

MERCURY



Service Manual



2.5/3.5 FourStroke

**2.5/3.5
FourStroke**

Serial Number 0R448033 and Above

90-8M0065421 NOVEMBER 2012

Manual Outline

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- A - Powerhead

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Important Information

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Electrical

2

Fuel System

3

Powerhead

4

Midsection

5

Lower Unit

6

Attachments


7

Manual Starter

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Notice to Users of This Manual

Throughout this publication, dangers, warnings, cautions, and notices (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

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, could result in engine or major component failure.

IMPORTANT: Identifies information essential to the successful completion of the task.

NOTE: Indicates information that helps in the understanding of a particular step or action.

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

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It is assumed that these personnel are familiar with marine product servicing procedures. Furthermore, it is assumed that they have been trained in the recommended service procedures of Mercury Marine Power Products, including 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 marine trade of all conceivable procedures and of the possible hazards and/or results of each method. 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.

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.

Refer to dealer service bulletins, operation maintenance and warranty manuals, and installation manuals for other pertinent information concerning the products described in this manual.

Precautions

It should be kept in mind, while working on the product, that the electrical and ignition systems 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 into the cylinders which could cause extensive internal damage when the engine is started.

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 reuse, care should be taken to select a replacement that matches the original.

Replacement Parts

Use of parts other than the recommended service replacement parts will void the warranty on those parts that are damaged as a result.

WARNING

Avoid fire or explosion hazard. Electrical, ignition, and fuel system components on Mercury Marine products comply with federal and international standards to minimize risk of fire or explosion. Do not use replacement electrical or fuel system components that do not comply with these standards. When servicing the electrical and fuel systems, properly install and tighten all components.

Cleanliness and Care of Product

A Mercury Marine Power Product is a combination of many machined, honed, polished, and lapped surfaces with tolerances measured in the ten thousands of an inch/mm. When any product component is serviced, care and cleanliness are important. 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 engine that is suspended. Engines should be attached to work stands, or lowered to ground as soon as possible.

Important Information

Section 1A - Master Specifications

**1
A**

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Model Specifications

Model Specifications	
Power	1.9 kW (2.5 hp) 2.6 kW (3.5 hp)
Weight (2.5 models)	
M	17 kg (38 lb)
ML	18 kg (40 lb)
Weight (3.5 models)	
M	17 kg (38 lb)
ML	18 kg (40 lb)
Recommended RPM range at WOT (3.5 models)	5000–6000 RPM
Recommended RPM range at WOT (2.5 models)	4500–5500 RPM
Idle speed (2.5/3.5 models)	
In neutral	1400 ± 100
In forward gear	1300 ± 100
Fuel	Automotive unleaded - minimum 87 octane, up to 10% ethanol
Oil type	
All temperatures	10W-30
Alternate oil viscosity above 4 °C (40 °F)	25W-40
Oil capacity	300 ml (10.0 fl oz)

Ignition Specifications

Ignition Specifications at 20 °C (68 °F)	
Ignition type	Digital capacitor discharge ignition
Spark plug type	NGK DPR6E
Spark plug gap	0.8–0.9 mm (0.031–0.035 in.)
Ignition timing at idle	3° ± 3° BTDC
Ignition timing at WOT	25° ± 3 BTDC
ECM RPM limiter	
RPM overspeed	6300 ± 200 RPM
Ignition coil	
Primary	Sealed internal
Secondary	2.2 k ohms ± 15%
Ignition coil to flywheel gap	0.3 mm (0.012 in.)

Carburetor Specifications

Carburetor Specifications 2.5 HP	
Venturi	9 mm (0.35 in.)
Throttle bore	16 mm (0.63 in.)
Main jet	#65
Main nozzle I.D.	1.4 mm (0.06 in.)
Slow jet	#38
Idle air jet	#115
Idle speed (neutral)	1400 ± 50 RPM
Idle speed (forward)	1300 ± 50 RPM
Float level (flange to float bottom)	10 mm (0.39 in.)
Pilot (idle mixture) screw	2 ± ½ turn out

Carburetor Specifications 3.5 HP	
Venturi	13 mm (0.51 in.)
Throttle bore	19 mm (0.75 in.)
Main jet	#68
Main nozzle I.D.	1.8 mm (0.07 in.)
Slow jet	#38
Idle air jet	#115
Idle speed (neutral)	1400 ± 50 RPM
Idle speed (forward)	1300 ± 50 RPM
Float level (from carburetor flange to bottom of float)	10 mm (0.39 in.)
Pilot (idle mixture) screw	2 ± ½ turn out

Cooling System Specifications

Cooling System Specifications	
Thermostat	
Start to open temperature	50–54 °C (122–129 °F)
Full open temperature	60–64 °C (140–147 °F)
Valve lift	2 mm (0.079 in.)
Water pressure	
Idle (at 1300 RPM)	3–7 kPa (0.4–1.0 psi)
WOT (at 5000 RPM)	40–75 kPa (5.8–10.9 psi)

Cylinder Block Specifications

Cylinder Block Specifications	
Cylinder bore	
Standard	55 mm (2.1653 in.)
Oversize	55.5 mm (2.1850 in.)
Maximum taper/out of round	0.06 mm (0.0024 in.)
Stroke	36 mm (1.42 in.)
Displacement	85.5 ml (5.22 in. ³)
Number of cylinders	1
Rotation	Clockwise
Crankshaft	
Runout	0.05 mm (0.002 in.)
Crankpin journal (standard)	19.98 mm (0.7866 in.)
Crankpin journal (service limit)	19.95 mm (0.7854 in.)
Connecting rod	
Wrist pin I.D. (standard)	14.01 mm (0.5516 in.)
Wrist pin I.D. (service limit)	14.04 mm (0.5528 in.)
Crankpin oil clearance (standard)	0.015–0.041 mm (0.0006–0.0016 in.)
Crankpin oil clearance (service limit)	0.060 mm (0.0024 in.)

Piston Specifications

Piston Specifications	
Piston outside diameter (standard)	54.96 mm (2.1638 in.)
Piston outside diameter (service limit)	54.90 mm (2.1614 in.)
Piston clearance (standard)	0.020–0.06 mm (0.0008–0.0024 in.)
Piston clearance (service limit)	0.15 mm (0.0059 in.)
Piston ring side clearance (standard)	
Top	0.04–0.08 mm (0.0016–0.0031 in.)
Middle	0.03–0.07 mm (0.0012–0.0028 in.)
Bottom	0.05–0.15 mm (0.002–0.0059 in.)
Piston ring side clearance (service limit)	
Top	0.10 mm (0.0039 in.)
Middle	0.09 mm (0.0035 in.)
Bottom	0.17 mm (0.0067 in.)
Piston ring end gap (standard)	
Top	0.15–0.30 mm (0.0059–0.0118 in.)
Middle	0.30–0.45 mm (0.0118–0.0177 in.)
Bottom	0.20–0.70 mm (0.0079–0.0276 in.)
Piston ring end gap (service limit)	
Top	0.5 mm (0.0197 in.)
Middle	0.7 mm (0.0276 in.)
Piston pin diameter (standard)	14.0 mm (0.5512 in.)
Piston pin diameter (service limit)	13.97 mm (0.5500 in.)

Camshaft and Valve Specifications

Camshaft and Valve Specifications	
Camshaft	
Runout limit	0.03 mm (0.0012 in.)
Cam lobe height (intake and exhaust)	23.78–24.04 mm (0.94–0.95 in.)
Upper bearing O.D.	11.95–11.97 mm (0.4705–0.4713 in.)
Lower bearing O.D.	12.95–12.97 mm (0.5098–0.5106 in.)
Valve spring free length	33.2–35.0 mm (1.307–1.378 in.)
Valve spring tilt limit	2 mm (0.079 in.)
Valve guide	
Intake	5.51–5.55 mm (0.2169–0.2185 in.)
Exhaust	5.51–5.57 mm (0.2169–0.2193 in.)
Valve stem O.D.	
Intake valve	5.45–5.47 mm (0.2146–0.2154 in.)
Exhaust valve	5.44–5.46 mm (0.2142–0.2150 in.)
Valve stem to valve guide clearance	
Intake	0.018–0.070 mm (0.0007–0.0028 in.)
Exhaust	0.025–0.080 mm (0.0010–0.0031 in.)
Valve seat angles	
First	30°
Second	45°
Third	60°
Valve stem seal color	
Intake	Black
Exhaust	Green
Valve seat width (intake and exhaust)	1.0–2.0 mm (0.0394–0.0787 in.)
Valve to rocker arm clearance	
Intake	0.06–0.14 mm (0.0024–0.0055 in.)
Exhaust	0.11–0.19 mm (0.0043–0.0075 in.)

Gear Housing Specifications

Gear Housing Specifications	
Gear ratio	
Model 2.5/3.5	2.15:1
Gear housing capacity	180 mL (6.1 fl oz)
Gear lubricant type	Premium or High Performance Gear Lubricant
Pinion teeth	13
Forward gear teeth	28
Clutch	Dog type (forward - neutral)
Forward gear backlash	0.050–0.152 mm (0.002–0.006 in.)
Propeller drive system	Drive (shear) pin
Propeller shaft trueness serviceability limit	0.152 mm (0.006 in.) maximum

Propellers

Propellers	
Standard (plastic)	7.4 dia. x 7 pitch
Optional (aluminum)	7.4 dia. x 5.7 pitch
Optional (plastic)	7.4 dia. x 5.7 pitch

Notes:

Important Information


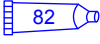
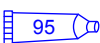

Section 1B - Maintenance

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Lubricants, Sealants, Adhesives

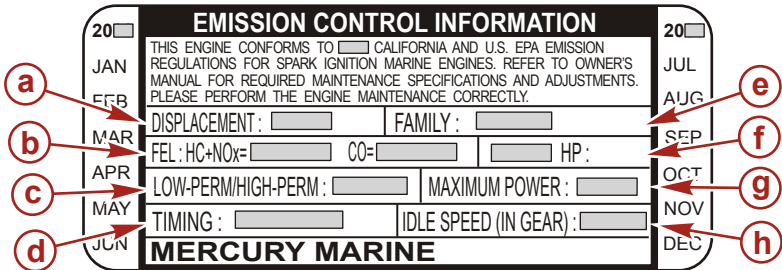
Tube Ref No.	Description	Where Used	Part No.
 34	Special Lubricant 101	Steering friction knob threads, swivel bracket bushing, tilt support pin, transom clamp screws	92-802865Q02
 82	Premium Gear Lubricant	Gearcase	92-858058K01
 95	2-4-C with PTFE	Steering friction knob threads, swivel bracket bushing, tilt support pin, transom clamp screws	92-802859A 1
 120	Corrosion Guard	External metal surfaces	92-802878 55

EPA Emission Regulations

All new 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 set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, wherever practicable, returned to the original intent of the design. **Maintenance, replacement, or repair of the emission control devices and systems may be performed by any marine spark ignition (SI) engine repair establishment or individual.**

Emission Certification Label

An emission certification label, showing emission levels and engine specifications directly related to emissions, is placed on the engine at time of manufacture.



EMISSION CONTROL INFORMATION

THIS ENGINE CONFORMS TO CALIFORNIA AND U.S. EPA EMISSION REGULATIONS FOR SPARK IGNITION MARINE ENGINES. REFER TO OWNER'S MANUAL FOR REQUIRED MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS. PLEASE PERFORM THE ENGINE MAINTENANCE CORRECTLY.

DISPLACEMENT: FAMILY:

FEL: HC+NOx= CO= HP:

LOW-PERM/HIGH-PERM: MAXIMUM POWER:

TIMING: IDLE SPEED (IN GEAR):

MERCURY MARINE

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- a - Piston displacement
- b - Maximum emission output for the engine family
- c - Percent of fuel line permeation
- d - Timing specification
- e - Family number
- f - Engine family description
- g - Engine power - kilowatts
- h - Idle speed

Owner Responsibility

The owner/operator is required to have routine 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 emission levels to exceed their predetermined factory specifications.

Selecting Accessories for Your Outboard

Genuine Mercury Precision or Quicksilver Accessories have been specifically designed and tested for your outboard. These accessories are available from Mercury Marine dealers.

IMPORTANT: Check with your dealer before installing accessories. The misuse of approved accessories or the use of nonapproved accessories can damage the product.

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.

Inspection and Maintenance Schedule

Before Each Use

- Check the engine oil level.
- Visually inspect the fuel system for deterioration or leaks.
- Check outboard for tightness on transom.
- Check propeller blades for damage.

After Each Use

- Flush out the outboard cooling system if operating in salt or polluted water. See **Flushing the Cooling System**.

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

- Lubricate all lubrication points. Lubricate more frequently when used in saltwater. See **Lubrication Points**.
- Change engine oil. The oil should be changed more often when the engine is operated under adverse conditions such as extended trolling. See **Changing Engine Oil**.
- Replace spark plug at first 100 hours or first year. After that, inspect the spark plug every 100 hours or once yearly. Replace the spark plug as needed. See **Spark Plug Inspection and Replacement**.
- Drain and replace gearcase lubricant. See **Gearcase Lubrication**.
- Check corrosion control anode. Check more frequently when used in saltwater. See **Corrosion Control Anode**.
- Check and adjust valve clearance, if necessary.¹
- Lubricate splines on the driveshaft.¹
- Replace water pump impeller.¹
- Check tightness of bolts, nuts, and other fasteners.

Before Periods of Storage

- Refer to Storage procedure. See **Storage** section.

Submerged Outboard

A submerged outboard will require service within a few hours by an authorized dealer once the outboard is recovered from the water. This immediate attention by a servicing dealer is necessary once the engine is exposed to the atmosphere to minimize internal corrosion damage to the engine.

Exterior Care

Your outboard is protected with a durable baked enamel finish. Clean and wax often using marine cleaners and waxes.

Flushing the Cooling System

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

Use a Mercury Precision or Quicksilver accessory (or equivalent) flushing attachment.

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

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



a - Plug and gasket

b - Hose coupling

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

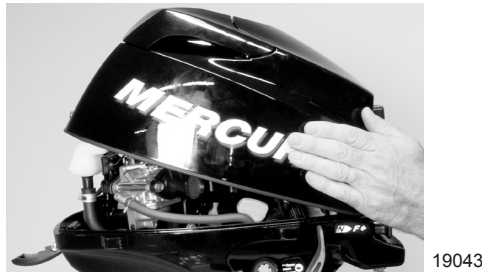
Top Cowl Removal and Installation

Removal

1. Release the rear cowl latch.



2. Lift up the rear of the cowl and push it towards the front of the engine to clear the front hook.

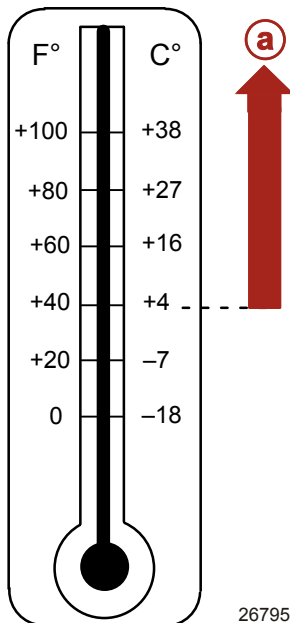


Installation

1. Engage the front hook and position the cowl over the engine.
2. Lock the rear cowl latch.

Engine Oil Recommendations

We recommend the use of Mercury or Quicksilver SAE 10W-30 multi-viscosity 4-Stroke Outboard Oil for general, all-temperature use. If SAE 25W-40 multi-viscosity oil is preferred, use Mercury MerCruiser 4-cycle engine oil or Quicksilver sterndrive and inboard 4-cycle engine oil. Never use 4-cycle engine oil that is not certified to meet or exceed any one or combination of the following American Petroleum Institute (API) Service Classification SH, SG, SF, CF-4, CE, CD, CDII. Severe engine damage may result from use of an inferior oil.



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Recommended SAE Viscosity for Engine Oil

- a** - SAE 25W-40 viscosity oil may be used at temperatures above 4 °C (40 °F)
- b** - SAE 10W-30 viscosity oil is recommended for use in all temperatures

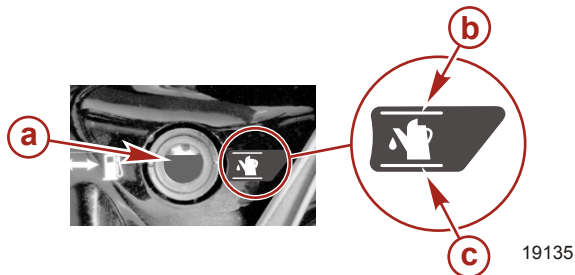
Checking Engine Oil

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

1. Position the outboard so it is sitting level.
2. Verify the oil level through the oil level inspection window. If the oil level is down toward the lower level mark, remove the oil fill cap, and fill up to the upper level mark.

NOTE: If oil level is at the lower mark, add 100 ml (3 oz.) of oil.

3. Reinstall the oil fill cap, and tighten securely.

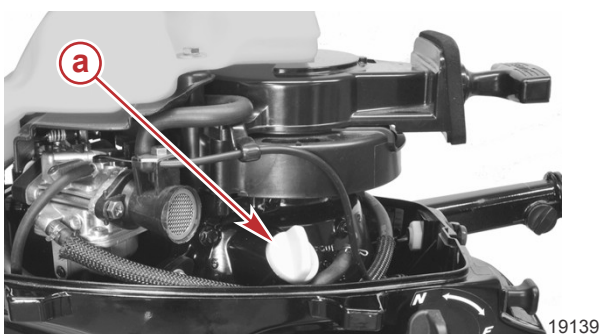


a - Oil level inspection window

b - Upper oil level

c - Lower oil level

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a - Oil fill cap

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Changing Engine Oil

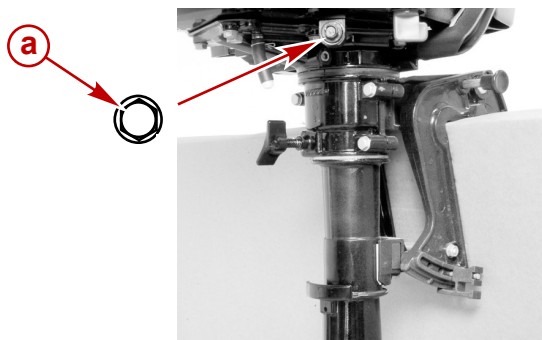
Engine Oil Capacity

Engine oil capacity is approximately 300 ml (10 fl. oz.).

Oil Changing Procedure

1. Place outboard in an upright (not tilted) position.
2. Turn 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.

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



a - Drain plug

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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 300 ml (10 fl. oz.) of oil. Reinstall the oil fill cap.

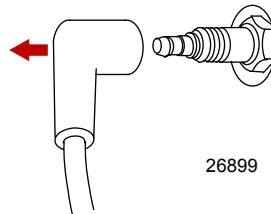
Idle engine for five minutes and check for leaks. Stop engine and check oil level. Add oil if necessary.

Spark Plug Inspection and Replacement

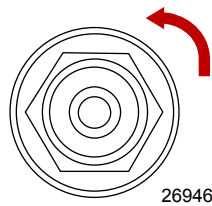
⚠ WARNING

Damaged spark plug boots may emit sparks which can ignite fuel vapors under the engine cowl, resulting in serious injury or death from a fire or explosion. To avoid damaging the spark plug boots, do not use any sharp object or metal tool to remove the spark plug boots.

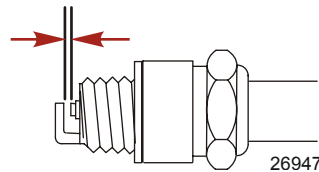
1. Remove the spark plug boot. Twist the rubber boot slightly and pull off.



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



3. Set the spark plug gap to specification.



Spark Plug	
Spark plug gap	0.9 mm (0.035 in.)

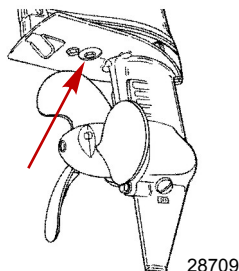
4. Before installing spark plug, clean off any dirt on the spark plug seat. Install plug finger-tight, and then tighten 1/4 turn or torque to specifications.

Description	Nm	lb-in.	lb-ft
Spark plug	27		20

Corrosion Control Anode

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

The anode requires periodic inspection especially in saltwater 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.

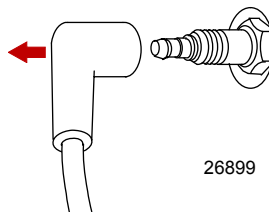


Propeller Replacement

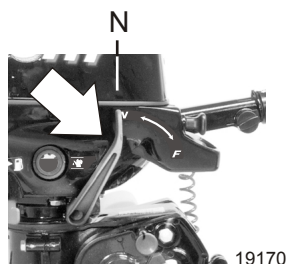
⚠ WARNING

Rotating propellers can cause serious injury or death. Never operate the boat out of the water with a propeller installed. Before installing or removing a propeller, place the drive unit in neutral and engage the lanyard stop switch to prevent the engine from starting. Place a block of wood between the propeller blade and the anti-ventilation plate.

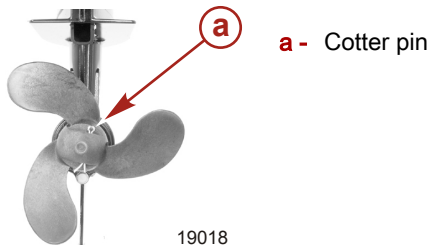
1. Remove the spark plug lead to prevent the engine from starting.



2. Move the gear shift lever into neutral.

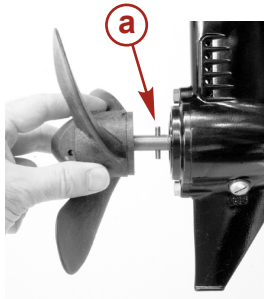


3. Straighten and remove the cotter pin.



Maintenance

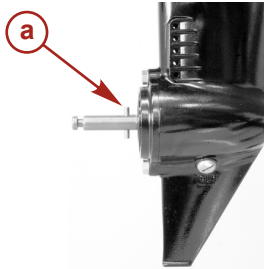
4. Pull the propeller straight off the shaft. Retain the drive pin. If the propeller is seized to the shaft and cannot be removed, have the propeller removed by an authorized dealer.



19022

a - Drive pin

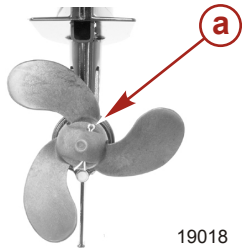
5. Insert the drive pin into the propeller shaft.



19023

a - Drive pin

6. Slide the propeller onto the shaft, making sure the slot in the propeller engages with the drive pin.
7. Install the cotter pin through the hole in the propeller and bend the cotter pin ends.



19018

a - Cotter pin

Gearcase Lubrication

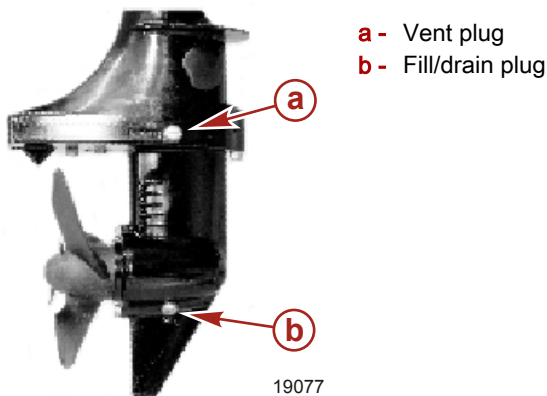
When adding or changing gearcase lubricant, visually check for the presence of water in the lubricant. If water is present, it may have settled to the bottom and will drain out prior to the lubricant, or it may be mixed with the lubricant, giving it a milky colored appearance. If water is noticed, have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

Examine the drained gearcase lubricant for metal particles. A small amount of 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 Gearcase

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

NOTE: Replace the sealing washers with new washers.

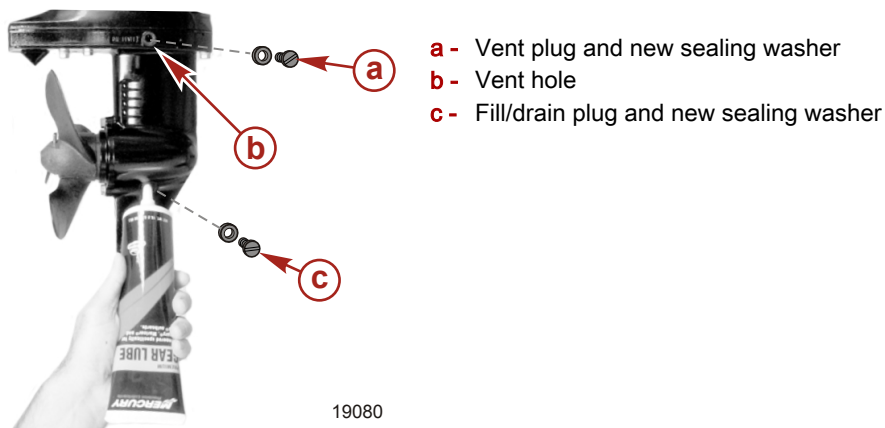



Gearcase Lubricant Capacity

Gearcase lubricant capacity is approximately 180 ml (6.0 fl oz).

Checking Lubricant Level and Refilling Gearcase

1. Place the outboard in a vertical operating position.
2. Remove vent plug.
3. Remove fill/drain plug. Place lubricant tube into the fill hole and add lubricant until it appears at the vent hole.





Tube Ref No.	Description	Where Used	Part No.
 82	Premium Gear Lubricant	Gearcase	92-858058K01

4. Stop adding lubricant. Use new sealing washer and install the vent plug before removing the lubricant tube.
5. Remove lubricant tube and reinstall cleaned fill/drain plug and new sealing washer.

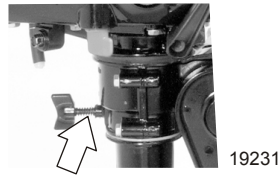
Lubrication Points

Lubricate the following with Quicksilver or Mercury Precision Lubricants 2-4-C with PTFE or Special Lubricant 101.

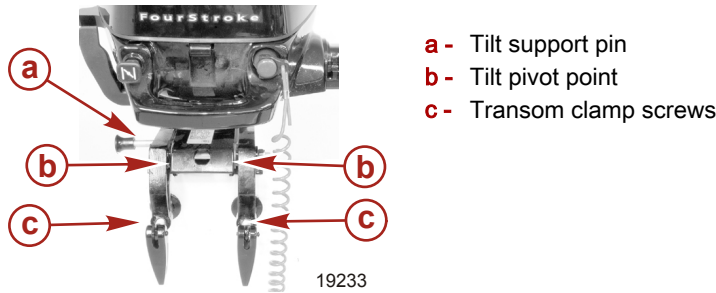
Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Steering friction knob threads, swivel bracket bushing, tilt support pin, transom clamp screws	92-802859A 1
 34	Special Lubricant 101	Steering friction knob threads, swivel bracket bushing, tilt support pin, transom clamp screws	92-802865Q02

Maintenance

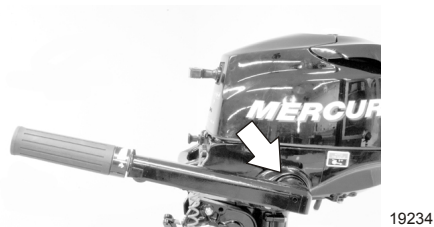
- Steering friction knob - lubricate threads.



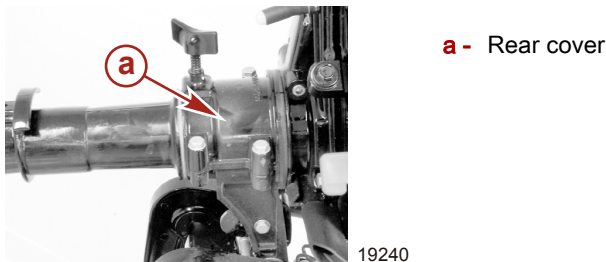
- Tilt support pin - lubricate pin
- Transom clamp screws - lubricate threads
- Tilt pivot point - lubricate with lightweight oil



- Tiller handle rubber bushing - lubricate internal diameter with lightweight oil.



- Swivel bracket - remove four bolts and rear cover and lubricate the inner nylon bushing.



Storage Preparation

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

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

NOTICE

Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.

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 and engine fuel system.

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

- Pour the required amount of gasoline stabilizer (follow instructions on container) into the fuel tank. Tip the fuel tank back and forth to mix stabilizer with the fuel.
- Place the outboard in water. Run the engine for five minutes to allow treated fuel to reach the carburetor.

Protecting External Outboard Components

- Lubricate all outboard components listed in **Maintenance - Inspection and Maintenance Schedule**.
- Touch up any paint nicks. See your dealer for touch-up paint.
- Spray Quicksilver or Mercury Precision Lubricants Corrosion Guard on external metal surfaces (except corrosion control anodes).

Tube Ref No.	Description	Where Used	Part No.
120	Corrosion Guard	External metal surfaces	92-802878 55

Protecting Internal Engine Components

- Remove the spark plug and inject a small amount of engine oil inside the cylinder.
- Rotate the flywheel manually several times to distribute the oil in the cylinder. Reinstall spark plug.
- Change the engine oil.

Gearcase

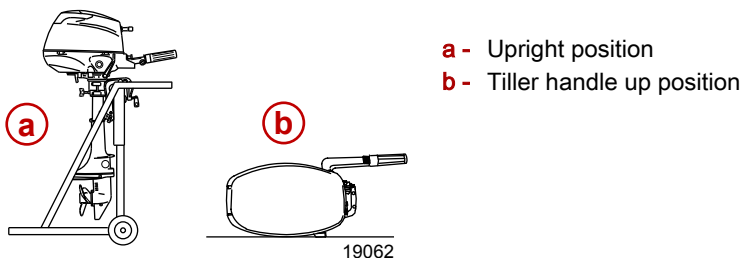
- Drain and refill the gearcase lubricant (refer to **Gearcase Lubrication**).

Positioning Outboard for Storage

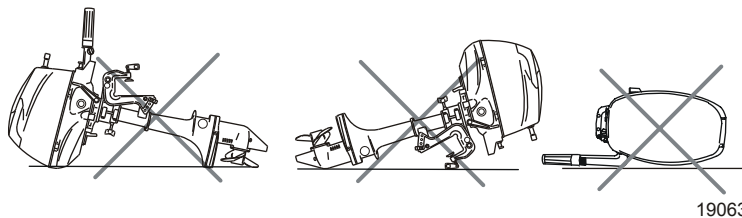
NOTICE

Storing the outboard in a tilted position can damage the outboard. Water trapped in the cooling passages or rain water collected in the propeller exhaust outlet in the gearcase can freeze. Store the outboard in the full down position.

1. Carry, transport, or store the outboard only in the following two positions. These positions will prevent oil from draining out of the crankcase.



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



Notes:

Important Information

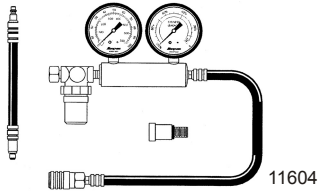
Section 1C - General Information

**1
C**

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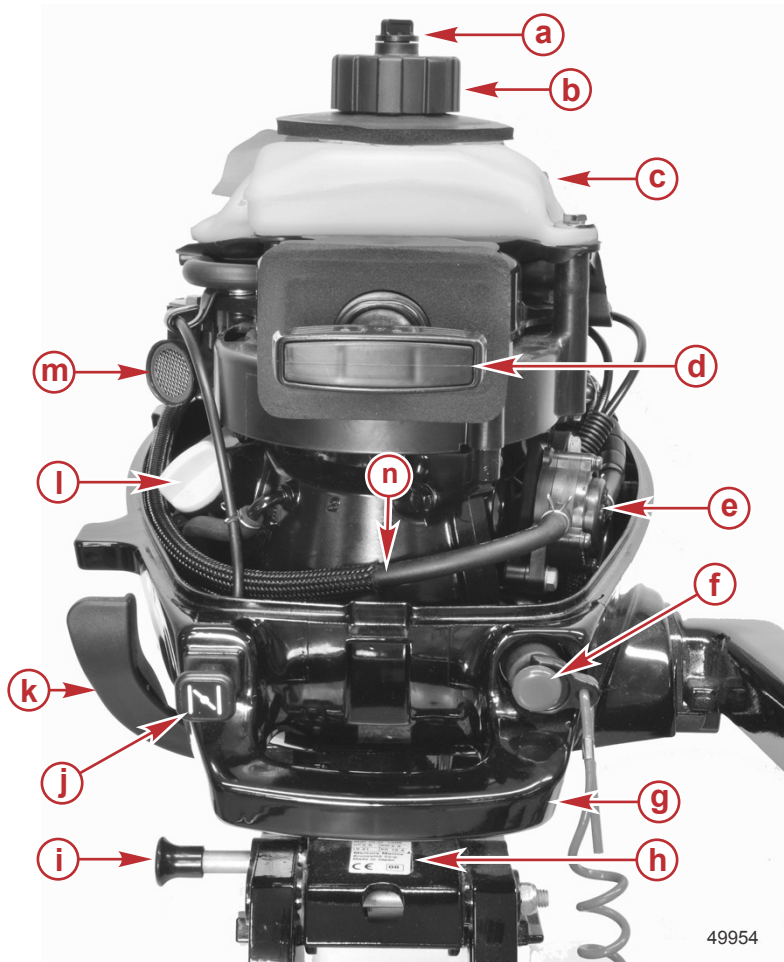
Component Identification.....	1C-2	Saltwater Submersion (Special Instructions).....	1C-8
2/2.5/3.5 FourStroke Front View.....	1C-2	Fresh Water Submersion (Special Instructions).....	1C-8
2/2.5/3.5 FourStroke Starboard View.....	1C-3	Compression Check.....	1C-9
2/2.5/3.5 FourStroke Aft View.....	1C-4	Cylinder Leakage Testing.....	1C-9
2/2.5/3.5 FourStroke Port View.....	1C-5	Painting Procedures.....	1C-9
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Instructions).....	1C-8	General Cleaning Instruction.....	1C-12

Special Tools

Cylinder Leakage Tester	Snap-On EEPV309A
 11604	Aids in checking cylinder leakdown.

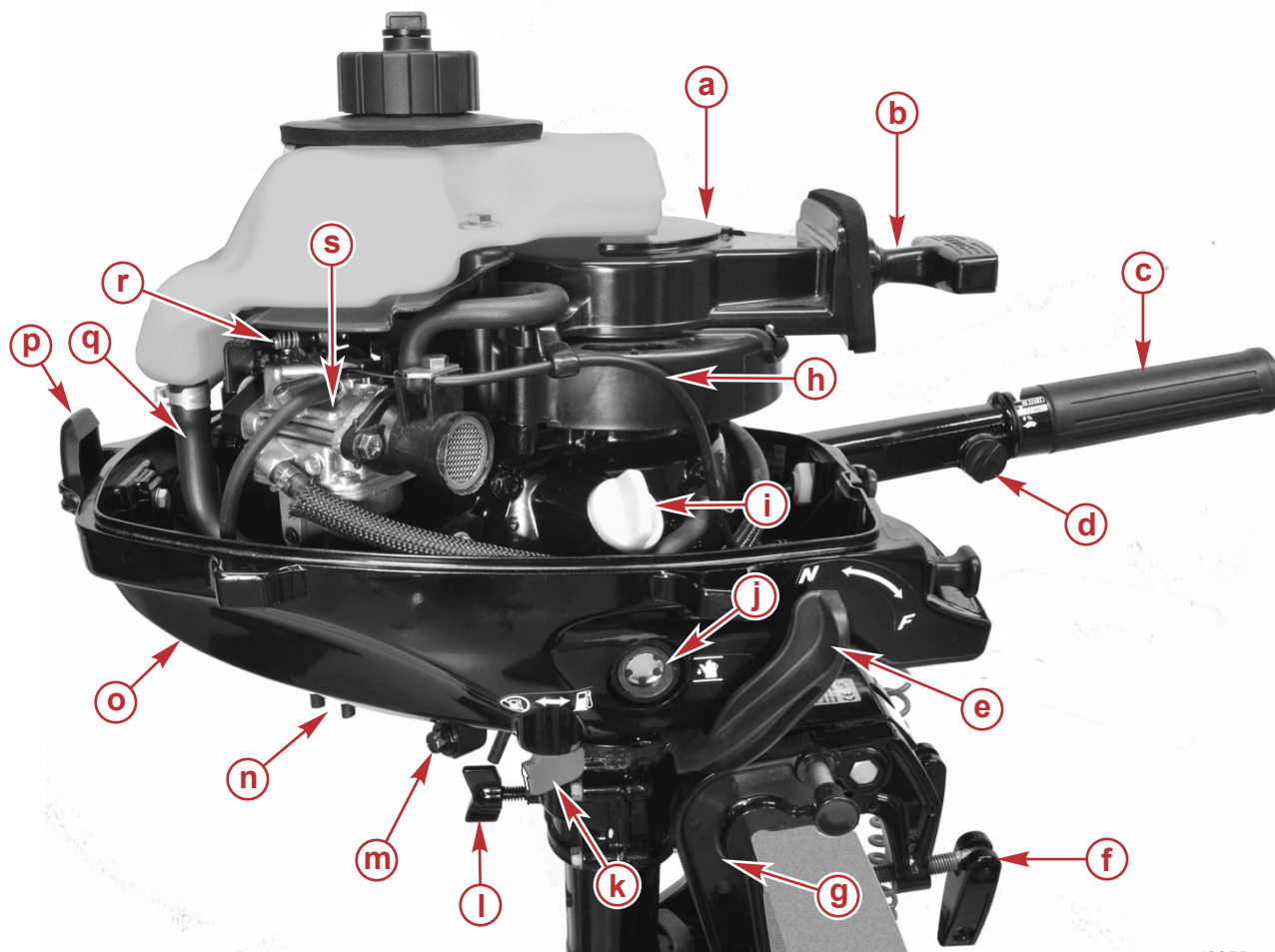
Component Identification

2/2.5/3.5 FourStroke Front View



- a** - Fuel cap vent
- b** - Fuel cap
- c** - Fuel tank
- d** - Recoil starter handle
- e** - Fuel pump
- f** - Stop switch with lanyard
- g** - Carry handle
- h** - Model decal
- i** - Tilt stopper
- j** - Choke knob
- k** - Shift lever
- l** - Oil fill cap
- m** - Air silencer
- n** - Fuel pump to carburetor hose

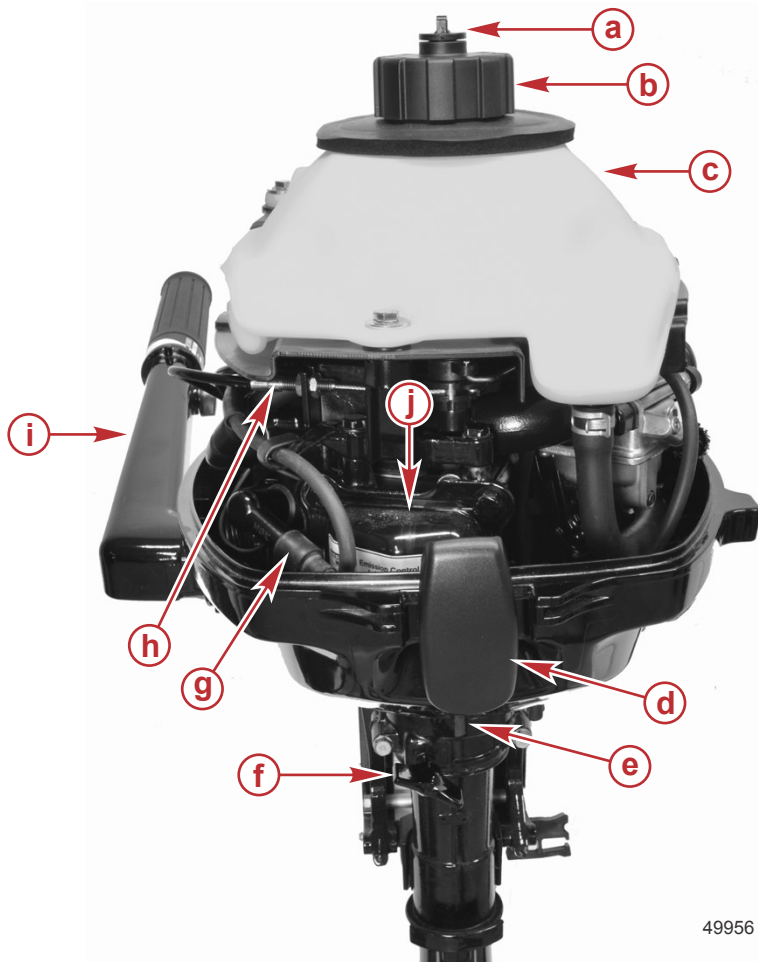
2/2.5/3.5 FourStroke Starboard View



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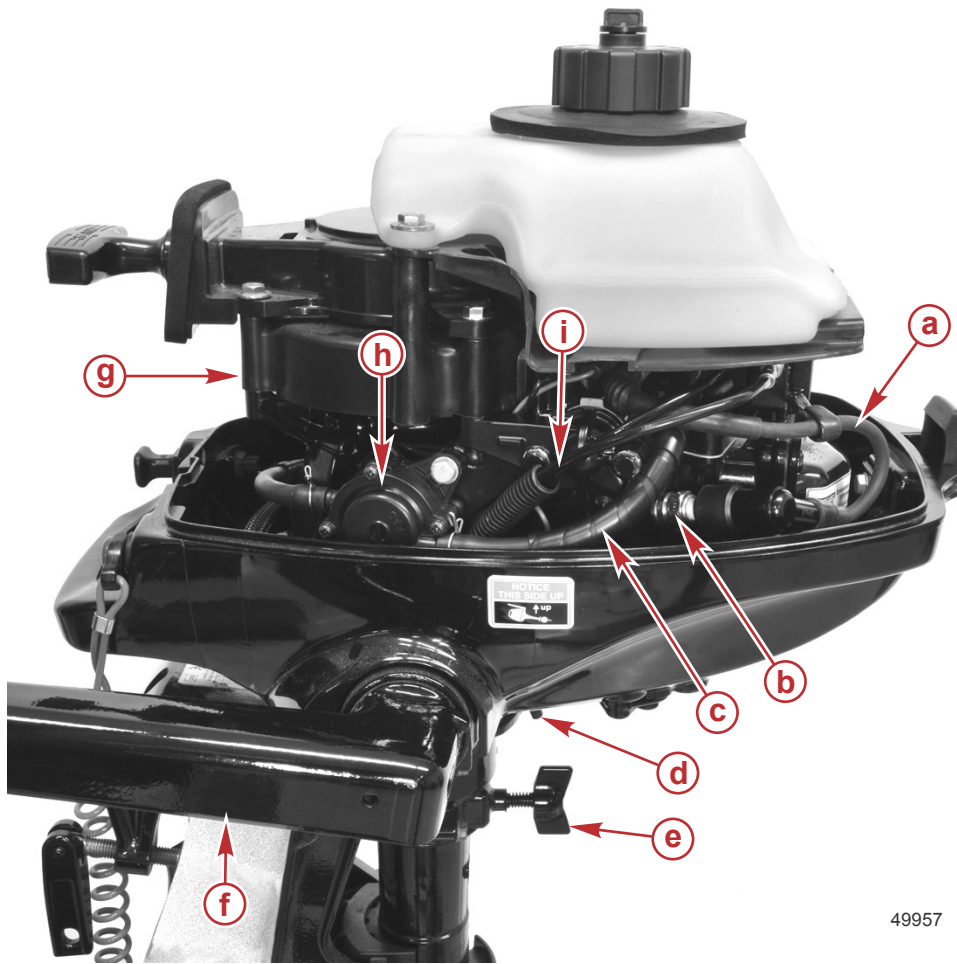
- a** - Recoil starter
- b** - Recoil starter handle
- c** - Throttle grip
- d** - Throttle friction knob
- e** - Shift lever
- f** - Clamp handle
- g** - Clamp bracket
- h** - Choke cable
- i** - Oil fill cap
- j** - Oil level sight window
- k** - Fuel tank on/off valve
- l** - Steering friction knob
- m** - Oil drain plug
- n** - Carburetor vent hoses
- o** - Bottom cowl
- p** - Rear cowl latch
- q** - Fuel tank outlet hose
- r** - Idle speed screw
- s** - Carburetor

2/2.5/3.5 FourStroke Aft View



- a** - Fuel cap vent
- b** - Fuel cap
- c** - Fuel tank
- d** - Rear cowl latch
- e** - Water pump indicator hose
- f** - Steering friction knob
- g** - Spark plug boot
- h** - Throttle cables
- i** - Tiller handle
- j** - Cylinder head cover

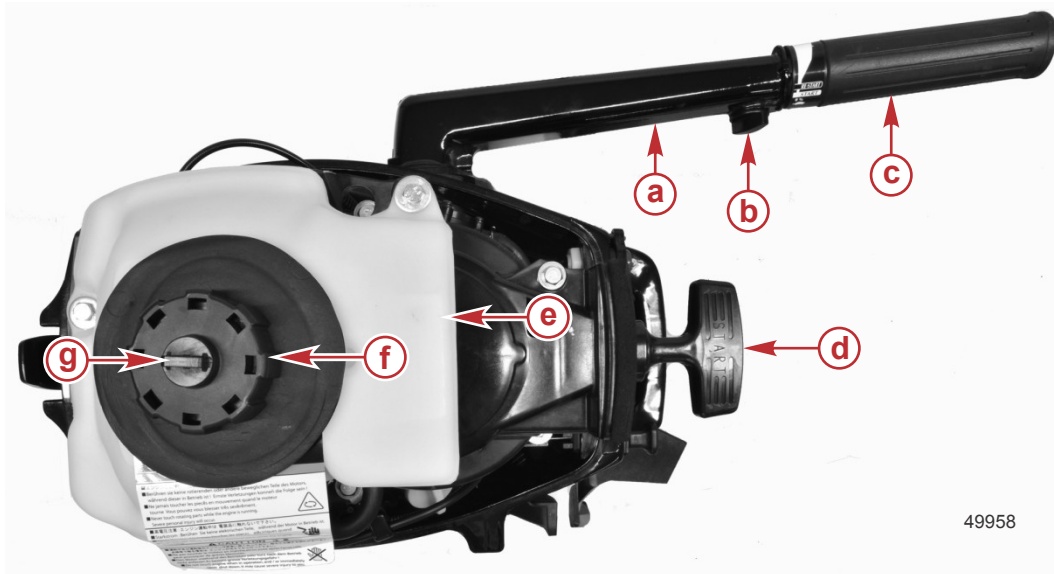
2/2.5/3.5 FourStroke Port View



- a** - High tension lead
- b** - Spark plug
- c** - Fuel pump pulse hose
- d** - Water pump indicator hose
- e** - Steering friction knob
- f** - Tiller handle
- g** - Flywheel cover
- h** - Fuel pump
- i** - Throttle cables

49957

2/2.5/3.5 FourStroke Top View



- a - Tiller handle
- b - Throttle friction knob
- c - Throttle twist grip
- d - Recoil starter handle
- e - Fuel tank
- f - Fuel cap
- g - Fuel cap vent

Conditions Affecting Performance

Weather

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

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

Summer conditions of high temperature, low barometric pressure, and high humidity all combine to reduce the engine power. This, in turn, is reflected in decreased boat speeds as much as 3 to 5 km/h (2 to 3 MPH) in some cases. Nothing will regain this speed for the boater but cooler, dry weather.

