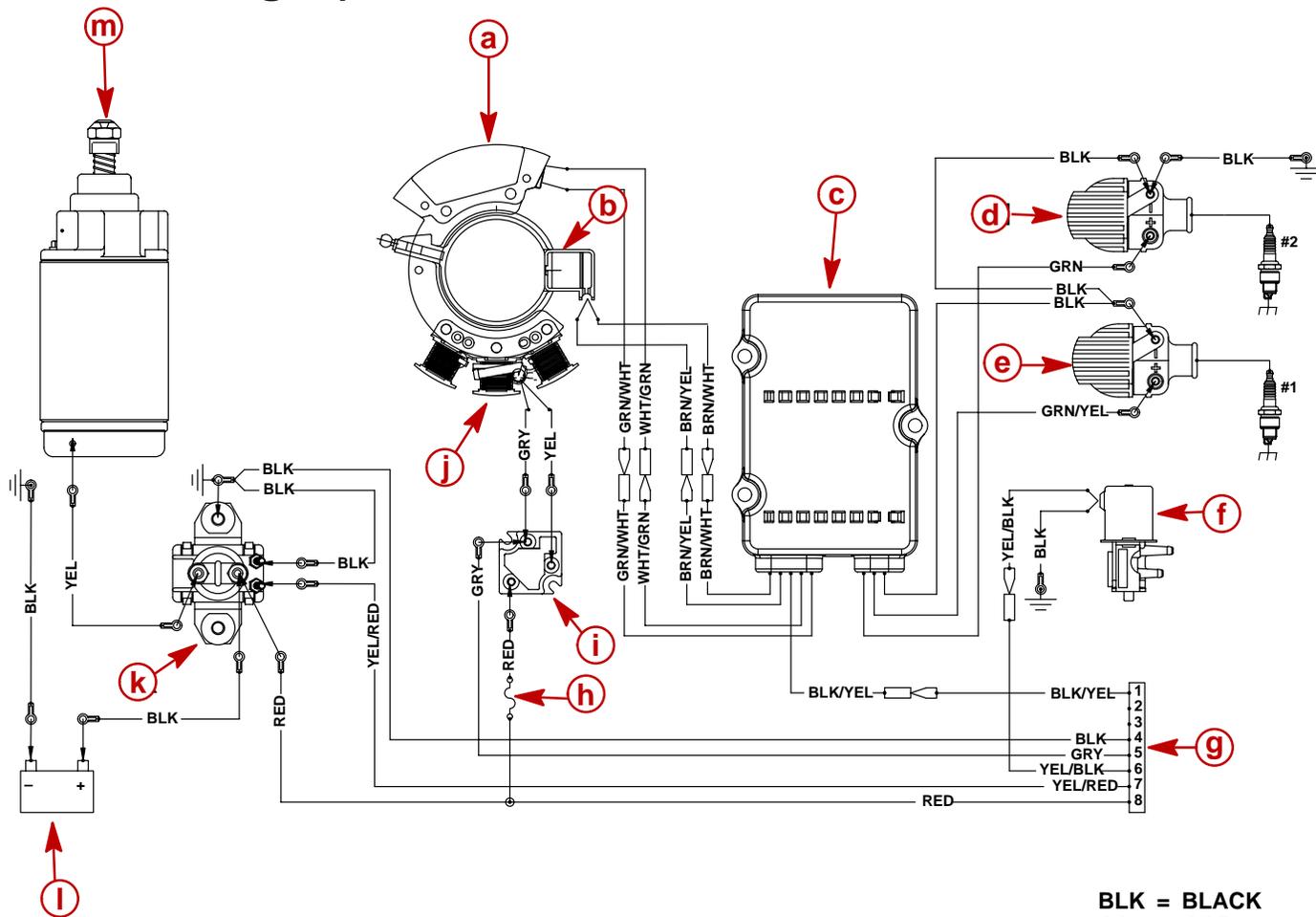
# Electric Start Models with Tiller Handle Start Button (1999 And Newer, Design I)



- a** - Stator
- b** - Trigger
- c** - Switch box
- d** - Ignition coil bottom cylinder
- e** - Ignition coil top cylinder
- f** - Emergency stop switch
- g** - Push button stop switch
- h** - Rectifier
- i** - Alternator stator
- j** - Neutral start switch
- k** - Push button start switch
- l** - Start solenoid
- m** - 12 VDC battery
- n** - Starter motor

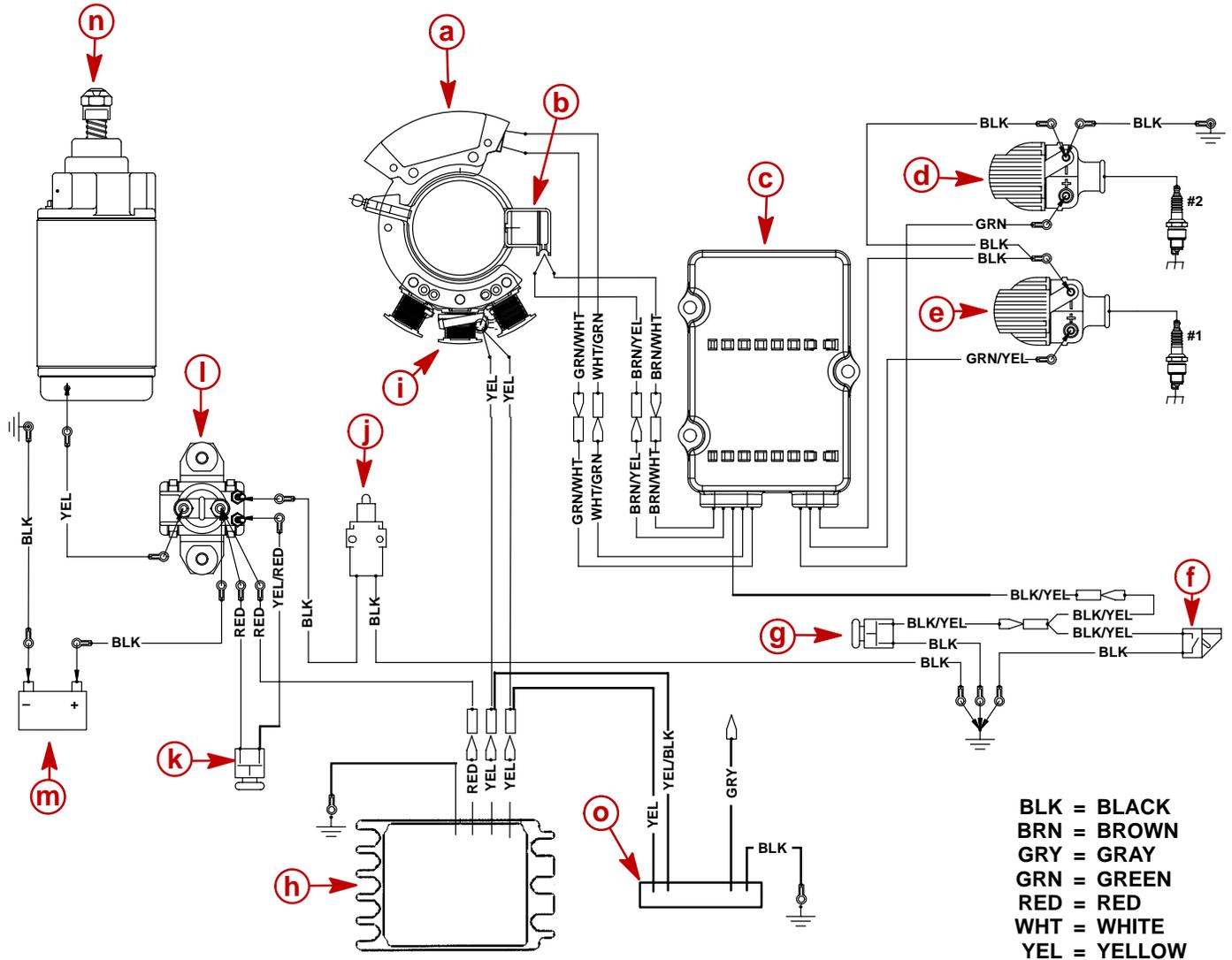


# Electric Models Equipped with Remote Control (1999 And Newer, Design I)





# Electric Start Models with Tiller Handle Start Button (1999 And Newer, Design II)

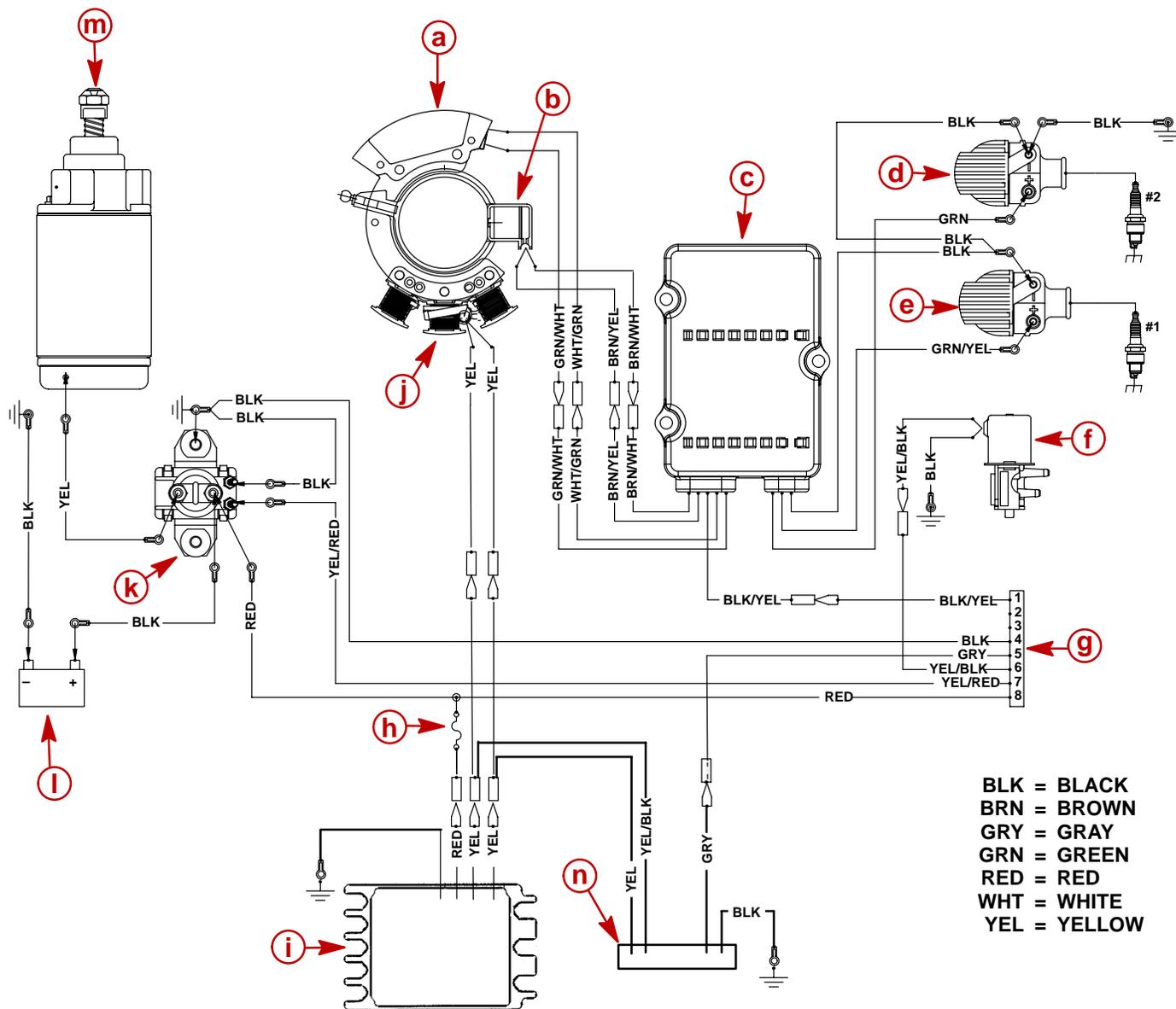


- a** - Stator
- b** - Trigger
- c** - Switch box
- d** - Ignition coil bottom cylinder
- e** - Ignition coil top cylinder
- f** - Emergency stop switch
- g** - Push button stop switch
- h** - Rectifier/Regulator
- i** - Alternator stator
- j** - Neutral start switch
- k** - Push button start switch
- l** - Start solenoid
- m** - 12 VDC battery
- n** - Starter motor
- o** - Tachometer module

BLK = BLACK  
 BRN = BROWN  
 GRY = GRAY  
 GRN = GREEN  
 RED = RED  
 WHT = WHITE  
 YEL = YELLOW



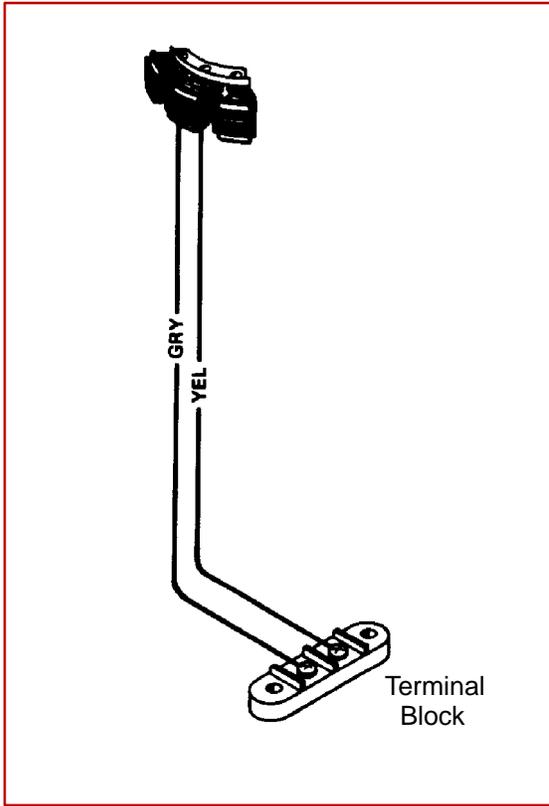
# Electric Models Equipped with Remote Control (1999 And Newer, Design II)



