



MARINER



MERCURY

SERVICE MANUAL

MODELS
Mercury/Mariner
4 · 5 · 6 (4-Stroke)

Starting Serial Numbers
0R000001 and Above



Notice

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

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

DANGER

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

WARNING

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

CAUTION

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

Notice to Users of This Manual

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

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

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

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

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

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



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

Cleanliness and Care of Outboard Motor

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

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

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

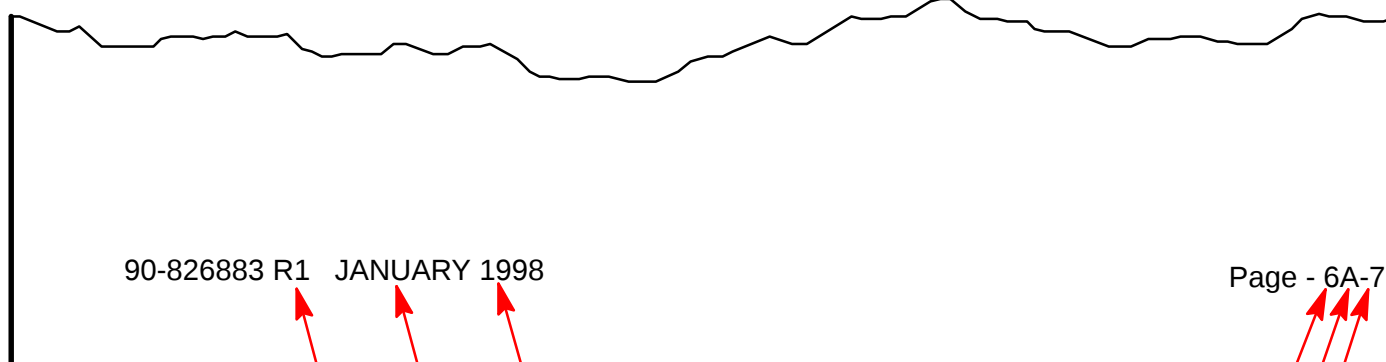
We reserve the right to make changes to this manual without prior notification.

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

Page Numbering

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

EXAMPLE:



Revision No. 1

Month of Printing

Year of Printing

Section Number

Part of Section Letter

Page Number



Service Manual Outline

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Mid-Section

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IMPORTANT INFORMATION

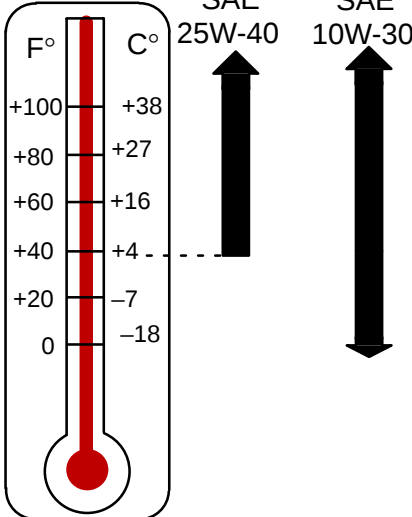
Section 1A - Specifications

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A**

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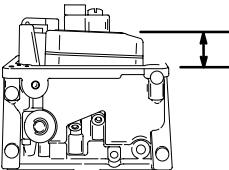
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Specifications

Model 4/5/6 (4-Stroke)		
HORSEPOWER (kW)	Model 4 Model 5 Model 6	4 hp (2.9 kW) 5 hp (3.7 kW) 6 hp (4.4 kW)
OUTBOARD WEIGHT	Short Shaft Long Shaft	55 lbs. (25.0 kg) 57 lbs. (26.0 kg)
FUEL	RECOMMENDED GASOLINE	Automotive Unleaded with a Minimum Pump Posted Octane Rating of 87
OIL	ENGINE OIL CAPACITY ENGINE OIL 	Either 15 fl oz. or 450 ml. SAE 10W-30 viscosity oil is recom- mended for use in all temperatures. SAE 25W-40 viscosity oil may be used at temperatures above 40° F (4° C). Use Quicksilver 4-Cycle Marine Oil with the proper viscosity for the expected temperature in your area (see range thermometer on left). If not available, use a premium quality 4-cycle engine oil, cer- tified to meet or exceed anyone of the following American Petroleum Institute (API) service classifications SH, SG, SF, CF-4, CE, CD, CDII.
CHARGING SYSTEM Readings taken @ 68°F (20°C).	Alternator (Optional) Type: Lighting Coil Lighting Coil Resistance Battery Charging Rectifier (Optional)	12 Volt 60 Watt (Non Regulated Lighting Coil) 0.31 - 0.47 Ω (YEL/RED - YEL/RED) 2 Amperes (Rectified)
STARTING SYSTEM	Manual Start	Recoil Starter



SPECIFICATIONS

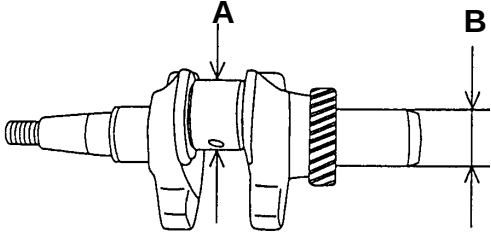
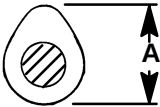
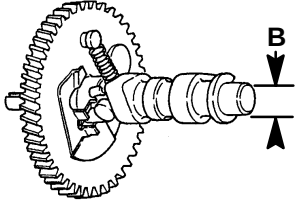
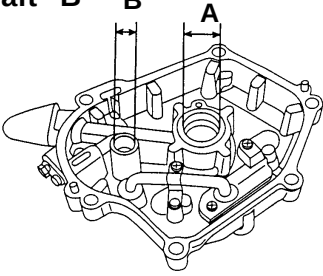
IGNITION SYSTEM Readings taken @ 68°F (20°C).	Type Spark Plug: Type Gap Hex Size Torque Firing Order Ignition Timing: (Fixed) Capacitor Charge Coil Resistance Trigger Coil Resistance Ignition Coil Resistance: Primary Secondary (W/o Boots) Spark Plug Boot Engine Speed Limiter Oil Pressure Switch (Red Light)	Capacitor Discharge Ignition NGK DCPR6E 0.035 in. (0.9 mm) 5/8 in. (16 mm) 13 lb-ft. (17.5 Nm) 1 25° ± 1° B.T.D.C. 95 - 134 Ω (WHT - BLK/RED) 149 - 243 Ω (RED/WHT - BLK) 0.02 - 0.38 Ω 3000 - 4400 Ω 3500 - 5200 Ω 6300 ± 200 RPM Continuity Below 3.5 psi ± 0.7 psi (24.5 ± 5 kPa)
CARBURETOR	Idle rpm (Out Of Gear) Idle rpm (In Forward Gear) Wide Open Throttle rpm (WOT) 4/5 (1999 & 2000) 4/5/6 (2001 & Newer) Pilot (Idle Mixture) Screw 4/5/6 (1999 & 2000) European Models Only 2001 & Newer 4 5 6 All Other Models Non-Adjustable Venturi Bore Diameter 4/5 6 Main Jet Size 4/5 (1999 & 2000) 4 (2001 & Newer) 5 (2001 & Newer) 6 (2000 & Newer) 4 (Bodensee) 5 (Bodensee) 6 (Bodensee) Pilot Jet 4 (1999 & 2000) 5 (1999 & 2000) 4/5 (2001 & Newer) 6 (2000 & Newer) 4/5 (Bodensee) 6 (Bodensee) Float Height 	1300 ± 50 rpm 1100 ± 50 rpm 4500 -5500 5000 - 6000 3 ± 1/2 Turns Out 2-1/8 ± 1/2 Turns Out 1-1/2 ± 1/2 Turns Out 2-3/4 ± 1/2 Turns Out 13.5 mm 15 mm #70 #58 #65 #75 #55 #62 #68 #40 #42 #38 #45 #38 #42 0.35 - 0.39 in. (9 - 10 mm)



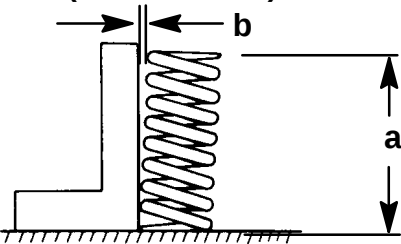
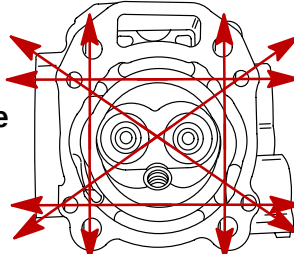
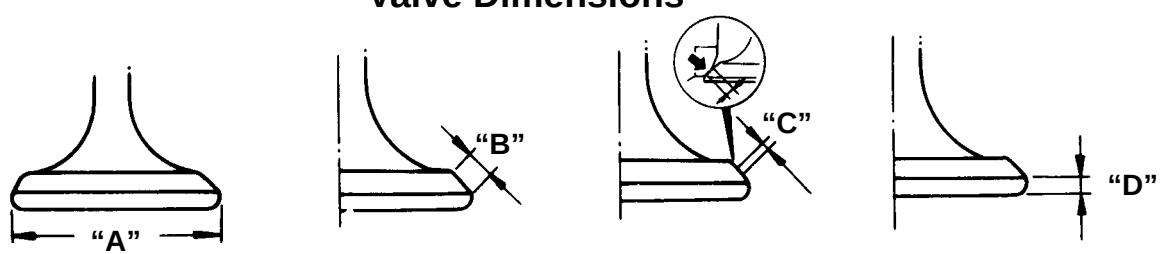
FUEL SYSTEM	Fuel Pump Type Fuel Pump: Pressure Plunger Stroke Diaphragm Stroke Fuel Tank Capacity	External (Plunger/Diaphragm) 2.5 - 5.0 psi (17 - 35 kPa) 0.059 in. (1.5 mm) 0.059 in. (1.5 mm) 3.2 US Gallons
CYLINDER BLOCK	Type Displacement Number of Cylinders	4 Stroke Cycle – Over Head Valve 7.5 cu. in. (123 cc) 1
STROKE	Length	1.77 in. (45 mm)
CYLINDER BORE	Diameter Standard Oversize-0.020 in. (0.50 mm) Taper/Out of Round Maximum Bore Type	2.323 in. (59.00 mm) 2.343 in. (59.50 mm) 0.003 in. (0.076 mm) Steel
PISTON	Piston Type O.D. at Skirt Standard Oversize-0.020 in. (0.50 mm)	Aluminum 2.321 in. (58.960 mm) 2.341 in. (59.460 mm)
PISTON CLEARANCE	Piston to Cylinder Clearance Piston Clearance Limit	0.001 - 0.002 in. (0.020 - 0.055 mm) 0.006 in. (0.15 mm)
RINGS	Ring End Gap (Installed) Top Middle Bottom (Oil Ring) Side Clearance: Top Middle Bottom (Oil Ring)	0.006 - 0.014 in. (0.15 - 0.35 mm) 0.012 - 0.020 in. (0.30 - 0.50 mm) 0.008 - 0.016 in. (0.20 - 0.40 mm) 0.0015 - 0.003 in. (0.04 - 0.08 mm) 0.0012 - 0.003 in. (0.03 - 0.07 mm) 0.0004 - 0.007 in. (0.01 - 0.18 mm)
COMPRESSION RATIO	Compression Ratio With Decompression 4/5 (1999 & 2000) 4/5 (2001 & Newer) 6 (2000 & Newer)	8.5:1 42 psi ± 14 psi (0.29 ± 0.1 MPa) 9.5:1 42 psi ± 14 psi (0.29 ± 0.1 MPa)
PISTON PIN	Outer Diameter Diameter of Piston Pin Hole Clearance between Piston Pin and Piston Pin Hole	0.6299 in. (16.00 mm) 0.6300 in. (16.002 mm) 0.0001 - 0.0005 in. (0.002 mm - 0.012 mm)
CONNECTING ROD	Oil Clearance (Big End) Side Clearance (Big End) Small End Inside Diameter	0.002 - 0.003 in. (0.053 - 0.079 mm) 0.008 - 0.016 in. (0.20 - 0.40 mm) 0.6303 in. (16.01 mm)



SPECIFICATIONS

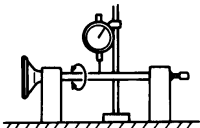
CRANKSHAFT	Crankshaft Runout Diameter of Crank Pin (A) Outer Diameter of Crankshaft in Oil Pan Bearing (B) 	Less than 0.002 in. (0.05 mm) 1.179 - 1.177 in. (29.94 - 29.91 mm) 0.983 - 0.982 in. (24.98 - 24.96 mm)
CAMSHAFT	Camshaft Dimensions Intake/Exhaust "A" 4 (1999 & 2000) 5 (1999 & 2000) 6 (2000) 4/5/6 (2001 & Newer)  Bearing Diameter "B" 	0.993 in. (25.24 mm) 1.047 in. (26.59 mm) 1.115 in. (28.33 mm) 1.115 in. (28.33 mm) 0.550 in. (13.98 mm)
OIL PAN	Inside Diameter of Oil Pan Bearing: Crankshaft "A" Camshaft "B"  Crankshaft to Oil Pan Bearing Clearance Camshaft to Oil Pan Bearing Clearance	0.985 in. (25.01 mm) 0.5515 in. (14.01 mm) 0.0006 - 0.0015 in. (0.015 - 0.040 mm) 0.0008 - 0.002 in. (0.02 - 0.05 mm)



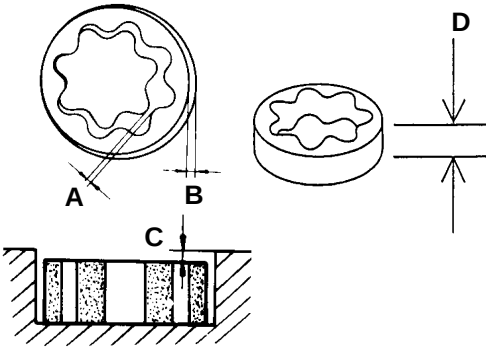
VALVE SPRING	Free Length (Intake/Exhaust) "a" Tilt Limit "b" (Intake/Exhaust) 4/5 (1999) 4/5/6 (2000 & Newer)  Compressed Pressure (Installed) Intake/Exhaust: Closed Height 0.965 in. (24.4 mm) 4/5 (1999 & 2000) 6 (2000) 4/5/6 (2001 & Newer) Open Height 0.709 in. (17.4 mm) 4/5 (1999 & 2000) 6 (2000) 4/5/6 (2001 & Newer) Direction of Winding (Intake/Exhaust)	a = 1.260 in. (32.0 mm) b = 0.044 in. (1.12 mm) a = 1.378 in. (35.0 mm) b = 0.044 in. (1.12 mm) 17 lbf. (7.7 kgf) 24 lbf. (10.8 kgf) 24 lbf. (10.8 kgf) 31 lbf. (14.0 kgf) 39.4 lbf. (17.9 kgf) 39.4 lbf. (17.9 kgf) Right Hand
CYLINDER HEAD	Warp Limit *  * Lines indicate straight edge measurement	0.0012 in. (0.03 mm)
Valve Dimensions  Head Diameter Face Width Seat Width Margin Thickness		



SPECIFICATIONS

VALVES	Valve/Valve Seat/Valve Guides:	
	Valve Clearance (cold)	
	Intake	0.002 - 0.005 in. (0.06 - 0.14 mm)
	Exhaust	0.004 - 0.007 in. (0.11 - 0.19 mm)
	Valve Dimensions:	
	"A" Head Diameter	
	Intake	0.980 - 0.988 in. (24.9 - 25.1 mm)
	Exhaust	0.941 - 0.949 in. (23.9 - 24.1 mm)
	"B" Face Width	
	Intake	0.102 in. (2.6 mm)
	Exhaust	0.102 in. (2.6 mm)
	"C" Seat Width	
	Intake	0.031 in. (0.8 mm)
	Exhaust	0.031 in. (0.8 mm)
	"D" Margin Thickness	
THERMOSTAT	Intake	0.028 in. (0.7 mm)
	Exhaust	0.047 in. (1.2 mm)
	Stem Outside Diameter	
	Intake	0.216 in. (5.48 mm)
	Exhaust	0.214 in. (5.44 mm)
	Guide Inside Diameter	
	Intake	0.2165 in. (5.5 mm)
	Exhaust	0.2165 in. (5.5 mm)
	Stem To Guide Clearance	
	Intake	0.0008 - 0.0017 in. (0.020 - 0.044 mm)
	Exhaust	0.0018 - 0.0028 in. (0.045 - 0.072 mm)
	Stem Run-out Limit (max.)	0.0006 in. (0.016 mm)
		
	Valve Opening Temperature	122°F - 129°F (50°C - 54°C)
	Full Open Temperature	145°F - 153°F (63°C - 67°C)
	Valve Lift (Minimum)	0.12 in. (3 mm)



LUBRICATION SYSTEM	Pump Type Engine Oil Pressure* (Warm Engine): @ 1300 rpm @ 5000 rpm Engine Oil Pan Capacity Oil Pump Clearance: Inner Rotor to Outer Rotor "A" Outer Rotor to Body "B" Rotor to Body (Side) "C" Height of Outer Rotor "D" Relief Valve Operating Pressure* 	Trochoid 4.0 psi (0.03 MPa) Minimum 21.0 psi (0.15 MPa) Minimum 0.95 pt (450 ml) 0.006 in. (0.15 mm) or Less 0.005 - 0.008 in. (0.12 - 0.20 mm) 0.0008 - 0.0028 in. (0.02 - 0.07 mm) 0.236 in. (5.99 mm) 31 - 40 psi (2.2 - 2.8 kg/cm²) 216 - 275 kPa
MID-SECTION	Transom Height - Short Shaft - Long Shaft Steering Pivot Range Tilt Pin Positions Total Tilt Angle Tilt Angle Shallow Water Tilt Angle Allowable Transom Thickness	17 in. (38 cm) 22 in. (51 cm) 78° 6 75° 4° - 24° 32.5° 2.2 in. (55 mm)
GEAR HOUSING (2.15:1)	Gear Ratio Gearcase Capacity Lubricant Type Forward Gear Number of Teeth Pinion Gear Number of Teeth Pinion Height Forward Gear Backlash Water Pressure*: @ 1300 rpm (Idle) Neutral @ 5000 rpm	2.15:1 6.5 fl oz (195 mL) Quicksilver Gear Lube-Premium Blend 28 Spiral/Bevel 13 Spiral/Bevel Floating No Adjustment 2.3 - 3.6 psi (16 - 25 kPa) 8 - 15 psi (55 - 103.5 kPa)

* Oil pressure specifications listed were obtained with oil at 165°F (75°C)

▪Water pressure readings will vary with thermostat operation.



Propeller Information Charts

Mercury/Mariner 4 (4-Stroke)

Wide Open Throttle RPM : 5000-6000
 Recommended Transom Heights : 15", 20"
 Right Hand Rotation Standard
 Gear Reduction : 2.15:1

Diameter	Pitch	No. of Blades	Material	Approx. Gross Boat Wgt. (lbs)	Approx. Boat Length	Speed Range (mph)	Propeller Part Number
8-3/8"	9"	3	Alum	Up to 400	Up to 14'	12-18	48-812950T1
8-3/8"	8"	3	Alum	300-500	13-15'	10-16	48-812950
8-3/8"	7"	3	Alum	400-700	14-16'	8-13	48-812949*
8-3/8"	6"	3	Alum	600+	15'+	1-11	48-16144
8-3/8"	6"	3	Alum	Sailboat		1-8	48-812951A1

Mercury/Mariner 5 (4-Stroke)

Wide Open Throttle RPM : 5000-6000
 Recommended Transom Heights : 15", 20"
 Right Hand Rotation Standard
 Gear Reduction : 2.15:1

Diameter	Pitch	No. of Blades	Material	Approx. Gross Boat Wgt. (lbs)	Approx. Boat Length	Speed Range (mph)	Propeller Part Number
8-3/8"	9"	3	Alum	Up to 500	Up to 14'	12-18	48-812950T1
8-3/8"	8"	3	Alum	400-700	13-15'	10-16	48-812950*
8-3/8"	7"	3	Alum	500-900	14-16'	8-13	48-812949
8-3/8"	6"	3	Alum	600+	15'+	1-11	48-16144
8-3/8"	6"	3	Alum	Sailboat		1-8	48-812951A1

Mercury/Mariner 6 (4-Stroke)

Wide Open Throttle RPM : 5000-6000
 Recommended Transom Heights : 15", 20"
 Right Hand Rotation Standard
 Gear Reduction : 2.15:1

Diameter	Pitch	No. of Blades	Material	Approx. Gross Boat Wgt. (lbs)	Approx. Boat Length	Speed Range (mph)	Propeller Part Number
8-3/8"	9"	3	Alum	Up to 500	Up to 14'	14-21	48-812950T1
8-3/8"	8"	3	Alum	500-800	13-15'	12-18	48-812950*
8-3/8"	7"	3	Alum	600-1100	14-16'	10-14	48-812949
8-3/8"	6"	3	Alum	800+	15'+	1-12	48-16144
8-3/8"	6"	3	Alum	Sailboat		1-9	48-812951A1

*Standard propeller shipped with outboard.



IMPORTANT INFORMATION

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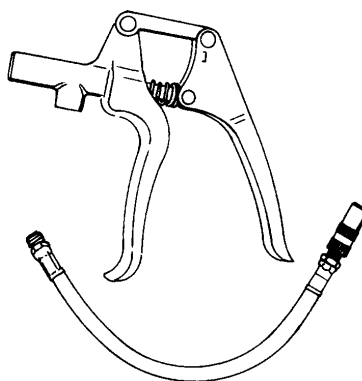
Specifications

Gear Case Lubricant Capacity

Gear Case Ratio	Capacity
2.15:1	6.6 fl oz. (195.0 ml)

Special Tools

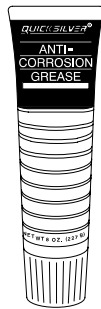
1. Grease Gun 91-37299A1



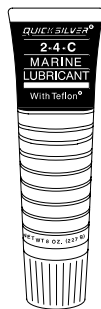


Quicksilver Lubricant/Sealant

1. Quicksilver Anti-Corrosion Grease P/N 92-850735A1



2. 2-4-C Marine Lubricant with Teflon P/N 92-850736A1



3. SAE 10-30W Motor Oil P/N 92-802833A1



4. Quicksilver Gear Lubricant P/N 92-19007A24





Inspection and Maintenance Schedule

Before Each Use

1. Check engine oil level.
2. Visually inspect the fuel system for deterioration or leaks.
3. Check outboard for tightness on transom.
4. 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. Change engine oil. The oil should be changed more often when the engine is operated under adverse conditions such as extended trolling.
3. Inspect and clean spark plugs.
4. Check fuel line filter for contaminants.
5. Check corrosion control anode. Check more frequently when used in salt water.
6. Drain and replace gear case lubricant.
7. Lubricate splines on the drive shaft.*
8. Check tightness of bolts, nuts, and other fasteners.
9. Replace water pump impeller.*

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

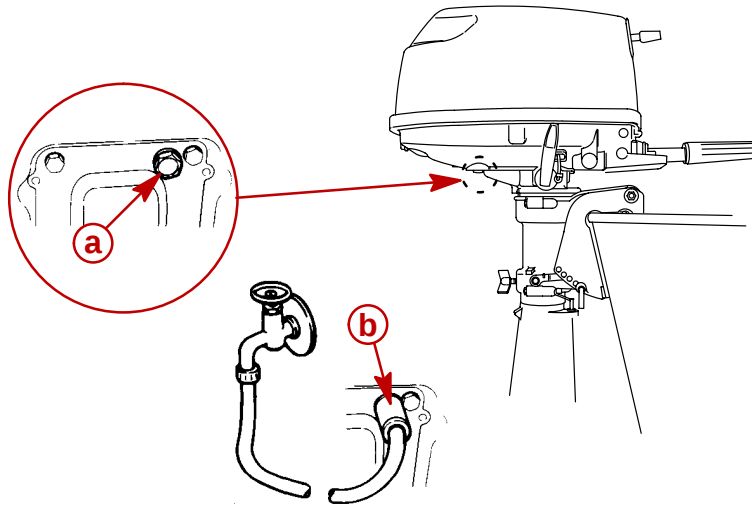


Flushing The Cooling System

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

NOTE: Do not run the engine while flushing the cooling system.

1. Remove plug and gasket and thread-in hose coupling.
2. Attach a water hose to the hose coupling. Turn on the water gently and flush the cooling system for 3 to 5 minutes.
3. Remove the thread-in hose coupling and reinstall plug and gasket.



- a-** Plug and Gasket
b- Hose Coupling

Fuel System

⚠ WARNING

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

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

Fuel Line Inspection

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

Engine Fuel Filter

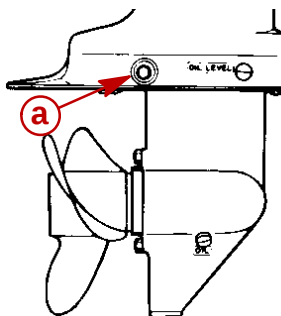
Inspect the fuel line filter. If the filter appears to be contaminated, remove and replace.



Corrosion Control Anode

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

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

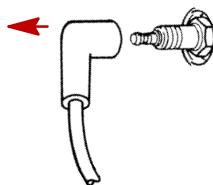


a - Anode

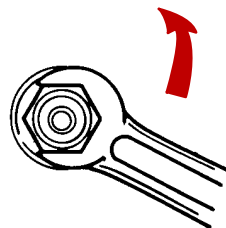
Spark Plug Inspection

Inspect spark plugs at the recommended intervals.

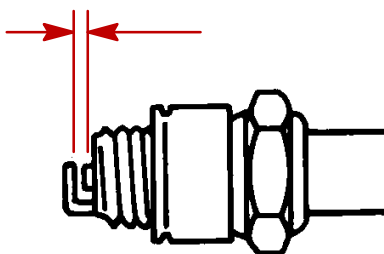
1. Remove the spark plug leads by twisting the rubber boots slightly and pull off.



2. Remove the spark plugs to inspect and clean. Replace spark plug if electrode is worn or the insulator is rough, cracked, broken, blistered or fouled.



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



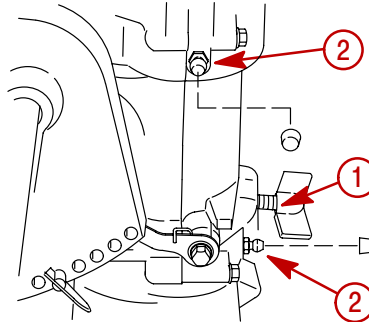
4. Before reinstalling spark plugs, clean away dirt on the spark plug seats. Install plugs finger tight, and tighten 1/4 turn or torque to 13 lb-ft (17.5 Nm).



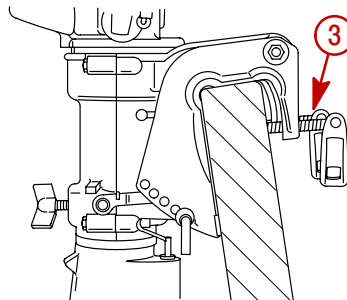
Lubrication Points

Lubricate Points 1 thru 5 with Quicksilver 2-4-C with Teflon Marine Lubricant or Special Lubricant 101.

1. Co-Pilot – Lubricate threads.
2. Swivel Bracket – Lubricate fitting.

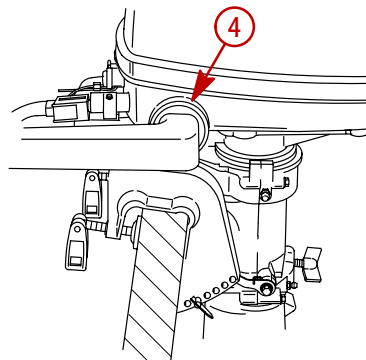


3. Transom Clamp Screws – Lubricate threads.

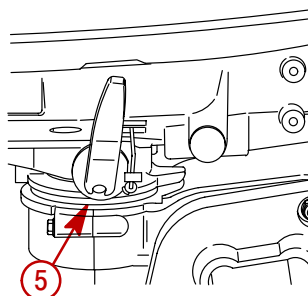


NOTE: Lubricating points 4 and 5 require disassembly of the product. These points should be lubricated at least once a year by an authorized dealer.

4. Tiller Handle Rubber Bushing – Lubricate internal diameter.

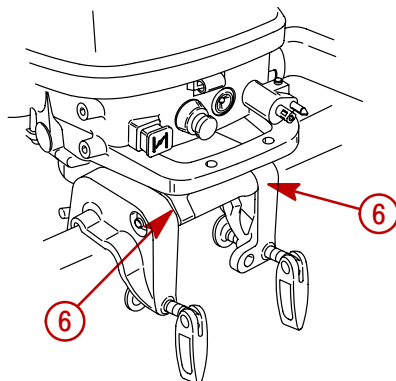


5. Shift Handle Detent – Lubricate detent.

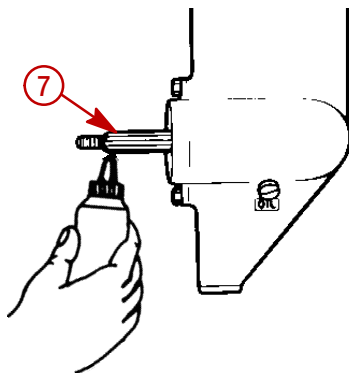


**Lubricate Point 6 with Light Weight Oil**

6. Tilt Pivot.

**Lubricate Point 7 with Quicksilver Anti-Corrosion Grease or 2-4-C with Teflon Marine Lubricant.**

7. Propeller Shaft – Refer to Propeller Replacement for removal and installation of the propeller. Coat the entire propeller shaft with lubricant to prevent the propeller hub from corroding to the shaft.





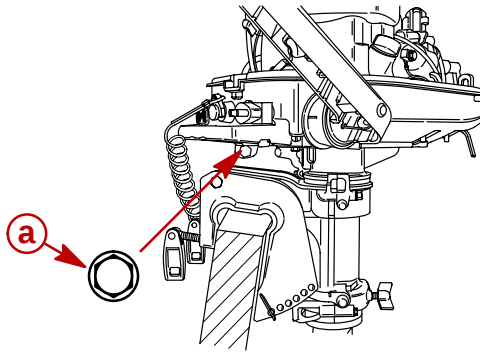
Changing Engine Oil

ENGINE OIL CAPACITY

15 fl oz. (450 mL)

OIL CHANGING PROCEDURE

1. Place outboard in an upright slightly tilted position.
2. Turn the steering on the outboard to gain access to the drain plug. Remove drain plug and drain engine oil into an appropriate container. Lubricate the seal on the drain plug with oil and reinstall.



a - Drain Plug

IMPORTANT: Inspect oil for signs of contamination. Oil contaminated with water will have a milky color to it; oil contaminated with fuel will smell strongly of fuel. If contaminated oil is noticed, have the engine checked by your dealer.

OIL FILLING

IMPORTANT: Do not overfill. Be sure that the outboard is upright (not tilted) when checking oil.

Remove the oil fill cap and refill with 15 fl oz. (450 mL) of oil. Reinstall the oil fill cap.

Idle engine for five minutes and check for leaks. Stop engine and check oil level on dipstick. Add oil if necessary.



Gear Case Lubrication

Gear Case Lubricant Capacity

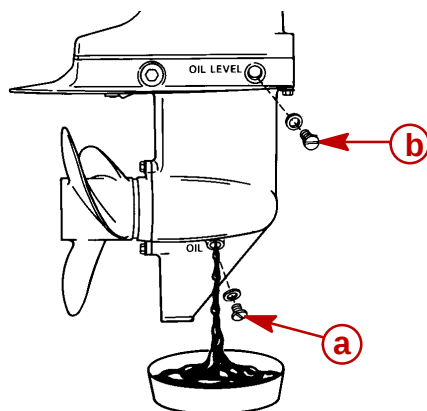
Gear Case Ratio	Capacity
2.15:1	6.6 fl oz. (195 mL)

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.

Also examine the gear case lubricant 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.

Draining Gear Case

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

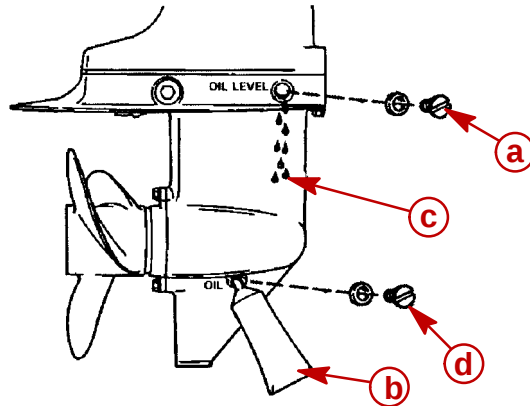


- a** - Fill/Drain Plug
b - Vent Plug



Checking Lubricant Level and Refilling Gear case

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



- a** - Vent Plug/Sealing Washer
b - Lubricant Tube
c - Vent Hole
d - Fill/Drain Plug and Sealing Washer

Storage Preparations

Fuel System

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

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

1. Portable Fuel Tank – Pour the required amount of 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 fill the fuel system.

Protecting External Engine Components

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



Protecting Internal Engine Components

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

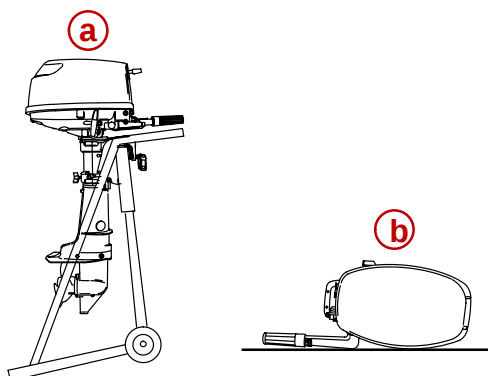
1. Change the engine oil.
2. Place the outboard in water or connect flushing attachment for circulating cooling water. Start the engine and let it run in neutral to warm up.
3. With engine running at fast idle, stop the fuel flow by disconnecting the remote fuel line. When engine begins to stall, quickly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

Gear Case

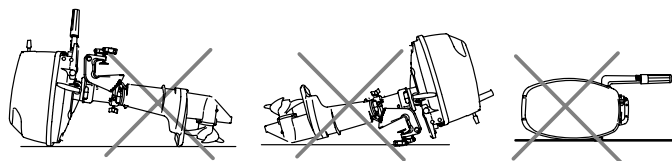
Drain and refill the gear case lubricant (refer to maintenance procedure).

Positioning Outboard for Storage

1. Carry, transport or store the outboard only in these two positions. These positions will prevent oil from draining out of the crankcase.
 - a. Upright
 - b. Tiller Side Down



2. Never carry, store or transport the outboard in these positions. Engine damage could result from oil draining out of the crankcase.



⚠ CAUTION

If outboard is on a boat and 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.



IMPORTANT INFORMATION

Section 1C - GENERAL INFORMATION

**1
C**

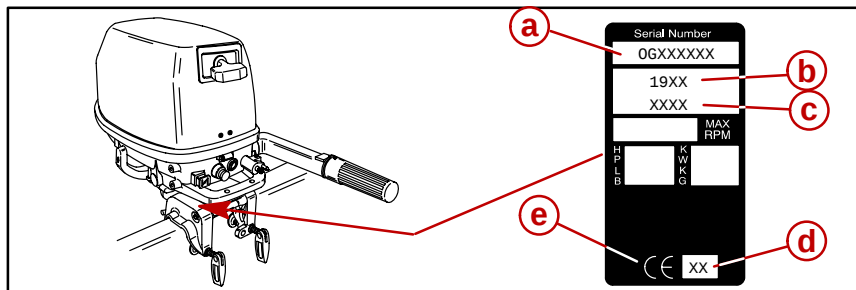
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Serial Number Location

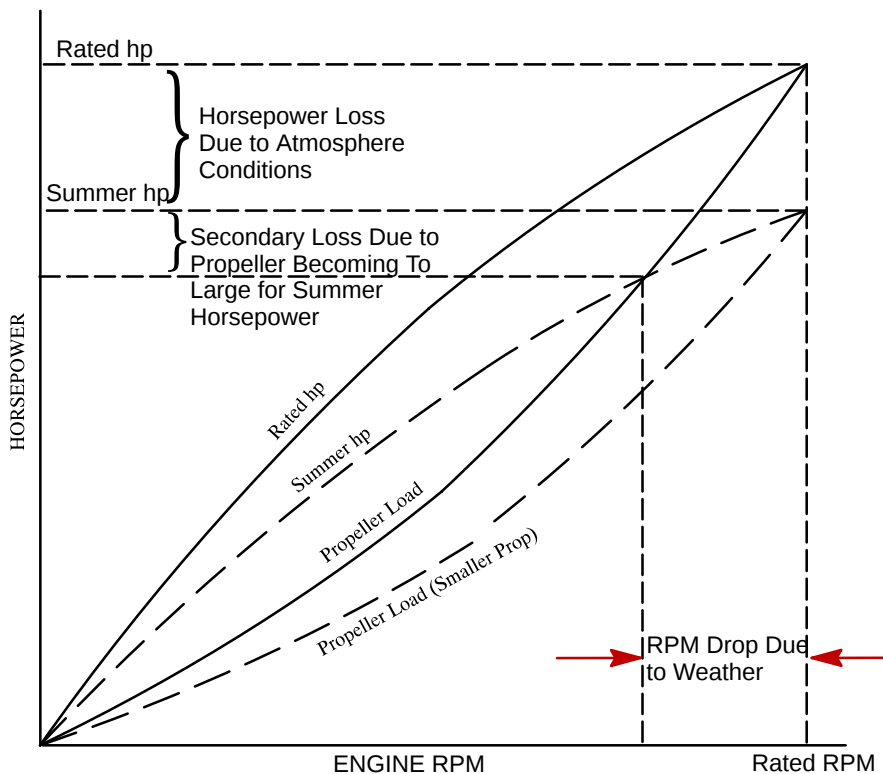
The Outboard serial number is located on the lower starboard side of the engine block. A serial number is also located on the top side of the swivel bracket.



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

Conditions Affecting Performance

Weather



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

Corporations internationally have settled on adoption of I.S.O. (International Standards Organization) engine test standards, as set forth in I.S.O. 3046 standardizing the computation of horsepower from data obtained on the dynamometer, 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).
 - c. Adjusting tilt pin to achieve best performance and handling.
 - (1.) Improves ease of planing off.
 - (2.) Generally improves rough water ride.
 - (3.) If excessive, can make the boat veer left and right (bow steer).

BOTTOM

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



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

WATER ABSORPTION

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

CAVITATION

Cavitation is caused by water vapor bubbles forming either from a sharp edge or angle on the gear case, from an irregularity in the propeller blade itself or from improper engine installation (too high). 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 4-cycle engine resembles the “pinging” heard in an automobile engine. It can be otherwise described as a tin-like “rattling” or “plinking” sound.

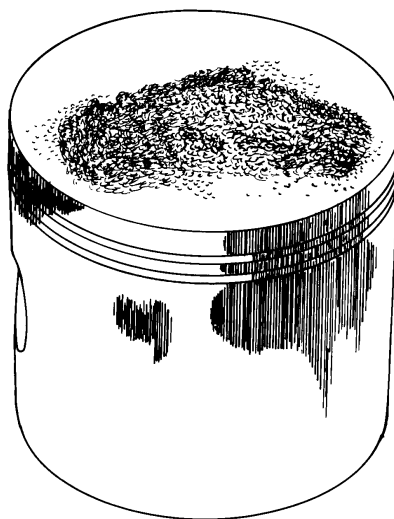
Detonation is an explosion of an unburned portion of the fuel/air charge after the spark plug has fired. Detonation creates severe shock waves in the engine, and these shock waves often find or create a weakness: The dome of a piston, cylinder head/gasket, piston rings or piston ring lands, piston pin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

A few of the most common causes of detonation in a marine 4-cycle application are as follows:

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

Detonation usually can be prevented if:

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



51115

Damaged Piston Resulting from Detonation



Following Complete Submersion

Submerged While Running (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.

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.

Fresh Water Submersion (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. Drain engine oil. Do not refill engine oil at this time.
5. Drain carburetor and clean fuel pump assembly.
6. Remove spark plug 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.
7. Pour alcohol into carburetor throat (alcohol will absorb water). Again rotate flywheel.
8. Turn engine over and pour alcohol into spark plug opening and rotate flywheel.
9. Turn engine over (place spark plug openings down) and pour engine oil into throat of carburetor while rotating flywheel to distribute oil throughout crankcase.
10. Again turn engine over and pour approximately one teaspoon of engine oil into spark plug opening. Again rotate flywheel to distribute oil in cylinder.
11. Dry all wiring and electrical components using compressed air.
12. Reinstall spark plug.
13. Refill engine crankcase with fresh oil.
14. 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.
15. 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.).

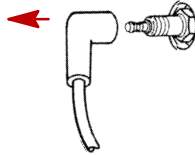


Propeller Removal/Installation

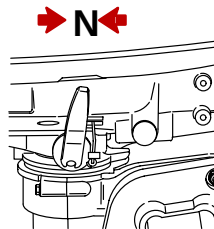
⚠ WARNING

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

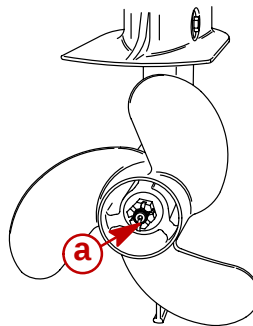
1. Remove the spark plug leads to prevent engine from starting.



2. Shift outboard to neutral position.

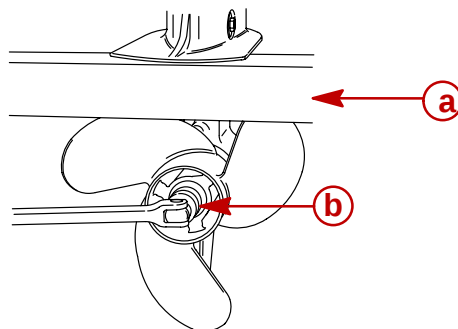


3. Straighten and remove cotter pin.



a - Cotter Pin

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

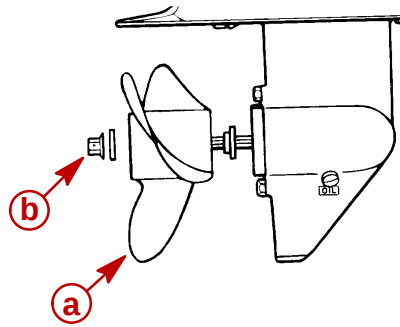


a - Block of Wood

b - Propeller Nut

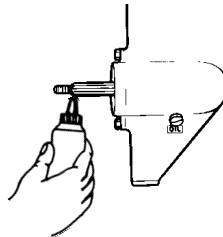


5. Pull propeller straight off shaft. If propeller is seized to the shaft and cannot be removed, have the propeller removed by an authorized dealer.



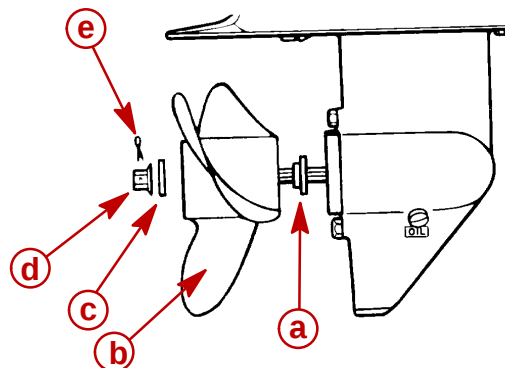
a - Propeller
b - Propeller Nut

6. Coat the propeller shaft with Quicksilver Anti-Corrosion Grease or 2-4-C Marine Lubricant with Teflon.



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

7. Install front thrust washer, propeller, rear thrust hub and propeller nut onto the shaft.
8. Place a block of wood between gear case and propeller to prevent rotation and tighten propeller nut. Secure propeller nut to the shaft with cotter pin.



a - Front Thrust Washer
b - Propeller
c - Rear Thrust Hub
d - Propeller Nut
e - Cotter Pin



Compression Check

1. Remove spark plugs.
2. Install compression gauge in spark plug hole.
3. Hold throttle plate at W.O.T.
4. Crank the engine over until the compression reading peaks on the gauge. Record the reading.
5. Check and record compression of cylinder. A reading below 36 psi might indicate a total engine wear problem.

Maximum (psi)*	Minimum (psi)*
50	36

*Compression listed above is with decompression assembly in operation.

Maximum (psi)*	Minimum (psi)*
130	100

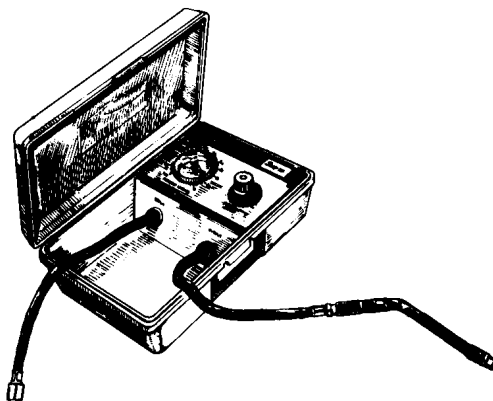
*Compression listed above is with decompression assembly not in operation. (Rocker arm on exhaust side is removed)

6. Compression check is important because an engine with low compression cannot be tuned successfully to give peak performance. It is essential, therefore, that improper compression be corrected before proceeding with an engine tuneup.
7. Cylinder scoring: If powerhead shows any indication of overheating, such as discolored or scorched paint, visually inspect cylinder for scoring or other damage as outlined in Section 4 "**Powerhead.**"



Cylinder Leakage Testing

NOTE: Cylinder leakage testing*, along with compression testing, can help the mechanic pinpoint the source of a mechanical failure by gauging the amount of leakage in an engine cylinder. Refer to the manufactures tester instructions for proper testing procedures.



* Courtesy of Snap-On-Tools

Cylinder Leakage Tester (Snap-On-Tools MT324)

NOTE: Spark plug hole is a 12 mm diameter. Use Snap-On Tool MT26-18 adapter with valve core removed.

Analysis

Due to standard engine tolerances and engine wear, no cylinder will maintain a 0% of leakage. It is important only that cylinders have somewhat consistent reading between them. Differences of 15 to 30% indicate excessive leakage. Larger engines tend to have a larger percentage of cylinder leakage than smaller engines.

If excessive leakage is present, first check that the piston is at top dead center of it's compression stroke. Leakage will naturally occur if the exhaust or intake valve is open.

To determine the cause of high percentage leaks, you must locate where the air is escaping from. Listen for air escaping thru the carburetor intake, adjacent spark plug holes, exhaust pipe, crankcase fill plug. Use the following table to aid in locating the source of cylinder leakage:

Air Escaping From:	Indicates Possible Defective:
Carburetor	Intake Valve
Exhaust System	Exhaust Valve
Crankcase Fill Plug	Piston or Rings
Cylinder	Head Gasket



Painting Procedures

Cleaning & Painting Aluminum Propellers & Gear Housings

WARNING

Avoid serious injury from flying debris. Avoid serious injury from airborne particles. Use eye and breathing protection with proper ventilation.

PROPELLERS

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

GEAR HOUSINGS

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

Procedure:

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

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

6. Mix epoxy chromate primer (DP-40) with equal part catalyst (DP-401) per manufacturers instructions, allowing proper induction period for permeation of the epoxy primer and catalyst.
7. Allow a minimum of one hour drying time and no more than one week before top coating assemblies.
8. Use Ditzler Urethane DU9000 for Mercury Black, DU34334 for Mariner Grey, and DU35466 for Force Charcoal, and DU33414M for Sea Ray White. Catalyze all four colors with Ditzler DU5 catalyst mixed 1:1 ratio. Reduce with solvents per Ditzler label.

**⚠ CAUTION**

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

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

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

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

Decal Application

Decal Removal

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

Instructions for “Wet” Application

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

TOOLS REQUIRED

1. Plastic Squeegee*
2. Stick Pin
3. Dish Washing **Liquid/Detergent without ammonia**** “Joy” and “Drift” are known to be compatible for this process.

* Automotive Body Filler Squeegee

** Do not use a soap that contains petroleum based solvents.

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

TEMPERATURE

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

SURFACE PREPARATION

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

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

DECAL APPLICATION

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



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

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

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



IMPORTANT INFORMATION

Section 1D - Outboard Motor Installation

**1
D**

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Notice to Installer and Owner	1D-2	Tilt Pin Adjustment	1D-4
Boat Horsepower Capacity	1D-2	Setting The Operating Angle Of Your Outboard .	1D-4
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Installing Outboard	1D-3	Installation Drawings	1D-6
Fastening Security Line	1D-4		



Notice to Installer and Owner

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

Boat Horsepower Capacity

U.S. COAST GUARD CAPACITY

MAXIMUM HORSEPOWER	XXX
MAXIMUM PERSON CAPACITY (POUNDS)	XXX
MAXIMUM WEIGHT CAPACITY	XXX

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

⚠ WARNING

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

Selecting Accessories For The Outboard

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

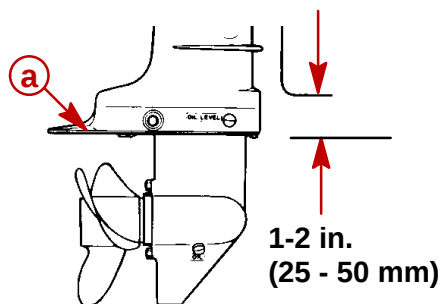
Mercury Marine Quicksilver accessories are available from Mercury Marine dealers.

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.



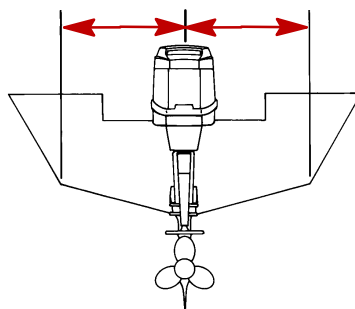
Installing Outboard

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

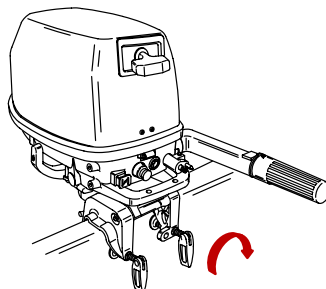


a - Anti-Ventilation Plate

2. Place outboard on center line of transom.



3. Tighten transom clamp handles.





Fastening Security Line

⚠ WARNING

If the length of security line being used is long enough to allow the outboard to disengage off the boat transom but is too short to not allow the outboard to submerge behind the boat and stop running, the outboard could continue running and propel itself back into the boat with the propeller rotating under power. This exposes the occupants to serious injury or death.

The primary purpose for installing a security line is to prevent loss of the outboard if the outboard becomes detached from the boat transom.

An effective security line should be of a working strength of at least five times the weight of the outboard.

The security line should be attached between the boat and outboard following one of these steps.

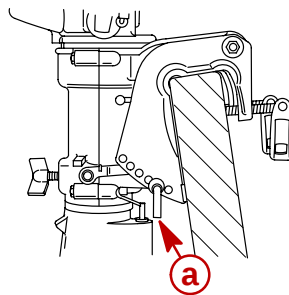
Step 1. The length of the security line should be short enough and affixed in a manner to prevent the outboard from rising up and disengaging off the boat transom.

Step 2. The length of the security line should be long enough and affixed in a manner to permit a detached outboard to submerge completely behind the boat and stop running but not too short that could allow the outboard to continue running and propel itself back into the boat.

Tilt Pin Adjustment

Setting The Operating Angle Of Your Outboard

1. The vertical operating angle of your outboard is adjusted by changing the position of the tilt pin in the adjustment holes provided. Proper adjustment allows the boat to run stable, achieve optimum performance, and minimize steering effort.



a - Tilt Pin

2. The tilt pin should be adjusted so the outboard is positioned to run perpendicular to the water when the boat is running at full speed. This allows the boat to be driven parallel to the water.
3. Arrange passengers and load in the boat so the weight is distributed evenly.

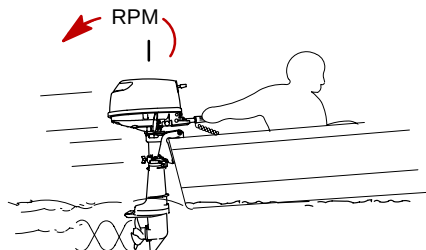


Engine Over-Speed Protection System

The system is activated if the engine speed should ever exceed the maximum allowable limit. This will protect the engine from mechanical damage.

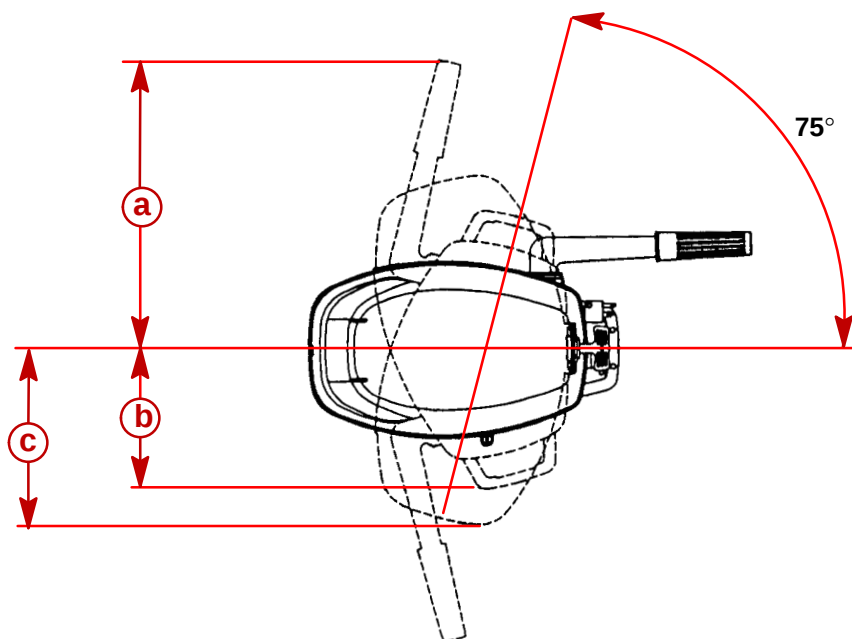
Anytime the engine over-speed system is activated, the system will automatically reduce the engine speed to within the allowable limit. If engine over-speed continues, have the outboard checked by your dealer.

NOTE: Your engine speed should never reach the maximum limit to activate the system unless the propeller is ventilating, an incorrect propeller is being used, or the propeller is faulty.

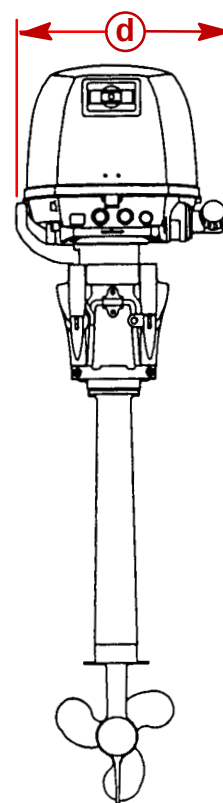
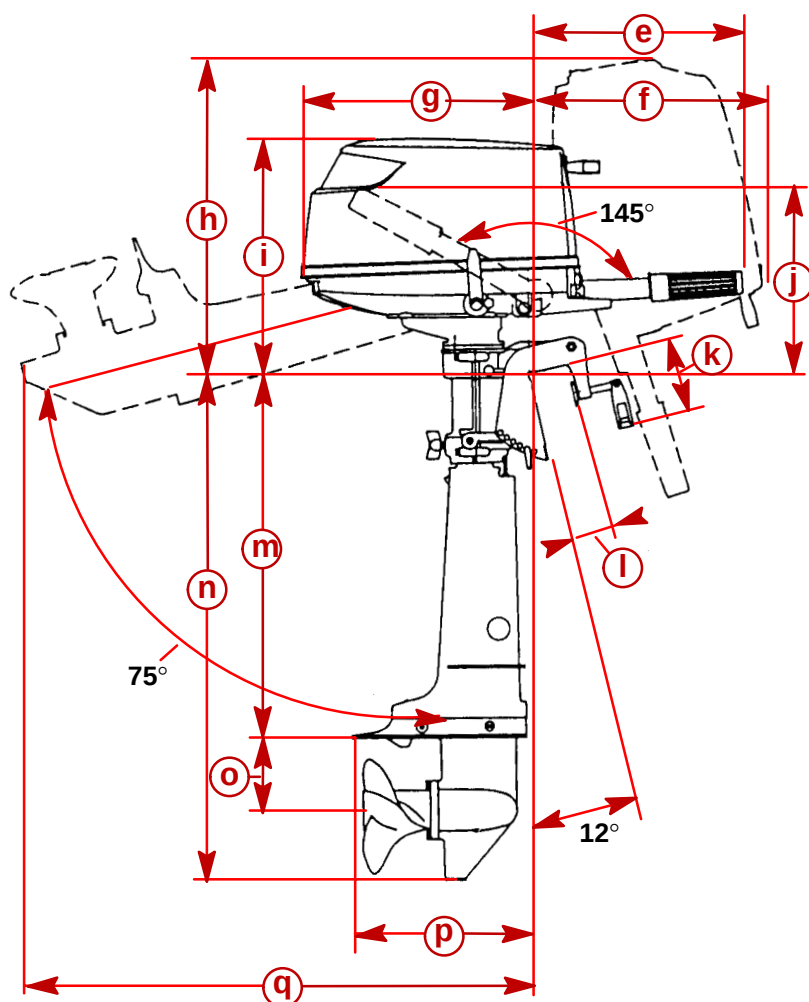




Installation Drawings



- a** – 17-1/2 in. (444.5 mm)
- b** – 8-17/64 in. (209.9 mm)
- c** – 10-7/16 in. (265.1 mm)
- d** – 12-51/64 in. (325 mm)
- e** – 12-63/64 in. (329.8 mm)
- f** – 14-11/64 in. (360 mm)
- g** – 13-49/64 in. (349.7 mm)
- h** – 19-3/32 in. (485 mm)
- i** – 14-3/8 in. (365.1 mm)
- j** – 11-5/8 in. (295.3 mm)
- k** – 4-5/16 in. (109.5 mm)
- l** – 2-1/16 in. (52.4 mm)
- m** – Short – 17-1/8 in. (435 mm)
Long – 22-1/8 in. (562 mm)
Ultra Long – 27-1/8 in. (689 mm)
- n** – Short – 25-3/4 in. (654.1 mm)
Long – 30-3/4 in. (781.1 mm)
Ultra Long – 35-3/4 in. (908.1 mm)
- o** – 4-45/64 in. (119.5 mm)
- p** – 8-17/64 in. (209.9 mm)
- q** – Short – 25-5/8 in. (650.9 mm)
Long – 29-9/16 in. (750.9 mm)
Ultra Long – 33-1/2 in. (850.9 mm)





ELECTRICAL

Section 2A - Ignition System

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Specifications	2A-1	Ignition Coil	2A-7
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Electrical Components	2A-4	Installation	2A-12
Description	2A-6	Flywheel	2A-12
Test Procedures	2A-6	Capacitor Charging Coil	2A-17
Direct Voltage Adaptor Specifications	2A-6	Trigger Coil	2A-18
Capacitor Charging Coil	2A-6	Ignition Coil	2A-19
Trigger Coil	2A-7	CDI Unit	2A-20

**2
A**

Specifications

IGNITION SYSTEM Readings taken @ 68°F (20°C).	Type Spark Plug: Type Gap Hex Size Torque Firing Order Ignition Timing: (Fixed) Capacitor Charge Coil Resistance Trigger Coil Resistance Ignition Coil Resistance: Primary Secondary (w/o Boots) Spark Plug Boot Engine Speed Limiter Oil Pressure Switch (Red Light)	Capacitor Discharge Ignition NGK DCPR6E 0.035 in. (0.9 mm) 5/8 in. (16 mm) 13 lb-ft (17.5 N·m) 1 25° ± 1° B.T.D.C. 95 - 134 Ω (WHT - BLK/RED) 149 - 243 Ω (RED/WHT - BLK) 0.02 - 0.38 Ω 3000 - 4400 Ω 3500 - 5200 Ω 6300 ± 200 RPM Continuity Below 3.5 psi ± 0.7 psi (24.5 ± 5 kPa) @ 68°F (20°C)

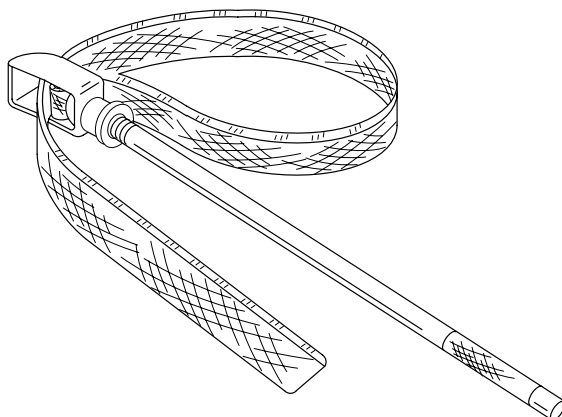
Direct Voltage Adaptor Specifications

Test	Selector Switch Position	DVA Leads		Volts @ 300-2000 RPM
		Red	Black	
Ignition Coil PRI	400 VDC	Ground	Black/Yellow Lead	120-300
Charge Coil	400 VDC	Black/Red Lead	Ground	150-325
Stop Circuit	400 VDC	Brown Lead	Ground	175-300

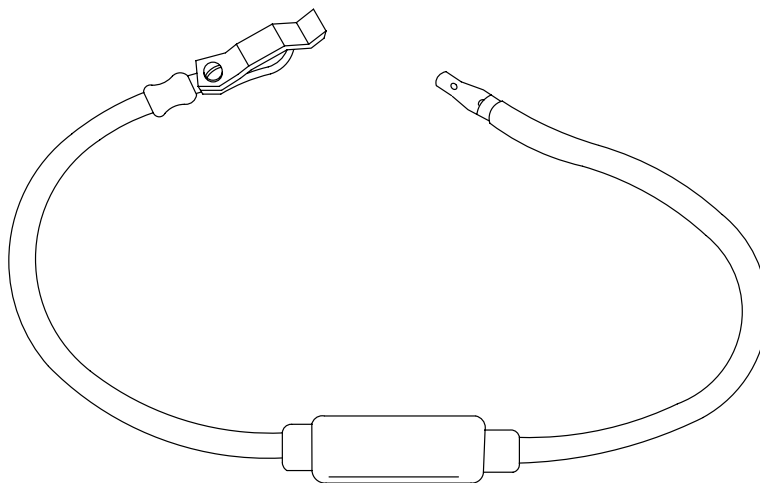


Special Tools

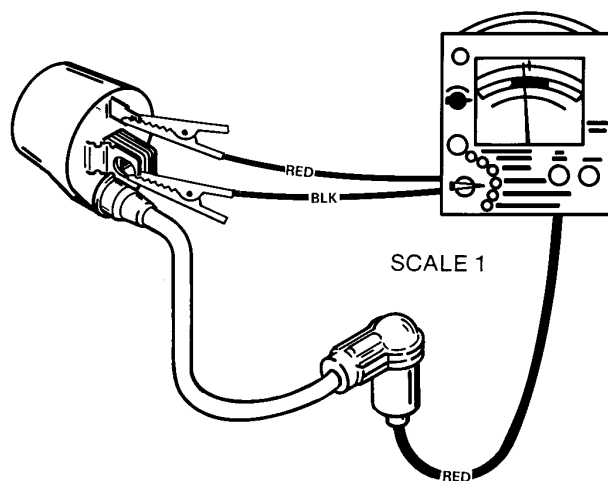
1. Strap Wrench (91-24937A1)



2. Spark Gap Tester (91-63998A1)

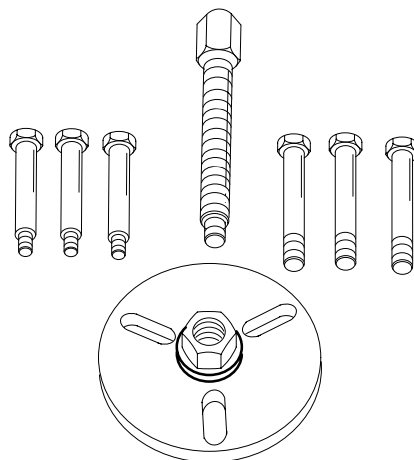


3. Magneto Analyzer Model 9800 (91-76032)

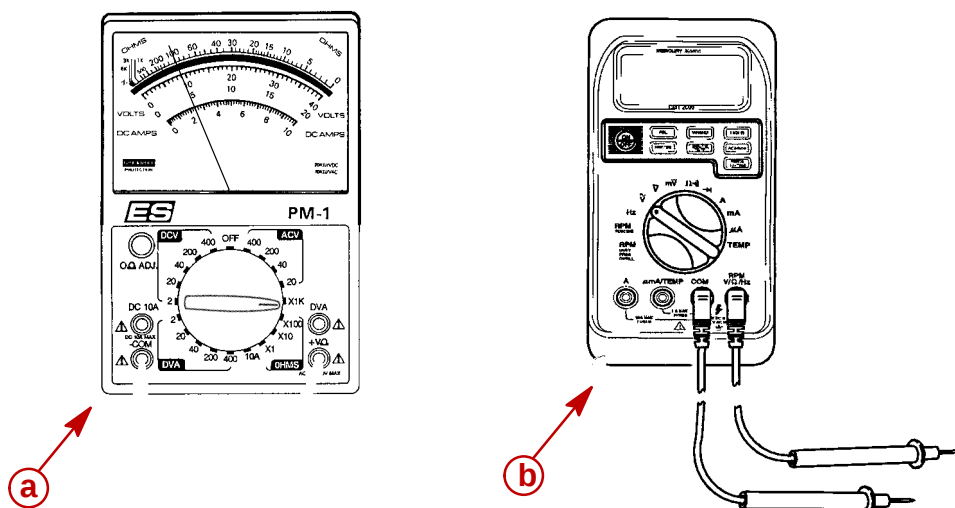




4. Flywheel Puller (91-83164M)



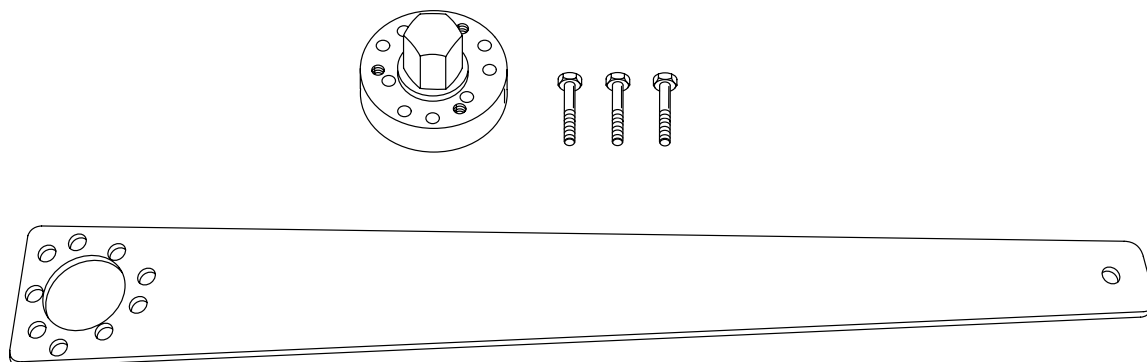
5. Multi-Meter/DVA Tester (91-99750) or DMT 2000 Digital Tachometer/Multi-Meter (91-854009A1)



a- Multi-Meter/DVA Tester 91-99750

b- DMT 2000 Digital Tachometer/Multi-Meter 91-854009A1

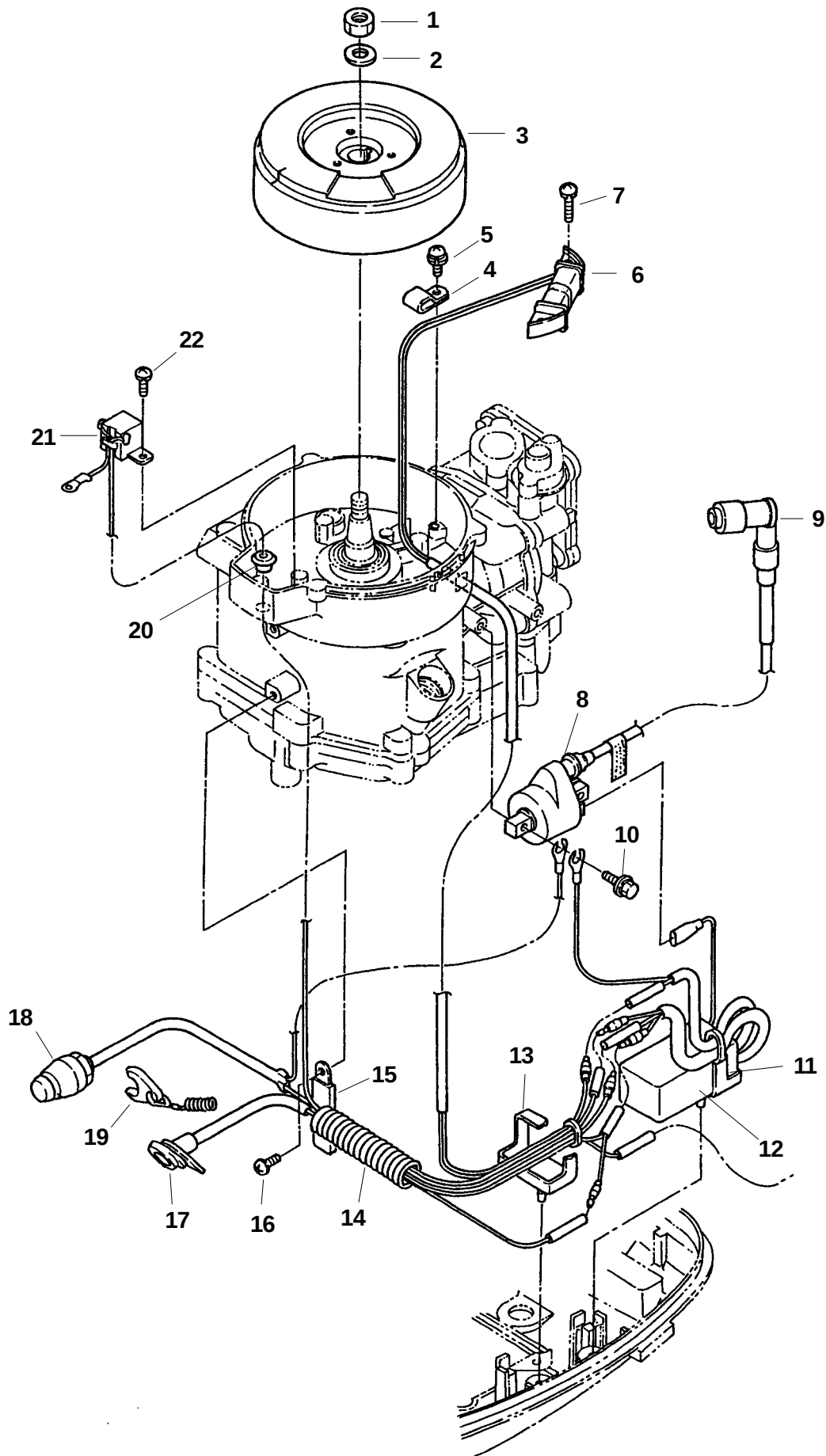
6. Flywheel Holder/Puller (91-804552)



57518



Electrical Components





Electrical Components

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	NUT		40	54
2	1	WASHER			
3	1	FLYWHEEL			
4	1	CLAMP			
5	1	SCREW	Drive Tight		
6	1	EXCITER COIL			
7	2	SCREW	14		1.5
8	1	IGNITION COIL			
9	1	BOOT			
10	2	BOLT (M6 x 20mm)	70		8
11	1	REAR DAMPER			
12	1	CD UNIT (4/5 H.P.)			
	1	CD UNIT (6 H.P.)			
13	1	FRONT DAMPER			
14	1	SLEEVE			
15	1	CLAMP			
16	1	SCREW	Drive Tight		
17	1	WARNING LAMP			
18	1	STOP SWITCH			
19	1	LANYARD			
20	1	GROMMET			
21	1	PULSER COIL			
22	2	SCREW	Drive Tight		



Description

A single cylinder capacitor discharge ignition (CDI) system is utilized on this model. Major components of this system are the flywheel/magneto, capacitor charging coil, CDI unit, ignition coil and a spark plug. A stop switch is provided which shorts the trigger coil to ground preventing ignition from taking place.

Test Procedures

IMPORTANT: When using an ohmmeter for any resistance test, always zero meter movement whenever scales are changed.

IMPORTANT: If engine misfires, runs rough or does not start, the ignition system should be checked with a volt meter capable of measuring 400 VDC or higher and direct voltage adaptor (91-89045) or multi-meter/DVA tester (91-99750). Follow instructions in test manual included with DVA or multi-meter DVA tester.

Direct Voltage Adaptor Specifications

Test	Selector Switch Position	DVA Leads		Volts ⁽¹⁾ @ 300-2000 RPM
		Red	Black	
Ignition Coil PRI	400 VDC	Ground	Black/Yellow Lead	120-300
Charge Coil	400 VDC	Black/Red Lead	Ground	150-325
Stop Circuit	400 VDC	Brown Lead	Ground	175-300

⁽¹⁾ Reading at cranking and/or idle speed.

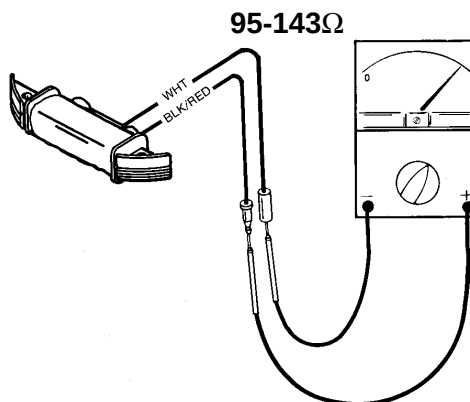
IMPORTANT: If DVA or Multi-Meter/DVA Tester is not available, alternate tests can be performed using an ohmmeter and a Models 9800 Merc-o-tronic Magneto Analyzer (91-76032), as follows.

Capacitor Charging Coil

⚠ CAUTION

DO NOT rotate flywheel during test or damage to meter may result.

1. Use an ohmmeter to perform the following test.



2. If meter readings are other than specified, replace capacitor charging coil. Refer to "Ignition Components Removal and Installation," following.



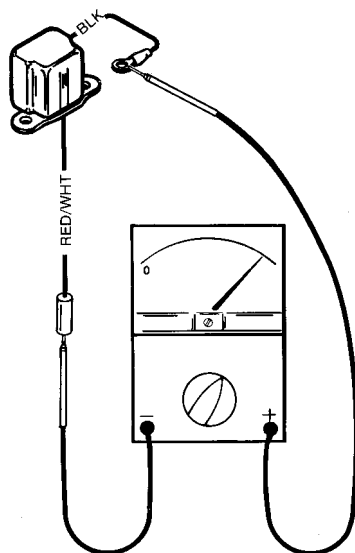
Trigger Coil

⚠ CAUTION

DO NOT rotate flywheel during test or damage to meter may result.

1. Use an ohmmeter to perform the following test.

149-223Ω

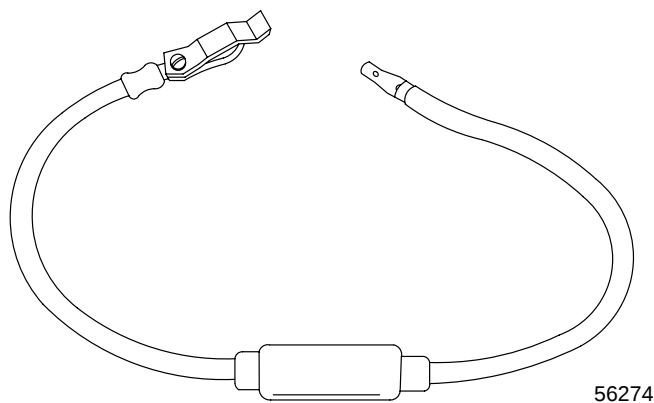


2. If meter readings are other than specified, replace trigger coil. Refer to "Ignition Components Removal and Installation," following.

Ignition Coil

A. SPARK TEST

1. Install spark gap tester (91-63998A1) between high tension spark plug lead and engine ground.

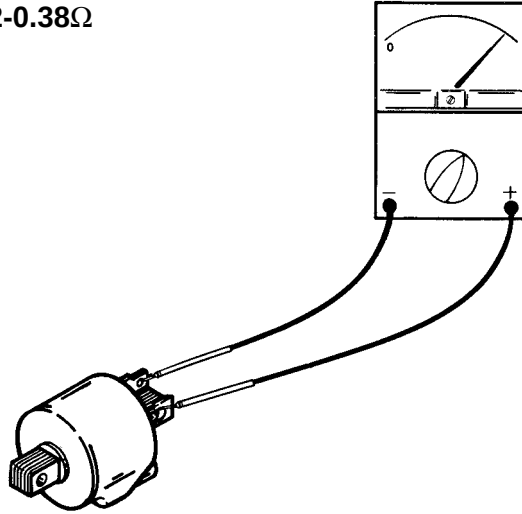


2. Crank engine over using starter rope. Spark should occur at tester.
3. If test yields no spark, or engine will not run properly, proceed to tests B thru E.

**B. RESISTANCE TEST**

1. Use an ohmmeter to perform the following primary winding test.

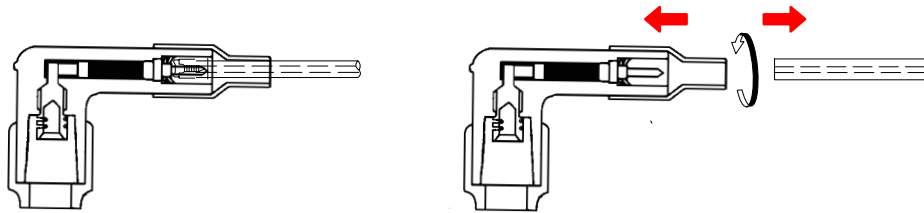
0.02-0.38Ω



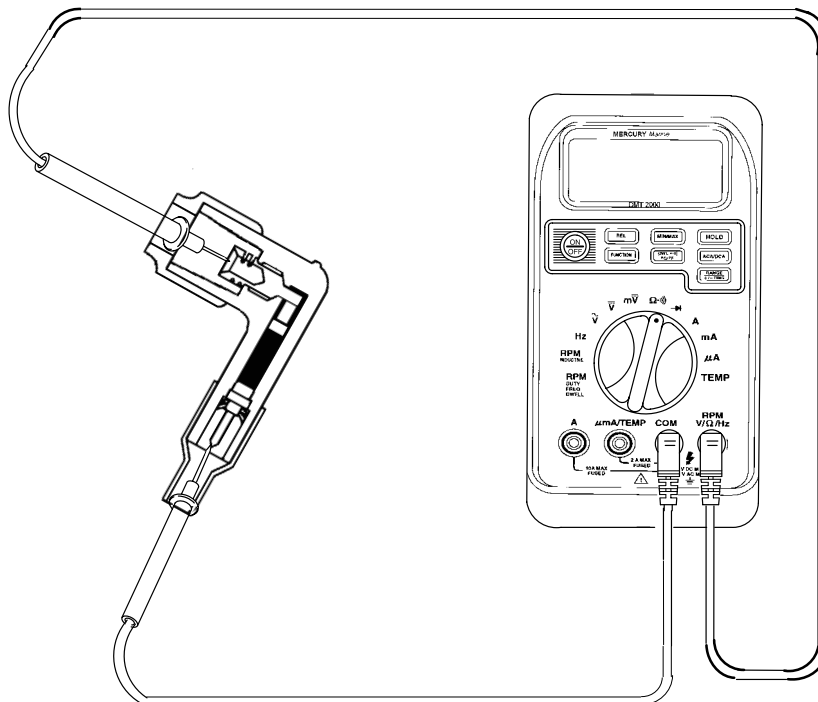
2. Use an ohmmeter to perform the following secondary winding test.

