Service Manual Outline

Notice

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

Notice to Users of This Manual

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

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

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

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

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

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

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

Cleanliness and Care of Outboard Motor

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

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

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 the 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 outboard which is suspended. Outboards should be attached to work stands, or lowered to ground as soon as possible.

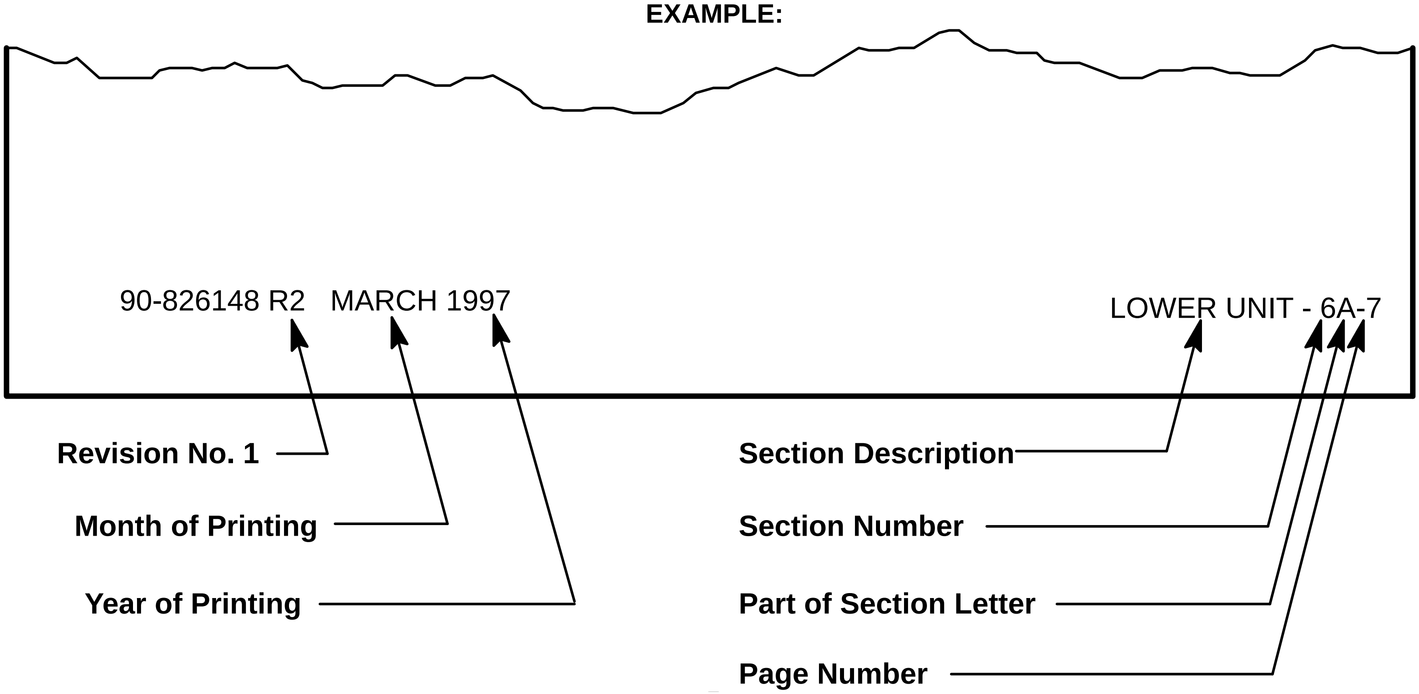
We reserve the right to make changes to this manual without prior notification.

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

Page Numbering

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

EXAMPLE:



IMPORTANT INFORMATION

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CYLINDER BLOCK	Type	4 Stroke Cycle – Over Head Camshaft
	Displacement	30.4 cu. in. (498cc)
	Number of Cylinders	2
STROKE	Length	2.953 in. (75 mm)
CYLINDER BORE	Diameter	
	Standard	2.5591 in. (65 mm)
	Oversize-0.020 in. (0.050 mm)	2.5787 in. (65.5 mm)
	Taper/Out of Round Maximum	0.003 in. (0.08 mm)
	Bore Type	Cast Iron
PISTON	Piston Type	Aluminum
	O.D. at Skirt	
	Standard	2.5570 - 2.5576 in. (64.950 - 64.965 mm)
	Oversize-0.020 in. (0.50mm)	2.5768 - 2.5774 in. (65.450 - 65.465 mm)
PISTON CLEARANCE	Piston to Cylinder Clearance	0.0014 - .0026 in. (0.035 - 0.065 mm)
RINGS	Ring End Gap (Installed)	
	Top	0.006 - 0.012 in. (0.15 - 0.03 mm)
	Middle	0.012 - 0.020 in. (0.30 - 0.50 mm)
	Bottom (Oil Ring)	0.008 - 0.028 in. (0.20 - 0.70 mm)
	Side Clearance:	
	Top	0.0008 - 0.0024 in. (0.02 - 0.06 mm)
	Middle	0.0008 - 0.0024 in. (0.02 - 0.06 mm)

SPECIFICATIONS

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General Specifications

Model 30/40		
HORSEPOWER (KW)	**Model 30 Model 40**	30 (22.4) 40 (29.8)
OUTBOARD WEIGHT	**15 in. (38 cm) 20 in. (51 cm) 22-1/2 in. (57 cm)**	156 lbs. (70.7kg) 161 lbs. (73.0kg) 166 lbs. (75.3kg)
CYLINDER BLOCK	**Type Displacement**	Two Cylinder - Two Cycle 39.3 cu. in. (644.4 cc)
STROKE	**Length**	2.796 in. (71 mm)
CYLINDER BORE	**Diameter (Standard) Diameter [Oversize 0.015 (.381 mm)] Taper/Out of Round Maximum Bore Type Cylinder Finish Hone (I.D.)**	2.993 in. (76 mm) 3.007 in. (76.38 mm) 0.003 in. (0.08 mm) Cast Iron 2.993 in. (76 mm)
CRANKSHAFT	**Top Main Bearing Journal Center Main Bearing Journal Bottom Ball Bearing Journal Connecting Rod Journal Runout**	1.375 in. (34.93 mm) 1.216 in. (30.89 mm) 1.385 in. (35.17 mm) 1.181 in. (29.99 mm) 0.003 in. (0.076 mm)
CONNECTING ROD	**Piston Pin End (I.D.) Crankpin End (I.D.)**	0.957 in. (24.31 mm) 1.499 in. (38.07 mm)
PISTON	**Piston Type O.D. at Skirt (Standard) O.D. at Skirt [Oversize 0.015 (.381 mm)] Ring End Gap**	Aluminum 2.988 in. (75.90 mm) 3.003 in. (76.28 mm) 0.010 in. - 0.018 in. (0.25 mm - 0.46 mm)
REEDS	**Reed Stand Open (Maximum) Reed Stop – Model 30 – Model 40**	0.020 in. (0.508 mm) 0.090 in. (2.286 mm) Not Adjustable
GEAR HOUSING	**Gear Ratio Gearcase Capacity Lubricant Type Forward Gear - No. of Teeth-Type Pinion Gear - No. of Teeth-Type Pinion Height Forward Gear Backlash Reverse Gear Backlash Water Pressure With Thermostat + Poppet – @ W.O.T. – @ Idle All Models W/O Thermostat + Poppet – @ W.O.T. – @ Idle Poppet Valve Opening 1994-1997 Poppet Valve Opening 1998 & Newer**	2.0:1 14.9 oz. (440 mL) Quicksilver Gear Lube Premium Blend 26 Spiral/Bevel 13 Spiral/Bevel 0.025 in. (0.64 mm) No Adjustment No Adjustment 5 – 7 PSI @ 5000 RPM 0.5 – 1.5 PSI @ 750 RPM 5 – 7 PSI @ 5000 RPM 0 – 1 PSI @ 750 RPM 900-1000 RPM 3000-3500 RPM

General Specifications

Model 30/40		
MID SECTION	**Transom Height - Short Shaft** **- Long Shaft** **Steering Pivot Range** **Tilt Pin Positions** **Total Tilt Angle** **Allowable Transom Thickness**	15 in. (38 cm) 20 in. (51 cm) 90° 5 + Shallow Water 70° 2-3/8 in. (60.3mm)
FUEL SYSTEM	**Fuel Pump Pressure** **- @ W.O.T.** **- @ Idle** **Recommended Gasoline** **Fuel Tank Capacity** **Break-in Gasoline Ratio** **Manual Outboard** **Electric Start Outboard**	 4-7 PSI (28-43 kPa) 2-1/2 – 4 PSI (17-27 kPa) Automotive Regular or Unleaded with a Minimum Pump Posted Octane Rating of 87 6.6 U.S. Gallons (5 Imp. Gals.; 25 Liters) 25:1 50:1 (In Fuel Tank)
OIL INJECTION	**Recommended Oil** **Oil Tank Capacity/Approx. Time** **Reserve Capacity/Approx. Time** **Output (cc/min.) w/Pump @ Full Open**	Quicksilver TC-W II or TC-W III 2-Cycle Outboard Oil 50.5 fl. oz. (1.5 liters) 4.7 Hours @ 5250 RPM 30 Minutes @ 5250 8.5 cc/10 Minutes @ 900 RPM
STARTING SYSTEM	**Manual Start** **Electric Start** **Starter Draw (Under Load)** **(No Load)**	Recoil 12 Volt 95 Amperes 20 Amperes
CHARGING SYSTEM	**Alternator Output** **- Electric Start** **Red Stator** **Black Stator** **- Manual Start**	Single Phase (12 Pole) 18 Amperes @ 3000 RPM 14 Amperes @ 5000 RPM 9 Amperes @ 3000 RPM
BATTERY	**Battery Rating**	465 Marine Cranking Amps (MCA) or 350 Cold Cranking Amps (CCA)
IGNITION SYSTEM	**Type** **Spark Plug Type (NGK)** **Spark Plug Gap** **Optional Plug (NGK)** **Firing Order**	Capacitor Discharge BP8H-N-10 0.040 in. (1.0mm) BPZ8H-N-10* 0.040 in. (1.0mm) 1-2

General Specifications

Model 30/40		
CARBURETOR SPECIFICATIONS	**Idle RPM**	700 - 800 RPM (In Forward Gear)
	Full Throttle RPM Range	
	- Model 30/ 40 Sea Pro/Marathon	4500 - 5500 RPM
	- Model 40	5000 - 5500 RPM
	Idle Mixture Screw Adjustment (Preset - Turns Out)	1-1/2 ± 1/4 (All Models Except 40 MLL) 1-3/4 ± 1/4 (WME-38 Carb on 40 MLL)
	Float Level	9/16 in. (14.29mm)
	Main Jet	
	- 30 Manual (WME-36/36A)/(WME-63)	0.054 in.
	- 30 Electric (WME-37/37A)/(WME-64)	0.054 in.
	- 40 Manual (WME-38)/(WME-66)	0.066 in.
	- 40 Electric (WME-39/39A)/(WME-67)	0.066 in.
	- 30 EHO (WME-42/42A)/(WME-65)	0.054 in.
TIMING SPECIFICATIONS	**Models with (S/N-0G59999 & Below)**	
	Idle	3° BTDC ± 3° (Not Adjustable)
	Maximum BTDC @ 2500-5500 RPM	25° ± 3° (Not Adjustable)
	Models with (S/N-0G590000 & Above)	
	Idle	8° BTDC ± 1°
	Maximum Spark Advance	1 Turn Clockwise After Contacting Throttle Plate

IMPORTANT INFORMATION

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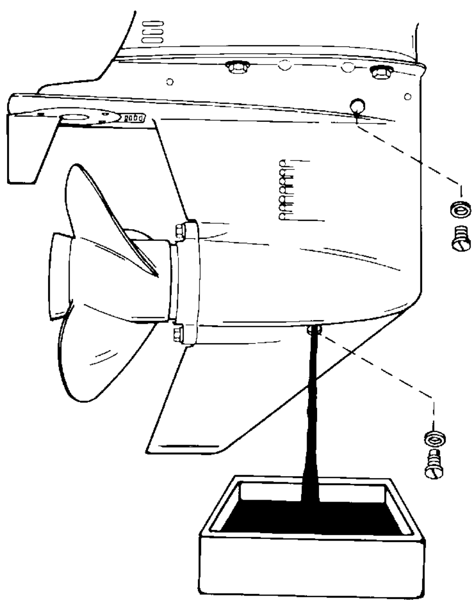

MAINTENANCE

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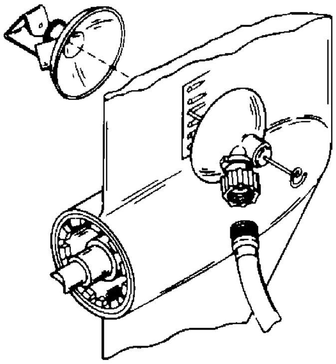
Specifications

Gear Case Lubricant Capacity

Gear Case Ratio	Capacity
2.00:1	14.9 fl. oz. (440 mL)

Special Tools

P/N 44357A2 Flushing Kit.



Quicksilver Lubricant/Sealant

Description	Part Number
Gear Lubricant-Premium Blend	92-19007A24
Anti-Corrosion Grease	92-78376A6
2-4-C Marine Lubricant w/Teflon	92-825407A12
SAE 30W Motor Oil	Obtain Locally

Inspection and Maintenance Schedule

Before Each Use

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

After Each Use

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

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

1. Lubricate all lubrication points. Lubricate more frequently when used in salt water.
2. Inspect and clean spark plugs.
3. Check engine fuel filter for contaminants.
4. Adjust carburetor(s) (if required).*
5. Check engine timing setup.*
6. Check corrosion control anodes. Check more frequently when used in salt water.
7. Drain and replace gear case lubricant.
8. Lubricate splines on the drive shaft.
9. Check power trim fluid.
10. Inspect battery.
11. Check control cable adjustments. *
12. Remove engine deposits with Quicksilver Power Tune Engine Cleaner.
13. Check tightness of bolts, nuts, and other fasteners.

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

Every 300 Hours of Use or Three Years

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

Before Periods of Storage

Refer to Storage Procedure (Page 1B-10).

Lubrication Points

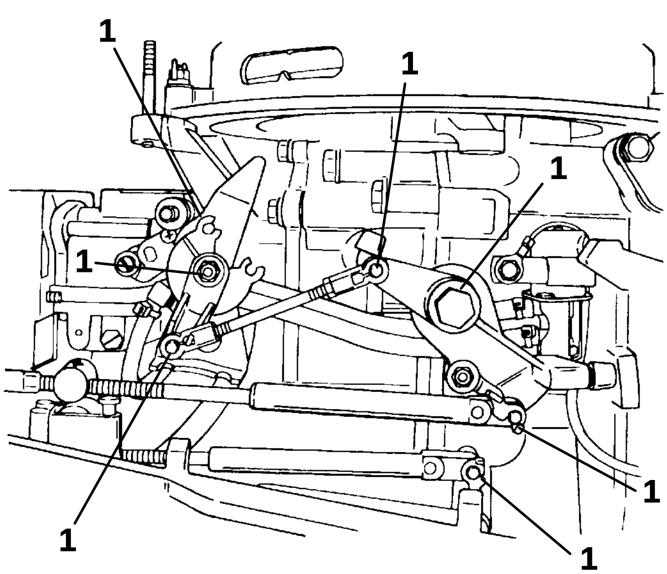
ITEM NO.	DESCRIPTION	TYPE OF LUBRICANT	FRESH WATER FREQUENCY	SALT WATER FREQUENCY
1	Throttle/Shift linkage Pivot Points	Quicksilver 2-4-C Marine Lubricant 100 Hours of Use or Once in Season	100 Hours of Use or Once in Season	
2	Upper Shift Shaft			
3	Swivel Pin			
4	Ride Guide Steering Cable			
5	Tilt Tube/Co-Pilot			
6	Steering Link Rod Pivot Points	SAE 30W Motor Oil		
7	Propellor Shaft	Quicksilver Special Lubricant 101 Anti-Corrosion Grease		
8	Starter Motor Pinion Gear	SAE 10W Motor Oil		
9 *	Gear Housing Bearing Carrier	Quicksilver Special Lubricant 101		
10 à	Gear Housing	Quicksilver Gear Lube		
D	Engine Crankshaft Splines to Drive Shaft Splines	Quicksilver 2-4-C Marine Lubricant	**Once in Season**	

* Refer to lubrication instructions outlined in "**Salt Water Corrosion - Gear Housing Bearing Carrier and Cover Nut**" of this section (see "Table of Contents").

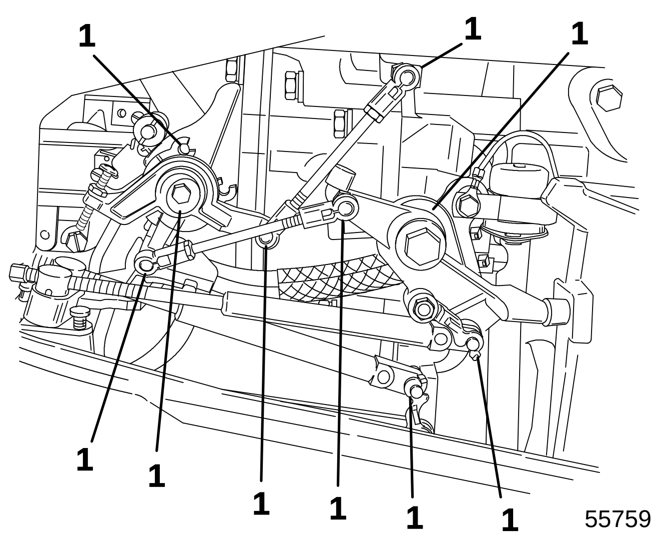
à Refer to "**Gear Housing Lubrication**" of this section (see "**Table of Contents**").

D Refer to "**Gear Housing Removal and Installation**" (Section 5).

(S/N-0G589999 & Below)



(S/N-0G590000 & Above)



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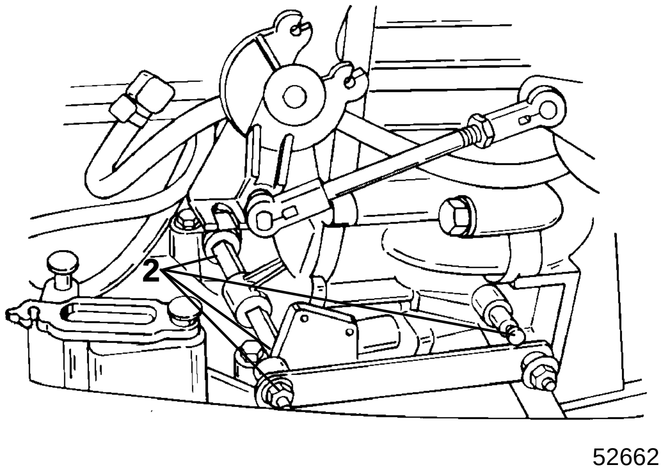
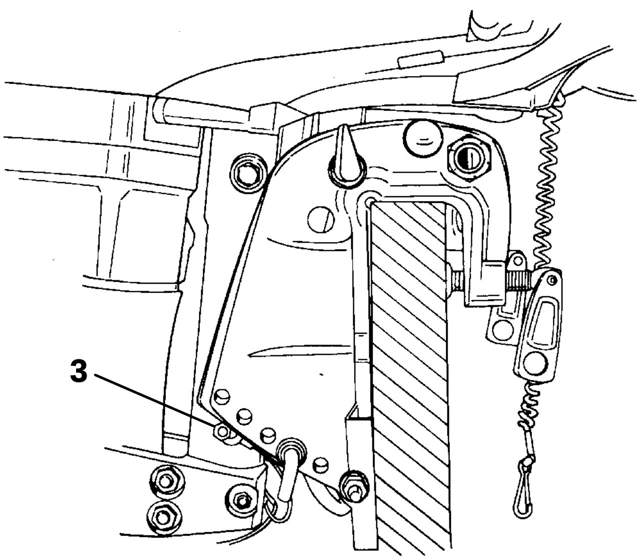


2 - Upper Shift Shaft Lubrication



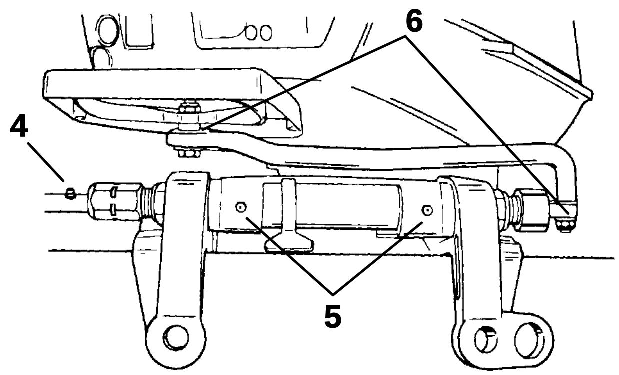
3 - Swivel Pin Grease Fittings

⚠ WARNING

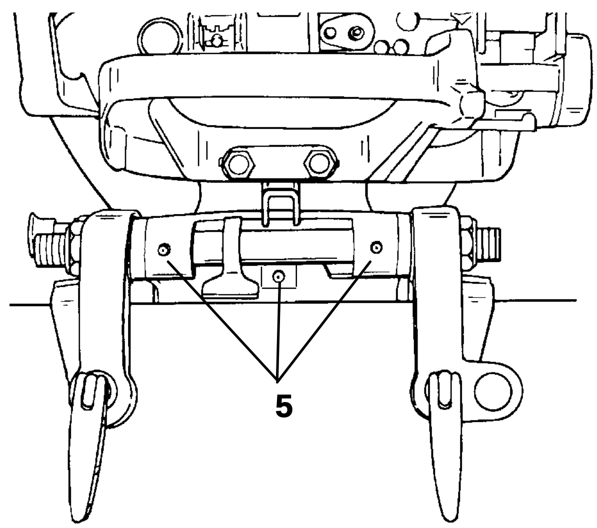
Core of steering cable (transom end) must be fully retracted into cable housing before lubricating cable. If cable is lubricated while extended, hydraulic lock of cable could occur.

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 Marine Lubricant. Lubricate all pivot points with SAE 30W engine oil.

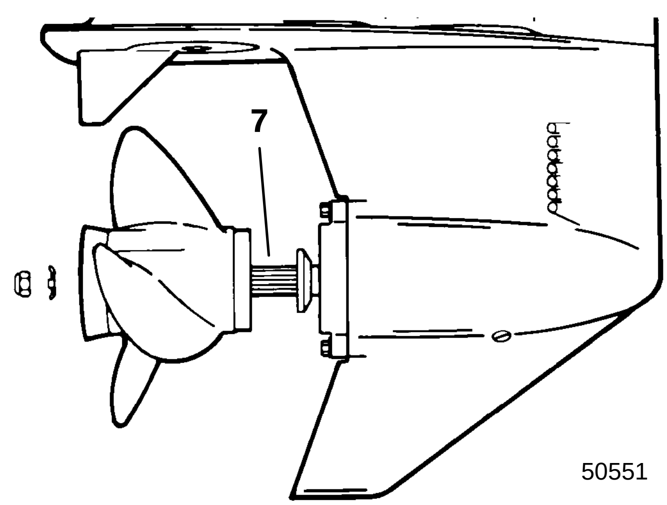
Electric and Remote Control Models



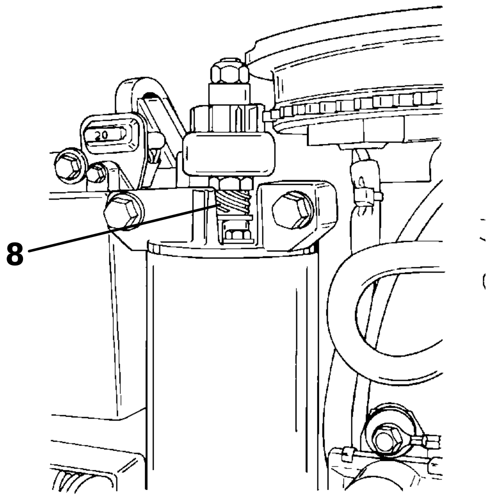
Tiller Handle Models



4 - Ride Guide Steering Grease Fitting
5 - Tilt Tube/Co-Pilot Grease Fitting
6 - Steering Link Rod Pivot Point Lubrication



7 - Propeller Shaft Lubrication



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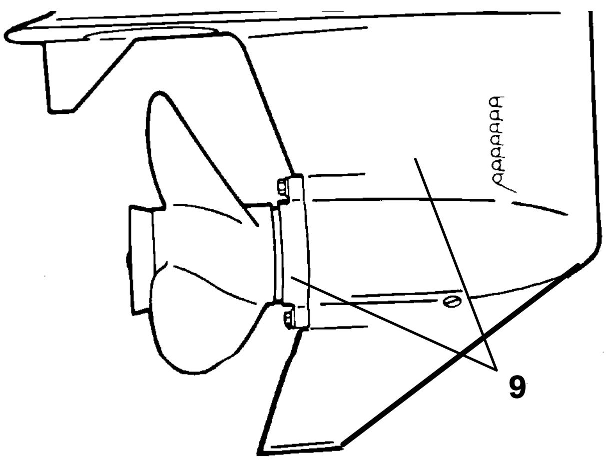
8 - Starter Motor Pinion Gear Lubrication



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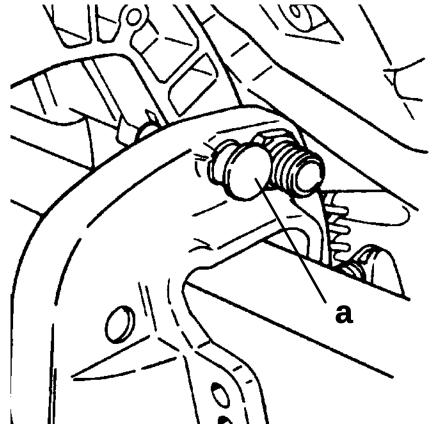
9 - Gear Housing Lubrication

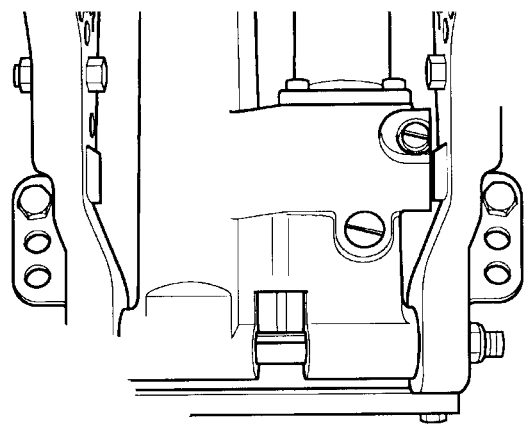
Checking Power Trim Fluid

1. Tilt outboard to the full up position and engage the tilt support pin.



a - Tilt Support Pin

2. Remove fill cap and check fluid level. The fluid level should be even with the bottom of the fill hole. Add Quicksilver Power Trim & Steering Fluid or automotive transmission fluid (ATF) Type F, FA, or Dexron III.



Gear Case Lubrication

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

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

⚠ WARNING

If gear housing is installed on outboard, to avoid accidental starting, disconnect (and isolate) spark plug leads from spark plugs before working near the propeller.

⚠ CAUTION

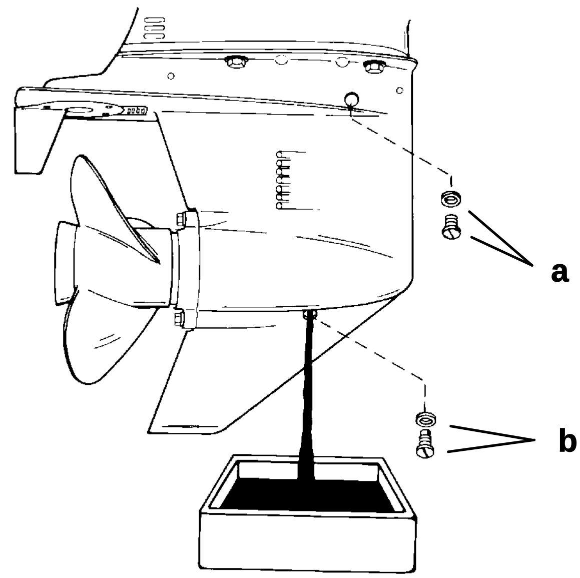
Do not use automotive grease in the gear housing. Use only Quicksilver Gear Lube or Quicksilver Super-Duty Lower Unit Lubricant.

Draining Gear Case

1. Tilt outboard so that lubricant in gear housing will drain toward front of housing, out fill hole and into clean container.

IMPORTANT: Inspect FILL and VENT plug washers for damage. Use new washer as needed.

2. Remove lubricant FILL plug and washer. Note amount of metal particles on magnetic FILL plug. Remove all magnetic particles from FILL plug.
3. Remove VENT plug and washer and allow all lubricant to drain.



a - Lubricant Vent Plug/Washer
b - Lubricant Fill Plug/Washer

4. Inspect gear lubricant for metal particles (lubricant will have a "metal flake" appearance). Presence of fine metal particles (resembling powder) on the FILL plug bar magnet indicates normal wear. The presence of metal chips on the FILL plug bar magnet indicates the need for gear housing disassembly and components inspection.
5. Note color of gear lubricant. White or cream color indicates presence of water in lubricant. Gear lubricant which has been drained from a gear housing recently in operation will have a yellowish color due to lubricant agitation/aeration. This is normal and should not be confused with the presence of water.
6. 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.

Checking Lubricant Level and Filling Gear Case

IMPORTANT: Never add lubricant to gear housing without first removing VENT plug, as trapped air will prevent housing from being filled. Fill gear housing only when outboard is in operating position.

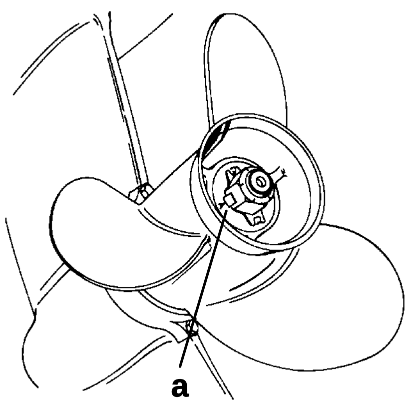
NOTE: Refer to "**Specifications**," for gear housing lubricant capacity.

1. With outboard in operating position, insert lubricant tube into fill hole.
2. Fill gear housing until excess lubricant flows from VENT hole.
3. Install VENT plug and washer.
4. Install FILL plug and washer.

Propeller Replacement

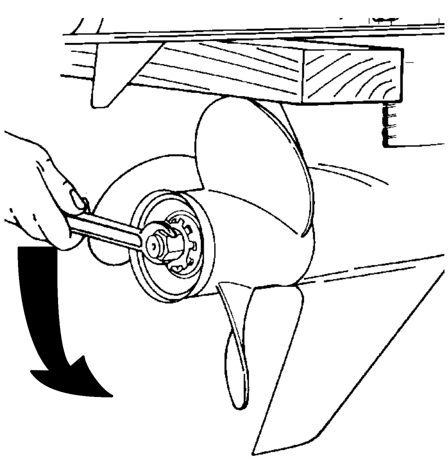
Removal

1. Shift outboard to neutral (N) position.
2. Remove the spark plug leads to prevent engine from starting.
3. Straighten the bent tabs on the propeller nut retainer.



a - Tabs

4. Place a block of wood between gear case and propeller to hold propeller and remove propeller nut.



5. Pull propeller straight off shaft. If propeller is seized to the shaft and cannot be removed, have the propeller removed by an authorized dealer.

Installation

⚠ WARNING

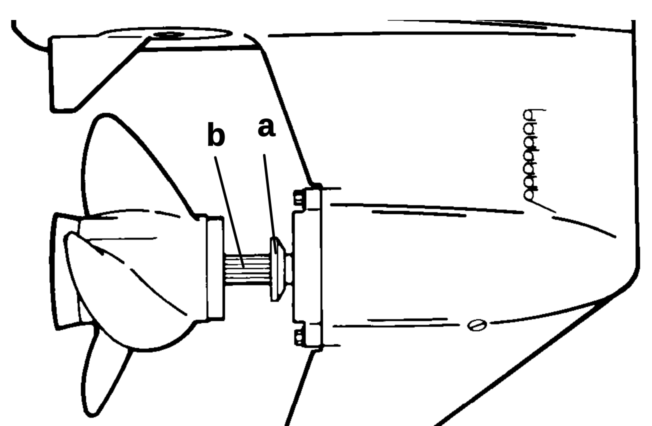
If the propeller shaft is rotated while the engine is in gear, there is the possibility that the engine will crank over and start. To prevent this type of accidental engine starting and possible serious injury caused from being struck by a rotating propeller, always shift outboard to neutral position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

⚠ CAUTION

If the propeller moves forward-and-aft on the propeller shaft (is loose), re-tighten the propeller nut. Operation with a loose propeller could cause damage to the thrust hub and gear housing during acceleration, deceleration or when shifting gears.

IMPORTANT: To assure that the propeller remains secure on the shaft during the season, periodically check propeller shaft nut for tightness.

1. To aid in future removal of the propeller, liberally coat the propeller shaft spline with one of the following Quicksilver lubricants:
   - Special Lubricant 101
   - Anti-Corrosion Grease
   - 2-4-C Marine Lubricant
2. Place forward thrust hub on propeller shaft.



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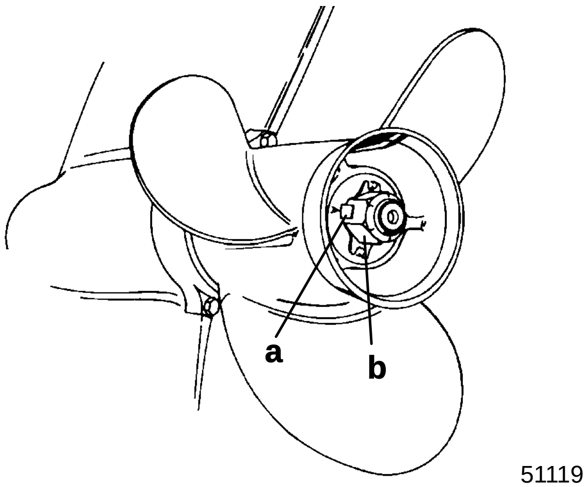
a - Thrust Hub
b - Propeller Shaft

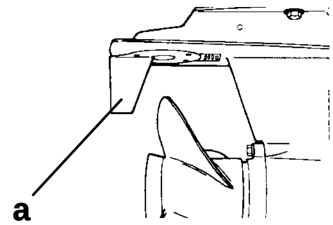
3. While aligning splines, place Quicksilver propeller and tab washer on propeller shaft.
4. To prevent propeller from rotating, place a flat block of wood between the anti-ventilation plate and the propeller.
5. Thread propeller nut on propeller shaft. Tighten securely with wrench [minimum of 55 lb. ft. (75.0 N·m) of torque] and bend tab washer to secure propeller nut.
6. After first use, bend the tab straight, re-tighten propeller nut [minimum of 55 lb. ft. (74.6 N·m) of torque] and again bend tab washer to secure nut. Check propeller periodically for tightness.

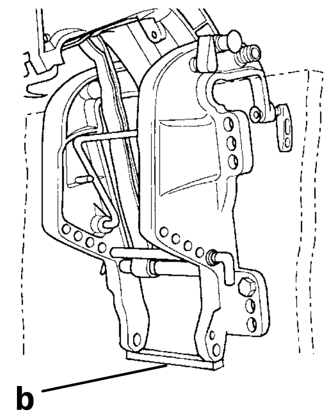


a - Tab Washer
b - Propeller Nut

Corrosion Control Anode

The trim tab on the gear case is a corrosion control anode and Models which have the longer type of transom brackets will have a second anode installed. An anode helps protect the outboard against galvanic corrosion by sacrificing its metal to be slowly eroded instead of the outboard metals.





a - Trim Tab
b - Anode

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

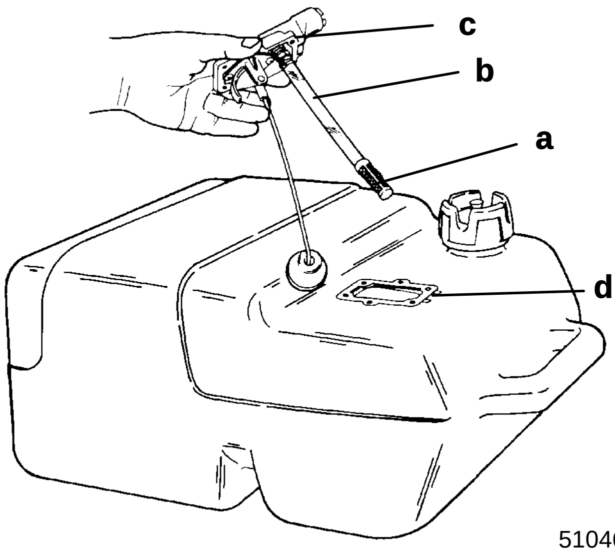
Fuel Tank

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.

FUEL TANK FILTER

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.



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

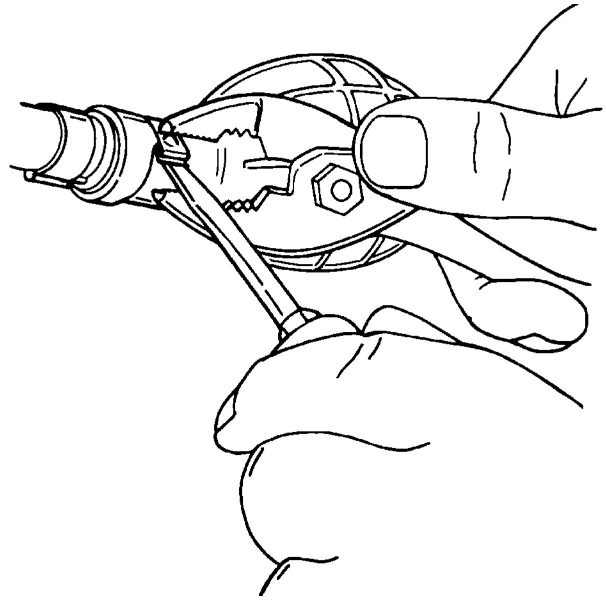
FUEL LINE AND PRIMER BULB

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.

1. To remove fuel line clamps, grip clamp with pliers and bend over, lapping hook backward.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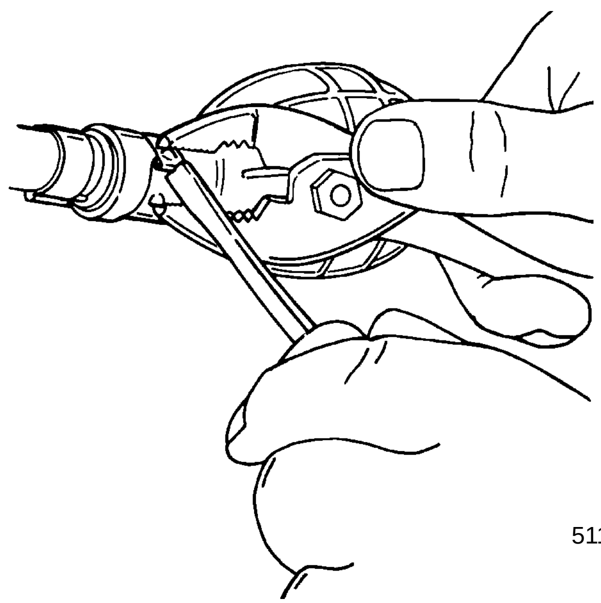
2. To install fuel line clamps, grip hose clamp with pliers and push down on hook with screwdriver until hooks interlock.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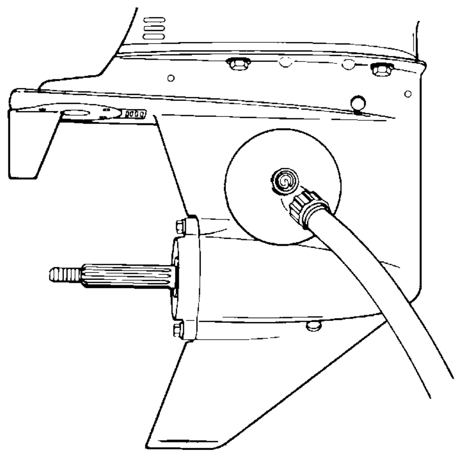
Flushing The Cooling System

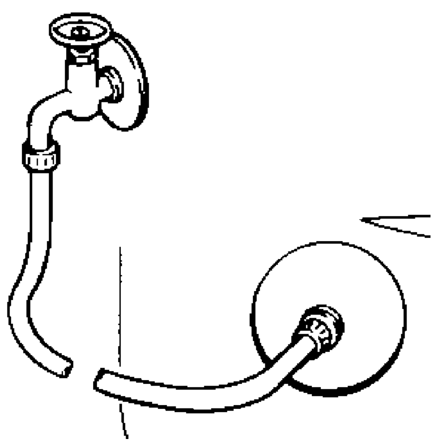
⚠ WARNING

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

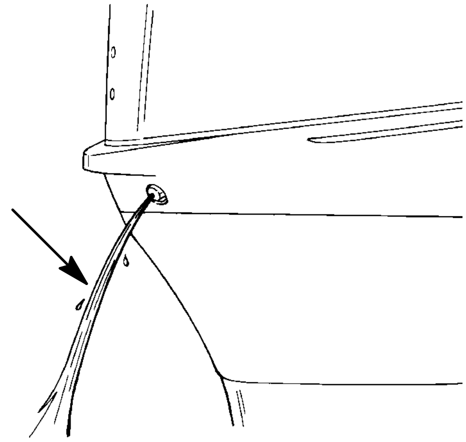
1. Remove propeller (refer to Propeller Replacement). Install the flushing attachment so the rubber cups fit tightly over the cooling water intake holes.



2. Attach a water hose to the flushing attachment. Turn on the water and adjust the flow so water is leaking around the rubber cups to ensure the engine receives an adequate supply of cooling water.



3. Start the engine and run it at idle speed in neutral shift position.
4. Adjust water flow (if necessary) so excess water continues leaking out from around the rubber cups to ensure the engine is receiving an adequate supply of cooling water.
5. Check for a steady stream of water flowing out of the water pump indicator hole. Continue flushing the outboard for 3 to 5 minutes, carefully monitoring water supply at all times.



6. Stop the engine, turn off the water, and remove the flushing attachment. Reinstall the propeller.

Storage

The major consideration in preparing your outboard for storage is to protect it from rust, corrosion, and damage caused by freezing of trapped water.

The following storage procedures should be followed to prepare your outboard for out-of-season storage or prolonged storage (two months or longer).

⚠ CAUTION

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

Fuel System

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

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

1. Portable Fuel Tank - Pour the required amount of Quicksilver Gasoline Stabilizer (follow instructions on container) into fuel tank. Tip fuel tank back and forth to mix stabilizer with the fuel.
2. Permanently Installed Fuel Tank - Pour the required amount of Quicksilver Gasoline Stabilizer (follow instructions on container) into a separate container and mix with approximately one quart (one liter) of gasoline. Pour this mixture into fuel tank.
3. Place the outboard in water or connect flushing attachment for circulating cooling water. Run the engine for ten minutes to allow treated fuel to reach the carburetors.

Protecting External Outboard Components

1. Lubricate all outboard components listed in the Inspection and Maintenance Schedule.
2. Touch up any paint nicks. See your dealer for touch-up paint.
3. Spray Quicksilver Corrosion Guard on engine exterior, electrical components, and other metal surfaces (except corrosion control anodes).

Protecting Internal Outboard Components

NOTE: *Before performing the following steps, make sure the fuel system has been prepared for storage. Refer to Fuel System (Page 1B-10).*

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

Gear Case

1. Drain and refill the gear case lubricant (refer to maintenance procedure).

Positioning Outboard for Storage

1. Store outboard in an upright (vertical) position to allow water to drain out of outboard.

⚠ CAUTION

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

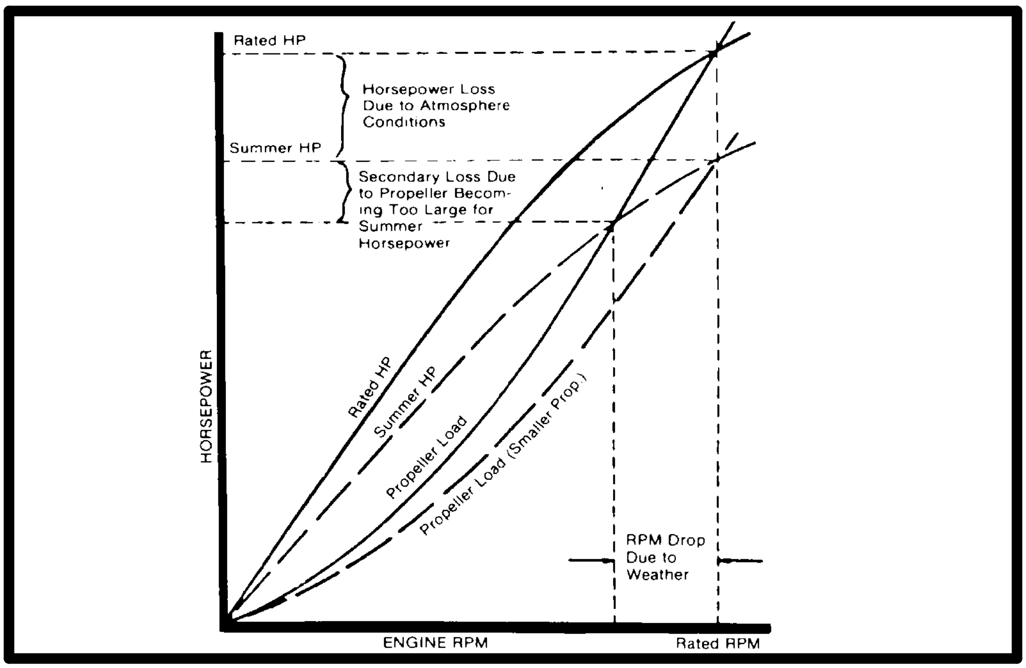
Battery Storage

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

IMPORTANT INFORMATION

1

C



GENERAL INFORMATION

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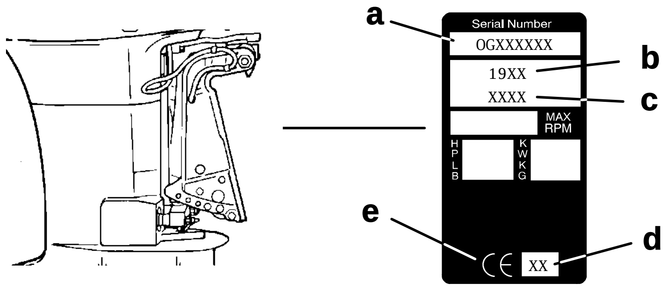
Serial Number Location

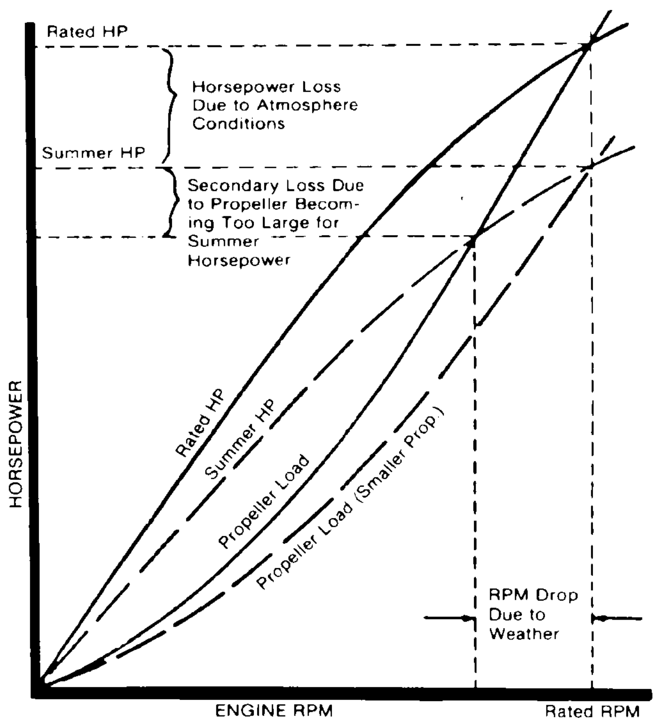
The Outboard serial number is located on the lower starboard side of the engine block. A serial number is also located on the starboard side of the swivel bracket.



a - Serial Number
b - Model Year
c - Model Description
d - Year Manufactured
e - Certified Europe Insignia

Conditions Affecting Performance

Weather



It's 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.

Boat

WEIGHT DISTRIBUTION

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

BOTTOM

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

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

TRIM

TRIMMING OUTBOARD "OUT" ("UP")

⚠ WARNING

Excessive trim "out" also may reduce the stability of some high speed hulls. To correct instability at high speed, reduce the power GRADUALLY and trim the outboard "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.)

1. Will lift bow of boat, generally increasing top speed.
2. Transfers steering torque harder to left on single outboard installations below 23 in. (584mm) transom height.
3. Increases clearance over submerged objects.
4. In excess, can cause porpoising and/or ventilation.
5. If trimmed out beyond the water pickup, reduced water supply can cause overheating resulting in engine damage.

TRIMMING OUTBOARD "IN" ("DOWN")

⚠ 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 angle (trim adjustment bolt relocation.)

1. Will help planing off, particularly with a heavy load.
2. Usually improves ride in choppy water.
3. In excess, can cause boat to veer to the left or right (bow steer).
4. Transfers steering torque harder to right (or less to the left) on single outboard installations.
5. Improves planing speed acceleration (by moving trim adjustment bolt one hole closer to transom).

WATER ABSORPTION

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

CAVITATION

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

Engine

DETONATION

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

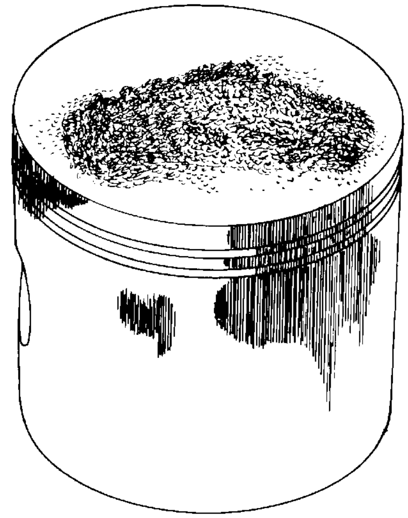
Detonation is an explosion of an unburned portion of the fuel/air charge after the spark plug has fired. Detonation creates severe shock waves in the engine, and these shock waves often find or create a weakness: The dome of a piston, cylinder head/gasket, piston rings or piston ring lands, piston pin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

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

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

Detonation usually can be prevented if:

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



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Damaged Piston Resulting from Detonation

Following Complete Submersion

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

Propeller Selection

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

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

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

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

Refer to "Quicksilver Accessory Guide" for a complete list of available propellers.

1. Select a propeller that will allow the engine to operate at or near the top of the recommended full throttle RPM range (listed in "**Specifications**," preceding) with a normal load. Maximum engine speed (RPM) for propeller selection exists when boat speed is maximum and trim is minimum for that speed. (High RPM, caused by an excessive trim angle, should not be used in determining correct propeller.) Normally, there is a 150-350 RPM change between propeller pitches.
2. If full throttle operation is below the recommended range, the propeller MUST BE changed to one with a lower pitch to prevent loss of performance and possible engine damage.

3. After initial propeller installation, the following common conditions may require that the propeller be changed to a lower pitch:

   a. Warmer weather and great humidity will cause an RPM loss.

   b. Operating in a higher elevation causes an RPM loss.

   c. Operating with a damaged propeller or a dirty boat bottom or gear housing will cause an RPM loss.

   d. Operation with an increased load (additional passengers, equipment, pulling skiers, etc.).

Propeller Information Chart - 30 HP

Wide Open Throttle RPM: 4500-5500
Recommended Transom Height: 15”, 20”, 22-1/2”
Right Hand Rotation Standard
Gear Reduction: 2:1

Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat Weight (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
10”	19”	3	Alum.	Up To 800	Up To 15’	36-45	48-73146A40
10”	17”	3	Alum.	Up To 1000	Up To 15’	31-45	48-73144A40
10”	16”	3	Steel	700-1200	13 - 16’	28-36	48-91818A5
10”	16”	3	Alum.	700-1200	13 - 16’	28-36	48-73142A40
10-1/8”	15”	3	Steel	900-1500	14 - 16’	26-34	48-76232A5
10-1/8”	15”	3	Alum.	900-1500	14 - 16’	26-34	48-73140A40
10-1/4”	14”	3	Steel	1200-1800	15 - 17’	24-32	48-76230A5
10-3/8”	14”	3	Alum.	1200-1800	15 - 17’	24-32	48-816706A40
10-3/8”	13”	3	Steel	1400-2000	15 - 18’	21-29	48-76228A5
10-1/2”	13”	3	Alum.	1400-2000	15 - 18’	21-29	48-816704A40
10-5/8”	12”	3	Steel	1600-2200	16 - 19’	18-27	48-79792A5
10-3/4”	12”	3	Alum.	1600-2200	16 - 19’	18-27	48-816702A40
11-5/8”	11”	3	Steel	1800-2400	16 - 20’	15-25	48-823478A5
10-7/8”	11”	3	Alum.	1800-2400	16 - 20’	15-25	48-85632A40
12”	10-1/2”	3	Alum.	1900-2600	17 -21’	14-23	48-42740A10
11-1/4”	10”	3	Alum.	2000-2700	18 - 21’	10-21	48-73132A40
12-1/4”	9”	3	Steel	Workboat	18’Up	6-18	48-97868A10
12-1/4”	9”	3	Alum.	Workboat		6-18	48-87818A10
12-1/2”	8”	3	Alum.	Workboat/ Houseboat		1-15	48-42738A10

Thrust Hub: 73345 (Forward)

Propeller Drive Hub: 43676

Diffuser Rings: 32201 (Aluminum)

Propeller Information Chart - 40 HP

Wide Open Throttle RPM: 5000-5500
Recommended Transom Height: 15", 20", 22-1/2"
Right Hand Rotation Standard
Gear Reduction: 2:1

Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat Weight (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
10"	19"	3	Alum.	Up To 800	Up To 15'	38-45	48-73146A40
10"	17"	3	Alum.	Up To 1000	Up To 15'	33-40	48-73144A40
10"	16"	3	Steel	700-1200	13 - 16'	30-36	48-91818A5
10"	16"	3	Alum.	700-1200	13 - 16'	30-36	48-73142A40
10-1/8"	15"	3	Steel	900-1500	14 - 16'	28-34	48-76232A5
10-1/8"	15"	3	Alum.	900-1500	14 - 16'	28-34	48-73140A40
10-1/4"	14"	3	Steel	1200-1800	15 - 17'	26-32	48-76230A5
10-3/8"	14"	3	Alum.	1200-1800	15 - 17'	26-32	48-816706A40
10-3/8"	13"	3	Steel	1400-2000	15 - 18'	23-29	48-76228A5
10-1/2"	13"	3	Alum.	1400-2000	15 - 18'	23-29	48-816704A40
10-5/8"	12"	3	Steel	1600-2200	16 - 19'	20-27	48-79792A5
10-3/4"	12"	3	Alum.	1600-2200	16 - 19'	20-27	48-816702A40
11-5/8"	11"	3	Steel	1800-2400	16 - 20'	17-25	48-823478A5
10-7/8"	11"	3	Alum.	1800-2400	16 - 20'	17-25	48-85632A40
12"	10-1/2"	3	Alum.	1900-2600	17 - 19'	16-23	48-42740A10
11-1/4"	10"	3	Alum.	2000-2700	18 - 21'	14-21	48-73132A40
12-1/4"	9"	3	Steel	Workboat/ Pontoon Boat	18' Up	10-18	48-97868A10
12-1/4"	9"	3	Alum.	Workboat/ Pontoon Boat		10-18	48-87818A10
12-1/2"	8"	3	Alum.	Workboat/ Houseboat		1-15	48-42738A10

Thrust Hub: 73345 (Forward)

Propeller Drive Hub: 43676

Diffuser Rings: 32201 (Aluminum)

IMPORTANT INFORMATION

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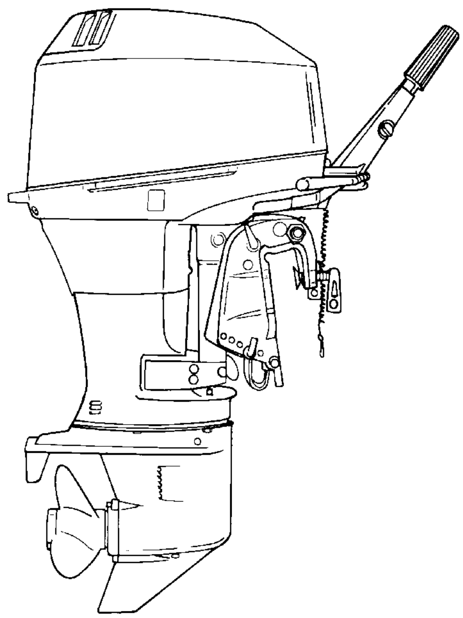


OUTBOARD MOTOR INSTALLATION

Table of Contents

Notice to Installer and Owner

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

Boat Horsepower Capacity

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

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

⚠ WARNING

Using an outboard that exceeds the maximum horsepower limit of a boat can:

1. **Cause loss of boat control**
2. **Place too much weight at the transom altering the designed flotation characteristics of the boat.**
3. **Cause the boat to break apart particularly around the transom area. Overpowering a boat can result in serious injury, death, or boat damage.**

Outboard Remote Control

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

⚠ WARNING

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

Selecting Accessories For The Outboard

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

Mercury Marine Quicksilver accessories are available from Mercury Marine dealers.

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

⚠ WARNING

Check with your dealer before installation of accessories. The misuse of acceptable accessories or the use of unacceptable accessories can result in serious injury, death, or product failure.

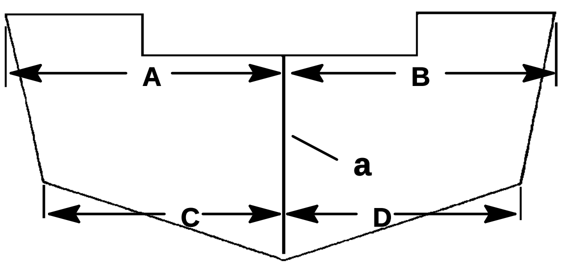
Selecting Steering Cables and Remote Control Cables

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.

Locate Centerline Of The Outboard

Locate (and mark with pencil) the vertical centerline of boat transom.



a - Centerline of Transom

NOTE: *Dimensions "A" & "B" and "C" & "D" are equal length.*

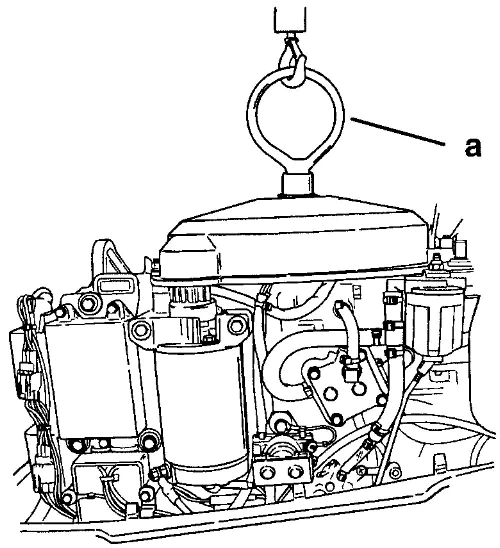
IMPORTANT: During installation of dual outboards, the following is recommended. A minimum of 22$^{1}/_{2}$ inches (570mm) centerline to centerline width is recommended. This is required to alleviate cowling interference during lock to lock turns if one outboard would be in the full tilt position, while the other outboard(s) are in the vertical running position.

Lifting Outboard

⚠ WARNING

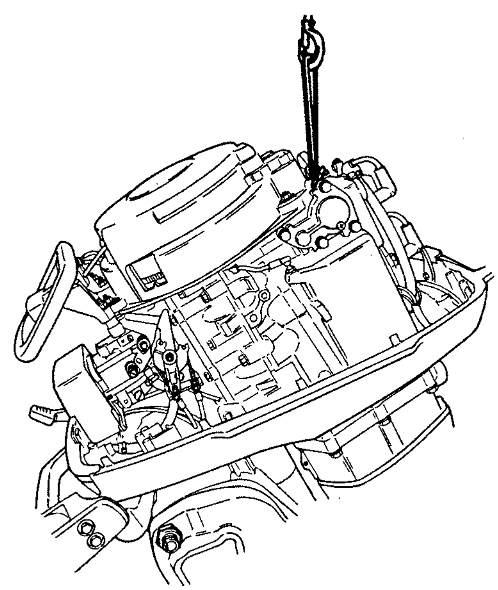
Verify that the lifting ring is threaded into the flywheel a minimum of 5 turns and that hoist has a maximum lift capacity over 500 lbs. (227 kg) BEFORE lifting outboard.

1. Electric Start Models - Remove plastic cap from center of flywheel. Thread lifting ring into flywheel hub a minimum of 5 turns. Replace plastic cap after installation.



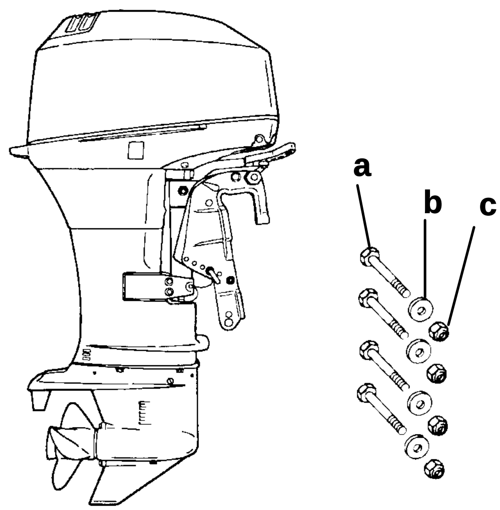
a - Lifting Ring

2. Manual Start Models - Use lifting eye on engine and lift outboard on boat transom.



Installing Outboard to Boat Transom

Models Without Transom Bracket Thumb Screws



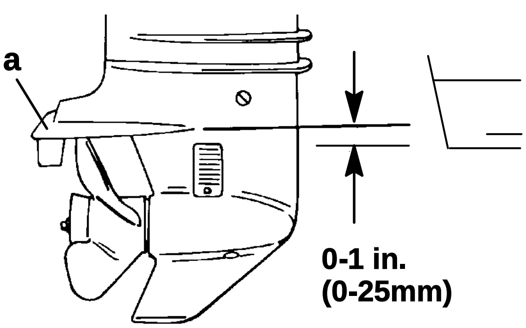
a - Mounting Bolts (4)
b - Flat Washers (4)
c - Locknuts (4)

⚠ WARNING

DO NOT, under any circumstances, allow upper outboard mounting bolts to be closer than 1 inch (25.4mm) to top of boat transom. Upper mounting bolts must never be installed thru shims.

NOTE: *When drilling into a fiberglass boat, place masking tape directly onto boat where mounting holes will be drilled to help prevent fiberglass from chipping.*

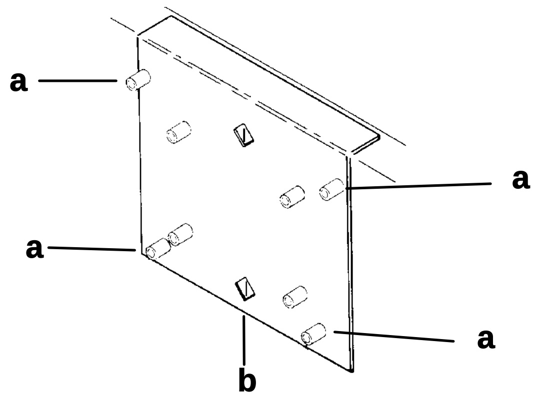
Measure the transom height of your boat. The boat bottom should be aligned or be within 1 in. (25mm) below the anti-ventilation plate of the outboard.



a - Anti-ventilation Plate

Use a 17/32 inch (13.5mm) diameter drill bit and drill two mounting holes for the upper set of mounting bolts and two holes for the lower set of mounting bolts.

NOTE: *If using "Transom Drilling Fixture" 91-98234A2), use holes (a) when drilling outboard mounting holes*

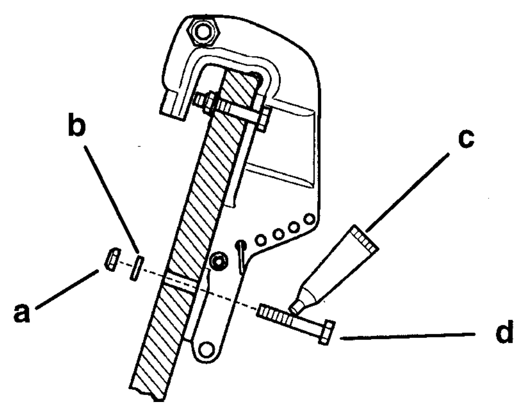


a - Use These Drilling Holes
b - Centerline of Transom

NOTE: *On some boats because of transom interference, it may be necessary to install the steering cable before fastening the outboard to the transom.*

Position outboard on boat transom. Align the mounting holes in the transom brackets that will place the outboard nearest to the recommended mounting height.

Apply marine sealer to shanks of mounting bolts (not threads) and secure outboard to transom with 4 bolts, flat washers and locknuts, as shown. Be sure that installation is water-tight.



a - Locknuts (4)
b - Flat Washers (4)
c - Marine Sealer
d - 1/2 Inch Diameter Bolts (4)

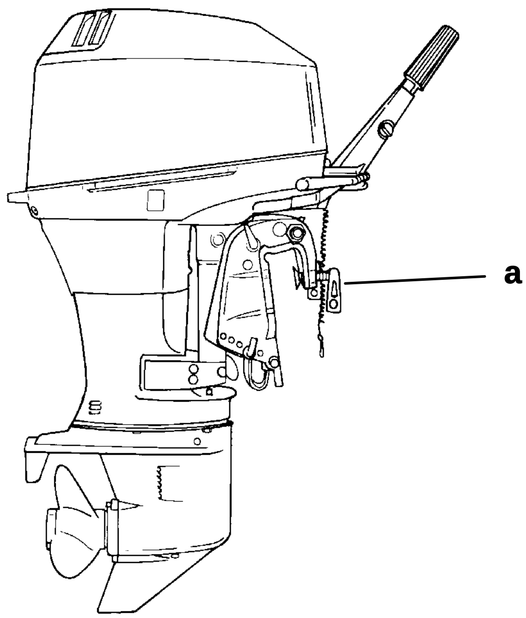
⚠ CAUTION

Marine sealer must be used on shanks bolts to make a water-tight installation.

⚠ WARNING

Before operation, the outboard must be correctly installed with four mounting bolts shown. Failure to correctly fasten outboard could result in outboard ejecting off boat transom causing serious injury, death, or property damage.

Models With Transom Bracket Thumb Screws



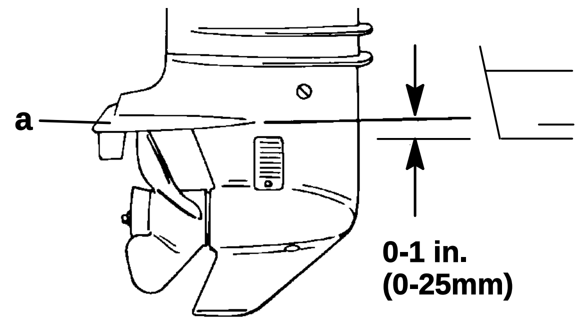
a - Transom Bracket Thumb Screws

⚠ WARNING

DO NOT, under any circumstances, allow the cupped washers on the ends of the thumb screws to be closer than 1 inch (25.4mm) to top of (real) boat transom, not shims.

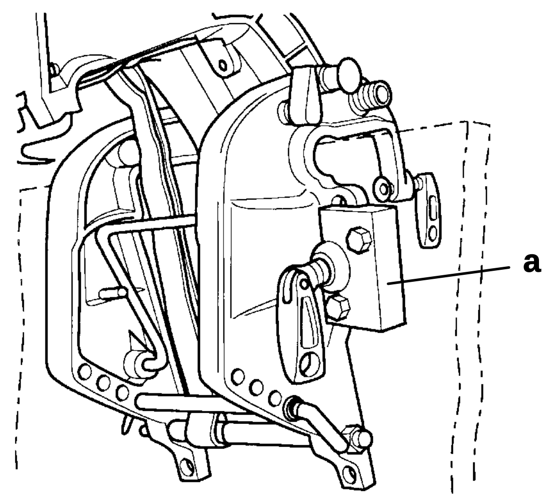
NOTE: *When drilling into a fiberglass boat, place masking tape directly onto boat where mounting holes will be drilled to help prevent fiberglass from chipping.*

Measure the transom height of your boat. The boat bottom should be aligned or be within 1 in. (25mm) below the anti-ventilation plate of the outboard.



a - Anti-Ventilation Plate

IMPORTANT: Outboards with transom bracket thumb screws can be secured to the boat transom, using optional Quicksilver Accessory Outboard Mounting Kit (“a” P/N 812432A5), to allow for quick removal and installation of outboard. Refer to installation instructions supplied with the mounting kit before drilling any mounting holes in the boat transom.



a - Mounting Kit

⚠ WARNING

Outboard must be fastened to boat transom one of two ways, permanently fastened to transom with thumb screws, and mounting bolts (provided), or secured to the transom using the optional outboard mounting kit (P/N 812432A5) should the outboard strike an underwater object or be steered into a sharp turn. Failure to fasten outboard correctly to the boat transom with mounting bolts or optional mounting kit could result in outboard ejecting suddenly off boat transom causing serious injury or death, boat damage or loss of outboard.

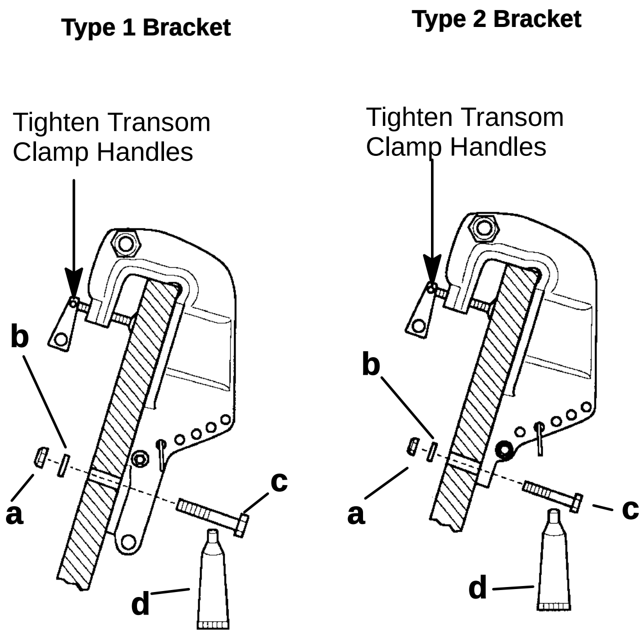
FASTENING OUTBOARD TO THE BOAT TRANSOM

Type 1 Bracket

Drill two 1/2 in. (12.5mm) holes thru a lower set of mounting holes and fasten outboard to boat transom with two 1/2 in. (12.5mm) mounting bolts, flatwashers and locknuts (provided).

Type 2 Bracket

Drill two 3/8 in. (9.5mm) holes thru the lower mounting holes and fasten outboard to the boat transom with two 3/8 in. (9.5mm) mounting bolts, flat washers and locknuts (provided).



a - Locknuts (2)
b - Flat Washers (2)
c - Mounting Bolts (2)
d - Marine Sealer

⚠ CAUTION

Marine sealer must be used on shanks bolts to make a water-tight installation.

Single Steering Cable and Steering Link Rod Installation

NOTE: *These instructions are for single cable-single outboard installations. Instructions for mounting dual engines are included with the applicable dual engine attaching kit. Refer to "Quicksilver Accessories Guide" to determine correct kit.*

Refer to "Quicksilver Accessories Guide" to determine correct length of steering cable.

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

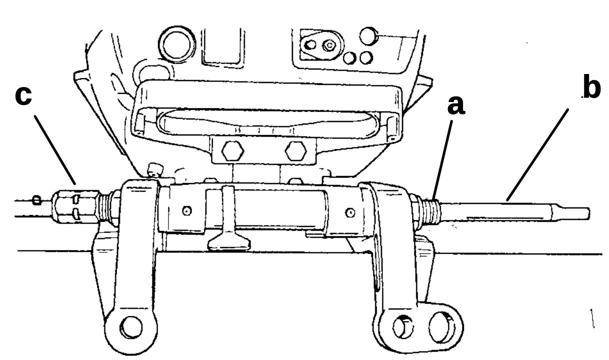
Install steering mount and steering wheel in accordance with installation instructions that accompany each.

Installing Ride Guide Steering Cable To The Outboard

IMPORTANT: Before installing steering cable in tilt tube, lubricate entire cable end with Quicksilver 2-4-C Marine Lubricant.

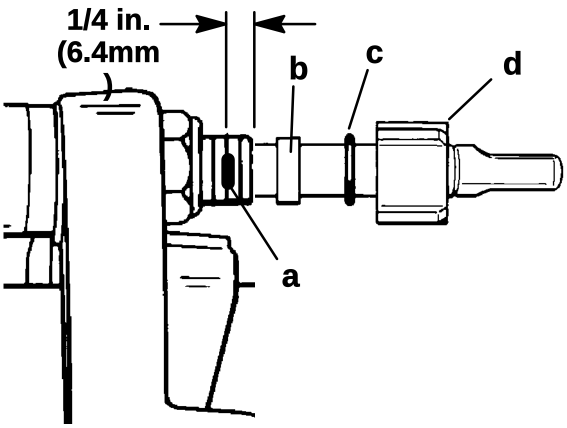
NOTE: *Ride Guide steering cable is lubricated at the factory and requires no additional lubrication at initial installation.*

1. Lubricate inside of outboard tilt tube and entire cable end with Quicksilver 2-4-C Marine Lubricant.
2. Insert steering cable end thru outboard tilt tube and secure steering cable to tilt tube with steering cable attaching nut, as shown. Torque nut to 35 lb. ft. (47.5 N·m).



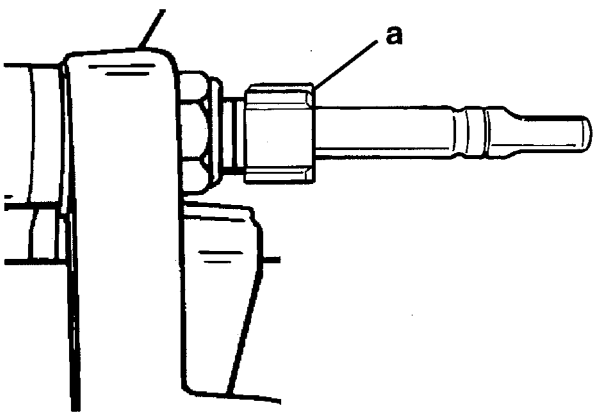
a - Tilt Tube
b - Cable End
c - Attaching Nut

3. Place a mark on the tilt tube, 1/4 in. (6.4mm) from end of tilt tube. Install plastic spacer, o-ring and cap onto steering cable as shown.



a - Mark
b - Plastic Spacer
c - O-ring
d - Cap

4. Thread cap onto the tilt tube up to the 1/4 in. (6.4mm) mark.



a - Cap

Steering Link Rod Installation

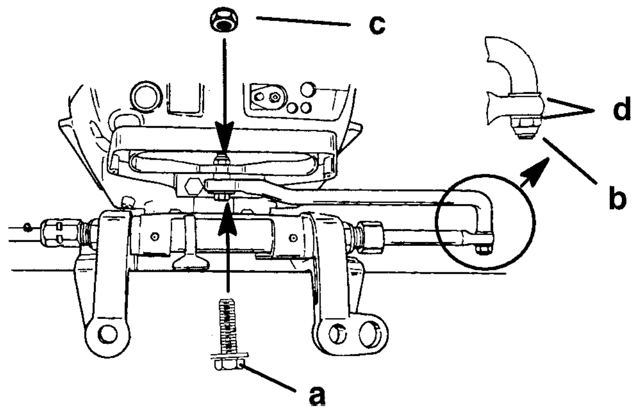
IMPORTANT: The steering link rod that connects the steering cable to the engine must be fastened using special washer head bolt ("a") (10-823919) and self locking nuts ("b" & "c") (11-34863). These locknuts must never be replaced with common nuts (non locking) as they will work loose and vibrate off freeing the link rod to disengage.

⚠ WARNING

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

1. Assemble steering link rod to steering cable with two flat washers and nylon insert locknut (11-34863). Tighten locknut until it seats, then back nut off 1/4 turn.

2. Assemble steering link rod to engine with special washer head bolt (10-823919) and nylon insert locknut (11-34863). First torque bolt to 20 lb. ft. (27.1 N·m), then torque locknut to 20 lb. ft. (27.1 N·m).



a - Washer Head Bolt
b - Nylon Insert Locknut
c - Nylon Insert Locknut
d - Flat Washer (2)

⚠ WARNING

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

Remote Control Installation

Refer to "Quicksilver Accessories Guide" to determine correct length of remote control cables.

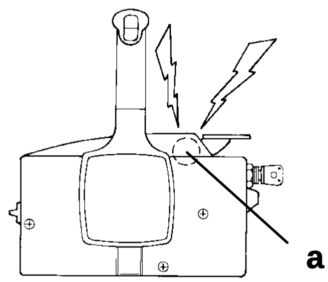
IMPORTANT: Remote control cables must be correct length. Sharp bends on too-short of cables result in "kinks;" too-long of cables require unnecessary bends and/or loops. Both conditions place extra stress on the cables.

IMPORTANT: Install control cables to remote control and mount remote control BEFORE attaching control cables to engine. Refer to installation instructions included with remote control.

Required Side Mount Remote Control or Ignition Key Switch Assembly

Boats Equipped with Side Mount Remote Control

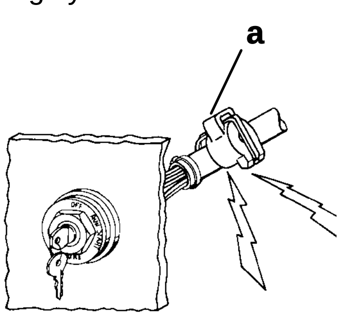
A Quicksilver Commander 2000 series Side Mount Remote Control equipped with a warning horn must be used with this outboard. This warning horn is necessary for the engine warning system.



a -Warning Horn

Boats Equipped with Panel Or Console Mount Remote Control

A Quicksilver Ignition Key/Choke Assembly equipped with a warning horn must be used with this engine. This warning horn is necessary for the engine warning system.

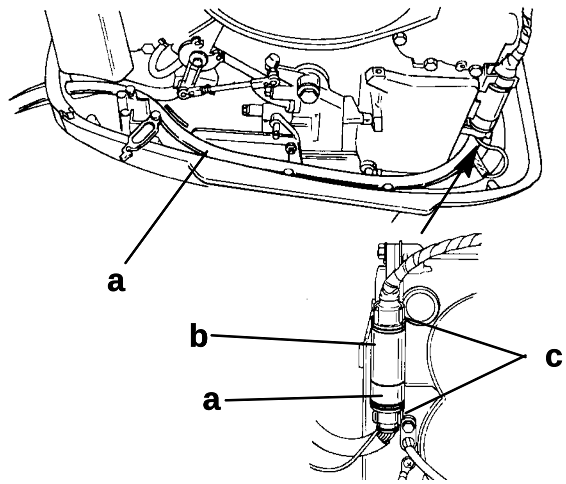


a - Warning Horn

Remote Wiring Connections

Electric Start Remote Control Model

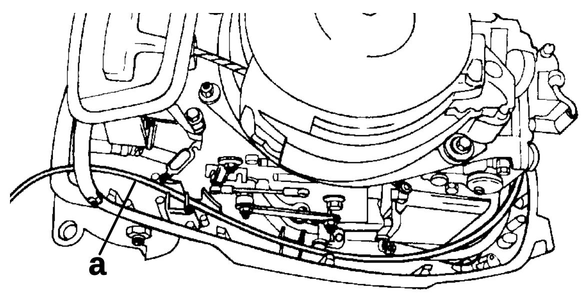
1. Route the remote wiring harness to the back of the engine block as shown.
2. Plug the remote wiring harness into the engine wiring harness connector.
3. Push connectors into the holder.



a - Remote Wire Harness
b - Engine Wire Harness Connector
c - Holder

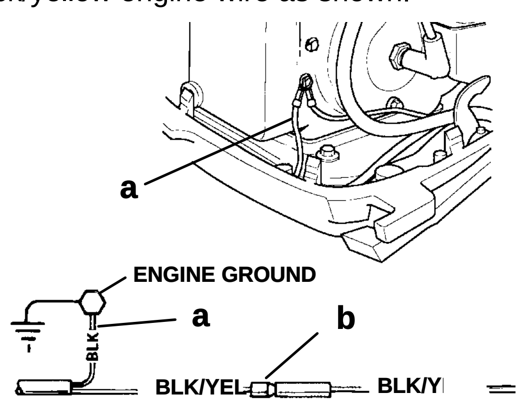
Manual Start Models Using Quicksilver 2000 Series Side Mount Remote Control

1. Route the remote control harness around the back of the engine block as shown. Position the harness so that the harness will not interfere with shift and throttle operation.



a - Remote Control Harness

2. Fasten the black wire from the remote control harness to engine ground and connect the black/yellow from the remote control harness to the black/yellow engine wire as shown.



a - Black Wire
b - Black/Yellow Lead

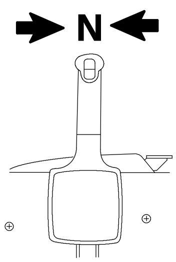
Shift and Throttle Cable Installation To The Outboard

Install cables into the remote control following the instructions provided with the remote control.

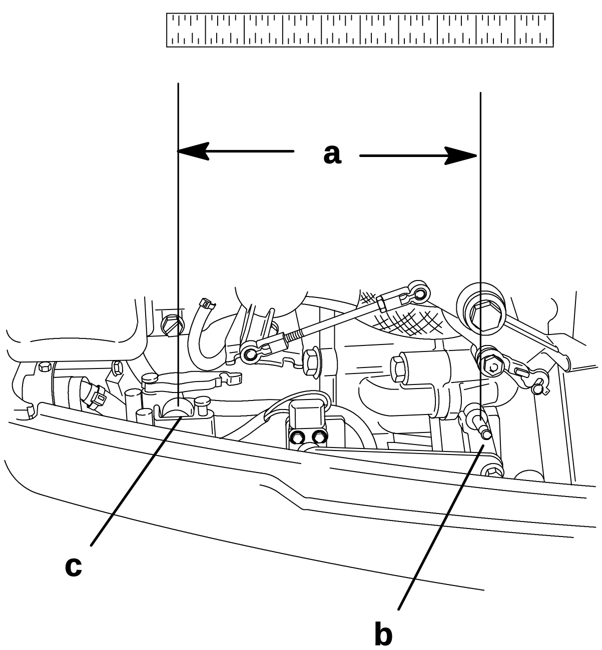
NOTE: *Install the shift cable to the engine first. The shift cable is the first cable to move when the remote control handle is moved out of neutral.*

Shift Cable Installation

1. Position remote control and outboard into neutral.

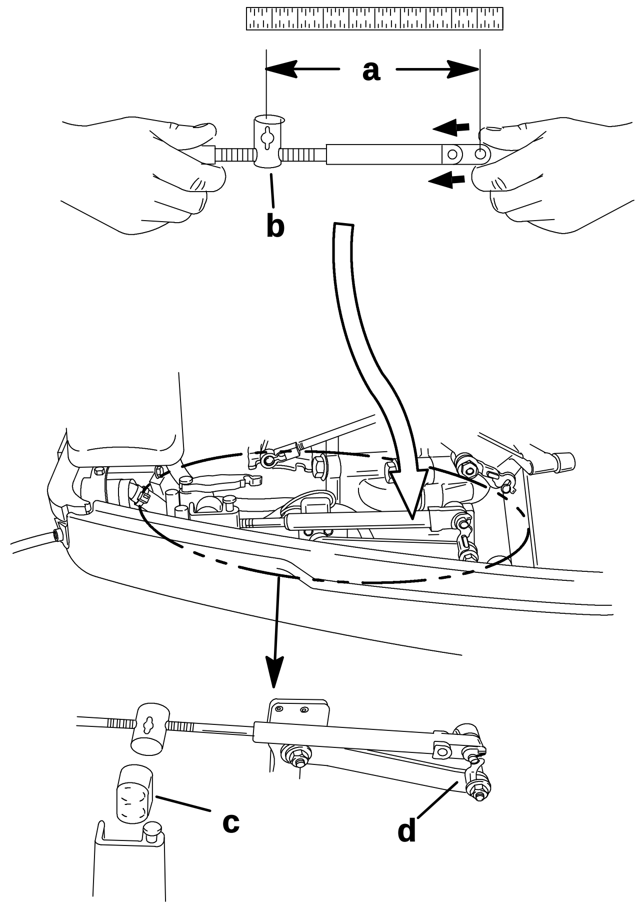


2. Measure distance "a" between mounting pin and middle of the barrel holder.



a - Distance Between Pin And Middle Of Barrel Holder
b - Mounting Pin
c - Barrel Holder

3. Push-in on the cable end until resistance is felt. Adjust the cable barrel to attain the measured distance "a" taken in Step 2.
4. Place cable barrel into the bottom hole in the barrel holder. Fasten cable to pin with retainer.

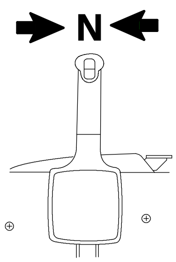


a - Move Cable Barrel To Attain The Measured Distance Taken In Step 2
b - Cable Barrel
c - Barrel Holder– Place Barrel Into Bottom Hole
d - Retainer

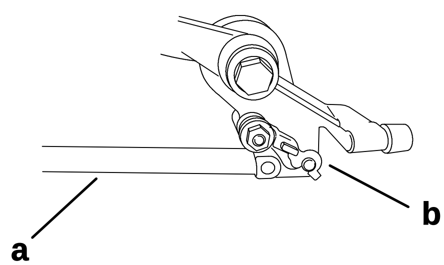
5. Check shift cable adjustments as follows:
   a. Shift remote control into forward. The propeller shaft should be locked in gear. If not, adjust the barrel closer to the cable end.
   b. Shift remote control into neutral. The propeller shaft should turn freely without drag. If not, adjust the barrel away from the cable end. Repeat steps a and b.
   c. Shift remote control into reverse while turning propeller. The propeller shaft should be locked in gear. If not, adjust the barrel away from the cable end . Repeat steps a thru c.
   d. Shift remote control back to neutral. The propeller shaft should turn freely without drag. If not, adjust the barrel closer to the cable end. Repeat steps a thru d.

Throttle Cable Installation

1. Position remote control into neutral.

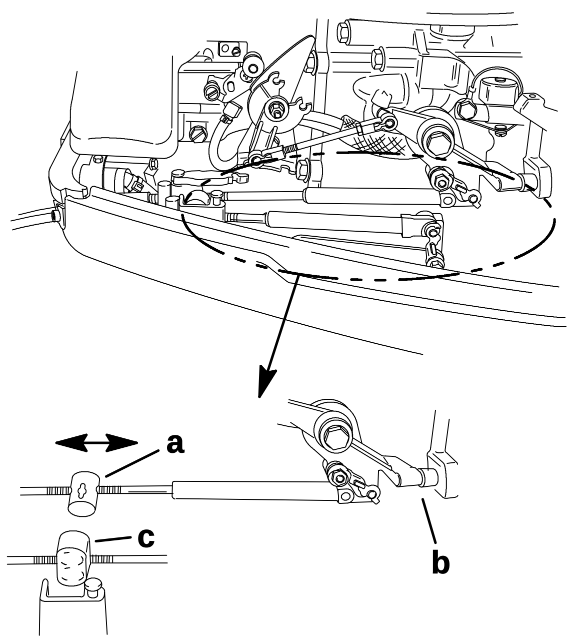


2. Install cable to the throttle lever. Secure with retainer.



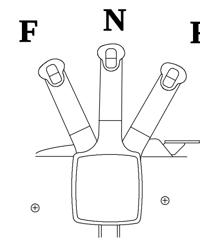
a - Throttle Cable
b - Retainer

3. Adjust the cable barrel so that the installed throttle cable will hold the throttle arm against the stop.

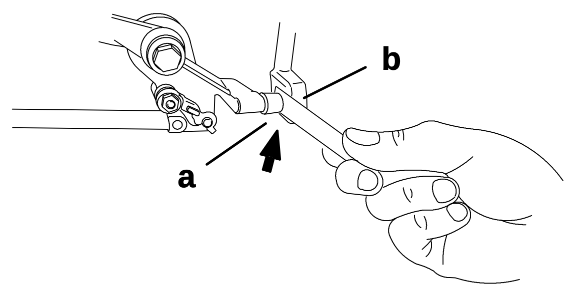


a - Cable Barrel – Adjust To Hold Throttle Arm Against Stop
b - Throttle Arm
c - Barrel Holder – Place barrel Into Top Hole

4. Check throttle cable adjustment as follows:
   a. Shift outboard into gear a few times to activate the throttle linkage. Make sure to rotate the propeller shaft while shifting into reverse.

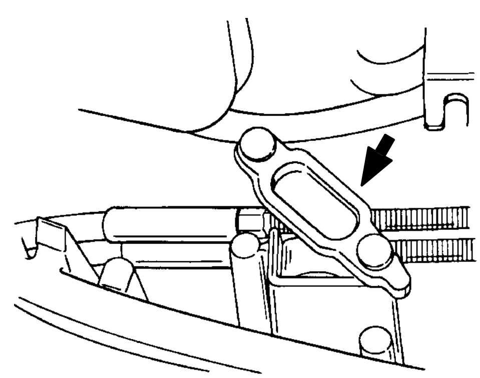


   b. Return remote control to neutral. Place a thin piece of paper between throttle arm and idle stop. Adjustment is correct when the paper can be removed without tearing, but has some drag on it. Readjust cable barrel if necessary.



a - Throttle Arm
b - Idle Stop

5. Lock the barrel holder in place with the cable latch.



Battery Connections

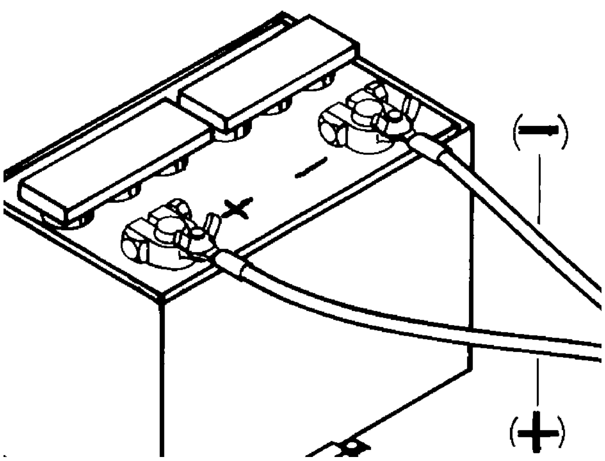
⚠ CAUTION

For dual outboard installations, the BLACK (-) battery cable of each engines starter motor ground circuit, MUST BE connected to each other by a common circuit (cable) capable of carrying the starting current of each engines' starter motor. [i.e. A locally obtained battery cable connected between the NEGATIVE (-) terminal of each outboards cranking battery.]

⚠ CAUTION

Failure to observe correct polarity when connecting battery cables to battery, will result in damage to the charging system.

1. Connect battery cables (from engine) to battery. Connect RED battery cable to POSITIVE terminal and BLACK battery cable to NEGATIVE (–) battery terminal.



Set Up Instructions For Oil Injection System

⚠ CAUTION

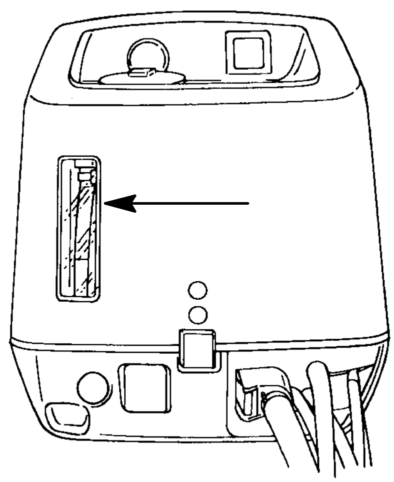
Oil injected engines additionally, must be run on a 50:1 gasoline/oil mixture in the fuel tank for the first 10 gallons of fuel. Refer to engine break-in procedure in the Operation & Maintenance Manual.

⚠ CAUTION

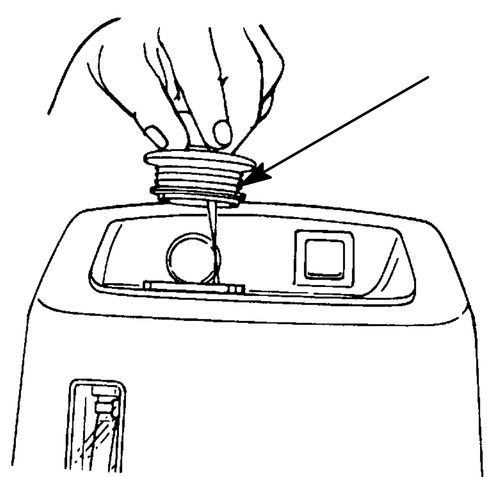
If an electric fuel pump is to be used on engines with oil injection, the fuel pressure at the engine must not exceed 6 psi (41.1 kPa). If necessary, install a pressure regulator between electrical fuel pump and engine and set at 6 psi maximum.

Filling The Oil Injection System

1. Check oil level using the sight gauge in front of the outboard.



2. Remove the fill cap and fill tank with oil. The oil tank capacity is 50.5 fl. oz. (1.5 liters).



Bleeding Air From The Oil Injection System

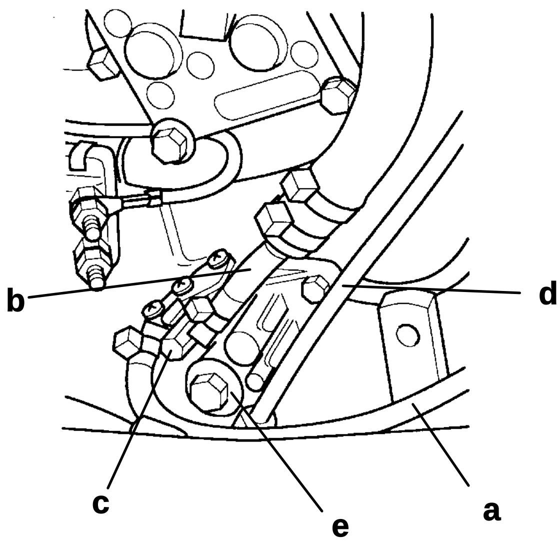
IMPORTANT: If air exists in either the oil pump inlet hose or oil pump outlet hose, the air MUST BE bled from the hose(s) or engine damage may occur.

BLEEDING AIR FROM THE OIL PUMP INLET HOSE

1. With the engine not running, place a shop towel below the oil pump.
2. Loosen bleed screw four (4) turns and allow oil to flow out of the bleed hole until no air bubbles exist in the inlet hose.

BLEEDING AIR FROM THE OIL PUMP OUTLET HOSE

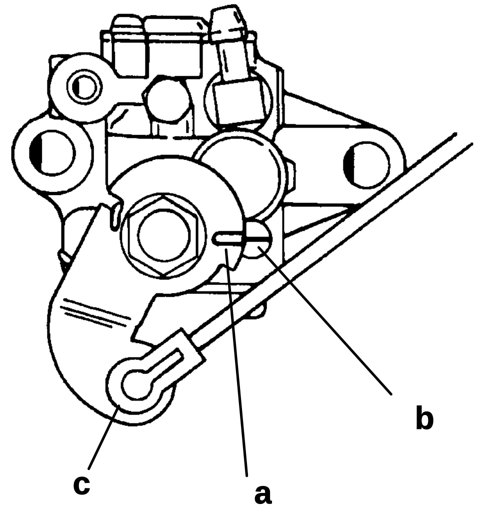
3. If any air bubbles are present in the outlet hose, they can be purged from the hose by removing link rod from the oil pump and rotating the pump arm fully clockwise while operating engine at 1000 to 1500 RPM.



a - Inlet Hose
b - Outlet Hose
c - Bleed Screw
d - Link Rod
e - Pump Arm

Adjusting The Oil Injection Pump

When carburetor linkage is at idle position, alignment mark on oil injection arm should be in-line with mark on pump as shown. If necessary, adjust link rod.



a - Alignment Mark
b - Mark On Pump
c - Link Rod

Propeller Installation

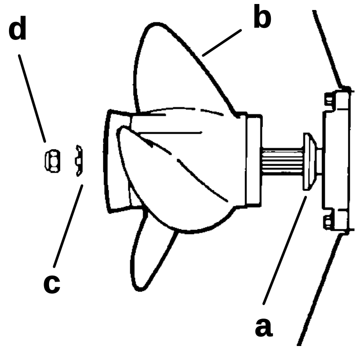
⚠ WARNING

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

1. Shift outboard to neutral (N) position.
2. Remove leads from spark plugs to prevent engine from starting.
3. Coat the propeller shaft with Quicksilver Anti-Corrosion Grease.

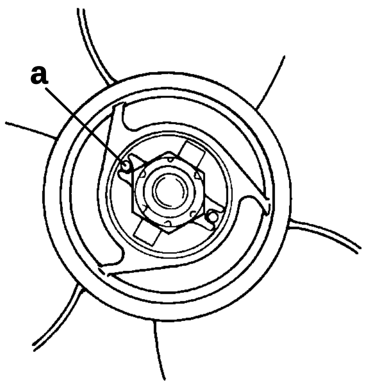
IMPORTANT: To prevent the propeller hub from corroding and seizing to the propeller shaft, especially in salt water, always apply a coat of Quicksilver Anti-Corrosion Grease to the entire shaft at the recommended maintenance intervals and also each time the propeller is removed.

4. Install thrust washer, propeller, propeller nut retainer, and propeller nut onto the shaft.



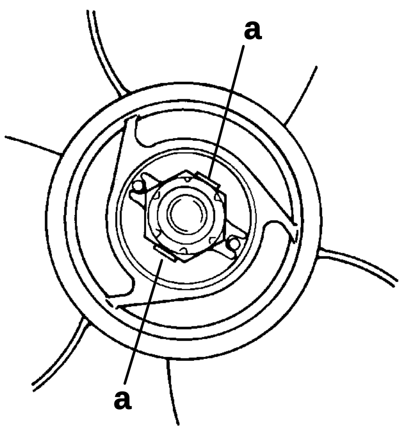
a - Thrust Washer
b - Propeller
c - Propeller Nut Retainer
d - Propeller Nut

5. Place propeller retainer over pins. Place a block of wood between gear case and propeller and tighten propeller nut to 55 lb. ft. (75 N·m), aligning flat sides of the propeller nut with tabs on the propeller nut retainer.



a - Pins

6. Secure propeller nut by bending tabs up and against the flats on the propeller nut.



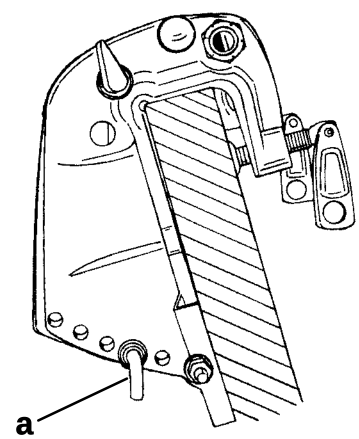
a - Tabs

Tilt Pin Adjustment

⚠ WARNING

DO NOT operate boat without the tilt pin installed. Failure to install tilt pin could result in outboard kicking up when operated in reverse causing serious injury, death, or property damage.

Place tilt pin in desired hole in the transom bracket so the outboard will run perpendicular to the water when the boat is running at full speed. This allows the boat to be driven parallel to the water.



a - Tilt Pin

Consider the following lists carefully when adjusting the tilt pin.

PLACING TILT PIN IN LOWER HOLES CAN:

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

PLACING TILT PIN IN UPPER HOLES CAN:

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

Trim Tab Adjustment

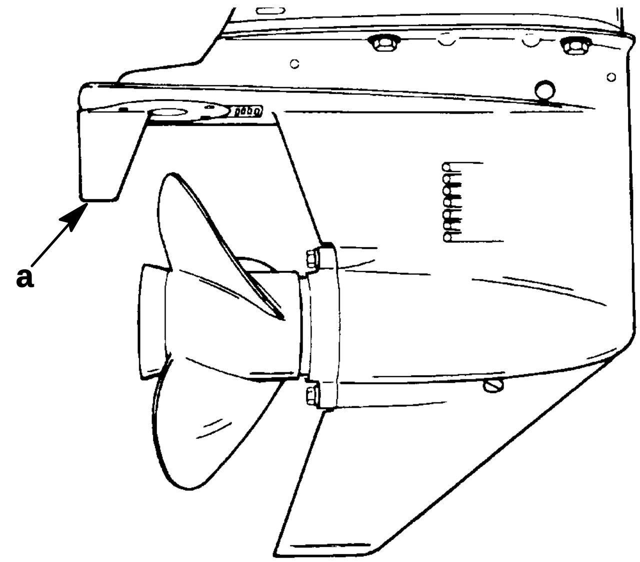
Propeller steering torque will cause your boat to pull in one direction. This steering torque is a normal thing that results from your outboard not being trimmed so the propeller shaft is parallel to the water surface. The trim tab can help to compensate for this steering torque in many cases and can be adjusted within limits to reduce any unequal steering effort.

NOTE: *Trim tab adjustment will have little effect reducing steering torque if the outboard is installed with the anti-ventilation plate approximately 2 inches (50 mm) or more above the boat bottom.*

MODELS WITHOUT POWER TRIM

Operate your boat at normal cruising speed trimmed to desired position by installing the "tilt pin" in the desired tilt pin hole. Turn your boat left and right and note the direction the boat turns more easily.

If adjustment is necessary, loosen trim tab bolt and make small adjustments at a time. If the boat turns more easily to the left, move the trailing edge of trim tab to the left. If the boat turns more easily to the right move the trailing edge of trim tab to the right. Retighten bolt and retest.

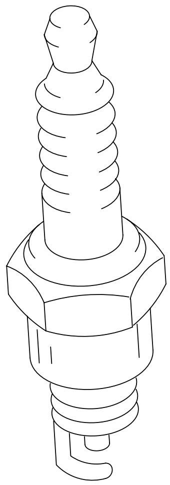


a - Trim Tab

ELECTRICAL

2

A



IGNITION

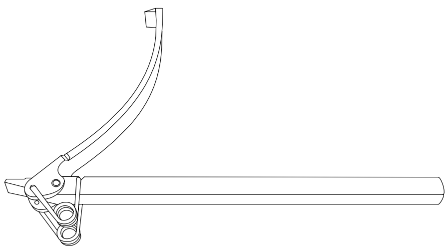
Table of Contents

Specifications

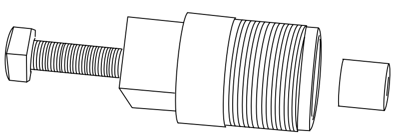
IGNITION SYSTEM	**Type** **Spark Plug Type (NGK)** **Spark Plug Gap** **Optional Plug (NGK)** **Spark Plug Gap** **Firing Order**	Capacitor Discharge BP8H-N-10 0.040 in. (1.0mm) BPZ8H-N-10* 0.040 in. (1.0mm) 1-2
TIMING SPECIFICATIONS	**Models With (S/N-0G589999 & Below) Idle** **Maximum BTDC @ 2500-5500 RPM (Not Adjustable)**	3° BTDC ± 3° (Not Adjustable) 25° BTDC ± 3°
	Models With (S/N-0G590000 & Above) Idle **Maximum Spark Advance**	8° BDTC ± 1° 1 Turn Clockwise After Contacting Throttle Plate

Special Tools

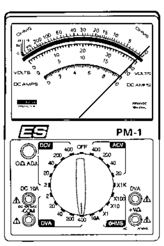
1. Flywheel Holder 91-52344



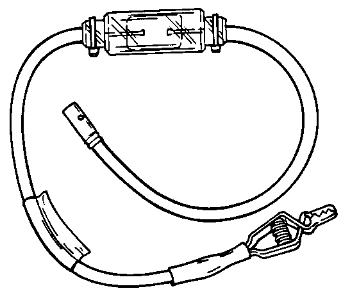
2. Flywheel Puller 91-73687A1



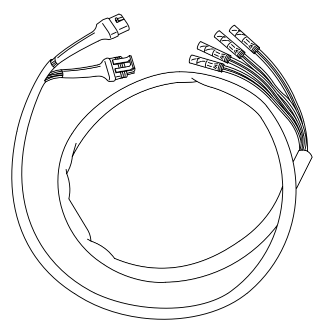
3. Volt/Ohm/DVA Meter 91-99750



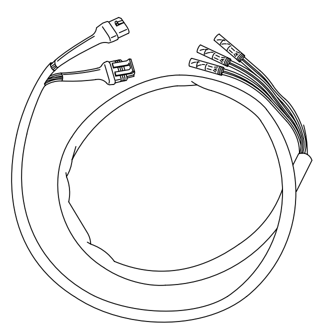
4. Spark Gap Tester 91-63998A1



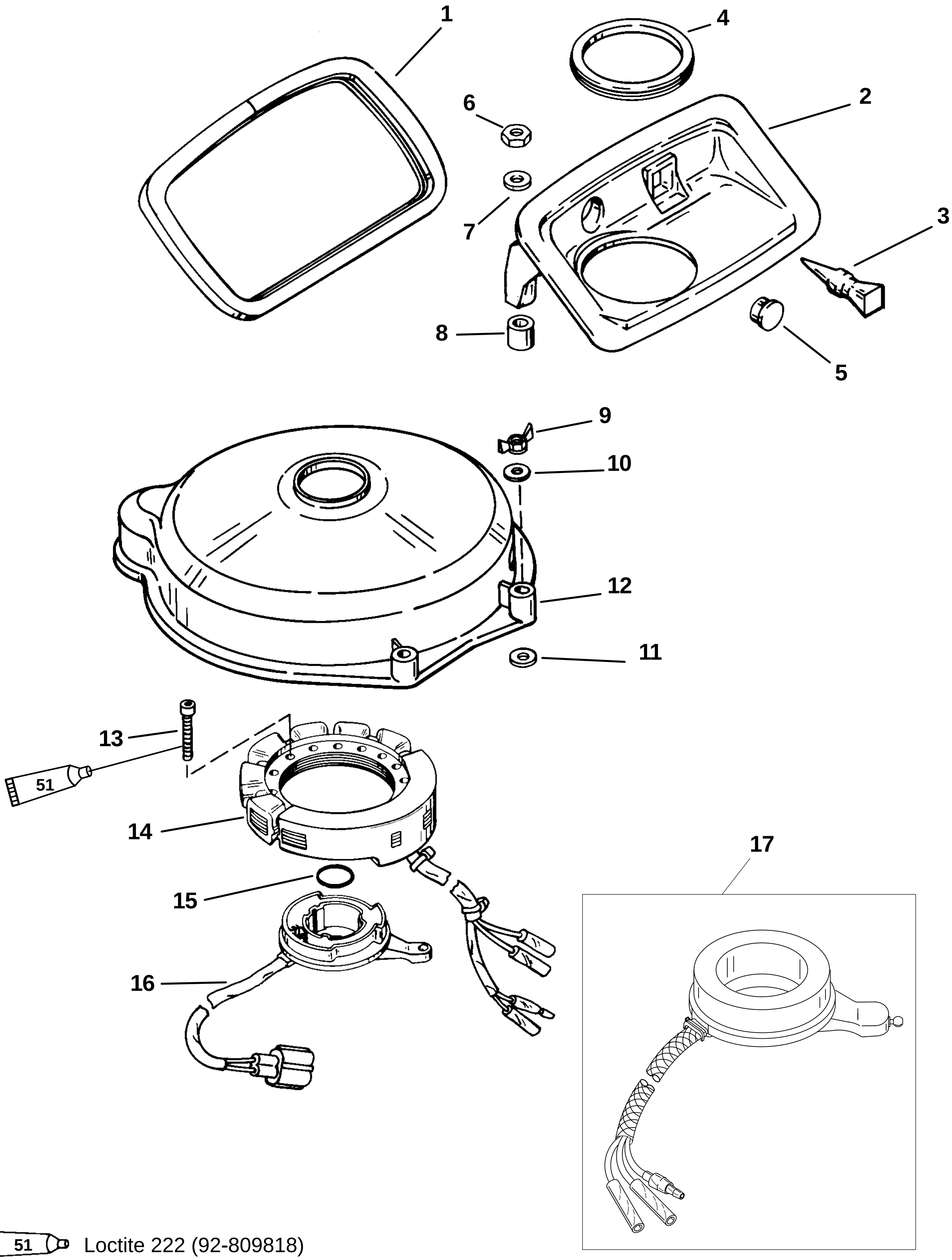
5. TPI/CDM Test Harness 84-825207A1 (S/N-0G589999 & Below)



6. TPI/CDM Test Harness 84-825207A2 (S/N-0G590000 & Above)



STATOR/TRIGGER (ELECTRIC MODELS)

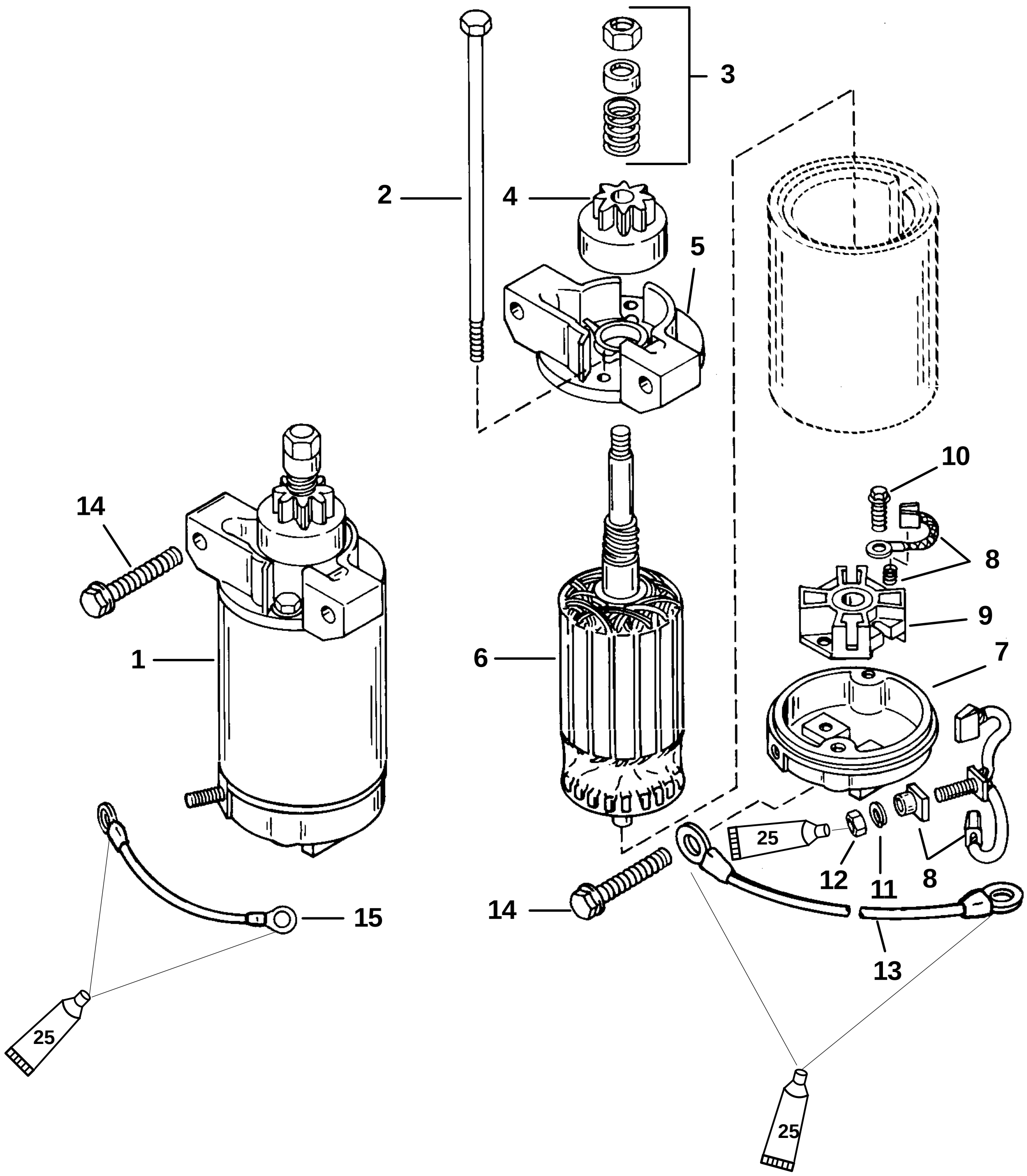


Loctite 222 (92-809818)

STATOR/TRIGGER (ELECTRIC MODELS)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
1	1	SEAL–Rest (Use where applicable)			
2	1	REST (OIL INJECTION) **I.D. of rest rope hole is 1/4 IN.**			
3	1	PLUG–Starter Handle			
2	1	REST KIT **I.D. of rest rope hole is 1/3 IN.**			
3	1	PLUG–Starter Handle			
4	1	GROMMET–Oil Tank			
5	1	PLUG–Primer Hole			
6	2	NUT (M6 x 1)			
7	2	WASHER			
8	2	SPACER			
9	4	WING NUT			
10	4	WASHER			
11	4	WASHER (Neoprene)			
12	1	COVER–Flywheel			
13	5	SCREW (M5 x 30)	50		5.6
14	1	STATOR			
15	1	O RING **(S/N-USA-0G589999/BEL-9973099 & BELOW)**			
16	1	TRIGGER ASSEMBLY			
17	1	TRIGGER ASSEMBLY **(S/N-USA-0G590000/BEL-9973100 & ABOVE)**			

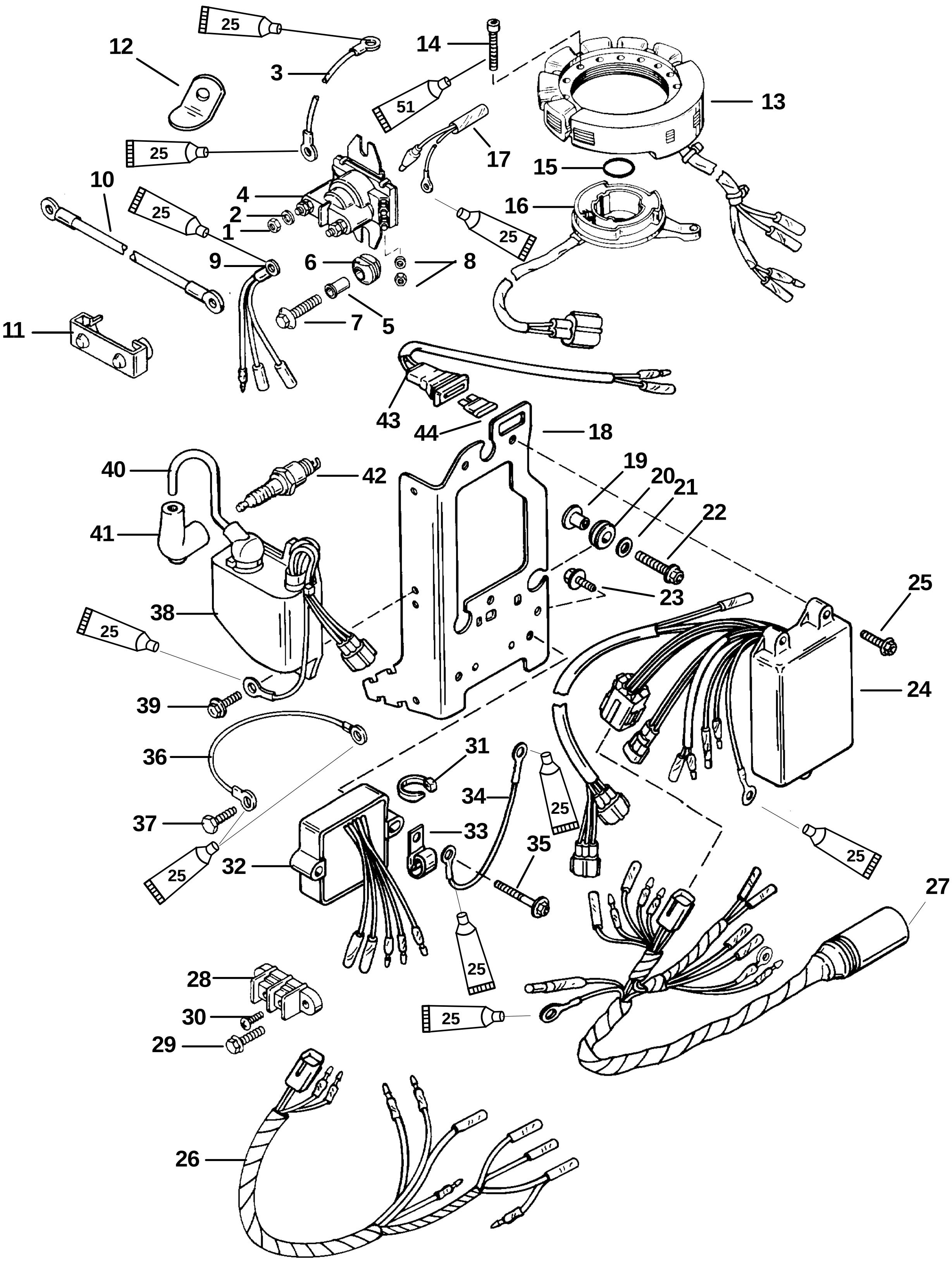
Starter Motor Components



25 Liquid Neoprene (92-25711--2)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	STARTER MOTOR			
2	1	THRU BOLT	70		7.9
3	1	DRIVE KIT			
4	1	DRIVE ASSEMBLY			
5	1	DRIVE CAP			
6	1	ARMATURE			
7	1	COMMUTATOR CAP			
8	1	BRUSH & SPRING KIT			
9	1	BRUSH HOLDER			
10	2	SCREW			
11	1	LOCKWASHER			
12	1	NUT (1/4-20)	60		6.8
13	1	BATTERY CABLE (5/16) **(POSITIVE)**			
14	3	SCREW (M8 x 45)		16.5	22.3
15	1	CABLE (BLACK–6 IN. – 1/4 IN. Terminals)			

ELECTRICAL COMPONENTS (S/N-0G380074/ BEL-MANUAL-9928507/BEL-ELEC-9928480 & Below)



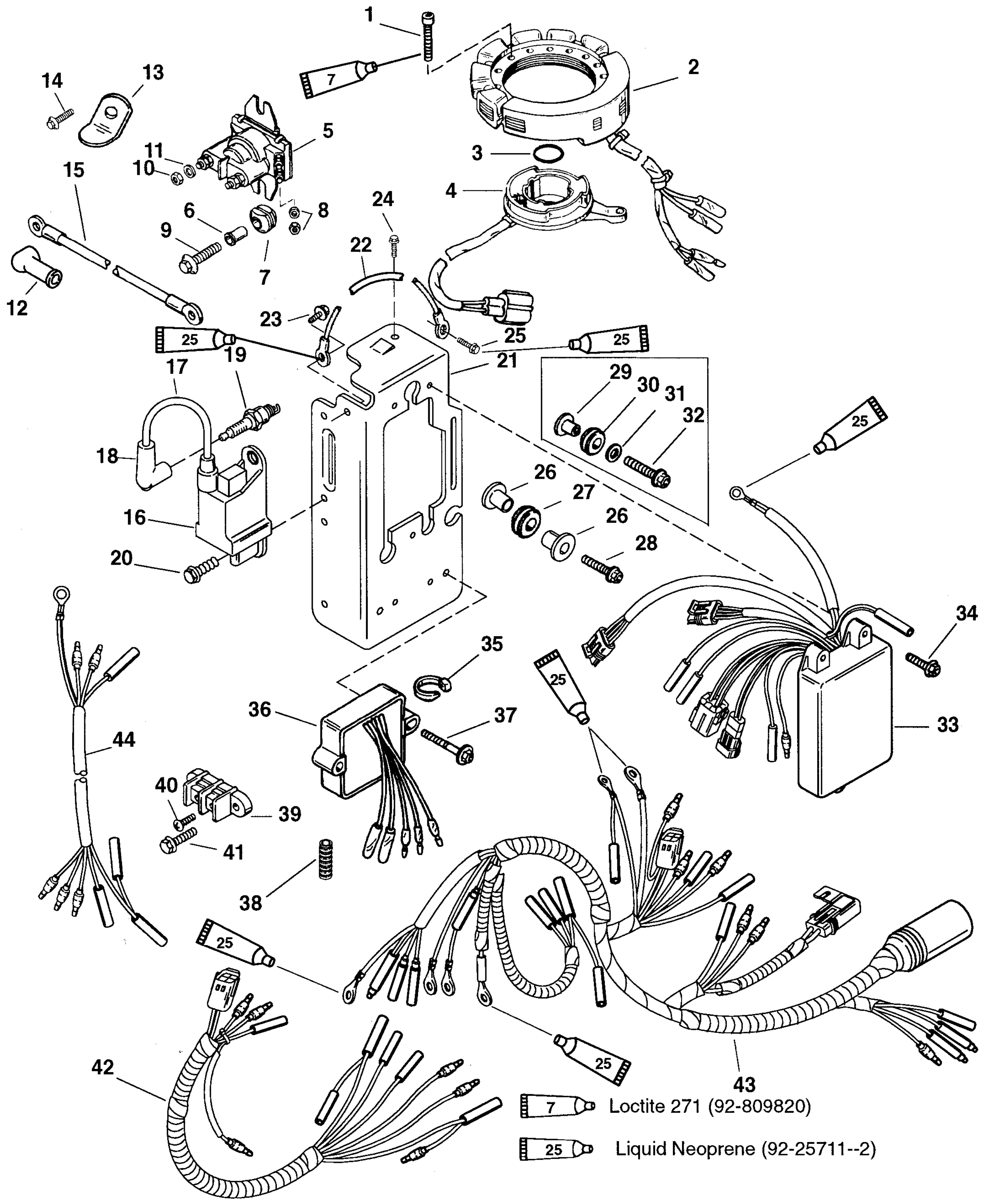
25 Liquid Neoprene (92-25711--2)

51 Loctite "222" Small Screw Threadlocker (92-809818)

Note: Apply Liquid Neoprene to all ring eyelet wiring terminals.