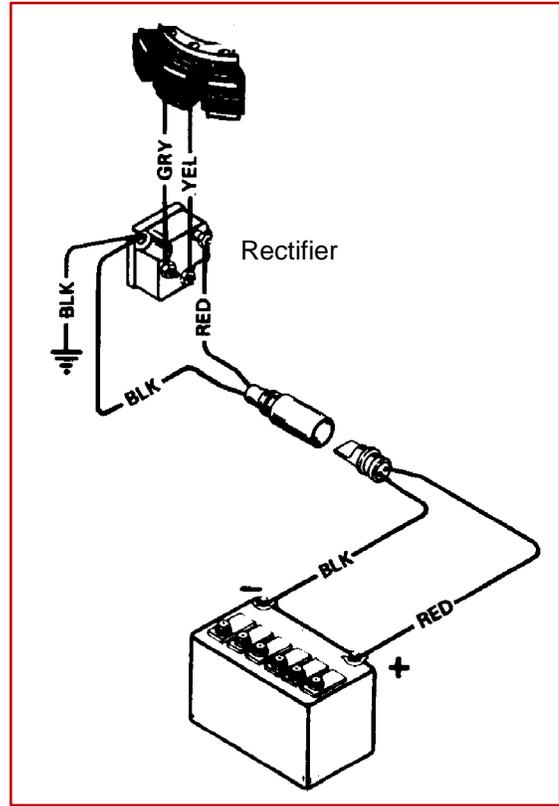
- a - Stator
- b - Trigger
- c - Switch box
- d - Ignition coil bottom cylinder
- e - Ignition coil top cylinder
- f - Choke solenoid
- g - Remote control harness
- h - Fuse holder (20 ampere fuse)
- i - Rectifier/Regulator
- j - Alternator stator
- k - Starter solenoid
- l - 12 VDC battery
- m - Starter motor
- n - Tachometer module



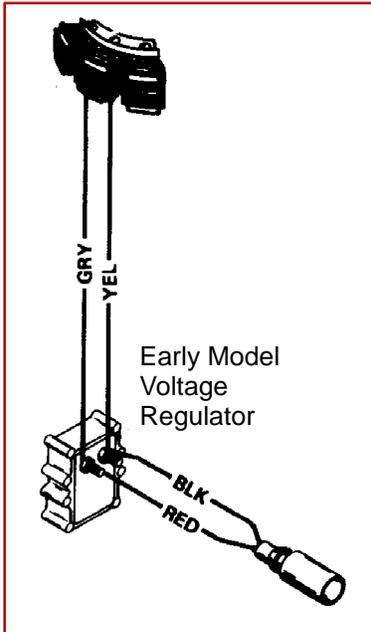
# Optional Electrical Accessories Wiring Diagrams



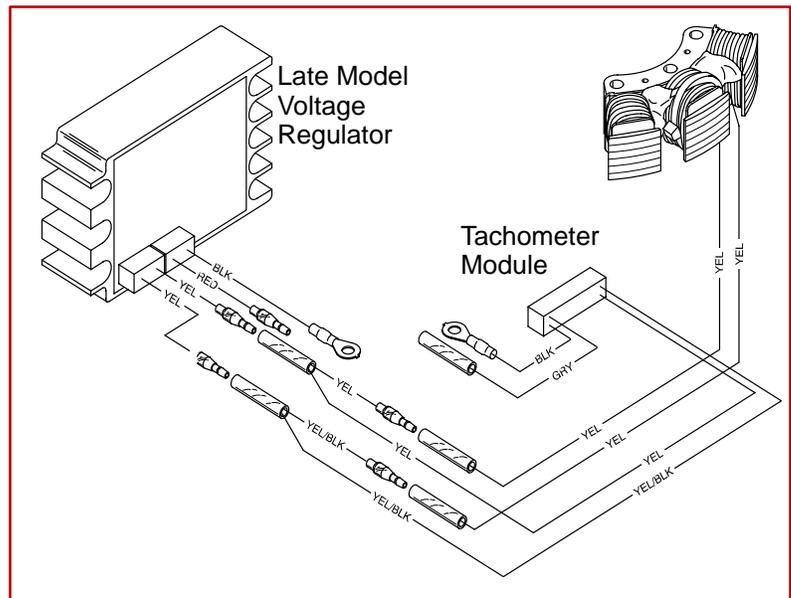
Manual Start Model with Lighting Coil and Unregulated AC Voltage



Manual Start Model with Battery Charging Kit



Manual Start Model with Voltage Regulator

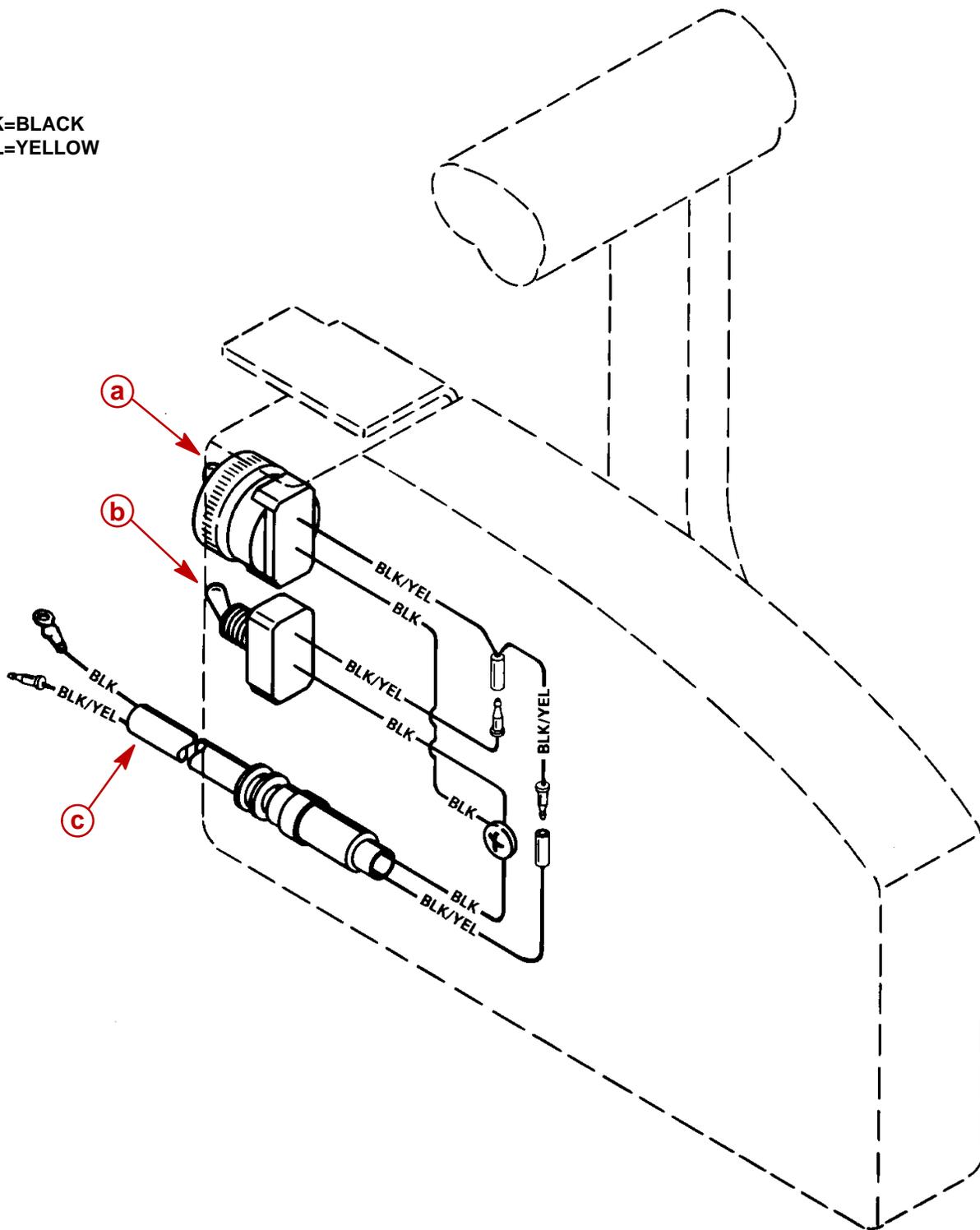


Late Model Voltage Regulator with Tachometer Module



# Commander 2000 Remote Control (Manual)

BLK=BLACK  
YEL=YELLOW



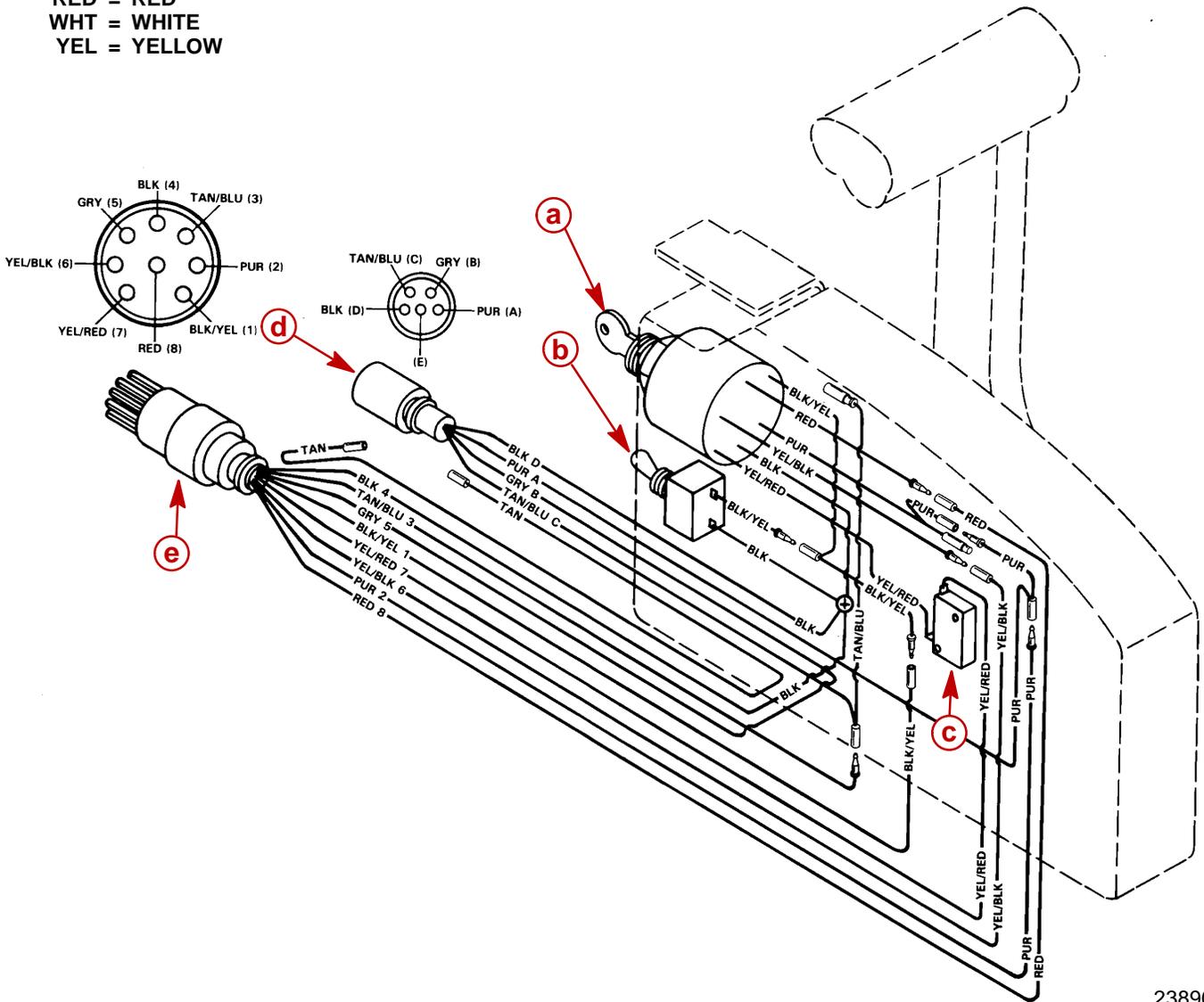
23893

- a** - RUN – OFF switch
- b** - Emergency stop switch
- c** - Stop switch harness