NOTE: High tension cables must have spark plug cap removed before testing. Cap contains 5k ohm resistor.

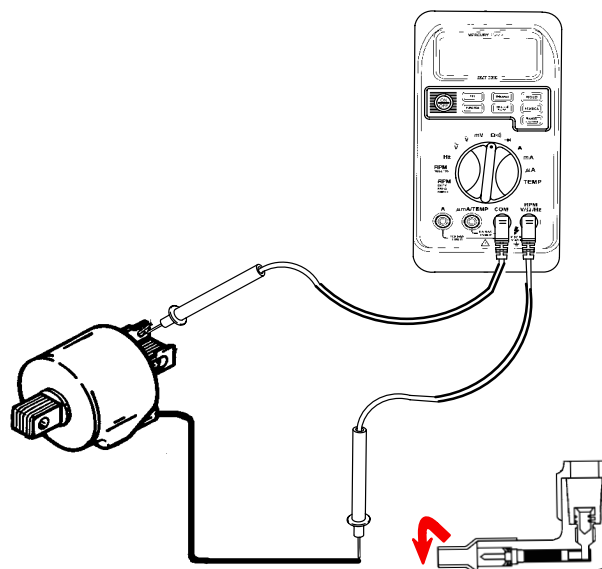
IMPORTANT: To remove spark plug cap from high tension leads, turn cap counter-clockwise while applying slight outward pressure. DO NOT PULL HARD or lead may be damaged. To install cap, turn cap clockwise threading cap onto high tension lead.



55852

**3500 - 5200 Ω** 

55853

3000-4400 Ω 

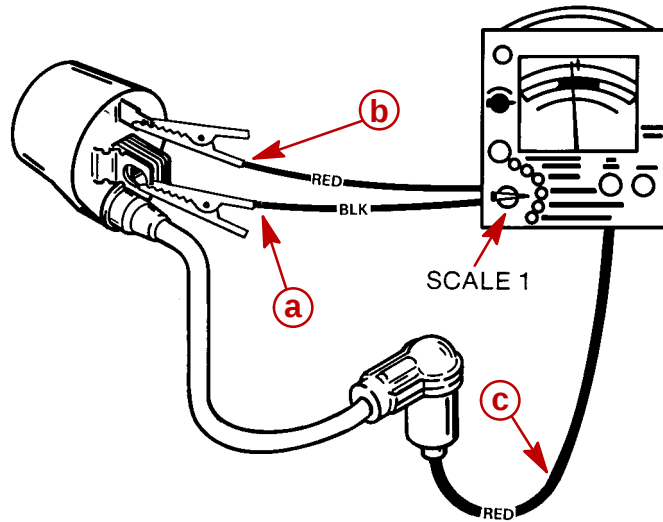
3. If meter readings are other than specified, replace ignition coil. Refer to "Ignition Component Removal Installation," following.



C. POWER TEST - OPTIONAL

IMPORTANT: A model 9800 Merc-o-tronic Magneto Analyzer (91-76032) with coil selector switch set on “CDI” must be used for test C thru E.

1. Connect magneto analyzer test leads to ignition coil.



- a-** Black Analyzer Test Leads - Connected to Ignition Coil Ground
- b-** Red Analyzer Test Lead - Connected to Spade Connector of Ignition Coil
- c-** Large Red Analyzer Test Lead - Connected to High Tension Spark Plug Lead (Wire Spring Inside Spark Plug Boot)

2. Turn “Hi-Lo” current control knob all the way left past “Lo” position.
3. Set analyzer to position 1 “Coil Power Test.”
4. Slowly turn current control knob clockwise while noting current value on scale 1.
5. When current value reaches 1.7 to 2.1 amperes, stop turning current control knob and note 5 mm spark gap; it should be firing steadily.
6. If spark is faint, intermittent or no spark occurs at 2.1 amperes, replace ignition coil.
7. If ignition coil checks out OK, proceed to Test D “High Speed Test.”

D. HIGH SPEED TEST - OPTIONAL

⚠ CAUTION

This test must be completed as quickly as possible and immediately upon completion, turn the “Hi-Lo” knob fully counterclockwise and put selector switch in “off” position.

1. Turn current control knob clockwise for maximum reading on meter scale 1. Do not exceed meter range (4 amps).
2. The 5mm spark gap should be firing constantly.
3. If spark is faint, intermittent or no spark occurs, the ignition coil is defective at high speed and must be replaced.
4. Turn current control knob fully counterclockwise and put selector switch to “off.”
5. If ignition coil checks out OK, proceed to Test E “Surface Insulation Test.”



E. SURFACE INSULATION TEST - OPTIONAL

⚠ CAUTION

Complete this test as rapidly as possible, as it is a severe test on the coil.

1. Remove large red test lead from high tension spark plug lead.
2. Plug insulation test probe into "Probe Test" jack on analyzer.
3. Set analyzer to position 1. "Coil Power Test."
4. Turn "Hi-Lo" current control knob to "Hi" position but DO NOT exceed meter range (4 amps).

IMPORTANT: DO NOT allow test probe to linger too long at any one point.

5. Pass insulation test probe over insulating surfaces of the ignition coil and high tension leads.
6. If coil or high tension lead insulation is cracked, leaking or damaged, a steady spark discharge will occur between the cracked or leaking surface and the test probe.

NOTE: A faint spark does not indicate damaged coil.

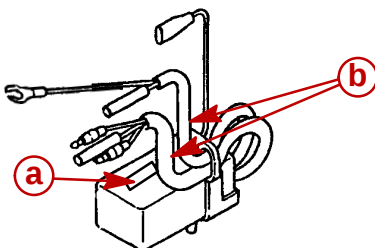
7. Turn current control knob fully counterclockwise and put selector switch in "off" position.
8. Replace ignition coil and leads if any surface is damaged.

CDI Unit

IMPORTANT: The CDI unit can only be tested satisfactorily using a volt meter (capable of measuring 400 volts DC or higher) and Direct Voltage Adaptor (91-99045), or Multi-Meter/DVA Tester (91-99750). Follow instructions in test manual included with DVA or Multi-Meter/DVA Tester.

Test	Selector Switch Position	DVA Leads		Volts (1) @ 300 - 2000 RPM
		RED	BLACK	
Ign. Coil Primary	400 VDC	Ground	BLACK/YELLOW	120 - 300
Charge Coil	400 VDC	BLACK/RED	Ground	150 - 325
Stop Circuit	400 VDC	BROWN	Ground	175 - 300

NOTE: 2000 model year outboards have model name stamped on surface top, indicating outer tube color, rev. limit (rpm), and ignition timing.



a - Model Name

b - Outer Tube

Model Name	Outer Tube Color	Rev. Limit (rpm)	Ignition Timing
CU2526	BLACK	5900	BTDC 5 - 25
CU2564	GRAY	5900	BTDC 25
CU2568	BLUE	6300	BTDC 25



Ignition Components Removal and Installation

Flywheel

NOTE: Flywheel assembly may be removed through the use of a Strap Wrench (91-24937A1) or Flywheel Holder/Puller (91-804552)

REMOVAL – STRAP WRENCH METHOD

1. Remove rewind starter. Refer to Section 8.

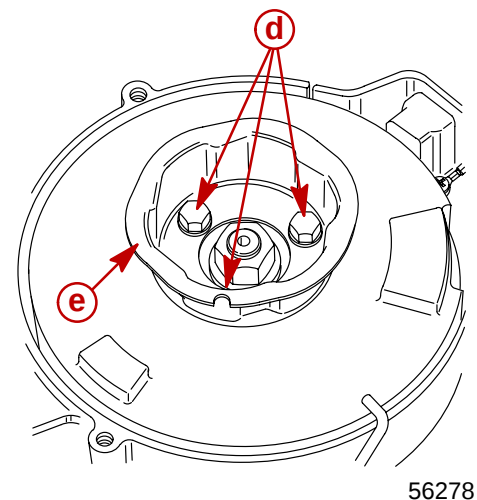
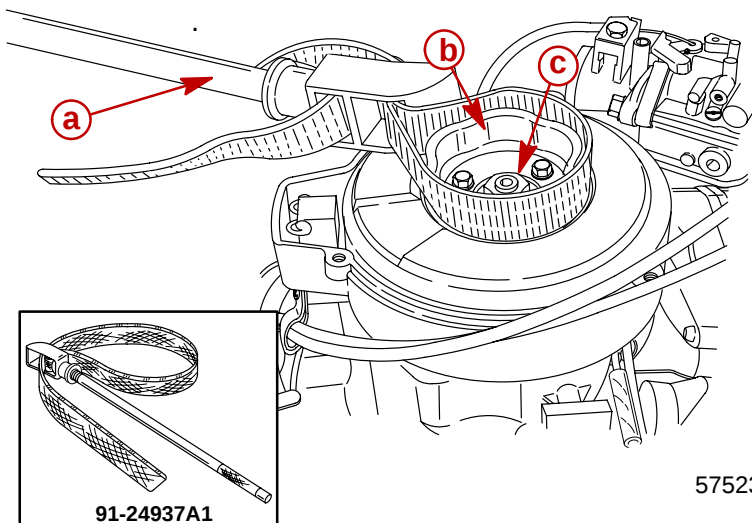
⚠ CAUTION

Do not strike flywheel with a hard object, as flywheel damage could occur.

⚠ WARNING

Engine could possibly start when turning flywheel during removal and installation; therefore, disconnect spark plug lead to prevent engine from starting.

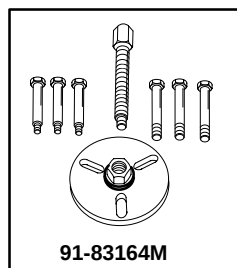
1. Use strap wrench to hold starter pulley. Loosen flywheel nut until nut is flush with end of crankshaft.
2. Remove three bolts and starter pulley.



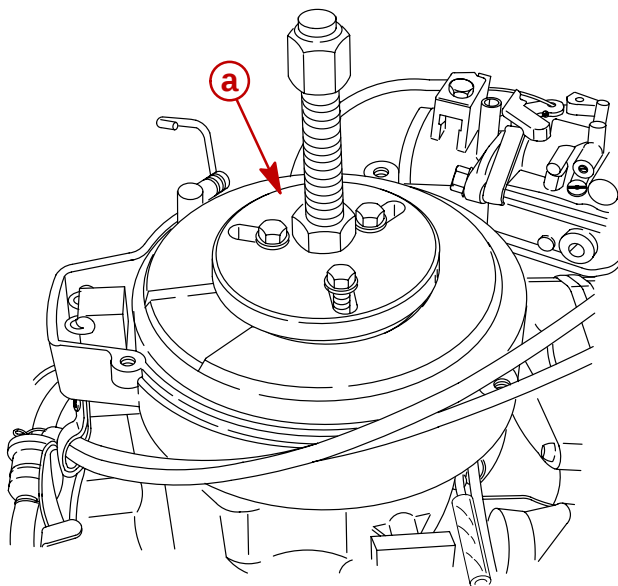
- a - Strap Wrench
- b - Starter Pulley
- c - Flywheel Nut
- d - Bolts (3)
- e - Starter Pulley



3. Use puller to pull flywheel.
4. Remove puller, flywheel nut, washer, flywheel and key.



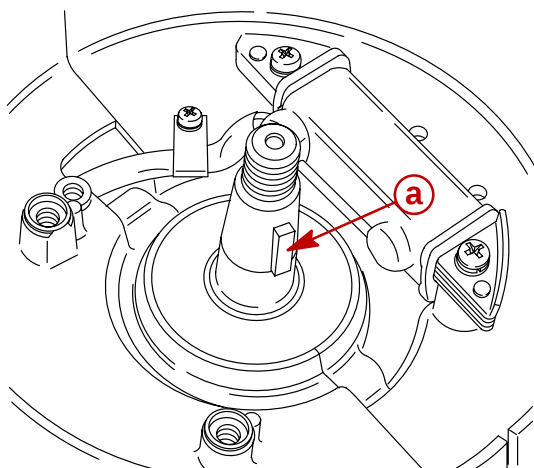
a - Puller



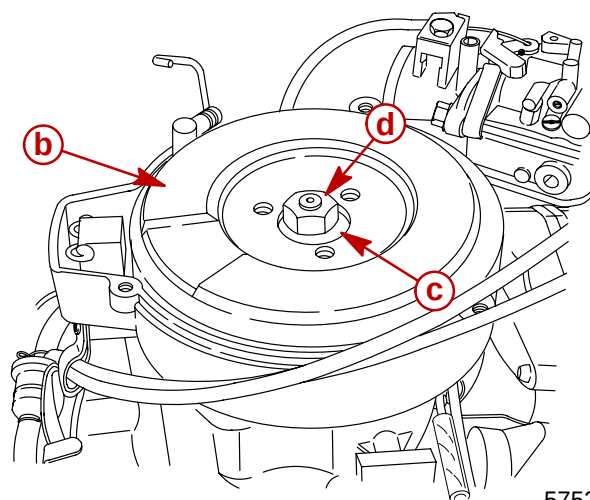
57524

INSTALLATION

1. Install flywheel key.
2. Install flywheel, washer and nut onto end of crankshaft.



56280



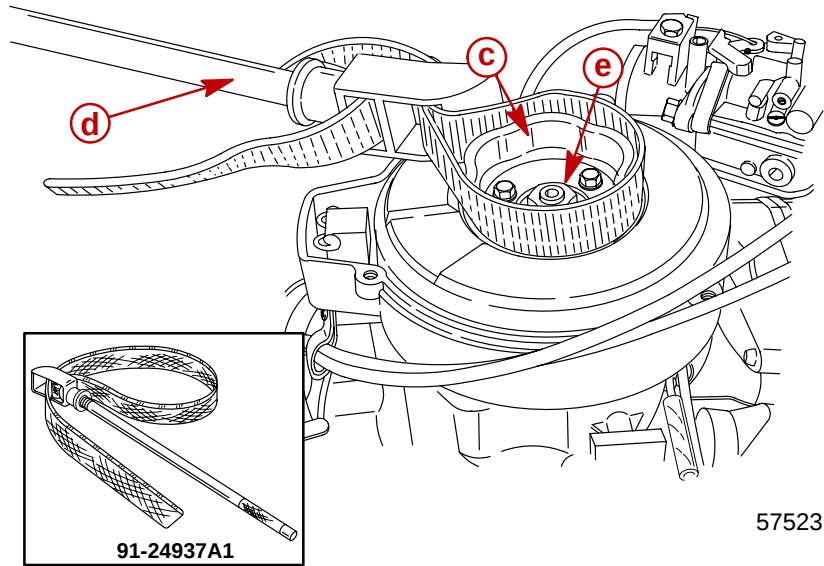
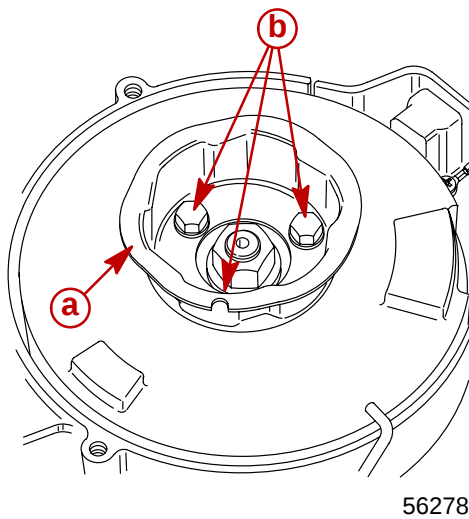
57522

- a** - Flywheel Key
b - Flywheel
c - Washer
d - Nut



INSTALLATION – Continued

1. Install starter pulley and three bolts and lockwashers. Torque to 70 lb-in. (8 Nm).
2. Hold starter pulley with strap wrench. Torque nut to 40 lb-ft (54.0 Nm).

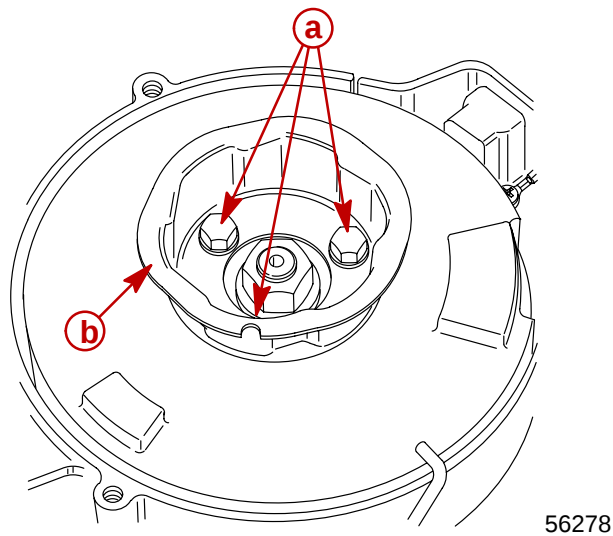


- a** - Starter Pulley
- b** - Bolts/Lockwashers (3)
- c** - Starter Pulley
- d** - Strap Wrench
- e** - Nut

3. Reinstall rewind starter and start-in-gear protection link rod, as outlined in Section 8 "Rewind Starter".

REMOVAL – FLYWHEEL HOLDER/PULLER METHOD

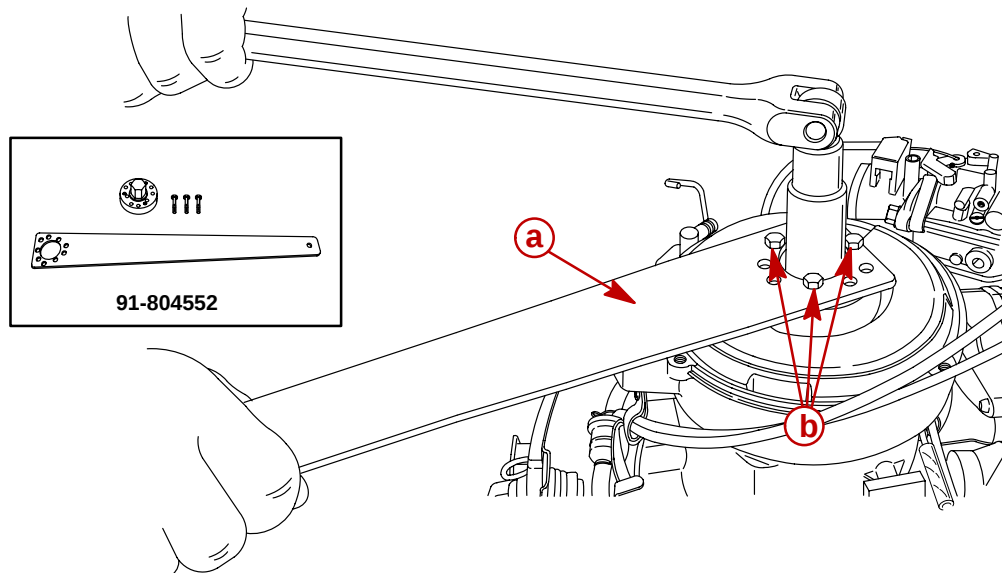
1. Remove rewind starter. Refer to Section 8.
2. Remove three bolts and starter pulley.



- a** - Bolts (3)
- b** - Starter Pulley

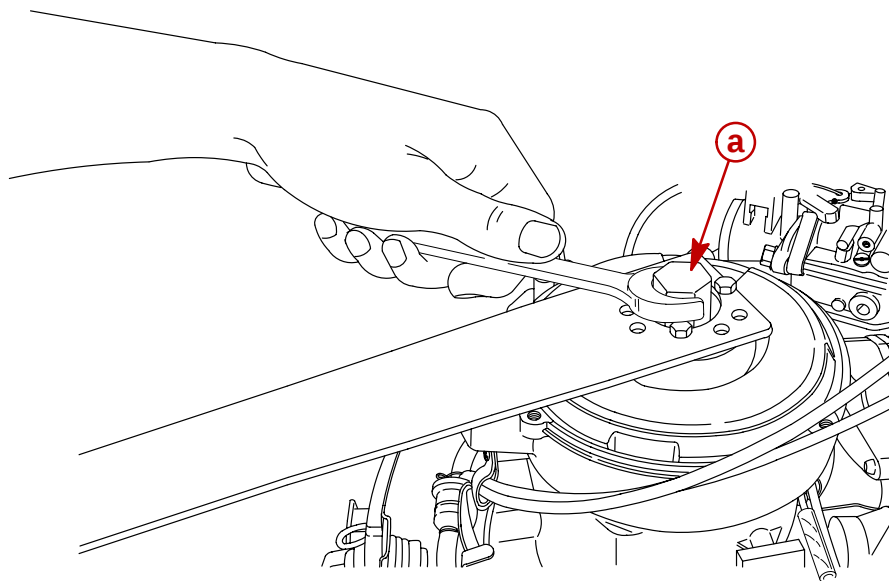


3. Secure flywheel holder to flywheel with 3 bolts. Loosen flywheel nut until nut is flush with end of crankshaft. Do not remove nut at this time.



57521

4. Thread flywheel puller into flywheel holder. While holding flywheel, tighten puller against crankshaft until flywheel loosens. Remove flywheel holder/puller. Remove flywheel nut. Remove flywheel.

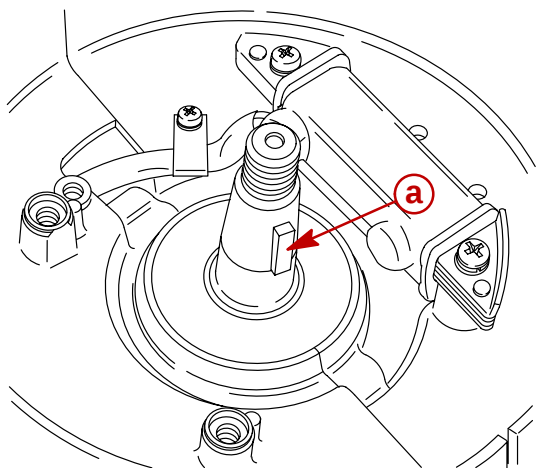


57519

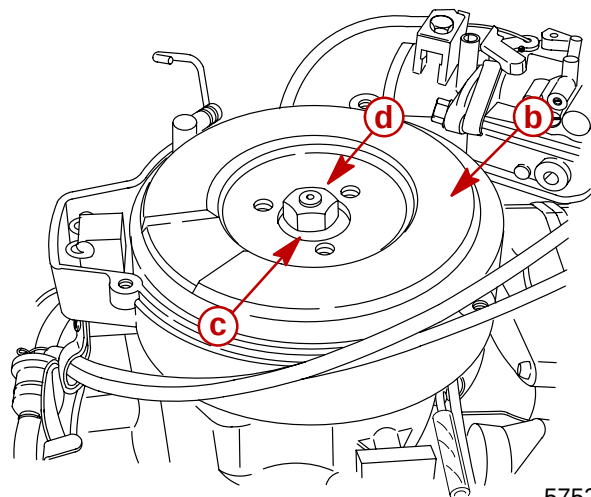


INSTALLATION

1. Install flywheel key.
2. Install flywheel, washer and nut onto end of crankshaft.



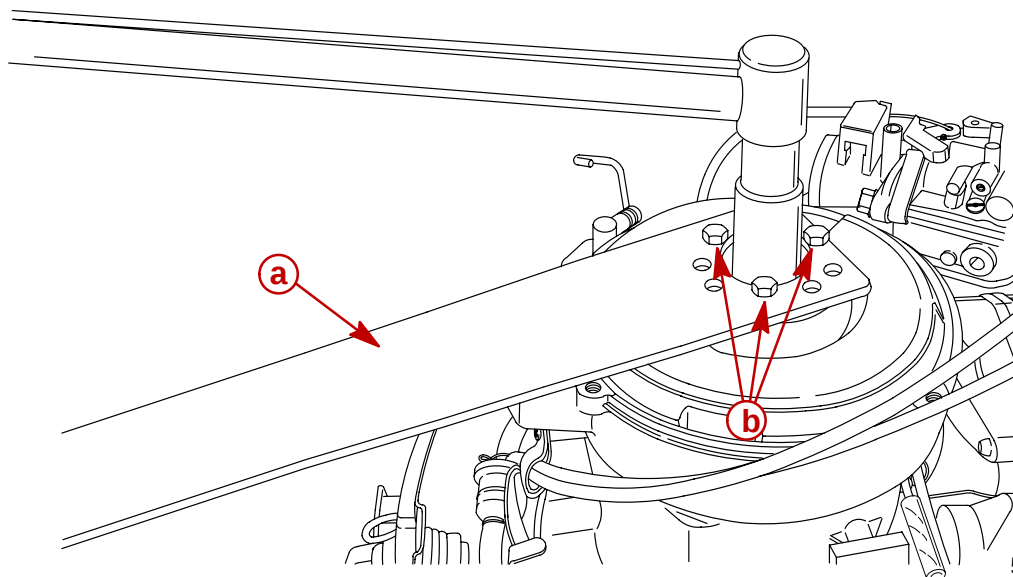
56280



57522

- a** - Flywheel Key
- b** - Flywheel
- c** - Washer
- d** - Nut

3. Secure flywheel holder to flywheel with 3 bolts.
4. Torque flywheel nut to 40 lb-ft (54.0 Nm)



57520

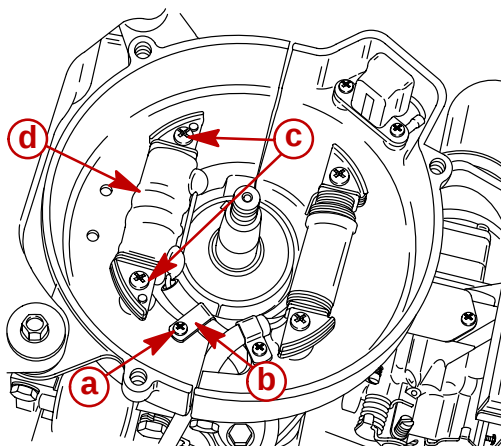
- a** - Flywheel Holder
- b** - Bolts (3)



Capacitor Charging Coil

REMOVAL

1. Remove flywheel. Refer to “Flywheel” - “Removal” preceding.
2. Remove screw and clamp.
3. Disconnect BLACK/RED and WHITE coil leads from CDI unit leads.
4. Remove screws securing capacitor charging coil, then remove coil.

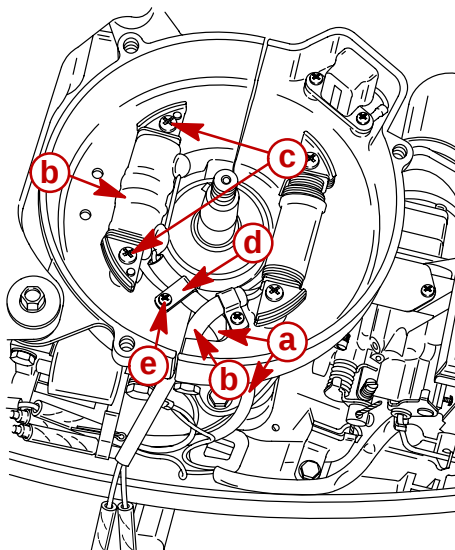


a - Screw
b - Clamp

c - Screws (2)
d - Capacitor Charging Coil

INSTALLATION

1. Route capacitor charging coil leads, as shown and place coil over mounting bosses of crankcase cover.
2. Secure coil with 2 screws. Torque screws to 14 lb-in. (1.6 Nm).
3. Secure coil leads/sleeve, using wire clamp and screw. Tighten screw securely.
4. Connect BLACK/RED and WHITE capacitor charging coil leads to CDI unit leads.



a - Coil Leads
b - Coil
c - Screws (2)

d - Wire Clamp
e - Screw

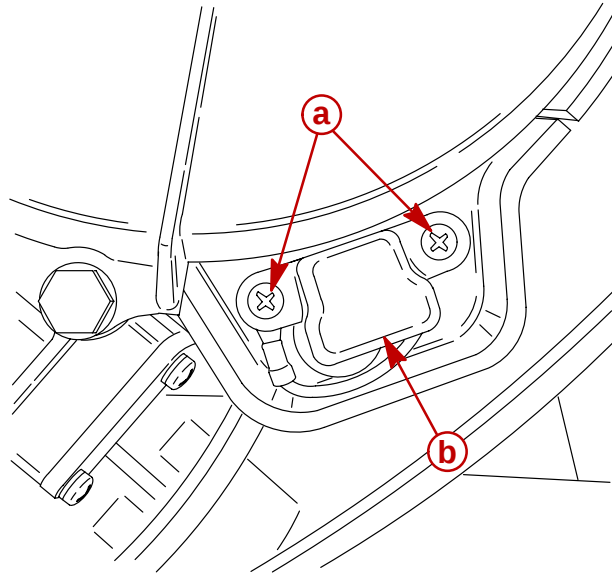
5. Reinstall flywheel, as outlined in “Flywheel” - “Installation,” preceding.



Trigger Coil

REMOVAL

1. Disconnect RED/WHITE coil lead from CDI unit.
2. Remove 2 screws and pull trigger coil from housing.

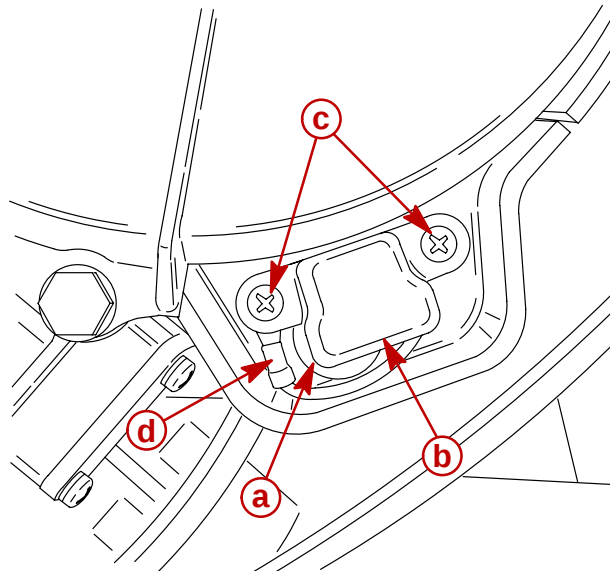


56286

- a-** Screws (2)
b- Trigger Coil

INSTALLATION

1. Route coil leads through rubber grommet and connect RED/WHITE coil lead to CDI unit lead.
2. Secure trigger coil using screws. Make sure to attach ground wire under screw as shown.



56286

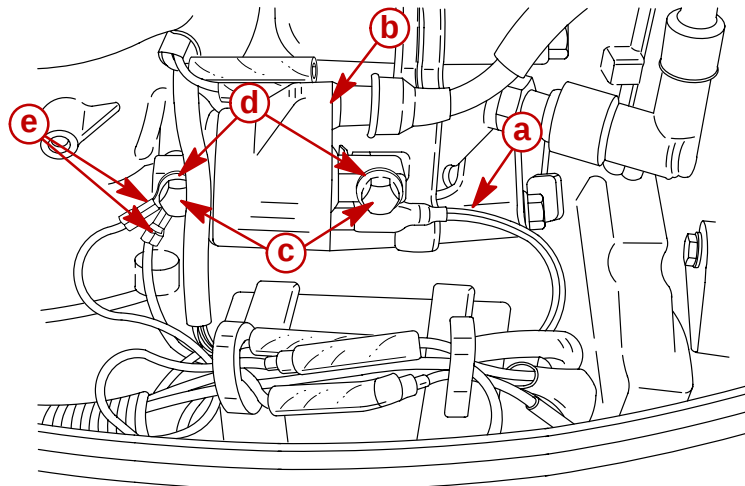
- a-** Rubber Grommet
b- Trigger Coil
c- Screws (2)
d- Ground Wire



Ignition Coil

REMOVAL

1. Disconnect BLACK/YELLOW CDI unit lead from coil.
2. Disconnect high tension plug lead from spark plug.
3. Remove bolts, and washers and remove coil while disconnecting BLACK ground wires.

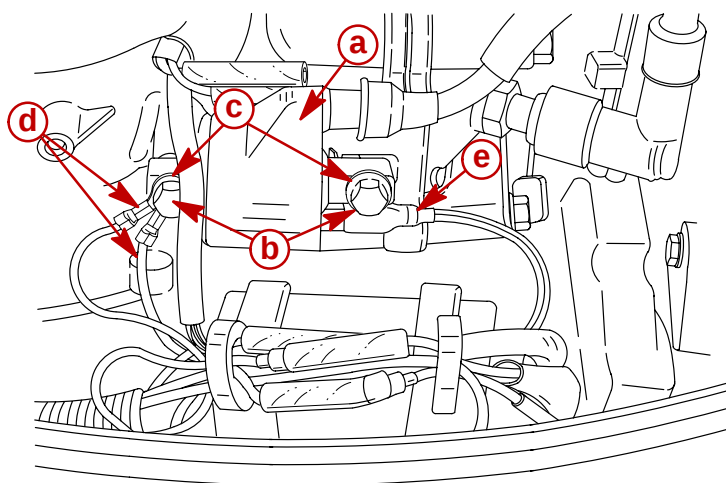


57522

- a** - BLACK/YELLOW CDI Lead
- b** - Coil
- c** - Bolts (2)
- d** - Washers (2)
- e** - BLACK Ground Wires

INSTALLATION

1. Secure ignition coil using bolts and washers. Torque bolts to 70 lb-in. (8 Nm). Make sure to connect BLACK ground wires as shown.
2. Reconnect BLACK/YELLOW CDI unit lead to ignition coil.



57522

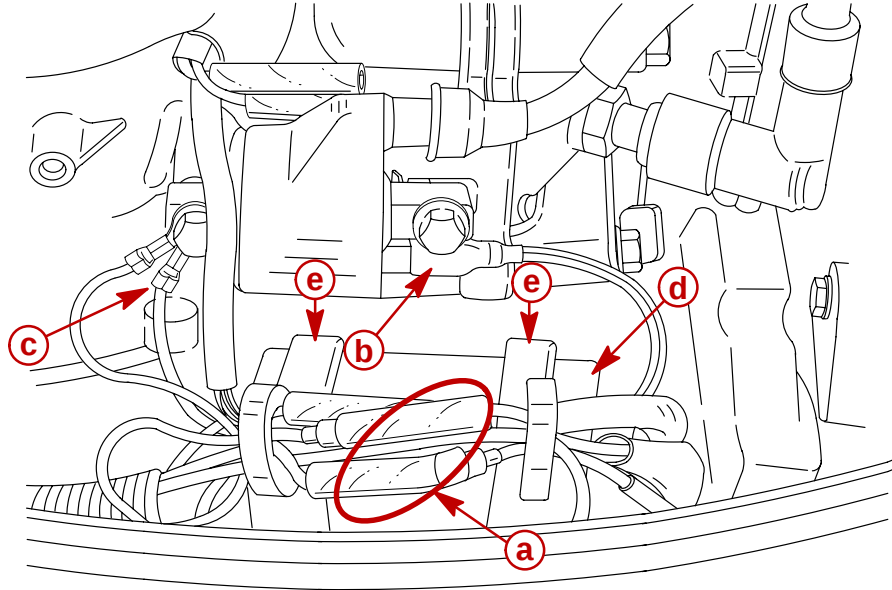
- a** - Coil
- b** - Bolts (2)
- c** - Washers (2)
- d** - BLACK Ground Wires
- e** - BLACK/YELLOW CDI Lead



CDI Unit

REMOVAL

1. Disconnect 4 CDI unit lead bullet connectors, BLACK/YELLOW CDI unit lead at ignition coil and BLACK CDI unit ground lead from ignition coil mounting bolt.
2. Slide CDI unit out of rubber brackets.



57522

- a** - Bullet Connectors
- b** - BLACK/YELLOW CDI Lead
- c** - BLACK CDI Ground Lead
- d** - CDI Unit
- e** - Rubber Brackets

INSTALLATION

1. Slide CDI unit into rubber brackets.
2. Connect 4 CDI unit lead bullet connectors, BLACK/YELLOW CDI unit lead to ignition coil and BLACK CDI unit ground lead under ignition coil mounting bolt.



ELECTRICAL

Section 2B - Charging System

Table of Contents

Specifications	2B-1	Removal	2B-4
Special Tools	2B-2	Installation	2B-4
Test Procedures	2B-3	Rectifier (Battery Charging)	2B-5
Lighting Coil	2B-3	Installation	2B-5
Rectifier Diode Test (Optional)	2B-3	Battery Connections	2B-7
Lighting Coil Removal and Installation	2B-4	Special Operating Instructions	2B-7

**2
B**

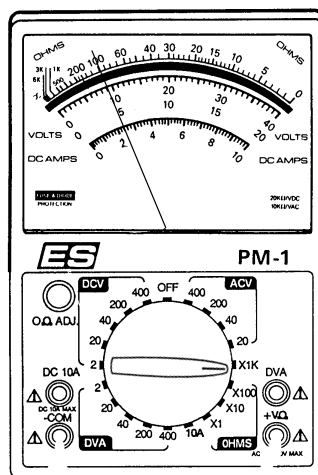
Specifications

CHARGING SYSTEM Readings taken @ 68°F (20°C).	Alternator (Optional) Type: Lighting Coil Lighting Coil Resistance Battery Charging Rectifier (Optional)	12 Volt 60 Watt (Non Regulated Lighting Coil) 0.31 - 0.47 Ω (YEL/RED - YEL/RED) 5 Amperes (Rectified)
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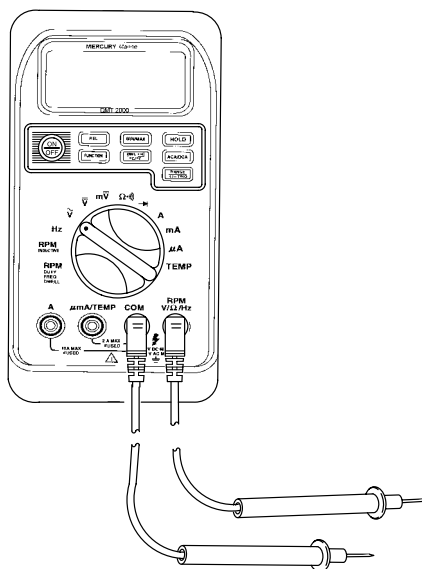


Special Tools

1. Multi-Meter/DVA Tester (91-99750)



2. DMT 2000 Digital Tachometer/Multi-meter (91-854009A1)





Test Procedures

IMPORTANT: When using an ohmmeter for any resistance test, always zero meter movement whenever scales are changed.

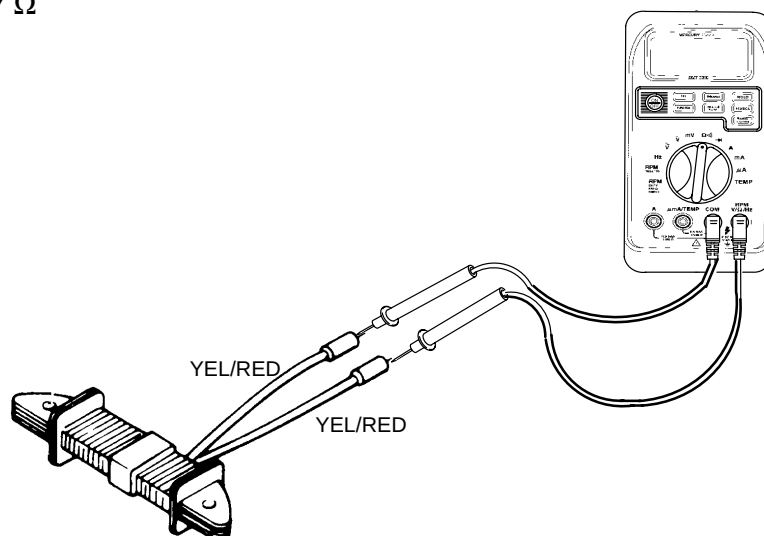
Lighting Coil

⚠ CAUTION

DO NOT rotate flywheel during test or damage to meter may result.

1. Use an ohmmeter to perform the following test.

0.31 - 0.47 Ω

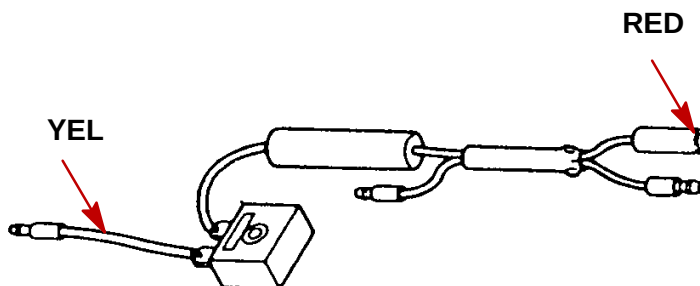


2. If meter readings are other than specified, replace lighting coil. Refer to "Ignition Components Removal and Installation," following.

Rectifier Diode Test (Optional)

CONTINUITY TEST

1. Connect ohmmeter between YEL and RED rectifier leads (note reading), then reverse test leads. Continuity should be found in only one direction.
2. Replace rectifier if reading are the same for both tests.

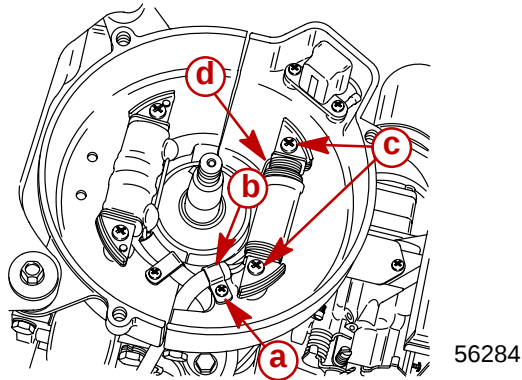




Lighting Coil Removal and Installation

Removal

1. Remove manual starter. Refer to Section 8.
2. Remove flywheel. Refer to Section 2A.
3. Remove screw and clamp.
4. Disconnect both YELLOW/RED coil leads.
5. Remove screws securing lighting coil, then remove coil.

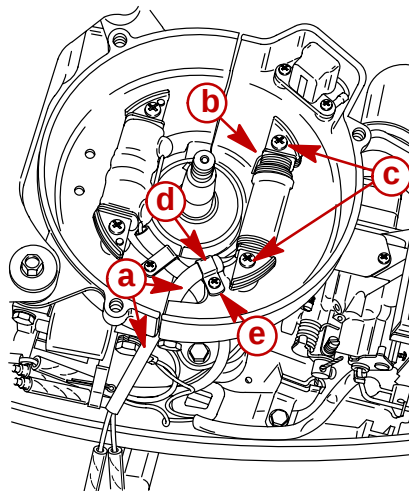


a - Screw
b - Clamp

c - Screws (2)
d - Lighting Coil

Installation

1. Route lighting coil leads, as shown and place coil over mounting bosses of crankcase cover.
2. Secure coil with 2 screws. Torque screws to 14 lb-in. (1.6 Nm).
3. Secure coil leads/sleeve, using wire clamp and screw. Tighten screw securely.
4. Connect both YELLOW/RED lighting coil leads to rectifier or lighting harness.



a - Lighting Coil Leads
b - Coil
c - Screws (2)

d - Wire Clamp
e - Screw

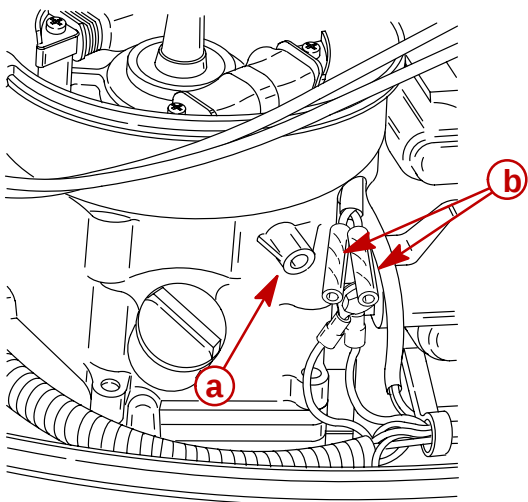
5. Install flywheel. Refer to Section 2A.
6. Install manual starter. Refer to Section 8.



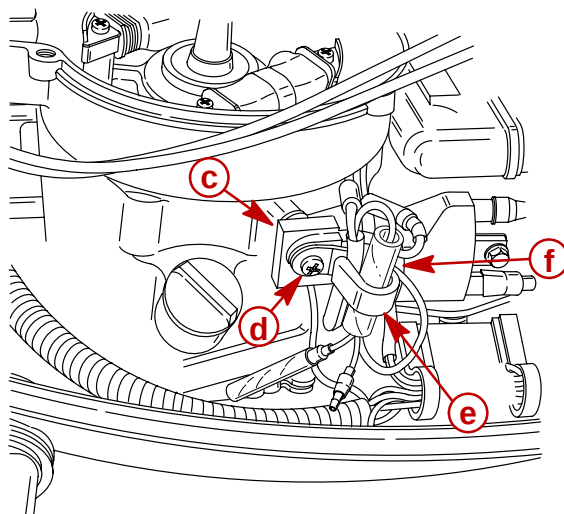
Rectifier (Battery Charging)

Installation

1. This rectifier kit provides DC current for battery charging, and must be installed in conjunction with Alternator Kit.
2. Secure rectifier to crankcase cover, as shown.



57352

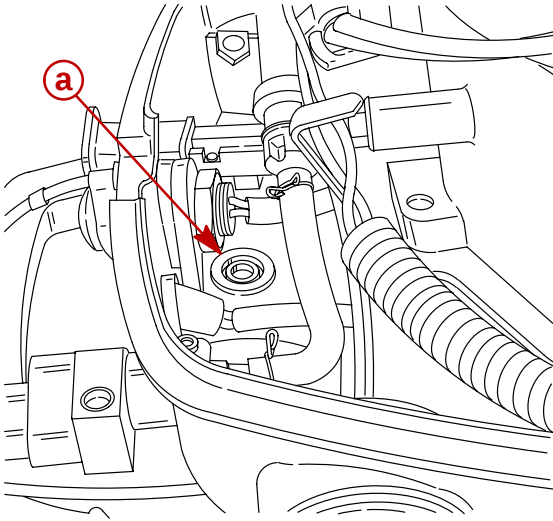


57353

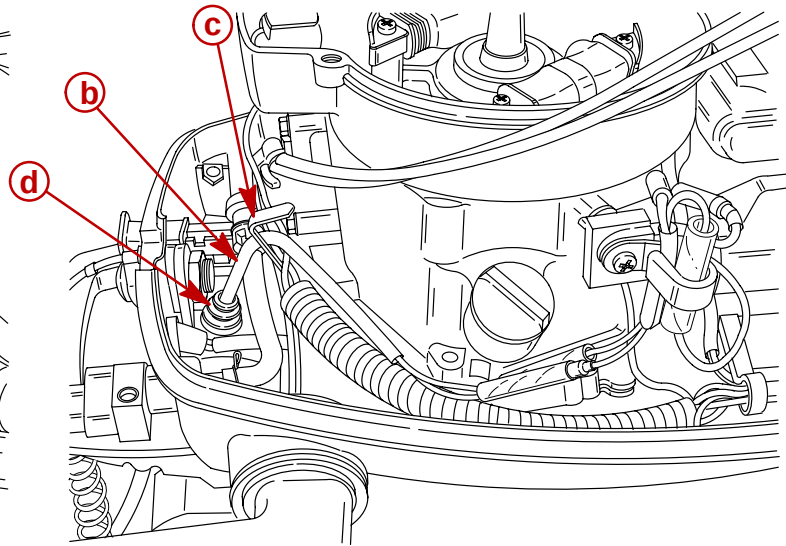
- a** - Threaded Boss
- b** - Alternator Leads
- c** - Rectifier
- d** - Screw and Lockwasher
- e** - Clamp
- f** - Fuse Holder



3. Remove and discard rubber plug from bottom cowl.
4. Refer to Wiring Diagram "A" and route extension harness thru opening in bottom cowl.



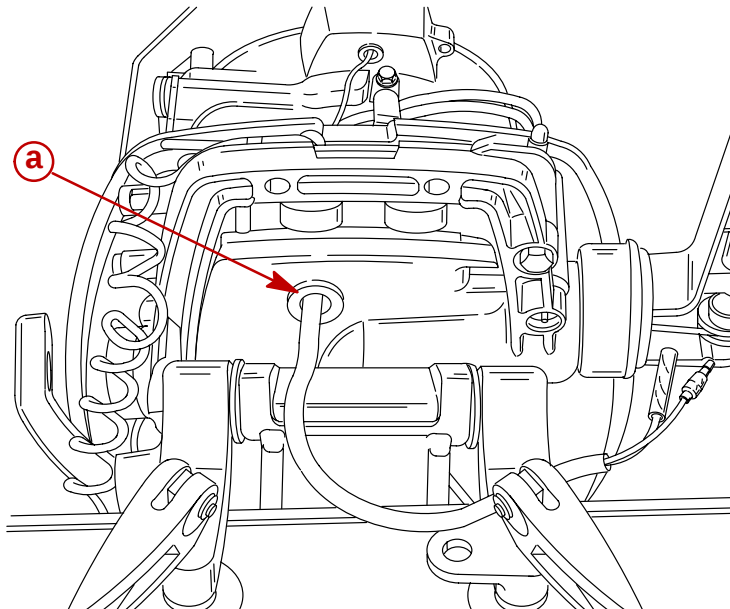
57354



57355

- a** - Plug
- b** - Harness
- c** - Clamp (existing)
- d** - Grommet (provided)

5. Push rubber grommet of extension harness, into opening in bottom cowl.

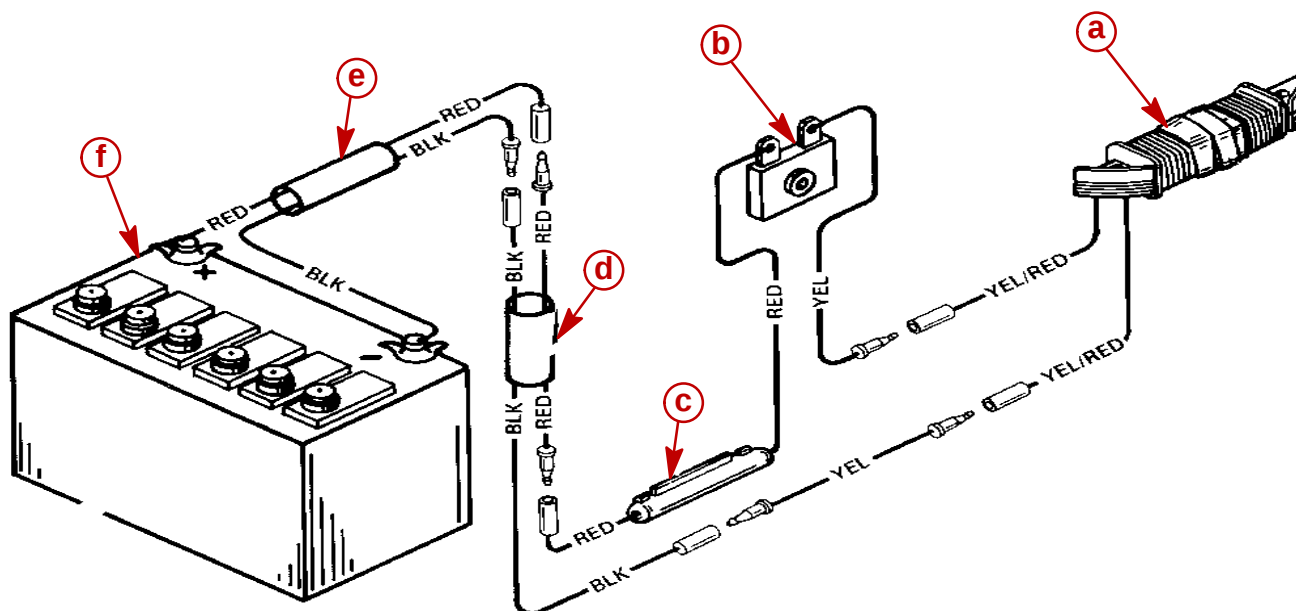


57356

- a** - Rubber Grommet



6. Make all wiring connections, as shown in wiring diagram "A".



WIRING DIAGRAM "A" Rectifier Kit Installation

- a- Alternator Kit (16837A2)
- b- Rectifier
- c- Fuse Holder with 10 Amp Fuse
- d- Extension Harness - 22 in. (56 cm) Long
- e- Battery Harness - 69 in. (175 cm) Long
- f- Battery

Battery Connections

⚠ CAUTION

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

House battery in a battery box and secure in a favorable position in boat.

Connect red battery harness lead to positive (+) battery terminal and black battery harness lead to negative (-) battery terminal.

Special Operating Instructions

⚠ CAUTION

Disconnect both (2) yellow/red alternator leads (refer to Wiring Diagram "A") before operating outboard motor without battery harness leads connected to battery.



ELECTRICAL

Section 2C - Timing and Synchronization

Table of Contents

Specifications	2C-1	TDC Timing Mark Alignment	2C-3
Special Tools	2C-2	Check Timing	2C-4
Ignition Timing	2C-3		

**2
C**

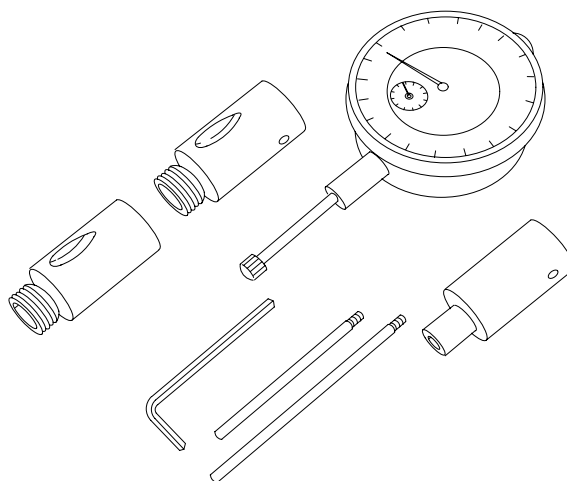
Specifications

IGNITION SYSTEM Readings taken @ 68°F (20°C).	Type	Capacitor Discharge Ignition
	Spark Plug: Type Gap Hex Size Torque Firing Order Ignition Timing: (Fixed) Capacitor Charge Coil Resistance Trigger Coil Resistance Ignition Coil Resistance: Primary Secondary (W/o Boots) Spark Plug Boot Engine Speed Limiter Oil Pressure Switch (Red Light)	NGK DCPR6E 0.035 in. (0.9 mm) 5/8 in. (16 mm) 13 lb-ft (17.5 Nm) 1 25° ± 1° B.T.D.C. 95 - 134 Ω (WHT - BLK/RED) 149 - 243 Ω (RED/WHT - BLK) 0.02 - 0.38 Ω 3000 - 4400 Ω 3500 - 5200 Ω 6300 ± 200 rpm Continuity Below 3.5 psi ± 0.7 psi (24.5 ± 5 kPa) @ 68°F (20°C)

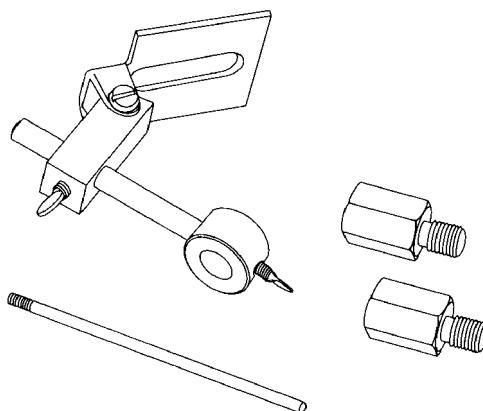


Special Tools

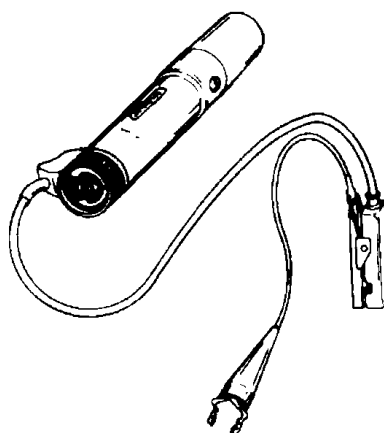
1. Dial Indicator Gauge Kit (91-58222A1)



2. Dial Indicator Adaptor Kit (91-83155)



3. Timing Light (91-99379)





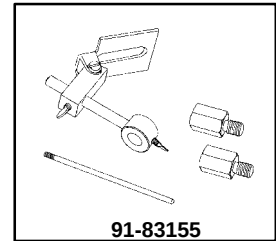
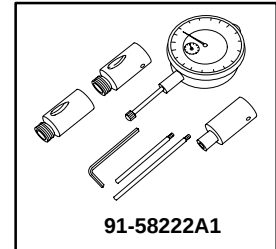
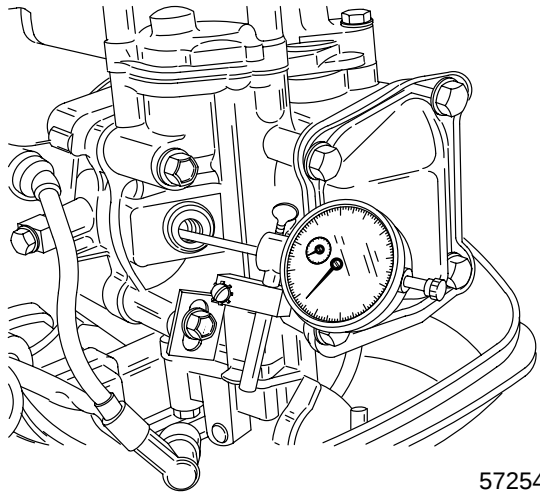


Ignition Timing

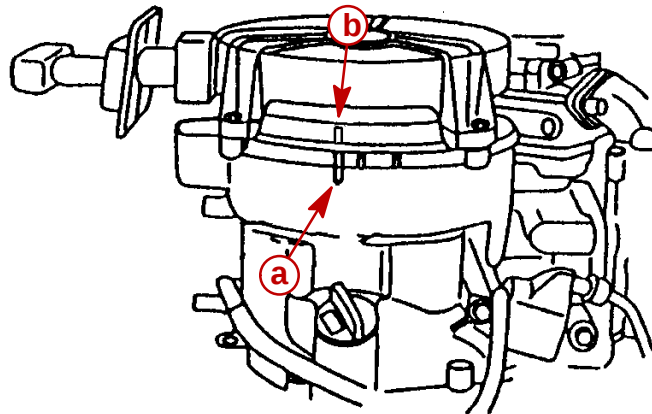
TDC Timing Mark Alignment

IMPORTANT: As this ignition system is fixed, no adjustment to ignition timing is possible. If ignition timing is not within specifications, refer to “Test Procedures” following to locate faulty component(s).

1. Remove spark plug.
2. Install dial indicator through spark plug opening in cylinder head.



3. Rotate flywheel to bring piston to TDC position. Check that crankcase cover/cylinder block TDC mark is aligned with timing mark on flywheel.



- a** - TDC Mark
b - Timing Mark

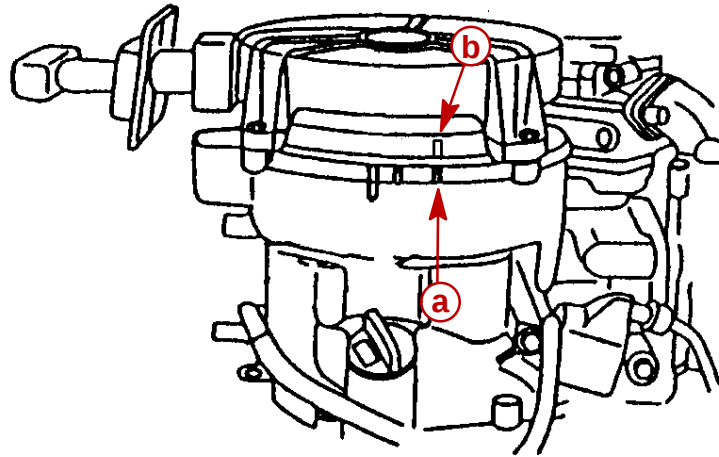
IMPORTANT: If timing mark on flywheel is not in alignment with crankcase cover/cylinder block TDC mark, check for (and correct) one or more of the following possible causes:

- a. Dial indicator has been improperly set up or misread.
- b. Flywheel key is sheared.
- c. Flywheel is installed incorrectly.
4. Remove dial indicator and adaptors.
5. Install spark plug and connect high tension spark plug lead.



Check Timing

1. Connect timing light (91-99379) to engine.
2. Start engine and allow it to warm up to normal operating temperature.
3. Throttle engine back to idle and shift into "Forward" gear.
4. With engine idling in "Forward" gear, use timing light and check flywheel timing mark alignment. Idle timing should be 25° B.T.D.C.
5. With engine in "Forward" gear, fully advance throttle to W.O.T. position. Use timing light and check that timing mark of flywheel maintains alignment with crankcase cover/cylinder block 25° B.T.D.C. timing mark.



a - 25° B.T.D.C.

b - Timing Mark of Flywheel



ELECTRICAL

Section 2D - Wiring Diagram

Table of Contents

Wiring Diagram	2D-2
----------------------	------

2
D



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

Component Labels:
 a - Crank Position Sensor
 b - Ignition Charge Coil
 c - Oil Pressure Switch
 d - Ignition Coil
 e - CDI Unit
 f - Oil Lamp
 g - Stop Switch
 h - Lighting Coil (Optional)
 i - Rectifier (Optional)
 j - Fuse -10 Amp (Optional)
 k - Battery
 l - Light Extension Harness (Optional)

The diagram illustrates the electrical system of a Honda CRF 125F. Key components and their connections include:
 - **Battery (k):** Connected to the main power lines.
 - **CDI Unit (e):** Receives signals from the Crank Position Sensor (a) and the Ignition Charge Coil (b). It provides power to the Ignition Coil (d) and the Lighting Coil (h).
 - **Ignition System:** The Ignition Charge Coil (b) is connected to the Ignition Coil (d). The Ignition Coil (d) is connected to the Ignition Switch (g) and the Ignition Relay (f).
 - **Lighting System:** The Lighting Coil (h) is connected to the Ignition Switch (g) and the Ignition Relay (f). The Ignition Relay (f) is connected to the Ignition Coil (d) and the Ignition Switch (g).
 - **Sensors:** The Crank Position Sensor (a) and the Oil Pressure Switch (c) are connected to the CDI Unit (e).
 - **Wiring:** The diagram shows various colored wires (RED, YEL, BLK, BRN, WHT, LIGHT-GRN) connecting the components. A legend at the top right defines the color codes.



FUEL SYSTEM

Section 3A - Fuel Pump & Integral Fuel Tank

Table of Contents

Specifications	3A-1	Fuel Pump Disassembly	3A-5
Quicksilver Lubricants and Service Aids	3A-1	Fuel Pump Reassembly	3A-7
Fuel Pump	3A-2	Integral Fuel Tank (4 HP Models Only)	3A-9
Fuel Pump Removal and Installation	3A-4		

**3
A**

Specifications

FUEL SYSTEM	Fuel Pump Type	External (Plunger/Diaphragm)
	Fuel Pump:	
	Pressure	2.5 - 5.0 psi (17 - 35 kPa)
	Plunger Stroke	0.059 in. (1.5 mm)
	Diaphragm Stroke	0.059 in. (1.5 mm)
	Fuel Tank Capacity	3.2 US Gallons

Quicksilver Lubricants and Service Aids

Part No.	Description
92-828000A12	4-Cycle Outboard Oil

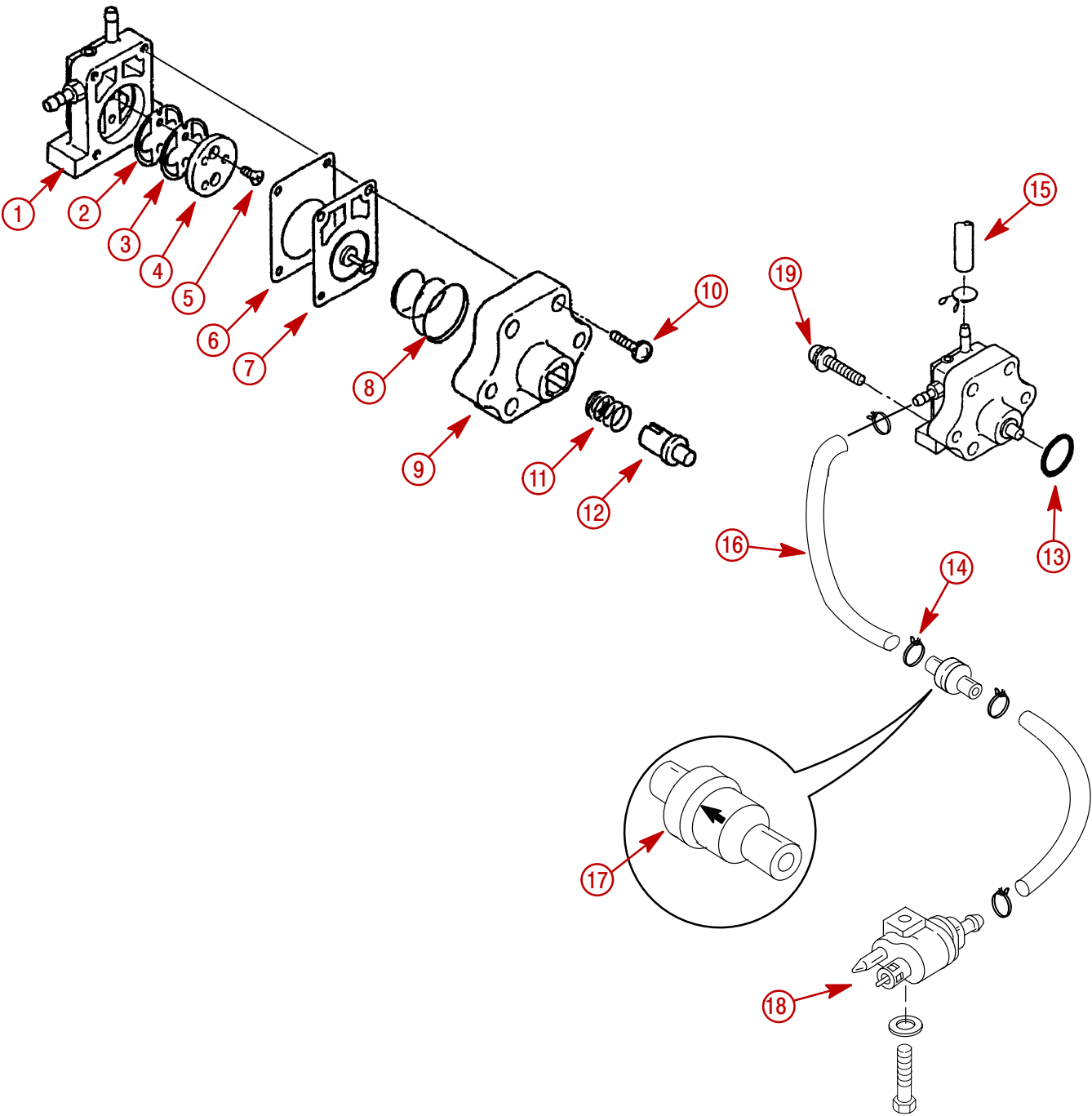
⚠ WARNING

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.



Fuel Pump





Fuel Pump

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	PUMP COVER			
2	1	STOP - CHECK VALVE (CLEAR PLASTIC)			
3	1	CHECK VALVE			
4	1	PLATE			
5	2	SCREW			
6	1	GASKET			
7	1	DIAPHRAGM			
8	1	SPRING			
9	1	PUMP BODY			
10	4	SCREW (M3x5)			
11	1	SPRING			
12	1	PLUNGER			
13	1	O-RING SEAL			
14	AR	HOSE CLAMP			
15	1	OUTLET HOSE			
16	1	INLET HOSE			
17	2	FILTER			
18	1	FUEL CONNECTOR			
19	2	SCREW	70		8



Fuel Pump Removal and Installation

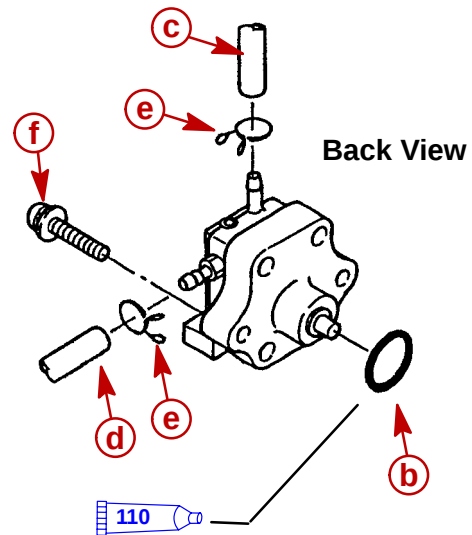
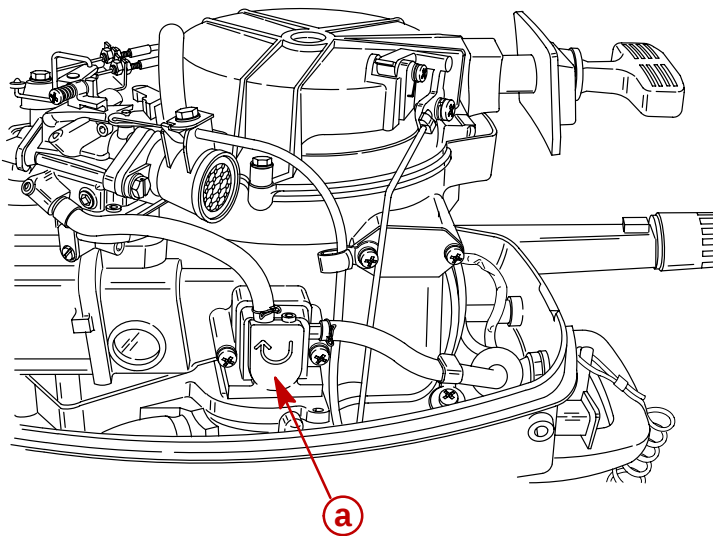
REMOVAL

1. Remove the fuel hoses from the fuel pump.
2. Remove the two mounting screws and remove the fuel pump.

INSTALLATION

1. Place O-ring seal on the back side of the fuel pump and install the pump. Tighten screws to the specified torque.
2. Reconnect the fuel hoses and secure fuel hoses with hose clamps.

Fuel Pump Mounting Screws
70 lb-in. (8 Nm)



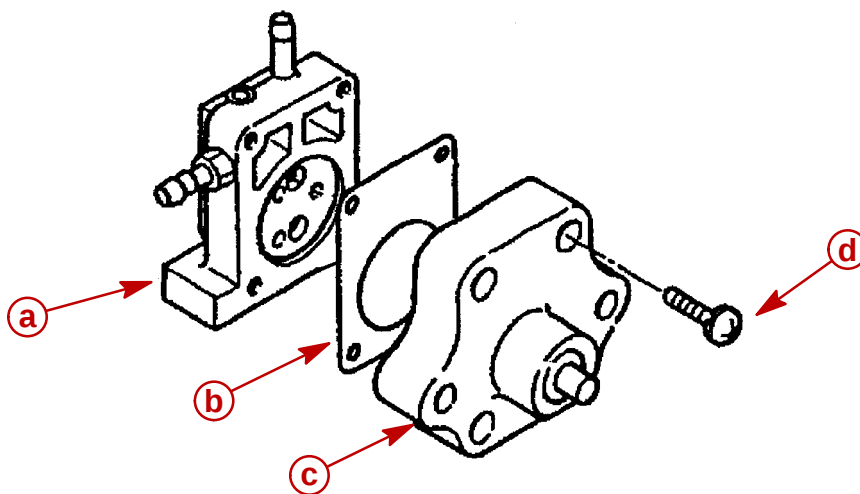
110 4-Stroke Outboard Oil (92-828000A12)

- a** - Fuel Pump
- b** - O-Ring
- c** - Outlet Fuel Hose
- d** - Inlet Fuel Hose
- e** - Hose Clamps (2)
- f** - Screws (2) M6 x 25 mm



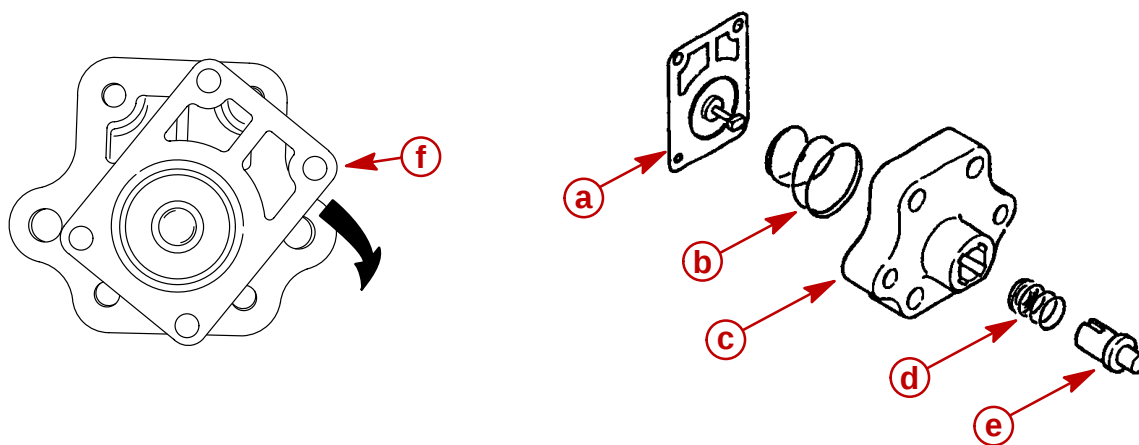
Fuel Pump Disassembly

1. Remove screws and separate the pump cover from the pump body.



- a** - Pump Cover
- b** - Gasket
- c** - Pump Body
- d** - Screw (4)

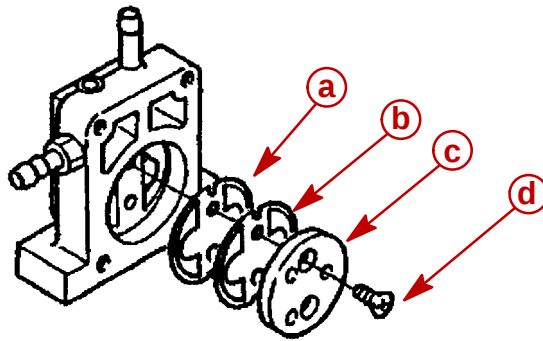
2. Remove diaphragm by pushing in the plunger while turning the diaphragm 90° clockwise or counterclockwise.



- a** - Diaphragm
- b** - Spring
- c** - Pump Body
- d** - Spring
- e** - Plunger
- f** - Unlock Diaphragm - Rotate 90°

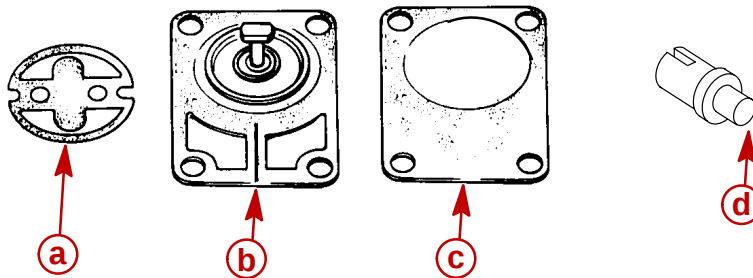


3. Remove screws and plate from pump cover to inspect check valve.



- a** - Stop - Check Valve (Clear Plastic)
- b** - Check Valve
- c** - Plate
- d** - Screw (2)

4. Inspect check valve, gasket, and diaphragm. Replace if damaged.
5. Replace plunger if tip is worn or grooved.

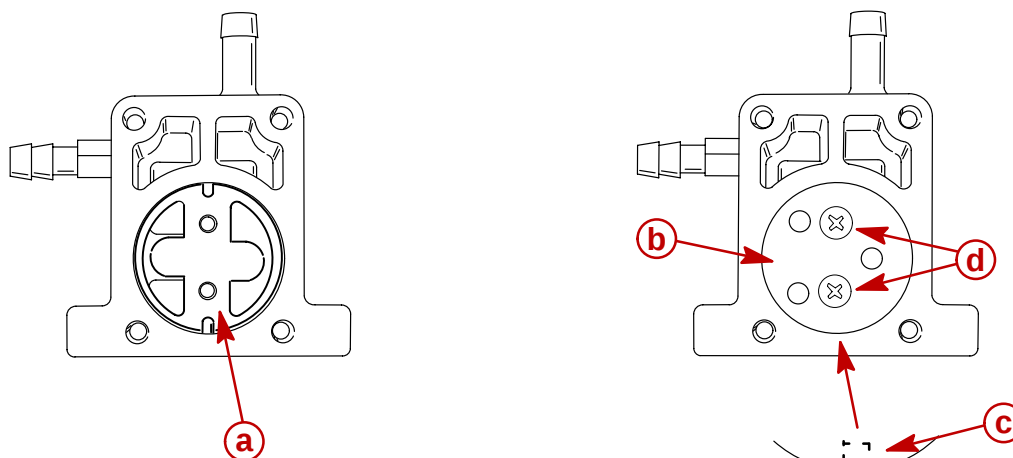


- a** - Check Valve
- b** - Diaphragm
- c** - Gasket
- d** - Plunger Tip



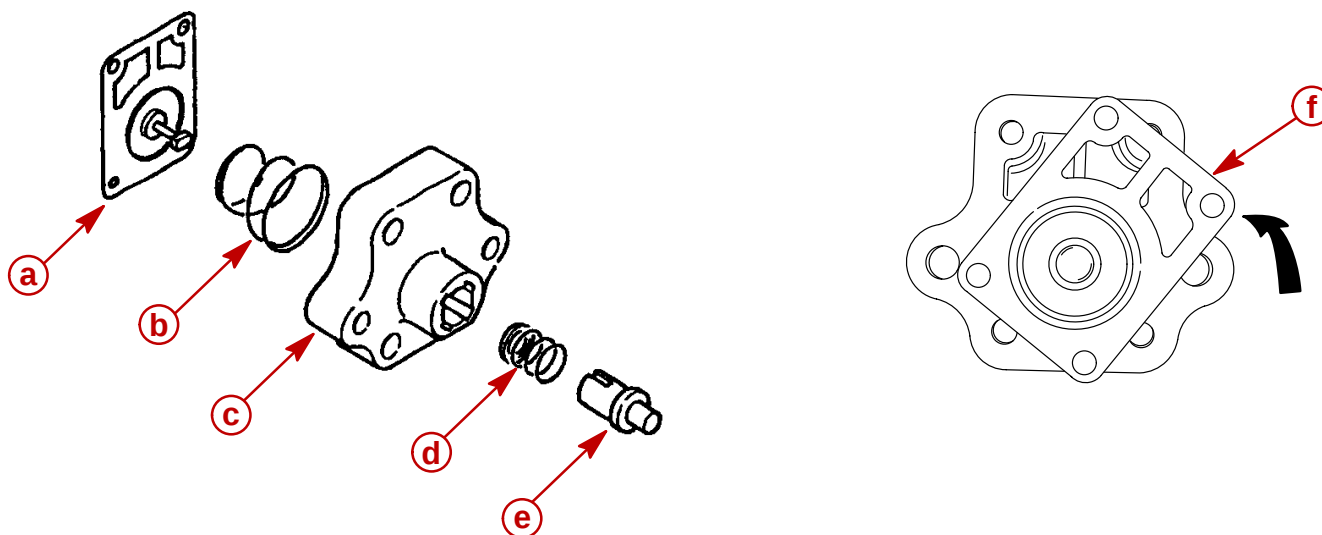
Fuel Pump Reassembly

1. Align the recess in the stop, check valve and plate with the projection on the pump cover.



- a** - Check Valve
- b** - Plate
- c** - Align Recess On Back Side of Plate With Projection
- d** - Screws (2)

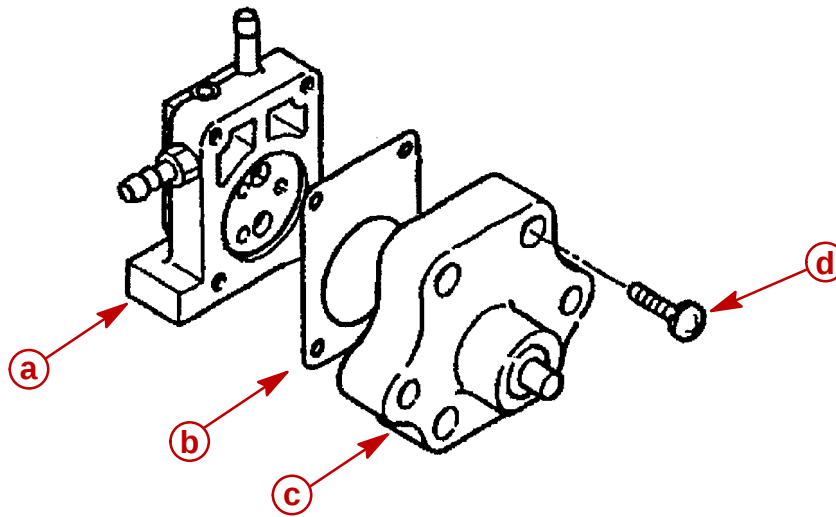
2. Align the slot in the plunger with the projection in the pump body.
3. Assemble the plunger, springs and diaphragm to the pump body.
4. Lock the diaphragm in place by setting the foot of the diaphragm into the plunger slot and rotating the diaphragm 90°.