Pointing out the consequences of weather effects, an engine running on a hot, humid day may encounter a loss of as much as 14% of the horsepower it would produce on a dry, brisk day. The horsepower that any internal combustion engine produces, depends upon the density of the air that it consumes. The density of air is dependent upon the ambient air temperature, the barometric pressure, and the humidity (water vapor) content.

Accompanying the effects of weather inspired loss of power is a second, but more subtle loss. Consider a boat rigged during cooler, less humid weather with a propeller that allowed the engine to turn within its recommended RPM range at full throttle. Higher temperatures with high humidity weather will consequently decrease the available horsepower. The propeller, in effect, is too large for the atmospheric conditions and the engine operates at less than its recommended RPM.

The engine rated horsepower is a direct relation to the engines' RPM. An engine with too large a propeller will have a further loss of horsepower and subsequent decrease in boat speed. This secondary loss of RPM and boat speed can be regained by switching to a smaller pitch propeller that allows the engine to run at recommended RPM.

For boaters to realize optimum engine performance under changing weather conditions, it is essential the engine has 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, the engine will be operating in an RPM range that discourages damaging detonation. This enhances overall reliability and durability of the engine.

Weight Distribution (Passengers and Gear) Inside the Boat

Shifting weight to rear (stern):

- Generally increases speed and engine RPM
- Causes bow to bounce in choppy water
- Increases danger of following wave splashing into the boat when coming off plane
- At extremes, can cause the boat to porpoise

Shifting weight to front (bow):

- Improves ease of planing
- Improves rough water ride
- At extremes, can cause the boat to veer back and forth (bow steer)

Bottom of Boat

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.

- **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.
- **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.
- **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-the-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 occurs when water flow cannot follow the contour of a fast-moving underwater object, such as a gear housing or a propeller. Cavitation increases propeller speed while reducing boat speed. Cavitation can seriously erode the surface of the gear housing or the propeller. Common causes of cavitation are:

- Weeds or other debris snagged on the propeller
- Bent propeller blade
- Raised burrs or sharp edges on the propeller

Elevation and Climate

Elevation and climate changes will affect the performance of your power package. Loss of performance can be caused by:

- Higher elevations
- Higher temperatures
- Low barometric pressures
- High humidity

For you to have optimum engine performance under changing weather conditions, it is essential that the engine be propped to allow the engine to operate at or near the top end of the specified maximum RPM range with a normal boat load during your normal boating weather conditions.

In most cases, recommended RPM can be achieved by changing to a lower pitch propeller.

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

General Information

- 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
- Deteriorated or inadequate engine cooling system
- Combustion chamber deposits: result in higher compression ratio

Detonation usually can be prevented if:

- The engine is correctly set up
- Regular maintenance is scheduled

Propeller Selection

IMPORTANT: The engines covered in this manual are equipped with an RPM rev-limiter that is set to an upper RPM limit. This limit, which is slightly above the normal operating range of the engine, helps prevent damage from excessive engine RPM. Once the RPM returns to the recommended operating RPM range, normal engine operation resumes.

The boat manufacturer and the selling dealer are responsible for equipping the power package with the correct propeller. Refer to Mercury Marine's web page <http://www.mercurymarine.com> for information.

Select a propeller that will allow the engine power package to operate at or near the top end of the recommended WOT operating RPM range with a normal load.

If full-throttle operation is below the recommended range, the propeller must be changed to prevent loss of performance and possible engine damage. On the other hand, operating an engine above the recommended operating RPM range will cause higher than normal wear and damage.

After initial propeller selection, the following common problems may require that the propeller be changed to a lower pitch.

- Warmer weather and greater humidity cause a loss of RPM.
- Operating in a higher elevation causes a loss of RPM.
- Operating with a dirty boat bottom causes a loss of RPM.
- Operating with increased load (additional passengers, pulling skiers) causes a loss of RPM.

For better acceleration, such as is needed for waterskiing, use the next lower pitch propeller. When not pulling skiers, do not operate at full throttle when using the lower pitch propeller.

Following Complete Submersion

Engine Submerged While Running (Special Instructions)

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

Saltwater Submersion (Special Instructions)

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

Fresh Water Submersion (Special Instructions)

1. Recover the engine as quickly as possible.
2. Remove the cowling.
3. Flush the exterior of the outboard with fresh water to remove mud, weeds, etc. Do not attempt to start the engine if sand has entered the powerhead. Disassemble the powerhead if necessary to clean the components.
4. Remove the spark plug and get as much water as possible out of the powerhead. Most of the water can be eliminated with portable engines by placing the engine in a horizontal position (with spark plug hole down) and rotating the flywheel.
5. Turn the engine over and pour alcohol into the spark plug opening and rotate the flywheel.
6. Again turn the engine over and pour approximately one teaspoon of engine oil into the spark plug opening. Rotate the flywheel to distribute the oil in the cylinder.
7. Dry all of the wiring and electrical components using compressed air.
8. Reinstall the spark plug.
9. Change the engine oil.
10. Attempt to start the engine using a fresh fuel source. If the engine starts, run the outboard for a short time and check for the presence of water in the oil. If water is present, the oil will appear milky. Drain and replace the oil as previously mentioned. If no water is present, restart the engine and run it for at least one hour to eliminate any water in the engine.

- If the engine fails to start, determine if the cause is fuel, electrical, or mechanical. The engine should be run within two hours after recovery from the water, or serious internal damage will occur. If unable to start the engine within two hours of recovery, disassemble the engine and clean all parts. Apply oil as soon as possible.

Compression Check

- Remove the spark plug.
- Install the compression gauge in the spark plug hole.
- Hold the throttle plate at WOT.
- Pull on the recoil rope to crank the engine over until the compression reading peaks on the gauge. Record the reading.
- A 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 tune-up.
- Cylinder scoring: If powerhead shows any indication of overheating, such as discolored or scorched paint, visually inspect cylinders for scoring or other damage as outlined in **Section 4 - Powerhead**.

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 manufacturer's tester instructions for proper testing procedures.

NOTE: Spark plug hole is a 14 mm diameter. Use Snap-On Tool MT26J-200 adapter (or equivalent) with valve core removed.

Cylinder Leakage Tester	Snap-On EEPV309A
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- Remove the spark plug.
- Rotate the engine clockwise until resistance is felt.
- Continue to rotate flywheel so the timing marks on the flywheel and cylinder block are in alignment. This will be the compression stroke for the cylinder.
- Complete the cylinder leak down test. Refer to the manufacturer's tester instructions for proper testing procedures.

Analysis

Due to standard engine tolerances and engine wear, no cylinder will maintain a 0% of leakage. Leakage greater than 15% indicates excessive leakage.

If excessive leakage is present, first check that the piston is at top dead center of its 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 through the intake, adjacent spark plug holes, exhaust pipe, and crankcase oil fill plug. Use the following table to aid in locating the source of cylinder leakage.

Air Escaping from	Possible Location
Air induction	Intake valve
Exhaust system	Exhaust valve
Oil fill plug	Piston/rings
Tell-tale hose	Head gasket

Painting Procedures

WARNING

Continuous exposure to airborne particles such as chemical vapors, dust, or spray can cause serious injury or death. Ensure that the work area is properly ventilated and wear protective eyewear, clothing, and respirators.

Propellers

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

Gear Housing

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 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.

1. Wash the gear housing with a muriatic acid base cleaner to remove any type of marine growth, and rinse with water.
2. Wash the gear housing with soap and water. Rinse with clean water.
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 aerosol spray paints as the paint will not properly adhere to the surface, nor will the coating be sufficiently thick to resist future paint blistering.
6. Mix Epoxy Chromate Primer DP-90LF with equal part catalyst DP-402LF per the manufacturer's instructions. Allow 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 the top coat application.
8. Use Ditzler Urethane DU9300 for Mercury Black, DU34334 for Mariner Grey, DU35466 for Force Charcoal, DU33414M for Sea Ray White, and DFHS 37372H for Verado Silver. Catalyze all five colors with Ditzler DU5 catalyst mixed 1:1 ratio. Reduce with solvents per Ditzler label.

WARNING

Continuous exposure to airborne particles such as chemical vapors, dust, or spray can cause serious injury or death. Ensure that the work area is properly ventilated and wear protective eyewear, clothing, and respirators.

NOTE: Apply one half to one mil even film thickness with a spray gun. Allow the paint to flash off for five minutes before applying the second even coat of one half to one mil film thickness. 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 the sacrificial 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 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.

Surface Preparation

Application Temperature

Apply the decal when the surface and ambient air temperature is between 16–37.3 °C (61–99 °F).

NOTE: Applying the decal near the minimum temperature specification, the adhesive bond will develop more slowly than temperature in the mid to upper specification range.

Step One General Cleaning

IMPORTANT: Do not shortcut the cleaning process. All of the surfaces are considered contaminated prior to a thorough surface cleaning preparation.

1. Mix a solution of 29.5 cc (1 fl oz) Joy or Dawn liquid dishwashing detergent with 3.7 Liter (4 US qt) of warm water.
2. Rinse cowl with clean water.
3. Dry the cowl with a clean Meguiar's Supreme Shine Microfiber Towel.
4. Avoid detergents or preparations that contain waxes, oils, or lotions.

Step Two Solvent Cleaning

1. Mix a solution of isopropyl alcohol and water to a 1:1 ratio. Store in a spray bottle and identify the solution with a label.

2. Saturate a clean paper towel with the isopropyl alcohol and water solution.
3. Wipe the cowl with the saturated towel followed immediately with a lint-free towel before the solution evaporates.
NOTE: Isopropyl alcohol evaporates quickly. You must wipe the surface immediately after applying the solution.
4. When the paper towel becomes contaminated with dirt, discard it and use a clean paper towel saturated with the isopropyl alcohol and water solution.
5. Ensure the surface has no contamination and is completely dry.
6. Start to apply the decals immediately after solvent cleaning.

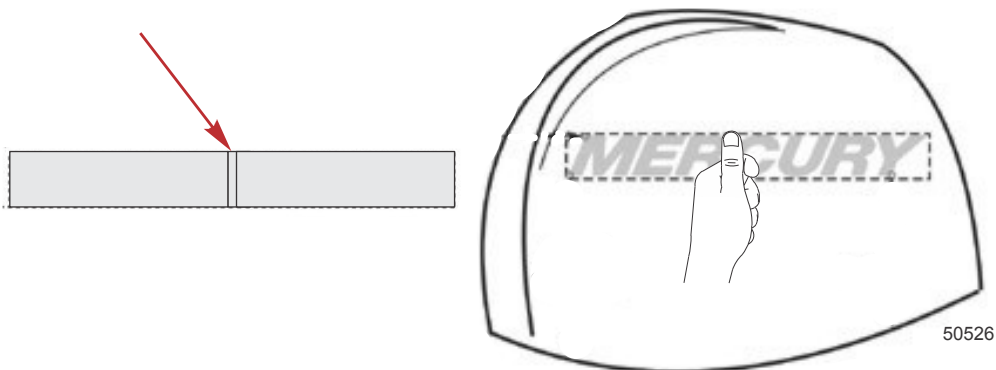
Decal Application

Application Tips

1. Ensure the surrounding work area and the surface are properly cleaned to avoid contamination.
2. Ensure the surface and the ambient air temperature is within the specified range.
3. Ensure your hands are clean and dry.
4. Ensure the paper liner on the decal does not become wet. A wet paper liner is very difficult to remove.
5. Use the recommended plastic applicator. The applicator should be new and must not be damaged.
 - a. If the decal has a premask, use the squeegee only.
 - b. If the decal does not have a premask, use a low friction sleeve or felt squeegee to prevent scratching or damaging the decal and cowl.
6. Use firm pressure on the squeegee with overlapping strokes.
7. Remove the premask and application tape at a 180° angle to the decal.
8. Puncture the air bubbles with an air release tool or straight pin. Do not use a knife or razor blade.
9. Immediately squeegee the entire decal after removing the premask tape.

Applying the Decal

1. Ensure your hands are clean and dry.
2. Remove the center paper liner strip from decal if applicable.
3. Align the decal according to the reference placement drawing and apply light pressure on the center strip location.



4. Align the decal and secure one side of the decal with your hand.
5. Lightly hinge the decal in half to expose the liner tape and remove the liner paper.
6. Apply a little tension to the decal and squeegee the entire decal from the center towards the outside edge with overlapping strokes.
7. Lightly hinge the other half of the decal to expose the liner tape and remove the liner paper.
8. Apply a little tension to the decal and squeegee the entire decal from the center towards the outside edge with overlapping strokes. Ensure to overlap the outside edge of the decal with the squeegee.
9. Inspect the decal closely for entrapped air bubbles. Use the squeegee to push the air bubble to the outside edge.
10. Remove the premask liner from the decal beginning at one corner and carefully pull the premask liner off and onto itself at a 180° angle.

IMPORTANT: When the premask is removed from the decal, the pulling force loosens the adhesive at the edges of the decal. It is imperative to squeegee the entire decal with special attention to the edges of the decal.



11. Do not allow the premask to remain on the decal for more than 24 hours after installation.
12. Squeegee the complete decal including all edges after the premask liner has been removed.

Entrapped Air Removal

The micro-comply adhesive has a unique pattern to the adhesive that allows entrapped air to escape through very small channels for a faster, easier installation. Always work from the center of the decal towards the edge. If the channels are closed off, use an air release tool or straight pin to aid in removing the bubble. Puncture one end of the bubble and use your thumb to push the entrapped air towards the puncture site. Do not use a knife or razor blade to puncture the decal.

Final Decal Squeegee

It is recommended to use a Meguiar's Supreme Shine Microfiber Towel for the final decal squeegee. With a firm hand pressure, work the decal from the center out to the edge. Ensure to pay attention to the edge of the decal during this final decal squeegee.

IMPORTANT: It is imperative to squeegee the entire decal with special attention to the edges of the decal.

IMPORTANT: Do not allow the new decal to have direct sunlight contact for a minimum of 24 hours.

Cleaning and Maintenance

IMPORTANT: Never use petroleum products or strong household cleaning chemicals to clean the outside surface of the cowls. Using petroleum products or strong household cleaning chemicals will cause damage to the decal and may damage the cowl.

IMPORTANT: Pressure wash and scrub brush with caution. Always use a wide spray pattern, low-pressure, and an angle less than 60° to the surface when using a pressure washer. Low angle water streams can lift the decal from the surface.

General Cleaning Instruction

- Rinse the surface well with lukewarm water to remove dirt.
- Use a soft cloth or sponge to gently wash the surface with a mild dishwashing soap with lukewarm water.
- Do not scrub, use a brush, or a squeegee.
- Rinse the surface thoroughly.
- Use a clean, soft, lint-free cloth to dry and prevent water spotting.

Important Information

Section 1D - Outboard Installation



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Boat Horsepower Capacity.....	1D-2	Installing the Outboard on the Transom.....	1D-2
Selecting Accessories for Your Outboard.....	1D-2	Tilt Pin Adjustment.....	1D-3
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Boat Transom Height Requirement.....	1D-2	Installation Drawings.....	1D-4

Boat Horsepower Capacity

⚠ WARNING

Exceeding the boat's maximum horsepower rating can cause serious injury or death. Overpowering the boat can affect boat control and flotation characteristics or break the transom. Do not install an engine that exceeds the boat's maximum power rating.

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.

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

26777

Selecting Accessories for Your Outboard

Genuine Mercury Precision or Quicksilver Accessories have been specifically designed and tested for your outboard. These accessories are available from Mercury Marine dealers.

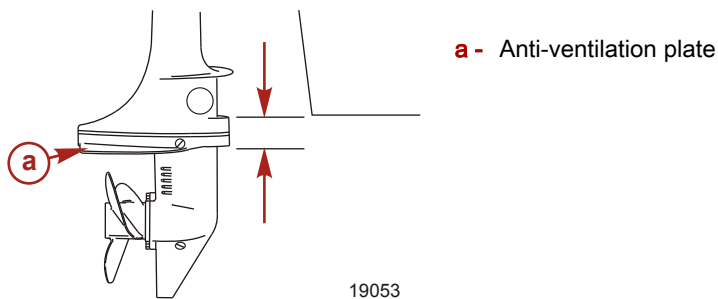
IMPORTANT: Check with your dealer before installing accessories. The misuse of approved accessories or the use of nonapproved accessories can damage the product.

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 the Outboard

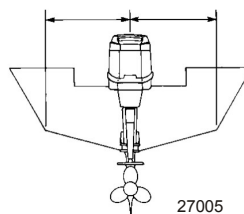
Boat Transom Height Requirement

Measure the transom height of the boat. The anti-ventilation plate should be 25–50 mm (1–2 in.) below the bottom of the boat.

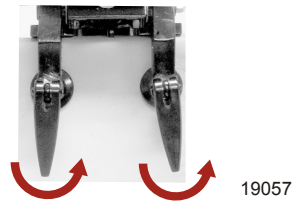


Installing the Outboard on the Transom

1. Place the outboard on the centerline of the transom.

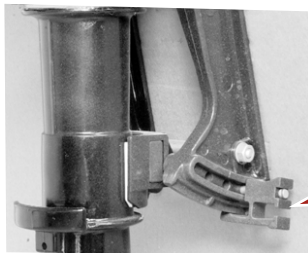


2. Tighten the transom clamp handles.



Tilt Pin Adjustment

1. The vertical operating angle of the 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.
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 the passengers and the load in the boat so the weight is distributed evenly.



a - Tilt pin

Engine Overspeed Protection System

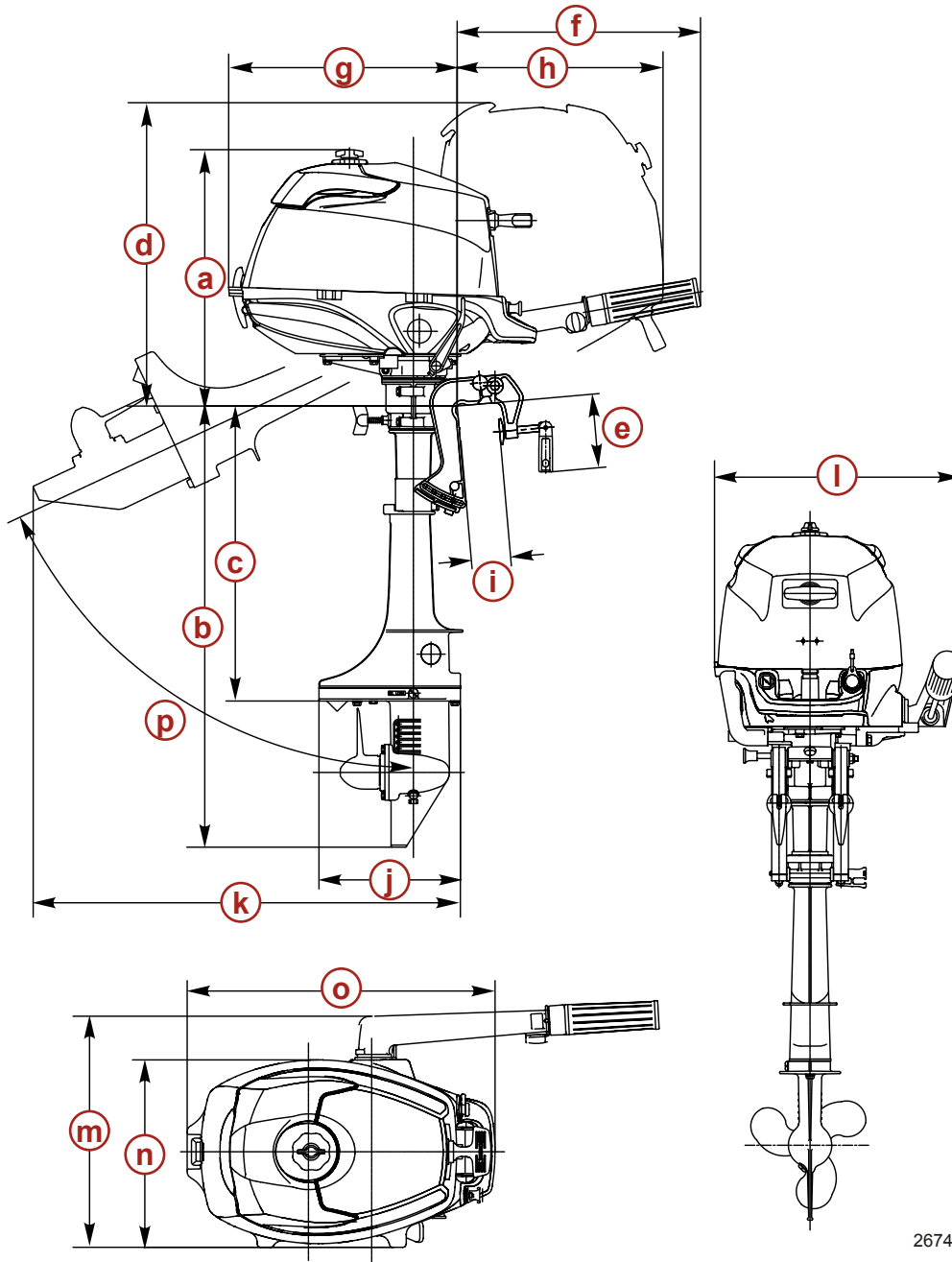
The system is activated if the engine speed should ever exceed the maximum allowable limit. This will protect the engine from mechanical damage.

Anytime the engine overspeed system is activated, the system will automatically reduce the engine speed to within the allowable limit. If the engine overspeed continues, the outboard should be inspected by an authorized mechanic.

NOTE: *The 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.*

Engine Overspeed Activation	
Activation RPM range	6300 ± 200 RPM

Installation Drawings



26743

Electrical

Section 2A - Ignition

Table of Contents


**2
A**

Ignition Specifications.....	2A-2	Ignition Coil Replacement.....	2A-8
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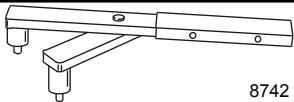

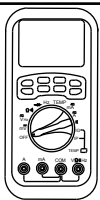

Ignition Specifications

Ignition Specifications at 20 °C (68 °F)	
Ignition type	Digital capacitor discharge ignition
Spark plug type	NGK DPR6E
Spark plug gap	0.8–0.9 mm (0.031–0.035 in.)
Ignition timing at idle	3° ± 3° BTDC
Ignition timing at WOT	25° ± 3 BTDC
ECM RPM limiter	
RPM overspeed	6300 ± 200 RPM
Ignition coil	
Primary	Sealed internal
Secondary	2.2 k ohms ± 15%
Ignition coil to flywheel gap	0.3 mm (0.012 in.)

Lubricants, Sealants, Adhesives

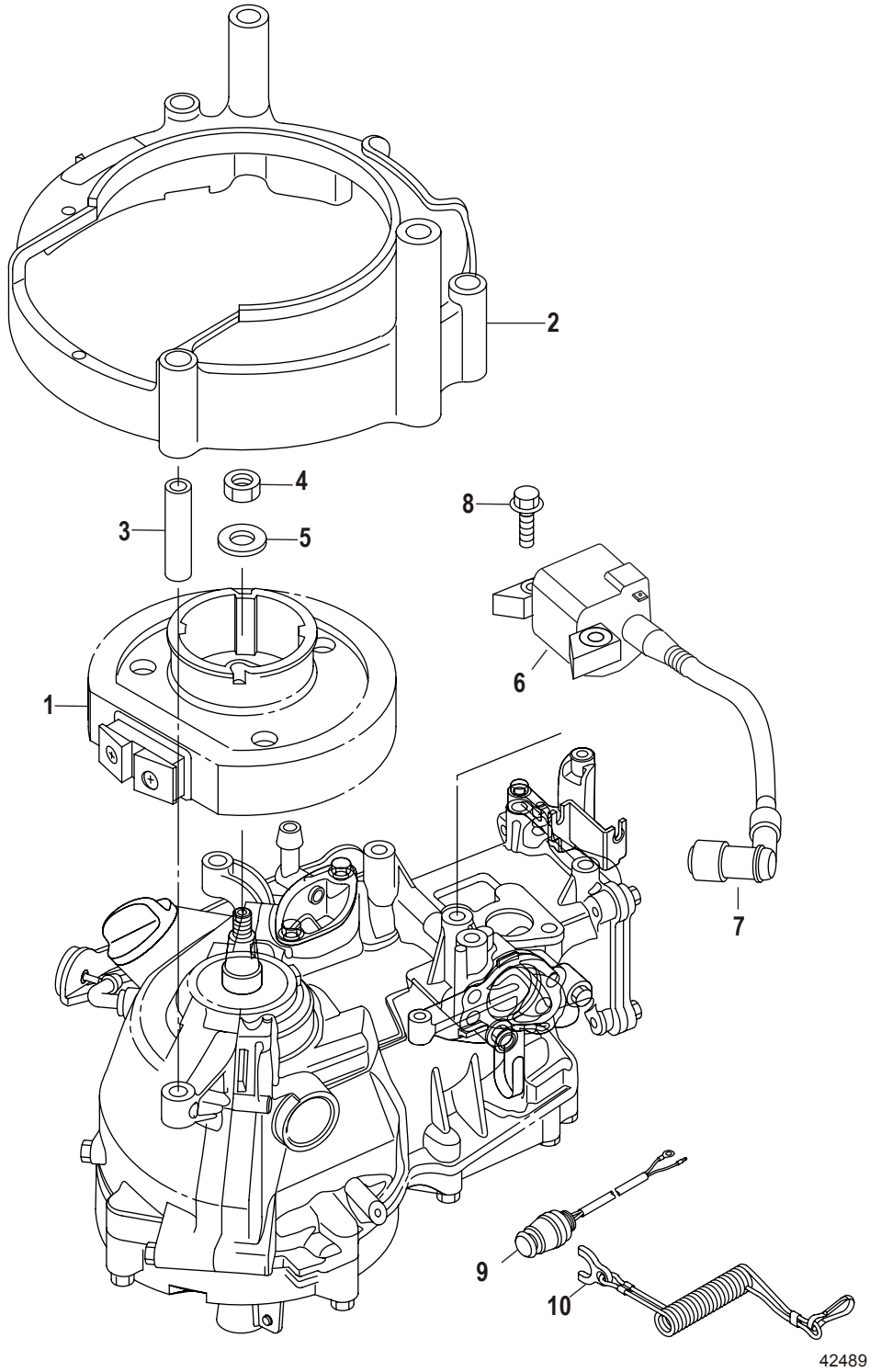
Tube Ref No.	Description	Where Used	Part No.
 66	Loctite 242 Threadlocker	Recoil starter assembly mounting bolts Fuel tank mounting bolts	92-809821

Special Tools

<p>Flywheel Holder</p>  <p>8742</p>	<p>91-83163M</p> <p>Holds and/or turns the flywheel while making engine repairs, also used to torque the flywheel or the engine coupler.</p>
<p>Puller Set</p>  <p>26245</p>	<p>FT8948-1</p> <p>Aids in the removal of the flywheel from the engine.</p>
<p>DMT 2004 Digital Multimeter</p>  <p>4516</p>	<p>91-892647A01</p> <p>Measures RPM on spark ignition (SI) engines, ohms, amperes, AC and DC voltages; records maximums and minimums simultaneously, and accurately reads in high RFI environments.</p>
<p>Timing Light</p>  <p>11561</p>	<p>91-99379</p> <p>Allows a technician to check ignition timing.</p>

Notes:

Flywheel and Ignition Components



42489

Flywheel and Ignition Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Flywheel			
2	1	Flywheel cover			
3	3	Collar			
4	1	Nut	45		33
5	1	Washer			
6	1	Ignition coil			
7	1	Spark plug lead			
8	2	Bolt (M6 x 20)	6	53	
9	1	Stop switch			
10	1	Lanyard			

Ignition System Description

A single digital capacitor discharge ignition (CDI) coil is utilized on this model. Major components of this system are the flywheel, ignition coil, and the spark plug. A stop switch is provided which shorts the ignition coil to ground preventing spark.

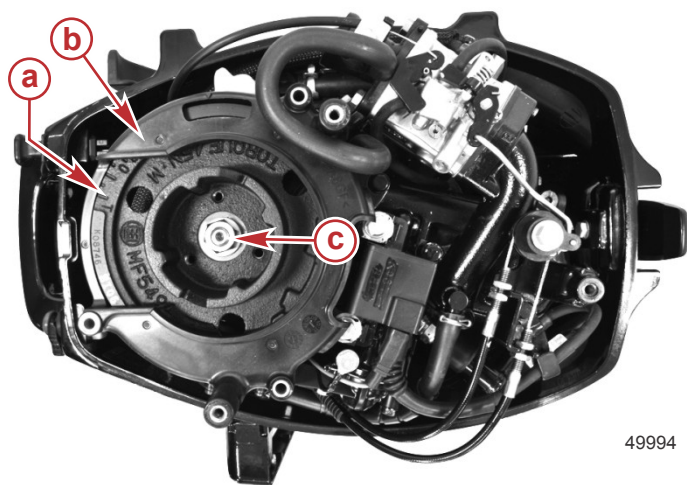
Flywheel Removal and Installation

Removal

⚠ WARNING

An unexpected engine start due to rotation of the flywheel may cause serious injury. During removal, installation, or adjustment of the flywheel, always remove the spark plug leads and isolate the leads to the engine ground.

1. Disconnect the spark plug lead from the spark plug.
2. Remove the fuel tank and recoil starter. Refer to **Section 8A - Recoil Starter**.
IMPORTANT: Use an approved container to collect and store the 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.
3. Remove the flywheel cover.
4. Use the flywheel holder to secure the flywheel. Remove the flywheel nut.



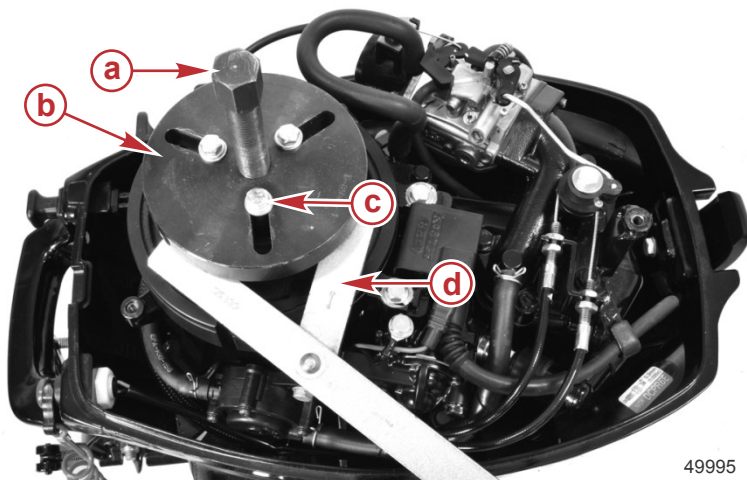
- a - Flywheel
- b - Cover
- c - Flywheel nut

49994

Flywheel Holder	91-83163M
-----------------	-----------

91-83163M

5. Attach the flywheel puller to the flywheel with three M6 x 60 bolts. Tighten the bolts to the specified torque.
6. Tighten the flywheel puller center screw until the flywheel is loose.
7. Remove the flywheel.



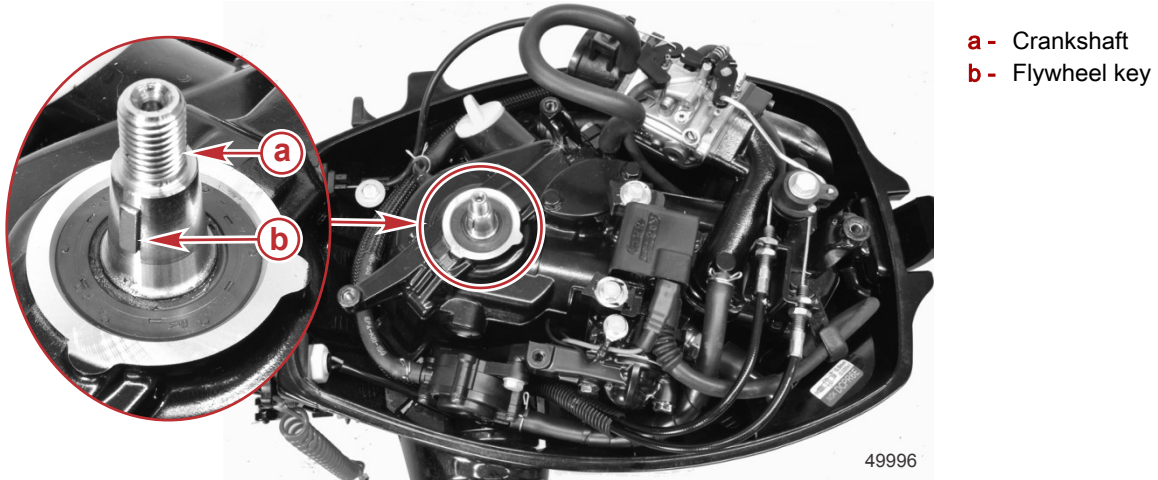
- a - Center screw
- b - Flywheel puller
- c - Bolts (M6 x 60) (3)
- d - Flywheel holder

49995

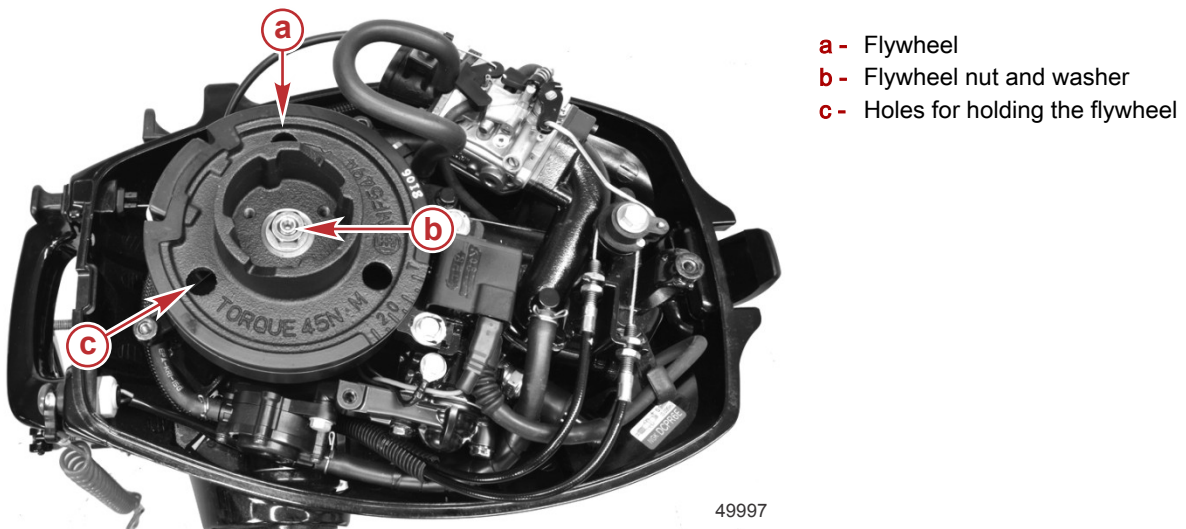
Puller Set	FT8948-1		
Description	Nm	lb-in.	lb-ft
Flywheel puller bolts	6	53	

Installation

1. Install the flywheel key into the crankshaft keyway.

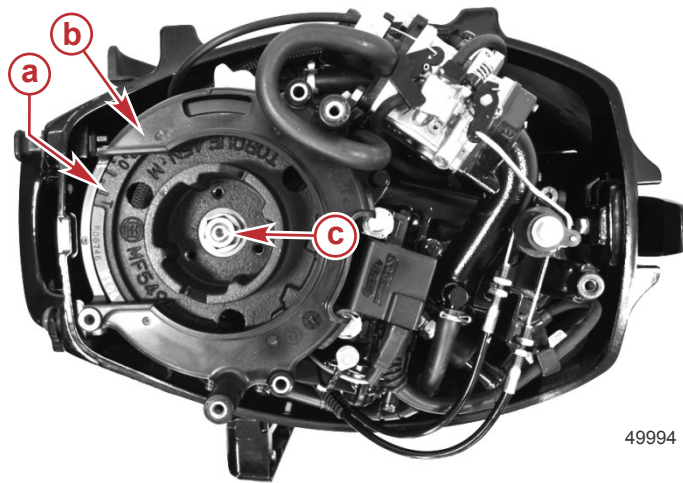


2. Align the flywheel keyway with the key. Install the flywheel onto the crankshaft. Ensure the flywheel is fully seated on the crankshaft taper.
3. Install the washer and flywheel nut.
4. Use the flywheel holding tool to hold the flywheel. Tighten the flywheel nut to the specified torque.



Flywheel Holder	91-83163M		
Description	Nm	lb-in.	lb-ft
Flywheel nut	45		33

5. Install the flywheel cover.



- a - Flywheel
- b - Cover
- c - Flywheel nut

49994

6. Install the recoil starter and fuel tank. Refer to **Section 8A - Recoil Starter**.
7. Connect the spark plug lead to the spark plug.

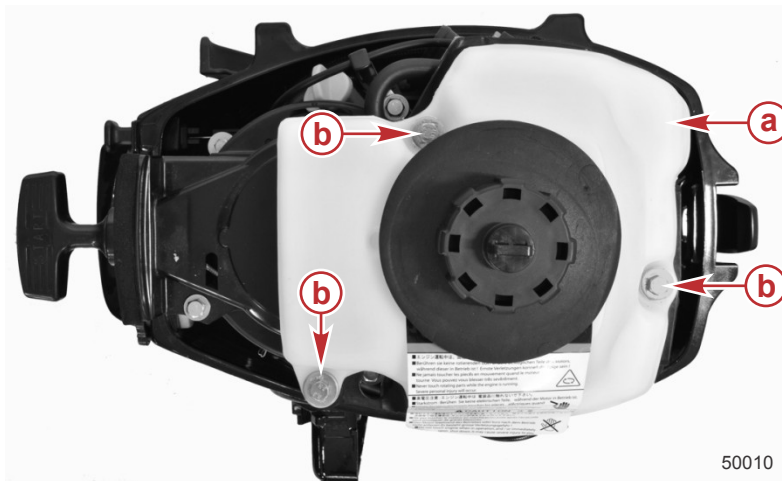
Ignition Coil Replacement

Removal

⚠ WARNING

Fuel is flammable and explosive. Ensure that the key switch is off and the lanyard is positioned so that the engine cannot start. Do not smoke or allow sources of spark or open flame in the area while servicing. Keep the work area well ventilated and avoid prolonged exposure to vapors. Always check for leaks before attempting to start the engine, and wipe up any spilled fuel immediately.

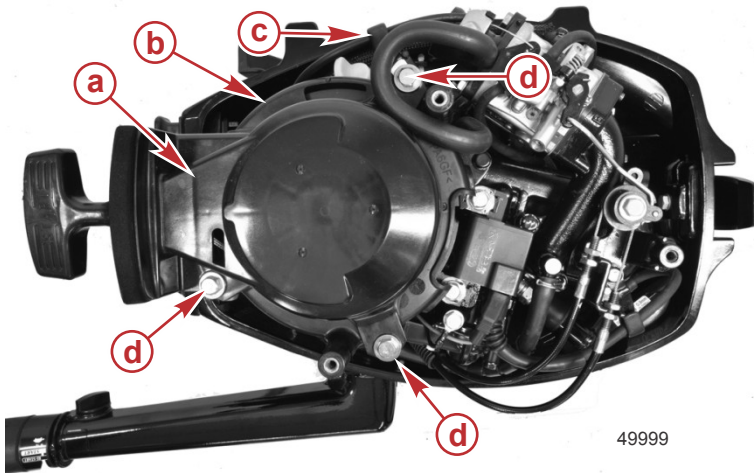
1. Disconnect the spark plug lead from the spark plug.
2. Drain the fuel tank.
3. Remove the three bolts and washers securing the fuel tank and remove the fuel tank from the engine.



- a - Fuel tank
- b - Bolt and washer (M6 x 25) (3)

50010

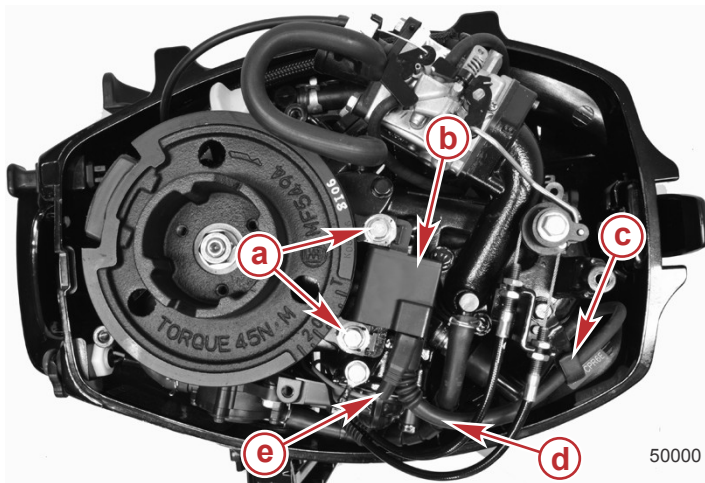
- Remove the recoil starter and flywheel cover.



- a** - Recoil starter
- b** - Flywheel cover
- c** - J-clip
- d** - Bolt and washer (M6 x 60) (3)

49999

- Disconnect the stop switch tan wire connector.
- Remove the two ignition coil mounting bolts.

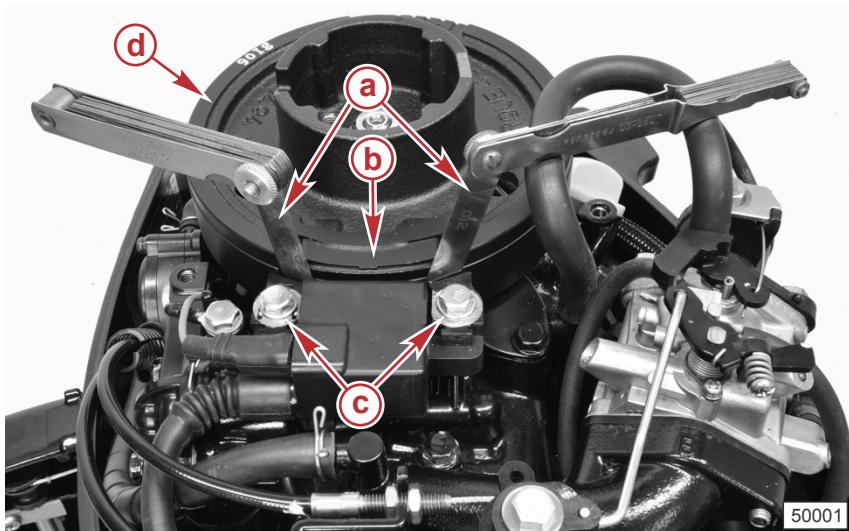


- a** - Ignition coil mounting bolts (M6 x 20) (2)
- b** - Ignition coil
- c** - J-clamp
- d** - Spark plug lead
- e** - Tan wire connector

50000

Installation

- Install the ignition coil onto the cylinder block.
- Install the two ignition coil mounting bolts. Do not tighten at this time.
- Use two 0.3 mm (0.012 in.) feeler gauges to set the gap between the ignition coil and the flywheel magnet.

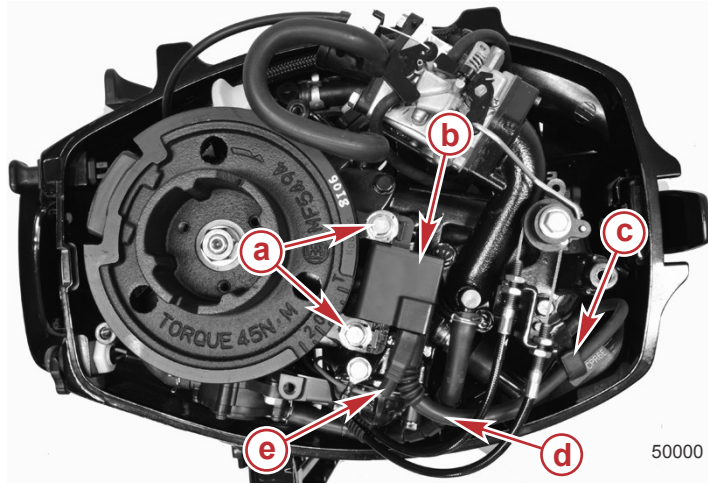


- a** - Feeler gauge (0.3 mm [0.012 in.])
- b** - Flywheel magnet
- c** - Ignition coil mounting bolt
- d** - Flywheel

50001

Ignition Specification	
Ignition coil gap	0.3 mm (0.012 in.)

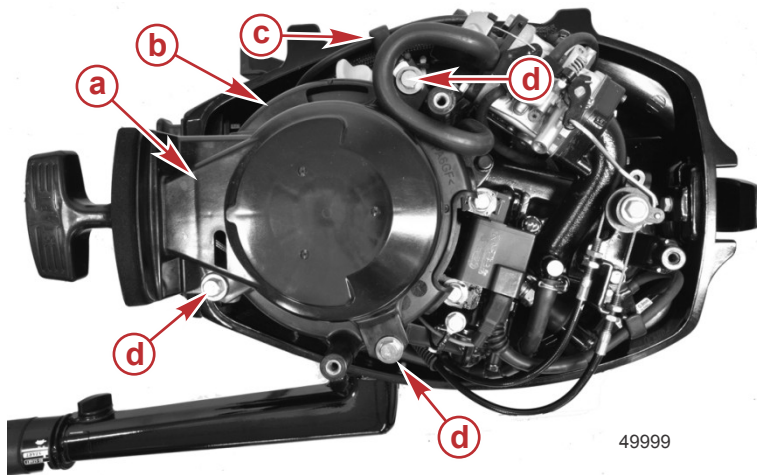
4. Tighten the two ignition coil mounting bolts to the specified torque.
5. Install the spark plug lead onto the spark plug and secure with the J-clamp.
6. Connect the stop switch tan wire connector.



- a - Ignition coil mounting bolts (M6 x 20) (2)
- b - Ignition coil
- c - J-clamp
- d - Spark plug lead
- e - Tan wire connector

Description	Nm	lb-in.	lb-ft
Ignition coil mounting bolts (M6 x 20) (2)	6	53	

- 7.
8. Apply Loctite 242 Threadlocker to the recoil starter assembly mounting bolts.
9. Install the recoil starter and flywheel cover. Tighten the bolts to the specified torque.