# Commander 2000 Remote Control (Electric Start)

BLK = BLACK  
 BRN = BROWN  
 GRY = GRAY  
 GRN = GREEN  
 RED = RED  
 WHT = WHITE  
 YEL = YELLOW

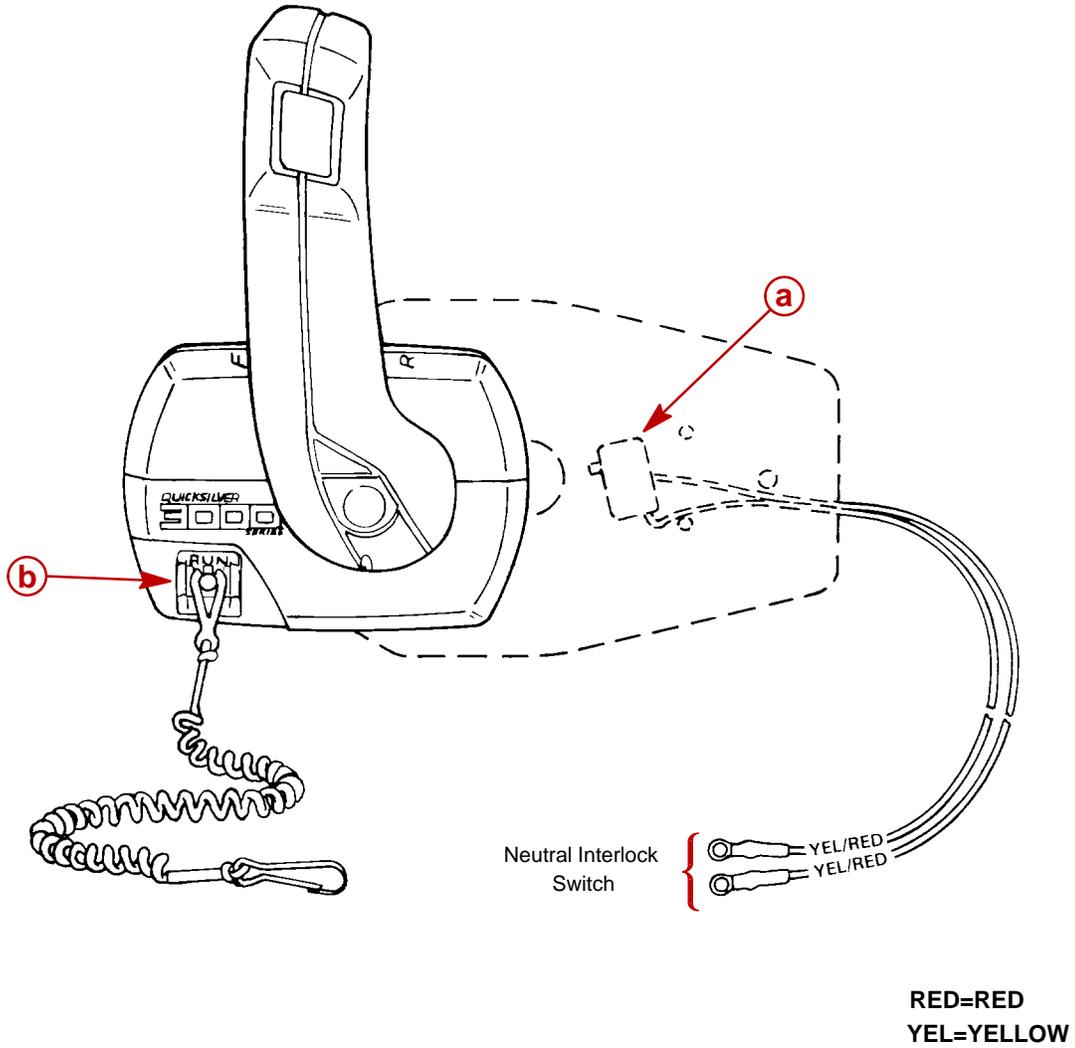


23890

- a** - Ignition/Choke switch
- b** - Emergency stop switch
- c** - Neutral start switch
- d** - Tachometer/Accessories harness connector
- e** - Wiring harness connector



# Commander 3000 Panel Mount Control



- a** - Neutral interlock switch
- b** - Emergency stop switch



# FUEL SYSTEM

## Section 3A – Fuel Delivery System

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# Specifications

Models 6/8/9.9/10/15		
<b>CARBURETOR SPECIFICATIONS</b>	<b>Type</b>	Center Bowl, Integral Fuel Pump
	<b>Idle RPM (In Gear) –</b>	
	<b>6</b>	650 ± 75
	<b>8</b>	725 ± 50
	<b>9.9/9.9 Sailpower</b>	725 ± 50
	<b>10 Sea Pro/Marathon</b>	850 ± 50
	<b>XR/MAG/Viking10</b>	725 ± 50
	<b>15</b>	725 ± 50
	<b>Wide Open Throttle RPM</b>	
	<b>6</b>	4000 – 5000
	<b>8</b>	4500 – 5500
	<b>9.9/9.9 Sailpower</b>	5000 – 6000
	<b>10 Sea Pro/Marathon</b>	5000 – 6000
	<b>XR/MAG/Viking10</b>	5000 – 6000
	<b>15</b>	5000 – 6000
	<b>15 Sea Pro/Marathon</b>	5000 – 6000
	<b>Idle Mixture Screw (Initial Setting)</b>	5000 – 6000
	<b>Float Setting (All Models)</b>	Refer to Section 3A
	<b>Main Jet –</b>	1 in. (25.4mm)
	<b>Thread size</b>	10–32
	1994 Model Year	
<b>6</b>	.042	
<b>8</b>	.046	
<b>9.9/9.9 Sailpower</b>	.052	
<b>10 Sea Pro/Marathon</b>	.064	
<b>XR10/MAG10</b>	.052	
<b>15</b>	.066	
	1995 and Newer	
<b>6</b>	.042	
<b>8</b>	.046	
<b>9.9/9.9 Sailpower</b>	.048	
<b>10 Sea Pro/Marathon</b>	.052	
<b>XR10/MAG10</b>	.052	
<b>15/Viking10</b>	.072	
<b>15 Sea Pro/Marathon</b>	.072	



# WMC Carburetor Specifications

## 1994

		MAIN JET				
MODEL	CARB	0 – 5000 ft (0 – 1524m)	5000 – 7500 ft (1524 – 2286m)	7500 – 10000 ft (1524 – 3048m)	FLOAT LEVEL	IDLE MIX
6	WMC-20B	.042	.040	.038	25.4mm (1 in.)	1-3/8 ± 1/4
8	WMC-18B	.046	.044	.042	25.4mm (1 in.)	1-3/8 ± 1/4
9.9	WMC-23	.052	.050	.048	25.4mm (1 in.)	1-3/8 ± 1/4
<b>XR10 Mag 10</b>	WMC-23	.052	.050	.048	25.4mm (1 in.)	1-3/8 ± 1/4
<b>Seapro Marathon 10</b>	WMC-42	.064	.062	.060	25.4mm (1 in.)	1-3/8 ± 1/4
15	WMC-73	.064	.062	.060	25.4mm (1 in.)	1-3/8 ± 1/4

## 1995 - 1996

		MAIN JET				
MODEL	CARB	0 – 5000 ft (0 – 1524m)	5000 – 7500 ft (1524 – 2286m)	7500 – 10000 ft (1524 – 3048m)	FLOAT LEVEL	IDLE MIX
6	WMC-20B	.042	.040	.038	25.4mm (1 in.)	1-3/8 ± 1/4
8	WMC-41	.046	.044	.042	25.4mm (1 in.)	1-1/2 ± 1/4
9.9	WMC-47	.048	.046	.044	25.4mm (1 in.)	1-1/2 ± 1/4
<b>XR10 Mag 10</b>	WMC-48	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
<b>Seapro Marathon 10</b>	WMC-50 WMC-50A	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
15	WMC-49	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4



# WMC Carburetor Specifications

## 1997

		MAIN JET				
MODEL	CARB	0 – 5000 ft (0 – 1524m)	5000 – 7500 ft (1524 – 2286m)	7500 – 10000 ft (1524 – 3048m)	FLOAT LEVEL	IDLE MIX
6	WMC-20B	.042	.040	.038	25.4mm (1 in.)	1-3/8 ± 1/4
8	WMC-41	.046	.044	.042	25.4mm (1 in.)	1-1/2 ± 1/4
9.9	WMC-47	.048	.046	.044	25.4mm (1 in.)	1-1/2 ± 1/4
XR10 Mag 10	WMC-48	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
Seapro Marathon 10	WMC-50A	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
15	WMC-49	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4
15 Seapro Marathon	WMC-55	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4

## 1998 – 2001

		MAIN JET				
MODEL	CARB	0 – 5000 ft (0 – 1524m)	5000 – 7500 ft (1524 – 2286m)	7500 – 10000 ft (1524 – 3048m)	FLOAT LEVEL	IDLE MIX
6	WMC-57	.042	.040	.038	25.4mm (1 in.)	1-1/4 ± 1/4
8	WMC-41A	.046	.044	.042	25.4mm (1 in.)	1-1/2 ± 1/4
9.9	WMC-47A	.048	.046	.044	25.4mm (1 in.)	1-1/2 ± 1/4
XR10 Mag 10	WMC-48A	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
Seapro Marathon 10	WMC-50B	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
15	WMC-49A	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4
15 Seapro Marathon	WMC-55A	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4



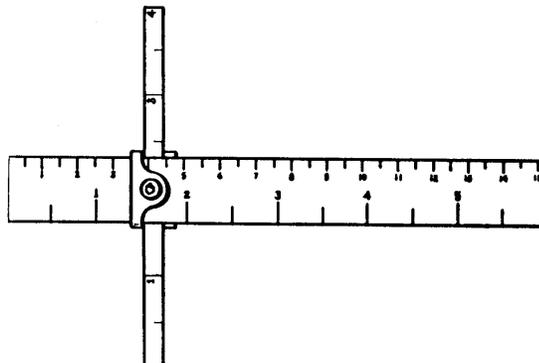
# WMC Carburetor Specifications

## 2002 and UP

MODEL	CARB	MAIN JET			FLOAT LEVEL	IDLE MIX
		0 – 5000 ft (0 – 1524m)	5000 – 7500 ft (1524 – 2286m)	7500 – 10000 ft (1524 – 3048m)		
6	WMC-66	.042	.040	.038	25.4mm (1 in.)	1-1/4 ± 1/4
8	WMC-74	.046	.044	.042	25.4mm (1 in.)	1-1/2 ± 1/4
9.9	WMC-61	.048	.046	.044	25.4mm (1 in.)	1-1/2 ± 1/4
XR10 Mag 10	WMC-62	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
Seapro Marathon 10	WMC-50B	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
10 Viking	WMC-63	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4
15	WMC-77	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4
15 Seapro Marathon	WMC-55A	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4