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	2	NUT (1/4-20)	50		5.6
2	2	LOCKWASHER			
3	1	CABLE ASSEMBLY (BLACK–4 IN.)			
4	1	SOLENOID ASSEMBLY			
5	1	BUSHING **ELECTRIC**			
6	1	GROMMET			
7	2	SCREW (M6 x 25)	40		4.5
8	2	NUT (8–32)	20		2.3
9	1	CABLE (RED) **ELECTRIC**			
10	1	BATTERY CABLE **(NEGATIVE)**			
11	1	INSULATOR			
12	1	RETAINER			
13	1	STATOR **(MANUAL)**			
14	5	SCREW (M5 x 30)	50		5.6
15	1	O RING			
16	1	TRIGGER			
17	1	HARNESS ASSEMBLY			
18	1	PLATE–Electrical			
19	3	BUSHING–Flanged			
20	3	GROMMET			
21	3	WASHER			
22	3	SCREW (M6 x 25)	100		11.3
23	1	SCREW (M6 x 14)	Drive Tight		
24	1	TPM ASSEMBLY			
25	3	SCREW (M5 x 20)	80		9.0
26	1	HARNESS ASSEMBLY–Engine **(MANUAL)**			
27	1	HARNESS ASSEMBLY–Engine **(ELECTRIC)**			
28	1	TERMINAL BLOCK			
29	2	SCREW (M5 x 12) **MANUAL**			
30	2	SCREW (10–16 x 3/8 IN.)			
31	AR	STA–STRAP			
32	1	VOLTAGE REGULATOR			
33	1	J–CLIP **ELECTRIC**			
34	1	CABLE **(BLACK–11 IN.)**			
35	2	SCREW (M6 x 35)	80		9.0
36	1	CABLE (BLACK–9 IN.)			
37	1	SCREW (10-16 x 3/5 IN.)			
38	2	CDM ASSEMBLY			
39	4	SCREW (M6 x 14)	80		9.0
40	2	HI–TENSION CABLE KIT			
41	2	BOOT KIT			
42	2	SPARK PLUG (NGK# BP8H-N-10)	240	20	27.1
42	2	SPARK PLUG (NGK# BPZ-8H-N-10)	240	20	27.1
43	1	SOCKET ASSEMBLY–FUSE **ELECTRIC**			
44	1	FUSE			

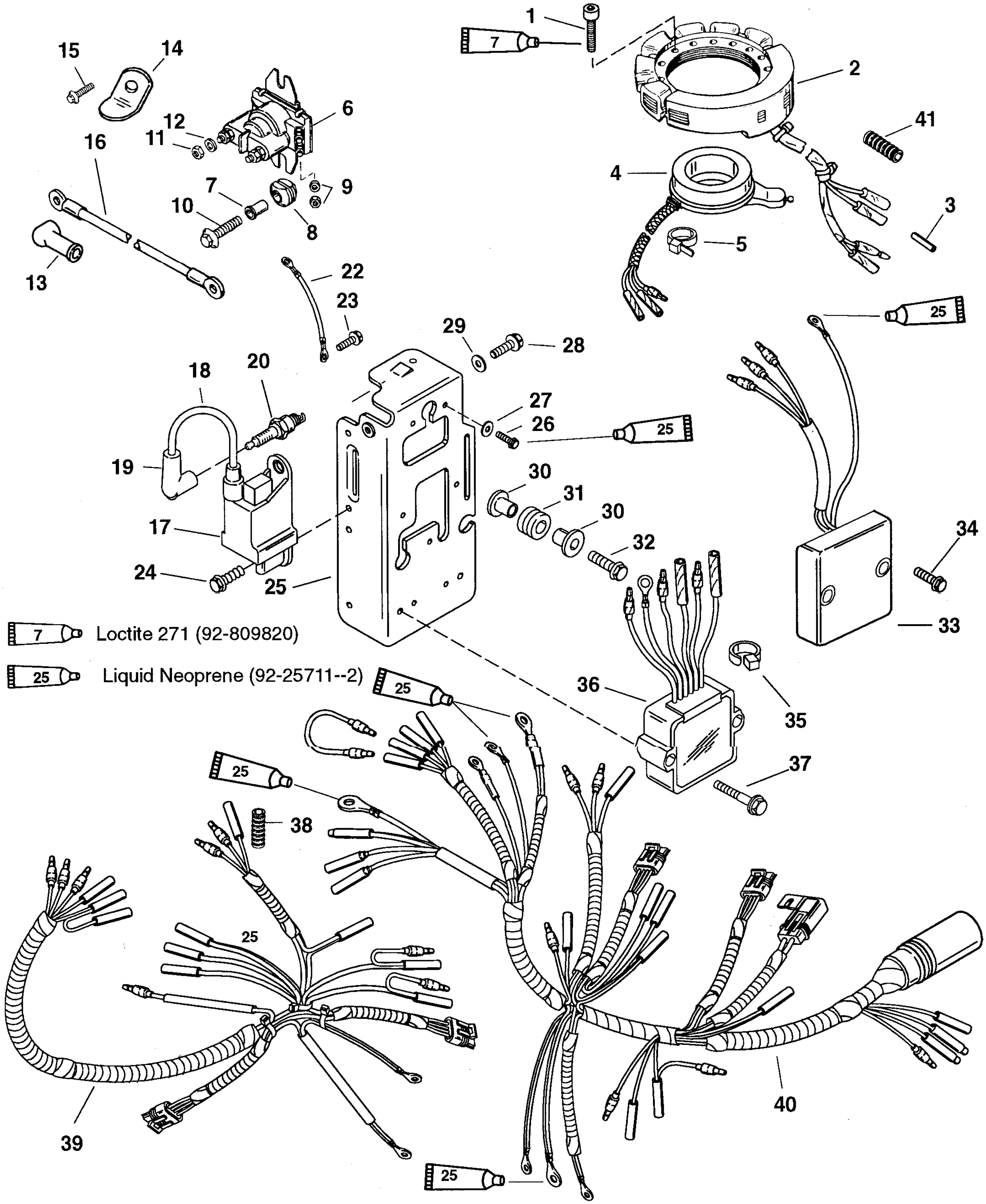
ELECTRICAL (S/N-USA-0G380075 Thru 0G589999/ BEL-MANUAL-9928508/BEL-ELEC-9928481 THRU 9973099)



NOTE: APPLY LIQUID NEOPRENE TO ALL RING END WIRING TERMINALS.

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	5	SCREW (M5 x 30) **MANUAL**	50		5.6
2	1	STATOR			
3	1	O RING			
4	1	TRIGGER			
5	1	SOLENOID ASSEMBLY			
6	2	BUSHING			
7	2	GROMMET			
8	2	NUT (8-32)			
9	2	SCREW (M6 x 25) **ELECTRIC**	40		4.5
10	2	NUT (1/4-20)	50		5.6
11	2	LOCKWASHER			
12	1	INSULATOR (RED)			
13	1	RETAINER (ELECTRIC HANDLE)			
14	1	SCREW			
15	1	BATTERY CABLE (NEGATIVE–ELECTRIC)			
16	2	CDM ASSEMBLY			
17	2	HI-TENSION CABLE			
18	1	BOOT			
19	2	SPARK PLUG (NGK# BP8H-N-10)	240	20	27.1
	2	SPARK PLUG (NGK#BPZ–8H–N–10)	240	20	27.1
20	4	SCREW (M6 x 14)	80		9.0
21	1	PLATE–Electrical			
22	1	CABLE (MANUAL)			
23	1	SCREW (M6 x 14)	80		9.0
24	1	SCREW (M5 x 12)(ELECTRIC)			
25	1	SCREW (M8 x 12)(MANUAL)			
26	6	BUSHING			
27	3	GROMMET **DESIGN I**			
28	3	SCREW (M6 x 30)			
29	3	BUSHING–Flanged			
30	3	GROMMET **DESIGN II**			
31	3	WASHER			
32	3	SCREW (M6 x 35)	100		11.3
33	1	TPM ASSEMBLY			
34	3	SCREW (M5 x 20)	80		9.0
35	3	STA–STRAP			
36	1	VOLTAGE REGULATOR **ELECTRIC**			
37	2	SCREW (M6 x 35)	80		9.0
38	1	CONDUIT			
39	1	TERMINAL BLOCK			
40	2	SCREW (10–16 x 3/8 IN.) **MANUAL**			
41	2	SCREW (M5 x 12)			
42	1	HARNESS ASSEMBLY–Engine **(MANUAL)**			
43	1	HARNESS ASSEMBLY–Engine **(ELECTRIC)**			
44	1	HARNESS **(ELECTRIC)**			

ELECTRICAL COMPONENTS
(S/N-USA-0G590000/ BEL-9973100 & Above)



NOTE: APPLY LIQUID NEOPRENE TO ALL RING END WIRING TERMINALS.

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	5	SCREW (M5 x 30)	50		5.6
2	1	STATOR **MANUAL**			
3	2	PLUG			
4	1	TRIGGER			
5	1	CABLE TIE (4 IN.)			
6	1	SOLENOID ASSEMBLY			
7	2	BUSHING			
8	2	GROMMET			
9	2	NUT (8-32)			
10	2	SCREW (M6 x 25) **ELECTRIC**	40		4.5
11	2	NUT (1/4-20)	50		5.6
12	2	LOCKWASHER			
13	1	INSULATOR (RED)			
14	1	RETAINER **(ELECTRIC HANDLE)**			
15	1	SCREW			
16	1	BATTERY CABLE (NEGATIVE–ELECTRIC)			
17	2	CDM ASSEMBLY			
18	2	HI-TENSION CABLE			
19	1	BOOT			
20	2	SPARK PLUG (NGK# BP8H-N-10)	240	20	27.1
21	2	SPARK PLUG (NGK#BPZ–8H–N–10)	240	20	27.1
22	1	CABLE **MANUAL**			
23	1	SCREW (M8 x 12)			
24	4	SCREW (M6 x 14)	60		6.7
25	1	PLATE–Electrical			
26	1	SCREW (M5 x 12)	60		6.7
27	1	WASHER			
28	1	SCREW (M6 x 14)	60		6.7
29	1	WASHER			
30	6	BUSHING			
31	3	GROMMET			
32	3	SCREW (M6 x 30)			
33	1	REV LIMITER **(MANUAL)**			
	1	REV LIMITER **(ELECTRIC)**			
34	2	SCREW (M6 x 25)	30		3.4
35	4	STA–STRAP (8 IN.)			
36	1	VOLTAGE REGULATOR			
37	2	SCREW (M6 x 35) **ELECTRIC**	60		6.7
38	1	CONDUIT			
39	1	HARNESS ASSEMBLY–Engine **(MANUAL)**			
40	1	HARNESS ASSEMBLY–Engine **(ELECTRIC)**			
41	1	CONDUIT			
	1	**POWERHEAD**			

Theory of Operation

The ignition system is alternator-driven with distributor-less capacitor discharge. Major components of the ignition system are the flywheel, stator, trigger, timing protection module (TPM), capacitor discharge modules (CDM) and spark plugs.

The stator assembly is mounted stationary below the flywheel and has 2 (red stator has 3) capacitor charging coils wound in series. The flywheel is fitted with 6 permanent magnets inside the outer rim. As the flywheel rotates the permanent magnets pass the capacitor charging coils causing the coils to produce AC voltage (230 - 330 volts). The AC voltage then is conducted to the capacitor discharge module (CDM) where it is rectified and stored in a capacitor. Part of the stator voltage (20 - 25 volts) is sent to the timing protection module (TPM) to power the timing circuit.

The trigger assembly (also mounted under the flywheel) has 1 coil. The flywheel has a another permanent magnet located around the center hub. As the flywheel rotates, this hub magnet passes the trigger coil. This causes the trigger coil to produce a AC voltage pulse which is sent to the TPM. The TPM delays this signal depending on engine RPM and forwards a trigger signal to a electronic switch (SCR) within the CDM.

The SCR switch discharges the stored voltage of the capacitor into the primary side of the CDM's ignition coil.

Capacitor voltage within the CDM is amplified as high as 45000 volts 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) electronically by the TPM monitoring trigger pulses.

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).

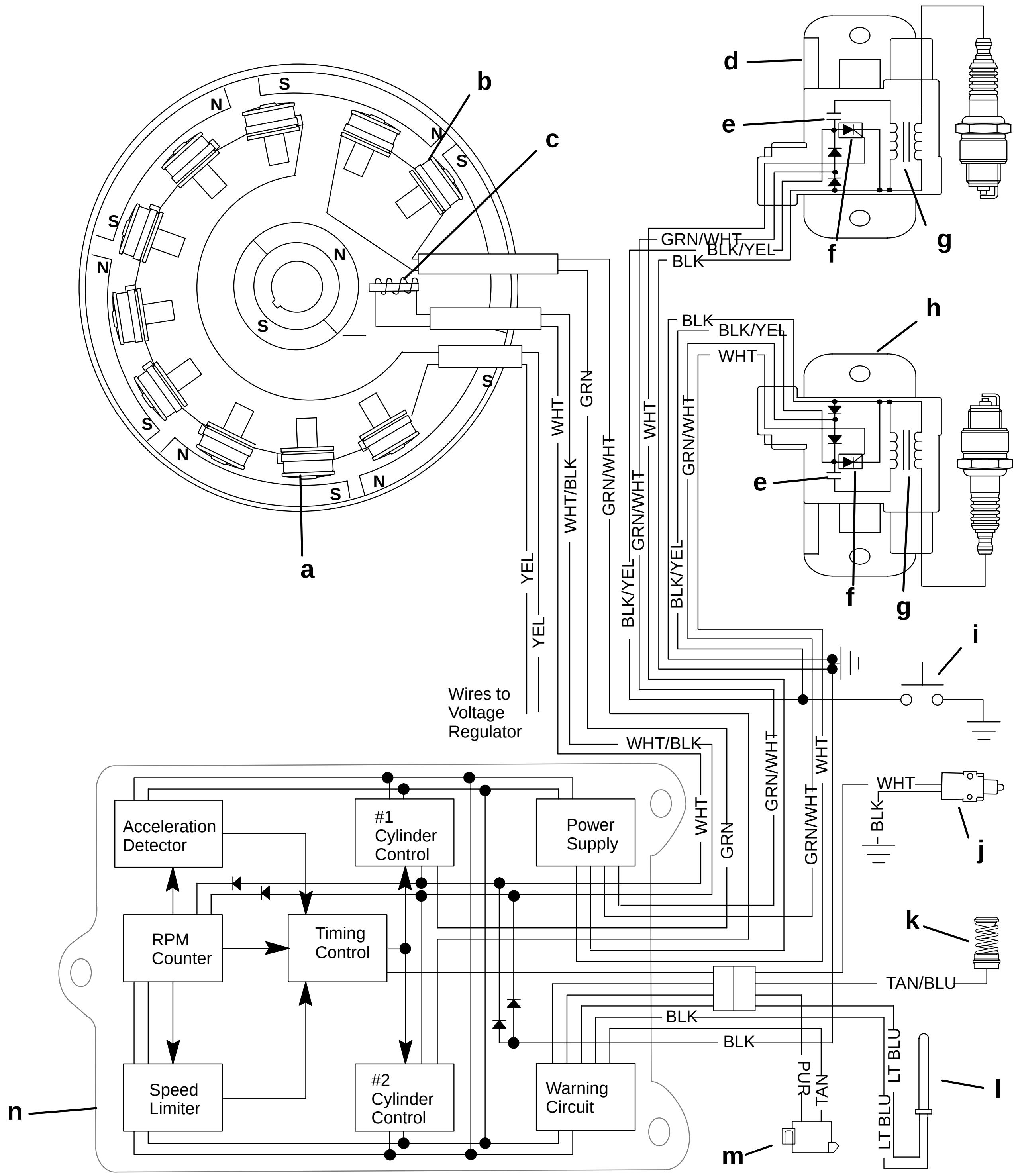
Ignition Component Description

Principle of Operation with Timing Protection Module (TPM)

Under normal circumstances, the TPM controls:

1. Spark timing by monitoring the trigger pulses and engine temperature.
2. Advances spark timing quickly to 25° BTDC under hard acceleration conditions.
3. Provides over-speed protection if engine RPM exceeds 5800. This occurs in 2 stages. Initially, timing is retarded from 25° BTDC to 14° BTDC. If RPM continues to increase above 6500, TPM will shut ignition off momentarily until RPM drops below 6500.
4. Provides an idle stabilizer function by advancing timing when engine RPM drops below 600. At crank speed of 300 RPM, timing can be as high as 10° BTDC.
5. Provides warning control of OVER-HEAT and LOW-OIL conditions. Warning is provided through activation of a continuous tone warning horn for either condition. An OVER-HEAT condition occurs when engine temperature rises above 190° F ± 8° (88° C ± 13°). The TPM will intermittently interrupt the ignition voltage to the capacitor discharge modules (CDM) to reduce maximum RPM to approximately 2500. The RPM will be limited and the warning horn will activate until engine temperature drops below 170° F ± 8° (77° C ± 13°).
   During a LOW-OIL condition, the TPM activates the warning horn when switch in engine-mounted oil tank is shorted to ground (closed). Engine RPM is NOT limited during a LOW-OIL condition.

Mercury/Mariner 30/40 (2 cyl.) ADI IGNITION SYSTEM (With Electronic Spark Advance)



a - Battery Charging Coils (8)
b - Ignition Charge Coils (2)
c - Trigger
d - CDM #1
e - Capacitor
f - SCR
g - Coil
h - CDM #2

i - Stop Switch
j - Neutral Start Switch
k - Temperature Sender
l - Low Oil Switch
m - Warning Horn
n - Timing & Protection Module

Principle Of Operation, CDM without Timing Protection Module (TPM)

The ignition system is alternator-driven with distributor-less capacitor discharge. Major components of the ignition system are the flywheel, stator, trigger, capacitor discharge modules (CDM and spark plugs.

The stator assembly is mounted stationary below the flywheel and has 3 capacitor charging coils wound in series. The flywheel is fitted with 6 permanent magnets inside the outer rim. As the flywheel rotates the permanent magnets pass the capacitor charging coils causing the coils to produce AC voltage (**260 - 320** volts). The AC voltage then is conducted to the capacitor discharge module (CDM) where it is rectified and stored in a capacitor.

The trigger assembly (also mounted under the flywheel) has 2 coil. The flywheel has another permanent magnet located around the center hub. As the flywheel rotates, the magnet passes the trigger coil. This causes the trigger coil to produce a AC voltage pulse which is sent to an electronic switch (SCR) within the CDM.

The SCR switch discharges the stored voltage of the capacitor into the primary side of the CDM's ignition coil.

Capacitor voltage within the CDM is amplified as high as 45000 volts to jump the gap at the spark plug.

The proceeding 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.

A rev-limiter (over-speed protection) circuit is contained inside the trigger assembly. The trigger pulse(s) provide power for the rev-limiter circuit, this circuit in turn counts the trigger pulses to determine engine RPM. IF the engine RPM increases above the specified RPM limit, the rev limiter will prevent the trigger pulses from reaching the CDM eliminating spark delivery to the cylinder. The Rev limiter will start to limit at 5900 ± 150 RPM and fully limit at 6200 ± 150 RPM.

Trigger Coil

One Piece assembly, containing two trigger coils-one for each cylinder located under flywheel. Is charged by single magnet on flywheel hub. Trigger pulses are sent to TPM or CDM.

NOTE: Trigger assemblies are different between TPM and non-TPM systems.

Stator

Located under the flywheel in the stator assembly are 3 charge coils wound in series, they provide voltage to the capacitor discharge modules (CDM). The charge coils also provide voltage to power the timing circuit in the TPM or CDM.

Capacitor Discharge Modules (CDM)

Each module contains an ignition coil and amplifier circuitry which produces approximately 45000 volts at the spark plugs.

Flywheel

Contains 6 magnets (12 pole) around circumference. One magnet located on inner hub for trigger. Outer magnets are for battery charge coils and ignition charge coils.

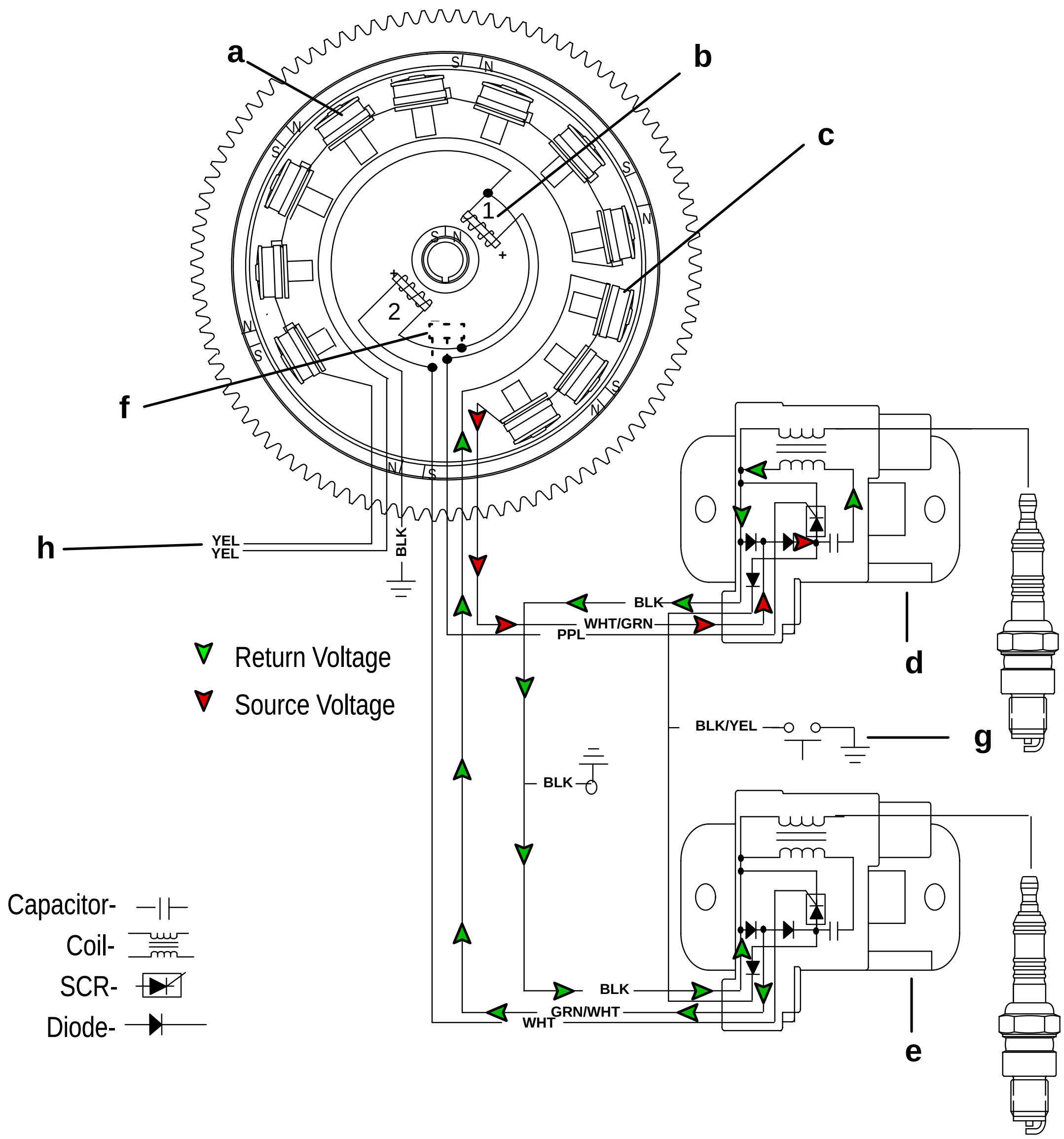
NOTE: The inner trigger hub are different between TPM and non-TPM systems.

Theory of Operation

This outboard ignition system is alternator–driven (distributor–less) capacitor discharge system. Major components of the ignition system are the flywheel, stator, trigger, capacitor discharge modules (CDM's) and spark plugs. Each capacitor discharge module functions as a combination switchbox and secondary ignition coil.

CAPACITOR CHARGING #1 CDM

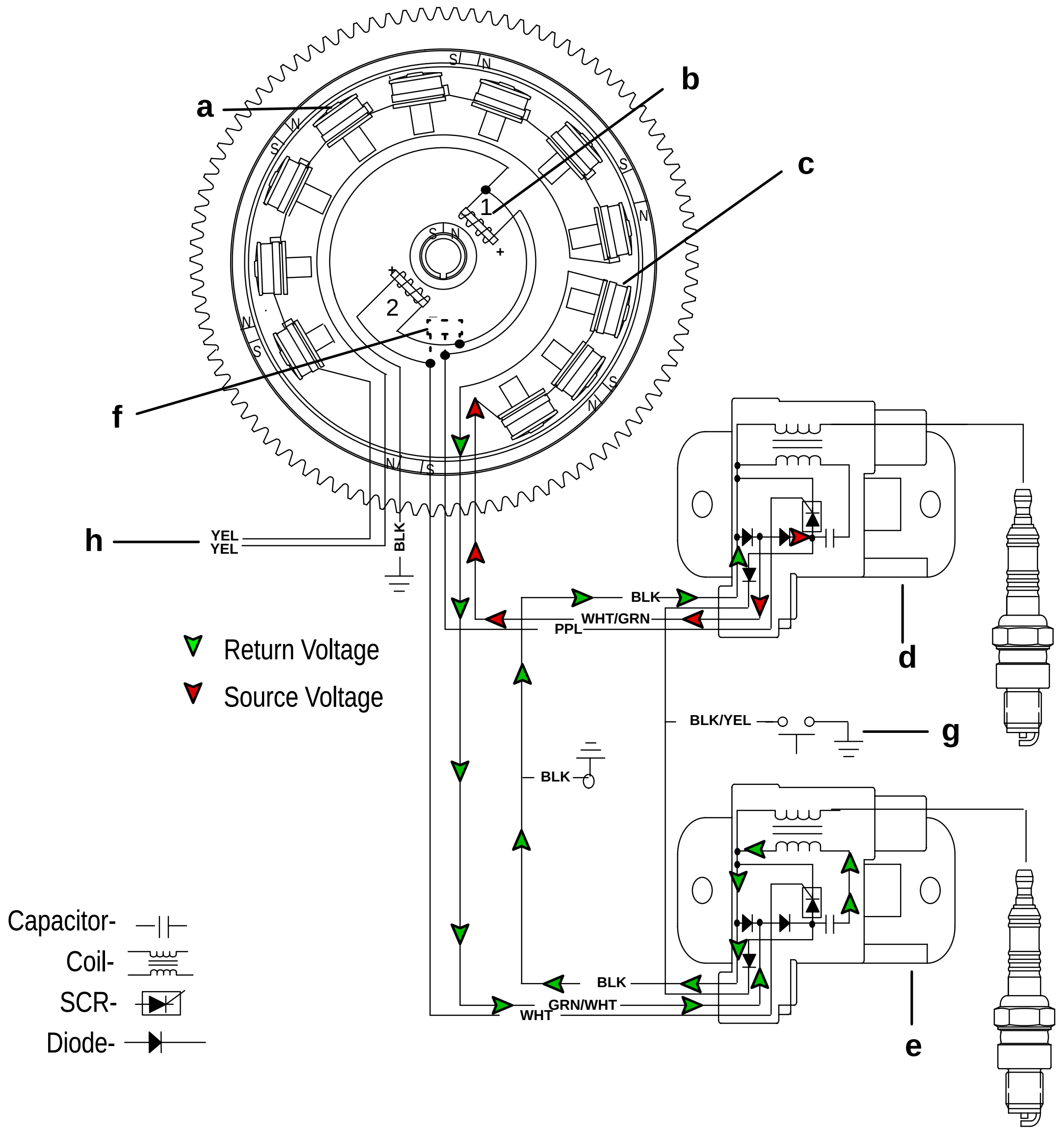
The STATOR assembly is mounted to the block below the flywheel and has 3 CAPACITOR CHARGING COILS wound in series. The FLYWHEEL is fitted with 6 permanent magnets inside the outer rim. The flywheel rotates the permanent magnets past the capacitor charging coils–causing the coils to produce AC voltage (260–320 volts). The AC voltage is then conducted to the CAPACITOR DISCHARGE MODULES (CDM), where it is rectified (DC) and stored in a capacitor. The stator voltage return path is through the ground wire of the other CDM and back through that CDM's charging coil wire to the capacitor charging coils.



a - Battery Charging Coils
b - Trigger Coils
c - Capacitor Charge Coils
d - CDM #1
e - CDM #2
f - Rev. Limiter
g - Stop Switch
h - To Voltage Regulator

CAPACITOR CHARGING #2 CDM

The flywheel rotates the permanent magnets past the capacitor charging coils–causing the coils to produce AC voltage (260–320 volts). The opposite voltage pulse is then conducted to the CAPACITOR DISCHARGE MODULES (CDM), where it is rectified (DC) and stored in a capacitor. The stator voltage return path is through the ground wire of the other CDM and back through that CDM's charging coil wire to the capacitor charging coils.

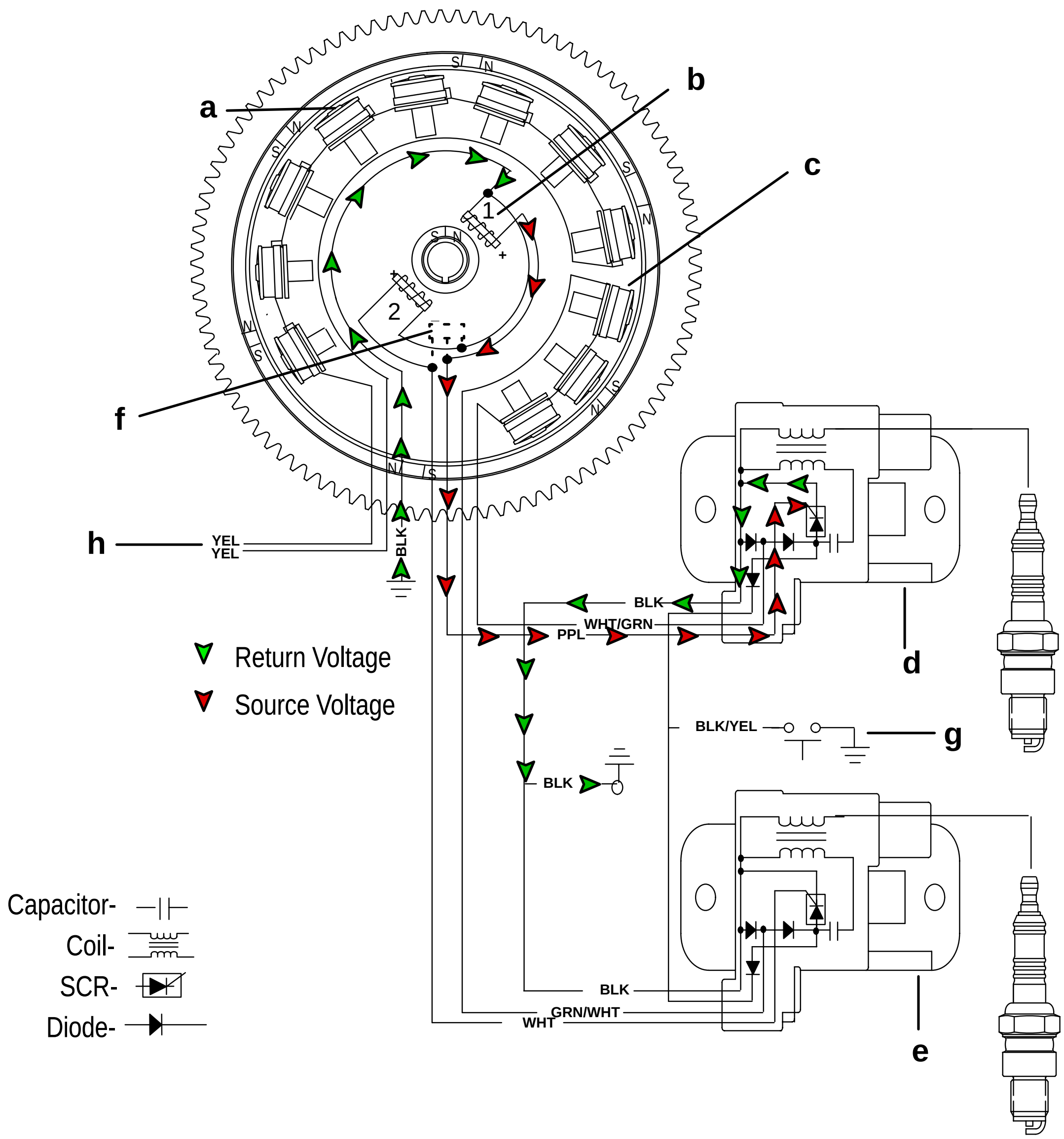


a - Battery Charging Coils
b - Trigger Coils
c - Capacitor Charge Coils
d - CDM #2
e - CDM #2
f - Rev. Limiter
g - Stop Switch
h - To Voltage Regulator

#1 Cylinder Trigger Circuit

The TRIGGER assembly (also mounted under the flywheel) has one coil for each cylinder. These coils are mounted adjacent to the flywheel center hub. The center hub of the flywheel contains a permanent magnet with one north–south transitions. As the flywheel rotates, the magnet north–south transitions pass the trigger coils. This causes the trigger coils to produce a voltage pulse which is sent to the respective capacitor discharge module (CDM).

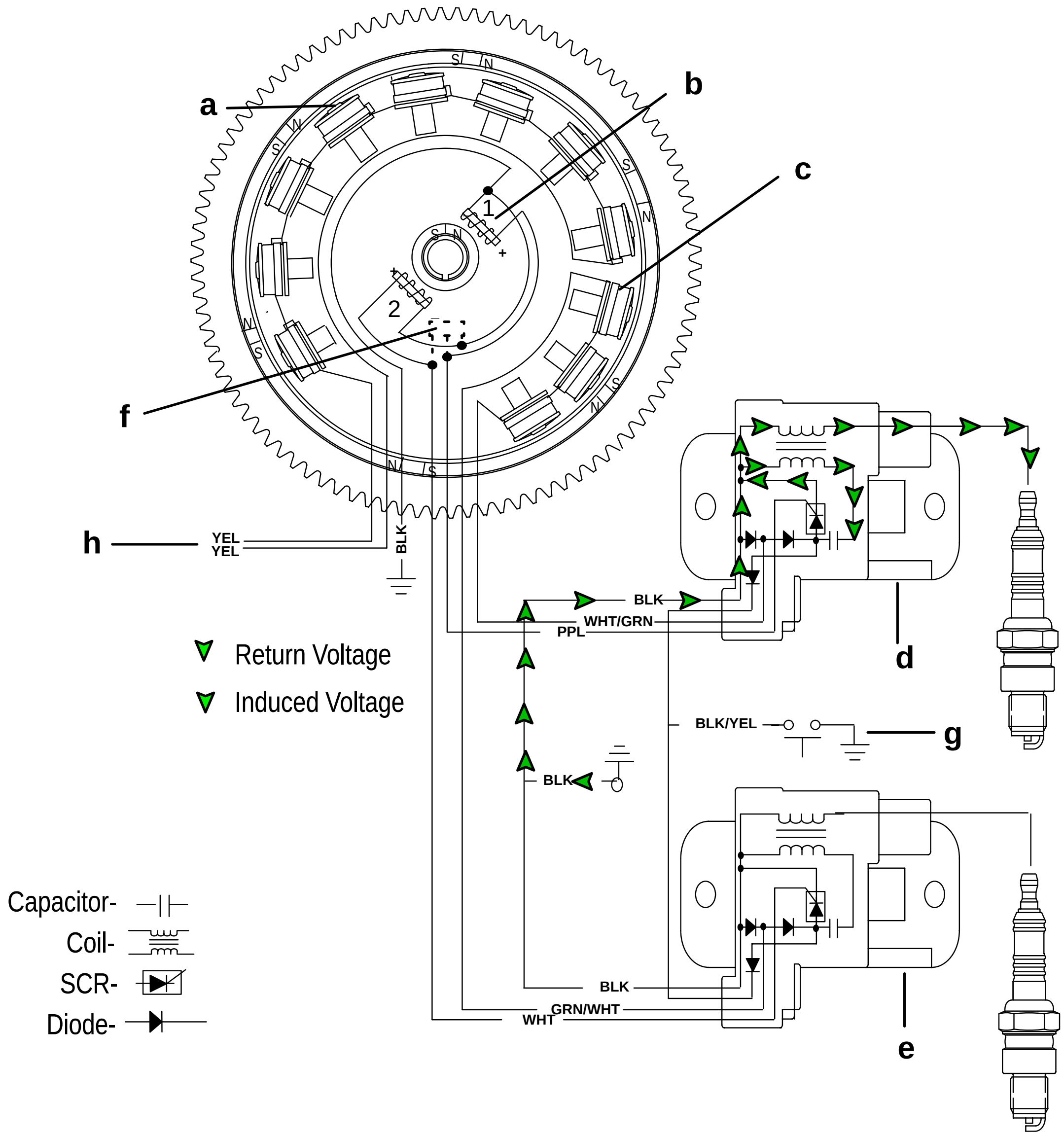
A positive voltage pulse (N–S) will activate the electronic switch (SCR) inside the capacitor discharge module (CDM). The switch discharges the capacitor voltage through the coil primary windings. The return voltage pulse exits the CDM through the ground wire and returns through the trigger ground. Once inside the trigger the voltage will supply the bias capacitor with a negative charge. For the next trigger in sequence to activate its CDM (SCR), the positive trigger voltage must first over come this offset bias capacitor voltage. The delay produced by having to over come this offset bias capacitor voltage prevents the timing from electronically advancing as engine speed increases.



a - Battery Charging Coils
b - Trigger Coils
c - Capacitor Charge Coils
d - CDM #1
e - CDM #2
f - Rev. Limiter
g - Stop Switch
h - To Voltage Regulator

Ignition Coil Circuit

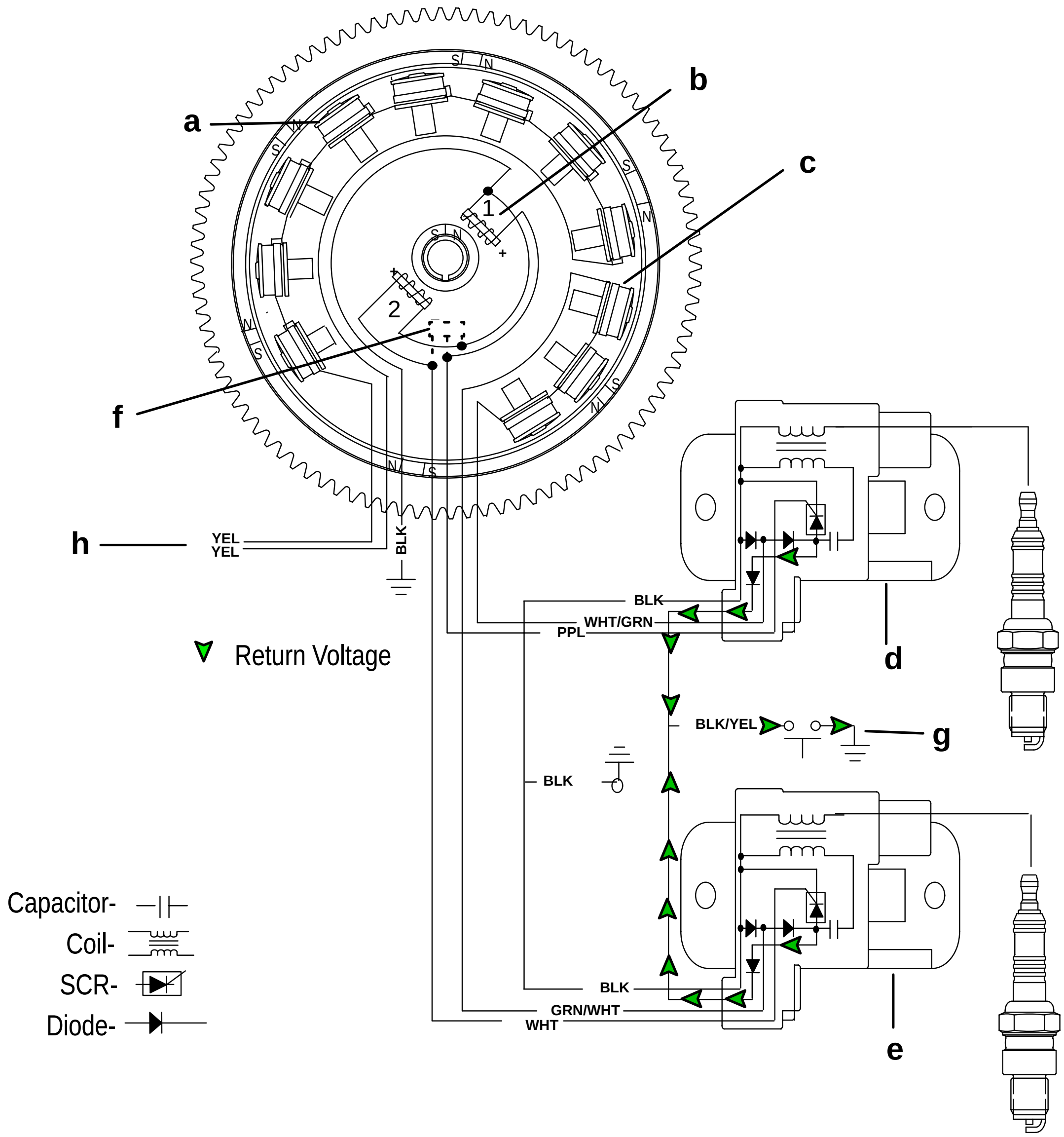
As the capacitor voltage flows through the primary windings of the ignition coil, a voltage is induced into the ignition coil secondary windings. This secondary voltage rises to the level required to jump the spark plug gap and return to ground. This secondary voltage can, if necessary, reach approximately 40,000 volts. To complete the secondary voltage path, the released voltage enters the ground circuit of CDM module.



a - Battery Charging Coils
b - Trigger Coils
c - Capacitor Charge Coils
d - CDM #1
e - CDM #2
f - Rev. Limiter
g - Stop Switch
h - To Voltage Regulator

Stop Circuit

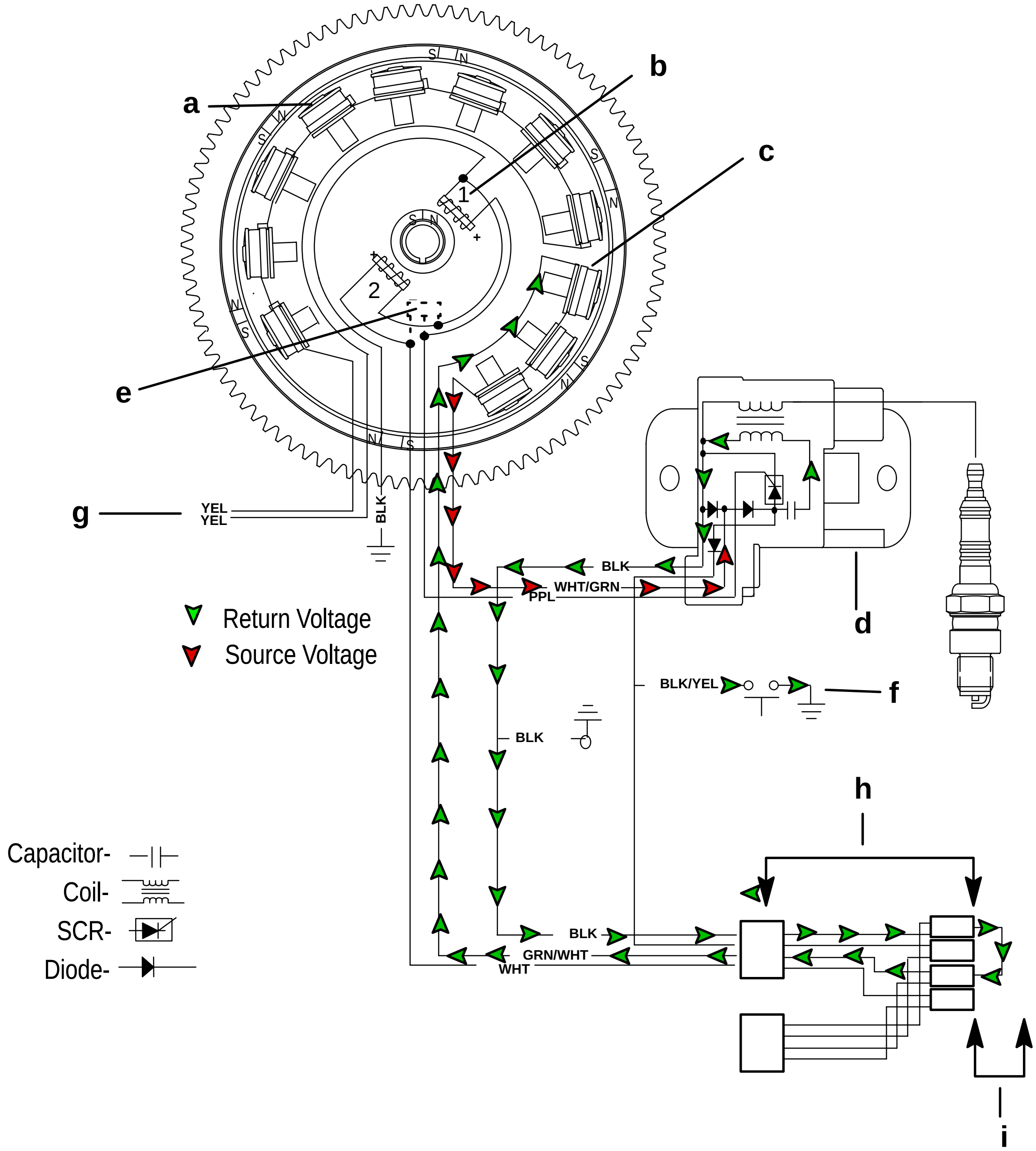
To stop the engine, the stop switch is closed allowing the capacitor charge current from the stator to drain directly to ground. NOTE: The CDM contains a zener diode (not shown for clarity). This diode prevents overcharging of the capacitor (and possible failure) if the SCR does not receive a trigger pulse.



a - Battery Charging Coils
b - Trigger Coils
c - Capacitor Charge Coils
d - CDM #1
e - CDM #2
f - Rev. Limiter
g - Stop Switch
h - To Voltage Regulator

To bypass a CDM with a failed stator voltage return path, install the DVA adaptor harness (to allow easy access to the wire connectors) and using the test jumper P/N 91–818812A1 (or equavilant) connect the stator charge wire to the CDM ground lead. This will allow the remaining CDM to function correctly.

NOTE 1: This test will work on 3 & 4 cylinder engines, however the number of CDM's (cylinders) that function correctly will vary.
NOTE 2: It is possible to ground one of the stator leads to ground (bypassing the CDM and harness). Do Not damage the wire connector by clamping the connector to ground with a bolt.



a - Battery Charging Coils
b - Trigger Coils
c - Capacitor Charge Coils
d - CDM #1
e - Rev. Limiter
f - Stop Switch
g - To Voltage Regulator
h - DVA Adaptor Harness P/N 84-825207A2
i - Test Jumper P/N 91-818812A1

Ignition Test Procedures

Direct Voltage Adapter (DVA) Test for Stator

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.

WARNING

When testing or servicing the ignition system, high voltage is present. 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 CDMs or TPM are not grounded to engine.

CAUTION

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

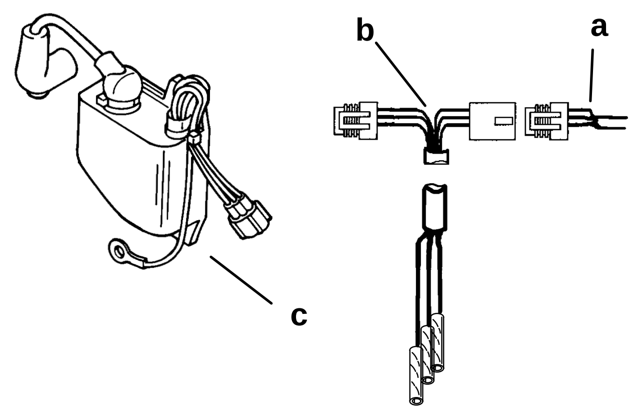
- **400 VDC* test position (or higher) MUST BE used for all tests.**
- **INSURE the Positive (+) lead/terminal of DVA is connected to the Positive (+) receptacle of meter**
- **DO NOT CHANGE meter selector switch position while engine is running and/or being "cranked".**
- **ALL COMPONENTS MUST BE GROUNDED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

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

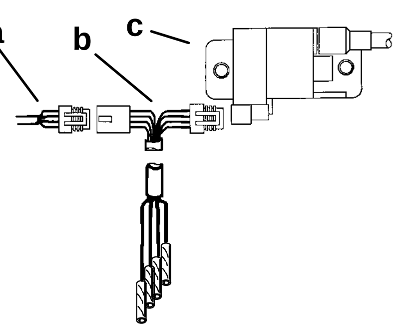
NOTE: *Test leads are not supplied with the DVA. Use test leads supplied with meter.*

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

Install test harness between ignition harness and CDM as shown.



a - Stator/Trigger Harness
b - Test Harness (P/N 91-825207A1)
c - Capacitor Discharge Module (P/N 822779)



a - Stator/Trigger Harness
b - Test Harness (P/N 91-825207A2)
c - Capacitor Discharge Module (P/N 827509)

TEST	Selector Switch Position	RED Lead	BLACK Lead	Voltage Reading* @ (300 - 4000) RPM
Stator	400 DVA	Red Test Harness (Green/White)	Ground	190 - 320
Stator	40 DVA	Green or White/Green	Ground	20 - 40

*** If voltage is low, disconnect one Capacitor Discharge Module (CDM) connector at a time while monitoring voltage reading.**

If voltage rises, replace that CDM. If voltage does not rise, replace stator.

Ignition Diagnostic Procedures

TROUBLESHOOTING TIP: With engine running, use inductive timing light to check spark advance of each cylinder as throttle is opened and closed. If timing advances and retards smoothly on each cylinder, ignition system is MOST LIKELY functioning properly.

IMPORTANT: If outboard appears to have an ignition system failure, it is recommended that before beginning in-depth troubleshooting:

a. Check ground leads on Timing Protection Module, Capacitor Discharge Modules and ground lead between ignition plate and engine block for proper continuity.

b. Disconnect and reconnect ignition harness connectors to verify proper continuity.

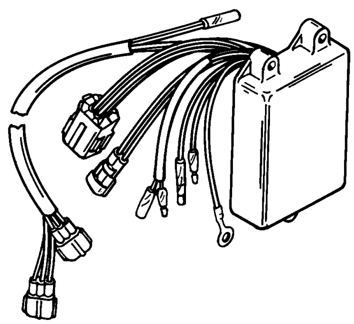
PROBLEM	CORRECTION
1. No Spark or Weak Spark on Both Cylinders	No Spark - Trigger, Stator or Timing Protection Module (TPM) Weak Spark - Stator
2. No Spark or Weak Spark on 1 Cylinder	Capacitor Discharge Module (CDM)
3. Timing Fluctuates - Note: It is normal for timing to fluctuate 2°-3° @ Idle. - If engine over-heats [above 190° F (88° C)], TPM will limit engine RPM to 2500. - If engine RPM exceeds 5800, TPM will retard timing from 25 BTDC TO 14° BTDC. - If RPM exceeds 6500 RPM, TPM will momentarily shut ignition off until RPM drops below 6500. - If engine RPM drops below 600, idle stabilizer in TPM will advance timing to as high as 10° BTDC @ cranking speed of 300 RPM.	Defective Engine Temperature Sensor Defective TPM
4. Timing will not Advance on both Cylinders	Defective TPM
5. Timing will not Advance on 1 Cylinder	Check wiring between CDM and TPM. If wiring is OK, replace CDM.
6. Engine Misfires @ High RPM	Defective CDM Defective TPM
7. Engine Hard to Start when Cold	Defective Fuel Enrichment Valve Defective TPM
8. Engine Misfires @ Low RPM but Runs Smooth @ High RPM	Defective Harness (loose connections) between TPM and CDM Defective CDM Defective TPM Defective Stator
9. Engine Starts Hard when Hot	Defective TPM
10. Engine will not Run over 2500 RPM and is not Over-Heating.	Defective Temperature Sensor Defective TPM
11. Engine Occasionally Misfires	Replace Standard Spark Plug with Inductor Plug

Testing Ignition Components

Resistance Tests

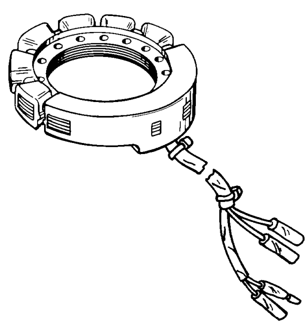
TIMING PROTECTION MODULE

Normally, if timing advances and retards with corresponding changes in RPM, most likely the TPM is functioning correctly. Refer to **“Ignition Diagnostic Procedures”** preceding, for individual failure scenarios.



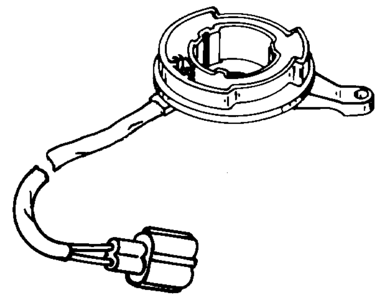
STATOR

A resistance check can be made on charge coils. Ohmmeter should indicate as follows:
Black Stator between GREEN/WHITE and GREEN leads (525-625 ohms)
Red Stator between GREEN/WHITE and WHITE/GREEN leads (660-710 ohms).

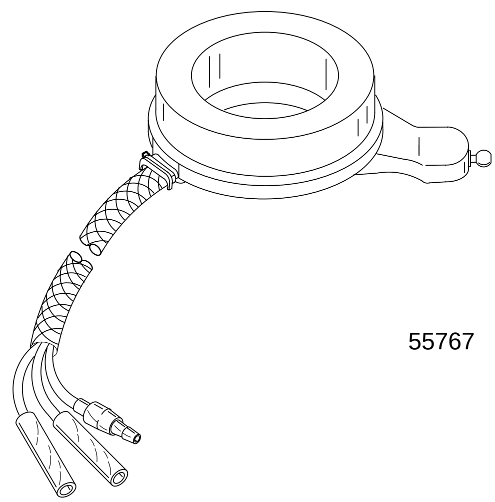


TRIGGER (S/N-0G589999 & BELOW)

A resistance check can be made on trigger coil between WHITE/BLACK and WHITE leads. Ohmmeter should indicate between 1100 - 1300 ohms.



TRIGGER (S/N-0G590000 & ABOVE)



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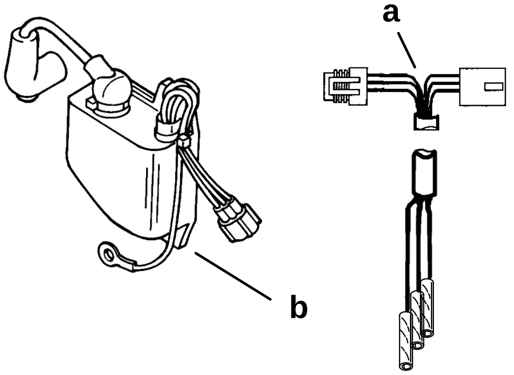
A resistance test is not used on the trigger. Test trigger as outlined under “Trigger Output Test”.

Trigger Output Test		20 DVA Scale
Positive Meter Lead (+)	Negative Meter Lead (–)	DVA Reading
White Test Harness Lead	Black Test Harness Lead	2 - 8 Volts

If reading is below specifications replace trigger. If reading is above specifications check CDM.

NOTE: *If voltage remains low after installing a new trigger, replace CDM.*

CAPACITOR DISCHARGE MODULE P/N822779



a - Test Harness P/N 91-825270A1
b - Capacitor Discharge Module P/N 822779

A resistance check can be made of the CDM as follows:

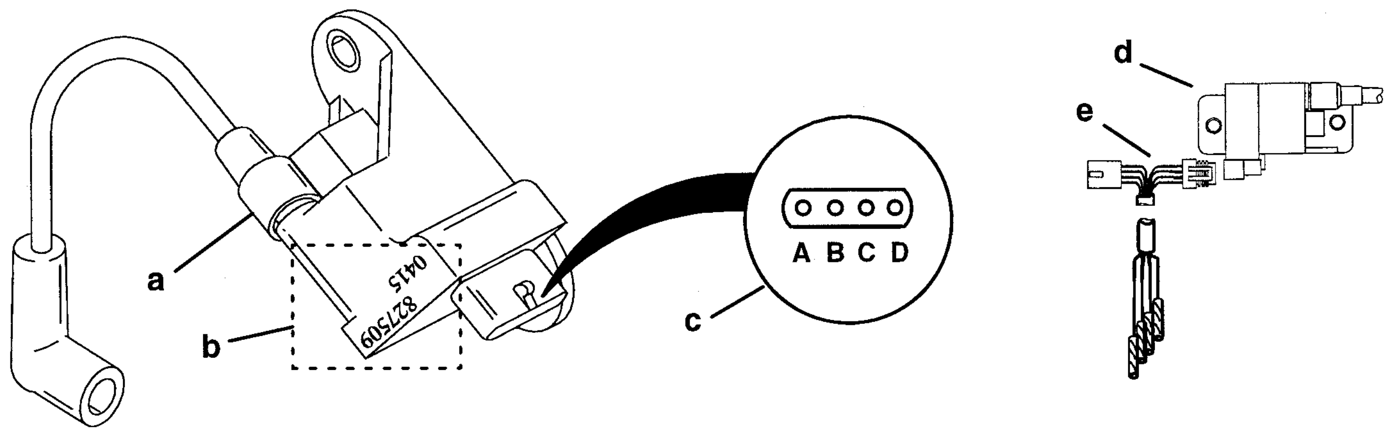
CAPACITOR DISCHARGE MODULE RESISTANCE CHECK-ANALOG METER			
Connect Positive (+) Meter Lead To:	**Connect Negative (–) Meter Lead To:**	**Ohms Scale**	**Reading**
Ground Lead	White Pin or White Test Harness Lead	R X 1	40 ± 10
GRN/WHT Pin or Red Test Harness Lead	Ground Lead	R X 1* Diode Reading	Continuity
Ground Lead	GRN/WHT Pin or Red Test Harness Lead	R X 1K* Diode Reading	No Continuity
GRN/WHT Pin or Red Test Harness Lead	BLK/YEL Pin or Black Test Harness Lead	R X 1K* Diode Reading	No Continuity
BLK/YEL Pin or Black Test Harness Lead	GRN/WHT Pin or Red Test Harness Lead	R X 1* Diode Reading	Continuity
Coil Tower	Ground Lead	R X 10	1000 ± 300

***NOTE:** Due to the differences in test meters battery polarity, results other than specified may be obtained. In such a case, reverse meter leads and re-test. If test results then read as specified on all tests CDM is O.K.. The diode measurements above will be opposite if using a Fluke® equivalent multimeter.*

CAPACITOR DISCHARGE MODULE RESISTANCE CHECK-DIGITAL METER			
Connect Positive (+) Meter Lead To:	**Connect Negative (–) Meter Lead To:**	**Ohms Scale**	**Reading**
Ground Lead	White PIn or White Test Harness Lead	Ω or 200	40 ± 10 Ohms
GRN/WHT Pin or Red Test Harness Lead	Ground Lead	(diode symbol)*	OL or OUCH
Ground Lead	GRN/WHT Pin or Red Test Harness Lead	(diode symbol)*	.400-.900
GRN/WHT Pin or Red Test Harness Lead	BLK/YEL Pin or Black Test Harness Lead	(diode symbol)*	.400-.900
BLK/YEL Pin or Black Test Harness Lead	GRN/WHT Pin or Red Test Harness Lead	(diode symbol)*	OL or OUCH or 1.
Coil Tower	Ground Lead	Ω or 2K	.800-1.200 KΩ

***NOTE:** Due to the differences in test meters battery polarity, results other than specified may be obtained. In such a case, reverse meter leads and re-test. If test results then read as specified on all tests CDM is O.K.. The diode measurements above will be as specified if using a Fluke® equivalent multimeter.*

Capacitor Discharge Module (P/N 827509) Ohms Test



a - Spark Plug Wire **IMPORTANT:** Spark Plug Wires Are Screwed into CDM.
b - Part Number: 827509
    Date Code:0415 (Julian Date and Year: 5=1995)
c - Pins are Labeled: A:Black - Ground
    B:Black/Yellow - Stop Circuit
    C:White - Trigger
    D:Green - Stator
d - Capacitor Discharge Module P/N 827509
e - Test Harness P/N 91-825207A2

A resistance check, although not necessary for any troubleshooting procedure, can be made of the CDM as follows:

NOTE: *This test can be performed using the test harness (p/n 84-825207A2). Do Not connect the test harness plug to the stator/trigger engine wire harness.*

CAPACITOR DISCHARGE MODULE RESISTANCE CHECK - ANALOG METER			
Connect Positive (+) Meter Lead To:	**Connect Negative (–) Meter Lead To:**	**Ohms Scale**	**Results:**
Ground Pin (A)/ or Black Test Harness Lead	White (C)/ or White Test Harness Lead	R x 100	1250 ± 300 Ohms
Green (D)/ or Green Test Harness Lead	Ground Pin (A)/ or Black Test Harness Lead	R x 100 Diode Reading*	Continuity
Ground Pin (A) or Black Test Harness Lead	Green (D)/ or Green Test Harness Lead	R x 100 Diode Reading*	No Continuity
Green (D)/ or Green Test Harness Lead	Black/Yellow (B)/ or Black/ Yellow Test Harness Lead	R x 100 Diode Reading*	No Continuity
Black/Yellow (B)/ or Black/ Yellow Test Harness Lead	Green (D)/ or Green Test Harness Lead	R x 100 Diode Reading*	Continuity
Spark Plug Terminal (At Spark Plug Boot)	Ground Pin (A) or Black Test Harness Lead	R x 100	1000 ± 300 Ohms

NOTE: *Due to the differences in test meters battery polarity, results other than specified may be obtained. In such a case, reverse meter leads and re-test. If test results then read as specified on all tests CDM is O.K.. The diode measurements above will be opposite if using a Fluke equivalent multimeter.*

CAPACITOR DISCHARGE MODULE RESISTANCE CHECK - DIGITAL METER

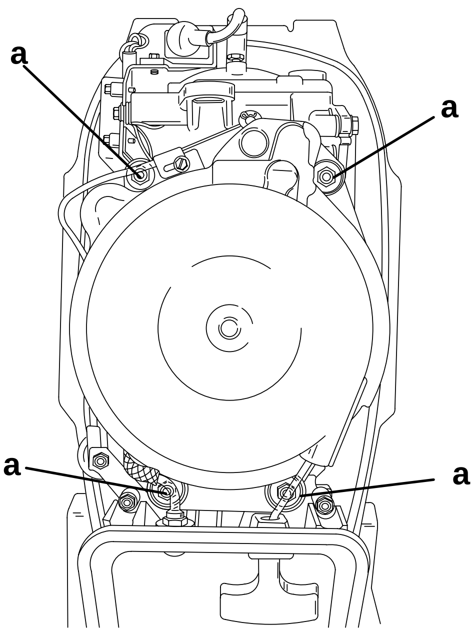
Connect Positive (+) Meter Lead To:	Connect Negative (–) Meter Lead To:	Ohms Scale	Results:
Ground Pin (A)/ or Black Test Harness Lead	White (C)/ or White Test Harness Lead	Ω or 2K	1.125-1.375 KΩ
Green (D)/ or Green Test Harness Lead	Ground Pin (A)/ or Black Test Harness Lead	▶|	OL or OUCH
Ground Pin (A) or Black Test Harness Lead	Green (D)/ or Green Test Harness Lead	▶|	.400-.900
Green (D)/ or Green Test Harness Lead	Black/Yellow (B)/ or Black/ Yellow Test Harness Lead	▶|	.400-.900
Black/Yellow (B)/ or Black/ Yellow Test Harness Lead	Green (D)/ or Green Test Harness Lead	▶|	OL or OUCH
Spark Plug Terminal (At Spark Plug Boot)	Ground Pin (A) or Black Test Harness Lead	Ω or 2K	.950-1.150 KΩ

NOTE: *Due to the differences in test meters battery polarity, results other than specified may be obtained. In such a case, reverse meter leads and re-test. If test results then read as specified on all tests CDM is O.K.. The diode measurements above will be as specified if using a Fluke equivalent multimeter.*

Ignition Components Removal

Flywheel

1. Remove flywheel nuts and washers.
2. Remove flywheel cover.

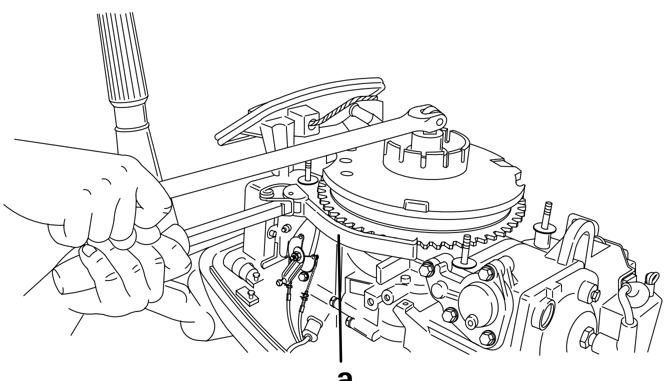


a - Nuts and Washers

⚠ 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.

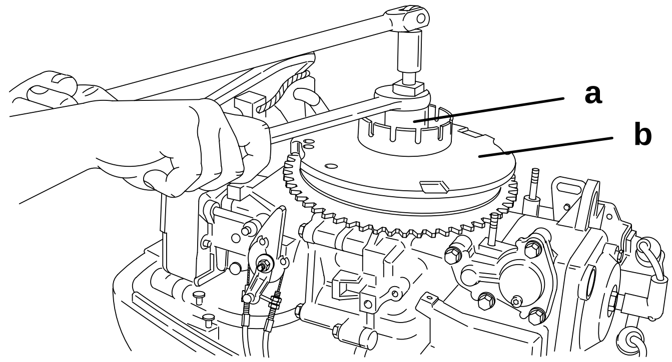
3. Disconnect spark plug leads from spark plugs.
4. While holding flywheel with Flywheel Holder (91-52344), remove flywheel nut and washer.



a - Flywheel Holder (91-52344)

5. Install Crankshaft Protector Cap (91-24161) on the end of crankshaft, then install Flywheel Puller (91-73687A1) into flywheel.
6. 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.*

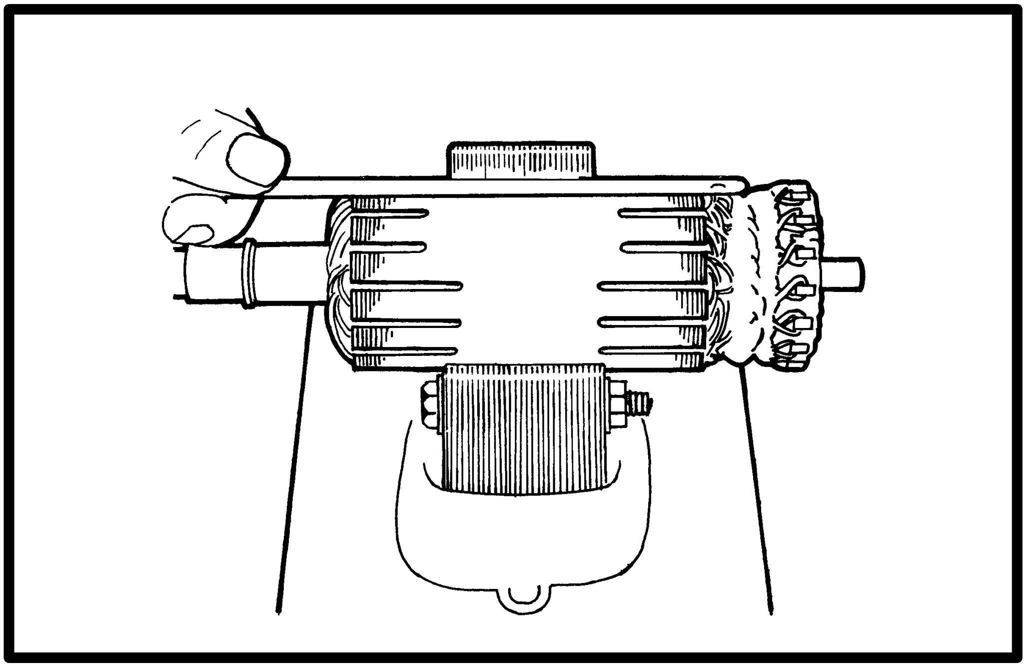


a - Flywheel Puller (91-73687A1)
b - Flywheel

ELECTRICAL

2

B



CHARGING & STARTING SYSTEM

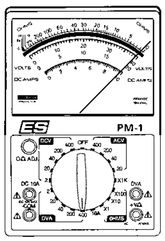
Table of Contents

Specifications

STARTING SYSTEM	**Manual Start** **Electric Start** **Starter Draw (Under Load)** **(No Load)**	Recoil 12 Volt 95 Amperes 20 Amperes
CHARGING SYSTEM	**Alternator Output** **– Electric Start** **– Manual Start**	Single Phase (12 Pole) 14 Amperes @ 5000 RPM 9 Amperes @ 3000 RPM

Special Tools

1. Volt/Ohm/DVA Meter 91-99750



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.

⚠ CAUTION

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

Recommended Battery

A 12 volt battery with a "Cold Cranking Amperage" rating minimum of 465 amperes.

Operating Engine Without Battery

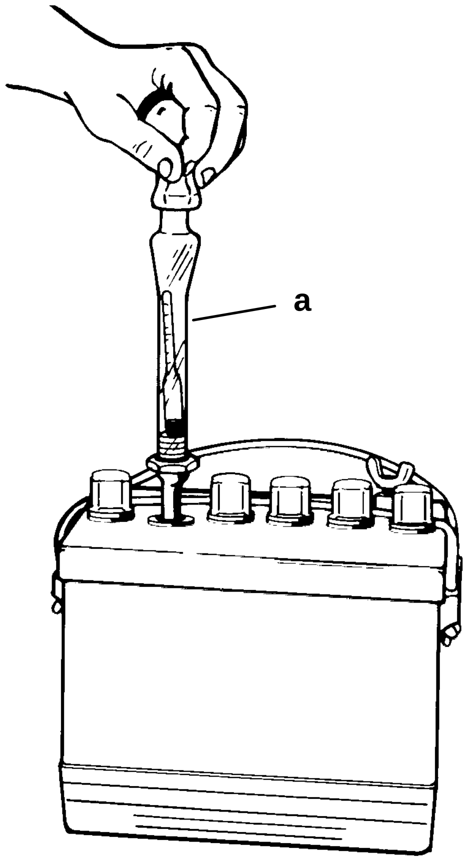
If desired (or in an emergency), engines equipped with an alternator can be started and operated without a battery (either disconnected or removed) if "**WARNING**", below, is followed.

⚠ WARNING

Before operating engine with battery leads disconnected from battery, disconnect stator leads (Yellow) from rectifier. Insulate (tape) stator lead ring terminals.

Specific Gravity Readings

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



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Hydrometer measures percentage of sulfuric 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.

⚠ CAUTION

During service, only distilled water should be added to the battery, not electrolyte.

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 Marine Lubricant, 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 re-install battery.

⚠ WARNING

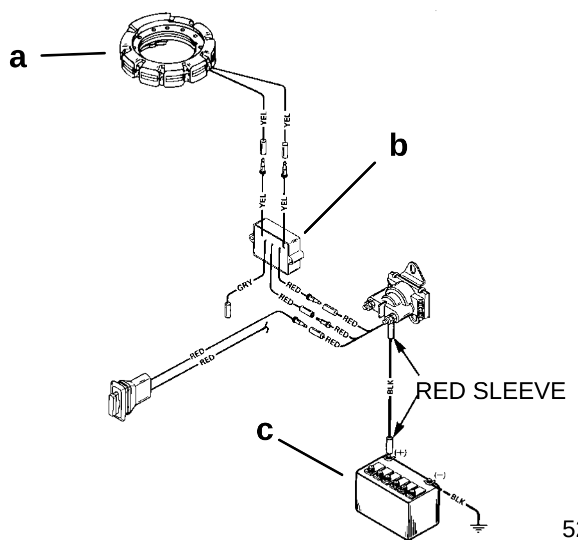
Hydrogen and oxygen gases are produced during normal battery operation or charging. Sparks or flame can cause this mixture to ignite and explode, if they are brought near the battery. Sulfuric acid in battery can cause serious burns, if spilled on skin or in eyes. Flush or wash away immediately with clear water.

Battery Charging System (14 or 18 Ampere Alternator)

Description

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

ELECTRIC START MODELS



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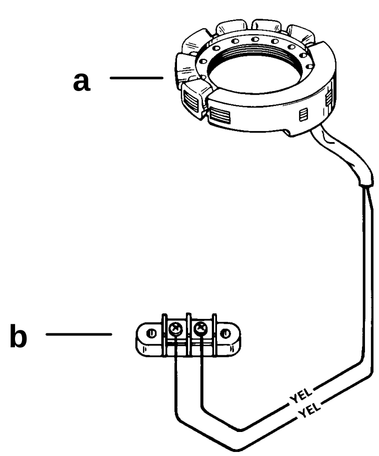
a - Stator
b - Regulator
c - Battery

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.

MANUAL START MODELS



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a - 9 Ampere Stator
b - Terminal Block

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”.
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) or disconnect bullet connectors from voltage regulator.
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.

9 AMPERE MANUAL STATOR (S/N-0G589999 & BELOW)

Test Leads	Resistance (Ohms)	Scale Reading (x––––)
Between YELLOW Leads	.17 – .19*	.17 – .19* (R x 1)
Between either YELLOW Lead and Ground	No Continuity	No Continuity (R x 1000)

9 AMPERE MANUAL STATOR (S/N-0G590000 & ABOVE)

Test Leads	Resistance (Ohms)	Scale Reading (x––––)
Between YELLOW Leads	.16 – .19*	.16 – .19* (R x 1)
Between either YELLOW Lead and Ground	No Continuity	No Continuity (R x 1000)

14 AMPERE STATOR

Test Leads	Resistance (Ohms)	Scale Reading (x––––)
Between YELLOW Leads	.22 – .24*	.22 – .24* (R x 1)
Between either YELLOW Lead and Ground	No Continuity	No Continuity (R x 1000)

16 AMPERE STATOR (S/N-0G590000 & ABOVE)

Test Leads	Resistance (Ohms)	Scale Reading (x––––)
Between YELLOW Leads	.16 – .19*	.16 – .19* (R x 1)
Between either YELLOW Lead and Ground	No Continuity	No Continuity (R x 1000)

18 AMPERE STATOR

Test Leads	Resistance (Ohms)	Scale Reading (x––––)
Between YELLOW Leads	.16 – .18*	.22 – .24* (R x 1)
Between either YELLOW Lead and 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.

Alternator System Test

9 AMPERE STATOR

IMPORTANT: Rectifier (optional accessory) must be functioning properly for accurate test results to be obtained.

1. Remove RED lead from (+) terminal of rectifier.
2. Connect RED (+) ammeter lead to rectifier (+) terminal and BLACK (–) ammeter lead to RED rectifier lead.
3. With engine running at the indicated RPM, the ammeter should indicate the following approximate amperes:

9 AMPERE STATOR (S/N-0G589999 & BELOW)

	RPM	AMPERES
9 Ampere Stator	Idle	0
	1000	0.2
	2000	6.5
	3000	9.0

9 AMPERE STATOR (S/N-0G590000 & ABOVE)

	RPM	AMPERES
9 Ampere Stator	Idle	0
	1000	0.6
	2000	8.0
	3000	9.0

4. If proper ampere readings are not obtained, replace stator.

14/16/18 AMPERE STATOR

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”. 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”. If cranking voltage is not acceptable, replace battery.
5. If cranking voltage is acceptable, disconnect larger diameter RED harness 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 harness wire, and BLACK (–) ammeter lead to POSITIVE terminal on starter solenoid.
8. Secure starter wires away from flywheel.
9. With engine running at the indicated RPM’s, the ammeter should indicate the following appropriate amperes:

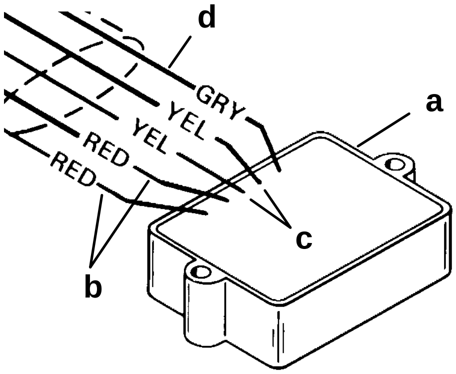
	RPM	AMPERES
14 Ampere Black Stator	Idle	2
	1000	7
	2000	12
	3000	13
	4000	13.5
	5000	14

	RPM	AMPERES
16 Ampere Stator	Idle	2.8
	1000	9.3
	2000	16

	RPM	AMPERES
18 Ampere Red Stator	Idle	3
	1000	9.5
	2000	17
	3000	18
	4000	18
	5000	18

10. A reading of 14 amperes at 5000 RPM indicates the charging system is functioning properly. The battery being discharged is due to the amperage draw on the system being greater than the amperage output of the engine charging system.

11. If ammeter reads less than required amperes @ 5000 RPM, test the stator; refer to “**Stator Ohm Test (Alternator Coils Only)**”. If stator tests OK, replace voltage regulator.



51000

a - Voltage Regulator/Rectifier
b - Red Lead (2)
c - Yellow Lead (2)
d - Grey Lead

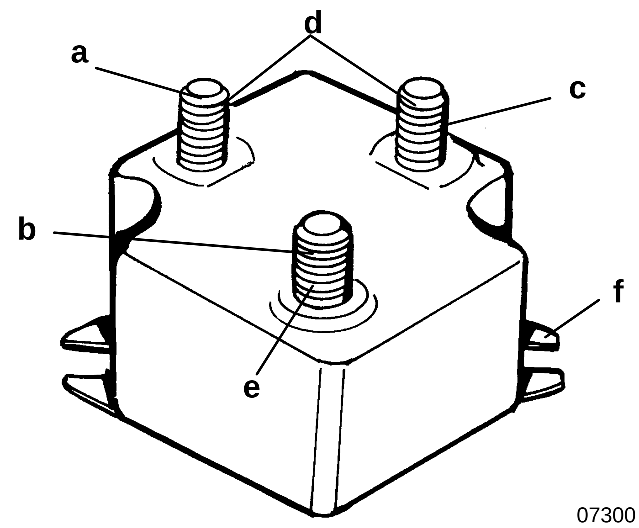
Rectifier Test

⚠ 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 drawing for rectifier terminal identification.



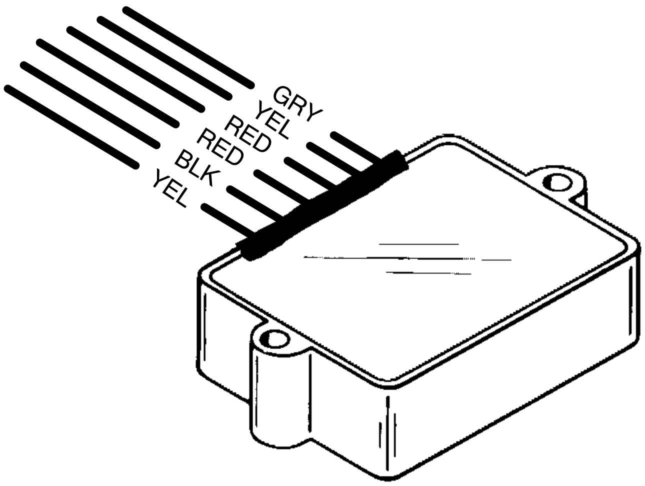
a - Terminal
b - Terminal
c - Terminal
d - Stator Terminals
e - Positive Terminal
f - Ground

Rectifier Test (continued)

- 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 O.K.
        - 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 O.K.

VOLTAGE REGULATOR/RECTIFIER TEST - Models with (S/N-0G590000 & Above)

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



DIODE TEST:

1. Set Ohm meter to R X 10 scale.
2. Connect Red (+) meter lead to RED regulator lead.
3. Connect Black (–) meter lead to YELLOW regulator lead.

TEST RESULTS:

100 - 400 OHMS

DIODE TEST:

1. Set Ohm meter to R X 1k scale.
2. Connect Black (–) meter lead to RED regulator lead.
3. Connect Red (+) meter lead to YELLOW regulator lead. Test. Then change Red (+) meter lead to the other YELLOW regulator lead for 2ND test reading.

TEST RESULTS (1ST READING):

40,000 to ∞ OHMS

TEST RESULTS (2ND READING):

∞ OHMS (No needle movement)

SCR TEST:

1. Set Ohm meter to R X 1k scale.
2. Connect Red (+) meter lead to regulator case.
3. Connect Black (–) meter lead to one YELLOW regulator Lead. Test. Connect Black (–) meter lead to the other YELLOW lead.

TEST RESULTS (BOTH TEST):

15,000-∞ OHMS (15k -∞)

TACHOMETER CIRCUIT TEST:

1. Set Ohm meter to R X 1k scale.
2. Connect Red (+) meter lead to GREY regulator lead.
3. Connect Black (–) meter lead to regulator case.

TEST RESULTS:

10,000 - 50,000 OHMS (10k - 50k)

STARTER SOLENOID TEST

Starting System

Starter Motor Amperes Draw

Starter Motor Part No.	No Load Amp. Draw	Normal Amp. Draw
50-822462	20 Amps	95 Amps
Starter Motor Teeth	10	

Starting System Components

The starting system consists of the following components.

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

Description

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

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

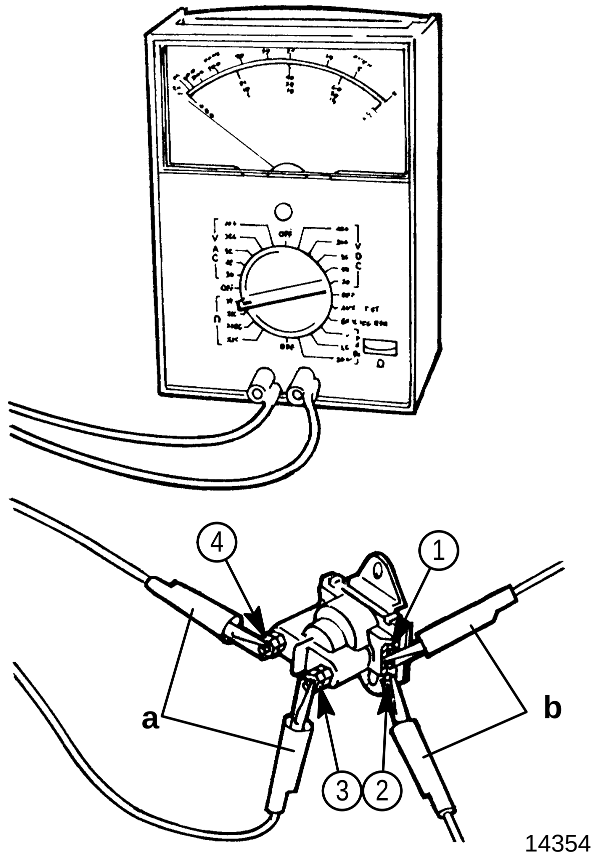
⚠ CAUTION

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

STARTER SOLENOID TEST

Test starter solenoid as follows:

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



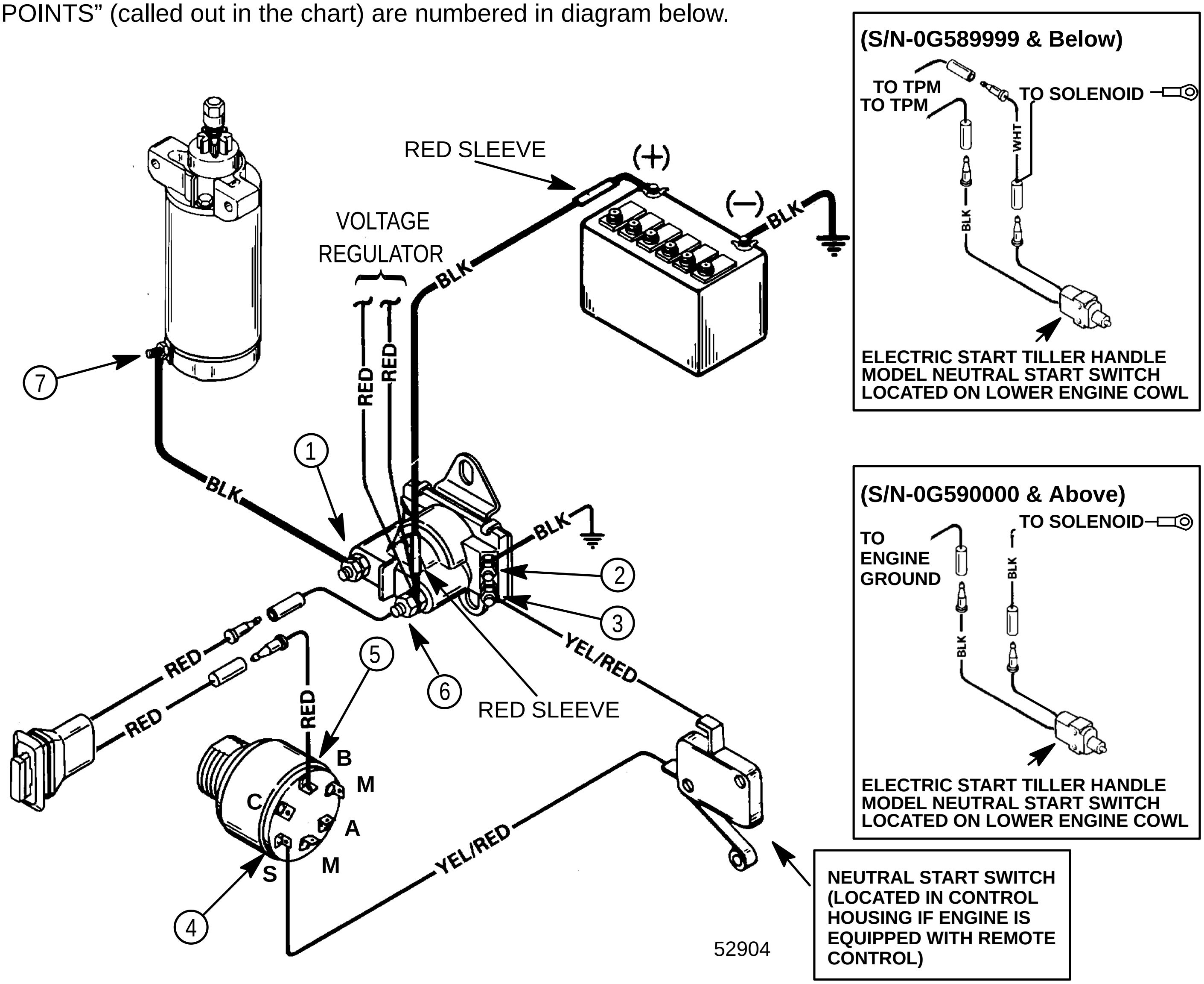
a - Ohmmeter Leads
b - 12-Volt Supply

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.

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



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.

** Battery Voltage*

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.

Electric Start Tiller Handle Model
Neutral start switch on lower engine cowl is open or BLACK or WHITE switch leads are disconnected or damaged.

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 O.K., check starter motor.

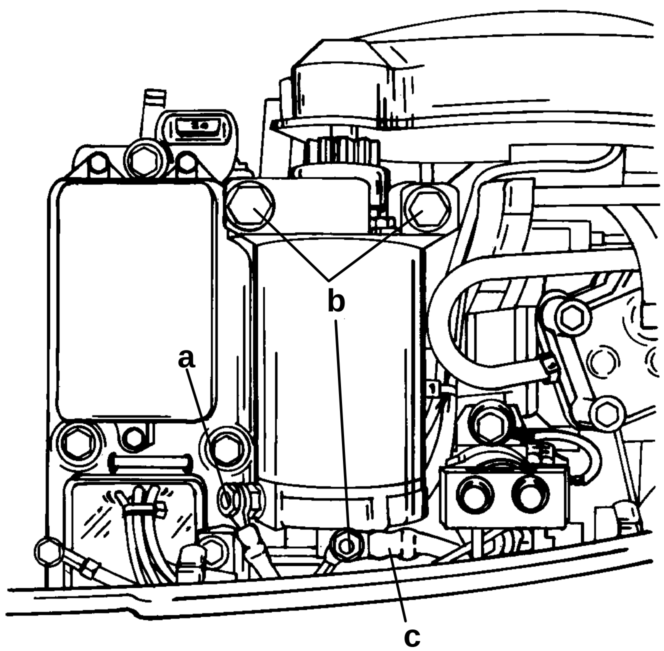
Starter Motor

Removal

⚠ CAUTION

Disconnect battery leads from battery before removing starter.

1. Disconnect battery leads from battery.
2. Disconnect BLACK cable (w/YELLOW sleeve).
3. Remove 3 bolts.
4. Remove starter.

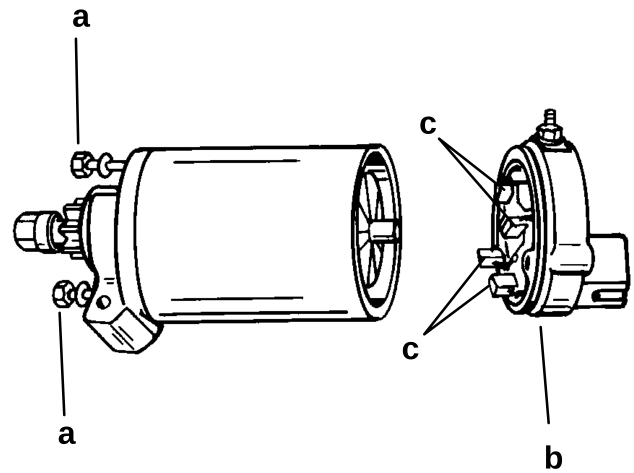


52669

a - Black Cable (w/YELLOW sleeve)
b - Bolts (3)
c - Black Cable (Negative Battery Lead)

Disassembly

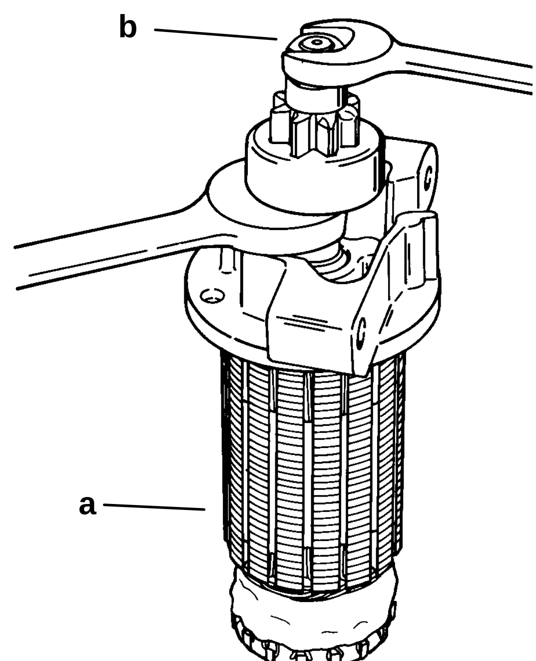
1. Remove two (2) thru bolts and commutator end cap, taking care not to lose brush springs.



52664

a - Thru Bolts
b - Commutator End Cap
c - Brush Springs

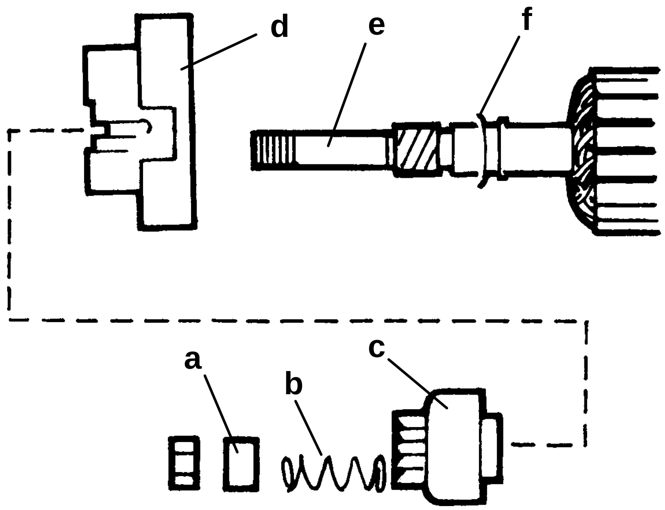
2. Pull armature from starter frame.
3. Remove locknut.



51711

a - Armature
b - Locknut

4. Remove components from armature.



11658

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

Cleaning and Inspection

1. Clean all 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. Check that the brush holder is not damaged or is not holding the brushes against the commutator.
5. Replace brushes that are pitted or worn to less than 1/4 in. (6.4mm) in length. Refer to “BRUSH REPLACEMENT”, following.
6. Replace a damaged or excessively worn bushing in the end cap.
7. Check the armature conductor (commutator bar junction) for a firm connection. A poor connection usually results in a burned commutator bar.
8. Re-surface and undercut a rough commutator, as follows:

⚠ CAUTION

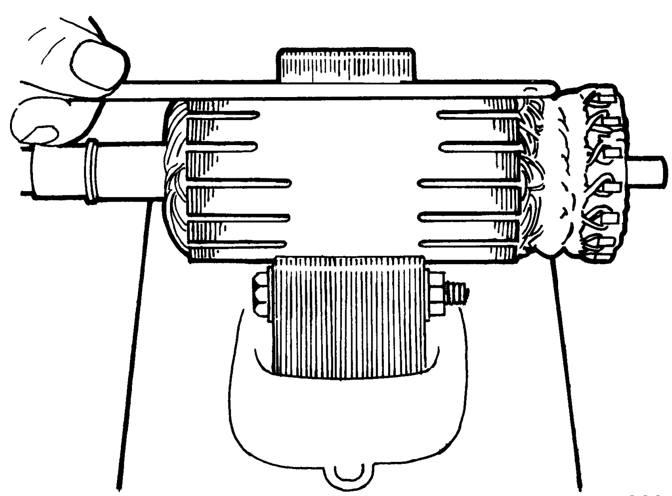
Do not turn down the commutator excessively.

   a. Re-surface the commutator and undercut the insulation between the commutator bars 1/3 in. (0.8mm) to the full width of the insulation, make sure that the undercut is flat.
   b. Clean the commutator slots after undercutting.
   c. De-burr the commutator lightly with No. 00 sandpaper, then clean the commutator.
   d. Check the armature on a growler for shorts. See “TESTING”, following.
9. Open-circuited armatures often can be saved where and open circuit is obvious and repairable. The most likely place for an open circuit is at the commutator bars. Long cranking periods overheat the starter motor so that solder in the connections melts. The poor connections cause arcing and burning of the commutator bars.
10. Repair bars, that are not too badly burned, by re-soldering the leads in bars (using rosin flux solder) and turning down the commutator in a lathe to remove burned material, then undercut the mica.
11. Clean out the copper or brush dust from slots between the commutator bars.
12. Check the armature for shorts and ground. See “TESTING”.

Testing

ARMATURE TEST FOR SHORTS

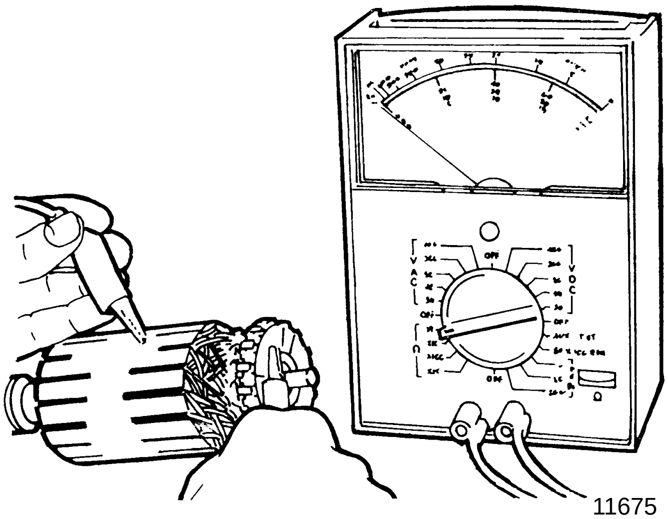
Check armature for short circuits by placing on growler and holding hack saw blade over armature core while armature is rotated. If saw blade vibrates, armature is shorted. Re-check after cleaning between commutator bars. If saw blade still vibrates, replace armature.



11669

ARMATURE TEST FOR GROUND

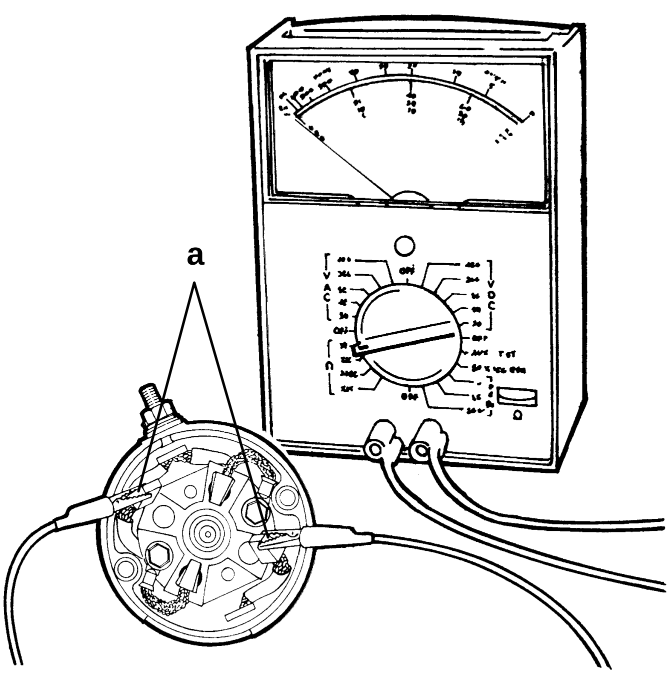
1. Set ohmmeter to (R x 1 scale). Place one lead of ohmmeter on armature core (or shaft) and other lead on commutator, as shown.
2. If meter indicates continuity, armature is grounded and must be replaced.



11675

CHECKING POSITIVE BRUSHES AND TERMINALS

1. Connect ohmmeter (R x 1 scale) leads between positive brushes.
2. Ohmmeter must indicate full continuity (zero resistance). If resistance is indicated, check lead to positive terminal solder connection. If connection cannot be repaired, brushes must be replaced. Refer to "BRUSH REPLACEMENT".

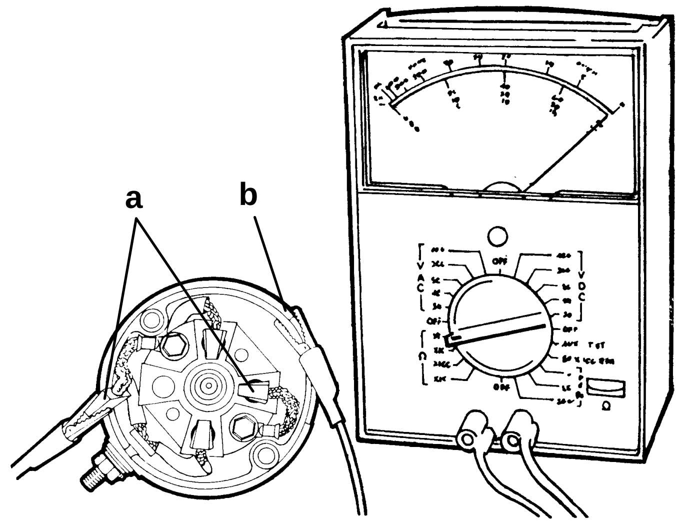


11673

a - Positive Brushes

TESTING NEGATIVE BRUSHES FOR GROUND

Set ohmmeter to (R x 1 scale). Place one lead of 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.



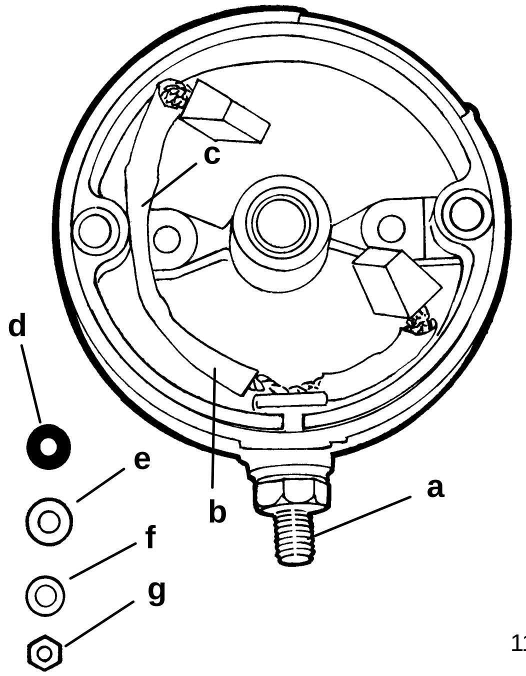
11674

a - Negative (-) Brushes
b - End Cap

Brush Replacement

IMPORTANT: Replace brushes that are pitted or worn to less than 1/4 in. (6.4mm) in length.

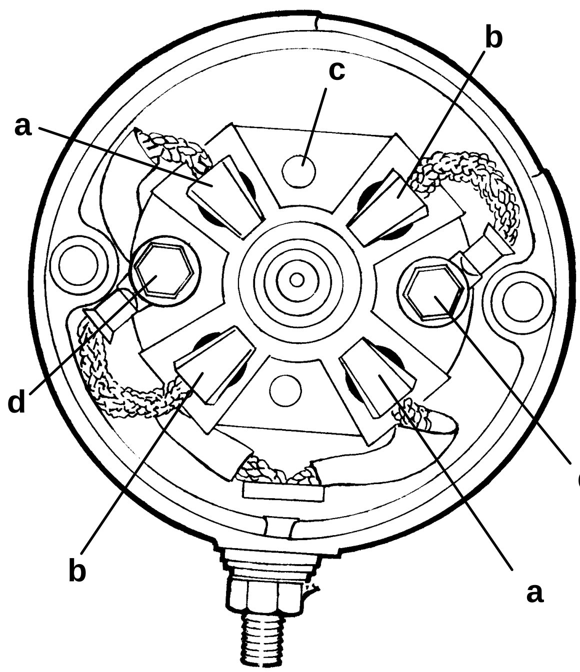
1. Install positive brushes into commutator end cap.



11660

a - Positive (+) Terminal
b - Long Brush Lead
c - Push Lead Into Slot
d - Insulating Washer
e - Flat Washer
f - Lock Washer
g - Nut

2. Install components.

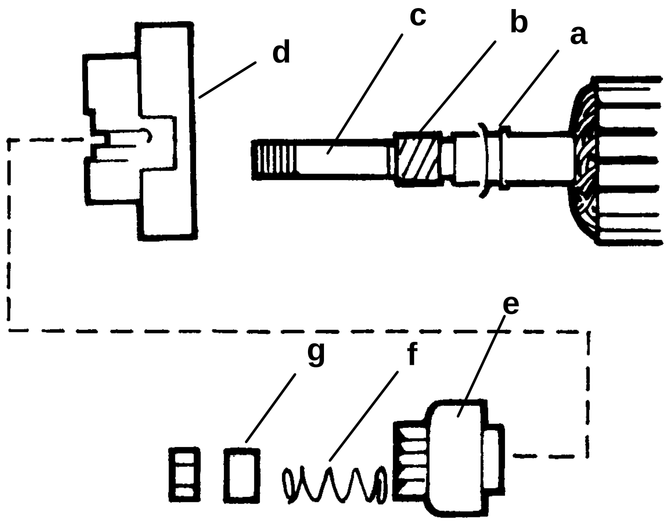


11656

a - Positive (+) Brushes
b - Negative (–) Brushes
c - Brush Holder
d - Bolts (Fasten Negative Brushes and Holder)

Reassembly

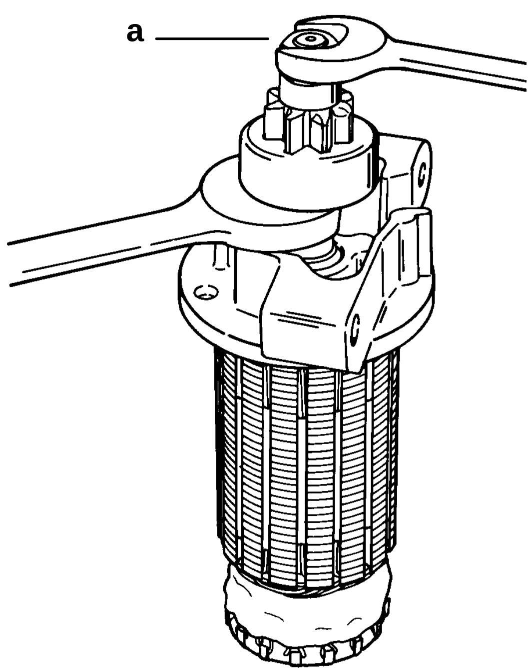
1. Lubricate helix threads and drive end cap bushing with SAE 10W oil.
2. Install components onto armature shaft.



11658

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

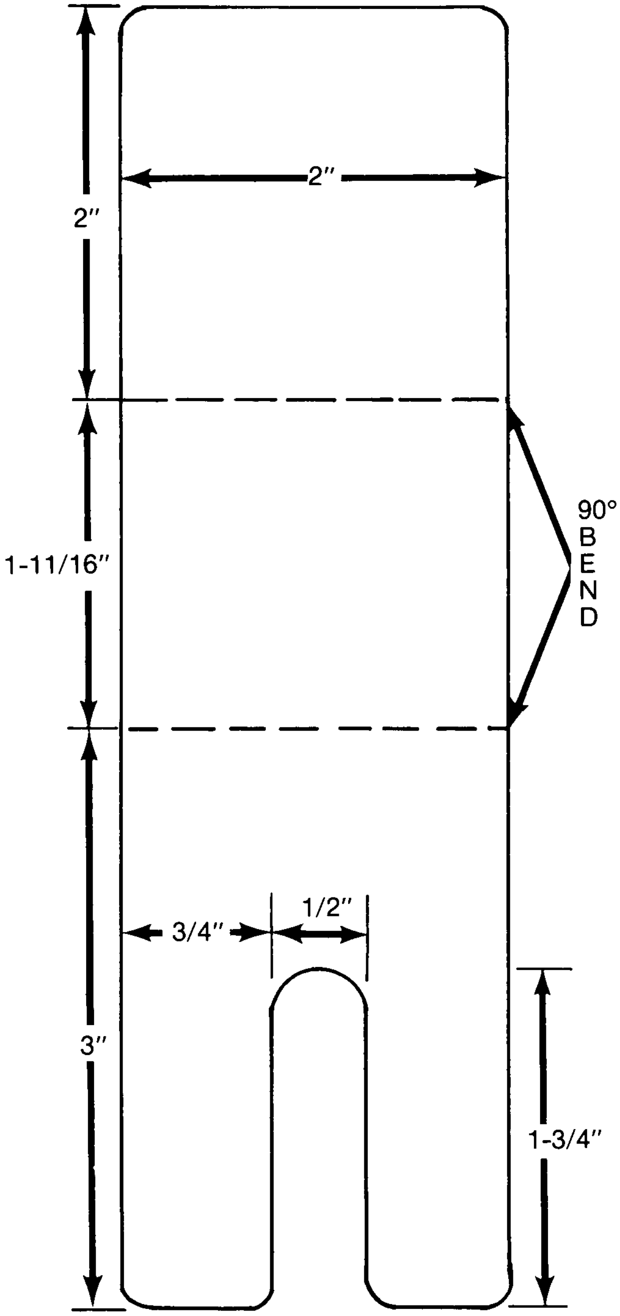
3. Install locknut.



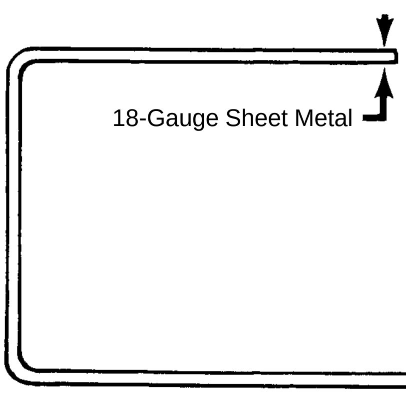
51711

a - Locknut

4. Construct a brush retainer tool as shown.



Brush Retainer Tool Layout (Full Size)

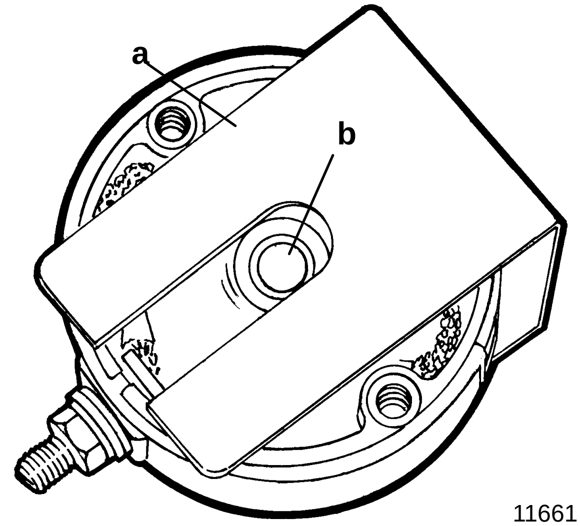


METRIC SCALE

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

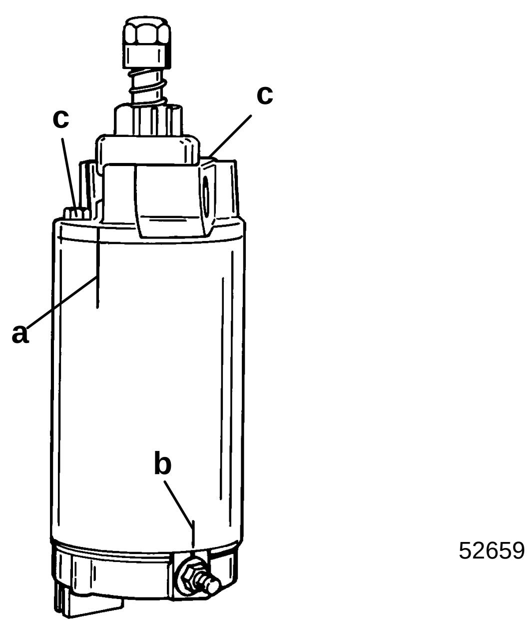
Brush Retainer Tool Side View (Full Size)

5. Place springs and brushes into brush holder and hold in place with brush retainer tool.
6. Lubricate bushing with one drop of SAE 10W oil. DO NOT over-lubricate.



a - Brush Retainer Tool
b - Bushing

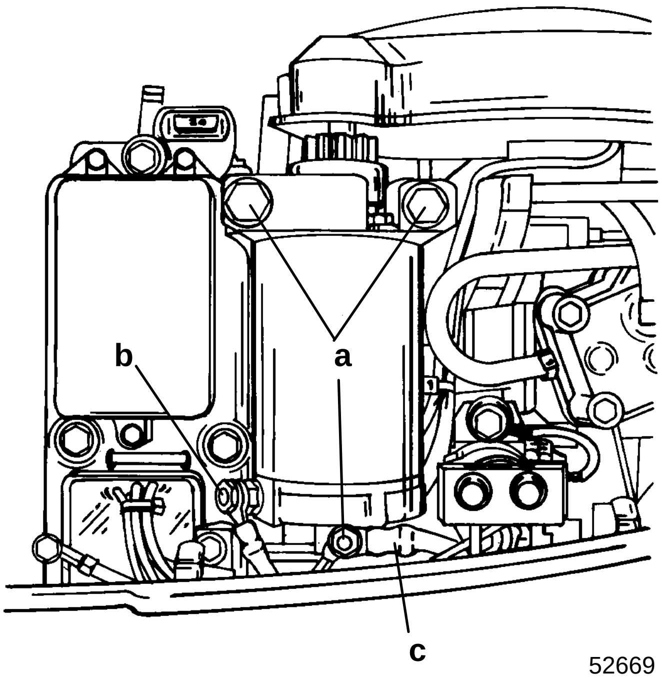
7. Position armature into starter frame so that commutator end of armature is at end of starter frame where permanent magnets are recessed 1 in. (25.4mm). Align marks as shown.
8. Install commutator end cap onto starter frame; align marks as shown, and remove brush retainer tool.
9. Install thru bolts and torque to 70 lbs. in. (7.9 N·m).



a - Alignment Marks
b - Alignment Marks
c - Bolt (2) Torque to 70 lb. in. (7.9 N·m)

Installation

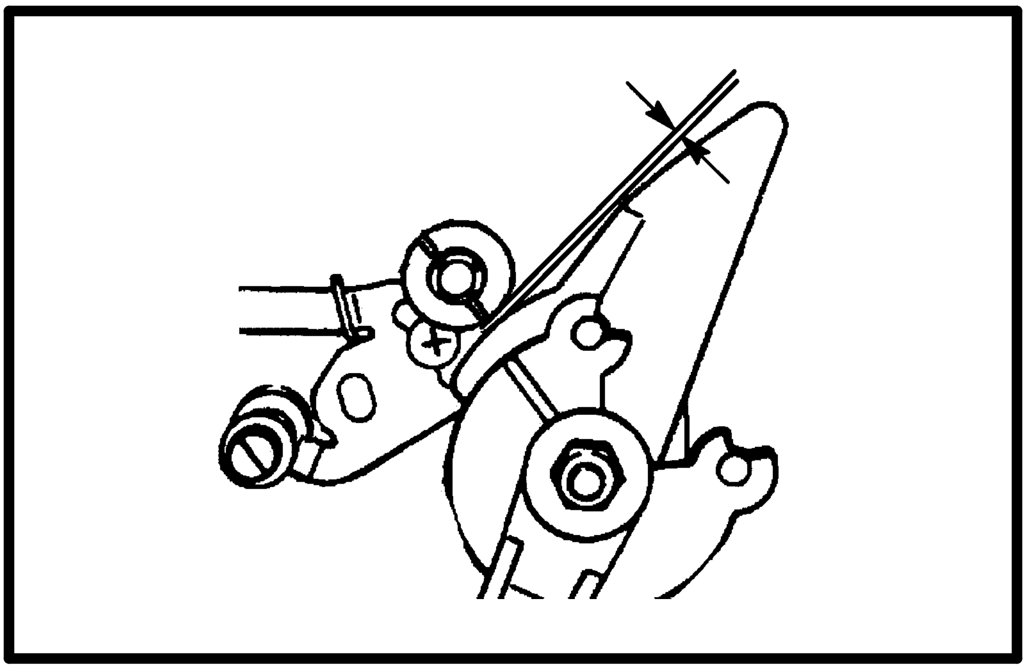
1. Secure starter to block with three (3) bolts. Torque bolts to 16.6 lb. ft. (22.5 N·m). Secure NEGATIVE battery lead to block with bottom bolt.
2. Connect battery lead (BLACK w/YELLOW sleeve) to starter. Torque attaching nut to 60 lb. in. (6.8 N·m).



a - Bolts (3)
b - Black Cable (w/YELLOW sleeve)
c - Black Cable (Negative Battery Lead)

ELECTRICAL

2
C



TIMING, SYNCHRONIZING & ADJUSTING

Table of Contents

Specifications

SPECIFICATIONS	**Idle RPM (In Forward Gear)** **Full Throttle RPM Range** **- Model 30, 40 Sea Pro, 40 Marathon** **- Model 40**	700-800 RPM 4500-5500 RPM 5000-5500 RPM
	Spark Plug Type (NGK) **Gap** **Optional Plug (NGK)**** **Gap** **Firing Order**	BP8H-N-10 0.040 in. (1.0mm) BPZ8H-N-10* 0.040 in. (1.0mm) 1-2
	Models with (S/N-0G589999 & Below) - Idle **Maximum BTDC @ 2500-5500 RPM**	3° BTDC ± 3° (Not Adjustable) 25° BTDC ± 3° (Not Adjustable)
	Models with (S/N-0G590000 & Above) - Idle **Maximum Spark Advance**	8° BTDC ± 1° 1 Turn Clockwise After Contacting Throttle Plate

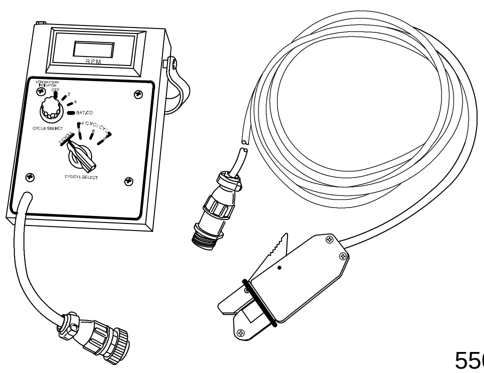
** Suppressor (Inductor) Spark Plug.