- a** - Diaphragm
- b** - Spring
- c** - Pump Base
- d** - Spring
- e** - Plunger
- f** - Lock Diaphragm - Rotate 90°



5. Install the pump body to the pump cover with four screws.



- a** - Pump Cover
- b** - Gasket
- c** - Pump Body
- d** - Screws (4)



Integral Fuel Tank (4 HP Models Only)

Disassembly/Assembly

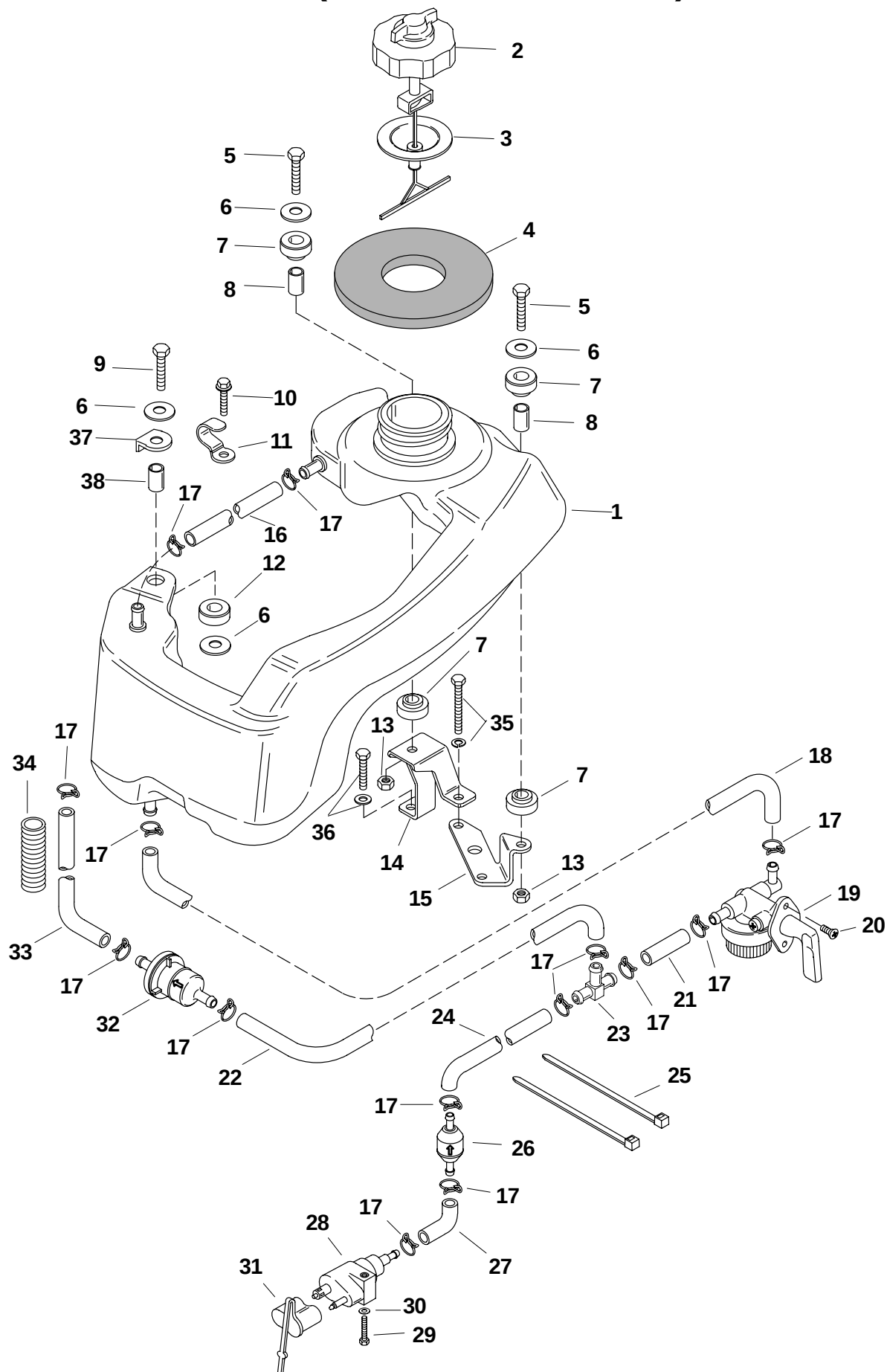
1. Turn fuel cock knob to off position.
2. Disconnect fuel hose from fuel cock.
3. Remove nuts, washers, rubber mounts, spacers and screws and lift fuel tank from its mounts.
4. Empty any remaining fuel from tank into a suitable container.

Cleaning/Inspection

1. Flush fuel tank with clean fuel.
2. Inspect fuel tank, and fuel cock for signs of leakage or damage. Replace components as necessary.
3. Inspect fuel filter screen on fuel cock for sediment build-up. Clean dirty screen with solvent or replace fuel cock if screen is damaged.
4. Replace in-line fuel filters if dirty.
5. Replace fuel tank cap, sealing ring, or gasket if damaged.



INTEGRAL FUEL TANK (4 HP MODELS ONLY)





INTEGRAL FUEL TANK (4 HP MODELS ONLY)

REF. NO.	QTY.	DESCRIPTION
1	1	FUEL TANK
	1	FUEL TANK (BODENSEE)
2	1	FUEL CAP
	1	FUEL CAP (BODENSEE)
3	1	GASKET
4	1	SEAL
5	2	SCREW
6	4	WASHER
7	5	RUBBER MOUNT
8	2	SPACER
9	1	BOLT
10	1	SCREW
11	1	CLAMP
12	1	RUBBER MOUNT
13	2	NUT
14	1	BRACKET
15	1	BRACKET
16	1	TUBING (9-7/8 IN.)
17	14	CLIP
18	1	TUBING (14 IN.)
19	1	FUEL COCK
20	2	SCREW
21	1	TUBING (1-3/8 IN.)
22	1	TUBING (8-1/2 IN.)
23	1	TEE FITTING
24	1	TUBING (5-1/4 IN.)
25	2	STA STRAP
26	1	CONNECTOR
27	1	HOSE (1-3/4 IN.)
28	1	FUEL CONNECTOR
29	1	BOLT
30	1	WASHER
31	1	PROTECTOR
32	1	FUEL FILTER
33	1	HOSE (7-1/8 IN.)
34	1	SLEEVE
35	1	BOLT (M6x45) (4 HP)
	1	BOLT (M6x40) (5/6 HP)
36	1	BOLT (M6x30) (4 HP)
	1	BOLT (M6x25) (5/6 HP)
37	1	PLATE
38	1	SPACER



FUEL SYSTEM

Section 3B - Carburetor

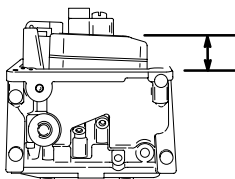
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Carburetor	3B-4	Inspection	3B-9
Carburetor Adjustments	3B-6	Carburetor Reassembly	3B-10

**3
B**

Specifications

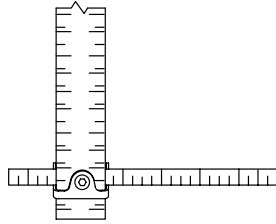
CARBURETOR	Idle rpm (Out Of Gear)	1300 ± 50 rpm
	Idle rpm (In Forward Gear)	1100 ± 50 rpm
	Wide Open Throttle rpm (WOT)	
	4/5 (1999 & 2000)	4500 -5500
	4/5/6 (2001 & Newer)	5000 - 6000
	Pilot (Idle Mixture) Screw	
	4/5/6 (1999 & 2000)	3 ± 1/2 Turns Out
	European Models Only	
	2001 & Newer	
	4	2-1/8 ± 1/2 Turns Out
	5	1-1/2 ± 1/2 Turns Out
	6	2-3/4 ± 1/2 Turns Out
	All Other Models Non-Adjustable	
	Venturi Bore Diameter	
	4/5	13.5 mm
	6	15 mm
	Main Jet Size	
	4/5 (1999 & 2000)	#70
	4 (2001 & Newer)	#58
	5 (2001 & Newer)	#65
	6 (2000 & Newer)	#75
	4 (Bodensee)	#55
	5 (Bodensee)	#62
	6 (Bodensee)	#68
	Pilot Jet	
	4 (1999 & 2000)	#40
	5 (1999 & 2000)	#42
	4/5 (2001 & Newer)	#38
	6 (2000 & Newer)	#45
	4/5 (Bodensee)	#38
	6 (Bodensee)	#42
	Float Height	0.35 - 0.39 in. (9 - 10 mm)





Special Tools

1. Carburetor Scale P/N 91-36392



55847

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.

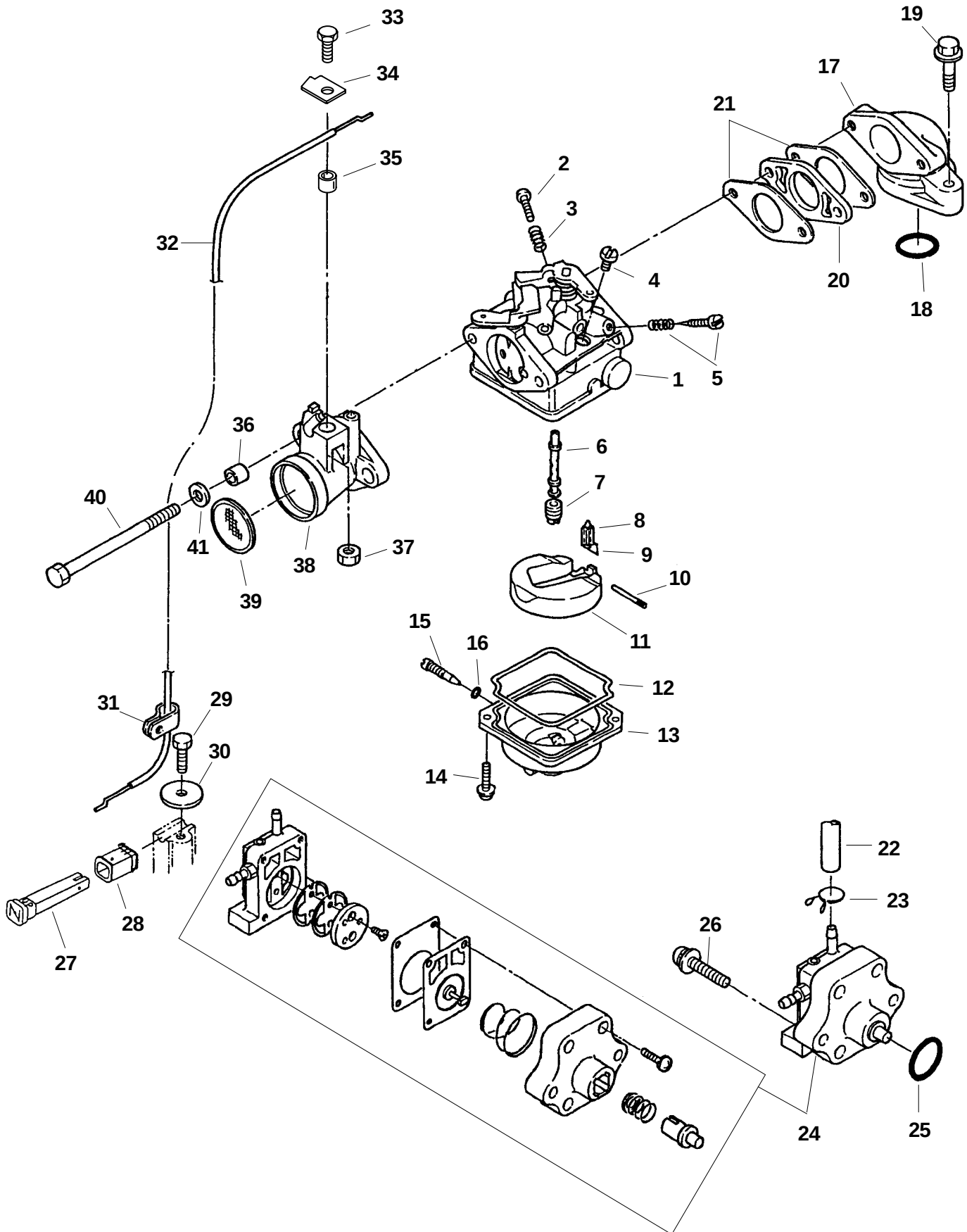
FUEL LEAKAGE FROM ANY PART OF THE FUEL SYSTEM CAN BE A FIRE AND EXPLOSION HAZARD WHICH CAN CAUSE SERIOUS BODILY INJURY OR DEATH. Careful periodic inspection of the entire fuel system is mandatory, particularly after engine storage. All fuel components, including fuel tanks, whether plastic, metal, or 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.



Notes:



Fuel System





Fuel System

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	CARBURETOR (4 H.P.)			
	1	CARBURETOR (5 H.P.)			
	1	CARBURETOR (6 H.P.)			
2	1	STOP SCREW			
3	1	SPRING			
4	1	PILOT JET (4 H.P.)			
	1	PILOT JET (5 H.P.)			
	1	PILOT JET (6 H.P.)			
5	1	PILOT SCREW SET			
6	1	MAIN NOZZLE (4 H.P.)			
	1	MAIN NOZZLE (5 H.P.)			
	1	MAIN NOZZLE (6 H.P.)			
7	1	MAIN JET (4 H.P.)			
	1	MAIN JET (5 H.P.)			
	1	MAIN JET (6 H.P.)			
8	1	FLOAT VALVE			
9	1	CLIP			
10	1	FLOAT PIN			
11	1	FLOAT			
12	1	GASKET			
13	1	FLOAT BOWL			
14	2	SCREW (M4 x 12 mm)			
15	1	DRAIN SCREW (M5 x 6 mm)			
16	1	O RING			
17	1	INLET MANIFOLD			
18	1	O RING			
19	2	BOLT (M6 x 25 mm)	70		8
20	1	INSULATOR GASKET (4/5 H.P.)			
	1	INSULATOR GASKET (6 H.P.)			
21	2	GASKET			
22	1	TUBING			
23	1	CLIP			
24	1	FUEL PUMP			
25	1	O RING			
26	2	SCREW (M6 x 25 mm)	70		8
27	1	CHOKE ROD			
28	1	BUSHING			
29	1	BOLT (M6 x 14 mm)	70		8
30	1	WASHER			
31	1	CLAMP			
32	1	CHOKE LINK WIRE			
33	1	BOLT (M6 x 20 mm)	70		8
34	1	BRACKET			
35	1	COLLAR			
36	2	COLLAR			
37	1	NUT			
38	1	AIR SILENCER			
39	1	FLAME TRAP			
40	2	BOLT (M6 x 85 mm)	70		8
41	2	WASHER			



Carburetor Adjustments

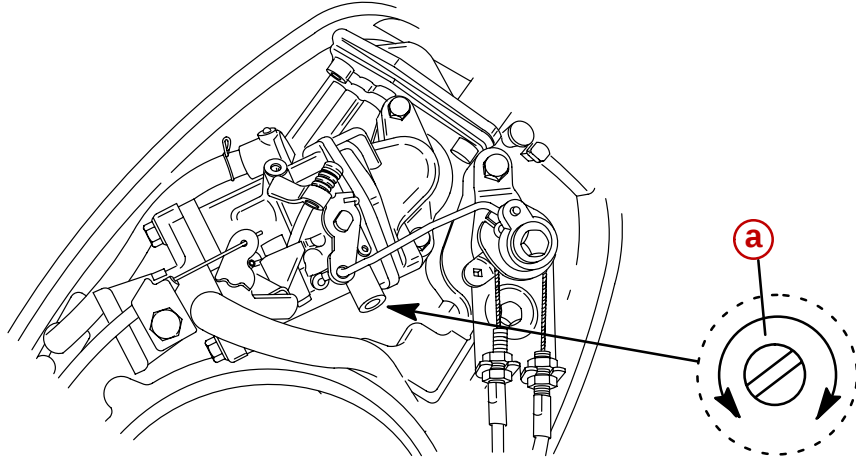
Idle Speed - Initial Setting

Pilot (Idle Mixture) Screw

1. Turn pilot mixture screw in (clockwise) until lightly seated then back out to an initial setting of $3 \pm 1/2$ turns.
2. Start engine and run at slow/idle speed in forward gear. Turn pilot screw in until engine starts to lose rpm, then back out $1/4$ turn and adjust for best performance.

NOTE: Allow time for engine to stabilize between adjustments. DO NOT adjust leaner than necessary to attain reasonably smooth idle.

If the engine hesitates on acceleration, readjust the pilot screw.

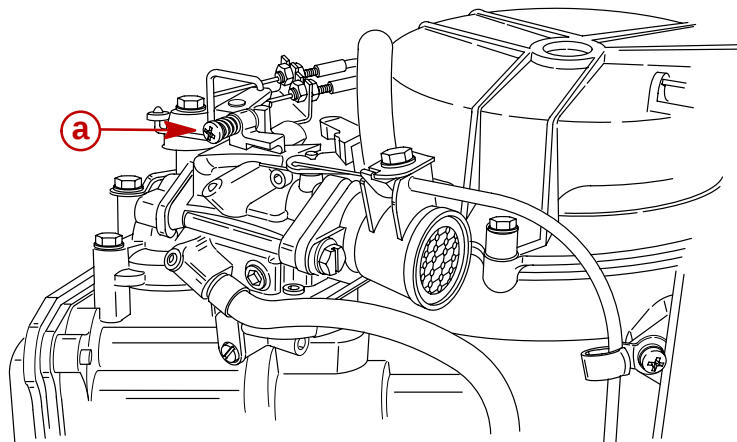


a - Pilot Mixture Screw

Idle Speed

1. Adjustment:
 - Tightening the screw increases engine speed.
 - Loosening the screw reduces engine speed.

Idle RPM
1300 rpm Out of Gear 1100 rpm in Gear



a - Idle Adjustment Screw



Carburetor Removal and Installation

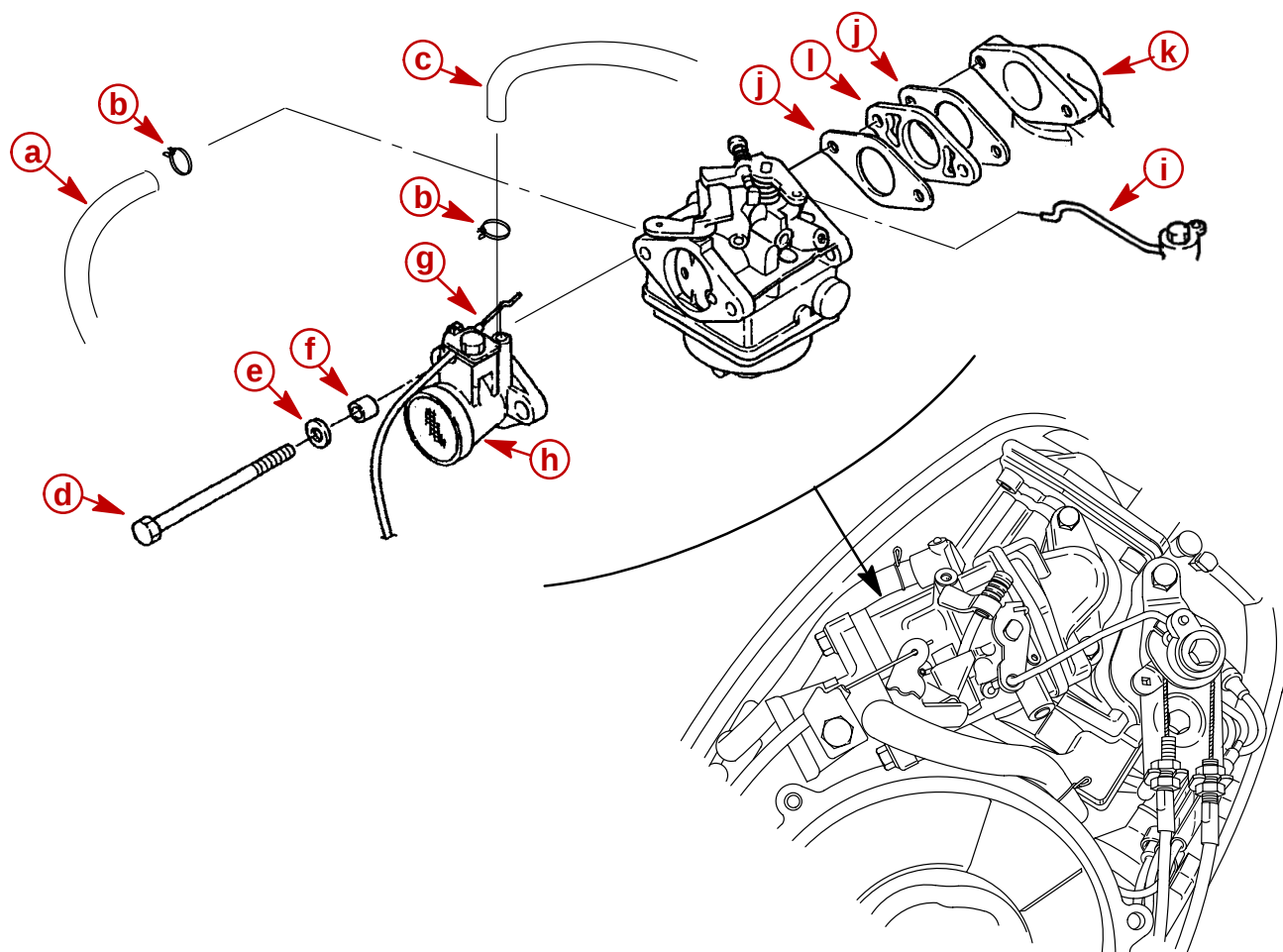
REMOVAL

1. Disconnect fuel supply from engine.
2. Remove the rewind starter.
3. Disconnect the fuel hose and breather hose.
4. Remove the two bolts securing the flame trap and carburetor to the intake manifold.
5. Disconnect the choke cable and throttle linkage from the carburetor. Remove carburetor.

INSTALLATION

1. Reconnect the choke cable and throttle linkage.
2. Install the carburetor as shown.
3. Reinstall the fuel hose and breather hose. Fasten the fuel hose with a hose clamp.

Carburetor Mounting Bolts Torque
70 lb-in. (8 Nm)



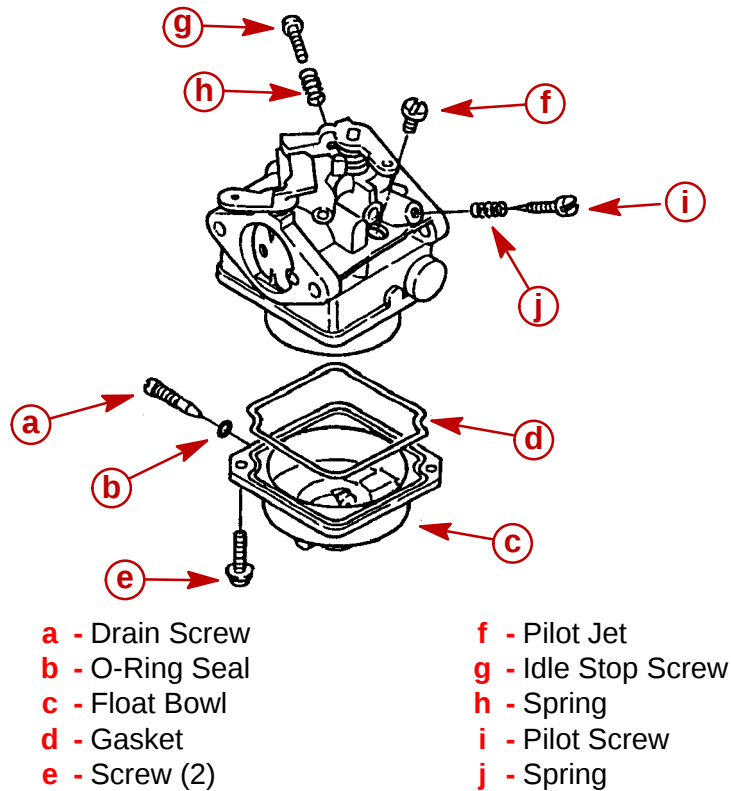
a - Fuel Hose
b - Hose Clamp (2)
c - Breather Hose
d - Bolt (2) M6 x 85 mm
e - Flat Washer (2)
f - Collar (2)

g - Choke Cable
h - Air Silencer
i - Insulator Gasket
j - Gasket
k - Intake Manifold
l - Throttle Linkage

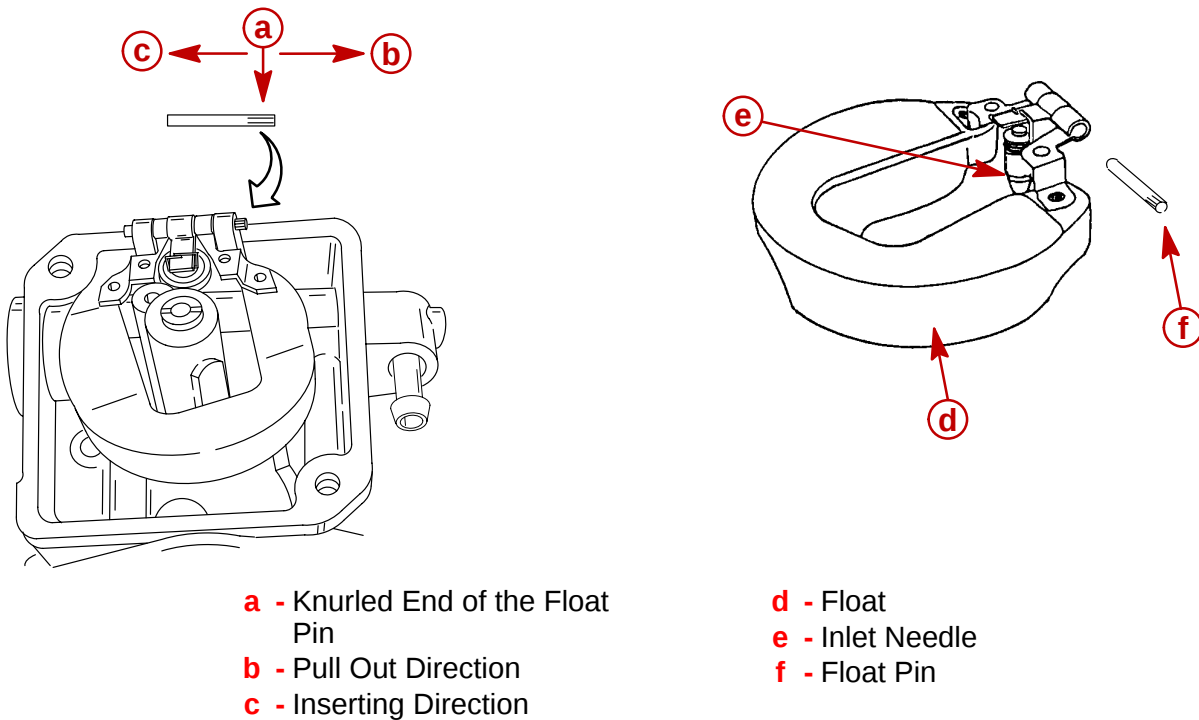


Carburetor Disassembly

1. Remove drain screw and drain the carburetor before disassembly.
2. Remove the float bowl.
3. Remove the idle stop screw and pilot jet.

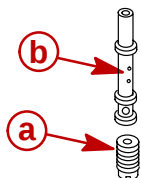
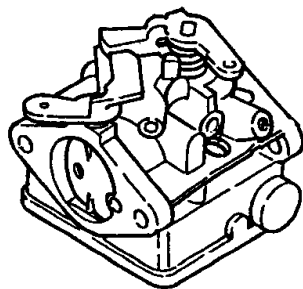


4. Push out float pin in the direction shown and remove the float.

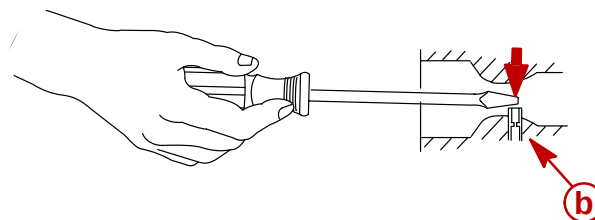




5. Remove the main jet.
6. Remove the main nozzle. The nozzle should drop out. If not, carefully push the nozzle out as shown.

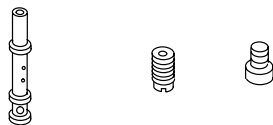


a - Main Jet
b - Main Nozzle

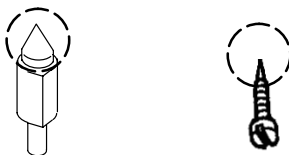


Inspection

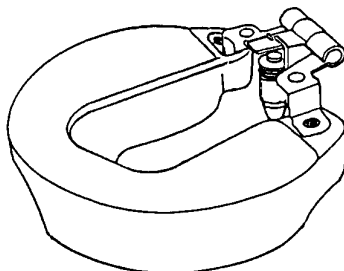
1. Clean the main jet, main nozzle, pilot jet and pilot screw thoroughly with compressed air before installation.



2. Inspect the tip of the needle valve and pilot mixture screw for wear.



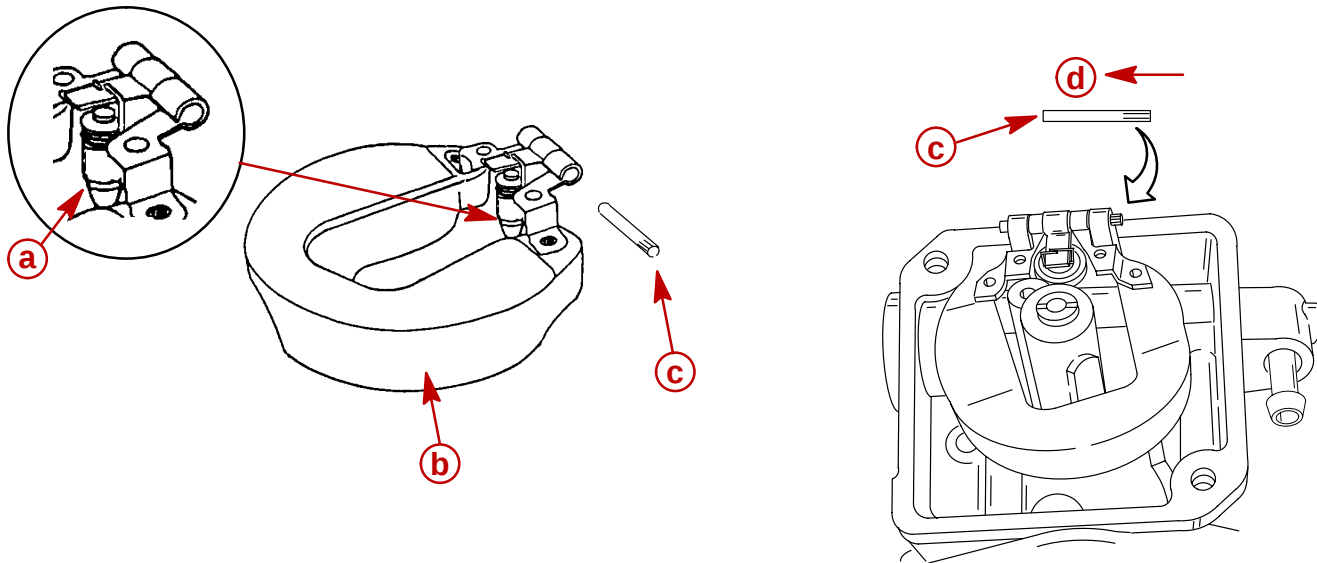
3. Inspect float for wear in the float arm that contacts the needle valve.





Carburetor Reassembly

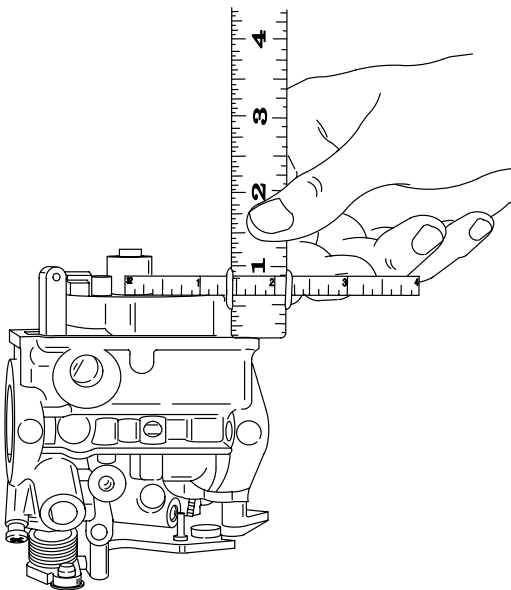
1. Install the needle valve assembly onto the metal tab.
2. Install the float.



- a** - Inlet Needle Assembly
b - Float
c - Float Pin
d - Inserting Direction

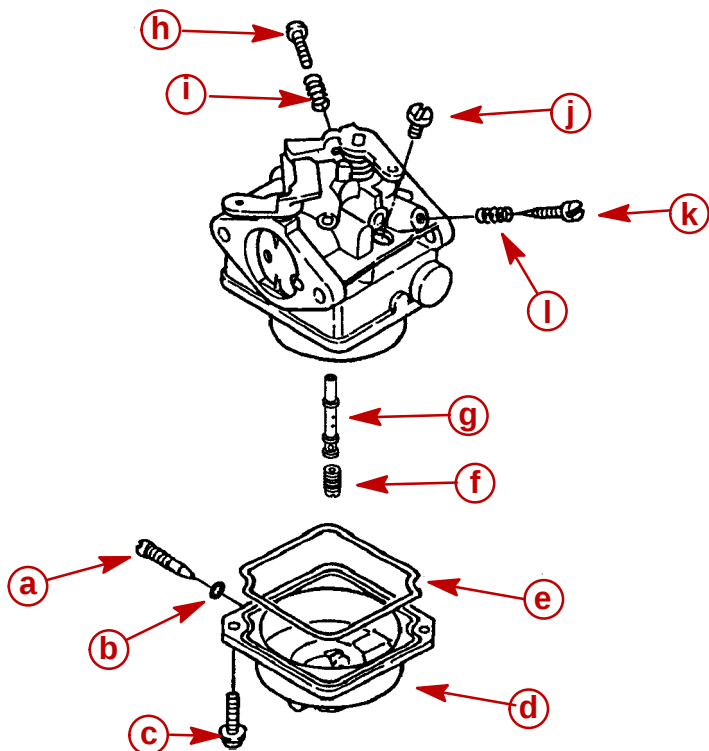
3. Check the float lever using a carburetor scale. Adjust float level by bending the metal tab to which the inlet needle is installed.

Float Level
0.35 - 0.39 in. (9 - 10 mm)





4. Reassemble the carburetor.



- a** - Drain Screw-M5 x 6 mm
- b** - Gasket-Drain Screw
- c** - Screws (4) M4 x 12 mm
- d** - Float Bowl
- e** - Gasket -Float Bowl
- f** - Main Jet

- g** - Main Nozzle
- h** - Idle Screw
- i** - Spring
- j** - Pilot Jet
- k** - Pilot Screw
- l** - Spring



FUEL SYSTEM

Section 3C – Emissions

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Exhaust Emissions Standards

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

What Are Emissions?

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

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

Hydrocarbons – HC

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

Carbon Monoxide – CO

Carbon is one of the elements that make up the fuel burned in the engine along with oxygen during the combustion process. If the carbon in the gasoline could combine with enough oxygen (one carbon atom with two oxygen atoms), it would come out of the engine in the form of carbon dioxide (CO₂). CO₂ is a harmless gas. But carbon often combines with insufficient oxygen (one carbon atom with one oxygen atom). This forms carbon monoxide, CO. Carbon monoxide is the product of incomplete combustion and is a dangerous, potentially lethal gas.

Oxides of Nitrogen - NOx

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

Controlling Emissions

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



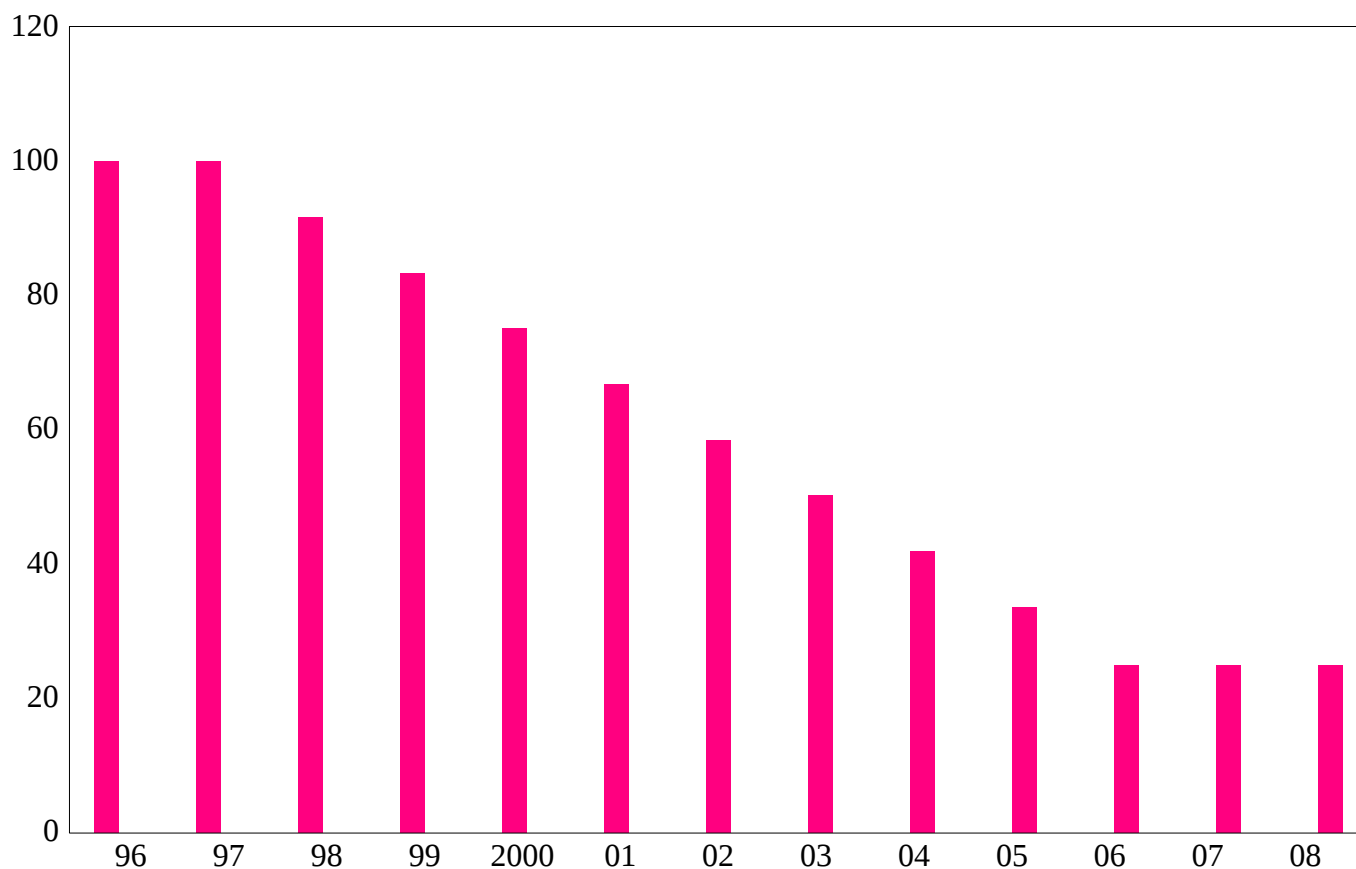
Stoichiometric (14.7:1) Air/Fuel Ratio

In the search to control pollutants and reduce exhaust emissions, engineers have discovered that they can be reduced effectively if a gasoline engine operates at an air/fuel ratio of 14.7:1. The technical term for this ideal ratio is stoichiometric. An air/fuel ratio of 14.7:1 provides the best control of all three elements in the exhaust under almost all conditions. The HC and CO content of the exhaust gas is influenced significantly by the air/fuel ratio. At an air/fuel ratio leaner than 14.7:1, HC and CO levels are low, but with a ratio richer than 14.7:1 they rise rapidly. It would seem that controlling HC and CO by themselves might not be such a difficult task; the air/fuel ratio only needs to be kept leaner than 14.7:1. However, there is also NO_x to consider.

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

OUTBOARD HYDROCARBON EMISSIONS REDUCTIONS

8 1/3% ↓ PER YEAR OVER 9 MODEL YEARS



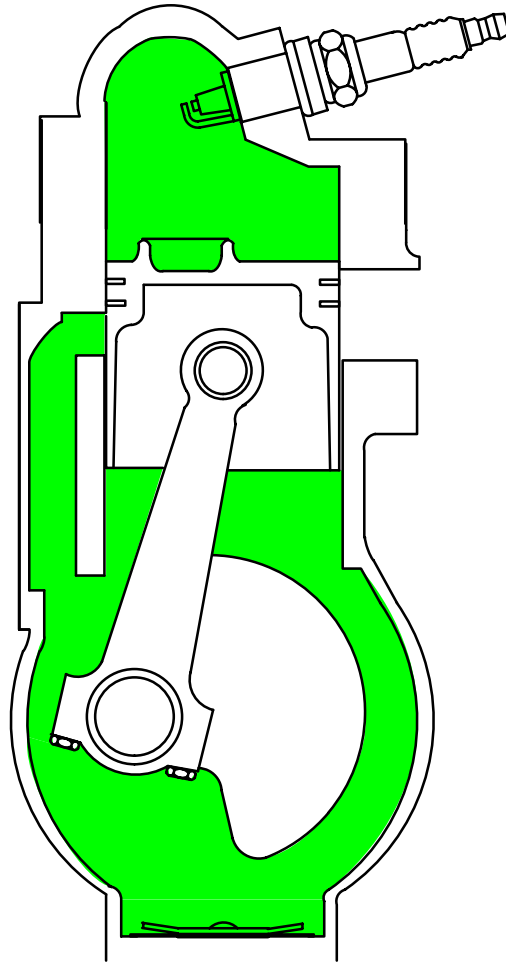


STRATIFIED VS HOMOGENIZED CHARGE

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

Homogenized Charge

A homogenized charge has the air/fuel particles mixed evenly throughout the cylinder. This mixing occurs inside the carburetor venturi, reed blocks, crankcase and/or combustion chamber. Additional mixing occurs as the fuel is forced through the transfer system into the cylinder. The homogenized charge has an air/fuel ratio of approximately 14.7:1 and is uniform throughout the cylinder.

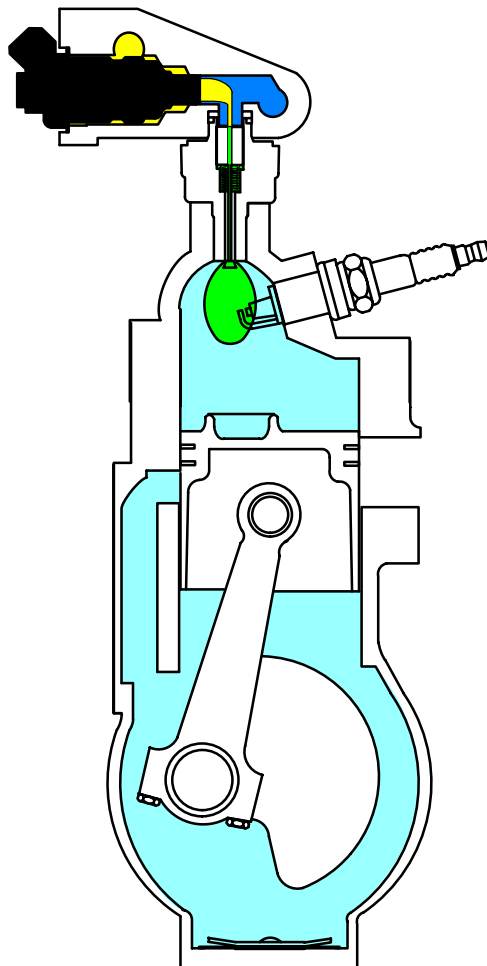




Stratified Charge

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

A stratified charge engine concentrates a rich mixture in the vicinity of the spark plug (air/fuel ratio less than 14.7:1). Elsewhere, the mixture is very lean or is comprised of air only.





Emissions Information

Manufacturer's Responsibility

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

Dealer Responsibility

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

Adjustments must be kept within published factory specifications.

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

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

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

Owner Responsibility

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

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

Exceptions:

- Carburetor jets may be changed for high altitude use in accordance with factory recommendations.
- Single engine exceptions may be allowed with permission from the EPA for racing and testing.



EPA Emission Regulations

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

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

VIA U.S. POSTAL SERVICE:

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

VIA EXPRESS or COURIER MAIL:

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

EPA INTERNET WEB SITE:

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

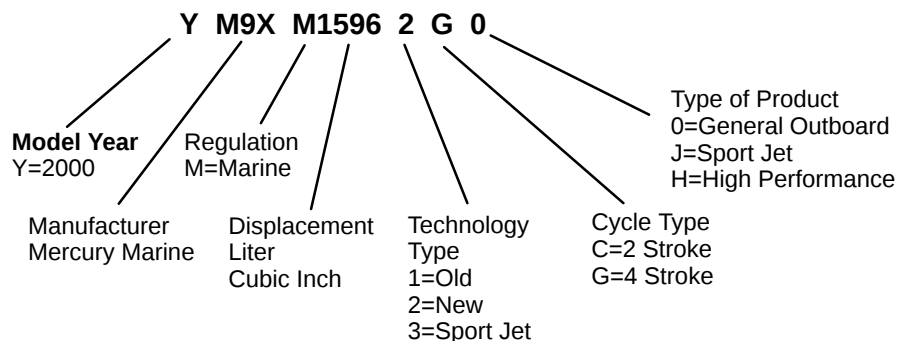


Manufacturer's Certification Label

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

		Emission Control Information	
This engine conforms to 2000 Model Year U.S. EPA regulations for Marine SI engines. Refer to Owners Manual for required maintenance			
j	Family: WM9XM.323220	Idle Speed (in neutral): 1100 RPM b	
i	FEL: 120 GM/KW-HR	4-5-6 (4-Stroke)	123 cc c
h	Timing (in degrees): Not Adjustable CDI Controlled d		
g	Standard Spark Plug: Gap: Suppressor Spark Plug: NGK DPR6E Gap: 0.035" (0.9 mm)	JULY 1999 e	
f	Valve Clearance (Cold) mm	Intake: 0.6-0.14 Exhaust: 0.11-0.19	

- a** - Spark Ignition (SI)
- b** - Idle Speed (In Neutral)
- c** - Cubic Centimeter
- d** - Engine Horsepower Rating
- e** - Month and Year of Production
- f** - Valve Clearance (Four Stroke engines only)
- g** - Recommended spark plug for best engine performance
- h** - Timing specifications when adjustable
- i** - FEL: Represents (Mercury Marine) statement of the maximum emissions output for the engine family
- j** - Family example





Service Replacement Certification Label

IMPORTANT: By federal law, it is required that all 1998 and newer Mercury Marine outboards have a visible and legible emission certification label. If this label is missing or damaged, replacement labels can be obtained from Mercury Marine.

Removal

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

Date Code Identification

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

MERCURY	Emission Control Information	123 CC	2000 PART #3R1-72089-2
This engine conforms to 2000 Model Year U.S. EPA regulations for marine SI engines.		Idle Speed (in neutral): 1300±50 RPM	
Refer to Owners Manual for required maintenance		Timing: Not Adjustable	
Family: YM9XM.323220		Spark Plug: NGK DPR6E Gap: 0.035" (0.9 mm)	
FEL: 120 GM/KW-HR		Valve Clearance (Cold) mm Intake: 0.06-0.14 Exhaust: 0.11-0.19	
		4-5-6 HP 4-Stroke	
JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC			

EMISSION CONTROL INFORMATION		2001 MY	
THIS ENGINE CONFORMS TO 2001 CALIFORNIA AND U.S. EPA EMISSION REGULATIONS FOR SPARK IGNITION MARINE ENGINES.			
REFER TO OWNER'S MANUAL FOR REQUIRED MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS.			
FAMILY: 11TXM.12322B		FEL: 50.00 g/kW-h	2.9-4.4 kW 123 ml
IDLE SPEED (IN GEAR) 1100r/min		TIMING: NOT ADJUSTABLE	
VALVE CLEARANCE (COLD) mm INTAKE: 0.06-0.14, EXHAUST: 0.11-0.19			
SPARK PLUG: NGK DCPR6E GAP: 0.8-0.9		4-6 HP 4-STROKE	
PART No. 3R1-72089-3		MERCURY MARINE	
2000		2001	
MAY JUNE JULY AUG SEP OCT NOV DEC JAN FEB MAR APR			



a - “V” Notch



b - Month of Manufacture



Installation

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

Decal Location

Model	Production Part No.	Service Part No.	Location on Engine
1999 Merc/Mar 4/5 HP (4-Stroke)	37-856984 18	37-856985 18	Front of Cylinder Block
2000 Merc/Mar 4/5/6 HP (4-Stroke)	3R1-72089-2	37-804651A00	Front of Cylinder Block
2001 Merc/Mar 4 HP (4-Stroke)	3R1-72089-3	37-804651A01	Valve Cover
2001 Merc/Mar 5/6 HP (4-Stroke)	3R1-72089-3	37-804651A01	Front of Cylinder Block



POWERHEAD

Section 4A - Cylinder Head

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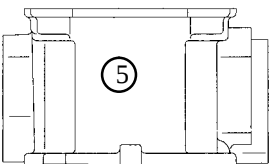
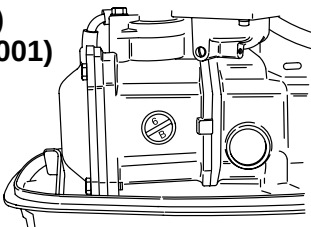
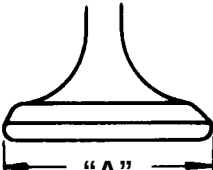
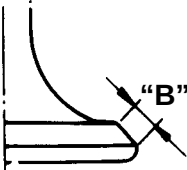
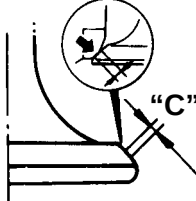
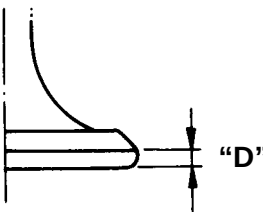
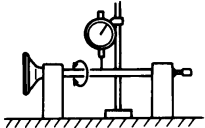
Specifications	4A-1	Cylinder Head Disassembly	4A-11
Special Tools	4A-3	Cleaning and Inspection	4A-13
Quicksilver Lubricants and Service Aids	4A-3	Cylinder Head	4A-13
Cylinder Block	4A-4	Cylinder Head Resurfacing	4A-14
Intake/Exhaust Valves	4A-6	Valves	4A-18
Adjustments	4A-8	Valve Springs	4A-20
Valve Clearance	4A-8	Cylinder Head Reassembly	4A-21
Cylinder Head Removal	4A-11	Cylinder Head Installation	4A-23

Specifications

4
A

VALVE SPRING	Free Length (Intake/Exhaust) "a" Tilt Limit "b" (Intake/Exhaust) 4/5 (1999) 4/5/6 (2000 & Newer) Compressed Pressure (Installed) Intake/Exhaust: Closed Height 0.965 in. (24.4 mm) 4/5 (1999 & 2000) 6 (2000) 4/5/6 (2001 & Newer) Open Height 0.709 in. (17.4 mm) 4/5 (1999 & 2000) 6 (2000) 4/5/6 (2001 & Newer) Direction of Winding (Intake/Exhaust)	a = 1.260 in. (32.0 mm) b = 0.044 in. (1.12 mm) a = 1.378 in. (35.0 mm) b = 0.044 in. (1.12 mm) 17 lbf. (7.7 kgf) 24 lbf. (10.8 kgf) 24 lbf. (10.8 kgf) 31 lbf. (14.0 kgf) 39.4 lbf. (17.9 kgf) 39.4 lbf. (17.9 kgf) Right Hand
CYLINDER HEAD	Warp Limit * * Lines indicate straight edge measurement	0.0012 in. (0.03 mm)

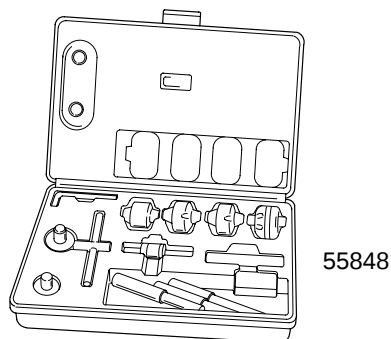


CYLINDER HEAD IDENTIFICATION	4/5 = 5 (1999 & 2000) 	6 = 6 (2000) 4/5/6 = 6 (2001) 
Valve Dimensions  Head Diameter  Face Width  Seat Width  Margin Thickness		
VALVES	Valve/Valve Seat/Valve Guides: Valve Clearance (cold) Intake Exhaust Valve Dimensions: "A" Head Diameter Intake Exhaust "B" Face Width Intake Exhaust "C" Seat Width Intake Exhaust "D" Margin Thickness Intake Exhaust Stem Outside Diameter Intake Exhaust Guide Inside Diameter Intake Exhaust Stem To Guide Clearance Intake Exhaust Stem Run-out Limit (max.) 	0.002 - 0.005 in. (0.06 - 0.14 mm) 0.004 - 0.007 in. (0.11 - 0.19 mm) 0.980 - 0.988 in. (24.9 - 25.1 mm) 0.941 - 0.949 in. (23.9 - 24.1 mm) 0.102 in. (2.6 mm) 0.102 in. (2.6 mm) 0.031 in. (0.8 mm) 0.031 in. (0.8 mm) 0.028 in. (0.7 mm) 0.047 in. (1.2 mm) 0.216 in. (5.48 mm) 0.214 in. (5.44 mm) 0.2165 in. (5.5 mm) 0.2165 in. (5.5 mm) 0.0008 - 0.0017 in. (0.020 - 0.044 mm) 0.0018 - 0.0028 in. (0.045 - 0.072 mm) 0.0006 in. (0.016 mm)



Special Tools

1. Valve Seat Cutter Kit (Obtain Locally).

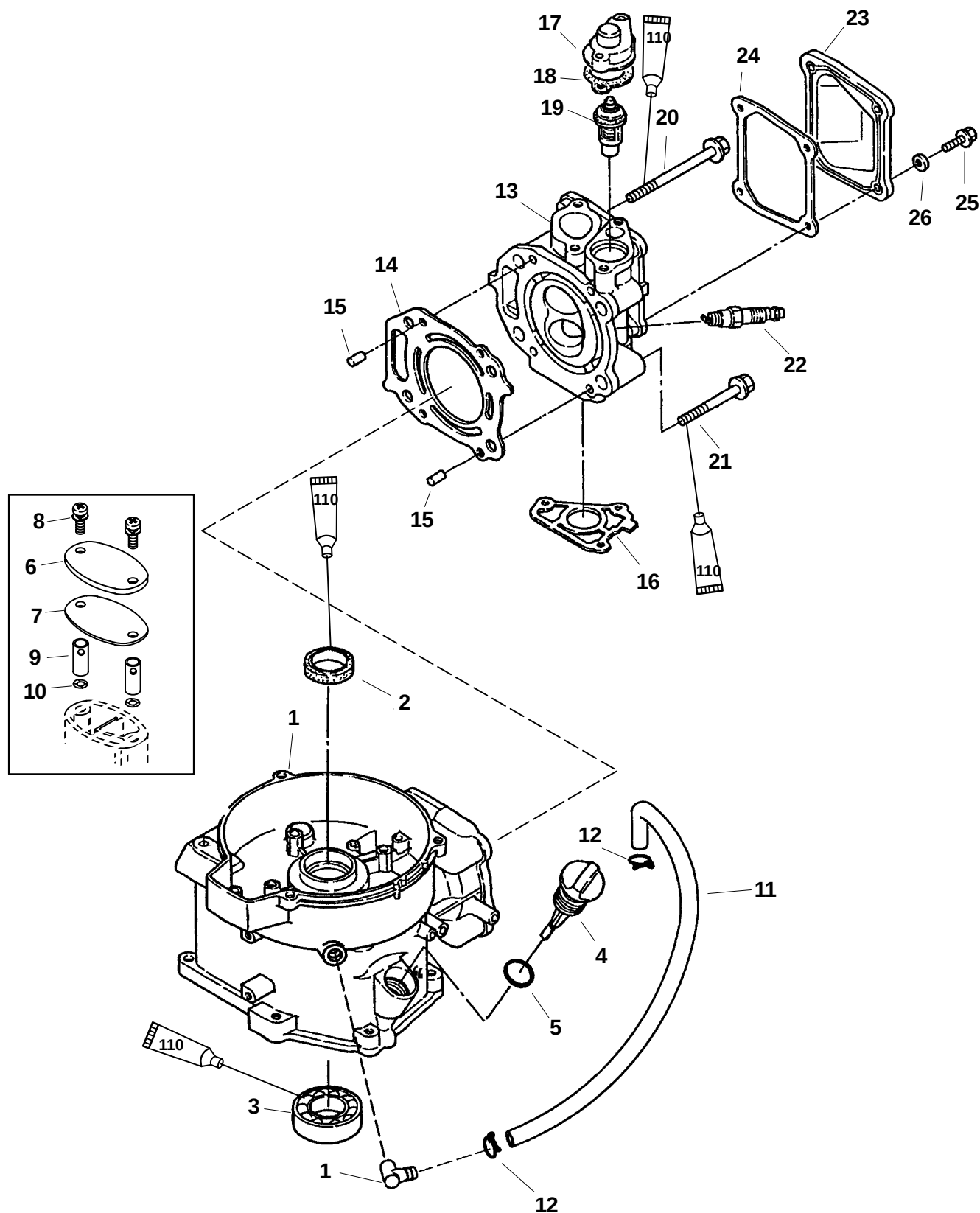


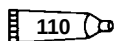
Quicksilver Lubricants and Service Aids

Part No.	Description
92-802878-57	Quicksilver Power Tune



Cylinder Block



 4 Cycle Oil (92-828000A12)

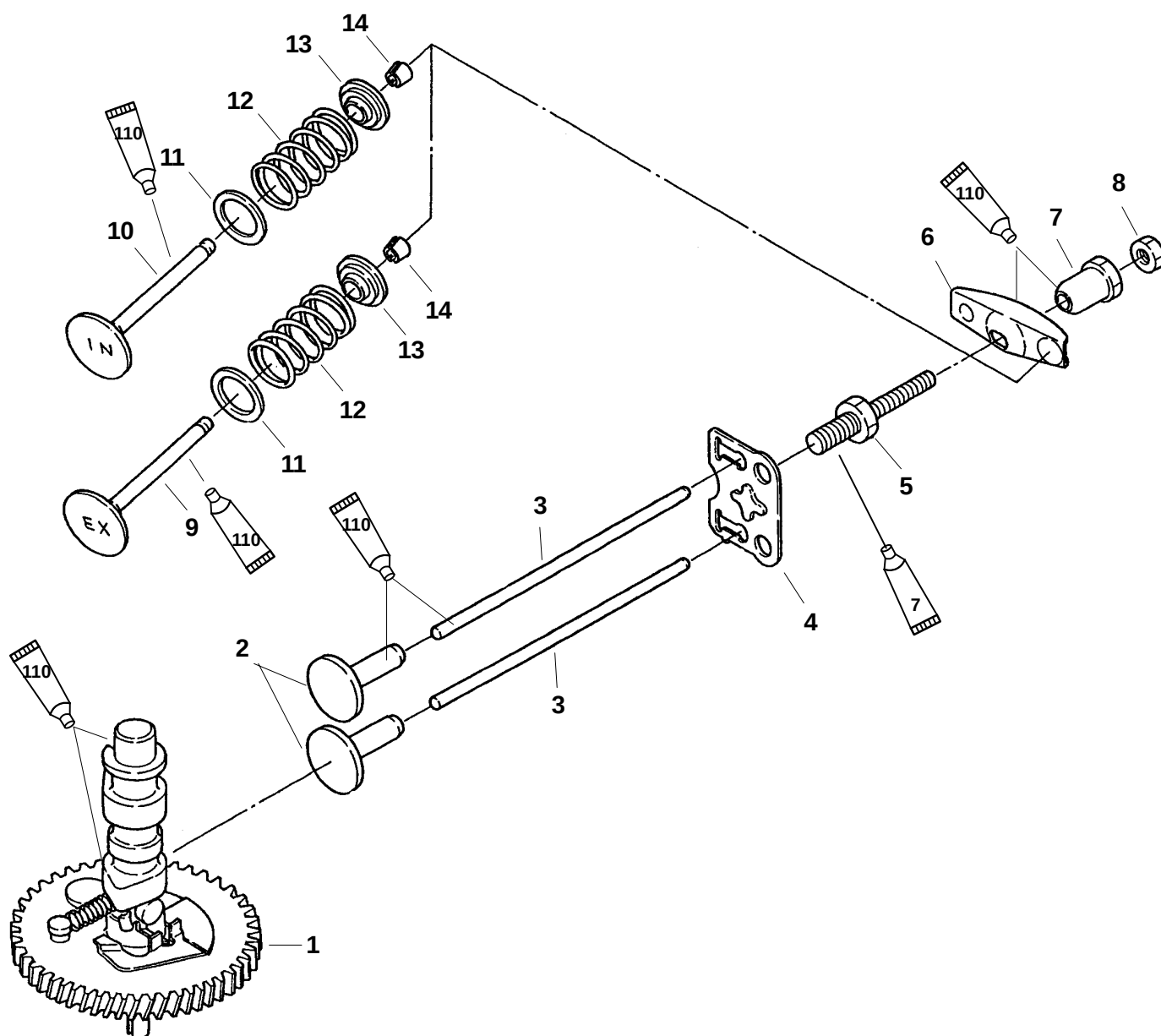


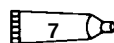
Cylinder Block

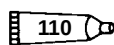
REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	CYLINDER BLOCK			
2	1	OIL SEAL			
3	1	BALL BEARING			
4	1	FILLER CAP			
5	1	O RING			
6	1	CAP			
7	1	GASKET			
8	2	BOLT	70		8
9	2	BREATHER TUBE			
10	2	WASHER			
11	1	TUBING			
12	2	CLAMP			
13	1	CYLINDER HEAD (4/5 H.P.)			
	1	CYLINDER HEAD (6 H.P.)			
14	1	GASKET			
15	2	DOWEL PIN			
16	1	GASKET			
17	1	THERMOSTAT COVER			
18	1	GASKET			
19	1	THERMOSTAT 126 degrees F (52 degrees C)			
20	2	BOLT (M8 x 90 mm)		18	24.5
21	2	BOLT (M8 x 60 mm)		18	24.5
22	1	SPARK PLUG (NGK#DCPR6E)		13	17.5
23	1	COVER			
24	1	GASKET			
25	4	BOLT (M6 x 20 mm)	70		8
26	4	WASHER			
-	1	GASKET SET			
-	1	POWERHEAD (4 H.P.)			
-	1	POWERHEAD (5 H.P.)			
-	1	POWERHEAD (6 H.P.)			



Intake/Exhaust Valves



 7 Loctite 271 (92-809820)

 110 4 Cycle Oil (92-828000A12)



Intake/Exhaust Valves

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	CAMSHAFT (4 H.P.)			
	1	CAMSHAFT (5 H.P.)			
	1	CAMSHAFT (6 H.P.)			
2	2	LIFTER			
3	2	PUSH ROD			
4	1	PLATE			
5	2	PIVOT BOLT		18	24.5
6	2	ROCKER ARM			
7	2	PIVOT			
8	2	NUT	90		10
9	1	EXHAUST VALVE			
10	1	INTAKE VALVE			
11	2	SEAT			
12	2	SPRING			
13	2	RETAINER			
14	4	VALVE KEEPER			



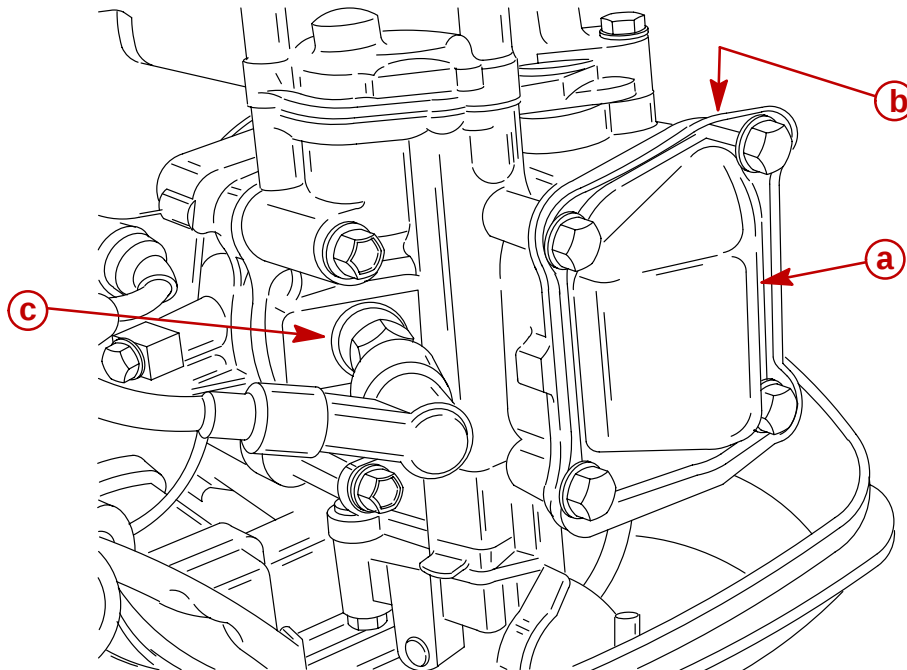
Adjustments

Valve Clearance

IMPORTANT: Make all valve adjustments while engine temperature is cool.

NOTE: Inspect cover gasket for cuts or tears. Replace gasket if damaged.

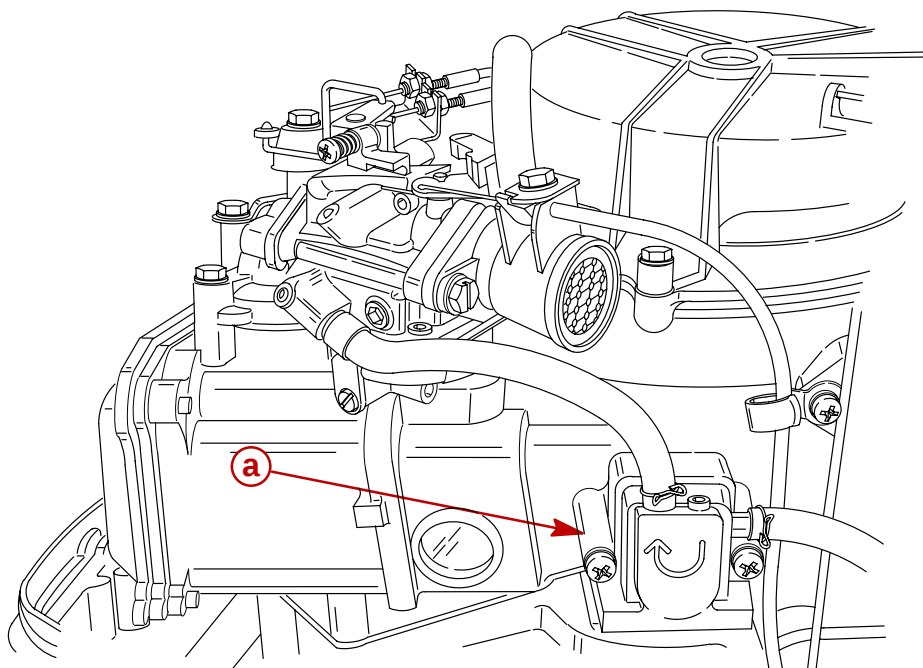
1. Remove cylinder cover and spark plug.



57252

- a** - Cylinder Head Cover
- b** - Cover Gasket
- c** - Spark Plug

2. Remove fuel pump.

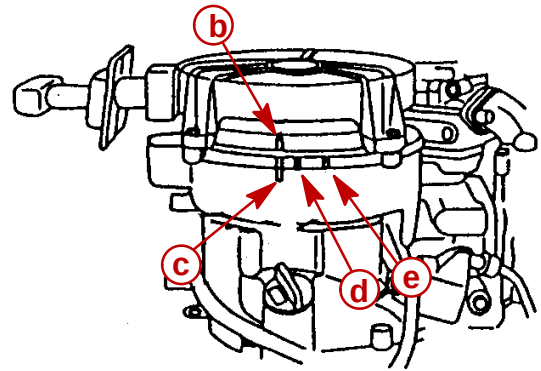
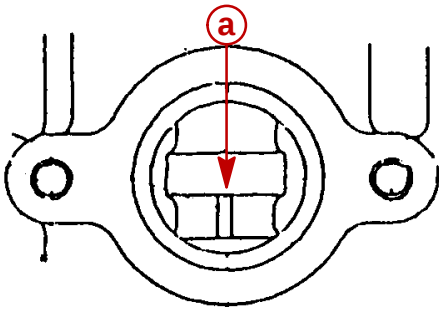


57231

- a** - Fuel Pump

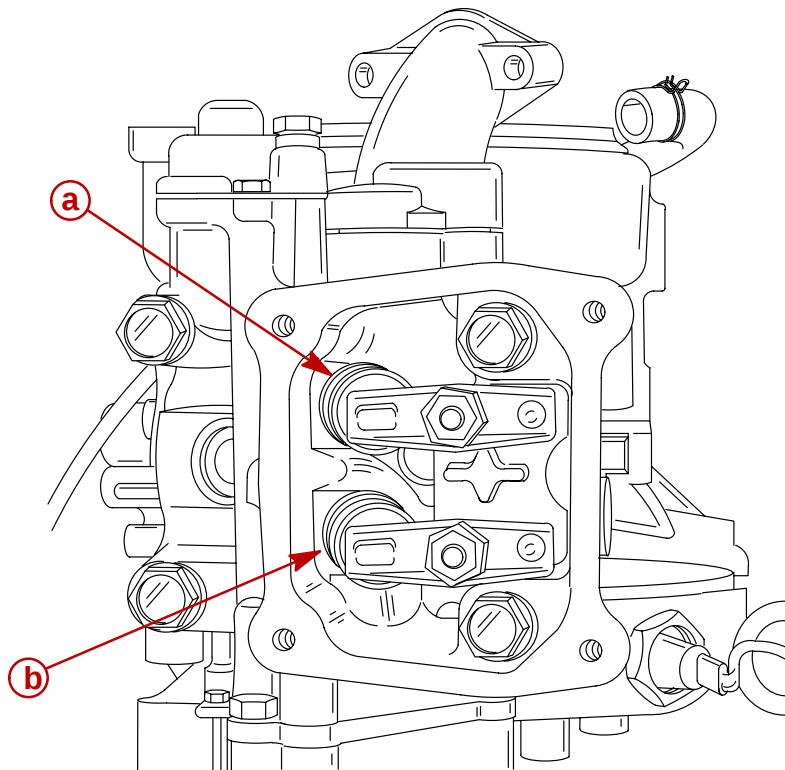


3. Rotate flywheel until raised mark on camshaft is visible through fuel pump hole and notched mark on flywheel aligns with TDC mark on block casting. Piston is now at top dead center and valve clearance may now be checked with feeler gauge.



- a** - Raised Mark on Camshaft
- b** - Notched Mark on Flywheel
- c** - TDC Mark
- d** - 5° BTDC Mark on Block Casting
- e** - 25° BTDC Mark on Block Casting

4. Measure valve clearance with a feeler gauge. Adjust if out of specification.



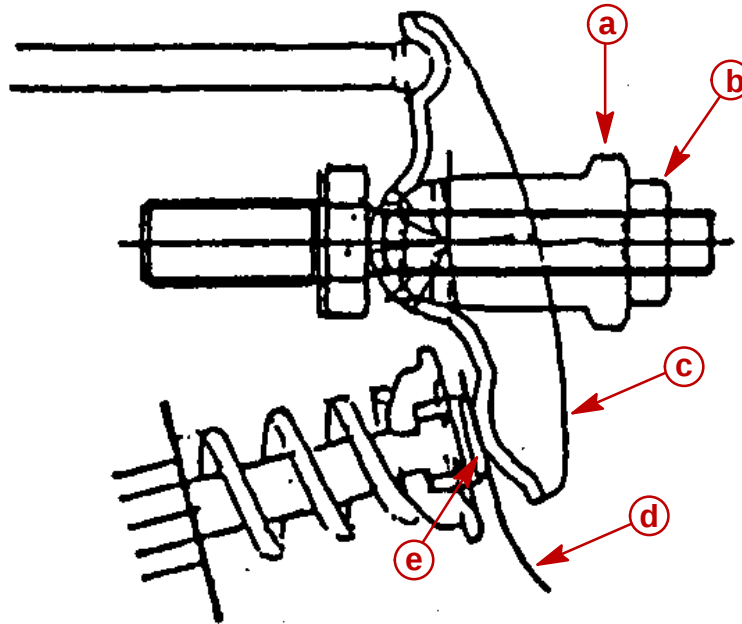
57250

- a** - Intake Valve
- b** - Exhaust Valve

Valve Clearance (Cold)	
Intake	0.002 - 0.005 in. (0.06 - 0.14 mm)
Exhaust	0.004 - 0.007 in. (0.11 - 0.19 mm)



5. If valve clearance adjustment is necessary, hold pivot and loosen lock nut.
6. Insert feeler gauge between rocker arm and valve.
7. Adjust the valve clearance by turning the pivot.
8. When proper clearance is achieved, hold pivot and tighten lock nut. Torque lock nut to 90 lb-in. (10 Nm).
9. Recheck valve clearance.



- a** - Pivot
- b** - Lock Nut [Torque to 90 lb-in. (10 Nm)]
- c** - Rocker Arm
- d** - Feeler Gauge
- e** - Valve

10. Reinstall cylinder cover. Torque 4 bolts to 70 lb-in. (8 Nm).
11. Reinstall fuel pump. Drive 2 attaching screws tight.
12. Reinstall spark plug. Torque plug to 13 lb-ft (17.5 Nm).



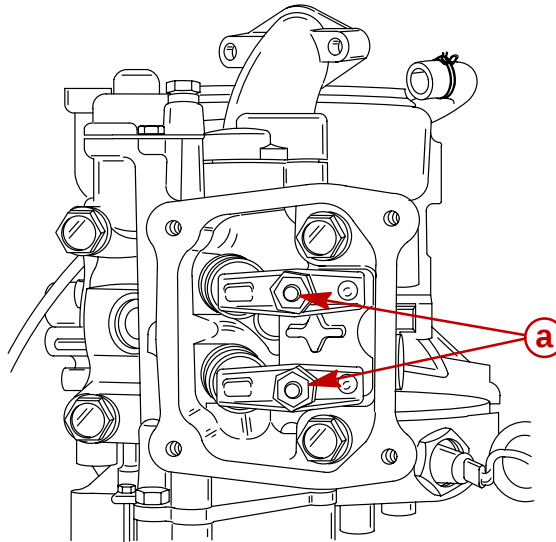
Cylinder Head Removal

Refer to Section 4B for cylinder head removal procedures.

Cylinder Head Disassembly

IMPORTANT: Note the location of valve train components for reassembly in their original location.

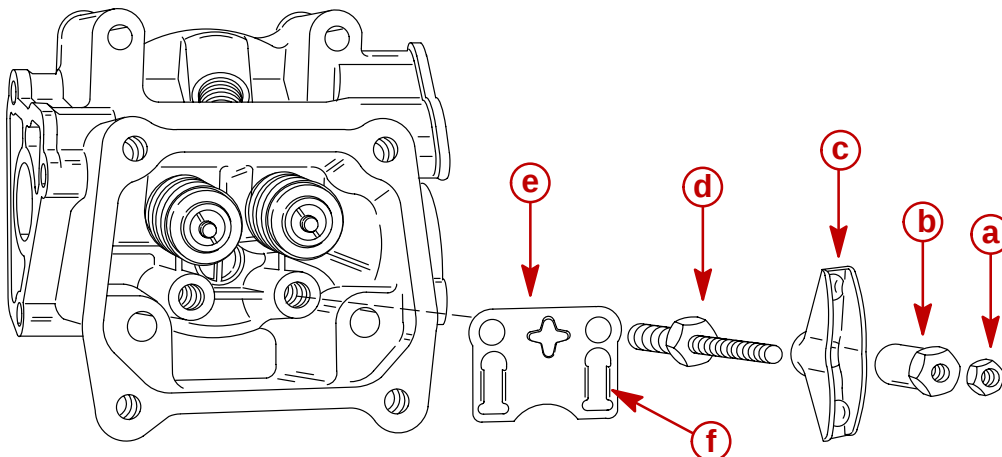
1. Loosen lock nuts.