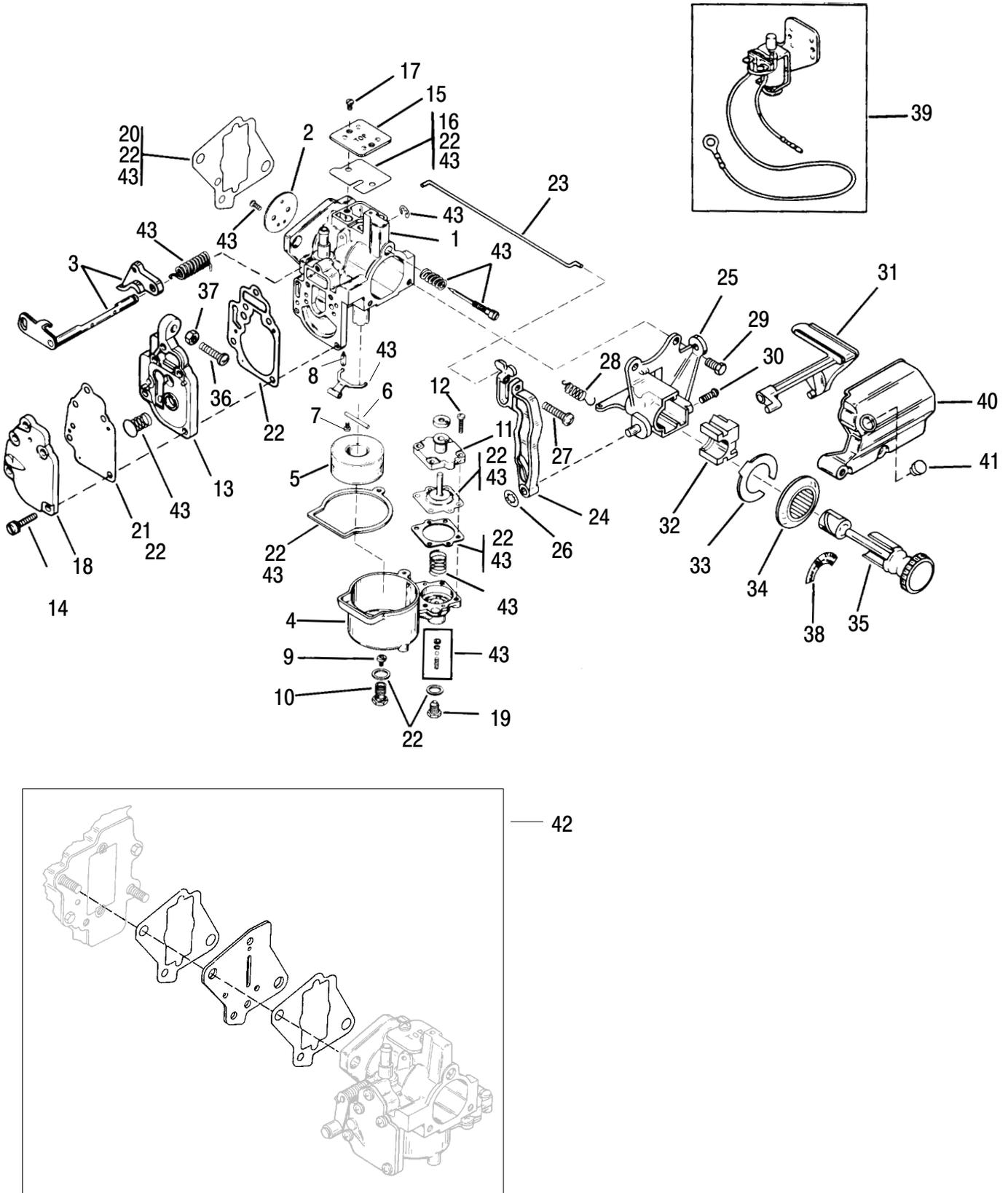
## Special Tools

### 1. Carburetor Scale





# Carburetor Assembly (6 - 8) (9.9 - USA-S/N-0G112449/BEL-S/N-9831799 & Below)





# Carburetor Assembly (6 - 8)

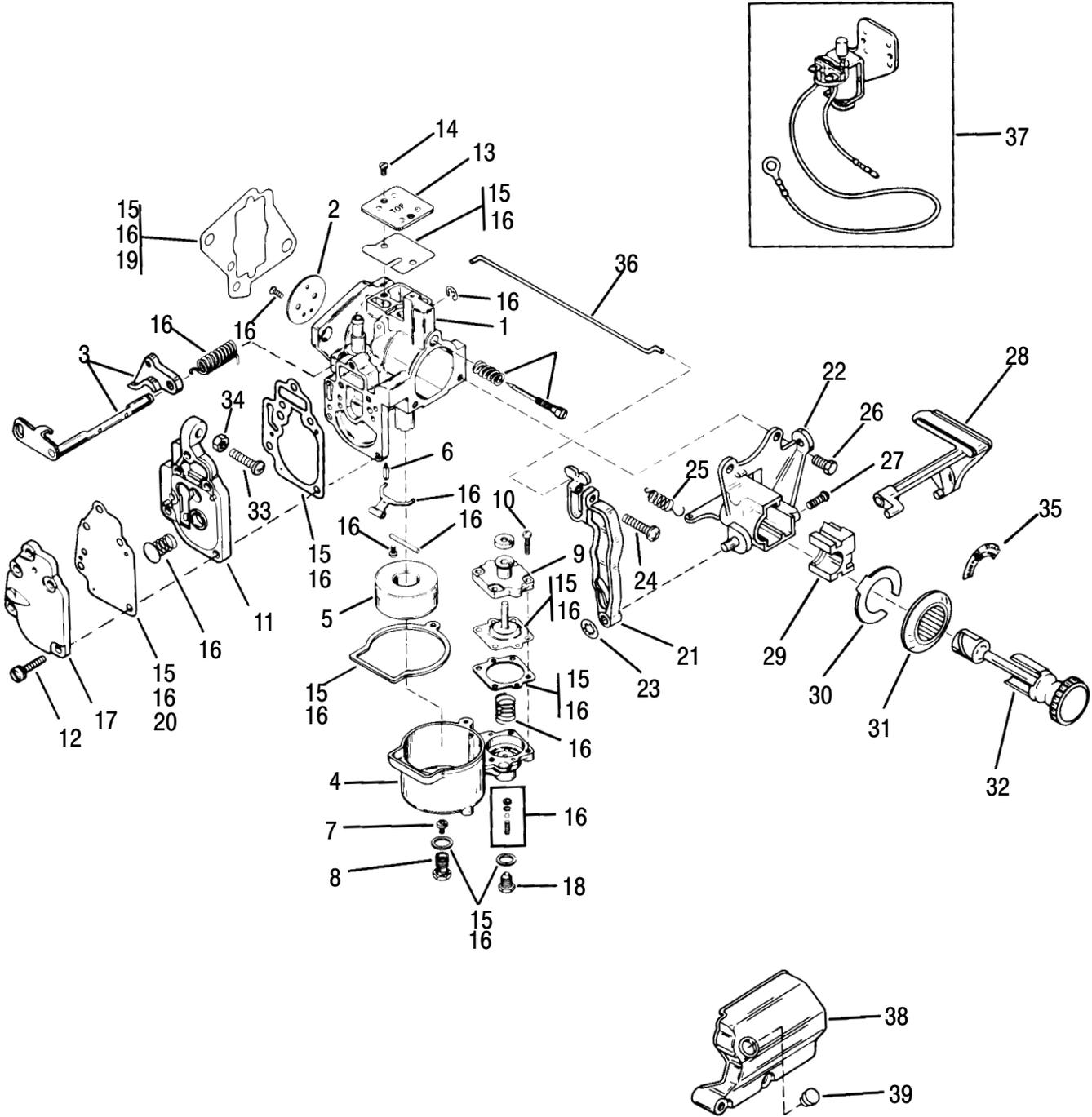
## (9.9 - USA-S/N-0G112449/BEL-S/N-9831799 & Below) (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N-m
1	1	CARBURETOR			
2	1	THROTTLE VALVE			
3	1	SHAFT			
4	1	FUEL BOWL			
5	1	FLOAT			
6	1	FLOAT PIN			
7	1	SCREW			
8	1	INLET NEEDLE VALVE			
9	1	MAIN FUEL JET			
10	1	PLUG-jet retainer	33		3.7
11	1	COVER-diaphragm			
12	4	SCREW	14		1.6
13	1	FUEL PUMP KIT			
14	5	SCREW-fuel pump	18		2.1
15	1	PLATE			
16	1	GASKET-electric choke			
17	2	SCREW	18		2.1
18	1	COVER-fuel pump			
19	1	PLUG	33		3.7
20	1	GASKET-carburetor (Use where applicable)			
21	1	DIAPHRAGM			
22	1	<b>GASKET/DIAPHRAGM KIT</b>			
23	1	IDLE WIRE			
24	1	FAST IDLE LEVER			
25	1	PRIMER BRACKET			
26	1	PUSHNUT			
27	1	SCREW			
28	1	SPRING			
29	2	SCREW (M5 x 8 x 12)	33		3.7
30	1	SCREW	Tighten Securely		
31	1	PRIMER LEVER			
32	1	CAM BLOCK			
33	1	RETAINING CLIP			
34	1	CHOKE BEZEL			
35	1	PRIMER KNOB			
36	1	SCREW			
37	1	NUT			
38	1	DECAL (SLOW/FAST)			
39	1	ELECTRIC CHOKE			
40	1	COVER			
41	1	PLUG			
42	1	<b>RESTRICTOR KIT</b>			
43	1	<b>REPAIR PARTS KIT</b>			



# Carburetor Assembly (15)

## USA-S/N-0G112449/BEL-S/N-9831799 & Below





# Carburetor Assembly (15)

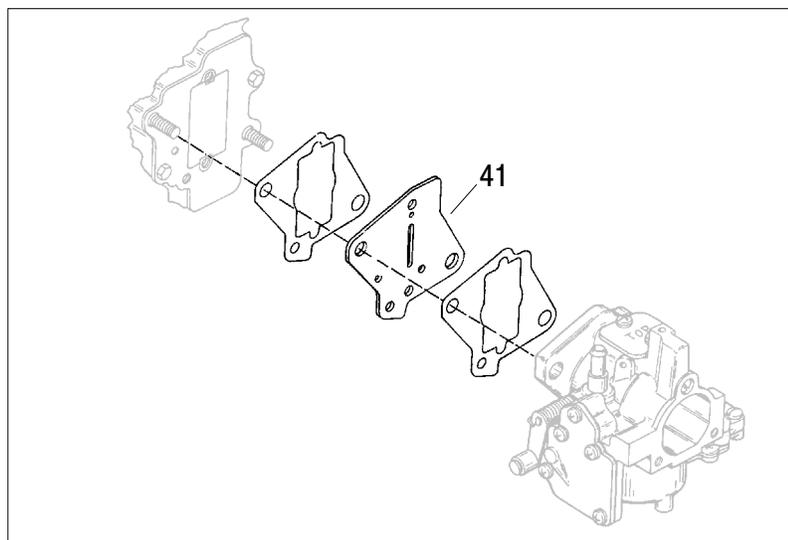
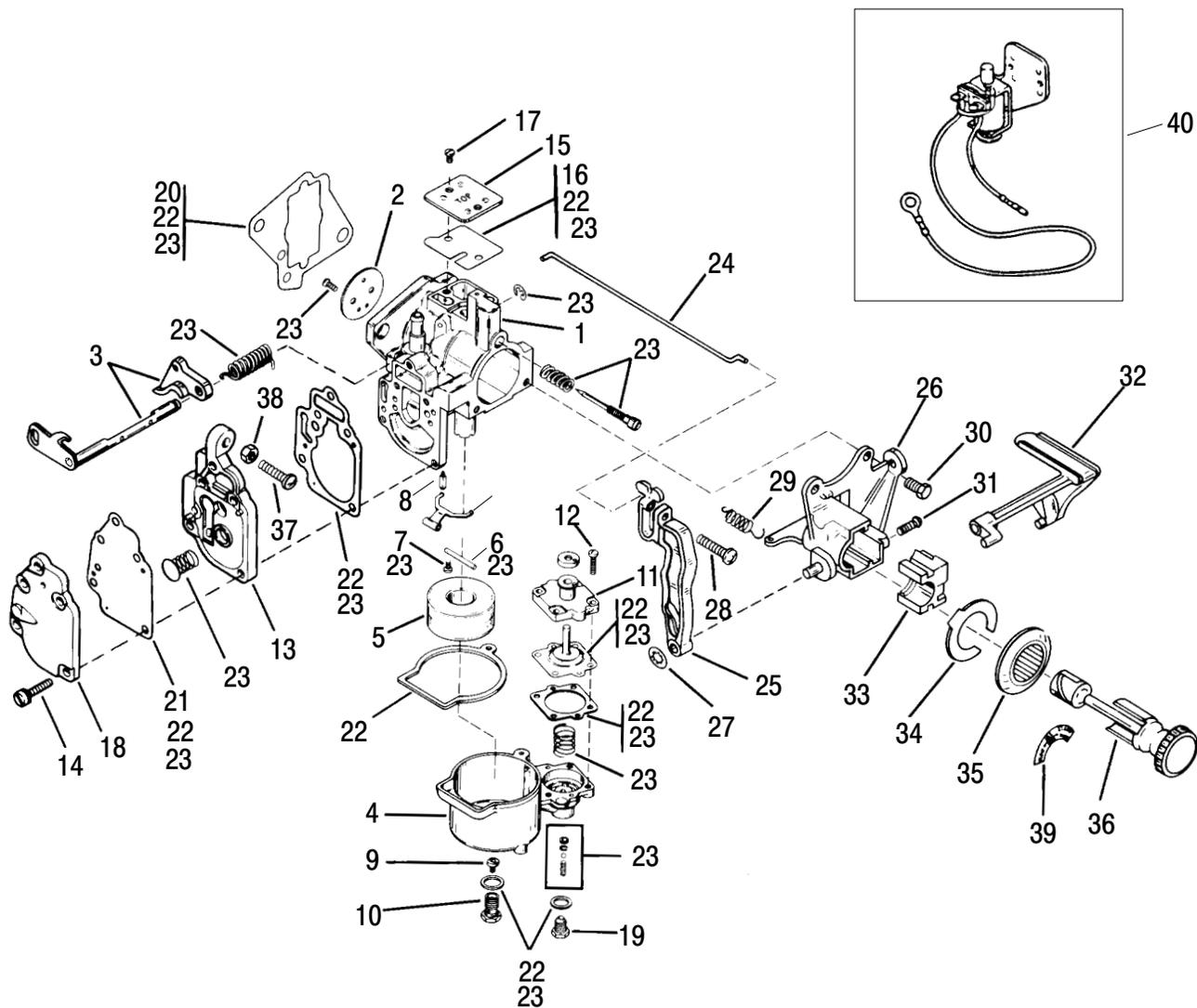
## USA-S/N-0G112449/BEL-S/N-9831799 & Below (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N-m
1	1	CARBURETOR (WMC-73)			
2	1	THROTTLE VALVE			
3	1	THROTTLE SHAFT (INCLS. SCREW & SPRING)			
4	1	FUEL BOWL			
5	1	FLOAT			
6	1	INLET NEEDLE VALVE			
7	1	MAIN FUEL JET (.066)			
8	1	PLUG-jet retainer	33		3.7
9	1	COVER-diaphragm			
10	4	SCREW-diaphragm cover	14		1.7
11	1	FUEL PUMP KIT			
12	5	SCREW-fuel pump cover	18		2.1
13	1	PLATE-cover			
14	2	SCREW-cover plate	18		2.1
15	1	GASKET/DIAPHRAGM KIT			
16	1	REPAIR PARTS KIT			
17	1	COVER-fuel pump			
18	1	PLUG	33		3.7
19	1	GASKET-carburetor			
20	1	DIAPHRAGM			
21	1	FAST IDLE LEVER			
22	1	PRIMER BRACKET			
23	1	PUSHNUT			
24	1	SCREW			
25	1	SPRING			
26	2	SCREW (M5 x 8 x 12)	33		3.7
27	1	SCREW	Tighten Securely		
28	1	PRIMER LEVER			
29	1	CAM BLOCK			
30	1	RETAINING CLIP			
31	1	CHOKE BEZEL			
32	1	PRIMER KNOB			
33	1	SCREW			
34	1	NUT			
35	1	DECAL (SLOW/FAST)			
36	1	IDLE WIRE			
37	1	ELECTRIC CHOKE			
38	1	COVER			
39	1	PLUG			



# CARBURETOR ASSEMBLY

## USA-S/N-0G112450/BEL-S/N-9831800 & Up





# Carburetor Assembly

## USA-S/N-0G112450/BEL-S/N-9831800 & Up (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N-m
1	1	CARBURETOR			
2	1	THROTTLE VALE			
3	1	SHAFT			
4	1	FUEL BOWL			
5	1	FLOAT			
6	1	FLOAT PIN			
7	1	SCREW			
8	1	INLET NEEDLE VALVE			
9	1	MAIN FUEL JET			
10	1	PLUG-jet retainer	33		3.7
11	1	COVER-diaphragm			
12	4	SCREW	14		1.6
13	1	FUEL PUMP KIT			
14	5	SCREW-fuel pump	18		2.1
15	1	PLATE			
16	1	GASKET			
17	2	SCREW	18		2.1
18	1	COVER-fuel pump			
19	1	PLUG	33		3.7
20	1	GASKET-carburetor			
21	1	DIAPHRAGM			
22	1	<b>GASKET/DIAPHRAGM KIT</b>			
23	1	<b>REPAIR PARTS KIT</b>			
24	1	IDLE WIRE			
25	1	FAST IDLE LEVER			
26	1	PRIMER BRACKET			
27	1	PUSHNUT			
28	1	SCREW (6-32 x 3/4)			
29	1	SPRING			
30	2	SCREW (M5 x 8 x 12)	33		3.7
31	1	SCREW (8-32 x 1/2)	Tighten Securely		
32	1	PRIMER LEVER			
33	1	CAM BLOCK			
34	1	RETAINING CLIP			
35	1	CHOKE BEZEL			
36	1	PRIMER KNOB			
37	1	SCREW (M5 x 30)			
38	1	NUT			
39	1	DECAL - Bezel Choke			
40	1	ELECTRIC CHOKE			
41	1	RESTRICTOR PLATE			



# Fuel System Troubleshooting

## General Information

Problems thought to be caused by the fuel system may be caused by one or more of the following six items listed below.

