MARINER OUTBOARDS

MERCURY OUTBOARDS

SERVICE MANUAL

MODELS
70 • 75 • 80 • 90 • 100 • 115

1987–1993 70 • 75 • 75 Marathon • 75XD • 75 Seapro • 80 • 90 (3 Cylinder) with Serial Numbers		1988–1993 100 • 115 (4 Cylinder) with Serial Numbers	
UNITED STATES	S/N 0A996142 thru 0D283221	UNITED STATES	S/N 0B209468 thru 0D283221
BELGIUM	S/N 09502135 thru 09793576	BELGIUM	S/N 09523034 thru 09793576
CANADA	S/N 0A722297 and Above	CANADA	S/N 0A731673 and Above

Printed in U.S.A.

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Notice

Throughout this publication, "Dangers", "Warnings" and "Cautions" (outlined in a border and 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

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 mechanic's 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 product's 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 is 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.

It is important to note that, during any maintenance procedure, replacement fasteners must have the same measurements and strength as those removed, whether metric or customary. Numbers on the heads of the metric bolts and on surfaces of metric nuts indicate their strength. Customary bolts use radial lines for this purpose, while most customary nuts do not have strength markings. Mismatched or incorrect fasteners can result in damage or malfunction, or possible personal injury. Therefore, fasteners removed should be saved for re-use 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. 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.

Before raising or removing an outboard engine from a boat, the following precautions should be adhered to:

1. Check that flywheel is secured to end of crankshaft with a locknut and lifting eye is threaded into flywheel a minimum of 5 turns.
2. Connect a hoist of suitable strength to the lifting eye.

In addition, personnel should not work on or under an engine which is suspended. Engines should be attached to work stands, or lowered to ground as soon as possible.

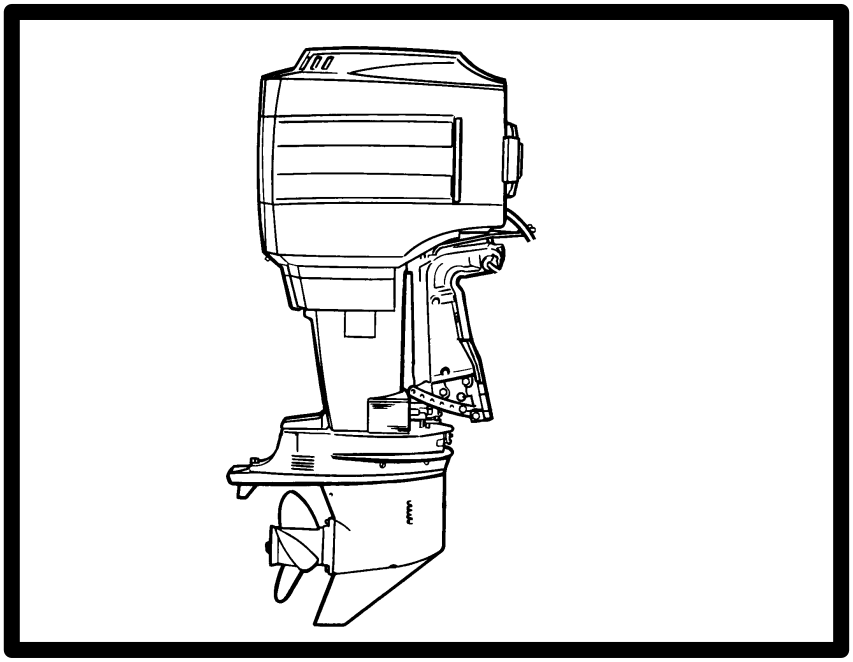
We reserve the right to make changes to this manual without prior notification.

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

Service Manual Outline

GENERAL INFORMATION AND SPECIFICATIONS

1



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General Specification

NOTE: Other specification (torques, etc.) are listed in the respective sections.

<table>
<tr><th></th><th>Model 70</th><th>Model 75</th><th>Model 80</th><th>Model 90</th></tr>
<tr><td>Horsepower</td><td>70 (52.2 kw)</td><td>75 (55.9 kw)</td><td>80 (59.6 kw)</td><td>90 (67.1 kw)</td></tr>
<tr><td>Idle RPM (in forward gear)</td><td colspan="4">650 - 700</td></tr>
<tr><td>Full Throttle RPM Range</td><td colspan="3">4750 - 5250</td><td>5000 - 5500</td></tr>
<tr><td>Piston Replacement</td><td colspan="4">71.12 (1165.7cc)</td></tr>
<tr><td>Cylinder Bore</td><td colspan="4">3.375 (85.7mm)</td></tr>
<tr><td>Stroke</td><td colspan="4">2.65 (67.3mm)</td></tr>
<tr><td>Engine Type</td><td colspan="4">3 Cylinder, 2 Cycle</td></tr>
<tr><td>Ignition Type</td><td colspan="4">C.D. Breakerless</td></tr>
<tr><td>Recommended Spark Plug</td><td colspan="2">NGK-BUHW-2 or AC-V40 FFK or Champion L78V</td><td colspan="2">Inductor Plugs: NGK-BUZHW-2 or Champion QL78V</td></tr>
<tr><td>Cylinder Firing Order</td><td colspan="4">1-3-2</td></tr>
<tr><td>Recommended Power Trim Fluid</td><td colspan="4">Quicksilver Power Trim & Steering Fluid or Automotive Transmission Fluid (ATF) Type F, FA or Dexron II</td></tr>
<tr><td>Recommended Gasoline</td><td colspan="4">Regular Leaded, Premium, Low-Lead and Lead-Free automotive gaso-lines with a minimum pump posted octane rating of 86</td></tr>
<tr><td>Recommended Oil</td><td colspan="4">Quicksilver TC-WII or TC-W3 2-Cycle Outboard Oil</td></tr>
<tr><td>Engine Weight ELO
ELOPT</td><td colspan="4">260 lbs.
280 lbs.</td></tr>
<tr><td>Fuel Tank Capacity</td><td colspan="4">6.6 U.S. Gallons
(5 Imp. Gals.; 25 Liters)</td></tr>
<tr><td>Gear Housing Lubricant Capacity</td><td colspan="4">22.5 fl. oz. (665.3ml)</td></tr>
<tr><td>Gasoline/Oil Ratio at Idle</td><td colspan="4">80:1</td></tr>
<tr><td>Gasoline/Oil Ratio at W.O.T.</td><td colspan="4">50:1</td></tr>
<tr><td>Gear Ratio</td><td colspan="4">2.3:1</td></tr>
<tr><td>Oil Injection Tank Capacity</td><td colspan="4" rowspan="2">1 gal. (3.78 liter)</td></tr>
<tr><td>Tank Capacity</td></tr>
<tr><td>Maximum operation per tank full of oil at W.O.T.</td><td colspan="4">6 hours</td></tr>
<tr><td>Oil remaining when warning buzzer sounds</td><td colspan="4">1 qt. (.95 liter)</td></tr>
<tr><td>Operating time remaining at wide open throttle when warn-ing buzzer sounds</td><td colspan="4">1 Hour</td></tr>
</table>

General Specification (continued)

NOTE: Other specification (torques, etc.) are listed in the respective sections.

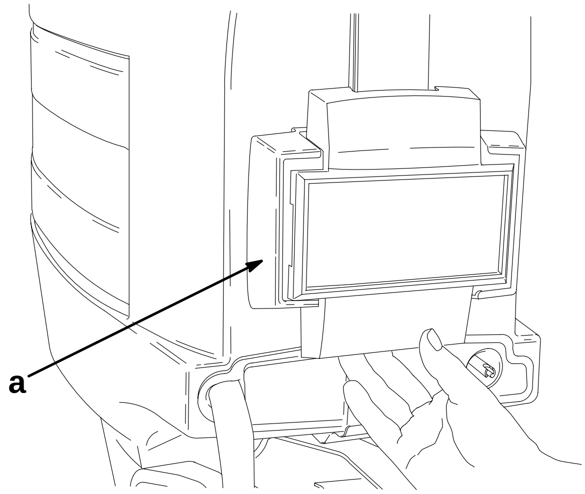
	Model 100	Model 115
Horsepower	100 (74.6 kw)	115 (85.8 kw)
Idle RPM (in forward gear)	650 - 700	
Full Throttle RPM Range	4750 - 5250	
Piston Replacement	105 (1720.9cc)	
Cylinder Bore	3.375 (85.7mm)	
Stroke	2.930 (74.4mm)	
Engine Type	4 Cylinder, 2 Cycle	
Ignition Type	C.D. Breakerless	
Recommended Spark Plug	NGK-BPH8H-N-10* Gap - 0.040 in. (1.0mm) Inductor Plug NGK BPZ 8H-N-10* Gap - 0.040 in. (1.0mm) NGK-BUHW	
Cylinder Firing Order	1-3-2-4	
Recommended Power Trim Fluid	Quicksilver Power Trim & Steering Fluid or Automotive Transmission Fluid (ATF) Type F, FA or Dexron II	
Recommended Gasoline	Regular Leaded, Premium, Low-Lead and Lead-Free automotive gaso-lines with a minimum pump posted octane rating of 86	
Recommended Oil	Quicksilver 2-Cycle Outboard Oil	
Engine Weight ELO ELOPT	340 lbs. 360 lbs.	
Fuel Tank Capacity	6.6 U.S. Gallons (5 Imp. Gals.; 25 Liters)	
Gear Housing Lubricant Capacity	22.5 fl. oz. (665.2ml)	
Gasoline/Oil Ratio at Idle	80:1	
Gasoline/Oil Ratio at W.O.T.	50:1	
Gear Ratio	2.07:1	
Oil Injection Tank Capacity		
Tank Capacity	1.4 gal. (5.3 liters)	
Maximum operation per tank full of oil at W.O.T.	5 hours	
Oil remaining when warning buzzer sounds	1 qt. (.95 liter)	
Operating time remaining at wide open throttle when warn-ing buzzer sounds	50 min. approx.	

*Improves running quality between 1800 – 2000 RPM.

Cowl Removal

Pull outward on starboard side of front shield (a).

Remove spring (b) from latch and open cowls.



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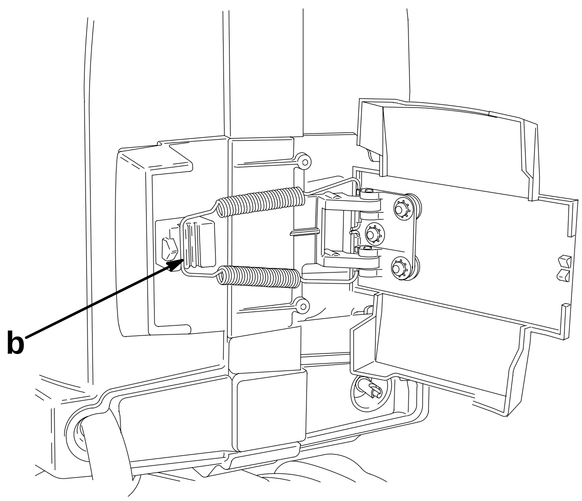

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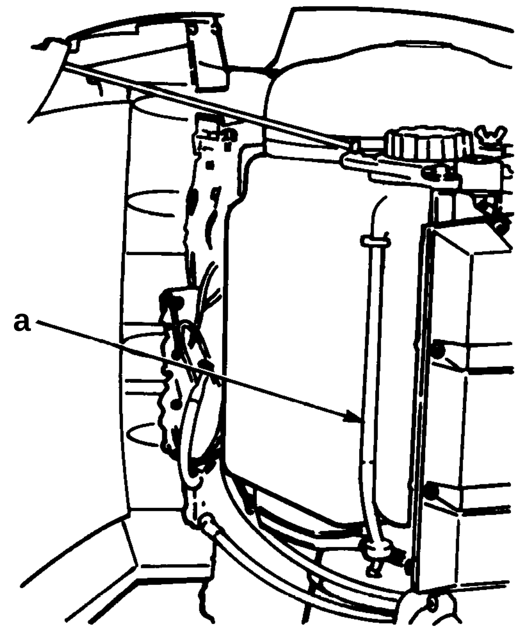
Filling Oil Injection System

Open starboard cowl (refer to cowl removal on this page). Some earlier outboards will have a cowl bracket to hold cowl open as shown.

Fill tank with recommended oil.



a - Oil Tank Tube

Power Trim System

GENERAL INFORMATION

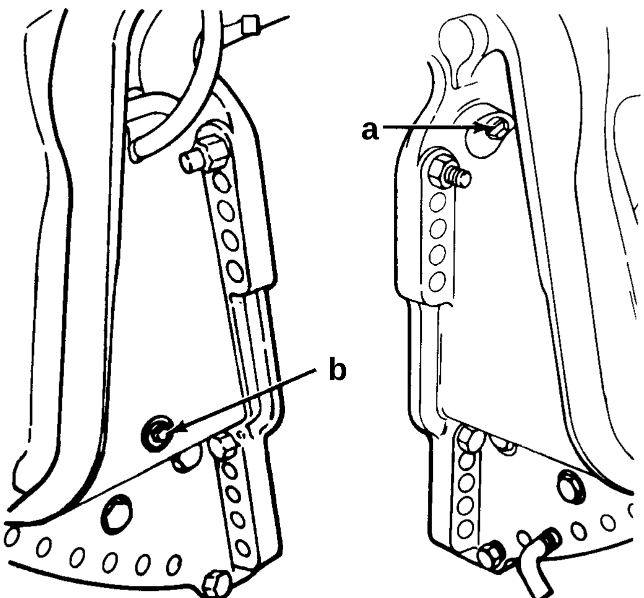
The power trim system is filled at the manufacturer and is ready for use.

Trim outboard through entire trailering range several times to remove any air from the system.

The trim system is pressurized and is not externally vented. The outboard can be raised or lowered manually by loosening the manual release valve four turns.

The trim "out" angle of this outboard is not adjustable. The trim system has an internal valve which will automatically stop the outward trim travel at 20° when engine RPM is approximately 2000 RPM or higher; outboard also has to be in water and in gear.

The outboard can be operated beyond the 20° trim limit for operating outboard in shallow water if engine RPM is kept below approximately 2000 RPM.



23321

a - Fill Screw (System is Pressurized, DO NOT Open Unless Outboard is Tilted to Full Up Position)
b - Manual Release Valve

Trim "In" Angle Adjustment

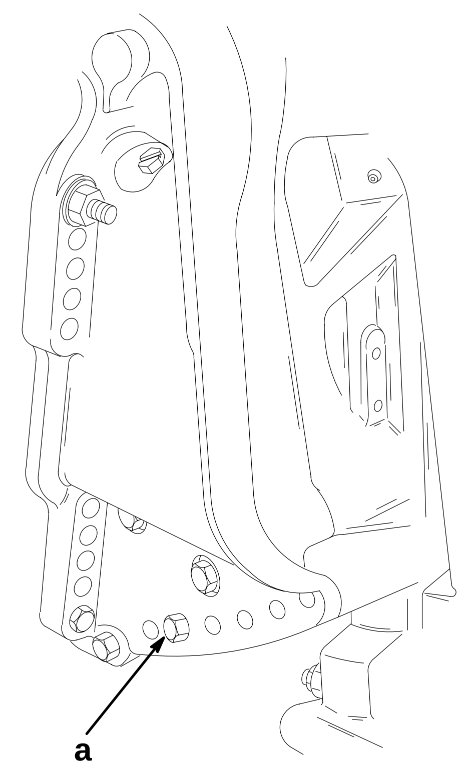
MODELS WITH POWER TRIM

⚠ WARNING

Operating some boats with outboard trimmed to the full "in" trim angle [not using trim adjustment bolt (a)] at planing speed will cause undesirable and/or unsafe steering conditions. Each boat MUST BE water tested for handling characteristics after outboard installation and after any trim adjustments.

IMPORTANT: Some boat/motor combinations, that do not use the trim adjustment bolt (a) and are trimmed to the full "in" trim angle, will not experience any undesirable and/or unsafe steering conditions during planing speed. Thus, not using trim adjustment bolt may be desired. However, some boats with outboard trimmed to the full "in" trim angle at planing speeds will cause undesirable and/or unsafe steering conditions. If these steering conditions are experienced, under no circumstances should the outboard be operated without the trim adjustment bolt and without the bolt adjusted in the proper holes to prevent unsafe handling characteristics.

Water test the boat not using the trim adjustment bolt. If undesirable and/or unsafe steering conditions are experienced (boat runs with nose down), install trim adjustment bolt in proper hole to prevent unsafe handling characteristics.

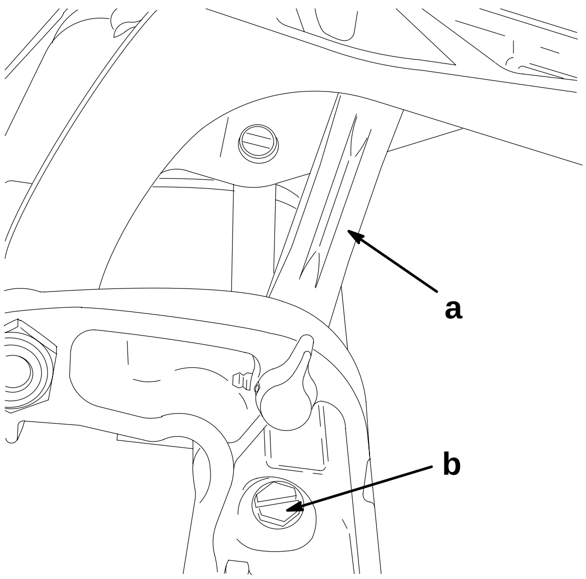


22744

Checking Trim System Fluid Level

IMPORTANT: This trim system is pressurized. Remove fill screw (b) when outboard is trimmed to the full "up" position. Retighten fill screw securely.

1. Trim outboard to full "up" position. Engage tilt lock lever. Trim system fluid can only be checked when outboard is in this position.
2. Remove fill screw and check fluid level. Fluid level should be visible in fill tube.
3. If necessary, add Quicksilver Power Trim and Steering Fluid; or Automatic Transmission Fluid (ATF) Type F, FA or Dextron II.



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a - Tilt Lock Lever
b - Fill Screw

Tilt Angle Adjustment

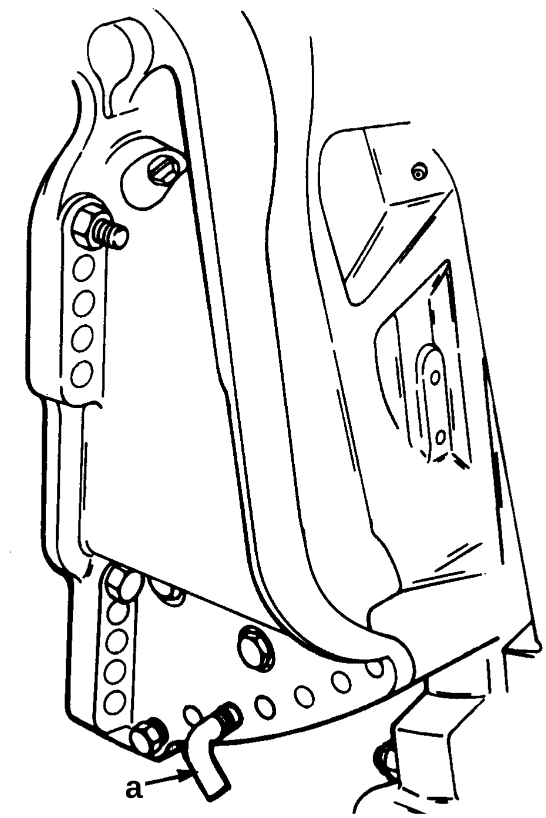
MODELS WITHOUT POWER TRIM

WARNING

Operating some boats at minimum trim "In" at planing speeds will cause undesirable and/or unsafe steering conditions. Each boat should be tested for handling characteristics after any adjustment is made to the tilt angle.

DO NOT OPERATE motor with tilt lock pin removed.

Adjust tilt angle of motor on transom with tilt lock pin so that anti-ventilation plate is about parallel and even with bottom of boat. Speed sometimes may be improved by tilting motor out one tilt pin hole to raise bow and reduce wetted surface. If motor is tilted in, boat will ride bow down, wetting more of the bottom and reducing speed, which generally will improve operation in rough water. Under ideal conditions, efficiency is best with lower unit operating in level position. Operation with excessive tilt angle will reduce performance noticeably and may induce ventilation. It is preferable to level boat by proper loading rather than by extreme adjustment of tilt angle.



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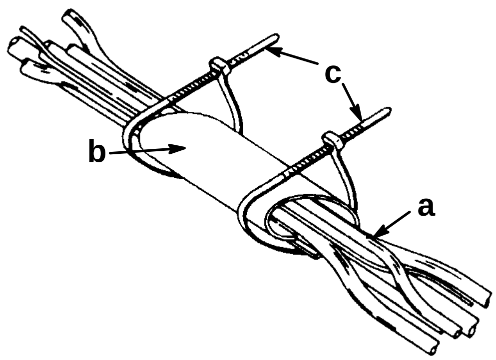
a - Tilt Lock Pin

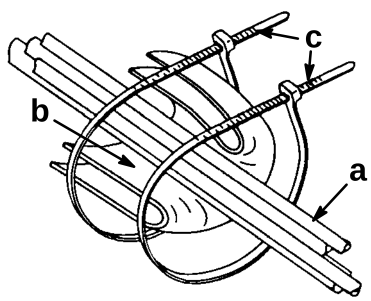
Connecting Engine Wiring Harness and Routing of Engine Battery Cables

⚠ WARNING

Cables passing through cowl must be protected from chafing or being cut, by using the neoprene sheet as described in the following steps. Failure to protect cables as described could result in electrical system failure and/or possible injury to occupants of boat.



Models with Power Trim

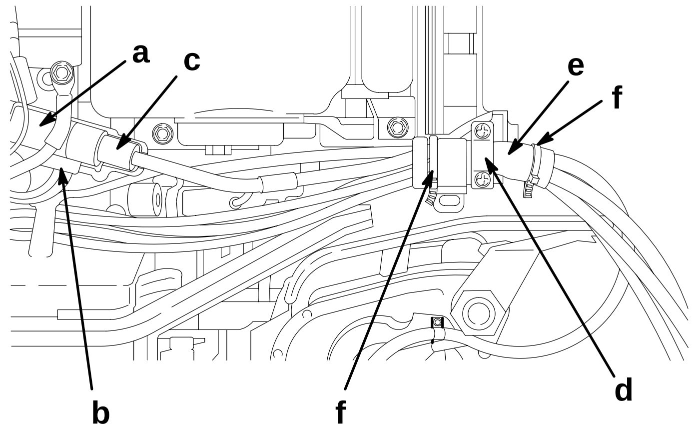


Models without Power Trim

a - Wiring Harness
b - Neoprene Sheet
c - Sta-Straps

1. Plug remote control harness connector into engine harness connector, then secure connector in place with retainer as shown.
2. Wrap neoprene sheet around cable bundle and secure each end with a sta-strap. Secure to bracket with retainer.

IMPORTANT: On Models without Power Trim, the neoprene sheet must be folded once and then wrapped around cables as shown.

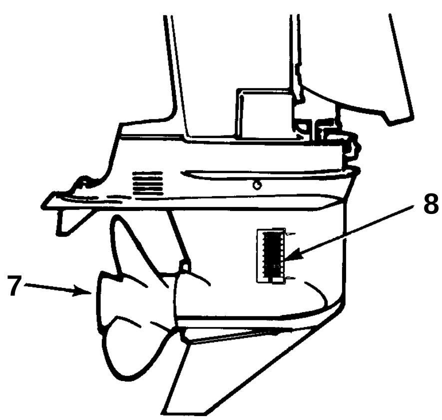


a - Engine Connector
b - Retainer
c - Harness Connector
d - Harness Retainer
e - Neoprene Sheet
f - Sta-Strap(s)

Models with Power Trim

Lubrication Points

No.	Description	Lubricant Used or Maintenance	Fresh Water Frequency	Salt Water Frequency
1	Ride-Guide Steering Cable	Quicksilver 2-4-C w/Teflon	Every 60 Days	Every 30 Days
2	Throttle-Shift Linkage			
3	Upper Shift Shaft			
4	Tilt Tube			
5	Swivel Pin			
6	Tilt Lock Lever			
7	Propeller Shaft	Quicksilver -2-4-C w/Teflon Anti-Corrosion Grease	Once in Season	Every 60 Days
8	Gear Housing	Quicksilver Gear Lube	Check and fill after 1st 10 days, then every 30 days Drain and Refill after 1st 25 hours, then after every 100 hours, or once a year before storing.	
9	Steering Link Rod Pivot Points	SAE 30W Engine Oil	Every 60 Days	Every 30 Days
10	Power Trim Pump Oil Level	Quicksilver Power Trim and Steering Fluid	Every 100 hours, or once in season	Same as Fresh Water
---	Engine Crankshaft Splines to Drive Shaft Splines	Quicksilver 2-4-C w/Teflon	Once in Season by Dealer	
11	Accelerator Pump Stem/Throttle Cam	Quicksilver 2-4-C w/Teflon	Once in Season	Every 60 Days



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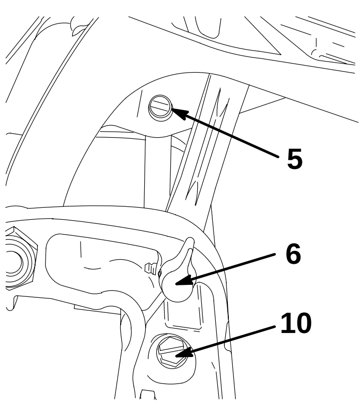

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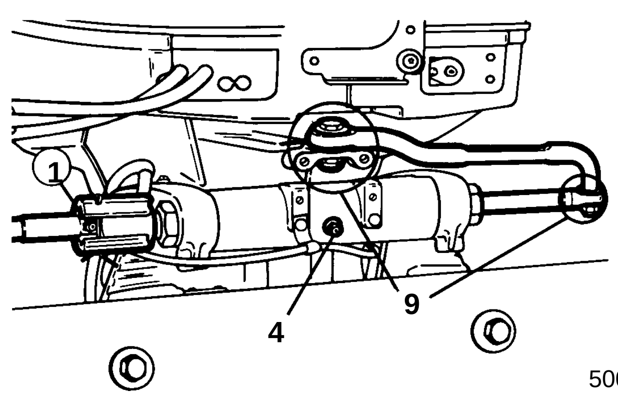
Ride-Guide Steering Cable and Pivot Points Lubrication

⚠ WARNING

Core of steering cable (transom end) must be fully retracted into cable housing before lubricating cable. If cable is lubricated while extended, hydraulic lock of cable could occur.

With core of Ride-Guide Steering cable (transom end) fully retracted, lubricate transom end of steering cable thru grease fitting and exposed portion of cable end with Quicksilver 2-4-C w/Teflon. Lubricate all pivot points with SAE 30W engine oil.



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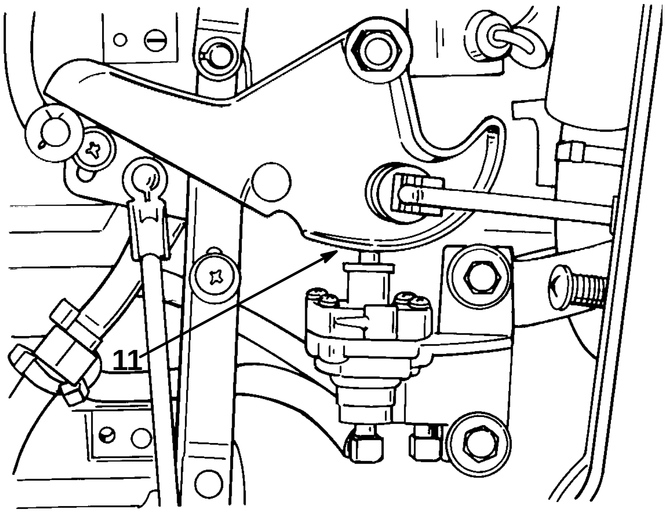
NOTE: 4 CYL. MODELS



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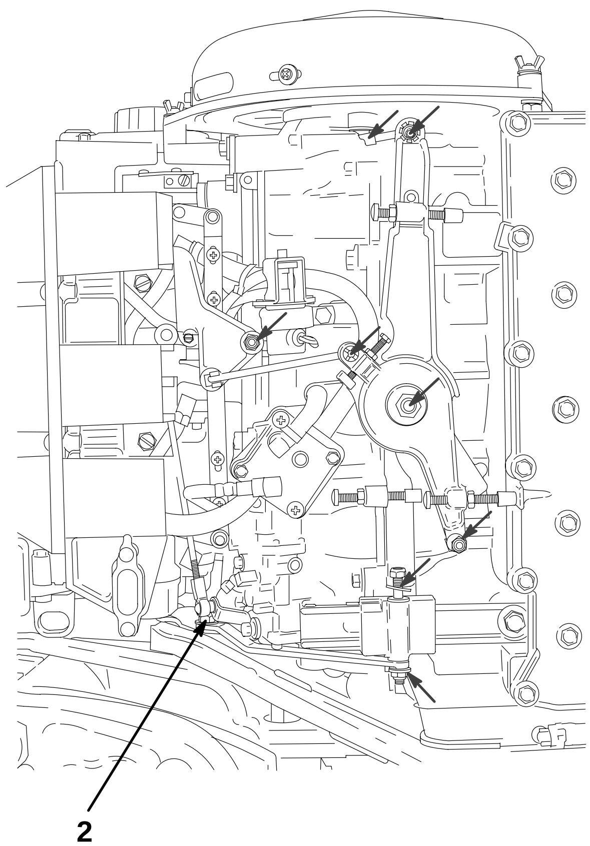
11 – Lubrication Points for Accelerator Pump Cam on 4 Cylinder Models Only



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2 – Lubrication Points are indicated with Arrows

Following Complete Submersion

Submerged engine treatment is divided into 3 distinct problem areas. The most critical is submersion in salt water; the second is submersion while running.

Salt Water Submersion (Special Instructions)

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.

Submerged While Running (Special Instructions)

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.

Submerged Engine (Fresh Water) (Plus Special Instructions)

1. Recover engine as quickly as possible.
2. Remove cowling.
3. Flush outside of engine 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 throat (alcohol will absorb water). Again rotate flywheel.
6. Turn engine over and pour alcohol into spark plug openings and again rotate flywheel.
7. Turn engine over (place spark plug opening 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. Reinstall spark plugs, carburetors and fuel pump.
11. 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.
12. If engine fails to start, determine cause (fuel, electrical or mechanical). DO NOT allow engine to remain idle for more than 2 hours, as serious internal damage will occur. If unable to start engine in this period, disassemble engine and clean all parts and apply oil as soon as possible.

Out-of-Season Outboard Storage

⚠ WARNING

As a safety precaution, when boat is in storage, remove positive (+) battery cable. This will eliminate possibility of accidental starting of engine and resultant overheating and damage to engine from lack of water.

In preparing an outboard for out-of-season storage, 2 precautions must be considered: 1) The engine must be protected from physical damage and 2) the engine must be protected from rust, corrosion and dirt.

1. Remove cowling from engine.
2. Place outboard in water or install Quicksilver Flushing Attachment over water intake by following instructions outlined in “Flushing Cooling System” (see “Table of Contents”).
3. Start engine and allow to warm up. Disconnect fuel line. When engine starts to stall quickly spray Quicksilver Storage Seal into each carburetor throat. Continue to spray until engine dies from lack of fuel.
4. Remove spark plugs and inject a 5 second spray of Quicksilver Storage Seal around the inside of each cylinder. Manually turn engine over several times to distribute Storage Seal throughout cylinders. Reinstall spark plugs.
5. If engine fuel filter appears to be contaminated, remove and replace. Refer to Section 3 “Fuel System and Carburetion.”
6. Drain and refill lower unit with Quicksilver Gear Lube, as explained in “Gear Housing Lubrication” (see “Table of Contents”).
7. Clean outboard thoroughly, including all accessible powerhead parts, and spray with Corrosion and Rust Preventive.
8. Refer to lubrication chart in this section (see “Table of Contents”) and lubricate all lubrication points.
9. Remove propeller. Apply Quicksilver Anti-Corrosion Grease or 2-4-C w/Teflon to propeller shaft and reinstall propeller. Refer to “Propeller Installation” (see “Table of Contents”).
10. If the water pickup is clogged, the speedometer will be inoperative. Clean the pickup with a piece of wire or blow out with compressed air. Before blowing out with air, disconnect the tubing from the speedometer.
11. To prevent freeze damage, drain the speedometer system of water completely before storage. Remove tubing from speedometer fitting and blow thru the tubing to remove water.
12. Store battery as outlined in “Out-of-Season Battery Storage,” following.
13. For out-of-season storage information on Autoblend units, refer to Section 8 in this service manual.

IMPORTANT: When storing outboard for the winter, be sure that all water drain holes in gear housing are open and free so that all water will drain out. If a speedometer is installed in the boat, disconnect the pickup tube and allow it to drain. Reconnect the tube after draining. Trapped water may freeze and expand, thus cracking gear housing and/or water pump housing. Check and refill gear housing with Quicksilver Gear Lube before storage to protect against possible water leakage into gear housing which is caused by loose lubricant vent plug or loose grease fill plug. Inspect gaskets under lubricant vent and fill plugs, replacing any damaged gaskets, before reinstalling plugs.

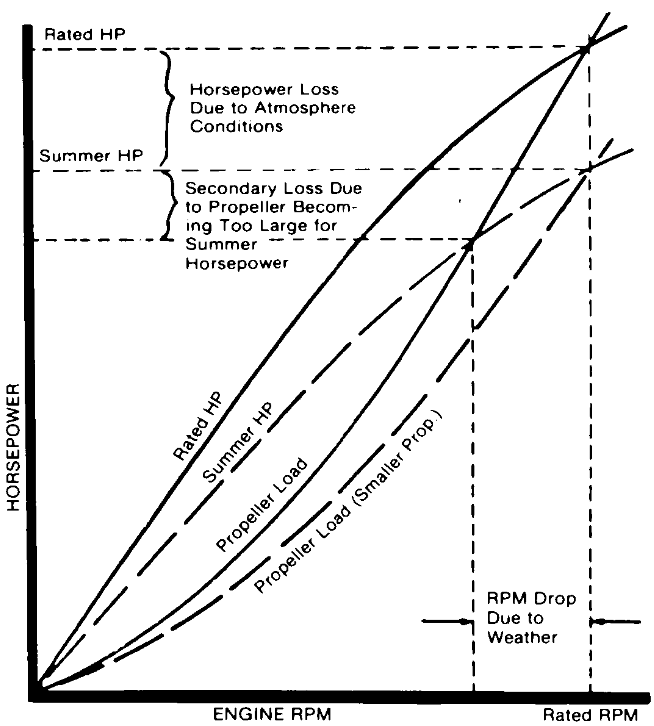
Out-of-Season Battery Storage

1. Remove battery as soon as possible and remove all grease, sulfate and dirt from top surface.
2. Cover PLATES with distilled water, but not over 3/16 in. (5mm) above perforated baffles.
3. Cover terminal bolts well with grease.
4. Store battery in a COOL, DRY place in a dry carton or box.
5. Remove battery from storage every 60 days. Check water level and place on charge for 5 to 6 hours at 6 amperes. DO NOT fast charge.

⚠ CAUTION

A discharged battery can be damaged by freezing.

How Weather Affects Engine Performance



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, correcting all values to the power that the engine will produce at sea level, at 30% relative humidity at 77° F (25° C) 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 2 or 3 miles-per-hour (3 or 5 Km 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.

Conditions Affecting Operation

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).
2. **Boat 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.
   a. **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.
   b. **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.
   c. **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.
3. **Gear Housing:** If unit is left in the water, marine vegetation may accumulate over a period of time in certain types of water. This growth must be removed from unit before operation, as it may clog the water inlet holes in the gear housing and cause the engine to overheat.

Detonation: Causes and Prevention

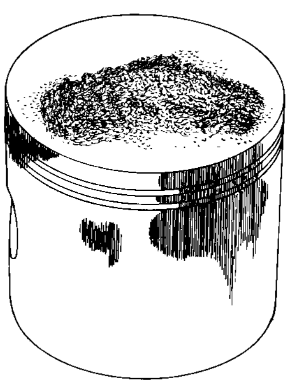
Detonation in a 2-cycle engine somewhat resembles the “pinging” heard in an automobile engine. It can be otherwise described as a tin-like “rattling” or “plinking” sound.

Detonation generally is thought of as spontaneous ignition, but it is best described as a noisy explosion in an unburned portion of the fuel/air charge after the spark plug has fired. Detonation creates severe, untimely, shock waves in the engine, and these shock waves often find or create a weakness: The dome of a piston, piston rings or piston ring lands, piston pin and roller bearings.

While there are many causes for detonation in a 2-cycle engine, emphasis is placed on those causes which are most common in marine 2-cycle application. A few, which are not commonly understood, are:

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

Detonation usually can be prevented, provided that 1) the engine is correctly set up and 2) diligent maintenance is applied to combat the detonation causes, listed, preceding.



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Damaged Piston Resulting from Detonation

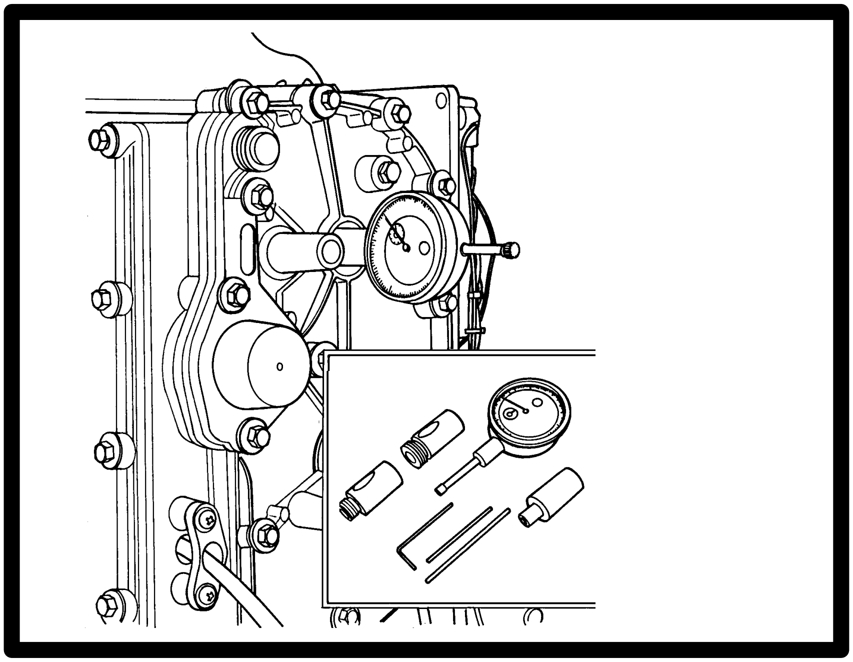
Compression Check

1. Remove spark plugs.
2. Install compression gauge in spark plug hole.
3. Hold throttle plates at W.O.T.
4. Crank engine thru at least 4 compression strokes to obtain highest possible reading.
5. Check and record compression of each cylinder. Variation of more than 15 psi (103.5 kPa) between cylinders indicates that lower compression cylinder is in some way defective, such as worn or sticking piston rings and/or scored piston and cylinder.
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 tune-up.
7. Cylinder scoring: If powerhead shows any indication of overheating, such as discolored or scorched paint, visually inspect cylinders for scoring or other damage as outlined in Section 4 “Powerhead.”

ELECTRICAL AND IGNITION

2

A



IGNITION SYSTEM

SUPPLEMENT TO 90-13645--2
Models 70/75/80/90/100/115
This replaces section 2A

Table Of Contents

Description

The outboard ignition system is alternator-driven with distributor-less capacitor discharge. Major components of the ignition system are the flywheel, stator, trigger, switch box, ignition coils and spark plugs.

The stator assembly is mounted stationary below the flywheel and has 2 capacitor charging coils. The flywheel is fitted with permanent magnets inside the outer rim. As the flywheel rotates the permanent magnets pass the capacitor charging coils. This causes the capacitor charging coils to produce AC voltage. The AC voltage then is conducted to the switch box where it is rectified and stored in a capacitor.

The trigger assembly (also mounted under the flywheel) has 3 coils. The flywheel has a second set of permanent magnets (located around the center hub). As the flywheel rotates the second set of magnets pass the trigger coils. This causes the trigger coils to produce an AC voltage that is conducted to an electric Silicon Controlled Rectifier (SCR) in the switch box.

The switch discharges the capacitor voltage into the ignition coil at the correct time and firing order sequence.

Capacitor voltage is conducted to the primary side of the ignition coil. The ignition coil multiplies this voltage high enough to jump the gap at the spark plug.

The preceding sequence occurs once-per-engine-revolution for each cylinder.

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

IMPORTANT: If the engine misfires, runs rough or does not start, the ignition system should be checked using a Multi-Meter/DVA Tester (91-99750), or a voltmeter (capable of measuring 400 volts DC, or higher) and Direct Voltage Adaptor (91-89045).

Test Procedures

Direct Voltage Adapter (DVA) Tests

⚠ WARNING

DANGER - HIGH VOLTAGE/SHOCK HAZARD! Do not touch ignition components and/or metal test probes while engine is running and/or being "cranked." STAY CLEAR OF SPARK PLUG LEADS. To assure personal safety, each individual spark plug lead should be grounded to engine.

⚠ CAUTION

To protect against meter and/or component damage, observe the following precautions:

- **400 VDC* test position (or higher) MUST BE used for all tests.**
- **INSURE the Positive (+) lead/terminal of DVA is connected to the Positive (+) receptacle of meter.**
- **DO NOT CHANGE meter selector switch position while engine is running and/or being "cranked."**
- **Switch box MUST BE GROUNDED during tests. Running or "cranking" engine with switch box ungrounded may damage switch box.**

* If using a meter with a built-in DVA, the DVA/400 VDC test position should be used.

NOTE: Test leads are not supplied with the DVA. Use test leads supplied with meter.

Test procedures and specifications are provided for **checking primary ignition voltage** while the engine is **running** and/or being **"cranked."**

TROUBLESHOOTING TIPS:

1. Intermittent, weak, or no spark output at **two** spark plugs usually indicates a **bad TRIGGER.**
2. Intermittent, weak, or no spark output at all **three** spark plugs usually indicates a **bad STATOR** or **SWITCH BOX.**
3. Intermittent, weak, or no spark at any **one** spark plug usually indicates a bad **SPARK PLUG, COIL, or SWITCH BOX.**

Test Sequence

1-A) Check primary input voltage to coils. (See Test Chart).

1. If voltage readings to coil(s) are **BELOW** specification, proceed with **Step 2-A.**
2. If voltage readings to coil(s) are **WITHIN** specifications, proceed with **Step 1-B.**

1-B) Check coils for spark. [Connect Spark Gap Tester (91-63998A1) between coil high voltage tower and spark plug.]

1. No spark or weak spark. **COIL** is bad.
2. Spark is OK, proceed with **Step 1-C.**

1-C) If Step 1-A and 1-B check OK, replace spark plugs.

If problem exists after replacing spark plugs, proceed with **Step 1-D.**

1-D) If Steps 1-A, 1-B, and 1-C check OK, check ignition timing.

1. If ignition timing **does not** check to specification (or a sudden or unexplained timing change occurs) check trigger advance linkage for loose and/or broken parts and check trigger magnet ring (on flywheel hub) for looseness and/or a shift in position.
2. If ignition checks to specification and engine does not run or runs poorly, **trouble exists with fuel system or engine mechanical.**

2-A) Check switch box "stop" circuit. (See Test Chart).

1. If reading is **BELOW** specifications, proceed with **Step 2-B.**
2. If reading is **ABOVE** specifications, the **Trigger** or **Switch Box** is bad (test trigger as outlined in this service manual section; if trigger checks OK, replace switch box and repeat check).
3. If reading is **WITHIN** specifications, proceed with **Step 3-A.**

2-B) Check ignition switch/wiring, as follows:

⚠ CAUTION

To prevent engine from starting, remove spark plug leads from ALL spark plugs and ground leads to engine.

1. Disconnect **ignition switch and stop switch** leads from switch box and isolate the leads.
2. Repeat check in **Step 2-A.**
3. If reading is still **BELOW** specification, proceed with **Step 3-A.**
4. If reading is **WITHIN** specification, **either the ignition switch, stop switch,** or **wiring** is bad.

3-A) Check stator low speed and high speed input to switch box. (See Test Chart).

1. If either the low speed or high speed reading to switch box is **BELOW** specification, **Stator** or **Switch Box** is bad (test stator as outlined in this service manual section; if stator checks to specification replace switch box and repeat check).
2. If both the low speed and high speed reading are **WITHIN** specification, replace switch box and repeat test.

Ignition System Test Chart

IMPORTANT: BEFORE attempting the ignition system checks, following, thoroughly read the preceding pages of these instructions to become familiar with the proper Automatic Distributorless Ignition (ADI) test sequence and procedures (particularly any "Safety Warnings" and "Cautions"). ALL tests are performed with lead wires connected – terminals exposed. SWITCH BOX MUST BE GROUNDED (CASE TO ENGINE BLOCK) FOR ALL TESTS – IF NOT, SWITCH BOXES MAY BE DAMAGED.

3 Cylinder Stators – 398-9710A13/14/28 and all 398-8778A– Stators
4 Cylinder Stators – 398-9710A15/31 and all 398-8778A– Stators

ADI Test Seq.	Test	Selector Sw. Position	DVA Leads Red	DVA Leads Black	Voltage Reading (1) @ 300-1000 RPM	Voltage Reading @ 1000-4000 RPM
1-A	Coil Primary	400 VDC*	Coil (+) Terminal	Coil (–) Terminal	150-250	180-280
2-A	Sw. Box – Stop Circuit	400 VDC*	Black/Yellow (3) Sw. Box Terminal	Ground	200-360	200-360
3-A 4-A	Stator – Low Speed	400 VDC*	Blue Sw. Box Terminal	Ground	200-300	200-330
3-A 4-A	Stator – High Speed	400 VDC*	Red Sw. Box Terminal	Ground	20-90	130-300
5-A	Sw. Box – Bias	20 VDC or 40 VDC	[See Note (1)] Ground	White/Black Sw. Box Terminal	2-10	10-30

(1) Using meter only, REVERSE LEAD POLARITY; connect leads as specified.
* If using a meter with a built-in DVA, place selector switch in the DVA/400 VDC position.

3 Cylinder Stator – 9 Ampere 398-9873A21 & 15 Ampere 398-9873A24

ADI Test Seq.	Test	Selector Sw. Position	DVA Leads Red	DVA Leads Black	Voltage Reading (1) @ 300-1000 RPM	Voltage Reading @ 1000-4000 RPM
1-A	Coil Primary	400 VDC*	Coil (+) Terminal	Coil (–) Terminal	145-250	210-240
2-A	Sw. Box – Stop Circuit	400 VDC*	Black/Yellow (3) Sw. Box Terminal	Ground	215-340	280-320
3-A 4-A	Stator – Low Speed	400 VDC*	Blue Sw. Box Terminal	Ground	215-340	280-320
3-A 4-A	Stator – High Speed	400 VDC*	Red Sw. Box Terminal	Ground	10-55	45-255
5-A	Sw. Box – Bias	20 VDC or 40 VDC	[See Note (1)] Ground	White/Black Sw. Box Terminal	2-30	10-30

(1) Using meter only, REVERSE LEAD POLARITY; connect leads as specified.
* If using a meter with a built-in DVA, place selector switch in the DVA/400 VDC position.

4 Cylinder Stator – 16 Ampere 398-9710A33

ADI Test Seq.	Test	Selector Sw. Position	DVA Leads Red	DVA Leads Black	Voltage Reading (1) @ 300-1000 RPM	Voltage Reading @ 1000-4000 RPM
1-A	Coil Primary	400 VDC*	Coil (+) Terminal	Coil (–) Terminal	110-300	215-265
2-A	Sw. Box – Stop Circuit	400 VDC*	Black/Yellow (3) Sw. Box Terminal	Ground	160-385	270-330
3-A 4-A	Stator – Low Speed	400 VDC*	Blue Sw. Box Terminal	Ground	160-385	270-330
3-A 4-A	Stator – High Speed	400 VDC*	Red Sw. Box Terminal	Ground	8-33	33-205
5-A	Sw. Box – Bias	20 VDC or 40 VDC	[See Note (1)] Ground	White/Black Sw. Box Terminal	2-30	10-30

(1) Using meter only, REVERSE LEAD POLARITY; connect leads as specified.
* If using a meter with a built-in DVA, place selector switch in the DVA/400 VDC position.

⚠ WARNING

When testing or servicing the ignition system, high voltage is present, be extremely cautious! DO NOT TOUCH OR DISCONNECT any ignition parts while engine is running, while key switch is on, or while battery cables are connected.

⚠ CAUTION

Failure to comply with the following items may result in damage to the ignition system.

1. **DO NOT reverse battery cable connections. The battery negative cable is (-) ground.**
2. **DO NOT “spark” battery terminals with battery cable connections to check polarity.**
3. **DO NOT disconnect battery cables while engine is running.**
4. **DO NOT crank engine when switch box is not grounded to engine.**

A process of elimination must be used when checking the ignition system without a Multi-Meter/DVA Tester (91-99750) or a voltmeter (capable of measuring 400 volts DC, or higher) and Direct Voltage Adaptor (91-89045), as the switch box and ignition coils cannot be thoroughly checked with conventional test equipment.

All other components can be tested with an ohmmeter. Before troubleshooting the ignition system, check the following:

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

STATOR TEST

NOTE: Stator can be tested without removing from engine.

1. Disconnect stator leads from switch box.
2. Use an ohmmeter and perform the following tests.

IMPORTANT: If stator is mounted on engine, black stator lead must be grounded to powerhead when testing.

9/18/24 AMPERE STATORS (3 CYLINDER)

Test Leads	Resistance (OHMS)	Scale Reading (x_________)
Between Blue Stator Lead and Red Stator Lead (Low Speed)	3600-4200 (90-140)	3.6-4.2 (R x 1000)
Between Red Stator Lead and Engine Ground* (Hi-Speed)	90-140	90-140 (R x 1)

9/18/24 AMPERE STATORS (4 CYLINDER)

Test Leads	Resistance (OHMS)	Scale Reading (x_________)
Between Blue Stator Lead and Blue/White Stator Lead (Low Speed)	6800-7600 (90-140)	6.8-7.6 (R x 1000)
Between Red Stator Lead and Red/White Stator Lead* (Hi-Speed)	90-140	90-140 (R x 1)

* Connect test lead to black stator lead if stator is removed from engine.

NOTE: Above readings are for a cold engine (room temperature). Resistance will increase slightly, if engine is warm.

3. If meter readings are other than specified, replace stator assembly.

IGNITION COIL TEST

IMPORTANT: Ohmmeter tests can only detect certain faults in the ignition coil. Replace ignition coil, if ohmmeter readings (listed in chart, following) are not as specified. If coil tests OK, and coil is still suspected of being faulty, use Multi-Meter/ DVA Tester (91-99750) or a voltmeter (capable of measuring 400 volts DC, or higher) and Direct Voltage Adaptor (91-89045) to thoroughly check coil.

1. Disconnect wires from coil terminals.
2. Pull spark plug lead out of coil tower.
3. Use an ohmmeter and perform the following tests.

Test Leads	Resistance (OHMS)	Scale Reading (x__________)
Between (+) and (–) Coil Terminals	.02-.04*	.02-.04* (R x 1)
Between Coil Tower and (–) Coil Terminal	800-1100**	8-11** (R x 100)

* The primary DC resistance of these coils generally is less than one (1) OHM. If a reading resembling a short is obtained, this would be acceptable.

** Copper wire is an excellent conductor, but it will have a noticeable difference in resistance from cold to hot temperatures. Reasonable variations from these readings are acceptable.

4. If meter readings are not as specified, replace ignition coil.

TRIGGER TEST (3 CYLINDER)

1. Disconnect all trigger leads from switch box.
2. Use an Ohmmeter and perform the following tests.

Test Leads	Resistance (OHMS)	Scale Reading (x__________)
Between Brown Trigger Lead and White/Black Trigger Lead	1100-1400	11-14 (R x 100)
Between White Trigger Lead and White/Black Trigger Lead	1100-1400	11-14 (R x 100)
Between Violet Trigger Lead and White/Black Trigger Lead	1100-1400	11-14 (R x 100)

NOTE: Above readings are for a cold engine (room temperature). Resistance will increase slightly, if engine is warm.

3. If meter readings are not as specified, replace trigger.

TRIGGER TEST (4 CYLINDER)

1. Disconnect all trigger leads from switch box.
2. Use an Ohmmeter and perform the following tests.

Test Leads	Resistance (OHMS)	Scale Reading (x__________)
Between Brown Trigger Lead and Black Trigger Lead	700-1000	7-10 (R x 100)
Between White Trigger Lead and Violet Trigger Lead	700-1000	7-10 (R x 100)

NOTE: Above readings are for a cold engine (room temperature). Resistance will increase slightly, if engine is warm.

3. If meter readings are not as specified, replace trigger.

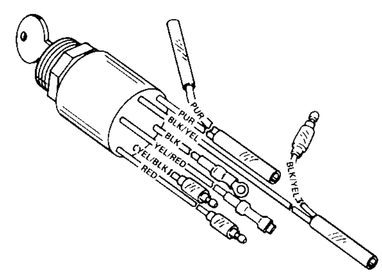
IGNITION (KEY) SWITCH TEST

1. Disconnect remote control wiring harness and instrument panel connector.

NOTE: Wiring diagram for control boxes is located in SECTION 2D.

2. Set ohmmeter on R x 1 scale for the following tests:

COMMANDER 2000 KEY SWITCH



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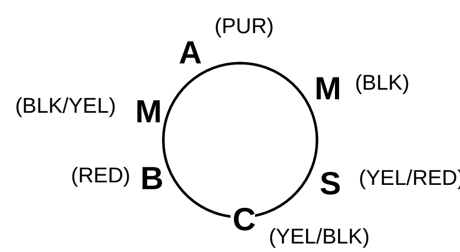
COMMANDER KEY SWITCH

BLK ● BLACK
PUR ● PURPLE
RED ● RED
YEL ● YELLOW



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 continuity test.

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

Ignition Components Removal and Installation

Flywheel

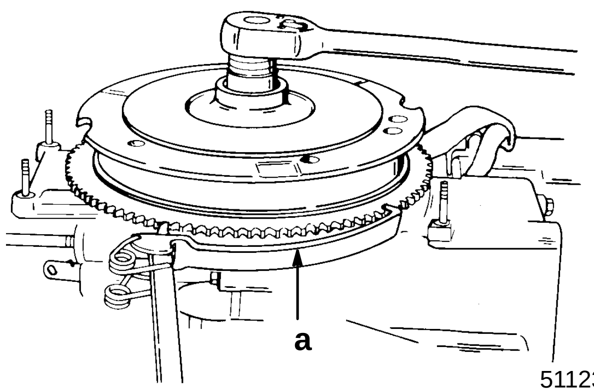
REMOVAL

1. Remove flywheel cover from engine.

⚠ WARNING

Engine could possibly start when turning flywheel during removal and installation; therefore, disconnect (and isolate) spark plug leads from spark plugs to prevent engine from starting.

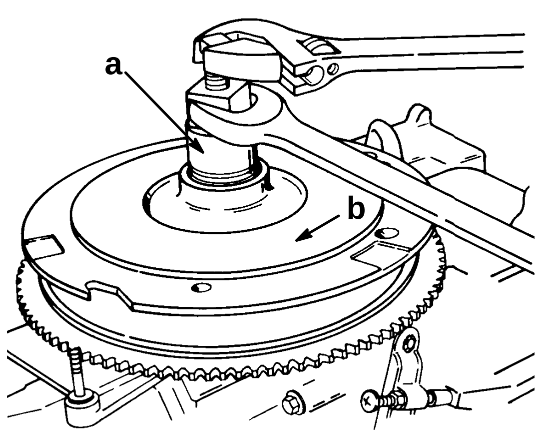
2. Disconnect spark plug leads from spark plugs.
3. While holding flywheel with Flywheel Holder (91-52344), remove flywheel nut and washer.



a - Flywheel Holder (91-52344)

4. Install Crankshaft Protector Cap (91-24161) on the end of crankshaft, then install Flywheel Puller (91-73687A1) into flywheel.
5. Remove flywheel.

NOTE: Neither heat or hammer should be used on flywheel to aid in removal as damage to flywheel or electrical components under flywheel may result.



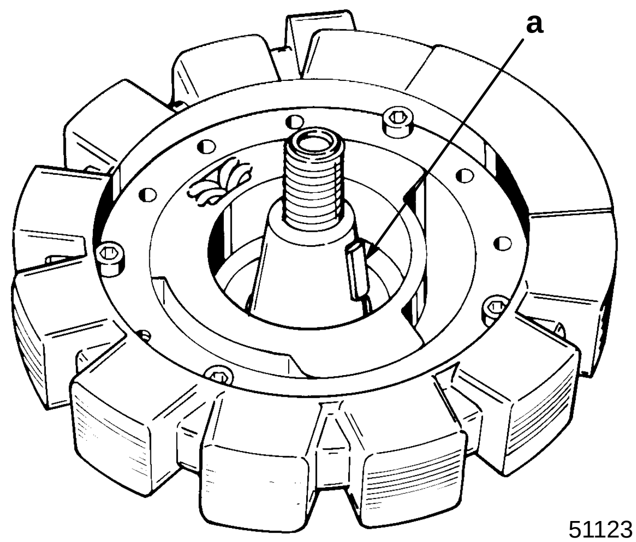
a - Flywheel Puller
b - Flywheel

INSTALLATION

⚠ WARNING

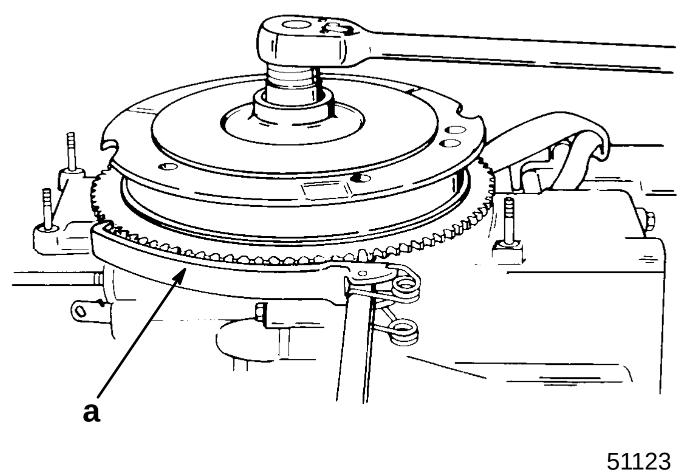
Engine could possibly start when turning flywheel during installation; therefore, disconnect (and isolate) spark plug leads from spark plugs to prevent engine from starting.

1. Disconnect spark plug leads from spark plugs.
2. Place flywheel key into slot in crankshaft.



a - Flywheel Key

3. Align slot in flywheel center bore with flywheel key and install flywheel onto crankshaft.
4. Install washer and locknut.
5. Hold flywheel with Flywheel Holder (91-52344); torque locknut to 120 lb. ft. (162.7 N·m).



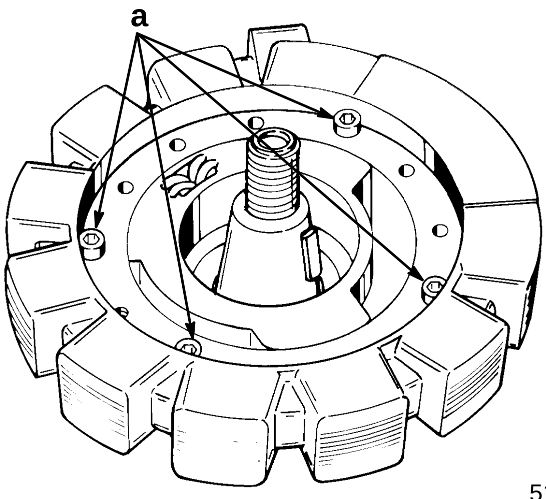
a - Flywheel Holder (91-52344)

6. Install flywheel cover.

Stator

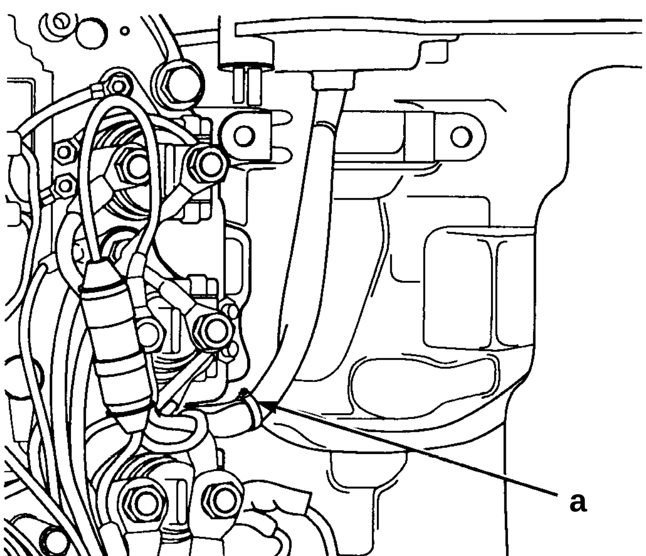
REMOVAL

1. Remove flywheel; refer to “Flywheel Removal.”
2. Remove screws.



a - Screws

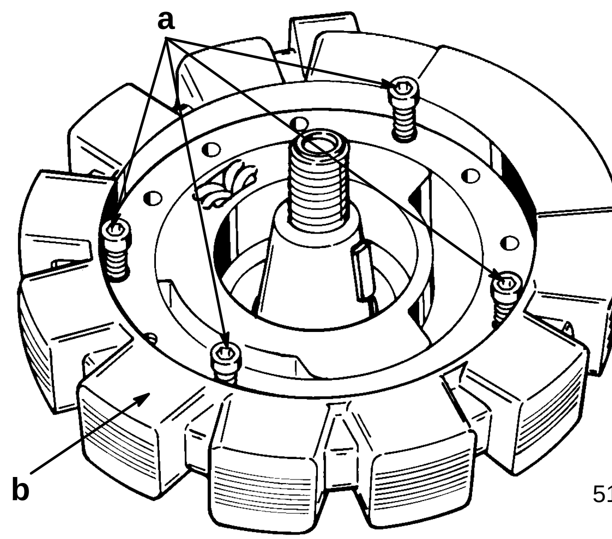
3. Remove starter motor as outlined in Section 2B.
4. Remove sta-strap.
5. Disconnect stator leads from switch box and remove stator.



a - Sta-Strap

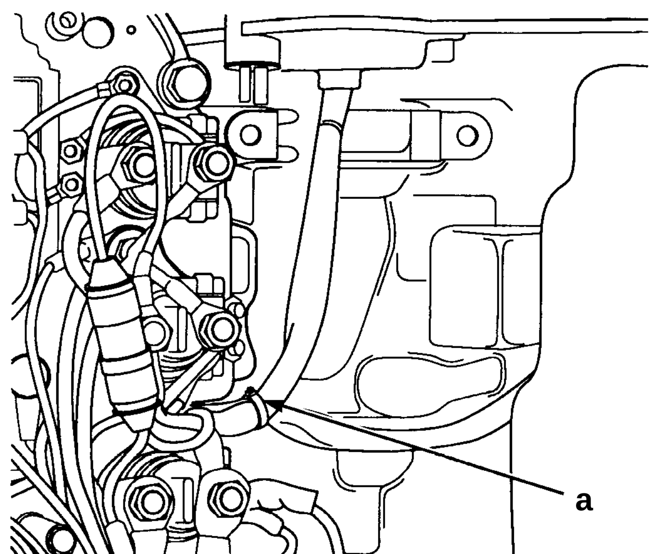
INSTALLATION

1. Install stator as shown.



a - Screws; apply Loctite Grade “A” on threads (unless Patch Screw used) and torque to 60 lbs. in. (6.6 N·m)
b - Stator

2. Connect stator leads; refer to wiring diagrams in Section 2D.
3. Install sta-strap.
4. Install starter motor; refer to Section 2B.



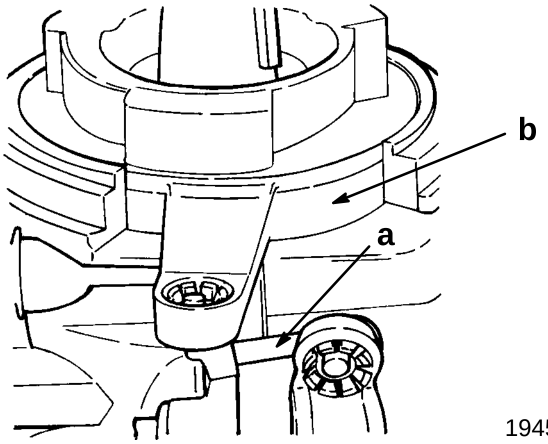
a - Sta-Strap

5. Install flywheel; refer to “Flywheel Installation”, preceding.

Trigger

REMOVAL

1. Remove flywheel and stator; refer to "Flywheel" and "Stator" removal, preceding.
2. Disconnect link arm and remove trigger.



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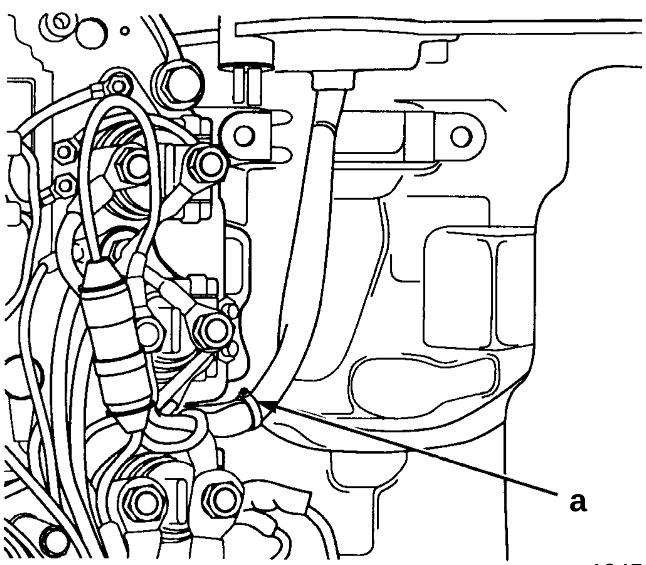
a - Link Arm
b - Trigger

3. Remove starter motor; refer to Section 2B.
4. Remove sta-strap.
5. Disconnect trigger leads from switch box and remove trigger.



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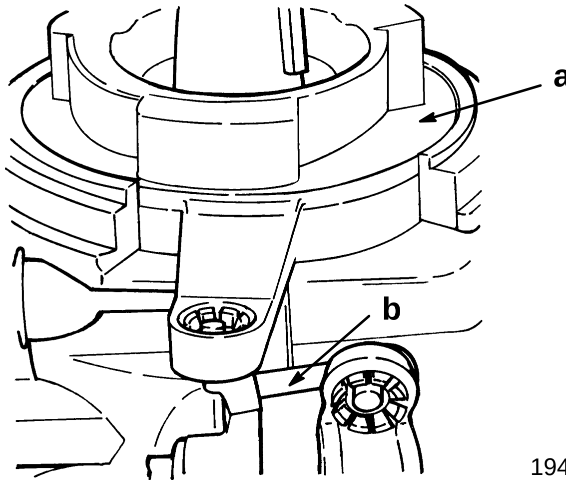
a - Sta-strap

INSTALLATION

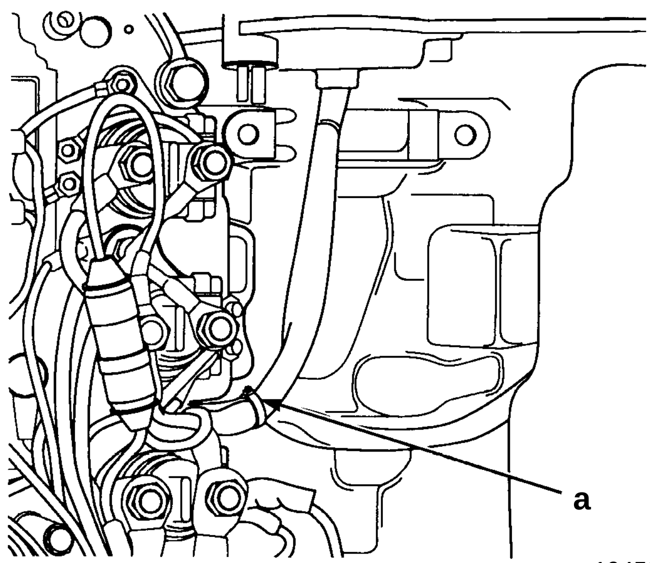
1. Install trigger and connect link arm.



19459

a - Trigger
b - Link Arm

2. Connect trigger leads to switch box; refer to wiring diagrams in Section 2D.
3. Install sta-strap.
4. Install starter motor; refer to Section 2B.



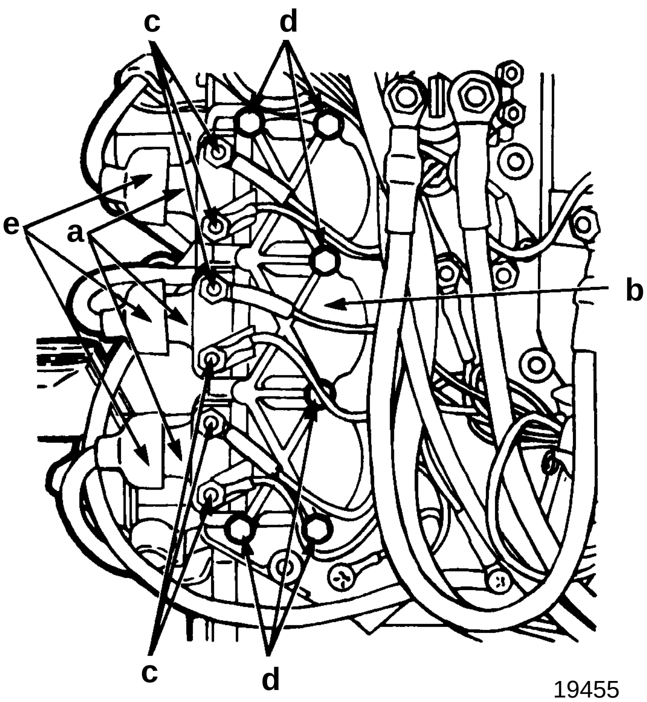
19453

a - Sta-strap

5. Install stator; refer to "Stator Installation," preceding.
6. Install flywheel; refer to "Flywheel Installation," preceding.

Ignition Coils (3 Cylinder Models)

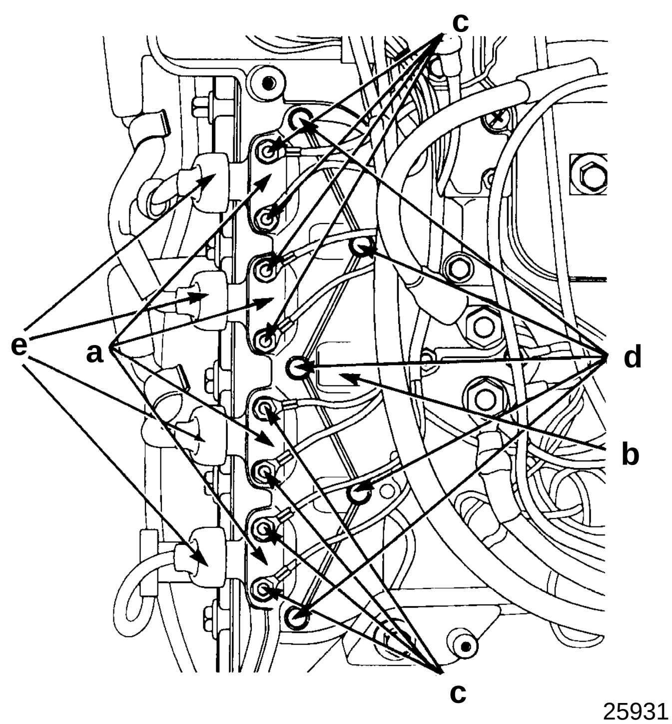
1. Refer to wiring diagrams in Section 2D when connecting wires.



a - Coils
b - Cover
c - Hex Nuts; Torque to 30 lb. in. (3.4 N·m),coat with Quicksilver Liquid Neoprene
d - Bolts; torque to 20 lb. in. (2.3 N·m)
e - Coil Tower Boots; form a water tight seal between coil tower and spark plug lead using Quicksilver Insulating Compound

Ignition Coils (4 Cylinder Models)

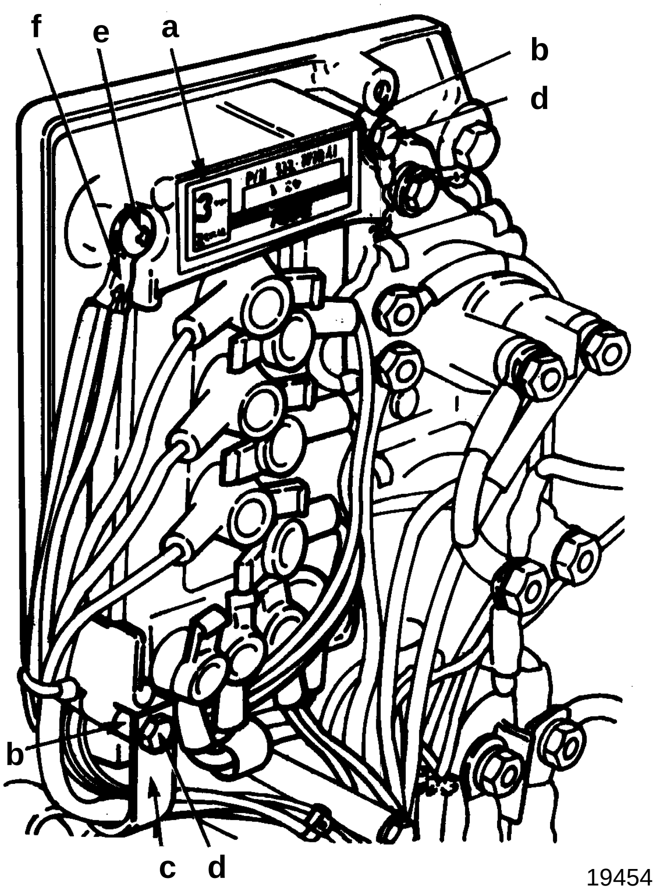
1. Refer to wiring diagrams in Section 2D when connecting wires.



a - Coils
b - Cover
c - Hex Nuts; Torque to 30 lb. in. (3.4 N·m), coat with Quicksilver Liquid Neoprene
d - Bolts; torque to 20 lb. in. (2.3 N·m)
e - Coil Tower Boots; form a water tight seal between coil tower and spark plug lead using Quicksilver Insulating Compound

Switch Box

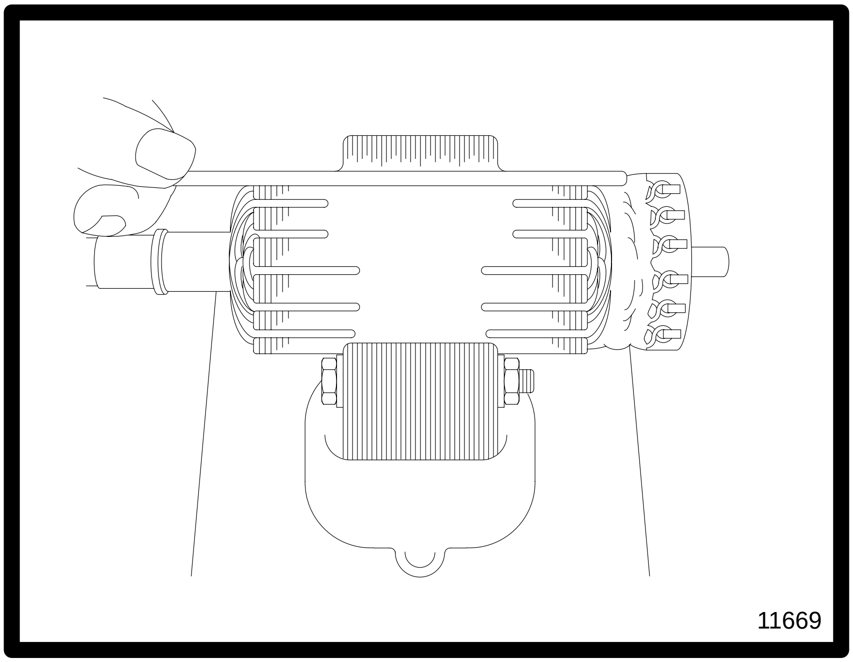
1. Refer to wiring diagrams in Section 2D when connecting wires.



19454

a - Switch Box
b - Bushings
c - J-Clip
d - Bolt [Torque to 40 lb. in. (4.5 N·m)]
e - Screw (Secure coil ground wires under screw)
f - Coil Ground Wires (BLACK)

ELECTRICAL AND IGNITION



2

B

BATTERY, CHARGING SYSTEM, AND STARTING SYSTEM

Table of Contents

Battery

Precautions

When charging batteries, an explosive gas mixture forms in each cell. A portion of this gas escapes thru 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.

Recommended Battery

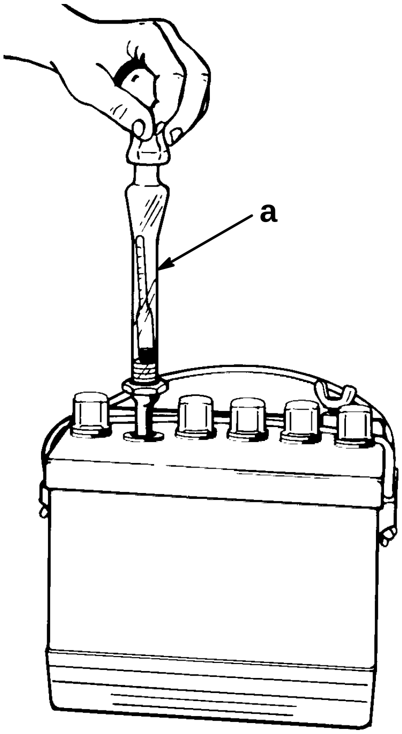
The 2-cycle Outboard type engine requires a 12 volt battery with a “Cold Cranking Amperage” rating for cranking and a “Reserve Capacity” rating. The minimum should be a “Cold Cranking Amperage” of 350 amperes and a “Reserve Capacity” of 100 minutes for engines outlined in this manual.

Operating Engine Without Battery

If desired (or in an emergency), engines equipped with an alternator can be started and operated without a battery (either disconnected or removed) if “Warning”, below, is followed.

Specific Gravity Readings

Use a hydrometer to measure specific gravity of electrolyte in each cell.



22532

a - Hydrometer

Hydrometer measures percentage of sulphuric acid in battery electrolyte in terms of specific gravity. As a battery drops from a charged to a discharged condition, acid leaves the solution and chemically combines with the plates, causing a decrease in specific gravity of electrolyte. An indication of concentration of electrolyte is obtained with a hydrometer.

When using a hydrometer, observe the following points:

1. Hydrometer must be clean (inside and out) to insure an accurate reading.
2. Never take hydrometer readings immediately after water has been added. Water must be thoroughly mixed with electrolyte by charging for at least 15 minutes at a rate high enough to cause vigorous gassing.
3. If hydrometer has built-in thermometer, draw liquid in several times to ensure correct temperature before taking reading.
4. Hold hydrometer vertically and draw in just enough liquid from battery cell so that float is free-floating. Hold hydrometer at eye level so that float is vertical and free of outer tube, then take reading at surface of liquid. Disregard curvature where liquid rises against float stem due to capillary action.
5. Avoid dropping electrolyte on boat or clothing, as it is extremely corrosive. Wash off immediately with baking soda solution.

Specific gravity of electrolyte varies not only with percentage of acid in liquid but also with temperature. As temperature drops, electrolyte contracts, so that specific gravity increases. Unless these variations in specific gravity are taken into account, specific gravity obtained by hydrometer may not give a true indication of concentration of acid in electrolyte.

A fully charged battery will have a specific gravity reading of approximately 1.270 at an electrolyte temperature of 80° F (27° C). If electrolyte temperature is above or below 80° F, additions or subtractions must be made in order to obtain a hydrometer reading corrected to 80° F standard. For every 10° F (3.3° C) above 80° F, add 4 specific gravity points (.004) to hydrometer reading. Example: A hydrometer reading of 1.260 at 110° F (43° C) would be 1.272 corrected to 80° F, indicating a fully charged battery.

For every 10° below 80° F, subtract 4 points (.004) from the reading. Example: A hydrometer reading of 1.272 at 0° F (–18° C) would be 1.240 corrected to 80° F, indicating a partially charged battery.

SPECIFIC GRAVITY CELL COMPARISON TEST

This test may be used when an instrumental tester is not available. To perform this test, measure specific gravity of each cell, regardless of state of charge, and interpret results as follows: If specific gravity readings show a difference between highest and lowest cell of .050 (50 points) or more, battery is defective and should be replaced.

Electrolyte Level

Check electrolyte level in battery regularly. A battery in use in hot weather should be checked more frequently because of more rapid loss of water. If electrolyte level is found to be low, then distilled water should be added to each cell until liquid level rises approximately 3/16″ (4.8mm) over plate. DO NOT OVERFILL, because this will cause loss of electrolyte and result in poor performance, short life and excessive corrosion.

Charging a Discharged Battery

The following basic rules apply to any battery charging situation:

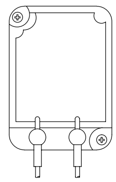
1. Any battery may be charged at any rate (in amperes) as long as spilling of electrolyte (from violent gassing) does not occur and as long as electrolyte temperature does not exceed 125° F (52° C). If spewing of electrolyte occurs, or if electrolyte temperature exceeds 125° F, charging rate (in amperes) must be reduced or temporarily halted to avoid damage to the battery.
2. Battery is fully charged when, over a 2-hour period at a low charging rate (in amperes), all cells are gassing freely (not spewing liquid electrolyte), and no change in specific gravity occurs. Full charge specific gravity is 1.260-1.275, corrected for electrolyte temperature with electrolyte level at 3/16″ (4.8mm) over plate. For most satisfactory charging, lower charging rates in amperes are recommended.
3. If, after prolonged charging, specific gravity of at least 1.230 on all cells cannot be reached, battery is not in optimum condition and will not provide optimum performance; however, it may continue to provide additional service, if it has performed satisfactorily in the past.
4. To check battery voltage while cranking engine with electric starter motor, place red (+) lead of tester on positive (+) battery terminal and black (–) lead of tester on negative (–) battery terminal. If the voltage drops below 9-1/2 volts while cranking, the battery is weak and should be recharged or replaced.

Winter Storage of Batteries

Battery companies are not responsible for battery damage, either in winter storage or in dealer stock, if the following instructions are not observed:

1. Remove battery from its installation as soon as possible and remove all grease, sulfate and dirt from top surface by running water over top of battery. Be sure, however, that vent caps are tight beforehand, and blow off all excess water thoroughly with compressed air. Check water level, making sure that plates are covered.
2. When adding distilled water to battery, be extremely careful not to fill more than 3/16″ (4.8mm) over plate inside battery. Battery solution or electrolyte expands from heat caused by charging. Overfilling battery will cause electrolyte to overflow (if filled beyond 3/16″ over plate).
3. Grease terminal bolts well with Quicksilver 2-4-C w/teflon, and store battery in COOL-DRY place. Remove battery from storage every 30-45 days, check water level (add water if necessary), and put on charge for 5 or 6 hours at 6 amperes. DO NOT FAST CHARGE.
4. If specific gravity drops below 1.240, check battery for reason, and then recharge. When gravity reaches 1.260, discontinue charging. To check specific gravity, use a hydrometer, which can be purchased locally.
5. Repeat preceding charging procedure every 30-45 days, as long as battery is in storage. When ready to place battery back in service, remove excess grease from terminals (a small amount is desirable on terminals at all times), recharge again as necessary and reinstall battery.

Optional Voltage Regulator Test



1. Check battery voltage at battery with engine running.
2. If battery voltage is above 14.5 volts, replace voltage regulator. Check condition of battery as over-charging may have damaged battery.
3. If battery voltage is below 14.5 volts, charge battery; refer to “Charging a Discharged Battery”, preceding. If battery can NOT be satisfactorily charged, replace battery.
4. If battery accepts a satisfactory charge, check battery voltage while cranking engine; refer to “Charging a Discharged Battery”, preceding. If cranking voltage is not acceptable, replace battery.
5. If cranking voltage is acceptable, disconnect end of RED wire (located between rectifier (+) terminal and starter solenoid) from rectifier. Secure RED wire (from voltage regulator) to rectifier (+) terminal with hex nut.
6. Connect RED (+) ammeter lead to (+) terminal of rectifier and BLACK (–) ammeter lead to RED wire (disconnected in last step).

IMPORTANT: For accurate test results the voltage at battery with engine running, in next step, must be 13.5 volts or less. It may be necessary to operate electrical accessories to drop voltage to 13.5 volts or less.

7. Run engine at 3000 RPM.
8. Meter should read between 7 - 9 amperes.
9. If meter reads 7 - 9 amperes, this indicates the charging system is functioning properly and the battery is being discharged because the amperage draw on the system is greater than the amperage output of the system.

NOTE: With engine running at the following RPM’S, the ammeter should indicate the following approximate amperes:

RPM	AMPERES
IDLE	1
1000	4
2000	8
3000	9

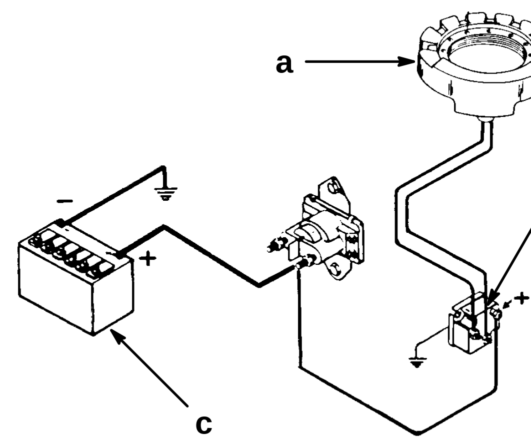
10. If the meter reads less than 7 amperes, test the stator; refer to “Standard Stator (Alternator Coils) Amperes Output”, following. If stator tests OK, replace voltage regulator.

Battery Charging System (9 Ampere Alternator)

Description

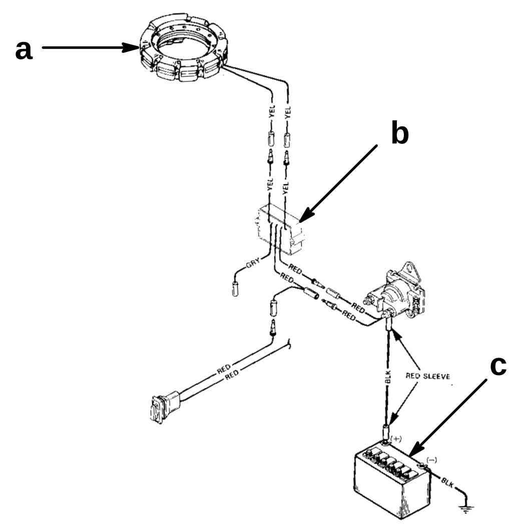
The battery charging system components are the stator, rectifier, and battery. Alternating current (generated in stator alternator coils) flows to the rectifier, which changes the alternating current to direct current for charging the battery.

MODELS EQUIPPED WITH RECTIFIER



a - Stator
b - Rectifier
c - Battery

MODELS EQUIPPED WITH REGULATOR



a - Stator
b - Regulator
c - Battery

The charging system may be damaged by: 1) reversed battery cables, 2) running the engine with battery cables disconnected and stator leads connected to rectifier, and 3) an open circuit, such as a broken wire or loose connection.

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. See “Rectifier Test”, following.
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 (from 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.

Stator Ohms Test (Alternator Coils Only)

NOTE: Stator can be tested without removing from engine.

1. Disconnect both YELLOW (stator leads) from terminals on rectifier (or terminal block).
2. Use an ohmmeter and perform the following test.

IMPORTANT: If stator is mounted on engine, black stator lead (if provided) must be grounded to powerhead when testing.

3. Replace stator if readings are outside ranges shown.

Test Leads	Resistance (Ohms)	Scale Reading (x________)
9 AMPERE STATOR		
Between YELLOW stator leads	.6 – 1.1*	.6 – 1.1* (R x 1)
Between either YELLOW stator lead and engine ground**	No Continuity	No Continuity (R x 1000)
16 AMPERE STATOR		
Between YELLOW stator leads	.17 – .19	.17 – .19 (R x 1)
Between either YELLOW stator lead and engine ground**	No Continuity	No Continuity (R x 1000)
24 AMPERE STATOR		
Between YELLOW stator leads	.05 – .15	.05 – .15 (R x 1)
Between either YELLOW stator lead and engine ground**	No Continuity	No Continuity (R x 1000)

* DC resistance of these windings generally is less than 1.5 ohms. If a reading (resembling a short) is obtained, this would be acceptable.

** If stator is removed from engine, connect test lead to black stator lead, if provided.

4. If meter readings are other than specified, replace stator.

Standard Stator (Alternator Coils) 9 Amperes Output

IMPORTANT: Rectifier must be functioning properly for accurate test results to be obtained.

1. If engine is equipped with a voltage regulator, disconnect voltage regulator leads at rectifier; reinstall hex nut on rectifier terminal that has yellow stator lead.
2. Remove red wire from (+) terminal of rectifier.
3. Connect RED (+) ammeter lead to rectifier (+) terminal and BLACK (–) ammeter lead to red rectifier wire.
4. Run engine at 3000 RPM.
5. Meter should read 7 - 9 amperes; if not, replace stator.

16 Amp Alternator System Test

(LARGE FINNED VOLTAGE REGULATOR/RECTIFIER)

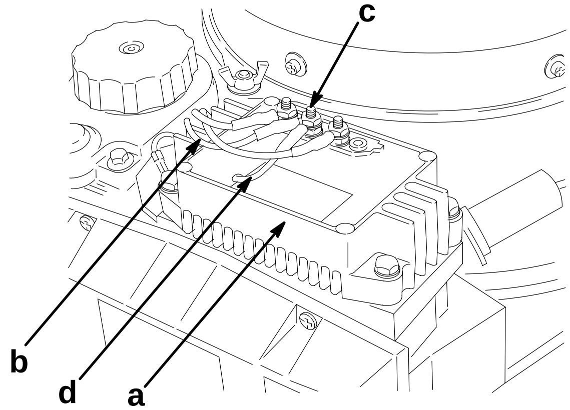
1. Check battery voltage at battery with engine running.
2. If battery voltage is above 14.5 volts, replace voltage regulator/rectifier. Check condition of battery as overcharging may have damaged battery.
3. If battery voltage is below 14.5 volts, charge battery; refer to “Charging a Discharged Battery”, preceding. If battery can NOT be satisfactorily charged, replace battery.
4. If battery accepts a satisfactory charge, check battery voltage while cranking engine; refer to “Charging a Discharged Battery”, preceding. If cranking voltage is not acceptable, replace battery.
5. If cranking voltage is acceptable, disconnect RED harness wire from center terminal.
6. Secure RED wire (d) on terminal (c) using hex nut.
7. Connect RED (+) ammeter lead to terminal (c) and BLACK (–) ammeter lead to RED harness wire (b).
8. Secure wires away from flywheel.

IMPORTANT: For accurate test results the voltage at battery with engine running, in next step, must be 13.5 volts or less. It may be necessary to operate electrical accessories to drop voltage to 13.5 volts or less.

9. With engine running at the indicated RPM’s, the ammeter should indicate the following approximate amperes:

RPM	AMPERES
IDLE	2
1000	10
2000	17
3000	18

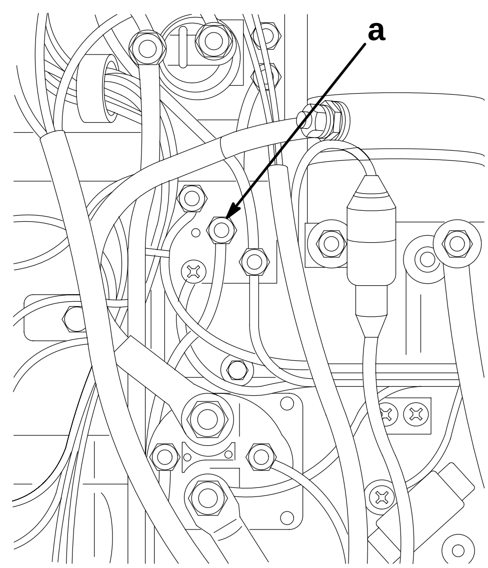
10. If ammeter indicates approximately 18 amperes at 3000 RPM, this indicates the charging system is functioning properly and the battery is being discharged because the amperage draw on the system is greater than the amperage output of the system.
11. If ammeter reads less than 18 amperes, test the stator; refer to “Stator Ohms Test (Alternator Coils Only)” [18 Ampere Stator], preceding. If stator tests OK, replace voltage regulator/rectifier.



21619

a - Voltage Regulator/Rectifier
b - RED Harness Wire
c - Center Terminal
d - RED Sense Lead

NOTE: If one or more of the 3 terminals on the terminal block are shorted to ground, the battery charging system output will be reduced.



26001

a - Terminal Block

16 Ampere Alternator System Test

(SMALL VOLTAGE REGULATOR/RECTIFIER)

1. Check battery voltage at battery with engine running.
2. If battery voltage is above 14.5 volts, replace voltage regulator/rectifier. Check condition of battery as overcharging may damage battery.
3. If battery voltage is below 14.5 volts, charge battery; refer to “Charging a Discharged Battery”, preceding. If battery can NOT be satisfactorily charged, replace battery.
4. If battery accepts a satisfactory charge, check battery voltage while cranking engine; refer to “Charging a Discharged Battery”, preceding. If cranking voltage is not acceptable, replace battery.
5. If cranking voltage is acceptable, disconnect larger diameter Red wire from STARTER SOLENOID terminal.
6. Remove smaller diameter RED wire (SENSE LEAD) from STARTER SOLENOID terminal and connect to the POSITIVE (+) terminal of a 9 VOLT transistor battery. Ground the NEGATIVE (–) terminal of the 9 VOLT battery to the engine.
7. Connect RED (+) ammeter lead to larger diameter RED wire, and BLACK (–) ammeter lead to POSITIVE terminal on STARTER SOLENOID.
8. Secure wires away from flywheel.
9. With engine running at the indicated RPM’s, the ammeter should indicate the following approximate amperes:

RPM	AMPERES
IDLE	2
1000	10
2000	17
3000	18

10. A reading of 18 amperes at 3000 RPM indicates the charging system is functioning properly. The battery is discharging due to the amperage draw on the system is greater than the amperage output of the engine charging system.
11. If ammeter reads less than 18 amperes, test the stator; refer to “Stator Ohms Test (Alternator Coils Only)”, [18 Ampere Stator], preceding. If stator tests OK, replace voltage regulator/rectifier.

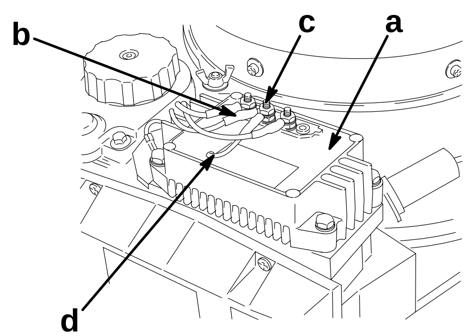
Optional 24 Amp Alternator System Test

(LARGE FINNED VOLTAGE REGULATOR/RECTIFIER)

1. Check battery voltage at battery with engine running.
2. If battery voltage is above 14.5 volts, replace voltage regulator/rectifier (a). Check condition of battery as overcharging may have damaged battery.
3. If battery voltage is below 14.5 volts, charge battery; refer to “Charging a Discharged Battery”, preceding. If battery can NOT be satisfactorily charged, replace battery.
4. If battery accepts a satisfactory charge, check battery voltage while cranking engine; refer to “Charging a Discharged Battery”, preceding. If cranking voltage is not acceptable, replace battery.
5. If cranking voltage is acceptable, disconnect RED harness wire (b) from terminal (c).
6. Secure RED wire (d) on terminal (c) using hex nut.
7. Connect RED (+) ammeter lead to terminal (c) and BLACK (–) ammeter lead to RED harness wire (b).
8. Secure wires away from flywheel.

IMPORTANT: For accurate test results the voltage at battery with engine running, in next step, must be 13.5 volts or less. It may be necessary to operate electrical accessories to drop voltage to 13.5 volts or less.

9. Run engine at 3000 RPM.
10. Meter should read 20 or more amperes.
11. If meter reads 20 or more amperes, this indicates the charging system is functioning properly and the battery is being discharged because the amperage draw on the system is greater than the amperage output of the system.
12. If meter reads less than 20 amperes, test the stator; refer to “Optional 24 Amp Stator (Alternator Coils) Amperes Output”, following. If stator tests OK, replace voltage regulator rectifier (a).



21619

Tachometer Terminal Block (Design 1)

DESCRIPTION

Contains a diode which blocks high voltage AC pulses (180 VAC) coming from the stator and allows low voltage DC pulses (20-30 VDC) to pass through to be counted by the tachometer. This terminal block (with diode) is only used with large, finned type regulators. This block is BLACK in color.

⚠ WARNING

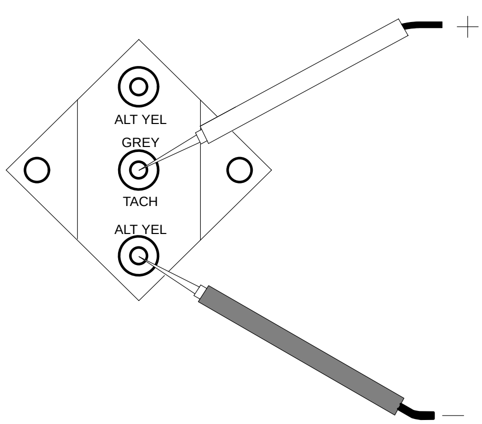
HIGH VOLTAGE is present at the tachometer block's stator side terminals, while the outboard is running. To avoid electrical shock, physical contact should not be made on these terminals or ANY IGNITION RELATED COMPONENT WHILE THE OUTBOARD IS RUNNING.

IMPORTANT: The following ohm test is used to determine the proper functioning of the diode located in the tachometer block. If the diode is OPEN (NO CONTINUITY IN EITHER DIRECTION), the tachometer will be inoperative.

TESTING TACHOMETER TERMINAL BLOCK (DESIGN 1)

With outboard NOT running, remove all leads from block. Using an ohmmeter, test block as shown, following. Continuity should be observed on the ohmmeter with the needle swinging in only ONE direction. NO CONTINUITY should be observed when test leads are reversed. If CONTINUITY is observed in BOTH directions or NO CONTINUITY is observed in either direction when leads are reversed, diode is defective and MUST BE REPLACED.

NOTE: There is only one diode located in the tachometer block. It may be located either between the center (TACH) terminal and the top (ALT) terminal or between the center (TACH) terminal and the lower (ALT) terminal.



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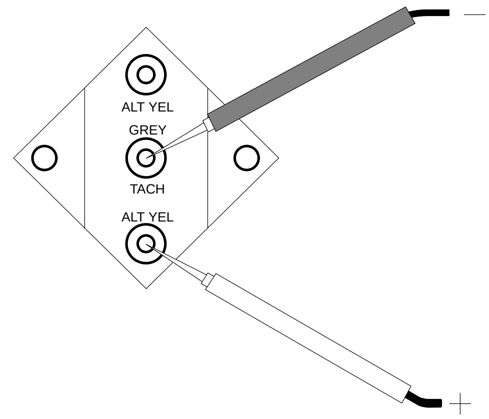

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Tachometer Terminal Block (Design 2)

DESCRIPTION

This block is a junction point for stator and tachometer signal wiring. It contains no electrical components. This block is LIGHT GREY in color and is to be used ONLY with small, non-finned voltage regulators. No test is required for this terminal block.

Tachometer Terminal Block (Design 1 and 2)

REMOVAL

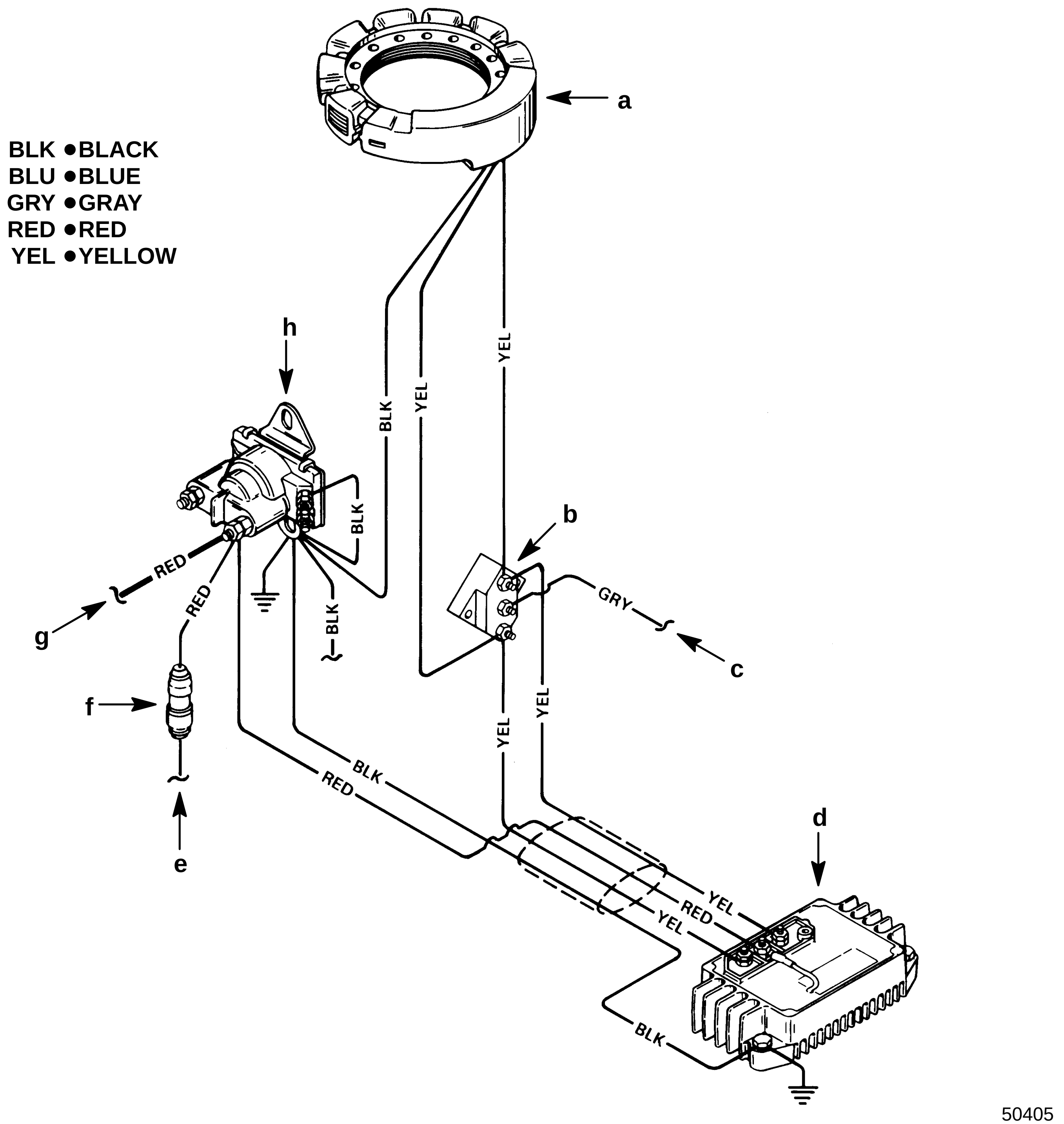
1. Remove two YELLOW alternator wires from block.
2. Remove GREY tachometer wire from block.
3. Remove two attaching screws and remove diode block.

INSTALLATION

1. Secure diode block to powerhead with two screws. Torque screws to 30 lb. in. (3.4 N·m).
2. Attach two YELLOW wires to "ALT YEL" terminals.
3. Attach GREY wire to "GREY TACH" terminal.

3 Cylinder 16 and 24 Ampere Battery Charging Wiring Diagram

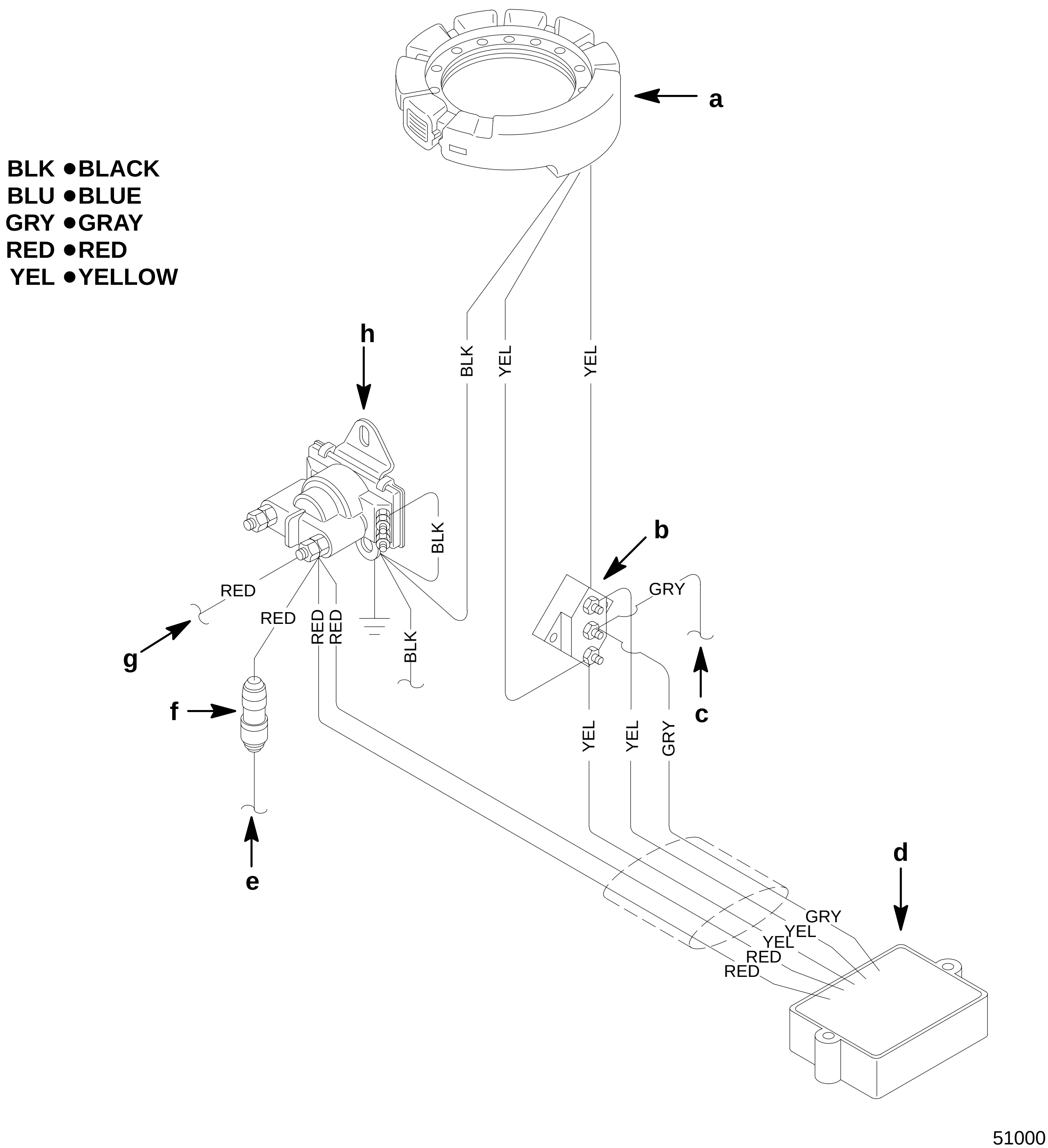
IMPORTANT: After electrical connections are made, coat all terminal connections using Quicksilver Liquid Neoprene (92-25711), to avoid corrosion.



a - Stator
b - Terminal Block
c - ToTachometer
d - Voltage Regulator/Rectifier
e - To Remote Control Harness
f - 20 Ampere Fuse
g - To Battery
h - Starter Solenoid

3 Cylinder 16 Ampere Battery Charging Wiring Diagram (with Small Voltage Regulator/Rectifier)

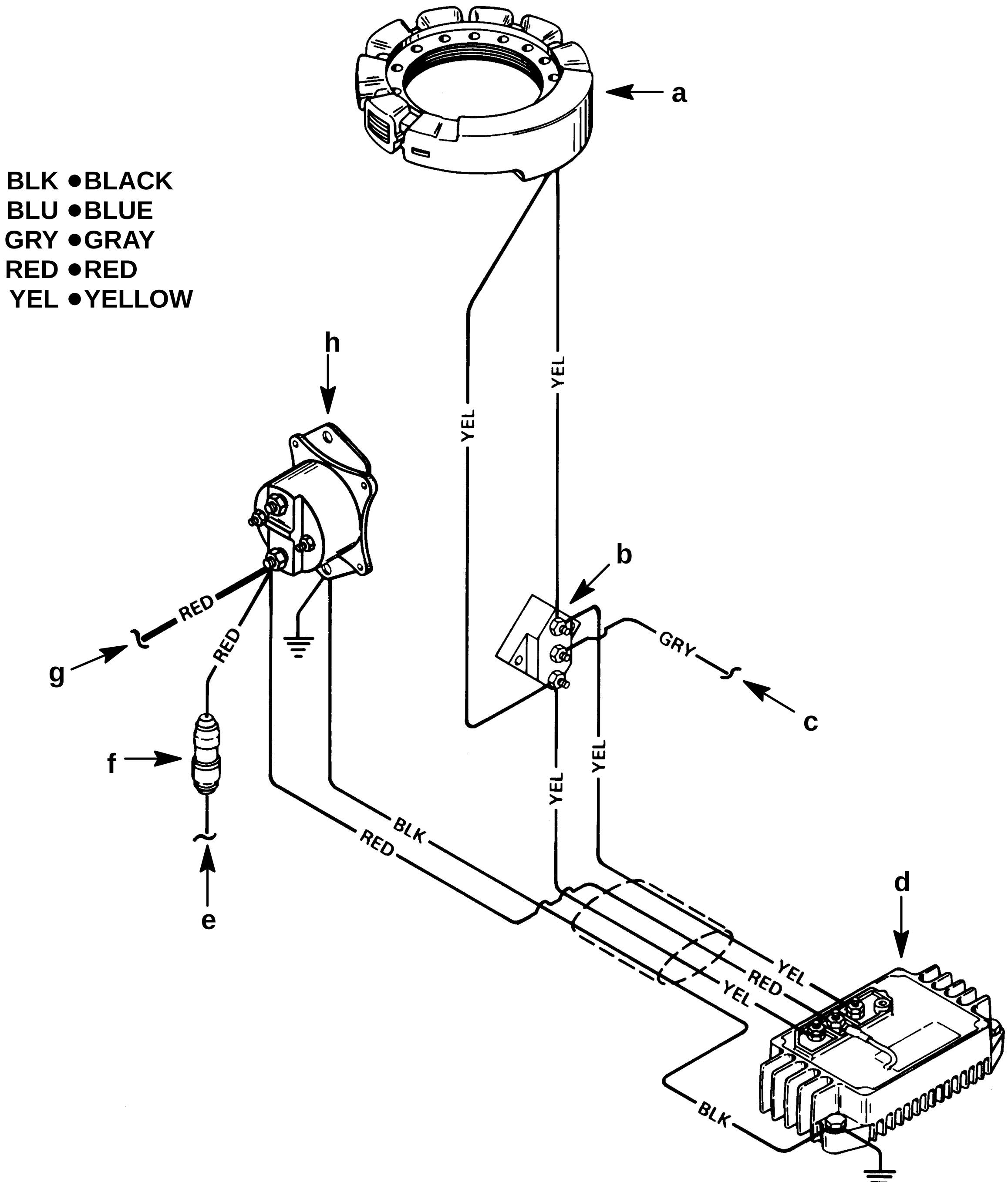
IMPORTANT: After electrical connections are made, coat all terminal connections using Quicksilver Liquid Neoprene (92-25711), to avoid corrosion.



a - Stator
b - Terminal Block
c - ToTachometer
d - Votage Regulator/Rectifier
e - To Remote Control Harness
f - 20 Ampere Fuse
g - Battery (+) Positive Terminal
h - Starter Solenoid

4 Cylinder 16 and 24 Ampere Battery Charging Wiring Diagram

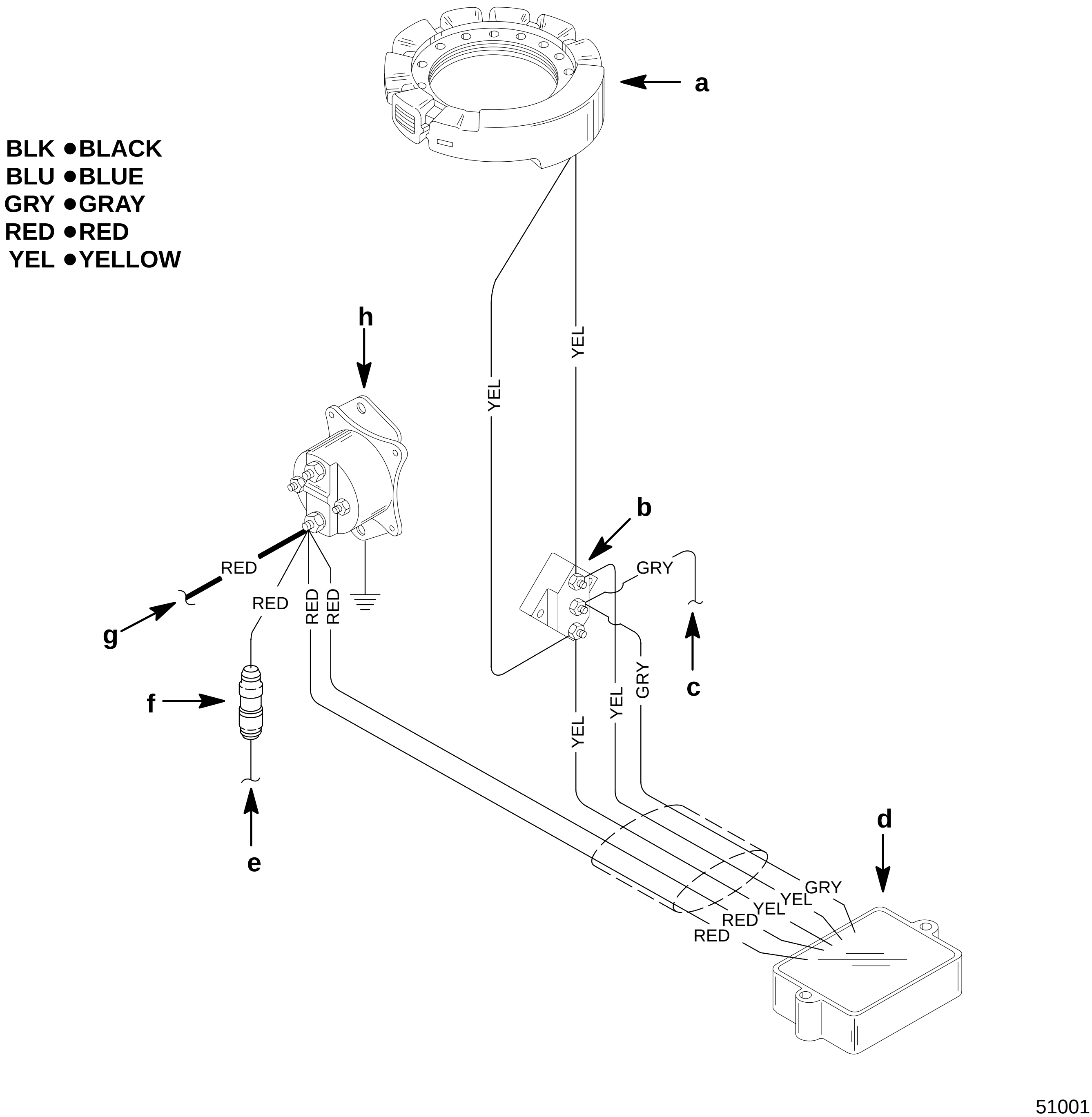
IMPORTANT: After electrical connections are made, coat all terminal connections using Quicksilver Liquid Neoprene (92-25711), to avoid corrosion.



a - Stator
b - Terminal Block
c - ToTachometer
d - Voltage Regulator/Rectifier
e - To Remote Control Harness
f - 20 Ampere Fuse
g - Battery (+) Positive Terminal
h - Starter Solenoid

4 Cylinder 16 Ampere Battery Charging Wiring Diagram (with Small Voltage Regulator/Rectifier)

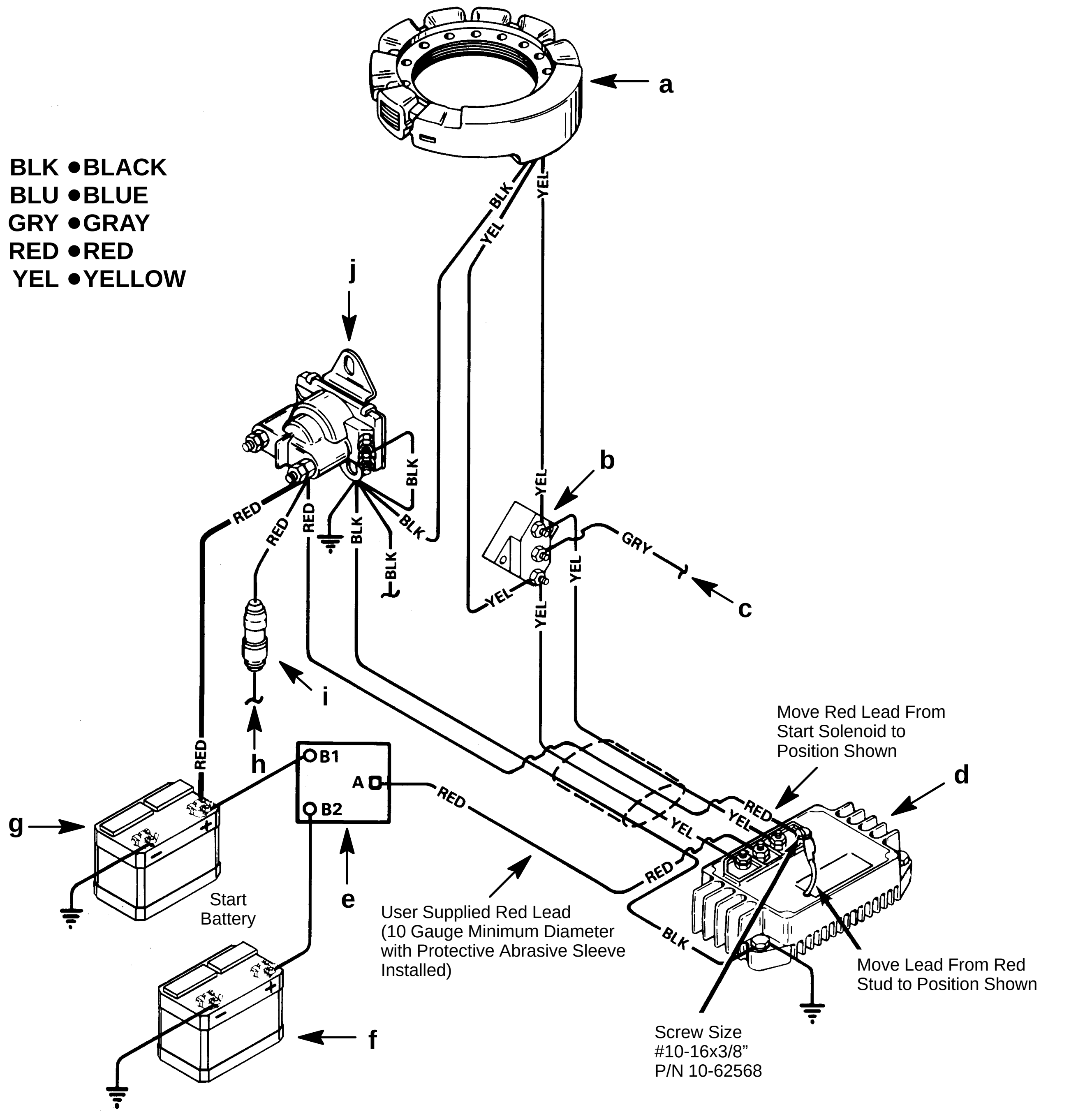
IMPORTANT: After electrical connections are made, coat all terminal connections using Quicksilver Liquid Neoprene (92-25711), to avoid corrosion.



a - Stator
b - Terminal Block
c - ToTachometer
d - Voltage Regulator/Rectifier
e - To Remote Control Harness
f - 20 Ampere Fuse
g - Battery (+) Positive Terminal
h - Starter Solenoid

3 Cylinder Battery Charging Diagram with Battery Isolator

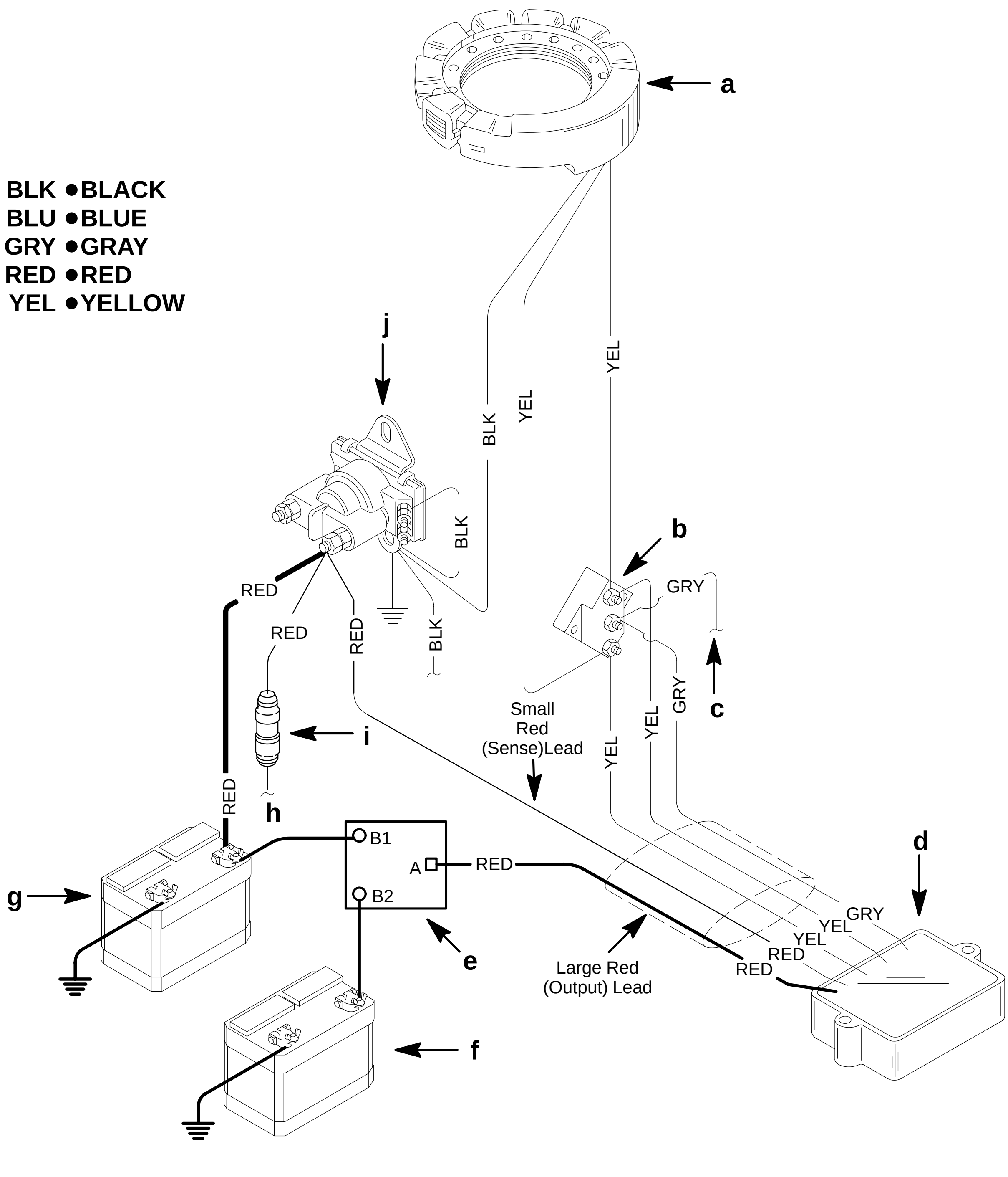
IMPORTANT: After electrical connections are made, coat all terminal connections using Quicksilver Liquid Neoprene (92-25711), to avoid corrosion.



a - Stator
b - Terminal Block
c - To Tachometer
d - Voltage Regulator/Rectifier
e - Battery Isolator
f - Auxiliary Battery
g - Start Battery
h - To Remote Control Harness
i - 20 Ampere Fuse
j - Starter Solenoid

3 Cylinder Battery Charging Diagram with Battery Isolator (Small Voltage Regulator)

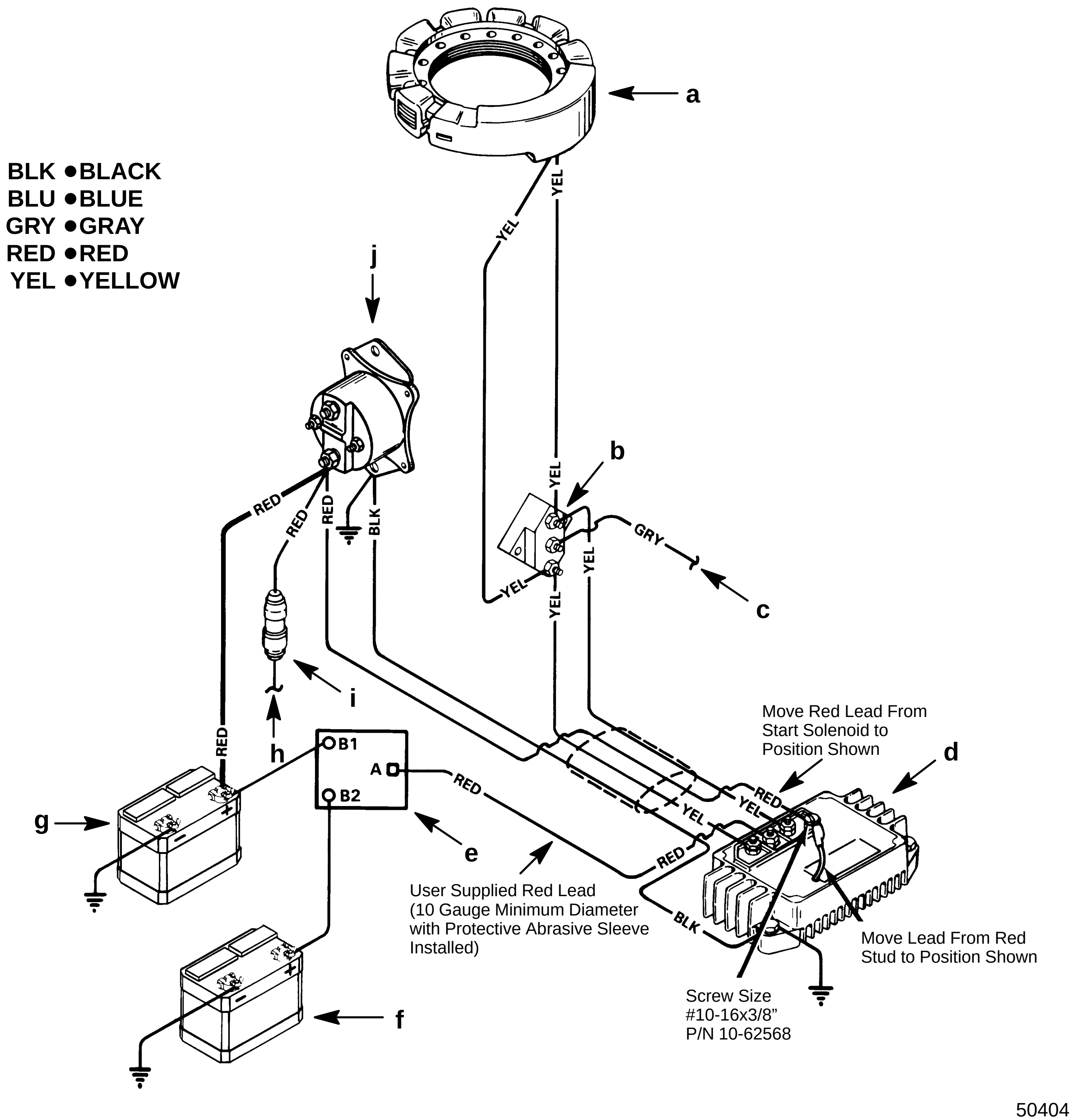
IMPORTANT: After electrical connections are made, coat all terminal connections using Quicksilver Liquid Neoprene (92-25711), to avoid corrosion.



a - Stator
b - Terminal Block
c - To Tachometer
d - Voltage Regulator/Rectifier
e - Battery Isolator
f - Auxiliary Battery
g - Start Battery
h - To Remote Control Harness
i - 20 Ampere Fuse
j - Starter Solenoid

4 Cylinder Battery Charging Diagram with Battery Isolator

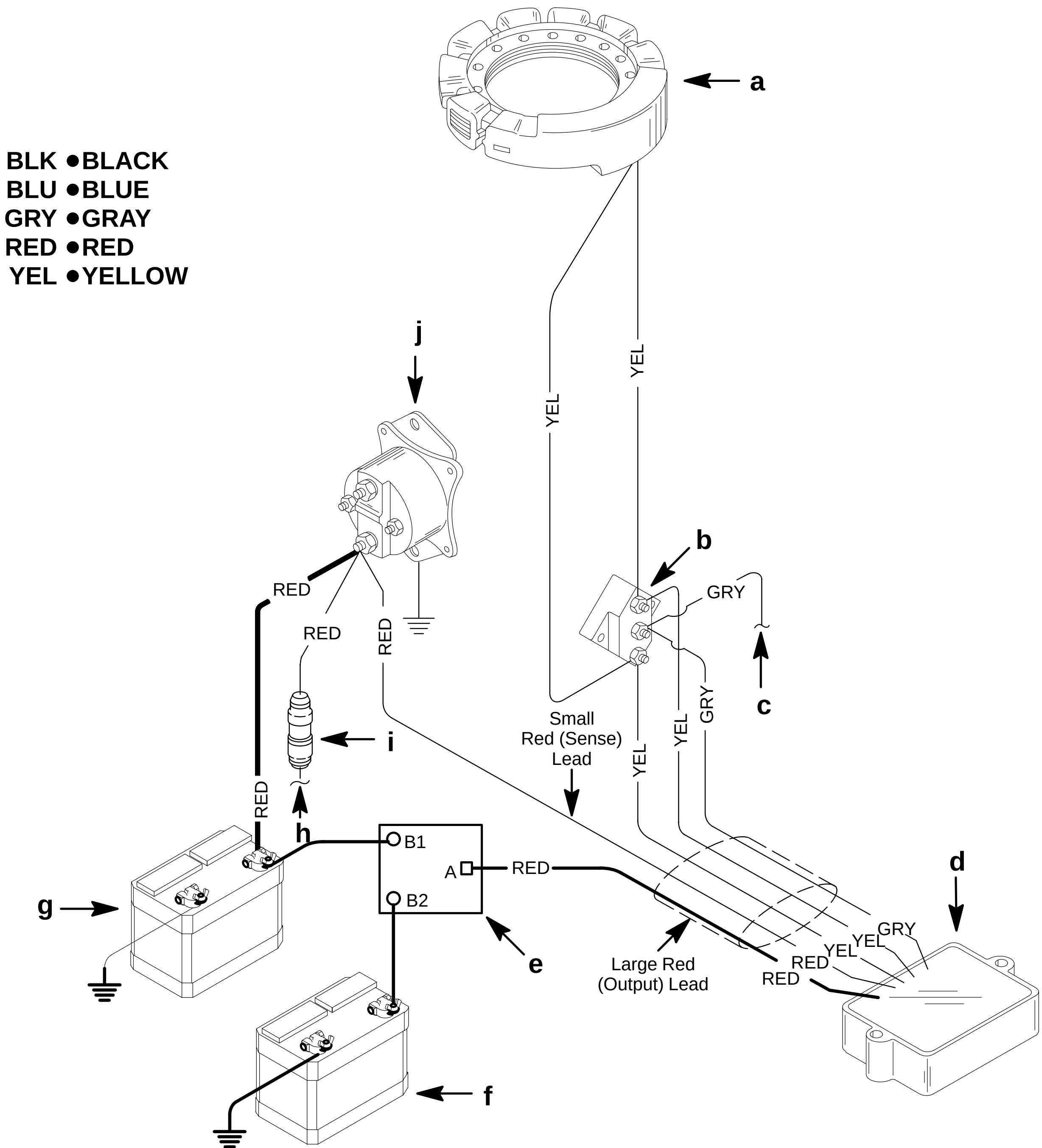
IMPORTANT: After electrical connections are made, coat all terminal connections using Quicksilver Liquid Neoprene (92-25711), to avoid corrosion.



a - Stator
b - Terminal Block
c - To Tachometer
d - Voltage Regulator/Rectifier
e - Battery Isolator
f - Auxiliary Battery
g - Start Battery
h - To Remote Control Harness
i - 20 Ampere Fuse
j - Starter Solenoid

4 Cylinder Battery Charging Diagram with Battery Isolator (Small Voltage Regulator)

IMPORTANT: After electrical connections are made, coat all terminal connections using Quicksilver Liquid Neoprene (92-25711), to avoid corrosion.



51050

a - Stator
b - Terminal Block
c - To Tachometer
d - Voltage Regulator/Rectifier
e - Battery Isolator
f - Auxiliary Battery
g - Start Battery
h - To Remote Control Harness
i - 20 Ampere Fuse
j - Starter Solenoid

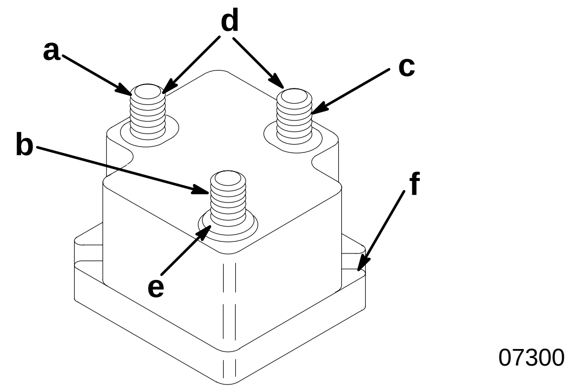
Rectifier Test

⚠ 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 illustration for rectifier terminal identification.



a - Terminal
b - Terminal
c - Terminal
d - Stator Terminals
e - Positive Terminal
f - Ground

Rectifier Test

Connect RED meter lead to ground, BLACK lead alternately to terminals “a” and “c”.

- Continuity Indicated. Connect BLACK meter lead to ground, RED lead alternately to terminals “a” and “c”.
  - No Continuity Indicated. Connect BLACK meter lead to terminal “b”, RED lead alternately to terminals “a” and “c”.
    - Continuity Indicated. Connect RED meter lead to terminal “b”, BLACK lead alternately to terminals “a” and “c”.
      - No Continuity Indicated. Rectifier tests OK.
      - Continuity Indicated. Replace Rectifier.
    - No Continuity Indicated. Replace Rectifier.
  - Continuity Indicated. Replace Rectifier.
- No Continuity Indicated. Connect BLACK meter lead to ground, RED lead alternately to terminals “a” and “c”.
  - No Continuity Indicated. Replace Rectifier.
  - Continuity Indicated. Connect BLACK meter lead to terminal “b”, RED lead alternately to terminals “a” and “c”.
    - Continuity Indicated. Replace Rectifier.
    - No Continuity Indicated. Connect RED meter lead to terminal “b”, BLACK lead alternately to terminals “a” and “c”.
      - No Continuity Indicated. Replace Rectifier.
      - Continuity Indicated. Rectifier tests OK.

Starting System

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.

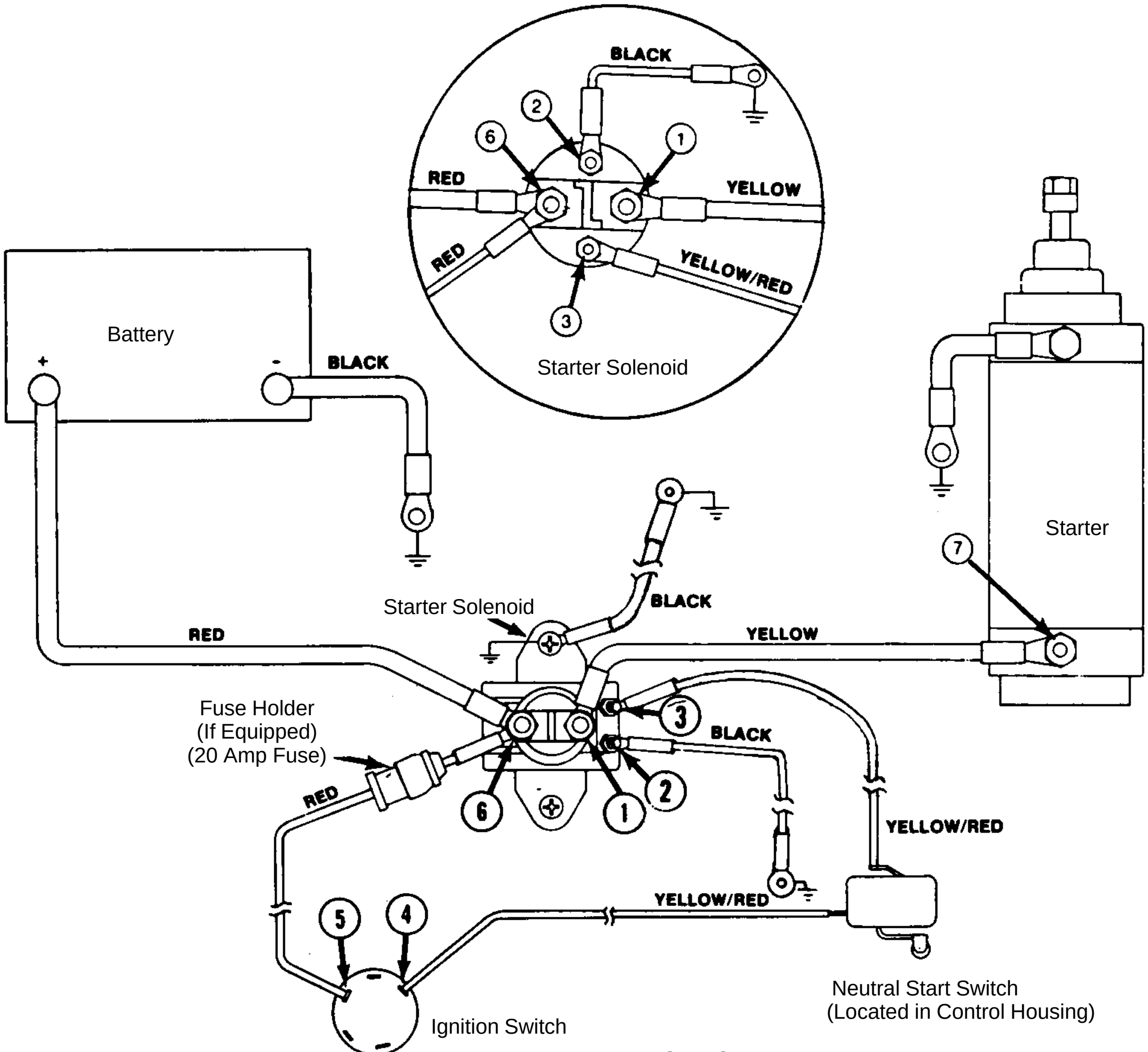
CAUTION

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; see diagram.



Starter Circuit

Starting Circuit Troubleshooting Flow Chart

Starter Motor Does Not Turn

SAFETY WARNING: Disconnect BLACK (starter motor) cable from starter solenoid test point 1 BEFORE making tests 1-thru-7 to prevent unexpected engine cranking.

TEST 1
Use an ohmmeter (R x 1 scale) and connect meter leads between NEGATIVE (–) battery post and common powerhead ground.

No continuity indicated; there is an open circuit in the BLACK negative (–) battery cable between the negative (–) battery post and the powerhead.

- Check cable for loose or corroded connections.
- Check cable for open.

Continuity Indicated

Proceed to TEST 2, on next page

TEST 2

a - Disconnect BLACK ground wire(s) from Test Point 2.

b - Connect voltmeter between common engine ground and Test Point 2.

c - Turn ignition key to “Start” position.

No voltage reading; proceed to TEST 3.

12 Volt Reading*
Check BLACK ground wire for poor connection or open circuit. Reconnect ground wire to starter solenoid; proceed to TEST 7.

TEST 3

a - Reconnect BLACK ground wire(s).

b - Connect voltmeter between common engine ground and Test Point 3.

c - Turn ignition key to “Start” position.

No voltage reading; proceed to TEST 4.

12 Volt Reading
Defective starter solenoid.

TEST 4

a - Connect voltmeter between common engine ground and Test Point 4.

b - Turn ignition key to “Start” position.

No voltage reading; proceed to TEST 5.

12 Volt Reading*
Neutral start switch is open, or YELLOW/RED wire is open between Test Points 4 and 3.

TEST 5
Connect voltmeter between common engine ground and Test Point 5.

No voltage reading; proceed to TEST 6.

12 Volt Reading*
Defective ignition switch.

TEST 6
Connect voltmeter between common engine ground and Test Point 6.

No voltage reading; check RED wire between battery (+) positive terminal and Test Point 6.

12 Volt Reading*
Check fuse in RED wire between test points 5 and 6. Check for open RED wire between test points 5 and 6.

TEST 7

a - Connect voltmeter between common engine ground and Test Point 1.

b - Turn ignition key to “Start” position.

No voltage reading; Defective starter solenoid.

12 Volt Reading*
Should hear solenoid click; proceed to Test 8.

TEST 8

a - Reconnect BLACK (starter motor) cable to starter solenoid Test Point 1.

b - Connect voltmeter between common engine ground and Test Point 7.

c - Turn ignition key to “Start” position.

No voltage reading; check BLACK cable for poor connection or open circuit.

12 Volt Reading*
Check BLACK ground cable at starter for loose or corroded connection, or open circuit. If cable is OK, check starter motor.

* Battery Voltage

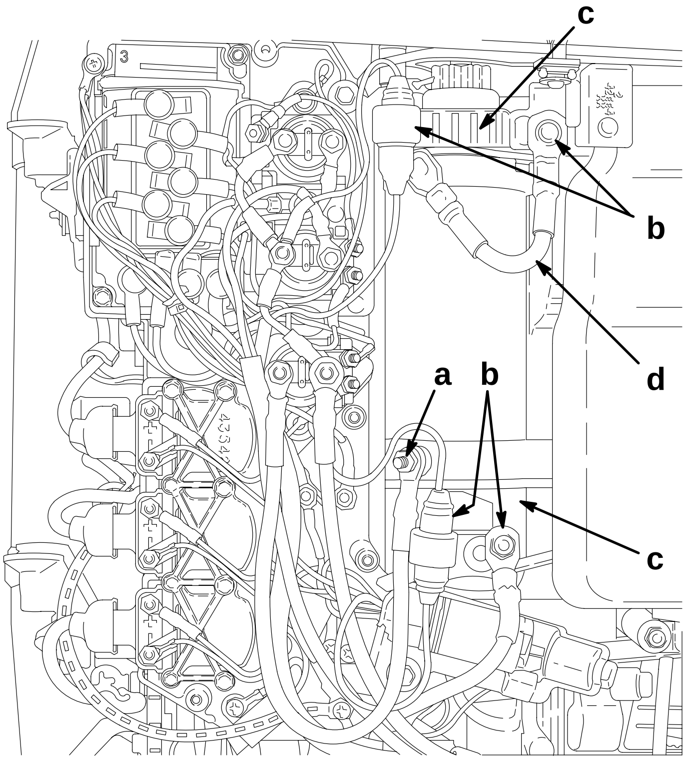
Starter Motor

Removal

⚠ CAUTION

Disconnect battery leads from battery before removing starter.

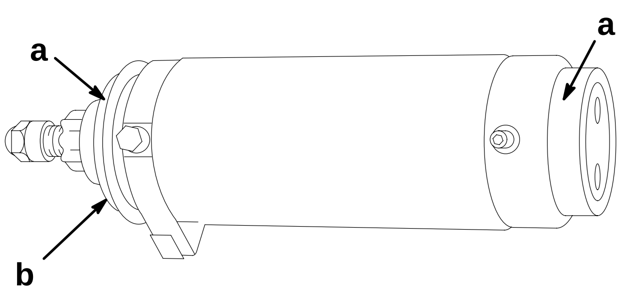
1. Disconnect battery leads from battery.
2. Disconnect YELLOW cable.
3. Remove 4 bolts and remove starter clamps.
4. Remove starter.
5. Remove BLACK cable.



20412

a - YELLOW Cable
b - Bolts (4)
c - Starter Clamps
d - BLACK Cable

6. Remove 2 rubber collars and 2 rubber bumpers.

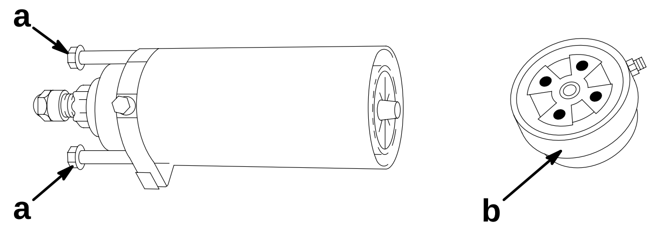


11645

a - Rubber Collar
b - Spacer (If Equipped)

Disassembly

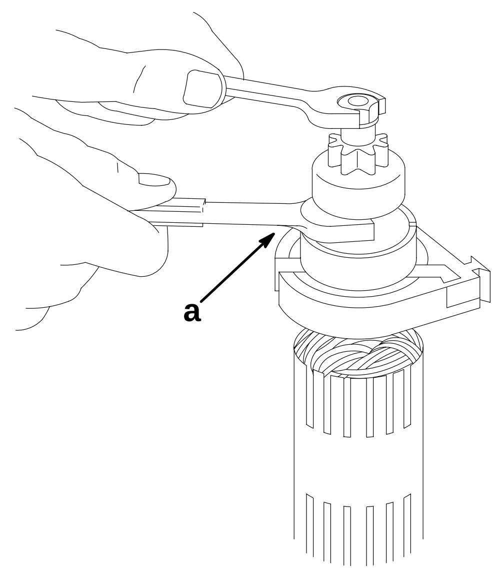
1. Remove 2 thru bolts and commutator end cap, taking care not to lose brush springs.



11646

a - Thru Bolts
b - Commutator End Cap

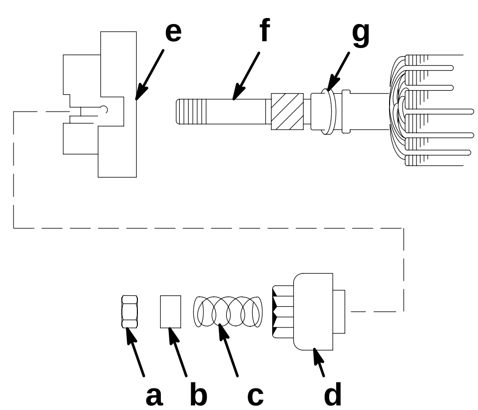
2. Pull armature from starter frame.
3. Remove locknut.



11659

a - Hold Armature Shaft With Wrench on Hex Portion of Drive Assembly

4. Remove components from armature.



11658

a - Locknut
b - Spacer
c - Spring
d - Drive Assembly
e - Drive End Cap
f - Armature Shaft
g - Washer

Starter Cleaning, Inspection and Testing

CLEANING AND INSPECTION

1. Clean all starter motor parts.
2. Check pinion teeth for chips, cracks or excessive wear.
3. Replace the drive clutch spring and/or collar if tension is not adequate or if wear is excessive.
4. Inspect brush holder for damage or for failure to hold brushes against commutator.
5. Replace brushes that are pitted or worn to less than 1/4″ (6.4mm) in length.
6. Inspect the armature conductor (commutator bar junction) for a tight connection. A loose connection (excessive heat from prolonged cranking melts solder joints) results in a burned commutator bar.
7. Resurface and undercut a rough commutator as follows:

CAUTION

Do not turn down the commutator excessively.

a. Resurface the commutator and undercut the insulation between the commutator bars 1/32″ (0.8mm) to the full width of the insulation and so that the undercut is flat.

b. Clean the commutator slots after undercutting.

c. Sand the commutator lightly with No. 00 sandpaper to remove burrs, then clean the commutator.

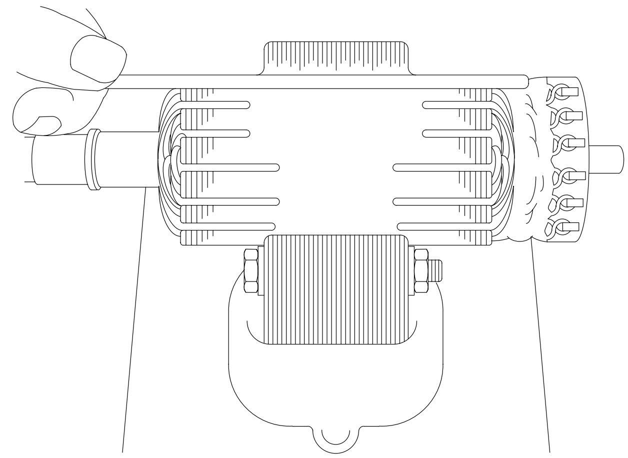
d. Recheck the armature on a growler for shorts as specified in the following procedure (“Testing”).

8. Open-circuited armatures often can be repaired. The most likely place for an open circuit is at the commutator bars, as a result of long cranking periods. Long cranking periods overheat the starter motor so that solder in the connections melts and is thrown out. The resulting poor connections then cause arcing and burning of the commutator bars.
9. Repair bars, that are not excessively burned, by resoldering the leads in bars (using rosin flux solder) and turning down the commutator in a lathe to remove burned material, then undercut the mica.
10. Clean out the copper or brush dust from slots between the commutator bars.
11. Check the armature for ground. See the following procedure (“Testing”).

Testing

ARMATURE TEST FOR SHORTS

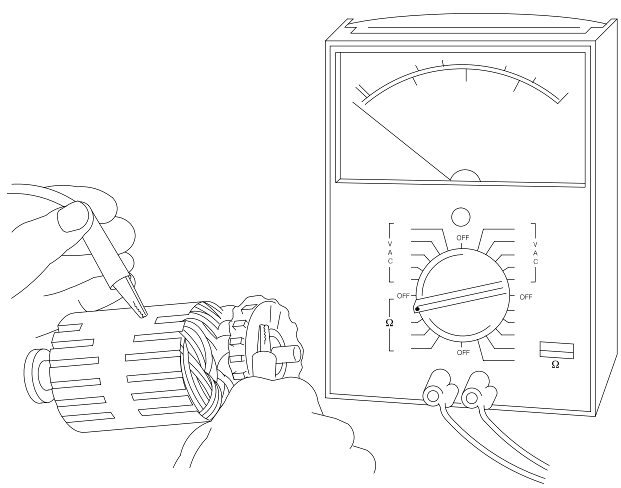
Check armature for short circuits by placing on growler and holding hack saw blade over armature core while armature is rotated. If saw blade vibrates, armature is shorted. Recheck after cleaning between commutator bars. If saw blade still vibrates, replace armature.



11669

ARMATURE TEST FOR GROUND

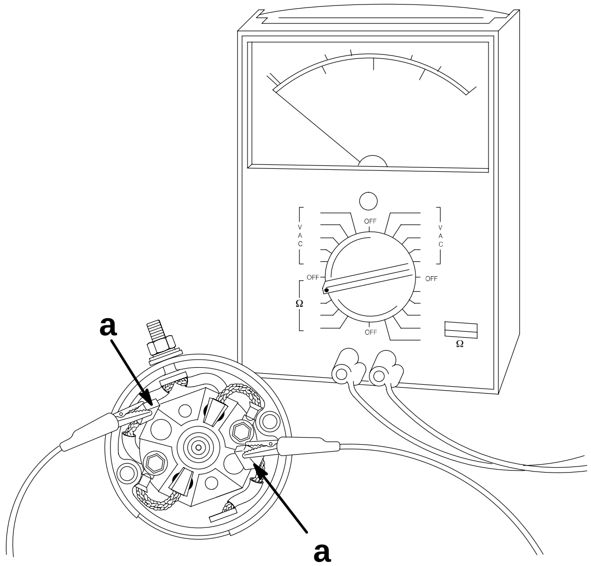
1. Set ohmmeter to (R x 1 scale). Place one lead of ohmmeter on armature core or shaft and other lead on commutator.
2. If meter indicates continuity, armature is grounded and must be replaced.



11675

CHECKING POSITIVE BRUSHES AND TERMINAL

Set ohmmeter to (R x 1 scale). Connect meter leads between POSITIVE brushes. Meter must indicate full continuity or zero resistance. If resistance is indicated, inspect lead to brush and lead to POSITIVE terminal solder connection. If connection cannot be repaired, brushes must be replaced.

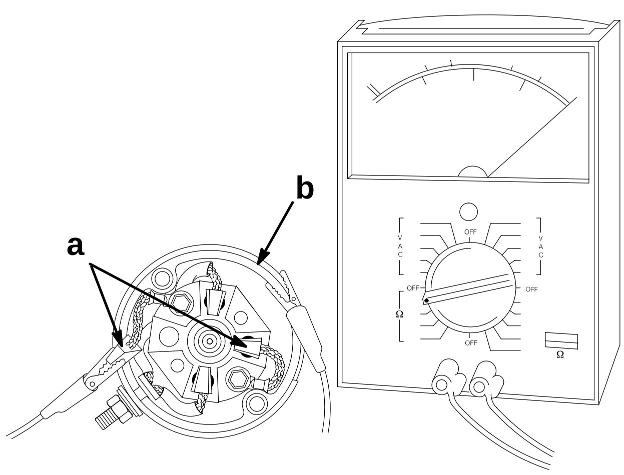


11673

a - POSITIVE (+) Brushes

TESTING NEGATIVE BRUSHES FOR GROUND

Set ohmmeter to (R x 1 scale). Place one lead of the ohmmeter on the NEGATIVE brush and the other lead on the end cap (bare metal). If the meter indicates NO continuity, replace the NEGATIVE brush. Repeat this procedure on the other NEGATIVE brush.

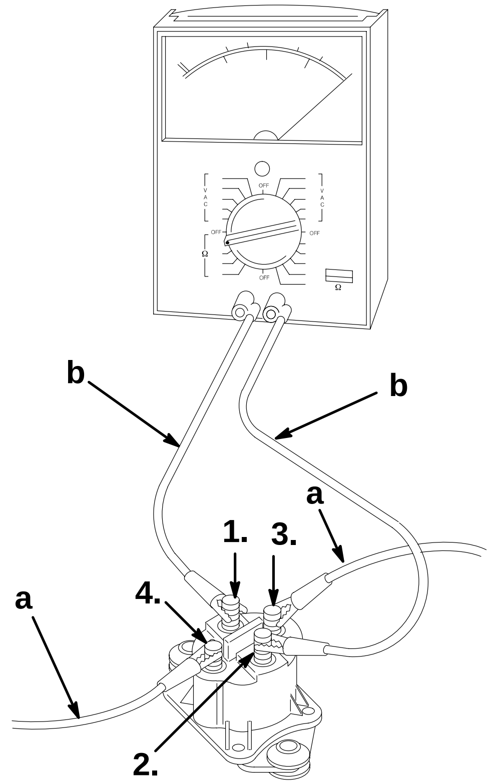


11674

a - NEGATIVE (–) Brushes
b - End Cap

STARTER SOLENOID TEST

1. Disconnect all wires from solenoid.
2. Use an ohmmeter (R x 1 scale) and connect meter leads between solenoid terminals 1 and 2.
3. Connect a 12-volt power supply between solenoid terminals 3 and 4. Solenoid should click and meter should read 0 ohms (full continuity).
4. If meter does not read 0 ohms (full continuity), replace solenoid.



51809

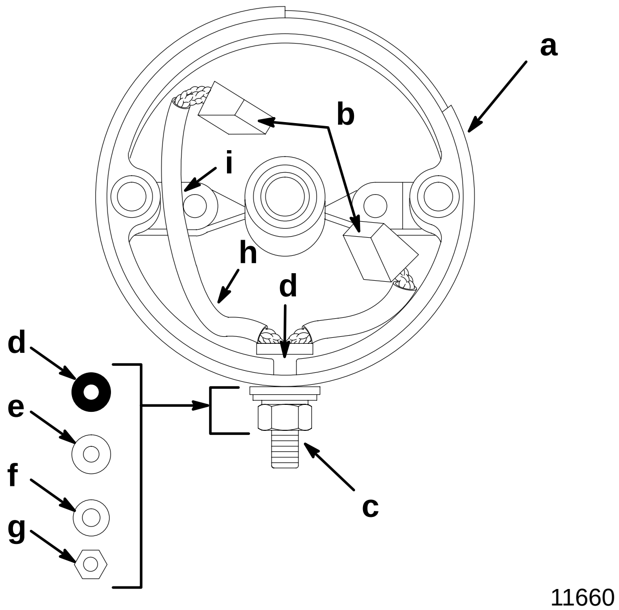
a - 12-Volt Supply
b - VOA Leads

Brush Replacement

STARTER REASSEMBLY

1. If brushes were removed, replace as follows:

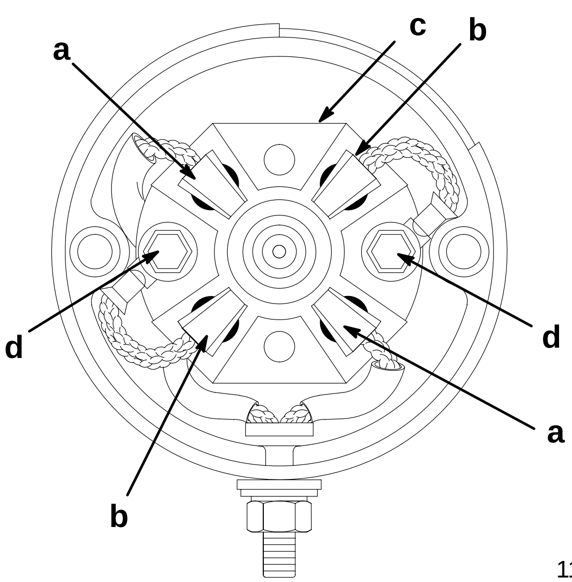
   a. Install POSITIVE brushes (along with POSITIVE terminal) into commutator end cap.



11660

a - End Cap
b - POSITIVE Brushes
c - POSITIVE Terminal
d - Insulating Bushing
e - Washer
f - Split Washer
g - Hex Nut
h - Long Brush Lead
i - Push Lead into Slot

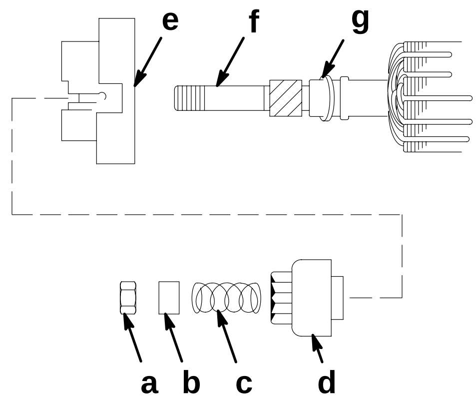
   b. Install NEGATIVE brushes (along with brush holder).



11656

a - POSITIVE (+) Brushes
b - NEGATIVE (–) Brushes
c - Brush Holder
d - Bolts (Fasten NEGATIVE Brushes and Holder)

2. If removed, reinstall parts on armature shaft. Use a new locknut and tighten securely on end of shaft.



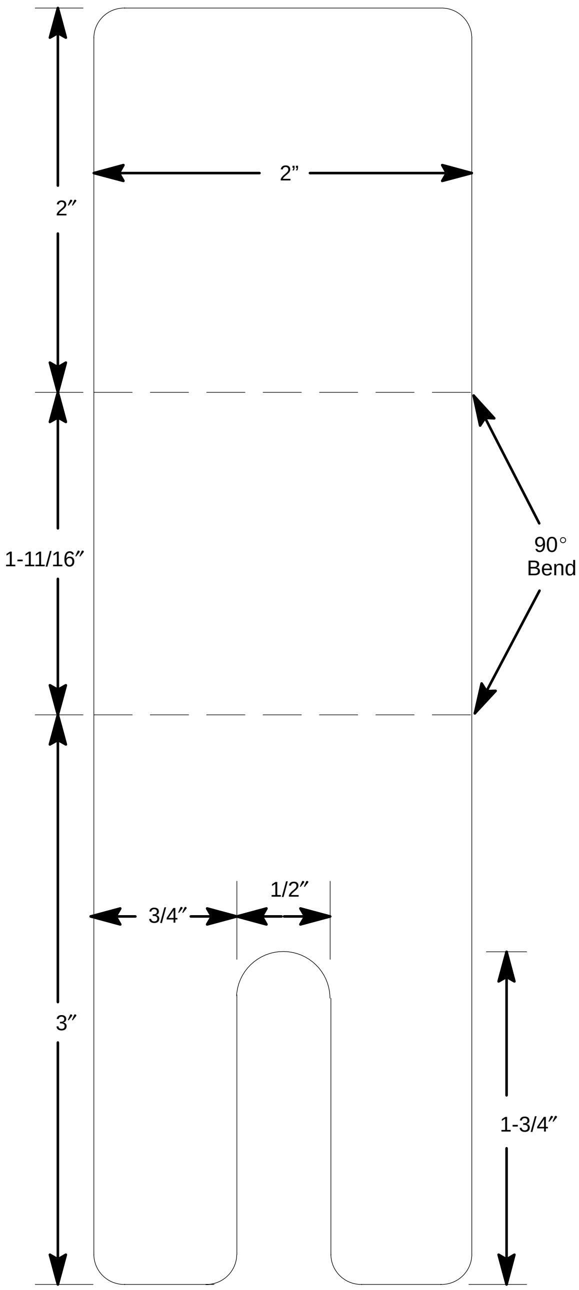
11658

a - Locknut
b - Spacer
c - Spring
d - Drive Assembly
e - Drive End Cap
f - Armature Shaft
g - Washer

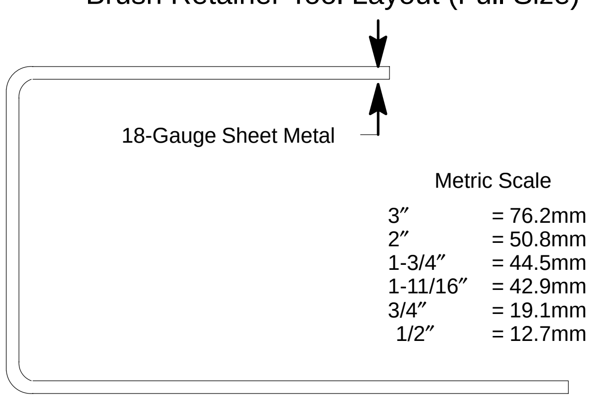
3. Lubricate helix threads on armature shaft with a drop of SAE 10W oil.

4. Lubricate bushing in drive end plate with a drop of SAE 10W oil.

5. Position armature into starter frame.
6. To prevent damage to brushes and springs when installing commutator end cap, it is recommended that a brush retaining tool be made as shown:



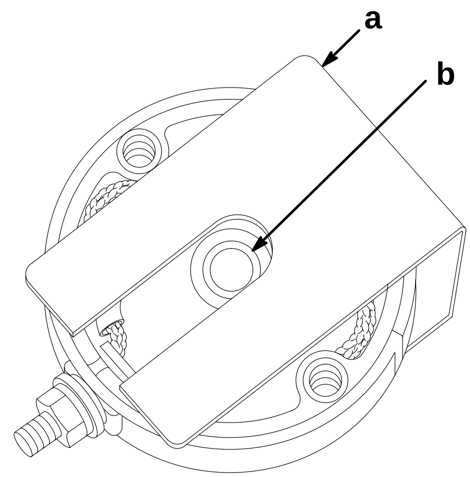
Brush Retainer Tool Layout (Full Size)



Metric Scale

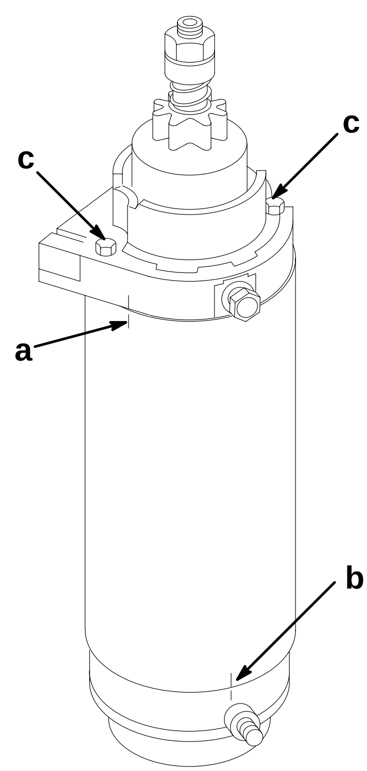
3″	= 76.2mm
2″	= 50.8mm
1-3/4″	= 44.5mm
1-11/16″	= 42.9mm
3/4″	= 19.1mm
1/2″	= 12.7mm

7. Lubricate bushing (located in commutator end cap) with one drop of SAE 10W oil. DO NOT over lubricate.
8. Place springs and brushes into brush holder and hold in place with brush retainer tool.



a - Brush Retainer Tool
b - Bushing (DO NOT Over Lubricate)

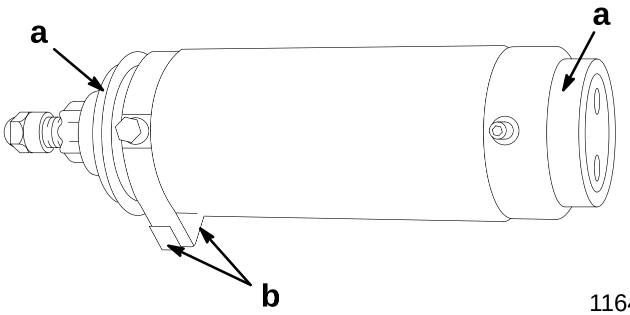
9. Install armature into starter frame and align match marks (a). Install commutator end cap onto starter frame and align match marks (b). Remove brush retainer tool. Install through bolts (c) and torque to 70 lb. in. (7.9 N·m).



a - Alignment Marks
b - Alignment Marks
c - Bolts [Torque to 70 lb. in. (7.9 N·m)]

Installation

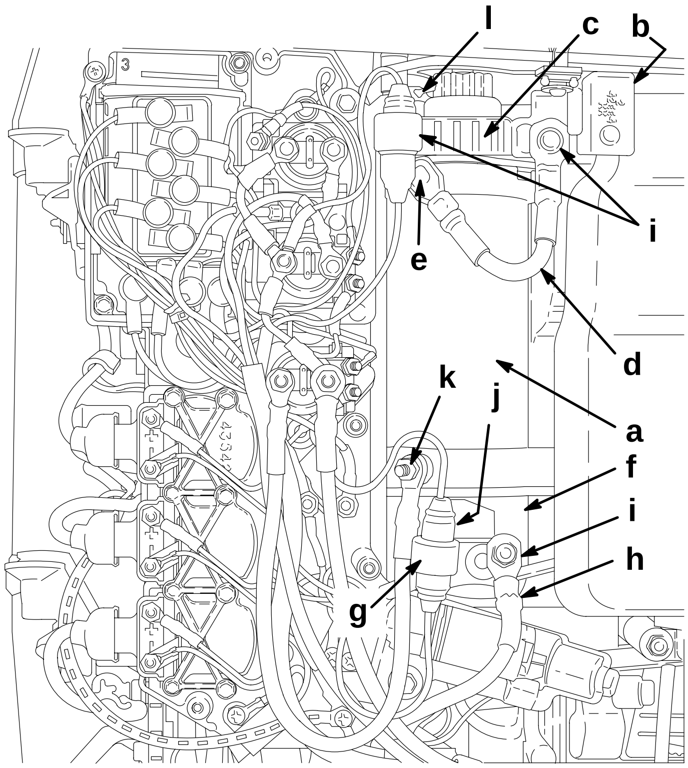
1. Install 2 rubber collars and 2 rubber bumpers.



11645

a - Rubber Collars
b - Rubber Bumpers

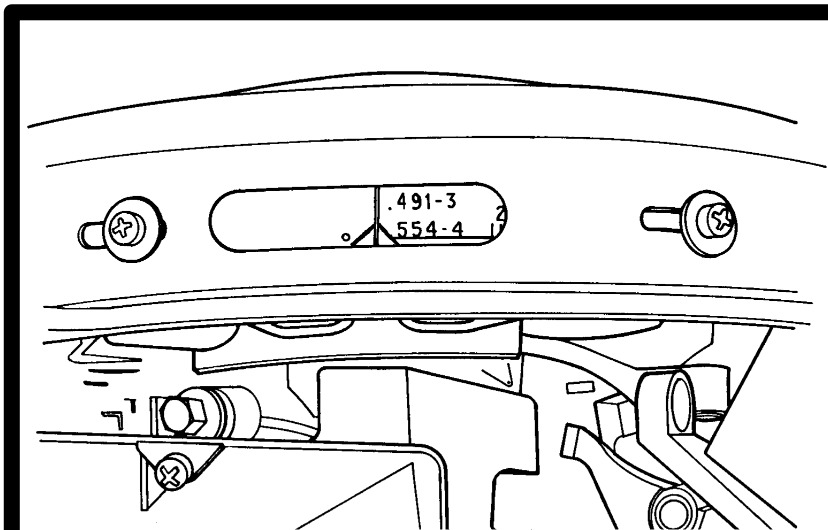
2. Install components as shown.
3. Connect battery leads to battery.



19452

a - Starter
b - Rubber Mount, oil tank
c - Clamp, upper
d - BLACK Cable
e - Bolt and Lockwasher
f - Clamp, lower
g - J-Clip (If Equipped)
h - BLACK Negative (-) Battery Cable
i - Bolts [Torque to 14.5 lb. ft. (19.7 N·m)]
j - Fuse Holder (If Equipped)
k - YELLOW Cable [Torque to nut to 60 lb. in. (6.7 N·m)]
l - Fuse Holder (If Equipped)

ELECTRICAL AND IGNITION



22480

2

C

TIMING/SYNCHRONIZING/ADJUSTING

Table Of Contents

Timing/Synchronizing/ Adjusting (3 Cylinder Models)

Specifications

70, 75 and 80 Models

Serial Number and Above

U.S.	B239242
Belgium	9502135
Canada	A730007

Full Throttle RPM Range	4750 - 5250
Idle RPM (in “FORWARD” Gear)	650 - 700
Maximum Timing @ 5000 RPM (@ Cranking Speed)	26° B.T.D.C. (28° B.T.D.C.)
Idle Timing	0° - 4° B.T.D.C.
Spark Plug	NGK BUHW-2
Firing Order	1-3-2

70, 75 and 80 Models

Serial Number and Below

U.S.	B239241
Belgium	9502134
Canada	A730006

Full Throttle RPM Range	4750 - 5250
Idle RPM (in “FORWARD” Gear)	650 - 700
Maximum Timing @ 5000 RPM (@ Cranking Speed)	22° B.T.D.C. (24° B.T.D.C.)
Idle Timing	0° - 4° B.T.D.C.
Spark Plug	NGK BUHW-2
Firing Order	1-3-2

90 Models

Full Throttle RPM Range	5000 - 5500
Idle RPM (in “FORWARD” Gear)	650 - 700
Maximum Timing @ 5000 RPM (@ Cranking Speed)	26° B.T.D.C. (28° B.T.D.C.)
Idle Timing	0° - 4° B.T.D.C.
Spark Plug	NGK BUHW-2
Firing Order	1-3-2

Mariner 75 Marathon/Merc 75XD

Full Throttle RPM Range	4750 - 5250
Idle RPM (in “FORWARD” Gear)	650 - 700
Maximum Timing @ 5000 RPM (@ Cranking Speed)	16° B.T.D.C. (18° B.T.D.C.)
Idle Timing	0° - 4° B.T.D.C.
Spark Plug	NGK BUHW-2
Firing Order	1-3-2

Special Tools

Part No.	Description
*91-58222A1	Dial Indicator Gauge Kit
*91-59339	Service Tachometer
*91-99379	Timing Light
91-63998A1	Spark Gap Tool

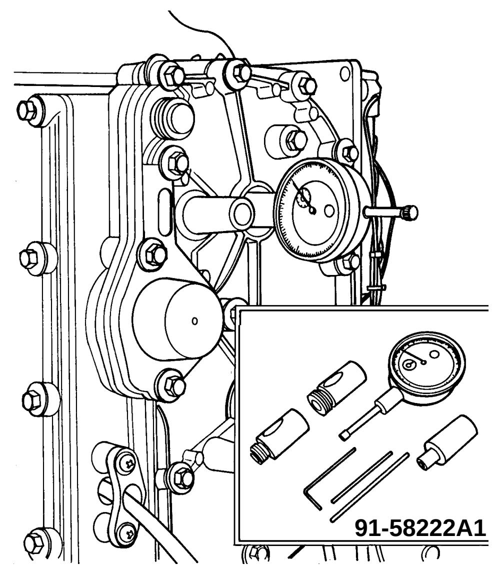
* May be obtained locally.