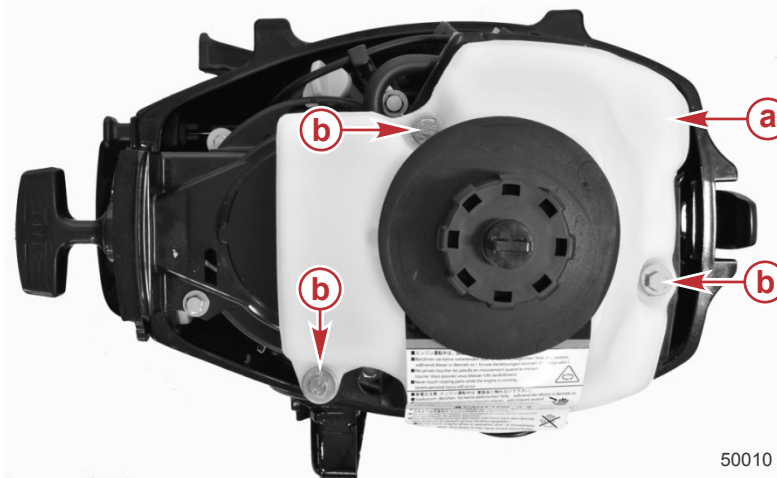
- a - Recoil starter
- b - Flywheel cover
- c - J-clip
- d - Bolt and washer (M6 x 60) (3)

Tube Ref No.	Description	Where Used	Part No.
66	Loctite 242 Threadlocker	Recoil starter assembly mounting bolts	92-809821

Description	Nm	lb-in.	lb-ft
Recoil starter assembly mounting bolts (M6 x 60) (3)	6	53	

10. Install the fuel tank assembly.

- Apply Loctite 242 Threadlocker to the three fuel tank mounting bolts. Install the bolts and washers. Tighten the bolts to the specified torque.



- a - Fuel tank
- b - Bolt and washer (M6 x 25) (3)

Tube Ref No.	Description	Where Used	Part No.
66	Loctite 242 Threadlocker	Fuel tank mounting bolts	92-809821

Description	Nm	lb-in.	lb-ft
Fuel tank mounting bolt (M6 x 25) (3)	6	53	

- Secure the fuel line hose to the fuel tank with a hose clamp.

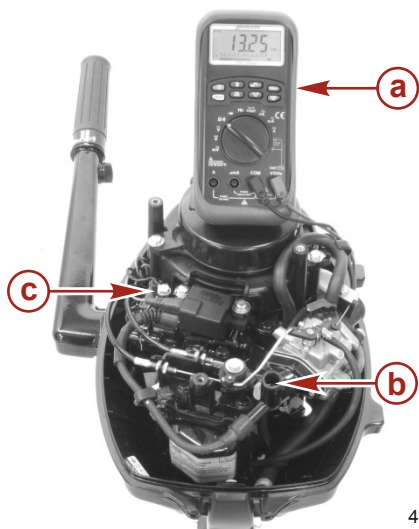
Ignition Coil Testing

Secondary Resistance

NOTE: The readings listed are taken at 20 °C (68 °F) with a digital ohmmeter. Due to the number of different manufacturers, meters available, and temperature variance; test results may vary.

NOTE: It is not necessary to remove the ignition coil from the powerhead for testing.

- Remove the spark plug cap from the spark plug.
- Measure the resistance between the spark plug lead and engine ground.



- a - DMT 2004 digital multimeter
- b - Spark plug cap/lead
- c - Black ground wire

DMT 2004 Digital Multimeter	91-892647A01
-----------------------------	--------------

Meter Test Leads		Meter Scale	Reading (kΩ)
Red	Black		
Spark plug lead	Black ground wire	Ω	10.7–15.7

- If the reading is other than specified, replace the ignition coil. Refer to **Ignition coil Replacement**.

Checking Ignition Timing

⚠ WARNING

Moving parts can cause serious injury or death. Wear eye protection and keep hands, hair, and clothing away from moving parts when performing tests or checking adjustments on an operating engine.

NOTE: The ignition timing is not adjustable. Use a timing light to verify that the ignition timing falls within the timing ranges as described in the following tests.

IMPORTANT: When checking the timing with the engine running, one of the following test procedures must be followed:

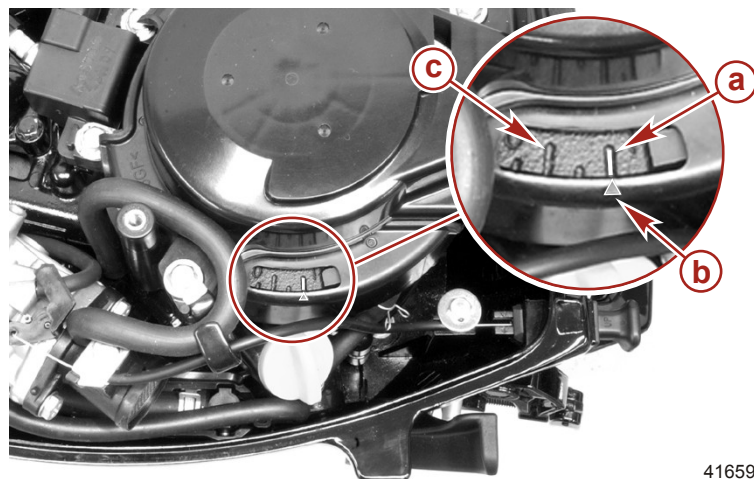
- In a test tank with a cut down propeller.
- On a boat secured to the trailer in the water with a cut down propeller.

- Attach the timing light to the spark plug lead.

Timing Light	91-99379
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- With the outboard in the water, start the engine and allow it to warm up for 2–3 minutes.
- Operate the engine at idle RPM. Visually check the timing pointer to verify it is within the required timing range on the flywheel.

NOTE: Each major timing mark equals 10°.



- a - 0° flywheel timing mark
- b - Pointer on flywheel cover
- c - 10° BTDC flywheel timing mark

41659

Ignition Timing	
At idle	3° BTDC ± 3°

- Shift the outboard into forward. Slowly increase the engine speed to 5900–6100 RPM.
- Visually check the timing pointer to verify the ignition timing advances with the RPM to the wide-open throttle timing specification.

Ignition Timing	
At wide-open throttle	25° BTDC ± 3°

Fuel System

Section 3A - Carburetor and Fuel Pump

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Removal.....	3A-9	Carburetor Assembly.....	3A-20

**3
A**

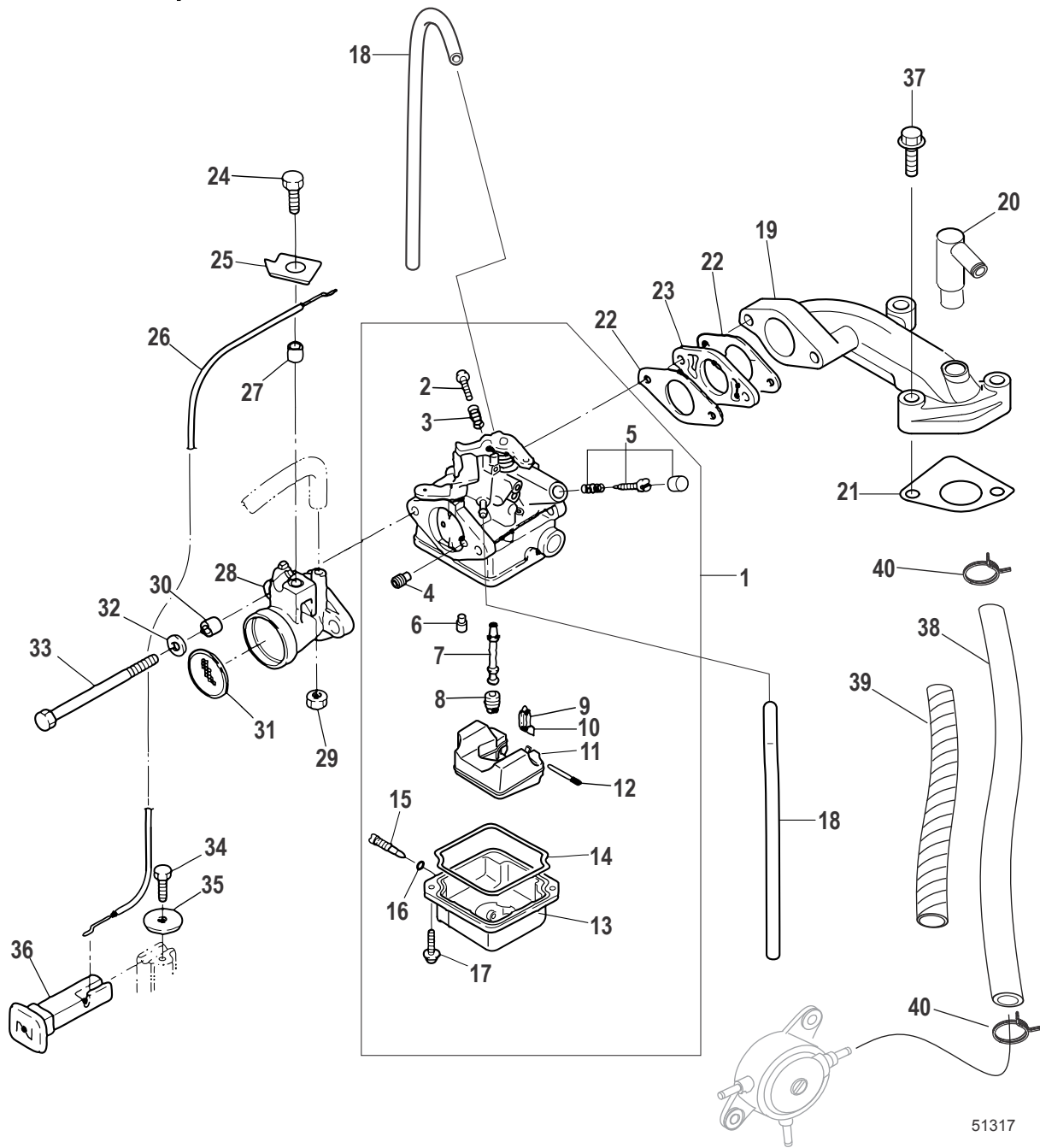
Carburetor Specifications

Carburetor Specifications 2.5 HP	
Venturi	9 mm (0.35 in.)
Throttle bore	16 mm (0.63 in.)
Main jet	#65
Main nozzle I.D.	1.4 mm (0.06 in.)
Slow jet	#38
Idle air jet	#115
Idle speed (neutral)	1400 ± 50 RPM
Idle speed (forward)	1300 ± 50 RPM
Float level (flange to float bottom)	10 mm (0.39 in.)
Pilot (idle mixture) screw	2 ± ½ turn out

Carburetor Specifications 3.5 HP	
Venturi	13 mm (0.51 in.)
Throttle bore	19 mm (0.75 in.)
Main jet	#68
Main nozzle I.D.	1.8 mm (0.07 in.)
Slow jet	#38
Idle air jet	#115
Idle speed (neutral)	1400 ± 50 RPM
Idle speed (forward)	1300 ± 50 RPM
Float level (from carburetor flange to bottom of float)	10 mm (0.39 in.)
Pilot (idle mixture) screw	2 ± ½ turn out

Notes:

Carburetor Components

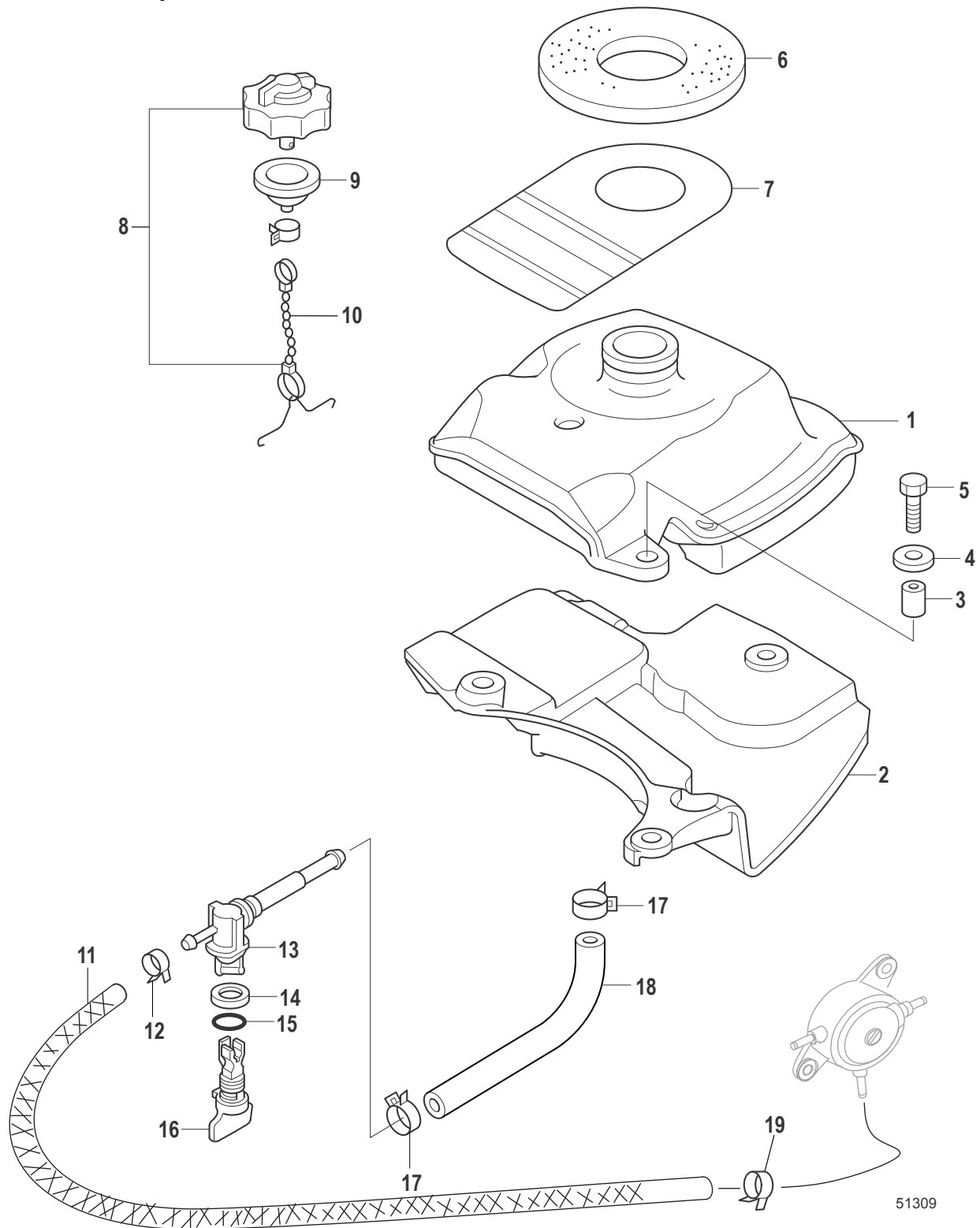


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Carburetor Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Carburetor			
2	1	Idle speed screw			
3	1	Spring			
4	1	Pilot jet			
5	1	Pilot mixture screw, spring, and tamperproof plug			
6	1	Rubber plug			
7	1	Main nozzle			
8	1	Main jet			
9	1	Float valve			
10	1	Clip			
11	1	Float			
12	1	Float pin			
13	1	Float bowl			
14	1	Gasket			
15	1	Drain screw (M5 x 6)			
16	1	O-ring			
17	2	Screw (M4 x 12)	2	18	
18	2	Hose			
19	1	Intake manifold			
20	1	Fitting			
21	1	Intake manifold gasket			
22	2	Carburetor gasket			
23	1	Insulator			
24	1	Tapping bolt (M6 x 16)	6	53	
25	1	Bracket			
26	1	Choke link cable			
27	1	Collar			
28	1	Air silencer			
29	1	Nut			
30	2	Collar			
31	1	Flame trap			
32	2	Washer			
33	2	Screw	6	53	
34	1	Bolt	6	53	
35	1	Washer			
36	1	Choke knob			
37	2	Bolt	10	88.5	
38	1	Pulse hose (intake manifold fitting to fuel pump)			
39	1	Protective sleeve			
40	2	Clamp			

Fuel Tank Components



51309

Fuel Tank Components

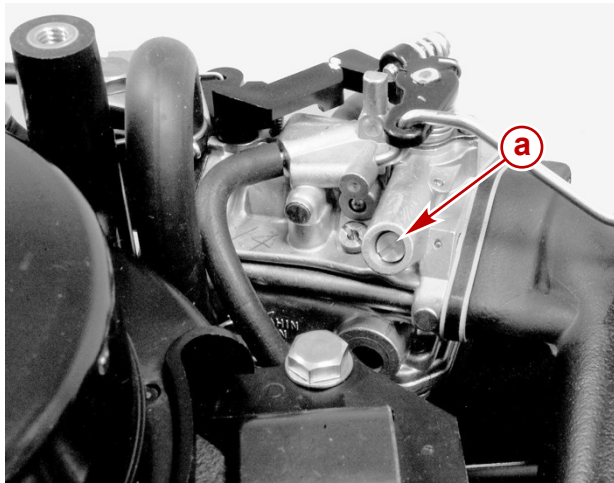
Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Fuel tank			
2	1	Cover			
3	3	Spacer			
4	3	Washer			
5	3	Bolt	6	53	
6	1	Seal			
7	1	Caution decal			
8	1	Fuel cap			
9	1	Gasket			
10	1	Hook			
11	1	Fuel hose to fuel pump inlet			
12	2	Clip			
13	1	Fuel valve			
14	2	Rubber seal			
15	1	O-ring			
16	1	Fuel valve knob			
17	2	Clip			
18	1	Fuel hose			
19	1	Clip			

Carburetor Adjustments

Pilot (Idle Mixture) Screw

IMPORTANT: The pilot mixture screw is set at the factory to allow the engine to meet established government emission specifications. The pilot mixture screw is normally hidden with a tamperproof plug. However, if the carburetor requires rebuilding and/or cleaning, the plug can be removed and the pilot mixture screw removed to facilitate cleaning. Follow the procedure below when the carburetor is rebuilt or cleaned.

1. When removing: Record the number of revolutions to lightly seat the pilot mixture screw.
2. When installing: Turn the pilot mixture screw in (clockwise) until lightly seated. Then back the screw out the same number of turns as measured during removal.
3. After installation, install a new tamperproof plug.



a - Pilot mixture screw (tamperproof plug removed)

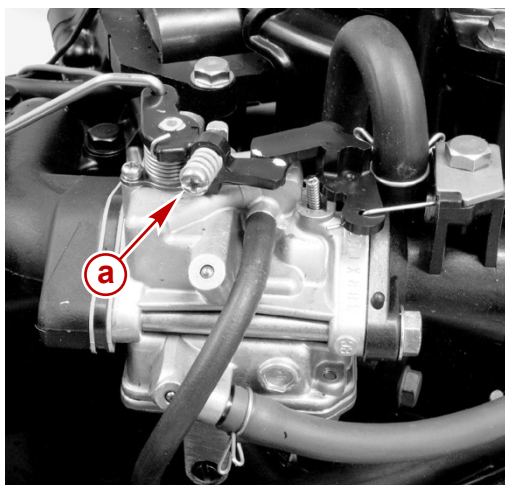
26506

Idle Speed

After the pilot (idle mixture) screw has been properly installed, adjust the idle speed screw to specification.

- Tightening the screw increases the engine speed.
- Loosening the screw reduces the engine speed.

Engine RPM (2.5/3.5)	
Idle speed (neutral)	1400 ± 50 RPM
Idle speed (forward)	1300 ± 50 RPM



a - Idle speed screw

26509

Fuel Pump Removal and Installation

⚠ WARNING

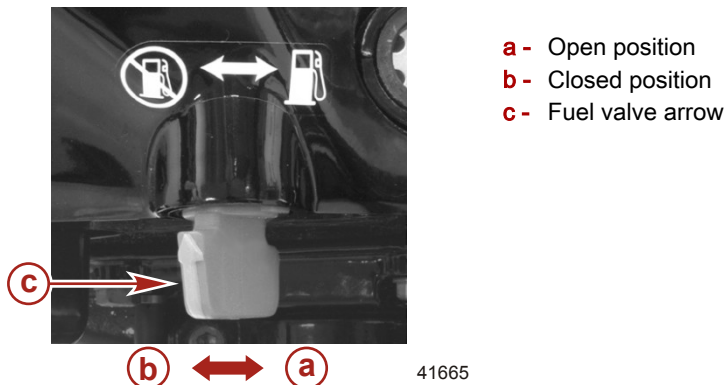
Fuel is flammable and explosive. Ensure that the key switch is off and the lanyard is positioned so that the engine cannot start. Do not smoke or allow sources of spark or open flame in the area while servicing. Keep the work area well ventilated and avoid prolonged exposure to vapors. Always check for leaks before attempting to start the engine, and wipe up any spilled fuel immediately.

⚠ WARNING

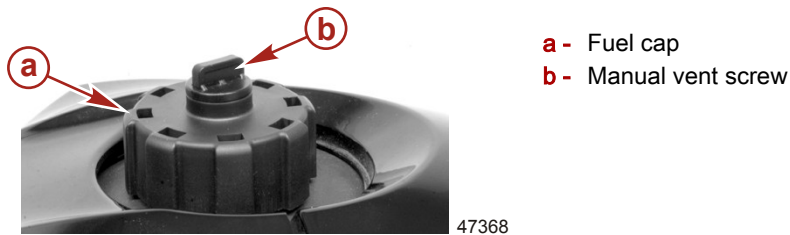
Fuel leakage is a fire or explosion hazard, which can cause serious injury or death. Periodically inspect all fuel system components for leaks, softening, hardening, swelling, or corrosion, particularly after storage. Any sign of leakage or deterioration requires replacement before further engine operation.

Removal

1. Close the fuel valve and run the engine until it stops. This will empty the fuel from the carburetor.



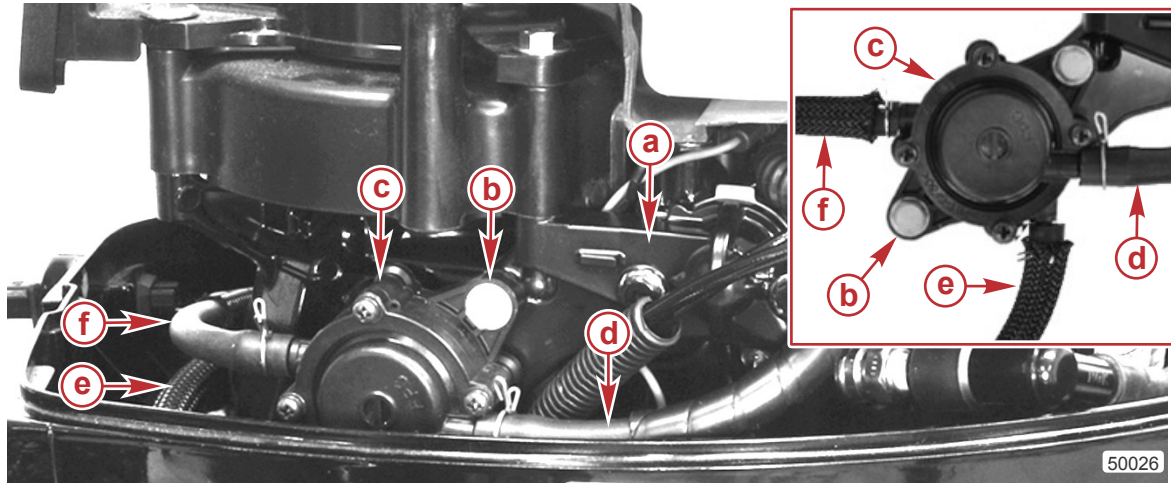
2. Close the fuel tank vent after the engine has stopped.



3. Remove the two bolts securing the fuel pump to the thermostat housing bracket.

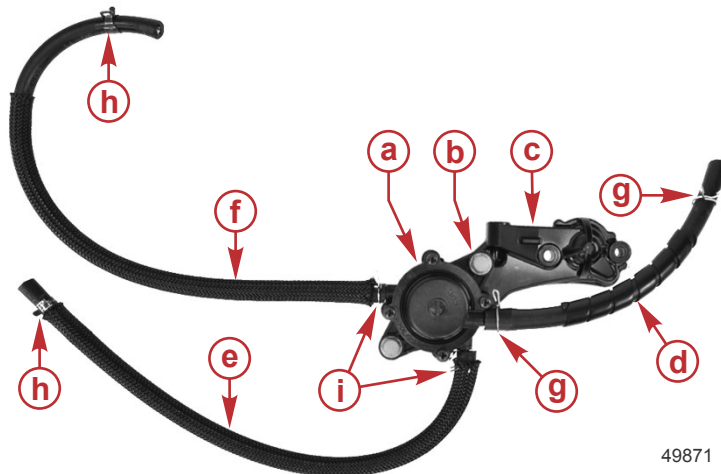
Carburetor and Fuel Pump

- Remove the three fuel hoses. Wipe up any spilled fuel immediately.



- a- Thermostat housing bracket
- b- Bolt (M6 x 30) (2)
- c- Fuel pump
- d- Pulse hose
- e- Fuel pump inlet hose
- f- Fuel pump outlet hose

Fuel Pump Hoses



- a- Fuel pump
- b- Bolt (M6 x 30) (2)
- c- Thermostat housing bracket
- d- Pulse hose to intake manifold fitting
- e- Fuel pump inlet hose from fuel shutoff valve
- f- Fuel pump outlet hose to carburetor
- g- Large hose clamp (2)
- h- Hose clamp
- i- Small hose clamp (2)

Installation

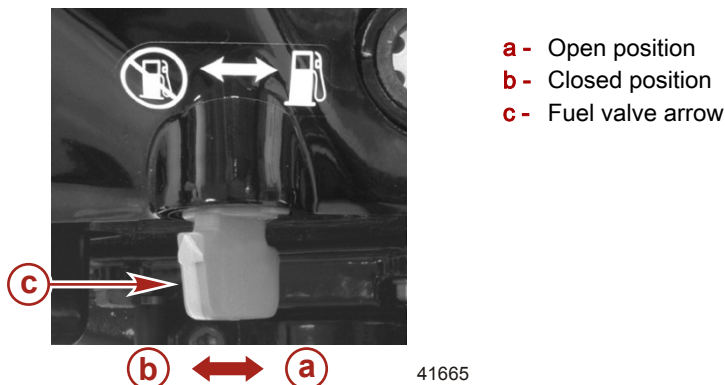
- Connect the hoses to the fuel pump. Secure the hoses with clamps.
- Attach the fuel pump to the thermostat housing bracket with two M6 x 30 bolts. Tighten the bolts to the specified torque.

Description	Nm	lb-in.	lb-ft
Fuel pump mounting bolts (M6 x 30) (2)	6	53	

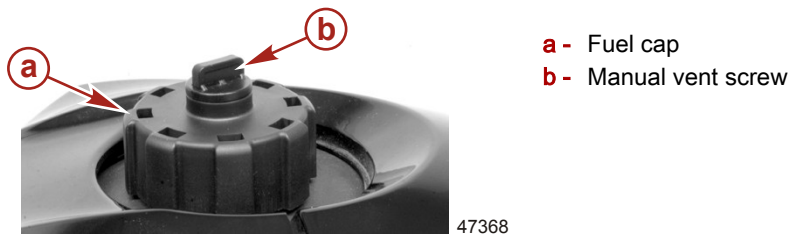
Carburetor Removal and Installation

Removal

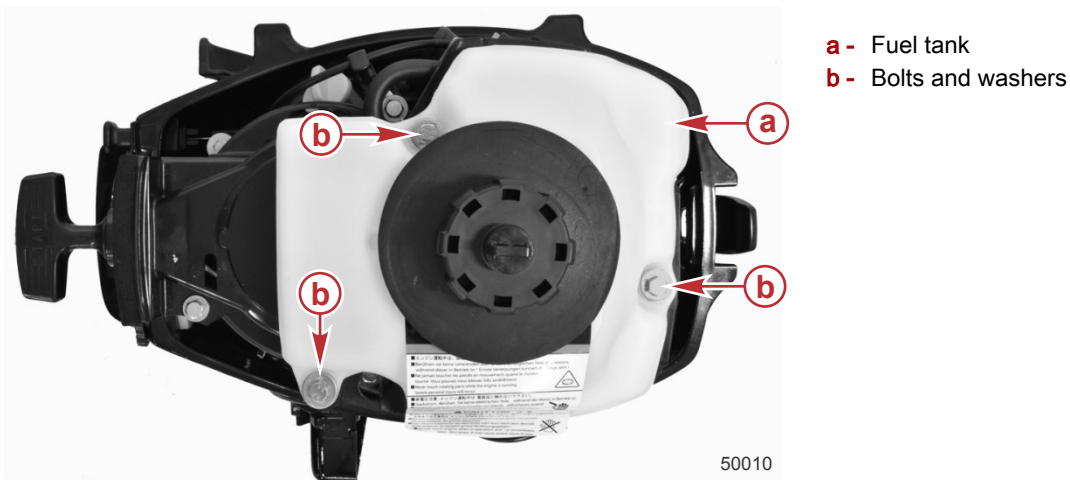
1. With the outboard in water, close the fuel valve and run the engine until it stops. This will empty the fuel from the carburetor.



2. Close the fuel tank vent after the engine has stopped.



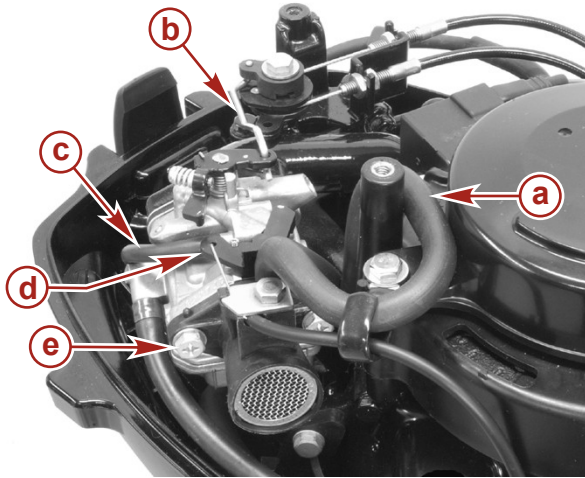
3. Remove the fuel hose from the carburetor.
4. Remove the three bolts and washers securing the fuel tank to the engine. Remove the fuel tank assembly from the engine.



5. Remove the crankcase breather hose from the powerhead.
6. Remove the vent hoses from the pan.
7. Remove the two bolts securing the air silencer and the carburetor to the intake manifold.

Carburetor and Fuel Pump

8. Disconnect the choke cable and the throttle linkage from the carburetor. Remove the carburetor from the engine.

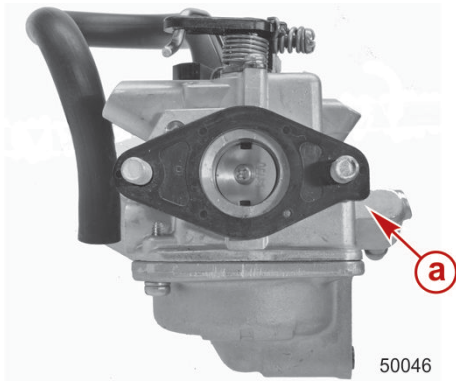


- a - Crankcase breather hose
- b - Throttle linkage
- c - Vent hose (1 of 2)
- d - Choke cable
- e - Carburetor/air silencer bolt (M6 x 85) (2)

41668

Installation

1. Connect the choke cable and the throttle linkage to the carburetor.
IMPORTANT: The carburetor mounting gaskets must be oriented correctly with the intake manifold before installing the carburetor. Improper orientation of the carburetor mounting gaskets will result in poor engine performance.

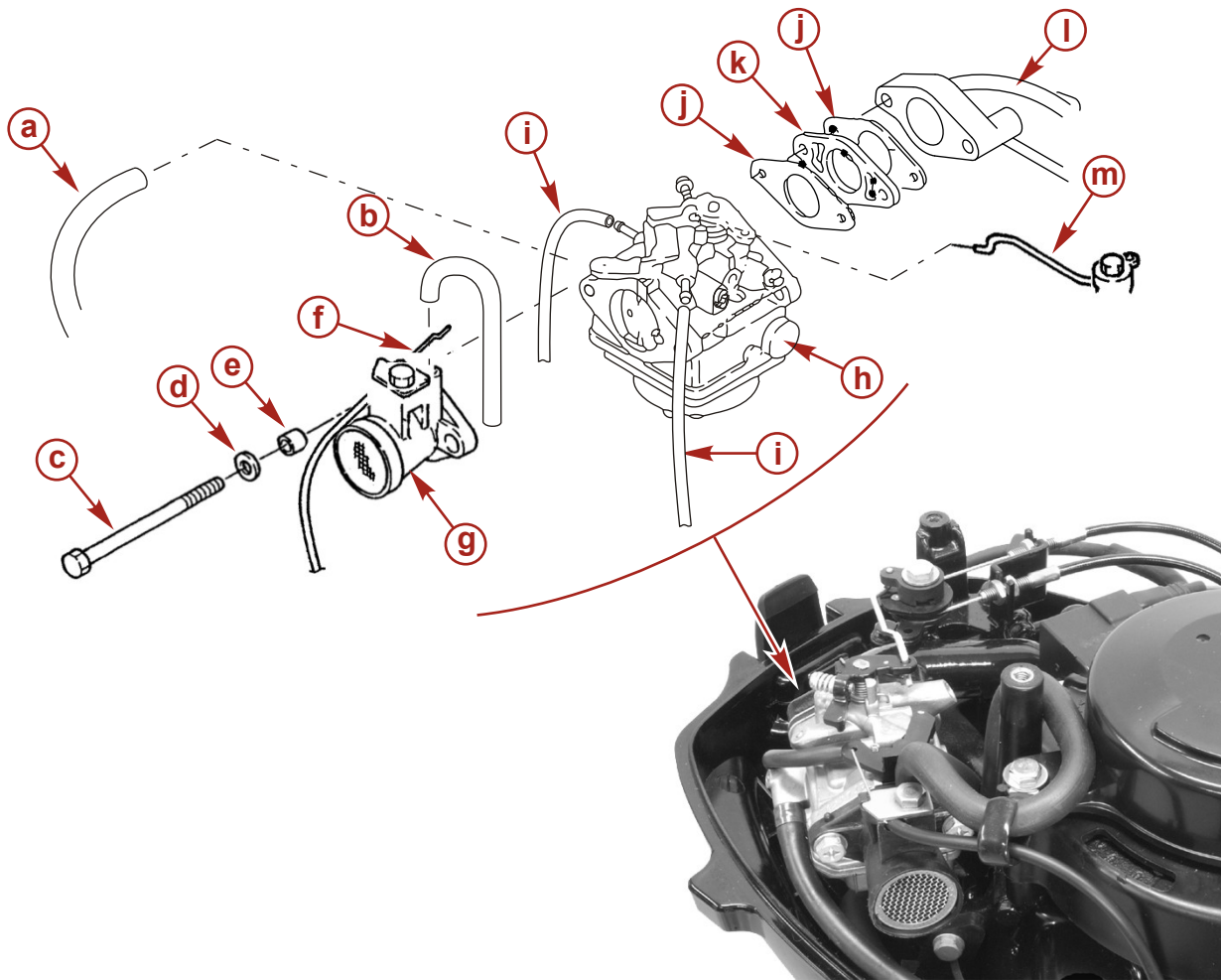


- a - Orientation notch

50046

2. Inspect the carburetor mounting gaskets for damage. Replace the gaskets as required.

- Secure the air silencer and carburetor to the intake manifold with two bolts, washers, and collars. Tighten the bolts to the specified torque.



41735

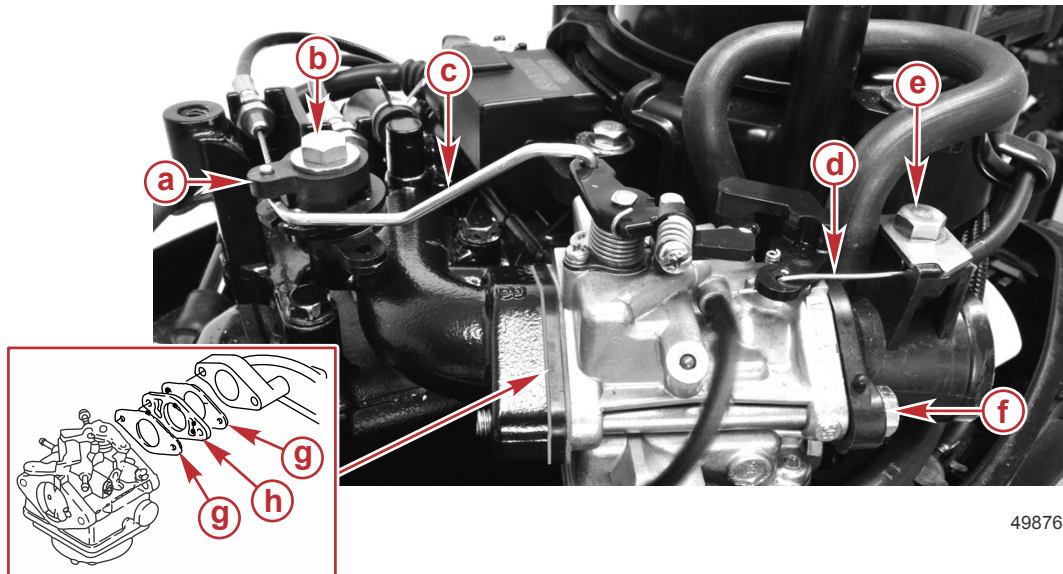
- a** - Fuel hose
- b** - Crankcase breather hose
- c** - Bolt (M6 x 85) (2)
- d** - Flat washer (2)
- e** - Collar (2)
- f** - Choke cable
- g** - Air silencer
- h** - Carburetor
- i** - Vent hose (2)
- j** - Gasket (2)
- k** - Insulator
- l** - Intake manifold
- m** - Throttle linkage

Description	Nm	lb-in.	lb-ft
Carburetor/air silencer bolt (M6 x 85) (2)	6	53	

- Install the crankcase breather hose. Secure the hose with a clamp.
- Install the vent hoses into the pan.
- Adjust the choke cable in the cable holder so the choke is fully functional.

Carburetor and Fuel Pump

7. Tighten the choke cable holder bolt and the throttle opener bolt to the specified torque.



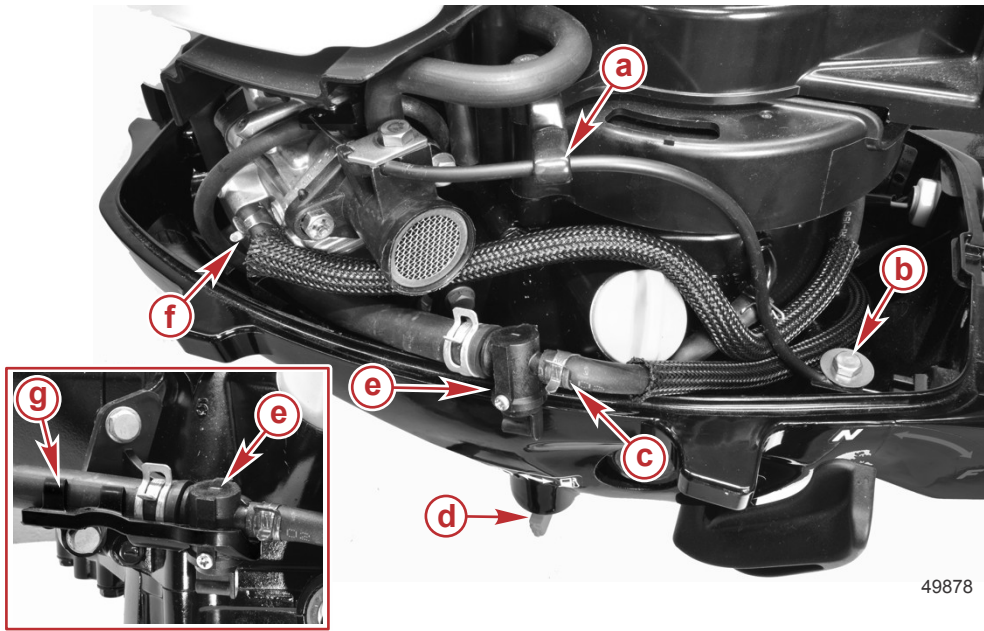
49876

- a - Throttle opener
- b - Throttle opener bolt
- c - Throttle rod
- d - Choke wire
- e - Choke cable holder bolt
- f - Carburetor mounting bolt (2)
- g - Gasket (2)
- h - Insulator

Description	Nm	lb-in.	lb-ft
Throttle opener bolt	6	53	
Choke cable holder bolt	6	53	

8. Attach the fuel pump outlet hose to the carburetor inlet.
9. Attach the fuel pump inlet hose to fuel shutoff valve. Secure the hoses with hose clamps.
IMPORTANT: Route the hoses as shown.
10. Install the fuel shutoff valve and hoses along the side of the powerhead.
- Align the fuel shutoff valve with the fuel shutoff knob
 - The fuel hose to the fuel tank snaps into the bracket attached to the cylinder block

11. Secure the choke cable with the J-clamp and the washer and bolt.



- a** - J-clamp
- b** - Washer and bolt securing choke cable
- c** - Fuel pump inlet hose
- d** - Fuel shutoff valve
- e** - Fuel shutoff valve knob
- f** - Fuel pump outlet hose
- g** - Bracket

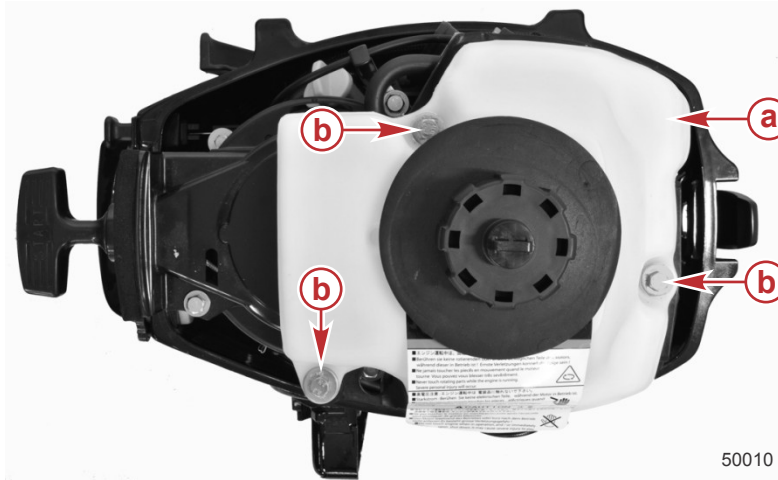
12. Route the fuel hoses as shown.



49932

Carburetor and Fuel Pump

13. Install the fuel tank onto the engine. Secure the fuel tank with three bolts and washers. Tighten the bolts to the specified torque.

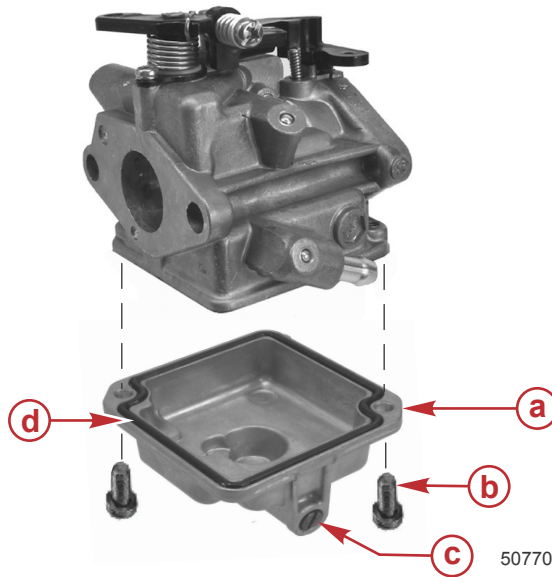


- a - Fuel tank
- b - Bolts and washers

Description	Nm	lb-in.	lb-ft
Fuel tank bolts	6	53	

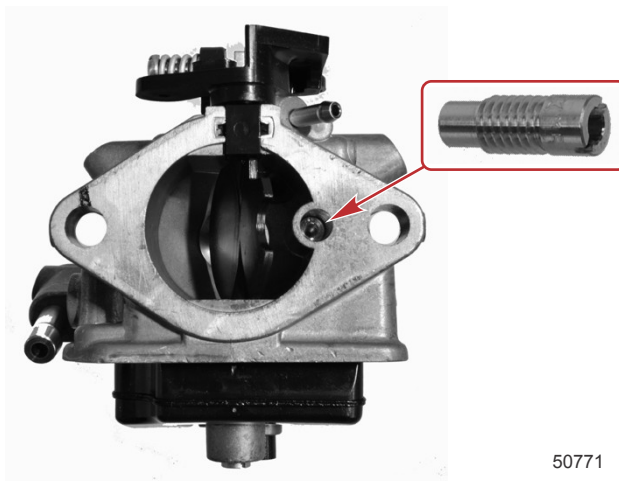
Carburetor Disassembly

1. Remove the drain screw and drain the carburetor before disassembly.
2. Remove the two screws securing the float bowl. Remove the float bowl.

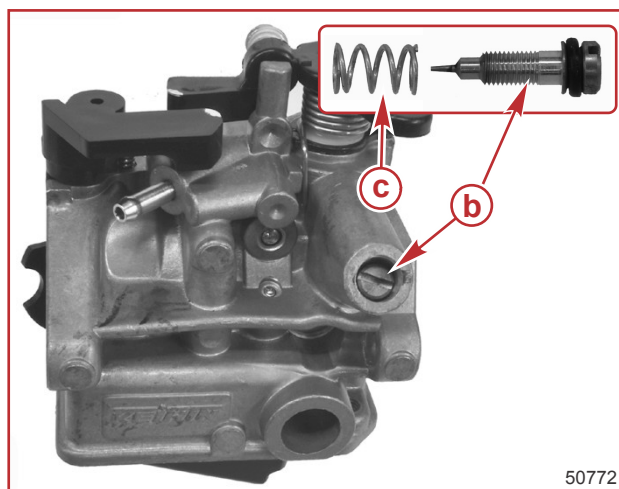
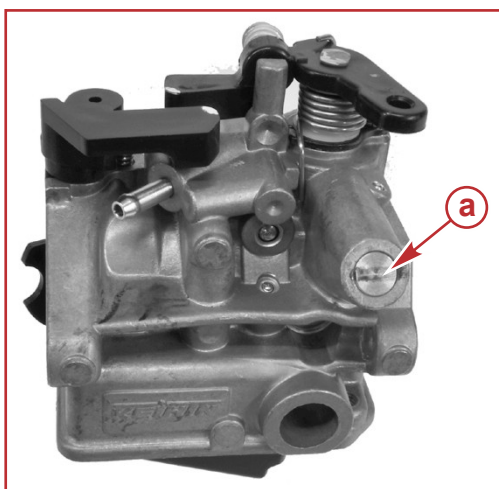


- a - Float bowl
- b - Screw
- c - Drain screw
- d - O-ring gasket

3. Remove the pilot jet.



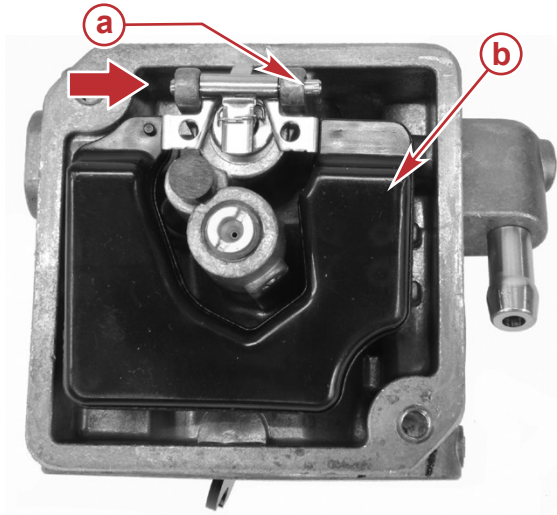
4. Remove the pilot mixture screw.
 - a. Remove the tamperproof plug.
 - b. Count and record the number of revolutions to lightly seat the pilot mixture screw. **IMPORTANT: This information will be used during carburetor assembly.**
 - c. Remove the pilot mixture screw and spring.