⚠ WARNING

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

Special Tools

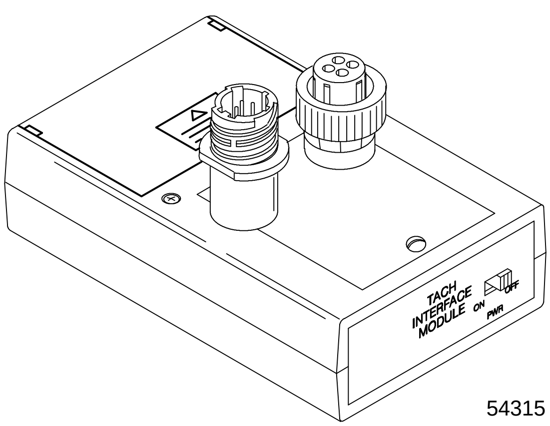
1. Service Tachometer P/N *91-59339



55002

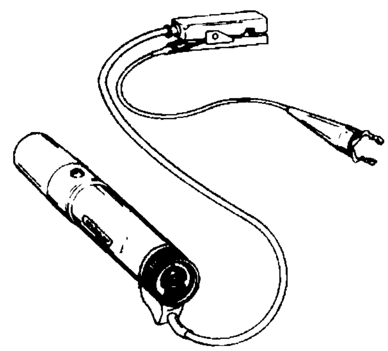
*May be obtained locally.

2. MercTach Interface Module P/N 91-825824A-2



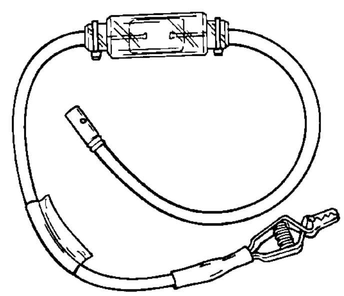
54315

3. Timing Light P/N *91-99379



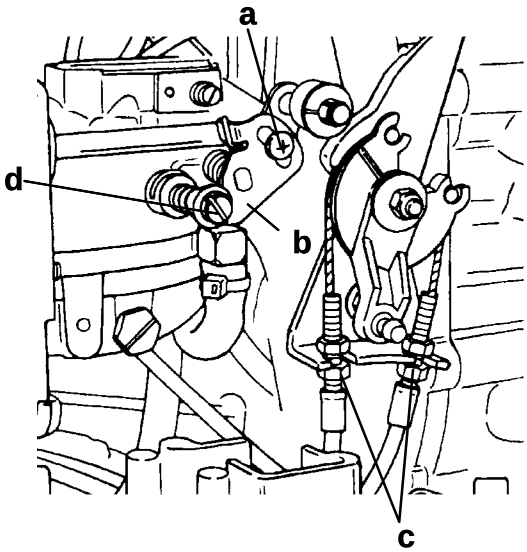
*May be obtained locally.

4. Spark Gap Tool P/N 91-63988A1



Tiller Handle Model (S/N-0G589999 & Below)

1. With engine off and gear shift in neutral position, loosen cam follower screw.
2. Back off idle speed screw until the throttle shutter positioner does not touch the taper of idle speed screw. (Throttle plate closed).
3. Loosen throttle cable jam nuts.



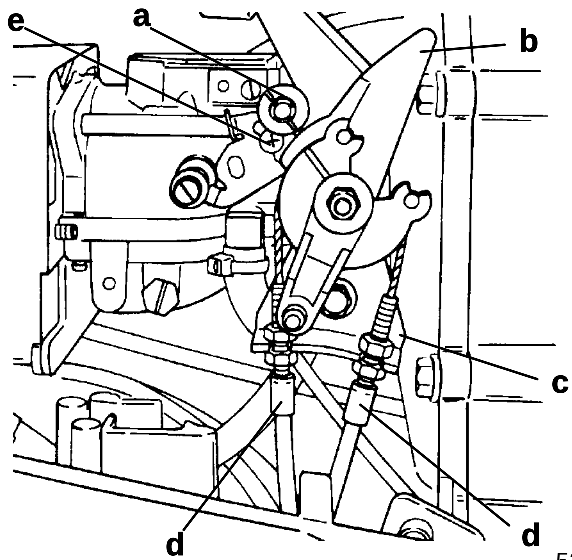
52301

a - Cam Follower Screw
b - Throttle Shutter Positioner
c - Jam Nut
d - Idle Speed Screw

4. With throttle at idle position, place cam follower roller against throttle cam. Center the roller with raised mark on throttle cam by adjusting the position of throttle cable sleeves in the mounting bracket.

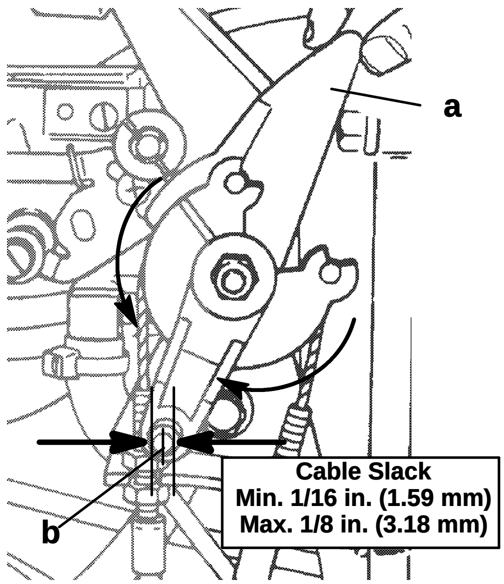
NOTE: *When positioning throttle cables, a minimum of 1/16 in. (1.59 mm) to a maximum of 1/8 in. (3.18 mm) slack must be allowed to prevent throttle cables from binding. (Rock throttle cam side to side and measure the amount of throttle cam travel at link rod ball.*

5. Tighten throttle cable jam nuts.



52300

a - Cam Follower Roller
b - Throttle Cam
c - Mounting Bracket
d - Throttle Cable Sleeve
e - Cam Follower Screw

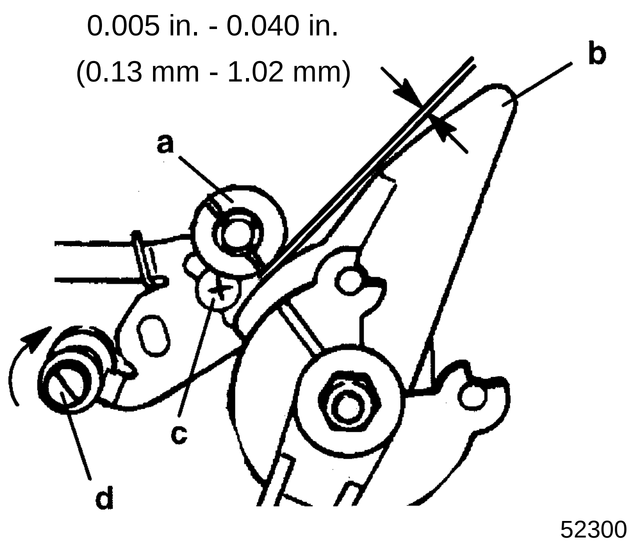


52300

a - Throttle Cam
b - Link Rod Ball

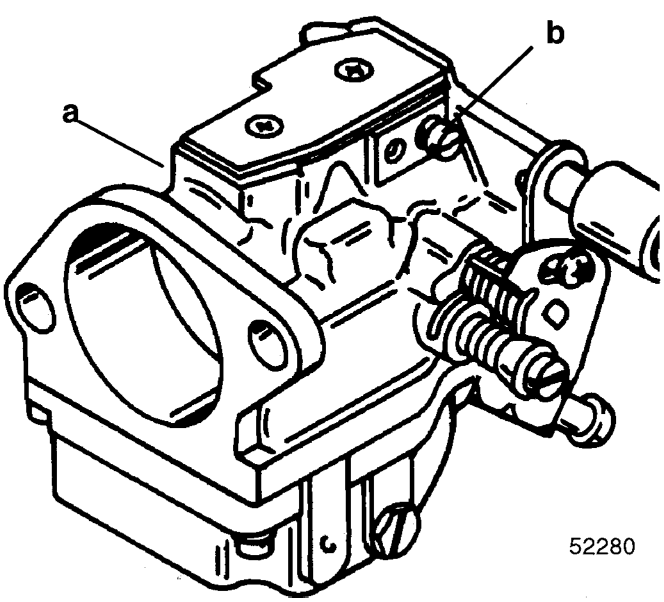
6. With cam follower resting on throttle cam, tighten the cam follower screw.

7. With throttle at idle position, turn idle speed screw clockwise "In" until a gap of 0.005 in. - 0.040 in. (0.13 mm - 1.02 mm) is achieved between throttle cam and cam follower.



a - Cam Follower Roller
b - Throttle Cam
c - Cam Follower Screw
d - Idle Speed Screw

8. Turn idle mixture screw in (clockwise) until **LIGHTLY** seated then, back out to an initial setting of 1-1/4 turns.



a - Carburetor
b - Mixture Screw

⚠ WARNING

Keep clear of propeller while cranking and running the outboard motor.

9. Connect the electrical harness and fuel line to engine.
10. With the outboard in the water, start engine and allow to warm up.
11. Adjust idle speed screw in "FORWARD" gear to specification.

NOTE: *When setting idle mixture, DO NOT adjust leaner than necessary to attain reasonably smooth idling. When in doubt, stay to the slightly rich side of the adjustment.*

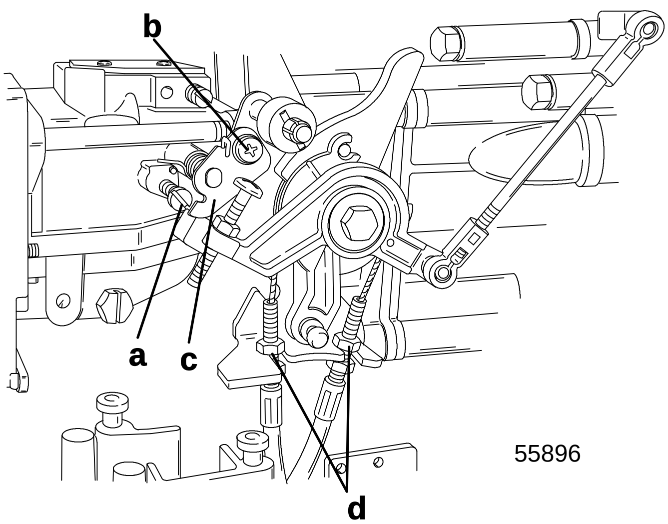
12. With engine running at idle speed in "FORWARD" gear, turn mixture screw "In" (clockwise) until engine starts to "bog" down and misfire. Back out 1/4 turn or more.
13. Check for too lean of mixture on acceleration. (Engine will "bog" on acceleration). Readjust if necessary.
14. Re-adjust idle speed screw in "FORWARD" gear to specification.
15. Check for too lean of mixture on acceleration. (Engine will "bog" on acceleration). Readjust if necessary.
16. Re-adjust idle speed screw in "FORWARD" gear to specification.

Timing Adjustments

NOTE: *No timing adjustments are required for the 30/40 model outboard with (S/N-0G589999 & Below).*

Tiller Handle Model with Mechanical Spark Advance (S/N-0G590000 & Above)

1. Check all electrical connections to ensure they are tight and secure (including battery connections on electric start models).
2. With engine off and gear shift in neutral position, loosen cam follower screw.
3. Back off idle speed screw until the throttle shutter positioner does not touch the taper of idle speed screw. (Throttle plate closed).
4. Loosen throttle cable jam nuts.

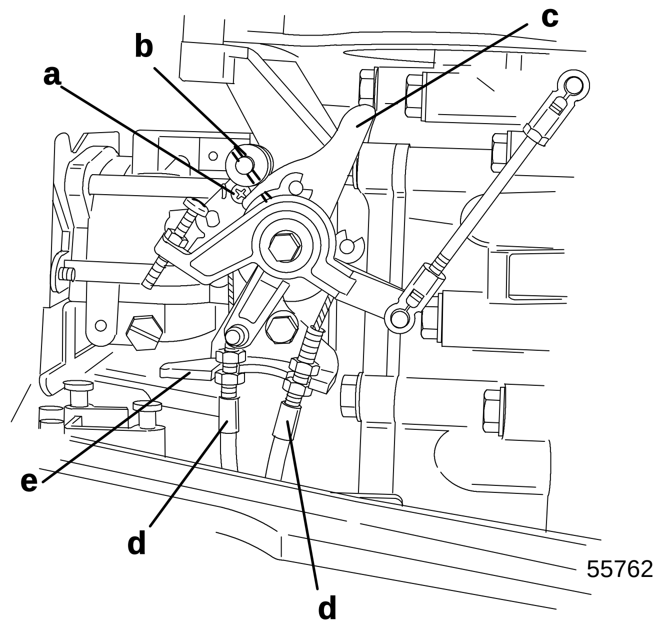


a - Idle Speed Screw
b - Cam Follower Screw
c - Throttle Shutter Positioner
d - Jam Nuts

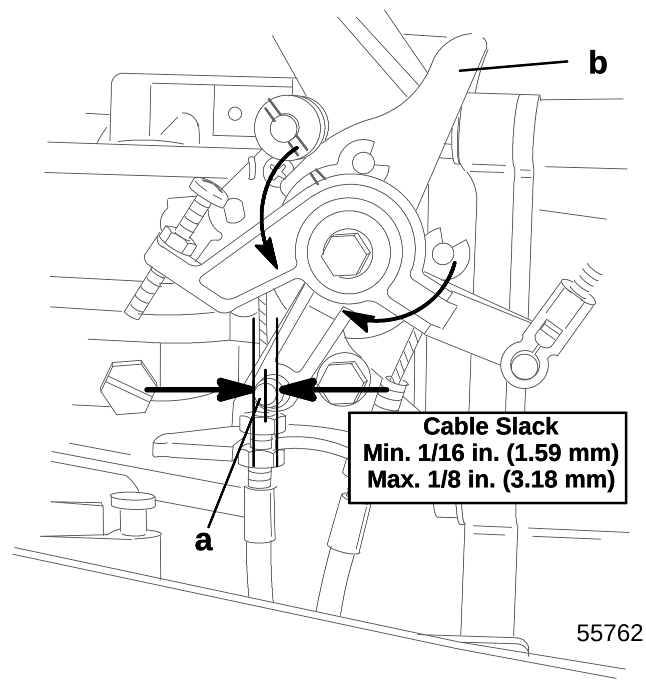
5. With throttle at idle position, place cam follower roller against throttle cam. Center the roller with raised mark on throttle cam by adjusting the position of throttle cable sleeves in the mounting bracket on tiller handle models or throttle link rod on remote control models.

NOTE: *When positioning throttle cables, a minimum of 1/16 in. (1.59 mm) to a maximum of 1/8 in. (3.18 mm) slack must be allowed to prevent throttle cables from binding. (Rock throttle cam side to side and measure the amount of throttle cam travel at link rod ball.*

6. Tighten throttle cable jam nuts.



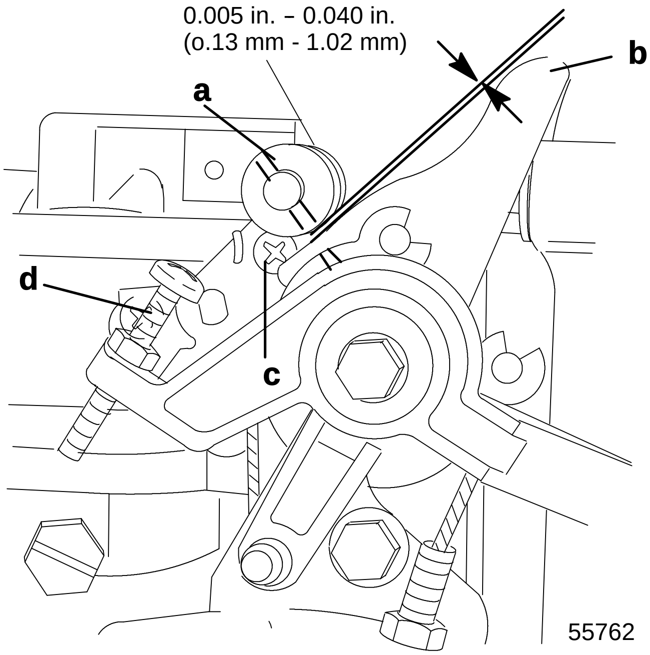
a - Cam Follower Screw
b - Cam Follower Roller
c - Throttle Cam
d - Throttle Cable Sleeve
e - Mounting Bracket



a - Link Rod Ball
b - Throttle Cam

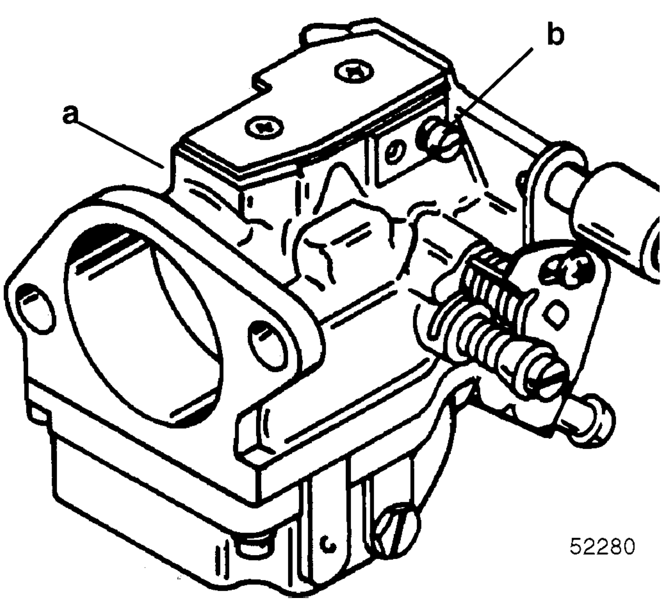
7. With cam follower resting on throttle cam, tighten the cam follower screw.

8. With throttle at idle position, turn idle speed screw clockwise "IN" until a gap of 0.005 in. - 0.040 in. (0.13 mm - 1.02 mm) is achieved between throttle cam and cam follower. This will open the throttle shutter enough to keep the engine running near idle speed after starting.



a - Cam Follower Roller
b - Throttle Cam
c - Cam Follower Screw
d - Idle Speed Screw

9. Turn idle mixture screw in (clockwise) until **LIGHTLY** seated then, back out to an initial setting of 1-1/2 turns.



a - Carburetor
b - Mixture Screw

⚠ WARNING

Keep clear of propeller while cranking and running the outboard motor.

10. Connect the fuel line to the engine and electrical harness on electric engines.
11. With the outboard in the water, start engine, check tell-tale, and allow to warm up.
12. Adjust idle speed screw in "FORWARD" gear to specification; (750 ± 50 rpm)
13. Check the idle timing and maximum spark advance. (If not within specifications, adjustment will be required).
    a. Idle timing: 8 ± 1 degrees B.T.D.C.
    b. Maximum spark advance: (22 - 28 Degrees, Reference only). One (1) Turn clockwise after contacting throttle plate.

TIMING AND MAXIMUM SPARK ADVANCE ADJUSTMENTS - MECHANICAL SPARK ADVANCE MODELS

IMPORTANT: Setting the idle timing is required before adjusting the maximum spark advance.

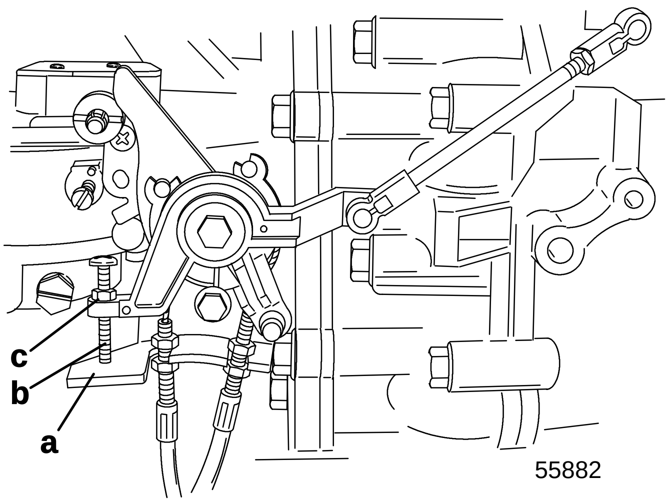
ADJUSTING IDLE TIMING

14. With the engine "OFF", snap the trigger link rod socket off ball stud and:
    a. Extend rod length to "ADVANCE" timing
    b. Shorten rod length to "RETARD" timing
15. Snap link rod onto ball stud, re-start engine and cycle the throttle mechanism through part throttle and back to idle three (3) times. Re-check idle timing and idle R.P.M. specification. Re-adjust if necessary.

ADJUSTING MAXIMUM SPARK ADVANCE

IMPORTANT: Setting the idle timing is required before adjusting the maximum spark advance.

16. Turn engine off.
17. Position twist grip or remote control lever to maximum throttle opening, (wide open throttle).
18. Loosen jam nut and turn screw counter-clockwise until screw no longer makes contact with throttle bracket platform.
19. Turn screw in (clockwise) until screw just makes contact with the throttle bracket platform and then give screw one (1) additional turn clockwise and tighten jam nut.



a - Throttle Bracket Platform
b - Screw
c - Jam Nut

20. With engine idling at specified R.P.M. in "FORWARD" gear, loosen cam follower screw and place cam follower roller against throttle cam and tighten cam follower screw. Cycle the throttle mechanism through part throttle and back to idle. Recheck in gear idle R.P.M..

***NOTE:** When setting idle mixture, DO NOT adjust leaner than necessary to attain reasonably smooth idling. When in doubt, stay to the slightly rich side of highest R.P.M..*

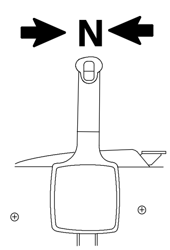
21. Adjust carburetor for best performance, after clearing the engine. With engine running at idle speed in "FORWARD" gear, turn mixture screw "IN" (clockwise) until engine starts to loose R.P.M., fire unevenly, and or misfires. Back out 1/4 turn or more. (See General Specifications for minimum and maximum adjustment).
22. Check for too lean of mixture on acceleration. (Engine will "hesitate" or "stall" on acceleration). Readjust mixture if necessary.
23. Re-adjust idle speed screw in "FORWARD" gear to specification.

Shift Link Rod Installation and Adjustment to Engine

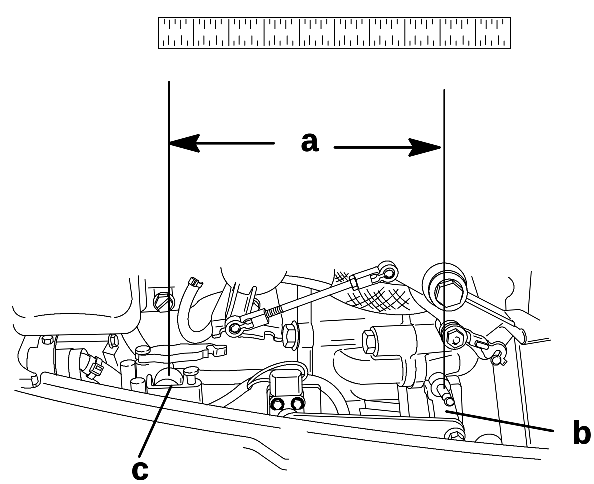
Install cables into the remote control following the instructions provided with the remote control.

***NOTE:** Install the shift cable to the engine first. The shift cable is the first cable to move when the remote control handle is moved out of neutral.*

1. Position remote control and outboard into neutral.

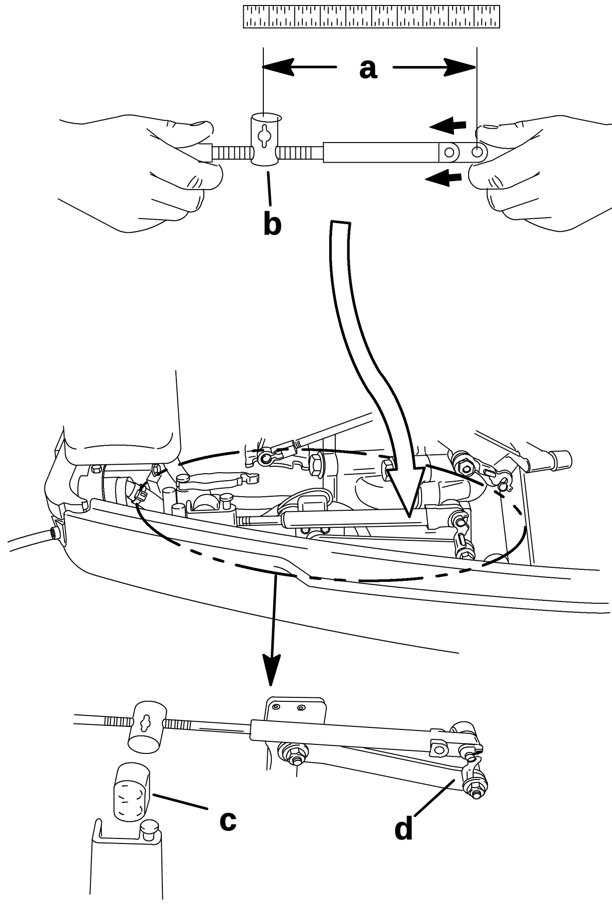


2. Measure distance "a" between mounting pin and middle of the barrel holder.



a - Distance Between Pin and Middle of Barrel Holder
b - Mounting Pin
c - Barrel Holder

3. Push-in on the cable end until resistance is felt. Adjust the cable barrel (b) to attain the measured distance “a” taken in Step 2.
4. Place cable barrel into the bottom hole in the barrel holder. Fasten cable to pin with retainer.

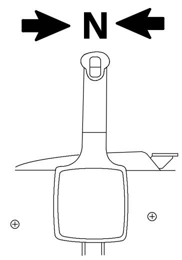


a - Move Cable Barrel To Attain The Measured Distance Taken In Step 2
b - Cable Barrel
c - Barrel Holder– Place Barrel Into Bottom Hole
d - Retainer

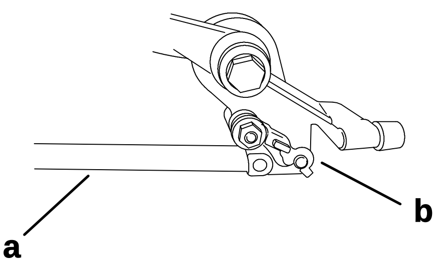
5. Check shift cable adjustments as follows:
   a. Shift remote control into forward. The propeller shaft should be locked in gear. If not, adjust the barrel closer to the cable end.
   b. Shift remote control into neutral. The propeller shaft should turn freely without drag. If not, adjust the barrel away from the cable end. Repeat steps a and b.
   c. Shift remote control into reverse while turning propeller. The propeller shaft should be locked in gear. If not, adjust the barrel away from the cable end . Repeat steps a thru c.
   d. Shift remote control back to neutral. The propeller shaft should turn freely without drag. If not, adjust the barrel closer to the cable end. Repeat steps a thru d.

Throttle Cable Installation

1. Position remote control into neutral.

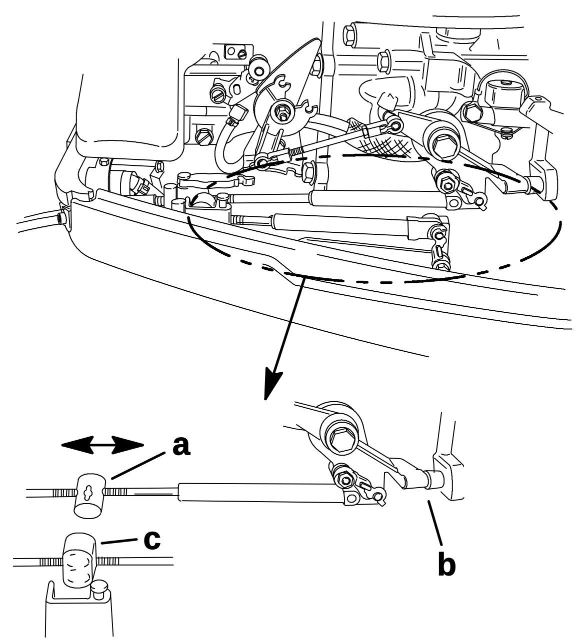


2. Install cable to the throttle lever. Secure with retainer.



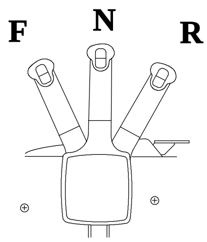
a - Throttle Cable
b - Retainer

3. Adjust the cable barrel so that the installed throttle cable will hold the throttle arm against the stop.

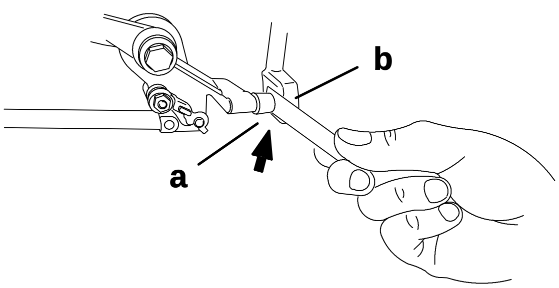


a - Cable Barrel – Adjust To Hold Throttle Arm Against Stop
b - Throttle Arm
c - Barrel Holder – Place barrel Into Top Hole

4. Check throttle cable adjustment as follows:
   a. Shift outboard into gear a few times to activate the throttle linkage. Make sure to rotate the propeller shaft while shifting into reverse.

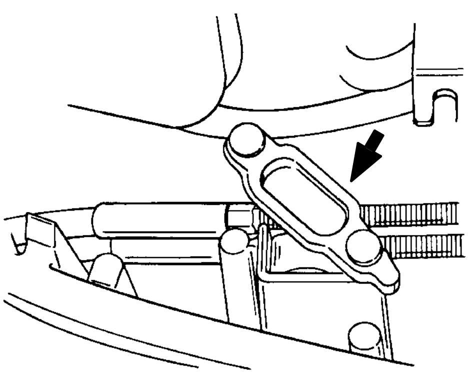


   b. Return remote control to neutral. Place a thin piece of paper between throttle arm and idle stop. Adjustment is correct when the paper can be removed without tearing, but has some drag on it. Readjust cable barrel if necessary.



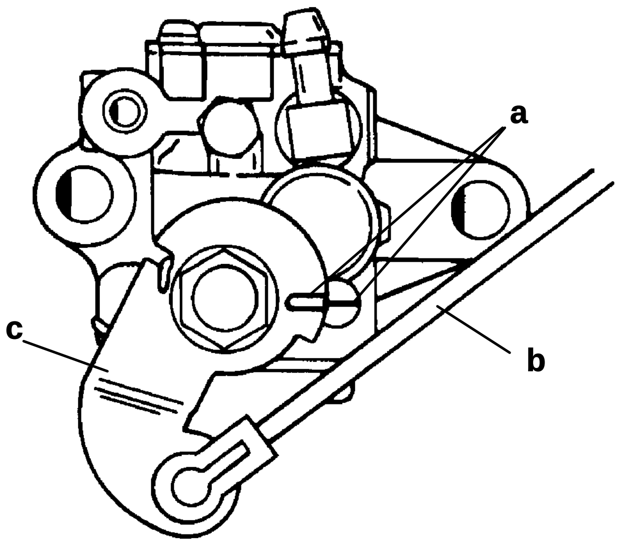
a - Throttle Arm
b - Idle Stop

5. Lock the barrel holder in place with the cable latch.



Oil Pump Adjustment

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



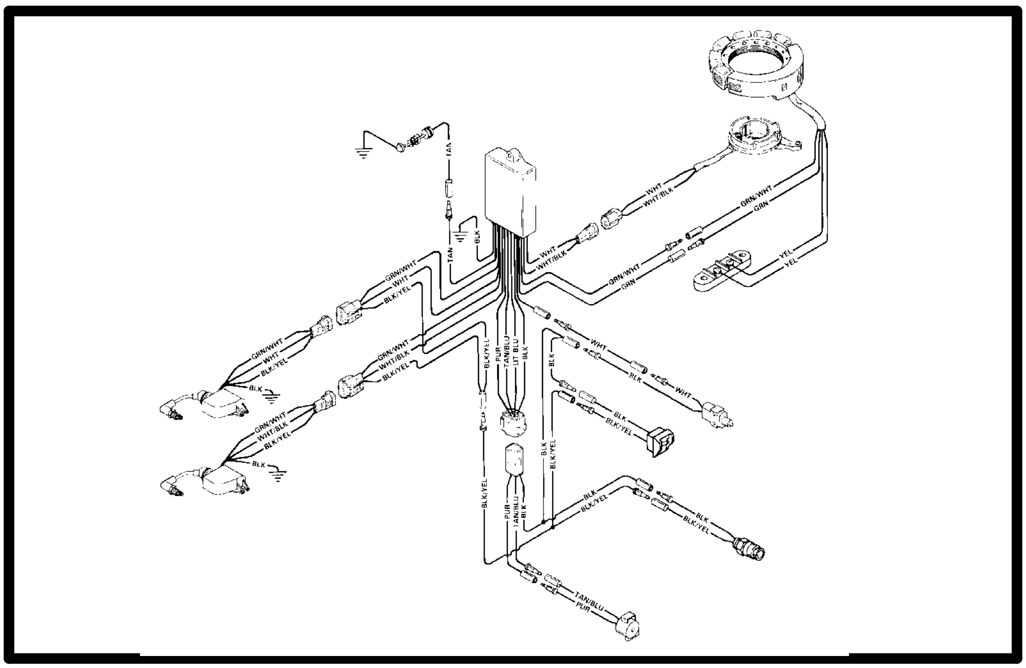
52365

a - Alignment Mark
b - Link Rod
c - Oil Pump Lever

ELECTRICAL

2

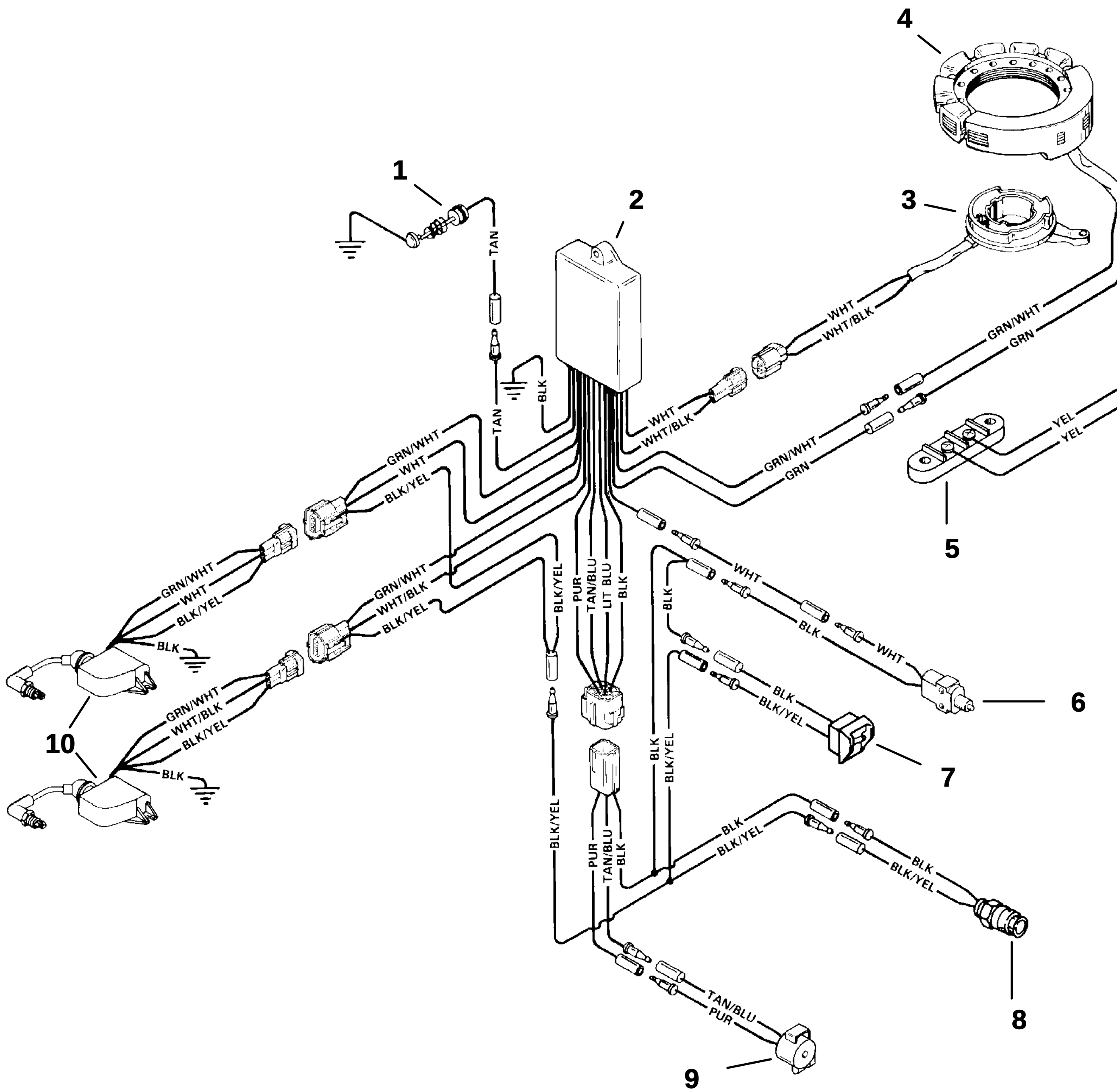
D



WIRING DIAGRAMS

Table of Contents

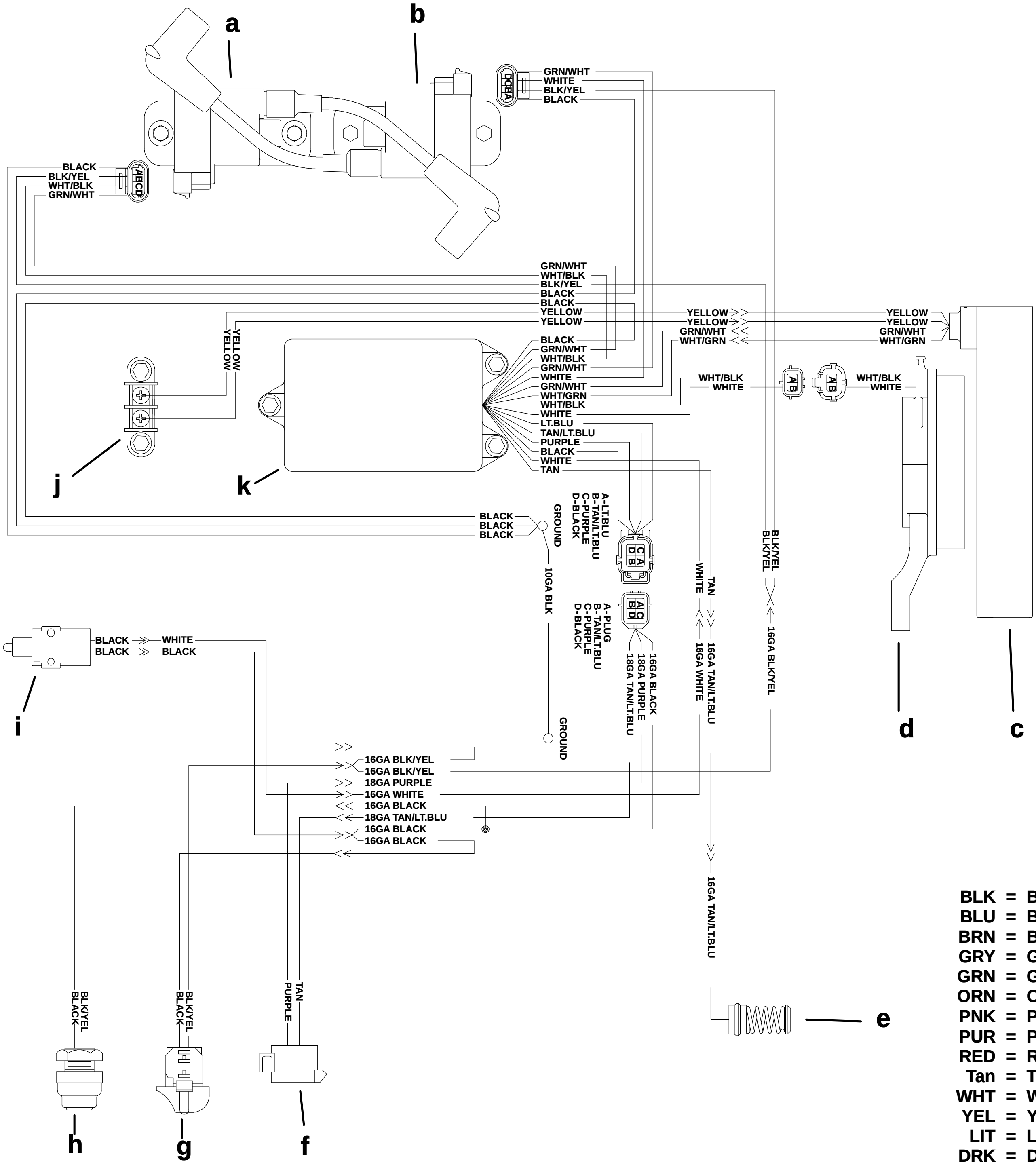
30/40 Manual Start Ignition Diagram (S/N 0G380074 & Below)



1 - Engine Temperature Sensor
2 - Timing and Protection Module (TPM)
3 - Trigger
4 - Stator
5 - Terminal Block
6 - Neutral Start Switch
7 - Emergency Stop Switch
8 - Stop Button
9 - Horn
10- Capacitor Discharge Module (CDM)

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

30/40 Manual Start Ignition Diagram
(S/N 0G380075 Thru S/N 0G589999)



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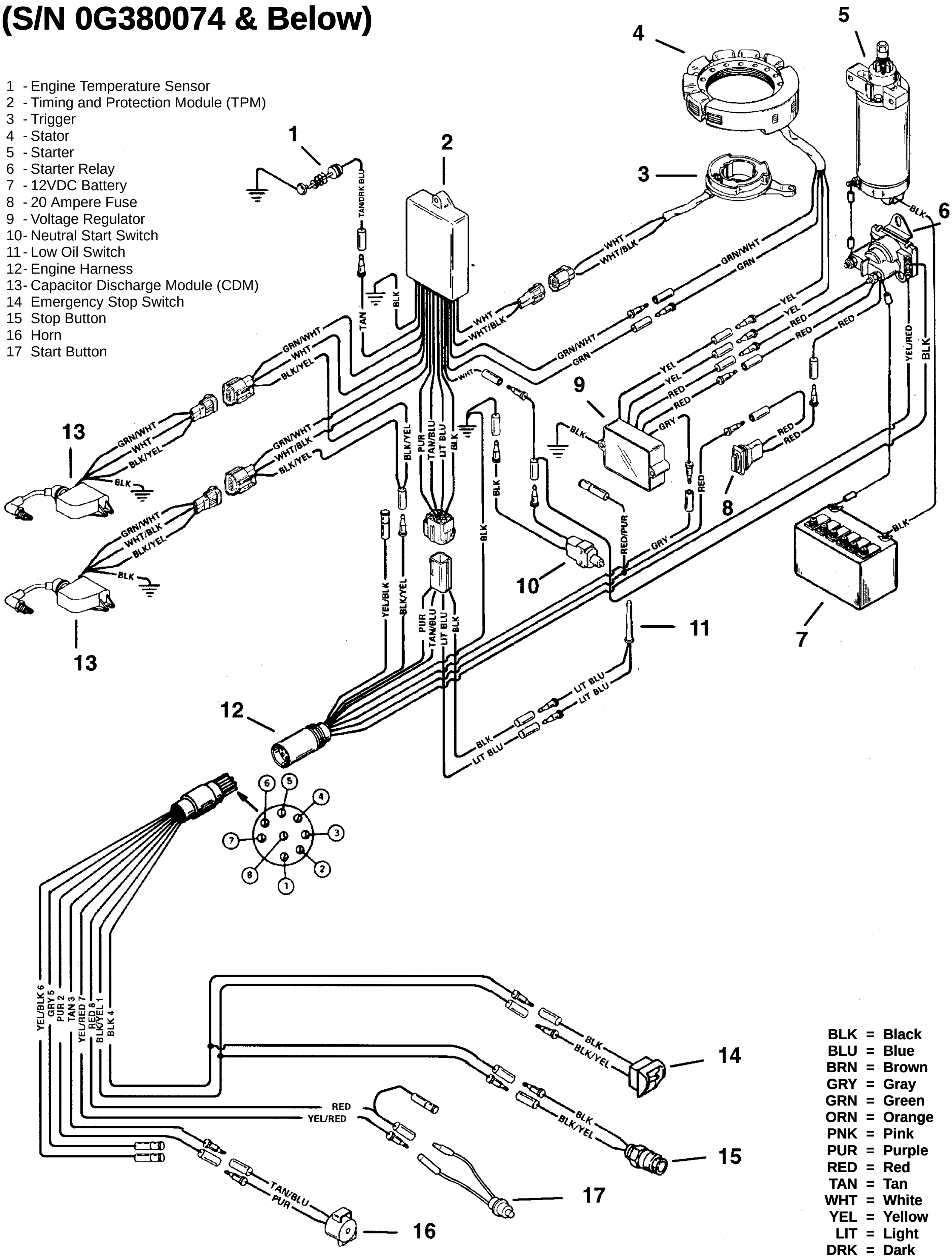
a - CDM 1
b - CDM 2
c - Stator
d - Trigger
e - Head Temperature Sensor
f - Warning Horn
g - Lanyard Stop Switch
h - Push Button Stop Switch
i - Neutral Switch
j - Terminal Block
k - TPM Module

30/40 Electric Start / Tiller Handle Ignition Diagram (S/N 0G380074 & Below)

1 - Engine Temperature Sensor
2 - Timing and Protection Module (TPM)
3 - Trigger
4 - Stator
5 - Starter
6 - Starter Relay
7 - 12VDC Battery
8 - 20 Ampere Fuse
9 - Voltage Regulator
10- Neutral Start Switch
11- Low Oil Switch
12- Engine Harness
13- Capacitor Discharge Module (CDM)
14 Emergency Stop Switch
15 Stop Button
16 Horn
17 Start Button



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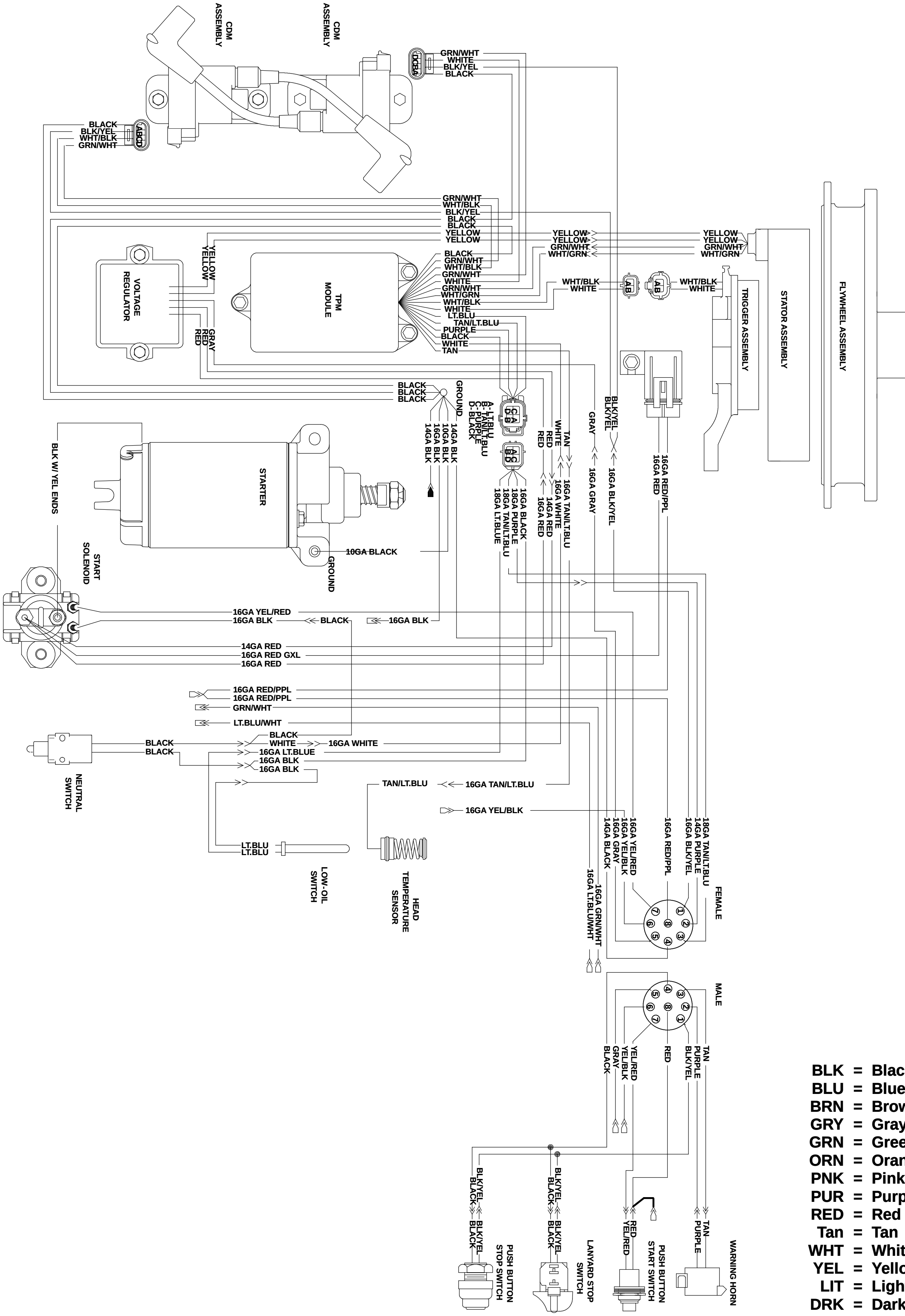
30/40 Electric Start / Tiller Handle Ignition Diagram
(S/N 0G380075 Thru S/N 0G589999)



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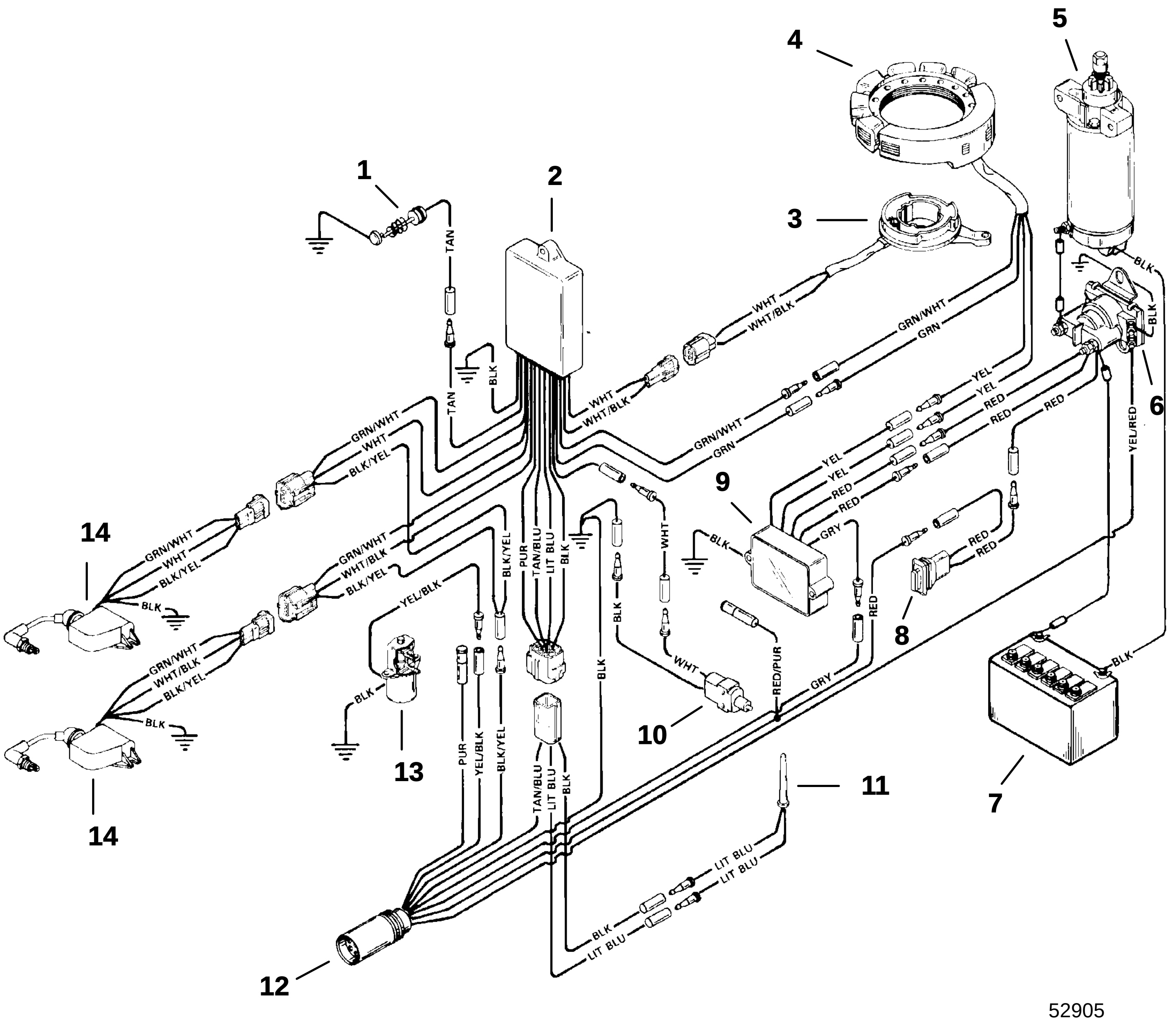
30/40 Electric Start Ignition Diagram (S/N 0G380074 & Below)



1 - Engine Temperature Sensor
2 - Timing and Protection Module (TPM)
3 - Trigger
4 - Stator
5 - Starter
6 - Starter Relay
7 - 12VDC Battery
8 - 20 Ampere Fuse
9 - Voltage Regulator
10- Neutral Start Switch
11- Low Oil Switch
12- Engine Harness
13- Fuel Enrichment Valve
14- Capacitor Discharge Module (CDM)

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GRY = Gray
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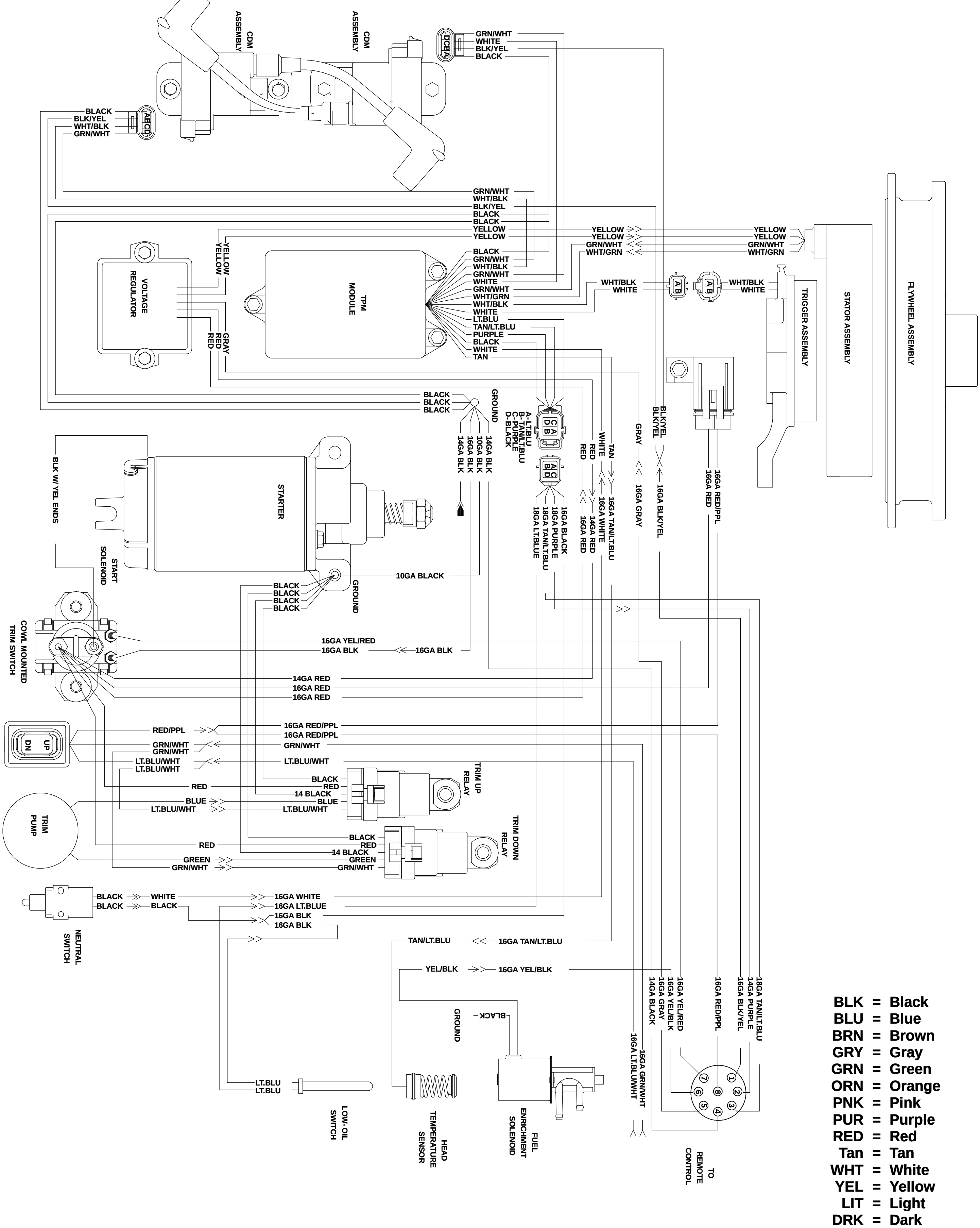
30/40 Electric Start Ignition Diagram (S/N 0G380075 Thru S/N 0G589999)



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GRN = Green
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WHT = White
YEL = Yellow
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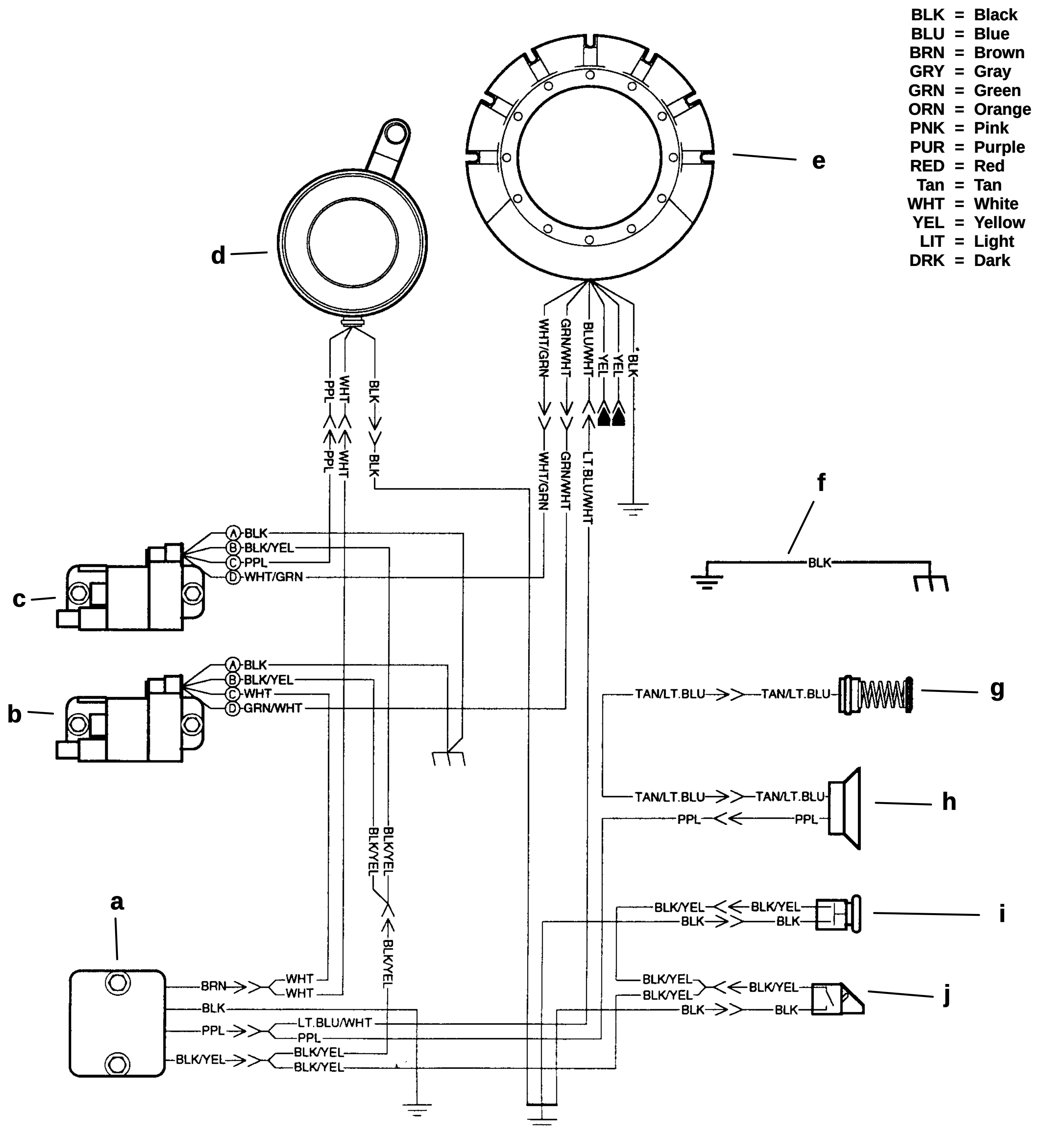
DRK = Dark

30/40 Manual Start / Tiller Handle Ignition Diagram (S/N-0G590000 & Above)



a - Rev Limiter
b - CDM 2
c - CDM 1
d - Trigger
e - Stator
f - Electrical Plate to Block
g - Temperature Switch
h - Warning Horn
i - Push Button Stop Switch
j - Lanyard Stop Switch

30 Electric Start Tiller Handle Ignition Diagram (S/N-0G590000 & Above)

BLK = Black
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GRY = Gray
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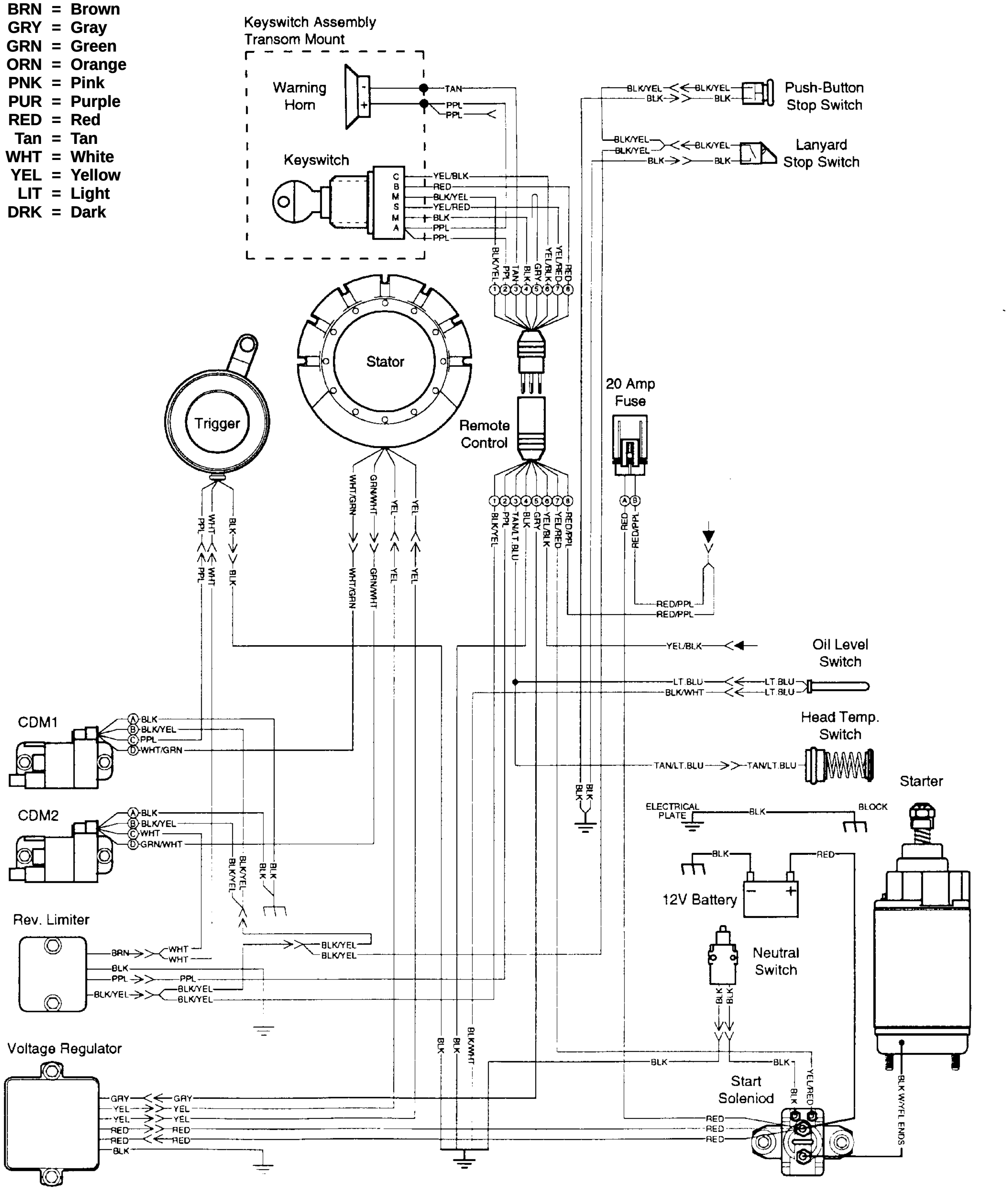

30/40 Electric Start Ignition Diagram (S/N-0G590000 & Above)

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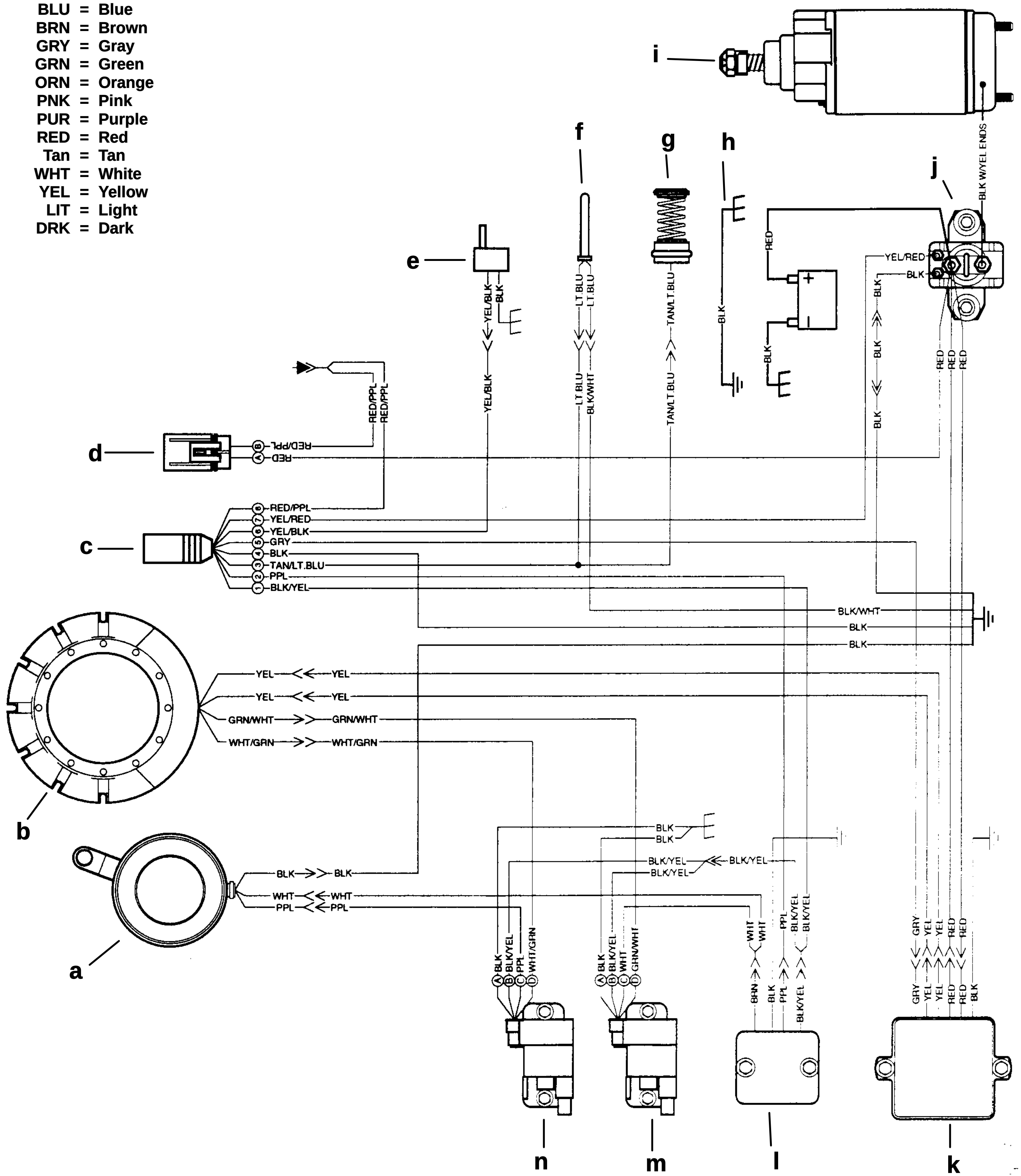
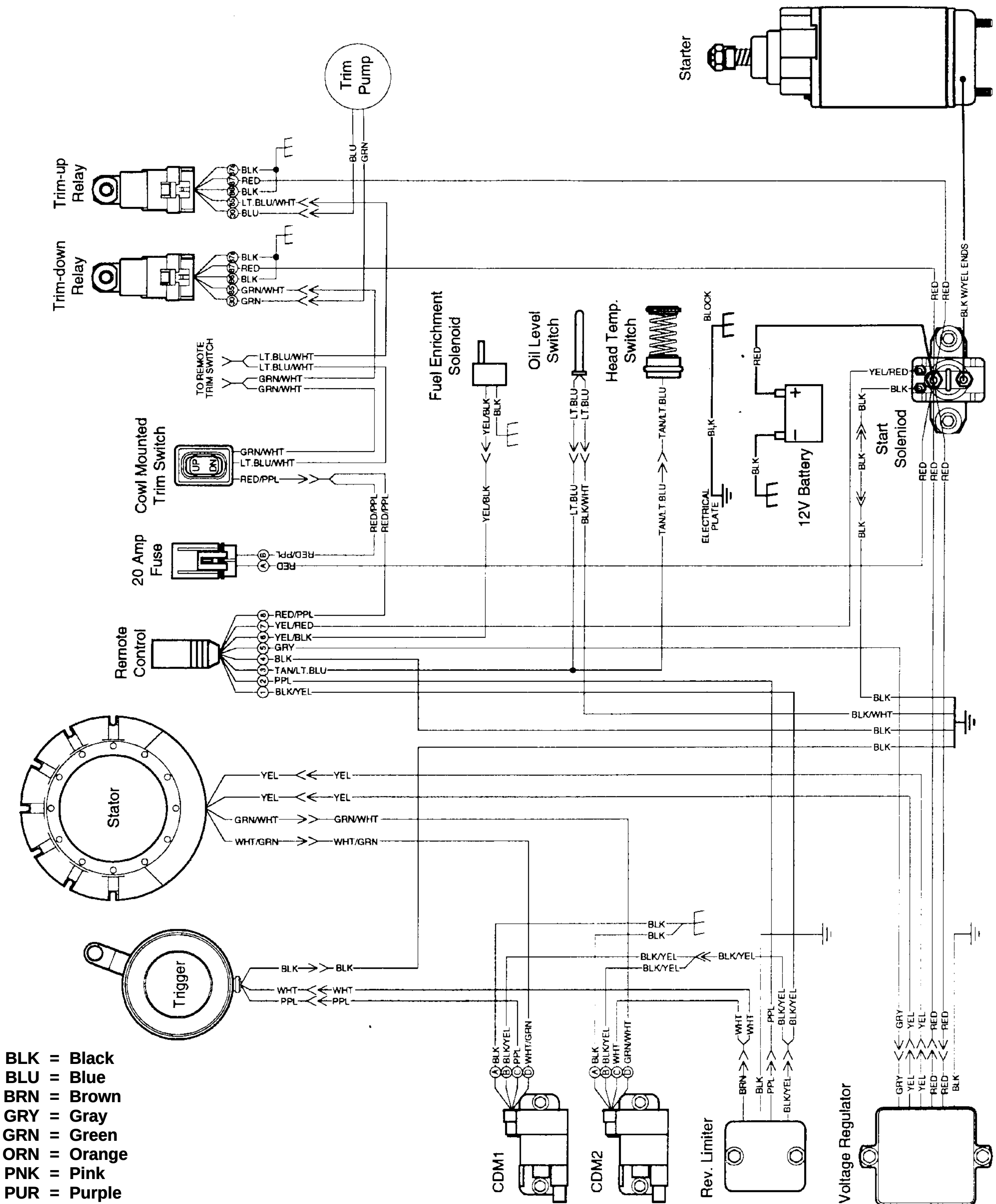


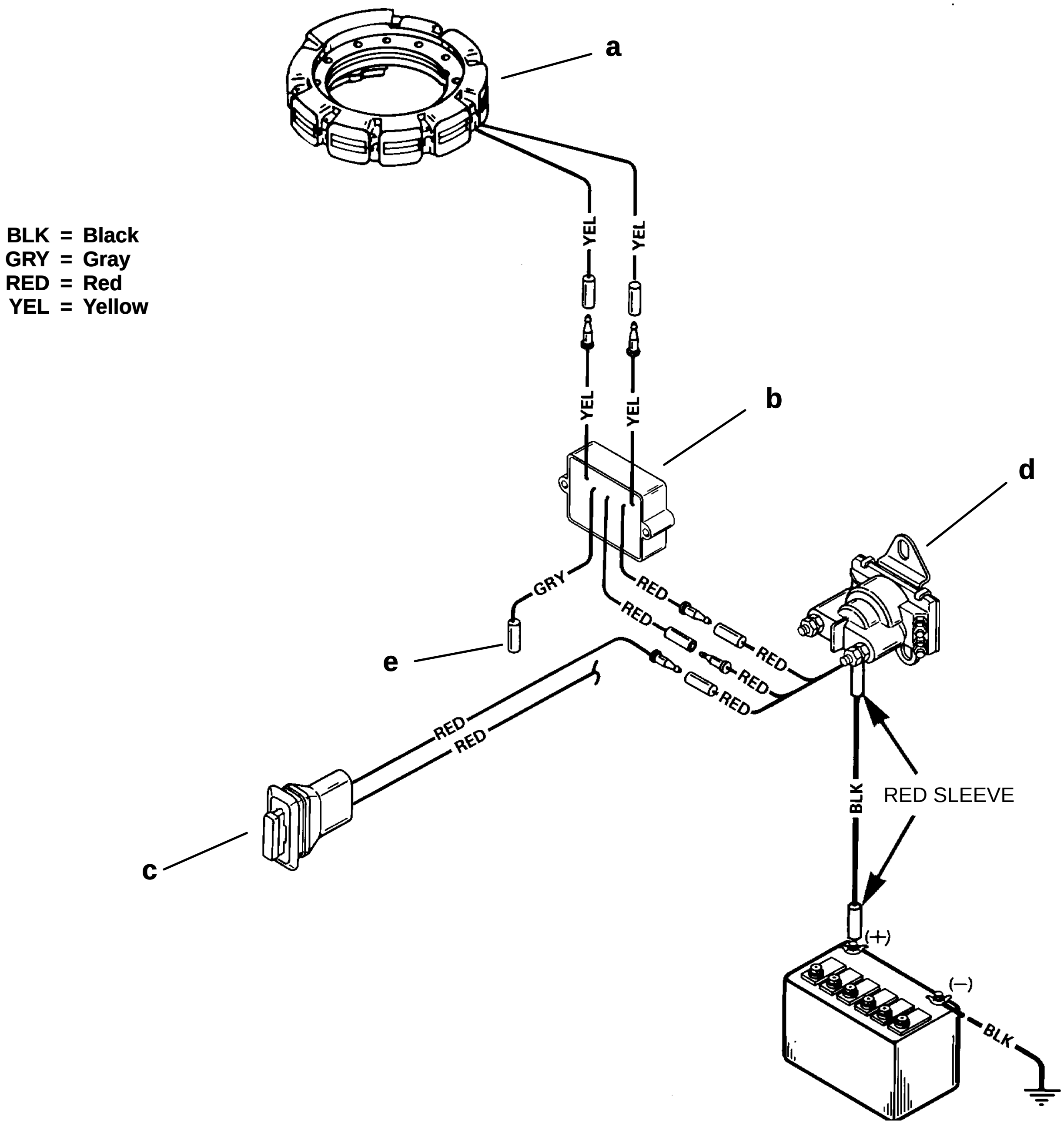
a - Trigger
b - Stator
c - Remote Control
d - 20 Amp Fuse
e - Fuel Enrichment Solenoid
f - Oil Level Switch
g - Head Temperature Switch
h - Electrical Plate To Block
i - Starter
j - Start Solenoid
k - Voltage Regulator
l - Rev. Limiter
m - CDM 2
n - CDM 1

30/40 Electric Start / Power Trim Ignition Diagram (S/N-0G590000 & Above)



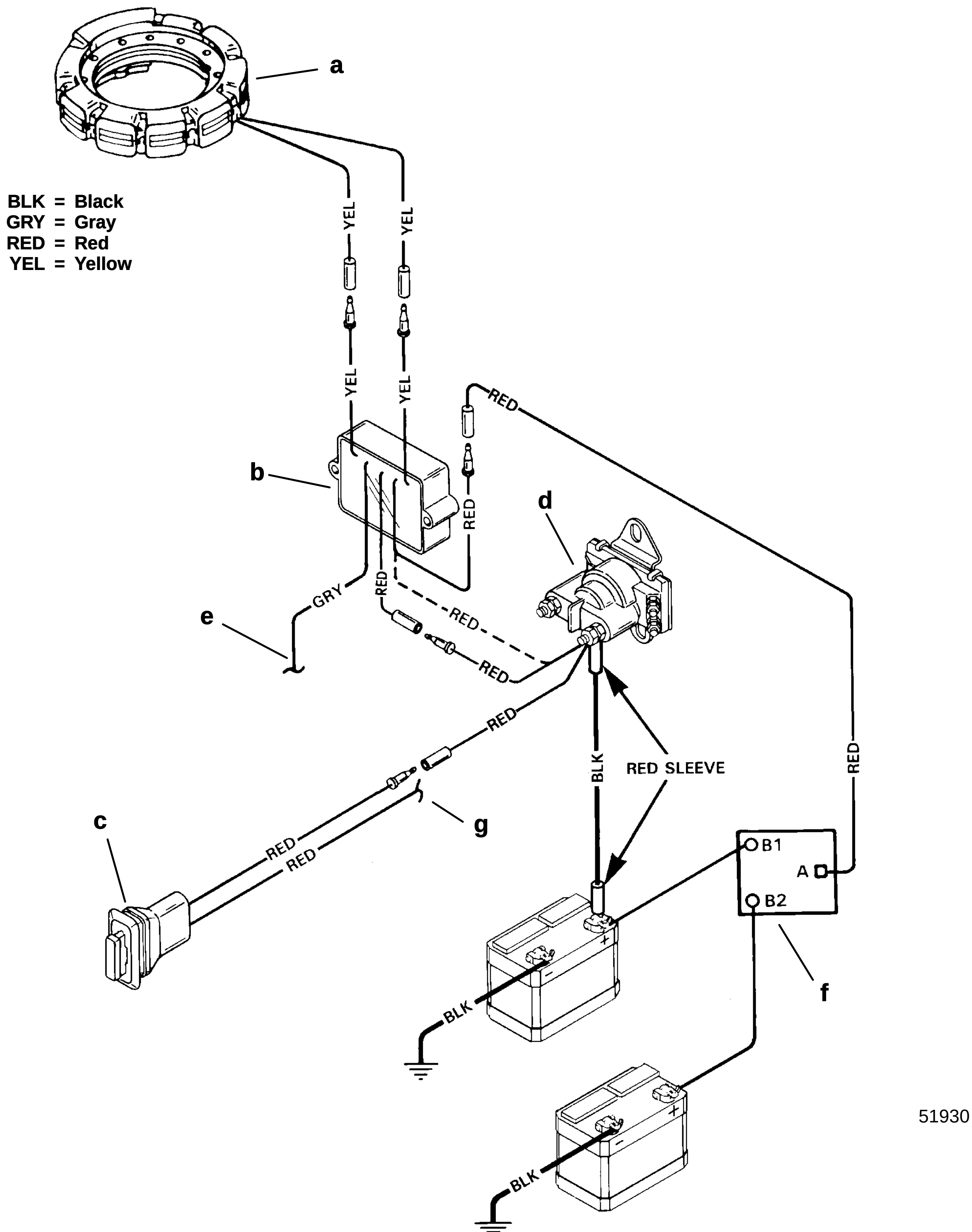
BLK = Black
BLU = Blue
BRN = Brown
GRY = Gray
GRN = Green
ORN = Orange
PNK = Pink
PUR = Purple
RED = Red
Tan = Tan
WHT = White
YEL = Yellow
LIT = Light
DRK = Dark

14 Ampere Stator Charging Diagram



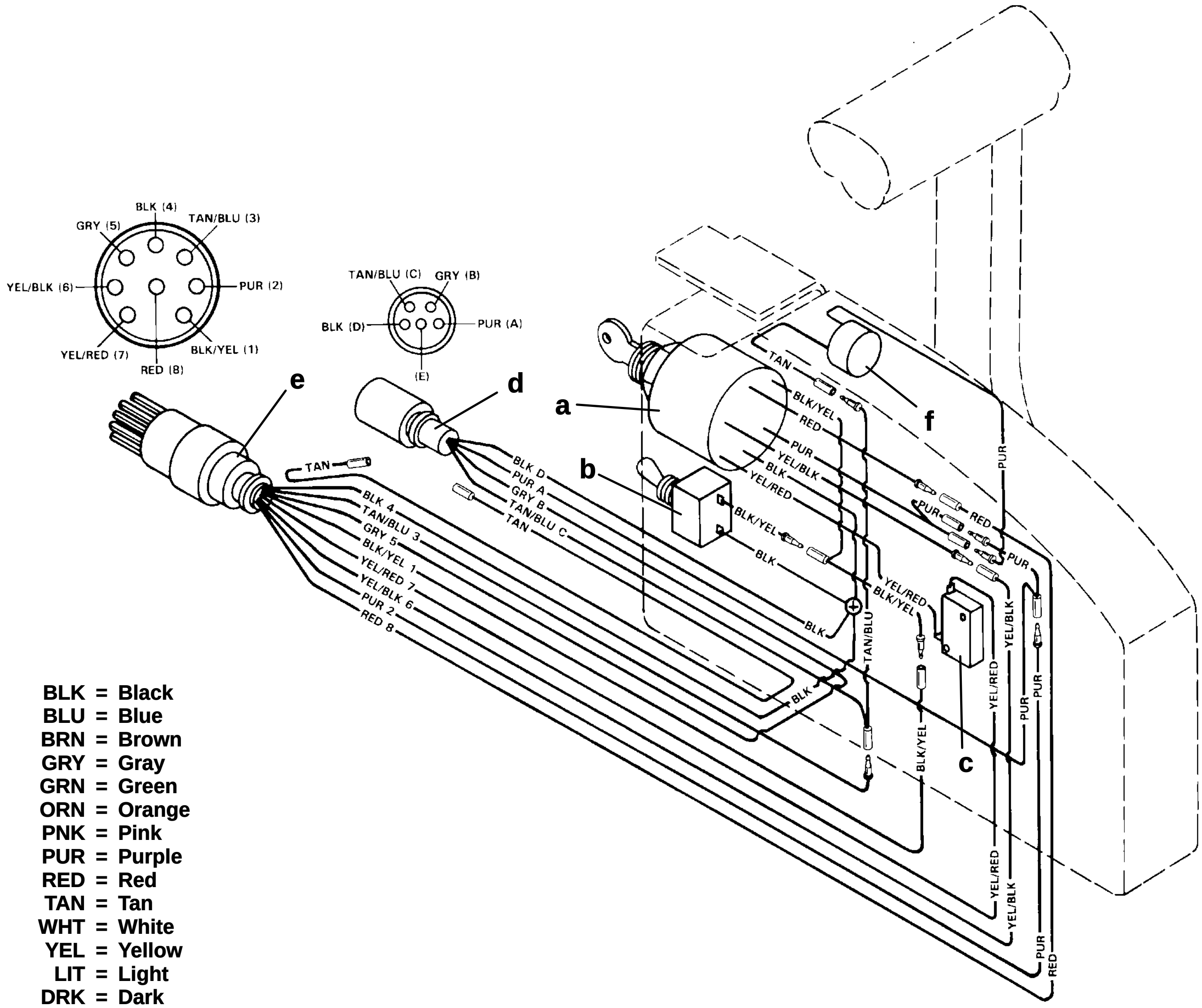
a - Stator/Alternator Assembly
b - Voltage Regulator
c - 20 Amp Fuse
d - Starter Solenoid
e - Gray Wire to Tachometer

14 Ampere Stator Charging Diagram With Battery Isolator



a - Stator/Alternator Assembly
b - Voltage Regulator
c - 20 Amp Fuse
d - Starter Solenoid
e - Gray Wire to Tachometer
f - Battery Isolation
g - To Engine Harness

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



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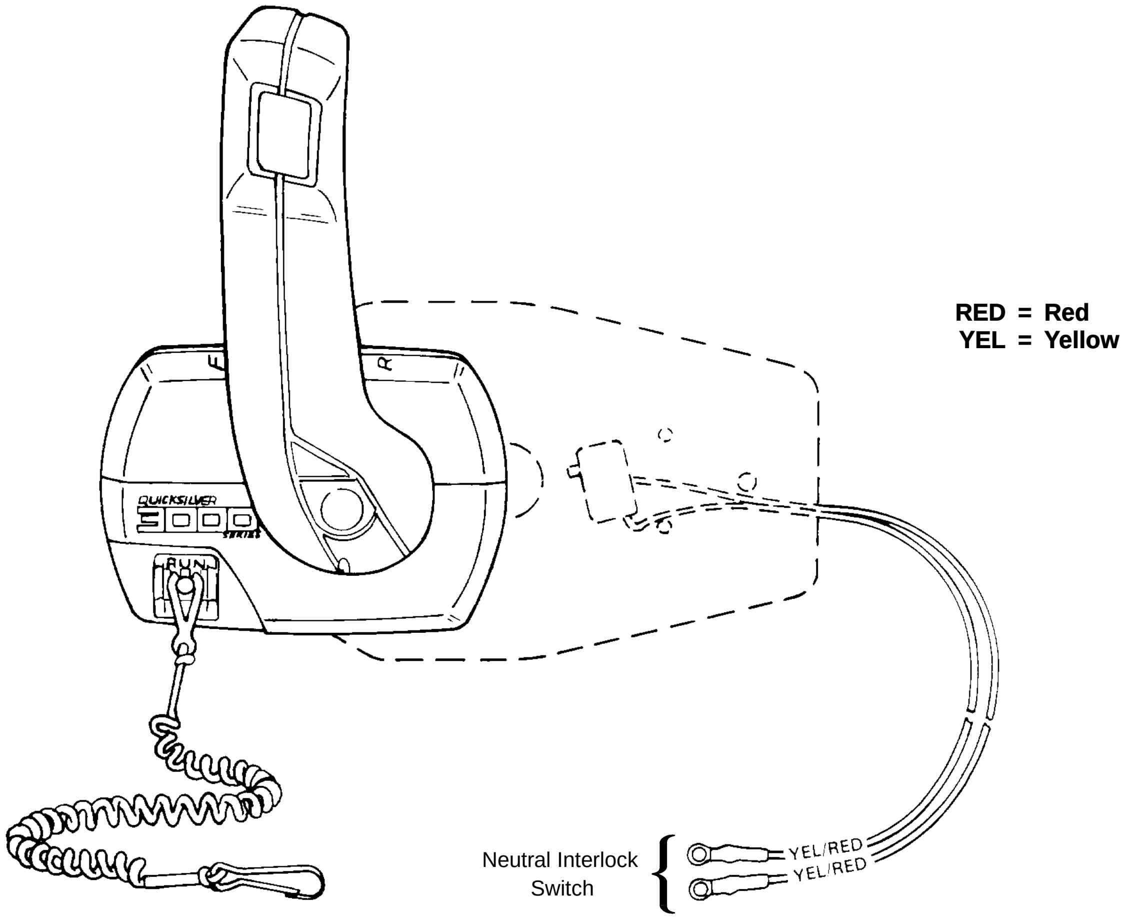
BRN = Brown
GRY = Gray
GRN = Green
ORN = Orange
PNK = Pink
PUR = Purple
RED = Red
TAN = Tan
WHT = White
YEL = Yellow
LIT = Light
DRK = Dark

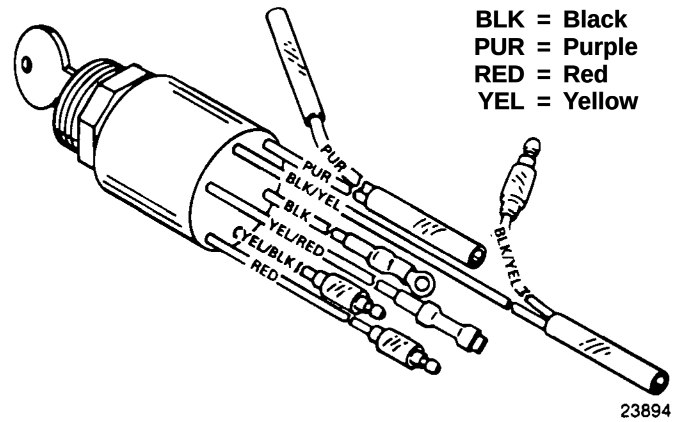
a - Ignition/Choke Switch
b - Emergency Stop Switch
c - Neutral Start Switch
d - Tachometer/Accessories Harness Connector
e - Wiring Harness Connector
f - Warning Horn

Commander 3000 Panel Mount Control



Commander 2000 Key Switch Test

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



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

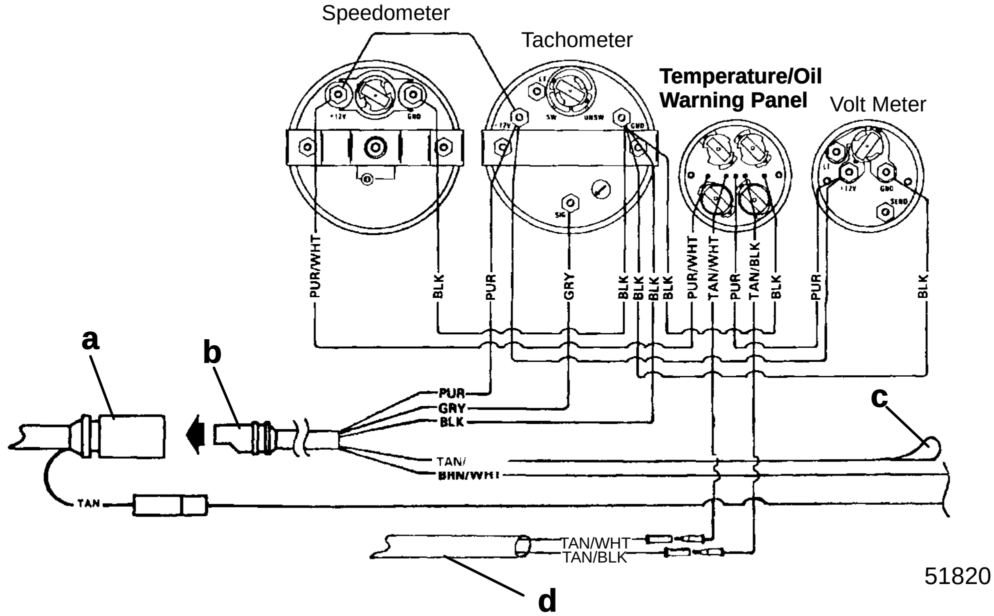
***Key switch must be positioned to "RUN" or "START" and key pushed in to actuate choke for this test.**

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

Instrument Wiring Connections

Without Light Switch

NOTE: *ANY INSTRUMENT WIRING HARNESS LEADS NOT USED MUST BE TAPED BACK TO THE HARNESS.*

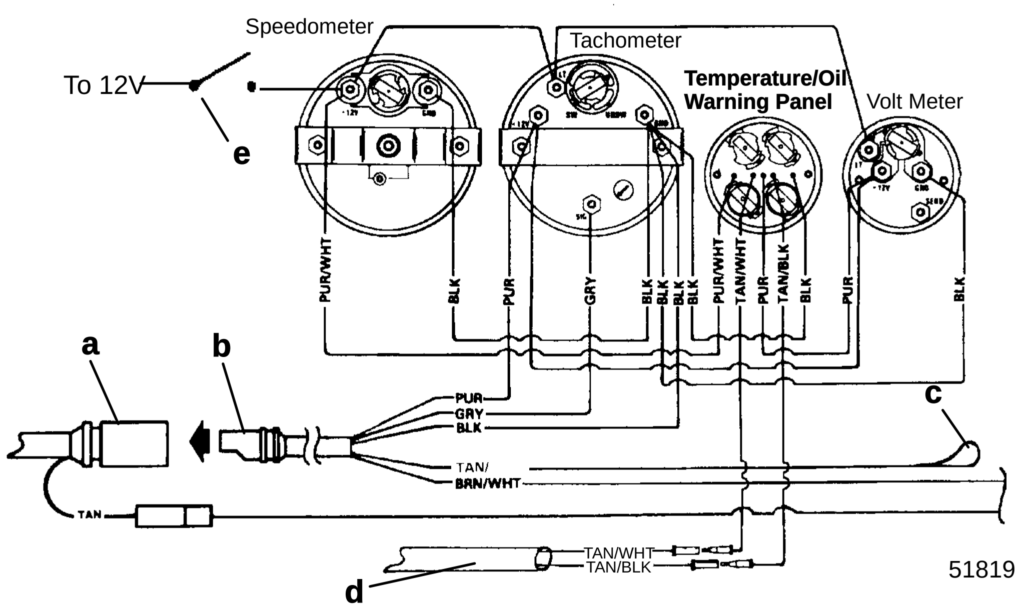


51820

a - Tachometer Receptacle-From Control Box or Ignition/ Choke Switch
b - Tachometer Wiring Harness
c - Lead to Optional Visual Warning Kit (Taped Back to Harness)
d - Cable Extension (For Two Function Warning Panel)
e - Light Switch

Wire	Where To
BLK=BLACK	GROUND
TAN/WHT=TAN/WHITE	OIL LIGHT
TAN/BLK=TAN/BLACK	TEMPERATURE LIGHT
TAN=TAN	TEMPERATURE GAUGE
PUR=PURPLE	IGNITION 12 VOLT
GRY=GRAY	TACHOMETER
BRN/WHT=BROWN/WHITE	TRIM GAUGE
TAN/BLU=TAN/BLUE	VISUAL WARNING KIT (OPT.)

With Light Switch

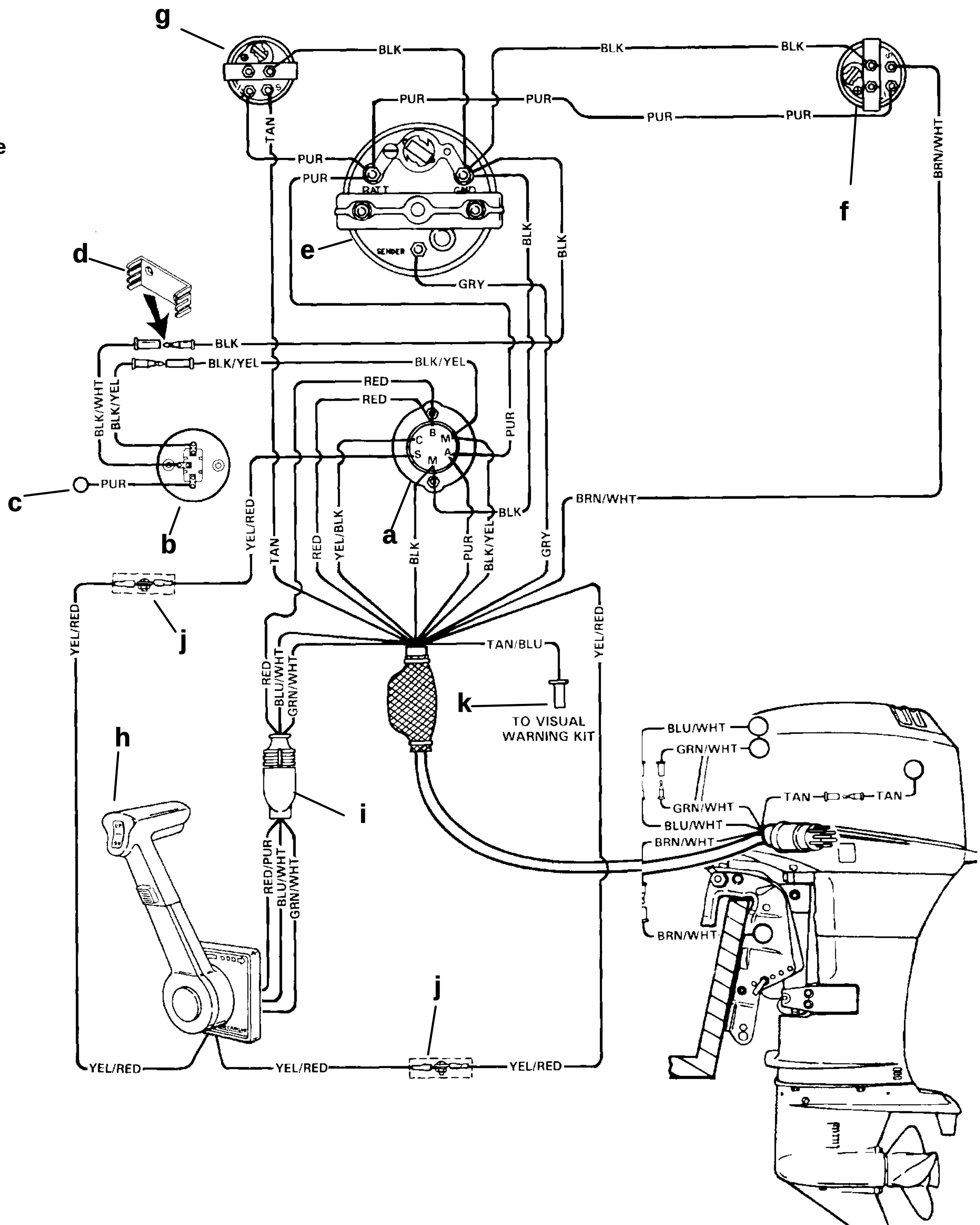


51819

Instrument/Lanyard Stop Switch Wiring Diagram

IMPORTANT: On installations where gauge options will not be used, tape back any unused wiring harness leads.

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

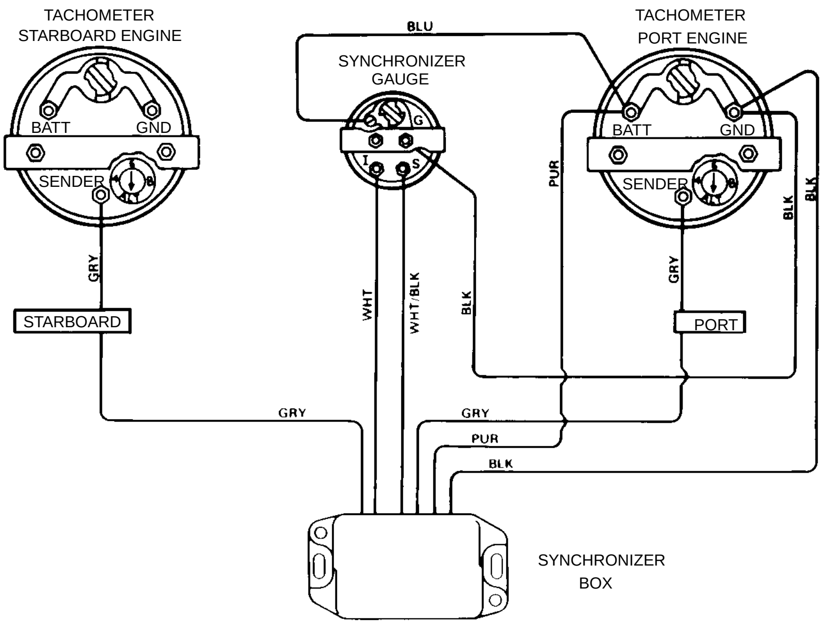


52715

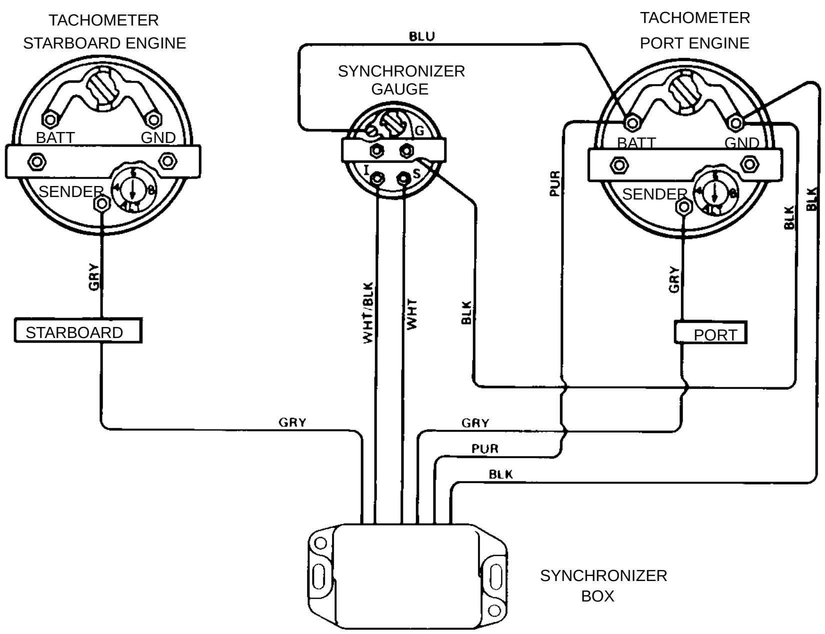
a - Ignition/Choke Switch
b - Lanyard Stop Switch
c - Lead Not Used On Outboard Installations
d - Retainer
e - Tachometer
f - Trim Indicator Gauge (Optional)
g - Temperature Gauge
h - Remote Control
i - Power Trim Harness Connector
j - Connect Wires Together with Screw and Hex Nut (2 Places); Apply Quicksilver Liquid Neoprene to Connections and Slide Rubber Sleeve over Each Connection
k - Lead to Optional Visual Warning Kit

Engine Synchronizer Wiring Diagram-Commander Gauges

1. Wiring Diagram – Gauge needle to point toward slow running engine.



2. Wiring Diagram – Gauge needle to point toward fast running engine.



Notes:

Instrument/Lanyard Stop Switch Wiring Diagram (Dual Outboard)

BLK = Black
BLU = Blue
BRN = Brown
GRY = Gray
GRN = Green
ORN = Orange
PNK = Pink
PUR = Purple
RED = Red
TAN = Tan
WHT = White
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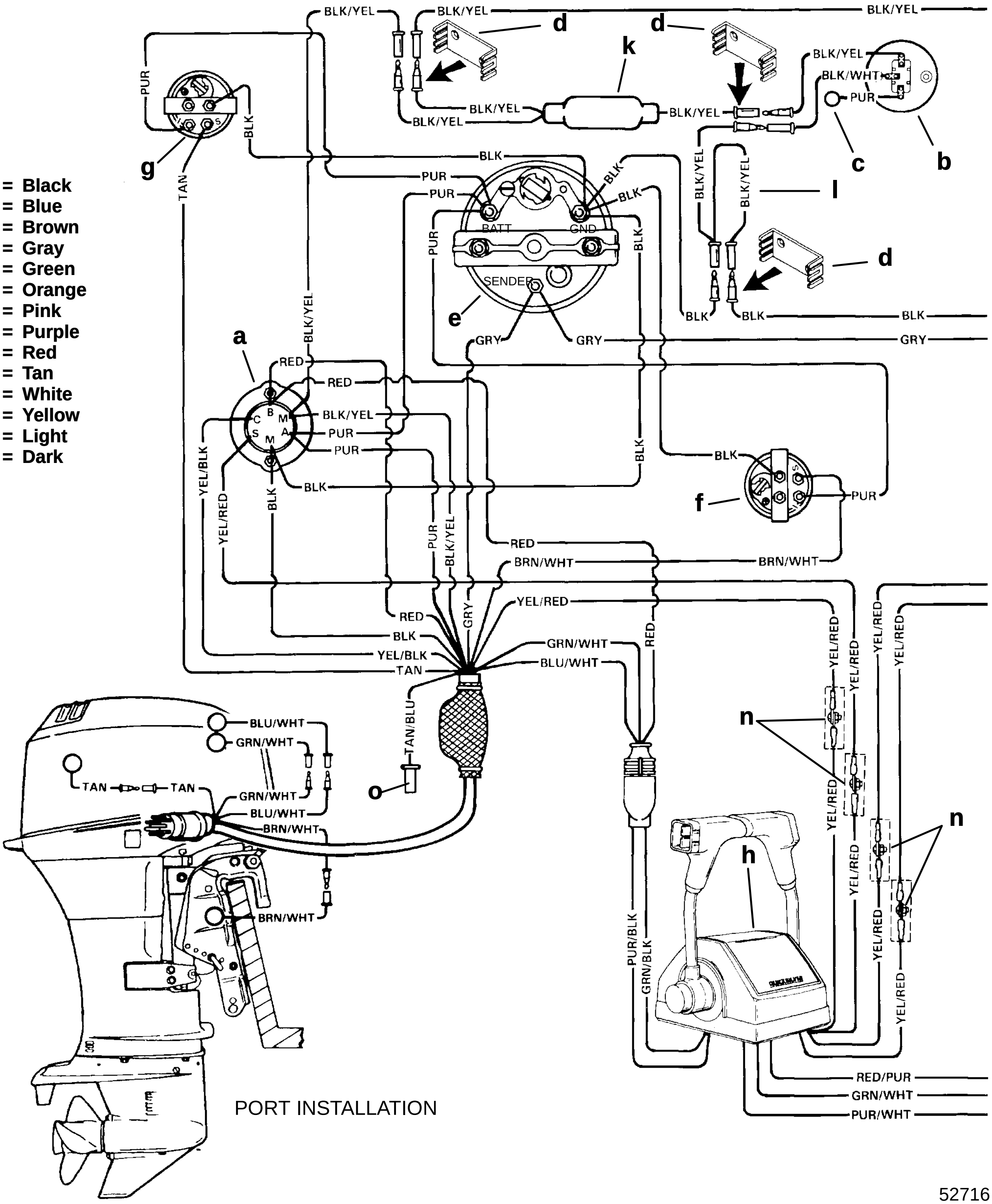
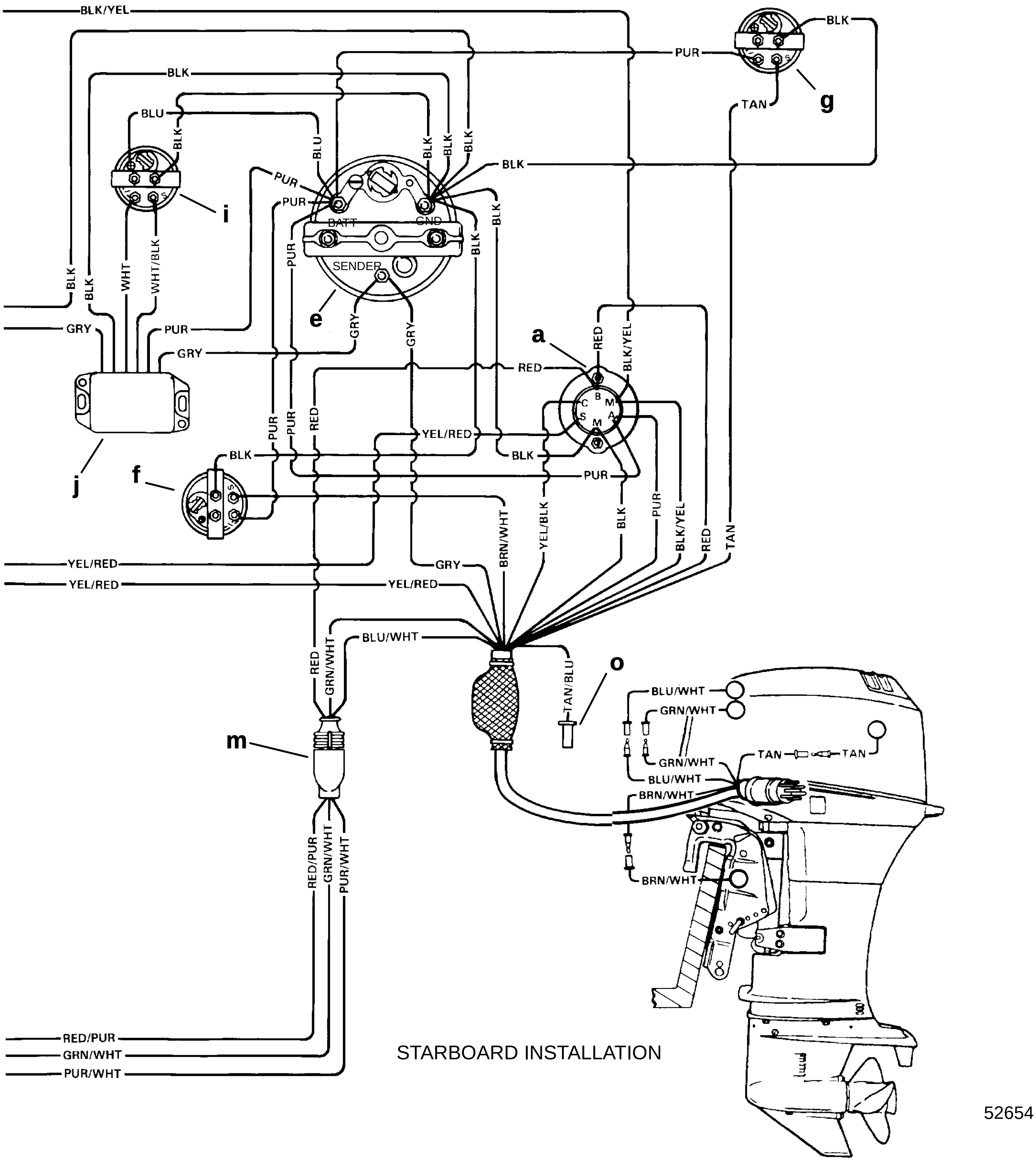


a - Ignition/Choke Switch
b - Lanyard Stop Switch
c - Lead Not Used on Outboard Installations
d - Retainer
e - Tachometer
f - Trim Indicator Gauge
g - Temperature Gauge
h - Remote Control
i - Synchronizer Gauge
j - Synchronizer Box

IMPORTANT: On installations where gauge options will not be used, tape back and isolate any unused wiring harness leads.



k - Lanyard/Diode

l - "Y" Harness

m - Power Trim Harness Connector

n - Connect Wires Together with Screw and Hex Nut (4 Places);Apply Quicksilver Liquid Neoprene to Connections and Slide Rubber Sleeve over Each Connection.

o - Lead to Visual Warning Kit

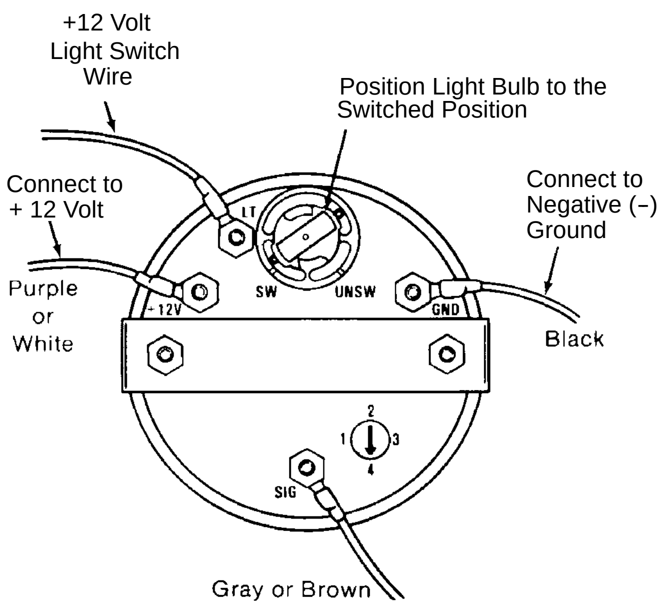
QSI Gauge Wiring Diagrams

Tachometer Wiring Diagram

Tachometer dial on back side of case must be set to position number 4.

WIRING DIAGRAM A

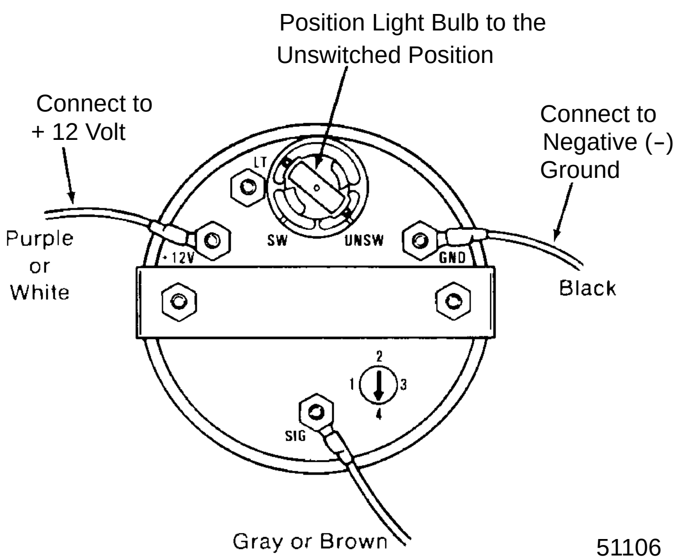
Use this wiring diagram when using a separate light switch for instrument lighting.



51106

WIRING DIAGRAM B

Use this wiring diagram when instrument lighting is wired directly to the ignition key switch. (Instrument lights are on when ignition key switch is turned on.)

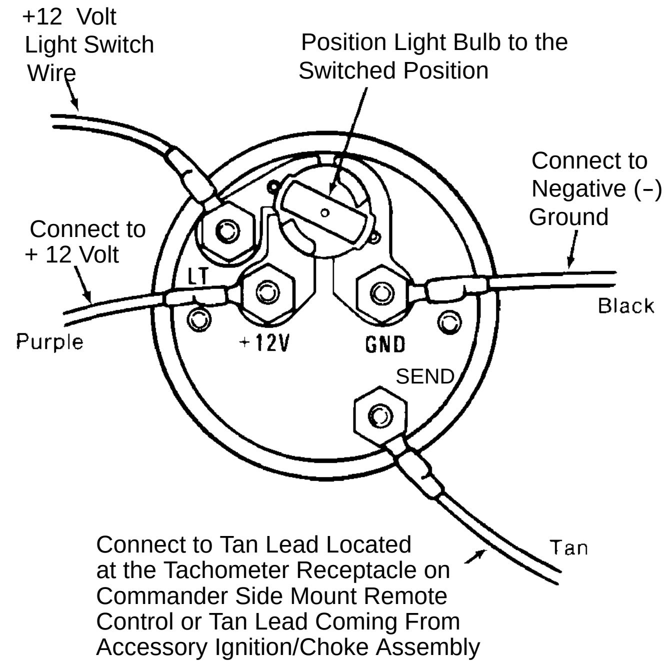


51106

Water Temperature Gauge

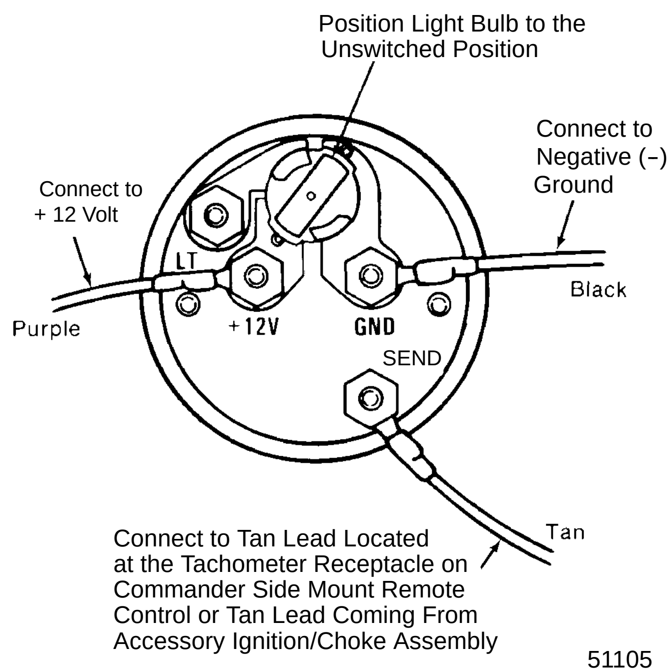
WIRING DIAGRAM A

Use this wiring diagram when using a separate light switch for instrument lighting.