57250

a - Lock nuts (2)

2. Remove pivots and rocker arms.
3. Remove 2 pivot bolts and guide plate.

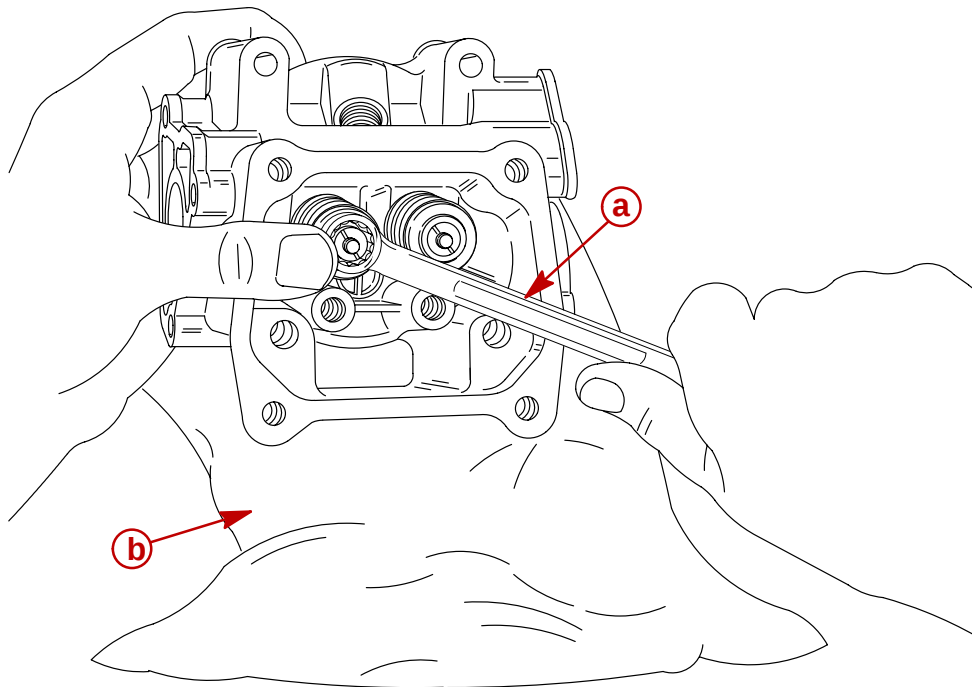


57247

a - Lock Nut
b - Pivot
c - Rocker Arm
d - Pivot Bolt
e - Guide Plate
f - Guide Tabs Face UP

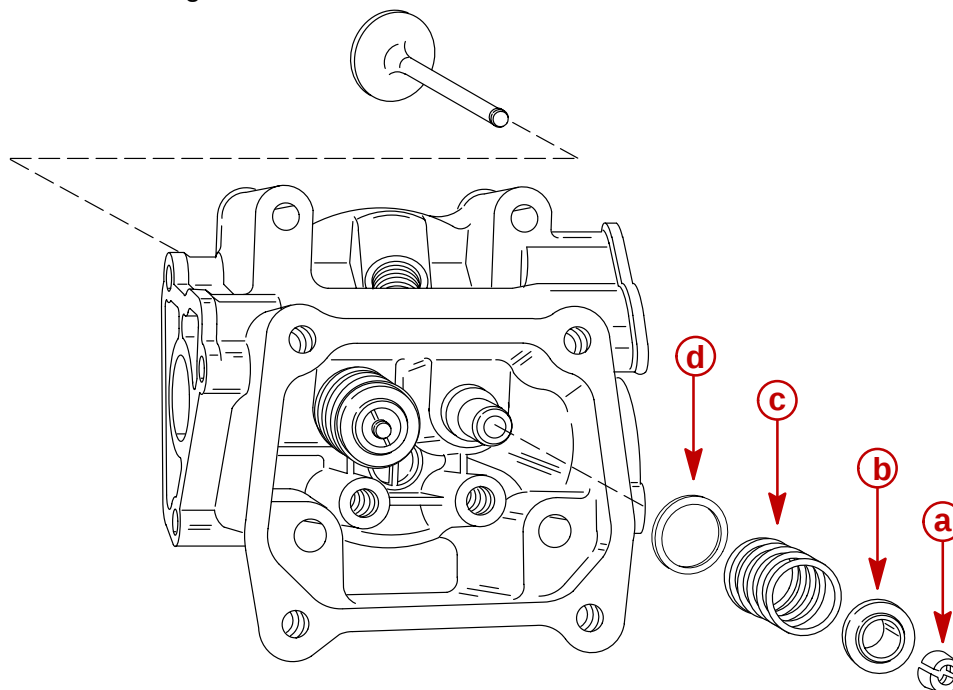


4. Place a rag under the cylinder head to support the valves. Using a suitable box end wrench, depress valve spring to release valve keepers. Remove keepers (2), valve spring retainer, valve spring and valve spring seat.



57338

- a** - Box End Wrench
- b** - Rag



57246

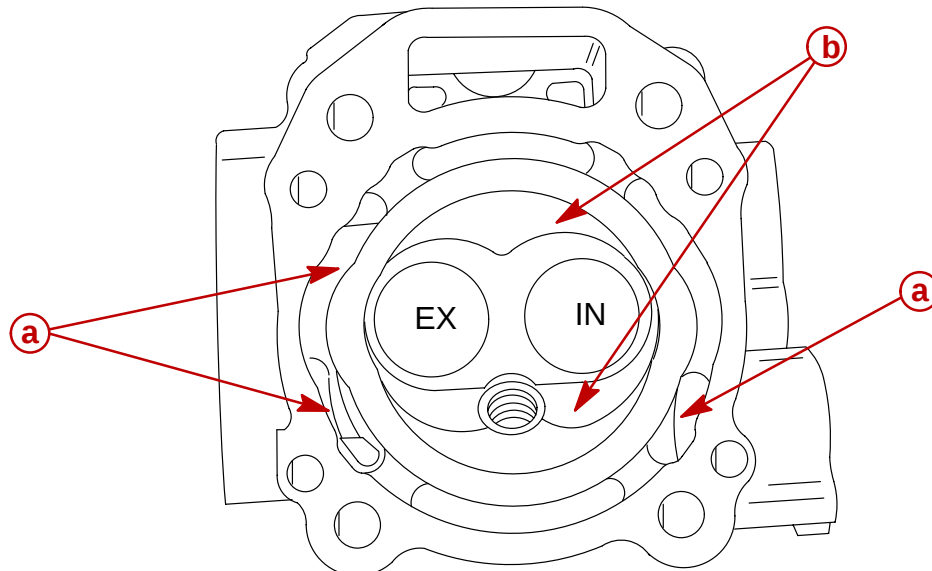
- a** - Keepers (2) per Valve
- b** - Valve Spring Retainer
- c** - Valve Spring
- d** - Valve Spring Seat



Cleaning and Inspection

Cylinder Head

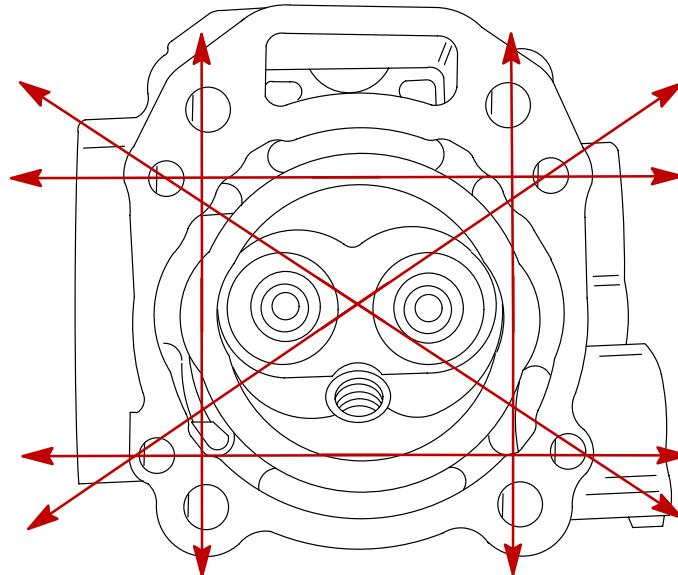
1. Inspect the cylinder head for mineral deposit blockage/corrosion in the water passage ways, clean any deposits/corrosion observed.
2. Inspect the cylinder head for carbon deposits in combustion chamber (use round scraper to clean away deposits). Be careful not to scratch or remove material.



57255

a - Water Passages
b - Combustion Chamber

3. Using a straight edge and a thickness gauge inspect cylinder head for warpage. Replace cylinder head if out of specification.



Cylinder Head Warpage Limit

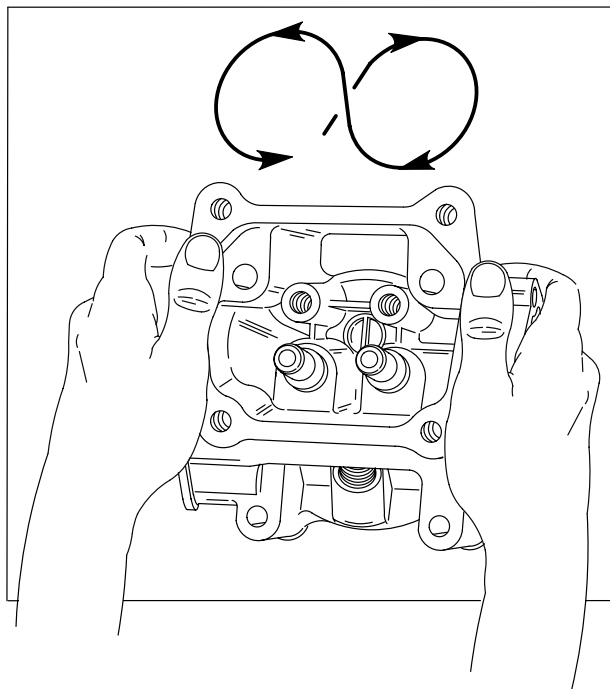
0.0012 in. (0.03 mm)



Cylinder Head Resurfacing

1. Place 400-600 grit wet sandpaper on flat surface.
2. Resurface the head using a figure eight motion until within the specifications.

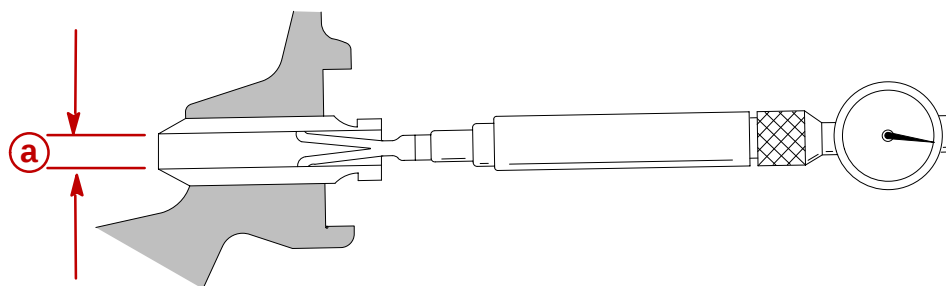
NOTE: Rotate the head several times during the resurfacing procedure to avoid removing too much material from one side.



57249

VALVE GUIDE INSPECTION

1. Measure the valve guide bore (a). If valve guide wear is out of specification, replace the cylinder head.



55794

Valve	Standard Inside Diameter	Out of Limit to Use
Intake	0.2165 in. (5.5 mm)	0.2181 in. (5.54 mm) or greater
Exhaust	0.2165 in. (5.5 mm)	0.2192 in. (5.57 mm) or greater

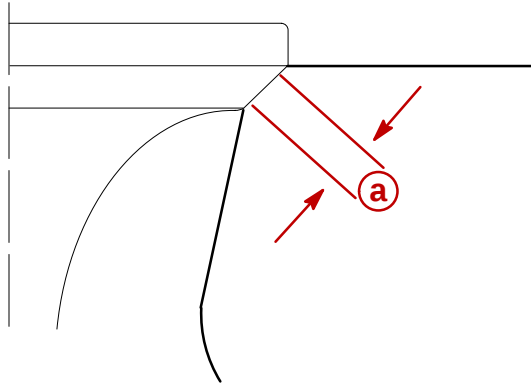


VALVE SEAT RECONDITIONING

Clean the carbon deposits from the combustion chambers and valve seats and check for pitting.

Several different types of equipment are available for reseating valve seats. Follow the equipment manufacturer's instructions.

Measure valve seat width. Resurface the valve seat if not in specification.

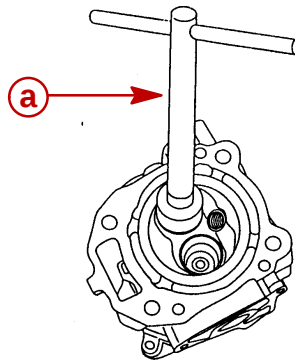


55799

a - Valve Seat Width

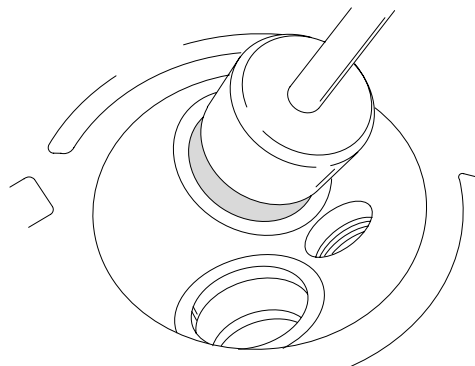
Valve Seat Width Specification "a"		
	Standard Value	Limit that requires repair
Intake Valve Seat	0.031 in. (0.8 mm)	0.070 in. (1.8 mm) or more
Exhaust Valve Seat	0.031 in. (0.8 mm)	0.070 in. (1.8 mm) or more

To reface valve seat, use a 60°, 45° or 15° cutter and finish with 60° valve seat cutter.



a - Valve Seat Cutter

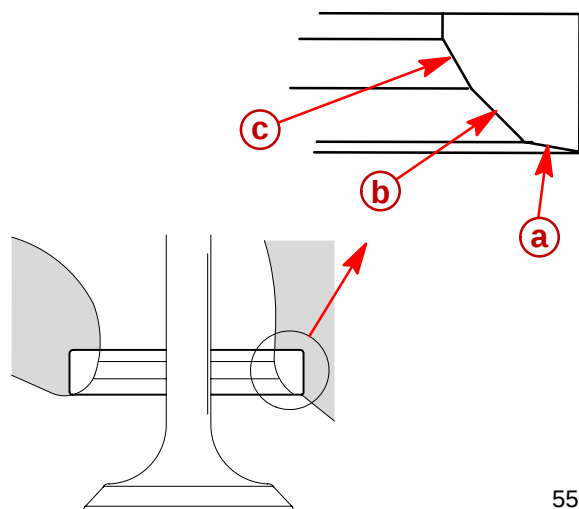
NOTE: Turn cutter clockwise only. Continue turning as cutter is lifted off valve seat



55795



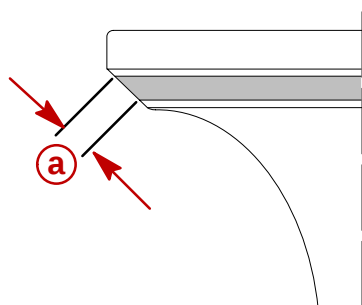
NOTE: If resurfacing the valve seats is required, resurface the valve seats to the specified angle shown in chart.



55798

Valve Seat Angle Specifications	
a	15°
b	45°
c	60°

CORRECT VALVE SEAT POSITION



55800

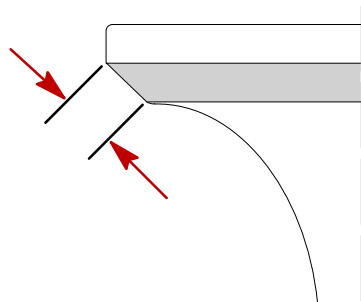
	Standard Value "a"	Limit that needs Repair
Intake Valve	0.031 in. (0.8 mm)	0.0708 in. (1.8 mm) or greater
Exhaust Valve	0.031 in. (0.8 mm)	0.0708 in. (1.8 mm) or greater

NOTE: After resurfacing the seats, inspect for even valve seating. Apply Prussian Blue compound or erasable felt-tipped marker ink to the valve faces. Insert the valves and then lift them and snap them closed against their seats several times. Do not allow the valve to rotate on the seat. The seating surface, as shown by the transferred marking compound, should have good contact all the around.



VALVE SEAT POSITIONS AND CORRECTIONS

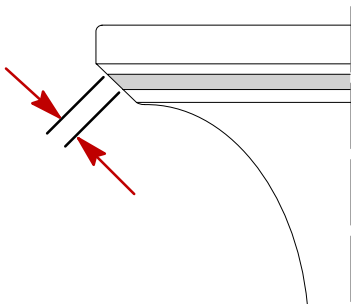
Condition: The valve seat is centered on valve face but it is too wide.



55799

Valve Seat Cutter Set		Desired Results
Use Lightly	15° Cutter	To reduce valve seat width
	60° Cutter	

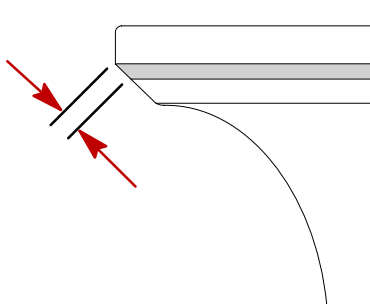
Condition: The valve seat is in the middle of the valve face but it is too narrow.



55800

Valve Seat Cutter Set		Desired Results
Use	45° Cutter	To achieve a uniform valve seat width

Condition: Valve seat is too narrow and it is near valve margin.

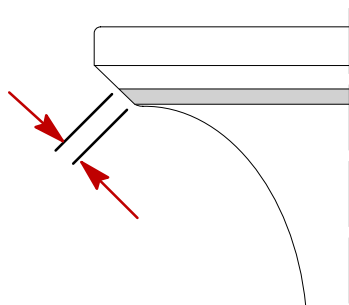


55801

Valve Seat Cutter Set		Desired Results
Use	15° Cutter, First	To center the seat and to achieve its width
	45° Cutter	



Condition: Valve seat is too narrow and is located near the bottom edge of the valve face.

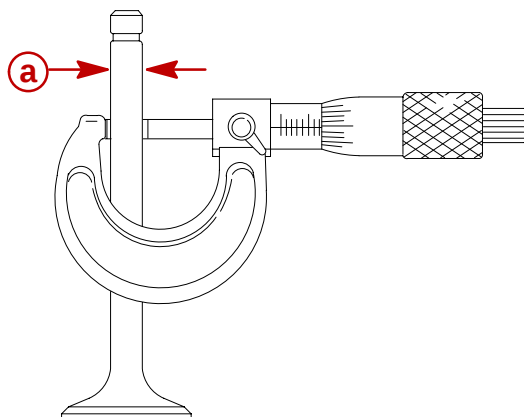


55802

Valve Seat Cutter Set		Desired Results
Use	60° Cutter, First	To center the seat and to increase its width
	45° Cutter	

Valves

1. Clean the carbon deposits from the valve. Discard any cracked, warped, or burned valves.
2. Measure the valve stem diameter to check for wear. Replace valves if not within specification.



55810

a - Valve Stem Diameter

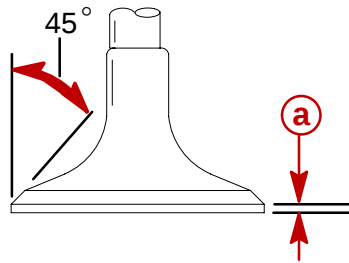
Valve Stem Diameter		
	Standard Value	Out of limit to use; replace valve
Intake Valve	0.216 in. (5.48 mm)	0.2145 in. (5.45 mm) or less
Exhaust Valve	0.214 in. (5.44 mm)	0.213 in. (5.41 mm) or less

3. Check the valve face for pitting. Valve faces that are pitted must be replaced or refaced.

NOTE: Several different types of equipment are available for refacing valves. Follow the equipment manufacturer's instructions.



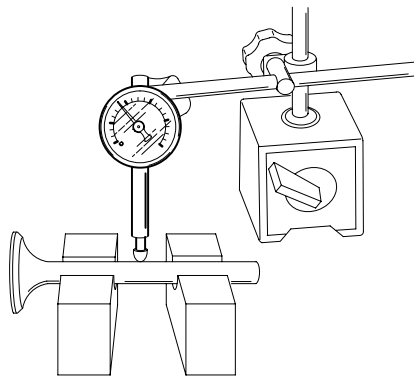
4. Check the margin thickness (a) of the valves after the valves have been ground. Any valve with a margin thickness of less than the specification, should be replaced.



55809

Margin Thickness "a"	
Intake Valve	0.028 - 0.047 in. (0.7 - 1.2 mm)
Exhaust Valve	

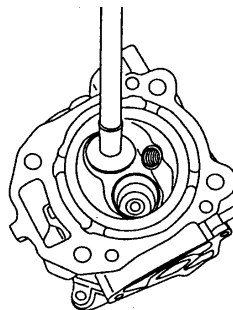
5. Measure valve stem runout, replace if out of specification.



55811

Valve Stem Runout Limit (Max.)	
Intake Valve Exhaust Valve	0.0006 in. (0.016 mm)

6. After repair of valve seat, lap the valve for proper fitting to valve seat.
7. Apply lapping compound to valve seat and lap valve while turning valve with valve lapper.
8. Apply lapping compound in 3 sequences; coarse compound first followed by medium and then fine compound last.



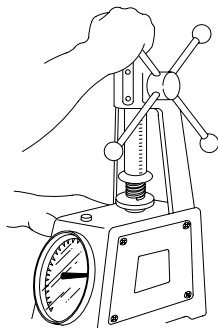
IMPORTANT: Before using lapping compound of a different grade, completely remove previously used compound.

IMPORTANT: After lapping is complete, wash valve and valve seat removing all lapping compound from them.



Valve Springs

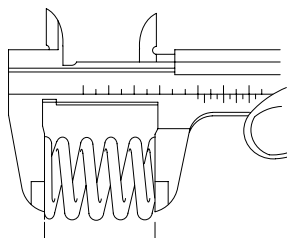
1. Check each spring under load on a spring tester. Replace any weak springs.



55796

Valve Spring Compressed Pressure (Installed)	
Closed Height 0.965 in. (24.4 mm) 4/5 (1999 & 2000) 6 (2000) 4/5/6 (2001 & Newer)	17 lbf. (7.7 kgf) 24 lbf. (10.8 kgf) 24 lbf. (10.8 kgf)
Open Height 0.709 in. (17.4 mm) 4/5 (1999 & 2000) 6 (2000) 4/5/6 (2001 & Newer)	31 lbf. (14.0 kgf) 39.4 lbf. (17.9 kgf) 39.4 lbf. (17.9 kgf)

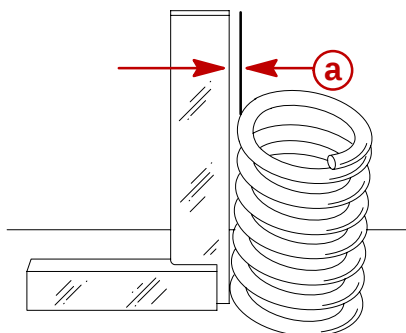
2. Check free length limit of each spring. Replace if out of specification.



55846

Valve Spring Free Length Limit	
4/5 (1999 & 2000) 6 (2000) 4/5/6 (2001 & Newer)	1.260 in. (32.0mm) 1.378 (35.0mm) 1.378 (35.0mm)

3. Check each spring on a flat surface using a square. Rotate spring and check space between the top coil and square. Replace if out of specification.



55797



Valve Spring Tilt Specification “a”
Less than 0.044 in. (1.12 mm)

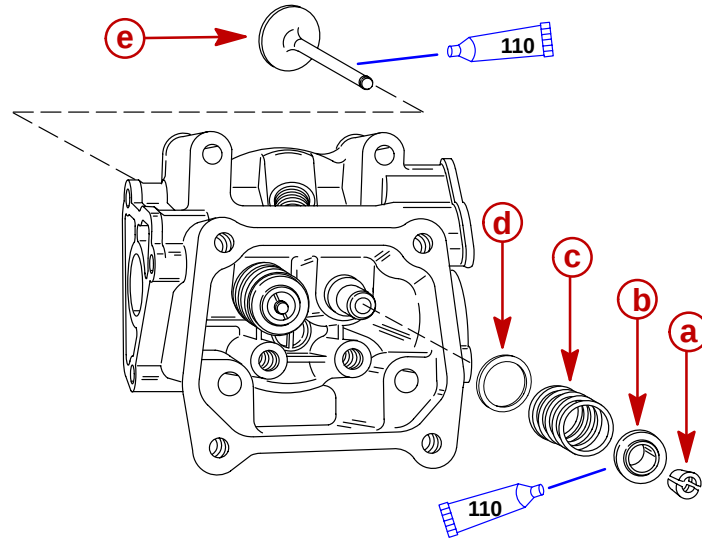


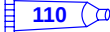
Cylinder Head Reassembly

IMPORTANT: Reassemble valve train components in their original location.

1. Install valves, lower seats, springs, spring retainers and keepers.

NOTE: Compress valve springs using a suitable box end wrench.

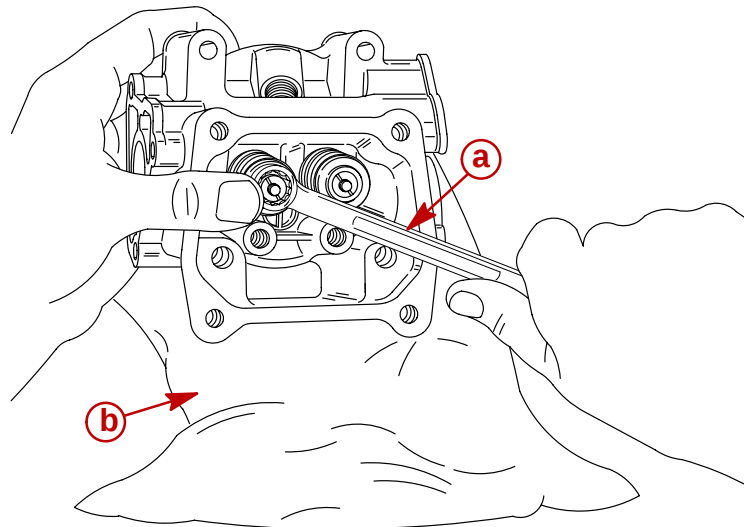


 **110** 4-Stroke Outboard Oil (92-828000A12)

57246

- a** - Keepers (2) per Valve
- b** - Valve Spring Retainer
- c** - Valve Spring
- d** - Valve Spring Seat
- e** - Intake Valve

2. Place a clean rag under the head to support the valves. Use a suitable box end wrench to compress springs while installing valve keepers.

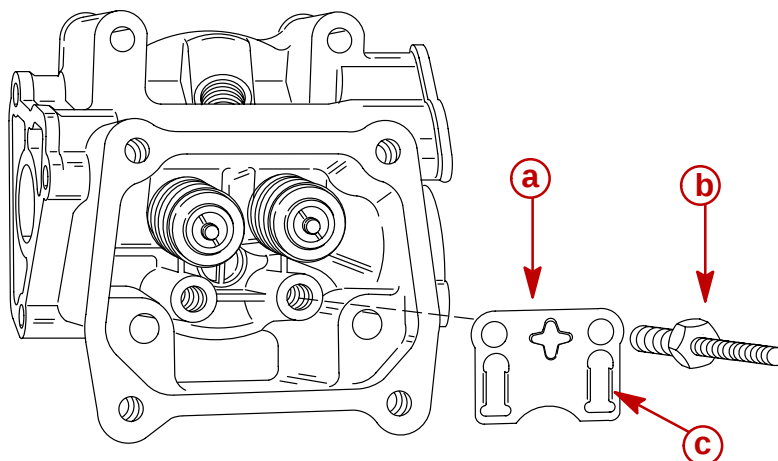


57338

- a** - Box End Wrench
- b** - Clean Rag



3. Install rocker arm plate and 2 pivot bolts. Torque pivot bolts to 18 lb-ft (24.4 Nm).

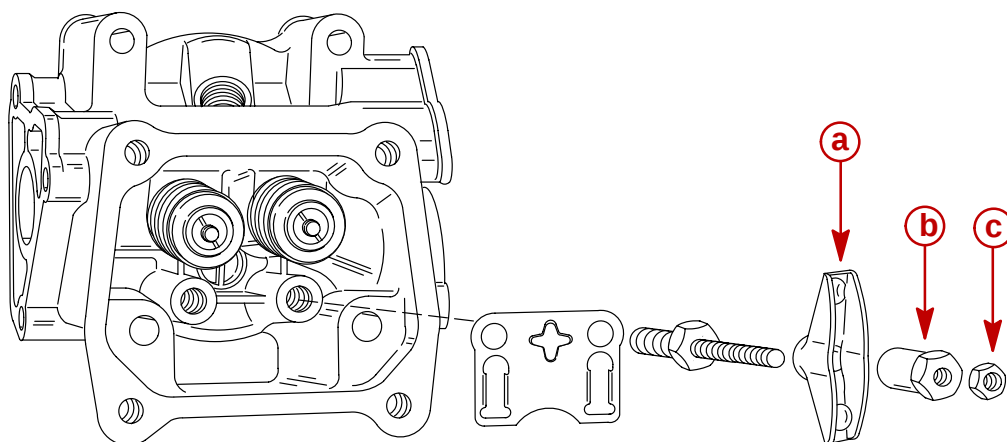


57247

- a** - Guide Plate
- b** - Pivot Bolts [Torque to 18 lb-ft (24.5 Nm)]
- c** - Guide Plate Tabs Face UP

4. Install rocker arms, pivots and lock nuts.

IMPORTANT: Do not tighten pivots and lock nuts. Rocker arms must be loose until after cylinder head assembly is installed on cylinder block and head bolts torqued. Push rods can then be aligned with rocker arms. Refer to valve adjustment procedure at that time.



57247

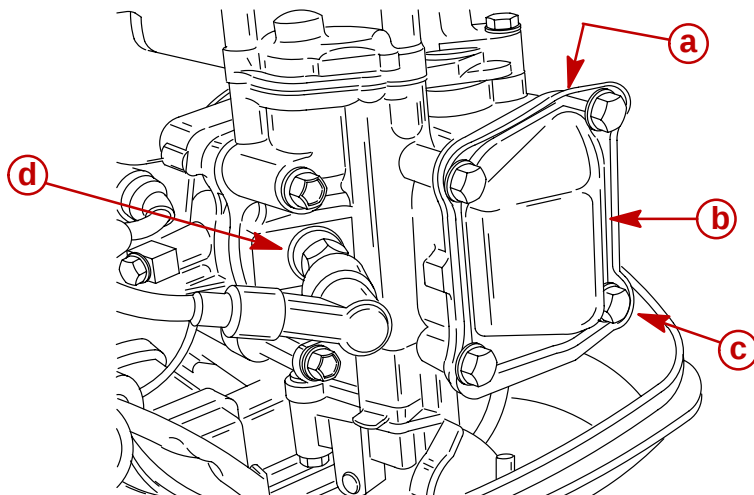
- a** - Rocker Arm
- b** - Pivot
- c** - Lock Nut



Cylinder Head Installation

Refer to Section 4B for proper cylinder head installation procedures with torque specifications and sequences.

1. Perform **valve clearance adjustment** at the beginning of this section.
2. Install cylinder head cover with new gasket.
3. Install spark plug.



57252

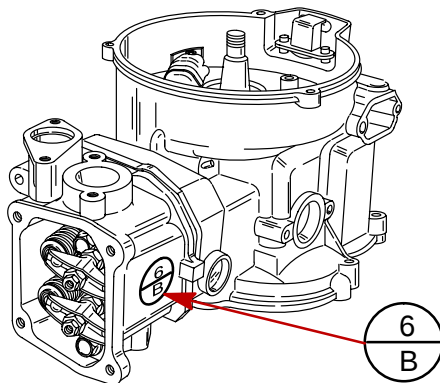
- a** - Gasket (New)
- b** - Cylinder Head Cover
- c** - Bolts (4) M6 x 20 mm
- d** - Spark Plug

Cylinder Head Cover Bolt Torque
70 lb-in. (8 Nm)

Spark Plug Torque
13 lb-ft (17.5 Nm)

Cylinder Head Identification Mark

NOTE: 2000 model year outboards have hp located on cylinder head. Cylinder head will be marked with a 5 or 6; 5 designating 4 and 5 hp, and 6 designating 6 hp. The letter below the number designates nothing. At 2001 model year, all (4/5/6) will be marked with a 6.





POWERHEAD

Section 4B - Cylinder Block and Crankcase

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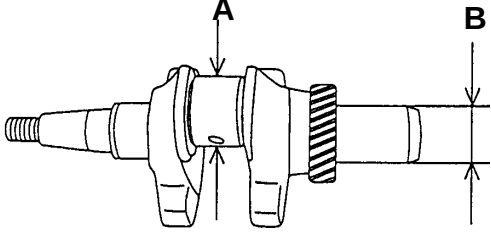
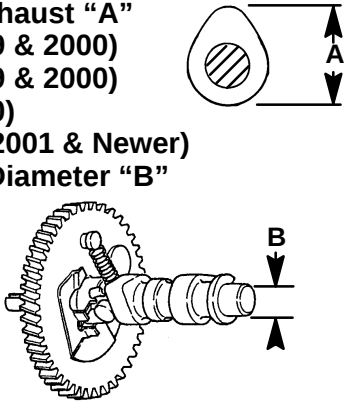
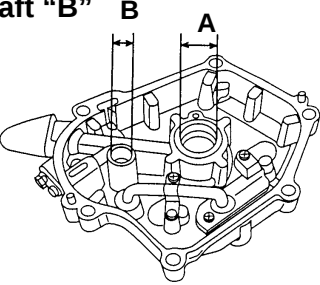
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Specifications

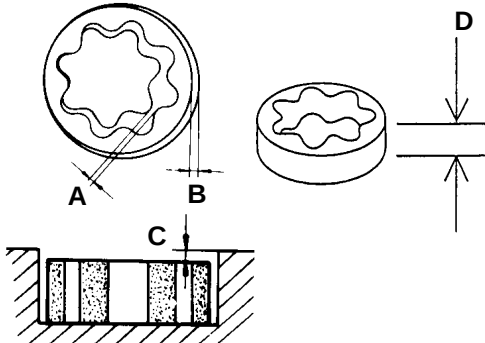
**4
B**

CYLINDER BLOCK	Type Displacement Number of Cylinders	4 Stroke Cycle – Over Head Valve 7.5 cu. in. (123 cc) 1
STROKE	Length	1.77 in. (45 mm)
CYLINDER BORE	Diameter Standard Oversize-0.020 in. (0.50 mm) Taper/Out of Round Maximum Bore Type	2.323 in. (59.00 mm) 2.343 in. (59.50 mm) 0.003 in. (0.076 mm) Steel
PISTON	Piston Type O.D. at Skirt Standard Oversize-0.020 in. (0.50 mm)	Aluminum 2.321 in. (58.960 mm) 2.341 in. (59.460 mm)
PISTON CLEARANCE	Piston to Cylinder Clearance Piston Clearance Limit	0.001 - 0.002 in. (0.020 - 0.055 mm) 0.006 in. (0.15 mm)
RINGS	Ring End Gap (Installed) Top Middle Bottom (Oil Ring) Side Clearance: Top Middle Bottom (Oil Ring)	0.006 - 0.014 in. (0.15 - 0.35 mm) 0.012 - 0.020 in. (0.30 - 0.50 mm) 0.008 - 0.016 in. (0.20 - 0.40 mm) 0.0015 - 0.003 in. (0.04 - 0.08 mm) 0.0012 - 0.003 in. (0.03 - 0.07 mm) 0.0004 - 0.007 in. (0.01 - 0.18 mm)
COMPRESSION RATIO	Compression Ratio With Decompression 4/5 (1999 & 2000) 4/5 (2001 & Newer) 6 (2000 & Newer)	8.5:1 42 psi ± 14 psi (0.29 ± 0.1 MPa) 9.5:1 42 psi ± 14 psi (0.29 ± 0.1 MPa)
PISTON PIN	Outer Diameter Diameter of Piston Pin Hole Clearance between Piston Pin and Piston Pin Hole	0.6299 in. (16.00 mm) 0.6300 in. (16.002 mm) 0.0001 - 0.0005 in. (0.002 mm - 0.012 mm)



CONNECTING ROD	Oil Clearance (Big End) Side Clearance (Big End) Small End Inside Diameter	0.002 - 0.003 in. (0.053 - 0.079 mm) 0.008 - 0.016 in. (0.20 - 0.40 mm) 0.6303 in. (16.01 mm)
CRANKSHAFT	Crankshaft Runout Diameter of Crank Pin (A) Outer Diameter of Crankshaft in Oil Pan Bearing (B) 	Less than 0.002 in. (0.05 mm) 1.179 - 1.177 in. (29.94 - 29.91 mm) 0.983 - 0.982 in. (24.98 - 24.96 mm)
CAMSHAFT	Camshaft Dimensions Intake/Exhaust "A" 4 (1999 & 2000) 5 (1999 & 2000) 6 (2000) 4/5/6 (2001 & Newer) Bearing Diameter "B" 	0.993 in. (25.24 mm) 1.047 in. (26.59 mm) 1.115 in. (28.33 mm) 1.115 in. (28.33 mm) 0.550 in. (13.98 mm)
OIL PAN	Inside Diameter of Oil Pan Bearing: Crankshaft "A" Camshaft "B"  Crankshaft to Oil Pan Bearing Clearance Camshaft to Oil Pan Bearing Clearance	0.985 in. (25.01 mm) 0.5515 in. (14.01 mm) 0.0006 - 0.0015 in. (0.015 - 0.040 mm) 0.0008 - 0.002 in. (0.02 - 0.05 mm)



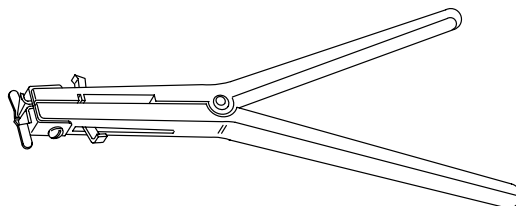
THERMOSTAT	Valve Opening Temperature Full Open Temperature Valve Lift (Minimum)	122°F - 129°F (50°C - 54°C) 145°F - 153°F (63°C - 67°C) 0.12 in. (3 mm)
LUBRICATION SYSTEM	Pump Type Engine Oil Pressure* (Warm Engine): @ 1300 rpm @ 5000 rpm Engine Oil Pan Capacity Oil Pump Clearance: Inner Rotor to Outer Rotor "A" Outer Rotor to Body "B" Rotor to Body (Side) "C" Height of Outer Rotor "D" Relief Valve Operating Pressure* 	Trochoid 4.0 psi (0.03 MPa) Minimum 21.0 psi (0.15 MPa) Minimum 0.95 pt (450 ml) 0.006 in. (0.15 mm) or Less 0.005 - 0.008 in. (0.12 - 0.20 mm) 0.0008 - 0.0028 in. (0.02 - 0.07 mm) 0.236 in. (5.99 mm) 31 - 40 psi (2.2 - 2.8 kg/cm ²) 216 - 275 kPa

* Oil pressure specifications listed were obtained with oil at 165°F (75°C)

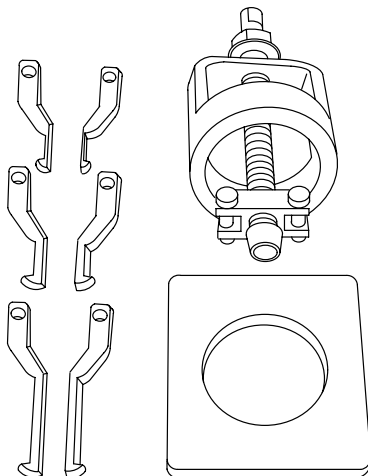


Special Tools

1. Piston Ring Expander (P/N 91-24697).



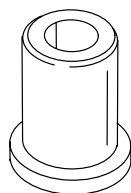
2. Puller Assembly (P/N 91-83165M)



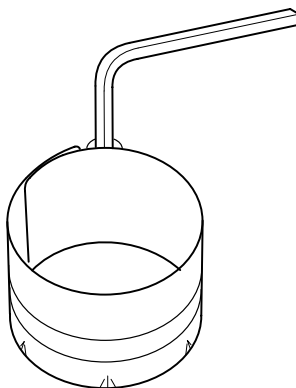
3. Driver (P/N 91-84529M) NLA



4. Mandrel (P/N 91-83272M) NLA



5. Piston Ring Compressor (P/N FT 2997)





Quicksilver Lubricants and Service Aids

Part No.	Description
92-809819	Loctite 271
92-809822	Loctite Pipe Sealant w/Teflon-567
92-828000A12	4-Cycle Outboard Oil

Powerhead - General Information

Powerhead "Disassembly" and "Reassembly" instructions are printed in a sequence that should be followed to assure best results when removing or replacing powerhead components. If complete disassembly is not necessary, start reassembly at point that disassembly was stopped. Usually, complete disassembly of the entire powerhead will be required.

If major powerhead repairs are to be performed remove powerhead from drive shaft housing. Powerhead removal is not required for 1) valve adjustment and 2) minor repairs on components such as ignition systems or carburetor.

This diagram illustrates the exploded view of a 125cc engine assembly. The main components shown include the cylinder head (13), cylinder (14), crankcase (1), and various sub-components like the carburetor (17), spark plug (19), and timing belt (11). The diagram is numbered 1 through 26, corresponding to the parts list. A detailed inset shows the assembly of the timing belt (11) with its tensioner (4) and guides (5, 12). Grease application points are marked with '110'.

Parts List:

Part Number	Description
1	Crankcase
2	Cylinder Head Gasket
3	Crankshaft Seal
4	Timing Belt Tensioner
5	Timing Belt Guide
6	Timing Belt Cover Gasket
7	Timing Belt Cover Gasket
8	Timing Belt Cover Bolt
9	Timing Belt Cover Bolt
10	Timing Belt Cover Bolt
11	Timing Belt
12	Timing Belt Guide
13	Cylinder Head
14	Cylinder
15	Cylinder Head Bolt
16	Cylinder Head Bolt
17	Carburetor
18	Carburetor Gasket
19	Spark Plug
20	Spark Plug Wire
21	Spark Plug Wire
22	Spark Plug
23	Timing Belt Cover
24	Timing Belt Cover Gasket
25	Timing Belt Cover Bolt
26	Timing Belt Cover Bolt

90-857138R1 MAY 2000

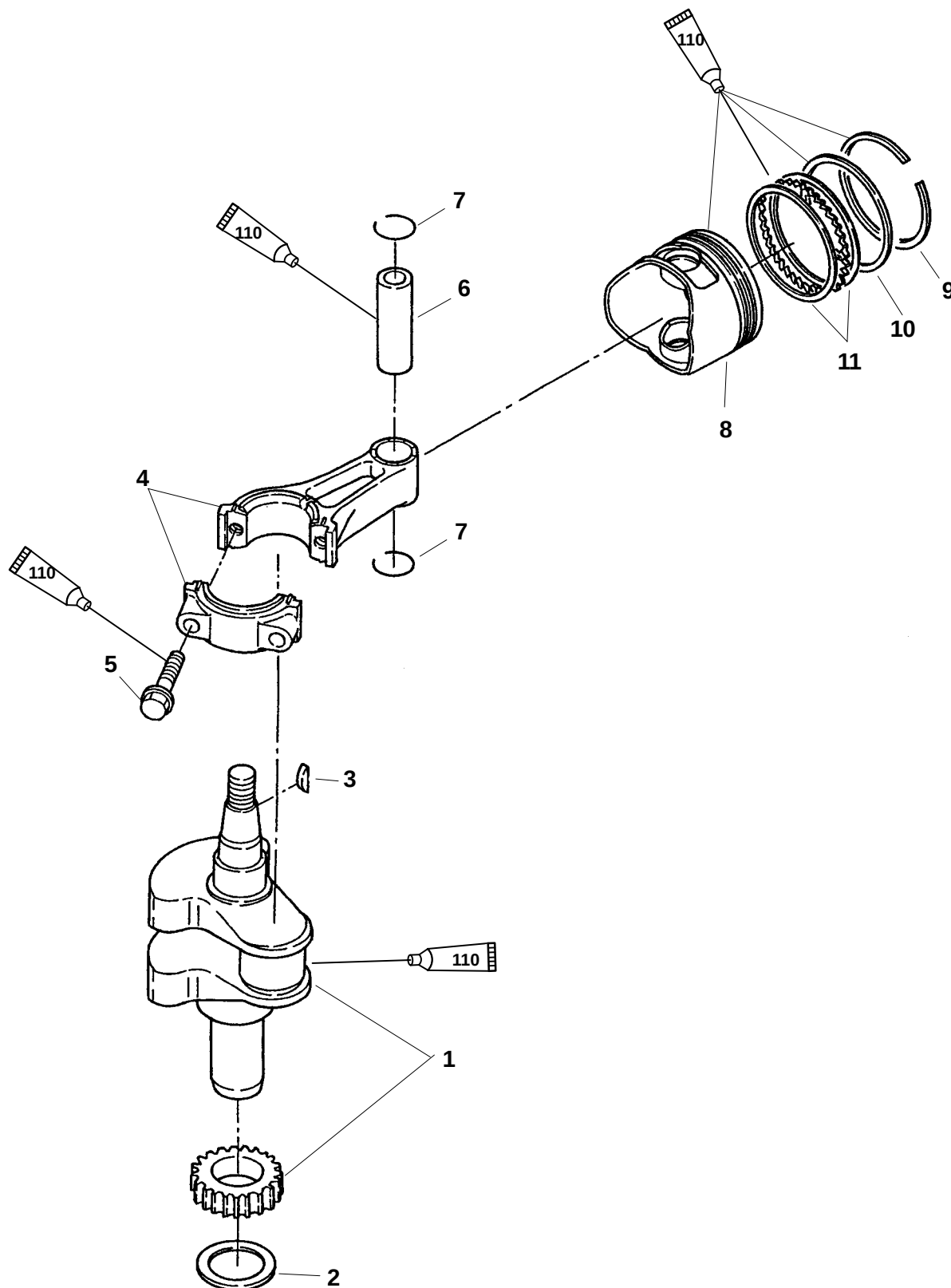


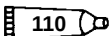
Cylinder Block

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	CYLINDER BLOCK			
2	1	OIL SEAL			
3	1	BALL BEARING			
4	1	FILLER CAP			
5	1	O RING			
6	1	CAP			
7	1	GASKET			
8	2	BOLT	70		8
9	2	BREATHER TUBE			
10	2	WASHER			
11	1	TUBING			
12	2	CLAMP			
13	1	CYLINDER HEAD (4/5 H.P.)			
	1	CYLINDER HEAD (6 H.P.)			
14	1	GASKET			
15	2	DOWEL PIN			
16	1	GASKET			
17	1	THERMOSTAT COVER			
18	1	GASKET			
19	1	THERMOSTAT 126 degrees F (52 degrees C)			
20	2	BOLT (M8 x 90 mm)		18	24.5
21	2	BOLT (M8 x 60 mm)		18	24.5
22	1	SPARK PLUG (NGK#DCPR6E)		13	17.5
23	1	COVER			
24	1	GASKET			
25	4	BOLT (M6 x 20 mm)	70		8
26	4	WASHER			
-	1	GASKET SET			
-	1	POWERHEAD (4 H.P.)			
-	1	POWERHEAD (5 H.P.)			
-	1	POWERHEAD (6 H.P.)			



Crankshaft



 110 4 Cycle Oil (92-828000A12)



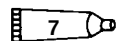
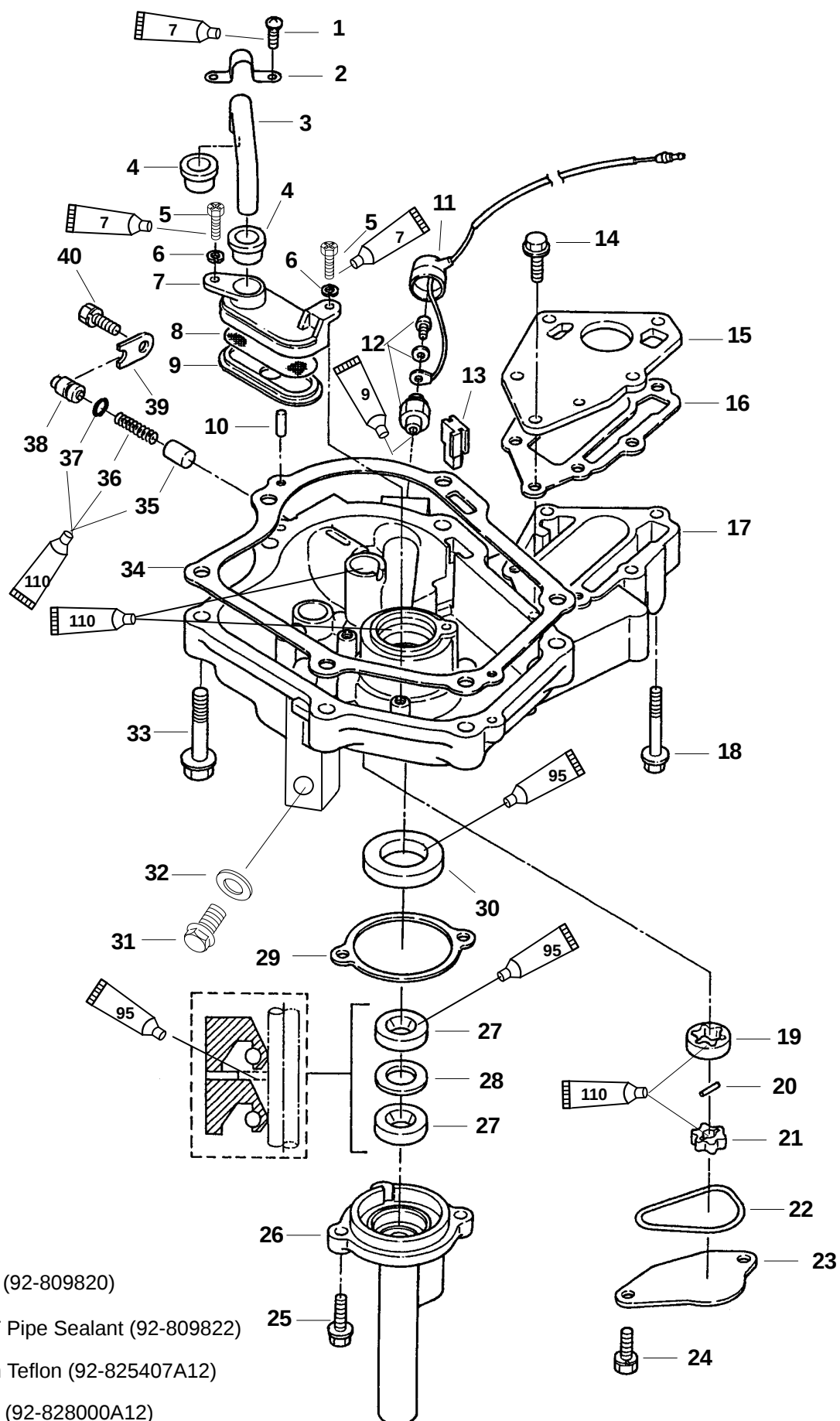
Crankshaft

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	CRANKSHAFT			
2	1	WASHER			
3	1	KEY			
4	1	CONNECTING ROD			
5	2	BOLT	106		12
6	1	PISTON PIN			
7	2	E RING			
8	1	PISTON (STANDARD) (4/5 H.P.)			
	AR	PISTON (.05 MM O/S) (4/5 H.P.)			
	1	PISTON (STANDARD) (6 H.P.)			
	AR	PISTON (.05 MM O/S) (6 H.P.)			
9	1	PISTON RING-TOP (STANDARD)			
	AR	PISTON RING-TOP (.05 MM O/S)			
10	1	PISTON RING-SECOND (STANDARD)			
	AR	PISTON RING-SECOND (.05 MM O/S)			
11	1	OIL RING (STANDARD)			
	AR	OIL RING (.05 MM O/S)			

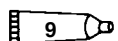
AR = As Required



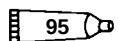
Oil Pan



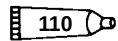
Loctite 271 (92-809820)



Loctite PST Pipe Sealant (92-809822)



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



4 Cycle Oil (92-828000A12)



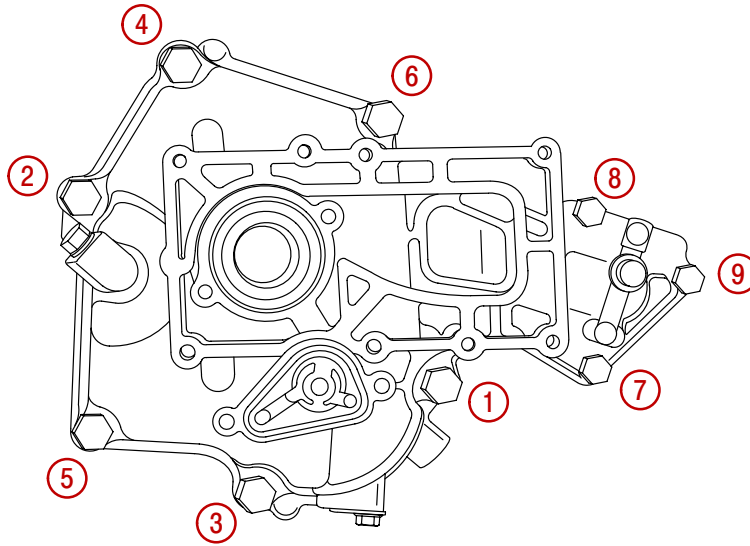
Oil Pan

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	SCREW (M5 x 16 mm)	31		3.5
2	1	STOPPER			
3	1	TUBING			
4	2	SEAL			
5	2	SCREW (M5 x 16 mm)	31		3.5
6	2	WASHER			
7	1	STRAINER HOUSING			
8	1	STRAINER			
9	1	CUP			
10	2	DOWEL PIN			
11	1	LEAD WIRE			
12	1	OIL PRESSURE SWITCH			
13	1	GROMMET			
14	3	BOLT (M6 x 20 mm)	70		8
15	1	EXHAUST PLATE			
16	1	GASKET			
17	1	OIL PAN			
18	3	BOLT (M6 x 40 mm)	80		9
19	1	ROTOR-OUTER			
20	1	PIN			
21	1	ROTOR-INNER			
22	1	O RING			
23	1	COVER			
24	2	BOLT (M6 x 16 mm)	70		8
25	2	BOLT (M6 x 20 mm)	70		8
26	1	HOUSING			
27	2	OIL SEAL			
28	1	SPACER			
29	1	GASKET			
30	1	OIL SEAL			
31	1	DRAIN BOLT			
32	1	WASHER			
33	6	BOLT (M8 x 40 mm)	221	18.5	25
34	1	GASKET			
35	1	CONTROL PLUNGER			
36	1	SPRING			
37	1	O RING			
38	1	SEAT			
39	1	COVER			
40	1	BOLT (M6 x 16 mm)	70		8
-	1	GASKET SET			



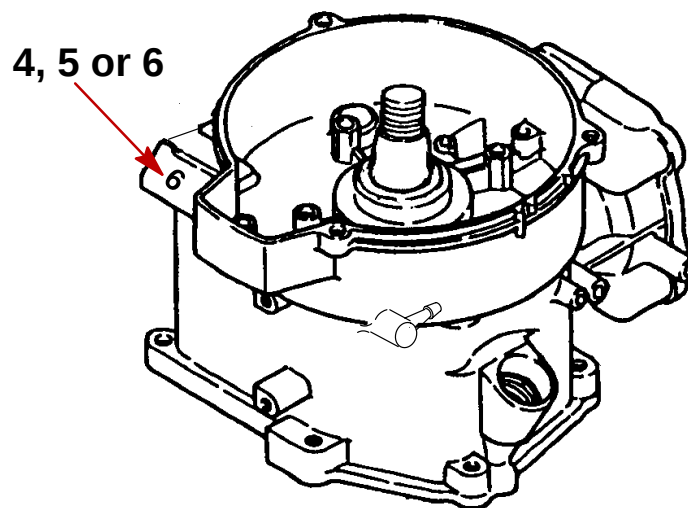
Torque Sequence

Oil Pan



Cylinder Block Identification Mark

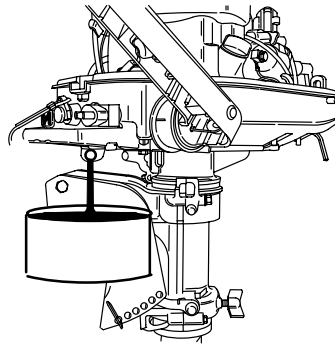
NOTE: 2000 model year outboards have hp located on cylinder block.



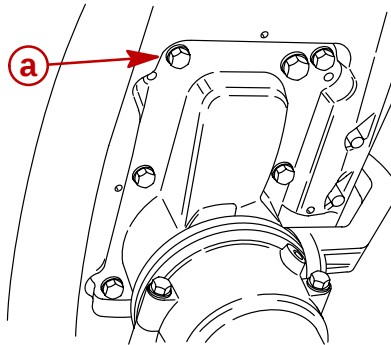


Powerhead Removal

1. Drain out the engine oil.



2. Remove or disconnect the following components:
 - a. Starter lock rod.
 - b. Choke wire
 - c. Throttle Cables
 - d. Stop switch, oil warning light and oil pressure wire connections
 - e. Ground wires at the ignition coil and exciter coil wires.
 - f. Fuel inlet hose.
3. Remove the six powerhead mounting bolts and lift powerhead upwards.



a - Bolts (6) M8 x 40 mm

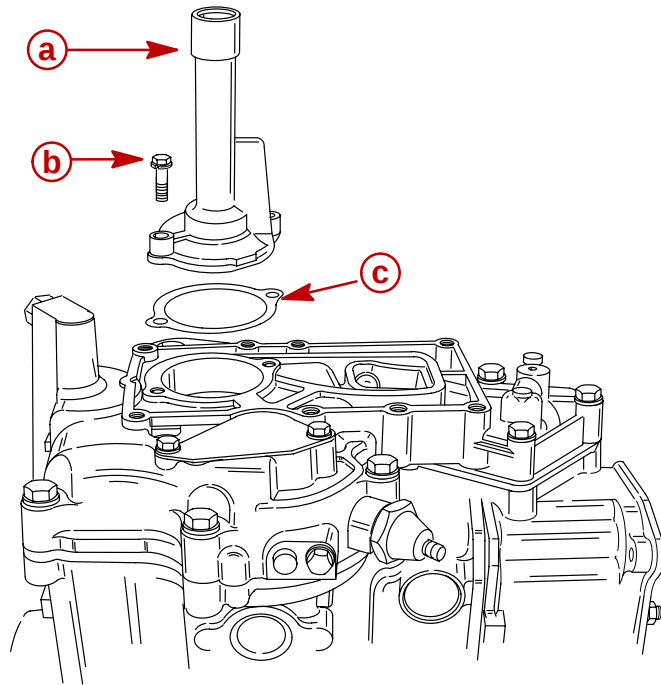
Removing Powerhead Components

1. Remove the following components:
 - a. Rewind starter assembly.
 - b. Remove the flywheel following instructions in Section 2A of this manual.
 - c. Exciter coil and pulsator coil.
 - d. Ignition coil.
 - e. Fuel pump and carburetor.



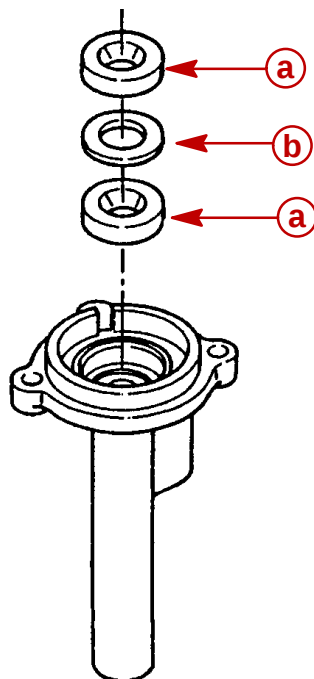
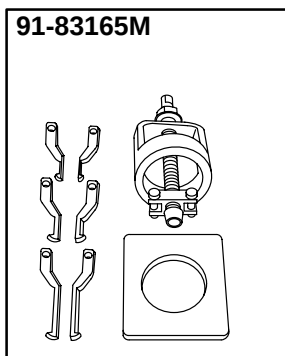
Powerhead Disassembly

1. Remove bolts from seal housing.
2. Use soft face hammer to loosen oil seal housing.



- a** - Oil Seal Housing
- b** - Bolt (2) M6 x 20 mm
- c** - Gasket

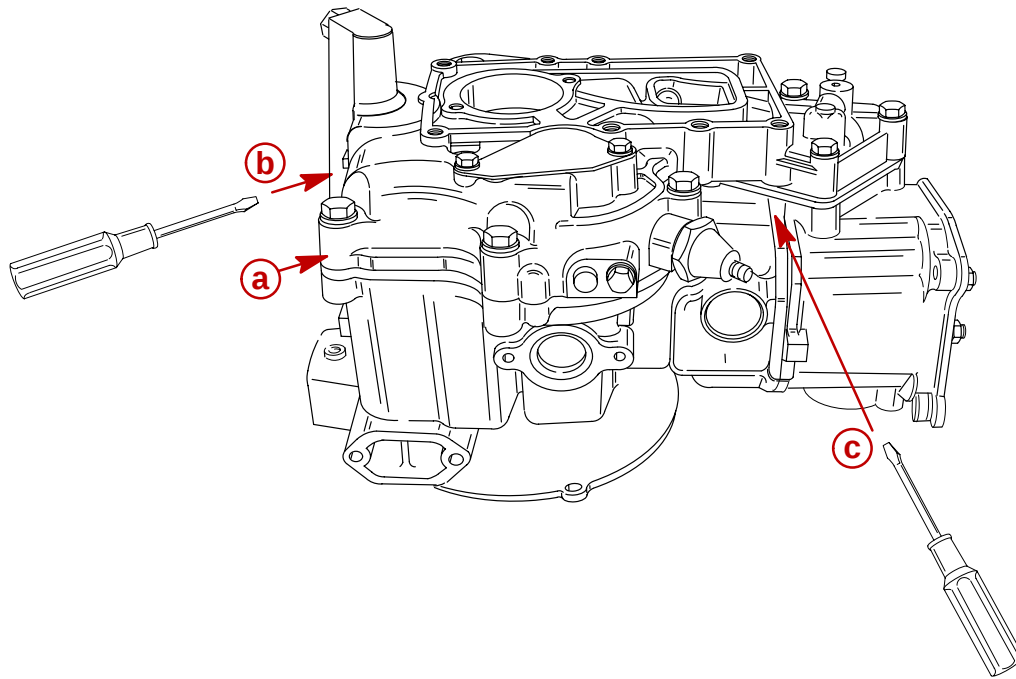
3. Use puller 91- 83165M to remove seals from the oil seal housing.



- a** - Oil Seal
- b** - Spacer

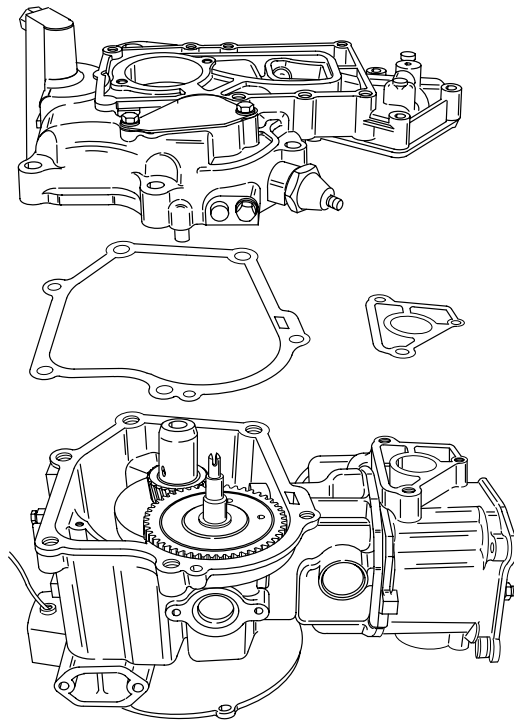


4. Remove the 9 bolts that fasten the oil pan to the cylinder block and cylinder head.
5. Break the oil pan seal. Pry up the oil pan at pry tab and in the open space beneath the oil pan.



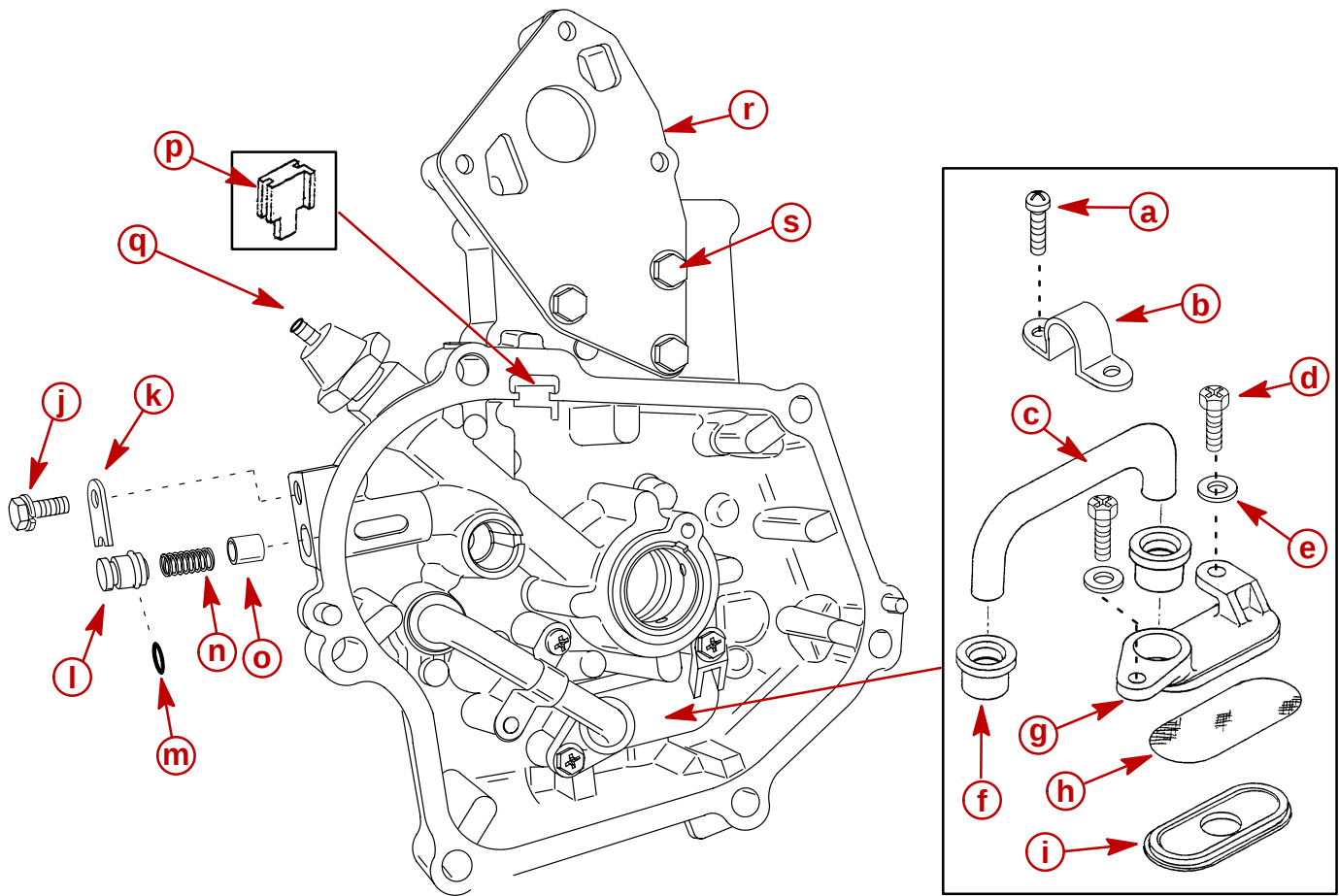
- a** - Oil Pan
- b** - Pry Tab
- c** - Pry Location Beneath the Oil Pan

6. Remove the oil pan.





7. Disassemble the oil pan.

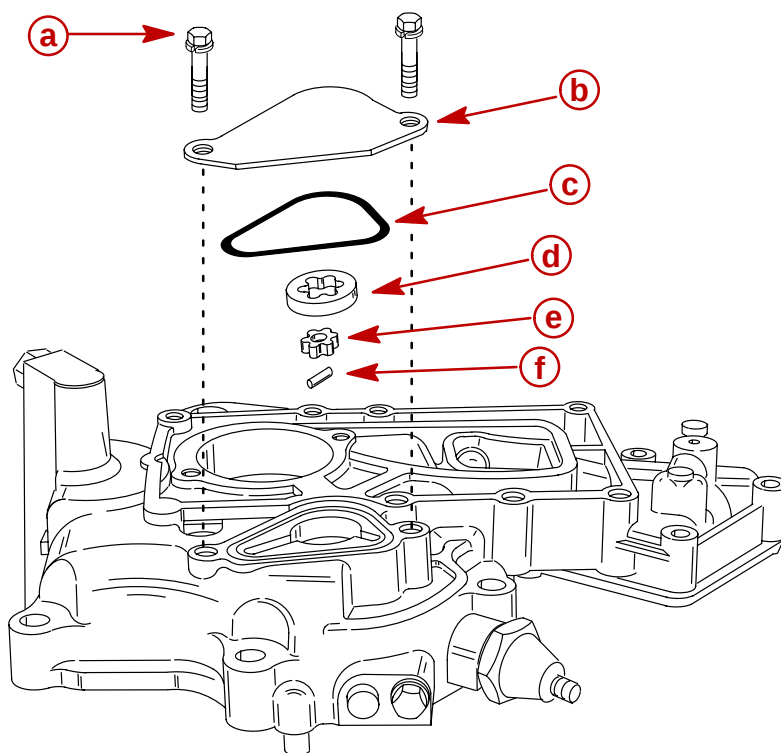


- a** - Screw M5 x 16 mm
- b** - Clamp
- c** - Pipe
- d** - Screw (2) M5 x 16 mm
- e** - Washer
- f** - Seal (2)
- g** - Body
- h** - Strainer
- i** - Cup
- j** - Bolt M6 x 16 mm

- k** - Cover
- l** - Seat
- m** - O-Ring Seal
- n** - Spring
- o** - Plunger
- p** - Grommet
- q** - Oil Pressure Sensor
- r** - Exhaust Plate with Gasket
- s** - Bolt (3) M6 x 20 mm

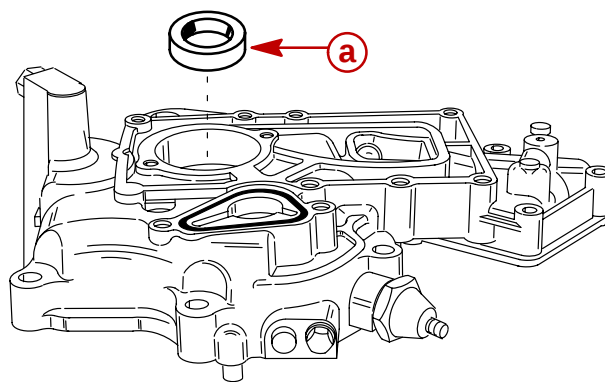


8. Disassemble the oil pump



- a** - Bolt (2) M6 x 20 mm
- b** - Cover
- c** - O-Ring Seal
- d** - Rotor - Outer
- e** - Rotor - Inner
- f** - Pin

9. Pull out the lower oil seal.

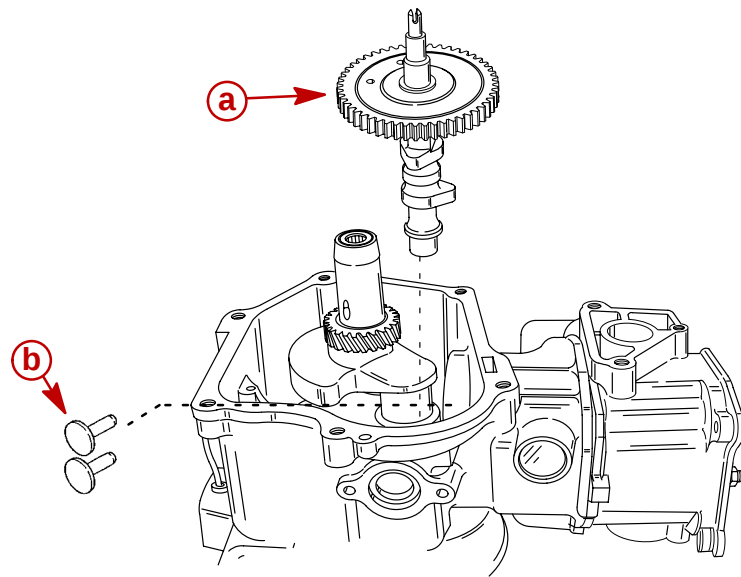


- a** - Lower Oil Seal



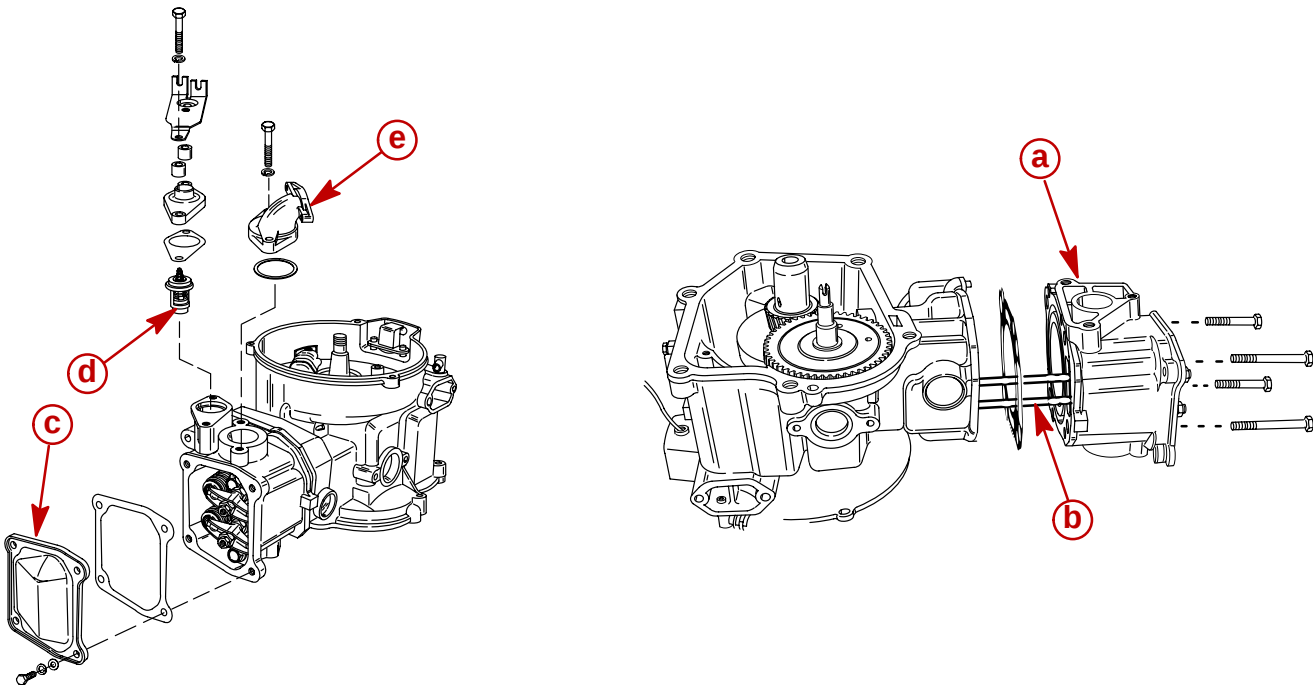
10. Pull out the camshaft and remove both valve lifters.

NOTE: Keep intake and exhaust valve components separate and reinstall in original location.



- a** - Camshaft
- b** - Valve Lifters

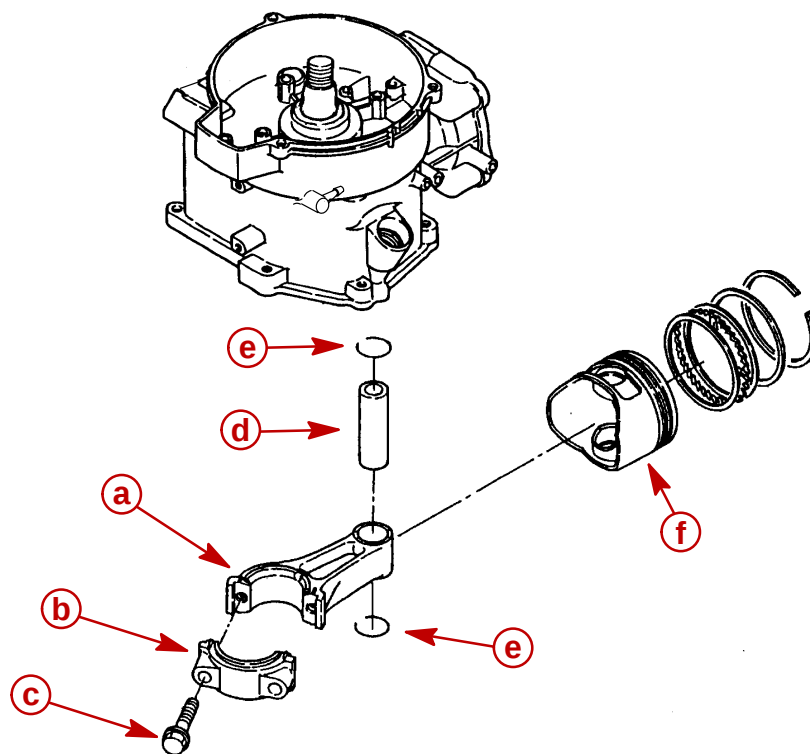
11. Remove the Cylinder Head Assembly.



- a** - Cylinder Head
- b** - Push Rods (2)
- c** - Cylinder Head Cover
- d** - Thermostat
- e** - Intake Manifold

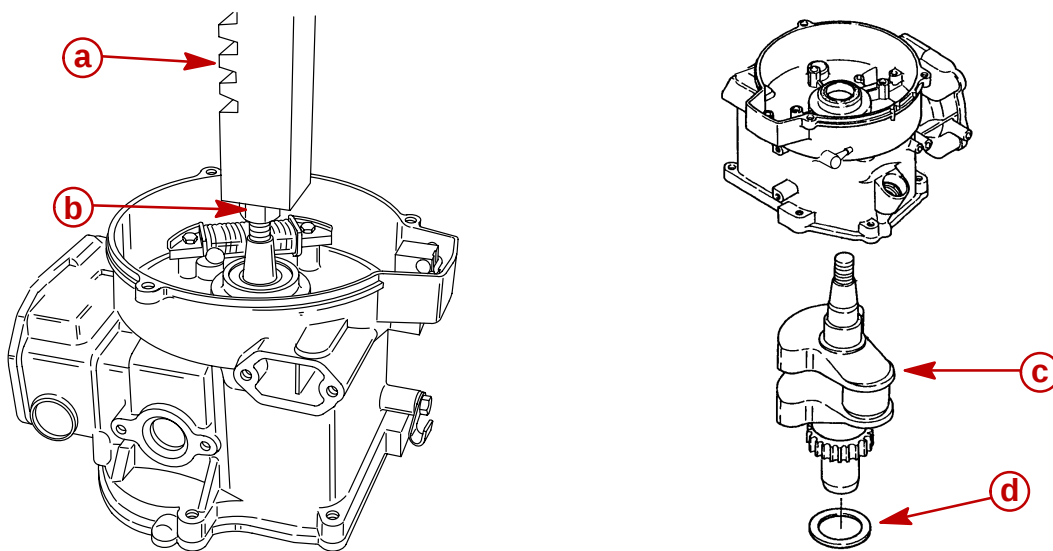


12. Remove piston assembly from the crankshaft.



- a** - Connecting Rod
- b** - Cap
- c** - Bolt (2)
- d** - Piston Pin
- e** - Clip (2)
- f** - Piston

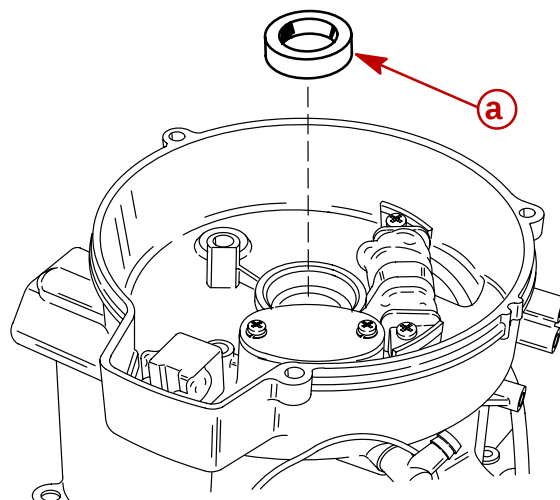
13. Press the crankshaft out of the cylinder block.