- a - Tamperproof plug
- b - Pilot mixture screw
- c - Spring

Carburetor and Fuel Pump

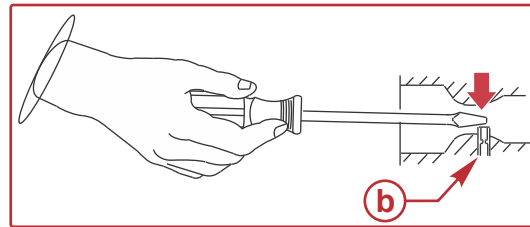
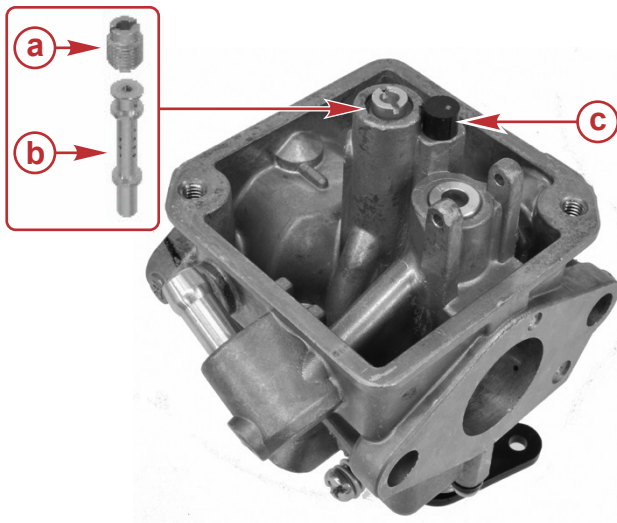
5. Push out the float pin in the direction shown. Remove the float and the inlet needle.



50773

- a - Knurled end of the float pin
- b - Float
- c - Inlet needle

6. Remove the rubber plug.
7. Remove the main jet.
8. Remove the main nozzle. The nozzle should drop out. If not, carefully push the nozzle out as shown.

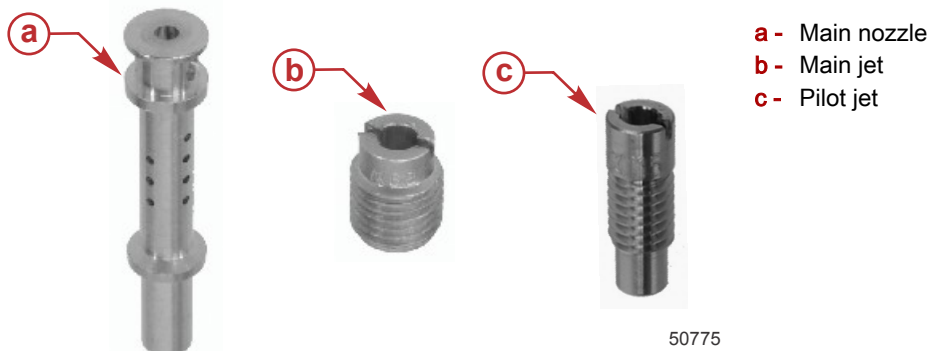


50774

- a - Main jet
- b - Main nozzle
- c - Rubber plug

Inspection

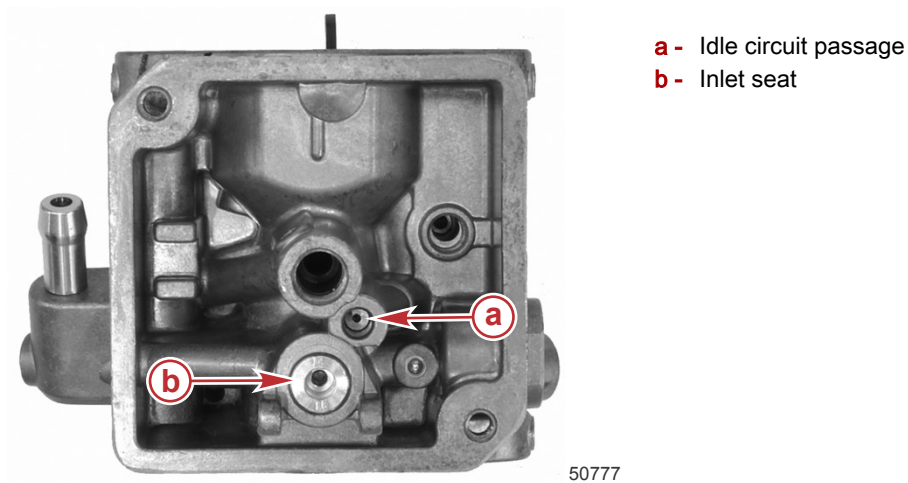
1. Clean the main jet, main nozzle, and pilot jet with a suitable solvent. Dry all components thoroughly with compressed air before installation.



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



3. Inspect the idle circuit passage and the inlet seat.



4. Inspect the float arm for wear at the location where it contacts the inlet needle.



Carburetor and Fuel Pump

- Clean the carburetor body, float bowl, and components in an ultrasonic cleaner. Follow the instructions of the manufacturer.

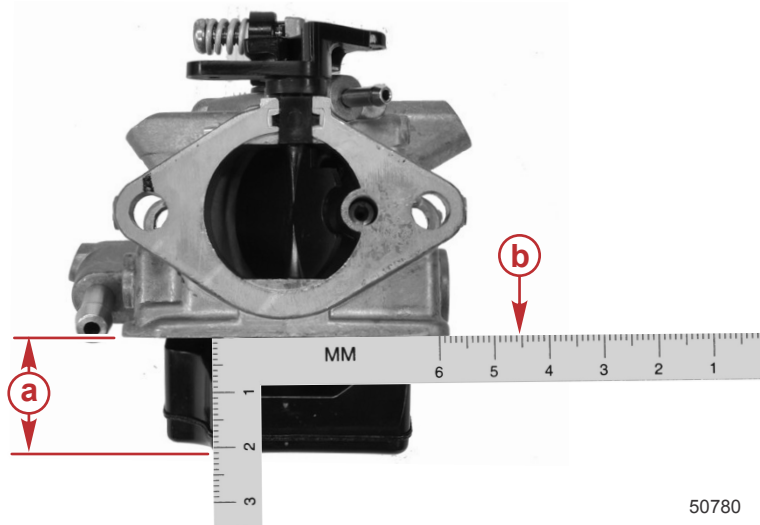
Carburetor Assembly

- Install the inlet needle assembly onto the float arm.
- Install the float. Push in the float pin in the direction of the arrow.



- a** - Inlet needle assembly
- b** - Float
- c** - Knurled end of float pin

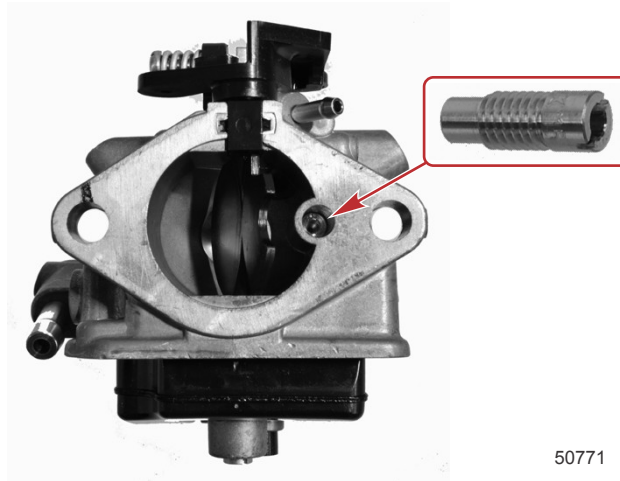
- Check the float level using a carburetor scale. Adjust the float level by bending the float arm.



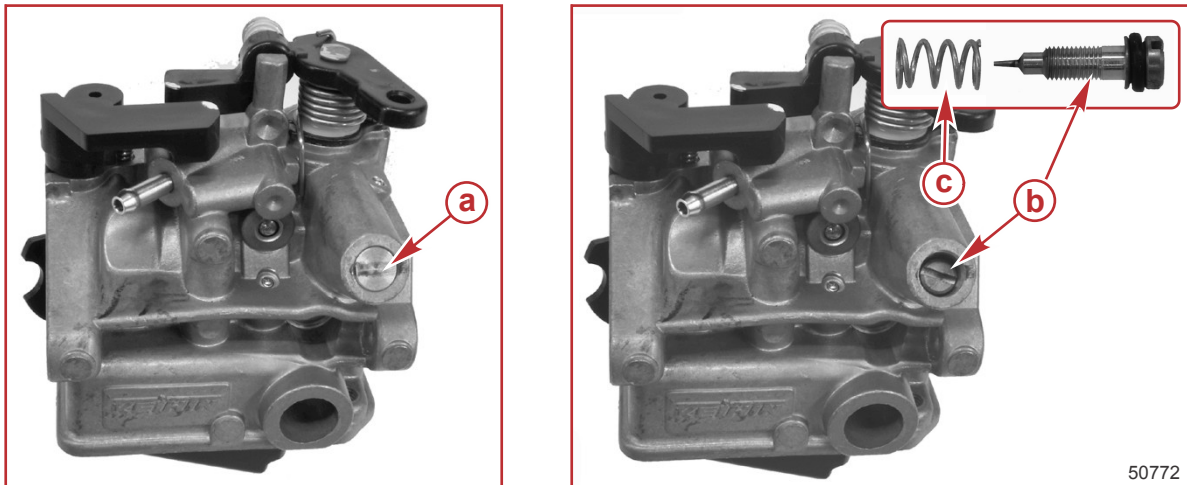
- a** - 21 mm (0.827 in.)
- b** - Carburetor scale (obtain locally)

Float Level Measurement	
Float level	21 mm (0.827 in.)

4. Install the pilot jet.



5. Install the pilot mixture spring and screw.
6. Turn the pilot mixture screw until it is seated. Then back the screw out the same number of turns as measured during removal.
7. Install a tamperproof plug. Refer to the parts manual for the part number.

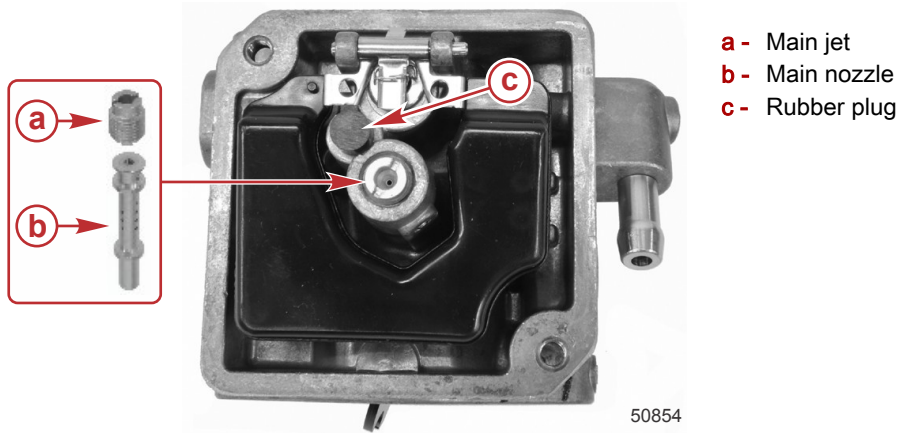


- a** - Tamperproof plug
- b** - Pilot mixture screw
- c** - Spring

8. Install the main nozzle and main jet.

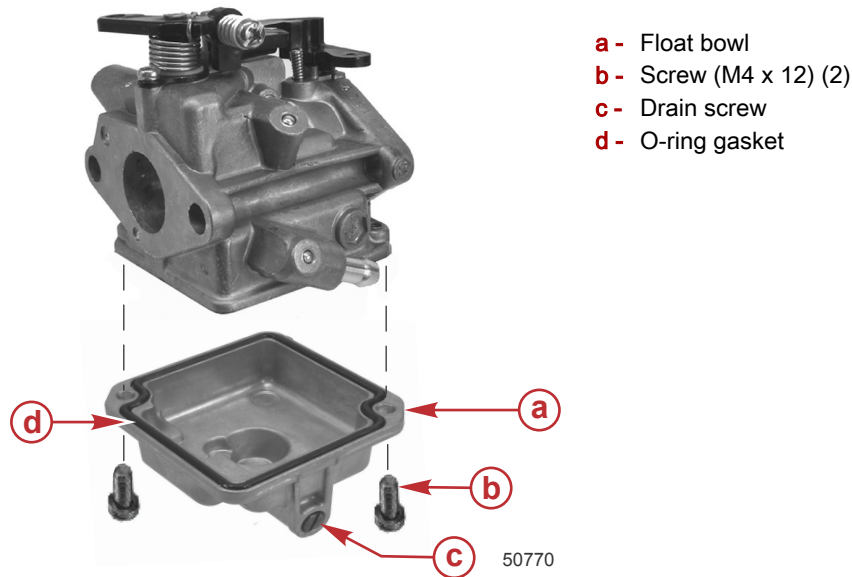
Carburetor and Fuel Pump

9. Install the rubber plug.



- a** - Main jet
- b** - Main nozzle
- c** - Rubber plug

10. Install the carburetor drain screw.
11. Install the O-ring gasket onto the float bowl.
12. Install the float bowl. Tighten the screws to the specified torque.



- a** - Float bowl
- b** - Screw (M4 x 12) (2)
- c** - Drain screw
- d** - O-ring gasket

Description	Nm	lb-in.	lb-ft
Float bowl screws (M4 x 12)	2	18	

Fuel System

Section 3B - Emissions

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Manufacturer's Responsibility.....	3B-3	Installation.....	3B-5

**3
B**

Exhaust Emission Standards

Through the Environmental Protection Agency (EPA), the federal government has established exhaust emission 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. Emission 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. 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 by-product 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

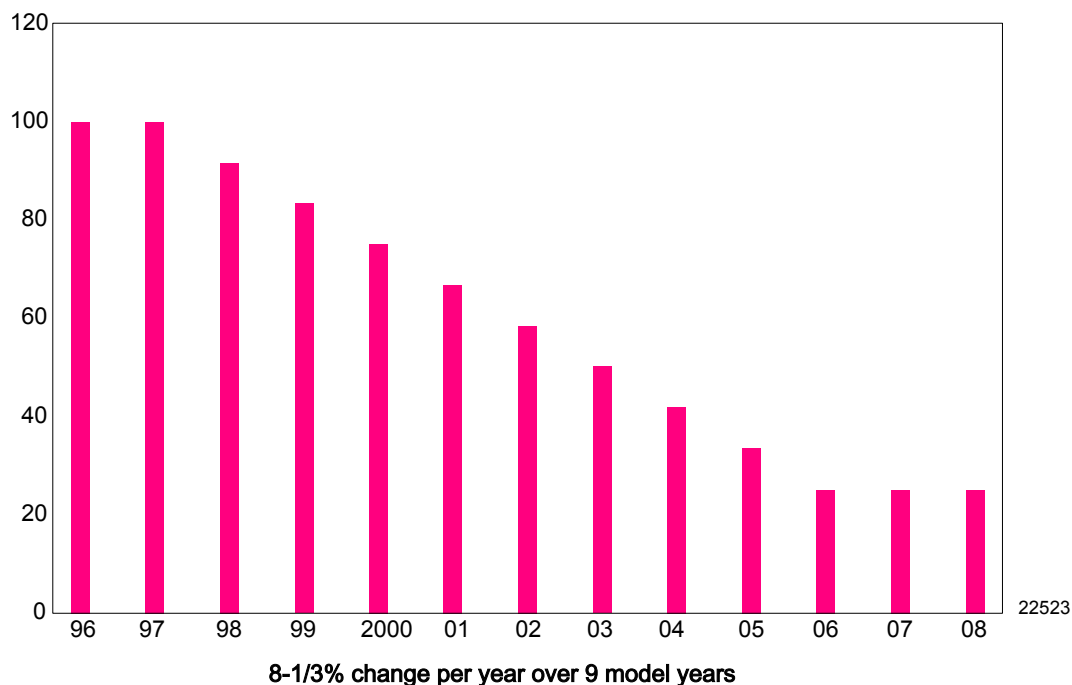
The reduction of exhaust emissions is accomplished by controlling the air/fuel ratio that goes into the combustion chamber and with adjusting the timing curve of the spark ignition.

Stoichiometric (14.7:1) Air/Fuel Ratio

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

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

Outboard Hydrocarbon Emissions Reduction



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

Emissions

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/omswwww>

Manufacturer's Certificate Label

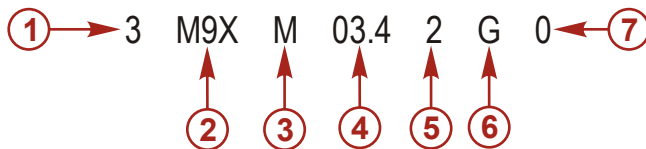
The certification label must be placed on each engine at the time of manufacture and must be replaced in the same location if damaged or removed. Shown below is a typical certification label and is not representative of any one model. Label shown below is not to scale.

MERCURY		EMISSION CONTROL INFORMATION	
THIS ENGINE CONFORMS TO <input type="checkbox"/> CALIFORNIA AND U.S. EPA EMISSION REGULATIONS FOR SPARK IGNITION MARINE ENGINES			
REFER TO OWNERS MANUAL FOR REQUIRED MAINTENANCE, SPECIFICATIONS, AND ADJUSTMENTS			
IDLE SPEED (in gear): <input type="text"/>		FAMILY: <input type="text"/>	
<input type="text"/> hp	<input type="text"/> cc	<input type="text"/> g/kWh	<input type="text"/>
TIMING (IN DEGREES): <input type="text"/>			
COLD VALVE CLEARANCE (mm): <input type="text"/>		SPARK PLUG: <input type="text"/>	
INTAKE: <input type="text"/>		EXHAUST: <input type="text"/>	

- a - Idle speed
- b - Engine horsepower
- c - Piston displacement
- d - Date of manufacture
- e - Valve clearance (if applicable)
- f - Family number
- g - Maximum emissions output for the engine family
- h - Timing specifications
- i - Recommended spark plug and gap

Family Number

The following is an illustration of a typical family number and is not a representation of any one model.



- 1 - Model year (3 = 2003)
- 2 - Manufacturer (Mercury Marine)
- 3 - Regulations (M = Marine)
- 4 - Engine displacement (decimal point = liters [03.4 = 3.4L]), (no decimal point = C.I. [0113 = 113 cubic inches])
- 5 - Technology type (1 = OB old tech, 2 = OB new tech, 3 = SportJet, 4 = OptiJet)
- 6 - Engine class (C = two-stroke, G = four-stroke)
- 7 - Product type (0 = all except, J = SportJet, E = EFI SportJet and 4-Stroke, 3 = OptiMax, H = high performance)

Service Replacement Certification Label


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

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.

		Emission Control Information	
THIS ENGINE CONFORMS TO (YEAR) CALIFORNIA AND U.S. EPA EMISSION REGULATIONS FOR SPARK IGNITION MARINE ENGINES			
REFER TO OWNERS MANUAL FOR MAINTENANCE, SPECIFICATIONS, AND ADJUSTMENTS			
IDLE SPEED (in gear): XXX RPM		FAMILY: -----.XXXXXX	
XXX HP	XXXX cc	FEL: XX.XXXX g/kWh	
TIMING (IN DEGREES):		XXXXXXXXXX	
PART NO. 37-XXXXXX	SPARK PLUG: GAP: X.X MM (X.X IN.)	XXXXXXXXXX	
COLD VALVE CLEARANCE (mm)	INTAKE: EXHAUST: 0.XX - 0.XX MM	0.XX - 0.XX MM	
JAN	FEB	MAR	APR
MAY	JUNE	JULY	AUG
SEP	OCT	NOV	DEC

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



11184

Installation

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

Model	Service Part Number	Location of Engine
Mercury/Mariner 2.5/3.5 FourStroke	If a replacement emission certification label is required, contact the Mercury Marine Service Department.	Inside of bottom cowl

Notes:

Powerhead

Section 4A - Powerhead

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**4
A**

Camshaft and Valve Specifications

Camshaft and Valve Specifications	
Camshaft	
Runout limit	0.03 mm (0.0012 in.)
Cam lobe height (intake and exhaust)	23.78–24.04 mm (0.94–0.95 in.)
Upper bearing O.D.	11.95–11.97 mm (0.4705–0.4713 in.)
Lower bearing O.D.	12.95–12.97 mm (0.5098–0.5106 in.)
Valve spring free length	33.2–35.0 mm (1.307–1.378 in.)
Valve spring tilt limit	2 mm (0.079 in.)
Valve guide	
Intake	5.51–5.55 mm (0.2169–0.2185 in.)
Exhaust	5.51–5.57 mm (0.2169–0.2193 in.)
Valve stem O.D.	
Intake valve	5.45–5.47 mm (0.2146–0.2154 in.)
Exhaust valve	5.44–5.46 mm (0.2142–0.2150 in.)
Valve stem to valve guide clearance	
Intake	0.018–0.070 mm (0.0007–0.0028 in.)
Exhaust	0.025–0.080 mm (0.0010–0.0031 in.)
Valve seat angles	
First	30°
Second	45°
Third	60°
Valve stem seal color	
Intake	Black
Exhaust	Green
Valve seat width (intake and exhaust)	1.0–2.0 mm (0.0394–0.0787 in.)
Valve to rocker arm clearance	
Intake	0.06–0.14 mm (0.0024–0.0055 in.)
Exhaust	0.11–0.19 mm (0.0043–0.0075 in.)

Cooling System Specifications

Cooling System Specifications	
Thermostat	
Start to open temperature	50–54 °C (122–129 °F)
Full open temperature	60–64 °C (140–147 °F)
Valve lift	2 mm (0.079 in.)
Water pressure	
Idle (at 1300 RPM)	3–7 kPa (0.4–1.0 psi)
WOT (at 5000 RPM)	40–75 kPa (5.8–10.9 psi)

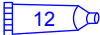


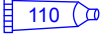
Piston Specifications

Piston Specifications	
Piston outside diameter (standard)	54.96 mm (2.1638 in.)
Piston outside diameter (service limit)	54.90 mm (2.1614 in.)
Piston clearance (standard)	0.020–0.06 mm (0.0008–0.0024 in.)
Piston clearance (service limit)	0.15 mm (0.0059 in.)
Piston ring side clearance (standard)	
Top	0.04–0.08 mm (0.0016–0.0031 in.)
Middle	0.03–0.07 mm (0.0012–0.0028 in.)
Bottom	0.05–0.15 mm (0.002–0.0059 in.)
Piston ring side clearance (service limit)	
Top	0.10 mm (0.0039 in.)
Middle	0.09 mm (0.0035 in.)
Bottom	0.17 mm (0.0067 in.)
Piston ring end gap (standard)	
Top	0.15–0.30 mm (0.0059–0.0118 in.)
Middle	0.30–0.45 mm (0.0118–0.0177 in.)
Bottom	0.20–0.70 mm (0.0079–0.0276 in.)
Piston ring end gap (service limit)	
Top	0.5 mm (0.0197 in.)
Middle	0.7 mm (0.0276 in.)
Piston pin diameter (standard)	14.0 mm (0.5512 in.)
Piston pin diameter (service limit)	13.97 mm (0.5500 in.)


Cylinder Block Specifications

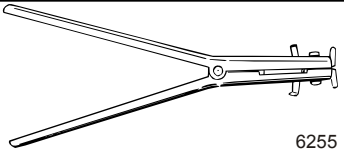
Cylinder Block Specifications	
Cylinder bore	
Standard	55 mm (2.1653 in.)
Oversize	55.5 mm (2.1850 in.)
Maximum taper/out of round	0.06 mm (0.0024 in.)
Stroke	36 mm (1.42 in.)
Displacement	85.5 ml (5.22 in. ³)
Number of cylinders	1
Rotation	Clockwise
Crankshaft	
Runout	0.05 mm (0.002 in.)
Crankpin journal (standard)	19.98 mm (0.7866 in.)
Crankpin journal (service limit)	19.95 mm (0.7854 in.)
Connecting rod	
Wrist pin I.D. (standard)	14.01 mm (0.5516 in.)
Wrist pin I.D. (service limit)	14.04 mm (0.5528 in.)
Crankpin oil clearance (standard)	0.015–0.041 mm (0.0006–0.0016 in.)
Crankpin oil clearance (service limit)	0.060 mm (0.0024 in.)

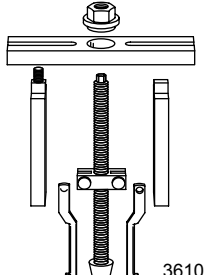
Lubricants, Sealants, Adhesives

Tube Ref No.	Description	Where Used	Part No.
 12	Loctite Master Gasket Kit	Cylinder block mating surfaces	92-12564 2
 66	Loctite 242 Threadlocker	Fuel tank mounting bolts Driveshaft seal housing bolts	92-809821
 95	2-4-C with PTFE	Inside diameter of the driveshaft seals Driveshaft splines	92-802859A 1
 110	4-Stroke 10W-30 Outboard Oil	Piston pin Piston rings Connecting rod, connecting rod cap, and the crankpin journal Crankshaft seal, bearings, piston rings, push rods, and valve lifters Camshaft ends and lobes Driveshaft seal housing O-rings	92-858045K01

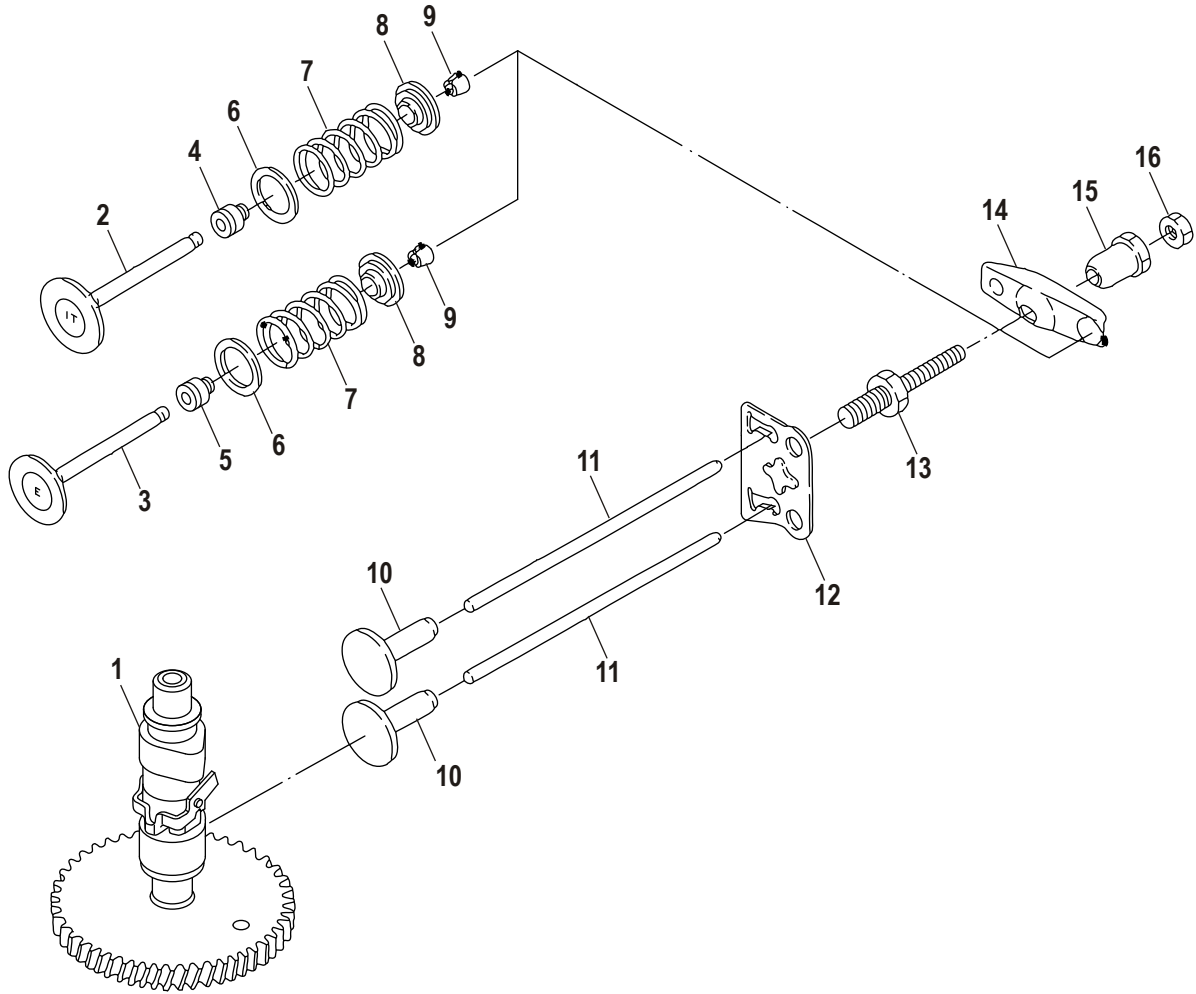
Special Tools

Universal Puller Plate	91-37241
 <p style="text-align: center;">8505</p>	Removes bearings from gears and the driveshaft

Piston Ring Expander	91-24697
 <p>6255</p>	Expands piston rings for removal and installation

Bearing Puller Assembly	91-83165T
 <p>3610</p>	Removes bearings, races and bearing carriers

Camshaft and Valve Components

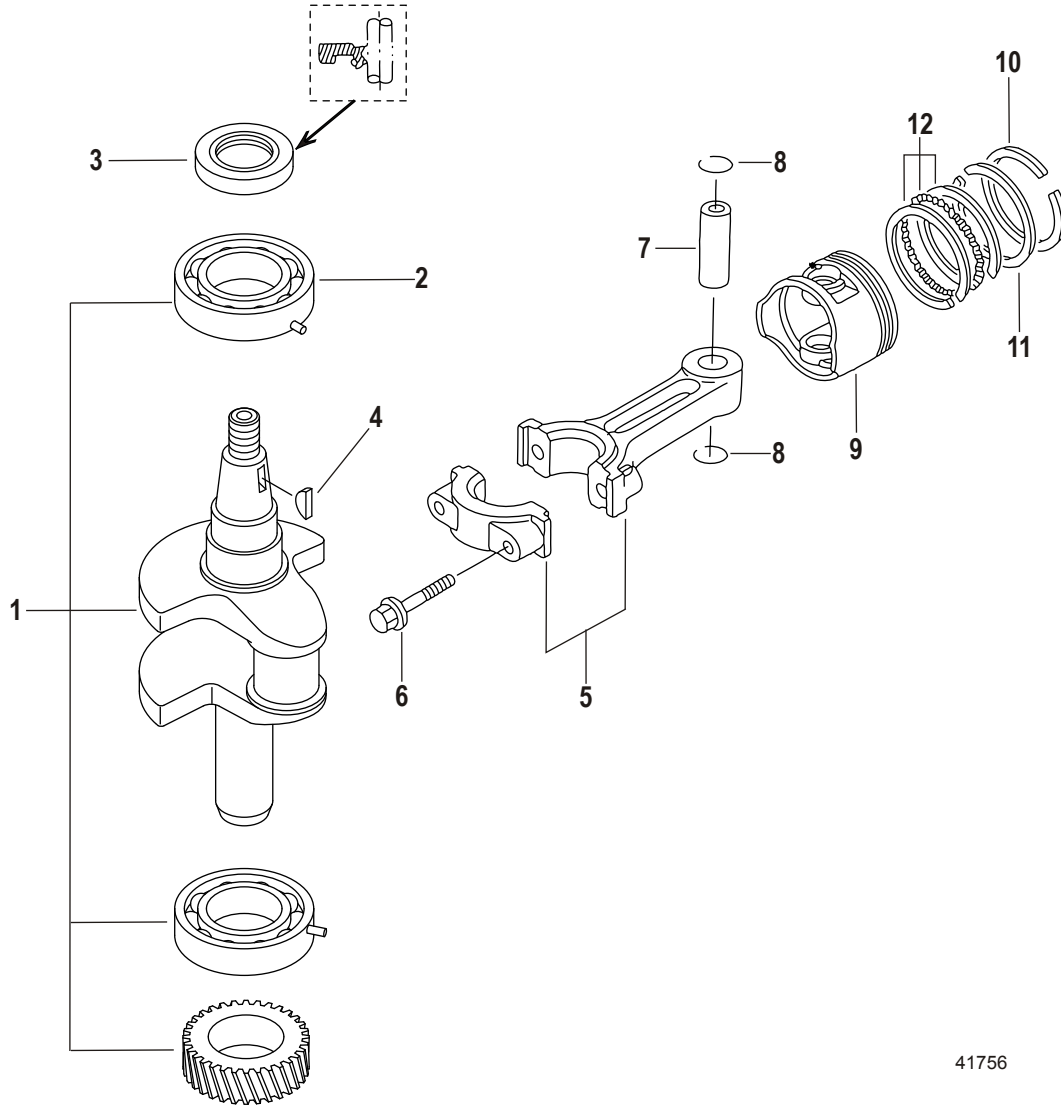


22493

Camshaft and Valve Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Camshaft assembly			
2	1	Intake valve			
3	1	Exhaust valve			
4	1	Intake seal (black)			
5	1	Exhaust seal (green)			
6	2	Seat			
7	2	Spring			
8	2	Retainer			
9	4	Keeper			
10	2	Lifter			
11	2	Push rod			
12	1	Push rod plate			
13	2	Pivot bolt	26		19.2
14	2	Rocker arm			
15	2	Pivot			
16	2	Nut	11	97	

Crankshaft, Piston, and Connecting Rod Components

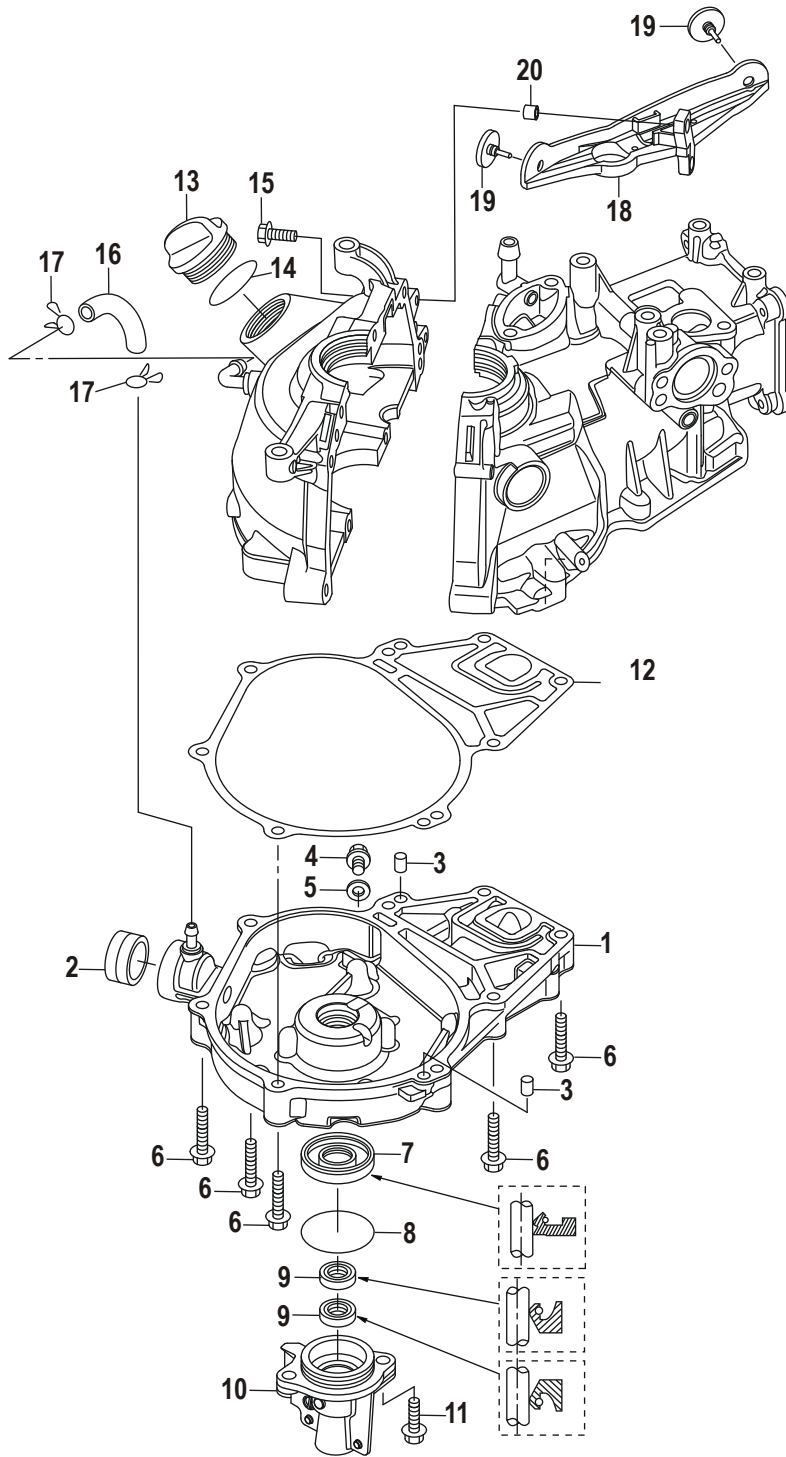


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Crankshaft, Piston, and Connecting Rod Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Crankshaft assembly			
2	1	Ball bearing			
3	1	Oil seal			
4	1	Key			
5	1	Connecting rod assembly			
6	2	Screw	First torque	6	53
			Final torque	11	97
7	1	Piston pin			
8	2	Clip			
9	1	Piston assembly			
10	1	Ring set			
11	1	Second piston ring			
12	1	Oil ring assembly			

Oil Pan Components

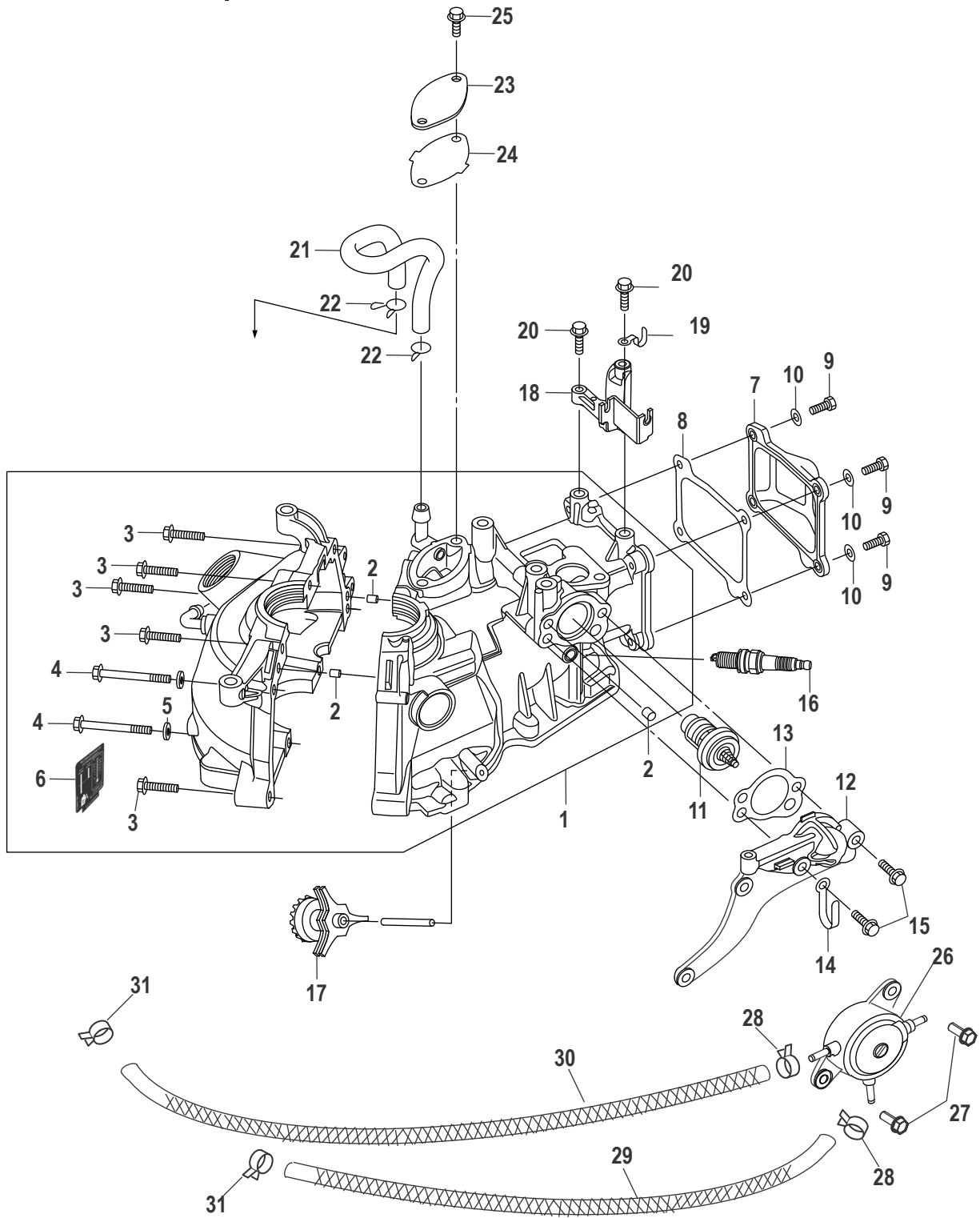


22492

Oil Pan Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Oil pan			
2	1	Oil level sight gauge			
3	3	Dowel pin			
4	1	Drain bolt	20	177	
5	1	Washer			
6	8	Bolt (M6 x 35)	11	97	
7	1	Oil seal			
8	1	O-ring			
9	2	Oil seal			
10	1	Driveshaft seal housing			
11	2	Bolt (M6 x 20)	6	53	
12	1	Oil pan gasket			
13	1	Oil filler cap			
14	1	O-ring			
15	2	Bolt (M6 x 20)	6	53	
16	1	Hose			
17	2	Clamp			
18	1	Starter bracket			
19	2	Damper			
20	2	Collar			

Cylinder Block Components



50918

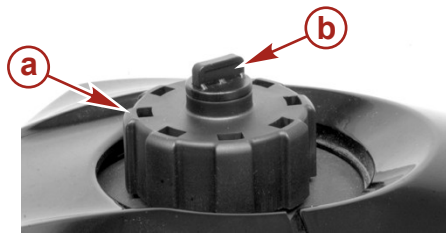
Cylinder Block Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Cylinder block			
2	3	Dowel pin			
3	6	Bolt (M6 x 35)	11	97	
4	2	Bolt (M6 x 75)	11	97	
5	2	Washer			
6	1	Recommended oil decal			
7	1	Cylinder head cover			
8	1	Cylinder head cover gasket			
9	4	Bolt (M6 x 16)	6	53	
10	4	Washer			
11	1	Thermostat			
12	1	Thermostat cap			
13	1	Thermostat cap gasket			
14	1	Clamp			
15	2	Bolt (M6 x 30)	6	53	
16	1	Spark plug			
17	1	Slinger			
18	1	Throttle cable bracket			
19	1	Clamp			
20	2	Bolt (M6 x 25)	6	53	
21	1	Breather hose			
22	2	Clamp			
23	1	Breather chamber cover			
24	1	Breather chamber cover gasket			
25	2	Bolt (M6 x 16)	6	53	
26	1	Fuel pump			
27	2	Bolt	6	53	
28	2	Clip			
29	1	Hose from fuel shutoff valve			
30	1	Hose to carburetor			
31	2	Clip			

Thermostat

Removal

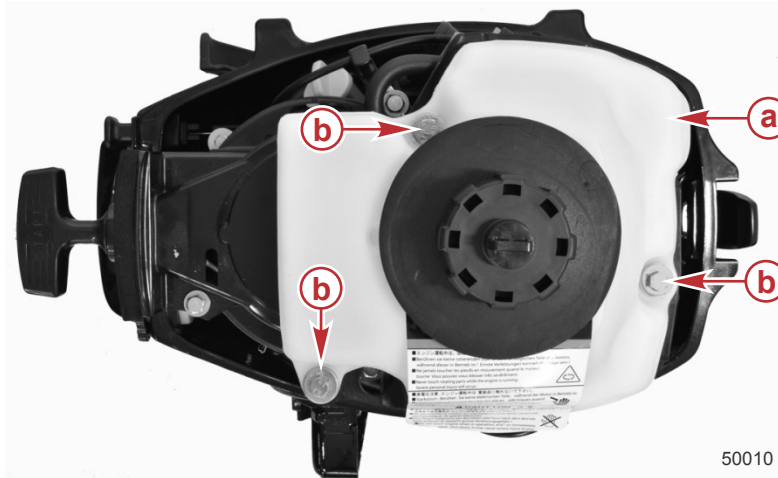
1. Close the manual vent screw on the fuel cap.