1. Propeller
2. Spark Plugs
3. Ignition Timing
4. Ignition Spark Voltage
5. Cylinder Compression
6. Reed Valves

Typical symptoms and solutions in troubleshooting a fuel system are shown below:

<b>Problem: Engine Turns Over but Will Not Start or Starts Hard When Cold</b> <b>Problem: Engine Idles Rough and Stalls.</b> <b>Problem: Engine Runs Uneven or Surges.</b> <b>Problem: Engine Will Not Accelerate.</b>	
Possible Cause	Corrective Action
Improper starting procedure used.	Review starting procedure as outlined in Operation and Maintenance Manual.
Fuel tank empty or too low. Improperly mixed fuel. Contaminants (water,dirt, etc.) in fuel.	Check fuel in tank and replace or add whichever is necessary.
Fuel tank air vent closed or restricted.	Check air vent on fuel tank. Air vent must be open all the way and free from any contaminants.
Pinched, cut, restricted fuel line or loose fuel line connection.	Inspect all fuel lines and replace as needed. Tighten fuel line connections.
Dirty or restricted fuel filter.	Inspect and replace or clean all fuel filters.
Choke solenoid or enrichment valve not operating.	Inspect solenoid or valve and wiring. Replace as required.
Needle and seat in carburetor that is either stuck open (flooding) or closed (no fuel).	Refer to carburetor disassembly in this section.
Improper carburetor jet, restricted jet or idle mixture screw out of adjustment.	Refer to carburetor adjustments in this section.
Improper float level.	Refer to carburetor adjustments in this section.
Low fuel pump pressure.	Disassemble and inspect fuel pump components.
Defective anti-siphon valve.	Inspect valve and/or test engine without valve in fuel system.



Possible Cause	Corrective Action
Improperly mixed fuel. Contaminants (water, dirt, etc.) in fuel.	Check fuel in tank and replace if necessary.
Carburetor loose on intake manifold.	Check tightness of carburetor nuts.
Reed block loose or gasket defective.	Using a pressure oil can, apply 2-cycle oil around reed block housing/crankcase housing matching surfaces and carburetor base. If engine RPM changes, tighten bolts/nuts or replace gaskets as required.
Improperly routed or restricted bleed hoses.	Refer to bleed hose routing in Powerhead section.
Damaged fuel pump diaphragm.	Disassemble and inspect fuel pump components.
Carburetor mixing chamber cover leaking air.	Tighten screws or replace gasket.
Off idle holes plugged.	Blow with compressed air.
Main nozzle or idle nozzle air bleed holes plugged.	Blow with compressed air.
Damaged reeds.	Refer to Section 4 for reed inspection.
Fuel pick-up outlet tube in fuel tank cracked.	Replace.
Wrong spark plug or improper spark plug gap.	Install correct plug or readjust gap.
Improper spark timing.	Reset timing to correct specifications.
Enrichener diaphragm leaking.	Replace diaphragm.

<b>Problem: Engine Floods</b>	
Possible Cause	Corrective Action
Dirt or debris are preventing inlet needle from seating.	Flush out inlet seat and clean inlet needle.
Worn inlet needle.	Replace.
Punctured float.	Replace.
Incorrect float setting.	Reset float.

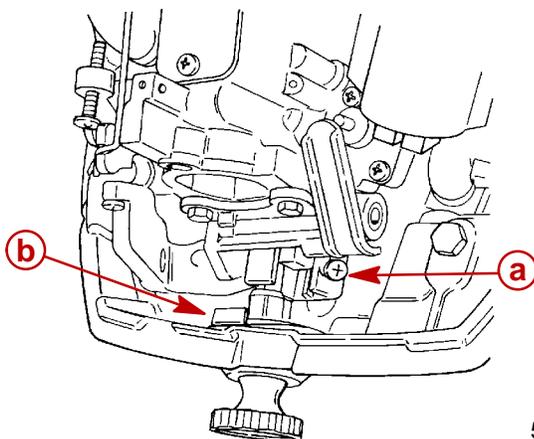
<b>Problem: Engine Runs Too Rich</b>	
Possible Cause	Corrective Action
Fuel level too high.	Reset float to correct level.
Carburetor floods.	See preceding Engine Floods.
Idle nozzle air holes plugged.	Blow out with compressed air.
Restricted air flow.	Inspect cowl air inlet and carburetor for obstructions.
Main fuel jet loose.	Retighten jet.



<b>Problem: Fuel Blowback Out of Carburetor</b>	
<b>Problem: Unable to Reduce Engine RPM to Slow Idle</b>	
<b>Possible Cause</b>	<b>Corrective Action</b>
Chipped or broken reeds on reed block.	Replace reeds.
<b>Problem: Rough Idle</b>	
<b>Possible Cause</b>	<b>Corrective Action</b>
Excessive preload on reeds.	Replace reeds.
<b>Problem: Engine Runs Too Lean</b>	
<b>Possible Cause</b>	<b>Corrective Action</b>
Carburetor is loose. Air leaks past mixing chamber cover.	Tighten bolts securely. Tighten cover or replace gasket.
Fuel level is too low.	Reset float level.
Clogged high speed jet.	Inspect jet for varnish or debris and clean.
Restricted fuel flow to carburetor.	Check fuel lines and filters for restricted flow.
Incorrect high speed jet.	Refer to main jet chart and replace with proper jet.
Idle mixture set too lean.	Adjust to run richer. Turn idle mix screw counterclockwise.
Air leakage into fuel system.	Inspect fuel line connections, hose clamps, fuel pump and fuel outlet tube (located in fuel tank) for loose fittings.
Anti-siphon valve restricting fuel flow.	Inspect valve and/or test engine without valve in fuel system.

## Carburetor Removal

1. Loosen primer cam retaining screw.
2. Remove retaining clip.

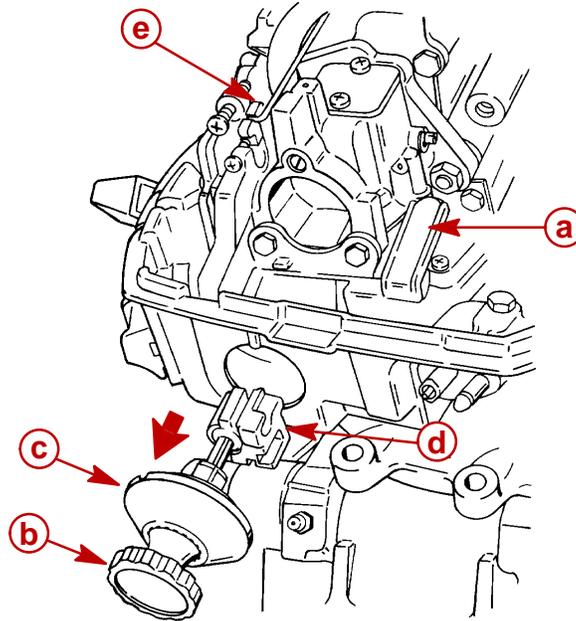


53072

- a** - Screw  
**b** - Retaining clip



3. Push down on primer arm and pull primer knob, bezel and slide block out of bottom cowl.
4. Remove link wire from fast idle lever.
5. Disconnect fuel line from carburetor.
6. Remove carburetor mounting nuts.
7. Lift carburetor from engine. Remove bleed line from fitting in bottom of carburetor.

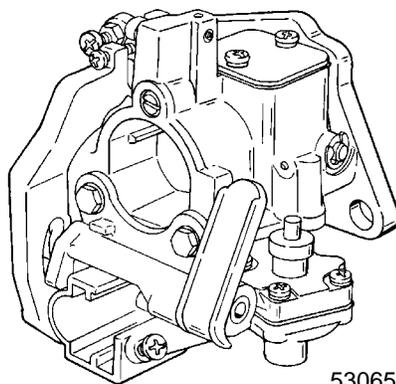


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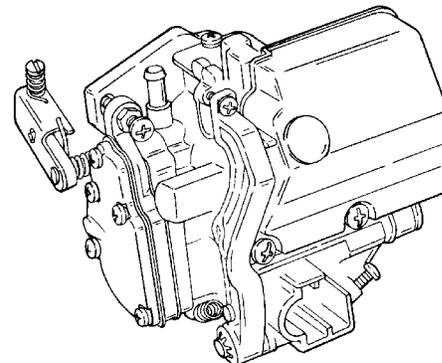
- a - Primer arm
- b - Primer knob
- c - Bezel
- d - Slide block
- e - Link wire

## Carburetor Installation

1. Install primer assembly components and air intake cover (on models so equipped) to carburetor.



53065

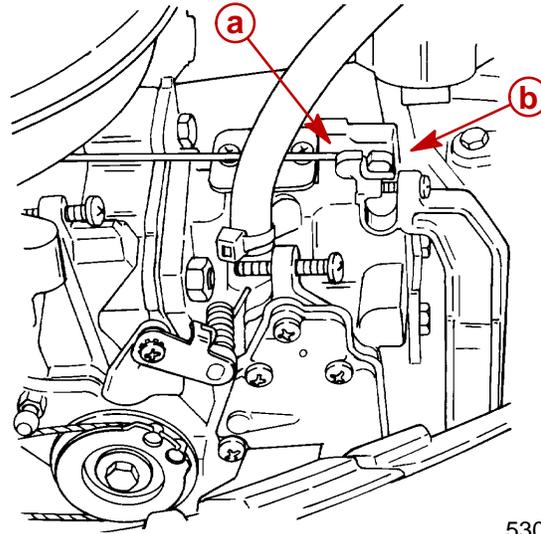


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**Model without Air Intake Cover****Models Equipped with Air Intake Cover**



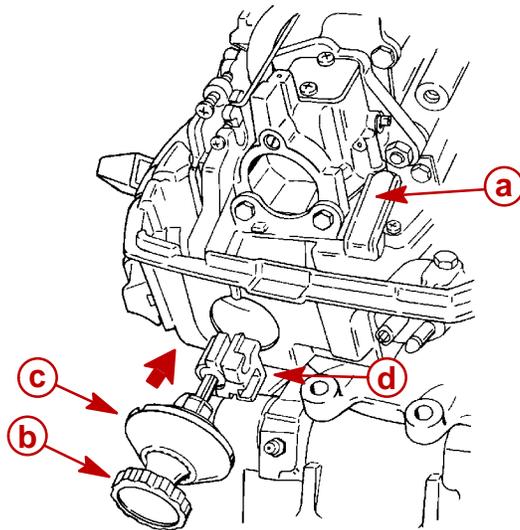
2. Reconnect bleed hose to fitting on carburetor and install carburetor and secure carburetor to engine with hex nuts.
3. Secure fuel line to carburetor with cable-tie.
4. Reconnect link wire to fast idle lever.



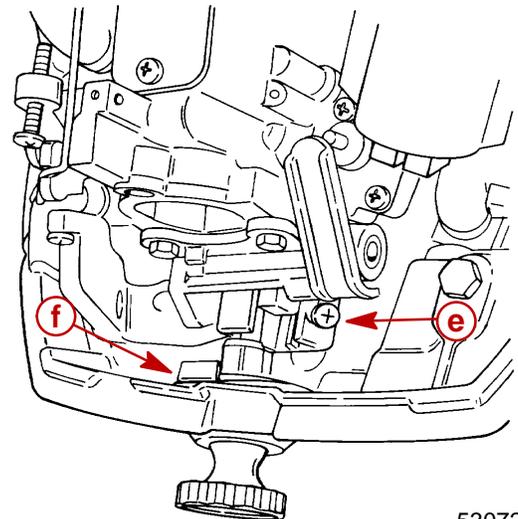
53073

- a** - Link wire
- b** - Fast idle lever

5. Push down on primer arm and insert primer knob, bezel and slide block into primer assembly.
6. Tighten screw to secure slide block in place.
7. Align notch in back side of bezel with tab on bottom cowl and secure bezel in place with retaining clip.



53071



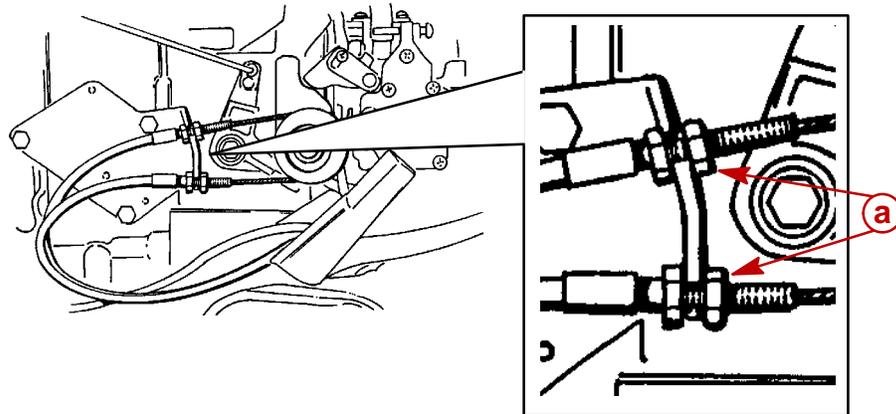
53072

- a** - Primer arm
- b** - Primer knob
- c** - Bezel
- d** - Slide block
- e** - Screw
- f** - Retaining clip



## Carburetor Adjustments

1. Place outboard in water.
2. Check tiller handle cable adjustment for full throttle movement in both **Forward** and **Reverse** gears. Adjust jam nuts for proper travel and to eliminate any slack.