Timing Pointer Adjustment

⚠ WARNING

Engine could start when turning flywheel to check timing pointer alignment. Remove spark plugs from engine to prevent engine from starting.

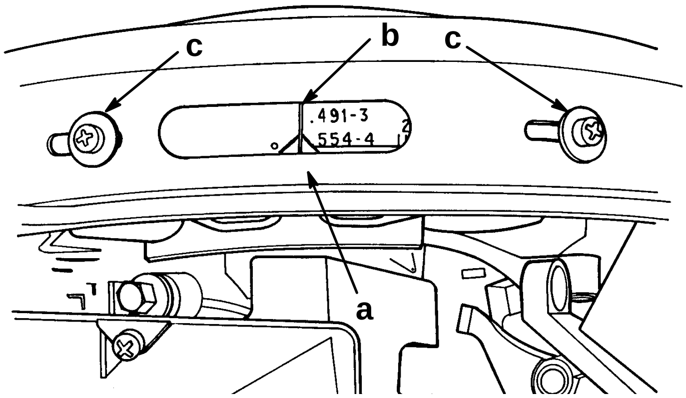
1. Install Dial Indicator P/N 91-58222A1 into no. 1 (top) cylinder.
2. Turn flywheel clockwise until no. 1 (top) piston is at top dead center (TDC). Set Dial Indicator to “0” (zero).



19062

3. Turn flywheel counterclockwise until Dial Indicator needle reads approximately 0.550 (13.97mm) BTDC, then turn flywheel clockwise so that needle reads 0.491 in. (12.47 mm) BTDC exactly.

4. Reposition timing pointer if necessary, so that timing pointer is aligned with 0.491 in. (12.47 mm) timing mark on flywheel. Retighten attaching screws.



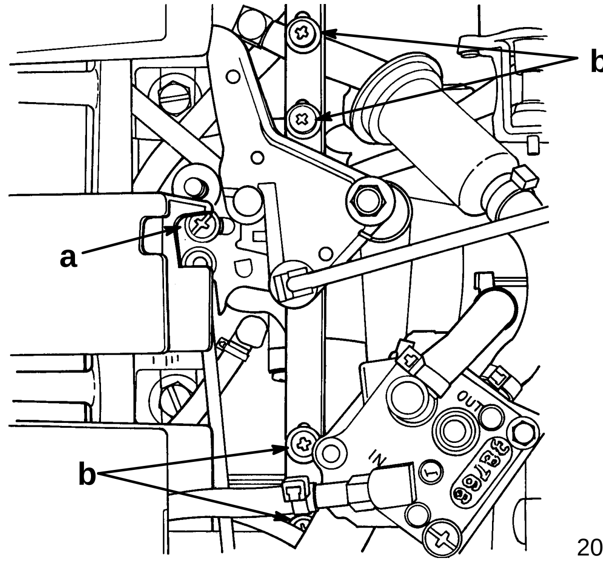
22480

a - Timing Pointer
b - Timing Mark
c - Attaching Screws

5. Remove Dial Indicator, and reinstall spark plug and high tension spark plug lead of no. 1 (top) cylinder only.

CARBURETOR SYNCHRONIZATION

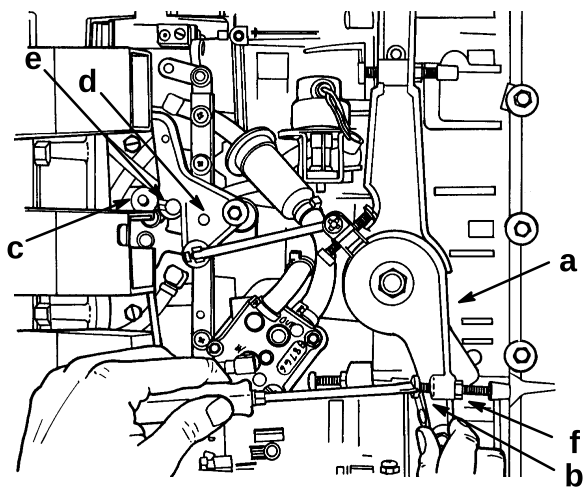
1. Disconnect remote fuel line from engine.
2. Connect remote control electrical harness to engine wiring harness.
3. Remove throttle cable barrel from barrel retainer.
4. Remove sound air box cover.
5. Loosen screw from throttle cam follower.
6. Loosen 4 synchronizing screws.
7. Look into throats of carburetors and make sure all throttle shutters are completely closed. Tighten synchronizing screws.
8. Recheck throttle shutters and make any necessary adjustments.



20440

a - Set Screw
b - Synchronizing Screws

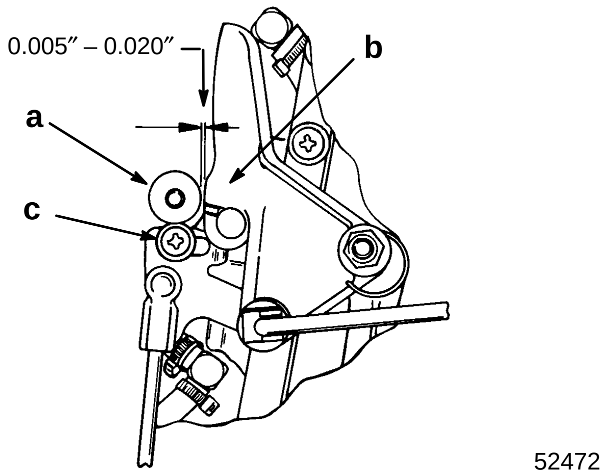
9. Hold throttle arm so that throttle stop screw is against stop.
10. Place roller of cam follower against throttle cam and adjust throttle stop screw to align raised mark of throttle cam with center of cam follower roller. Tighten locknut.



20428

a - Throttle Arm
b - Throttle Stop Screw
c - Roller
d - Throttle Cam
e - Raised Mark
f - Lock Nut

11. Holding throttle arm against throttle stop screw, adjust cam follower, so that a clearance of 0.005 in. - 0.020 in. (0.127 - 0.508 mm) exists between roller of cam follower and throttle cam. Tighten set screw securing cam follower.

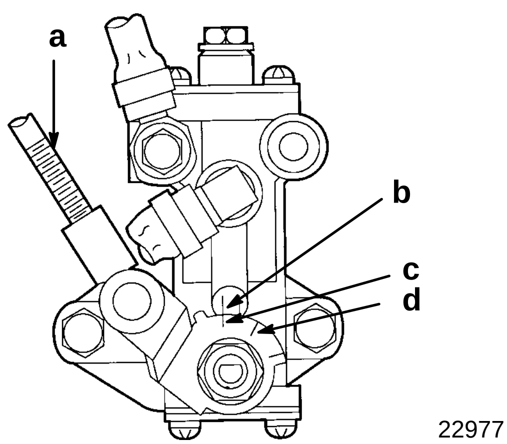


a - Roller
b - Throttle Cam
c - Set Screw

CARBURETOR/OIL PUMP SYNCHRONIZATION

IMPORTANT: Some engines may have an additional stamped mark (d) which SHOULD NOT be used.

1. While holding throttle arm at idle position, adjust length of link rod so that stamped mark of oil pump body aligns with stamped mark of oil pump lever.



a - Link Rod
b - Mark of Oil Pump Body
c - Mark of Oil Pump Lever
d - Mark NOT Used

TIMING ADJUSTMENTS

⚠ CAUTION

Engine is timed while cranking engine with starter motor. To prevent engine from starting when being cranked, all spark plugs must be removed, except no. 1 (top) cylinder plug.

NOTE: If initial timing adjustments are made without engine running, then final timing checks should be made with engine running due to timing advance characteristics of ignition system. Minimum engine RPM required to check maximum timing advance is 3000 RPM.

IDLE TIMING ADJUSTMENT

1. Connect timing light to no. 1 (top) spark plug.

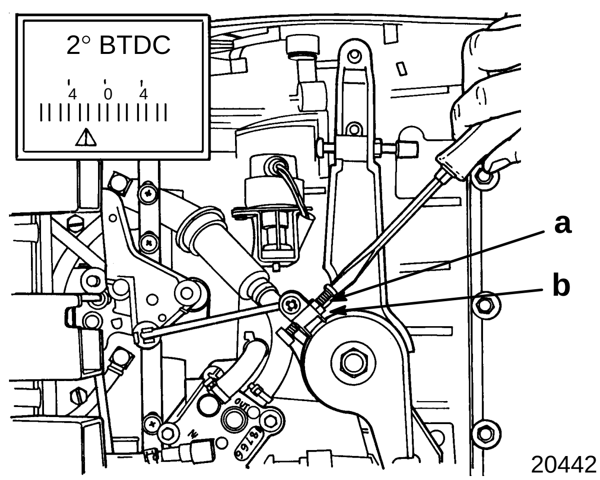
⚠ WARNING

Before cranking engine, keep clear of propeller as it may rotate.

2. Shift engine to **"Neutral"**.

IMPORTANT: To accurately time engine at cranking speed, a fully charged battery must be used.

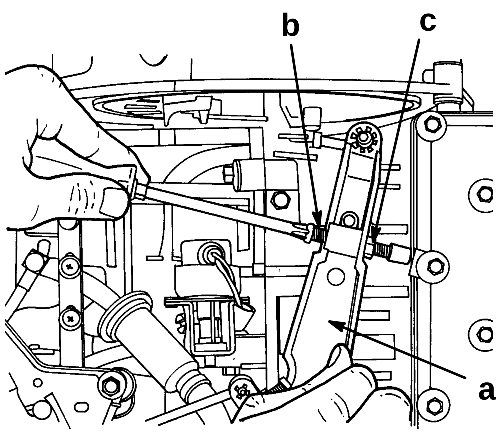
3. Holding throttle arm at idle position, crank engine with starter motor and adjust idle timing screw to align 2° BTDC timing mark of flywheel with timing pointer. Tighten locknut.



a - Idle Timing Screw
b - Locknut

MAXIMUM TIMING

1. Hold control arm so that maximum spark advance screw is against stop.
2. Crank engine with starter motor and adjust maximum spark advance screw to align the specified BTDC timing mark on flywheel with timing pointer (due to the advance characteristic of this ignition system, this cranking speed adjustment will automatically be reduced by 2° at an engine speed of 5000 RPM). Tighten locknut.

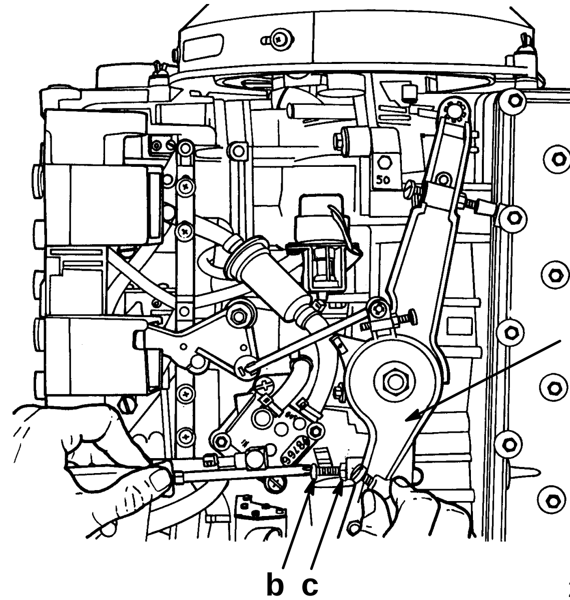


a - Control Arm
b - Maximum Spark Advance Screw
c - Locknut

NOTE: If initial timing adjustments are made without engine running, then final timing checks should be made with engine running due timing advance characteristics of ignition system. Minimum engine RPM required to check maximum timing advance is 3000 RPM.

MAXIMUM THROTTLE

1. Hold throttle arm against full throttle stop screw. Adjust full throttle stop screw to allow throttle shutters to open fully, then turn stop screw in (clockwise) an additional 1/2 turn, to prevent throttle lever of center carburetor from acting as a stop. Tighten locknut.
2. Install remaining spark plugs and high tension spark plug leads.

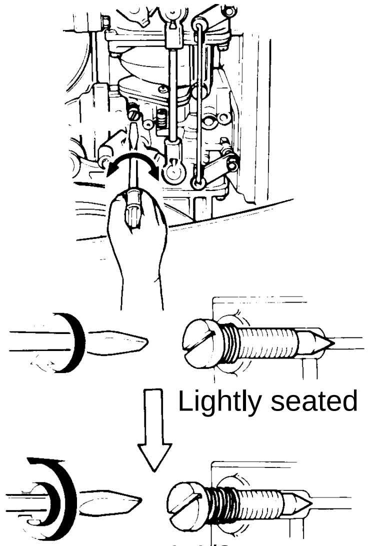


a - Throttle Arm
b - Full Throttle Stop Screw
c - Locknut

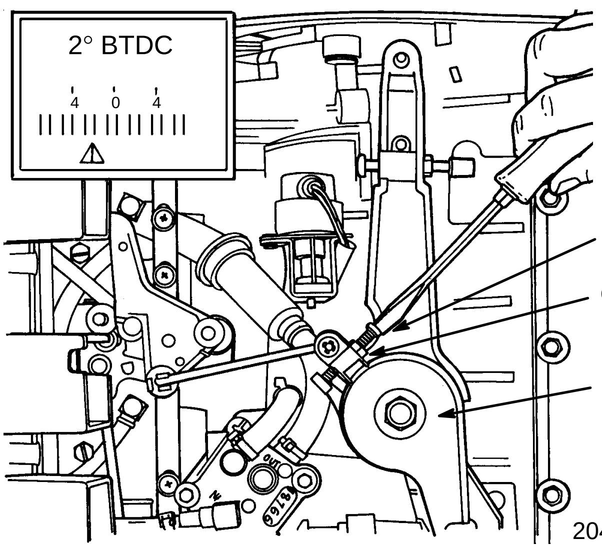
IDLE ADJUSTMENT

1. With engine in water, connect electrical harness and fuel line to engine. Start engine and allow to warm up.

2. Shift into “Forward” gear and adjust carburetor low speed mixture screws properly (refer to “Carburetor” section).



3. Holding throttle arm (NO TAG) at idle position, adjust idle timing screw (NO TAG) to attain an engine idle RPM of 650-700 RPM in “Forward” gear. Tighten locknut (NO TAG) and turn off engine.



a - Throttle Arm
b - Idle Timing Screw
c - Locknut

NOTE: On this type of engine, idle RPM is adjusted exclusively with ignition timing.

Throttle Cable Installation

1. With end of throttle cable connected to throttle lever, hold throttle lever against idle stop. Adjust throttle cable barrel to slip into barrel retainer on cable anchor bracket with a very light preload of throttle lever against idle stop. Lock barrel in place.

IMPORTANT: Excessive preload on throttle cable will cause difficulty when shifting from forward to neutral. (Readjust throttle cable barrel, if necessary.)

2. Check preload on throttle cable by placing a thin piece of paper between idle stop screw and idle stop. Preload is correct when paper can be removed without tearing but has some drag on it. (Readjust throttle cable barrel, if necessary.)

Timing/Synchronizing/ Adjusting (4 Cylinder Models)

Specifications

Models 100/115

Full Throttle RPM Range	4750 - 5250
Idle RPM (in "FORWARD" Gear)	650 - 700
Maximum Timing @ 3000 RPM (@ Cranking Speed)	23° B.T.D.C. (25° B.T.D.C.)
Idle Timing	2° - 4° B.T.D.C.
Spark Plug	NGK BP8H-N-10* [0.040 in. (1.0mm) gap] NGK BPZ8H-N-10* [0.040 in. (1.0mm) gap] NGK BUHW
Firing Order	1-3-2-4

*Improves running quality between 1800 – 2000 RPM

Special Tools

Part No.	Description
*91-58222A1	Dial Indicator Gauge Kit
*91-59339	Service Tachometer
*91-99379	Timing Light

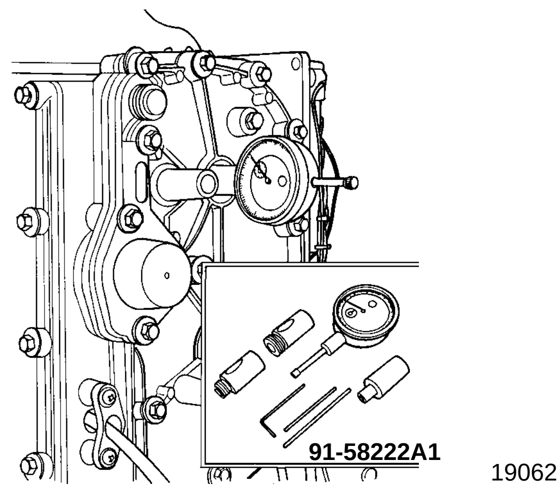
* May be obtained locally.

Timing Pointer Alignment

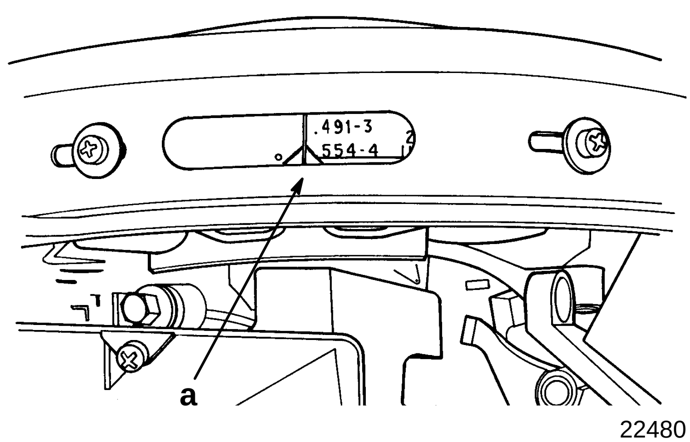
⚠ WARNING

Engine could start when turning flywheel to check timing pointer alignment. Remove all spark plugs from engine to prevent engine from starting.

1. Remove aft cowl support bracket.
2. Install Dial Indicator 91-58222A1 into no. 1 (top) cylinder.
3. Turn flywheel in a clockwise direction until no. 1 piston is a TDC, then set Dial Indicator at "0" (zero).



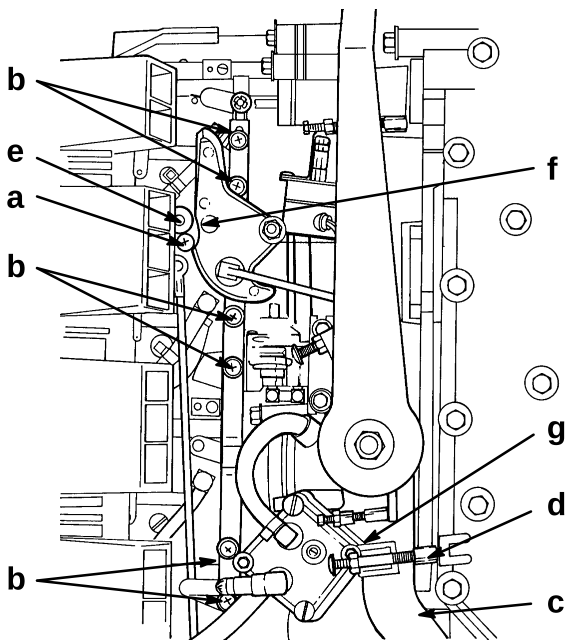
4. Turn flywheel counterclockwise until Dial Indicator needle reads approximately 0.600 in. BTDC, then turn flywheel clockwise, so that needle reads 0.554 in. BTDC exactly.
5. Reposition timing pointer, if necessary, so that 0.554 in. mark is aligned with groove in timing pointer.
6. Remove Dial Indicator and reinstall spark plug and spark plug lead on no. 1 cylinder.



a - Timing Pointer

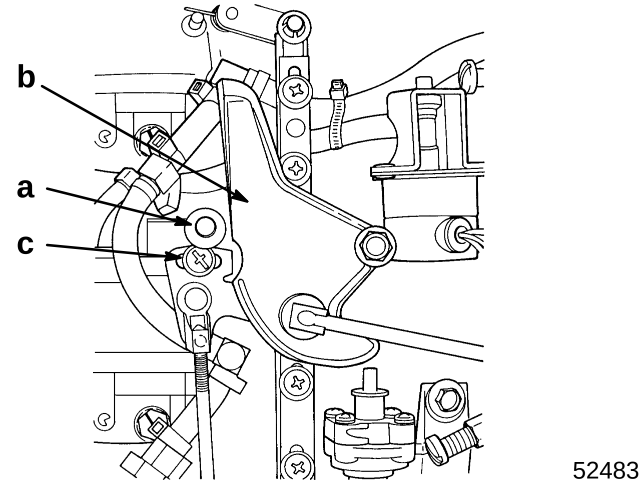
CARBURETOR SYNCHRONIZATION

1. Remove sound box cover.
2. Loosen cam follower adjustment screw.
3. Loosen 6 synchronizing screws.
4. Look into throats of carburetors and make sure all throttle shutters are completely closed.
5. Apply light down pressure on carburetor synchronizing shaft and tighten 6 synchronizing screws from top to bottom.
6. Recheck throttle shutters and make any necessary adjustment.
7. Hold throttle arm so that the throttle stop screw is against stop.
8. Place roller of cam follower against throttle cam and adjust throttle stop screw to align raised mark of throttle cam with center of cam follower roller. Tighten locknut.



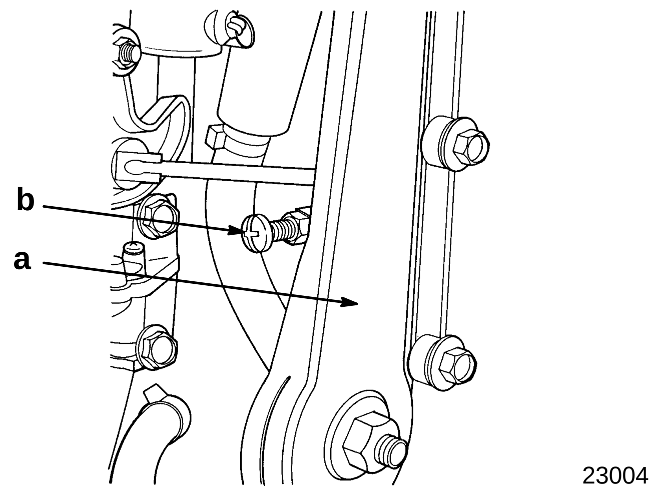
a - Cam Follower Adjustment Screw
b - Synchronizing Screws
c - Throttle Arm
d - Idle Stop Screw
e - Roller
f - Throttle Cam
g - Locknut

9. Holding throttle arm at idle position, adjust cam follower so that a clearance of 0.005 in. - 0.020 in. (0.127mm - 0.508mm) exists between roller and throttle cam. Tighten screw securing cam follower.



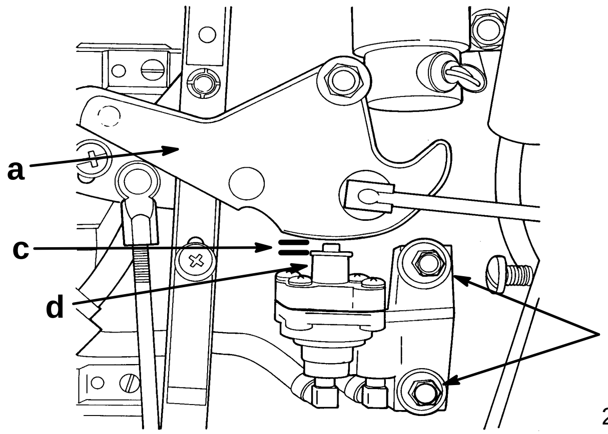
a - Roller
b - Throttle Cam
c - Screw

10. Hold throttle arm against full throttle stop. Adjust full throttle stop screw to allow throttle shutters to open fully. To prevent throttle shutters to act as a stop, screw in stop screw clockwise 1/2 turn and tighten locknut.



a - Throttle Arm
b - Full Throttle Stop Screw

11. Hold throttle cam in full throttle position. If necessary adjust acceleration pump adjusting bolts position so that a gap of 0.030 in. (0.762mm) exists between throttle cam and top of acceleration pump aluminum housing.

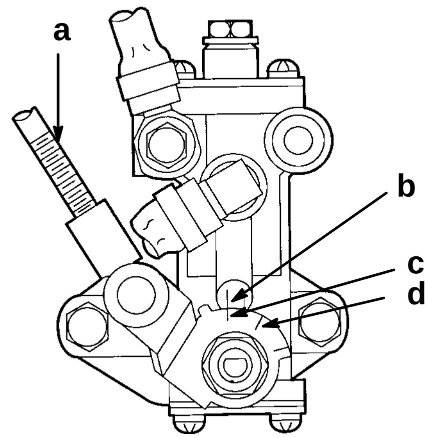


a - Throttle Cam
b - Bolts
c - 0.030 in. (0.762mm) Gap
d - Accelerator Pump

CARBURETOR/OIL PUMP SYNCHRONIZATION

IMPORTANT: Some engines may have an additional stamped mark (d) which SHOULD NOT be used.

1. While holding throttle arm at idle position, adjust length of link rod so that stamped mark of oil pump body aligns with stamped mark of oil pump lever.
2. Move throttle arm from idle to wide open throttle while checking link rod for any interference with hoses, cable ties, etc.



a - Link Rod
b - Mark of Oil Pump Body
c - Mark of Oil Pump Lever
d - Mark NOT Used

TIMING ADJUSTMENTS

⚠ CAUTION

Engine can be timed while cranking engine with starter motor. To prevent engine from starting when being cranked, all spark plugs should be removed.

NOTE: If initial timing adjustments are made without engine running, then final timing checks should be made with engine running due timing advance characteristics of ignition system. Minimum engine RPM required to check maximum timing advance is 3000 RPM.

1. Insert Spark Gap Tool (91-63998A1) in no. 1 (top) cylinder spark plug boot and attach alligator clip to good ground.
2. Remove throttle cable barrel from barrel retainer.

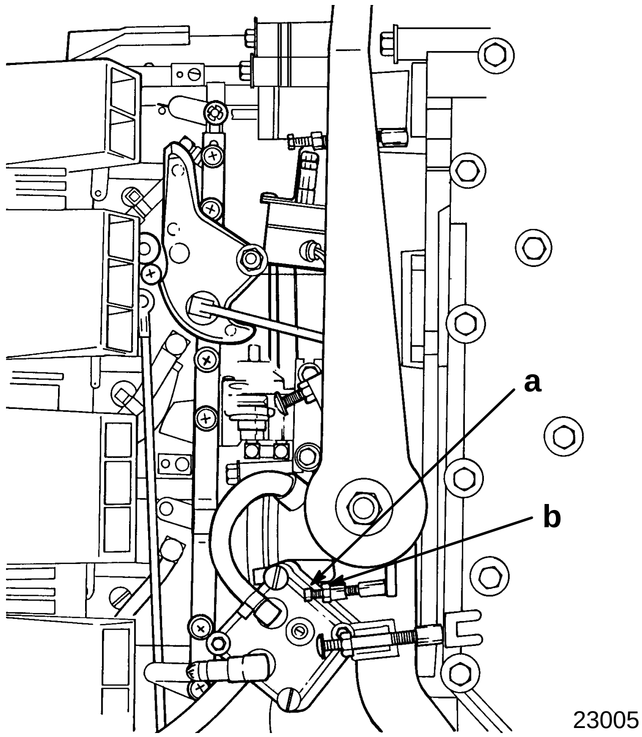
IDLE TIMING ADJUSTMENT

⚠ WARNING

Before cranking engine, keep clear of propeller, as it may rotate.

IMPORTANT: To accurately time engine at cranking speed, a fully charged battery must be used.

1. Connect timing light to no. 1 (top) spark plug lead.
2. Shift engine into neutral.
3. Holding throttle arm at idle position, crank engine with starter motor and adjust idle timing screw to align 2 degrees BTDC timing mark of flywheel with timing pointer. Tighten locknut.

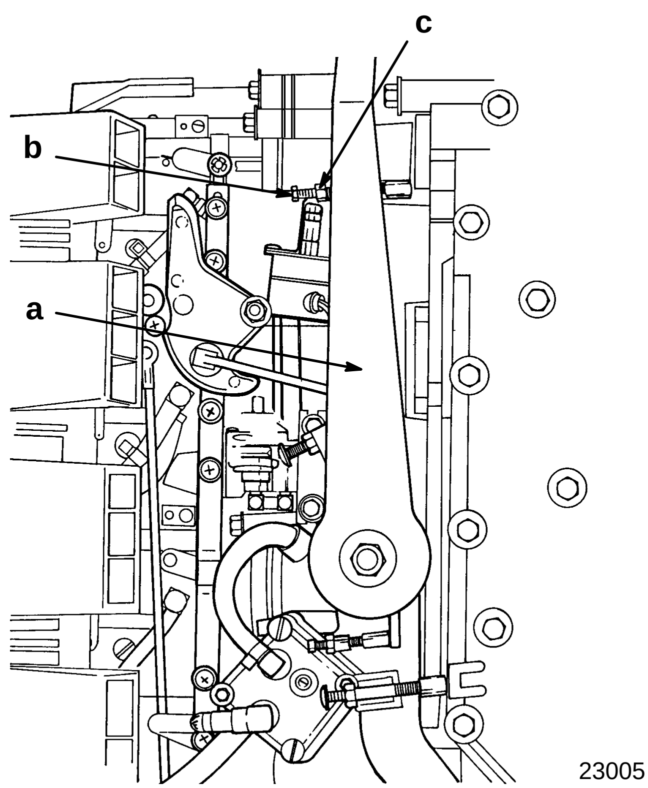


a - Idle Timing Screw
b - Locknut

MAXIMUM TIMING

1. Hold control arm against maximum advance stop. Crank engine with starter motor and adjust maximum advance screw to align 25° BTDC mark on flywheel with timing pointer (due to the advance characteristics of ignition system, this cranking speed adjustment will automatically be reduced to 23° BTDC at engine speed of 5000 RPM). Tighten locknut.

NOTE: If initial timing adjustments are made without engine running, then final timing checks should be made with engine running due timing advance characteristics of ignition system. Minimum engine RPM required to check maximum timing advance is 3000 RPM.



a - Control Arm
b - Maximum Advance Screw
c - Locknut

Carburetor Specifications

Carburetor number stamped at TOP of carburetor mounting flange

NOTE: Early model engines may have identification stamped on face of air box mounting flange.

Carb Number	Location	Model HP	Main Jet*	Bowl* Vent Jet
WME-11, 20- 1 2 3	Top Carburetor Top Center Carburetor Bottom Center Carburetor Bottom Carburetor	100	.054	None
WME-14, 21- 1 2 3	Top Carburetor Top Center Carburetor Bottom Center Carburetor Bottom Carburetor	115	.076	None

* Standard jets listed are for operation of engine from 0-762 m (0-2500 ft.) of elevation (see jet size chart).

INITIAL STARTING ADJUSTMENTS

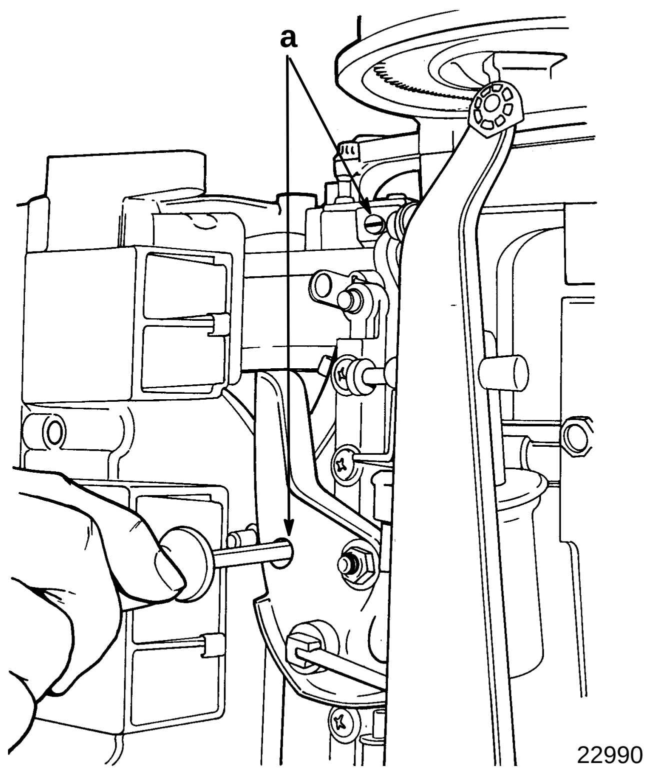
NOTE: For adjusting carburetor throttle linkage and synchronizing carburetors, see section “Timing/ Synchronizing/Adjusting” of this manual.

After service or replacement of carburetor, turn low speed mixture screw adjustment in (clockwise) until it seats lightly, then back off (each carburetor) to specifications (**100-**1-3/4 turns or **115-**1-1/2 turns). This will permit engine start-up.

LOW SPEED MIXTURE ADJUSTMENTS

NOTE: Only the top two carburetors on four cylinder models have an adjustable low speed mixture screw.

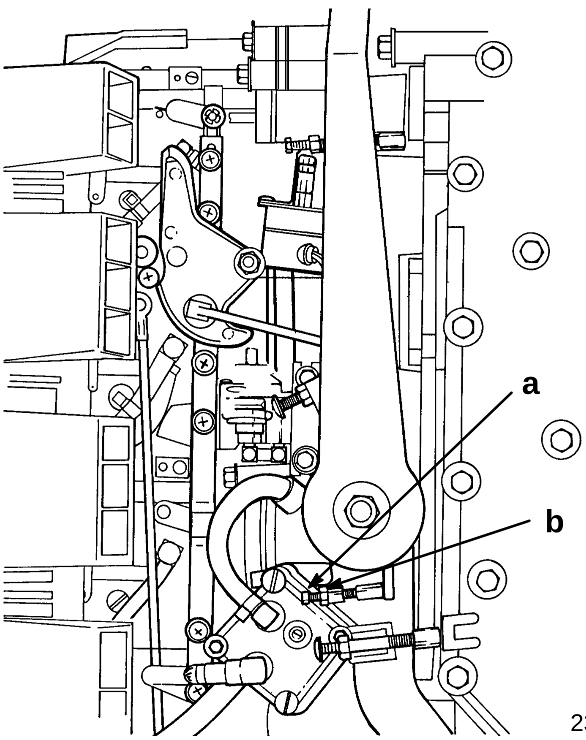
1. Start engine and allow to warm up (run for several minutes). Throttle back to idle for about one minute to allow RPM to stabilize.
2. With engine running at idle speed (in water) in “Forward” gear (prop on), turn low speed mixture screw, IN (clockwise) until engine starts to “bog” down and misfire. Back out 1/4 turn or more.
3. Check for too lean mixture on acceleration.
4. DO NOT adjust leaner than necessary to attain reasonable smooth idling. When in doubt, stay on the slightly rich side of the adjustment.



a - Low Speed Mixture Screw

Idle Adjustment

1. With engine in water, connect electrical harness and fuel line to engine. Start engine and allow to warm up.
2. Properly adjust carburetor low speed mixture screws. Refer to “Carburetor Adjustments” section 3A.
3. Holding throttle arm at idle position (throttle cable barrel removed from barrel retainer), adjust idle timing screw to attain an engine idle RPM of 650-700 RPM in “Forward” gear. Tighten locknut and turn off engine.



a - Idle Timing Screw
b - Locknut

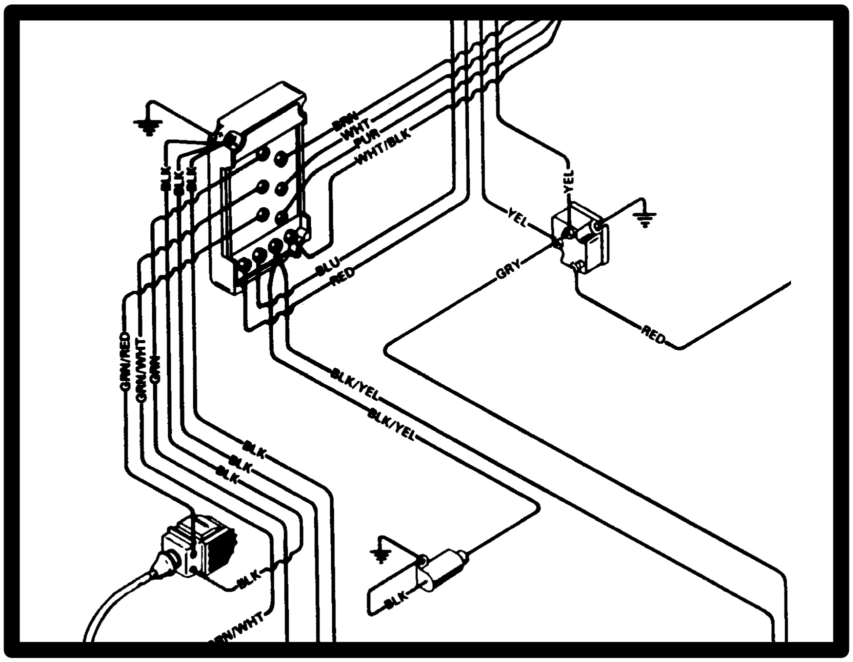
Throttle Cable Installation

1. With end of throttle cable connected to throttle lever, hold throttle lever against throttle stop. Adjust throttle cable barrel to slip into barrel retainer on cable anchor bracket with a very light preload of throttle lever against throttle stop. Lock barrel in place.

IMPORTANT: Excessive preload on throttle cable will cause difficulty when shifting from forward to neutral. (Readjust throttle cable barrel, if necessary.)

2. Check preload on throttle cable by placing a thin piece of paper between throttle stop screw and stop. Preload is correct when paper can be removed without tearing, but has some drag on it. Readjust throttle cable barrel, if necessary.)
3. Reinstall sound box cover.

ELECTRICAL AND IGNITION



WIRING DIAGRAMS

2

D

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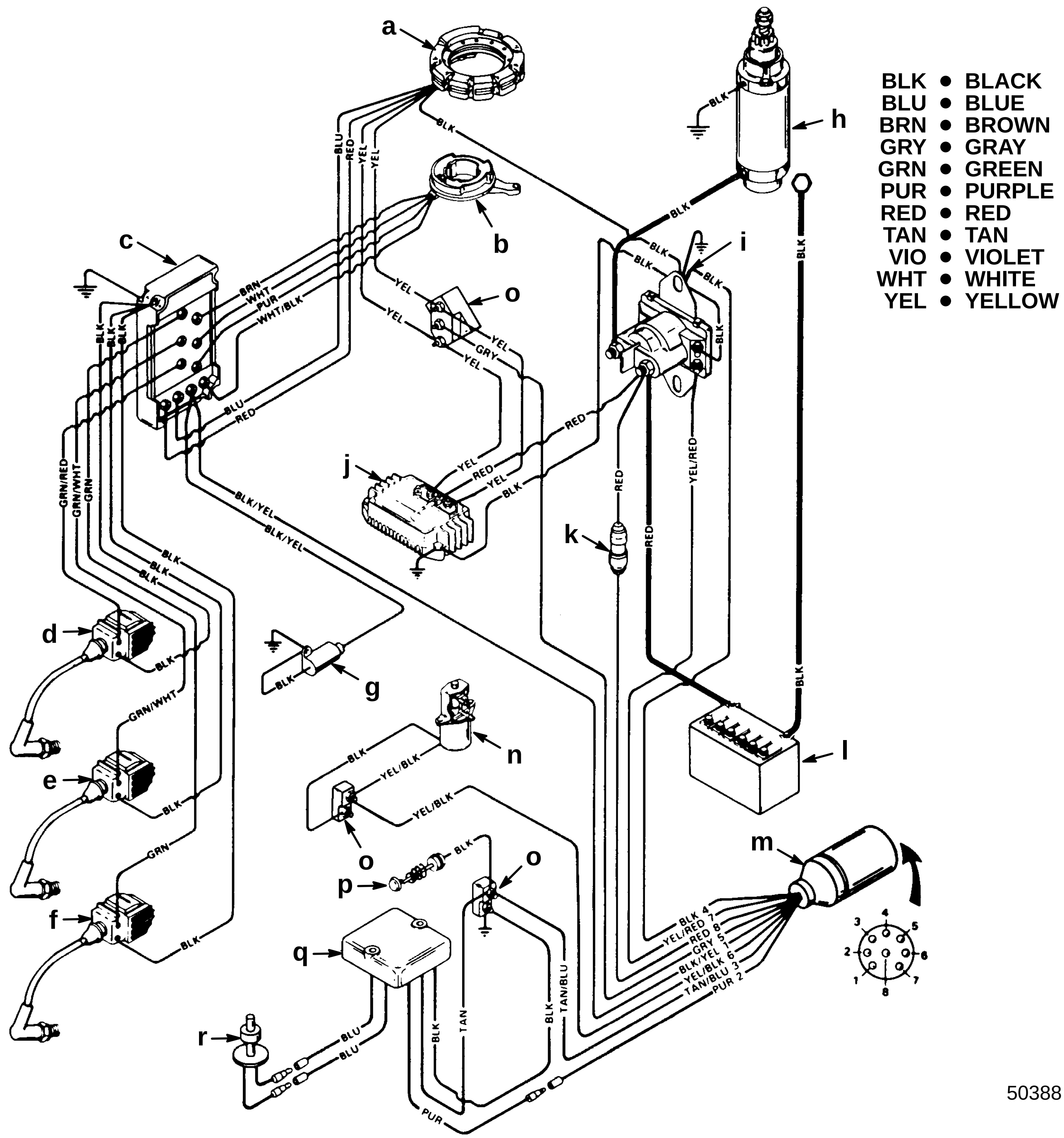
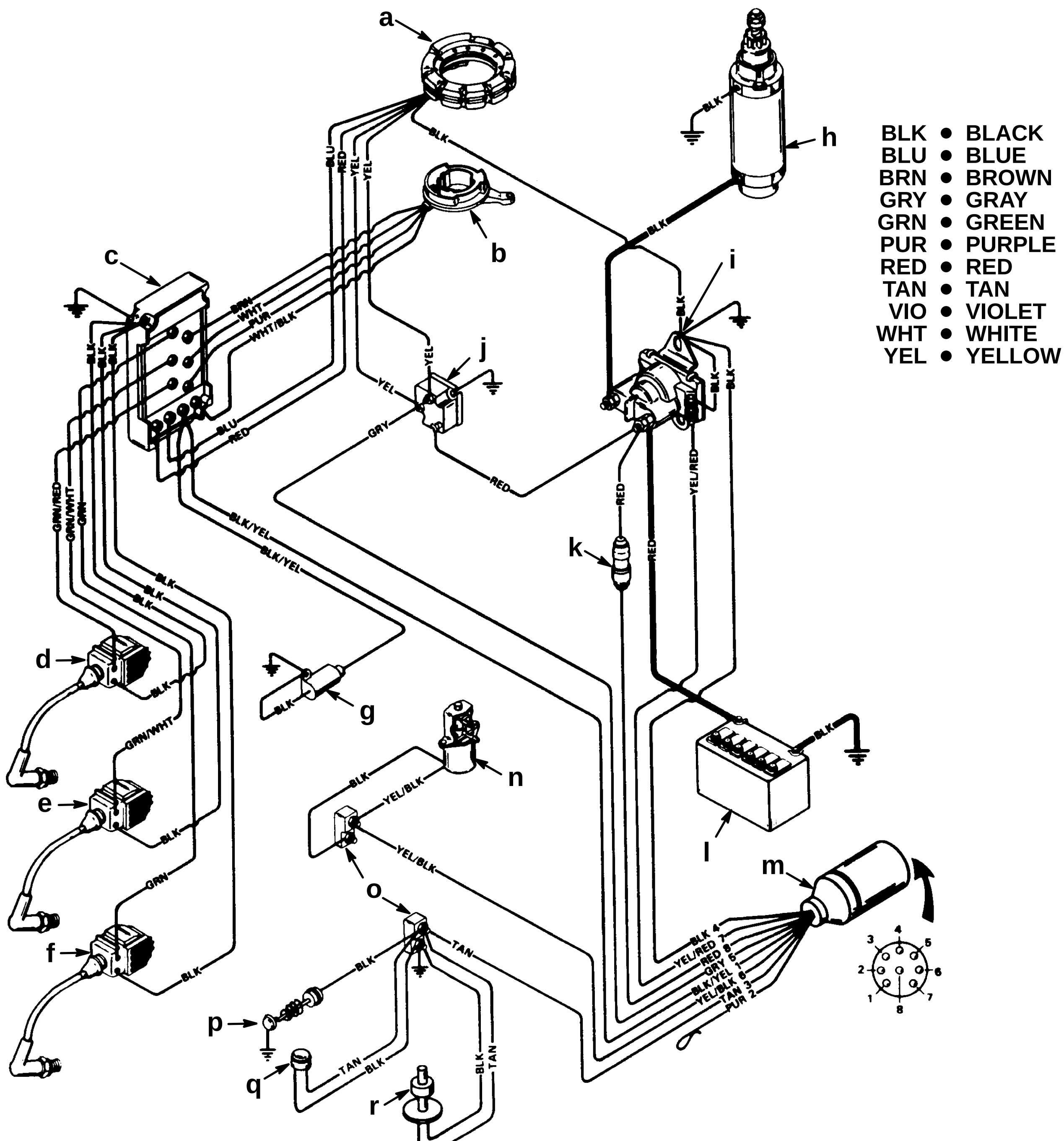
Engine Wiring Diagram (3 Cylinder Models With Low Oil Warning Module)



a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Cylinder No. 1
e - Ignition Coil Cylinder No. 2
f - Ignition Coil Cylinder No. 3
g - Mercury (Tilt) Stop Switch
h - Starter Motor
i - Starter Solenoid
j - Voltage Regulator/Rectifier
k - Fuse Holder (20 Amp Fuse)
l - Battery
m- Wiring Harness Connector
n - Enrichment Valve
o - Terminal Block
p - Temperature Switch – Opens [170°F ± 8° (77°C ± 8°)]
Closes [190°F ± 8° (88°C ± 8°)]
q - Low Oil Warning Module
r - Low Oil Sensor

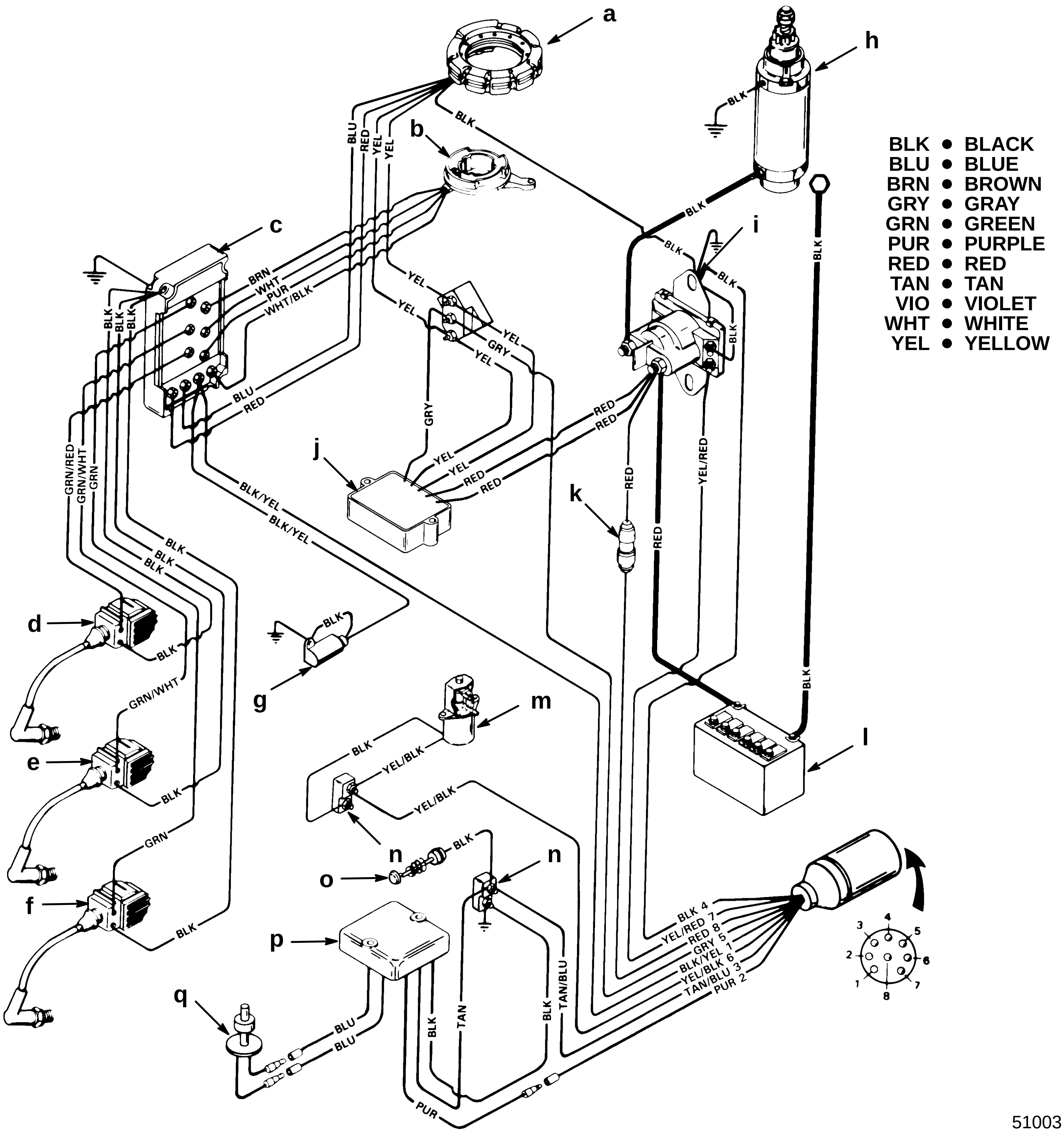
Engine Wiring Diagram (3 Cylinder Models Without Low Oil Warning Module)



23888

a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Cylinder No. 1
e - Ignition Coil Cylinder No. 2
f - Ignition Coil Cylinder No. 3
g - Mercury (Tilt) Stop Switch
h - Starter Motor
i - Starter Solenoid
j - Rectifier
k - Fuse Holder (20 Amp Fuse)
l - Battery
m- Wiring Harness Connector
n - Enrichment Valve
o - Terminal Block
p - Temperature Switch – Opens [170°F ± 8° (77°C ± 8°)]
Closes [190°F ± 8° (88°C ± 8°)]
q - Test Button
r - Low Oil Sensor

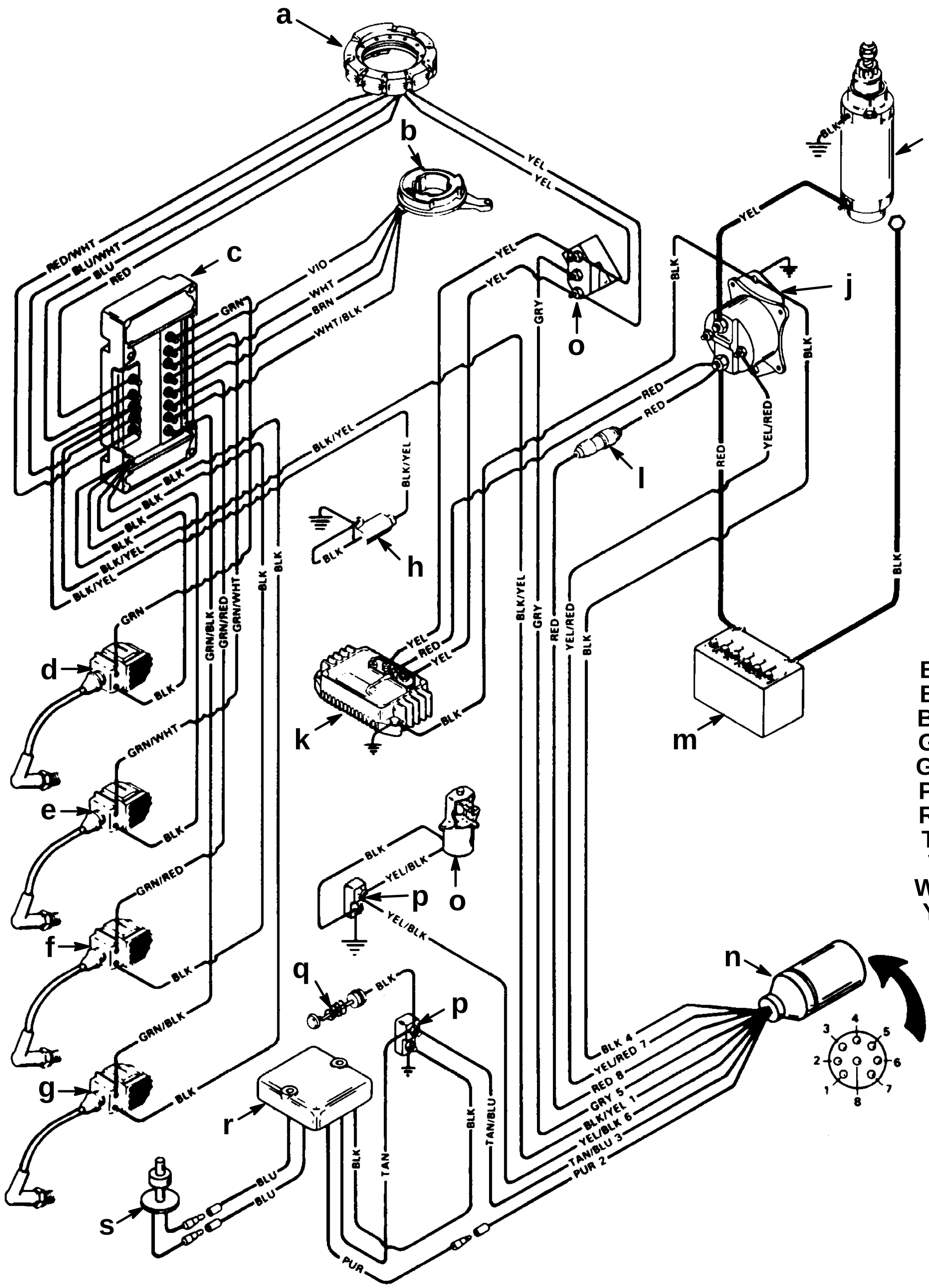
Engine Wiring Diagram (3 Cylinder Models With Small Voltage Regulator/Rectifier)



51003

a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Cylinder No. 1
e - Ignition Coil Cylinder No. 2
f - Ignition Coil Cylinder No. 3
g - Mercury Switch
h - Starter Motor
i - Starter Solenoid
j - Voltage Regulator/Rectifier
k - 20 Amp Fuse
l - Battery
m - Fuel Enrichment Valve
n - Terminal Block
o - Overheat Temperature Sensor
p - Warning Module
q - Low Oil Sensor (Float)

Engine Wiring Diagram
(4 Cylinder Models)



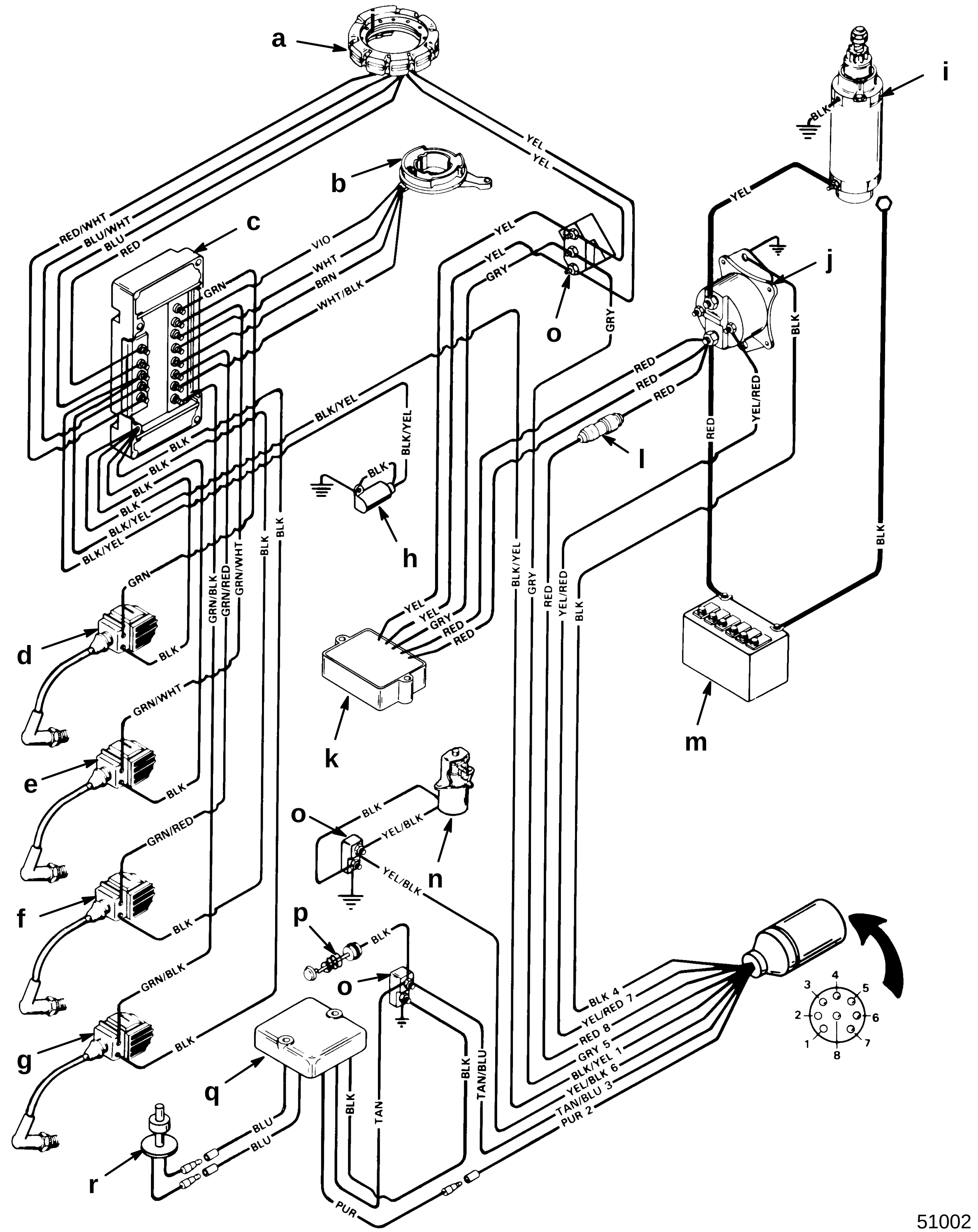
BLK	●	BLACK
BLU	●	BLUE
BRN	●	BROWN
GRY	●	GRAY
GRN	●	GREEN
PUR	●	PURPLE
RED	●	RED
TAN	●	TAN
VIO	●	VIOLET
WHT	●	WHITE
YEL	●	YELLOW

50389

a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Cylinder No. 1
e - Ignition Coil Cylinder No. 2
f - Ignition Coil Cylinder No. 3
g - Ignition Coil Cylinder No. 4
h - Mercury (Tilt) Stop Switch
i - Starter Motor
j - Starter Solenoid
k - Voltage Regulator/Rectifier
l - Fuse Holder (20 Amp Fuse)
m- Battery
n - Wiring Harness Connector
o - Enrichment Valve
p - Terminal Block
q - Temperature Switch – Opens [170°F ± 8° (77°C ± 8°)]
Closes [190°F ± 8° (88°C ± 8°)]
r - Low Oil Warning Module
s - Low Oil Sensor

Engine Wiring Diagram (4 Cylinder Models With Small Voltage Regulator/Rectifier)

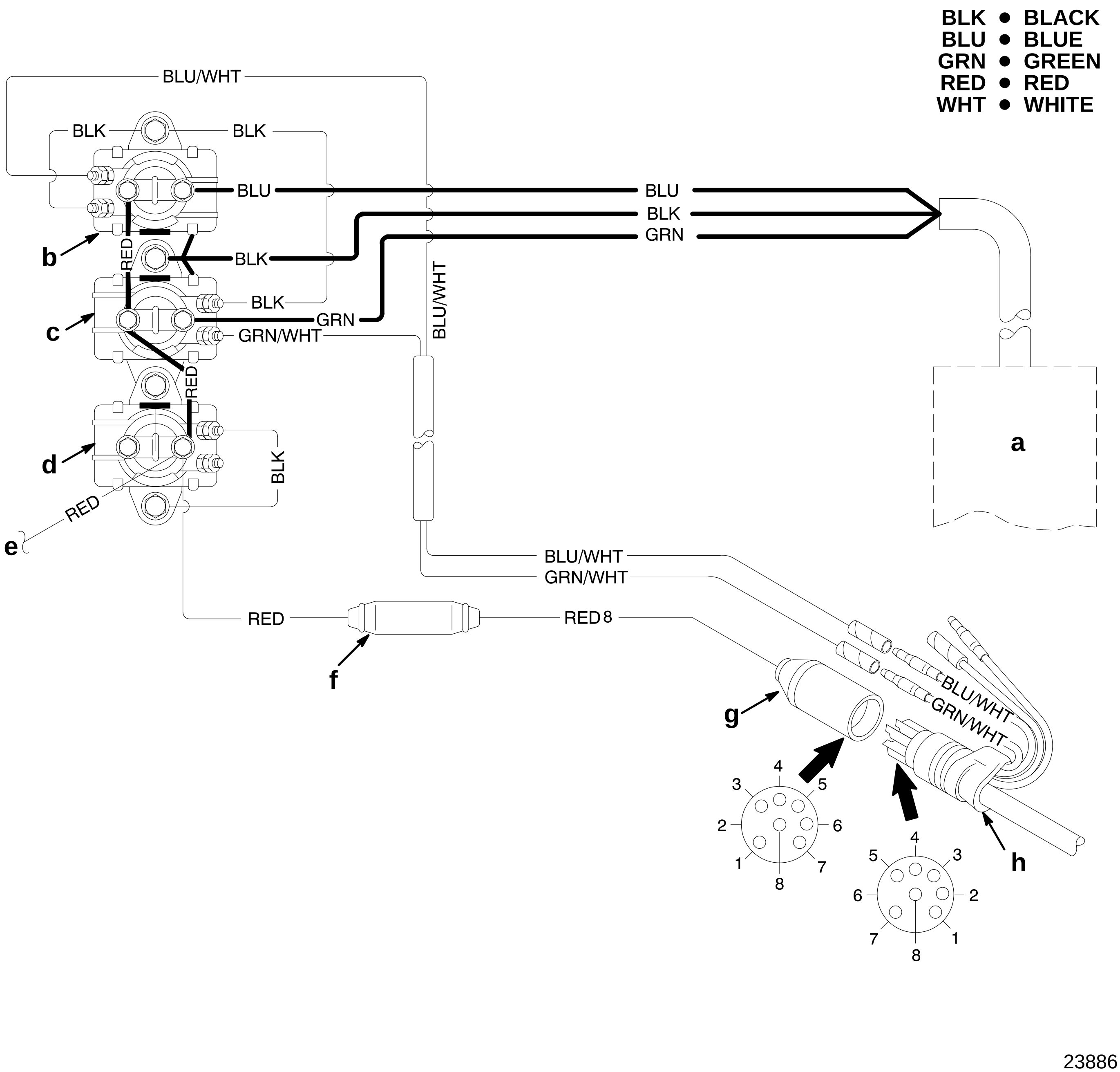
BLK	●	BLACK
BLU	●	BLUE
BRN	●	BROWN
GRY	●	GRAY
GRN	●	GREEN
PUR	●	PURPLE
RED	●	RED
TAN	●	TAN
VIO	●	VIOLET
WHT	●	WHITE
YEL	●	YELLOW



51002

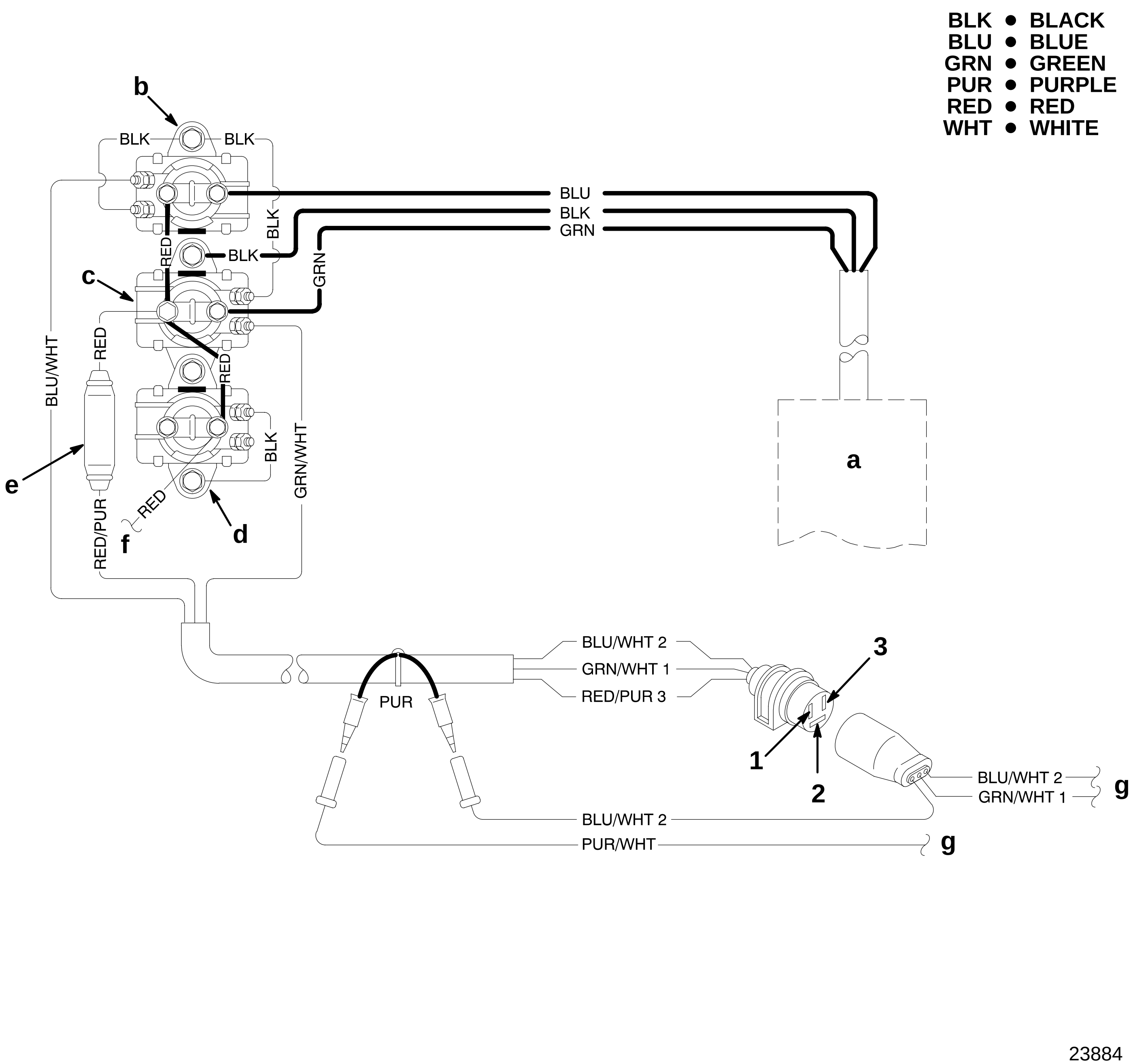
a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Cylinder No. 1
e - Ignition Coil Cylinder No. 2
f - Ignition Coil Cylinder No. 3
g - Ignition Coil Cylinder No. 4
h - Mercury Switch
i - Starter Motor
j - Starter Solenoid
k - Voltage Regulator/Rectifier
l - 20 Amp Fuse
m - Battery
n - Fuel Enrichment Valve
o - Terminal Block
p - Overheat Sensor
q - Warning Module
r - Low Oil Sensor (Float)

Power Trim System Wiring Diagram (3 Cylinder Models Using COMMANDER 2000 Side Mount Remote Control)



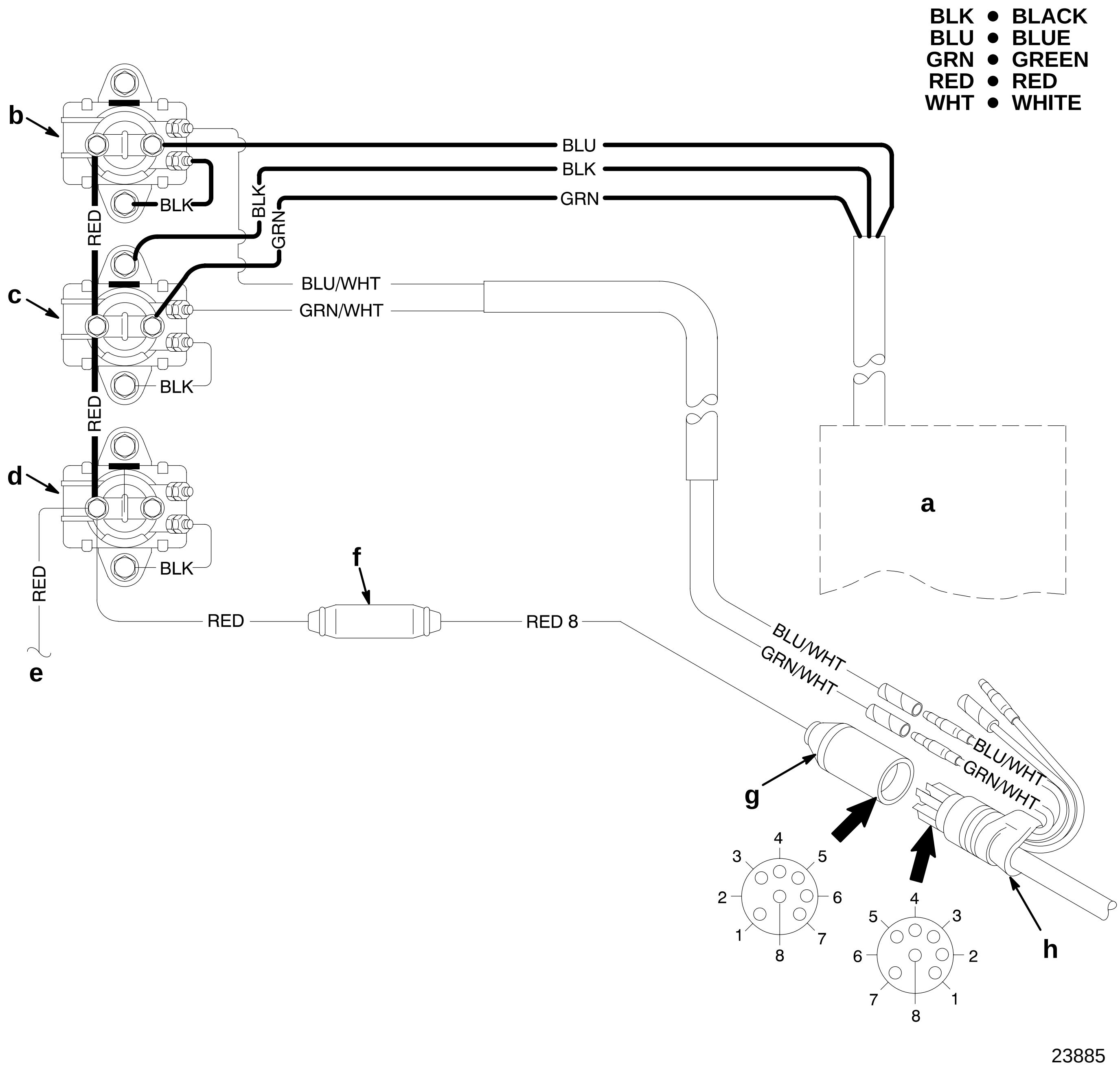
a - Power Trim Pump Motor
b - Trim Solenoid “UP”
c - Trim Solenoid “DOWN”
d - Engine Starter Motor Solenoid
e - Red (+) Battery Cable
f - Fuse Holder (20 Amp Fuse)
g - Engine Wiring Harness Connector
h - Remote Control Wiring Harness Connector

Power Trim System Wiring Diagram (3 Cylinder Models Using COMMANDER Side Mount Remote Control)



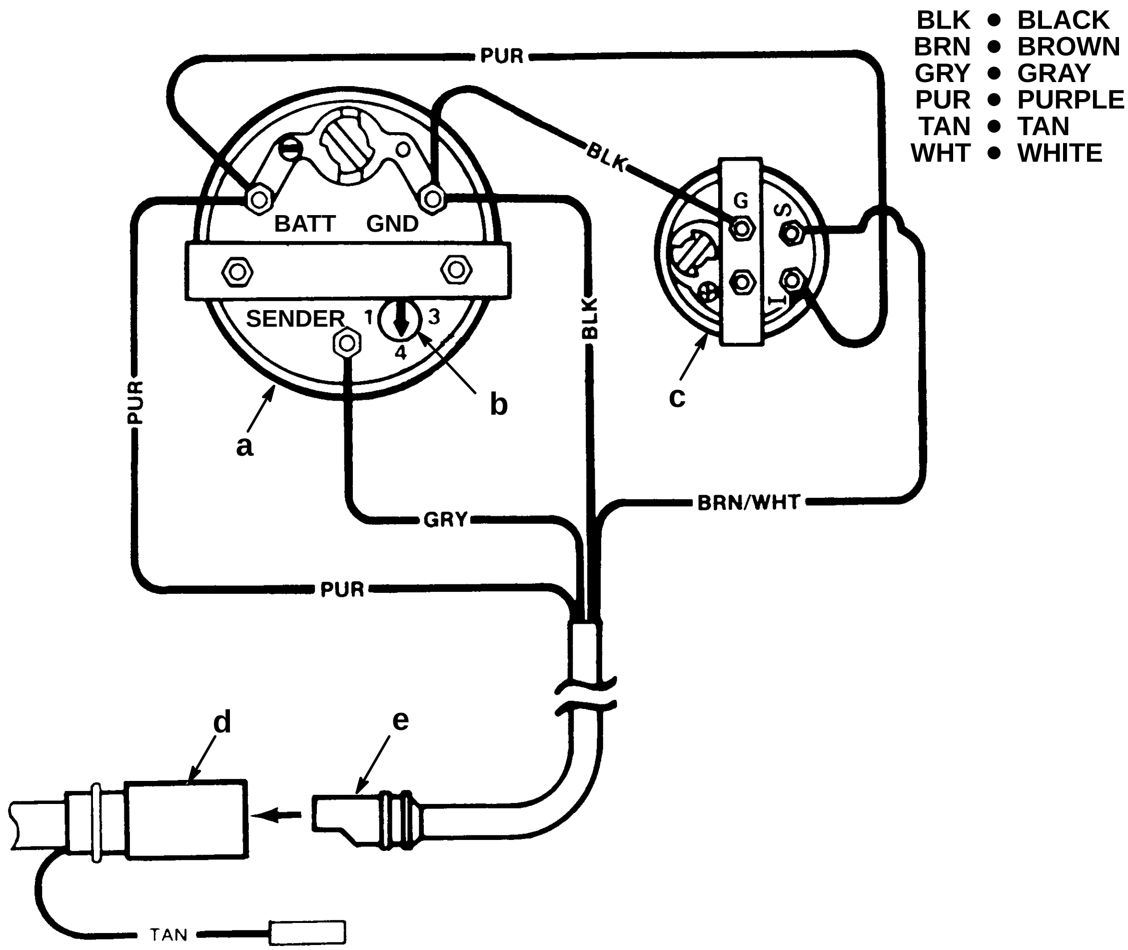
a - Power Trim Pump Motor
b - Trim Solenoid "UP"
c - Trim Solenoid "DOWN"
d - Engine Starter Motor Solenoid
e - Fuse Holder (20 Amp Fuse)
f - Red (+) Battery Cable
g - Wires from Remote Control

Power Trim System Wiring Diagram (4 Cylinder Models Using COMMANDER 2000 Side Mount Remote Control)



a - Power Trim Pump Motor
b - Trim Solenoid "UP"
c - Trim Solenoid "DOWN"
d - Engine Starter Motor Solenoid
e - Red (+) Battery Cable
f - Fuse Holder (20 Amp Fuse)
g - Engine Wiring Harness Connector
h - Remote Control Wiring Harness Connector

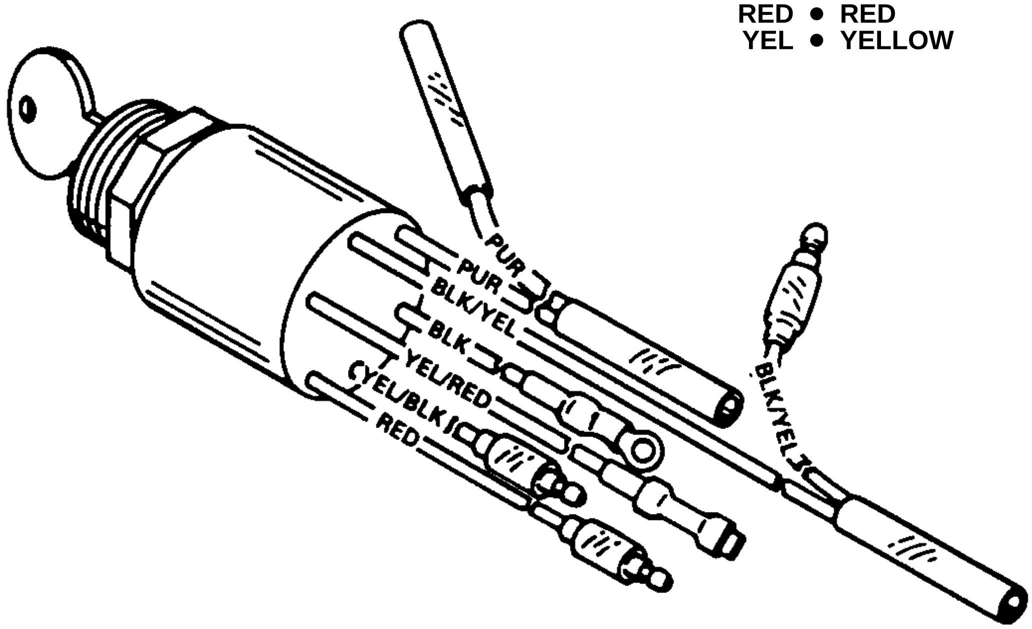
Tachometer (With Adjustable Dial) and Trim Indicator Gauge Wiring Diagram



a - Tachometer
b - Position Dial to Point Toward “4”
c - Trim Indicator Gauge (Optional)
d - Tachometer/Accessories Harness Plug from Remote Control
e - Tachometer/Accessories Harness

Key/Choke Switch Continuity Test (COMMANDER 2000 Side Mount Remote Control)

BLK ● BLACK
PUR ● PURPLE
RED ● RED
YEL ● YELLOW

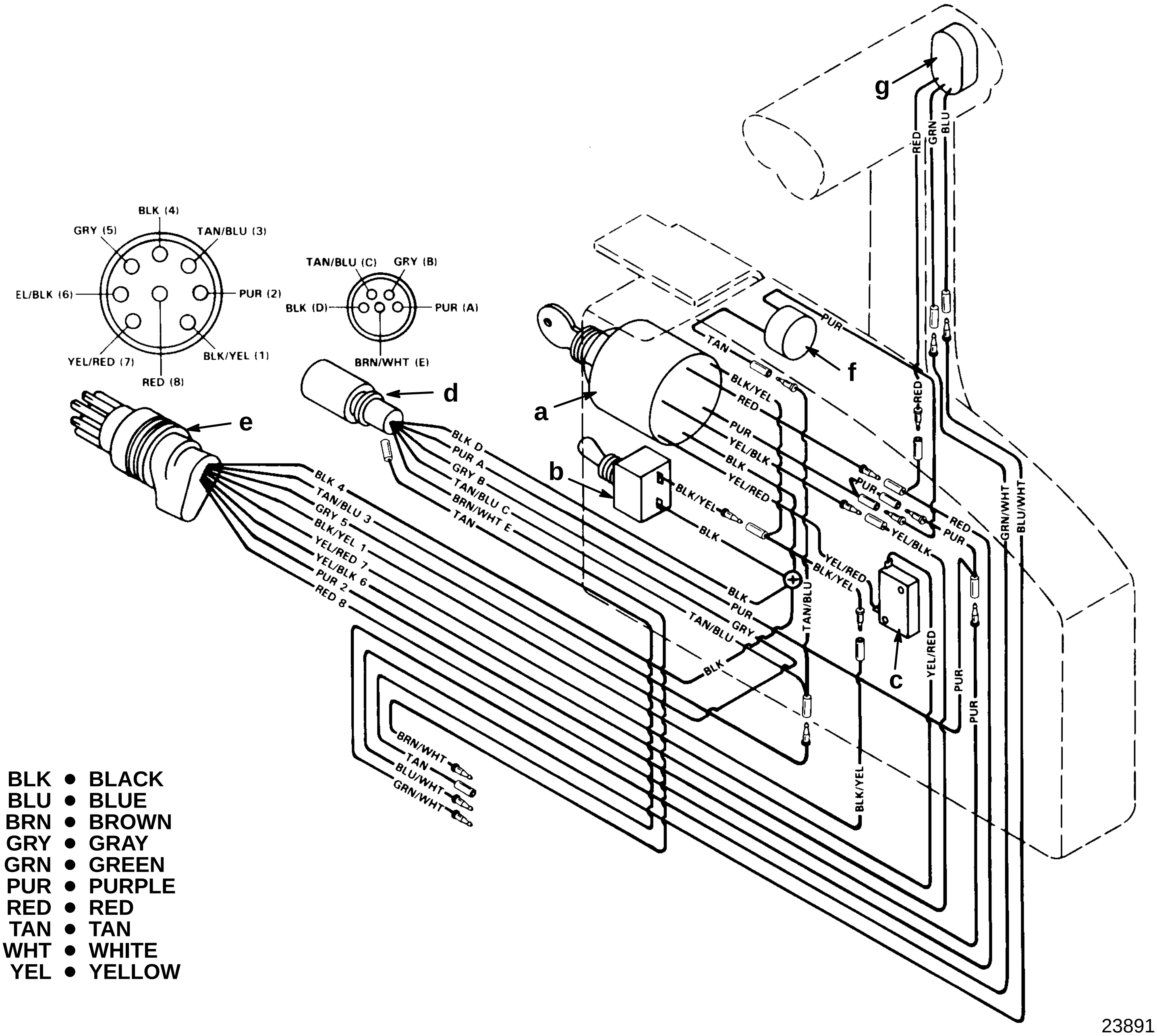


23894

“OFF”	**BLK/YEL – BLK**
“RUN”	**RED – PUR**
“START”	**RED – PUR – YEL/RED**
PUSH (CHOKE)*	**RED – YEL/BLK**

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

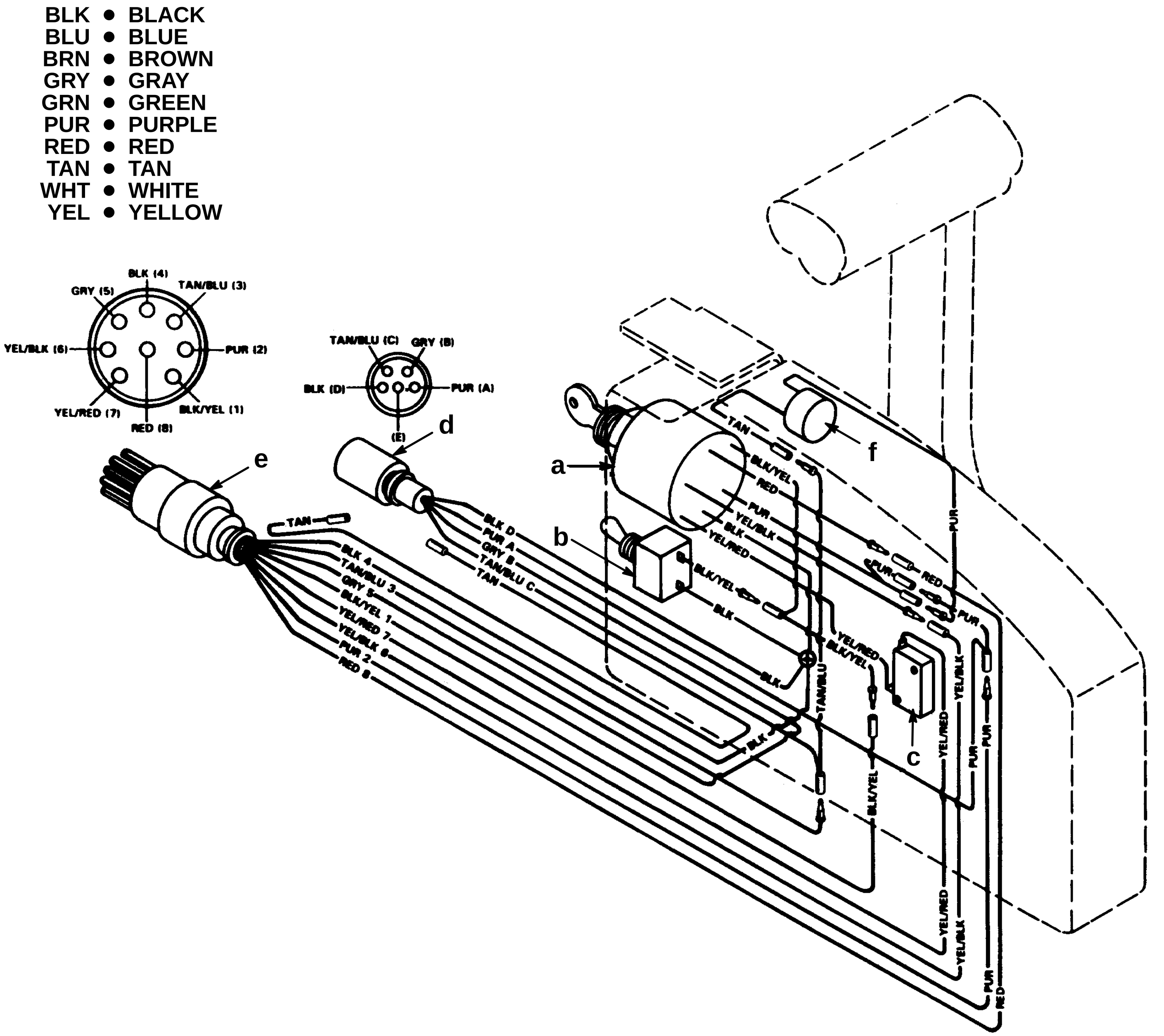
COMMANDER 2000 Side Mount Remote Control (Power Trim/Tilt Electric Start With Warning Horn) Wiring Diagram



BLK	•	BLACK
BLU	•	BLUE
BRN	•	BROWN
GRY	•	GRAY
GRN	•	GREEN
PUR	•	PURPLE
RED	•	RED
TAN	•	TAN
WHT	•	WHITE
YEL	•	YELLOW

a - Ignition/Choke Switch
b - Emergency Stop Switch
c - Neutral Start Switch
d - Tachometer/Accessories Harness Connector
e - Wiring Harness Connector
f - Warning Horn
g - Trim/Tilt Switch

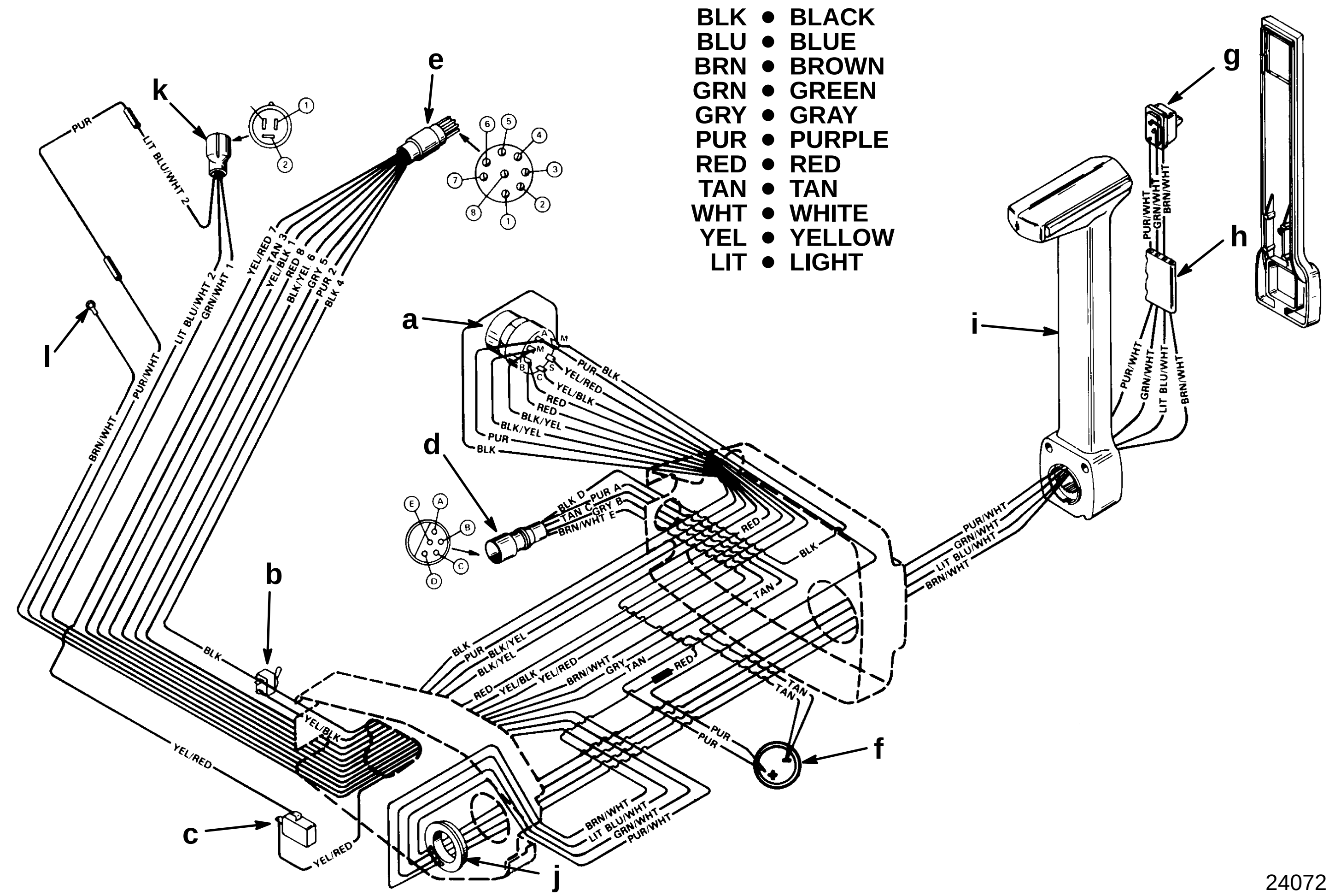
COMMANDER 2000 Side Mount Remote Control (Electric Start With Warning Horn) Wiring Diagram



23892

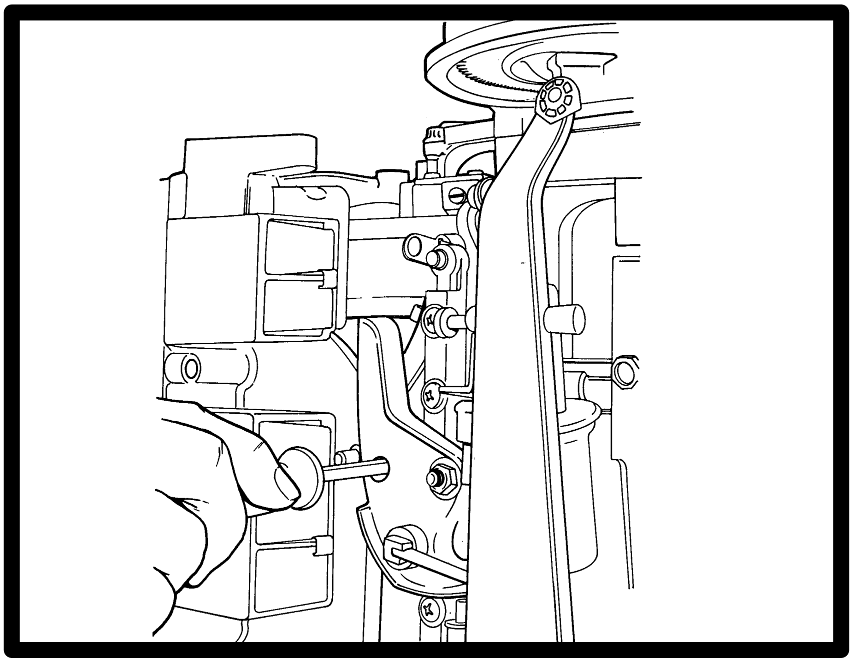
a - Ignition/Choke Switch
b - Emergency Stop Switch
c - Neutral Start Switch
d - Tachometer/Accessories Harness Connector
e - Wiring Harness Connector
f - Warning Horn

COMMANDER Side Mount Remote Control (Power Trim/Tilt Electric Start With Warning Horn) Wiring Diagram



a - Ignition/Choke Switch
b - Emergency Stop Switch
c - Neutral Start Switch
d - Tachometer/Accessories Harness Connector
e - Wiring Harness Connector
f - Warning Horn
g - Trim/Tilt Switch
h - Wire Retainer
i - Control Handle
j - Trim Harness Bushing
k - Trim Harness Connector
l - Lead to Trim Indicator Gauge

FUEL SYSTEM AND CARBURETION



3

A

Table Of Contents

Fuel Pumps

General Information

FUEL PUMP DESCRIPTION/OPERATION

The fuel pump is a crankcase-pressure-operated, diaphragm-type pump. Crankcase pulsating pressure (created by the up-and-down movement of piston) is transferred to fuel pump by way of a passage (hole) between crankcase and fuel pump.

When piston is in an upward motion, a vacuum is created in the crankcase, thus pulling in a fuel/air mixture (from carburetor) into crankcase. This vacuum also pulls in on the fuel pump diaphragm, thus the inlet check valve (in fuel pump) is opened and fuel (from fuel tank) is drawn into fuel pump.

Downward motion of the piston forces the fuel/air mixture out of the crankcase into the cylinder. This motion also forces out on the fuel pump diaphragm, which, in turn, closes the inlet check valve (to keep fuel from returning to fuel tank) and opens the outlet check valve, thus forcing fuel to the carburetors.

CHECKING FOR RESTRICTED FUEL FLOW CAUSED BY ANTI-SIPHON VALVES

While anti-siphon valves may be helpful from a safety stand-point, they clog with debris, they may be too small, or they may have too heavy a spring. Summarizing, the pressure drop across these valves can, and often does, create operational problems and/or powerhead damage by restricting fuel to the fuel pump and carburetor(s). Some symptoms of restricted (lean) fuel flow, which could be caused by use of an anti-siphon valve, are:

- Loss of fuel pump pressure
- Loss of power
- High speed surging
- Preignition/detonation (piston dome erosion)
- Outboard cuts out or hesitates upon acceleration
- Outboard runs rough
- Outboard quits and cannot be restarted
- Outboard will not start
- Vapor lock

Since any type of anti-siphon device must be located between the outboard fuel inlet and fuel tank outlet, a simple method of checking [if such a device (or bad fuel) is a problem source] is to operate the outboard with a separate fuel supply which is known to be good, such as a remote fuel tank.

If, after using a separate fuel supply, it is found that the anti-siphon valve is the cause of the problem, there are 2 solutions to the problem; either (1) remove the anti-siphon valve or (2) replace it with a solenoid-operated fuel shutoff valve.

Testing

Install clear fuel hose(s) between fuel pump and carburetor(s). Run engine, and inspect fuel passing thru hose(s) for air bubbles. If air bubbles are found, see "Air Bubbles in Fuel Line," below. If air bubbles are NOT found, see "Lack of Fuel Pump Pressure," continued on next page.

Troubleshooting Fuel Pump

PROBLEM: AIR BUBBLES IN FUEL LINE	
Possible Cause	**Corrective Action**
Low fuel in fuel tank.	Fill tank with fuel.
Loose fuel line connection.	Check and tighten all connections.
Fuel pump fitting loose.	Tighten fitting.
A hole or cut in fuel line.	Check condition of all fuel lines and replace any found to be bad.
Fuel pump anchor screw(s) loose.	Tighten all screws evenly and securely.
Fuel pump gasket(s) worn out.	Rebuild fuel pump.

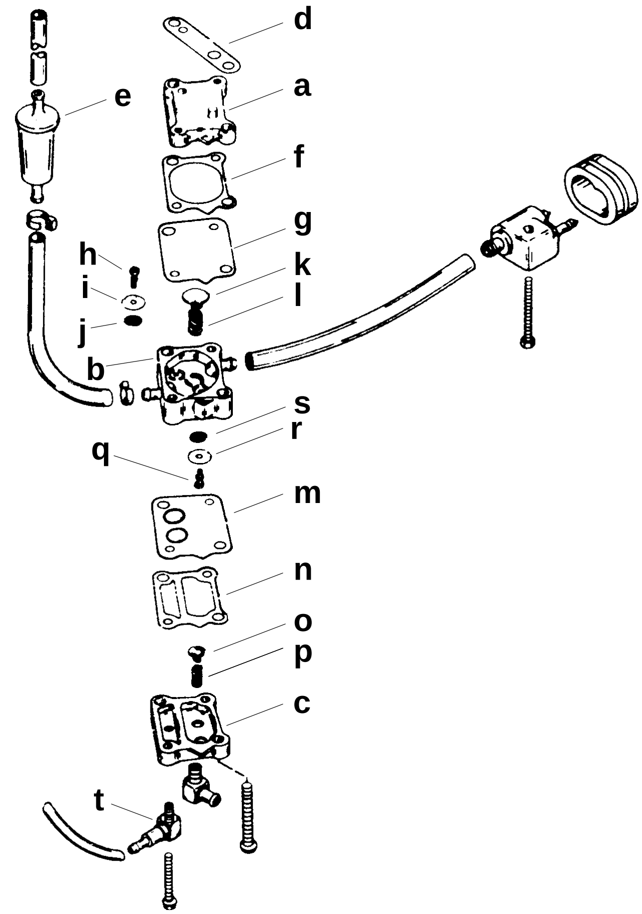
PROBLEM: LACK OF FUEL PUMP PRESSURE	
Possible Cause	**Corrective Action**
An anti-siphon valve.	Read "Checking for Restricted Fuel Flow, Caused by Anti-Siphon Valves" preceding.
Air in fuel line.	"Air Bubbles in Fuel Line", preceding.
A dirty or clogged fuel filter.	Clean or replace fuel filter.
The fuel pickup in fuel tank clogged or dirty.	Clean or replace pickup.
Worn out fuel pump diaphragm.	Rebuild fuel pump.
Defective (hole or crack) check valve(s) in fuel pump (unlikely).	Rebuild fuel pump.
Broken check valve retainer.	Rebuild fuel pump.
Pulse hole plugged.	Remove fuel pump and clean out hole.

Troubleshooting Fuel Pump (continued)

PROBLEM: LACK OF FUEL PUMP PRESSURE	
Possible Cause	**Corrective Action**
Hole in pulse hose (1 pulse hose).	Replace pulse hose.
Loose pulse hose.	Tighten connection.
Boost diaphragm gasket distorted or out of place.	Check seal between mating surfaces where "rib" divides pulse chamber – gasket must align with rib; check for distorted gasket. Align or replace gasket if necessary.

Fuel Pump Components (Design 1)

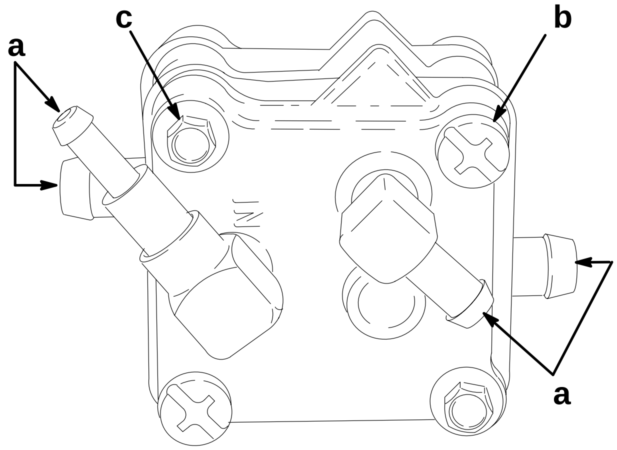
NOTE: In fuel pump reassembly, remember that respective diaphragms go against the mating surfaces of the fuel pump body, and respective gaskets are between the diaphragms and end caps. Gaskets should always be replaced on fuel pump assembly.



a - Fuel Pump Base
b - Fuel Pump Body
c - Chamber Plate
d - Gasket, Base
e - Fuel Filter – Inline
f - Gasket, Pulse Chamber
g - Diaphragm, Fuel Pump
h - Retainer, Check Valve
i - Check Valve
j - Check Valve Rubber Disc
k - Main Compression Spring End Cap
l - Main Compression Spring
m- Boost Diaphragm
n - Boost Chamber Gasket
o - Boost Compression Spring End Cap
p - Boost Compression Spring
q - Retainer, Check Valve
r - Check Valve
s - Check Valve Rubber Disc
t - Check Valve Assembly

Fuel Pump Removal/Installation (Design 1)

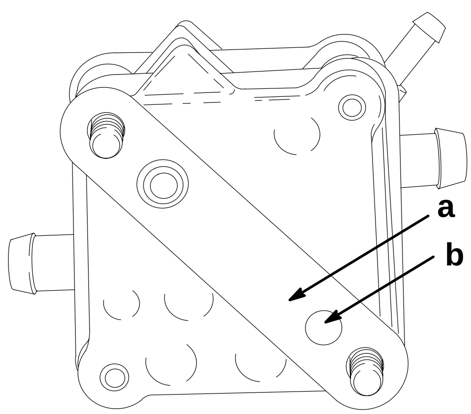
- Remove 4 hoses from fuel pump.
- Remove 2 phillips-head screws -- lift off fuel pump.
- Remove 2 hex-head bolts to disassemble fuel pump.



20427

a - Fuel Pump
b - Screws (2 Each)
c - Bolts (2 Each)

- Remove gasket from backside (fuel pump base) -- replace gasket as necessary -- check gasket in port area carefully.



20417

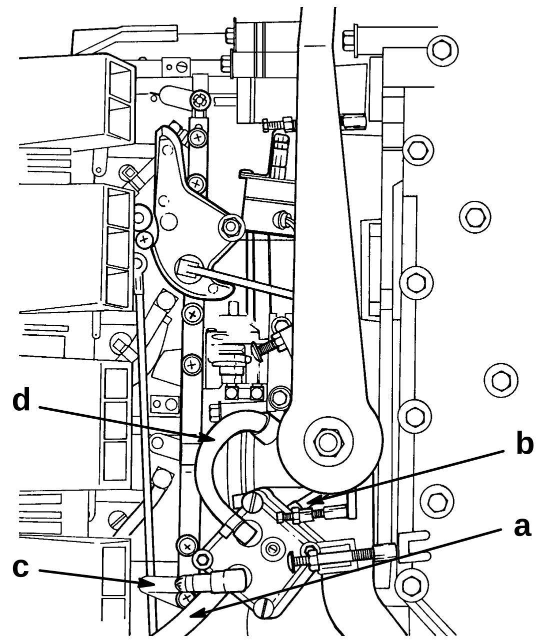
a - Gasket
b - Port Area

Reinstall Fuel Pump (Design 1)

⚠ CAUTION

After reinstalling fuel pump, ALWAYS check all fuel line connections for leaks, with engine running.

- Reinstall fuel pump to powerhead, as shown, with 2 phillips-head screws.
- Attach fuel lines (inlet and outlet).
- Attach oil injection hose.
- Attach pulse hose.
- Secure each hose connection with a sta-strap.



a - Inlet Fuel Hose
b - Outlet Fuel Hose
c - Oil Injection Hose
d - Pulse Hose

Fuel Pump Cleaning, Inspection, Disassembly and Reassembly (Design 1 and 2)

- Disassemble by removing 2 hex-head bolts; remove/disassemble fuel pump parts.

Fuel Pump – Cleaning/Inspection

Clean fuel pump housing, check valves, pulse chamber, and pump base in solvent, and dry all but check valves with compressed air.

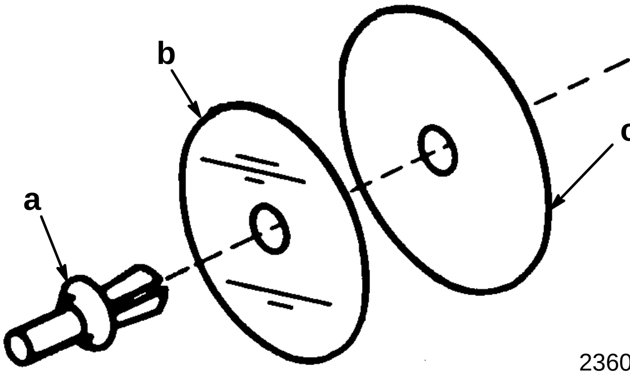
Inspect each check valve (2 ea.), for cracks and/or holes. Check each black rubber disc (2 ea.) to see that the black coating is not coming off. Unless damaged while disassembled, replacement is seldom necessary. Inspect the Check Valve Assembly on Chamber Plate (check by both pressure and suction to hose barb), to see that check ball is moving and functioning (1-3 psi required).

Inspect fittings on fuel pump housing for looseness or any signs of fuel or air leaks. Replace or tighten fitting if leak is found, or replace chamber Plate Assembly.

Check Valve Reassembly

ASSEMBLY (DESIGN I)

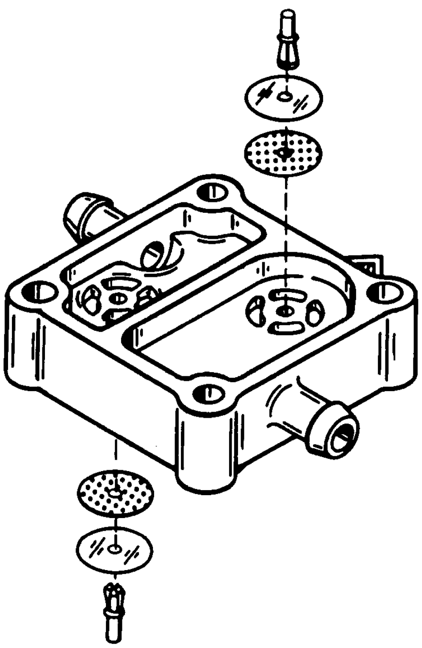
1. Insert retainer thru plastic disc and rubber check valve.



23601

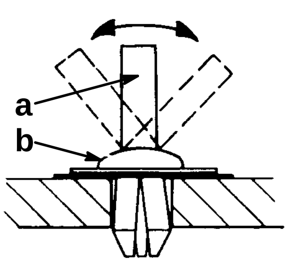
a - Retainer
b - Plastic Disc
c - Check Valve

2. Install check valves and retainers into fuel pump body.



24514

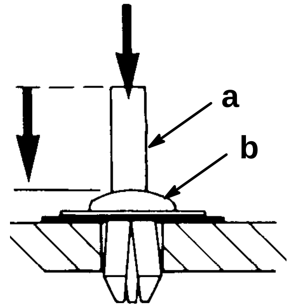
3. With retainer installed in pump body, break retainer rod from retainer by bending sideways.



23601

a - Retainer Rod
b - Retainer

4. Reinstall rod into retainer cap and, use a small hammer or hammer and punch to tap rod down into retainer until flush with top of retainer.



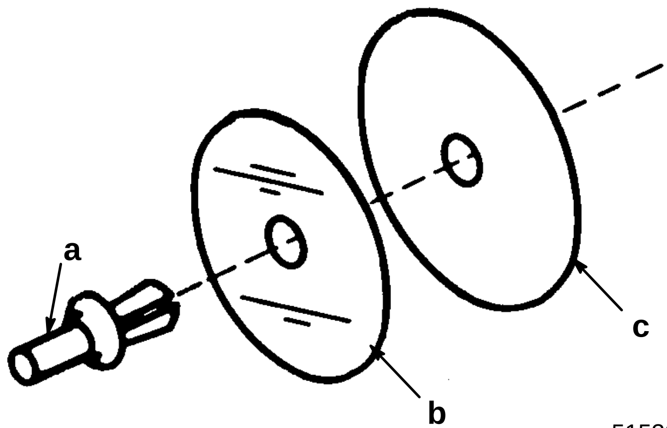
23601

a - Rod
b - Retainer Cap

Check Valve Reassembly

ASSEMBLY (DESIGN II)

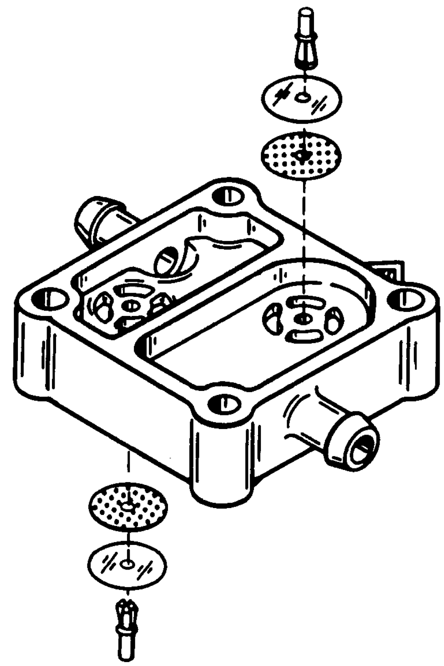
1. Insert retainer thru plastic disc and rubber check valve.



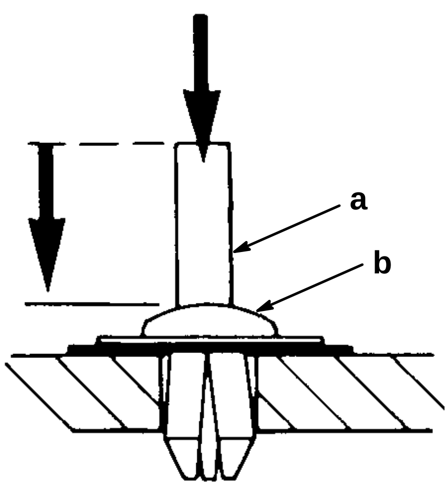
51530

a - Retainer
b - Plastic Disc
c - Check Valve

2. Install check valves and retainers into fuel pump body.


51530

3. Reinstall rod into retainer cap and, use a small hammer or hammer and punch to tap rod down into retainer until flush with top of retainer.



a - Rod
b - Retainer Cap

Step-by-Step Reassembly

IMPORTANT: ALWAYS REPLACE GASKETS.

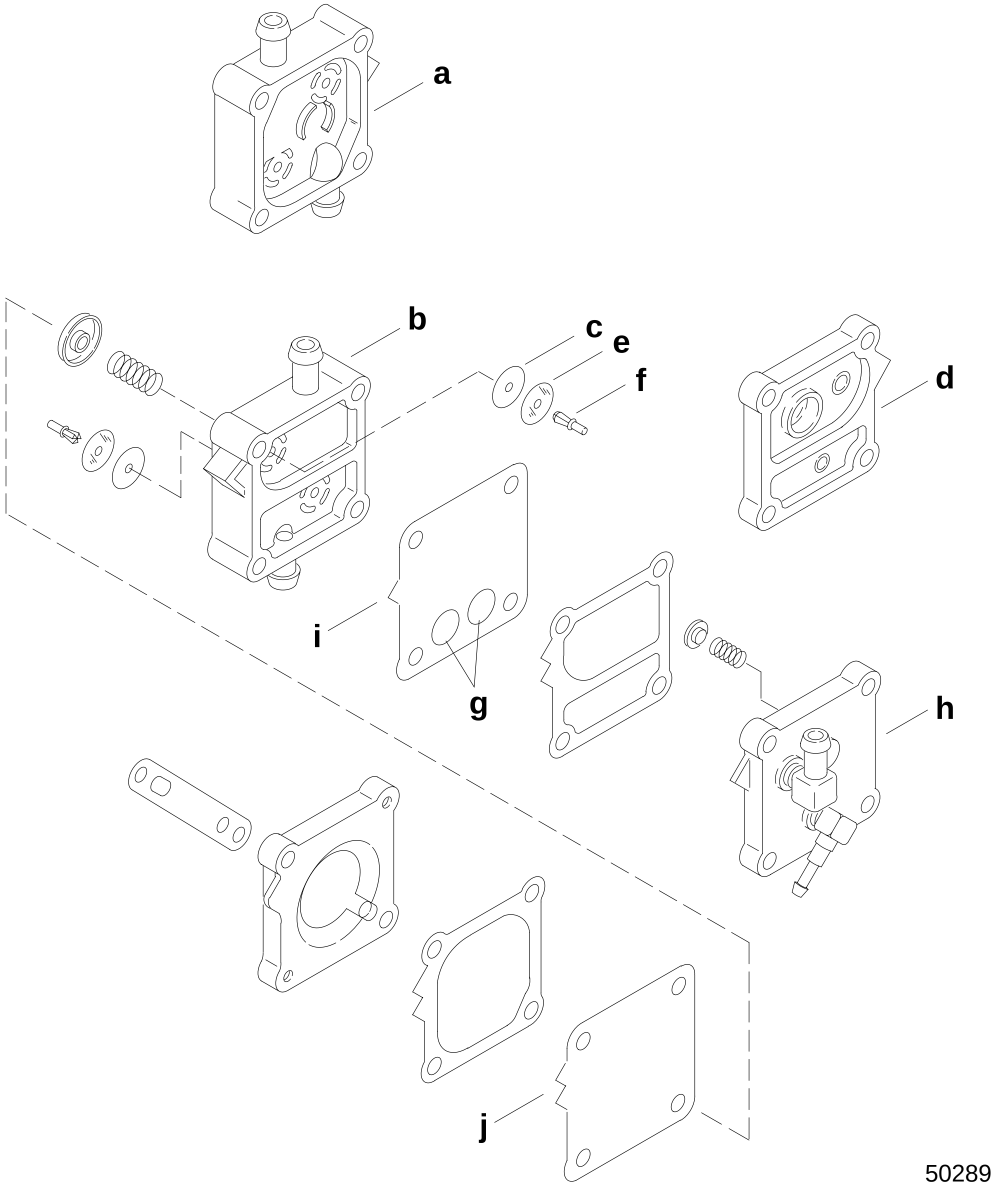
STEP-BY-STEP FUEL PUMP REASSEMBLY

After reassembling check valve in fuel pump body, using the following procedure will help insure proper reassembly:

1. Insert two 3 in. minimum length 1/4″ bolts (not the fuel pump bolts) OR 1/4″ dowels, through the opposite large holes (6mm bolt holes) in the chamber plate, as locating dowels, and turn plate upside down so that the inner side is facing up.
2. Insert coil spring and cap in place.
3. Place Boost Chamber GASKET over dowels (bolts) and lower onto Chamber Plate -- BE SURE that gasket directional alignment is correct and that “V-tabs” are aligned.
4. Place Boost DIAPHRAGM over dowels, and lower to assembly.
5. Place Fuel Pump Body over dowels, and lower to assembly.
6. Insert Coil Spring and Cap in pump body.
7. Place Fuel Pump DIAPHRAGM over dowels, and lower to assembly.
8. Place Pulse Chamber GASKET over dowels, and lower to assembly.
9. Place Fuel Pump Base over dowels, and lower to assembly.
10. Grasp assembly firmly and clamp together with hands--turn over, and insert the 5mm Fuel Pump BOLTS (hex-head); After tightening, remove dowels (1/4″ bolts) used for locators.
11. Check that the directional alignment of all parts is correct and that the “V-Tabs” are aligned.

70-75-80-90 (3 cyl.) (Design 1)

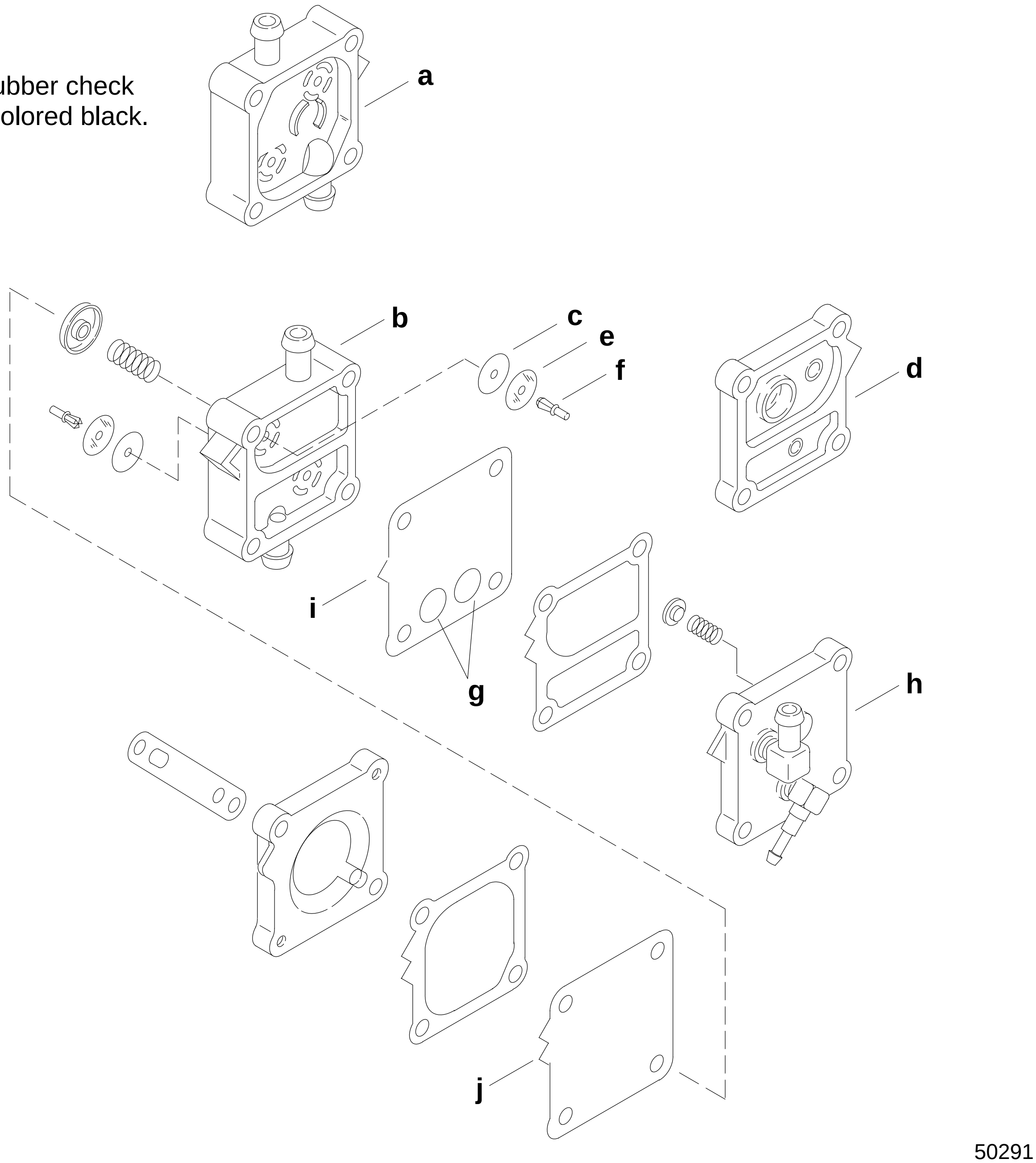
Previous body with rubber check valve retainers was colored black.



a - Body (Opposite Side View)
b - Natural Body (Off White)
c - Rubber Valve
d - Cover (Opposite Side View)
e - Plastic Disc
f - Plastic Check Valve Retainer
g - Two Oil Passage Holes
h - Cast Aluminum Cover
i - One Tab
j - Two Tabs

100-115 (4 cyl.) (Design 1)

Previous body with rubber check valve retainers was colored black.

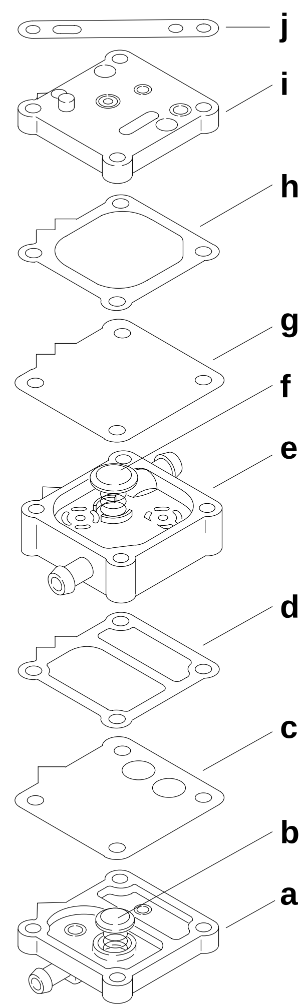


a - Body (Opposite Side View)
b - Natural Body (Off White)
c - Rubber Valve
d - Cover (Opposite Side View)
e - Plastic Disc
f - Plastic Check Valve Retainer
g - Two Oil Passage Holes
h - Cast Aluminum Cover
i - One Tab
j - Two Tabs

REASSEMBLY SEQUENCE (DESIGN 1)

⚠ CAUTION

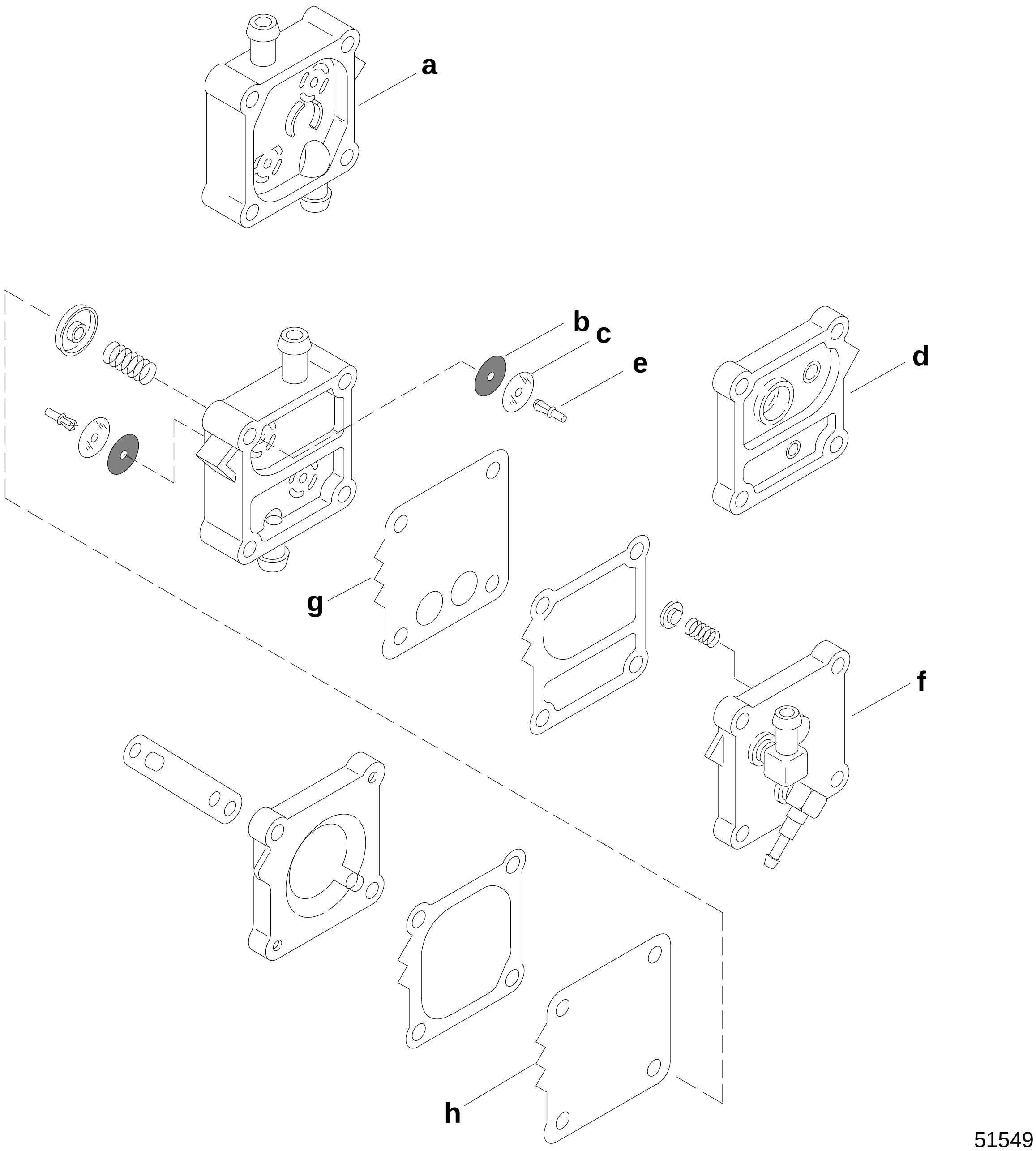
Observe position of both Pulse Chamber DIAPHRAGM and GASKET. The two larger holes allow oil injection output to enter the gas flow. Failure to reinstall as shown WILL result in extensive damage to engine.



a - Chamber Plate (Step 1)
b - Boost Compression Spring & Cap (Step 2)
c - Boost Chamber Gasket (Step 3)
d - Boost Diaphragm (Step 4)
e - Fuel Pump Body (Step 5)
f - Main Compression Spring & Cap (Step 6)
g - Fuel Pump Diaphragm (Step 7)
h - Pulse Chamber Gasket (Step 8)
i - Fuel Pump Base (Step 9)
j - Fuel Pump to Powerhead Gasket - Shown for Identification Purposes Only

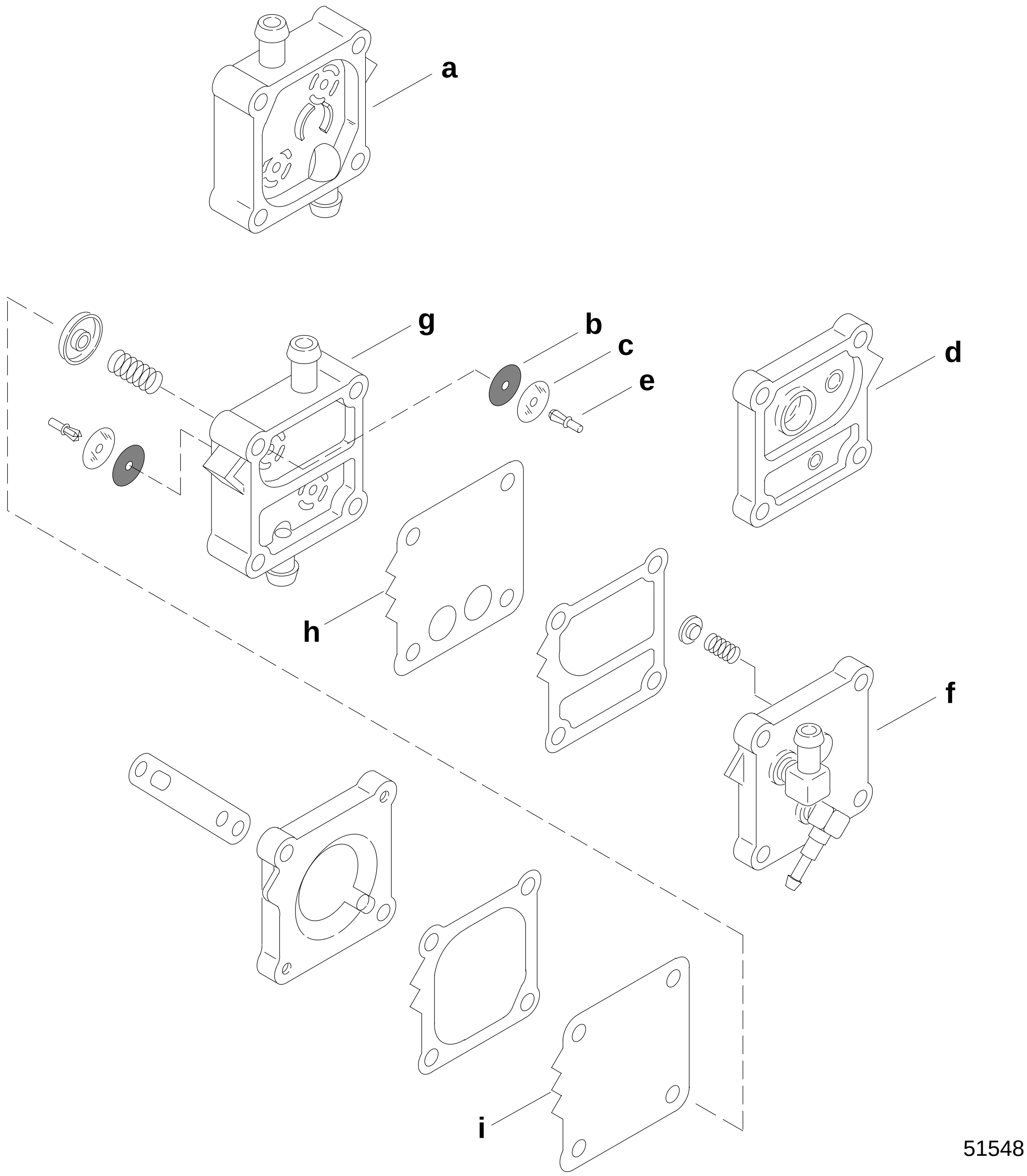
Reinstalling Fuel Pump to Powerhead - see preceding page

70-75-80-90 (3 cyl.) (Design 2)



a - Body (Opposite Side View)
b - Rubber Valve
c - Plastic Disc
d - Cover (Opposite Side View)
e - Plastic Check Valve Retainer
f - Cast Aluminum Cover
g - Three Tabs
h - Three Tabs

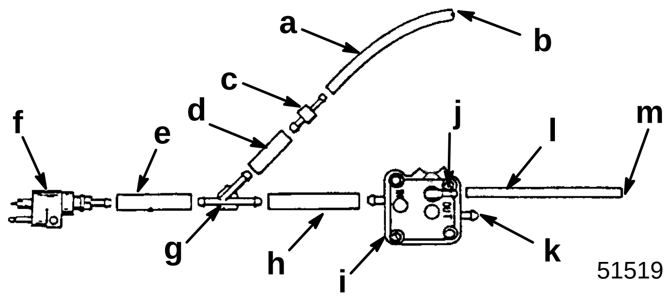
100-115 (4 cyl.) (Design 2)



a - Body (Opposite Side View)
b - Rubber Valve
c - Plastic Disc
d - Cover (Opposite Side View)
e - Plastic Check Valve Retainer
f - Cast Aluminum Cover
g - Body
h - Three Tabs
i - Three Tabs

Installation of Design 2 Fuel Pump

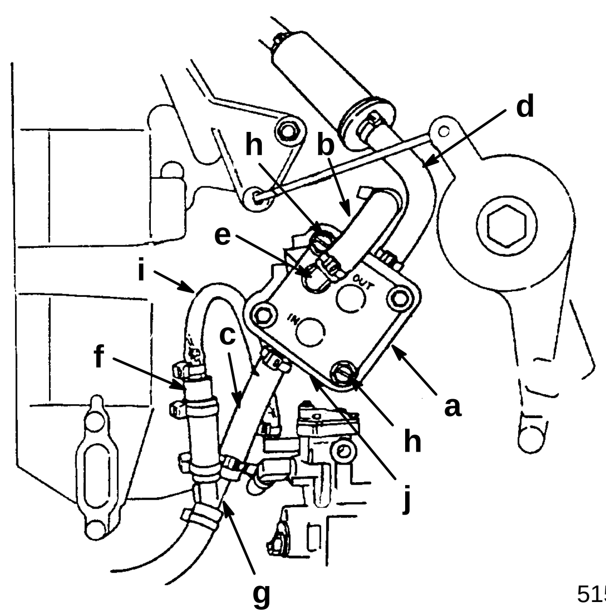
MODEL 70, 75, 80, 90



51519

a - Clear Tube [5.5 in. (139.7mm)]
b - To Oil Pump Outlet
c - Check Valve
d - Hose [1.5 in. (38.1mm)]
e - Hose [2.5 in. (63.5mm)]
f - Fuel Line Connector
g - Y-Fitting
h - Hose [3 in. (76.2mm)]
i - Fuel Pump
j - 90 Degree Elbow
k - Fuel Outlet to Filter
l - Hose [2.5 in. (63.5mm)]
m- To Pulse Fitting on Powerhead

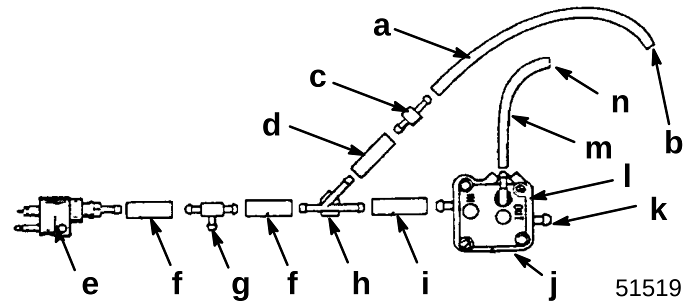
MODEL 70, 75, 80, 90



51516

a - Fuel Pump
b - Pulse Hose
c - Inlet Hose
d - Outlet Hose (Replace with Molded Hose)
e - Elbow [Apply PERFECT SEAL (92-34227--1) to threads]
f - Check Valve
g - Y-Connector
h - Screws [Torque to 55 lb. in. (6.2 N·m)]
i - Clear Tubing [5.5 in. (139.7mm)]
j - Gasket (Cylinder Block to Fuel Pump) (HIDDEN)

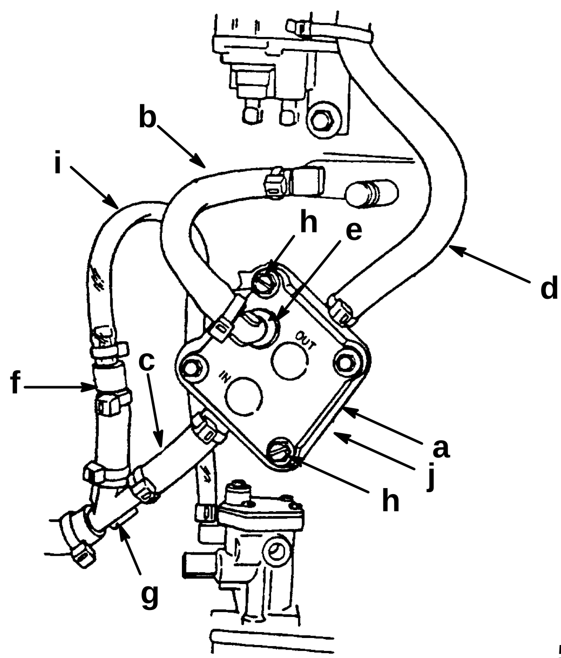
MODEL 100, 115



51519

a - Clear Tube [8 in. (203.2mm)]
b - To Oil Pump Outlet
c - Check Valve
d - Hose [1.5 in. (38.1mm)]
e - Fuel Connector
f - Hose [1.5 in. (38.1mm)]
g - T-Fitting (EXISTING)
h - Y-Fitting
i - Hose [1.75 in. (44.5mm)]
j - Fuel Pump
k - Fuel Outlet to Filter
l - 90 Degree Elbow
m- Hose [4 in. (101.6mm)]
n - To Pulse Fitting on Powerhead

MODEL 100, 115



51516

a - Fuel Pump
b - Pulse Hose
c - Inlet Hose
d - Outlet Hose
e - Elbow [Apply PERFECT SEAL (92-34227--1) to threads]
f - Check Valve
g - Y-Connector
h - Screws [Torque to 55 lb. in. (6.2 N·m)]
i - Clear Tubing [8 in. (203.2mm)]
j - Gasket (Cylinder Block to Fuel Pump) (HIDDEN)

Carburetion

Fuel System Troubleshooting

Troubles, that are caused by items 1-thru-5, listed below, may give the impression that a problem exists in the fuel system:

1. Spark plugs
2. Ignition spark voltage
3. Cylinder compression
4. Reed valves
5. Ignition timing

Troubleshooting Charts

PROBLEM 1: ENGINE TURNS OVER BUT WILL NOT START OR STARTS HARD WHEN COLD	
Possible Cause	**Corrective Action**
Improper starting procedure.	Check procedure, as outlined in "Operation and Maintenance Manual."
Fuel tank empty; improperly mixed fuel; contaminants (water, dirt, etc.) in fuel.	Check fuel in fuel tank and replace or add.
Fuel tank air vent closed or restricted.	Air vent must be open and free from contaminants.
A pinched or restricted fuel line.	Check, and replace as needed.
Dirty or restricted fuel filter.	Check, replace or clean.
Enrichener valve not operating.	Check enrichener system. (Refer to "Enrichener System" following.)
An inlet needle (in carburetor) that is stuck open or closed. (A needle stuck open, will cause a flooding condition. A needle stuck closed, will prevent fuel from entering carburetor.)	Remove, clean, or replace.
Anti-Siphon valve restricting fuel flow.	Refer to "Checking for Restricted Fuel Flow caused by Anti-Siphon Valves", following.

See "Checking for Restricted Fuel Flow caused by Anti-Siphon Valves", page 3A-1.

PROBLEM: ENGINE FLOODS	
Possible Cause	**Corrective Action**
Dirt or foreign particles 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.

PROBLEM: ENGINE RUNS TOO LEAN	
Possible Cause	**Corrective Action**
Carburetor is loose. Air leaks past mixing chamber cover.	Tighten bolts securely. Tighten cover or replace gasket.
Fuel level too low.	Reset float level.
Clogged high speed jet.	Check and clean.
Restricted fuel flow to carburetor.	Check fuel lines and filter(s) 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 richener.
Air leakage into fuel system.	Check fuel line connections, hose clamps, fuel pump, and fuel outlet tube (located in fuel tank) for loose fittings.
Anti-Siphon valve restricting fuel flow.	Refer to "Checking for restricted fuel flow caused by Anti-Siphon valves."

PROBLEM: ENGINE RUNS TOO RICH	
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.	Check cowl air inlet and carburetor for obstructions.
Main Fuel Jet loose.	Retighten Jet.

PROBLEM 1: ENGINE IDLES ROUGH AND STALLS	
PROBLEM 2: ENGINE RUNS UNEVEN OR SURGES	
PROBLEM 3: ENGINE WILL NOT ACCELERATE	
Possible Cause	**Corrective Action**
Fuel tank air vent closed or restricted.	Check - Air vent must be open all-the-way and free from restrictions.
A pinched, cut or restricted fuel line; also loose fuel line connection.	Check all fuel lines and replace as needed. Check and tighten all fuel line connections.
A dirty or restricted fuel filter.	Check, replace, or clean all fuel filters.
Restricted filter in fuel tank.	Clean by rinsing in clean lead-free gasoline or kerosene.
Improperly mixed fuel; contaminants (water, dirt, etc.) in fuel.	Check fuel and replace, if necessary.
An inlet needle (in carburetor) that is either stuck open or closed. (A needle, that is stuck open, will cause a flooding condition. A needle, that is stuck closed, will prevent fuel from entering carburetor.)	Remove and replace with new inlet needle.
Incorrect idle mixture adjustment.	Re-adjust.
Damaged fuel pump diaphragm.	Replace.
Carburetor is loose.	Tighten bolts securely.
Chamber cover leaking air.	Tighten or replace gasket.
Off idle holes plugged.	Blow out with compressed air.
Main nozzle or idle nozzle air bleed holes plugged.	Blow out with compressed air.
Improper main jet or restricted jet.	Clean or replace with proper jet (refer to “Main Jet Chart”).
Damaged reed(s).	Inspect reeds as outlined in Section 4A.
A crack in the fuel pick-up outlet tube (located in fuel tank).	Replace.
A crack in the fuel outlet tube (located in fuel tank.)	Replace.
Anti-Siphon valve restricting fuel flow.	Refer to “Checking for Restricted Fuel Flow Caused by Anti-Siphon Valves,” following.

PROBLEM: FUEL BLOW-BACK OUT OF CARBURETOR	
Possible Cause	**Corrective Action**
Chipped/Broken (reed-block) Reeds	Replace Reeds.
PROBLEM: ROUGH IDLE	
If related to reed-block, indicates excessive preload in reeds.	Replace Reeds.
PROBLEM: CAN’T REDUCE ENGINE RPM TO SLOW IDLE	
Multiple Chipped Reeds.	Replace Reeds.

Checking for Restricted Fuel Flow Caused by Anti-Siphon Valves

While anti-siphon valves are helpful from a safety standpoint, they clog, they may be too small, or they may have too heavy a spring. The pressure drop across these valves can, create operational problems and/or powerhead damage by restricting fuel. Some symptoms of restricted (lean) fuel flow, are:

1. Loss of fuel pump pressure
2. Loss of power
3. High speed surging
4. Preignition/detonation (piston dome erosion)
5. Outboard cuts out or hesitates upon acceleration
6. Outboard runs rough
7. Outboard quits and cannot be restarted
8. Outboard will not start
9. Vapor lock

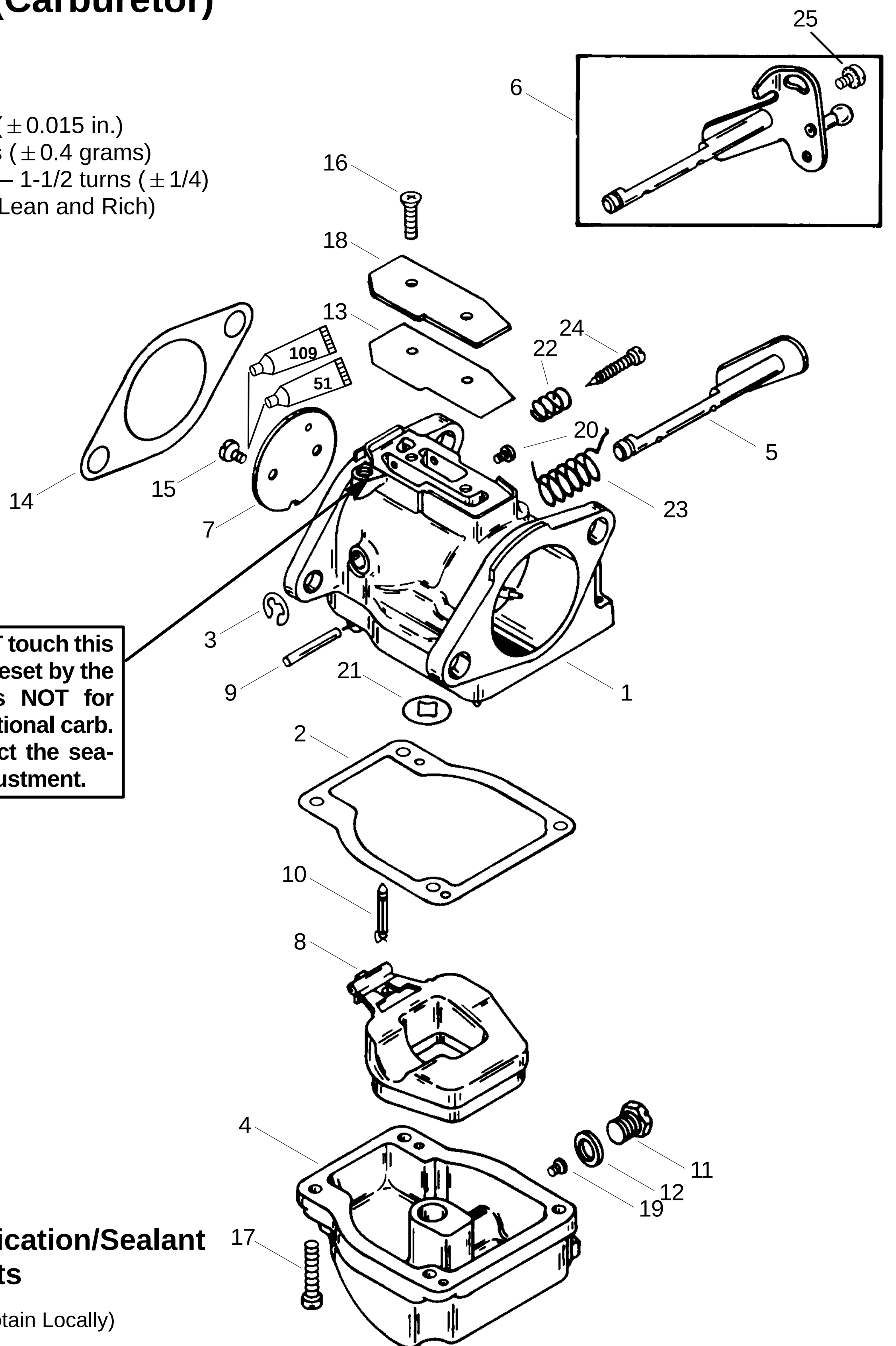
Any type of anti-siphon device must be located between the outboard fuel inlet and fuel tank outlet. A method of checking [if such a device (or bad fuel) is a problem source] is to operate the outboard with a separate fuel supply which is known to be good.

If, it is found that the anti-siphon valve is the cause of the problem, either 1) replace the anti-siphon valve or 2) replace it with a solenoid-operated fuel shutoff valve.

Fuel System (Carburetor)

Specifications

Float Setting – 7/16 in (± 0.015 in.)
Float Weight – 7 grams (± 0.4 grams)
Idle Adjustment Screw – 1-1/2 turns (± 1/4)
(Set Halfway Between Lean and Rich)



IMPORTANT: DO NOT touch this adjustment. This is preset by the manufacturer, and is NOT for field service. Conventional carb. cleaners will not affect the sealant securing this adjustment.

Quicksilver Lubrication/Sealant Application Points

51 Loctite 222 (Obtain Locally)

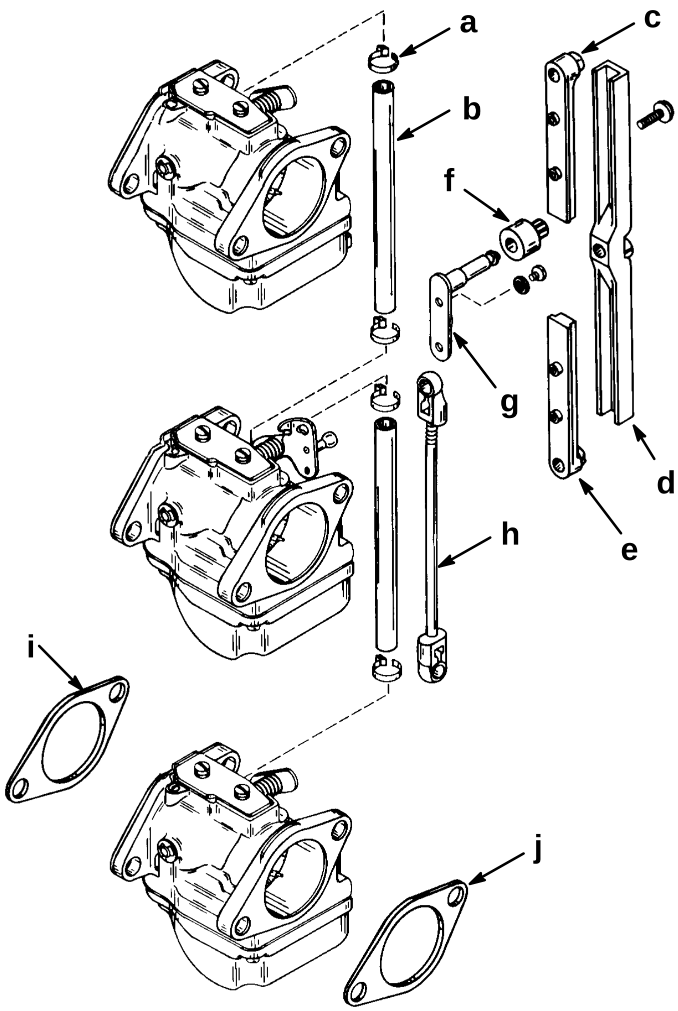
109 Loctite Primer “T” (92-59327-1)

Fuel System (Carburetor) (Continued)

REF. NO.	QUAN.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	Carburetor Body			
2	1	Gasket			
3	1	Retaining Ring			
4	1	Fuel Bowl			
5	1	Throttle Shaft (Upper/Bottom)			
6	1	Throttle Shaft (Center)			
7	1	Throttle Valve			
8	1	Float			
9	1	Float Shaft			
10	1	Inlet Needle Valve			
11	1	Plug	22		2.5
12	1	Gasket			
13	1	Gasket			
14	1	Gasket			
15	2	Screw	6		0.7
16	2	Screw	18		2.1
17	2	Screw	18		2.1
18	1	Cover Plate			
19	1	Main Jet	14		1.6
20	1	Vent Jet	6		0.7
21	1	Gasket			
22	1	Spring			
23	1	Spring			
24	1	Idle Mixture Screw			
25	1	Screw			

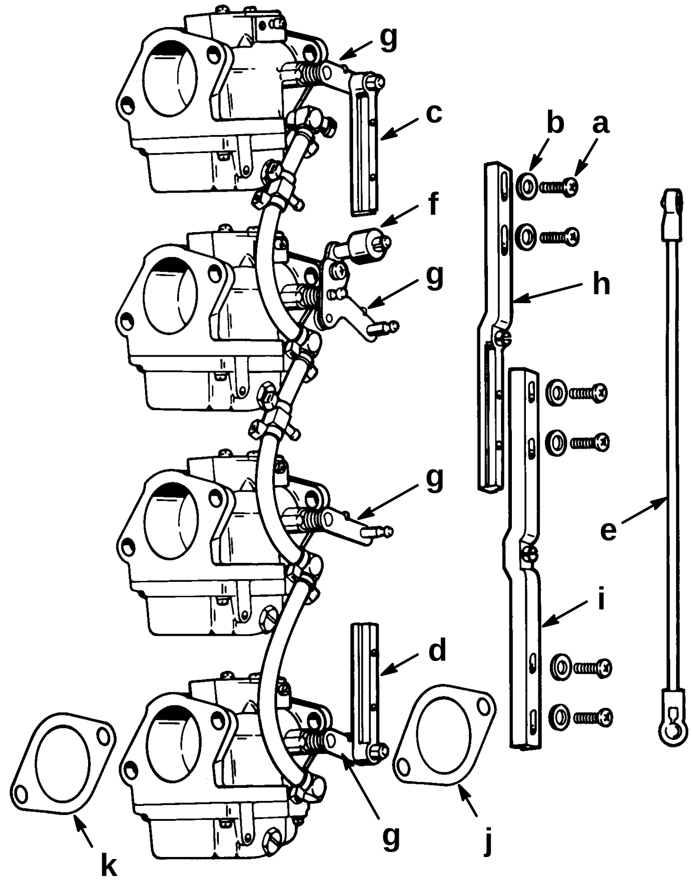
Fuel System (Linkage)

3 Cylinder Carburetor/Linkage Arrangement



a - Sta-Straps (4)
b - Fuel Liners (2)
c - Throttle Link
d - Throttle Arm
e - Throttle Link
f - Roller
g - Arm
h - Oil Injection Pump Link
i - Gasket
j - Gasket

4 Cylinder Carburetor/Linkage Arrangement



a - Screw (6)
b - Washer (6)
c - Carburetor Link
d - Carburetor Link
e - Oil Injection Pump Link Rod
f - Roller
g - Throttle Shaft
h - Throttle Link
i - Throttle Link
j - Gasket
k - Gasket

Carburetor Adjustments

INITIAL STARTING ADJUSTMENT

After service or replacement of carburetor, turn low speed mixture screw adjustment in (CLOCKWISE) until it seats LIGHTLY – then back off (each carburetor) the number of turns per model as indicated, following:

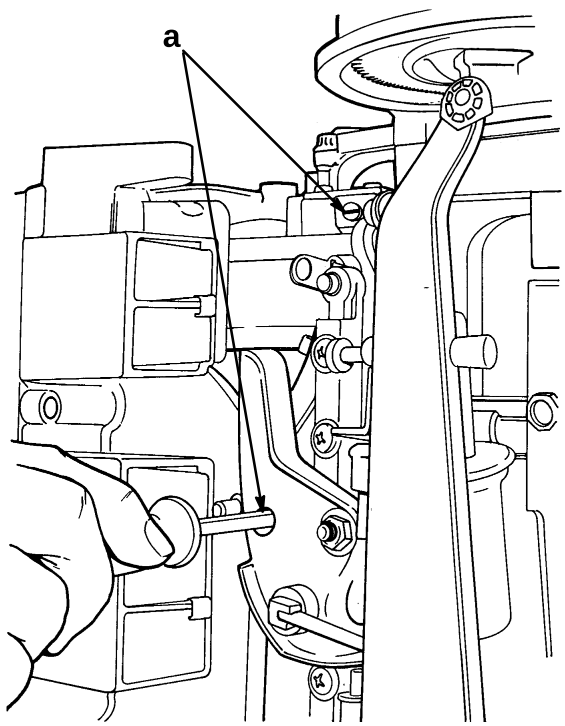
70 H.P. --- 1-1/4	90 H.P. --- 1-1/2
75 H.P. --- 1-1/2	100 H.P. --- 1-3/4
80 H.P. --- 1-1/2	115 H.P. --- 1-1/2

This adjustment will permit engine startup.

LOW SPEED MIXTURE ADJUSTMENT

NOTE: Only the top two carburetors on four cylinder models have adjustable idle mixture screws.

1. Start engine and allow to warm-up (run for several minutes). Throttle back engine to idle for about one minute to allow RPMs to stabilize.
2. With engine running at idle speed -- in water -- IN FORWARD GEAR (prop on) -- turn low speed mixture screw IN (clockwise) until engine starts to “bog” down and misfire. Back out 1/4 turn or more.

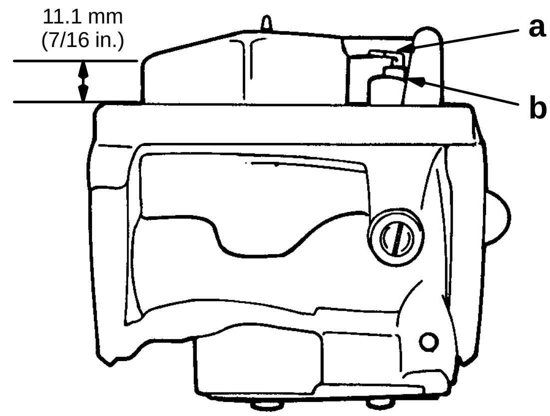


a - Low Speed Mixture Screw

3. Check for too lean mixture on acceleration.
4. DO NOT adjust leaner than necessary to attain reasonably smooth idling. When in doubt, stay on the slightly rich side of the adjustment.

CARBURETOR FLOAT ADJUSTMENT

1. If installed, remove carburetor as outlined in “Carburetor Removal”, following.
2. Remove fuel bowl and gasket and check float level as shown.
3. If necessary, adjust float level by bending metal tab on float to which inlet needle is clipped.



a - Metal Tab
b - Inlet Needle

Specification Sheet - WME Carburetors

Carburetor Number Stamped at TOP of carburetor mounting flange.

NOTE: Early model engines may have identification stamped on face of air box mounting flange.

Carburetor Number	Location	Model H.P.	Main Jet*	Bowl Vent Jet*
WME-9 - 1 2 3	Top Carburetor Center Carburetor Bottom Carburetor	80	.064	.094
WME-7 - 1 2 3	Top Carburetor Center Carburetor Bottom Carburetor	70	.072	.094
WME-10 - 1 2 3	Top Carburetor Center Carburetor Bottom Carburetor	90	.072	.094
WME-8 - 1 2 3	Top Carburetor Center Carburetor Bottom Carburetor	75	.068	.094
WME-11 - 1 2 3 4	Top Carburetor Top Center Carburetor Bottom Carburetor Bottom Carburetor	100	.054	NONE
WME-14 - 1 2 3 4	Top Carburetor Top Center Carburetor Bottom Carburetor Bottom Carburetor	115	.076	NONE

* Standard Jets listed are for operation of engine from 0'-2500 ft. (0-762 M) of elevation. See page 3A-12 (this section) for jet-size chart.

CARBURETOR FASTENER TORQUES:

Main Jet	14 lb. in. (1.6 N·m)
Main Jet Cap Plug	22 lb. in. (2.5 N·m)
Float Bowl	18 lb. in. (2.1 N·m)
Throttle Plate Screw	6 lb. in. (0.7 N·m) (Loctite® 609 used, OR: RC-35 – WITH PRIMER OR: Loctite 222 – WITH PRIMER)
Cover Plate Screw	18 lb. in. (2.1 N·m)
Back Drag Jet	6 lb. in. (0.7 N·m)
Carb. (Air Box) Stud Nuts (6)	100 lb. in. (11.3 N·m)

SETTINGS:

Float Setting	7/16° (±.015) See photo/diagram (this section), page 3A-18
Float Weight	7 grams (±1 gr.) (.4 gr./cc)
Idle Adjust Screw	1-1/2 turns (±1/4 turn) (set half-way between lean and rich).

FUEL PUMP SPECIFICATIONS:

Fuel Pump Assembly Bolts	55 lb. in. (6.2 N·m)
Fuel Pump Mounting Screws	55 lb. in. (6.2 N·m)

FUEL PUMP PRESSURE:

Engine Side at W.O.T.	4-6 psi. (depending on RPMs)

SEALANTS:

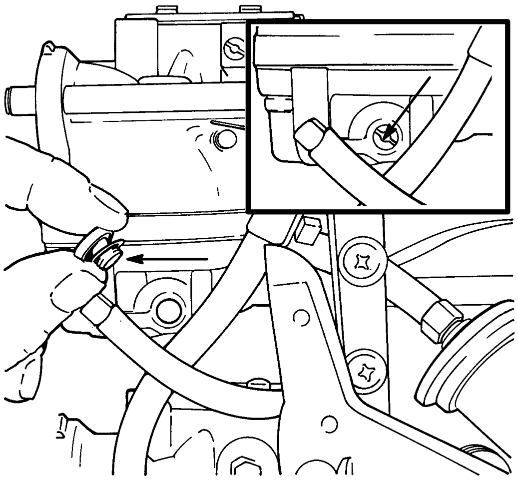
Fuel Pump Check Valve Assembly	Loctite® Pipe Sealant w/teflon
Carb Throttle Plate Screw:	Loctite® 609 OR: RC-35 WITH PRIMER OR Loctite 222 WITH PRIMER

IDLE SPEED ADJUSTMENT

Adjust engine idle RPM as outlined in Section 2C "Timing/Synchronizing/Adjusting".

MAIN (HIGH SPEED) JET ADJUSTMENT

The carburetor is equipped with a fixed high speed jet and normally no adjustment is required. However, extreme changes in weather (temperature and humidity) and/or elevation may result in a too lean or rich fuel mixture at wide-open-throttle, which may require a change in the high speed jet. A smaller size main jet will lean the fuel mixture, and a larger size jet will enrichen the fuel mixture.



20365

STANDARD HIGH SPEED JET CHART

Model	Carburetor Number	Main Jet Size (inch)	Bowl Vent Jet (inch)
70	WME-7	.072	.094
75	WME-8, 17	.068	.094
80	WME-9	.064	.094
90	WME-10 WME-19	.072 .066	.094 .094
100	WME-11, 20	.054	NONE
115	WME-14, 21	.076	NONE

REJETTING CARBURETORS FOR HIGH ALTITUDE OPERATION

The carburetor jet installed at the factory is for engine operation at sea level through an elevation of 5000 feet (1524m) above sea level. If the engine is to be operated at an altitude higher than 5000 feet (1524m), then it will be necessary to rejet the carburetors. Refer to the jet chart following for jet recommendations at approximate altitudes.

Normally, for every 1000 feet (304.8m) of altitude increase, main jet size is reduced by 2%. However, this does not always hold true for all situations; different boat, motor, load and ambient air temperature conditions may require different jets – I.E. – going a jet size richer than recommended for a particular altitude may improve acceleration. It may also be noted that no noticeable improvement in engine performance was achieved by changing the standard main jet at altitudes up to 5000 feet (1524m). Above 5000 feet, however, changing jets did improve performance.

Several additional changes to improve engine performance at higher altitudes are as follows:

1. Idle timing should be advanced 2-3 degrees at 5000 feet (1524m) and above.
2. Prop engine at the top of the recommended RPM scale +/–150 RPM.
3. Reset idle mixture screws for best idle. With standard idle mixture setting (sea level) considered to be at the 12 o'clock position, adjust the mixture screw leaner for all models as follows:

5000 ft. (1524m)	7500 ft. (2286m)	10000 ft. (3048m)
1 o'clock	1 o'clock	2 o'clock

4. Change gear ratio:

Model	Above 5000 ft. (1524m)
70, 75, 80, 90 – Std. Ratio – 2.33:1	None Available
100, 115 – Std. Ratio – 2.08:1	2.33:1

HIGH ALTITUDE JET CHART

Model	Carb	Std. Jet	5000 ft. (1524m)	7500 ft. (2286m)	10000 ft. (3048m)
70	WME-7	.072	.072	.070	.068
75	WME-8, 17	.068	.068	.066	.064
80	WME-9	.064	.064	.062	.060
90	WME-10 WME-19	.072 .066	.072 .066	.068 .062	.066 .060
100	WME-11, 20	.054	.054	.050	.048
115	WME-14, 21	.076	.076	.072	.068

JET ORIFICE SIZE/PART NUMBER CHART

NOTE: Thread size for jets is 10-32.

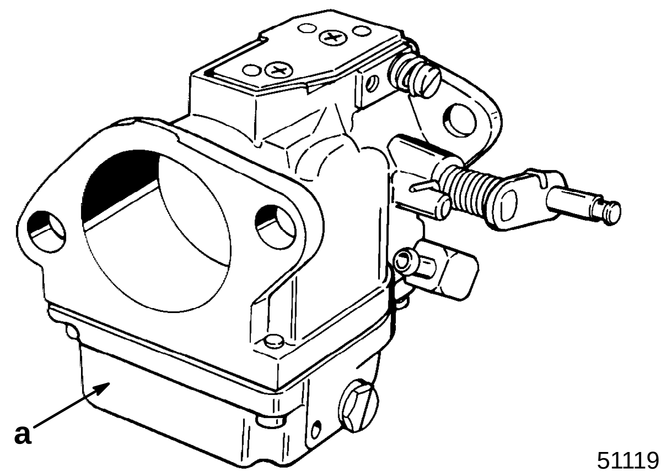
Jet Orifice Size (Inches)	Part Number	Jet Orifice Size (Inch)	Part Number
.040	19266040	.058	1395-7831
.042	1399-5315	.060	1395-6487
.044	1395-7394	.062	1399-4217
.046	1399-5317	.064	1399-4216
.048	1395-6246	.066	1399-4215
.050	1395-6028	.068	1395-6029
.052	1395-6359	.070	1395-6030
.054	1399-5225	.072	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		

CARBURETOR REMOVAL AND DISASSEMBLY

Carburetor Removal - remove the six nuts (on carb studs), and lift off carburetor assembly. See Section 4A, this manual, for step-by-step procedure.

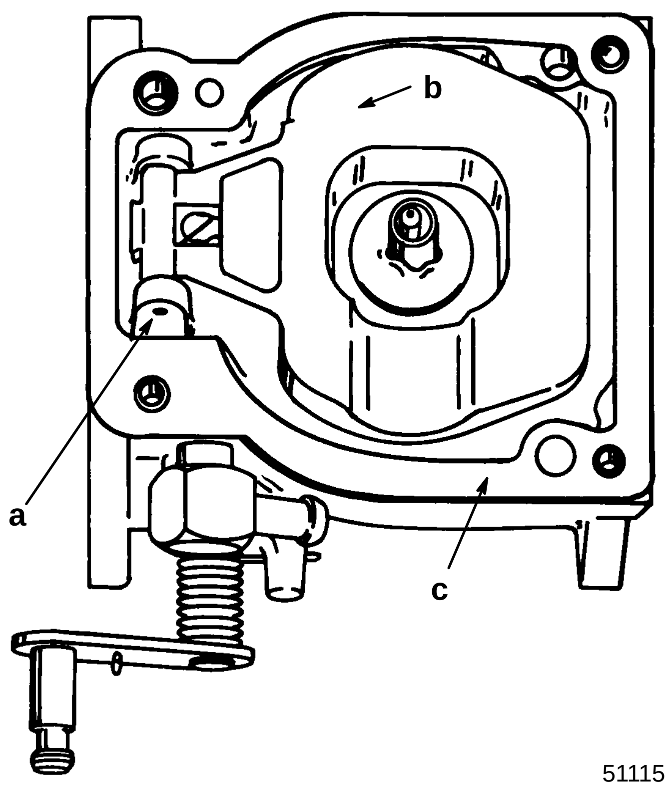
To Disassemble

- Remove fuel bowl.



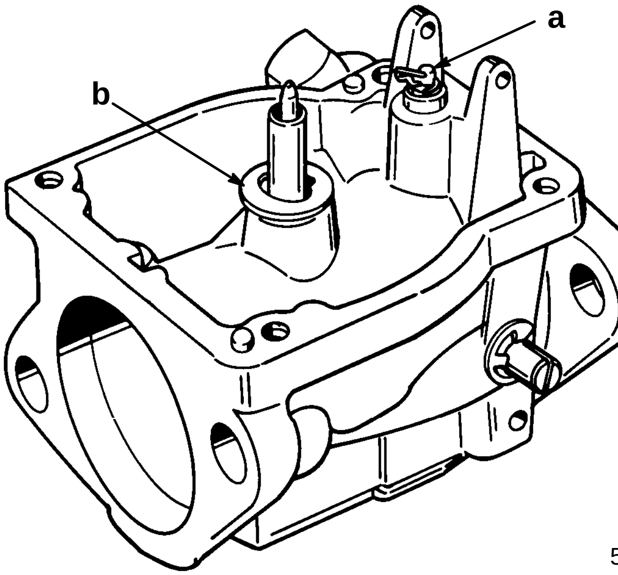
a - Fuel Bowl

- Remove float pin and remove float.
- Remove fuel bowl gasket.



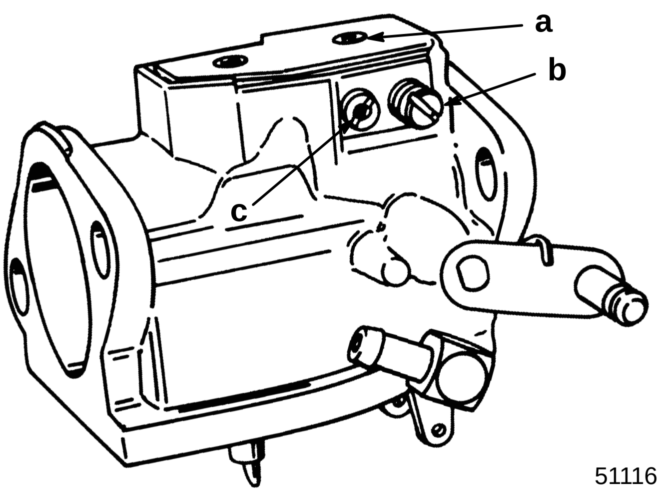
a - Float Pin
b - Float
c - Gasket

- Remove fuel inlet needle.
- Remove stem gasket.



a - Fuel Inlet Needle
b - Stem Gasket

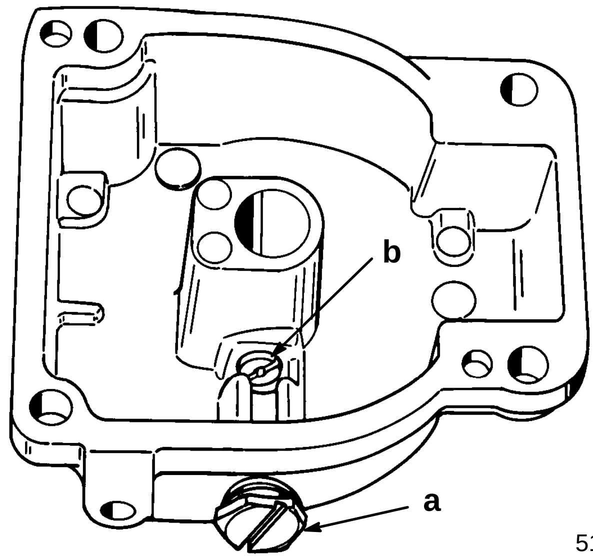
- Remove mixing chamber cover and gasket.
- Remove low speed mixture screw.
- Remove bowl vent jet (black drag) (3-Cylinder Models only).



a - Mixing Chamber Cover and Gasket
b - Idle Mixture Screw
c - Bowl Vent Jet

Carburetor Disassembly

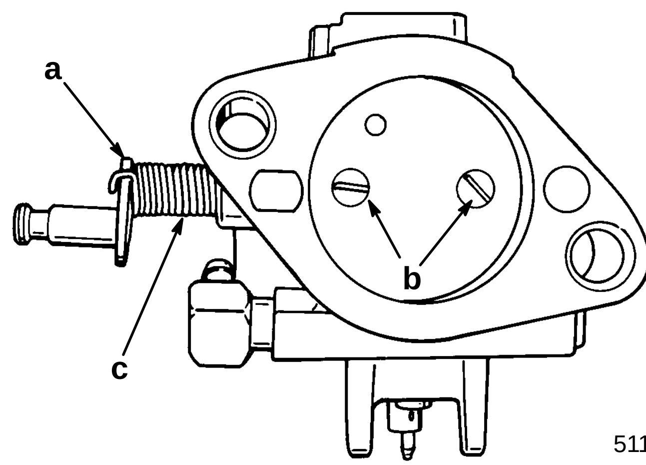
- Remove main jet plug and gasket.
- Remove main jet.



a - Main Jet Plug and Gasket
b - Main Jet

NOTE: It is not necessary to disassemble carburetor beyond this point for cleaning. Examine throttle shaft for wear and inspect for damaged throttle shutter plate.

If removal of throttle shaft and/or throttle shutter plate is necessary, remove 2 screws, which secure throttle shutter plate to throttle shaft. Remove retaining clip from end of throttle shaft, then pull shaft out of carburetor.



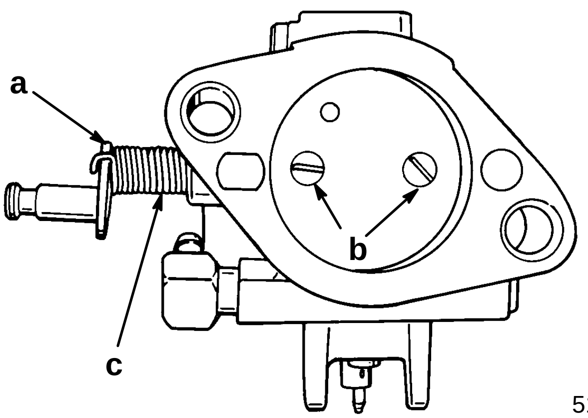
a - Throttle Shaft
b - Screw (2)
c - Throttle Shaft Spring

CLEANING AND INSPECTION

1. Carefully inspect carburetor body and fuel bowl for cracks, stripped threads, plugged or restricted passages and passage plugs that show signs of leakage.
2. Thoroughly clean all carburetor parts with a mild cleaning solution (that will not damage rubber or plastic) to remove dirt, gum and varnish that may have accumulated.
3. After washing parts, blow parts dry with compressed air. Be sure to blow air thru all passages, orifices and nozzles.
4. Check float hinge in the float pin area for wear and check float for leaks. Replace parts as necessary.
5. Examine inlet needle for wear. If worn, replace with new inlet needle.

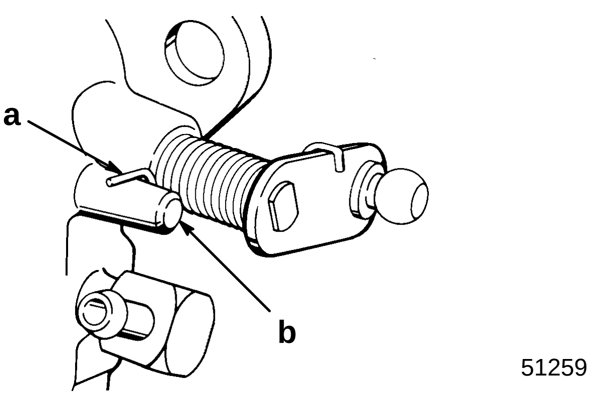
Carburetor Reassembly

- If removed, install throttle shaft throttle shutter plate — 2 screws (use specified Loctite®), and throttle shaft spring as shown. Install retaining clip on other end of shaft.



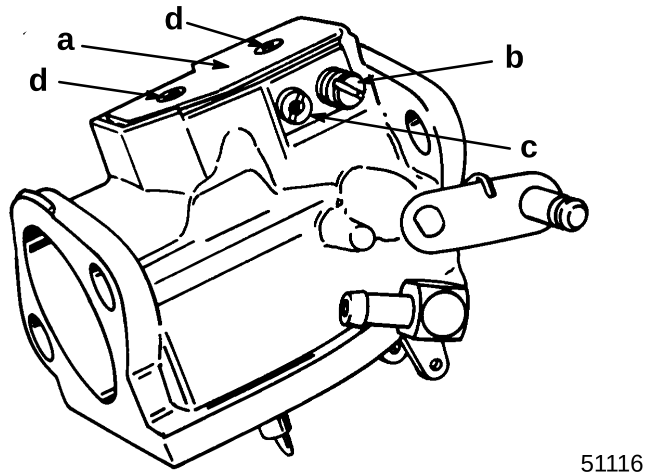
a - Throttle Shaft
b - Screws (2)
c - Throttle Shaft Spring

- Spring "tensions on stud".