- a** - Press
- b** - Flywheel Nut - Thread Onto End of Crankshaft
- c** - Crankshaft
- d** - Washer

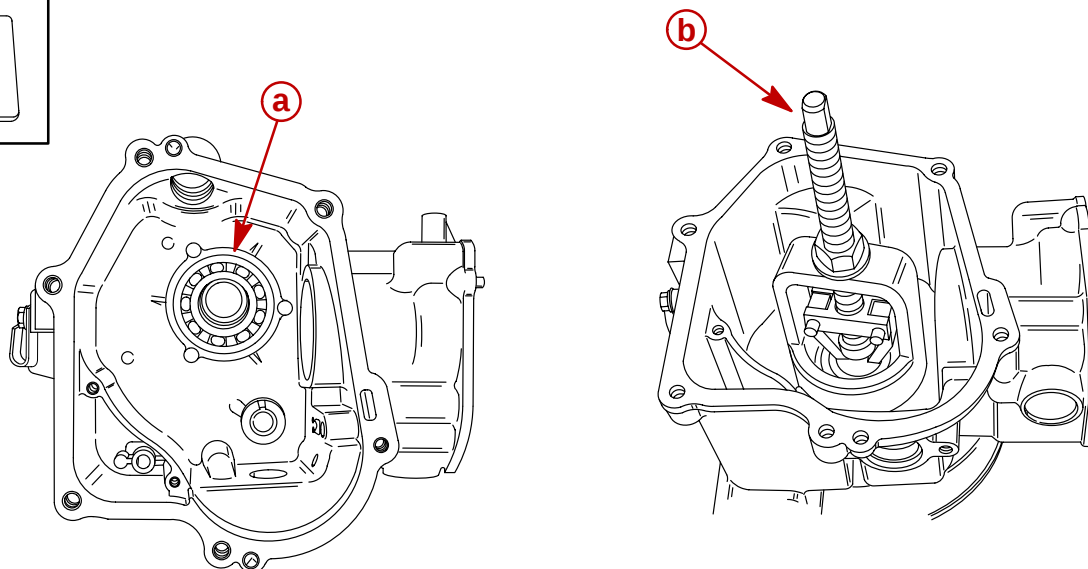
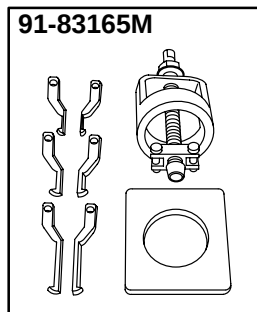


14. Pry out the upper oil seal.



a - Upper Oil Seal

15. If the replacement of the upper ball bearing is necessary, use puller 91-83165M and pull out the bearing.

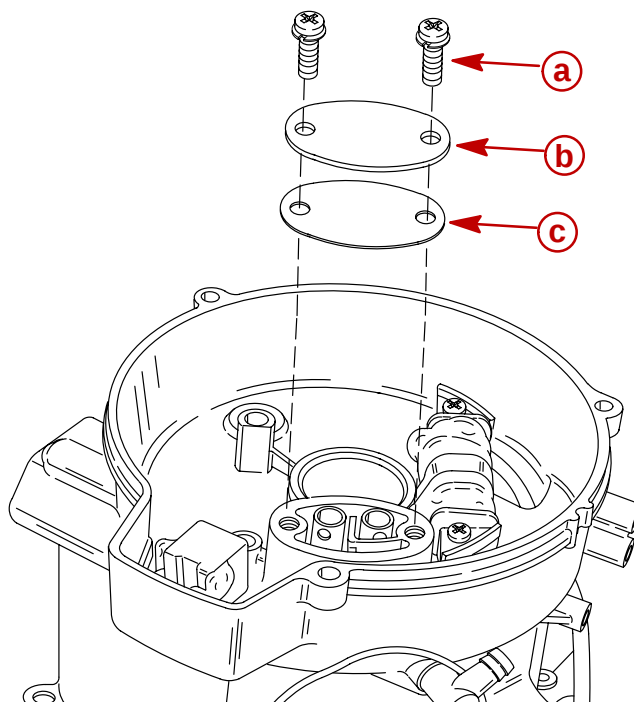


a - Upper Ball Bearing

b - Puller 91-83165M

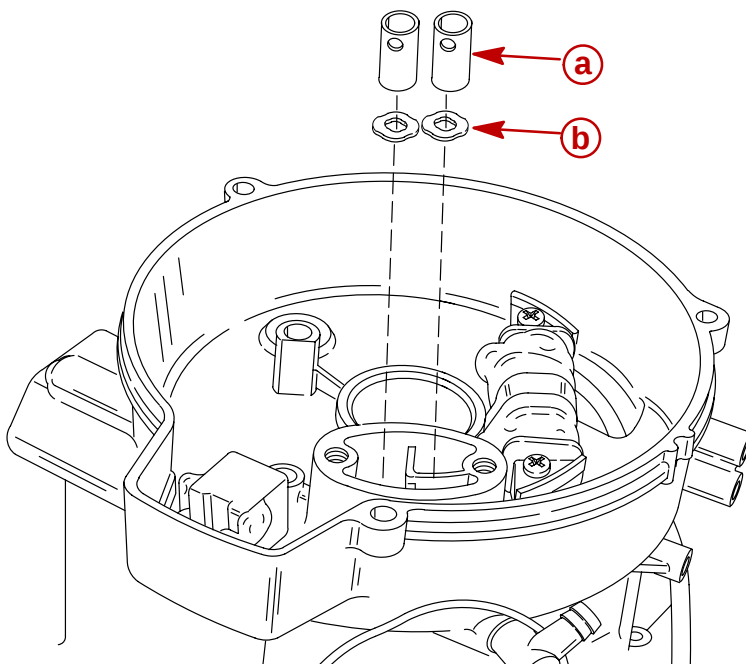


16. Remove the breather cap.



- a** - Screw (2)
- b** - Breather Cap
- c** - Gasket

17. Remove the breather tubes and wave washers.



- a** - Breather Tube (2)
- b** - Wave Washer (2)

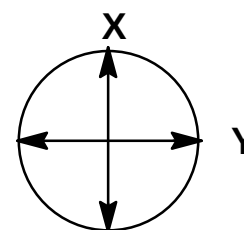
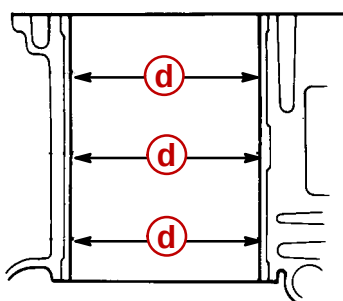
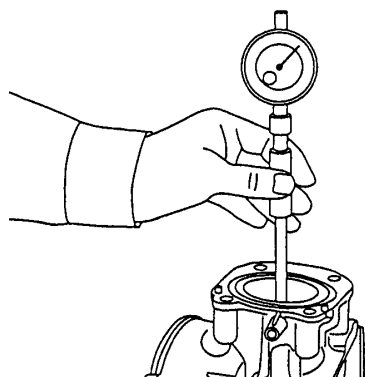


Inspection

Measuring Cylinder Bore

1. Measure the cylinder bore diameter “d” at three locations in both X and Y axis.
2. If the cylinder bore is beyond the limits listed in the tables below, it will be necessary to bore or replace the cylinder block.

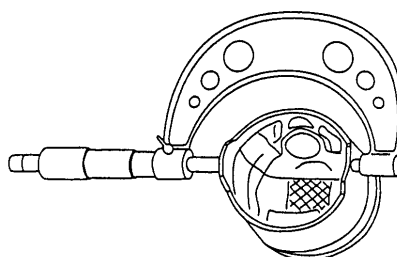
Standard Value	Out of the Limit
2.323 in. (59.00 mm)	If 2.326 in. (59.07 mm) or more, cylinder can be bored to accept oversize piston
0.020 in. (0.50 mm) Oversize 2.343 in. (59.50 mm)	If 2.345 in. (59.57 mm) or more, cylinder block needs replacement.



Measuring Diameter of the Piston Skirt

Measure diameter of the piston

Standard Value	Out of the Limit
2.321 in. (58.96 mm)	If 2.319 in. (58.90 mm) or less, piston needs replacement.
0.020 in. (0.50 mm) Oversize 2.341 in. (59.460 mm)	If 2.339 in. (59.40 mm) or more, cylinder block needs replacement.



Measuring Piston Clearance (Clearance Between Piston and Cylinder)

Minimum cylinder bore measurement
 – maximum piston measurement
 = piston clearance

Standard Value	Out of the Limit
0.001 - 0.002 in. (0.020 – 0.055 mm)	If 0.006 in. (0.15 mm) or more, requires replacement.



Measuring Outer Diameter of Piston Pin

Standard Value	Out of the Limit
0.6299 in. (16 mm)	If 0.6287 in. (15.97 mm) or less requires replacement

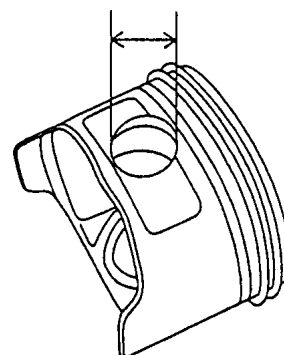
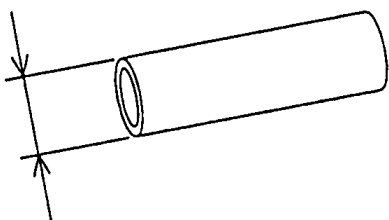
Measuring Diameter of the Piston Pin Hole

Standard Value	Out of the Limit
0.6300 in. (16.002 mm)	Depends on clearance between piston pin and hole.

Clearance Between Piston Pin and Piston Pin Hole

Standard Value	Out of the Limit
0.0001 - 0.0005 in. (0.002 – 0.012 mm)	If 0.00157 in. (0.04 mm) or more requires replacement

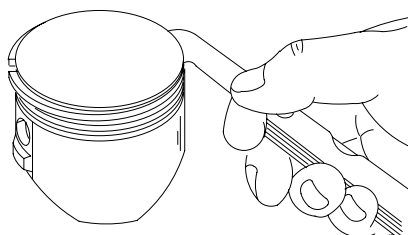
1. Subtract the piston pin diameter from the piston pin hole diameter.



Measuring Piston Ring Side Clearance

	Standard Value	Out of the Limit
Top	0.0015 - 0.003 in. (0.04 – 0.08 mm)	If 0.0039 in. (0.10 mm) or more requires replacement
Second	0.0012 - 0.003 in. (0.03 – 0.07 mm)	If 0.0035 in. (0.09 mm) or more requires replacement
Oil	0.0004 - 0.007 in. (0.01 – 0.18 mm)	If 0.0082 in. (0.21 mm) or more requires replacement

1. Measure between piston ring and ring groove.

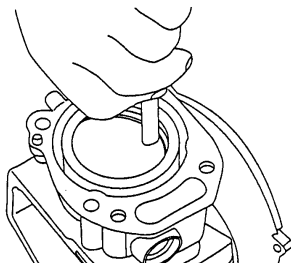




Measuring Piston Ring End Gap

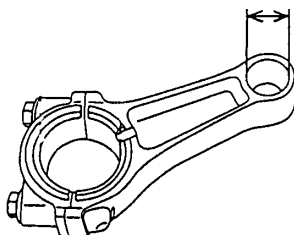
	Standard Value	Out of the Limit
Top	0.006 - 0.014 in. (0.15 – 0.35 mm)	If 0.020 in. (0.5 mm) or more requires replacement
Second	0.012 - 0.020 in. (0.30 – 0.50 mm)	If 0.028 in. (0.7 mm) or more requires replacement
Oil	0.008 - 0.016 in. (0.20 – 0.40 mm)	If 0.024 in. (0.6 mm) or more requires replacement

Push piston rings into cylinder approximately 0.8 in. (20 mm) deep. Push in the rings using the piston.



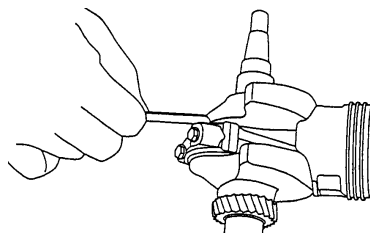
Measuring Diameter of the Small End of Connecting Rod

Standard Value	Out of the Limit
0.6303 in. (16.01 mm)	If 0.6315 in. (16.04 mm) or more requires replacement



Measuring Side Clearance of the Big End of Connecting Rod

Standard Value	Out of the Limit
0.008 - 0.016 in. (0.2 – 0.4 mm)	If 0.027 in. (0.7 mm) or more requires replacement



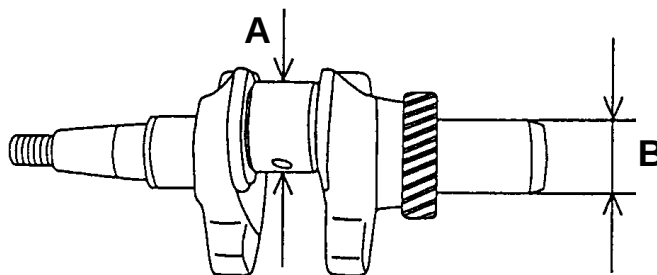


Measuring Diameter of Crank Pin “A”

Standard Value	Out of the Limit
1.179 in. (29.94 mm)	If 1.177 in. (29.91 mm) or less requires replacement

Measuring Outer Diameter of Crankshaft in the Oil Pan Bearing “B”

Standard Value	Out of the Limit
0.983 in. (24.98 mm)	If 0.982 in. (24.96 mm) or less requires replacement



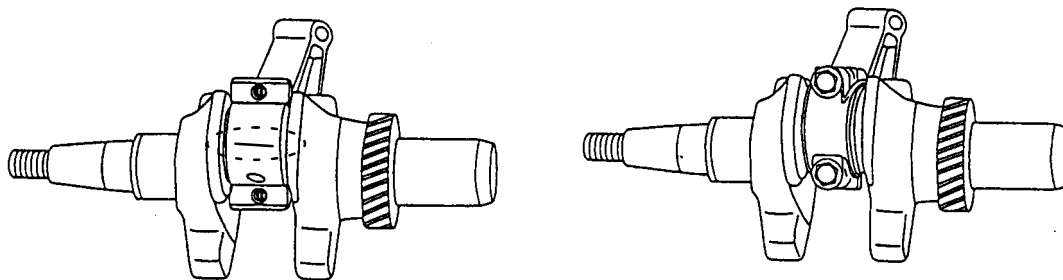
Measuring Oil Clearance at Big End of Connecting Rod Using Plastigauge

Standard Value	Out of the Limit
0.002 - 0.003 in. (0.053 - 0.079 mm)	If 0.0035 in. (0.090 mm) or more requires replacement

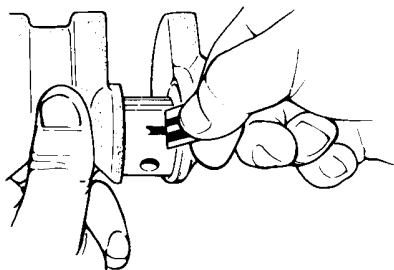
1. Clean all the oil from the connecting rod and crank pin.
2. Place the connecting rod on the crank pin.
3. Place a piece of plastigauge on the crank pin.

IMPORTANT: Do not rotate connecting rod when measuring clearance.

4. Install the connecting rod cap. Torque bolts to 106 lb-in. (12 Nm).



5. Remove the connecting rod cap and measure the compressed plastigauge to check the connecting rod oil clearance. Out of specification, replace.





Measuring Camshaft Lobe Height “A” Intake/Exhaust

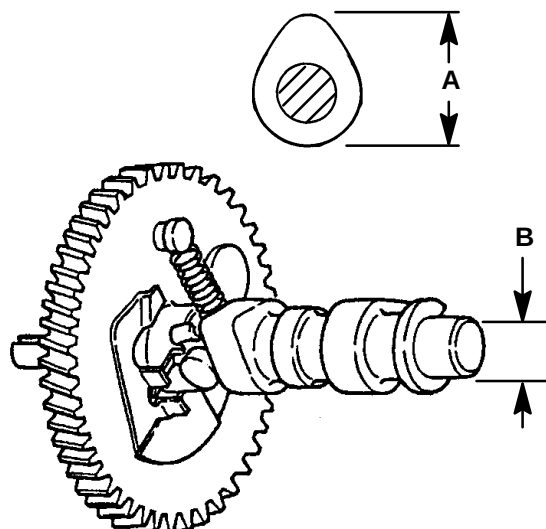
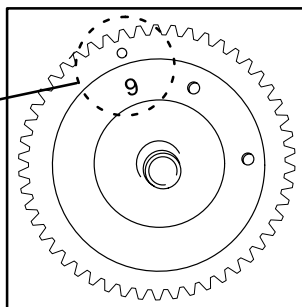
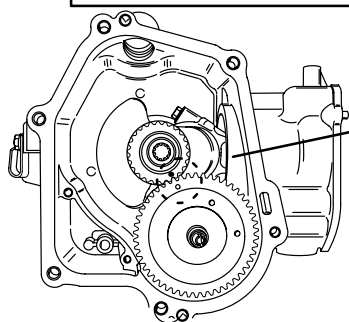
NOTE: 2000 model year outboards have hp mark located on cam gear as shown below. For 2001 model year, all will have 6 hp camshaft.

Standard Value	Out of the Limit
4 hp - 0.993 in. (25.24 mm)	0.983 in. (24.96 mm) or less requires replacement
5 hp - 1.047 in. (26.59 mm)	1.037 in. (26.33 mm) or less requires replacement
6 hp - 1.115 in. (28.33 mm)	1.105 in. (28.06 mm) or less requires replacement

Measuring Camshaft Bearing Diameter “B”

Standard Value	Out of the Limit
0.550 in. (13.98 mm)	0.549 in. (13.95 mm) or less requires replacement

CAM ID	
4 (1999 & 2000)	4
5 (1999 & 2000)	5
6 (2000)	6
4/5/6 (2001)	6



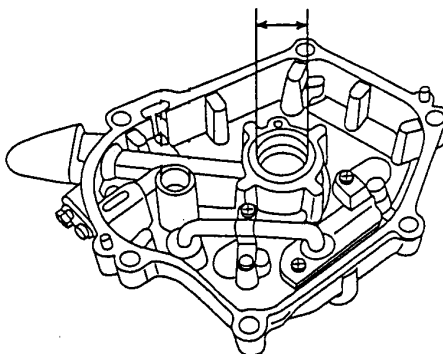
Measuring Inside Diameter of Oil Pan Bearing - Crankshaft

Standard Value	Out of the Limit
0.985 in. (25.01 mm)	Depends of clearance

Clearance Between the Oil Pan Bearing and Crankshaft

Standard Value	Out of the Limit
0.0006 - 0.0015 in. (0.015 – 0.040 mm)	If 0.002 in. (0.06 mm) or more requires replacement

Subtract the crankshaft diameter from the oil pan bearing diameter.





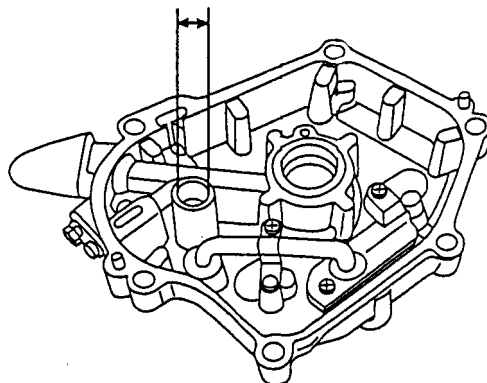
Measuring Inside Diameter of Oil Pan Bearing - Camshaft

Standard Value	Out of the Limit
0.5515 in. (14.01 mm)	Depends of clearance

Clearance Between the Oil Pan Bearing and Camshaft

Standard Value	Out of the Limit
0.0008 - 0.002 in. (0.02 - 0.05 mm)	If 0.0028 in. (0.07 mm) or more requires replacement

Subtract the camshaft diameter from the oil pan diameter.

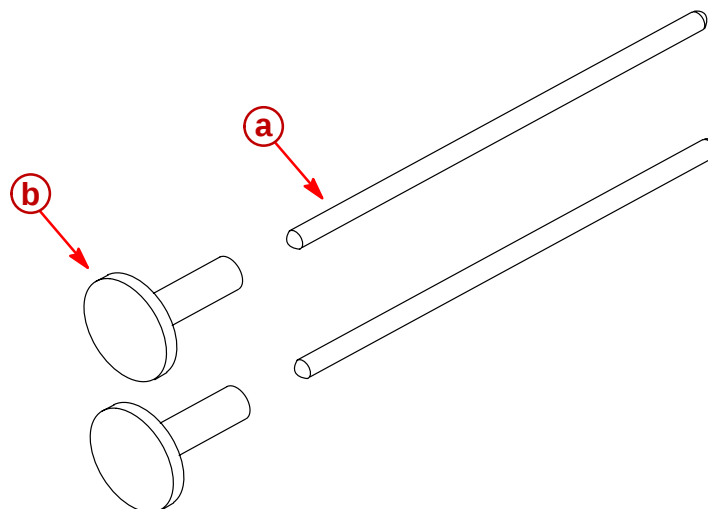


Inspecting Push Rod

1. Inspect push rod for straightness, replace if bent.
2. Replace push rod if corroded or if tips of rod are worn.

Inspecting Valve Lifter

1. Replace valve lifter if worn or corroded.

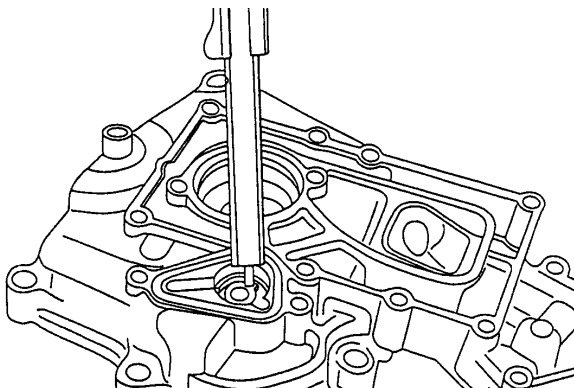


a - Push Rod
b - Valve Lifter



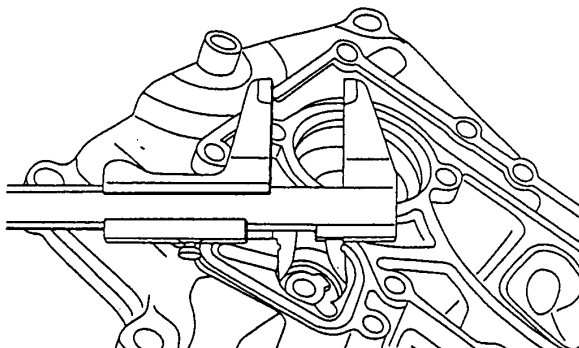
Measuring Depth of Oil Pump Body

Standard Value	Out of the Limit
0.236 in. (6.0 mm)	If 0.238 in. (6.06 mm) or more requires replacement



Measuring Inside Diameter of Oil Pump Body

Standard Value	Out of the Limit
0.909 in. (23.09 mm)	If 0.910 in. (23.13 mm) or more requires replacement



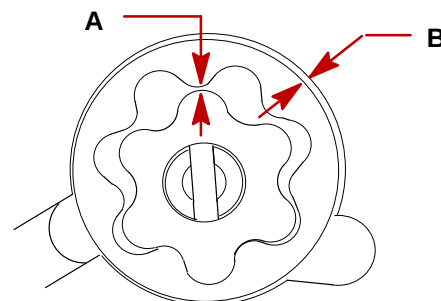
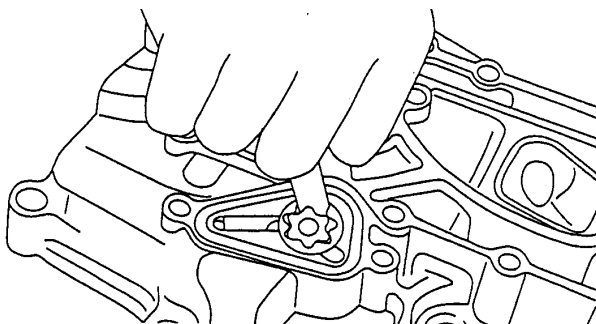


Measuring Clearance Between Inner and Outer Rotors “A”

Standard Value	Out of the Limit
0.006 in. (0.15 mm) or less	If 0.008 in. (0.20 mm) or more requires replacement

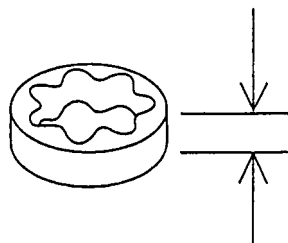
Measure Clearance Between Outer Rotor and Body “B”

Standard Value	Out of the Limit
0.005 - 0.008 in. (0.12 - 0.20 mm)	If 0.010 in. (0.25 mm) or more requires replacement



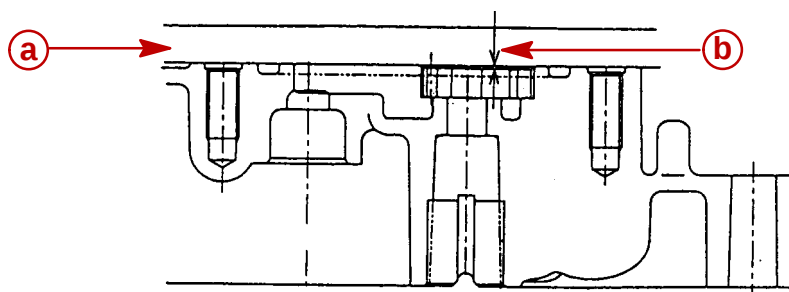
Measuring Height of Oil Pump Outer Rotor

Standard Value	Out of the Limit
0.236 in. (5.99 mm)	If 0.234 in. (5.96 mm) or less requires replacement



Measuring Side Clearance Between Oil Pump Outer Rotor and Body

Standard Value	Out of the Limit
0.0008 - 0.0028 in. (0.02 - 0.07 mm)	If 0.004 in. (0.10 mm) or more requires replacement

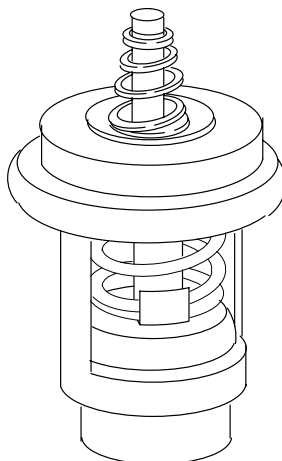


- a** - Straight Edge
- b** - Clearance Measured Using a Feeler Gauge



Measuring/Testing Thermostat

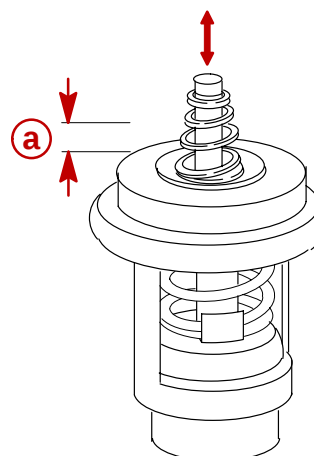
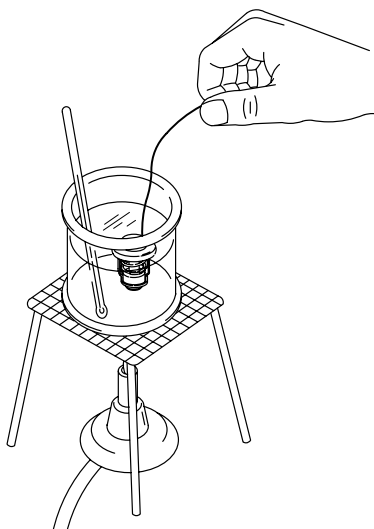
1. Inspect thermostat, replace if stuck or damaged.



2. Use **Measurement Test** following to measure:
 - a. Valve opening temperature.
 - b. Valve lift.

MEASUREMENT TEST

1. Tie a piece of thread (or other non-conductive material) onto the thermostat.
2. Suspend the thermostat in water.
3. Heat water slowly while observing the thermostat.



a - Valve Lift

Water Temperature	Valve Lift
Below 122° F (50° C)	0 in. (0 mm)
Above 145° F (67° C)	Minimum 0.12 in. (3 mm)



Powerhead Reassembly

General

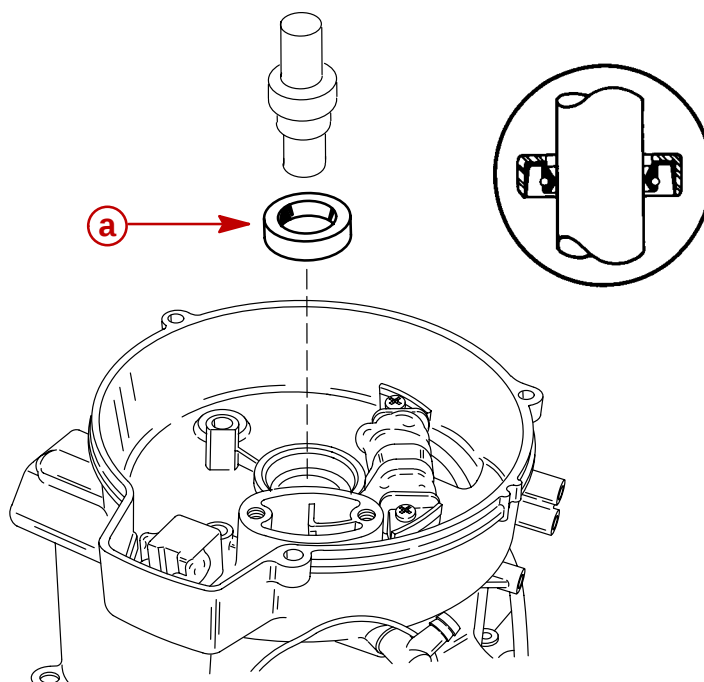
Before proceeding with powerhead reassembly, be sure that all parts to be reused have been carefully cleaned and thoroughly inspected as outlined in "Cleaning and Inspection," preceding. Parts, which have not been properly cleaned (or which are questionable), can severely damage an otherwise perfectly good powerhead within the first few minutes of operation.

New gaskets **MUST BE** installed during reassembly.

During reassembly, lubricate parts with Quicksilver 4-Cycle Outboard Oil whenever "light oil" is specified. Quicksilver part numbers of lubricants, sealers and locking compounds are listed under "Quicksilver Lubricants and Service Aids," preceding.

A torque wrench is required for correct reassembly of powerhead. **DO NOT** attempt to reassemble powerhead without using a torque wrench. Attaching bolts for covers and housings **MUST BE** torqued by tightening bolts in 3 progressive steps (following specified torque sequence) until specified torque is reached. Powerhead torques are listed under "Torque Specifications," preceding.

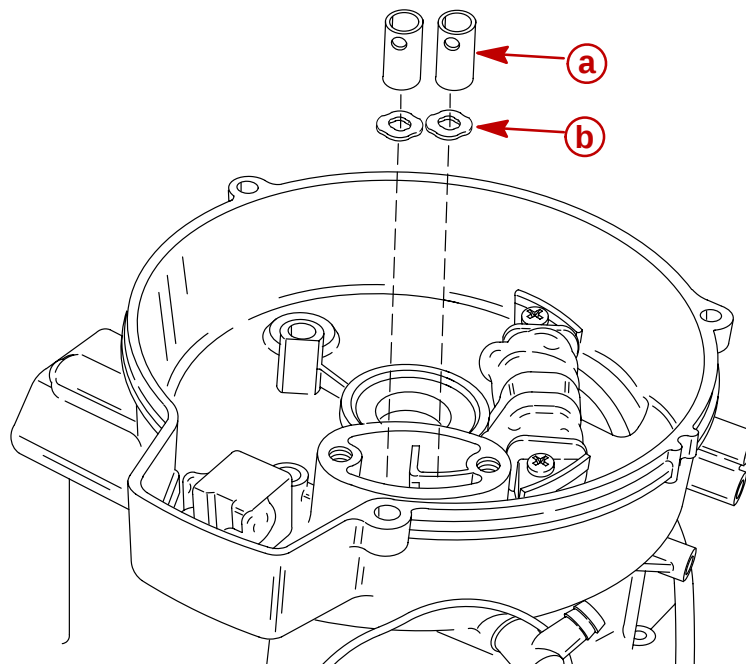
1. Install new oil seal using a suitable mandrel.



a - Oil Seal – Press in Until it Bottoms Out

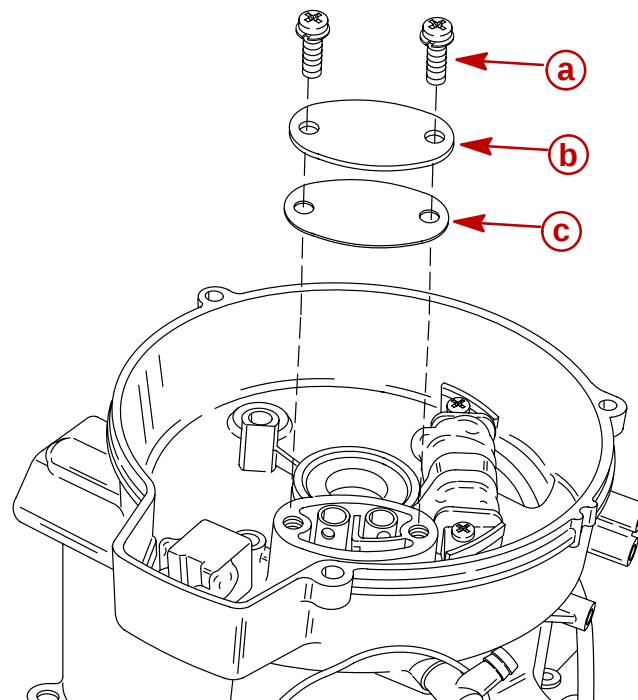


2. Install the breather tubes and wave washers.



- a** - Breather Tube (2)
- b** - Wave Washer (2)

3. Install the breather cap.



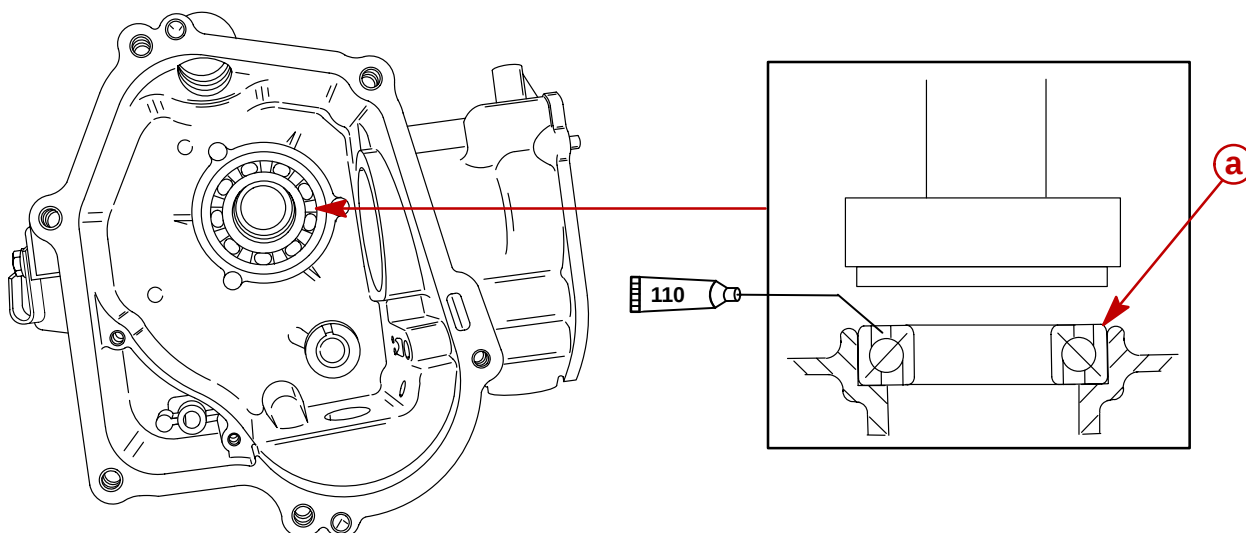
- a** - Screw (2)
- b** - Breather Cap
- c** - Gasket

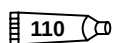
Breather Cap Screw Torque

70 lb-in. (8 Nm)



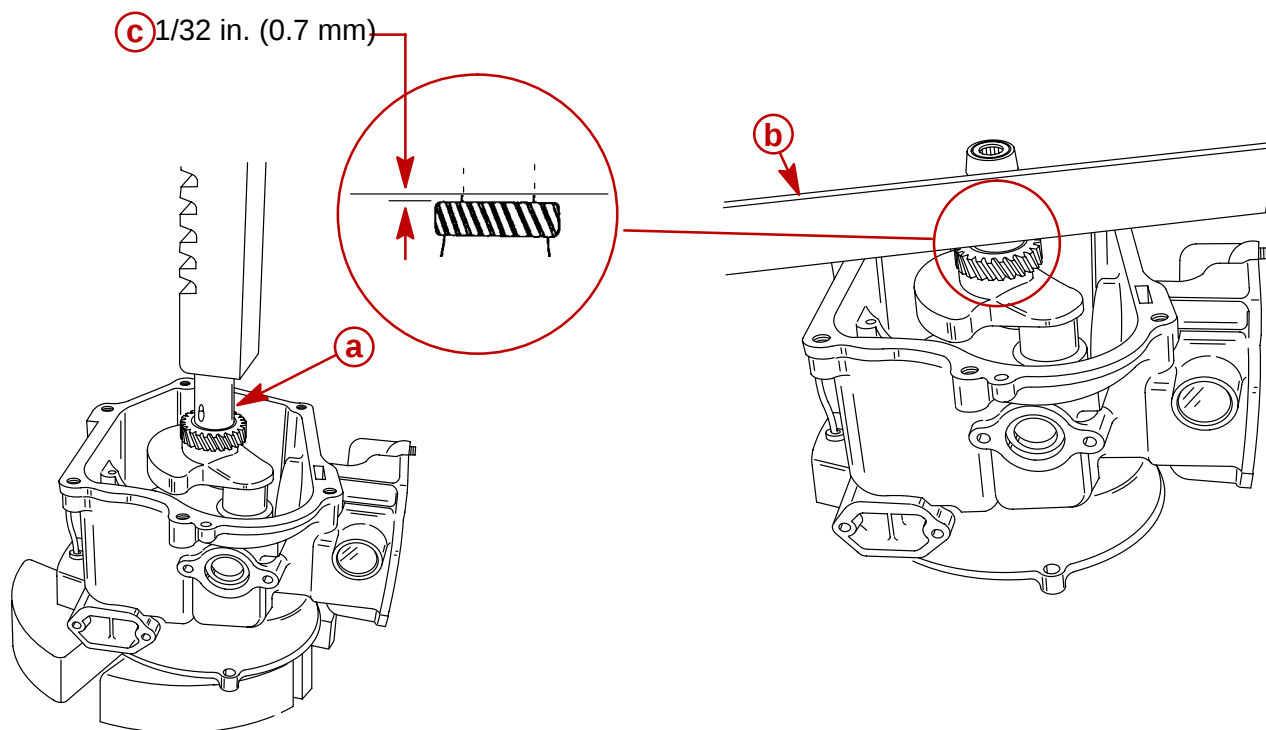
4. Press the top bearing into housing using a suitable mandrel (numbered side of bearing facing oil pan). Press only on bearing outer race and until the bearing is fully seated in the housing.



 4-Stroke Outboard Oil (92-828000A12)

a - Top Bearing – Press in Until it Bottoms Out

5. Press oiled crankshaft into the top bearing. Make sure the crankshaft is seated against the top bearing.
6. Check to see if the top bearing and crankshaft are fully seated. Lay a straight edge across the cylinder block and measure the distance between top of gear and straight edge. The distance should be 1/32 in. (0.7 mm).



- a** - Press Crankshaft into Top Bearing Until it is Fully Seated
b - Straight Edge
c - Required Distance Between Gear and Straight Edge

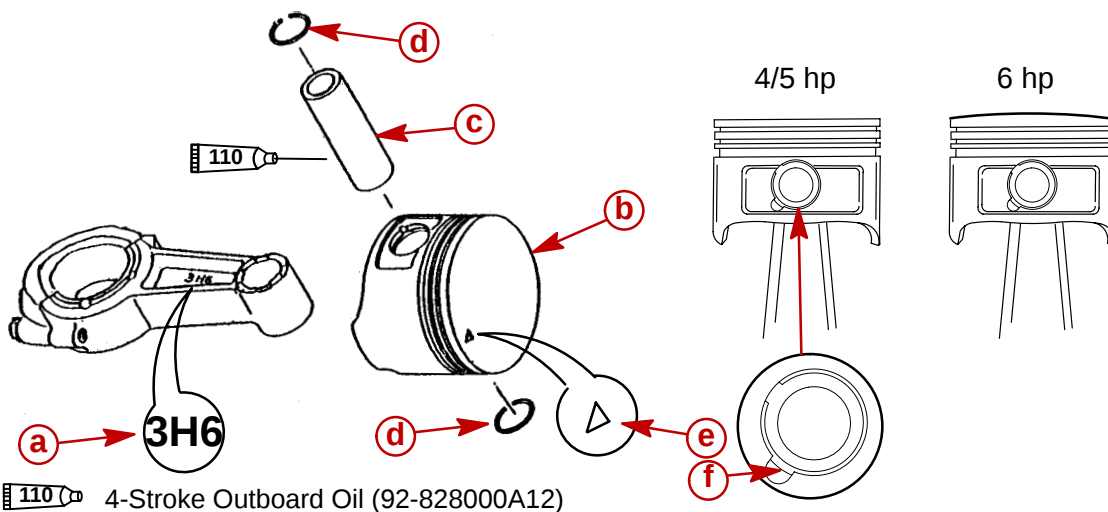


7. Assemble connecting rod to piston, secure with piston pin and **new** piston pin clips.

NOTE: Make sure the connecting rod is orientated correctly for reassembling (**3H6** mark must face the oil pan).

NOTE: Reassemble the piston so that the arrow faces the camshaft.

NOTE: 4/5 hp has flat top piston. 6 hp has dome type piston. 6 hp will be marked on top of piston.



a - Connecting Rod (3H6 must Face the Oil Pan)

b - Piston

c - Piston Pin

d - Piston Pin Clip (2)

e - Direction Arrow (Must Face The Camshaft)

f - Piston Pin Clips Should Bridge the Notch in the Piston

Piston Ring and Piston Identification Marks			
Size	Top Piston Ring	Second Piston Ring	Piston
<u>Standard Size</u> NOTE: Some early models may not have these identification marks NOTE: 6 hp will have a 6 on top of piston			
<u>Oversize</u> NOTE: Some early models may not have these identification marks			

**CAUTION**

Eye protection must be worn while installing piston rings.

IMPORTANT: Do Not mistake the top and second piston rings. The rings are different and must be installed in correct order.

NOTE: The piston ring end gaps must be staggered as shown to avoid alignment with the piston pin.

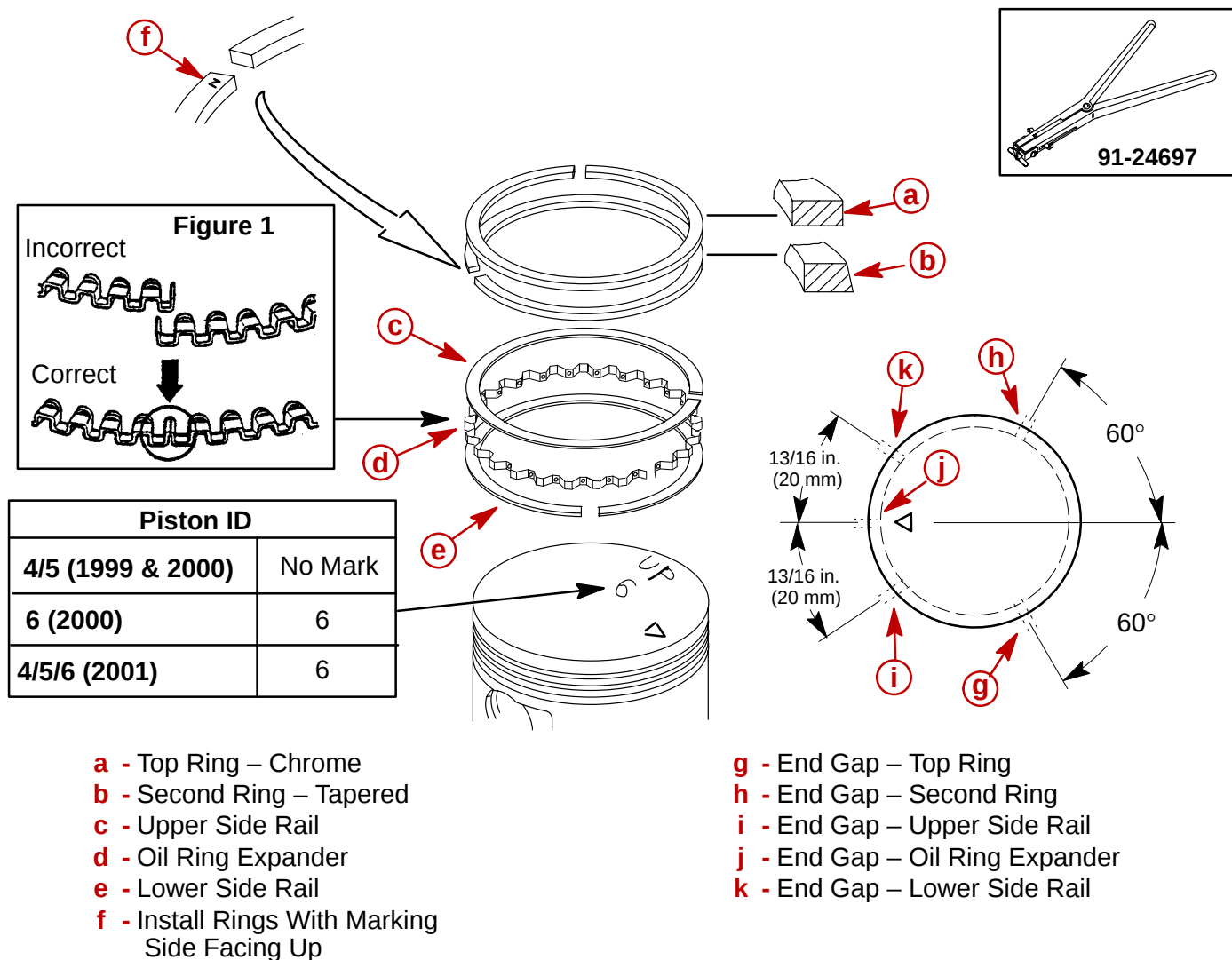
8. Install the oil ring as follows:

- Set the oil ring expander in the oil ring groove. Position the ring ends with the 120° location as shown. Match the ring ends correctly as shown in Figure 1.
- While holding down the oil ring ends by a thumb, install the upper side rail. Position the end gap at 13/16 in. (20 mm) to the left of the oil ring ends.
- As in the same manner as the above step b, install the lower side rail. Position the end gap at 13/16 in. (20 mm) to the right of the oil ring ends.

9. Install the top and second ring in the correct order. Install the piston rings with the marking side facing up.

10. Make sure the rotation of the piston rings are smooth.

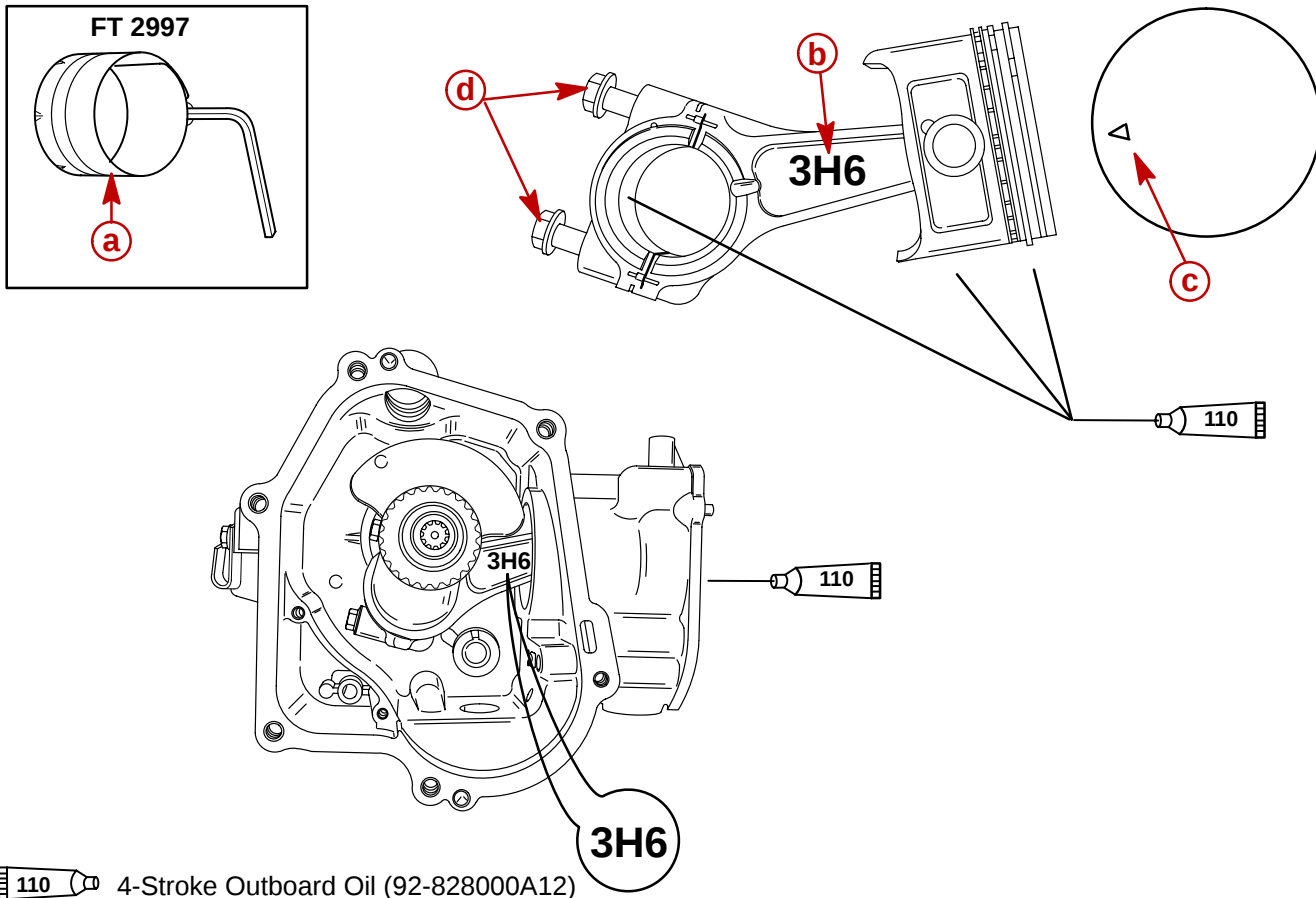
11. Position the piston end gaps at the positions shown.





12. Lubricate piston, rings, connecting rod journals and cylinder bore with engine oil.
13. Use Piston Ring Compressor (FT 2997) to compress rings.
14. Position mark 3H6 towards oil pan.
15. Position the direction arrow < towards the cam shaft.
16. Install the piston assembly.

Connecting Rod Bolt Torque
1st Torque: 53 lb-in. (6 Nm)
2nd Torque: 106 lb-in. (12 Nm)

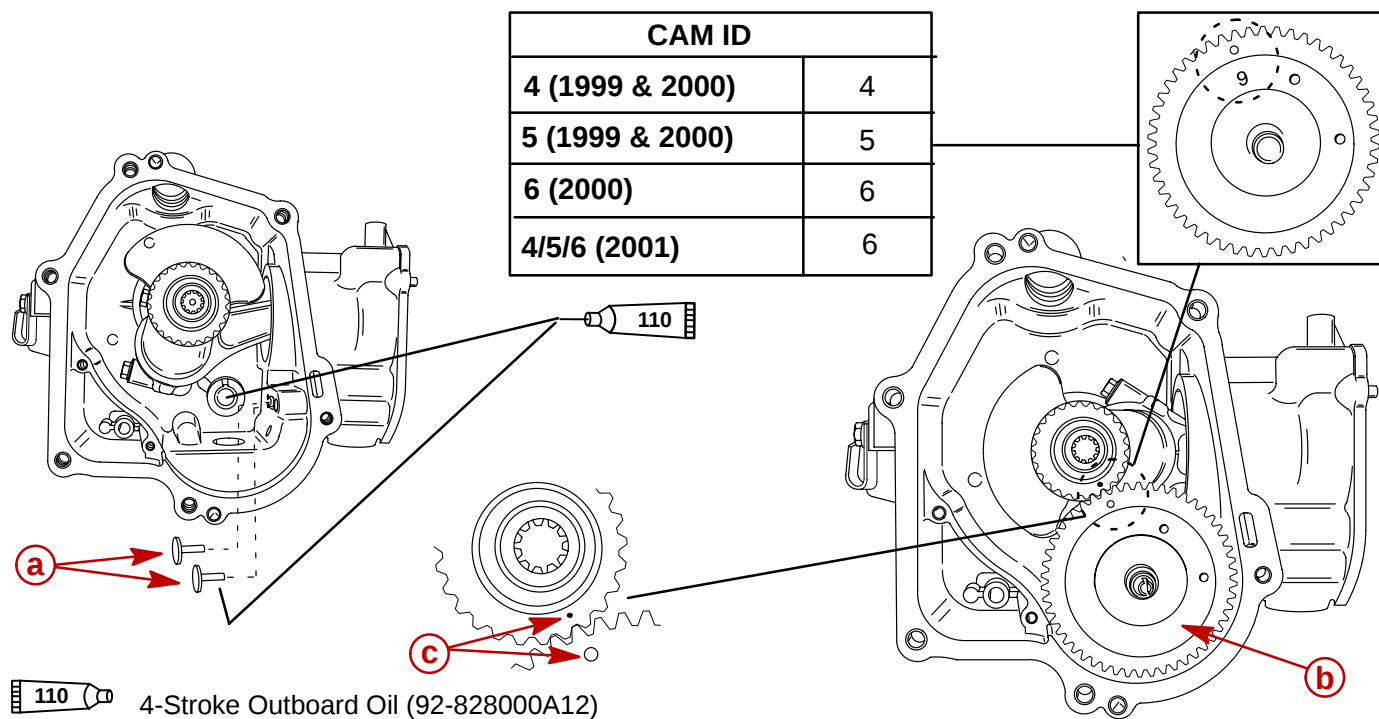


- a** - Piston Ring Compressor (FT2997)
- b** - Position Mark 3H6 Towards Oil Pan
- c** - Direction Arrow (Must Face The Camshaft)
- d** - Connecting Rod Bolts (2)



17. Install the lifters at this time.

18. Reassemble the camshaft. Align the mark on the camshaft with the mark on the timing gear.

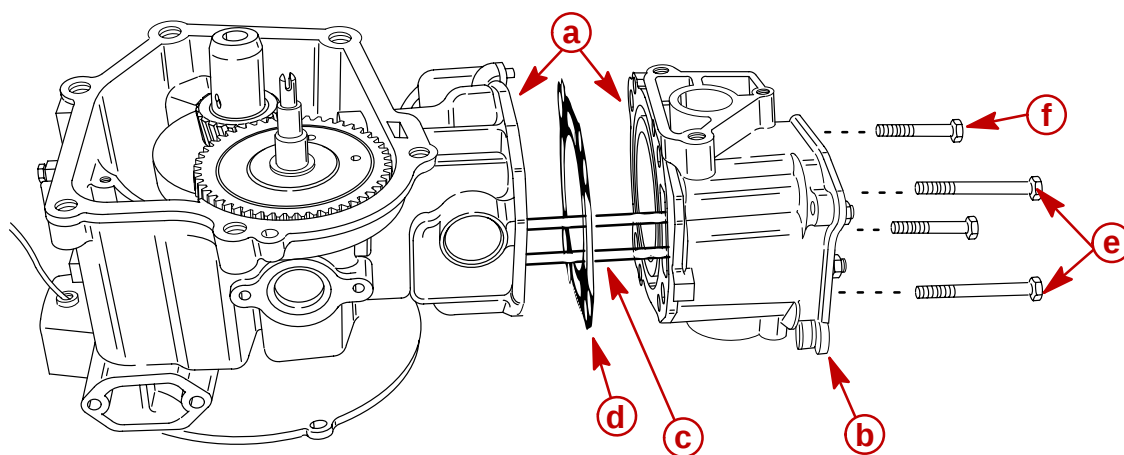


- a** - Lifters
- b** - Camshaft
- c** - Alignment Marks

19. Reinstall the cylinder head.

NOTE: Be sure cylinder head and cylinder block gasket surfaces are clean and free of oil.

Cylinder Head Bolt Torque
18 lb-ft (24.5 Nm)



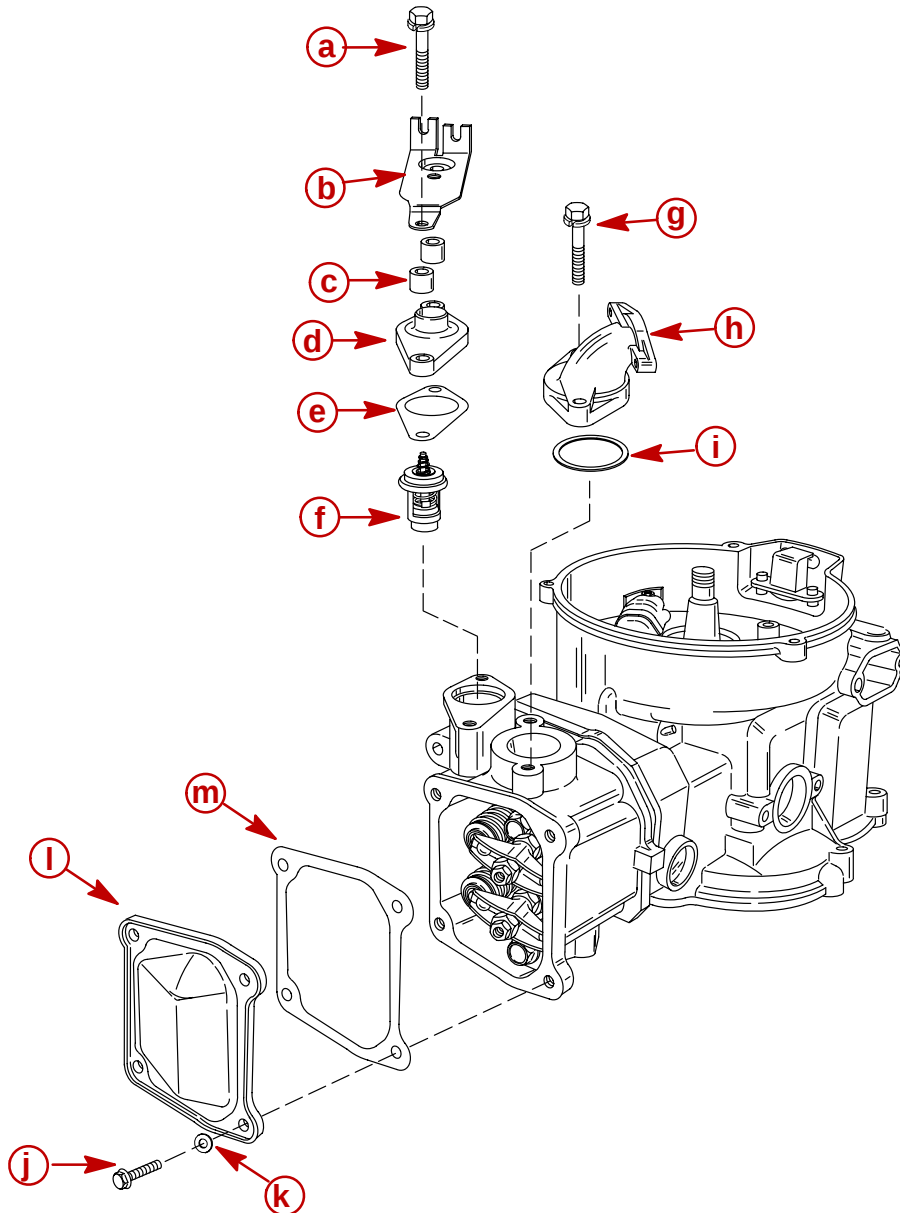
- a** - Make Sure Gaskets Surfaces are Clean and Free of Oil
- b** - Cylinder Head
- c** - Push Rods (2)
- d** - Gasket
- e** - Bolt (2) M8 x 90 mm
- f** - Bolts (2) M8 x 60 mm



20. Reinstall covers and intake manifold to the cylinder head.

Covers and Intake Manifold Bolt Torque

- (a) Thermostat Cover Bolts: 70 lb-in. (8 Nm)
 (g) Intake Manifold Bolts: 70 lb-in. (8 Nm)
 (k) Cylinder Head Cover Bolts: 70 lb-in. (8 Nm)



- a** - Bolt (2) M6 x 40 mm
b - Throttle Cable Bracket
c - Spacer (2)
d - Thermostat Cover
e - Gasket
f - Thermostat
g - Bolt (2) M6 x 25 mm

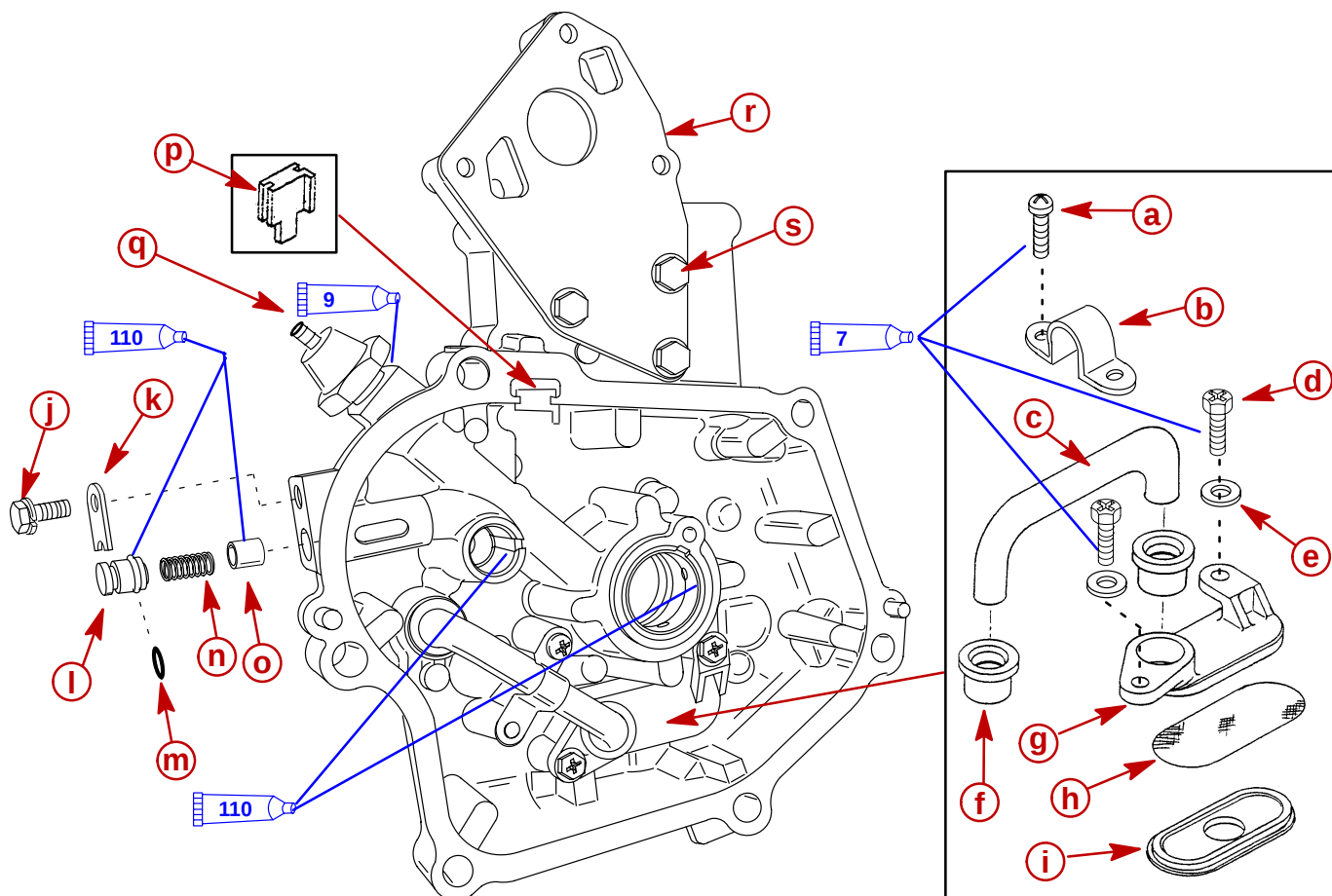
- h** - Intake Manifold
i - O-Ring Seal
j - Bolt (4) M6 x 20 mm
k - Flat Washer (4)
l - Cylinder Head Cover
m - Gasket



21. Reinstall the parts shown to the oil pan.

Covers and Intake Manifold Bolt Torque

- (a) Clamp Screw: 31 lb-in. (3.5 Nm)
(d) Oil Pump Body Bolt: 31 lb-in. (3.5 Nm)
(j) Oil Pressure Relief Valve Bolt: 70 lb-in. (8 Nm)
(s) Exhaust Plate Bolt: 70 lb-in. (8 Nm)



7 Loctite "271" (92-809819)

9 Loctite Pipe Sealant w/Teflon-567 (92-809822)

110 4-Stroke Outboard Oil (92-828000A12)

a - Screw M5 x 16 mm

b - Clamp

c - Pipe

d - Screw (2) M5 x 16 mm

e - Flat Washer (2)

f - Seal (2)

g - Body

h - Strainer

i - Cup

j - Bolt M6 x 16 mm

k - Cover

l - Seat

m - O-Ring Seal

n - Spring

o - Plunger

p - Grommet

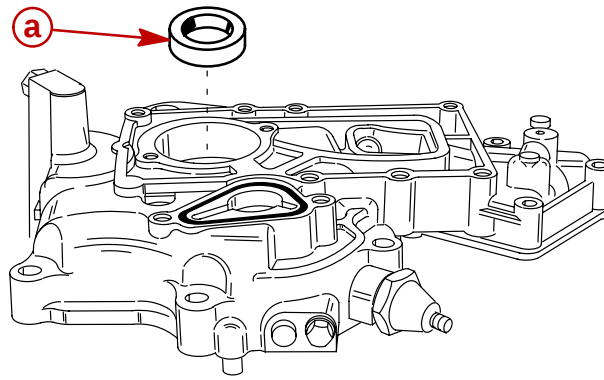
q - Oil Pressure Sensor

r - Exhaust Plate with Gasket

s - Bolt (3) M6 x 20 mm

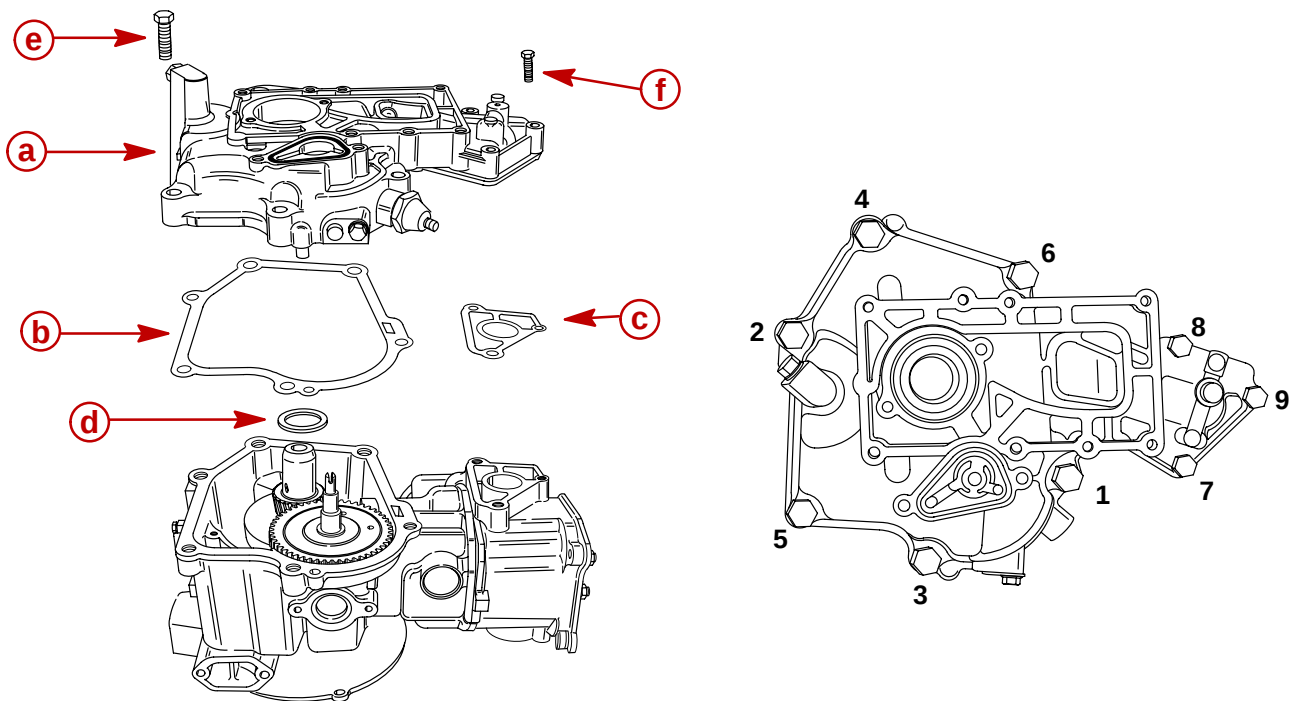


22. Install new oil seal in the oil pan using a suitable mandrel.



a - Oil Seal

23. Install the oil pan. Torque bolts following torque sequence.



- a** - Oil Pan
- b** - Gasket - Oil Pan
- c** - Gasket - Cylinder Head
- d** - Washer - Place on Crankshaft
- e** - Bolt with Washers (6) M8 × 40 mm
- f** - Bolt with Washers (3) M6 × 40 mm

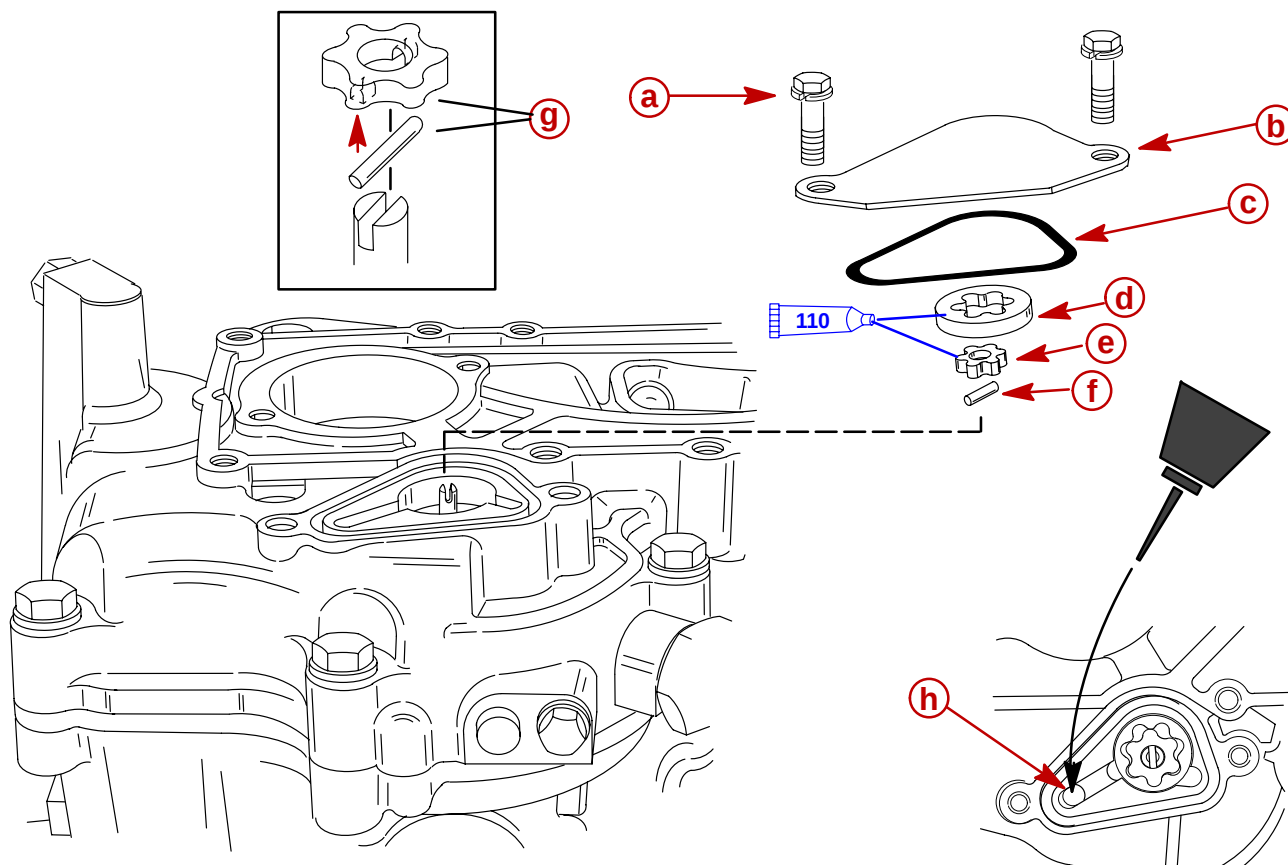
Oil Pan Bolt Torque

M8 × 40 mm Bolt (6): 18.5 lb-ft (25 Nm)
M6 × 40 mm Bolt (3): 80 lb-in. (9 Nm)



24. Reinstall the oil pump.

25. Prime the oil pump by pouring approximately 1 fl oz. (30 ml) of engine oil into the oil pump inlet side.



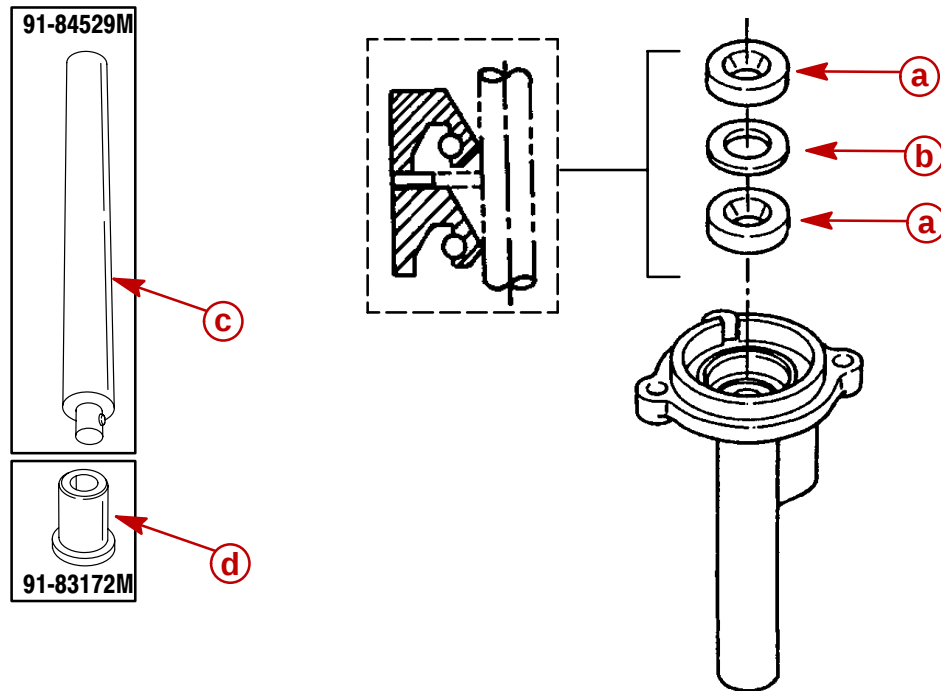
110 4-Stroke Outboard Oil (92-828000A12)

- a** - Bolt (2) M6 X 16 mm
- b** - Cover
- c** - O-Ring Seal
- d** - Rotor - Outer
- e** - Rotor - Inner
- f** - Pin
- g** - Match the Pin With the Pocket in the Inner Rotor
- h** - Pour Approximately 1 fl oz. (30 ml) of Engine Oil into the Oil Pump Inlet Side

Oil Pump Cover Bolt Torque
70 lb-in. (8 Nm)

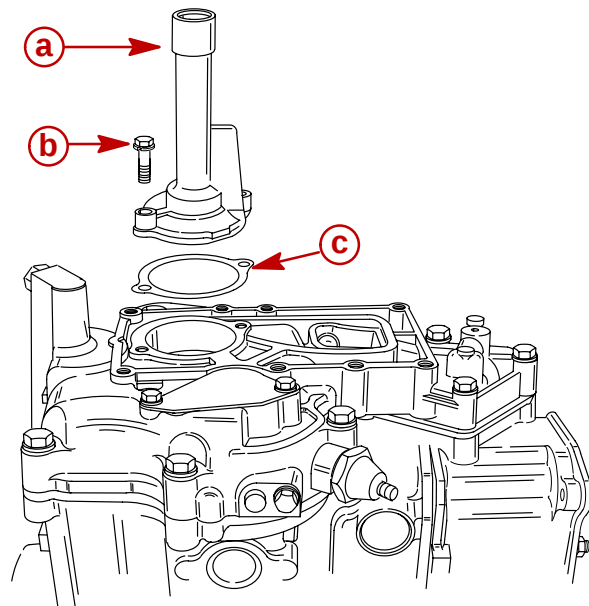


26. Support oil seal housing and install two seals and spacer. Use driver and mandrel as shown.



- a** - Seal
- b** - Spacer
- c** - Driver
- d** - Mandrel

27. Reinstall the oil seal housing.



- a** - Oil Seal Housing
- b** - Bolt (2) M6 x 20 mm
- c** - Gasket

Oil Seal Housing Bolt Torque

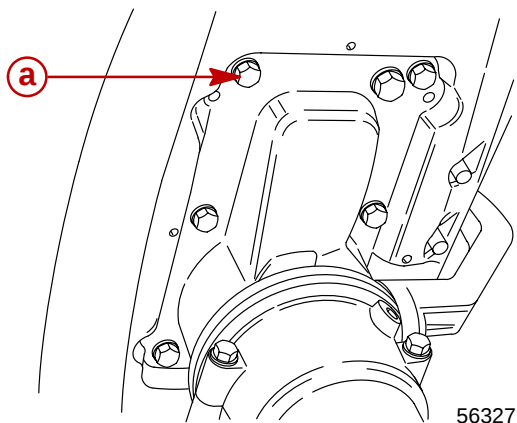
70 lb-in. (8 Nm)



Powerhead Installation

1. Secure powerhead (with new gasket) onto drive shaft housing using 6 bolts. Torque bolts to 70 lb-in. (8 Nm).

Powerhead Mounting Bolt Torque
70 lb-in. (8 Nm)



a - Powerhead Mounting Bolts with Washers (6) M6 x 30 mm

2. Install the following components/assemblies referring to the listed service manual section(s).

Component/Assembly	Section
a Rewind Starter	8
b Flywheel/CDI Unit/Ignition Coils	2A
c Carburetor	3B
d Fuel Pump	3A
e Throttle Linkage	7



MID-SECTION

Section 5

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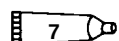
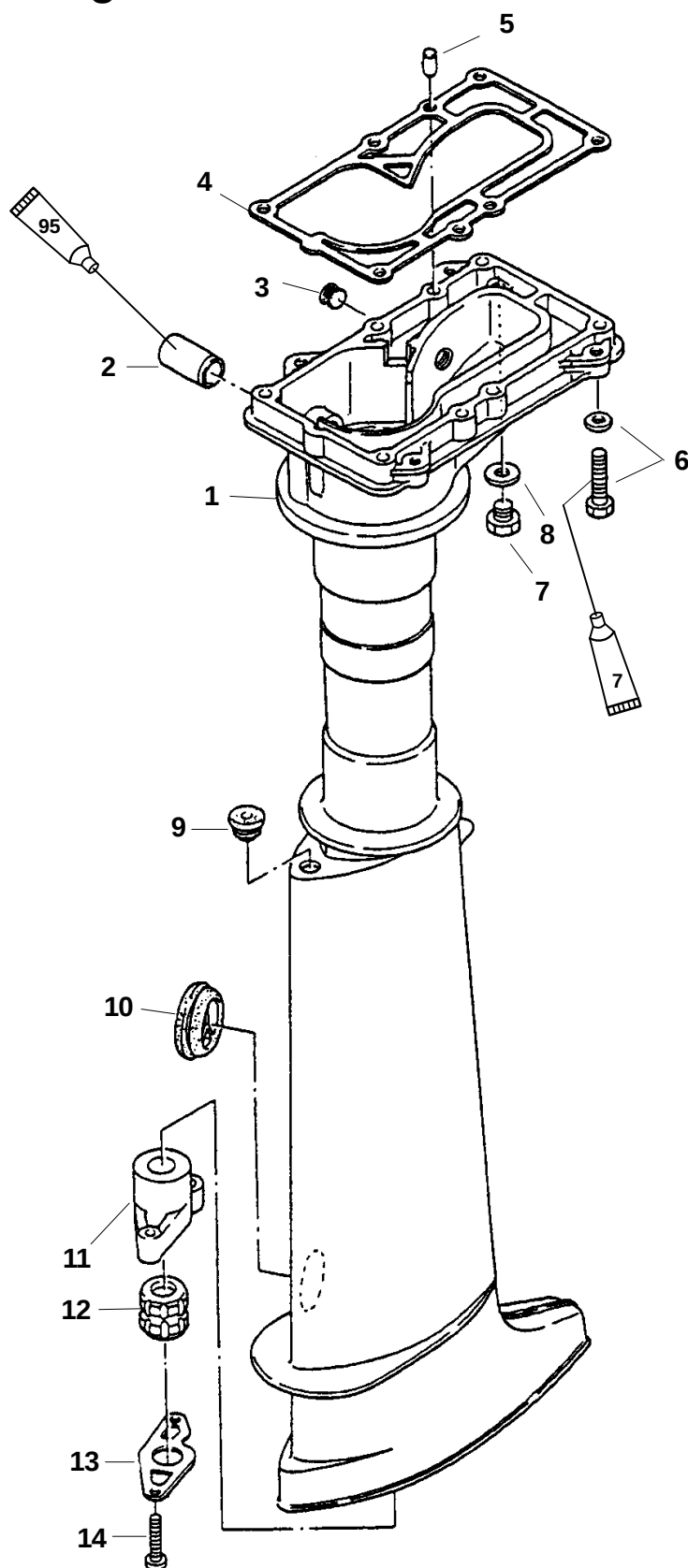
Quicksilver Lubricants and Service Aids	5-1	Reassembly	5-8
Driveshaft Housing	5-2	Clamp Bracket/Swivel Bracket	5-8
Clamp Brackets	5-4	Drive Shaft Housing	5-11
Cowling	5-6	Bottom Cowling	5-12
Disassembly	5-8	Water Tube	5-13

Quicksilver Lubricants and Service Aids

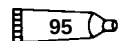
92-825407A12	2-4-C with Teflon Marine Lubricant
92-809820	Loctite 271
92-13783A24	Quicksilver Super Duty Gear Lubricant



Driveshaft Housing



Loctite 271 (92-809820)



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



Driveshaft Housing

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	DRIVESHAFT HOUSING (SHORT)			
	1	DRIVESHAFT HOUSING (LONG)			
2	1	BUSHING			
3	1	EXHAUST PLUG			
4	1	GASKET			
5	2	DOWEL PIN			
6	6	BOLT	70		8
7	1	WATER PLUG			
8	1	GASKET			
9	1	GROMMET			
10	1	GROMMET			
11	1	HOUSING			
12	1	BUSHING (LONG)			
13	1	RETAINER			
14	2	SCREW (SHORT)			
	2	SCREW (LONG)			



This exploded view diagram illustrates the assembly of a mechanical component, likely a valve or actuator. The parts are numbered 1 through 37. The diagram shows the following components and their assembly sequence:

- Part 1:** The main body or housing, which is assembled with **Part 2** (a bracket or flange) and **Part 3** (a pin or screw).
- Part 4:** A bracket or flange that is assembled with **Part 5** (a pin or screw) and **Part 6** (a pin or screw).
- Part 7:** A bracket or flange that is assembled with **Part 8** (a pin or screw) and **Part 9** (a pin or screw).
- Part 10:** A bracket or flange that is assembled with **Part 11** (a pin or screw) and **Part 12** (a pin or screw).
- Part 13:** A bracket or flange that is assembled with **Part 14** (a pin or screw) and **Part 15** (a pin or screw).
- Part 16:** A bracket or flange that is assembled with **Part 17** (a pin or screw) and **Part 18** (a pin or screw).
- Part 19:** A bracket or flange that is assembled with **Part 20** (a pin or screw) and **Part 21** (a pin or screw).
- Part 22:** A bracket or flange that is assembled with **Part 23** (a pin or screw) and **Part 24** (a pin or screw).
- Part 25:** A bracket or flange that is assembled with **Part 26** (a pin or screw) and **Part 27** (a pin or screw).
- Part 28:** A bracket or flange that is assembled with **Part 29** (a pin or screw) and **Part 30** (a pin or screw).
- Part 31:** A bracket or flange that is assembled with **Part 32** (a pin or screw) and **Part 33** (a pin or screw).
- Part 34:** A bracket or flange that is assembled with **Part 35** (a pin or screw) and **Part 36** (a pin or screw).
- Part 37:** A bracket or flange that is assembled with **Part 38** (a pin or screw) and **Part 39** (a pin or screw).