WIRING DIAGRAM B

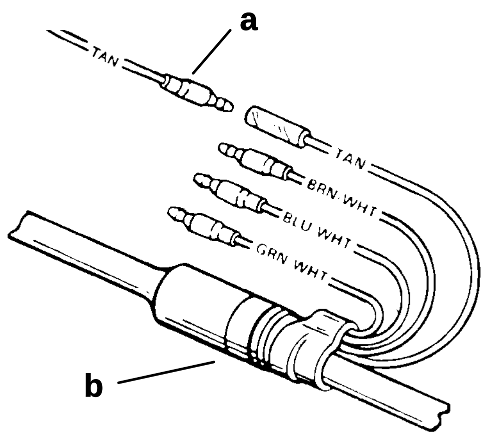
Use this wiring diagram when instrument lighting is wired directly to the ignition key switch. (Instrument lights are on when ignition key is turned on.)



51105

Route TAN lead on starboard side of engine to engine/remote control harness. Connect as shown.

IMPORTANT: Tape back and isolate any unused wiring harness leads.



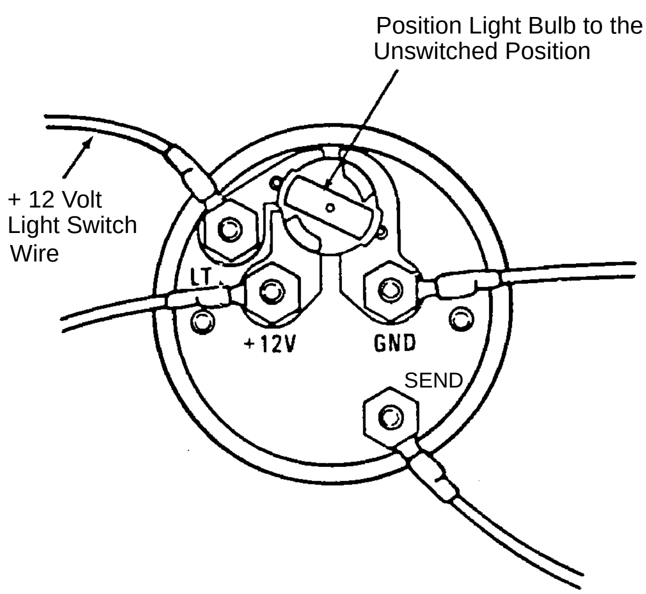
28086

a - Lead from Temperature Sender
b - Engine/Remote Control Harness

Engine Synchronizer Wiring Diagram

LIGHT BULB POSITION A

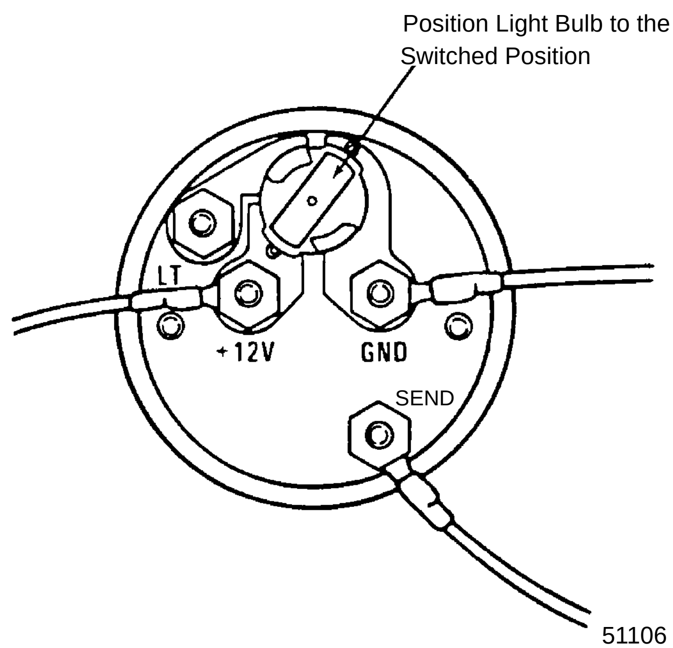
Use this position when using a separate light switch for instrument lighting.



51105

LIGHT BULB POSITION B

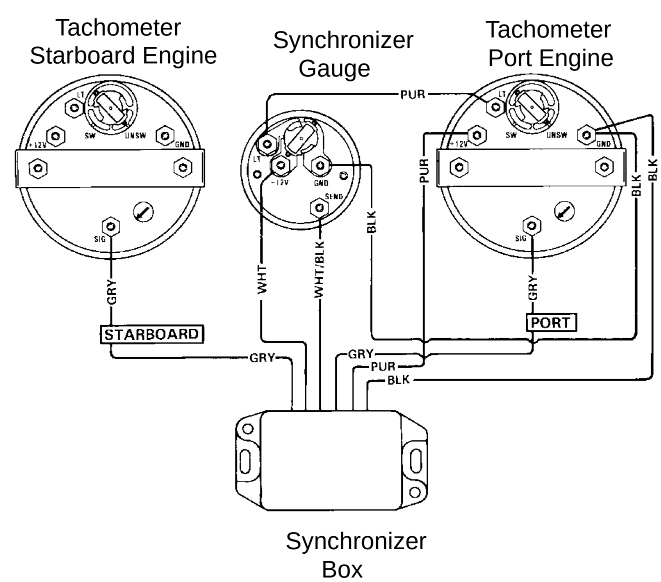
Use this position when instrument lighting is wired directly to the ignition key switch. (Instrument lights are on when ignition key switch is turned on.)



51106

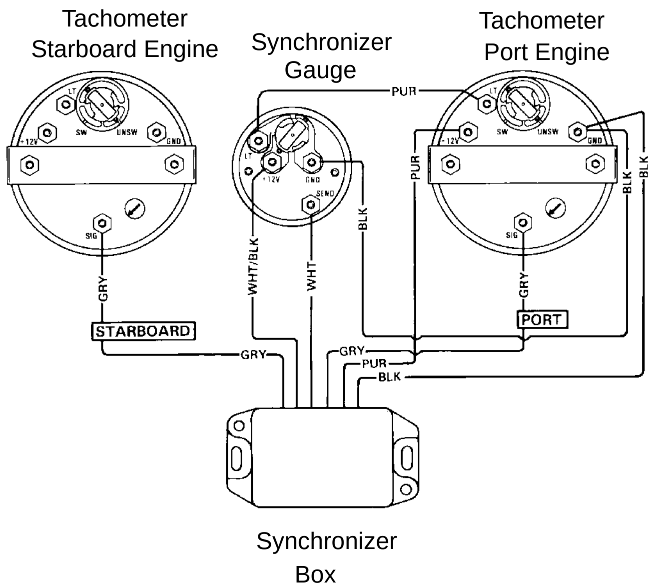
Synchronizer wiring can be accomplished two different ways as an option to the user.

Wiring Diagram – Gauge needle to point toward slow running engine



52566

Wiring Diagram – Gauge needle to point toward fast running engine



52565

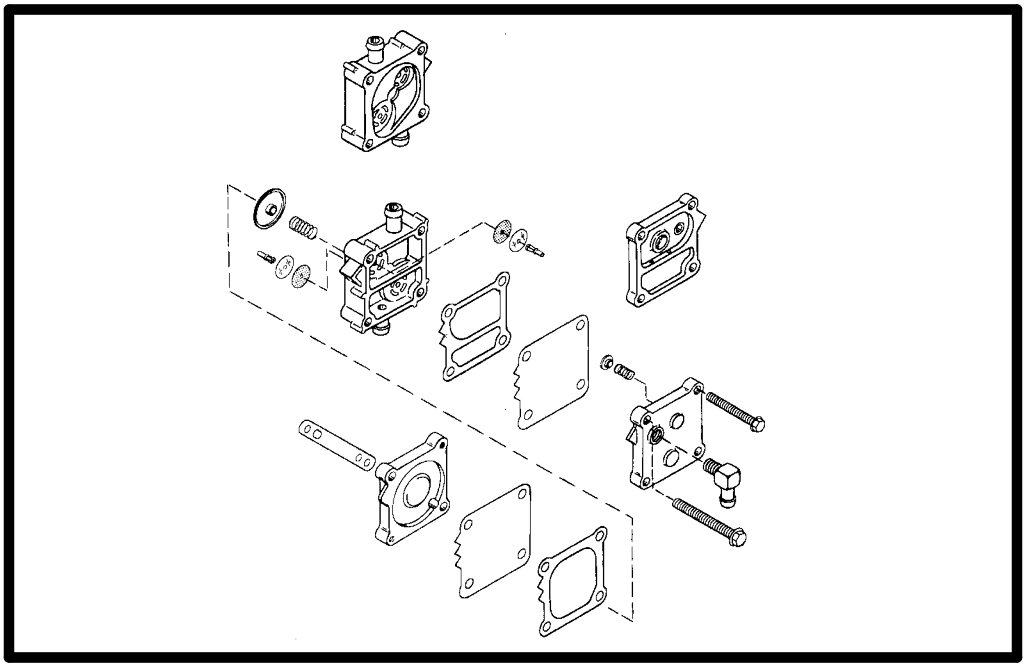
CLEANING GAUGES

Clean gauge by washing with fresh water to remove sand and salt deposits. Wipe off with a soft cloth moistened with water. The gauge may be scored or damaged if wiped with abrasive material (sand, saline or detergent compounds, etc.) or washed with solvents such as trichloroethylene, turpentine, etc.

FUEL SYSTEM

3

A



FUEL PUMP

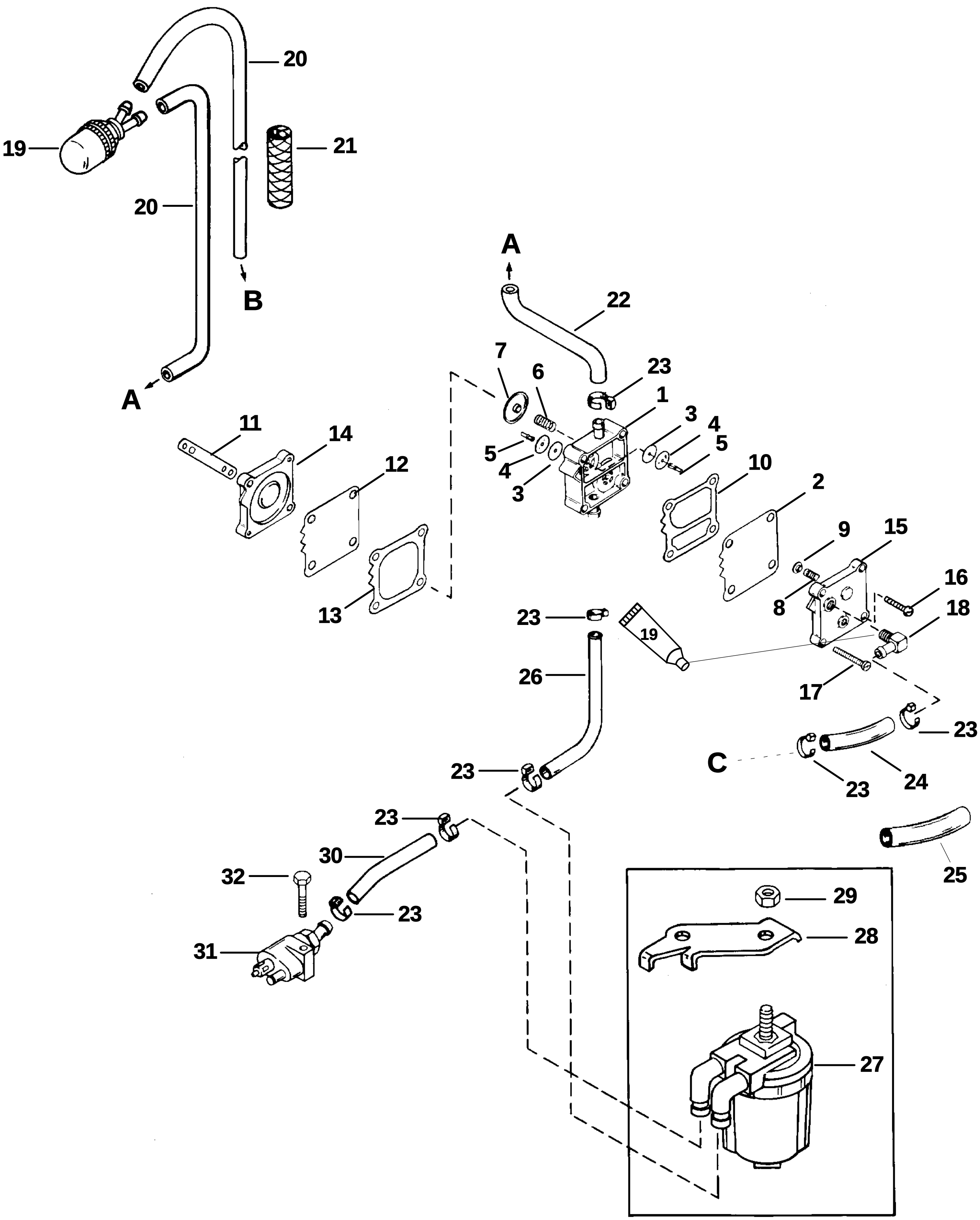
Table of Contents

Specifications

Fuel Pump Pressure:	
@ 5000 RPM	4.0 - 7.0 PSI
@ 750 RPM	2.5 - 4.0 PSI

Electric fuel pump pressure, if used, must be limited to no more than 6.0 PSI.

FUEL PUMP (MANUAL)

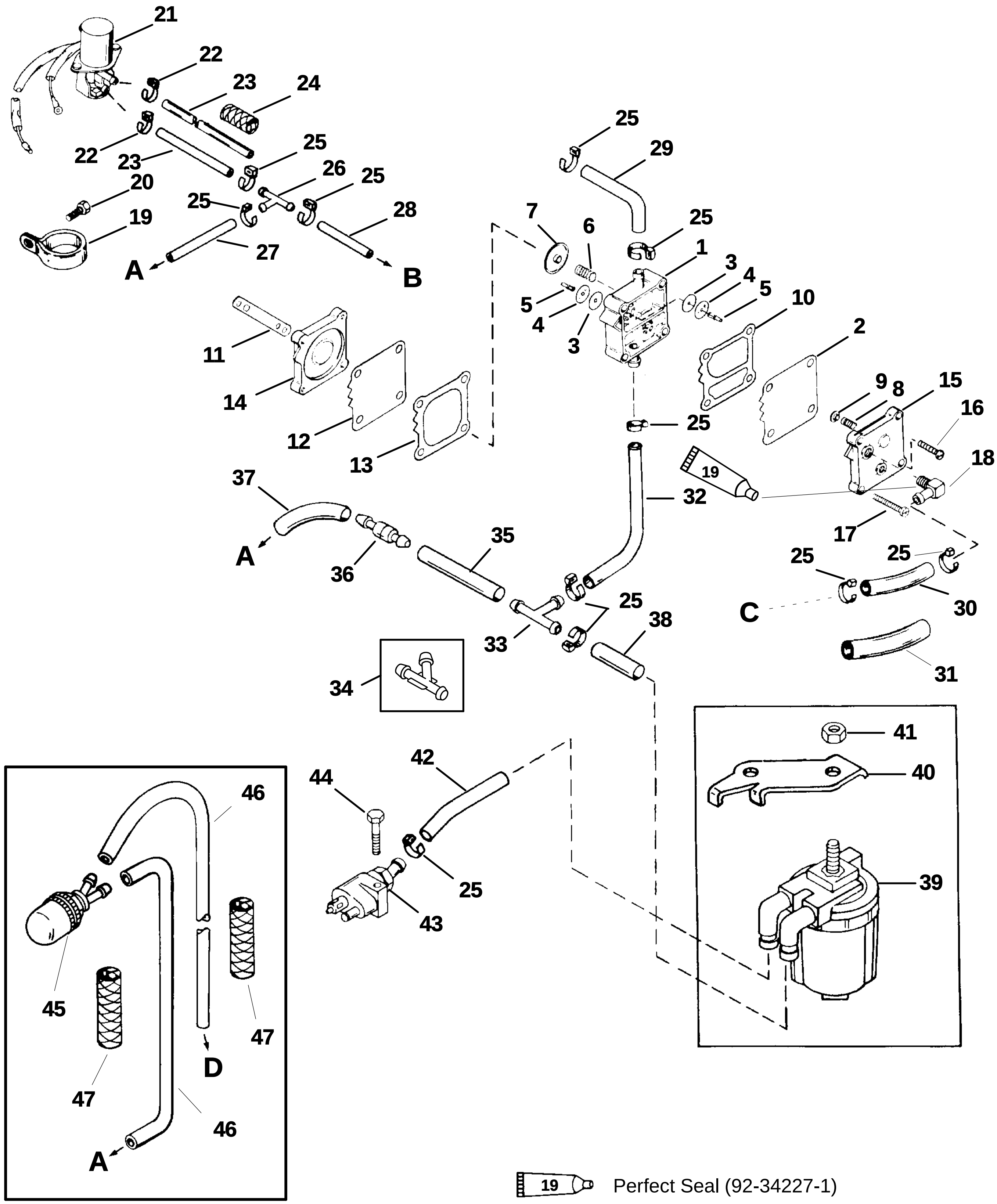


19 Perfect Seal (92-34227-1)

A = TO CARBURETOR **B = TO INTAKE MANIFOLD** **C = TO CRANKCASE**

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	FUEL PUMP ASSEMBLY			
2	1	DIAPHRAGM KIT			
3	2	RUBBER CHECK VALVE			
4	2	CHECK VALVE			
5	2	RETAINER			
6	1	SPRING			
7	1	CAP			
8	1	SPRING			
9	1	CAP			
10	1	GASKET-Boost			
11	1	GASKET			
12	1	DIAPHRAGM			
13	1	GASKET-Pulse			
14	1	BASE			
15	1	PLATE			
16	2	SCREW-pump to crankcase (M6 x 1 x 50)	55		6.2
17	2	SCREW-pump	55		6.2
18	1	FITTING			
19	1	PRIMER BULB			
20	2	HOSE (9-1/2 IN.)			
21	1	SLEEVE			
22	1	HOSE			
23	AR	STA-STRAP			
24	1	HOSE (3-1/4 IN.)			
25	1	INSULATOR			
26	1	HOSE (MOLDED)			
27	1	FUEL FILTER			
28	1	BRACKET			
29	1	NUT (M6 x 1)	Drive Tight		
30	1	HOSE (14-1/4 IN.)			
31	1	FUEL CONNECTOR			
32	1	SCREW	100		11.3

FUEL PUMP (ELECTRIC)



A = TO OIL PUMP B = TO MANIFOLD C = TO CRANKCASE D = TO TEE

FUEL PUMP (ELECTRIC)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	FUEL PUMP ASSEMBLY			
2	1	DIAPHRAGM KIT			
3	2	RUBBER CHECK VALVE			
4	2	CHECK VALVE			
5	2	RETAINER			
6	1	SPRING			
7	1	CAP			
8	1	SPRING			
9	1	CAP			
10	1	GASKET-Boost			
11	1	GASKET			
12	1	DIAPHRAGM			
13	1	GASKET-Pulse			
14	1	BASE			
15	1	PLATE			
16	2	SCREW-pump to crankcase (M6 x 1 x 50)	55		6.2
17	2	SCREW-pump (M5 x .8 x 40)	55		6.2
18	1	FITTING			
19	1	CLAMP			
20	1	SCREW (M6 x 16)			
21	1	SOLENOID VALVE			
22	2	STA-STRAP			
23	2	HOSE (11 1/2 IN.)			
24	1	SLEEVE (1/2 x 5 IN.)			
	1	SLEEVE (3/8 x 7-1/2 IN.)			
25	AR	STA-STRAP			
26	1	TEE FITTING			
27	1	HOSE (4 IN.)			
28	1	HOSE (3-1/4 IN.)			
29	1	HOSE			
30	1	HOSE (3-1/4 IN.)			
31	1	INSULATOR			
32	1	HOSE (MOLDED)			
	1	TUBING (9 IN.)			
33	1	TEE **(DESIGN I)**			
34	1	CONNECTOR **(DESIGN II)**			
35	1	TUBING (4 IN.)			
36	1	CHECK VALVE			
37	1	HOSE (1-1/2 IN.)			
38	1	TUBING (1-1/4 IN.)			
39	1	FUEL FILTER			
40	1	BRACKET			
41	1	NUT (M6 x 1)	Drive Tight		
42	1	HOSE (14 1/4 IN.)			
43	1	FUEL CONNECTOR			
44	1	SCREW			
45	1	PRIMER BULB			
46	2	HOSE (9-1/2 IN.) **ELECTRIC HANDLE**			
47	AR	SLEEVE (3/8 x 7-1/2 IN.)			
	1	SLEEVE (1/2 x 5 IN.)			

Theory of Operation

The fuel pump is a crankcase-pressure-operated, diaphragm-type pump. Crankcase pulsating pressure is transferred by way of a passage (hole) from the crankcase to the fuel pump.

When the piston travels upward, a vacuum is created in the crankcase. This vacuum pulls in the fuel pump diaphragm, the inlet check valve (in fuel pump) is opened and, and fuel is drawn into fuel pump.

Downward motion of the piston forces out the fuel pump diaphragm, closes the inlet check valve (to keep fuel from returning to fuel tank) and opens the outlet check valve, forcing fuel to the carburetors.

Troubleshooting

⚠ WARNING

FIRE AND EXPLOSION HAZARD. Observe fire prevention rules, particularly NO SMOKING. Before servicing any part of the fuel system, disconnect electrical system at the battery. Drain the fuel system completely. Use an approved container to collect and store fuel. Wipe up any spillage immediately. Materials used to contain spillage must be disposed of in an approved receptacle. Any fuel system service must be performed in a well ventilated area.

FUEL LEAKAGE FROM ANY PART OF THE FUEL SYSTEM CAN BE A FIRE AND EXPLOSION HAZARD WHICH CAN CAUSE SERIOUS BODILY INJURY OR DEATH. Careful periodic inspection of the entire fuel system is mandatory, particularly after engine storage. All fuel components, including fuel tanks, whether plastic, metal, or fiberglass, fuel lines, primer bulbs, fittings, swelling, and must be inspected for corrosion. Any sign of leakage or deterioration necessitates replacement before further engine operation.

Checking For Restricted Fuel Flow Caused By Anti-siphon Valves

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

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

Testing

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

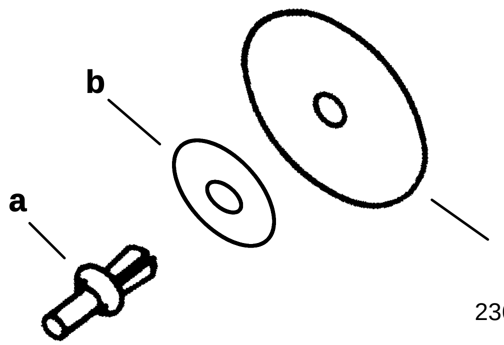
PROBLEM: AIR BUBBLES IN FUEL LINE	
Possible Cause	**Corrective Action**
Low fuel in tank.	Fill tank.
Loose fuel line connection.	Inspect and tighten connections.
Fuel pump fitting loose.	Tighten fitting.
A hole or cut in fuel line.	Inspect condition of fuel lines and replace any found bad.
Fuel pump anchor screws loose.	Inspect and tighten all screws.
Fuel pump gaskets worn out.	Rebuild fuel pump.

PROBLEM: LACK OF FUEL PUMP PRESSURE	
Possible Cause	**Corrective Action**
Anti-siphon valve.	Refer to "Checking for Restricted Fuel Flow Caused by Anti-siphon Valves" preceding.
Air in fuel line.	"Air Bubbles in Fuel Line," preceding.
Dirty or clogged fuel filter.	Clean or replace filter.
Dirty or clogged fuel pickup in fuel tank.	Clean or replace pickup.
Worn out fuel pump diaphragm.	Rebuild pump.
Defective check valves in fuel pump.	Rebuild pump.
Broken check valve retainer.	Rebuild pump.
Pulse hole plugged.	Remove pump and clean out hole.
Hole in 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. Align or replace gasket as necessary.

Reassembly

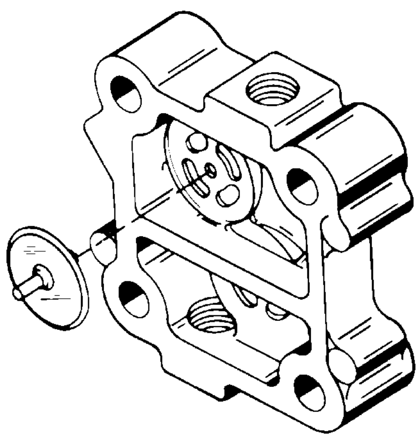
Check Valve Assembly

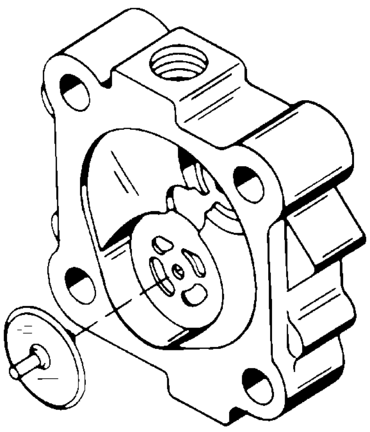
1. Insert retainer (a) thru plastic disc (b) and rubber check valve (c).



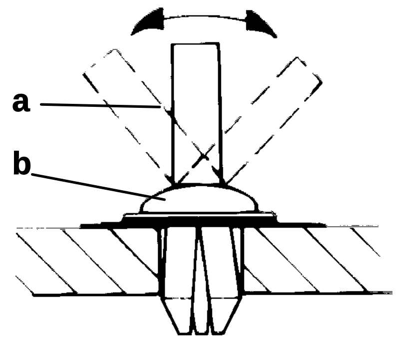
a - Retainer
b - Plastic Disc
c - Rubber Check Valve

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



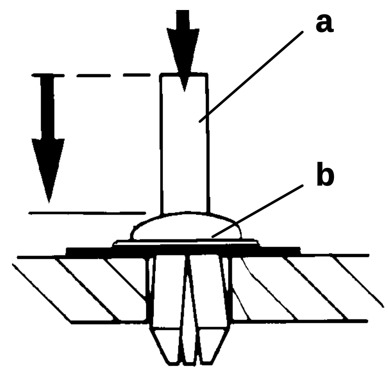


3. With retainer installed in pump body, break retainer rod (a) from retainer (b) by bending sideways.



a - Retainer Rod
b - Retainer

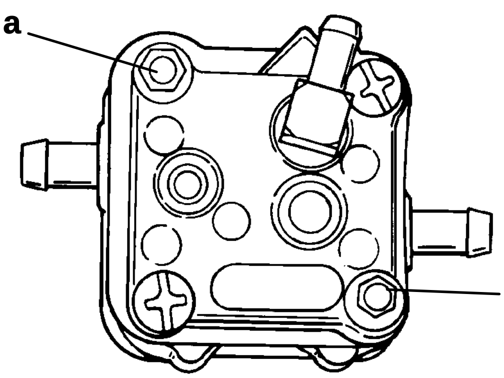
4. Reinstall rod (a) into retainer cap (b) and, use a small hammer or hammer and punch to tap rod down into retainer until flush with top of retainer.



a - Rod
b - Retainer Cap

Fuel Pump Assembly

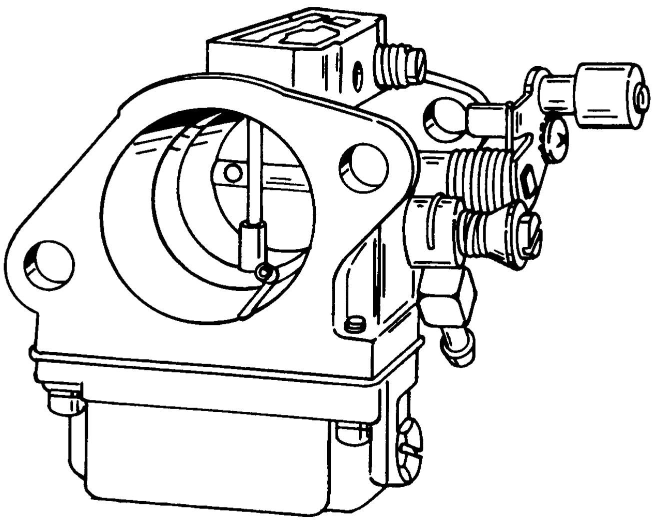
1. Assemble remaining components as shown in "Fuel Pump Exploded View".
2. Install bolts and torque to 55 lb. in. (6.2 N·m).



a - Bolt (2) Torque to 55 lb. in. (6.2 N·m)

FUEL SYSTEM

3
B



CARBURETOR

Table of Contents

Specifications

Idle RPM	700 - 800 RPM (In Forward Gear)
Wide Open Throttle (W.O.T.) RPM **- Model 30/40 Marathon/40 Seapro** **- Model 40**	 4500 - 5500 RPM 5000 - 5500 RPM
Idle Mixture Screw Adjustment (Preset-Turns Out)	1-1/2 ± 1/4
Float Level	9/16 in. (14.29mm)

WME Carburetor Specifications

NOTE: *Carburetor Number Stamped at Top of Carburetor Flange.*

Carburetor Number	Model H.P.	Main Jet Size	Bowl Vent Jet	Back Drag Jet	Float Setting	Pre-Set Idle Screw (Open)
WME-36 / WME-36A	30 H.P. Manual	0.054 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns
WME-37 / WME-37A	30 H.P. Electric	0.054 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns
WME-38	40 H.P. Manual	0.066 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns
WME-39 / WME-39A	40 H.P. Electric	0.066 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns
WME-42 / WME-42A	30 H.P. EHO	0.054 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns
WME-63	30 H.P Manual	0.054 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns
WME-64	30 H.P. Electric	0.054 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns
WME-65	30 H.P. EHO	0.054 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns
WME-66	40 H.P. Manual	0.066 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns
WME-67	40 H.P. Electric	0.066 in.	None	None	9/16 in. (14.29 mm)	1-1/2 Turns

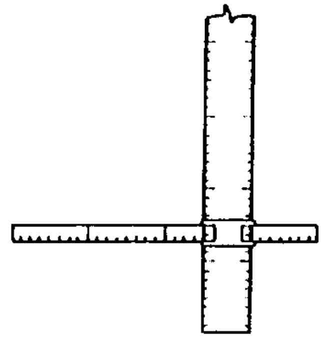
Jet Orifice Size Chart

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

Jet Orifice Size-inches	Part Number
0.040	19266040
0.042	1399-5315
0.044	1395-7394
0.046	1399-5317
0.048	1395-6246
0.050	1395-6028
0.052	1395-6359
0.054	1399-5225
0.056	1399-5213
0.058	1395-7831
0.060	1395-6487
0.062	1399-4217
0.064	1399-4216
0.066	1399-4215
0.068	1395-6029
0.070	1395-6030
0.072	1395-6207
0.074	1399-3794
0.076	1399-3796
0.078	1395-6680
0.080	1395-6201
0.082	1399-3518
0.084	1399-3517
0.086	1395-5815
0.088	1395-6202
0.090	1395-6247
0.092	1395-5733
0.094	1395-8423
0.096	1399-6249
0.098	1395-7335

Special Tools

P/N 91-36392 Carburetor Scale



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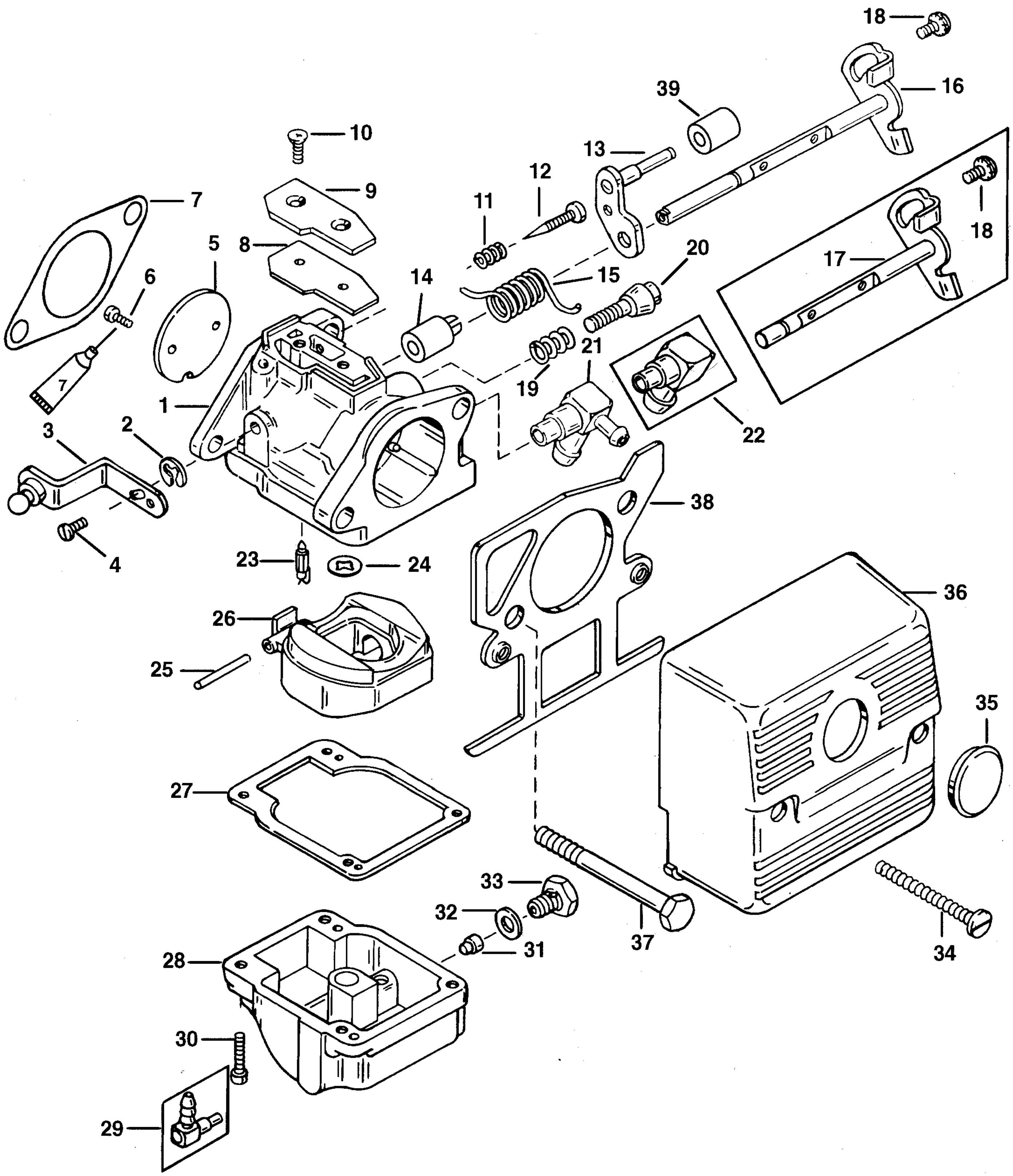
Notes:

CARBURETOR

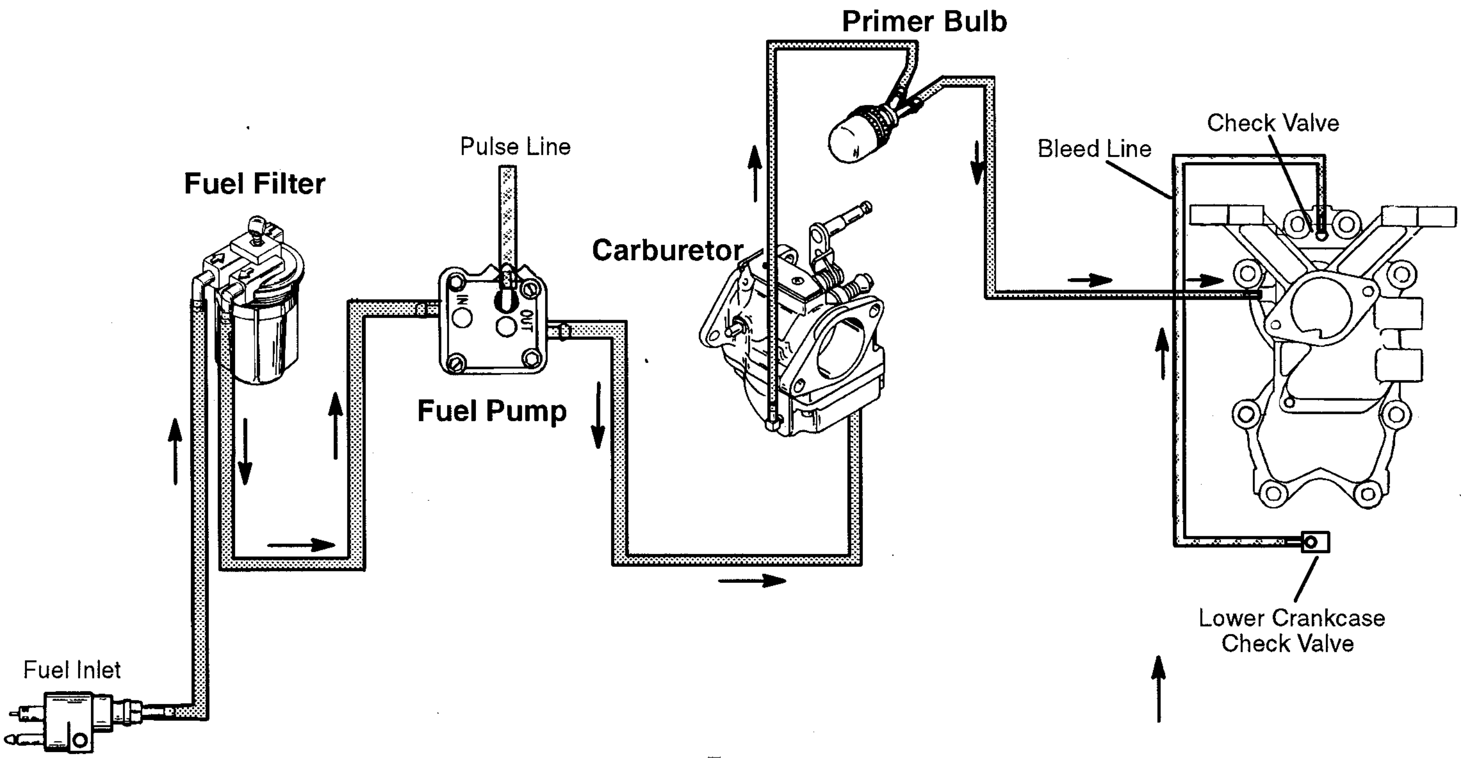


7 Loctite 271 (92-809820)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	CARBURETOR **(MANUAL – 40) (WME 66)**			
	1	CARBURETOR **(ELECTRIC – 40) (WME 67)**			
	1	CARBURETOR **(MANUAL – 30) (WME 63)**			
	1	CARBURETOR **(ELECTRIC/ELECTRIC HANDLE – 30) (WME 64)**			
	1	CARBURETOR **(ELECTRIC HANDLE – 30)(WME 65)**			
2	1	RETAINING RING			
3	1	LEVER–Oil (ELECTRIC)			
4	1	SCREW–Lever Retainer	Drive Tight		
5	1	THROTTLE VALVE			
6	2	SCREW–Throttle valve	6		0.7
7	1	GASKET–Flange			
8	1	GASKET–Cover plate			
9	1	COVER PLATE			
10	2	SCREW–Cover plate	18		2.1
11	1	SPRING–Idle needle			
12	1	IDLE NEEDLE			
13	1	LEVER			
14	1	BUSHING–Throttle Shaft			
	1	BUSHING–Throttle Shaft **(WME-63 THRU 67)**			
15	1	SPRING–Throttle return			
16	1	THROTTLE SHAFT **(ELECTRIC)**			
17	1	THROTTLE SHAFT **(MANUAL)**			
18	1	SCREW–Throttle adjustment	Drive Tight		
19	1	SPRING–Idle adjustment **(WME-36 THRU 42A)**			
20	1	SCREW–Idle speed			
	1	SCREW–Idle speed **(WME-63 THRU 67)**			
21	1	FITTING (Part of Ref # 1) **(ELECTRIC)**			
22	1	FITTING (Part of Ref # 1) **(MANUAL)**			
23	1	INLET NEEDLE VALVE			
24	1	GASKET–Nozzle Well			
25	1	FLOAT SHAFT			
26	1	FLOAT			
27	1	GASKET–Fuel bowl			
28	1	FUEL BOWL **(MANUAL & WME-42)**			
	1	FUEL BOWL **(ELECTRIC)**			
29	1	FITTING (Part of Ref # 28) **(MANUAL & WME-42)**			
30	4	SCREW–Fuel Bowl	18		2.1
31	1	MAIN FUEL JET **(.066 - 40 H.P.)**			
	1	MAIN FUEL JET **(.054 - 30 H.P.)**	14		1.6
32	1	SEAL–Drain plug			
33	1	PLUG KIT	22		2.5
34	2	SCREW (M6 x 55)	Drive Tight		
35	1	PLUG–Cap			
36	1	COVER–Carburetor			
37	2	SCREW (M8 x 100) Hex Head Cap	100		11.3
38	1	PLATE–Carburetor			
39	1	ROLLER			

Fuel System Fuel Flow

MANUAL START MODELS



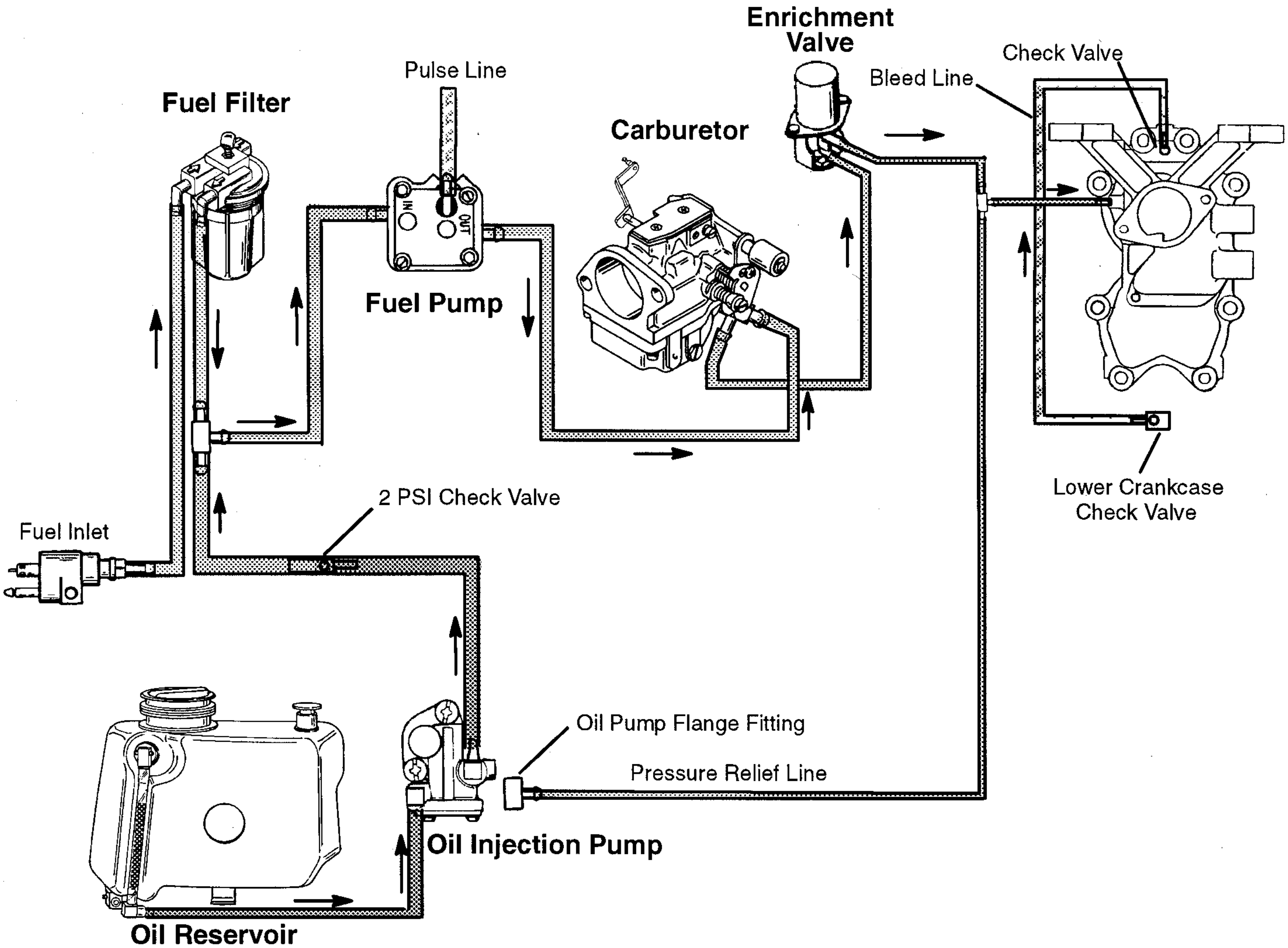
WARNING

All safety precautions should be adhered to when testing the primer bulb system. Fuel should be directed into suitable container and all flammable materials extinguished and sources of spark turned off.

NOTE: *The manual starting primer bulb is designed to provide a rich fuel mixture to the engine during cold start conditions. When the primer bulb is pressed in, fuel is forced from the primer bulb into the intake manifold via hose and fitting on the side of the manifold. When the primer bulb is released , a suction is created in the bulb and fuel is drawn into the bulb though a hose from the carburetor float bowl. Removing the primer hose from the intake manifold and pressing the primer bulb will determine if the primer is working properly as fuel should be expelled from the hose whenever the primer bulb is pressed.*

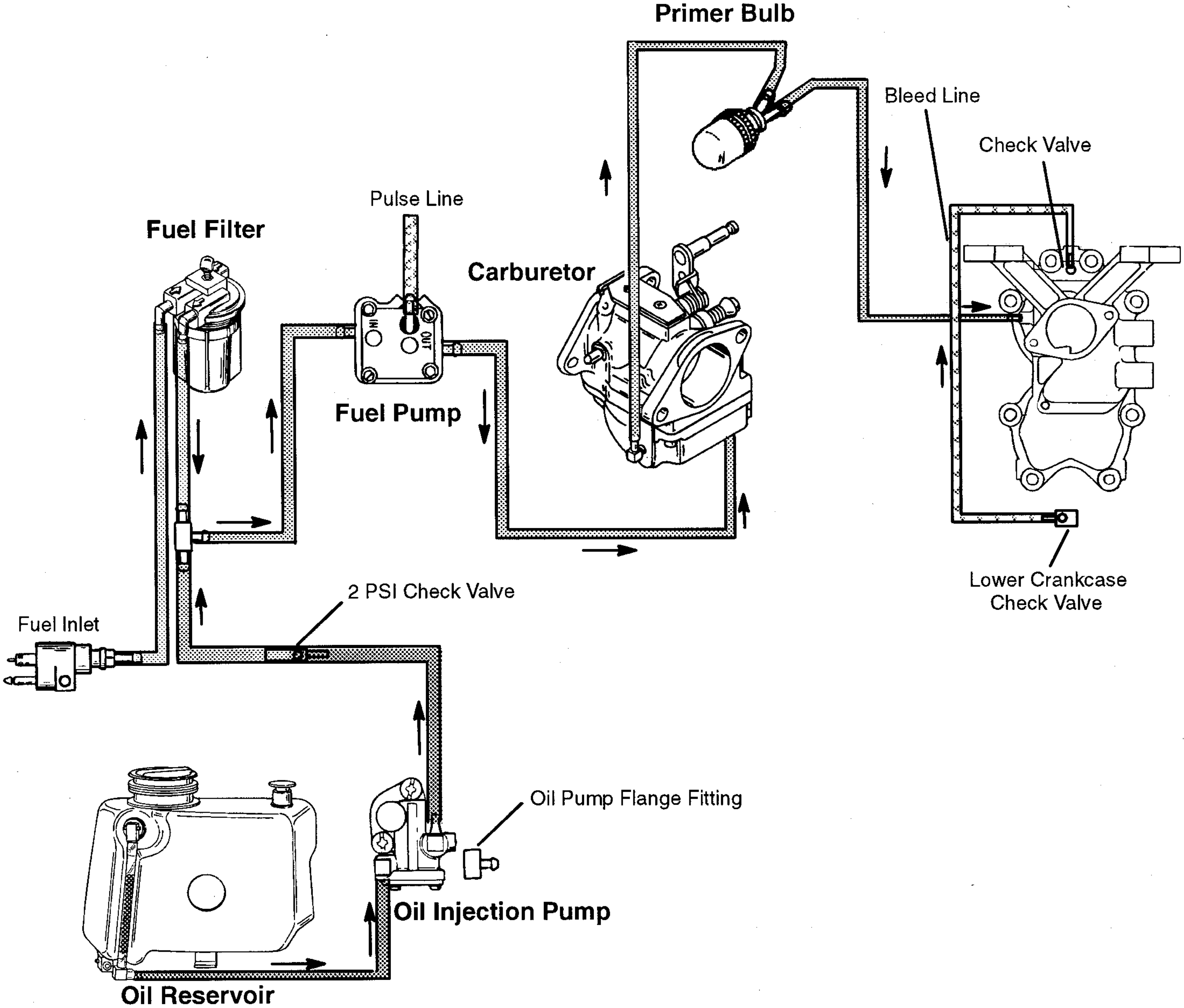
Fuel System Fuel Flow

ELECTRIC START MODELS



Fuel System Fuel Flow

ELECTRIC START TILLER HANDLE MODELS



Carburetor Adjustments

Initial Starting Adjustment

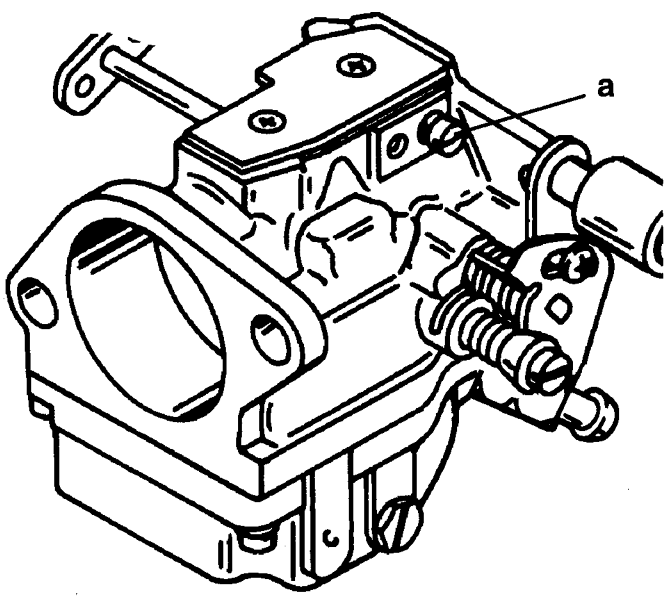
Turn idle mixture screw adjustment “in” (clockwise) until it seats **lightly** then, back off 1-1/2 turns.

Idle Speed Adjustment

1. Adjust engine idle RPM as outlined in Section 2C “Timing/Synchronizing/Adjusting.”

Idle Mixture Screw Adjustment

1. Start engine and allow to warm-up. Throttle back engine to idle for about one minute.
2. With engine running at idle speed in “Forward” gear --turn idle mixture screw IN (clockwise) until engine starts to “bog” down and misfire. Back out 1/4 turn or more.



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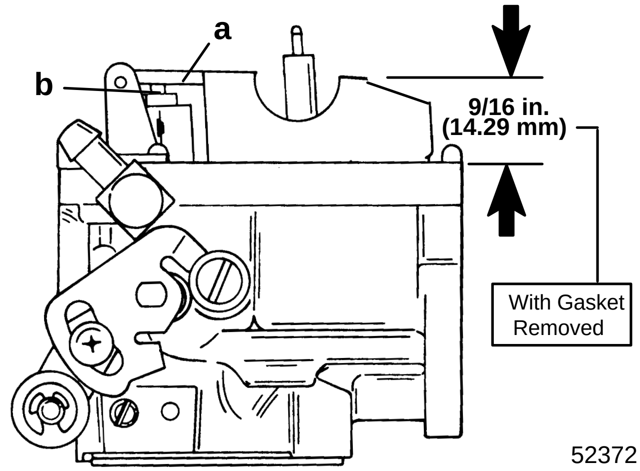
a - Idle Mixture Screw

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. Remove carburetor as outlined in “Carburetor Removal,” following.
2. Remove fuel bowl and gasket and check float level using a carburetor scale.



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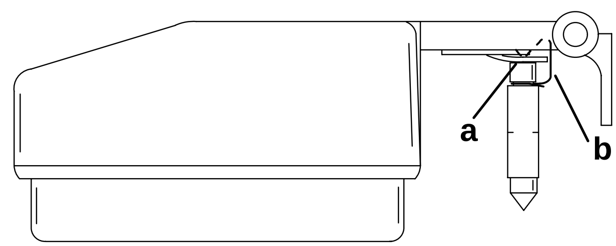
a - Metal Tab
b - Inlet Needle

3. Attach Spring Clip on Inlet Needle to metal float tab and place needle into its seat.



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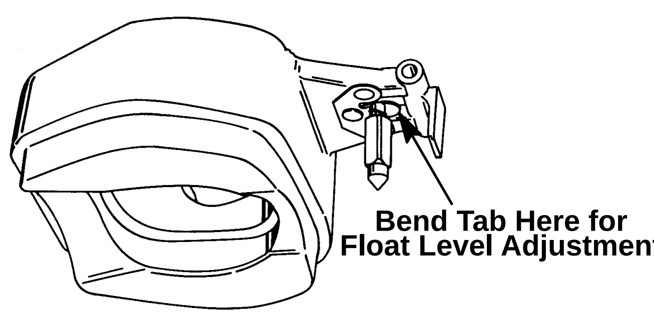
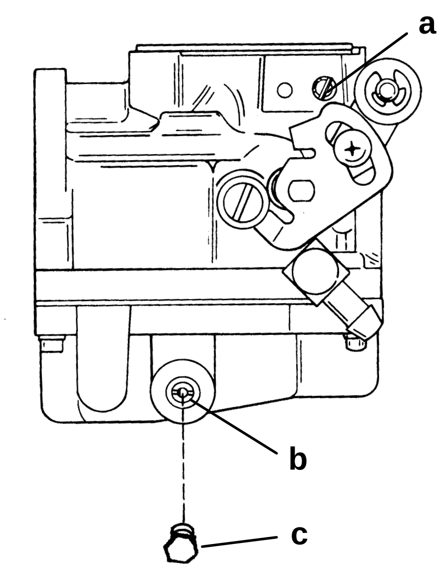
a - Metal Float Tab
b - Spring Clip

4. If necessary, adjust float level by bending metal tab (on float) to which inlet needle is clipped.



Main (High Speed) Jet Adjustment

The carburetor has a fixed high speed jet. 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 enrich the fuel mixture.



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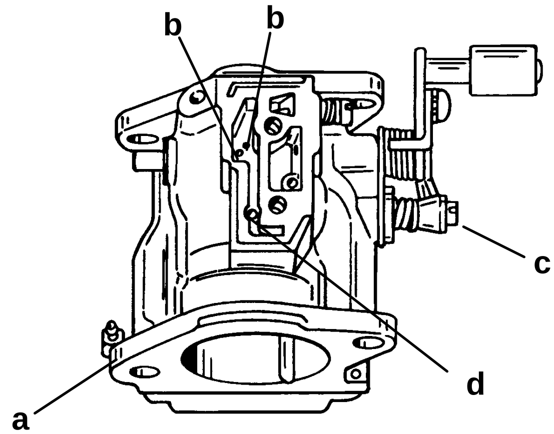
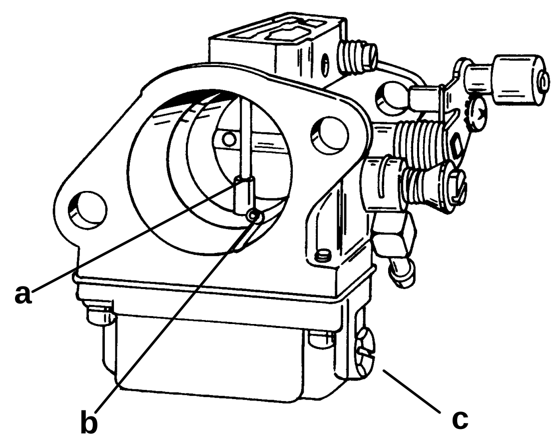
a - Idle Mixture Screw
b - High Speed Jet
c - Bowl Drain (Remove Plug)



a - Carburetor Number Location
b - Off Idle Transfer Ports
c - Idle Speed Screw
d - Idle Pickup Tube



a - Idle Pickup Tube
b - Bowl Vent Tube
c - Main Jet Plug

Rejetting Carburetors For High Altitude Operation

The carburetor jet installed at the manufacturer is for engine operation at sea level through an elevation of 2500 feet (762m) above sea level. If the engine is to be operated at an altitude higher than 2500 feet above sea level, it will be necessary to rejet (remove the carburetor jets and install jets with a different orifice size) the carburetors. Each time the engine is to be operated at a different elevation from the previous time, refer to the "Carburetor Jet Charts" following, and rejet the carburetors for elevation engine will be operated at.

High Altitude Jet Chart	
Engine Operation Elevation (Above Sea Level)	**High Speed Jet Size**
2500' - 5000' (750 - 1500m)	.002" smaller (than standard jet)
5000' - 7500' (1500 - 2250m)	.004" smaller (than standard jet)
7500' and Up (2250m and Up)	.006" smaller (than standard jet)

*Standard Jets listed are for operation of engine from 0 ft-2500 ft. (0-762 M) of elevation.

Fuel System Troubleshooting

General Information

Problems that are thought to be caused by the fuel system may, in reality, be something completely different. Items, that are shown in the list on the right, could give the impression that there is a problem in the fuel system.

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

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

Problem: Engine Turns Over but Will Not Start or Starts Hard When Cold	
Possible Cause	**Corrective Action**
Improper starting procedure used.	Review starting procedure as outlined in “Operation and Maintenance Manual.”
Fuel tank empty or too low. Improperly mixed fuel. Contaminants (water,dirt, etc.) in fuel.	Check fuel in tank and replace or add whichever is necessary.
Fuel tank air vent closed or restricted.	Check air vent on fuel tank. Air vent must be open all-the-way and free from any contaminants.
Pinched, cut, restricted fuel line or loose fuel line connection.	Inspect all fuel lines and replace as needed. Tighten fuel line connections.
Dirty or restricted fuel filter.	Inspect and replace or clean all fuel filters.
Choke solenoid or enrichment valve not operating.	Inspect solenoid or valve and wiring. Replace as required.
Needle and seat in carburetor that is either stuck open (flooding) or closed (no fuel).	Refer to carburetor disassembly in this section.
Improper carburetor jet, restricted jet or idle mixture screw out of adjustment.	Refer to carburetor adjustments in this section.
Improper float level.	Refer to carburetor adjustments in this section.
Low fuel pump pressure.	Refer to Section 3B for Fuel Pump Testing.
Defective anti-siphon valve.	Refer to Section 3B.

Possible Cause	Corrective Action
Improperly mixed fuel. Contaminants(water, dirt, etc.) in fuel.	Check fuel in tank and replace if necessary.
Fuel tank air vent closed or restricted.	Check air vent on tank. Vent must be open all-the-way and free from any contaminants.
A pinched, cut or restricted fuel line. Also loose fuel line connection.	Inspect all fuel lines and replace as needed. Inspect and tighten all fuel line connections.
Dirty or restricted fuel filter.	Inspect and replace or clean all fuel filters.
Low fuel pump pressure.	Refer to Section 3B “Fuel Pumps.”
Defective anti-siphon valve.	Refer to Section 3B “Fuel Pumps.”
Needle and seat in carburetor that is either stuck open or closed.	Refer to carburetor adjustments in this section.
Improper carburetor jet, restricted jet or idle mixture screw out of adjustment.	Refer to carburetor adjustments in this section.
Improper float level.	Refer to carburetor adjustments in this section.
Carburetor loose on intake manifold.	Check tightness of carburetor nuts.
Reed block loose or gasket defective.	Using a pressure oil can, apply 2-cycle oil around reed block housing/crankcase housing matching surfaces and carburetor base. If engine RPM changes, tighten bolts/nuts or replace gaskets as required.
Improperly routed or restricted bleed hose(s).	Refer to bleed hose routing in “Powerhead” section.
Damaged fuel pump diaphragm.	Refer to Section 3B, “Fuel Pump.”
Carburetor mixing chamber cover leaking air.	Tighten screws or replace gasket.
Off idle holes plugged.	Blow with compressed air.
Main nozzle or idle nozzle air bleed holes plugged.	Blow with compressed air.
Damaged reeds.	Refer to Section 4A for reed inspection.
Fuel pick-up outlet tube in fuel tank cracked.	Replace

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

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.	Inspect cowl air inlet and carburetor for obstructions.
Main fuel jet loose.	Re-tighten jet.

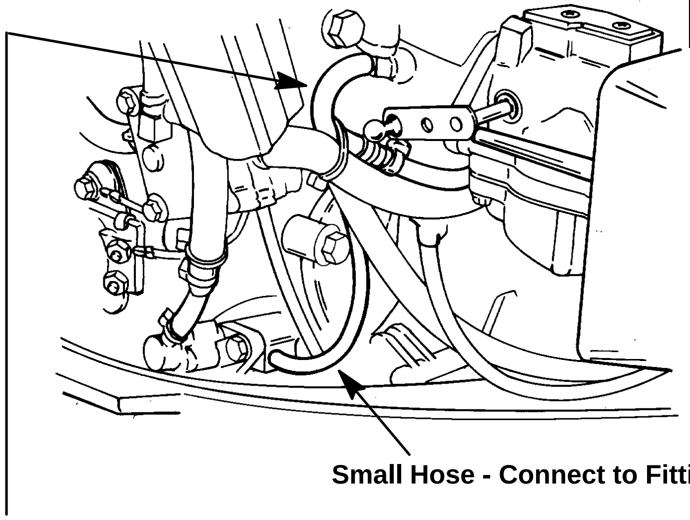
Problem: Fuel Blow back Out of Carburetor Problem: Unable to Reduce Engine RPM to Slow Idle	
Possible Cause	**Corrective Action**
Chipped or broken reeds on reed block.	Replace reeds.
Problem: Rough Idle	
Possible Cause	**Corrective Action**
Excessive pre-load on reeds.	Replace reeds.

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 is too low.	Reset float level.
Clogged high speed jet.	Inspect jet for varnish or debris and clean.
Restricted fuel flow to carburetor.	Check fuel lines and 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 richer (turn idle mix screw counterclockwise).
Air leakage into fuel system.	Inspect fuel line connections, hose clamps, fuel pump and fuel outlet tube (located in fuel tank) for loose fittings.
Anti-siphon valve restricting fuel flow.	Refer to Section 3B for checking for restriction of fuel flow caused by anti-siphon valve.

Enrichener System (Electric Start Models)

The enrichener system provides the engine with extra fuel charge for ease of starting cold engine. The system consists of an electrically operated enrichener valve which is connected by a hose to the intake manifold.

The enrichener system is pressurized by squeezing the fuel line primer bulb or by the fuel pump when the engine is being cranked. When the ignition key is turned to the “on” position and pushed in (and held in), current is sent to the valve causing it to open, which allows pressurized fuel to pass thru a hose to a fitting on the intake manifold. When the key (or choke button) is released, the valve will return to the closed position. The valve can be operated manually by pressing and holding button located at bottom of valve. The small hose connected to fitting at the base of the oil pump relieves excess crankcase pressure at the oil pump drive.



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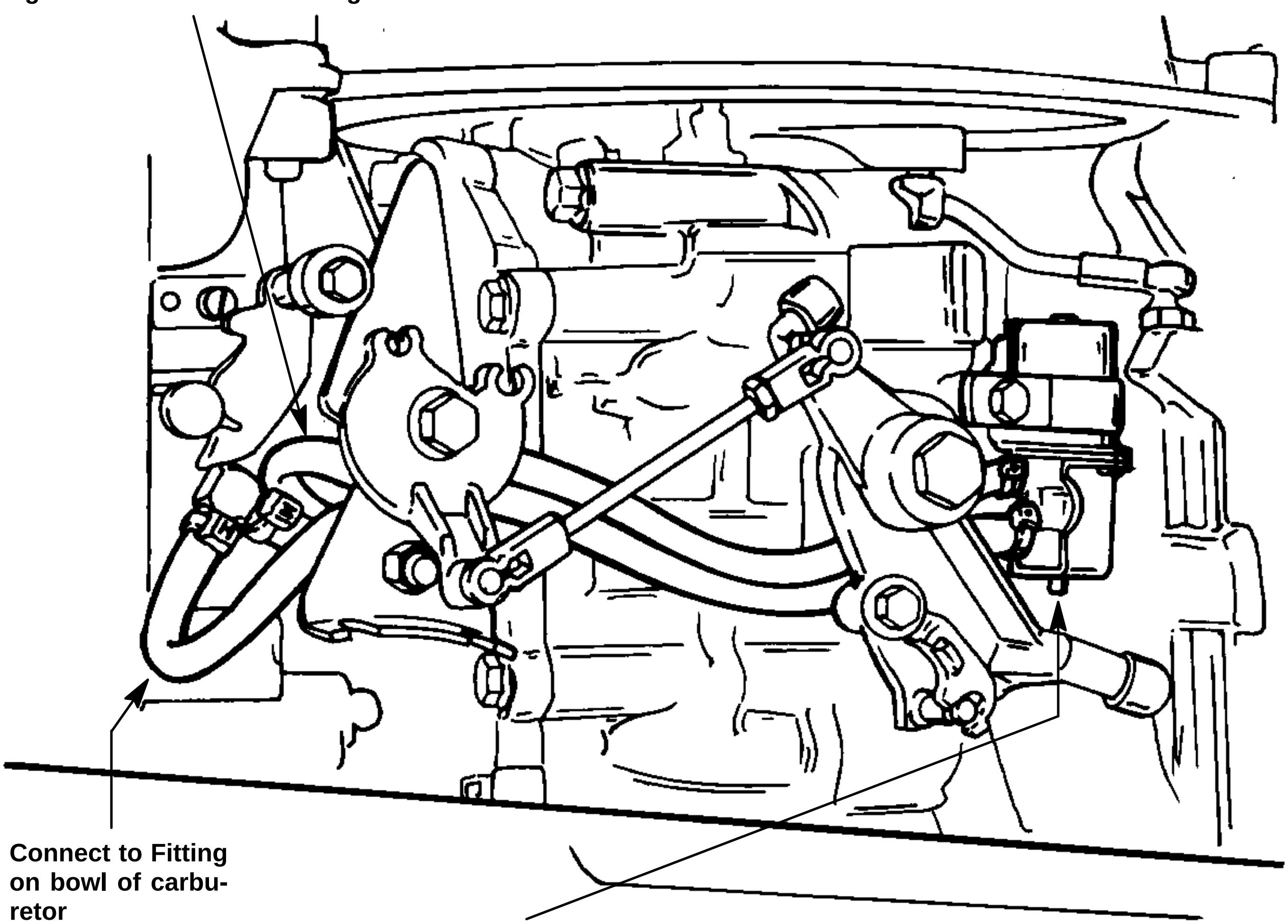
Small Hose - Connect to Fitting at Base of Oil Pump

Large Hose - Connect to Fitting on Intake Manifold



Connect to Fitting on bowl of carburetor

Enrichener Valve Manual Operation Button

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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.

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.

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 connections(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.

Fuel Flow from Fitting
Valve is O.K. Check hoses and fittings from valve to carburetor 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 fittings for leaks or obstructions.

FUEL SYSTEM

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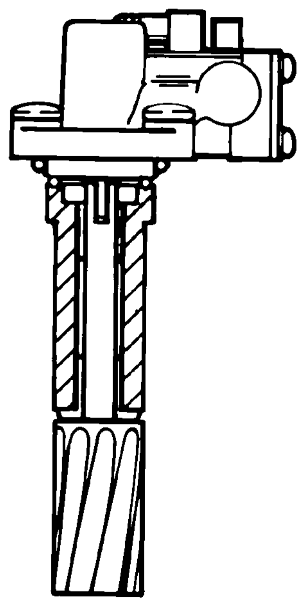


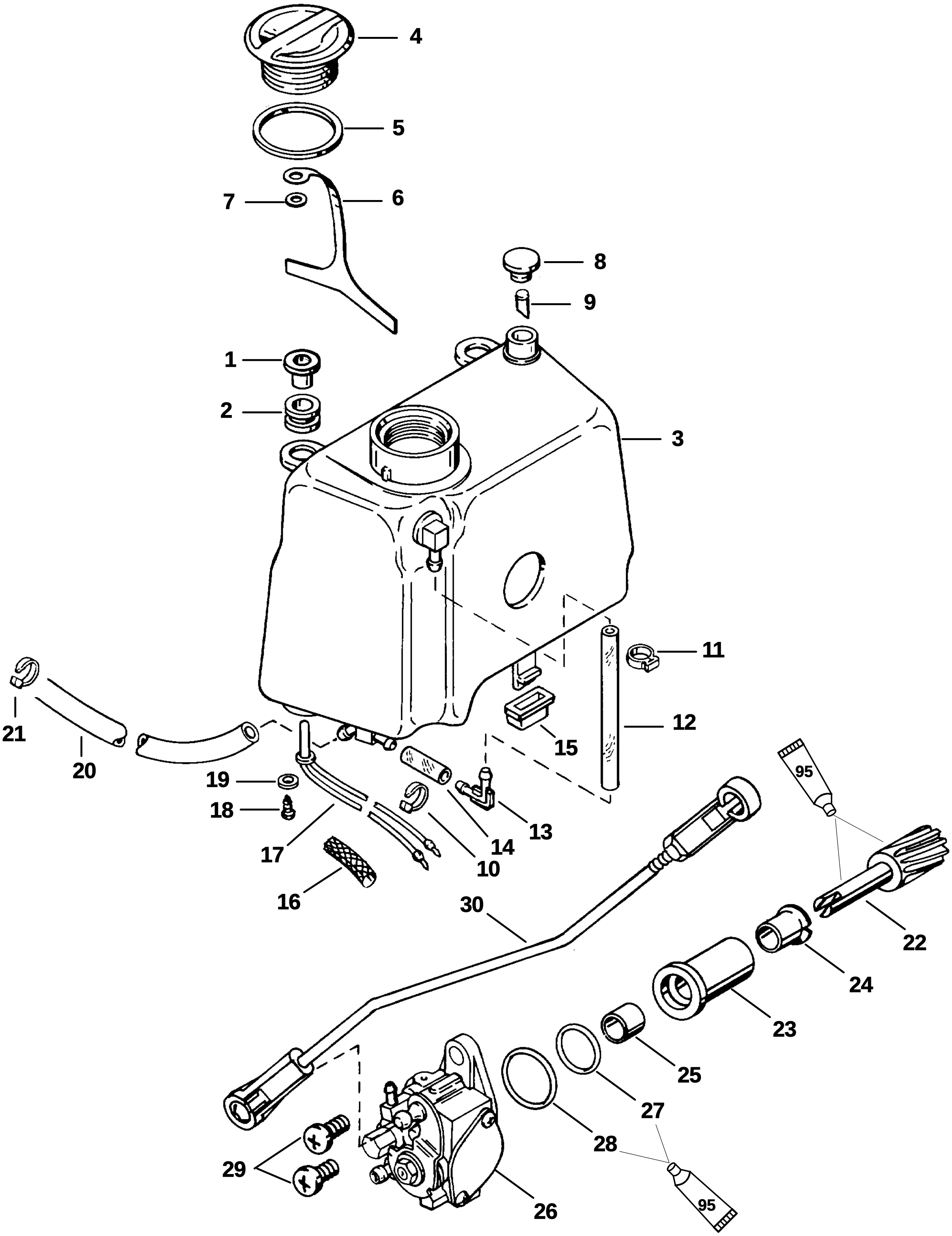
OIL INJECTION

Table of Contents

Specifications

Oil Injection	**Recommended Oil**	Quicksilver TC-WII or TC-W III 2- Cycle Outboard Oil
	Oil Tank Capacity/Approx. Time	50.5 fl. oz. (1.5 Liters) 4.7 Hours @ 5250 RPM
	Reserve Capacity/Approx. Time	30 Minutes @ 5250
	Output w/Pump @ Full Open	8.5cc/10 Minutes @ 900 RPM

Oil Injection Components



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

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	2	BUSHING-Flanged			
2	2	GROMMET			
3	1	OIL TANK ASSEMBLY			
4	1	CAP ASSEMBLY			
5	1	GASKET			
6	1	RETAINER			
7	1	NUT-Push			
8	1	VENT ASSEMBLY			
9	1	VALVE			
10	2	STA-STRAP			
11	2	CLAMP			
12	1	TUBING (4-3/4 IN.)			
13	1	ELBOW			
14	1	TUBING (1-1/4 IN.)			
15	1	GROMMET			
16	1	SPACER			
17	1	SWITCH			
18	1	SCREW (.164-18 x .375)			
19	1	WASHER			
20	1	TUBING (10”)			
21	1	STA-STRAP			
22	1	DRIVEN GEAR			
23	1	BEARING ASSEMBLY			
24	1	BUSHING (FLANGED)			
25	1	BUSHING			
26	1	OIL INJECTION PUMP			
27	1	O RING			
28	1	O RING			
29	2	SCREW (M5 x 20)	50		5.6
30	1	LINK			

Theory of Operation

The oil injection system delivers a oil mixture thru a variable ratio oil pump.

The engine mounted oil reservoir holds 50.5 (1.5 Liters) which will provide 4.5 hours of running time at wide open throttle.

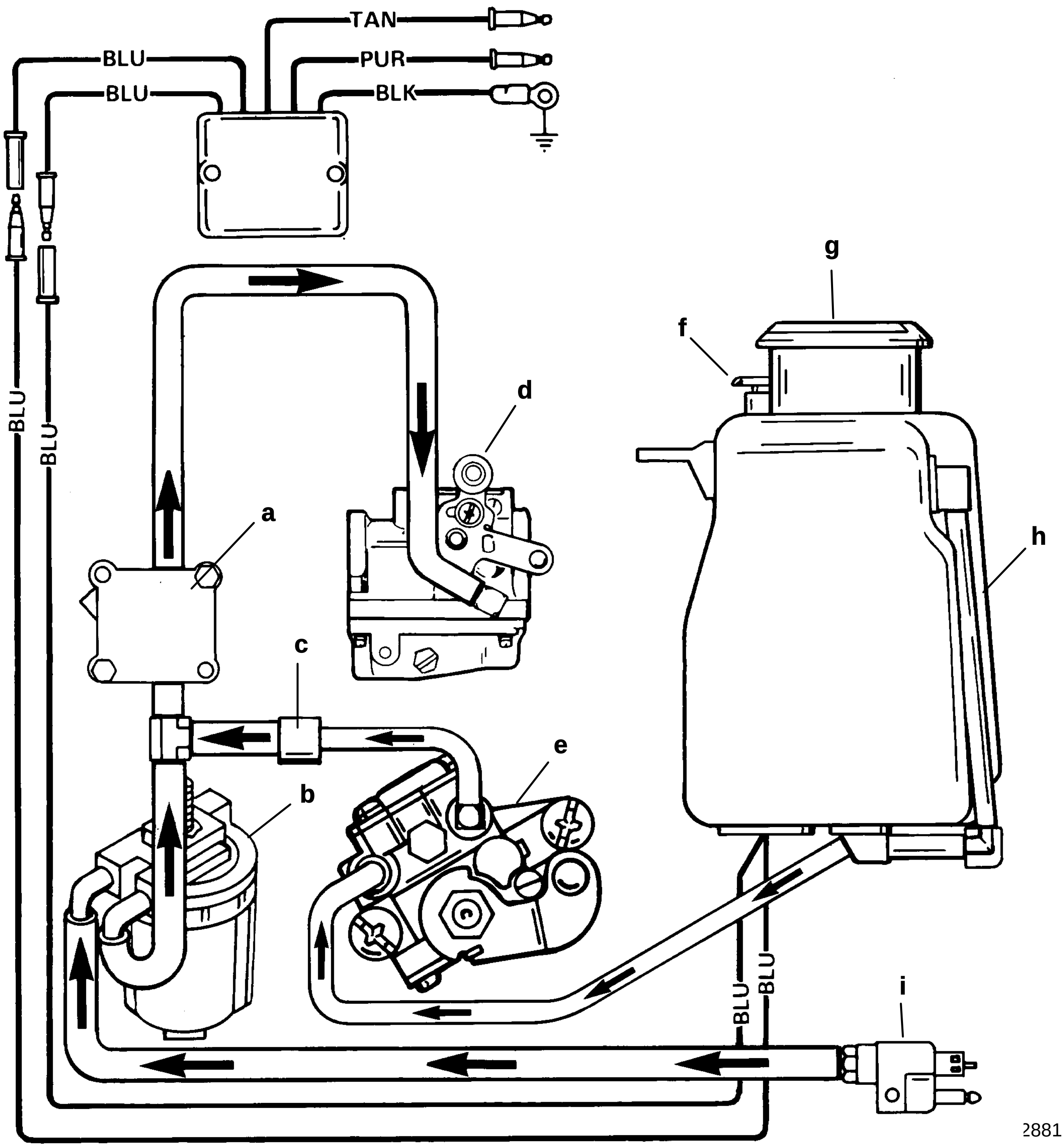
A low oil warning horn will be activated when 7 fl. oz. (200cc) of oil remains in the reservoir. This will provide approximately 30 minutes of wide open throttle running before oil is depleted.

The crankshaft driven oil pump injects oil into the fuel before the fuel pump.

Oil Injection System

1. **Oil Reservoir**
   The oil reservoir gravity feeds oil to the oil pump. The reservoir contains a low oil sensor which activates a warning horn when 7 fl. oz. (200cc) of oil remains in the reservoir.
2. **Oil Injection Pump**
   The crankshaft driven oil pump is a variable ratio oil pump which provides an oil/fuel mixture of 100:1 @ idle and 60:1 @ WOT.
3. **Check Valve Vent**
   Provides air to oil reservoir for proper venting and also prevents oil leaks when outboard is tilted forward.
4. **2 PSI Check Valve**
   This valve prevents gasoline from being forced into oil line.
5. **Low Oil Sensor**
   When oil level in reservoir drops to approximately 7 fl. oz. (200cc), the sensor will signal warning module to activate warning horn.
6. **Timing and Protection Module (TPM) for (S/N-0G589999 & Below)**
   If the oil in the reservoir drops to less than 7 fl. oz. (200 cc), the low oil sensor in the reservoir will signal the warning module to activate the warning horn. If the powerhead temperature should exceed 190°±8°F (88°±13°C), the overheat temperature sensor in the water jacket cover will signal the warning module to activate the warning horn.

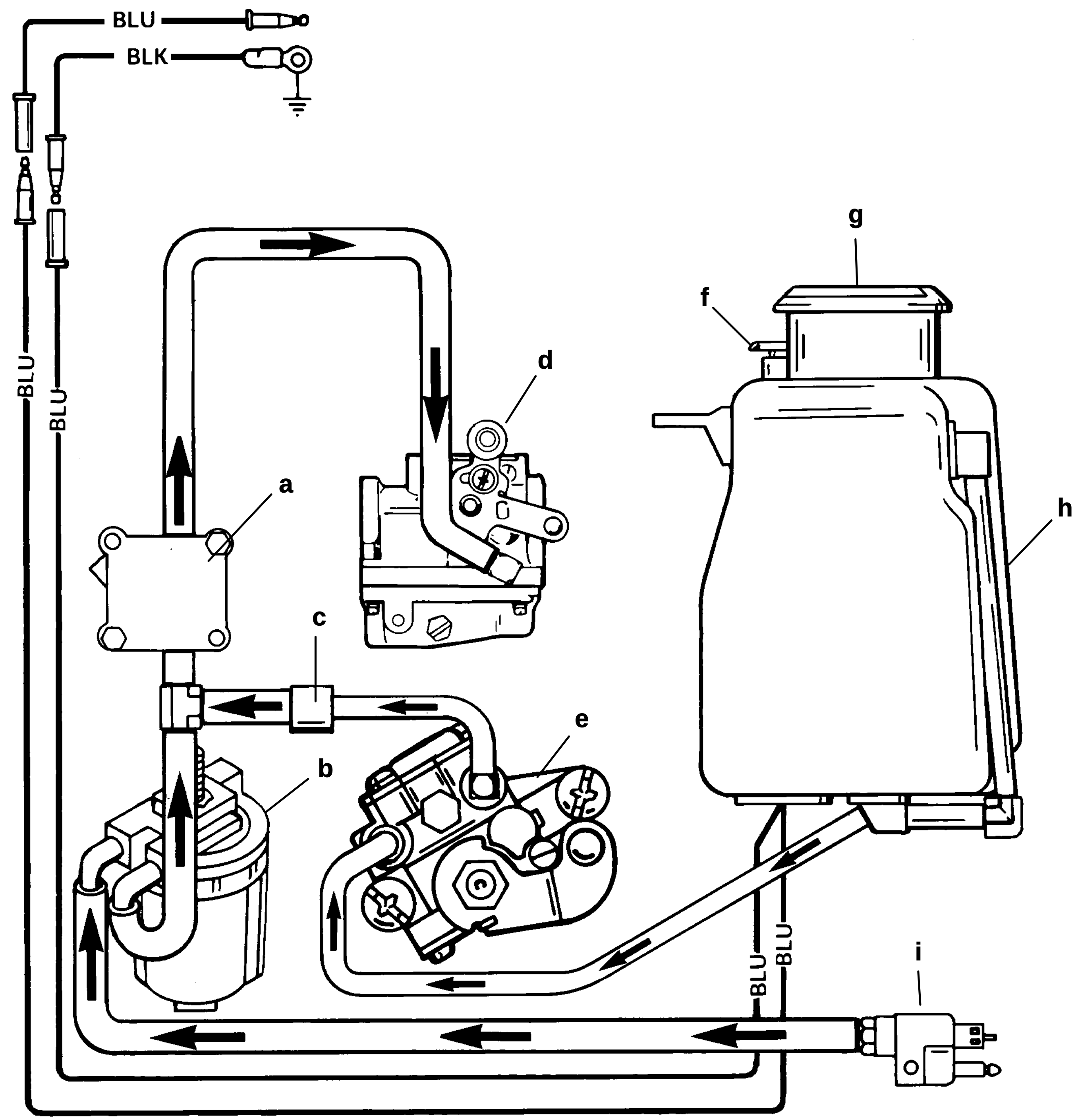
Oil Injection Flow System (Variable Ratio Oil Pump) S/N-0G589999 & Below



a - Fuel Pump
b - Fuel Filter
c - Check Valve (2 PSI)
d - Carburetor
e - Oil Pump

f - Vent
g - Fill Cap
h - Oil Level Sight Gauge
i - Fuel Line Connector

Oil Injection Flow System (Variable Ratio Oil Pump) S/N-0G590000 & Above



a - Fuel Pump
b - Fuel Filter
c - Check Valve (2 PSI)
d - Carburetor
e - Oil Pump

f - Vent
g - Fill Cap
h - Oil Level Sight Gauge
i - Fuel Line Connector

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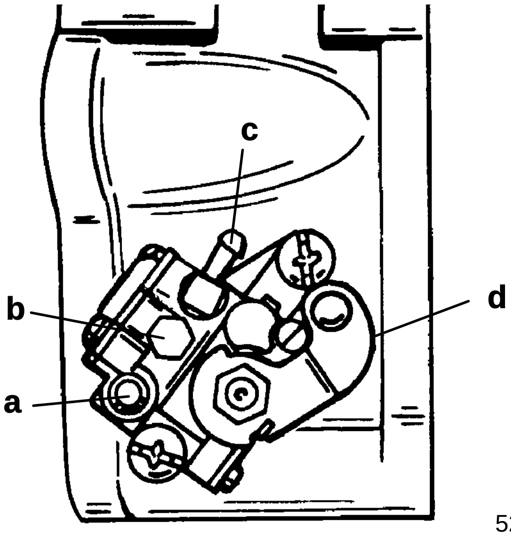
Pump Drive Assembly (Variable Ratio Oil Pump)



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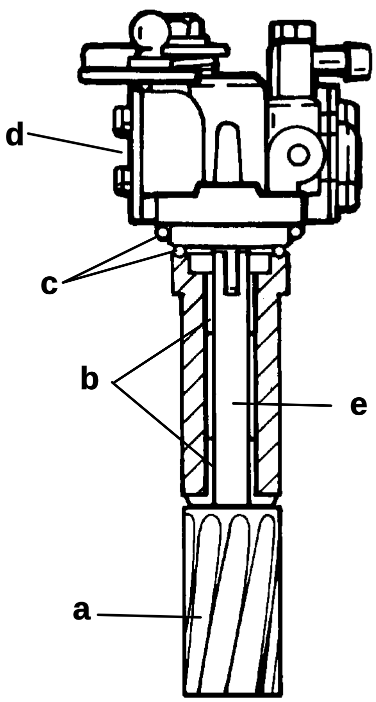
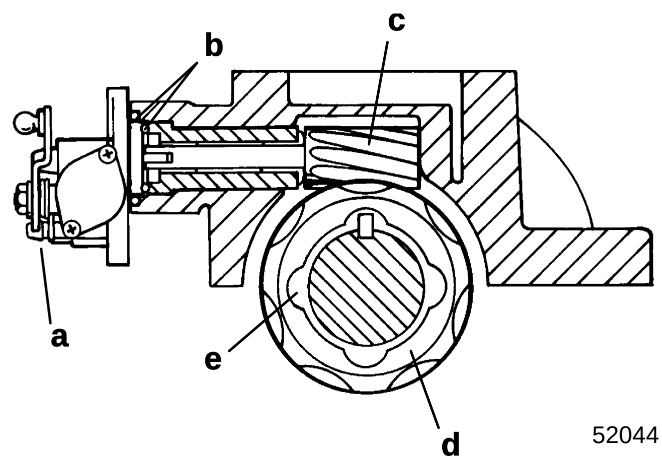
a - Oil Inlet
b - Bleed Screw
c - Oil Outlet
d - Oil Pump



52044

a - Driven Gear
b - Bushing (2)
c - O-ring (2)
d - Oil Pump
e - Apply Needle Bearing Assembly Lubricant to Shaft



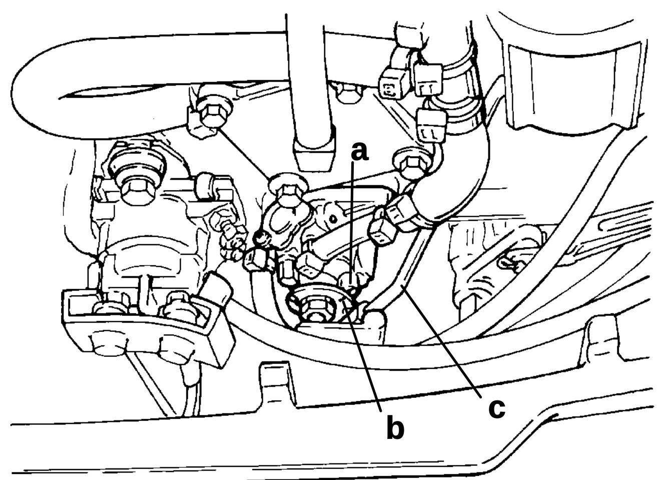
52044

a - Oil Pump
b - O-Ring (2)
c - Driven Gear
d - Drive Gear
e - Crankshaft

Adjustments

Carburetor/Oil Pump Synchronization

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.



52899

a - Mark on Body
b - Mark on Lever
c - Link Rod

Troubleshooting

Bleeding Air From Oil Injection System

⚠ CAUTION

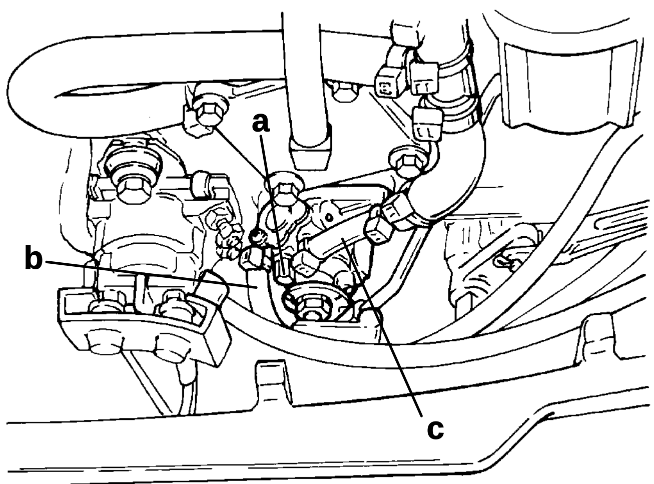
If air exists in either oil pump hose (inlet or outlet), the air MUST BE bled from hose(s) or engine damage may occur.

BLEEDING AIR FROM OIL PUMP INLET HOSE

With engine not running, place a shop towel below oil pump. Loosen bleed screw three to four turns and allow air bubbles to exit inlet hose. Torque bleed screw to 25 lb. in. (2.8 N·m). This procedure also allows oil pump to fill with oil.

BLEEDING AIR FROM OIL PUMP OUTLET HOSE

Purge air from outlet hose by running engine (on 50:1 gasoline/oil mixture in fuel tank) at idle speed until no air bubbles are present in outlet hose.



52899

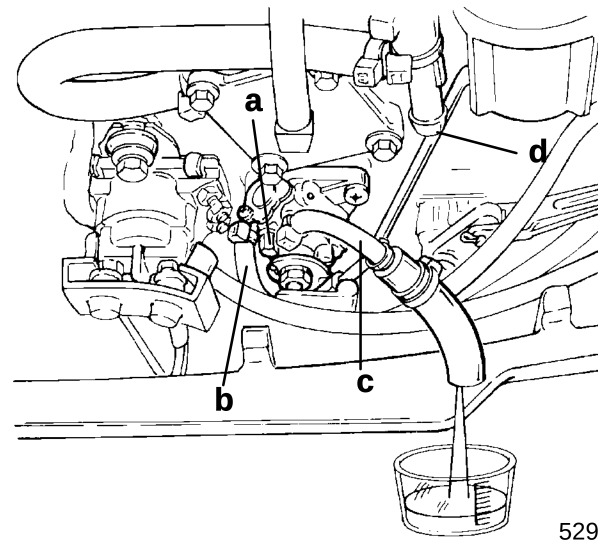
a - Bleed Screw
b - Inlet Hose
c - Outlet Hose

Oil Pump Volume (Flow) Test

⚠ WARNING

The input fuel line TEE fitting from which the oil line was removed MUST BE CAPPED OFF to prevent fuel leakage while the engine is running.

NOTE: *The following specifications are determined with the outboard running off a remote fuel supply with pre-mix fuel. The oil pump output hose (clear) must be disconnected from the input fuel line TEE fitting and directed into a graduated container. The input fuel line TEE fitting from which the oil line was removed MUST BE CAPPED OFF to prevent fuel leakage while the engine is running.*



52900

a - Bleed Screw
b - Inlet Hose
c - Outlet Hose
d - Cap Off

Flow specifications are as follows:

@ 900 RPM with oil pump link arm DISCONNECTED and pump arm rotated FULL CLOCKWISE and HELD AGAINST PUMP CASTING = 8.5cc ± 10% in 10 minutes.

POWERHEAD

4

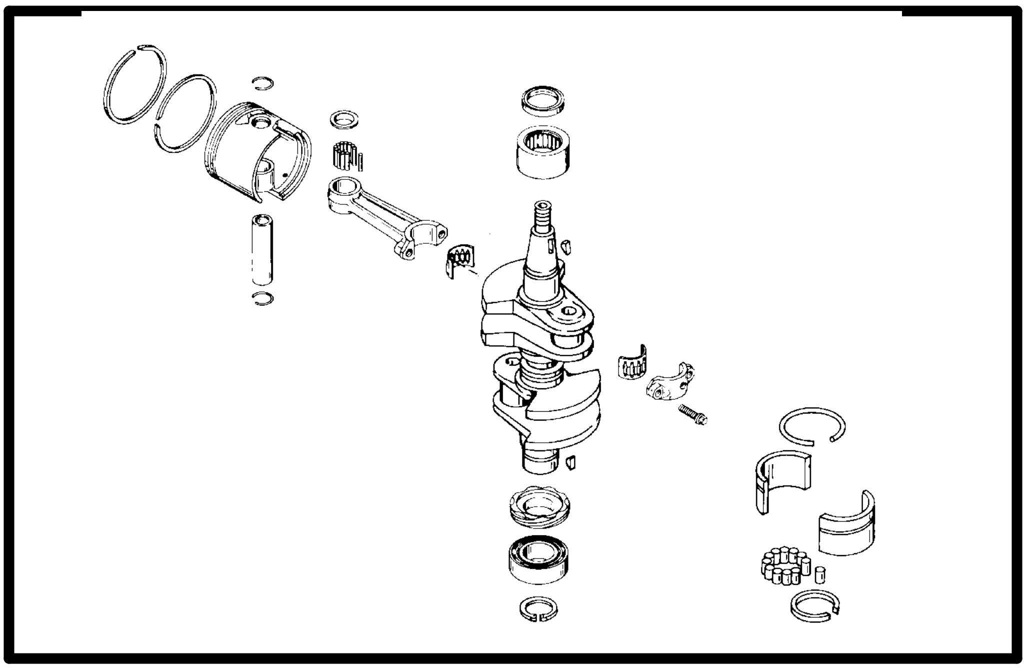


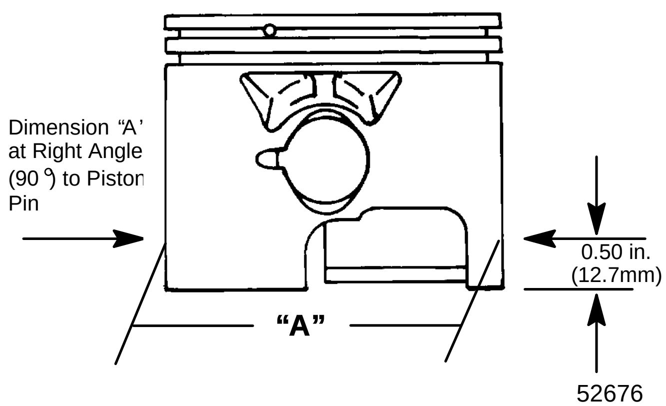
Table of Contents

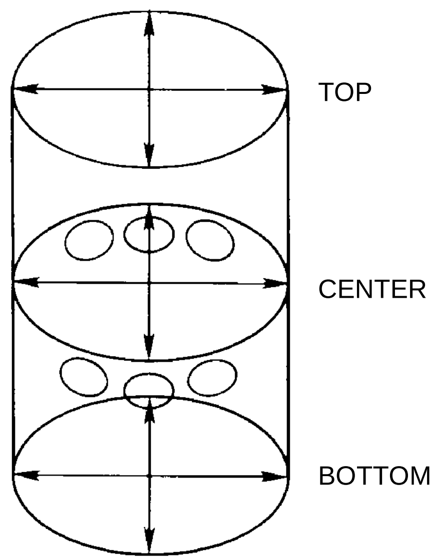
Specifications

BLOCK	**Type** **Displacement**	2 Cyl. Loop Charged 39.3 cu. in. (644.4cc)
REED VALVE OPENING	**Opening (Max. Allowable)**	0.020 in. (0.50mm)
STROKE	**Length**	2.796 in. (71.0mm)
CYLINDER BORE	**Dia. Standard** **Taper/Out of Round Max**	2.993 in. (76.0mm) 0.003 in. (0.08mm)
PISTON	**Dia. Standard***	2.988 in. (75.90mm)
PISTON RING	**End Gap**	0.010 in. to 0.018 in. (0.254mm to 0.457mm)
WATER PRESSURE	**With Thermostat + Poppet** **@ Idle** **@ W.O.T.** **All Models W/O Thermostat + Poppet** **@ Idle** **@W.O.T.** **Poppet Valve Opening 1994-1997** **Poppet Valve Opening 1998 & Newer**	 1/2 - 1-1/2 PSI @750 RPM 5 - 7 PSI @ 5000 RPM 0 - 1 PSI @ 750 RPM 5 - 7 PSI @ 5000 RPM 900-1000 RPM 3000-3500 RPM

*See important information below.

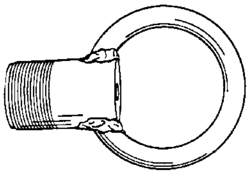
IMPORTANT: Using a micrometer, measure dimension "A" at location shown. Dimension "A" should be 2.988 in. ± .001 for a STANDARD size piston.



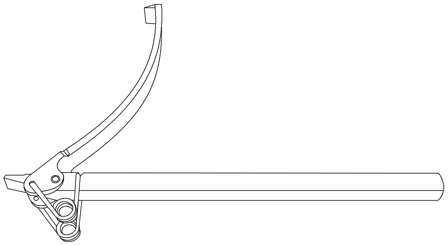


Special Tools

1. Lifting Eye 91-90455



2. Flywheel Holder 91-52344



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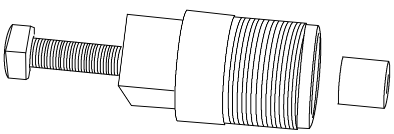
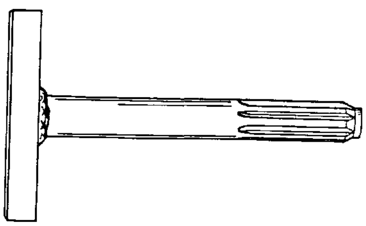
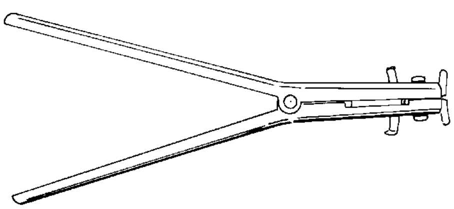
3. Flywheel Puller 91-73687A1



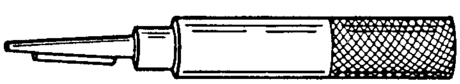
4. Powerhead Stand 91-827001A1



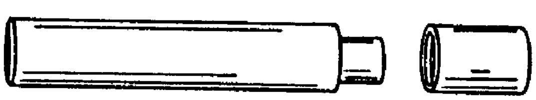
5. Piston Ring Expander 91-24697



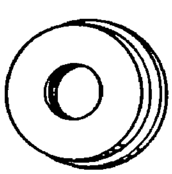
6. Lock Ring Removal Tool 91-52952A1



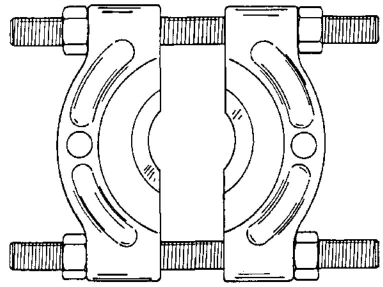
7. Piston Pin Tool 91-74607A2



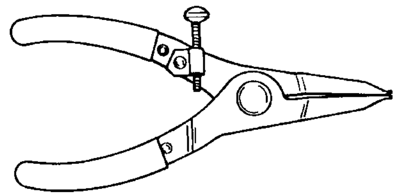
8. Driver Head 91-55919



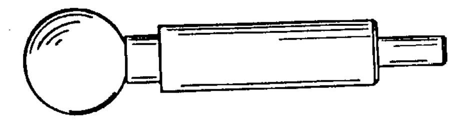
9. Universal Puller Plate 91-37241



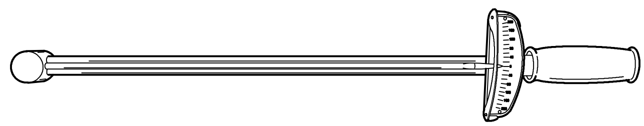
10. Snap Ring Pliers 91-24283



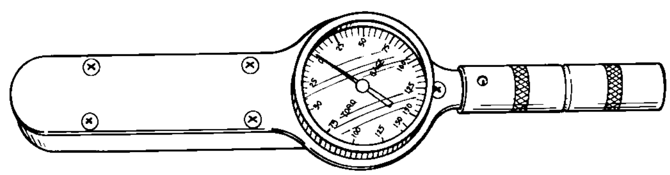
11. Piston Lock Ring Installer 91-77109A1



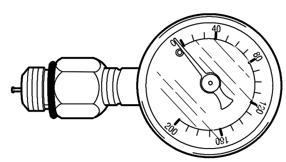
12. Torque Wrench (0-200 lb. ft.) 91-32610*



13. Torque Wrench (0-150 lb. in.) 91-66274*



14. Compression Tester 91-29287



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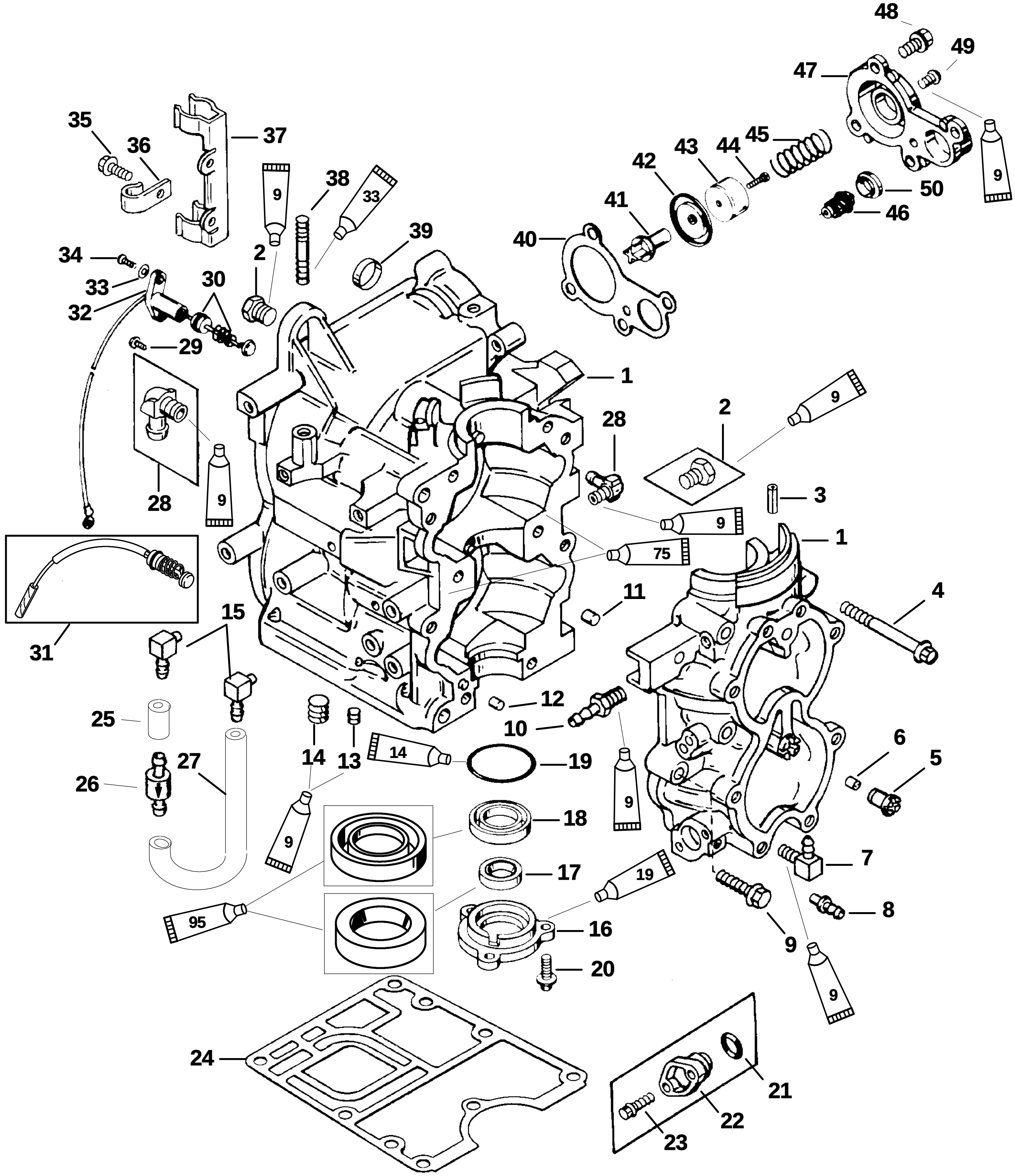
Notes:

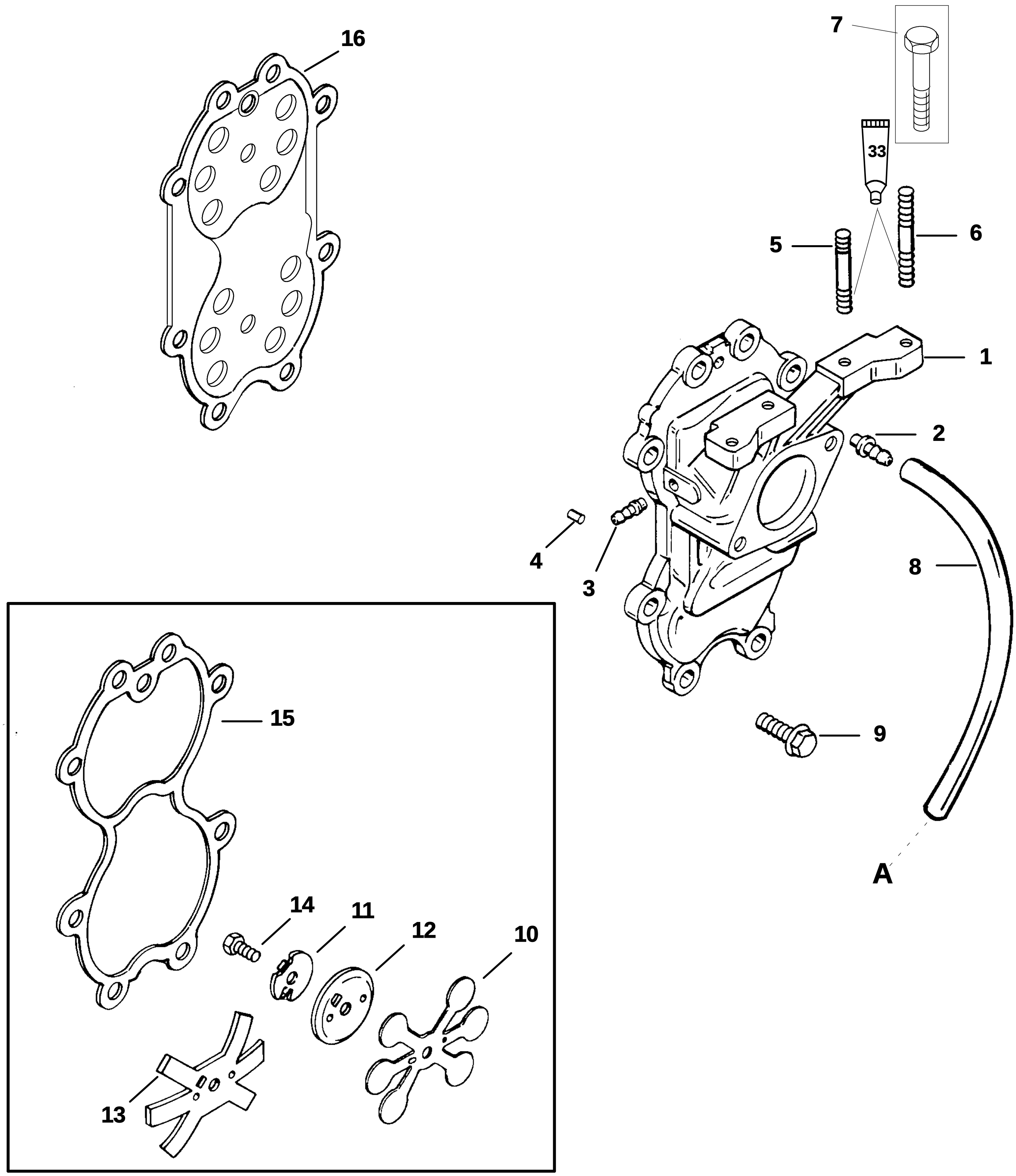
Cylinder Block Components



9	Loctite Pipe Sealant with Teflon (592)
14	2 Cycle Outboard Oil (92-13249A24)
19	Perfect Seal (92-34227-1)
33	Loctite "RCA/680" Retaining Compound (92-809833)
75	Loctite "518" Master Gasket (92-12564-2)
95	2-4-C With Teflon (92-825407A12)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
1	1	CYLINDER BLOCK			
2	2	PIPE PLUG (1/8 Hex Head-Brass)			
3	1	ROLL PIN (Used on models prior to 1998)			
4	6	SCREW (M8 x 80 Hex flange head)	200	16.5	22.4
5	1	CARRIER ASSEMBLY			
6	1	CHECK VALVE			
7	1	CHECK VALVE			
8	1	FITTING **(BARBED-ELECTRIC)**			
9	4	SCREW (M8 x 40 Hex Flange Head)	200	16.5	22.4
10	1	CONNECTOR (Male)			
11	2	PIN-CENTER MAIN			
12	1	DOWEL PIN			
13	1	PIPE PLUG (1/8 IN.-Brass)			
14	1	PIPE PLUG (3/8-18)			
15	2	ELBOW			
16	1	END CAP			
17	1	OIL SEAL			
18	1	OIL SEAL			
19	1	O RING			
20	3	SCREW (M8 x 1.25 x 20 Hex flange head)	200	16.5	22.4
21	1	O RING (Included with Ref #1)			
22	1	COVER **MANUAL**			
23	2	SCREW (M5 x .8 x 20 Hex Washer Head)			
24	1	GASKET-Cylinder block (Inc. w/ Ref #1)			
25	1	TUBING (1-1/2 IN.)			
26	1	CHECK VALVE (Double End)			
27	1	TUBING (5-1/2 IN.)			
28	1	ELBOW (1/8-MALE)			
29	1	SCREW (#10-16 x .60 Self Tap)	Drive Tight		
30	1	SENDER-Temperature **(DESIGN I)**			
31	1	SENDER-Temperature **(DESIGN II)**			
32	1	RETAINER-Sender			
33	1	WASHER			
34	1	SCREW (#10-16 x .60 Self Tap)	Drive Tight		
35	2	SCREW (Qty. of 4 on Electric)			
36	1	CLAMP **ELECTRIC**			
37	1	CLAMP			
38	2	STUD (M6 x 1 x 44 Double end)			
39	1	PLATE-SERIAL #			
40	1	GASKET-Poppet cover (Included with Ref #1)			
41	1	POPPET			
42	1	DIAPHRAGM			
43	1	WASHER (Special)			
44	1	SCREW (# 10-16 x .75)			
45	1	SPRING **(S/N-USA-0G590000 /BEL-9973100 & Above)**			
46	1	THERMOSTAT (130 Degrees)			
45	1	SPRING **(S/N-USA-0G589999 /BEL-9973099 & Below)**			
46	1	THERMOSTAT (120 Degrees)			
47	4	COVER			
48	1	SCREW (M8 x 1.25 x 25) (Incl. w/ Ref #1)	200	16.5	22.4
49	1	SCREW (8-18 x .31 Self Tap) **(International)**	Drive Tight		
50	1	GASKET-Thermostat (Included w/ Ref #1)			

INDUCTION MANIFOLD

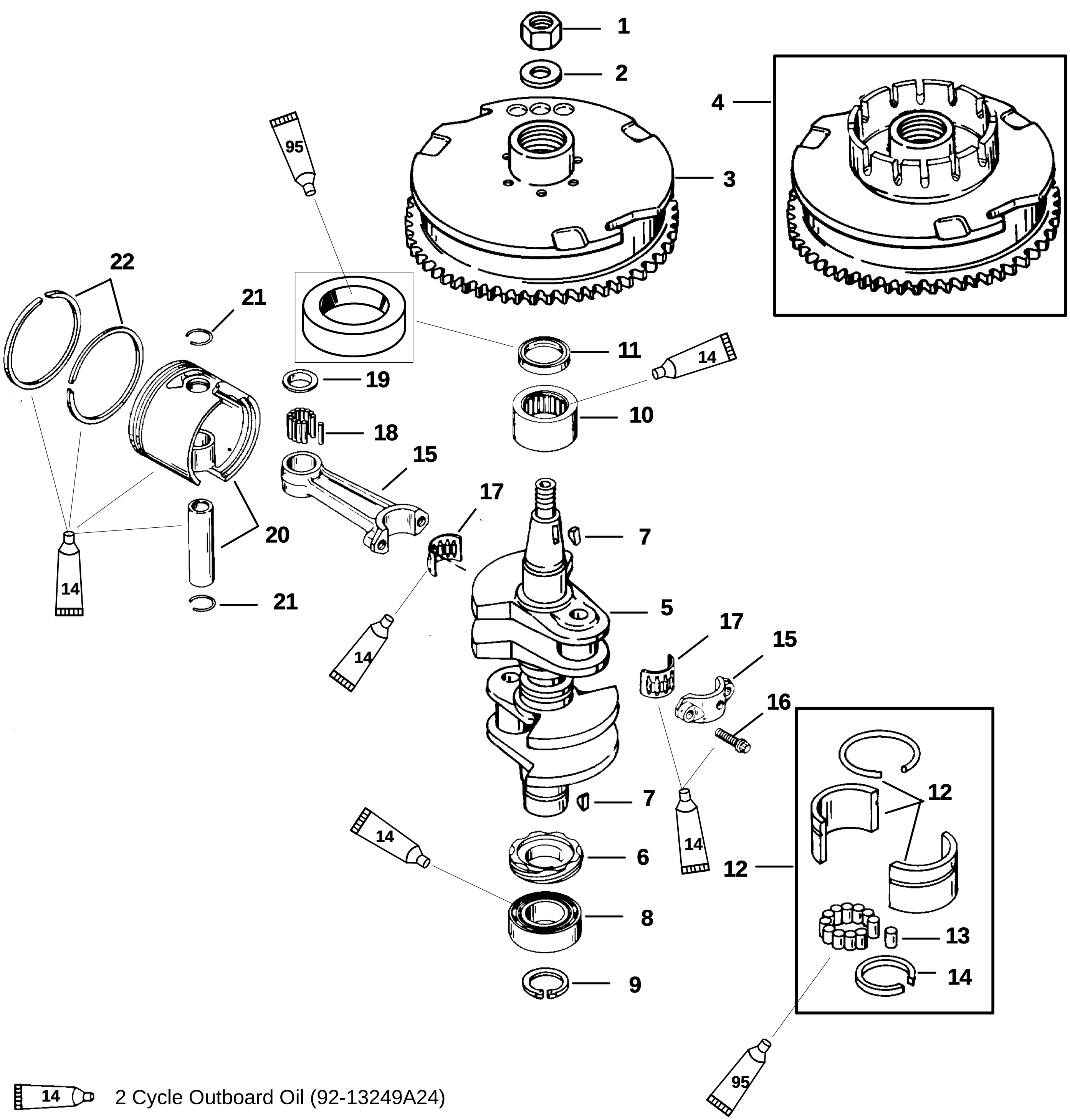


33 Loctite 680 (92-809833)

A = TO BASE OF OIL PUMP

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	INDUCTION MANIFOLD **(S/N-0G380074/ BEL-9905360 & BELOW)**			
	1	INDUCTION MANIFOLD **(S/N-0G380075/ BEL-9905361 & ABOVE)**			
2	1	CHECK VALVE			
3	1	FITTING (Barbed)			
4	4	DOWEL PIN (Component of Ref #1) **(S/N-0G380074/ BEL-9905360 & BELOW)**			
5	2	STUD (M6 x 1 x 44)			
6	2	STUD (M6 x 1 x 55)**(STUD ATTACHING)**			
7	2	SCREW (M6 x 40)**(SCREW ATTACHING)**			
8	1	TUBING (12 1/2 IN.)			
9	8	SCREW (M8 x 30) **(S/N-OG380075/ BEL-9905361 & UP)**	200	16.5	22.4
	8	SCREW (M8 x 1.25 x 25 Hex flange head)	200	16.5	22.4
10	2	REED ASSEMBLY			
11	2	TAB WASHER **S/N-USA-0G380074/BEL-(30)-9905360/ BEL-(40)-9905385 & BELOW**			
12	2	RETAINER–Reed **(40 H.P.)**			
13	2	RETAINER–Reed **(30 H.P.)**			
14	2	SCREW (M6 x 1 x 16 Hex head cap)	100		11.3
15	1	GASKET–Manifold			
16	1	REED VALVE **(30 H.P.)** **S/N-USA-0G380075/BEL-9905361 & ABOVE**			
	1	REED VALVE **(40 H.P.)** **S/N-USA-0G380075/BEL-9905386 & ABOVE**			

CRANKSHAFT/PISTON/FLYWHEEL



14 2 Cycle Outboard Oil (92-13249A24)

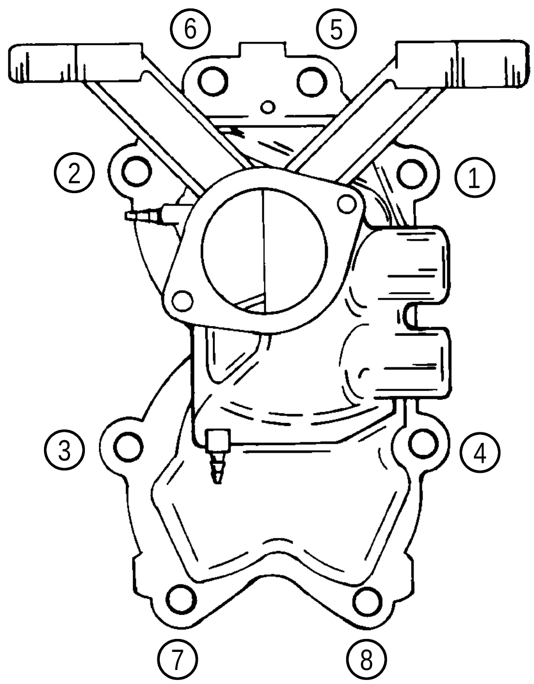
95 2-4-C With Teflon (92-825407A12)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	NUT (M16 x 1.5)		95	129
2	1	WASHER			
3	1	FLYWHEEL **(ELECTRIC) S/N-USA-0G590000/BEL-9973100 & ABOVE**			
4	1	FLYWHEEL **(MANUAL)**			
3	1	FLYWHEEL**(ELECTRIC)S/N-US-0G589999/BEL-9973099 & BELOW**			
4	1	FLYWHEEL **(MANUAL)**			
5	1	CRANKSHAFT ASSEMBLY			
6	1	GEAR ASSEMBLY (DRIVER)			
7	2	KEY			
8	1	BALL BEARING			
9	1	RETAINING RING			
10	1	ROLLER BEARING ASSEMBLY			
11	1	OIL SEAL			
12	1	BEARING ASSEMBLY–Center main			
13	14	ROLLER			
14	1	RING–Seal			
15	2	CONNECTING ROD ASSEMBLY			
16	4	SCREW (1/4–28)	192	16	21.7
17	2	ROLLER BEARING ASSEMBLY			
18	58	NEEDLE ROLLER			
19	4	THRUST WASHER			
20	2	PISTON **(STANDARD) S/N-USA-0G590000/BEL-9973100 & ABOVE**			
	AR	PISTON **(.015 O.S.)**			
	2	PISTON **(STANDARD)S/N-USA-0G589999/BEL-9973099 & BELOW**			
	AR	PISTON **(.015 O.S.)**			
21	4	RING–Lock			
22	1	PISTON RING SET **(STANDARD)**			
	AR	PISTON RING SET **(.015 O.S.)**			

Torque Sequence

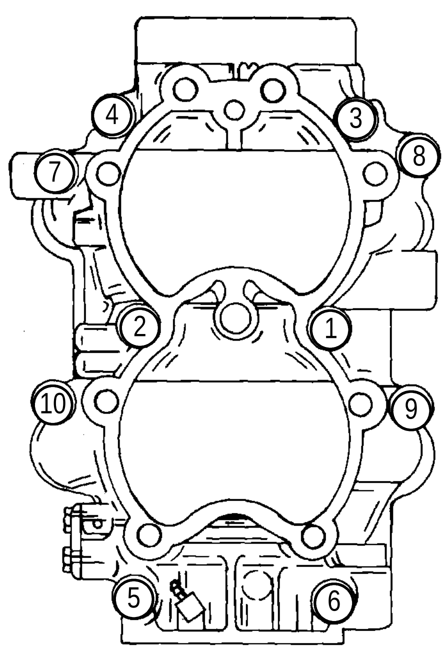
Intake Manifold Bolts

Torque bolts to 16.5 lb. ft. (22.4 N·m).