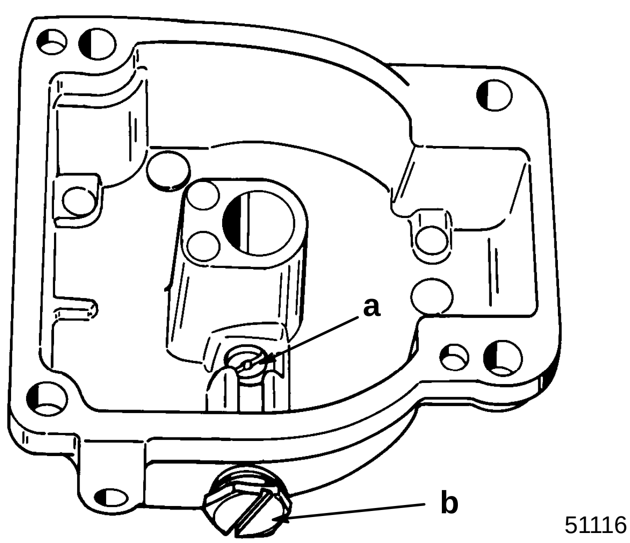
a - Spring
b - Stud

- Install mixing chamber cover and gasket as shown.
- Install low speed mixture screw.
- Install bowl vent jet (back drag) (3-Cylinder Models only).



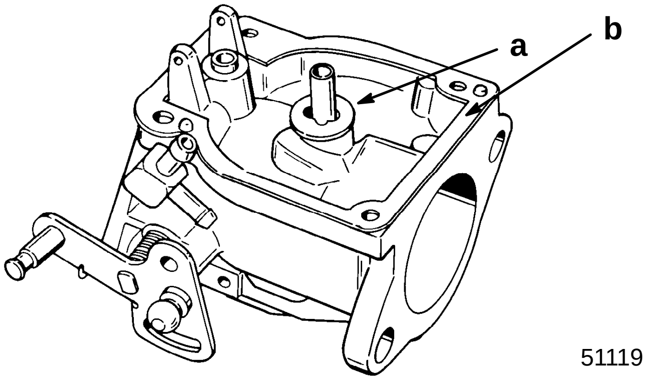
a - Mixing Chamber Cover and Gasket
b - Idle Mixture Screw
c - Bowl Vent Jet
d - Screw (2) Torque 18 lb. in. (2.1 N·m)

- Install main jet.
- Install main jet plug and gasket.



a - Main Jet [Torque 14 lb. in (1.6 N·m)]
b - Main Jet Plug and Gasket [Torque 22 lb. in. (2.5 N·m)]

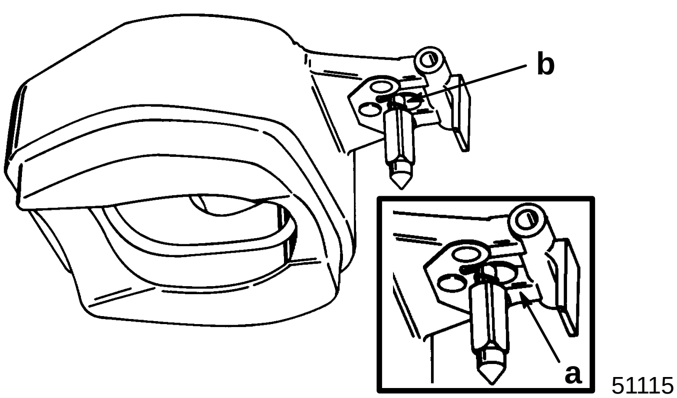
- Install stem gasket.
- Install fuel bowl gasket.



a - Stem Gasket
b - Fuel Bowl Gasket

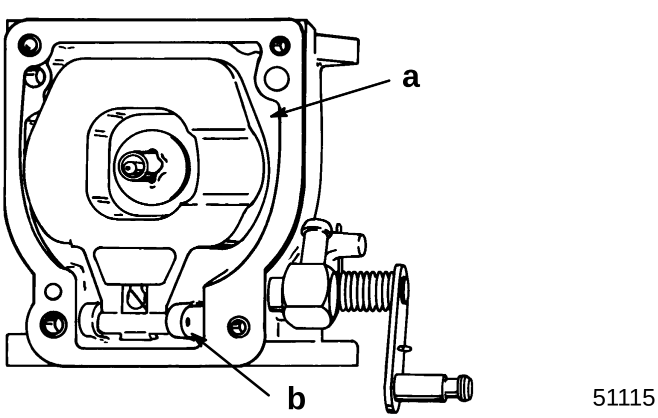
NOTE: If spring clip on inlet needle was removed, or if needle was replaced, be sure spring clip is reattached.

- Attach spring clip on inlet needle to metal float tab and place needle into its seat.



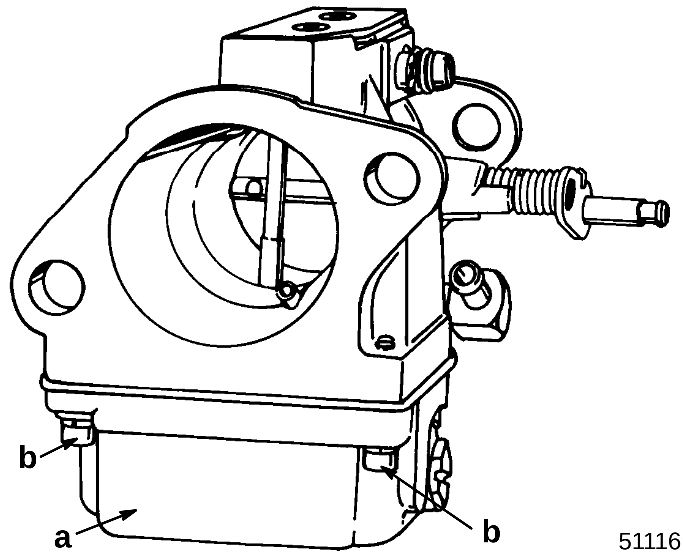
a - Spring Clip
b - Float Tab

- Install float into carburetor with float pin.
- Adjust float following “Float Adjustment,” Page 3A-18.



a - Float
b - Float Pin

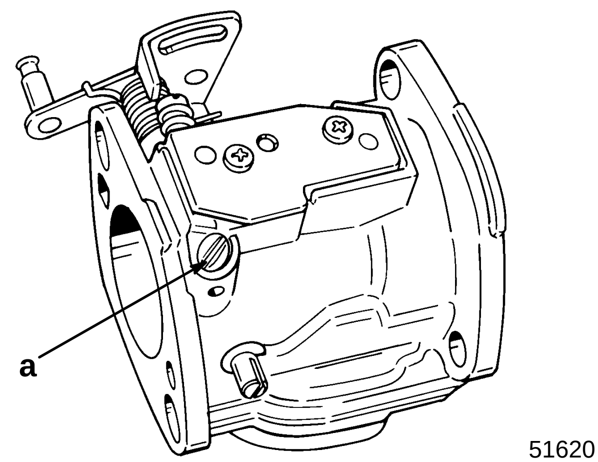
- Install float bowl.



a - Float Bowl
b - Screw (4) Torque 18 lb. in. (2.1 N·m)

IDLE AIR SCREW

Idle air screw is preset by the manufacturer and is NOT for field service. If the idle air screw should become misadjusted, set air screw at 1/4 TURN OUT from a LIGHTLY SEATED position.



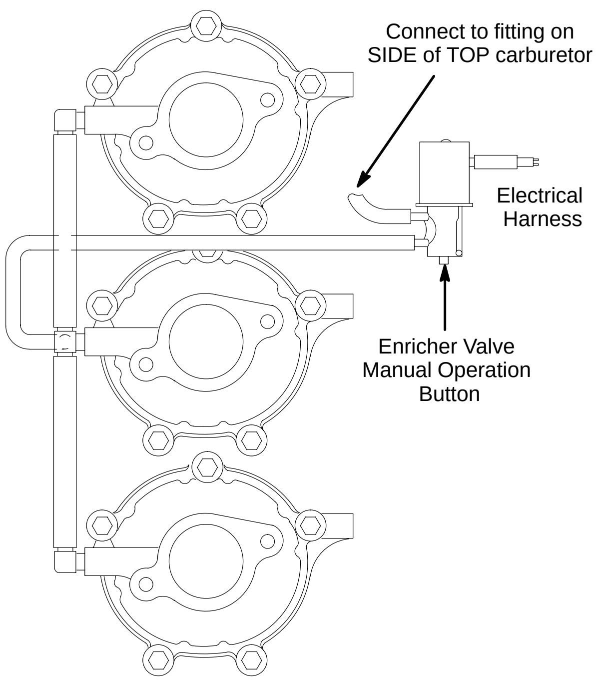
a - Idle Air Screw

Enrichener System

Description for Three Cylinder Engines

Fuel flows from top carburetor float bowl to fuel enrichment valve. Valve is electrically opened when key is turned to the "ON" position and pushed in (and held in). Fuel is supplied to engine through fittings located in the top, middle, and bottom carburetors. Valve returns to the closed position when key (or choke button) is released. Valve can be operated manually by PRESSING and HOLDING button located at bottom of valve.

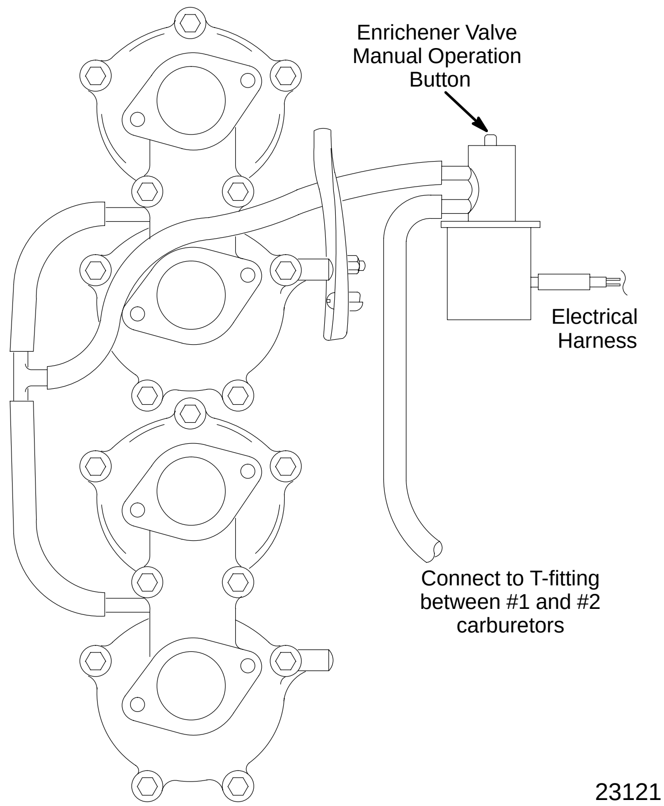
Enrichener Valve Hose Installation - Three Cylinder Engines



Description for Four Cylinder Engines

Enrichener valve receives fuel from a T-fitting between #1 and #2 carburetors. Valve is electrically opened when ignition key is turned to the "ON" position and pushed in (and held in). Fuel is dispensed to T-fittings on intake manifold of cylinders #2 and #4. Internal passages route fuel from cylinders #2 and #4 to cylinders #1 and #3. Valve returns to the closed position when key (or choke button) is released. Valve can be operated manually by PRESSING and HOLDING button located on top of valve.

Enrichener Valve Hose Installation - Four Cylinder Engines



IMPORTANT: Use of enrichener if engine is warm could result in engine flooding.

ENRICHENER VALVE TEST

Push key (or choke button) in. Valve should click.

No Click

Check for battery voltage to yellow/black wire at terminal block on engine when key (or choke button) is pushed in.

Battery Voltage Indicated

Check for loose or corroded connection between YELLOW/BLACK wire and black wire (under same screw at terminal block).

Check that other BLACK wire at terminal block is properly grounded.

Repair connection(s) as necessary, then push key (or choke button) in. If enrichener valve DOES NOT click, replace valve.

No Voltage Indicated

Check for open in YELLOW/BLACK wire between key switch (or choke button) and terminal block.

Click

Squeeze primer bulb until bulb is firm. Remove lower hose from fitting on enrichener valve. Place a container under valve, then push key (or choke button). Check for fuel flow from fitting.

Fuel Flow from Fitting

Valve is O.K. Check hoses and fittings from valve to carburetors for leaks or obstructions.

No Fuel Flow from Fitting

Remove upper hose from fitting on enrichener valve. If fuel flows from hose, replace valve. If not, check hose and carburetor fitting for leaks or obstructions.

Acceleration Pump Circuit Operation - Four Cylinder Engines

ACCELERATOR PUMP - Receives pressurized fuel from T-fitting in fuel line between #1 and #2 carburetors. Pump is actuated by throttle cam. Pumps to two check valve/injector nozzles in #3 and #4 cylinder boost passages.

FUEL FILTER - 74 micron filter. Prevents debris from plugging check valve/injector nozzles.

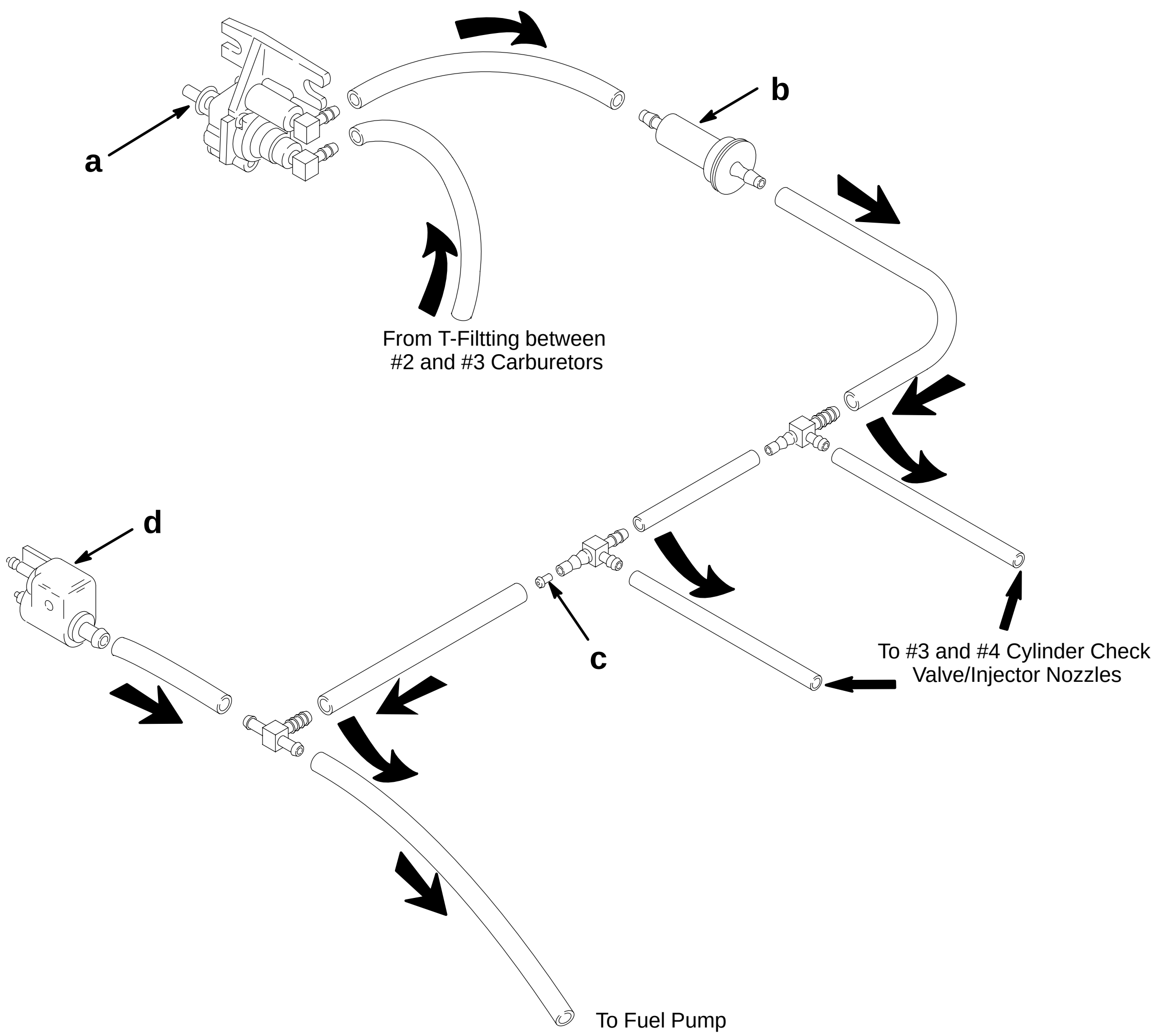
CHECK VALVE/INJECTOR NOZZLE - 2 assemblies, one each for #3 and #4 cylinders. Fuel passes from check valve thru .026 inch orifice (injector nozzle) and into respective cylinder boost passage.

FLOW RESTRICTOR - Helps equalize pressure within the accelerator pump circuit while allowing air or any vapor which has formed to pass through and be vented at the carburetors.

FUEL CONNECTOR - Spring loaded shut off valve which connects boat fuel tank with outboard fuel system.

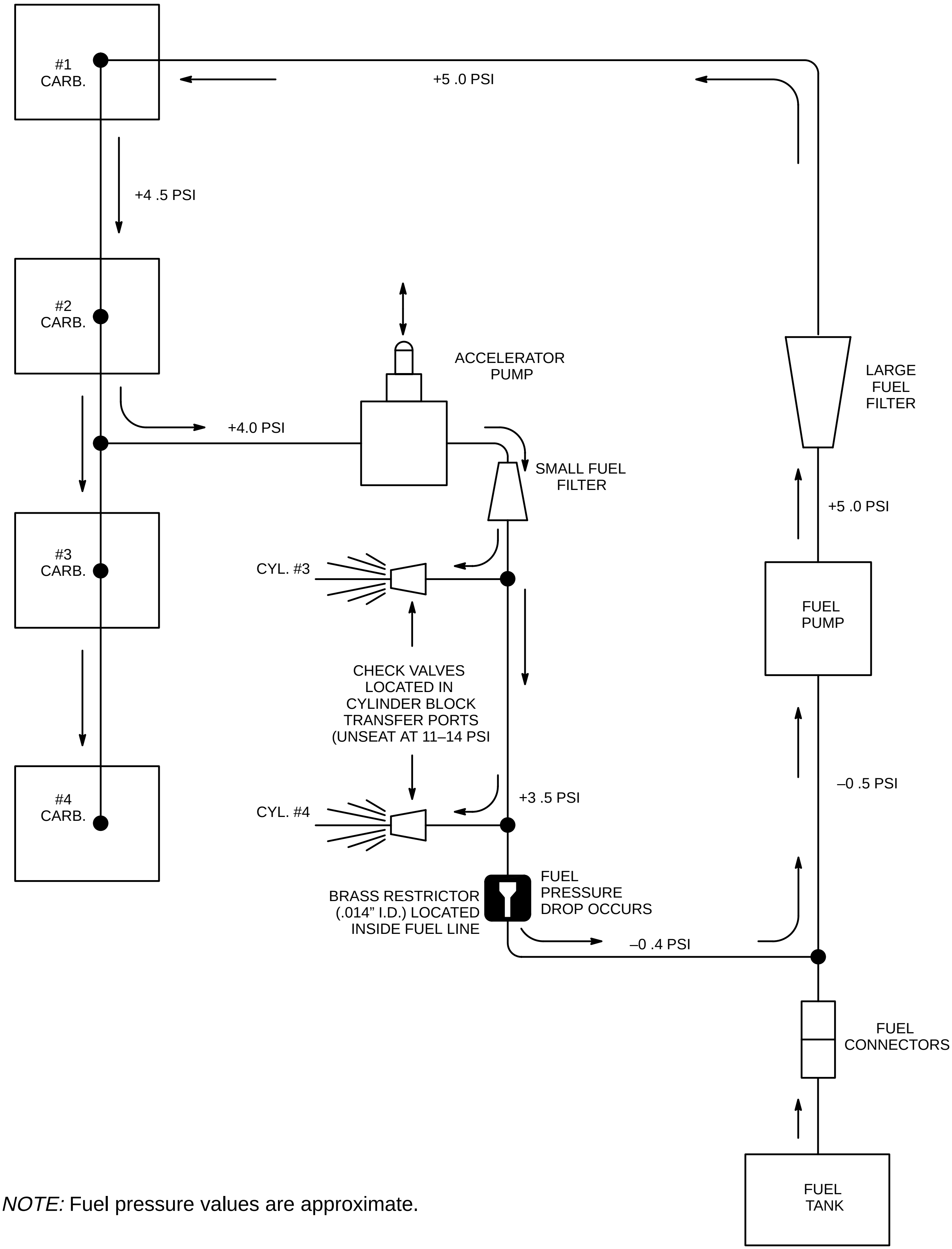
IMPORTANT: The distance between the accelerator pump and the throttle cam determines the amount of fuel the accelerator pump will discharge. If accelerator pump is moved or replaced, refer to SECTION 2C for correct positioning of accelerator pump.

ACCELERATOR PUMP FUEL FLOW CIRCUIT



a - Accelerator Pump
b - Fuel Filter
c - Flow Restrictor
d - Fuel Connector

Acceleration Pump Fuel Flow Circuit for Four Cylinder Engines



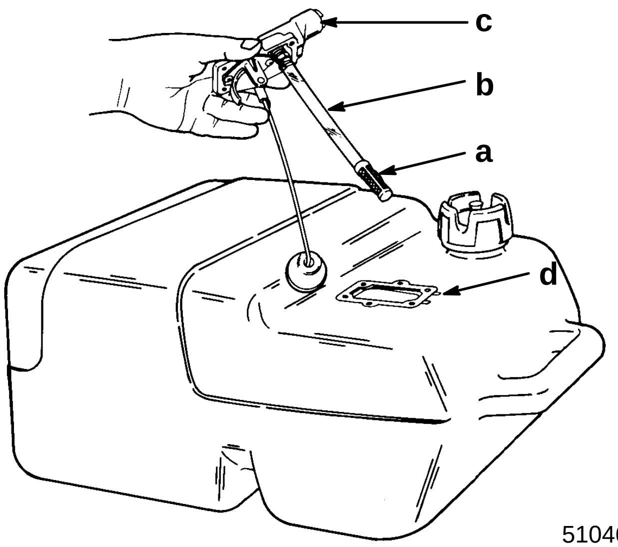
NOTE: Fuel pressure values are approximate.

Fuel Tank

MAINTENANCE

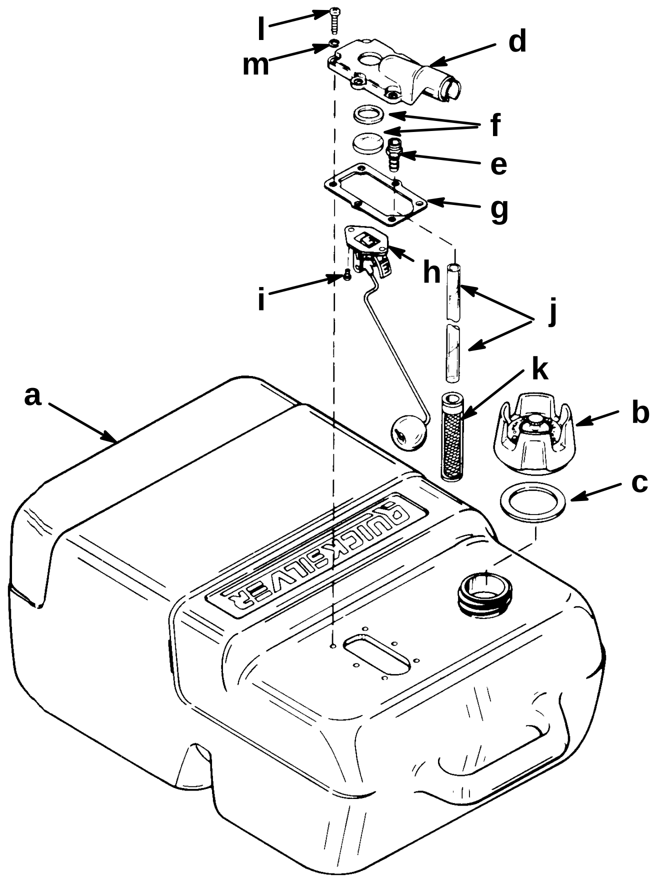
The inside of the fuel tank should be cleaned once each season. Dirt or water may have entered the fuel tank during refilling. Clean the tank by flushing with clean, lead-free gasoline or kerosene.

If a fuel restriction problem is encountered, the fuel filter on end of outlet tube may be obstructed. Remove cover and inspect filter for varnish, dirt or deposits. Clean filter by rinsing in clean, lead-free gasoline or kerosene.



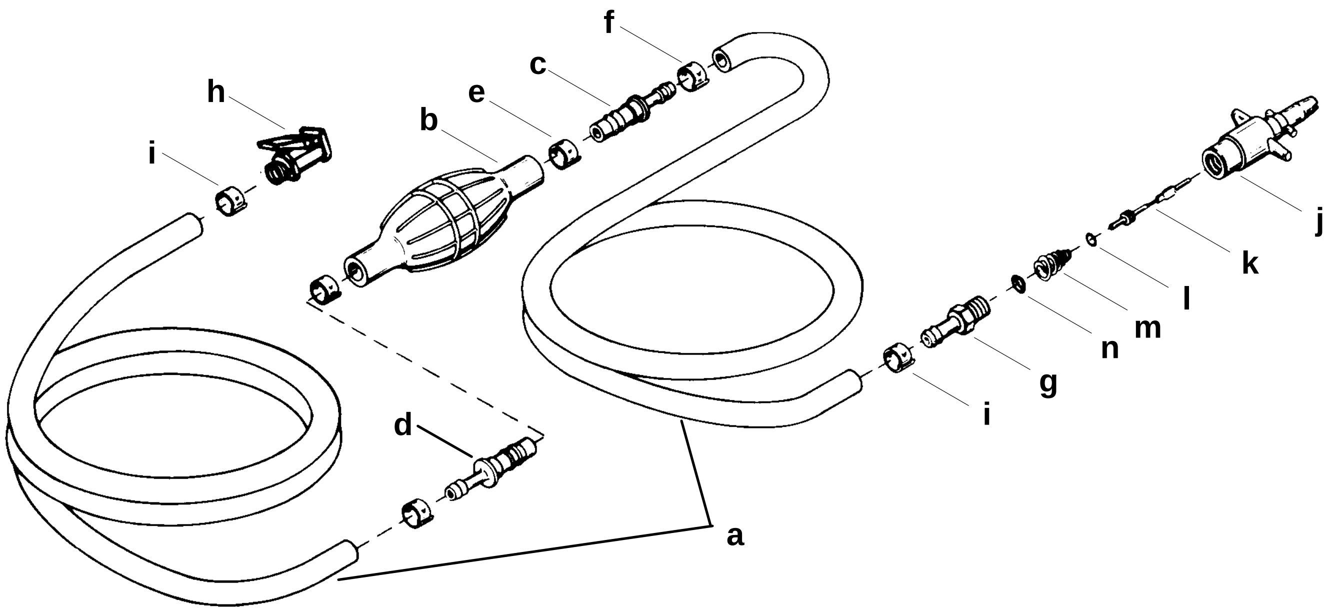
a - Fuel Tank Filter
b - Pick-Up Tube
c - Cover
d - Gasket

Fuel Tank Components



a - Fuel Tank Assembly (Plastic - 6.6 Gal.)
b - Filler Cap
c - Gasket, Filler Cap
d - Pick-Up Body Assembly
e - Adaptor
f - Window Assembly
g - Gasket, Pick-Up Body
h - Fuel Gauge Assembly
i - Screw, Fuel Gauge (2)
j - Hose
k - Filter
l - Screw, Pick-Up Body (6)
m- Washer, Pick-Up Body Screw (6)

Fuel Line and Primer Bulb Assembly



a - Fuel Line Assembly
b - Primer Bulb Assembly
c - Check Valve, Inlet
d - Fittng, Outlet
e - Clamp, Primer Bulb to Check Valve (Large)
f - Clamp, Fuel Line to Check Valve (Small)
g - Connector, Fuel Tank (Outlet)
h - Connector, Engine (Inlet)
i - Clamp, Fuel Line to Connector
j - Bayonet Body Assembly (Fuel Tank End)
k - Stem, Bayonet Body
l - O-ring, Bayonet Body Stem
m- Spring, Bayonet Body Stem
n - Washer, Cupped - Body Spring

Maintenance

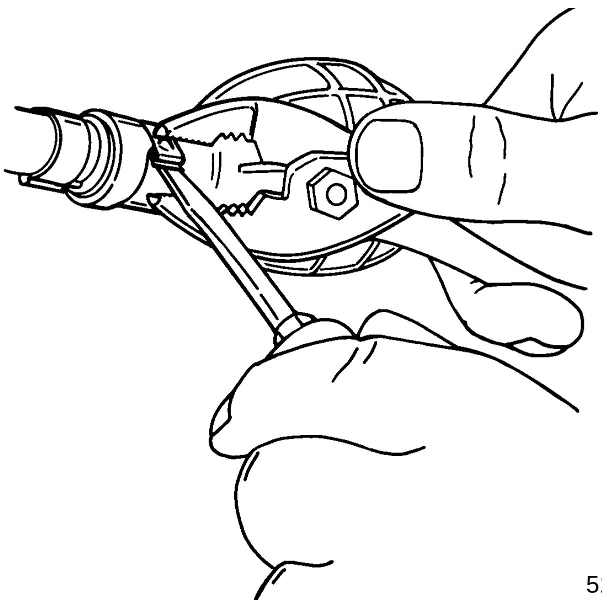
Periodically check fuel line and primer bulb for cracks, breaks, restrictions or chafing. Check all fuel line connections for tightness. All fuel line connections must be clamped securely.

Primer bulb assembly has 2 check valves: Fuel inlet (toward tank) and a fuel outlet (toward engine).

The fuel inlet valve allows fuel to fill primer bulb but closes to prevent fuel from returning to tank when bulb is squeezed. The fuel outlet valve opens when primer bulb is squeezed to allow fuel flow to carburetor, but closes as bulb is released to prevent fuel from returning to primer bulb.

FUEL LINE CLAMP REMOVAL AND INSTALLATION

1. To remove fuel line clamps, grip clamp with pliers and bend overlapping hook backwards.



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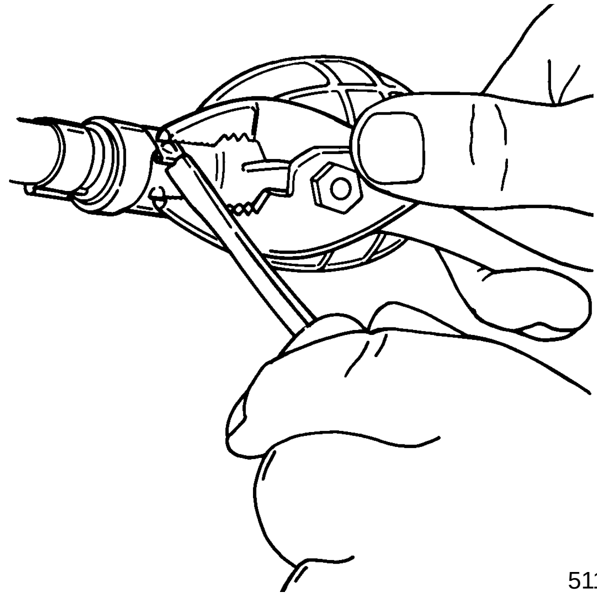
Removing Fuel Line Clamps

2. To install fuel line clamps, grip hose clamp with pliers and push down on hook with screwdriver until hooks interlock.



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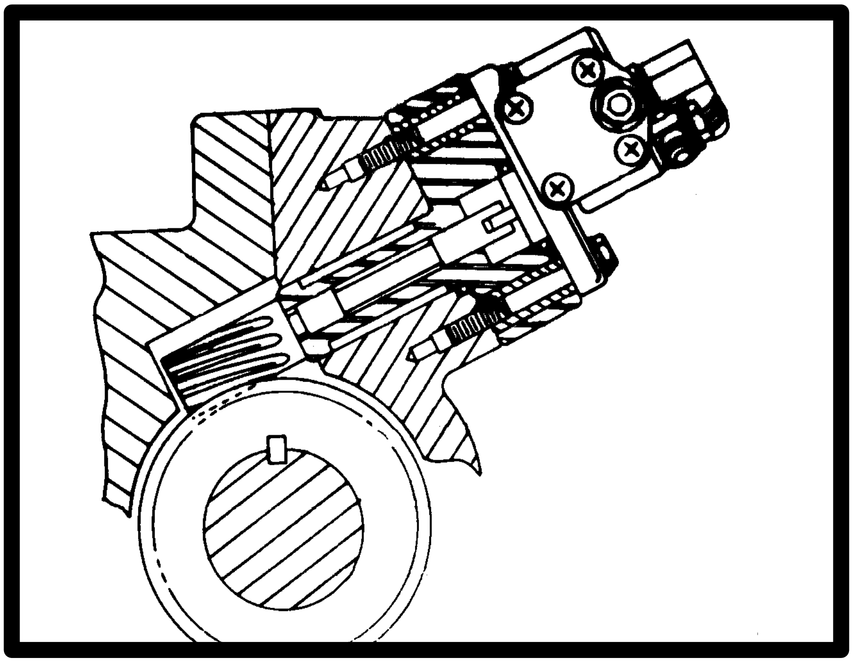
Installing Fuel Line Clamps

OIL INJECTION SYSTEM



3

B

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Description

⚠ CAUTION

Be careful not to get dirt or other contamination in tank, hoses or other components of the oil injection system.

⚠ CAUTION

Engines with oil injection must be run on a fuel/oil ratio of 50:1 in the fuel tank, in addition to the oil supplied by the oil injection system, for the first 30 gallons of fuel. Refer to break-in procedure in the Operation and Maintenance Manual.

⚠ CAUTION

If an electric fuel pump is to be used on engines with oil injection, the fuel pressure at the engine must not exceed 6 psig. If necessary, install a pressure regulator between electric fuel pump and engine and set at 6 psig maximum.

The major components of the oil injection system are an oil tank, oil pump, and low oil warning system.

The oil tank is attached to the powerhead and holds oil for delivery to the oil pump.

Oil is gravity fed to the oil pump via a hose.

The oil pump injects oil into the fuel at the fuel pump, and is driven by the crankshaft.

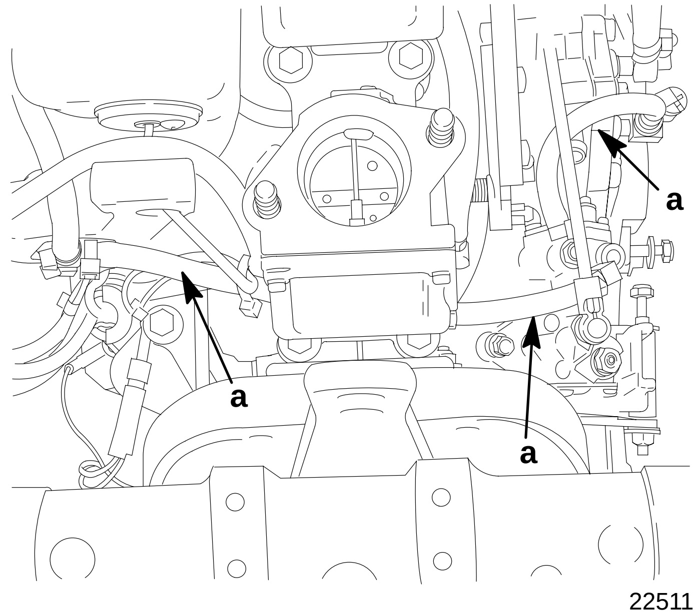
A link rod is connected between the throttle linkage and oil pump lever. When the throttle position is changed, the link rod rotates the oil pump valve, which changes the fuel/oil ratio from approximately 80:1 at idle speed, to 50:1 at wide-open-throttle.

The oil tank is equipped with a low oil sensor and a magnetic float. When oil level in oil tank drops to approximately 1 quart (.95 liter), the magnetized float will complete the circuit between the low oil sensor leads, causing the warning horn to sound.

IMPORTANT: Warning horn is also connected to the powerhead temperature sensor. If the warning horn sounds, either the oil level in oil tank is low, or the powerhead is overheated.

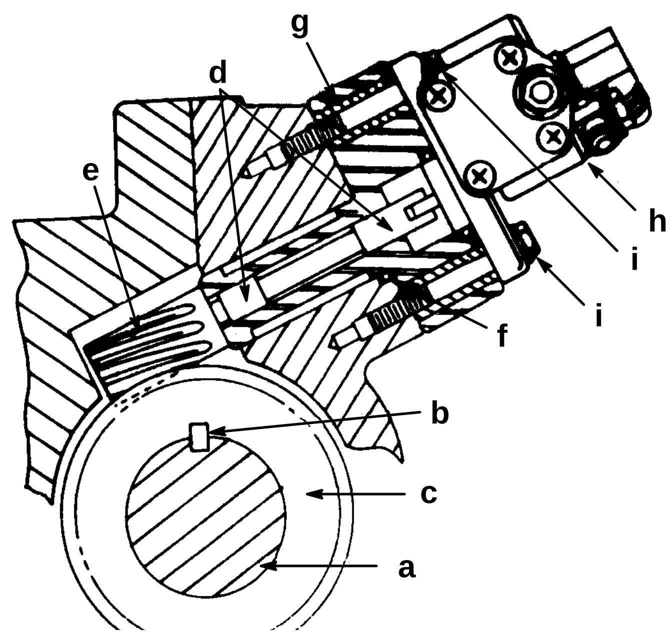
A warning horn test button is located next to oil tank fill cap. When ignition switch is in the “Run” position and warning horn test button is depressed, the horn should sound.

Hose Connections



a - Oil Hose Connections

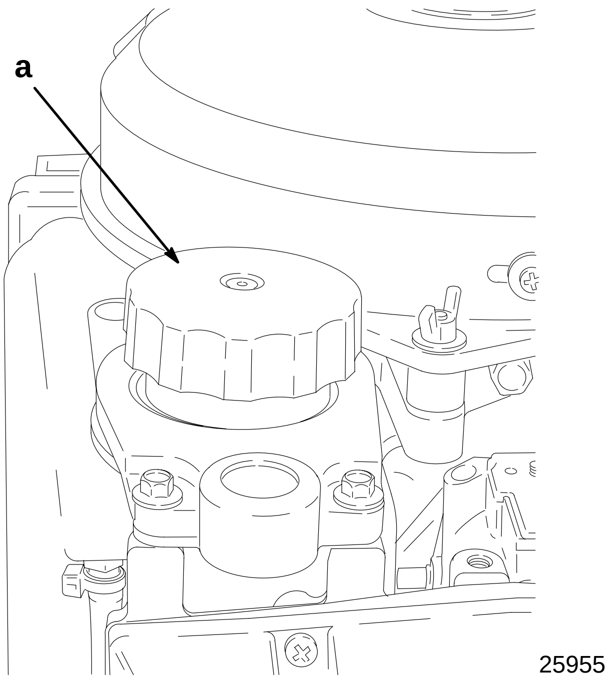
Oil Pump Drive System



a - Crankshaft
b - Drive Key
c - Drive Gear
d - Apply Quicksilver 2-4-C w/Teflon on Both Areas
e - Driven Gear
f - O-Rings [.739″ (18.77mm) I.D. x .809″ (20.55mm) O.D.]
g - Spacer
h - Oil Pump
i - Bolts; Torque to 60 lb. in. (6.8 N.m)

Filling Oil Tank

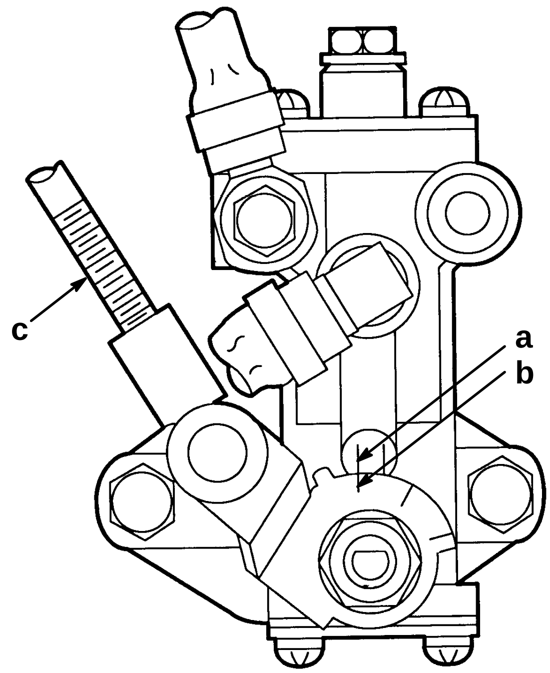
1. Quicksilver 2-Cycle Outboard Oil is recommended for this oil injection system. In an emergency, when Quicksilver 2-Cycle Outboard Oil is not available, substitute a high quality 2-cycle oil that is intended for outboard use and meets BIA rating TC-WII or TC-W3, shown on oil container. BIA rating TC-W is the Boating Industry Association's designation for approved, 2-cycle water-cooled outboard oils.
2. Remove fill cap from the oil tank and fill tank with oil. Retighten the fill cap.



a - Fill Cap

Carburetor/Oil Pump Synchronization

1. While holding throttle arm at idle position, adjust length of link rod so that stamped mark of oil pump body aligns with stamped mark of oil pump lever, and lever is in closed position.
2. Check full travel of link rod that it does not interfere with hoses, sta-straps, etc.



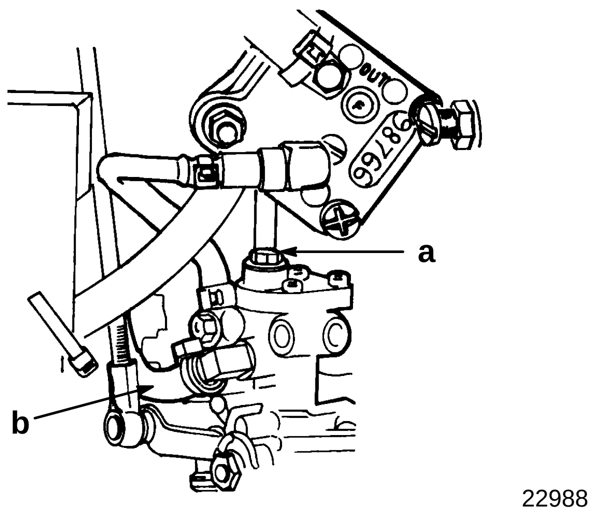
a - Mark on Body
b - Mark, Fully Closed on Lever
c - Link Rod

Bleeding Air from Oil Injection System

IMPORTANT: If air exists in either oil pump hose (inlet or outlet), the air MUST BE bled from the hose(s) before operating engine.

Bleeding Air from Oil Pump Inlet Hose

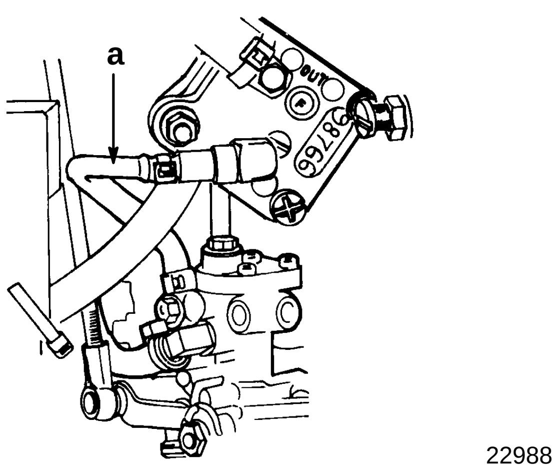
1. With engine not running, place a shop towel below the oil pump. Loosen bleed screw three to four turns and allow oil to flow from bleed hole until no air bubbles are present in inlet hose. Torque bleed screw to 25 lb. in. (2.8 N·m). This procedure also allows oil pump to fill with oil.



a - Bleed Screw
b - Inlet Hose

Bleeding Air from Oil Pump Outlet Hose

1. Purge air from outlet hose, by running engine at idle speed, until no air bubbles are present in outlet hose.

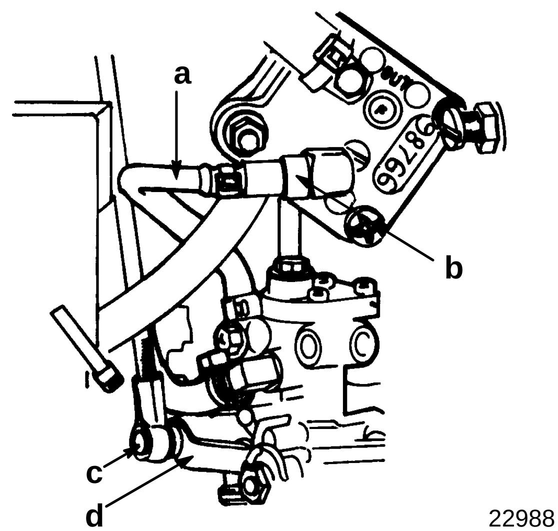


a - Outlet Hose

Oil Pump Test

NOTE: A graduated container is required to perform this test.

1. Connect engine to remote fuel tank containing a 50:1 fuel/oil mixture (25:1 if during break-in period).
2. Attach flush device to outboard or place outboard in test tank.
3. Remove top cowling.
4. Disconnect oil outlet hose from fuel pump fitting.
5. Plug fuel pump fitting.
6. Remove link rod end from oil flow regulator.
7. Rotate oil pump regulator full counterclockwise and hold it in this position, (wide-open pump position).
8. Attach an accurate service tachometer to engine.
9. Place end of hose into graduated container.



a - Outlet Hose
b - Fuel Pump Fitting
c - Link Rod End
d - Pump Regulator

10. Run engine at 700 RPM for 15 minutes.
11. 3 Cylinder:
    pump # 42959/42959--1/42959--2 = 21 ± 1.9cc
    pump # 42959--3 = 25 ± 2.3cc

    4 Cylinder:
    pump # 44345/44345--1/44345--2 = 28.6 ± 2.6cc
    pump # 44345--3 = 33.3 ± 4cc

NOTE: Pump output specifications are derived at 70 degrees room temperature. Cooler or warmer test temperature will result in LESS oil pump discharge.

Low Oil Sensor Test

NOTE: Low oil sensor is located in bottom of oil tank.

1. Disconnect low oil sensor leads (tan and black) from terminal block.
2. Using an ohmmeter, perform both tests in chart, following.

Oil Level in Oil Tank	Test Leads Between	Scale Reading (x__________)
1/2 Full to Full	Low Oil Sensor Leads (tan and black)	No Continuity* (R x 1)
Empty	Low Oil Sensor Leads (tan and black)	Continuity** (R x 1)

* If continuity is indicated, check to see if float (located inside oil tank) is stuck in place or if magnet (attached to bottom of float) has come loose. If float checks O.K., replace sensor.

** If continuity is NOT indicated, check to see if float (located inside oil tank) is stuck in place. If float is NOT stuck in place, replace sensor (bottom of oil tank – remove screw and retract sensor).

Warning Horn System

Models Equipped with Test Button (3 Cylinder Only)

DESCRIPTION

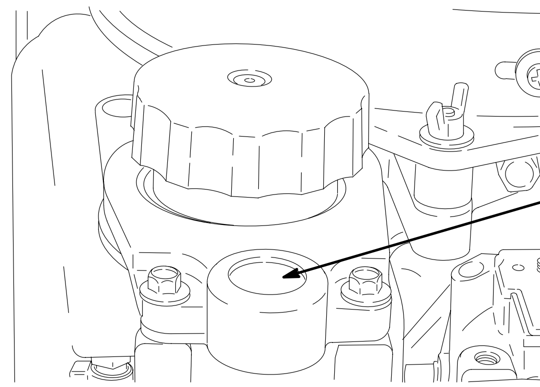
Major components of the warning horn system are an ignition switch, warning horn, low oil sensor, powerhead temperature sensor, and warning horn test button.

With the ignition switch in the “Run” position, electrical current is routed thru the warning horn and supplied to the powerhead temperature sensor, low oil sensor, and warning horn test button. If the powerhead overheats, the oil level in the oil tank drops below approximately 1 quart (.95 liter), or the warning horn test button is depressed, the electrical circuit completed, and the warning horn will sound.

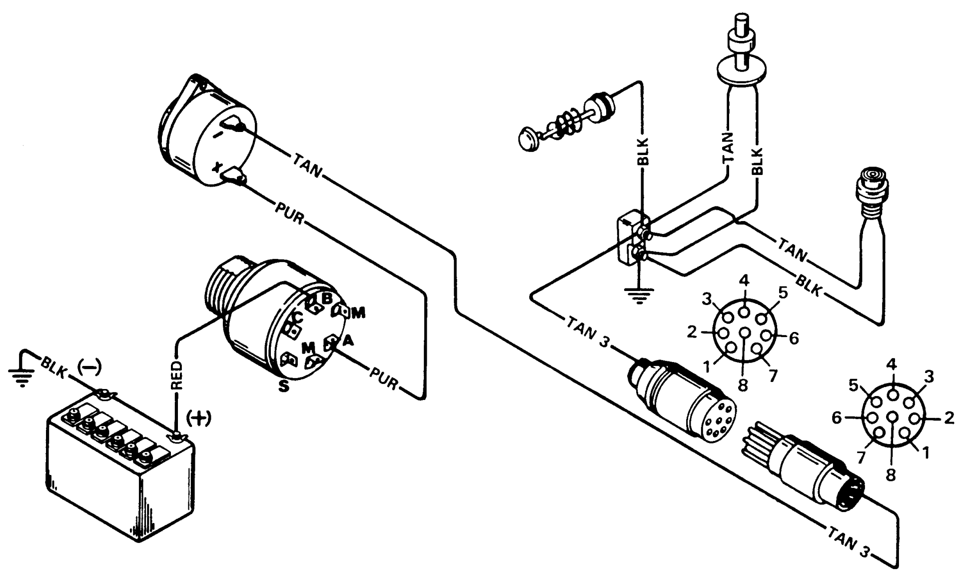
WARNING HORN SYSTEM CHECK

IMPORTANT: Warning horn will sound if powerhead is overheated or if oil level in oil tank has dropped below approximately 1 quart (.95 liter).

1. Turn ignition key switch to “Run” position.
2. Depress test button. Warning horn will sound if system is functioning properly.
3. Turn key switch to “Off” position.



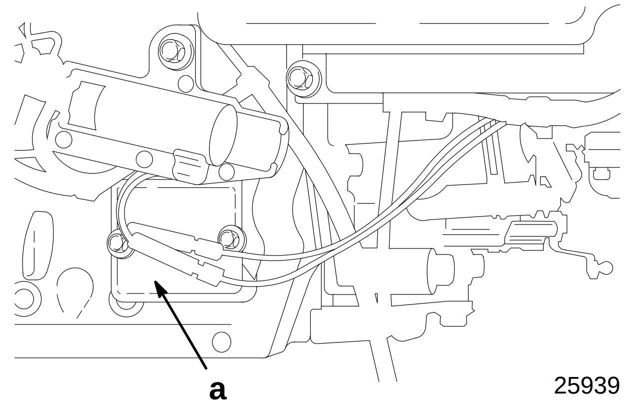
a - Test Button



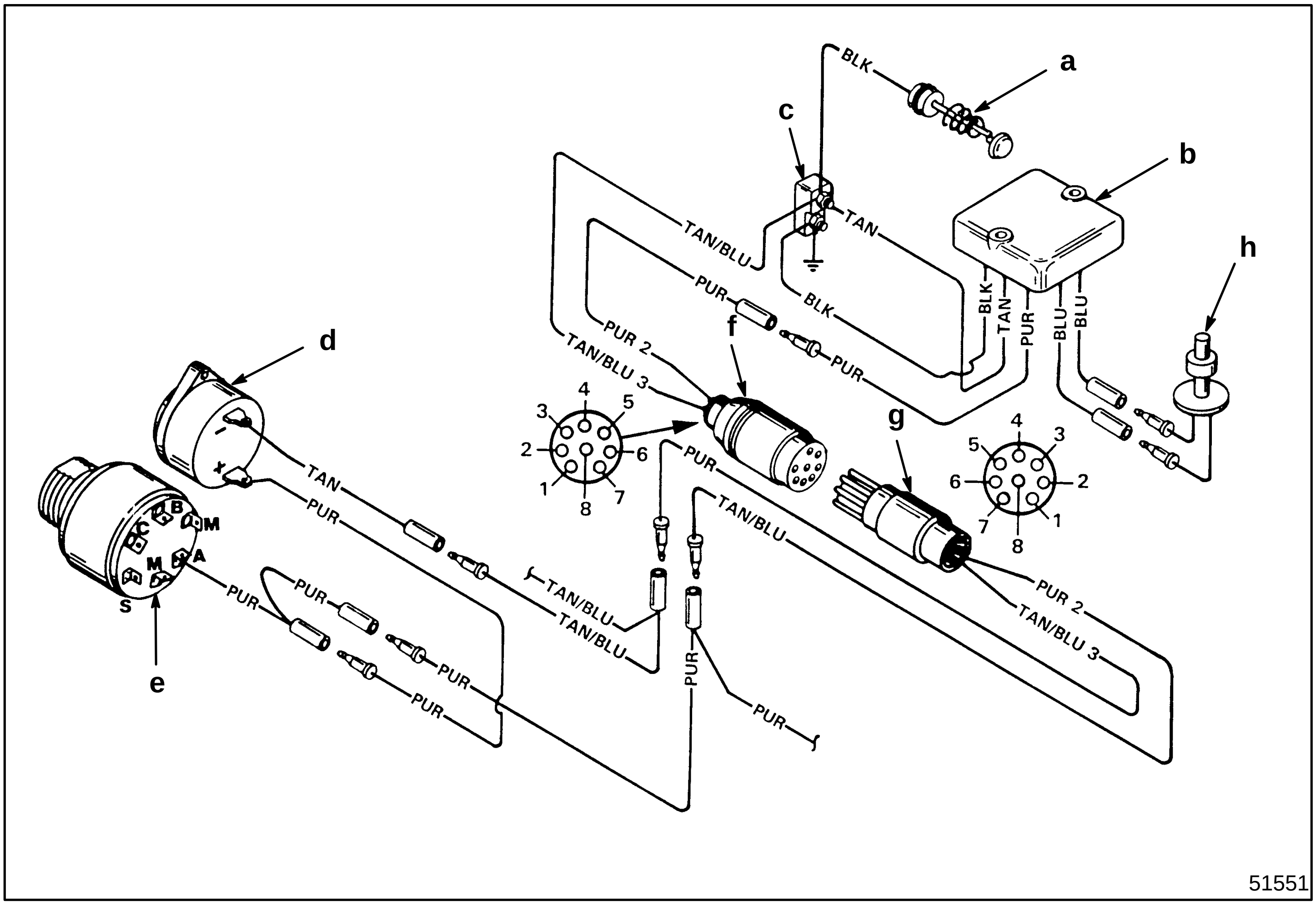
Models Not Equipped With Test Button (3 and 4 Cylinder)

DESCRIPTION

Self-test of the warning system is performed by turning the ignition key to the “RUN” position. A steady beep is indicative of an overheat condition. An intermittent beep refers to a low oil condition. Both overheat and low oil conditions are monitored by a warning module mounted on the starboard side of the engine block.

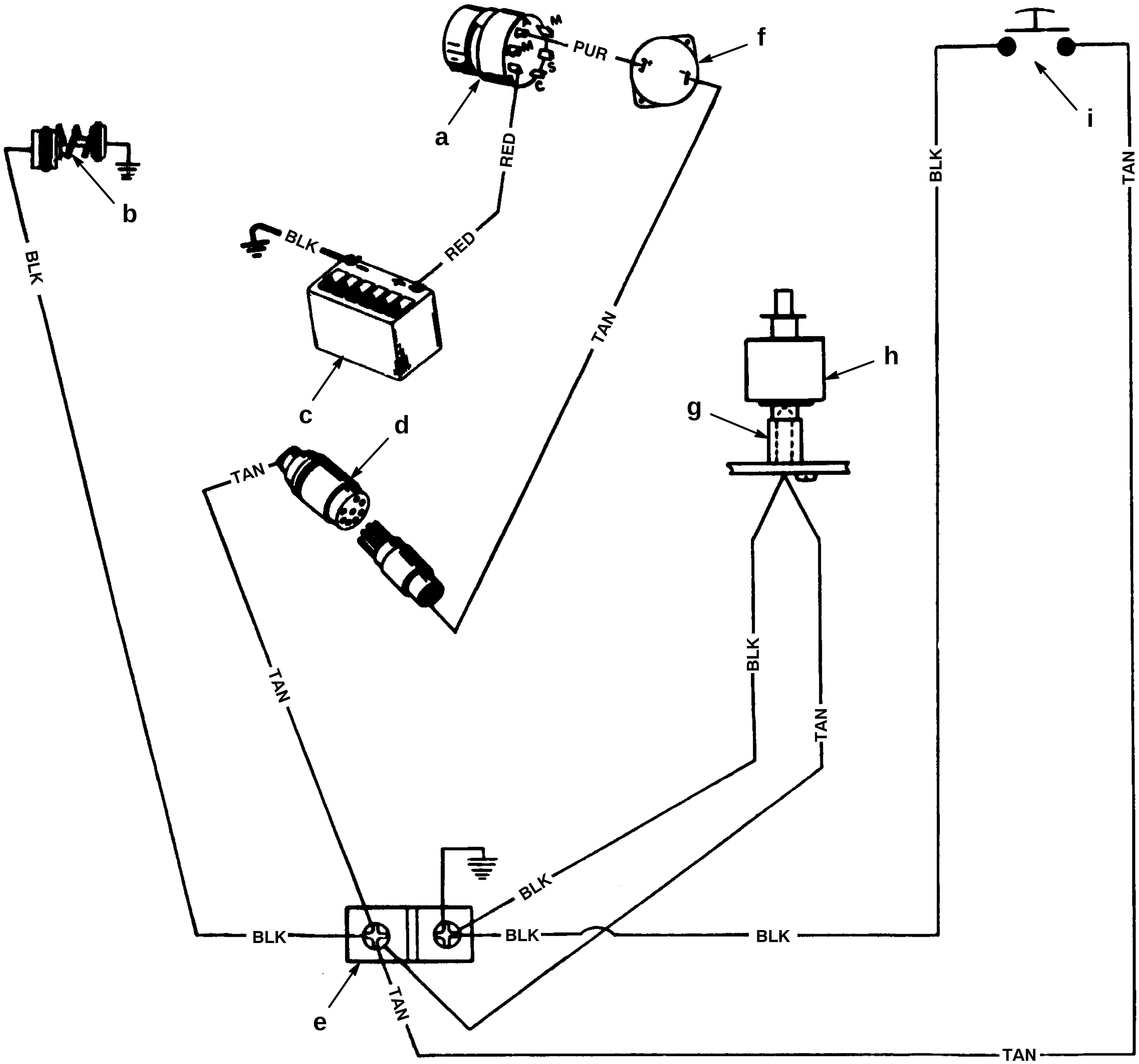


a - Warning Module



a - Powerhead Temperature Sensor
b - Warning Module
c - Terminal Block
d - Warning Horn
e - Ignition Switch
f - Engine Harness
g - Remote Control Harness
h - Low Oil Sensor

WARNING HORN SYSTEM WIRING DIAGRAM



a - Ignition Switch
b - Powerhead Temperature Sensor
c - Battery
d - Wiring Harness Connectors
e - Terminal Block
f - Warning Horn
g - Low Oil Sensor
h - Magnetic Float
i - Warning Horn Test Button (Some Models)

Oil Injection System Troubleshooting Chart

(Models with Warning Module)

Troubleshooting the Oil Injection System

If a problem occurs with the oil injection system and the warning horn sounds in a pulsating manner, stop engine and check if problem is caused by (1) low oil level – 1 quart remaining, (2) the oil injection pump, or (3) a faulty warning module.

1. Open the engine cowling and check oil level in engine reservoir. If oil level is approximately one quart or less, the problem is low oil level. Add oil to reservoir.

NOTE: There is a safety reserve of oil left in the reservoir after the low oil warning is sounded. There is enough oil for approximately 50 minutes of full throttle operation on four cylinder engines and approximately 1 hour of full throttle operation on three cylinder engines.

2. If there is more than 1 quart of oil in the reservoir, then the problem may be in the oil injection pump. DO NOT run engine on straight gas when a problem may be in the oil injection pump. Engine can be run by connecting a remote fuel tank of 50:1 gas and oil mixture to engine.

Troubleshooting Chart

PROBLEM: Warning horn does not sound when ignition key is turned to “ON” position.

POSSIBLE CAUSE	CORRECTIVE ACTION
Horn malfunction or open (TAN) wire between horn and engine	Disconnect tan lead from main engine wiring harness at terminal block on engine. Ground this tan lead to engine ground. Warning horn should sound. If not, check tan wire between horn and engine for open circuit and check horn.
Warning Module	Check if all warning module leads are connected to harness leads. If so, warning module may be faulty.
Using incorrect side mount remote control or ignition/ choke assembly.	Refer to Quicksilver Accessory Guide for correct components

PROBLEM: Warning horn stays on when ignition key is turned to “ON” position.

POSSIBLE CAUSE	CORRECTIVE ACTION
Engine overheat sensor	If horn sounds a continuous “beep”, the engine overheat sensor may be faulty. Disconnect overheat sensor (BLACK Wire) and turn ignition key to “ON” position. If horn still sounds a continuous “beep”, the warning module is faulty. Replace module and retest. If “beep” does not sound, then engine overheat sensor is faulty. Replace and retest.
Warning Module	If horn continues to sound on intermittent “beep”, the warning module is faulty or oil level is too low.

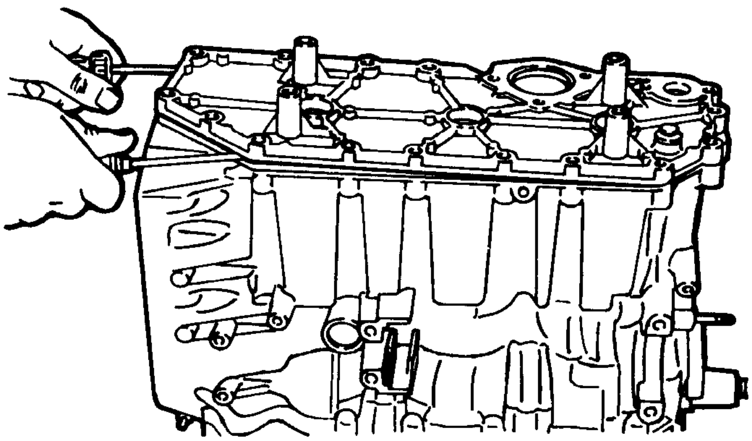
PROBLEM: Warning horn sounds when engine is running. Oil level in engine reservoir is full.

POSSIBLE CAUSE	CORRECTIVE ACTION
Defective low oil sensor	Disconnect both low oil sensor leads (LIGHT BLUE) from bullet connectors. Connect an ohmmeter between leads. There should be no continuity through sensor. If continuity exists, sensor is faulty.
Drive system of oil injection pump	Refer to page 3B-3, “Oil Pump Test” to determine if oil pump is operating properly.
Warning Module	Replace warning module.

POWERHEAD

4

A



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3-CYLINDER ENGINES

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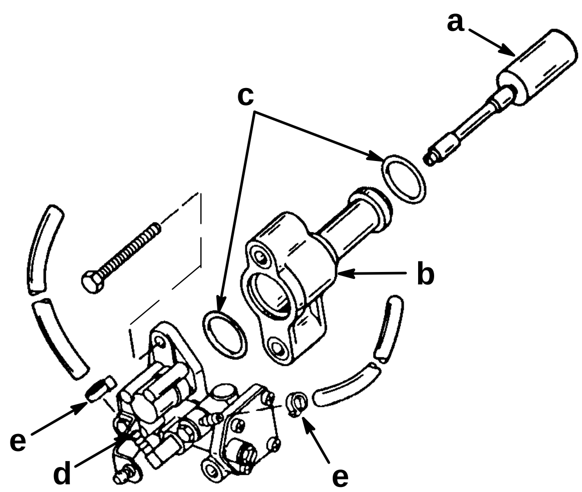
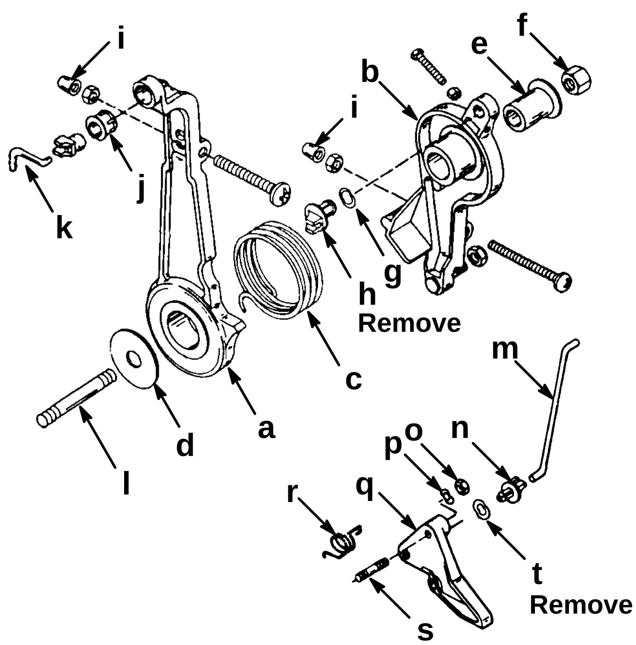


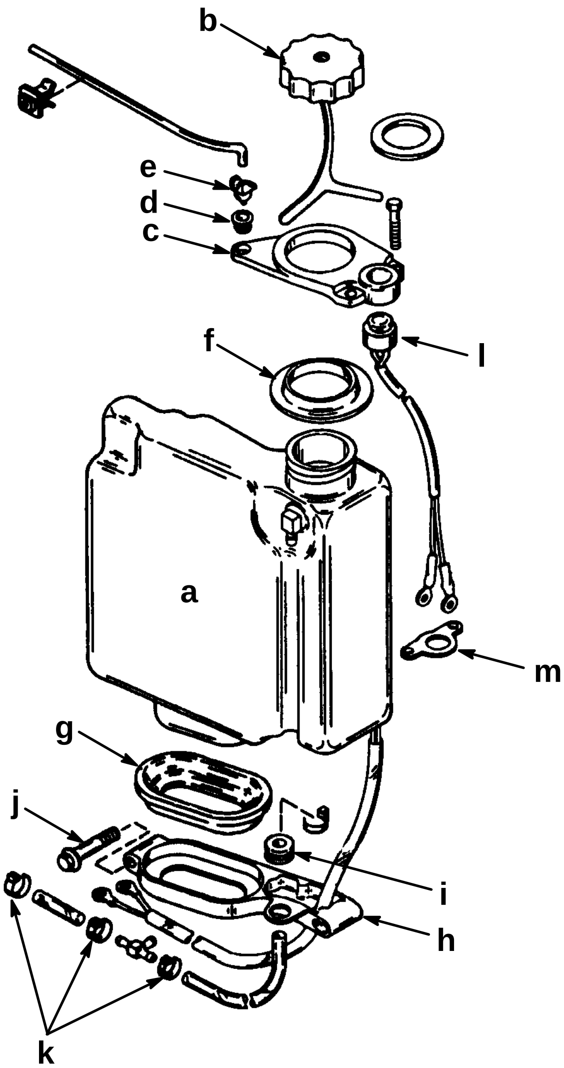
a - Drive Gear
b - Adapter Assembly
c - O-rings
d - Oil Pump Assembly
e - Sta-Straps

Oil Pump Assembly



a - Spark Advance Lever	k - Spark Advance Rod
b - Throttle Control Lever	l - Stud
c - Torsion Spring	m- Link Arm
d - Washer	n - Swivel Bushing
e - Flanged Bushing	o - Locknut
f - Nut	p - Washer
g - Wave Washer **(Remove)**	q - Throttle Cam
h - Swivel Bushings (2)	r - Return Spring
i - Nylon Caps (2)	s - Stud
j - Swivel Base	t - Wave Washer **(Remove)**

Control Arm Lever Assembly



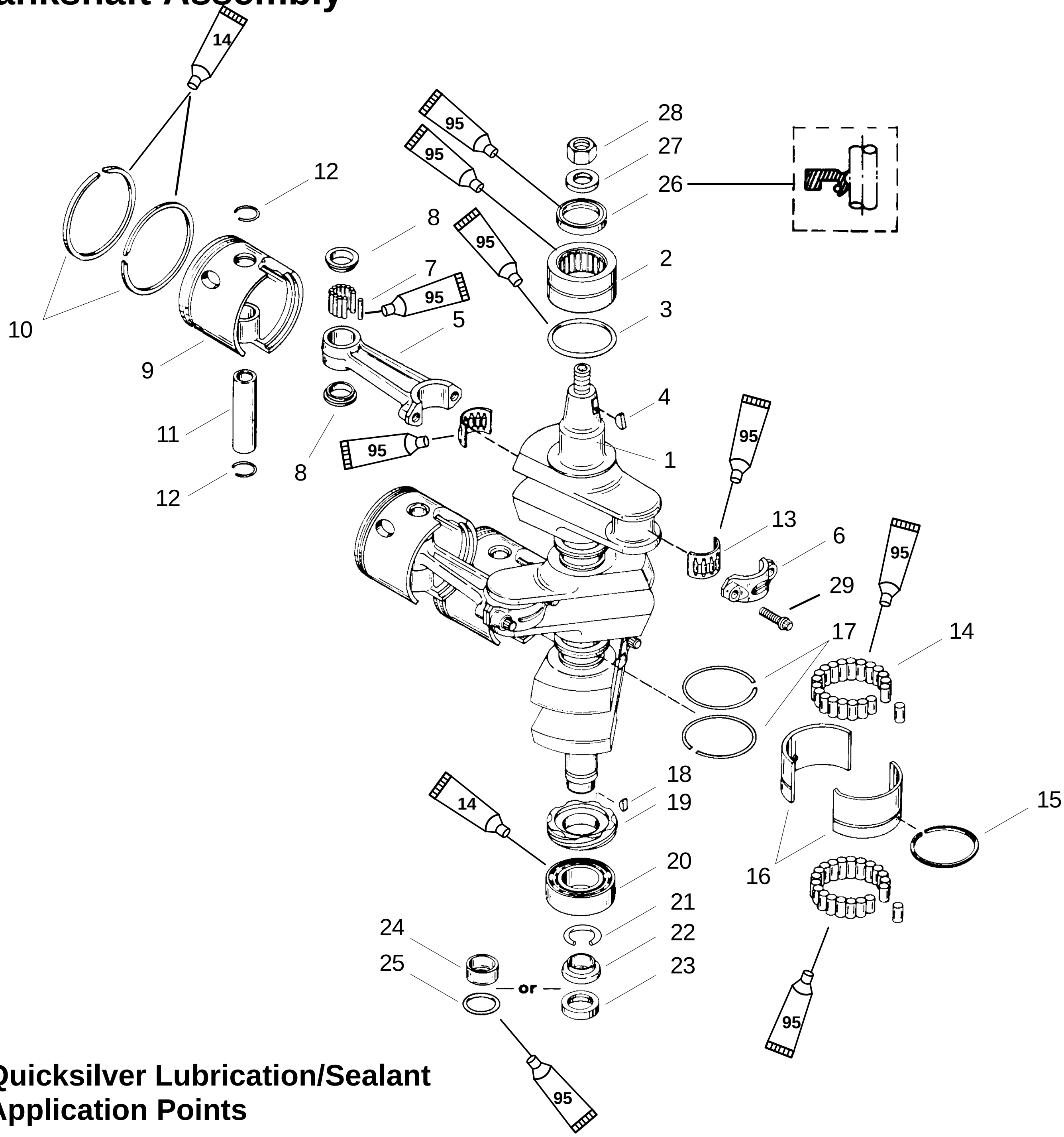
a - Oil Tank
b - Oil Cap Assembly
c - Oil Tank Neck Bracket
d - Swivel Base
e - Swivel Bushing
f - Oil Tank Neck Boot
g - Oil Tank Base Boot
h - Oil Tank Base
i - Grommet
j - Bolt --[Torque to 160 lb. in. (18.1 N·m)]
k - Sta-Straps
l - Switch Assembly (Without Warning Module)
m- Switch Cover

Oil Tank Assembly

THROTTLE LEVER AND LINKAGE WAVE WASHER REMOVAL - MODELS 70-75-80-90-100

When servicing 3 cylinder model 70-75-80-90 and 4 cylinder 100/115 HP outboards for any reason, remove the wave washers from the swivel bushings. Removal of the wave washers will prevent the swivels from breaking during removal/installation. Future production outboards will have the wave washers removed.

Crankshaft Assembly



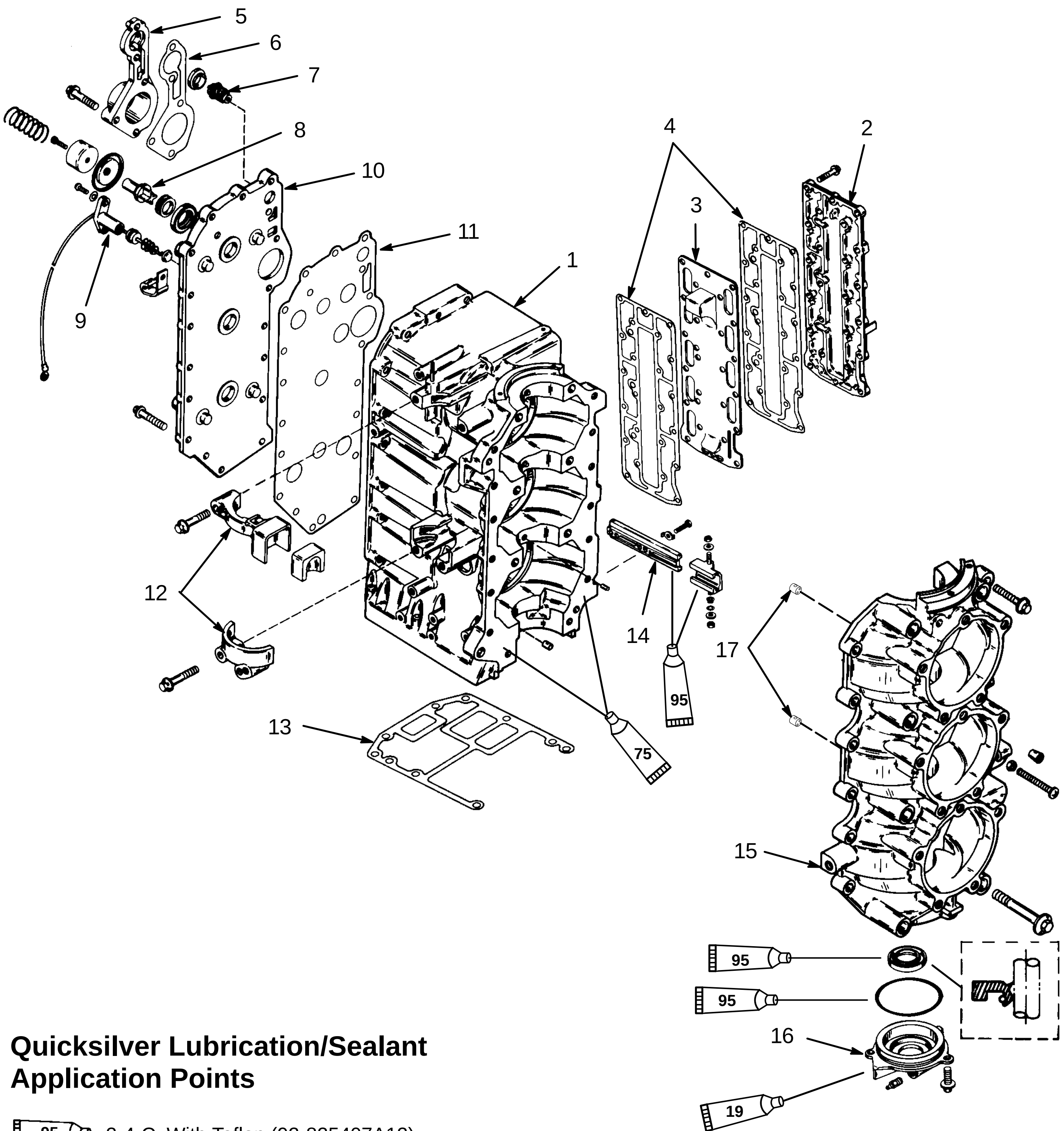
Quicksilver Lubrication/Sealant Application Points

95 2-4-C With Teflon (92-825407A12)

14 2 Cycle Outboard Oil (92-13249A24)

REF. NO.	QUAN.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	Crankshaft			
2	1	Upper Main Bearing			
3	1	O-Ring Seal			
4	1	Key-Flywheel			
5	3	Connecting Rod			
6	3	Connecting Rod Cap			
7	29	Piston Pin Needle Bearings			
8	6	Needle Bearing Locating Rings			
9	3	Piston			
10	6	Piston Rings - 2 Each			
11	3	Piston Pin			
12	6	Piston Pin Retainer Rings - 2 Each			
13	1	Rod Bearing Assembly			
14	1	Center Main Bearings - (32 Each Main)			
15	2	Retaining Ring - Center Mains			
16	1	Bearing Race - (1 Set Each)			
17	1	Crankshaft Sealing Rings, Metal (2 Each Main)			
18	1	Key-Gear			
19	1	Gear			
20	1	Lower Main Ball Bearing			
21	1	Retaining Ring (If Equipped)			
22	1	Seal Carrier Assembly			
23	1	Crankshaft Seal			
24	1	Wear - Sleeve			
25	1	O-Ring Crankshaft Seal			
26	1	Upper Main Bearing Seal			
27	1	Flat Washer			
28	1	Flywheel Nut		120	162.7
29	6	Rod Bolt	Apply Light Oil to Threads and Bolt Face: 1st Torque - 15 lb. in. (1.7 N·m) – Check Alignment 2nd Torque - 30 lb. ft. (40.7 N·m) Turn Bolt an Additional 90° after 2nd Torque is Attained		

Powerhead Block and Cover Assemblies



Quicksilver Lubrication/Sealant Application Points

95 2-4-C With Teflon (92-825407A12)

75 Loctite Master Gasket (92-12564-1)

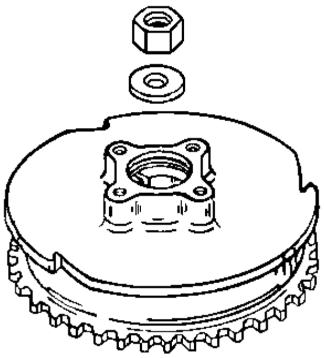
19 Perfect Seal (92-34227-1)

Powerhead Block and Cover Assemblies (Continued)

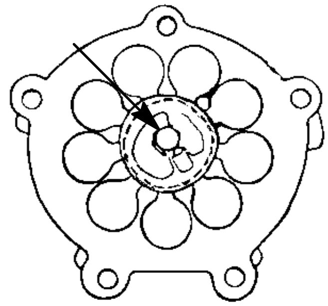
REF. NO.	QUAN.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	Cylinder Block			
2	1	Exhaust Plate Cover			
3	1	Exhaust Divider Plate			
4	2	Exhaust Plate Gaskets			
5	1	Thermostat/Poppet Valve Cover			
6	1	Thermostat/Poppet Valve Cover Gasket			
7	1	Thermostat			
8	1	Poppet Valve Assembly			
9	1	Temperature Sensor			
10	1	Cylinder Cover			
11	1	Cylinder Cover Gasket			
12	1	Starter Hold-Down Brackets			
13	1	Gasket--Powerhead to Driveshaft Housing			
14	1	Shift Rail			
15	1	Crankcase Cover			
16	1	Crankcase End Cap (Lower)			
17	2	Check Valves			

Torque Specifications, Torque Sequences

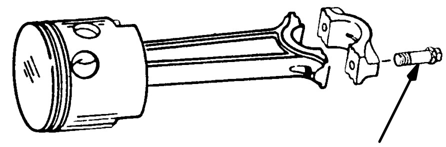
Flywheel Nut
120 lb. ft. (162.7 N·m)



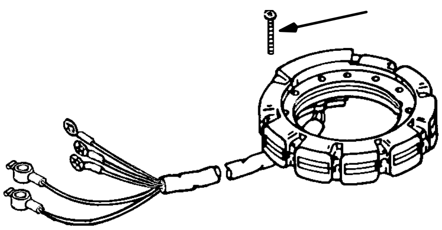
Reed Block Assembly
80 lb. in. (9.0 N·m)



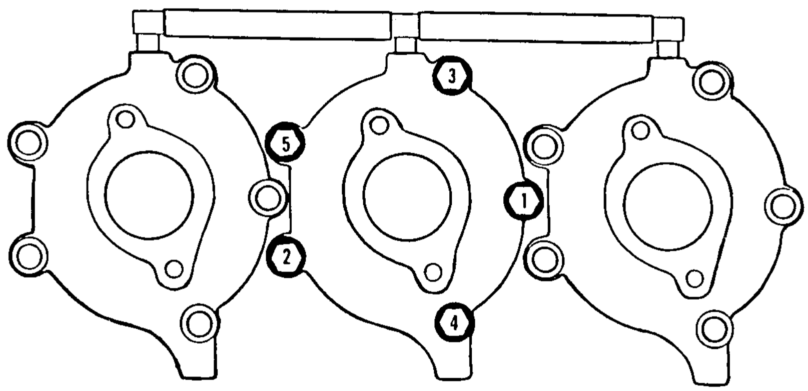
Connecting Rod Bolts
30 lb. ft. (40.7 N·m)
Check Alignment
Turn bolt 90° further after torque of
30 lb. ft. is reached
IMPORTANT: See page 4A-32
(this Section)



Stator Screws
60 lb. in. (6.8 N·m)
Add Loctite 271
to Threads Unless Patch
Screw is Used.

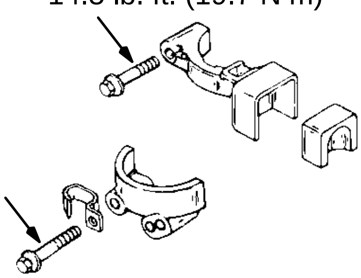


Intake Manifolds
18 lb. ft. (24.4 N·m)
(Each Manifold)

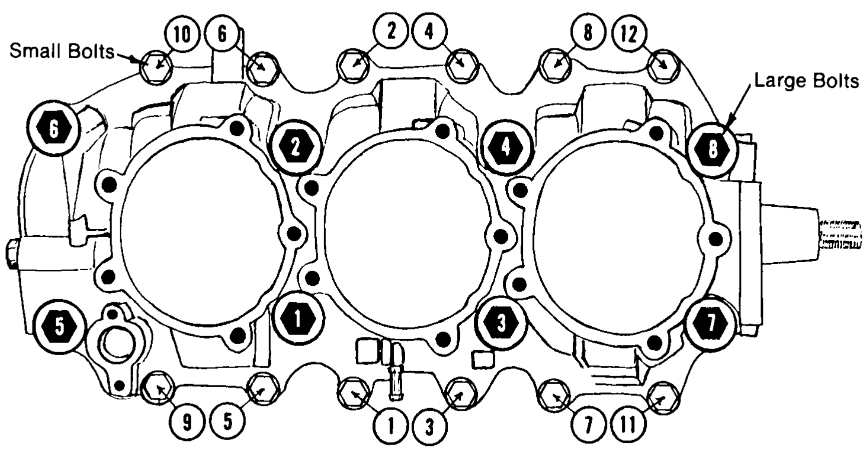


Spark Plugs
20 lb. ft. (27.1 N·m)

Starter Motor Hold-Down Bolts
14.5 lb. ft. (19.7 N·m)

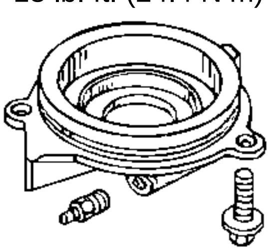


Crankcase Cover Bolts
1st Torque Pattern (Large Bolts) = 25 lb. ft. (33.9 N·m)
2nd Torque Pattern (Small Bolts) = 18 lb. ft. (24.4 N·m)
– 3 Step Torque on Each Pattern –

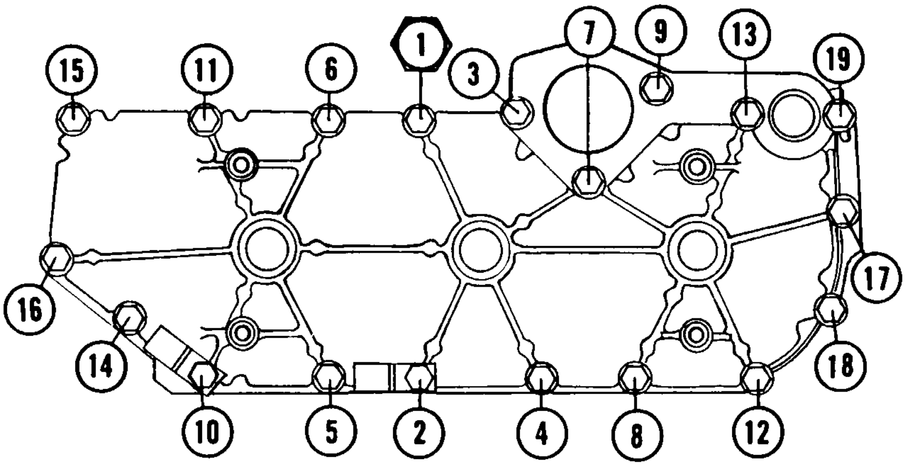


Torque All Large Bolts First - Then Torque All Small Bolts.

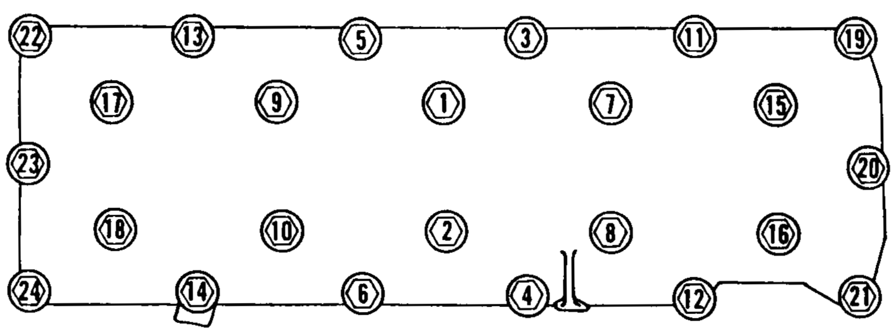
Crankcase End Cap Bolts (Lower)
18 lb. ft. (24.4 N·m)



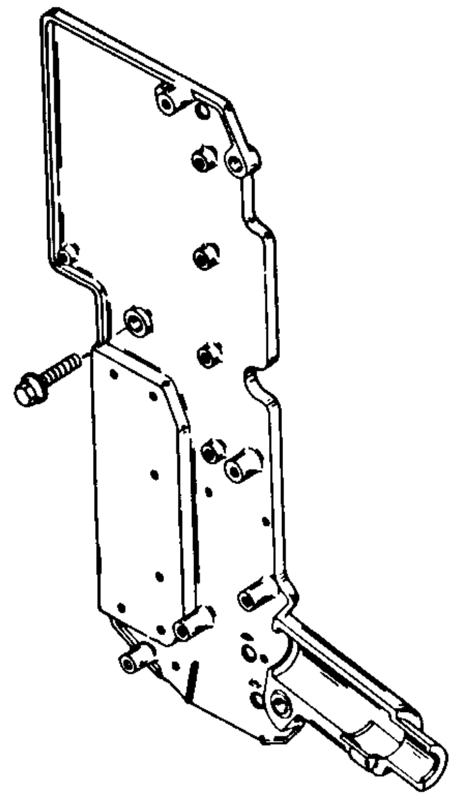
Cylinder Block Cover
18 lb. ft. (24.4 N·m)



Exhaust Cover (and Divider Plate)
18 lb. ft. (24.4 N·m)



Electrical Component Plate
13.5 lb. ft. (18.3 N·m)
Loctite 271 Required.



We recommend that you read the sub-section on reassembly BEFORE proceeding. There are specifics relating to this engine which are NOT applicable to prior engines.

TORQUE SPECIFICATIONS		
Application (Listed in Reassembly Sequence)		**Torque**
Rod Cap Bolts	1st Torque 2nd Torque (after checking alignment)	15 lb. in. (1.7 N·m) 30 lb. ft. (40.7 N·m) Recheck Alignment NOTE: See page 4A-32
Crankcase End Cap Bolts (Lower)		18 lb. ft. (24.4 N·m)
Crankcase Cover	1st Torque Pattern (Large Bolts) 2nd Torque Pattern (Small Bolts)	25 lb. ft. (33.9 N·m) 18 lb. ft. (24.4 N·m)
Cylinder Block Cover		18 lb. ft. (24.4 N·m)
Exhaust Cover (and Divider Plate) Bolts		18 lb. ft. (24.4 N·m)
Oil Injection Pump Bolts (or Plate Cover)		60 lb. in. (6.8 N·m)
Fuel Pump Screws		40 lb. in. (4.5 N·m)
Electrical Component Mounting Plate Bolts - Loctite 271 used		13.5 lb. ft. (18.3 N·m)
Stator Screws (Loctite 271 used unless Patch Screw used)		60 lb. in. (6.8 N·m)
Starter Motor Hold-Down Bolts		14.5 lb. ft. (19.7 N·m)
Flywheel		120 lb. ft. (162.7 N·m)
Intake Manifolds		18 lb. ft. (24.4 N·m)
Air Box Plate		100 lb. in. (11.3 N·m)
Cowl Mounting Bracket		150 lb. in. (16.9 N·m)
Powerhead to Driveshaft Housing		44 lb. ft. (59.7 N·m)

OTHER	
Spark Plugs	20 lb. ft. (27.1 N·m)
Screw in Poppet Valve	No torque requirement - tighten securely
Shift Rail Bolts	150 lb. in. (16.9 N·m)

Tools for Powerhead Repair

Part No.	Tool Description
91-52344	Flywheel Holder
91-24161	Protector Cap
91-73687A1	Flywheel Puller
91-90455	Lifting Eye
91-24697	Piston Ring Expander
91-74607A1	Piston Pin Tool
91-77109A1	Locking Installation Tool
91-812549	Powerhead Stand

SEALANTS/LOCTITES® NEEDED

Loctite 271 (Obtain Locally)

Master Gasket Sealant Kit
Quicksilver® No. 92-12564 1 (Loctite Kit)

Quicksilver® Perfect Seal No. 4 (92-34227-1)

General Information

DISASSEMBLY AND REASSEMBLY

If complete disassembly is not necessary, start at appropriate spot; start reassembly at point disassembly stopped.

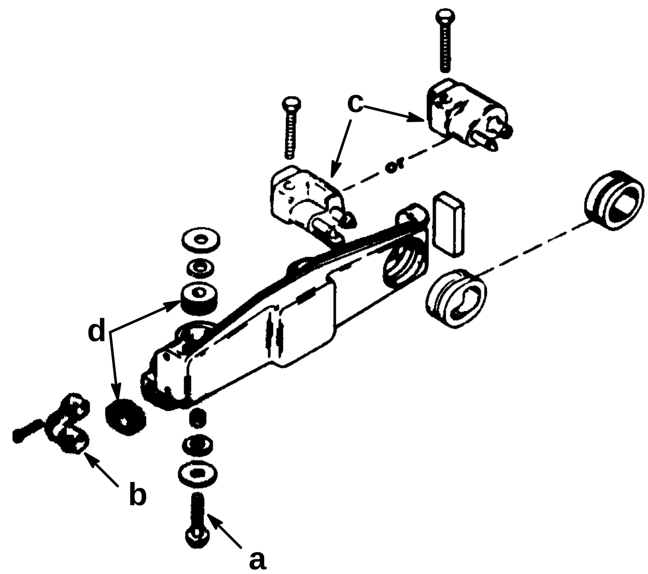
If major powerhead repairs are being done, remove powerhead from lower unit. It is not necessary to remove powerhead for:

a. Visual check for scoring or broken rings (cylinder walls and pistons), by viewing through exhaust ports.

b. Minor external repair (i.e. - ignition system, carburetors, reed blocks, thermostat checks, etc.).

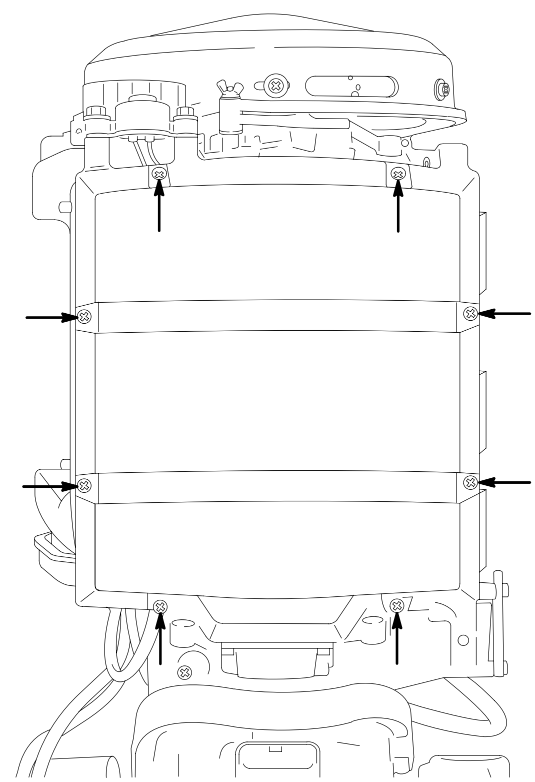
Powerhead Component Removal

1. **Remove Front Cowl Bracket** before removing air box cover, by removing 2 bolts, cable retainer, and fuel connector. Bushings normally remain in brackets. Cowl and bracket seals/bushings stay attached to respective locations. If seal replacement is necessary, remove old seals at time of replacement.



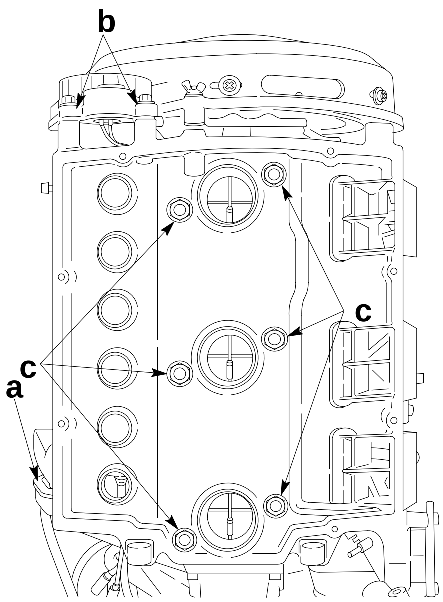
a - Bolts
b - Cable Retainer
c - Fuel Connector
d - Bushings

2. Remove Air Box Cover by removing 8 screws.



20335

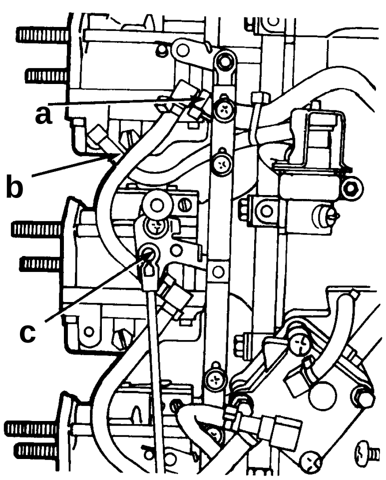
3. Remove 10mm bolt from lower oil tank support (starboard side of engine, base).
4. Remove 2 (8mm) Bolts from upper oil tank neck brace.
5. Remove Air Box by removing 6 nuts and pulling off of carburetor studs.
6. Disconnect Oil Lines - Remove Oil Reservoir.



19097

a - Oil Tank Support
b - Bolts (8mm)
c - Nuts (6)

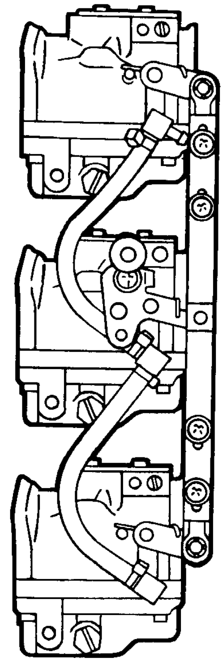
7. Disconnect Throttle Linkage (c).
8. Remove main fuel hose (a), and fuel hose (b). Lift carburetors off as 1-unit assembly (see next column).



19093

a - Main Fuel Hose
b - Fuel Enrichment Hose
c - Throttle Linkage

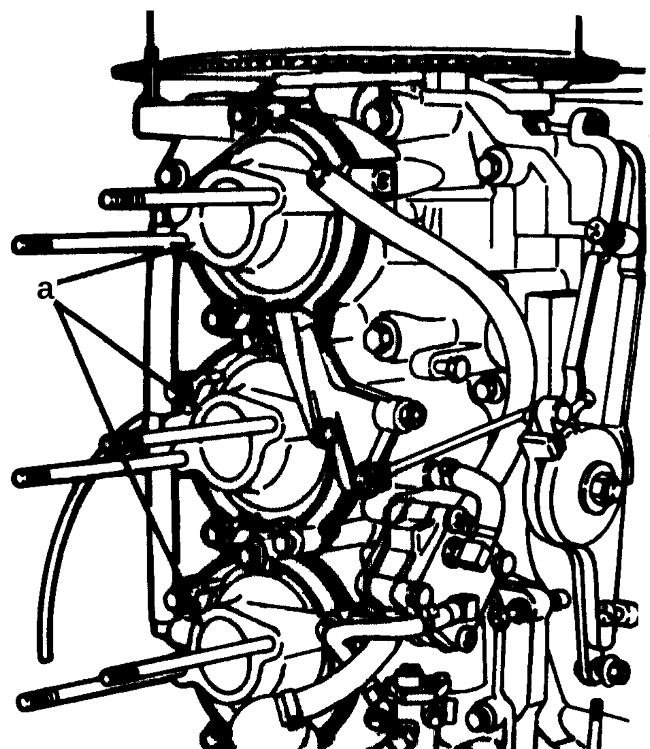
9. Remove Flywheel Cover by removing 3 wing nuts.



1-unit Removal Of Carburetor Assembly.

19546

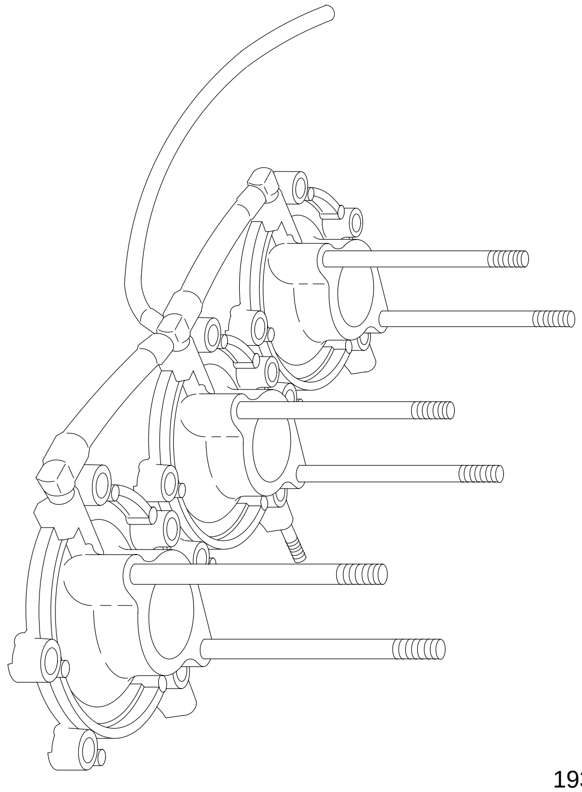
10. Remove Intake Manifolds - see below.



19547

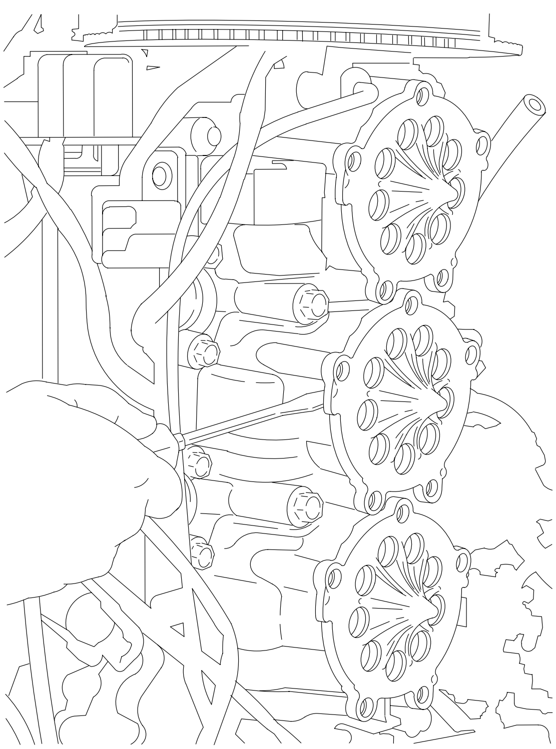
a - Intake Manifolds

11. The intake manifolds may be removed as 1-unit.



19330

12. Pry off each Reed-Block, as shown, using screw-driver.



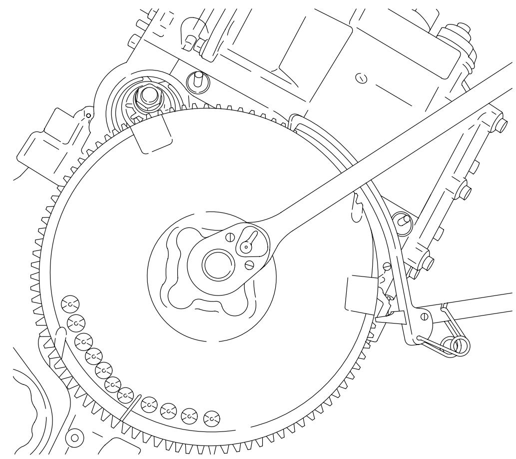
19549

Flywheel Removal

⚠ CAUTION

DO NOT strike end of puller center bolt to remove flywheel, or damage may result to crankshaft or bearings.

1. Remove flywheel cover from powerhead.
2. While holding flywheel with Flywheel Holder (91-52344), remove flywheel nut and washer.



20344

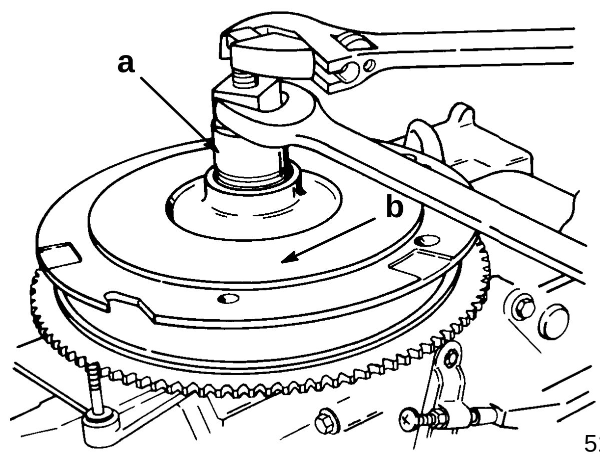
⚠ CAUTION

Crankshaft damage may result if a protector cap is not used between crankshaft and puller.

3. Install a crankshaft Protector Cap (91-24161) on end of crankshaft, then install Flywheel Puller (91-73687A1) into flywheel.
4. Install crankshaft Protector Cap (91-24161) on the end of crankshaft, then install Flywheel Puller (a) (91-73687A1) into flywheel (b).

NOTE: Neither heat nor hammer should be used on flywheel to aid in removal as damage to flywheel or electrical components under flywheel may result.

5. Remove flywheel.

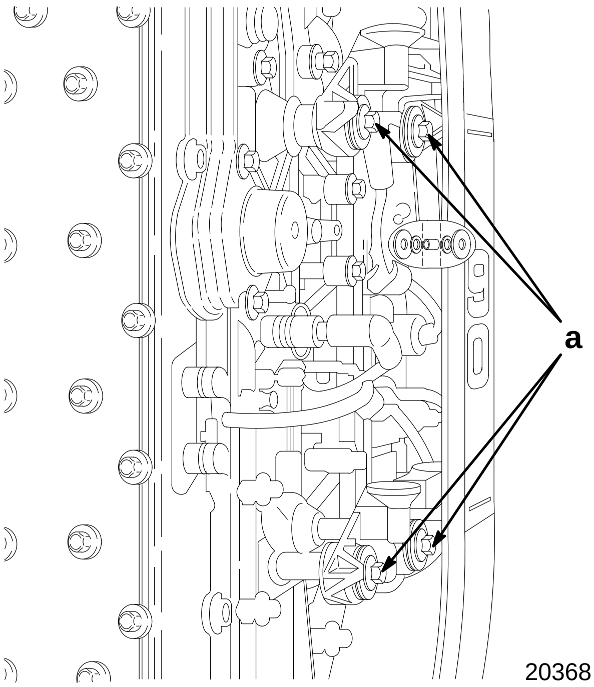


51124

6. Remove Rear Cowl Mounting Bracket from powerhead by removing 4 bolts.
7. Remove Ignition Components, from powerhead, including starter motor

- Stator Plate and Trigger
- Starter Motor
- Electrical Components Mounting Plate
- Plug Wires
- Temperature Sensor
- Solenoid

NOTE: Removal of wiring harness and components, as a unit, is advisable to simplify reassembly.

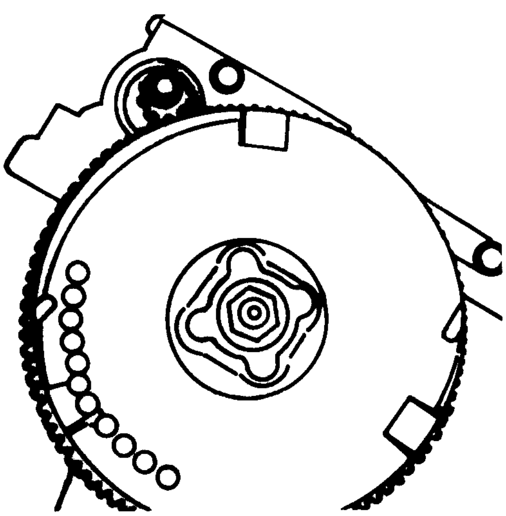


20368

a - Bolts

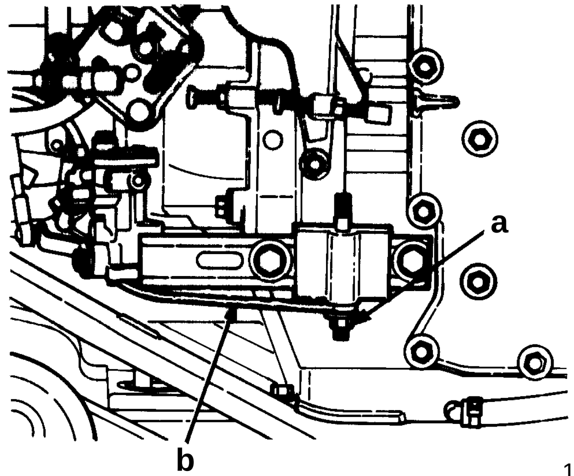
(Disconnect cable to Power Trim [3 wires])

Temporarily install flywheel with nut as shown.



20346

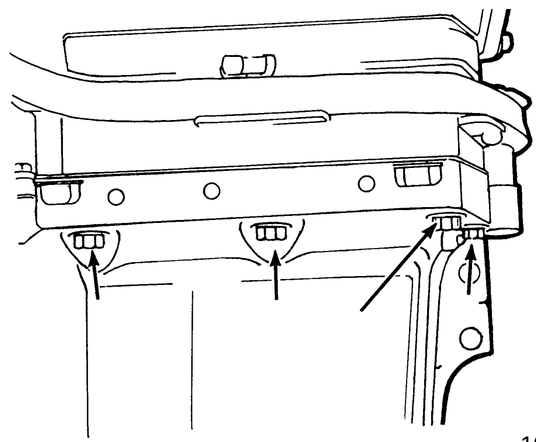
8. Remove shift arm linkage at stud.



19060

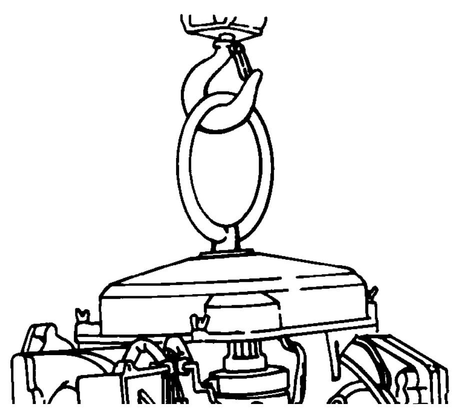
a - Shift Arm Linkage
b - Stud

9. Remove 8 bolts (3 each side, 2 backside) which secure powerhead to driveshaft housing.



19070

10. nstall Lifting Eye (91-90455) onto flywheel. Thread on at least 5 full turns.
11. Twist powerhead or move back and forth to break gasket between powerhead and exhaust plate.
12. Using a hoist, lift powerhead assembly from driveshaft housing.

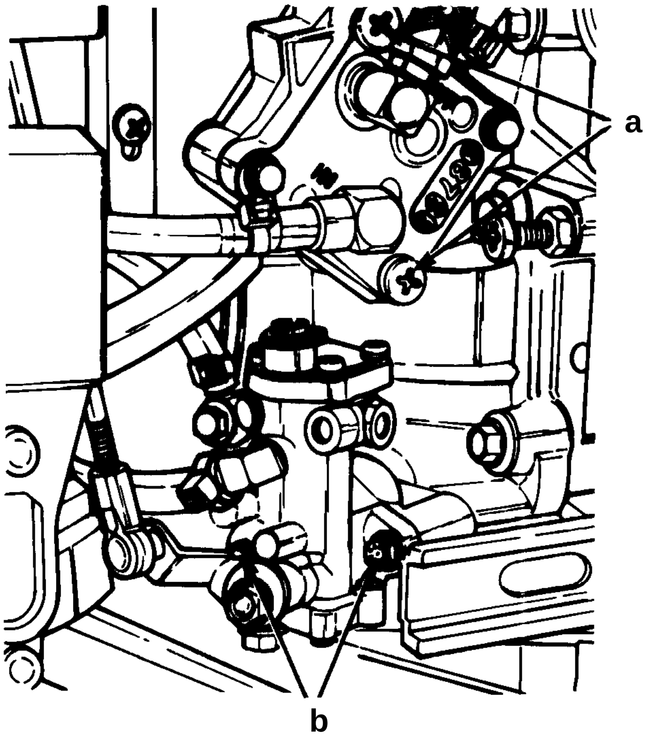


20031

13. Place powerhead on bench.

Powerhead Disassembly

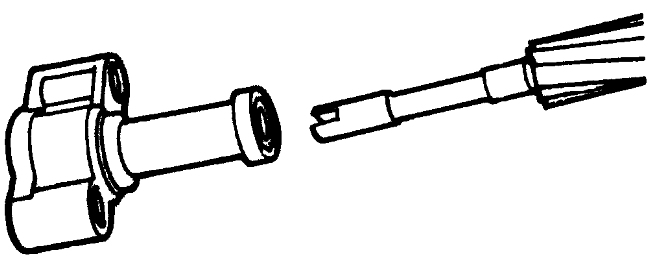
1. Remove fuel pump by removing 2 screws.
2. Remove oil injection pump by removing 2 bolts.
3. Remove hoses to fuel pump and oil injection pump.



19056

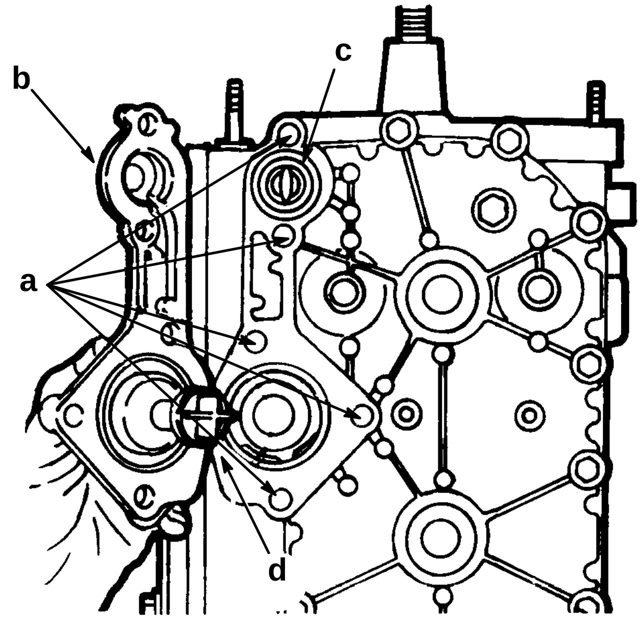
a - Screws
b - Bolts

4. Remove oil injection pump shaft and housing.



20041

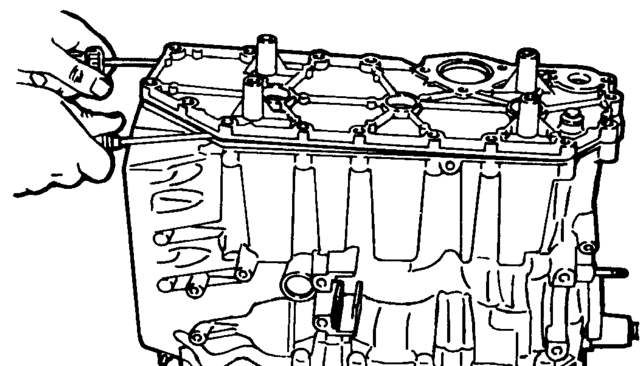
5. Remove thermostat housing and components.



25907

a - Bolts
b - Thermostat Cover
c - Thermostat
d - Poppet Valve

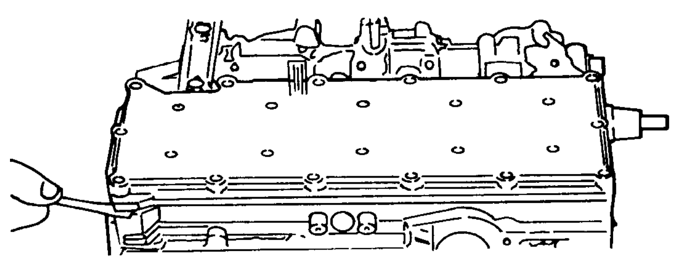
6. Remove cylinder block cover.



20039

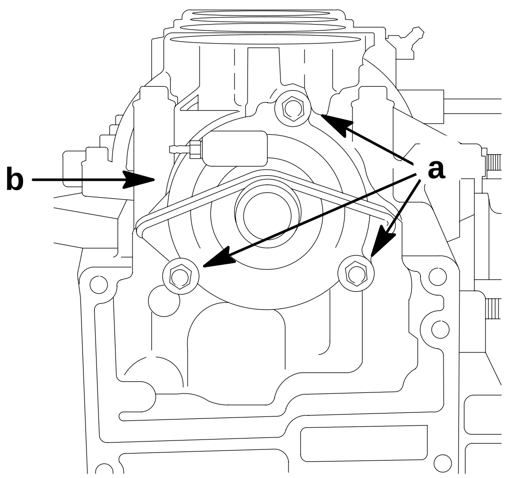
NOTE: There are "pry-slots" on casting as shown by screwdriver positions.

7. Remove exhaust cover and divider plate.



20029

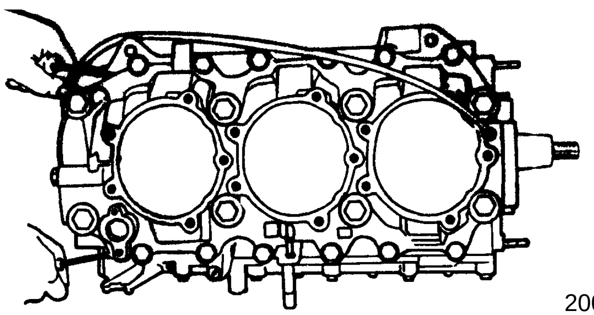
8. Remove 3 bolts from crankcase end cap (lower).



20020

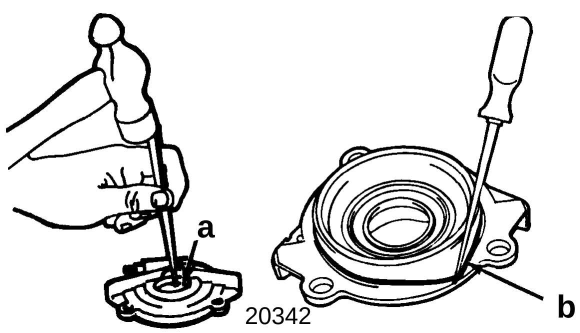
a - Bolts
b - End Cap

9. Remove crankcase bolts, and cover.



20032

10. Remove crankcase endcap (lower).
11. Remove oil seal and O-ring seal.



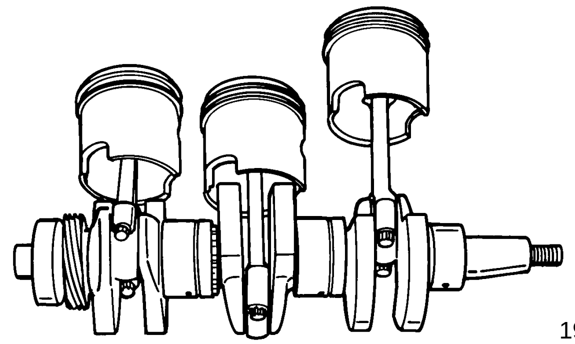
20341

a - Oil Seal
b - O-Ring

Some models may have a wear sleeve with an O-ring seal. See page 4A-16.

12. Crankshaft may be removed as an assembly, or by component parts.

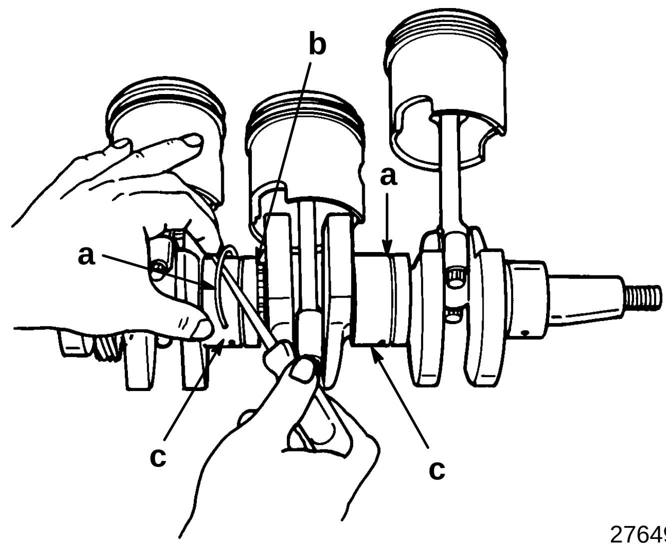
IMPORTANT: If removed by components, rod caps MUST be reassembled on the same rod - in the dame direction. (Each mating surface is slightly different), so rebolt cap to rod immediately, or mark rods and caps.



19314

13. Remove main roller bearing assemblies (2) from crankshaft as follows;

- Remove retaining ring.
- Remove race.
- Remove main roller bearings.



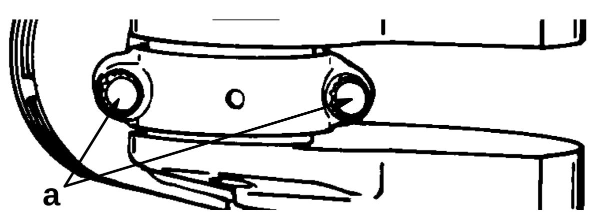
27649

a - Retaining Ring
b - Race
c - Main Roller Bearings

14. Remove 2 bolts, each rod cap, using a 3/8”, 12 point socket.

IMPORTANT: Before disassembly, use a carbide-tip scriber to mark caps and rods, to return pistons to proper cylinder.

15. Remove piston assembly from crankshaft; reattach caps to respective rods, as each is removed. CAPS MUST BE INSTALLED IN SAME DIRECTION ON SAME ROD, or mating surfaces will not seat properly.

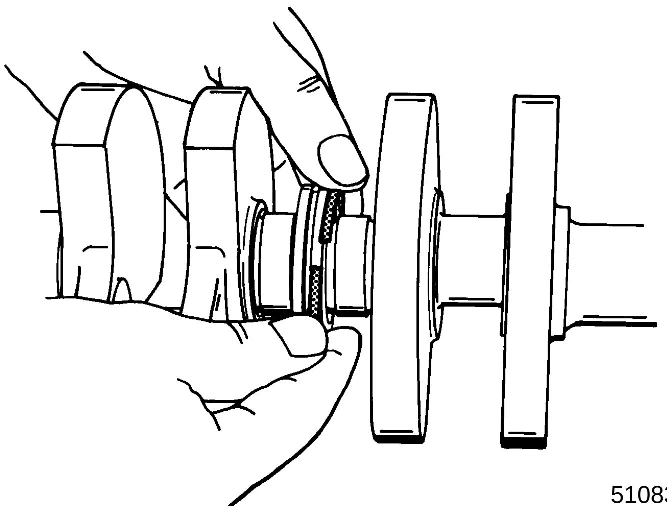


19328

a - Bolts

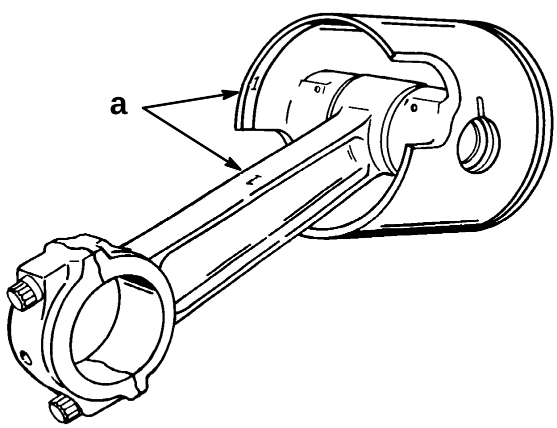
IMPORTANT: On some engines, BOTH the piston rod and rod cap bolt holes are threaded. The rod cap and rod must be aligned and held tight together when threading in rod cap bolts. Check mating surfaces to be sure that they are tight together after bolt enters the threads in the piston rod.

16. Remove main bearing sealing rings - 2 per center main journal.



51083

17. Using an awl, scribe identification number of connecting rod on inside of piston. Reassemble piston on same connecting rod.

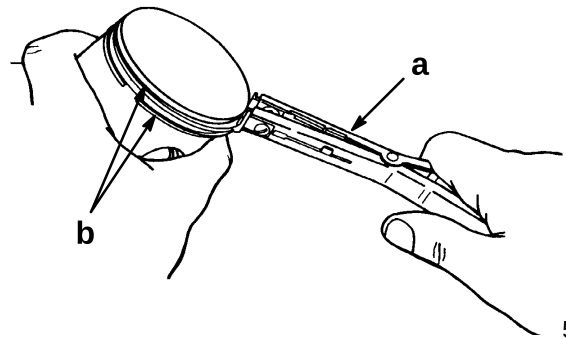


17770

a - Scribe Mark

18. Use piston ring expander (91-24697) to remove piston rings. Always install new piston rings.

NOTE: Cylinders must be honed in order for new rings to seat properly.



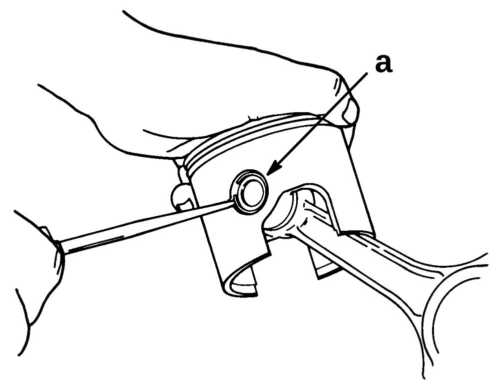
51081

a - Piston Ring Expander (P/N 91-24697)
b - Piston Rings

⚠ CAUTION

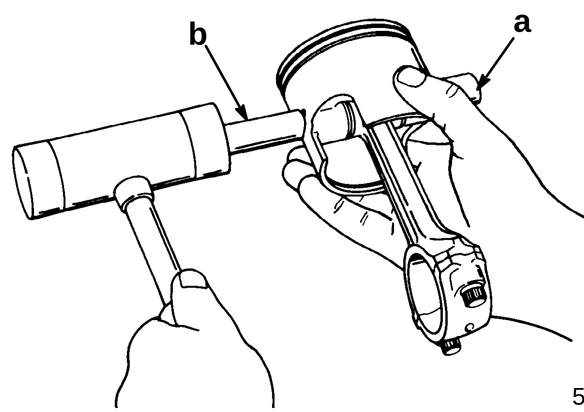
Eye protection MUST BE worn while removing piston pin lockrings from piston.

19. Using an awl, remove piston pin lockrings (a) from both ends of piston pin. Never re-use piston pin lockpins. Hold shop cloth over lockring area when snapping out lockrings.



51083

20. Support piston and tap out piston pin (a), using service tool (b) 91-74607A2, as shown.

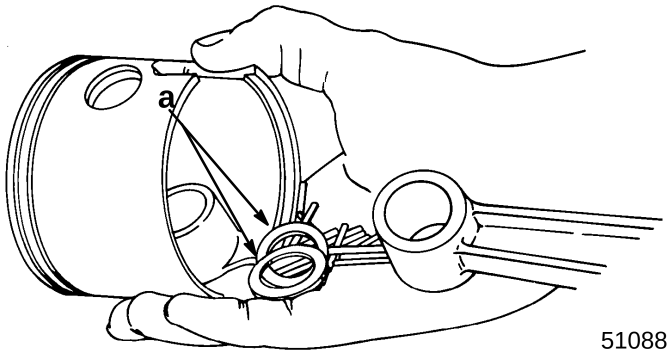


51086

a - Piston Pin
b - Wrist Pin Tool (91-74607A2)

21. Remove piston pin needle bearings (29 per piston pin) and locating washers (2 per piston) as shown.

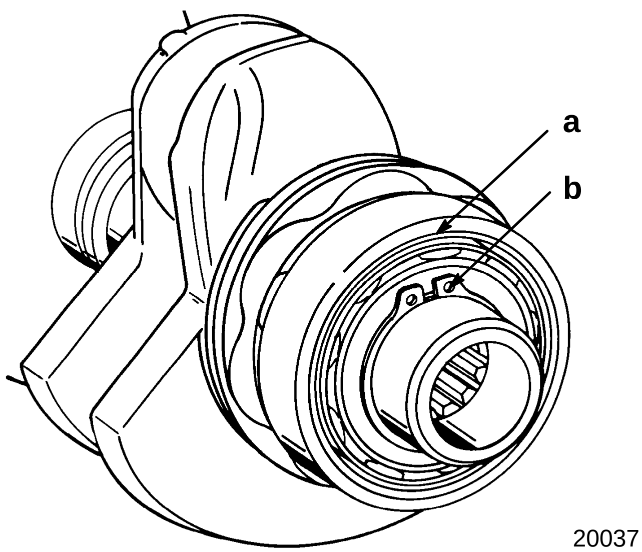
IMPORTANT: We recommend that you use new needle bearings at reassembly for lasting repair. However, if needle bearings must be re-used, keep each set of bearings identified for reassembly on same connecting rod.



a - Locating Washers

22. Inspect crankshaft bearing.

Only if removal is necessary, remove retaining ring , using a pair of snap-ring pliers.

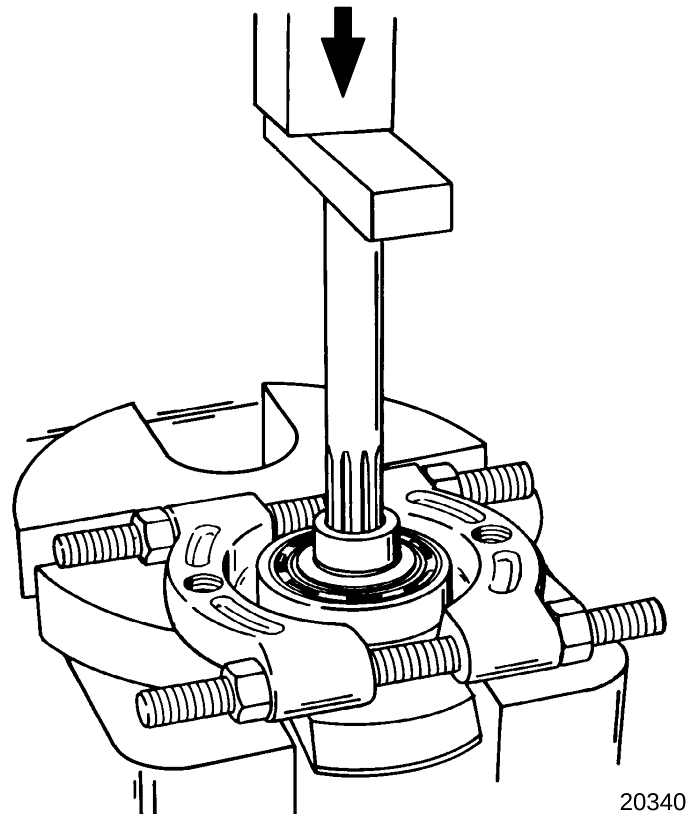


a - Crankshaft Bearing
b - Retaining Ring

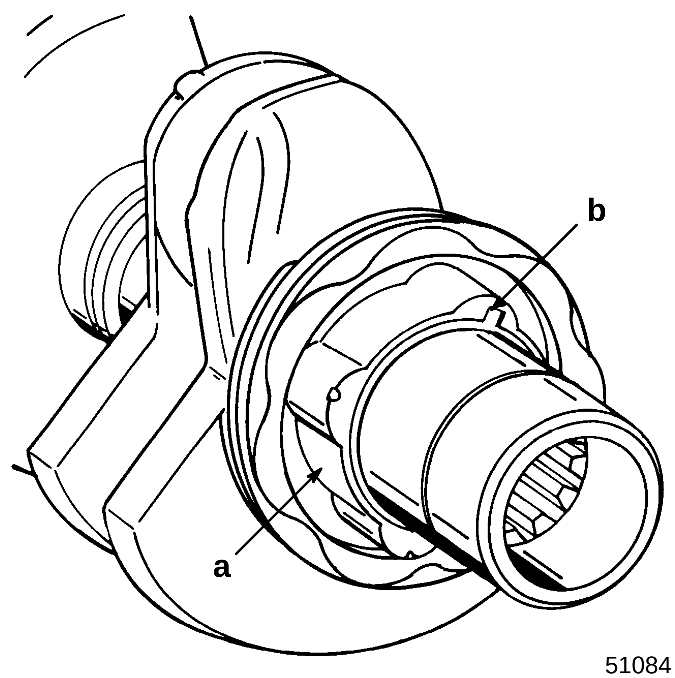
NOTE: There is NO main bearing retaining ring or retaining ring groove in the crankshaft on the following outboards:

75/90--SERIAL NUMBER OC259434 and above.

23. Press crankshaft out of bearing, as shown.



24. If oil pump drive gear replacement is necessary, remove gear after pressing off main bearing (slides-off shaft). Lower crankshaft seal carrier.

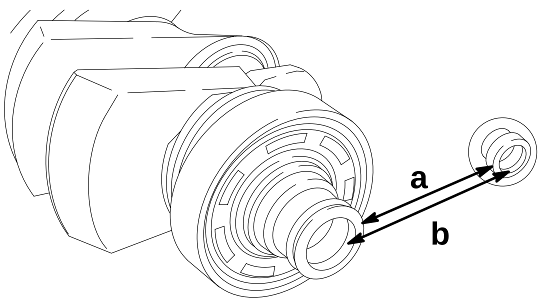


a - Oil Drive Gear
b - Key

Seal carrier is press-fitted into the spline end of crankshaft.

NOTE: Seal should be replaced as a routine procedure without regard to appearance, to prevent water leakage into crankshaft/driveshaft splines.

1. Remove seal by prying out of carrier, using an awl.
2. Inspect seal carrier for damage or looseness.
3. If replacement of carrier is necessary, use a pliers to pull carrier from crankshaft, or tap gently off with screwdriver and mallet.



20037

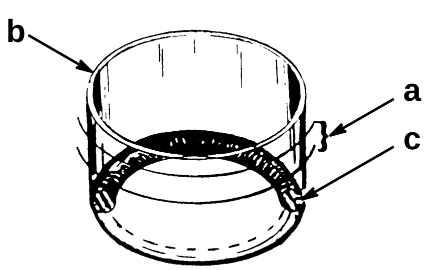
a - Seal Carrier
b - Seal

- OR -

Some models may be equipped with the following sleeve (b), which retains an O-ring seal (c). The sleeve is pushed over the crankshaft end until it bottoms-out on a crank flange, leaving space for the O-ring between the sleeve lip and the end of the crankshaft. Pop out the O-ring with an awl - replace the O-ring seal.

IMPORTANT: The End Cap (lower) inside seal rides on the “wear sleeve” (area “a”). If the outer surface of the sleeve (in area “a”) is grooved or corroded/pitted, replace by pulling off the sleeve with pliers--it may be necessary to heat the sleeve to release the Loctite® sealant. Replace O-ring AFTER wear-sleeve is installed on crankshaft.

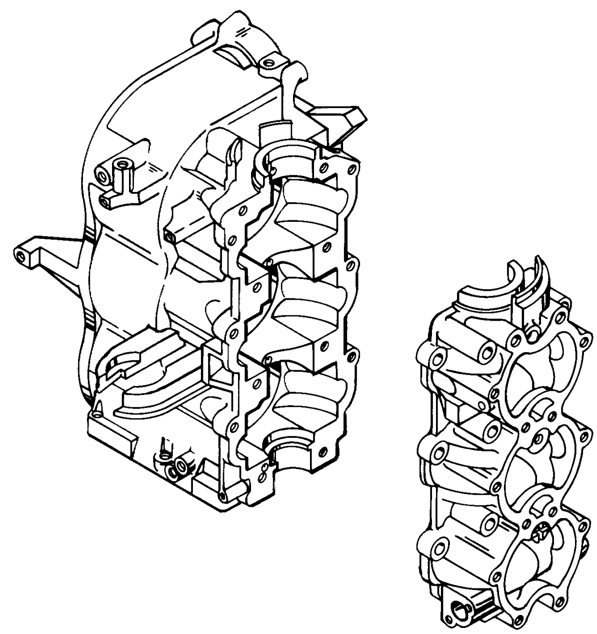
To install the sleeve, apply Loctite 271 to the crankshaft; align sleeve squarely with crankshaft, place a block of wood over end of sleeve, and tap lightly until it bottoms-out. Wipe off excess sealant. The sleeve is lightweight (31-gauge) stainless steel - DO NOT collapse the end contour or otherwise distort its shape. Align squarely - Tap gently!



Cleaning and Inspection

Cylinder Block and Crankcase Cover

IMPORTANT: Crankcase cover and cylinder block are a matched, line-bored assembly and never should be mismatched by using a different crankcase cover or cylinder block.



1. Inspect cylinder block and crankcase cover for cracks or fractures.
2. Check gasket surfaces for nicks, deep grooves, cracks and distortions that could cause compression leakages.
3. Check that all water passages in cylinder block are not obstructed. Check locating pins in cylinder block that they are tight.
4. Check crankcase cover fuel/bleed passages that they are not obstructed. Verify that check valves in crankcase cover are not damaged.
5. Thoroughly clean cylinder block and crankcase cover. Verify that all sealant and old gaskets are removed from matching surfaces. Clean all carbon deposits from exhaust ports.
6. Inspect spark plug holes for stripped or damaged threads.

CAUTION

If crankcase cover and cylinder block is to be submerged in a very strong cleaning solution, it will be necessary to remove the crankcase cover/cylinder block bleed system from cover/cylinder block to prevent damage to hoses and check valves.

CYLINDER BORE SIZE	
Piston Size	**Cylinder Block Finish Hone**
Standard Diameter	3.375 in. (85.725mm)
.015 Oversize	3.390 in. (86.106mm)
.030 Oversize	3.405 in. (86.487mm)

- Inspect cylinder bores for scoring (a transfer of aluminum from piston to cylinder wall). Cylinder wall scoring usually can be “cleaned up” by honing or reboring.

⚠ CAUTION

When reboring cylinder block, remove hone frequently and check condition of cylinder walls. DO NOT hone any more than absolutely necessary, as hone can remove cylinder wall material rapidly.

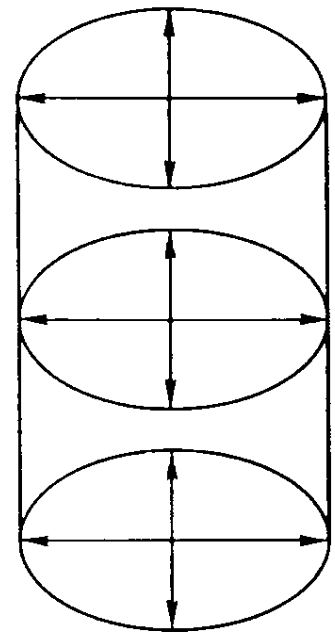
HONING PROCEDURE

Follow hone manufacturer’s recommendations for use of hone cleaning and lubrication during honing.

IMPORTANT: After honing, bores should be thoroughly cleaned with hot water and detergent. Scrub well with stiff bristle brush and rinse with hot water. If any abrasive material is allowed to remain in the cylinder bore, it will cause a rapid wear of new piston rings and cylinder bore. After cleaning, bores should be swabbed several times with 2 cycle engine oil and a clean cloth. Wipe excess oil with clean, dry cloth. Cylinders should not be cleaned with kerosene or gasoline. Clean remainder of cylinder block.

- Hone all cylinder walls just enough to de-glaze.

- Measure cylinder bore inside diameter (with an inside micrometer) of each cylinder, as shown below. Check for tapered, out-of-round (“egg-shaped”) and oversize bore.



- If a cylinder bore is tapered, out-of-round or worn more than **0.003 in. (0.076mm)** from standard “Cylinder Block Finish Hone” diameter (refer to chart), it will be necessary to rebore that cylinder(s) to designated oversize bore and install oversize piston(s) and piston rings during reassembly.

NOTE: The weight of an oversize piston is approximately the same as a standard size piston; therefore, it is not necessary to rebore all cylinders in a block just because one cylinder requires reboring.

IMPORTANT: Ports must be deburred after honing.

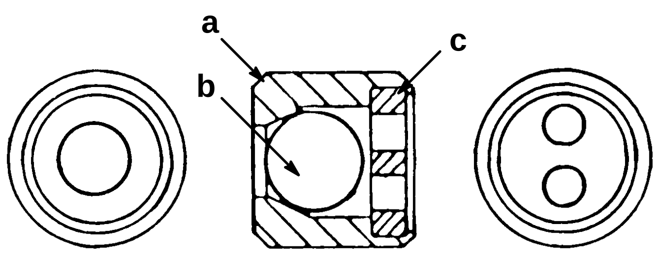
- After honing and thoroughly cleaning cylinder bores, apply 2 cycle outboard oil to cylinder walls to prevent rusting.

Check Valves

DESIGN I (MODELS WITH CHECK VALVE ONLY)

Located in crankcase cover under center main bearings.
These can be damaged by hot combustion blow-by into crankcase.

To Check: Look through hole - if you see light, the nylon ball is bad - probably melted; REPLACE valve. If you see no light, insert fine wire into check valve hole to see if there is slight movement of the nylon ball; if ball moves, valve is o.k. otherwise, replace check valve.



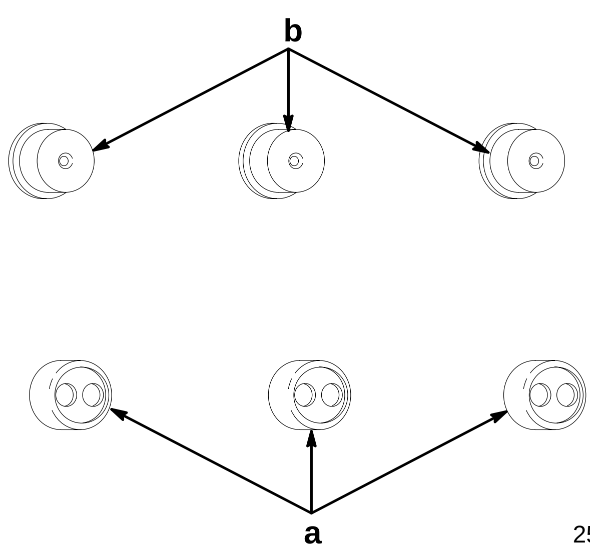
a - Check-Valve Body
b - Nylon Ball
c - Ball Retainer

IMPORTANT: If it is determined that the check valves must be replaced or that restrictors are not installed with the check valves, it is recommended that the Bleed Check Valve/Restrictor Kit (22-814204A1) be installed.

DESIGN 2 (MODELS WITH CHECK VALVE AND RESTRICTOR)

BLEED CHECK VALVE/RESTRICTOR KIT (22-814204A1)

COMPONENTS CONTAINED IN KIT:



25704

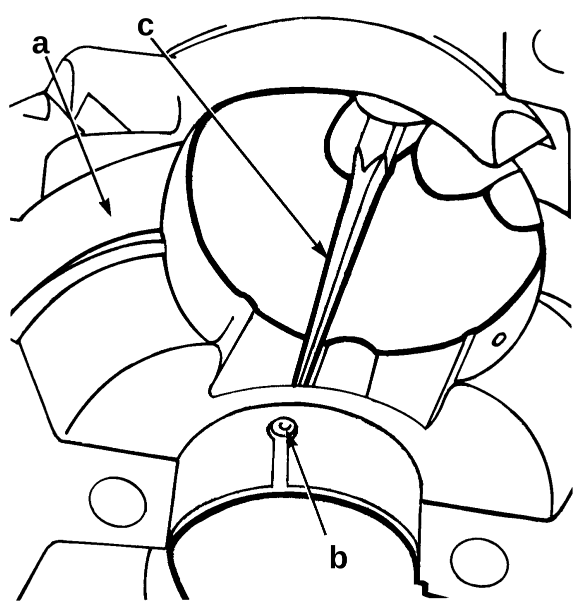
a - Bleed Check Valve (3 Each)
b - Restrictor (3 Each)

This kit is for use in three cylinder 71 cubic inch 70, 75, 80 and 90 horsepower models and four cylinder 105 cubic inch 100 and 115 horsepower models.

NOTE: Three cylinder and four cylinder outboards with starting serial number OC123214 and above have these kits installed from factory.

Installation Instructions:

1. Referring to appropriate service manual, remove powerhead from driveshaft housing.
2. Remove all assemblies as required to obtain access to crankcase cover.
3. Remove crankcase cover from cylinder block.
4. Using a 5/32″ (3.9mm) punch, carefully tap bleed check valves out of crankcase cover. (Tap check valve towards crankshaft side of crankcase cover.)

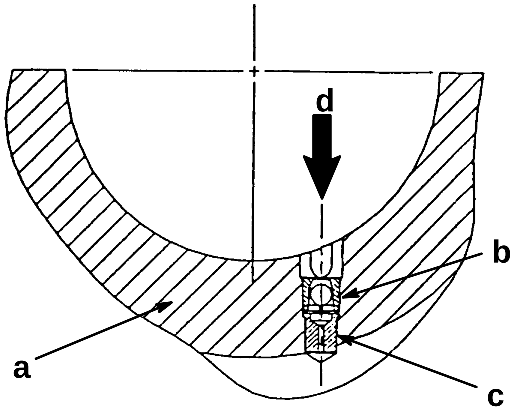


25703

a - Crankcase Cover
b - Bleed Check Valve
c - Punch (5/32”- 3.9mm)

NOTE: Three cylinder models will require TWO bleed check valves and TWO restrictors. Four cylinder models will require THREE bleed check valves and THREE restrictors.

5. With FUNNEL SHAPE side of restrictor facing crankshaft side of crankcase cover, carefully tap restrictor into crankcase cover until seated.
6. With ONE HOLE side of bleed check valve facing crankshaft, carefully tap check valve into crankcase cover until seated against restrictor. BE CAREFUL NOT TO OVERSEAT CHECK VALVE as check valve case may distort and valve will not function properly.



a - Crankcase Cover
b - Check Valve Assembly P/N 21-42657A1
c - Valve Restrictor P/N 22-814204
d - Install From Crankshaft Side

Check Valve/Restrictor Assembly

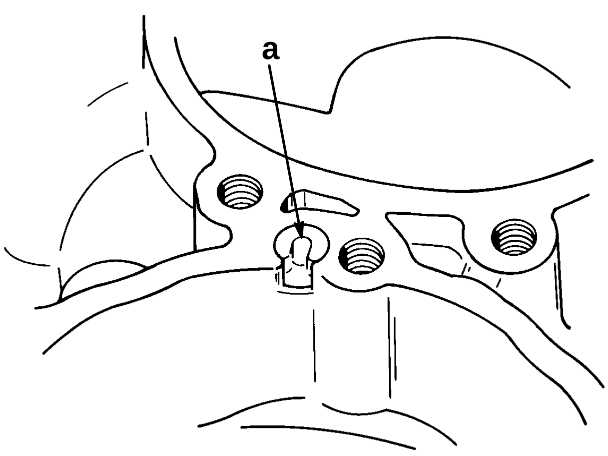
7. Verify check balls are free to move in check valve case after installation. If check balls are not loose, check valve case was damaged during installation and MUST BE replaced.
8. Reassemble powerhead per appropriate service manual instructions and reinstall on driveshaft housing.

DESIGN 3 (MODELS WITH CHECK VALVE AND CARRIER)

NOTE: DESIGN 3 check valves may be replaced without splitting crankcase halves.

REMOVAL

1. Remove carburetors and intake manifold/reed block assemblies. Refer to page 4A-10/11 for procedure.
2. Grasp carrier and remove carrier/check valve assembly from crankcase cover.

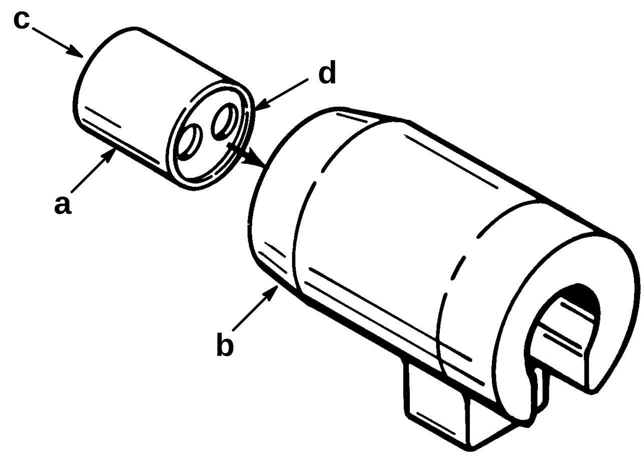


51621

a - Carrier/Check Valve Assembly

3. Push check valve out of carrier. If nylon ball within check valve is stuck or carrier is charred, replace check valve and/or carrier as required.

IMPORTANT: SINGLE HOLE side of check valve MUST FACE CRANKCASE.

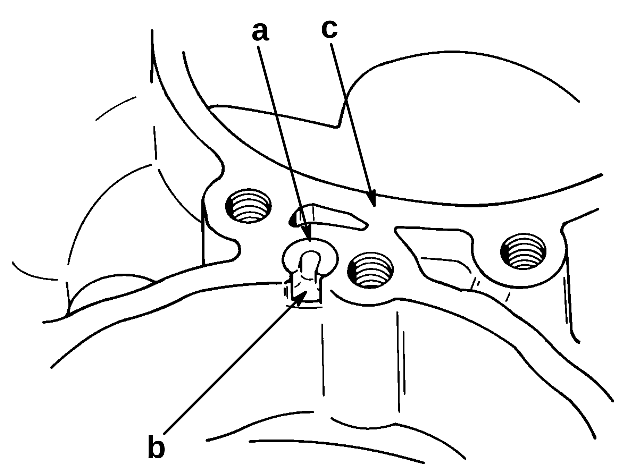


51131

a - Check Valve
b - Carrier
c - Single Hole
d - Double Hole

INSTALLATION

1. Install check valve (if removed) inside of carrier (single hole of valve faces tapered end of carrier).
2. Align carrier tab with slot in crankcase cover and insert check valve/carrier assembly into cover.



51621

a - Check Valve/Carrier Assembly
b - Slot
c - Crankcase Cover

3. Clean mating surfaces of crankcase cover and intake manifold. Install new gaskets.
4. Install intake manifold/reed block assemblies to crankcase cover. Refer to PAGE 4A-6 for torque specification and tightening sequence.
5. Install carburetors. Torque carburetor (AIR BOX) stud nuts to 100 lb. in. (11.3 N·m).
6. Carburetors MUST BE SYNCHRONIZED. Refer to SECTION 2C for proper procedures.
7. Reinstall air box cover.
8. Reinstall top cowling.

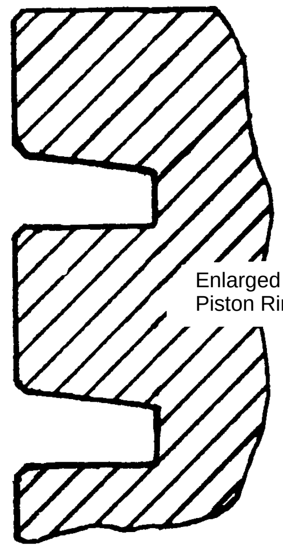
Piston and Piston Rings

IMPORTANT: If engine was submerged while engine was running, piston pin and connecting rod may be bent. If piston pin is bent, piston must be replaced. Piston pins are not sold separately because of matched fit into piston. If piston pin is bent, connecting rod must be checked for straightness (refer to "Connecting Rods" for checking straightness).

- Inspect piston for scoring and excessive piston skirt wear.
- Check tightness of piston ring locating pins. Locating pins must be tight.
- Thoroughly clean pistons. Carefully remove carbon deposits, with a soft wire brush or carbon remover solution. DO NOT burr or round off machined edges.
- Inspect piston grooves for wear and carbon accumulation. If necessary, scrape carbon from piston ring grooves being careful not to scratch sides of grooves. Refer to procedure for cleaning piston ring grooves.

CLEANING PISTON RING GROOVES

IMPORTANT: The piston rings are half-keystone rings – (tapered on the top side) - follow cleaning and inspection carefully! Chromed ring is installed on top.



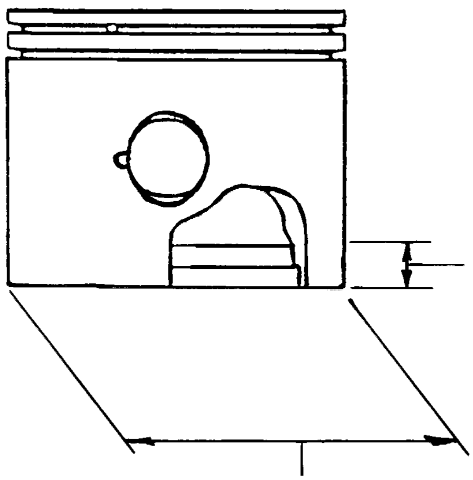
⚠ CAUTION

Care must be taken not to scratch the side surfaces of ring groove. Scratching the side surfaces of the ring groove will cause damage to the ring groove.

- Use a bristle brush and carbon remover solution to remove carbon from side surfaces.
- A tool can be made for cleaning the inner diameter of the tapered ring grooves. The tool can be made from a broken tapered piston ring with the side taper removed to enable inside edge of the ring to reach the inside diameter of the groove. Carefully scrape the carbon from inner diameter of ring grooves. Care must be taken not to damage the grooves by scratching the surfaces of the grooves.

MEASURING PISTON SKIRT

Measure piston skirt at right angle (90°) to piston pin centerline, 0.50 in. (12.7mm) up from bottom edge of skirt.



PISTON SIZE	PISTON SKIRT DIAMETER	CYLINDER BORE FINISH HONE
Standard Piston	3.371 in. (85.623mm)	3.375 in. (85.725mm)
0.015 in. (0.381mm) Oversize	3.386 in. (86.004mm)	3.390 in. (86.106mm)
0.030 in. (0.752mm) Oversize	3.401 in. (86.385mm)	3.405 in. (86.487mm)

Crankshaft

- Inspect crankshaft to drive shaft splines for wear. (Replace crankshaft, if necessary.)
- Check crankshaft for straightness. Total maximum runout for crankshaft is 0.006 (0.152mm). Replace as necessary.
- Inspect crankshaft oil seal surfaces. Sealing surfaces must not be grooved, pitted or scratched. (Replace as necessary.)
- Check all crankshaft bearing surfaces for rust, water marks, chatter marks, uneven wear and/or overheating. (Refer to “Connecting Rods.”)
- If necessary, clean crankshaft surfaces with crocus cloth as shown.

51089

- Thoroughly clean (with solvent) and dry crankshaft and crankshaft ball bearings. Recheck surfaces of crankshaft. Replace crankshaft if surfaces cannot be properly “cleaned up”. If crankshaft will be reused, lubricate surfaces of crankshaft with light oil to prevent rust. DO NOT lubricate crankshaft ball bearings at this time.

WARNING

DO NOT spin-dry crankshaft ball bearing with compressed air.

Connecting Rods

If necessary, clean connecting rod surfaces as follows:

- Attach end caps to connecting rods. Following these directions, tighten rod cap attaching bolts to specifications. Recheck alignment. Refer to 4A-32.

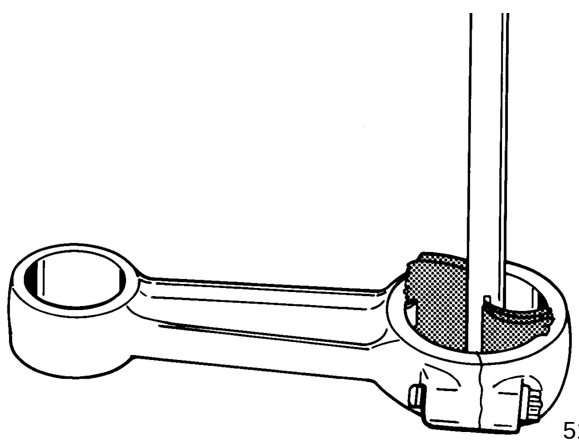
⚠ CAUTION

Crocus cloth MUST BE USED to clean bearing surface at crankshaft end of connecting rod. DO NOT use any other type of abrasive cloth.

- Clean crankshaft end of connecting rod by using crocus cloth placed in a slotted 3/8 in. (9.5mm) diameter shaft, as shown. Insert shaft in a drill press and operate press at full speed while keeping connecting rod at a 90° angle to slotted shaft.

IMPORTANT: Clean connecting rod just enough to clean bearing surfaces. DO NOT continue to clean after marks are removed from bearing surfaces.

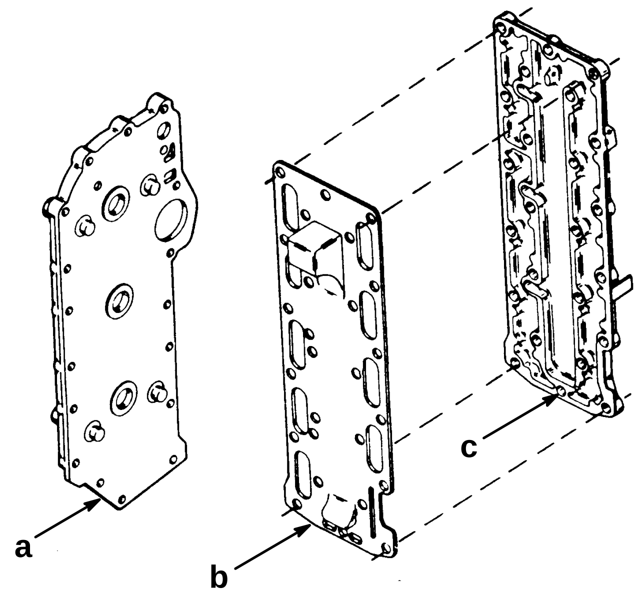
- Clean piston pin end of connecting rod, using same method as above. Use 320 grit carborundum cloth instead of crocus cloth.
- Thoroughly wash connecting rods to remove abrasive grit. Recheck bearing surfaces of connecting rods. Replace any connecting rod that cannot be properly polished. Lubricate bearing surfaces of connecting rods which will be reused with 2 cycle engine oil to prevent rust.



51083

Cylinder Cover, Exhaust Divider Plate and Exhaust Cover

- Thoroughly clean cylinder cover and gasket surfaces.
- Inspect cylinder cover. Check for cracks which could cause water leakage.
- Replace cylinder cover as necessary.
- Thoroughly clean gasket surfaces of exhaust divider plate and exhaust manifold cover.
- Inspect exhaust divider plate and exhaust manifold cover for grooves, cracks or distortion that could cause leakage. Replace parts as necessary.

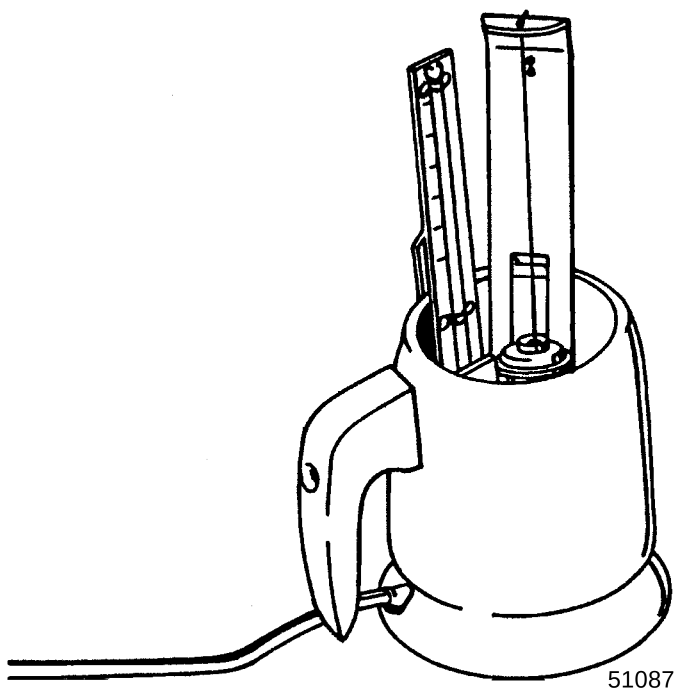


a - Cylinder Cover
b - Divider Plate
c - Exhaust Cover

Thermostat

Wash thermostat with clean water. Using a thermostat tester, similar to the one shown, test thermostat as follows:

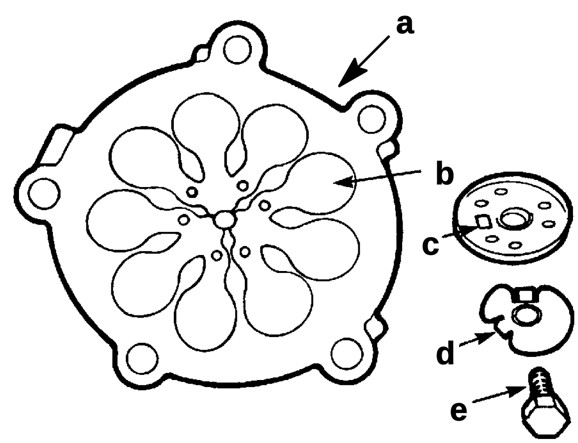
- Open thermostat valve, then insert a thread between valve and thermostat body. Allow valve to close against thread.
- Suspend thermostat (from thread) and thermometer inside tester so that neither touches the container. Bottom of thermometer must be even with bottom of thermostat to obtain correct thermostat opening.
- Fill thermostat tester with water to cover thermostat.
- Plug tester into electrical outlet.
- Observe temperature at which thermostat begins to open. Thermostat will drop off thread when it starts to open. Thermostat must begin to open when temperature reaches 5° F (3° C) above designated stamping on bottom of thermostat.
- Continue to heat water until thermostat is completely open.
- Unplug tester unit.
- Replace thermostat, if it fails to open at the specified temperature, or if it does not fully open.



51087

Reed Blocks

NOTE: Do not disassemble reed block unless necessary. It may be necessary to apply heat to bolt (e) to soften Loctite® before removal.

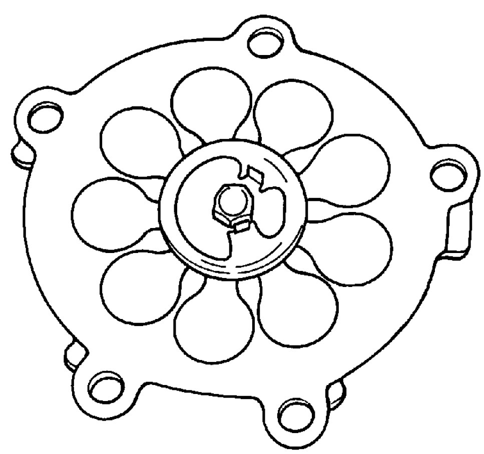


19331

a - Reed Block
b - Reed (3 Sets)
c - Retaining Washer
d - Tab Washer
e - Bolt

IMPORTANT: Do not “flop” (reverse) the reed for additional use - replace reed when necessary.

BACKSIDE - REED BLOCK ASSEMBLED

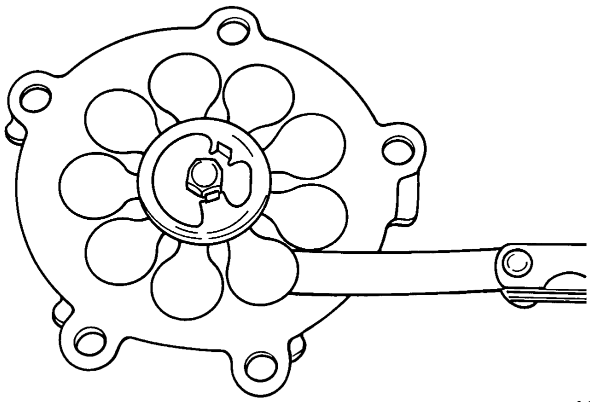


19332

There are 3 reed segments. Reed should lie flat. There should be no preload (pressure between reed and reed-block), but a slight preload is tolerable.

The maximum allowable opening between reed and reed-block is 0.020 (in.). This must be checked with a flat blade feeler gauge, as shown.

If the opening exceeds 0.020 (in.), or if the reed is chipped, cracked, or otherwise damaged, replace.

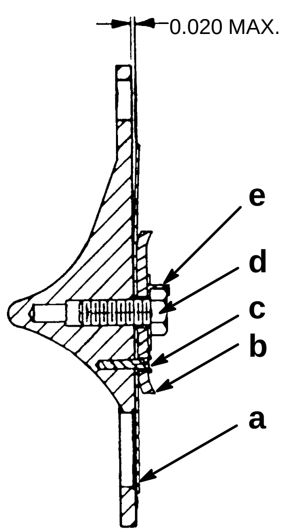


19337

⚠ CAUTION

Replace Locking Tab-Washer. DO NOT REUSE.

If reed block was disassembled, reassemble by locating reeds on pins with retaining washer . Use new tab washer. Insert bolt, and torque to 80 lb. in. (9.0 N·m); then, if necessary, continue the torque to align flat on hex-head to locking tab - Do not exceed 100 lb. in. (11.3 N·m) torque. Bend up tab to secure bolt position.



a - Reeds
b - Retaining Washer
c - Pins
d - Bolt
e - Locking Tab

Powerhead Reassembly and Installation

General Information

Before proceeding with powerhead reassembly, be sure that all parts to be reused have been carefully cleaned and thoroughly inspected, as outlined in “Cleaning and Inspection”. Parts, which have not been properly cleaned (or which are questionable), can severely damage an otherwise perfectly good powerhead within a few minutes of operation. All new powerhead gaskets must be installed during assembly.

During reassembly, lubricate parts with Quicksilver 2-Cycle Outboard Oil whenever 2-cycle oil is specified and Quicksilver 2-4-C W/Teflon whenever grease is specified.

A torque wrench is essential for correct reassembly of powerhead. Do not attempt to reassemble powerhead without using a torque wrench.

EXAMPLE: If Exhaust Cover bolts require a torque of 220 lb. in. (24.9 N·m), (a) tighten all bolts to 73 lb. in. (8.2 N·m), following specified torque sequence, (b) tighten all bolts to 146 lb. in. (16.6 N·m), following torque sequence, then finally, (c) tighten all bolts to 220 lb. in. (24.9 N·m), following torque sequence.

End Cap

Clean thoroughly, including seal and O-ring seats; remove perfect seal residue and clean cap-to-head mating surfaces.

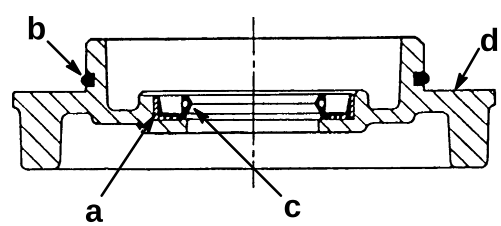
Apply a thin bead of Loctite 271 to outer face on end cap oil seal. Wipe off excess Loctite after installing.

Using suitable mandrel, press oil seal into cap until fully seated. Remove any excess Loctite.

NOTE: Lip of seal goes in.

Lubricate oil seal lip with 2-4-C w/Teflon.

Lubricate O-ring seal with 2-4-C w/Teflon; install in groove.



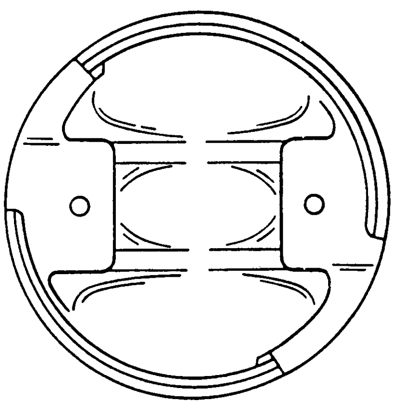
a - Outer Face
b - O–Ring
c - Seal Lip
d - Mating Surface

IMPORTANT: There are two types of piston/rod assemblies available for the 3 cylinder powerheads:

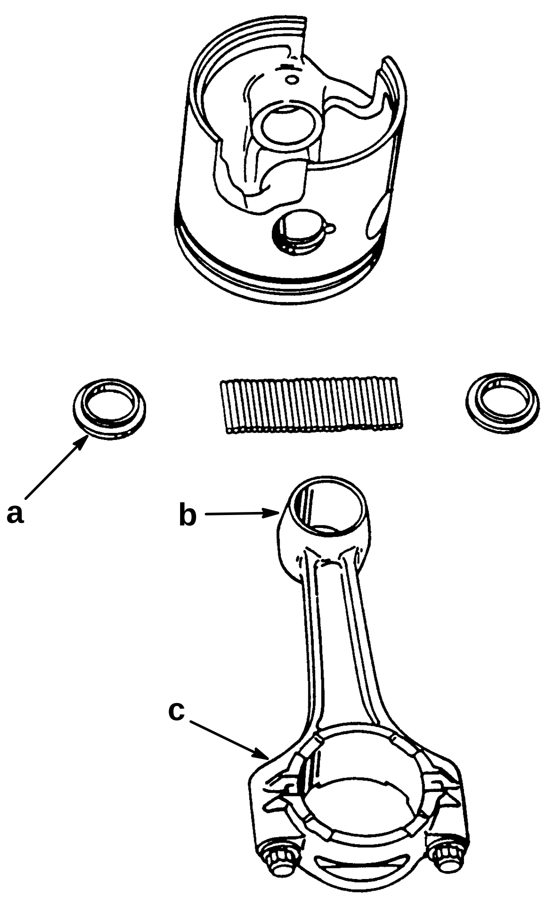
Design 1 – Bottom guided (centered in bore by crankshaft)

Design 2 – Top guided (centered in bore by piston)

DESIGN 1 - BOTTOM GUIDED



Bottom View of Piston



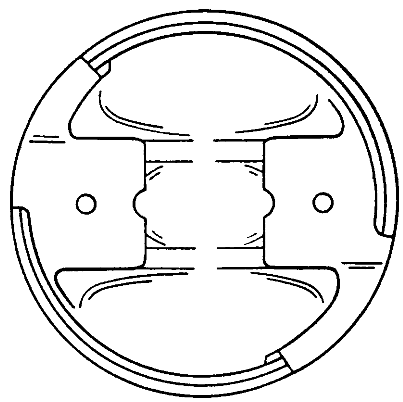
51536

a - Ridged Washer
b - Smooth
c - Scalloped

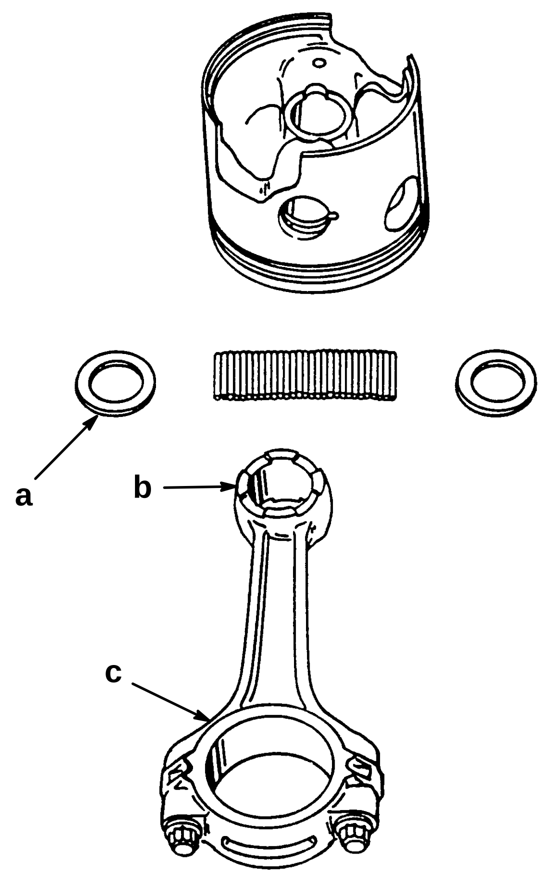
Top guided piston and rod assembly can be installed in a powerhead with bottom guided piston and rod assemblies.

However, individual components cannot be intermixed – I.E. – Top guided piston cannot be used with a bottom guided rod.

DESIGN 2 - TOP GUIDED



Bottom View of Piston



51536

a - Flat Washer
b - Scalloped
c - Smooth

CAUTION

Any GREASE used for bearings INSIDE the Powerhead MUST BE gasoline soluble. Use only Quicksilver Needle Bearing Assembly Lubricant (92-42649A-1) or 2-4-C w/Teflon (92-825407A12). If other lubricants are used inside the Powerhead, damage to engine may occur.

Assembling Rod to Piston

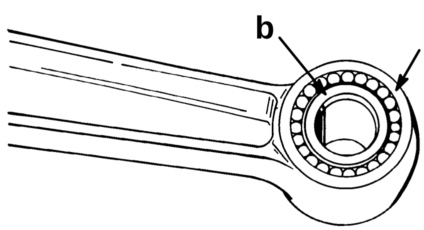
Place clean needle bearings on a clean sheet of paper and lubricate with Quicksilver Needle Bearing Lubricant (92-42649A1) or 2-4-C w/Teflon (92-825407A12).

NOTE: There are 29 needle bearings per piston.

CAUTION

Never intermix new needle bearings with used needle bearings at the same connecting rod end. Never intermix needle bearings on one connecting rod with those of another connecting rod. Should one (or more) piston pin needle bearing of a connecting rod require replacement (or should one or more be lost), replace all of that connecting rod's piston pin needle bearings.

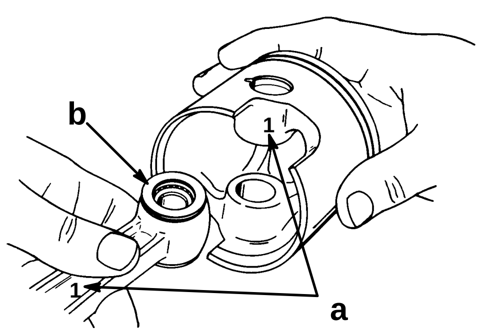
Place sleeve, which is part of Piston Pin Tool (91-74607A1), into connecting rod and install needle bearing around sleeve, as shown.



19537

a - Needle Bearings (29)
b - Sleeve [From Piston Pin Tool (91-74607A2)]

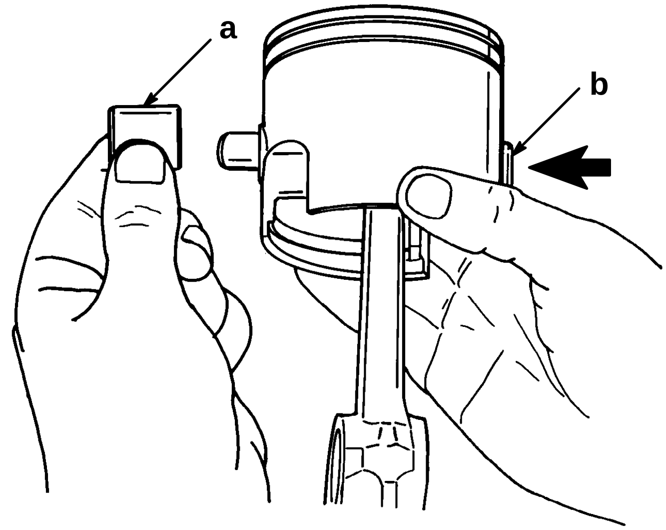
Place locating washers on connecting rod; keeping locating washers in place, carefully place piston over end of rod. Use disassembly marks for matching rod to piston and direction of insertion (which side of rod is "UP").