47368

- a - Fuel cap
- b - Manual vent screw

2. Remove the three bolts securing the fuel tank and move the fuel tank to the side.

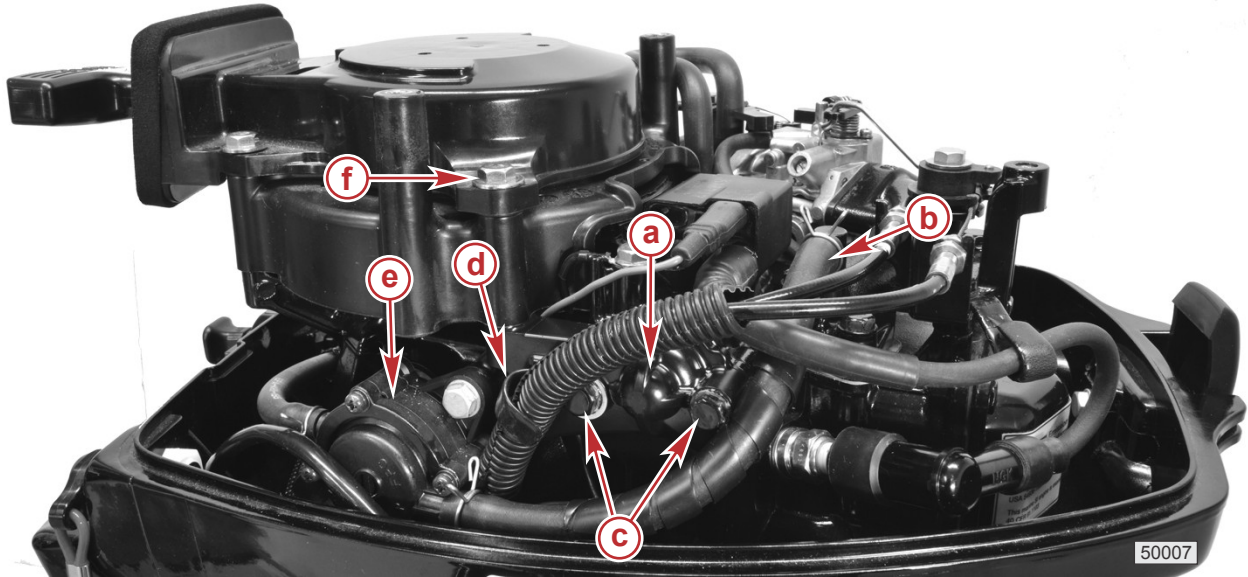


50010

- a - Fuel tank
- b - Bolt (M6 x 25) and washer

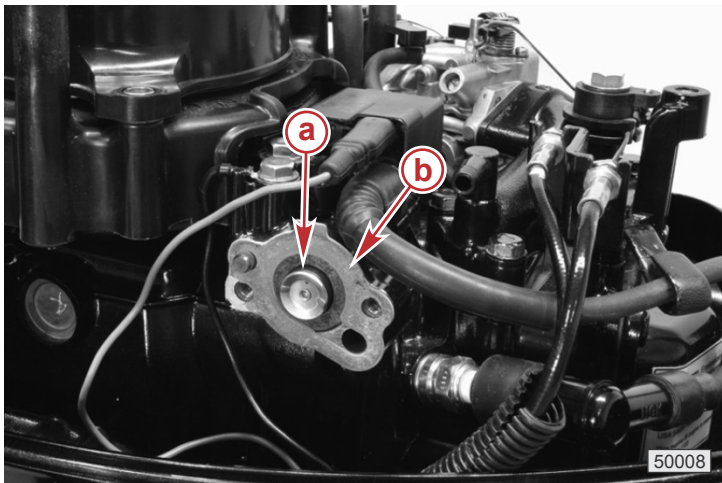
3. Straighten the J-clamp securing the throttle cables.
4. Remove the two M6 x 30 bolts securing the thermostat housing bracket to the cylinder block.
5. Remove the M6 x 60 bolt securing the recoil starter to the thermostat housing bracket.
6. Remove the fuel pump pulse hose at the intake manifold fitting.

7. Move the thermostat housing bracket with the fuel pump to the side.



- a - Thermostat cap
- b - Fuel pump pulse hose
- c - Bolts (M6 x 30) (2)
- d - J-clamp
- e - Fuel pump
- f - Bolt (M6 x 60)

8. Remove the gasket and thermostat.

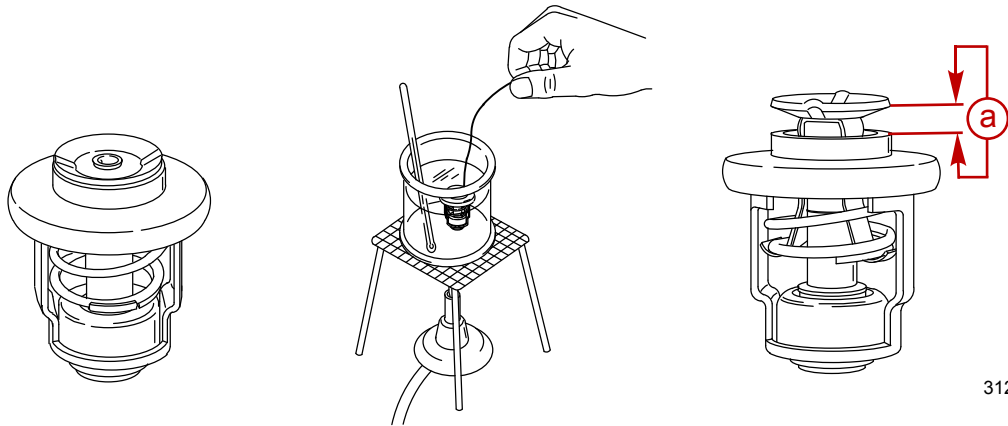


- a - Thermostat
- b - Gasket

Inspection

1. Tie a piece of thread or other nonconductive material onto the thermostat.
2. Suspend a thermometer in the water.
IMPORTANT: Do not allow the thermometer to contact the heating surface of the container. An inaccurate temperature reading may result.
3. Slowly heat the water while observing the thermostat and thermometer.

4. Measure the thermostat opening when the specified water temperature is achieved.



3120

a - Minimum thermostat valve lift

Thermostat Specifications	
Start to open temperature	50–54 °C (122–129 °F)
Full open temperature	60–64 °C (140–147 °F)
Minimum thermostat valve lift	2 mm (0.079 in.)

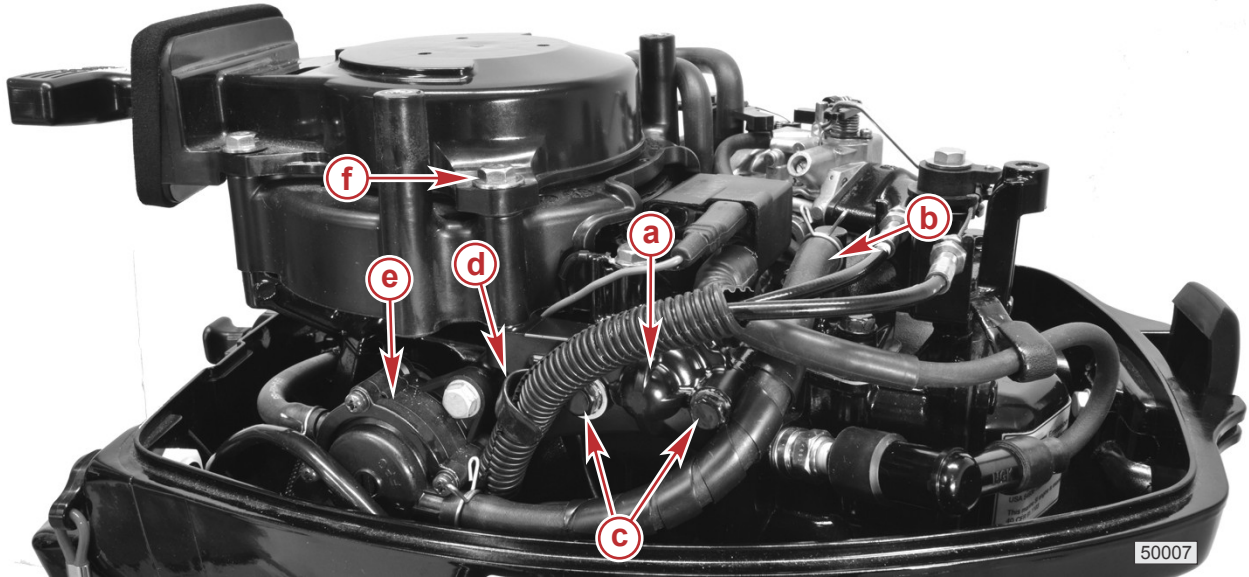
Installation

1. Clean the gasket surfaces on the thermostat housing bracket and cylinder block.
2. Install the thermostat.
3. Install a new thermostat gasket.
4. Install the thermostat housing bracket. Tighten the bolts to the specified torque.
5. Install the M6 x 60 bolt through the recoil starter. Tighten the bolt to the specified torque.

Description	Nm	lb-in.	lb-ft
Thermostat housing bracket mounting bolts (3)	6	53	
Recoil starter bolts (M6 x 60)	6	53	

6. Secure the throttle cables with the J-clamp.

- Install the fuel pump pulse hose to the intake manifold fitting. Secure the hose with a hose clamp.



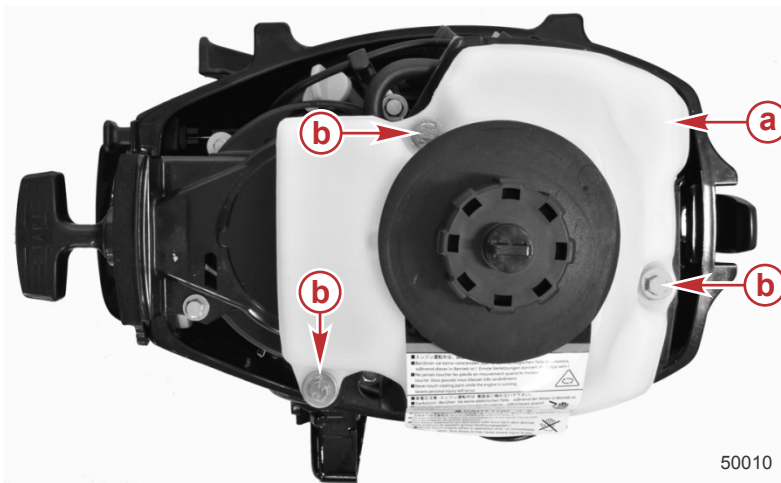
- a - Thermostat cap
- b - Fuel pump pulse hose
- c - Bolts (M6 x 30) (2)
- d - J-clamp
- e - Fuel pump
- f - Bolt (M6 x 60)

- Install the fuel tank assembly. Attach the fuel line to the fuel tank and secure it with a hose clamp.


⚠ WARNING

Fuel is flammable and explosive. Ensure that the key switch is off and the lanyard is positioned so that the engine cannot start. Do not smoke or allow sources of spark or open flame in the area while servicing. Keep the work area well ventilated and avoid prolonged exposure to vapors. Always check for leaks before attempting to start the engine, and wipe up any spilled fuel immediately.

- Apply Loctite 242 Threadlocker to the fuel tank mounting bolts. Install the bolts and washers and tighten the bolts to the specified torque.



- a - Fuel tank
- b - Bolt (M6 x 25) and washer

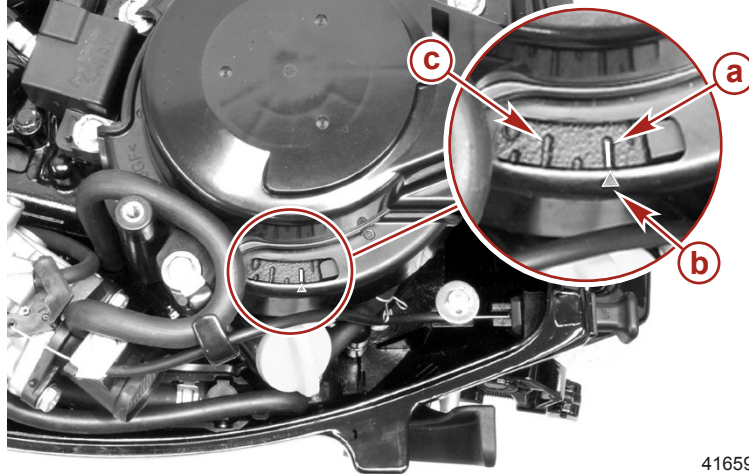
Tube Ref No.	Description	Where Used	Part No.
 66	Loctite 242 Threadlocker	Fuel tank mounting bolts	92-809821

Description	Nm	lb-in.	lb-ft
Fuel tank mounting bolts (M6 x 25) (3)	6	53	

Valve Clearance Adjustment

IMPORTANT: Adjust the valve clearance while the engine temperature is cool.

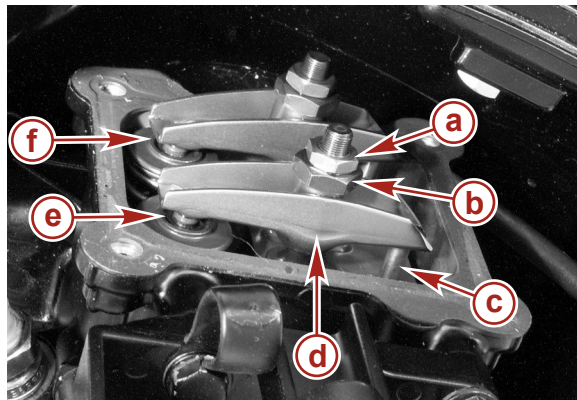
- Align the timing mark on the flywheel to 0° TDC on the compression stroke. The piston is at top dead center and both valves are closed. The valve clearance may now be checked.



- a - 0° flywheel timing mark
- b - Pointer on flywheel cover
- c - 10° BTDC flywheel timing mark

41659

- Remove the spark plug lead and the cylinder head cover.
- Measure each valve clearance with a feeler gauge.



- a - Nut
- b - Pivot
- c - Push rod
- d - Rocker arm
- e - Intake valve
- f - Exhaust valve

26681

Valve to Rocker Arm Clearance	
Intake	0.06–0.14 mm (0.0024–0.0055 in.)
Exhaust	0.11–0.19 mm (0.0043–0.0075 in.)

- Adjust if out of specification.
 - Hold the pivot and loosen the nut.
 - Adjust valve clearance by rotating the pivot.
 - When the proper clearance is achieved, hold the pivot and tighten the nut to the specified torque.

Description	Nm	lb-in.	lb-ft
Rocker arm nut	11	97	

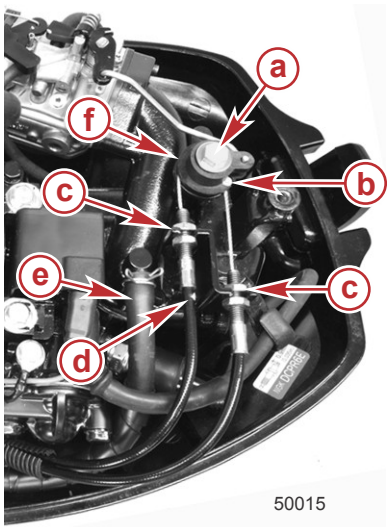
- Recheck valve clearance.
- Clean the cylinder head and cover surface.
 - Install a new gasket.
 - Attach the cylinder head cover to the cylinder block with four bolts. Tighten the bolts to the specified torque.

Description	Nm	lb-in.	lb-ft
Cylinder head cover bolts (M6 x 16) (4)	6	53	

- Install the spark plug lead to the spark plug. Secure the spark plug lead with the J-clamp.

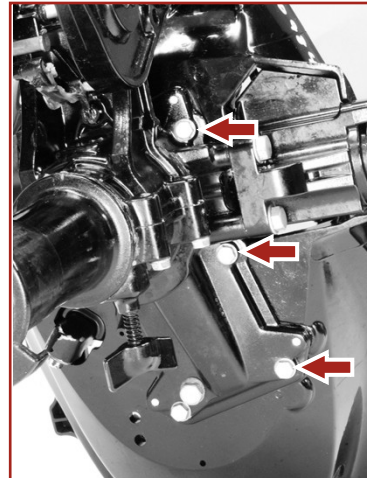
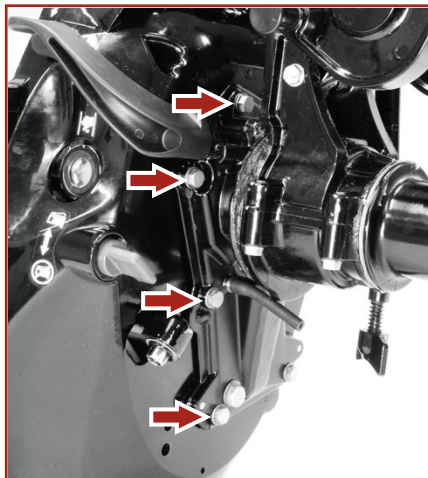
Powerhead Removal

- Drain the engine oil.
- Remove the fuel tank and recoil starter. Refer to **Section 8A - Recoil Starter**.
- Remove the fuel pump pulse hose from the intake manifold.
- Remove the throttle cables.
 - Place a match mark on the acceleration throttle cable, as shown.
 - Loosen the throttle cable jam nuts.
 - Remove the throttle drum bolt.
 - Remove the throttle cable ends from the throttle drum.
 - Remove the throttle drum assembly and cable bracket.



- a - Throttle drum bolt (M6 x 35)
- b - Throttle cable ends
- c - Jam nuts (two per cable)
- d - Match mark on acceleration throttle cable
- e - Fuel pump pulse hose
- f - Throttle drum

- Remove the carburetor. Refer to **Section 3A - Carburetor and Fuel Pump**.
- Remove the ignitor. Refer to **Section 2A - Ignition**.
- Remove the ignitor ground wire.
- Remove the flywheel. Refer to **Section 2A - Ignition**.
- Remove the seven powerhead mounting bolts.
- Remove the powerhead.

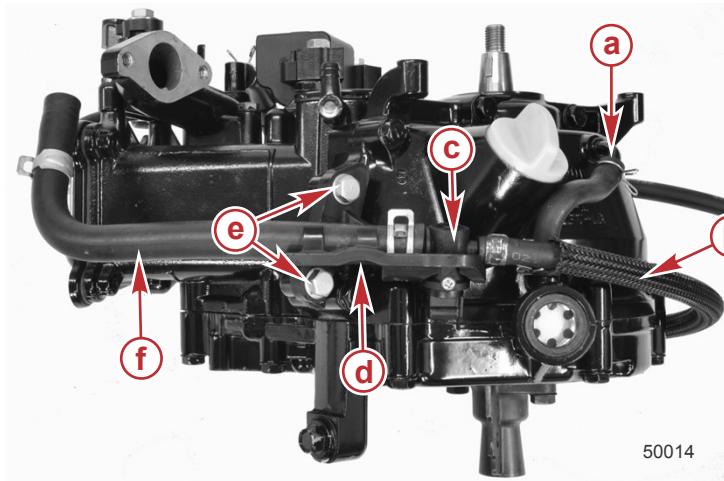


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Powerhead Disassembly

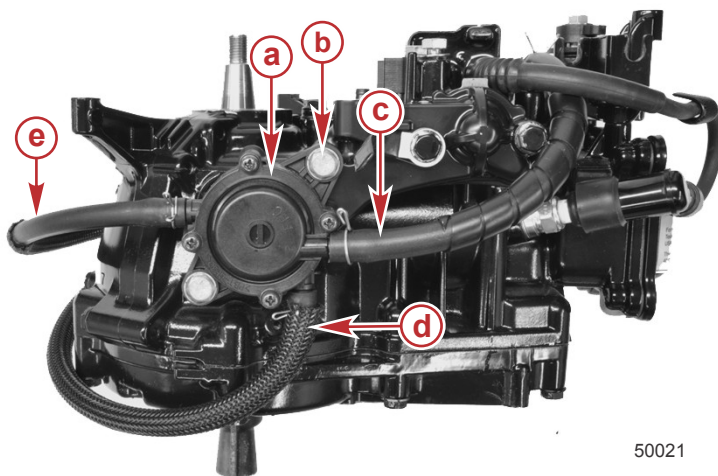
Oil Pan Removal

1. Remove the oil sight gauge hose.
2. Remove the fuel shutoff valve/hose assembly.
3. Remove the fuel shutoff valve bracket.



- a - Oil sight gauge hose
- b - Fuel pump inlet hose
- c - Fuel shutoff valve
- d - Fuel shutoff valve bracket
- e - Bolt (M6 x 20) with washer
- f - Fuel tank outlet hose

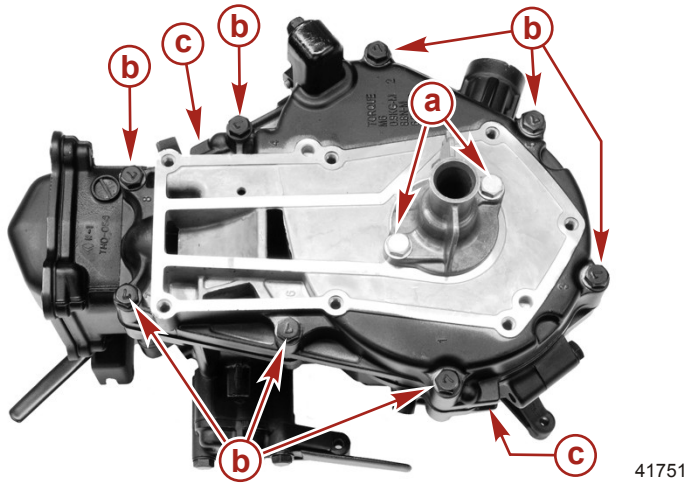
4. Remove the hoses from the fuel pump. Wipe up any spilled fuel immediately.
5. Remove the two bolts securing the fuel pump.



- a - Fuel pump
- b - Bolt (M6 x 30) (2)
- c - Pulse hose
- d - Hose from the fuel shutoff valve
- e - Hose to the carburetor

6. Remove the eight bolts securing the oil pan to the cylinder block.
7. Remove the oil pan.
8. Remove the oil pan/cylinder block gasket.

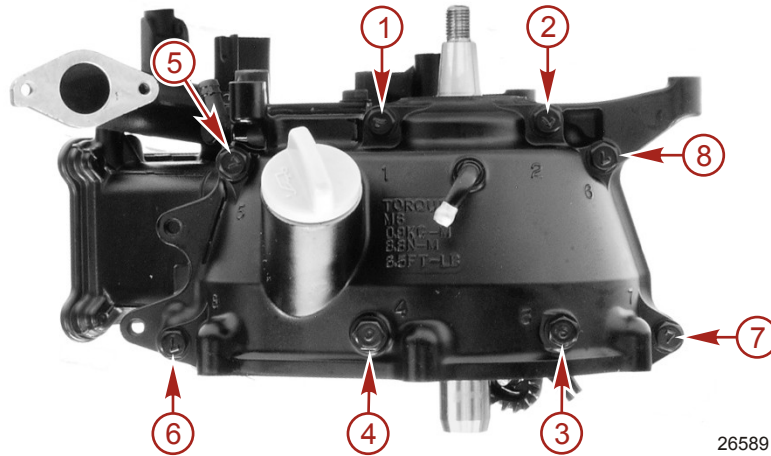
9. Remove the bolts securing the driveshaft seal housing.



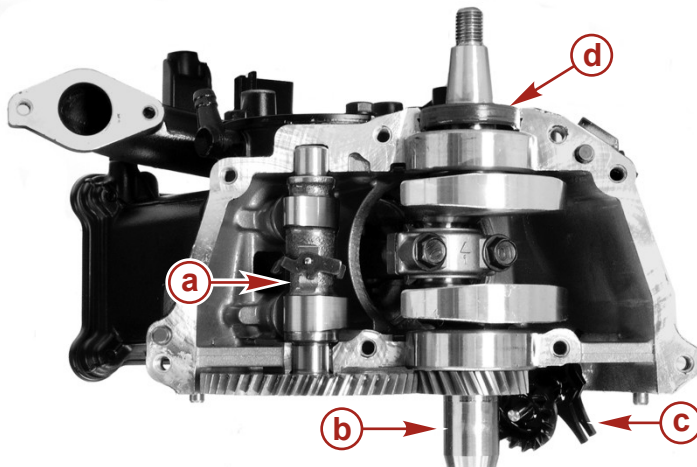
- a** - Driveshaft seal housing bolts (M6 x 20) (2)
- b** - Oil pan bolts (M6 x 35) (8)
- c** - Pry point

Cylinder Block Disassembly

1. Remove the seven bolts securing the two cylinder block housings and separate the cylinder block housings.



2. Remove the camshaft/gear assembly from the cylinder block.
3. Remove the crankshaft/connecting rod/piston assembly from the cylinder block.
4. Remove the oil slinger from the cylinder block.

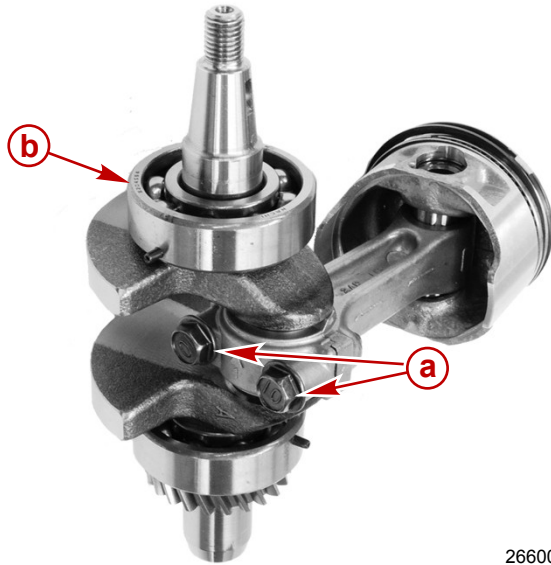


- a** - Camshaft assembly
- b** - Crankshaft/connecting rod/piston assembly
- c** - Oil slinger
- d** - Crankshaft seal

Crankshaft/Piston Disassembly

1. Remove the two bolts from the connecting rod cap.
2. Remove the piston assembly from the crankshaft.
3. Remove the upper bearing on the crankshaft using a universal puller plate.

NOTE: The lower bearing and gear are not serviceable.

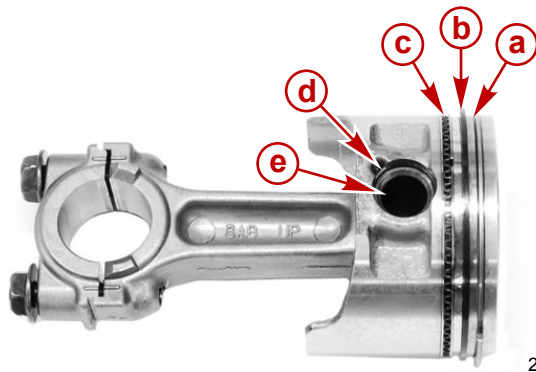


- a - Connecting rod cap bolts
- b - Upper bearing

26600

Universal Puller Plate	91-37241
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4. Remove the piston pin clips and piston pin.
5. Use a piston ring expander to remove the top ring and middle ring.
6. Remove the oil ring top scraper, bottom scraper, and the oil control ring.



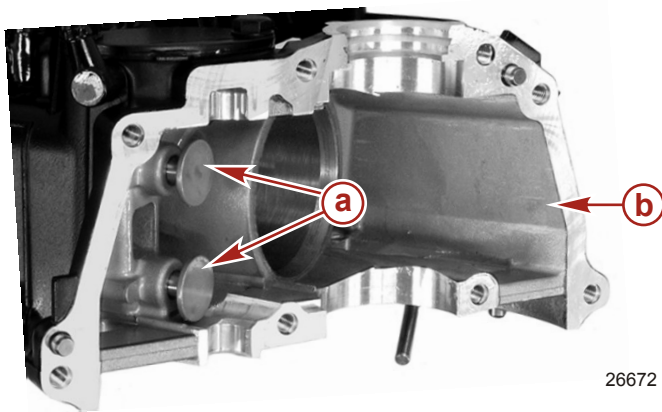
- a - Top ring
- b - Middle ring
- c - Oil rings
- d - Piston pin clip
- e - Piston pin

26619

Piston Ring Expander	91-24697
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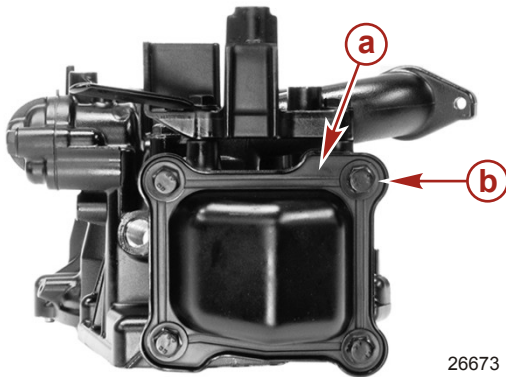
Valve Lifter/Rocker Arm Disassembly

1. Remove the valve lifters and push rods.



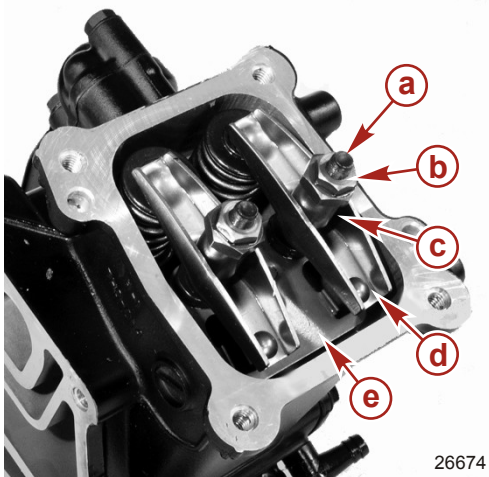
- a** - Valve lifter and push rod
- b** - Cylinder block

2. Remove the cylinder head cover.
3. Remove the gasket. Clean the gasket surface on the cylinder head cover and the cylinder block.



- a** - Cylinder head cover
- b** - Bolt and washer (M6 x 16) (4)

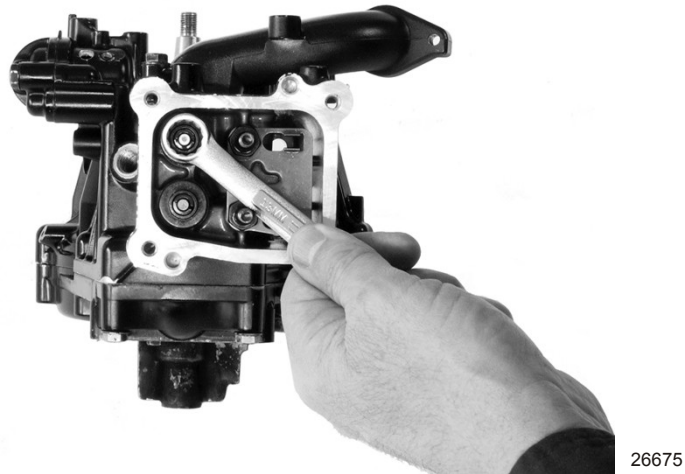
4. Remove the rocker arm nut.
5. Remove the rocker arm pivot and rocker arm.
6. Remove the pivot bolt and guide plate.



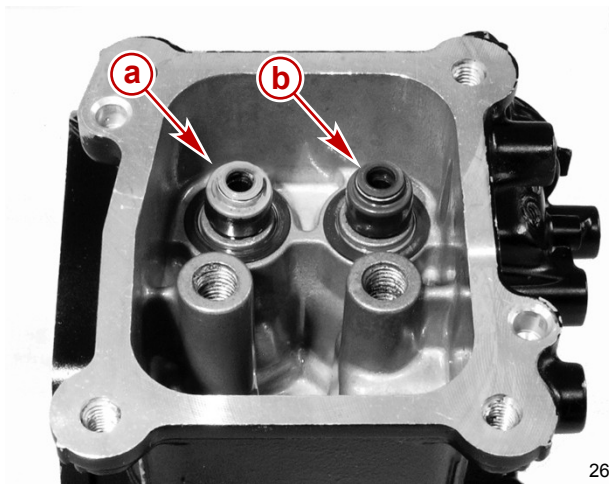
- a** - Pivot bolt
- b** - Nut
- c** - Pivot
- d** - Rocker arm
- e** - Guide plate

7. Use a suitable box end wrench to compress the valve spring to release the valve keepers.

NOTE: Hold the valves in place from the cylinder bore end during the disassembly procedure.



8. Remove the valve keepers, valve spring retainer, spring, and spring seat.
9. Remove the intake and exhaust valves.
10. Remove the intake and exhaust valve seals.



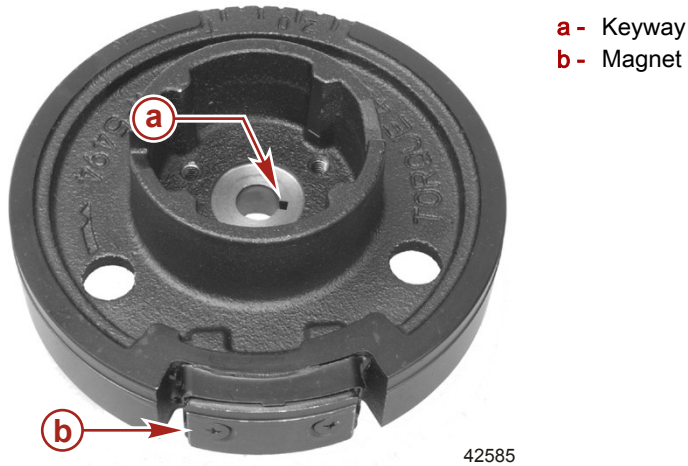
- a** - Exhaust valve seal (green)
- b** - Intake valve seal (black)

Cleaning/Inspection/Repair

Flywheel

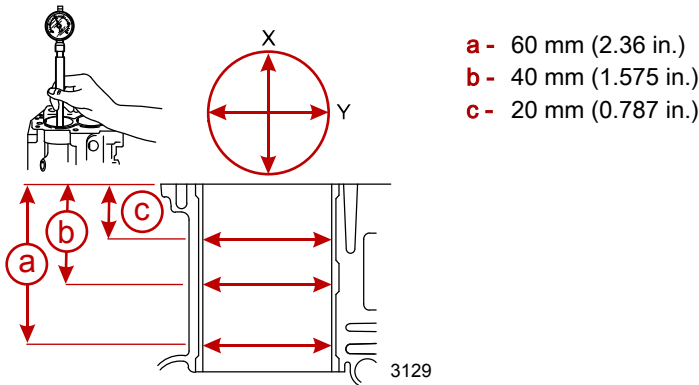
1. Inspect the flywheel keyway. Replace if damaged or worn.

2. Ensure the flywheel magnet is secured to the flywheel.



Cylinder Bore Measurement

1. Inspect the water jacket areas for mineral deposit and blockage. Clean the water jacket area as needed.
2. Inspect the surface of the cylinder bores. Deep scoring will require the cylinder block to be bored oversize and finished honed.
3. Measure the cylinder bore in six places with a cylinder bore gauge. Determine the maximum taper/out of round of the cylinder bore.

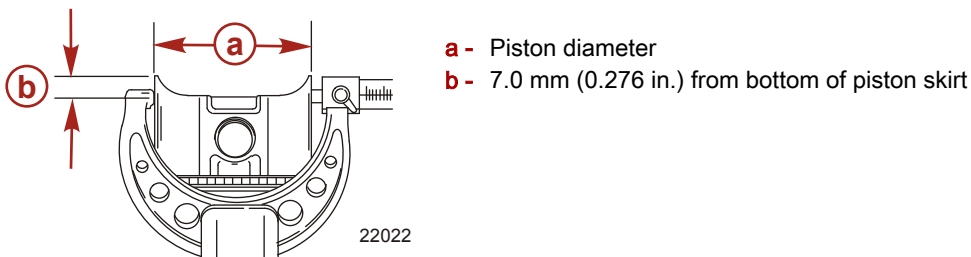


Cylinder Bore	
Maximum taper/out of round	0.06 mm (0.00236 in.)
Standard bore finish hone	55 ± 0.01 mm (2.165 ± 0.00039 in.)
Oversize bore finish hone	55.5 ± 0.01 mm (2.185 ± 0.00039 in.)

Piston

Diameter

1. Inspect the piston. Replace if damaged or worn.
2. Measure the piston at a point 7.0 mm (0.276 in.) from the bottom of the piston skirt and 90° from the wrist pin. Replace the piston if out of specification.

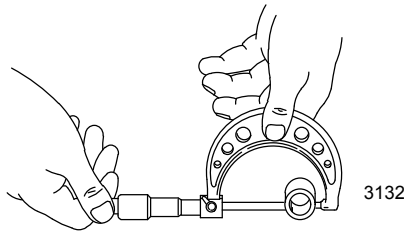


Piston	
Outside diameter (standard)	54.96 mm (2.1638 in.)
Outside diameter (service limit)	54.90 mm (2.1614 in.)
Clearance (standard)	0.02–0.06 mm (0.00078–0.00236 in.)
Clearance (service limit)	0.15 mm (0.0059 in.)

- To determine a piston to cylinder wall clearance, use this formula:
 - Minimum cylinder bore measurement – maximum piston diameter measurement = piston to cylinder wall clearance.

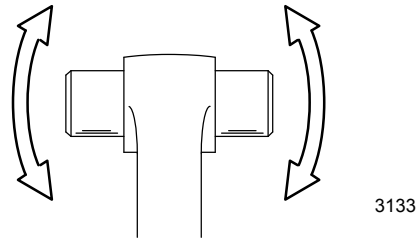
Piston Pin

- Measure the piston pin.

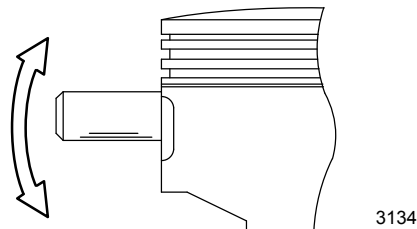


Piston Pin	
Inside diameter (standard)	14.0 mm (0.5512 in.)
Inside diameter (service)	13.97 mm (0.550 in.)

- Place the piston pin into the connecting rod and check for free play. There should be no noticeable free play. Replace the pin and/or the connecting rod as necessary.



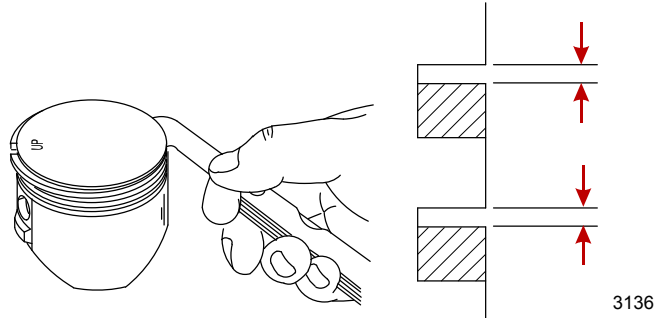
- Place the piston pin into the piston and check for free play. There should be no noticeable free play. Replace the pin and/or the piston as necessary.



Piston Rings

Piston Ring Side Clearance

Measure the piston ring side clearance and replace the piston or rings if out of specification.



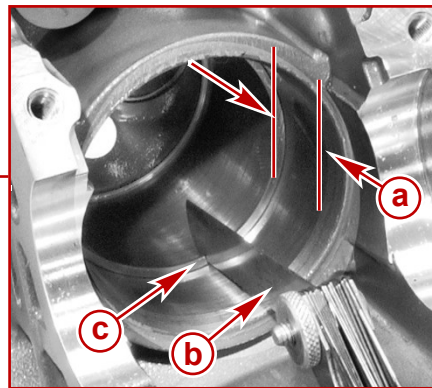
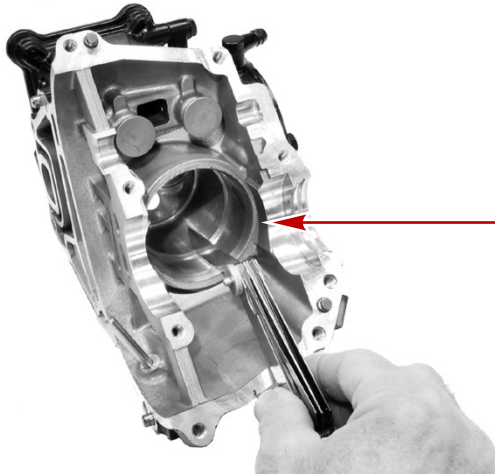
3136

Piston Ring Side Clearance (Standard)	
Top	0.04–0.08 mm (0.0016–0.0031 in.)
Middle	0.03–0.07 mm (0.0012–0.00276 in.)
Bottom	0.05–0.15 mm (0.002–0.0059 in.)

Piston Ring Side Clearance (Service Limit)	
Top	0.10 mm (0.0039 in.)
Middle	0.09 mm (0.0035 in.)
Bottom	0.17 mm (0.0067 in.)

Piston Ring End Gap Clearance

1. Push the piston ring into the bore of the cylinder with the crown of the piston to a depth of 20 mm (0.787 in.).
2. Measure piston ring end gap clearance.
3. Replace rings as a set if out of specification.



26622

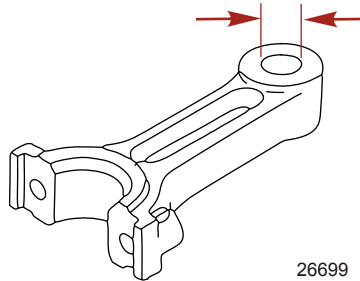
- a** - 20 mm (0.787 in.)
- b** - Feeler gauge
- c** - Piston ring end gap

Piston Ring End Gap (Standard)	
Top	0.15–0.30 mm (0.0059–0.0118 in.)
Middle	0.30–0.45 mm (0.0118–0.0177 in.)
Bottom	0.20–0.70 mm (0.0079–0.0276 in.)

Piston Ring End Gap (Service Limit)	
Top	0.5 mm (0.0197 in.)
Middle	0.7 mm (0.0276 in.)

Connecting Rod

1. Measure the small end inside diameter of the connecting rod.

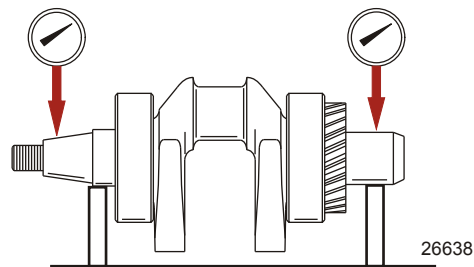


Connecting rod	
Wrist pin diameter (standard)	14.01 mm (0.5516 in.)
Wrist pin diameter (service)	14.04 mm (0.5528 in.)

Crankshaft

Crankshaft Runout

1. Thoroughly clean the crankshaft and inspect the bearing surfaces. Replace the crankshaft if the bearing surfaces are pitted, scored, or discolored.
2. Measure the crankshaft for runout. Replace the crankshaft if out of specification.

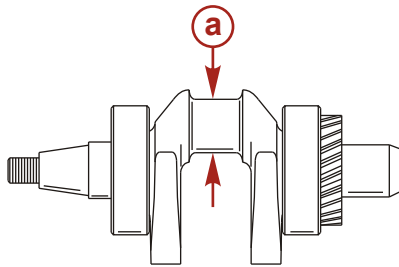


Crankshaft	
Runout	0.05 mm (0.002 in.)

Crankshaft Journal

1. Measure the crankpin journal.

- Replace the crankshaft if the journal is out of specification.



a - Crankpin journal diameter

26639

Crankshaft Bearing Journal	
Crankpin journal (standard)	19.98 mm (0.7866 in.)
Crankpin journal (service limit)	19.95 mm (0.7854 in.)

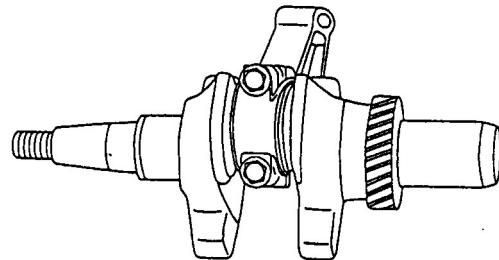
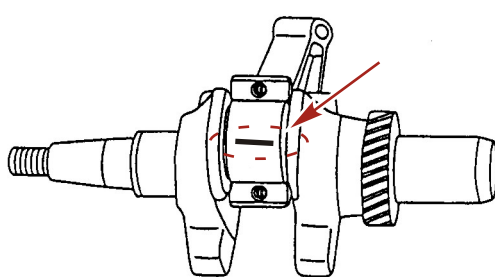
Crankshaft Bearings

- Inspect the crankshaft bearings for:
 - Rusted balls or races
 - Fractured ring
 - Worn or galled surfaces
 - Badly discolored balls or races
 - General feeling of roughness
- Replace the upper crankshaft bearing if defective.
- Replace the crankshaft if the lower bearing is defective.

NOTE: The lower crankshaft bearing is not serviceable.

Measuring Crankpin Oil Clearance

- Clean the oil from the connecting rod bearing surface and connecting rod crankshaft journal.
- Install the connecting rod onto the crankshaft.
IMPORTANT: Make sure the "UP" mark on the connecting rod faces towards the flywheel end of the crankshaft.
- Place a piece of plastigauge on the crankpin journal.
- Install the connecting rod cap and tighten the connecting rod cap screws to the specified torque.
IMPORTANT: Do not rotate crankshaft while performing this measurement.

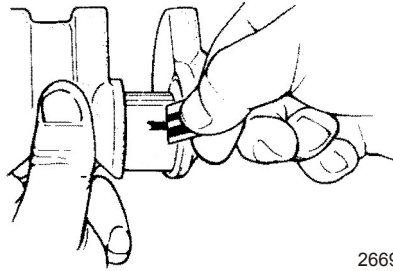


26696

Description		Nm	lb-in.	lb-ft
Connecting rod cap screw	First	6	53	
	Final	11	97	

- Remove the connecting rod cap.

6. Measure the plastigauge at its maximum compressed width.



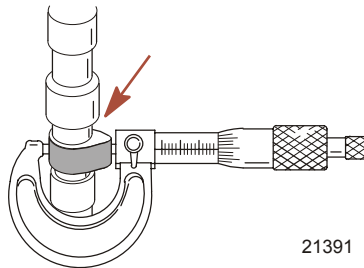
Connecting Rod	
Oil clearance (standard)	0.015–0.041 mm (0.0006–0.0016 in.)
Oil clearance (service limit)	0.060 mm (0.0024 in.)

7. If the oil clearance is out of specification limit, measure the diameter of the connecting rod and the crankpin journal. Replace as needed.

Inspecting the Camshaft and Valves

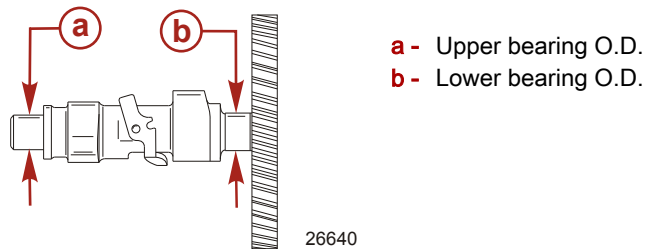
Camshaft

1. Measure the cam lobe at its maximum valve lift. Replace the cam if any of the cam lobe dimensions are out of specification.



Cam Lobe	
Intake and exhaust	23.78–24.04 mm (0.94–0.95 in.)

2. Measure the diameter of the upper and lower bearing journals. Replace the cam if the journal dimensions are out of specification.