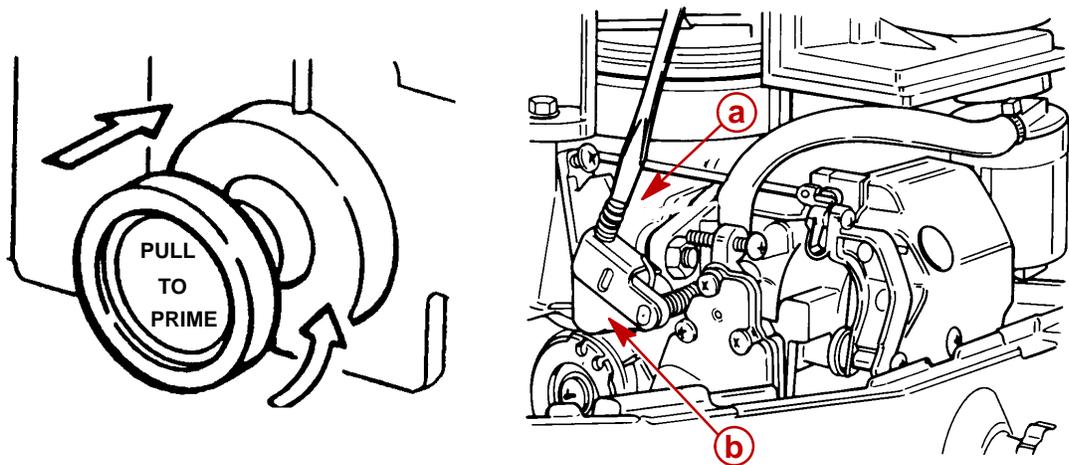


**a** - Adjustment jam nuts

## INITIAL CARBURETOR ADJUSTMENTS

### Idle Speed Screw (Models So Equipped)

1. Shift outboard to **Neutral** and place throttle twist grip to **Slow**.
2. Push primer/fast idle knob completely in and rotate knob fully counterclockwise.
3. Back idle speed screw off of cam follower.
4. Turn idle speed screw clockwise until it just touches cam follower, then inward an additional 1/2 turn to slightly open throttle plate.



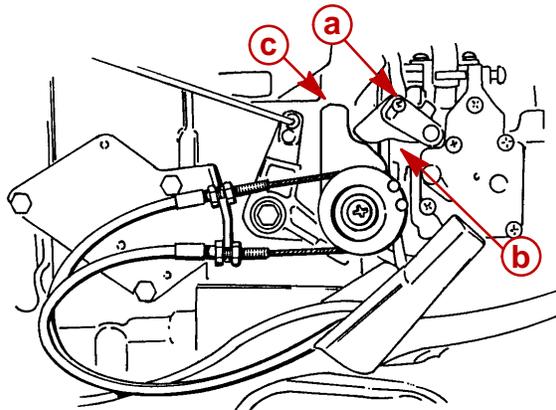
**a** - Idle speed screw

**b** - Cam follower



**NOTE:** For Models NOT equipped with an idle speed screw:

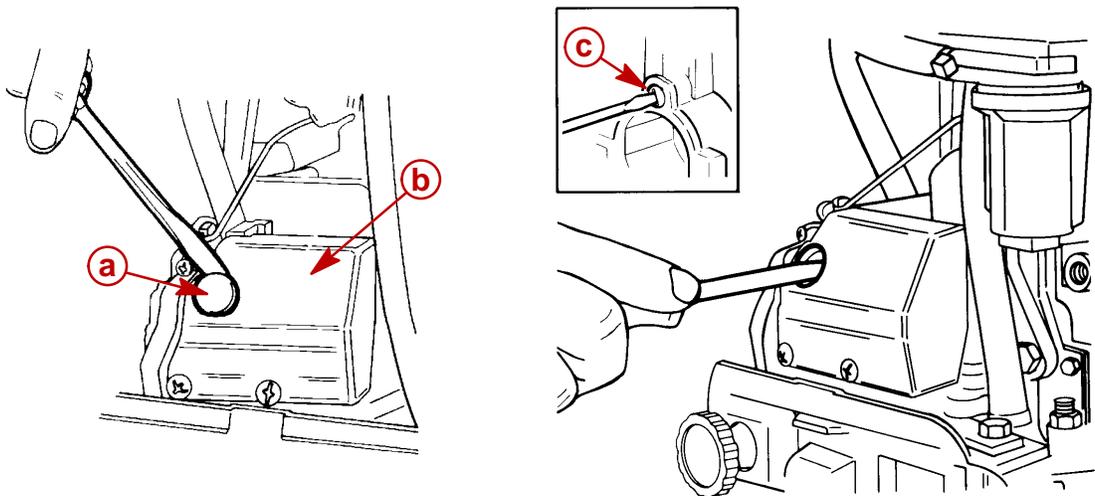
1. Loosen cam locking screw.
2. Press cam follower down until it contacts throttle cam.
3. Retighten cam locking screw.



- a** - Cam locking screw
- b** - Cam follower
- c** - Throttle cam

### LOW SPEED MIXTURE SCREW

1. Remove access plug from carburetor air intake cover.
2. Turn low speed mixture screw slowly clockwise until it seats lightly, then back screw out 1-1/2 to 1-3/8 turns. Turning mixture screw in tight will damage needle and seat.
3. Do not install access plug at this time.

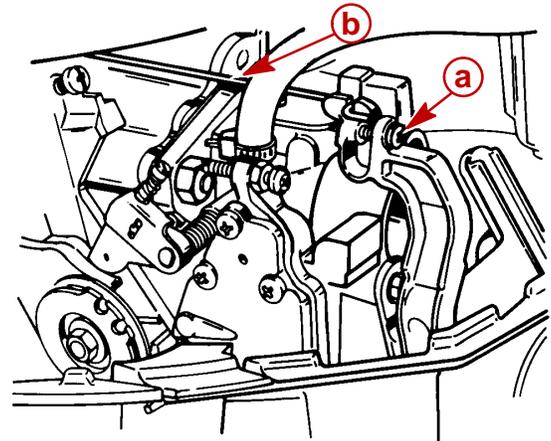
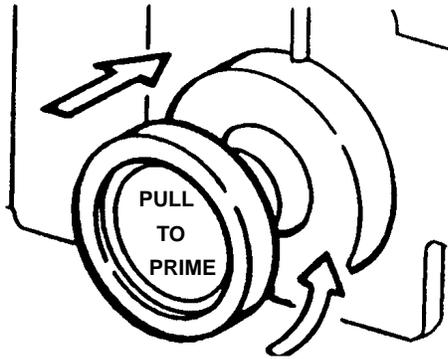


- a** - Plug
- b** - Air intake cover
- c** - Low speed mixture screw



## IDLE WIRE ADJUSTMENT

1. Push primer/fast idle knob completely in and rotate fully counterclockwise.
2. Shift engine to **Neutral**.
3. Adjust screw to remove all clearance between idle wire and trigger.
4. Check fast idle speed by turning primer knob to full clockwise position. Fast idle speed should be 1500 - 2000 RPM.

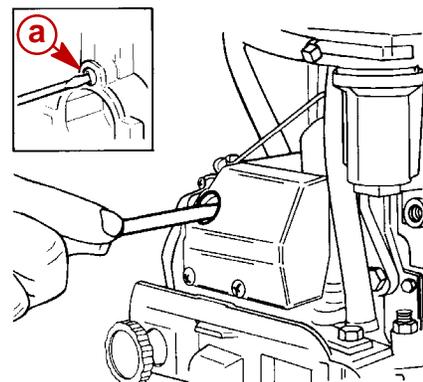
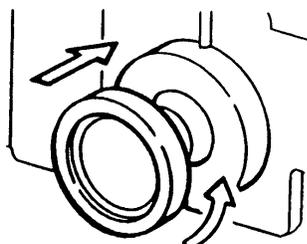


- a** - Adjustment screw  
**b** - Idle wire

## IDLE ADJUSTMENT

### Low speed Mixture Adjustment

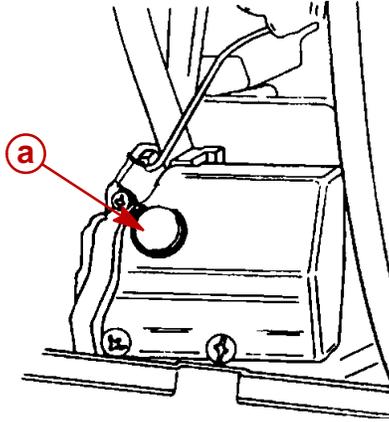
1. Start engine and allow to warm up (run for several minutes). Throttle engine back to idle for about one minute to allow RPM to stabilize.
2. Push primer/fast idle knob completely in and rotate knob fully counterclockwise.
3. With engine running at idling speed while in **Forward** gear, turn low speed mixture screw counterclockwise until engine starts to load up from over-rich mixture.
4. Slowly turn low speed mixture screw clockwise until cylinders fire evenly and engine picks up speed.



- a** - Low speed mixture screw



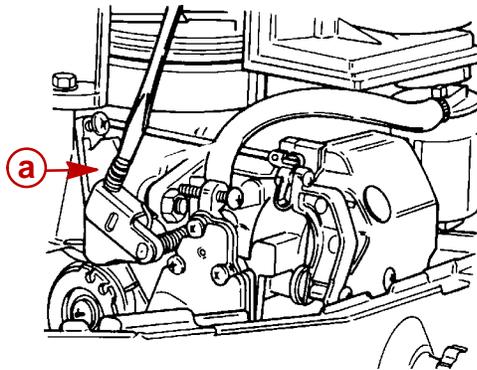
5. Continue turning mixture screw clockwise until too lean a mixture is obtained and engine slows down and misfires.
6. Set low speed mixture screw halfway between rich and lean.
7. DO NOT adjust leaner than necessary to attain reasonably smooth idling. When in doubt, set mixture slightly richer rather than too lean.
8. Install access plug into opening in carburetor air intake cover.



**a** - Access plug

#### IDLE SPEED ADJUSTMENT (MODELS EQUIPPED WITH IDLE SCREW)

1. With engine running at idle in **Forward** gear, make sure primer/fast idle knob is pushed completely in and rotate fully counterclockwise to stop.
2. Adjust idle speed screw to obtain recommended idle speed. Refer to **Section 1A**.



**a** - Idle speed screw

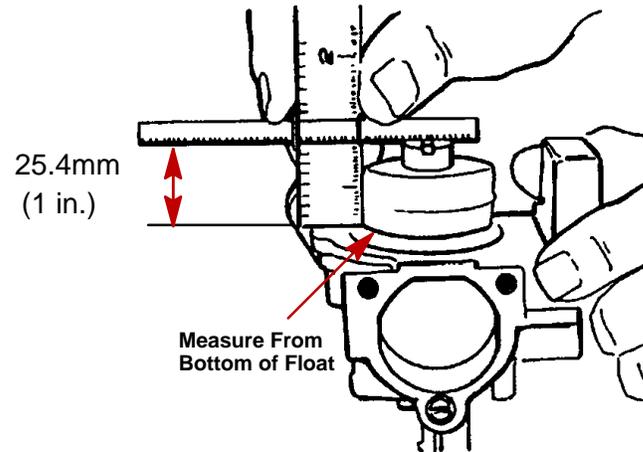
#### IDLE SPEED ADJUSTMENT (MODELS NOT EQUIPPED WITH AN IDLE SPEED SCREW)

For models not equipped with an idle speed screw, the carburetor has been calibrated at the factory to maintain an idle speed of  $650 \pm 75$  RPM in **Forward** gear.

**CARBURETOR FLOAT ADJUSTMENT**

Check float level by removing fuel bowl and checking level of float as shown.

If necessary, adjust float level by bending float hinge.

**JET ORIFICE SIZE/PART NUMBER CHART**

**NOTE:** Thread size for jets is 10-32.

<b>JET ORIFICE SIZE/PART NUMBER CHART</b>			
<b>Jet Orifice Size (Inch)</b>	<b>Part Number</b>	<b>Jet Orifice Size (Inch)</b>	<b>Part Number</b>
.040	19266040	.058	1395-7831
.042	1399-5315	.060	1395-6487
.044	1395-7394	.062	1399-4217
.046	1399-5317	.064	1399-4216
.048	1395-6246	.066	1399-4215
.050	1395-6028	.068	1395-6029
.052	1395-6359	.070	1395-6030
.054	1399-5225	.072	1395-6207
.056	1399-5213	.074	1399-3794
.076	1399-3796	.094	1395-8423
.078	1395-6680	.096	1399-6249
.080	1395-6201	.098	1395-7335
.082	1399-3518		
.084	1399-3517		
.086	1395-5815		
.088	1395-6202		
.090	1395-6247		
.092	1395-5733		



## Rejetting Carburetors for High Altitude

Factory installed main fuel jets are normally adequate for proper performance up to approximately 1524m (5000 ft) above sea level. Between 609.6m (2000 ft) and 1524m (5000 ft) the reduction of the main fuel jets may result in improved performance and fuel economy. Above 1524m (5000 ft), however, it is recommended that main jet size be reduced as shown per 304.8m (1000 ft) in the following chart. RETURN TO LOWER ELEVATION: Carburetor jet changes must be reversed to avoid a lean fuel condition when used at low elevation.