51083

a - Scribed Identification Number
b - Locating Washer

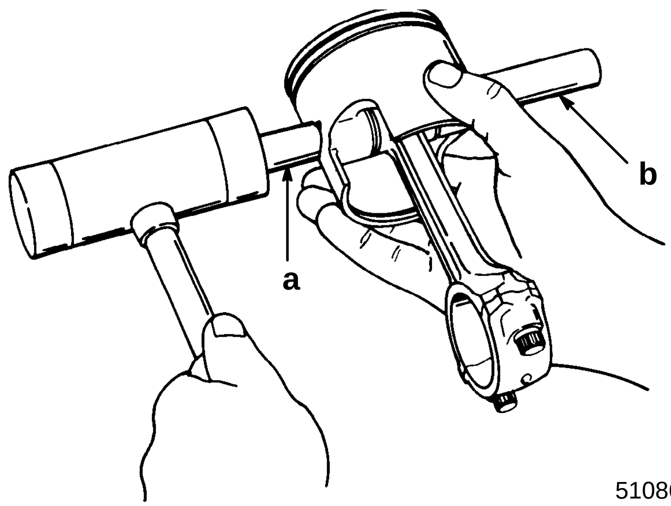
Insert piston pin tool through piston in the direction shown, pushing out sleeve.



51080

a - Sleeve
b - Piston Pin Tool (91-74607A2)

Place piston pin over end of tool, and tap into position (driving tool out other side).



51086

a - Piston Pin
b - Piston Pin Tool

WARNING

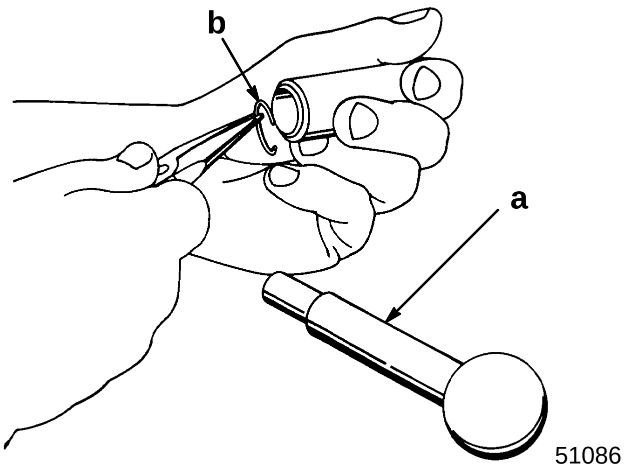
Eye protection must be worn while installing piston pin lockrings.

Install new piston pin lockrings (each side of piston) using Lockring Tool (91-77109A1).

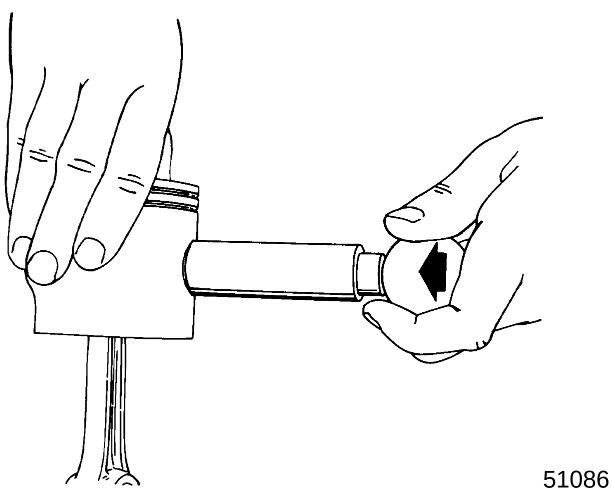
Make sure lockrings are properly seated in piston grooves.

⚠ CAUTION

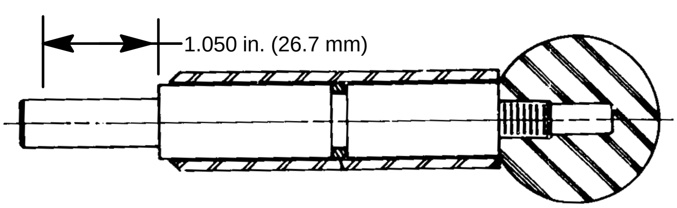
Do not reuse piston pin lockrings. Use only new lockrings and make sure they are properly seated in piston grooves.



a - Lockring Installation Tool (91-77109A1)
b - Lockring (2)

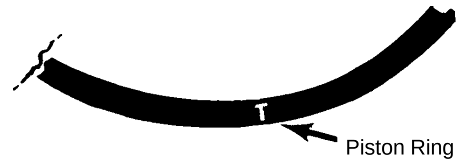


NOTE: Shaft of Lockring Installation Tool 91-77109A1 must be modified (shortened) to 1.050 in. (26.7 mm).

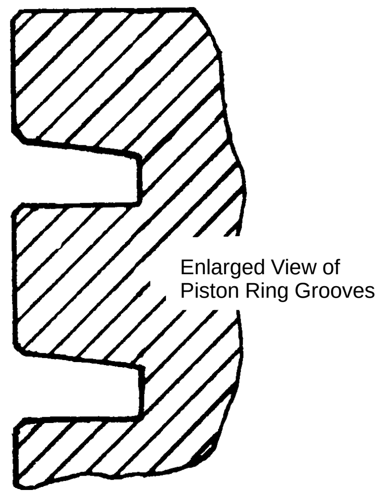


Piston Ring Installation

IMPORTANT: Piston ring side with letter or mark must be facing up.



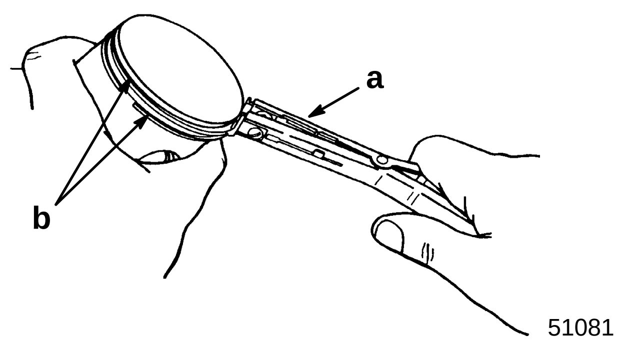
Piston rings are TAPERED top side, and flat (rectangular) on the bottom side (half-keystone rings).



⚠ CAUTION

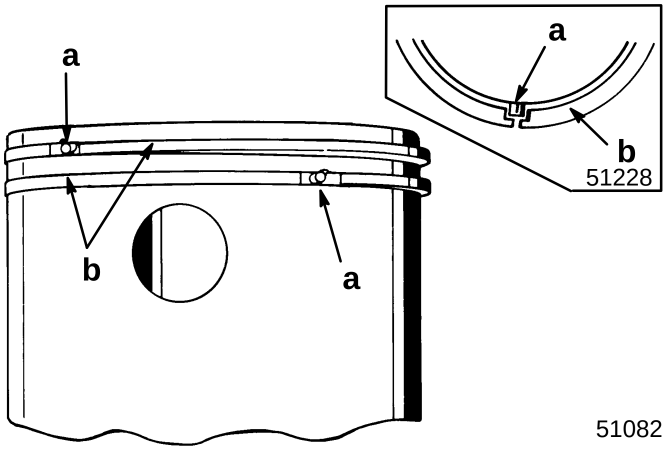
Care must be taken not to scratch the side surfaces of ring groove. Scratching this area will damage the ring groove.

1. Install piston ring in appropriate groove on piston using Piston Ring Expander Tool. Spread rings just enough to slip over piston.
2. Check piston rings to be sure they fit freely in groove. Lubricate rings and cylinder wall with 2-cycle oil.



a - Piston Ring Expander
b - Piston Rings

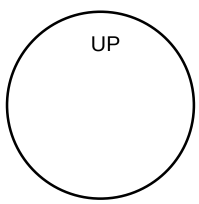
3. Align piston ring end gaps with ring locating pins as shown. Check locating pins making sure they are tight.



51082

a - Locating Pin
b - Piston Rings

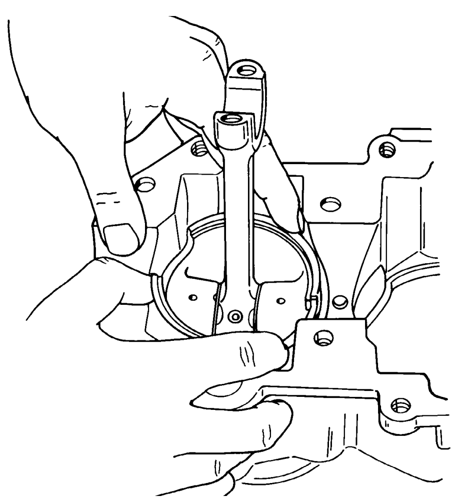
4. Remove connecting rod cap from connecting rod being installed.
5. Install each piston with “UP” identification facing flywheel end. Pistons MUST be installed in this direction.



⚠ CAUTION

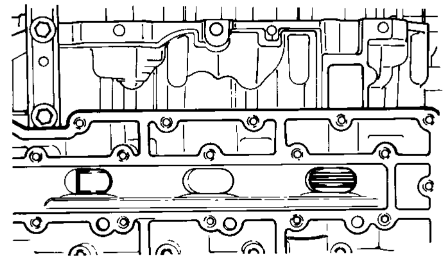
Pistons must be installed very carefully into cylinders. Piston rings can not be inspected thru exhaust ports.

6. Bottom end of cylinder bore has taper which permits the insertion of the piston into block without using a piston ring compressor. Place piston carefully into cylinder.



51087

Check rings by viewing through exhaust ports while depressing rings with a screwdriver. If no spring tension is there (ring fails to “spring” back), the ring is probably broken and must be replaced, NOW, before installing the crankshaft.



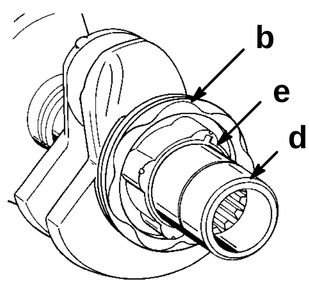
20338

Crankshaft Installation

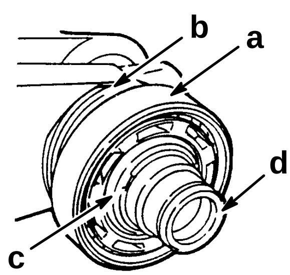
- If Lower Bearing and Gear were removed from crankshaft, reassemble using arbor press and suitable mandrel for bearing; gear slides on. (NOTE keyway and key in gear to crankshaft assembly.)
- Install main bearing retaining ring after pressing main bearing tight against the oil gear.

NOTE: There is NO main bearing retaining ring or retaining ring groove in the crankshaft on the following outboards:

75/90–SERIAL NUMBER OC 259434 and above.



51084

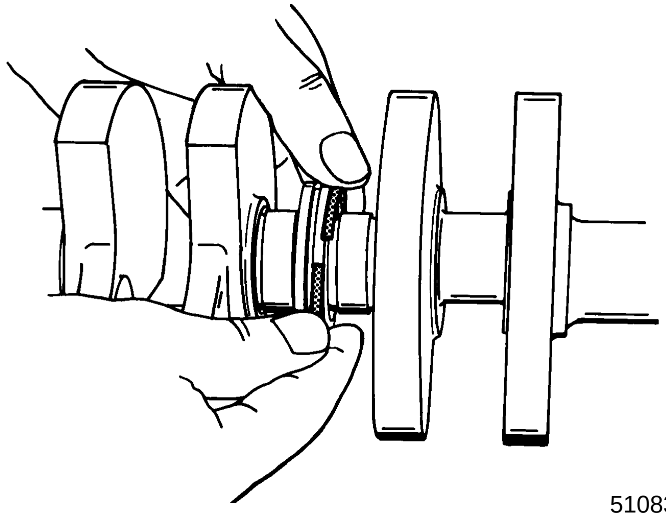


25949

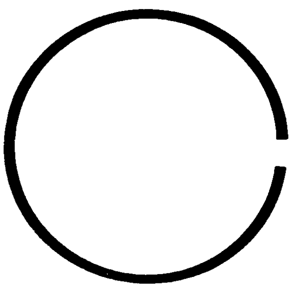
a - Lower Bearing
b - Gear
c - Retaining Ring
d - Seal Carrier
e - Key

- If Seal Carrier above was removed, replace by placing a piece of wood on carrier and tapping gently with a mallet, keeping carrier “square” during insertion, seal fully to crankshaft. See page 4A-17 -- (Powerhead Disassembly, this Section), for wear-sleeve reinstallation, if so equipped.

- Install 2 ring seals into slot between each center main bearing and position ring seal end gaps 180° apart.



51083

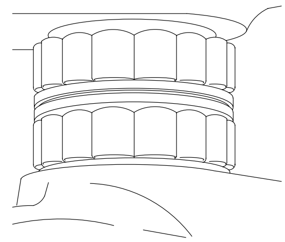


RING SEAL
2 Each Center
Main

⚠ CAUTION

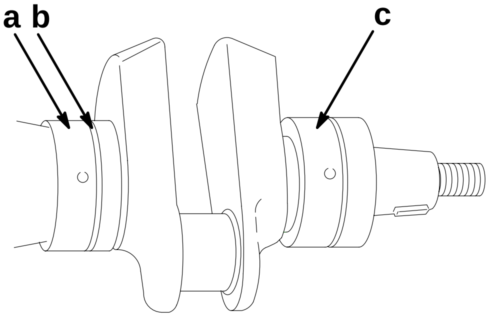
Any GREASE used for bearings INSIDE the Powerhead MUST BE gasoline soluble. Use only Quicksilver Needle Bearing Assembly Lubricant (92-42649A-1) or 2-4-C w/Teflon (92-825407A12). If other lubricants are used inside the Powerhead, damage to engine may occur.

Grease crankshaft journal with Needle Bearing Assembly Lubricant, to hold bearings in place. Position bearings on journal, 32 each center main bearing.



20046

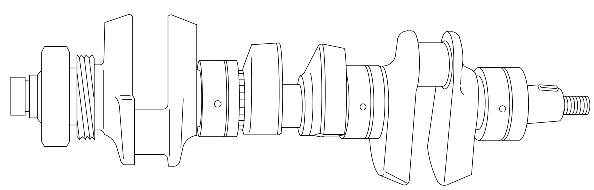
Attach bearing races with holes toward lower gear end of crankshaft. Secure each main bearing race with retaining ring.



20040

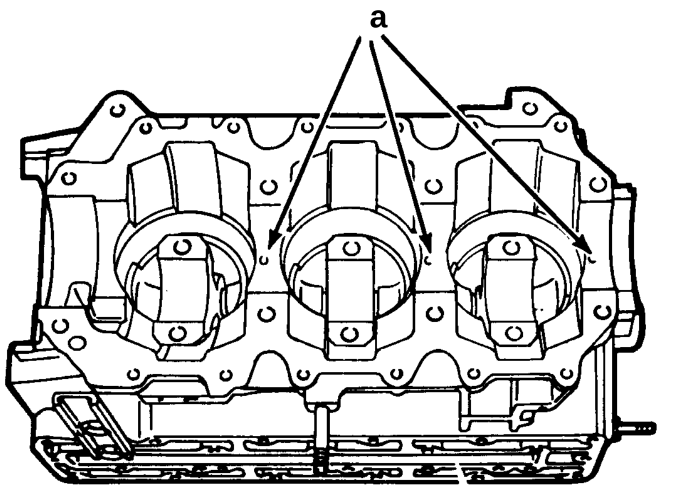
a - Main Bearing Race
b - Retaining Ring
c - Top Main Bearing

To install top main bearing, lubricate needle bearing with light oil, and slide bearing assembly, (holes toward lower end), onto shaft.



20040

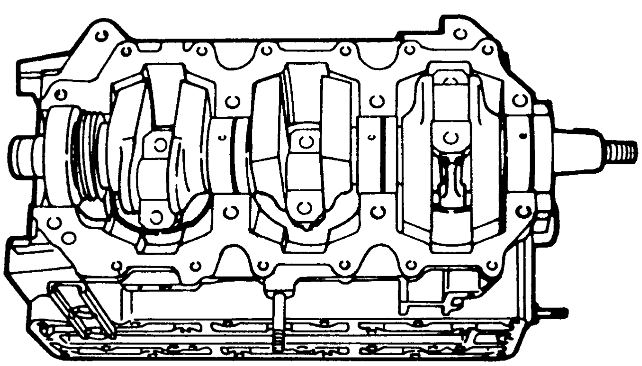
Position Cylinder Block and Piston Rods, as shown. Note locating pins.



20038

a - Locating Pins

Place crankshaft into cylinder block; align and seat top and center main bearings so that locating pins on block mate with holes in each bearing race.



20336

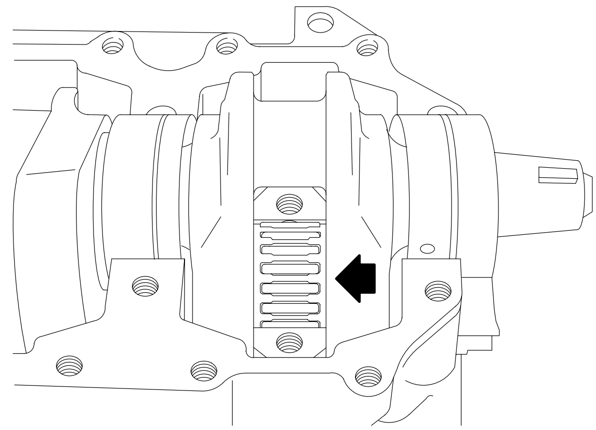
INSTALLING RODS TO CRANKSHAFT

Pull rod up to position shown.

Grease rod, bearing area, with Needle Bearing Assembly Lubricant or 2-4-C w/Teflon - lay roller bearings out on clean sheet of paper and grease each bearing.

Place Bearing Cage in position.

Place Bearings in cage.



20045

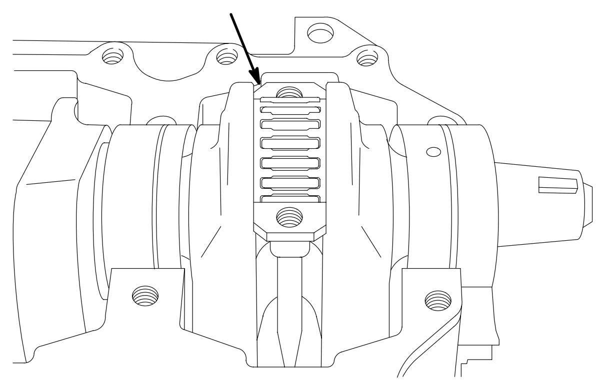
Grease crankshaft journal with Needle Bearing Assembly Lubricant or 2-4-C w/Teflon.

Pull-up rod into contact with crankshaft journal.

Place Bearing Cage on crankcase journal.

Place Bearings into cage.

Align bearing cages with rod-to-cap mating surfaces.

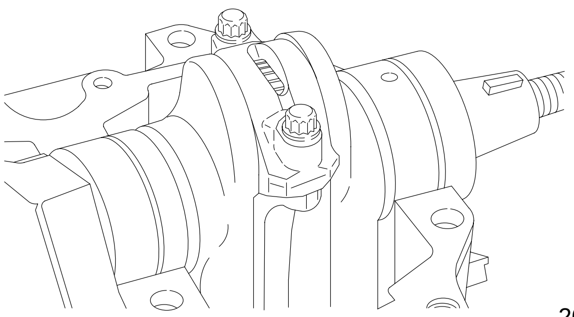


20030

NOTE: Make sure that Rod Bolt Hole threads and Rod Cap Bolt Hole threads are clean and oil free before reassembly.

- Place Rod Cap carefully over cage and bearings, and while holding cap tight to rod, and rod tight to journal, insert bolt and lightly tighten, observing cap-to-rod alignment. Install other bolt, rechecking alignment.

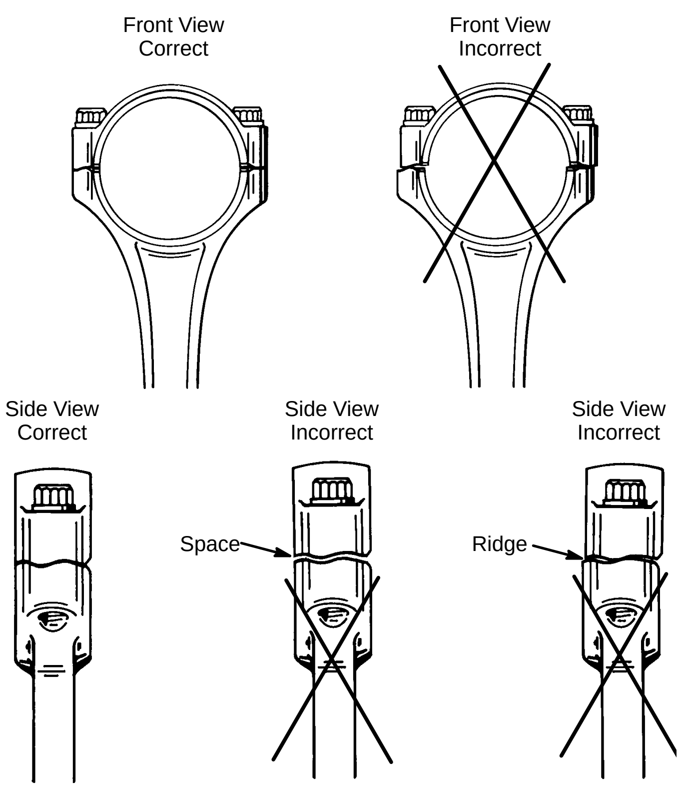
IMPORTANT: On some engines, BOTH the piston rod and rod cap bolt holes are threaded. The rod cap and rod must be aligned and held tight together when threading in bolt. Check that mating surfaces are tight together after bolt enters the threads in the piston rod.



20033

Connecting Rod Cap Alignment

1. Check each connecting rod for correct alignment by carefully running fingernails up and down edge of rod cap. If not aligned, a ridge can be seen or felt at the separating line. Correct any misalignment.

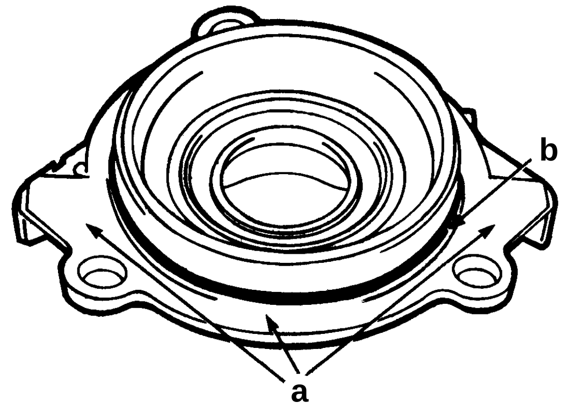


51224

2. When connecting rods are attached, and bolts drawn down finger tight, torque rod-cap bolts to 15 lb. in. (1.7 N·m). Recheck alignment. **Retorque 1/4 in. bolts to 15 lb. ft. (20.3 N·m) or 5/16 in. bolts to 30 lb. ft. (40.7 N·m).** Recheck alignment. Turn each rod-cap bolt 90° further after 30 lb. ft. reading is acquired.

- Replace lower crankshaft End Cap.

1. Coat mating surface with Perfect Seal. DO NOT coat O-ring seal.
2. Bolt to block (2 bolts) - finger tighten - lightly.



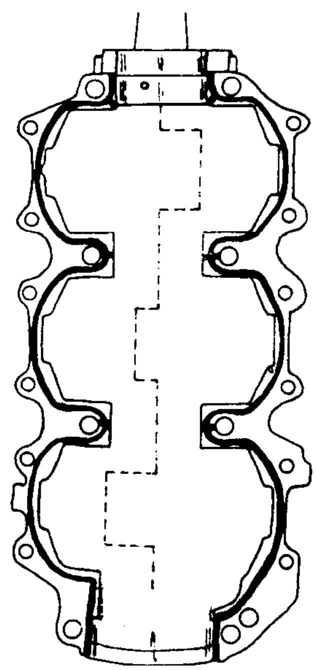
19336

a - Mating Surface
b - O-ring Seal

Crankcase Cover to Block

LOCTITE MASTER GASKET SEALANT,. 92-12564-1 is used; it comes as a kit, which includes Primer and Sealant. Instructions contained in the kit MUST BE FOLLOWED EXACTLY. (Clean both surfaces).

IMPORTANT: Extend sealer to edge on each center main journal to prevent blow-by between cylinders.

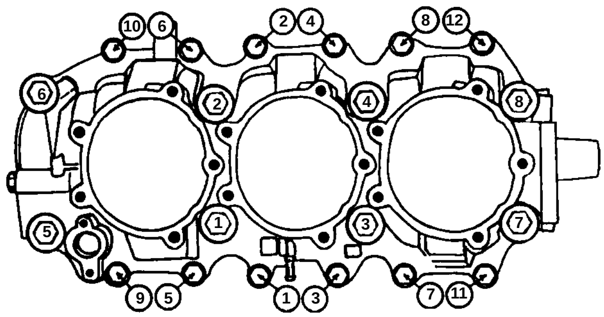


Sealant “Bead Pattern” indicated by bold line.

REATTACH CRANKCASE COVER

- After the application of the Loctite Master Gasket Sealing Kit, place crankcase cover onto block, and align.
- Recheck that bolt holes and bolts are clean to assure accurate torque.
- Insert bolts - note 2 sizes and finger tighten.
- Loctite End Cap Bolt and install in remaining (End Cap to Cover) hole.
- Torque Crankcase Cover Bolts.

IMPORTANT: This is a Double Torque Pattern.



Torque large bolt sequence first.

1st Torque Pattern (#1-8) on Large Bolts - 25 lb. ft. (33.9 N·m)

2nd Torque Pattern (#1-12) on Small Bolts - 18 lb. ft. (24.4 N·m)

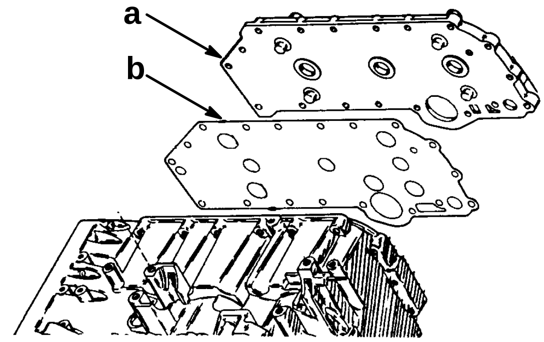
- Torque all (lower) end cap bolts (3 bolts) to 18 lb. ft. (24.4 N·m)
- Reattach bleed line hose

NOTE: Inspect ALL hoses on reinstallation; replace when necessary.

Note on Major Cover Gaskets: These are new gaskets impregnated with a coating that causes the gasket to retain torque. It is not necessary to use sealant on gasket, or Loctite on bolts.

Cylinder Block Cover

- Align cover and gasket on block.

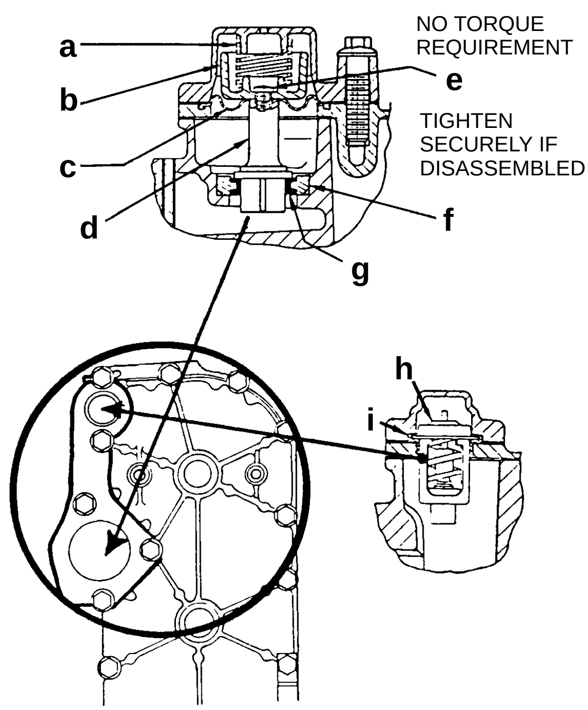


a - Cover
b - Gasket

- Install thermostat cover and components, as follows:

1. Insert poppet valve (d) into valve seat (f).
2. Install cover gasket over poppet.
3. Insert thermostat (h) into well.
4. Align cover, with poppet spring (a) seated as shown.
5. Depress cover, and insert bolts - finger tighten.

Note seating of thermostat gasket (h) and poppet gasket diaphragm (c). These, and gasket “g” are replaceable when necessary.

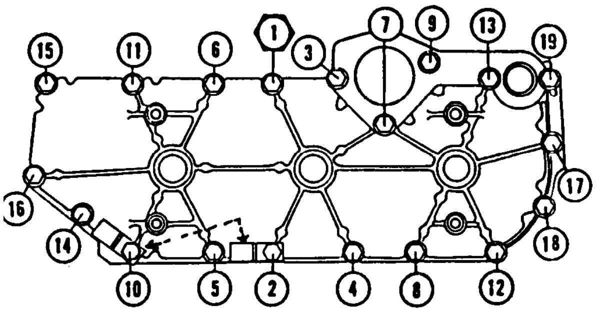


- Position clips, align cover holes and insert bolts - finger tighten (located under bolts #2 and 10).
- Insert remaining cover bolts - finger tighten.

NOTE: Keep clips positioned, as shown, during torque sequence.

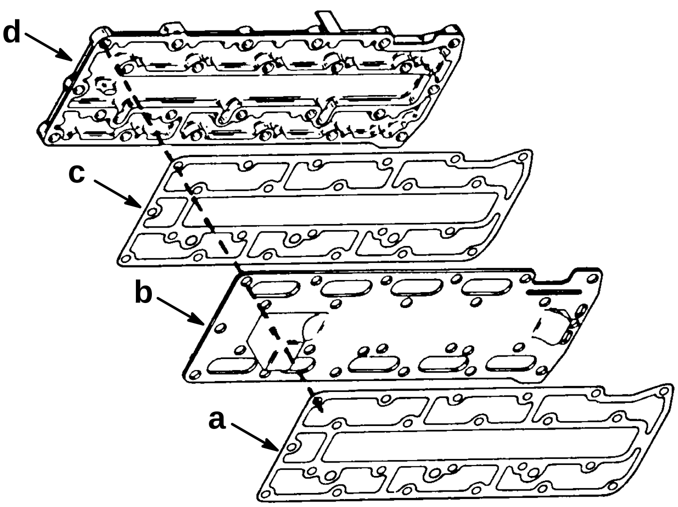
CYLINDER HEAD COVER TORQUE SEQUENCE

All Cover Bolts: 18 lb. ft. (24.4 N·m)



Exhaust Plate Cover and Exhaust Divider Plate

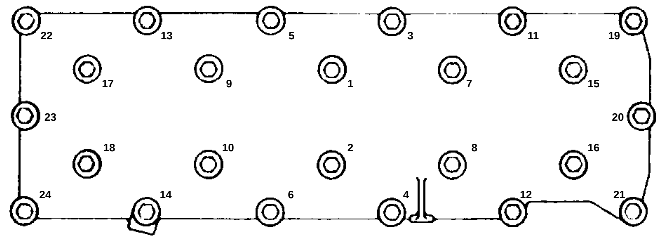
- Assemble in order shown.
  a. Exhaust Plate Gasket
  b. Divider Plate
  c. Exhaust Plate Gasket
  d. Exhaust Plate Cover



- Insert bolts (24) and finger tighten.
- Torque bolts in sequence.

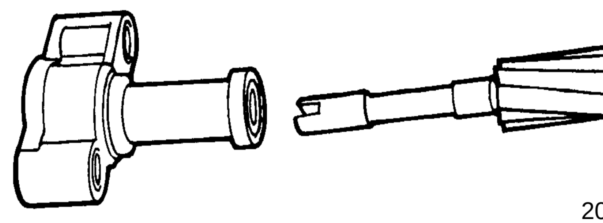
EXHAUST PLATE COVER TORQUE SEQUENCE

All Cover Bolts: 18 lb. ft. (24.4 N·m)



- Reinstall Oil Injection Pump Shaft and housing; check O-rings - replace as necessary.

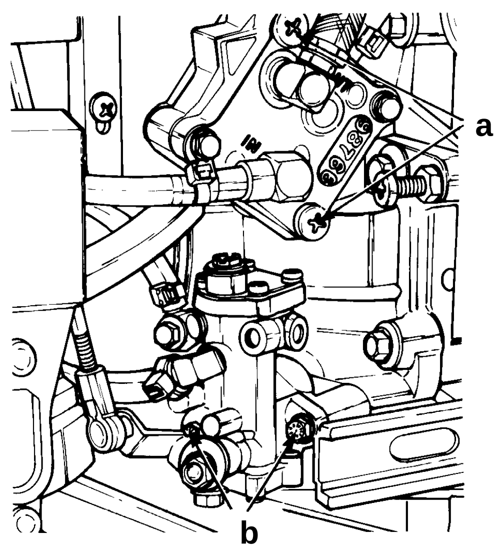
IMPORTANT: Insure that gears engage properly and that the O-rings are seated properly on reassembly, or an oil injection failure could occur, resulting in possible powerhead damage.



20041

IMPORTANT: After reinstalling shaft and housing, turn crankshaft - make sure oil pump shaft turns.

- Reinstall Oil Injection Pump - 2 bolts. Torque to 60 lb. in. (6.8 N·m).
- Reinstall Fuel Pump - 2 screws. Torque to 55 lb. in. (6.2 N·m).
- Reattach fuel/oil line hoses and secure with stay-straps.

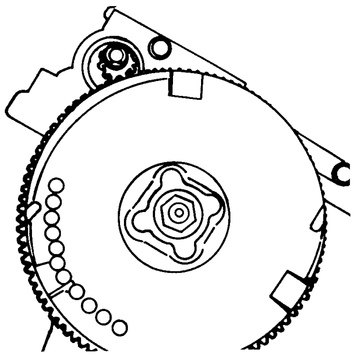


19056

a - Screws [Torque to 55 lb. in. (6.2 N·m)]
b - Bolts [Torque to 60 lb. in. (6.8 N·m)]

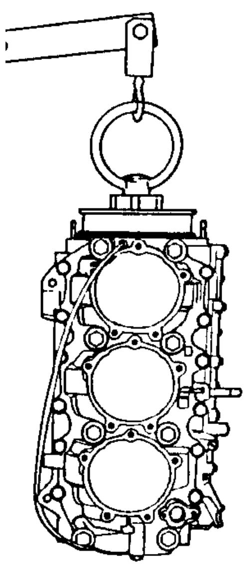
Powerhead to Driveshaft Housing

- Temporarily install flywheel with nut, as shown.



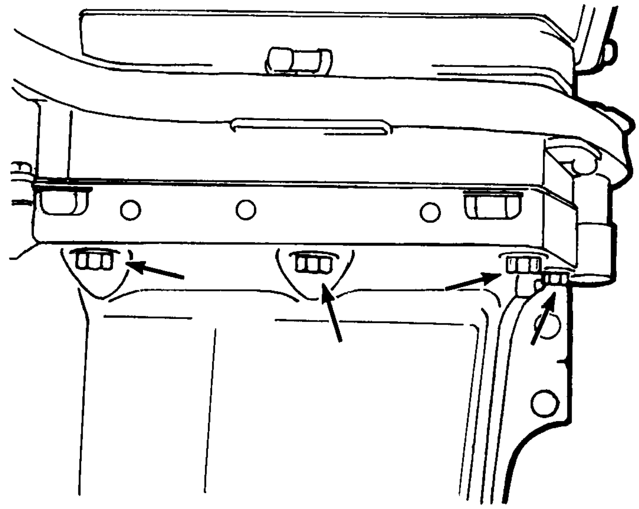
20346

- Install lifting eye (91-90455) onto flywheel. Thread on at least 5 full turns.
- After checking mating surfaces between powerhead and driveshaft housing for condition and cleanliness, use hoist to lift powerhead, being careful not to damage powerhead to driveshaft housing gasket surface.
- Place new gasket over locating pins on driveshaft housing-to-powerhead mating surface.
- Apply a small amount of Quicksilver 2-4-C w/Teflon to driveshaft splines.
- Recheck for correct installation of tip-seal in crankshaft seal carrier.
- Use hoist to lower powerhead into driveshaft housing, turning flywheel, if necessary, to align crankshaft splines with driveshaft splines. Lower so that powerhead is fully installed and aligned on locating pins.



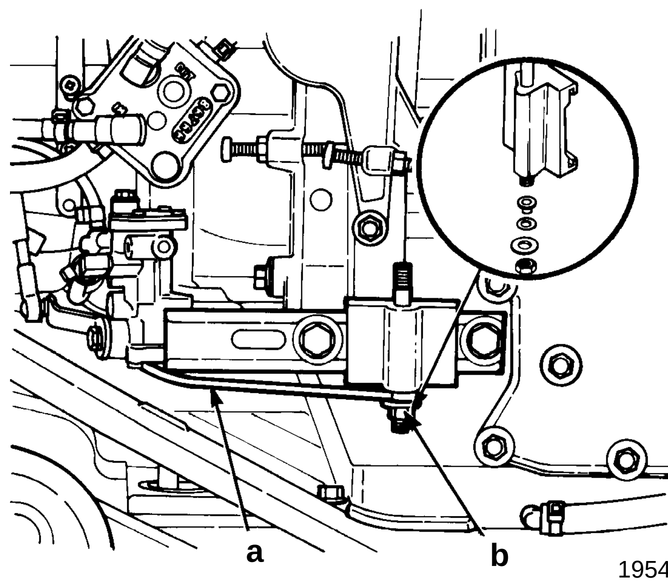
20031

Clean holes (threads) and bolts thoroughly, with Locquic Primer T (92-59327-1). Dry, apply Loctite 271 to bolts, and install. There are 8 bolts (3 each side, 2 backside). Torque in 3 Steps to 45 lb. ft. (61.0 N·m).



19070

Reattach shift arm linkage on stud.



19544

a - Shift Arm Linkage
b - Stud

NOTE: For specific information on rewiring, see Section 4-D, "Wiring Diagrams" (this manual).

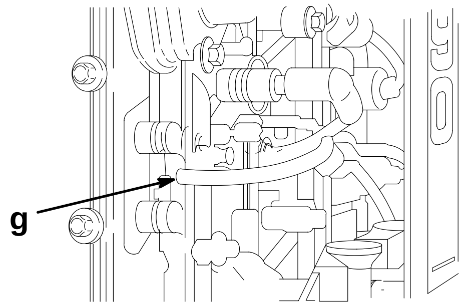
REINSTALL WIRING HARNESS AND COMPONENTS, AS A UNIT

- Reinstall Trigger Assembly and Stator Assembly. (Refer to Section 2 - this manual.) Apply Loctite 271 to stator screws and torque to 60 lb. in. (6.8 N·m).
- Attach Electrical Component Mounting Plate. Apply Loctite 271 to bolts and torque to 13.5 lb. ft. (18.3 N·m).
- Install Starter Motor as outlined in Section 2. Torque to 14.5 lb. ft. (19.7 N·m).
- Attach Enrichener Valve and connect hose. See Section 3B.

NOTE: See Section 2-D “Wiring Diagrams.”

- Attach Temperature Sensor (g), with 2 screws.

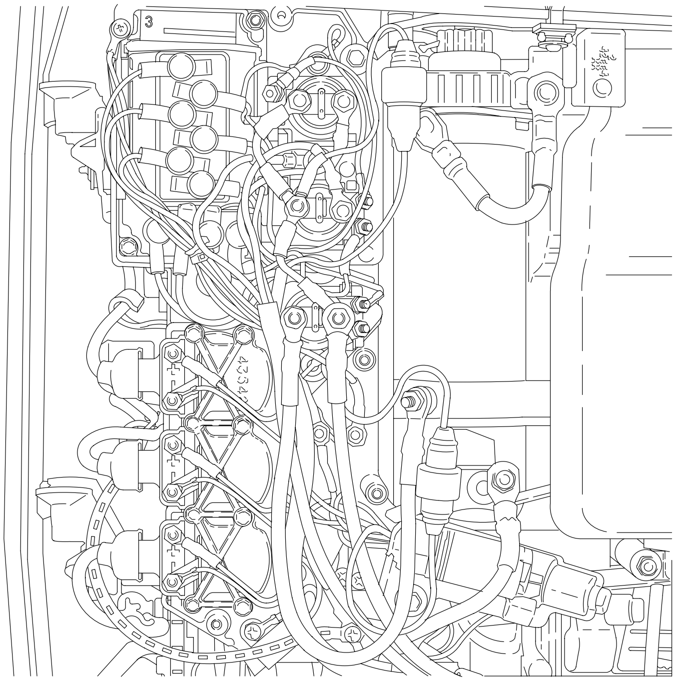
NOTE: Temperature sensor opens at 170°F ± 8° (77°C ± 8°); closes at 190°F ± 8° (88°C ± 8°)



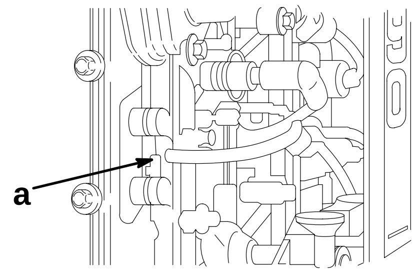
20368

- Attach Test Button, if so equipped.

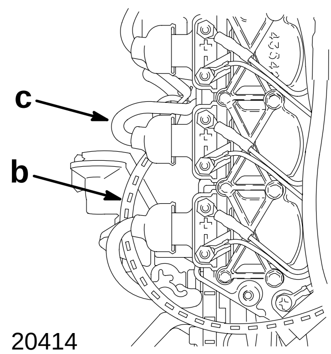
ELECTRICAL COMPONENTS INSTALLED



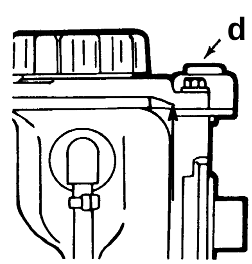
20412



20368



20414

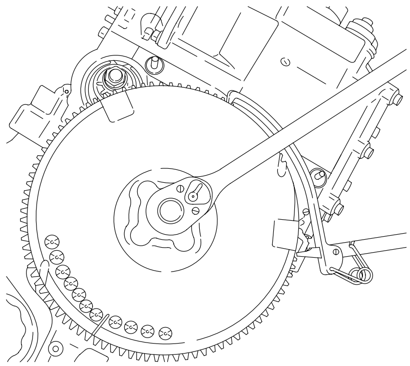


25955

a - Temperature Sensor
b - Temperature Sensor Wire
c - Spark Plug Wires
d - Horn Test Button

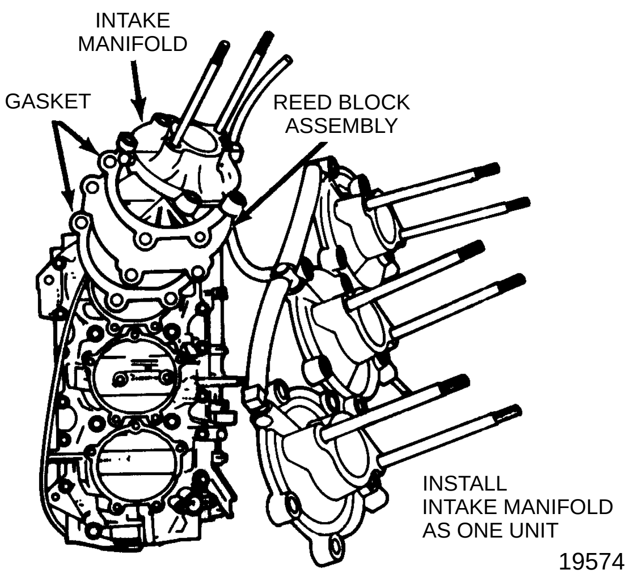
Flywheel Installation

1. Reinstall Flywheel, washer and nut.
2. Torque Flywheel Nut to 120 lb. ft. (162.7 N·m).



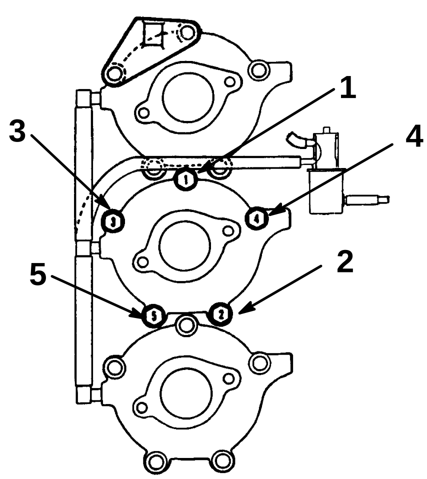
20344

3. Reinstall Reed Block Housings, Intake Manifolds, and Flywheel Cover Bracket.



19574

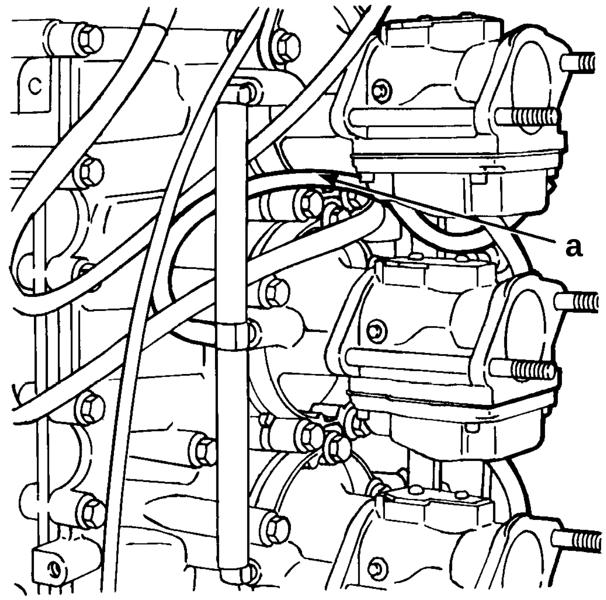
INTAKE MANIFOLD - TORQUE SEQUENCE



4. Torque each intake manifold, in sequence, to 18 lb. ft. (24.4 N·m).

NOTE: Flywheel Cover Bracket uses longer bolts.

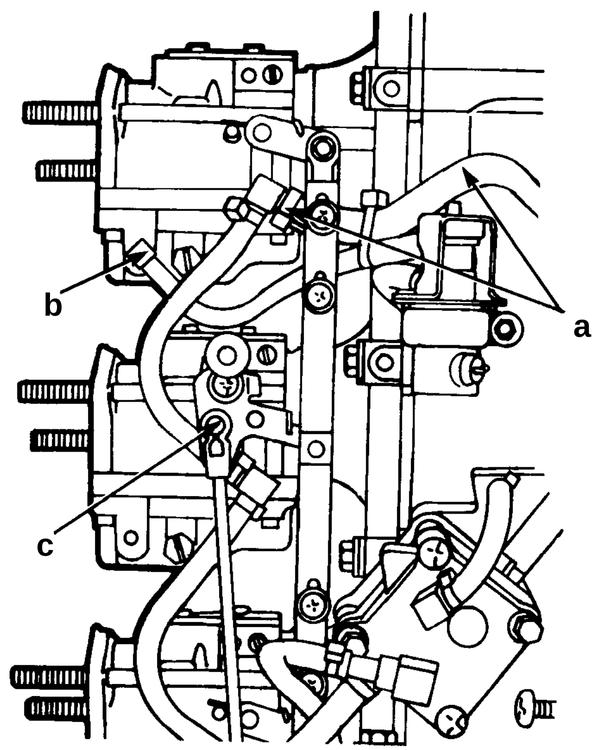
5. Install Carburetor Gaskets.
6. Reinstall Carburetors as Single-Unit Assembly. Note manifold hose position and connection.



19094

a - Manifold Hose

7. Reconnect main fuel line hose, and fuel enrichment hose. Secure fuel line “a” with sta-strap.
8. Reconnect throttle linkage.

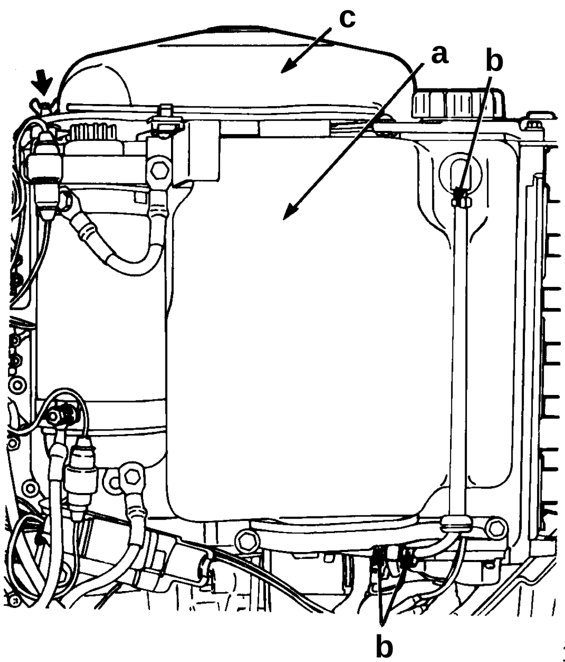


19093

a - Main Fuel Hose
b - Fuel Enrichment Hose
c - Throttle Linkage

9. Reinstall Flywheel Cover. Tighten 3 wing-nuts securely.
10. Reinstall oil reservoir. Reconnect hoses and secure with sta-straps. See Section 3B for more details, if necessary.

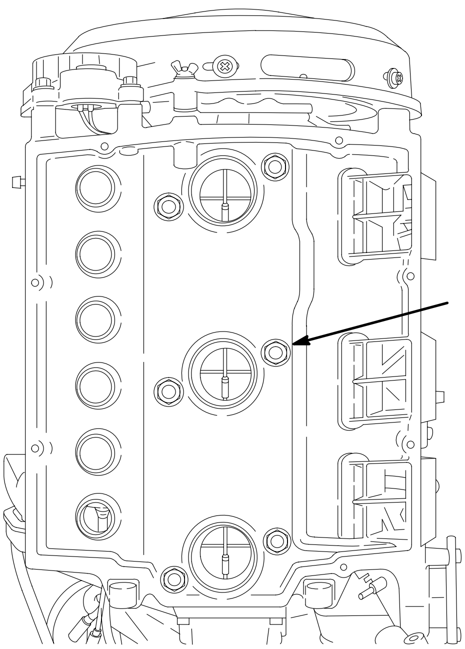
See “Oil Reservoir” diagrams at beginning of this section.



19072

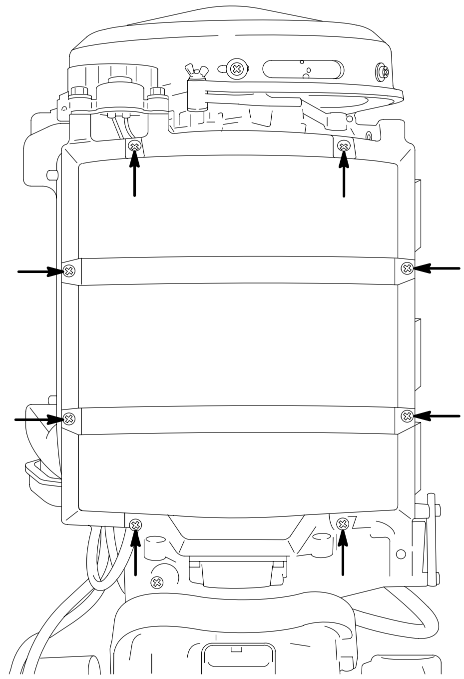
a - Oil Reservoir
b - Sta-straps
c - Flywheel Cover

11. Install Gaskets - Air Box Plate to carburetor.
12. Reinstall Air Box Plate.
13. Torque bolts to 100 lb. in. (11.3 N·m).



19097

14. Reinstall Air Box Cover and Gasket; tighten screws securely.



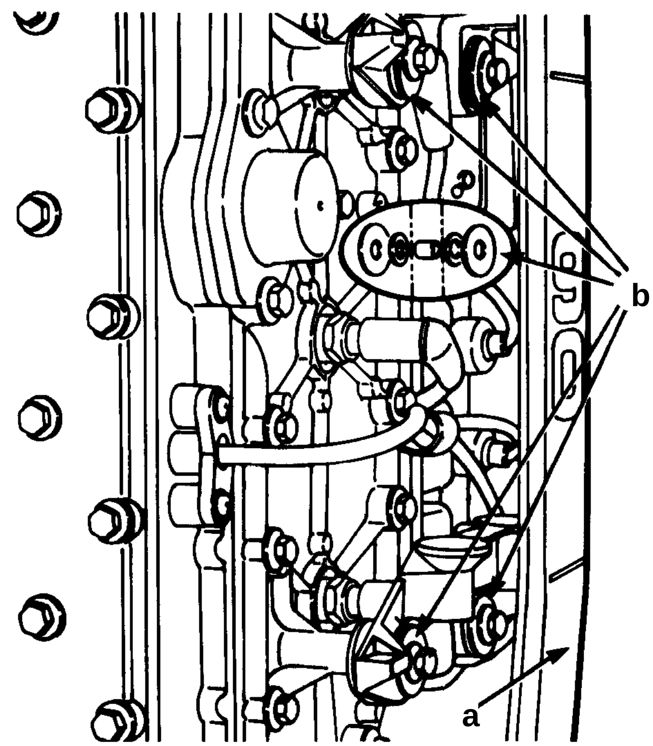
20335

ATTACH REAR COWL MOUNTING BRACKET

Bracket attaches with 4 bolts.

Note washer sequence (4 places).

Torque bolts to 150 lb. in. (16.9 N·m).

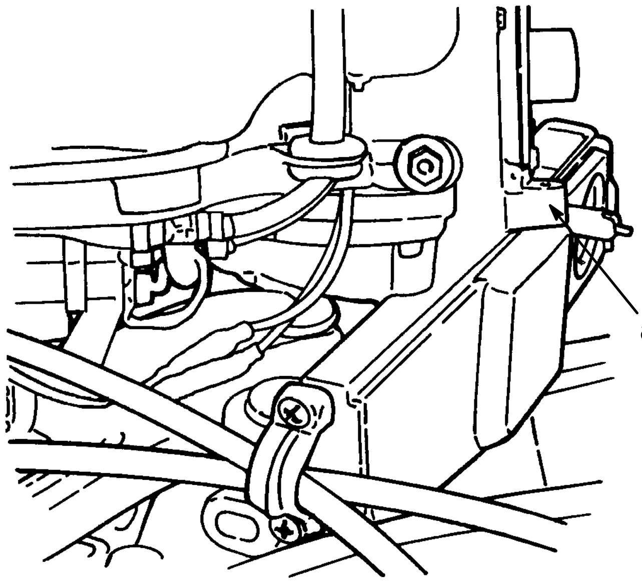


20368

a - Bracket
b - Washer

ATTACH FRONT COWL MOUNTING BRACKET

Front cowl mounting bracket is installed in location “a”.

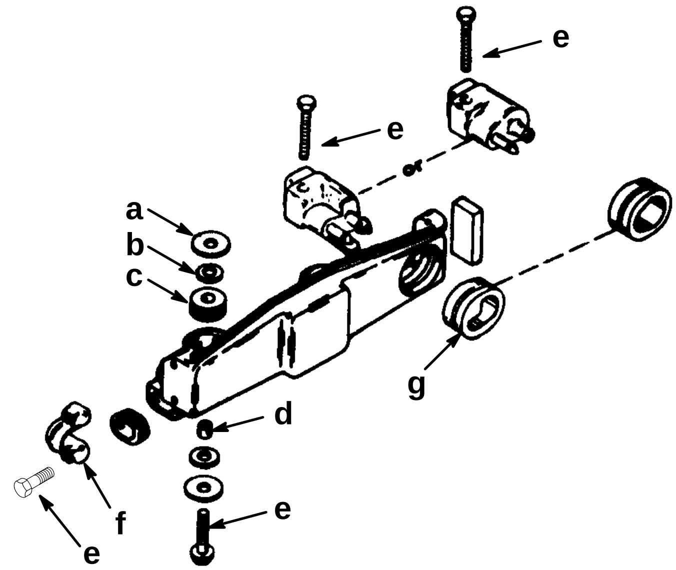


19072

Install Mounting Bracket, as shown below. Grommets “c” and “g” normally are left in place in the bracket on disassembly. Bushing “d” inserts in grommet “c”.

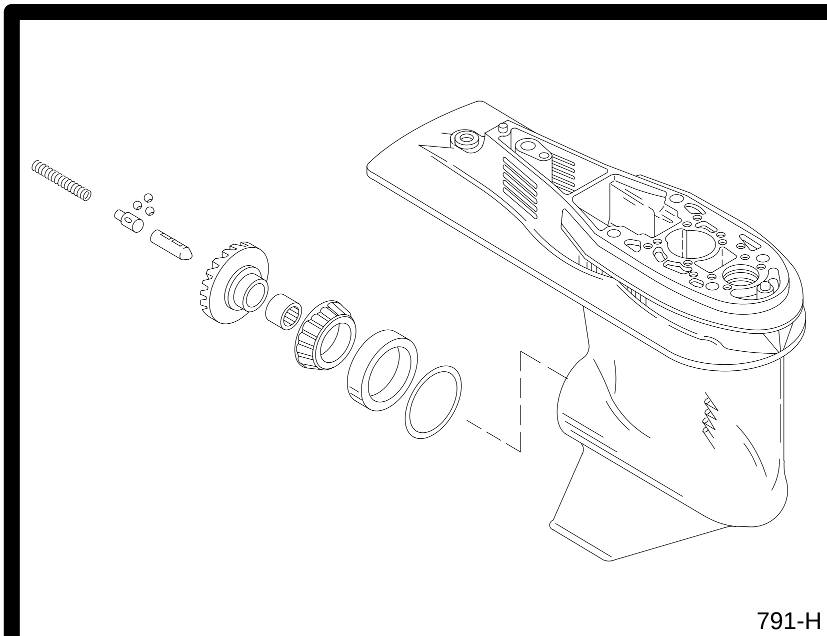
Position wiring and secure with cable retainer (“strap” casting).

Note sequence of washers, etc.



a - Washer
b - Washer
c - Grommet
d - Bushing
e - Screw
f - Retainer
g - Grommet
h - Seal

LOWER UNIT



5

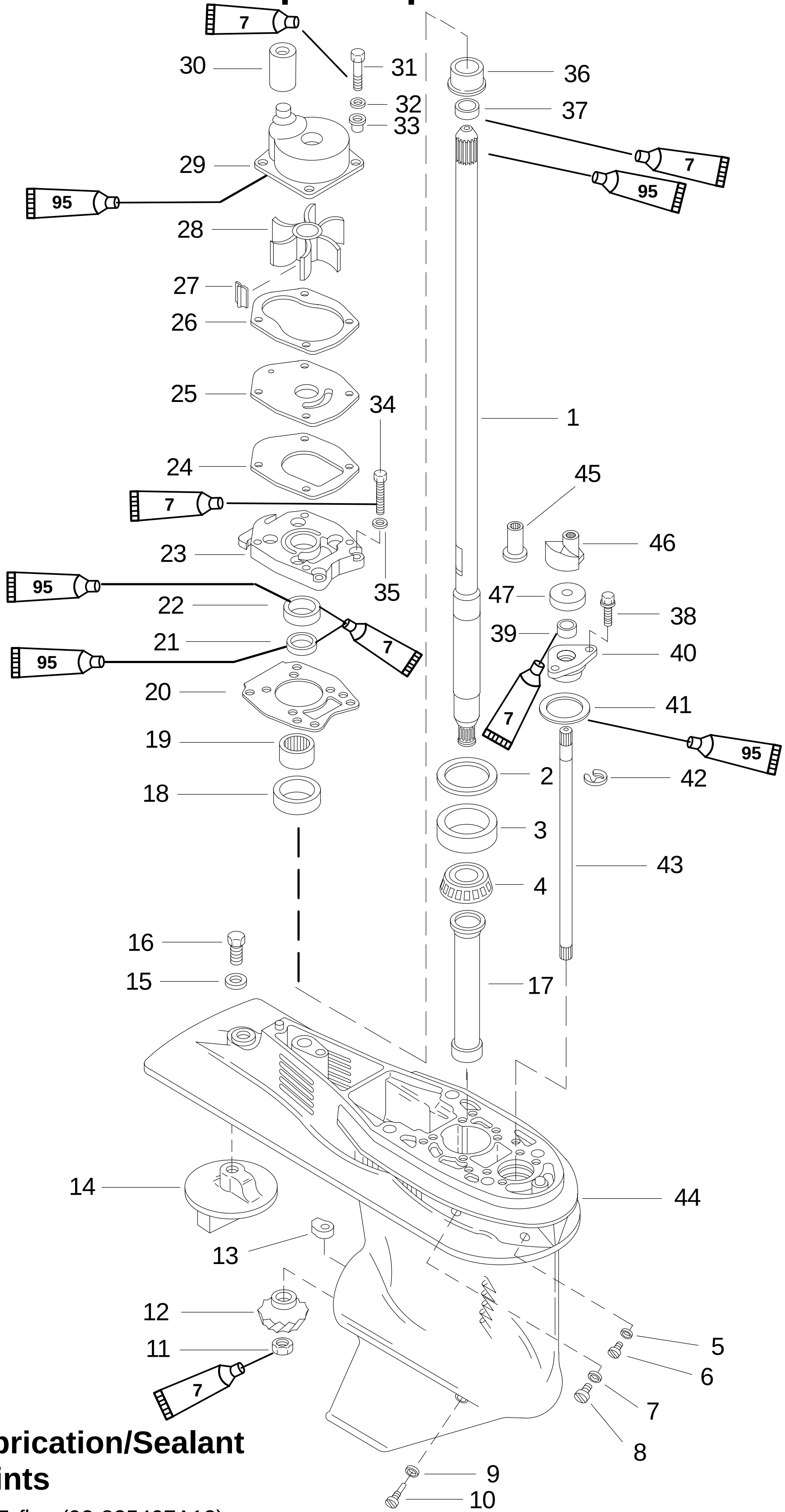
A

GEAR HOUSING

Table of Contents

Notes:

Drive Shaft and Water Pump Components



Quicksilver Lubrication/Sealant Application Points

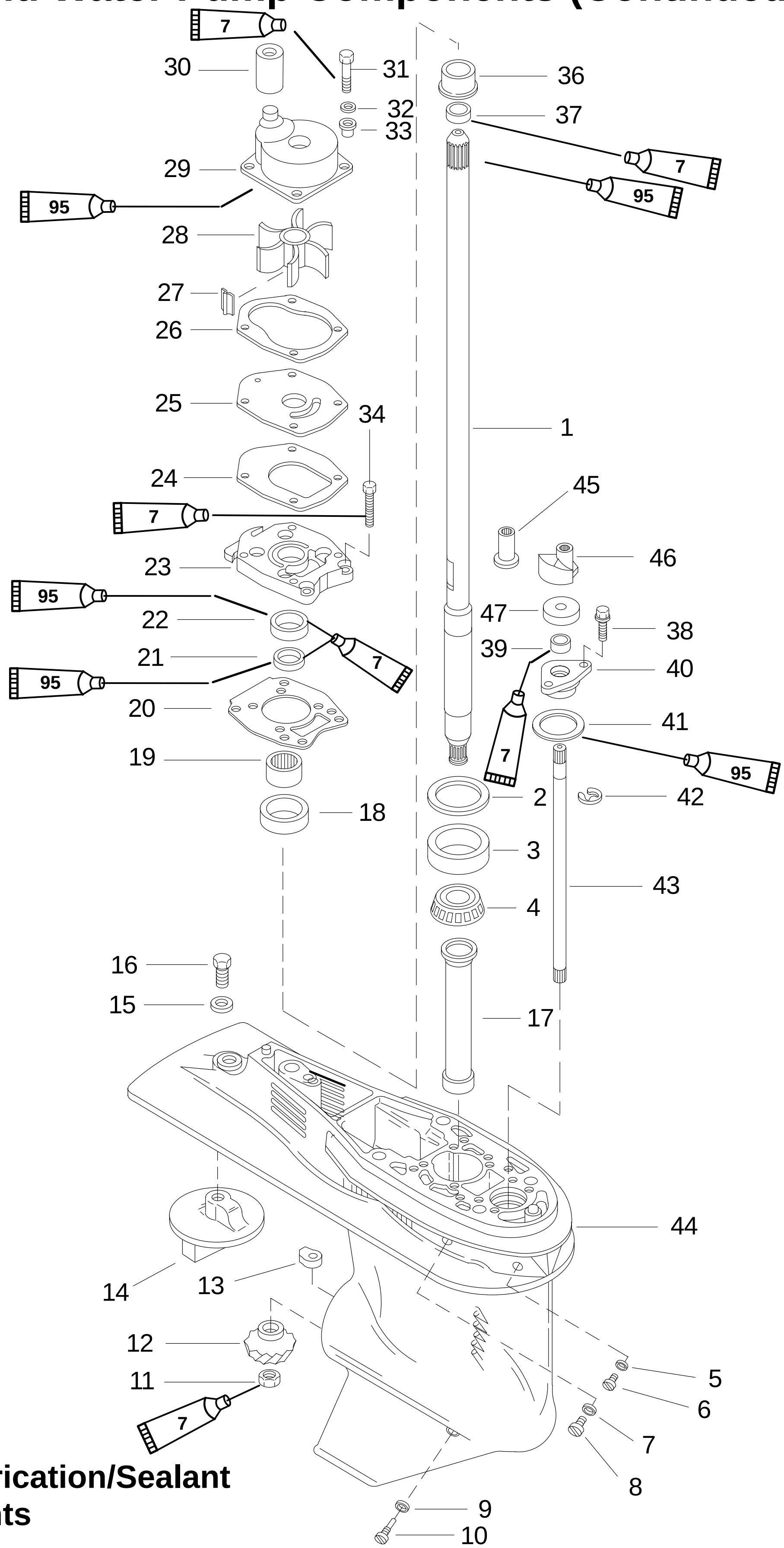
95 — 2-4-C With Teflon (92-825407A12)

7 — Loctite 271 (Obtain Locally)

Drive Shaft and Water Pump Components (Continued)

REF. NO.	QUAN.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	Drive Shaft (Long)			
		Drive Shaft (X-Long)			
2	1	Shim			
3	1	Bearing Race			
4	1	Tapered Bearing			
5	1	Washer			
6	1	Screw	60		6.8
7	1	Washer			
8	1	Screw	60		6.8
9	1	Washer			
10	1	Screw (Magnetic)	60		6.8
11	1	Pinion Nut		70	94.9
12	1	Pinion Gear			
13	1	Shift Cam (Letters Face Up)			
14	1	Trim Tab			
15	1	Washer			
16	1	Trim Tab Bolt		22	29.8
17	1	Oiler Tube			
18	1	Carrier			
19	1	Needle Bearing (Numbers Face Up)			
20	1	Gasket (Not used with nylon cover assy.)			
21	1	Oil Seal (Lip Up)			
22	1	Oil Seal (Lip Down)			
23	1	Cover Assembly			
24	1	Gasket			
25	1	Face Plate			
26	1	Gasket			

Drive Shaft and Water Pump Components (Continued)



Quicksilver Lubrication/Sealant Application Points

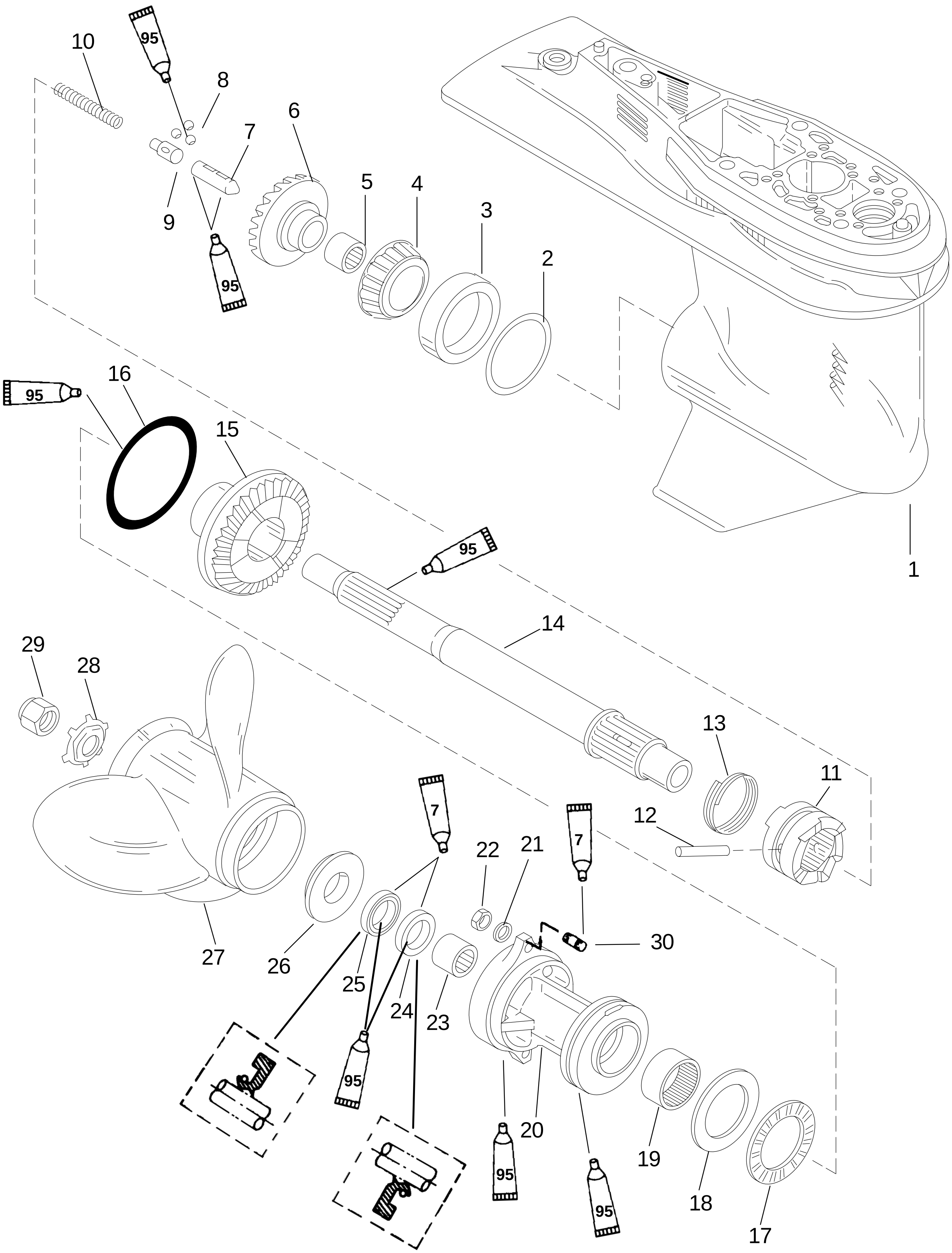
95 2-4-C With Teflon (92-825407A12)

7 Loctite 271 (Obtain Locally)

Drive Shaft and Water Pump Components (Continued)

REF. NO.	QUAN.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
27	1	Impeller Drive Key			
28	1	Impeller			
29	1	Water Pump Assembly			
30	1	Water Tube Seal			
31	4	Water Pump Bolt	60		6.8
32		Delete			
33		Delete			
34	6	Cover Screw	60		6.8
35		Delete			
36	1	Wear Sleeve			
37	1	Seal Ring			
38	2	Bushing Screw	35		3.9
39	1	Oil Seal (Lip Up)			
40	1	Shift Shaft Bushing			
41	1	O-Ring			
42	1	Shift Shaft “E” Ring			
43	1	Shift Shaft (Long)			
	1	Shift Shaft (X-Long)			
44	1	Gear Housing			
45	1	Shift Shaft Adapter			
46	1	Reverse Lock Cam			
47	1	Washer			

Propeller Shaft Components



95 2-4-C With Teflon (92-825407A12)

7 Loctite 271 (Obtain Locally)

REF. NO.	QUAN.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	Gear Case			
2	1	Shim			
3	1	Bearing Race			
4	1	Tapered Roller Bearing			
5	1	Roller Bearing			
6	1	Forward Gear			
7	1	Cam Follower			
8	3	Ball Bearing			
9	1	Slide Cross Pin			
10	1	Spring			
11	1	Clutch			
12	1	Clutch Cross Pin			
13	1	Retainer Spring			
14	1	Propeller Shaft			
15	1	Reverse Gear			
16	1	O-Ring			
17	1	Thrust Bearing			
18	1	Thrust Washer			
19	1	Roller Bearing			
20	1	Bearing Carrier			
21	1	Washer			
22	1	Nut (Design 2) or Bolt (Design 1)	260	21.7	29.4
23	1	Roller Bearing			
24	1	Oil Seal (Lip In)			
25	1	Oil Seal (Lip Out)			
26	1	Thrust Washer			
27	1	Propeller			
28	1	Tab Washer			
29	1	Propeller Nut		55	75
30	2	Stud			

Special Tools

Part No.	Description
91-46086A1	Puller Jaws
91-85716	Puller Bolt
91-34569A1	Slide Hammer
91-36569	Mandrel*
91-37263	Mandrel*
91-37323	Driver Rod*
91-56775	Drive Shaft Holding Tool
91-37241	Universal Puller Plate
91-83165M	Bearing Puller Assembly
91-31106	Mandrel
91-31108	Oil Seal Driver
91-37350	Mandrel
91-31229	Threaded Rod*
11-24156	Nut*
91-78473	Backlash Indicator Tool (3 Cyl)
91-58222A1	Dial Indicator
91-83155	Dial Indicator Adaptor Kit
91-12349A2	Pinion Gear Locating Tool
91-14308A1	Bearing Race Tool
91-14309A1	Bearing Installation Tool
91-14310A1	Wear Sleeve Installation Tool
91-14311A1	Bearing Preload Tool
91-13945	Bearing Installation Tool
91-13949	Oil Seal Driver
91-19660	Backlash Indicator Tool (4 Cyl)

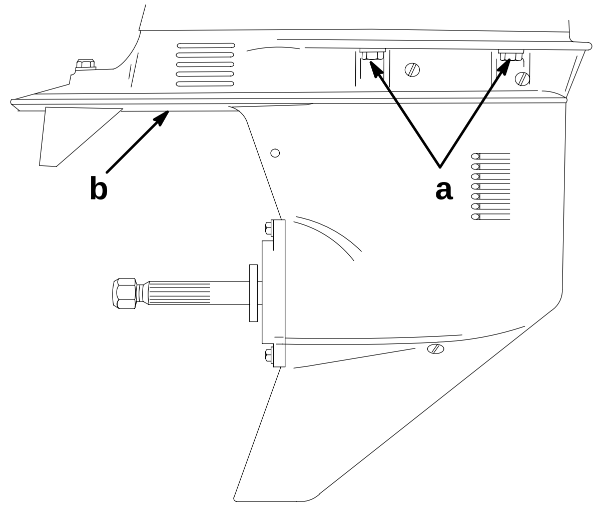
* From Bearing Removal and Installation Kit (91-31229A5)

Removal

⚠ WARNING

To prevent accidental engine starting, remove (and isolate) spark plug leads from spark plugs before removing gear housing.

1. Remove (and isolate) spark plug leads from spark plugs.
2. Shift engine into forward gear.
3. Tilt engine to full “Up” position.
4. Remove 4 bolts (or locknuts on 1995 Models) and washers (two each side).
5. Remove locknut and washer.
6. Remove gear housing.



51552

a - Bolts (or Locknuts) and Washers
b - Locknut and Washer

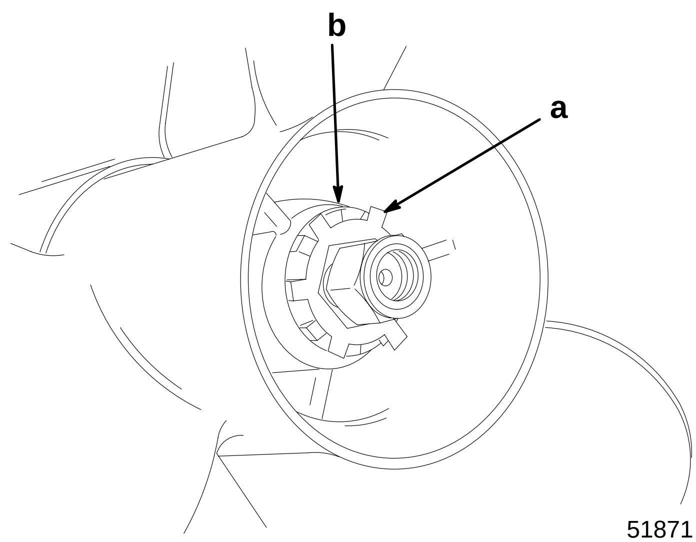
Disassembly

Propeller Removal

⚠ WARNING

If gear housing is not removed from drive shaft housing, before attempting to remove or install the propeller, remove (and isolate) spark plug leads from spark plugs to prevent engine from starting accidentally.

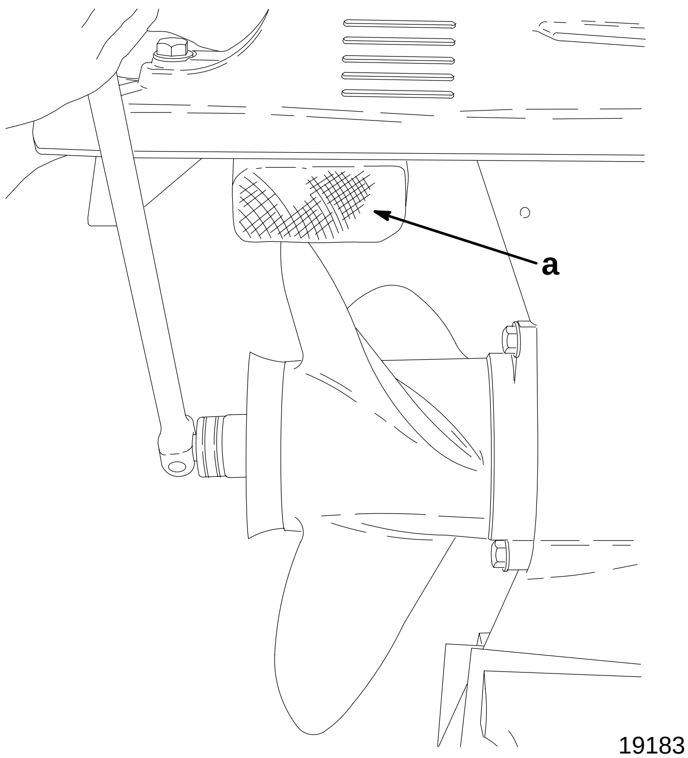
1. Bend tabs of tab washer away from hub.



51871

a - Tab Washer
b - Hub

2. Place a block of wood, as shown, to prevent propeller from rotating and to protect hands during removal of nut.
3. Remove nut and pull components from shaft.



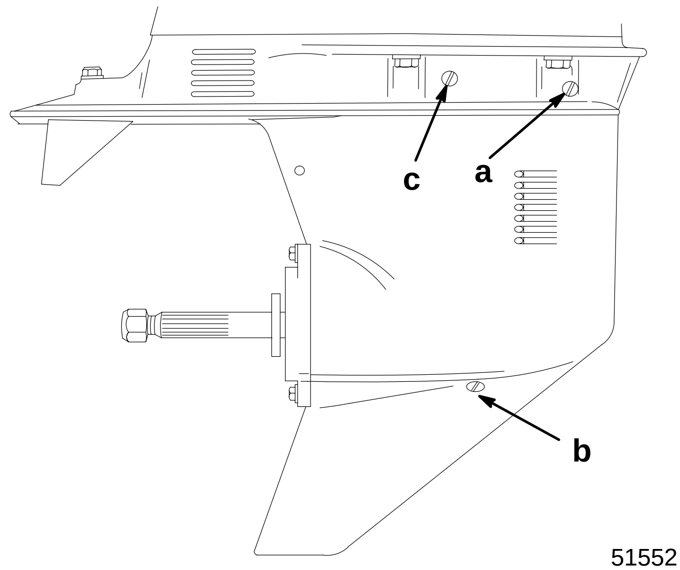
a - Block of Wood

Draining and Inspecting Gear Housing Lubricant

⚠ WARNING

If gear housing is installed on engine, to avoid accidental starting, disconnect (and isolate) spark plug leads from spark plugs before working near the propeller.

1. With gear housing in normal running position, place a clean pan under housing and remove the two vent screws and one fill/drain screw (with gaskets).

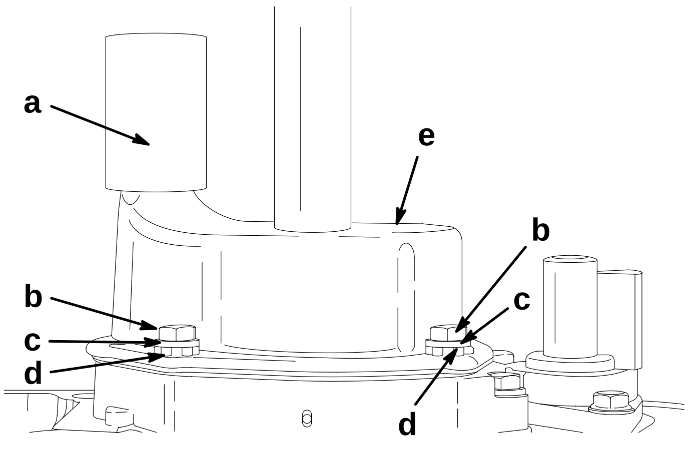


a - Oil Level Screw
b - Fill/Drain Screw
c - Vent Screw

2. Inspect gear lubricant for metal particles (lubricant will have a “metal flake” appearance). Presence of fine metal particles (resembling powder) on the drain plug bar magnet indicates normal wear. The presence of metal chips on the drain plug bar magnet indicates the need for gear housing disassembly and component inspection.
3. Note color of gear lubricant. White or cream color MAY indicate presence of water in lubricant. Gear lubricant which has been drained from a gear case recently in operation will have a yellowish color due to lubricant agitation/aeration. Gear lube which is mixed with assembly lubricant (Special Lube 101 or 2-4-C w/Teflon will also be creamy white in color. This is normal and should not be confused with the presence of water. If water is supected to be present in gearcase, a pressure check of gearcase should be made (with no lubricant in gearcase). Gearcase should hold 10 to 12 psi of pressure for 5 minutes without leaking down. Pouring a portion of the gear lubricant into a glass jar and allowing the lubricant to settle will allow any water in the lube to separate and settle to the bottom of the jar.
4. Presence of water in gear lubricant indicates the need for disassembly and inspection of oil seals, seal surfaces, O-rings, water pump gaskets as well as gear housing components for damage. If gearcase is rebuilt, gearcase should be pressure checked before filling with lubricant.

Water Pump (Design 1)

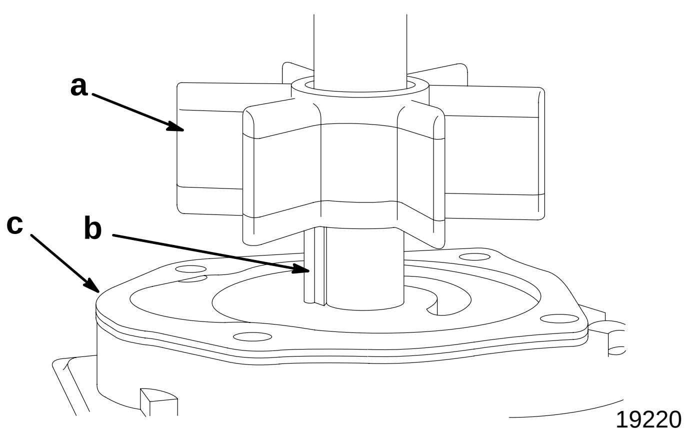
1. If water tube seal stayed on water tube (inside of drive shaft housing) when gear housing was removed, pull water tube seal from water tube.
2. Replace water tube seal, if damaged.
3. Remove 4 bolts, washers, and isolators.
4. Remove cover.



a - Water Tube Seal
b - Bolts (4 each)
c - Washers (4 each)
d - Isolators (4 each)
e - Cover

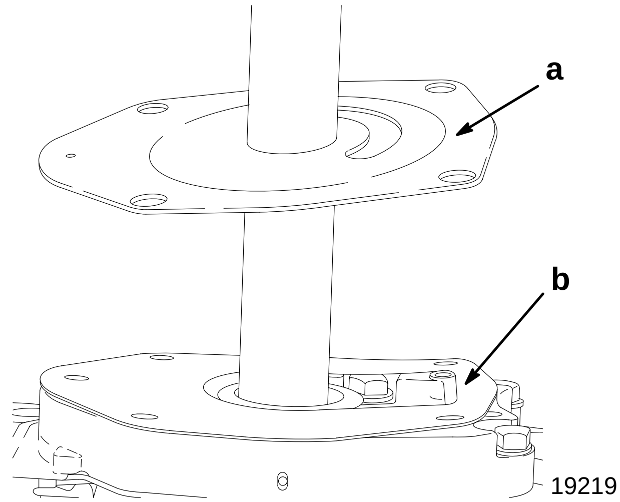
IMPORTANT: The circular groove formed by the impeller sealing bead should be disregarded when inspecting cover (Step 5) and plate (Step 9), as the depth of the groove will not affect water pump output.

5. Replace cover if thickness of steel at the discharge slots is 0.060″ or less, or if groove(s) (other than impeller sealing bead groove) in cover roof are more than 0.030″ (0.762mm) deep.
6. Lift impeller, drive key, and gasket from drive shaft.



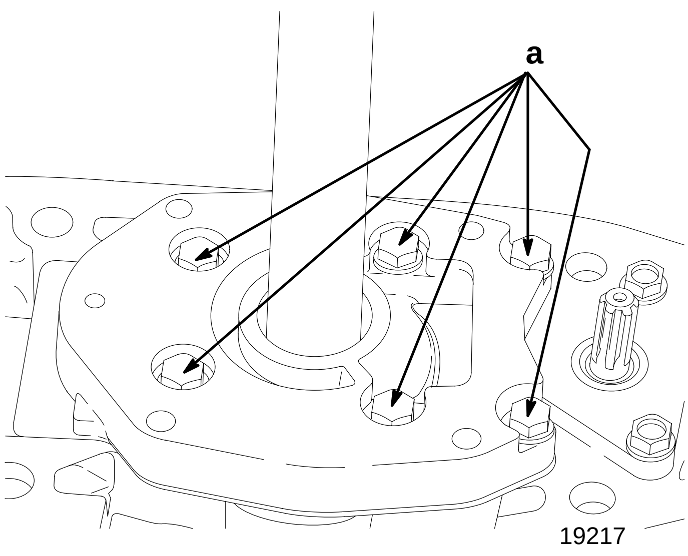
a - Impeller
b - Drive Key
c - Gasket

7. Inspect impeller. Replace impeller if any of the following conditions exist:
   – Impeller blade(s) are cracked, torn, or worn.
   – Impeller is glazed or melted (caused by operation without sufficient water supply).
   – Rubber portion of impeller is not bonded to impeller hub.
8. Remove plate and gasket.
9. Replace plate if groove(s) (other than impeller sealing bead groove) in plate are more than 0.030″ (0.762mm) deep.



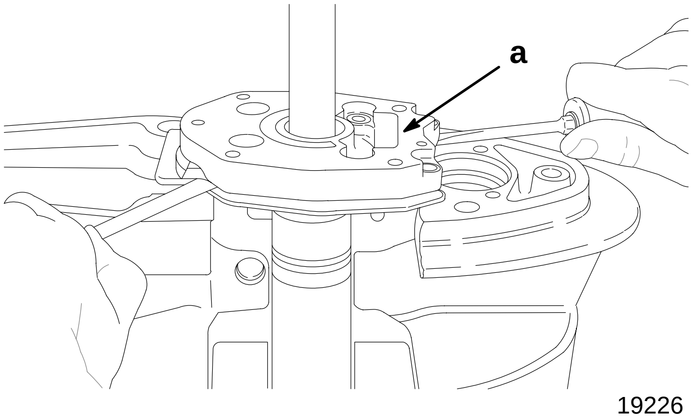
a - Plate
b - Gasket

10. Remove bolts and washers.



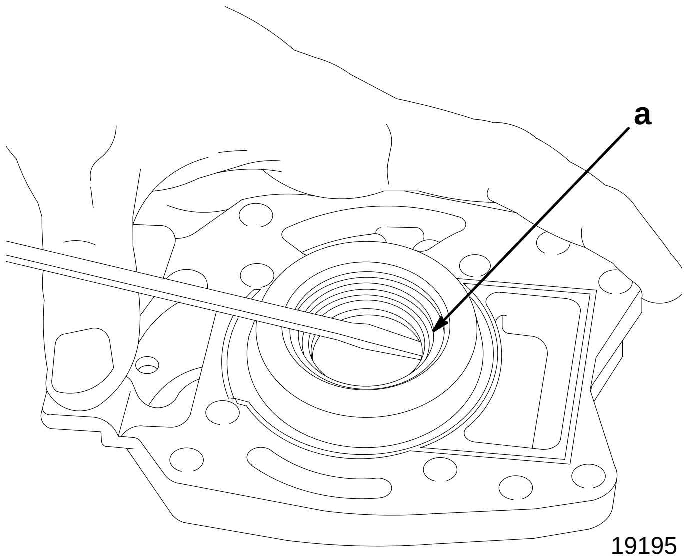
a - Bolts and Washers (6 each)

11. Remove water pump base.



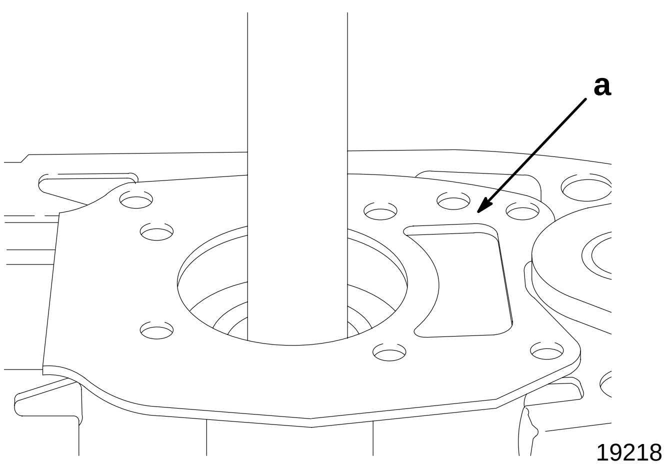
a - Water Pump Base

12. Remove (and discard) seals.



a - Seals

13. Remove gasket.

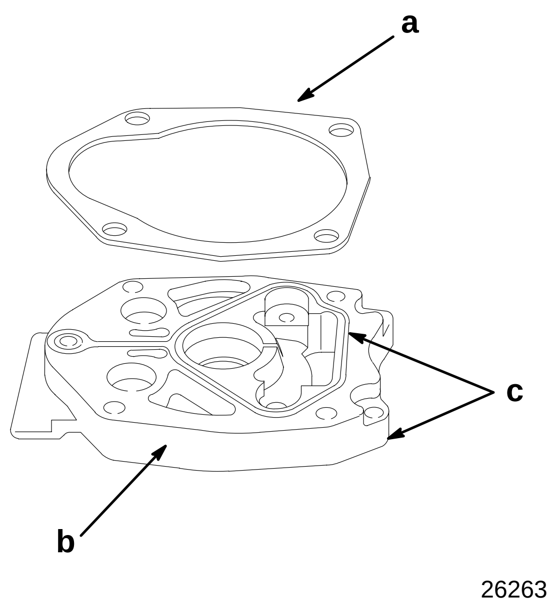


a - Gasket

Water Pump (Design 2)

NOTE: Disassembly procedure for DESIGN 2 model water pump is the same as for DESIGN 1 model water pump, previous.

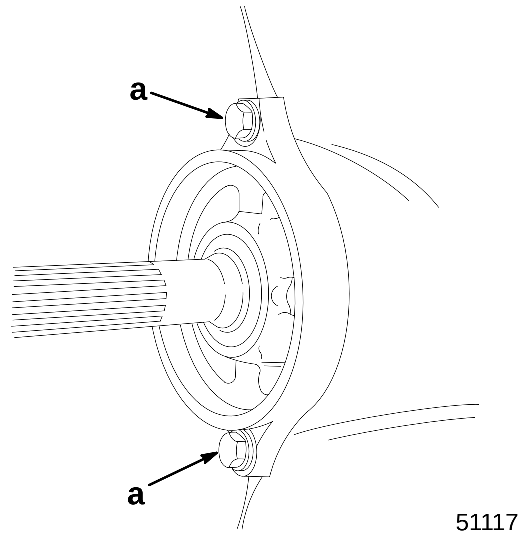
IMPORTANT: Gear housing on 3 CYLINDER MODELS 70, 75, 80, 90 and 4 CYLINDER MODELS 100 and 115 have been modified to accept a new style plastic water pump base (P/N 19282A1). This new base does not require gaskets as it has a silicone impregnated seal on the top and bottom. As long as this silicone seal is not damaged – i.e., cuts or abrasions – it will retain its sealing capabilities. This new water pump base CANNOT BE USED on older gear housings. The aluminum water pump base (P/N 43055A2) is still available for use with the older gear housings.



a - Water Pump Cover Gasket
b - Plastic Pump Base
c - Silicone Seal (Both Sides)

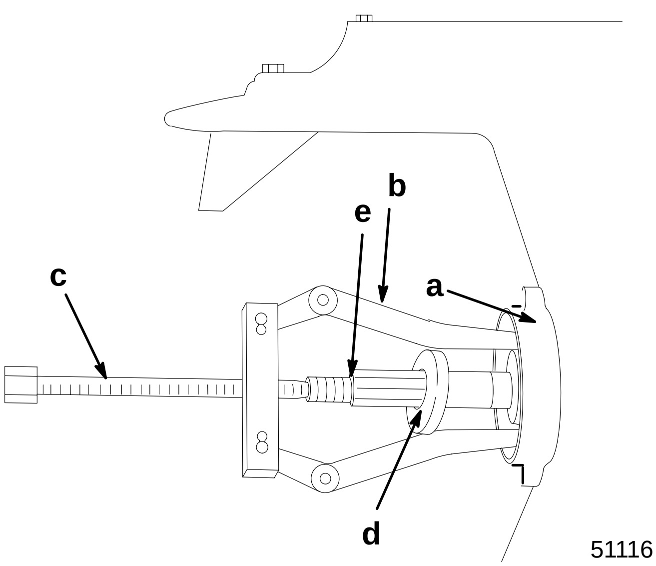
Bearing Carrier and Propeller Shaft

1. Drain lubricant from gear housing; refer to "Draining and Inspecting Gear Housing Lubricant."
2. Remove bolts and washers or self locking nuts if applicable.



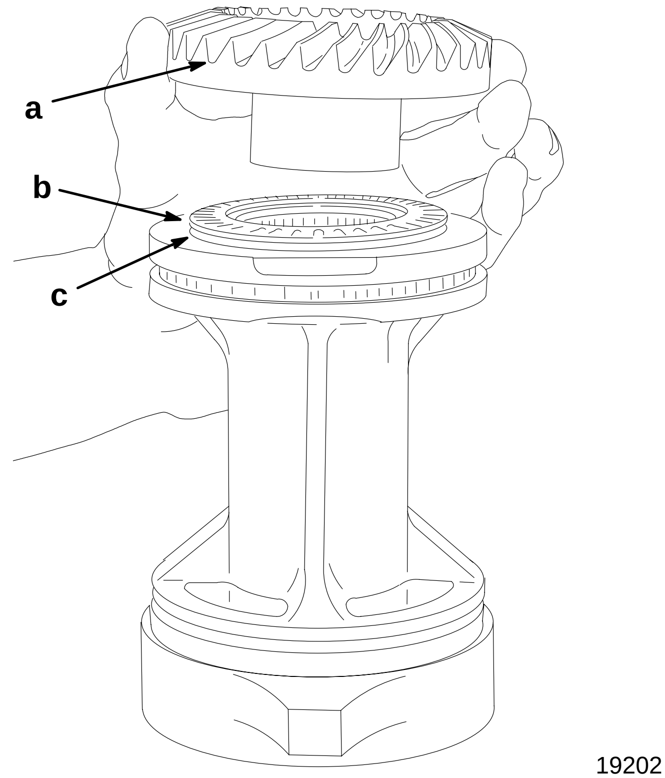
a - Bolt and Washers or Locknuts

3. With propeller shaft horizontal, pull carrier to break seal with gear housing. Remove bearing carrier/propeller shaft components as an assembly, taking care not to lose cam follower or 3 metal balls in end of propeller shaft.
4. Remove propeller shaft from bearing carrier.



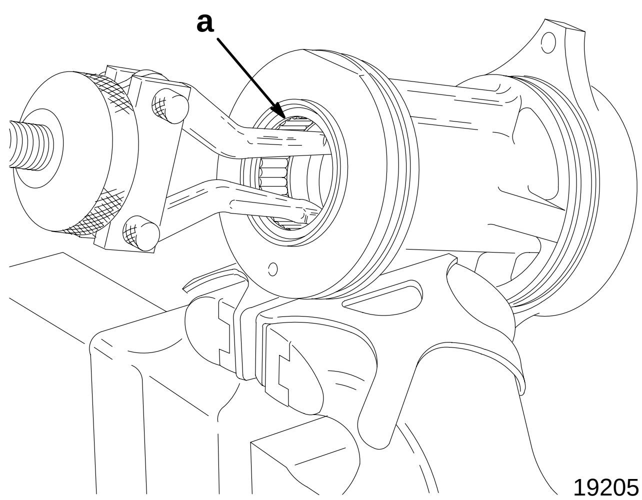
a - Bearing Carrier
b - Puller Jaws (91-46086A1)
c - Puller Bolt (91-85716)
d - Thrust Hub
e - Propeller Shaft

5. Lift reverse gear, thrust bearing and thrust washer from bearing carrier.
6. Replace reverse gear if gear teeth or clutch teeth on reverse gear are chipped or worn. If reverse gear must be replaced, pinion gear and sliding clutch should be inspected for damage.
7. Replace thrust bearing and thrust washer if rusted, pitted or damaged.



a - Reverse Gear
b - Thrust Bearing
c - Thrust Washer

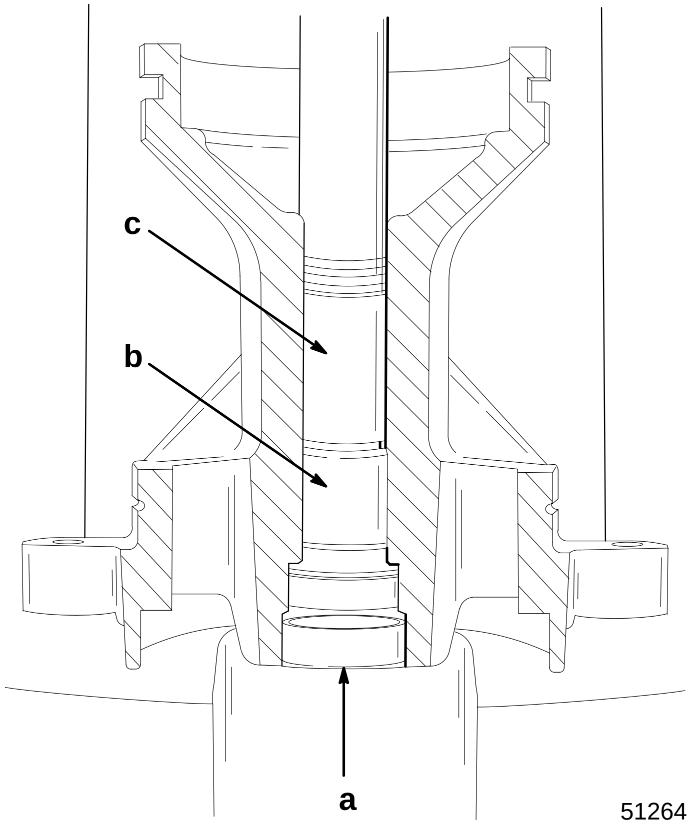
8. If bearing is rusted or does not roll freely, replace bearing. Remove bearing using Slide Hammer (91-34569A1).



a - Bearing

9. If bearing is rusted or does not roll freely, replace bearing. Remove bearing and oil seals using Mandrel* (91-36569) and Driver Rod* (91-37323). Discard oil seals.

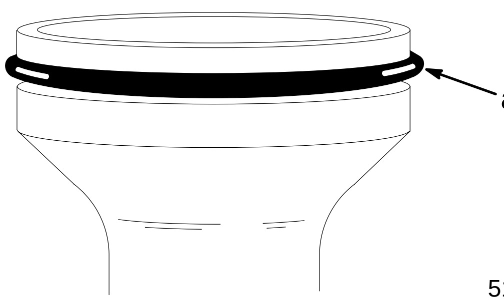
* From Bearing Removal and Installation Kit (91-31229A5).



51264

a - Bearing
b - Mandrel (91-26569)
c - Driver Rod (91-37323)

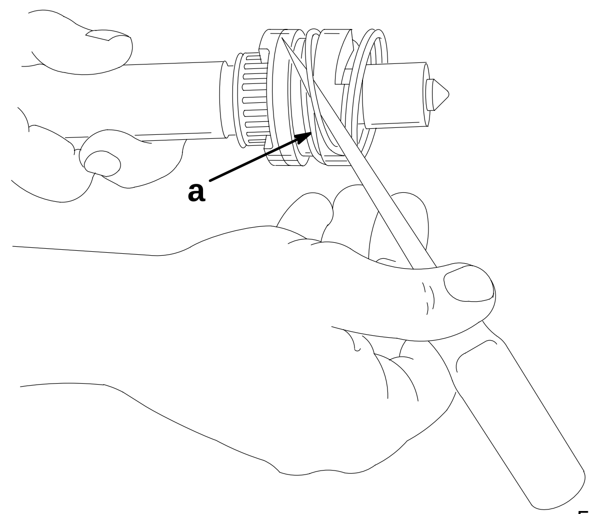
10. Remove (if not removed with bearing in Step 9) propeller shaft seals and O-ring.



51263

a - O-ring

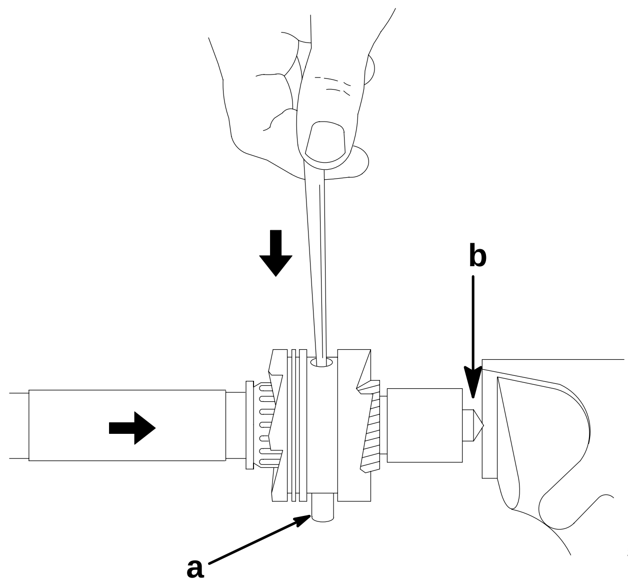
11. Remove spring.



51876

a - Spring

12. Apply constant pressure to cam follower to prevent cam follower assembly from ejecting from propeller shaft while pushing cross pin out of clutch dog.



51800

a - Cross Pin
b - Cam Follower

13. Remove components from propeller shaft.

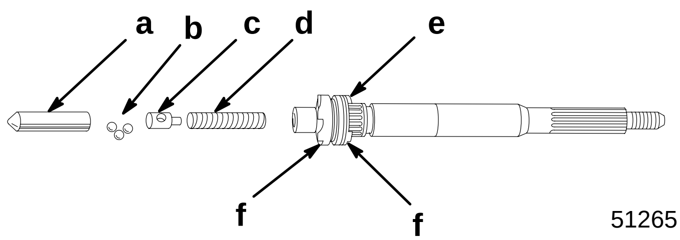
14. Replace cam follower if worn or pitted.

15. Replace sliding clutch if jaws are rounded or chipped. Rounded jaws indicate one or more of the following:

   a. Improper shift cable adjustment.

   b. Engine idle speed too high while shifting.

   c. Shifting from neutral to reverse (or forward) too slowly.



a - Cam Follower
b - 3 Metal Balls
c - Guide Block
d - Spring
e - Sliding Clutch
f - Jaws

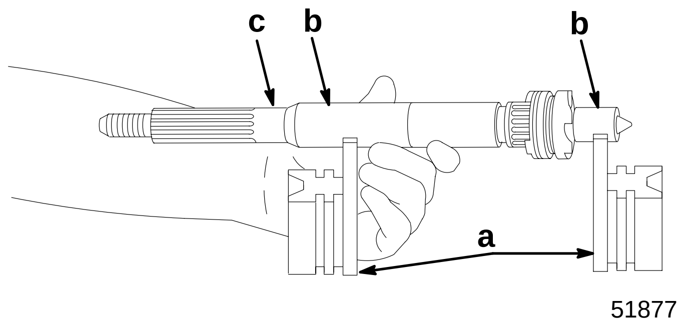
16. Check bearing surfaces of propeller shaft for pitting or wear. If shaft is worn or pitted, replace shaft and corresponding bearing.

17. Replace propeller shaft if any of the following exist:

   a. Splines are twisted or worn.

   b. Oil seal surface is grooved.

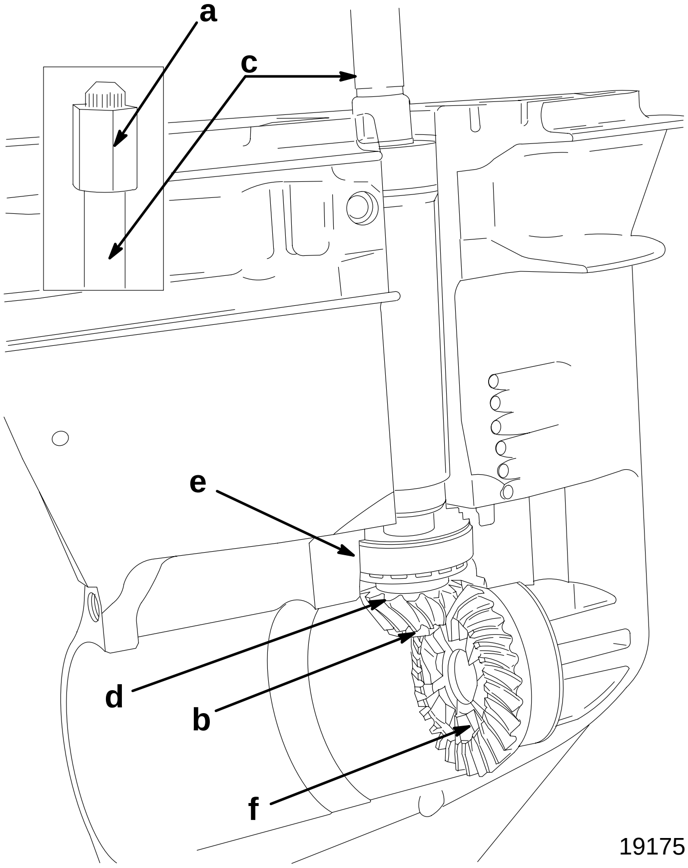
   c. Shaft has a noticeable “wobble” or is bent more than 0.009 in. (0.228mm). Prop shaft trueness should be measured with a dial indicator with prop shaft on V-blocks.



a - V-Blocks
b - Bearing Surfaces
c - Measure with Dial Indicator at this Point.

Pinion Gear, Drive Shaft, and Forward Gear

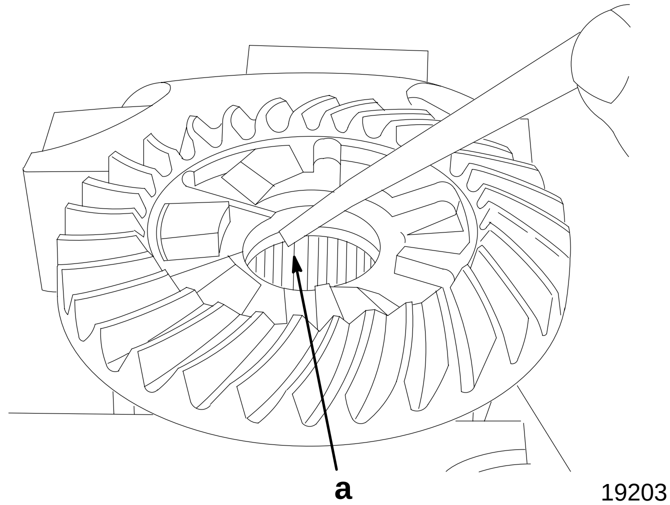
1. Hold drive shaft using Drive Shaft Holding Tool (91-56775); remove (and discard) pinion nut.
2. Remove drive shaft, pinion gear, bearing and forward gear .
3. Replace pinion gear if it is chipped or worn.
4. Replace bearing and race if either are rusted or damaged; or if bearing does not roll freely. To remove race, refer to “Lower Drive Shaft Bearing Race,” following.
5. Replace forward gear if gear teeth or clutch teeth are chipped or worn.



19175

a - Drive Shaft Holding Tool (91-56775)
b - Pinion Nut
c - Drive Shaft
d - Pinion Gear
e - Bearing
f - Forward Gear

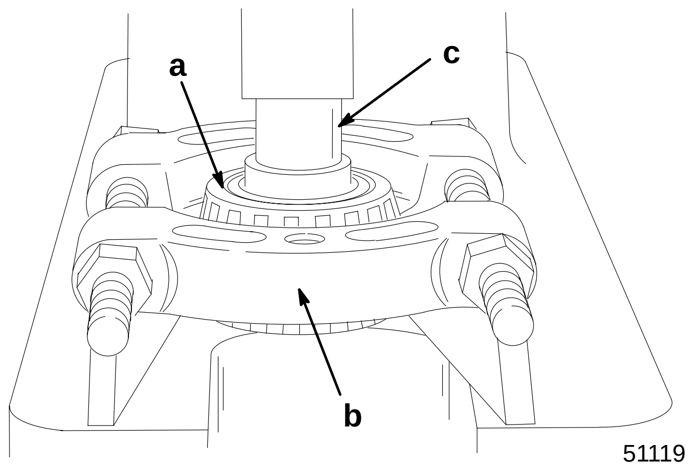
6. Replace bearing if it is rusted or does not roll freely; use a punch and hammer to remove bearing.



19203

a - Bearing

7. Replace forward gear bearing and race if either are rusted or damaged; or if bearing does not roll freely. Remove bearing from gear using Universal Puller Plate (91-37241) and mandrel. To remove race, refer to “Forward Gear Bearing Race,” following.



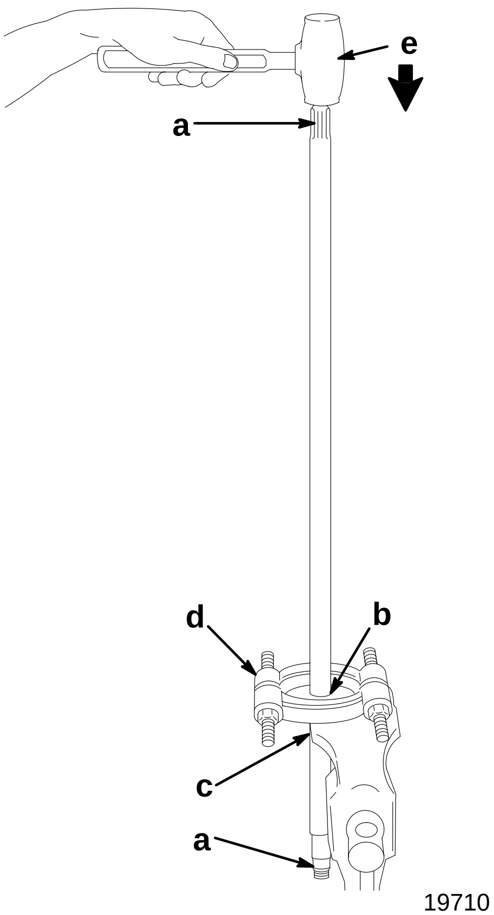
51119

a - Forward Gear Bearing
b - Universal Puller Plate (91-37241)
c - Mandrel

8. Replace drive shaft if splines are worn or twisted.
9. If bearing surface is damaged, replace drive shaft and corresponding bearing.

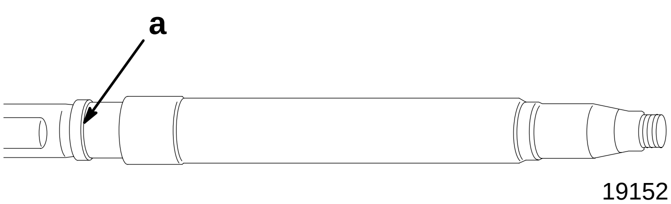
IMPORTANT: Do not tighten vise against drive shaft.

10. If wear sleeve is deeply grooved allowing water to enter gear case, remove (and discard) sleeve using Universal Puller Plate (91-37241) and lead hammer.



a - Splines
b - Bearing Surface
c - Wear Sleeve
d - Universal Puller Plate (91-37241)
e - Lead Hammer

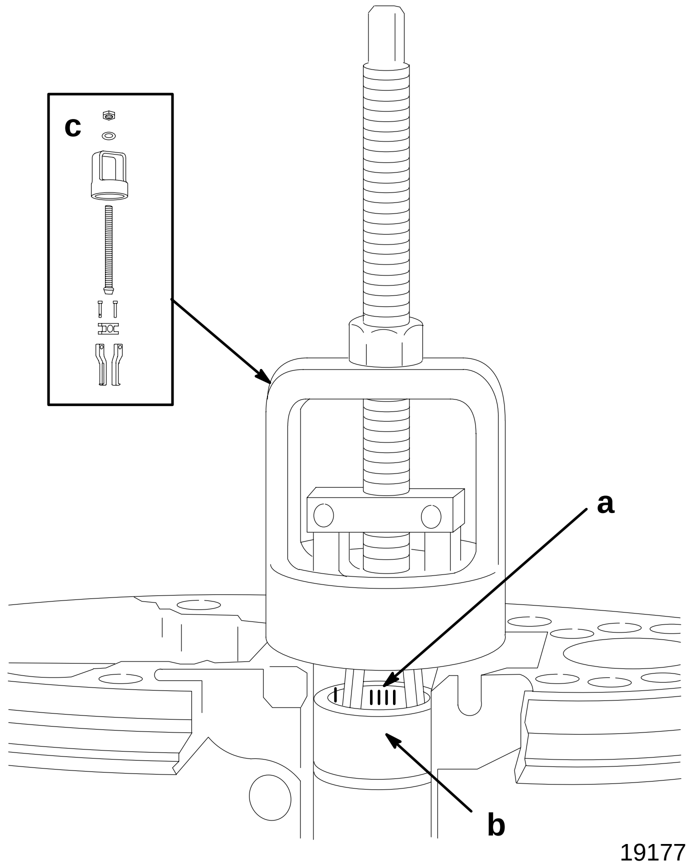
11. Remove (and discard) rubber ring.



a - Rubber Ring

Upper Drive Shaft Bearing

1. Replace upper drive shaft bearing and sleeve if either are rust stained, or if bearing will not roll freely. Remove bearing and then sleeve using Puller Assembly (91-83165M) with suitable jaws.

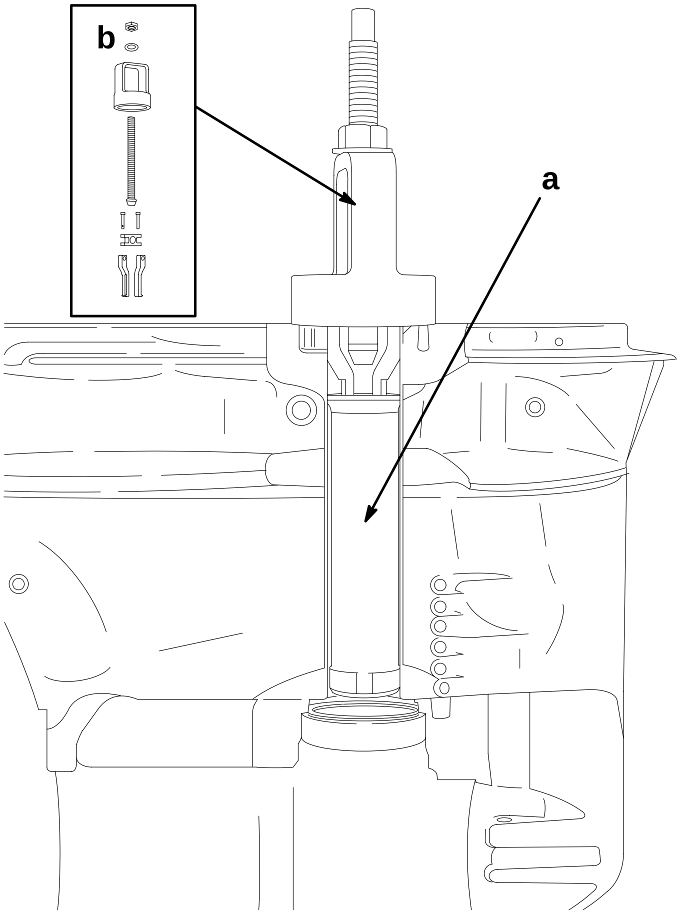


a - Upper Drive Shaft Bearing
b - Sleeve
c - Puller Assembly (91-83165M)

IMPORTANT: Upper drive shaft bearing/sleeve must be removed prior to oil sleeve removal. Refer to "Upper Drive Shaft Bearing," preceding.

Oil Sleeve

1. Remove oil sleeve (if necessary) using Puller Assembly (91-83165M) with suitable jaws.



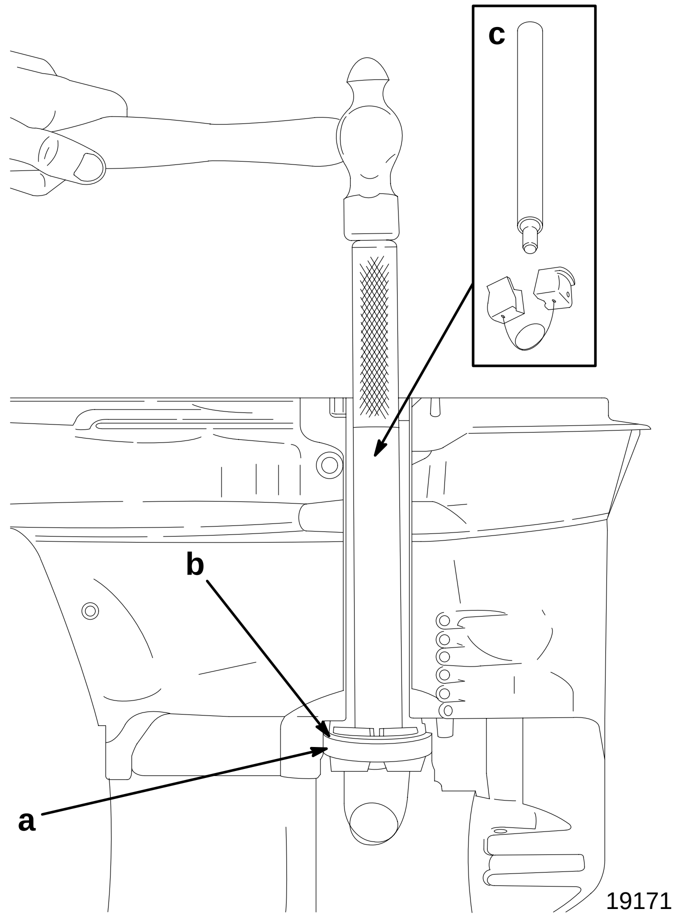
a - Oil Sleeve
b - Puller Assembly (91-83165M)

IMPORTANT: Upper drive shaft bearing/sleeve and oil sleeve do not have to be removed for lower drive shaft bearing race removal.

Lower Drive Shaft Bearing Race

IMPORTANT: Retain shim(s) for reassembly.

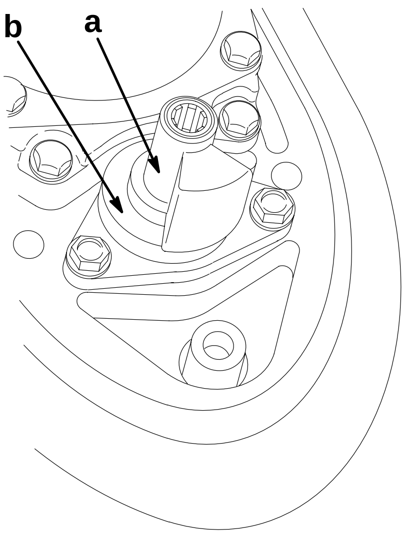
1. Remove race and shim(s) using bearing race tool (91-14308A1).



a - Race
b - Shim(s)
c - Bearing Race Tool (91-14308A1)

Shift Shaft

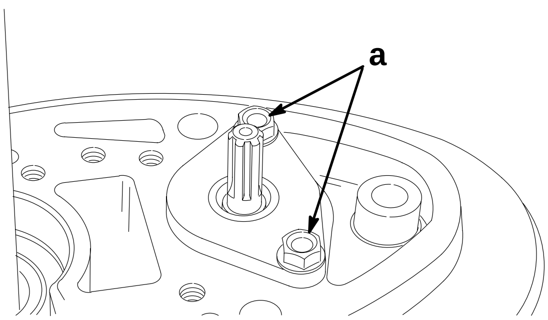
1. Remove shift shaft coupler and nylon spacer.



19221

a - Shift Shaft Coupler
b - Spacer

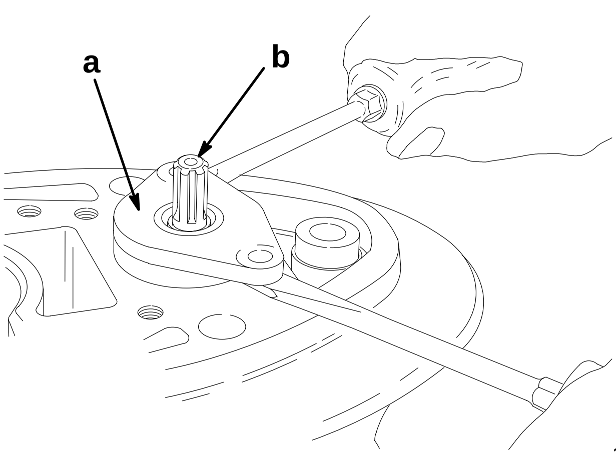
2. Remove bolts.



19216

a - Bolts

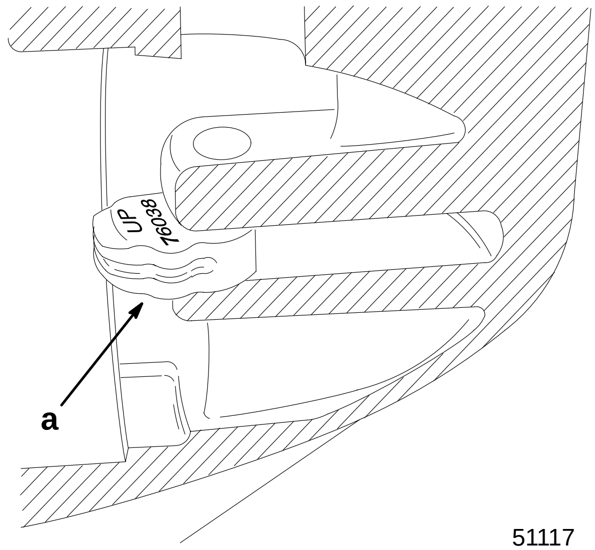
3. Remove shift shaft bushing and shift shaft.



19225

a - Bushing
b - Shift Shaft

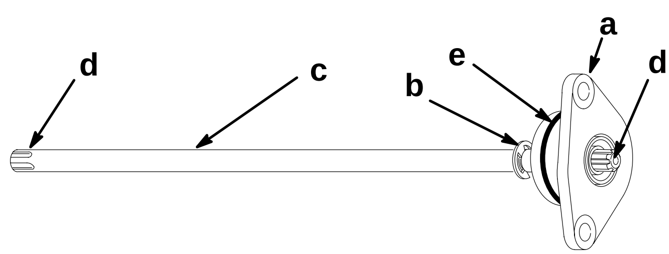
4. Remove shift cam from housing.
5. Replace shift cam if worn.



51117

a - Shift Cam

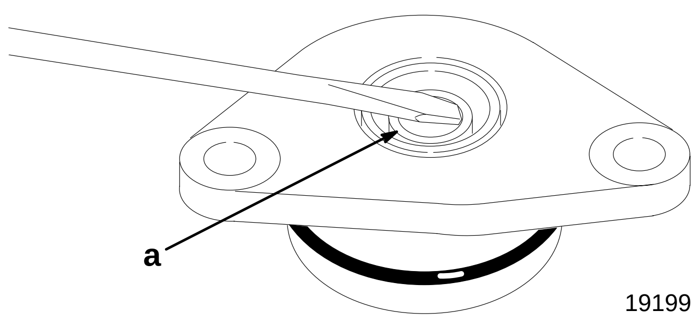
6. Remove shift shaft bushing and clip from shift shaft.
7. Replace shift shaft if splines are worn or shaft is twisted.
8. Remove (and discard) O-ring.



19200

a - Bushing
b - Clip
c - Shift Shaft
d - Splines
e - O-ring

9. Remove (and discard) seal.



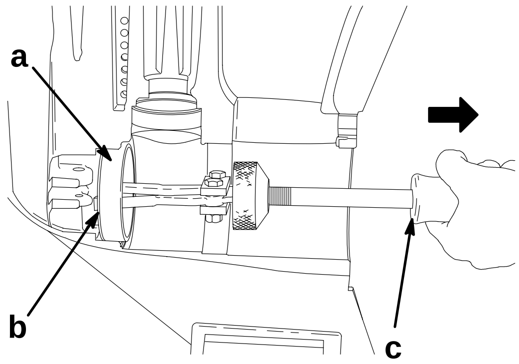
19199

a - Seal

Forward Gear Bearing Race

IMPORTANT: Retain shim(s) for reassembly.

1. Remove race and shim(s) using Slide Hammer (91-34569A1).



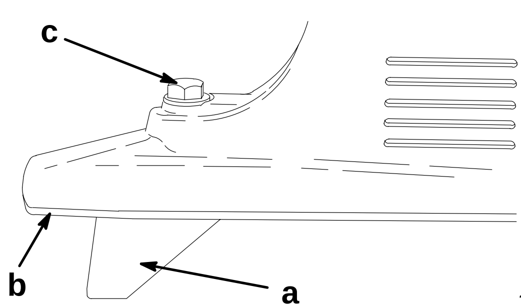
27653

a - Race
b - Shim(s)
c - Slide Hammer (91-34569A1)

Trim Tab Adjustment and Replacement

IMPORTANT: The trim tab is made of a special alloy to aid in protecting the drive shaft housing and gear housing from galvanic corrosion (corrosion and pitting of metal surfaces). Do not paint or place protective coating on the trim tab, or trim tab corrosion protection function will be lost.

1. Replace trim tab if 50% (or more) consumed. Mark location of old trim tab on anti-ventilation plate before removal; install new trim tab in same location.
2. The trim tab provides a means to offset (balance) some of the “steering load” that is caused by “propeller torque” at higher operating speeds. If at higher speeds the boat turns more easily to the left, loosen bolt, move the trim tab (trailing edge) to the left (when viewed from behind); retighten bolt. Turn trim tab (trailing edge) to the right if the boat turns more easily to the right.



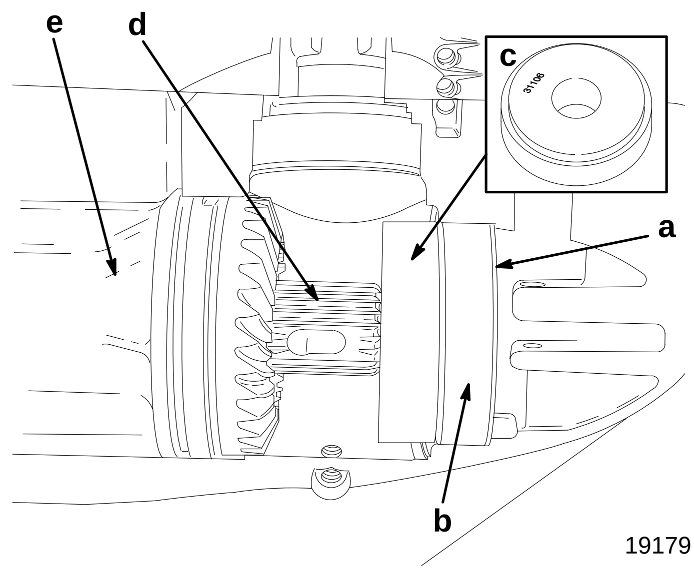
19172

a - Trim Tab
b - Anti-Ventilation Plate
c - Retaining Bolt and Washer; Torque Bolt to 22 lbs. ft. (29.8 N·m)

Reassembly

Forward Gear Bearing Race

1. Place shim(s) (retained from disassembly) into housing. If shim(s) were lost, or a new gear housing is being assembled, start with 0.010″ (0.254mm) shim(s).
2. Assemble components as shown; drive race into housing by striking propeller shaft end with lead hammer.

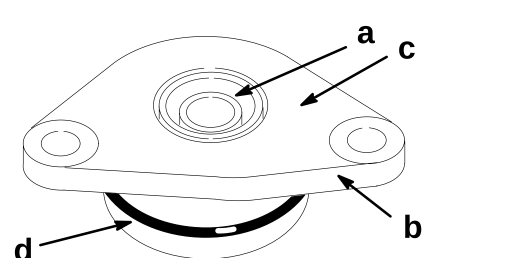


19179

a - Shim(s)
b - Race, Apply Quicksilver Needle Bearing Assembly Lubricant on O.D.
c - Mandrel (91-31106)
d - Disassembled Propeller Shaft
e - Assembled Bearing Carrier

Shift Shaft

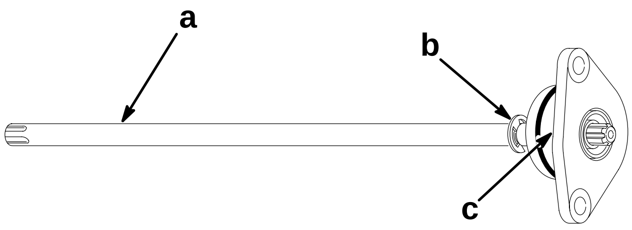
1. Apply Loctite 271 on O.D. of new seal.
2. Press seal into shift shaft bushing until seal is flush with surface.
3. Install new O-ring.
4. Apply 2-4-C with Teflon on O-ring and I.D. of seal.



19199

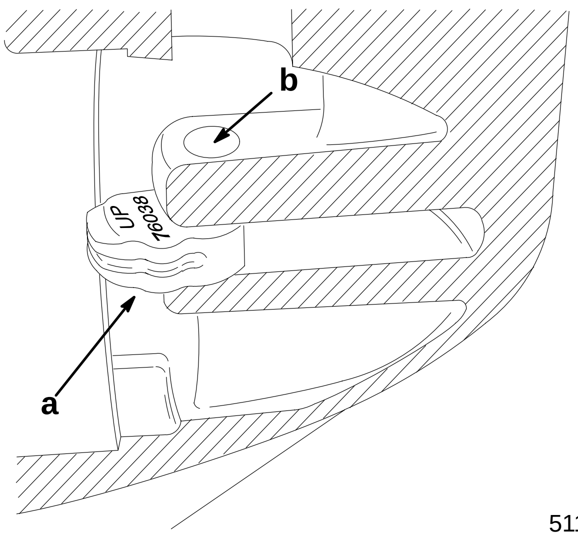
a - Seal
b - Bushing
c - Surface
d - O-ring

5. Assemble components as shown.



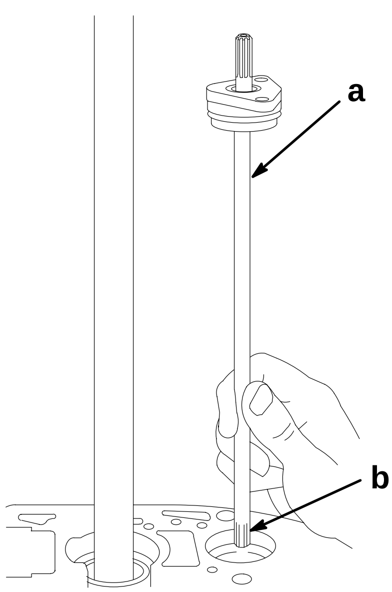
a - Shift Shaft
b - “E” Clip
c - Shift Shaft Bushing

6. Install shift cam (numbers toward top of gear housing); align hole in shift cam with hole.



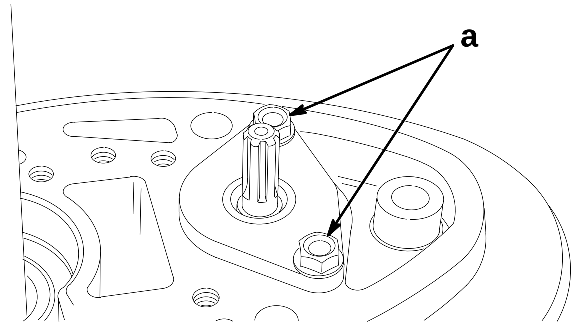
a - Shift Cam (Numbers UP)
b - Hole

7. Install shift shaft assembly; insert splines into shift cam.



a - Shift Shaft Assembly
b - Splines

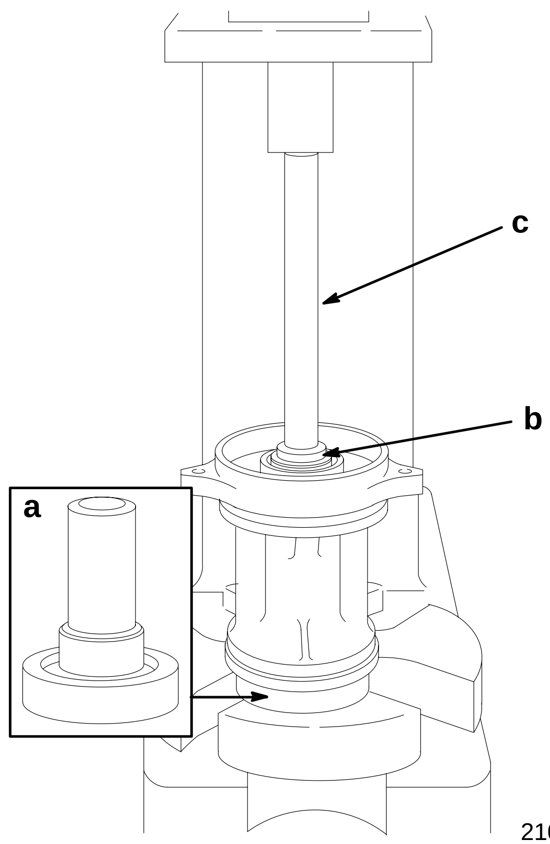
8. Apply Loctite 271 on bottom 1/2 of threads of bolts; install bolts and torque to 60 lb. in. (6.8 N·m).



a - Bolts [Torque to 60 lb. in. (6.8 N·m)]

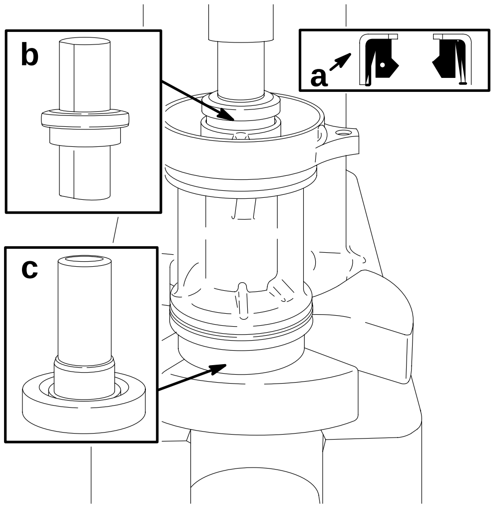
Bearing Carrier Reassembly

1. Lubricate O.D. of bearing and bearing carrier bore with Quicksilver 2-4-C w/Teflon.
2. Protect lip on forward side of bearing carrier, using bearing installation tool (91-13945).
3. Press propeller shaft needle bearing (number side toward mandrel) into carrier, until bearing bottoms out.



a - Bearing Installation Tool (91-13945)
b - Mandrel (91-37263)
c - Suitable Driver Rod

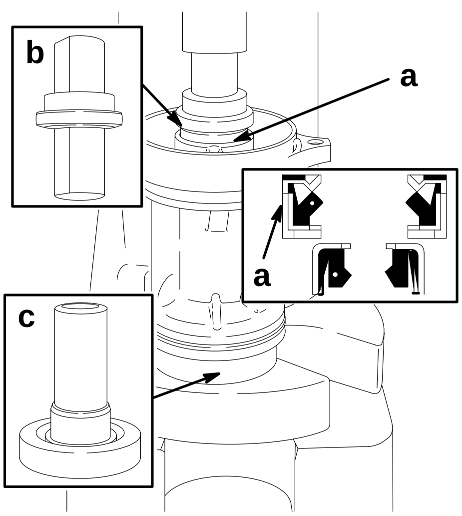
4. Place smaller diameter seal on longer shoulder of Oil Seal Driver (91-31108) with seal lip away from shoulder.
5. Protect lip on front side of bearing carrier using Bearing Installation Tool (91-13945). Apply Loctite 271 on O.D. of seal. Press seal into carrier until tool bottoms.



21040

a - Seal
b - Oil Seal Driver (91-31108)
c - Bearing Installation Tool (91-13945)

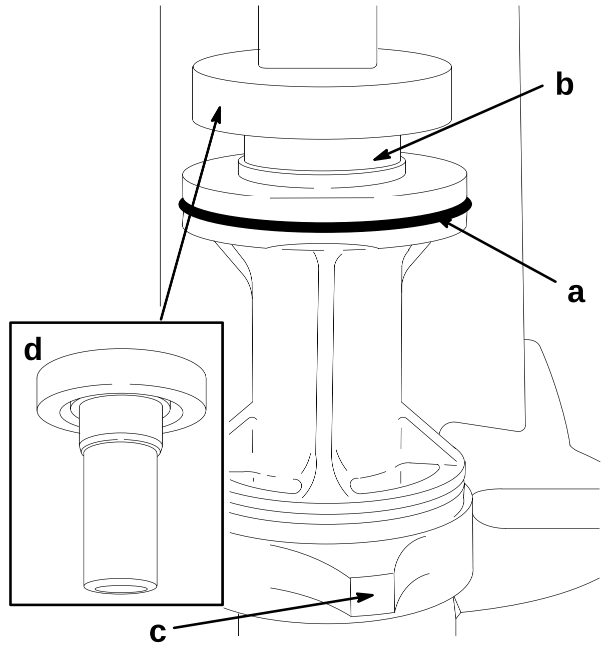
6. Place larger diameter seal on shorter shoulder of Oil Seal Driver (91-31108) with seal lip toward shoulder.
7. Protect lip on front side of bearing carrier using Bearing Installation Tool (91-13945). Apply Loctite 271 on O.D. of new seal. Press seal into carrier until tool bottoms.



21041

a - Seal
b - Oil Seal Driver (91-31108)
c - Bearing Installation Tool (91-13945)

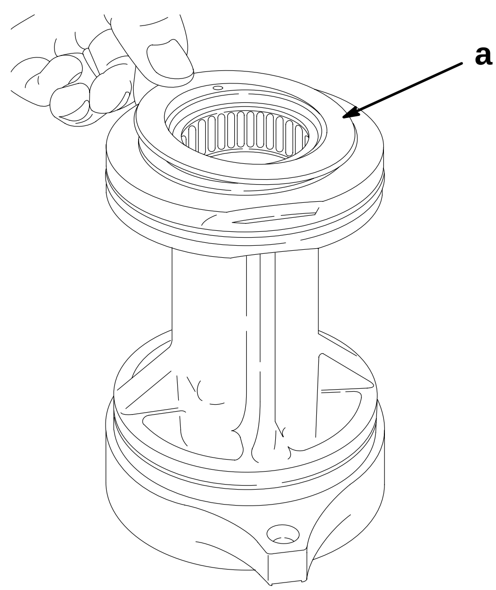
8. Install O-ring.
9. Lubricate O-ring with 2-4-C w/Teflon. Lubricate seal lips with 2-4-C w/Teflon (92-825407A12). Lubricate outside diameter of bearing with a light coating of 2-4-C w/Teflon.
10. Press bearing into carrier until tool bottoms.



19163

a - O-ring
b - Bearing, Numbered Side Toward Tool
c - Seal Lips
d - Bearing Installation Tool (91-13945)

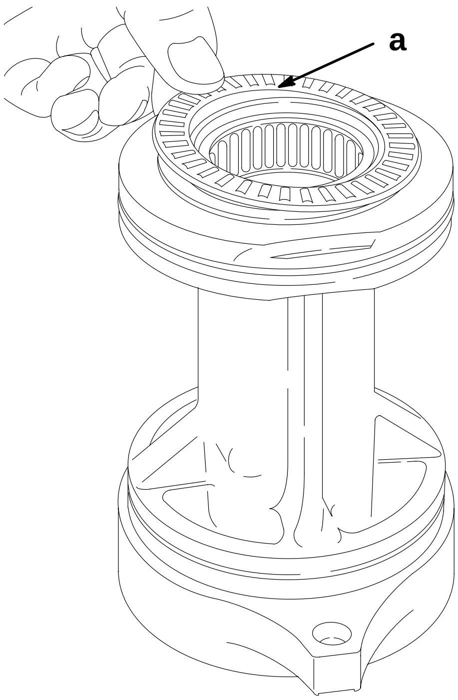
11. Install thrust washer. Coat thrust washer with Quicksilver Gear Lubricant (92-13783A24).



19167

a - Thrust Washer

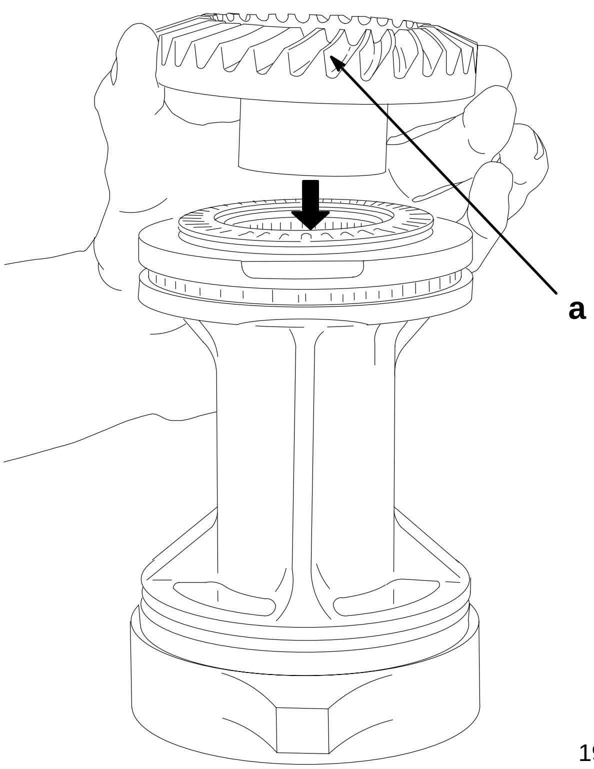
12. Install thrust bearing . Coat thrust bearing with Quicksilver Gear Lubricant (92-13783A24).



19168

a - Thrust Bearing

13. Install reverse gear.

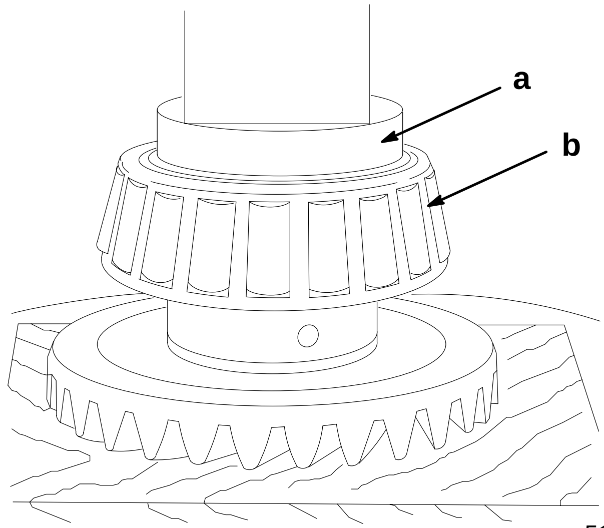


19202

a - Reverse Gear

Forward Gear Reassembly

1. Press bearing onto gear (press only on inner race of bearing).

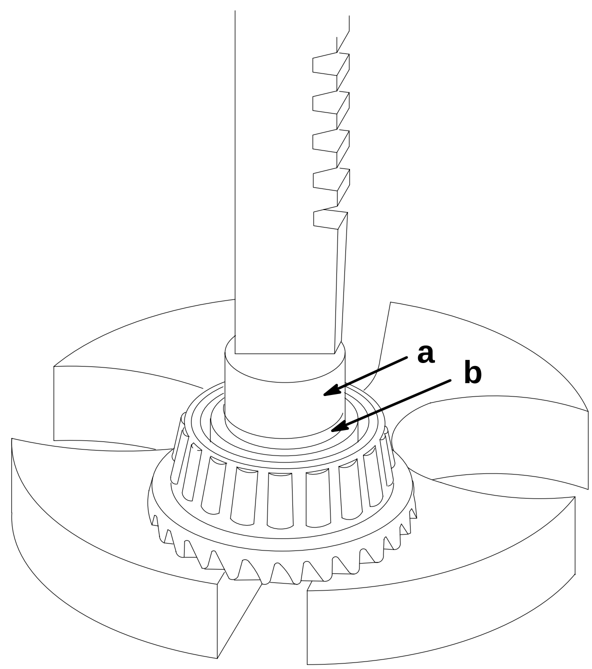


51869

a - Mandrel (91-37350)
b - Bearing; Lubricate I.D. with Quicksilver 2-4-C w/Teflon

2. Apply 2-4-Cw/Teflon to bore in center of gear.
3. Press bearing into gear until bearing bottoms out.

NOTE: Do not apply pressing force AFTER bearing bottoms out as bearing damage could result.

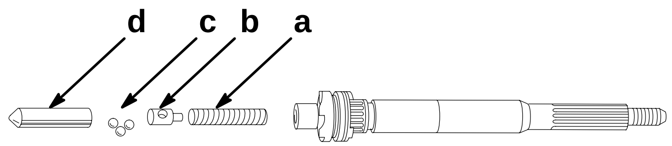


28062

a - Mandrel
b - Bearing, Numbered Side Toward Mandrel

Propeller Shaft Reassembly

1. Install components into propeller shaft in sequence shown.

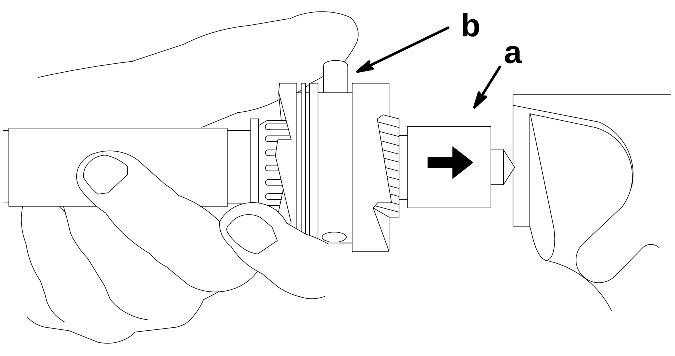


19154

a - Spring
b - Guide Block
c - 3 Metal Balls*
d - Cam Follower*

*Hold in Place With Quicksilver 2-4-C w/Teflon

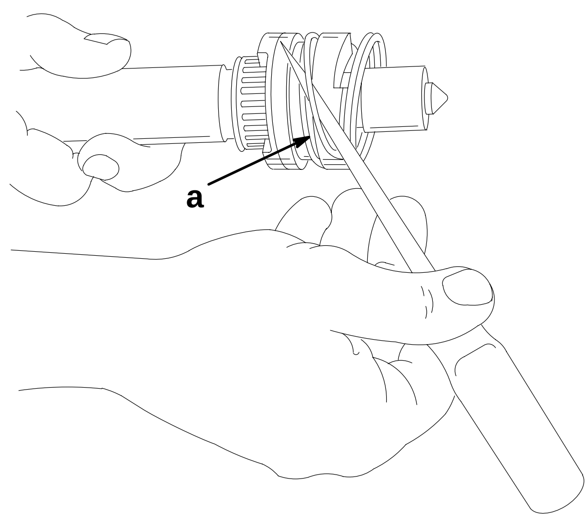
2. Install cross pin.



51800

a - Apply Pressure in This Direction
b - Cross Pin

3. Install spring. DO NOT overlap springs.



51876

a - Spring

Drive Shaft Wear Sleeve Installation

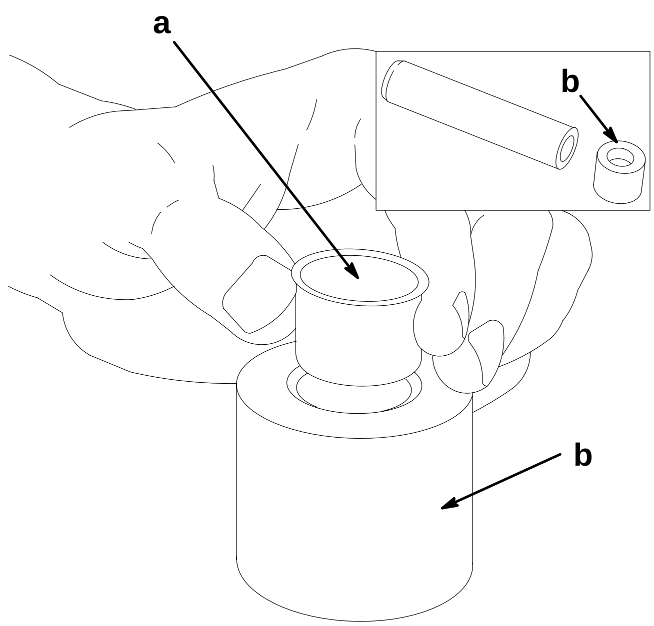
1. Install new rubber ring.
2. Apply a light coat of Loctite 271 on outside diameter of rubber ring.

19152

a - Ring

3. Insert sleeve into holder*.

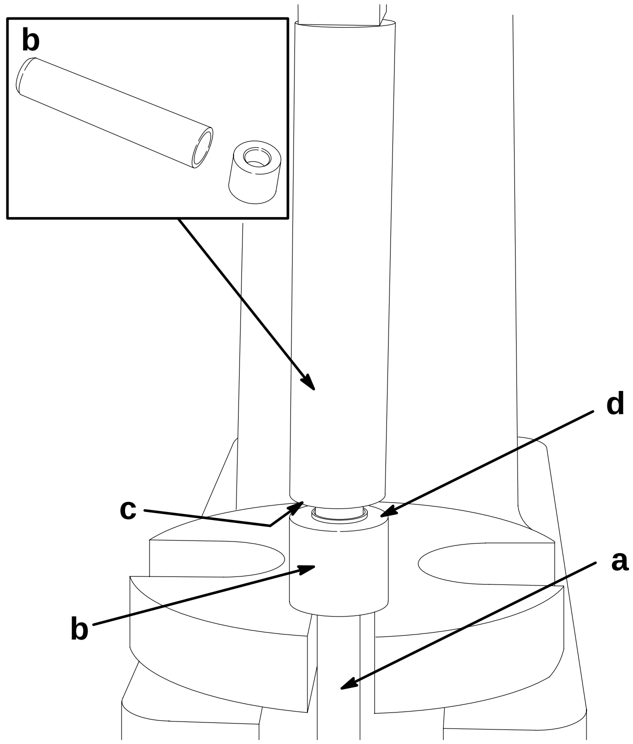
*Component of Wear Sleeve Installation Tool (91-14310A1).



19169

a - Sleeve
b - Holder

4. Press sleeve onto drive shaft using Wear Sleeve Installation Tool (91-14310A1); continue pressing until surface contacts surface.



19166

a - Drive Shaft
b - Wear Sleeve Installation Tool
c - Surface
d - Surface

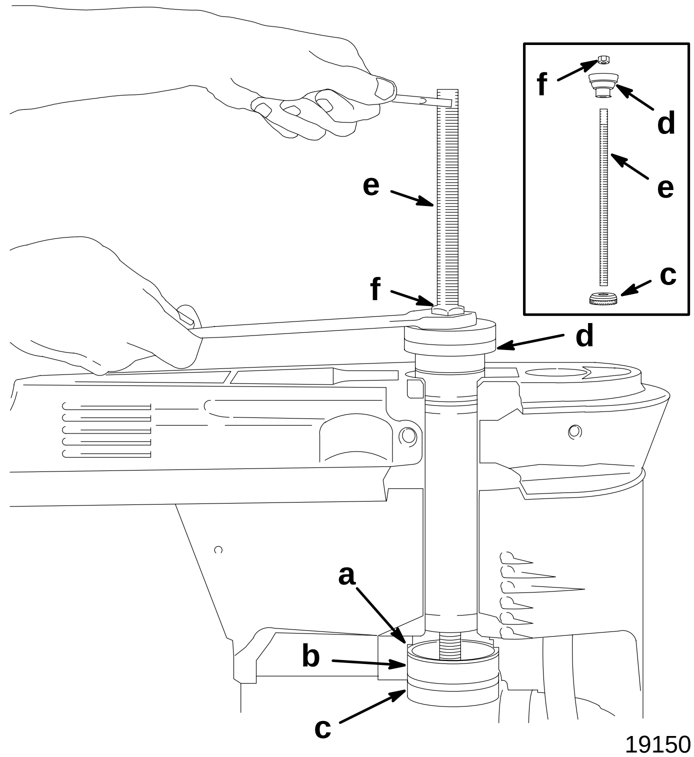
5. Remove excess Loctite from assembled shaft.

Lower Drive Shaft Bearing Race Installation

IMPORTANT: Lower drive shaft bearing cup can be installed with or without upper drive shaft bearing/sleeve and oil sleeve installed.

1. Lubricate O.D. of bearing race with Quicksilver 2-4-C w/Teflon.
2. Install shim(s) and bearing race into housing.

NOTE: Verify shim(s) are not cocked when drawing up race.



19150

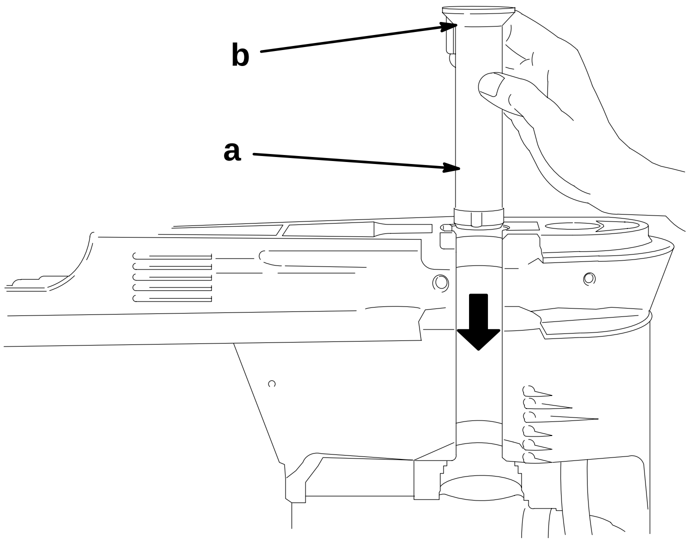
a - Shim(s); Retained From Disassembly. If Shim(s) Were Lost or a New Gear Housing is Being Assembled, Start With 0.025″ (0.635mm) Shim(s)
b - Bearing Race
c - Mandrel*
d - Mandrel*
e - Threaded Rod** (91-31229)
f - Nut** (11-24156)

*From Bearing Installation Tool (91-14309A1)

**From Bearing Removal and Installation Kit (91-31229A5)

Oil Sleeve Installation

1. Install oil sleeve with tab positioned as shown.

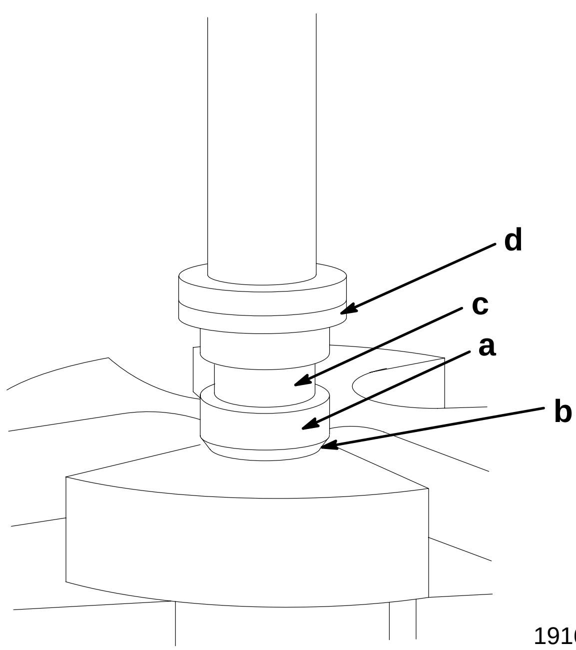


19173

a - Oil Sleeve
b - Tab

Upper Drive Shaft Bearing Installation

1. Lubricate I.D. of bearing holder and O.D. of bearing with 2-4-C w/ Teflon.
2. Press bearing into sleeve.



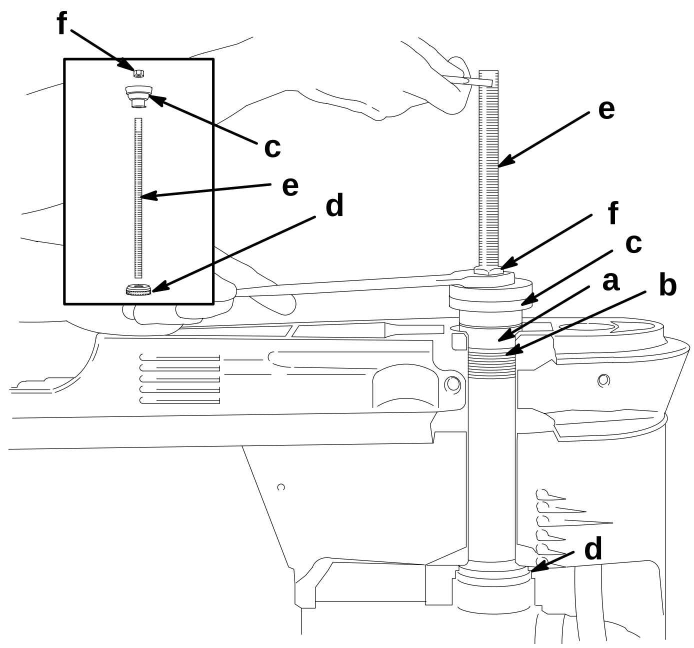
19164

a - Bearing Sleeve
b - Tapered End
c - Bearing; Numbered Side Toward Mandrel
d - Mandrel; From Bearing Installation Tool (91-14309A1)

IMPORTANT: Oil sleeve must be installed prior to upper drive bearing installation.

IMPORTANT: Upper drive shaft bearing/sleeve can be installed with or without lower drive shaft bearing cup installed.

3. Install bearing/sleeve into housing.



19151

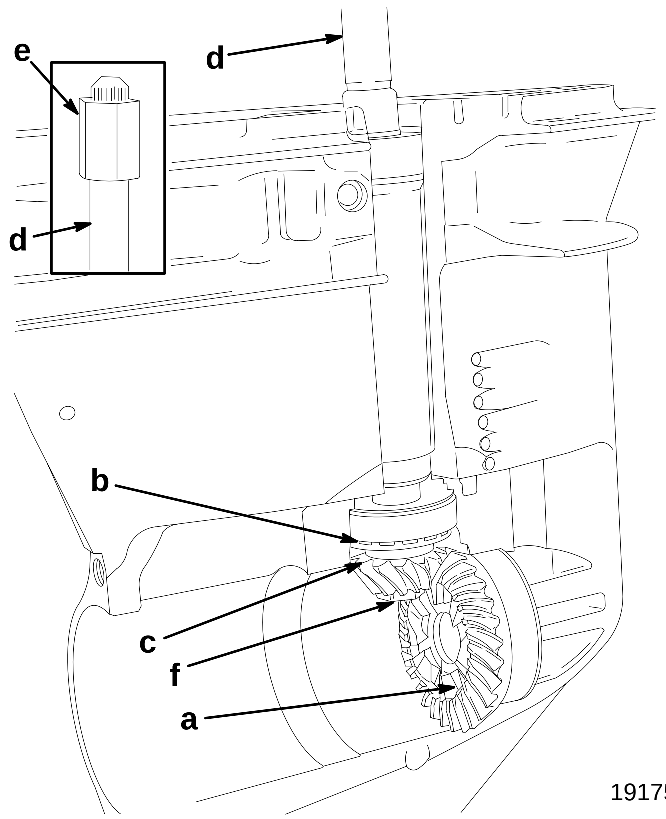
a - Bearing/Sleeve
b - Tapered End
c - Mandrel*
d - Mandrel*
e - Threaded Rod** (91-31229)
f - Nut** (11-24156)

*From Bearing Installation Tool (91-14309A1)

**From Bearing Removal and Installation Kit (91-31229A5)

Forward Gear, Lower Drive Shaft Bearing, Pinion Gear, and Drive Shaft Installation

1. Install components in sequence shown.



19175

a - Forward Gear/Bearing: Work Quicksilver gear lube into bearing rollers.
b - Lower Drive Shaft Tapered Roller Bearing: Work Quicksilver gear lube into bearing rollers.
c - Pinion Gear
d - Drive Shaft
e - Drive Shaft Holding Tool (91-56775)
f - Pinion Nut (New): Apply Loctite 271 to threads during final assembly (after pinion gear depth and forward gear backlash have been set), torque to 70 lb. ft. (95 N·m).

Pinion Gear Depth and Forward Gear Backlash

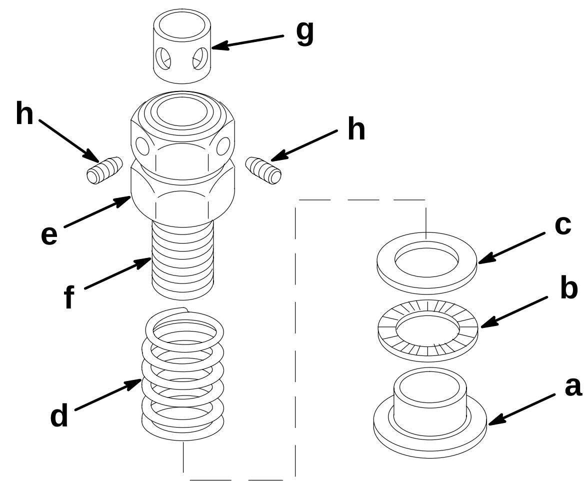
DETERMINING PINION GEAR DEPTH

NOTE: Read entire procedure before attempting any change in shim thickness.

IMPORTANT: Forward gear assembly must be installed in gear housing when checking pinion gear depth or an inaccurate measurement will be obtained.

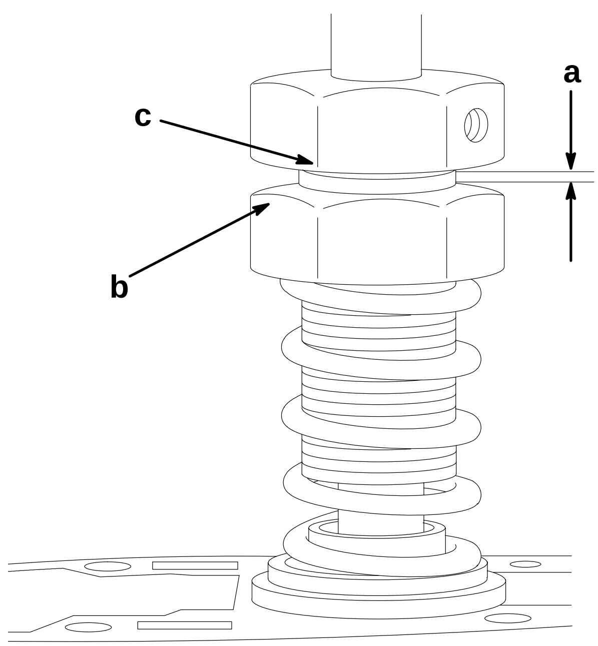
1. Clean the gear housing bearing carrier shoulder and diameter.

2. With gear housing positioned up right (drive shaft vertical), install Bearing Preload Tool (91-14311A1) over drive shaft in sequence shown.



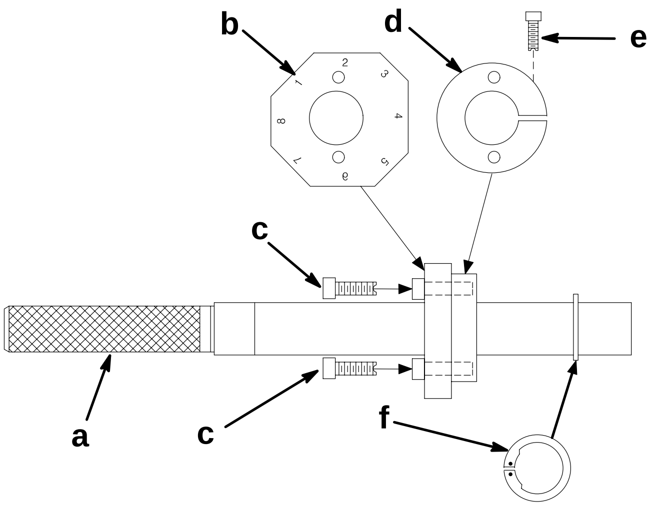
a - Adaptor: Bearing surfaces clean and free of nicks
b - Thrust Bearing: Oiled and able to move freely
c - Thrust Washer: Clean and free of nicks and bends
d - Spring
e - Nut: Threaded all-the-way onto bolt
f - Bolt: Held snug against spring
g - Sleeve: Holes in sleeve must align with set screws
h - Set Screw (2): Tightened against drive shaft, bolt should not slide on drive shaft.

3. Measure distance (a) between top of nut (b) and bottom of bolt head (c).
4. Increase distance (a) by 1″ (25.4mm).
5. Rotate drive shaft 5 to 10 revolutions. This should properly seat upper drive shaft tapered roller bearing.



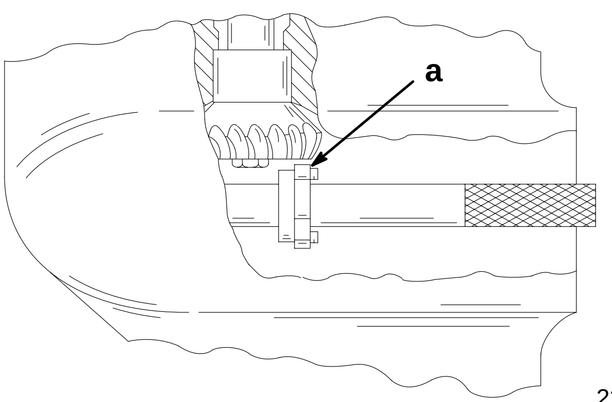
19884

6. Assembly Pinion Gear Locating Tool (91-12349A2) as shown; do not tighten collar retaining bolt at this time.



a - Arbor
b - Gauging Block; Install With Numbers Away From Split Collar
c - Bolt; Gauging Block Retaining
d - Split Collar
e - Bolt; Collar Retaining
f - Snap Ring

7. Insert tool into forward gear assembly; position gauging block under pinion gear as shown.



22067

a - Gauging Block

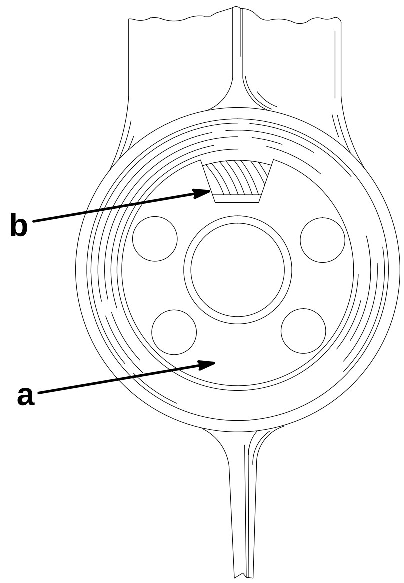
8. Remove tool, taking care not to change gauging block position, and tighten collar retaining bolt.

9. Insert tool into forward gear assembly; position proper numbered flat (from chart) of gauging block – under pinion gear.

MODEL	GEAR RATIO (PINION GEAR TEETH/ REVERSE GEAR TEETH)	USE FLAT NO.
75-thru-90 (3 Cylinder)	13/30	8
100/115/125 (4 Cylinder)	14/29	2

10. Install the number "3" locating disc against bearing carrier shoulder in gear housing.

11. Position access hole as shown.



24643

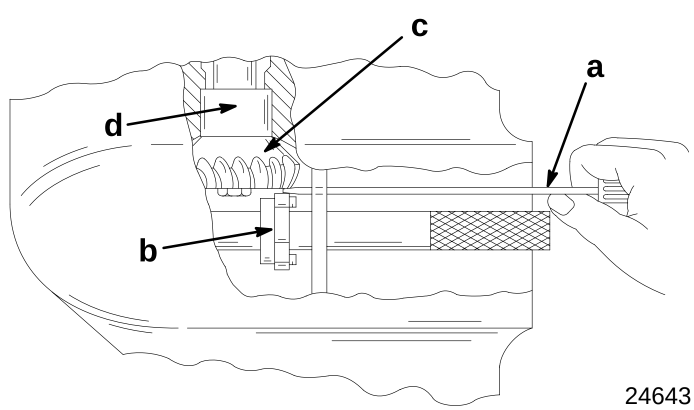
a - Locating Disc
b - Access Hole

12. Determine pinion gear depth by inserting a feeler gauge thru access hole in locating disc.

13. The correct clearance between gauging block and pinion gear is 0.025″ (0.64mm).

14. If clearance is correct, leave Bearing Preload Tool on drive shaft and proceed to "Determining Forward Gear Backlash," following.

15. If clearance is incorrect, add (or subtract) shims from above bearing race to lower (or raise) pinion gear. When reinstalling pinion nut, apply Loctite 271 on threads of nut.



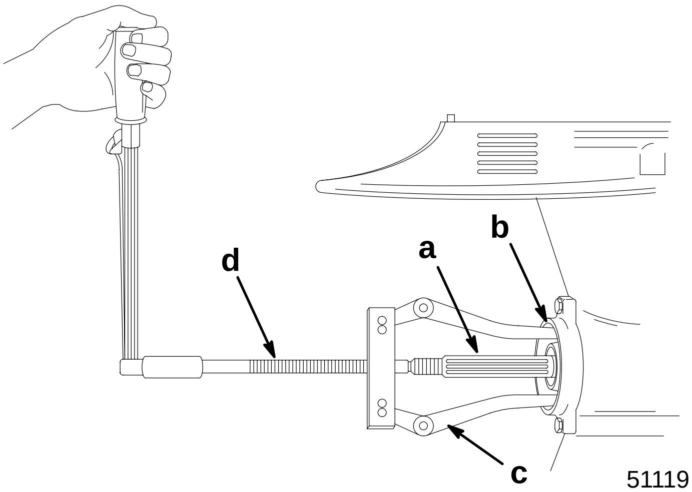
24643

a - Feeler Gauge
b - Gauging Block
c - Pinion Gear
d - Bearing Race

DETERMINING FORWARD GEAR BACKLASH

NOTE: Read entire procedure before attempting any change in shim thickness.