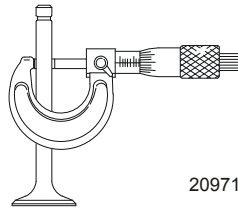


Cam Bearing Journal	
Upper bearing O.D.	11.95–11.97 mm (0.4705–0.4713 in.)
Lower bearing O.D.	12.95–12.97 mm (0.5098–0.5106 in.)

Valves

1. Inspect the valves for damage/warpage. Replace if necessary.

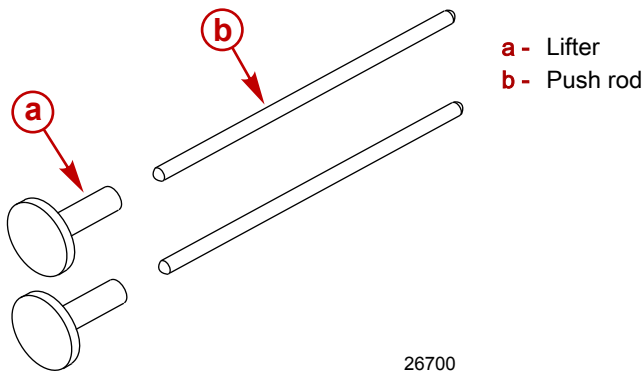
2. Measure the valve stem outer diameter. Replace the valves if out of specification.



Valve Stem O.D.	
Intake	5.45–5.47 mm (0.2146–0.2154 in.)
Exhaust	5.44–5.46 mm (0.2142–0.2150 in.)

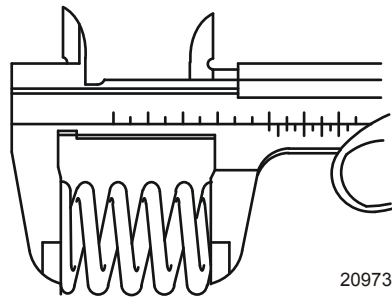
Lifters and Push Rods

1. Replace the valve lifter if worn or corroded.
2. Replace the push rod if worn or corroded.
3. Inspect the push rod for straightness. Replace if bent.



Valve Springs

1. Check the free length of each spring. Replace the valve springs if out of specification.

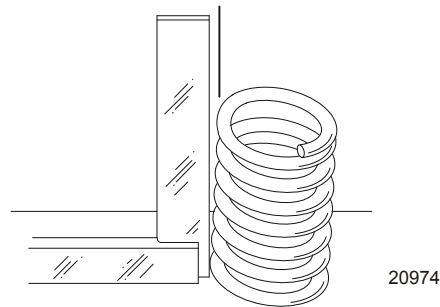


Valve Spring	
Free length	33.2–35 mm (1.307–1.378 in.)

2. Measure the valve spring tilt. Replace the valve springs if out of specification.

Powerhead

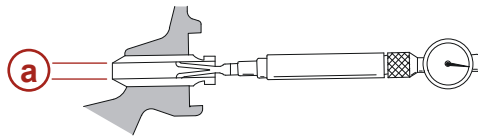
NOTE: Check each spring on a flat surface using a square. Rotate spring and check space between the top coil and square.



Valve Spring	
Tilt limit	2.0 mm (0.0787 in.)

Valve Guides

Measure the valve guide inner diameter. If valve guide wear is out of specification, replace the cylinder head.

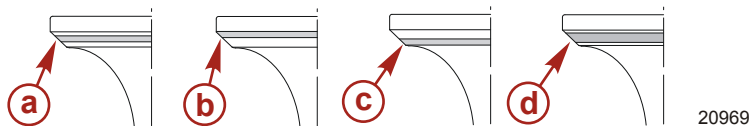


a - Valve guide I.D.

Valve Guide I.D.	
Intake	5.51–5.55 mm (0.217–0.2185 in.)
Exhaust	5.51–5.57 mm (0.217–0.2193 in.)

Valve Seat Reconditioning

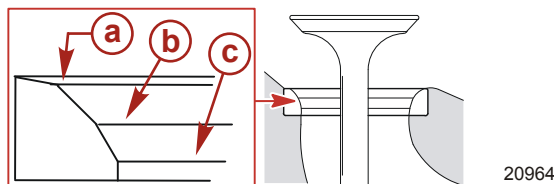
1. Clean the carbon deposits from the combustion chambers and valve seats. Check the valve seats for pitting.
2. Several different types of equipment are available for reseating valve seats. Follow the equipment manufacturers instructions.
3. Apply a thin, even layer of mechanic's bluing dye (Dykem) onto the valve seat.
4. Insert the valve into the valve guide and lap the valve slowly on the valve seat.
5. Remove the valve and measure the valve seat contact pattern width. Resurface the valve seat if not in specification.



a - Correct valve seat contact width
b - Valve seat too high
c - Valve seat too low
d - Valve seat too wide

Valve Seat Contact Width	
Intake and exhaust valve	1.0–2.0 mm (0.0393–0.0787 in.)

6. To reface a valve seat, use a 30°, 45°, and 60° valve seat cutting tool.

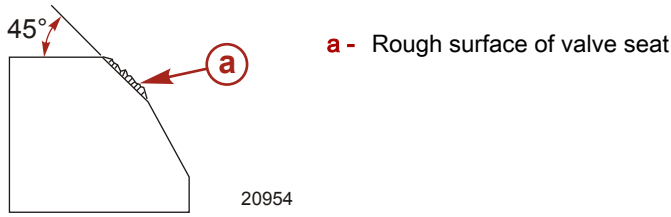


a - 30° angle
b - 45° angle
c - 60° angle

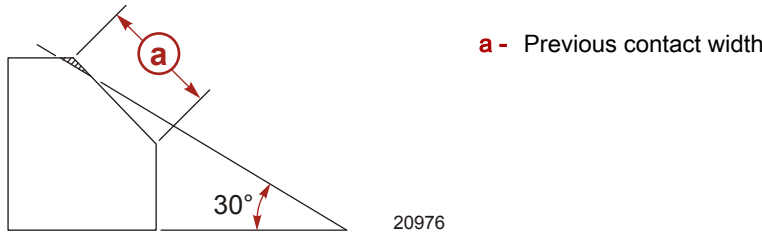
NOTE: When twisting the cutter, keep an even downward pressure to prevent chatter marks.

NOTE: After refacing the valve seat or replacing the valve and valve guide, the valve seat and valve face should be lapped.

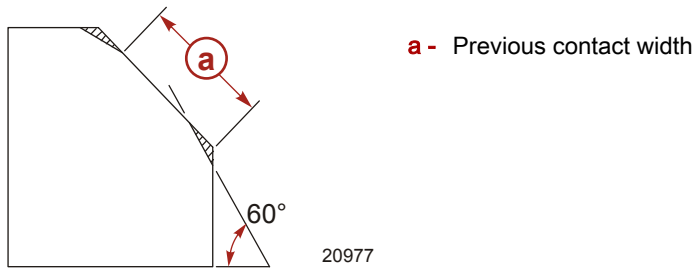
- Start with the 45° cutting tool to clean up any pitting or rough surface of the valve seat.



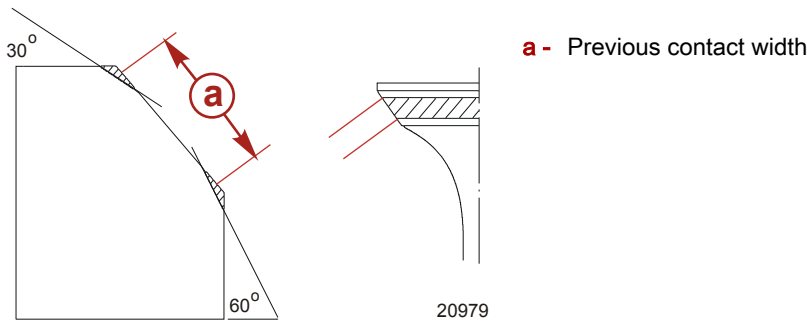
- Use the 30° cutting tool to adjust the contact width of the top edge of the valve seat.



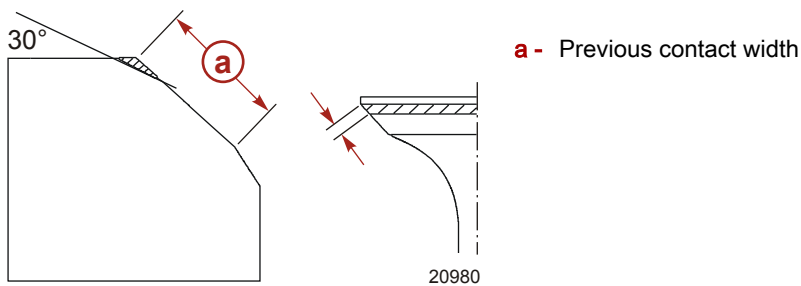
- Use the 60° cutting tool to adjust the contact width of the bottom edge of the valve seat.



- If the valve seat contact area is too wide and situated in the center of the valve face, use the 30° cutting tool to cut the top edge of the valve seat and the 60° cutting tool to cut the bottom edge of the valve seat, to adjust its contact width.

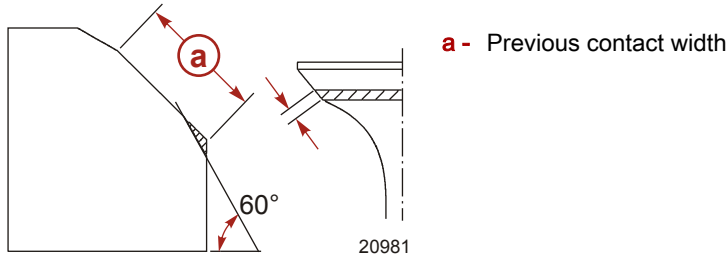


- If the valve seat contact area is too narrow and situated near the top of the valve face, use the 30° cutting tool to cut the top edge of the valve seat. If necessary, use the 45° cutting tool to center the area of contact and set its width.



Powerhead

- If the valve seat contact area is too narrow and situated near the bottom of the valve face, use the 60° cutting tool to cut the bottom edge of the valve seat. If necessary, use the 45° cutting tool to center the area of contact and set its width.

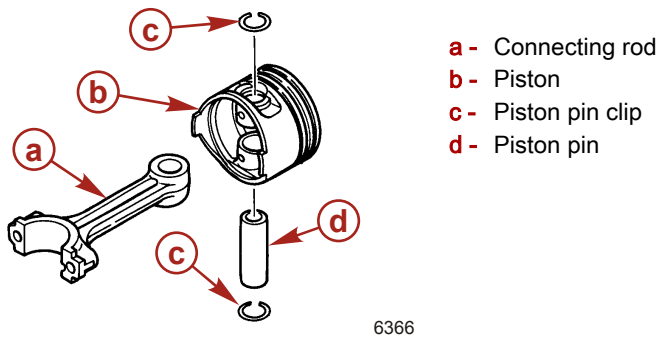


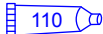
Piston/Crankshaft Reassembly

Piston Assembly

Assemble the connecting rod to the piston. Lubricate the piston pin with 4-Stroke 10W-30 Outboard Oil. Install the piston pin and secure with a new piston pin clip.

IMPORTANT: Ensure the "UP" on the connecting rod and piston are facing the same direction.



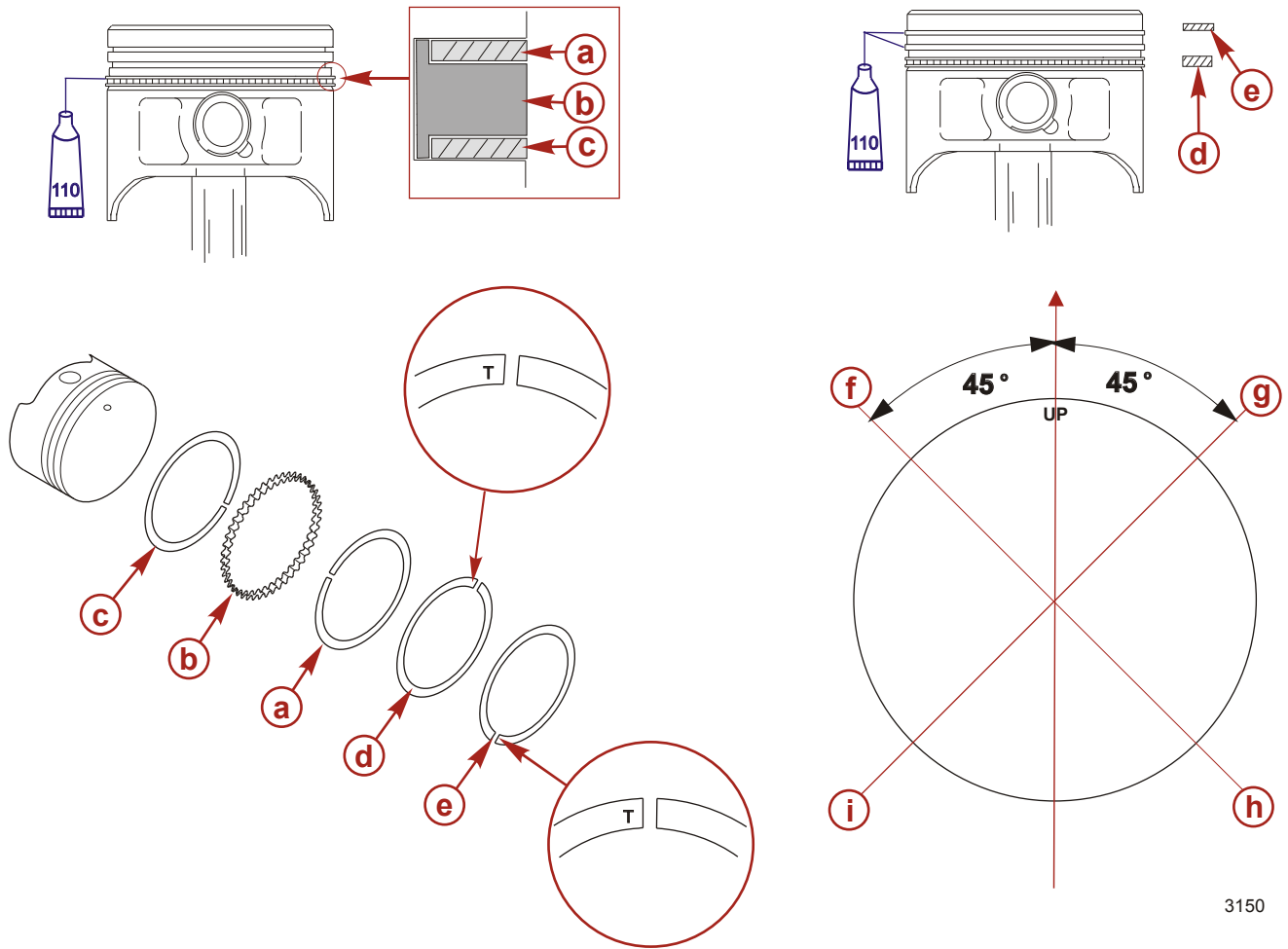
Tube Ref No.	Description	Where Used	Part No.
 110	4-Stroke 10W-30 Outboard Oil	Piston pin	92-858045K01

Piston Ring Installation


IMPORTANT: Use caution when installing piston rings to avoid scratching piston.

- Install oil ring, second ring, and top ring.
IMPORTANT: The "T" on the first and second ring must face the crown of piston.

- Lubricate rings with 4-Stroke 10W-30 Outboard Oil after rings are installed on piston.



- a - Top oil control ring
- b - Expander
- c - Bottom oil control ring
- d - Second ring
- e - Top ring
- f - End gap - Top ring
- g - End gap - Bottom oil control ring
- h - End gap - Second ring
- i - End gap - Top oil control ring

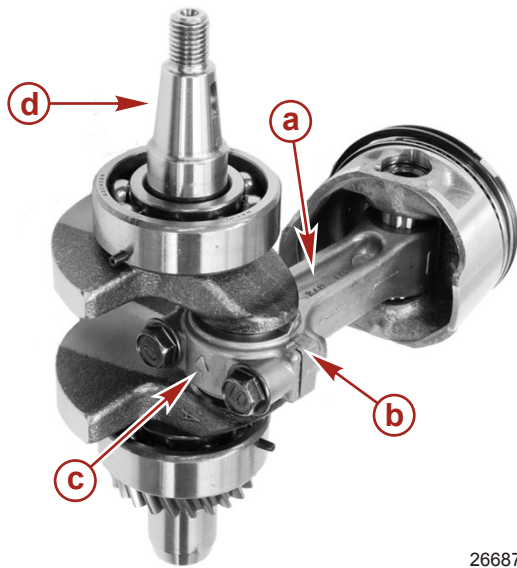
Tube Ref No.	Description	Where Used	Part No.
 110	4-Stroke 10W-30 Outboard Oil	Piston rings	92-858045K01

Piston/Crankshaft Installation

- Lubricate the connecting rod, connecting rod cap, and the crankpin journal with 4-Stroke 10W-30 Outboard Oil.
- Assemble the connecting rod to the crankshaft journal.
IMPORTANT: Ensure the "UP" on the piston/connecting rod faces the flywheel end of the crankshaft.
- Install the connecting rod cap and screws onto the crankpin journal.
IMPORTANT: Ensure the arrowhead and the match mark lines on the connecting rod cap face the flywheel end of the crankshaft.


Powerhead

- Tighten the connecting rod cap screws to the specified torque in two stages.



- a** - Connecting rod
- b** - Arrowhead and match mark
- c** - Connecting rod cap
- d** - Crankshaft

26687

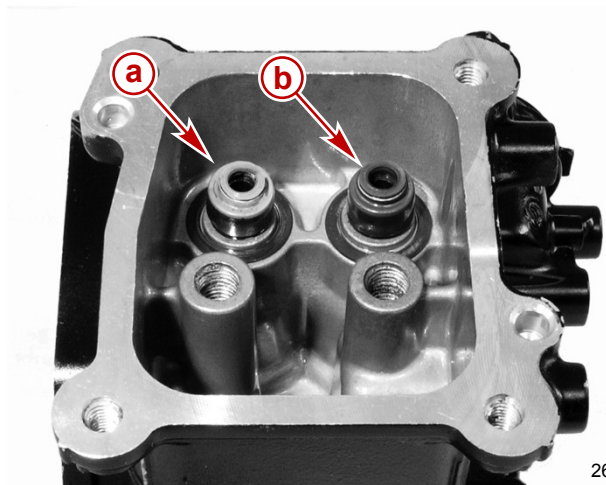
Tube Ref No.	Description	Where Used	Part No.
 110	4-Stroke 10W-30 Outboard Oil	Connecting rod, connecting rod cap, and the crankpin journal	92-858045K01

Description		Nm	lb-in.	lb-ft
Connecting rod cap screw	First	5	44	
	Final	11	97	

Powerhead Assembly

Valve Train Assembly

- Install the intake and exhaust valve seals.

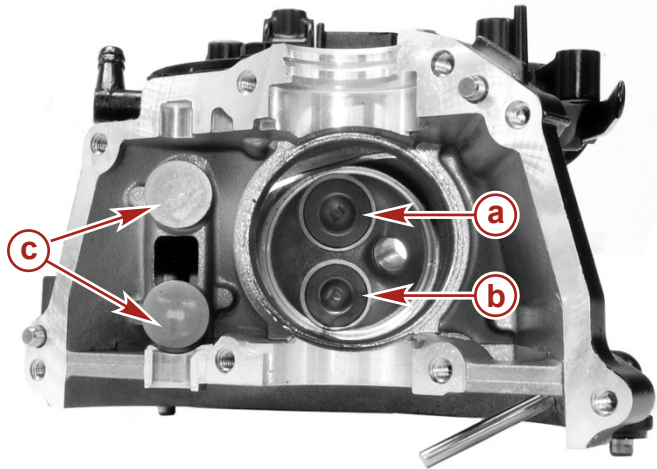


- a** - Exhaust valve seal (green)
- b** - Intake valve seal (black)

26676

- Install the intake and exhaust valves.

3. Install the valve lifters and push rods.

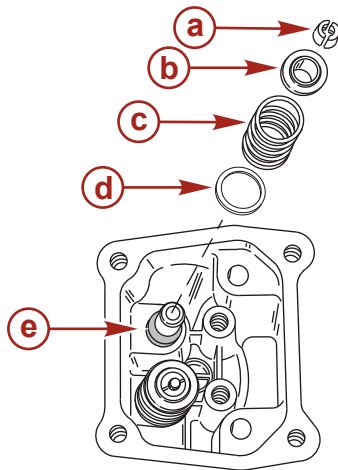


- a - Intake valve
- b - Exhaust valve
- c - Valve lifter and push rod

26716

4. Install the spring seat, spring, and valve spring retainer.
5. Use a suitable box end wrench to compress the valve spring to install the valve keepers.

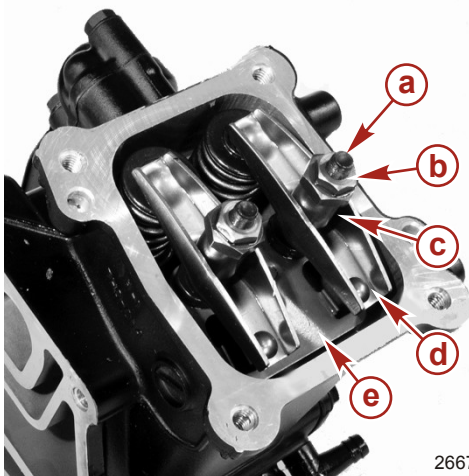
NOTE: Hold the valves in place from the cylinder bore end during the assembly procedure.



- a - Keepers
- b - Retainer
- c - Spring
- d - Seat
- e - Seal

42589

6. Install the guide plate and pivot bolts.
7. Install the rocker arms and rocker arm pivots.
8. Install the rocker arm nuts.



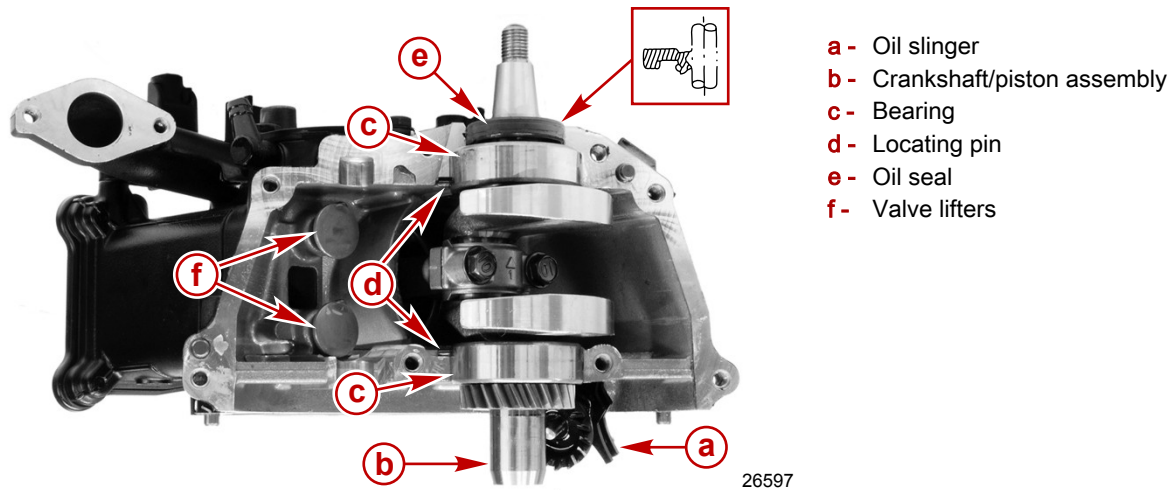
- a - Pivot bolt
- b - Nut
- c - Pivot
- d - Rocker arm
- e - Guide plate


26674

Cylinder Block Assembly

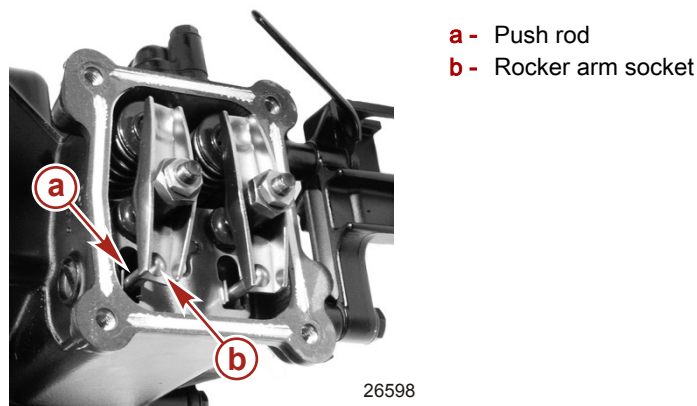
IMPORTANT: The cylinder bore must be clean before installing the piston. Clean with light honing oil, as necessary. After honing, clean the cylinder bore with water and detergent. After cleaning, swab the cylinder bore several times with outboard oil and a clean cloth, then wipe with a clean dry cloth.

1. Clean the mating surfaces of both cylinder block halves.
2. Install the oil slinger onto the shaft in the cylinder block.
3. Install a new crankshaft seal onto the crankshaft. Position the oil seal as shown.
4. Lubricate the crankshaft seal, bearings, and piston rings with 4-Stroke 10W-30 Outboard Oil.
5. Ensure the "UP" mark on the piston is towards the flywheel. Push the piston into the cylinder bore until all the rings have entered the cylinder.
6. Continue pushing until the crankshaft bearings fit into the cylinder block.
7. Ensure the crankshaft bearing locating pins are positioned in the notch on the cylinder block.
8. Ensure the crankshaft seal is parallel with the crankshaft and centered in the seal area of the cylinder block.
9. Lubricate the push rods and valve lifters with 4-Stroke 10W-30 Outboard Oil.



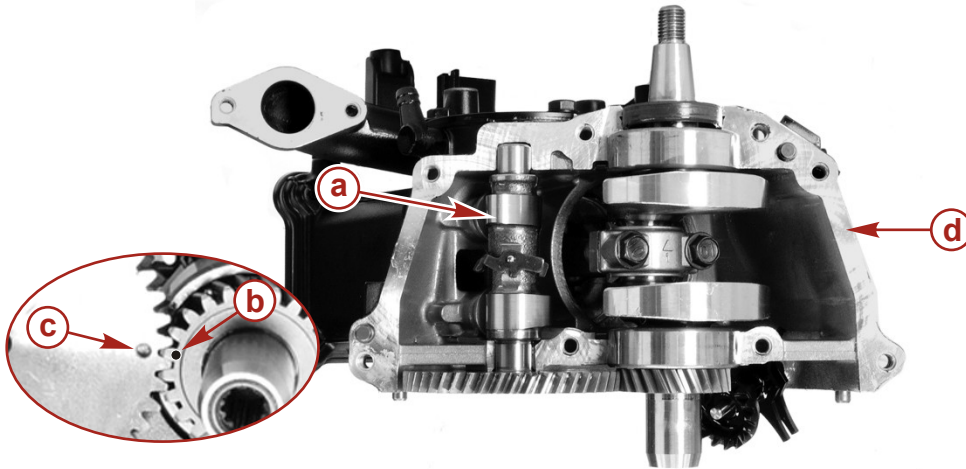
Tube Ref No.	Description	Where Used	Part No.
 110	4-Stroke 10W-30 Outboard Oil	Crankshaft seal, bearings, piston rings, push rods, and valve lifters	92-858045K01

10. Ensure that both push rods are seated in the socket on the rocker arm.



11. Lubricate the camshaft ends and lobes with 4-Stroke 10W-30 Outboard Oil.
12. Install the camshaft/gear assembly from the cylinder block.
13. Align the timing marks on the crankshaft gear with the camshaft gear.

- Apply a continuous bead of Loctite Master Gasket to the contact surface of the crankcase. Follow the instructions contained in the Loctite Master Gasket Kit.

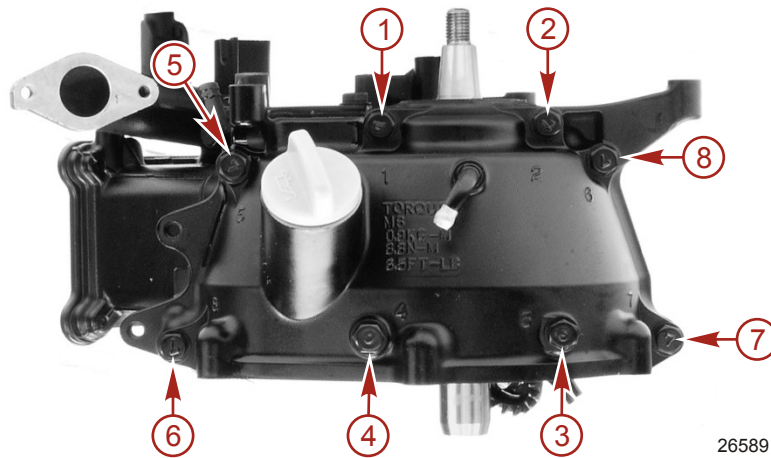


- a - Camshaft/gear assembly
- b - Crankshaft timing mark
- c - Camshaft timing mark
- d - Cylinder block mating surface

26599

Tube Ref No.	Description	Where Used	Part No.
110	4-Stroke 10W-30 Outboard Oil	Camshaft ends and lobes	92-858045K01
12	Loctite Master Gasket Kit	Cylinder block mating surfaces	92-12564 2

- Assemble the cylinder block housings.
- Secure the cylinder block housings with eight bolts.
- Tighten the bolts in sequence to the specified torque.



26589

Description	Nm	lb-in.	lb-ft
Cylinder block housing bolts (M6 x 35)	11	97	

Driveshaft Seal Replacement

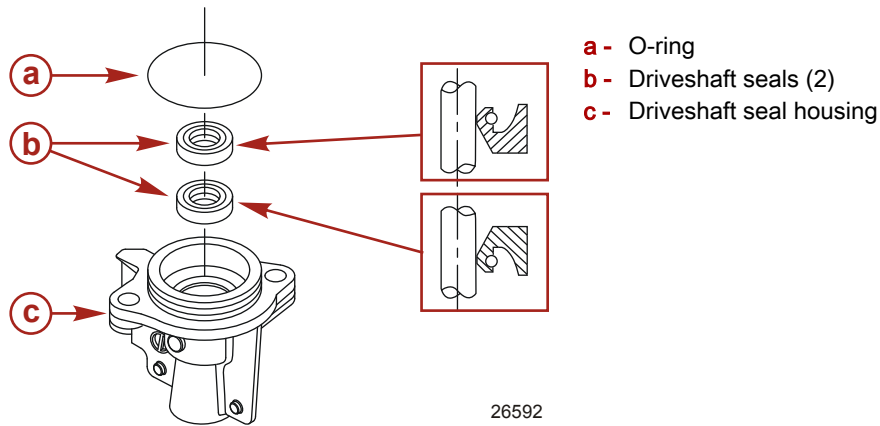
- Remove the seals using a bearing puller.

Bearing Puller Assembly	91-83165T
-------------------------	-----------

- Lubricate the O-ring with 4-Stroke 10W-30 Outboard Oil.
- Lubricate the inside diameter of the seals with 2-4-C with PTFE.

Powerhead

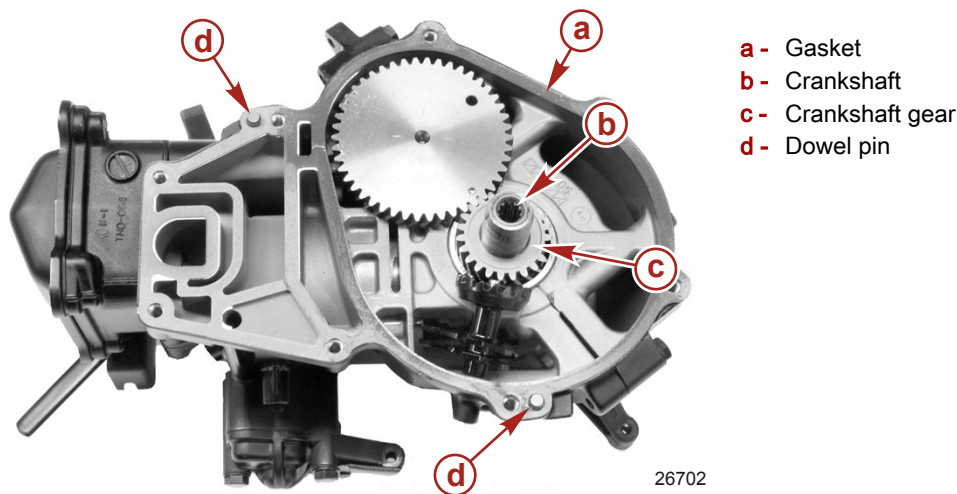
- Install new seals and O-ring.



Tube Ref No.	Description	Where Used	Part No.
110	4-Stroke 10W-30 Outboard Oil	Driveshaft seal housing O-rings	92-858045K01
95	2-4-C with PTFE	Inside diameter of the driveshaft seals	92-802859A 1

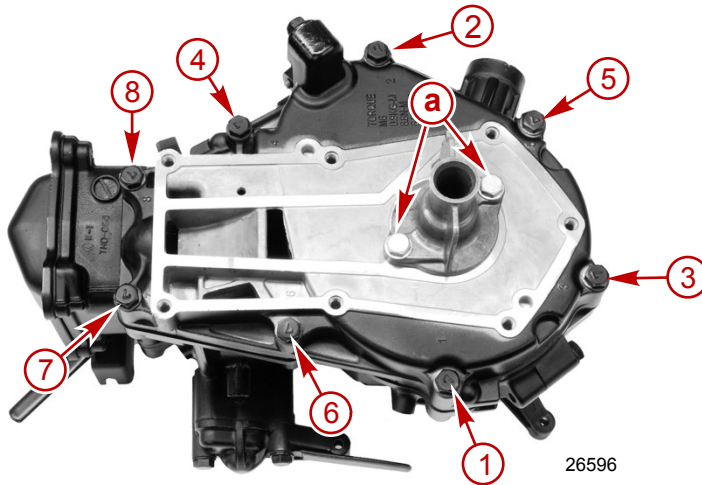
Oil Pan Installation

- Clean the gasket surface of the cylinder block and the oil pan.
- Ensure the dowel pins are installed in the cylinder block.
- Install a new oil pan/cylinder block gasket.



- Secure the oil pan to the cylinder block with eight bolts. Tighten the bolts in sequence to the specified torque.
- Apply Loctite 242 Threadlocker to the two driveshaft seal housing bolts.

- Secure the driveshaft seal housing to the oil pan with the two bolts. Tighten the bolts to the specified torque.

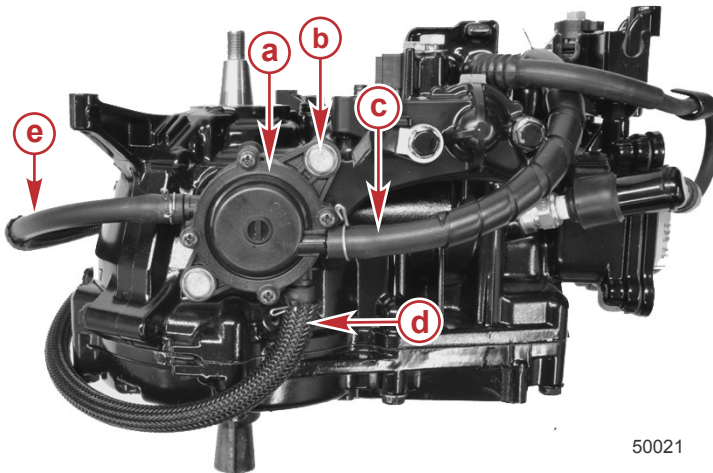


a - Driveshaft seal housing bolts (M6 x 20) (8)

Tube Ref No.	Description	Where Used	Part No.
66	Loctite 242 Threadlocker	Driveshaft seal housing bolts	92-809821

Description	Nm	lb-in.	lb-ft
Oil pan/cylinder block bolts (M6 x 35) (8)	11	97	
Driveshaft seal housing bolts (M6 x 20) (2)	6	53	

- Attach the hoses to the fuel pump. Secure the hoses with clamps.
- Attach the fuel pump pulse hose to the intake manifold fitting. Secure the hose with a clamp.
- Attach the fuel pump to the thermostat housing bracket. Tighten the bolts to the specified torque.



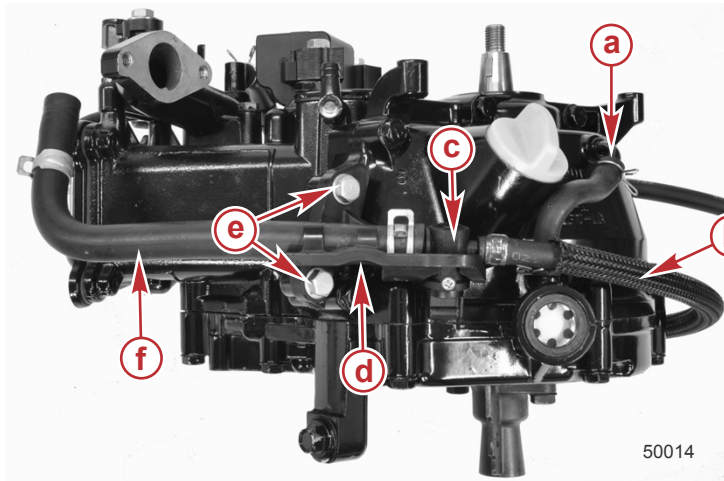
a - Fuel pump
 b - Bolt (M6 x 30) (2)
 c - Pulse hose
 d - Hose from the fuel shutoff valve
 e - Hose to the carburetor

Description	Nm	lb-in.	lb-ft
Fuel pump mounting bolts (M6 x 30) (2)	6	53	

- Attach the oil sight gauge hose and secure with a hose clamp.

Powerhead

11. Secure the fuel shutoff valve bracket to the cylinder block with two bolts. Tighten the bolts to the specified torque.

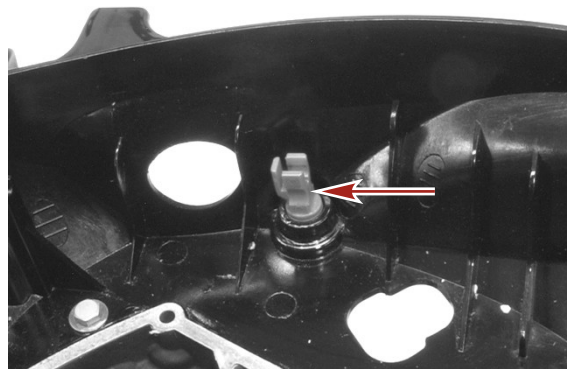


- a - Oil sight gauge hose
- b - Fuel pump inlet hose
- c - Fuel shutoff valve
- d - Fuel shutoff valve bracket
- e - Bolt (M6 x 20) with washer
- f - Fuel tank outlet hose

Description	Nm	lb-in.	lb-ft
Bolt (M6 x 20) with washer	6	53	

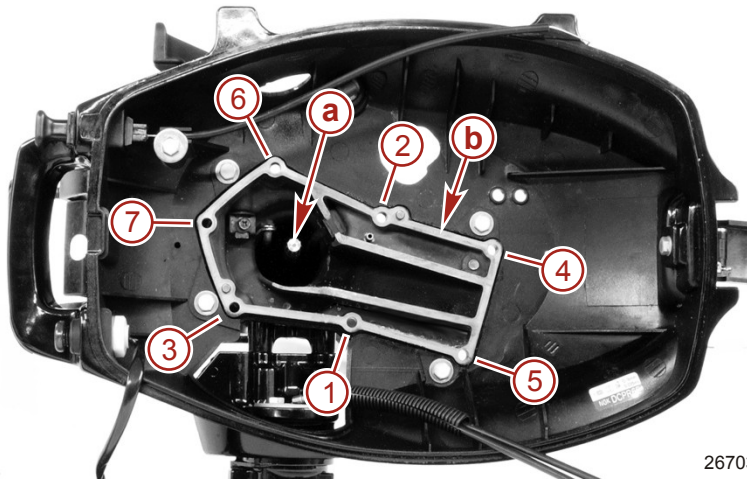
Powerhead Installation

1. Install the fuel shutoff knob into the pan.




2. Clean the driveshaft housing powerhead mounting surface.
3. Install a new gasket.
4. Lubricate the driveshaft splines with 2-4-C with PTFE. Do not apply lubricant to the top of the driveshaft.
5. Align the fuel shutoff valve with the shutoff knob.
6. Align the driveshaft to the crankshaft spline and install the powerhead.

- Secure the powerhead to the driveshaft housing with seven bolts. Tighten the bolts in sequence to the specified torque.



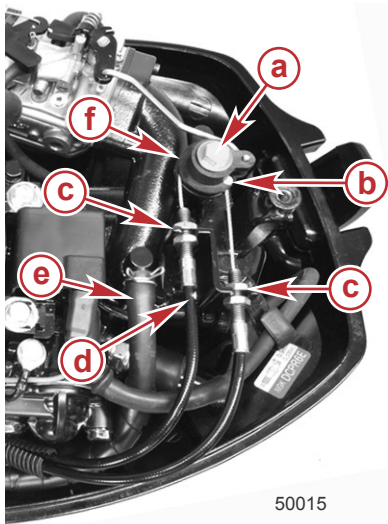
- a - Driveshaft
- b - Gasket surface

26703

Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Driveshaft splines	92-802859A 1

Description	Nm	lb-in.	lb-ft
Powerhead mounting bolts (M6 x 35) (7)	11	97	

- Install the flywheel and flywheel cover. Refer to **Section 2A - Ignition**.
- Adjust the valve clearance. Refer to **Valve Clearance Adjustment**.
- Install the carburetor. Refer to **Section 3A - Carburetor and Fuel Pump**.
- Install the ignitor. Refer to **Section 2A - Ignition**.
- Install the throttle drum and cable bracket.
- Install the throttle cables. Refer to **Section 7B - Tiller Handle**.
- Install the fuel pump pulse hose onto the fitting on the intake manifold.