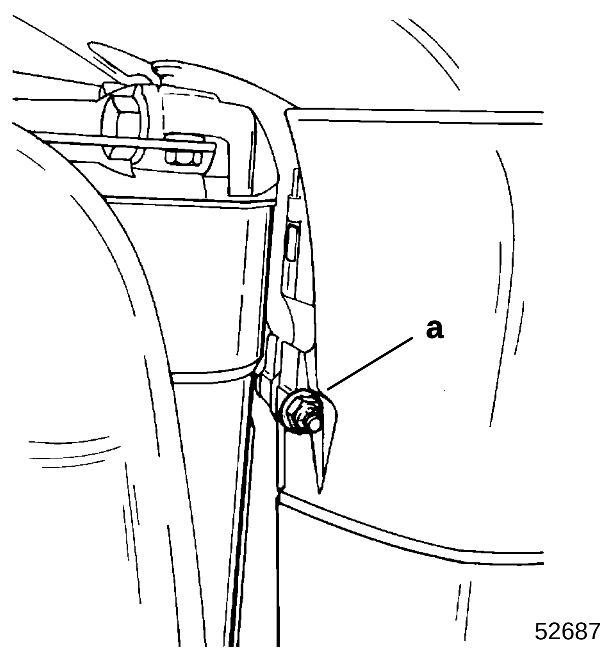
Crankcase Cover Bolts

Torque bolts to 16.5 lb. ft. (22.4 N·m).



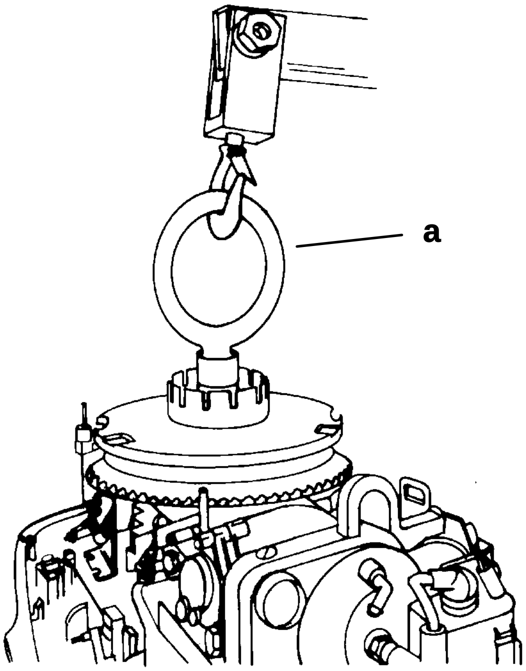
Powerhead Removal

1. Disconnect battery leads from battery (if applicable).
2. Remove spark plug leads from spark plugs.
3. Disconnect remote control harness from engine (if applicable) - or lanyard and stop button/horn wiring on manual models.
4. Disconnect fuel connector from engine. Fuel line must also be removed at either engine tray or fuel filter.
5. Remove throttle and shift cables.
6. Remove BLACK ground lead between powerhead and engine tray.
7. Remove tell-tale hose from powerhead.
8. Remove anti-start in gear cable on manual start models and disconnect neutral switch bullet connectors on all models.
9. Remove primer hoses from carb and manifold on manual start models and remove recoil starter.
10. Remove bolt, nut and flat washer securing upper drive shaft housing cover and remove cover.



a - Bolt, Nut, Flat Washer

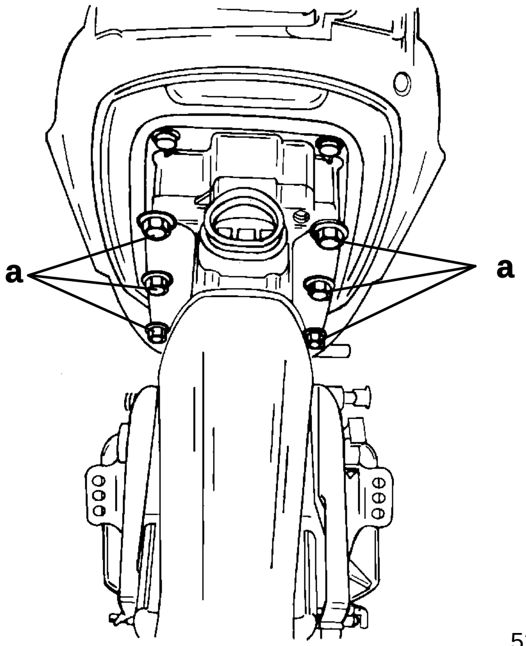
11. Thread lifting eye at least 5 turns into flywheel.



52689

a - Lifting Eye (P/N 91-90455)

12. Remove 6 bolts securing powerhead to drive shaft housing.



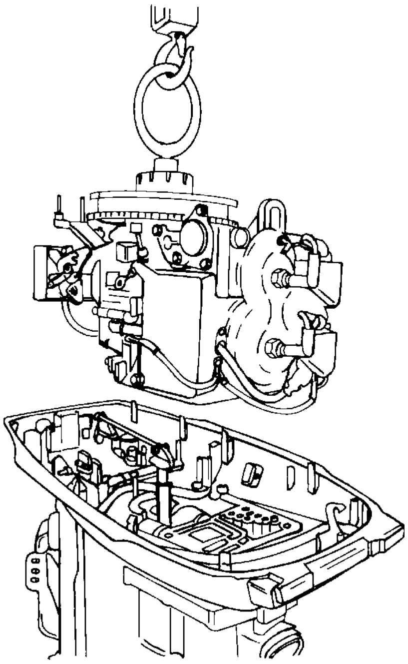
52688

a - Bolt (6)

⚠ WARNING

DO NOT leave powerhead suspended from hoist. Powerhead should be installed on a suitable stand or lowered to floor upon removal from drive shaft housing to avoid personal injury or damage to product.

13. Using suitable hoist, remove powerhead from drive shaft housing.



52690

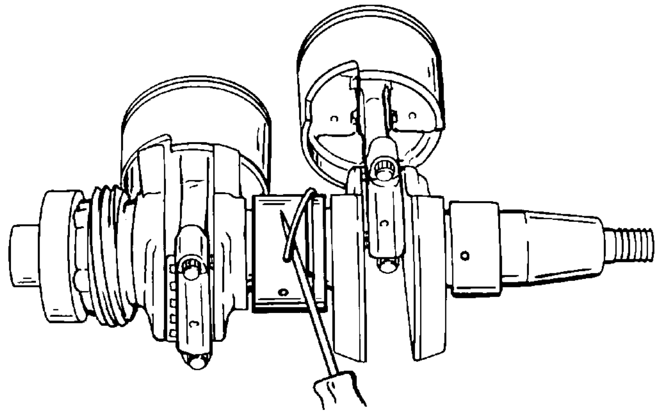
NOTE: *Refer to appropriate sections in service manual for removal of individual fuel and electrical sub-assemblies from powerhead.*

Component/Assembly	Section
Starter Motor	2B
Ignition Switch Box	2A*
Ignition Coil	2A*
Starter Solenoid	2B*
Voltage Regulator/Rectifier	2B*
Flywheel	2A
Stator Assembly	2A*
Trigger Assembly	2A*
Air Silencer	3B
Carburetor and Linkage	3B
Fuel Pump	3A
Fuel Enrichment Valve	3B
Shift Cable Latch Assembly	7A
Control Cable Anchor Bracket	7A
Warning Module	3C*
Oil Pump	3C

NOTE: *All ignition and electrical components can be removed and installed as an assembly.*

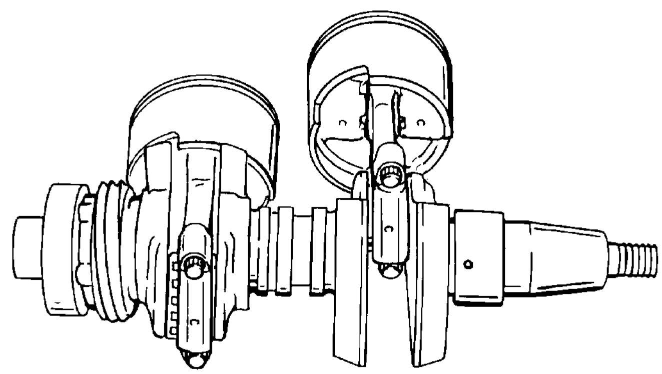
Crankshaft Disassembly

1. Remove center main bearing.



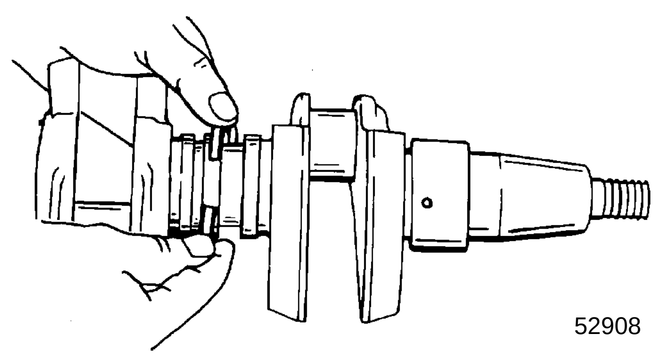
52906

2. Remove rod cap bolts and keep components with respective connecting rod. Reattach caps to respective rod as each piston/rod assembly is removed. **CAPS MUST BE INSTALLED IN SAME DIRECTION ON SAME ROD or BEARING FAILURE WILL RESULT.**



52907

3. Remove main bearing sealing ring.

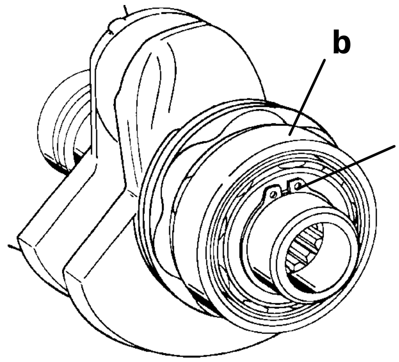


52908

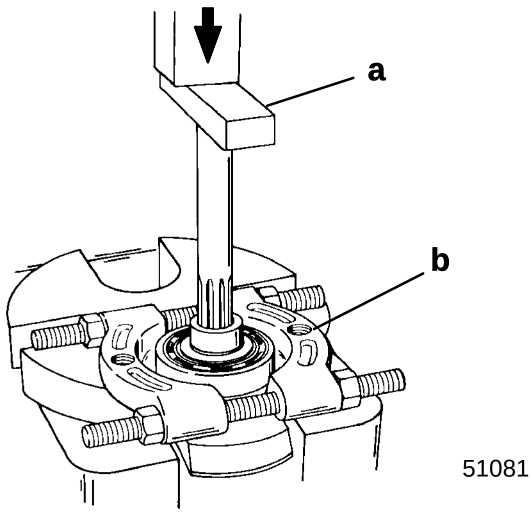
CAUTION

Removal of lower crankshaft bearing will damage bearing and will require replacement.

4. Inspect lower bearing for roughness and excessive looseness. Remove retaining ring and bearing only if necessary.

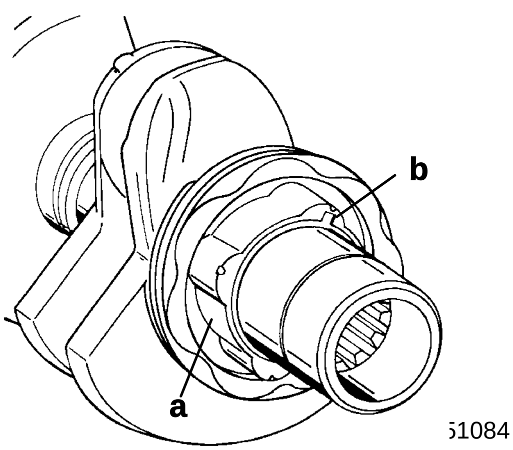


a - Retaining Ring
b - Bearing



a - P/N 91-827001A1
b - P/N 91-37241

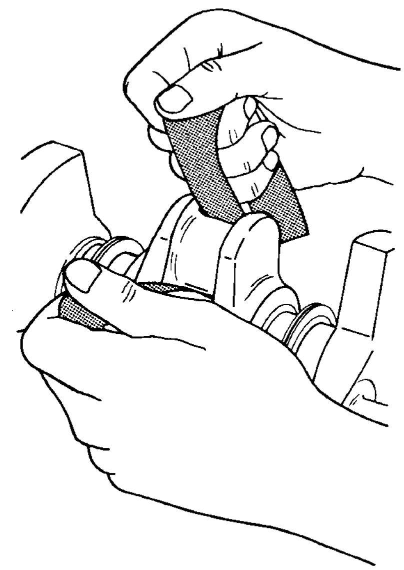
5. Inspect oil drive gear for cracks and excessive wear. Replace if necessary.



a - Oil Drive Gear
b - Key

Crankshaft Inspection

- Inspect crankshaft to drive shaft splines for wear. (Replace crankshaft, if necessary.)
- Check crankshaft for straightness [(0.003 in. (0.076mm) maximum]. (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.



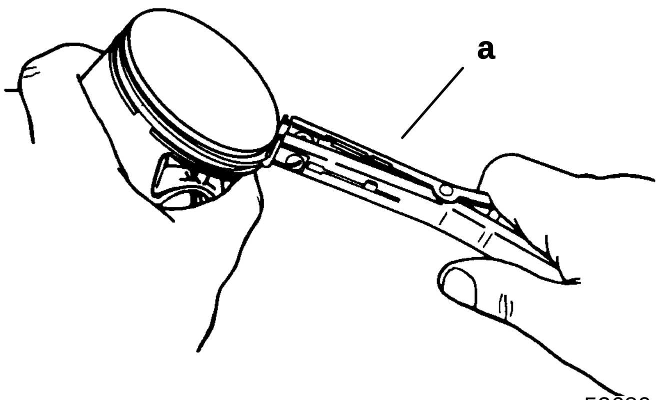
- Thoroughly clean (with solvent) and dry crankshaft and crankshaft ball bearings. Recheck surfaces of crankshaft. Replace crankshaft if surfaces cannot be properly cleaned up. If crankshaft will be reused, lubricate surfaces with 2 cycle oil to prevent rust. DO NOT lubricate ball bearings at this time.

WARNING

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

Piston and Connecting Rod Disassembly

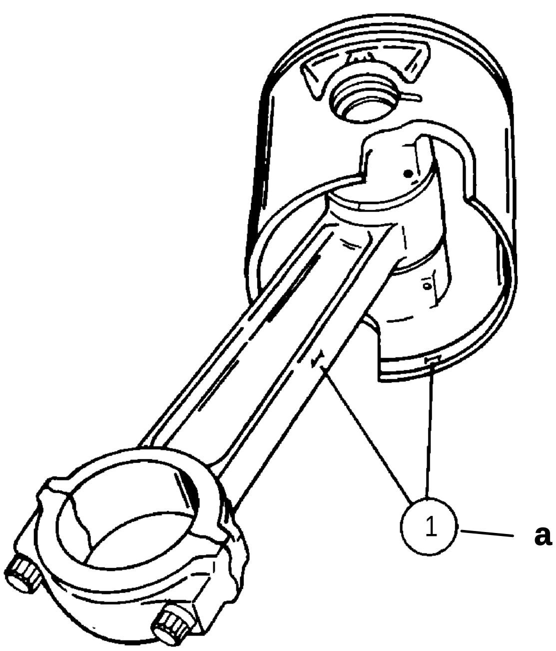
1. Remove piston rings. Always install new piston rings.



52680

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

2. Scribe cylinder number (1 or 2) on inside of each piston and rod assembly as they are removed to insure reassembly of correct piston to same connecting rod.



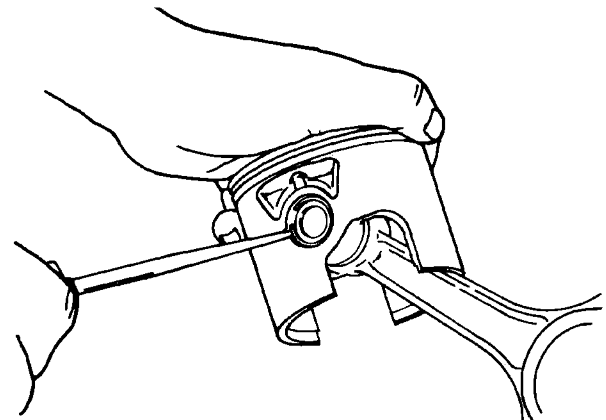
52681

a - Mark Piston & Rod for Correct Reassembly

⚠ CAUTION

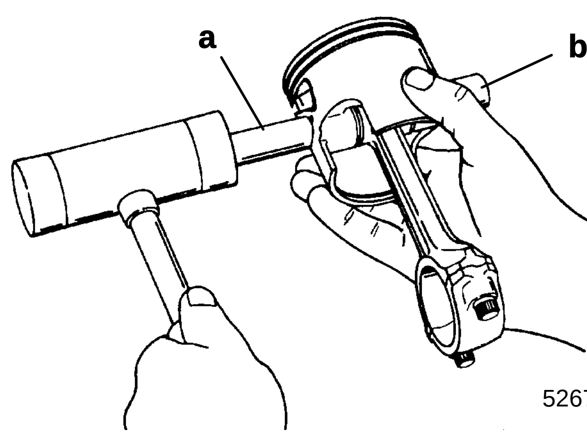
Safety glasses should be worn when removing or installing lock rings.

3. Remove piston pin lock rings using awl. Always install new lock rings.



52679

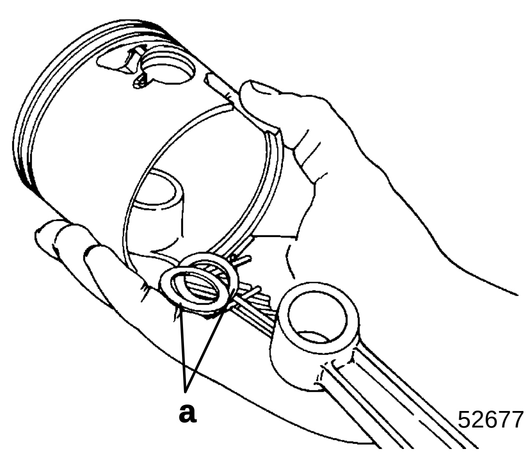
4. Remove piston pin.



52678

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

5. Remove piston pin needle bearings (29 per piston pin) and locating washers (“a” 2 per piston) as shown.

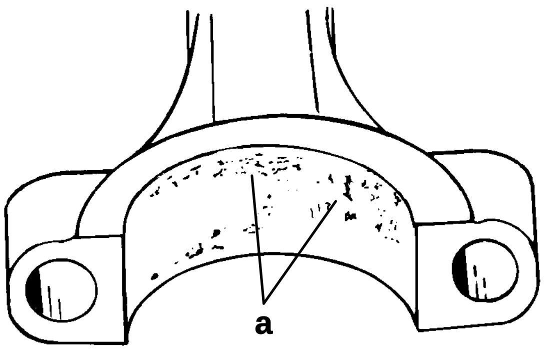


52677

a - Locating Washers

Connecting Rods

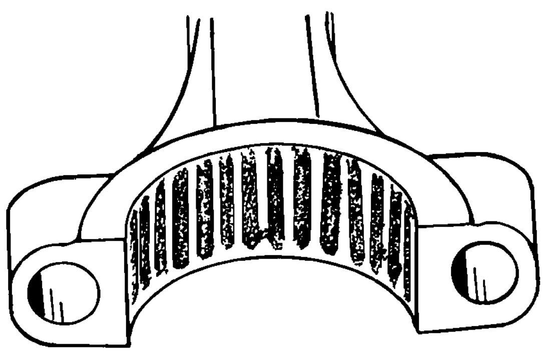
1. Check connecting rods for alignment by placing rods on a surface plate. If light can be seen under any portion of machined surfaces, if rod has a slight wobble on plate, or if a 0.002 in. (0.051mm) feeler gauge can be inserted between any machined surface and surface plate, rod is bent and must be discarded.
2. **Overheating:** Overheating is visible as a bluish bearing surface color that is caused by inadequate lubrication or excessive RPM.
3. **Rust:** Rust formation on bearing surfaces causes uneven pitting of surface(s).



51853

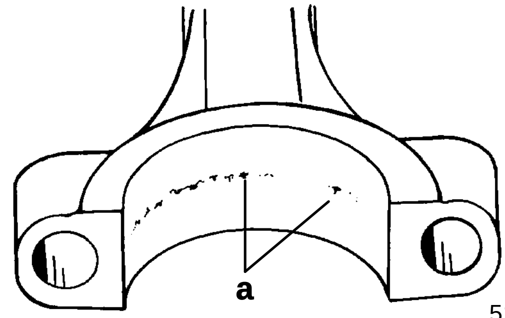
a - Pitting

4. **Water Marks:** When bearing surfaces are subjected to water contamination, a bearing surface "etching" occurs. This etching resembles the size of the bearing.



51853

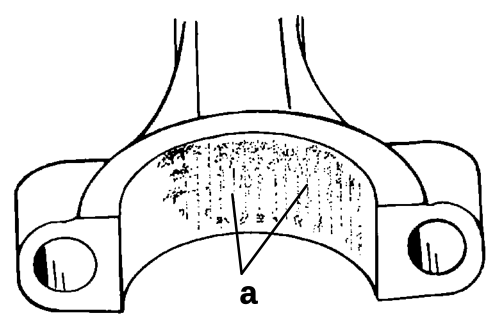
5. **Spalling:** Spalling is the loss of bearing surface, and it resembles flaking or chipping. Spalling will be most evident on the thrust portion of the connecting rod in line with the "I" beam. General bearing surface deterioration could be caused by or accelerated by improper lubrication.



51853

a - Spalling

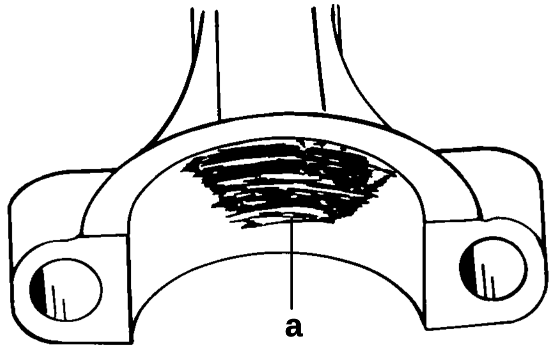
6. **Chatter Marks:** Chatter marks are the result of a combination of low speed - low load - cold water temperature operation, aggravated by inadequate lubrication and/or improper fuel. Under these conditions, the crankshaft journal is hammered by the connecting rod. As ignition occurs in the cylinder, the piston pushes the connecting rod with tremendous force, and this force is transferred to the connecting rod journal. Since there is little or no load on the crankshaft, it bounces away from the connecting rod. The crankshaft then remains immobile for a split second until the piston travel causes the connecting rod to catch up to the waiting crankshaft journal, then hammers it. The repetition of this action causes a rough bearing surface(s) which resembles a tiny washboard. In some instances, the connecting rod crank pin bore becomes highly polished. During operation, the engine will emit a "whirr" and/or "chirp" sound when it is accelerated rapidly from idle speed to approximately 1500 RPM, then quickly returned to idle. If the preceding conditions are found, replace both the crankshaft and connecting rod(s).



51853

a - Chatter Marks Between Arrows

7. **Uneven Wear:** Uneven wear could be caused by a bent connecting rod.

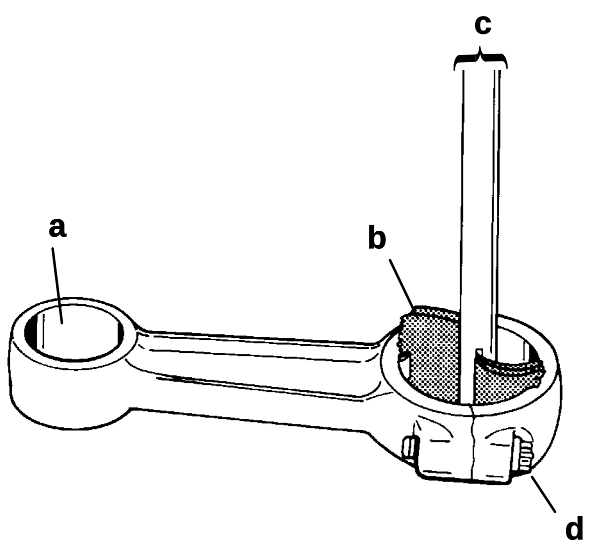


51853

a - Uneven Wear Between Arrows

⚠ CAUTION

Crocus cloth MUST BE USED to clean bearing surface at CRANKSHAFT END OF CONNECTING ROD.
320 grit Carborundum cloth MUST BE USED to clean bearing surface at PISTON PIN END OF CONNECTING ROD.
VERIFY CAP TO ROD ALIGNMENT BEFORE TORQUING ROD BOLTS.
DO NOT continue to clean connecting rod bearing surfaces after marks have been removed.



NOTE: Wash rod to remove abrasive grit and apply 2 cycle oil to bearing surfaces to prevent rust.

51083

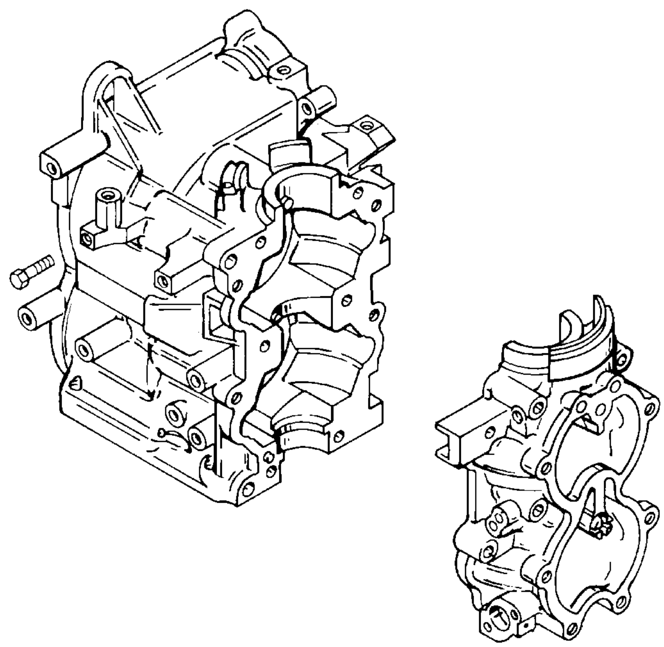
a - 320 Carborundum Cloth
b - Crocus Cloth
c - To Drill Motor
d - Torque to 16 lb. (21.7 N·m)

***NOTE:** Wash rod to remove abrasive grit and apply 2 cycle oil to bearing surfaces to prevent rust.*

Cleaning and Inspection

Cylinder Block and Crankcase Cover

IMPORTANT: Crankcase cover and cylinder block are matched, line-bored assembly should not be mismatched by using a different crankcase cover or cylinder block.



52651

- Inspect cylinder block and crankcase cover for cracks or fractures.
- Check gasket surfaces for nicks, deep grooves, cracks and distortions that could cause compression leakages.
- Check that all water passages in cylinder block are not obstructed. Check locating pins in cylinder block that they are tight.
- Check crankcase cover fuel/bleed passages that they are not obstructed. Verify that check valves in crankcase cover are not damaged.
- 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.
- 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 Bores

1. Inspect cylinder bores for scoring, scuffing or a transfer of aluminum from piston to cylinder wall. Scoring or scuffing, if NOT TOO SEVERE, can normally be removed by honing. If a transfer of aluminum has occurred, an acidic solution such as "TIDY BOWL CLEANER" should be applied to the areas of the cylinder bore where transfer of aluminum has occurred. After the acidic solution has removed the transferred aluminum, thoroughly flush the cylinder bore(s) to remove any remaining acid. Cylinder walls may now be honed to remove any glaze and to aid in the seating of new piston rings.

HONING PROCEDURE

a. When cylinders are to be honed, follow the hone manufacturer's recommendations for use of the hone and cleaning and lubrication during honing.

b. For best results, a continuous flow of honing oil should be pumped into the work area. If pumping oil is not practical, use an oil can. Apply oil generously and frequently on both stones and work area.

CAUTION

When honing 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.

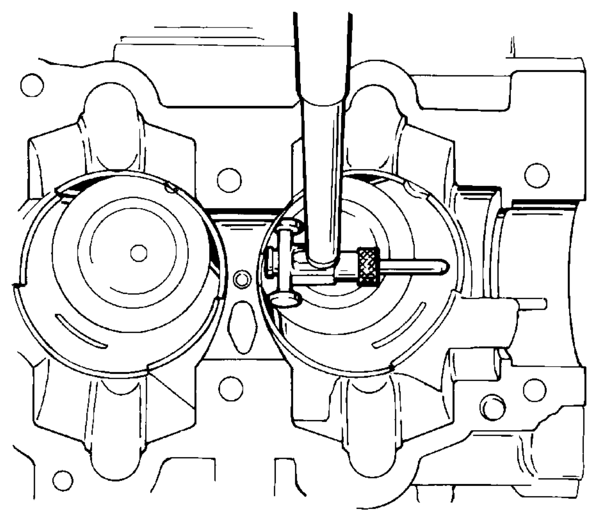
c. Start stroking at smallest diameter. Maintain firm stone pressure against cylinder wall to assure fast stock removal and accurate results.

d. Localize stroking in the smallest diameter until drill speed is constant throughout length of bore. Expand stones, as necessary, to compensate for stock removal and stone wear. Stroke at a rate of 30 complete cycles per minute to produce best cross-hatch pattern. Use honing oil generously.

e. Thoroughly clean cylinder bores with hot water and detergent. Scrub well with a stiff bristle brush and rinse thoroughly with hot water. A good cleaning is essential. If any of the abrasive material is allowed to remain in the cylinder bore, it will cause rapid wear of new piston rings and cylinder bore in addition to bearings. After cleaning, bores should be swabbed several times with engine oil and a clean cloth, then wiped with a clean, dry cloth. Cylinders **should not** be cleaned with kerosene or gasoline. Clean remainder of cylinder block to remove excess material spread during honing operation.

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

3. Measure cylinder bore diameter (with a snap gauge micrometer) at top, middle and bottom of each cylinder, as shown below. Check for tapered, out-of-round (egg-shaped) and oversize bore.



52886

CYLINDER BORE SIZE	
PISTON SIZE	**CYLINDER BLOCK FINISH HONE**
Standard Diameter	2.993 in. 76.022 mm
.015 Oversize	3.007 in. 76.38 mm

4. 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, preceding), it will be necessary to re-bore that cylinder(s) to 0.015 in. (0.381mm) oversize or re-sleeve and install oversize piston(s) and piston rings during reassembly.

IMPORTANT: Ports must be deburred after honing.

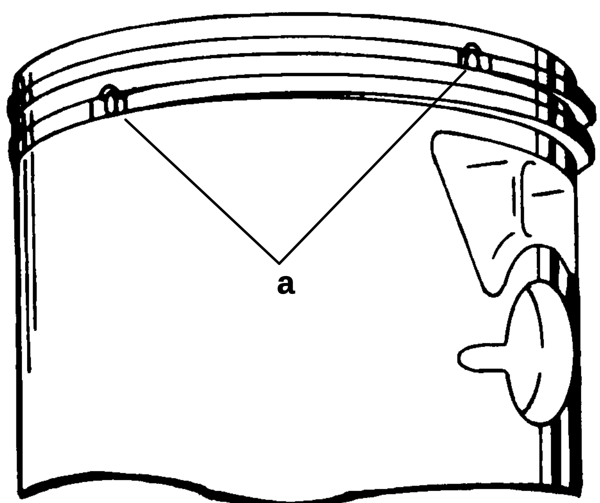
NOTE: *The weight of an oversize piston is approximately the same as a standard size piston; therefore, it is not necessary to re-bore all cylinders in a block just because one cylinder requires re-boring.*

5. After honing and thoroughly cleaning cylinder bores, apply light oil to cylinder walls to prevent rusting.

Pistons and Piston Rings

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

1. Inspect pistons for scoring and excessive piston skirt wear.
2. Check tightness of piston ring locating pins. Locating pins must be tight.



a - Locating Pins

3. Thoroughly clean pistons. Carefully remove carbon deposits from pistons, with a soft wire brush or carbon remove solution. Do not burr or round off machined edges.

Inspect piston ring 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 following for cleaning piston ring grooves.

CLEANING PISTON RING GROOVES

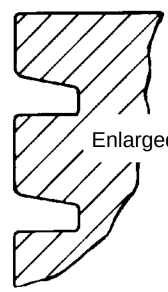
Keystone (tapered) ring grooves

⚠ CAUTION

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

1. Use a bristle brush and carbon remover solution to remove carbon from side surfaces.
2. 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 the inside edge of the ring to reach the inner diameter of the groove. Carefully scrape carbon from inner diameter of ring grooves. Care must be taken not to damage the grooves by scratching the side surfaces of the grooves.

Piston with two half keystone (half tapered) rings

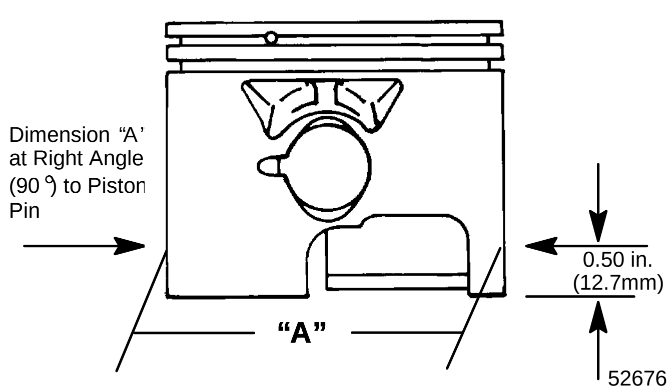


MEASURING PISTON ROUNDNESS

Piston has a barrel profile shape and is not a true diameter.

1. Using a micrometer, measure dimension "A" at location shown. Dimension "A" should be as indicated in chart following.

Piston	Dimension "A"
Standard Piston	2.988 in. ± .001 in.
.015 in. Oversize Piston	3.003in. ± .001in.



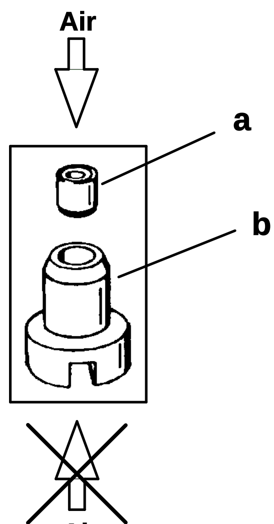
Check Valve

NOTE: *Check valve can be replaced by removing intake manifold when powerhead is attached to driveshaft housing.*

The check valve is a 3/16 in. (4.76 mm) diameter brass casing containing a nylon ball-valve. It can be damaged by hot combustion blow-by into crankcase (ie.: backfire, or a hole in top of piston, etc.).

TO CHECK: Inspect check valve by looking through hole. If light can be seen 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 nylon ball. If ball moves, valve is O.K. Replace valve if ball does not move.

Install check valve into check valve holder as shown.



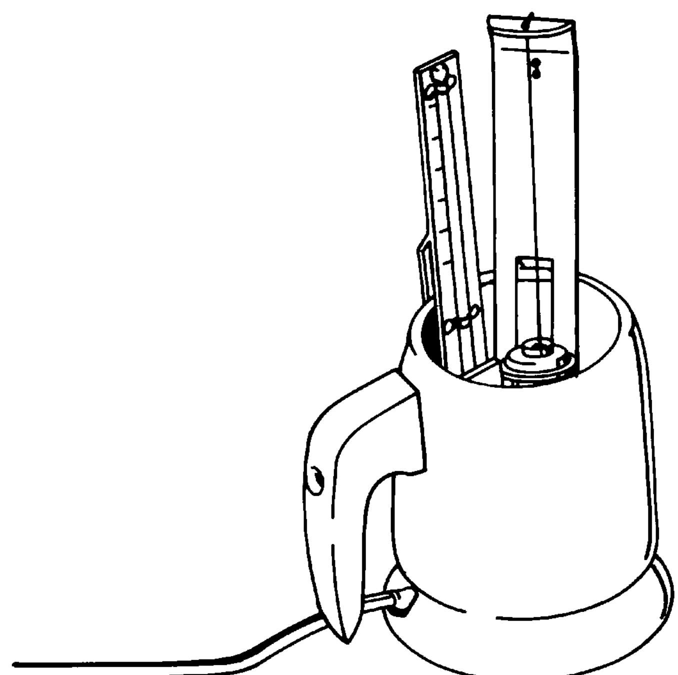
51080

a - Check Valve
b - Check Valve Holder

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.

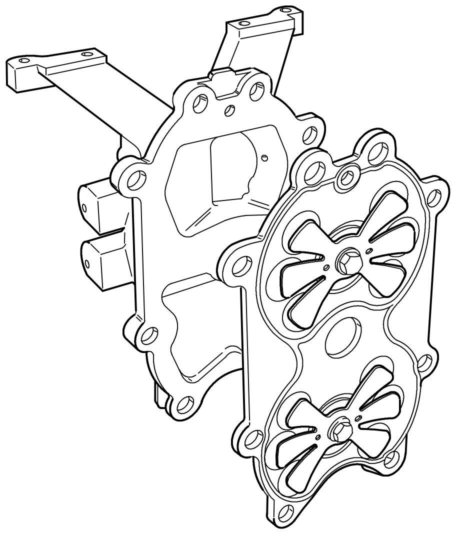


51087

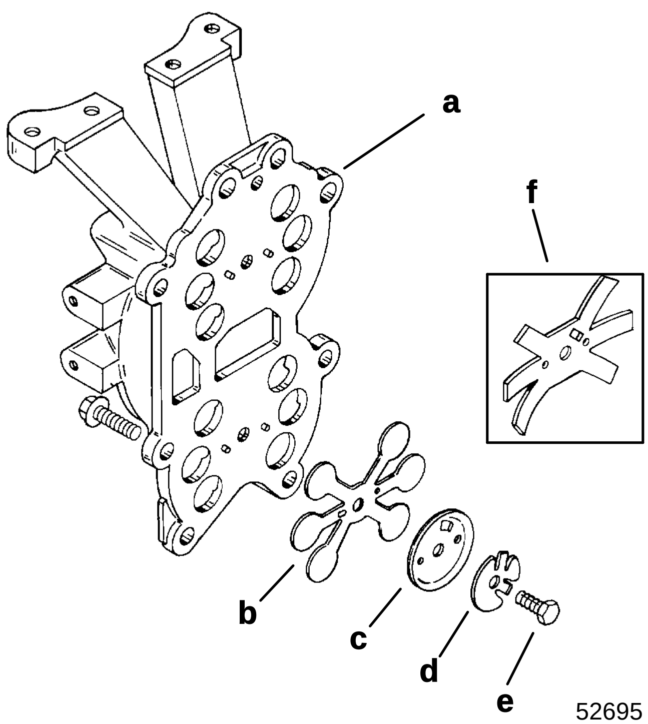
Reed Blocks

NOTE: *Do not disassemble reed block unless necessary.*

S/N 0G380075 & Above



S/N 0G380074 & Below



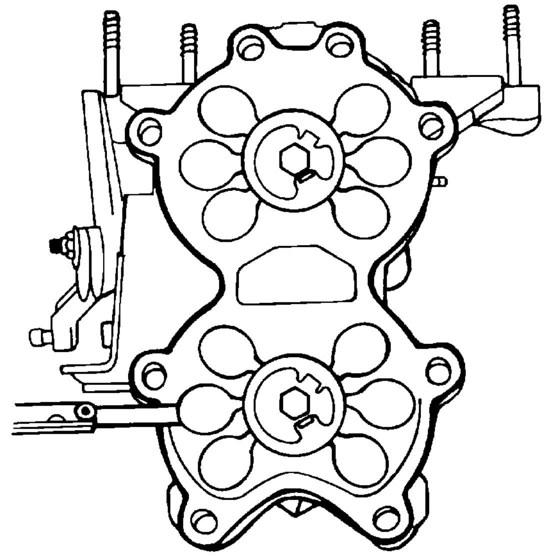
a - Reed Block
b - Reed (2 Sets)
c - Retaining Washer (40 HP Only)
d - Tab Washer
e - Bolt
f - Reed Stop (30 HP Only)

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

Reed should lie flat. There should be no pre-load (pressure between reed and reed-block), although a slight pre-load is tolerable.

The maximum allowable opening between reed and reed-block is .020 in. (0.5mm). This must be checked with a flat blade feeler gauge, as shown.

If the opening exceeds .020 in. (0.5 mm), or if the reed is chipped, cracked or otherwise damaged, replace.

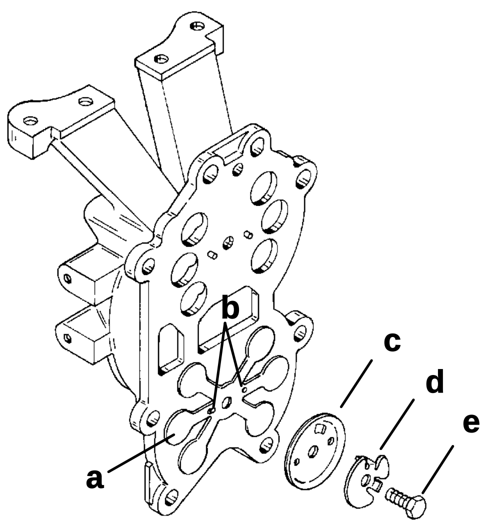


⚠ CAUTION

Replace locking tab-Washer. DO NOT REUSE.

REASSEMBLY S/N 0G380074 & BELOW

If reed block was disassembled, reassemble by locating reeds on pins with retaining washer. Using new tab washer, insert bolt and torque to 60 lb. in. (6.8 N·m); then, if necessary, continue the torque to align flat on hex-head to locking tab (e). DO NOT exceed 100 lb. in. (11.3 N·m) of torque. Bend up lock tab to secure bolt position.

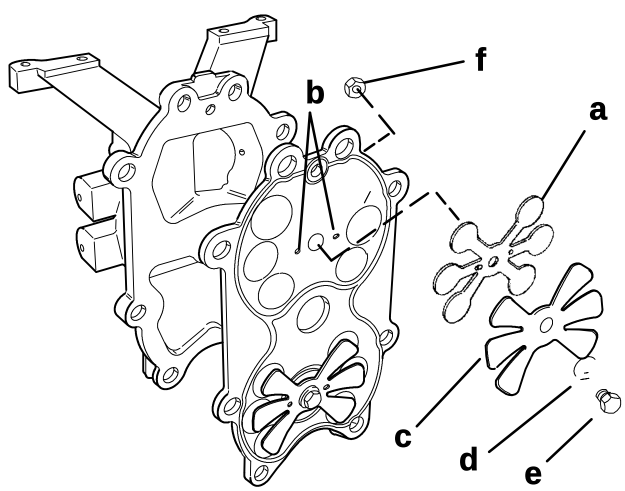


52896

a - Reed
b - Pins
c - Retaining Washer
d - Tab Washer
e - Bolt - Torque to 60 lb. in. (6.8 N·m)

REASSEMBLY S/N 0G380075 & ABOVE

If reed block was disassembled, reassemble by locating reeds and reed stops on pins. Secure to reed plate with bolt, washer, and nut. Torque to 60 lb. in. (6.8 N·m).



a - Reeds
b - Locating Pins
c - Reed Stops
d - Washer
e - Bolt
f - Nut

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 Marine Lubricant whenever grease is specified.

⚠ CAUTION

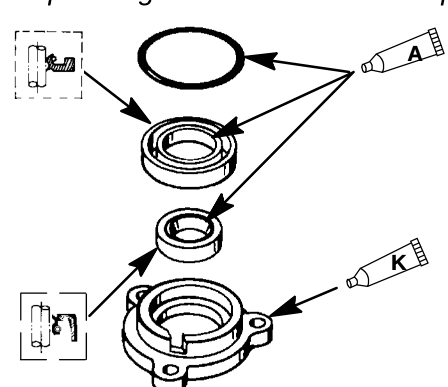
Any GREASE used for bearings INSIDE the powerhead MUST BE gasoline soluble. Use only Quicksilver Needle Bearing Assembly Lubricant. DO NOT use 2-4-C Marine Lubricant, or other lubricants inside the powerhead, or damage may occur.

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

End Cap

1. Clean thoroughly, including seal and O-ring seats; remove Perfect Seal residue and clean cap-to-head mating surface.
2. Using suitable mandrel, press oil seals into cap until fully seated.

NOTE: *Lip of smaller seal faces away from powerhead. Lip of larger seal faces towards powerhead.*



A 2-4-C w/Teflon (92-825407A12)
K Perfect Seal (92-34227-1)

52683

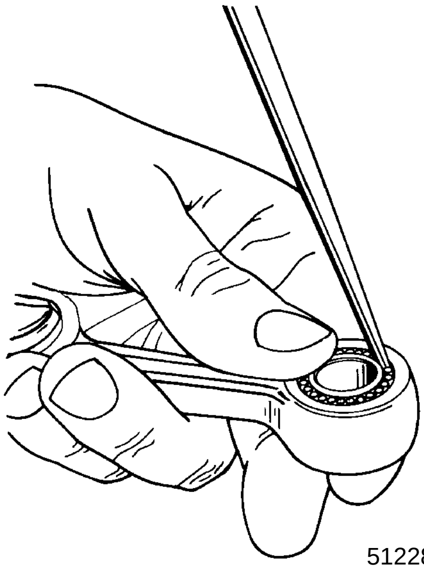
Assembling Rod to Piston

⚠ CAUTION

DO NOT intermix new needle bearings with used needle bearings. Needle bearings MUST BE REPLACED AS A SET. DO NOT intermix needle bearings from one connecting rod with those of another connecting rod.

1. Place clean needle bearings on a clean sheet of paper and lubricate with Quicksilver Needle Bearing Lubricant.

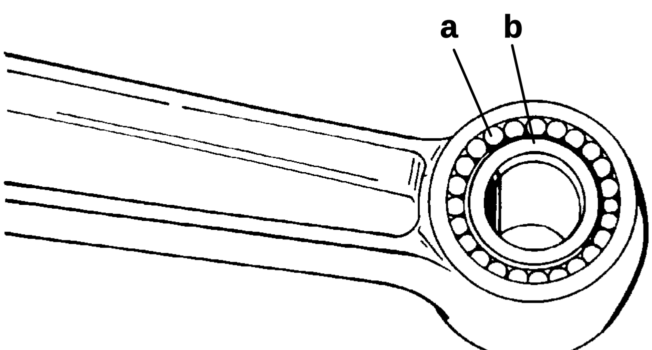
Service Tip



51228

If the tip of an awl can be inserted between needle bearings, one or more needles are missing and must be replaced.

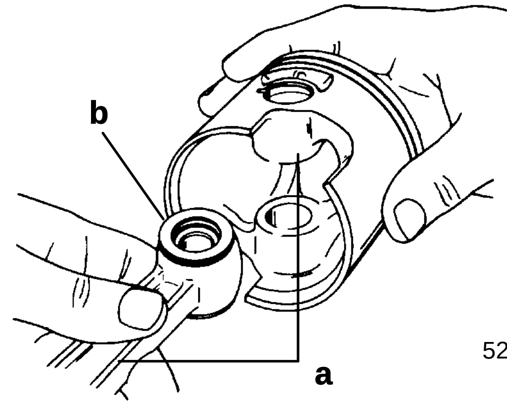
2. Install needle bearings.



51081

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

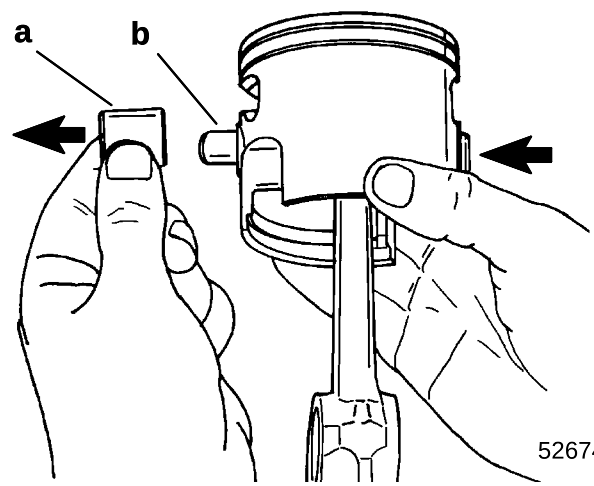
3. Place locating rings on connecting rod, carefully place piston over end of rod. Refer to scribed identification number for matching rod to piston and direction of assembly (which side of rod is "UP").



52675

a - Scribed Identification Number
b - Locating Washer

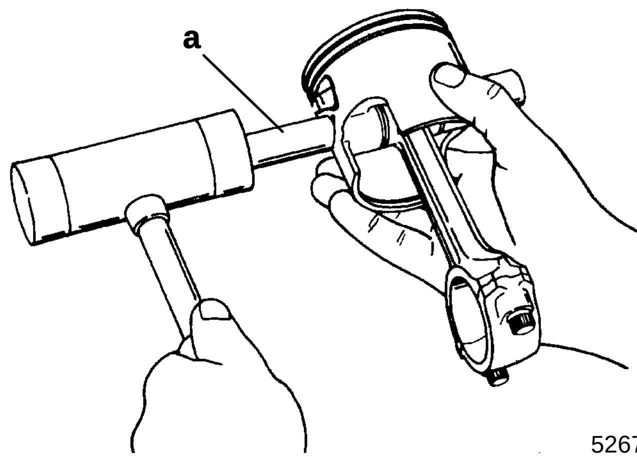
4. Push sleeve from piston using piston pin tool.



52674

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

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



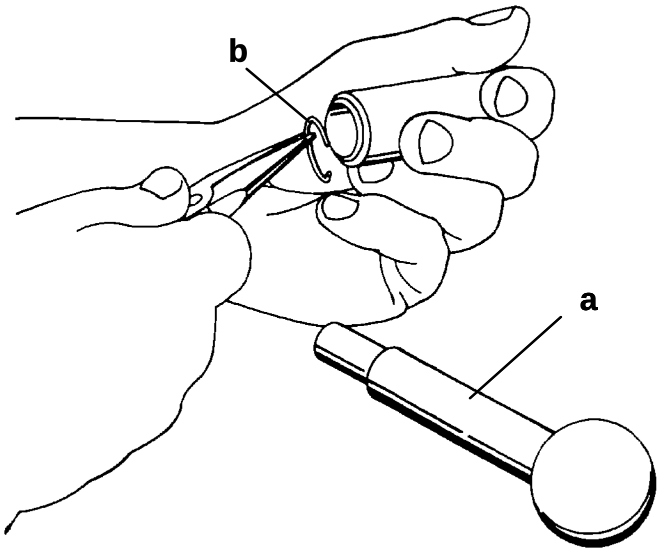
52678

a - Piston Pin Tool (P/N 91-74607A2)

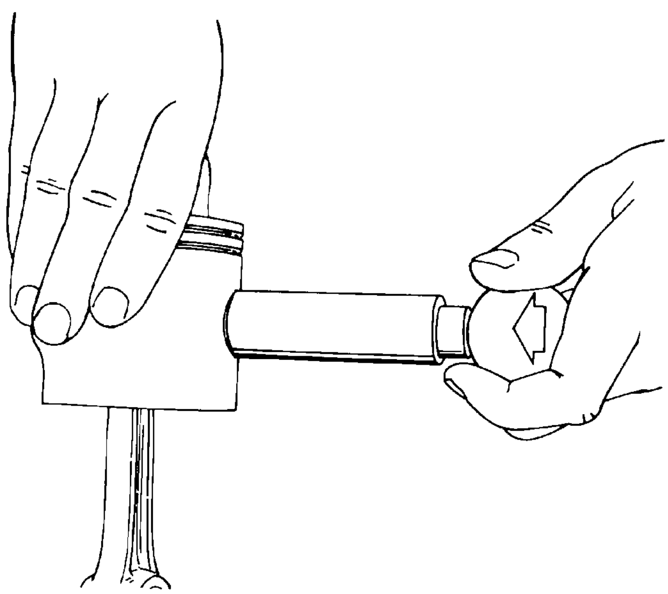
6. Install new piston pin lock rings (each side of piston) using Lockring Tool (91-77109A1).
7. Make sure lockrings are properly seated in piston grooves.

⚠ CAUTION

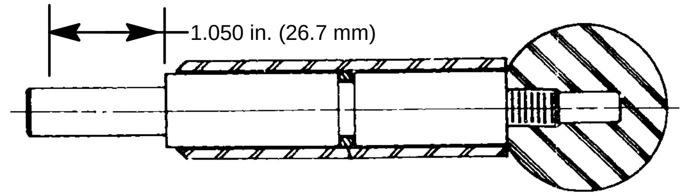
Do not re-use piston pin lockrings. Use only new lockrings and make sure they are properly seated in piston grooves.



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



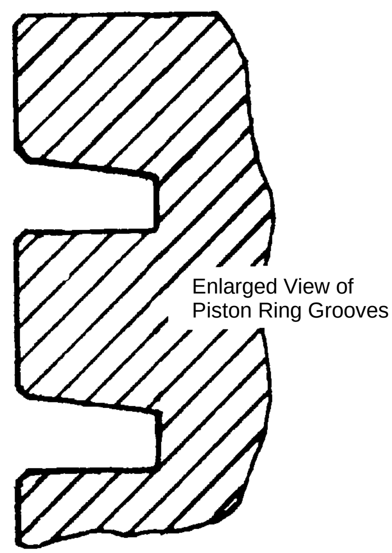
***NOTE:** Shaft of Lock ring Installation Tool 91-77109A1 must be modified (shortened) to 1.050 in. (26.7 mm).*



Piston Ring Installation

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

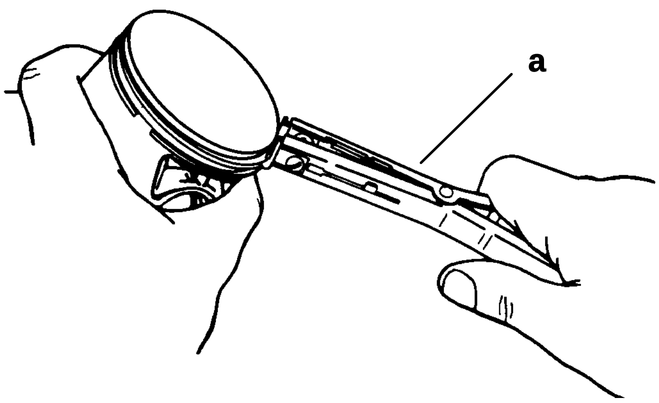
Piston rings are TAPERED top side, and flat (rectangular) on the bottom side (half-keystone rings).



⚠ CAUTION

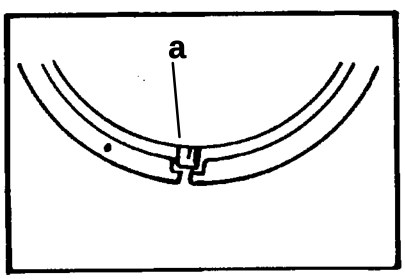
Care must be taken not to scratch the side surfaces of ring groove. Scratching this area will damage the ring groove.

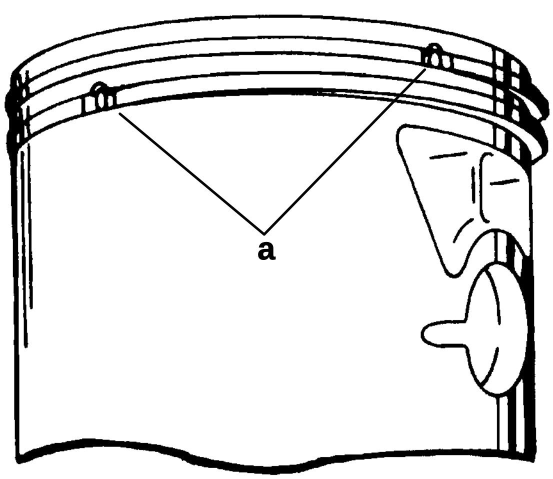
1. Install piston ring in appropriate groove on piston using Piston Ring Expander Tool. Spread rings just enough to slip over piston.
2. Check piston rings to be sure they fit freely in groove. Lubricate rings and cylinder wall with 2-cycle oil.



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

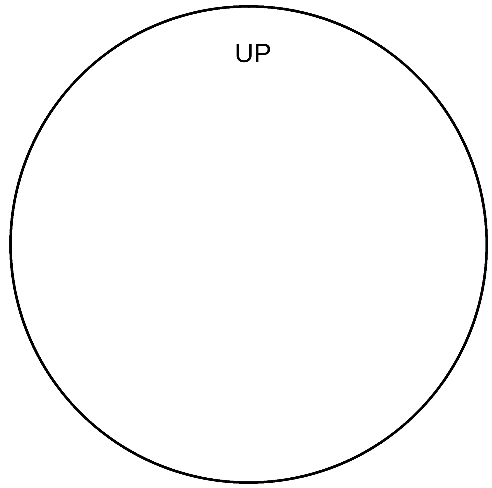
3. Align piston ring end gaps with ring locating pins as shown. Check locating pins making sure they are tight.





a - Locating Pins

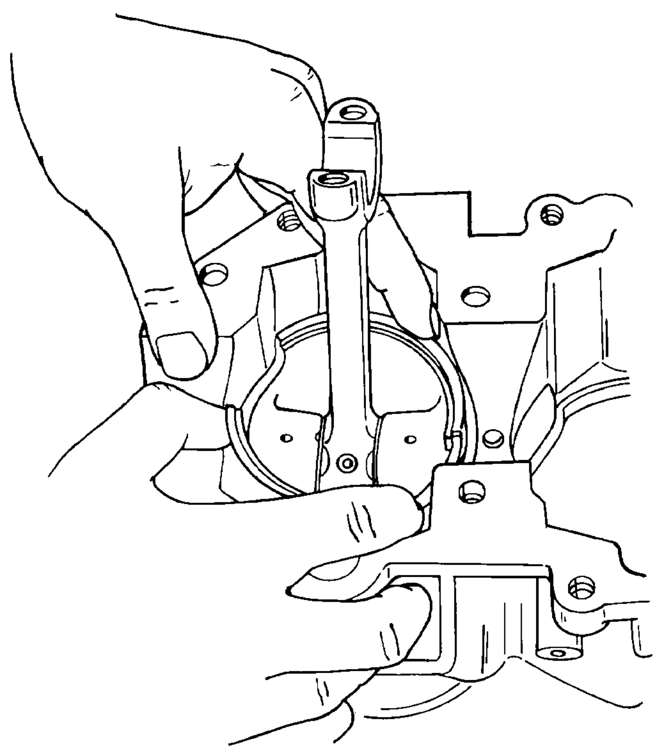
4. Remove connecting rod cap from connecting rod being installed.
5. Install each piston with "UP" identification facing flywheel end. Pistons MUST be installed in this direction.



⚠ CAUTION

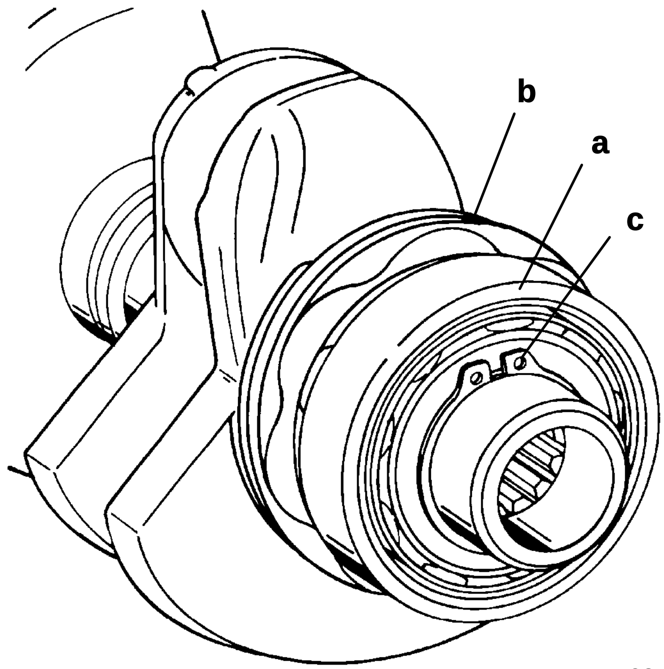
Pistons must be installed very carefully into cylinders. Piston rings can not be inspected thru exhaust ports.

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.



Crankshaft Installation

1. If lower bearing and gear were removed from crankshaft, slide gear in place (note keyway and key in gear to crankshaft assembly). Install bearing to crankshaft using an arbor press and suitable mandrel.
2. Install main bearing retaining ring after pressing main bearing tight against oil gear.



a - Lower Bearing
b - Gear
c - Retaining Ring

⚠ CAUTION

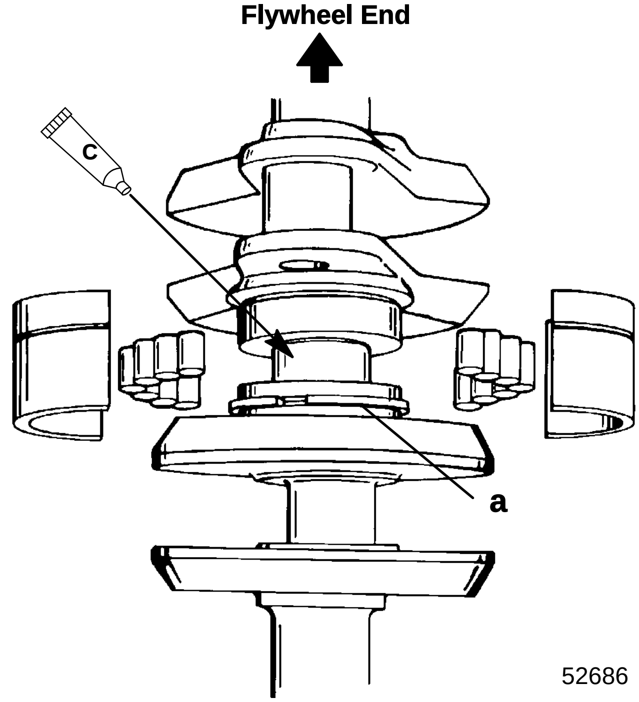
Safety glasses should be worn when removing or installing ring seal.

3. Install ring seal to crankshaft.

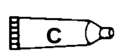
⚠ CAUTION

Any grease used for bearings INSIDE the powerhead MUST BE gasoline soluble. Use only Quicksilver Needle Bearing Assembly Lubricant. DO NOT use 2-4-C Marine Lubricant, or other lubricants inside powerhead, or damage to engine may occur.

4. Grease crankshaft journal with Quicksilver Needle Bearing Assembly Lubricant to hold bearing in place. Position needle bearings on journal. There are 14 bearings for center main.



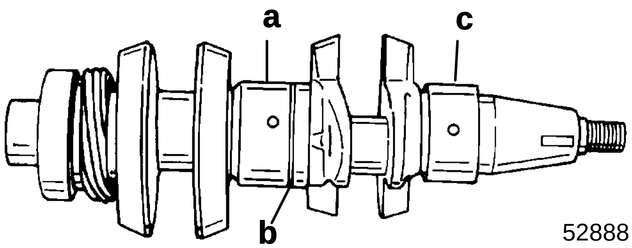
a - Seal Ring



Needle Bearing Assy. Lub. (92-825265A1)

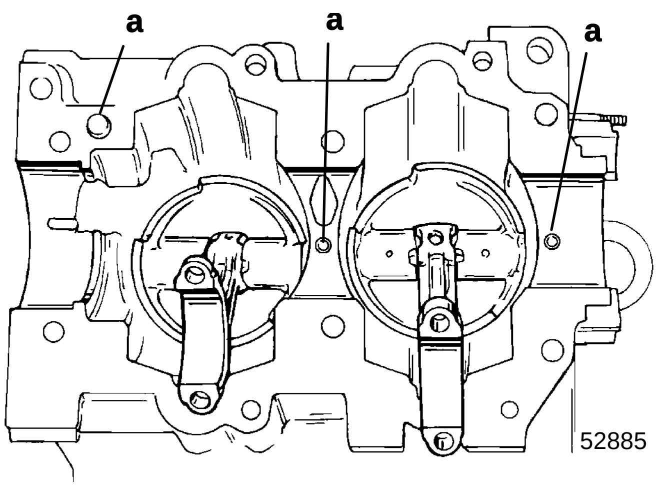
IMPORTANT: Snap ring groove faces up towards flywheel.

5. Attach main bearing races with holes towards lower gear end of crankshaft. Secure each main bearing race with retaining ring. Lubricate top main bearing with 2-cycle engine oil and install to crankshaft as shown.



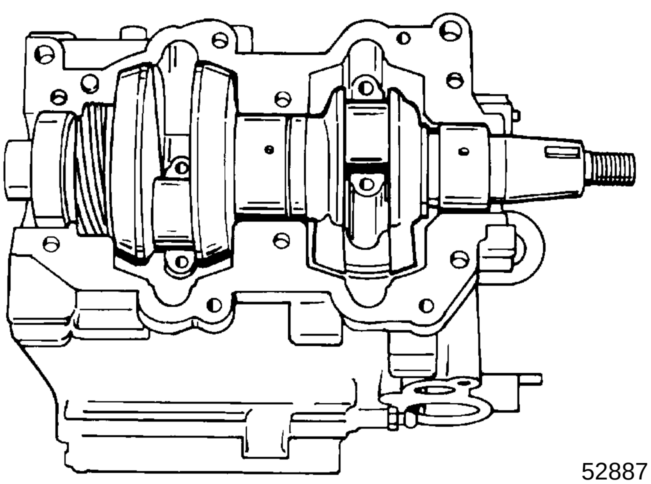
a - Main Bearing Race
b - Retaining Ring **(Groove Faces Flywheel)**
c - Top Main Bearing (One Piece)

6. Position cylinder block and piston rods as shown. Insert locating pins (a).



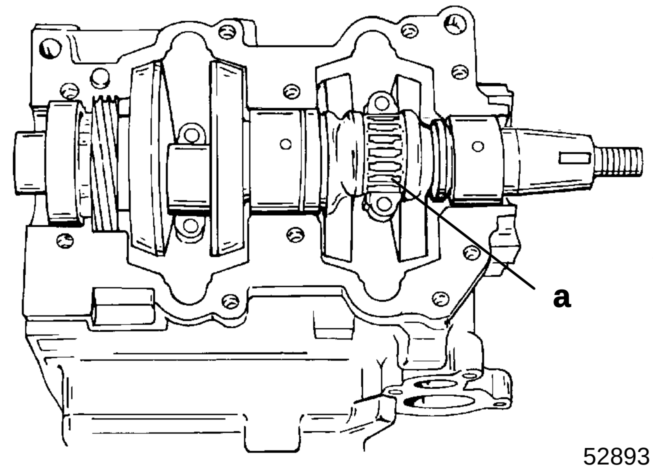
Lower End **Flywheel End**

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



Installing Rods to Crankshaft

1. Oil rod and bearing cage with 2-cycle oil.
2. Pull rod into place and install bearing cages as shown.

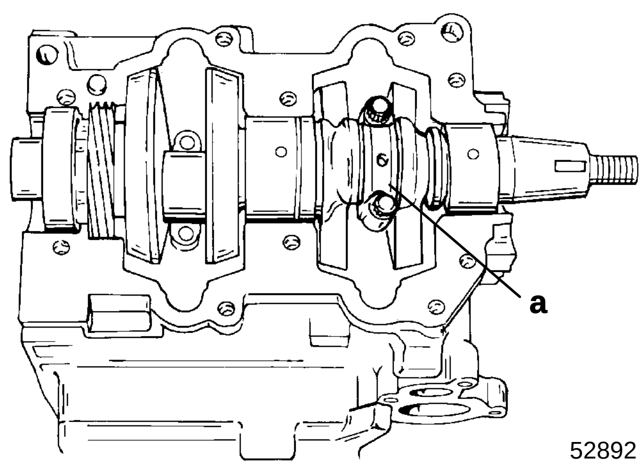


a - Bearing Cage

NOTE: *Clean rod bolt/rod cap bolt holes of oil and debris before reassembly.*

IMPORTANT: The rod cap and rod must be aligned and held together when threading oiled bolt. Check that mating surfaces are tight together after bolt enters threads in piston rod.

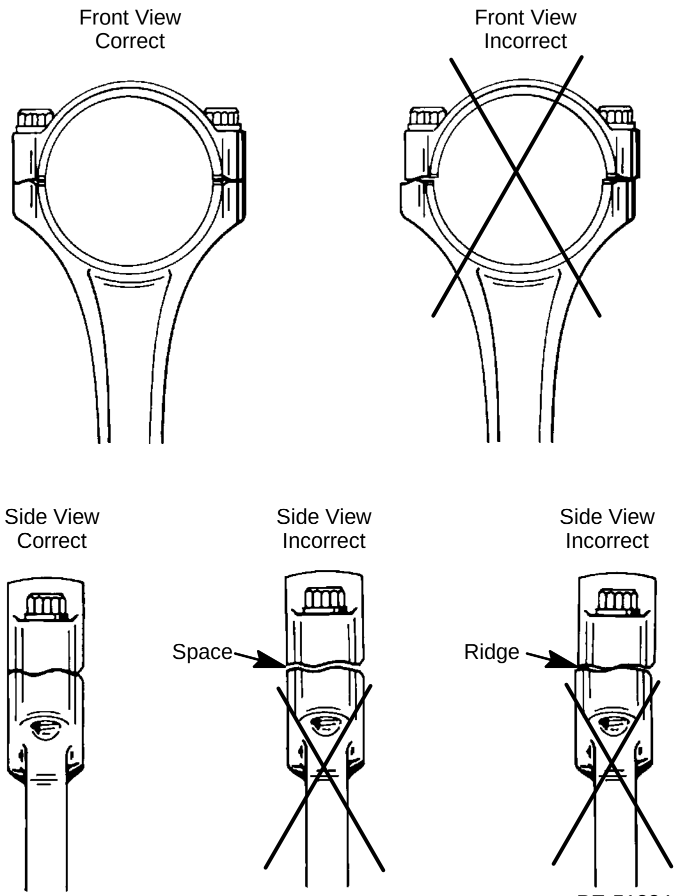
3. Place rod cap over bearing cages. While holding cap to rod, insert slightly oiled bolts and lightly tighten while observing cap to rod alignment.



a - Rod Cap

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.

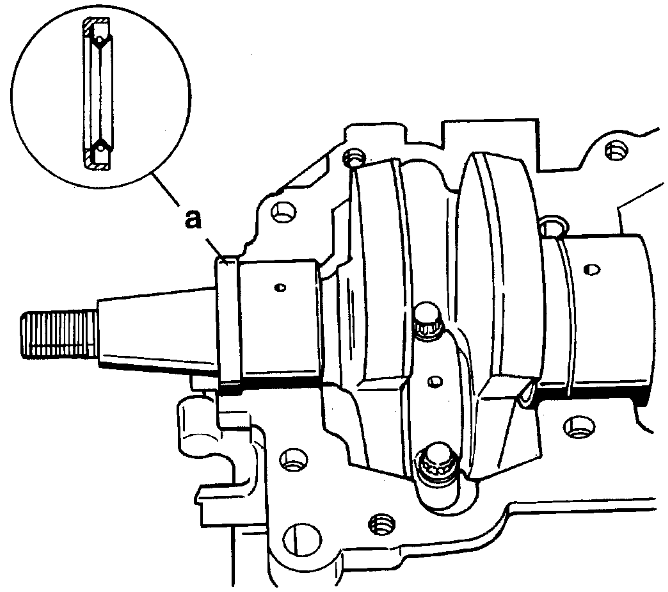


PE-51224

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. **Re-torque bolts to 16.0 lb. ft. (21.7 N·m).** Recheck alignment.

Crankcase Cover to Block

1. Install upper seal on crankshaft and seat seal against bearing w/lips facing bearing.

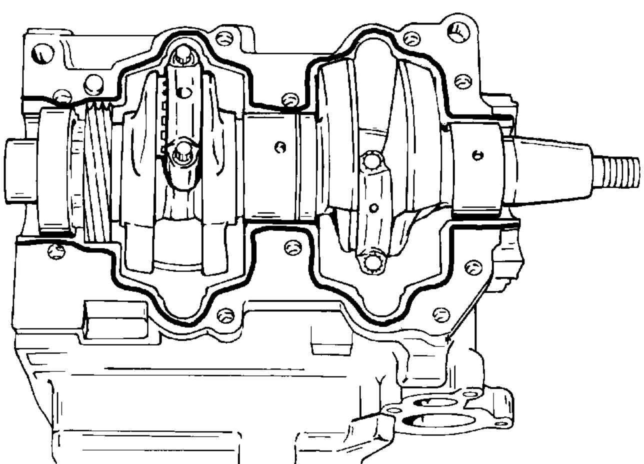


52879

a - Oil Seal (Lubricate Inside with 2-4-C Marine Lubricant)

2. Apply LOCTITE MASTER GASKET SEALANT to clean block surface. Instructions in kit must be followed exactly.

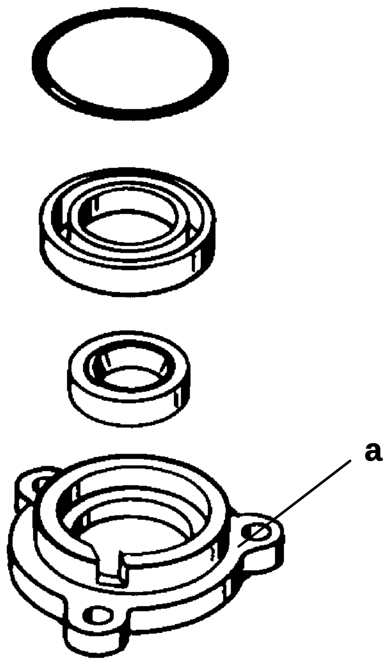
IMPORTANT: Extend sealer to edge on each center main journal to prevent blow-by between cylinders.



52891

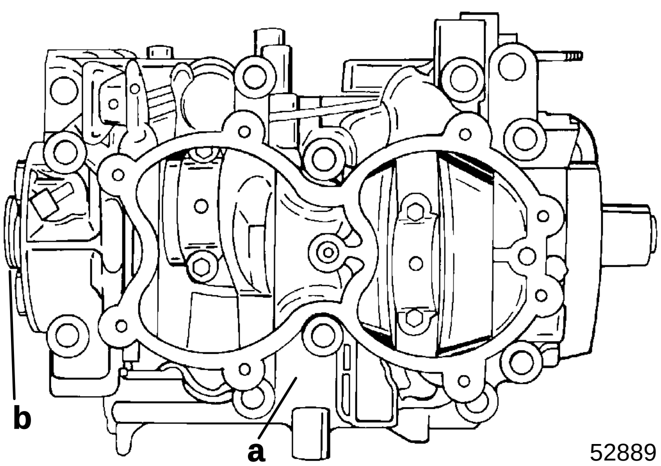
Sealant "Bead Pattern" Indicated by Bold Line Above

3. Install end cap assembly (lubricate seals with 2-cycle engine oil) to block. Apply Perfect Seal to flange of end cap (a).



a - End Cap Flange

4. Place crankcase cover onto block.

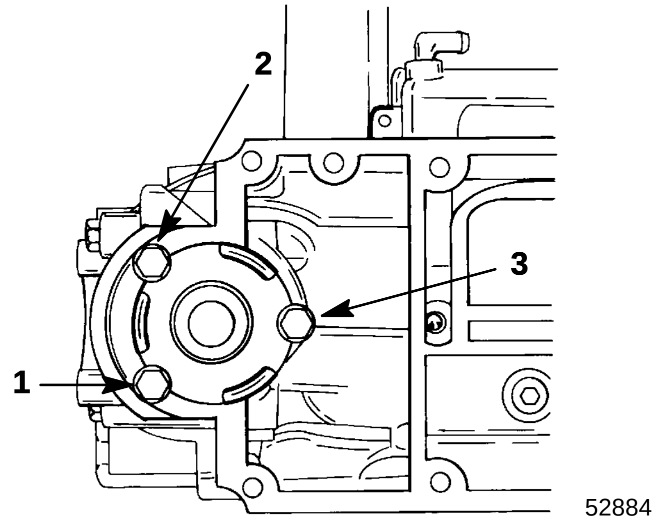


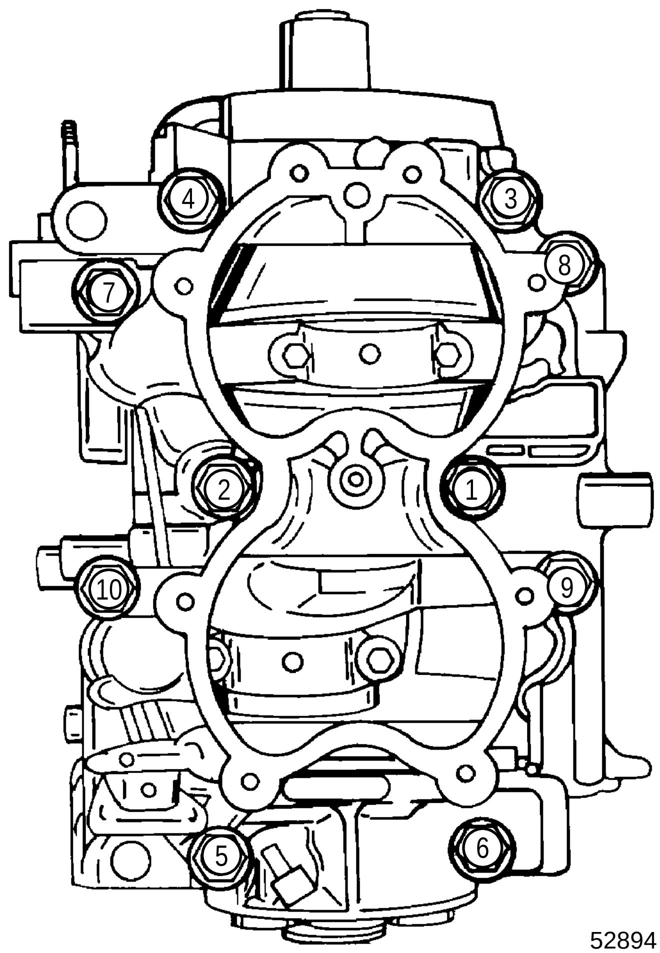
a - Crankcase Cover
b - End Cap

5. Insert clean bolts and finger tighten.

IMPORTANT: Torque crank case cover bolts FIRST before torquing end cap cover bolts.

6. Torque bolts to 16.5 lb. ft. (22.4 N·m) following sequence shown below.





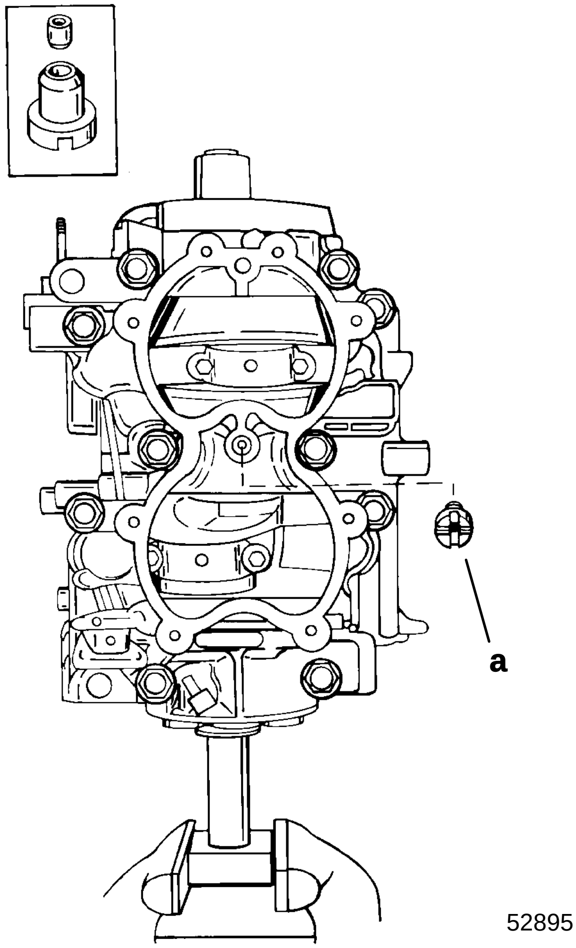
NOTE: *Inspect all hoses on reinstallation. Replace if necessary.*

Intake/Reed Block Manifold Installation

1. Place engine on repair stand or on bench.

NOTE: *Powerhead repair stand 91-827001A1 can be used.*

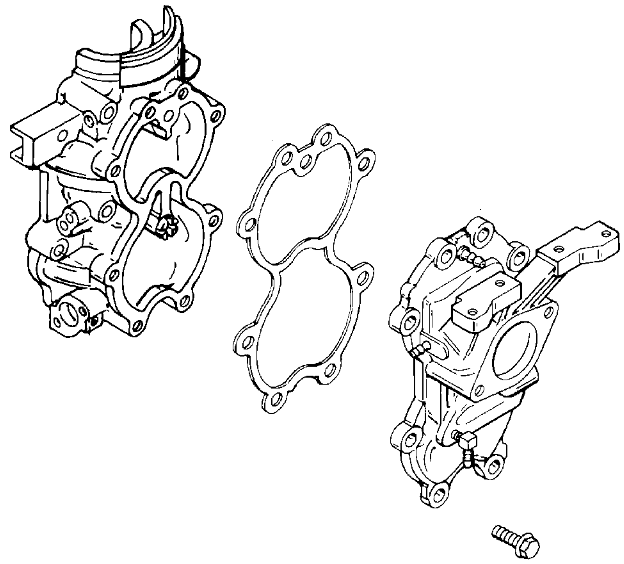
2. Install check valve/holder.



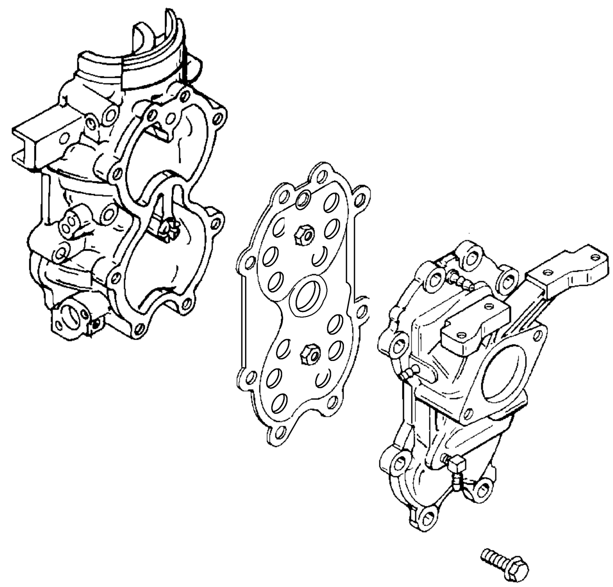
a - Check Valve/Holder

3. Install reed block manifold and intake manifold with gasket to cylinder block.

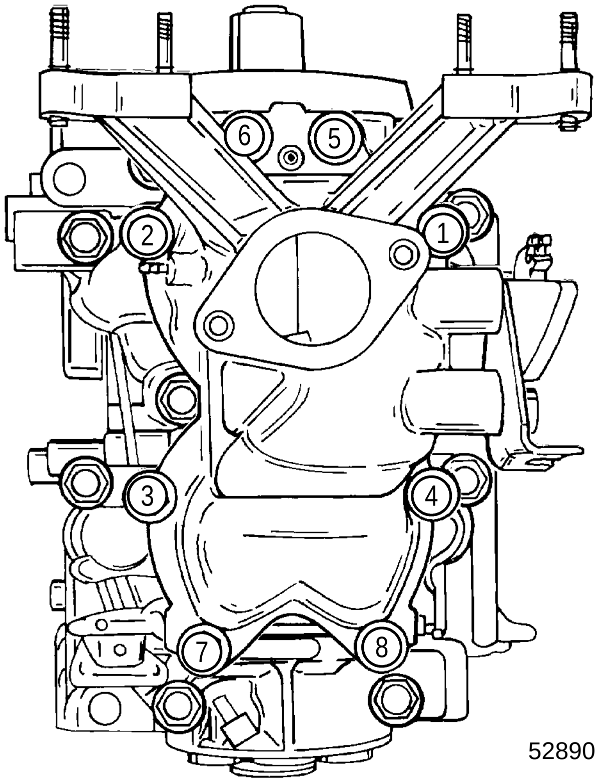
S/N 0G380074 & Below



S/N 0G380075 & Above



4. Install bolts and torque to 16.5 lb. ft. (22.4 N·m) in sequence shown below.

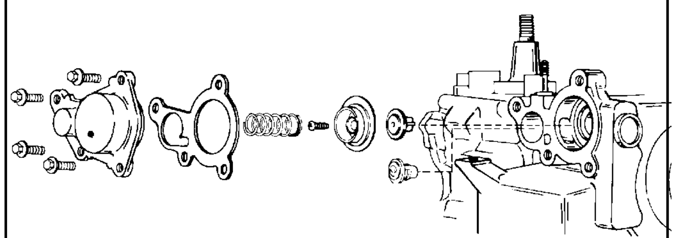


52890

Thermostat Cover Installation

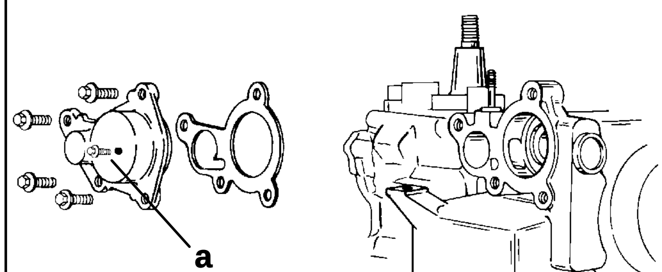
1. Install thermostat components into cylinder block. Torque bolts to 16.5 lb. ft. (22.4 N·m).

ELECTRIC MODELS 1994 THRU 1997
ALL MODELS 1998 AND ABOVE



52653

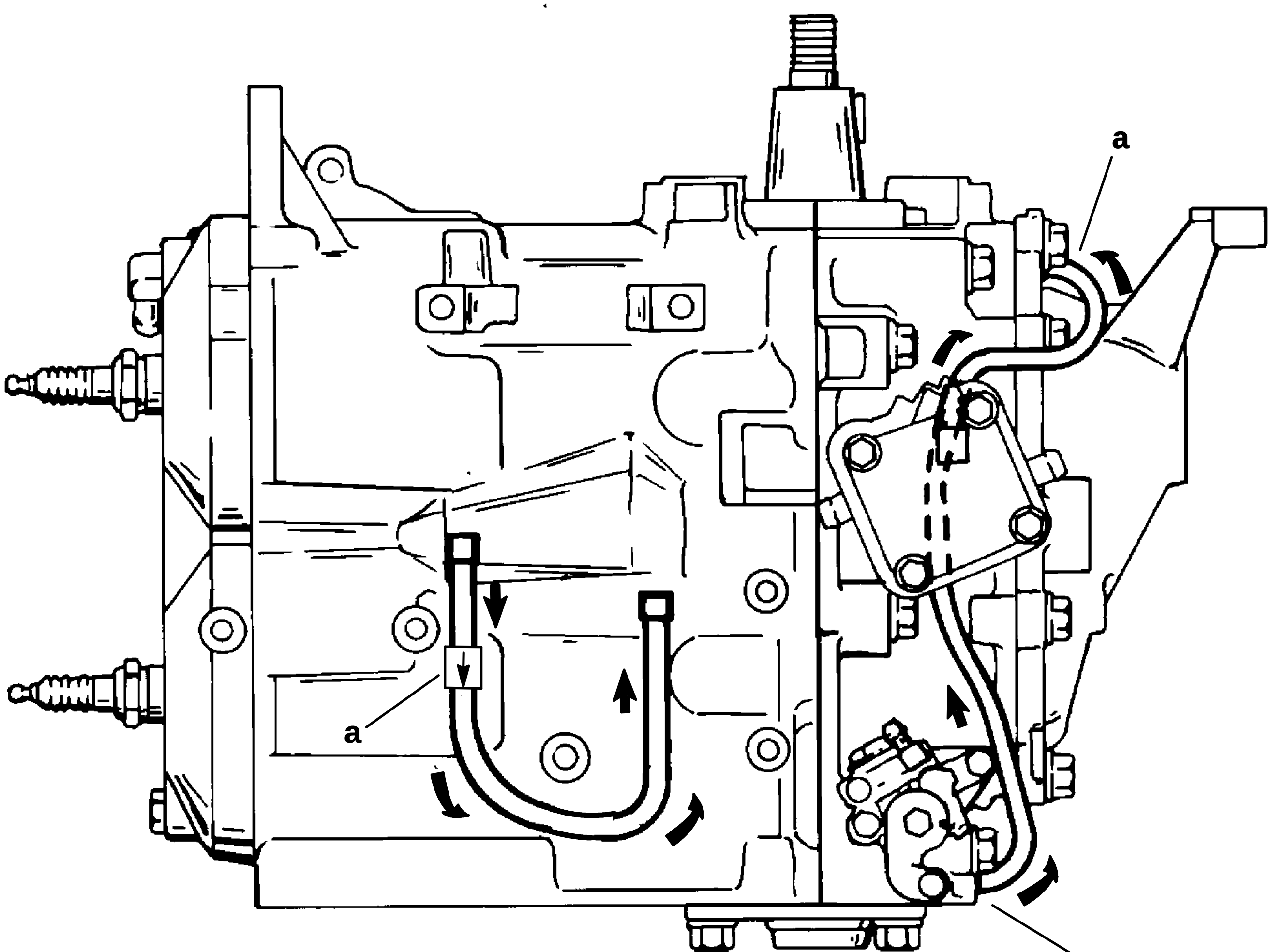
MANUAL MODELS 1994 THRU 1997



52652

a - Plug - Apply Loctite Pipe Sealant with Teflon (592) to Threads

30/40 Bleed Hose Routing



a - Check Valves

IMPORTANT: If engine smokes excessively at idle and/or runs rough (chugs) at off-idle when accelerating, inspect check valves in bleed hoses for proper functioning. Check valves should flow in one direction only.

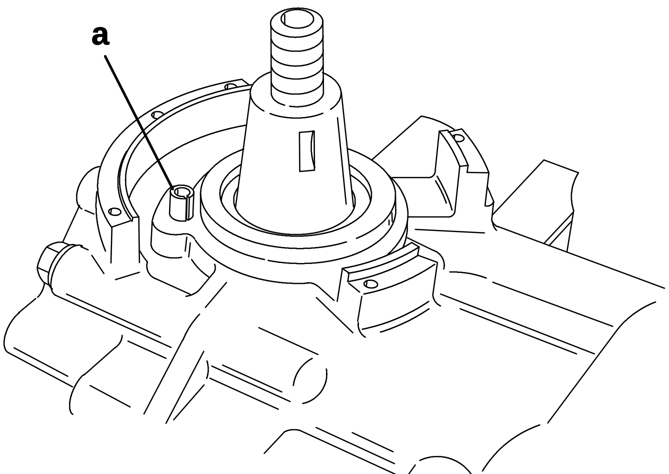
Powerhead Installation

The following components/assemblies can be installed prior to installation of powerhead on drive-shaft housing:

Component/Assembly	Section
Starter Motor	2B
Capacitor Discharge Module	2A*
Starter Solenoid	2B*
Voltage Regulator/Rectifier	2B*
Flywheel	2A
Stator Assembly	2A*
Trigger Assembly	2A*
Air Silencer	3B
Carburetor and Linkage	3B
Fuel Pump	3A
Fuel Enrichment Valve	3B
Shift Cable Latch Assembly	7A
Control Cable Anchor Bracket	7A
Warning Module	3C*
Oil Pump	3C

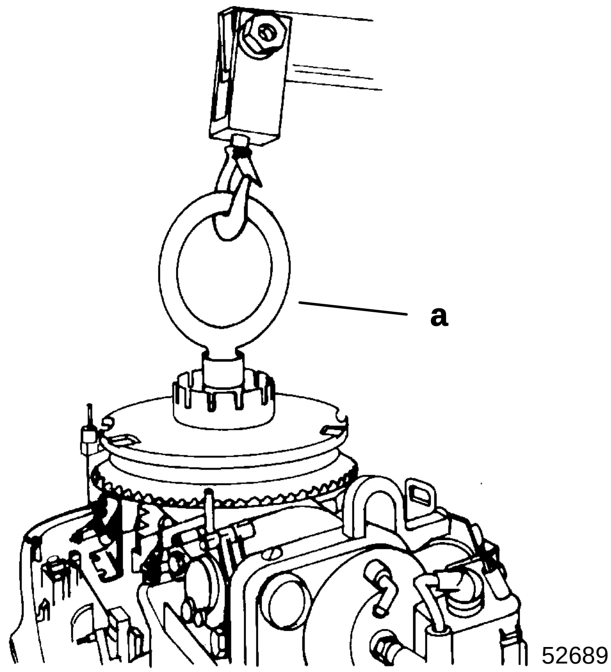
* Note: All ignition and electrical components can be installed as an assembly.

***NOTE:** New trigger for mechanical spark advance for 1998 and newer models does not use roll pin to lock trigger in place. Trigger must be loose. For models before 1998, roll pin is required to hold trigger. Insert into hole as shown.*



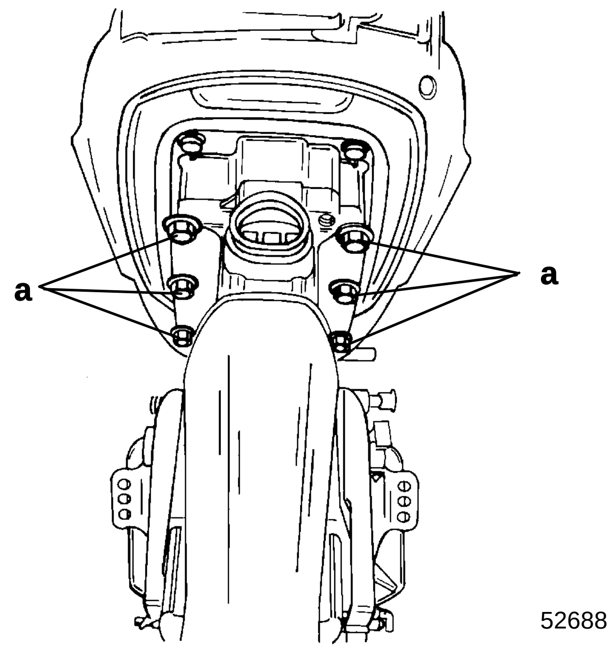
a - Roll Pin

1. Thread lifting eye at least 5 turns into flywheel.



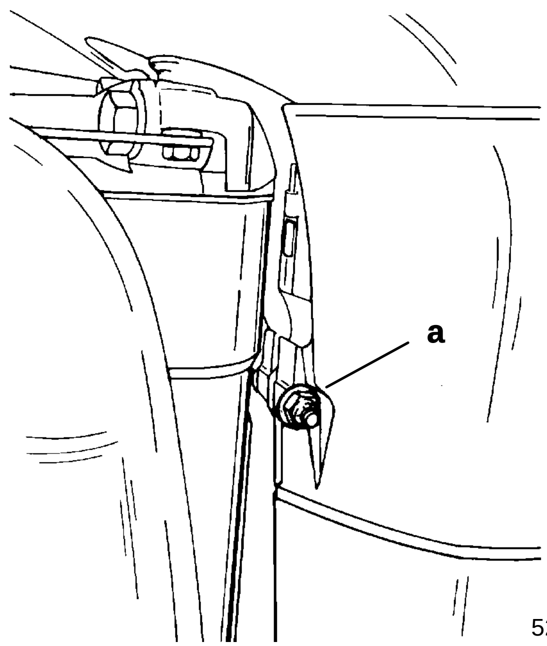
a - Lifting Eye (P/N 91-90455)

2. Remove all old gasket material from powerhead base and matching drive shaft housing surface.
3. Install new powerhead base gasket.
4. Apply a light coat of Special Lubricant 101 to drive shaft splines. DO NOT apply lubricant to TOP of drive shaft as grease may preload drive shaft/ crankshaft resulting in damage to powerhead and/or gear housing.
5. Secure powerhead to drive shaft housing with 6 bolts. Torque bolts to 29.2 lb ft. (39.6 N·m).



a - Bolt (6) Torque to 29.2 lb. ft. (39.6 N·m)

6. Install upper drive shaft housing cover and secure cover with bolt, nut and flat washer.



a - Bolt, Nut, Washer

Test Run Procedure

⚠ CAUTION

While priming fuel system with primer bulb prior to starting engine, inspect all fuel line connections and components for gasoline leaks. Repair any fuel leaks BEFORE starting outboard.

⚠ CAUTION

When engine is started, IMMEDIATELY check that water pump is operating. Operation of water pump is indicated by water discharging from "tell tale".

While test running outboard, check powerhead assembly for leaks and/or unusual noises. Make any repairs BEFORE placing outboard in service.

Break-in Procedure

⚠ CAUTION

Severe damage to the engine can result by not complying with the Engine Break-in Procedure.

MODELS WITH OIL INJECTION

Engine Break-in Fuel Mixture

Use a 50:1 (2%) gasoline/oil mixture in the first tank of fuel. Use of this fuel mixture combined with oil from the oil injection system will supply adequate lubrication during engine break-in.

Engine Break-in Procedure

Vary the throttle setting during the first hour of operation. During the first hour of operation, avoid remaining at a constant speed for more than two minutes and avoid sustained wide open throttle.

MODELS WITHOUT OIL INJECTION

Engine Break-in Fuel Mixture

Use a 25:1 (4%) gasoline/oil mixture in the first tank of fuel.

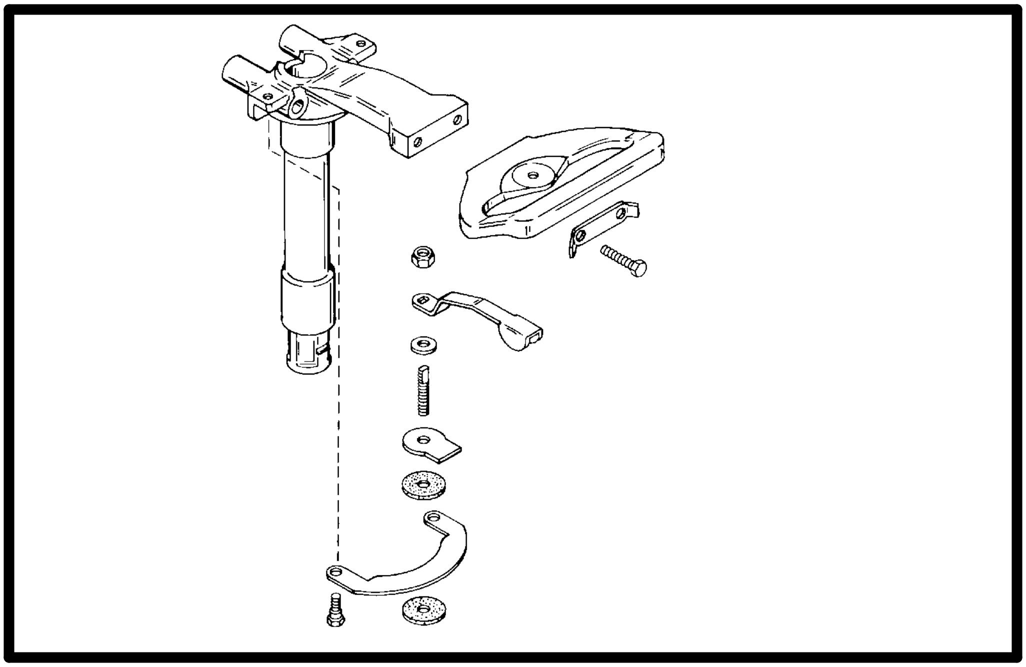
Engine Break-in Procedure

Vary the throttle setting during the first hour of operation. During the first hour of operation, avoid remaining at a constant speed for more than two minutes and avoid sustained wide open throttle.

MID-SECTION

5

A



CLAMP/SWIVEL BRACKETS AND DRIVE SHAFT HOUSING

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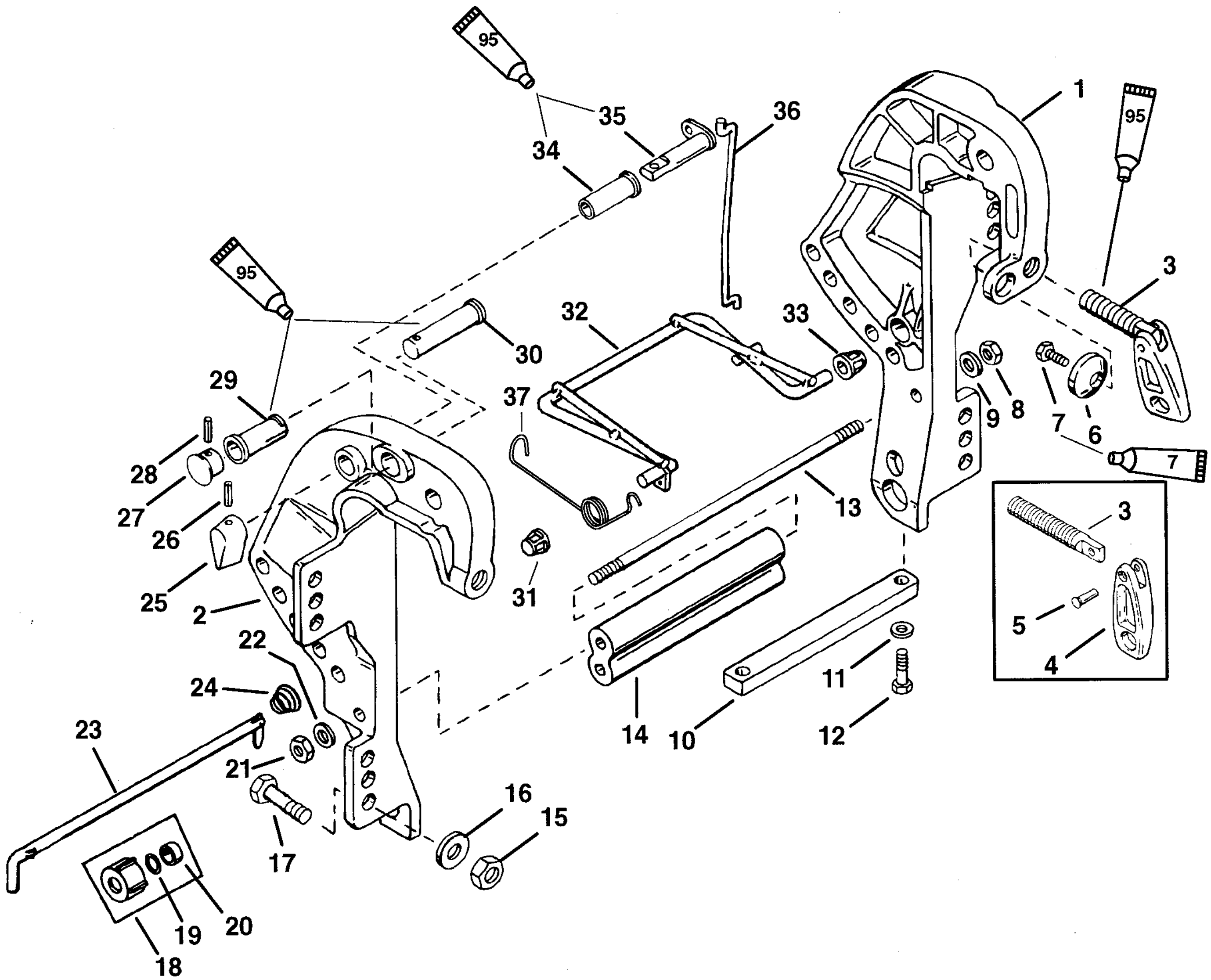
Notes:

Clamp Bracket Components



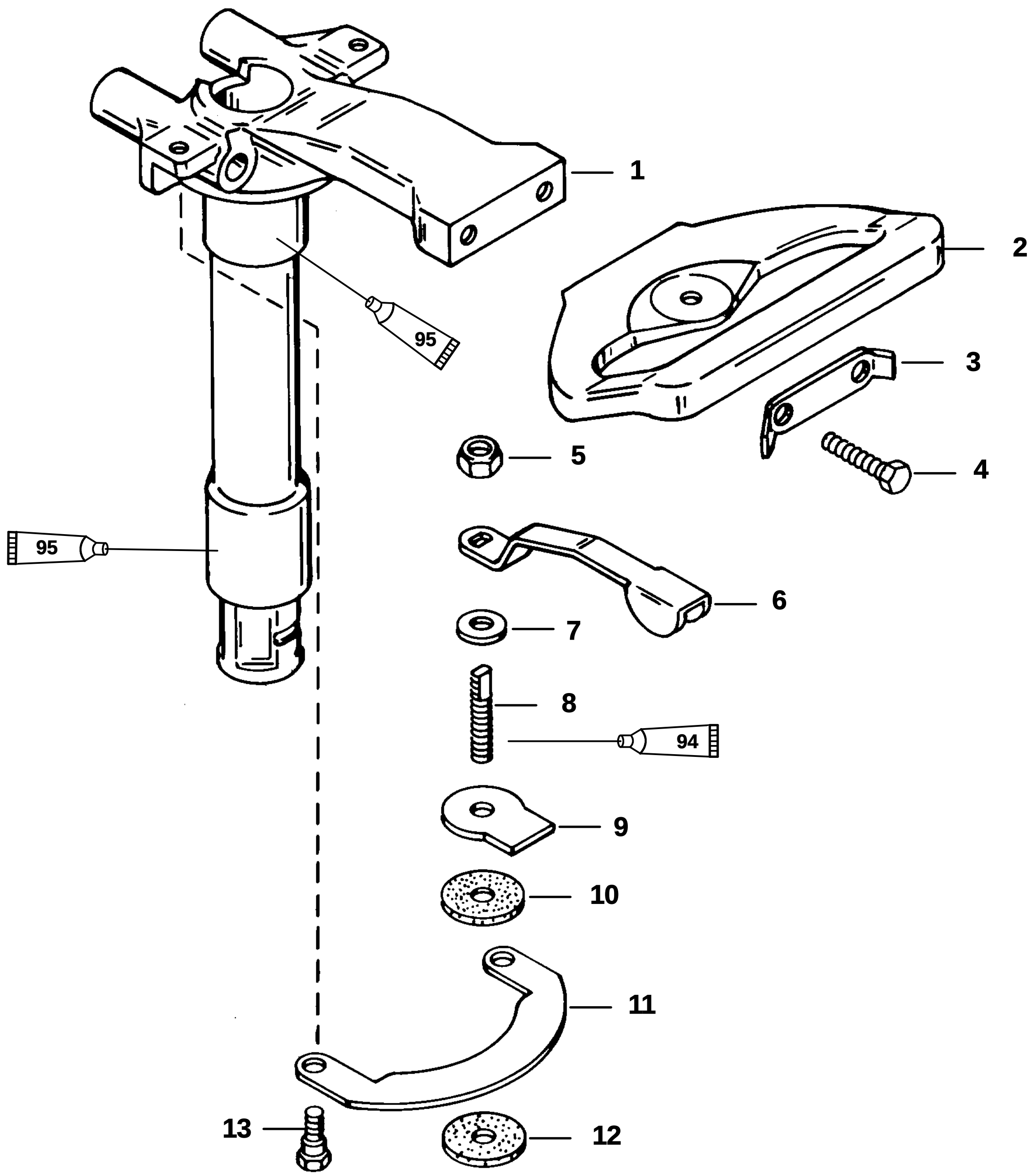
7 Loctite "271" Adhesive Sealant (92-809819)

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

Clamp Bracket Components

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	CLAMP BRACKET **(BLACK)** **PORT SHORT**			
	1	CLAMP BRACKET **(GRAY)** **1 lower mounting hole**			
	1	CLAMP BRACKET **(BLACK)** **PORT LONG**			
	1	CLAMP BRACKET **(GRAY)** **3 lower mounting holes**			
2	1	CLAMP BRACKET **(BLACK)** **STBD. SHORT**			
	1	CLAMP BRACKET **(GRAY)** **1 lower mounting hole**			
	1	CLAMP BRACKET **(BLACK)** **STBD. LONG**			
	1	CLAMP BRACKET **(GRAY)** **3 lower mounting holes**			
3	2	THUMB SCREW ASSEMBLY			
4	2	HANDLE			
5	2	RIVET **MANUAL**			
6	2	WASHER			
7	2	SCREW (Hex shoulder)	60		6.8
8	1	NUT (M10 x 1.5)		28	37.9
9	1	WASHER			
10	1	ANODE			
11	2	WASHER			
12	2	SCREW (M6 x 25)	60		6.8
13	1	STUD (M10 x 277)			
14	1	SPACER			
15	4	NUT (.500-20) **(LONG)**	Drive Tight		
	2	NUT (.500-20) **(SHORT) (TOP)**	Drive Tight		
	2	NUT (M10 x 1.5) **(SHORT) (BOTTOM)**	Drive Tight		
16	4	WASHER **(LONG)**			
	2	WASHER **(SHORT) (TOP)**			
	2	WASHER **(SHORT) (BOTTOM)**			
17	4	SCREW (.500-20 x 4”) **(LONG)**			
	2	SCREW (.500-20 x 4”) **(SHORT) (TOP)**			
	2	SCREW **(SHORT) (BOTTOM)**			
18	1	SEAL KIT			
19	1	O RING			
20	1	SPACER			
21	1	NUT (M10 x 1.5)		28	37.9
22	1	WASHER			
23	1	TILT LOCK PIN			
24	1	SPRING			
25	1	LEVER-Shallow Water Drive			
26	1	ROLL PIN			
27	1	CAP-Tilt Stop Pin			
28	1	ROLL PIN			
29	1	BUSHING			
30	1	PIN-Tilt Stop			
31	1	BUSHING (PLASTIC)			
32	1	ROD-Shallow Water Drive			
33	1	BUSHING (PLASTIC)			
34	1	BUSHING			
35	1	ARM			
36	1	LINK ROD			
37	1	SPRING			

Swivel Tube Components



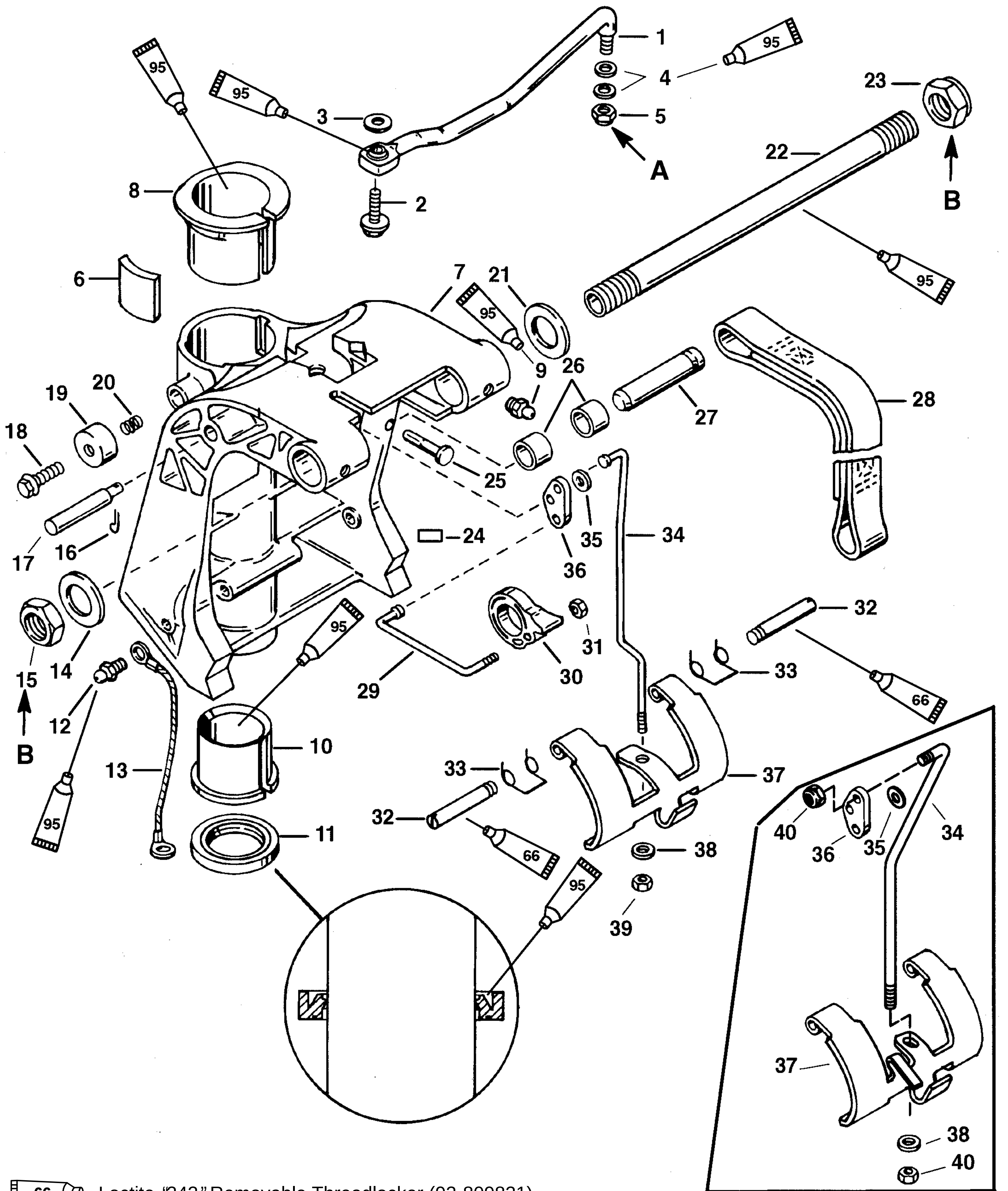
94 Anti-Corrosion Grease (92-78376A6)

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

Swivel Tube Components

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	SWIVEL TUBE HEAD **(BLACK)**			
	1	SWIVEL TUBE HEAD **(GRAY)**			
2	1	HANDLE -Carrying **(BLACK)**			
	1	HANDLE -Carrying **(GRAY)**			
3	1	TAB WASHER			
4	2	SCREW (M10 x 45 Hex head cap)		32	43.4
5	1	NUT (.375-24)			
6	1	LEVER-Co-pilot			
7	1	WASHER			
8	1	ROD (THREADED)			
9	1	BRAKE PLATE			
10	1	DISC-Brake			
11	1	PLATE-Swivel Head			
12	1	DISC-Brake			
13	2	SCREW (HEX SHOULDER)	70		7.9

Swivel Bracket Components



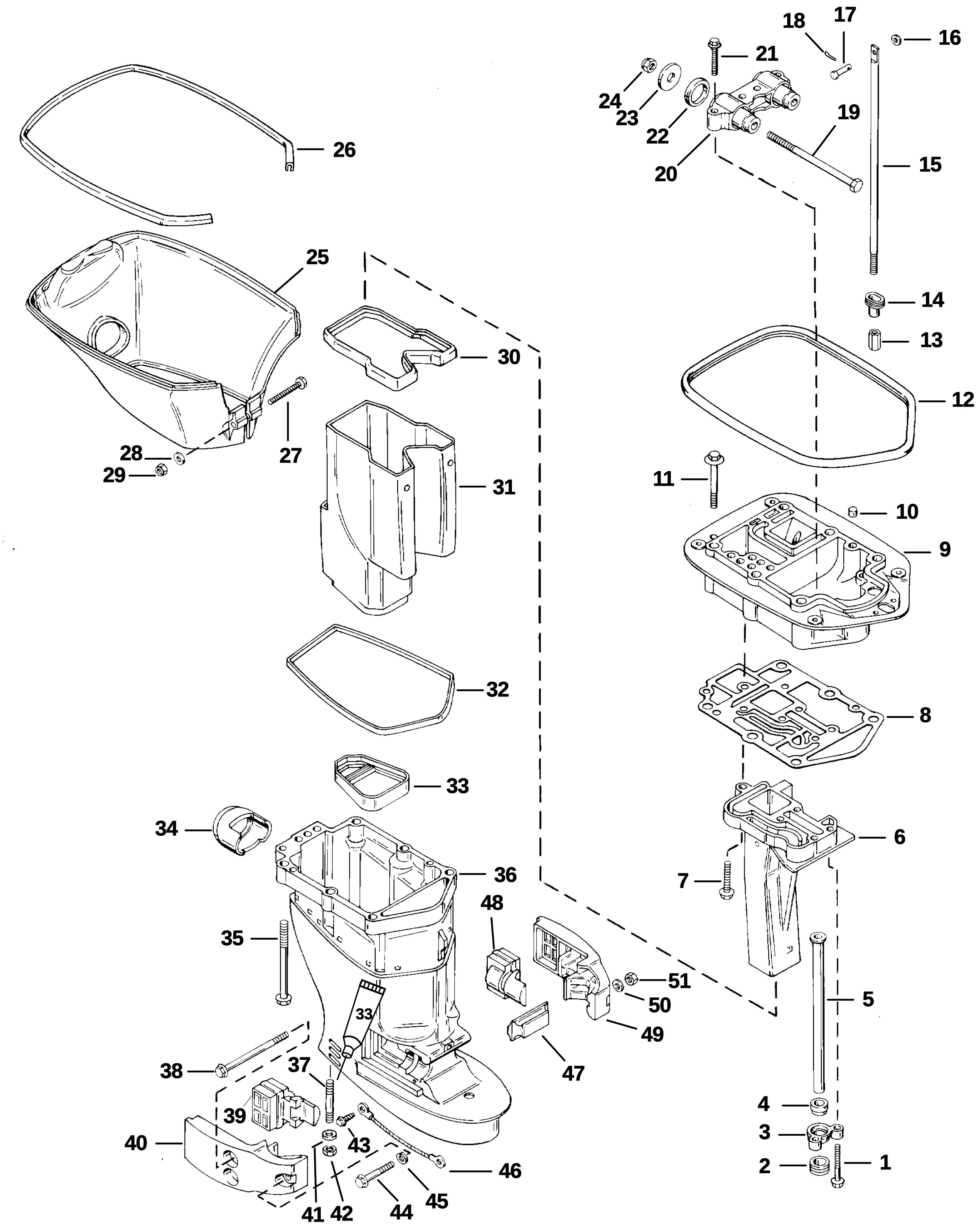
66 Loctite "242" Removable Threadlocker (92-809821)

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

A - Tighten nut until it seats and then back off 1/4 turn.
B - Tighten nut to 32 lb. ft. (43.4 N·m) and then back off 1/4 turn.