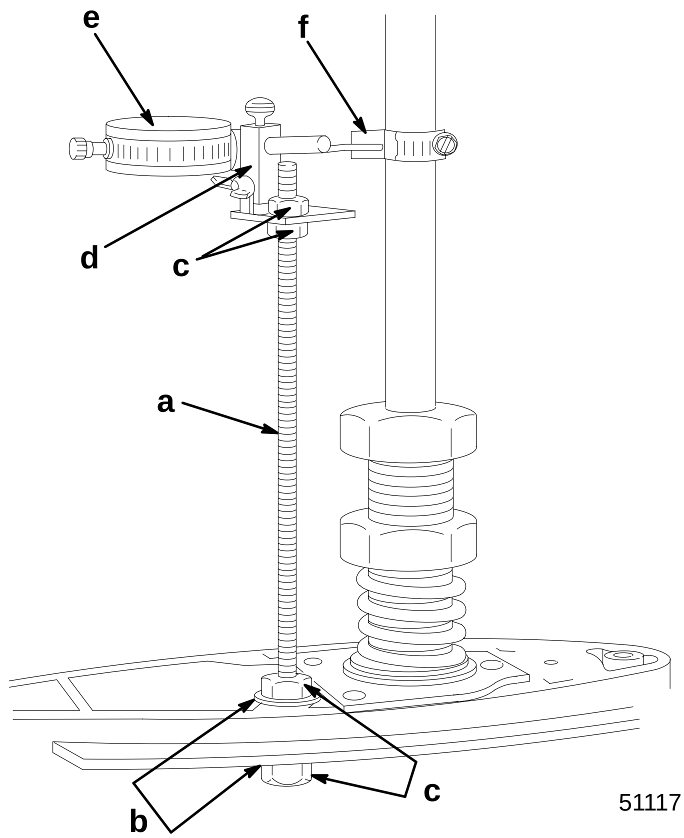
1. Obtain correct pinion gear depth; refer to “Determining Pinion Gear Depth,” preceding.
2. Install Bearing Preload Tool (91-14311A1) on drive shaft; refer to “Determining Pinion Gear Depth,” preceding.
3. Install components as shown.



a - Propeller Shaft*
b - Bearing Carrier* (Assembled)
c - Puller Jaws (91-46086A1)
d - Puller Bolt (91-85716); Torque to 45 lbs. in. (5.1 N·m)

*Refer to “Bearing Carrier and Propeller Shaft Installation,” following.

4. Rotate drive shaft 5 to 10 revolutions. This should properly seat forward gear tapered roller bearing.
5. Install components as shown.



a - Threaded Rod (Obtain Locally)
b - Washers
c - Nuts
d - Dial Indicator Adaptor Kit (91-83155)
e - Dial Indicator (91-58222A1)
f - Backlash Indicator Tool

6. Position Dial Indicator on appropriate line (from chart) marked on Backlash Indicator Tool.

MODEL	ALIGN POINTER OF DIAL INDICATOR WITH MARK
75-thru-90 (3 Cylinder) Backlash Indicator Tool (91-78473)	4
100/115/125 (4 Cylinder) Backlash Indicator Tool (91-19660)	1

7. Lightly turn drive shaft back-and-forth (no movement should be noticed at propeller shaft).
8. Dial Indicator registers amount of backlash, which must be between specification shown in chart.

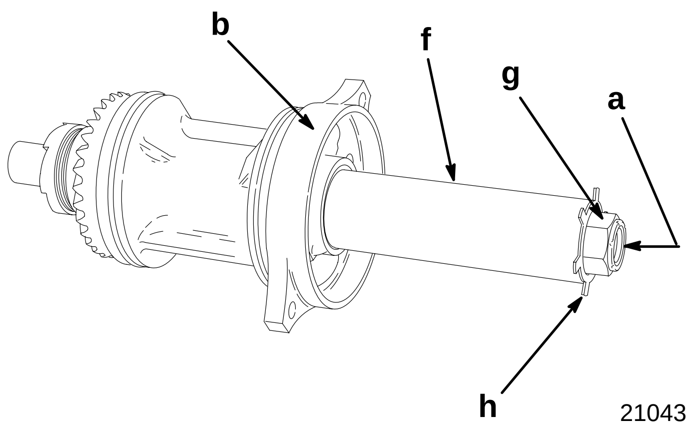
MODEL	DIAL INDICATOR MINIMUM	READING MAXIMUM
75-thru-90 (3 Cylinder)	0.012 in. (0.30mm)	0.019 in. (.48mm)
100/115/125 (4 Cylinder)	0.015 in. (0.38mm)	0.022 in. (0.55mm)

9. If backlash is less than the minimum specification, remove shim(s)* from in front of forward gear bearing race to obtain correct backlash. When reinstalling pinion nut, apply Loctite 271 on threads of nut.
10. If backlash is more than the maximum specification, add shim(s)* in front of forward gear bearing race to obtain correct backlash. When reinstalling pinion nut, apply Loctite 271 on threads of nut.

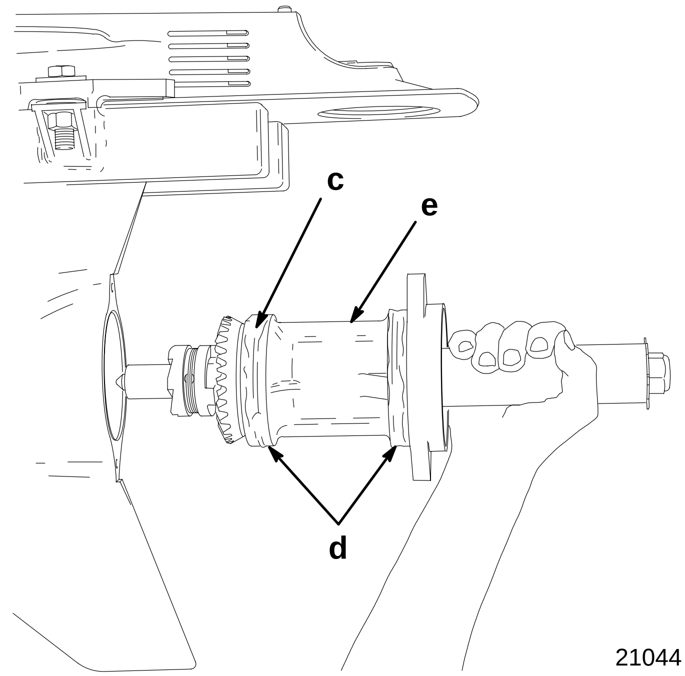
* By adding or subtracting 0.001″ (0.025mm) shim, the backlash will change approximately 0.001″ (.025mm).

Bearing Carrier and Propeller Shaft Installation

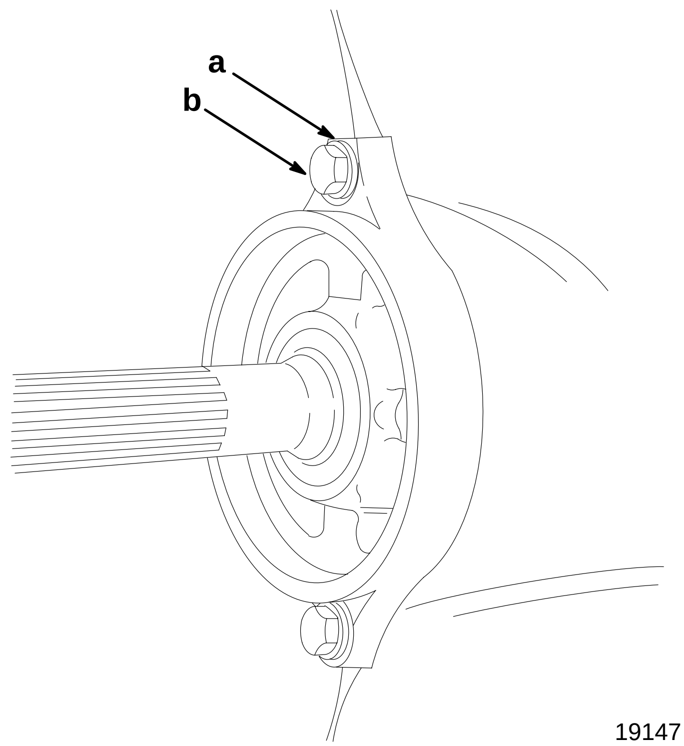
1. Insert propeller shaft assembly into bearing carrier.
2. Before installing bearing carrier assembly into gear housing, obtain locally a 6″ (152.4mm) long by 1-1/4″ – 1-1/2″ (31.7 – 38.1mm) diameter piece of PVC pipe. Install the PVC pipe (f) over the prop shaft (a) and secure the pipe against the bearing carrier assembly (b) with the propeller nut (g) and tab washer (h). This will allow the reverse gear to apply pressure to the reverse gear thrust bearing to prevent the thrust bearing from being inadvertently dislodged as the bearing carrier assembly is installed in the gear housing.



3. Lubricate o-ring (c) and areas (d) with 2-4-C w/ Teflon (92-825407A12).
4. Install bearing carrier and propeller shaft into housing with the word “TOP” located on flange (e) toward top of housing.



5. Install components as shown.



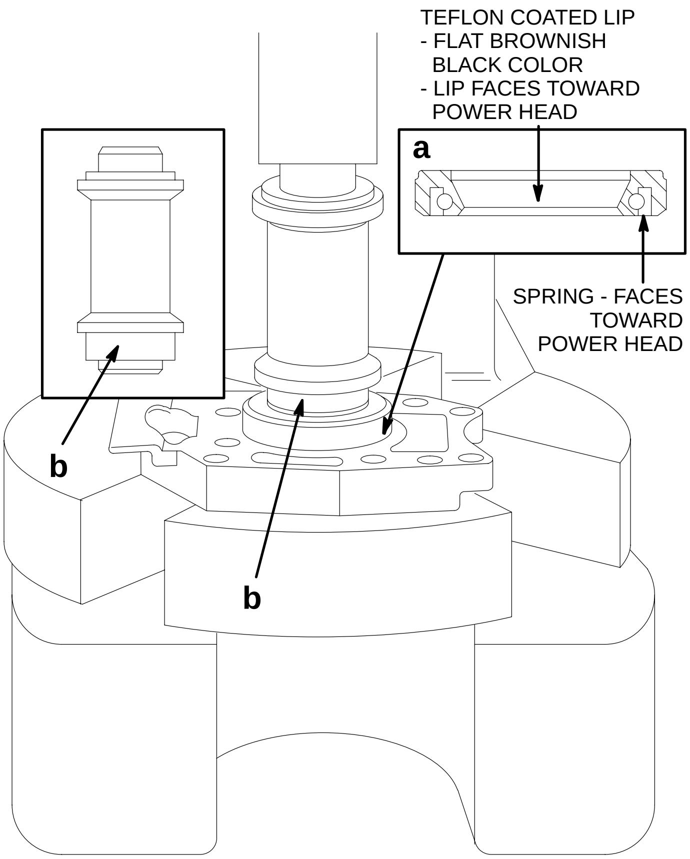
a - Washers

b - Bolts; Apply Loctite 271 on Threads and Torque to 21.7 lb. ft. (29.4 N·m)

NOTE: If nuts are used in place of bolts (b), torque nuts to 21.7 lb. ft. (29.4 N·m).

Water Pump Reassembly and Installation

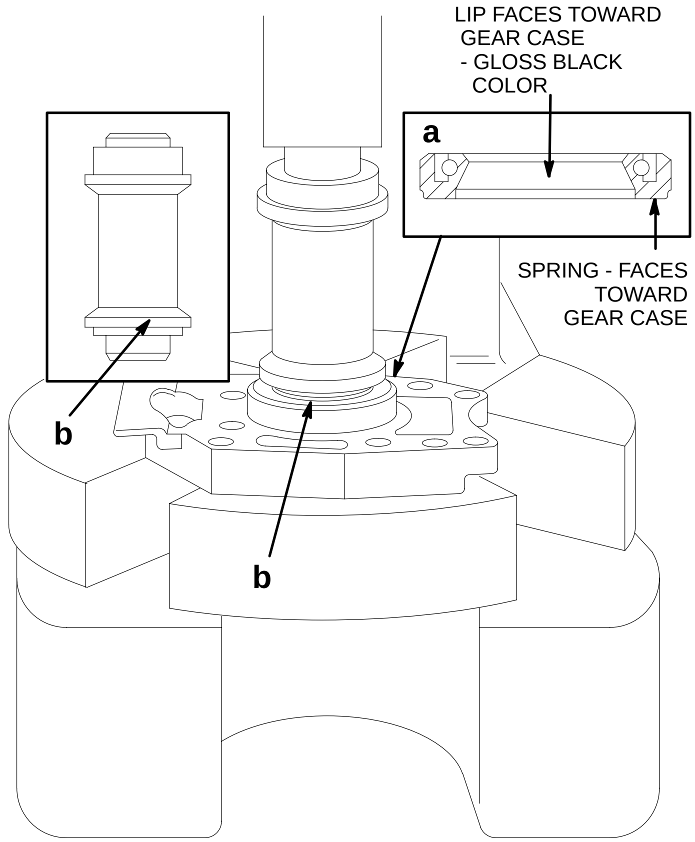
6. Place seal on longer shoulder side of Oil Seal Driver (91-13949) with seal lip away from shoulder.
7. Apply Loctite 271 on O.D. of seal; press seal into water pump base until tool bottoms.



51553

a - Seal
b - Oil Seal Driver (91-13949)

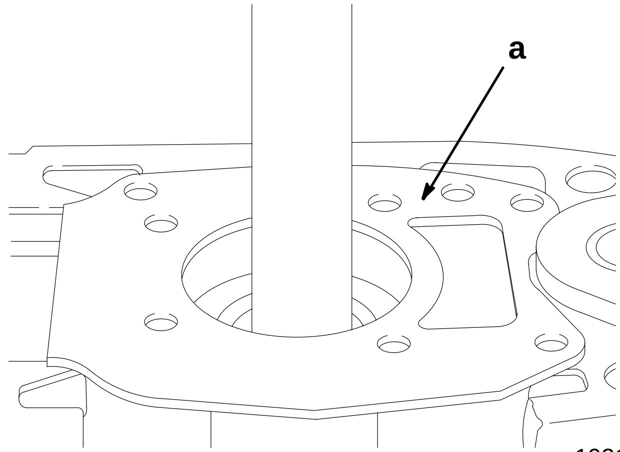
8. Place seal on shorter shoulder side of Oil Seal Driver (91-13949) with seal lip toward shoulder.
9. Apply Loctite 271 on O.D. of seal; press seal into water pump base until tool bottoms.
10. Lubricate lip of each seal with Quicksilver 2-4-C w/ Teflon (92-825407A12).



51553

a - Seal
b - Oil Seal Driver (91-13949)

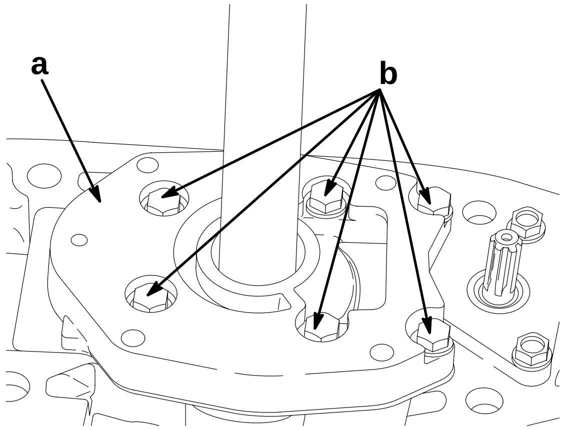
11. Install gasket.



19218

a - Gasket

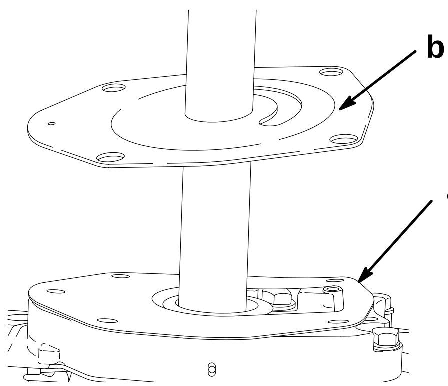
12. Install components as shown.



19217

a - Water Pump Base
b - Bolts and Washers; Apply Loctite 271 on Threads and Torque to 60 lb. in. (6.8 N·m).

13. Install gasket and plate.

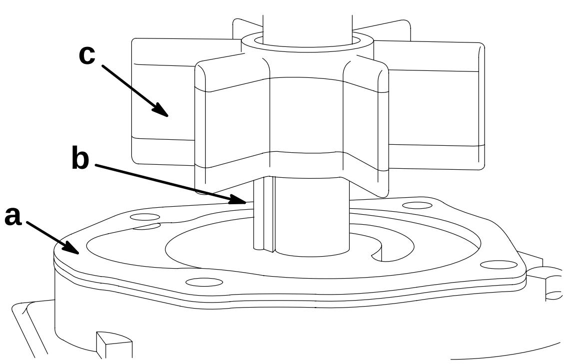


19219

a - Gasket
b - Plate

IMPORTANT: If the old impeller will be re-used, impeller must be installed in original (clockwise) direction of rotation.

14. Install gasket, drive key and impeller.



19220

a - Gasket
b - Drive Key
c - Impeller

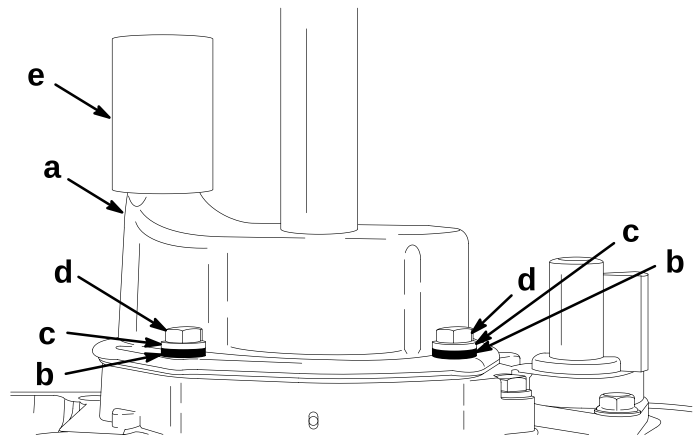
15. Lubricate I.D. of cover with Quicksilver 2-4–C w/ Teflon (92-825407A12).

16. Rotate drive shaft clockwise and push cover down over impeller.

17. Install cover.

18. If water tube seal stayed on water tube (inside of drive shaft housing) when gear housing was removed, pull water tube seal from water tube.

19. Lubricate I.D. of water tube seal with Quicksilver 2-4-C w/Teflon (92-825407A12) and install as shown.



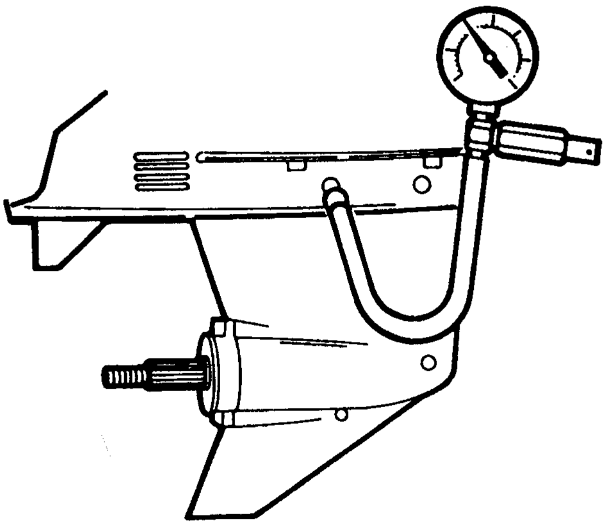
19212

a - Cover
b - Isolators (4) – If Equipped
c - Washers (4)
d - Bolts (4); Apply Loctite 271 on Threads and Torque to 60 lb. in. (6.8 N·m).
e - Water Tube Seal

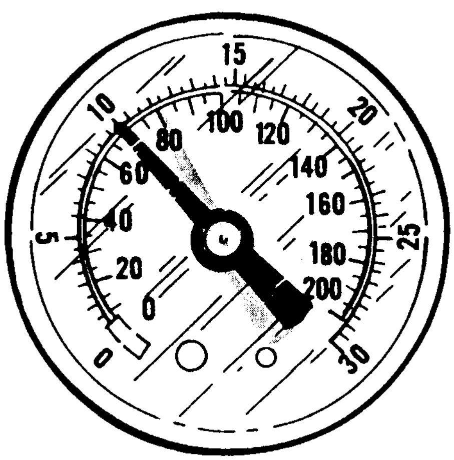
NOTE: It is recommended that the gearcase be pressure tested for leaks after reassembly and BEFORE gear lube is added. Gearcase should hold 10 to 12 psi for 5 minutes.

Gear Housing Pressure Test

1. Remove vent plug and install pressure test gauge



2. Pressurized housing to 10 to 12 psi and observe gauge for 5 minutes.
3. Rotate drive shaft,prop shaft and move shift shaft while housing is pressurized to check for leaks.



4. If pressure drop is noted, immerse housing in water.
5. Re-pressurize to 10 to 12 psi and check for air bubbles.
6. Replace leaking seals as necessary. Retest housing.

Note: Gearcase should hold 10 to 12 psi for 5 minutes.

7. Remove tester from housing and install vent plug.

Filling Gear Housing With Lubricant

NOTE: Gear housing lubricant capacity is 22.5 fl. oz. (665.2ml).

⚠ WARNING

If gear housing is installed on engine, to avoid accidental starting, disconnect (and isolate) spark plug leads from spark plugs before working near the propeller.

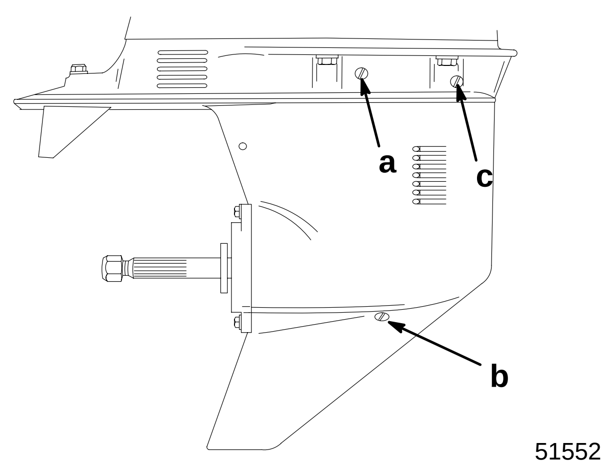
⚠ CAUTION

Do not use automotive grease in the gear housing. Use only Quicksilver Gear Lube or Quicksilver Super-Duty Lower Unit Lubricant.

1. Remove any gasket material from “Fill” and “Vent” screws and gear housing.
2. Install new gaskets on “Fill” and “Vent” screws.

IMPORTANT: Never apply lubricant to gear housing without first removing “Vent” screws or gear housing cannot be filled because of trapped air. Fill gear housing only when housing is in a vertical position.

3. Remove lubricant “Fill” screw and gasket from gear housing.
4. Insert lubricant tube into “Fill” hole, then remove “Vent” screws and gaskets.
5. Fill gear housing with lubricant until excess starts to flow out of one (first) “Vent” screw hole.
6. Replace this lubricant “Vent” screw and gasket only and continue filling until excess starts to flow out of second lubricant “Vent” screw hole.



a - Vent Screw
b - Fill/Drain Screw
c - Oil Level Vent Screw

7. Replace second lubricant “Vent” screw and gasket.

IMPORTANT: Do not lose more than one fluid ounce (30cc) of gear lubricant while reinstalling “FILL” screw.

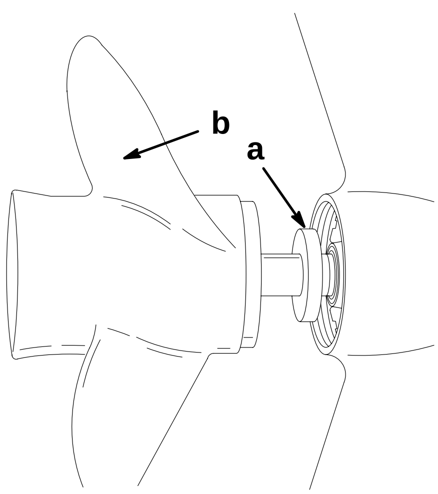
8. Remove lubricant tube from “Fill” hole; install “Fill” screw and gasket.

Propeller Installation

⚠ WARNING

If gear housing is not removed from drive shaft housing, before attempting to remove or install the propeller, remove (and isolate) spark plug leads from spark plugs to prevent engine from starting accidentally.

1. Apply a liberal coat of one of the following Quicksilver products on propeller shaft splines:
   - Special Lubricant 101 (P/N 92-13872A1)
   - 2-4-C w/Teflon (92-825407A12)
   - Anti-Corrosion Grease (92-19007A24)
2. Install components as shown.



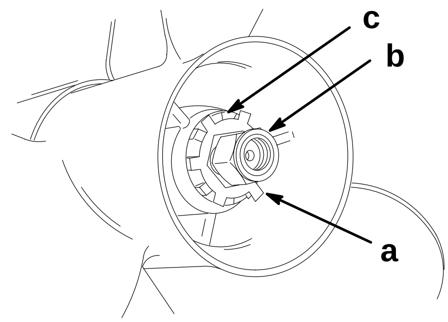
a - Thrust Hub; Flat Surface Toward Propeller
b - Propeller

3. Install tab washer and locknut.
4. Thread locknut onto propeller shaft until locknut is recessed into tab washer.
5. Torque locknut to 55 lbs. ft. (75 N·m).
6. Bend 3 tabs of tab washer down into grooves to secure locknut. If tab washer tabs do not align with slots, continue to tighten locknut to obtain alignment.

⚠ CAUTION

Do not misinterpret propeller shaft movement with propeller movement. If propeller and propeller shaft together move forward-and-aft, this is normal; however, propeller should not move forward-and-aft on propeller shaft.

7. After first use, retighten propeller nut and again secure with tab washer. Propeller should be checked periodically for tightness, particularly if a stainless steel propeller is used.



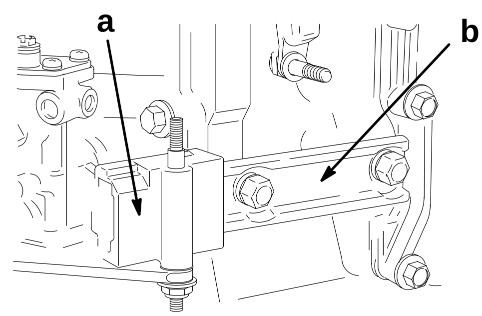
a - Tab Washer
b - Locknut
c - Grooves

Installation

⚠ WARNING

Disconnect (and isolate) spark plug leads from spark plugs before installing gear housing onto drive shaft housing. Failure to follow this warning could result in accidental engine starting and possible injury.

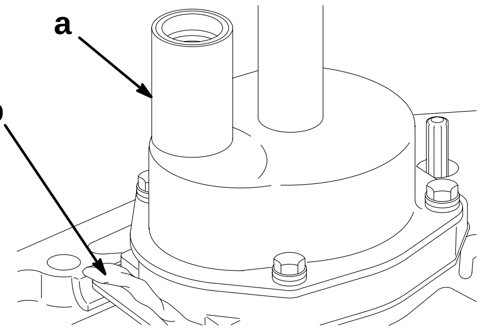
1. Position shift block in forward gear position, as shown.



a - Shift Block; Front of Block MUST Extend 1/8″ (3.2mm) Past Front of Rail.
b - Rail

2. Tilt engine to full up position and engage tilt lock lever.
3. Shift gear housing into neutral position. Propeller shaft will rotate freely in either direction.

4. Install water tube seal; lube I.D. of seal with Quicksilver 2-4-C w/Teflon (92-825407A12).
5. Apply a bead of RTV Sealer as shown.



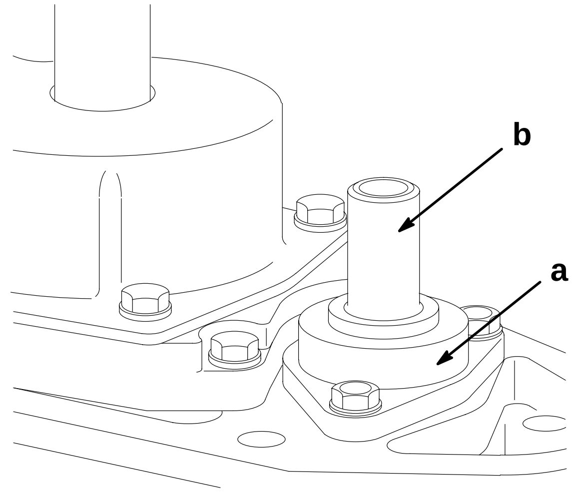
19215

a - Water Tube Seal
b - RTV Sealer

⚠ CAUTION

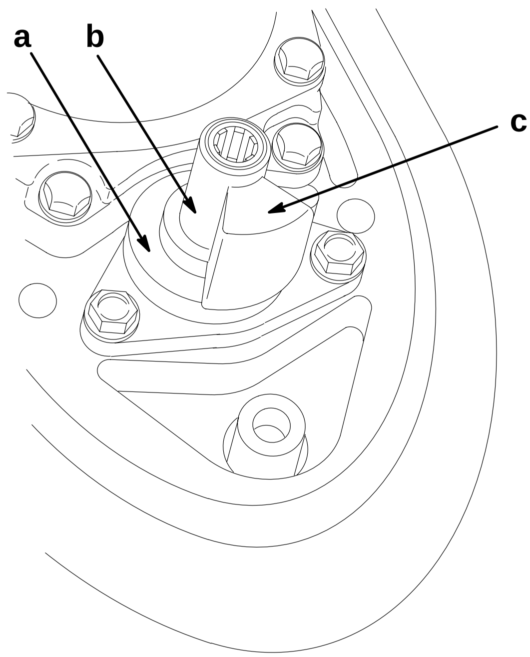
Do not use lubricant on top of drive shaft. Excess lubricant, that is trapped in clearance space, will not allow drive shaft to fully engage with crankshaft. Subsequently, tightening the gear housing fasteners (while lubricant is on top of drive shaft) will load the drive shaft/crankshaft and damage either or both the power head and gear housing. Top of drive shaft is to be wiped free of lubricant.

6. Apply a light coat of Quicksilver 2-4-C w/Teflon onto drive shaft splines.
7. Apply a light coat of Quicksilver 2-4-C w/Teflon on gear case shift shaft splines and upper shift shaft splines. Do not use lubricant on ends of shift shafts.
8. Install components as shown in appropriate photo.



19883

a - Nylon Spacer
b - Shift Shaft Coupler; Used on Models Equipped with Power Trim



19221

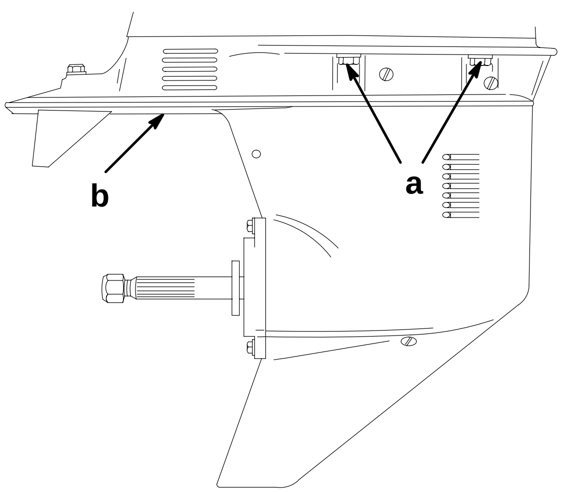
a - Nylon Spacer
b - Shift Shaft Coupler; Used on Models NOT Equipped with Power Trim
c - Flat; MUST BE Positioned Toward Front of Gear Housing.

9. Shift gear housing into forward gear position. In forward gear the gear housing will ratchet when propeller shaft is turned clockwise and resistance will be felt when propeller shaft is rotated counterclockwise.
10. Apply Loctite Grade 271 on threads of gear housing retaining bolts.

NOTE: If, while performing Step 11, the drive shaft splines will not align with the crankshaft splines, place a propeller onto propeller shaft and turn it counterclockwise as the gear housing is being pushed toward drive shaft housing.

NOTE: During installation of gear housing, it may be necessary to move the shift block (located under cowl) slightly to align upper shift shaft splines with shift shaft coupler splines.

11. Position gear housing so that the driveshaft is protruding into drive shaft housing.
12. Move gear housing up toward drive shaft housing, while aligning upper shift shaft splines with shift shaft coupler splines, water tube with water tube seal, and crank shaft splines with drive shaft splines.
13. Install 4 bolts and washers (two each side).
14. Install locknut and washer.
15. Torque bolts and locknut (or nuts only if applicable) to 40 lbs. ft. (54 N·m).



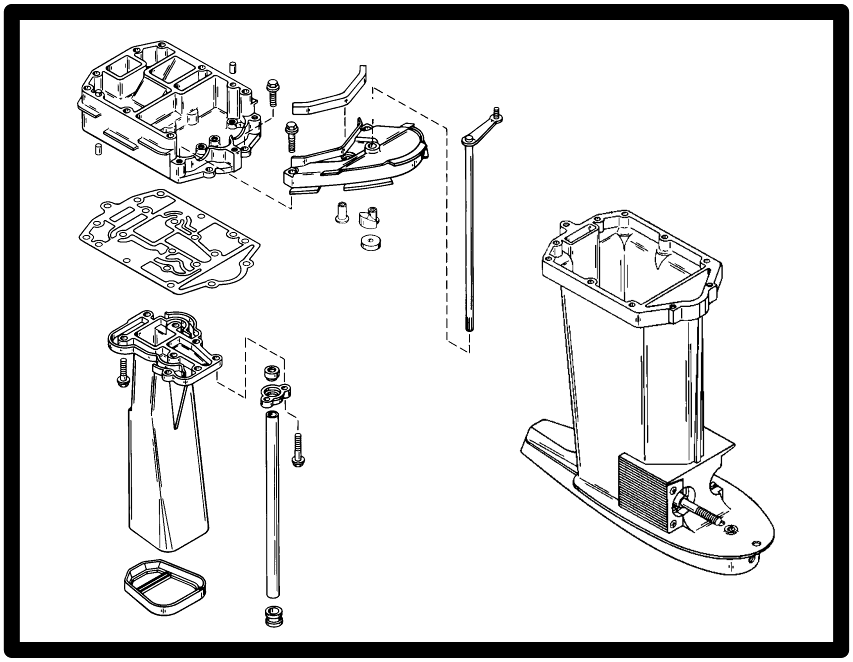
51552

a - Bolts and Washers (4)
b - Locknut and Washer

16. Check shift operation as follows:
    a. Place shift lever in forward gear. Gear housing should ratchet when propeller shaft is turned clockwise and resistance should be felt when propeller shaft is turned counterclockwise.
    b. Place shift lever in neutral. Propeller shaft should rotate freely in either direction.
    c. While rotating propeller shaft, place shift lever in reverse gear. Resistance should be felt when propeller shaft is rotated in either direction.

IMPORTANT: If shift operation is not as described, preceding, the gear housing must be removed and the cause corrected.

LOWER UNIT



MID-SECTION

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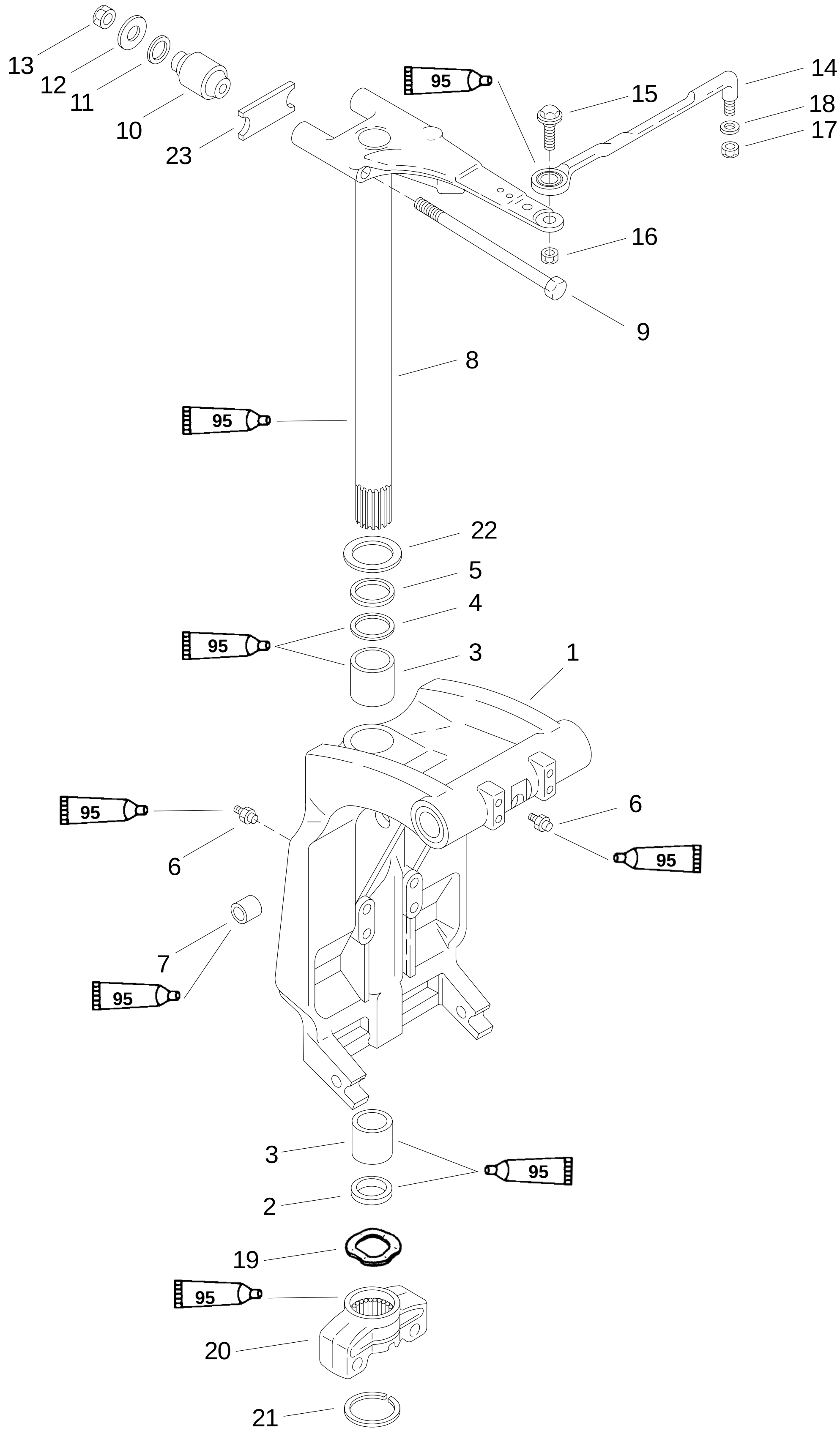
Notes:

Swivel Bracket Components



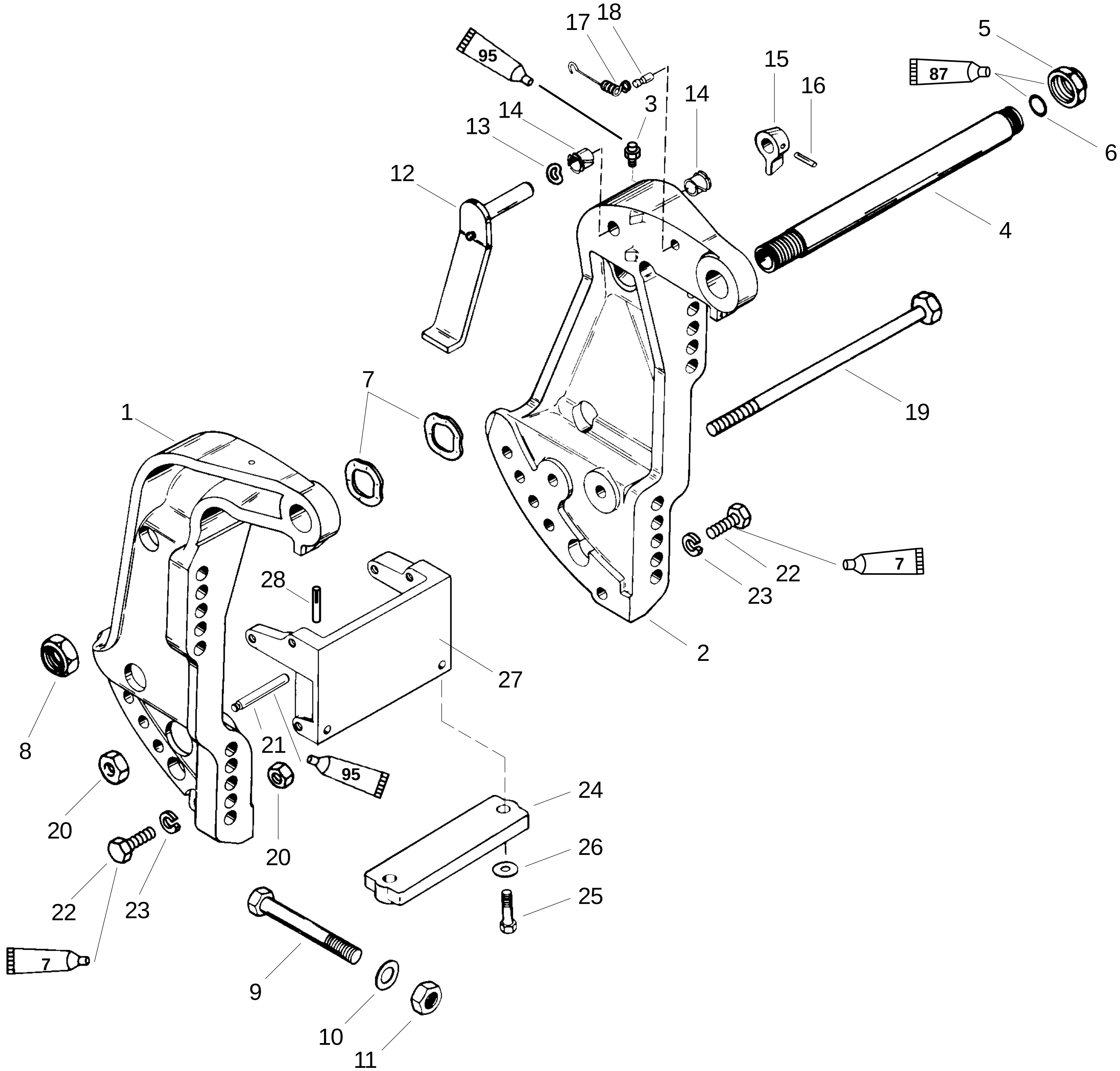
Quicksilver Lubrication/Sealant Application Points

95 2-4-C With Teflon (92-825407A12)

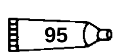
Swivel Bracket Components (Continued)

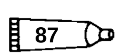
REF. NO.	QUAN.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
1	1	Swivel Bracket			
2	1	Oil Seal (LIPS FACE DOWN)			
3	2	Bushing			
4	1	O-Ring (UPPER)			
5	1	Spacer (UPPER)			
6	2	Grease Fitting	40		4.5
7	2	Bushing			
8	1	Swivel Pin and Steering Arm Assembly			
9	2	Bolt			
10	2	Rubber Mount (UPPER)			
11	2	Washer			
12	2	Washer			
13	2	Nut		80	108.4
14	1	Steering Link Assembly			
15	1	Bolt – 1-1/4 in. (31.7mm) Long			
16	1	Lock Nut		20	27.1
17	1	Lock Nut	120		13.5
18	2	Washer			
19	1	Wave Washer			
20	1	Bottom Yoke			
21	1	Retaining Ring			
22	1	Thrust Washer (ALUMINUM SIDE TOWARDS SWIVEL BRACKET)			
23	1	Bumper			

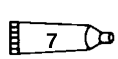
Transom Bracket Components



Quicksilver Lubrication/Sealant Application Points


2-4-C With Teflon (92-825407A12)

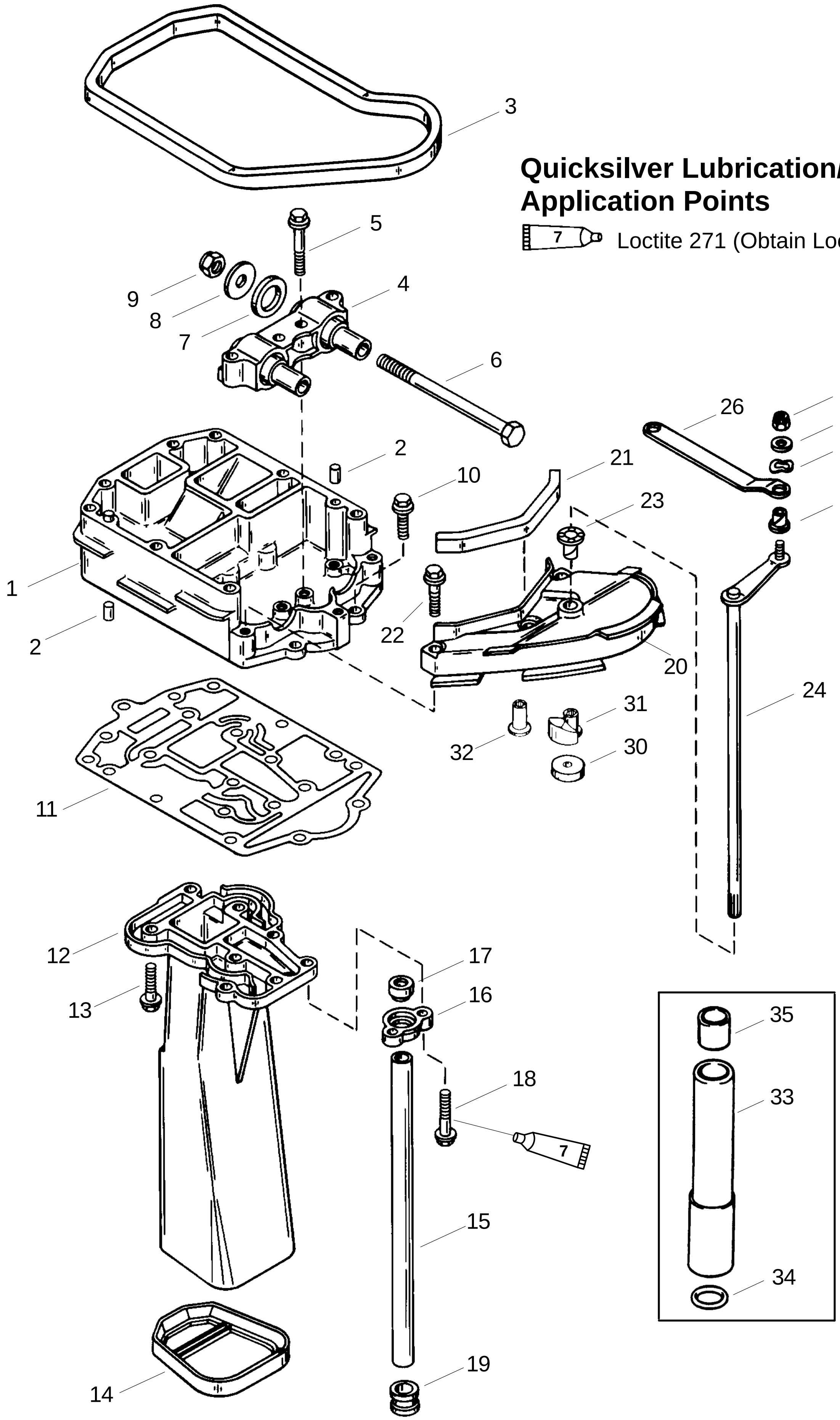

Quicksilver Gear Lubricant (92-13783A24)


Loctite 271 (Obtain Locally)

Transom Bracket Components (Continued)

REF. NO.	QUAN.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	Transom Bracket (STARBOARD)			
2	1	Transom Bracket (PORT)			
3	1	Grease Fitting (PORT TRANSOM BRACKET)	40		4.5
4	1	Tilt Tube			
5	1	Nut (1″-14); No Torque Requirement, Drive Nut Until Bottomed On Shoulder Of Tilt Tube			
6	1	O-Ring			
7	2	Wave Washer			
8	1	Nut (7/8″-14); No Torque Requirement - Drive Nut Until Assembly Is Drawn Together, But Must Be Free To Pivot			
9	4	Bolt			
10	4	Washer			
11	4	Nut			
12	1	Tilt Lock Lever			
13	1	Wave Washer			
14	2	Bushing			
15	1	Knob			
16	1	Roll Pin			
17	1	Spring			
18	1	Groove Pin			
19	1	Bolt			
20	1	Nut			
21	1	Lower Shock Absorber Shaft			
22	6	Bolt		30	40.7
23	6	Lockwasher			
24	1	Anode			
25	2	Bolt	60		6.8
26	2	Washer			
27	1	Bracket			
28	1	Groove Pin			

Exhaust Plate Components



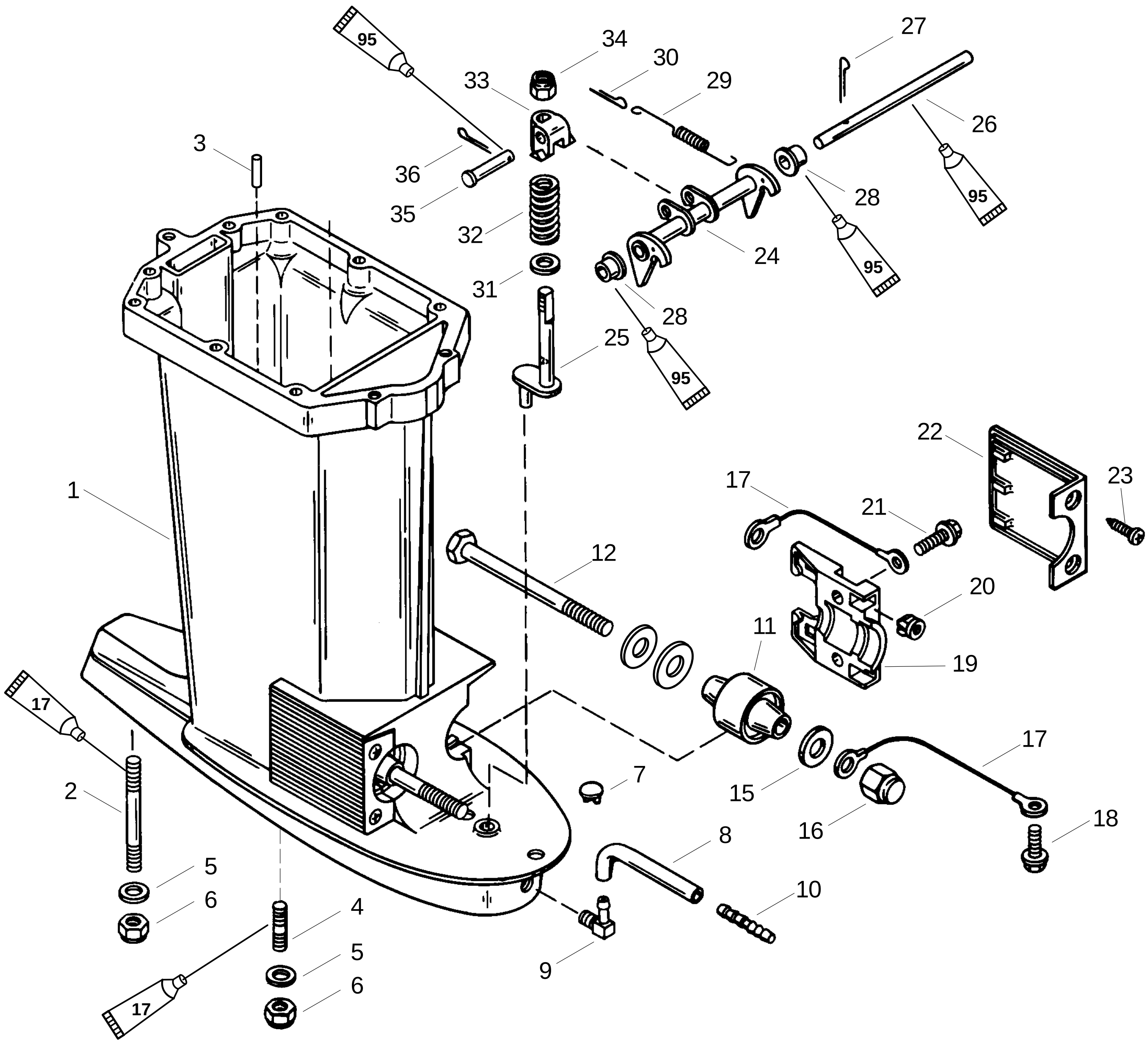
Quicksilver Lubrication/Sealant Application Points

7 Loctite 271 (Obtain Locally)

Exhaust Plate Components (Continued)

REF. NO.	QUAN.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	Exhaust Plate			
2	3	Dowel Pin			
3	1	Lower Cowl Seal			
4	1	Upper Mount			
5	4	Bolt – Upper Mount to Exhaust Plate		23	31.2
6	2	Bolt – Upper Mount			
7	2	Spacer – Upper Mount Bolt			
8	2	Washer – Upper Mount Bolt			
9	2	Nut – Upper Mount Bolt		80	108.5
10	3	Bolt – Exhaust Plate		15	20.3
11	1	Gasket – Exhaust Plate			
12	1	Exhaust Tube			
13	2	Bolt – Exhaust Tube to Plate		15	20.3
14	1	Seal – Lower Exhaust Tube			
15	1	Water Tube			
16	1	Clamp – Water Tube Seal			
17	1	Seal – Upper Water Tube			
18	2	Bolt – Water Tube Clamp	80		9.0
19	1	Grommet – Water Tube			
20	1	Bracket – Lower Cowl			
21	1	Seal – Lower Cowl Bracket			
22	3	Bolt – Lower Cowl Bracket		23	31.2
23	1	Shift Shaft Bushing			
24	1	Upper Shift Shaft			
25	1	Shift Shaft Bushing			
26	1	Shift Link			
27	1	Wave Washer – Shift Shaft			
28	1	Washer – Shift Nut;			
29	1	Lock Nut – Shift Shaft; No Torque Requirement - Drive Unit Tight, But Joint Must Be Free To Pivot			
30	1	Shift Shaft Spacer			
31	1	Shift Shaft Coupling – Non-Power Trim			
32	1	Shift Shaft Coupling – Power Trim			
33	1	Water Tube Extension			
34	1	O-Ring – Extra Long Shaft Only			
35	1	Seal – Extra Long Shaft Only			

Drive Shaft Housing Components



Quicksilver Lubrication/Sealant Application Points

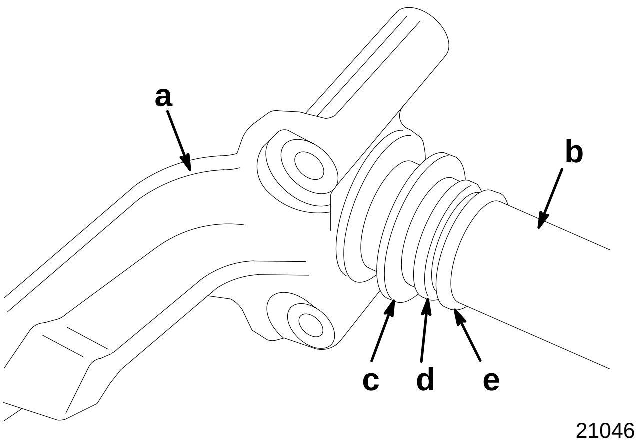
95 2-4-C With Teflon (92-825407A12)

17 Loctite 35 (92-59328-1)

Drive Shaft Housing Components (Continued)

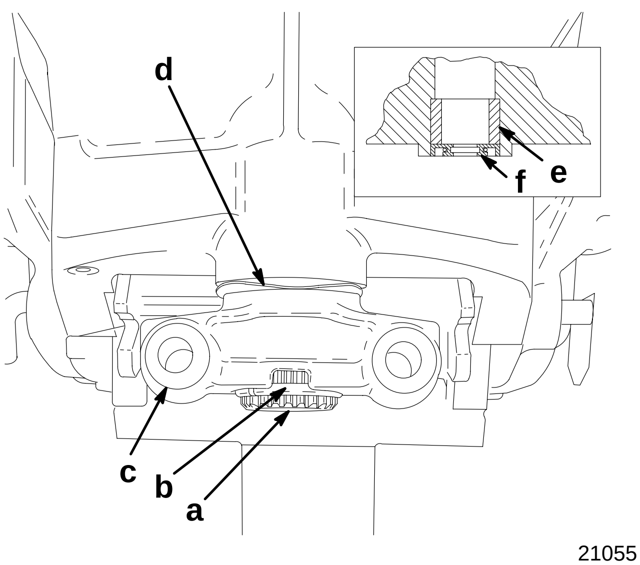
REF. NO.	QUAN.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	Drive Shaft Housing			
2	1	Drive Shaft Housing Stud			
3	2	Dowel Pin			
4	4	Gear Housing Stud			
5	5	Washer			
6	5	Nut		40	54.5
7	1	Plug – Power Trim			
8	1	Speedometer Pick Up Assembly			
9	1	90 Degree Connector			
10	1	Straight Connector			
11	2	Lower Mount			
12	2	Lower Mount Bolt			
13	2	Washer (CHAMFER SIDE TOWARDS MOUNT)			
14	2	Washer			
15	2	Washer			
16	2	Nut		50	67.8
17	1	Ground Strap			
18	1	Ground Strap Bolt			
19	2	Lower Mount Clamp			
20	4	Nylon Nut			
21	4	Clamp Bolt		13.8	18.7
22	2	Lower Mount, Cover			
23	4	Cover Screws	Drive Tight		
		NON POWER TRIM			
24	1	Reverse Lock Hook			
25	1	Push Rod			
26	1	Shaft			
27	1	Cotter Pin			
28	2	Bushing			
29	1	Spring			
30	1	Cotter Pin			
31	1	Washer			
32	1	Push Rod Spring			
33	1	Push Rod Yoke			
34	1	Nut			
35	1	Clevis Pin			
36	1	Cotter Pin			

Reference Views



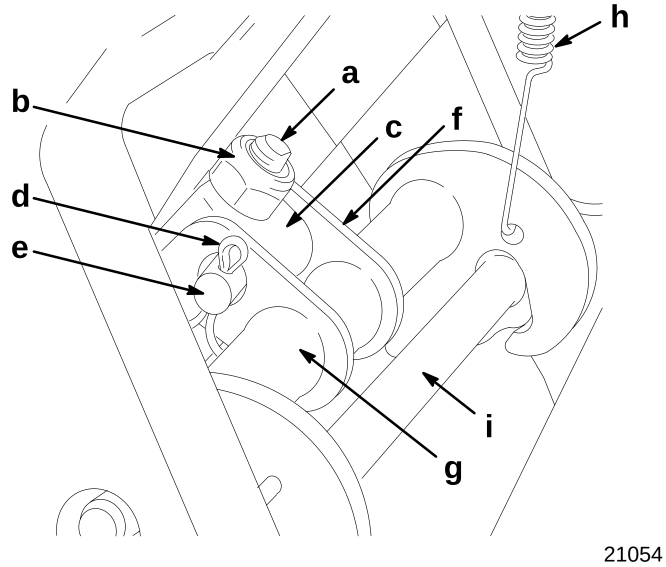
a - Steering Arm
b - Swivel Pin
c - Thrust Washer (Aluminum side towards swivel bracket)
d - Spacer (Upper)
e - O-Ring

Swivel Pin/Steering Arm



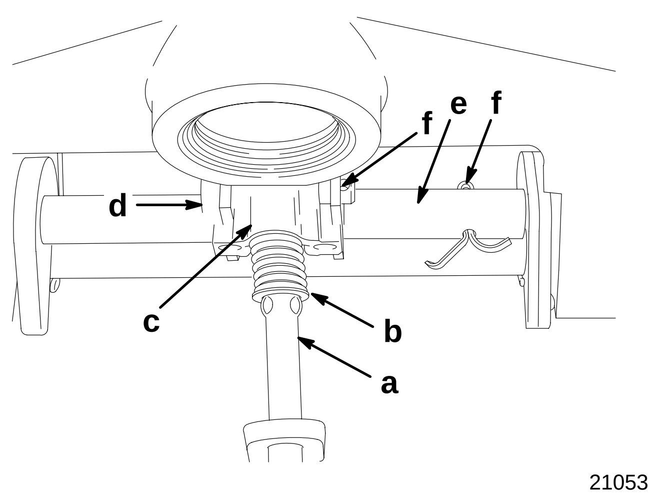
a - Swivel Pin
b - Retaining Ring
c - Yoke
d - Wave Washer
e - Bushing (Lower)
f - Oil Seal (Lips Face Down)

Lower Mount Point (Yoke)



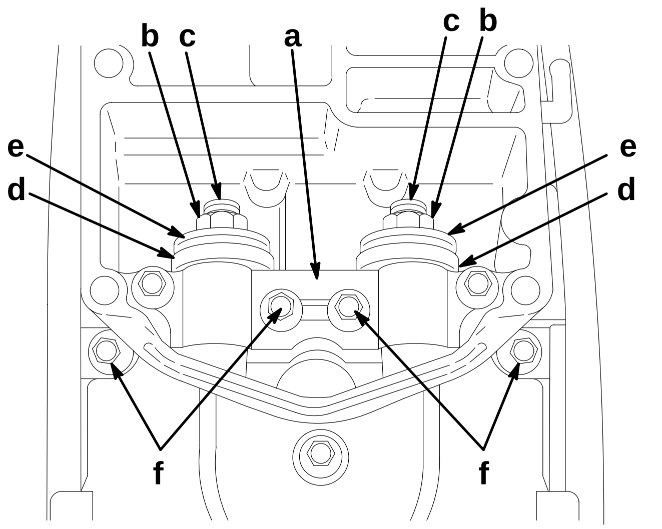
a - Push Rod End
b - Nut
c - Push Rod Yoke
d - Cotter Pin
e - Clevis Pin
f - Reverse Lock Hook Shaft Arm
g - Reverse Lock Hook Shaft
h - Return Spring
i - Tilt Pin

Non Power Trim Reverse Lock Hook (Shown From Above)



a - Push Rod Shaft
b - Spring
c - Push Rod Yoke
d - Clevis Pin
e - Reverse Lock Hook Shaft
f - Cotter Pin (2)

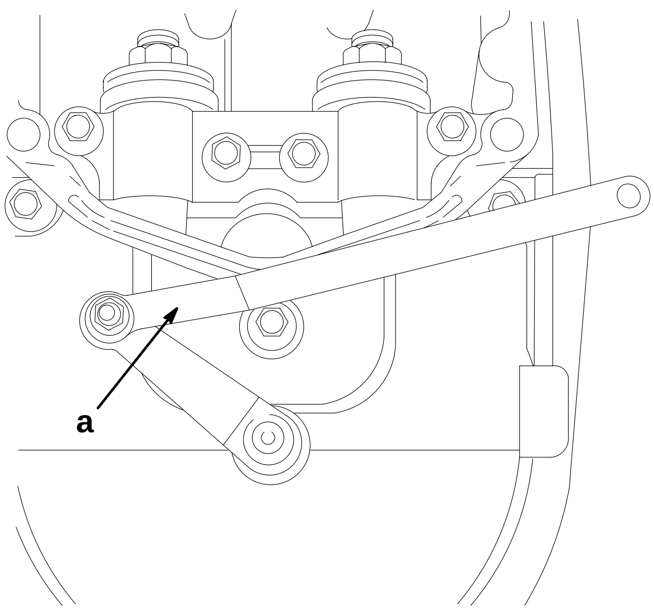
Non Power Trim Reverse Lock Hook (Shown From Below)



21048

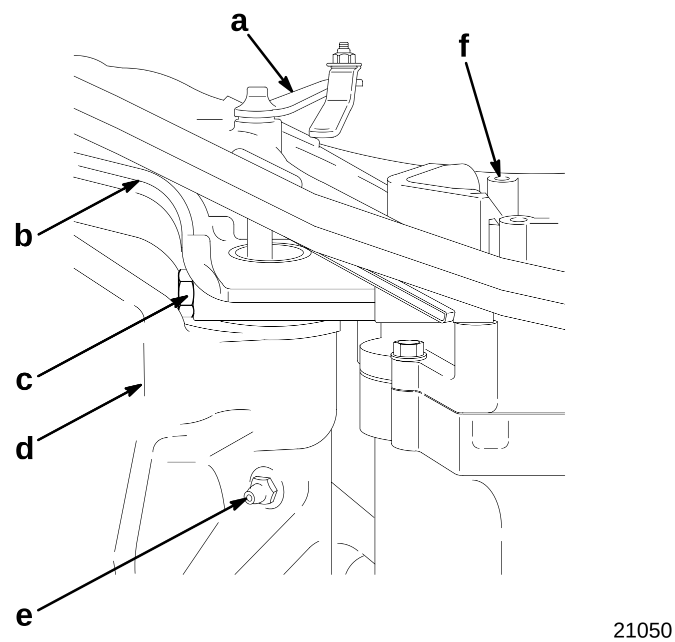
a - Upper Mount
b - Nut (2) [Torque to 80 lb. ft. (108.5 N·m)]
c - Bolt (2)
d - Rubber Space (2)
e - Washer (2)
f - Bolt (4) [Torque to 23 lb. in. (31.2 N·m)]

Upper Mount



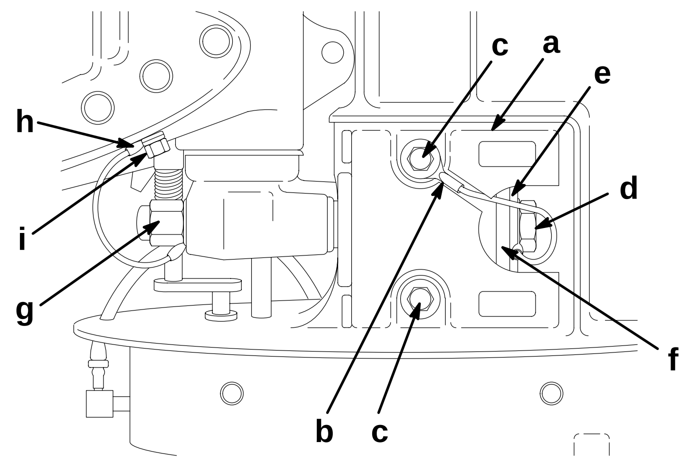
21049

a - Upper Shift Linkage



21050

a - Upper Shift Linkage
b - Steering Arm/Swivel Pin
c - Upper Mount Bolt
d - Swivel Bracket
e - Grease Fitting
f - Mid-Section Drive Shaft Housing

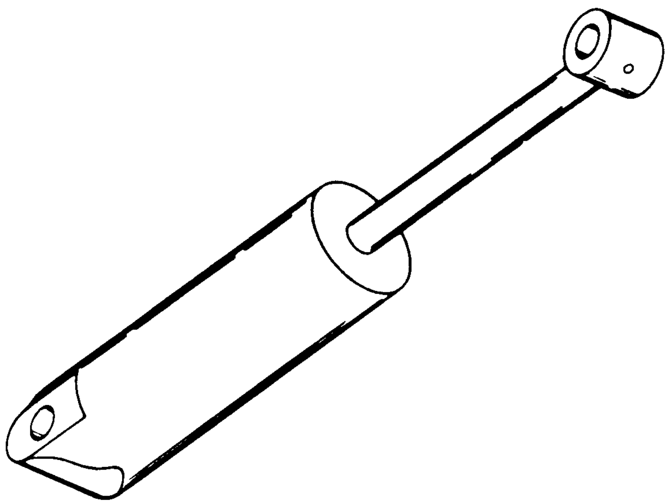


21051

a - Lower Mount Clamp
b - Ground Strap
c - Bolt (2) [Torque to 15 lb. ft. (20.3 N·m)]
d - Lower Mount Bolt
e - Washer
f - Washer
g - Nut [Torque to 50 lb. ft. (67.8 N·m)]
h - Ground Strap
i - Bolt

Lower Mount (Port Side Shown)

LOWER UNIT



SHOCK ABSORBER

5

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Engines Equipped with a Single Shock Absorber

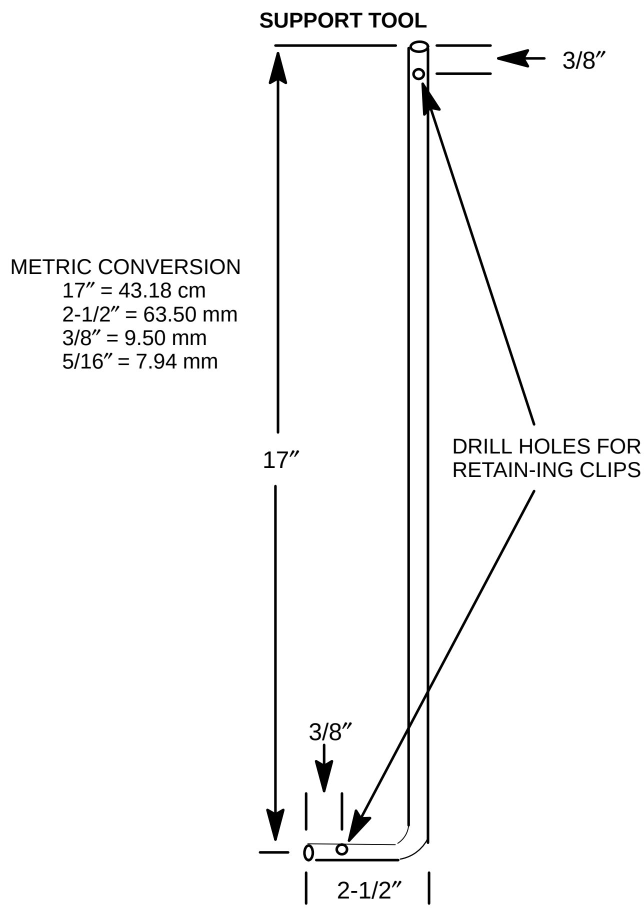
Removal

1. Tilt engine to full "UP" position and engage tilt lock lever.

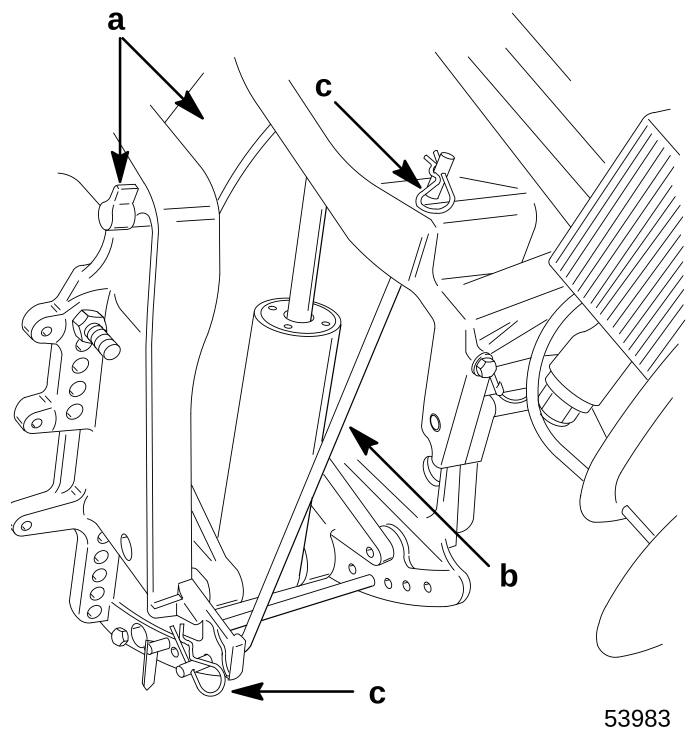
⚠ WARNING

Failure to support engine as shown could result in personal injury and/or damage to engine or boat.

IMPORTANT: Support engine with tool as shown, to prevent engine from tipping over center into boat when retaining pin is removed.



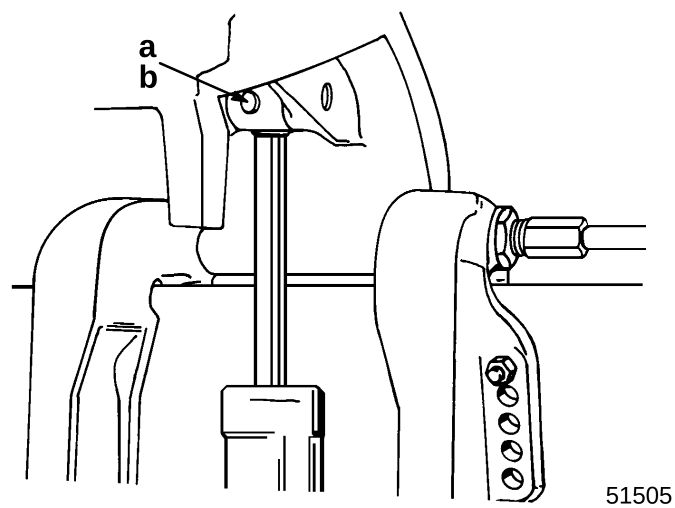
Use a metal rod (5/16" diameter) to make support tool.



a - Tilt Lock Lever
b - Support Tool
c - Retaining Clips

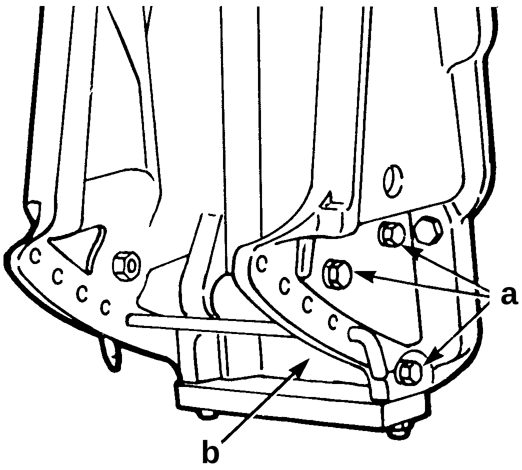
2. To remove tilt pin when straight cross pin is installed, use a punch and hammer to drive out tilt pin (shearing cross pin) and remove halves of sheared cross pin.
3. To remove tilt pin when headed cross pin is installed, use diagonal cutters to pry cross pin out of tilt pin. Push out tilt pin.

IMPORTANT: Cross pin should not be reused after removal. Replace with a new pin.



a - Cross Pin (Design 1 - Straight)
b - Cross Pin (Design 2 - Headed)

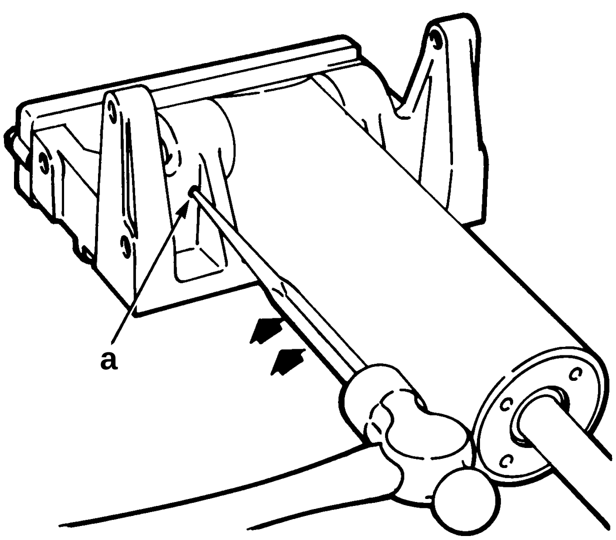
4. Support lower mount bracket and remove (6) bolts.



17244

a - Bolts (3 Each Side)
b - Lower Mount Bracket

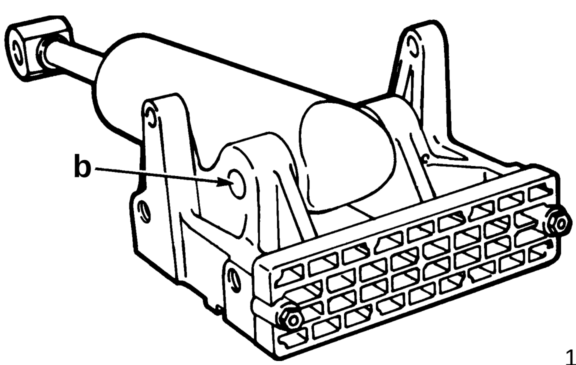
5. Remove shock absorber from lower mount bracket by driving out cross pin using a punch and hammer.



17257

a - Cross Pin

6. Push out retaining pin.

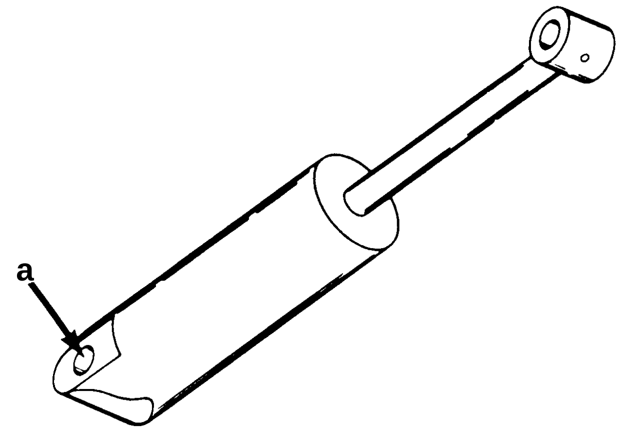


17258

b - Retaining Pin

Inspection and Repair

1. Inspect bushings and replace if worn.



a - Bushings

⚠ CAUTION

The shock absorber is pressurized with gas. Do not disassemble unless fluid is leaking from shock absorber.

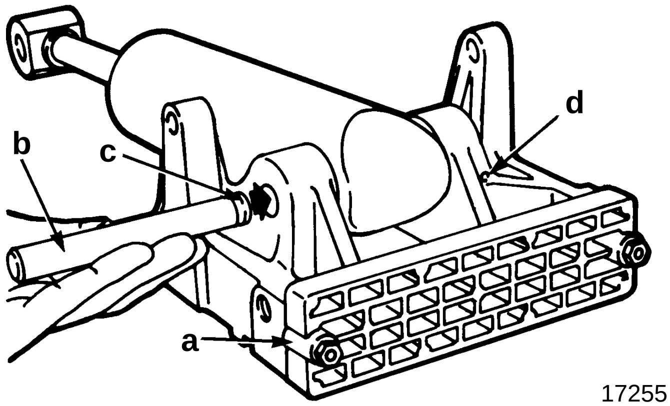
NOTE: A pressurized shock absorber makes tilting of the engine easier than a non-pressurized shock absorber.

If the shock absorber leaks fluid it can be rebuilt by installing "Shock Absorber Repair Kit" (P/N 41760A2), however, the shock absorber will no longer be pressurized and the force needed to tilt the engine will be increased to that of a non-pressurized shock absorber. Instructions are supplied with kit.

If the shock absorber leaks fluid and a pressurized shock absorber is desired, replace shock absorber as an assembly.

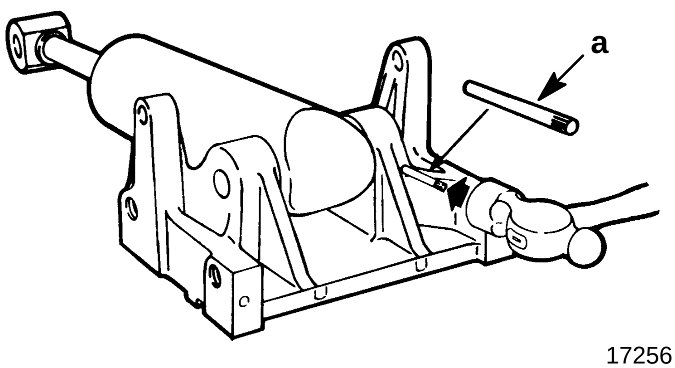
Installation

1. Remove anode plate. Lubricate retaining pin with Quicksilver 2-4-C w/Teflon. Place shock absorber into lower mount bracket, as shown, and install retaining pin so that groove aligns with hole.

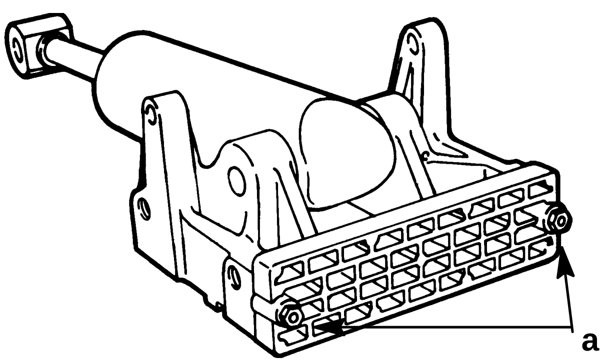


a - Anode Plate
b - Retaining Pin
c - Groove
d - Cross Pin Hole

2. Drive cross pin (flush) into lower mount bracket, as shown and reinstall anode plate. Secure anode with 2 bolts and washers. Torque bolts to 60 lb. in. (6.8 N·m).

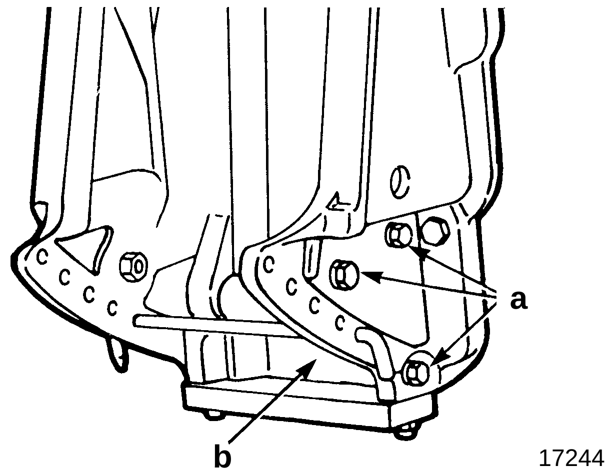


a - Cross Pin



a - Bolts [Torque to 60 lb. in. (6.8 N·m)]

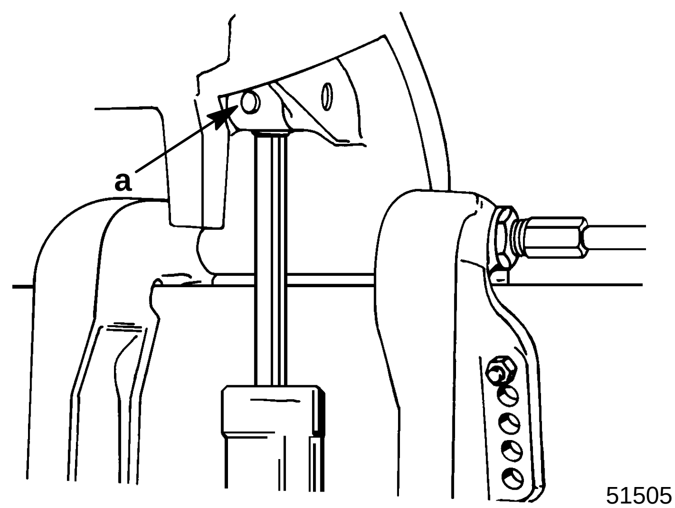
3. Reinstall shock absorber assembly between clamp brackets and secure shock assembly to clamp brackets with 6 bolts and lockwashers (3 each clamp bracket). Torque bolts to 30 lb. ft. (40.7 N·m).



a - Bolts [Torque to 30 lb. ft. (40.7 N·m)]
b - Shock Asorber Assembly

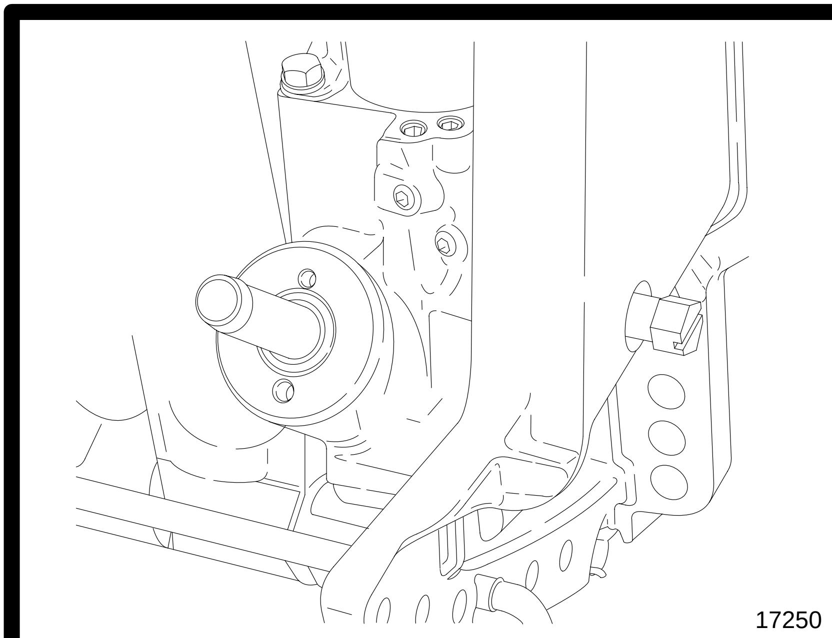
4. Reinstall tilt pin through swivel bracket and shock absorber eye.

5. Install new cross pin securing shock to tilt pin.



a - Cross Pin

POWER TRIM



DESIGN I
(SIDE FILL RESERVOIR)

6

A

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Power Trim - General Information

Description

The Power Trim System consists of an electric motor, pressurized fluid reservoir, pump, tilt cylinder, and two trim rams.

The remote control (or trim panel) has switches that trim the outboard “Up” or “Down” and tilt the engine for “Trailering”. The outboard can be trimmed and tilted under power or when the outboard is not running.

Trimming Characteristics

NOTE: Because hull designs react differently in varying water conditions, varying the trim position will often improve the ride and boat handling. When trimming from a mid-trim position (with outboard trim tab in a straight fore and aft position), expect the following:

TRIMMING OUTBOARD “UP” (OUT):

⚠ WARNING

Excessive trim “Out” may reduce the stability of some high speed hulls. To correct instability, reduce the power gradually and trim the outboard “In” slightly before resuming high speed operation. A rapid reduction in power will result in a sudden change of steering torque and may cause additional boat instability.

Will lift boat bow, increasing top speed.

Transfers steering torque harder to port (left) on installations above 23 in. transom height.

Increases gearcase clearance over submerged objects.

Excess trim can cause “porpoising” and/or ventilation.

⚠ WARNING

Excessive outboard trim angle will result in insufficient water supply causing water pump and/or powerhead overheating damage. Insure water level is above water intake holes whenever outboard is running.

The “Up” circuit actuates the “up” solenoid (under outboard cowl) and closes the motor circuit. The electric motor drives the pump, forcing fluid thru passageways into the “up” side of the trim cylinders.

The trim cylinders position the outboard at the desired trim angle in the 20 degree maximum trim range. The system will not allow the outboard to be trimmed above the 20 degree trim range as long as the engine RPM is above approximately 2000 RPM.

The outboard can be trimmed above the 20 degree maximum trim angle (for shallow water operation, etc.), by keeping the engine RPM below 2000. If the RPM increases over 2000, propeller thrust (if propeller is deep enough) will result in the trim system to return the outboard to the 20 degree maximum trim position.

TRIMMING OUTBOARD “DOWN” (IN):

⚠ WARNING

Excessive speed at minimum trim “In” may result in undesirable and/or unsafe steering conditions. Test for handling characteristics after any adjustment is made to the trim angle (and tilt pin location).

Aids planing, particularly with heavy loads.

Improves ride in choppy water conditions.

Excess trim “In” can cause “bow steer” (boat veers to left or right).

Transfers steering torque to starboard (right).

Improves acceleration to planing speed.

The “Down” circuit actuates the “down” solenoid (under engine cowl) and closes the motor circuit. The electric motor drives the pump in the opposite direction as the “up” circuit, forcing fluid thru passageways into the “down” side of the tilt ram. The tilt ram moves the engine down to the desired position.

Trailering Outboard

The “Up” circuit first moves the trim cylinders; when the trim cylinders extend fully, the tilt ram extends to tilt the outboard to the full “Up” position for trailering.

Before the boat is trailered, the operator should check for clearance between the outboard skeg and pavement to prevent damage to skeg from striking pavement.

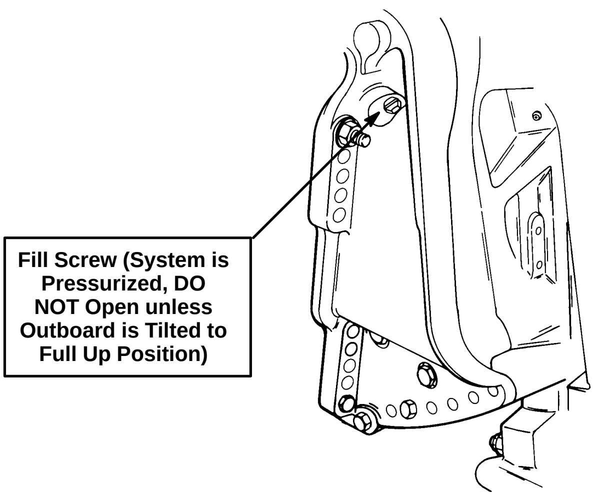
If the outboard must be tilted for clearance between skeg and pavement, a device such as a “Transom Saver” should be installed to prevent stress to boat transom from outboard weight while the boat/outboard are being trailered.

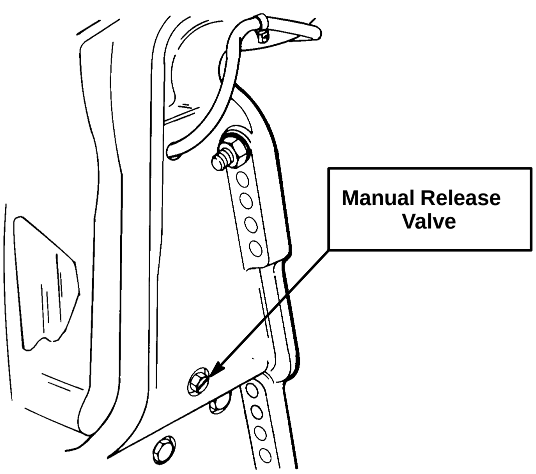
Tilting Outboard Manually

⚠ WARNING

Before opening the manual release valve knob, insure all persons are clear of outboard as outboard will drop to full "Down" when valve is opened.

The outboard can be raised or lowered manually by opening the manual release valve 3 to 4 turns counterclockwise. Close manual release valve to hold outboard at the desired tilt position.





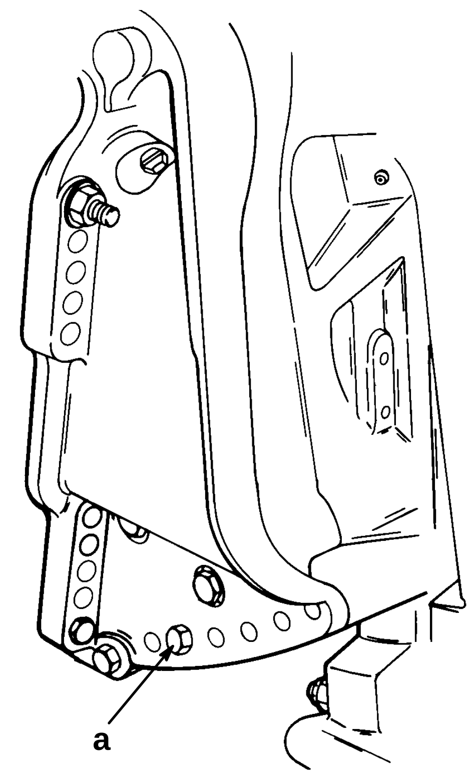
23321

Trim "In" Angle Adjustment

⚠ WARNING

Boat operation with outboard trimmed to the full "In" trim angle [not using the trim angle adjustment bolt] at planing speed may result in undesirable and/or unsafe steering conditions. A water test for handling/steering conditions is required after any trim angle adjustments.

IMPORTANT: Some boat/motor combinations not using the trim angle adjustment bolt and trimmed to the full "In" trim angle position may not exhibit any undesirable and/or unsafe handling and/or steering characteristics at planing speed. If so, not using the trim angle adjustment bolt may be advantageous to acceleration and planing. A water test is required to determine if these characteristics apply to a particular boat/motor combination.

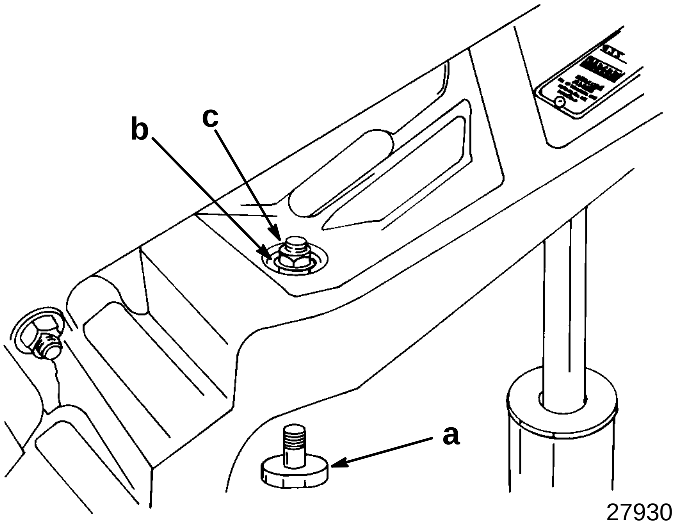


23321

a - Trim Angle Adjustment Bolt

Striker Plate Replacement

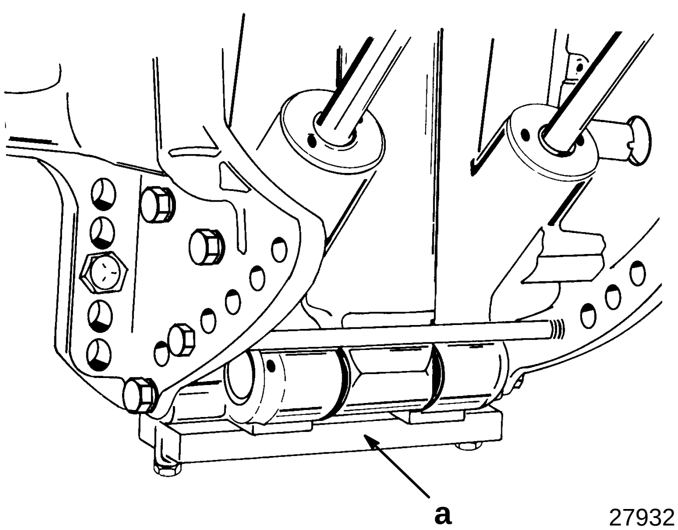
Visually inspect striker plates and replace if worn excessively.



a - Striker Plate (2)
b - Lockwasher
c - Locknut. Torque to 80 lb. in. (9.0 N·m)

Anode Plate

Anode plate is a self-sacrificing alloy plate that is consumed gradually by corrosion while providing protection to the midsection and power trim from galvanic corrosion. Replace anode plate when it is 50% consumed.



a - Anode Plate

IMPORTANT: Do not paint or place protective coating on anode plate, or corrosion protection function will be lost.

Trim Indicator Gauge

A Quicksilver Trim Indicator Gauge accessory kit is available for the power trim sender (if not previously installed).

Fill, Check, and Purge - Power Trim System

TO FILL:

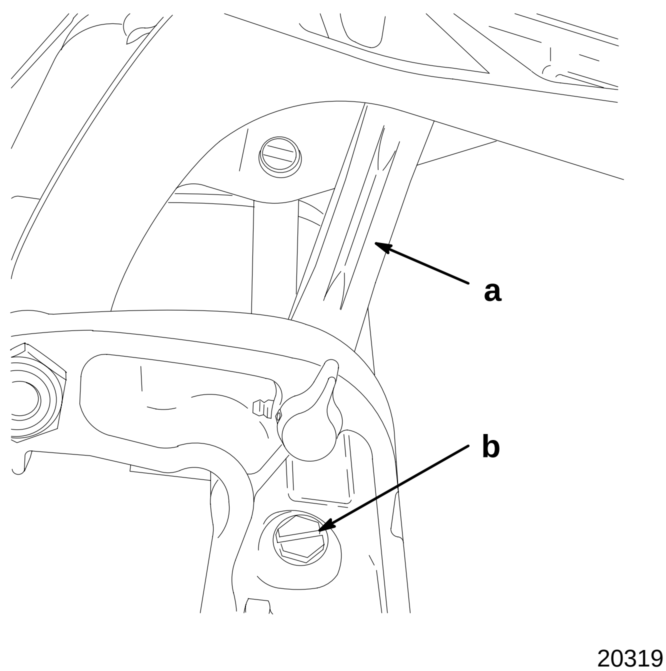
IMPORTANT: This trim system is pressurized. Remove "Fill" plug only when outboard is tilted to the full "Up" position or the trim/tilt rams are fully extended. Retighten "Fill" plug before tilting outboard down or retracting tilt/trim rams.
Remove "Fill" plug and O-ring. System is full when oil level is present at fill hole. Tighten "Fill" plug securely

Trim engine to full "up" position. Engage tilt lock lever. Trim system fluid can only be checked when engine is in this position.

Slowly remove fill screw and check fluid level. Fluid level should be visible in fill tube.

If necessary, add Quicksilver Power Trim and Steering Fluid or Automatic Transmission Fluid (ATF) Type F, FA or Dexron II to power trim system.

Reinstall fill screw; tighten screw securely.



a - Tilt Lock Lever
b - Fill Screw

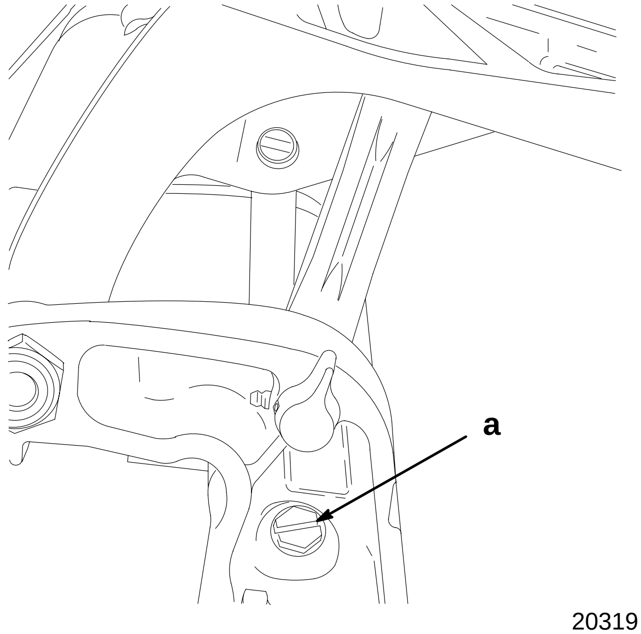
Bleeding Air From Power Trim System

To determine if the Power Trim system contains air, position engine so two trim rods are slightly extended. Do not extend tilt ram. Push down on lower unit. If trim rods retract into trim cylinders more than 1/8″ (3.2mm), it will be necessary to bleed air from the Power Trim system.

Bleed air from Power Trim system as follows:

IMPORTANT: This trim system is pressurized. Remove fill screw only when engine is trimmed to the full “up” position. Retighten fill screw securely before trimming engine down.

Trim engine 3 or 4 times thru entire trim range; check fluid level (fill if necessary) each time engine is trimmed to the full “up” position. See “Checking Fluid Level and Filling,” preceding.



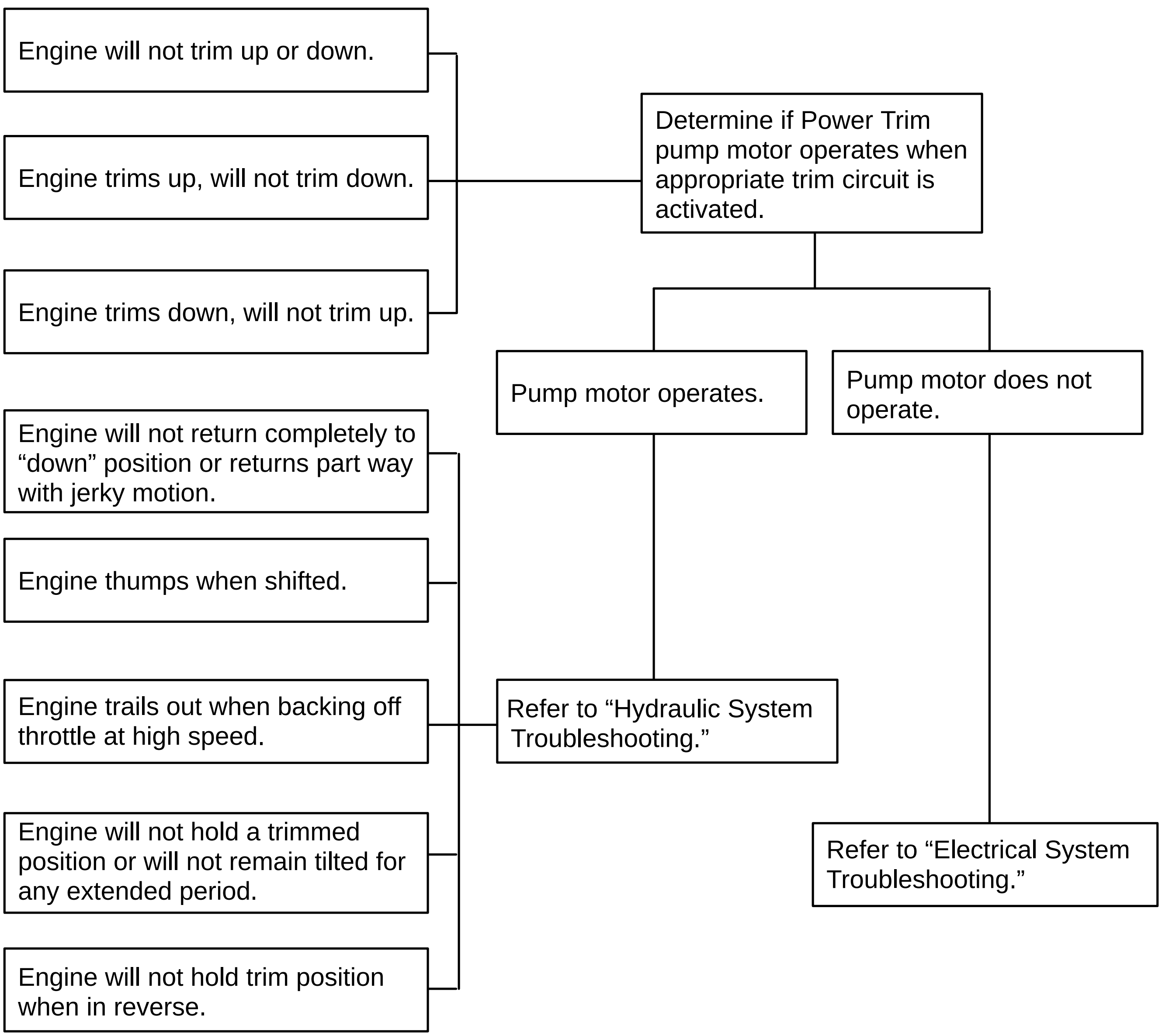
a - Fill Screw

Troubleshooting

Determining if Problem is Electrical or Hydraulic

When a problem is encountered with the Power Trim system, the first step is to determine whether the malfunction is in the “electrical system” or the “hydraulic system.” Refer to the following chart to determine which system is at fault.

Trouble Chart



Hydraulic System Troubleshooting

IMPORTANT: Operate Power Trim system after each check to see if problem has been corrected. If problem has not been corrected, proceed to next check.

1. Check that manual release valve knob is tightened to full right (clockwise) position.
2. Check trim pump fluid level and fill if necessary. Refer to "Filling and Bleeding the Power Trim System," preceding.
3. Check for external leaks in Power Trim system. Replace defective part(s) if leak is found.
4. Check for air in Power Trim system and bleed if necessary. Refer to "Filling and Bleeding the Power Trim System," preceding.

⚠ CAUTION

Do not remove check valve from port trim rod. Check valve is preset to operate at a specific pressure. Removal and reinstallation of check valve could result in improper operating pressure and possible Power Trim system damage.

5. If engine will not hold a tilted (trailer) position (leaks down to trim position) – Remove port trim rod assembly from Power Trim housing; refer to "Trim Rod Removal," following.

   Inspect check valve (located in port trim rod) for debris; clean debris from check valve if found. If debris can not be cleaned from check valve, replace trim rod and check valve as an assembly.

   Inspect trim rod O-ring and replace if damaged. Reinstall trim rod in housing; refer to "Trim Rod Installation," following.

6. Disconnect trim pump motor wires, and remove starboard transom bracket from engine. Refer to "Removal" instructions in "Power Trim Assembly Removal and Installation," following.

   Slowly remove fill screw to bleed pressure from reservoir.

   Place a pan under manual release valve, and slowly remove valve. Inspect the valve and O-rings for damage.

   If damaged component(s) are found, replace component(s) and proceed to STEP 9.

   If damaged component(s) are not found, reinstall manual release valve and proceed to STEP 7.

7. Remove Power Trim assembly from engine; refer to "Removal" instructions in "Power Trim Assembly Removal and Installation," following.

   Disassemble Power Trim assembly; refer to "Trim Rod," "Tilt Ram," and "Pump Replacement," following. Inspect O-rings for damage. Inspect check valves for debris that could cause them to remain open.

   If O-rings are damaged or debris is found, replace O-rings or clean debris from check valve(s), then reassemble Power Trim assembly and proceed to STEP 9.

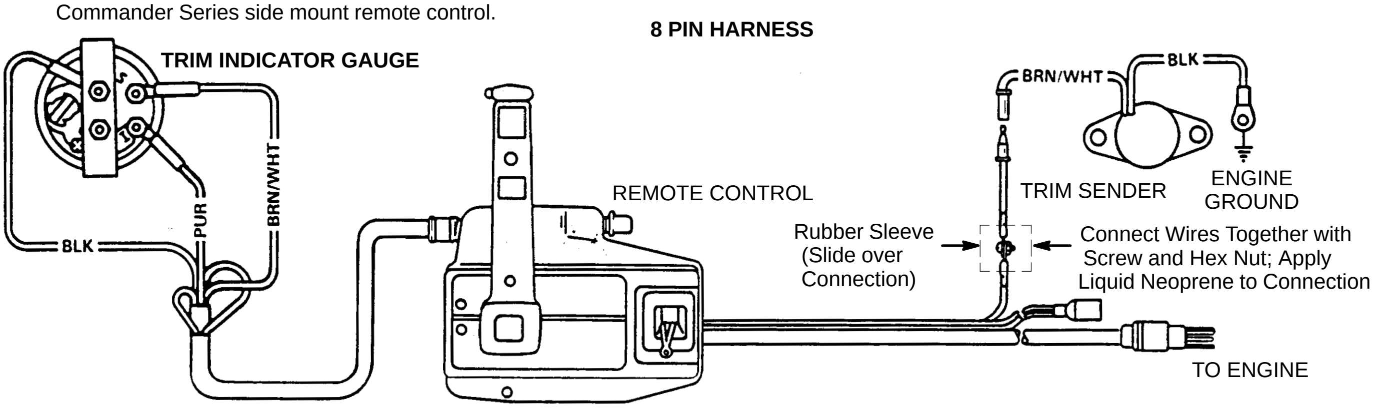
   If damaged O-ring(s) or debris are not found, proceed to STEP 8.

8. Replace pump assembly; refer to "Pump Replacement," following.
9. Install Power Trim assembly and/or starboard transom bracket, steering retaining nut (models with thru-tilt tube steering) and motor wires; refer to "Installation" instructions in "Power Trim Assembly Removal and Installation," following.

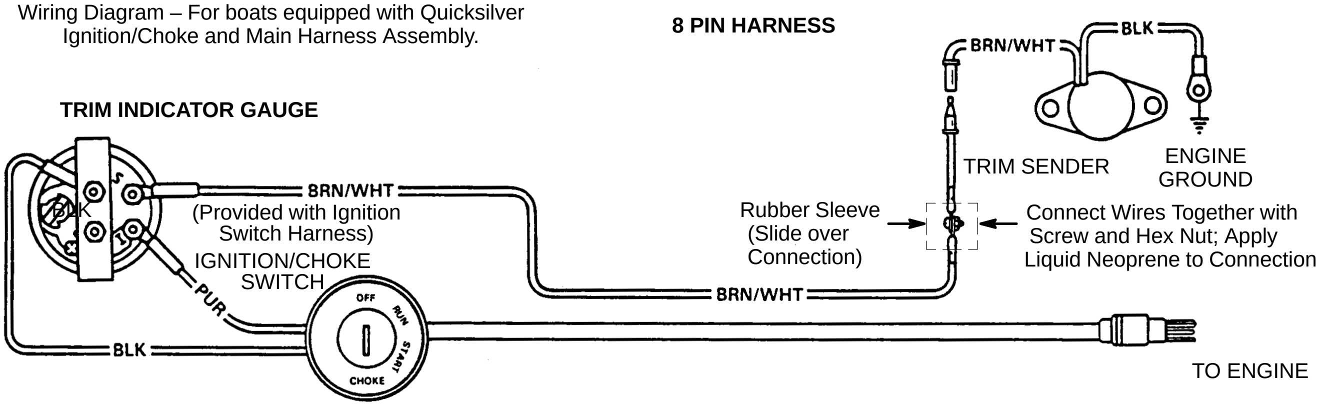
Wiring Diagram

Trim Indicator Gauge and Trim Sender Wiring Diagrams

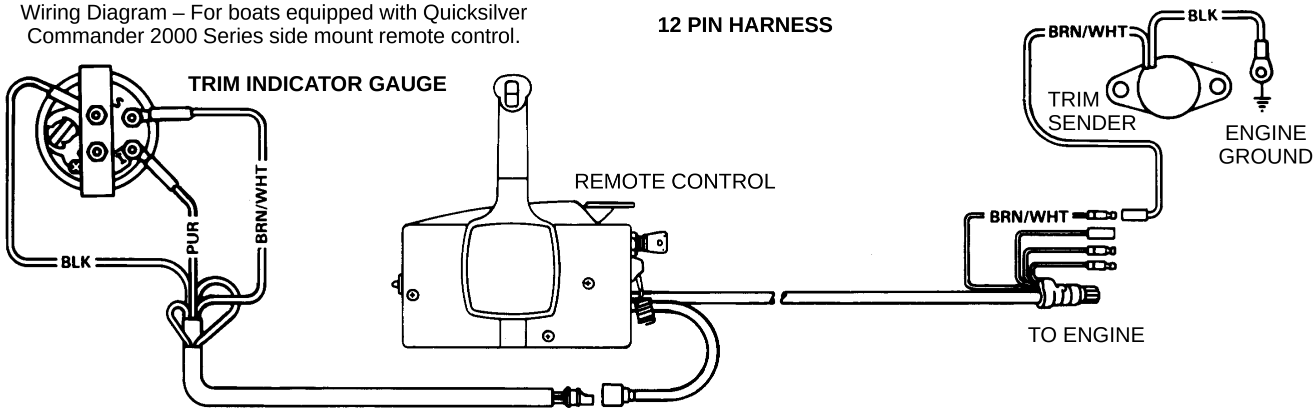
Wiring Diagram – For boats equipped with Quicksilver Commander Series side mount remote control.



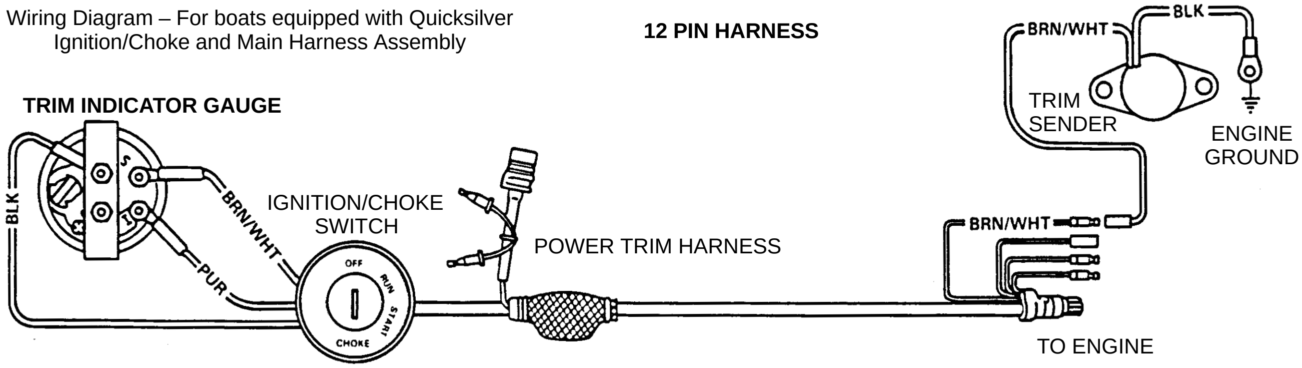
Wiring Diagram – For boats equipped with Quicksilver Ignition/Choke and Main Harness Assembly.



Wiring Diagram – For boats equipped with Quicksilver Commander 2000 Series side mount remote control.

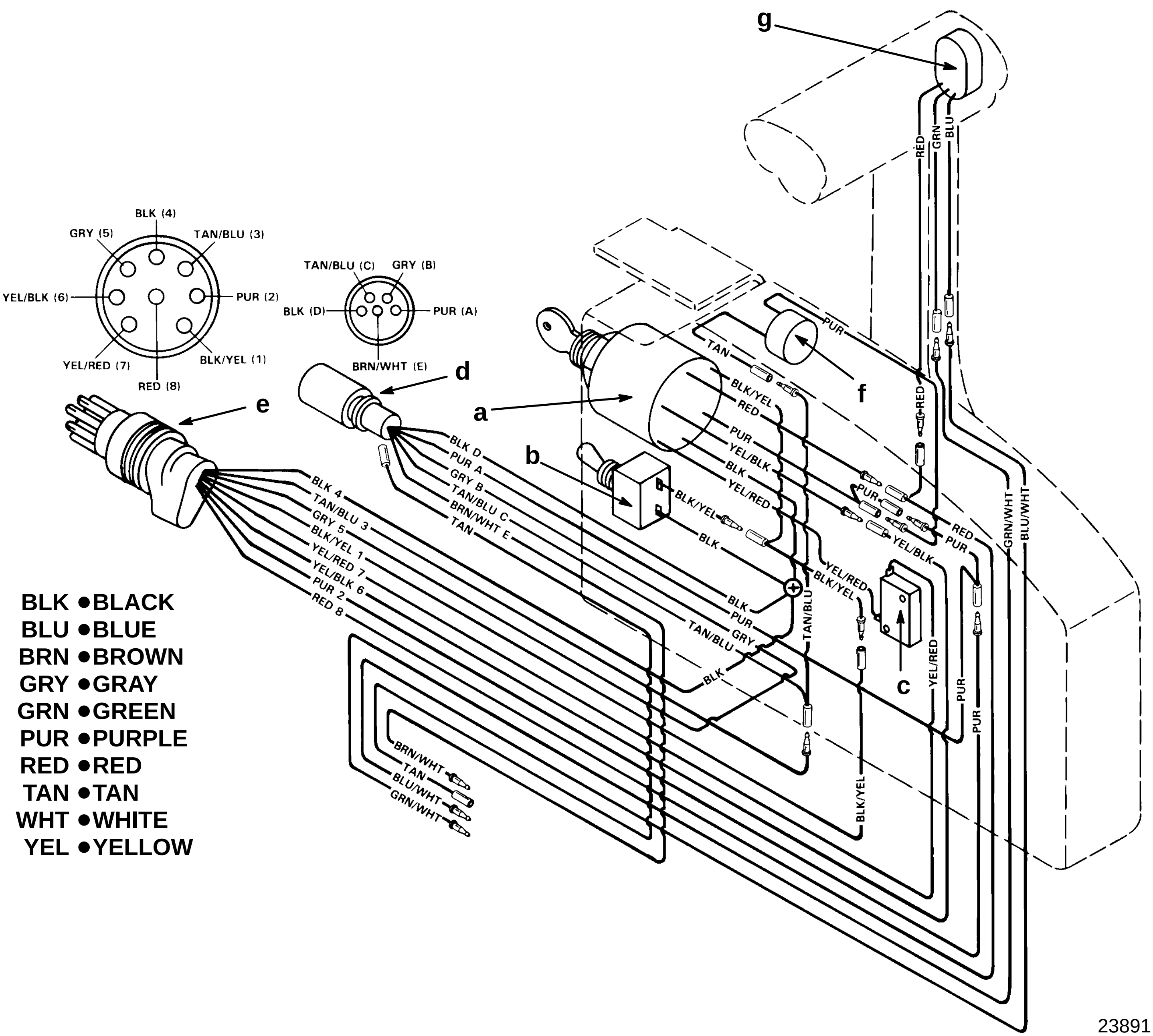


Wiring Diagram – For boats equipped with Quicksilver Ignition/Choke and Main Harness Assembly



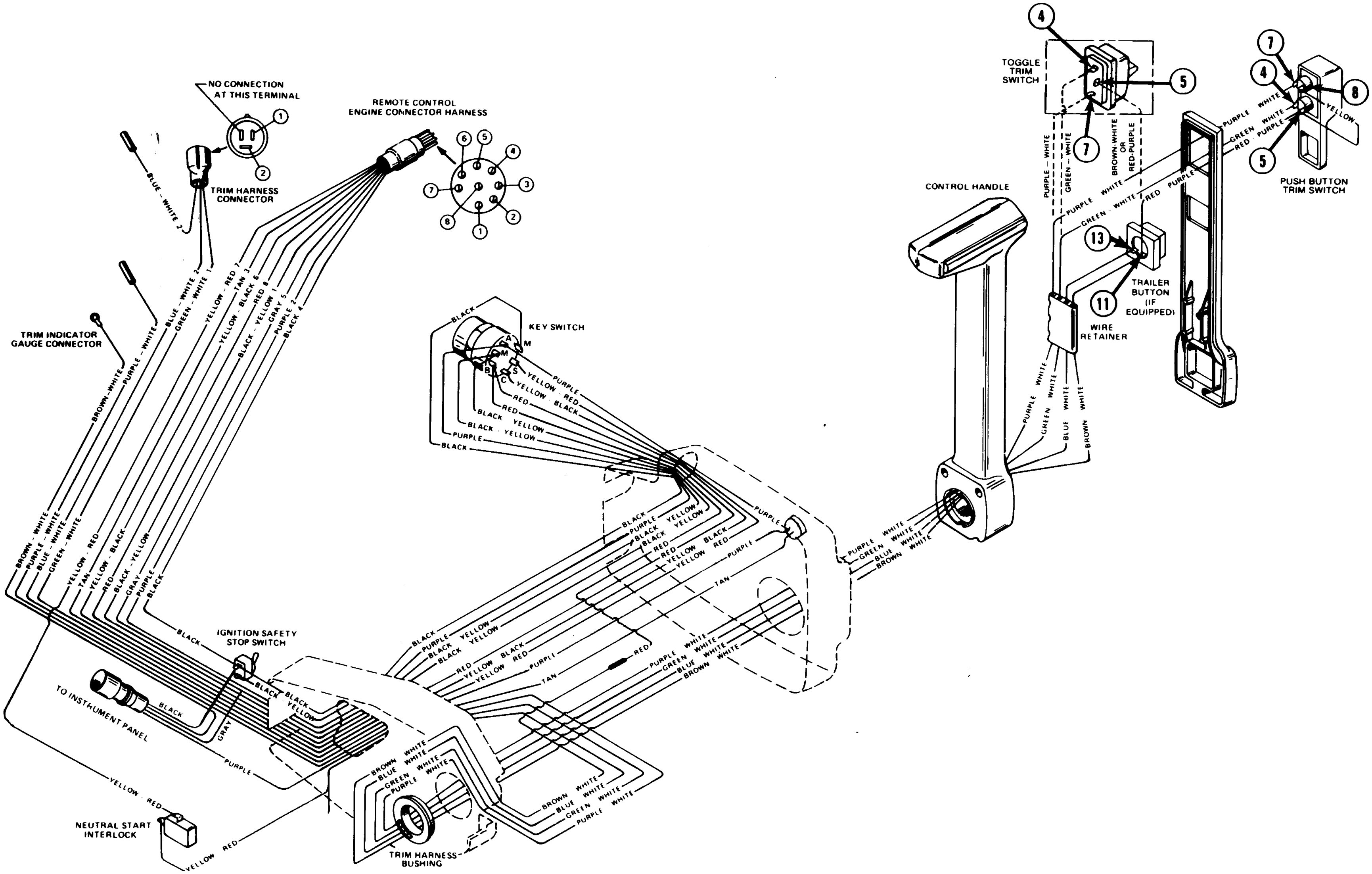
22908

Side Mount Remote Control Wiring Diagram



23891

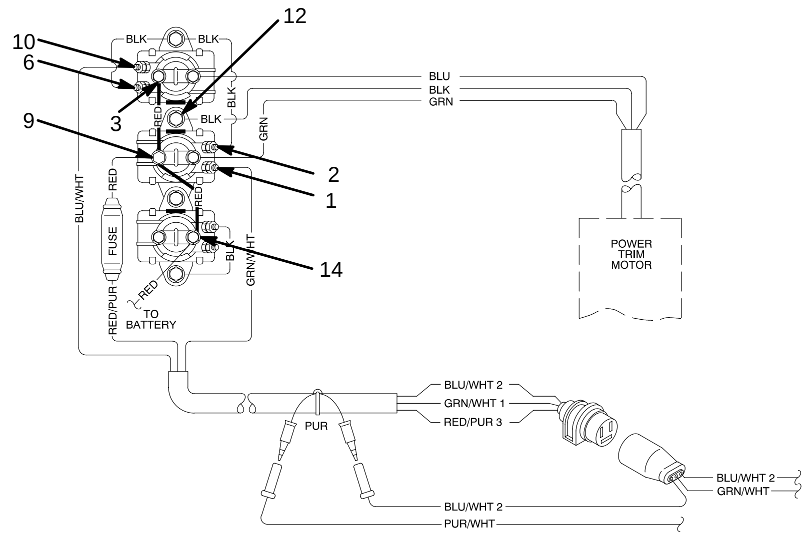
a - Ignition/Choke Switch
b - Emergency Stop Switch
c - Neutral Start Switch
d - Tachometer/Accessories Harness Connector
e - Wiring Harness Connector
f - Warning Horn
g - Trim/Tilt Switch



Commander Side Mount Remote Control Wiring Diagram

Power Trim System Wiring Diagram (3 Cylinder Models Using COMMANDER Side Mount Remote Control)

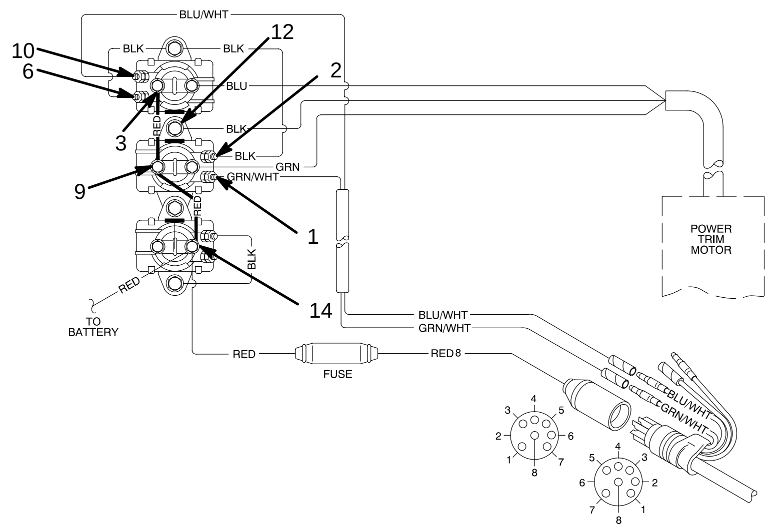
- BLK • BLACK
- BLU • BLUE
- GRN • GREEN
- PUR • PURPLE
- RED • RED
- WHT • WHITE



23884

Power Trim System Wiring Diagram (3 Cylinder Models Using COMMANDER 2000 Side Mount Remote Control)

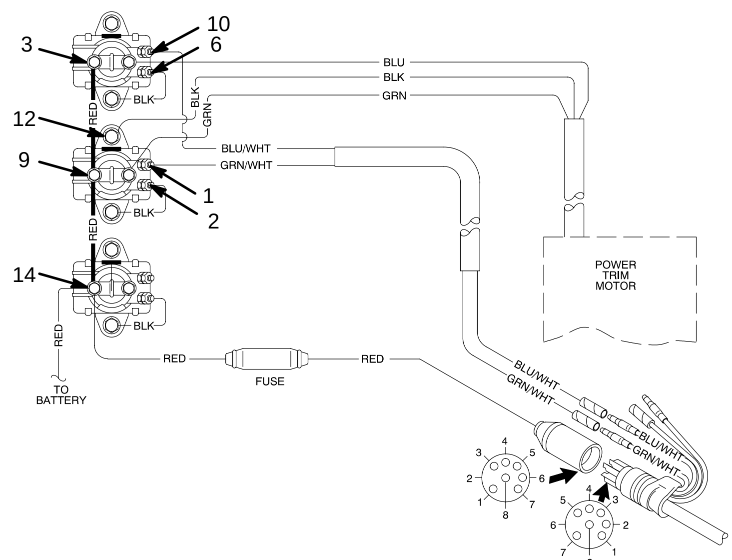
- BLK • BLACK
- BLU • BLUE
- GRN • GREEN
- RED • RED
- WHT • WHITE



23886

Power Trim System Wiring Diagram (4 Cylinder Models Using COMMANDER 2000 Side Mount Remote Control)

- BLK • BLACK
- BLU • BLUE
- GRN • GREEN
- RED • RED
- WHT • WHITE



23885

Electrical System Troubleshooting

General Checks

Before troubleshooting the Power Trim electrical system, check the following:

1. Check for disconnected wires.
2. Make certain all connections are tight and corrosion free.
3. Check that plug-in connectors are fully engaged.
4. Make certain battery is fully charged.

Refer to the preceding wiring diagrams for connection points when troubleshooting the electrical system. (Connection points are specified by number.)

Troubleshooting the "Trailer" Circuit* (When "Up" Circuit Is OK)

*** Remote Control Equipped with Trailer Button**

Use an Ohmmeter (R x 1 scale) and check continuity of wire between Point 10 on "Up" solenoid and Point 13 on trailer button. If no continuity, wire is open.

If wire is OK, disconnect all battery leads from battery and check continuity across trailer button terminals with trailer button depressed. If no continuity is indicated, trailer button is faulty.

Troubleshooting the "Up" and "Trailer" Circuits* (Both Circuits Inoperative: "Down" Circuit Is OK)

*** Remote Control Equipped with Trailer Button**

Connect Voltmeter red lead to Point 10 and BLACK lead to ground.

Depress the trailer button.

Battery Voltage Indicated:

Connect Voltmeter RED lead to Point 3.

No Voltage Indicated:

There is an open circuit in wires [BLUE-WHITE (or BLUE), PURPLE-WHITE (or PURPLE)] between "Up" solenoid and trim buttons.

Battery Voltage Indicated:

- Connect Voltmeter RED lead to Point 6.
- Depress trailer button.

No Voltage Indicated:

- Check for loose or corroded connection at Point 9 or Point 3.
- Check RED lead between Point 9 and Point 3 for open.

Battery Voltage Indicated:

- Check "Up" solenoid terminals for loose or corroded connections.
- Check BLACK ground wire (on "Up" solenoid) for corrosion or open.
- Test "Up" solenoid. Refer to "Motor and Electrical Tests," following.

No Voltage Indicated:

Solenoid is defective.

Troubleshooting the "Up" Circuit* (When "Trailer" Circuit Is OK)

*** Remote Control Equipped with Trailer Button**

Use an Ohmmeter (R x 1 scale) and check continuity of wire between Point 10 on "Up" solenoid and Point 7 on trim button.

Continuity:

Connect Voltmeter RED lead to Point 8 (push button trim switch) or Point 5 (toggle trim switch) and BLACK lead to ground.

No Continuity:

Wire is open between Point 10 and Point 7.

Battery Voltage Indicated:

- Connect Voltmeter red lead to Point 7.
- Depress "Up" trim button.

No Voltage Indicated:

Wire is open between trailer button Point 11 and trim switch Point 8 (push button trim switch) or Point 5 (toggle trim switch).

Battery Voltage Indicated:

- Check for poor connection at Point 7.

No Voltage Indicated:

- Trim switch is defective.

Troubleshooting the "Down," "Up" and "Trailer" Circuits* (All Circuits Inoperative)

*** Remote Control Equipped with Trailer Button**

Check two in-line fuses (under cowl) to see if fuses are blown.

Blown Fuse:

- Correct problem that caused fuse to blow.
- Replace fuse.

Fuses Not Blown:

Connect Voltmeter red lead to Point 3 and black lead to ground. Battery voltage should be indicated.

No Voltage Indicated:

- Check battery leads and RED leads (between engine starter motor solenoid and Point 3) for poor connections or open circuits.
- Check battery charge.

Battery Voltage Indicated:

- Connect Voltmeter RED lead to Point 10.
- Depress "Trailer" button and check for battery voltage.

continued on next page . . .

Troubleshooting the “Down,” “Up” and “Trailer” Circuits* (All Circuits Inoperative)

*** Remote Control Equipped with Trailer Button**

continued from preceding page

Battery Voltage Indicated:

- Check BLACK ground wires at solenoids for poor connection or poor ground.
- Check BLACK motor lead for poor ground at Point 12. If wire is grounded, the pump motor is faulty. Refer to “Motor and Electrical Tests/Repair,” following.

No Voltage Indicated:

Connect RED Voltmeter lead to Point 11, and BLACK lead to ground.

No Voltage Indicated:

Check that voltage is being supplied to control by performing the following checks:

- DO NOT start engine.
- Turn ignition switch to “Run” position.
- Check for voltage at any instrument, using a Voltmeter.

Battery Voltage Indicated:

There is an open circuit in each wire [GREEN-WHITE, BLUE-WHITE, and PURPLE-WHITE (or PURPLE)] between trim buttons and trim pump.

- Check all trim harness connectors for loose or corroded connections.
- Check for pinched or severed wires.

No Voltage Indicated:

RED wire is open between Point 14 and terminal “b” on the back of the ignition switch.

- Check for loose or corroded connections.
- Check for open in wire.

Battery Voltage Indicated:

There is an open circuit in wire between Point 11 and terminal “b” on the back of the ignition switch.

Troubleshooting the "Down" Circuit (When "Up" Circuit Is OK)

Remote Controls With or Without Trailer Buttons

Connect Voltmeter RED lead to Point 1 and BLACK lead to ground.

Depress the "Down" trim button.

Battery Voltage Indicated:

Connect Voltmeter RED lead to Point 9.

No Voltage Indicated:

Connect Voltmeter RED lead to Point 4 and BLACK lead to ground. Depress "Down" trim button. If battery voltage is indicated, wire is open between Points 4 and 1.

Battery Voltage Indicated:

- Connect Voltmeter RED lead to Point 2.
- Depress "Down" trim button.

No Voltage Indicated:

There is an open circuit between Point 9 and positive (+) battery terminal.

- Check for loose or corroded connections.
- Check wires for open.

Battery Voltage Indicated:

- Check "Down" solenoid terminals for loose or corroded connections.
- Check BLACK ground wire (on "Down" solenoid) for corrosion or open.
- Test "Down" solenoid. Refer to "Motor and Electrical Tests," see Index.

No Voltage Indicated:

Solenoid is defective.

No Voltage Indicated:

Connect Voltmeter RED lead to Point 5. If battery voltage is indicated, trim switch is faulty. If no battery voltage, check for loose or corroded connection at Point 5 or open circuit in wire supplying current to Point 5.

Troubleshooting the “Up” Circuit* (When “Down” Circuit Is OK)

*** Remote Control NOT Equipped with Trailer Button**

Connect Voltmeter RED lead to Point 10 and BLACK lead to ground.

Depress the “Up” trim button.

Battery Voltage Indicated:

Connect Voltmeter RED lead to Point 3.

No Voltage Indicated:

Trim Switch is faulty or there is an open circuit in wires [GREEN-WHITE, BLUE-WHITE and PURPLE-WHITE (or PURPLE)] between trim point 7 and trim pump.

- Check trim switch.
- Check all trim harness connectors for loose or corroded connections.
- Check for pinched or severed wires.

Battery Voltage Indicated:

- Connect Voltmeter RED lead to Point 6.
- Depress “Up” trim button.

No Voltage Indicated:

- Check for loose or corroded connection at Point 9 or Point 3.
- Check RED lead between Point 9 and Point 3 for open.

Battery Voltage Indicated:

- Check “Up” solenoid terminals for loose or corroded connections.
- Check BLACK ground wire (on “Up” solenoid) for corrosion or open.
- Test “Up” solenoid. Refer to “Motor and Electrical Tests/Repair,” following.

No Voltage Indicated:

Solenoid is defective.

Troubleshooting the "Down" and "Up" Circuits* (All Circuits Inoperative)

*** Remote Control NOT Equipped with Trailer Button**

Check two in-line fuses (under cowl) to see if fuses are blown.

Blown Fuse:

- Correct problem that caused fuse to blow.
- Replace fuse.

Fuses Not Blown:

Connect Voltmeter red lead to Point 3, and black lead to ground. Battery voltage should be indicated.

No Voltage Indicated:

- Check battery leads and RED leads (between engine starter motor solenoid and Point 3) for poor connections or open circuits.
- Check battery charge.

Battery Voltage Indicated:

- Connect Voltmeter RED lead to Point 10 and black lead to ground.
- Depress "Up" trim button and check for battery voltage.

Battery Voltage Indicated:

- Check BLACK ground wires at solenoids for poor connection or poor ground.
- Check BLACK motor lead for poor ground at Point 12. If wire is grounded, the pump motor is faulty. Refer to "Motor and Electrical Tests/Repair," following.

No Voltage Indicated:

Connect RED Voltmeter lead to Point 5, and BLACK lead to ground.

No Voltage Indicated:

Check that voltage is being supplied to control by performing the following checks:

- DO NOT start engine.
- Turn ignition switch to "Run" position.
- Check for voltage at any instrument, using a Voltmeter.

Battery Voltage Indicated:

Trim switch is faulty or there is an open circuit in wires [GREEN-WHITE, BLUE-WHITE and PURPLE-WHITE (or PURPLE)] between trim buttons and trim pump.

- Check trim switch.
- Check all trim harness connectors for loose or corroded connections.
- Check for pinched or severed wires.

No Voltage Indicated:

Red wire is open between Point 14 and RED terminal on back of the ignition switch.

- Check for loose or corroded connections.
- Check for open in wire.

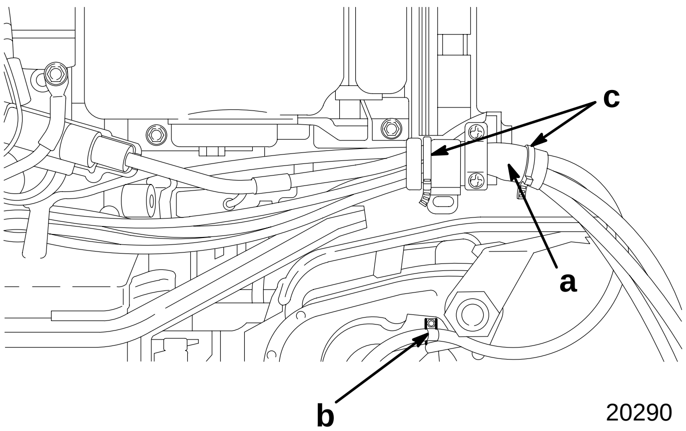
Battery Voltage Indicated:

There is an open circuit in wire between Point 5 and RED terminal on the back of the ignition switch.

Power Trim Assembly Removal and Installation

Removal

1. Remove clamps on transom bracket to free power trim wiring.

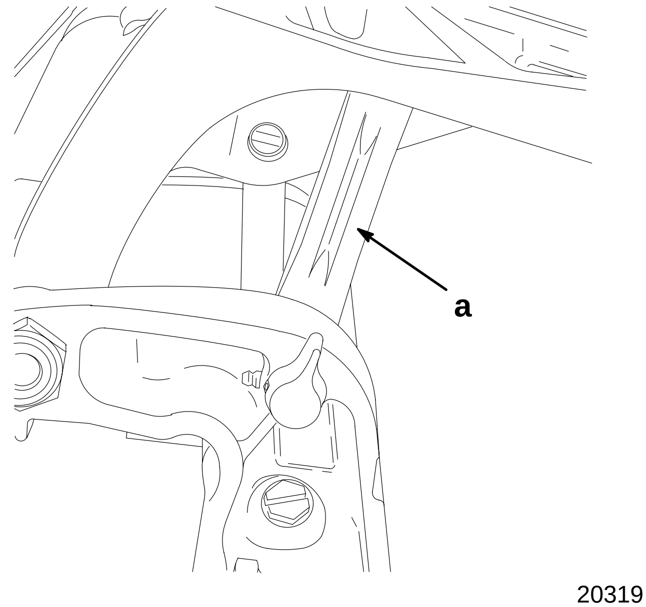


a - Harness Retainer
b - Clamp
c - Sta-Strap(s)

2. Raise outboard to full “Up” position and engage tilt lock lever.

⚠ WARNING

Failure to support outboard as shown could result in personal injury and/or damage to outboard or boat.

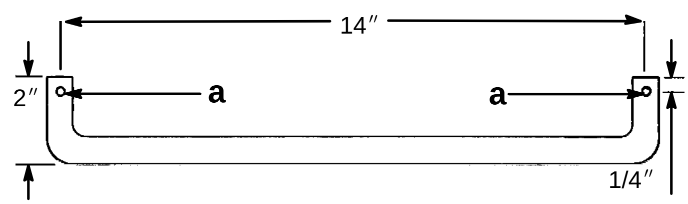


a - Tilt Lock Lever

IMPORTANT: Support outboard as shown above to prevent engine from tipping when power trim retaining pin is removed.

SUPPORT TOOL

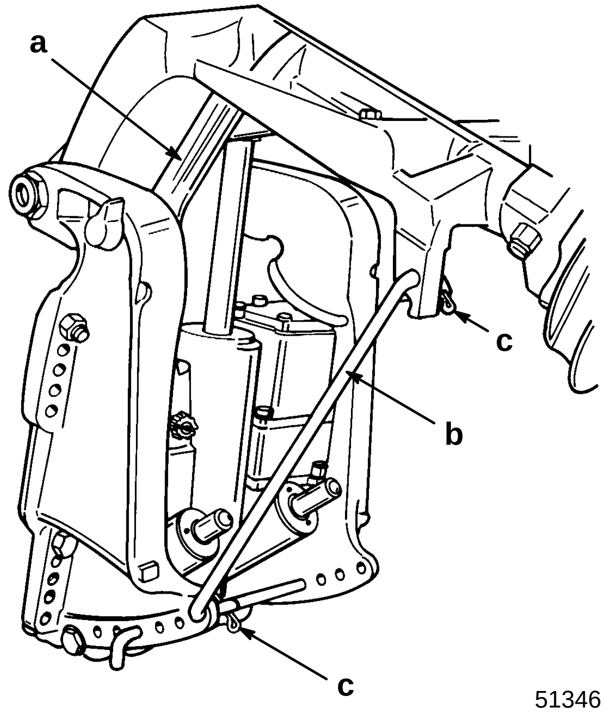
3/8 in. diameter metal rod (a used shift shaft works well).



a - Drill Holes for Retaining Clips

METRIC CONVERSION

14″ = 35.56cm
2″ = 50.8mm
3/8″ = 9.5mm
1/4″ = 6.35mm



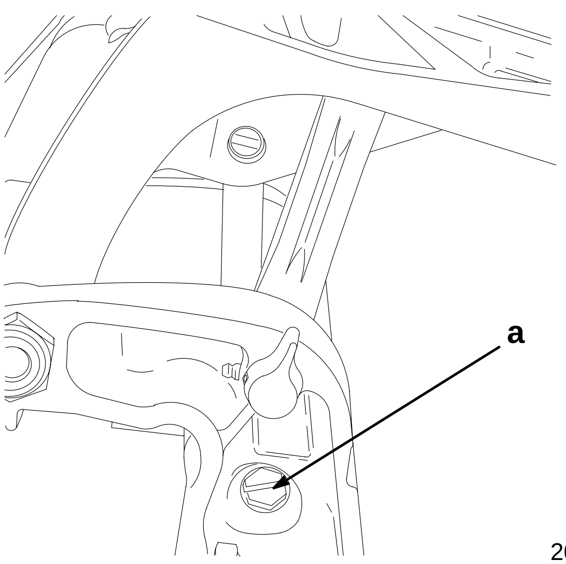
51346

a - Tilt Lock Lever
b - Support Tool
c - Retaining Clips

⚠ CAUTION

Disconnect battery cables at battery before removing power trim wires from solenoids.

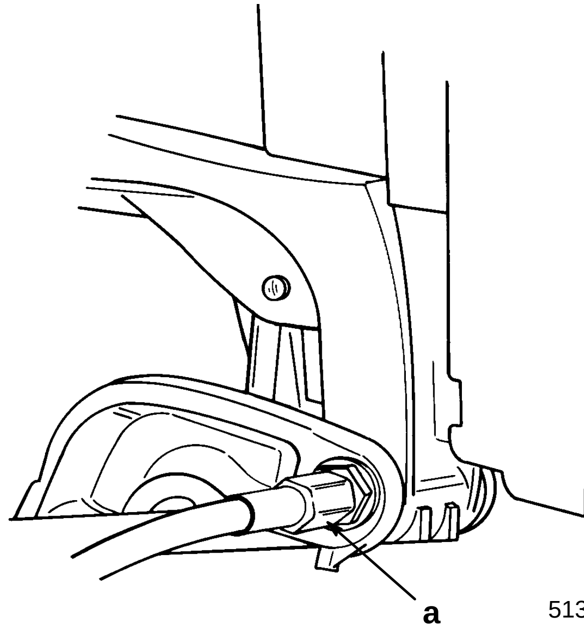
3. Disconnect power trim wires at solenoids (BLUE, GREEN, and BLACK).
4. Open filler cap and release any remaining pressure in the system.



20319

a - Filler Cap

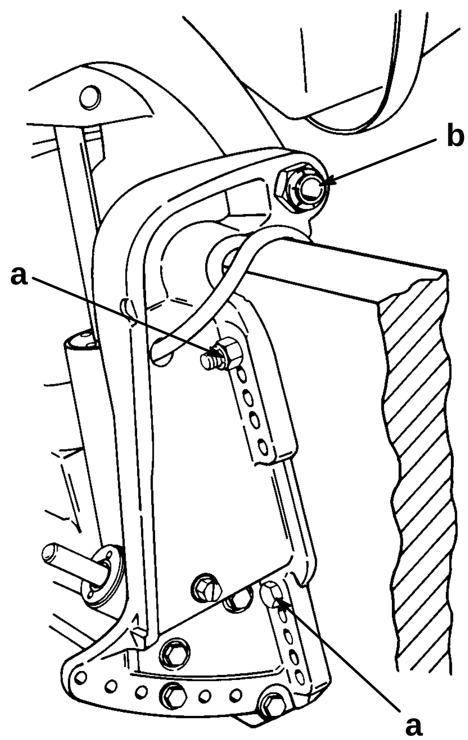
IMPORTANT: Outboards equipped with thru-the-tilt-tube steering - remove steering link arm from end of steering cable and cable retaining nut from tilt tube.



51354

a - Retaining Nut

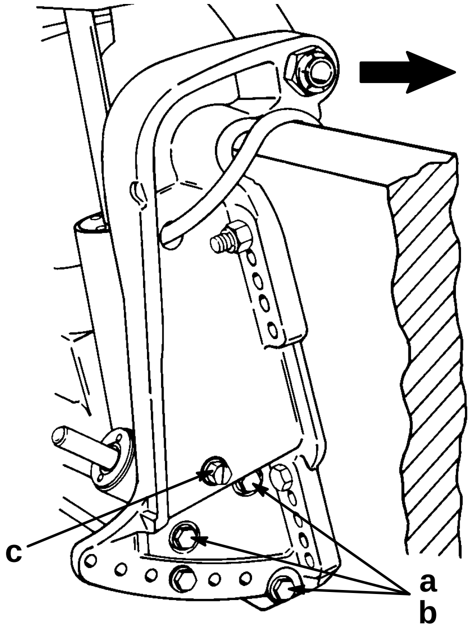
5. Remove outboard transom mounting bolts, and loosen tilt tube nut until nut is flush with end of tilt tube thread.



51375

a - Transom Mount Bolts (2)
b - Tilt Tube Nut (flush with end of thread)

6. Remove 3 screws and washers and move starboard transom bracket so that manual release valve will clear bracket when power trim is removed.

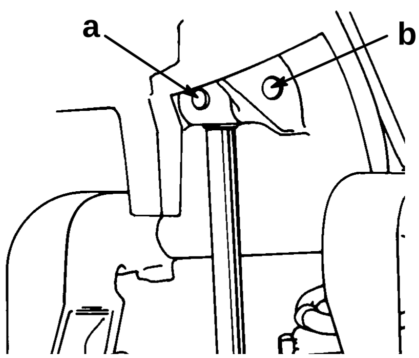


51375

a - Screws (3)
b - Washers (3)
c - Manual Release Valve

IMPORTANT: Cross pin (a) should not be reused. Replace with new cross pin.

7. Drive out cross pin, push out upper swivel pin, and remove 3 screws and washers retaining trim system. Remove system from outboard.

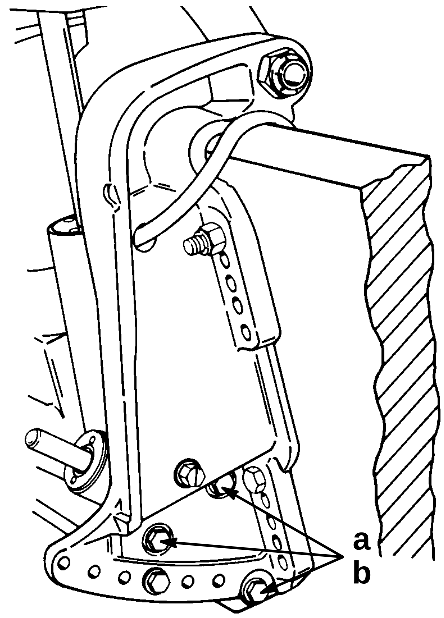


51339

a - Cross Pin
b - Upper Swivel Pin

Installation

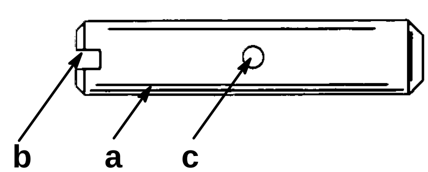
1. Paint any exposed metal surfaces to prevent corrosion.
2. Apply Loctite 271 to screws. Install trim system, starboard transom bracket, and tilt tube nut.



51375

a - Screw (6) Torque to 45 lb. ft. (61.0 N·m)
b - Flatwasher (6) Install one per screw

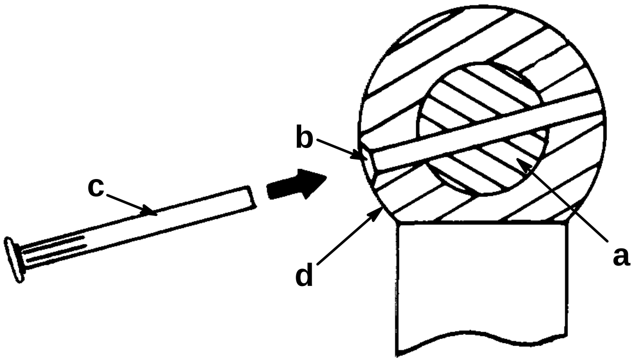
3. Use a 12 volt power source to extend tilt ram up to align upper swivel shaft hole and end of ram. Connect trim motor wires (BLUE wire to POSITIVE (+), BLACK wire to NEGATIVE (-). If ram extends too far, retract ram by connecting GREEN wire to POSITIVE (+).
4. Install Upper Swivel Pin with slotted end to left (port) side of engine.



a - Upper Swivel Pin
b - Slotted End
c - Cross Hole (in line with slotted end)

IMPORTANT: Cross pin should not be reused. Install a new pin.

5. Position slot on end of swivel shaft in line with hole in tilt ram end. Insert a punch into tilt ram hole to align cross hole in upper swivel shaft. Tap new cross pin in until flush.



a - Upper Swivel Shaft (Slot is in line with cross hole)
b - Chamfered End of Hole (Faces away from transom)
c - Cross Pin (Tri-lobe Design)
d - Tilt Ram End

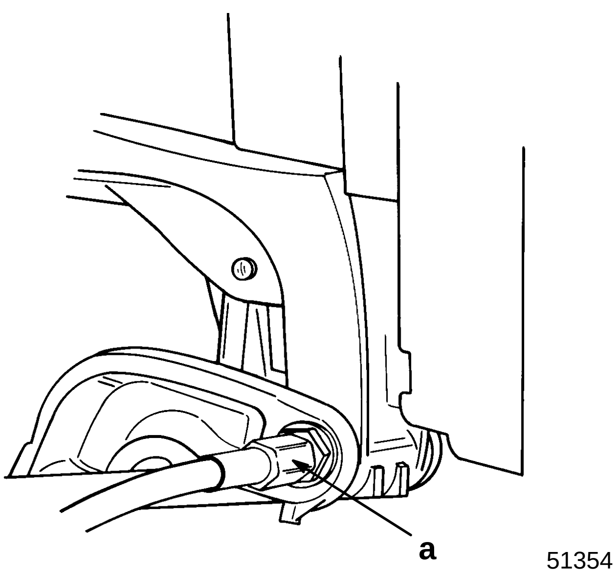
6. Connect trim motor wires to solenoids. Refer to Wiring Diagrams in this manual. Route trim wires as specified in this manual.
7. Apply marine sealer to shanks of mount bolts and install transom mount bolts.

IMPORTANT: Do not use an impact driver to tighten transom mount bolts.

Apply marine sealer to threads of mount bolts. Secure with flat washers and locknuts. Be sure installation is watertight.

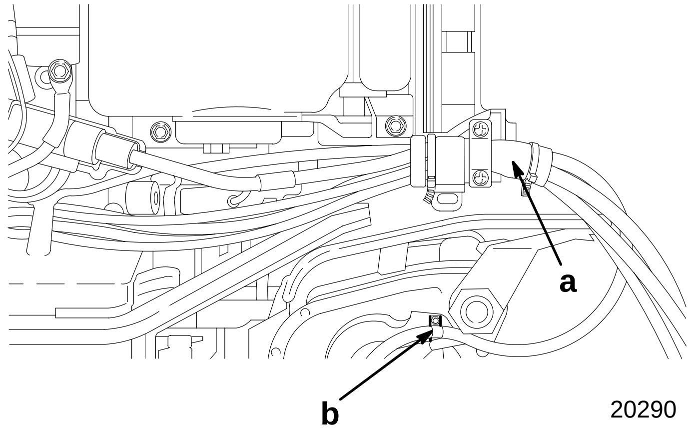
8. Tighten tilt tube nut securely.

IMPORTANT: Outboards equipped with thru-the-tilt-tube steering: Tighten steering cable retaining nut securely to tilt tube.



a - Steering Cable Retaining Nut

9. Apply Quicksilver Liquid Neoprene (91-25511--2) on all electrical connections.



a - Harness Retainer
b - Clamp

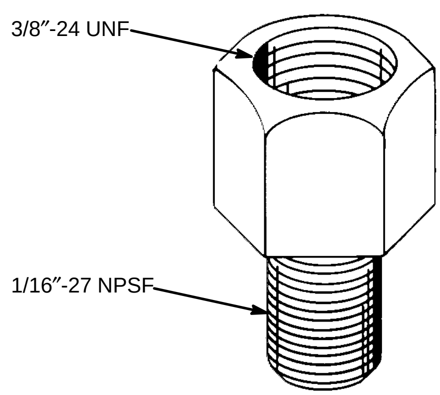
⚠ WARNING

Electrical wires passing through cowl openings must be protected from chafing or being cut. Follow the recommended procedures outlined in Section 1 of this Manual. Failure to protect wires as described could result in electrical system failure and/or injury to occupants of boat.

Testing Power Trim System With Test Gauge Kit (91-52915A3)

IMPORTANT: This test will not locate problems in the trim system. The test will show if the system is correct after a repair. If minimum pressures are not obtainable, the trim system requires additional repair.

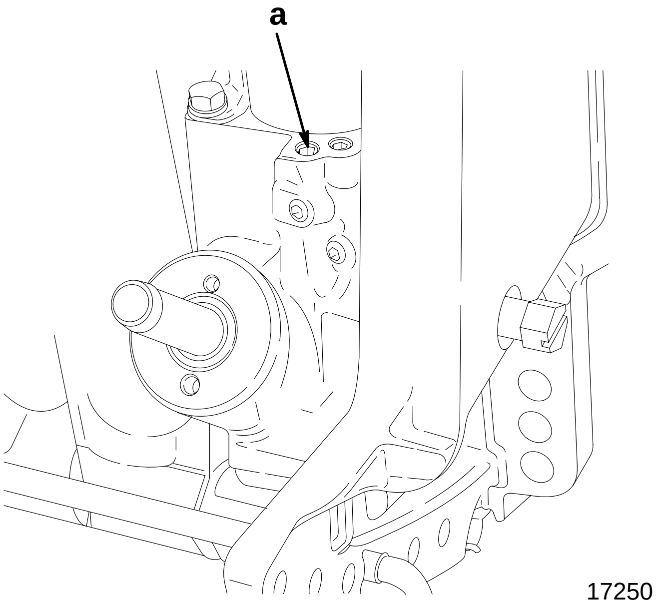
Use Adapter Fitting (22-11243) to connect test gauge to trim system.



“UP” Pressure Check

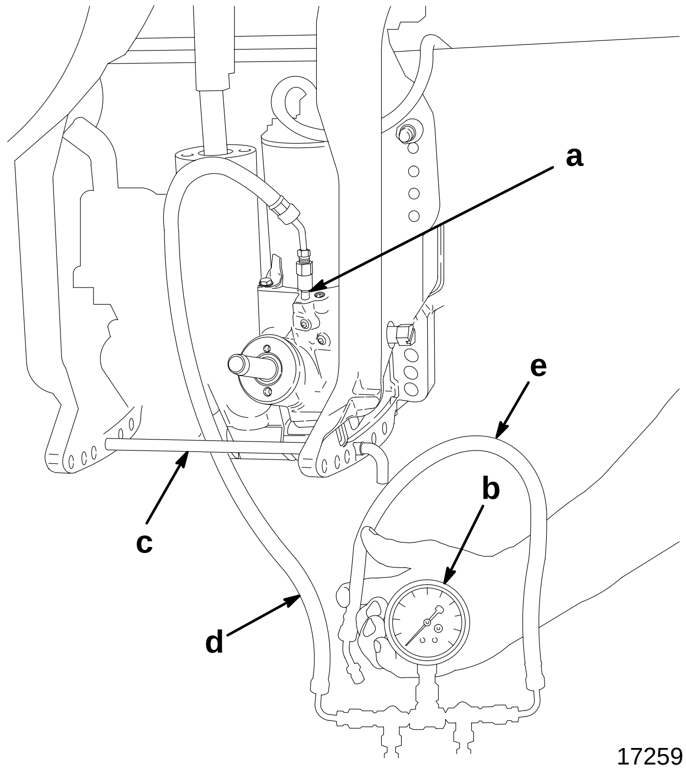
IMPORTANT: Insure battery is fully charged before performing tests.

1. Tilt outboard to full “Up” position and engage tilt lock lever.
2. Slowly remove “Fill” plug to bleed pressure from reservoir.
3. Turn Manual Release Valve 3 to 4 turns (counterclockwise) to bleed any remaining pressure.
4. Remove allen plug.



a - Allen Plug

5. Install components.



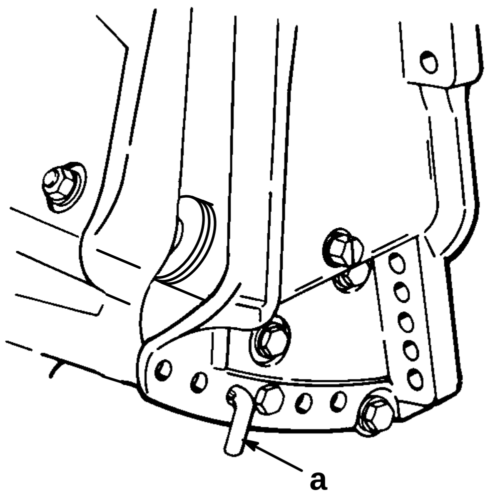
a - Adaptor Fitting (22-11243)
b - Test Gauge Assembly
c - Tilt Pin (Position in Hole Shown)
d - Hose (Route Hose Behind Tilt Pin, as Shown)
e - Hose (Not Used for This Check)

6. Disengage tilt lock lever.

⚠ CAUTION

Failure to install spare tilt pin (or hardened bolts and nuts) in hole shown could result in transom bracket failure and possible injury.

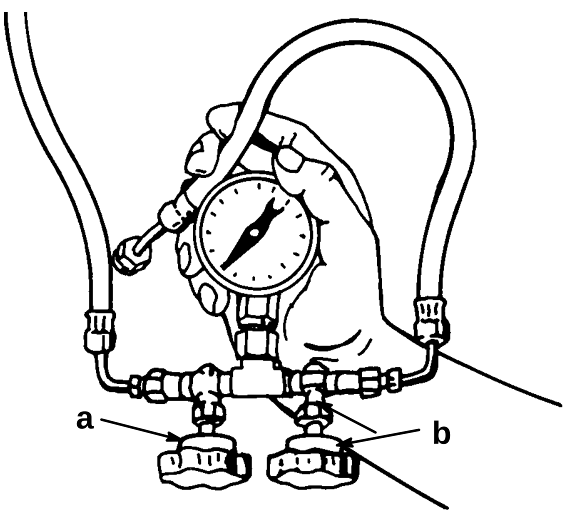
7. Move outboard "In" until hole in swivel bracket "ear" aligns with the third tilt hole in transom bracket. Lock engine in trim range by installing a 3/8 in. (9.5mm) diameter tilt pin or two 3/8 in. (9.5mm) hardened bolts and nuts thru the transom brackets and swivel bracket in the hole shown.



18456

a - Tilt Pin Hole
(Install Spare Tilt Pin or Hardened Bolts and Nuts)

8. Install "Fill" plug.
9. Close Manual Release Valve (clockwise).
10. Open valve (a) and close valve (b).



51374

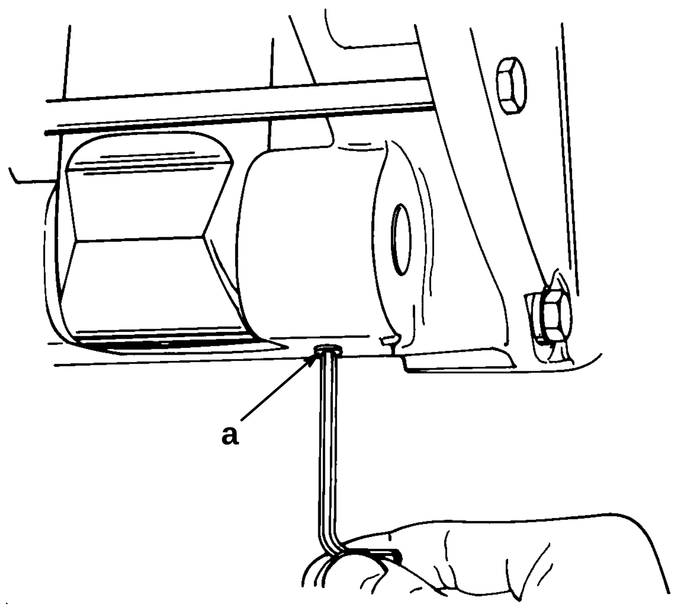
a - Open Valve
b - Close Valve

11. Run trim "UP". The minimum pressure should be 1300 P.S.I. (91 kg/cm^2).
12. Run trim "DOWN" to release pressure and remove spare tilt pin or bolts and nuts.
13. Tilt outboard full "UP" and engage tilt lock lever.
14. Slowly remove "Fill" plug to bleed pressure.
15. Open Manual Release Valve 3 to 4 turns to bleed any remaining pressure.
16. Remove test gauge hose and adapter, and install allen plug.

NOTE: If pressure is less than 1300 PSI (91 kg/cm2), troubleshoot system per instructions on page 6A-6.

"DOWN" Pressure Check

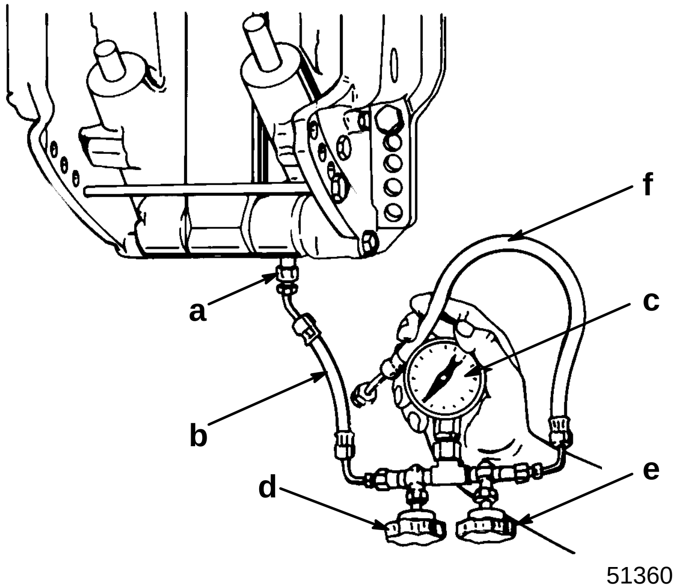
1. Repeat steps 1 through 4 from preceding **"UP"** pressure check, removing allen plug as shown.



51367

a - Allen Plug

2. Install components.

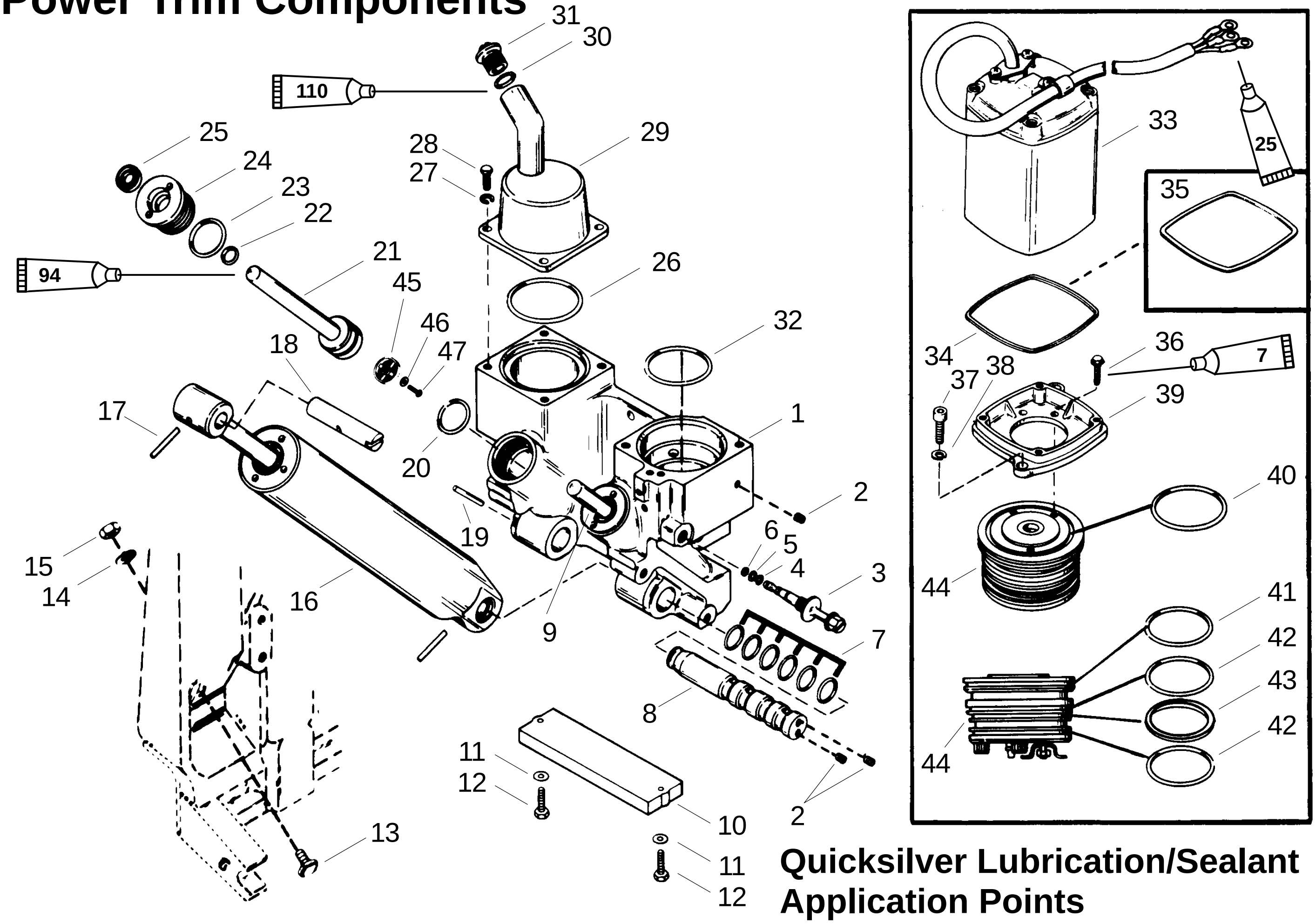


a - Adapter Fitting (22-11243)
b - Hose (route hose so it will not be pinched when outboard is trimmed "DOWN")
c - Test Gauge Assembly
d - Valve Open
e - Valve Close
f - Hose (not used for this test)

3. Open valve (d) and close valve (e).
4. Install fill plug.
5. Close Manual Release Valve (clockwise).
6. Run trim "DOWN". Minimum pressure should be 500 P.S.I. (35 kg/cm^2).
7. Tilt outboard full "UP" and engage tilt lock lever.
8. Slowly remove "Fill" plug to bleed pressure.
9. Open Manual Release Valve 3 to 4 turns to release any remaining pressure.
10. Remove test gauge hose and adapter fitting. Install allen plug.
11. Fill Power Trim system and purge system; refer to "Fill, Check, and Purge" preceding.

NOTE: If pressure is less than 500 PSI (35 kg/cm2), troubleshoot system per instructions on Page 6A-6.

Power Trim Components



Quicksilver Lubrication/Sealant Application Points

94 Anti-Corrosion Grease (92-78376A6)

110 Power Trim and Steering Fluid (92-90100A12)

25 Liquid Neoprene (92-25711--2)

7 Loctite 271 (Obtain Locally)

REF. NO.	DESCRIPTION	TORQUE		
		lb. in.	lb. ft.	N·m
1	Housing			
2	Allen Plug			
3	Manual Release Valve			
●4	O-ring [.239″ (6.07mm) I.D.]			
●5	O-ring [.208″ (5.28mm) I.D.]			
●6	O-ring [.114″ (2.90mm) I.D.]			
●7	O-ring [.989″ (25.12mm) I.D.]			
8	Shaft			
9	Trim Rod Assembly, Starboard			
10	Anode Plate			
11	Washer			
12	Bolt	70		7.9
13	Striker Plate, Trim Rod			
14	Lockwasher			
15	Nut	80		9.0

Power Trim Components (Continued)

REF. NO.	DESCRIPTION	TORQUE		
		lb. in.	lb. ft.	N·m
16	Tilt Cylinder Assembly			
17	Cross Pin			
18	Retaining Pin			
19	Pin			
●20	O-ring [1.248″ (31.70mm) I.D.]			
21	Trim Rod Assembly w/Check Valve, Port			
●22	O-ring [.612″ (15.54mm) I.D.]			
●23	O-ring [1.475″ (37.47mm) I.D.]			
24	Cap, Trim Cylinder			
●25	Seal			
●26	O-ring (2.864″ I.D.)			
27	Washer			
28	Bolt			
29	Reservoir Cover			
●30	O-ring [.583″ (14.81mm) I.D.]			
31	Fill Screw			
■●32	O-ring [2.739″ (69.57mm) I.D.] (If Equipped)			
33	"Square" Motor Assembly			
34	Square Ring, used when end frame cap has groove			
35	Gasket, used when end frame cap does NOT have groove			
36	Bolt	70		7.9
37	Allen Bolt	70		7.9
38	Lockwasher			
39	End Frame Cap			
40	O-ring (or Flat Ring)			
■41	O-ring [2.739″ (69.57mm) I.D.]			
■42	O-ring [2.614″ (66.40mm) I.D.]			
■43	Flat Ring			
44	Pump Assembly			
45	Screen (If Equipped)			
46	Washer (If Equipped)			
47	Screw (If Equipped)			

■ Contents of "Pump Seal Kit" (P/N 12663)
● Contents of "Power Trim O-ring Kit" (P/N 25-48462A1)
* It is recommended O-ring be installed even if pump was not originally equipped with this O-ring.

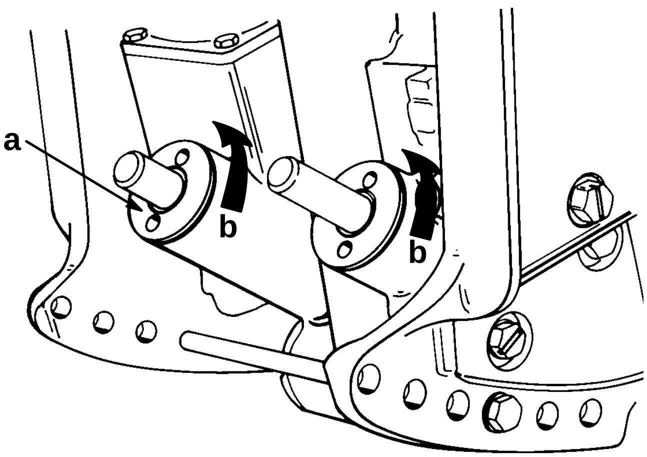
Hydraulic Repair

TRIM ROD REMOVAL AND REPAIR

NOTE: Power Trim does not have to be removed from outboard to remove trim rods.

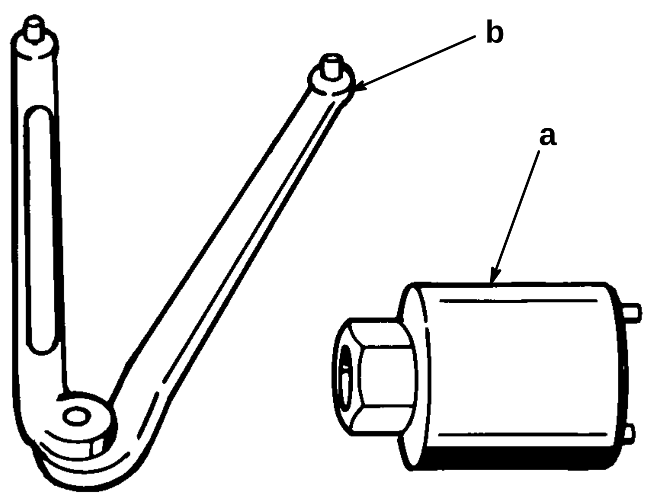
1. Tilt outboard to full "UP" position and engage tilt lock lever.
2. Slowly remove "Fill" plug to bleed reservoir pressure.
3. Turn Manual Release Valve 3 to 4 turns (counter-clockwise) to bleed remaining pressure.
4. Remove trim rod cylinder caps.

NOTE: Place a clean pan under trim system to catch fluid.



51353

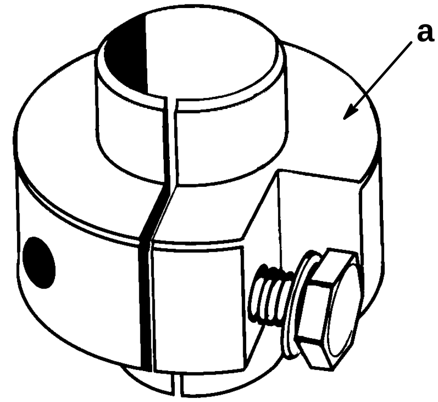
a - Trim Rod Cylinder Cap
b - Turn Counterclockwise to Remove



51337

a - Removal Tool (91-44487A1)
b - Spanner Wrench (91-74951)

5. Install trim rod removal tool and pull trim rod from cylinder.



27933

a - Trim Rod Removal Tool (91-44486A1)

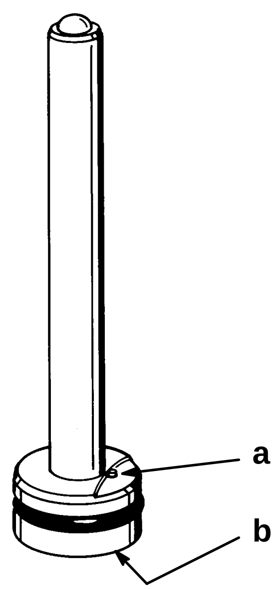
CLEANING AND INSPECTION - TRIM RODS AND CAPS

⚠ CAUTION

Do not remove check valve (a). Check valve is preset to operate at a specific pressure. Removal and installation of check valve could result in improper operating pressure and possible system damage.

NOTE: Check valve is in port side trim rod only.

1. Inspect check valve and check valve screen for debris; if debris cannot be removed, replace trim rod assembly. Clean trim rod with parts cleaner and dry with compressed air.

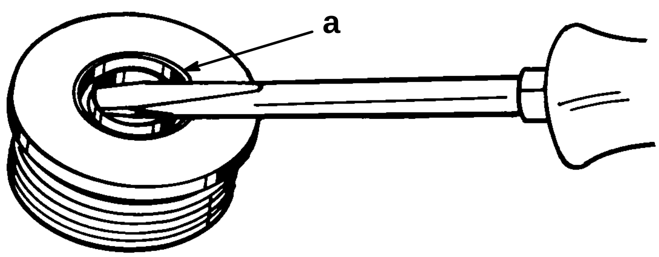


51352

a - Check Valve
b - Check Valve Screen

Trim Rod End Cap Seal

1. Inspect trim cap end seal and replace if damaged or if seal does not keep trim rod clean.



a - Seal (Remove as shown)

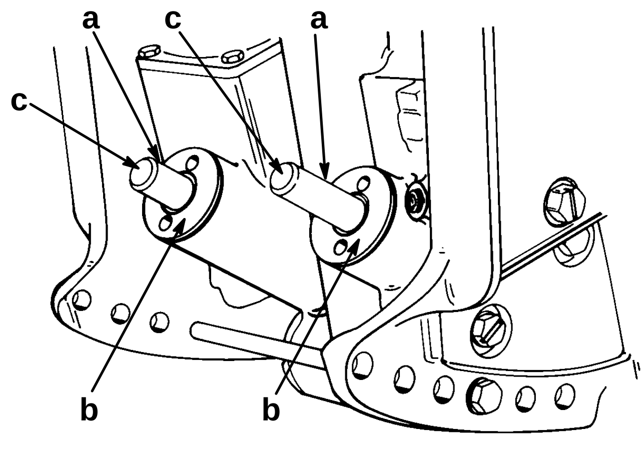
2. Install new seal with seal lip up.