The diagram also includes several assembly instructions:

- Apply **95** (grease or lubricant) to the contact surfaces of **Part 1**, **Part 2**, **Part 3**, **Part 4**, **Part 5**, **Part 6**, **Part 7**, **Part 8**, **Part 9**, **Part 10**, **Part 11**, **Part 12**, **Part 13**, **Part 14**, **Part 15**, **Part 16**, **Part 17**, **Part 18**, **Part 19**, **Part 20**, **Part 21**, **Part 22**, **Part 23**, **Part 24**, **Part 25**, **Part 26**, **Part 27**, **Part 28**, **Part 29**, **Part 30**, **Part 31**, **Part 32**, **Part 33**, **Part 34**, **Part 35**, **Part 36**, **Part 37**, **Part 38**, and **Part 39**.
- Apply **95** (grease or lubricant) to the contact surfaces of **Part 1**, **Part 2**, **Part 3**, **Part 4**, **Part 5**, **Part 6**, **Part 7**, **Part 8**, **Part 9**, **Part 10**, **Part 11**, **Part 12**, **Part 13**, **Part 14**, **Part 15**, **Part 16**, **Part 17**, **Part 18**, **Part 19**, **Part 20**, **Part 21**, **Part 22**, **Part 23**, **Part 24**, **Part 25**, **Part 26**, **Part 27**, **Part 28**, **Part 29**, **Part 30**, **Part 31**, **Part 32**, **Part 33**, **Part 34**, **Part 35**, **Part 36**, **Part 37**, **Part 38**, and **Part 39**.
- Apply **95** (grease or lubricant) to the contact surfaces of **Part 1**, **Part 2**, **Part 3**, **Part 4**, **Part 5**, **Part 6**, **Part 7**, **Part 8**, **Part 9**, **Part 10**, **Part 11**, **Part 12**, **Part 13**, **Part 14**, **Part 15**, **Part 16**, **Part 17**, **Part 18**, **Part 19**, **Part 20**, **Part 21**, **Part 22**, **Part 23**, **Part 24**, **Part 25**, **Part 26**, **Part 27**, **Part 28**, **Part 29**, **Part 30**, **Part 31**, **Part 32**, **Part 33**, **Part 34**, **Part 35**, **Part 36**, **Part 37**, **Part 38**, and **Part 39**.



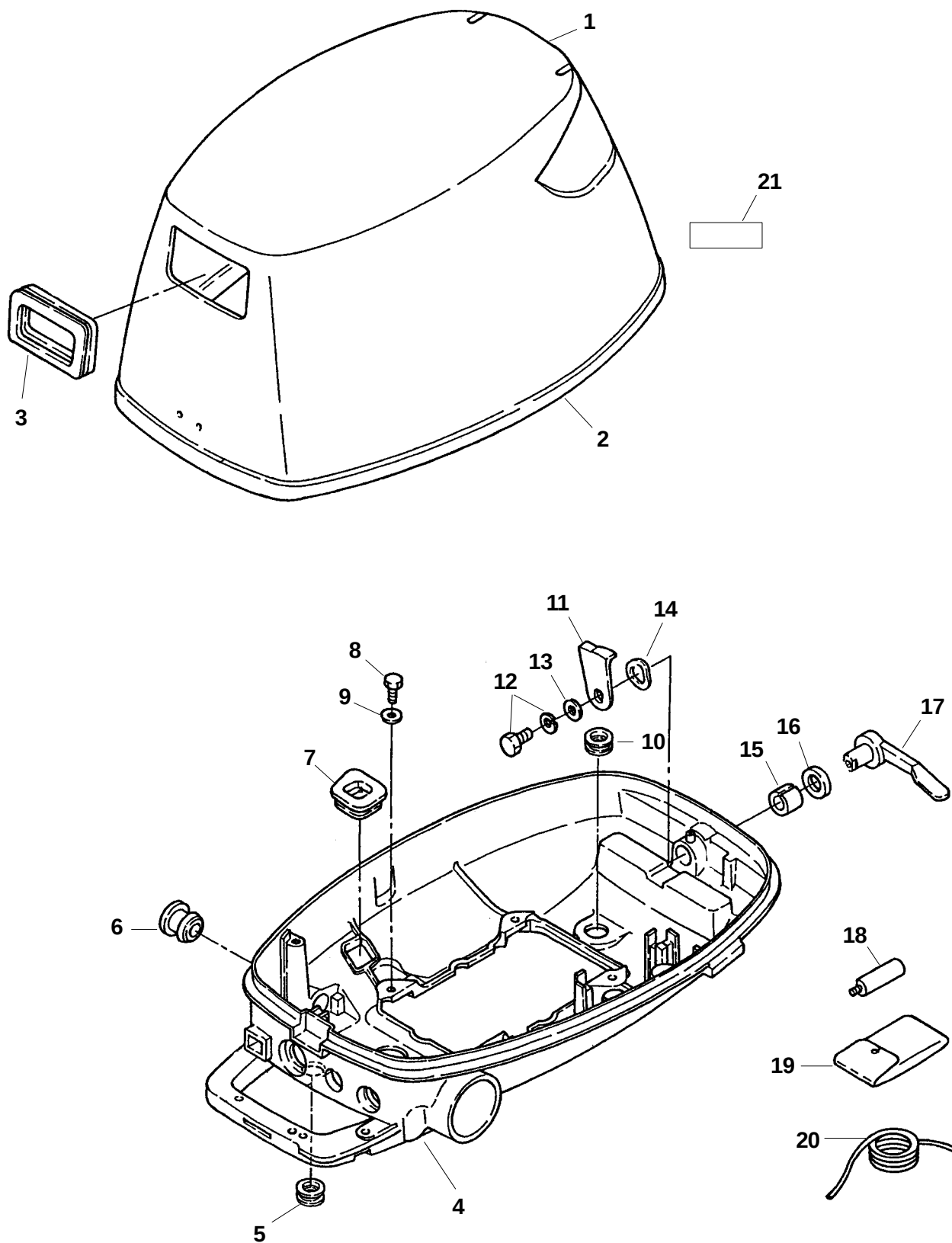


Clamp Brackets

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	STARBOARD CLAMP BRACKET			
2	1	PORT CLAMP BRACKET			
3	1	BOLT			
4	2	WASHER			
5	1	WASHER			
6	1	NUT	25		2.8
7	1	DISTANCE PLATE			
8	2	SCREW	36		4
9	1	SPRING			
10	1	TILT STOPPER			
11	1	GRIP			
12	2	BOLT	70		8
13	1	SET PLATE			
14	2	BUSHING			
15	2	CLAMP SCREW KIT			
16	2	WASHER			
17	1	THRUST ROD			
18	1	SPRING			
19	1	SPRING			
20	1	WASHER			
21	1	SCREW			
22	1	SWIVEL BRACKET A			
23	1	SWIVEL BRACKET B			
24	1	THRUST PLATE			
25	1	BUSHING-UPPER			
26	1	BUSHING-LOWER			
27	2	THRUST PLATE			
28	4	BOLT	70		8
29	1	SCREW			
30	1	SPRING			
31	1	WASHER			
32	2	GREASE FITTING			
33	2	CAP			
34	1	REVERSE LOCK ARM			
35	2	BOLT	70		8
36	1	SPRING			
37	1	SPRING			



Cowling





Cowling

REF. NO.	QTY.	DESCRIPTION
1	1	TOP COWL (BLACK)
	1	TOP COWL (SILVER)
2	1	SEAL
3	1	GROMMET
4	1	BOTTOM COWL
5	1	GROMMET
6	1	GROMMET
7	1	GROMMET
8	4	BOLT
9	4	WASHER
10	1	GROMMET
11	1	COVER HOOK
12	1	BOLT
13	1	WASHER
14	1	WAVE WASHER
15	1	BUSHING
16	1	SEAL RING
17	1	HOOK LEVER
18	1	FLUSH PLUG
19	1	TOOL KIT
20	1	ROPE
21	1	DECAL-EPA INFO(1999)(SEE NOTE)
	1	DECAL-EPA INFO(2000)(SEE NOTE)

NOTE: THE EPA LABEL HAS IMPORTANT INFORMATION ON EPA EMISSION REGULATIONS. REPLACE ANY MISSING OR UNREADABLE EPA LABEL.



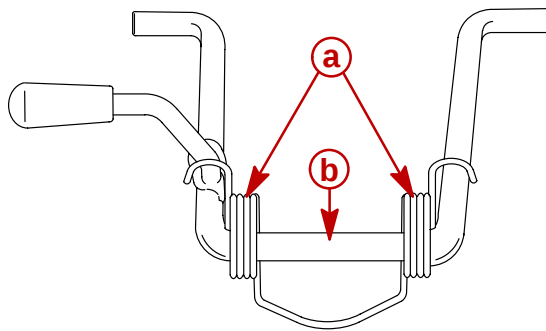
Disassembly

Refer to parts view on page 5A-4 and disassemble mid-section components as required.

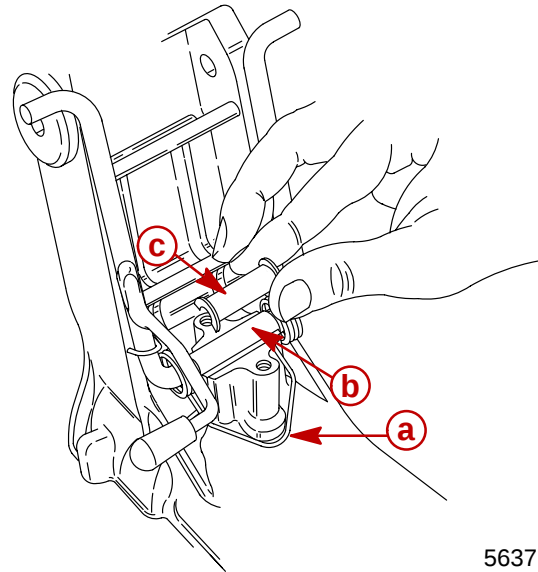
Reassembly

Clamp Bracket/Swivel Bracket

1. Install tilt lever spring over tilt lever.
2. Place tilt lever/spring in pocket of swivel bracket.



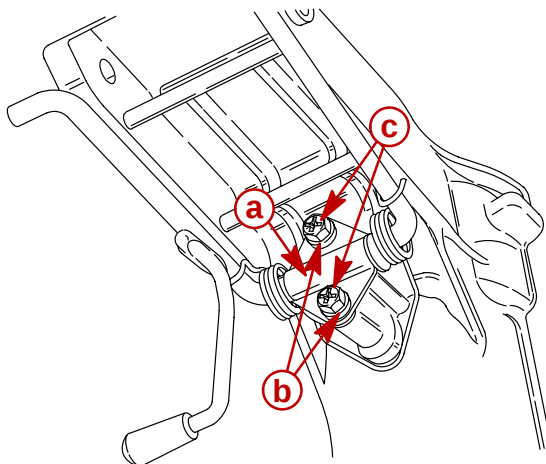
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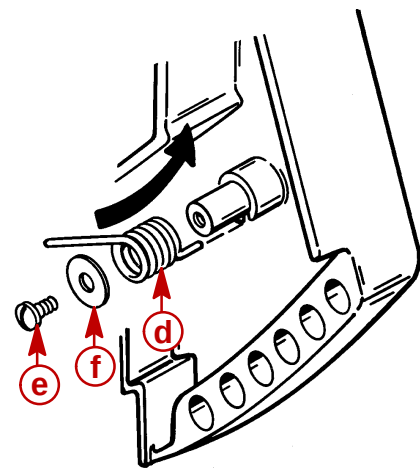
- a** - Tilt Lever Spring
- b** - Tilt Lever
- c** - Nylon Bushing Halves (2); Coat I.D. with 2-4-C w/Teflon Marine Lubricant

3. Secure tilt lever/spring to swivel bracket, using plate, lock washers and bolts. Torque bolts to 70 lb-in. (8 Nm).
4. Secure tilt spring to starboard clamp bracket, using screw and washer.



56372

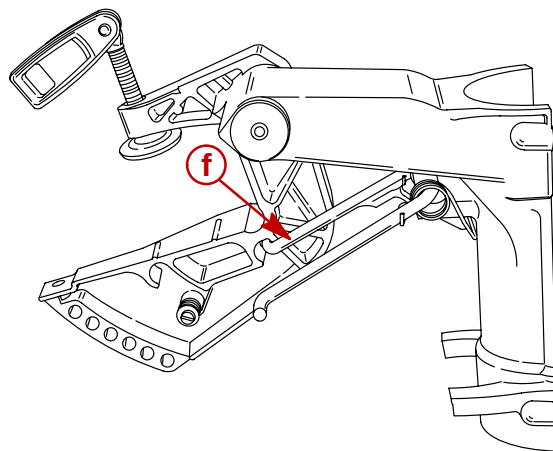
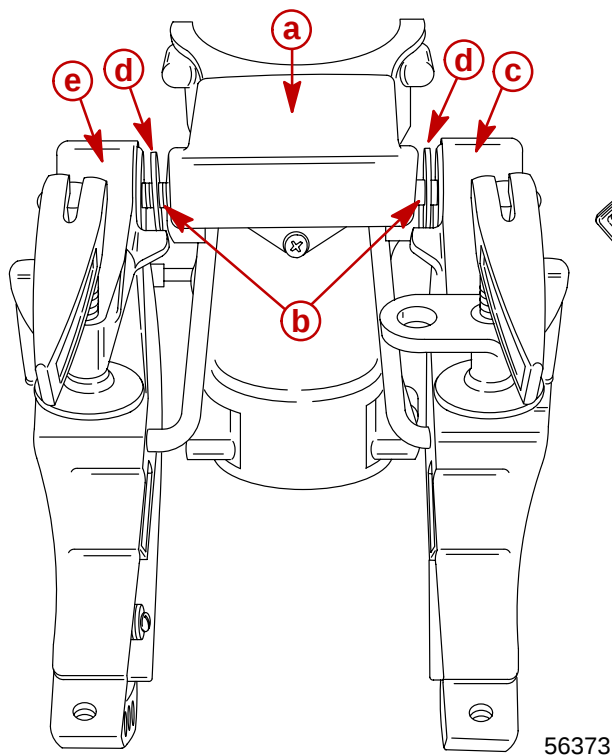
- a** - Plate
- b** - Lock Washer (2)
- c** - Bolt (2)



- d** - Tilt Spring
- e** - Screw
- f** - Washer

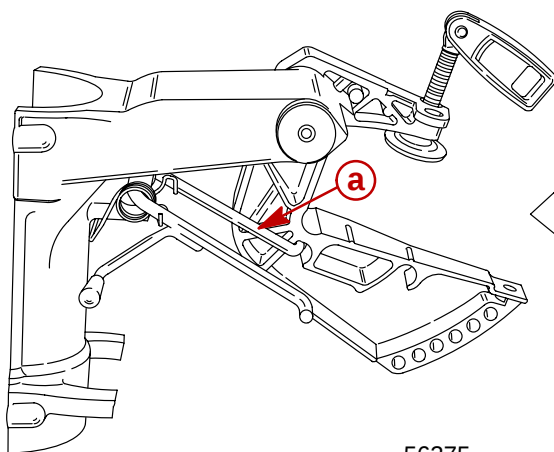


5. Secure clamp brackets to swivel bracket.

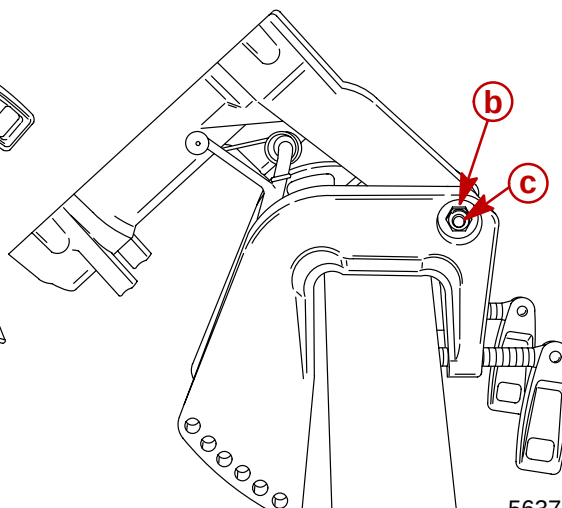


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- a** - Swivel Bracket
- b** - Bolt; Installed from Port Side
- c** - Clamp Bracket (Port)
- d** - Washers (2); Coat with 2-4-C w/Teflon Marine Lubricant
- e** - Clamp Bracket (Starboard)
- f** - Tilt Lever Indexed in Starboard Clamp Bracket

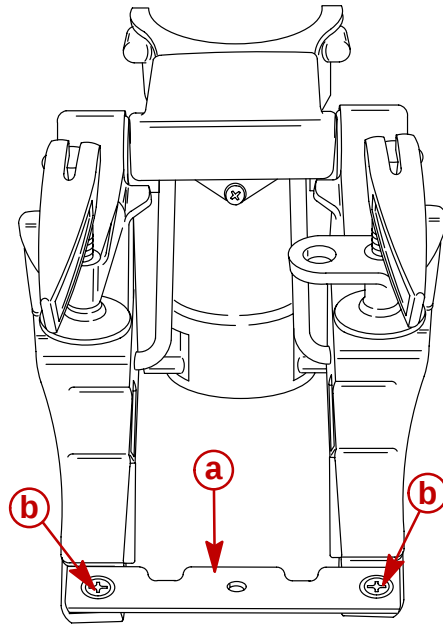


56375



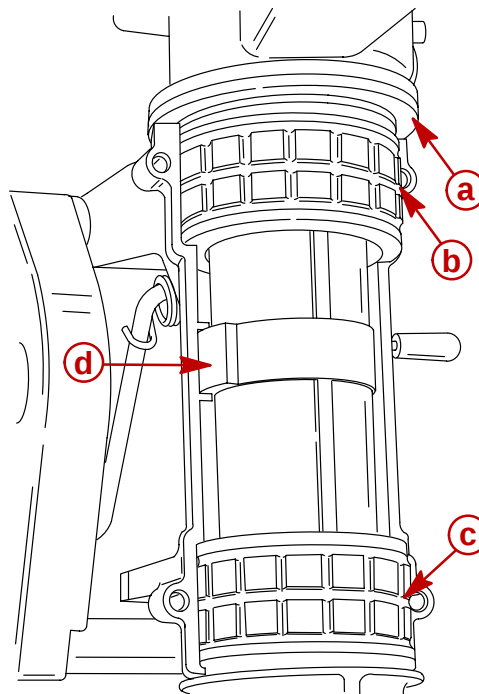
56376

- a** - Tilt Lever Indexed in Port Clamp Bracket
- b** - Washer
- c** - Nut; Torque to 25 lb-in. (2.8 Nm)



56379

- a** - Tie Bar
- b** - Screws (2); Torque Screws to 36 lb-in. (4 Nm)



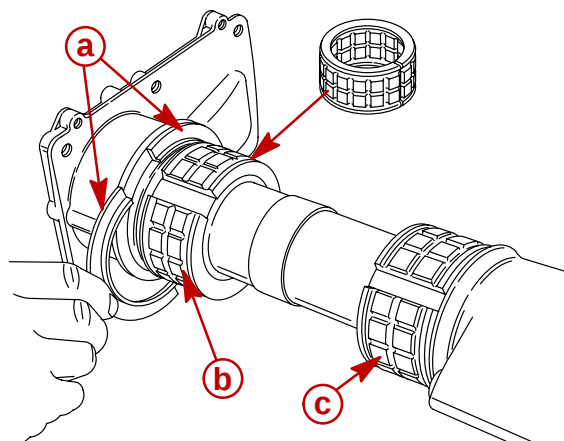
56377

- a** - Nylon Bushing Halves
- b** - Rubber Mount - Upper
- c** - Rubber Mount - Lower
- d** - Friction Plate



Drive Shaft Housing

1. Apply a thin coat of 2-4-C w/Teflon Marine Lubricant to both inside and outside diameters of rubber mounts.
2. Install rubber mounts and nylon bushing halves onto drive shaft housing.



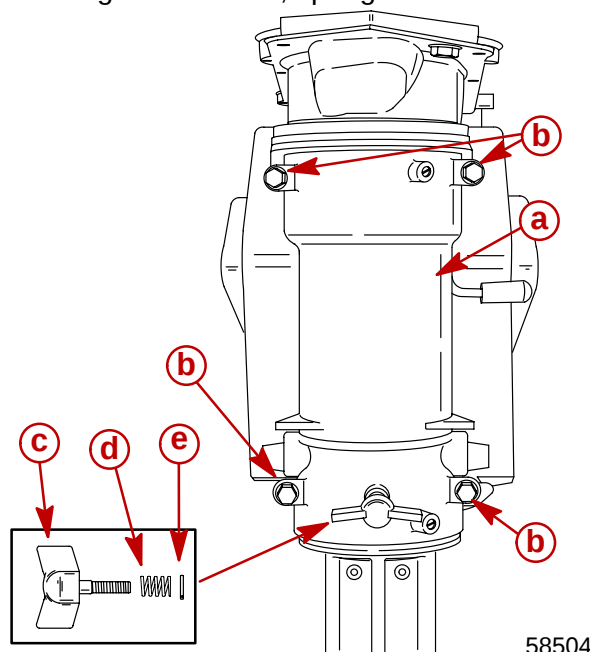
56378

- a** - Nylon Bushing Halves (2); Coat with 2-4-C w/Teflon Marine Lubricant
- b** - Rubber Mount - Upper (Marked "Up")
- c** - Rubber Mount - Lower

3. Install drive shaft housing into swivel bracket, positioning rubber mounts and nylon bushing halves, as shown.

IMPORTANT: Rubber face of friction plate and area of drive shaft housing traveled by friction plate must be free of lubrication.

4. Install friction plate into pocket of swivel bracket.
5. Install rear half of swivel bracket over drive shaft housing, and secure it to front half, using 4 bolts with washers. Torque bolts to 70 lb-in. (8 Nm).
6. Install steering friction knob, spring and washer.

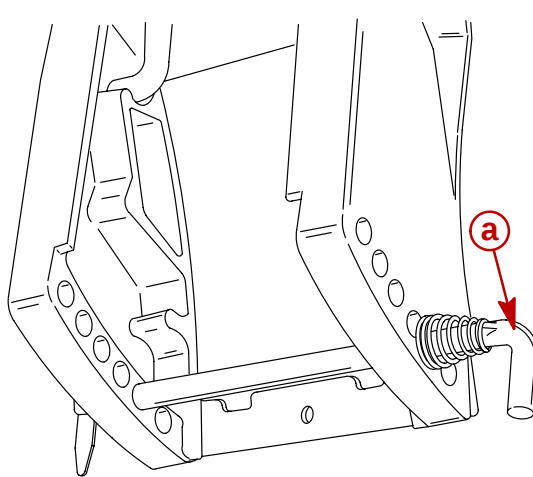


58504

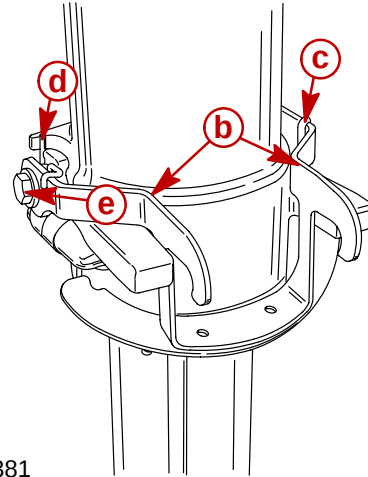
- a** - Rear Half
- b** - Bolt (4)
- c** - Steering Friction Knob
- d** - Spring
- e** - Washer



7. Install tilt lock pin.
8. Secure reverse lock hook onto bosses of swivel bracket.



56381

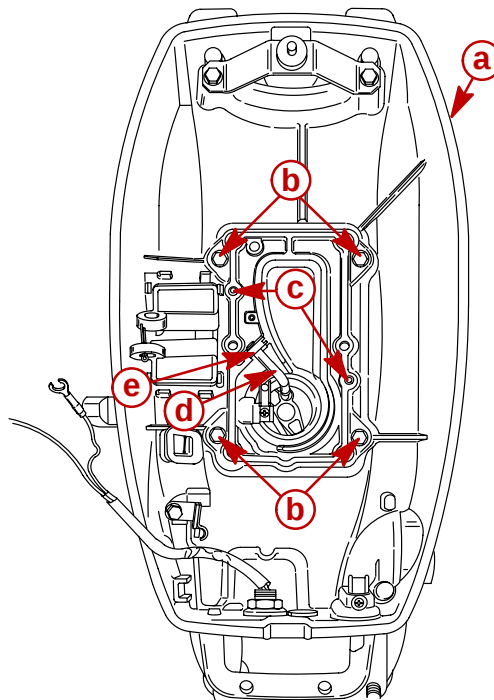


56382

- a** - Tilt Lock Pin
- b** - Reverse Lock Hook
- c** - Spring - Port
- d** - Spring - Starboard
- e** - Bolts (2); Torque Bolts to 70 lb-in. (8 Nm)

Bottom Cowling

1. Attach components to bottom cowl and secure bottom cowl to drive shaft housing, as shown.



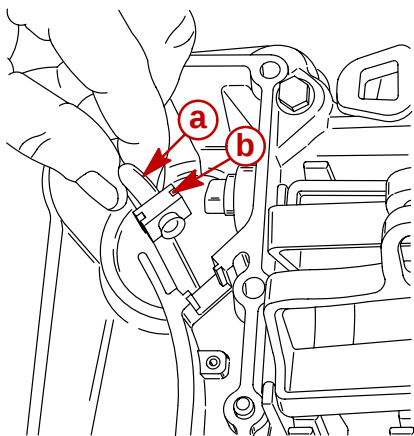
56383

- a** - Bottom Cowl
- b** - Bolt with Washer (4); Torque Bolts to 70 lb-in. (8 Nm)
- c** - Guide Pins (2)
- d** - Water Tube
- e** - Water Tube Seal

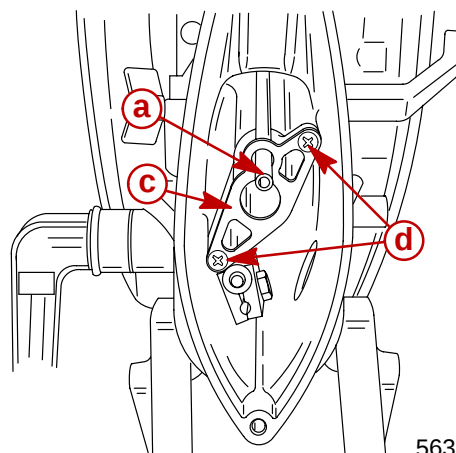


Water Tube

1. Install water tube into drive shaft housing, as shown.



56384



56385

- a** - Water Tube
- b** - Water Tube Seal
- c** - Guide Plate
- d** - Screw (2)

2. Install shift linkage, as outlined in Section 8 “Shift Linkage.”
3. Install powerhead, as outlined in Section 4A “Powerhead.”
4. Install gear housing, as outlined in Section 6 “Gear Housing.”



GEAR HOUSING

Section 6

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Specifications

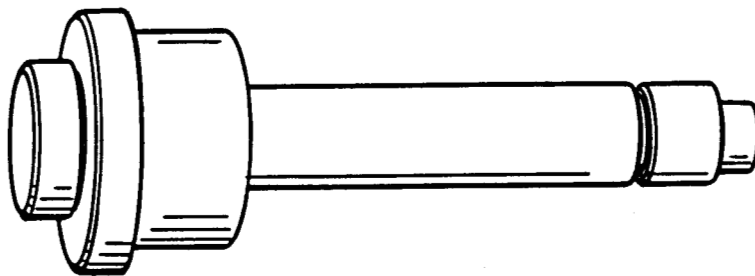
GEAR HOUSING (2.15:1)	Gear Ratio	2.15:1
	Gearcase Capacity	6.5 fl oz (195 mL)
	Lubricant Type	Quicksilver Gear Lube-Premium Blend
	Forward Gear	
	Number of Teeth	28 Spiral/Bevel
	Pinion Gear	
	Number of Teeth	13 Spiral/Bevel
	Pinion Height	Floating
	Forward Gear Backlash	No Adjustment
	Water Pressure*:	
	@ 1300 rpm (Idle) Neutral	2.3 - 3.6 psi (16 - 25 kPa)
	@ 5000 rpm	8 - 15 psi (55 - 103.5 kPa)

*Water pressure readings will vary with thermostat operation.

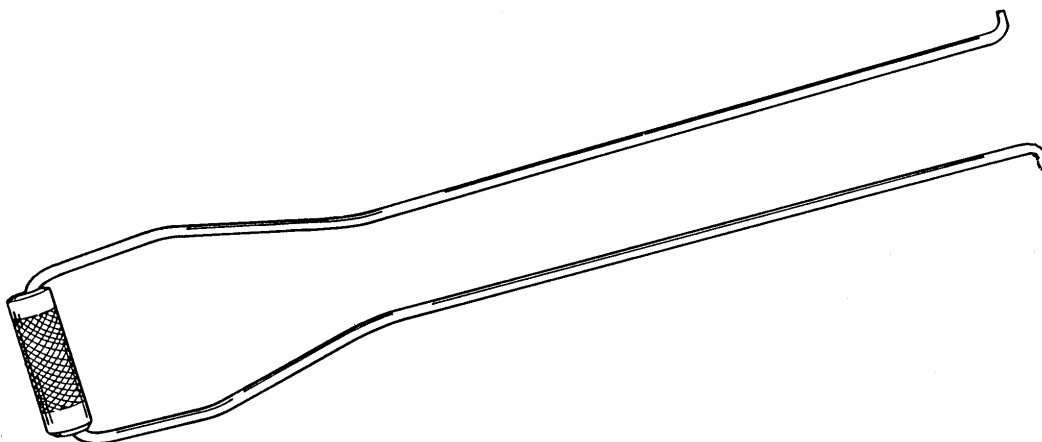


Special Tools

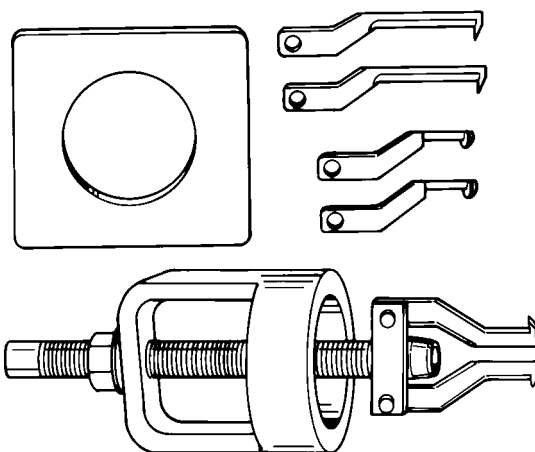
1. Lower Drive Shaft Bearing Drive (91-17351) NLA



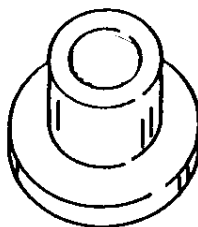
2. Puller (91-27780)



3. Puller Assembly (91-83165M)

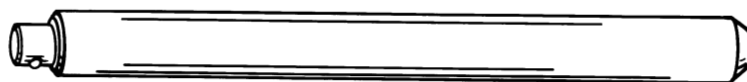


4. Mandrel (91-83174M) NLA

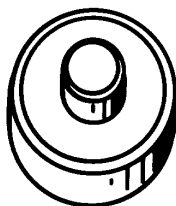




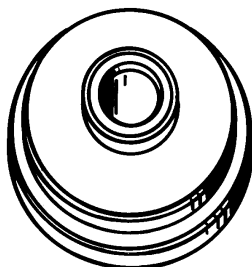
5. Driver Rod (91-84529M) NLA



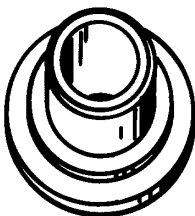
6. Mandrel (91-84530M) NLA



7. Mandrel (91-84532M) NLA



8. Mandrel (91-84536M) NLA

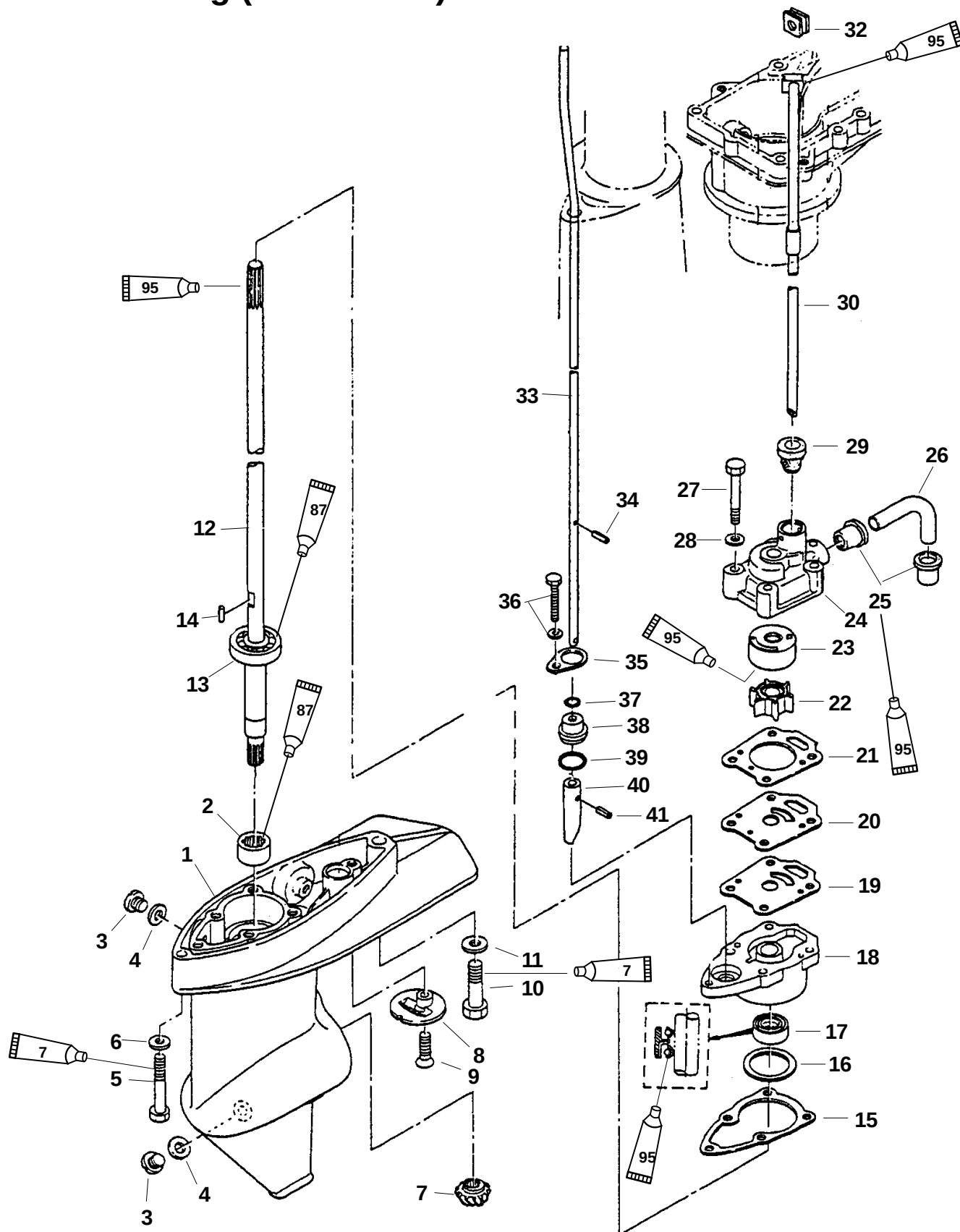


Quicksilver Lubricants and Service Aids

Part No.	Description
92-13872A1	Special Lubricant 101
92-19007A24	Quicksilver Gear Lubricant
92-34227-1	Perfect Seal
92-825407A12	2-4-C with Teflon Marine Lubricant



Gear Housing (Drive Shaft)



7 Loctite 271 (92-809820)

87 Super Duty Gear Lubricant (92-13783A24)

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



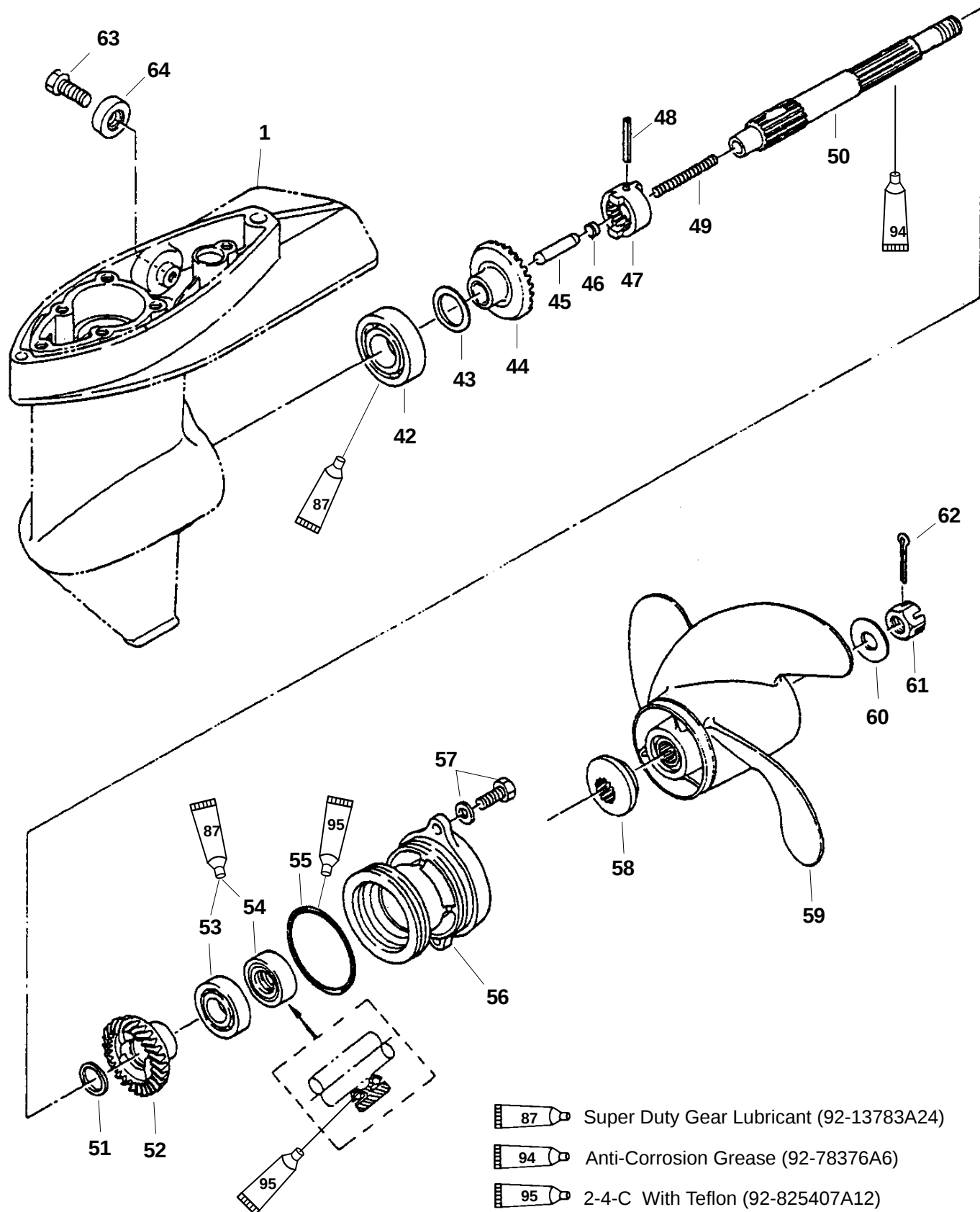
Gear Housing (Drive Shaft)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
–	1	GEAR HOUSING (SHORT)			
–	1	GEAR HOUSING (LONG)			
1	1	GEAR HOUSING (BASIC)			
2	1	BEARING			
3	2	PLUG			
4	2	GASKET			
5	1	BOLT	70		8
6	1	WASHER			
7	1	PINION GEAR			
8	1	WATER STRAINER			
9	1	SCREW	70		8
10	1	BOLT	70		8
11	1	WASHER			
12	1	DRIVESHAFT (SHORT)			
	1	DRIVESHAFT (LONG)			
13	1	BEARING			
14	1	KEY			
15	1	GASKET			
16	AR	SHIM (0.1)			
	AR	SHIM (0.15)			
17	1	OIL SEAL			
18	1	WATER PUMP HOUSING–LOWER			
19	1	GASKET			
20	1	GUIDE PLATE			
21	1	GASKET			
22	1	IMPELLER			
23	1	LINER			
24	1	WATER PUMP HOUSING–UPPER			
25	2	SEAL			
26	1	HOSE			
27	4	BOLT	70		8
28	4	WASHER			
29	1	SEAL			
30	1	WATER TUBE (SHORT)			
31	1	WATER TUBE (LONG)			
32	1	GROMMET			
33	1	CAM ROD (SHORT)			
		CAM ROD (LONG)			
34	1	ROLL PIN			
35	1	RETAINER			
36	1	BOLT	70		8
37	1	O RING			
38	1	BUSHING			
39	1	O RING			
40	1	CLUTCH CAM			
41	1	ROLL PIN			

AR = As Required



Gear Housing (Prop Shaft)





Gear Housing (Prop Shaft)

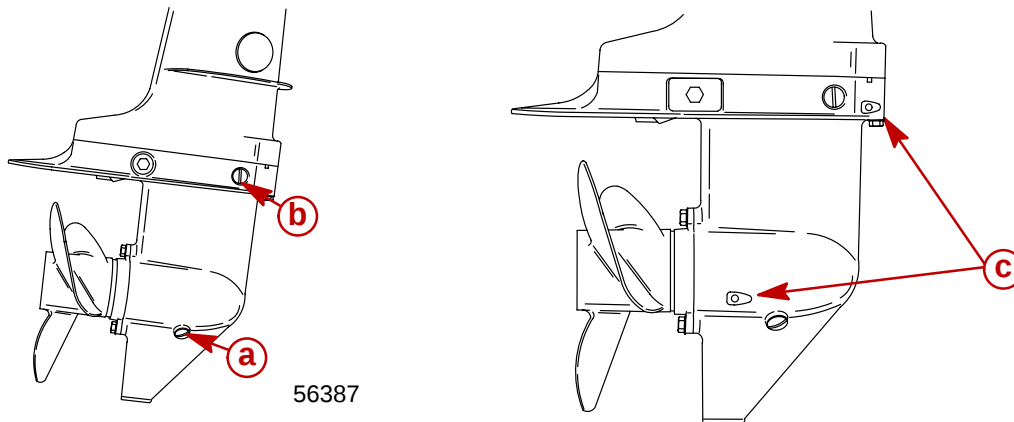
REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
–	1	GEAR HOUSING (SHORT)			
–	1	GEAR HOUSING (LONG)			
1	1	GEAR HOUSING-BASIC			
42	1	BEARING			
43	AR	SHIM (0.1)			
	AR	SHIM (0.15)			
44	1	FORWARD GEAR			
45	1	PUSH ROD			
46	1	RETAINER			
47	1	CLUTCH			
48	1	PIN			
49	1	SPRING			
50	1	PROPELLER SHAFT			
51	1	WASHER			
52	1	REVERSE GEAR			
53	1	BEARING			
54	1	OIL SEAL			
55	1	O RING			
56	1	BEARING CARRIER			
57	2	BOLT	70		8
58	1	THRUST HOLDER			
59	OPT.	PROPELLER (6 PITCH)			
	OPT.	PROPELLER (6 PITCH – SAILBOAT)			
	1	PROPELLER (7 PITCH – 4 H.P. STANDARD)			
	1	PROPELLER (8 PITCH - 5 H.P. STANDARD)			
	OPT	PROPELLER (9 PITCH)			
60	1	WASHER			
61	1	PROP NUT			
62	1	COTTER PIN			
63	1	BOLT	70		8
64	1	ANODE			



Draining and Inspecting Gear Housing Lubricant

1. Remove "OIL" (fill) plug and "OIL LEVEL" (vent) plug. Let gear housing lubricant drain into clean drain pan.

NOTE: 2000 model year and later outboards have upper and lower water drain holes.



- a** - Fill Plug
- b** - Vent Plug
- c** - Water Drain Holes

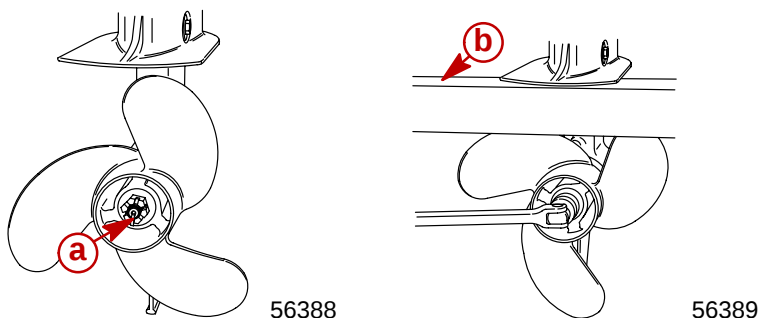
2. Inspect lubricant for metal particles. Presence of a small amount of fine particles (resembling powder) indicates normal wear. Presence of larger particles or a large quantity of fine particles indicates need for gear housing disassembly and component inspection.
3. Note the color of lubricant. White or cream color indicates presence of water in lubricant.
4. Check drain pan for water separation from lubricant. Presence of water in lubricant indicates the need for disassembly and inspection of oil seals, seal surfaces, O-rings, gas-kets and gear housing components.

Propeller Removal

⚠ WARNING

To prevent accidental engine starting remove and isolate spark plug lead from spark plug before removing gear housing, place a block of wood between the anti-ventilation plate and propeller, to protect hands from propeller blades while turning propeller nut.

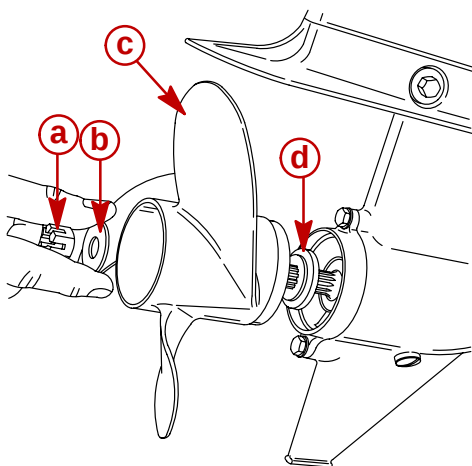
1. Remove cotter pin.
2. Place a block of wood between anti-ventilation plate and propeller blade.



- a** - Cotter Pin
- b** - Block of Wood



3. Remove nut, washer, propeller and thrust hub.



56390

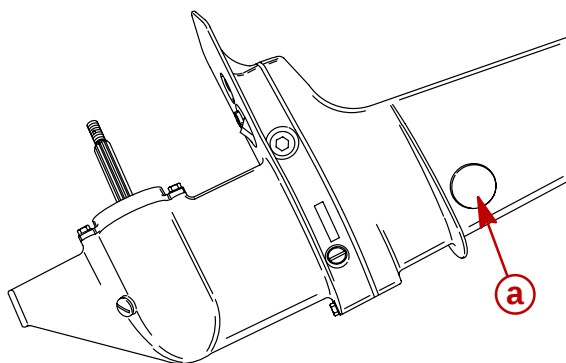
- a** - Nut
- b** - Washer
- c** - Propeller
- d** - Thrust Hub

Gear Housing Removal

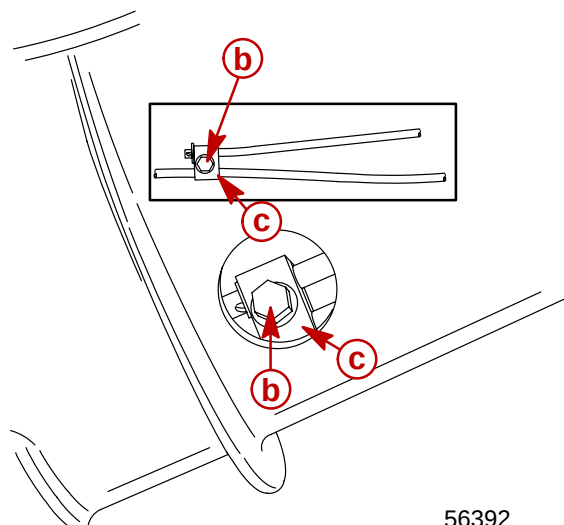
⚠ WARNING

To prevent accidental engine starting, remove (and isolate) spark plug lead from spark plug **BEFORE** removing gear housing.

1. Remove (and isolate) spark plug lead from spark plug.
2. Shift outboard into "Reverse" gear.
3. Tilt (and lock) outboard to full "Up" position.
4. Remove plug.
5. Loosen bolt to loosen shift shaft clamp.



56391

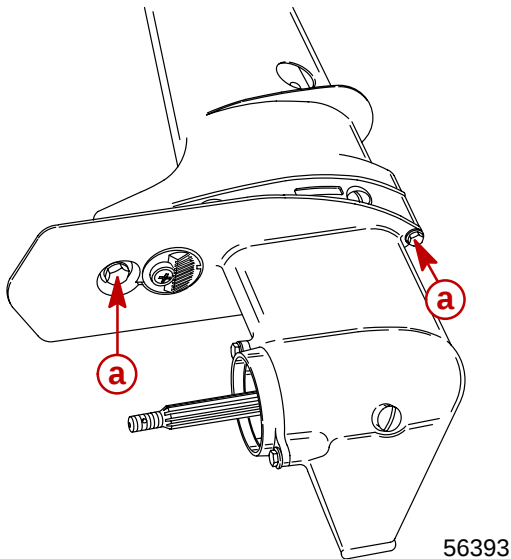


56392

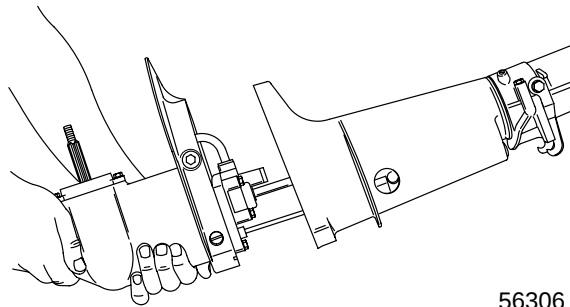
- a** - Plug
- b** - Bolt
- c** - Shift Shaft Clamp



6. Remove bolts with washers.
7. Guide gear housing from drive shaft housing.



a - Bolts with Washers



56306

Gear Housing Disassembly

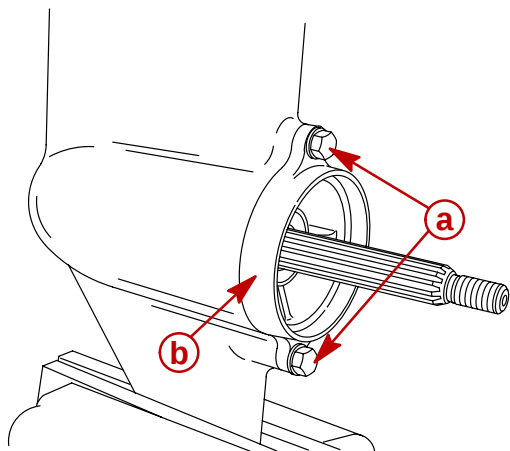
Bearing Carrier

1. Remove two bolts that secures bearing carrier.

⚠ CAUTION

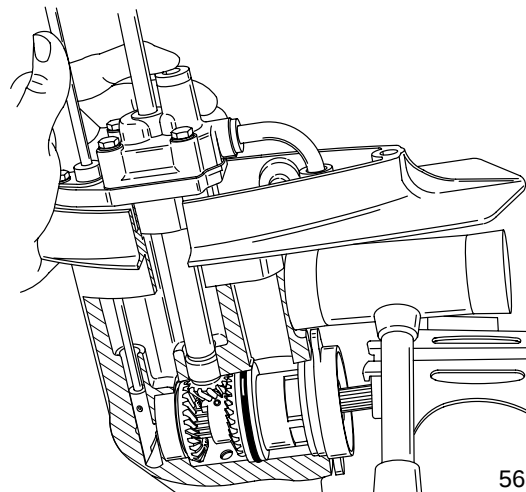
Make sure to keep gear housing from falling when bearing carrier loosens.

2. Clamp propeller shaft in soft jaw vise. Use soft face mallet to strike gear housing approximately midway between anti-ventilation plate and bearing carrier cavity.



56394

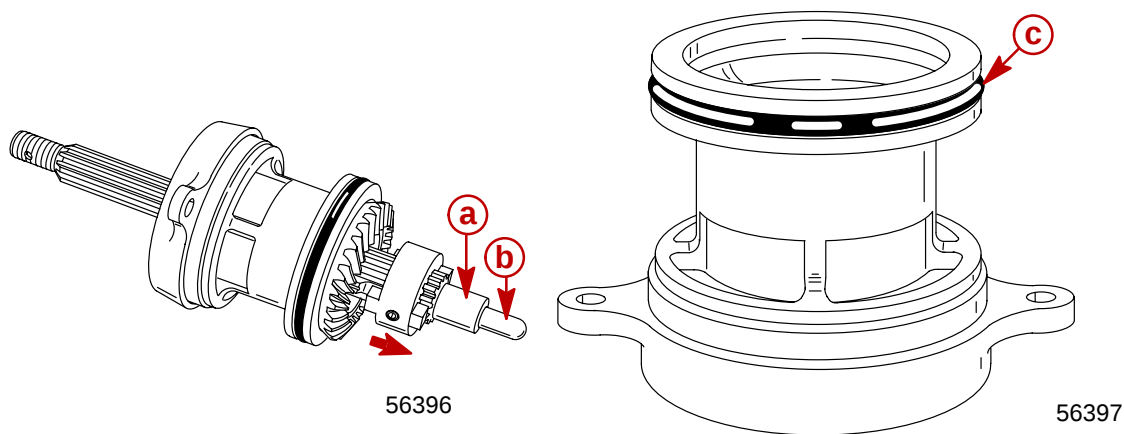
a - Bolts (2)
b - Bearing Carrier



56395



3. Pull propeller shaft from bearing carrier. Retain cam follower with propeller shaft.
4. Remove O-ring.



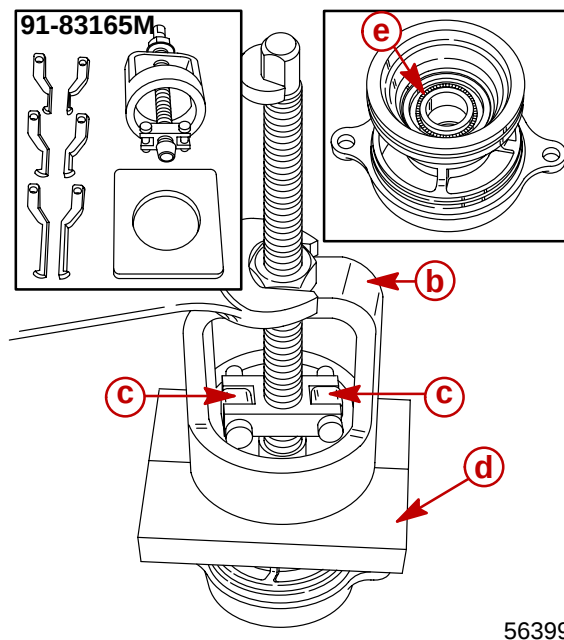
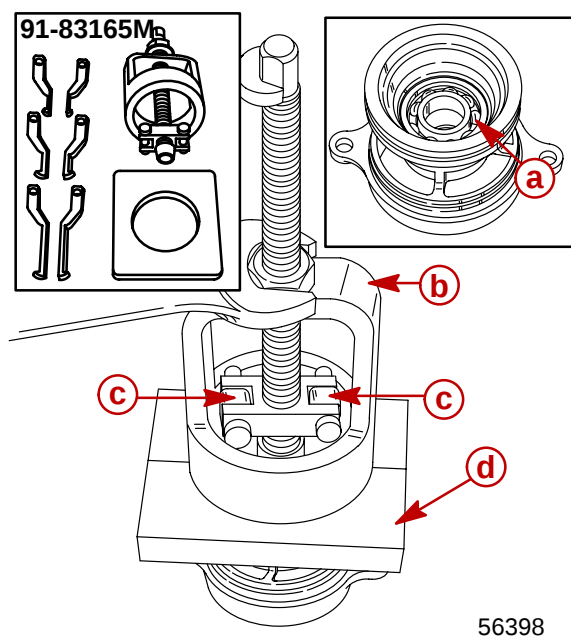
- a** - Propeller Shaft
- b** - Cam Follower
- c** - O-ring

IMPORTANT: Propeller shaft bearing is damaged during removal. Do not remove bearing unless replacement is necessary. Refer to “Cleaning and Inspection,” following.

5. Remove propeller shaft bearing using puller assembly with suitable jaws and suitable plate.

NOTE: Propeller shaft bearing has to be removed (see step 5) before removing propeller shaft oil seal.

6. Remove propeller shaft oil seal, using puller assembly with suitable jaws and suitable plate.

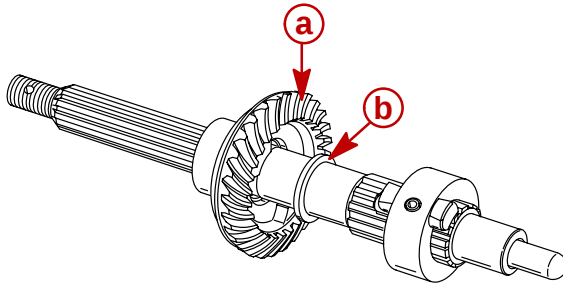


- a** - Propeller Shaft Bearing
- b** - Puller Assembly
- c** - Suitable Jaws
- d** - Suitable Plate
- e** - Propeller Shaft Oil Seal

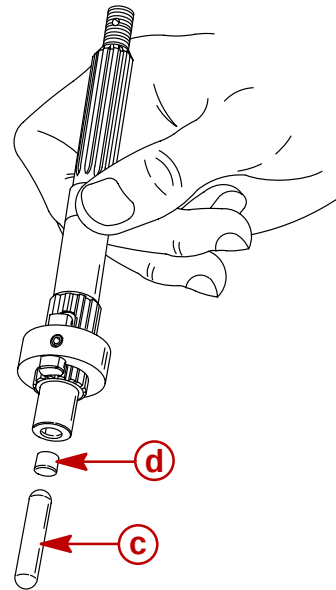


Propeller Shaft

1. Remove reverse gear and washer.
2. Remove cam follower and guide.



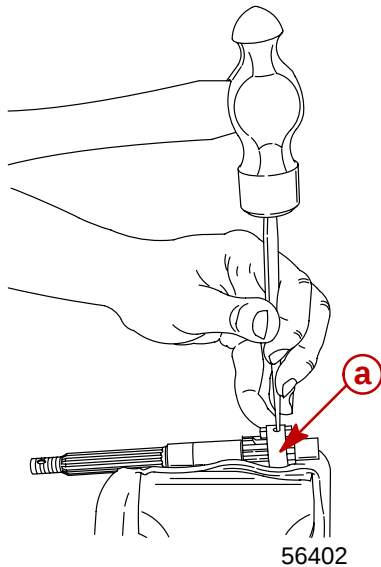
56400



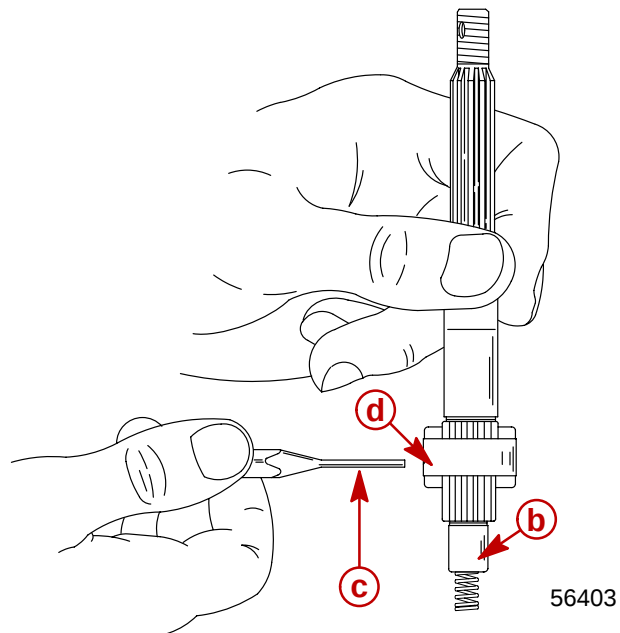
56401

- a** - Reverse Gear
- b** - Washer
- c** - Cam Follower
- d** - Guide

3. Using a punch, tap cross pin from sliding clutch. Leave punch in hole to retain spring at this time.
4. Put end of shaft against solid object. Remove punch from sliding clutch, and slowly release spring compression.



56402

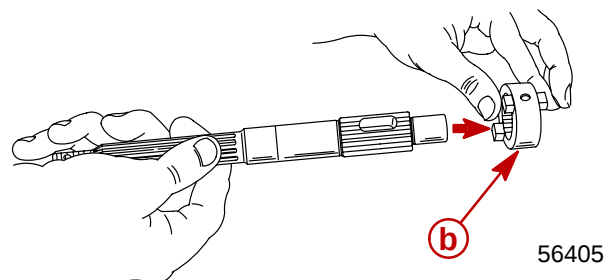
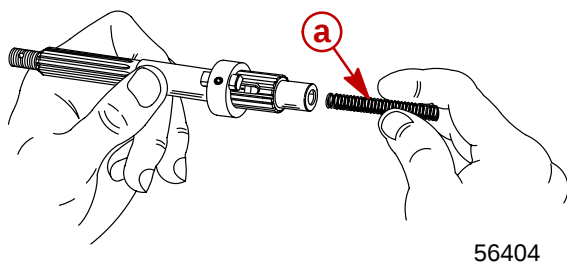


56403

- a** - Sliding Clutch
- b** - End of Shaft
- c** - Punch
- d** - Sliding Clutch



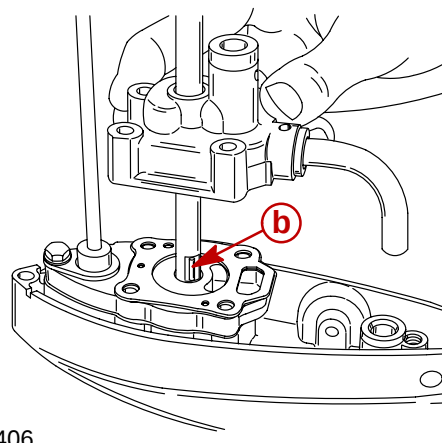
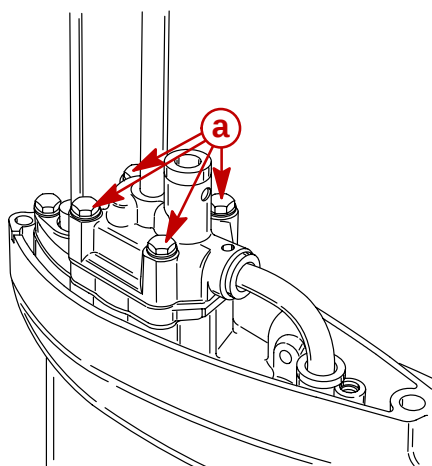
5. Remove spring.
6. Remove sliding clutch.



- a** - Spring
b - Sliding Clutch

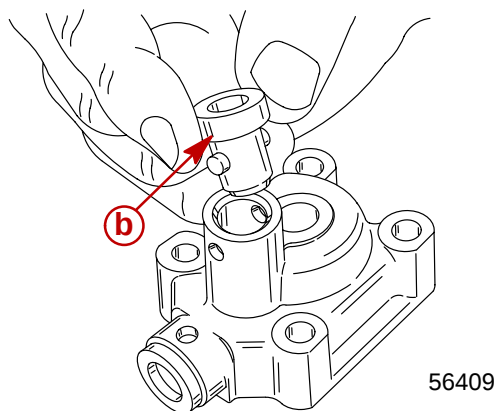
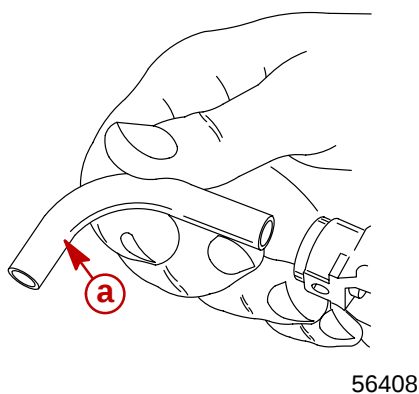
Water Pump Housing and Impeller

1. Remove 4 bolts with flat washers.
2. Remove water pump housing components and drive pin from drive shaft.



- a** - Bolts (4)
b - Drive Pin

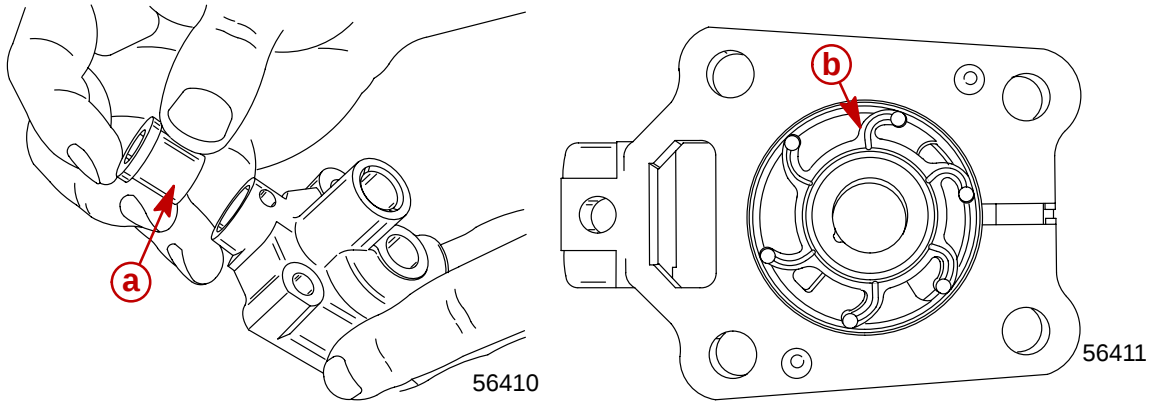
3. Remove water pickup tube.
4. Remove water tube seal.



- a** - Pick-up Tube
b - Water Tube Seal

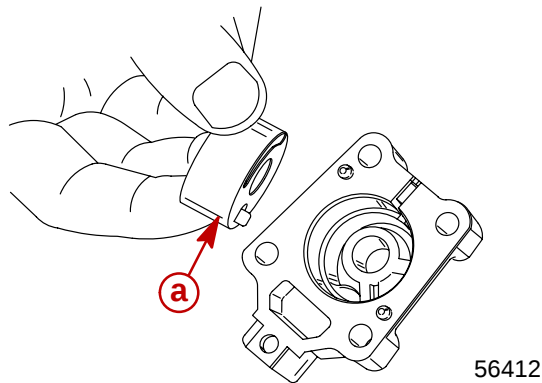


5. Remove water pickup seal.
6. Remove water pump impeller.



- a** - Water Pick-up Seal
b - Water Pump Impeller

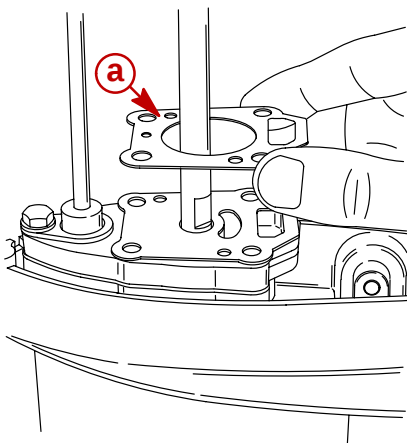
7. Remove insert.



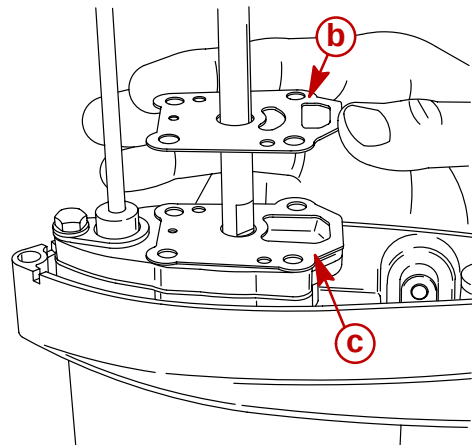
- a** - Insert

Water Pump Base and Shift Shaft

1. Remove gasket.
2. Remove plate and gasket.



56413

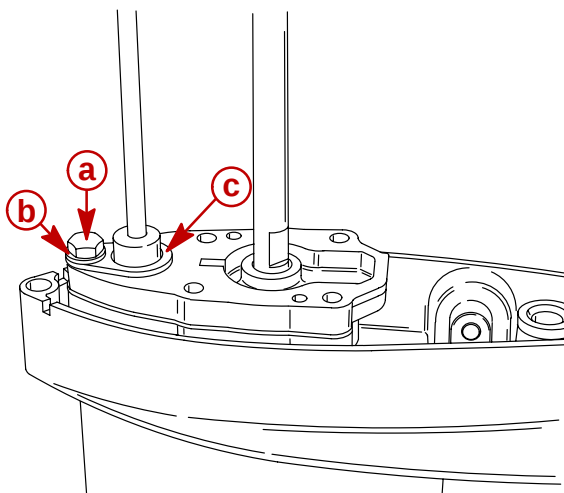


56414

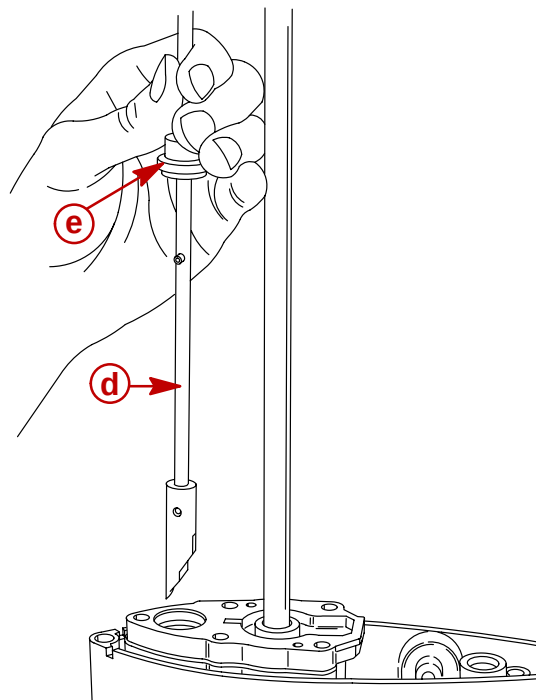
- a** - Gasket
b - Plate
c - Gasket



3. Remove bolt, washer and retainer plate.
4. Remove shift shaft assembly and bushing.



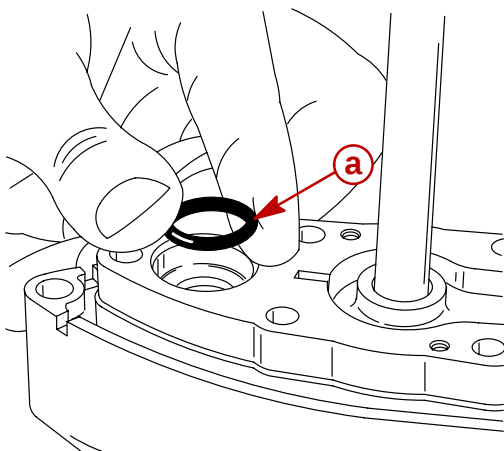
56415



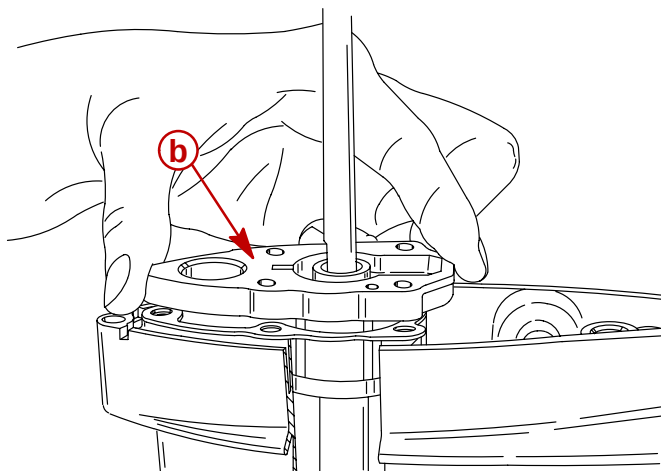
56416

- a** - Bolt
- b** - Washer
- c** - Retainer Plate
- d** - Shift Shaft Assembly
- e** - Bushing

5. Remove O-ring.
6. Remove water pump base.



56417

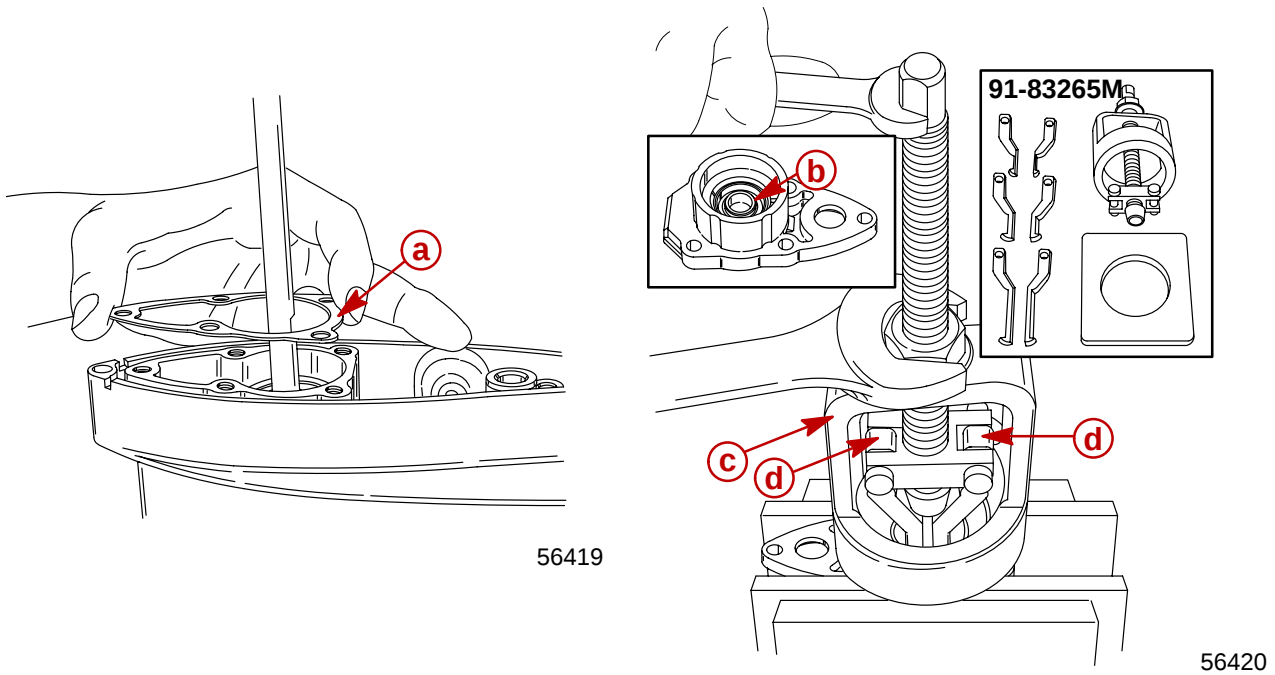


56418

- a** - O-ring
- b** - Water Pump Base

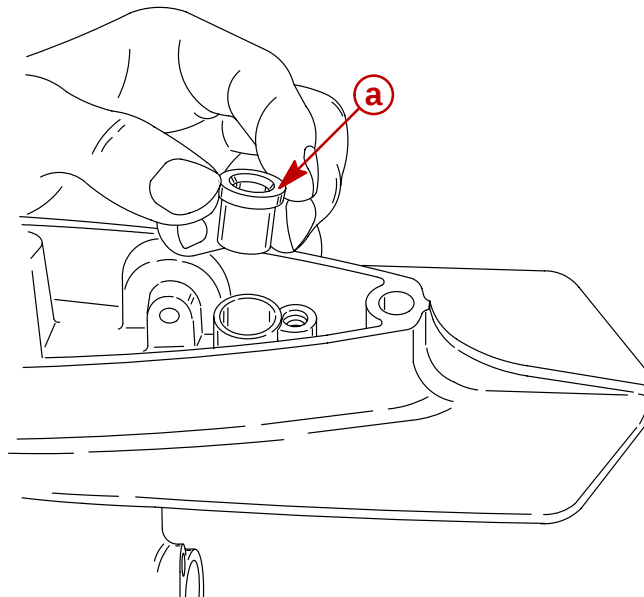


7. Remove gasket.
8. Support water pump in a vise and remove drive shaft oil seal using puller assembly with suitable jaws.