Feet Meter	1000 304.8	2000 609.6	3000 914.4	4000 1219.2	5000 1524	6000 1828.8	7000 2133.6	8000 2438.4	9000 2743.2	10000 3048	11000 3352.8	12000 3657.6
Jet Size												
0.034	0.034	0.034	0.032	0.032	0.032	0.032	0.032	0.032	0.030	0.030	0.030	0.030
0.036	0.036	0.036	0.034	0.034	0.034	0.034	0.034	0.032	0.032	0.032	0.032	0.032
0.038	0.038	0.038	0.036	0.036	0.036	0.036	0.036	0.034	0.034	0.034	0.034	0.034
0.040	0.040	0.040	0.038	0.038	0.038	0.038	0.038	0.036	0.036	0.036	0.036	0.034
0.042	0.042	0.042	0.040	0.040	0.040	0.040	0.038	0.038	0.038	0.038	0.038	0.036
0.044	0.044	0.044	0.042	0.042	0.042	0.042	0.040	0.040	0.040	0.040	0.038	0.038
0.046	0.046	0.046	0.044	0.044	0.044	0.044	0.042	0.042	0.042	0.042	0.040	0.040
0.048	0.048	0.048	0.046	0.046	0.046	0.046	0.044	0.044	0.044	0.042	0.042	0.042
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0.056	0.056	0.054	0.054	0.054	0.054	0.052	0.052	0.052	0.050	0.050	0.050	0.048
0.058	0.058	0.056	0.056	0.056	0.056	0.054	0.054	0.054	0.052	0.052	0.052	0.050
0.060	0.060	0.058	0.058	0.058	0.056	0.056	0.056	0.054	0.054	0.054	0.052	0.052
0.062	0.062	0.060	0.060	0.060	0.058	0.058	0.058	0.056	0.056	0.056	0.054	0.054
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0.066	0.066	0.064	0.064	0.064	0.062	0.062	0.062	0.060	0.060	0.060	0.058	0.058
0.068	0.068	0.066	0.066	0.066	0.064	0.064	0.064	0.062	0.062	0.060	0.060	0.060
0.070	0.070	0.068	0.068	0.068	0.066	0.066	0.064	0.064	0.064	0.062	0.062	0.062
0.072	0.072	0.070	0.070	0.070	0.068	0.068	0.066	0.066	0.066	0.064	0.064	0.062
0.074	0.074	0.072	0.072	0.070	0.070	0.070	0.068	0.068	0.068	0.066	0.066	0.064
0.076	0.076	0.074	0.074	0.072	0.072	0.072	0.070	0.070	0.068	0.068	0.068	0.066
0.078	0.078	0.076	0.076	0.074	0.074	0.074	0.072	0.072	0.070	0.070	0.068	0.068
0.080	0.080	0.078	0.078	0.076	0.076	0.076	0.074	0.074	0.072	0.072	0.070	0.070
0.082	0.082	0.080	0.080	0.078	0.078	0.076	0.076	0.076	0.074	0.074	0.072	0.072
0.084	0.084	0.082	0.082	0.080	0.080	0.078	0.078	0.076	0.076	0.076	0.074	0.074
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0.088	0.088	0.086	0.086	0.084	0.084	0.082	0.082	0.080	0.080	0.078	0.078	0.076
0.090	0.090	0.088	0.088	0.086	0.086	0.084	0.084	0.082	0.082	0.080	0.080	0.078
0.092	0.092	0.090	0.090	0.088	0.088	0.086	0.086	0.084	0.084	0.082	0.082	0.080
0.094	0.094	0.092	0.092	0.090	0.090	0.088	0.088	0.086	0.086	0.084	0.084	0.082
0.096	0.096	0.094	0.094	0.092	0.092	0.090	0.090	0.088	0.086	0.086	0.084	0.084
0.098	0.098	0.096	0.096	0.094	0.092	0.092	0.090	0.090	0.088	0.088	0.086	0.086



# Fuel Pump

## Removal and Disassembly

**IMPORTANT: Fuel pump check valve diaphragm and gasket should NOT be re-used once the fuel pump is disassembled.**

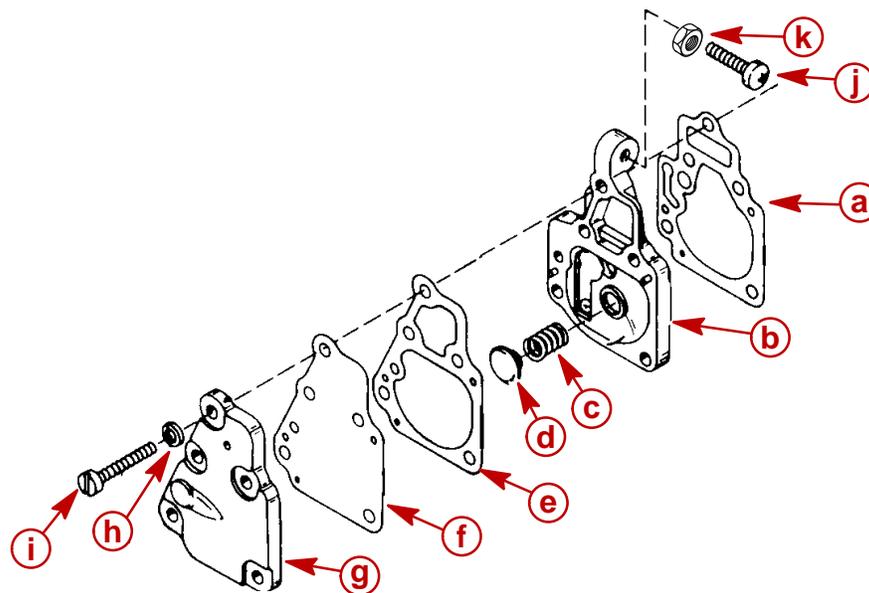
1. Remove 5 screws securing fuel pump assembly to carburetor.
2. Separate fuel pump components.

## Cleaning and Inspection

1. Clean and dry all parts thoroughly.
2. Inspect pump body and base on carburetor for nicks, cracks or rough gasket surface.
3. Inspect pump check valve diaphragm. Diaphragm **MUST BE** flat and free from holes and imperfections.
4. Pump body surface below check valves **MUST BE** flat so that check valve will seat.

## Reassembly and Installation

1. Inspect all parts for serviceability.
2. Reassemble fuel pump.
3. Secure fuel pump assembly to carburetor with 5 screws. Torque screws to 3.2 Nm (18 lb-in.).



- a** - Gasket
- b** - Pump body
- c** - Spring
- d** - Cap
- e** - Gasket
- f** - Diaphragm
- g** - Pump cover
- h** - Lock washer (5)
- i** - Screw (5) [Torque screws to 3.2 Nm (18 lb-in.)]
- j** - Maximum spark advance screw
- k** - Nut

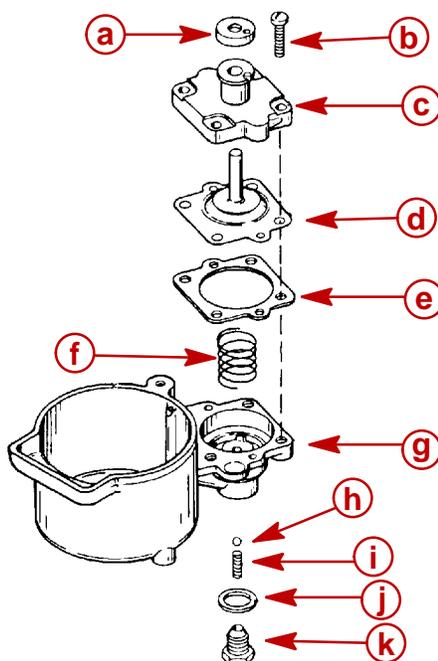


# Primer System

The primer system provides extra fuel to the outboard whenever the primer knob is pulled out. The primer system components should be inspected carefully for serviceability. The diaphragm and gaskets should be inspected for cuts or abrasions. Replace accordingly. The primer check ball and springs should be inspected for debris, varnish or rust which restrict free movement.

## SYMPTOMS OF A DEFECTIVE PRIMER SYSTEM

1. Outboard is hard to start.
  - a. Diaphragm is cut.
  - b. Primer check ball is stuck in the closed position.
  - c. Primer passage is plugged with debris or varnish.
2. Outboard smokes excessively at idle.
  - a. Primer check ball is not seated due to debris, varnish or damaged check ball spring.



- a** - Seal
- b** - Screw (4) [Torque to 1.6 Nm (14 lb-in.)]
- c** - Cover
- d** - Diaphragm
- e** - Gasket
- f** - Spring
- g** - Primer bowl
- h** - Check ball
- i** - Spring
- j** - Gasket
- k** - Plug



## Servicing Sight Bowl Fuel Filter

### ⚠ WARNING

Exercise extreme caution when cleaning fuel filter elements. Gasoline is extremely flammable and highly explosive under certain conditions. Always stop the engine and DO NOT smoke or allow open flames in the area while cleaning fuel filter elements.

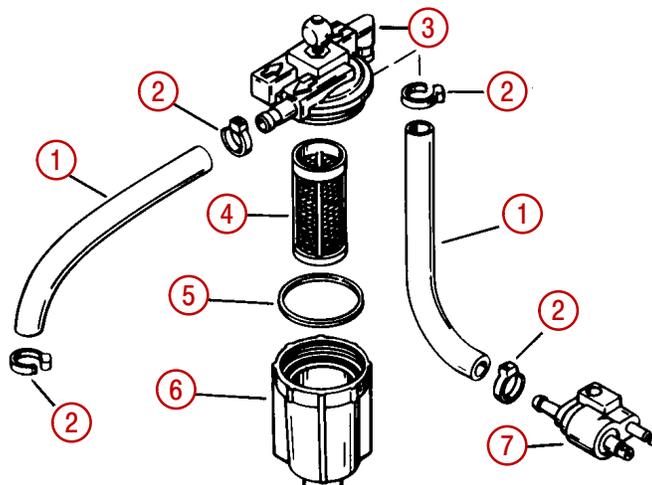
### ⚠ CAUTION

DO NOT turn or tilt fuel filter assembly when removing or installing. PULL STRAIGHT DOWN when removing assembly. PUSH STRAIGHT UP when installing assembly. Turning or tilting fuel filter may break fuel line connection on filter.

The sight bowl fuel filter removes dirt and water from the fuel.

Check the sight bowl frequently and clean the filter as required.

1. Verify that the sight bowl rubber sealing ring is properly positioned in the bowl.
2. Reinstall element in filter cover.
3. Thread sight bowl onto filter cover.
4. Tighten bowl securely by hand.



- 1 - Fuel Line
- 2 - Cable-tie (4)
- 3 - Cover
- 4 - Filter
- 5 - Rubber sealing washer
- 6 - Sight bowl
- 7 - Fuel line connector



# FUEL SYSTEM

## Section 3B – Emissions

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**3  
B**

## Exhaust Emissions Standards

Through the Environmental Protection Agency (EPA), the federal government has established exhaust emissions standards for all new marine engines sold in the U.S.

### What Are Emissions?

Emissions are what comes out of the exhaust system in the exhaust gas when the engine is running. They are formed as a result of the process of combustion or incomplete combustion. To understand exhaust gas emissions, remember that both air and fuel are made of several elements. Air contains oxygen and nitrogen among other elements; gasoline contains mainly hydrogen and carbon. These four elements combine chemically during combustion. If combustion were complete, the mixture of air and gasoline would result in these emissions: water, carbon dioxide and nitrogen, which are not harmful to the environment. But combustion is not usually complete. Also, potentially harmful gases can be formed during and after combustion.

All marine engines must reduce the emission of certain pollutants, or potentially harmful gases, in the exhaust to conform with levels legislated by the EPA. Emissions standards become more stringent each year. Standards are set primarily with regard to three emissions: hydrocarbons (HC), carbon monoxide (CO) and oxides of nitrogen (NOx).

### Hydrocarbons – HC

Gasoline is a hydrocarbon fuel. The two elements of hydrogen and carbon are burned during combustion in combination with oxygen. But they are not totally consumed. Some pass through the combustion chamber and exit the exhaust system as unburned gases known as hydrocarbons.

### Carbon Monoxide – CO

Carbon is one of the elements that make up the fuel burned in the engine along with oxygen during the combustion process. If the carbon in the gasoline could combine with enough oxygen (one carbon atom with two oxygen atoms), it would come out of the engine in the form of carbon dioxide (CO<sub>2</sub>). CO<sub>2</sub> is a harmless gas. But carbon often combines with insufficient oxygen (one carbon atom with one oxygen atom). This forms carbon monoxide, CO. Carbon monoxide is the product of incomplete combustion and is a dangerous, potentially lethal gas.



## Oxides of Nitrogen - NOx

NOx is a slightly different byproduct of combustion. Nitrogen is one of the elements that makes up the air going into the engine. Under extremely high temperatures it combines with oxygen to form oxides of nitrogen (NOx). This happens in the engine's combustion chambers when temperatures are too high. NOx itself is not harmful, but when exposed to sunlight it combines with unburned hydrocarbons to create the visible air pollutant known as smog. Smog is a serious problem in California as well as many other heavily populated areas of the United States.

## Controlling Emissions

There are two principle methods of reducing emissions from a two stroke marine engine. The first method is to control the air/fuel ratio that goes into the combustion chamber. The second is to control the time when this air/fuel mixture enters the combustion chamber. Timing is important, to prevent any unburned mixture from escaping out of the exhaust port.

## Stoichiometric (14.7:1) Air/Fuel Ratio

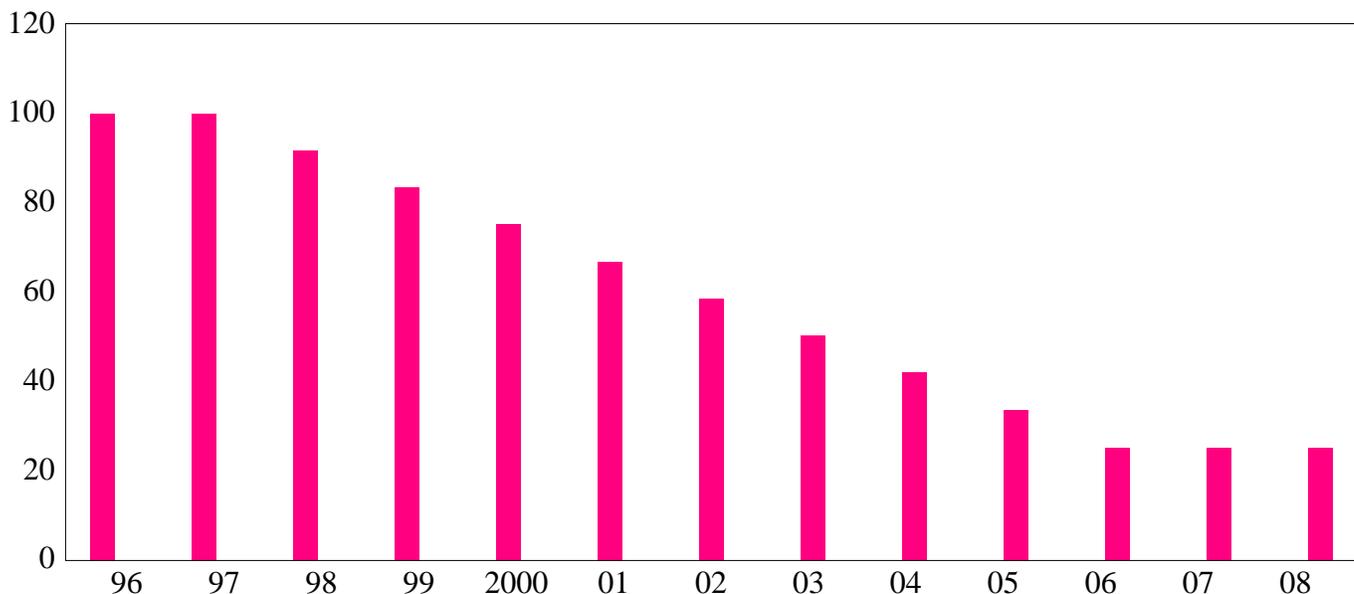
In the search to control pollutants and reduce exhaust emissions, engineers have discovered that they can be reduced effectively if a gasoline engine operates at an air/fuel ratio of 14.7:1. The technical term for this ideal ratio is stoichiometric. An air/fuel ratio of 14.7:1 provides the best control of all three elements in the exhaust under almost all conditions.