TRIM ROD INSTALLATION

IMPORTANT: Components must be free of dirt and lint. Any debris in the system can cause system to malfunction.

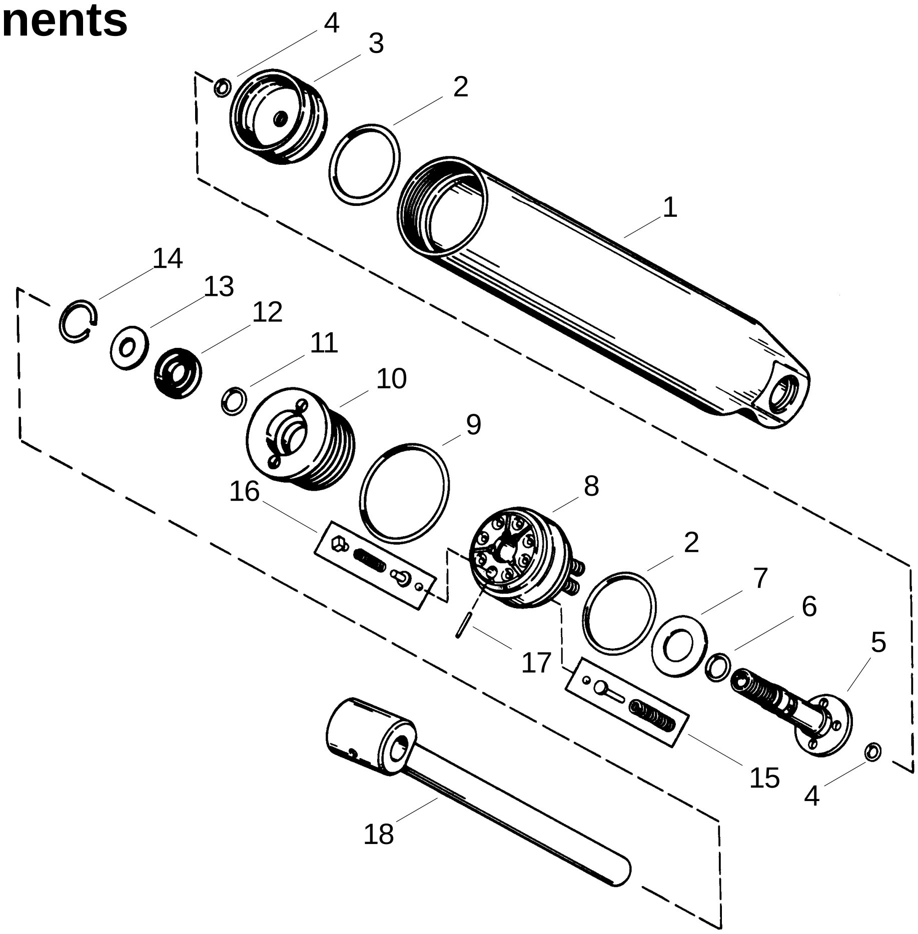
NOTE: Install trim rod with check valve in the port (left) cylinder.

1. Apply Quicksilver Power Trim and Steering Fluid on all O-rings and seals before installation.
2. Install trim rods and caps. Use Installation Tool (91-44487A1) or Spanner Wrench (91-74951) to tighten caps securely.



a - Trim Rods
b - Cylinder End Caps
c - Rod End Rollers (lubricate with Quicksilver Anti-Corrosion Grease or 2-4-C w/Teflon)

Tilt Ram Components



REF. NO.	QUAN.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	Housing, Tilt Ram			
°2	1	O-ring (1.957″ I.D.)			
3	1	Cup			
°4	1	O-ring (.307″ I.D.)			
5	1	Rod End			
°6	1	O-ring (.661″ I.D.)			
7	1	Washer			
8	1	Piston			
°9	1	O-ring (2.067″ I.D.)			
°10	1	Cap			
11	1	O-ring (.854″ I.D.)			
°12	1	Scraper			
°13	1	Washer			
°14	1	Retaining Ring			
15	1	Check Valve Assembly			
16	1	Check Valve Assembly			
17	1	Roll Pin			
18	1	Rod			

° Contents of “Tilt Cylinder O-ring Kit” (P/N 25-41478A1)

Tilt Ram

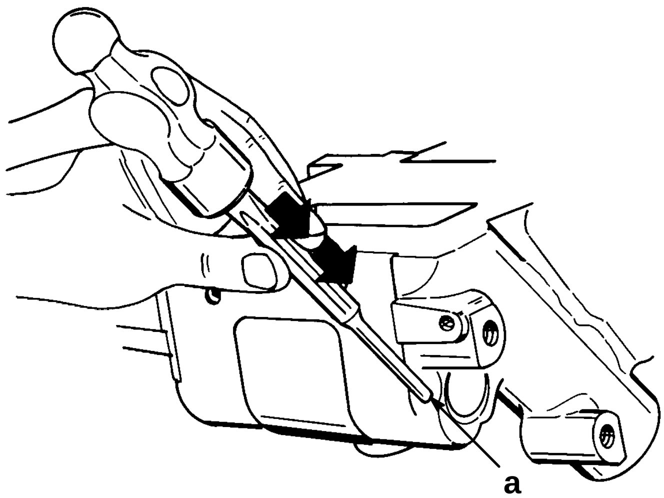
REMOVAL

1. Remove Power Trim assembly from engine, refer to “Removal” instructions in “Power Trim Assembly Removal and Installation,” preceding.

   Slowly remove fill screw to bleed pressure from reservoir.

   From a full closed (clockwise) position, slowly open manual release valve 3 to 4 turns (counterclockwise) to bleed remaining pressure from Power Trim system.

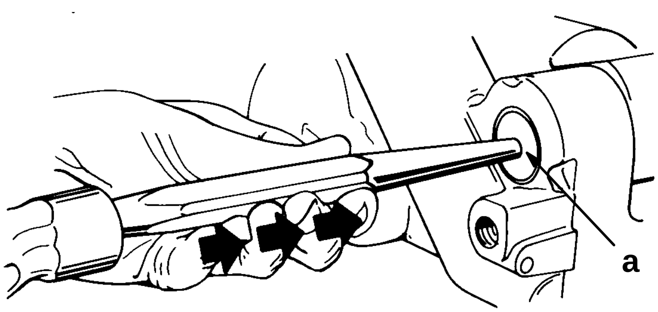
   Remove pin by driving pin in direction shown.



51366

a - Pin

2. Remove shaft by driving shaft in direction shown.



51355

a - Shaft

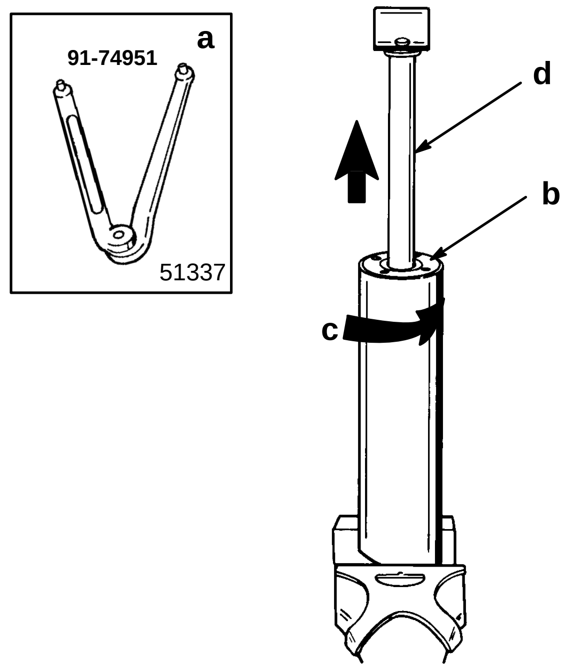
DISASSEMBLY

1. Secure tilt ram (at its base) in a soft jawed vise.

   Using Spanner Wrench, loosen cap by turning cap in direction.

   Remove ram from vise, and pour fluid from ram.

   Pull rod assembly out of ram.



51364

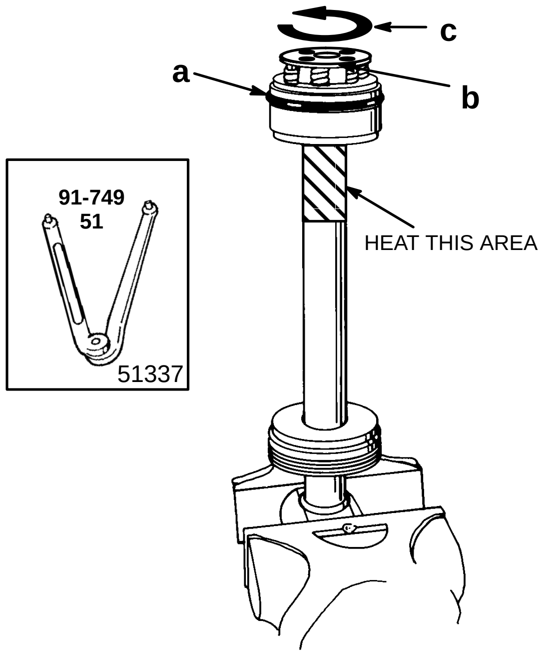
a - Spanner Wrench
b - Cap
c - Turn in Counterclockwise Direction
d - Rod Assembly

2. Clamp tilt rod in a soft jawed vise, as shown.

   Remove o-ring.

   Heat rod with Torch Lamp (91-63209 or 91-74042).

   Using spanner wrench (91-74951), remove rod end by turning rod end in direction shown.

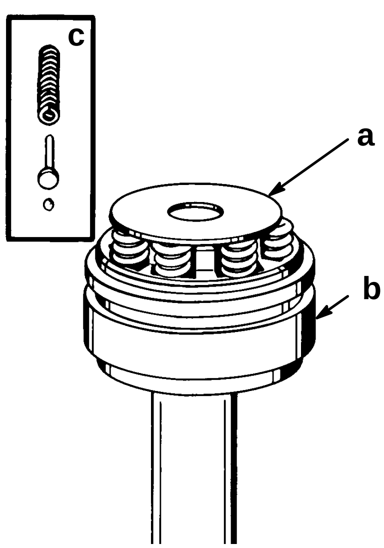


51340

a - O-ring
b - Rod End
c - Turn in Counterclockwise Direction

3. Lift washer and piston from rod; do not let check valve assemblies fall.

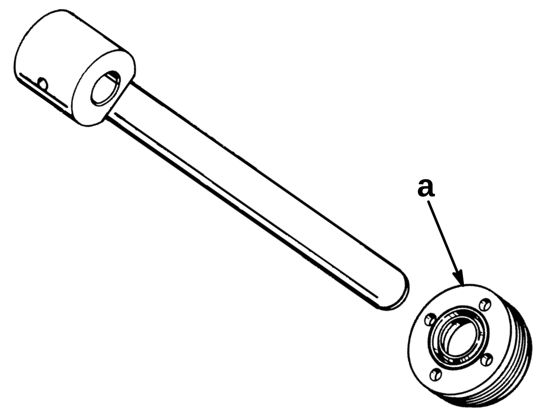
   Remove check valve assemblies.



51363

a - Washer
b - Piston
c - Valve Assemblies

4. Slide cap off from rod.

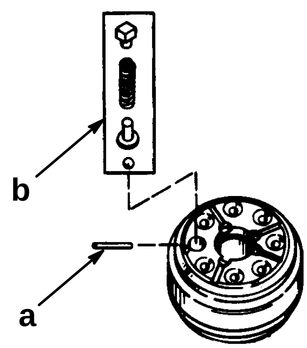


51376

a - Cap

5. Remove roll pin using a punch and hammer.

   Remove check valve assembly.

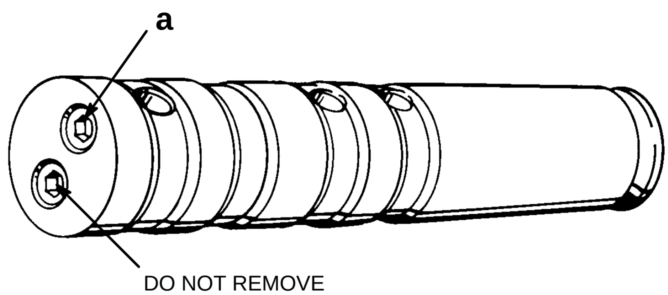


a - Roll Pin
b - Check Valve Assembly

6. Remove allen plug from shaft.

IMPORTANT: Remove plug from same side as holes in shaft.

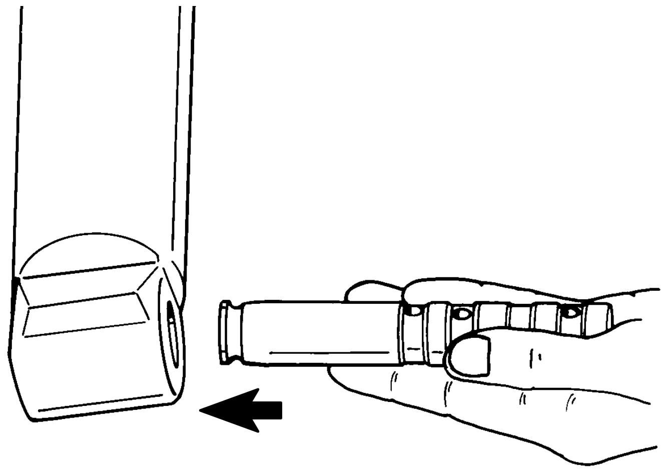
Lubricate shaft with Automatic Transmission Fluid (ATF) Type A or AF.



51361

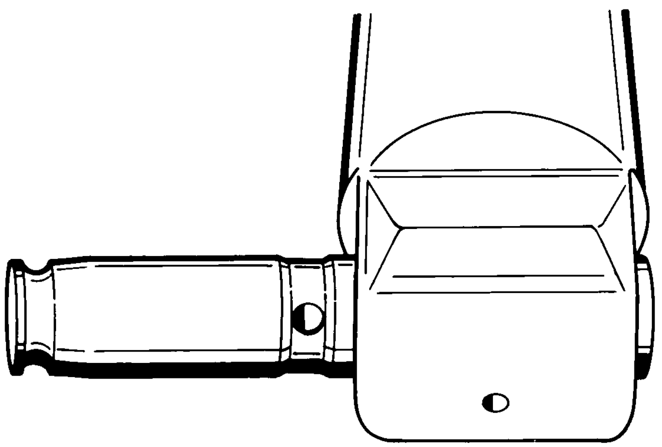
a - Allen Plug

7. Insert shaft into housing, as shown.



51342

Tap shaft into housing until shaft is positioned as shown.



51365

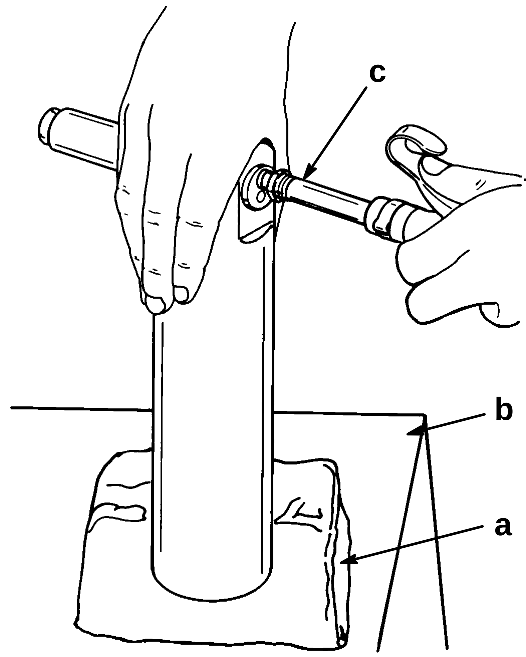
⚠ DANGER

Cup will be expelled from housing at a high velocity when air pressure is applied. Failure to place housing as shown could result in severe personal injury or death.

8. Place housing, as shown.

   Hold down on housing and inject air into shaft opening, as shown.

   Reinstall allen plug into shaft.



51353

a - Shop Cloth
b - Solid Work Bench (or Floor)
c - Air Nozzle

CLEANING AND INSPECTION

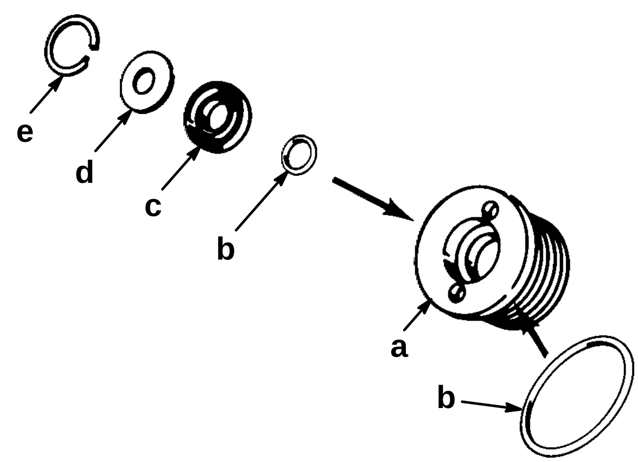
Inspect O-rings, and replace if damaged.

Clean components with parts cleaner and dry with compressed air.

Inspect tilt rod. If scraper (located in cap) has failed to keep rod clean, replace scraper; refer to instructions, following.

SCRAPER REPLACEMENT

Use a screwdriver to remove components from cap.



a - Cap
b - O-ring (2)
c - Scraper Seal
d - Washer
e - Retaining Ring

REASSEMBLY

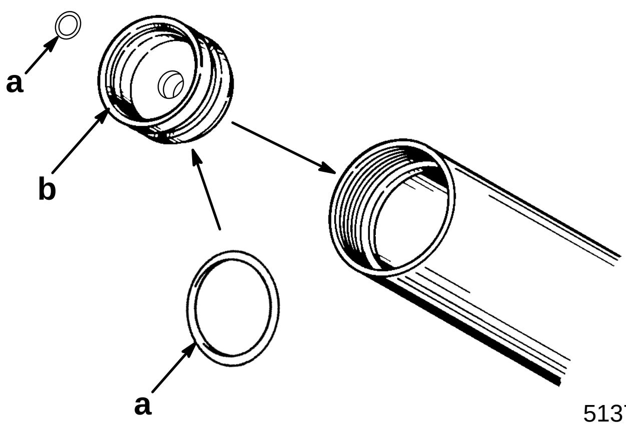
IMPORTANT: Components must be dirt and lint free. Slightest amount of debris in Power Trim system could cause system to malfunction.

1. Apply Automatic Transmission Fluid (ATF) Type A (Dexron II) on O-rings during reassembly.

NOTE: Refer to "Tilt Ram Components" for proper O-ring sizes.

Install O-rings.

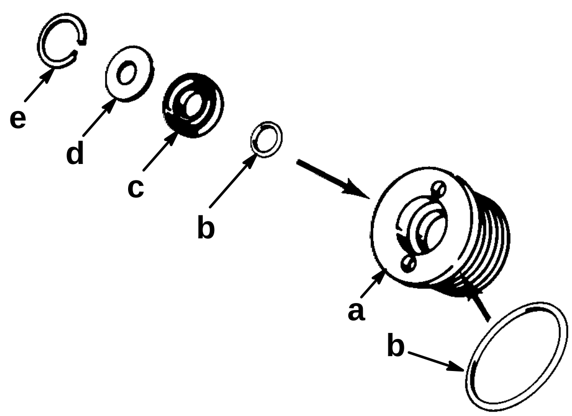
2. Insert cup into housing.



51372

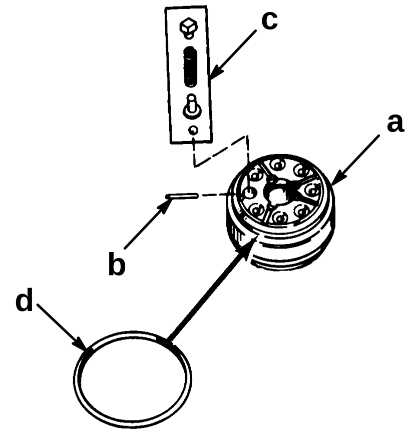
a - O-ring
b - Memory Piston Cup (Design 1 shown)

3. Assemble cap, as shown.



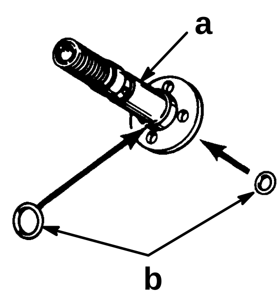
a - End Cap
b - O-ring (2)
c - Scraper Seal
d - Washer
e - Retaining Ring

4. Install components, as shown.



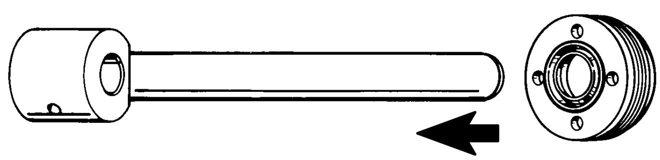
a - Piston
b - Roll Pin
c - Check Valve Assembly
d - O-ring

5. Install O-rings in locations shown.



a - Rod End
b - O-rings

6. Install end cap.

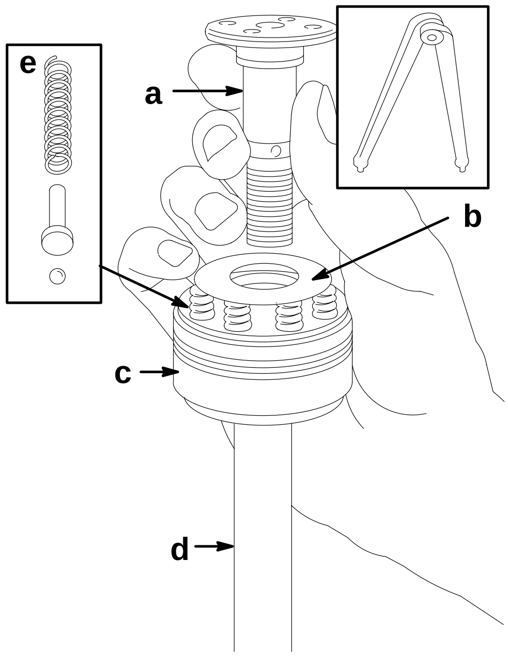


51376

NOTE: Some tilt rams have one check valve spring that is a lighter duty than the other six springs.

7. Install components onto rod, as shown.

Screw rod end into rod. Tighten rod end securely using Spanner Wrench.

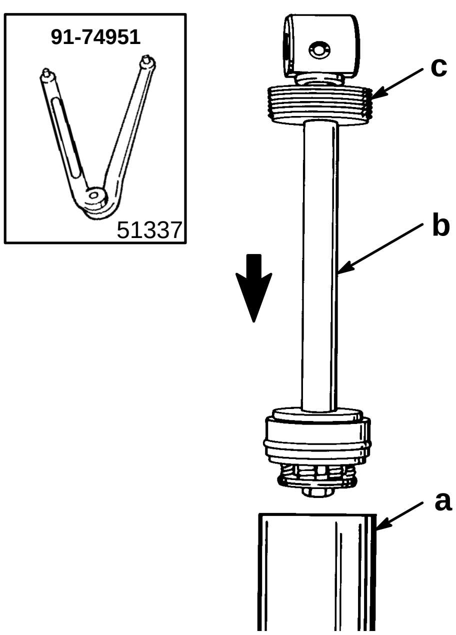


a - Rod End
b - Washer
c - Piston
d - Rod
e - Check Valve Assemblies (7)

8. Clamp housing in a soft jawed vise.

   Install rod assembly into housing.

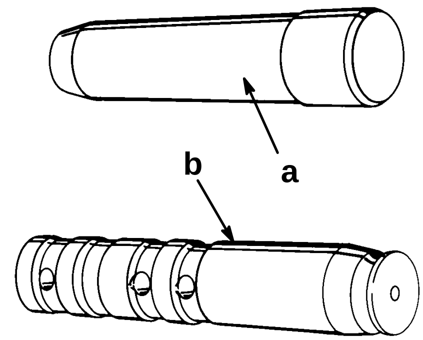
   Tighten cap securely using Spanner Wrench (91-74951).



a - Housing
b - Rod Assembly
c - Cap

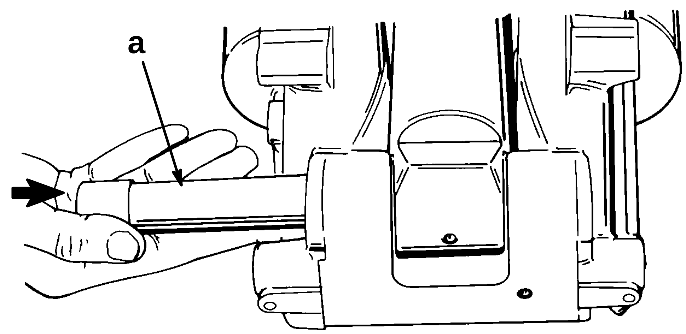
INSTALLATION

1. Lubricate alignment tool and shaft with Quicksilver Power Trim and Steering Fluid or Automatic Transmission Fluid (ATF) Type F, FA or Dexron II.



a - Alignment Tool (91-11230)
b - Shaft

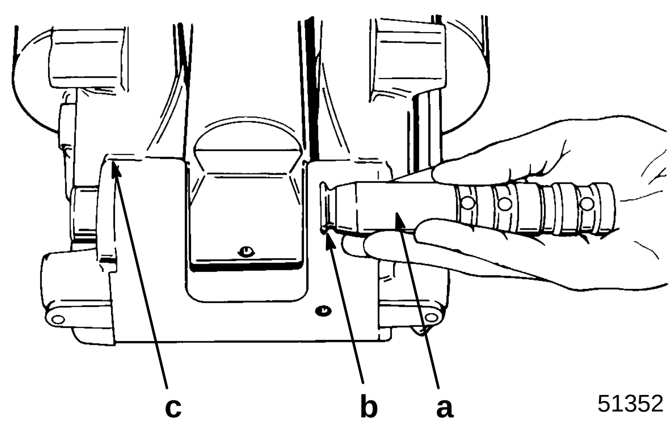
2. Align tilt ram with Power Trim housing by inserting alignment tool in direction shown.



a - Alignment Tool

3. Install shaft into housing, as shown.

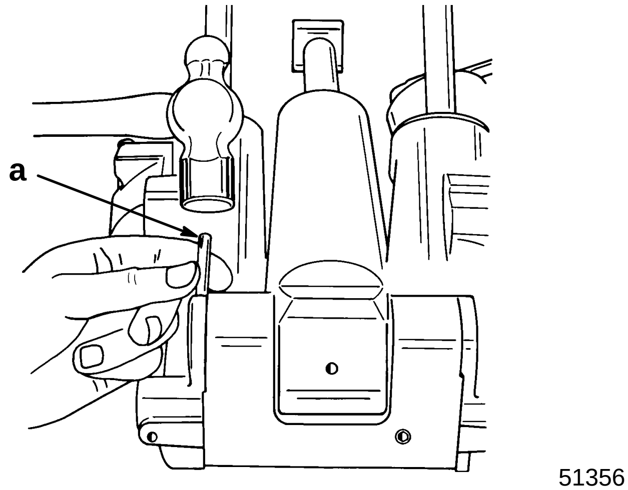
   Groove will align with hole when shaft is properly installed.



a - Shaft
b - Groove
c - Hole

4. Install pin. Drive pin in until flush.

   Install Power Trim assembly on engine, refer to "Installation" instructions in "Power Trim Assembly Removal and Installation," preceding.



a - Pin (Drive Against Knurled End)

Pump Replacement

IMPORTANT: The pump is not rebuildable. If pump is defective, replace as an assembly.

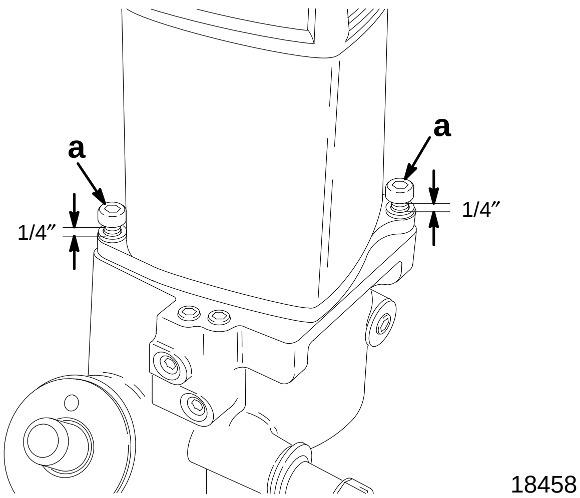
NOTE: Power Trim assembly does not have to be removed from engine to replace pump.

1. Disconnect trim pump motor wires, and remove starboard transom bracket from engine; refer to "Removal" instructions in "Power Trim Assembly Removal and Installation," preceding.

   Unseat motor and pump assembly from housing as follows:

OPERATIVE TRIM MOTOR

Loosen 2 bolts until 1/4″ (6mm) of each bolt is exposed. Do not remove bolts.



a - Bolts

Tighten manual release valve to full right (clockwise).

Operate trim motor in "Up" direction by connecting trim motor wires to a 12-volt battery [BLUE wire to POSITIVE (+) terminal and BLACK wire to NEGATIVE (–) terminal].

Slowly remove fill screw to bleed pressure from reservoir.

From a full closed (clockwise) position, slowly turn manual release valve counterclockwise four turns to bleed remaining pressure from system.

Remove 2 bolts and lockwashers.

Lift motor and pump assembly from housing.

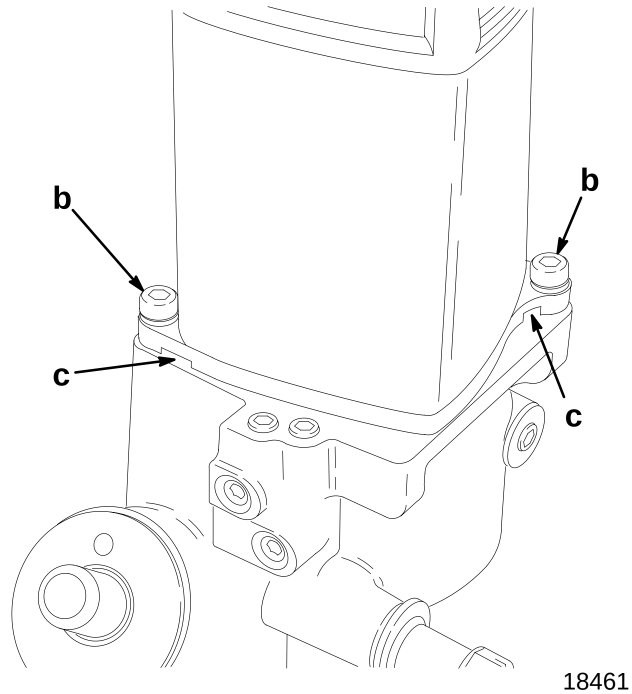
INOPERATIVE TRIM MOTOR

Slowly remove fill screw to bleed pressure from reservoir.

From a full closed (clockwise) position, slowly turn manual release valve counterclockwise four turns to bleed remaining pressure from system.

Remove 2 bolts and lockwashers.

Using 2 screwdrivers, pry up on motor at slots.

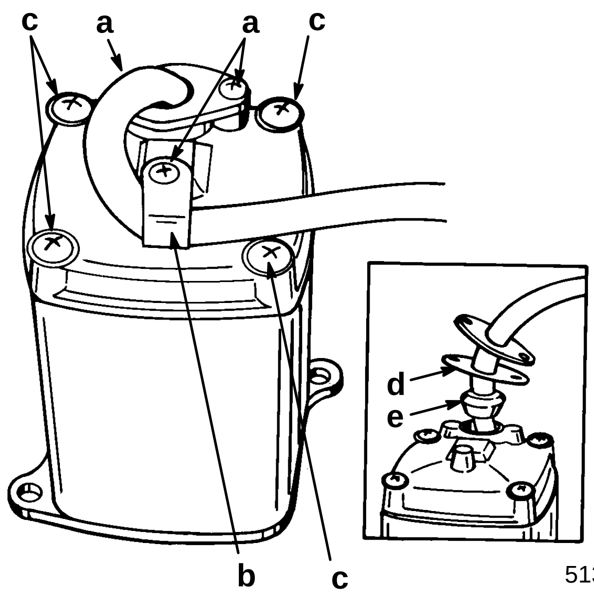


b - Bolts
c - Slots

2. Remove screws and clamp.

   Remove screws.

   Lift motor from end cap, taking care not to drop armature.



51345

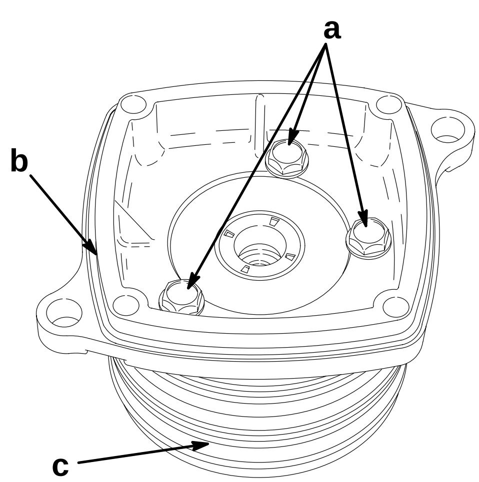
a - Screw (3)
b - Clamp
c - Screw (4)
d - Gasket
e - Grommet

3. Remove bolts.

NOTE: Some motors use 2 bolts to secure end frame cap.

   Lift end cap from pump.

   Follow "Reassembly" and "Installation" instructions in "Motor Repair," following.



18469

a - Bolts
b - End Cap
c - Pump

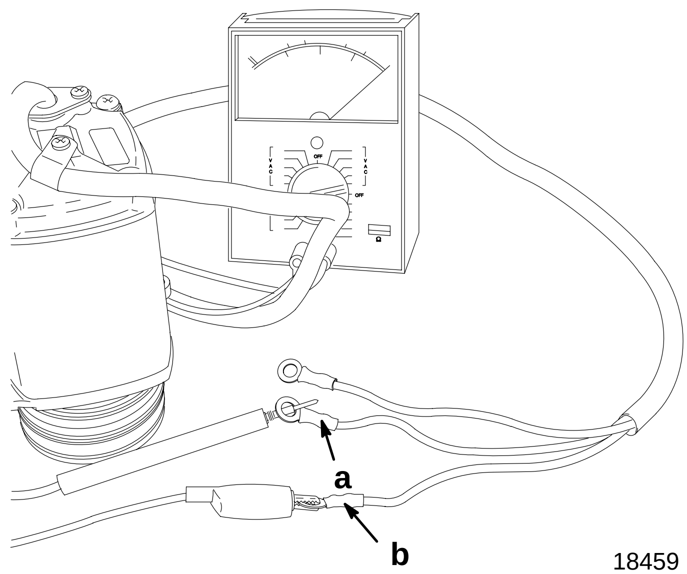
Motor and Electrical Tests/Repair

Thermal Overload Switch Test

IMPORTANT: If trim pump has just been operated, do not run pump for approximately one minute before testing thermal overload switch. After this period of time the switch should close (reset itself) and pump again may be operated. Perform the following check(s) only if switch does not reset itself.

MOTOR ASSEMBLED

Connect Ohmmeter (R x 1 scale) leads as shown. If switch is good, full continuity (zero ohms) will be indicated. If full continuity is not indicated, disassemble motor and recheck switch per instructions, following.



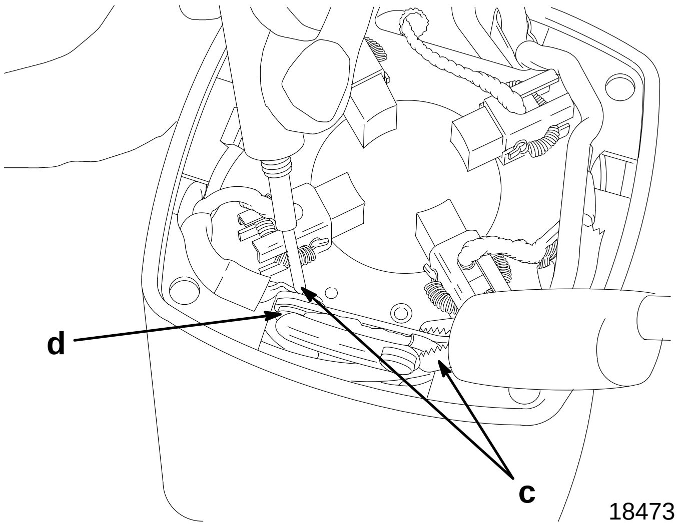
18459

a - Motor Wire (BLUE)
b - Motor Wire (BLACK)

MOTOR DISASSEMBLED

Connect Ohmmeter (R x 1 scale) leads as shown. If switch is good, full continuity (zero ohms) will be indicated.

If full continuity is not indicated, clean switch contact surfaces, using an ignition point file.



c - Test Leads
d - Switch Contact Surface

Recheck switch; if full continuity is not indicated, replace brush card. Switch is supplied on brush card.

Trim Pump Motor Test

⚠ WARNING

Do not perform this test near flammables (or explosives), as a spark may occur when making connections.

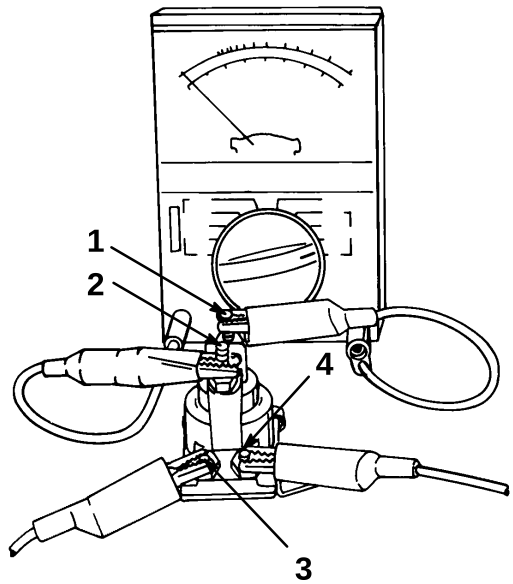
1. Disconnect BLUE (motor) wire and BLACK (motor) wire at solenoids.
2. Connect a 12-volt supply to motor wires [POSITIVE (+) wire to BLUE (motor) wire, and NEGATIVE (–) wire to BLACK (motor) wire]. Motor should run.
3. If motor does not run, disassemble motor and check components. Refer to “Motor Repair,” following.

Solenoid Test

⚠ WARNING

Do not perform this test near flammable materials, as a spark may occur while making electrical connections.

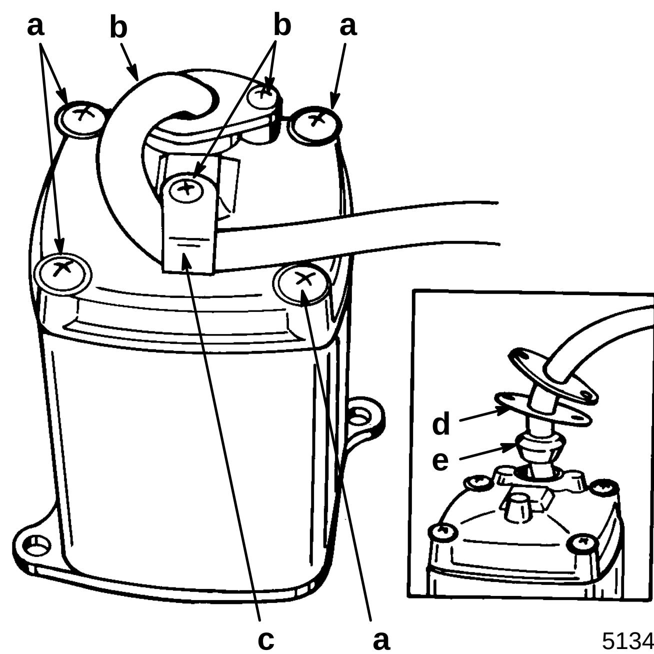
1. Disconnect all wires from solenoid terminals.
2. Set an Ohmmeter to R x 1 scale and connect meter leads to solenoid terminals 1 and 2.
3. Connect a 12-volt power supply to terminals 3 and 4. Solenoid should click and meter should read zero (0) ohms (full continuity).



4. If meter does not read zero (0) ohms, replace solenoid.

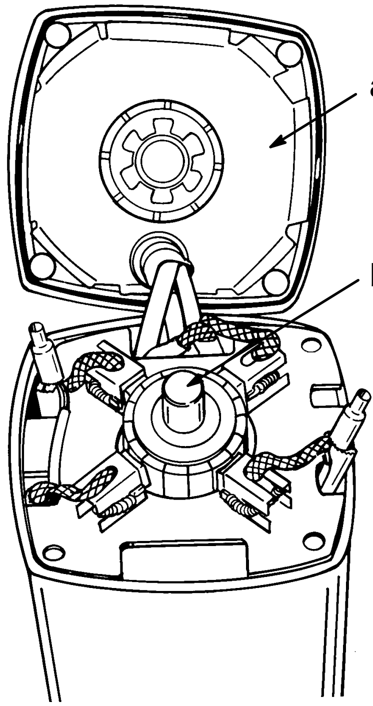
Motor Disassembly

1. Remove screws and clamp.



a - Screw (4)
b - Screw (3)
c - Clamp
d - Gasket
e - Grommet

2. Lift motor from end cap. Use care not to drop armature.



51349

a - End Cap
b - Armature

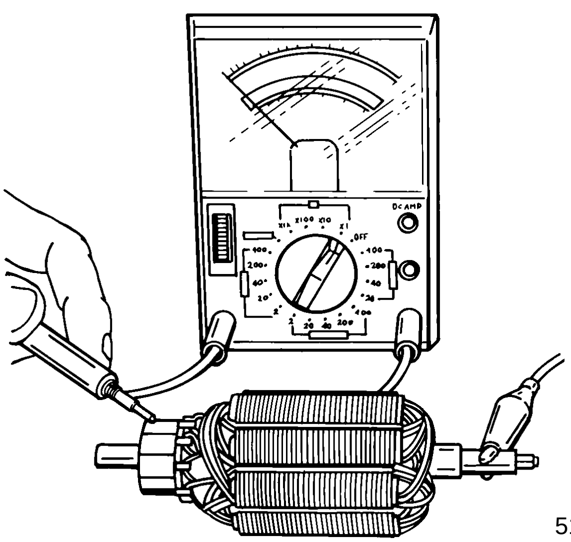
Armature Tests

TEST FOR SHORTS

Check armature on a Growler per the Growler manufacturer's instructions. Replace armature if a short is indicated.

TEST FOR GROUND

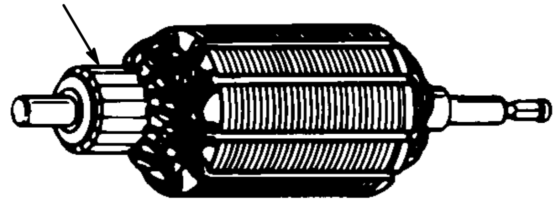
1. Use an Ohmmeter (R x 1 scale). Connect one lead on armature shaft and other lead on commutator. If continuity is indicated, armature is grounded. Replace armature.



51359

CHECKING AND CLEANING COMMUTATOR

1. If commutator is worn, it may be turned on an armature conditioner or a lathe.
2. Clean commutator with "OO" sandpaper.



a - Commutator

Field Tests

IMPORTANT: Commutator end of armature must be installed in brushes when performing the following tests.

Ohmmeter Leads Between	Resistance (Ohms)	Scale Reading* (x________)
Green and Blue Motor Wires	0	Full Continuity (R x 1)
Green and Black Motor Wires	0	Full Continuity (R x 1)
Blue and Black Motor Wires	0	Full Continuity (R x 1)
Black Motor Wire, and Frame (Motor Housing)	No Continuity	No Continuity (R x 1)
Green Motor Wire, and Frame	No Continuity	No Continuity (R x 1)
Blue Motor Wire, and Frame	No Continuity	No Continuity (R x 1)

*If specified readings are not obtained, check for:

- defective armature
- dirty or worn brushes
- dirty or worn commutator

If defective components are found, repair or replace component(s) and retest.

Trim Sender (Optional Accessory) Test

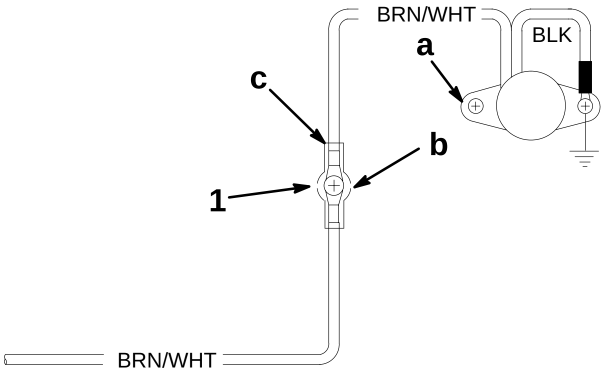
Check trim sender BLACK lead for proper ground.

Trim engine to full "Down" position.

Place ignition switch in "Off" position.

Connect Ohmmeter (R x 1 scale) leads between engine ground and Point 1.

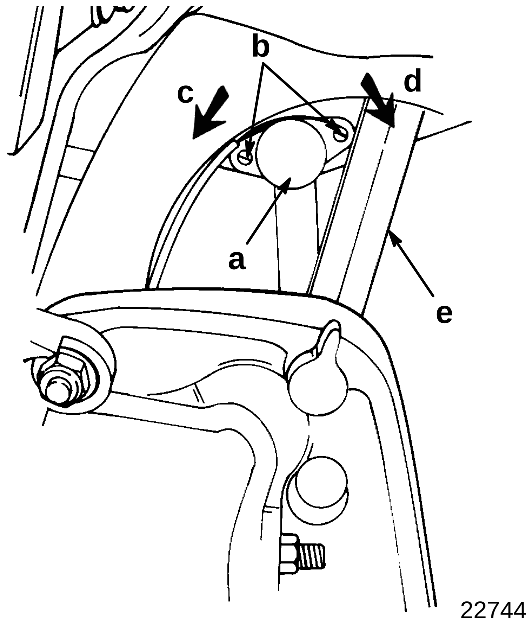
Depress "Up" trim button. Ohmmeter needle should move as the engine is trimmed up. If needle does not move, the trim sender is defective.



a - Trim Sender
b - Connect with Screw and Hex Nut (Coat with Liquid Neoprene)
c - Rubber Sleeve (Slide Over Connection)

Trim Indicator Gauge (Optional Accessory) Needle Adjustment

Trim engine to full "Down" position. If trim indicator needle is not at the bottom of the green arc on the gauge face, tilt engine "up" to gain access to the trim sender. Loosen screws and reposition trim sender, as shown. Trim engine to full "Down" position and re-check needle position.



a - Trim Sender
b - Screws, Loosen to Rotate Sender
c - Turn Sender **Counterclockwise** to Raise Needle Reading
d - Turn Sender **Clockwise** to Lower Needle Reading
e - Tilt Lock Lever

Motor Repair

REMOVAL

NOTE: Power Trim assembly does not have to be removed from engine to repair motor.

Remove motor and pump as an assembly; refer to "Pump Replacement," preceding.

DISASSEMBLY

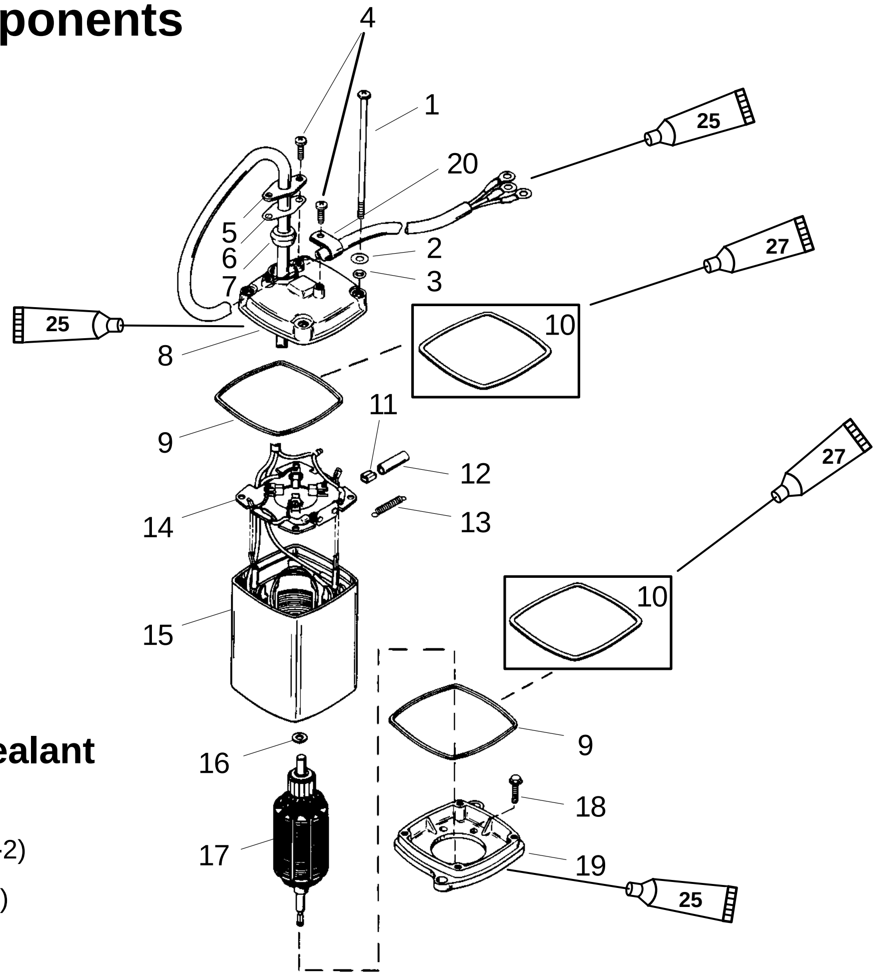
Refer to "Pump Replacement," preceding, for proper disassembly procedure.

CLEANING AND INSPECTION

Inspect O-rings, and replace if damaged.

Clean, inspect and test motor components; refer to "Brush Replacement," "Armature Test," and "Field Tests," preceding.

"Square" Motor Components



Quicksilver Lubrication/Sealant Application Points

25 Liquid Neoprene (92-25711--2)

27 Bellows Adhesive (92-86166)

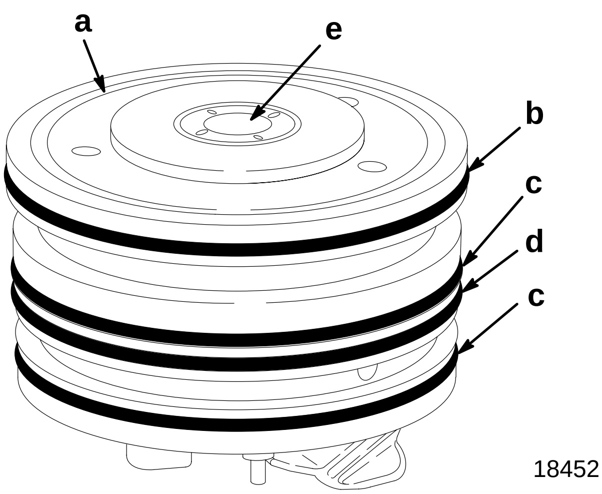
REF. NO.	QUAN.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	4	Thru Bolt	13		1.5
2	4	Nylon Washer (If Equipped)			
3	4	O-ring			
4	3	Self-Tapping Screw	13		1.5
5	1	Retainer, metal			
6	1	Nylon Isolator (If Equipped)			
7	1	Seal, rubber			
8	1	End Frame Cap, upper			
9	2	Square Ring, used when end frame cap has groove			
10	2	Gasket, used when end frame cap does not have groove			
11	3	Connector, metal			
12	2	Sleeve			
13	4	Brush Spring			
14	1	Brush Card			
15	1	Field and Frame Assembly			
16	1	Thrust Washer			
17	1	Armature			
18	2 or 3	Bolt	70		7.9
19	1	End Frame Cap, lower			
20	1	Clamp			

Reassembly

IMPORTANT: Components must be dirt and lint free. Slightest amount of debris in Power Trim system could cause system to malfunction.

1. Install O-rings and flat ring(s).

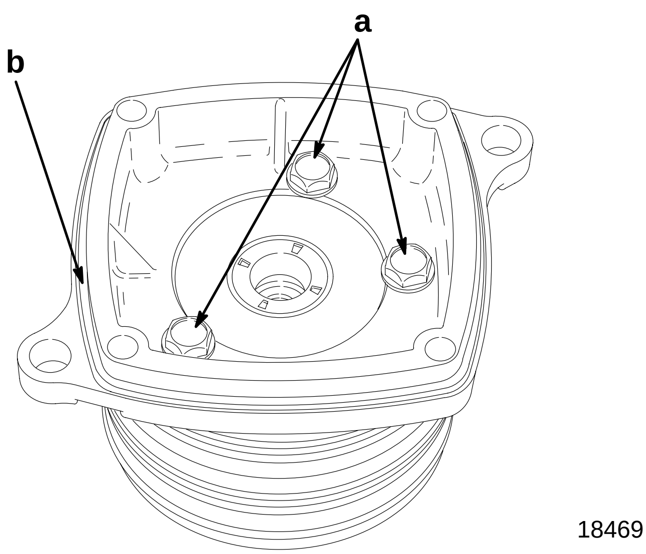
   Apply Quicksilver Power Trim and Steering Fluid or Automatic Transmission Fluid (ATF) Type F, FA or Dexron II on lip of seal.



18452

a - O-ring (or Flat Ring)
b - O-ring [2.739″ (69.57mm) I.D.]
c - O-ring [2.614″ (66.40mm) I.D.]
d - Flat Ring
e - Seal

2. Apply Loctite 271 on bolts, and install end frame cap.



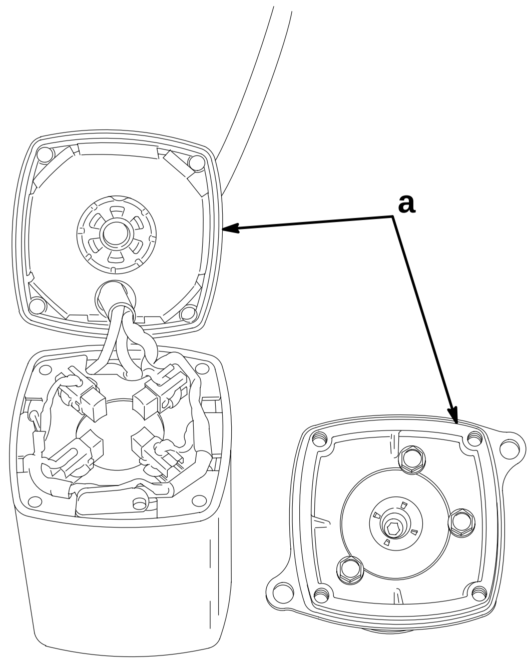
18469

a - Bolts
b - End Cap

NOTE: Some motors use 2 bolts to secure end frame cap.

3. Install a flat ring (if equipped) into groove in each end cap.

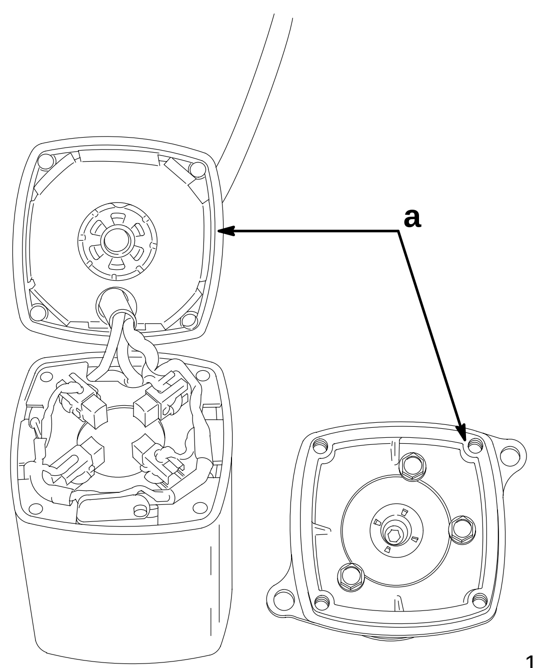
NOTE: Verify rings are not twisted after installation.



18465

a - Flat Ring (If Equipped)

Glue a rubber gasket (if equipped) onto each end cap using Quicksilver Bellows Adhesive.

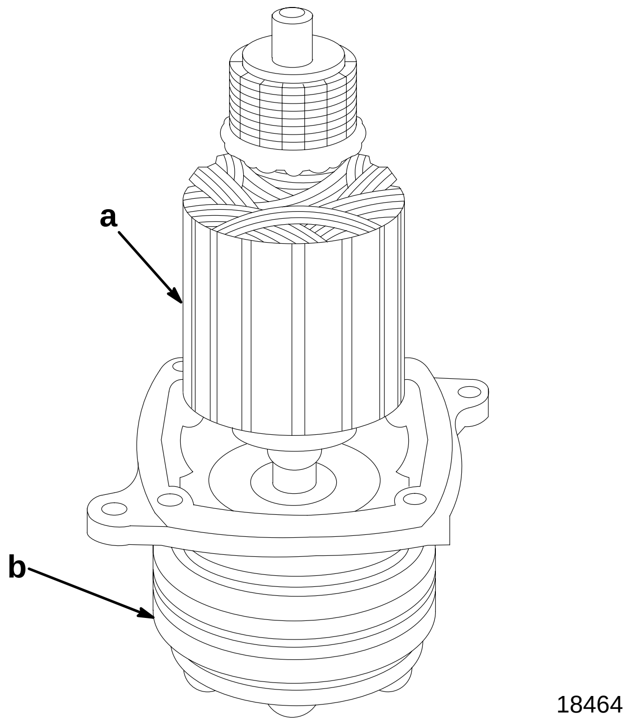


18462

a - Rubber Gasket

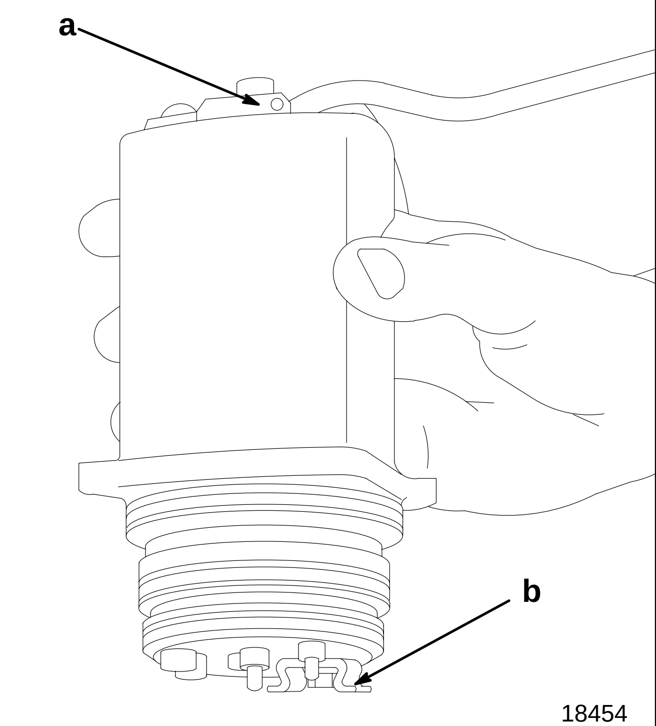
4. Install armature into pump.

   Rotate armature to align hex shaft with pump.



a - Armature
b - Pump

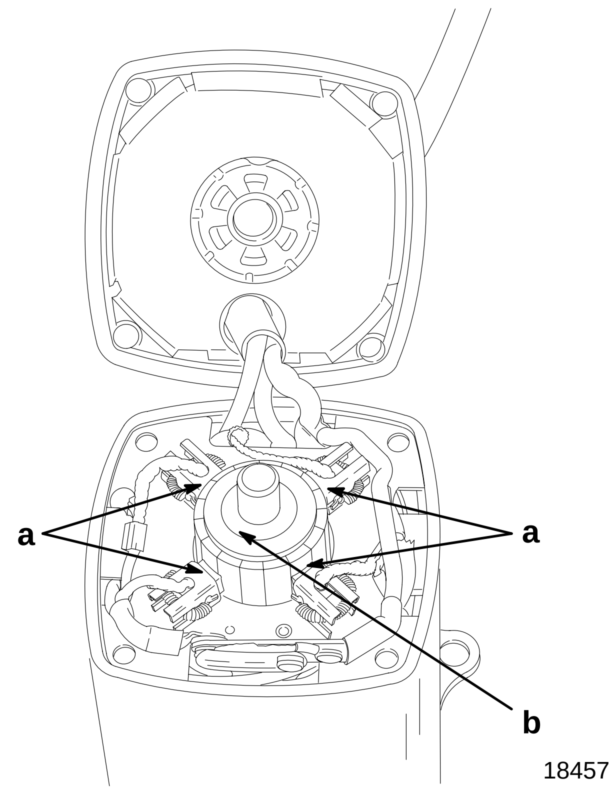
5. Install field and frame assembly onto pump as shown.



a - Thermal Overload Switch
b - Rocker Arm

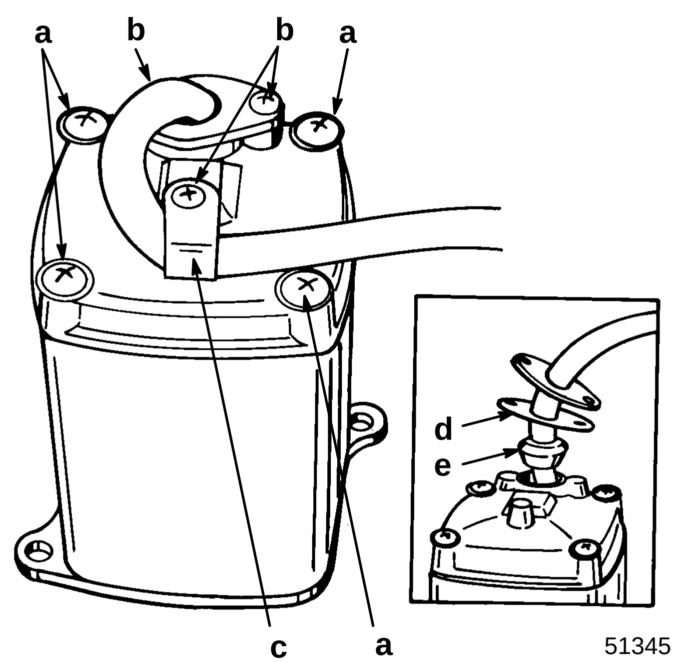
6. Spread brushes; position brushes as shown.

   Install thrust washer (if equipped).



a - Brushes
b - Thrust Washer

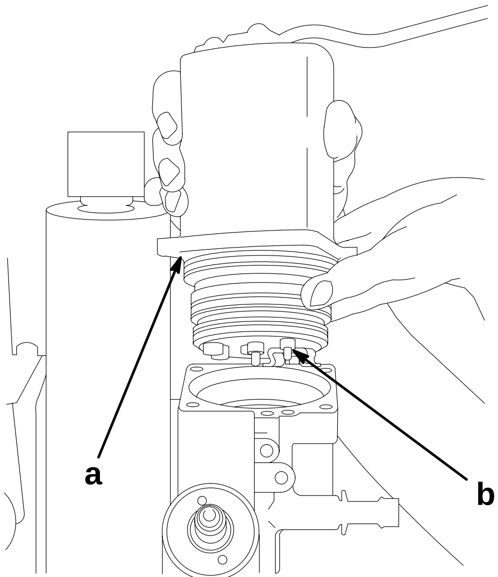
7. Install end cap and screws.



a - Screw (4)
b - Screw (3)
c - Clamp
d - Gasket
e - Grommet

8. Install O-ring [2.739″ (69.57mm) I.D.]. It is recommended O-ring be installed even if pump did not originally have O-ring.

   Insert pump and motor assembly into Power Trim housing, with rocker arm positioned as shown.



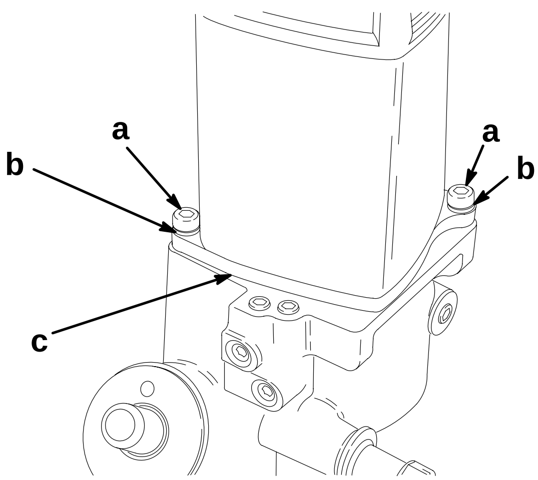
18453

a - O-ring
b - Rocker Arm

9. Apply Quicksilver Perfect Seal on threads of 2 bolts.

   Secure motor using 2 bolts and lockwashers.

   Waterproof Power Trim system by applying Quicksilver Liquid Neoprene on seam.



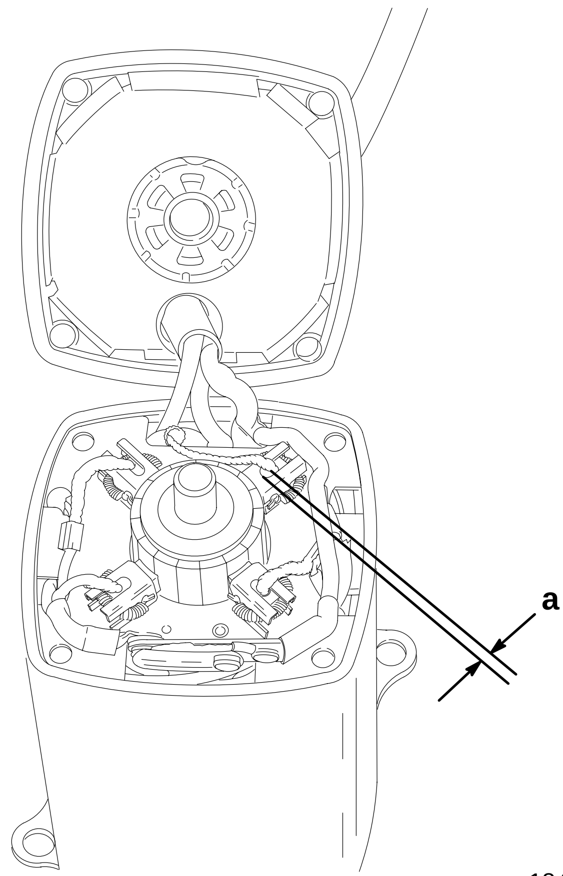
18461

a - Bolts
b - Lockwashers
c - Seam

10. Install starboard transom bracket, steering retaining nut (models with thru-tilt tube steering), and motor wires; refer to “Installation” instructions in “Power Trim Assembly Removal and Installation,” preceding.

Brush Replacement (“Square” Motor)

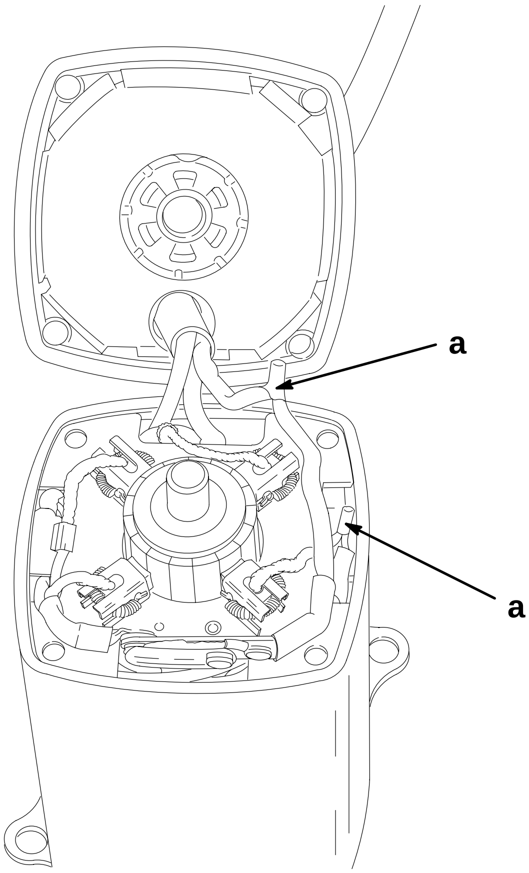
1. Brush replacement is recommended if brushes are pitted, chipped, or if distance (a) between the brush pigtail and end of brush holder slot is 1/16″ or less. Check the distance with armature installed, as shown.



18457

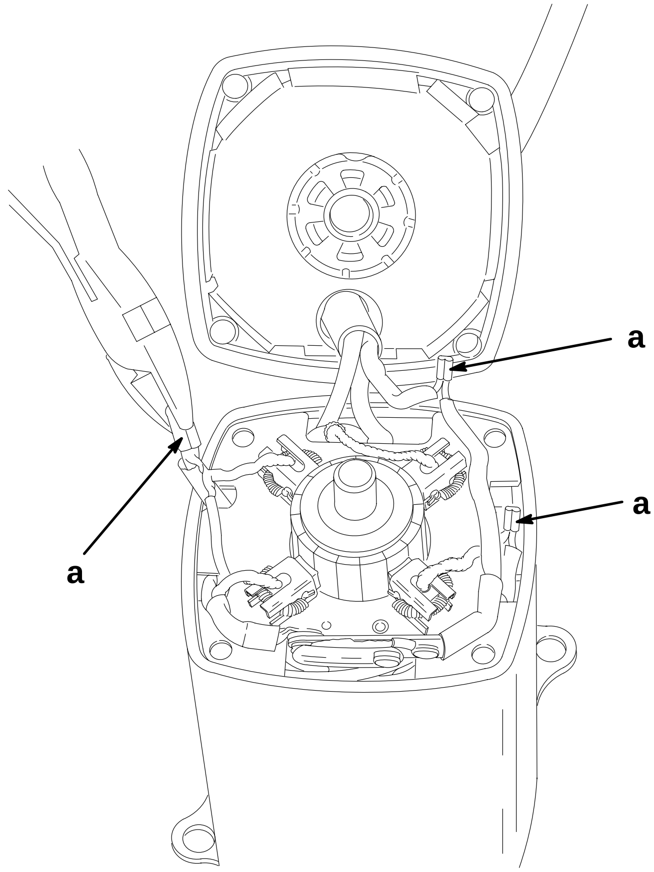
a - Distance =1/16 in. (1.6mm)

2. To replace brush card, remove plastic insulators.



a - Insulators

3. Remove metal connectors by separating the slit in connectors using a side cutter, as shown.



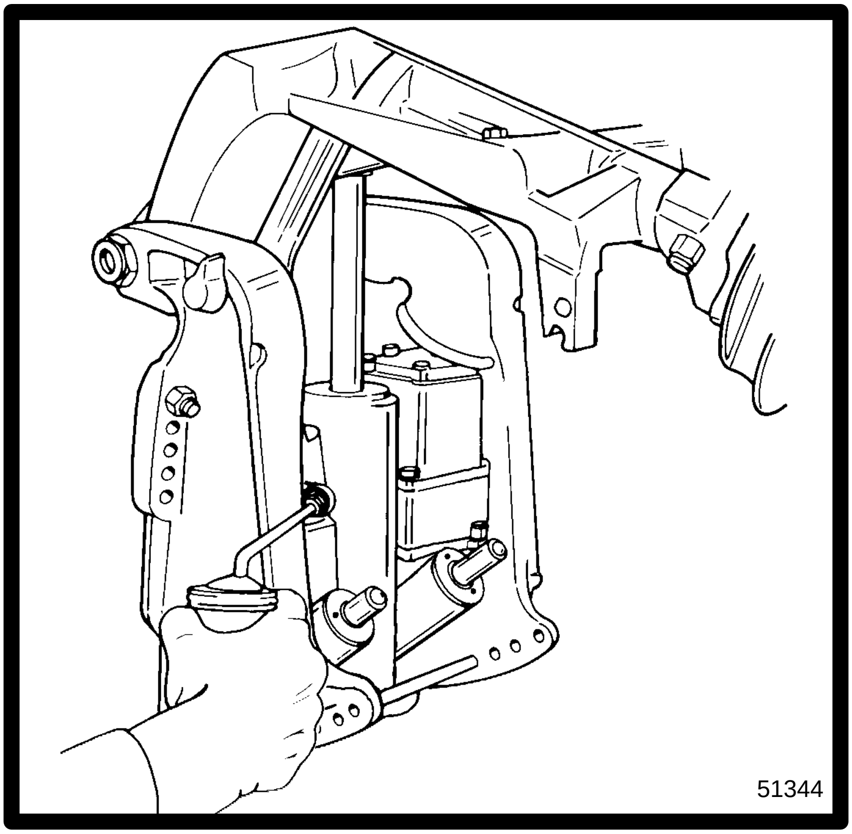
a - Metal Connectors

Install new brush card.

Crimp metal connectors on connections.

Use heat shrink tubing to insulate connections.

POWER TRIM



DESIGN II
(AFT FILL RESERVOIR)

Table Of Contents

Power Trim System

Specifications

Test	Readings
Trim "UP"	1300 PSI (91 kg/cm^2) Maximum Pressure
Trim "DOWN"	500 PSI (35 kg/cm^2) Minimum Pressure

Special Tools

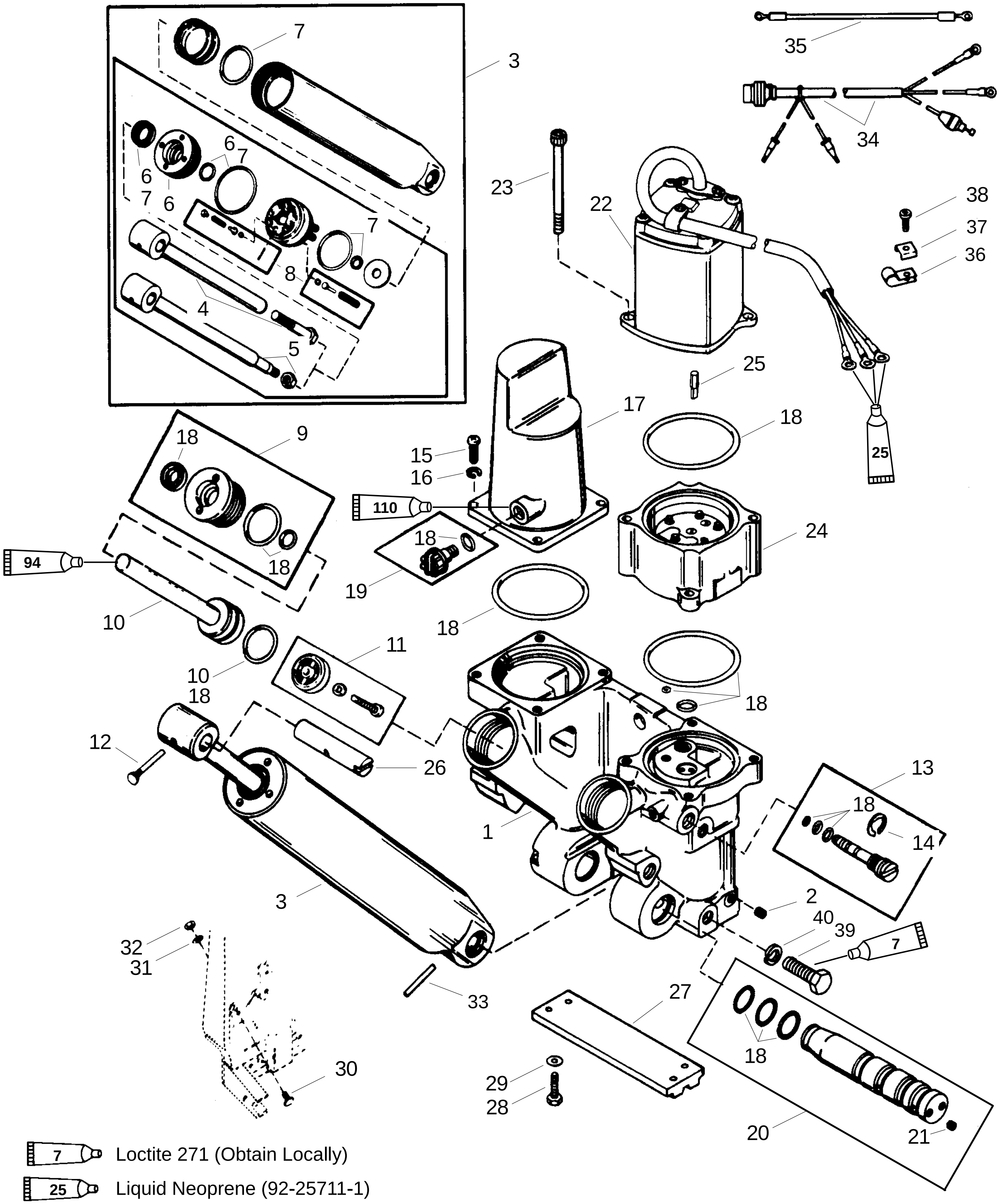
Part No.	Description
91-11230	Alignment Tool
91-44486A1	Trim Rod Removal Tool
91-44487A1	Trim Rod Guide Removal Tool
91-52915A3	Power Trim Test Gauge Kit
91-11243	Adaptor Fitting
91-74951	Spanner Wrench
91-99750	Multi-Meter DVA Tester

Quicksilver Lubricants and Service Aids

Part No.	Description
91-90100A12	Power Trim and Steering Fluid
Obtain Locally	Loctite 271
91-25711-1	Liquid Neoprene
91-78376A6	Anti-Corrosion Grease

Power Trim Components

NOTE: All O-rings - Lubricate with Power Trim and Steering Fluid.



7 Loctite 271 (Obtain Locally)

25 Liquid Neoprene (92-25711-1)

110 Power Trim and Steering Fluid (92-90100A12)

94 Anti-Corrosion Grease (92-19007A24)

Power Trim Components (Continued)

REF. NO.	QUAN.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	Manifold			
2	9	Pipe Plug			
3	1	Tilt Cylinder Assembly			
4	1	Piston Rod (Bolt Type) Design 1			
5	1	Piston Rod (Nut Type) Design 2			
6	1	Guide Kit			
7	1	O-ring Repair Kit (811607A1)			
8	1	Check Valve Kit			
9	1	Guide Assembly			
10	1	Piston and Rod Assembly (Port)			
10	1	Piston and Rod Assembly (Starboard)			
11	1	Trim Filter Assembly			
12	1	Groove Pin			
13	1	Valve Assembly			
14	1	E-ring			
15	4	Screw			
16	4	Washer			
17	1	Cover			
18	1	O-ring Kit (811612A1)			
19	1	Plug Assembly			
20	1	Shaft Assembly			
21	2	Plug Pipe			
22	1	Trim Motor			
23	2	Screw (Long)	70		7.9
23	2	Screw (Short)	70		7.9
24	1	Pump			
25	1	Driveshaft			
26	1	Shaft			
27	1	Anode Assembly			
28	2	Screw	60		6.8
29	2	Washer			
30	2	Striker Plate			
31	2	Lockwasher			
32	2	Nut	80		9.0
33	1	Groove Pin			
34	1	Control Harness, Power Trim			
35	1	Cable (6-3/8″ – Red)			
35	1	Cable (24″ – Red)			
35	1	Cable (2-3/4″ – Red)			
36	2	Clip, Pump Wire			
37	2	C-Washer, Clip Screw			
38	2	Screw, Clip to Transom Bracket			
39	6	Screw, Manifold		30	40.7
40	6	Flatwasher, Manifold Screw			

Power Trim - General Information

Description

The Power Trim System consists of an electric motor, pressurized fluid reservoir, pump, tilt cylinder, and two trim rams.

The remote control (or trim panel) has switches that trim the outboard "Up" or "Down" and tilt the engine for "Trailering". The outboard can be trimmed and tilted under power or when the outboard is not running.

Trimming Characteristics

NOTE: Because hull designs react differently in varying water conditions, varying the trim position will often improve the ride and boat handling. When trimming from a mid-trim position (with outboard trim tab in a straight fore and aft position), expect the following:

TRIMMING OUTBOARD "UP" (OUT):

⚠ WARNING

Excessive Trim "Out" may reduce the stability of some high speed hulls. To correct instability, reduce the power gradually and trim the outboard "In" slightly before resuming high speed operation. A rapid reduction in power will result in a sudden change of steering torque and may cause additional boat instability.

Will lift boat bow, increasing top speed.

Transfers steering torque harder to port (left) on installations above 23 in. transom height.

Increases gearcase clearance over submerged objects.

Excess trim can cause "porpoising" and/or ventilation.

⚠ WARNING

Excessive outboard trim angle will result in insufficient water supply causing water pump and/or powerhead overheating damage. Insure water level is above water intake holes whenever outboard is running.

The "Up" circuit actuates the "up" solenoid (under outboard cowl) and closes the motor circuit. The electric motor drives the pump, forcing fluid thru passageways into the "up" side of the trim cylinders.

The trim cylinders position the outboard at the desired trim angle in the 20 degree maximum trim range. The system will not allow the outboard to be trimmed above the 20 degree trim range as long as the engine RPM is above approximately 2000 RPM.

The outboard can be trimmed above the 20 degree maximum trim angle (for shallow water operation, etc.), by keeping the engine RPM below 2000. If the RPM increases over 2000, propeller thrust (if propeller is deep enough) will result in the trim system to return the outboard to the 20 degree maximum trim position.

TRIMMING OUTBOARD "DOWN" (IN):

⚠ WARNING

Excessive speed at minimum trim "In" may result in undesirable and/or unsafe steering conditions. Test for handling characteristics after any adjustment is made to the trim angle (and tilt pin location).

Aids planing, particularly with heavy loads.

Improves ride in choppy water conditions.

Excess trim "In" can cause "bow steer" (boat veers to left or right).

Transfers steering torque to starboard (right).

Improves acceleration to planing speed.

The "Down" circuit actuates the "down" solenoid (under engine cowl) and closes the motor circuit. The electric motor drives the pump in the opposite direction as the "up" circuit, forcing fluid thru passageways into the "down" side of the tilt ram. The tilt ram moves the engine down to the desired position.

Trailering Outboard

The "Up" circuit first moves the trim cylinders; when the trim cylinders extend fully, the tilt ram extends to tilt the outboard to the full "Up" position for trailering.

Before the boat is trailered, the operator should check for clearance between the outboard skeg and pavement to prevent damage to skeg from striking pavement.

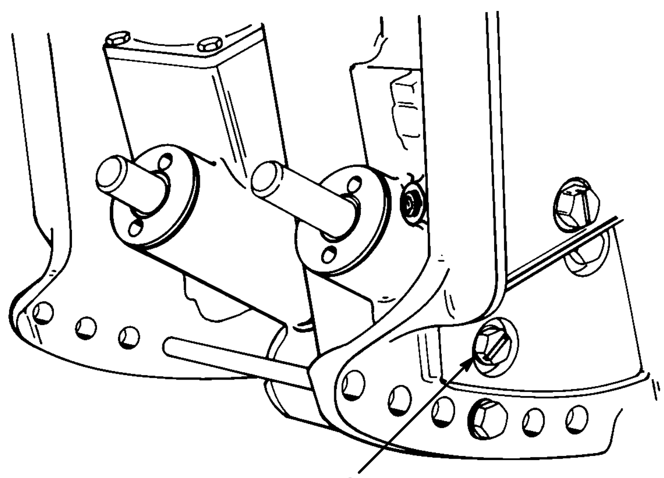
If the outboard must be tilted for clearance between skeg and pavement, a device such as a "Transom Saver" should be installed to prevent stress to boat transom from outboard weight while the boat/outboard are being trailered.

Tilting Outboard Manually

⚠ WARNING

Before opening the manual release valve knob, insure all persons are clear of outboard as outboard will drop to full "Down" when valve is opened.

The outboard can be raised or lowered manually by opening the manual release valve 3 to 4 turns counterclockwise. Close manual release valve to hold outboard at the desired tilt position.



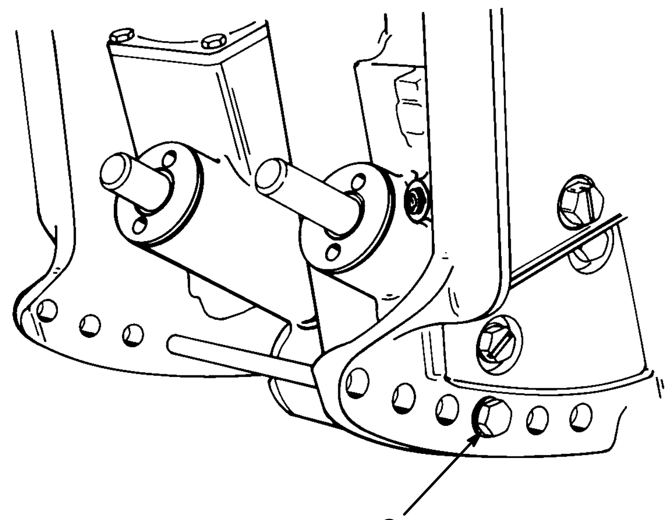
a - Manual Release Valve

Trim "In" Angle Adjustment

⚠ WARNING

Boat operation with outboard trimmed to the full "In" trim angle [not using the trim angle adjustment bolt (a)] at planing speed may result in undesirable and/or unsafe steering conditions. A water test for handling/steering conditions is required after any trim angle adjustments.

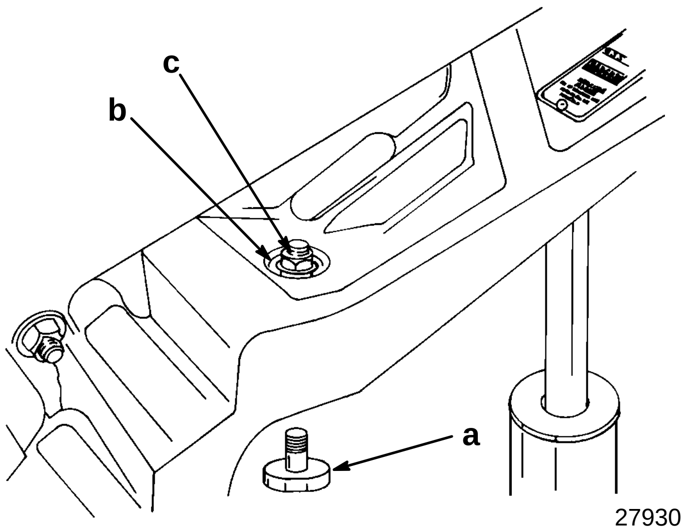
IMPORTANT: Some boat/motor combinations not using the trim angle adjustment pin (a) and trimmed to the full "In" trim angle position may not exhibit any undesirable and/or unsafe handling and/or steering characteristics at planing speed. If so, not using the trim angle adjustment bolt (a) may be advantageous to acceleration and planing. A water test is required to determine if these characteristics apply to a particular boat/ motor combination.



a - Trim Angle Adjustment Bolt

Striker Plate Replacement

Visually inspect striker plates (a) and replace if worn excessively.

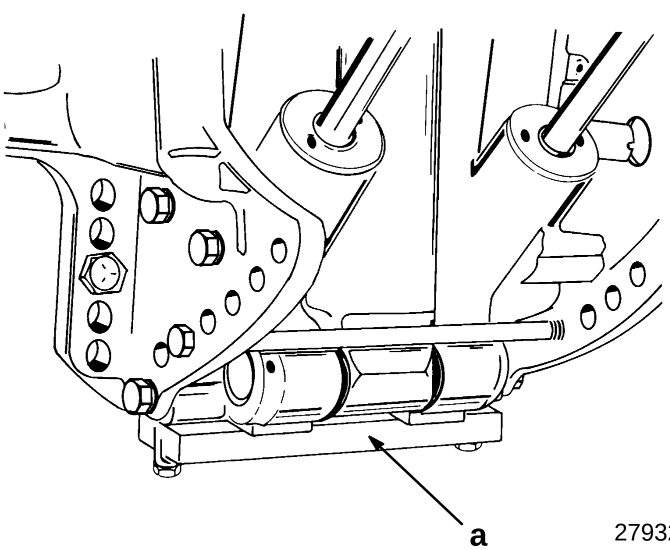


27930

a - Striker Plate (2)
b - Lockwasher
c - Locknut - Torque to 80 lb. in. (9.0 N·m)

Anode Plate

Anode plate (a) is a self-sacrificing alloy plate that is consumed gradually by corrosion while providing protection to the midsection and power trim from galvanic corrosion. Replace anode plate when it is 50% consumed.



27932

a - Anode Plate

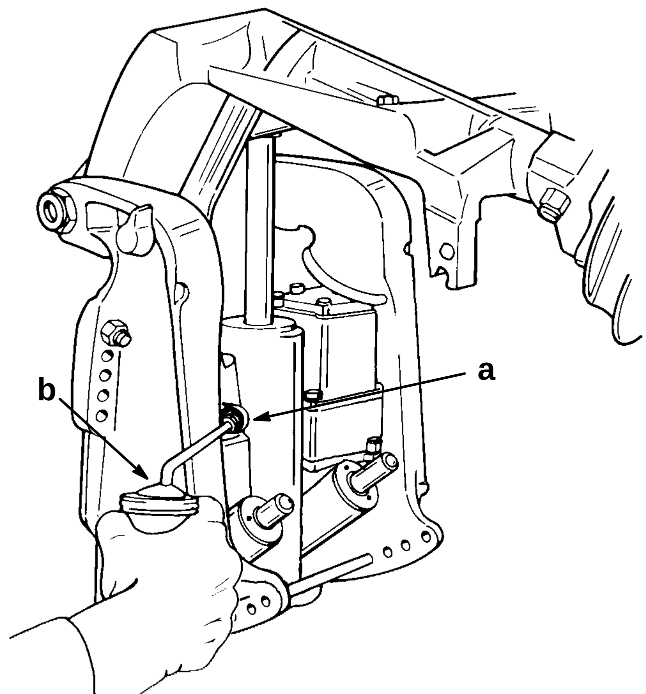
IMPORTANT: Do not paint or place protective coating on anode plate, or corrosion protection function will be lost.

Trim Indicator Gauge

A Quicksilver Trim Indicator Gauge accessory kit is available for the power trim sender (if not previously installed).

Fill, Check, and Purge - Power Trim System

IMPORTANT: This trim system is pressurized. Remove "Fill" plug only when outboard is tilted to the full "Up" position or the trim/tilt rams are fully extended. Retighten "Fill" plug before tilting outboard down or retracting tilt/trim rams.
Remove "Fill" plug and O-ring. System is full when oil level is present at fill hole. Tighten "Fill" plug securely.



51344

a - Fill Plug and O-ring (remove to fill system, tighten securely)
b - Oil Can (fill system with Quicksilver Power Trim and Steering Fluid)

NOTE: Automatic Transmission Fluid (ATF) Type F, FA, or Dexron II may be used.

TO PURGE:

IMPORTANT: Fill plug and O-ring must be tightened securely before purging system.

IMPORTANT: Run Trim System in short "jogs" until pump is primed and trim system moves. If trim motor is run without priming pump, driveshaft failure could result.

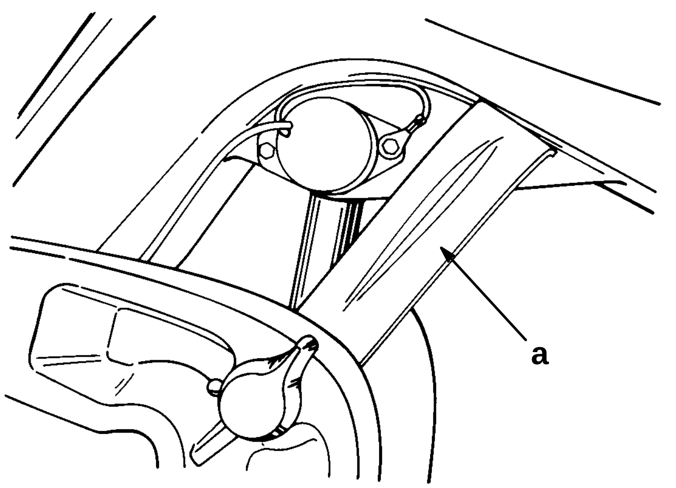
Cycle outboard through entire trim/tilt range 4 times. Check fluid level after purging system.

Push down on outboard when trim rams are slightly extended. If rams retract more than 1/8 in. (3.2 mm), air is present in system. Cycle system again and check fluid level.

TO CHECK:

CAUTION

Tilt outboard to full "Up" position and engage tilt lock lever before checking fluid level. System is pressurized. Extend trim and tilt rams fully to depressurize system.



51368

a - Tilt Lock Lever (engage to support engine in "Up" position)

Remove fill plug and O-ring. System is full when oil level is present at filler hole. Tighten fill plug securely.

Hydraulic System Troubleshooting

IMPORTANT: Operate Power Trim System after each check to see if problem is corrected. If problem has not been corrected, proceed to next check.

1. Check that Manual Release Valve knob is tightened to full right (clockwise) position.
2. Check trim pump fluid level and fill if necessary. (Refer to "**Fill, Check, and Purge - Power Trim System**") preceding.
3. Check for external leaks in the system. Replace defective parts if leak is found.
4. Check for air in the system and purge if necessary. (Refer to **"Fill, Check, and Purge - Power Trim System"**) preceding.

NOTE: When troubleshooting the hydraulic system, cleanliness, and inspection of sealing surfaces, seals, O-rings, and moving parts is important. The internal pressures required for proper operation of the Power Trim System require these parts to be in excellent condition. Replace any parts that may be suspect of failure.

Troubleshooting

IMPORTANT: Determine if Electrical or Hydraulic problem exists.

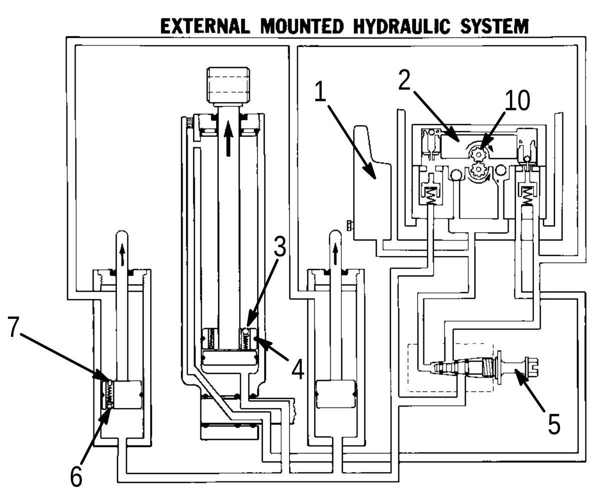
HYDRAULIC SYSTEM TROUBLESHOOTING

IMPORTANT: Make one correction at a time. Check operation of trim system before proceeding to the next check.

CONDITION OF TRIM SYSTEM	PROBLEM
A. Trim motor runs; trim system does not move up or down.	1, 2, 5, 10
B. Does not trim full down. Up trim OK.	2, 3, 4
C. Does not trim full up. Down trim OK.	1, 6
D. Partial or “Jerky” down/up.	1
E. “Thump” noise when shifting.	2, 3, 6, 7
F. Does not trim under load.	8, 9
G. Does not hold trim position under load.	2, 5, 6
H. Trail out when backing off from high speed.	3, 4
I. Leaks down and does not hold trim.	2, 5, 7
J. Trim motor working hard and trims slow up and down.	8, 9
K. Trims up very slow.	1, 2, 8, 9
L. Starts to trim up from full down position when “IN” trim button is depressed.	3, 4
M. Trim position will not hold in reverse.	3, 4

PROBLEM

1. Low oil Level.
2. Pump Assembly faulty.
3. Tilt ram piston ball not seated (displaced, dirt, nickel seat).
4. Tilt ram piston O-ring leaking or cut.
5. Manual release valve leaking (check condition of O-rings) (Valve not fully closed.)
6. Lower check valve not seating in port side trim ram.
7. Upper check valve not seating in port side trim ram.
8. Check condition of battery.
9. Replace motor assembly.
10. Broken motor/pump driveshaft.



51491

ELECTRICAL SYSTEM TROUBLESHOOTING

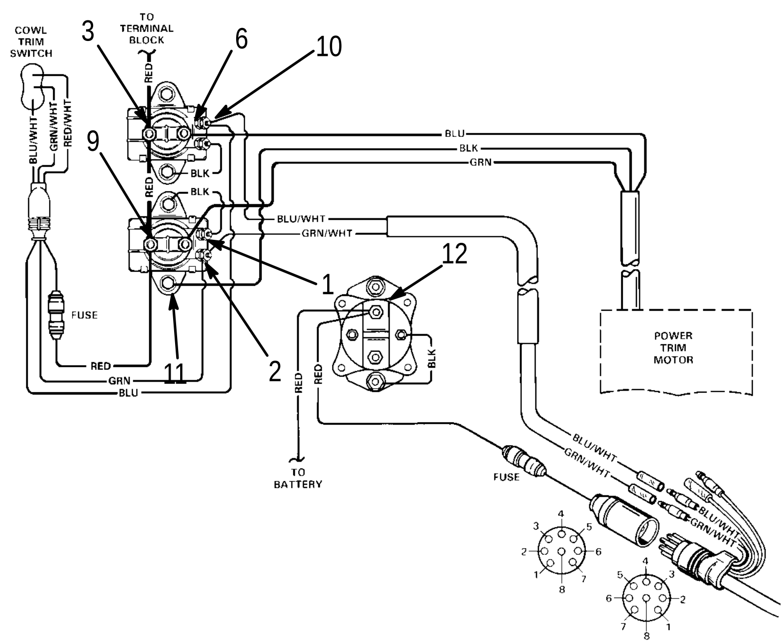
CONDITION OF TRIM SYSTEM	PROBLEM
A. Trim motor does not run when trim button is depressed.	1, 2, 4, 5, 6, 7
B. Trim system trims opposite of buttons.	3
C. Cowl mounted trim buttons do not activate trim system.	2, 4, 5, 6

PROBLEM

1. Battery low or discharged.
2. Open circuit in trim wiring.
3. Wiring reversed in remote control.
4. Wire harness corroded through.
5. Internal motor problem (brushed, shorted armature).
6. Blown fuse(s).
7. Trim Solenoids Failed

NOTE: Refer to following pages to troubleshoot Power Trim Electrical System.

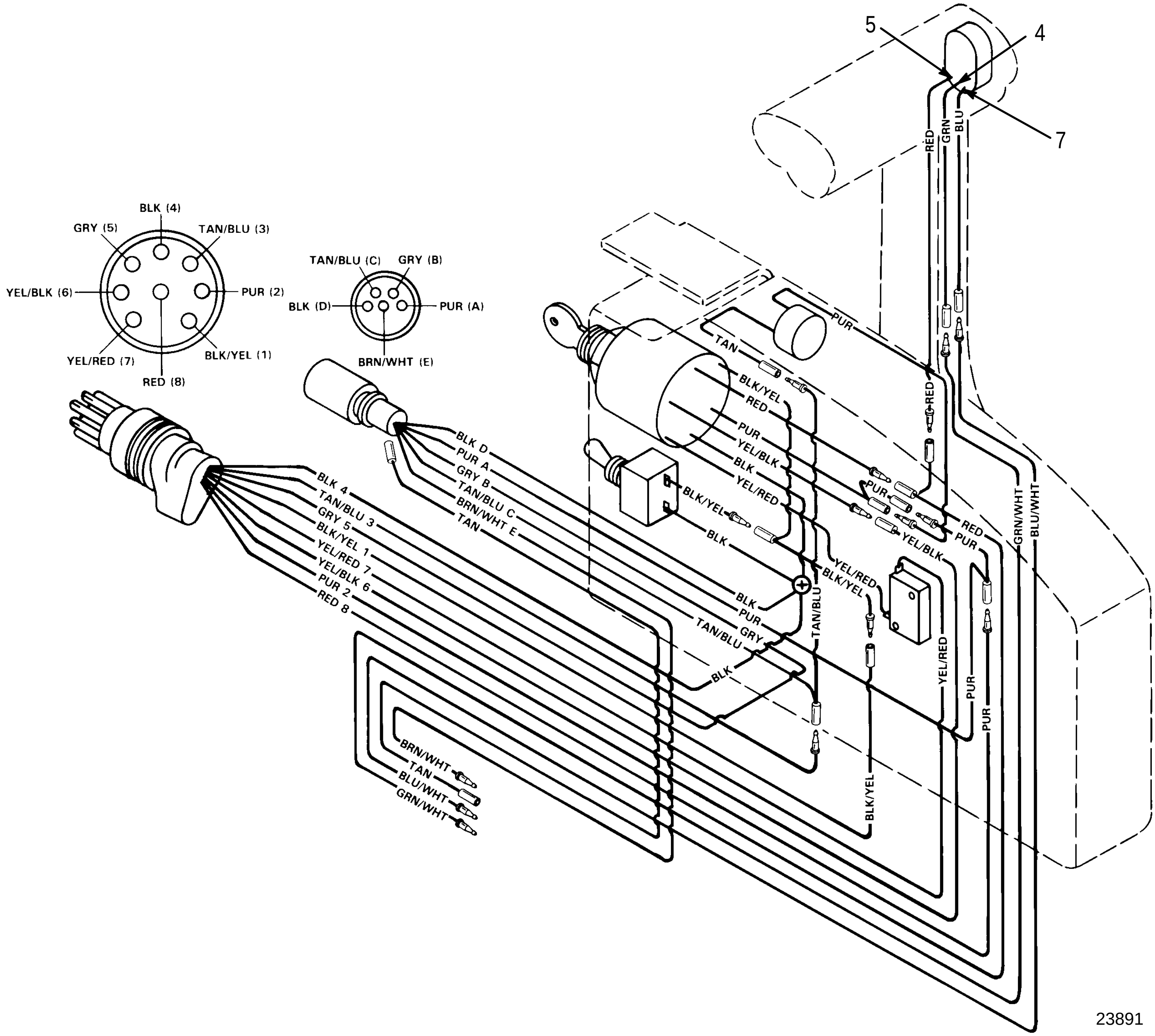
POWER TRIM SYSTEM WIRING DIAGRAM



BLK = Black
BLU = Blue
GRN = Green
RED = Red
WHT = White

51306

Side Mount Remote Control Wiring Diagram (Test Points for Electrical Troubleshooting)



Electrical System Troubleshooting

GENERAL CHECKS

Before troubleshooting the Power Trim electrical system, check the following:

1. Check for disconnected wires.
2. Make certain all conditions are tight and corrosion free.
3. Check that plug-in connectors are fully engaged.
4. Make certain battery is fully charged.

Refer to the preceding four wiring diagrams for connection points when troubleshooting the electrical systems (Connection points are specified by number).

Troubleshooting the “Down” Circuit (When “Up” Circuit is OK)

Connect Voltmeter RED lead to Point 1 and BLACK lead to ground.

Depress the “Down” trim button.

Battery Voltage Indicated:
Connect Voltmeter RED lead to Point 9.

Battery Voltage Indicated:
- Connect Voltmeter RED lead to Point 2.
- Depress “Down” trim button.

Battery Voltage Indicated:
- Check “Down” solenoid terminals for loose or corroded connections.
- Check BLACK ground wire (on “Down” solenoid) for corrosion or open.
- Test “Down” solenoid. Refer to “Motor and Electrical Tests”, see Index.

No Voltage Indicated:
Solenoid is defective.

No Voltage Indicated:
- There is an open circuit between Point 9 and positive (+) battery terminal.
- Check for loose or corroded connections.
- Check wires for open.

No Voltage Indicated:
Connect Voltmeter RED lead to Point 4 and BLACK lead to ground. Depress “Down” trim button. If battery voltage is indicatied, wire is open between Points 4 and 1.

No Voltage Indicated:
Connect Voltmeter RED lead to Point 5. If battery voltage is indicated, trim switch is faulty. If no battery voltage, check for loose or corroded connection at Point 5 or open circuit in wire supplying current to Point 5.

Troubleshooting the "Up" Circuit (When "Down" Circuit is OK)

Connect Voltmeter RED lead to Point 10 and BLACK lead to ground.

Depress the "Up" trim button.

Battery Voltage Indicated:
Connect Voltmeter RED lead to Point 3.

No Voltage Indicated:
There is an open circuit in wires (BLUE-WHITE, PURPLE-WHITE, or PURPLE) between "Up" solenoid and trim switch.

Battery Voltage Indicated:

- Connect Voltmeter RED lead to Point 6.
- Depress "Up" trim button.

No Voltage Indicated:

- Check for loose or corroded connection at Point 9 or Point 3.
- Check RED lead between Point 9 and Point 3 for open.

Battery Voltage Indicated:

- Check "Up" solenoid terminals for loose or corroded connections.
- Check BLACK ground wire (on "Up" solenoid) for corrosion or open.
- Test "Up" solenoid. Refer to "Motor and Electrical Tests/Repair", following.

No Voltage Indicated:
Solenoid is defective.

Troubleshooting the "Down" and "Up" Circuits (All Circuits Inoperative)

Check in-line fuses (under cowl) to see if fuses are blown.

Blown Fuse:

- Correct problem that caused fuse to blow.
- Replace fuse.

Fuse Not Blown:

Connect Voltmeter RED lead to Point 3 and BLACK lead to ground. Battery voltage should be indicated.

No Voltage Indicated:

- Check battery leads and RED leads (between engine starter motor solenoid and Point 3) for poor connections or open circuits.
- Check battery charge.

Battery Voltage Indicated:

- Connect Voltmeter RED lead to Point 10.
- Depress "Up" trim button and check for battery voltage.

Battery Voltage Indicated:

- Check BLACK ground wires at solenoids for poor connection or poor ground.
- Check BLACK motor lead for poor ground at Point 11. If wire is grounded, the pump motor is faulty. Refer to "Motor and Electrical Tests/Repair," following.

No Voltage Indicated:

Connect RED Voltmeter lead to Point 5, and BLACK lead to ground.

No Voltage Indicated:

Check that voltage is being supplied to control by performing the following checks:

- DO NOT start engine.
- Turn ignition switch to "Run" position.
- Check for voltage at any instrument, using a Voltmeter.

Battery Voltage Indicated:

Trim switch is faulty or there is an open circuit in wires [GREEN-WHITE, BLUE-WHITE AND PURPLE-WHITE (OR PURPLE)] between trim buttons and trim pump.

- Check trim switch.
- Check all trim harness connectors for loose or corroded connections.
- Check for pinched or severed wires.

No Voltage Indicated:

RED wire is open between Point 12 and red terminal on back of the ignition switch.

- Check for loose or corroded connections.
- Check for open in wire.

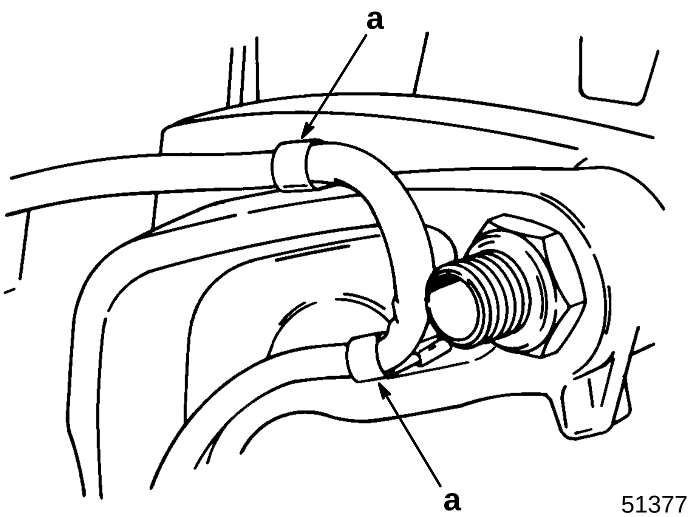
Battery Voltage Indicated:

There is an open circuit in wire between Point 5 and RED lead terminal on the back of the ignition switch.

Power Trim Assembly Removal and Installation

Removal

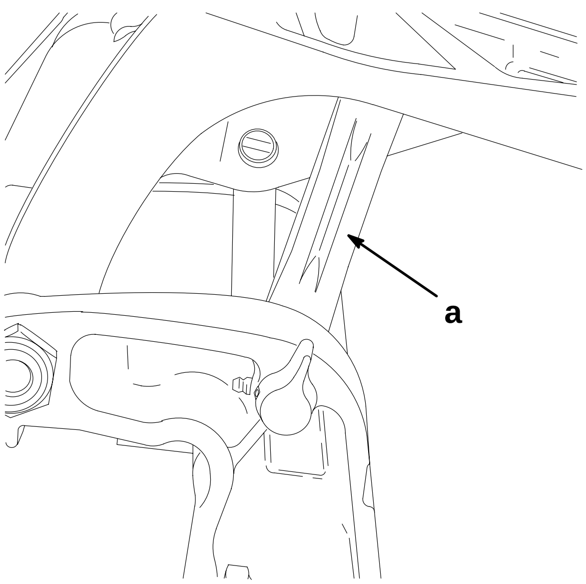
1. Remove clamps on transom bracket to free power trim wiring.



51377

a - Clamps

2. Raise outboard to full "Up" position and engage tilt lock lever.

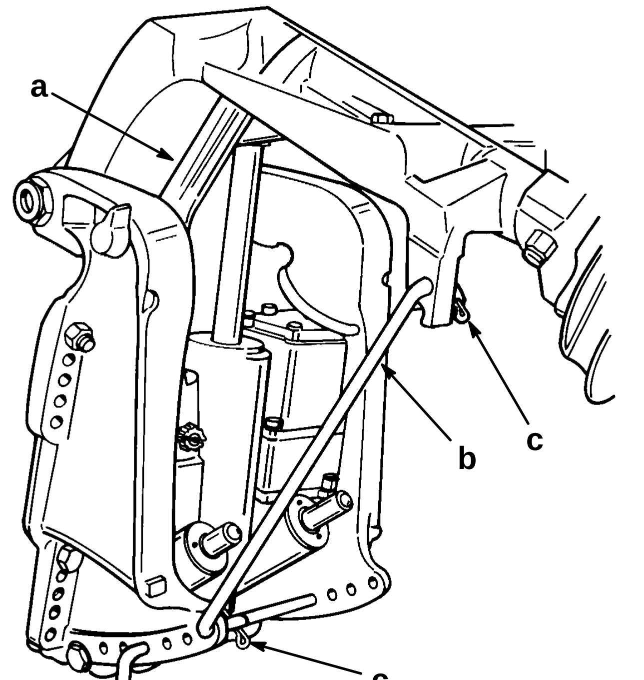


50605

a - Tilt Lock Lever

⚠ WARNING

Failure to support outboard as shown could result in personal injury and/or damage to outboard or boat.



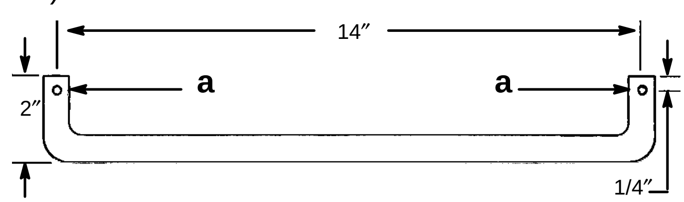
51346

a - Tilt Lock Lever
b - Support Tool
c - Retaining Clips

IMPORTANT: Support outboard as shown above to prevent engine from tipping when power trim retaining pin is removed.

SUPPORT TOOL

3/8 in. diameter metal rod (a used shift shaft works well).



a - Drill Holes for Retaining Clips

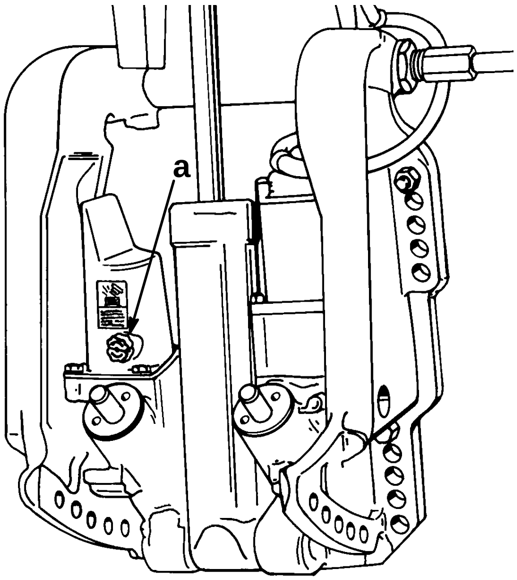
METRIC CONVERSION

14 in. = 35.56 cm	2 in. = 50.80 mm
3/8 in. = 9.50 mm	1/4 in. = 6.35 mm

⚠ CAUTION

Disconnect battery cables at battery before removing power trim wires from solenoids.

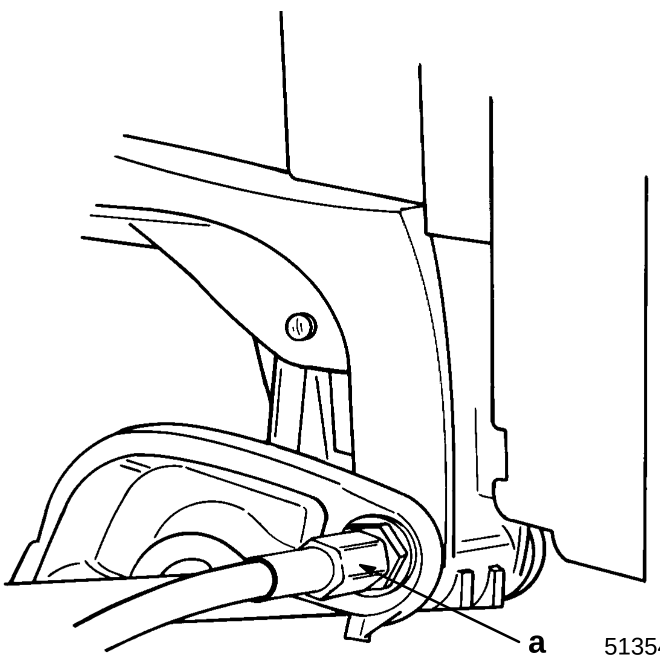
3. Disconnect power trim wires at solenoids (BLUE, GREEN, and BLACK).
4. Open filler cap and release any remaining pressure in the system.



51339

a - Filler Cap

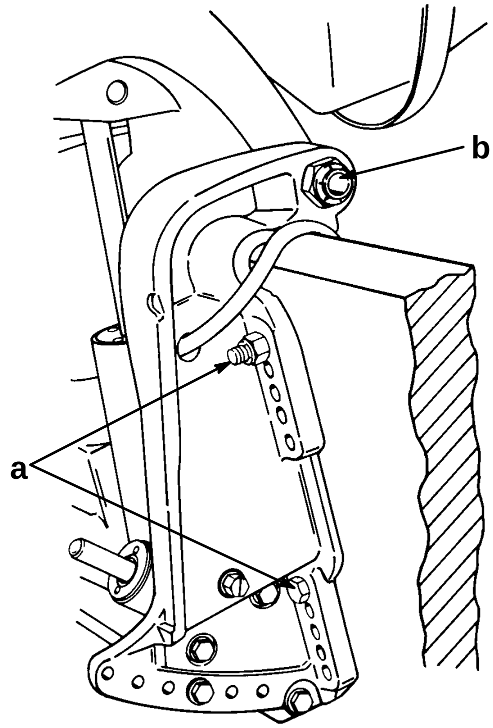
IMPORTANT: Outboards equipped with thru-the-tilt-tube steering - remove steering link arm from end of steering cable and cable retaining nut from tilt tube.



51354

a - Retaining Nut

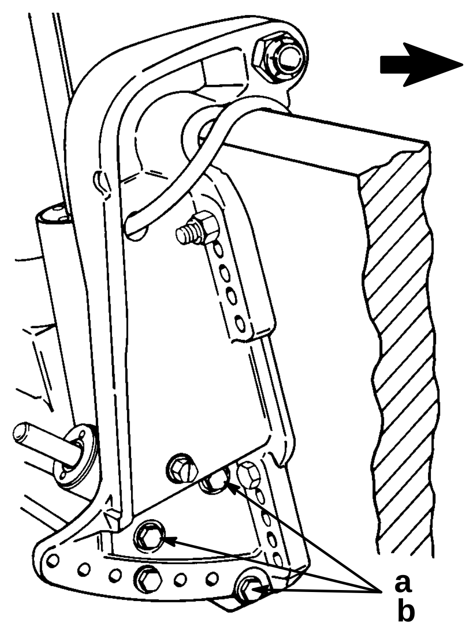
5. Remove outboard transom mounting bolts, and loosen tilt tube nut until nut is flush with end of tilt tube thread.



51375

a - Transom Mount Bolts (2)
b - Tilt Tube Nut (flush with end of thread)

6. Remove 3 screws and washers and move starboard transom bracket.

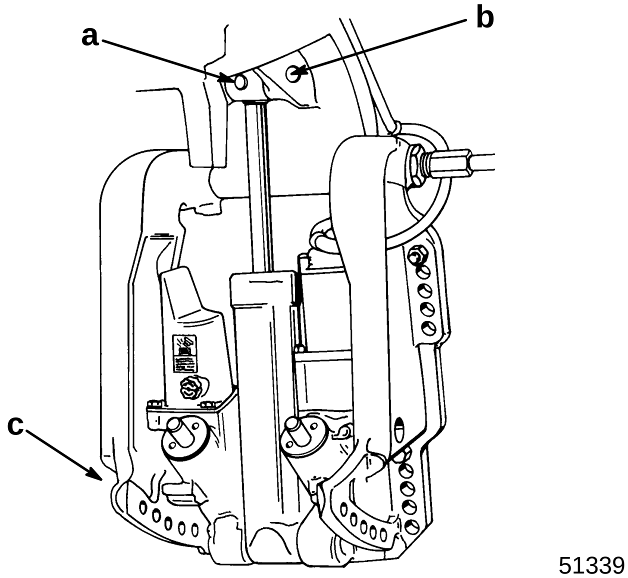


51375

a - Screws (3)
b - Washers (3)

IMPORTANT: Cross pin (a) should not be reused. Replace with new cross pin.

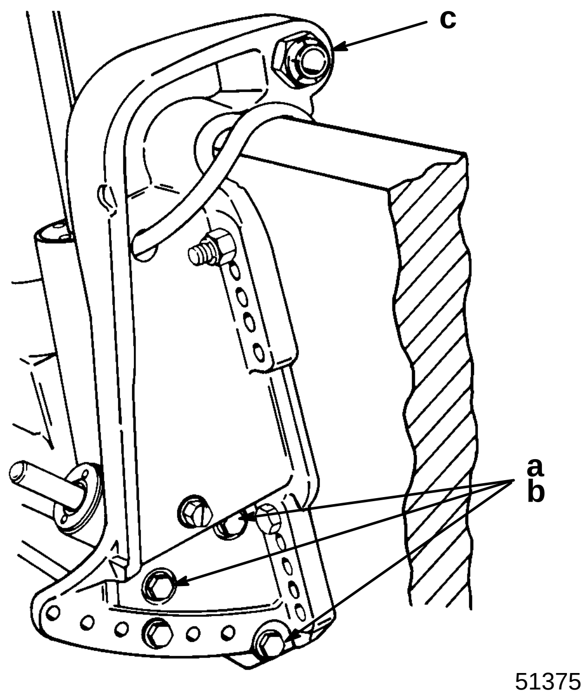
7. Drive out cross pin, push out upper swivel pin, and remove 3 screws and washers retaining trim system. Remove system from outboard.



a - Cross Pin
b - Upper Swivel Pin
c - Port Transom Bracket Screws and Washers (3) - Remove to release trim system from outboard.

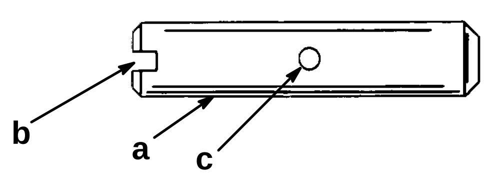
Installation

1. Paint any exposed metal surfaces to prevent corrosion.
2. Apply Loctite 271 to screws. Install trim system, starboard transom bracket, and tilt tube nut.



a - Screw (6) - Torque to 45 lb. ft. (61.0 N·m)
b - Flatwasher (6) - Install one per screw
c - Tilt Tube Nut

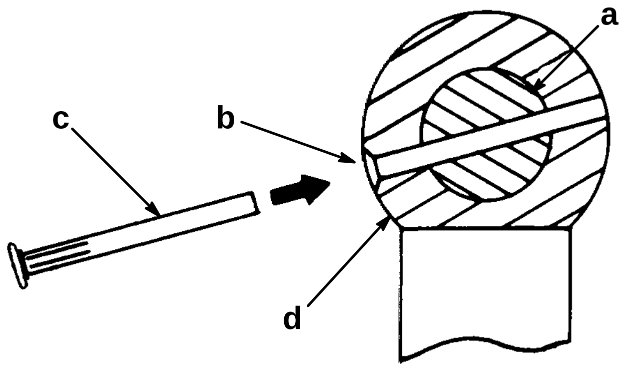
3. Use a 12 volt power source to extend tilt ram up to align upper swivel shaft hole and end of ram. Connect trim motor wires (BLUE wire to positive (+), BLACK wire to negative (-). If ram extends too far, retract ram by connecting GREEN wire to positive (+).
4. Install Upper Swivel Pin with slotted end to left (port) side of engine.



a - Upper Swivel Pin
b - Slotted End
c - Cross Hole (in line with slotted end)

IMPORTANT: Cross pin should not be reused. Install a new pin.

5. Position slot on end of swivel shaft in line with hole in tilt ram end. Insert a punch into tilt ram hole to align cross hole in upper swivel shaft. Tap new cross pin in until flush.



a - Upper Swivel Shaft (Slot is in line with cross hole)
b - Chamfered End of Hole (Faces away from transom)
c - Retaining Pin
d - Tilt Ram End

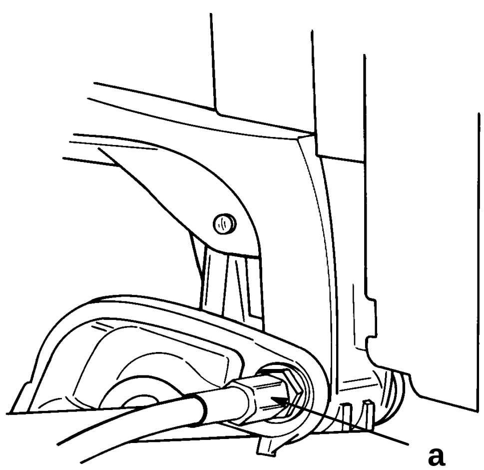
6. Connect trim motor wires to solenoids. Refer to Wiring Diagrams in this manual. Route trim wires as specified in this manual.
7. Apply marine sealer to shanks of mount bolts and install transom mount bolts.

IMPORTANT: Do not use an impact driver to tighten transom mount bolts.

Apply marine sealer to threads of mount bolts. Secure with flat washers and locknuts. Be sure installation is watertight.

8. Tighten tilt tube nut securely.

IMPORTANT: Outboards equipped with thru-the-tilt-tube steering: Tighten steering cable retaining nut securely to tilt tube.



a - Steering Cable Retaining Nut

9. Apply Quicksilver Liquid Neoprene (91-25511--2) on all electrical connections.

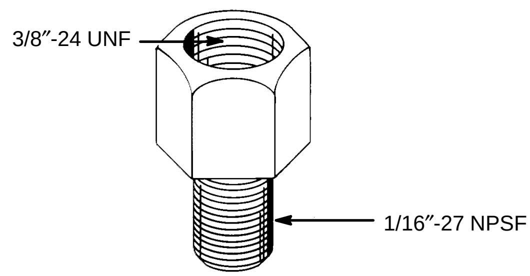
⚠ WARNING

Electrical wires passing through cowl openings must be protected from chafing or being cut. Follow the recommended procedures outlined in Section 1 of this Manual. Failure to protect wires as described could result in electrical system failure and/or injury to occupants of boat.

Testing Power Trim System With Test Gauge Kit (91-52915A3)

IMPORTANT: This test will not locate problems in the trim system. The test will show if the system is correct after a repair. If minimum pressures are not obtainable, the trim system requires additional repair.

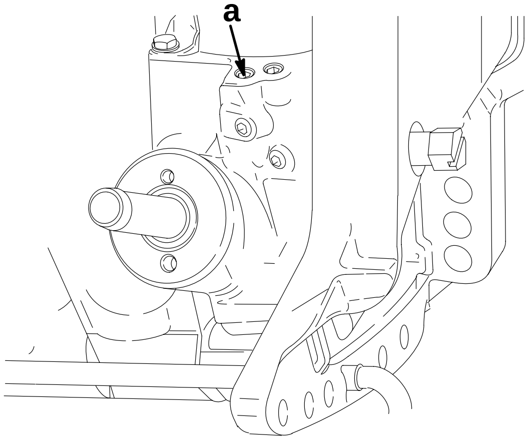
Use Adapter Fitting (22-11243) to connect test gauge to trim system.



“UP” Pressure Check

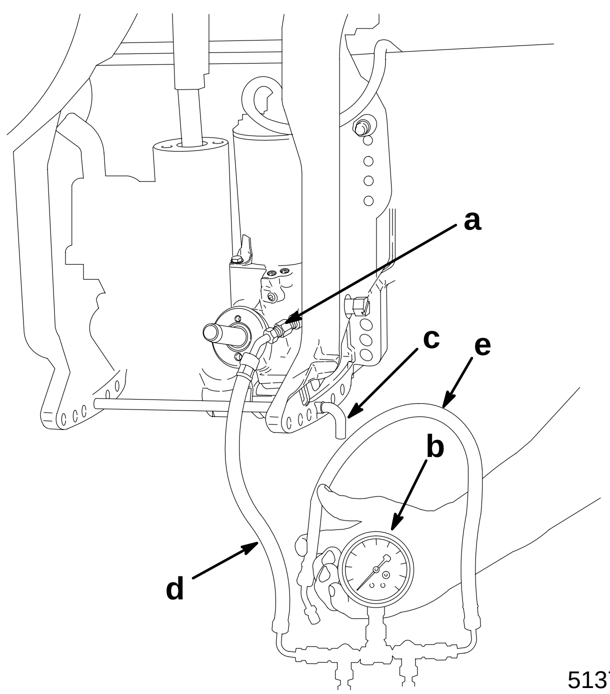
IMPORTANT: Insure battery is fully charged before performing tests.

1. Tilt outboard to full “Up” position and engage tilt lock lever.
2. Slowly remove “Fill” plug to bleed pressure from reservoir.
3. Turn Manual Release Valve 3 to 4 turns (counterclockwise) to bleed any remaining pressure.
4. Remove allen plug.



a - Allen Plug

5. Install components.



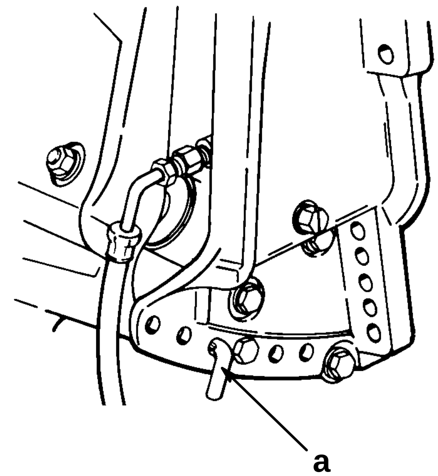
a - Adapter Fitting (22-11243)
b - Test Gauge Assembly
c - Tilt Pin (Position in hole shown)
d - Hose
e - Hose (not used for this check)

6. Disengage tilt lock lever.

⚠ CAUTION

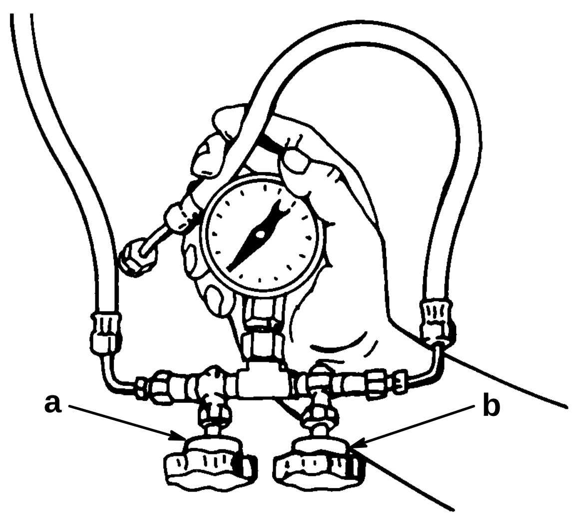
Failure to install spare tilt pin (or hardened bolts and nuts) in hole shown could result in transom bracket failure and possible injury.

7. Move outboard “In” until hole in swivel bracket “ear” aligns with the third tilt hole in transom bracket. Lock engine in trim range by installing a 3/8 in. (9.5 mm) diameter tilt pin or two 3/8 in. (9.5 mm) hardened bolts and nuts thru the transom brackets and swivel bracket in the hole shown.



a - Tilt Pin Hole (Install spare tilt pin or hardened bolts and nuts.)

8. Install “Fill” plug.
9. Close Manual Release Valve (clockwise).
10. Open valve (a) and close valve (b).



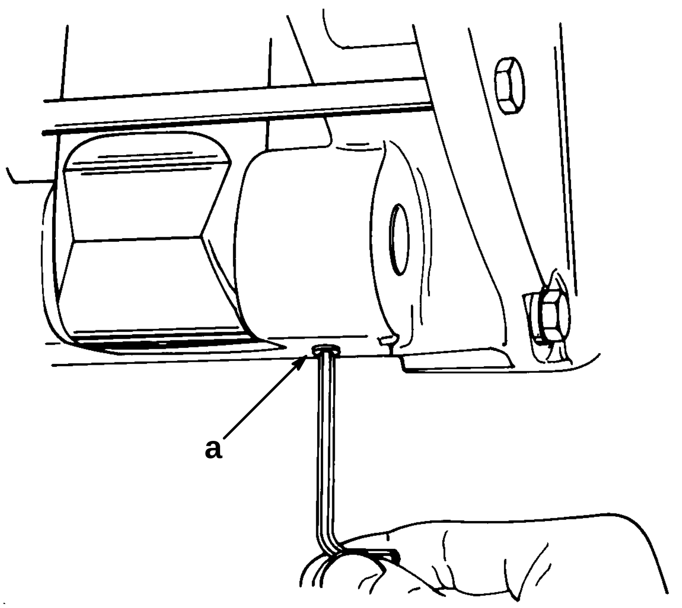
a - Open valve
b - Close valve

11. Run trim “UP”. The minimum pressure should be 1300 P.S.I. (91 kg/cm^2).
12. Run trim “DOWN” to release pressure and remove spare tilt pin or bolts and nuts.
13. Tilt outboard full “UP” and engage tilt lock lever.
14. Slowly remove “Fill” plug to bleed pressure.
15. Open Manual Release Valve 3 to 4 turns to bleed any remaining pressure.
16. Remove test gauge hose and adapter, and install allen plug.

NOTE: If pressure is less than 1300 PSI (91 kg/cm2), troubleshoot system per instructions on page 6B-7.

“DOWN” Pressure Check

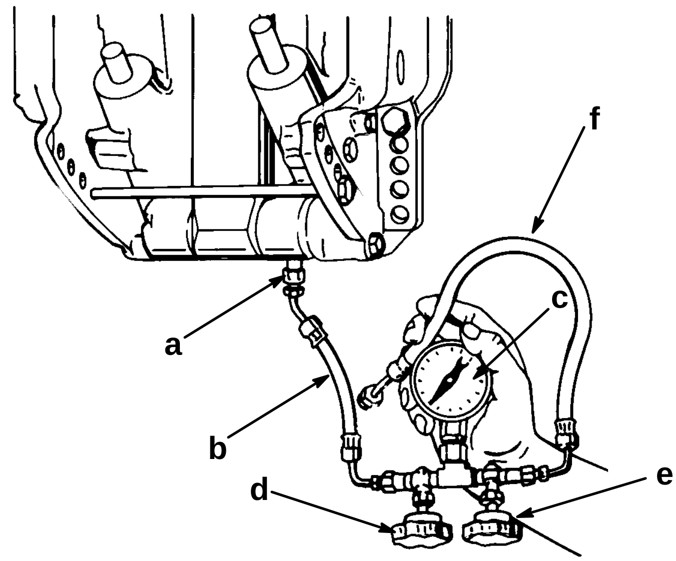
1. Repeat steps 1 through 4 from preceding **“UP”** pressure check, removing allen plug as shown.



51367

a - Allen Plug

2. Install components.



51360

a - Adapter Fitting (22-11243)
b - Hose (route hose so it will not be pinched when outboard is trimmed “DOWN”)
c - Test Gauge Assembly
d - Valve
e - Valve
f - Hose (not used for this test)

3. Open valve (d) and close valve (e).
4. Install fill plug.
5. Close Manual Release Valve (clockwise).
6. Run trim “DOWN”. Minimum pressure should be 500 P.S.I. (35 kg/cm^2).
7. Tilt outboard full “UP” and engage tilt lock lever.
8. Slowly remove “Fill” plug to bleed pressure.
9. Open Manual Release Valve 3 to 4 turns to release any remaining pressure.
10. Remove test gauge hose and adapter fitting. Install allen plug.
11. Fill Power Trim system and purge system; refer to “Fill, Check, and Purge” preceding.

NOTE: If pressure is less than 500 PSI (35 kg/cm^2), troubleshoot system per instructions on page 6B-7.

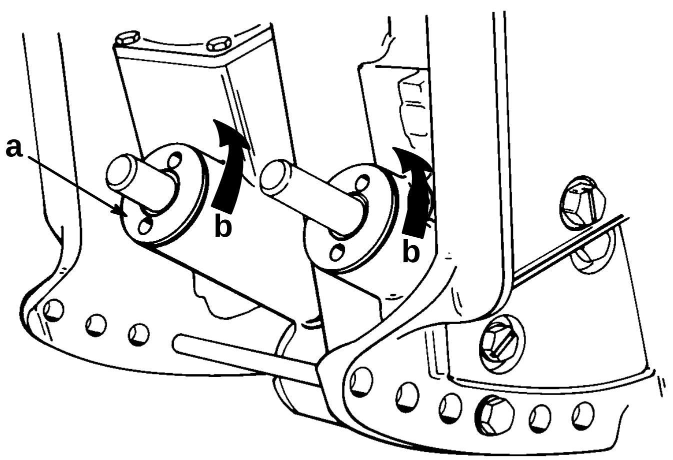
Hydraulic Repair

TRIM ROD REMOVAL AND REPAIR

NOTE: Power Trim does not have to be removed from outboard to remove trim rods.

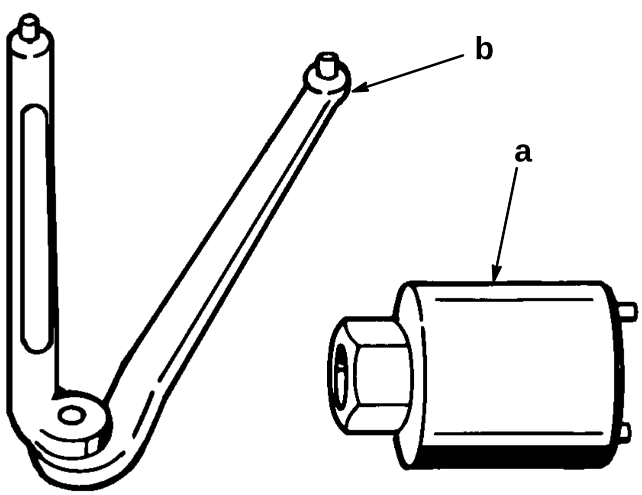
1. Tilt outboard to full “UP” position and engage tilt lock lever.
2. Slowly remove “Fill” plug to bleed reservoir pressure.
3. Turn Manual Release Valve 3 to 4 turns (counter-clockwise) to bleed remaining pressure.
4. Remove trim rod cylinder caps.

NOTE: Place a clean pan under trim system to catch fluid.



51353

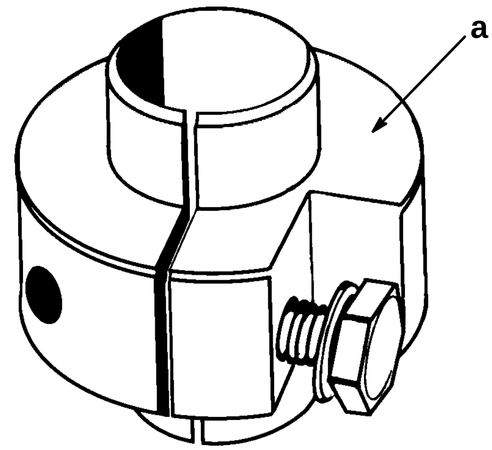
a - Trim Rod Cylinder Cap
b - Turn Counterclockwise to Remove



51337

a - Removal Tool (91-44487A1)
b - Spanner Wrench (91-74951)

5. Install trim rod removal tool and pull trim rod from cylinder.



27933

a - Trim Rod Removal Tool (91-44486A1)

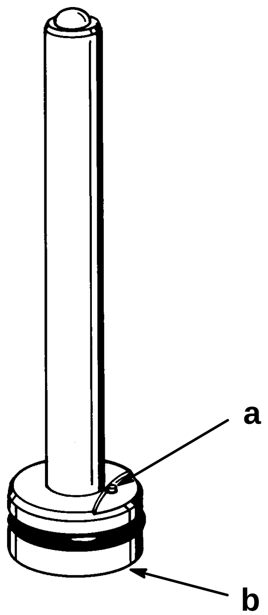
CLEANING AND INSPECTION - TRIM RODS AND CAPS

⚠ CAUTION

Do not remove check valve (a). Check valve is preset to operate at a specific pressure. Removal and installation of check valve could result in improper operating pressure and possible system damage.

NOTE: Check valve is in port side trim rod only.

1. Inspect check valve and check valve screen for debris; if debris cannot be removed, replace trim rod assembly. Clean trim rod with parts cleaner and dry with compressed air.

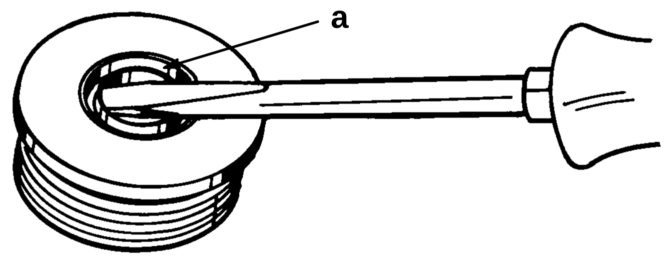


51352

a - Check Valve
b - Check Valve Screen

Trim Rod End Cap Seal

1. Inspect trim cap end seal and replace if damaged or if seal does not keep trim rod clean.



51343

a - Seal (Remove as shown)

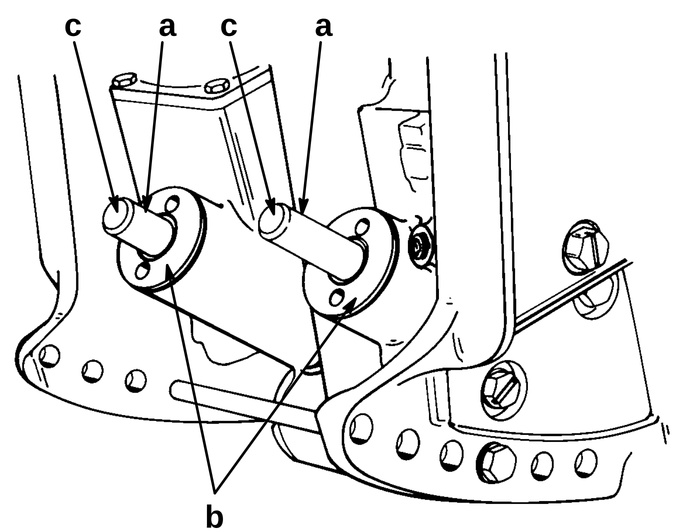
2. Install new seal with seal lip up.

TRIM ROD INSTALLATION

IMPORTANT: Components must be free of dirt and lint. Any debris in the system can cause system to malfunction.

NOTE: Install trim rod with check valve in the port (left) cylinder.

1. Apply Quicksilver Power Trim and Steering Fluid on all O-rings and seals before installation.
2. Install trim rods and caps. Use installation tool (91-44487A1) or spanner wrench (91-74951) to tighten caps securely.



51353

a - Trim Rods
b - Cylinder End Caps
c - Rod End Rollers (Lubricate with Quicksilver Anti-Corrosion Grease or 2-4-C w/Teflon)

Tilt Ram

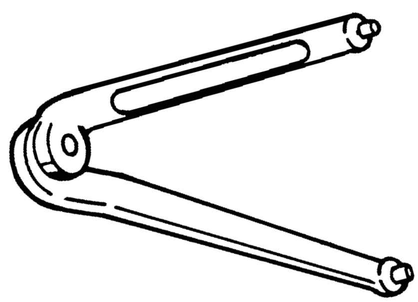
REMOVAL - TILT ROD ASSEMBLY ONLY

NOTE: Tilt Rod Assembly can be removed from cylinder without removing entire power trim system from outboard. Refer to page 6A-13 to remove upper swivel pin.

⚠ CAUTION

Insure Power Trim System Is Depressurized Prior To Tilt Rod Removal.

1. Use spanner wrench (91-74951) to loosen tilt ram end cap.



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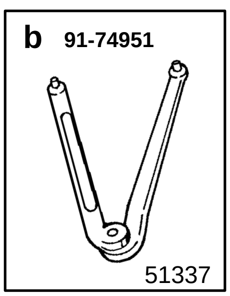
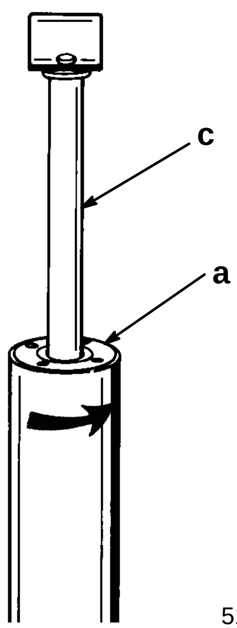


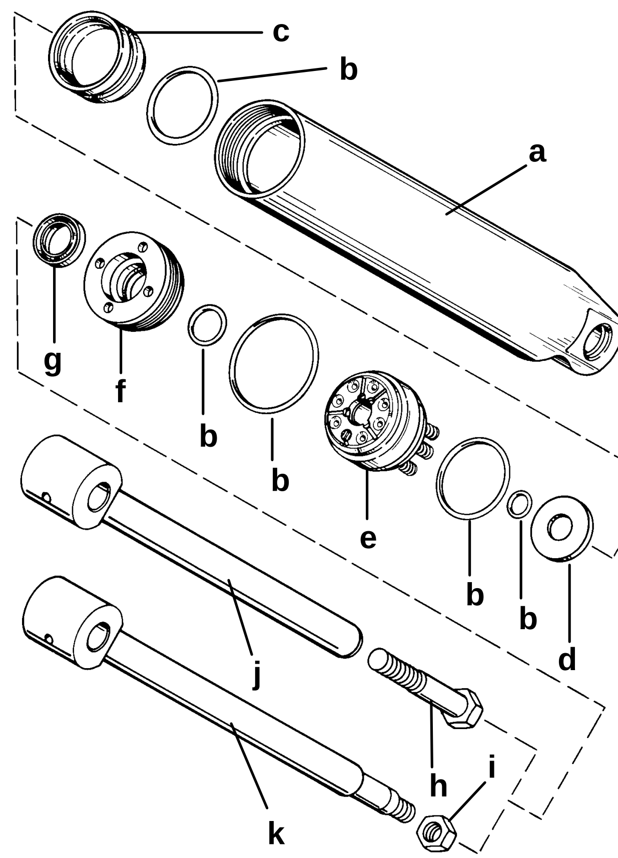


51364

a - End Cap
b - Spanner Wrench (91-74951) (Turn counterclockwise)
c - Tilt Rod - Pull to remove.

NOTE: Place a clean pan under tilt ram to catch fluid.

TILT RAM COMPONENTS



51372

a - Housing - Tilt Ram
b - O-ring* (5)
c - Memory Piston**
d - Washer
e - Piston Assembly
f - End Cap
g - Oil Seal
h - Bolt (Design 1)
i - Nut (Design 2)
j - Tilt Rod (Design 1)
k - Tilt Rod (Design 2)

* O-ring Repair Kit Available, P/N 811607A1 (Includes item g, Oil Seal)

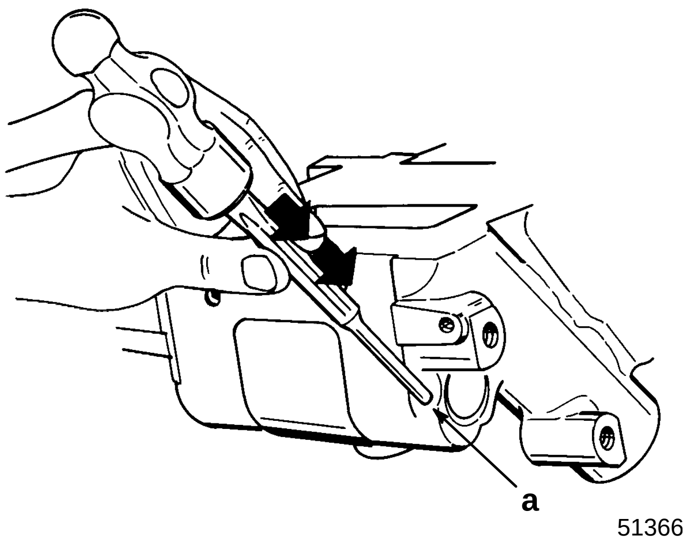
** Memory piston (c) for tilt rods (j and k) are different and must be used with correct tilt rod/cylinder assembly. Memory piston for Design 1 tilt rod is flat, Design 2 is dished to clear nut and thread.

TILT RAM REMOVAL - POWER TRIM SYSTEM REMOVED FROM OUTBOARD

⚠ CAUTION

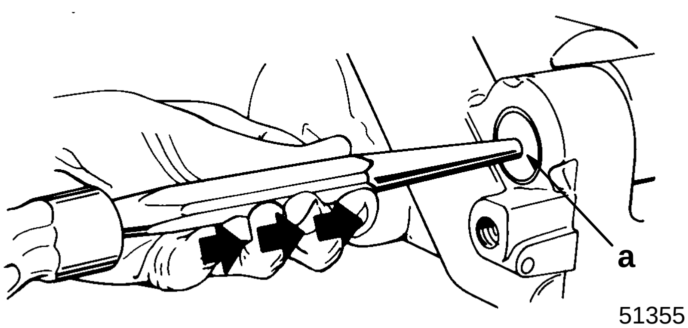
Insure Trim System Is Depressurized Prior To Tilt Ram Removal.

1. Remove cross pin.



a - Cross Pin (Remove as shown)

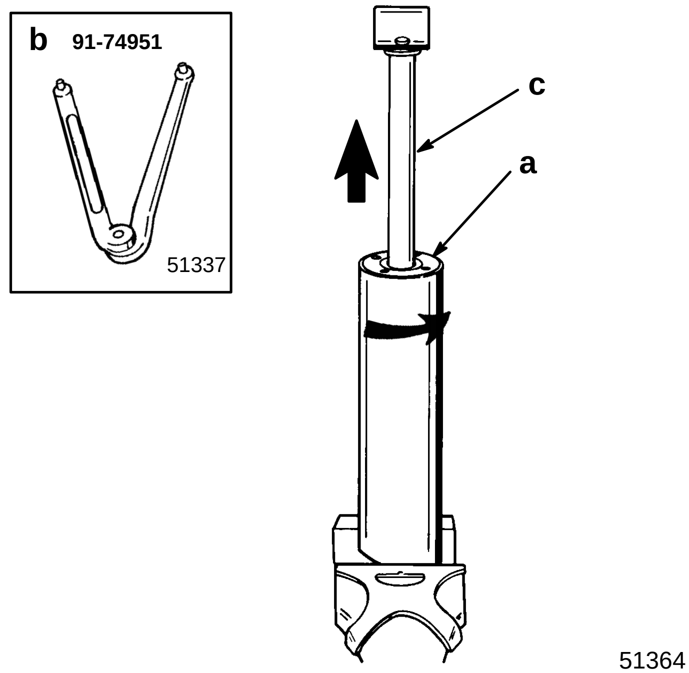
2. Remove lower swivel pin.



a - Lower Swivel Pin (Remove as shown)

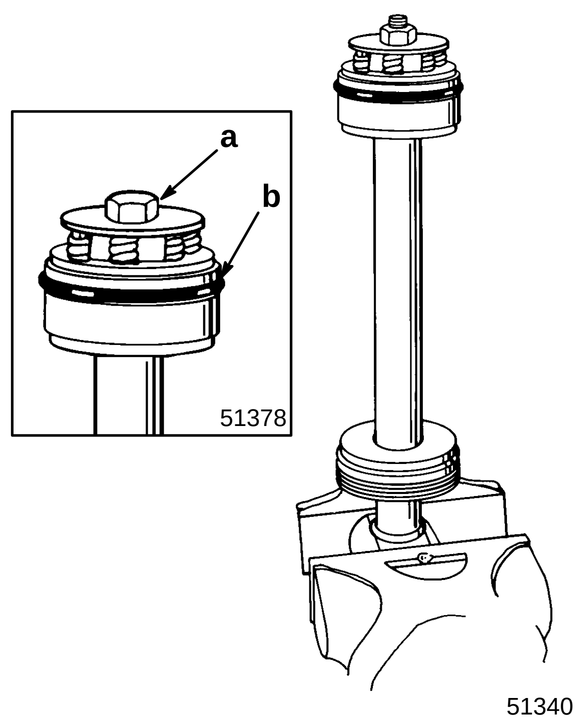
Disassembly

1. Secure tilt ram in a soft jawed vise. Remove tilt rod and cap.



a - Cap (Turn counterclockwise to remove)
b - Spanner Wrench (91-74951)
c - Tilt Rod - Pull to remove

2. Clamp tilt rod in a soft jawed vise. Remove bolt or nut as applicable to disassemble rod assembly. Remove O-ring.

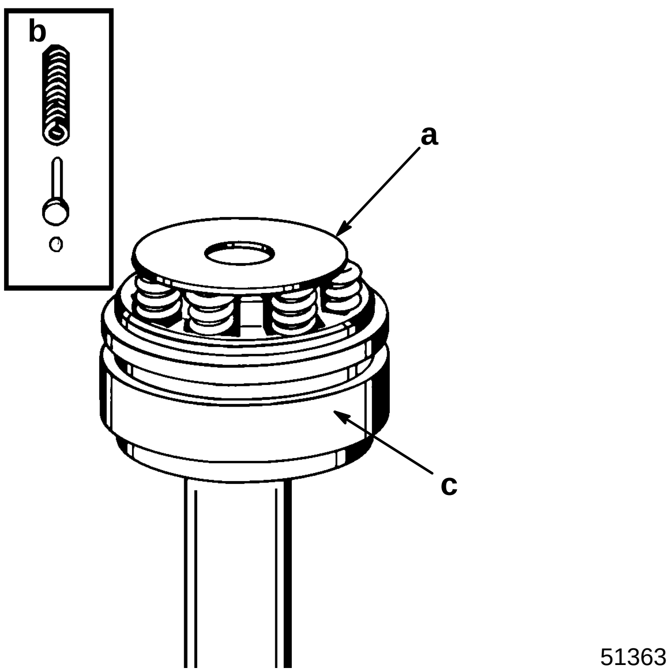


a - Bolt (Design 1) or Stud/Nut (Design 2)
b - O-ring

IMPORTANT: Note Design 1 and 2 previous. Design 1 tilt rod assembly replaces either tilt rod assembly Either design will fit as a (replace) cylinder assembly complete.
Design 2 will NOT fit a cylinder originally using a Design 1 tilt rod assembly.
Memory Pistons for Design 1 and 2 differ also and must be used only on the cylinder the piston was removed from.

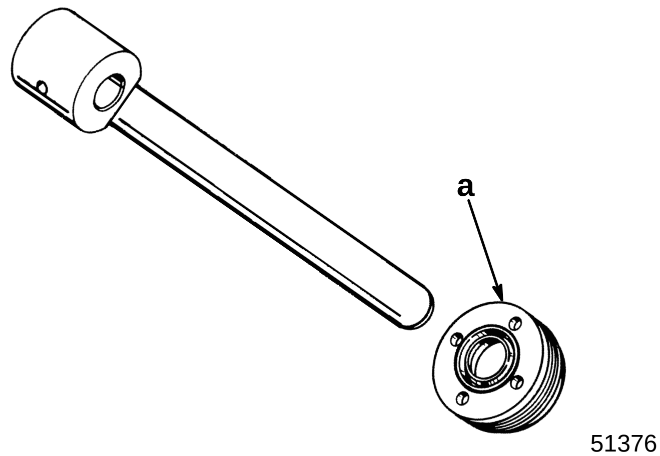
3. Remove washer, check valve assemblies, and piston.

NOTE: Check valve held in by roll pin can be cleaned but not removed.



a - Washer
b - Check Valve Assembly (7)
c - Piston

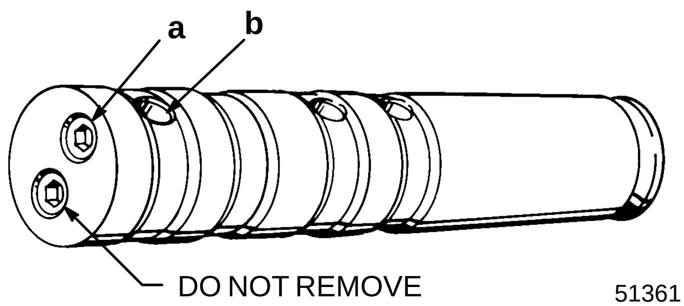
4. Remove end cap from tilt rod.



a - End Cap

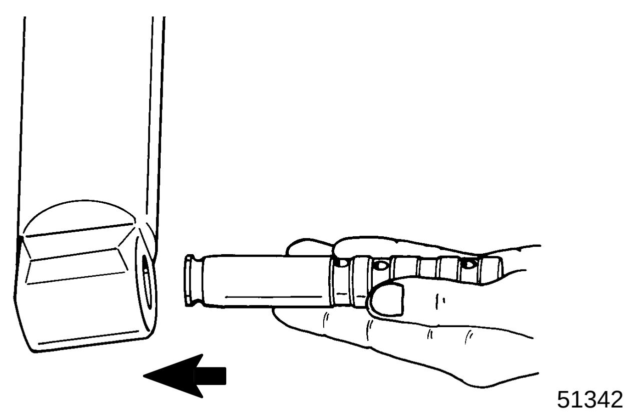
5. Remove allen plug.

IMPORTANT: Remove plug from same side as holes in shaft.

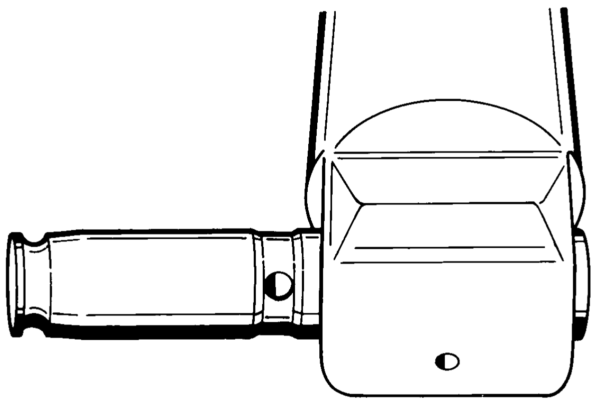


a - Allen Plug
b - Hole in Shaft

6. Lubricate shaft with Quicksilver Power Trim and Steering Fluid. Insert shaft into cylinder.



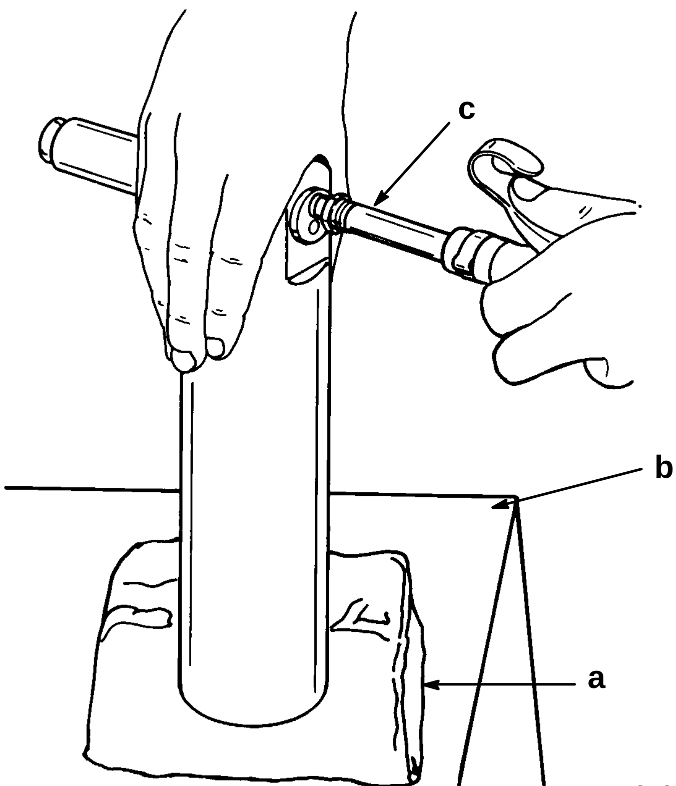
7. Tap shaft into cylinder until shaft is positioned as shown.



51365

> **⚠ WARNING**
>
> **Memory Piston Cup may be expelled at a high velocity when air pressure is applied. Failure to place cylinder as shown below could result in personal injury.**

8. Place cylinder as shown. Hold down on cylinder and inject air into shaft opening.



51353

a - Shop Cloth
b - Solid Surface
c - Air Nozzle

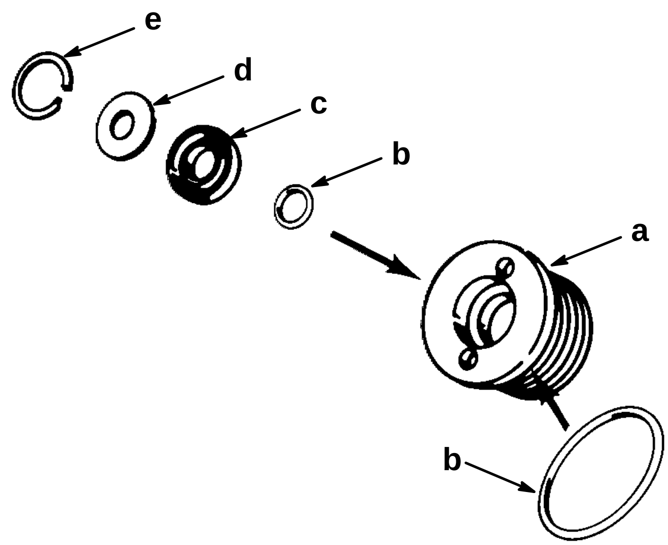
9. Remove shaft after Memory Piston Cup has been expelled. Replace allen plug removed in Step 5 and tighten securely.

CLEANING AND INSPECTION

1. Inspect all internal parts for damage or wear. Clean and replace parts as necessary.
2. Inspect tilt rod for scratches. Replace scraper seal in rod end cap if tilt rod is scratched or worn.
3. Slight scratches or tool marks less than 0.005 in. (0.1 mm) deep in cylinder are acceptable.

Scraper Seal Replacement

1. Remove components from end cap.



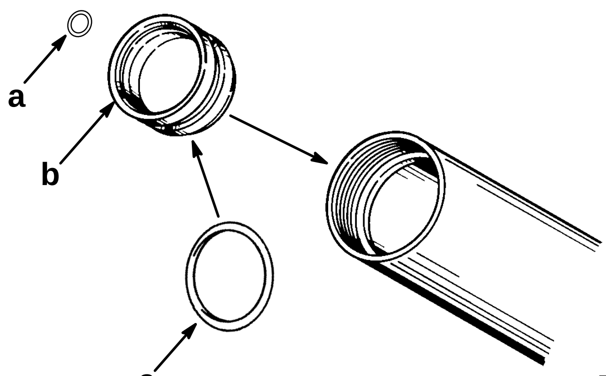
a - Cap
b - O-ring (2)
c - Scraper Seal
d - Washer
e - Retaining Ring

REASSEMBLY

IMPORTANT: Components must be clean for reassembly. Any debris in the system can cause the system to malfunction.

NOTE: Refer to “Tilt Ram Components” for proper O-ring sizes.

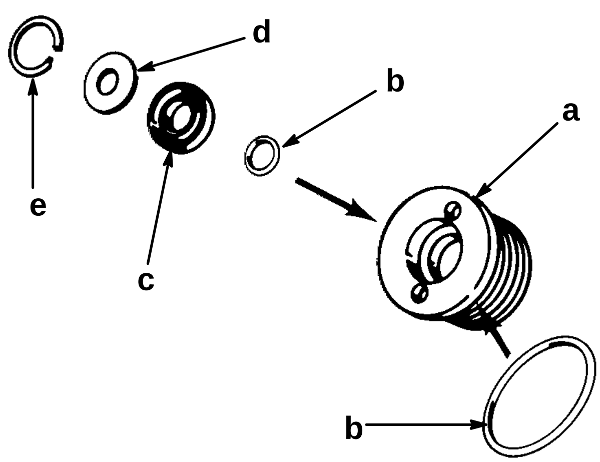
1. Apply Quicksilver Power Trim and Steering Fluid on O-rings prior to reassembly.
2. Install O-ring on Memory Piston Cup and install in cylinder.



51372

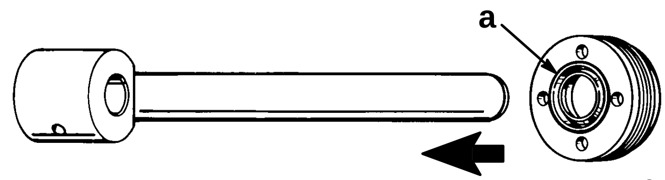
a - O-ring
b - Memory Piston Cup

3. Assemble end cap.



a - End Cap
b - O-ring (2)
c - Scraper Seal
d - Washer
e - Retaining Ring

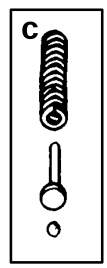
4. Install end cap.



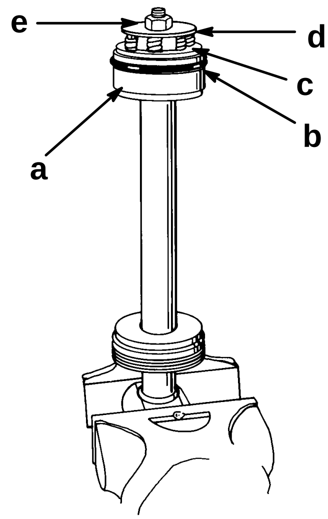
51376

a - End Cap

5. Install components on rod.



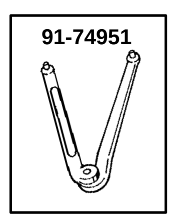
51363



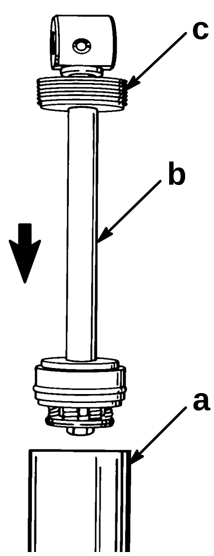
51340

a - Piston
b - O-ring
c - Check Valve Assembly (7)
d - Washer
e - Bolt or Locknut (Tighten securely)

6. Clamp cylinder in a soft jawed vise and install tilt rod assembly. Use spanner wrench and tighten end cap securely.



51337

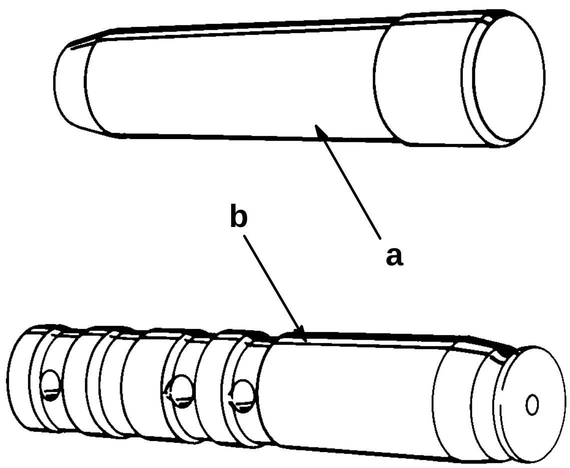


51341

a - Cylinder
b - Tilt Rod Assembly
c - End Cap (Tighten securely) - Use spanner wrench

TILT RAM ASSEMBLY INSTALLATION

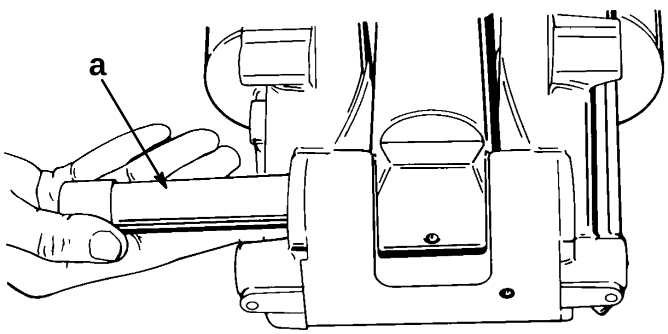
1. Lubricate alignment tool (91-11230) and shaft. Use Quicksilver Power Trim and Steering Fluid.



51369

a - Alignment Tool (91-11230)
b - Shaft

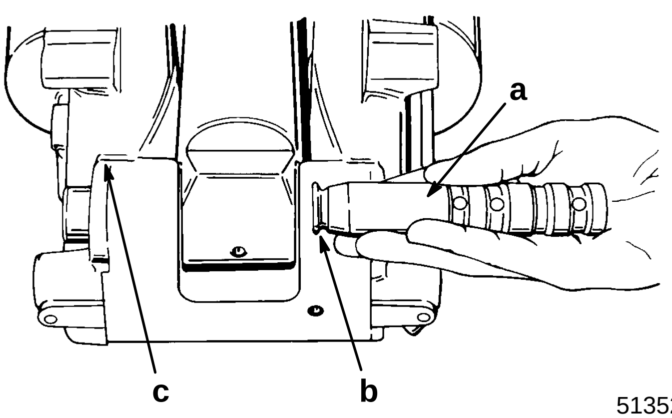
2. Align tilt ram and housing using alignment tool.



51348

a - Alignment Tool (91-11230)

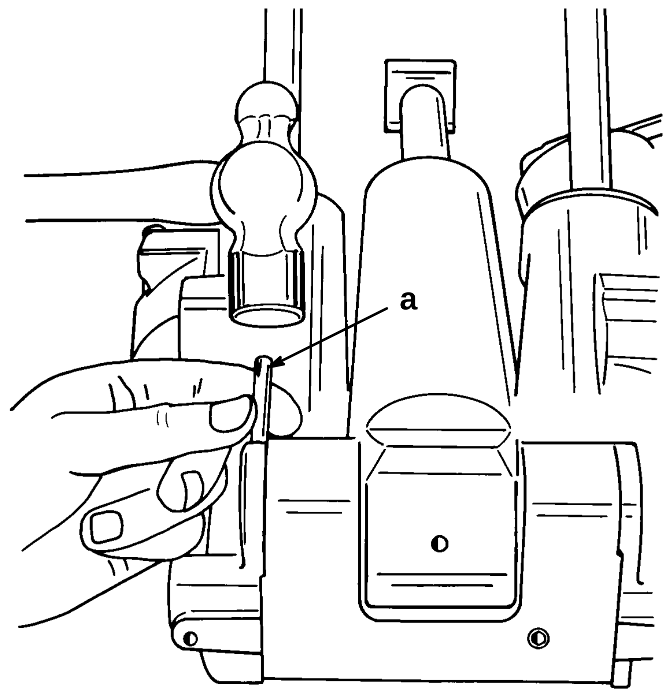
3. Install shaft.



51352

a - Shaft
b - Groove
c - Hole [groove (b) will align with this hole]

4. Drive pin in until flush.



51356

a - Pin (Drive against knurled end)

5. Install Power Trim Assembly on outboard. Refer to “Installation” instructions on pages 6B-16 and 6B-17.

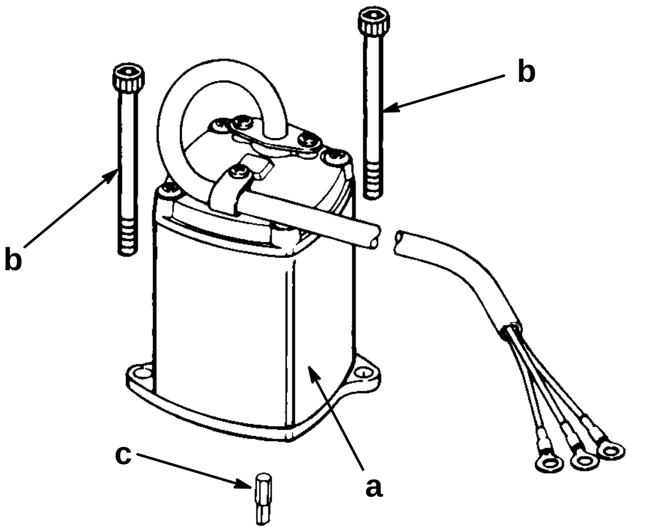
MOTOR AND PUMP REPLACEMENT

IMPORTANT: The pump is not rebuildable. If pump is defective, replace as an assembly.

NOTE: Power Trim System does not have to be removed from outboard to replace pump or motor.

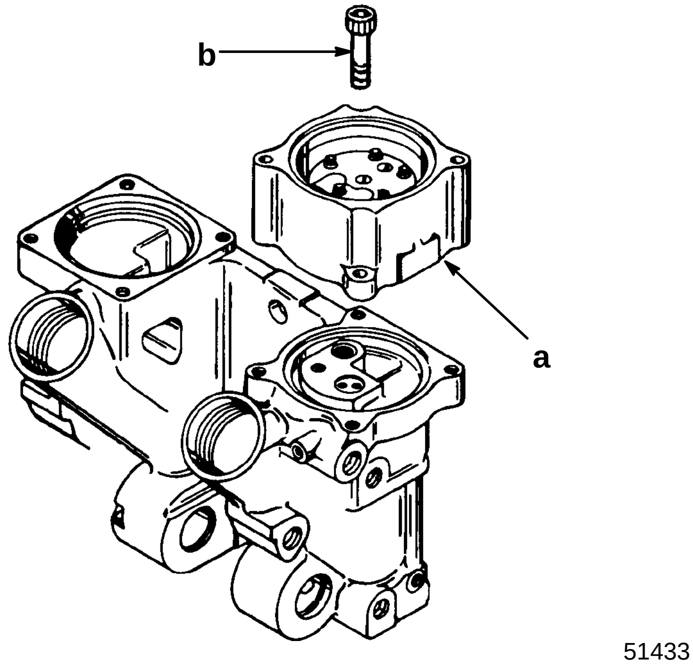
1. Tilt outboard to full "UP" position. Depressurize power trim system, and loosen starboard transom bracket as outlined in **"Removal and Installation"** on page 6B-14.
2. Remove 2 screws to remove motor from system.

NOTE: Driveshaft is a loose part and may fall out of motor when motor is removed.



a - Motor
b - Screw (2)
c - Driveshaft

3. Remove two screws to remove pump.



a - Pump
b - Screw (2)

Motor and Electrical Tests/Repair

Trim Pump Motor Test

⚠ WARNING

Do not perform this test near flammable materials, as a spark may occur while making electrical connections.

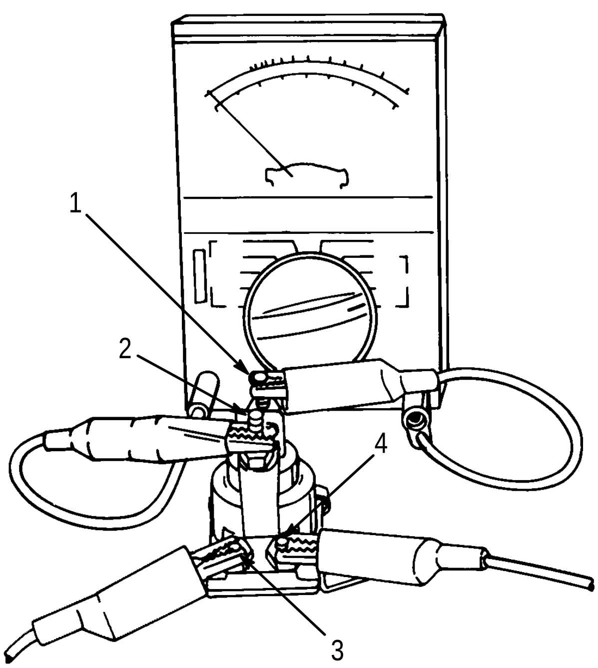
1. Connect a 12 volt power supply to motor wires [positive (+) to blue wire and negative (-) to black wire]. Motor should run. Disconnect blue wire and connect green wire to positive (+) terminal of power supply. Motor should run.
2. If motor does not run, disassemble and check components.