- a** - Gasket
- b** - Drive Shaft Oil Seal
- c** - Puller Assembly
- d** - Suitable Jaws

9. Remove water pickup tube seal.



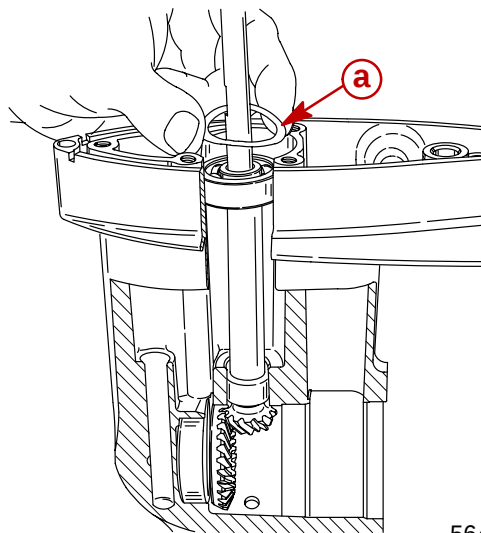
- a** - Water Pick-up Tube Seal



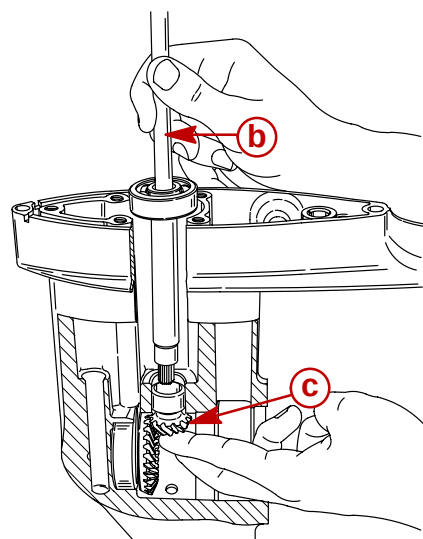
Drive Shaft

IMPORTANT: Retain shim(s) for reassembly.

1. Remove shim(s).
2. Remove drive shaft assembly and pinion gear.



56422



56423

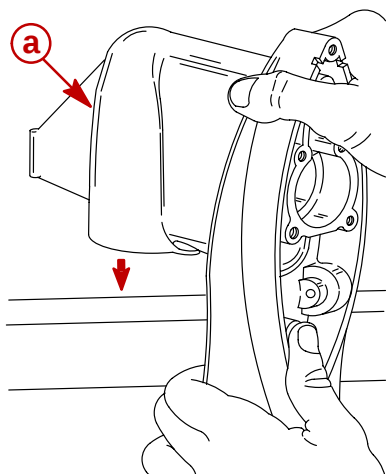
- a** - Shims
- b** - Drive Shaft Assembly
- c** - Pinion Gear

Forward Gear and Bearing

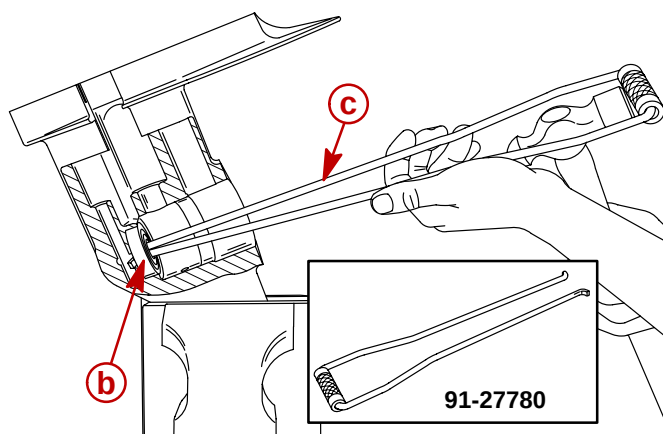
1. To remove forward gear, strike open end of gear housing on a block of wood as shown, dislodging gear from bearing. Make sure to retain shim(s) found behind gear for reassembly.

IMPORTANT: Forward gear bearing is damaged during removal. DO NOT remove bearing unless replacement is necessary. Refer to "Cleaning and Inspection" following.

2. Remove forward gear bearing using puller.



56425



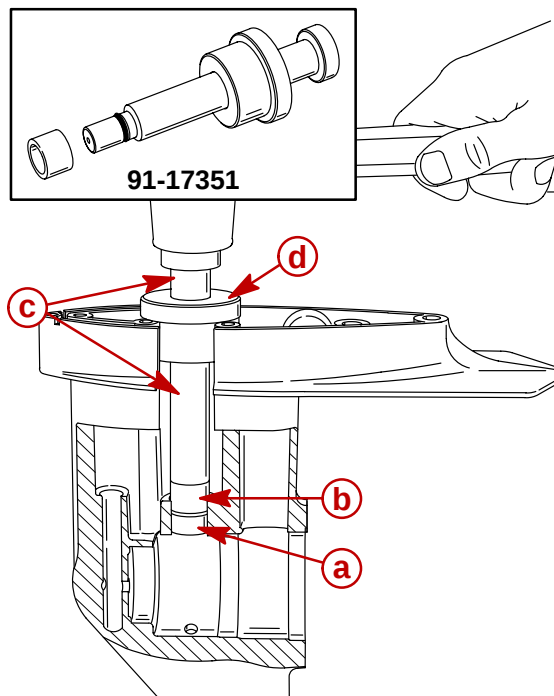
56426

- a** - Open End of Gear Housing
- b** - Forward Gear Bearing
- c** - Puller



Lower Drive Shaft Needle Bearing

1. Drive lower drive shaft needle bearing from gear housing, using bearing removal/installation tool.



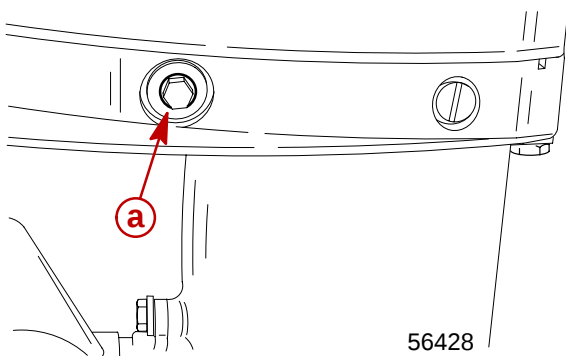
56427

- a** - Lower Drive Shaft Needle Bearing
- b** - Collar: Installed on End of Driver Rod
- c** - Driver Rod
- d** - Guide Bushing: Seated in Water Pump Base Cavity of Gear Housing

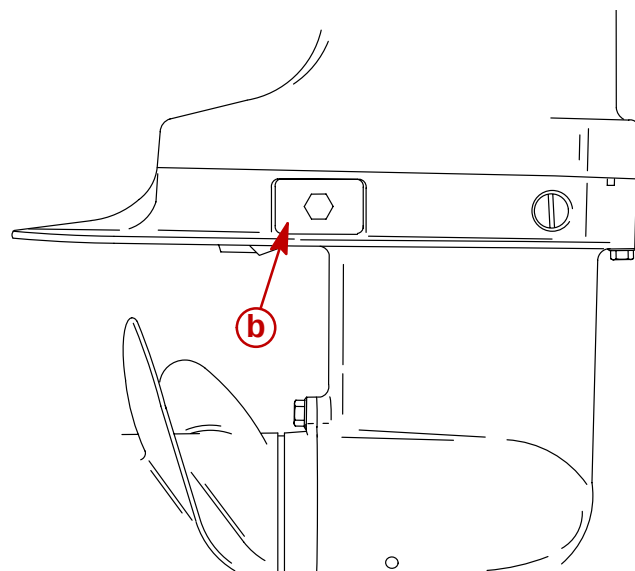
Zinc Anode

1. Remove and replace zinc anode if more than 50% consumed.

NOTE: 2000 model year outboards have rectangular style zinc anode.



56428



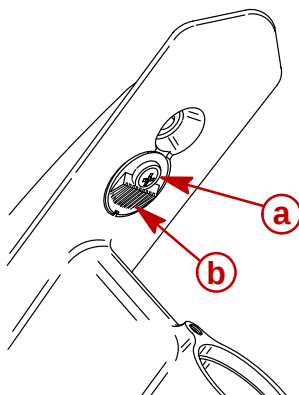
57757

- a** - Zinc Anode (1999)
- b** - Rectangular Style Zinc Anode (2000 and Later)



Water Pickup Screen

1. Remove screw and water pickup screen.



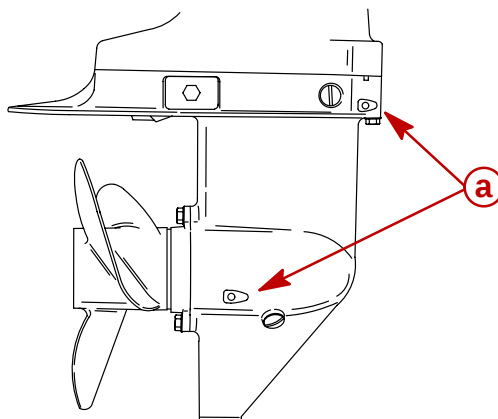
56429

- a** - Screw
b - Water Pick-up Screen

Cleaning and Inspection

Gear Housing/Bearing Carrier Castings

1. Thoroughly clean gear housing/bearing carrier castings. Be sure all old gasket material is removed from mating surfaces and that carbon deposits have been removed from exhaust passages.
2. Inspect castings for cracks or fractures.
3. Inspect upper and lower water drain holes to ensure they are not clogged.



- a** - Water Drain Holes

4. Check sealing surfaces for nicks, deep grooves and distortion which could cause leaks.
5. Check water passages for obstructions.

Bearings

BALL BEARINGS

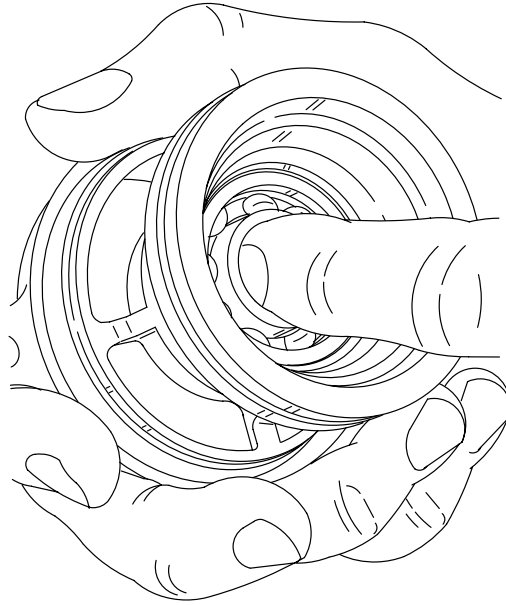
CAUTION

DO NOT spin-dry ball bearings with compressed air.

1. Clean bearing in solvent and dry with compressed air.
2. Bearing should be free of rust stains.
3. Attempt to work inner bearing race in-and-out. There should not be excessive play.



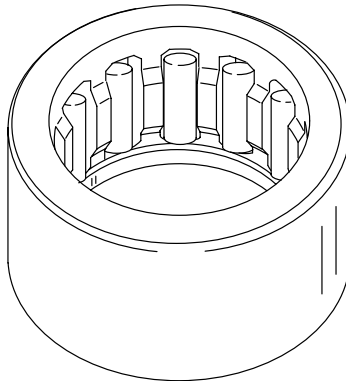
4. Lubricate ball bearing with Quicksilver Gear Lube. Rotate inner bearing race. Bearing should have smooth action. If ball bearing sounds or feels rough or has catches, remove and discard bearing. Refer to "Disassembly" preceding.



56430

NEEDLE BEARING

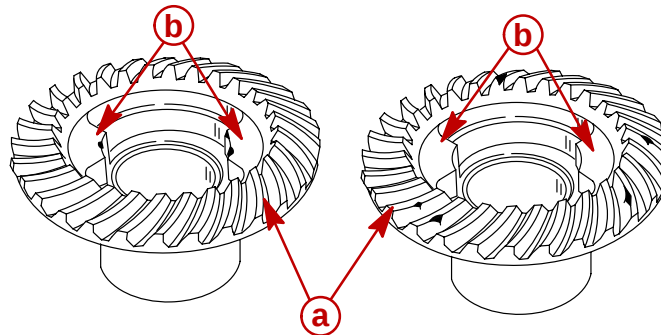
1. Clean needle bearings in solvent and dry with compressed air.
2. Replace bearing if needles are rusted, fractured, worn, galled badly, discolored, or if area of shaft that bearing contacts is worn or pitted. Refer to "Drive Shaft" following.



56431

Forward, Reverse and Pinion Gears

1. Replace gear if gear teeth or clutch teeth are chipped, worn or cracked.



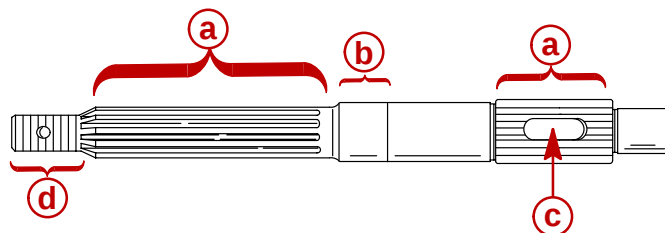
56432

a - Gear Teeth
b - Clutch Teeth



Propeller Shaft

1. Replace propeller shaft if any of the following conditions exist:
 - a. Splines are twisted or worn.
 - b. Oil seal surfaces are deeply grooved; allowing water to enter gear housing.
 - c. Sliding clutch slot worn.
 - d. Propeller nut threads stripped, damaged or excessively worn.

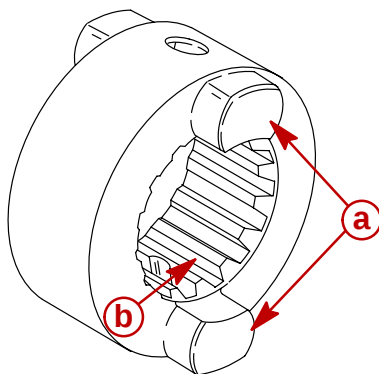


56433

2. Check propeller shaft for straightness. Place shaft on either balance wheels or “V” blocks and rotate shaft while observing spline area for bend (wobble). Replace shaft (if bent).

Sliding Clutch

1. Replace sliding clutch if jaws are rounded or chipped or splines are damaged or worn.

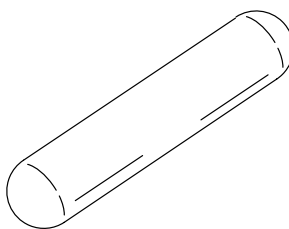


56434

a - Jaws
b - Splines

Cam Follower

1. Replace cam follower if end of follower shows signs of wear.



56435

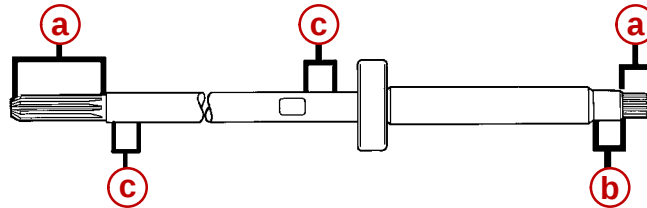
Water Pump Components

1. Replace water pump components if worn, grooved or if components show evidence of over heat or other damage.



Drive Shaft

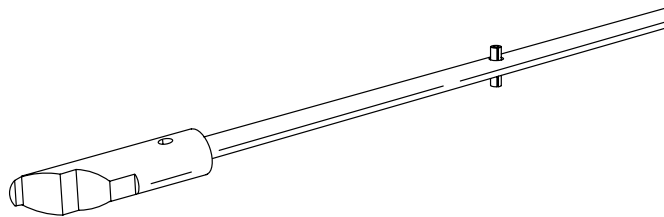
1. Replace drive shaft if any of the following conditions exist:
 - a. Splines are twisted or worn.
 - b. Lower drive shaft needle bearing race surfaces are pitted or worn. Replace corresponding bearing as well.
 - c. Oil seal surfaces are deeply grooved or pitted allowing grease to wash off crankshaft splines or water to enter gear housing.



- a** - Splines
b - Bearing Race Surface
c - Oil Seal Surface

Shift Shaft

Inspect shift shaft/cam for signs of wear, damaged roll pins or bent shaft.

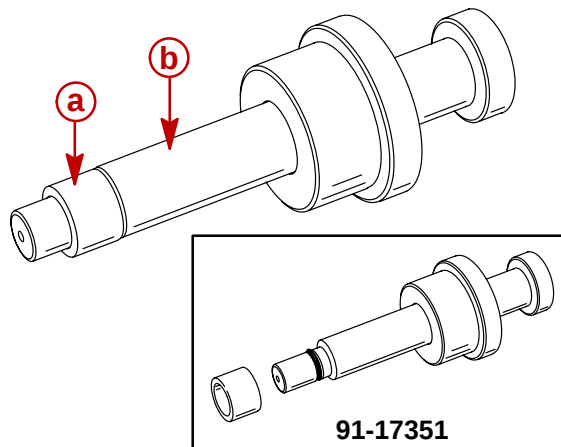


56436

Gear Housing Reassembly

Lower Drive Shaft Needle Bearing

1. Place drive shaft needle bearing onto end of driver rod of bearing removal/installation tool. (Numbered side of bearing toward tool.)

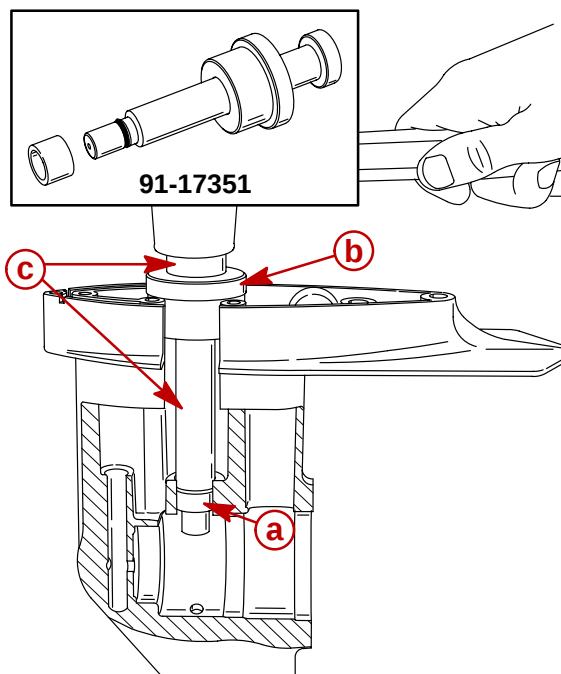


- a** - Drive Shaft Needle Bearing
b - End of Driver Rod

56437



2. Drive lower drive shaft needle bearing into gear housing, using bearing removal/installation tool.

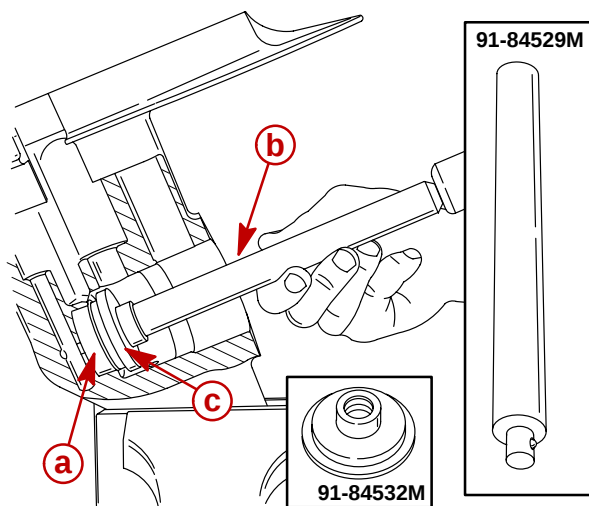


56438

- a** - Lower Drive Shaft Needle Bearing: Installed on End of Driver Rod
- b** - Guide Bushing: Seated in Water Pump Cavity of Gear Housing
- c** - Driver Rod: Tap in with Hammer Until Head of Driver Rod Seats Against Guide Bushing

Forward Gear Bearing

1. Install forward gear ball bearing (numbered side of bearing toward tool) using driver rod and mandrel.



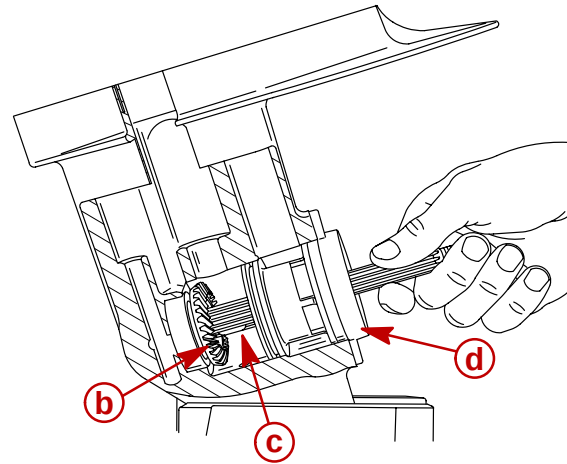
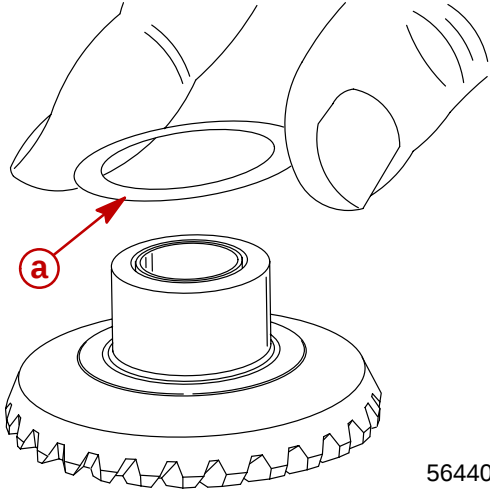
56439

- a** - Forward Gear Ball Bearing
- b** - Driver Rod
- c** - Mandrel



Forward Gear

1. Install shim(s) removed during disassembly on forward gear.
2. Install forward gear into bearing, using propeller shaft and bearing carrier as a guide.

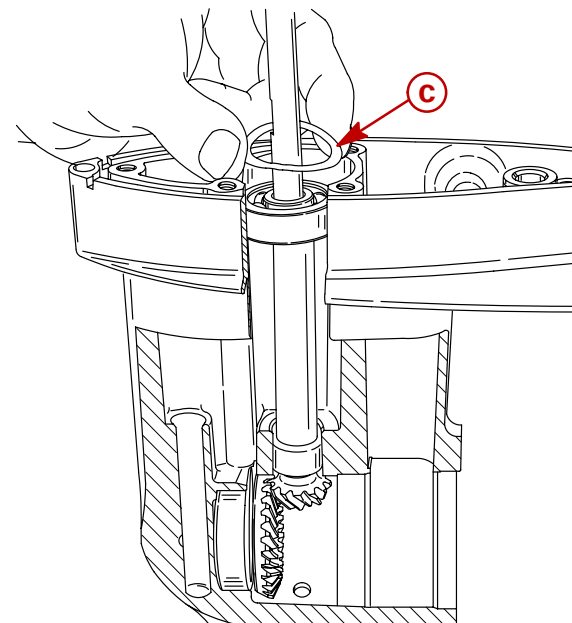
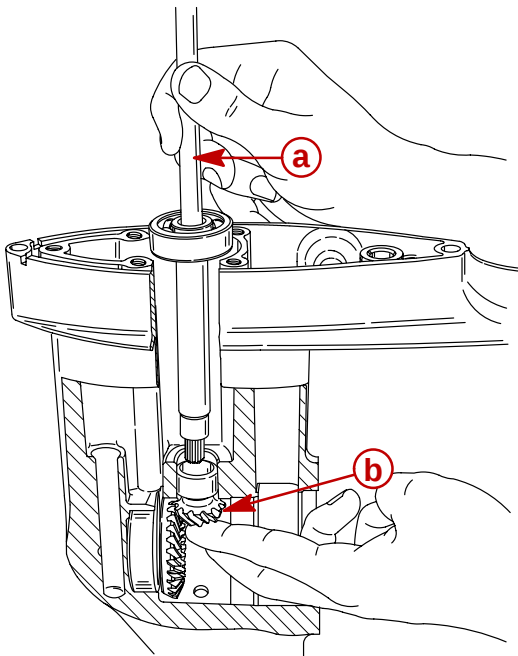


- a** - Shims
- b** - Forward Gear
- c** - Propeller Shaft
- d** - Bearing Carrier

Pinion Gear and Drive Shaft

NOTE: Rotate drive shaft when installing to align splines with pinion gear.

1. Install drive shaft into pinion gear as shown.



- a** - Drive Shaft
- b** - Pinion Gear
- c** - Shims

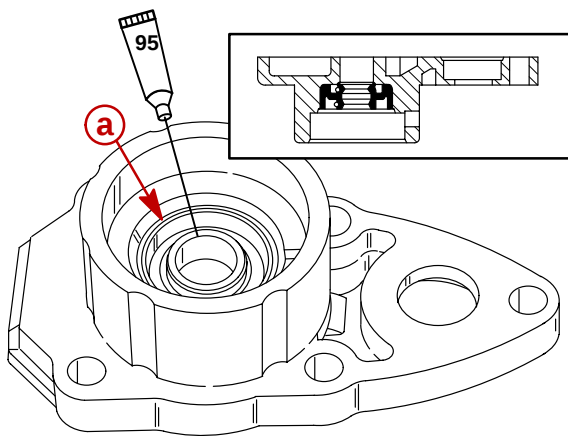
2. Reinstall shims removed during disassembly.



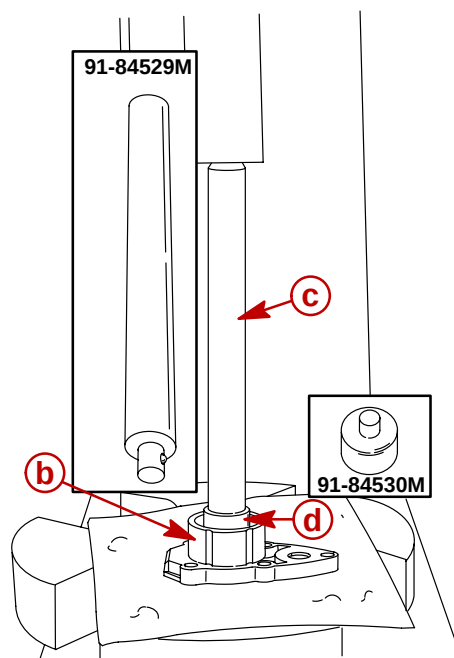
Water Pump Base and Shift Shaft

IMPORTANT: Seal should be installed flush with water pump base as shown.

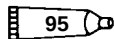
1. Push new oil seal into water pump base using rod and mandrel.
2. Lubricate seal lip with 2-4-C w/Teflon Marine Lubricant.



56443

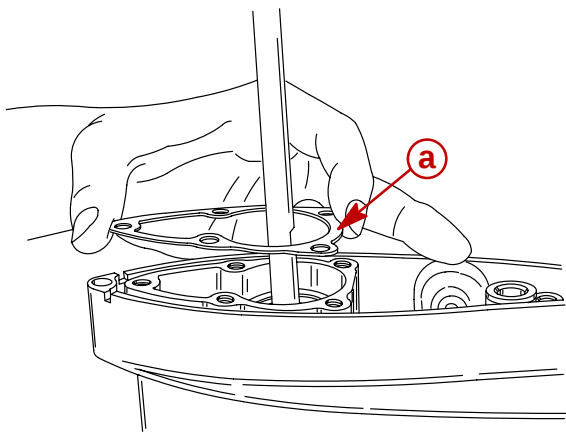


56442

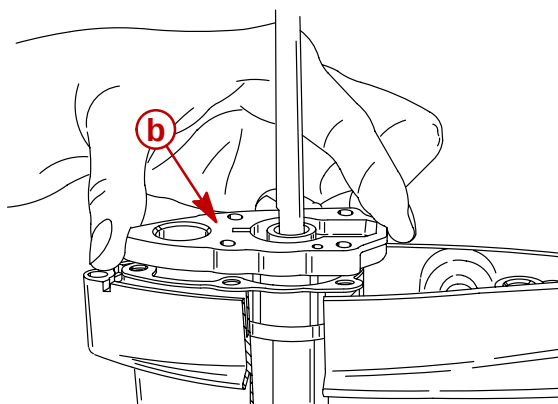
 95 2-4-C With Teflon (92-825407A12)

- a** - Oil Seal
- b** - Water Pump Base
- c** - Rod
- d** - Mandrel

3. Install new water pump base gasket.
4. Install water pump base.



56419



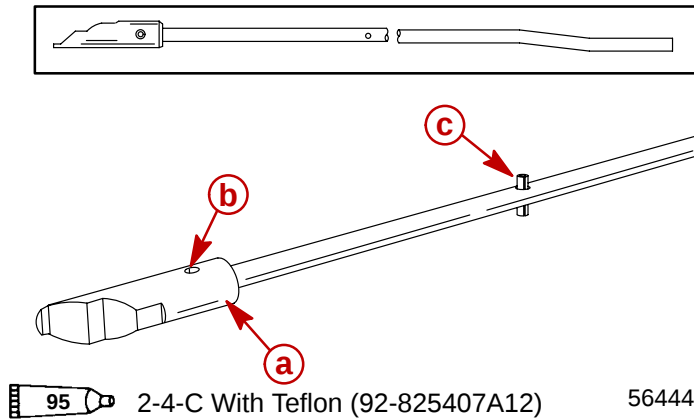
56418

- a** - Water Pump Base Gasket
- b** - Water Pump Base

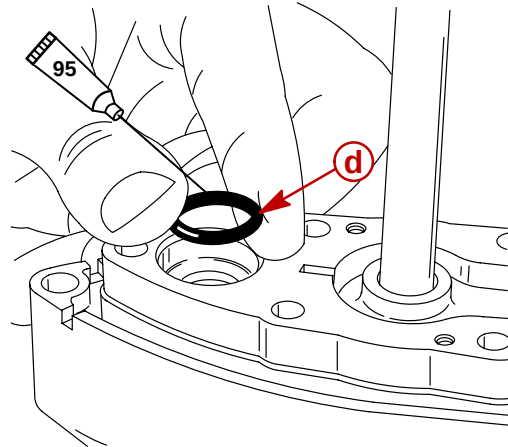


IMPORTANT: Make sure taper of cam is opposite to bend in shift shaft as shown.

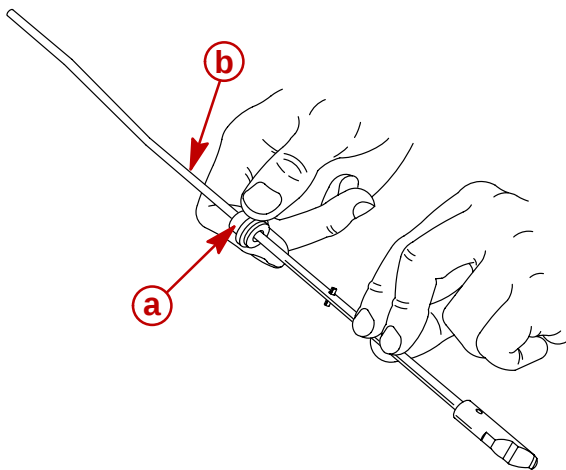
5. Secure cam to shift shaft with roll pin and install (center) pin in shaft.
6. Lubricate O-ring with 2-4-C w/Teflon Marine Lubricant and install into water pump base.



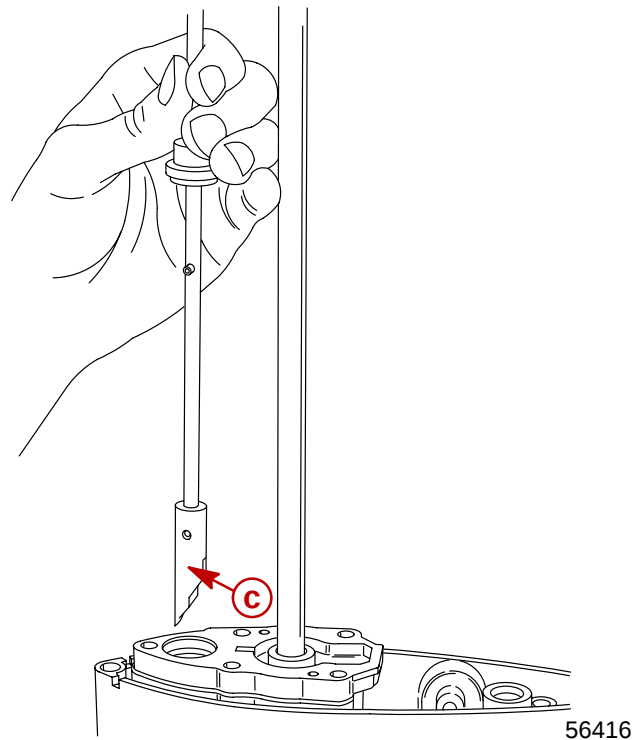
- a** - Cam
- b** - Roll Pin
- c** - Center Pin
- d** - O-ring



7. Slide bushing on shift shaft.
8. Position taper of cam toward drive shaft and insert shift shaft into gear housing.

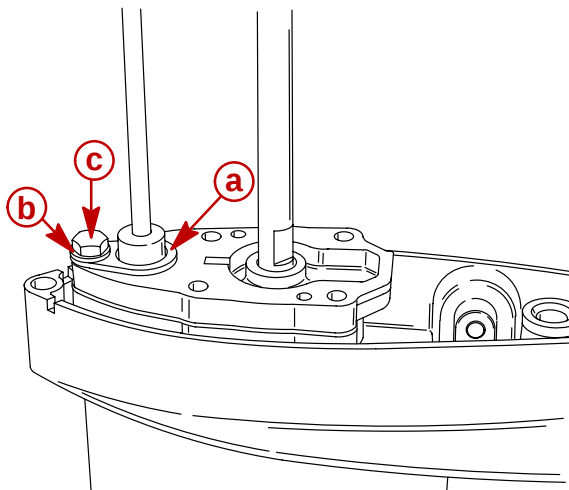


- a** - Bushing
- b** - Shift Shaft
- c** - Taper

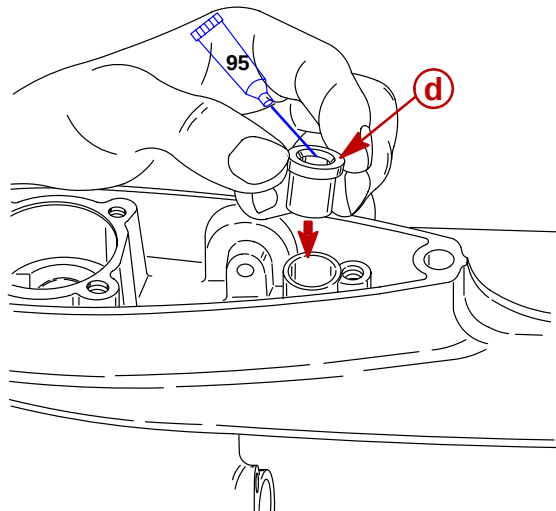




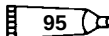
9. Install retainer plate, washer and bolt. Torque bolt to 70 lb-in. (8 Nm).
10. Install water pickup tube seal and apply 2-4-C w/Teflon Marine Lubricant to I.D. of seal.



56415



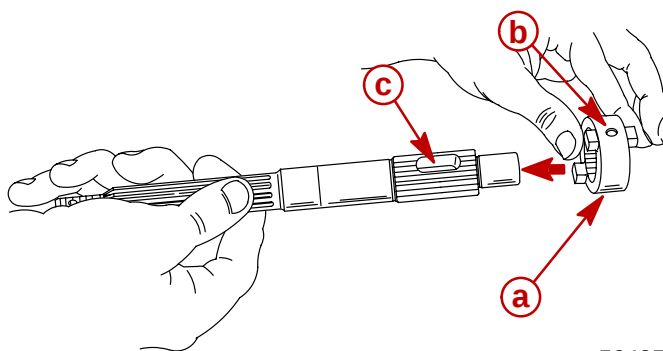
56446

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

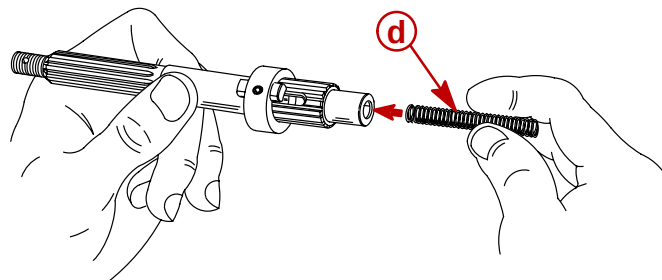
- a** - Retainer Plate
- b** - Washer
- c** - Bolt
- d** - Seal

Propeller Shaft

1. Install sliding clutch so that cross pin hole of clutch aligns with slot in propeller shaft.
2. Install spring.



56405

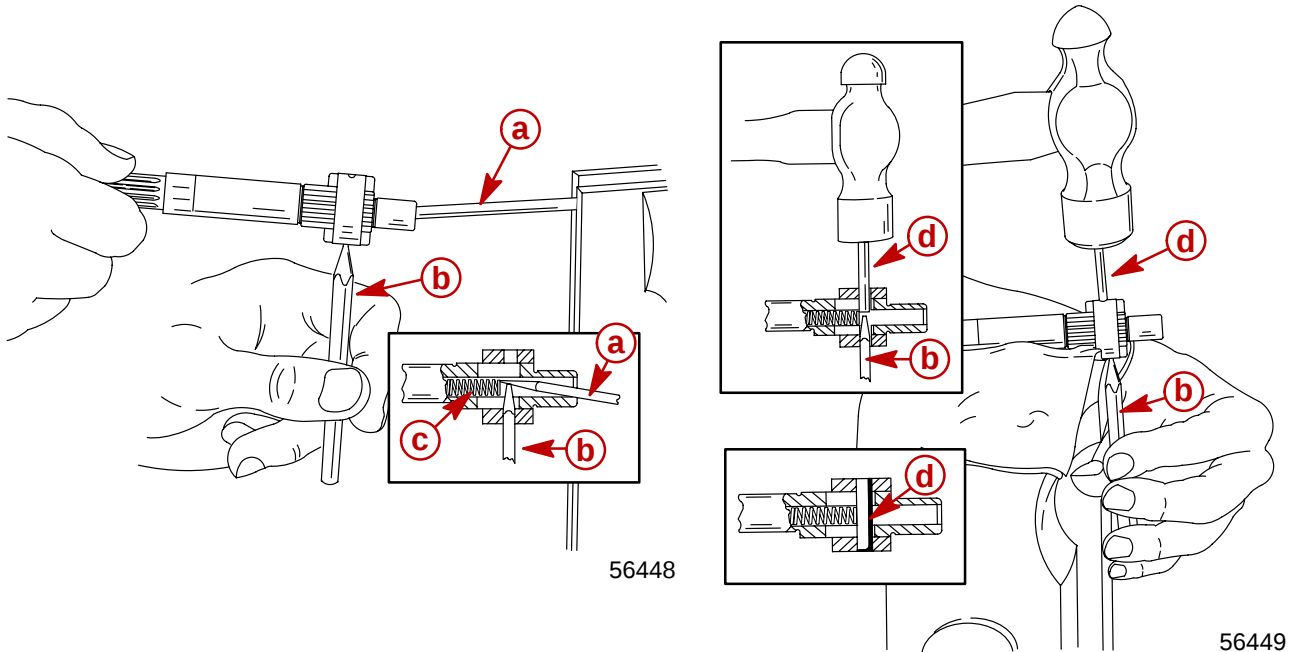


56404

- a** - Sliding Clutch
- b** - Cross Pin Hole
- c** - Slot
- d** - Spring

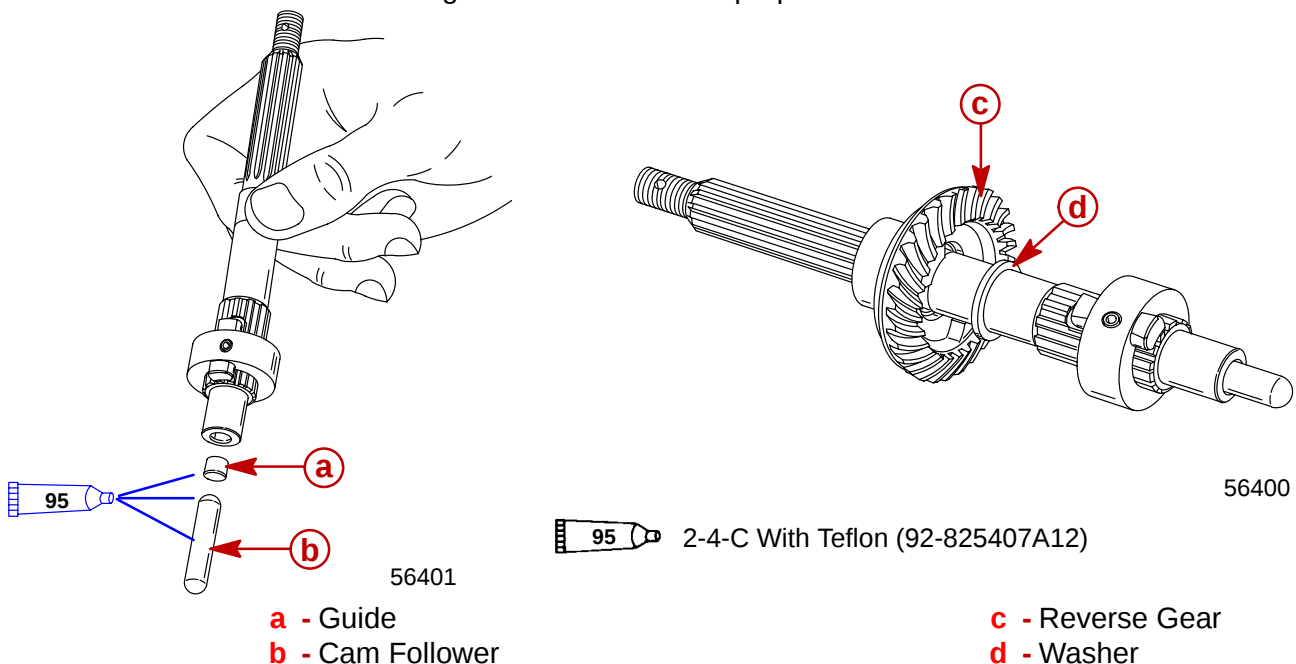


3. Mount a suitable screwdriver or drift punch in a vise. Tool must 1) fit into end of propeller shaft and 2) compress spring as shown.
4. Compress spring beyond cross pin hole and insert punch thru cross pin holes to retain spring as shown.
5. Install cross pin opposite to punch driving punch out of clutch as cross pin is installed. Cross pin should be centered into clutch, as shown.



- a** - Suitable Screwdriver Blade or Punch
- b** - Punch
- c** - Spring
- d** - Cross Pin

6. Apply a small amount of 2-4-C w/Teflon Marine Lubricant to hold guide and cam follower in place. Install guide and cam follower into end of propeller shaft.
7. Install reverse gear and washer onto propeller shaft as shown.



- a** - Guide
- b** - Cam Follower

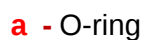
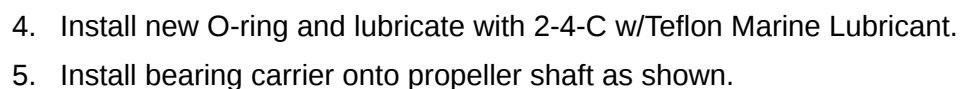
- c** - Reverse Gear
- d** - Washer



1. Install propeller shaft oil seal into bearing carrier using driver rod and mandrel.
2. Lubricate lip of oil seal using 2-4-C w/Teflon Marine Lubricant.

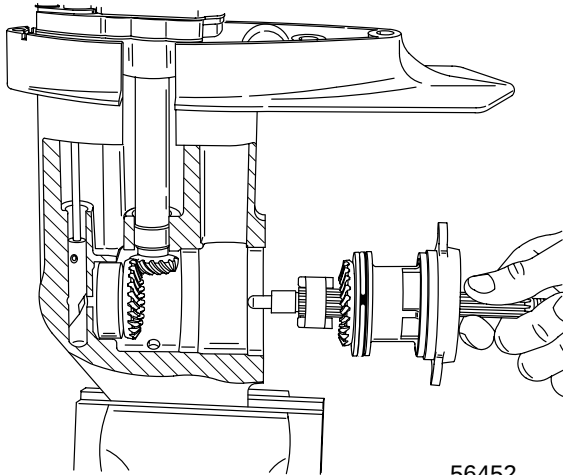
Press only on bearing outer race when installing.

3. Press propeller shaft bearing (from numbered side) into carrier using mandrel.

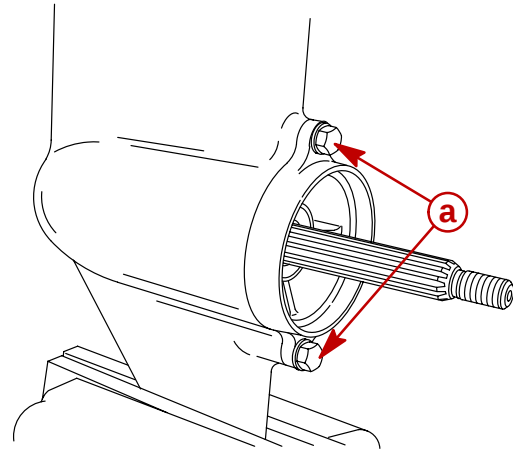




6. Install bearing carrier and propeller shaft assembly into gear housing.
7. Secure carrier assembly with 2 bolts and washers. Torque bolts to 70 lb-in. (8 Nm).



56452

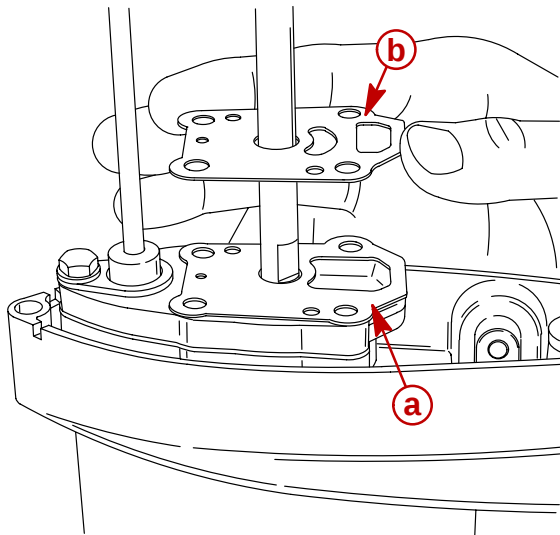


56394

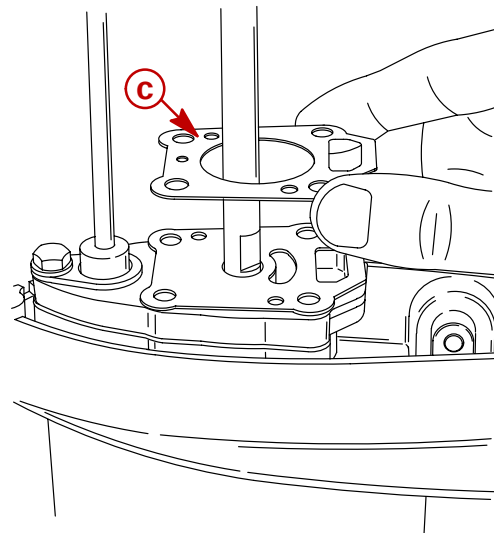
a - Bolts (2)

Impeller and Water Pump Housing

1. Install gasket and plate.
2. Install gasket.



56414

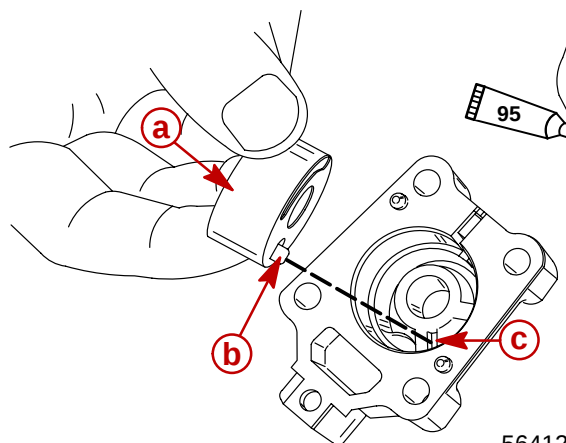


56413

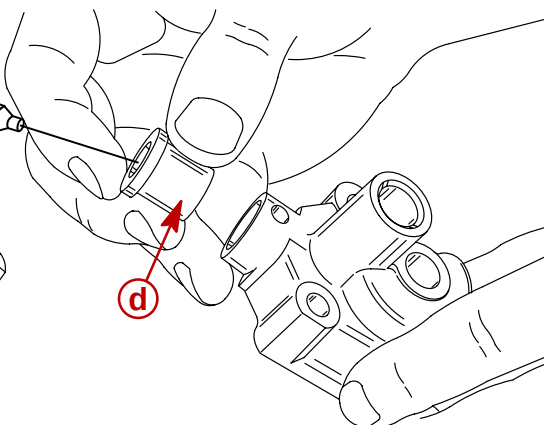
a - Gasket
b - Plate
c - Gasket



3. Install water pump insert into water pump housing making sure to position locating tab of insert into slot of housing.
4. Install water pick-up tube seal. Lubricate I.D. of seal with 2-4-C w/Teflon Marine Lubricant.



56412

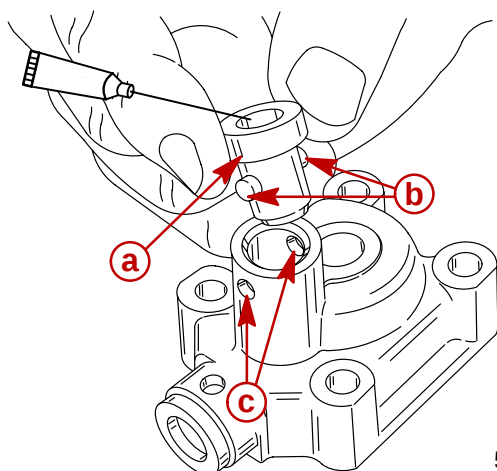


56410

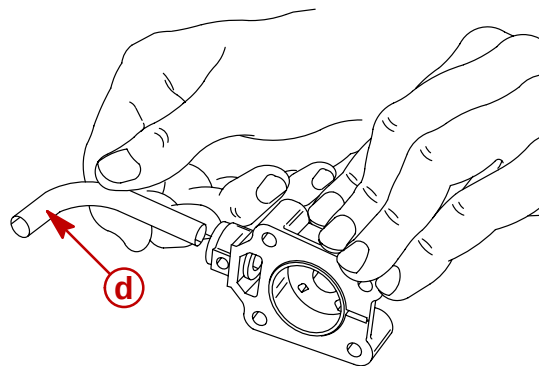
 95 2-4-C With Teflon (92-825407A12)

- a** - Water Pump Insert
- b** - Locating Tab
- c** - Slot
- d** - Pick-up Tube Seal

5. Install water tube seal into base so rubber tabs insert into holes. Lubricate I.D. of seal with 2-4-C Marine Lubricant.
6. Install water pickup tube into seal as shown.



56409



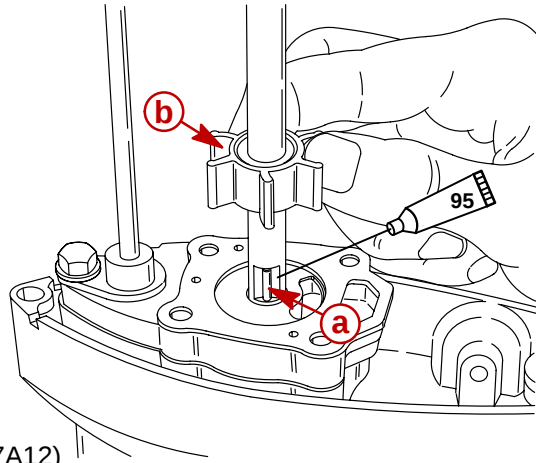
56453

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

- a** - Water Tube Seal
- b** - Rubber Tabs
- c** - Holes
- d** - Water Pick-up Tube



7. Lubricate drive pin with 2-4-C w/Teflon Marine Lubricant and place into flat of shaft as shown. Install water pump impeller over drive pin.

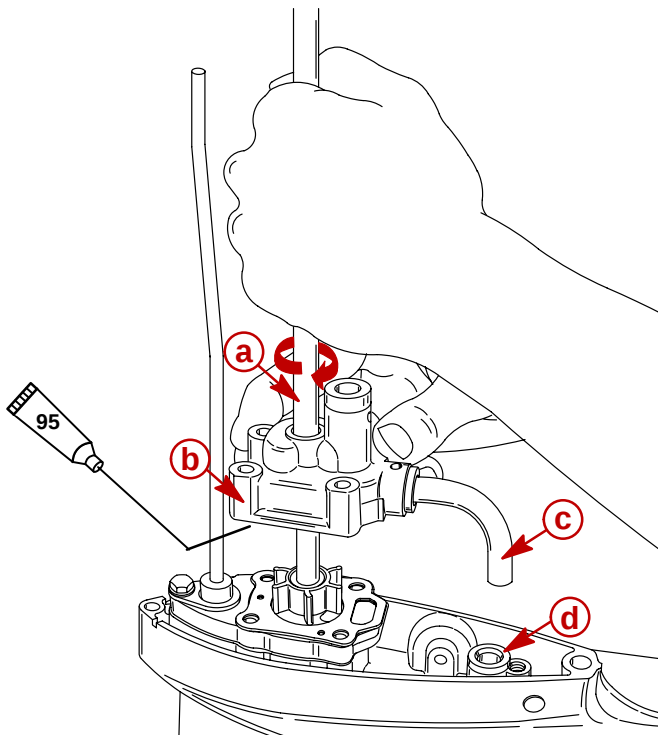


2-4-C With Teflon (92-825407A12)

56454

- a** - Drive Pin
- b** - Water Pump Impeller

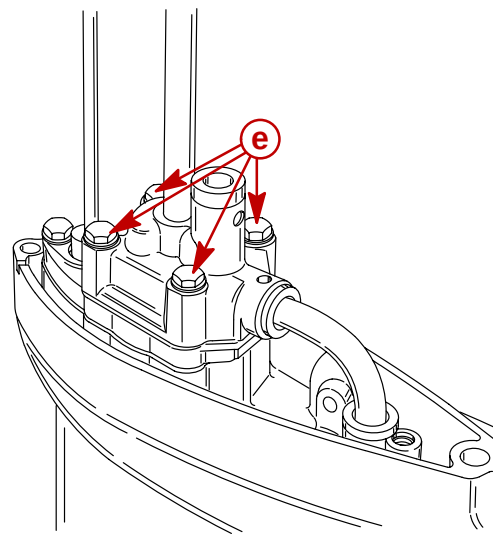
8. Apply a light coat of 2-4-C w/Teflon Marine Lubricant to the inside of the water pump impeller insert.
9. While rotating drive shaft clockwise, push down on water pump housing to cover impeller guiding water pickup tube into seal.
10. Secure water pump housing to gear housing with four bolts and washers. Torque bolts to 70 lb-in. (8 Nm).



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

56455

- a** - Rotate Drive Shaft Clockwise
- b** - Water Pump Housing
- c** - Water Pickup Tube



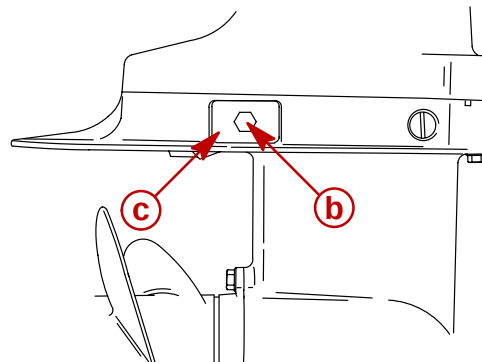
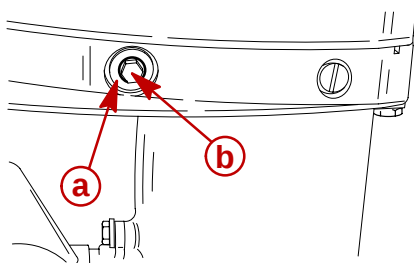
56406

- d** - Seal
- e** - Bolts/Washers (4)



Zinc Anode

1. Secure zinc anode with bolt. Torque bolt to 70 lb-in. (8 Nm).

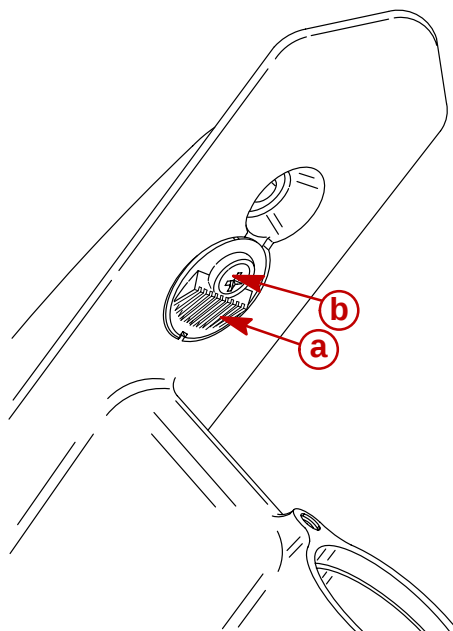


56428

- a** - Zinc Anode (1999)
- b** - Bolt
- c** - Zinc Anode (2000 and Later)

Water Pickup Screen

1. Secure pick-up screen using screw.



56429

- a** - Pick-up Screen
- b** - Screw

Gear Housing Installation

⚠ WARNING

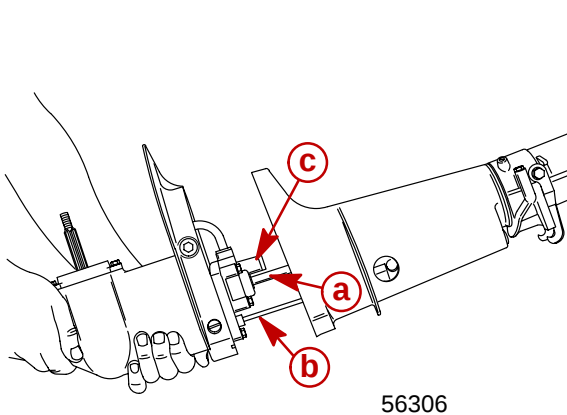
To prevent accidental engine starting remove (and isolate) spark plug lead from spark plug before installing gear housing.

1. Remove and isolate spark lead from spark plug.
2. Tilt and lock outboard to full "UP" position.

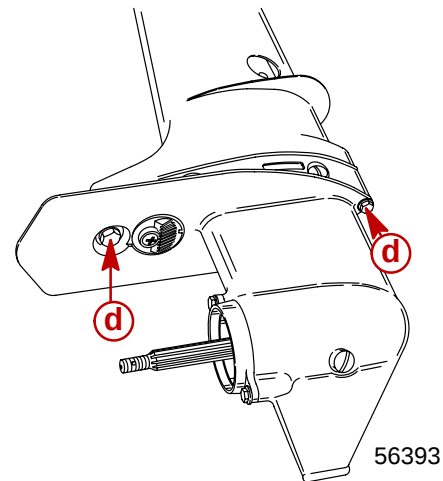


IMPORTANT: Both gear housing and outboard shift lever must be shifted into reverse when installing gear housing to enable the shift shaft to align with clamp.

3. Shift outboard shift lever to "Reverse."
4. While rotating propeller shaft, push down on shift shaft to place gear housing into "Reverse" gear. Propeller shaft will not rotate more than a few degrees in either direction when in reverse.
5. Lubricate splines of drive shaft with 2-4-C w/Teflon Marine Lubricant.
6. Guide gear housing into driveshaft housing while aligning the following.
 - a. Driveshaft and splines into upper drive shaft seal guide tube and into crankshaft splines. It may be necessary to rotate flywheel to align splines.
 - b. Shift shaft with hole in clamp located on end of upper shift shaft and out thru grommet in driveshaft housing which operates reverse lock hook.
 - c. Seal of water pump housing with water tube.
7. Secure gear housing to driveshaft housing using 2 bolts and flat washers. Torque bolts to 70 lb-in. (8 Nm).



56306

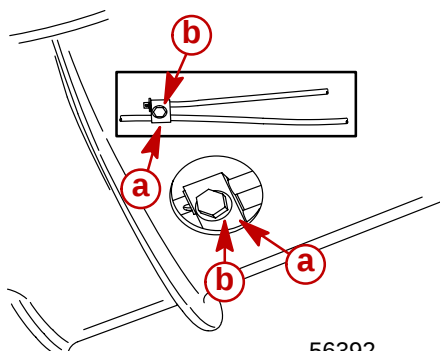


56393

a - Drive Shaft
b - Shift Shaft

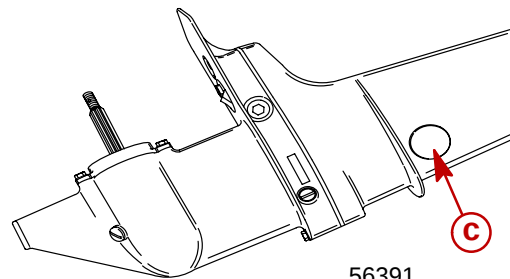
c - Water Tube
d - Bolts (2)

8. Secure upper shift shaft and lower shift shaft together using clamp. Tighten bolt securely.
9. Check shift operation for gearcase neutral and shift handle neutral to be in sync. Readjust shift handle clamp if necessary.
10. Install plug.



56392

a - Clamp
b - Bolt



56391

c - Plug



Propeller Installation

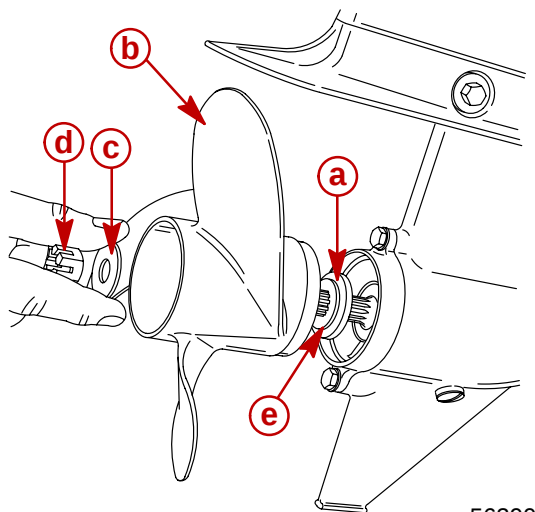
⚠ CAUTION

To prevent accidental engine starting remove (and isolate) spark plug lead from spark plug. Put a block of wood between anti-ventilation plate and propeller blade.

1. Coat propeller shaft with one of the following Quicksilver products:
 - a. Anti-Corrosion Grease
 - b. 2-4-C w/Teflon Marine Lubricant
2. Install thrust hub, propeller, washer and nut onto propeller shaft, starting propeller nut by hand.

NOTE: Thrust plate on thrust hub is available as a separate part. Replace if worn.

3. Put a block of wood between anti-ventilation plate and propeller. Torque nut to 150 lb-in. (17 Nm).



56390

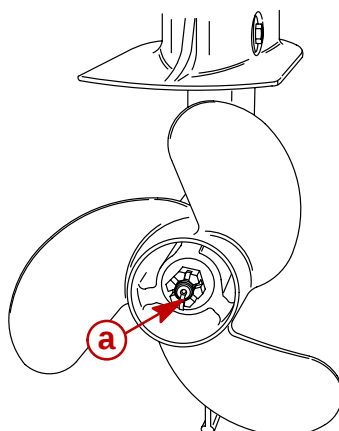
- a - Thrust Hub
- b - Propeller
- c - Washer
- d - Nut



56389

- e - Thrust Plate
- f - Block of Wood
- g - Anti-Ventilation Plate

4. Secure nut with cotter pin.



56388

- a - Cotter Pin



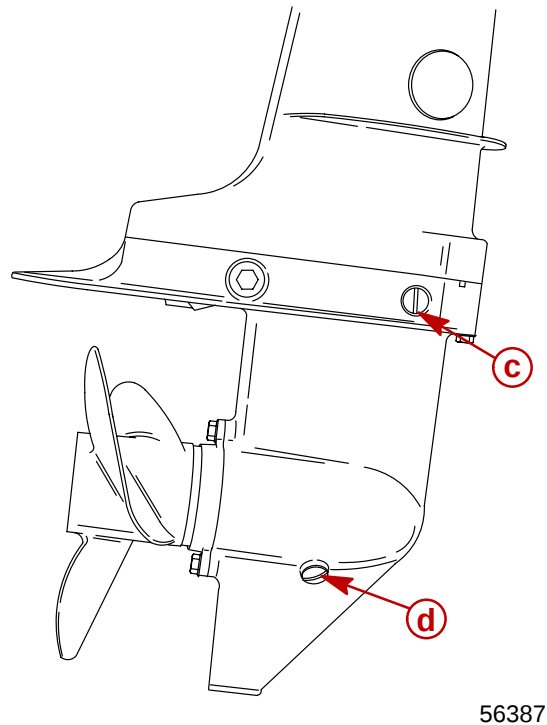
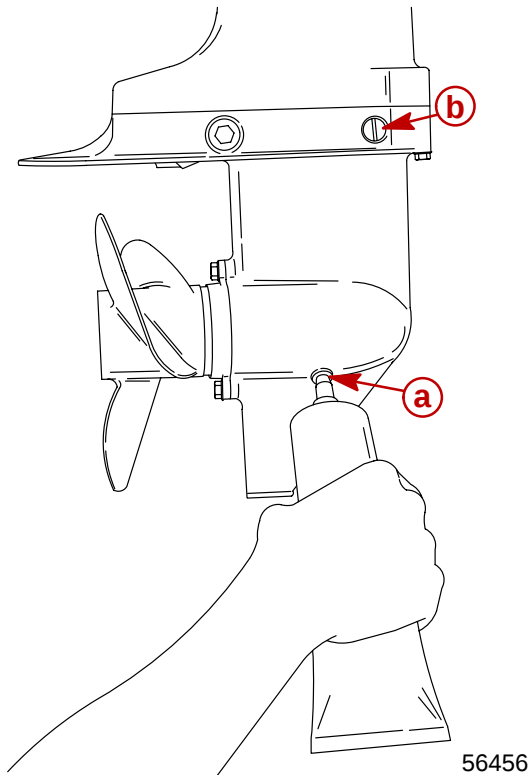
Filling Gear Housing with Lubricant

IMPORTANT: DO NOT use automotive lubricant in gear housing. Use only Quicksilver Gear Lube.

1. Remove any old gasket material from “OIL” and “OIL LEVEL” plugs and from around plug openings of gear housing.
2. Install new gaskets on “OIL” and “OIL LEVEL” plugs.

IMPORTANT: Never add lubricant to gear housing without first removing “OIL LEVEL” (vent) plug, as trapped air will prevent housing from being filled. Fill gear housing only when outboard is in operating position.

3. With outboard in operating position, insert lubricant tube into “OIL” (fill) hole.
4. Fill gear housing with lubricant, until excess starts to flow from “OIL LEVEL” (vent) hole (approximately 6.5 fl oz. [195 mL] of Quicksilver Gear Lube).
5. Install “OIL LEVEL” (vent) plug.
6. Remove lubricant tube and install “OIL” (fill) plug.



- a** - Fill Hole
- b** - Vent Hole
- c** - Vent Plug
- d** - Fill Plug



CONTROLS

Section 7A - Shift Linkage

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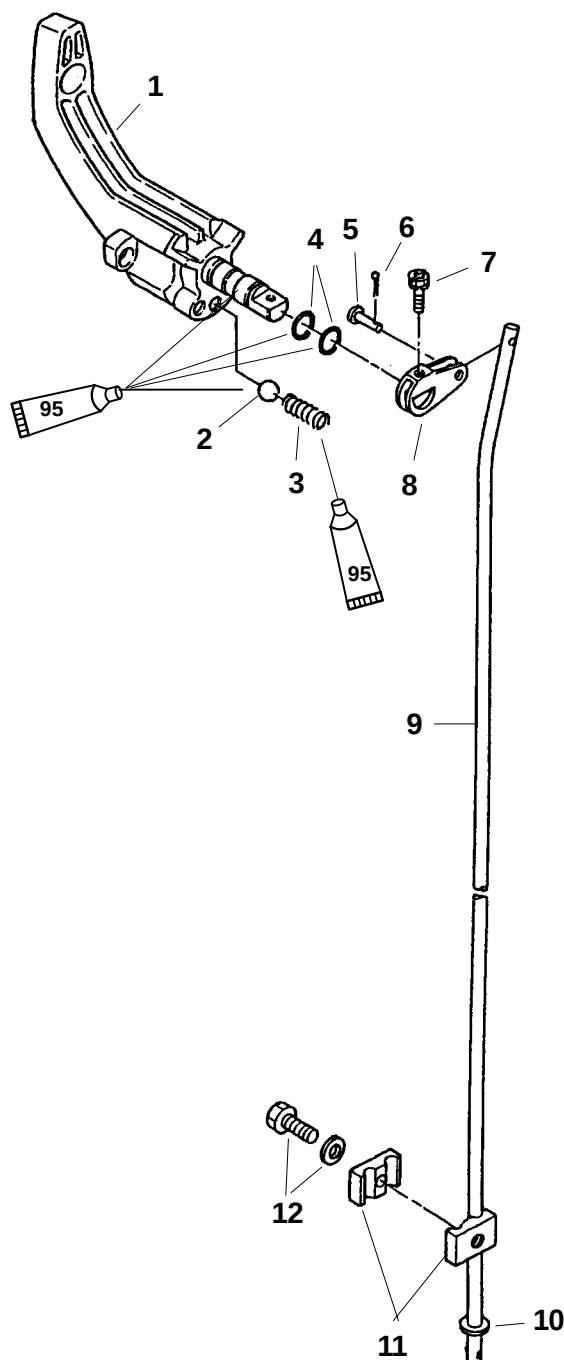
Shift Components	7A-2
Removal/Disassembly	7A-4
Reassembly/Installation	7A-5

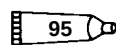
Quicksilver Lubricants and Service Aids

Part No.	Description
92-825407A12	2-4-C with Teflon Marine Lubricant



Shift Components



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



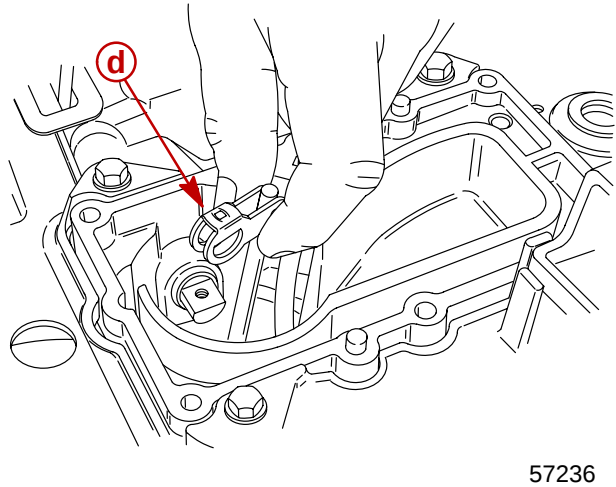
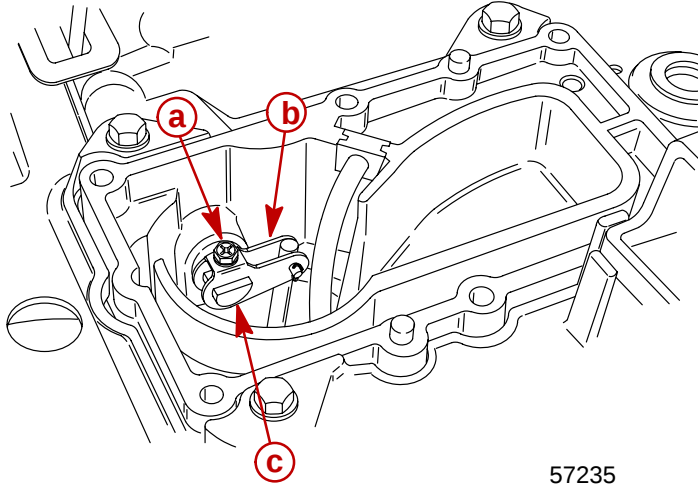
Shift Components

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	SHIFT LEVER			
2	1	BALL			
3	1	SPRING			
4	2	O RING			
5	1	PIN			
6	1	COTTER PIN			
7	1	BOLT	Drive Tight		
8	1	SHIFT ROD LEVER			
9	1	SHIFT ROD (SHORT)			
	1	SHIFT ROD (LONG)			
10	1	WASHER			
11	1	JOINT (SET)			
12	1	SCREW	Drive Tight		



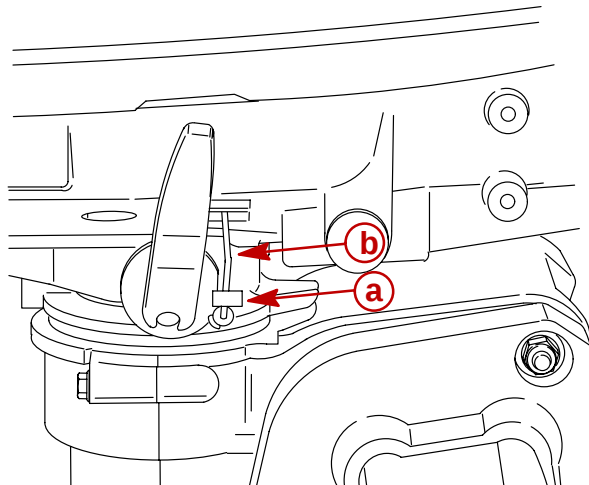
Removal/Disassembly

1. Remove powerhead referring to Section 4A "Powerhead" Also remove gear housing referring to Section 6, "Gear Housing."
2. Remove screw and slide lever off shaft of shift lever.
3. Remove upper shift shaft and lever assembly.



- a** - Screw
- b** - Slide Lever
- c** - Shift Lever Shaft
- d** - Shift Shaft Lever Assembly

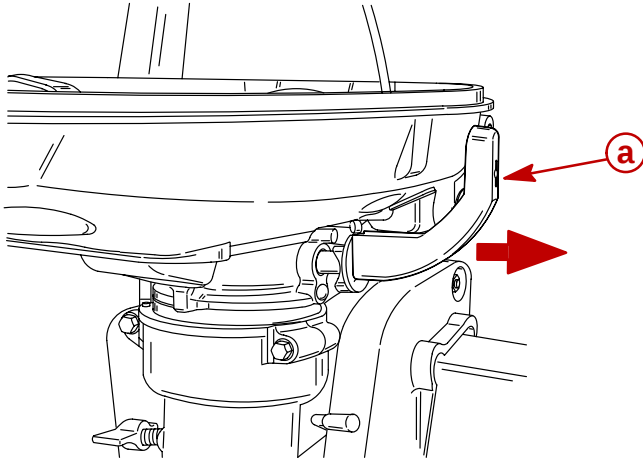
4. Disconnect starter lock rod snap and remove rod.