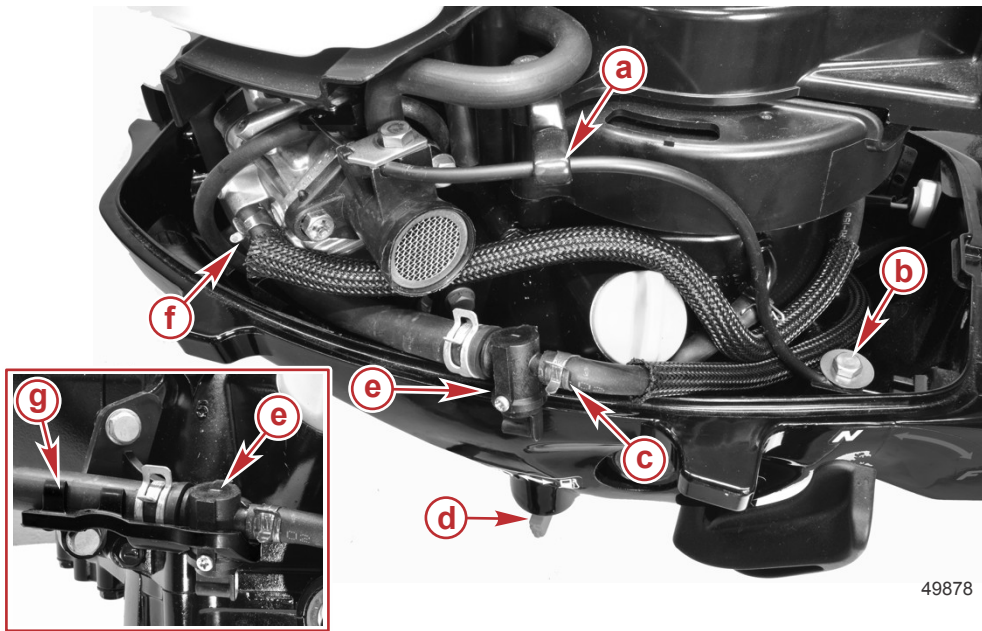


- a - Throttle drum bolt (M6 x 35)
- b - Throttle cable ends
- c - Jam nuts (two per cable)
- d - Match mark on acceleration throttle cable
- e - Fuel pump pulse hose
- f - Throttle drum

50015

- Attach the fuel pump to the carburetor inlet hose and the fuel pump to fuel shutoff hose. Secure the hoses with hose clamps.
IMPORTANT: Route the hoses as shown.
- Install the fuel shutoff valve and hoses along the side of the powerhead.
 - Align fuel shutoff valve with the fuel shutoff knob
 - The fuel hose to the fuel tank snaps into the bracket attached to the cylinder block

17. Secure the choke cable with the J-clamp and the washer and bolt.



- a - J-clamp
- b - Washer and bolt securing choke cable
- c - Fuel hose to the fuel pump
- d - Fuel shutoff valve
- e - Fuel shutoff valve knob
- f - Fuel hose from the fuel pump
- g - Bracket

18. Route the fuel hoses as shown.



19. Install the fuel tank and recoil starter. Refer to **Section 8A - Recoil Starter**.

20. Fill the crankcase with the specified engine oil. Refer to **Section 1A - Master Specifications**.



Midsection

Section 5A - Clamp/Swivel Bracket and Driveshaft Housing

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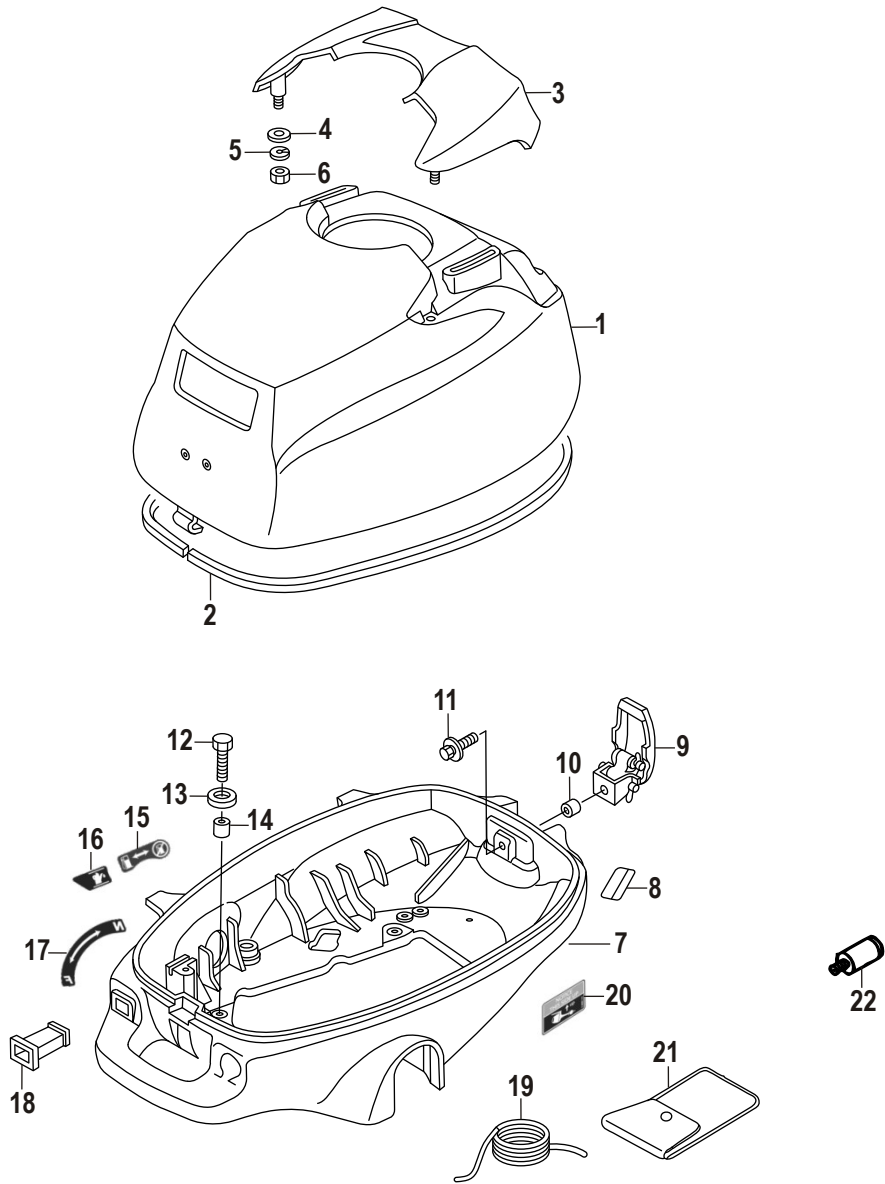
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Reassembly and Installation.....	5A-10		

Lubricants, Sealants, Adhesives

Tube Ref No.	Description	Where Used	Part No.
 7	Loctite 271 Threadlocker	Swivel bracket special flange head bolts	92-809819
 95	2-4-C with PTFE	Driveshaft housing between flanges, swivel bracket thrust plate, and plastic bushing	92-802859A 1
		Swivel bracket rubber bushing	

Notes:

Cowling Components

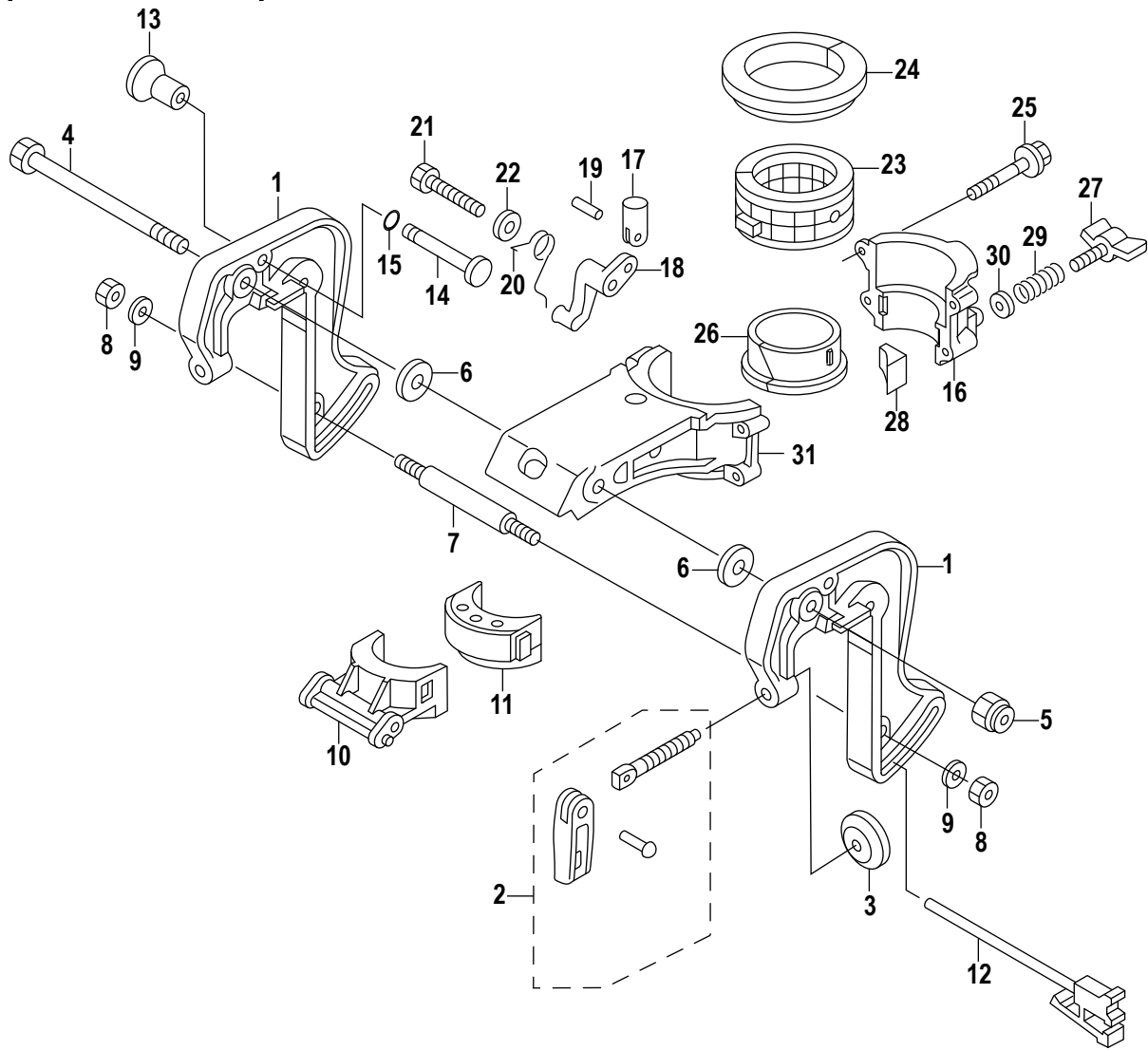


22482

Cowling Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Top cowl			
2	1	Cowl seal			
3	1	Tilt handle			
4	4	Washer			
5	4	Lockwasher			
6	4	Nut	6	53	
7	1	Bottom cowl			
8	1	Spark plug decal			
9	1	Cowl latch			
10	1	Collar			
11	1	Bolt	6	53	
12	4	Bolt	6	53	
13	4	Washer			
14	4	Collar			
15	1	Fuel level decal			
16	1	Oil level decal			
17	1	Shift decal			
18	1	Bushing			
19	1	Auxiliary start rope			
20	1	Notice This Side Up decal			
21	1	Tool kit			
22	1	Flushing plug			

Clamp Bracket Components

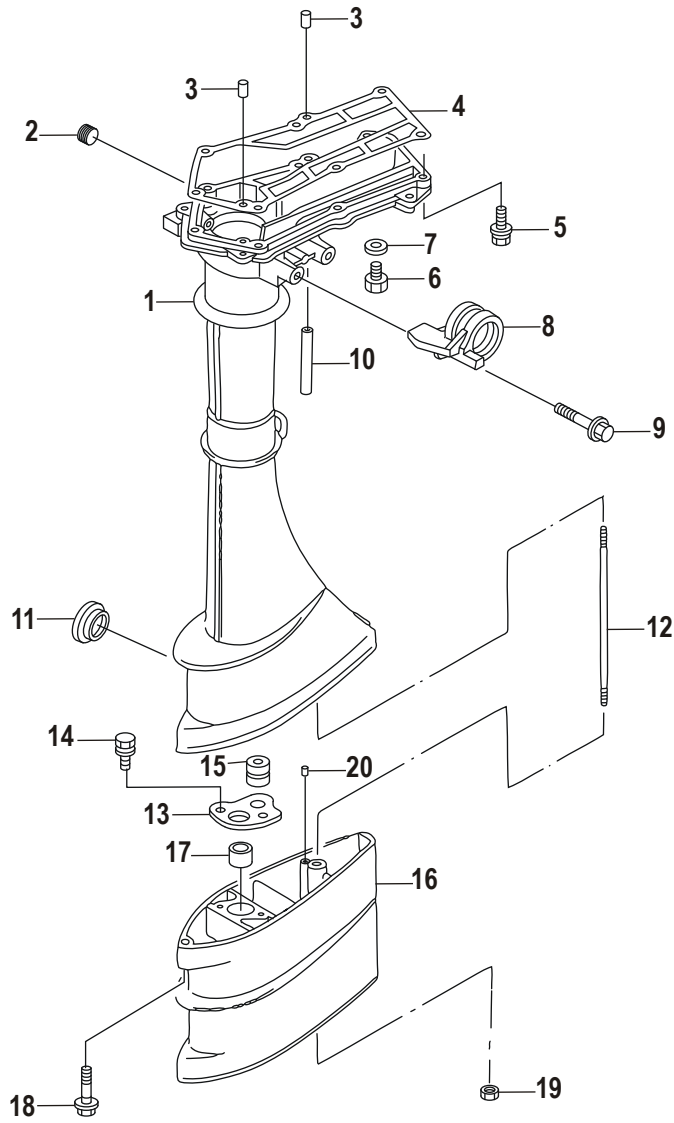


22490

Clamp Bracket Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	2	Clamp bracket			
2	2	Clamp screw assembly			
3	2	Pad			
4	1	Screw			
5	1	Nut (M8)	9	80	
6	2	Washer			
7	1	Rod			
8	2	Nut	6	53	
9	2	Washer			
10	1	Thrust support			
11	1	Damper			
12	1	Thrust rod			
13	1	Knob			
14	1	Tilt pin			
15	1	O-ring			
16	1	Swivel bracket cap			
17	1	Stopper			
18	1	Steering stop lever			
19	1	Pin			
20	1	Spring			
21	1	Bolt	6	53	
22	1	Washer			
23	1	Bushing			
24	1	Thrust plate			
25	4	Special flange head bolt	11	97	
26	1	Bushing			
27	1	Adjusting screw			
28	1	Friction pad			
29	1	Spring			
30	1	Washer			
31	1	Swivel bracket			

Driveshaft Housing Components



22488

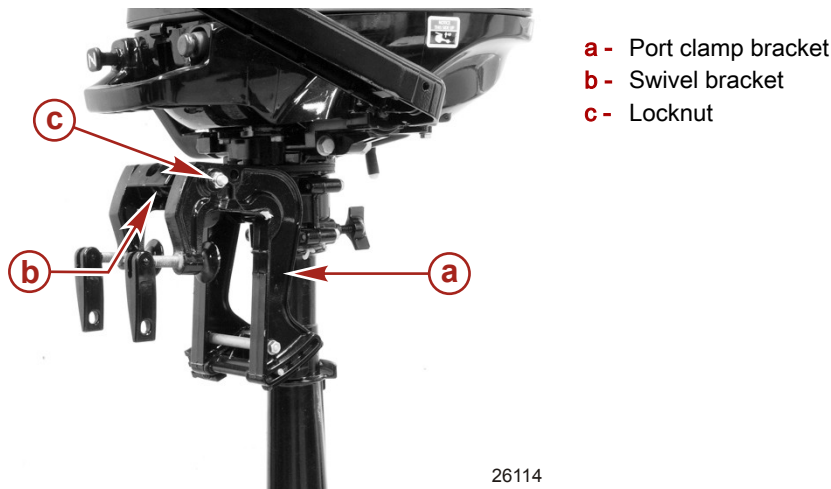
Driveshaft Housing Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Driveshaft housing			
2	1	Plug			
3	2	Dowel pin			
4	1	Driveshaft housing gasket			
5	7	Bolt	6	53	
6	1	Flush plug	15	132	
7	1	Gasket			
8	1	Steering bracket			
9	2	Bolt	15	132	
10	1	Hose			
11	1	Grommet			
12	1	Stud			
13	1	Stopper			
14	2	Bolt	6	53	
15	1	Grommet			
16	1	Extension housing			
17	1	Bushing			
18	1	Bolt	11	97	
19	1	Nut	6	53	
20	1	Dowel pin			

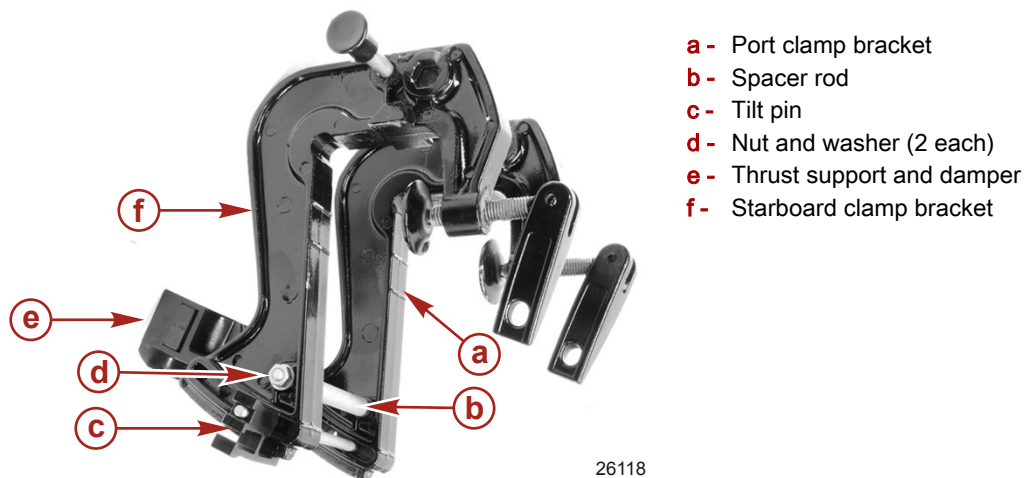
Clamp Bracket Removal and Installation

Removal and Disassembly

1. Remove the locknut on the port clamp bracket. Remove the bolt.
2. Remove the clamp brackets from the swivel bracket.



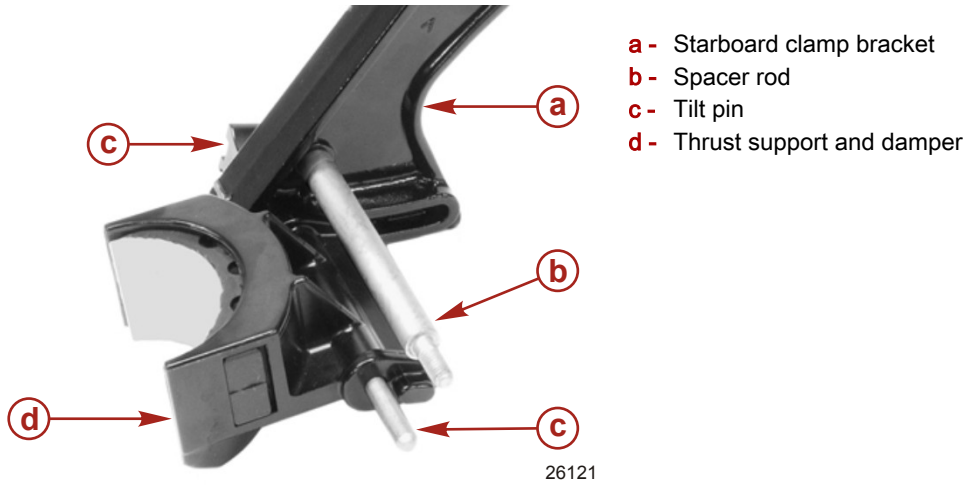
3. Remove the nut and washer from each end of the spacer rod.
4. Remove the tilt pin from the starboard clamp bracket.
5. Remove the thrust support and damper.



Reassembly and Installation

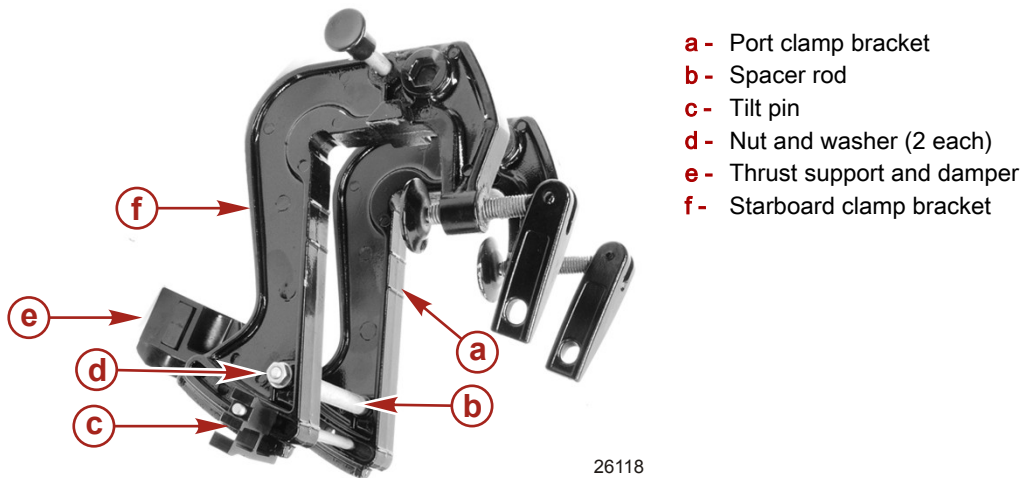
1. Assemble the spacer rod to the starboard clamp bracket.
2. Secure the spacer rod with a washer and nut.
3. Install the tilt pin through the starboard clamp bracket.

- Install the thrust support and damper onto the tilt pin.



- a - Starboard clamp bracket
- b - Spacer rod
- c - Tilt pin
- d - Thrust support and damper

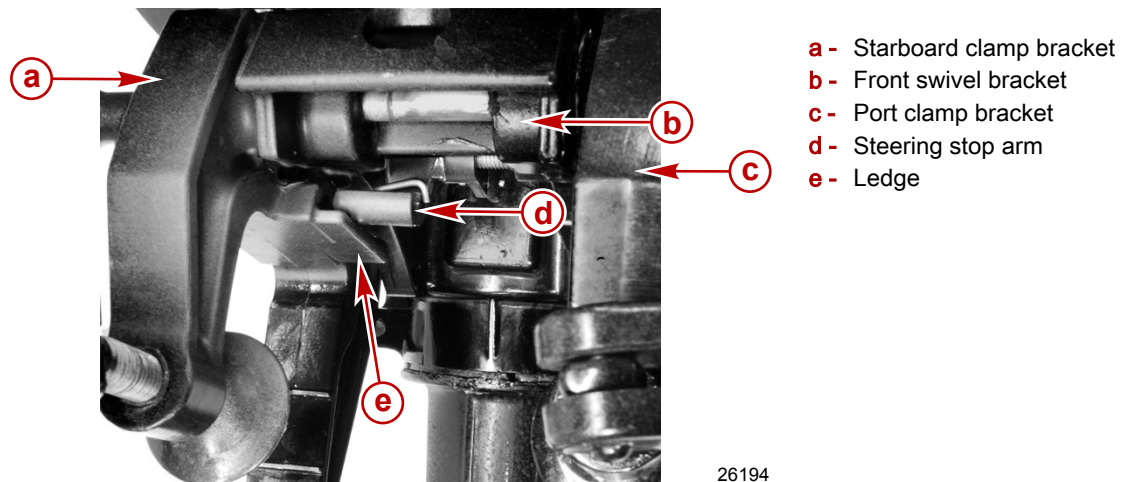
- Assemble the port clamp bracket to the starboard clamp bracket, spacer rod, and tilt pin.
- Install a washer and nut to the spacer rod. Tighten the two nuts to the specified torque.



- a - Port clamp bracket
- b - Spacer rod
- c - Tilt pin
- d - Nut and washer (2 each)
- e - Thrust support and damper
- f - Starboard clamp bracket

Description	Nm	lb-in.	lb-ft
Spacer rod nut (2)	6	53	

- Assemble the clamp brackets onto the swivel bracket.
- Ensure that the steering stop arm is installed above the ledge on the starboard clamp bracket.

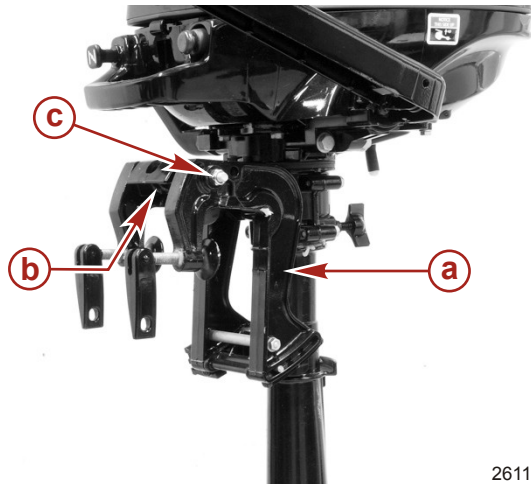


- a - Starboard clamp bracket
- b - Front swivel bracket
- c - Port clamp bracket
- d - Steering stop arm
- e - Ledge

- Install a washer between each clamp bracket and the front swivel bracket.

Clamp/Swivel Bracket and Driveshaft Housing

10. Install the bolt through the clamp brackets (start from the starboard side) and the front swivel bracket. Install a locknut onto the bolt. Tighten the locknut to the specified torque.



- a - Port clamp bracket
- b - Swivel bracket
- c - Locknut

26114

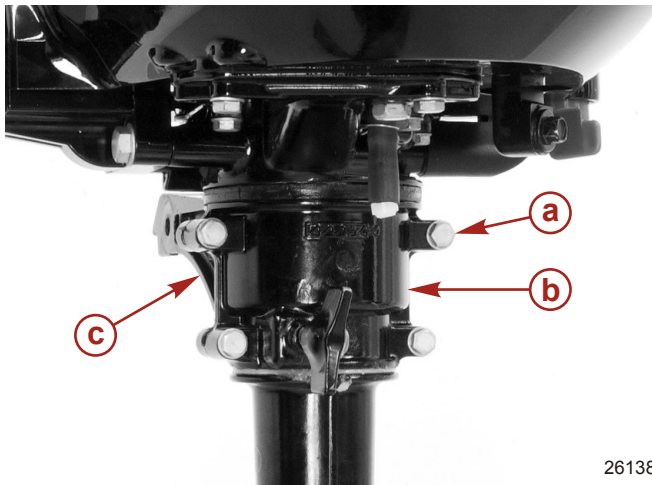
Description	Nm	lb-in.	lb-ft
Clamp/swivel bracket locknut	9	80	

Swivel Bracket Removal/Installation

NOTE: The swivel bracket may be removed and disassembled with or without prior removal of the clamp brackets.

Removal

1. Remove the four special bolts from the swivel bracket sections.
2. Remove the swivel bracket cap from the driveshaft housing.



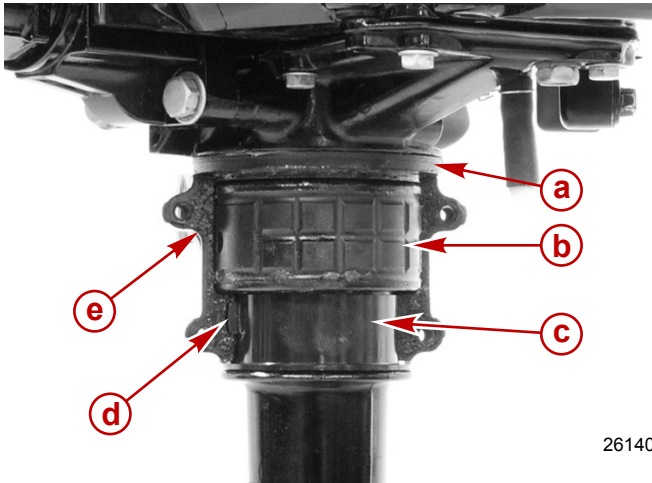
- a - Special bolt and washer (4) (M6 x 35)
- b - Swivel bracket cap
- c - Front swivel bracket

26138

3. Remove the swivel bracket and rubber bushing from the driveshaft housing.

NOTE: The rubber bushing is attached to the front swivel bracket with adhesive.

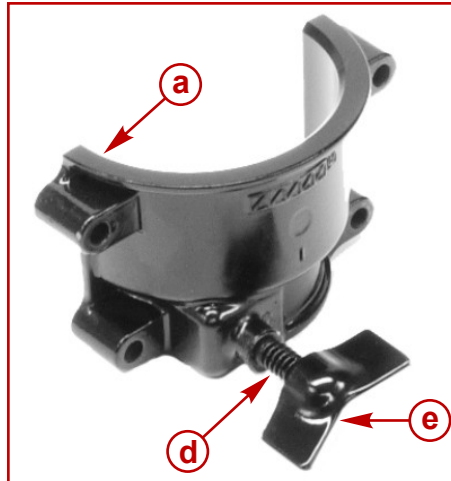
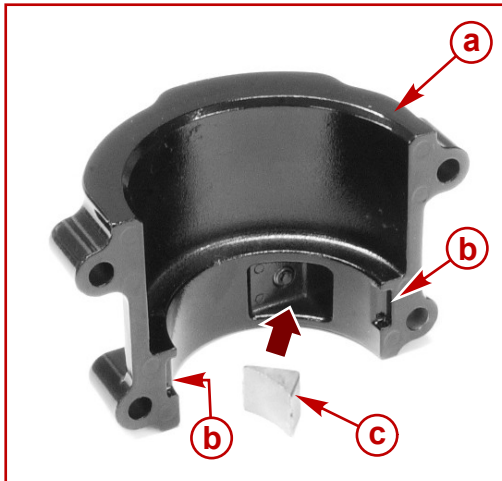
4. Remove the thrust plate and split plastic bushing.



- a - Thrust plate
- b - Rubber bushing
- c - Split plastic bushing
- d - Tab
- e - Front swivel bracket

26140

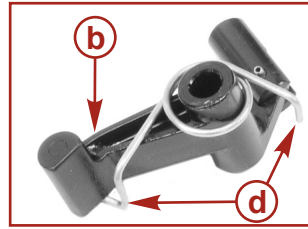
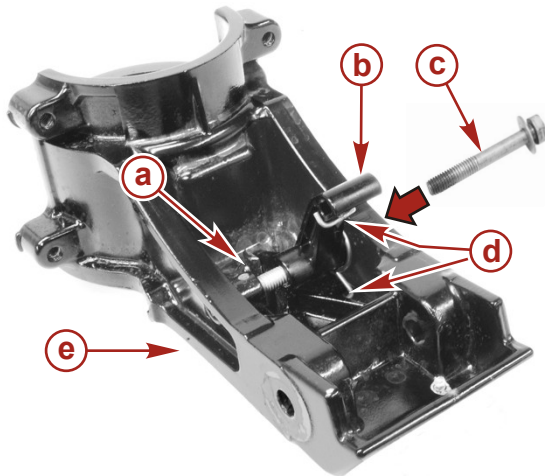
Steering Co-Pilot Components



26135

- a - Swivel bracket cap
- b - Pocket for split plastic bushing tab
- c - Friction pad
- d - Washer and spring
- e - Steering co-pilot adjusting screw

Steering Stop Components

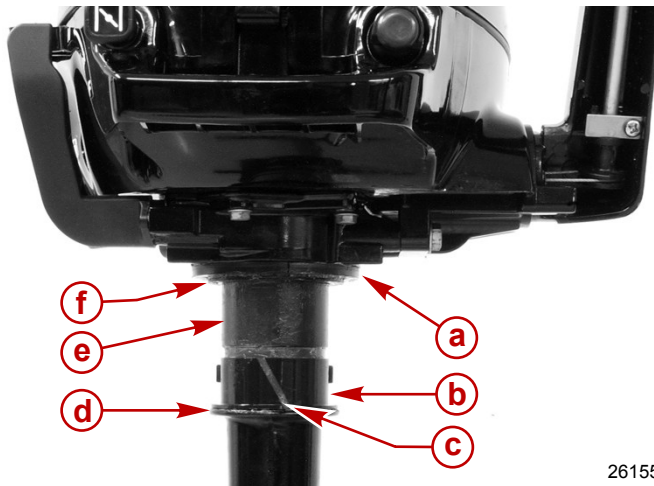


- a - Stopper and pin
- b - Steering stop lever
- c - Bolt and washer
- d - Spring ends
- e - Swivel bracket

26145


Installation

1. Lubricate the driveshaft housing between the upper and lower flanges with 2-4-C with PTFE.
2. Install the thrust plate and split plastic bushing onto the driveshaft housing.
NOTE: Install the split plastic bushing with the split facing towards the front of the engine.
3. Lubricate the thrust plate and plastic bushing with 2-4-C with PTFE.



- a - Thrust plate
- b - Plastic bushing
- c - Split in plastic bushing
- d - Lower flange
- e - Driveshaft housing
- f - Upper flange

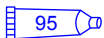
26155

Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Driveshaft housing between flanges, swivel bracket thrust plate, and plastic bushing	92-802859A 1

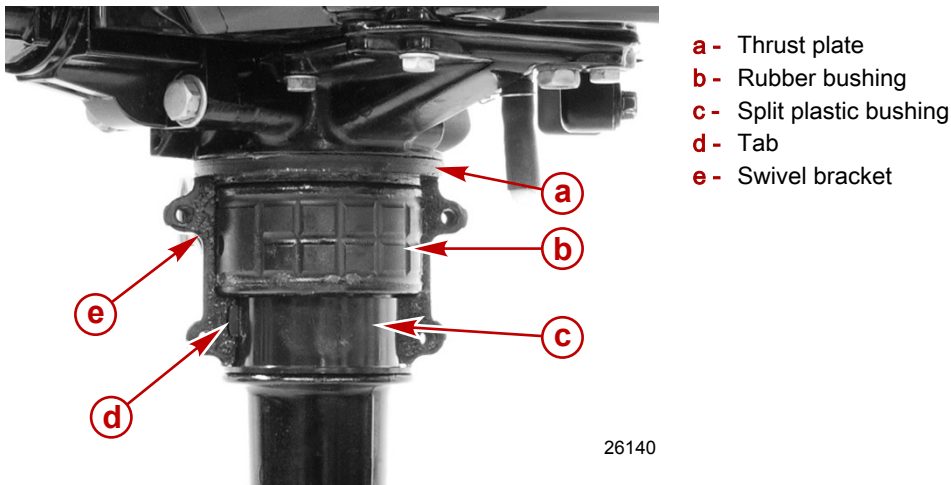
4. Align the tab on the rubber bushing with the pocket of the swivel bracket. Install the rubber bushing onto the swivel bracket.
NOTE: It is not necessary to use adhesive to attach the rubber bushing onto the front swivel bracket.

- Lubricate the inside of the rubber bushing with 2-4-C with PTFE.



Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Swivel bracket rubber bushing	92-802859A 1

- Install the swivel bracket with the rubber bushing onto the driveshaft housing.

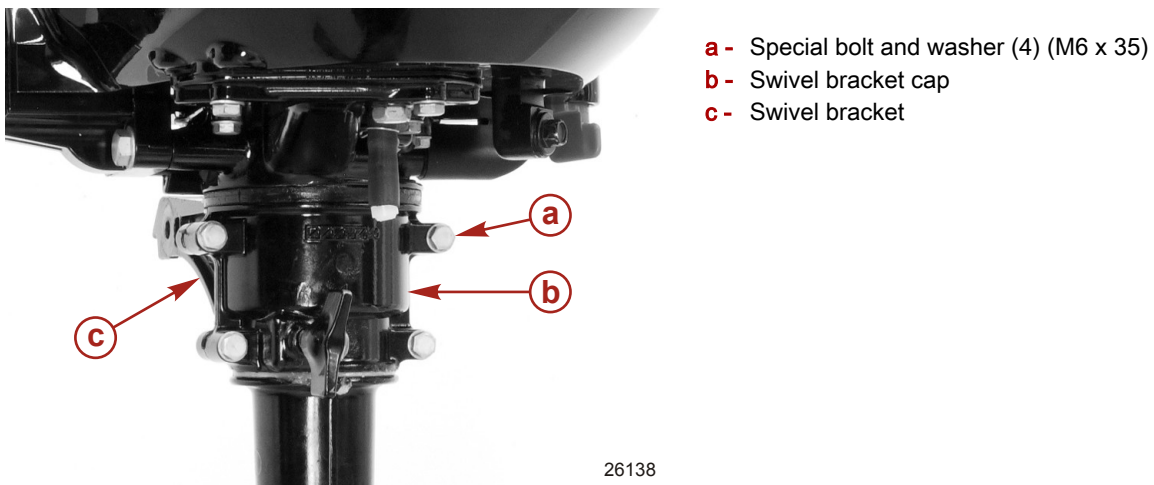


- Attach the swivel bracket cap to the swivel bracket.


NOTE: The split plastic bushing tabs fit into the cast pockets of the swivel bracket cap.

- Apply Loctite 271 Threadlocker to the four special flange head bolt threads. Install the bolts. Tighten the bolts to the specified torque.

IMPORTANT: Do not use common bolts to secure the swivel bracket/swivel bracket cap.



Clamp/Swivel Bracket and Driveshaft Housing

Tube Ref No.	Description	Where Used	Part No.
	Loctite 271 Threadlocker	Swivel bracket special flange head bolts	92-809819

Description	Nm	lb-in.	lb-ft
Swivel bracket special flange head bolts (4) (M6 x 35)	11	97	

Lower Unit

Section 6A - Gear Housing

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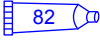


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**6
A**

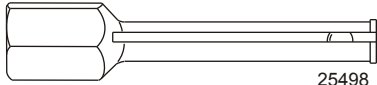


Gear Housing Specifications


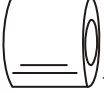

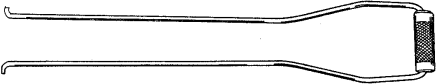
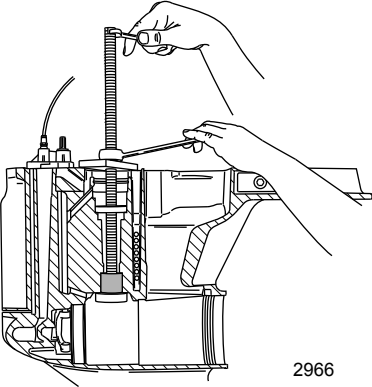
Gear Housing Specifications	
Gear ratio	
Model 2.5/3.5	2.15:1
Gear housing capacity	180 mL (6.1 fl oz)
Gear lubricant type	Premium or High Performance Gear Lubricant
Pinion teeth	13
Forward gear teeth	28
Clutch	Dog type (forward - neutral)
Forward gear backlash	0.050–0.152 mm (0.002–0.006 in.)
Propeller drive system	Drive (shear) pin
Propeller shaft trueness serviceability limit	0.152 mm (0.006 in.) maximum

Lubricants, Sealants, Adhesives

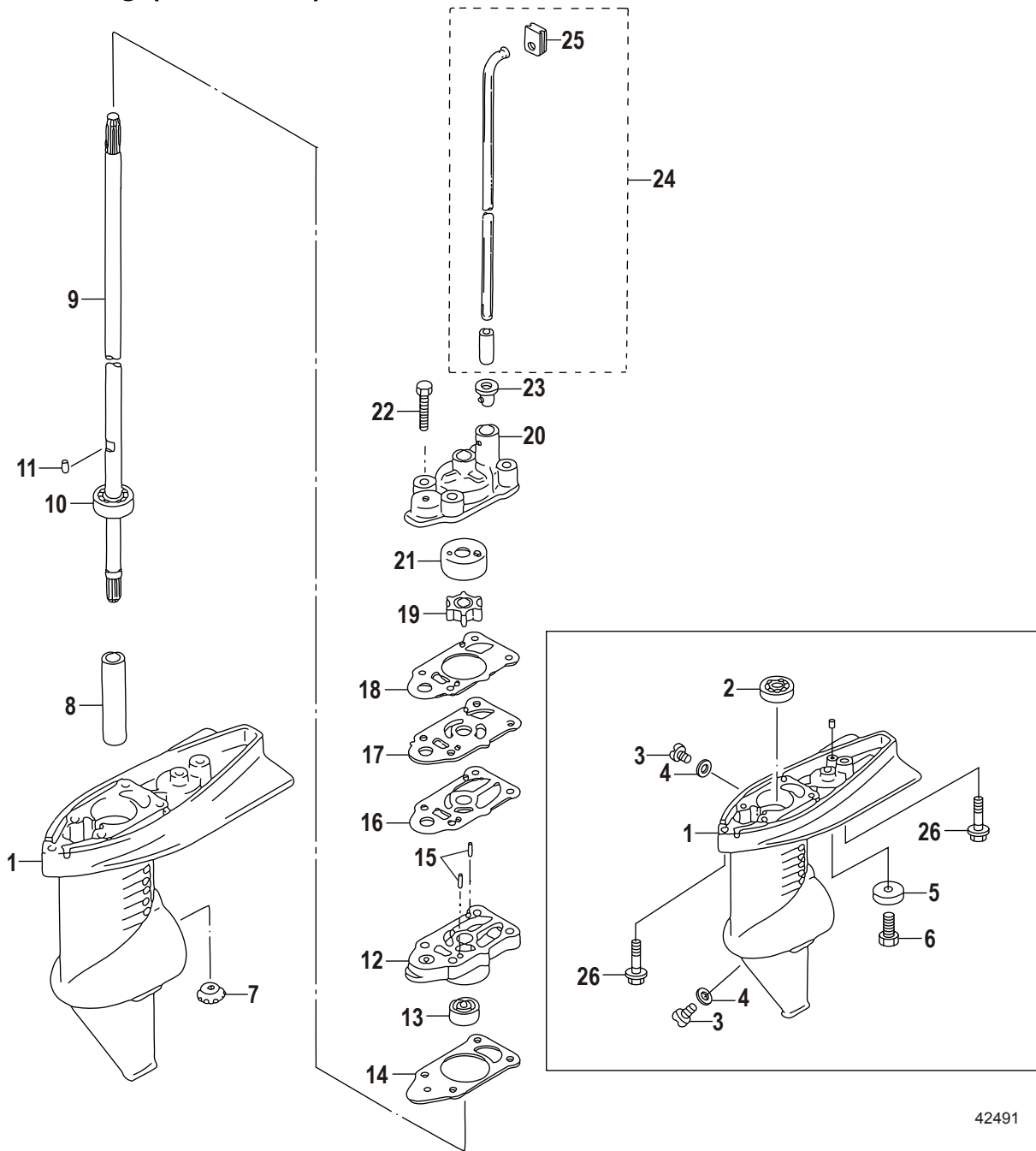
Tube Ref No.	Description	Where Used	Part No.
 66	Loctite 242 Threadlocker	Water pump cover bolt threads	92-809821
 82	Premium Gear Lubricant	Outside diameter of lower bearing race	92-858058K01
		Outside diameter of forward gear bearing	
		Forward gear bronze bearing	
		Inside diameter of the upper driveshaft bearing	
 87	High Performance Gear Lubricant	Gear housing cavity	92-858064K01
 95	2-4-C with PTFE	Water pump base seal lips	92-802859A 1
		Clutch end of cam follower	
		Seal lips	
		Outside diameter of carrier bearing	
		Bearing carrier O-ring surface	
		Shift shaft surface	
		Inside of pump cover insert	
		Inside diameter of water tube seal	
Driveshaft splines			

Special Tools

Collet  25498	Snap-On CG 40-9 Aids in the removal of gears and bearings; use with expanding rod.
Expanding Rod  12538	Snap-On CG 40-4 Aids in the removal of gears and bearings; use with collet.
Slide Hammer  6761	91-34569A 1 Aids in the removal of various engine components. Use with puller jaws.

Dial Indicator	91-58222A1
 <p>9479</p>	Measures distance, movement, and runout; used for drive system assembly and engine setup
Protector Cap	91-24161
 <p>13445</p>	Protects the crankshaft when removing the flywheel; use with flywheel puller (91-849154T 1)
Universal Puller Plate	91-37241
 <p>8505</p>	Removes bearings from gears and the driveshaft
Puller	91-27780
 <p>8760</p>	Removes gears, bearings, and races
Bearing Removal and Installation Kit	91-31229A7
 <p>2966</p>	<p>Installs and removes the bearings in all gearcases. 91-31229A7 Tool assembly includes the following components: 11-24156 Hex Nut 12-34961 Washer 91-15755T Bearing Carrier 91-29310 Plate 91-29610 Pilot Plate 91-30366T1 Mandrel 91-31229 Puller Shaft 91-32325T Driver Head 91-32336 Driver Needle Bearing 91-36379 Puller/Head Gear 91-36569T Driver Head 91-36571T Pilot Washer 91-37292 Roller Bearing 91-37311 Driver Head 91-37312 Driver Head 91-37323 Driver Head Rod 91-37324 Pilot Washer 91-37350T Pilot Mandrel 91-38628T Puller/Driver Head 91-52393 Driver Needle Bearing 91-52394 Head Pull Rod</p>

Gear Housing (Driveshaft)

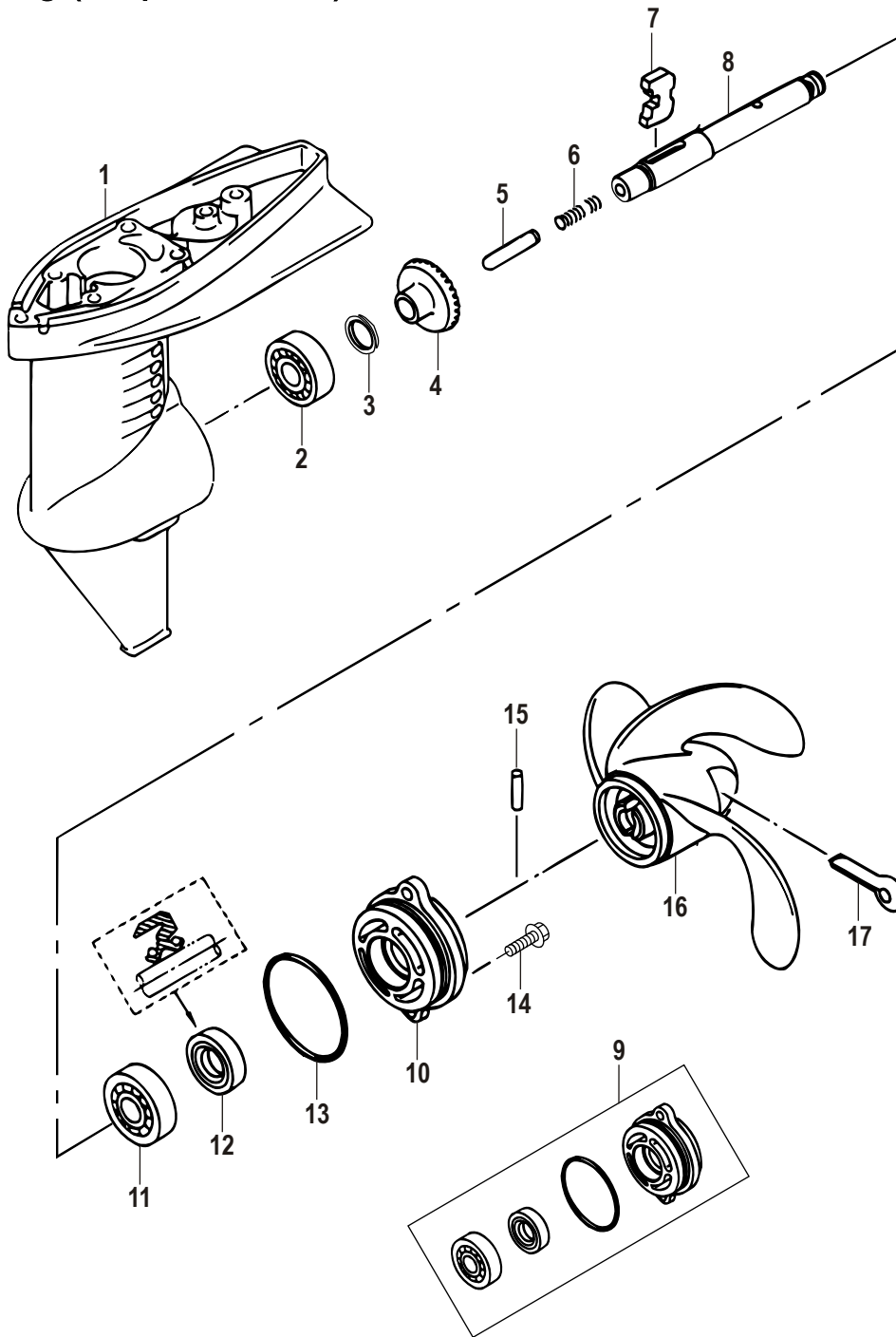


42491

Gear Housing (Driveshaft)

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Gear housing			
2	1	Ball bearing			
3	2	Plug	6.8	60	
4	2	Gasket			
5	1	Anode			
6	1	Bolt (M6 x 16)	5.6	50	
7	1	Pinion gear			
8	1	Spacer			
9	1	Driveshaft			
10	1	Ball bearing			
11	1	Key			
12	1	Water pump base			
13	1	Oil seal			
14	1	Water pump base gasket			
15	2	Roll pin			
16	1	Gasket			
17	1	Water pump guide plate			
18	1	Water pump cover gasket			
19	1	Impeller			
20	1	Water pump cover			
21	1	Liner			
22	4	Bolt	5.6	50	
23	1	Grommet			
24	1	Water tube			
25	1	Grommet			
26	2	Bolt	5.6	50	

Gear Housing (Propeller Shaft)

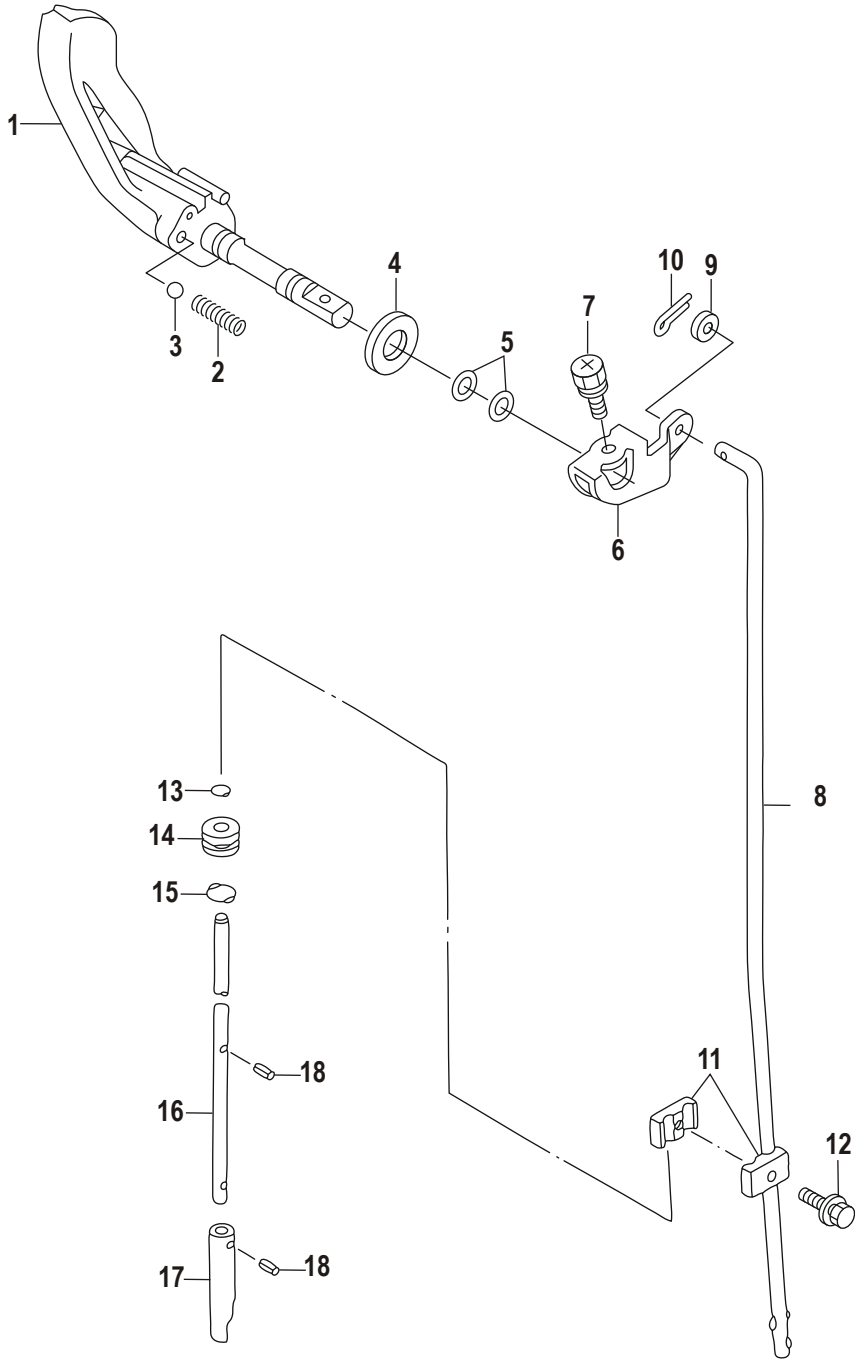


22478

Gear Housing (Propeller Shaft)

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Gear housing			
2	1	Ball bearing			
3	AR	Shim (0.1) (0.15)			
4	1	Forward gear			
5	1	Cam follower			
6	1	Spring			
7	1	Clutch			
8	1	Propeller shaft			
9	1	Bearing carrier assembly			
10	1	Bearing carrier			
11	1	Ball bearing			
12	1	Oil seal			
13	1	O-ring			
14	2	Bolt	5.6	50	
15	1	Shear pin (stainless steel)			
16	1	Propeller			
17	1	Cotter pin			

Shift Linkage Components



22474

Shift Linkage Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Shift lever			
2	1	Spring			
3	1	Detent ball			
4	1	Washer			
5	2	O-ring			
6	1	Shift shaft lever			
7	1	Screw (M5 x 12)	4	35	
8	1	Upper shift shaft			
9	1	Washer			
10	1	Cotter pin			
11	1	Joint			
12	1	Bolt (M6 x 16)	6	53	
13	1	O-ring			
14	1	Bushing			
15	1	O-ring			
16	1	Lower shift shaft			
17	1	Clutch cam			
18	2	Pin			

General Service Recommendations

There may be more than one way to disassemble or reassemble a particular part. It is recommended that the entire procedure be read prior to repair.