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	LINK ROD			
2	1	SCREW (1-1/2 IN.)	240	20	27.1
3	1	WASHER			
4	2	WASHER			
5	2	NUT (.375-24)			
6	1	PUCK-Co-pilot **(NON HANDLE MODELS)**			
7	1	SWIVEL BRACKET ASSEMBLY **(BLACK)**			
	1	SWIVEL BRACKET ASSEMBLY **(GRAY)**			
8	1	BUSHING (UPPER)			
9	3	GREASE FITTING			
10	1	BUSHING (LOWER)			
11	1	SEAL			
12	1	GREASE FITTING			
13	1	CABLE ASSEMBLY			
14	1	WASHER			
15	1	NUT (.875-14)			
16	1	COTTER PIN			
17	1	PIVOT PIN-Reverse Lock			
18	1	SCREW (M8 x 10) (**HANDLE)**			
	1	SCREW (M8 x 1.25 x 25)			
19	1	BOOT-Rubber **NON HANDLE**			
20	1	SPRING			
21	1	WASHER			
22	1	TILT TUBE			
23	1	NUT (.875-14)			
24	1	DECAL-Co-pilot			
25	1	PIN (TRILOBE)			
26	2	BUSHING			
27	1	PIVOT PIN (UPPER)			
28	1	STRAP-Tilt Stop **(NON POWER TRIM)**			
29	1	LINK-Reverse Lock (UPPER)			
30	1	LEVER-Reverse Lock			
31	1	NUT			
32	2	PIN-Reverse Lock			
33	2	SPRING-Reverse Lock			
34	1	LINK-Reverse Lock			
35	1	WASHER **1/8 IN. DIA. LINK ROD**			
36	1	ARM-Reverse Lock			
37	1	REVERSE LOCK			
38	1	WASHER			
39	1	NUT			
34	1	LINK-Reverse Lock			
35	1	WASHER **3/16 IN. DIA. LINK ROD**			
36	1	ARM-Reverse Lock			
37	1	REVERSE LOCK			
38	1	WASHER (Use where applicable)			
40	2	NUT			

Drive Shaft Housing Components

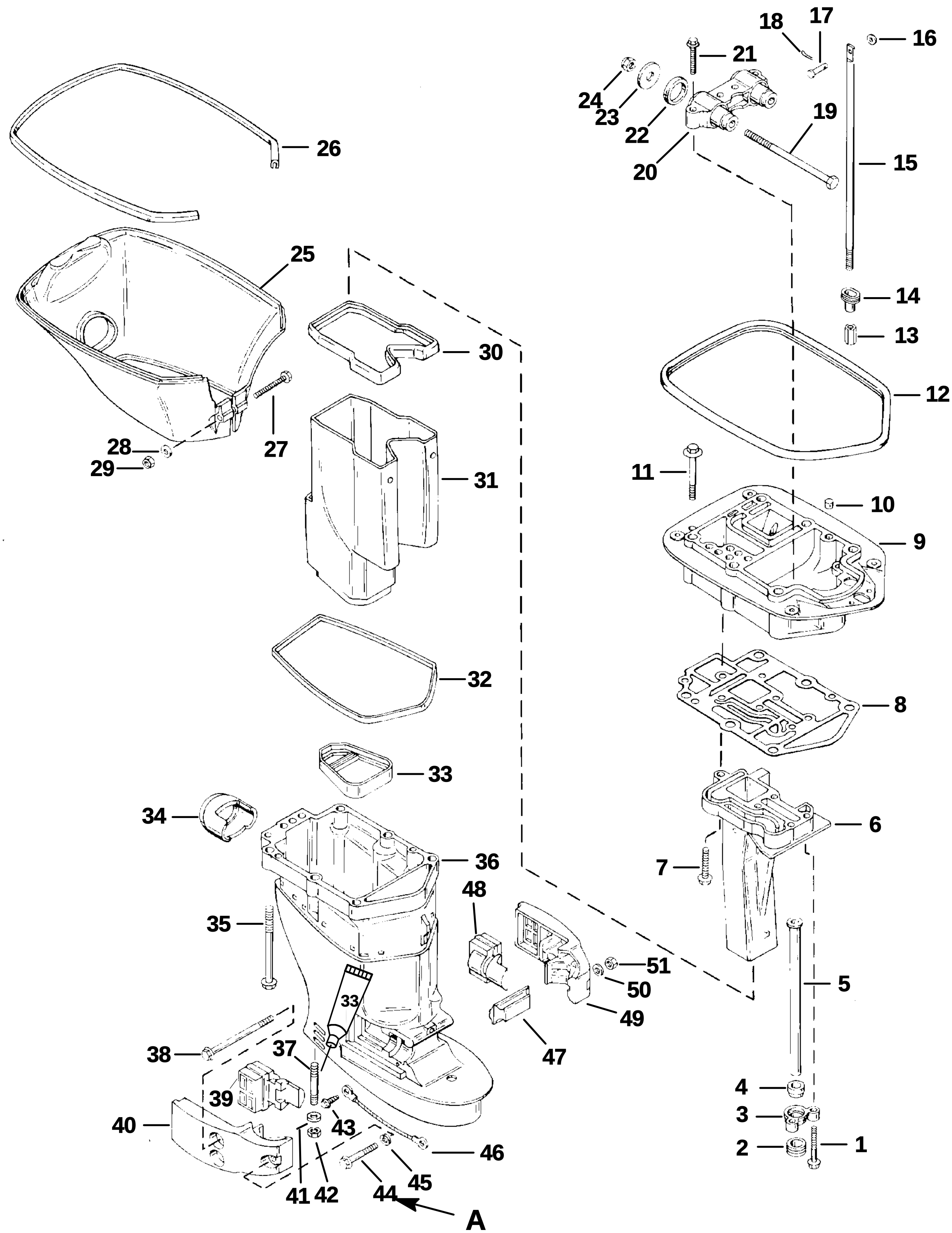


33 Loctite "RCA/680" Retaining Compound (92-809833)

Drive Shaft Housing Components

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	2	SCREW (M8 x 1.25 x 55)	198	16.5	22.4
2	1	GROMMET-Water Tube			
3	1	CLAMP-Water Tube			
4	1	SEAL-Water Tube			
5	1	WATER TUBE **(SHORT)**			
	1	WATER TUBE **(LONG)**			
6	1	EXHAUST TUBE			
7	3	SCREW (M8 x 1.25 x 45)	198	16.5	22.4
8	1	GASKET-Drive Shaft Housing			
9	1	ADAPTOR PLATE **(BLACK)**			
	1	ADAPTOR PLATE **(GRAY)**			
10	4	DOWEL PIN			
11	1	SCREW (M10 x .75)	198	16.5	22.4
12	1	SEAL-Bottom Cowl			
13	1	COUPLER			
14	1	GROMMET-Shift Shaft			
15	1	SHIFT SHAFT (UPPER)			
16	1	WASHER			
17	1	PIN-Shift Link			
18	1	COTTER PIN			
19	2	SCREW (M12 x 1.75 x 162)			
20	1	MOUNT			
21	4	SCREW (M8 x 1.25 x 45)			
22	2	WASHER			
23	2	WASHER			
24	2	NUT (M12 x 1.75)		50	67.8
25	1	TRIM COVER **(BLACK)**			
	1	TRIM COVER **(GRAY)**			
26	1	BUMPER			
27	1	SCREW (M5 x .8 x 60)			
28	1	WASHER			
29	1	NUT (M5 x .8)			

Driveshaft Housing Components



33 Loctite "RCA/680" Retaining Compound (92-809833)

A - Torque the rear TOP and then the BOTTOM lower mount bolt/nut first; then torque the FRONT bolt/nut. After torquing the front bolt/nut, retorque the rear top and bottom bolt/nut.

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
30	1	SEAL-Exhaust Bucket			
31	1	EXHAUST BUCKET			
32	1	BUMPER-Trim Cover			
33	1	SEAL-Exhaust Tube			
34	1	SEAL-Idle Relief			
35	6	SCREW (M10 x 110)		29	39.3
36	1	DRIVESHAFT HOUSING **(SHORT-BLACK)**			
	1	DRIVESHAFT HOUSING **(SHORT-GRAY)**			
	1	DRIVESHAFT HOUSING **(LONG-BLACK)**			
	1	DRIVESHAFT HOUSING **(LONG-GRAY)**			
37	1	STUD (M10 x 1.5 x 50) **(SHORT/LONG)**			
	1	STUD (M10 x 1.5 x 114) **(X-LONG)**			
38	2	SCREW (M8 x 1.25 x 120)			
39	1	MOUNT (LOWER)			
40	1	COVER-Mount **(BLACK)**			
	1	COVER-Mount **(GRAY)**			
41	1	WASHER			
42	1	NUT (M10)		40	54.2
43	2	SCREW (10-16 x .38)			
44	1	SCREW (M8 x 1.25 x 65)			
45	1	LOCKWASHER			
46	1	CABLE ASSEMBLY			
47	1	BUMPER (FRONT)			
48	1	MOUNT (LOWER)			
49	1	COVER-Mount **(BLACK)**			
	1	COVER-Mount **(GRAY)**			
50	3	WASHER			
51	3	NUT (M8 x 1.25)	240	20	27.1

Drive Shaft Housing Disassembly/Reassembly

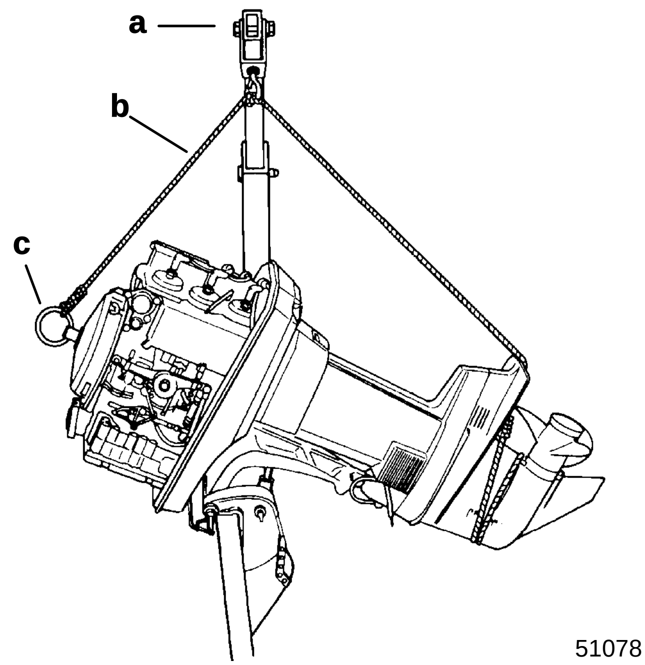
Servicing components such as steering arm, drive shaft housing, exhaust assembly and swivel bracket will usually require powerhead and/or gear housing removal.

Refer to SECTION 4 for powerhead removal and SECTION 6 for gear housing removal.

The transom bracket, lower mount bracket, tilt tube and lower engine mounts can be serviced without powerhead/gear housing removal. However, OUTBOARD MUST BE SUPPORTED BEFORE SERVICING COMPONENTS.

⚠ WARNING

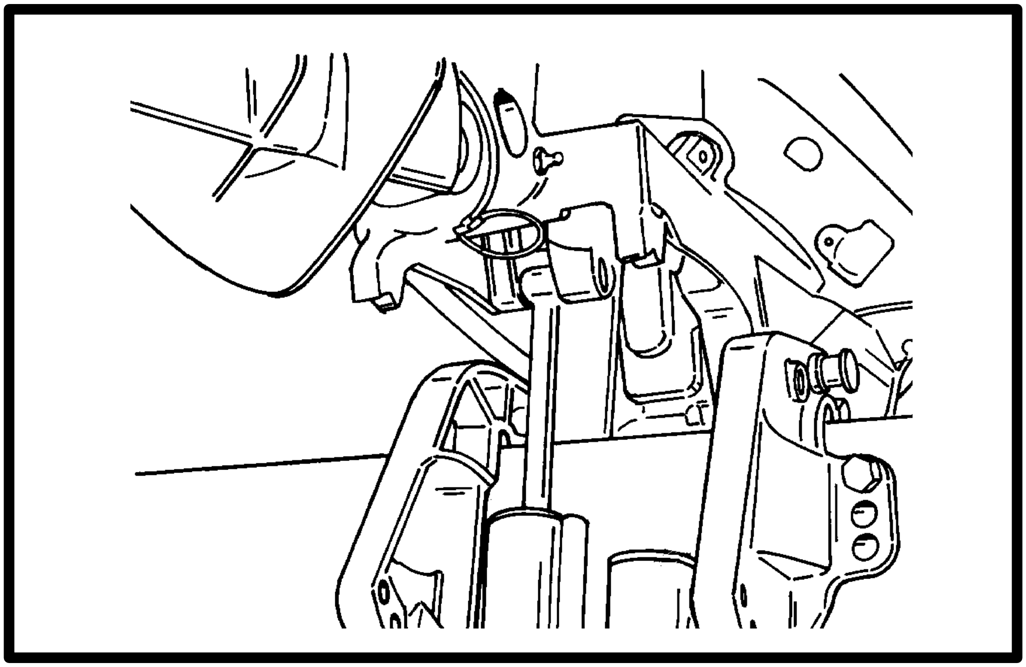
Failure to support outboard as shown could result in personal injury and/or damage to outboard or boat.



a - Hoist
b - Rope
c - Lifting Eye (91-90455)

IMPORTANT: All gaskets should be replaced when removing powerhead and/or disassembling drive shaft housing. Corresponding gasket mating surfaces should be cleaned of any gasket material before installing new gaskets.

MID SECTION



POWER TRIM

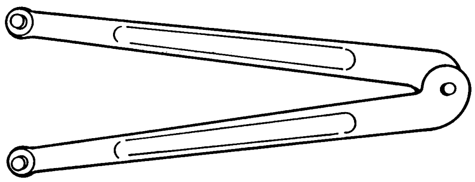
5

B

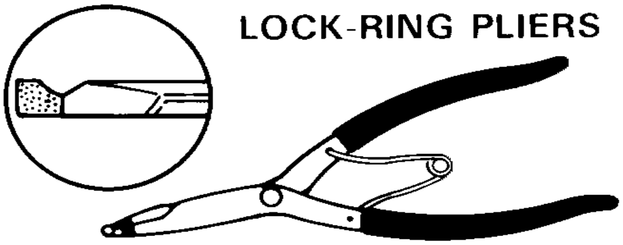
Table of Contents

Special Tools

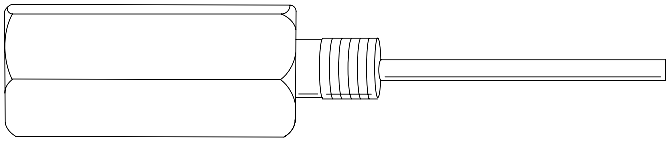
1. Spanner Wrench P/N 91-74951



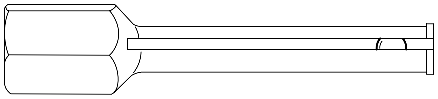
2. Lock-Ring Pliers P/N 91-822778A3



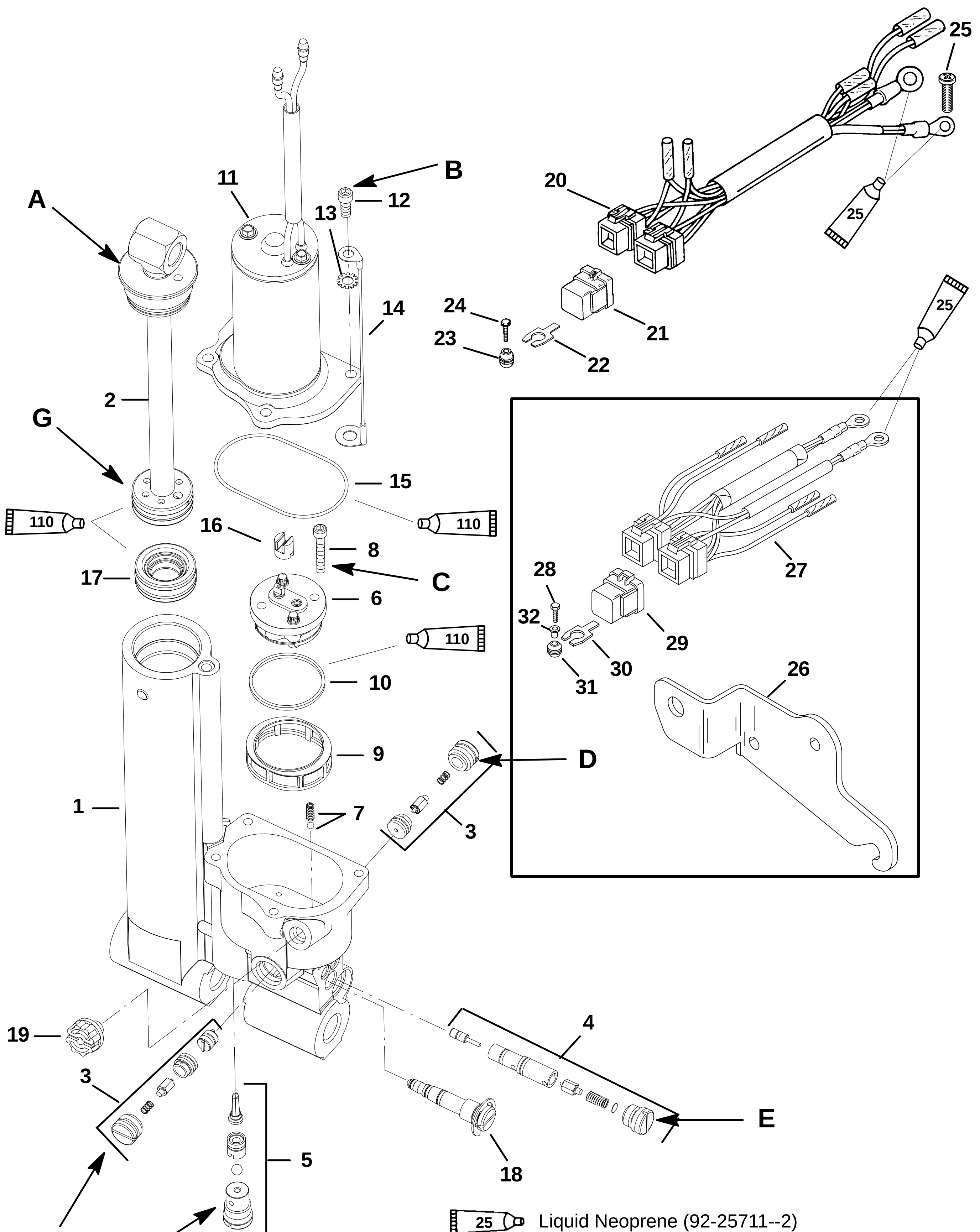
3. Expanding Rod P/N CG 41-11



4. Collet P/N CG 41-14



POWER TRIM COMPONENTS



25 Liquid Neoprene (92-25711--2)

110 Power Trim and Steering Fluid (92-90100A12)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	POWER TRIM ASSEMBLY **(S/N-USA-0G124404/BEL-9948794 & BELOW)**			
	1	POWER TRIM ASSEMBLY **(S/N-USA-0G124405/BEL-9948795 & ABOVE)**			
–	1	O RING KIT			
2	1	SHOCK ROD ASSY. **(S/N-USA-0G124404/BEL-9948794 & BELOW)**			
	1	SHOCK ROD ASSY. **(S/N-USA-0G124405/BEL-9948795 & ABOVE)**		45	61
3	1	PILOT CHECK ASSEMBLY	120		13.6
4	1	TILT RELIEF VALVE ASSEMBLY	120		13.6
5	1	SUCTION SEAT ASSEMBLY	120		13.6
6	1	PUMP ASSEMBLY			
7	1	BALL & SPRING			
8	1	SCREW	70		7.9
9	1	FILTER			
10	1	O RING			
11	1	MOTOR ASSEMBLY			
12	4	SCREW	80		9.0
13	4	WASHER			
14	1	CABLE			
15	1	O RING			
16	1	COUPLER			
17	1	MEMORY PISTON			
18	1	MANUAL RELEASE VALVE ASSEMBLY	Drive Tight		
19	1	RESERVOIR PLUG	Drive Tight		
–	1	HARNESS ASSEMBLY–Trim			
20	1	HARNESS ASSEMBLY–Trim **DESIGN I**			
21	2	RELAY			
22	2	BRACKET			
23	2	GROMMET			
24	2	SCREW (M6 x 1 x 25)			
25	1	SCREW (10-16 x 5/8–Self-Tap)			
26	1	BRACKET			
27	1	HARNESS-Trim			
28	2	SCREW (M6 x 25) **DESIGN II**			
29	2	RELAY ASSEMBLY			
30	2	BRACKET			
31	2	GROMMET			
32	2	BUSHING			

A - TORQUE CYLINDER CAP TO 45 LB. FT. (61 N·M)

B - TORQUE SCREW TO 80 LB. IN. (9.0 N·M)

C - TORQUE SCREW TO 70 LB. IN. (7.9 N·M)

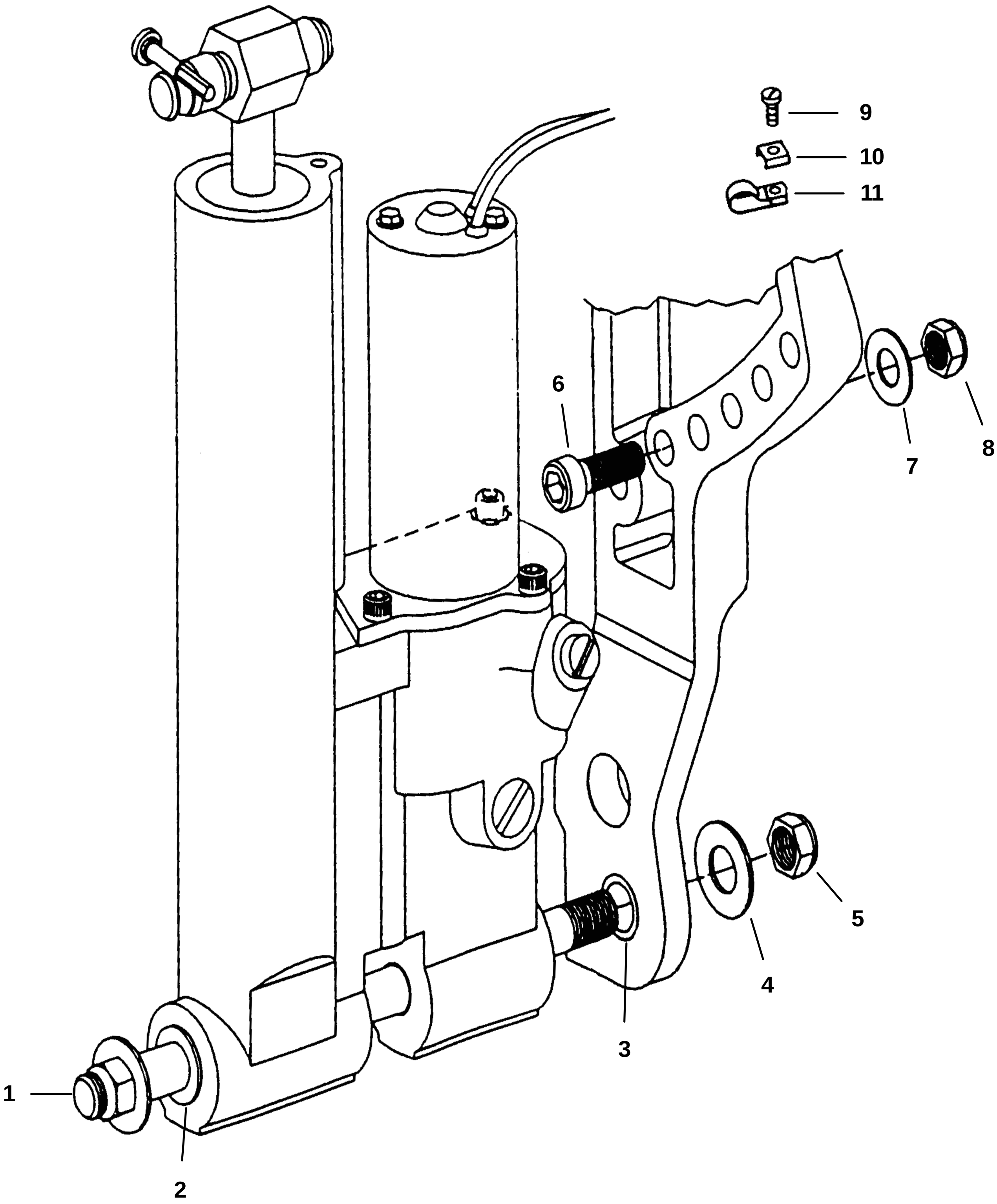
D - TORQUE PILOT CHECK PLUG TO 120 LB. IN. (13.6 N·M)

E - TORQUE TILT RELIEF PLUG TO 120 LB. IN. (13.6 N·M)

F - TORQUE SUCTION SEAT PLUG TO 120 LB. IN. (13.6 N·M)

G - TORQUE SHOCK PISTON TO 45 LB. FT. (61 N·M)

POWER TRIM MOUNTING



REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	PIN–anchor (14MM)			
2	2	BUSHING			
3	2	BUSHING			
4	2	WASHER			
5	2	NUT			
6	2	SCREW (M10 x 40)			
7	2	WASHER			
8	2	NUT			
9	1	SCREW (10-16 x .38)	DRIVE TIGHT		
10	1	C WASHER			
11	2	CLIP			

Theory Of Operation

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.

Adjustments

Trimming Characteristics

NOTE: *Because varying hull designs react differently in various degrees of rough water, it is recommended to experiment with trim positions to determine whether trimming "up" or "down" will improve the ride in rough water.*

When trimming your 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, general increasing top speed.
- Transfers steering torque harder to port 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 will drive the pump, thus forcing automatic transmission fluid through internal passageways into the "up" side of the trim cylinder.

The trim cylinder/trim rod 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 pin relocation).

- Will help planing off, particularly with a heavy load.
- Usually improves ride in choppy water.
- In excess, can cause boat to veer to port or starboard (bow steer).
- Transfers steering torque harder to starboard (or less to port).
- Improves planing speed acceleration (by moving tilt pin 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, thus forcing automatic transmission fluid through internal passageways into the "down" side of the trim cylinder. The trim rod will move the engine downward 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.

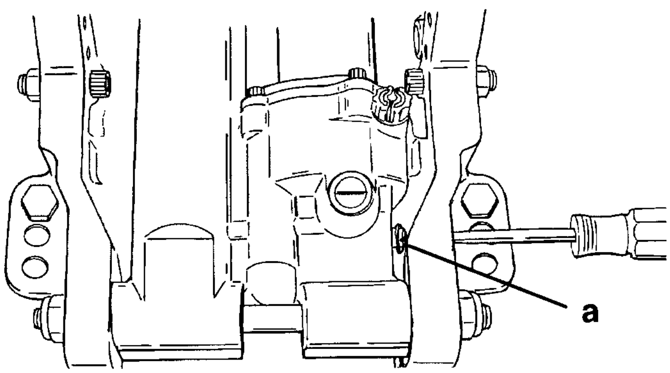
While operating "up" circuit, the cylinder rod will continue to tilt the outboard to a full up position for trailering.

Tilting Outboard Up and Down Manually

⚠ WARNING

Before loosening the manual release valve, make sure all persons are clear of engine as engine will drop to full "down" position when valve is loosened.

With power trim installed, the outboard can be raised or lowered manually by opening the manual release valve 3 to 4 turns (counterclockwise).



a - Manual Release Valve

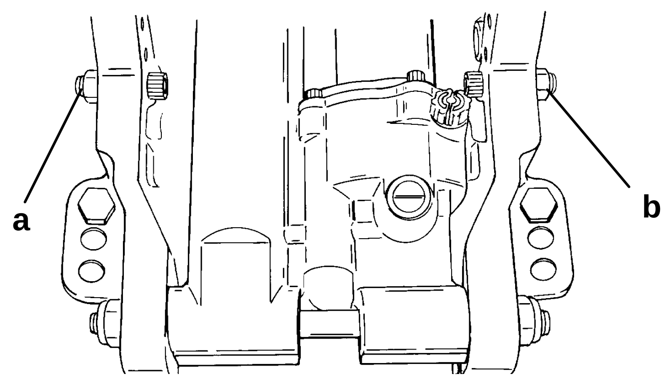
Trim "In" Angle Adjustment

⚠ WARNING

Operating some boats with engine trimmed to the full "in" trim angle 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 are trimmed to the full "in" trim angle, will not experience any undesirable and/or unsafe steering conditions during planing speed. 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, adjust the left and right tilt stop pins to prevent unsafe handling characteristics.

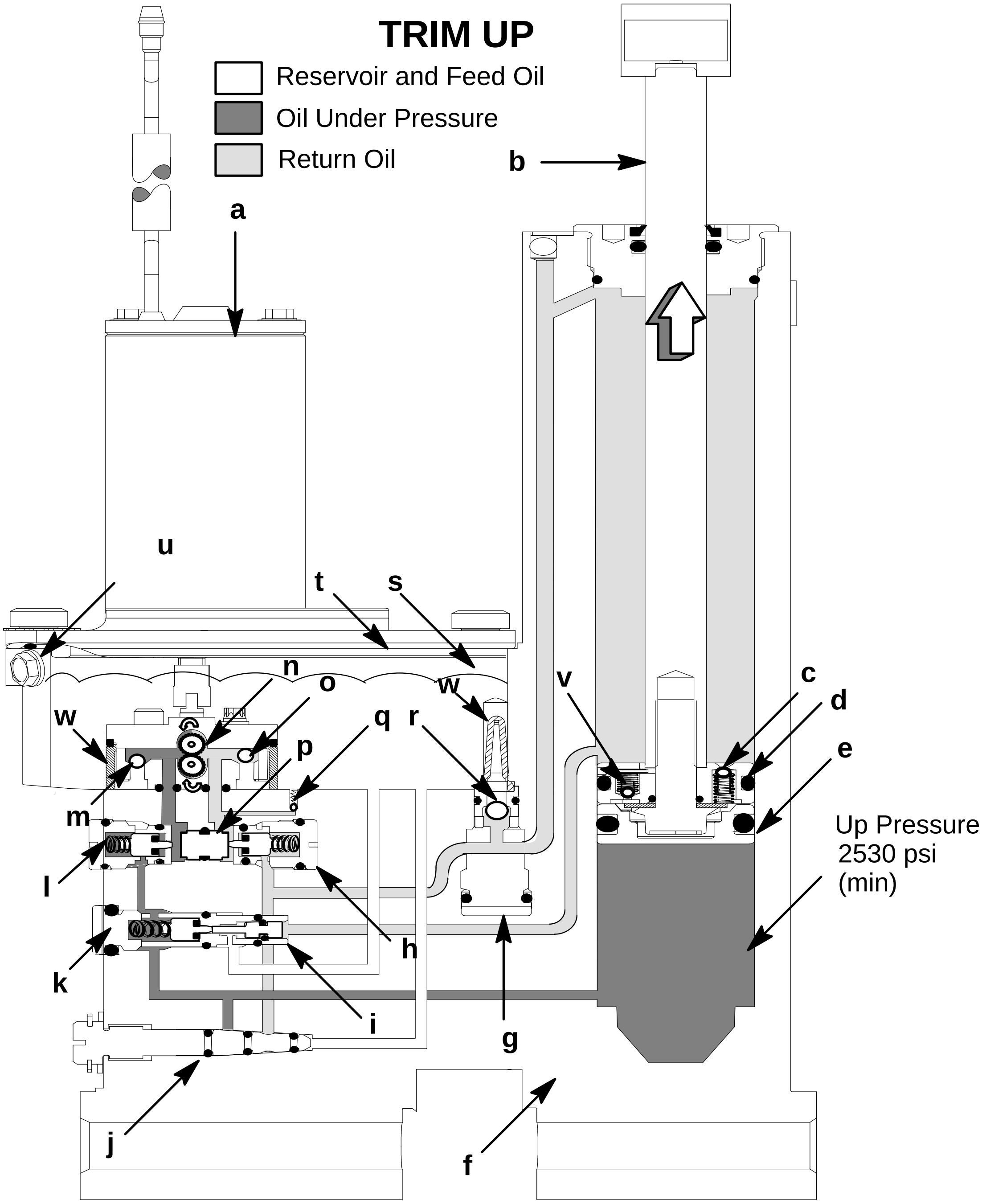
Water test the boat. If undesirable and/or unsafe steering conditions are experienced (boat runs with nose down), adjust the left and right tilt stop pins in proper hole to prevent unsafe handling characteristics.



a - Left Tilt Stop Pin
b - Right Tilt Stop Pin

IMPORTANT: In order to remove the right tilt stop pin it may be necessary to remove the upper pivot pin and pivot the tilt/trim assembly out of the clamp brackets. See "Power Trim System Removal" to remove the upper pivot pin.

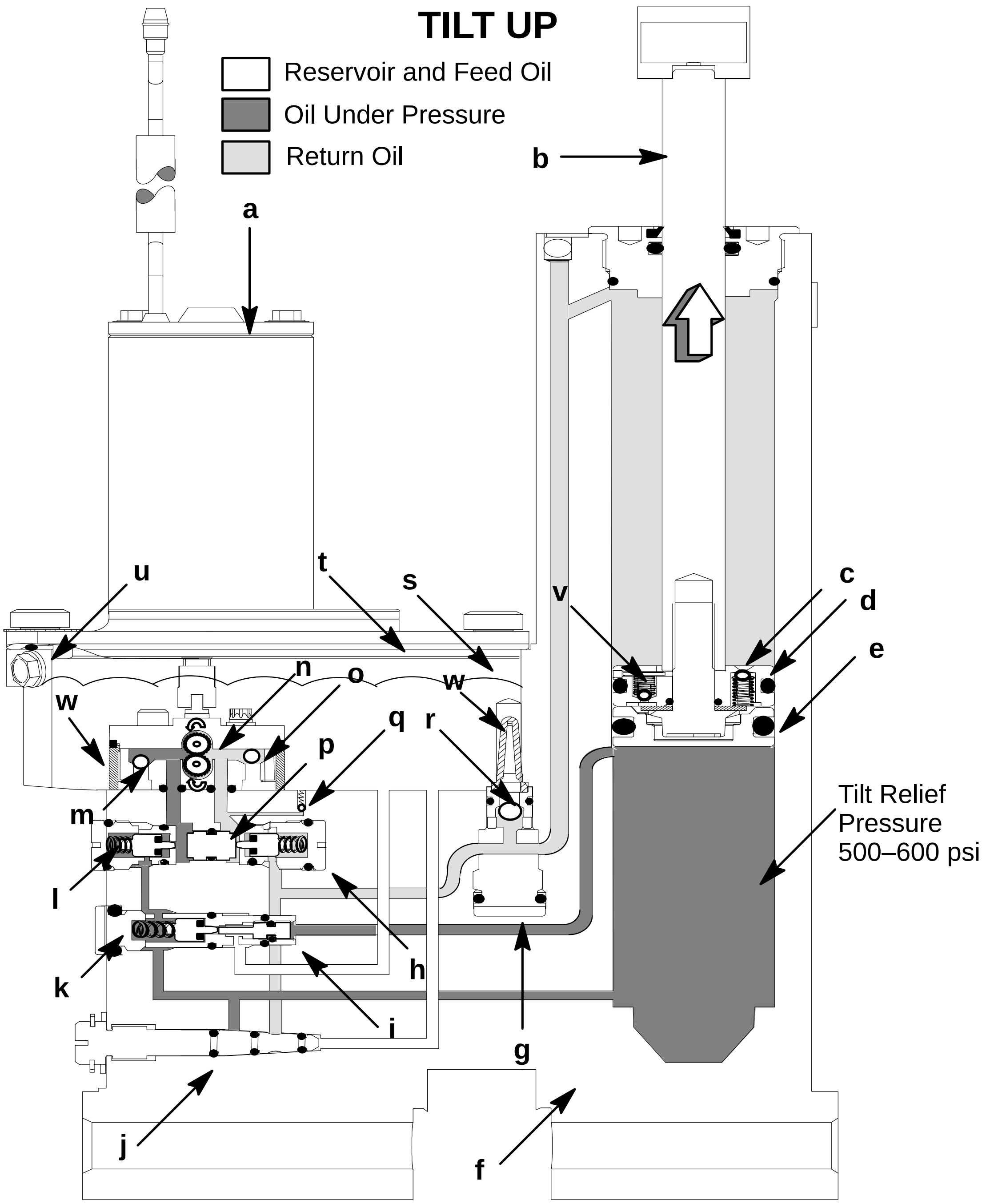
POWER TRIM FLOW DIAGRAMS



- a - Electric Motor
- b - Trim Ram
- c - Impact Relief Valve
- d - Shock Piston
- e - Memory Piston
- f - Manifold
- g - Suction Seat
- h - Down Pressure Operated Valve
- i - Tilt Relief Actuator
- j - Manual Release Valve
- k - Tilt Relief Valve
- l - Up Pressure Operated Valve
- m - Down Circuit Feed Valve
- n - Oil Pump
- o - Up Circuit Feed Valve
- p - Shuttle Valve
- q - Down Pressure Regulating Valve
- r - Check Ball
- s - Reservoir Oil
- t - Oil Reservoir
- u - Oil Fill Cap
- v - Shock Return Valve
- w - Filter

TRIM UP

When the trim switch is activated in the up position, the electric motor (a) begins to rotate the pump gears (n), the oil pump draws a small amount of oil through the filter, up circuit pick–up and past the feed valve check ball (o). The oil pump gear (n) rotation forces oil into the passages for the up circuit. Oil, under pressure, will slide the shuttle valve (p) against the down circuit pressure operated valve (h). The shuttle valve will mechanically open the down pressure operated valve, allowing oil from the down cavity of the trim cylinder, to flow into the oil pump. This returning oil, from the down cavity, will supply most of the oil required for the up circuit. Oil in the up circuit is blocked from returning into the reservoir (t) by the ball inside the down circuit feed valve (m). The pressure of the oil will force the up circuit pressure operated valve (l) to open, allowing the oil to enter the passages inside the manifold (f) leading to the trim cylinder up cavity. Oil is blocked from all other passages by the closed manual tilt valve (j) and closed tilt relief valve (k). Oil under pressure will enter the trim cylinder below the memory piston (e). With an increasing amount of oil entering the cylinder, the memory piston contacts the shock piston (d) and forces the trim rod (b) up and out, raising the outboard motor. Oil on the top of the shock piston exits through a passage running down along the side of the cylinder and enters the manifold passages. Inside the manifold the oil seats the ball (r) inside the suction valve (g), closing the passage into the reservoir. The oil is drawn back into the pump (n) through the open pressure operated valve (h) and enters the pump as supply for the up circuit.



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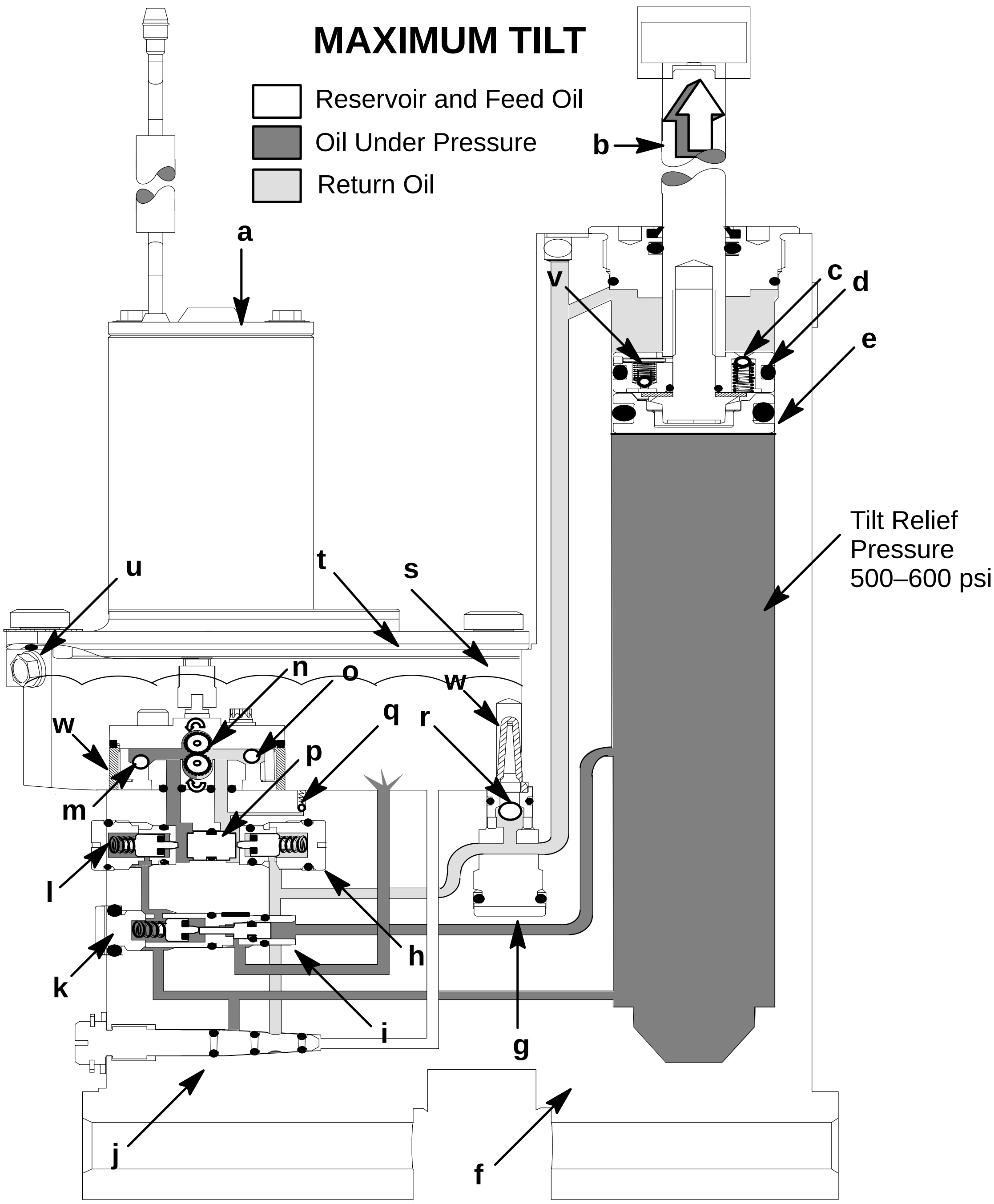
u - Oil Fill Cap
v - Shock Return Valve
w - Filter

TILT UP

In the up mode, as the trim rod (b) extends from the cylinder, the memory piston (e) clears or uncovers the pressure relief passage. Oil from the up cavity will enter this passage and open the tilt pressure relief valve (k). This valve lowers the amount of pressure available to lift the outboard motor. With the engine in forward gear, and at high engine rpm, the oil pressure available will not be able to overcome the propeller thrust, limiting the trim range to below the pressure relief orifice. When the engine rpm's fall or if engine is not in forward gear, the oil pressure is available to extend the trim ram (b) up into the tilt range.



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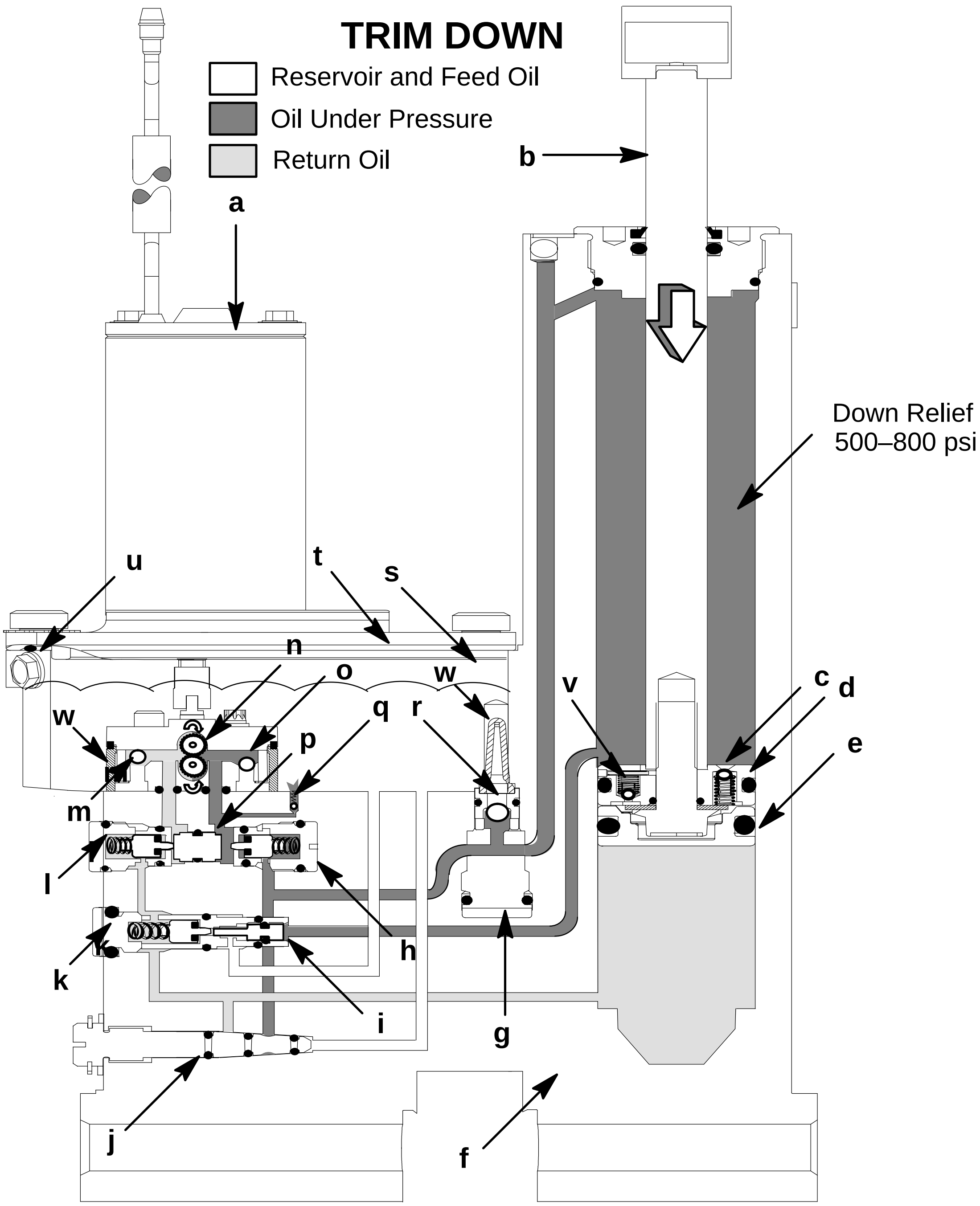
w - Filter

MAXIMUM TILT

With the cylinder at maximum travel, and due to no ram movement, the pressure inside of the trim cylinder will increase to the pressure required to move the tilt relief actuator (i). The tilt relief actuator's "pin" opens the tilt relief valve (k). Up pressure flows into the trim relief passage, and return back into the reservoir (t).



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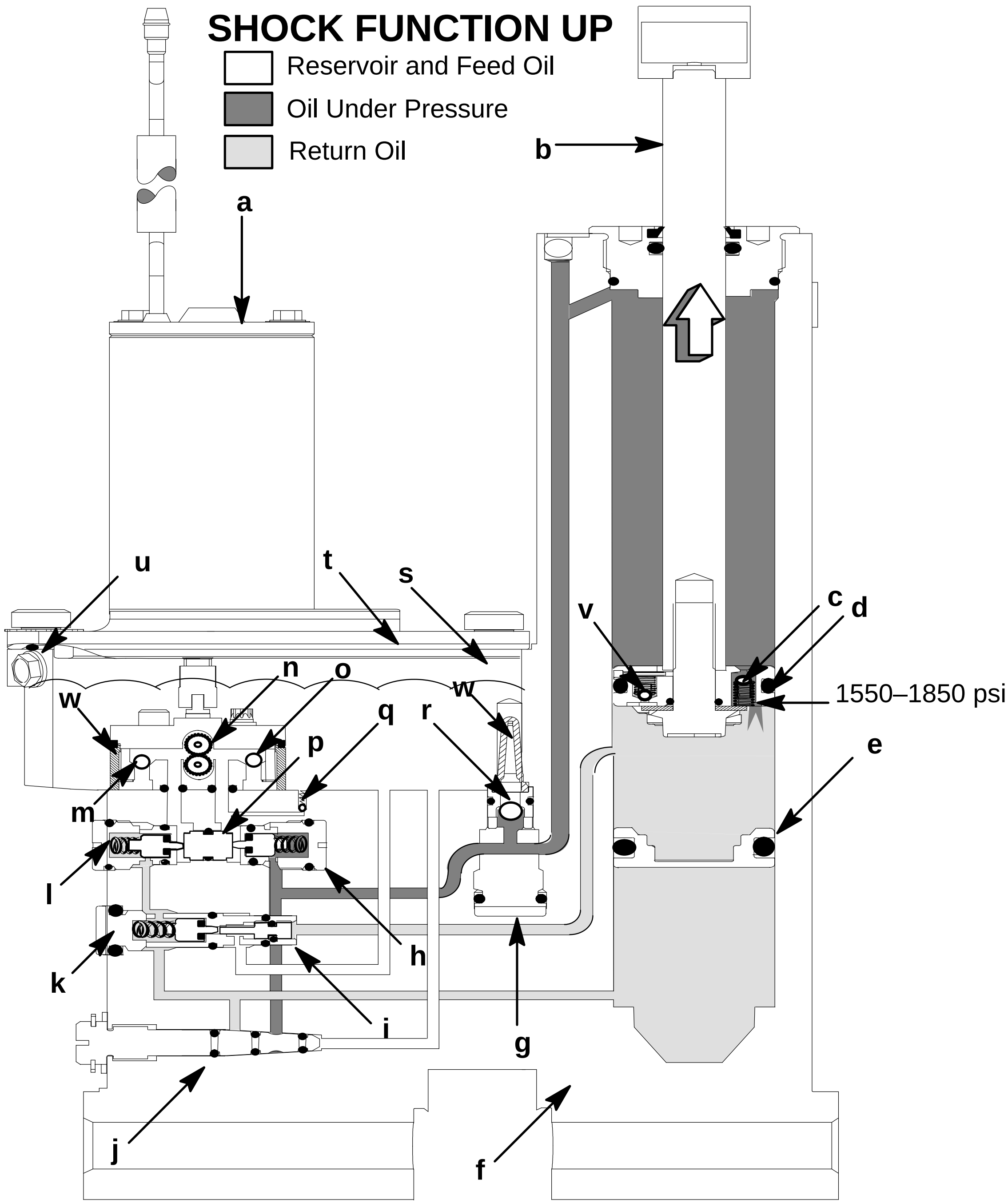
u - Oil Fill Cap
v - Shock Return Valve
w - Filter

DOWN MODE

When the trim switch is activated in the down position, the electric motor (a) will rotate the pump (n) in the opposite direction. With the pump gears rotating backwards, the flow of oil is reversed. Oil is drawn through the filter, past the feed check ball (m), into the down circuit oil pick–up and finally into the oil pump. The pump feeds pressurized oil into the down passages, oil will slide the shuttle valve (p) into the up circuit pressure operated valve (l). The shuttle valve will mechanically open the pressure operated valve and allow oil, from the up cavity of the trim cylinder (f), to return into the oil pump. This returning oil, from the up cavity, will supply the oil required for the down circuit. The oil is blocked from returning into the reservoir by the ball (p) inside the up circuit feed valve. Oil, under pressure, opens the pressure operated valve (h) and enters the down passages inside of the manifold (f). The manifold passage connects into the trim cylinder passage leading to the top of the cylinder. The cavity, inside the cylinder, above the shock piston (d) is the down cavity. As the down cavity fills with oil, the trim ram (b) retracts into the cylinder, lowering the outboard motor. Oil from the up cavity exits the cylinder and is drawn back into the pump through the open pressure operated valve (l). When the trim ram reached full travel, the oil pressure inside the down circuit will rise until the down pressure relief valve (q) opens, bypassing oil back into the reservoir(t). When the trim button is released, and the oil pump stops supplying pressure, both of the pressure operated valves (h & l) will close and; if open, the down pressure regulating valve (q) will close. The closed valves will lock the fluid on either side of the shock piston (d), holding the outboard motor in position.



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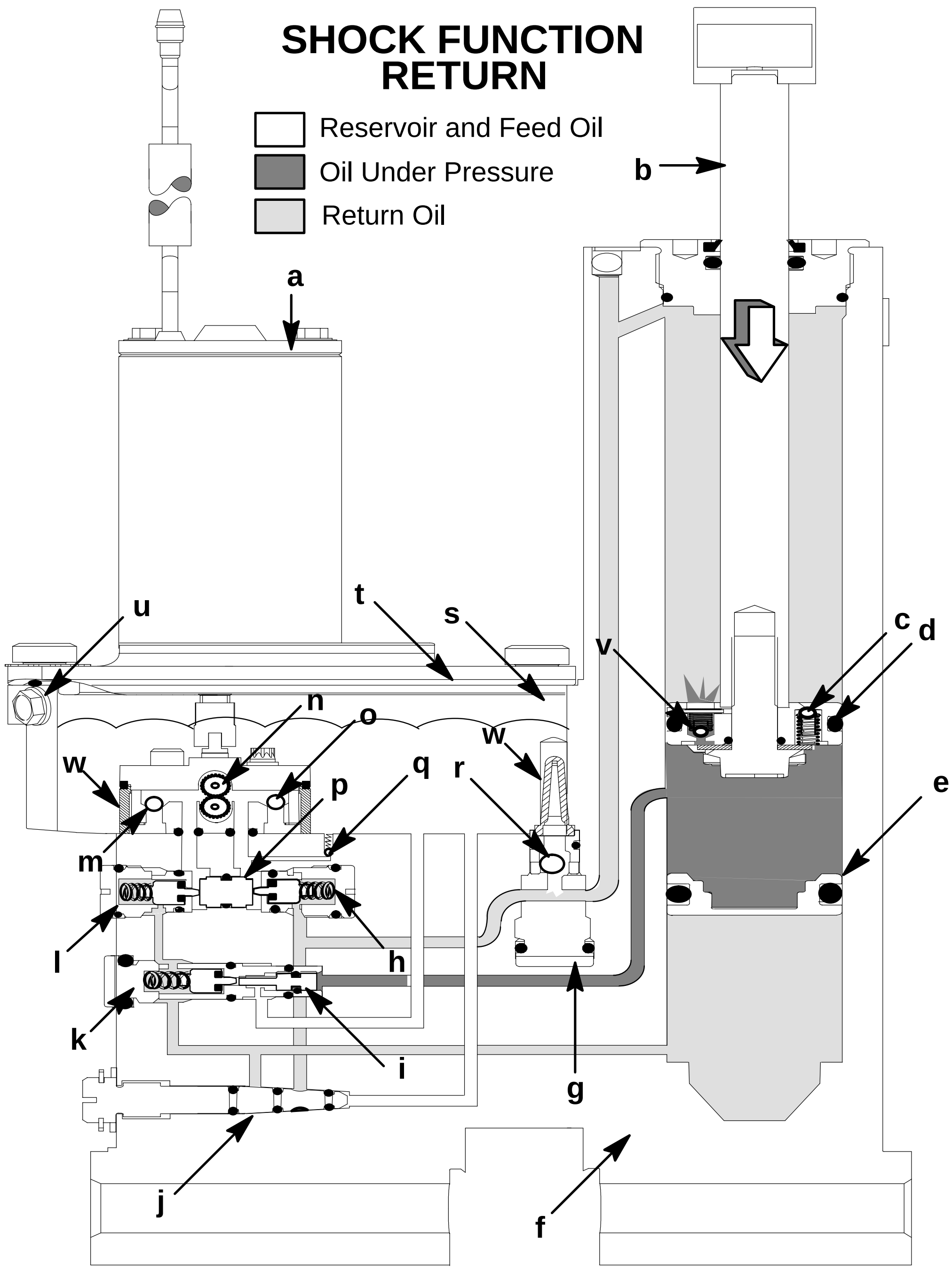
v - Shock Return Valve
w - Filter

SHOCK FUNCTION UP

Oil inside the down cavity is locked in a static position by the closed pressure operated valve (h), the manual release valve (j) and the tilt relief valve (k). If the outboard strikes an underwater object while in forward gear the trim ram (b) will try to rapidly extend from the cylinder , the pressure increases inside the trim cylinder down cavity and connecting passages. The rise in pressure will seat the check ball (r) inside the suction valve (g), preventing fluid from returning into the reservoir. When the pressure increases to the level required, the impact relief valves (c), located inside the shock piston (d), will open and allow the fluid to pass through the shock piston. As the fluid passes through the piston, the trim ram (b) will extend from the trim cylinder. The memory piston (e) is held in position by vacuum, created by the oil in the up cavity being locked in a static position. Therefore; oil passing through the trim ram piston is trapped between the memory piston (e) and shock piston (d).

SHOCK FUNCTION RETURN



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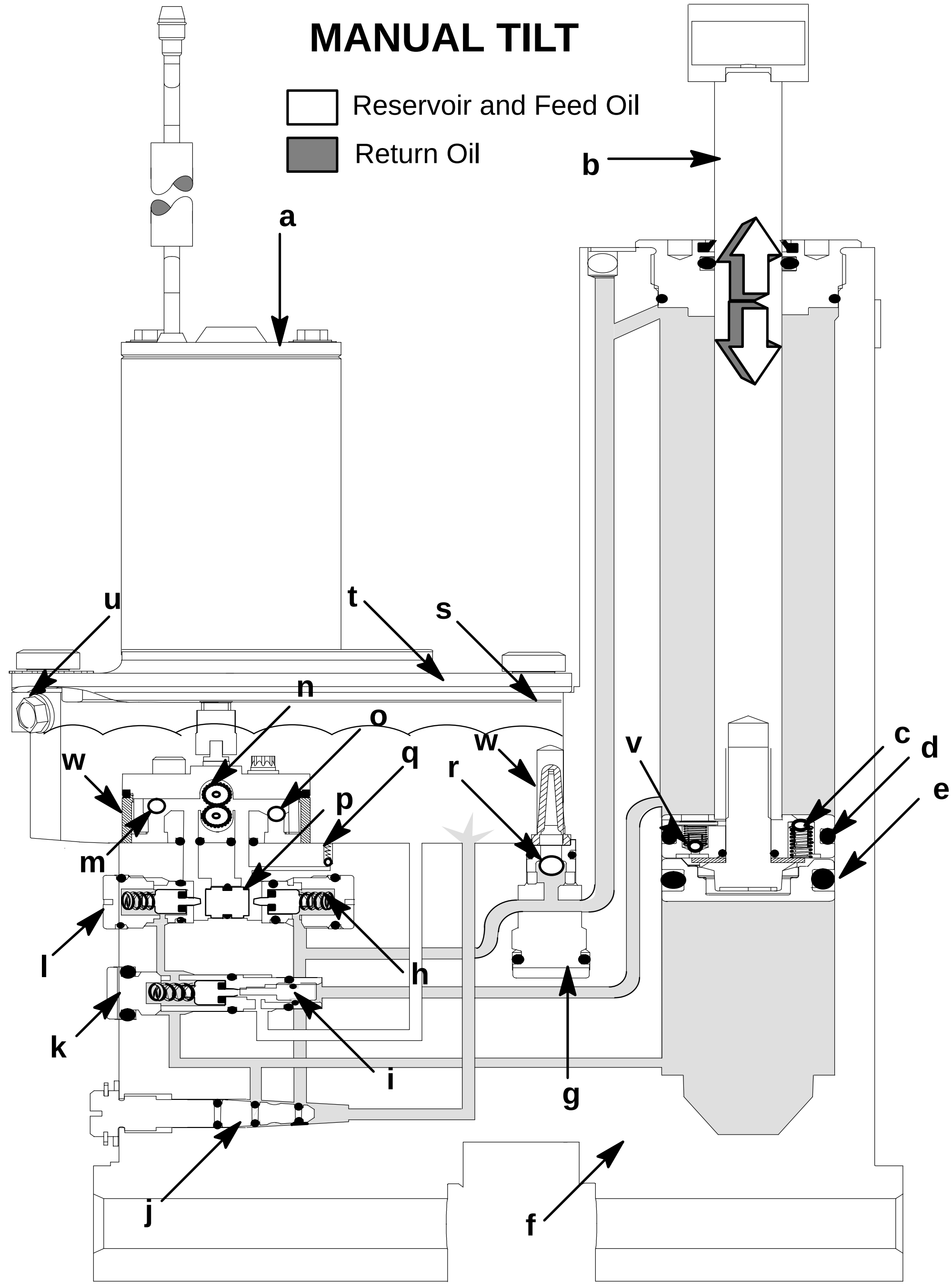
SHOCK FUNCTION RETURN

After the engine clears the under water object, the weight of the engine will increase the oil pressure between the memory piston (e) and shock piston (d) to the level required to open the shock return valve (v), inside the shock piston, allowing the oil to bleed back through the shock piston into the down cavity. If required, additional oil will enter the down cavity through the suction valve (g). This will return the engine back against the memory piston (e) in to the original running position.

MANUAL TILT



a - Electric Motor
b - Trim Ram
c - Impact Relief Valve
d - Shock Piston
e - Memory Piston
f - Manifold
g - Suction Seat
h - Down Pressure Operated Valve
i - Tilt Relief Actuator
j - Manual Release Valve
k - Tilt Relief Valve
l - Up Pressure Operated Valve
m - Down Circuit Feed Valve

n - Oil Pump
o - Up Circuit Feed Valve
p - Shuttle Valve
q - Down Pressure Regulating Valve
r - Check Ball
s - Reservoir Oil
t - Oil Reservoir
u - Oil Fill Cap
v - Shock Return Valve
w - Filter

MANUAL TILT

To manually tilt the outboard engine, the owner will need to back out the manual tilt valve (j). With the valve backed out, the internal passages inside the manifold are connected together. These passages connect both the cylinder down and up cavities together, along with the reservoir (t), allowing the engine to be raised or lowered. Trim ram (b) movement will continue until the manual tilt valve is closed, locking the fluid inside of the cylinder and manifold.

Troubleshooting

Support outboard with tilt lock pin when servicing power trim system.

IMPORTANT: After debris or failed components have been found (during troubleshooting procedure) it is recommended that unit be disassembled completely and ALL O-rings be replaced. Check ball valve components and castings must be cleaned using engine cleaner and compressed air or replaced prior to re-assembly.

IMPORTANT: Power trim system is pressurized. Outboard must be in the full "UP" position (trim rod fully extended) prior to fill/drain plug, or manual release valve removal.

Refer to instructions following if disassembly is required when servicing.

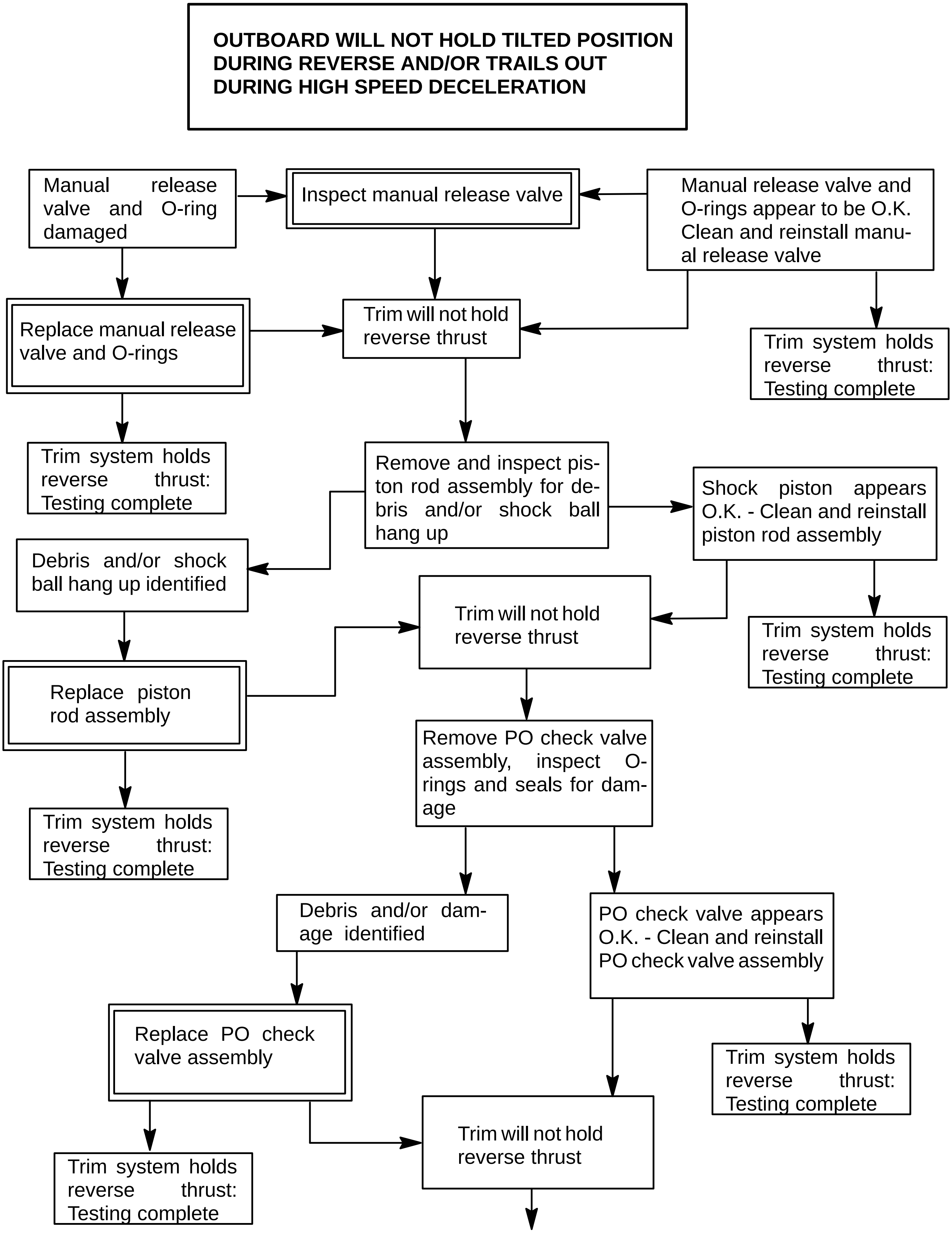
Follow preliminary checks before proceeding to troubleshooting flow diagrams (following).

Preliminary Checks

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 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 "Bleeding Power Trim Unit".
3. Check for external leaks in Power Trim system. Replace defective part(s) if leak is found.
4. Outboard not holding tilted position (falls down to trim position) indicates debris or defective components in trim assembly. Clean or replace components as required.

Hydraulic System Troubleshooting Flow Chart



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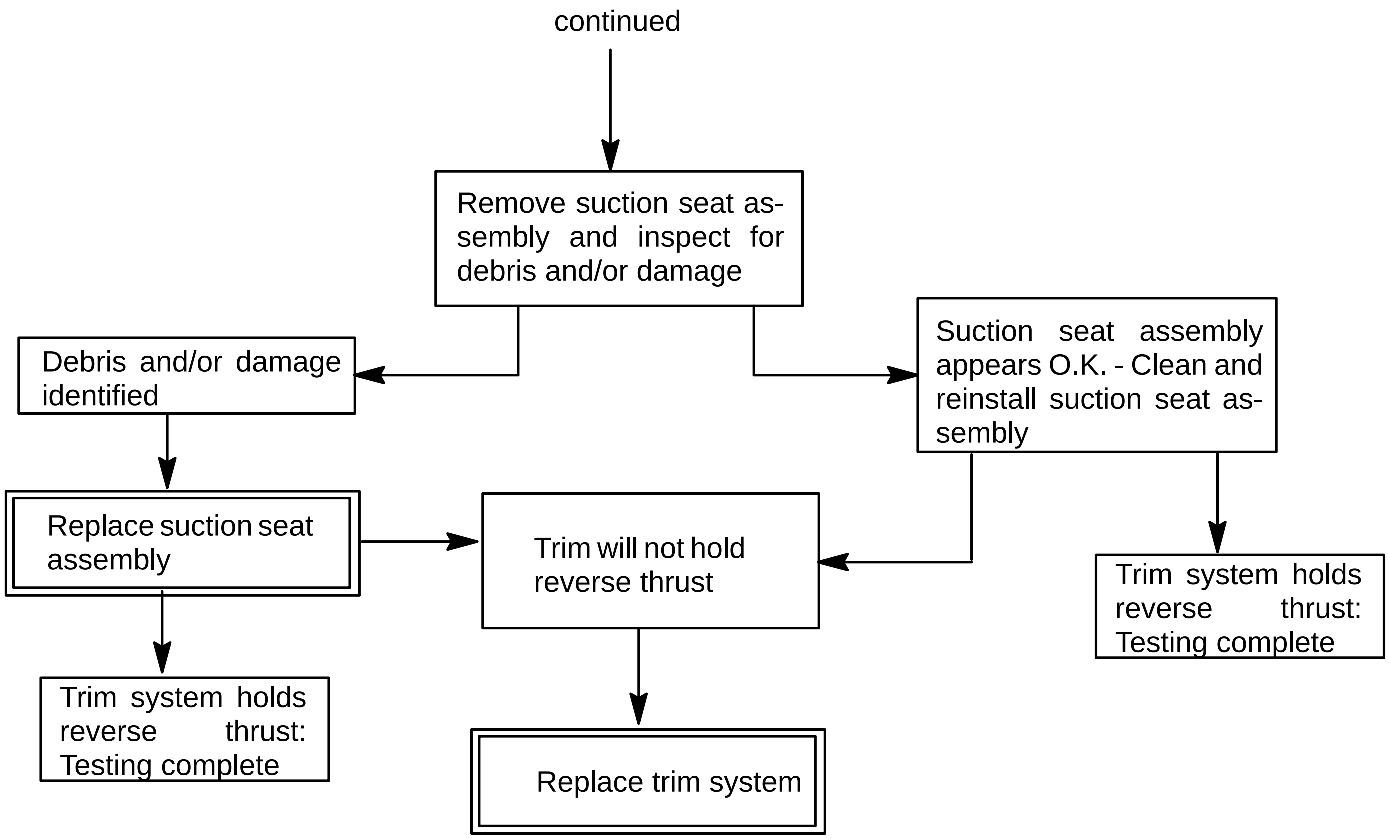
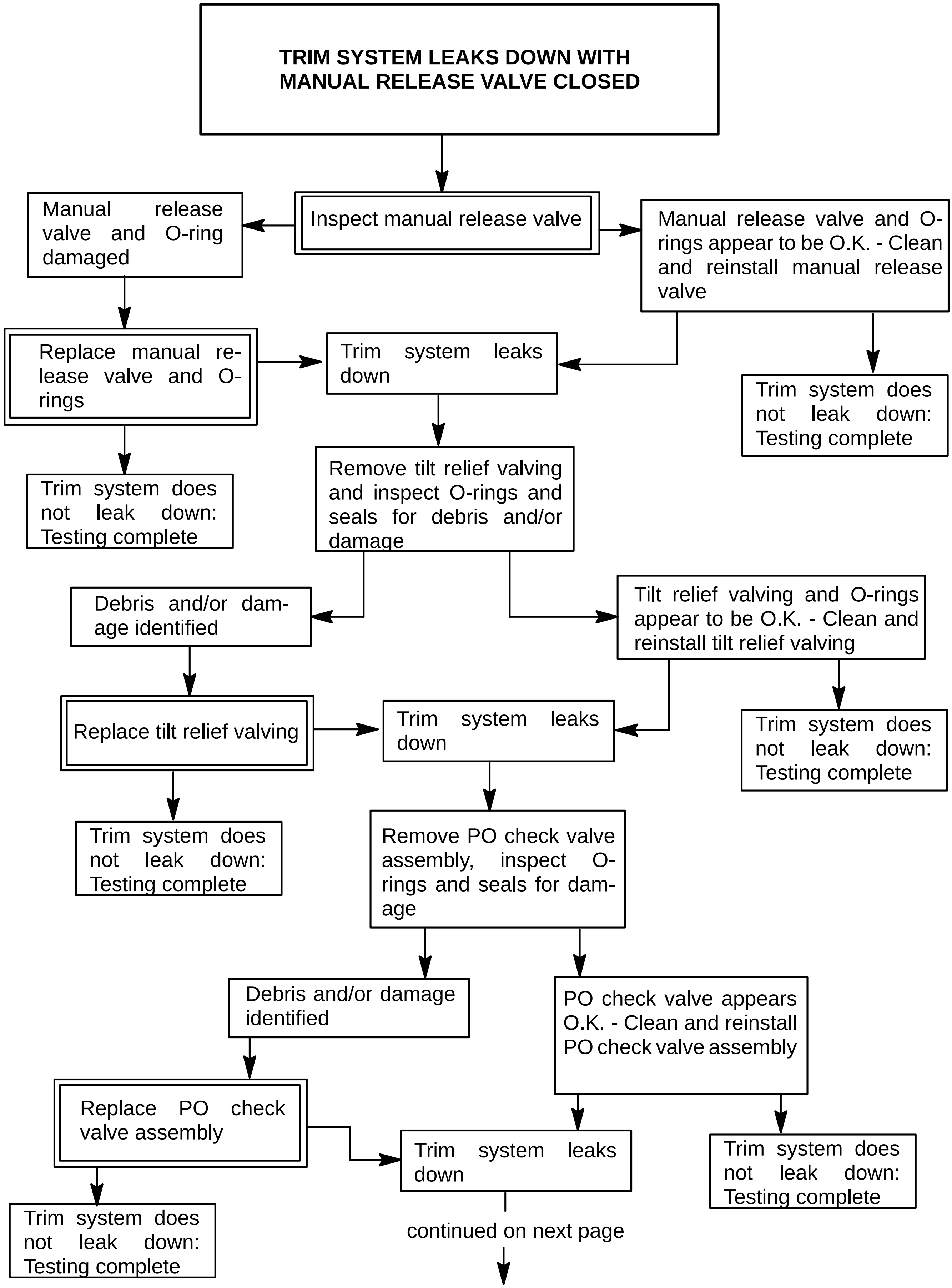
Hydraulic System Troubleshooting Flow Chart



Hydraulic System Troubleshooting Flow Chart



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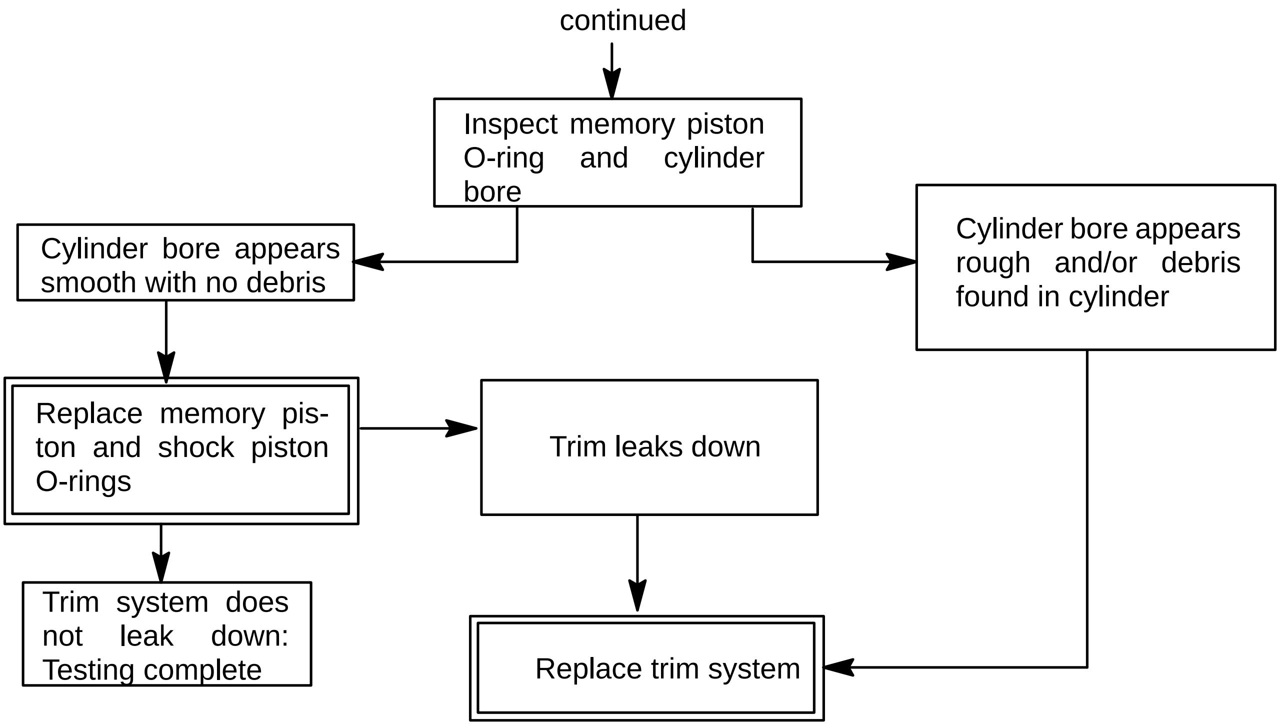
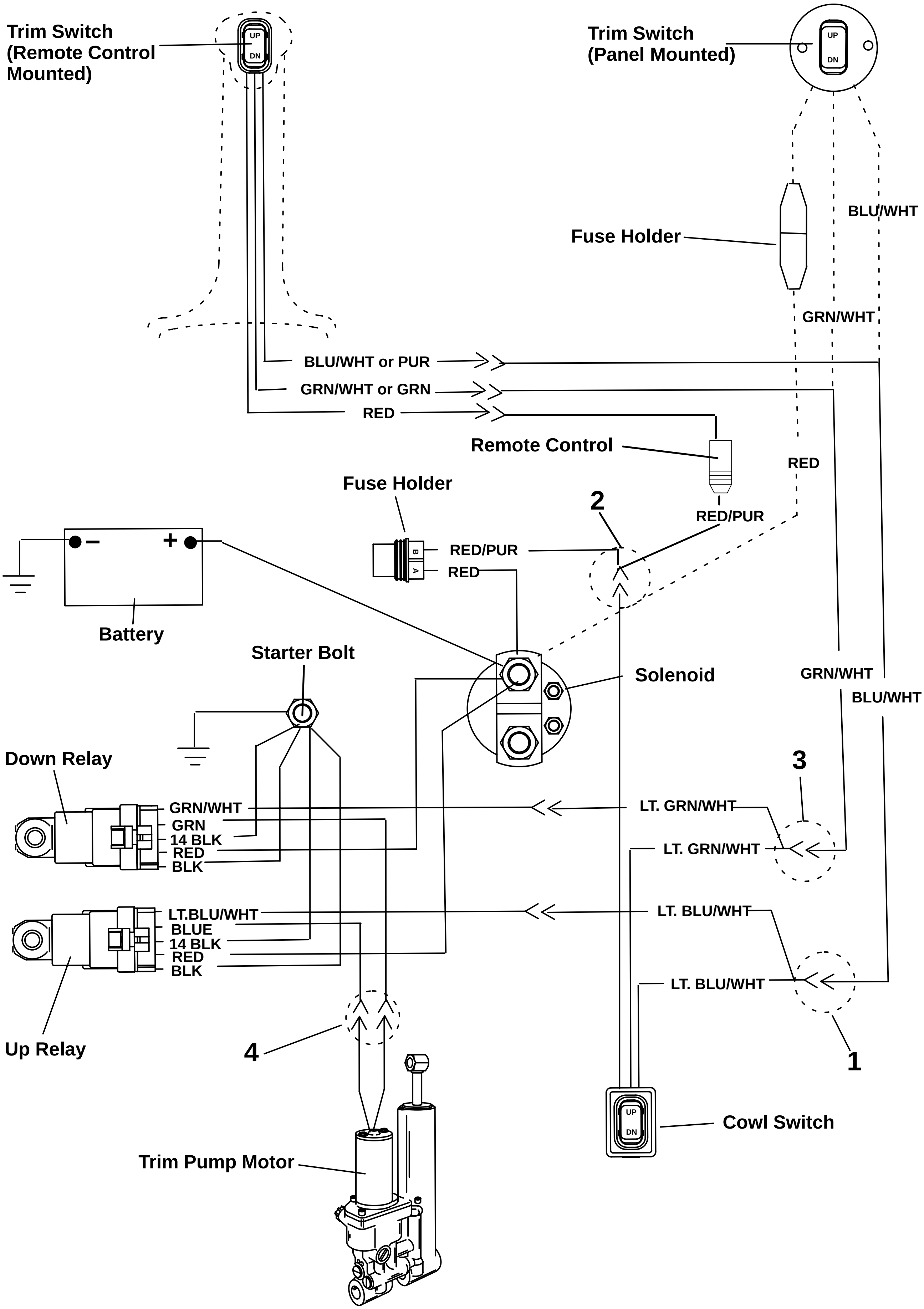
Hydraulic System Troubleshooting Flow Chart



Troubleshooting the Power Trim Electrical System



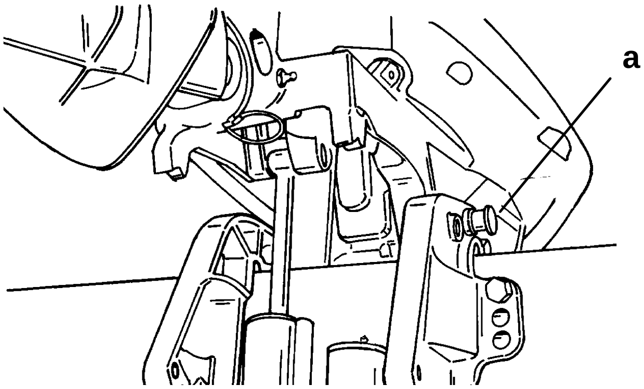
Troubleshooting the Power Trim Electrical System

Refer to wiring diagram on preceding page for location of wire connections.

Problem	Possible Cause	Remedy
Trim Switch “UP” is inoperative, but the Cowl Switch “UP” does operate.	1. Open wire between Wire Connection (1) and Trim Switch. 2. Faulty Trim Switch.	1. Check for a open connection or cut wire. 2. Replace
Cowl Switch “UP” is inoperative, but the Trim Switch “UP” does operate.	1. Open wire between Wire Connection (2) and Solenoid. 2. Faulty Cowl Switch.	1. Check for a open connection or cut wire. 2. Replace
Trim Switch “UP” and Cowl Switch “UP” are both inoperative.	1. Open wire between Wire Connection (1) and the Up Relay 2. Open BLK wire between ground and UP Relay. 3. Open RED wire between Solenoid and Up Relay 4. Faulty Up Relay .	1. Check for an open connection. 2. Check for an open connection. 3. Check for an open connection. 4. Replace
Trim Switch “DOWN” is inoperative, but the Cowl Switch “DOWN” does operate.	1. Open wire between Wire Connection (3) and Trim Switch. 2. Faulty Trim Switch.	1. Check for a open connection or cut wire. 2. Replace
Cowl Switch “DOWN” is inoperative, but the Trim Switch “DOWN” does operate.	1. Open wire between Wire Connection (2) and Solenoid. 2. Faulty Cowl Switch.	1. Check for a open connection or cut wire. 2. Replace
Trim Switch “DOWN” and Cowl Switch “DOWN” are both inoperative.	1. Open wire between Wire Connection (3) and the Up Relay. 2. Open BLK wire between ground and Down Relay. 3. Open RED wire between Solenoid and Down Relay. 4. Faulty Down Relay.	1. Check for an open connection. 2. Check for an open connection. 3. Check for an open connection. 4. Replace
Trim Switch “UP” and “DOWN” are both inoperative, but the Cowl Switch does operate.	1. 20 AMP Fuse blown. 2. Faulty trim switch. 3. Wire is open between fuse holder and solenoid. 4. Wire is open between fuse holder and trim switch.	1. Replace fuse. Locate the cause of the blown fuse. Check electrical wiring for a shorted circuit. 2. Replace 3. Check for a open connection or cut wire. 4. Check for a loose or corroded connection.
Trim Switch and Cowl Switch are both inoperative.	1. One of the Trim Pump Motor wires is open between the motor and the Relays. 2. Faulty trim pump motor.	1. Check wire connections (4) for loose or corroded condition. 2. If voltage is present at connections (4) when the appropriate trim button is pressed, than motor is faulty. Replace motor.
Trim system operates (motor runs) without pressing the switches.	1. The Trim or Cowl switch is shorted.	1. Replace

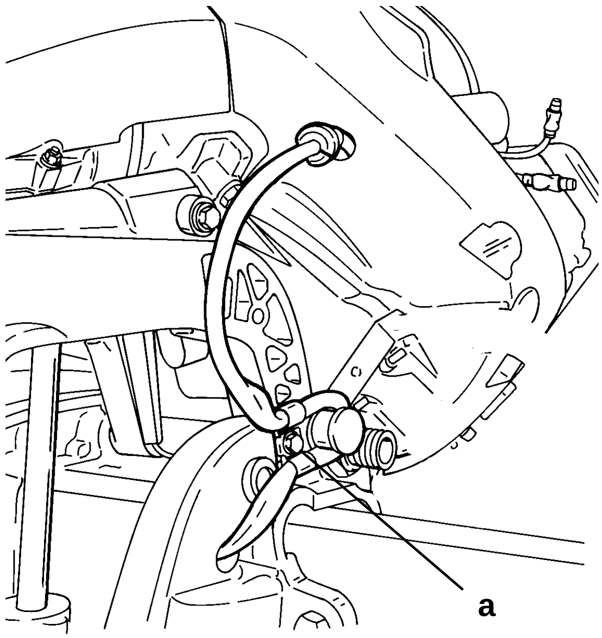
Power Trim System Removal

1. Tilt outboard to the full up position and support with tilt lock pin.



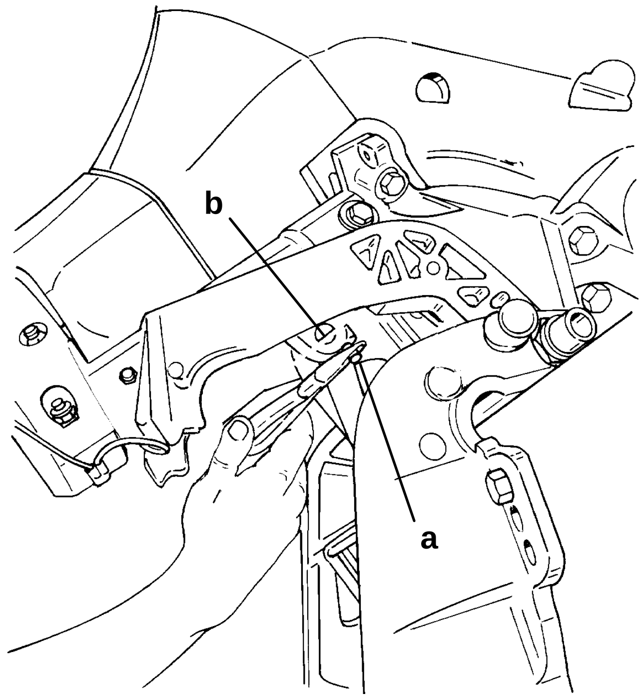
a - Tilt Lock Pin

2. Disconnect the power trim wire harness and remove clamps.



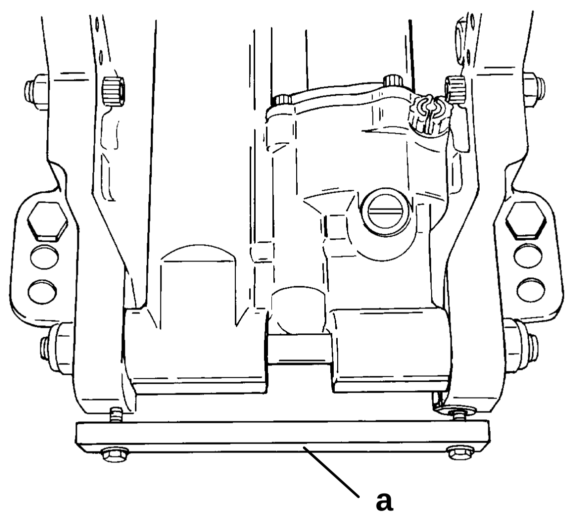
a - Power Trim Wire Harness Clamps

3. Remove the trilobe pin.
4. Drive out the upper pivot pin.



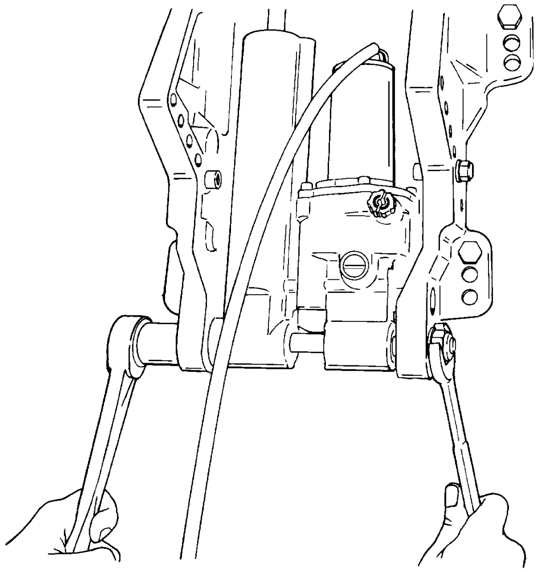
a - Trilobe Pin
b - Upper Pivot Pin

5. Remove the sacrificial anode.



a - Sacrificial Anode

6. Remove nuts and washers securing the lower pivot pin. Remove lower pivot pin. Retain the pivot pin bushings from the clamp brackets and trim unit.
7. Remove the trim unit.

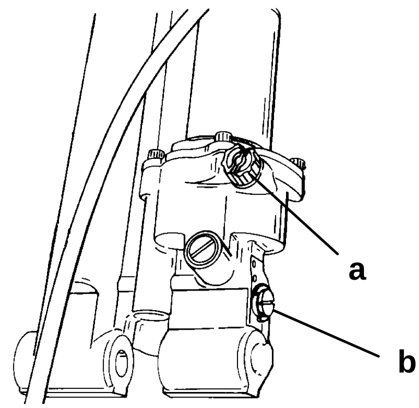


Disassembly

Shock Rod Removal

IMPORTANT: Power trim system is pressurized. Outboard must be in the full “UP” position (trim rod fully extended) prior to fill/drain plug, or manual release valve removal.

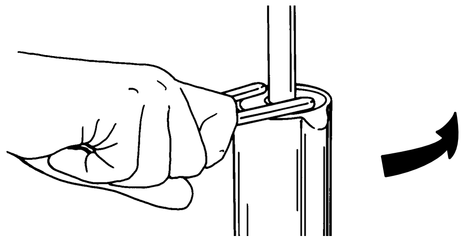
1. Remove reservoir cap.
2. Remove manual release valve assembly.



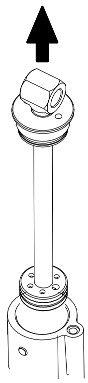
a - Reservoir Cap
b - Manual Release Valve

3. Drain power trim fluid as shown.

4. Secure power trim assembly in a soft jaw vise.
5. Unscrew end cap assembly from cylinder using spanner wrench 91-74951.

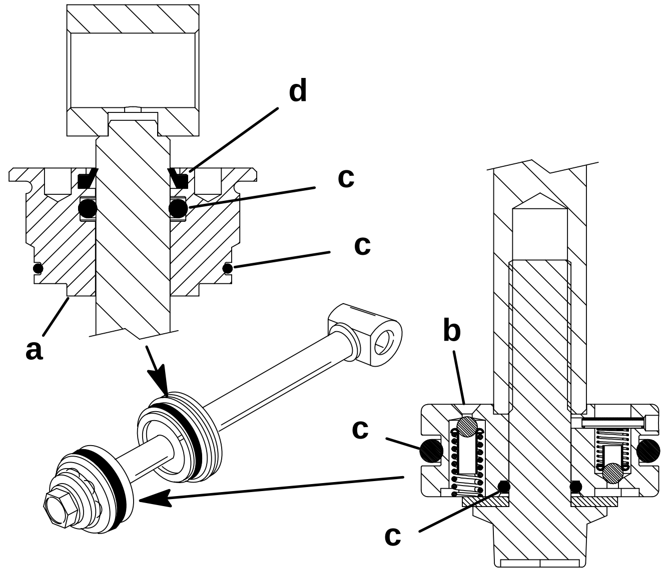


6. Remove shock rod assembly from cylinder.



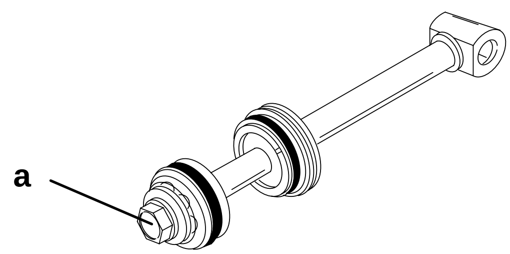
Shock Rod Disassembly

NOTE: *The only serviceable items on the shock rod assembly are the o-rings and wiper ring. If shock rod requires any other repair, replace shock rod assembly.*



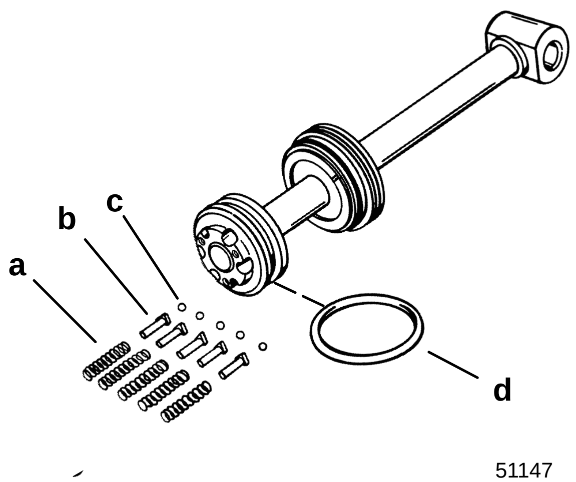
a - End Cap
b - Shock Piston
c - O-ring
d - Wiper Ring

1. Place shock rod assembly on clean work surface.
2. Remove bolt from end of shock rod.



a - Bolt

3. Remove check ball components from shock rod piston.
4. Remove o-ring from shock rod piston.

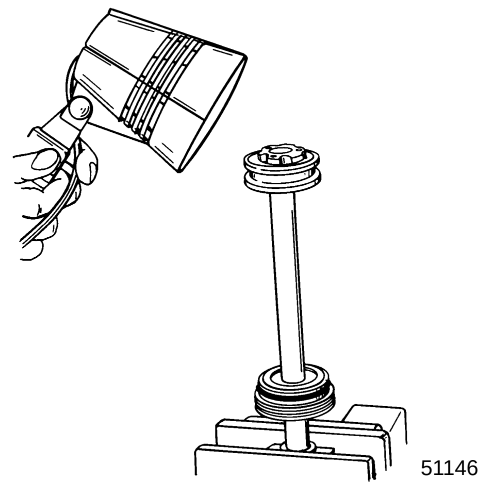


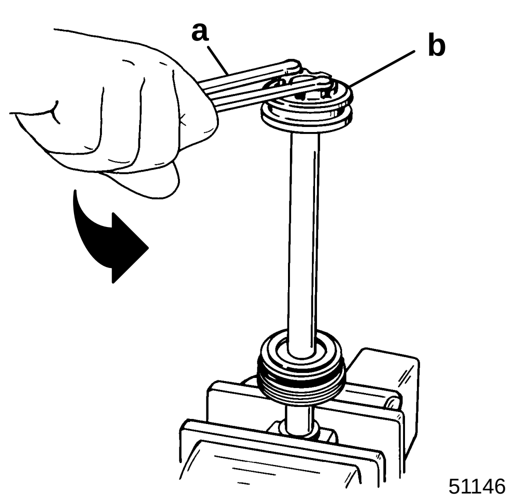
a - Spring (5)
b - Seat (5)
c - Ball (5)
d - O-ring

⚠ CAUTION

When removing shock piston, spanner wrench must have 1/4 in. x 5/16 in. long pegs to avoid damage to shock piston.

5. Place shock rod into soft jawed vise and apply heat to loosen piston using torch lamp (P/N 91-63209).
6. Loosen shock rod piston using spanner wrench [1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs].
7. Allow shock rod piston to cool. Remove from shock rod.

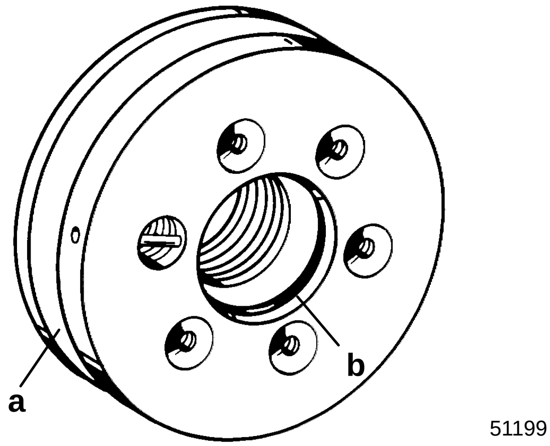




a - Spanner Wrench
b - Shock Rod Piston

8. Inspect check valve for debris; clean debris from check valve if found. If debris cannot be cleaned from check valve, replace shock piston as an assembly.
9. Clean shock and components with compressed air.

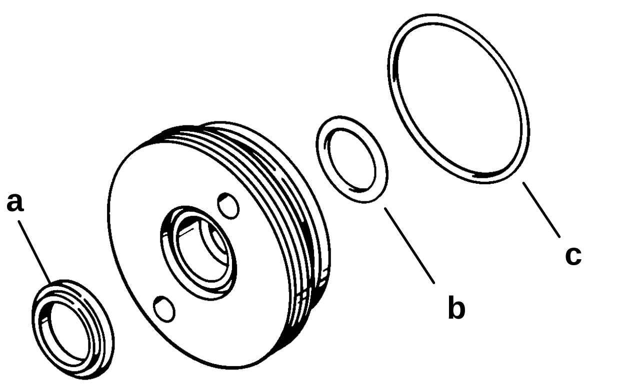
10. Remove inner o-ring from shock rod piston.



51199

a - Shock Piston
b - O-ring

11. Remove cylinder end cap assembly from shock rod.
12. Inspect shock. If wiper (located in cap) has failed to keep rod clean, replace wiper.
13. Place end cap on clean work surface.
14. Remove rod wiper, inner o-ring, and outer o-ring.

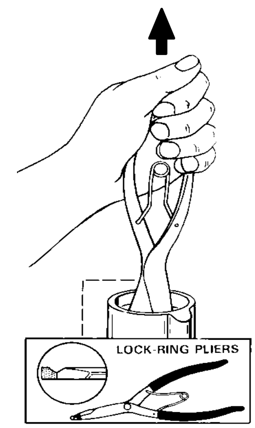


51145

a - Rod Wiper
b - Inner O-ring
c - Outer O-ring

Memory Piston Removal

15. Remove memory piston from cylinder using one of two methods:
    a. Using lock ring pliers (Craftsman P/N 4735) or suitable tool.

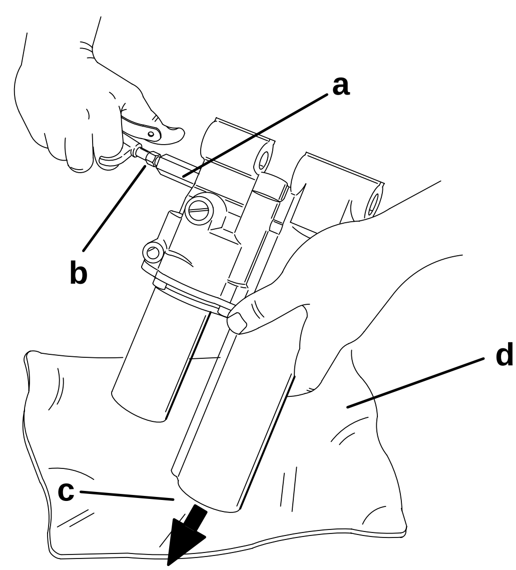


    b. Blowing compressed air into manual release valve hole using adaptor (P/N 91-822778A3).

⚠ WARNING

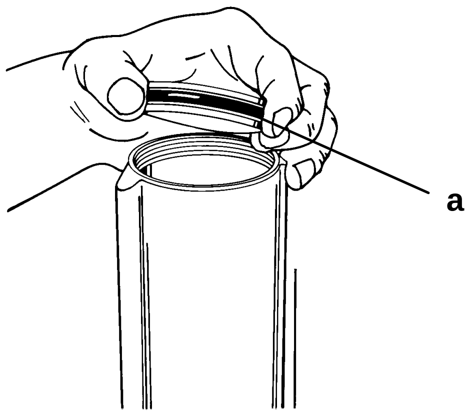
Memory piston cup may be expelled at a high velocity when air pressure is applied. Failure to place cylinder as shown below could result in personal injury.

NOTE: *Point cylinder opening down and away. Use a shop rag or towel to avoid damage to the memory piston.*



a - Adaptor
b - Air Hose
c - Memory Piston Exit
d - Shop Rag

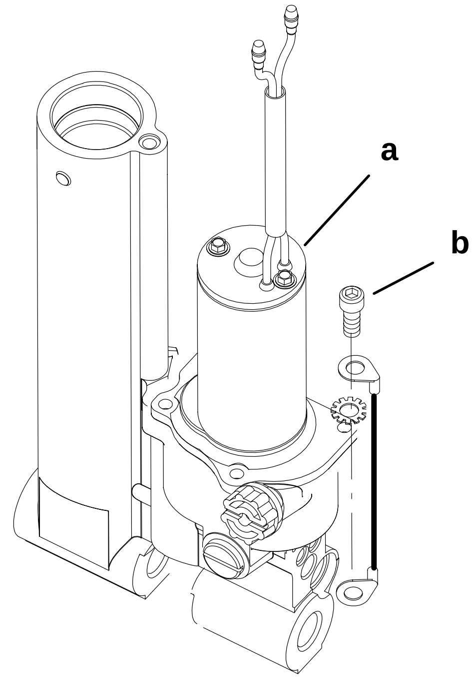
16. Remove o-ring from memory piston.



a - O-ring

Trim Motor Removal

1. Secure power trim assembly in soft jawed vise.
2. Remove screws securing trim motor to manifold.
3. Remove motor assembly.

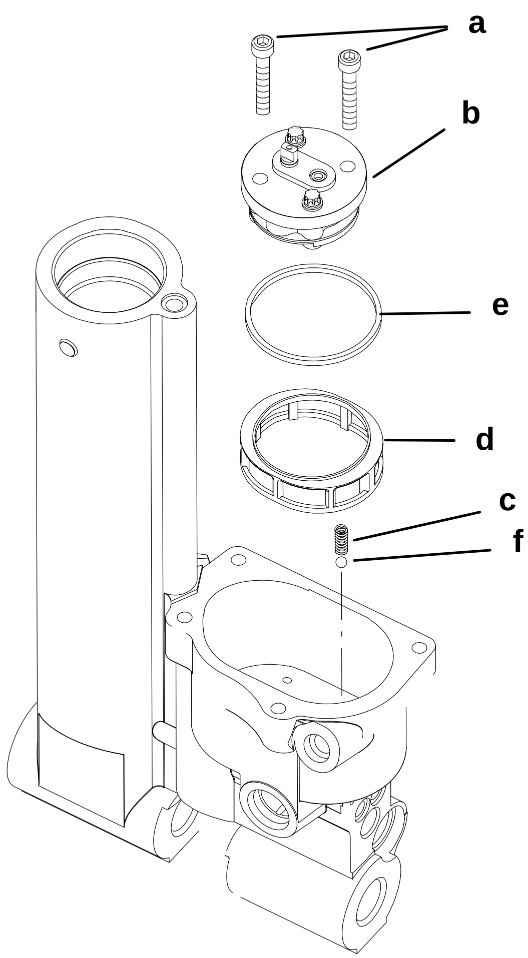


a - Trim Motor
b - Screw (4)

Oil Pump Removal

1. Remove oil filter and pump from manifold.

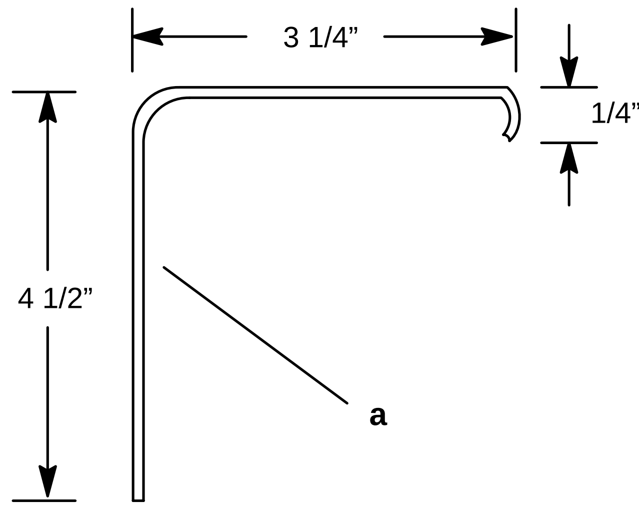
IMPORTANT: DO NOT disassemble the oil pump. The pump is not serviceable.



a - Screw (2)
b - Oil Pump
c - Spring
d - Filter
e - O-Ring
f - Down Relief Ball

Tilt Relief Valve Removal

NOTE: *The following procedures requires the use of a Snap-On blind hole removal tool #CG-4111 with 5/16” attachment #41-12. Or a removal tool can be fabricated with the material and specifications listed below.*

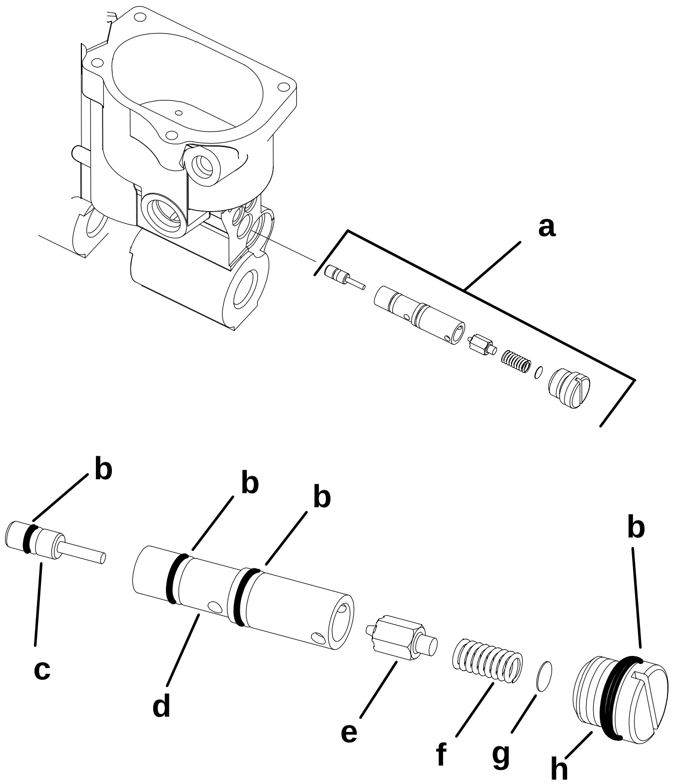


a - Removal Tool made from .060 Stainless Steel Rod

1. Unscrew plug from manifold and remove spring and poppet assembly.

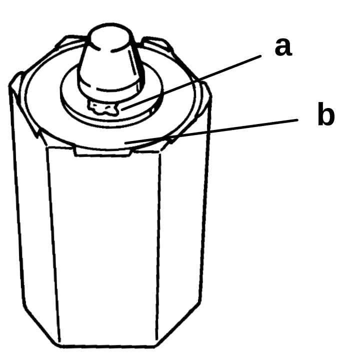
NOTE: *Do not lose shim that may be lodged in the plug.*

2. Use the removal tool and pull out the pilot valve.



a - Tilt Relief Valve Assembly
b - O-Rings
c - Actuator Pin
d - Pilot Valve
e - Poppet Assembly
f - Spring
g - Shim
h - Plug

IMPORTANT: Inspect poppet assembly for debris in the area shown. If debris is found on poppet replace poppet.



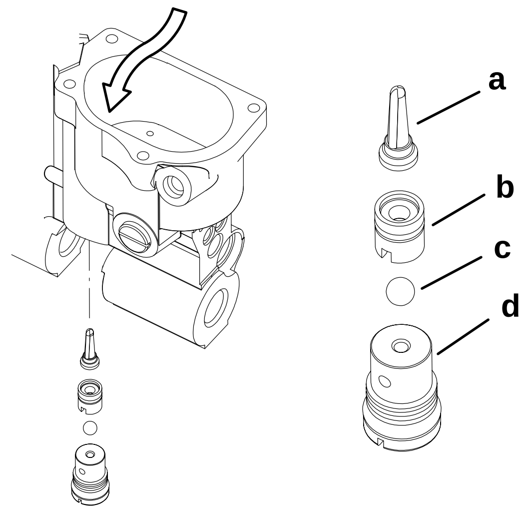
a - Debris Under Valve Tip
b - Rubber Seat

Suction Seat Removal

1. Unscrew plug from manifold and remove ball.
2. Use a pin punch and knock the filter and suction seat out from the inside of the manifold cavity.

⚠ CAUTION

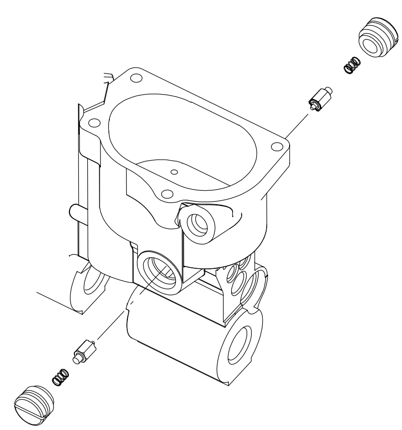
DO NOT use any tool on the suction seat as any damage to the surface will not allow the ball to seat.



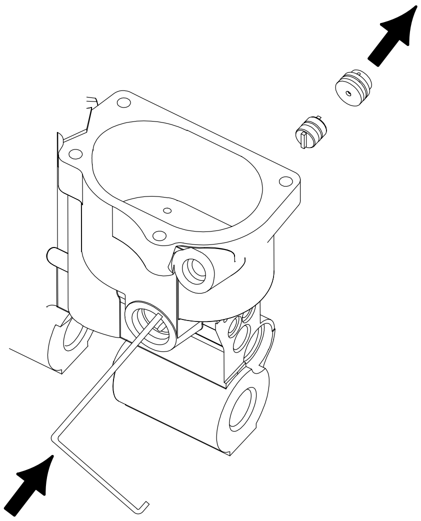
a - Filter
b - Suction Seat
c - Ball
d - Plug

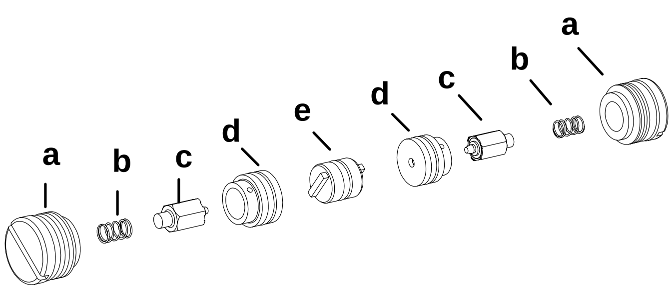
Pilot Check Valve Assembly Removal

1. Unscrew both plugs.
2. Remove both springs and poppets.



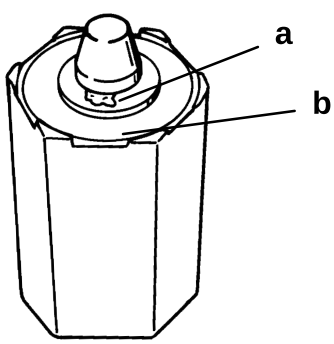
3. Use the (.060 wire) removal tool (see previous page) and push out the spool and one seat.
4. From opposite side, use a punch and push out the remaining seat.





a - Plug (2)
b - Spring (2)
c - Poppet Assembly (2)
d - Seat (2)
e - Spool (1)

IMPORTANT: Inspect poppet assemblies for debris in the area shown. If debris is found on poppets replace poppets.



a - Debris Under Valve Tip
b - Rubber Seat

Cleaning/Inspection/Repair

IMPORTANT: Components must be dirt and lint free. Slightest amount of debris in Power Trim system could cause system to malfunction.

Clean shock rod and components with parts cleaner and dry with compressed air.

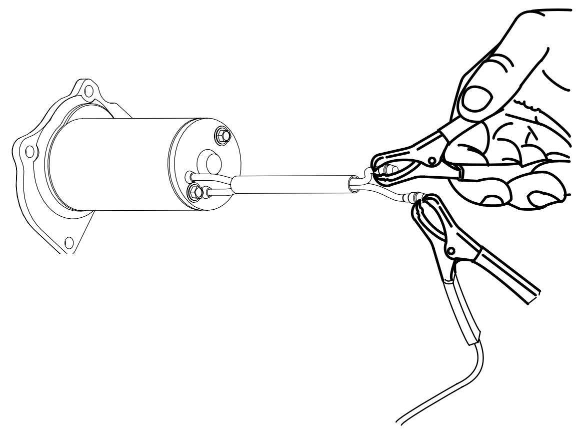
It is recommended that all O-rings in trim system be replaced. Use O-Ring Kit 25-827668A1.

Lubricate all O-rings with power trim fluid.