The HC and CO content of the exhaust gas is influenced significantly by the air/fuel ratio. At an air/fuel ratio leaner than 14.7:1, HC and CO levels are low, but with a ratio richer than 14.7:1 they rise rapidly. It would seem that controlling HC and CO by themselves might not be such a difficult task; the air/fuel ratio only needs to be kept leaner than 14.7:1. However, there is also NOx to consider.

As the air/fuel ratio becomes leaner, combustion temperatures increase. Higher combustion temperatures raise the NOx content of the exhaust. But, enriching the air/fuel ratio to decrease combustion temperatures and reduce NOx also increases HC and CO, as well as lowering fuel economy. So the solution to controlling NOx - as well as HC and CO - is to keep the air/fuel ratio as close to 14.7:1 as possible.

## Outboard Hydrocarbon Emissions Reductions

8-1/3% ↓ Per Year Over 9 Model Years





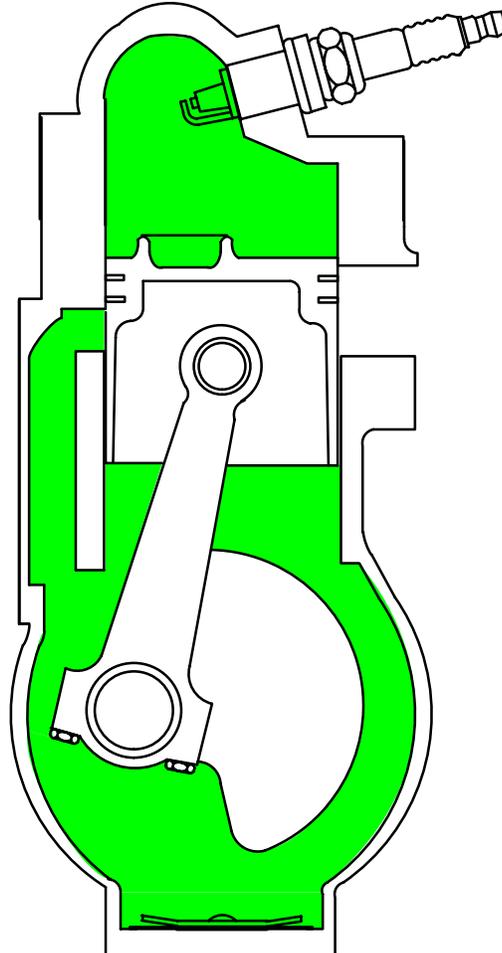
## Stratified vs. Homogenized Charge

DFI engines use a stratified charge inside the combustion chamber to aid in reducing emissions. All other models use a homogenized charge. The difference between the two is:

### Homogenized Charge

A homogenized charge has the fuel/air particles mixed evenly throughout the cylinder. This mixing occurs inside the carburetor venturi, reed blocks and crankcase. Additional mixing occurs as the fuel is forced through the transfer system into the cylinder.

The homogenized charge is easy to ignite as the air/fuel ratio is approximately 14.7:1.

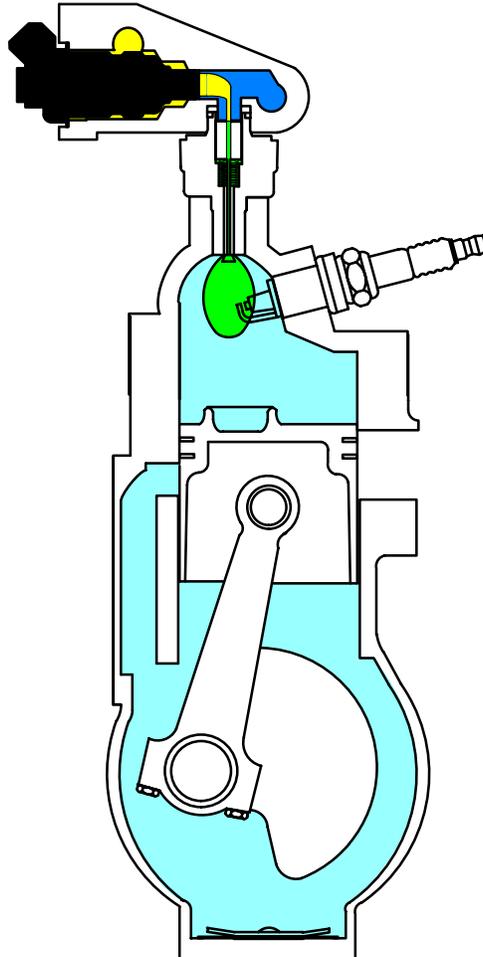




## Stratified Charge

A stratified charge engine only pulls air through the transfer system. The fuel required for combustion is forced into the cylinder through an injector placed in the top of the cylinder (head). The injector sprays a fuel/air mixture in the form of a bubble into the cylinder. Surrounding this bubble is air supplied by the transfer system. As the bubble is ignited and burns, the surrounding air provides almost complete combustion before the exhaust port opens.

A stratified charge is hard to ignite, the fuel/air bubble is not evenly mixed at 14.7:1 and not easily ignited.



## Emissions Information

### Manufacturer's Responsibility:

Beginning with 1998 model year engines, manufacturers of all marine propulsion engines must determine the exhaust emission levels for each engine horsepower family and certify these engines with the United States Environmental Protection Agency (EPA). A certification decal/emissions control information label, showing emission levels and engine specifications directly related to emissions, **must** be placed on each engine at the time of manufacture.



## Dealer Responsibility:

When performing service on all 1998 and later outboards that carry a certification, attention must be given to any adjustments that are made that affect emission levels.

Adjustments must be kept within published factory specifications.

Replacement or repair of any emission related component must be executed in a manner that maintains emission levels within the prescribed certification standards.

Dealers are **not** to modify the engine in any manner that would alter the horsepower or allow emission levels to exceed their predetermined factory specifications.

Exceptions include manufacturers prescribed changes, such as that for altitude adjustments.

## Owner Responsibility:

The owner/operator is required to have engine maintenance performed to maintain emission levels within prescribed certification standards.

The owner/operator is **not** to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

Single engine exceptions may be allowed with permission from the EPA for racing and testing.

## EPA Emission Regulations:

All new 1998 and later outboards manufactured by Mercury Marine are certified to the United States Environmental Protection Agency as conforming to the requirements of the regulations for the control of air pollution from new outboard motors. This certification is contingent on certain adjustments being set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, whenever practicable, returned to the original intent of the design.

The responsibilities listed above are general and in no way a complete listing of the rules and regulations pertaining to the EPA laws on exhaust emissions for marine products. For more detailed information on this subject, you may contact the following locations:

### VIA U.S. POSTAL SERVICE:

Office of Mobile Sources  
Engine Programs and Compliance Division  
Engine Compliance Programs Group (6403J)  
401 M St. NW  
Washington, DC 20460

### VIA EXPRESS or COURIER MAIL:

Office of Mobile Sources  
Engine Programs and Compliance Division  
Engine Compliance Programs Group (6403J)  
501 3rd St. NW  
Washington, DC 20001

### EPA INTERNET WEB SITE:

<http://www.epa.gov/omswww>

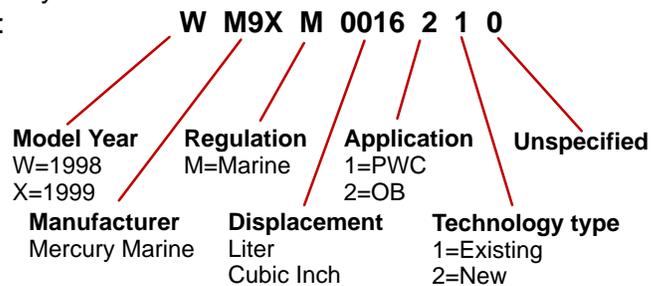


**CERTIFICATION LABEL:**

The certification label must be placed on each engine at the time of manufacture and must be replaced in the same location if damaged or removed. Shown below is a typical certification label and is not representative of any one model. Label shown below is not to scale; (shown at twice the normal size).

<b>MERCURY MARINE</b>		<b>Emission Control Information</b>		<b>262</b>	<b>1998</b>
		<b>CC</b>	<b>PART # 37-855211 4</b>		
This engine conforms to 1998 Model Year U.S. EPA regulations for marine SI engines.		This engine is certified to operate on regular 87 octane unleaded fuel (R+M)/2			
Refer to Owners Manual for required maintenance. Exhaust Emission Control Systems: None		Idle Speed (in gear): 725 RPM 850 RPM (10W)			
Engine Lubricants: 2-Cycle Outboard Oil NMMA/BIA Certified TC-W3	Fuel/Oil Ratio: 50:1	Timing: Idle: 8° BTDC WOT: 36° BTDC			
Family: WM9XM0016210		Spark Plug: NGK BP8HS-15	Gap: .060"		
FEL: 243.11 GM/KW-HR		Valve Clearance (Cold) mm		9.9-15 HP	
		Intake: N/A	Exhaust: N/A		
JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC					

- a** - Spark Ignition (SI)
- b** - Model year of engine and production decal part number
- c** - Type and octane of fuel used to establish emission levels
- d** - Timing specifications when adjustable
- e** - Spark plug gap in thousandths of an inch
- f** - Recommended spark plug for best engine performance
- g** - Engine horsepower rating
- h** - Cubic centimeter
- i** - Valve clearance (four stroke engines only)
- j** - Recommended oil/fuel ratio for best engine performance and minimal emissions
- k** - Month of production (boxing month will be punched)
- l** - FEL: represents (Mercury Marine) statement of the maximum emissions output for the engine family
- m** - Family example:



- n** - Engine lubricants recommended by the manufacturer



# Service Replacement Certification Label

**IMPORTANT:** By federal law, it is required that all 1998 and newer Mercury Marine outboards have a visible and legible emission certification label. If this label is missing or damaged, contact Mercury Marine Service for replacement if appropriate.

## Removal

Remove all remaining pieces of the damaged or illegible label. Do not install new label over the old label. Use a suitable solvent to remove any traces of the old label adhesive from the display location.

## Date Code Identification

Cut and remove a "V" notch through the month of engine manufacture before installing the new label. The month of manufacture can be found on the old label. If the label is missing or the date code illegible, contact Mercury Marine Technical Service for assistance.

	<b>Emission Control Information</b>	262 CC	<b>2003</b> PART # 37-804662 03
This engine conforms to 2003 Model Year U.S. EPA regulations for marine SI engines.		Idle Speed (in gear): 850 RPM	
Refer to Owners Manual for required maintenance		Timing: IDLE: 8° BTDC, WOT: 36° BTDC	
Family: 3M9XM00161CO		Spark Plug: NGK BP8H-N-15 Gap: .152 mm (0.060 in.)	
FEL: 243.11 G/MKW-HR		Valve Clearance (Cold) mm Intake: N/A Exhaust: N/A	
			<b>9.9 - 15 HP</b>
<div style="display: flex; justify-content: space-between; padding: 0 10px;"> <span>(b) →</span> <span>JAN</span> <span>FEB</span> <span>MAR</span> <span>APR</span> <span>MAY</span> <span>JUNE</span> <span>JULY</span> <span>AUG</span> <span>SEP</span> <span>OCT</span> <span>NOV</span> <span>DEC</span> </div> <div style="text-align: center; margin-top: 5px;"> <span>(a) ↑</span> </div>			

- a** - "V" notch
- b** - Month of manufacture



## Installation

Install the label on a clean surface in the original factory location.

### Decal Location:

Model	Service Part No.	Location on Engine
1998 Merc/Mar 262cc (6-8 hp)	37-855577 3	Inside Rear Top Cowl
1998 Merc/Mar 262cc (9.9-15 hp)	37-855577 4	Inside Rear Top Cowl
1999 Merc/Mar 262cc (6-8 hp)	37-856985 3	Inside Rear Top Cowl
1999 Merc/Mar 262cc (9.9-15 hp)	37-856985 4	Inside Rear Top Cowl
2000 Merc/Mar 262cc (6-8 hp)	37-804659A00	Inside Rear Top Cowl
2000 Merc/Mar 262cc (9.9-15 hp)	37-804662A00	Inside Rear Top Cowl
2001 Merc/Mar 262cc (6-8 hp)	37-804659A01	Inside Rear Top Cowl
2001 Merc/Mar 262cc (9.9-15 hp)	37-804662A01	Inside Rear Top Cowl
2002 Merc/Mar 262cc (6-8 hp)	37-804659A02	Inside Rear Top Cowl
2002 Merc/Mar 262cc (9.9-15 hp)	37-804662A02	Inside Rear Top Cowl
2003 Merc/Mar 262cc (6-8 hp)	37-804659A03	Inside Rear Top Cowl
2003 Merc/Mar 262cc (9.9-15 hp)	37-804662A03	Inside Rear Top Cowl