- a** - Starter Lock Rod Snap
- b** - Rod

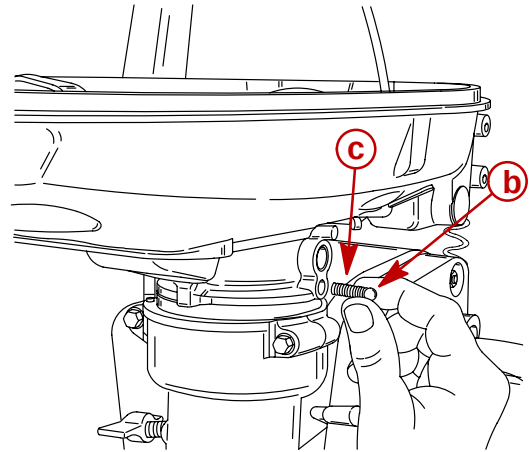


5. Remove shift lever.
6. Remove detent ball and spring.



57238

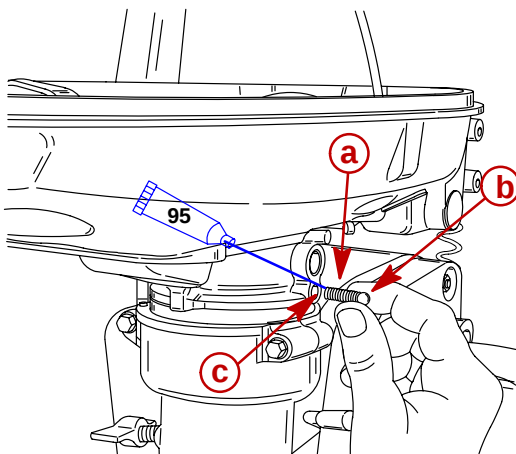
- a** - Shift Lever
- b** - Detent Ball
- c** - Spring



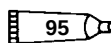
57239

Reassembly/Installation

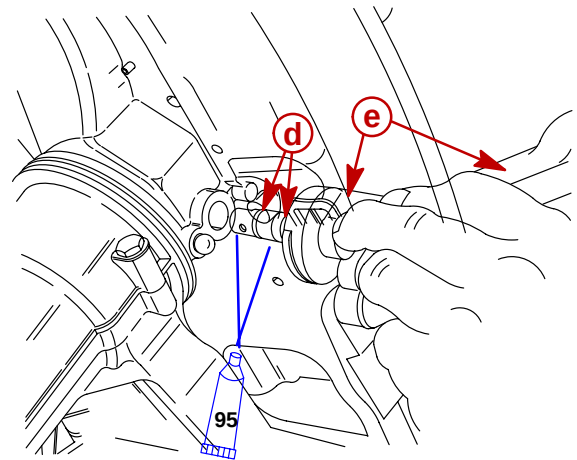
1. Lubricate detent spring and ball with 2-4-C with Teflon Marine Lubricant and install ball and spring in cavity as shown.
2. Install two O-rings on shaft of shift lever. Coat shaft and O-rings with 2-4-C with Teflon Marine Lubricant and install shift lever.



57239

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

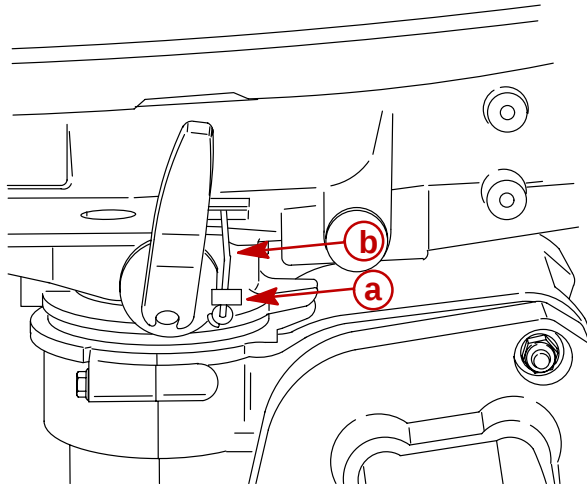
- a** - Detent Spring
- b** - Ball
- c** - Cavity
- d** - O-rings (2)
- e** - Shift Lever Shaft



56539



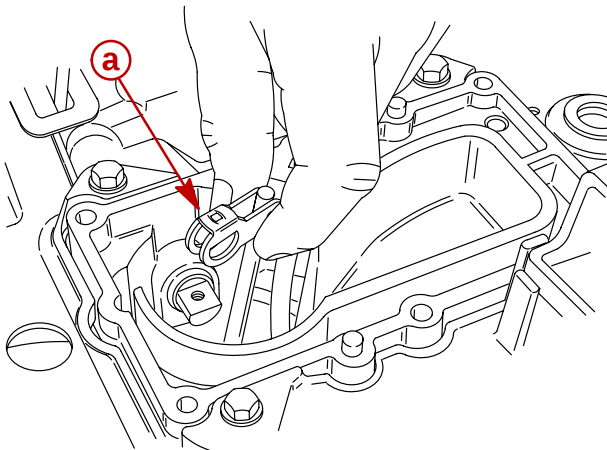
3. Install starter lock rod and secure with snap.



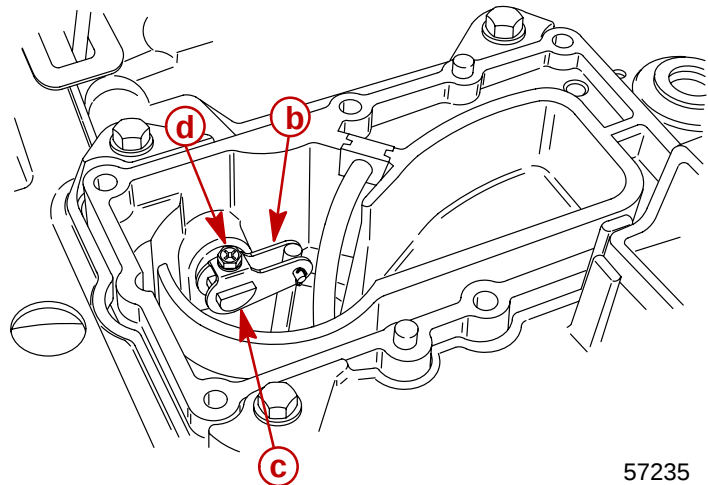
56990

- a** - Starter Lock Rod
- b** - Snap

4. Install upper shift shaft assembly into drive shaft housing.
5. Secure lever on shaft of shift lever with screw as shown. Tighten screw securely.



57236



57235

- a** - Shift Shaft Assembly
- b** - Lever
- c** - Shaft
- d** - Screw

6. Reinstall powerhead. Refer to Section 4B "Powerhead."
7. Reinstall gear housing. Refer to Section 6 "Gear Housing."



CONTROLS

Section 7B - Tiller Handle

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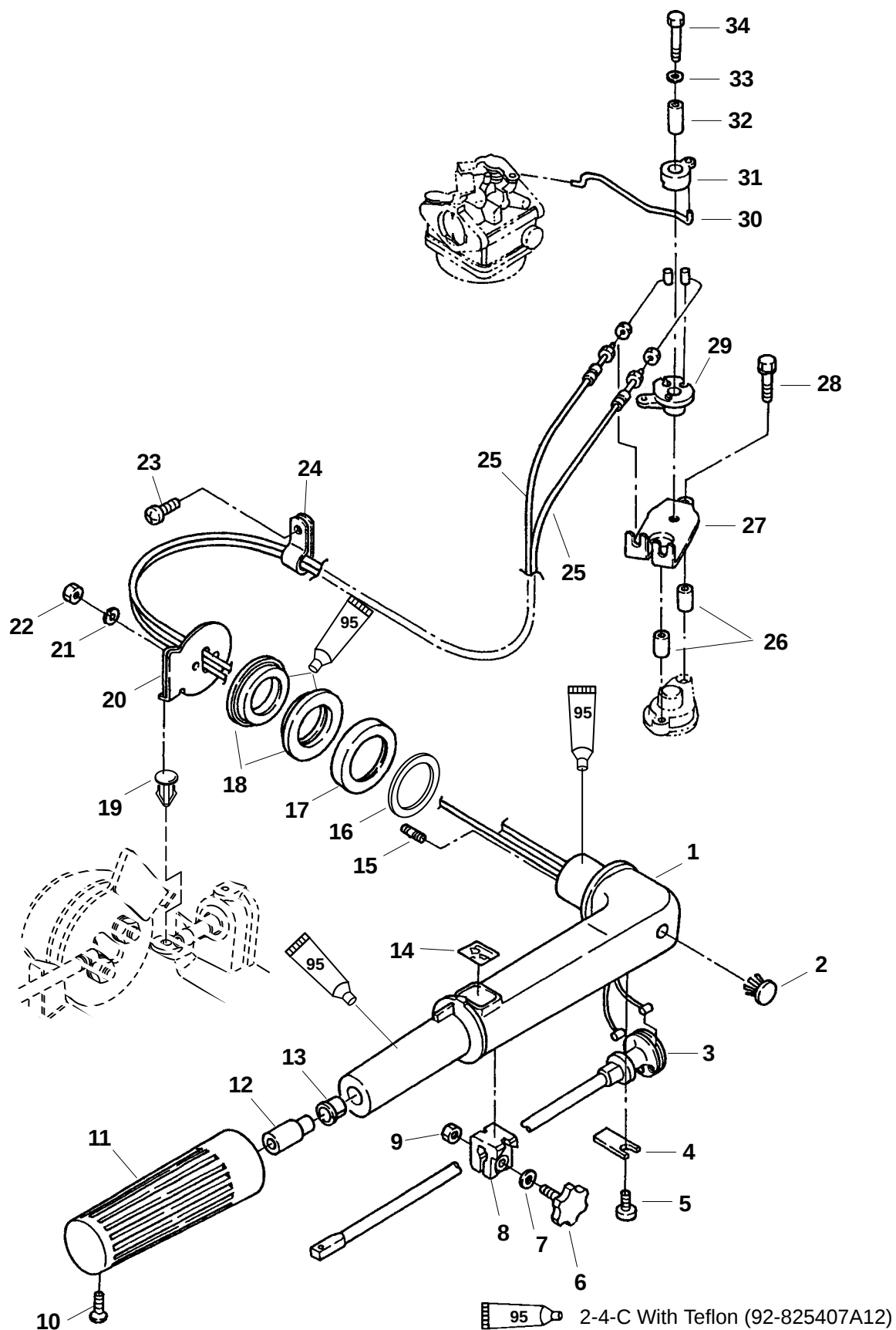
Steering Handle	7B-2	Disassembly	7B-5
Steering Handle	7B-3	Reassembly	7B-7
Removal	7B-4	Installation	7B-9

Quicksilver Lubricants and Service Aids

Part No.	Description
92-825407A12	2-4-C with Teflon Marine Lubricant



Steering Handle





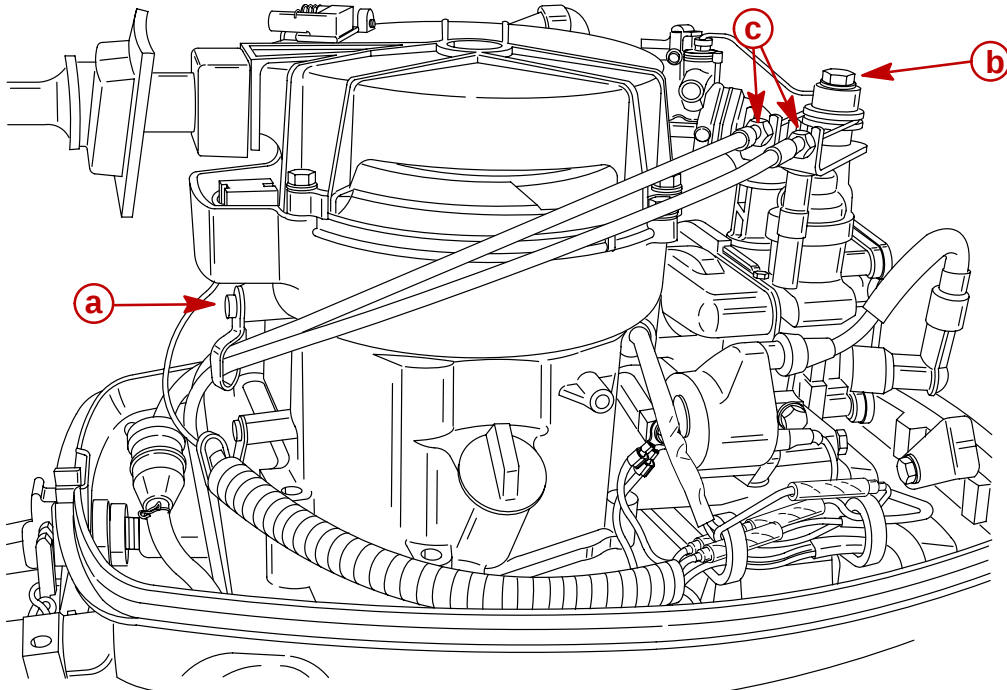
Steering Handle

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
—	1	STEERING HANDLE KIT			
1	1	STEERING HANDLE			
2	1	RIVET			
3	1	THROTTLE SHAFT			
4	1	BRACKET			
5	1	SCREW	DRIVE TIGHT		
6	1	ADJUSTING SCREW			
7	1	WASHER			
8	1	FRICTION PIECE			
9	1	NUT			
10	1	SCREW	DRIVE TIGHT		
11	1	GRIP			
12	1	SHAFT-RUBBER			
13	1	BUSHING			
14	1	DECAL			
15	2	STUD	TIGHT		
16	1	WASHER			
17	1	SPACER			
18	2	BUSHING			
19	1	BUMPER			
20	1	STOPPER			
21	2	LOCKWASHER			
22	2	NUT	70		8
23	1	SCREW	DRIVE TIGHT		
24	1	CLAMP			
25	2	THROTTLE WIRE			
26	2	COLLAR			
27	1	BRACKET			
28	2	BOLT	70		8
29	1	THROTTLE DRUM			
30	1	THROTTLE ROD			
31	1	THROTTLE OPENER			
32	1	COLLAR			
33	1	WASHER			
34	1	BOLT	70		8



Removal

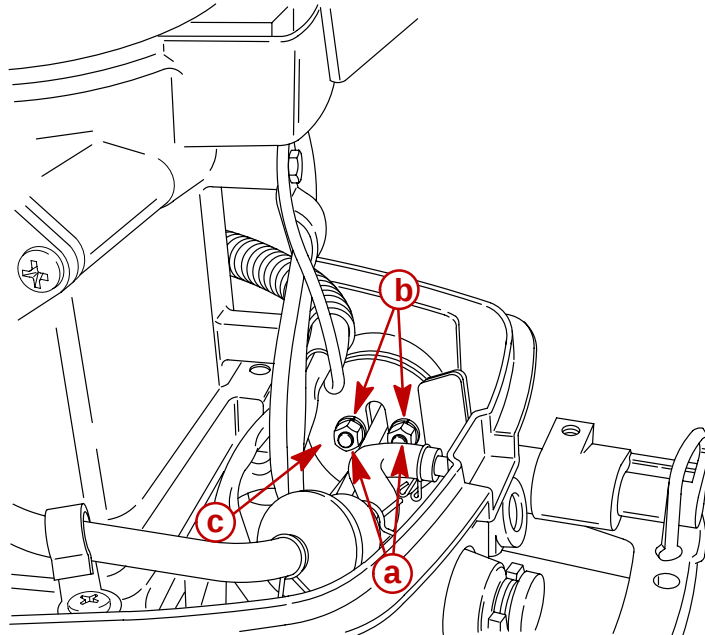
1. Remove J-Clip Screw.
2. Remove throttle drum retaining bolt.
3. Loosen throttle cable adjustment nuts and remove cables from drum.



57230

- a** - J-Clip Screw
- b** - Bolt
- c** - Nuts (2)

4. Remove 2 nuts and lockwashers securing retaining plate.

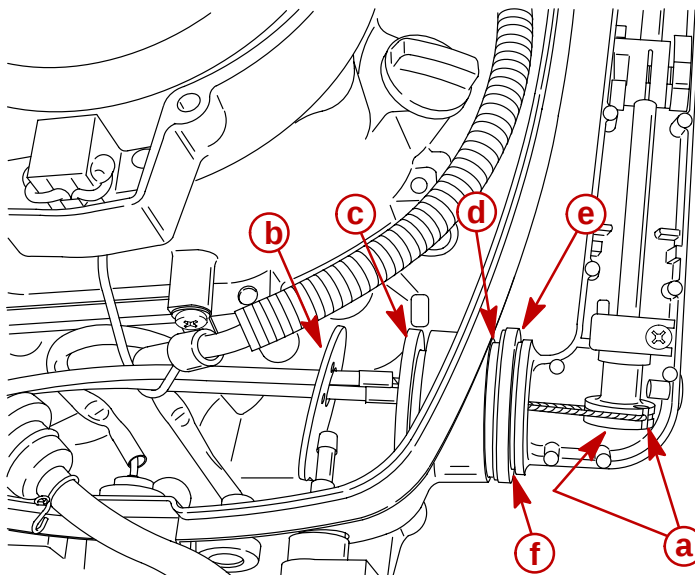


57010

- a** - Nuts (2)
- b** - Lockwashers (2)
- c** - Retaining Plate



5. Remove cable ends from pulley of throttle shaft and remove tiller handle from bottom cowl.

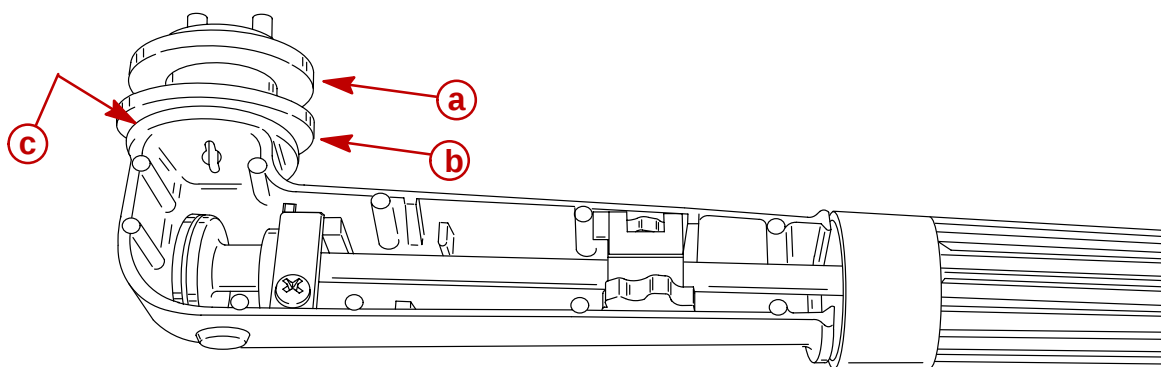


57011

- a - Cable Ends
- b - Retainer Plate
- c - Inner Bushing
- d - Outer Bushing
- e - Sleeve
- f - Nylon Washer

Disassembly

1. Slide outer bushing, sleeve and nylon washer (hidden) from handle.

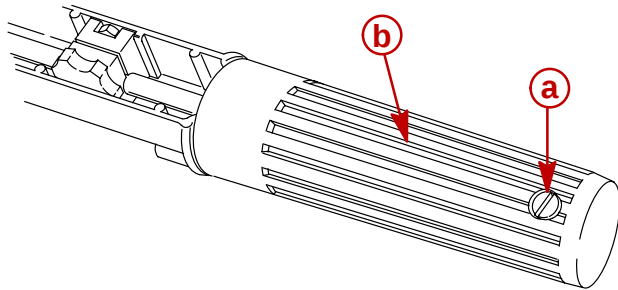


57009

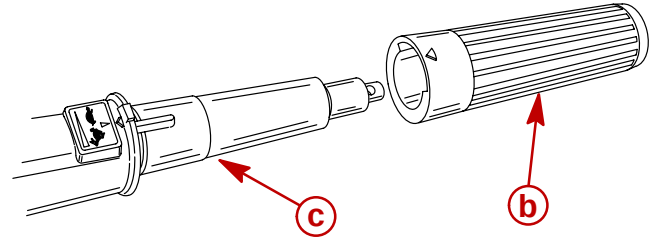
- a - Outer Bushing
- b - Sleeve
- c - Nylon Washer



2. Remove screw from handle grip.
3. Remove handle grip from handle.



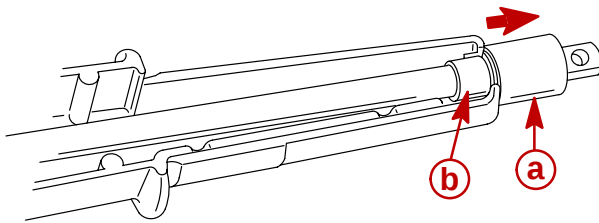
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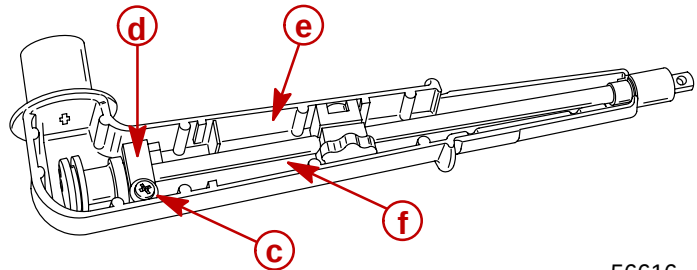
56614

- a** - Screw
- b** - Handle Grip
- c** - Handle

4. Remove rubber spacer and nylon bushing from throttle shaft.
5. Remove screw and plate from handle. Then pull throttle shaft from handle.



56615

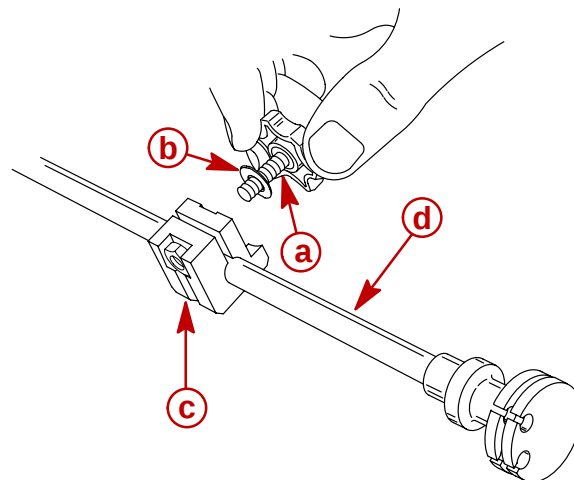


56616

- a** - Rubber Spacer
- b** - Nylon Bushing
- c** - Screw

- d** - Plate
- e** - Handle
- f** - Throttle Shaft

6. Remove adjusting screw and washer from friction block. Then slide block off shaft.



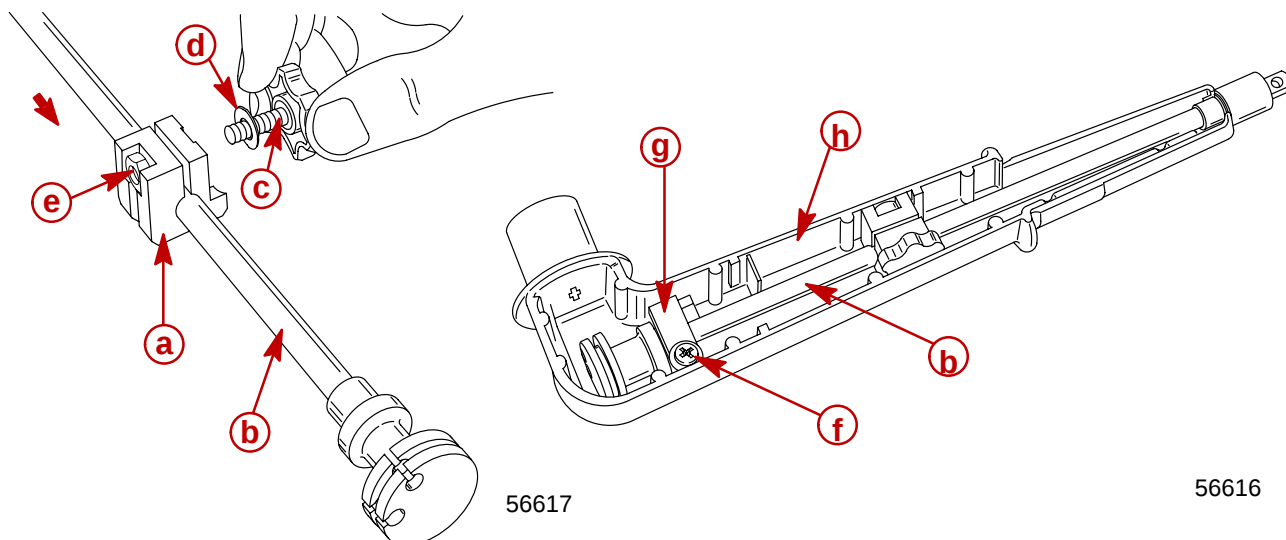
56617

- a** - Adjusting Screw
- b** - Washer
- c** - Friction Block
- d** - Throttle Shaft



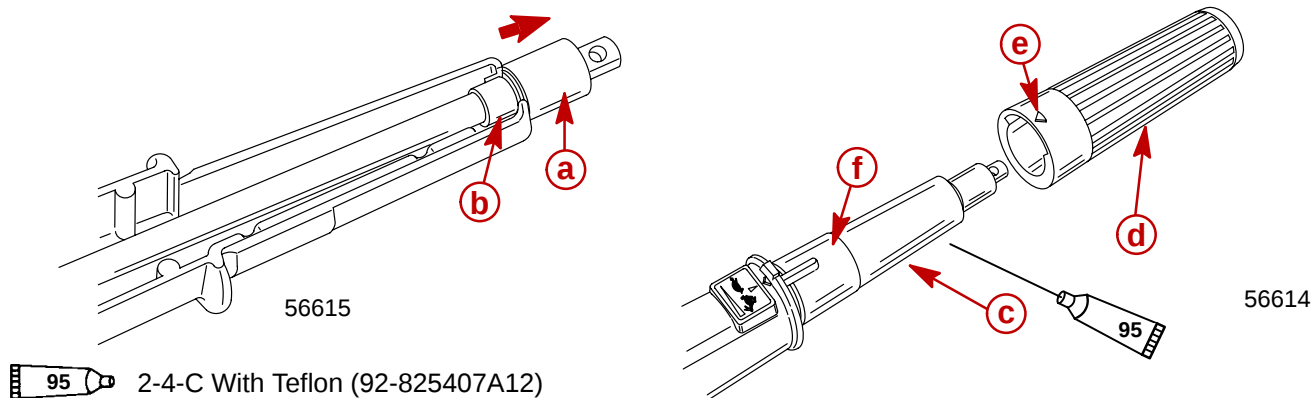
Reassembly

1. Slide friction block over throttle shaft and secure adjustment screw to block, using washer and nut.
2. Install throttle shaft into handle and secure with screw and plate.



- a** - Friction Block
- b** - Throttle Shaft
- c** - Adjustment Screw
- d** - Washer
- e** - Nut
- f** - Screw
- g** - Plate
- h** - Handle

3. Install nylon bushing and rubber spacer over throttle shaft.
4. Apply 2-4-C Marine Lubricant to handle and install handle grip aligning arrow of grip with boss of handle.

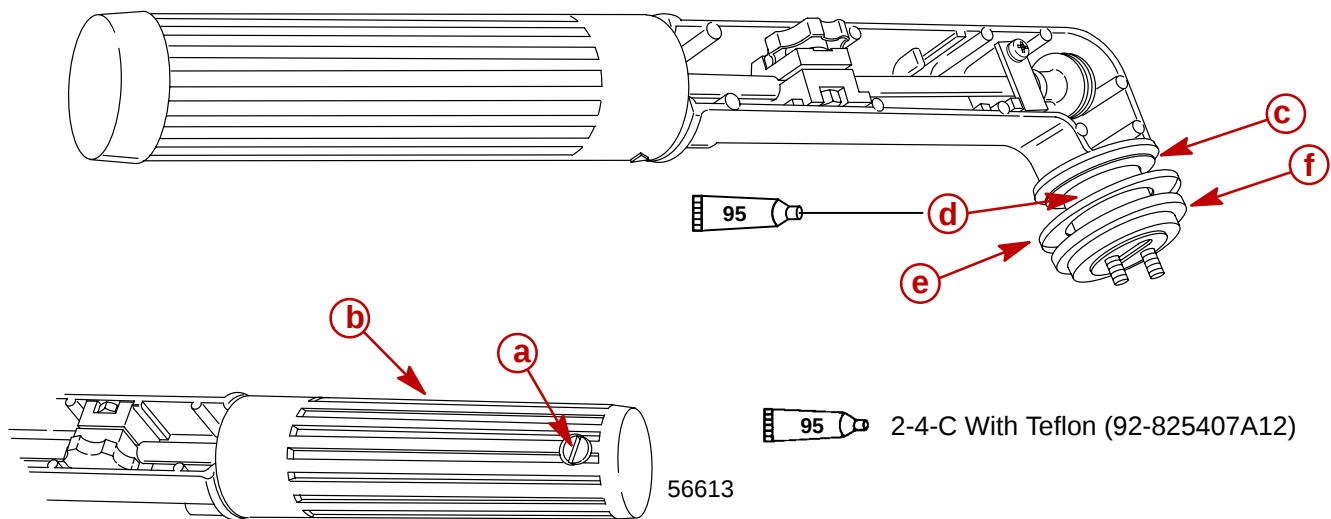


2-4-C With Teflon (92-825407A12)

- a** - Rubber Space
- b** - Nylon Bushing
- c** - Handle
- d** - Handle Grip
- e** - Aligning Arrow
- f** - Boss

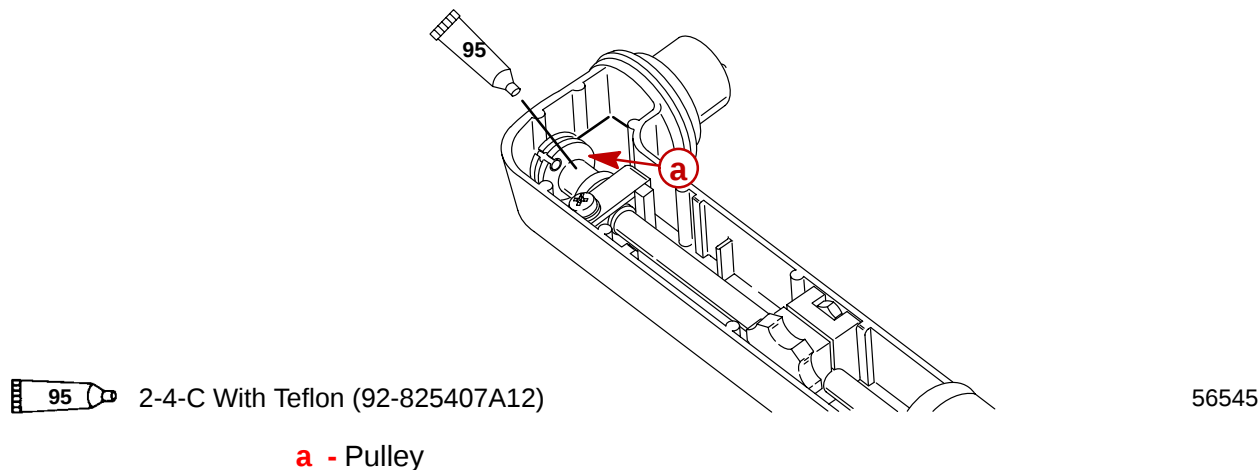


5. Pushing handle grip against rubber spacer, to align holes and secure grip to end of throttle shaft, using screw.
6. Apply 2-4-C Marine Lubricant to handle and install nylon washer, spacer and outer bushing onto tiller handle.



- a** - Screw
- b** - Handle Grip
- c** - Nylon Washer
- d** - Handle
- e** - Spacer
- f** - Outer Bushing

7. Lubricate pulley of throttle shaft, with 2-4-C w/Teflon Marine Lubricant.

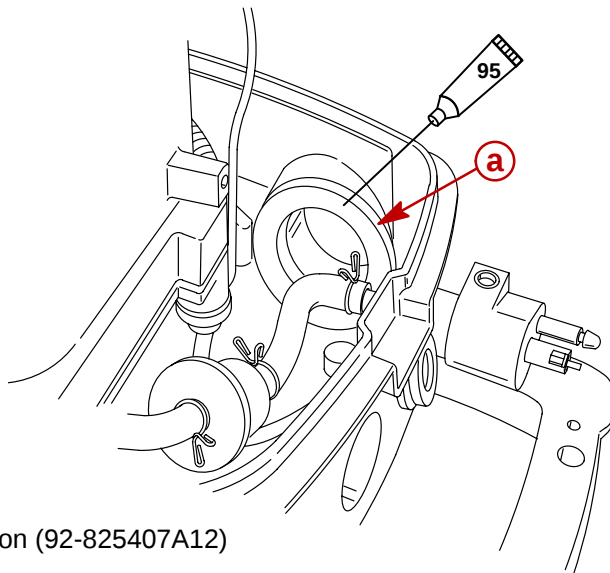


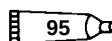
- a** - Pulley



Installation

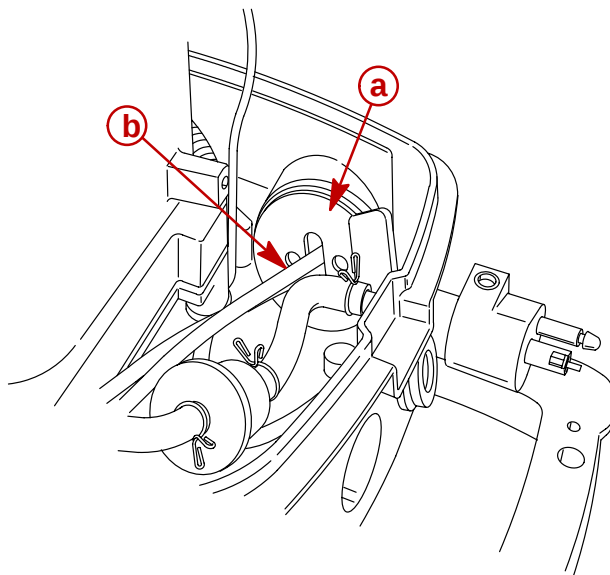
1. Install inner bushing in bottom cowl. Lubricate bushing with 2-4-C w/Teflon Marine Lubricant.



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

a - Inner Bushing

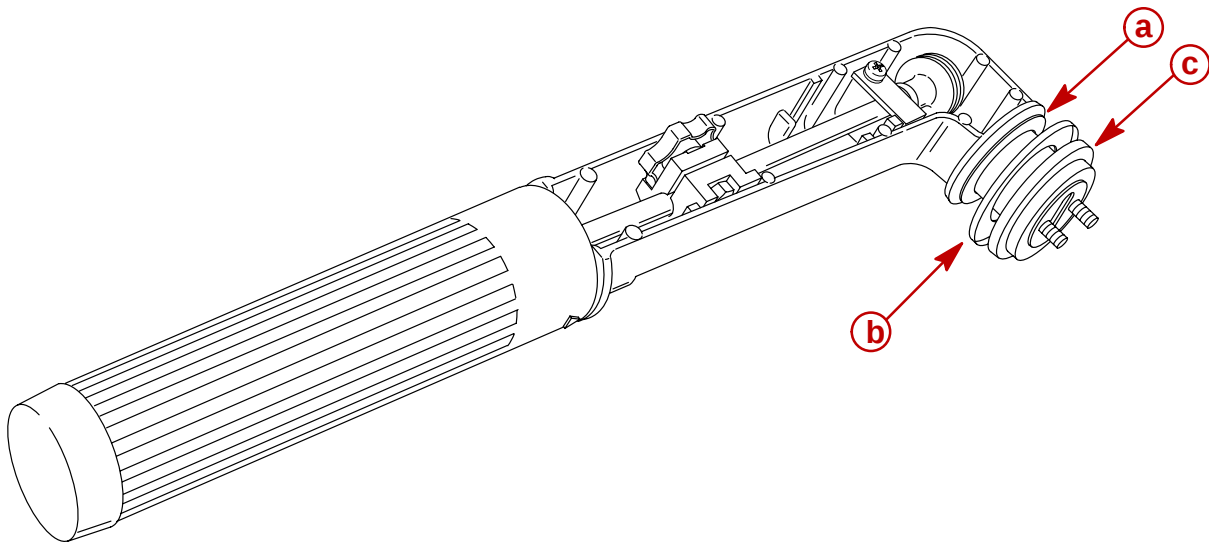
2. Insert throttle cables through plate and inner bushing.



a - Cables
b - Retainer Plate



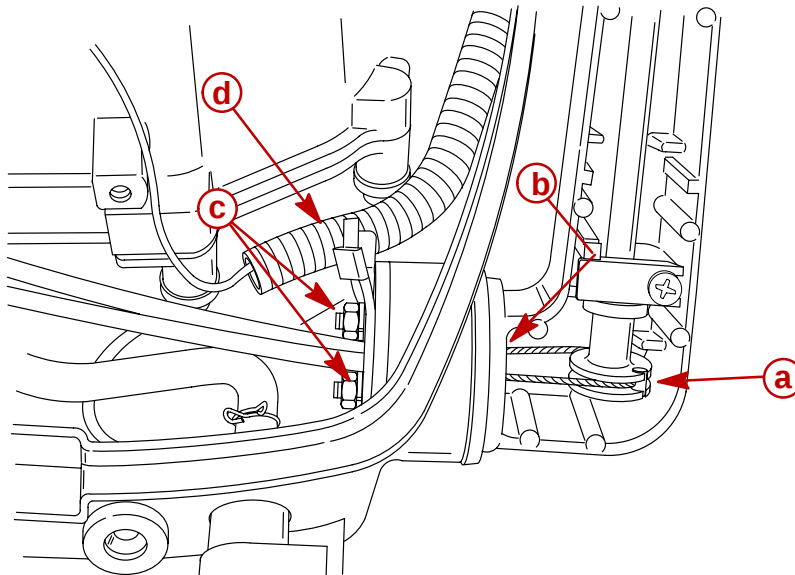
3. Install nylon washer, spacer and outer bushing onto tiller handle.



57502

- a** - Nylon Washer
- b** - Spacer
- c** - Outer Bushing

4. Connect throttle cables to cable drum in tiller handle and (while keeping throttle cables in their respective locating pockets) install tiller handle assembly onto bottom cowl. Secure tiller arm with 2 nuts and lockwashers. Torque nuts to 70 lb-in. (8 Nm).

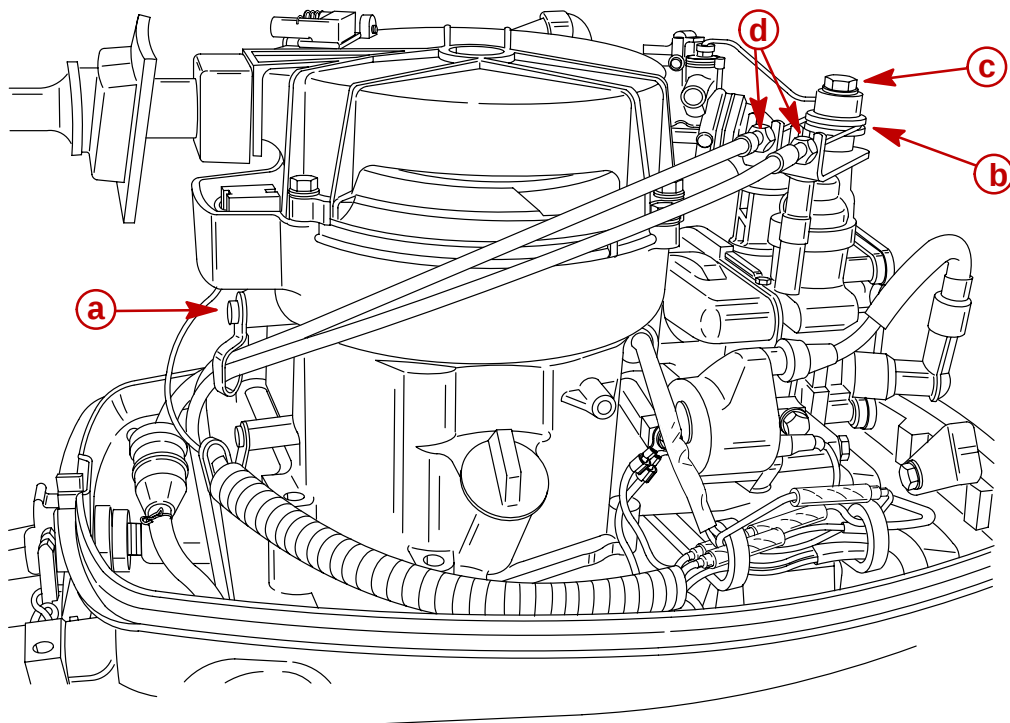


57501

- a** - Cable Drum
- b** - Locating Pockets (hidden)
- c** - Nuts and Lockwashers [Torque to 70 lb-in. (8 Nm)]
- d** - Verify wire harness is clear of retainer plate stop when tiller handle is tilted up



5. Route throttle cables to carburetor and secure with j-clip.
6. Slide throttle cable ends into throttle drum. Secure throttle drum with bolt.
7. Place end of throttle cable jackets into retaining bracket.
8. With throttle arm of carburetor against idle speed screw, remove slack from throttle cables with adjustment nuts.



57230

- a** - J-clip
- b** - Throttle Drum
- c** - Bolt
- d** - Adjustment Nuts



MANUAL STARTER

Section 8

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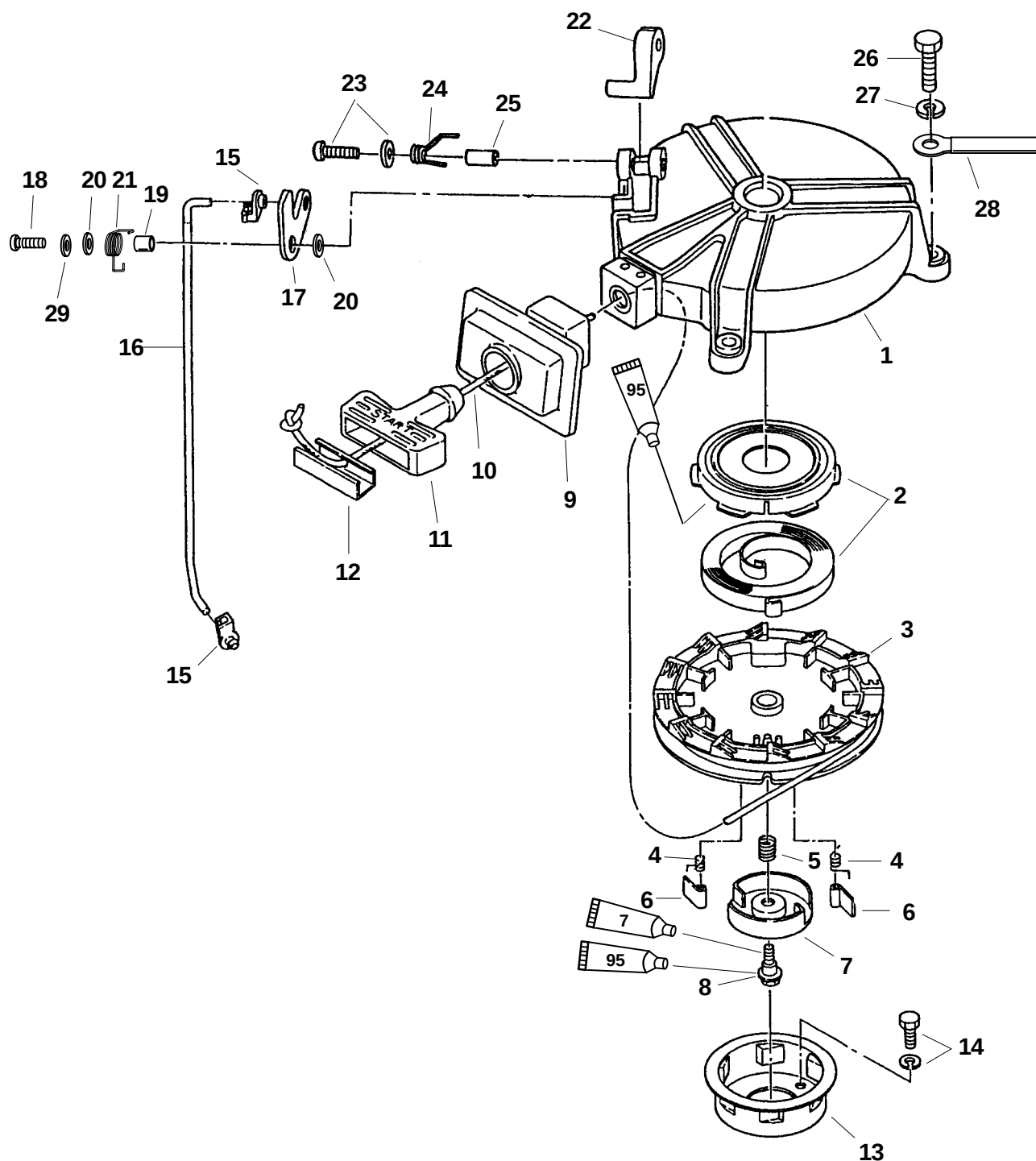
Recoil Starter	8-2	Disassembly	8-5
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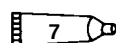
Quicksilver Lubricants and Service Aids

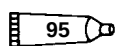
Part No.	Description
92-809819	Loctite 271
92-825407A12	2-4-C with Teflon Marine Lubricant



Recoil Starter



 Loctite 271 (92-809820)

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



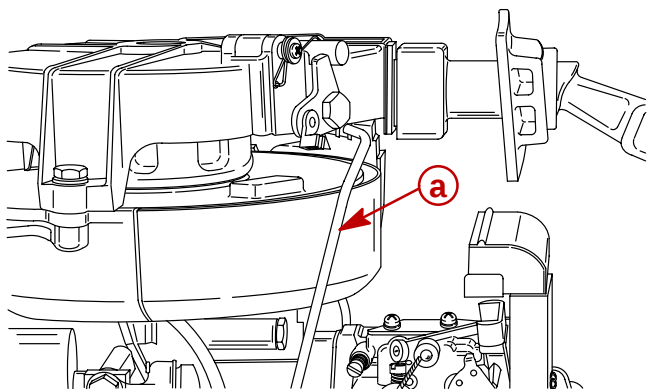
Recoil Starter

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
—	1	RECOIL STARTER ASSEMBLY			
1	1	STARTER HOUSING			
2	1	SPRING SET			
3	1	REEL			
4	2	RETURN SPRING			
5	1	FRICTION SPRING			
6	2	RATCHET			
7	1	FRICTION PLATE			
8	1	BOLT	70		8
9	1	SEAL PLATE			
10	1	STARTER ROPE			
11	1	STARTER HANDLE			
12	1	ROPE ANCHOR			
13	1	STARTER PULLEY			
14	3	BOLT	70		8
15	2	ROD SNAP			
16	1	STARTER LOCK ROD			
17	1	STARTER LOCK CAM			
18	1	SCREW	Drive Tight		
19	1	COLLAR			
20	2	WASHER			
21	1	SPRING			
22	1	STARTER LOCK			
23	1	SCREW	Drive Tight		
24	1	SPRING			
25	1	COLLAR			
26	3	BOLT	70		8
27	3	LOCKWASHER			
28	1	CLAMP			
29	1	LOCKWASHER			

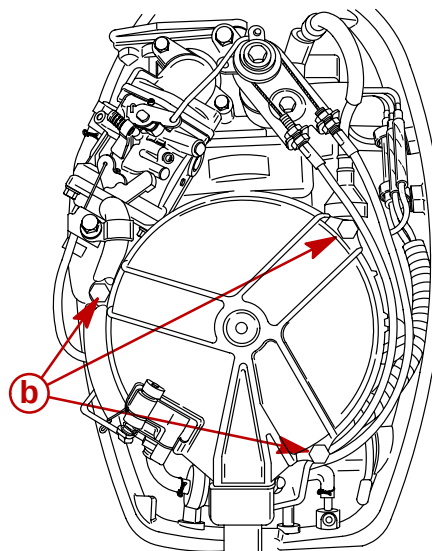


Removal

1. Remove top cowl.
2. Disconnect interlock link rod.
3. Remove three bolts and lift manual starter assembly.



56489

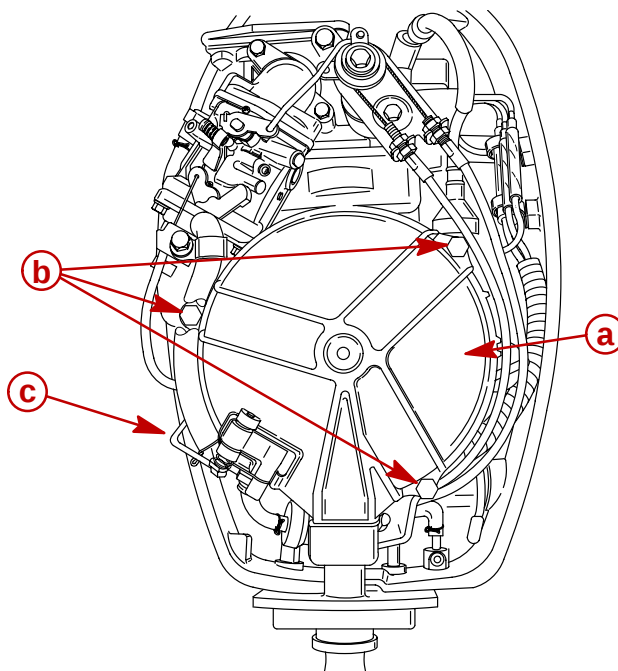


57229

- a** - Link Rod
b - Bolts (3)

Installation

1. Install rewind assembly, using bolts and lockwashers. Torque bolts to 70 lb-in. (8 Nm). Reconnect interlock link rod.



57229

- a** - Rewind Assembly
b - Bolts/Lockwashers
c - Link Rod



Disassembly

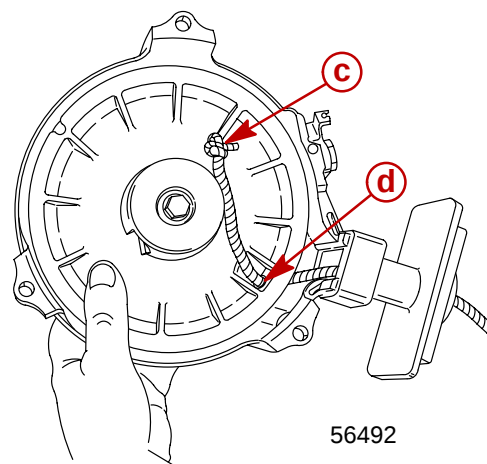
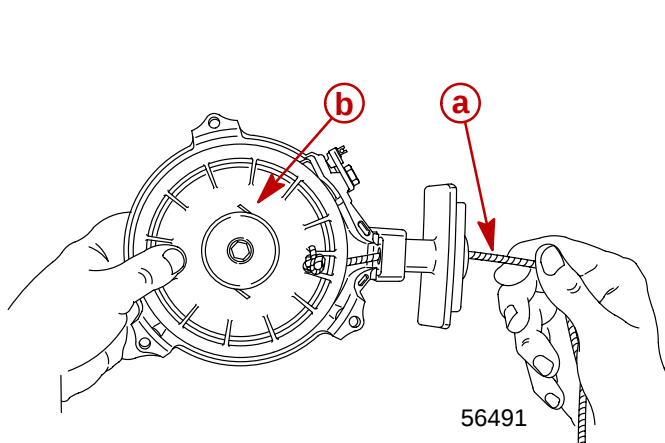
⚠ WARNING

When disassembling rewind starter, **SAFETY GLASSES** must be worn, in case spring should uncoil.

⚠ CAUTION

Starter sheave must be firmly held against spring tension to prevent spring from unwinding.

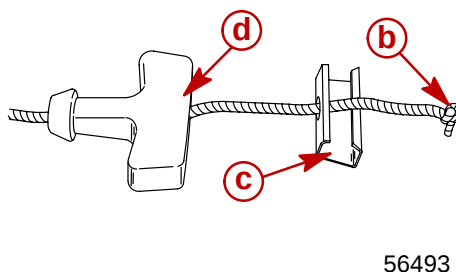
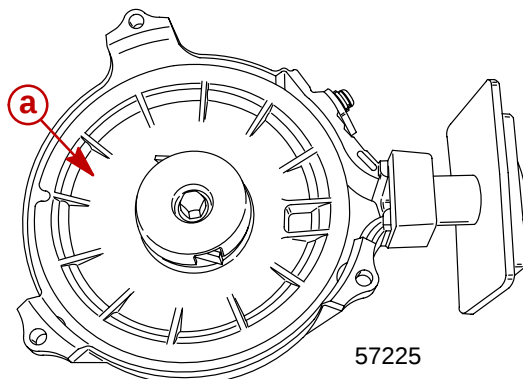
1. Pull starter rope until rope is fully unwound from sheave. Hold sheave in this position, complete steps 2 and 3.
2. Lift end of rope from knot recess and untie or cut off knot. Pull remaining rope from starter sheave.



- a** - Starter Rope
- b** - Sheave
- c** - End of Rope
- d** - Knot Recess

3. Allow sheave to slowly unwind to release spring tension.
4. Untie or cut off knot and pull starter rope from retainer and handle.

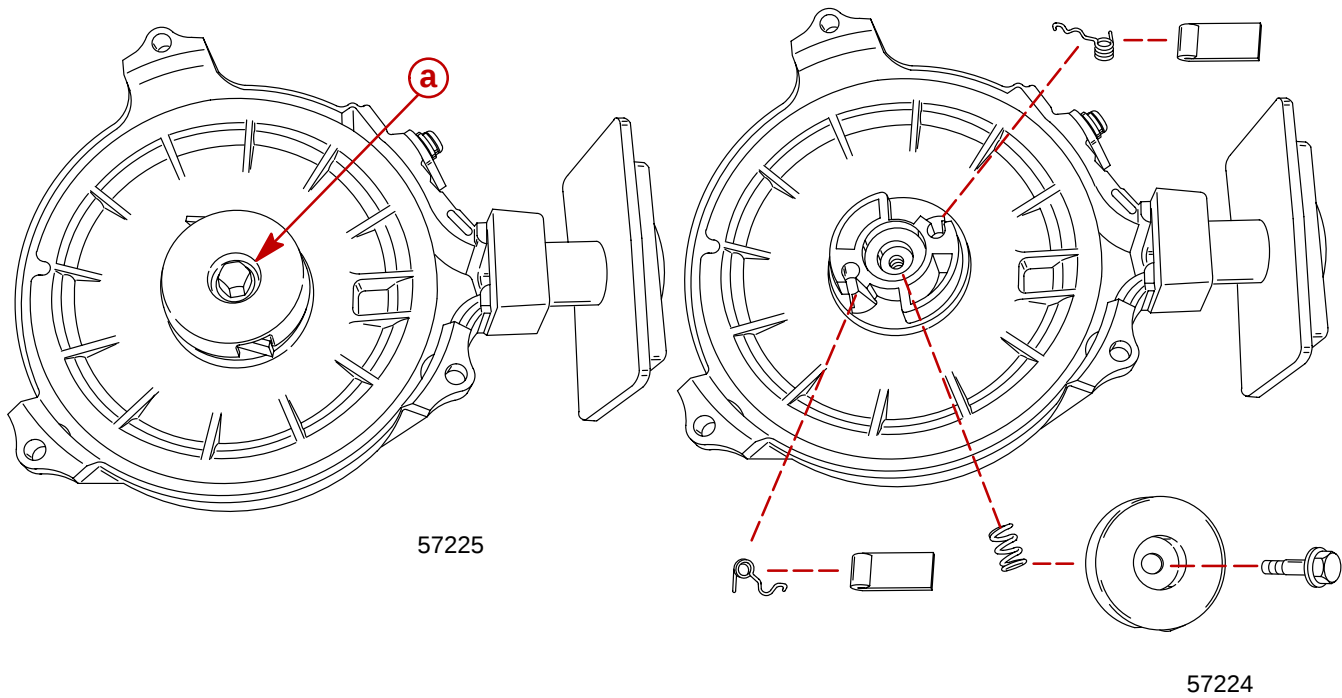
IMPORTANT: Melt ends of starter rope to prevent fraying.



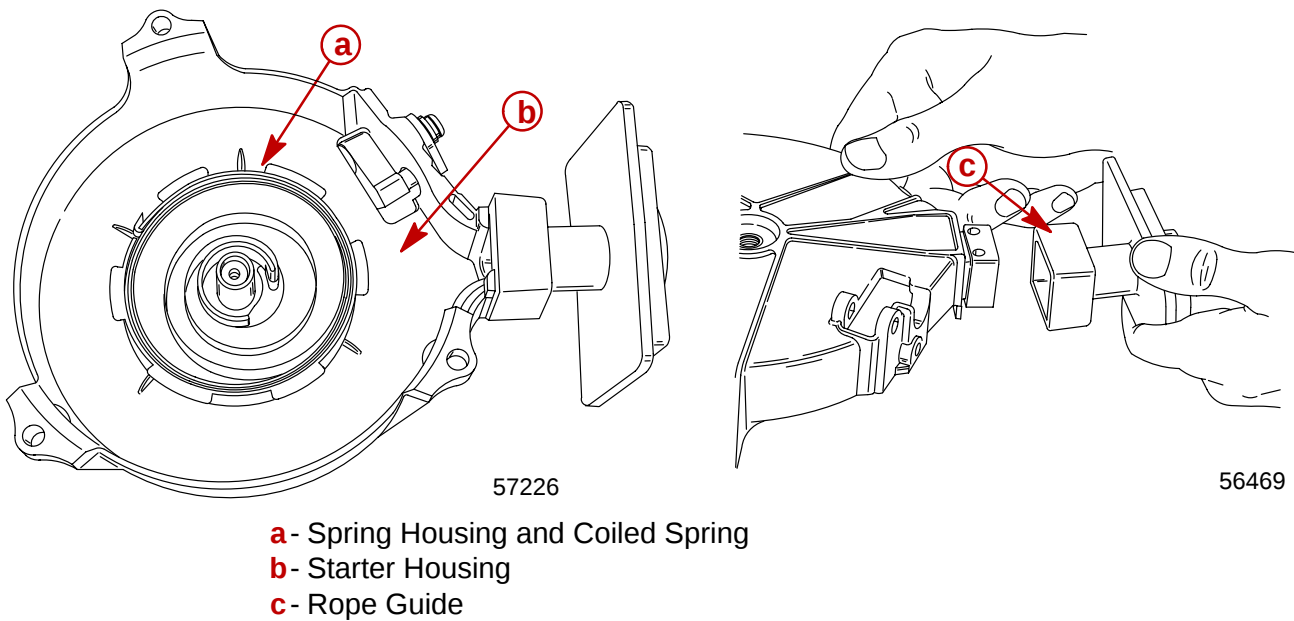
- a** - Sheave
- b** - Knot
- c** - Retainer
- d** - Handle



5. Remove bolt.
6. Lift starter sheave assembly from housing.
7. Disassemble components as shown.



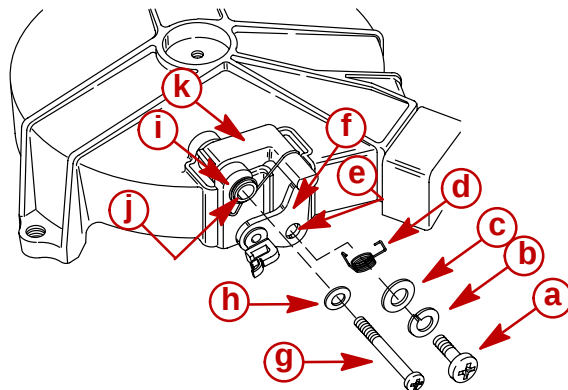
8. Lift spring housing and coiled spring out of starter housing.
9. If necessary, remove rope guide.





10. Remove starter interlock screw, lockwasher, flat washer, spring, collar (hidden) and cam.

11. Remove screw, washer, spring, collar, and starter lock.



a - Starter Interlock Screw
b - Lockwasher
c - Flat Washer
d - Spring
e - Collar (hidden)
f - Cam

g - Screw
h - Washer
i - Spring
j - Collar
k - Starter Lock

Cleaning and Inspection

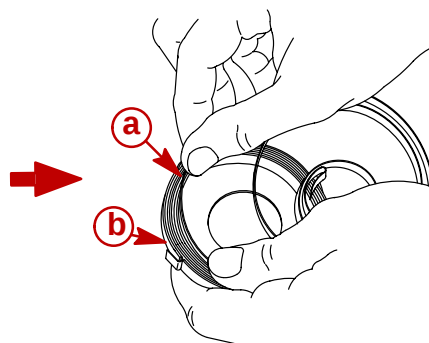
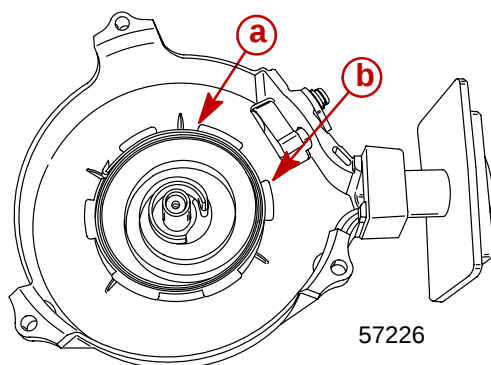
1. Clean components in solvent and dry with compressed air.

⚠ WARNING

Spring tension is strong enough to cause serious injury if spring is released.

IMPORTANT: It is not necessary to remove rewind spring from housing for inspection.

2. If necessary, remove rewind spring from spring housing, by carefully unwinding coiled spring.



a - Rewind Spring
b - Spring Housing

3. Inspect rewind spring for kinks, burrs, corrosion or breakage.

4. Inspect starter sheave, rope guide and starter housing for nicks, grooves, cracks, wear or distortion, especially area of rope travel.

5. Inspect interlock components, springs, ratchet pawls, and friction plate for wear or damage.

6. Inspect starter rope for wear.

7. Replace components as necessary.

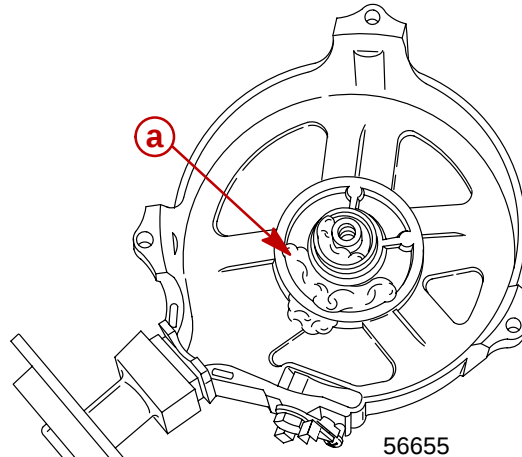


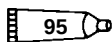
Reassembly

⚠ CAUTION

When reassembling rewind starter, safety glasses must be worn in case spring should uncoil out of housing.

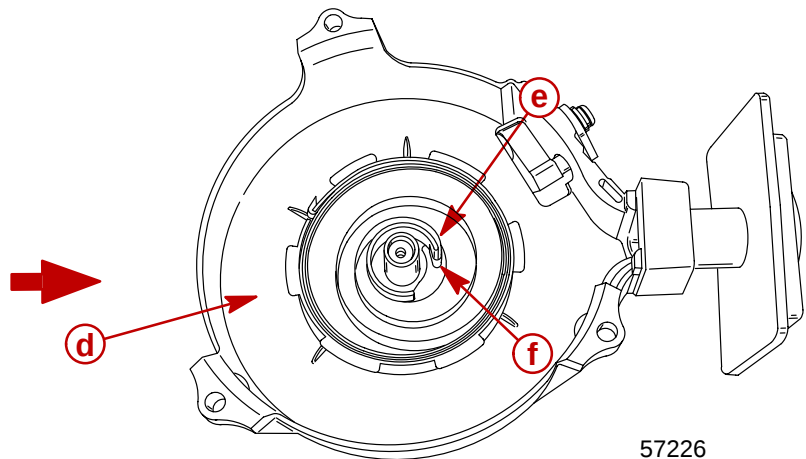
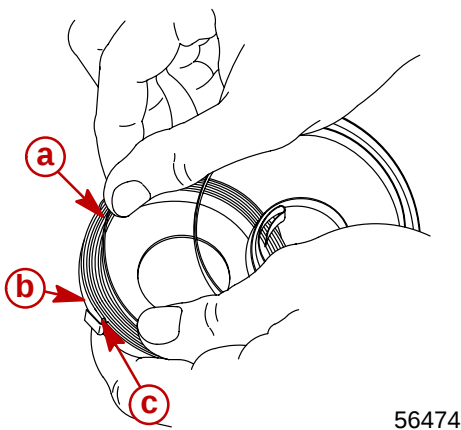
1. Apply a small amount of 2-4-C Marine Lubricant in starter housing as shown.



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

a - 2-4-C Marine Lubricant

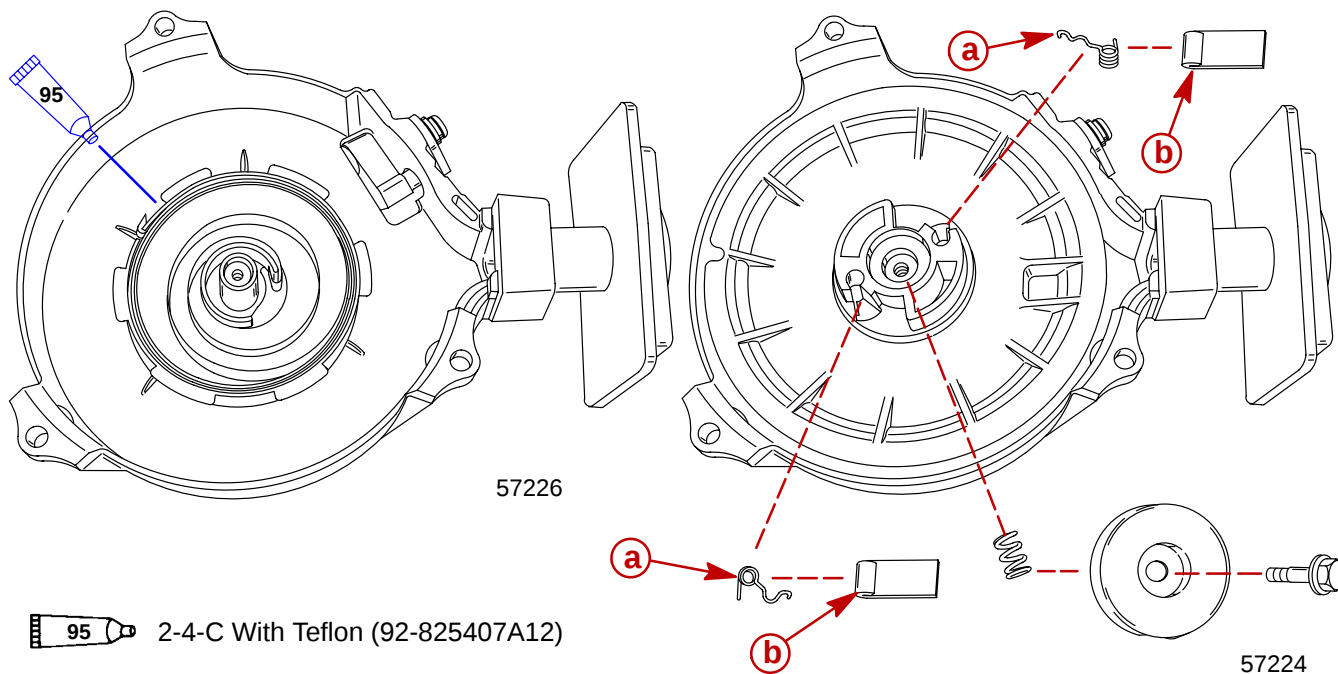
2. Apply a thin coat of non-metallic low temperature grease to spring cavity of starter housing.
3. Place outer hook of starter spring in slot of housing and wind spring clockwise into spring cavity.
4. Install spring/housing assembly into starter housing while positioning inner spring hook onto starter housing tab.



a - Outer Hook
b - Starter Spring
c - Slot
d - Starter Housing
e - Inner Spring Hook
f - Starter Housing Tab

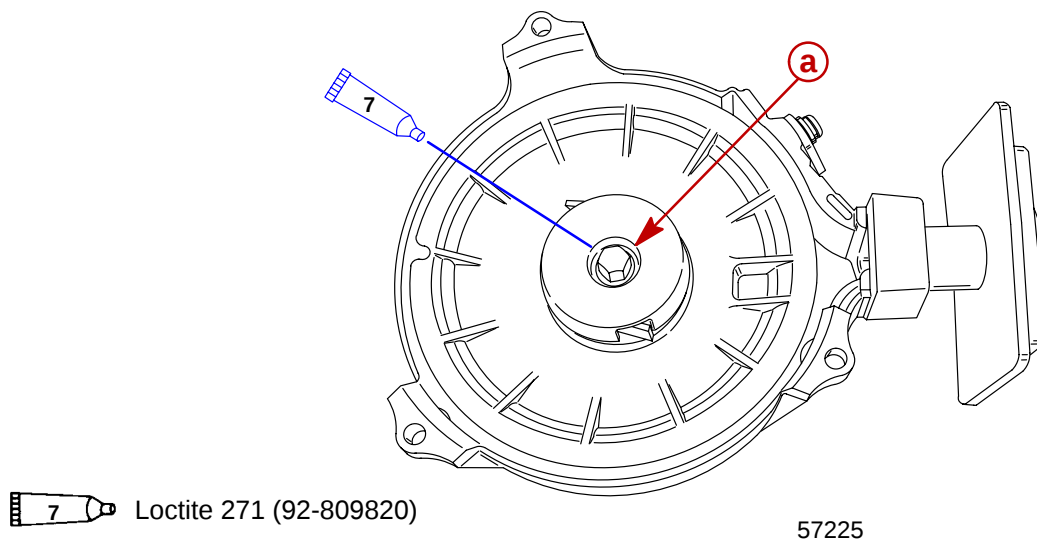


5. Apply a small amount of 2-4-C Marine Lubricant in starter housing and install sheave.
6. Install ratchet pawls, and pawl springs into starter sheave as shown.



- a** - Pawl Springs (2)
b - Ratchet Pawls (2)

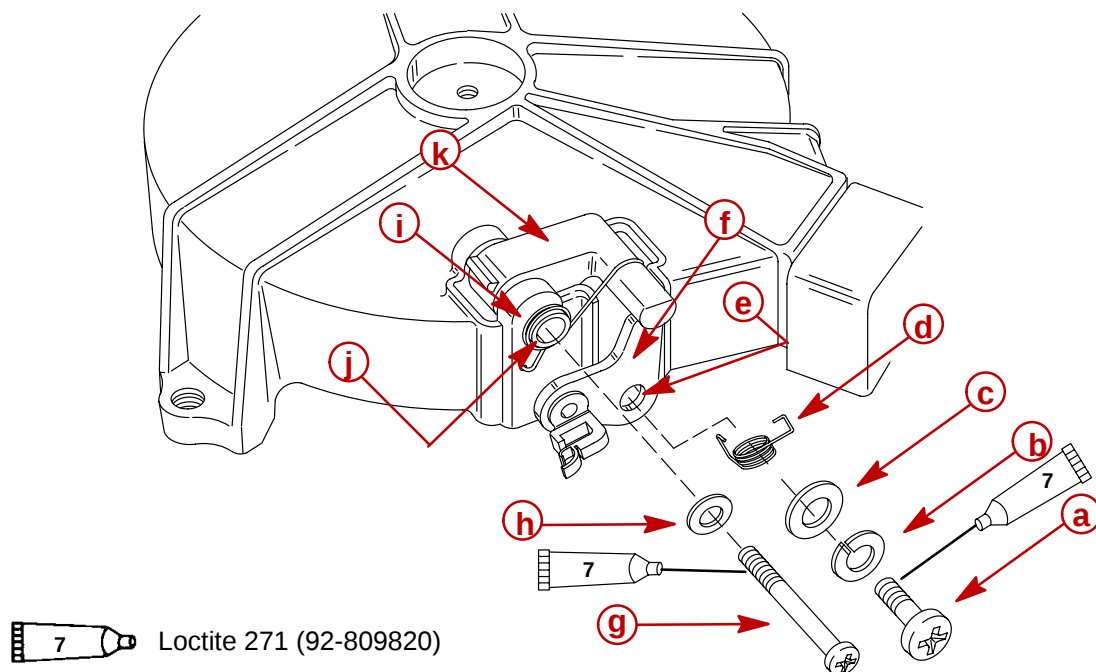
7. Apply Loctite 271 to bolt. Torque bolt to 70 lb-in. (8 Nm).



- a** - Bolt



8. Install rope guide if previously removed. Install interlock components, if removed, as shown. Apply Loctite 271 to threads on screw (a) and screw (g) and tighten securely.

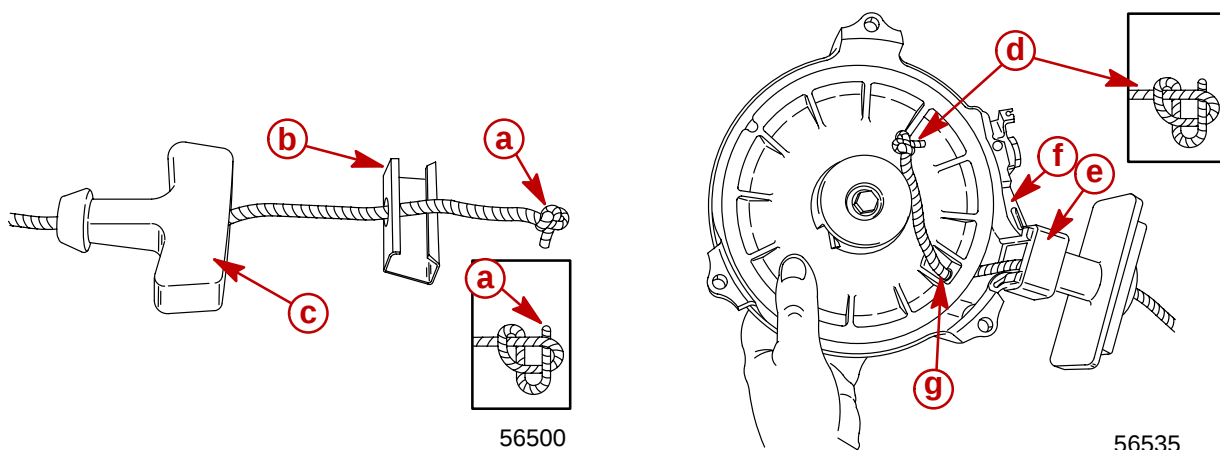


57227

- a** - Screw
- b** - Lockwasher
- c** - Flat Washer
- d** - Spring
- e** - Collar (hidden)
- f** - Interlock Cam
- g** - Screw
- h** - Flat Washer
- i** - Spring
- j** - Collar (hidden)
- k** - Starter Lock

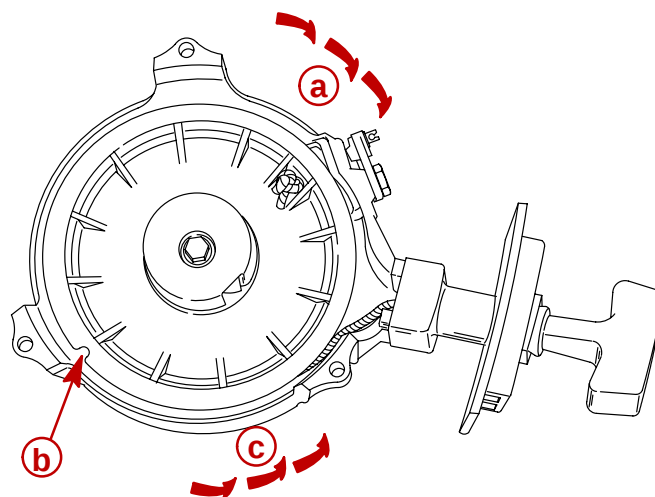


9. Tie knot as shown, thread rope thru retainer and handle.
10. Thread starter rope thru rope guide, starter housing and starter sheave. Tie knot in end of rope as shown in inset and pull knot tight.



- a** - Knot
- b** - Retainer
- c** - Handle
- d** - Starter Rope
- e** - Rope Guide
- f** - Starter Housing
- g** - Starter Sheave

11. Turn sheave 2-1/2 turns **CLOCKWISE** with rope coiling into sheave. Hold rope in slot while turning sheave 3 turns **COUNTERCLOCKWISE**. Allow sheave to slowly rewind remainder of loose rope.



- a** - Turn Sheave 2-1/2 Turns Clockwise
- b** - Slot
- c** - Turn Sheave 3 Turns Counterclockwise

12. Pull starter handle and check for the following:
 - a. Smooth operation of starter pawls.
 - b. Free movement of starter rope.
 - c. Starter rope rewinds completely.

13. Install manual starter assembly on engine as shown on page 8-4.



COLOR DIAGRAMS

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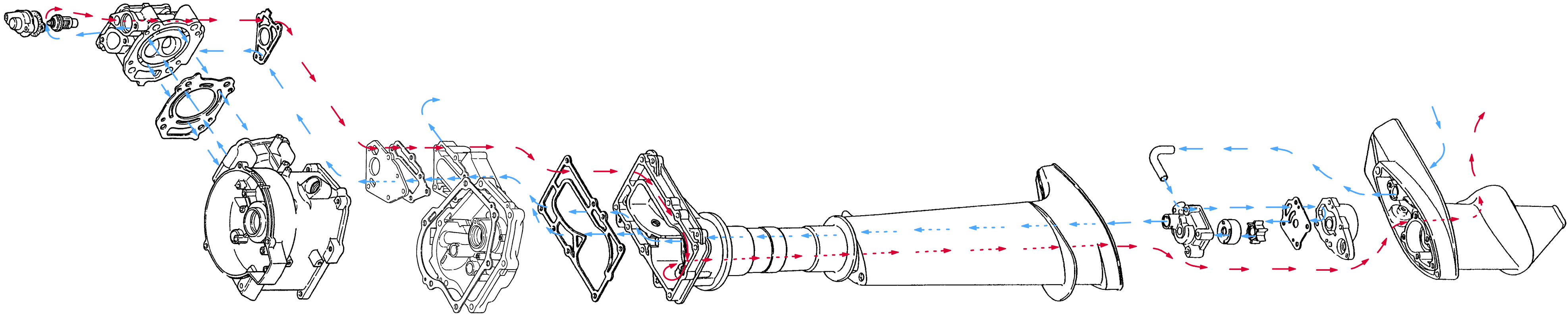


4/5/6 (4-STROKE) WIRING DIAGRAM

-
- The diagram illustrates the electrical system for a vehicle, showing the following components and their connections:
- 1:** Battery terminal connection.
 - 2:** Alternator terminal connection.
 - 3:** Two yellow wires connected to the battery.
 - 4:** Two red wires connected to the battery.
 - 5:** A fuse block with a red wire connected to the battery.
 - 6:** A fuse block with a red wire connected to the battery.
 - 7:** A fuse block with a red wire connected to the battery.
 - 8:** A fuse block with a red wire connected to the battery.
 - 9:** A red wire connected to the battery.
 - 10:** A green wire connected to the battery.
 - 11:** A green wire connected to the battery.
 - 12:** A green wire connected to the battery.
- The diagram shows the following connections:
- The battery is connected to the alternator via a red wire (1).
 - The alternator is connected to the battery via a red wire (2).
 - The battery is connected to the starter motor via a red wire (3).
 - The battery is connected to the starter motor via a red wire (4).
 - The battery is connected to the starter motor via a red wire (5).
 - The battery is connected to the starter motor via a red wire (6).
 - The battery is connected to the starter motor via a red wire (7).
 - The battery is connected to the starter motor via a red wire (8).
 - The battery is connected to the starter motor via a red wire (9).
 - The battery is connected to the starter motor via a red wire (10).
 - The battery is connected to the starter motor via a red wire (11).
 - The battery is connected to the starter motor via a red wire (12).



4/5/6 (4-STROKE) WATER FLOW DIAGRAM





4/5/6 (4-STROKE) OIL FLOW DIAGRAM