Trim Motor Electrical Tests

1. Connect a 12 volt supply to motor leads. If motor fails to run, replace pump motor.

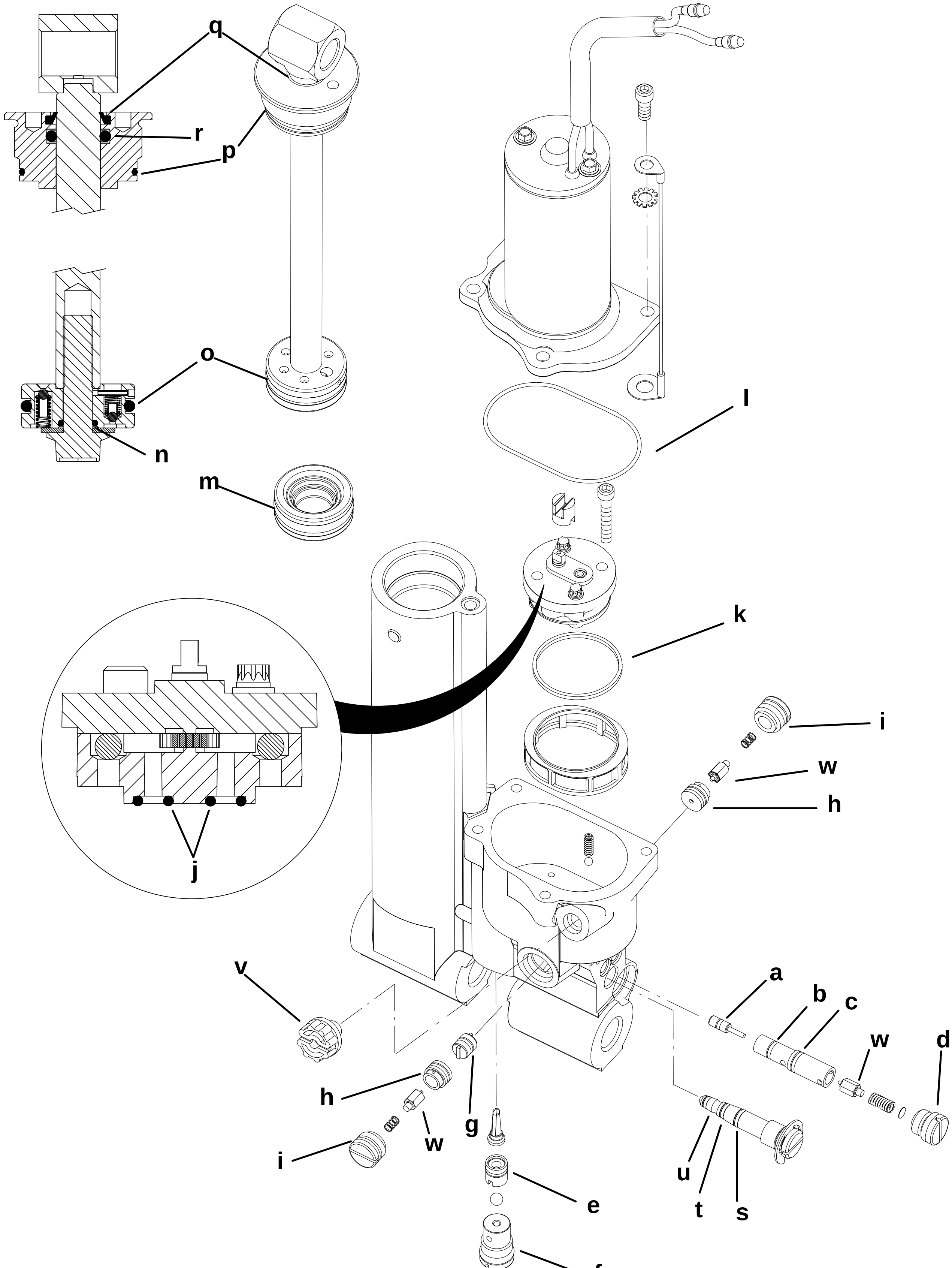
IMPORTANT: Trim Motor is not serviceable. If motor fails to run, replace motor assembly



Reassembly

O-Ring and Seal Placement

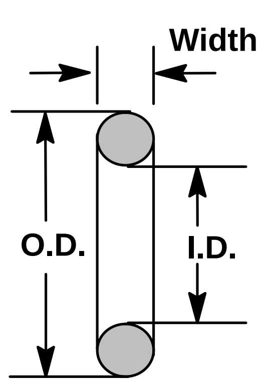
O-Rings and Seals are part of O-Ring Kit 25-827668A1



O-Ring and Seal Placement

O-Ring	Description	O-Ring I.D.	O-Ring O.D.	O-Ring Width
a	Actuator Pin	0.07 in. (1.78 mm)	0.21 in. (5.33 mm)	0.07 in. (1.78 mm)
b	Tilt Relief Cartridge	0.239 in. (6.07 mm)	0.379 in. (9.63 mm)	0.07 in. (1.78 mm)
c	Tilt Relief Cartridge	0.301 in. (7.65 mm)	0.441 in. (11.20 mm)	0.07 in. (1.78 mm)
d	Tilt Relief Plug	0.359 in. (9.12 mm)	0.565 in. (14.35 mm)	0.139 in. (3.53 mm)
e	Suction Seat	0.301 in. (7.65 mm)	0.441 in. (11.20 mm)	0.07 in. (1.78 mm)
f	Suction Seat Plug	0.487 in. (12.37 mm)	0.693 in. (17.60 mm)	0.103 in. (2.62 mm)
g	Spool	0.239 in. (6.07 mm)	0.379 in. (9.63 mm)	0.07 in. (1.78 mm)
h	P. O. Check Seat	0.364 in. (9.25 mm)	0.504 in. (12.80 mm)	0.07 in. (1.78 mm)
i	P. O. Check Plug	0.489 in. (12.42 mm)	0.629 in. (15.98 mm)	0.07 in. (1.78 mm)
j	Pump Ports	0.145 in. (3.68 mm)	0.285 in. (7.24mm)	0.07 in. (1.78 mm)
k	Pump Filter	O-ring, Pump Filter - Square Cut		
l	Reservoir/Motor	2.614 in. (66.40 mm)	2.754 in. (70.0 mm)	0.07 in. (1.78 mm)
m	Memory Piston	1.037 in. (26.34 mm)	1.457 in. (37.0 mm)	0.21 in. (5.33 mm)
n	Piston Bolt	0.364 in. (9.25 mm)	0.504 in. (12.80 mm)	0.07 in. (1.78 mm)
o	Shock Piston	1.171 in. (29.74 mm)	1.449 in. (36.80 mm)	0.139 in. (3.53 mm)
p	Cylinder Cap	1.364 in. (34.65 mm)	1.50 in. (38.10 mm)	0.07 in. (1.78 mm)
q	Wiper Ring			
r	Cylinder Cap - Inner	0.546 in. (13.87 mm)	0.752 in. (19.10 mm)	0.139 in. (3.53 mm)
s	Manual Release Valve	0.239 in. (6.07 mm)	0.379 in. (9.63 mm)	0.07 in. (1.78 mm)
t	Manual Release Valve	0.176 in. (4.47 mm)	0.316 in. (8.03 mm)	0.07 in. (1.78 mm)
u	Manual Release Valve	0.114 in. (2.90 mm)	0.254 in. (6.45 mm)	0.07 in. (1.78 mm)
v	Reservoir Plug	0.426 in. (10.82 mm)	0.566 in. (14.38 mm)	0.07 in. (1.78 mm)
w	Check Valve			

Cutaway Veiw Of O-Ring



Power Trim Reassembly

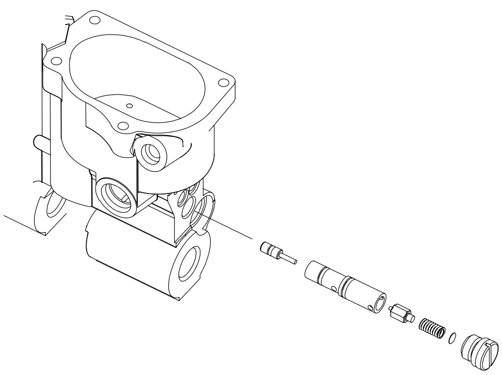
IMPORTANT: Lubricate all O-rings with Quicksilver Power Trim Fluid (92-90100A12). If not available, use automotive (ATF) automatic transmission fluid.

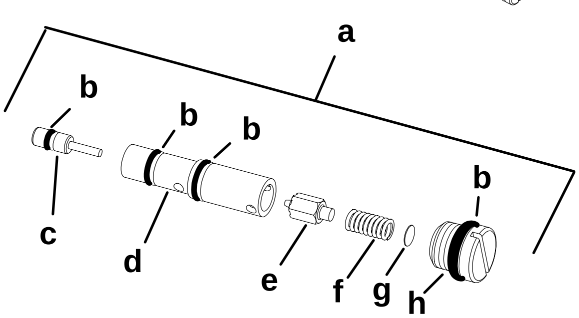
Tilt Relief Valve Reassembly

1. Lubricate O-rings with power trim fluid.
2. Place actuator pin into pilot valve.
3. Install and seat the pilot valve into manifold. Seat the pilot valve using a 9/32″ or 7 mm socket on OUTSIDE diameter of the pilot valve.

IMPORTANT: The pilot valve must be seated using a suitable mandrel on the OUTSIDE diameter.

4. Install poppet, spring, shim (if used) and plug. Torque plug to 120 lb. in. (13.5 N·m).

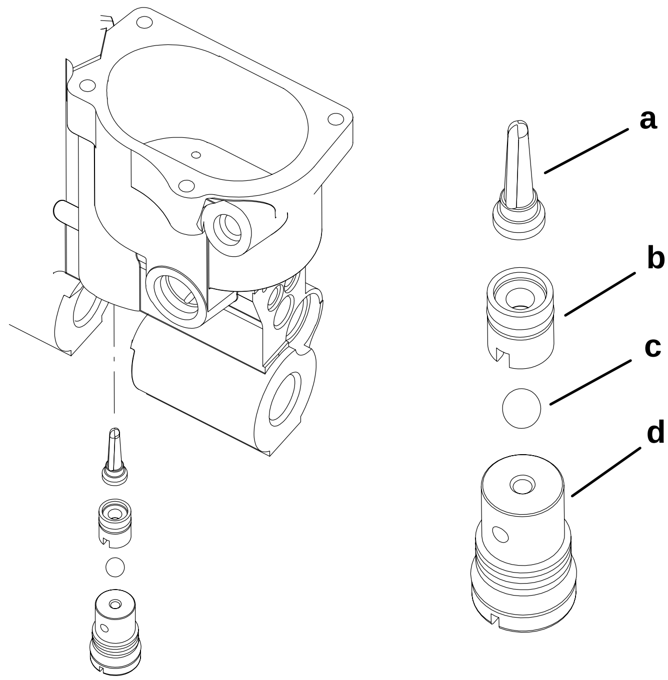




a - Tilt Relief Valve Assembly
b - O-Rings
c - Actuator Pin
d - Pilot Valve
e - Poppet Assembly
f - Spring
g - Shim
h - Plug - Torque to 120 lb. in (13.5 N·m)

Suction Seat Reassembly

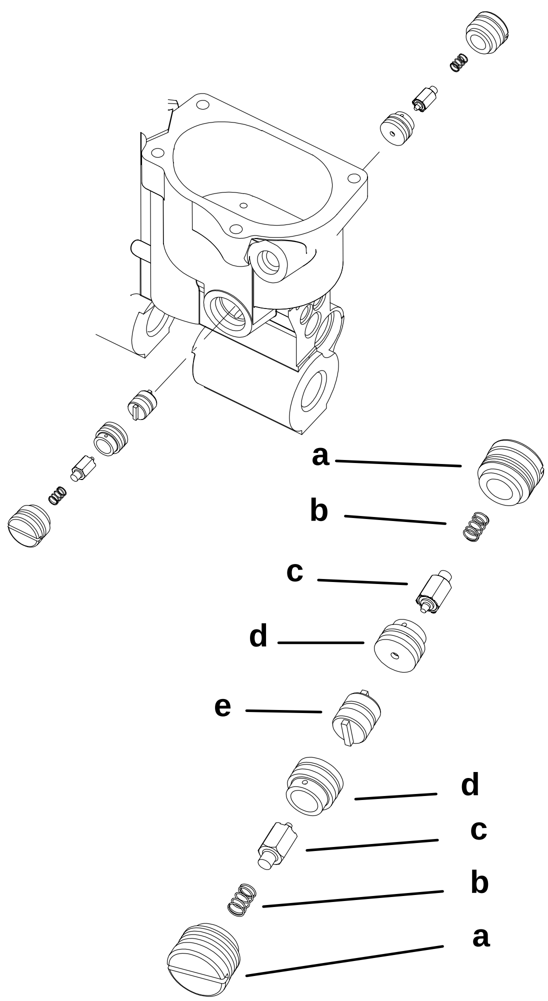
1. Lubricate O-rings with power trim fluid.
2. Install filter and suction seat using a 9/32” or 7 mm socket on OUTSIDE diameter of suction seat.
3. Install ball and plug. Torque plug to 120 lb. in. (13.5 N·m).



a - Filter
b - Suction Seat
c - Ball
d - Plug - Torque to 120 lb. in (13.5 N·m)

Pilot Check Valve Reassembly

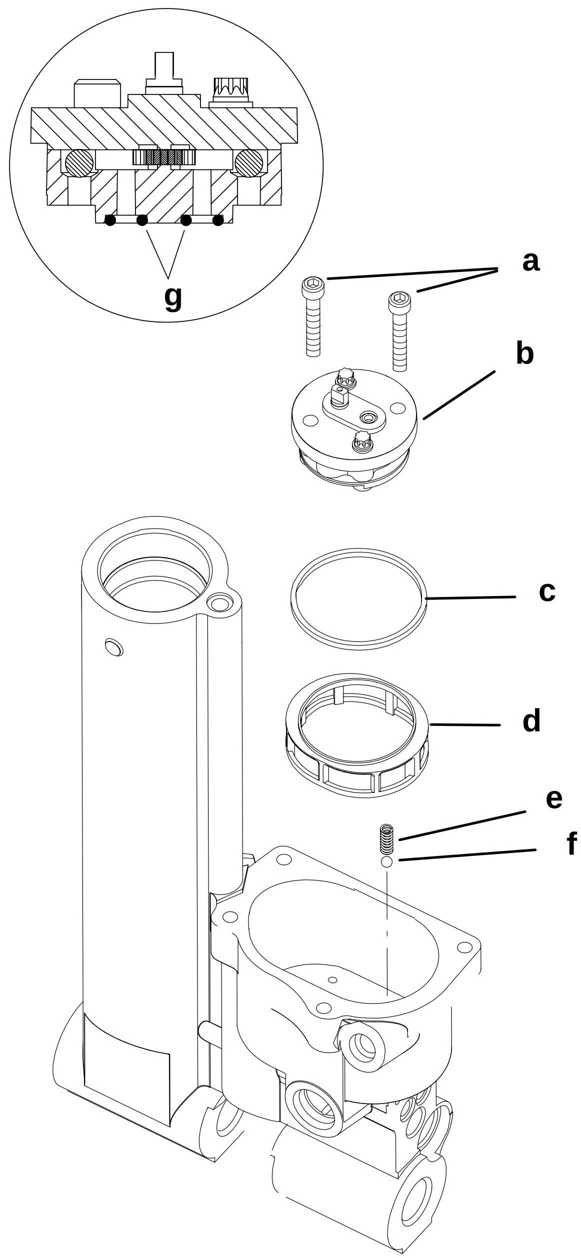
1. Lubricate o-rings with power trim fluid.
2. Install one of the seats into manifold. Push the seat into place using a 9/32" or 7 mm socket on the OUTSIDE diameter of the seat.
3. Install corresponding poppet, spring and plug.
4. From the opposite side of the manifold, install spool and the other seat. Push the seat into place using a 9/32" or 7 mm socket on OUTSIDE diameter of seat.
5. Install remaining poppet, spring and plug. Torque plugs to 120 lb. in. (13.5 N·m).



a - Plug (2) - Torque to 120 lb. in (13.5 N·m)
b - Spring (2)
c - Poppet (2)
d - Seat (2)
e - Spool

Oil Pump Reassembly

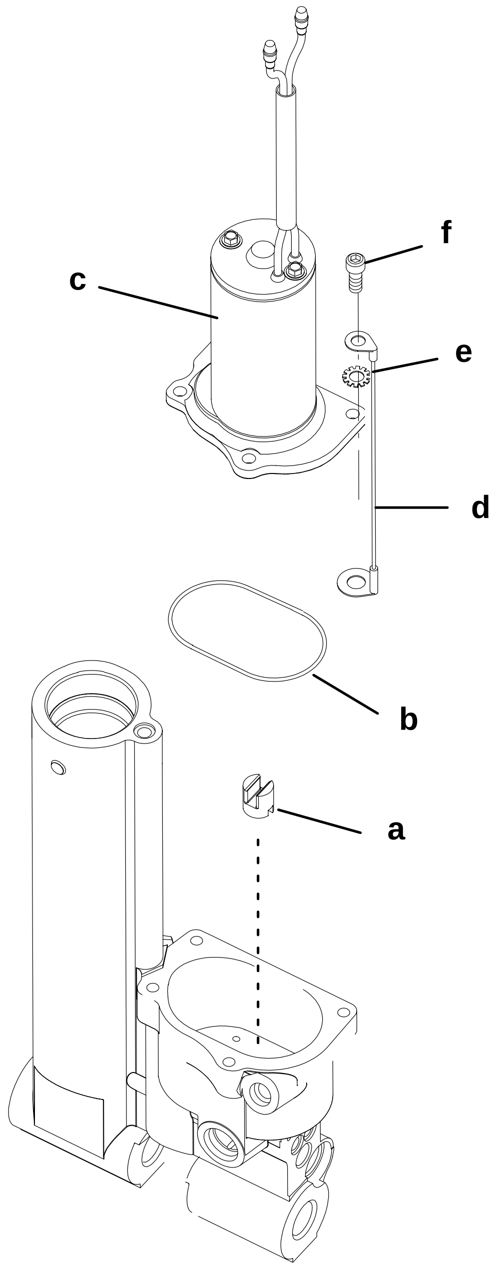
1. Install the down relief ball and spring into manifold.
2. Check to see that O-Rings are placed on bottom of pump.
3. Place O-Ring (square cut) on filter.
4. Place filter over the oil pump.
5. Install oil pump with two (2) screws. Torque screws to 70 lb. in. (7.9 N·m).



a - Screws (2) - Torque to 70 lb. in (7.9 N·m)
b - Oil Pump
c - O-ring
d - Filter
e - Spring
f - Down Relief Ball
g - Pump O-Ring (2)

Trim Motor Reassembly

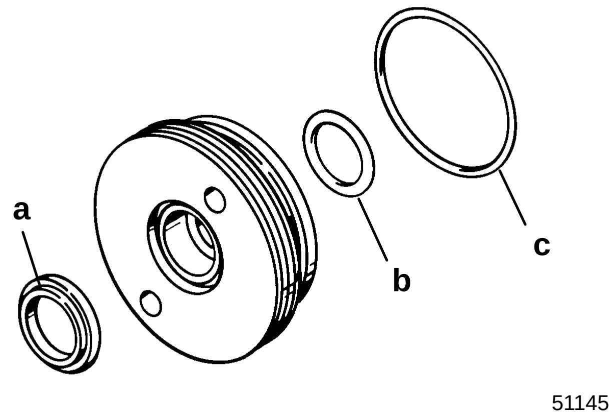
1. Align coupler between oil pump and motor.
2. Install trim motor and secure with four (4) screws. Torque screws to 80 lb. in. (9.0 N·m).



a - Coupler
b - O-ring
c - Trim Pump Motor
d - Ground Strap
e - Lock Washer (1)
f - Screws (4) - Torque to 80 lb. in (9.0 N·m)

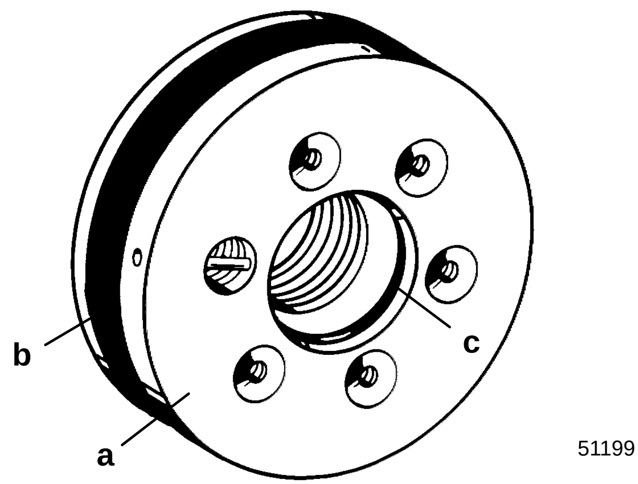
Shock Rod Reassembly

1. Install lubricated o-rings to end cap.
2. Install rod wiper.



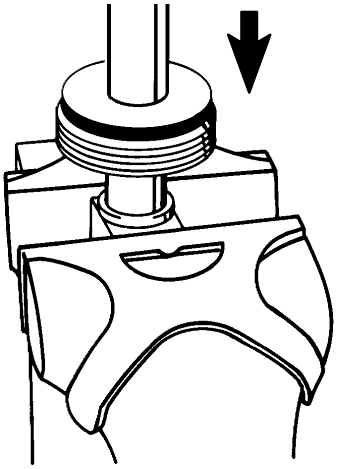
a - Rod Wiper
b - Inner O-ring
c - Outer O-ring

3. Install lubricated o-rings to shock piston.



a - Shock Piston
b - O-ring
c - O-ring

4. Clamp shock rod in soft jawed vise.
5. Position cylinder end cap onto rod as shown.

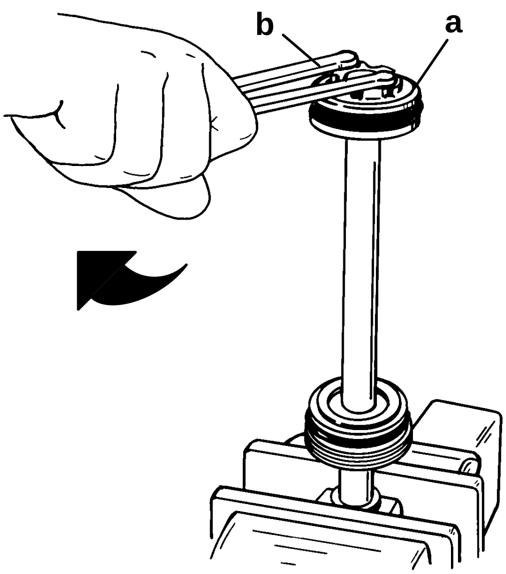


51146

⚠ CAUTION

When installing shock rod piston, spanner wrench must have1/4 in. x 5/16 in. (6.4mm x8mm) long pegs to avoid damage to shock rod piston.

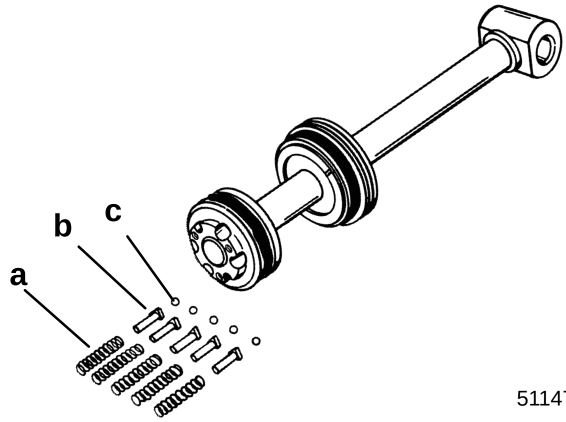
6. Apply Loctite Grade "A" (271) to threads on shock rod.
7. Install shock rod piston.
8. Tighten shock rod piston securely using spanner wrench (1/4 in. x 5/16 in. long pegs). If a torquing type spanner tool is used to tighten shock piston, then torque to 45 lb. ft. (61 N·m).



51146

a - Shock Rod Piston - Torque to 45 lb. ft (61 N·m)
b - Spanner Wrench

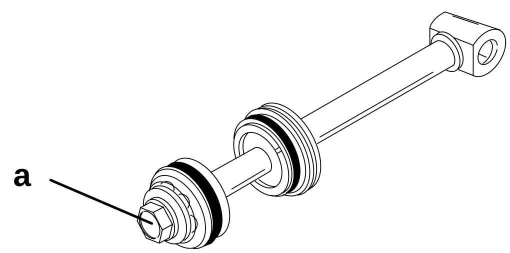
9. Remove shock rod assembly from vise.
10. Install ball, seat, and spring (five sets) to shock rod piston.



51147

a - Spring (5)
b - Seat (5)
c - Ball (5)

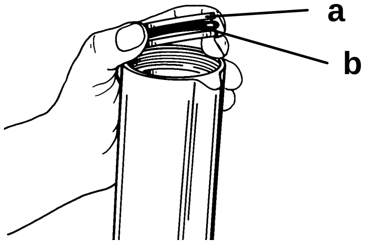
11. Secure components with shock piston bolt. Torque bolt to 45 lb.in. (61 Nm).



a - Bolt - Torque to 45 lb. ft. (61 N·m)

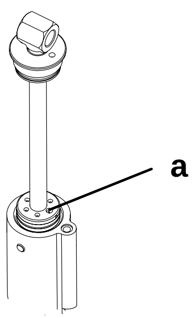
Shock Rod Installation

1. Place trim cylinder in soft jawed vice.
2. Install lubricated o-ring to memory piston and place into cylinder. Push memory piston all the way to bottom.



a - Memory Piston
b - O-ring

3. Fill cylinder three inches (76.2mm) from top of cylinder using Dexron III, (ATF) automatic transmission fluid. If not available, use Quicksilver Power Trim and Steering Fluid.
4. Install shock rod into cylinder until power trim fluid flows through oil blow off ball passage. Fill remaining cylinder to just below the cylinder threads.

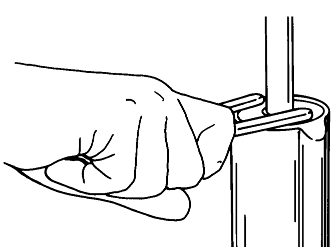


a - Oil Blow Off Ball Passage

⚠ CAUTION

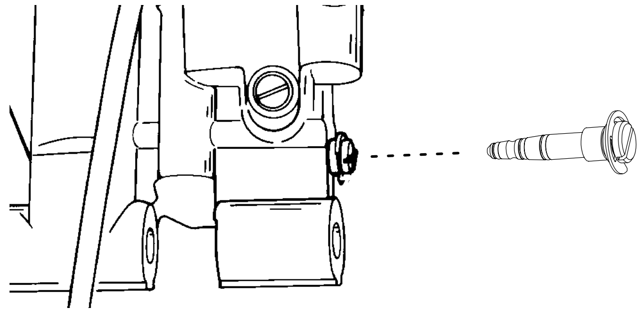
End cap must not make contact with shock rod piston when tightening. Shock rod piston must be positioned in cylinder deep enough to avoid contact.

5. Tighten end cap securely using spanner wrench [3/16 in. x 5/16 in. (4.8mm x 8mm) long pegs].. If a torquing type spanner tool is used to tighten end cap, then torque to 45 lb. ft. (61.0 N·m).



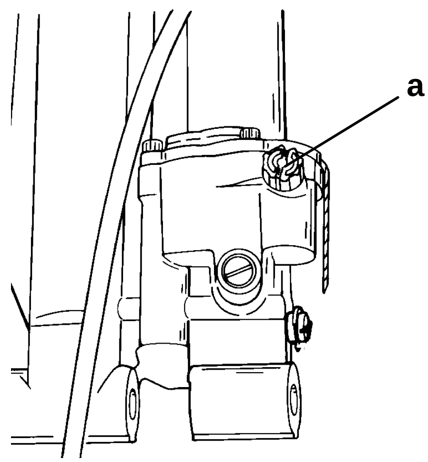
Manual Release Valve Installation

1. Install “E” clip (if removed) and lubricate O-Rings with power trim fluid.
2. Insert manual release valve into manifold and tighten securely.



Bleeding Power Trim Unit

1. Secure power trim unit in soft jawed vise.
2. Remove reservoir plug. Add power trim fluid until its even with the bottom of the fill hole. Reinstall plug.
3. Close the manual release valve. (Turn full clockwise).

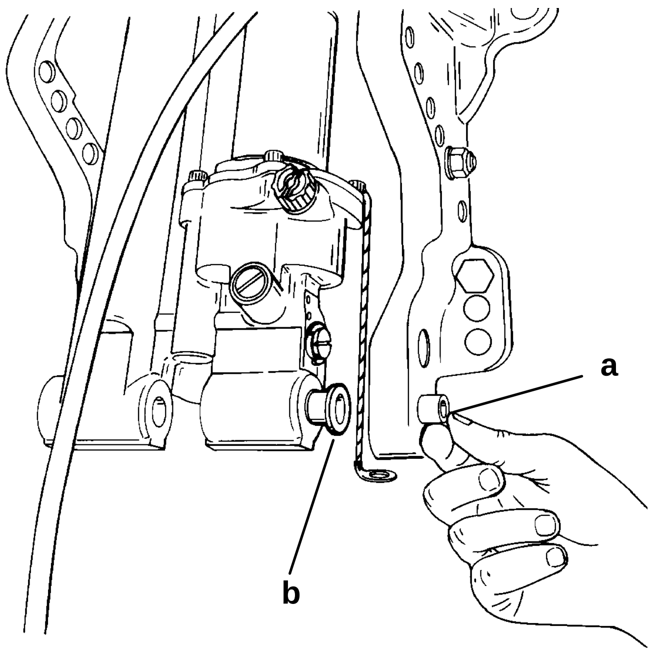


a - Reservoir Plug

4. Connect the positive lead to (blue) trim motor wire and negative lead to (green) trim motor wire and drive shock rod to the up position.
5. Using a 12 volt power supply, connect the positive lead to the (green) trim motor wire, and the negative lead to the (blue) trim motor wire and drive the shock rod to the down position.
6. Recheck fluid level with rod fully extended, add fluid if required and repeat cycle until fluid level stays even with the bottom of the fill hole.

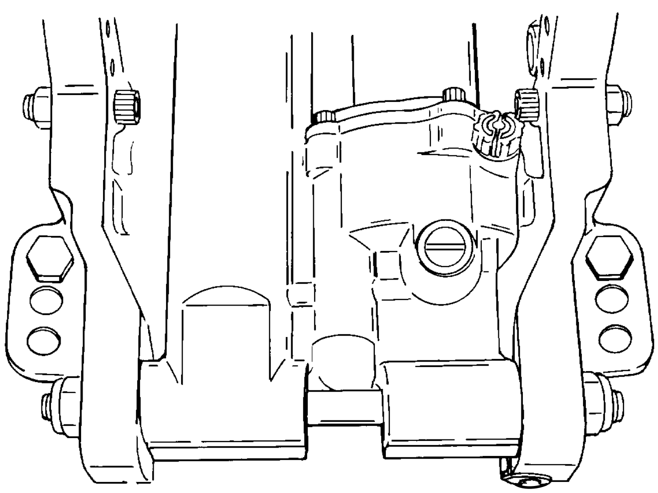
Power Trim System Installation

1. Lubricate lower pivot pin, mounting holes and bushings with 2-4-C Marine Lubricant.
2. Install lower pivot pin bushings into the clamp brackets and trim unit.

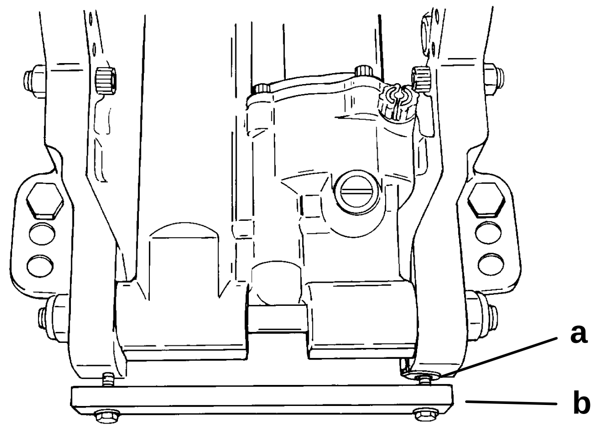


a - Bushing (2) Install into each Clamp Bracket
b - Bushing (2) Install into each side of Trim Unit

3. Install lower pivot pin. Secure with flat washers and nuts. Torque nuts to 18 lb. ft. (24.4 N·m).



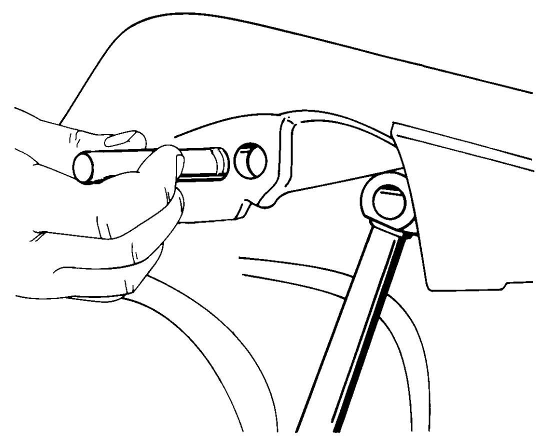
4. Install sacrificial anode to clamp brackets. Fasten ground strap between anode and clamp bracket. Torque bolts to 60 lb. in. (6.8 N·m).



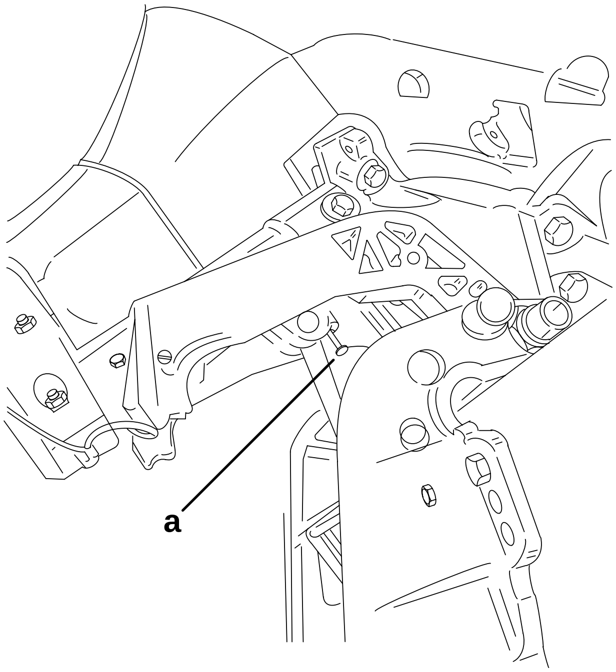
a - Ground Wire
b - Sacrificial Anode

5. Lubricate the upper pivot pin and mounting holes with 2-4-C Marine Lubricant.
6. Fasten shock rod with the upper pivot pin.

NOTE: *Pivot pin should be installed with grooved end inserted first.*

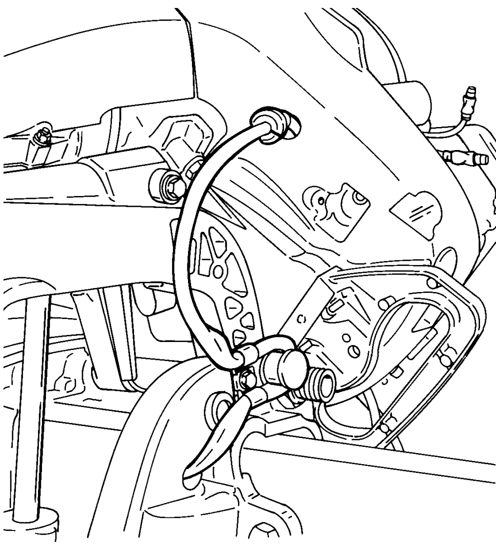


7. Secure upper pivot pin with trilobe pin. Press tri-lobe pin in until its fully seated.

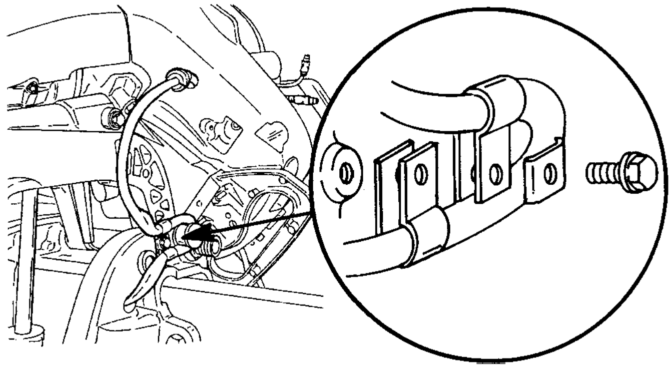


a - Trilobe Pin

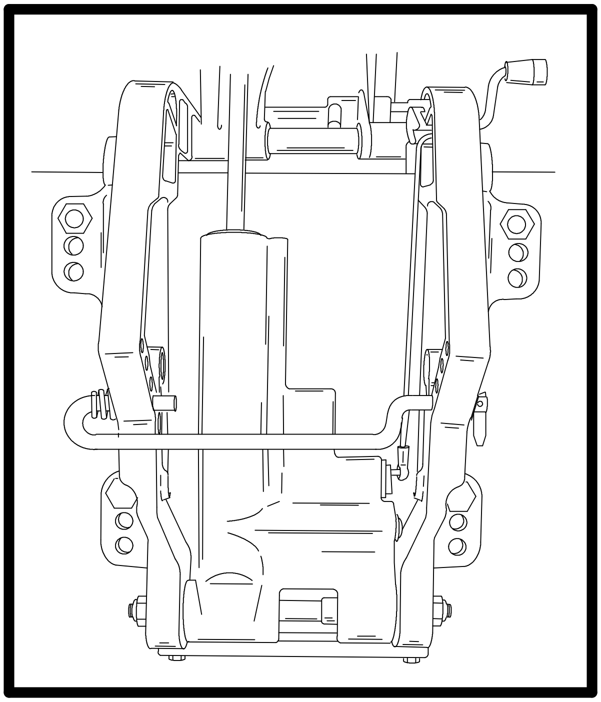
8. Re-connect trim wire harness leads (see wiring diagram Section 2D for proper connections).
9. Recheck fluid level (tilt/trim rod fully extended).
10. Route wire harness through clamp bracket and cowling.



11. Secure wire harness with clamps as shown.



MID-SECTION



GAS ASSIST MANUAL TILT

5

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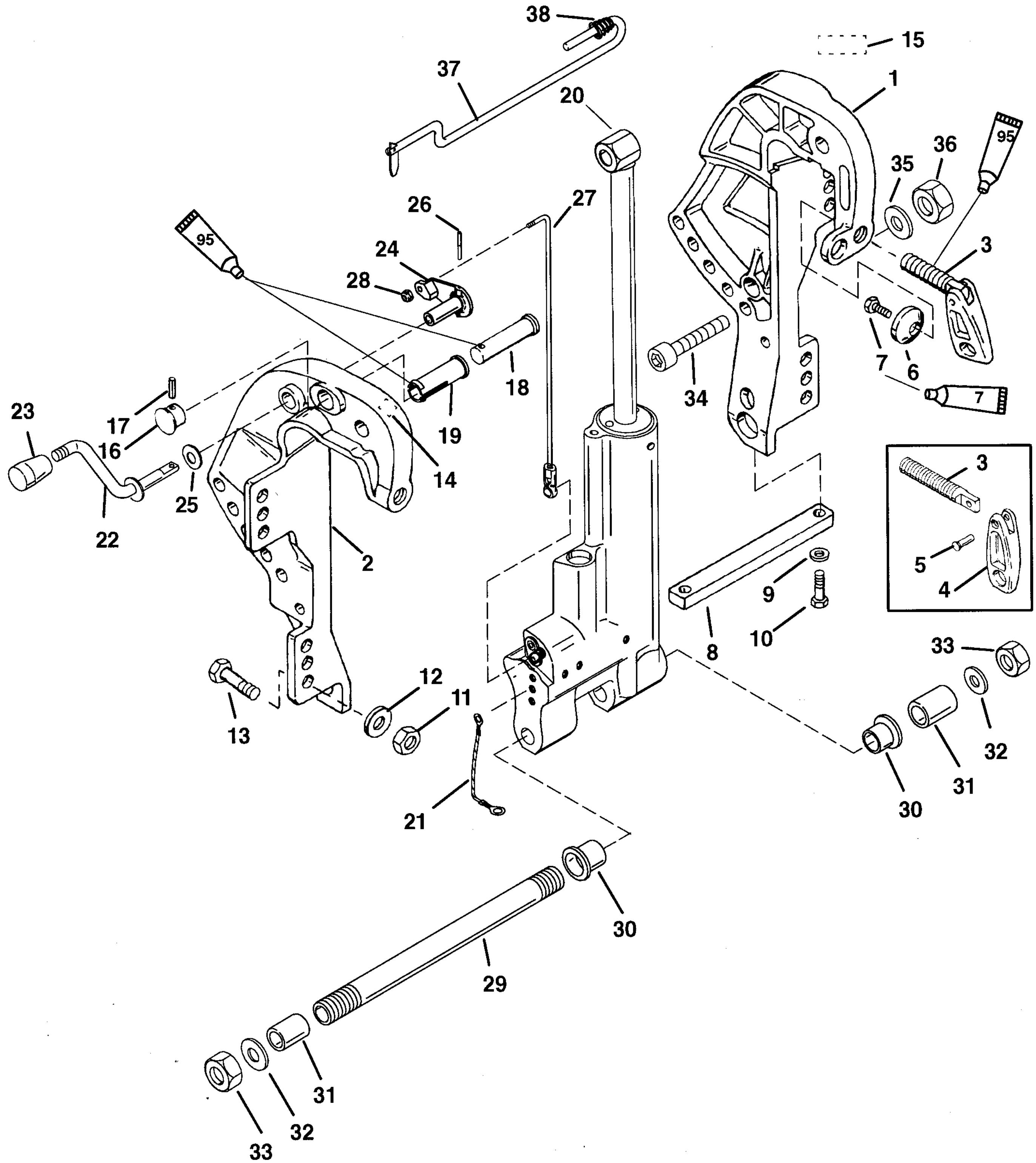
Notes:

CLAMP BRACKET (GAS ASSIST TRIM)



7 Loctite "271" Adhesive Sealant (92-809819)

95 2-4-C w/Teflon (92-825407A12)

CLAMP BRACKET (GAS ASSIST TRIM)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
1	1	CLAMP BRACKET **(BLACK)** **PORT**			
	1	CLAMP BRACKET **(GRAY)**			
2	1	CLAMP BRACKET **(BLACK)** **STARBOARD**			
	1	CLAMP BRACKET **(GRAY)**			
3	2	THUMB SCREW ASSEMBLY			
4	2	HANDLE			
5	2	RIVET **MANUAL**			
6	2	WASHER			
7	2	SCREW (Hex shoulder)	60		6.8
8	1	ANODE			
9	2	WASHER			
10	2	SCREW (M6 x 25)	60		6.8
11	2	NUT (.500-20)	Drive Tight		
12	2	WASHER			
13	2	SCREW (.500-20 x 4 IN.)			
14	1	DECAL-Tilt Lock			
15	1	DECAL-Warning			
16	1	CAP–Tilt Stop Pin			
17	1	ROLL PIN			
18	1	BUSHING			
19	1	PIN–Tilt Stop			
20	1	TRIM, Hydraulic assist			
21	1	CABLE			
22	1	TILT LEVER			
23	1	TILT KNOB **GAS ASSIST TRIM**			
24	1	LEVER ARM			
25	1	WAVE WASHER			
26	1	ROLL PIN (1/8 x 3/4 IN.)			
27	1	LINK			
28	1	NUT			
29	1	ANCHOR PIN (14MM)			
30	2	BUSHING			
31	2	BUSHING **GAS ASSIST TRIM &**			
32	2	WASHER **POWER TRIM MOUNTING**			
33	2	NUT			
34	2	SCREW (M10 x 40)			
35	2	WASHER			
36	2	NUT			
37	1	TILT LOCK PIN **NON POWER TRIM**			
38	1	SPRING			

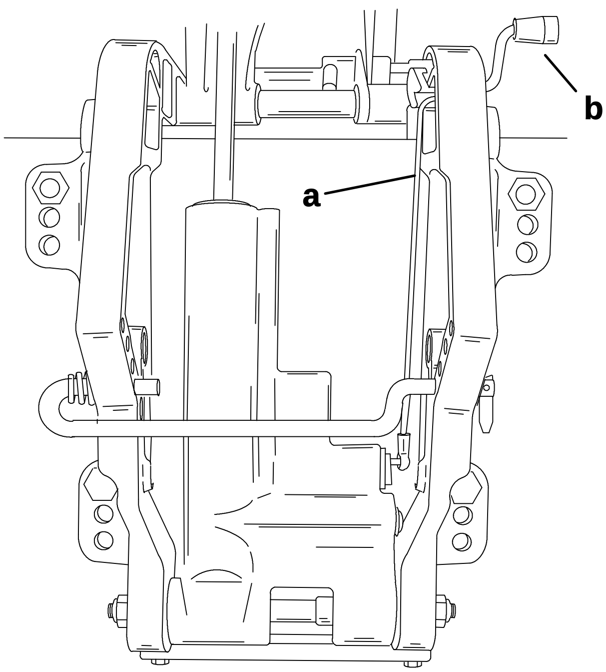
Hydraulic Assist Adjustments

⚠ WARNING

This hydraulic assist system's contents are under pressure. Do not puncture disassemble or apply heat or flame.

IMPORTANT: If debris or leaking is found, unit must be replaced This hydraulic assist system is NOT SERVICEABLE. Replace is necessary.

1. Check manual release cam adjustment. Cam must open and close freely. Adjust cam link rod as necessary.

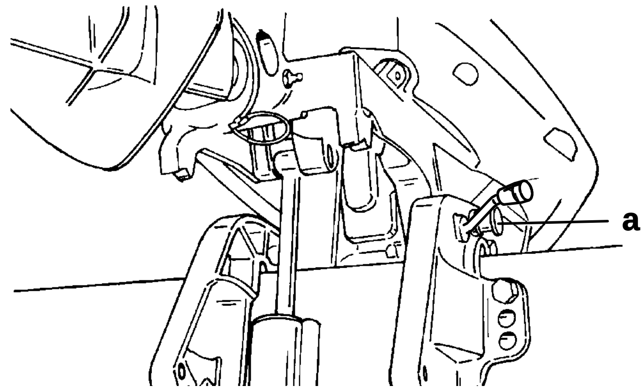


a - Link Rod
b - Manual Release Lever

2. Check for external leaks in the manual tilt system. Replace unit if leak is found.

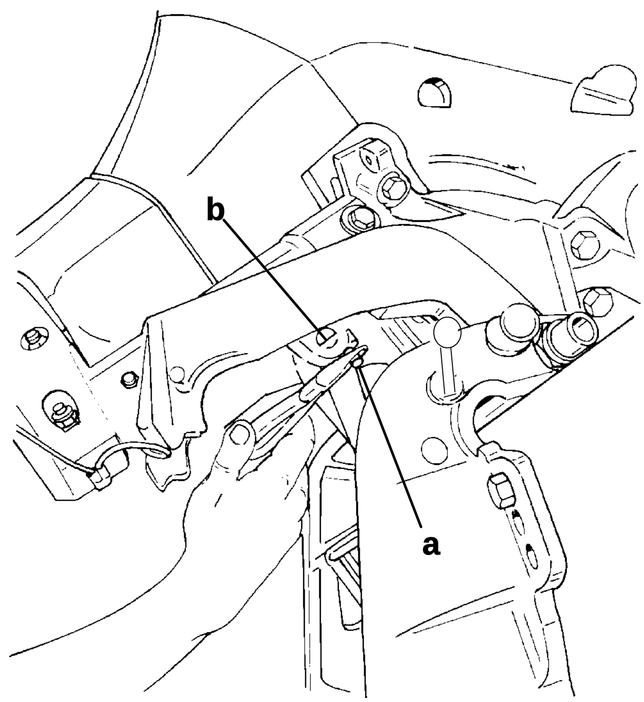
Manual Trim System Removal

1. Tilt outboard to the full up position and support with tilt stop pin.



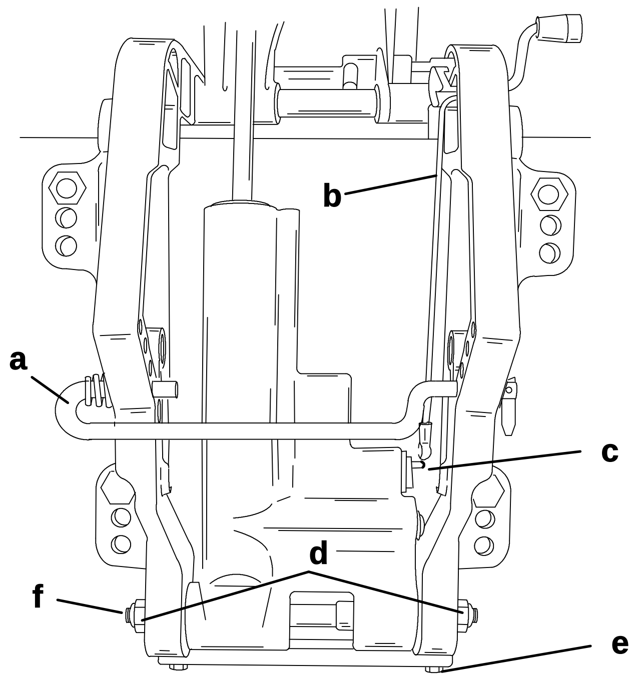
a - Tilt Stop Pin

2. Remove the trilobe pin.
3. Drive out the upper pivot pin.



a - Trilobe Pin
b - Upper Pivot Pin

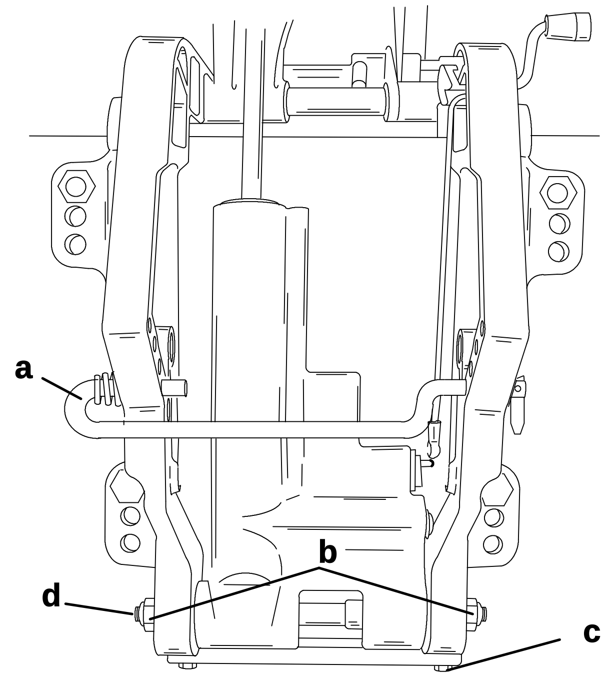
4. Disconnect link rod from cam lever.
5. Remove tilt lock pin. Remove nuts and washers securing the lower pivot pin. Remove anode bolt to remove ground strap. Remove lower anchor pin. Retain the anchor pin bushings from the clamp brackets and trim unit.
6. Remove trim unit.



a - Tilt Lock Pin
b - Link Rod
c - Cam Lever
d - Nut (2)
e - Anode Bolt/Ground Strap
f - Pivot Pin

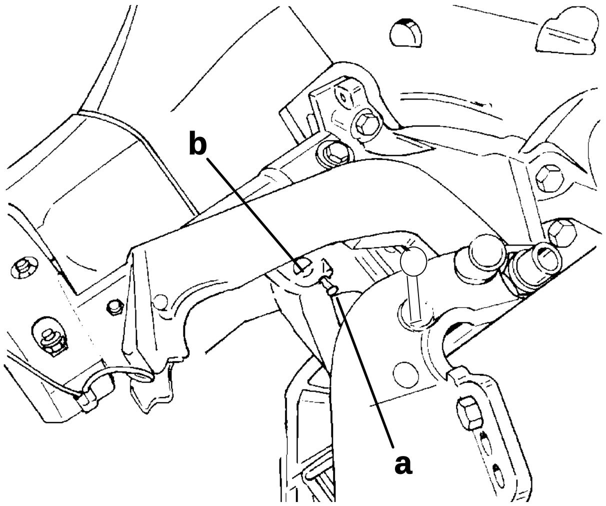
Manual Trim System Installation

1. Apply 2-4-C Marine Lubricant (92-90018A12) to surface of lower anchor pin and anchor pin hole. Place trim into proper position. Install anchor pin and bushings into anchor pin hole and clamp brackets. Install nuts and washers to anchor pin and tighten securely. Install ground strap and anode bolt.
2. Install tilt lock pin.



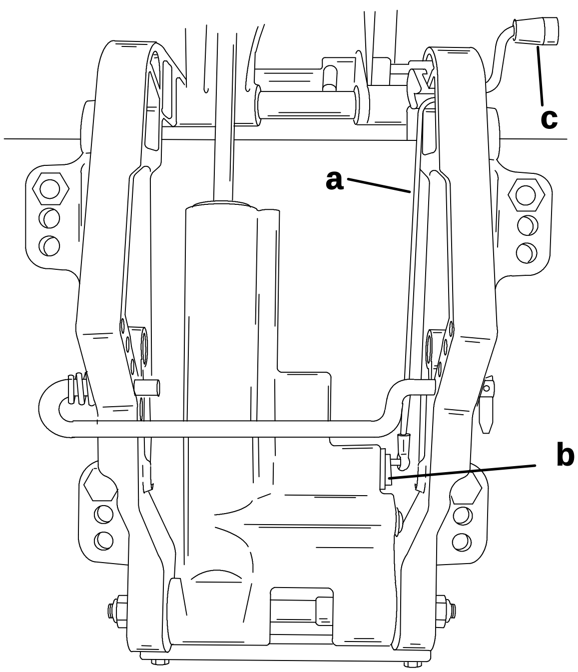
a - Tilt Lock Pin
b - Nut (2)
c - Anode Bolt/Ground Strap
d - Pivot Pin

3. Apply 2-4-C Marine Lubricant (92-90018A12) to surface of upper pivot pin, pivot hole and shock rod hole.
4. Position trim into position and drive pivot pin into swivel bracket and through shock rod until pivot pin is flush with swivel bracket. Drive trilobe pin into its hole until seated.



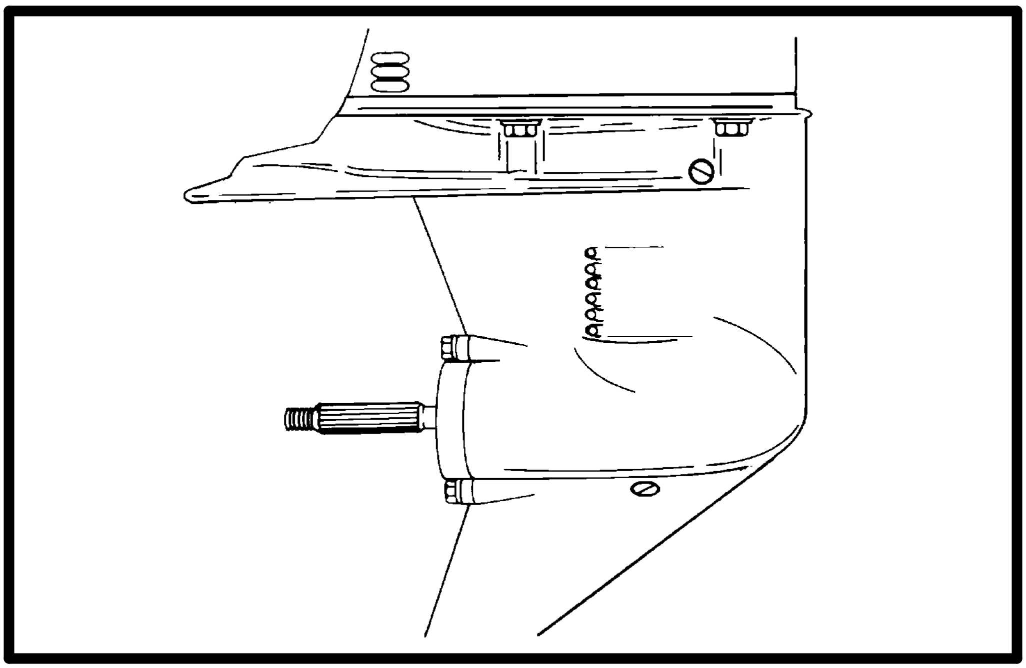
a - Trilobe Pin
b - Upper Pivot Pin

5. Connect link rod onto cam lever.
6. Check manual release cam adjustment. Cam must open and close freely. Adjust cam link rod as necessary.



a - Link Rod
b - Cam Lever
c - Manual Release Lever

LOWER UNIT



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Specifications

Gear Ratio	2.00:1
Gearcase Capacity	14.9 fl. oz. (440 mL)
Lubricant Type	Quicksilver Gear Lube Premium Blend
Forward Gear **Number Of Teeth** **Type**	 26 Spiral/Bevel
Pinion Gear **Number Of Teeth** **Type**	 13 Spiral/Bevel
Pinion Height	No Adjustment
Forward Gear Backlash	No Adjustment
Reverse Gear Backlash	No Adjustment
Water Pressure **With Thermostat & Poppet** **-@ W.O.T.** **-@ Idle** **All Models W/O Thermostat + Poppet** **-@ W.O.T.** **-@ Idle** **Poppet Valve Opening 1994-1997** **Poppet Valve Opening 1998 & Newer**	 5 - 7 PSI @ 5000 RPM 0.5 - 1.5 PSI @ 750 RPM 5 - 7 PSI @ 5000 RPM 0 - 1 PSI @ 750 RPM 900-1000 RPM 3000-3500 RPM

NOTE: *Before filling gear case, apply 10-15 PSI of air pressure at the VENT hole. Pressure should not drop for 15 seconds while alternately applying a 2-3 pound force to the top of the shift shaft in the fore and aft direction.*

General Service Recommendations

There may be more than one way to "disassemble" or "reassemble" a particular part(s), therefore, it is recommended that the entire procedure be read prior to repair.

IMPORTANT: Read the following before attempting any repairs.

In many cases, disassembly of a sub-assembly may not be necessary until cleaning and inspection reveals that disassembly is required for replacement of one or more components.

Service procedure order in this section is a normal disassembly-reassembly sequence.

Threaded parts are right hand (RH), unless otherwise indicated.

When holding, pressing or driving is required, use soft metal vise jaw protectors or wood for protection of parts. Use a suitable mandrel (one that will contact only the bearing race) when pressing or driving bearings.

Whenever compressed air is used to dry a part, verify that no water is present in air line.

Bearings

All bearings must be cleaned and inspected. Clean bearings with solvent and dry with compressed air. Air should be directed at the bearing so that it passes through the bearing. DO NOT spin bearing with compressed air as this may cause bearing to score from lack of lubrication. After cleaning, lubricate bearings with Quicksilver Gear Lubricant. DO NOT lubricate tapered bearing cups until after inspection.

Inspect all bearings for roughness, catches and bearing race side wear. Work inner bearing race in-and-out, while holding outer race, to check for side wear. When inspecting tapered bearings, determine condition of rollers and inner bearing race by inspecting bearing cup for pitting, scoring, grooves, uneven wear, imbedded particles and/or discoloration from over-heating. Always replace tapered bearing and race as a set.

Inspect gear housing for bearing races that have spun in their respective bores. If race(s) have spun, gear housing must be replaced.

Roller bearing condition is determined by inspecting the surface of the shaft that the roller bearing supports. Check shaft surface for pitting scoring, grooving, imbedded particles, uneven wear and/or discoloration from overheating. The shaft and bearing must be replaced if such a condition exists.

Seals

As a normal procedure, all O-rings and oil seals SHOULD BE REPLACED without regard to appearance. To prevent leakage around seals, apply Loctite 271 to outer diameter of all metal case seals. When using Loctite on seals or threads, surfaces must be clean and dry. Apply 2-4-C w/Teflon on all O-rings and on I.D. of oil seals. Apply 2-4-C w/Teflon to external surfaces of bearing carrier.

Special Tools

1. Bearing 31-85560

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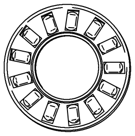
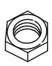
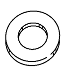


2. Driver 91-13779

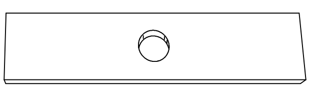
3. Bearing Puller & Installation Tool 91-31229A7
   a. Nut 11-24156

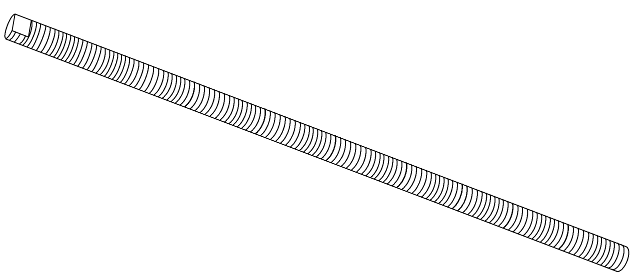
   b. Washer (2) 12-34961

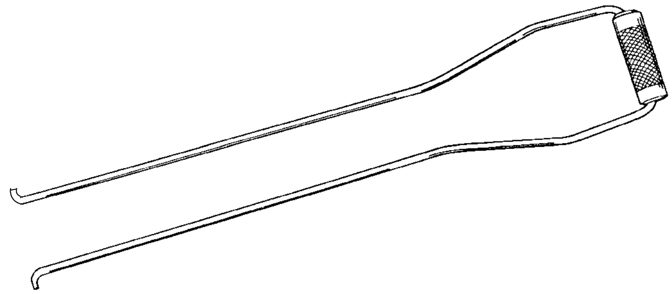
   c. Plate 91-29310

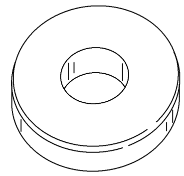
   d. Shaft 91-31229

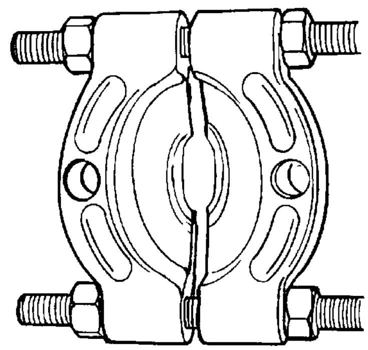
4. Bearing Puller Tool 91-27780



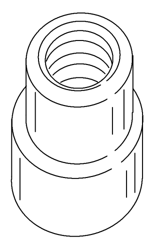
5. Mandrel 91-36571



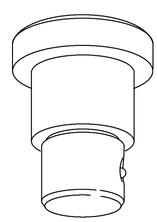
6. Universal Puller Plate 91-37241



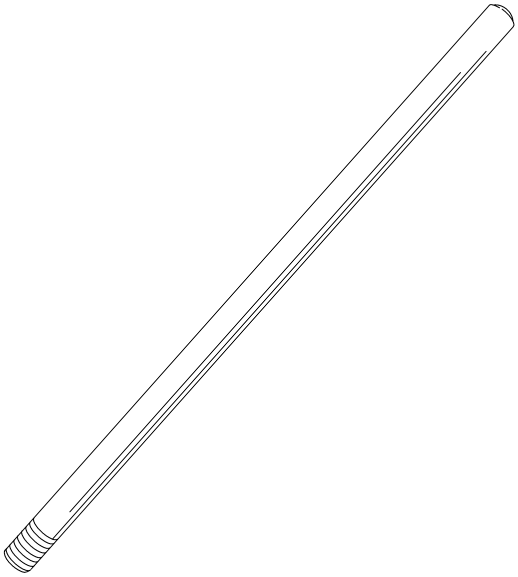
7. Driver Head 91-37312



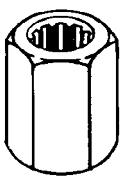
8. Driver 91-817011



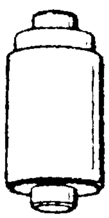
9. Driver Rod 91-37323



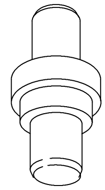
10. Drive Shaft Holding Tool 91-825196



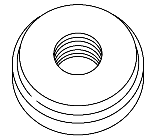
11. Mandrel 91-825197



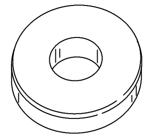
12. Driver 91-817007



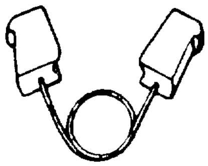
13. Mandrel 91-825198



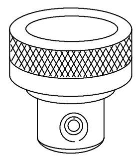
14. Pilot 91-825199



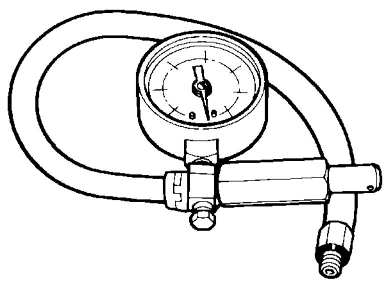
15. Spring Hook 91-825200A1



16. Driver 91-826872

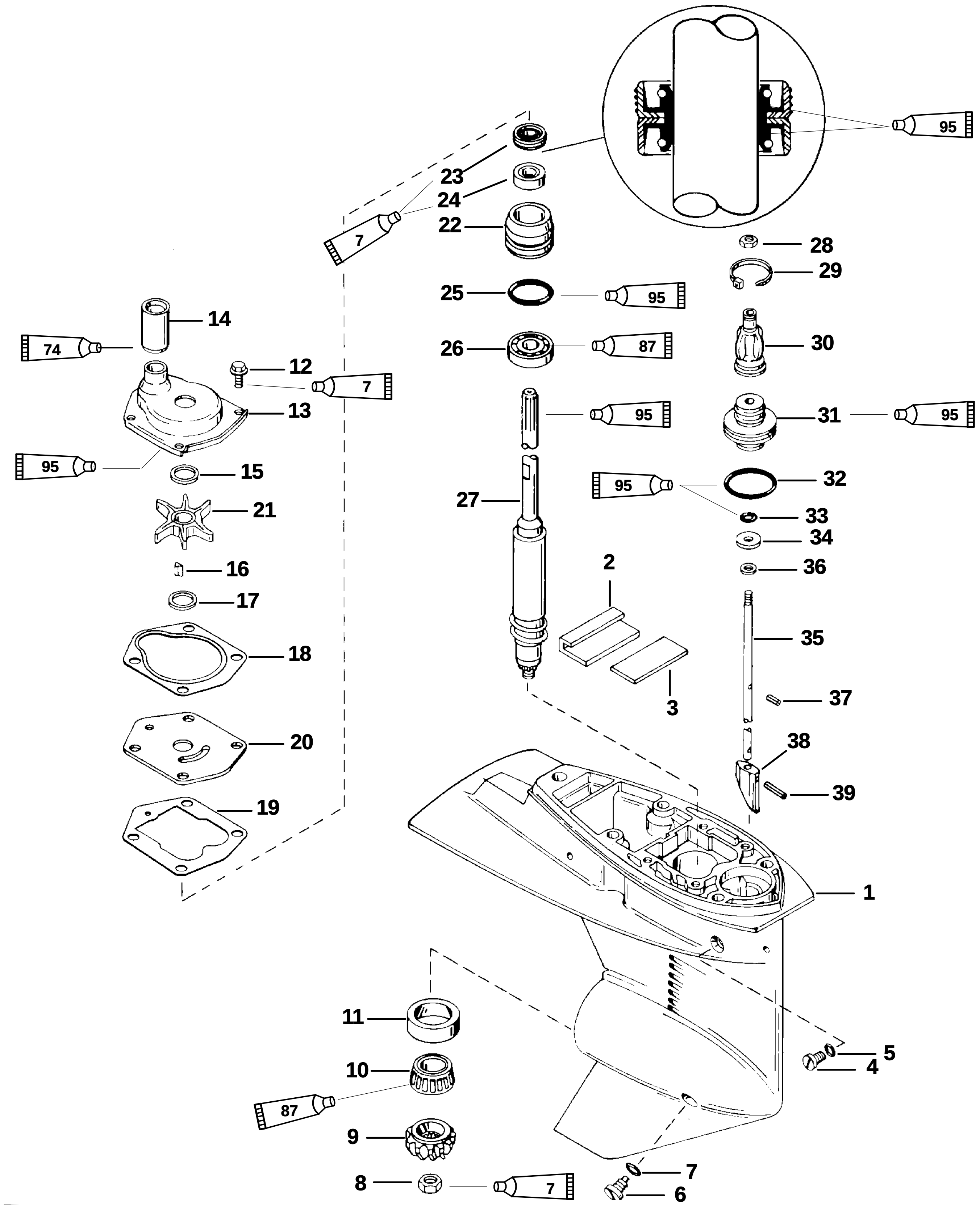


17. Leakage Tester FT8950



Notes:

Gear Housing Components (Drive Shaft)



7 Loctite “271” Adhesive Sealant (92-809819)

74 Loctite 405 (Obtain Locally)

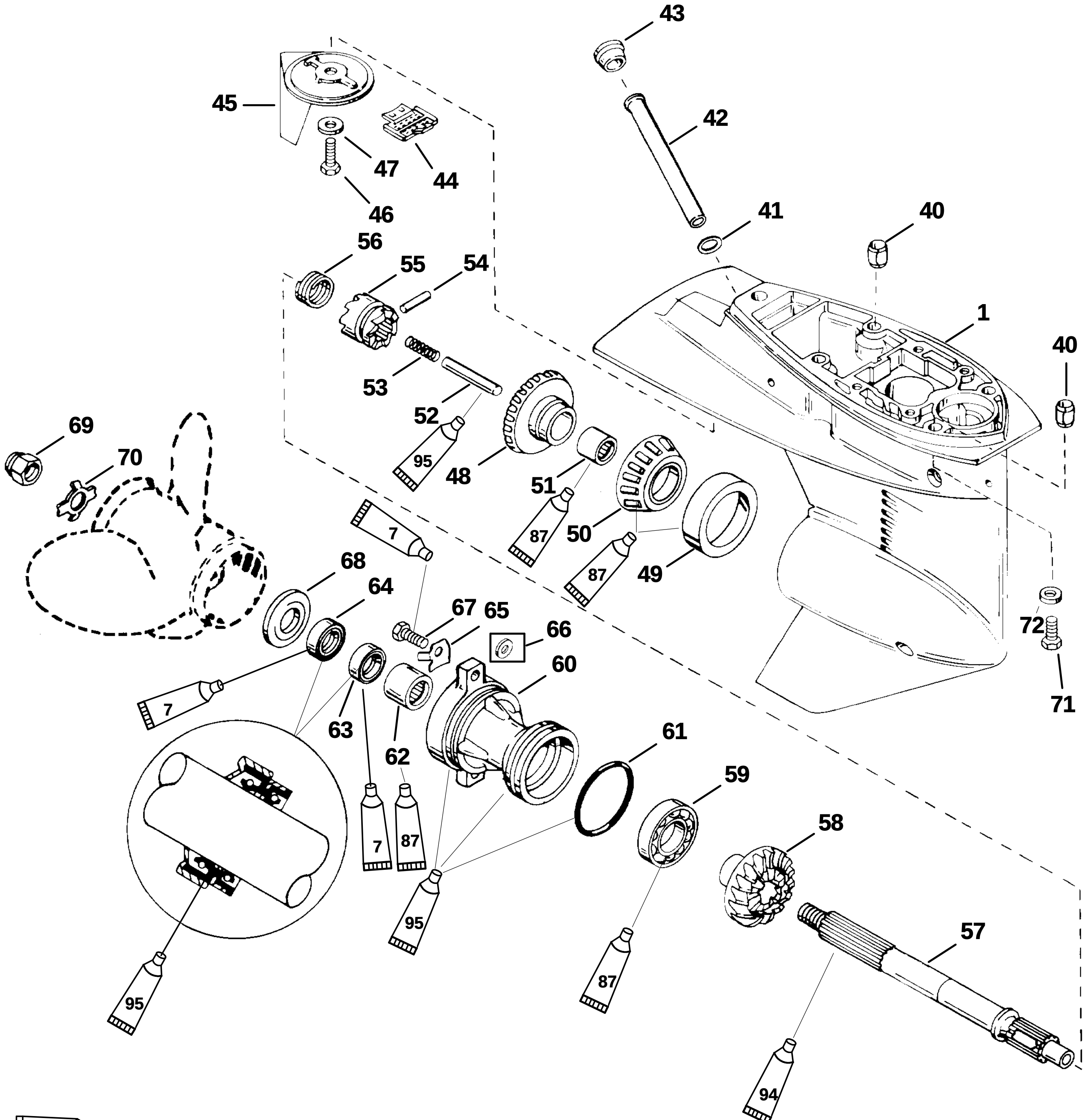
87 Super Duty Gear Lubricant (92-13783A24)

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

Gear Housing Components (Drive Shaft)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
–	1	GEAR HOUSING **(SHORT-BLACK)**			
–	1	GEAR HOUSING **(LONG-BLACK)**			
–	1	GEAR HOUSING **(X-LONG-BLACK)**			
–	1	GEAR HOUSING **(SHORT-GRAY)**			
–	1	GEAR HOUSING **(LONG-GRAY)**			
–	1	GEAR HOUSING **(X-LONG-GRAY)**			
1	1	GEAR HOUSING **(BASIC-BLACK)**			
	1	GEAR HOUSING **(BASIC-GRAY)**			
2	1	SEAL/PLATE KIT			
3	1	PLATE (Part Of Ref #2)			
4	1	SCREW (.375-16 x .25)	55		6.2
5	1	WASHER-Sealing			
6	1	DRAIN SCREW (MAGNETIC)	55		6.2
7	1	WASHER-Sealing			
8	1	NUT		50	67.8
9	1	PINION GEAR			
10	1	BEARING ASSEMBLY-Roller			
11	1	CUP (Part Of Ref #10)			
12	4	SCREW (M6 x 16)	60		6.8
13	1	WATER PUMP ASSEMBLY			
14	1	SEAL-Water Tube **(SHORT/LONG)**			
15	1	WASHER			
16	1	KEY			
17	1	WASHER			
18	1	GASKET			
19	1	GASKET (LOWER)			
20	1	FACE PLATE			
21	1	IMPELLER			
22	1	WATER PUMP BASE ASSEMBLY			
23	1	SEAL-Oil			
24	1	SEAL-Oil			
25	1	O RING			
26	1	BALL BEARING			
27	1	DRIVESHAFT **(SHORT)**			
	1	DRIVESHAFT **(LONG)**			
	1	DRIVESHAFT **(X-LONG)**			
28	1	NUT **(INCLUDED WITH REF #35)**			
29	1	CABLE TIE			
30	1	BOOT-Shift Shaft			
31	1	RETAINER-Shift Shaft			
32	1	O RING			
33	1	O RING			
34	1	WASHER			
35	1	SHIFT SHAFT **(SHORT)**			
	1	SHIFT SHAFT **(LONG)**			
	1	SHIFT SHAFT **(X-LONG)**			
36	1	WASHER			
37	1	ROLL PIN			
38	1	CAM-Shift			
39	1	PIN			

Gear Housing Components (Propeller Shaft)



7 Loctite “271” Adhesive Sealant (92-809819)

87 Super Duty Gear Lubricant (92-13783A24)

94 Anti-Corrosion Grease (92-78376A6)

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

Gear Housing Components (Propeller Shaft)

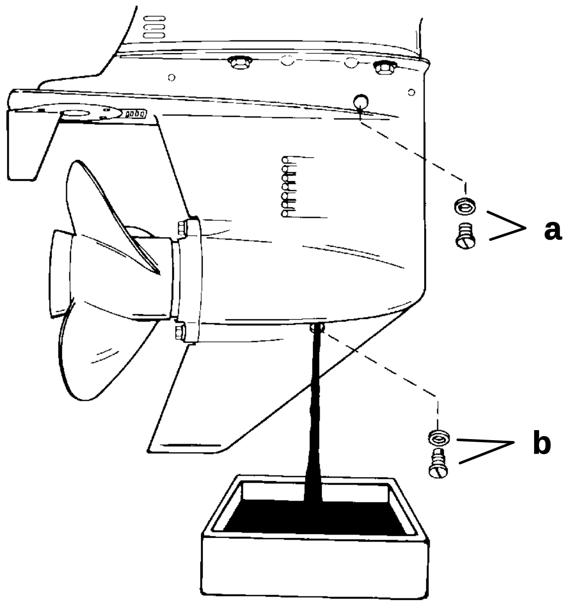
REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
–	1	GEAR HOUSING **(SHORT-BLACK)**			
–	1	GEAR HOUSING **(LONG-BLACK)**			
–	1	GEAR HOUSING **(X-LONG-BLACK)**			
–	1	GEAR HOUSING **(SHORT-GRAY)**			
–	1	GEAR HOUSING **(LONG-GRAY)**			
–	1	GEAR HOUSING **(X-LONG-GRAY)**			
1	1	GEAR HOUSING **(BASIC-BLACK)**			
	1	GEAR HOUSING **(BASIC-GRAY)**			
40	2	DOWEL PIN			
41	1	GASKET Water Tube			
42	1	TUBE			
43	1	PLUG-RUBBER			
44	1	SCREEN-Water Inlet			
45	1	TRIM TAB			
46	1	SCREW (M8 x 20)	186	15.5	20.1
47	1	WASHER			
48	1	FORWARD GEAR ASSEMBLY			
49	1	ROLLER BEARING ASSEMBLY			
50	1	CUP			
51	1	ROLLER BEARING			
52	1	FOLLOWER-Cam			
53	1	SPRING			
54	1	PIN-Cross			
55	1	CLUTCH			
56	1	SPRING			
57	1	PROPELLER SHAFT			
58	1	REVERSE GEAR			
59	1	BALL BEARING			
60	1	BEARING CARRIER			
61	1	O RING			
62	1	NEEDLE BEARING			
63	1	OIL SEAL			
64	1	OIL SEAL			
65	2	TAB WASHER (Use where applicable)			
66	2	WASHER (Replaces Tab Washer)			
67	2	SCREW (M8 x 25 - Cap Screw)	198	16.5	22.4
	2	SCREW (Washer-Head Screw)	198	16.5	22.4
68	1	THRUST HUB			
69	1	PROP NUT KIT		55	74.6
70	1	TAB WASHER			
71	4	SCREW **(SHORT/LONG)**		40	54.2
72	4	WASHER			

Draining and Inspecting Gear Lubricant

⚠ WARNING

If gear housing is installed on outboard, 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 vent plug and fill/drain plug (with gaskets).



a - Vent Plug/Washer
b - Fill/Drain Plug/Washer

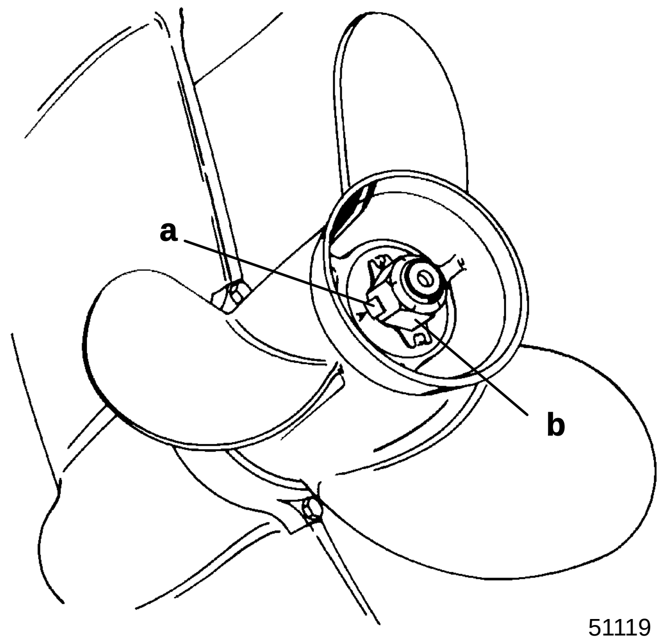
2. Inspect gear lubricant for metal particles (lubricant will have a "metal flake" appearance). Presence of fine metal particles (resembling powder) on the drain plug magnet indicates normal wear. Metal chips on the magnet indicate the need for gear housing disassembly and component inspection.
3. Note color of gear lubricant. White or cream color indicates presence of water. Gear lubricant drained from a gear case assembled with Special Lubricant 101 or a gear case recently in operation will have a yellowish color due to lubricant agitation/aeration. This is normal and should not be confused with the presence of water.
4. Presence of water indicates the need for disassembly and inspection of oil seals, o-rings, gaskets and components for damage.

Propeller Removal

⚠ WARNING

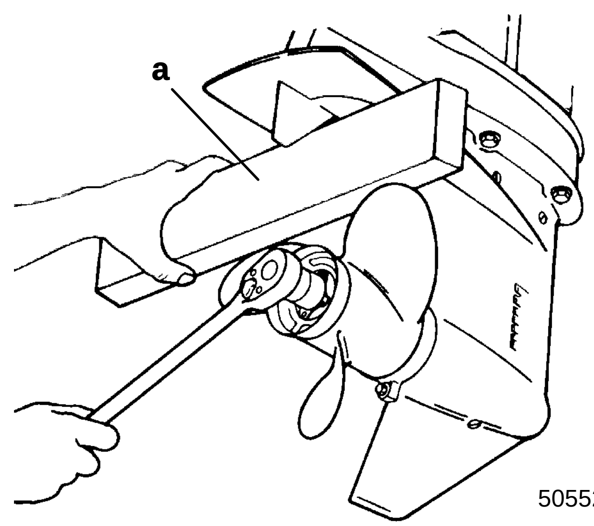
If gear housing is not removed from outboard, before attempting to remove or install the propeller, remove (and isolate) spark plug leads from spark plugs to prevent outboard from starting.

1. Bend tabs of tab washer (a) away from nut (b).



51119

2. Use a block of wood (a) to prevent propeller from rotating. Remove nut and pull components from shaft.



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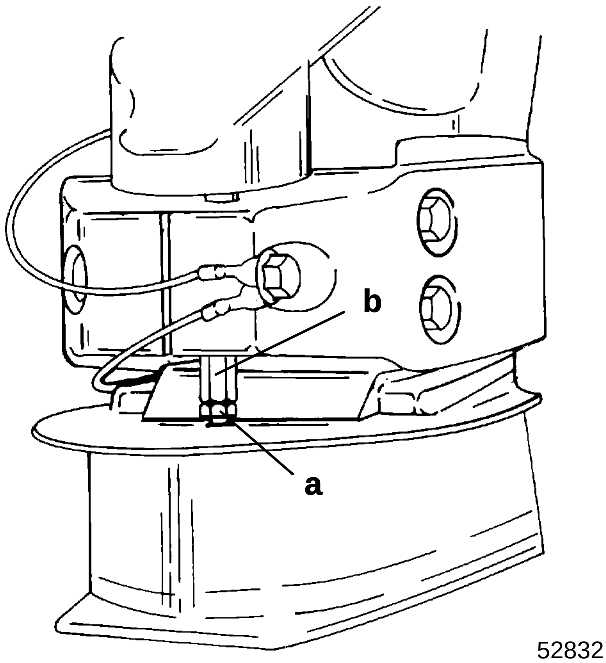
Gear Housing Removal

⚠ WARNING

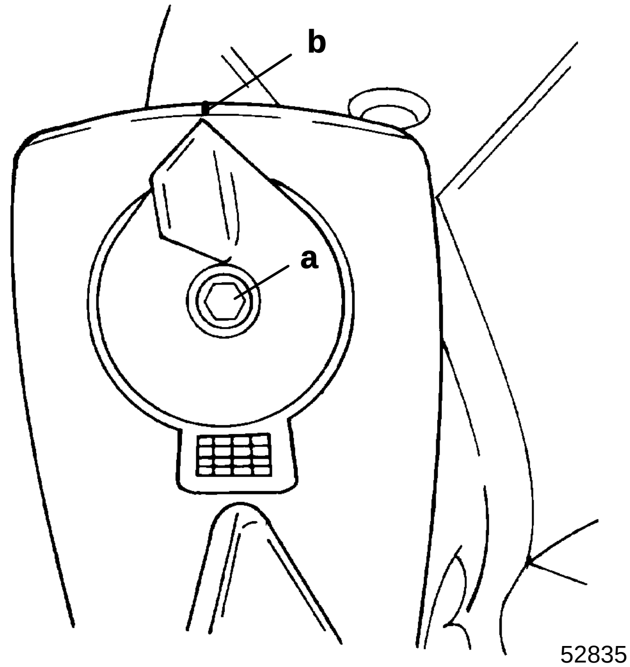
To prevent accidental engine starting, remove (and isolate) spark plug leads from spark plugs before removing gear housing.

1. Remove (and isolate) spark plug leads from spark plugs.
2. Shift into NEUTRAL.
3. Loosen jam nut. Unscrew attaching nut to separate shift shaft.



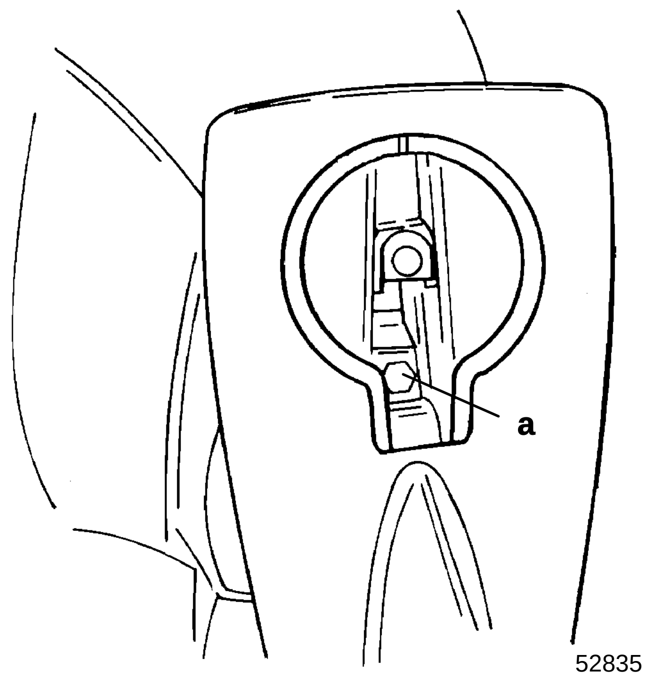
a - Jam Nut
b - Attaching Nut

4. Make a scribe line showing alignment of trim tab to gear case and remove trim tab bolt and washer.



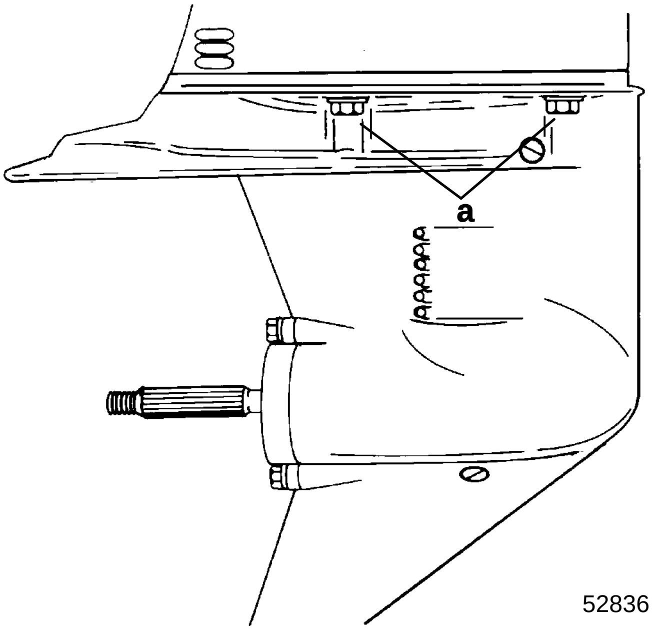
a - Bolt and Washer
b - Scribe Line

5. Remove nut and washer in trim tab cavity.



a - Nut and Washer

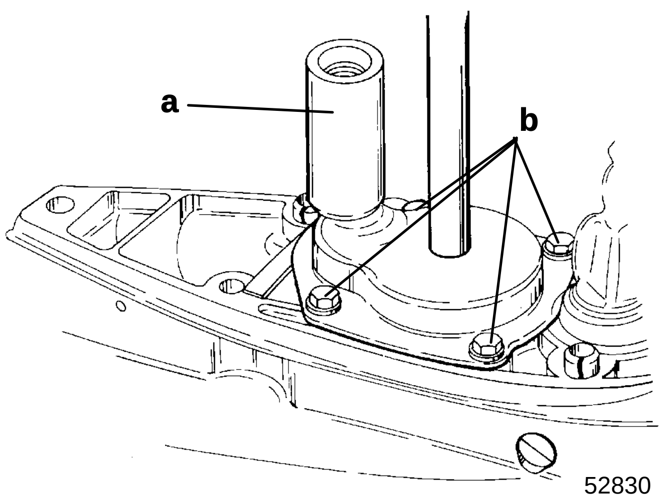
6. Remove 4 bolts securing gear case to drive shaft housing.



a - Bolt (4)

NOTE: *If water tube seal remained in drive shaft housing, remove seal from housing and reinstall on water pump cover. Secure seal to cover with Loctite 405.*

7. Remove 4 bolts securing pump cover.

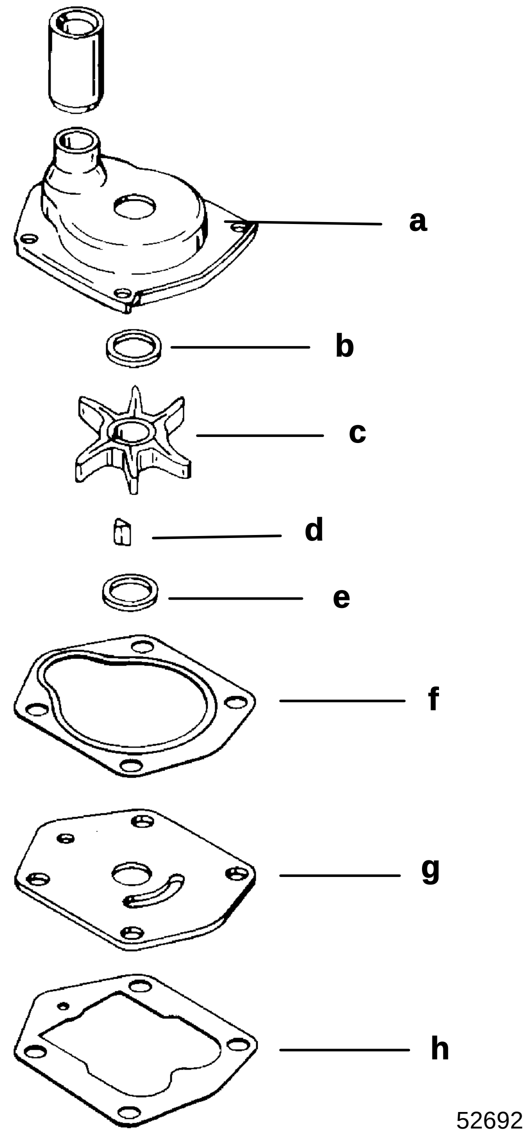


a - Seal
b - Bolt (4)

NOTE: *Replace cover if thickness of steel at discharge slots is 0.060 in. (1.524mm) or less, or if groove(s)(other than impeller sealing groove) in cover roof are more than 0.030 in. (0.762mm) deep.*

8. Remove cover, washer (above impeller), impeller, key and washer (below impeller).

9. Remove cover gasket, base plate and base gasket.

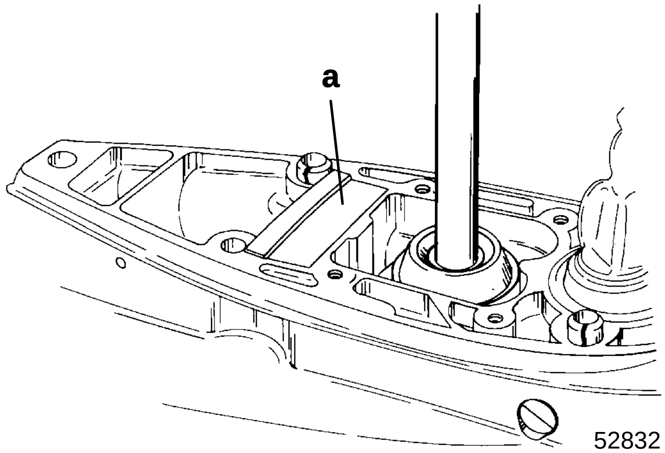


a - Cover
b - Washer (above impeller)
c - Impeller
d - Key
e - Washer (below impeller)
f - Cover Gasket
g - Base Plate
h - Base Gasket

NOTE: *Replace impeller if:*

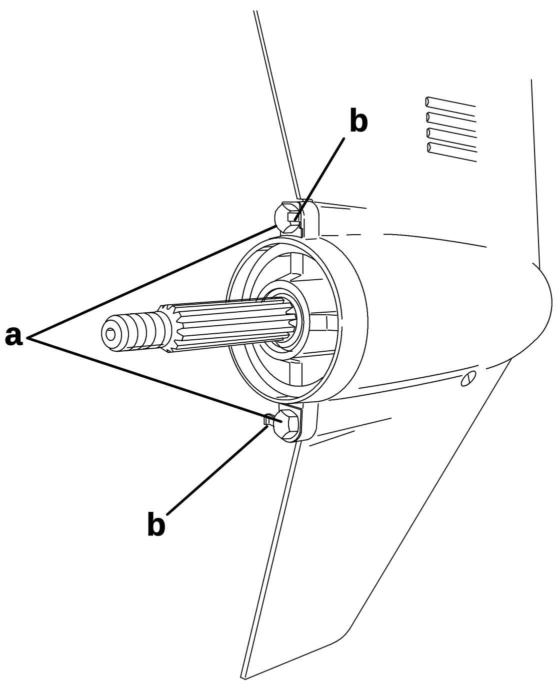
- *Impeller blades are cracked, torn or worn.*
- *Impeller is glazed or melted (caused by in sufficient water supply.)*
- *Rubber portion of impeller is not bonded to impeller hub.*

10. Remove and/or replace exhaust deflector plate if damaged.



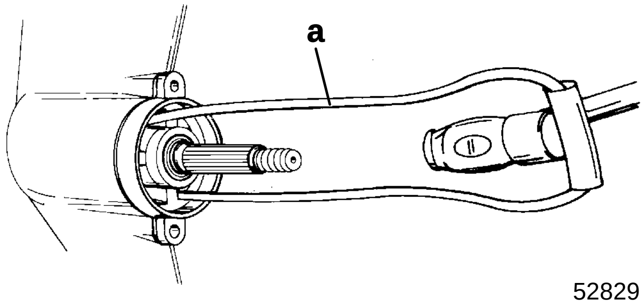
a - Exhaust Deflector Plate

11. Remove bearing carrier attaching bolts and locking tab washers. Discard tab washers.



a - Bolts and Tab Washers
b - Tab Washers

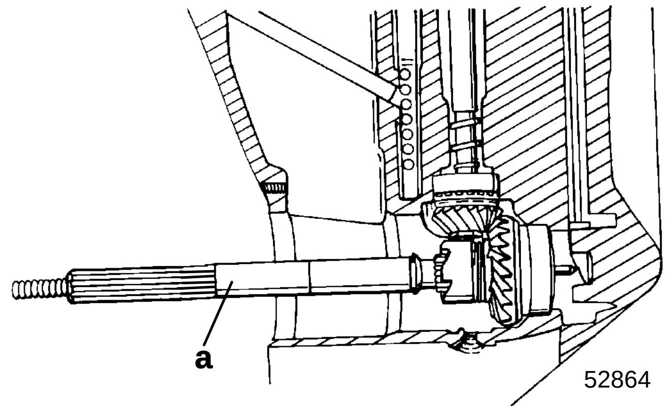
12. Using Puller (91-27780), remove carrier assembly from gear case.



a - Puller (91-27780)

NOTE: *When removing propeller shaft assembly, cam follower may dislodge. Retrieve follower from gear housing*

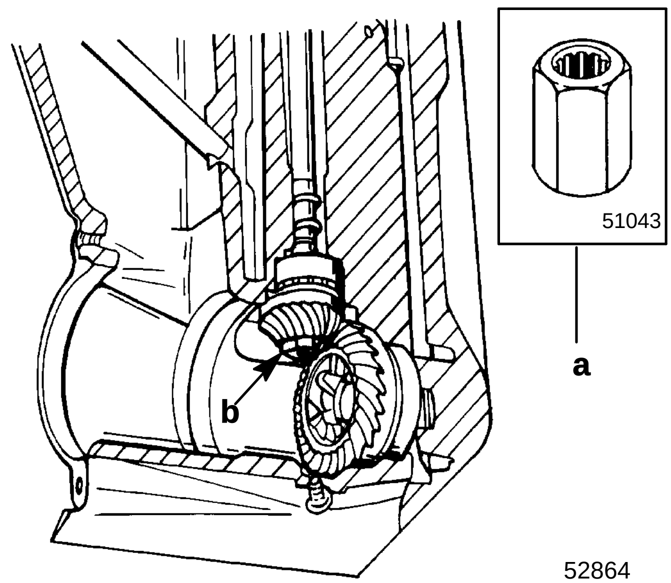
13. Remove propeller shaft assembly.



a - Propeller Shaft

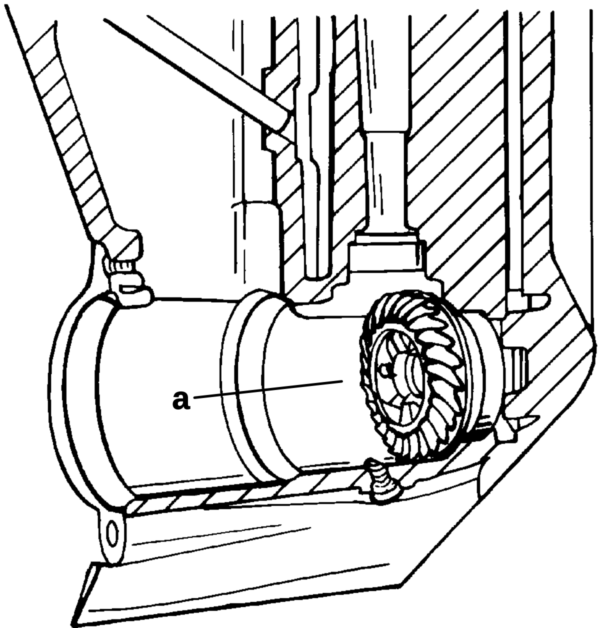
14. Remove pinion nut and discard.

15. Remove drive shaft assembly and pinion gear.



a - Drive Shaft Holding Tool (91-825196)
b - Pinion Gear

16. Remove FORWARD gear.



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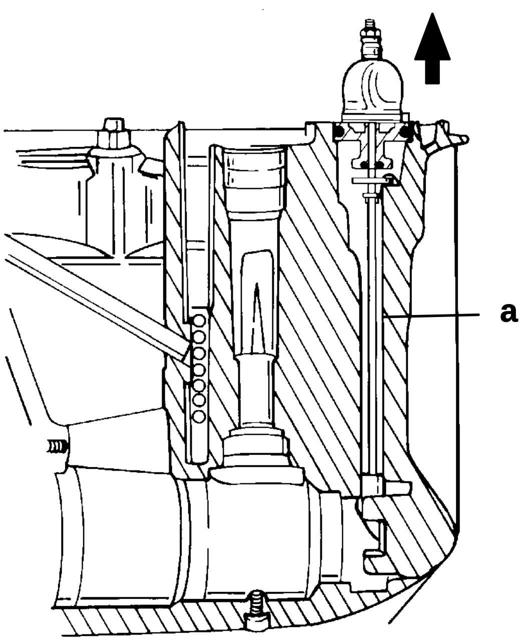
a - Forward Gear

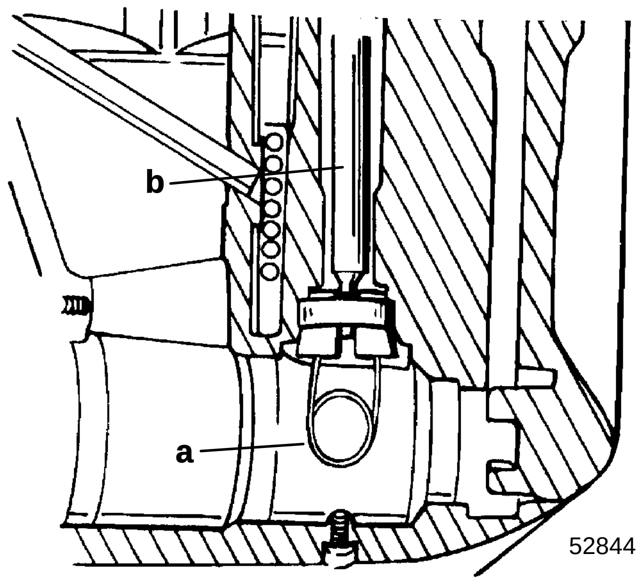
17. Remove shift shaft assembly



52841

a - Shift Shaft Assembly

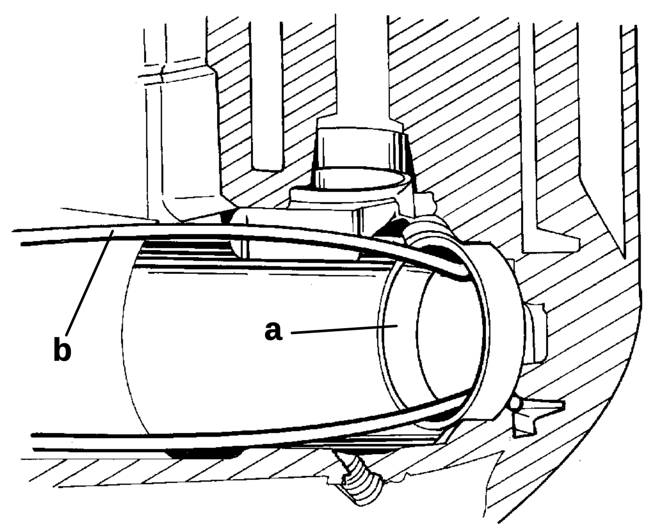
18. Insert pinion bearing race PULLER (91-825200A1) through gear case and position inside of pinion bearing race. Insert DRIVER (91-13779) into puller through drive shaft cavity and drive out race.



52844

a - Puller (91-825200A1)
b - Driver (91-13779)

19. Remove FORWARD bearing race with PULLER (91-27780).



53838

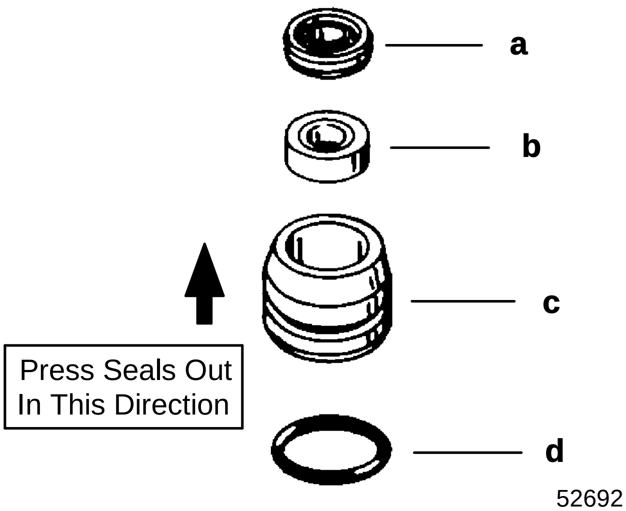
a - Race
b - Puller (91-27780)

Water Pump Seals

NOTE: *All gaskets, seals and o-rings should be replaced as a normal repair procedure during gear case disassembly.*

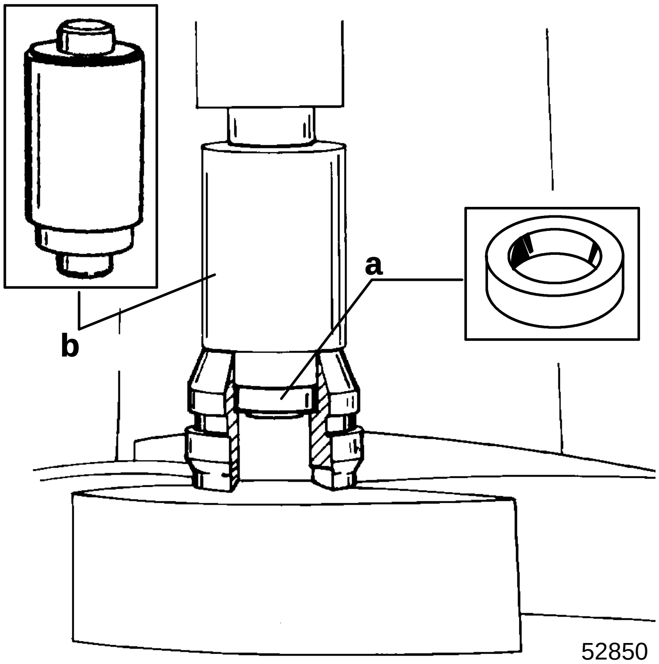
NOTE: *DO NOT use a screwdriver to remove seals from carrier as carrier may be damaged.*

1. Using a suitable mandrel, press both seals from carrier.



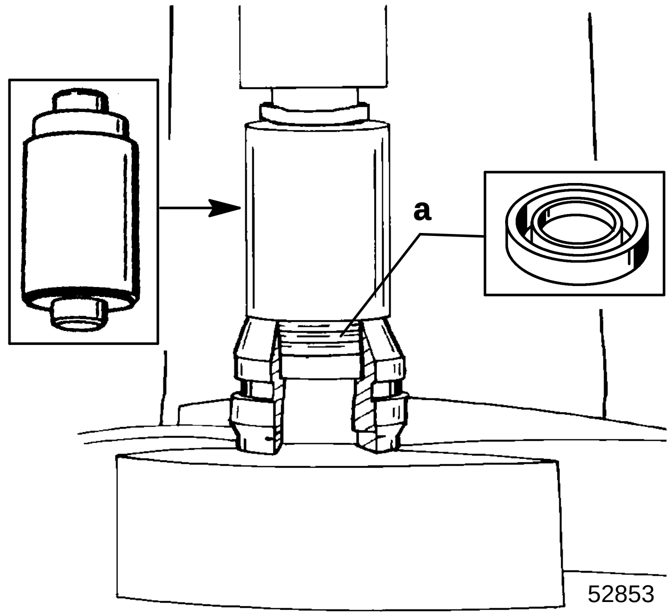
a - Neoprene Ribbed Seal
b - Metal Cased Seal
c - Carrier
d - O-ring

2. Apply Loctite 271 to the O.D. of the metal cased seal. With seal lip facing away from the large shoulder of MANDREL (91-825197), press seal into carrier until mandrel bottoms on carrier.



a - Seal (Metal Cased)
b - Mandrel (91-825197)

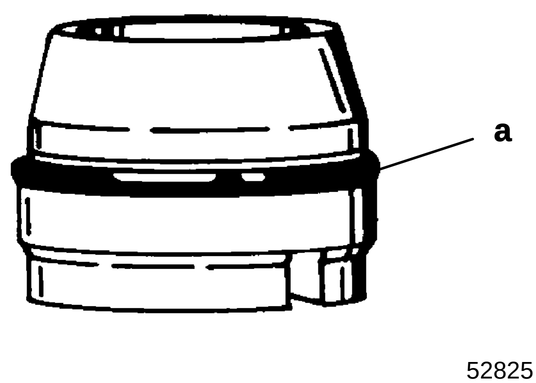
3. With lip of ribbed neoprene O.D. seal facing towards small shoulder of Mandrel (91-825197), press seal into carrier until mandrel bottoms on carrier.



a - Seal (Ribbed Neoprene)

NOTE: *Apply a light coat of 2-4-C w/Teflon (92-825407A12) to the lips of both seals after installation in carrier.*

4. Apply a light coat of 2-4-C w/Teflon to the new o-ring and install on carrier.

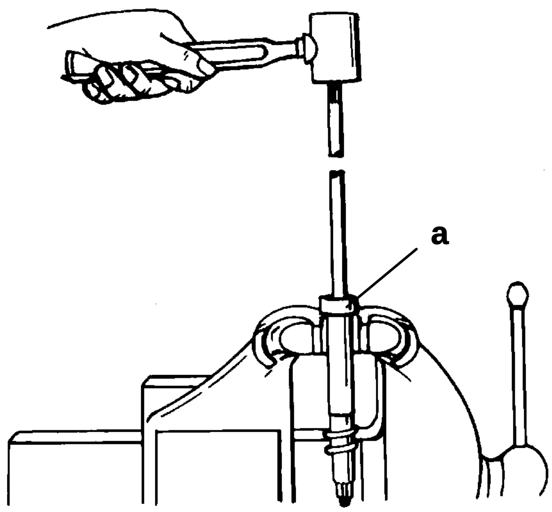


a - O-ring

Inspection

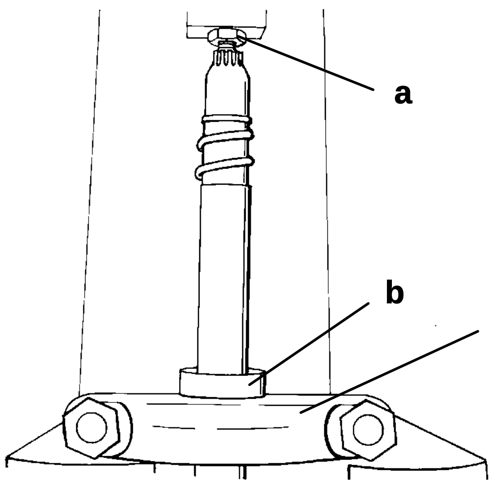
Upper Drive Shaft Bearing

1. Inspect bearing for rust, roughness or discoloration from lack of lubricant.
2. DO NOT remove bearing from drive shaft unless bearing must be replaced as removal process will damage bearing.
3. If bearing must be replaced, position drive shaft assembly in vise (jaws of vise supporting only bearing) and while holding drive shaft, strike top of drive shaft with lead hammer and drive bearing off.



a - Bearing

4. To install new bearing, thread old pinion nut 3/4 way onto drive shaft. Position Universal Puller Plate (91-37241) under bearing and press on pinion nut while holding drive shaft until bearing seats against shoulder.



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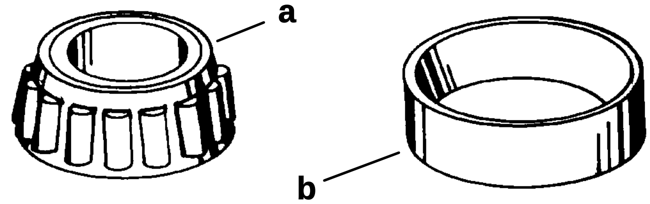
a - Old Pinion Nut (Nut Should be Above Drive Shaft)
b - Bearing
c - Universal Puller Plate (91-37241)

Pinion Gear Bearing

1. Inspect bearing for rust, roughness or discoloration from lack of lubricant.
2. If bearing is damaged, bearing and race must be replaced as an assembly.
3. If race appears to have spun in drive shaft bore, gear case housing must be replaced.

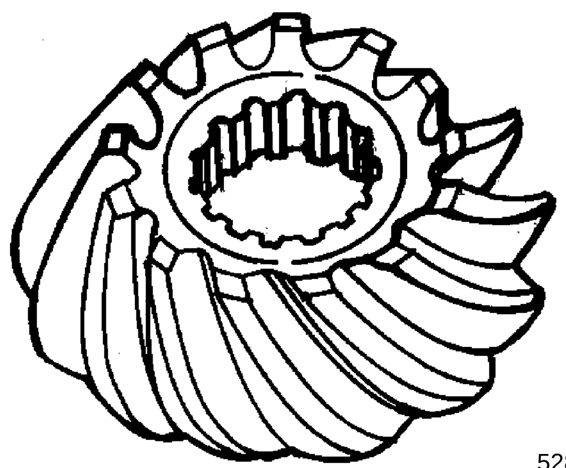


52823

a - Bearing
b - Race

Pinion Gear

1. Inspect pinion gear teeth for rust, chipping, excessive wear (teeth are sharp edged) or broken.
2. If pinion gear teeth are damaged, also inspect forward and reverse gear teeth for damage.
3. Replace gears as required.

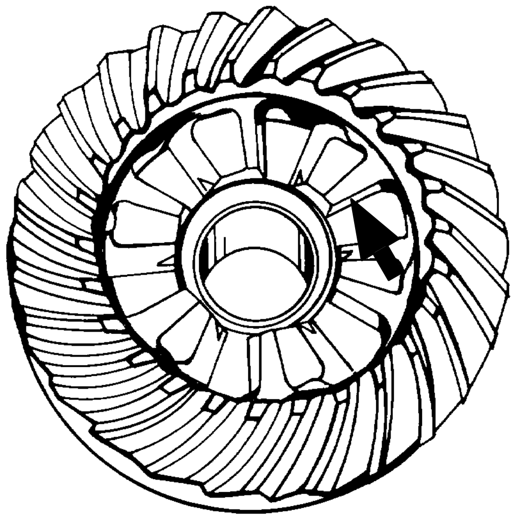


52839

Forward Gear

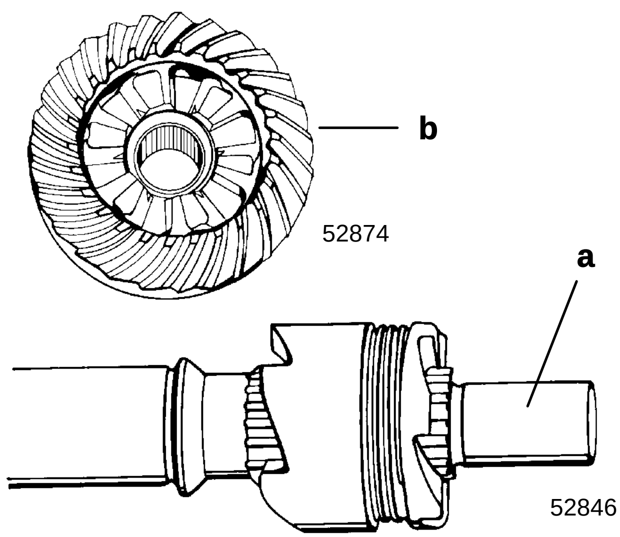
1. Inspect forward gear teeth for rust, chipping, excessive wear (teeth are sharped edged), or broken teeth.
2. Inspect forward gear clutch jaws for wear. Rounded jaws indicate the following:
   a. Improper shift cable adjustment.
   b. Engine idle speed too high.

c. Shifting too slowly.



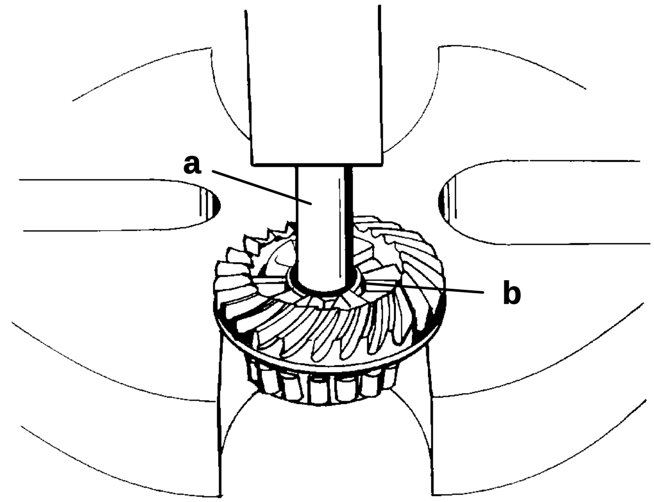
52874

3. Inspect propeller shaft forward gear bearing surface to determine condition of forward gear needle bearing. If bearing surface is discolored (from lack of lubricant), pitted or worn, propeller shaft and bearing should be replaced.



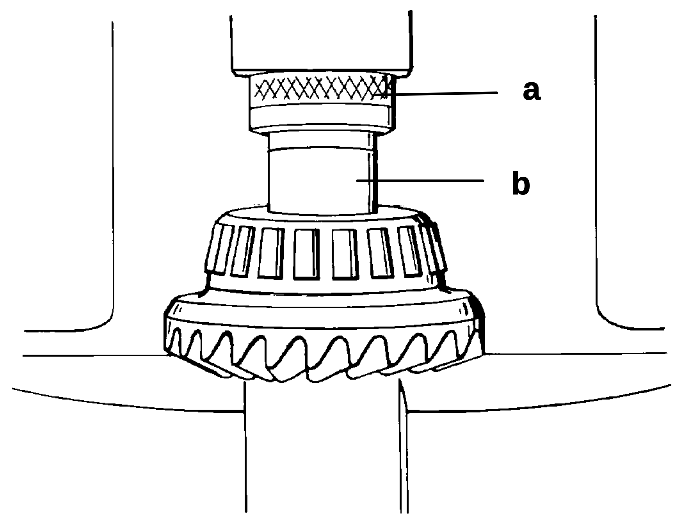
a - Bearing Surface
b - Bearing

4. Use a suitable mandrel to press needle bearing out of forward gear.



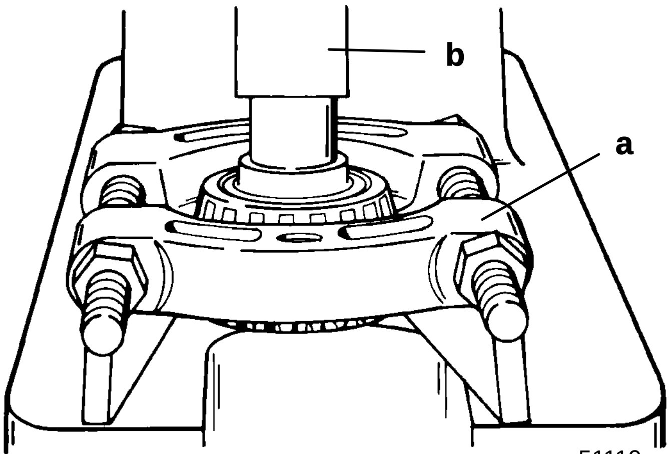
a. - Mandrel (14mm socket)
b - Bearing

5. Use Driver 91-826872 to press new needle bearing into forward gear. Press on NUMBERED side of bearing.



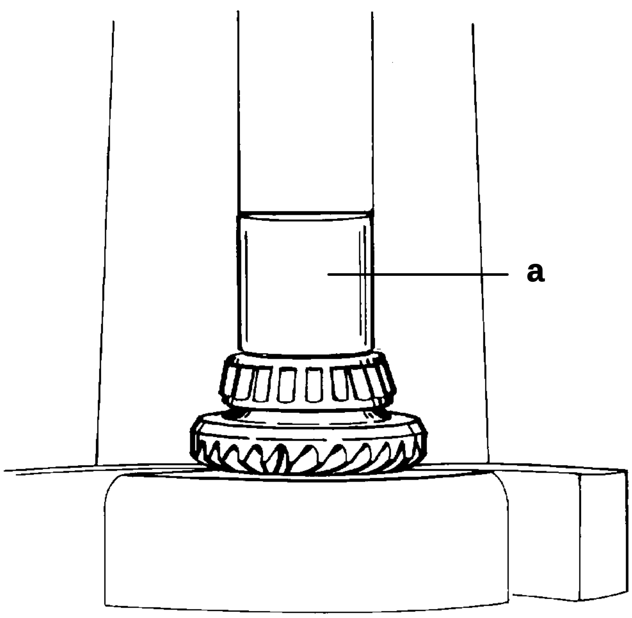
a - Driver (P/N 91-826872)
b - Bearing

6. Inspect forward gear tapered bearing and race for rust, roughness or excessive wear (looseness).
7. If bearing is in serviceable condition, DO NOT remove bearing from gear as removal process will damage bearing.
8. If bearing must be replaced, remove bearing from gear using Universal Puller Plate (91-37241) and suitable mandrel.
9. Replace bearing and race as a set. Use suitable mandrel to press bearing onto gear. PRESS ONLY ON INNER RACE when installing bearing.