Solenoid Test

⚠ WARNING

Do not perform this test near flammable materials, as a spark may occur while making electrical connections.

1. Disconnect all wires from solenoid terminals.
2. Set an Ohmmeter to Rx1 scale and connect meter leads to solenoid terminals 1 and 2.
3. Connect a 12 volt power supply to terminals 3 and 4. Solenoid should click and meter should read zero (0) ohms (full continuity).

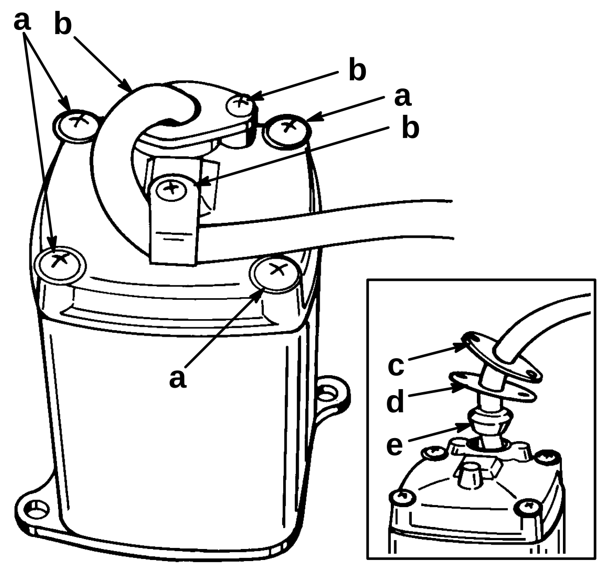


51338

4. If meter does not read zero (0) ohms, replace solenoid.

MOTOR DISASSEMBLY

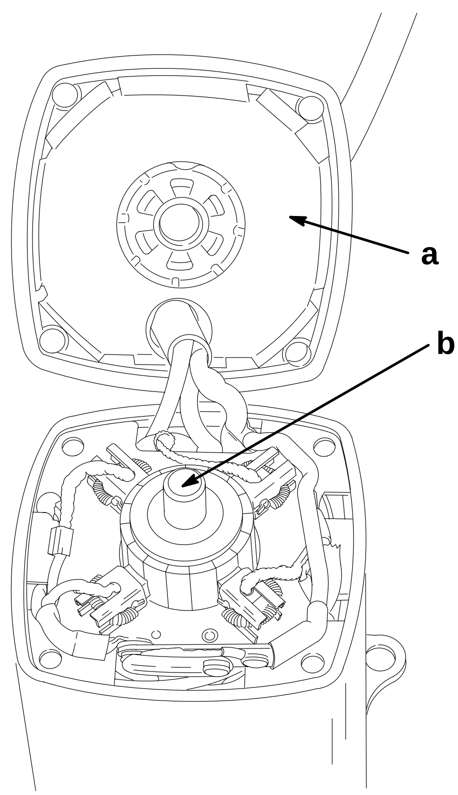
1. Remove screws and clamp.



51345

a - Screw (4)
b - Screw (3)
c - Clamp
d - Grommet
e - Gasket

2. Lift motor from end cap. Use care not to drop armature.



18457

a - End Cap
b - Armature

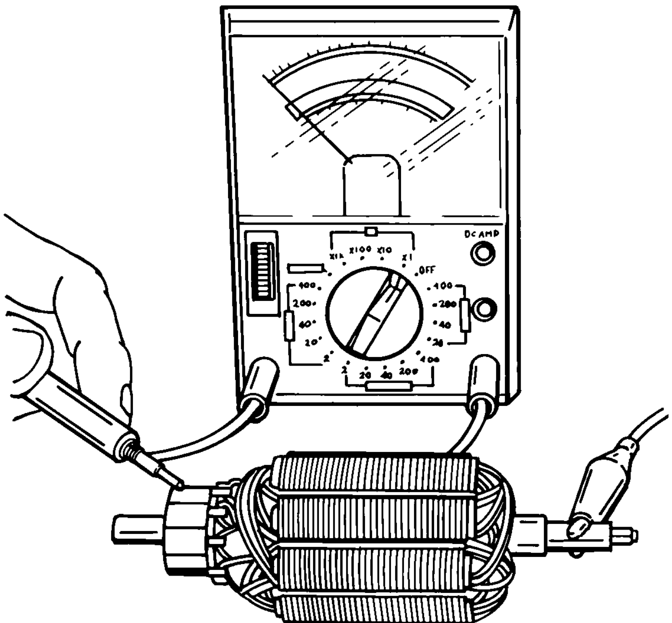
Armature Tests

TEST FOR SHORTS

Check armature on a Growler per the Growler manufacturer's instructions. Replace armature if a short is indicated.

TEST FOR GROUND

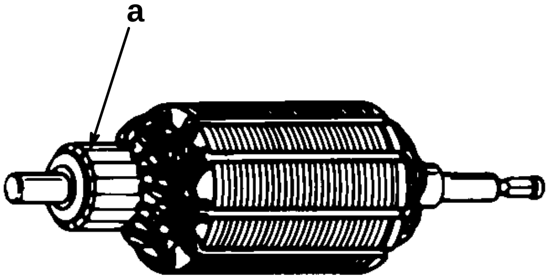
1. Use an Ohmmeter (R x 1 scale). Connect one lead on armature shaft and other lead on commutator. If continuity is indicated, armature is grounded. Replace armature.



51359

CHECKING AND CLEANING COMMUTATOR

1. If commutator is worn it may be turned on an armature conditioner or a lathe.
2. Clean commutator with "00" sandpaper.



a - Commutator

FIELD TESTS

IMPORTANT: Commutator end of armature must be installed in brushes when performing the following tests.

Ohmmeter Leads Between	Resistance (Ohms)	Scale Reading* (x________)
Green and Blue Motor Wires	0	Full Continuity (R x 1)
Green and Black Motor Wires	0	Full Continuity (R x 1)
Blue and Black Motor Wires	0	Full Continuity (R x 1)
Black Motor Wire, and Frame (Motor Housing)	No Continuity	Full Continuity (R x 1)
Green Motor Wire, and Frame	No Continuity	Full Continuity (R x 1)
Blue Motor Wire, and Frame	No Continuity	Full Continuity (R x 1)

* If specified readings are not obtained, check for:

- defective armature
- dirty or worn brushes
- dirty or worn commutator

If defective components are found, repair or replace component(s) and retest.

Motor Repair

REMOVAL

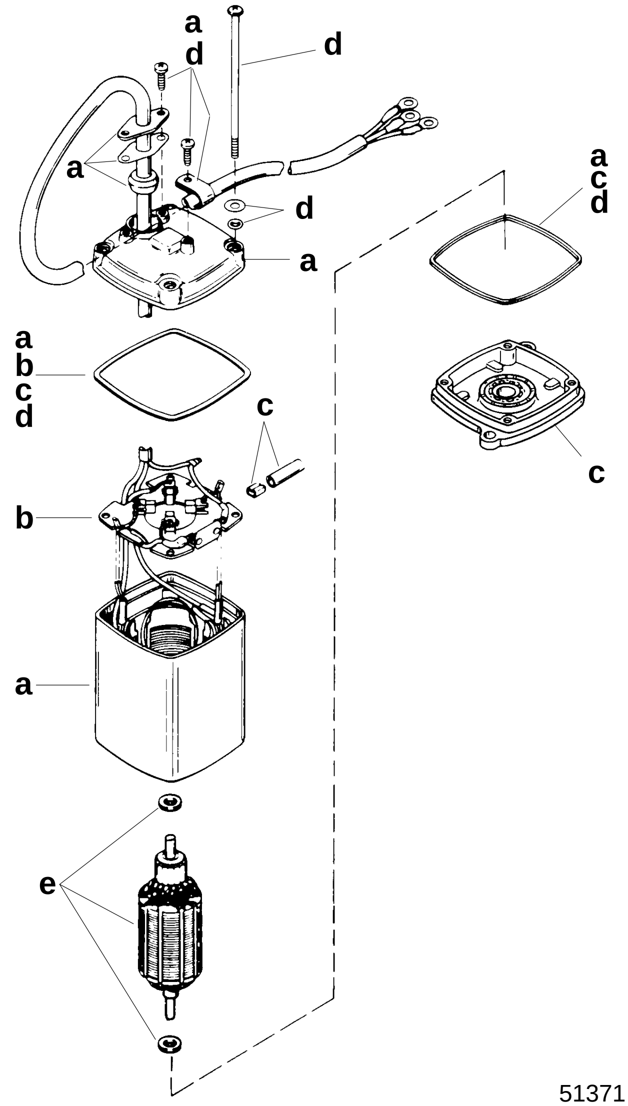
NOTE: Power Trim System does not have to be removed from outboard to repair/replace motor.

DISASSEMBLY

Refer to **"Motor Disassembly"** on page 6B-29 to disassemble motor from pump.

CLEANING AND INSPECTION

Inspect O-rings and replace if necessary. Clean, inspect, and test motor components. Refer to **"Brush Replacement," "Armature Test,"** and **"Field Tests"** for inspection and test procedures.

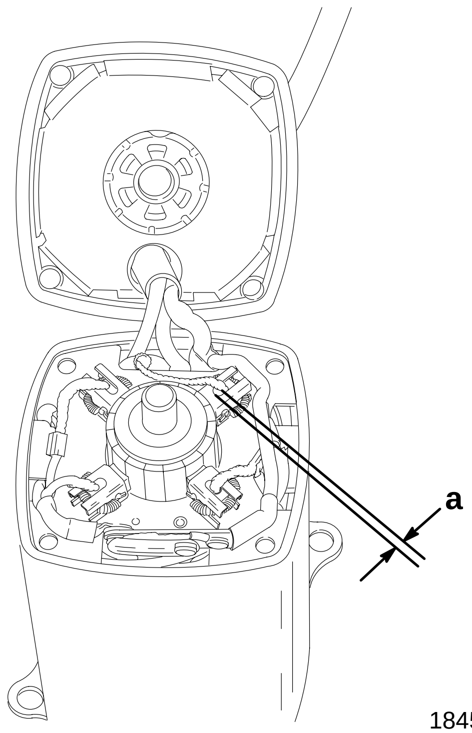


Power Trim Motor

a - Frame and Field Kit
b - Brush Card Kit
c - End Frame Kit
d - Seal Kit
e - Armature Kit

BRUSH REPLACEMENT

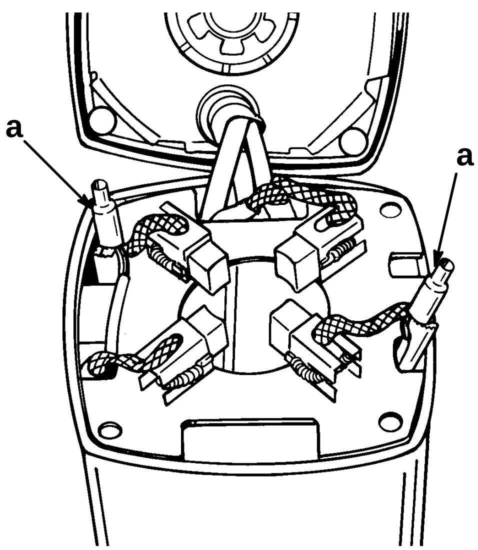
1. Brush replacement is required if brushes are pitted, chipped, or if distance (a) between the brush pigtail and end of brush holder slot is 1/16 in. or less. Check distance with armature installed.



18457

a - 1/16 in.

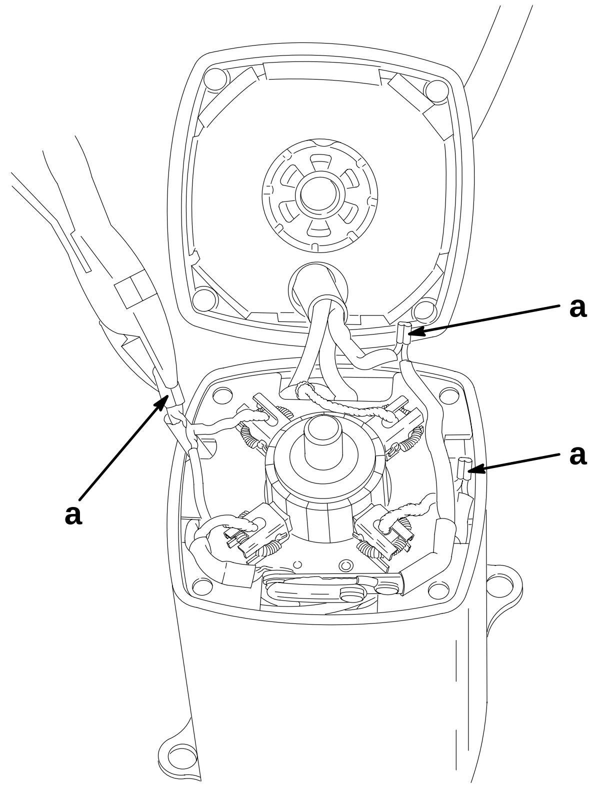
2. To replace brush card, remove insulators.



51350

a - Insulators

3. Remove metal connectors.



18466

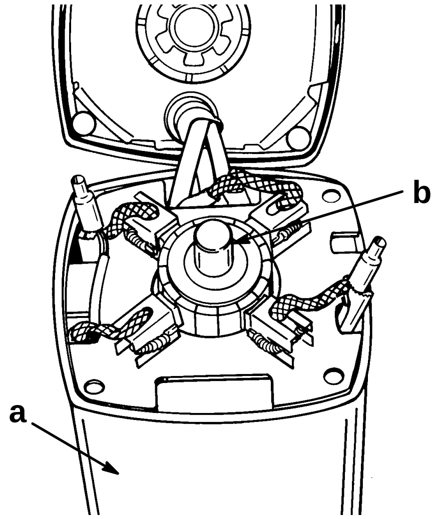
a - Metal Connectors

4. Install new brush card.
5. Crimp new metal connectors onto wires.
6. Insulate connections with heat shrink tubing.

Reassembly

IMPORTANT: Components must be clean. Any debris in power trim system can cause system to malfunction.

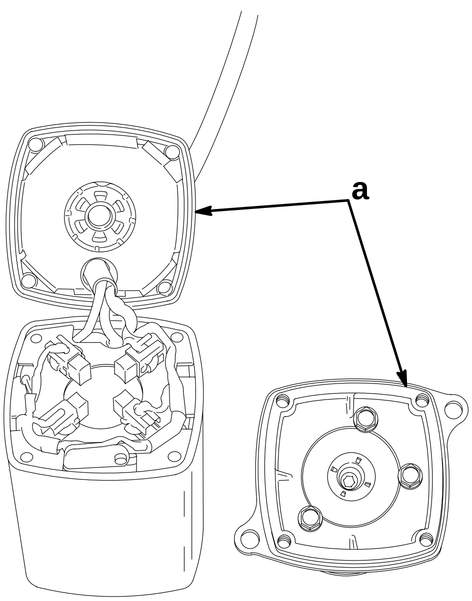
1. Install armature in motor housing.



51349

a - Motor Housing
b - Armature (Spread brushes to insert commutator)

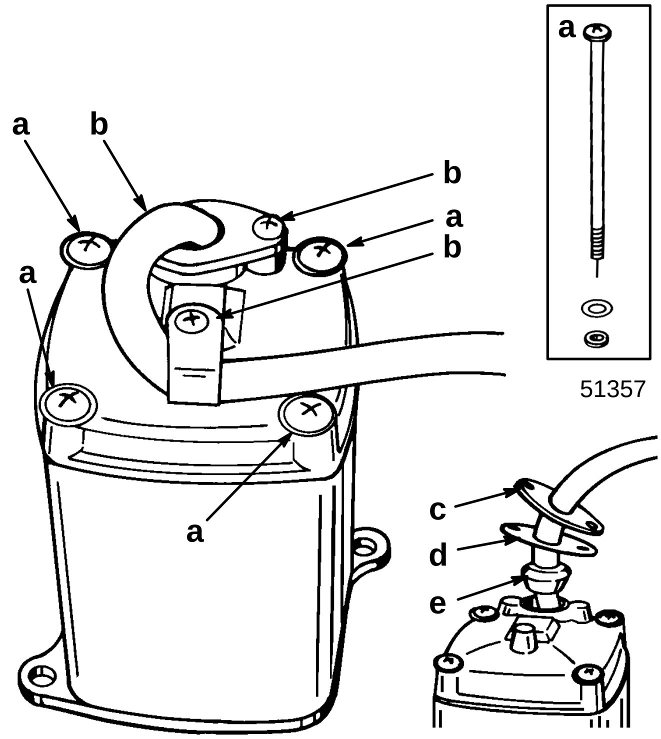
2. Install square-rings in end caps being careful that square ring is not twisted.



18465

a - Square-rings

3. Install screws and clamp. Tighten screws securely.



51345

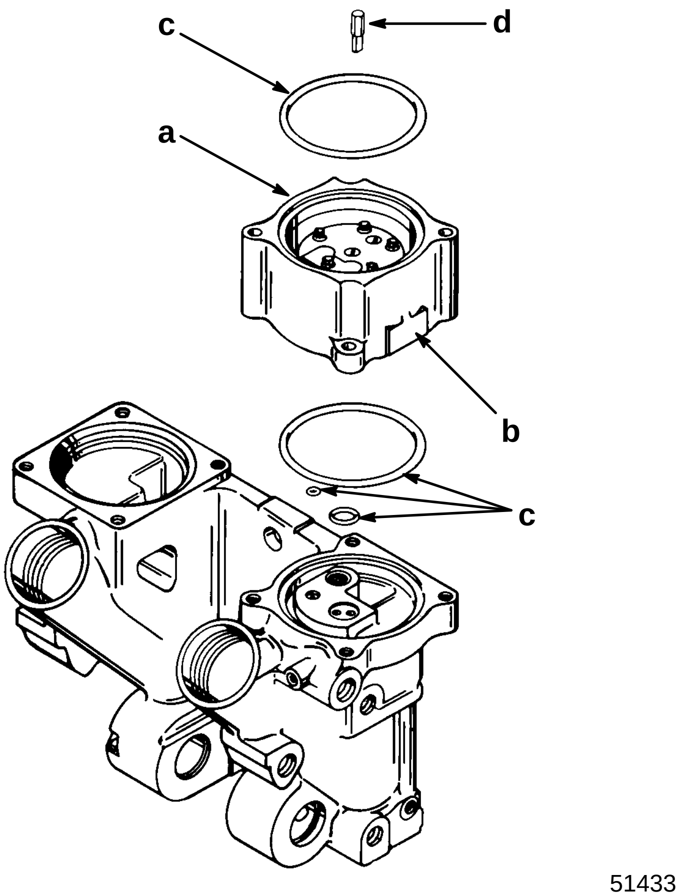
a - Screw (4) - Contains flat washer and O-ring
b - Screw (3)
c - Clamp
d - Gasket
e - Grommet

Reassembly - Motor and Pump

NOTE: Driveshaft is a loose part and may fall out of position.

1. Install pump onto power trim manifold. Insure O-rings are in proper locations. Secure with two (2) screws. Torque screws to 70 lb. in. (7.9 N·m).

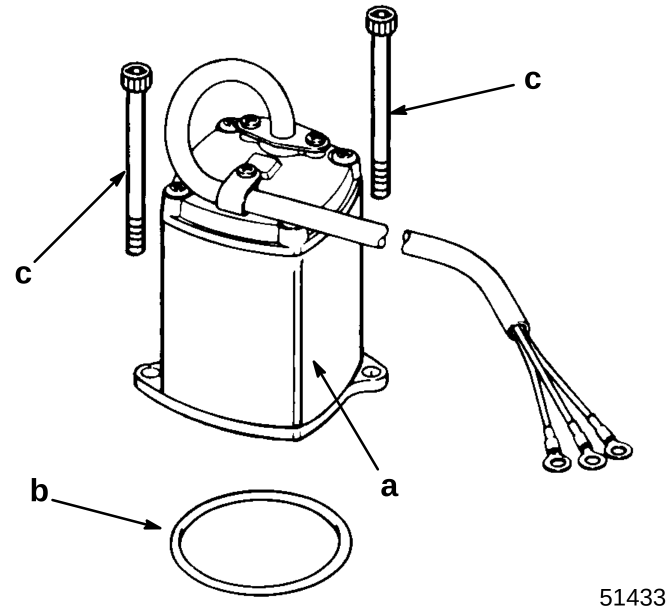
IMPORTANT: Install pump with location flat facing towards starboard transom bracket.



a - Pump (Flat towards starboard transom bracket)
b - Flat (Faces starboard transom bracket)
c - O-rings (4)
d - Driveshaft (Install in **center** hole in pump)

2. Fill pump with Quicksilver Power Trim and Steering Fluid prior to installing motor.
3. Install motor, secure with two (2) screws. Route wiring; refer to Wiring Diagrams in this service manual. Torque screws to 70 lb. in. (7.9 N·m).

NOTE: Insure motor and driveshaft are aligned.



a - Motor
b - O-ring
c - Screw (2) - Torque screws to 70 lb. in. (7.9 N·m)

4. Complete reassembly of Power Trim System as outlined in **“Installation”** on page 6B-15 and 6B-16.

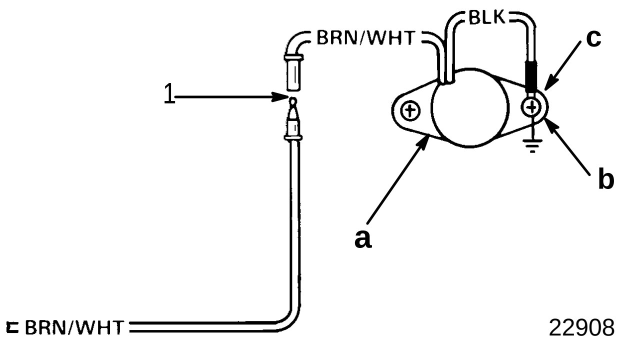
Priming Power Trim System

1. Fill system with Quicksilver Power Trim and Steering Fluid or Automatic Transmission Fluid (ATF) Type F or FA. Refer to **“Fill, Check, and Purge”** on page 6B-5.

IMPORTANT: Run Trim System in short “jogs” until pump motor primes and trim system moves. If trim motor is run without priming pump, driveshaft failure could result.

Trim Sender (Optional Accessory) Test

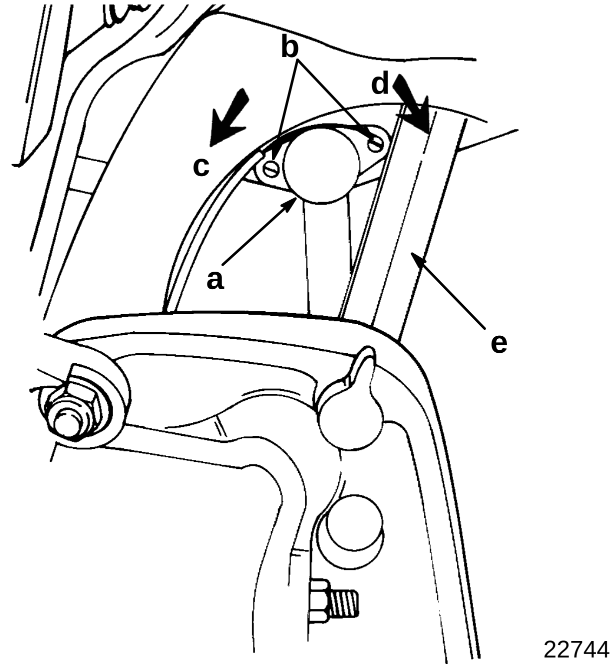
1. Check trim sender black lead for proper ground.
2. Trim outboard to full “DOWN” position.
3. Place ignition switch to “ON” position.
4. Connect Ohmmeter (R x 1 scale) leads between outboard ground and Point 1.
5. Depress “UP” button. Ohmmeter needle should move as the outboard is trimmed up. If needle does not move, trim sender is defective.



a - Trim Sender
b - Connect with screw and hex nut (coat with liquid neoprene).
c - Rubber Sleeve (Slide over connection)

Trim Indicator Gauge Needle Adjustment

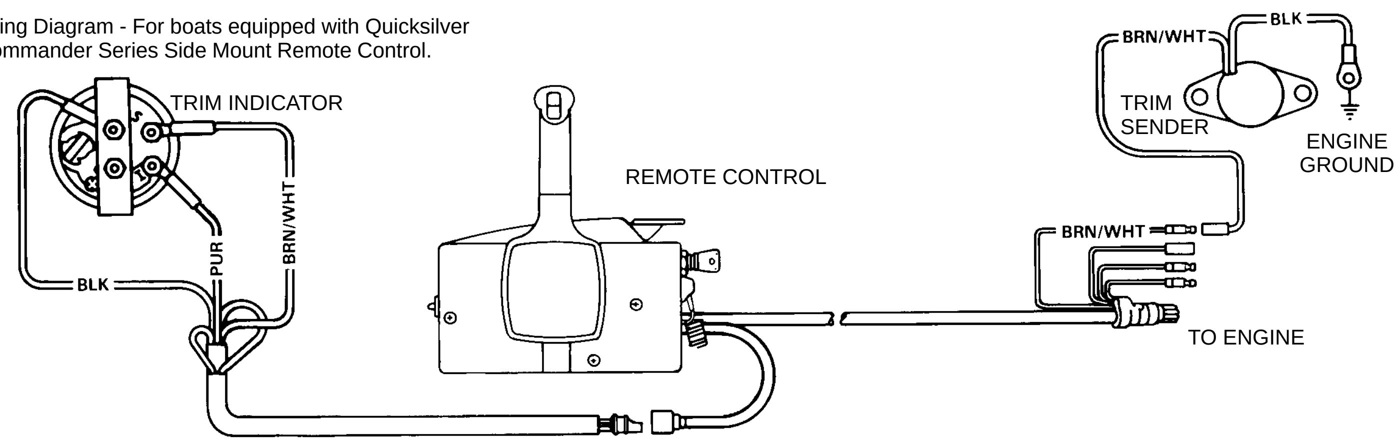
1. Turn ignition key to "RUN" position.
2. Tilt outboard to full "IN" position. Needle of trim indicator gauge should be in full "IN" position.
3. If not, tilt outboard to full "OUT" position to gain access to trim sender and engage tilt lock lever.
4. Loosen trim sender screws and reposition trim sender.
5. Tighten trim sender screws.



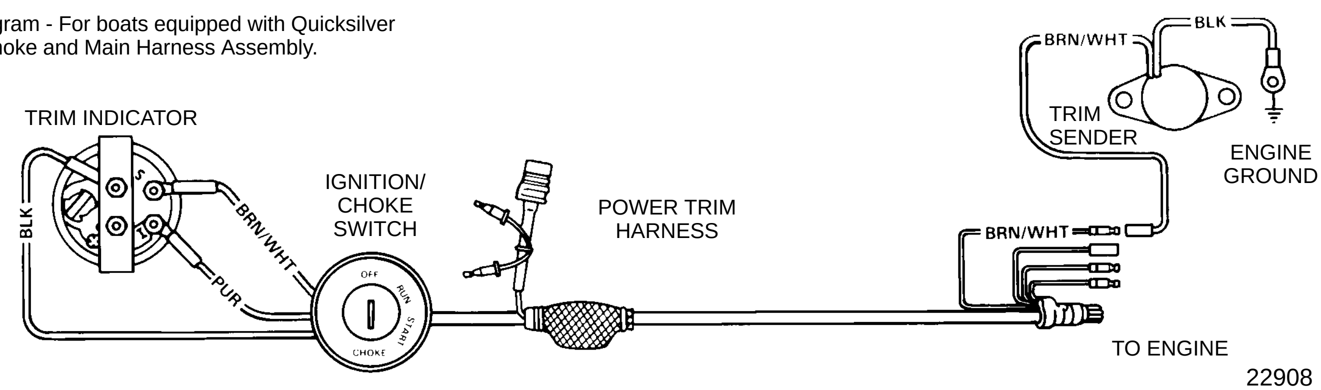
a - Trim Sender
b - Screws, loosen to rotate sender
c - Turn sender **counterclockwise** to raise needle reading.
d - Turn sender **clockwise** to lower needle reading.
e - Tilt Lock Lever

Trim Indicator Wiring Diagrams

Wiring Diagram - For boats equipped with Quicksilver Commander Series Side Mount Remote Control.



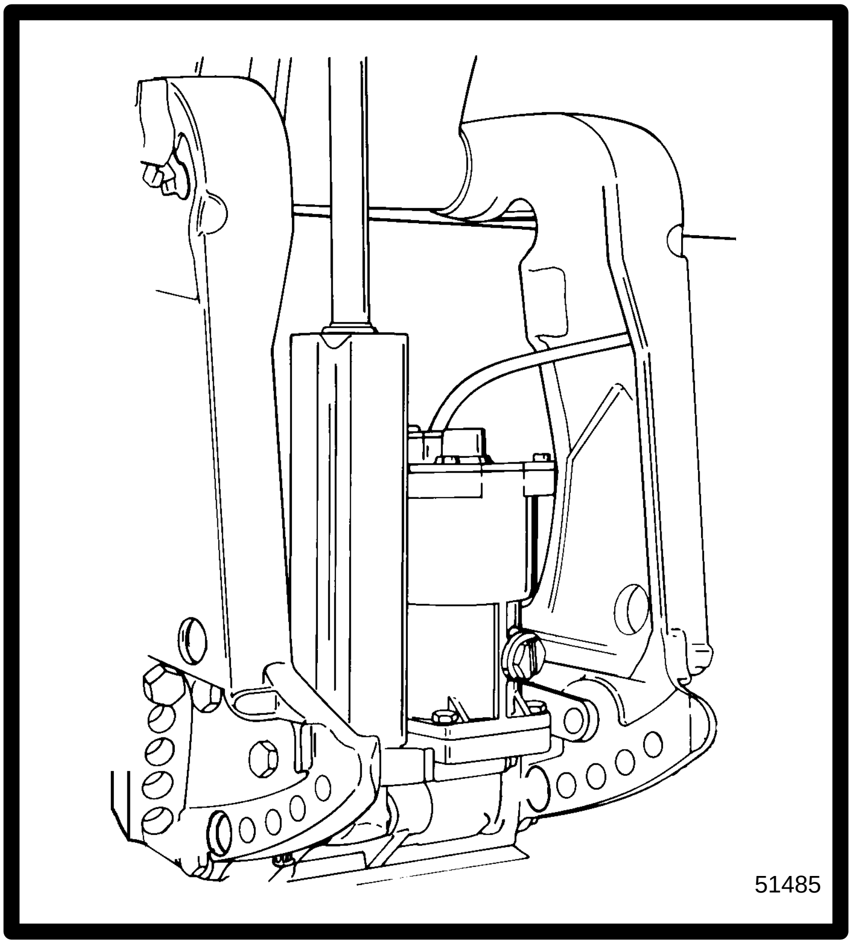
Wiring Diagram - For boats equipped with Quicksilver Ignition/Choke and Main Harness Assembly.



POWER TRIM

6

C



SINGLE RAM

Table Of Contents

Special Tools

Part No.	Description
91-63209	Torch Lamp
91-74951	Spanner Wrench
91-99750	Multi-Meter DVA Tester

Quicksilver Lubricants and Service Aids

Part No.	Description
91-90100A12	Power Trim and Steering Fluid
Obtain Locally	Loctite 271
91-25711-1	Liquid Neoprene
91-78376A6	Anti-Corrosion Grease

Power Trim - General Information

Description

The Power Trim system consists of an electric motor, pressurized fluid reservoir, pump and trim cylinder.

The remote control (or trim panel) is equipped with a switch that is used for trimming the outboard “up” and “down”, and for tilting the outboard for shallow water operation (at slow speed) or for “trailering”. The outboard can be trimmed “up” or “down” while engine is under power or when engine is not running.

Trimming Characteristics

When trimming outboard from a mid-trim position (trim tab in neutral, straight fore-and-aft position), you can expect the following results:

TRIMMING OUTBOARD “UP” (“OUT”)

⚠ WARNING

Excessive trim “out” may reduce the stability of some high speed hulls. To correct instability at high speed, reduce the power gradually and trim the motor “In” slightly before resuming high speed operation. (Rapid reduction in power will cause a sudden change of steering torque and may cause additional momentary boat instability.)

Will lift bow of boat, usually increasing top speed.

Transfers steering torque harder to port (left) on installations below 23 in. transom height.

Increases clearance over submerged objects.

In excess, can cause “porpoising” and/or ventilation.

In excess, can cause insufficient water supply to water pump resulting in serious water pump and/or powerhead overheating damage.

⚠ WARNING

Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage. Make sure that water level is above gear housing water intake holes whenever engine is running.

Operating “Up” circuit will actuate the “up” relay (located under engine cowl) and close the electric motor circuit. The electric motor drives the pump, forcing fluid thru internal passageways into the “up” side of the trim cylinder.

The trim cylinder/trim ram will position the engine at the desired trim angle within the 20° maximum trim range. The Power Trim system is designed so the engine cannot be trimmed beyond the 20° maximum trim angle as long as engine RPM is above approximately 2000 RPM.

The engine can be raised beyond the 20° maximum trim angle for shallow water operation, etc., by keeping the engine RPM below 2000 RPM. If engine RPM increases above 2000 RPM, the thrust created by the propeller (if deep enough in the water) will cause the trim system to automatically lower the engine back to the 20° maximum trim angle.

TRIMMING OUTBOARD “DOWN” (“IN”)

⚠ WARNING

Excessive speed at minimum trim “In” may cause undesirable and/or unsafe steering conditions. Each boat should be tested for handling characteristics after any adjustment is made to the tilt angle (tilt bolt relocation).

Will help planing off, particularly with a heavy load.

Usually improves ride in choppy water.

In excess, can cause boat to veer to the left or right (bow steer).

Transfers steering torque harder to right (or less to the left).

Improves planing speed acceleration (by moving tilt bolt one hole closer to transom).

Operating “Down” circuit will actuate the “down” relay (located under engine cowl) and close the electric motor circuit (motor will run in opposite direction of the “Up” circuit). The electric motor will drive the pump, forcing fluid thru internal passageways into the “down” side of the tilt ram. The tilt ram will move the engine down to the desired angle.

Trailering Outboard

⚠ WARNING

Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage. Make sure that water level is above gear housing water intake holes whenever engine is running.

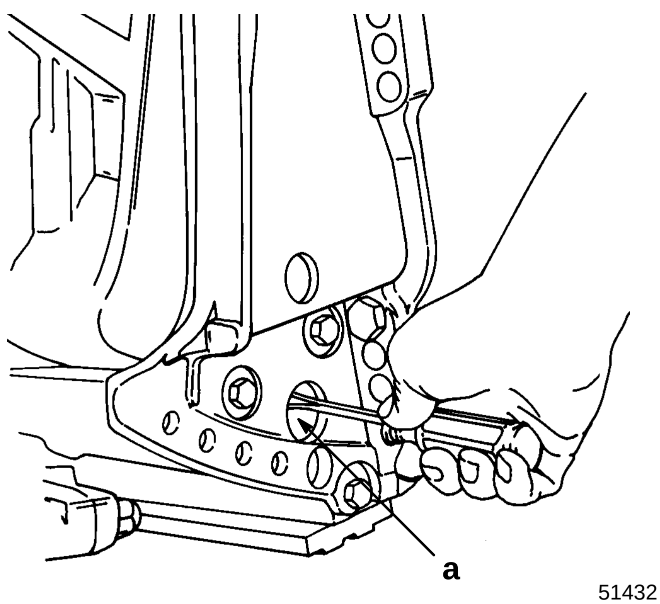
While operating “up” circuit, the ram will continue to tilt outboard to full up position for trailering.

Tilting Outboard Up and Down Manually

⚠ WARNING

Before opening the manual release valve, make sure all persons are clear of engine as engine will drop to full “down” position when valve is opened.

With power trim installed, the outboard can be raised or lowered manually by opening the manual release valve 3 turns **maximum** (counterclockwise).



a - Manual Release Valve

Trim “In” Angle Adjustment

⚠ WARNING

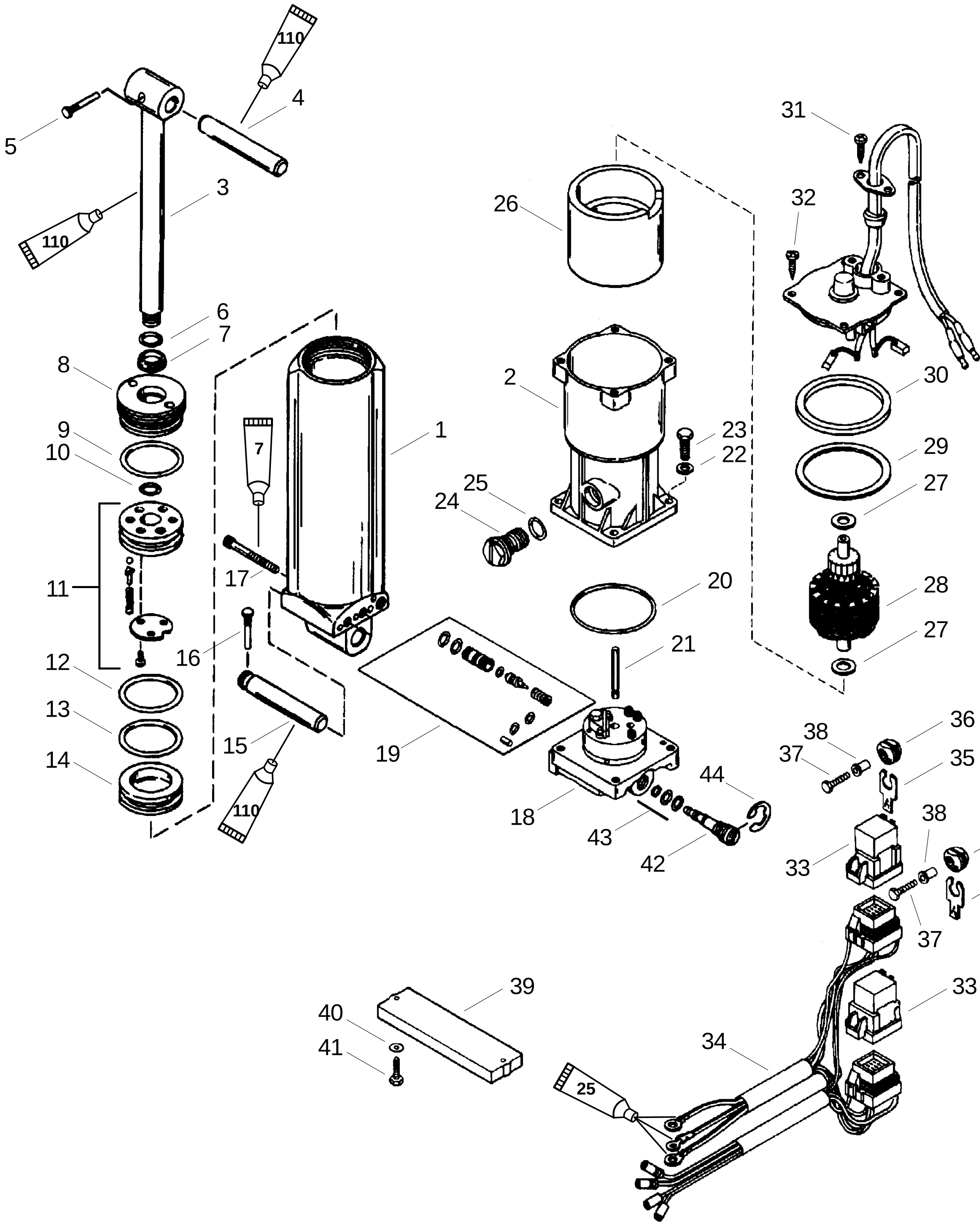
Operating some boats with engine trimmed to the full “in” trim angle [not using trim adjustment bolt] at planing speed will cause undesirable and/or unsafe steering conditions. Each boat must be water tested for handling characteristics after engine installation and after any trim adjustments.

IMPORTANT: Some boat/motor combinations, that do not use the trim adjustment bolt and are trimmed to the full “in” trim angle, will not experience any undesirable and/or unsafe steering conditions during planing speed. Thus, not using trim adjustment bolt may be desired. However, some boats with engine trimmed to the full “in” trim angle at planing speed will cause undesirable and/or unsafe steering conditions. If these steering conditions are experienced, under no circumstances should the engine be operated without the trim adjustment bolt and without the bolt adjusted in the proper holes to prevent unsafe handling characteristics.

Water test the boat not using the trim adjustment bolt. If undesirable and/or unsafe steering conditions are experienced (boat runs with nose down), install trim adjustment bolt in proper hole to prevent unsafe handling characteristics.

Notes:

Power Trim System Components



NOTE: Lubricate all O-rings and seals with 110

Quicksilver Lubrication/Sealant Application Points

110 Power Trim and Steering Fluid (92-90100A12)

7 Loctite 271 (Obtain Locally)

25 Liquid Neoprene (92-25711--2)

Power Trim System Components (Continued)

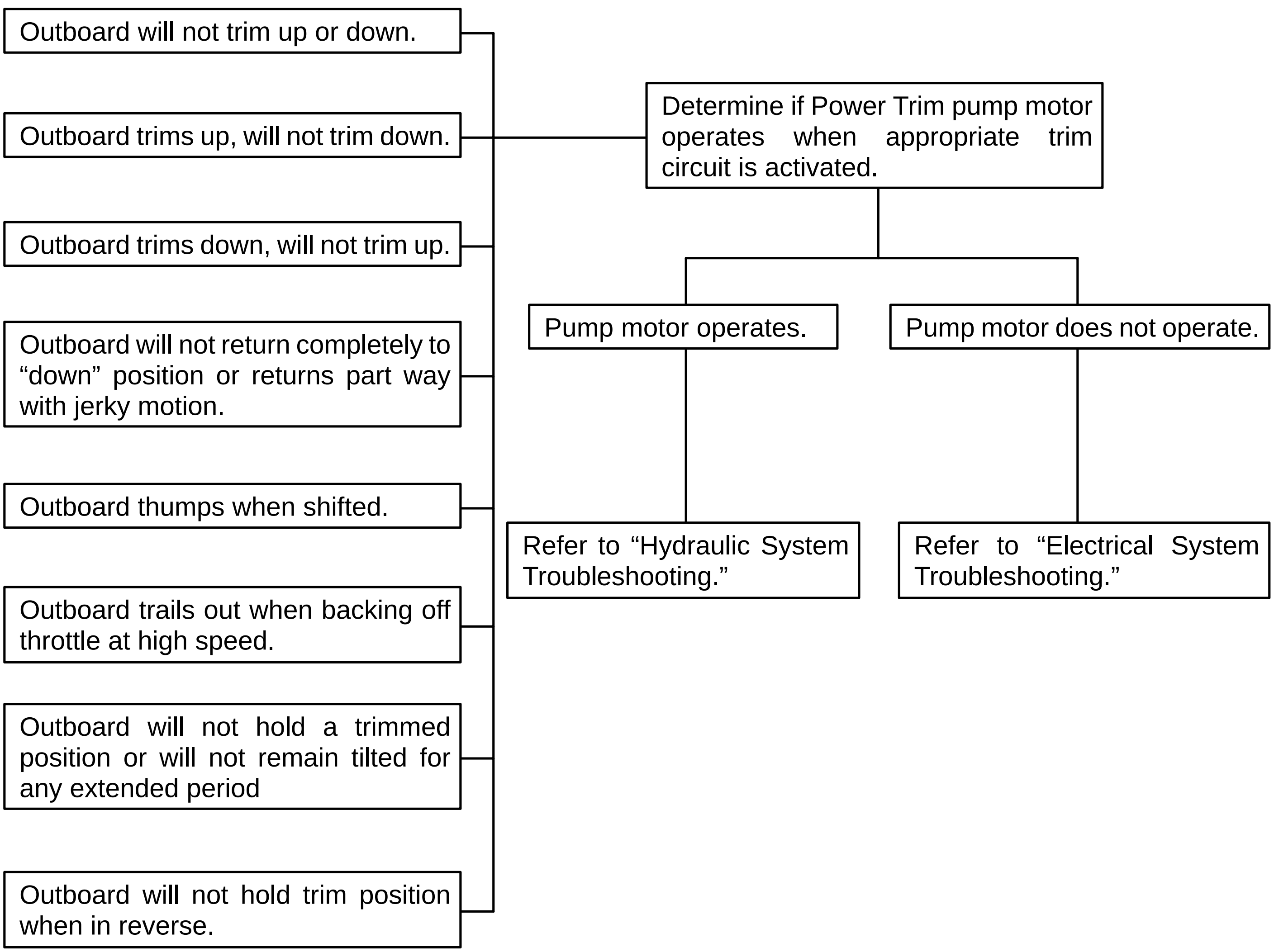
REF. NO.	QUAN.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	Tilt/Trim Cylinder			
2	1	Reservoir/Motor Housing			
3	1	Piston Rod			
4	1	Upper Pivot Shaft			
5	1	Cross Pin			
6	1	O-ring			
7	1	Seal-End Cap			
8	1	End Cap			
9	1	O-ring			
10	1	O-ring			
11	1	Piston Assembly	35		4.0
12	1	O-ring			
13	1	O-ring			
14	1	Memory Piston			
15	1	Lower Pivot Shaft			
16	1	Cross Pin			
17	2	Screw	100		11.3
18	1	Pump Assembly			
19	1	Pilot Valve Assembly			
20	1	O-ring			
21	1	Driveshaft			
22	4	Washer			
23	4	Screw	70		7.9
24	1	Fill Screw			
25	1	O-ring			
26	1	Motor Frame			
27	2	Thrust Washer			
28	1	Armature			
29	1	Ring			
30	1	Seal			
31	2	Screw	13		1.5
32	4	Screw	13		1.5
33	2	Relay			
34	1	Wiring Harness			
35	2	Relay Mount			
36	2	Rubber Mount			
37	2	Screw	35		4.0
38	2	Spacer			
39	1	Anode			
40	2	Washer			
41	2	Screw	70		8.0
42	1	Manual Release Valve			
43	3	O-rings			
44	1	E-Clip			

Troubleshooting

Determining if Problem is Electrical or Hydraulic

When a problem is encountered with the Power Trim system, the first step is to determine whether the malfunction is in the “electrical system” or the “hydraulic system.” Refer to the following chart to determine which system is at fault.

Problem Chart



Hydraulic System Troubleshooting

Support outboard with tilt lock lever when servicing power trim system.

After debris or failed components have been found (during troubleshooting procedures) disassemble unit completely and replace all O-rings. Check ball valve components and castings must be cleaned using engine cleaner and compressed air or replaced prior to reassembly.

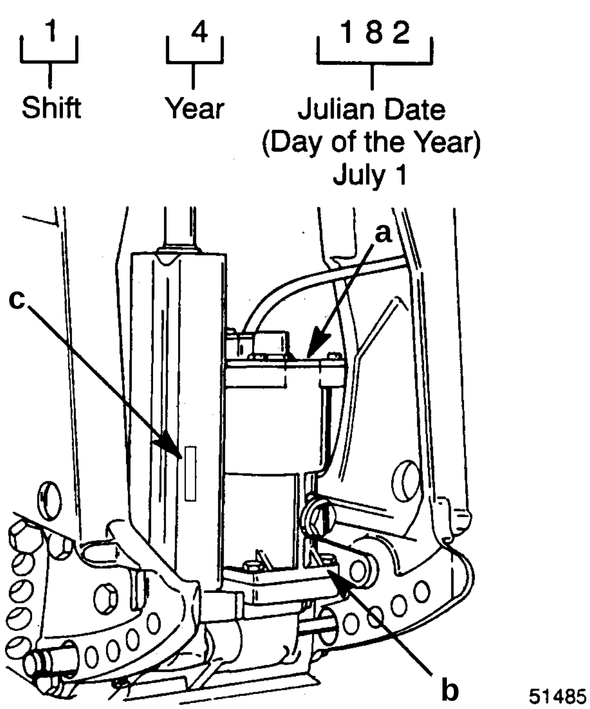
Power trim system is pressurized. Outboard must be in the full "UP" position (cylinder fully extended) prior to fill screw or manual release valve removal.

Refer to instructions following if disassembly is required.

Follow preliminary checks before proceeding to troubleshooting flow diagrams (following).

Date Code Location

Date codes are placed on power trim assemblies at date of manufacture. These date codes are designed to quickly identify assemblies which may be affected by service bulletins pertaining to specific problems. Note date code on trim assembly and compare to date code listed on service bulletins before making repairs.



a - Label on Top Cover of Motor
b - Motor Reservoir Flange
c - Embossed into the CAUTION Decal on Trim/Tilt Cylinder

Preliminary Checks

Operate Power Trim System after each check to see if problem is corrected. If not, proceed with the next check.

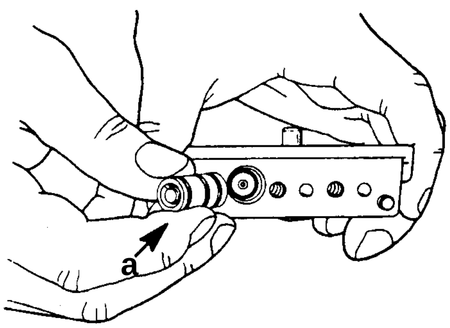
1. Check that manual release valve is tightened to full right (clockwise) position.
2. Check trim pump fluid level with outboard in full "UP" position and fill if necessary. Refer to "Fill and Purge the Power Trim System."
3. Check for external leaks in Power Trim system. Replace defective part(s) if leak is found.
4. Outboard not holding tilted position (falls to trim in position) indicates debris or defective components in trim valve assembly. Clean or replace components as required.
5. Check manual release valve for broken stem and one O-ring remaining in the release valve passage. (Separate the manifold assembly from the cylinder to dislodge broken stem.) Install new release valve and test system.
6. Check for nicked, deteriorated, or misplaced O-rings throughout trim system.

Leak Down Check - Pump and Manifold Assembly

The 1993 and 1994 models listed with power trim date codes 13011 through 23288 ONLY may experience a very slow trim rate (one minute or more) with the outboard drifting back down as soon as the UP trim button is released. This failure usually occurs when the unit is new or after 3 or 4 weeks of non use. The cause may be a stuck spool inside the sleeve due to an oversize or a hard o-ring on the spool (SERVICE BULLETIN No. 93-22A).

NOTE: Scribe pump housing and manifold before disassembly.

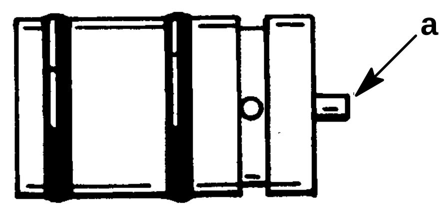
1. Remove tilt cylinder from the manifold and replace pilot valve assembly.



50999

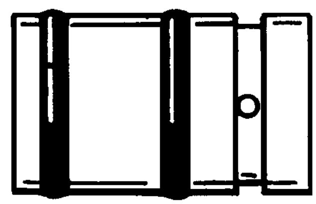
a - Sleeve with Spool Inside

2. The spool is considered stuck when the pin end is protruding out past the end of the sleeve.

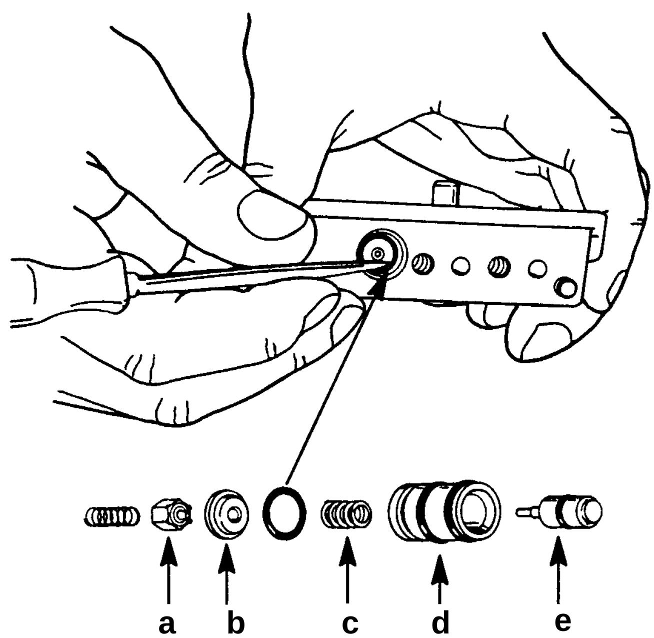


SPOOL STUCK 52790

a - Spool Pin



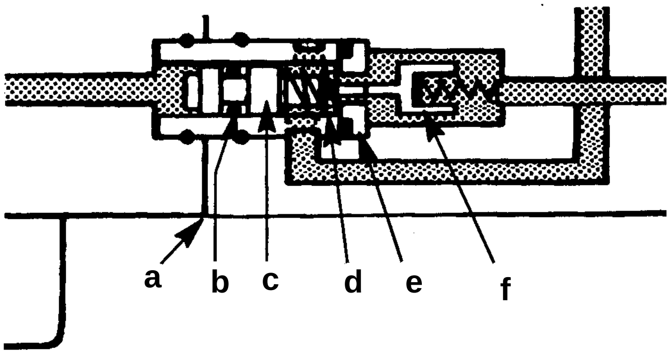
SPOOL NOT STUCK 52791



Pilot Valve and Seat Removal

a - Pilot Valve
b - Valve Seat
c - Return Spring
d - Sleeve
e - Spool

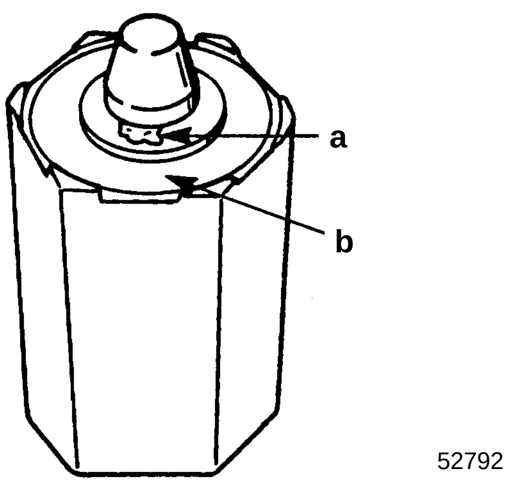
3. A leak path is created between the UP side of the cylinder and the reservoir when the spool sticks holding the pilot valve open.



a - Cylinder/Manifold Mating Surface
b - O-ring
c - Spool
d - Return Spring
e - Valve Seat
f - Pilot Valve Held Open (away from valve seat)

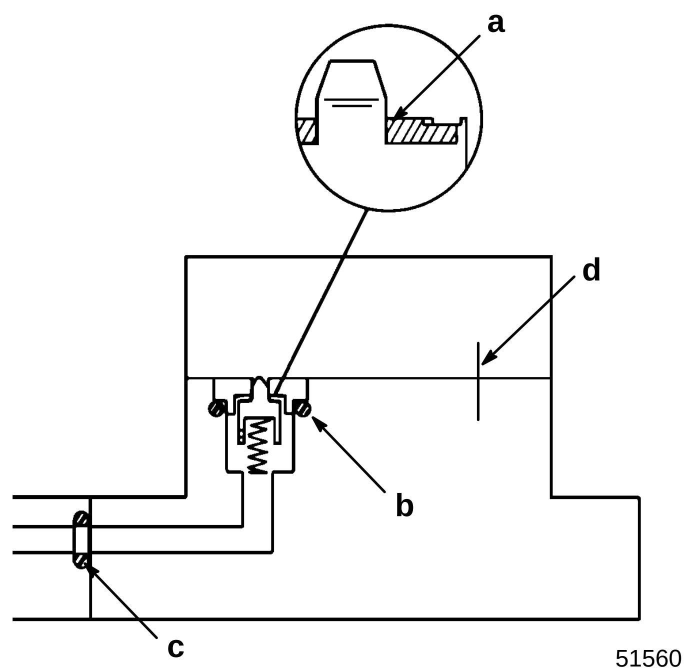
4. Power trim units with date code 23289 and higher have improved o-rings and improved surface finish on the inside of the sleeve to correct the problem.

5. To correct a slow leak down, check for debris between the valve seat and valve.



a - Chip under Valve Tip
b - Rubber Seat

6. Inspect for nicked, deteriorated, or misplaced O-ring .



a - Valve and Seat
b - O-ring
c - O-ring
d - Scribe Mark

Reassembly

1. Install the spool into sleeve from the chamfered end (end opposite the cross hole).

2. Insert spool into sleeve until end is flush with the chamfered end of the sleeve. Inserting the spool too far into the sleeve may allow the spool o-ring to contact the sharp edges of the sleeve cross hole and damage the o-ring.

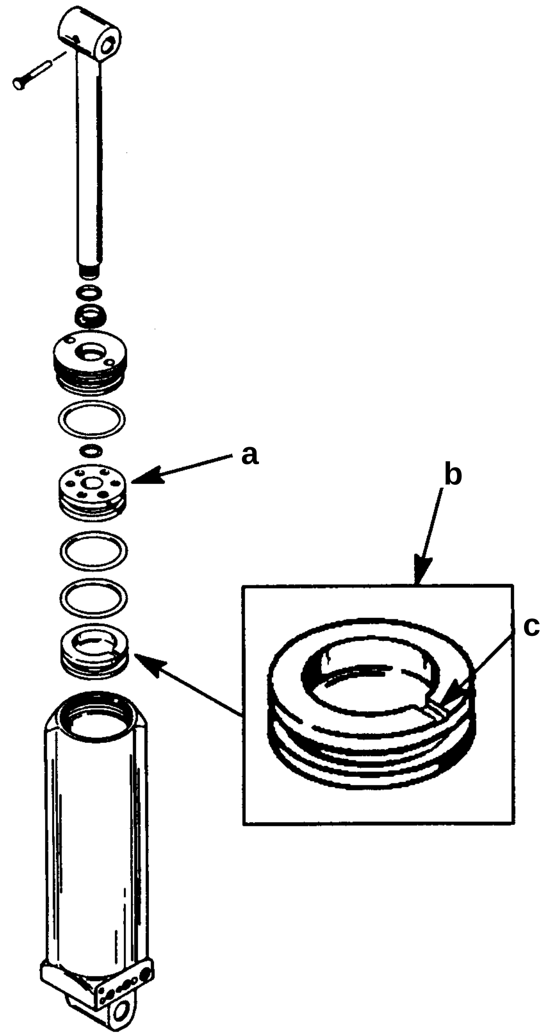
3. After reassembly, insert driveshaft and check pump rotor resistance to turning - housing halves can shift/turn during reassembly. Align scribe marks carefully.

Power Trim Partial Leak Down at Maximum Trim

Power Trim Date Code 14182 and Below – Service Bulletin No. 94-13.

Some units, when trimmed to the maximum 20 degree limit, will leak down approximately 5 degrees and then hold. The leak will ONLY occur while the boat is under power. The cause for the 5 degree leak down is the lack of a fluid passage between the shock piston and the memory piston.

1. Disassemble the tilt ram assembly and remove the memory piston.
2. Cut a small groove 0.020 –0.040 in. (0.5 – 1.0mm) deep across the top face of the memory piston. The groove will allow oil passage when the shock piston and memory piston are in contact. The groove can be made with a hacksaw or triangular file.
   NOTE: Power trim assemblies with Date Code 14183 and ABOVE have a groove in the shock piston to allow fluid passage. The memory piston remains the same and does not have a groove across the face.
3. Remove all burrs and filings from the memory piston.
4. Reassemble the trim/tilt ram assembly using new o-rings and seals.

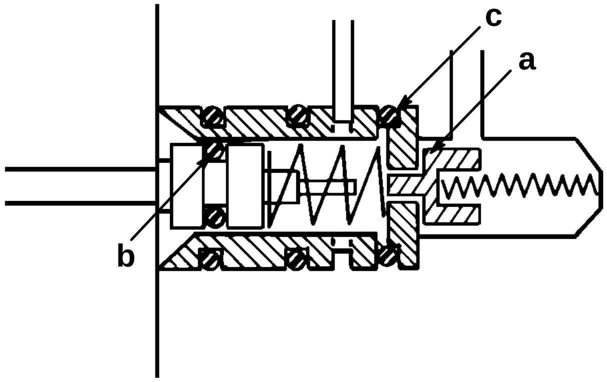


a - Shock Piston
b - Memory Piston
c - 0.020 – 0.040 in. (0.5 – 1.0mm) Groove

Leak Down Check - Pilot Valve Assembly

1. Debris or chips between valve and seat (a), usually imbedded in rubber valve seat.
2. Pilot valve installed from non-chamfered end of spool, results in nicked or damaged O-ring (b).
3. Nicked or deteriorated O-ring (c).

A leak path is created between the UP side of the cylinder and the reservoir. The trim system will leak down until the trim port in cylinder is covered.

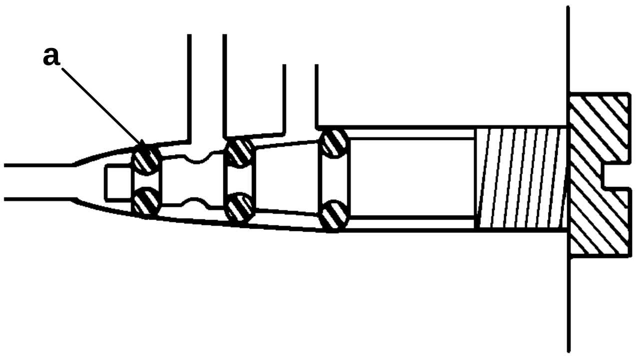


51560

a - Valve and Seat
b - Pilot Valve O-ring
c - O-ring

Leak Down Check - Manual Release Valve

1. Debris or chips under O-ring (a).
2. Flash from valve molding causing O-ring (a) to not seal.
3. Nicked O-ring (a).



51560

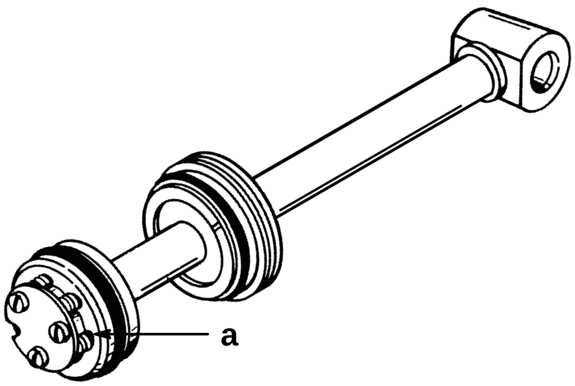
a - O-ring

Leaks Past Ball and Seat - Piston Assembly

Unit will trim to full or near full down position and then will begin to trim up while trim switch is held in ‘‘DOWN” mode.

If trim switch is released, outboard can be pushed (by hand) down to the point where trim UP started.

1. Inspect balls and seats in piston assembly for debris or damage. Repair or replace balls/seats.



51143

a - Ball and Seat. Check all for debris or damage.

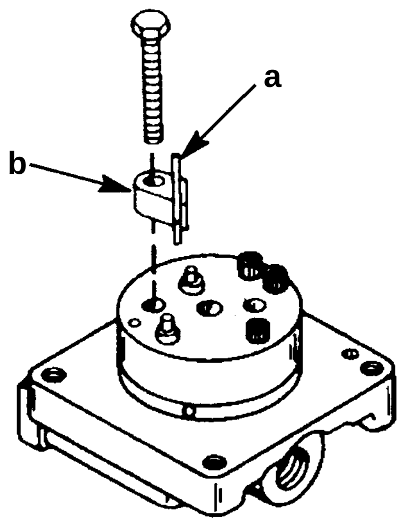
Power Trim Rocker Arm

Power Trim Date Code 14182 and Below. Refer to Service Bulletin No. 92-12.

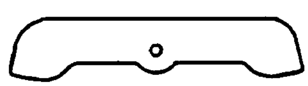
Outboard in the trim position will not trim up or down OR pump motor will lock up (not turn) in either direction.
Outboard in the tilt position will not tilt up or down OR pump motor will run slow in either direction.

Single ram power trim that will not trim or tilt up or down may have a pump/manifold assembly with a broken rocker arm.

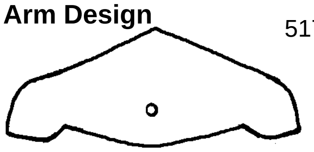
1. Replace broken rocken with improved rocker arm assembly 823180A1.



a - Rocker Arm
b - Rocker Arm Assembly

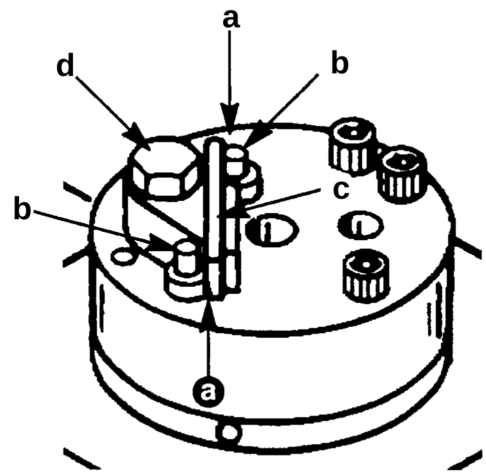


Previous Rocker Arm Design 51742



Improved Rocker Design 51742

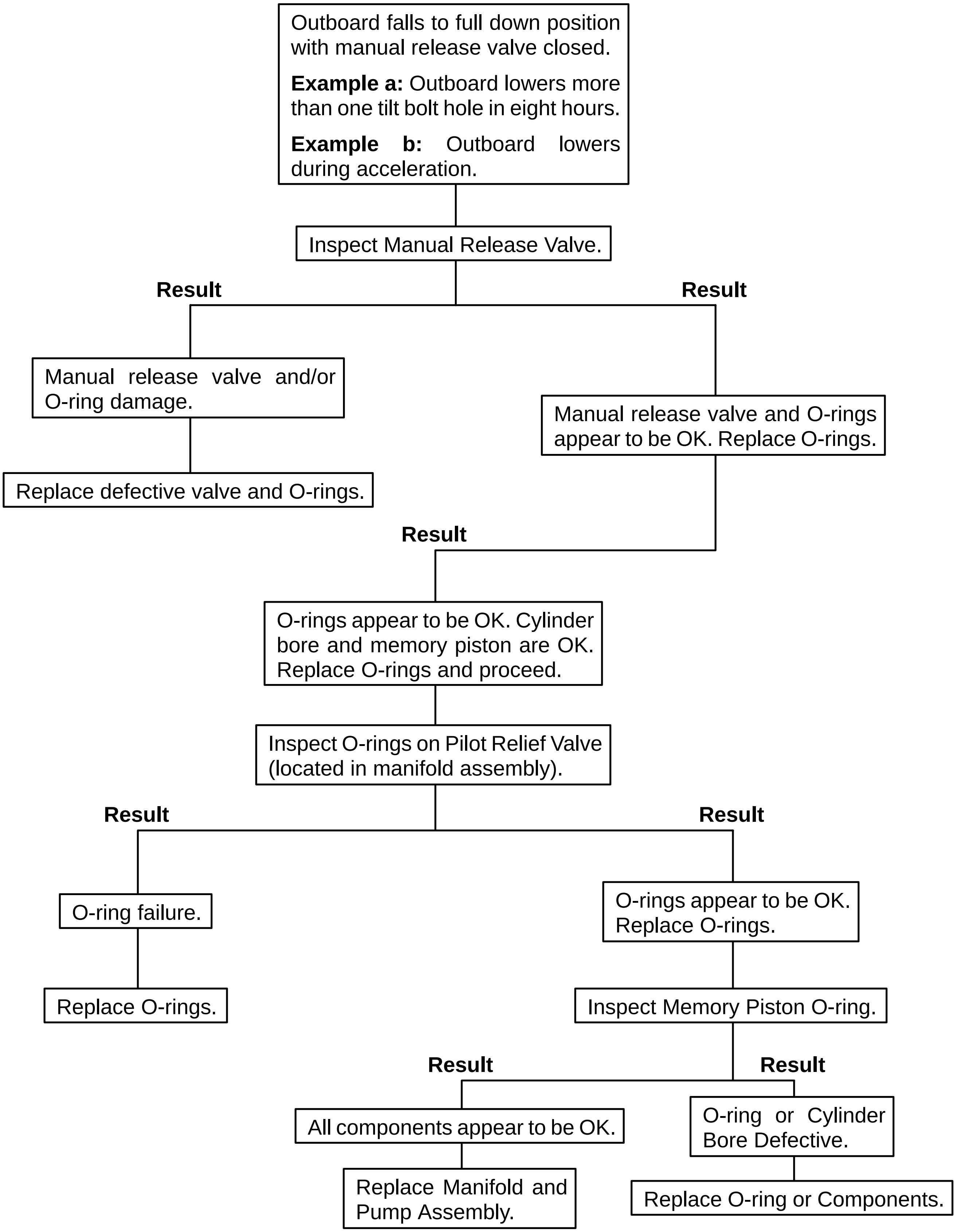
2. Clearance between the side of the rocker arm and each pin is 0.001 to 0.010 in. (0.025 – 0.25mm).
3. Torque bolt to 125 – 140 lb. in. (14.1 – 15.8 N·m).



51560

a - Clearance Between Each Pin and Rocker Arm – 0.001 to 0.010 in. (0.025 – 0.25mm)
b - Pump Pins
c - Rocker Arm
d - Bolt [Torque to 125 – 140 lb. in. (14.1 – 15.8 N·m)]

Troubleshooting Flow Diagram

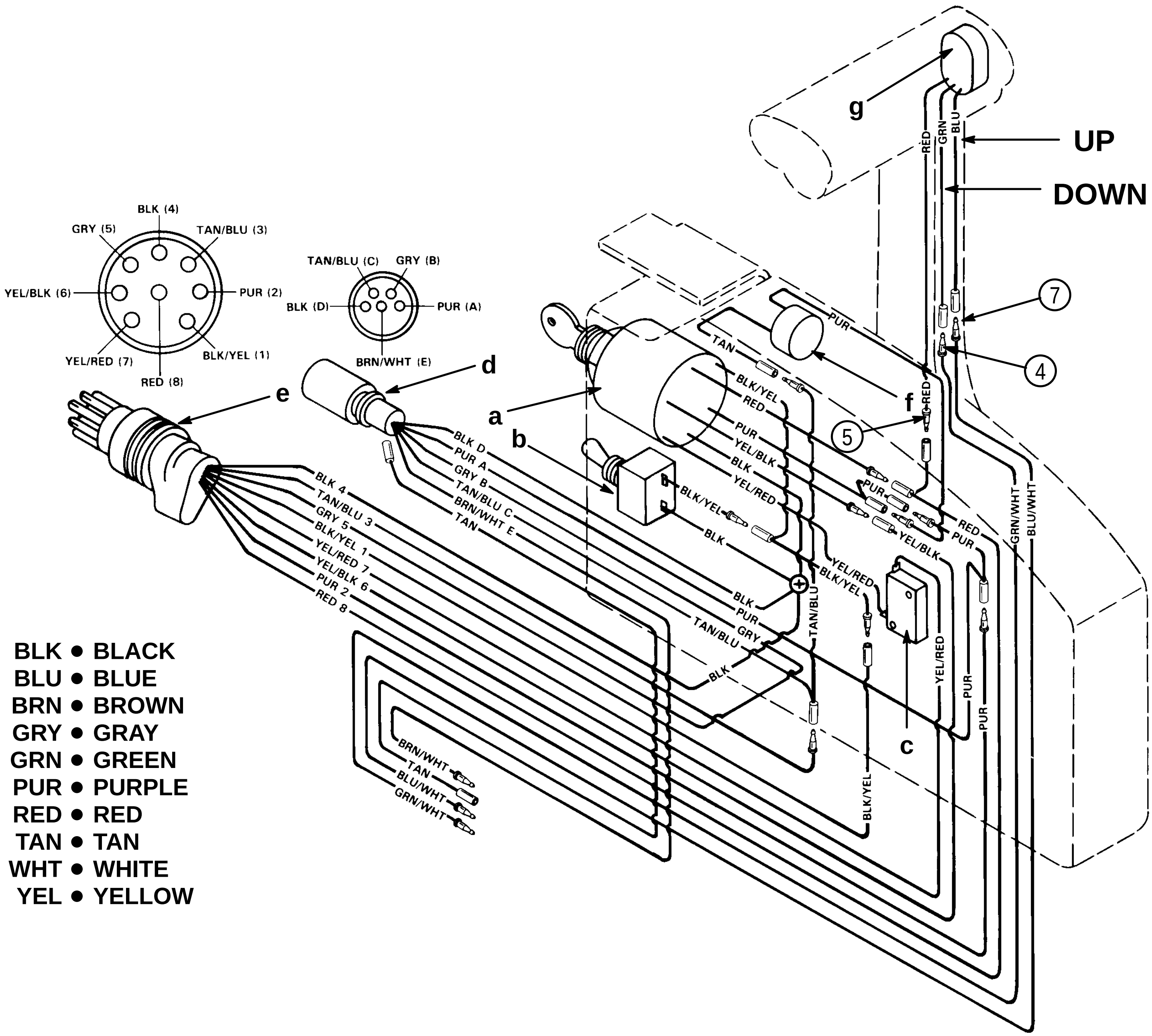


Troubleshooting Flow Diagram

- Outboard will not hold tilted position in reverse and/or trails out during high speed deceleration.
  - Inspect Manual Release Valve.
    - **Result**
      - Manual release valve and/or O-ring damage.
        - Replace defective valve and O-rings.
    - **Result**
      - Manual release valve and O-rings appear to be OK. Replace O-rings and proceed.
        - Inspect Trim Rod Piston Check Valve.
          - **Result**
            - No debris or defective components found.
              - Inspect Manifold Reverse Thrust Valve.
                - Replace Pump and Manifold Assembly.
          - **Result**
            - Debris found in check valve components.
              - Clean check valve components using engine cleaner and compressed air or replace.

Electrical System Troubleshooting

COMMANDER 2000 Side Mount Remote Control (Power Trim/Tilt Electric Start with Warning Horn) Wiring Diagram



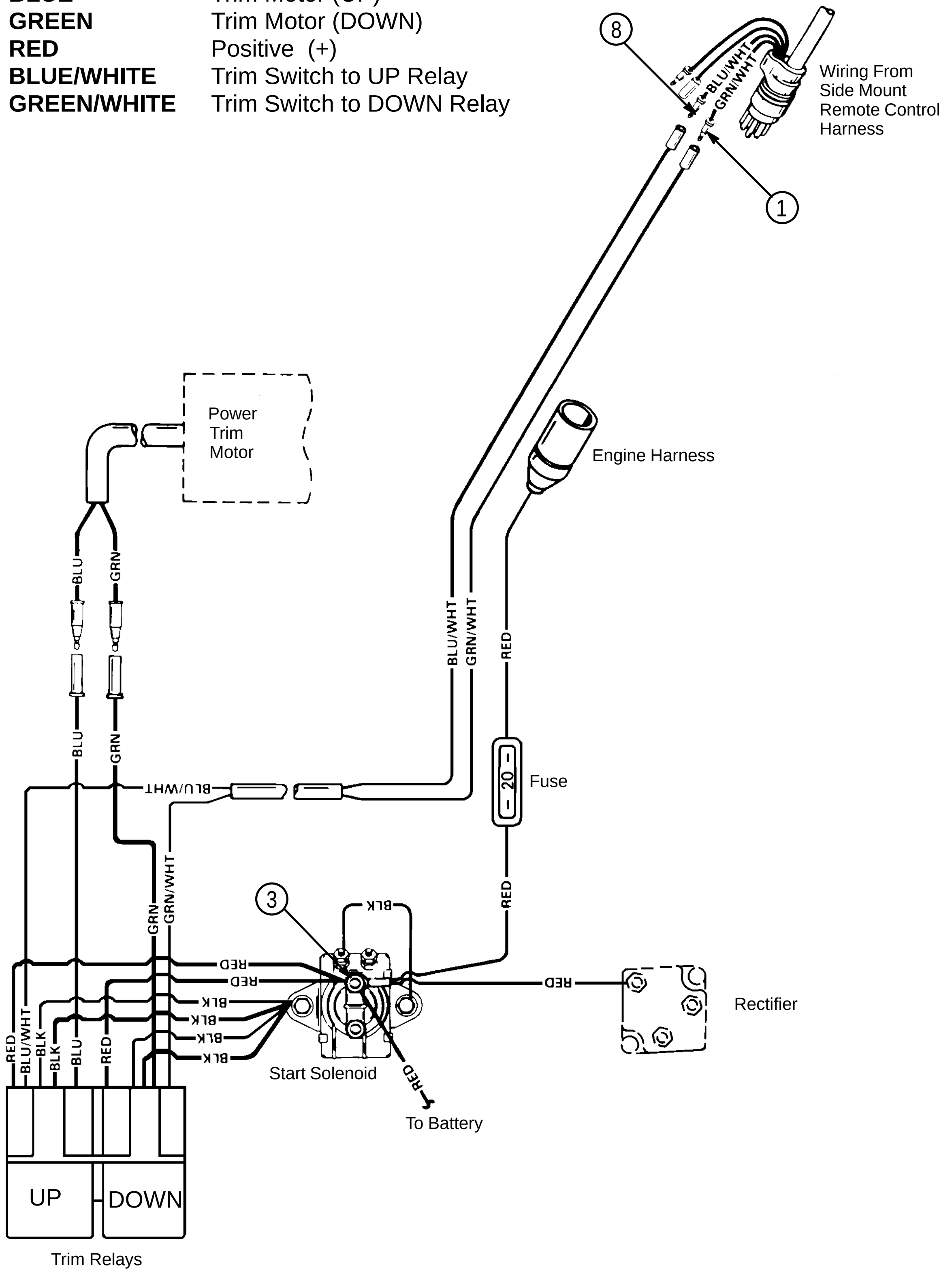
BLK	●	BLACK
BLU	●	BLUE
BRN	●	BROWN
GRY	●	GRAY
GRN	●	GREEN
PUR	●	PURPLE
RED	●	RED
TAN	●	TAN
WHT	●	WHITE
YEL	●	YELLOW

23891

a - Ignition/Choke Switch
b - Emergency Stop Switch
c - Neutral Start Switch
d - Tachometer/Accessories Harness Connector
e - Wiring Harness Connector
f - Warning Horn
g - Trim/Tilt Switch

Power Trim System Wiring Diagram

BLK	**● BLACK**	Negative (–)
BLU	**● BLUE**	Trim Motor (UP)
GRN	**● GREEN**	Trim Motor (DOWN)
RED	**● RED**	Positive (+)
BLU/WHT	**● BLUE/WHITE**	Trim Switch to UP Relay
GRN/WHT	**● GREEN/WHITE**	Trim Switch to DOWN Relay



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Troubleshooting the “Down” Circuit*
(When “Up” Circuit is OK)

***Remote Control Not Equipped with Trailer Button**

Connect Voltmeter red lead to Point 1 and black lead to ground.

Depress the “Down” trim button.

Battery Voltage Indicated:

Down Relay is Defective. Replace and retest.

No Voltage Indicated:

Connect Voltmeter red lead to Point 4 and black lead to ground. Depress “Down” trim button. If battery voltage is indicated, wire is open between Points 4 and 1.

No Voltage Indicated:

Connect Voltmeter red lead to Point 5. If battery voltage is indicated, trim switch is faulty. If no battery voltage, check for loose or corroded connection at Point 5 or open circuit in wire supplying current to Point 5.

Troubleshooting the “Up” Circuit*
(When “Down” Circuit Is OK)

***Remote Control NOT Equipped with Trailer Button**

Connect Voltmeter red lead to Point 8 and black lead to ground.

Depress the “Up” trim button.

Battery Voltage Indicated:

UP Relay is defective. Replace and retest.

No Voltage Indicated:

Connect Voltmeter red lead to Point 7 and black lead to ground. Depress “Down” trim button. If battery voltage is indicated, wire is open between Points 7 and 8.

No Voltage Indicated:

Connect Voltmeter red lead to Point 5. If battery voltage is indicated, trim switch is faulty. If no battery voltage, check for loose or corroded connection at Point 5 or open circuit in wire supplying current to Point 5.

Troubleshooting the “Down” and “Up” Circuits (All Circuits Inoperative)*

***Remote Control NOT Equipped with Trailer Button**

Check in-line fuse (under cowl) to see if fuse is blown

Blown Fuse:

- Correct problem that caused fuse to blow.
- Replace fuse.

Fuse Not Blown:

Connect Voltmeter red lead to Point 3 and black lead to ground, Battery voltage should be indicated.

No Voltage Indicated:

- Check battery leads for poor connections or open circuits.
- Check battery charge.

Battery Voltage Indicated:

- Connect Voltmeter red lead to Point 8 and black lead to ground.
- Depress “Up” trim button and check for battery voltage.

No Voltage Indicated:

Connect red Voltmeter lead to Point 5, and black lead to ground.

Battery Voltage Indicated:

- Check black ground wires for poor connection or poor ground.
- Pump motor is faulty. Refer to “Motor and Electrical Tests/Repair,” following.

No Voltage Indicated:

Check that voltage is being supplied to control by performing the following checks:

- DO NOT start engine.
- Turn ignition switch to “Run” position.
- Check for voltage at any instrument, using a Voltmeter.

Battery Voltage Indicated:

Trim switch is faulty or there is an open circuit in wires (green-white, blue-white) between trim buttons and trim pump.

- Check trim switch.
- Check all trim harness connectors for loose or corroded connections.
- Check for pinched or severed wires.

No Voltage Indicated:

Red wire is open between Point 3 and red terminal on back of the ignition switch.

- Check for loose or corroded connections.
- Check for open circuit in wire.

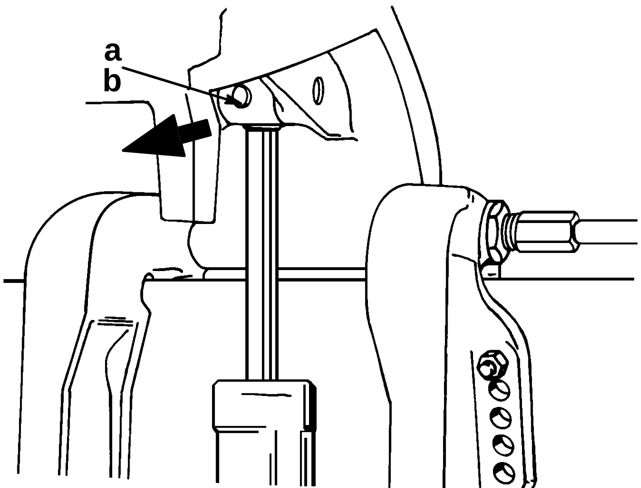
Battery Voltage Indicated:

There is an open circuit in wire between Point 5 and Red terminal on the back of the ignition switch.

Power Trim System Removal

Support outboard with tilt lock lever when servicing power trim system.

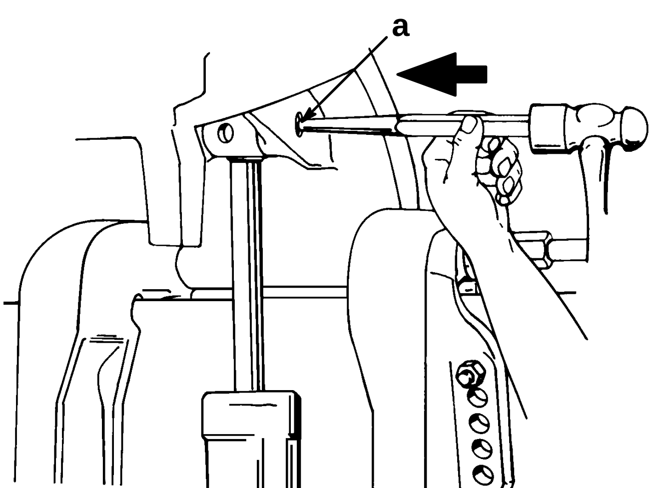
1. Disconnect power trim harness from outboard wiring harness.
2. Remove screw and clip securing wiring harness to clamp bracket.
3. Remove trim gauge sender (if equipped).
4. Use suitable tool to remove upper headed cross pin. Retain pin. Straight pin is hard to remove (see item 5).



51505

a - Cross Pin (Design 1 - Straight)
b - Cross Pin (Design 2 - Headed)

5. Drive out upper pivot pin. This will shear cross pin.

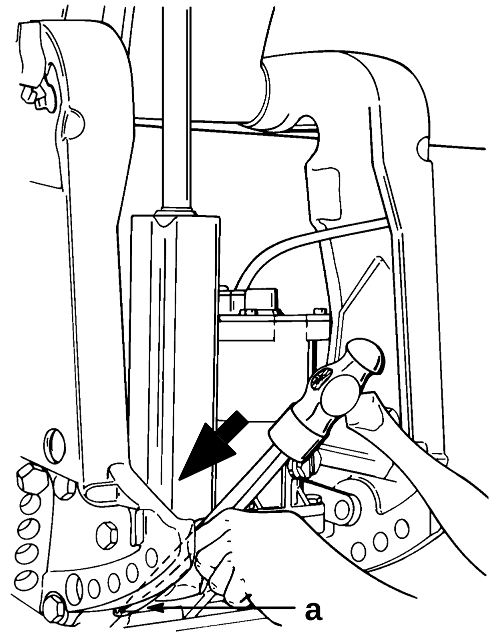


50515

a - Upper Pivot Pin

Inspect cross pin hole and pivot pin hole for damage.

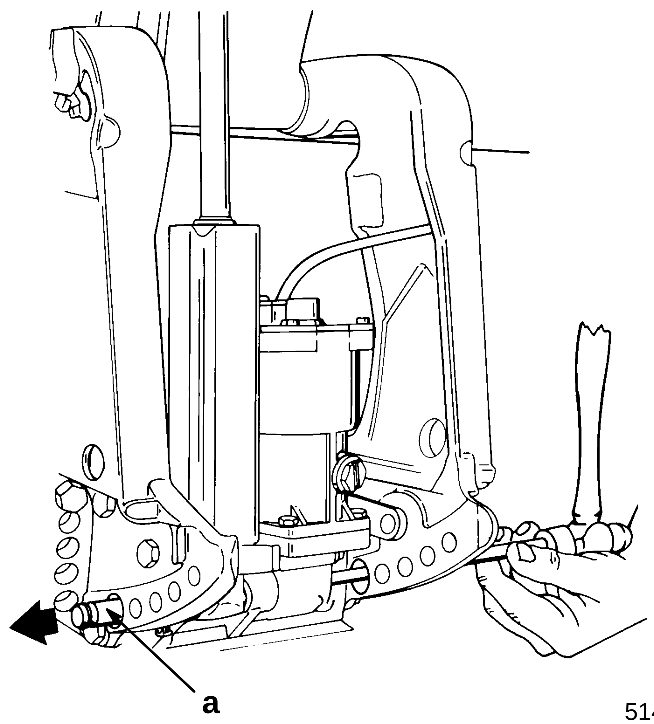
6. Use suitable punch to remove lower cross pin. Retain cross pin.



51506

a - Cross Pin

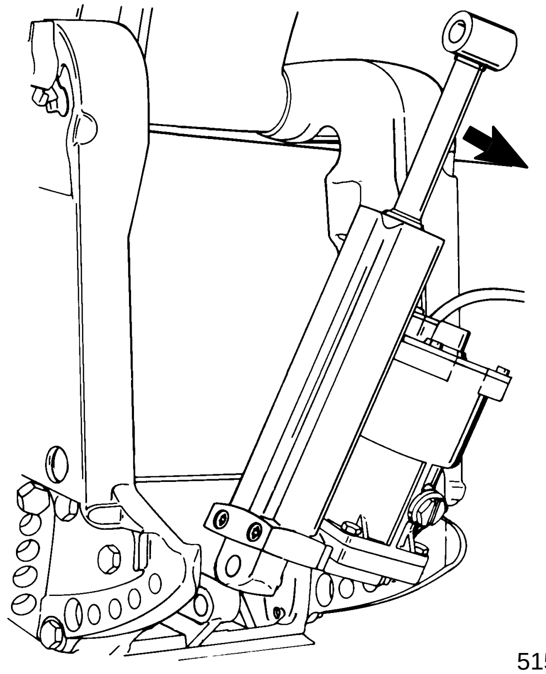
7. Use suitable punch to drive out lower pivot pin.



51485

a - Pivot Pin

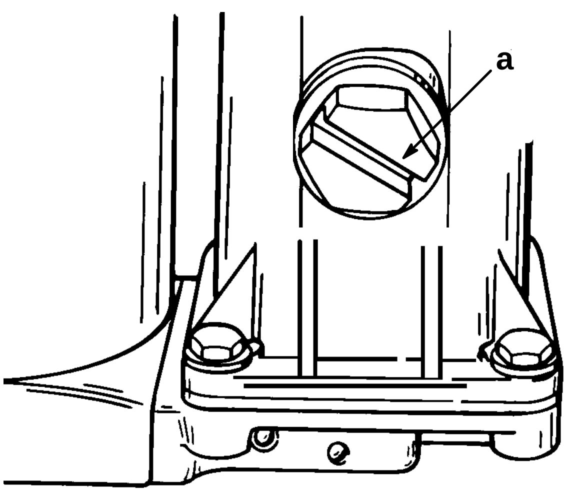
8. Tilt power trim assembly (top first) out from clamp bracket and remove assembly.



51506

NOTICE: Trim ram should be fully extended BEFORE removing fill screw as system is under pressure (and will spray out fluid) if fill screw is removed with ram retracted.

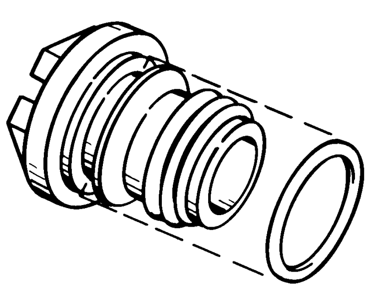
9. Remove fill screw and drain unit.



51505

a - Fill Screw

10. Remove O-ring from fill cap.

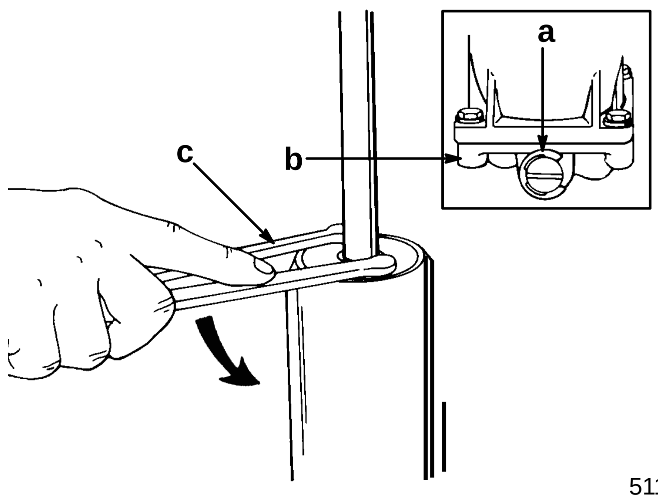


51194

Power Trim System Disassembly

Trim Rod Removal

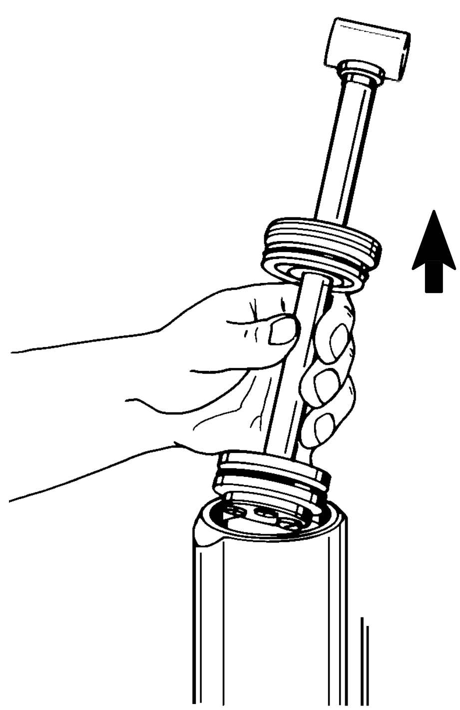
1. Secure power trim assembly in soft jawed vise.
2. Open manual release valve three turns **maximum** (counterclockwise) and position trim rod to full up position.
3. Remove cylinder end cap assembly from cylinder using spanner wrench (1/4 in. x 5/16 in. long pegs).



51194

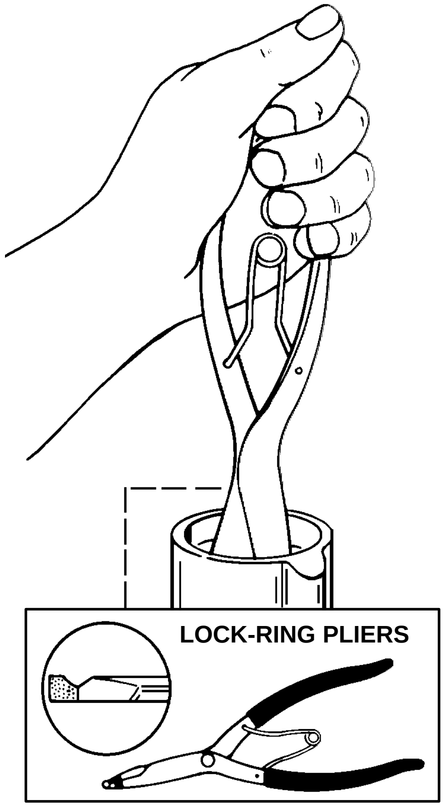
a - Manual Release Valve
b - Manifold
c - Spanner Wrench (P/N 91-74951)

4. Remove trim rod assembly from cylinder.



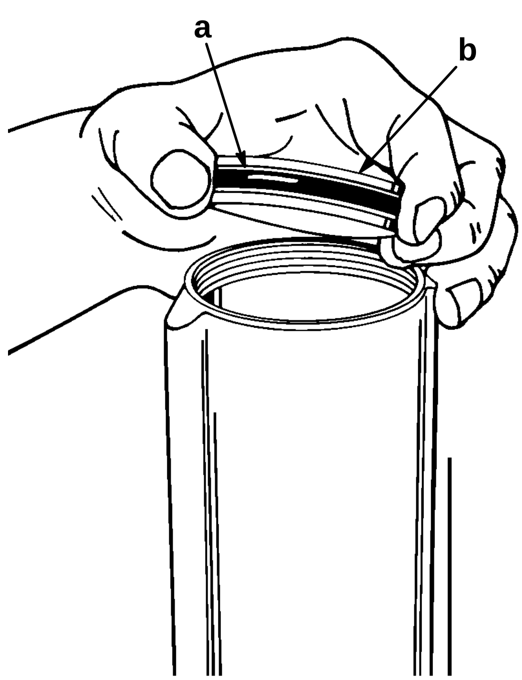
51196

5. Remove memory piston from cylinder using lock-ring pliers (Craftsman P/N 4735) or suitable tool.



51193

6. Remove O-ring from memory piston.



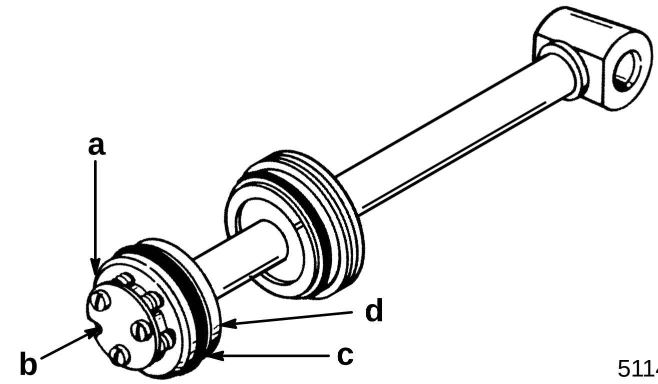
51196

a - O-ring
b - Memory Piston

1. Place trim rod assembly on clean work surface.
2. Remove trim system from vise and empty fluid into appropriate container.

Trim Rod Disassembly

1. Place trim rod assembly on clean work surface.
2. Remove screws securing plate to trim rod piston and O-ring.
3. Remove check ball components from trim rod piston.



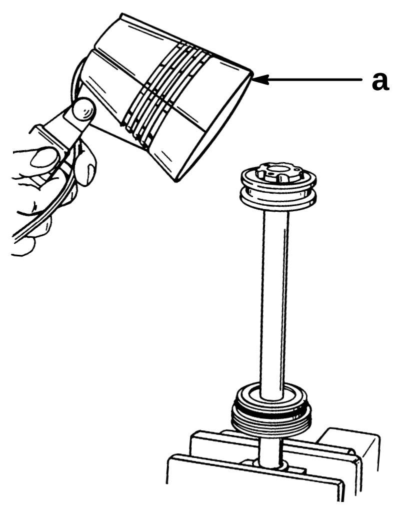
51143

a - Screw (3)
b - Plate
c - O-ring
d - Piston

CAUTION

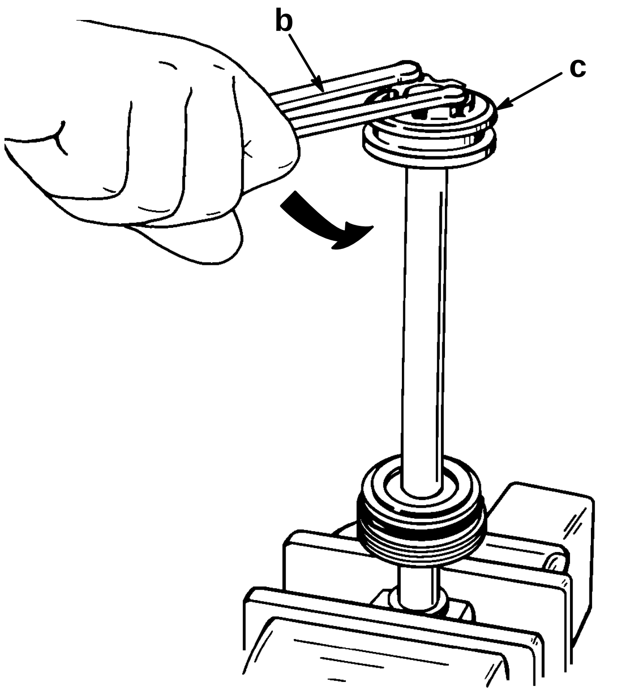
When removing Trim Rod piston, spanner wrench must have 1/4 in. x 5/16 in. long pegs to avoid damage to trim piston.

4. Place trim rod into soft jawed vise and apply heat to shock piston using torch lamp (91-63209).
5. Loosen trim rod piston using spanner wrench (1/4 in. x 5/16 in. long pegs).
6. Allow trim rod piston to cool. Remove from trim rod.



51146

a - Torch Lamp



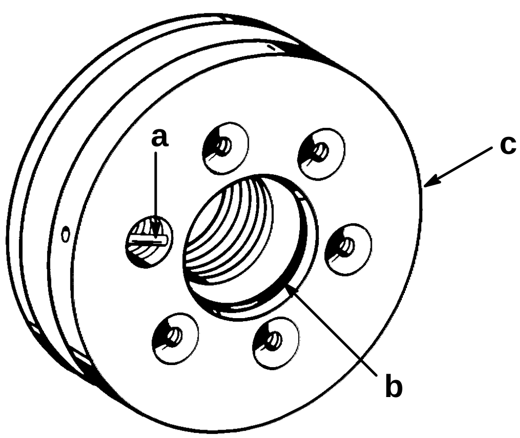
51146

b - Spanner Wrench
c - Trim Rod Piston

⚠ CAUTION

Do not remove check ball components (a) from trim rod piston. Removal and re-installation of check valve could result in improper operating pressure and possible power trim system damage. If check valve is defective, replace trim rod piston.

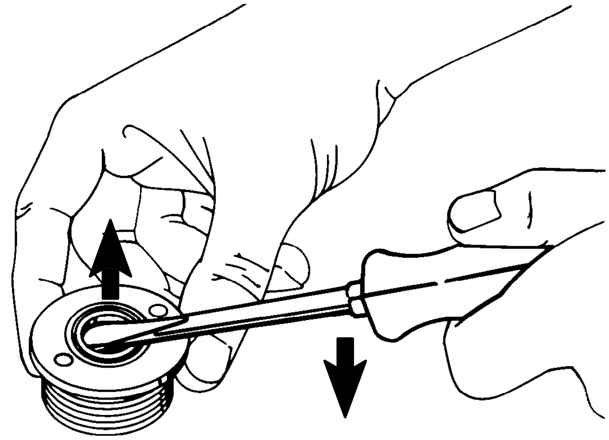
7. Remove inner O-ring from piston.



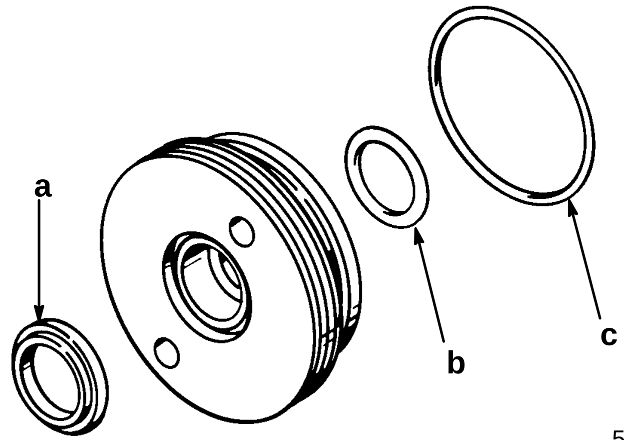
51199

a - Check Ball Components
b - O-ring
c - Piston

8. Remove rod wiper, inner O-ring and outer O-ring.



51147

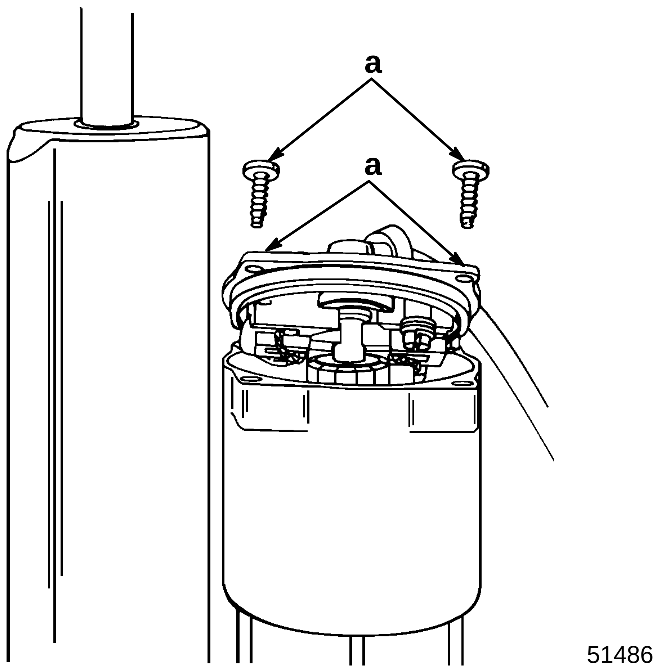


51145

a - Rod Wiper
b - Inner O-ring
c - Outer O-ring

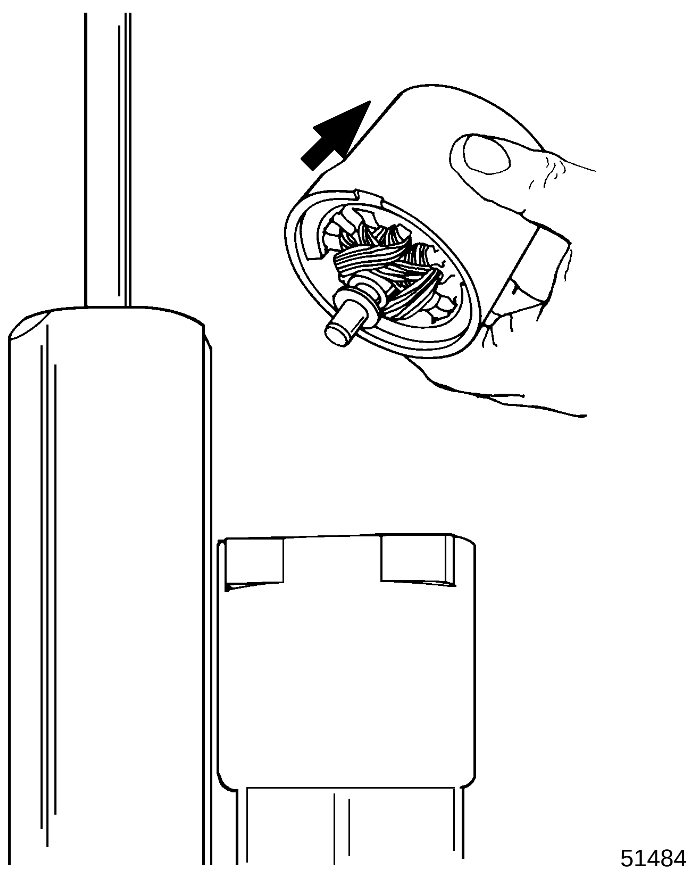
Trim “Motor” Removal

1. Secure power trim assembly in soft jawed vise.
2. Remove screws securing end cap to reservoir and remove end cap.



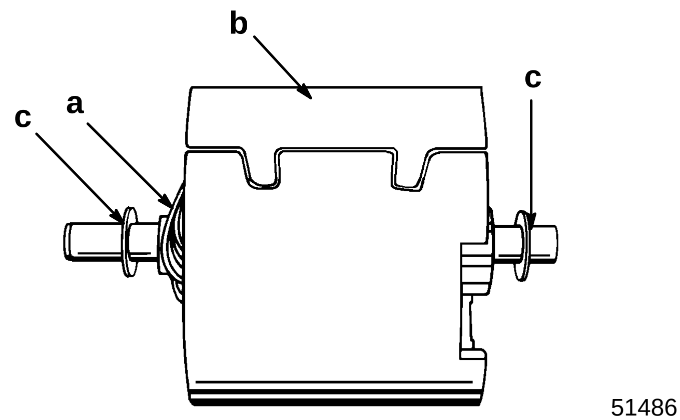
a - Screws (4)

3. Remove motor from reservoir.



Trim “Motor” Disassembly

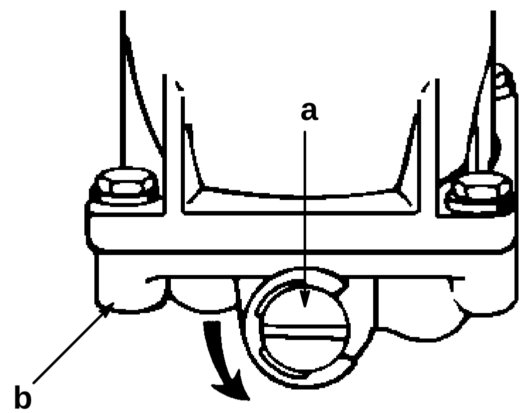
1. Remove armature from motor frame. Note position of washers on armature.



a - Armature
b - Motor Frame
c - Washer (1 each end of armature)

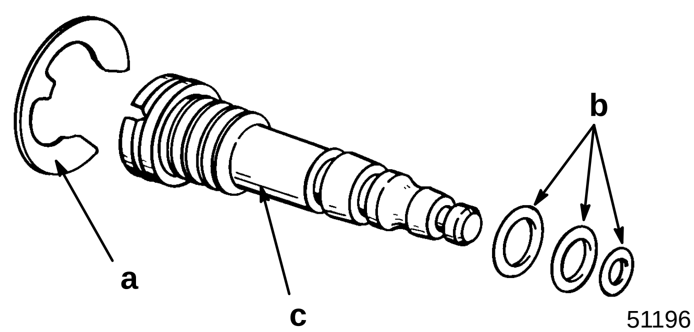
Reservoir Assembly Removal

1. Remove manual release valve from manifold.



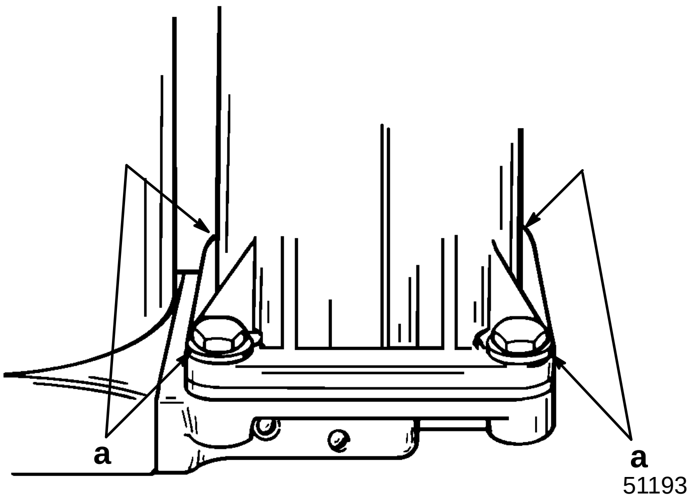
a - Manual Release Valve
b - Manifold

2. Remove “E” clip and O-rings from manual release valve.



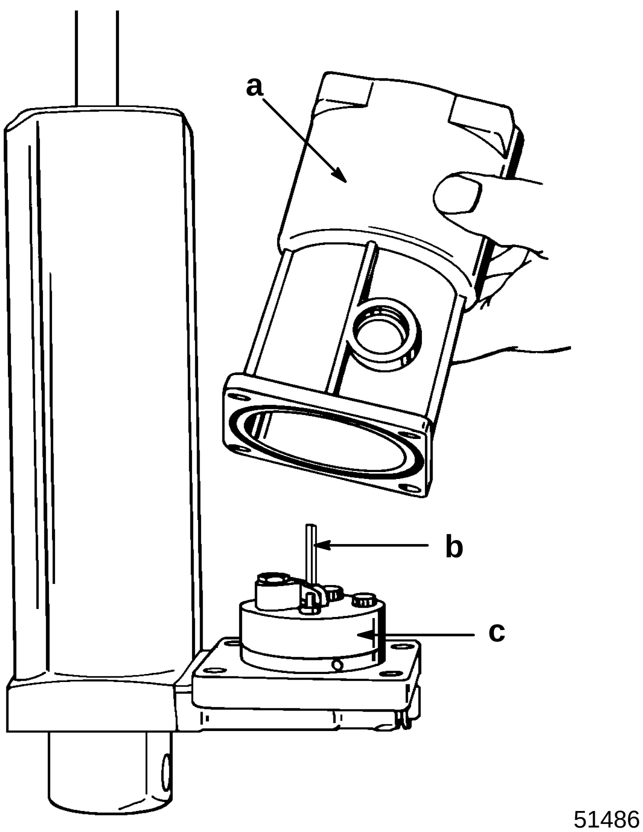
a - “E” Clip
b - O-rings
c - Manual Release Valve

3. Remove four screws securing reservoir to manifold.



a - Screws (4)

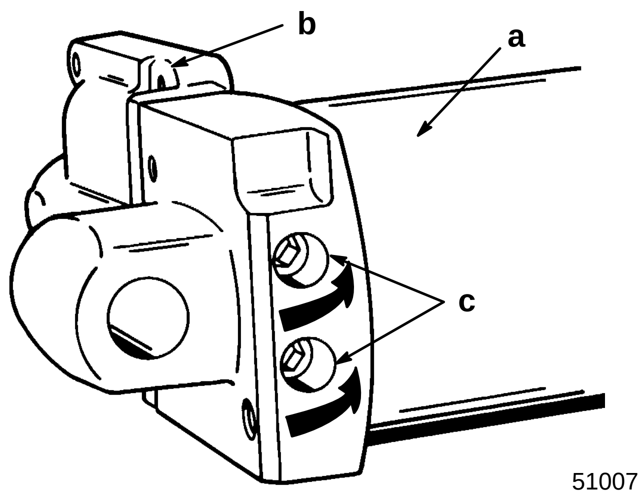
4. Remove reservoir from manifold.
5. Remove drive shaft from oil pump.



a - Reservoir
b - Driver Shaft
c - Oil Pump

Manifold Removal

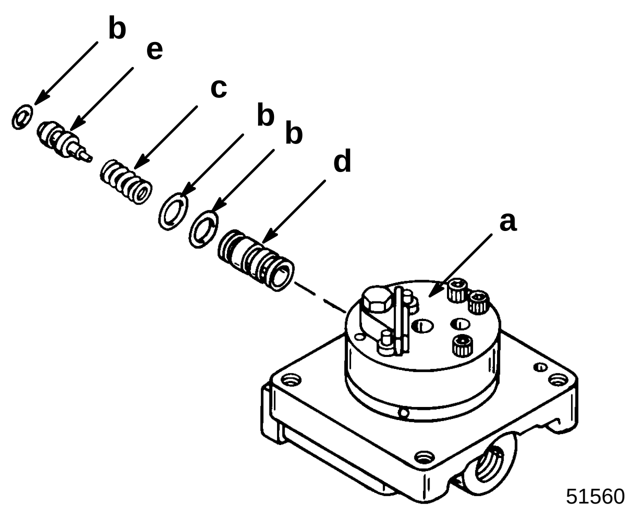
1. Remove screws and manifold from cylinder.



a - Trim Cylinder
b - Manifold
c - Screw (2)

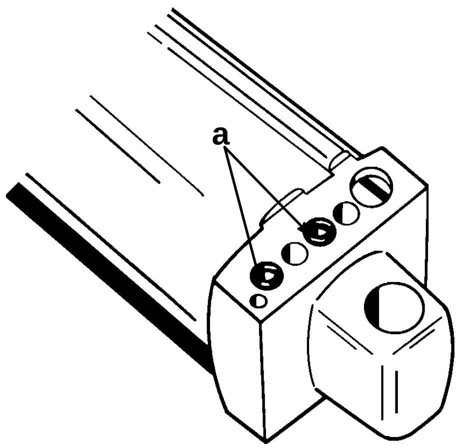
2. Remove check valve components from manifold.

IMPORTANT: Sleeve (d) is chamfered on I.D. on end opposite drilled cross hole. Install spool (e) (with O-ring installed) from chamfered end of sleeve to avoid possibility of damaging O-ring on spool.



a - Manifold and Pump
b - O-ring (3)
c - Spring
d - Sleeve
e - Spool

3. Remove O-rings from cylinder.



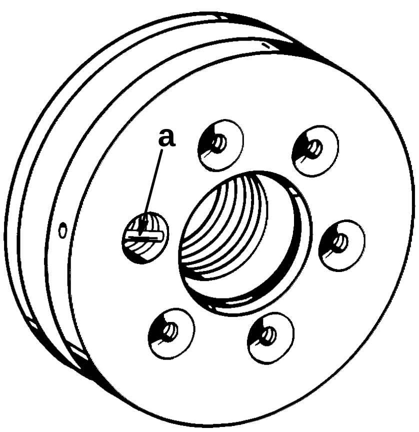
51008

a - O-rings

Cleaning and Inspection of Trim Rod Components

⚠ CAUTION

Do not remove check ball components (a) from trim rod piston. Removal and re-installation of check valve could result in improper operating pressure and possible power trim system damage.



51199

a - Check Ball Components

Inspect check valve for debris; clean debris form check valve if found. If debris cannot be cleaned from check valve, replace trim rod piston as an assembly.

Clean trim rod and components with parts cleaner and dry with compressed air.

It is recommended that all O-rings in trim system be replaced.

Inspect trim rod. If scraper (located in cap) has failed to keep rod clean, replace scraper.

Lubricate all O-rings using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.

Motor and Electrical Tests/Repair

Trim Pump Motor Test

⚠ WARNING

Do not perform this test near flammables (or explosives), as a spark may occur when making connections.

1. Disconnect GREEN (motor) wire and BLUE (motor) wire from trim system wiring harness.
2. Connect a 12 volt power supply to motor wires (POSITIVE to BLUE; NEGATIVE to GREEN results in motor up direction. POSITIVE to GREEN; NEGATIVE to BLUE results in motor down direction). Motor should run.
3. If motor does not run, disassemble motor and check components.

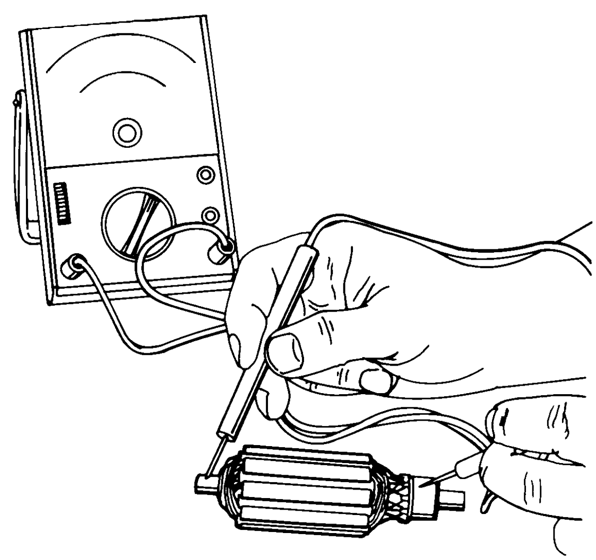
Armature Tests

TEST FOR SHORTS

Check armature on a Growler (follow Growler manufacturer's test instructions). Indication of a short requires replacement of armature.

TEST FOR GROUND

Use an Ohmmeter (R x 1 scale). Place one lead on Ohmmeter on armature shaft and other lead on commutator, as shown. If continuity is indicated, armature is grounded and must be replaced.

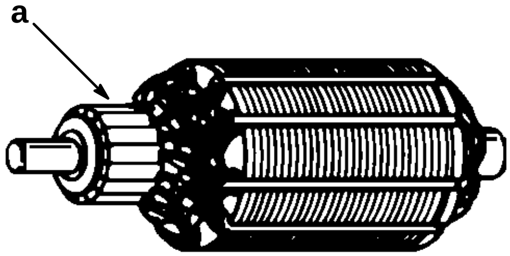


51195

CHECKING AND CLEANING COMMUTATOR

If commutator is worn it can be turned down on an armature conditioner tool or on a lathe.

Clean commutator with “00” sandpaper.

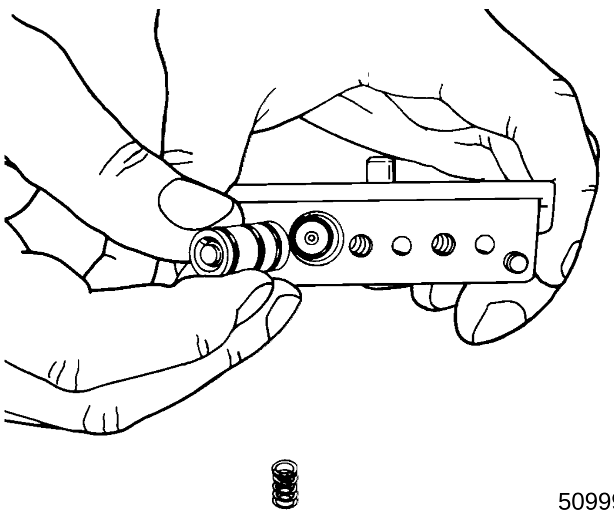


a - Commutator

Power Trim System Reassembly

Manifold Installation

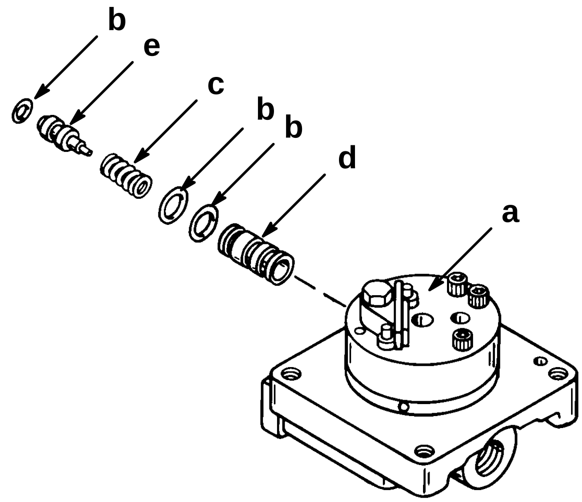
IMPORTANT: Install spring, check valve and O-ring into manifold. Position components in place using sleeve to seat in place.



50999

1. Install check valve components into pump manifold.

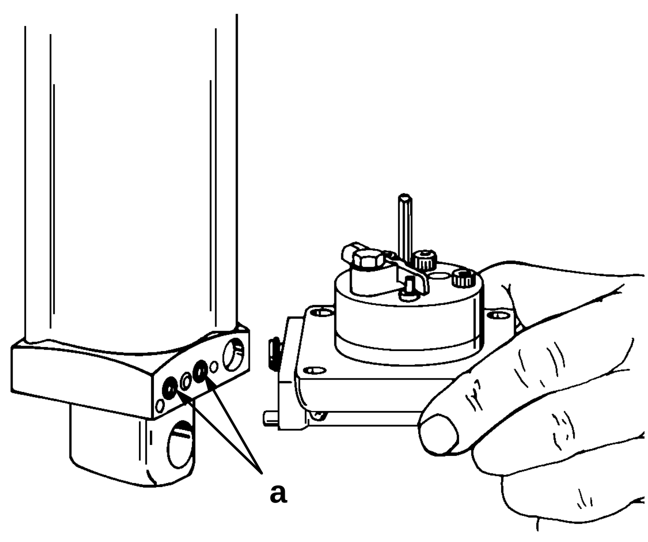
IMPORTANT: Sleeve (d) is chamfered on I.D. on end opposite drilled cross hole. Install spool (e) (with O-ring installed) from chamfered end of sleeve to avoid possibility of damaging O-ring on spool.



51560

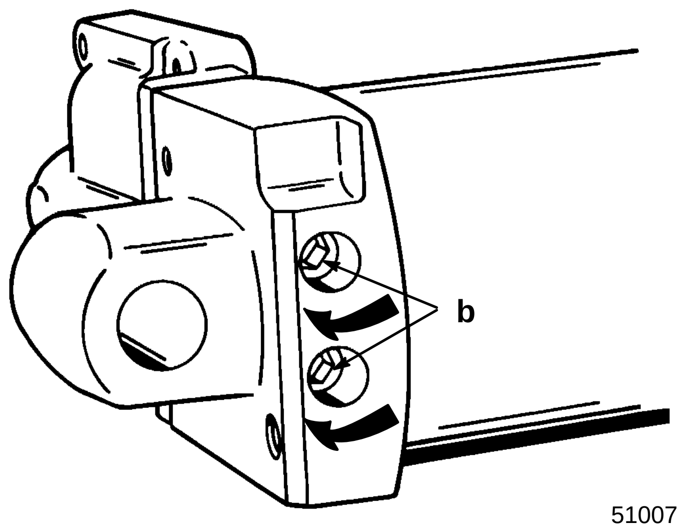
a - Manifold and Pump
b - O-ring (3)
c - Spring
d - Sleeve
e - Spool

2. Install O-rings on cylinder and secure manifold assembly to cylinder using screws. Torque screws to 100 lb. in. (11.3 N·m).



51486

a - O-ring (2)

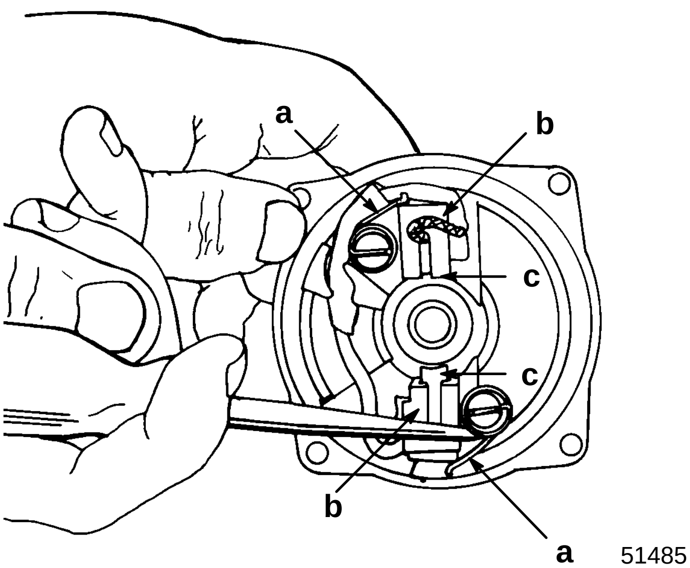


b - Screws [100 lb. in. (11.3 N·m)]

3. Secure power trim unit in soft jawed vise.

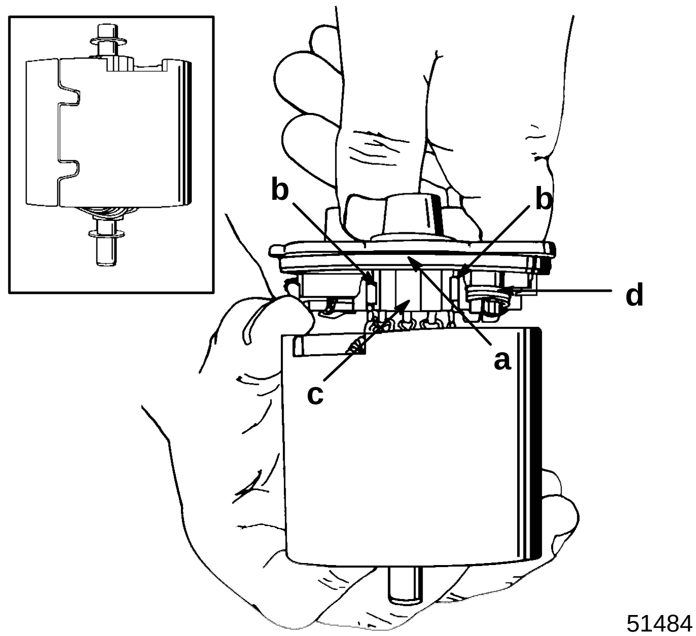
Trim Motor Reassembly

1. Place brush tension springs on outer ends of brush housings to release tension on brushes.



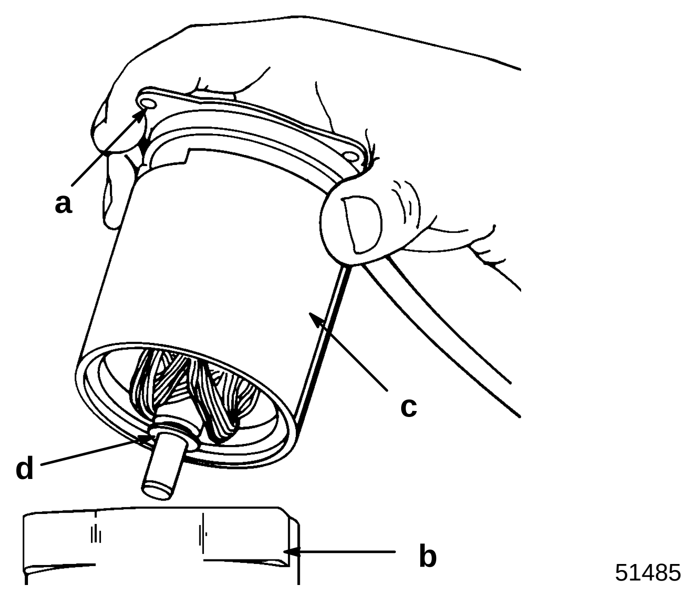
a - Brush Tension Spring (2)
b - Brush Housing (2)
c - Brush (2)

2. Lubricate end cap bushing with Quicksilver 2-4-C Lubricant and install armature and motor frame into end cap. As brushes contact commutator, release brush tension spring from ends of brush housings (returning springs to apply brush pressure to commutator). Install washer on each end of armature before installing armature into end cap (see inset).



a - End Cap Bushing. Lubricate with Quicksilver 2-4-C w/Teflon
b - Brush (2)
c - Commutator
d - Brush Tension Spring (2)

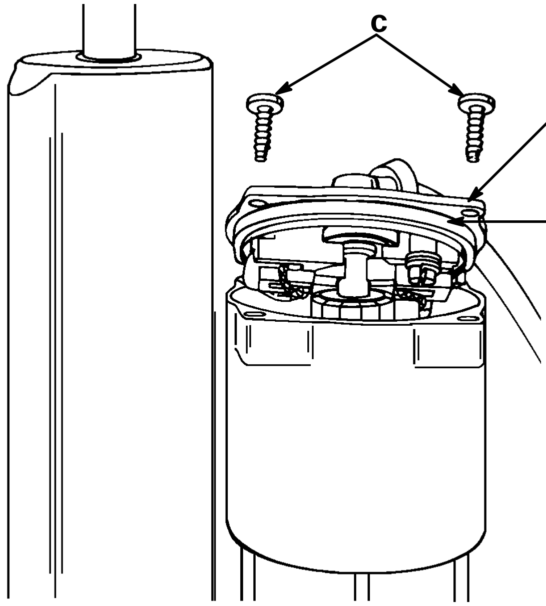
3. Guide armature and motor frame into reservoir housing as shown.



a - End Cap
b - Motor Housing
c - Armature and Motor Frame
d - Washer (One Each End of Armature)

Reservoir Installation

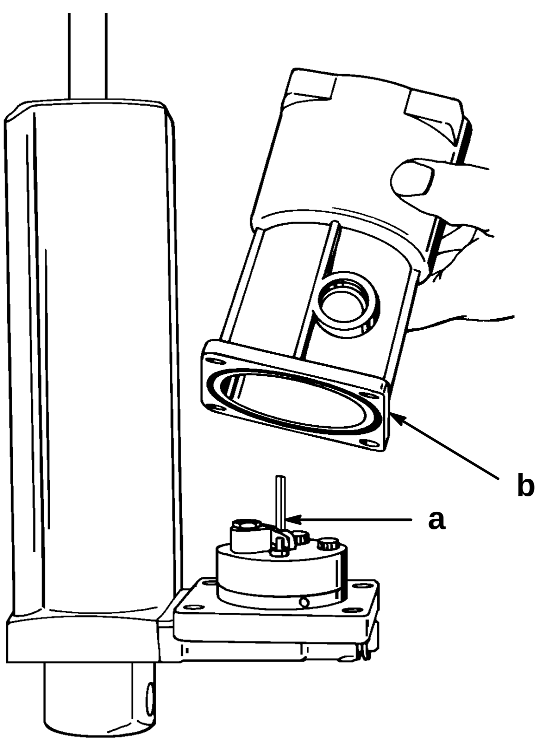
1. Torque end cap screws to 13 lb in. (1.5 N·m).



51486

a - End Cap
b - O-ring
c - Screws (4)

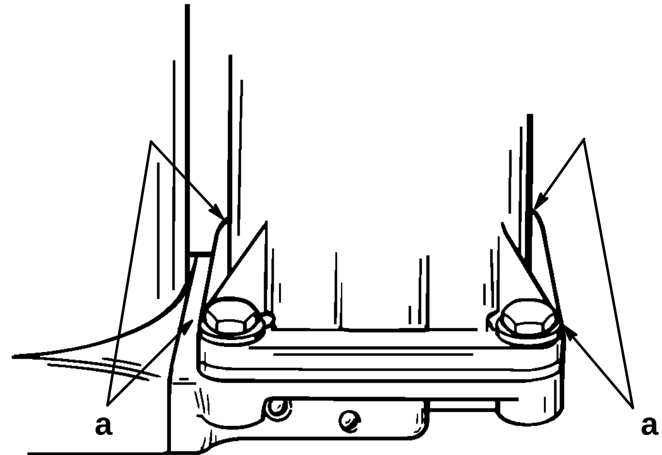
2. Place drive shaft into oil pump.
3. Install lubricated O-ring to base of reservoir.
4. Carefully guide (with motor) down onto drive shaft.



51486

a - Drive Shaft
b - O-ring

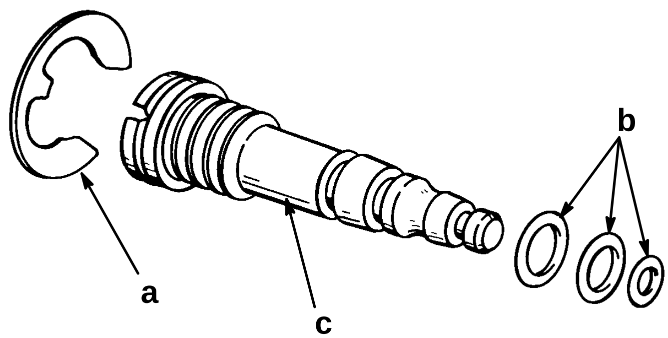
5. Secure reservoir to manifold using four screws. Torque screws to 70 lb. in. (7.9 N·m).



51193

a - Screw

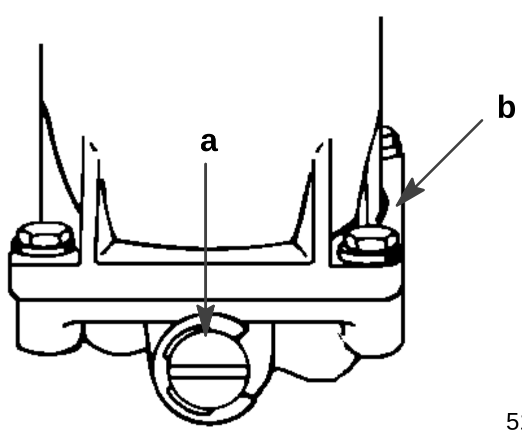
6. Install lubricated O-rings and "E" clip to manual release valve.



51196

a - "E" Clip
b - O-ring
c - Manual Release Valve

7. Insert manual release valve into manifold and tighten snuggly. Back release valve out 3 turns **maximum** allowing trim rod installation.

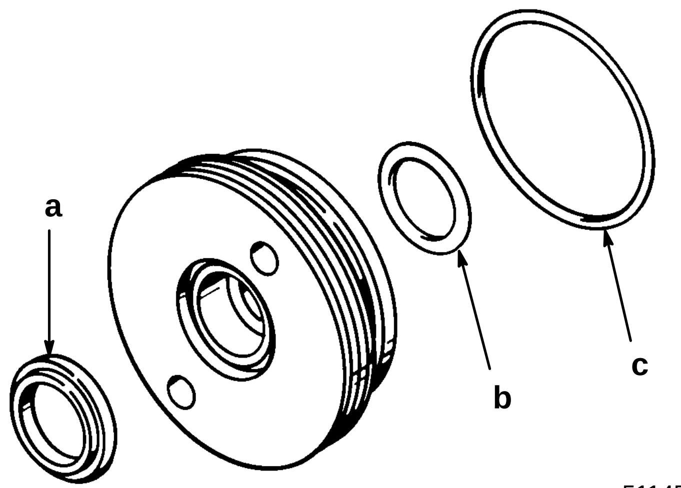


51194

a - Manual Release Valve
b - Manifold

Trim Rod Reassembly

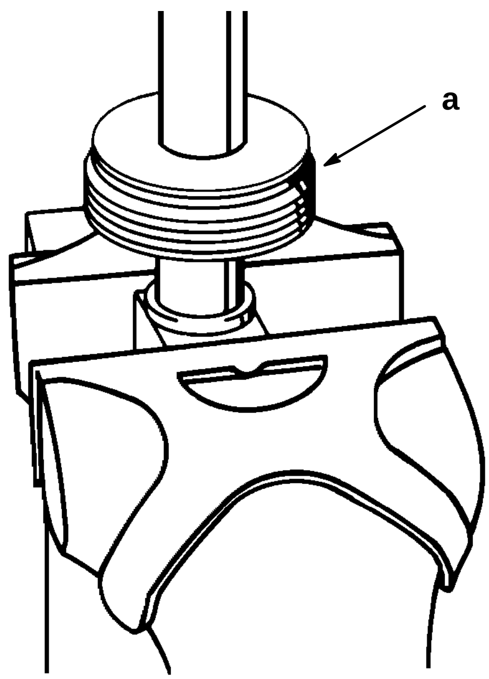
1. Install lubricated O-rings and rod wiper to end cap.



51145

a - Rod Wiper
b - Inner O-ring
c - Outer O-ring

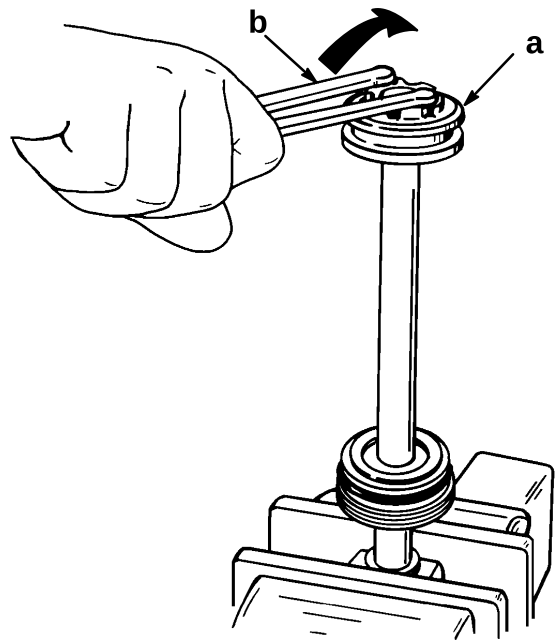
2. Secure trim rod in soft jawed vise as shown.
3. Slide end cap onto trim rod.



51146

a - End Cap

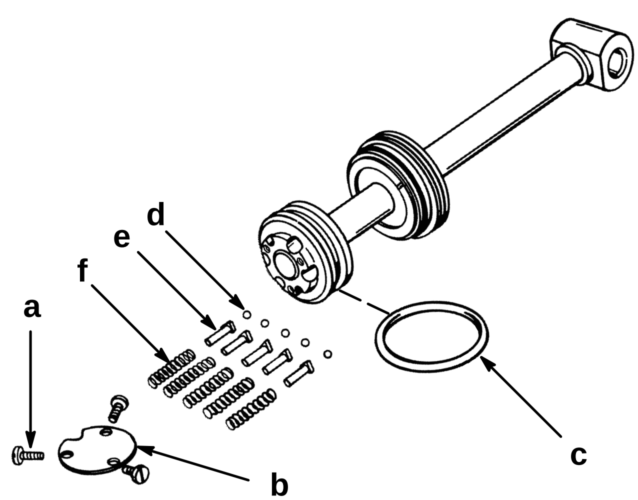
4. Apply Loctite 271 (Obtain Locally) to threads of trim rod and install rod piston. Tighten piston securely using spanner wrench (1/4 in. x 5/16 in. long peg).



51146

a - Trim Rod Piston
b - Spanner Wrench

5. Install lubricated O-ring to trim rod piston.
6. Install check ball components into its respective bore.

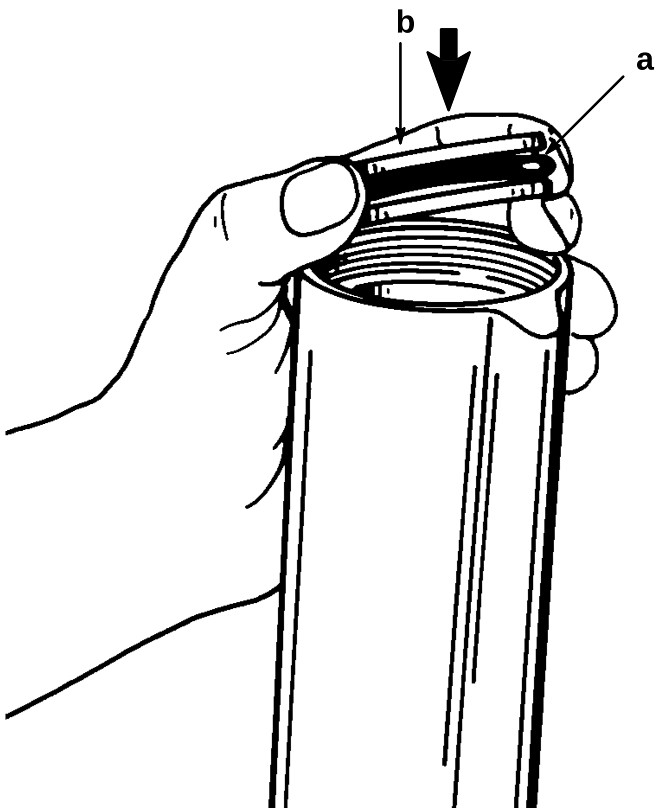


51147

a - Screw (3)
b - Plate
c - O-ring
d - Ball (5)
e - Seat, Spring (5)
f - Spring (5)

Trim Rod Installation

1. Place trim cylinder in soft jawed vise.
2. Fill trim cylinder three inches (76.2mm) from top of cylinder using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.
3. Install lubricated O-ring to memory piston and place into cylinder. Push piston down to level of oil.

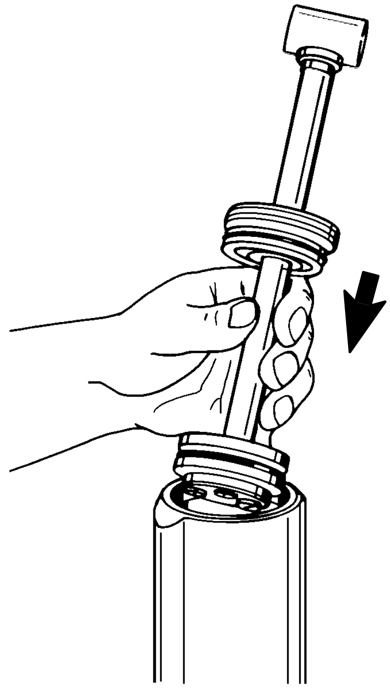


51144

Memory piston must not contact end cap during trim rod/end cap installation.

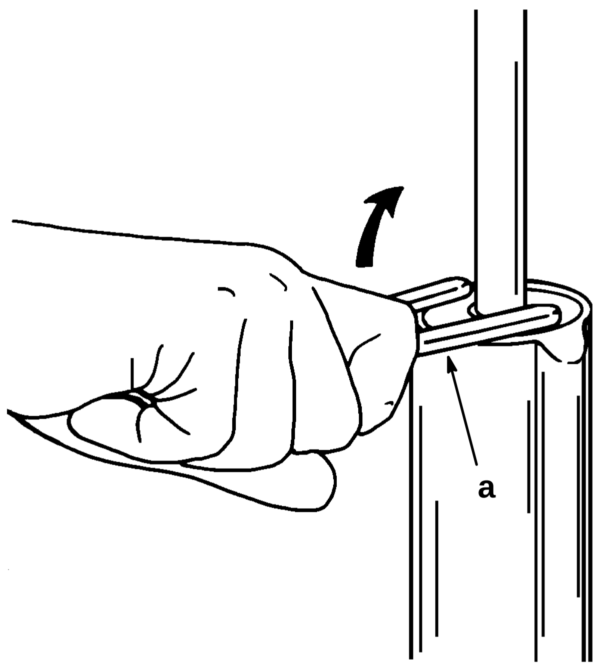
a - O-ring
b - Memory Piston

4. Install trim rod into cylinder.



51196

5. Tighten end cap assembly to cylinder securely using spanner wrench (1/4 in. x 5/16 in. long pegs).



51145

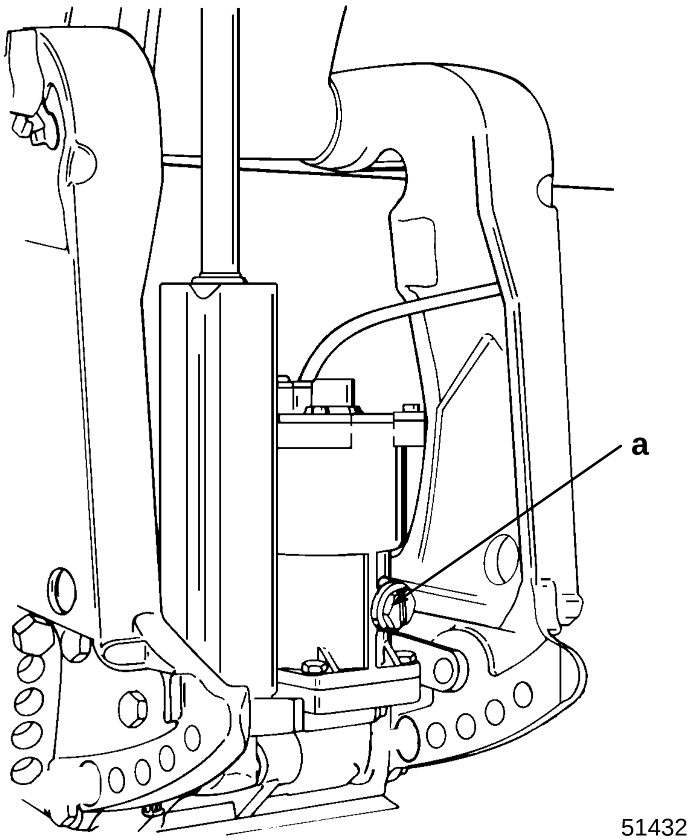
a - Spanner Wrench (91-74951)

6. Tighten manual release valve snuggly following end cap installation.

Purging Power Trim Unit

Manual release valve must be in full closed position during power trim purging and operation.

1. Secure power trim unit in soft jawed vise.
2. Remove fill cap. Add Quicksilver Power Trim and Steering Fluid (92-90100A12) or Automatic Transmission Fluid (ATF) Type F, FA or Dexron II up to threads of reservoir. Install cap.

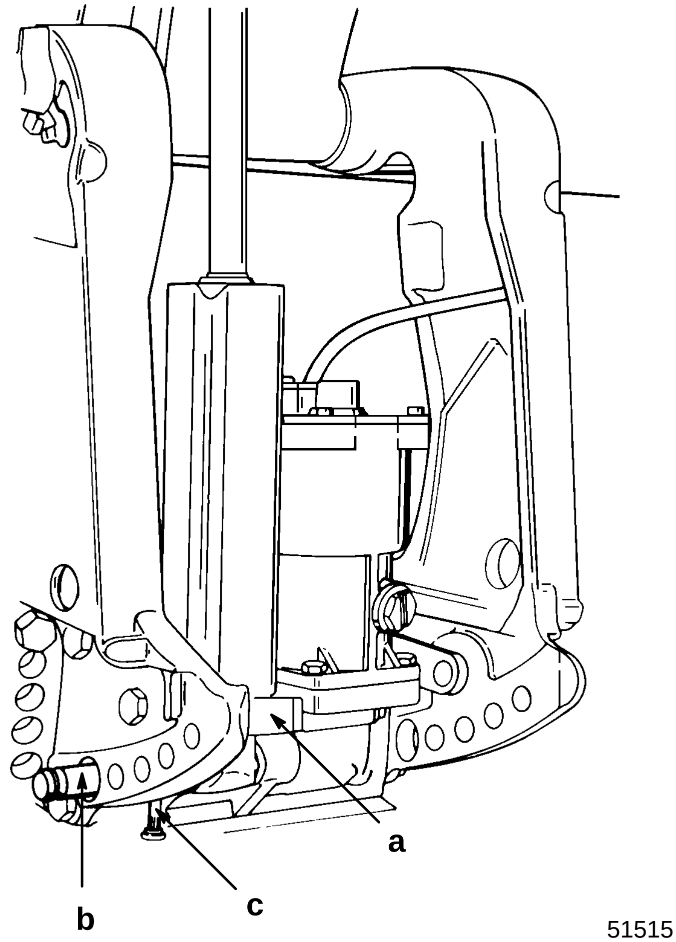


a - Fill Cap

3. Using a 12 volt power supply connect POSITIVE lead to GREEN wire, NEGATIVE lead to BLUE wire and drive trim rod to the DOWN position. Connect POSITIVE lead to BLUE wire and NEGATIVE lead to GREEN wire and drive trim rod to the UP position. Recheck fluid level, add fluid as required and repeat cycle until fluid level remains at lower portion of threads.

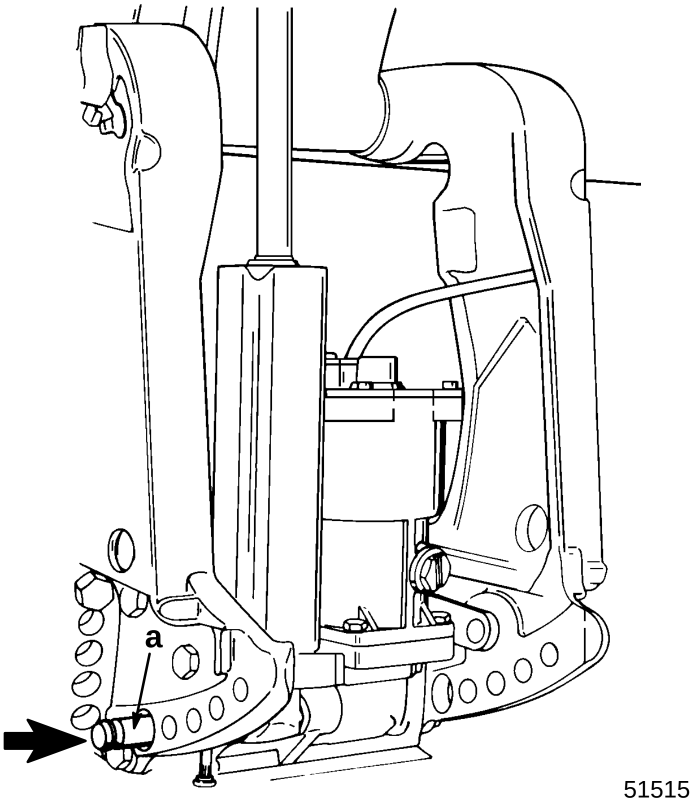
Power Trim Unit Installation

1. Apply 2-4-C w/Teflon (92-825407A12) to lower pivot pin bore and pivot pin surface.
2. Position trim cylinder assembly (BOTTOM FIRST) between clamp brackets and route trim pump electrical harness through access hole in starboard clamp bracket.
3. Start lower pivot pin into pivot pin bore and position lower cross pin (RETAINED) in its respective hole.



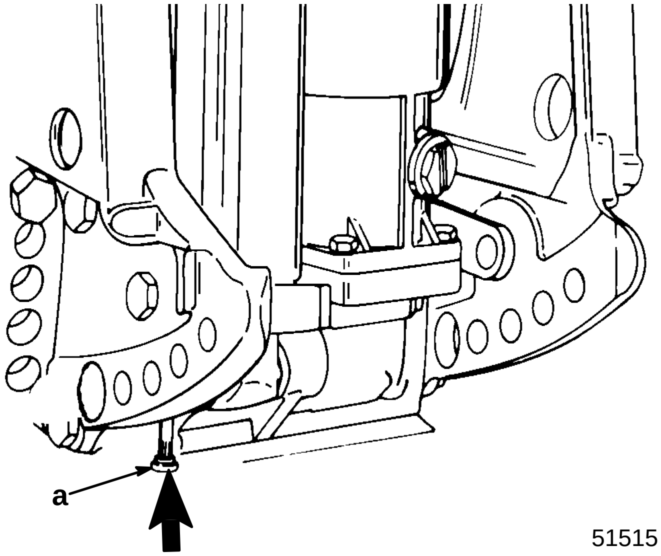
a - Trim Cylinder Assembly
b - Lower Pivot Pin
c - Lower Cross Pin

4. Using a suitable punch, drive lower pivot pin into clamp bracket and trim cylinder assembly until pivot pin is flush with outside surface.



a - Lower Pivot Pin

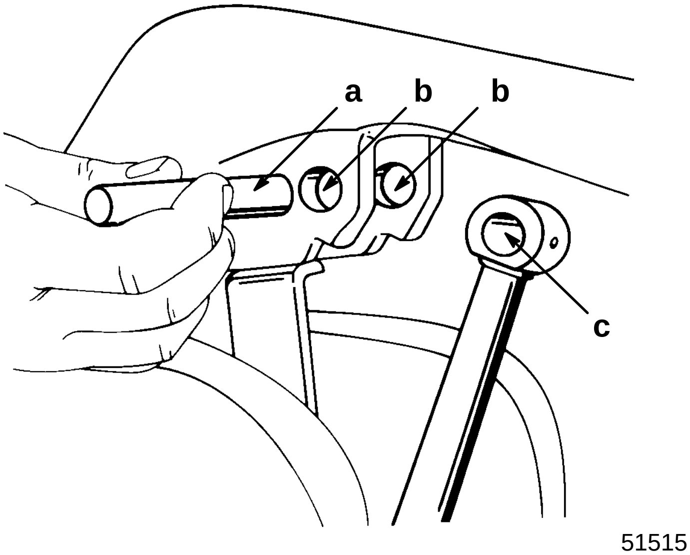
5. Using a suitable punch, drive lower cross pin into its respective bore until seated.

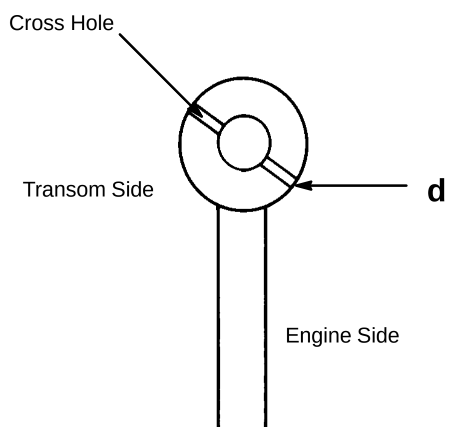


a - Lower Cross Pin

6. Apply 2-4-C w/Teflon (92-825407A12) to surface of upper pivot pin, pivot pin bore and trim ram bore.

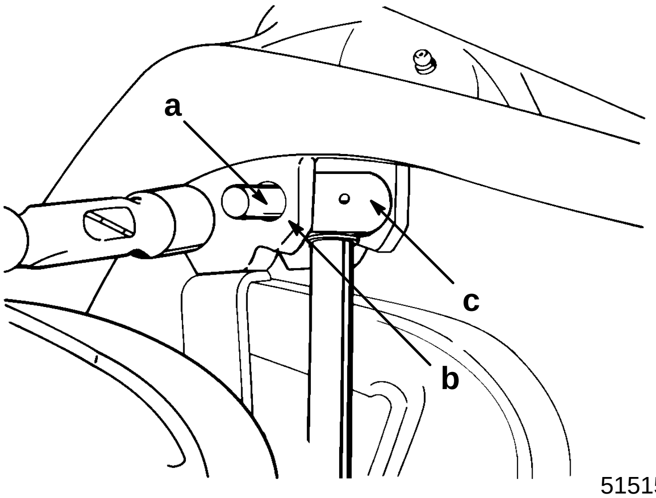
NOTE: Install trim ram with cross hole located as shown .If trim ram is installed reversed, the trim sender (if installed) will not operate.





a - Pivot Pin
b - Pivot Pin Bore
c - Trim Ram Bore
d - Install Trim Ram As Shown

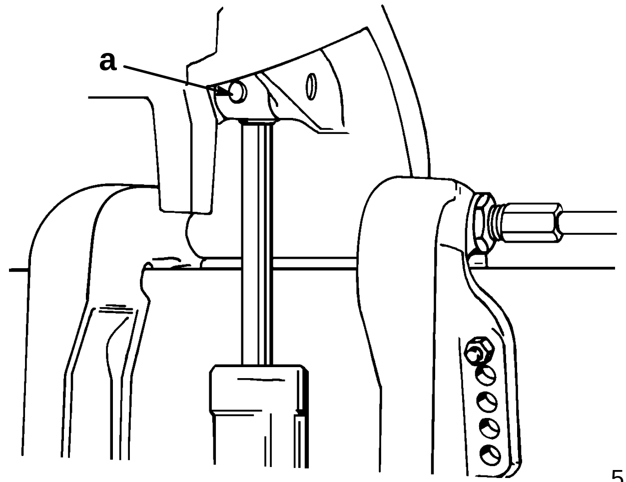
7. Using a suitable mallet, drive upper pivot pin into swivel bracket and through trim ram until pivot pin is flush with swivel bracket.



51515

a - Pivot Pin
b - Swivel Bracket
c - Trim Ram

8. Drive upper retaining pin in until seated.



51505

a - Retaining Pin

9. Recheck fluid level.
10. Power trim may now be operated to lower outboard to desired position. Trim system is self purging.
11. Reconnect power trim leads to relays under ignition cover.
12. Reinstall spark plug leads to spark plugs.
13. Reinstall cowls.
14. Connect battery leads to battery terminals.

ENGINE ATTACHMENTS/ ENGINE INSTALLATION

7

A

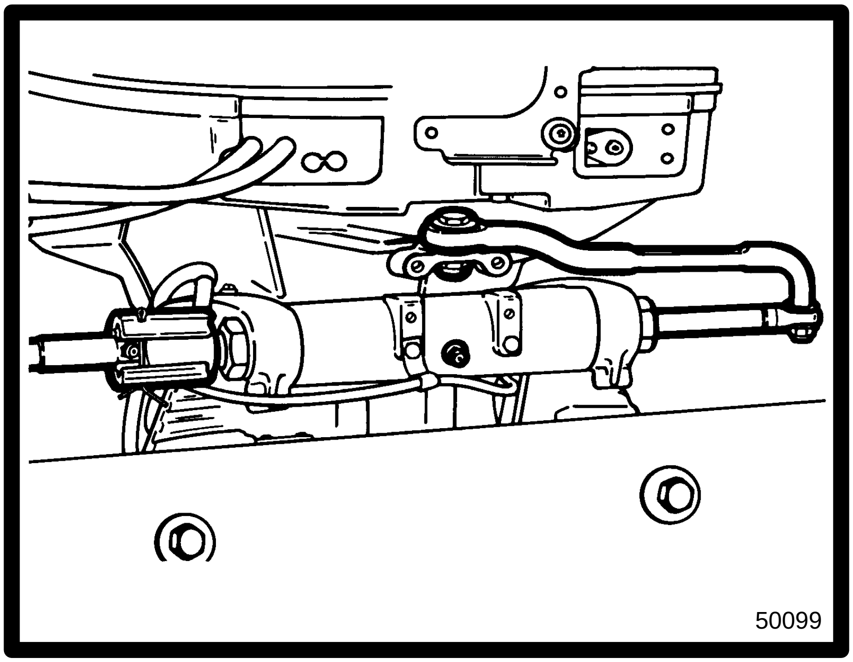


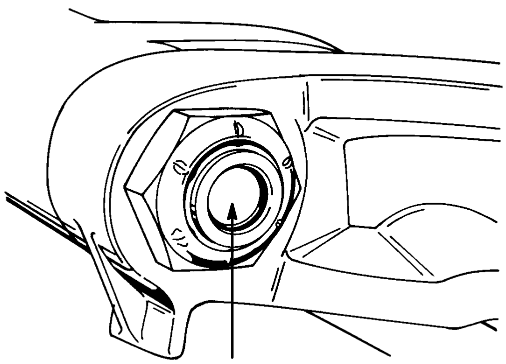
Table Of Contents

Steering Cable and Steering Link Rod Installation

⚠ CAUTION

Control cables must be the correct length when installed. Cables that are too long may bind or kink putting extra stress on cables.

1. Install steering mount and steering wheel in accordance with installation instructions that accompany each.
2. Lubricate seal inside of engine tilt tube and entire steering cable end with Quicksilver 2-4-C w/Teflon.

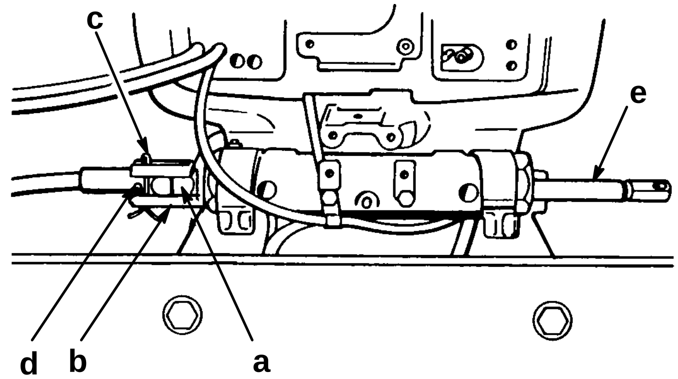


51890

a - Seal

IMPORTANT: Before installing steering cable into tilt tube, lubricate seal and entire cable end with Quicksilver 2-4-C w/Teflon.

3. Insert steering cable end thru engine tilt tube and secure steering cable to tilt tube with steering cable attaching nut as shown. Torque nut to 35 lbs. ft. (47.5 N·m).
4. Install rubber bumper on inside of locking sleeve, then install locking sleeve over steering cable attaching nut) and secure with cotter pin . Spread ends of cotter pin. Be sure to install cotter pin so that it is located in-between attaching nut and grease fitting , as shown.



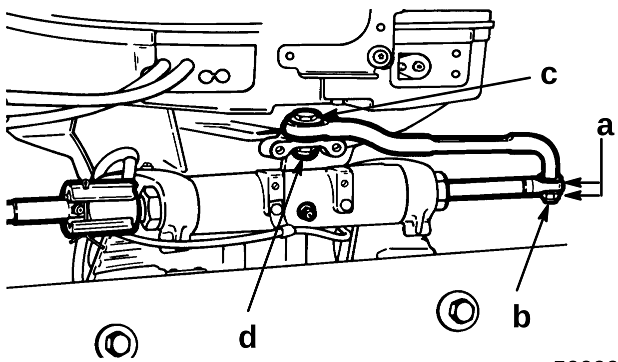
50130

a - Cable Nut
b - Locking Sleeve
c - Cotter Key
d - Grease Fitting
e - Steering Cable

⚠ CAUTION

Steering link must be installed in rear hole in engine steering arm. Failure to install in rear hole may cause damage to steering system.

5. Lubricate hole in end of steering cable with Quicksilver 2-4-C w/Teflon and assemble steering link rod to steering cable with 2 flat washers and locknut as shown. Torque locknut to 120 lbs. in. (13.5 N·m) maximum and back off 1/4- turn.
6. Lubricate ball joint in steering link rod with 30W oil and assemble to rear hole in engine steering arm with pivot bolt and locknut. Torque pivot bolt, then locknut to 20 lbs. ft. (27.1 N·m).



50099

a - Flat Washers (2)
b - Locknut
c - Pivot Bolt
d - Locknut

Ride-Guide Attachment – Dual Front Installation (92876A2)

⚠ WARNING

Quicksilver Super Ride-Guide Steering (Dual Cables) must be used with this attaching kit. Failure to adhere to this requirement could result in steering system failure.

Installation and Maintenance

IMPORTANT: The distance from each engine's centerline to the side of transom opening must be a minimum of 16″ (40.6cm).

This kit contains all necessary parts to connect both engines to Ride-Guide Steering cables for 22-1/2″ thru 24-1/2″, refer to Figure 14, page 7A-14 for additional extension couplers.

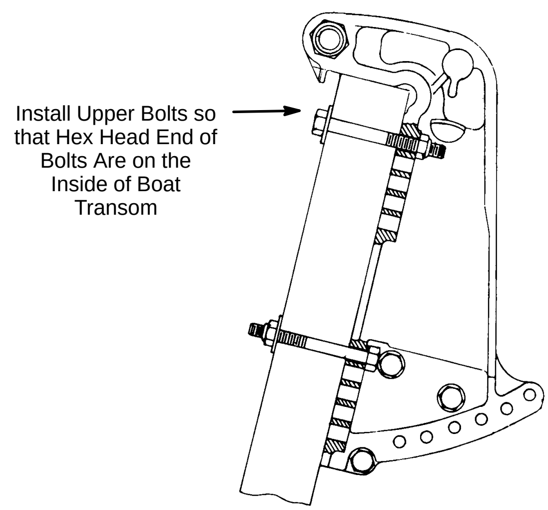
Cable Routing Types

Use "1" or "2", following, to route steering cables:

1. Parallel cable routing: Cables routed together down starboard side of boat. Refer to "Parallel Routed Steering Cables and Attaching Kit Installation," immediately following.
2. Opposite side cable routing: One cable routed down starboard side of boat and one cable routed down port side of boat. Refer to "Opposite Side Routed Steering Cables and Attaching Kit Installation," page 7A-8.

⚠ CAUTION

With this kit installed, the upper (engine) mounting bolts must be installed so that hex head end of bolts is on the inside of boat transom, as illustrated below. Failure to install upper mounting bolts, as shown in illustration, could result in interference between outer steering cable locking sleeve and ends of mounting bolts when engine is tilted up.



Parallel Routed Steering Cables and Attaching Kit Installation

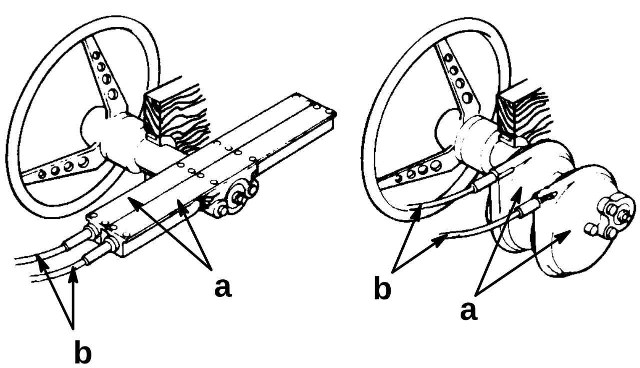
(Both Steering Cables Routed Together Down Starboard Side of Boat)

Super Ride-Guide Steering Kit Installation

IMPORTANT: It may be necessary to install steering cable into tilt tube of starboard engine before mounting engine.

Both gear racks or rotary steering heads must be installed so that both steering cables will be routed together on the same side of the boat and will push-and-pull together.

1. Install Super Ride-Guide Steering Kit in accordance with instructions included with Super Ride-Guide Kit.
2. Make sure that both gear racks or rotary steering heads are installed so that both steering cables are routed together and will push-and-pull together (Figure 1).



a - Straight Rack (Left); Rotary Steering (Right)
b - Steering Cables (Install so that Both Cables Will Push-and-pull Together.)

Figure 1. Super Ride-Guide Steering Kits Installed

⚠ WARNING

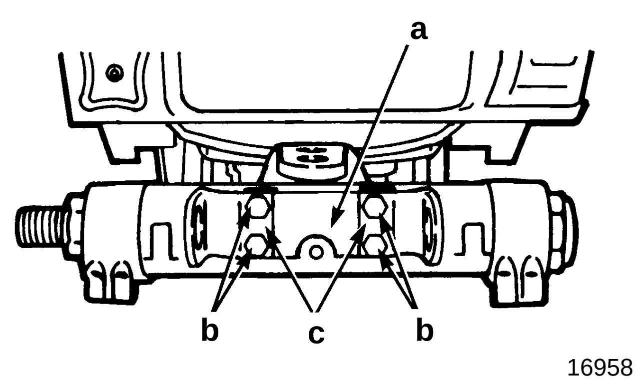
Before using engine after installation of cables, check to see that boat will turn right when steering wheel is turned right and that boat will turn left when wheel is turned left. Do this check at all tilt angles and thru full range of turn angles.

Installing Steering Cables and Steering Link Rods to Engines

1. Install tube mounting bracket (Figure 2) to starboard mounted engine with 2 locking retainers and 4 bolts. Torque bolts to 100 lbs. in. (11.3 N·m) and bend end of locking retainers up and against flat on each bolt, as shown in Figure 2.

⚠ WARNING

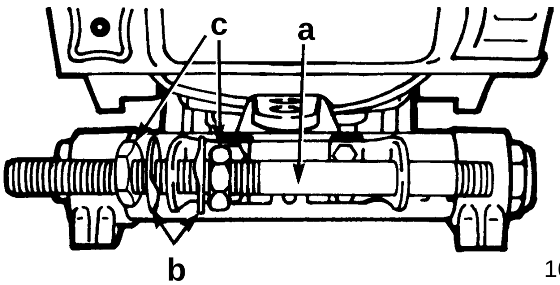
Locking retainer ends must be bent up and against flat on each bolt, that secures mounting bracket to engine, to prevent bolts from turning out.



a - Tube Mounting Bracket
b - Bolts
c - Locking Retainers (Bend Ends Up and Against Flat on Bolts.)

Figure 2. Tube Mounting Bracket Installed

2. Install steering cable mounting tube into mounting bracket with 2 adjustment nuts and tab lock washers, as shown in Figure 3. Be sure that longer threaded end of tube is toward steering cable attaching nut side of engine.
3. Temporarily adjust tube so that longer threaded end of tube is extended out the same distance as engine tilt tube. Do not tighten adjustment nuts at this time.



a - Steering Cable Mounting Tube
b - Tab Lock Washers
c - Adjustment Nuts (Rounded Edge Facing Out)

Figure 3. Steering Cable Mounting Tube Installed

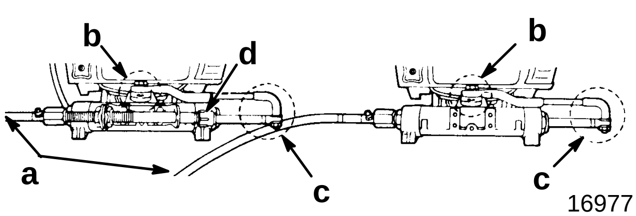
4. Install steering cables, as follows:

IMPORTANT: Before installing steering cables, lubricate inside of port mounted engine tilt tube and inside of steering cable mounting tube with Quicksilver 2-4-C w/Teflon. Verify that rubber O-ring seal (located in engine tilt tube) also is lubricated.

a. Lubricate inside of (port) engine tilt tube with Quicksilver 2-4-C w/Teflon. Make sure that rubber O-ring seal (located in engine tilt tube) also is lubricated.

b. Lubricate inside of steering cable mounting tube with Quicksilver 2-4-C w/Teflon.

c. Insert ends of steering cables thru engine tilt tube and cable mounting tube (Figure 4). Thread steering cable attaching nuts onto tubes hand-tight.



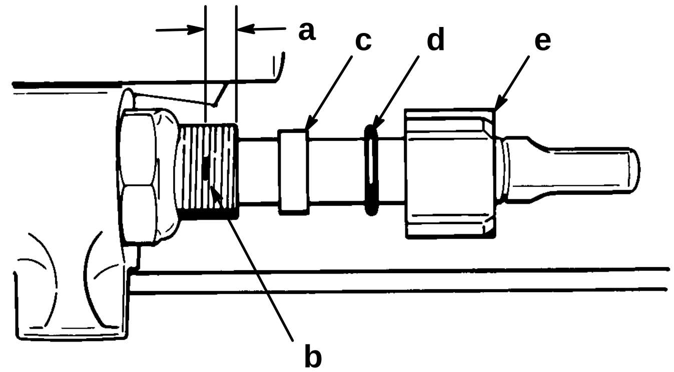
a - Steering Cables Routed Down Starboard Side
b - See Figure 7 for Correct Parts Sequence
c - See Figure 8 for Correct Parts Sequence
d - Seal

Figure 4. Steering Cables and Steering Link Rods Installed

NOTE: Torque steering cables attaching nuts and install locking sleeve after final tension adjustment.

5. Install steering cable seal to steering cable mounting tube, as follows:

a. Place a mark on steering cable mounting tube 5/8″ (15.8mm) from end of tube (Figure 5).

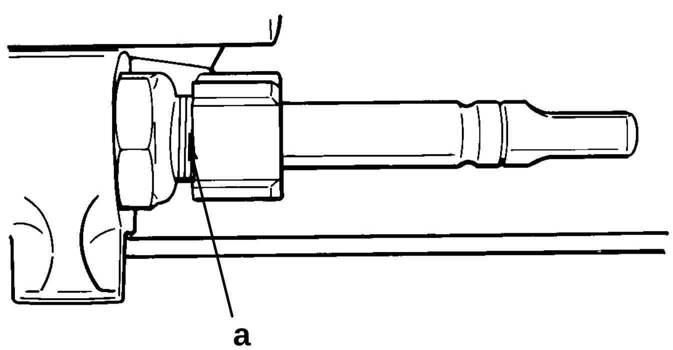


a - 5/8″ from End of Tube
b - Place Mark on Tube Here.
c - Nylon Spacer
d - O-ring
e - Cap

Figure 5. Seal Installation Sequence

b. Slide nylon spacer, O-ring and cap (from kit) over steering cable (Figure 5).

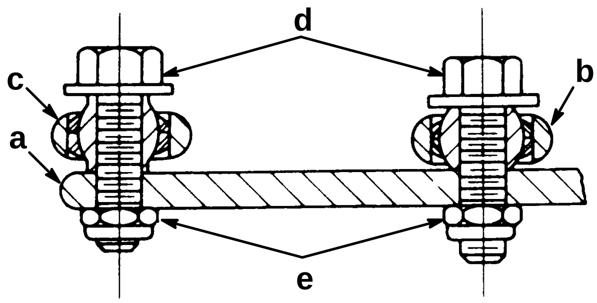
c. Thread cap onto steering cable mounting tube up to mark (made on tube in Step “a” (Figure 6).



a - Mark Made in Step 5a

Figure 6. Steering Cable Seal Installed

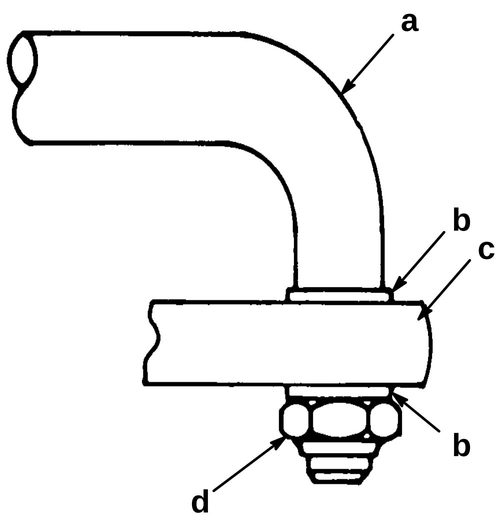
6. Install link rods (Figure 4) to engine steering arms. Fasten each link rod to steering arm onto top side rear hole with pivot bolt and locknut, as shown in Figure 7. Torque each pivot bolt to 20 lbs. ft. (27.1 N·m), then thread locknut onto pivot bolt and torque nut to 20 lbs. ft. (27.1 N·m).



a - Engine Steering Arm
b - Steering Link Rod
c - Steering Eye and Coupler
d - Pivot Bolts - Torque to 20 lbs. ft. (27.1 N·m)
e - Locknuts - Torque to 20 lbs. ft. (27.1 N·m)

Figure 7. Steering Link Rod and Steering Eye with Coupler Installed on Engine Steering Arm

7. Lubricate hole(s) in end of steering cable(s) with Quicksilver 2-4-C w/Teflon and assemble steering link rod(s) to steering cable end, as shown in Figure 8. Tighten self-locking nut until it seats [DO NOT exceed 120 lbs. in. (13.5 N·m)], **then back nut off 1/4-turn.**



a - Steering Link Rod
b - Flat Washer (5/8" O.D.)
c - Steering Cable End
d - Locknut; Tighten Until it Seats [DO NOT Exceed 120 lbs. in. (13.5 N·m)], then Back Nut Off 1/4-Turn.