REMOVAL

a - Universal Puller Plate (91-37241)
b - Mandrel (15/16 in. socket)

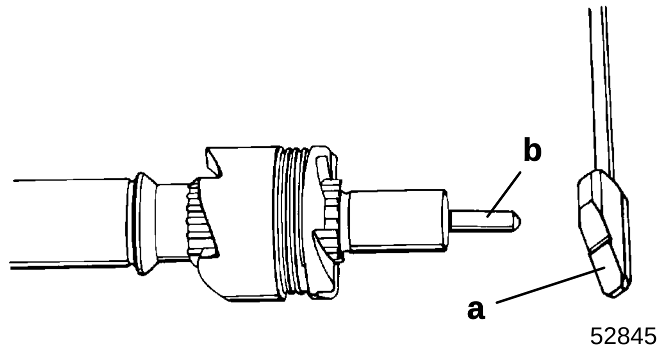


INSTALLATION

a - Mandrel (1-1/8 in. socket)

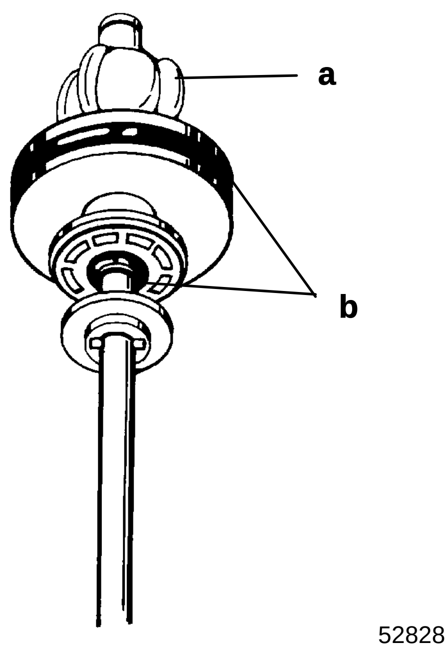
Shift Shaft

1. Inspect shift cam for wear or galling. Replace cam if necessary.
2. If cam is worn, inspect cam follower in end of propeller shaft for wear.



a - Cam Follower
b - Shift Cam

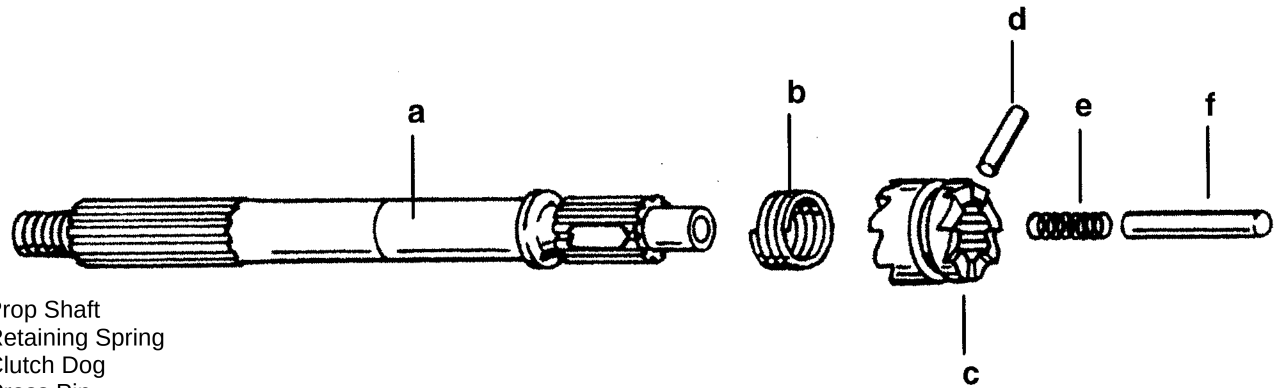
3. Inspect shift shaft boot for deterioration.
4. Inspect shift shaft carrier o-ring for cuts or abrasions. It is a good service procedure to replace all o-rings, seals and gaskets regardless of appearance.



a - Boot
b - O-ring

Propeller Shaft Disassembly

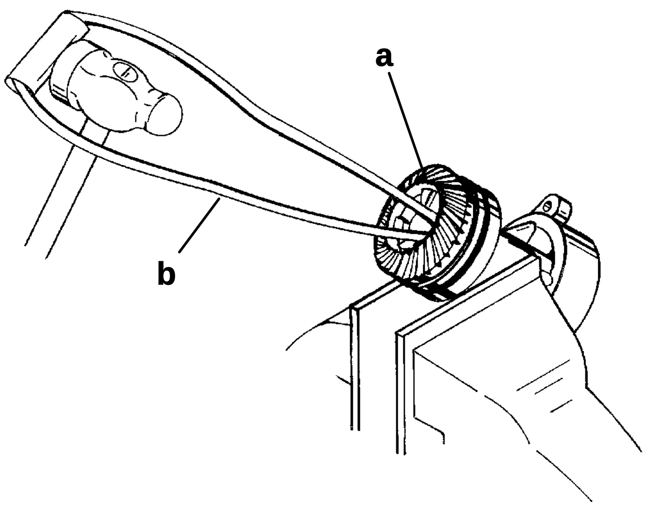
1. Remove propeller shaft from carrier and disassemble shaft.



52877

a - Prop Shaft
b - Retaining Spring
c - Clutch Dog
d - Cross Pin
e - Cam Follower Spring
f - Cam Follower

2. Remove reverse gear and bearing from carrier with Puller 91-27780.



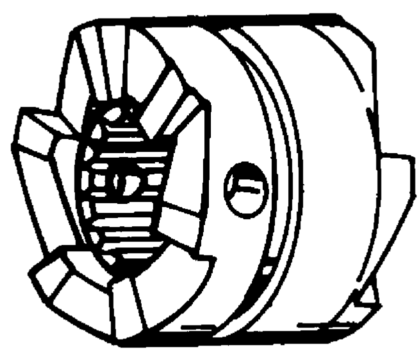
52840

a - Reverse Gear and Bearing
b - Puller (91-27780)

Propeller Shaft and Carrier Inspection

Clutch Dog

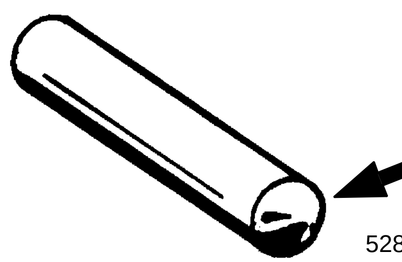
1. Inspect clutch jaws for chips or rounding off.
2. If wear is present, inspect corresponding forward or reverse gear matching jaws for similar wear. Replace appropriate components as required.



52824

Cam Follower

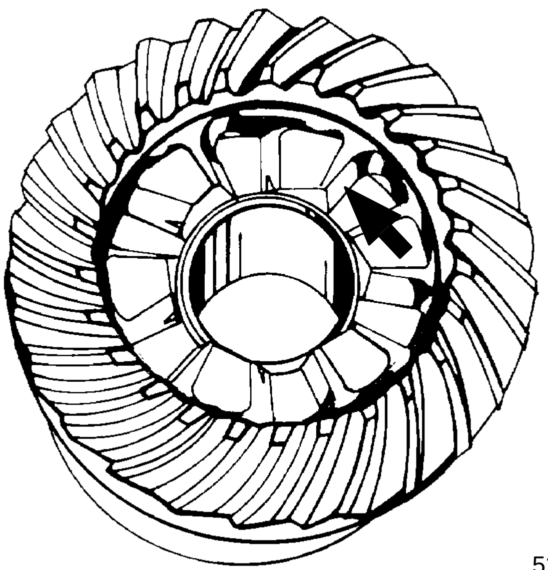
1. Inspect cam follower for wear or galling.
2. If wear is present, inspect corresponding shift cam for wear. Replace if worn.



52822

Reverse Gear

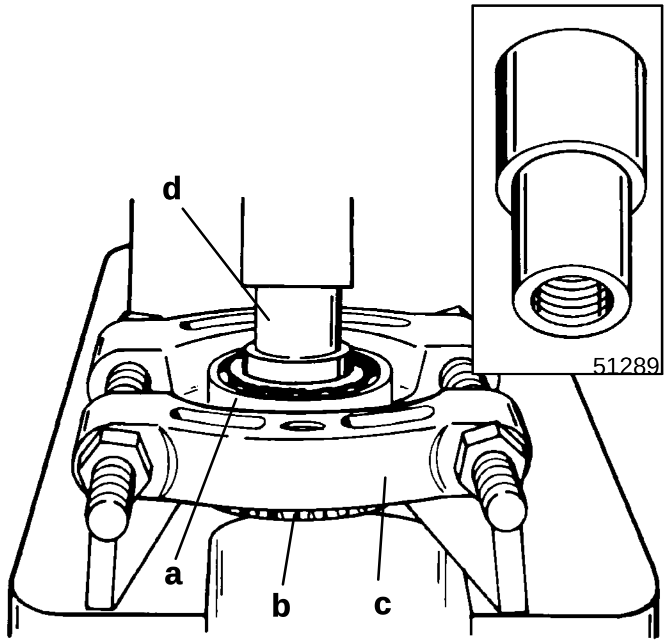
1. Inspect reverse gear teeth for rust, chipping excessive wear (teeth are sharped edged) or broken teeth.
2. Inspect reverse gear clutch jaws for wear. Rounded jaws indicate the following:
   a. Improper shift cable adjustment.
   b. Engine idle speed too high.
   c. Shifting too slowly.



52875

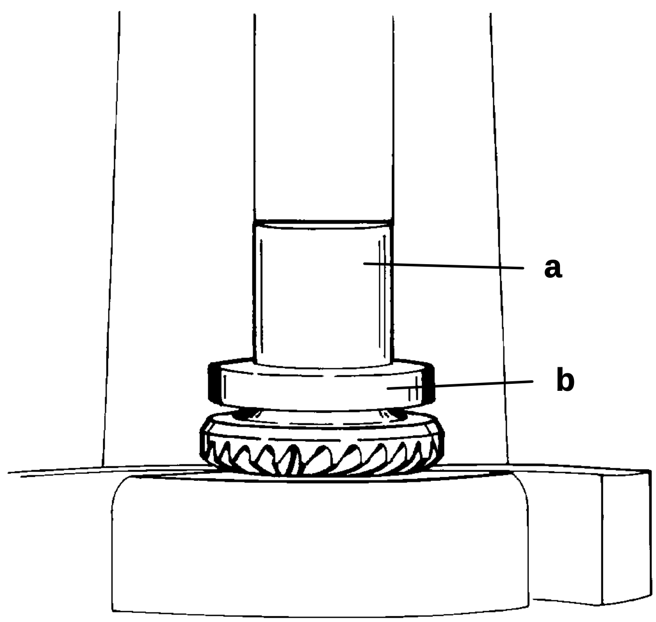
Reverse Gear Bearing

1. Inspect bearing for rust, roughness or excessive wear (looseness).
2. If bearing is in serviceable condition, DO NOT remove bearing from gear as removal will damage bearing.
3. If bearing must be replaced, remove bearing from gear using Universal Puller Plate (91-37241) and Driver (91-37312).
4. Install new bearing using a suitable mandrel. PRESS ONLY ON INNER RACE when installing bearing.



REMOVAL 51269

a - Bearing
b - Reverse Gear
c - Universal Puller Plate (91-37241)
d - Driver (91-37312)



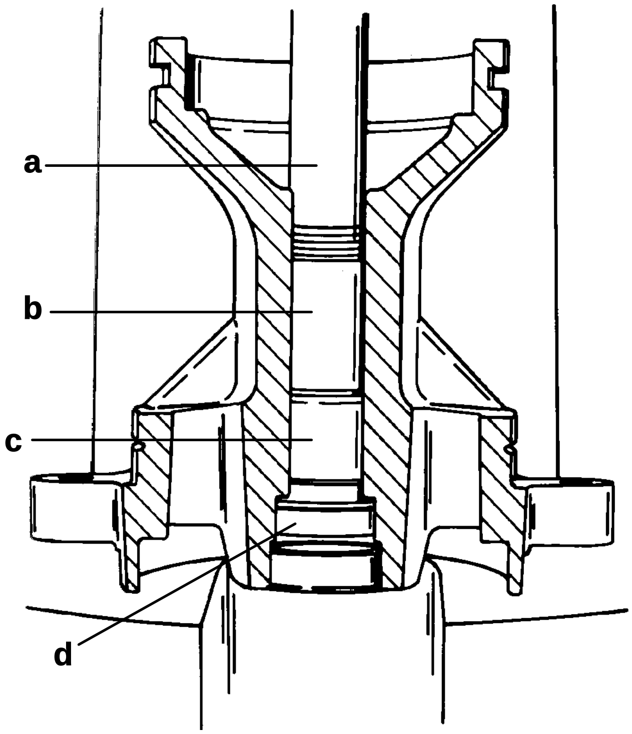
INSTALLATION 52867

a - Mandrel (1-1/4 in. socket)
b - Bearing

Bearing Carrier

NEEDLE BEARING

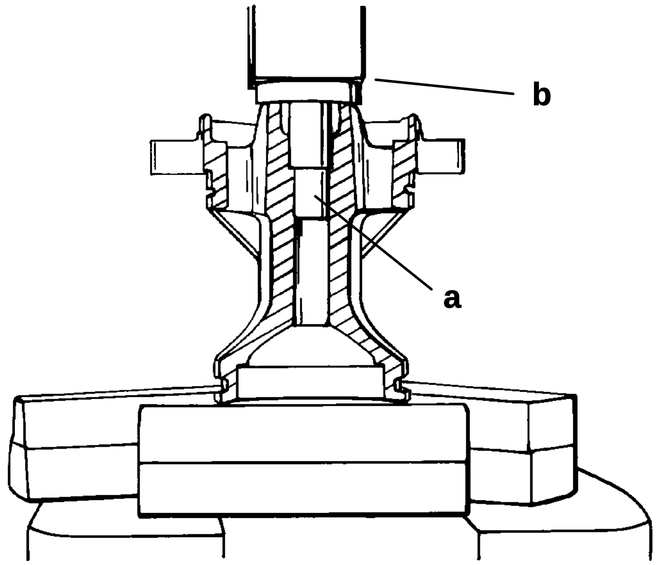
1. The condition of the carrier needle bearing can be determined by inspecting its running surface on the propeller shaft.
2. If the shaft is discolored (from lack of oil) or pitted, replace bearing and shaft.
3. Bearing can be removed by using Driver Rod (91-37323) and Driver (91-37312). Removing bearing will also remove both propeller shaft seals.



51264

a - Driver Rod (91-37323)
b - Driver (91-37312)
c - Needle Bearing
d - Seals

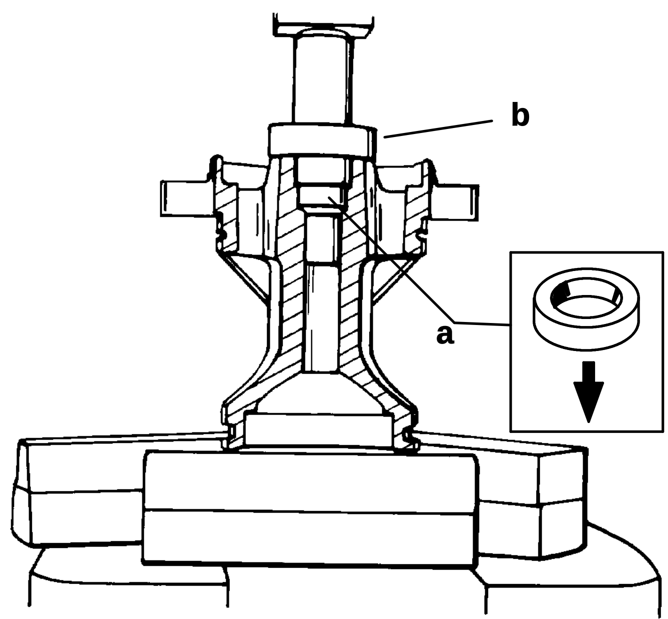
4. Apply a light coat of Special Lubricant 101 (92-13872A1) to O.D. of bearing.
5. Install bearing using Mandrel 91-817011.
6. Press bearing into carrier until mandrel bottoms on carrier.



52861

a - Bearing
b - Mandrel (91-817011)

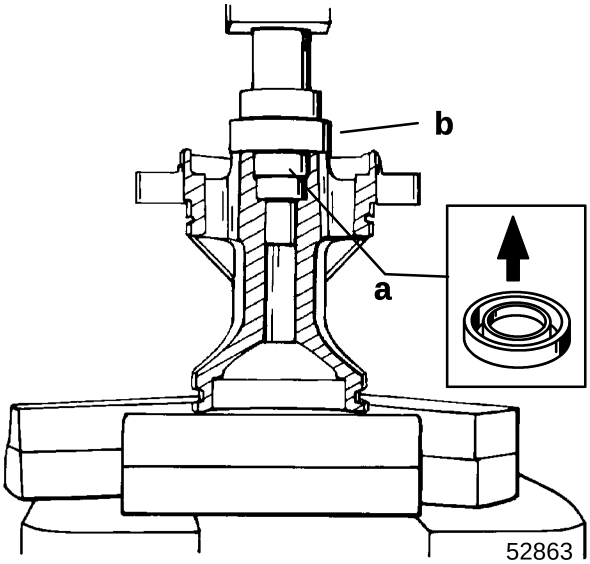
7. Apply Loctite 271 (92-823089--1) to O.D. of small diameter seal.
8. With seal lip FACING AWAY FROM LARGE SHOULDER of Mandrel 91-817007, press seal into carrier until mandrel bottoms on carrier.



52862

a - Seal
b - Mandrel (91-817007)

9. Apply Loctite 271 to O.D. of large diameter seal.
10. With seal lip FACING TOWARDS SMALL SHOULDER of Mandrel 91-817007, press seal into carrier until mandrel bottoms on carrier.

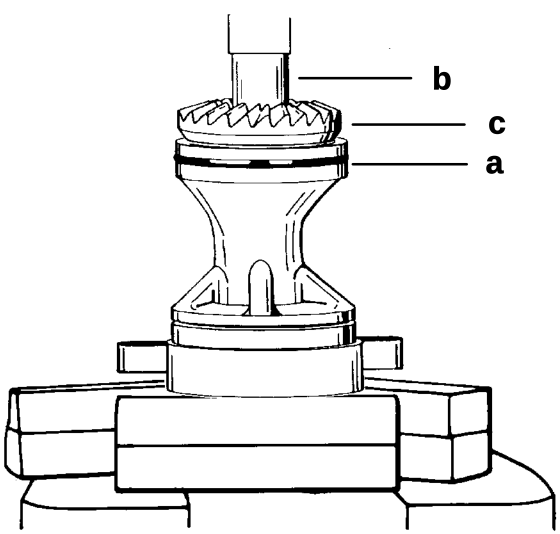


a - Seal
b - Mandrel (91-817007)

11. Bearing carrier o-ring should be inspected for cuts and abrasions.

NOTE: *It is a good repair procedure to replace all o-rings and seals regardless of appearance.*

12. Apply 2-4-C w/Teflon to o-ring and install on carrier.
13. Using suitable mandrel, press reverse gear assembly into carrier.



a - O-ring
b - Mandrel (3/4 in. Socket)
c - Reverse Gear Assembly

Gear Housing Reassembly

IMPORTANT: The 30/40 gear case assembly does not have have any shims for the gear assemblies. Backlash cannot be adjusted. The mechanic must verify that all bearing races are firmly seated in the gear case during reassembly and that all gear case components are in serviceable condition. Prior to installing the seal carrier and water pump assembly on the drive shaft, the FORWARD gear should be held stationary (with a screw driver or similar tool). While pulling up on the drive shaft, lightly turn the shaft back and forth. A light "clicking" sound should be heard indicating the presence of backlash between FORWARD and PINION gears. If this backlash is not present, the pinion gear race and/or forward gear race are not fully seated. Races should be removed and inspected for debris. Reinstall races and check backlash. If backlash is still not present, replace gear housing.

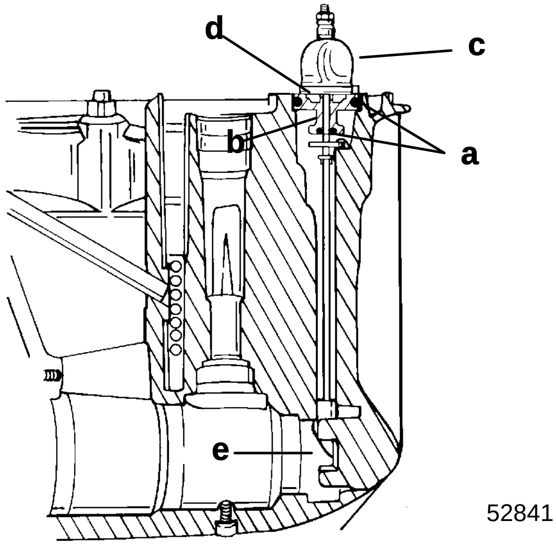
Shift Shaft Assembly

1. Apply 2-4-C w/Teflon (92-825407A12) to new o-rings and install o-rings on shift shaft and carrier.
2. Install carrier on shift shaft.

IMPORTANT: When installing shift shaft assembly into gear housing, DO NOT BOTTOM OUT SHAFT IN HOUSING. Pull up on shift shaft until shift boot is not deformed. If shaft is bottomed out, cross pin in clutch dog will be bent by cam follower when tightening carrier bolts.

3. Install shift shaft/carrier assembly into gear housing.
4. Secure boot to carrier with sta-strap.

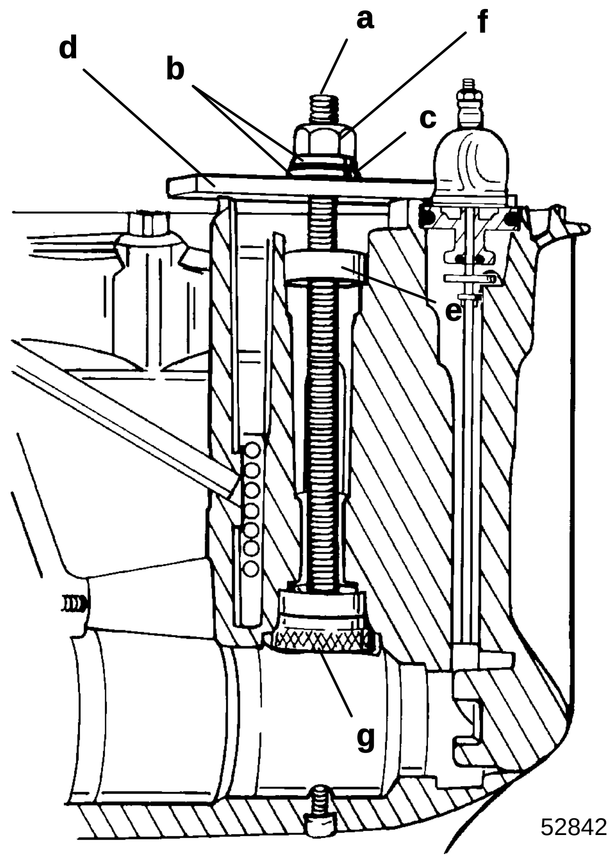
5. Position shift shaft so ramp faces towards propeller shaft.



a - O-rings
b - Carrier
c - Boot
d - Sta-strap
e - Ramp

Pinion Bearing Race

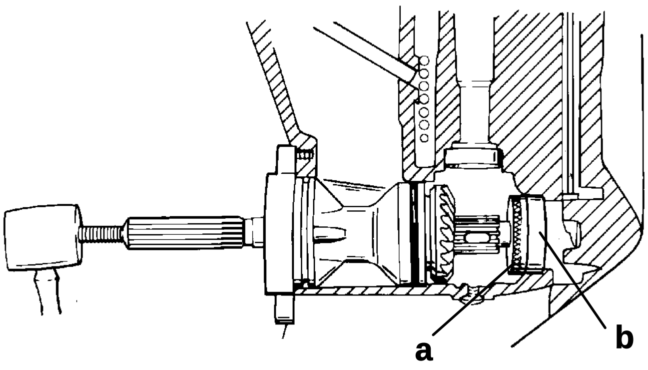
1. Apply Super Duty Gear Lubricant (92-13783A24) to O.D. of race.
2. Position race in gear housing (NUMBERS UP - TAPERED SIDE FACING DOWN).
3. Draw race up into housing until seated.



a - Threaded Rod (91-31229)
b - Washer (2) (12-34961)
c - Bearing (31-85560)
d - Plate (91-29310)
e - Pilot (91-825199)
f - Nut (11-24156)
g - Mandrel (91-825198)

Forward Gear

1. Apply Super Duty Gear Lubricant to O.D. of race. Install forward gear bearing race into housing using Mandrel 91-36571 and propeller shaft. Use a lead hammer on prop shaft to prevent damage to threads. Bearing carrier should be installed to keep prop shaft centered while seating race.

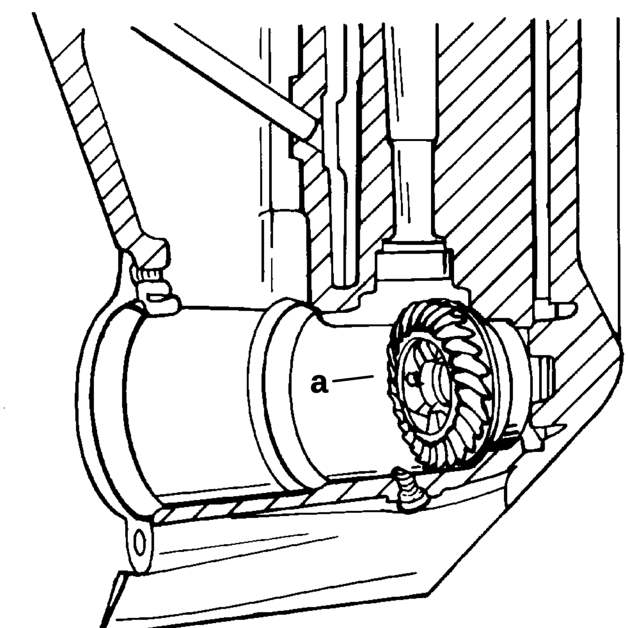


52843

a - Race
b - Mandrel (91-36571)

NOTE: *Remove drain plug/magnet assembly from gear case (if installed) to prevent possible breakage of magnet if struck by forward gear.*

1. Install forward gear and bearing assembly into forward gear race.

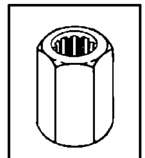


52870

a - Forward Gear Assembly

Pinion Gear/Drive Shaft Assembly

1. Clean pinion nut and pinion nut threads of drive shaft with Loctite Primer T (92-59327-1).
2. Position pinion bearing into race while installing drive shaft and pinion gear into housing.
3. Apply Loctite 271 (92-809819) to pinion nut threads.
4. Install **new** pinion nut, with rounded corners FACING pinion gear, onto drive shaft.
5. Using Drive Shaft Holding Tool (91-825196) to hold drive shaft, torque pinion nut to 50 lb. ft. (67.8 N·m).



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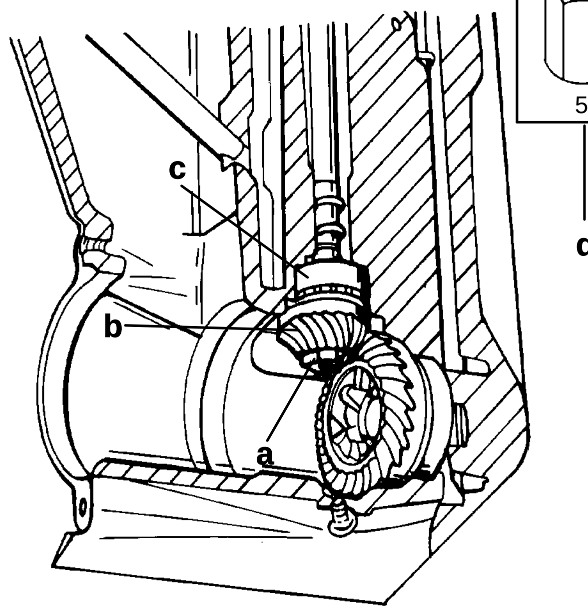
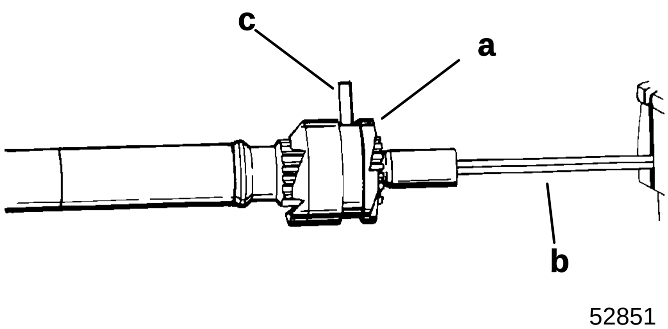


52864

a - Pinion Nut [Torque to 50 lb. ft. (67.8 N·m)]
b - Pinion Gear
c - Pinion Bearing
d - Drive Shaft Holding Tool

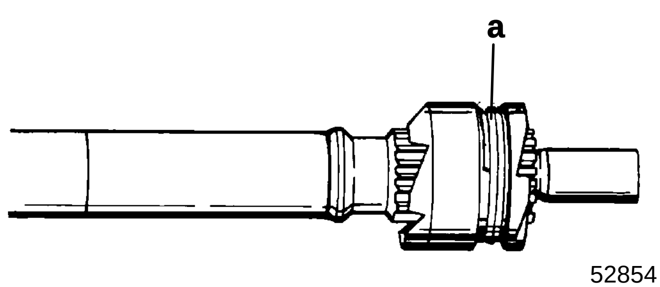
Propeller Shaft

1. Slide clutch (SHORT SHOULDER FACES FORWARD GEAR) over propeller shaft aligning cross pin hole with slot in propeller shaft.
2. Insert cam follower spring into propeller shaft.
3. Using a 3/16 in. Allen wrench or similar device, compress the follower spring enough to insert the cross pin partially through clutch.
4. Remove wrench and press cross pin through clutch and propeller shaft until flush.



a - Short Shoulder
b - Allen Wrench
c - Cross Pin

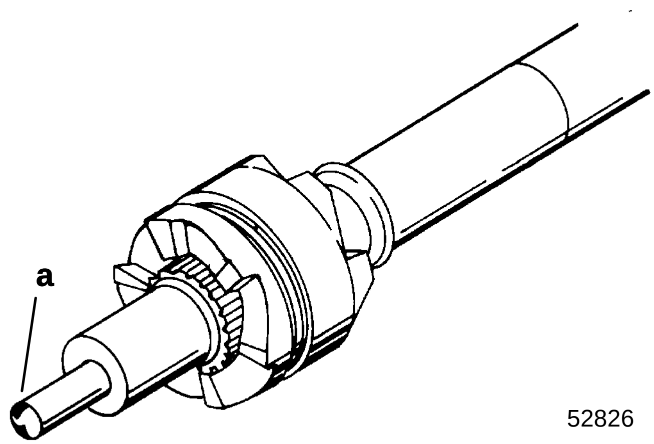
5. Reinstall retaining spring. POSITION SPRING SO AS SPRING COILS LAY FLAT IN CLUTCH GROOVE.



a - Spring

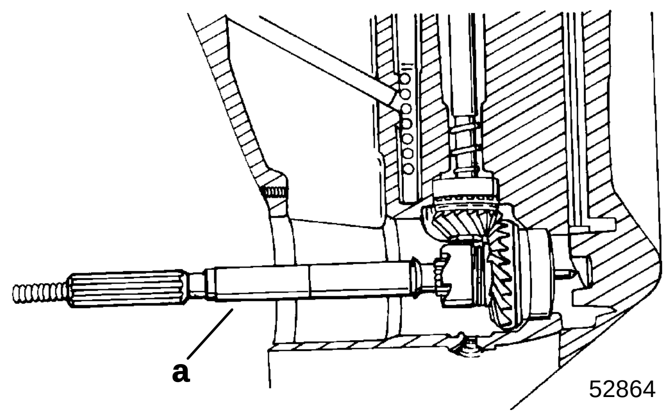
NOTE: *Applying 2-4-C w/Teflon to cam follower will aid in retention of follower in propeller shaft during installation of propeller shaft assembly into gear case.*

6. Install cam follower.



a - Cam Follower

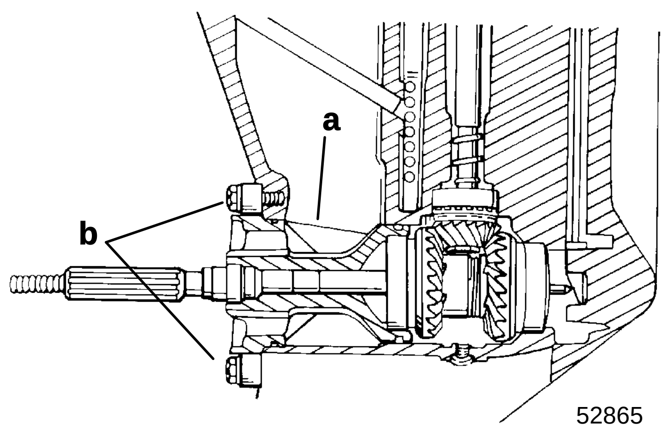
7. Install propeller shaft assembly into gear case.



a - Propeller Shaft Assembly

Bearing Carrier

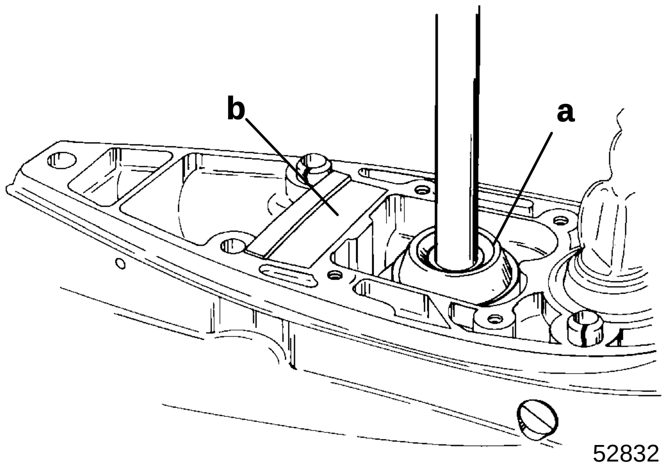
1. Install carrier into gear case.
2. Install new locking tab washers onto retaining bolts and torque bolts to 16.5 lb ft. (22.4 N·m).



a - Carrier
b - Bolts and Tab Washers [Torque to 200 lb. in. (22.6 N·m)]

Water Pump

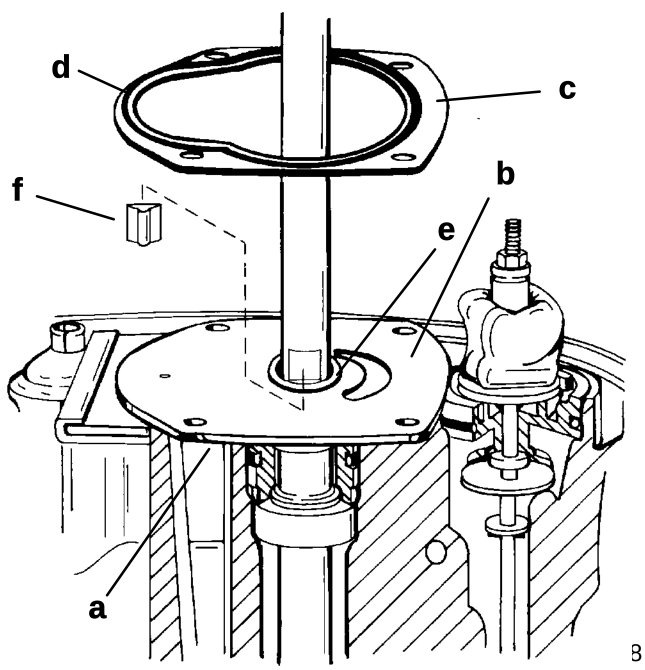
1. Install water pump seal carrier.
2. Install exhaust deflector plate, if removed.



52832

a - Seal Carrier
b - Exhaust Deflector

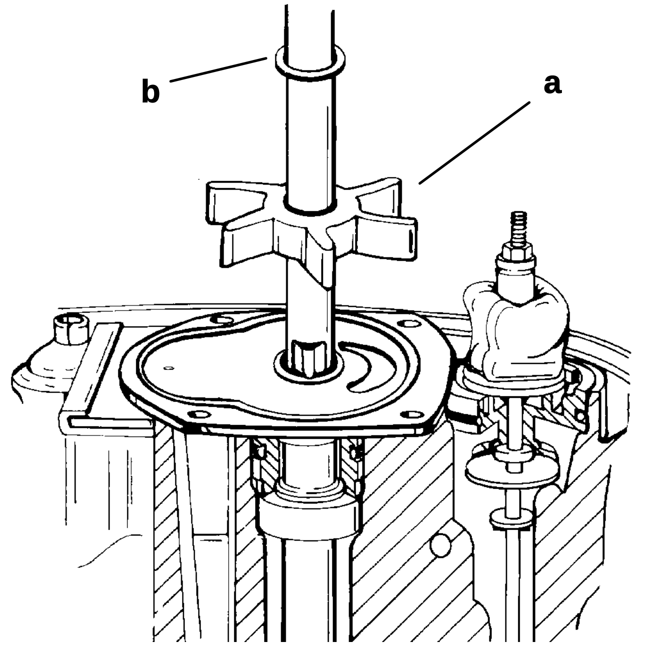
3. Install base gasket, base plate, pump cover gasket (NEOPRENE STRIP FACES UP), nylon washer and impeller key.



a - Base Gasket
b - Base Plate
c - Cover Gasket
d - Neoprene Strip
e - Nylon Washer
f - Key

IMPORTANT: If impeller being installed has been previously used and vanes have taken a "set," DO NOT INSTALL THE IMPELLER WITH THE VANES REVERSED FROM THEIR PREVIOUS "SET" AS VANE BREAKAGE WILL OCCUR SHORTLY AFTER UNIT IS RETURNED TO SERVICE.

4. Install impeller and nylon washer.

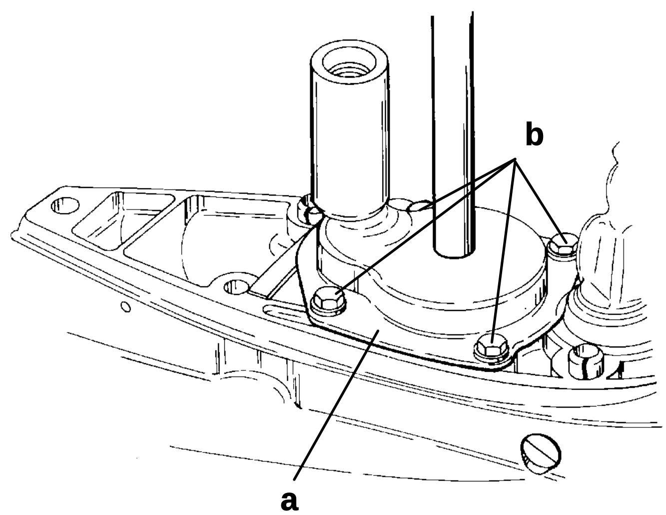


52869

a - Impeller
b - Nylon Washer

NOTE: *Apply a light coat of 2-4-C w/Teflon to inside of pump cover to ease installation of cover over impeller.*

5. Install pump cover. Rotate drive shaft CLOCKWISE while pressing cover down over impeller.
6. Apply Loctite 271 to retaining bolts and torque bolts to 60 lb. in. (6.8 N·m).

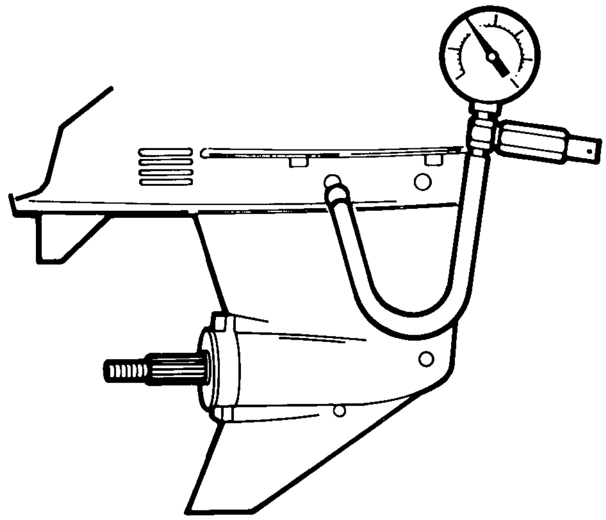


52830

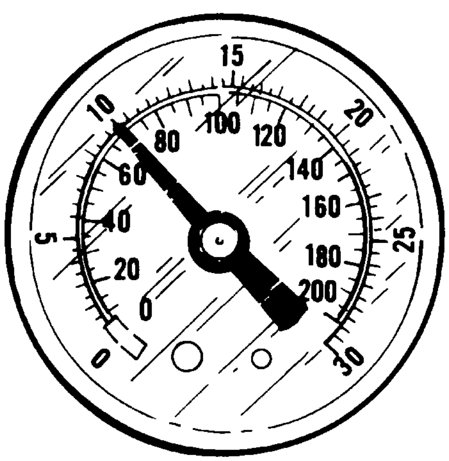
a - Cover
b - Bolts [Torque to 60 lb. in. (6.8 N·m)]

Gear Housing Pressure Test

1. Remove vent plug and install pressure test gauge. Tighten securely.



2. Pressurize housing to 10-15 p.s.i. and observe gauge for 5 minutes.
3. Rotate drive shaft, prop shaft and move shift rod while housing is pressurized to check for leaks.



4. If pressure drop is noted immerse housing in water.
5. Re-pressurize to 10-15 p.s.i. and check for air bubbles.
6. Replace leaking seals as necessary. Retest housing.

NOTE: *It should hold 10-15 p.s.i. for 5 minutes.*

7. Remove tester from housing and install vent plug.

Gear Housing Installation

Filling Gear Housing with Lubricant

NOTE: *Gear housing lubricant capacity is approximately 14.9 fl. oz. (440 ml).*

⚠ WARNING

If gear housing is installed on outboard, disconnect (and isolate) spark plug leads from spark plugs before working near the propeller.

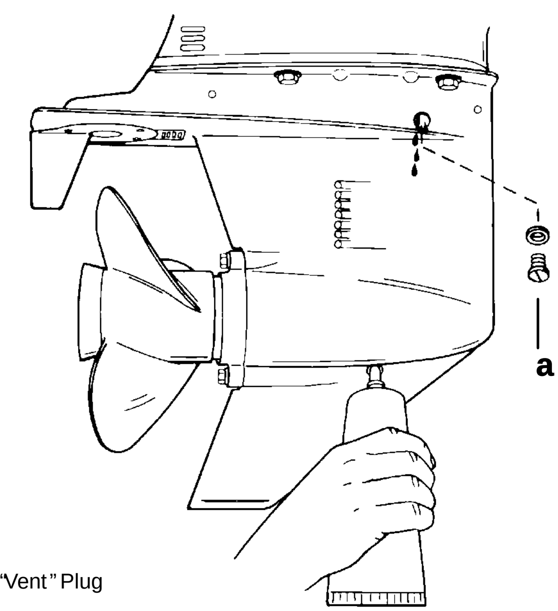
⚠ CAUTION

Do not use automotive grease in the gear housing. Use only Quicksilver Gear Lube.

1. Remove any gasket material from "Fill" and "Vent" plugs and gear housing. Install new gaskets on "Fill" and "Vent" plugs.

IMPORTANT: Never add lubricant without removing "Vent" plug. Gear housing cannot be filled because of trapped air. Fill gear housing when driveshaft is in a vertical position.

2. Remove "Fill" plug and gasket.
3. Insert lubricant tube in "Fill" hole, then remove "Vent" plug and gasket.
4. Fill until excess lubricant flows out of "Vent" hole.
5. Replace this "Vent" plug and gasket.
6. Install "Fill" plug and gasket.



a - "Vent" Plug

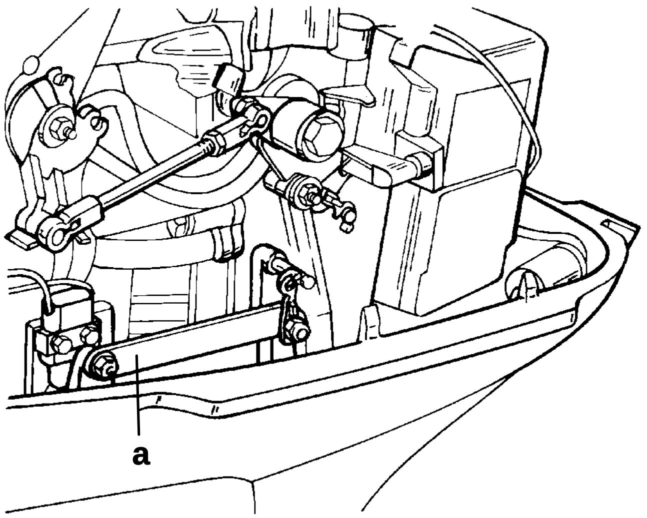
7. Torque "Fill" and "Vent" screws to 55 lb. in. (6.2 N·m).

Installing Gear Housing to Drive Shaft Housing

⚠ WARNING

Disconnect (and isolate) spark plug leads before installing gear housing onto drive shaft housing.

1. Position shift lever in NEUTRAL gear position.



52872

a - Shift Lever

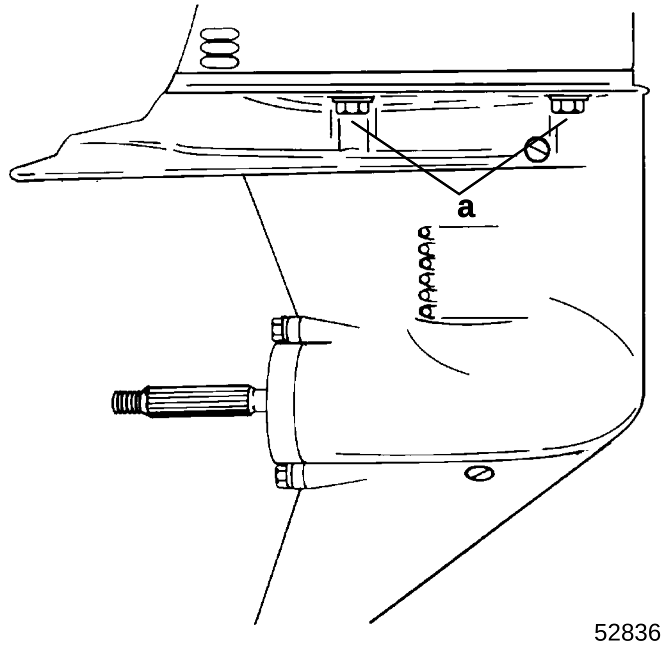
2. Tilt engine to full "Up" position. Engage tilt lock lever.
3. Shift gear housing into NEUTRAL. Propeller shaft will rotate freely in either direction.

IMPORTANT: Liberally apply 2-4-C Marine Lubricant w/Teflon to drive shaft splines.

4. Apply 2-4-C w/Teflon to drive shaft splines.
5. Position drive shaft into drive shaft housing. Move gear housing upwards in drive shaft housing while aligning both shift shafts, water tube seal and drive shaft splines.

NOTE: *If the drive shaft splines will not align with the crankshaft splines, rotate flywheel slightly while pushing gear housing into drive shaft housing.*

6. Install 4 bolts and washers, (two each side). Torque bolts to 40 lb. ft. (54.2 N·m).

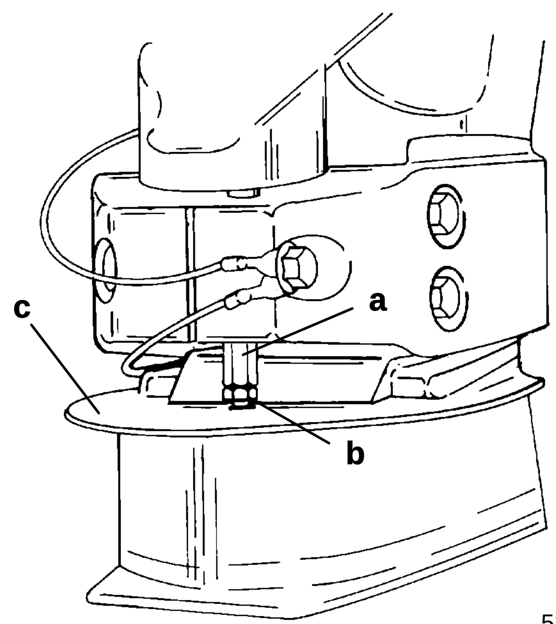


52836

a - Bolt and Washers (2 each side) [Torque Bolt to 40 lb. ft. (54.2 N·m)]

NOTE: *After reconnecting shift shaft, bottom of jam nut should be approximately flush with top of spray plate.*

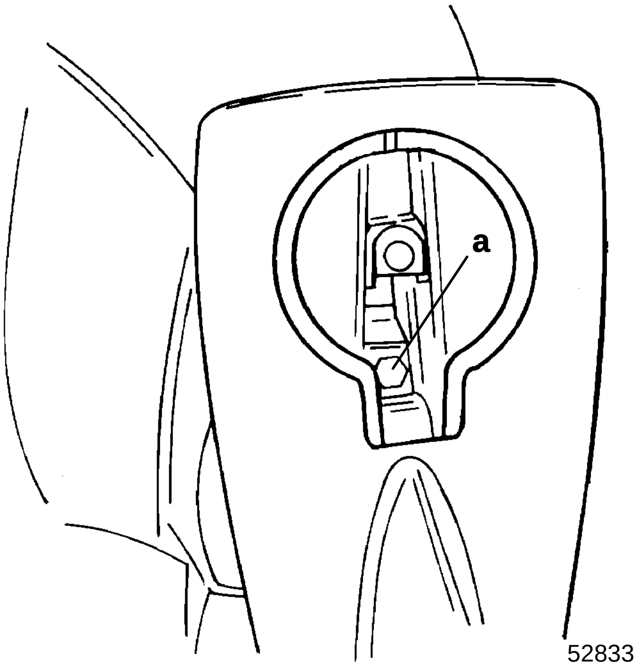
7. Reconnect shift shaft with coupler nut and jam nut. Tighten jam nut against coupler nut.



52834

a - Coupler Nut
b - Jam Nut
c - Spray Plate

8. Install locknut and washer. Torque nut to 40 lb. ft. (54.2 N·m).



a - Locknut and Washer [Torque Nut to 40 lb. ft. (54.2 N·m)]

9. Check shift operation.
   a. In NEUTRAL, propeller shaft should turn freely in either direction.
   b. In FORWARD, propeller shaft SHOULD NOT TURN COUNTERCLOCKWISE.
   c. In REVERSE, propeller shaft SHOULD NOT TURN IN EITHER DIRECTION.

IMPORTANT: If shift operation is not as described, remove the gear housing and correct the shift operation.

Trim Tab Adjustment and Replacement

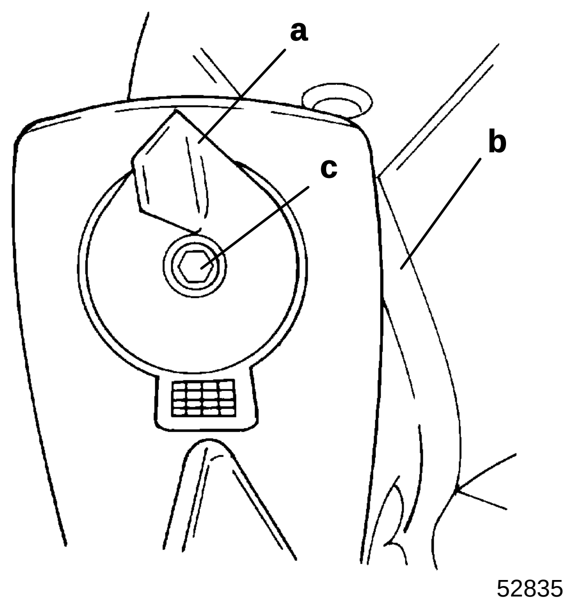
IMPORTANT: The trim tab is made of a special alloy to aid in protecting the drive shaft housing and gear housing from galvanic corrosion (corrosion and pitting of metal surfaces). Do not paint or place protective coating on the trim tab, or trim tab corrosion protection function will be lost.

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.

1. Check trim tab position as follows:
   a. Operate boat at the speed at which it would normally be operated.
   b. If the boat pulls to the right (starboard), the trailing edge of trim tab must be moved to the right. If the boat pulls to the left (port), the trailing edge of trim tab must be moved to the left.
2. If necessary, adjust trim tab as follows:
   a. Shift engine control into NEUTRAL and turn ignition key to "OFF" position.

***NOTE:** Loosen trim tab bolt sufficiently to allow trim tab to disengage from locking ridges in gear case before attempting to move tab. DO NOT strike trim tab with a hard object to make adjustments.*

   b. If boat pulls to the left, adjust trailing edge of trim tab to the left. If boat pulls to the right, adjust trailing edge of trim tab to the right.



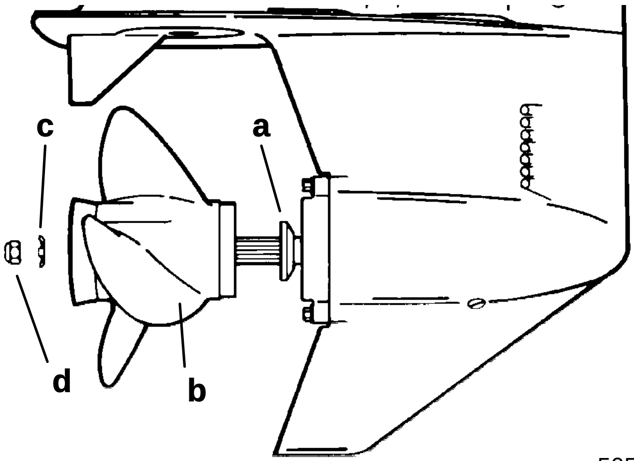
a - Trim Tab
b - Anti-Ventilation Plate
c - Retaining Bolt and Washer; Torque Bolt to 15.8 lb. ft. (21.4 N·m)

Propeller Installation

⚠ WARNING

Disconnect and isolate spark plug leads when working near the propeller to prevent the outboard from starting.

1. Apply one of the following Quicksilver products on propeller shaft splines.
   - Special Lubricant 101 (92-13872A1)
   - 2-4-C Marine Lubricant w/Teflon (92-825407A12)
2. Install components.



50551

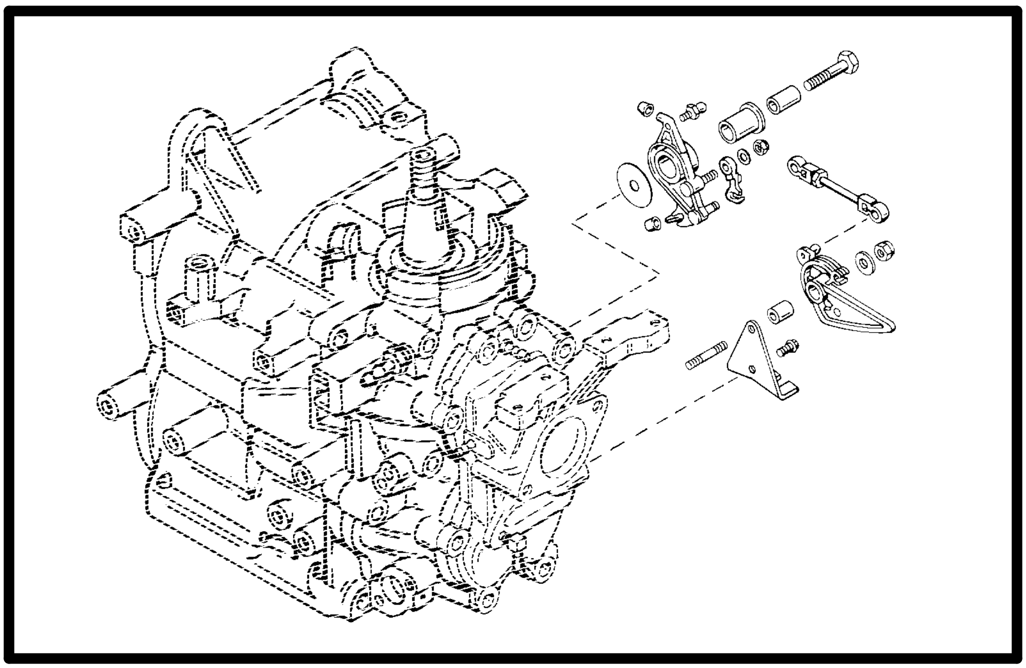
a - Thrust Hub; Flat Surface Towards Propeller
b - Propeller
c - Tab Washer; Bend Tabs Down Against Nut Flats
d - Locknut; Torque to 55 lb. ft. (74.5 N·m)

⚠ CAUTION

Do not misinterpret propeller shaft movement for propeller movement. Propeller and propeller shaft may move fore-and-aft. However, the propeller itself should not move fore-and-aft on the propeller shaft.

3. Re-check propeller nut for tightness after first use. Check for tightness periodically, especially if a stainless propeller is used.

ATTACHMENTS/CONTROL LINKAGE



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A

THROTTLE/SHIFT LINKAGE

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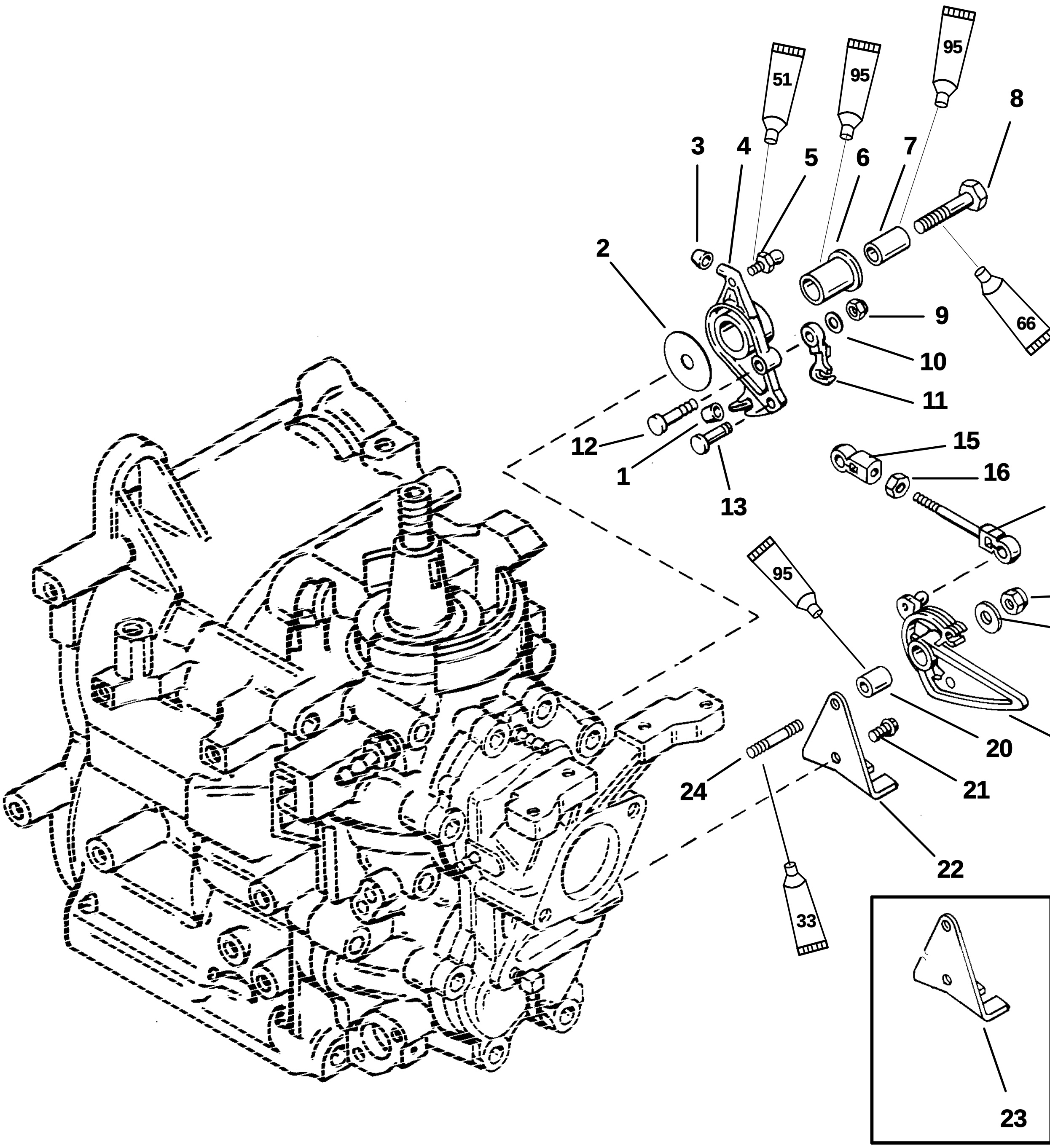
Notes:

Throttle Linkage Components (S/N-0G589999 & Below)

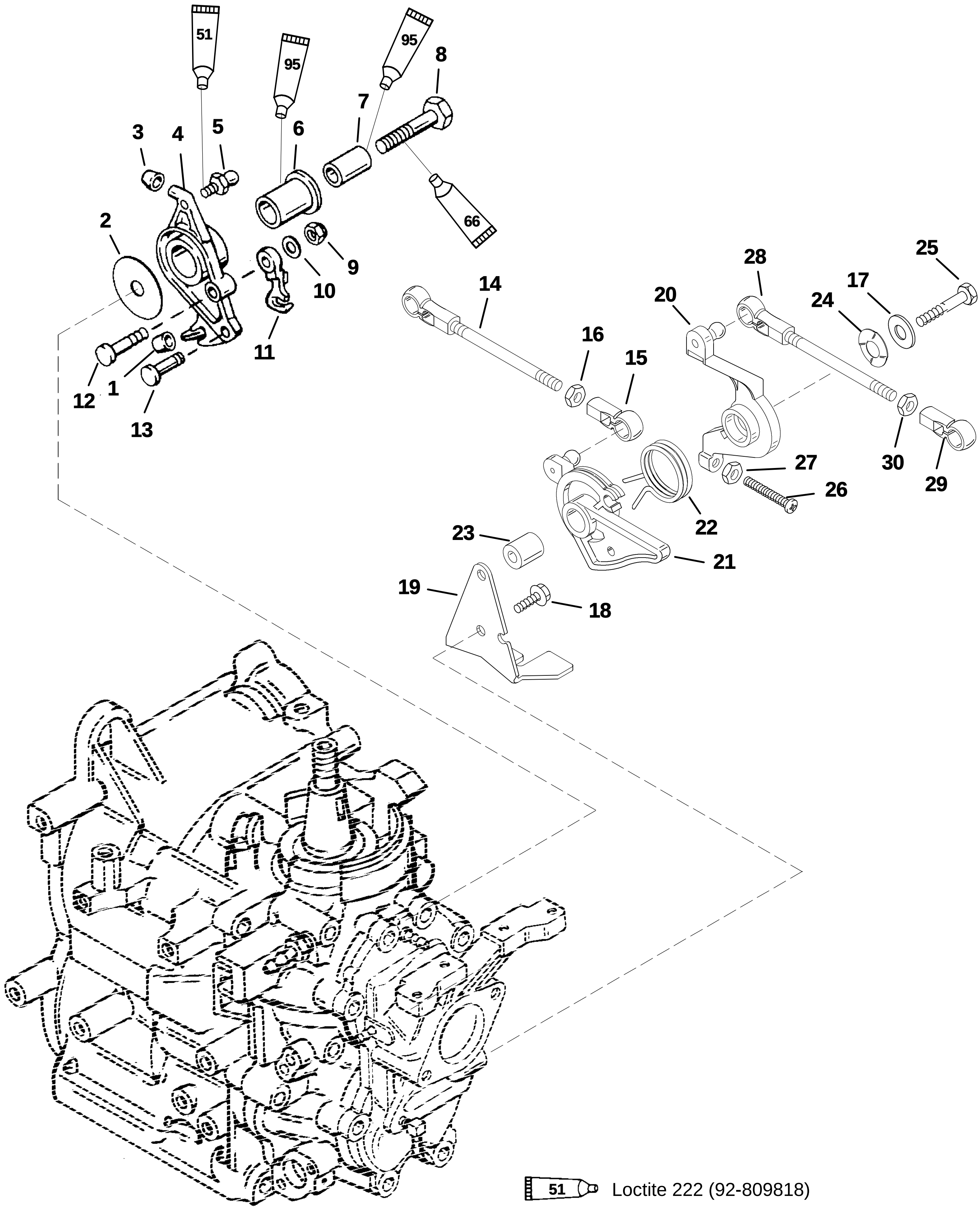


33	Loctite 680 (Obtain Locally)
51	Loctite "222" Small Screw Threadlocker (92-809818)
66	Loctite "242" Removable Threadlocker (92-809821)
95	2-4-C With Teflon (92-825407A12)

Throttle Linkage (S/N-0G589999 & Below)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	BUMPER-Throttle Stop			
2	1	WASHER			
3	1	BUMPER-Throttle Stop			
4	1	LEVER-Throttle Control			
5	1	BALL-Threaded			
6	1	BUSHING KIT			
7	1	INSERT			
8	1	SCREW (M10 x 45)		16.7	22.6
9	1	NUT (M6)	Drive Tight - But Joint Must Move Freely		
10	1	WASHER			
11	1	RETAINER			
12	1	INSERT-Pin			
13	1	PIN			
14	1	LINK-Throttle Control			
15	2	SOCKET-Ball			
16	1	NUT			
17	1	NUT (M6)	100		11.3
18	1	WASHER			
19	1	CAM-Throttle Control			
20	1	BUSHING			
21	1	SCREW (M6 x 16)	100		11.3
22	1	BRACKET-Throttle Cable **(2 HOLES)**			
23	1	BRACKET-Throttle Cable **(3 HOLES)**			
24	1	STUD (M6 x 1 x 44)			

THROTTLE LINKAGE (S/N-0G590000 & Above)



51 Loctite 222 (92-809818)

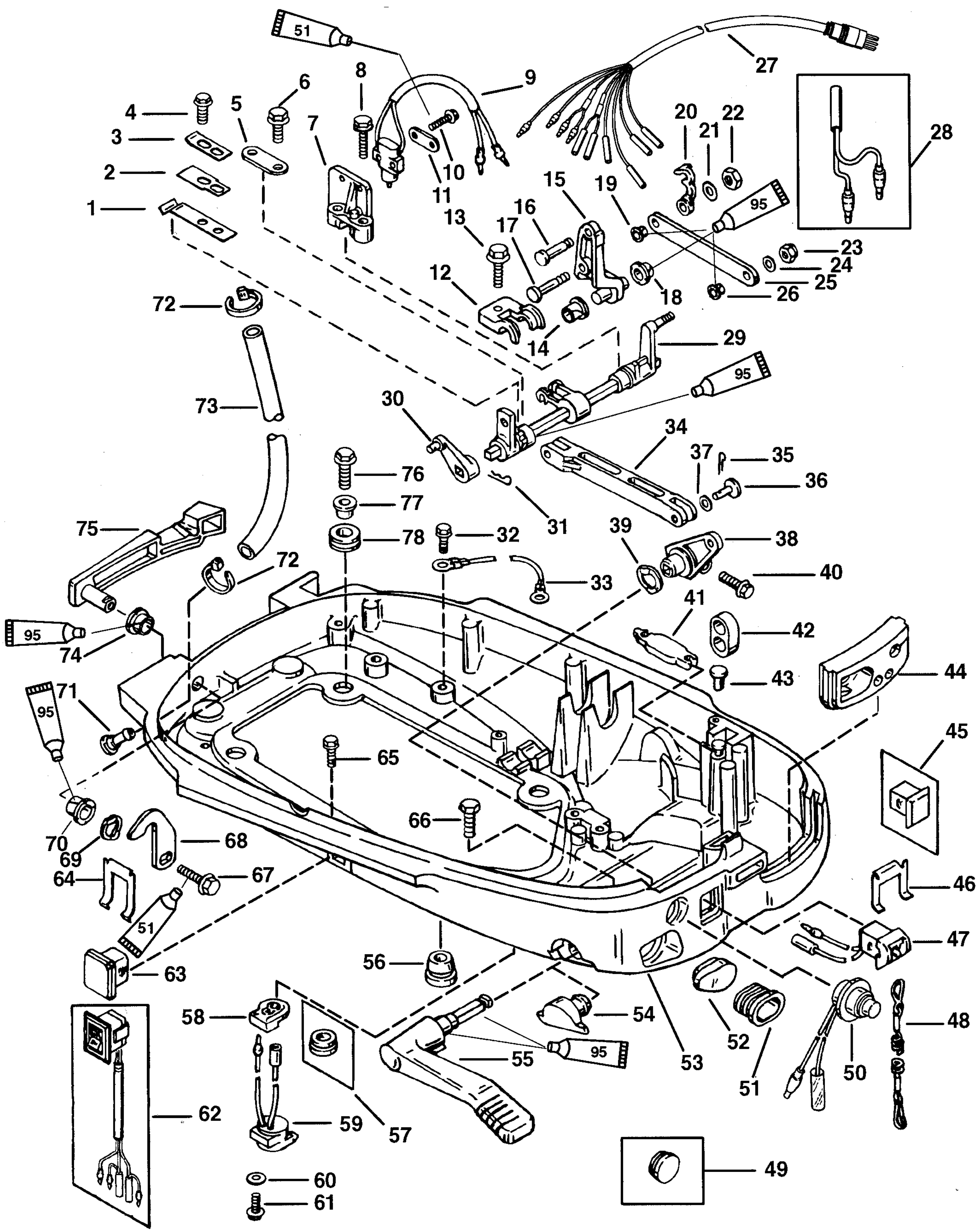
66 Loctite 242 (92-809821)

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

THROTTLE LINKAGE (S/N-0G590000 & ABOVE)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	BUMPER–Throttle Stop			
2	1	WASHER			
3	1	BUMPER–Throttle Stop			
4	1	LEVER–Throttle Control			
5	1	BALL–Threaded			
6	1	BUSHING KIT			
7	1	INSERT			
8	1	SCREW (M10 x 45)		16.7	22.6
9	1	NUT (M6)	Drive Tight – But Joint Must Move Freely		
10	1	WASHER			
11	1	RETAINER			
12	1	INSERT–Pin			
13	1	PIN			
14	1	LINK–Throttle Control			
15	2	SOCKET–Ball			
16	1	NUT			
17	1	WASHER			
18	1	SCREW (M6 x 16)	100		11.3
19	1	BRACKET-Throttle Cable			
20	1	SPARK ARM			
21	1	THROTTLE CAM			
22	1	SPRING			
23	1	BUSHING			
24	1	WAVE WASHER			
25	1	SCREW (M6 x 35)			
26	1	SCREW (M5 x 35)			
27	1	NUT			
28	1	SPARK CONTROL LINK			
29	2	SOCKET–Ball			
30	1	NUT			

Bottom Cowl/Shift Components

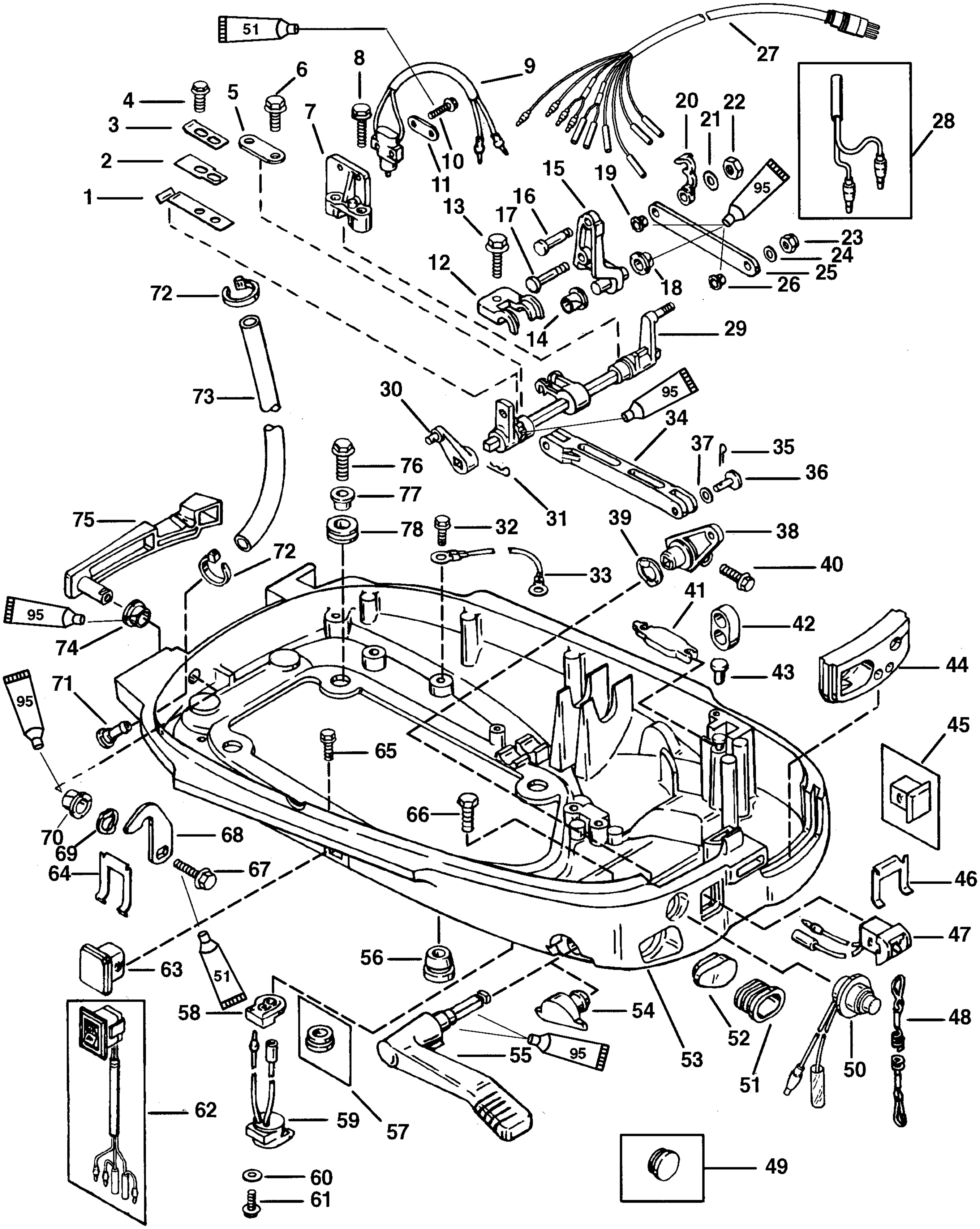


51 Loctite "222" Small Screw Threadlocker (92-809818)

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

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	SPRING-Detent			
2	2	SPRING-Backing			
3	1	PLATE			
4	2	SCREW (M5 x 14)	75		8.5
5	1	STRAP-Horizontal Shift Shaft			
6	1	SCREW (M6 x 1 x 16)	100		11.3
7	1	CLAMP-Horizontal Shift Shaft			
8	2	SCREW (M6 x 1 x 30)	100		11.3
9	1	SWITCH			
10	2	SCREW (M3 x .5 x 20)	Drive Tight		
11	1	PLATE-Switch			
12	1	CAP-Intermediate Lever			
13	1	SCREW (M6 x 16)	100		11.3
14	1	BUSHING			
15	1	LEVER-Intermediate			
16	1	INSERT			
17	1	PIN			
18	1	BUSHING			
19	1	NYLINER			
20	1	RETAINER			
21	1	WASHER			
22	1	NUT (M6)	Drive Tight - But Joint Must Be Free		
23	1	NUT (M6)			
24	1	WASHER			
25	1	LINK-Shift			
26	1	NYLINER			
27	1	HARNESS **ELECTRIC HANDLE**			
28	1	HARNESS ADAPTOR			
29	1	SHIFT SHAFT-Horizontal			
30	1	LEVER-Interlock Actuating			
31	1	COTTER PIN			
32	1	SCREW (M10-16 x .38 Self Tap)			
33	1	CABLE (BLACK-7 1/2")			
34	1	SHIFT ROD			
35	2	COTTER PIN			
36	2	PIN-Shift Rod			
37	2	LOCKWASHER			
38	1	LEVER-Shift			
39	1	WAVE WASHER			
40	1	SCREW (M5 x .8 x 16)			
41	1	LATCH			
42	1	CUP			
43	2	DRIVE SCREW			
44	1	SEAL			

Bottom Cowl/Shift Components



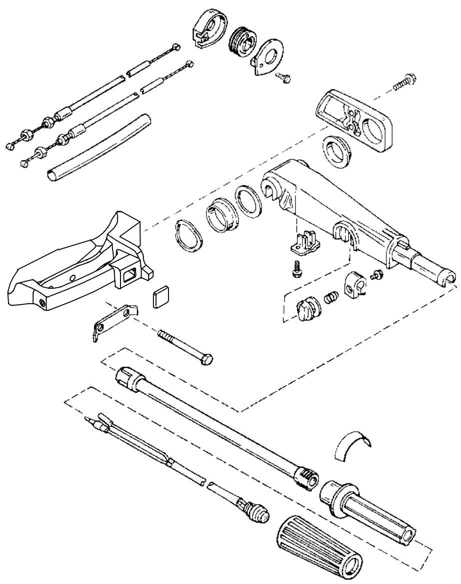
51 Loctite “222” Small Screw Threadlocker (92-809818)

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

Bottom Cowl/Shift Components

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
45	1	PLUG-Stop Switch			
46	1	RETAINER			
47	1	STOP SWITCH			
48	1	LANYARD STOP SWITCH			
49	1	GROMMET			
50	1	SWITCH **(ELECTRIC HANDLE)**			
51	1	SEAL-Throttle Cable			
52	1	SEAL-Throttle Cable			
53	1	BOTTOM COWL **(BLACK)**			
	1	BOTTOM COWL **(GRAY)**			
54	1	PLUG-Shift Lever			
55	1	SHIFT HANDLE			
56	1	GROMMET			
	1	GROMMET **(SPLIT - POWER TRIM)**			
57	1	PLUG-Warning Alarm **(ELECTRIC)**			
58	1	SEAL-Warning Horn			
59	1	ALARM			
60	1	WASHER			
61	1	SCREW (M5 x .8 x 12)	Drive Tight		
62	1	SWITCH ASSEMBLY **(POWER TRIM)**			
63	1	PLUG-Trim Switch			
64	1	RETAINER			
65	1	SCREW (M10-16 x 1/2 Self Tap)	75		8.5
66	1	SCREW (M5 x 16)-Interlock Cable			
67	1	SCREW (M6 x 16)	100		11.3
68	1	CAM-Latch			
69	1	WAVE WASHER			
70	1	BUSHING			
71	1	FITTING-Telltale			
72	2	STA-STRAP			
73	1	TUBING (15”)			
74	1	BUSHING			
75	1	LEVER-Cowl Latch **(BLACK)**			
	1	LEVER-Cowl Latch **(GRAY)**			
76	4	SCREW (M6 x 25)	100		11.3
77	4	BUSHING			
78	4	GROMMET			

ATTACHMENTS/CONTROL LINKAGE



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B

TILLER HANDLE

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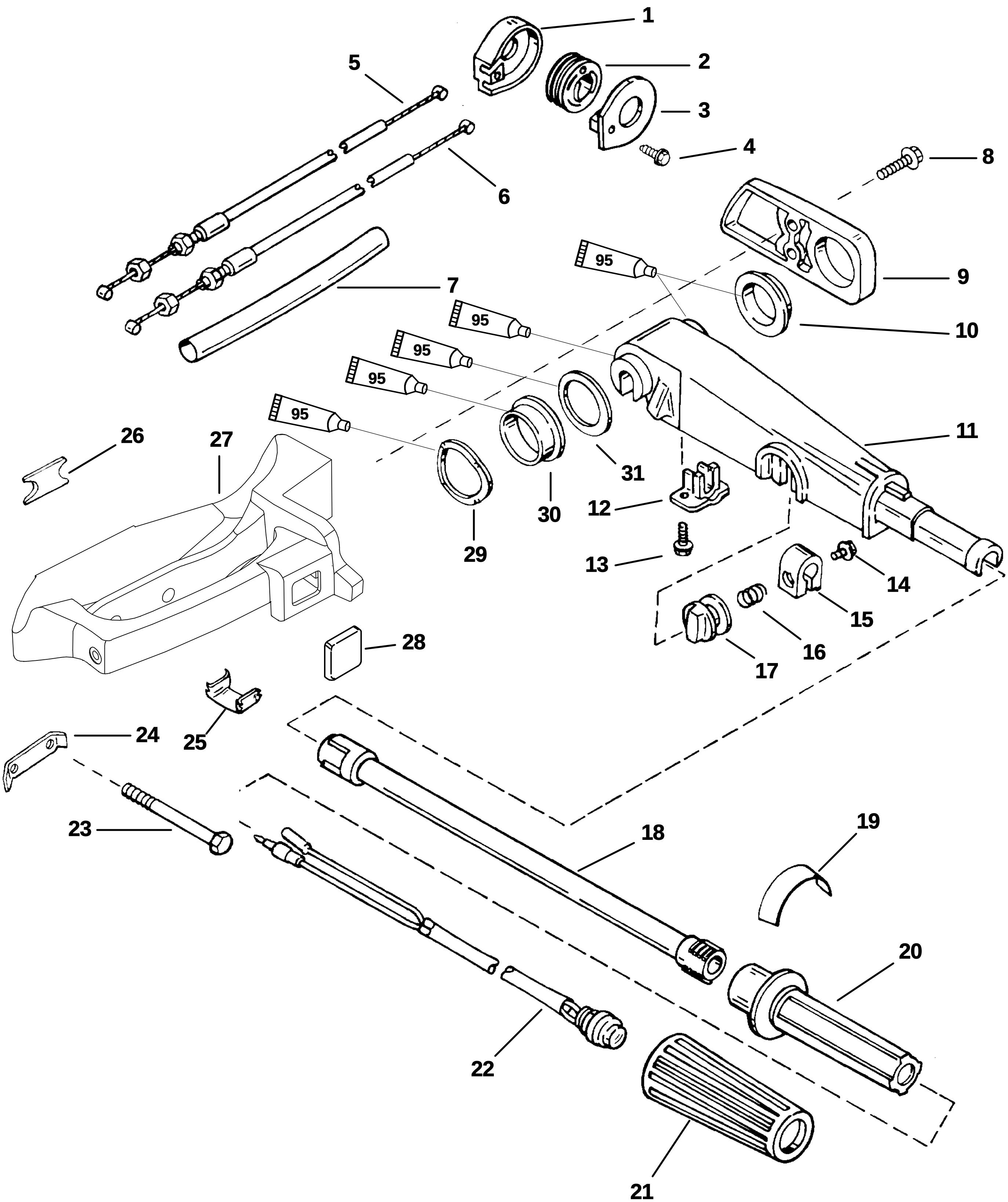
Notes:

Tiller Handle Components

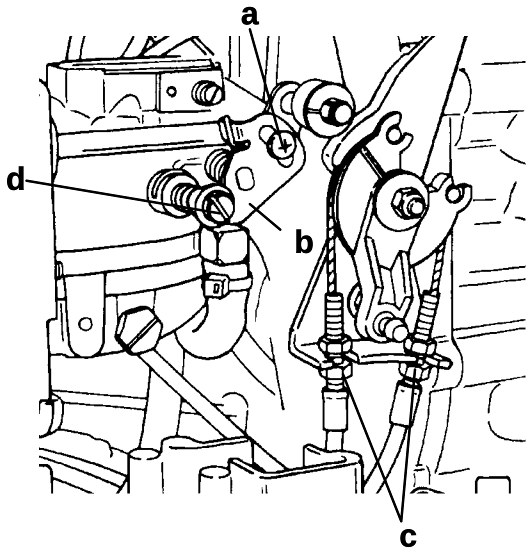


95 2-4-C With Teflon (92-825407A12)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	COVER KIT			
2	1	PULLEY			
3	1	CASE (Part of Ref #1)			
4	1	SCREW (10-16 x 1/2” Self Tap)	20		2.3
5	1	CABLE-Throttle			
6	1	CABLE-Throttle			
7	1	SLEEVE-Insulation			
8	2	SCREW (M8 x 1.25 Hex flange head)		16.5	22.4
9	1	COVER-Side **(BLACK)**			
	1	COVER-Side **(GRAY)**			
10	1	BUSHING			
11	1	ARM-Steering Handle **(BLACK)**			
	1	ARM-Steering Handle **(GRAY)**			
12	1	RETAINER			
13	1	SCREW (M5 x .8 x 12 Hex Flange Head)	35		4.0
14	1	SCREW (M6 x 1 x 25 Hex Head Cap)			
15	1	LOCK-Throttle			
16	1	SPRING			
17	1	KNOBS-Throttle			
18	1	TILLER TUBE			
19	1	DECAL **(TURTLE/RABBIT)**			
	1	DECAL **(SLOW/FAST)**			
20	1	HANDLE-Throttle			
21	1	GRIP-Throttle Handle			
22	1	SWITCH-Stop			
23	2	SCREW (M10 x 90 Hex Head Cap)		35	47.5
24	1	TAB WASHER			
25	1	CLIP-Cable Retainer			
26	1	BUMPER			
27	1	BRACKET-Tiller **(BLACK)**			
	1	BRACKET-Tiller **(GRAY)**			
28	1	PLUG			
29	1	WAVE WASHER			
30	1	BUSHING			
31	1	WASHER			

Adjustments
Tiller Handle Model (S/N-0G589999 & Below)

1. With engine off and gear shift in neutral position, loosen cam follower screw.
2. Back off idle speed screw until the throttle shutter positioner does not touch the taper of idle speed screw. (Throttle plate closed).
3. Loosen throttle cable jam nuts.



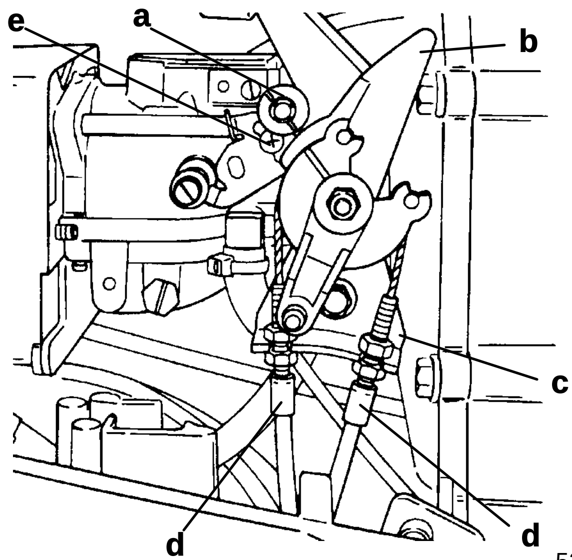
52301

a - Cam Follower Screw
b - Throttle Shutter Positioner
c - Jam Nut
d - Idle Speed Screw

4. With throttle at idle position, place cam follower roller against throttle cam. Center the roller with raised mark on throttle cam by adjusting the position of throttle cable sleeves in the mounting bracket.

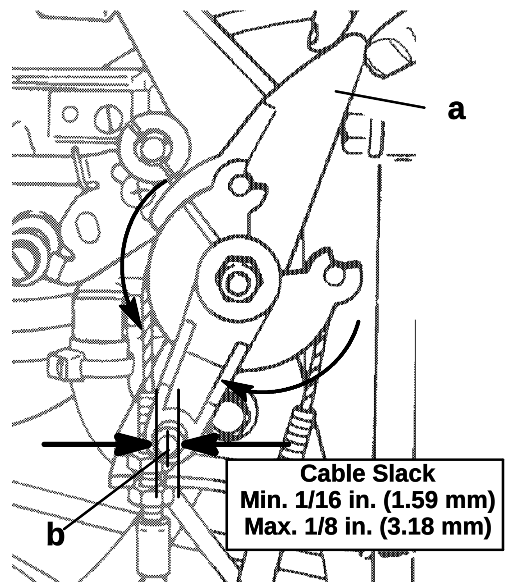
NOTE: *When positioning throttle cables, a minimum of 1/16 in. (1.59 mm) to a maximum of 1/8 in. (3.18 mm) slack must be allowed to prevent throttle cables from binding. (Rock throttle cam side to side and measure the amount of throttle cam travel at link rod ball.*

5. Tighten throttle cable jam nuts.



52300

a - Cam Follower Roller
b - Throttle Cam
c - Mounting Bracket
d - Throttle Cable Sleeve
e - Cam Follower Screw



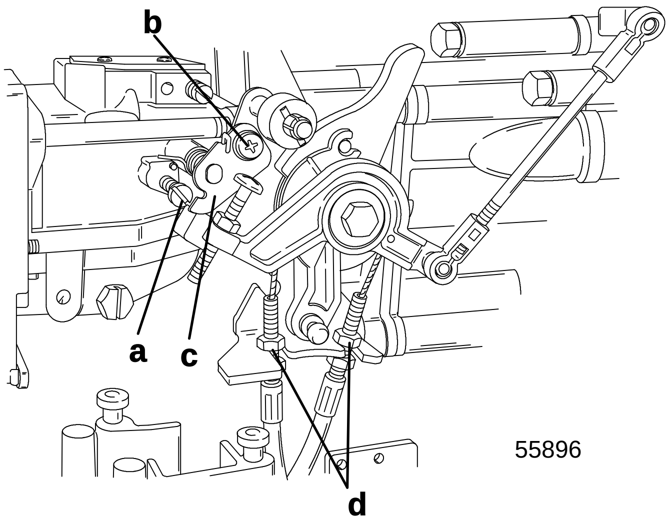
52300

a - Throttle Cam
b - Link Rod Ball

6. With cam follower resting on throttle cam, tighten the cam follower screw.

Adjustments
Tiller Handle Model with Mechanical Spark Advance (S/N-0G590000 & Above)

1. With engine off and gear shift in neutral position, loosen cam follower screw.
2. Back off idle speed screw until the throttle shutter positioner does not touch the taper of idle speed screw. (Throttle plate closed).
3. Loosen throttle cable jam nuts.

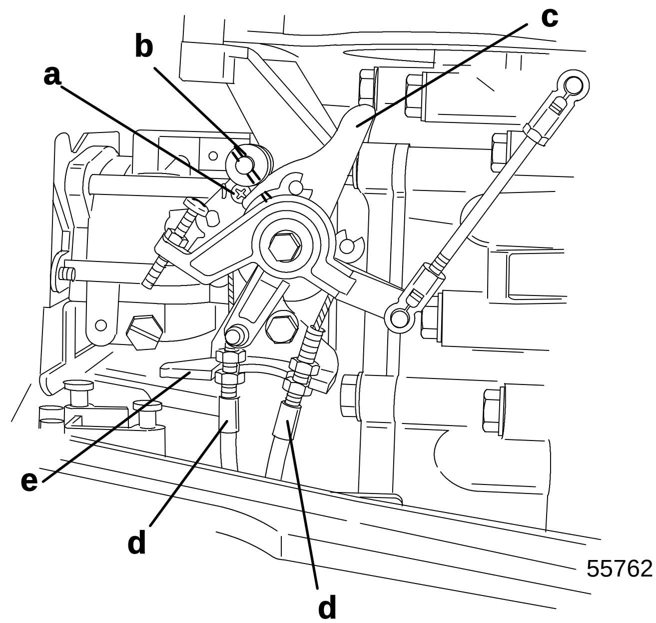


a - Idle Speed Screw
b - Cam Follower Screw
c - Throttle Shutter Positioner
d - Jam Nuts

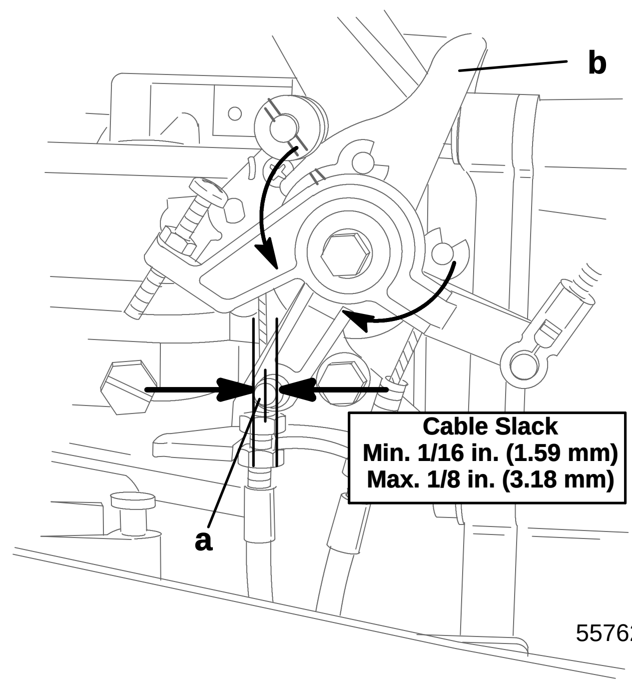
4. With throttle at idle position, place cam follower roller against throttle cam. Center the roller with raised mark on throttle cam by adjusting the position of throttle cable sleeves in the mounting bracket on tiller handle models or throttle link rod on remote control models.

NOTE: *When positioning throttle cables, a minimum of 1/16 in. (1.59 mm) to a maximum of 1/8 in. (3.18 mm) slack must be allowed to prevent throttle cables from binding. (Rock throttle cam side to side and measure the amount of throttle cam travel at link rod ball.*

5. Tighten throttle cable jam nuts.



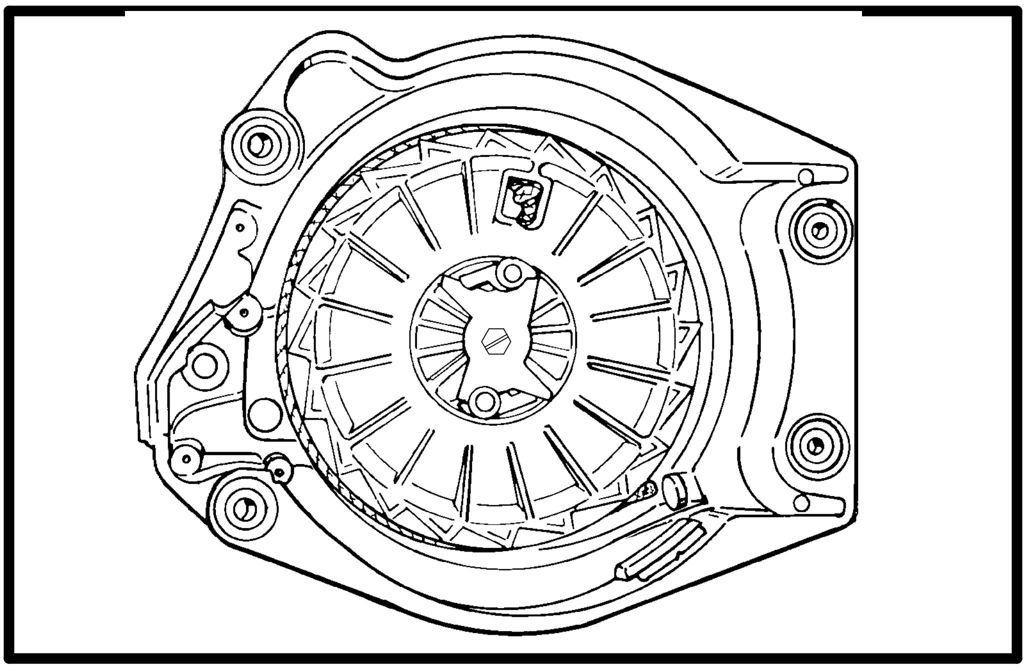
a - Cam Follower Screw
b - Cam Follower Roller
c - Throttle Cam
d - Throttle Cable Sleeve
e - Mounting Bracket



a - Link Rod Ball
b - Throttle Cam

6. With cam follower resting on throttle cam, tighten the cam follower screw.

MANUAL STARTER



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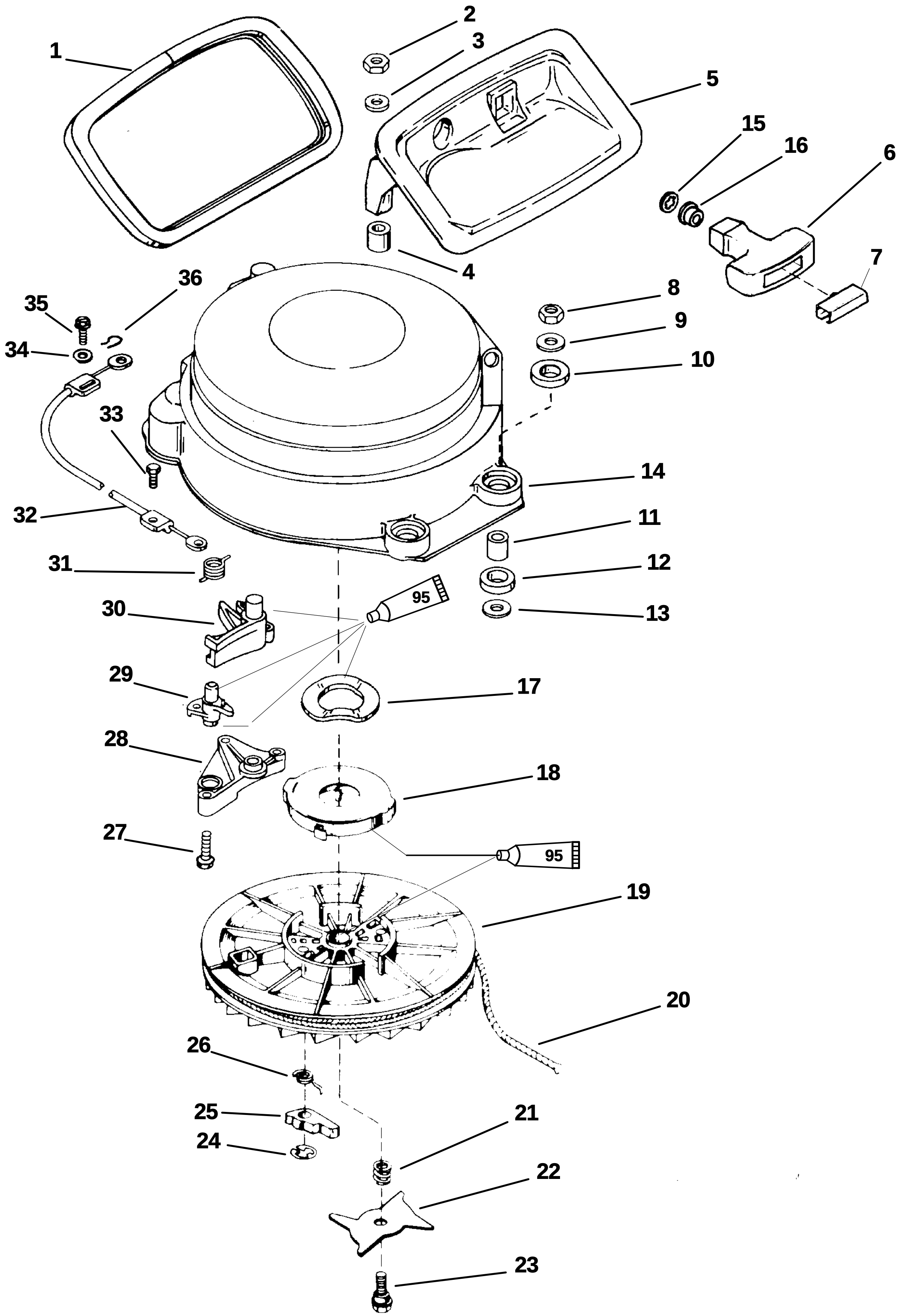
Manual Start Components



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

Manual Start Components

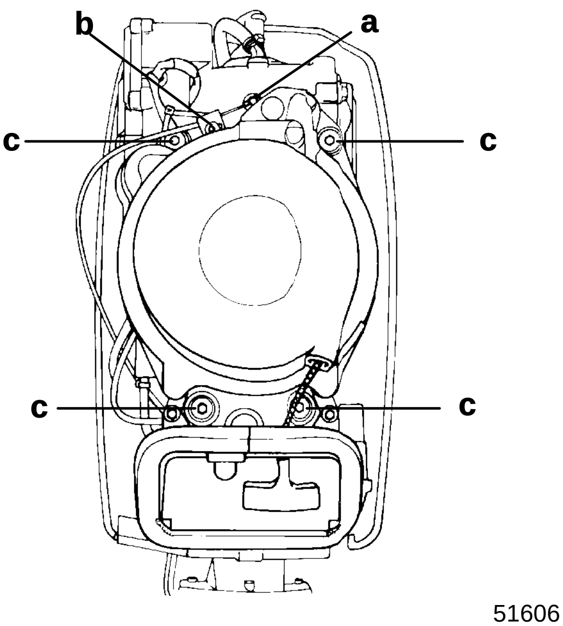
REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	SEAL-Handle rest			
2	2	NUT (M6 x 1)			
3	2	WASHER			
4	2	SPACER-Handle rest			
5	1	REST-Starter Handle			
6	1	HANDLE-Starter			
7	1	RETAINER			
8	4	WING NUT	90		10.2
9	4	WASHER			
10	4	GROMMET			
11	4	BUSHING			
12	4	GROMMET			
13	4	WASHER			
-	1	RECOIL STARTER **(S/N-USA-0G239163/BEL-9864479 & BELOW)**			
	1	RECOIL STARTER **(S/N-USA-0G239164/BEL-9864480 & ABOVE)**			
14	1	HOUSING			
15	1	RETAINING RING			
16	1	BUSHING-Rope			
17	1	LOCKWASHER			
18	1	SPRING/KEEPER ASSEMBLY			
19	1	SHEAVE-Starter			
20	1	STARTER ROPE			
21	1	SPRING			
22	1	CAM			
23	1	SCREW (1/4-20)	135		15.3
24	2	RETAINING RING			
25	2	CAM			
26	2	SPRING			
27	3	SCREW (10-16 x 1 IN.)			
28	1	RETAINER			
29	1	CAM			
30	1	LEVER **(S/N-USA-0G239163/BEL-9864479 & BELOW)**			
	1	LEVER **(S/N-USA-0G239164/BEL-9864480 & ABOVE)**			
31	1	SPRING			
32	1	CABLE-Interlock			
33	1	SCREW (M5 x .8 x 16)			
34	1	WASHER			
35	1	SCREW (10-16 x .625)			
36	1	COTTER PIN			

Rewind Starter Disassembly

⚠ WARNING

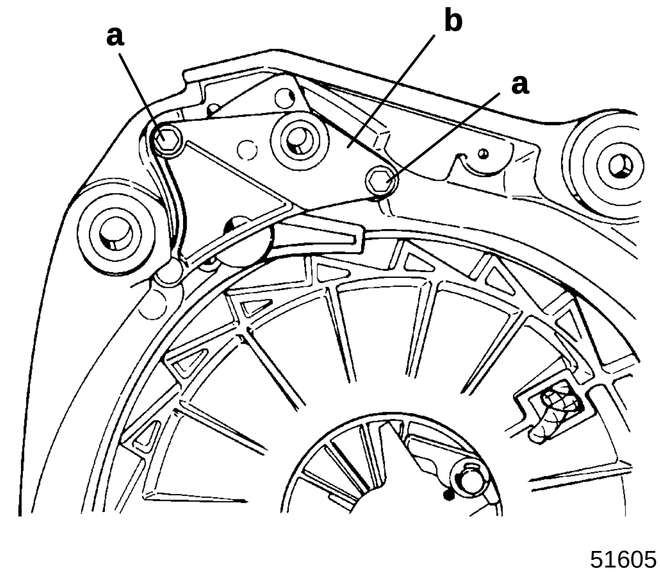
When disassembling and reassembling rewind starter, SAFETY GLASSES must be worn in case rewind spring uncoils out of the housing.

1. Untie knot in starter rope and release starter rope to allow rewind spring to unwind.
2. Remove retaining clip and attaching screw which secures shift interlock cable to starter housing.
3. Remove rewind starter from engine.



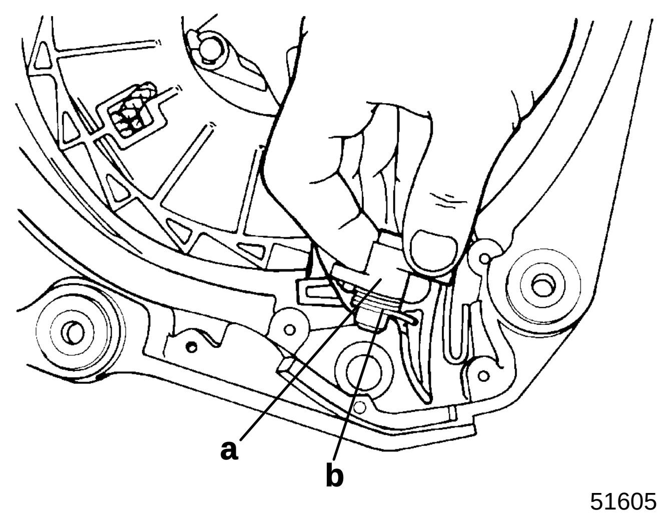
a - Retaining Clip
b - Screw
c - Bolts (4)

4. Remove cam retainer.



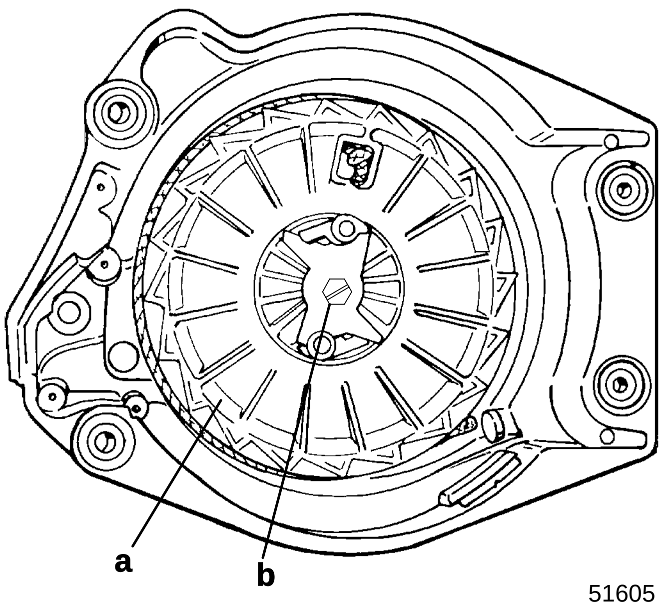
a - Screws
b - Retainer

5. Remove cam and spring.



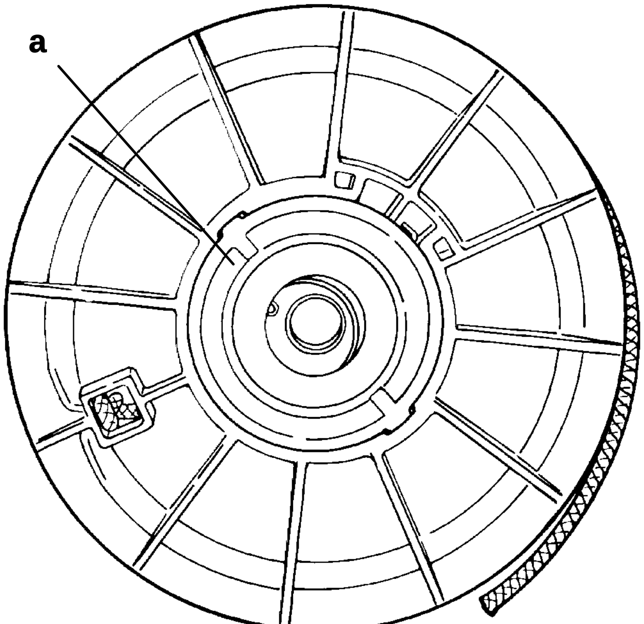
a - Cam
b - Spring

6. Remove starter sheave.



a - Starter Sheave
b - Screw

7. Spring is replaced as a spring/cover assembly.



a - Spring Assembly

Cleaning and Inspection

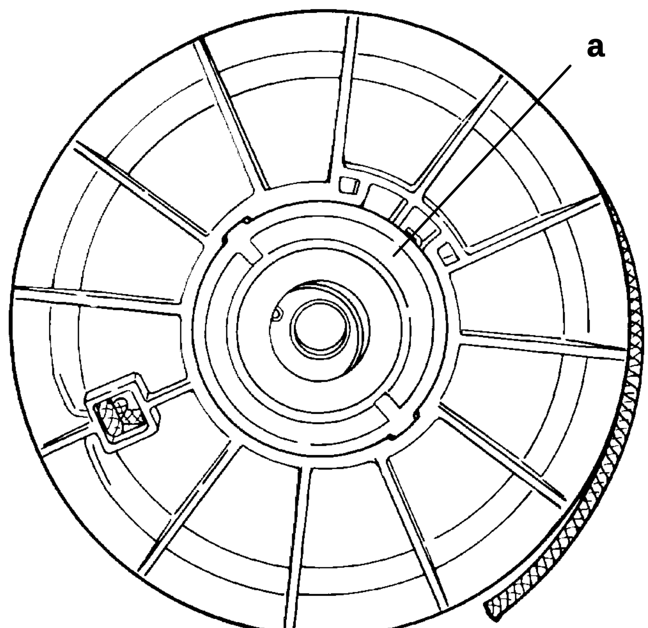
1. Clean components in solvent and dry with compressed air.
2. Inspect rewind spring for kinks, burrs, corrosion of breakage.
3. Inspect starter sheave, rope guide and starter housing for nicks, grooves, cracks, wear or distortion, especially area of rope travel.
4. Inspect bushing, starter drive pawl and spring for wear or damage.
5. Inspect starter rope for wear.
6. Replace components as necessary.

Rewind Starter Reassembly

WARNING

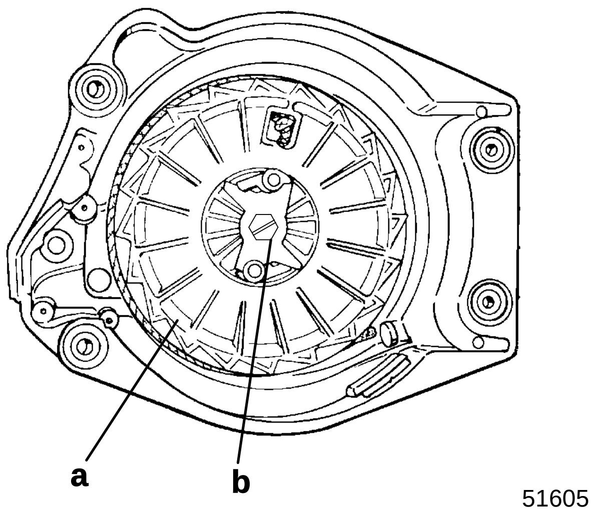
When reassembling rewind starter, SAFETY GLASSES must be worn in case rewind spring uncoils out of the housing.

1. Install spring/cover assembly into sheave.



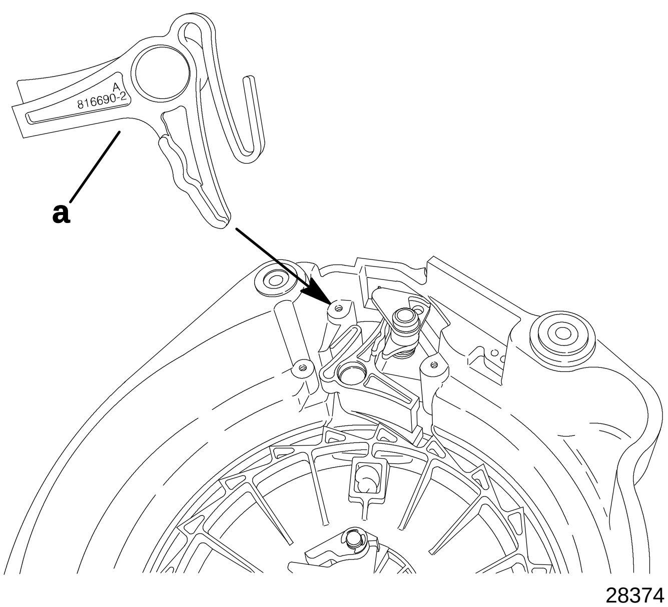
a - Spring Assembly

2. Install starter sheave to housing and secure in place with screw. Torque to 135 lb. in. (15.3 N·m).



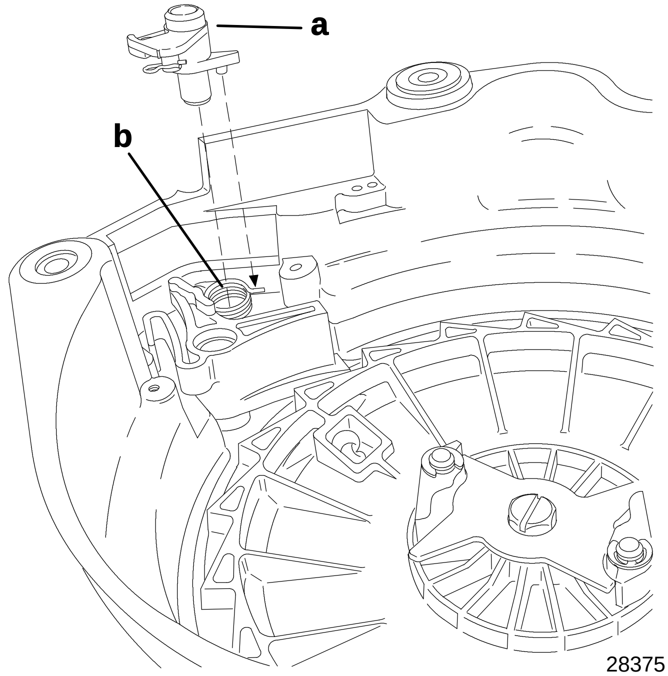
a - Starter Sheave
b - Screw

3. Install interlock lever.



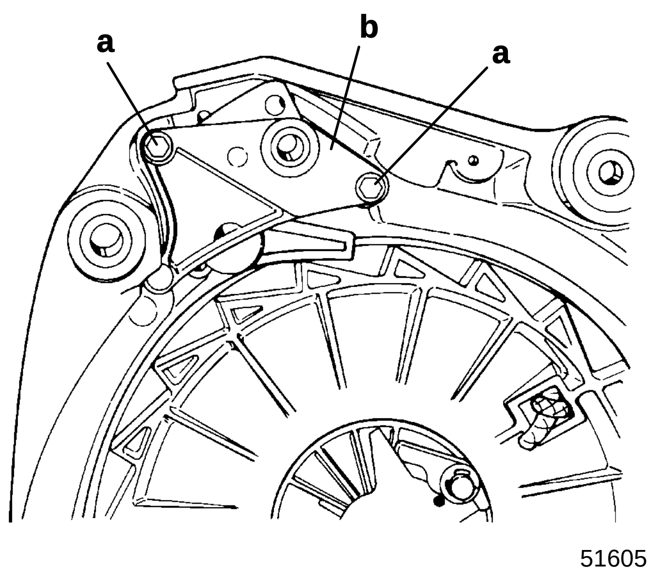
a - Interlock Lever

4. Position cam lever spring into recess of starter housing and re-install cam lever.



a - Cam Lever
b - Cam Lever Spring

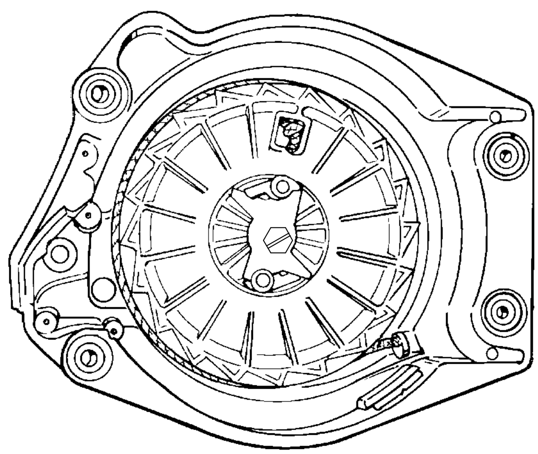
5. Install cam retainer and secure with screws.



a - Screws
b - Cam Retainer

Adjusting Rewind Spring Tension

1. Rotate sheave counterclockwise until it stops (coil is bound). Then back off one full turn, plus what is needed to align rope end with hole in housing. Never back off sheave less than one full turn.
2. Route starter rope thru rope guide in housing. Tie a slip knot in rope approximately 12 in. (305 mm) from end of rope.



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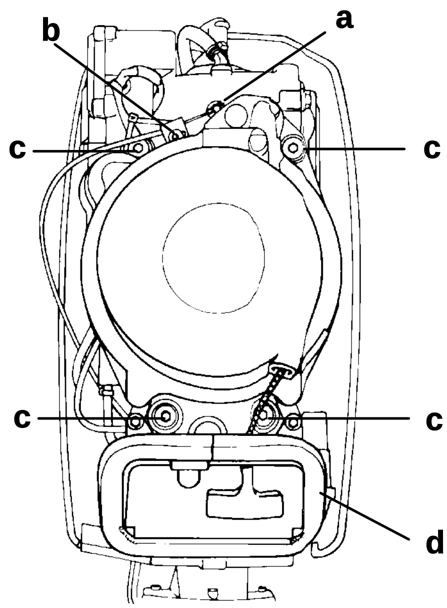
NOTE: *Check operation of rewind and rewind tension before outboard installation.*

3. Install rewind starter to engine.
4. Pull starter rope thru bracket, handle, and rope retainer. Secure rope retainer with knot in rope.



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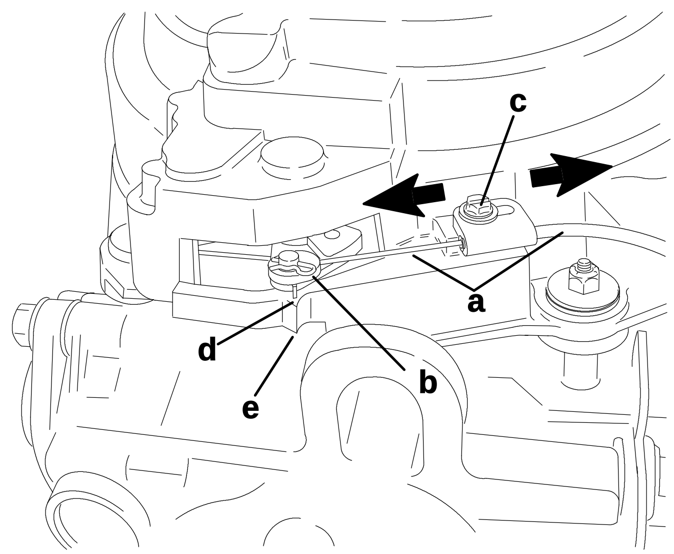
a - Retaining Clip
b - Screw
c - Nuts (4) Torque to 90 lb. in. (10.2 N·m)
d - Bracket

Starter Interlock Cable Adjustment

IMPORTANT: Lubricate core wire of interlock cable with light oil prior to making adjustments.

1. While rotating the propeller shaft, place the gear shift lever into REVERSE.
2. Return the gear shift lever to NEUTRAL without going past neutral detent.
3. Place end of interlock cable over pin of cam lever and secure with hair pin (Figure 4.)
4. Secure interlock cable to starter housing using adjusting screw. Do not tighten screw at this time.
5. Adjust interlock cable to align raised mark of cam lever with pointer of rewind housing.



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a - Interlock Cable
b - Hair Pin
c - Adjustment Screw
d - Raised Mark of Cam Lever
e - Pointer of Rewind Housing

6. Tighten cable adjustment screw and check adjustment after 4 or 5 shift cycles.