Figure 8. Steering Link Rod Assembled on Steering Cable

Steering Eyes and Coupler Installation

1. Position engines so that they are facing straight forward. (Distance between centers of threaded pivot bolt holes in engine steering arms must be equal to distance between propeller shaft centers.)
2. Lubricate inside of rubber sleeves (Figure 9) and slide onto coupler.
3. Slide rubber bushings (Figure 9) onto steering eyes.
4. Thread steering eyes (Figures 9 and 10) into coupler and adjust steering eyes so that distance between centers of pivot bolt holes in steering eyes is the same distance as between centers of threaded pivot holes in engine steering arms. Exposed steering eye threads should be equal at both ends of coupler and must not extend out of coupler more than 2-3/4″ (70mm).

⚠ WARNING

Both steering eyes must be threaded into coupler 3/4″ (19mm) minimum. Thread length of steering eye is 3-1/2″ (89mm), so exposed thread must not extend out of coupler more than 2-3/4″. Failure to adhere to this requirement could result in steering system failure.

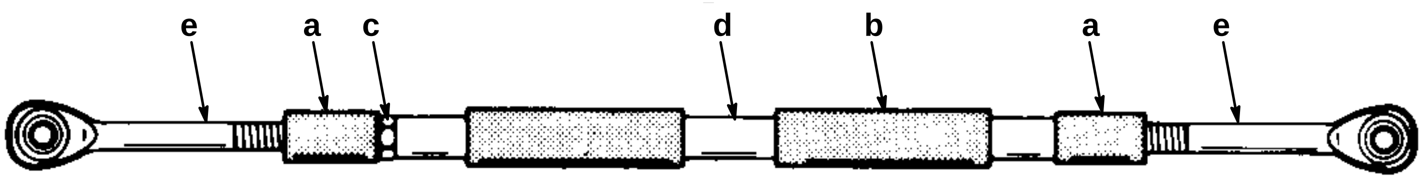
5. Lubricate steering eye threads, pivot bolts, and ball joints with Quicksilver Anti-Corrosion Grease (92-78376-12) before assembling.
6. Assemble steering eyes and coupler to top side, front holes of steering arm with pivot bolts and locknuts, as shown in Figures 7 and 10.

IMPORTANT: With steering eyes and coupler installed and before tightening pivot bolts, check engine alignment. Distance between pivot bolts centers and distance between propeller shaft centers must be equal for proper steering. If adjustment is necessary, remove pivot bolt from one steering eye and turn eye in or out to correct alignment. Both steering eyes MUST BE threaded into coupler 3/4″ (19mm) minimum.

7. Torque pivot bolts to 20 lbs. ft. (27.1 N·m), then thread self-locking nut (Figure 7) onto bolts and torque nuts to 20 lbs. ft. (27.1 N·m).

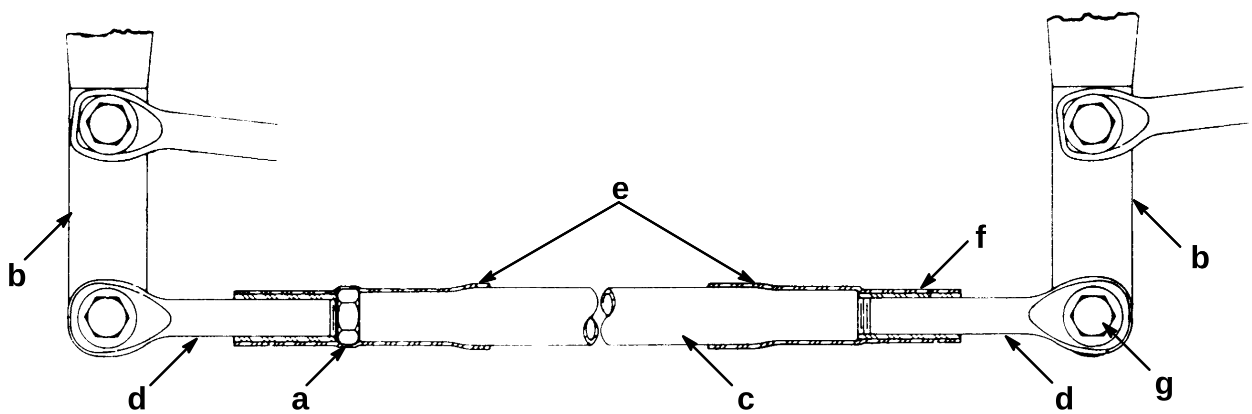
⚠ WARNING

Both steering eyes MUST BE threaded into coupler 3/4″ minimum, and jam nut (Figure 9) must be secured against coupler to prevent coupler from turning. Torque jam nut to 20 lbs. ft.



a - Rubber Bushing
b - Rubber Sleeve
c - Jam Nut; Torque to 20 lbs. ft. (27.1 N·m)
d - Coupler
e - Steering Eye

Figure 9. Coupler Assembled



a - Jam Nut; Torque to 20 lbs. ft. (27.1 N·m)
b - Engine Steering Arm
c - Coupler
d - Steering Eye
e - Rubber Sleeves
f - Rubber Bushings
g - Pivot Bolt and Locknut

Figure 10. Coupler Parts Sequence

8. Secure coupler with jam nut, as shown in Figures 9 and 10, and torque to 20 lbs. ft. (27.1 N·m).
9. Position rubber bushings as shown above.
10. Slide both rubber sleeves over exposed threads on each steering eye (Figure 10).

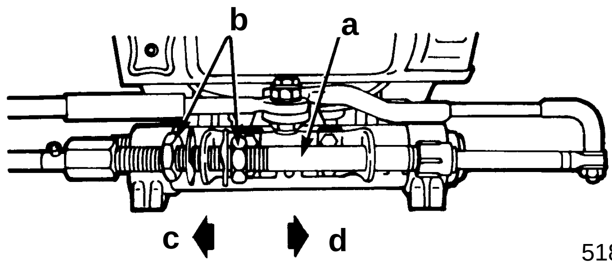
⚠ WARNING

Tension adjustment – steering cable mounting tube must be adjusted away from end of steering cable when adding tension to steering system (to remove slack). Failure to adjust tube this way may result in hard steering, if one engine is tilted up while operating boat.

Steering System Tension Adjustment (Parallel Routed Steering Cables)

IMPORTANT: After this Ride-Guide Attachment Kit is installed, there must be proper tension in the steering system. Not enough tension will cause slack (play) in steering system. Too much tension will cause steering cables to bind. Perform Step 1, following, to adjust for correct tension.

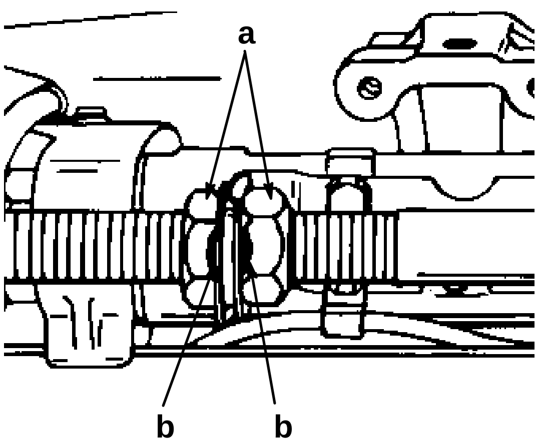
1. Loosen adjustment nuts and push steering cable mounting tube (by-hand) toward end of steering cable (to remove slack in steering system). Tighten adjustment nuts and check system for slack (play) or too much tightness. If steering system is too tight, readjust tube away from end of steering cable (Figure 11) or, if too much slack (play) exists in system, readjust tube toward end of steering cable (Figure 11). Tighten nuts and readjust, if necessary.



a - Steering Cable Mounting Tube
b - Adjustment Nuts
c - Adjust Tube in This Direction to Remove Slack from Steering System
d - Adjust Tube in This Direction to Reduce Tightness from Steering System

Figure 11. Steering System Tension Adjustment (Parallel Routed Steering Cables)

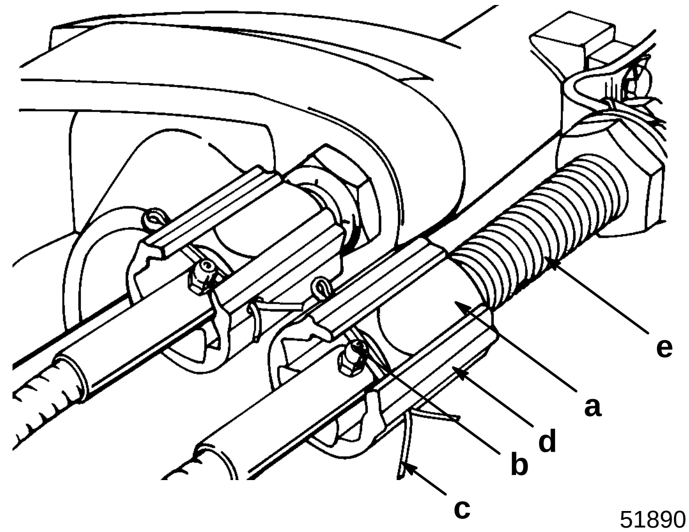
2. After steering system tension is adjusted correctly, torque adjustment nuts (Figure 12) to 35 lbs. ft. (47.5 N·m) and bend a tab lockwasher against a flat on each nut.



a - Adjustment Nuts - Torque to 35 lbs. ft. (47.5 N·m)
b - Tab Lockwasher (Bend Against Flat on Each Nut.)

Figure 12. Adjustment Nuts Secured with Locktabs

3. Secure each steering cable attaching nut to tubes by torquing steering cable attaching nuts (Figure 13) to 35 lbs. ft. (47.5 N·m).
4. Install rubber bumpers on inside of locking sleeves, then install a locking sleeve over each steering cable attaching nut and secure with cotter pin. Spread ends of cotter pin. Be sure to install cotter pin so that it is located in-between attaching nut and grease fitting (Figure 13).



a - Steering Cable Attaching Nut -Torque to 35 lbs. ft. (47.5 N·m)
b - Grease Fitting
c - Cotter Pin
d - Locking Sleeve
e - Cable Mounting Tube

Figure 13. Steering Cables Fastened to Tubes

5. Install new trim tabs as outlined in “Trim Tab Installation,” following.

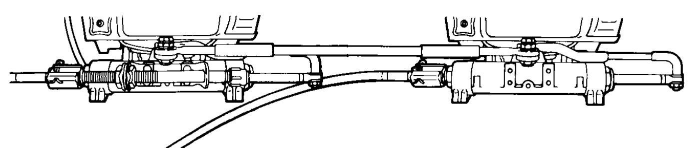


Figure 14. Attachment Kit Installation Complete

⚠ WARNING

After installation is complete (and before operating engine), 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 thru full range (left and right) at all tilt angles to assure interference-free movement.

Opposite Side Routed Steering Cables and Attaching Kit Installation

(ONE CABLE ROUTED DOWN STARBOARD SIDE OF BOAT AND ONE CABLE ROUTED DOWN PORT SIDE OF BOAT)

IMPORTANT: Steering cable must be installed into tilt tube of “port” engine before engine is mounted.

Super Ride-Guide Steering Kit Installation

Install Super Ride-Guide Steering Kit in accordance with instructions included with Super Ride-Guide Kit.

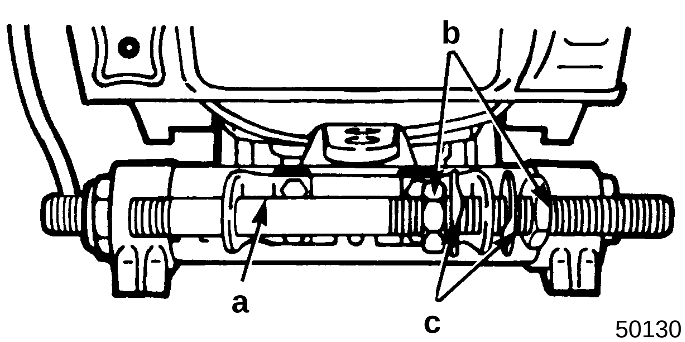
Installing Steering Cables and Steering Link Rods to Engines

1. Install tube mounting bracket to (starboard) mounted engine with 2 locking retainers and 4 bolts. Torque bolts to 100 lbs. in. (11.3 N·m) and bend end of locking retainers up against flat on each bolt, as shown in Figure 1.

⚠ WARNING

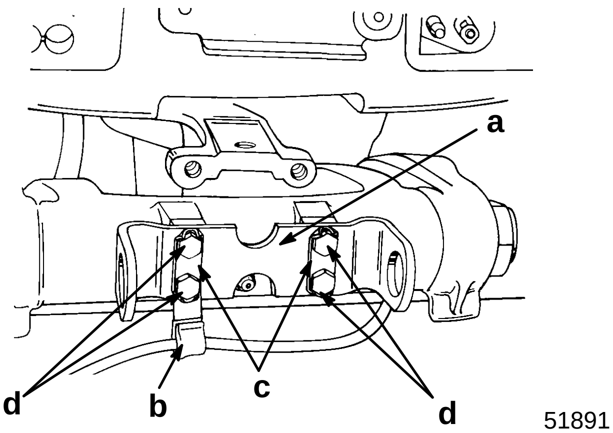
Locking retainer ends must be bent up and against flat on each bolt, that secures tube mounting bracket to engine, to prevent bolts from turning out.

2. Install steering cable mounting tube into mounting bracket with 2 adjustment nuts and tab lockwashers, as shown in Figure 2. Be sure that longer threaded end of tube is toward steering cable attaching nut side of engine.
3. Temporarily adjust tube so that longer, threaded end of tube is aligned with outward edge of transom bracket. DO NOT tighten adjustment nuts at this time.



a - Tube Mounting Bracket
b - Bolts
c - Locking Retainers (Bend Ends Up and Against Flat on Bolts.)

Figure 1. Tube Mounting Bracket Installed



a - Mounting Bracket for Steering Cable Mounting Tube
b - “J” Clip - Supplied with Outboard
c - Locking Retainers (2)
d - Bolts (4) - 5/8 in. (16mm) Long - Torque to 100 lb. in. (11.3 N·m), then Bend Corner Tabs of Locking Retainers Up and Against Flats on Each Bolt

Figure 2. Steering Cable Mounting Tube Installed

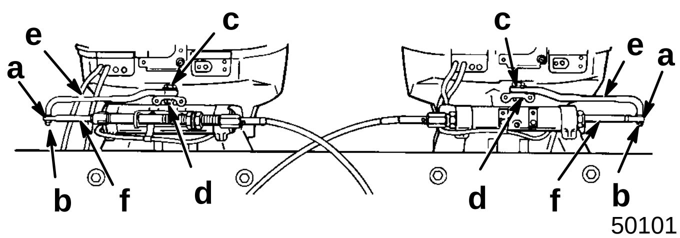
4. Install steering cables, as follows:

IMPORTANT: Lubricate inside of (port mounted) engine tilt tube and inside of steering cable mounting tube with Quicksilver 2-4-C w/Teflon. Make sure that rubber O-ring seal (located in engine tilt tube) is lubricated.

a. Lubricate inside of (port) engine tilt tube with Quicksilver 2-4-C w/Teflon. Make sure that rubber O-ring seal (located in engine tilt tube) is lubricated.

b. Lubricate inside of steering cable mounting tube with Quicksilver 2-4-C w/Teflon.

c. Insert ends of steering cables thru engine tilt tube and cable mounting tube (Figure 3). Thread steering cable attaching nuts hand-tight onto tubes.



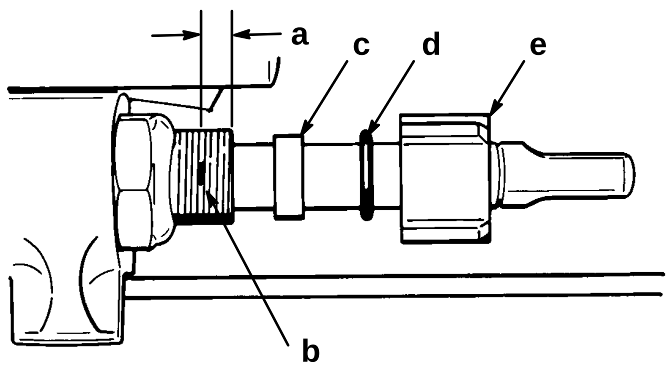
a - Flat Washer (2 Each Link Rod)
b - Nylon Insert Locknut - Torque Until it Seats [DO NOT Exceed 120 lb. in. (13.5 N·m) of Torque], then Back Off 1/4-Turn
c - Special Washer Head Bolt (10-14000) - Torque to 20 lb. ft. (27.1 N·m)
d - Nylon Insert Locknut - Torque to 20 lb. ft. (27.1 N·m)
e - Steering Link Rod
f - Steering Cable End

Figure 3. Steering Cables and Link Rod Installed

NOTE: Torque steering cables' attaching nuts and install locking sleeves after final tension adjustment.

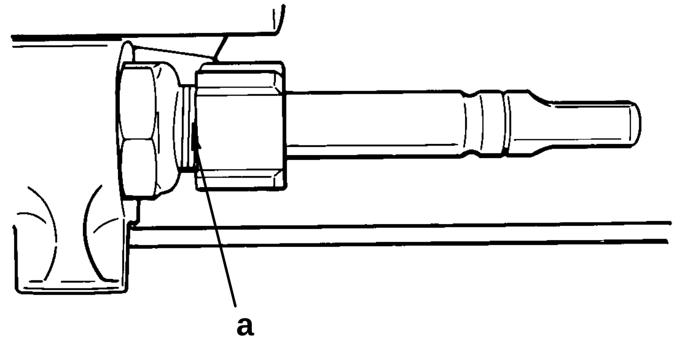
5. Install steering cable seal to steering cable mounting tube, as follows:

   a. Place a mark on steering cable mounting tube 5/8″ (16mm) from end of tube (Figure 4).



a - 5/8″ from End of Tube
b - Place Mark on Tube Here.
c - Nylon Spacer
d - O-ring
e - Cap

Figure 4. Seal Installation Sequence



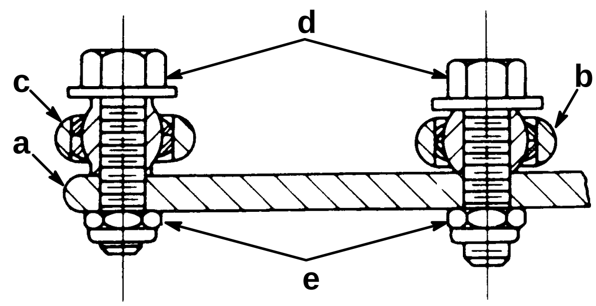
a - Mark Made in Step 5a

Figure 5. Steering Cable Seal Installed

   b. Slide plastic spacer, O-ring and cap (from kit) over steering cable (Figure 4).

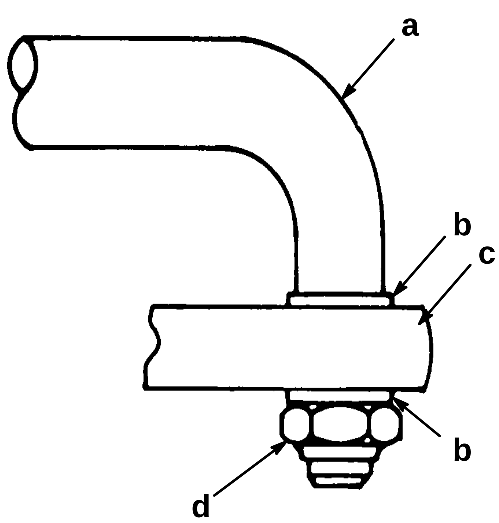
   c. Thread cap onto steering cable mounting tube up to mark (made on tube in Step "a" (Figure 5).

6. Install link rods (supplied with engines) to engine steering arms (Figure 3). Fasten each link rod to steering arm onto topside rear hole with pivot bolt and locknut, as shown in Figure 6. Torque each pivot bolt to 20 lbs. ft. (27.1 N·m), then thread lock-nut onto pivot bolt and torque nut to 20 lbs. ft. (27.1 N·m).



a - Engine Steering Arm
b - Steering Link Rod
c - Steering Eye and Coupler
d - Pivot Bolts - Torque to 20 lbs. ft. (27.1 N·m)
e - Locknuts - Torque to 20 lbs. ft. (27.1 N·m)

Figure 6. Steering Link Rod and Steering Eye with Coupler Installed on Engine Steering Arm



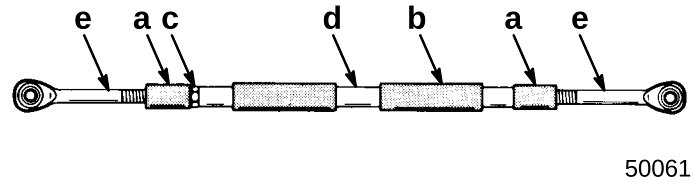
a - Steering Link Rod
b - Flat Washer (5/8″ O.D.)
c - Steering Cable End
d - Locknut; Tighten Until it Seats [DO NOT Exceed 120 lbs. in. (13.5 N·m)], then Back Nut Off 1/4-Turn.

Figure 7. Steering Link Rod Assembled on Steering Cable

7. Lubricate hole(s) in end of steering cable(s) with Multi-purpose Lubricant and assemble steering link rod(s) to steering cable end, as shown in Figure 7. Tighten self-locking nut until it seats [DO NOT exceed 120 lbs. in. (13.5 N·m)], **then back nut off 1/4-turn.**

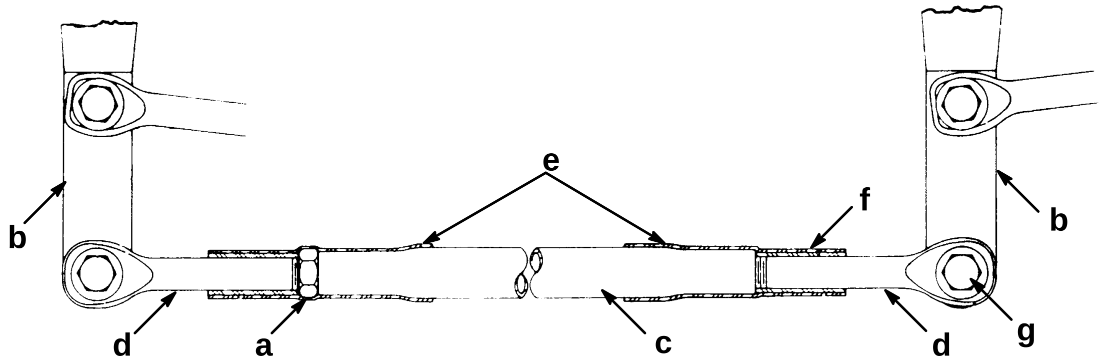
Steering Eyes and Coupler Installation

1. Position engines so that they are facing straight forward. (Distance between centers of threaded pivot bolt holes in engine steering arms must be equal to distance between propeller shaft centers.)
2. Lubricate inside of rubber sleeves (Figure 8) and slide onto coupler.
3. Slide rubber bushings (Figure 8) onto steering eyes.



a - Rubber Bushing
b - Rubber Sleeve
c - Jam Nut; Torque to 20 lbs. ft. (13.5 N·m)
d - Coupler
e - Steering Eye

Figure 8. Coupler Assembled



a - Jam Nut; Torque to 20 lbs. ft. (27.1 N·m)
b - Engine Steering Arm
c - Coupler
d - Steering Eye
e - Rubber Sleeves
f - Rubber Bushing
g - Pivot Bolt and Locknut; Torque to 20 lbs. ft. (27.1 N·m)

Figure 9. Coupler Parts Sequence

4. Thread steering eyes (Figures 8 and 9) into coupler and adjust steering eyes so that distance between centers of pivot holes in steering eyes is the same distance as between centers of threaded pivot holes in engine steering arms. Exposed steering eye threads should be equal at both ends of coupler and must not extend out of coupler more than 2-3/4″ (70mm).

⚠ WARNING

Both steering eyes must be threaded into coupler 3/4″ (19mm) minimum. Thread length of steering eye is 3-1/2″ (89mm), so exposed thread must not extend out of coupler more than 2-3/4″ (69.8mm). Failure to adhere to this requirement could result in steering system failure.

5. Lubricate steering eye threads, pivot bolts and ball joints with Quicksilver Corrosion Grease (92-78376-12) or Corrosion Guard (92-78379-12) before assembling.
6. Assemble steering eyes and coupler to top side front holes of steering arm with pivot bolts and locknuts, as shown in Figures 6 and 9.

IMPORTANT: With steering eyes and coupler installed and before tightening pivot bolts, check engine alignment. Distance between pivot bolts' centers and distance between propeller shaft centers must be equal for proper steering. If adjustment is necessary, remove pivot bolt from one steering eye and turn eye in or out to correct alignment. Both steering eyes MUST BE threaded into coupler 3/4″ (19mm) minimum.

7. Torque pivot bolts to 20 lbs. ft. (27.1 N·m), then thread self-locking nut onto bolts and torque nuts to 20 lbs. ft. (27.1 N·m).

⚠ WARNING

Both steering eyes MUST BE threaded into coupler 3/4″ minimum, and jam nut (Figures 8 and 9) must be secured against coupler to prevent coupler from turning. Torque jam nut to 20 lbs. ft. (13.5 N·m).

8. Secure coupler with jam nut, as shown in Figure 9. Torque to 20 lbs. ft. (27.1 N·m).
9. Position rubber bushings as shown above.
10. Slide both rubber sleeves over exposed threads on each steering eye (Figure 9).

⚠ WARNING

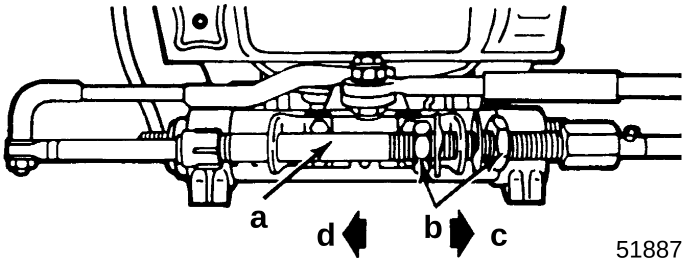
Tension adjustment – steering cable mounting tube must be adjusted away from end of steering cable when adding tension to steering system (to remove slack). Failure to adjust tube this way may result in hard steering, if one engine is tilted up while operating boat.

Steering System Tension Adjustment

OPPOSITE SIDE ROUTED STEERING CABLES

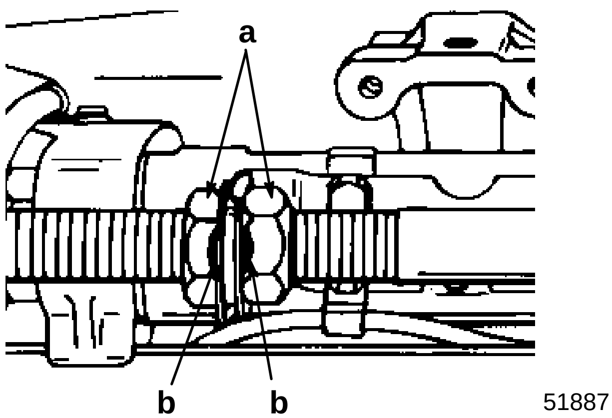
IMPORTANT: After this Ride-Guide Attachment Kit is installed, there must be proper tension in the steering system. Not enough tension will cause slack (play) in steering system. Too much tension will cause steering cables to bind. Perform Step 1, following, to adjust for correct tension.

1. Loosen adjustment nuts and pull steering cable mounting tube (by hand) away from end of steering cable (to remove slack in steering system). Tighten adjustment nuts and check system for slack (play) or too much tightness. If steering system is too tight, readjust tube toward end of steering cable (Figure 10) or, if too much slack (play) exists in system, readjust tube away from end of steering cable (Figure 10). Tighten nuts and readjust, if necessary.



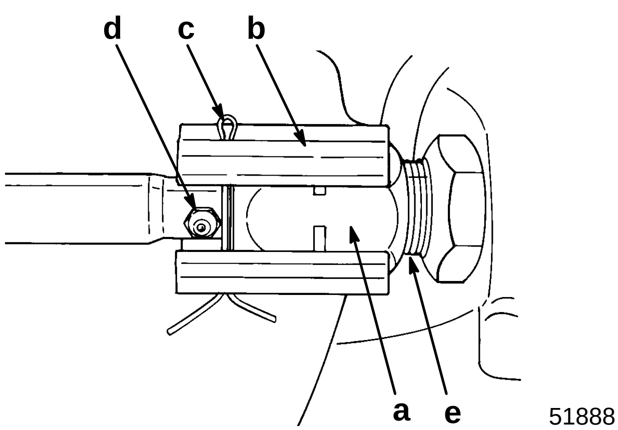
a - Steering Cable Mounting Tube
b - Adjustment Nuts
c - Adjust Tube in This Direction to Remove Slack from Steering System
d - Adjust Tube in This Direction to Reduce Tightness from Steering System

Figure 10. Steering System Tension Adjustment (Opposite Side Routed Steering Cables)



a - Adjust Nuts; Torque to 35 lbs. ft. (47.5 N·m)
b - Tab Lockwashers (Bend Against Flat on Each Nut.)

Figure 11. Adjustment Nuts Secured with Locktabs



a - Steering Cable Attaching Nut;Torque to 35 lbs. in. (47.5 N·m)
b - Locking Sleeve (Provided with Ride-Guide Steering Cables)
c - Cotter Pin
d - Grease Fitting
e - Cable Guide Tube

Figure 12. Steering Cables Fastened to Tubes

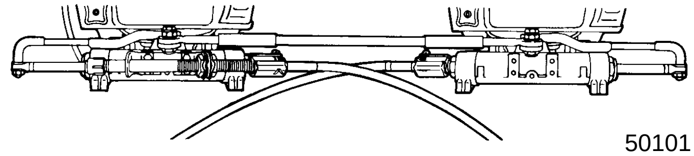


Figure 13. Attachment Kit Installation Complete

2. After steering system tension is adjusted correctly, torque adjustment nuts (Figure 11) to 35 lbs. ft. (47.5 N·m) and bend a tab lockwasher against a flat on each nut.

3. Secure each steering cable attaching nut to tubes by torquing steering cable attaching nuts (Figure 12) to 35 lbs. ft. (47.5 N·m).

4. Install rubber bumpers on inside of locking sleeves, then install a locking sleeve over each steering cable attaching nut and secure with cotter pin. Spread ends of cotter pin. Be sure to install cotter pin so that it is located in-between attaching nut and grease fitting (Figure 12).

5. Install new trim tabs as outlined in “Trim Tab Installation,” following.

⚠ WARNING

After installation is complete (and before operating engine), 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 thru full range (left and right) at all tilt angles to assure interference-free movement.

Trim Tab Installation

IMPORTANT: With dual engine installation, existing trim tabs MUST BE replaced with new trim tabs (supplied with kit).

1. Install new trim tabs as follows:

   a. Shift engine controls into neutral and turn ignition keys to “Off” position.

   b. Remove plastic cap from rear of both drive shaft housings, loosen bolt, that secures trim tab to gear housing, and remove both trim tabs from gear housing.

   c. Install special trim tabs (supplied with kit) to both gear housings, using existing bolts. Tighten bolts securely. Initial trim tab setting should be straight to rear of engine. Replace plastic caps on drive shaft housing.

2. Check trim tab position as follows:

   a. Operate boat at normal cruise throttle setting and adjust trim to optimum setting. Turn steering wheel to left and right, noting in which direction wheel turns more easily.

   b. If wheel turns more easily to left, then the trailing edge of trim tab must be turned to left (when viewing motor from behind). Reverse procedure if boat turns more easily to right.

Trim Tab Adjustment

1. Shift engine controls into neutral and turn ignition keys to “Off” position.

IMPORTANT: Trim tabs MUST BE set in the same position on both engines.

2. Remove plastic cap from rear of drive shaft housing and loosen bolt and trim tab.
3. Position trailing edge of trim tab to left (viewing motor from behind), if steering wheel turns more easily to left. Position trailing edge of trim tab to right (viewing motor from behind), if steering wheel turns more easily to right.
4. Tighten both trim tab bolts securely and replace plastic caps.
5. Operate boat per “Check trim tab position as follows,” preceeding, to check trim tab setting. Readjust trim tabs, if necessary.

Maintenance Instructions

Maintenance inspection is owner’s responsibility and must be performed at intervals specified, following:

Normal Service – Every 50 hrs. of operation or 60 days (whichever comes first)

***Severe Service –** Every 25 hrs. of operation or 30 days (whichever comes first)

* Operation in a salt water area is considered **“Severe Service.”**

1. Carefully check steering system components for wear. Replace worn parts.
2. Check steering system fasteners to be sure that they are torqued to correct specifications.

NOTE: Ride-Guide steering cables are lubricated at the factory and require no additional lubrication at initial installation.

⚠ WARNING

Core of each steering cable (transom end) must be fully retracted into cable housing before lubricating cable. If cable is lubricated while extended, hydraulic lock of cable could occur.

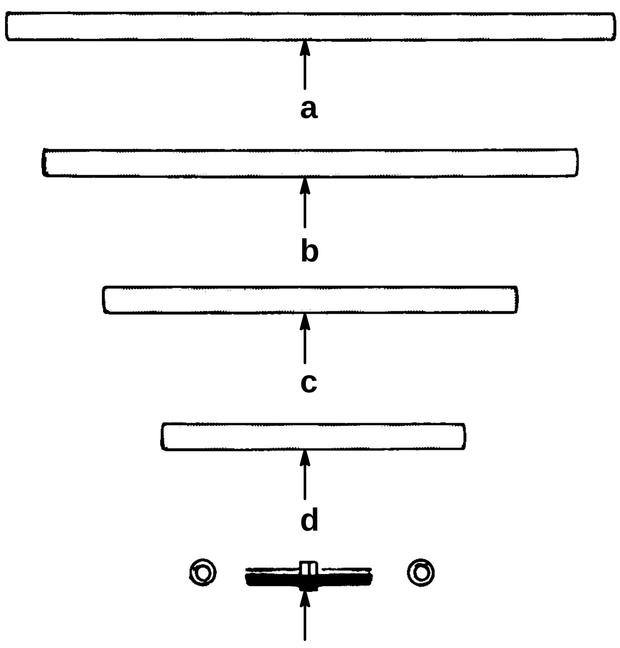
3. With core of Ride-Guide steering cables (transom end) fully retracted, lubricate transom end of steering cables thru grease fittings (Figure 12) with Quicksilver 2-4-C w/Teflon. Lubricate exposed portion of cable end with 2-4-C w/Teflon.
4. Lubricate pivot points and ball joints in link rods and coupler steering eyes with Quicksilver Anti-Corrosion Grease or Corrosion Guard.
5. Inspection and lubrication of steering head assembly (rotary or straight rack) should be performed once each year (by your Authorized Dealer) or whenever steering mount and/or steering head are disassembled, or if steering effort has increased. Lubricate with Quicksilver 2-4-C w/Teflon.

⚠ WARNING

When 2 couplers are connected together with coupler link rod, a lockwasher must be used on each side of coupler link rod, and link rod must be torqued to 20 lbs. ft. (27.1 N·m) into end of each coupler.

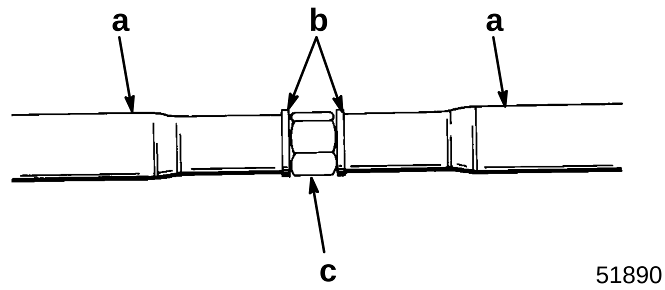
Ride Guide Steering Attachment Extension Couplers

Outboard Center Line Distance	Required Coupler(s) Between Steering Eyes (Shown Below)
22-1/2 in. thru 24-1/2 in. (57.2cm thru 62.2cm)	12 in. (30.5cm) Coupler
23-1/2 in. thru 27-1/2 in. (59.7cm thru 69.9cm)	15 in. (38.1cm) Coupler (Supplied with this kit)
26-1/2 in. thru 30-1/2 in. (67.3cm thru 75.5cm)	18 in. (45.7cm) Coupler
30 in. thru 34 in. (76.3cm thru 86.4cm)	9 in. (22.9cm) Coupler and 12 in. (30.5cm) Coupler (Connected together with coupler link rod)
33 in. thru 37 in. 83.8cm thru 94.0cm	12 in. (30.5cm) Coupler and 12 in. (30.5cm) Coupler (Connected together with coupler link rod)



a - 18 in. (45.7cm) Coupler (97932-3)
b - 15 in. (38.1cm) Coupler (97932-2)
c - 12 in. (30.5cm) Coupler (97932-1)
d - 9 in. (22.9cm) Coupler (97932-4)
e - Coupler Link Rod (98181A1)

Figure 14.



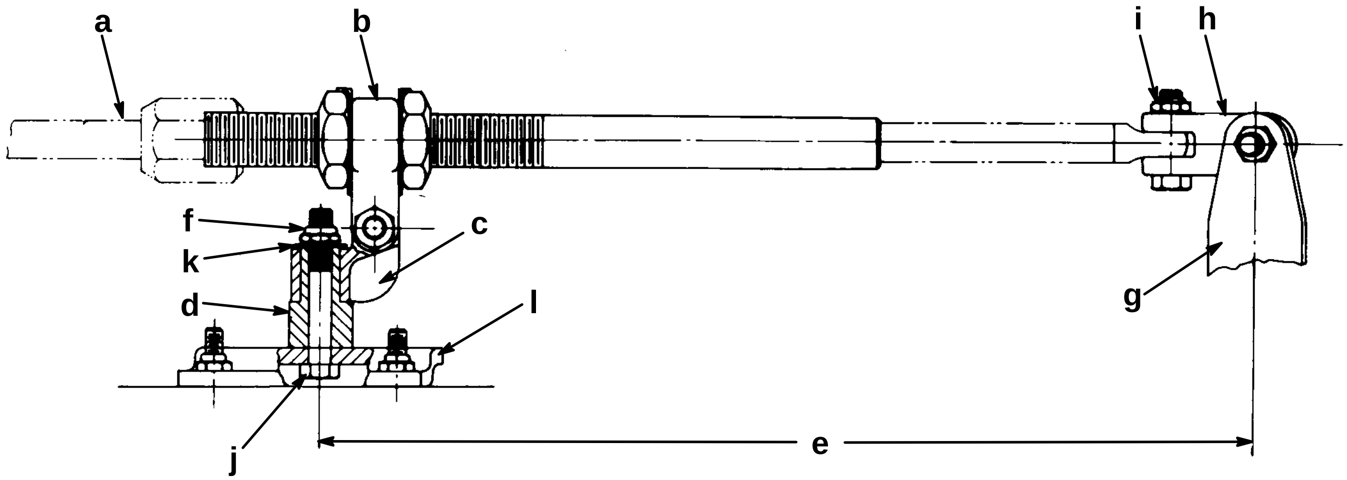
a - Couplers Connected Together
b - Lockwashers
c - Coupler Link Rod - Torque to 20 lbs. ft. (27.1 N·m) into End of Each Coupler.

Couplers Connected Together with Coupler Link Rod

Transom Mounted Ride-Guide Attaching Kit Installation (73770A1)

Attaching Kit Installation

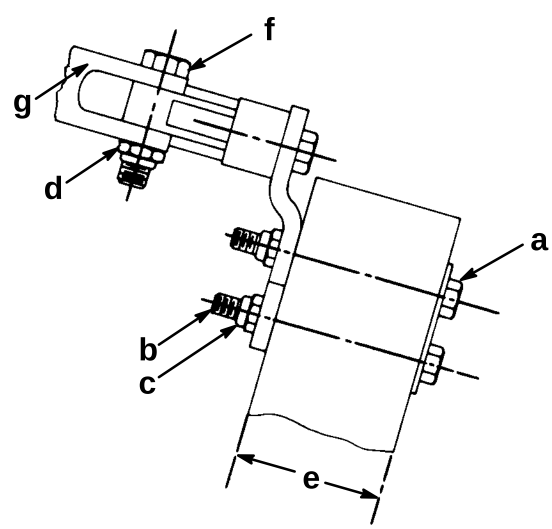
1. Lubricate both holes in pivot block (Figure 1) with Quicksilver 2-4-C w/Teflon.
2. Place pivot block on pivot spacer and secure to transom bracket with 3/8 in. x 2-1/2 in. (9.5mm x 63.5mm) bolt, flat washer and locknut, as shown in Figure 1. Torque locknut to 20 lbs. ft. (27.1 N·m).



a - Ride-Guide Cable
b - Ride-Guide Yoke
c - Pivot Block
d - Pivot Spacer
e - 15 in. (38.1cm) (Centerline of Attaching Kit Pivot to Centerline of Outboard)
f - Pivot Attaching Locknut - Torque to 20 lbs. ft. (27.1 N·m)
g - Outboard Steering Arm
h - "Clevis Kit"
i - Ride-Guide Cable Attaching Locknut - Torque to 10 lbs. ft. (13.5 N·m)
j - Bolt - 3/8 in. x 2-1/2 in. (9.5mm x 63.5mm)
k - Flat Washer
l - Transom Bracket

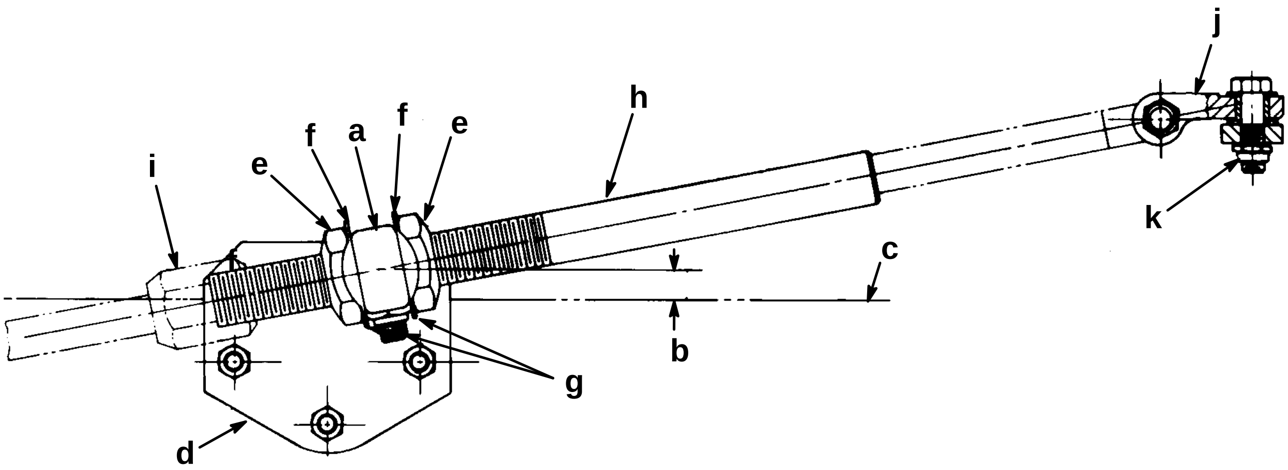
Figure 1

3. Place Ride-Guide yoke on pivot block and secure with 7/16 in. x 1-3/4 in. (11.1mm x 44.5mm) bolt and locknut, as shown in Figures 1 and 2. Torque locknut to 10 lbs. ft. (13.5 N·m), **then back off 1/4-turn.**
4. Install one cable tube jam nut onto steering cable tube. Place tab washer over Ride-Guide yoke, then insert cable tube thru tab washer and yoke. Install second cable tube jam nut onto cable tube but do not tighten at this time (Figure 3).
5. Position transom attaching kit on transom as follows:
   a. Determine centerline of outboard, then measure 15 in. (38.1cm) over from this centerline and draw a vertical line on transom (Figure 1).
   b. Position attaching kit on transom so that **transom bracket is centered on the 15 in. (38.1cm)** (Figure 1) at a height where the **center of Ride-Guide yoke is even with, or not more than 1/2 in. (12.7mm)** above top edge of transom (Figure 3).



a - Transom Backing Plate
b - Bolt - 5/16 in. x 3-1/4 in. (7.9mm x 82.5mm)
c - Locknut - Torque to 10 lbs. ft. (13.5 N·m)
d - Ride-Guide Yoke Attaching Locknut - Torque to 10 lbs. ft. (13.5 N·m) **Then Back Off 1/4-Turn.**
e - 2-3/8 in. (60.3mm) Maximum Transom Thickness
f - Bolt - 7/16 in. x 1-3/4 in. (11.1mm x 44.5mm)
g - Ride-Guide Yoke

Figure 2



a - Ride-Guide Yoke
b - 0 in. to 1/2 in. (0mm to 12.8mm) (Center of Ride-Guide Yoke to Top of Transom)
c - Top of Transom
d - Transom Bracket
e - Cable Tube Jam Nuts - Torque to 35 lbs. ft. (47.4 N·m)
f - Tab Washer
g - After Jam Nuts are Torqued to Specification, Bend Locking Tabs against Nuts.
h - Cable Guide Tube
i - Ride-Guide Cable Attaching Nut - Torque to 35 lbs. ft. (47.4 N·m)
j - "Clevis Kit"
k - Clevis Attaching Locknut - Torque to 20 lbs. ft. (27.1 N·m)

Figure 3

NOTE: When drilling thru transom, be sure that holes are drilled perpendicular to transom.

6. With attaching kit positioned as outlined preceding, use 3 holes in transom bracket as a guide and drill three 11/32 in. (8.7mm) holes thru transom.
7. Use a marine-type sealer on three 5/16 in. x 3-1/4 in. (7.9mm x 82.6mm) bolts. Secure attaching kit to transom, using transom backing plate, 3 bolts (with sealer) and 3 locknuts, installed as shown in Figure 2. Torque locknuts to 10 lbs. ft. (13.5 N·m).

STEERING CABLE INSTALLATION

1. Lubricate steering cable end with Quicksilver 2-4-C w/Teflon.
2. Install steering cable thru steering cable tube and secure to cable tube with cable attaching nut (Figure 3). Do not tighten cable attaching nut at this time.
3. Attach Ride-Guide cable to outboard steering arm, using the proper "Clevis Kit." Installation instructions for clevis are with "Clevis Kit."
4. Adjust 2 large jam nuts on cable tube of attaching kit, so that **steering wheel** is in normal straight-driving position with outboard in straight-running position. Torque each jam nut to 35 lbs. ft. (47.4 N·m), then bend a side of tab washer against flat of each jam nut (Figure 3).
5. Torque Ride-Guide cable attaching nut (which secures cable to guide tube) to 35 lbs. ft. (47.4 N·m) (Figure 3). Install locking sleeve over cable attaching nut and secure with cotter pin. Spread ends of cotter pin.

NOTE: Some Ride-Guide steering cables may not be equipped with locking sleeve and cotter pin. If cable being installed does not have these parts, disregard instructions to install them.

⚠ WARNING

After installation is completed (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 thru full range (left and right) at all tilt angles to assure interference-free movement.

Maintenance Instructions

Lubrication and maintenance inspection is owner's responsibility and must be performed at intervals specified, following:

Normal Service – Every 50 hrs. of operation or 60 days (whichever comes first)

***Severe Service –** Every 25 hrs. of operation or 30 days (whichever comes first)

* Operation in a salt water area is considered **"Severe Service."**

⚠ CAUTION

Core of steering cable must be fully retracted into cable housing when lubricating cable. If cable is lubricated while extended, hydraulic lock of cable could occur.

1. Lubricate outboard end of Ride-Guide steering cable (thru grease fitting next to cable attaching nut) with Quicksilver 2-4-C w/Teflon.

NOTE: Ride-Guide steering cable is lubricated at the factory and requires no additional lubrication at initial installation.

2. Lubricate all steering system pivot points (and exposed portion of steering cable core) with Quicksilver 2-4-C w/Teflon. Lubricate at intervals specified preceding.
3. Carefully check steering system components for wear (at intervals specified, preceding). Replace worn parts.
4. Check steering system fasteners (at intervals specified, preceding) to be sure that they are torqued to correct specifications. (Figures 1, 2 and 3).

Ride-Guide Steering Cable/Attaching Kit Installation (92876A3)

Dual Cable - Single Outboard

⚠ WARNING

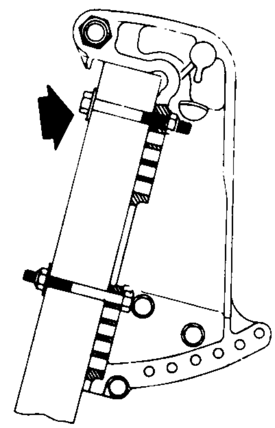
Quicksilver Super Ride-Guide Steering (dual cables) MUST BE USED with this attaching kit. Failure to adhere to this requirement could result in steering system failure.

Refer to **"Quicksilver Accessories Guide"** to determine correct length of steering cables and remote control cables.

IMPORTANT: Steering cables and 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.

⚠ CAUTION

With this kit installed, the upper (outboard) mounting bolts MUST BE installed so that hex head end of bolts is on the inside of boat transom, as illustrated. Failure to install upper mounting bolts, as shown in illustration, could result in interference between outer steering cable locking sleeve and ends of mounting bolts when outboard is tilted up.

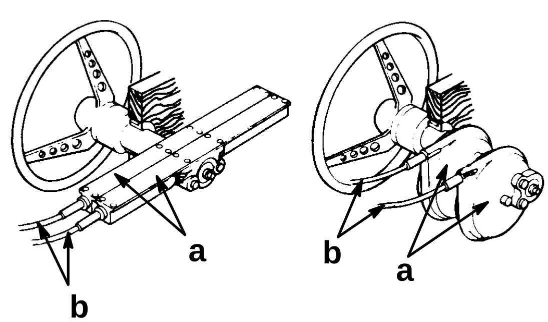


Install upper bolts so that hex head end of bolts is on the inside of boat transom.

Super Ride-Guide Steering Kit Installation

IMPORTANT: Both gear racks or rotary steering heads must be installed so that both steering cables will be routed together on the same side of the boat and will push-and-pull together.

1. Install Super Ride-Guide Steering Kit in accordance with instructions included with Super Ride-Guide Kit.
2. Make sure that both gear racks or rotary steering heads are installed so that both steering cables are routed together down starboard side of boat and will push-and-pull together.



a - Straight Rack (Left); Rotary Steering (Right)
b - Steering Cables (Install so that Both Cables Will Push-and-pull Together.)

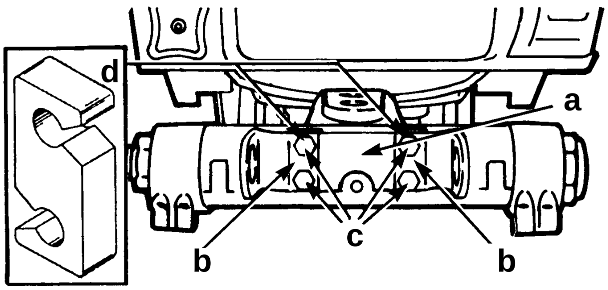
Mounting Bracket Installation

IMPORTANT: Spacers (d) must be installed between engine and mounting bracket.

1. Install mounting bracket (a) to engine with 2 spacers (d), 2 locking retainers (b) and 4 bolts (c). Torque bolts to 100 lb. in. (11.3 N·m) and bend end of locking retainers up and against flat on each bolt, as shown.

⚠ WARNING

The locking retainer ends must be bent up and against flat on each bolt, that secures mounting bracket engine, to prevent bolts from turning out.



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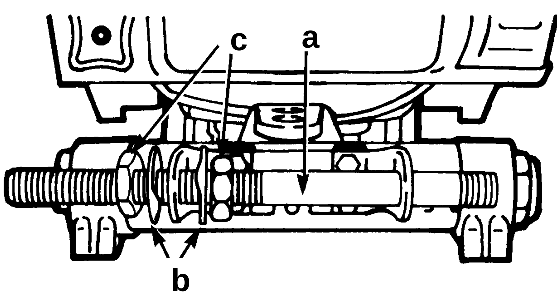
2. Install steering cable mounting tube (a) into mounting bracket with 2 adjustment nuts (c) and locking tab washer (b), as shown. Be sure that longer, threaded end of tube is toward steering cable attaching nut side of engine.
3. Temporarily adjust tube so that longer, threaded end of tube is extended out the same distance as engine tilt tube. Do not tighten adjustment nuts at this time.



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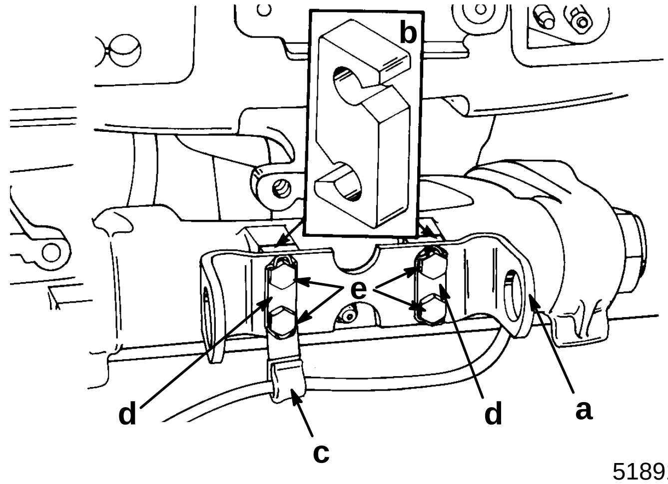
Steering Cable Mounting Tube Installation

IMPORTANT: Spacers (b) must be installed between outboard swivel bracket and mounting bracket for steering cable mounting tube to provide proper spacing between steering cables.

Secure mounting bracket for steering cable mounting tube on to swivel bracket of outboard.



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a - Mounting Bracket for Steering Cable Mounting Tube
b - Spacer (2)
c - "J" Clip (Supplied with Outboard.)
d - Locking Retainer (2)
e - Bolts (4) - 7/8 in. (22.2mm) Long - Torque to 100 lb. in. (11.3 N·m), then Bend Corner Tabs of Locking Retainers Up and Against Flats on Each Bolt.

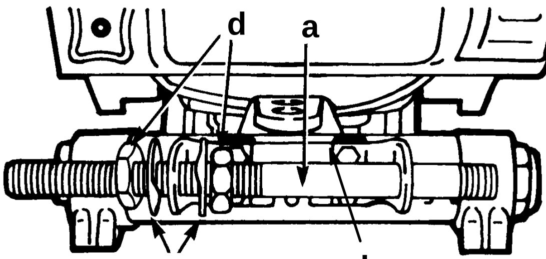
⚠ WARNING

Locking retainer corner tabs, MUST BE bent up and against flats on each bolt that secures mounting bracket for steering cable mounting tube to outboard swivel bracket, to prevent bolts from turning out.

COUPLER INSTALLATION

Install steering cable mounting tube into mounting bracket with 2 adjusting nuts and 2 locking tab washers. Verify longer threaded end of tube is toward starboard side of boat.

Temporarily adjust tube so that longer threaded end of tube extends out the same distance as the outboard tilt tube. Do not tighten adjustment nuts at this time.



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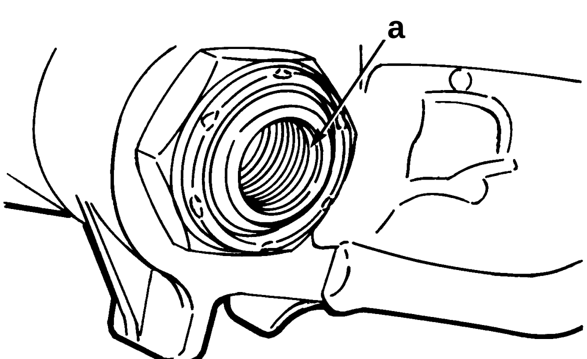
a - Steering Cable Mounting Tube (End of Tube with Longer Threads Toward Starboard Side of Boat)
b - Mounting Bracket
c - Locking Tab Washers (2)
d - Adjustment Nuts (Flats of Nuts Facing Toward Locking Tab Washer)

Installing Steering Cables

IMPORTANT: Lubricate inside of outboard tilt tube, inside of steering cable mounting tube and rubber O-ring seal (located in outboard tilt tube) with Quicksilver 2-4-C w/Teflon before installing steering cables.

Lubricate inside of outboard tilt tube and inside of steering cable mounting tube with Quicksilver 2-4-C w/Teflon. Verify rubber O-ring seal (located in outboard tilt tube) is lubricated.



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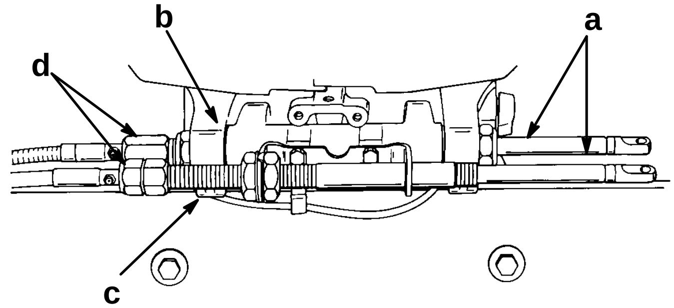
a - Seal

Insert steering cable ends thru outboard tilt tube and cable mounting tube. Thread steering cable attaching nuts on to tubes hand tight.

Torque steering cable attaching nuts only after final steering adjustments have been made.



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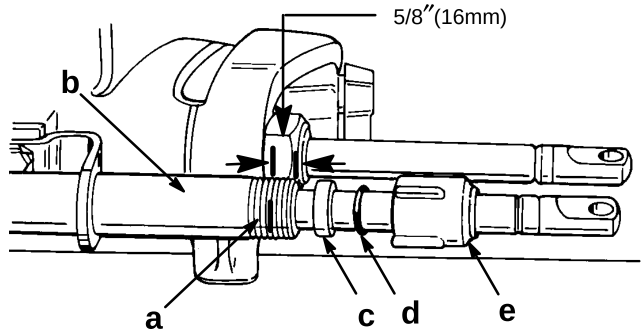
a - Steering Cable Ends
b - Outboard Tilt Tube
c - Cable Mounting Tube
d - Cable Attaching Nuts

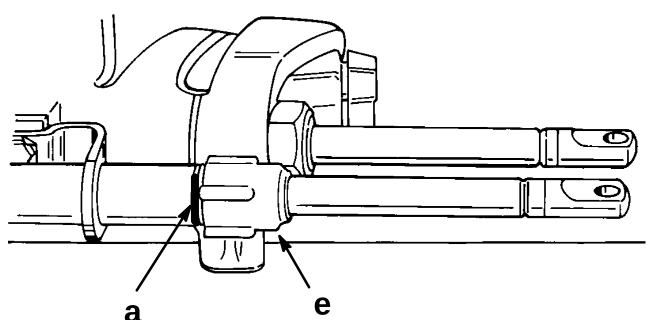
Place a mark on steering cable mounting tube 5/8 in. (16mm) from end of mounting tube. Slide plastic spacer, O-ring and cap over steering cable.



51890

a - Mark
b - Steering Cable Tube
c - Spacer
d - O-ring
e - Cap

Thread cap (e) onto steering cable mounting tube, up to mark (a).



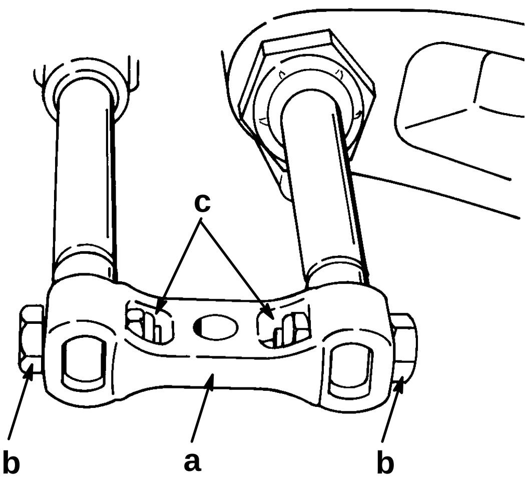
51890

Coupler Installation

⚠ WARNING

Locknuts must be used with bolts to secure steering cables to coupler. Failure to adhere to this requirement could result in steering system failure.

Slide coupler onto steering cable ends and secure each steering cable to coupler with bolt and locknut as shown. Tighten to a torque of 20 lb. ft. (27.1 N·m).



51888

a - Coupler
b - Bolt
c - Locknut

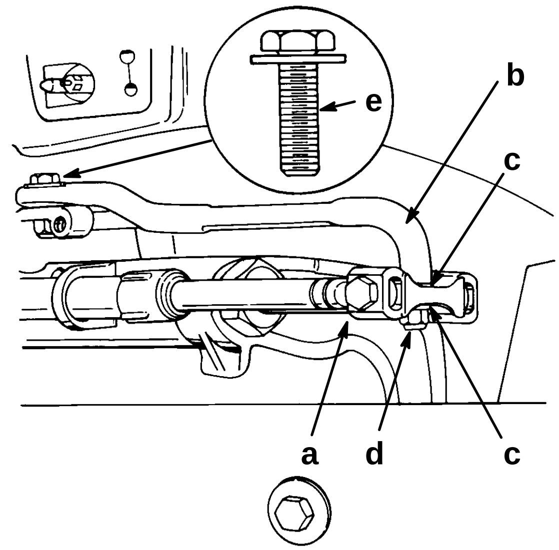
Installing Link Rod

⚠ WARNING

Steering link rod MUST BE secured between outboard steering arm and steering coupler, using special washer head bolt (10-14000) and two nylon insert locknuts (11-34863), as shown. Both special washer head bolt and nylon insert locknuts MUST BE tightened as specified.

Lubricate hole in steering coupler, with Quicksilver 2-4-C w/Teflon. Assemble steering link rod to steering coupler, using 2 flat washers (one each side of coupler) and nylon insert locknut. Tighten locknut until it seats [DO NOT exceed 120 lb. in. (13.5 N·m) of torque], then back nut off 1/4 turn.

Lubricate ball joint in steering link rod with SAE 30W Motor Oil. Secure link rod to outboard steering arm, using special washer head bolt (10-14000) provided and nylon insert locknut as shown. Torque special bolt to 20 lb. ft. (27.1 N·m), then torque locknut to 20 lb. ft. (27.1 N·m).



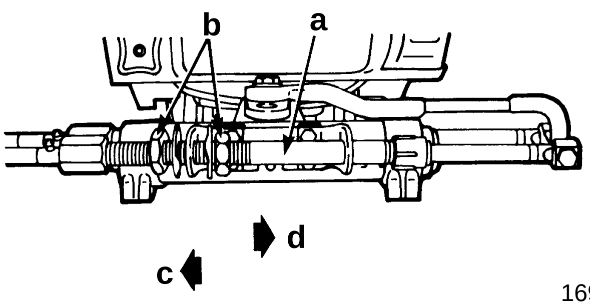
51790

a - Steering Coupler
b - Steering Link Rod
c - Flat Washer (2)
d - Nylon Insert Locknut - Torque until it seats [DO NOT exceed 120 lb. in. (13.5 N·m) of torque], then back nut off 1/4 turn.
e - Special Washer Head Bolt (10-14000) - Torque to 20 lb. ft. (27.1 N·m)

STEERING SYSTEM TENSION ADJUSTMENT

IMPORTANT: After this dual steering cable attachment kit is installed, there must be proper tension in forward mounted steering cable for this attachment kit to operate properly. Not enough tension will cause slack (or play) in steering system. Too much tension will cause steering cables to bind. Perform the following steps to adjust for correct tension.

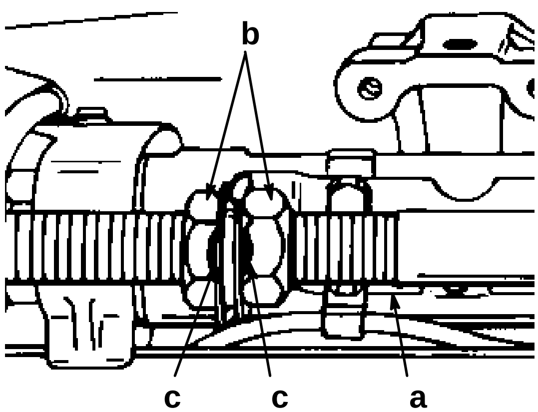
Loosen adjustment nuts and pull steering cable mounting tube (by hand) away from end of steering cable (to remove slack in steering system). Tighten adjustment nuts against mounting bracket and check system for slack (play). If steering system is too tight, readjust tube toward end of steering cable or, if too much slack (play) exists in system, readjust tube away from end of steering cable. Tighten nuts against mounting bracket and readjust, if necessary.



16961

a - Steering Cable Mounting Tube
b - Adjustment Nuts
c - Adjust Tube in This Direction to Remove Slack from Steering System.
d - Adjust Tube in This Direction to Reduce Tension from Steering System.

After steering system tension is adjusted correctly, tighten adjustment nuts against mounting bracket, to a torque of 35 lb. ft. (47.4 N·m) and bend a tab lock washer against a flat on each nut.

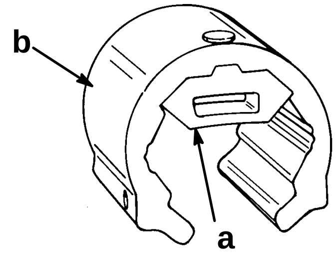


51887

a - Steering Cable Mounting Tube
b - Adjustment Nuts; Torque to 35 lb. ft. (47.4 N·m)
c - Tab Lock Washer (Bend Against Flat on Each Adjustment Nut)

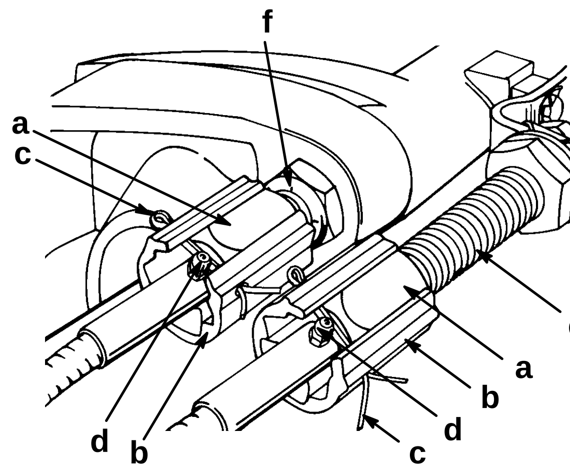
Tighten steering cable attaching nuts of each steering cable to a torque of 35 lb. ft. (47.4 N·m).

Install rubber bumpers (a) on inside of each locking sleeve (b).

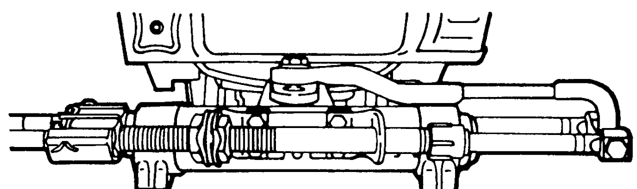


51889

Install locking sleeves over steering cable attaching nuts and secure with cotter pins. Spread ends of cotter pins. Be sure to install cotter pin so that it is located in between attaching nut and grease fitting.



51890



51452

a - Steering Cable Attaching Nut - Torque to 35 lb. ft. (47.4 N·m)
b - Locking Sleeve (If So Equipped)
c - Cotter Pin
d - Grease Fitting
e - Steering Cable Mounting Tube
f - Outboard Tilt Tube

⚠ WARNING

After installation is complete (and before operating outboard(s), 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 thru full range (left and right) at all tilt angles to assure interference-free movement.

Maintenance Instructions

Maintenance inspection is owner's responsibility and must be performed at intervals specified, following:

Normal Service – Every 50 hrs. of operation or 60 days (whichever comes first)

***Severe Service** – Every 25 hrs. of operation or 30 days (whichever comes first)

* Operation in a salt water area is considered **"Severe Service."**

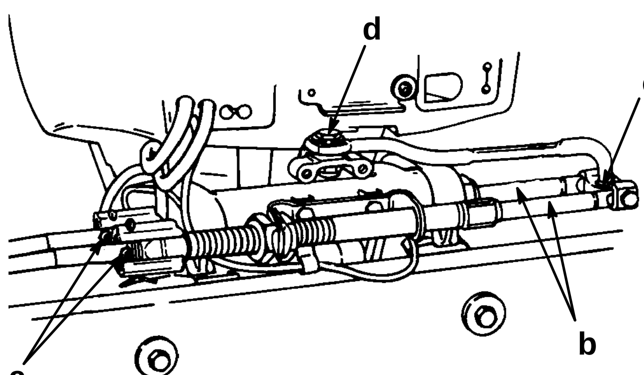
1. Carefully check steering system components for wear. Replace worn parts.
2. Check steering system fasteners to be sure that they are torqued to correct specifications.

Ride-Guide steering cables are lubricated at the factory and require no additional lubrication at initial installation.

⚠ WARNING

Core of each steering cable (transom end) must be fully retracted into cable housing before lubricating cable. If cable is lubricated while extended, hydraulic lock could occur.

3. With core of Ride-Guide steering cable (transom end) fully retracted, lubricate transom end of steering cables thru grease fittings with 2-4-C w/ Teflon. Lubricate exposed portion of cable ends with 2-4-C w/Teflon.
4. Lubricate pivot point of steering link rod and ball joint of link rod/steering coupler with SAE 30W Motor Oil.
5. Inspection and lubrication of steering head assembly (rotary or straight rack) should be performed once each year (by your Authorized Dealer) or whenever steering mount and/or steering head are disassembled, or if steering effort has increased. Lubricate with 2-4-C w/Teflon.



50135

a - Grease Fitting
b - Cable Ends
c - Pivot Point
d - Ball Joint

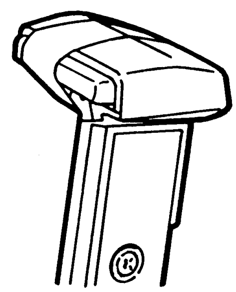
Remote Control Installation

Shift Cable Installation and Adjustment to Engine

IMPORTANT: Install control cables to remote control and mount remote control BEFORE attaching control cables to engine.

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

If remote control has a neutral lock release, secure the release in the depressed position using a piece of tape, as shown. Now you can locate the true neutral detent.

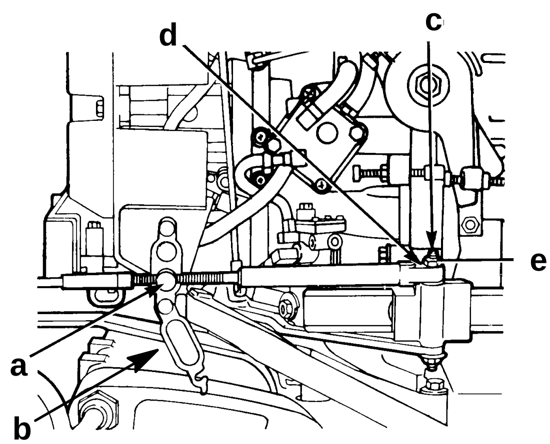


22752

NOTE: Rotate remote control handle back and forth. You will feel three detent positions; center detent is neutral.

1. Position remote control handle in neutral detent.
2. Manually shift engine into neutral (propeller will rotate freely).

3. Adjust cable barrel to attain the same length between cable barrel and hole in end of cable guide as exists between barrel retainer and shift actuator stud, with a slight preload toward reverse.
4. Place end of shift cable on shift actuator stud then place plastic washer on stud and secure with locknut.
5. If used, remove tape from control handle.
6. Check shift cable adjustment as follows:
   a. **Shift remote control into forward gear**. Now, check prop shaft. The shaft should not be able to turn counterclockwise. If it does, adjust cable barrel closer to cable end guide.
   b. **Shift remote control into neutral**. The prop shaft now should turn freely without drag. If not, adjust cable barrel away from cable end guide. Repeat steps a and b.
   c. **Shift remote control into reverse as the prop shaft is rotated by hand**. The prop shaft should not be able to turn in either direction. If it does, adjust cable barrel away from cable end guide. Repeat steps a thru c.
   d. **Shift remote control into neutral**. The prop shaft should turn freely without drag. If not, adjust cable barrel closer to cable end guide. Repeat steps a thru d.

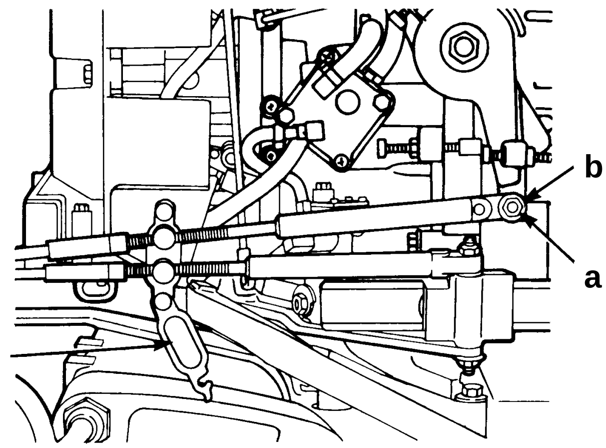


22888

a - Cable Barrel
b - Barrel Retainer
c - Shift Actuator Stud
d - Plastic Washer
e - Locknut

Throttle Cable Installation and Adjustment to Engine

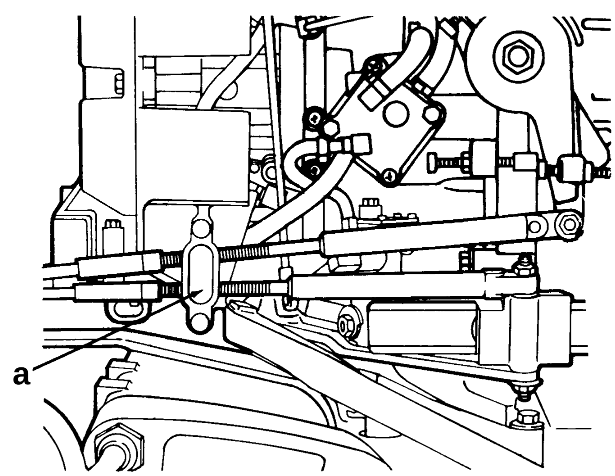
1. Shift remote control into neutral.
2. Attach end of throttle cable to stud on throttle lever and secure with locknut as shown. Be sure to first put on the cable end, then the plastic washer and finally the locknut. Snug up the locknut and then back off 1/4-turn.



22888

a - Locknut
b - Plastic Washer

3. Hold engine throttle lever against idle stop. Adjust brass barrel so that there will be a slight preload of throttle lever against the idle stop. Lock brass barrels in place with barrel retainer.
4. Proper preload on throttle cable can be checked by placing a piece of paper between idle stop screw and idle stop. Preload is correct when the paper can be removed without tearing but has some drag on it. If necessary, readjust brass barrel.



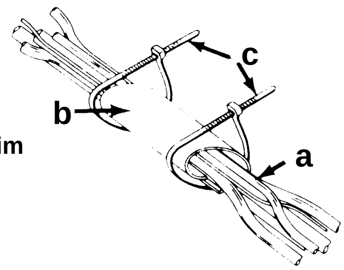
18432

a - Barrel Retainer

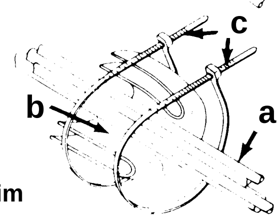
Connecting Engine Wiring Harness and Routing of Engine Cables

⚠ WARNING

Wiring passing through cowl must be protected from damage by using a neoprene sheet as shown. Failure to protect wiring could cause chafing or cuts in wiring resulting in electrical system failure and/or possible bodily injury.



Models with Power Trim



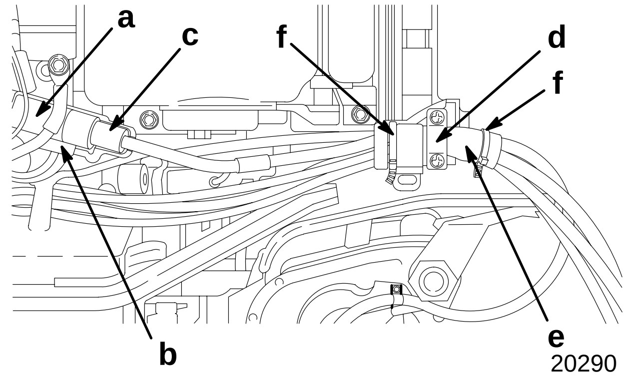
Models without Power Trim

a - Wiring Harness
b - Neoprene Sheet
c - Sta-Straps

1. Plug remote control harness connector into engine harness connector, then secure connector in place with retainer as shown.

IMPORTANT: On Models without Power Trim, the neoprene sheet must be folded once and then wrapped around cables as shown.

2. Wrap neoprene sheet around cable bundle and secure each end with a sta-strap. Secure to bracket with retainer.

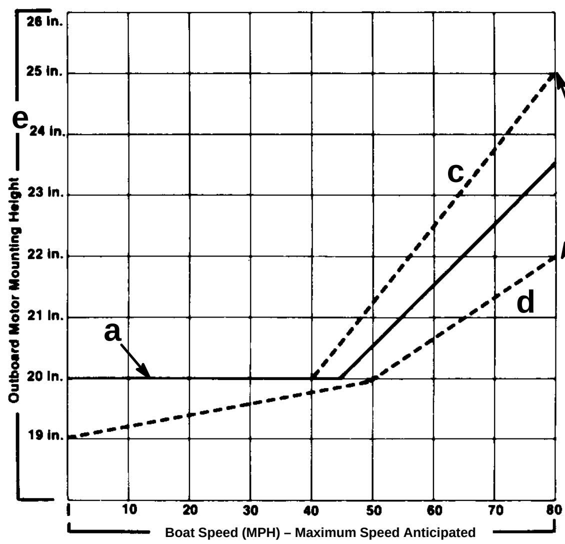


a - Engine Connector
b - Retainer
c - Harness Connector
d - Harness Retainer
e - Neoprene Sheet
f - Sta-Strap(s)

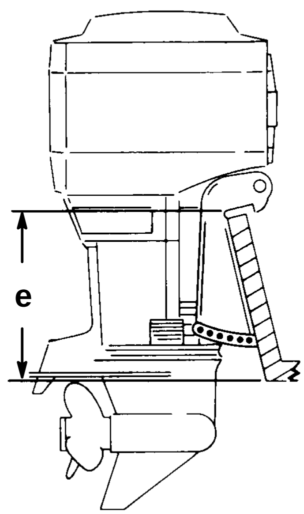
Models with Power Trim

Installing Outboard Motor on Transom

Determining Recommended Outboard Mounting Height



1 in. = 25.4mm
1 MPH = 1.6 Km/h



IMPORTANT: Add 5 in. (12.7cm) to Mounting Height for "XL" Models.

a - This solid line is recommended to determine the outboard mounting height dimension. Use transom mounting bolt holes that will position outboard nearest to the recommended height. After engine break-in (if necessary), raise or lower outboard one position at a time to attain best performance. See **"Important"** immediately following.

IMPORTANT: Increasing the height of outboard generally will provide the following: 1) Less steering torque, 2) more top speed, 3) greater boat stability, but, 4) will cause more prop "break loose" which may be particularly noticeable when planing off or with load.

b - These broken lines represent the extremes of known successful outboard mounting height dimensions.

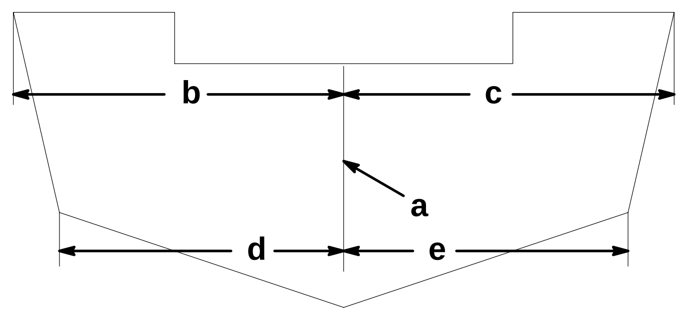
c - This line may be preferred to determine outboard mounting height dimension, if maximum speed is the only objective.

d - This line may be preferred to determine outboard mounting height dimension for dual outboard installation.

e - Outboard mounting height (height of outboard transom bracket from bottom of boat transom). For heights over 22 in. (560mm), a propeller, that is specifically designed for surfacing operation, such as the "Chopper" series, usually is preferred.

Locate Centerline of Boat Transom

Locate (and mark with pencil) vertical centerline (a) of boat transom, as shown.



NOTE: Dimensions "b" and "c" and "d" and "e" are equal length.

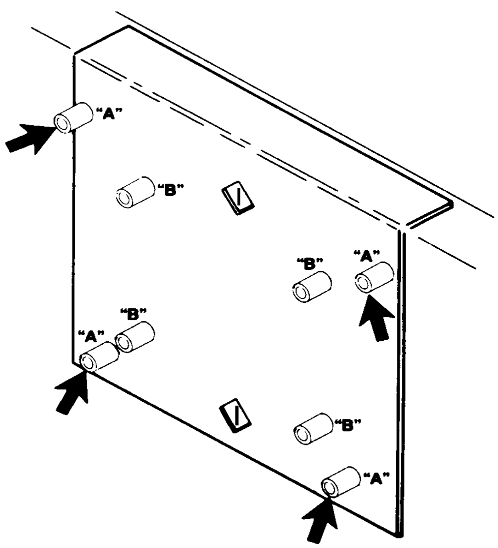
Drilling Outboard Mounting Holes

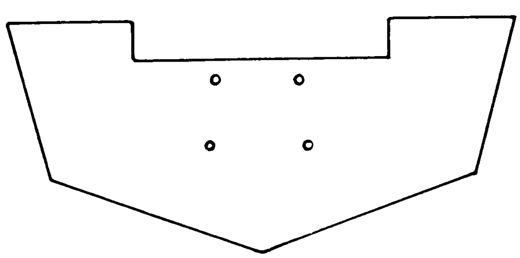
IMPORTANT: Before drilling any mounting holes, carefully read "Determining Recommended Outboard Motor Mounting Height", preceding. There is a 3/4 in. (19mm) difference between outboard mounting holes in transom bracket.

⚠ WARNING

DO NOT, under any circumstances, allow upper outboard mounting bolts to be closer than 1 in. (25.4mm) from top of boat transom. Upper mounting bolts must never be installed thru shims.

IMPORTANT: If using "Transom Drill Fixture" (91-98234A2), use drill guide holes marked "A" when drilling outboard mounting holes.



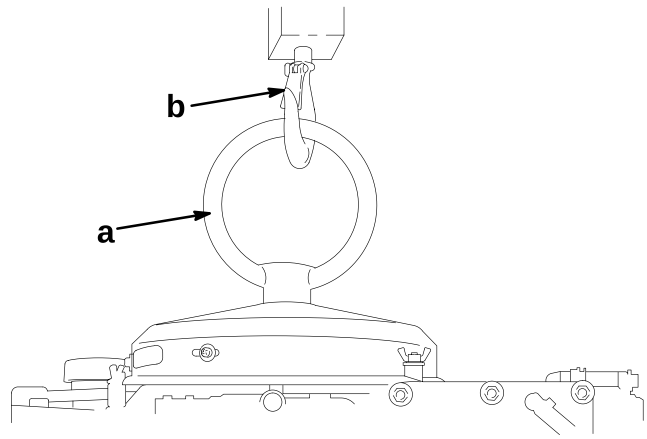


Lifting Engine

⚠ WARNING

Make sure that lifting eye is threaded into flywheel a minimum of 5 turns and that hoist has a minimum lift capacity of at least 500 lbs. (227 kg) BEFORE lifting engine.

1. Remove cowling from engine and plastic cap from center of flywheel. Thread lifting eye into flywheel hub a minimum of 5 turns. Replace plastic cap after installation.
2. Connect hoist [minimum lift capacity of 500 lbs. (227 kg)] to lifting eye. Lift engine and place on boat transom.



25929

a - Lifting Eye (C-91-75132)
b - Hoist

Installing Engine to Transom

⚠ CAUTION

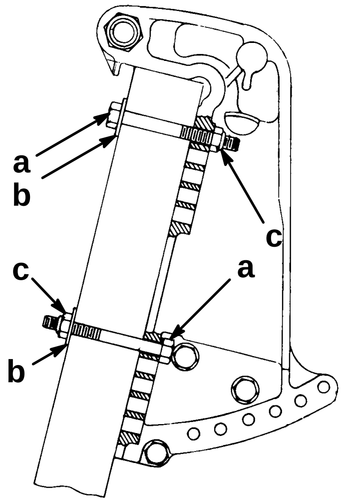
Marine sealer must be used on shanks of mounting bolts to make a water-tight installation.

NOTE: Because of clearance on some boats it will be necessary to install steering cable on engine before installing engine to transom. Refer to page 1 of this instruction.

IMPORTANT: DO NOT use an impact driver when tightening transom mounting bolts.

1. Determine engine mounting height dimension from graph (STEP 1) and use engine mounting holes that will position engine nearest to recommended height.

2. Apply marine sealer to shanks of mounting bolts (not threads) and secure engine to transom with 4 bolts, flat washers and locknuts, as shown. Be sure that installation is water-tight.

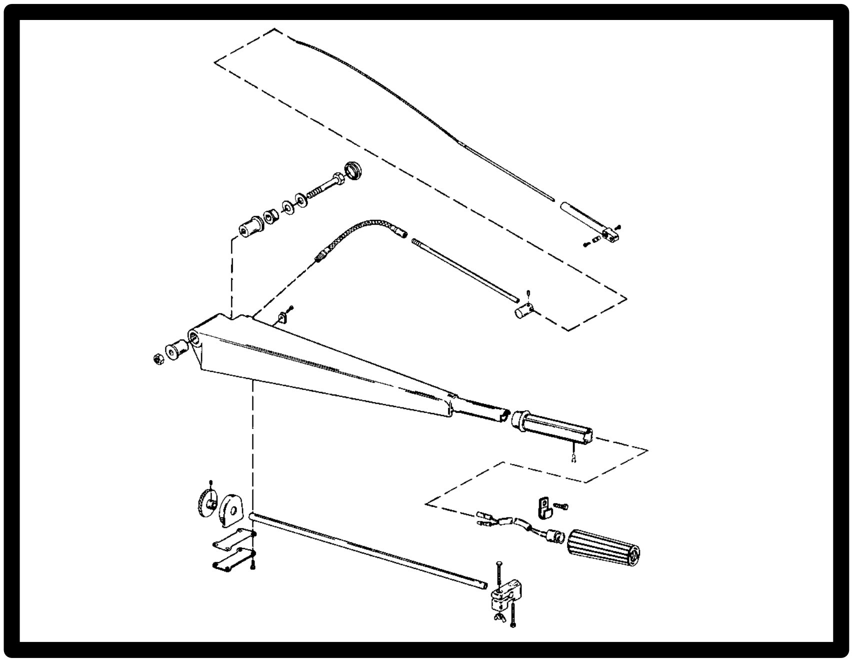


a - Mounting Bolt - 4-1/2 in. (11.4mm) long (4 Req'd.)
b - Flat Washer (4 Req'd.)
c - Locknut (4 Req'd.)

⚠ WARNING

Before operating, motor(s) MUST BE SECURED to boat transom with four 1/2″ diameter bolts and locknuts, as follows: 2 bolts must be installed thru upper mounting holes and 2 bolts thru lower mounting holes, as shown in step 5. Installation must be water-tight, and engine should be checked for tightness on the transom during operation. Failure to bolt engine to transom (using 4 bolts and locknuts, as shown in step 5) may result in damage to boat and/or loss of motor and possible injury to occupants of boat.

OUTBOARD MOTOR INSTALLATION/ ATTACHMENTS



7

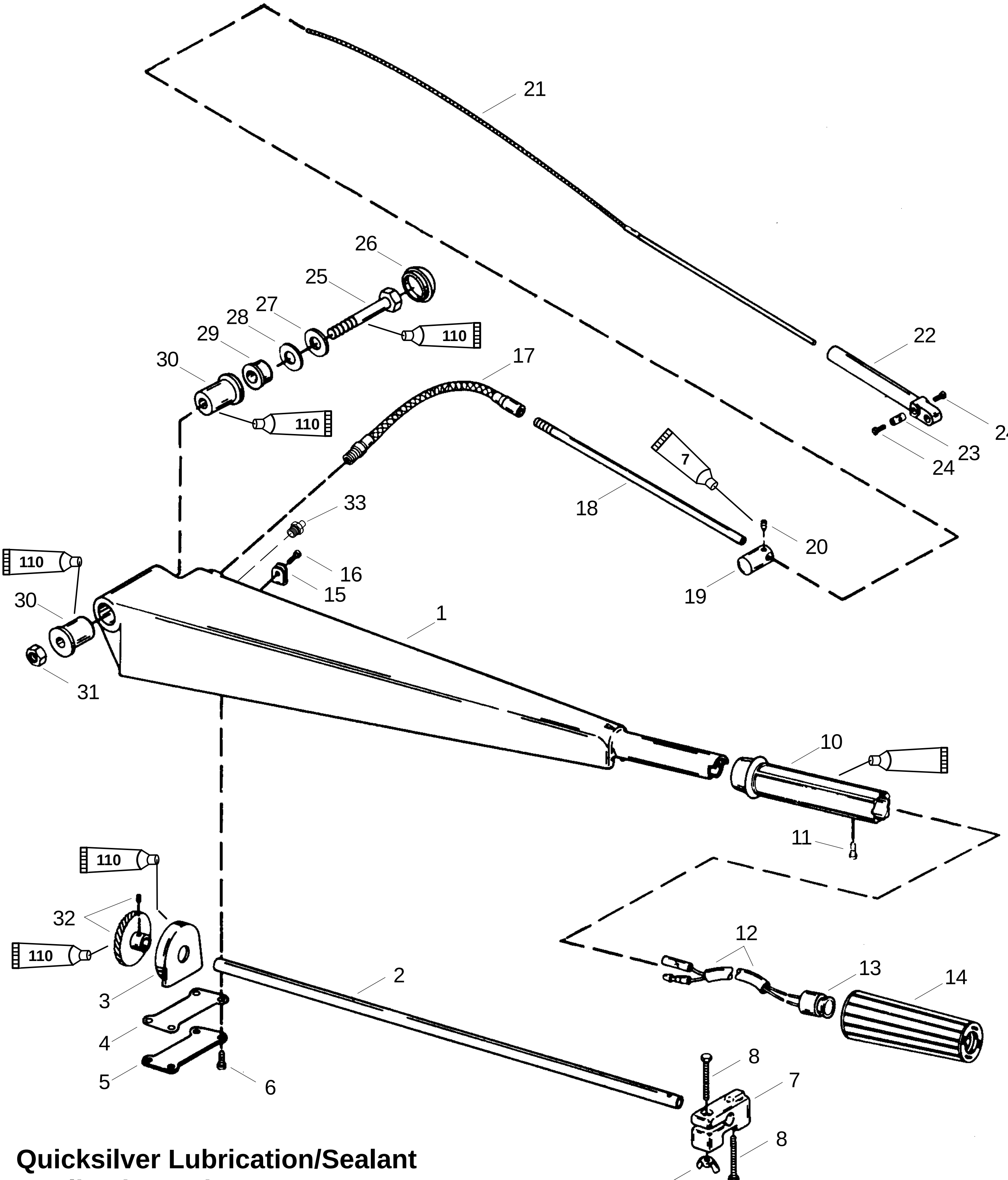
B

TILLER HANDLE AND CO-PILOT

Table Of Contents

Notes:

Tiller Arm Components



Quicksilver Lubrication/Sealant Application Points

110 2-4-C W/Teflon (92-825407A12)

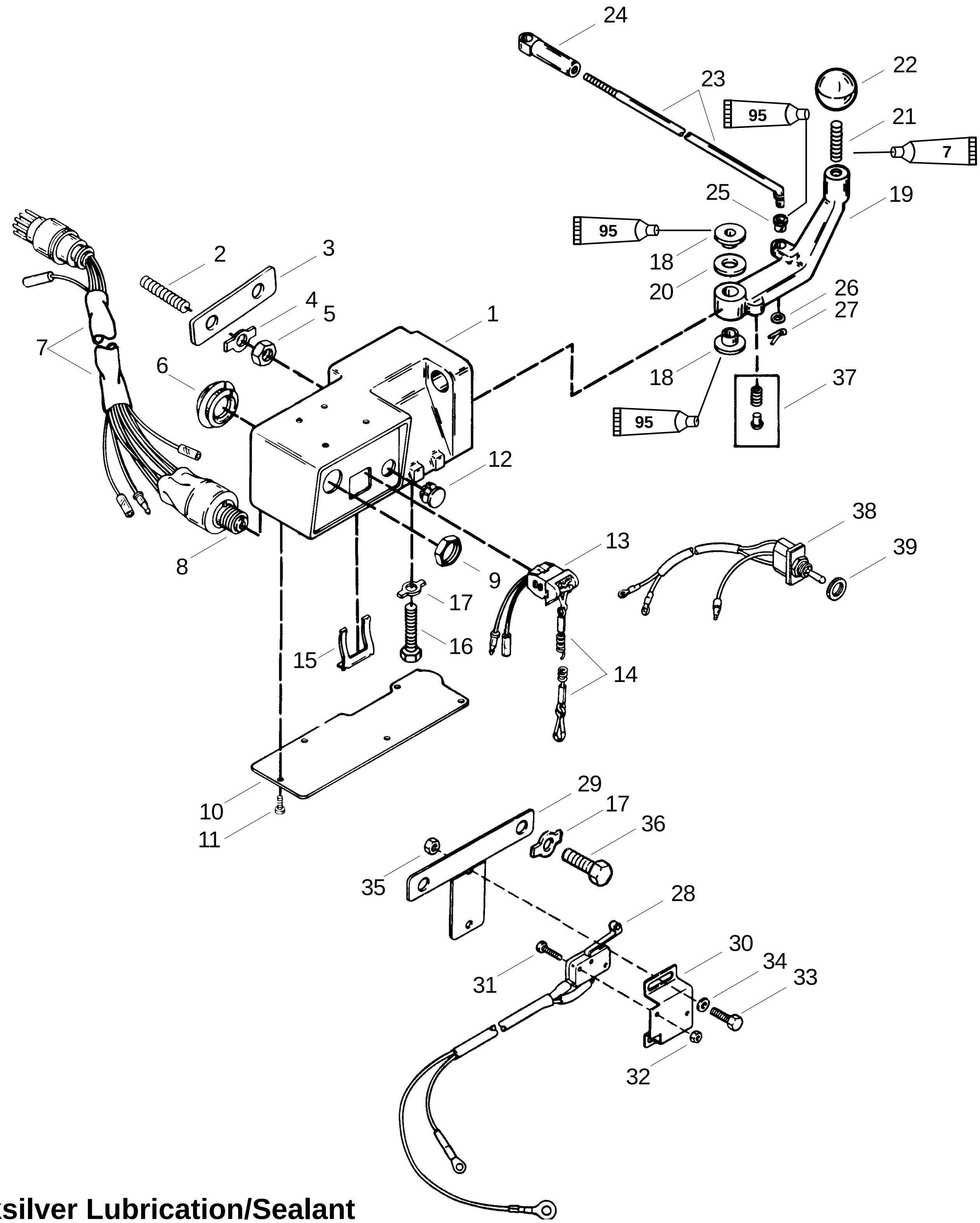
Soapy Water Solution (Obtain Locally)

7 Loctite 271 (Obtain Locally)

Tiller Arm Components (Continued)

REF. NO.	QUAN.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	Steering Arm			
2	1	Throttle Tube			
3	1	Housing			
4	1	Gasket			
5	1	Plate			
6	4	Screw	Drive Tight		
7	1	Throttle Clamp			
8	2	Screw	40		4.5
9	1	Nut			
10	1	Throttle Handle			
11	1	Screw	Drive Tight		
12	1	Stop Switch Harness			
13	1	Stop Switch			
14	1	Grip			
15	1	Clip			
16	1	Screw			
17	1	Conduit			
18	1	Guide Tube			
19	1	Barrel			
20	1	Set Screw	9		1.0
21	1	Cable			
22	1	Cable Guide			
23	1	Anchor			
24	2	Set Screw	Drive Tight		
25	1	Bolt			
26	1	Cap			
27	1	Washer			
28	1	Washer			
29	1	Spacer			
30	1	Bushing			
31	1	Nut	40		4.5
32	1	Gear Assembly			
33	1	Grease Fitting			

Tiller Arm Bracket Assembly



Quicksilver Lubrication/Sealant Application Points

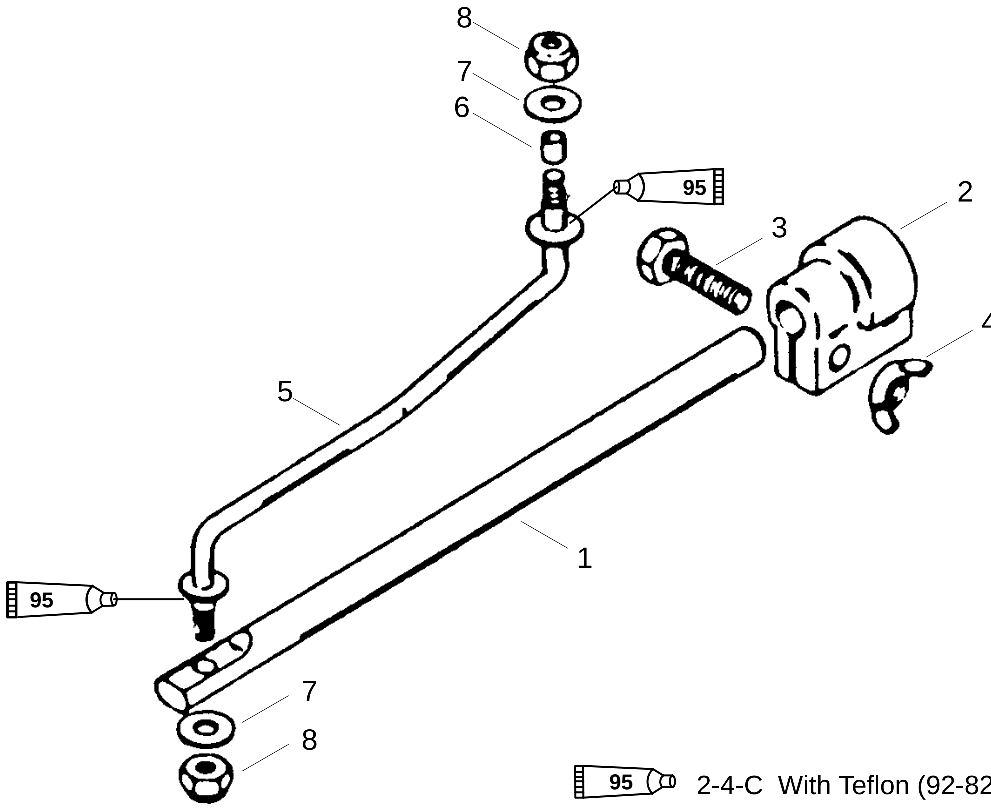
95 2-4-C With Teflon (92-825407A12)

7 Loctite 271 (Obtain Locally)

Tiller Arm Bracket Assembly (Continued)

REF. NO.	QUAN.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
1	1	Bracket Assembly			
2	2	Stud			
3	1	Spacer			
4	2	Tab Washer			
5	2	Nut		35	47.4
6	1	Grommet			
7	1	Harness Assembly			
8	1	Key Switch			
9	1	Nut			
10	1	Cover			
11	6	Screw	Drive Tight		
12	1	Plug			
13	1	Stop Switch Assembly			
14	1	Lanyard			
15	1	Retainer			
16	1	Bolt	110		12.4
17	3	Tab Washer			
18	2	Bushing			
19	1	Shift Lever			
20	1	Washer			
21	1	Stud			
22	1	Shift Knob			
23	1	Shift Rod			
24	1	Rod End			
25	1	Bushing			
26	1	Washer			
27	1	Cotter Pin			
28	1	Neutral Start Switch			
29	1	Bracket			
30	1	Switch Bracket			
31	2	Screw			
32	2	Nut	Drive Tight		
33	2	Bolt			
34	2	Washer			
35	2	Nut	Drive Tight		
36	2	Bolt		15	20.3
37	1	Detent Assembly			
38	1	Trim Switch			
39	1	Nut			

Co-Pilot Components

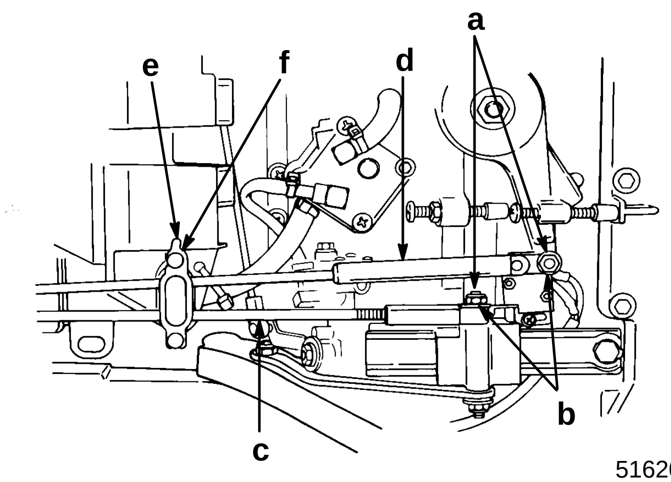


2-4-C With Teflon (92-825407A12)

REF. NO.	QUAN.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	Pilot Rod			
2	1	Friction Assembly			
3	1	Bolt			
4	1	Wing Nut			
5	1	Steering Link Rod			
6	1	Bushing			
7	2	Washer			
8	2	Nut -- Tighten until it seats; do not exceed 120 lb. in. (13.6 N·m), then back off 1/4 turn.	120		13.6

Tiller Arm/Shift Lever Removal

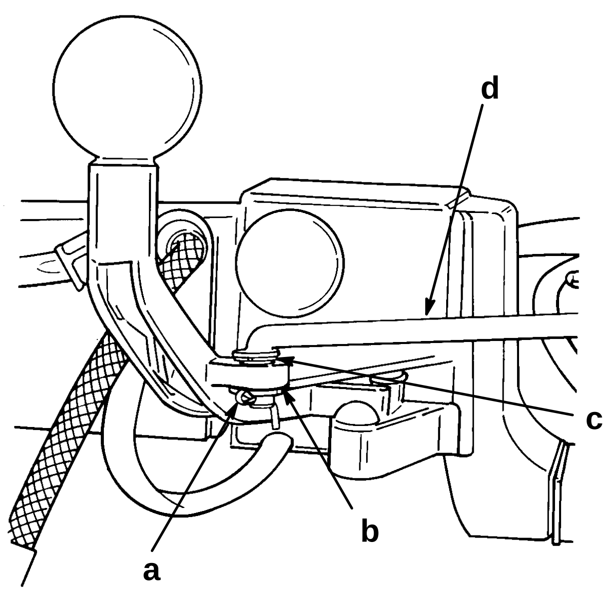
1. Remove BATTERY CABLES from BATTERY.
2. Remove outboard cowling.
3. Remove nuts securing shift link rod and throttle cable to engine. Release latch and remove shift link rod and throttle cable from anchor bracket.



51620

a - Locking Nut
b - Washer
c - Shift Cable
d - Throttle Cable
e - Latch
f - Anchor Bracket

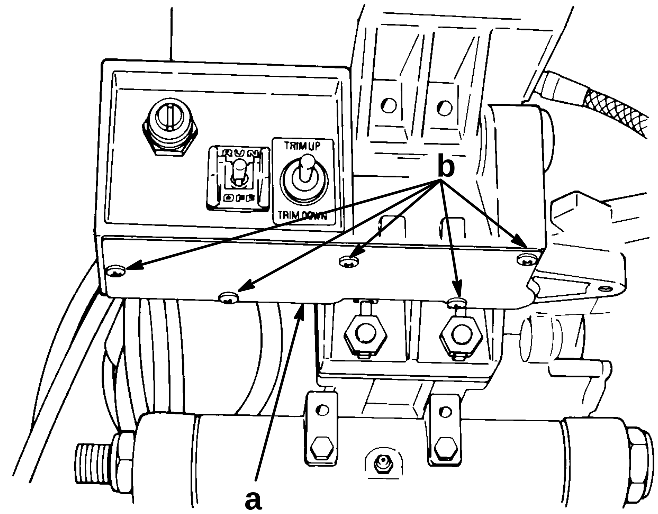
4. Remove cotter key, washer, bushing and shift link rod from shift lever.



51624

a - Cotter Key
b - Washer
c - Bushing
d - Shift Link Rod

5. Remove access cover from underneath tiller handle bracket.

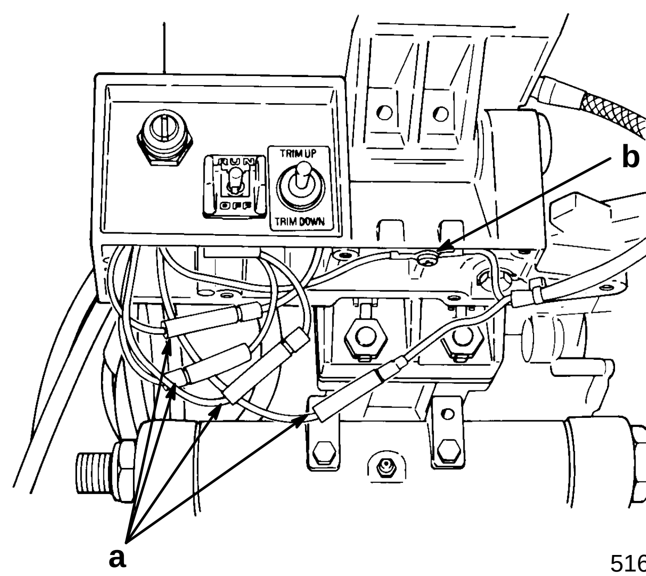


51626

a - Access Cover
b - Screws

6. Disconnect key switch, lanyard stop switch and tiller stop switch leads at bullet connectors.

   Remove screw securing key switch and tiller stop switch ground leads.

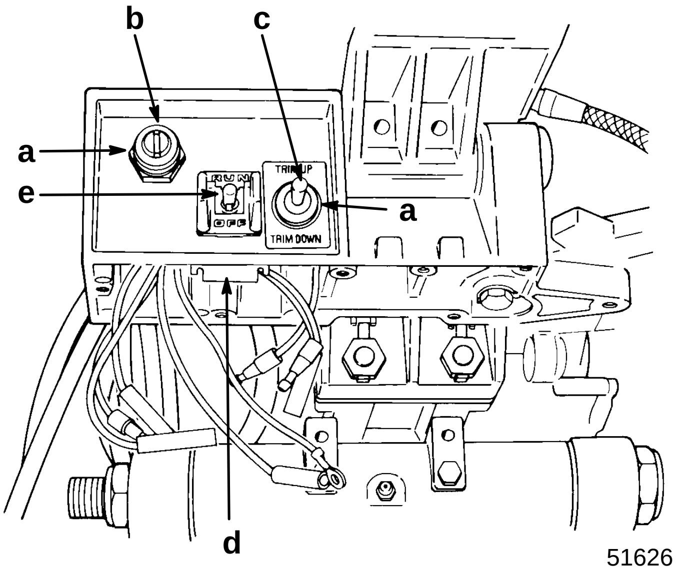


51626

a - Bullet Connectors
b - Screw

7. Remove nuts securing key switch and trim switch to tiller handle bracket.

   Remove clip securing lanyard stop switch and remove switch from bracket.

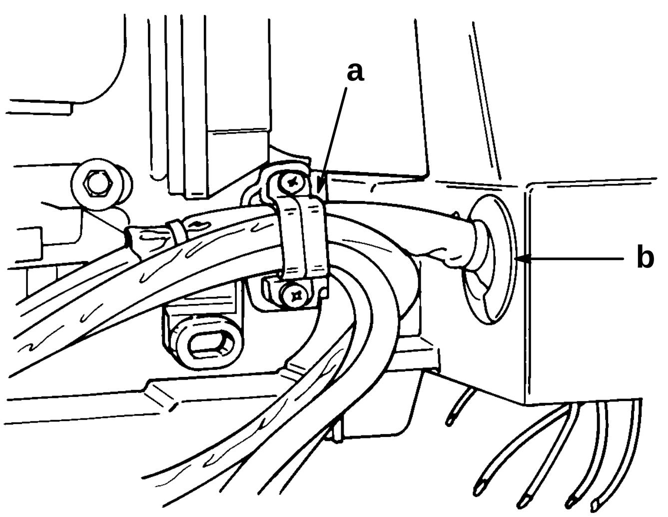


51626

a - Nuts
b - Key Switch
c - Trim Switch
d - Clip
e - Lanyard Stop Switch

8. Remove harness retainer from outboard.

   Remove grommet from tiller bracket.



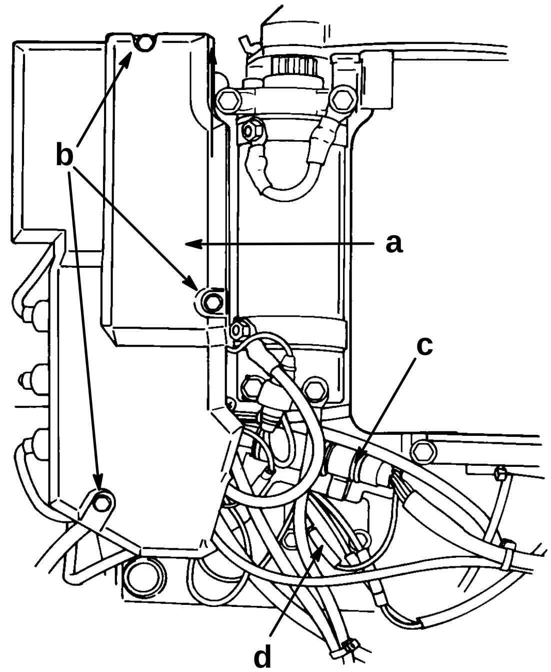
51624

a - Harness Retainer
b - Grommet

9. Remove electrical panel access cover.

   Disconnect switch harness from engine harness plug.

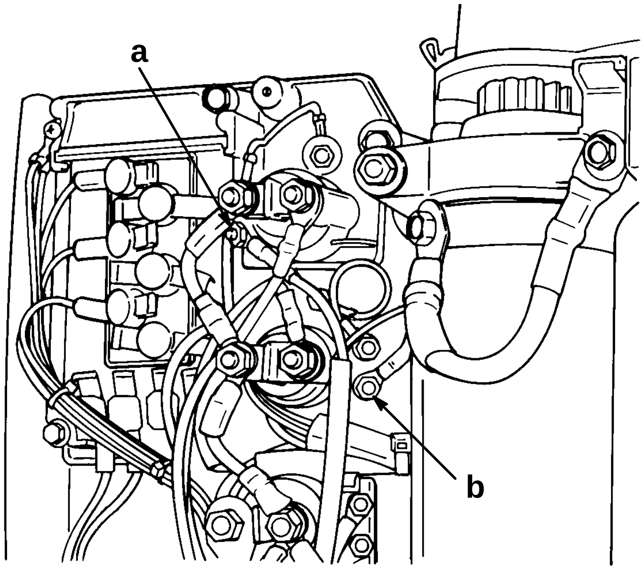
   Disconnect PURPLE bullet connector.



51621

a - Access Cover
b - Bolts
c - Switch Harness
d - PURPLE Lead

10. Disconnect BLUE/WHITE and GREEN/WHITE trim leads from trim solenoids.

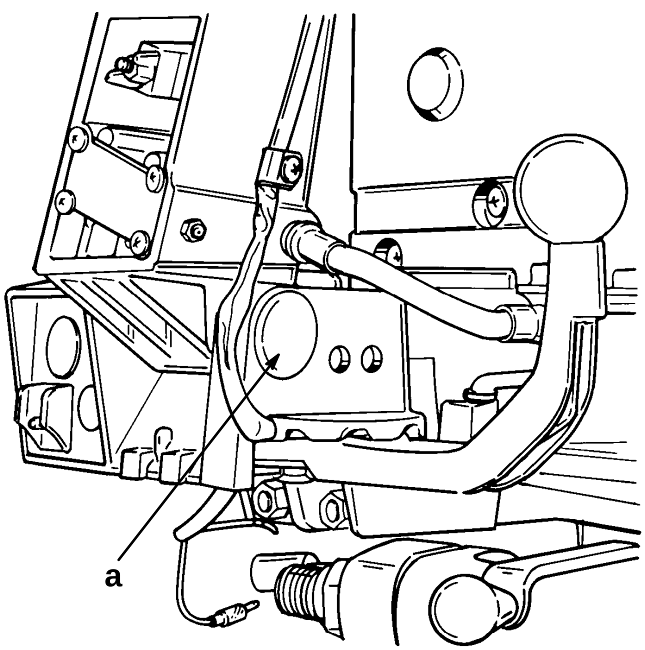


51622

a - BLUE/WHITE Lead
b - GREEN/WHITE Lead

11. Remove key switch, trim switch and their harnesses from tiller bracket.

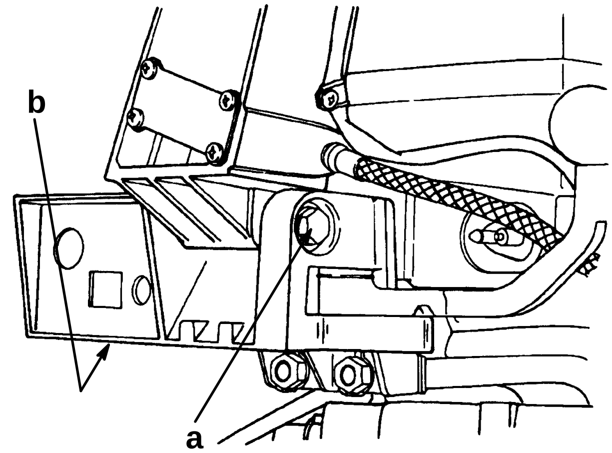
12. Remove plug from tiller handle bracket.



51608

a - Plug

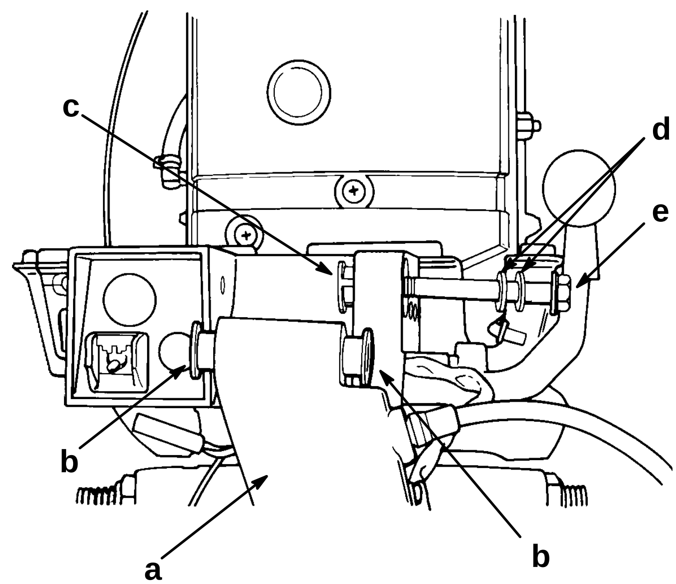
13. Remove bolt and nut (hidden) from tiller handle bracket.



51625

a - Bolt
b - Nut (Hidden)

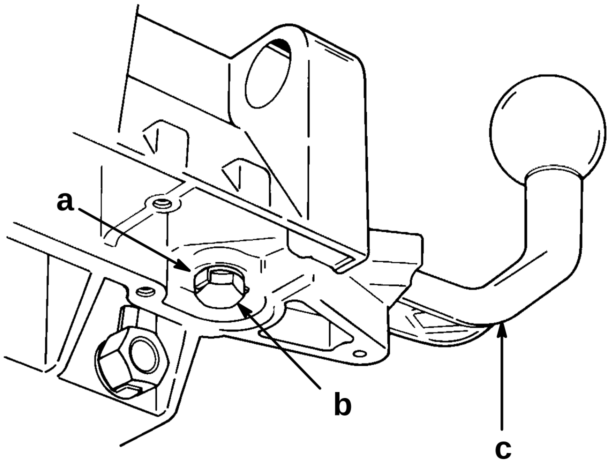
14. Remove tiller handle, 2 nylon bushings, stainless bushing and 2 flat washers from bracket.



51606

a - Tiller Handle
b - Nylon Bushings (2)
c - Stainless Steel Bushing
d - Flat Washers (2)
e - Bolt

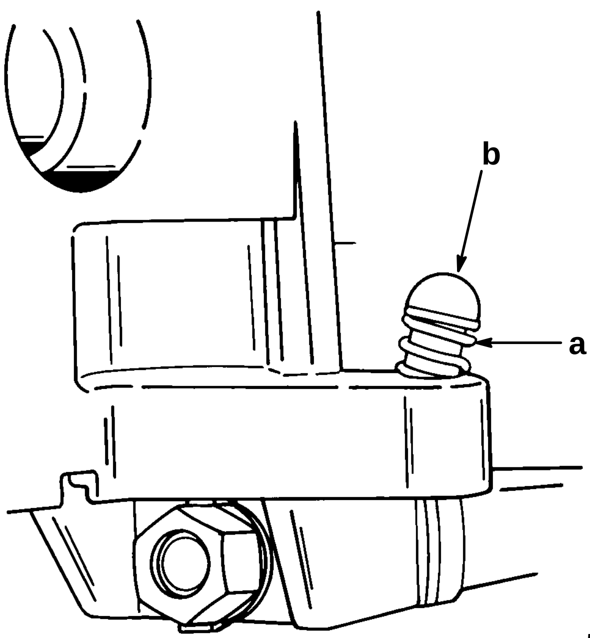
15. Bend tab washer away from bolt securing shift lever and remove bolt and lever from bracket.



51622

a - Tab Washer
b - Bolt
c - Shift Lever

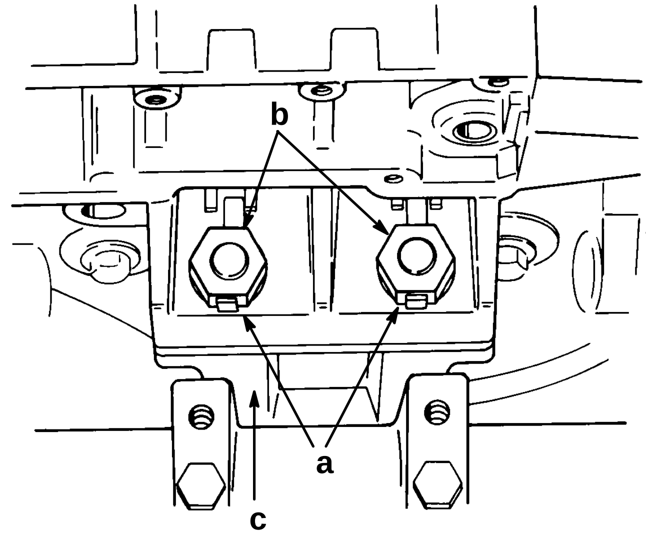
16. Remove spring and detent pin from bracket.



51621

a - Spring
b - Detent Pin

17. Bend tabs on tab washers away from nuts securing bracket to steering arm. Remove nuts, tab washers and bracket from steering arm.

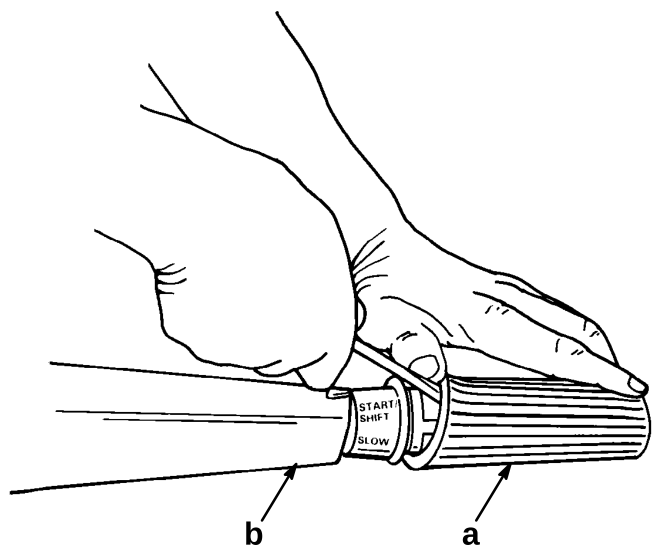


51621

a - Tab Washer
b - Nut
c - Steering Arm

Tiller Handle Disassembly

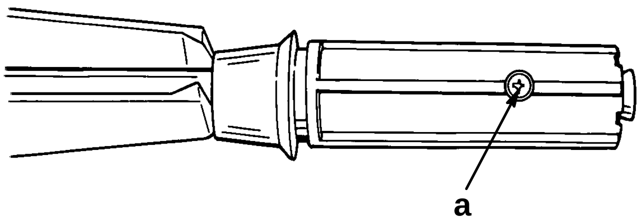
1. Using a flat tip screwdriver, carefully pry/push rubber grip off tiller handle.



51603

a - Grip
b - Tiller Handle

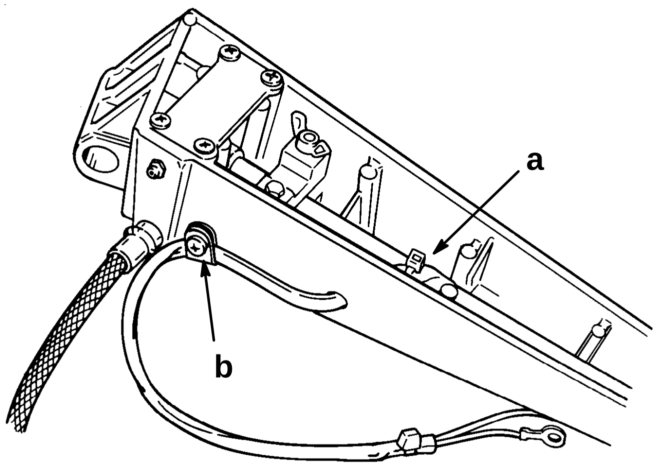
2. Remove screw from twist grip.



51603

a - Screw

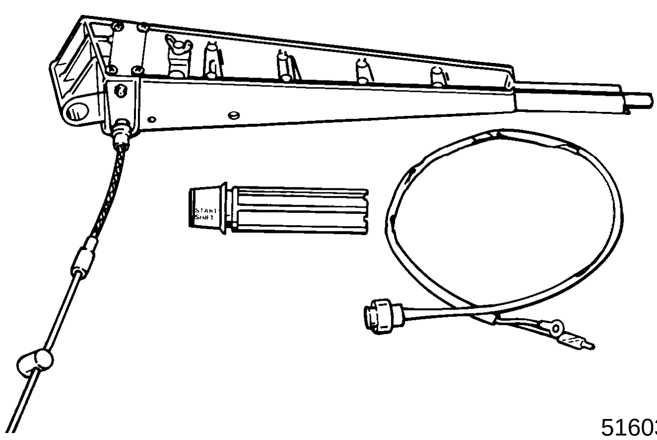
3. Cut sta-strap securing stop switch harness and remove screw from harness J-clip.



51603

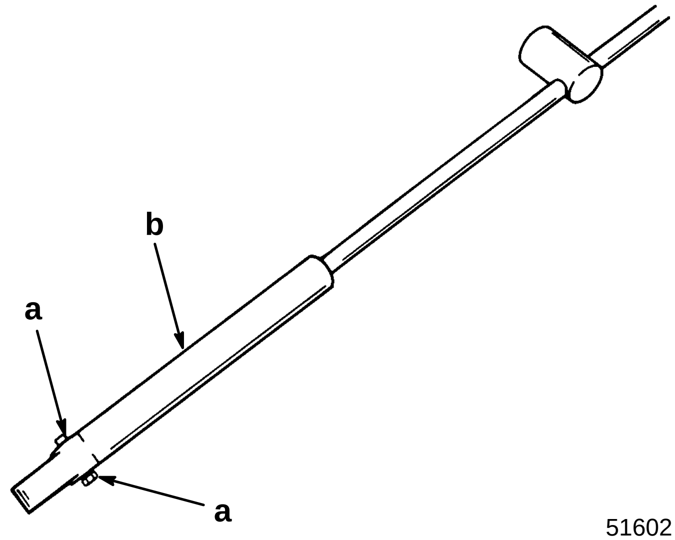
a - Ties
b - Screw

4. Remove stop switch and twist grip from tiller handle.



51603

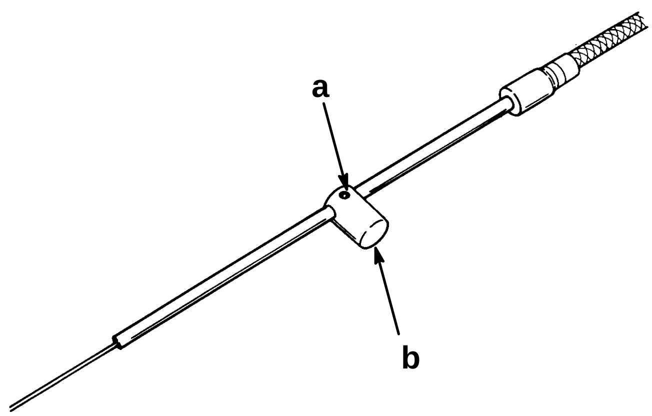
5. Remove throttle cable anchor screws and remove cable guide.



51602

a - Anchor Screws
b - Throttle Cable Guide

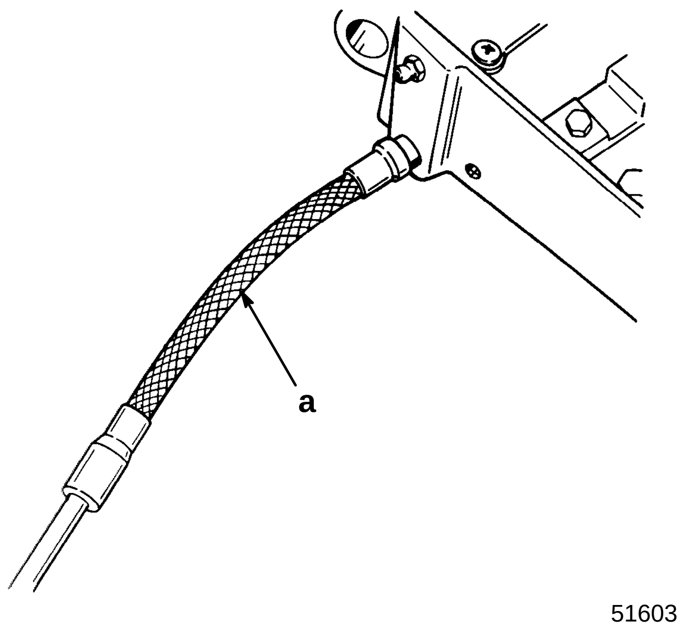
6. Remove allen screw from brass barrel and remove barrel.



51602

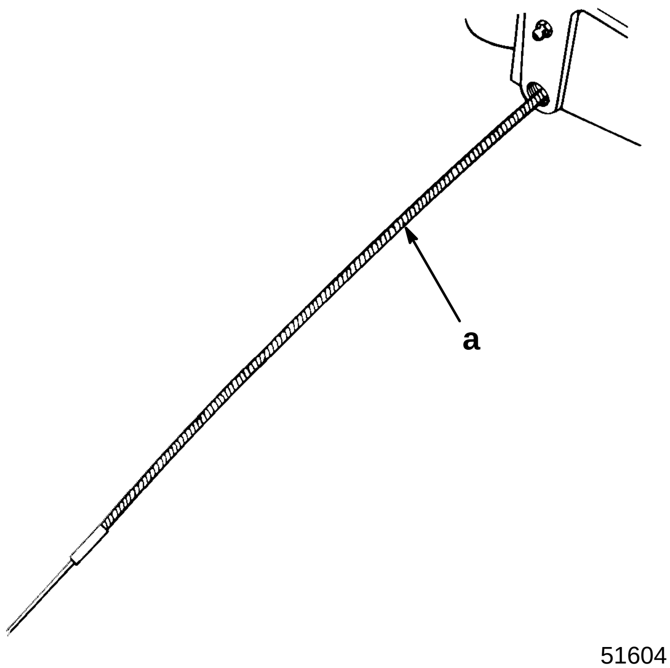
a - Allen Screw
b - Brass Barrel

7. Unscrew (counterclockwise) stainless conduit from tiller handle.



a - Conduit

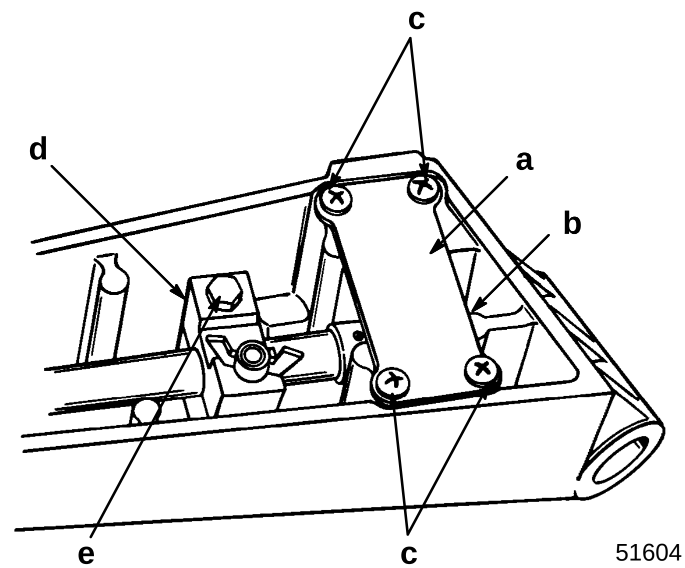
8. Pull throttle cable from tiller handle.



a - Throttle Cable

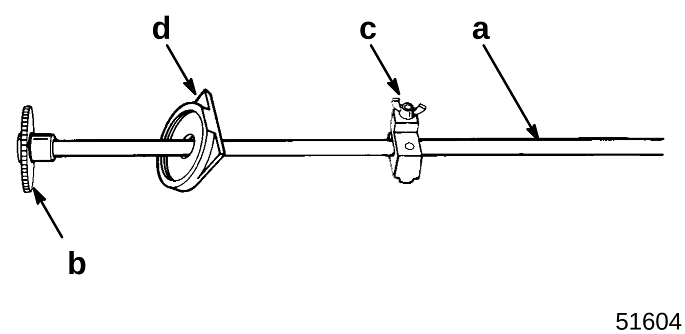
9. Remove cover plate and gasket from tiller handle.

10. Remove bolt from throttle friction assembly.



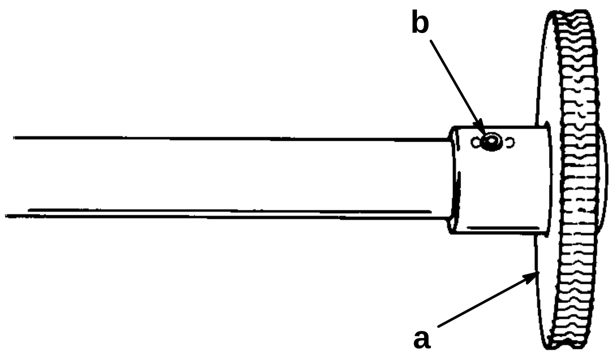
a - Cover Plate
b - Gasket (below plate)
c - Screws
d - Throttle Friction Assembly
e - Bolt

11. Remove throttle arm, gear assembly and friction device from tiller handle. Slide gear cover and friction device off of throttle arm.



a - Throttle Arm
b - Gear Assembly
c - Friction Device
d - Gear Cover

12. Drive out drift pin and remove throttle gear from throttle arm.

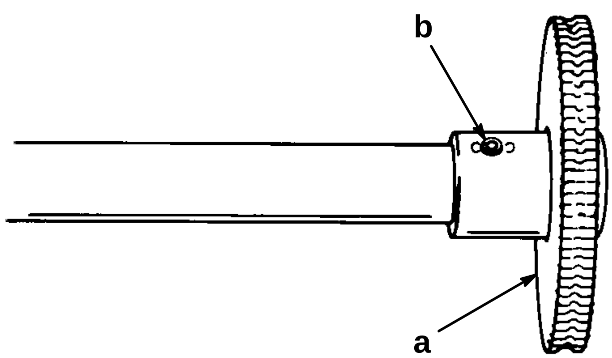


51602

a - Gear
b - Drift Pin

Tiller Arm Reassembly

1. Reinstall throttle gear on throttle arm and secure gear to arm with new drift pin.

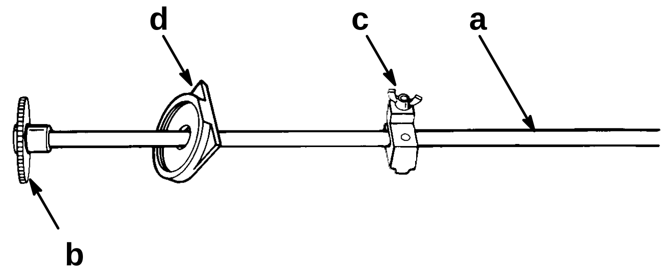


51602

a - Gear
b - Drift Pin

2. Apply a light coat of2-4-C w/Teflon to gear teeth and inside of gear cover.

3. Slide cover and friction device onto throttle arm.

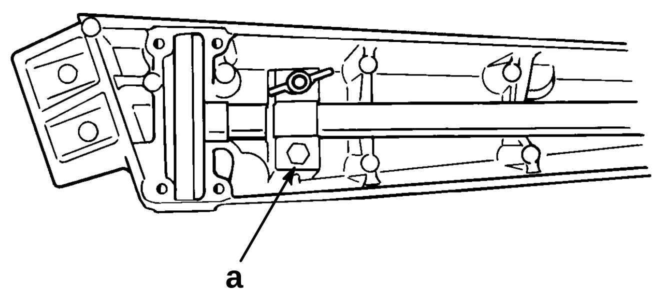


51604

a - Throttle Arm
b - Gear
c - Throttle Friction Device
d - Cover

4. Install throttle arm assembly into tiller arm.

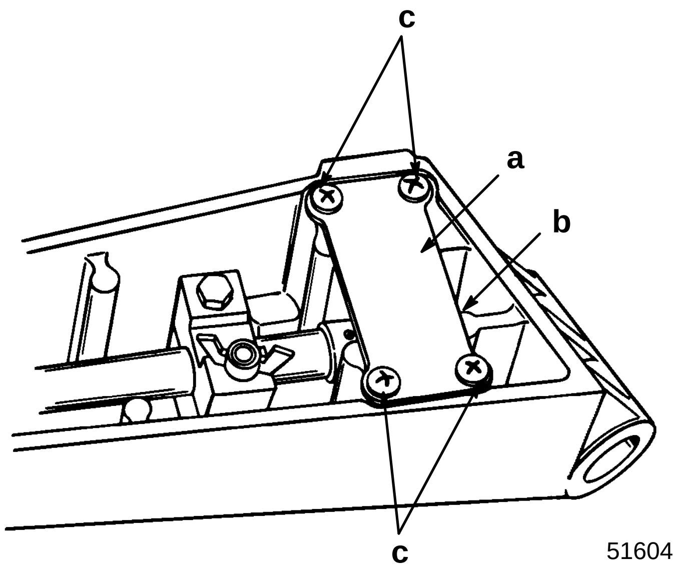
5. Torque friction device attaching bolt to 40 lb. in. (4.5 N·m).



51604

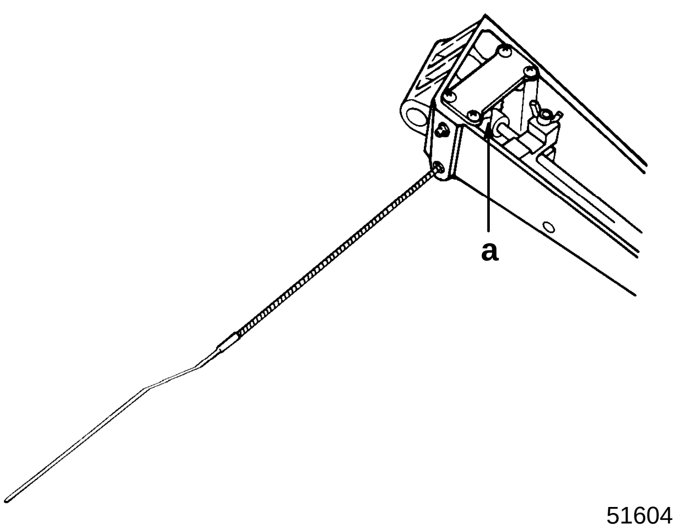
a - Bolt [Torque to 40 lb. in. (4.5 N·m)]

6. Install gasket and cover plate over gear assembly. DO NOT OVERTIGHTEN attaching screws.



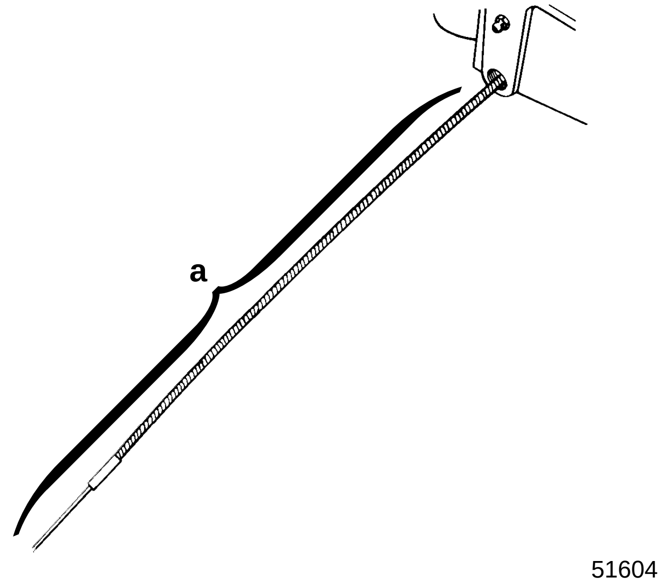
a - Cover Plate
b - Gasket (below cover)
c - Screws

7. Rotate throttle arm so that twist grip attaching screw hole faces DOWN and gear drift pin faces UP.
8. Insert throttle cable (CURVED END FACING UP) into tiller handle gear assembly while rotating tiller arm COUNTERCLOCKWISE.



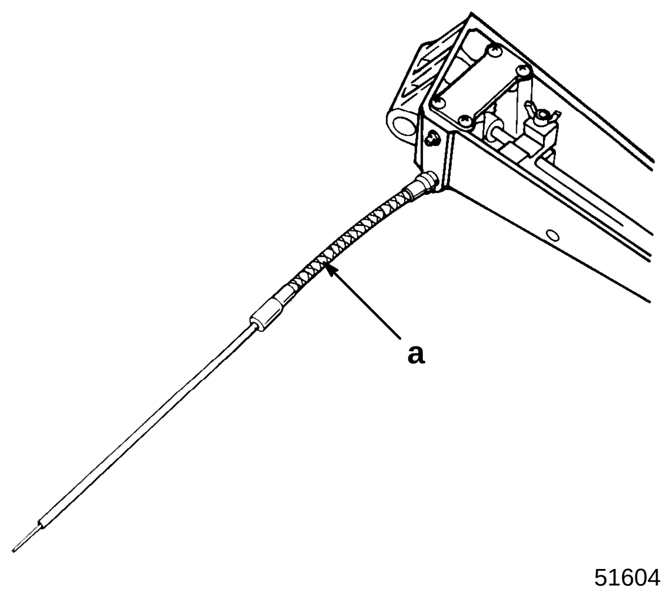
a - Gear Drift Pin (FACES UP)

9. Retract throttle cable into gear assembly until approximately 17 in. (43 cm) extends from the tiller arm.



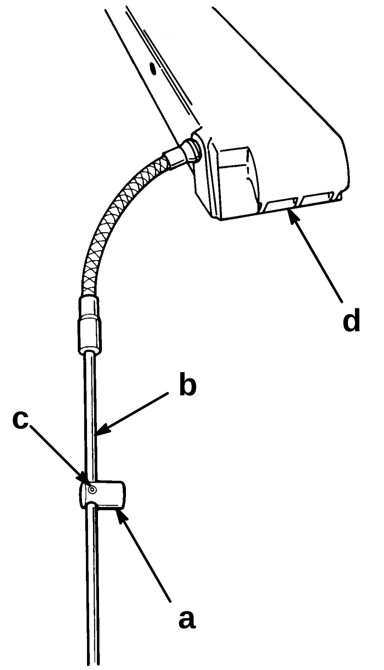
a - Cable [Extends 17 in. (43 cm)]

10. Slide stainless steel conduit over throttle cable and thread into tiller arm until lightly seated. Rotate conduit COUNTERCLOCKWISE ONE FULL TURN from a lightly seated position.



a - Stainless Steel Conduit

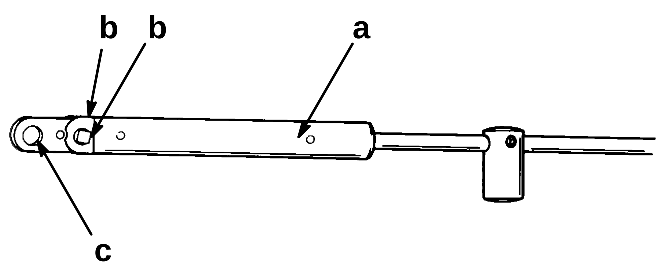
11. Slide brass barrel over throttle cable tube. Secure barrel to tube with allen screw approximately 3.5 in. (89 mm) from stainless conduit. DO NOT OVERTIGHTEN screw as tubing may be crushed binding throttle cable. Position barrel to face towards tiller handle.



51607

a - Brass Barrel
b - Tube
c - Allen Screw
d - Tiller Handle

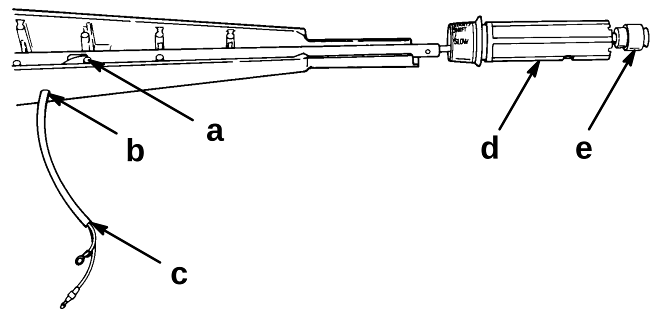
12. Install throttle cable guide onto throttle cable. Secure guide to cable with anchor and two screws. Guide hole should face up.



51602

a - Cable Guide
b - Screws (2)
c - Hole (faces up)

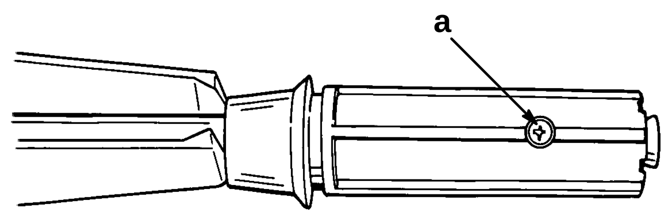
13. Position throttle arm slot to face stop harness exit hole in tiller handle. Route stop switch harness through twist grip, into throttle arm, and out through side of tiller handle.



51602

a - Slot
b - Exit Hole
c - Harness
d - Twist Grip
e - Stop Switch

14. Secure twist grip to throttle arm with attaching screw.



51603

a - Screw

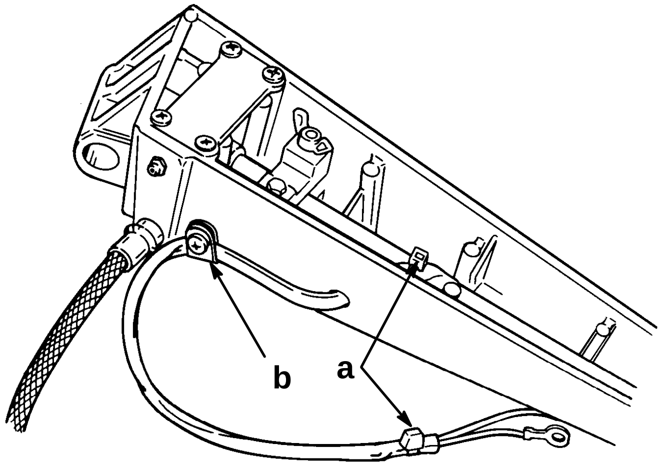
15. Sta-strap harness to throttle arm.

⚠ CAUTION

Allow enough slack in harness (rotate throttle grip in both directions) before securing harness to handle assembly with J-clip.

16. Attach harness to tiller arm with J-clip allowing enough slack in harness for full throttle rotation.

17. Attach sta-strap to end of harness sleeve.

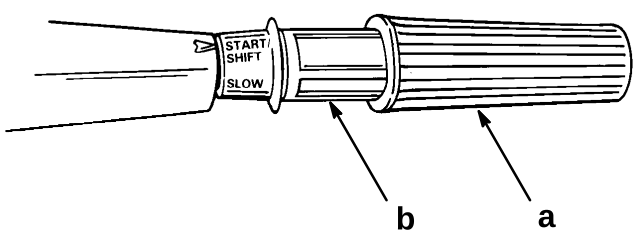


51603

a - Sta-strap
b - J-clip

18. Install rubber twist grip by aligning ridges on plastic twist grip with grooves inside of rubber grip.

NOTE: Applying a soapy water solution to rubber grip will ease installation.



51603

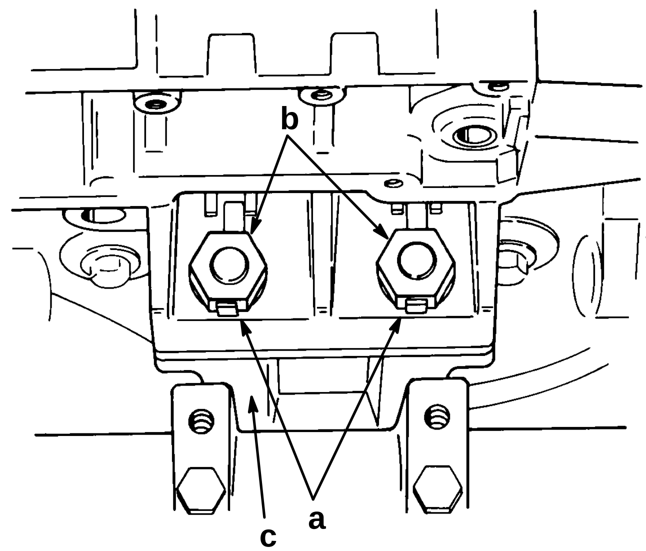
a - Ridges
b - Grooves (under handle)

Tiller Handle/Shaft Bracket Installation

1. Slide bracket over steering arm studs. Secure bracket to arm with retained nuts and NEW tab washers.

   Torque nuts to 35 lb. ft. (47.5 N·m).

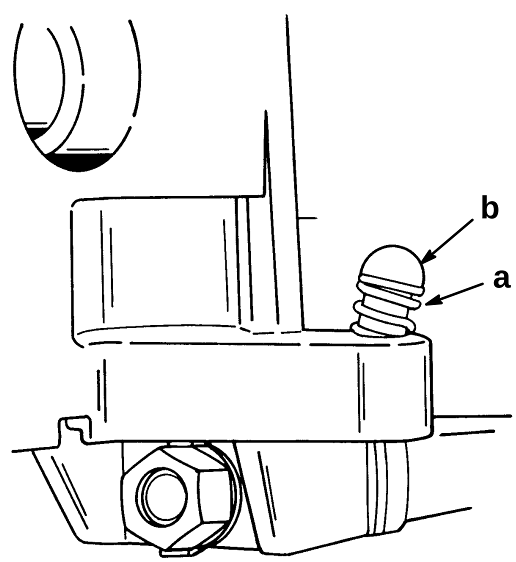
   Bend locking tabs against flats of nuts.



51621

a - Tab Washer
b - Nut
c - Steering Arm

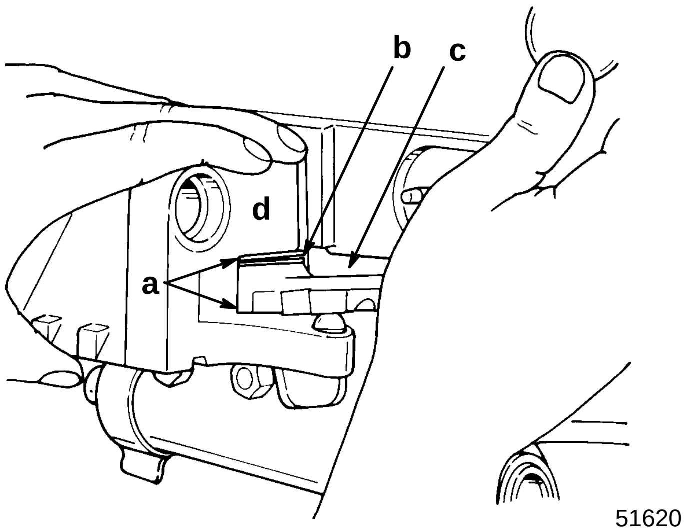
2. Install retained spring and detent pin into tiller handle bracket.



51621

a - Spring
b - Detent Pin

3. Insert bushings and thrust washer into shift lever. Install shift lever onto bracket.

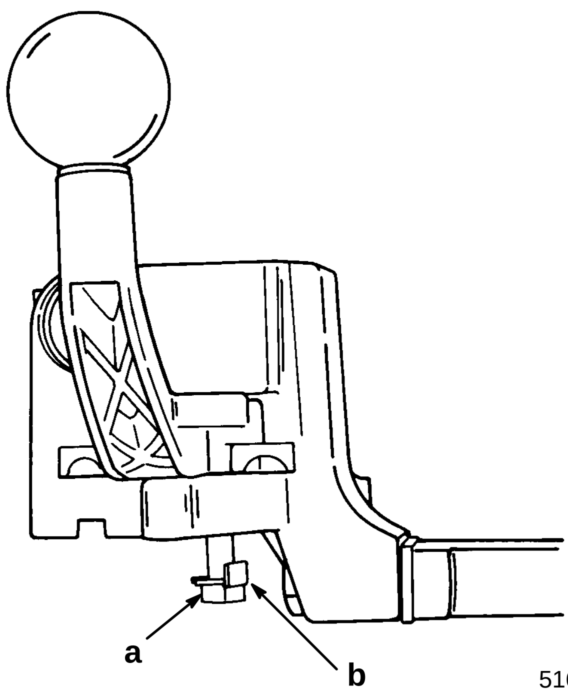


51620

a - Bushings
b - Thrust Washer
c - Shift Lever
d - Bracket

4. Secure shift lever to bracket with bolt and NEW tab washer. Align tab washer with slot in bracket.

   Torque bolt to 110 lb. in. (12.4 N·m).



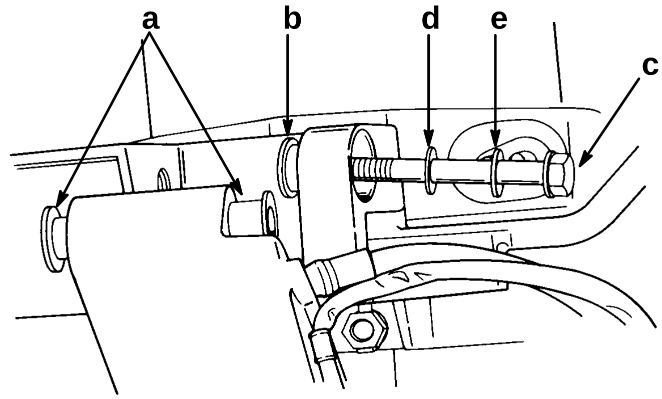
51620

a - Bolt
b - Tab Washer

5. Install two nylon bushings into tiller handle.

   Install stainless bushing into bracket.

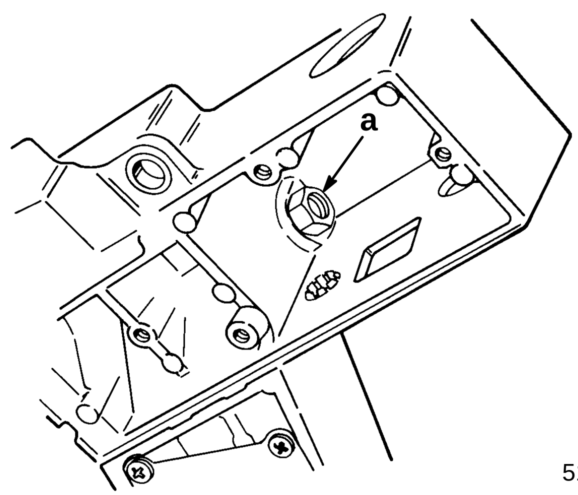
   Install tiller handle to bracket using bolt and two washers.



51622

a - Nylon Bushings
b - Stainless Bushing
c - Bolt
d - Washer (Thin)
e - Washer (Thick)

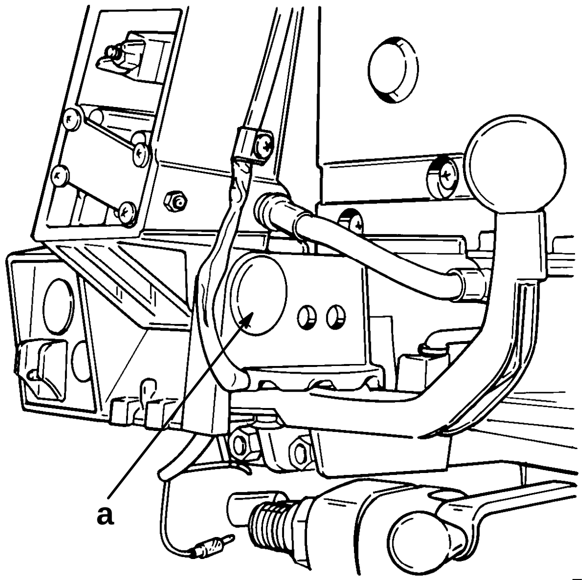
6. Secure bolt in place with nut. Torque nut to 40 lb. ft. (54.2 N·m).



51623

a - Nut

7. Reinstall plug.



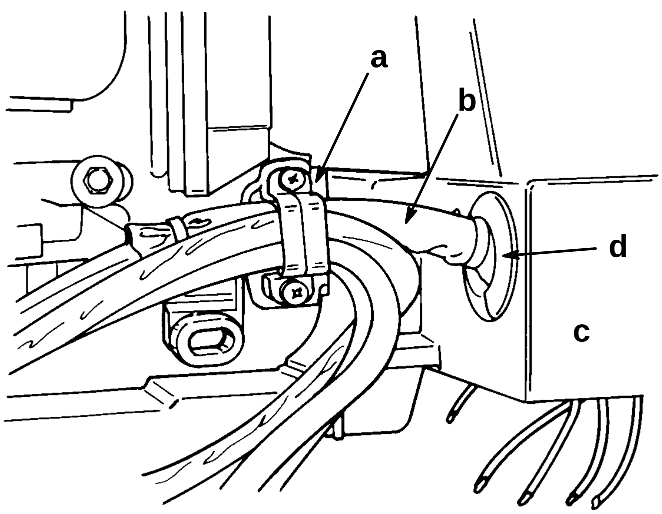
51608

a - Plug

8. Route key switch and trim switch harness through tiller bracket. Secure both switches to bracket with respective nuts.

   Install grommet in harness access hole.

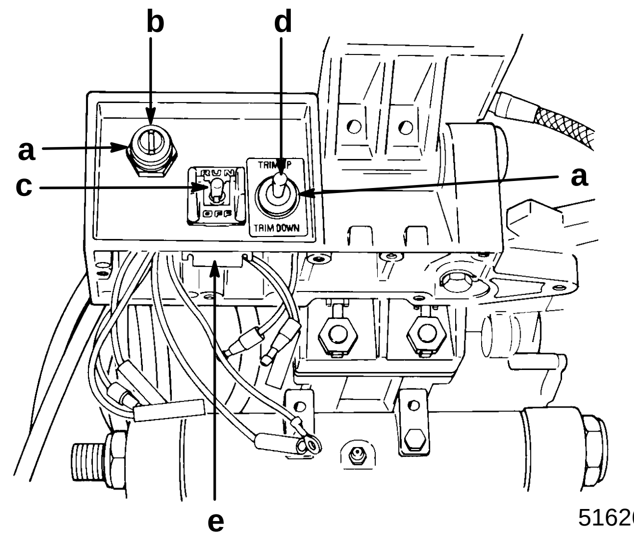
   Secure harness with harness retainer.



51624

a - Harness Retainer
b - Switch Harness
c - Tiller Bracket
d - Grommet

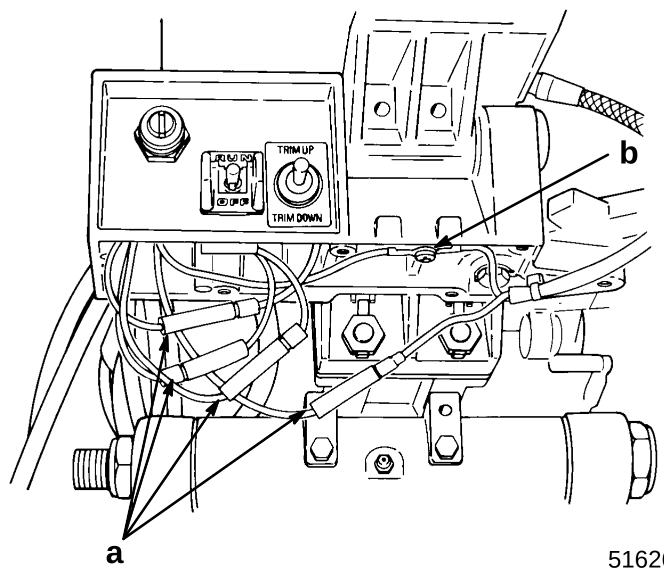
9. Reinstall lanyard stop switch in bracket and secure with clip.



51626

a - Nuts
b - Key Switch
c - Lanyard Stop Switch
d - Trim Switch
e - Clip

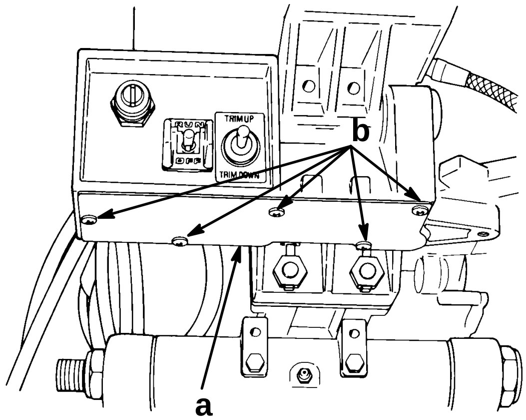
10. Reconnect key switch, trim switch and remote stop switch leads at bullet connectors. Secure harness BLACK ground lead and tiller handle remote stop switch ground lead to bracket with self-tapping screw.



51626

a - Bullet Connectors
b - Screw

11. Secure access cover to tiller bracket with five screws. DO NOT OVERTIGHTEN SCREWS.

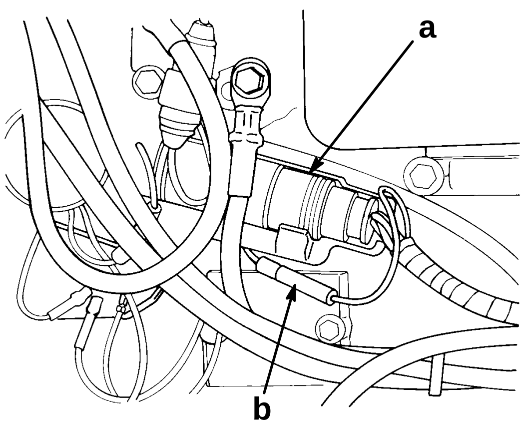


51626

a - Access Cover
b - Screws

12. Connect switch harness plug to engine harness plug.

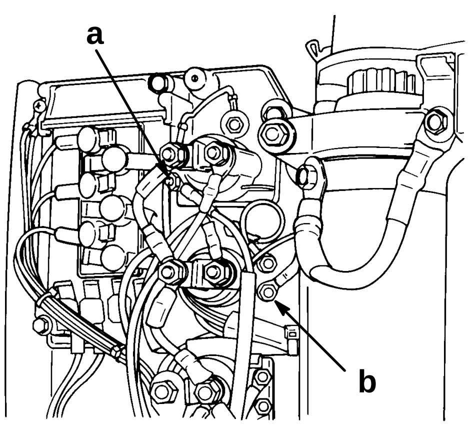
Reconnect PURPLE bullet connector.



51623

a - Switch Harness Plug
b - PURPLE Bullet Connector

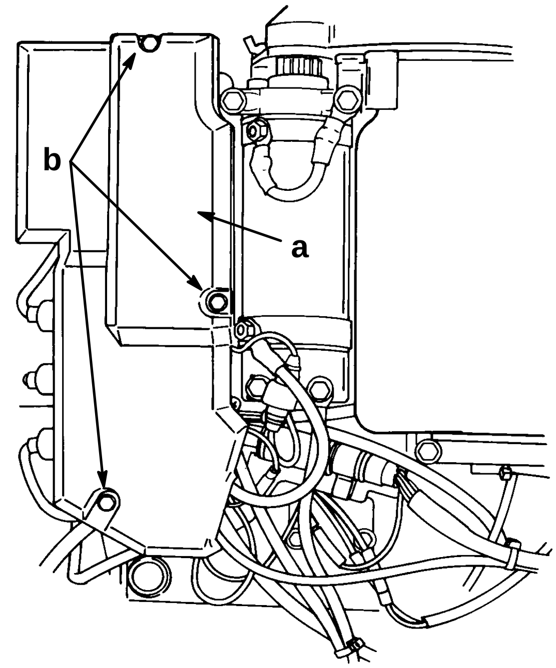
13. Reconnect trim switch leads to trim solenoids.



51622

a - BLUE/WHITE Lead
b - GREEN/WHITE Lead

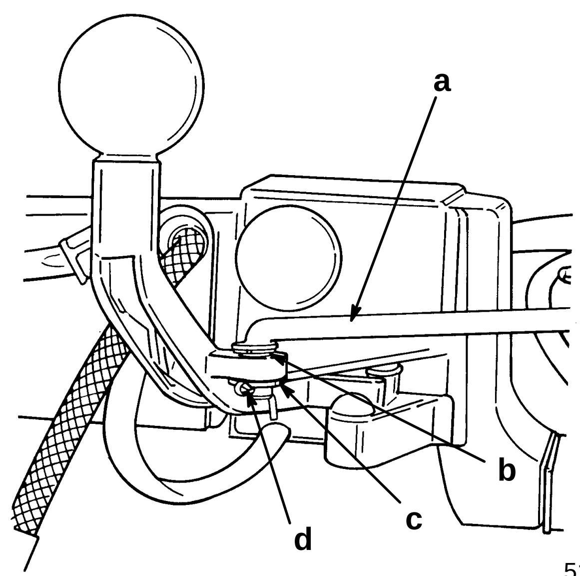
14. Reinstall electrical panel access cover and secure with screws. Torque screws to 30 lb. in. (3.4 N·m).



51621

a - Panel
b - Screws - Torque to 30 lb. in. (3.4 N·m)

15. Reconnect shift link rod to shift lever using bushing, washer and cotter key.

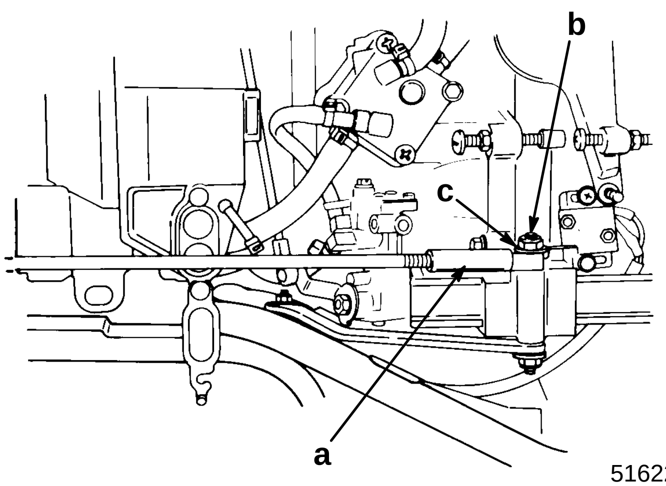


51624

a - Shift Link Rod
b - Bushing
c - Washer
d - Cotter Key

Shift Link Rod Installation and Adjustment to Engine

1. Position shift lever handle into neutral detent.
2. Manually shift outboard into neutral (propeller will rotate freely).
3. Adjust shift link rod end to slip over shift actuator bolt with slight preload adjustment toward reverse.
4. Place hole in end of shift link rod end over stud of shift actuator and secure with lock nut and washer. Tighten until snug then back off 1/4 turn.



51622

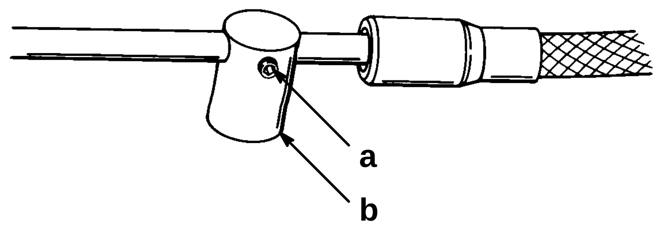
a - Shift Link Rod End
b - Shift Actuator Stud
c - Lock Nut

5. Check shift link rod adjustment as follows:
   a. Place engine shift lever in “F” (Forward) position. Propeller should not rotate in a COUNTERCLOCKWISE direction. If propeller does rotate COUNTERCLOCKWISE, length of shift link rod must be reduced and Step “a” repeated.
   b. Place engine shift lever in “N” (Neutral) position. Propeller should rotate freely without drag. If not, length of shift link rod must be increased and Steps “a” and “b” repeated
   c. While rotating propeller, place engine shift lever in “R” (Reverse) position. If propeller can be rotated in either direction, length of shift link rod must be increased and Steps “a” thru “c” repeated.
   d. Place engine shift lever in “N” (Neutral) position. Propeller should turn freely without drag. If not, length of shift link rod must be decreased and Steps “a” thru “d” repeated.

Throttle Cable Installation and Adjustment to Engine

IMPORTANT: Turn throttle cable conduit clockwise until bottomed on tiller handle then back off one turn before reconnecting throttle cable to engine.

1. Rotate throttle twist grip fully clockwise to stop “IDLE” position.
2. Back out set screw from throttle cable barrel until 2 or 3 threads of set screw are exposed.



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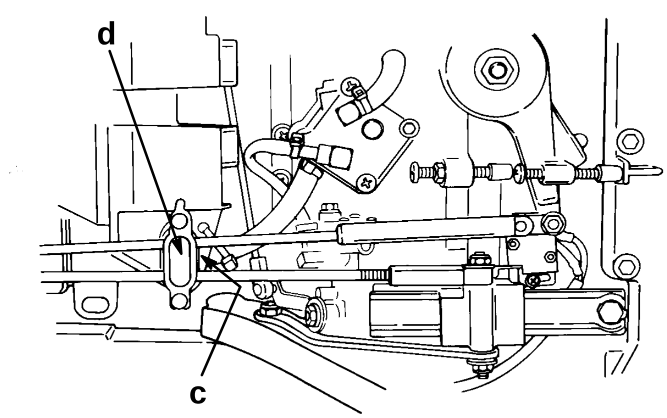
a - Set Screw
b - Throttle Cable Barrel

3. Place end of throttle cable guide over peg of throttle lever and secure with locknut and washer. Tighten until snug then back off 1/4 turn.

⚠ CAUTION

DO NOT exceed 1/4 turn on set screw after it has bottomed-out.

4. Holding engine throttle lever against idle stop, adjust throttle cable barrel to slip into upper hole of barrel receptacle, with a very light preload of throttle lever against idle stop. Apply small amount of Loctite 271 to threads of allen screw and tighten until snug, then an additional 1/8 turn. Lock barrel in place with barrel retainer.



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c - Barrel Receptacle
d - Barrel Retainer

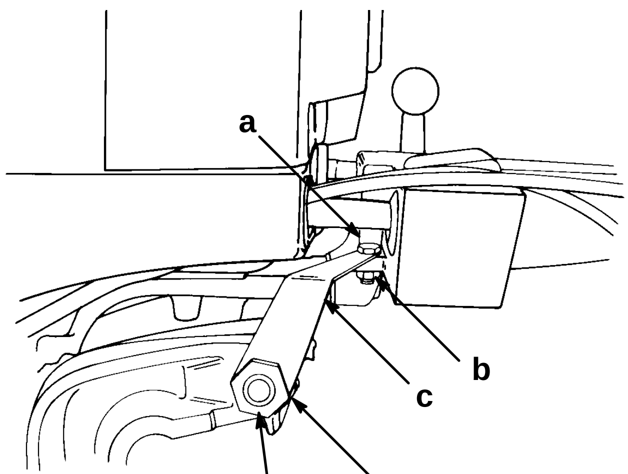
5. Check preload on throttle cable by placing a thin piece of paper between idle stop screw and idle stop. Preload is correct when paper can be removed without tearing, but has some drag on it. Readjust cable barrel, if necessary.
6. Reinstall outboard cowling.
7. Reconnect POSITIVE (+) and NEGATIVE (–) cables to battery.

Co-Pilot Installation

⚠ WARNING

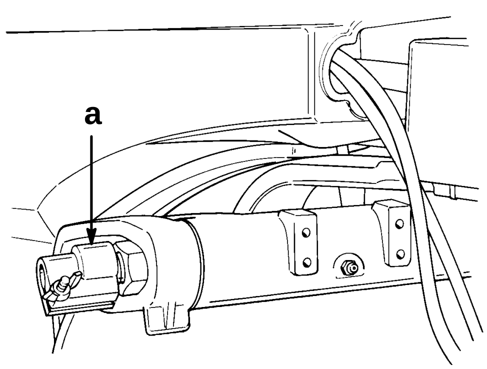
Co-Pilot Assembly (supplied) MUST BE installed on tiller handle models.

1. Remove and discard shipping bracket components, if installed.



a - Bolt
b - Nut
c - Shipping Bracket
d - Washer
e - Nut

2. Thread friction device onto starboard end of tile tube, until securely tightened and position wing nut toward front of outboard as shown.



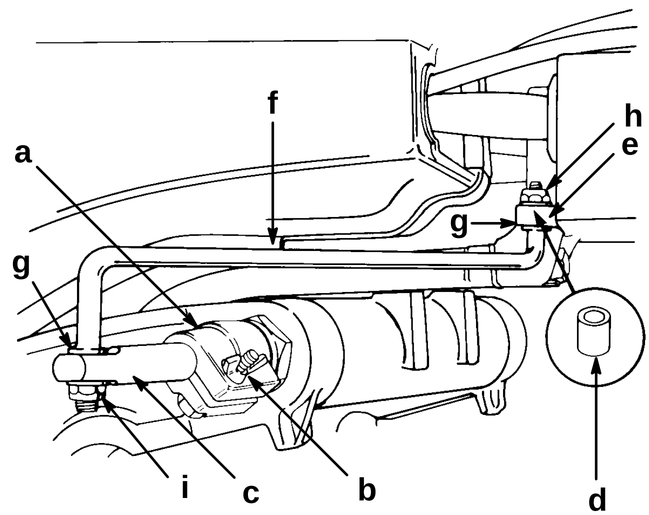
a - Friction Device

3. Loosen wing nut on friction device and insert pilot rod thru friction device and into tilt tube.
4. Lubricate both ends of link rod with Quicksilver 2-4-C w/Teflon.
5. Secure link rod between steering handle assembly and pilot rod end as shown.
6. Adjust wing nut on friction device to provide desired steering control.

IMPORTANT: Tighten wing nut to increase friction; loosen to decrease friction.

⚠ WARNING

If wing nut is tightened, it may not be possible to steer the outboard in an emergency.



a - Steering Friction Device
b - Wing Nut
c - Pilot Rod
d - Spacer (Hidden) - Place in hole of steering handle assembly.
e - Steering Handle Assembly
f - Link Rod - Short bend of link rod to steering handle.
g - Flat Washer (2)
h - Locknut - Torque to 120 lb. in. (13.6 N·m)
i - Locknut - Tighten until it seats DO NOT exceed 120 lb. in. (13.6 N·m), then back off 1/4 Turn.