IMPORTANT: Read the following before attempting any repairs.

Disassembly of a subassembly may not be necessary until cleaning and inspection reveals that disassembly is required for replacement of one or more components.

Service procedure order in this section is a normal disassembly/reassembly sequence. It is suggested that the sequence be followed without deviation to assure proper repairs. When performing partial repairs, follow the instructions to the point where the desired component can be replaced, then proceed to reassembly and installation of that component in the reassembly part of this section. Use the **Table of Contents** to find the correct page number.

Threaded parts are right-hand (RH), unless otherwise indicated.

When holding, pressing, or driving is required, use soft metal vise jaw protectors or wood for protection of parts. Use a suitable mandrel that will contact only the bearing race when pressing or driving bearings.

Whenever compressed air is used to dry a part, verify that no water is present in the air line.

Bearings

Upon disassembly of the gear housing, all bearings must be cleaned and inspected. Clean the bearings with solvent and dry with compressed air. Air should be directed at the bearing so that it passes through the bearing. Do not spin the bearing with compressed air, as this may cause the bearing to score from lack of lubrication. After cleaning, lubricate the bearings with High Performance Gear Lubricant. Do not lubricate the tapered bearing cups until after inspection.

Inspect all bearings for roughness, catches, and bearing race side wear. Work the inner bearing race in and out, while holding the outer race, to check for side wear.

When inspecting the tapered bearings, determine the condition of the rollers and the inner bearing race by inspecting the bearing cup for pits, scoring, grooves, uneven wear, imbedded particles, and/or discoloration from overheating. Always replace the tapered bearing and race as a set.

Inspect the gear housing for bearing races that have spun in their respective bores. If the race has spun, the gear housing must be replaced.

Roller bearing condition is determined by inspecting the bearing surface of the shaft that the roller bearing supports. Check the shaft surface for pits, scoring, grooves, imbedded particles, uneven wear, and/or discoloration from overheating. The shaft and bearing must be replaced if the conditions described are found.

Shims

Keep a record of all shim amounts and their location during disassembly to aid in reassembly. Be sure to follow the shimming instructions during reassembly, as gears must be installed to the correct depth and have the correct amount of backlash to avoid noisy operation and premature gear failure.

Seals

As a normal procedure, all O-rings and oil seals should be replaced without regard to appearance. To prevent leakage around oil seals, apply Loctite 271 Threadlocker to the outer diameter of all metal case oil seals. When using Loctite on seals or threads, the surfaces must be clean and dry. To ease installation, apply 2-4-C with PTFE on all O-rings. To prevent wear, apply 2-4-C with PTFE on the I.D. of oil seals.

Draining and Inspecting the Gear Housing Lubricant

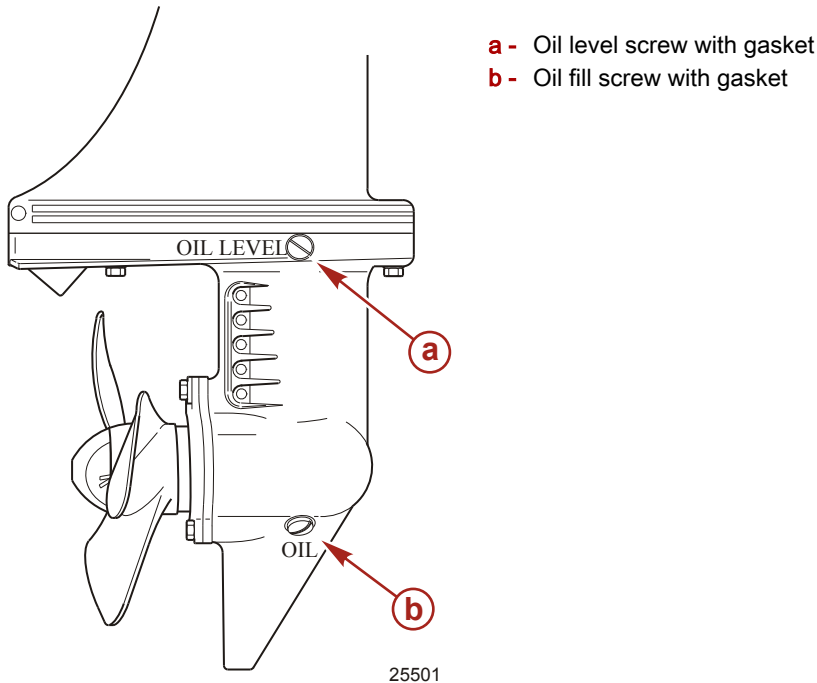
WARNING

Rotating propellers can cause serious injury or death. Never operate the boat out of the water with a propeller installed. Before installing or removing a propeller, place the drive unit in neutral and engage the lanyard stop switch to prevent the engine from starting. Place a block of wood between the propeller blade and the anti-ventilation plate.

1. With the gear housing in the normal running position, place a clean pan under the housing and remove the oil fill screw with its gasket. Remove the oil level screw with its gasket.
2. Inspect the gear lubricant for metal particles (lubricant will have a metal flake appearance). The presence of metal flakes indicates the need for gear housing disassembly and component inspection.

NOTE: When draining the gearcase for the first time, the lubricant may appear cream colored due to the mixing of the assembly lubricant and gear lubricant. This is not an indication of water intrusion. If, during subsequent draining of the gearcase, the lubricant appears cream colored or milky, water may be present. The gearcase should be disassembled and all gaskets, seals and O-rings replaced. Inspect all components for water damage.

- Note the color of the gear lubricant. White or cream color indicates the presence of water in the lubricant. Check the drain pan for water separation from the lubricant. The presence of water in the gear lubricant indicates the need for disassembly and inspection of the oil seals, seal surfaces, O-rings, and gear housing components. Pressure check the gearcase prior to disassembly and again after reassembly to verify repairs have been properly completed.

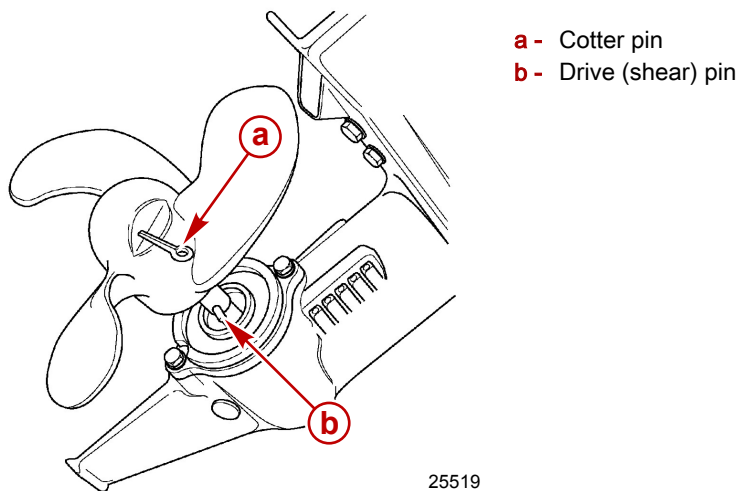


Propeller Removal

⚠ WARNING

Rotating propellers can cause serious injury or death. Never operate the boat out of the water with a propeller installed. Before installing or removing a propeller, place the drive unit in neutral and engage the lanyard stop switch to prevent the engine from starting. Place a block of wood between the propeller blade and the anti-ventilation plate.

- Remove the cotter pin and pull the propeller off of the propeller shaft.
- Remove the drive (shear) pin.



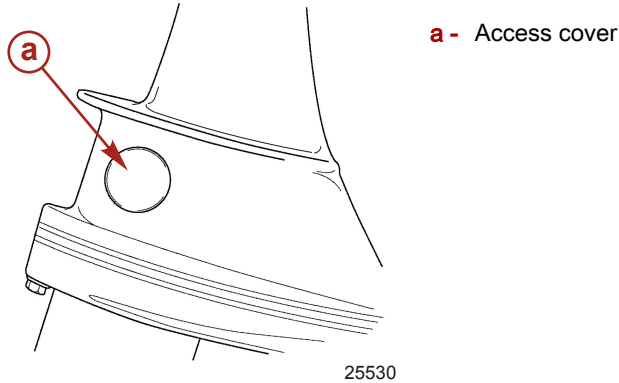
Gear Housing Removal

- Close the fuel shut-off valve.

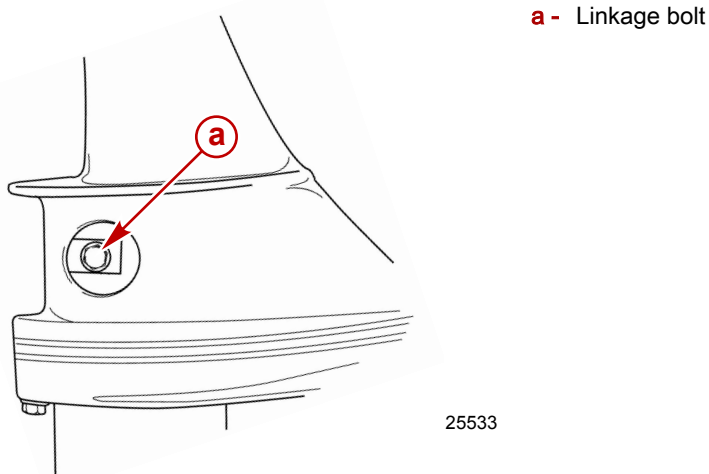
⚠ WARNING

Accidental starting can cause serious injury. Before removing or installing the gear housing, disconnect and isolate the spark plug leads. Disable the ignition system by removing the keys from the ignition (if equipped) and engaging the lanyard stop switch to prevent the engine from starting.

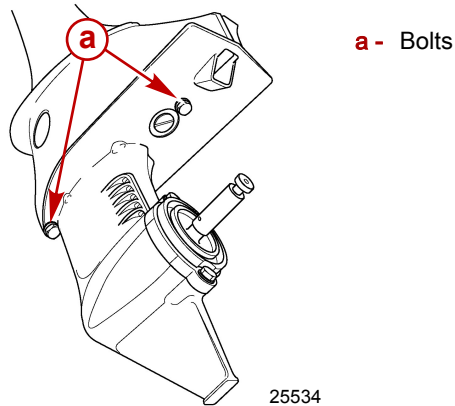
2. Place the gear shift lever in the neutral position.
3. Tilt the engine to the full up position.
4. Remove the shift linkage access cover.



5. Loosen (do not remove) the linkage bolt.



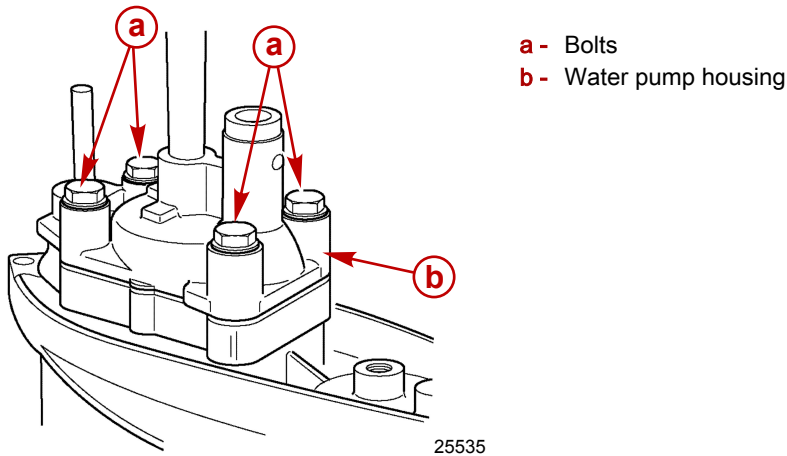
6. Remove the two bolts. Pull the gear housing from the driveshaft housing.



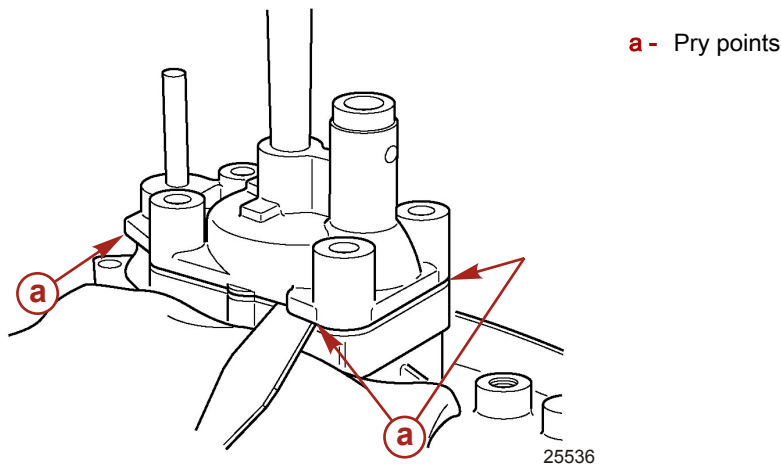
Gear Housing Disassembly

Water Pump

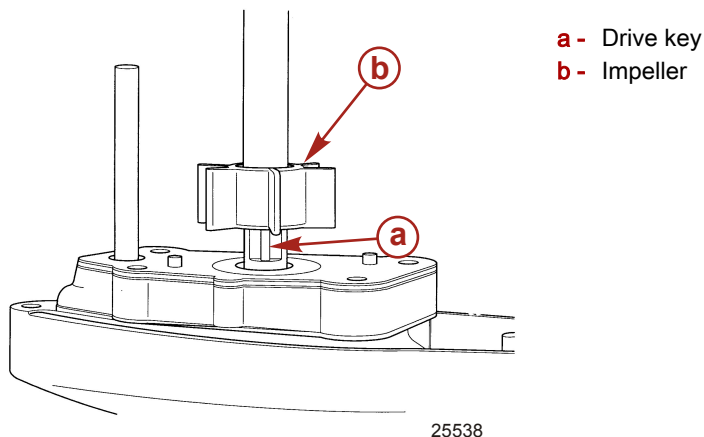
1. Remove the four bolts securing the water pump housing.



2. Use padding to protect the gear housing surface while applying pressure against the housing pry points.



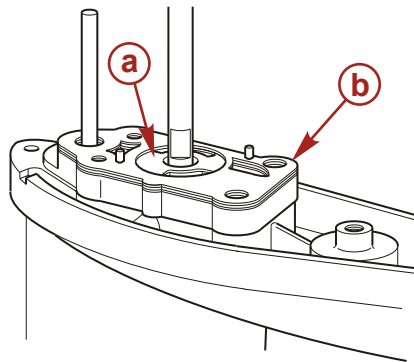
3. Remove the impeller and drive key from the driveshaft. Replace the impeller if:
 - The impeller blades are cracked, torn, or worn.
 - The impeller is glazed or melted (caused by insufficient water supply).
 - The rubber portion of the impeller is not bonded to the impeller hub.



IMPORTANT: The circular groove formed by the impeller sealing bead should be disregarded when inspecting the cover insert and the base plate. The depth of the groove will not affect the water pump output. If other grooves (from sand or debris) are present, the insert and/or base plate should be replaced.

Gear Housing

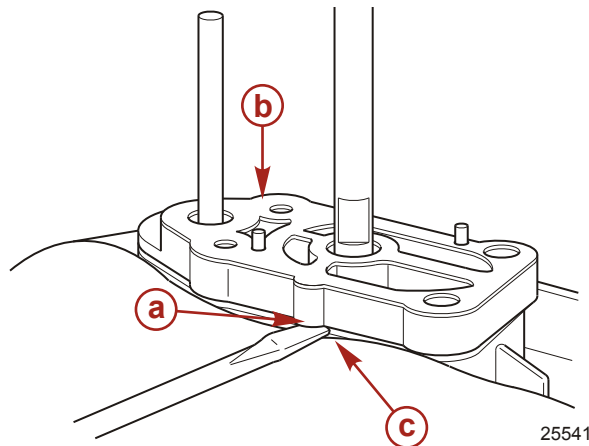
4. Inspect the pump cover for damage from excessive heat - charring, blistering, or discoloration. Replace the cover as required.
5. Remove the base plate and the gasket.



- a - Base plate
- b - Gasket

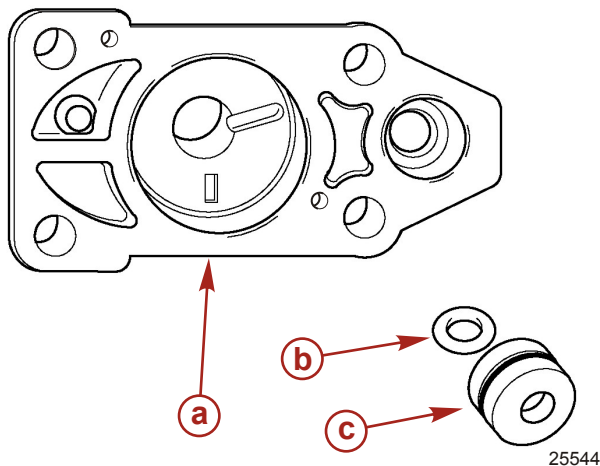
IMPORTANT: If only water pump repair procedures are to be performed, hold the driveshaft down while prying/lifting up on the pump base to prevent the driveshaft from disconnecting from the pinion gear. If the driveshaft separates from the pinion gear, the gear housing must be disassembled to realign the driveshaft with the pinion gear.

6. Pad the gear housing surface and pry up on the pump base to remove the base.

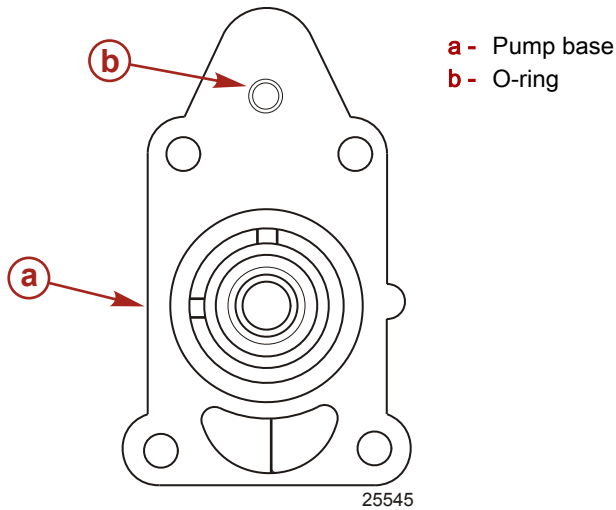


- a - Pry point
- b - Pump base
- c - Pad

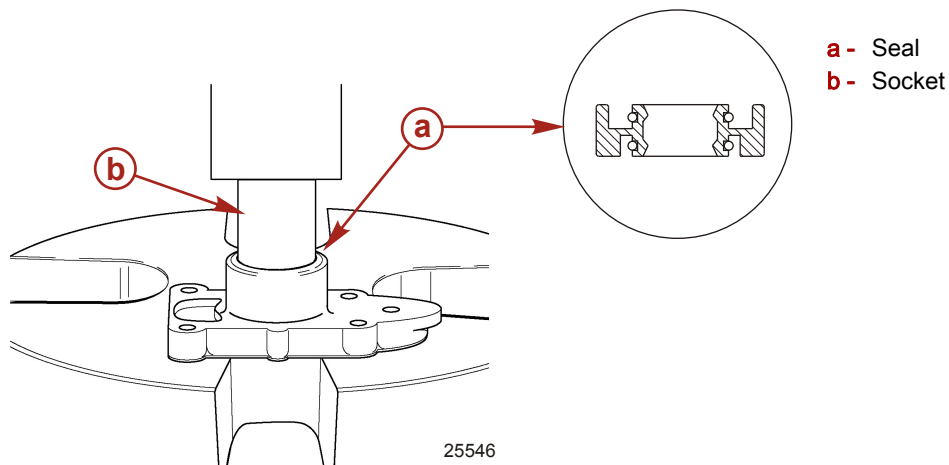
7. The shift shaft O-rings are located in both the upper pump housing and the lower pump base. The O-rings should be replaced as a normal service procedure.




- a - Upper housing
- b - O-ring
- c - Carrier O-ring



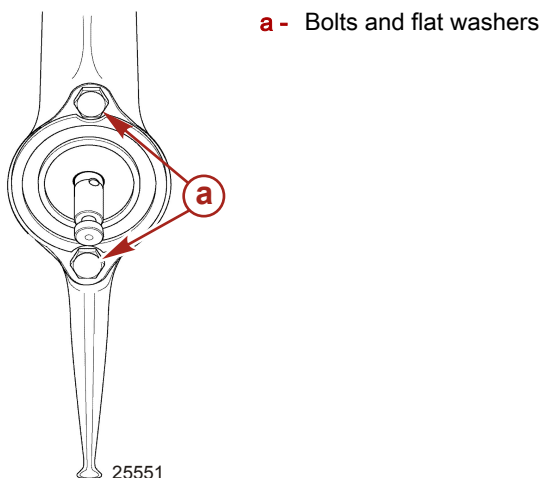
8. The water pump base seal should be replaced as a normal repair procedure. Use a punch to remove the seal, being careful not to damage the pump base seal surface. If the surface is damaged, replace the water pump base.
9. Apply 2-4-C with PTFE to the new seal lips. Press the new seal into the pump base with a 16 mm (11/16 in.) socket.



Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Water pump base seal lips	92-802859A 1

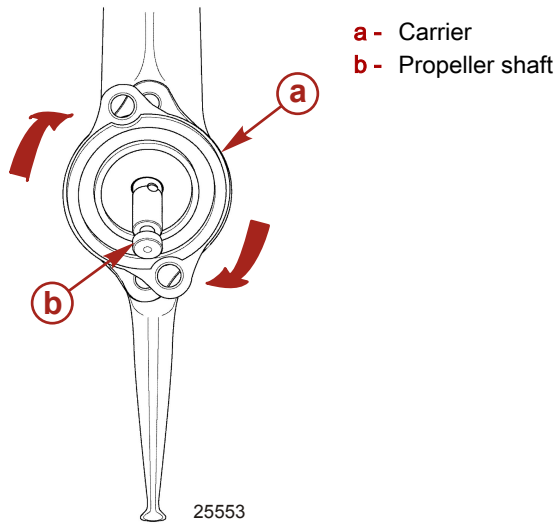
Bearing Carrier and Propeller Shaft

1. Remove the two bolts and flat washers.

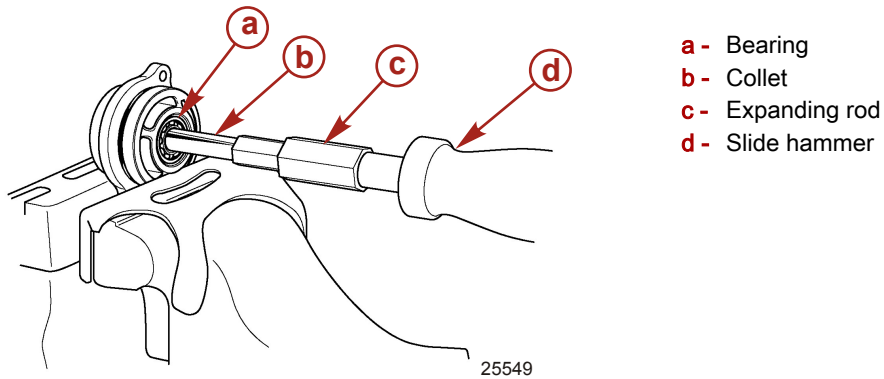


Gear Housing

- Tap on either side of the carrier with a leather/rubber mallet to break the adhesion between the carrier and the gear housing. Remove the carrier and the propeller shaft.

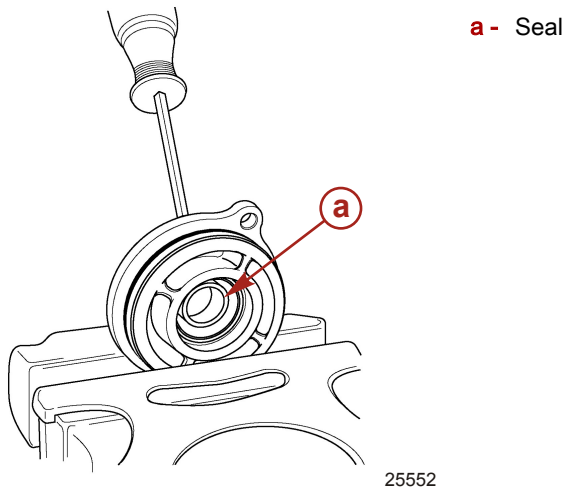


- Inspect the carrier ball bearing for serviceability. If the bearing is rusted or does not roll freely, replace the bearing. If the bearing must be replaced, use a slide hammer with the following Snap-On Tools:
 - Expanding rod CG 40-4
 - Collet 7/16 CG 40-9

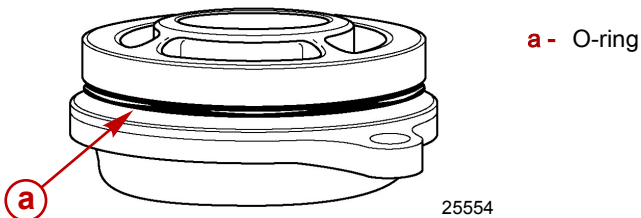


Collet	Snap-On CG 40-9
Expanding Rod	Snap-On CG 40-4
Slide Hammer	91-34569A 1

NOTE: The propeller shaft seal cannot be replaced without removing the carrier bearing. Removal of the bearing may damage the bearing. Do not remove the bearing unless necessary and at that time, replace the propeller shaft seal. Remove the seal with a punch being careful not to scar the carrier seal surface. If the surface is damaged, the carrier must be replaced.

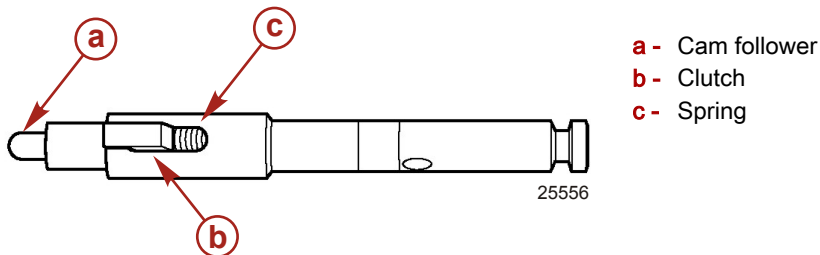


4. Remove the carrier O-ring and inspect the O-ring for cuts or abrasions. Replace the O-ring as required.



Propeller Shaft Disassembly

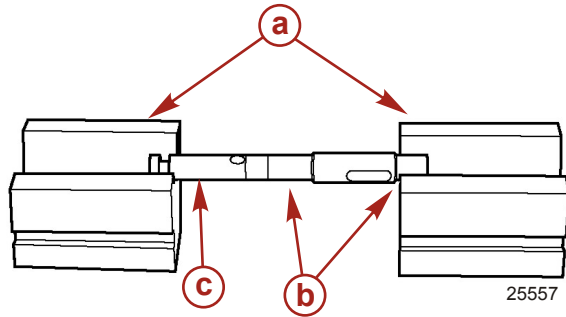
1. Remove the cam follower and inspect both ends for wear. If the cam follower is worn or pitted, replace the follower.
2. Compress the spring with an awl or a small screwdriver and remove the clutch. Replace the clutch if the teeth are rounded, chipped, or if wear is evident from the cam follower or the spring. Rounded jaws indicate the following:
 - Improper shift cable adjustment
 - Engine idle speed too high
 - Shifting too slowly



3. Replace the propeller shaft if:
 - Oil seal surface is grooved

Gear Housing

- Propeller shaft has a noticeable wobble or is bent more than 0.152 mm (0.006 in.). Check the propeller shaft trueness with a dial indicator and V-blocks.



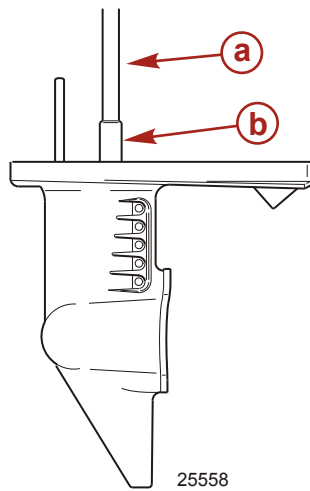
- a - V-blocks
- b - Bearing surfaces
- c - Check with dial indicator here

Dial Indicator

91-58222A1

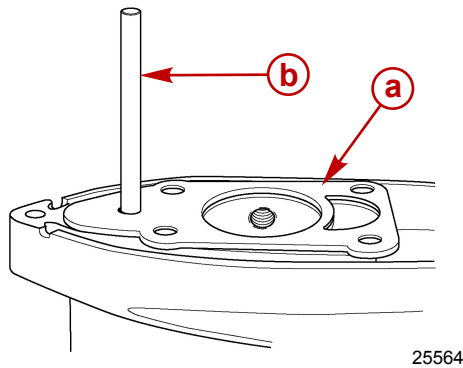
Driveshaft, Pinion Gear, and Forward Gear

- Remove the driveshaft and spacer from the gear housing.



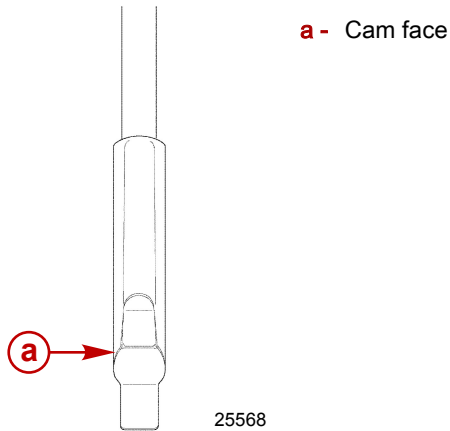
- a - Driveshaft
- b - Spacer

- Remove the water pump base gasket and the shift shaft from the gear housing.

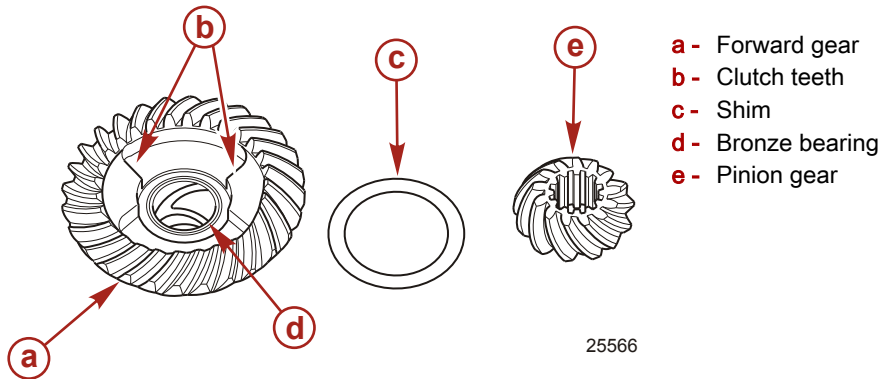


- a - Gasket
- b - Shift shaft

- Inspect the shift cam face for roughness or galling from the cam follower. If the cam face is worn, replace the shift cam assembly.

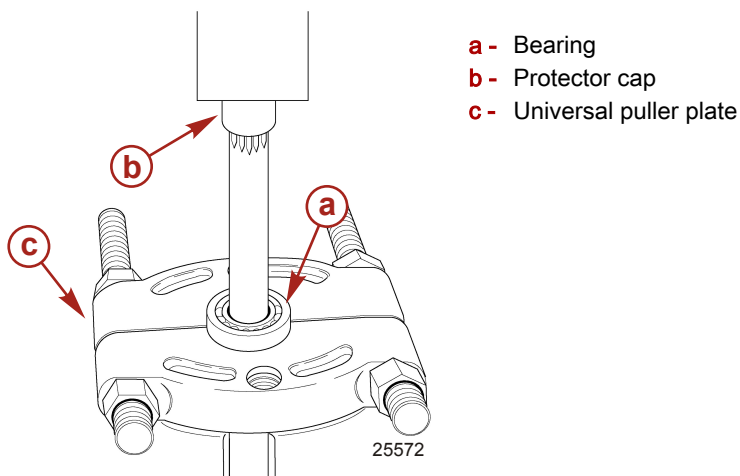


- Remove the forward gear and shim.
 - Inspect the forward gear clutch teeth for wear.
 - Inspect the bronze bearing for wear.
 - Inspect the forward gear teeth and pinion gear teeth for chips or excessive wear.



Upper Driveshaft Bearing

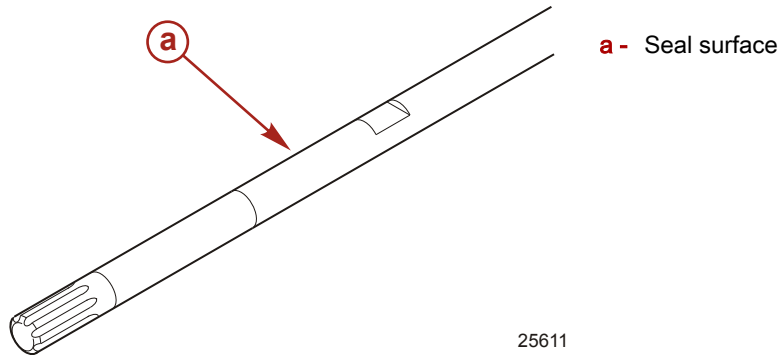
- Inspect the upper driveshaft ball bearing for rust or rough movement. If necessary, replace the bearing. Use a protector cap to protect the driveshaft while removing the bearing using a press and universal puller plate.



Protector Cap	91-24161
Universal Puller Plate	91-37241

Gear Housing

2. Inspect the driveshaft where the water pump seals ride. If a fingernail can catch in the grooves, the driveshaft should be replaced.

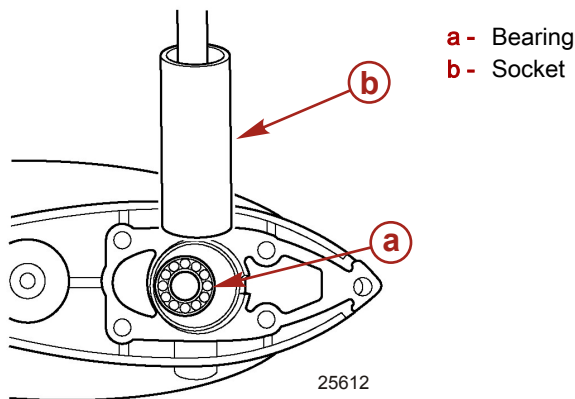


Lower Driveshaft Bearing/Forward Gear Bearing

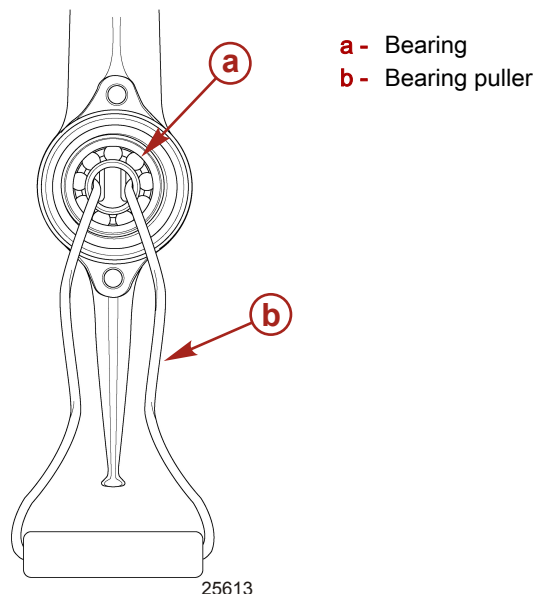
IMPORTANT: Do not remove the forward gear ball bearing or the lower driveshaft ball bearing from the gear housing unless replacement is necessary. The removal process may damage the bearings.

IMPORTANT: If the forward gear bearing and the lower driveshaft bearing are removed from the gear housing, inspect the gear housing for signs of the bearing race spinning in their respective bores. This usually occurs as a result of bearing seizure from lack of lubricant or from water intrusion. If either bearing spins in their respective bore, the gear housing must be replaced.

1. Inspect the lower driveshaft ball bearing for roughness. If necessary, remove the bearing by driving the bearing downward with a 3/4 in. socket.



2. Inspect the forward gear ball bearing for roughness. If necessary, remove the bearing using a bearing puller.

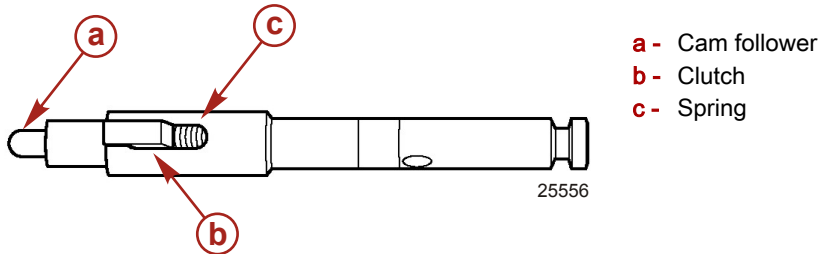


Puller	91-27780
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Gear Housing Assembly

Propeller Shaft Assembly

1. Compress the clutch spring and insert the clutch into the propeller shaft.
2. Apply a small amount of 2-4-C with PTFE to the clutch end of the cam follower. This will aid in retaining the cam follower in the propeller shaft during installation of the propeller shaft into the gear housing.



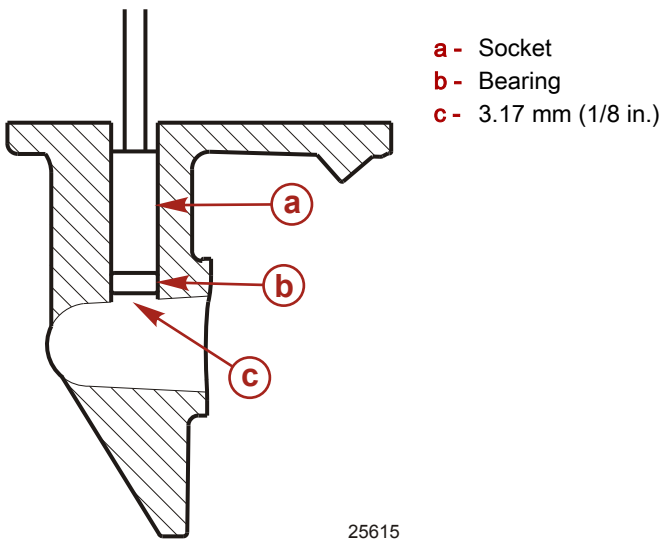
- a - Cam follower
- b - Clutch
- c - Spring

Tube Ref No.	Description	Where Used	Part No.
95	2-4-C with PTFE	Clutch end of cam follower	92-802859A 1

Lower Driveshaft Bearing

Lubricate the outside diameter of the lower bearing race with Premium Gear Lubricant. Place the bearing into the driveshaft bore (number side faces up). Using a 3/4 in. socket, carefully tap the bearing (check alignment frequently) into position approximately 3.17 mm (1/8 in.) from the bottom of the bore.

IMPORTANT: If the lower driveshaft bearing is not positioned low enough in the driveshaft bore, the water pump base will preload the upper and lower driveshaft bearings resulting in the premature failure of both bearings.



- a - Socket
- b - Bearing
- c - 3.17 mm (1/8 in.)

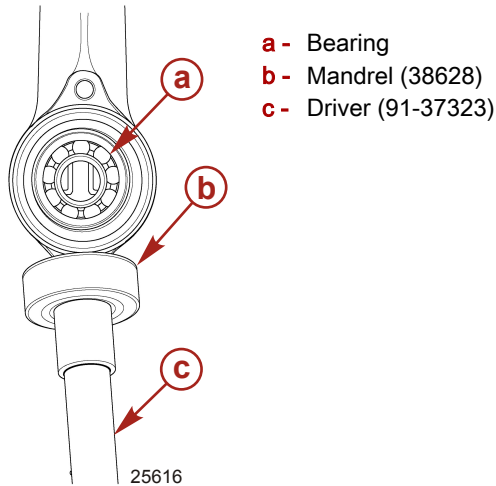
Tube Ref No.	Description	Where Used	Part No.
82	Premium Gear Lubricant	Outside diameter of lower bearing race	92-858058K01

Forward Gear Bearing


NOTE: Press on the number side of the bearing when seating the bearing into the gear housing.

Gear Housing

Lubricate the outside diameter of the bearing with Premium Gear Lubricant. Position the bearing in the gear housing. Seat the bearing in the gear housing using a mandrel and a driver from the bearing removal and installation kit.

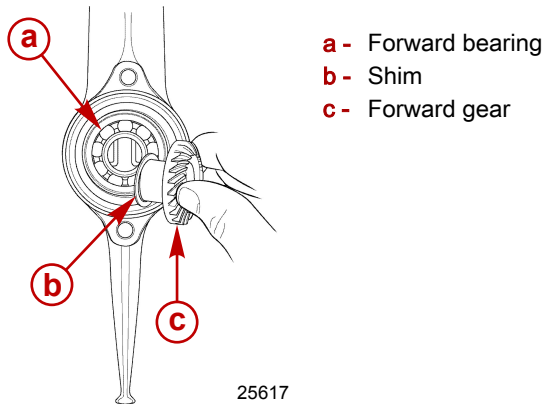


- a - Bearing
- b - Mandrel (38628)
- c - Driver (91-37323)

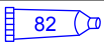
Tube Ref No.	Description	Where Used	Part No.
 82	Premium Gear Lubricant	Outside diameter of forward gear bearing	92-858058K01
Bearing Removal and Installation Kit		91-31229A7	

Forward Gear

- Lubricate the forward gear bronze propeller shaft bearing and the roller bearing surface with Premium Gear Lubricant.
- Place the forward gear with the shim (retained) into the forward bearing.

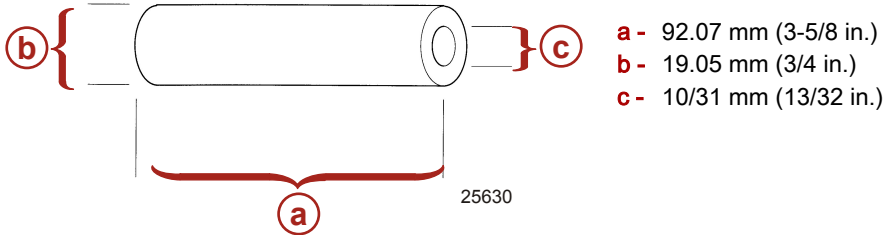


- a - Forward bearing
- b - Shim
- c - Forward gear

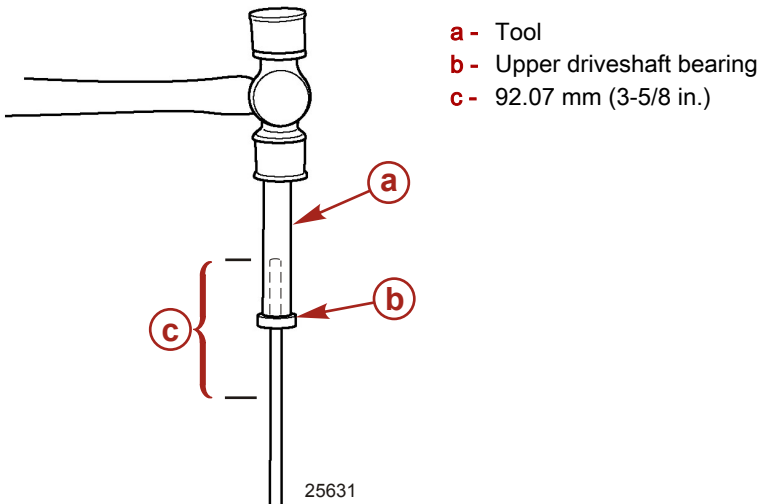
Tube Ref No.	Description	Where Used	Part No.
 82	Premium Gear Lubricant	Forward gear bronze bearing	92-858058K01


Driveshaft

- Lubricate the inside diameter of the new upper driveshaft bearing with Premium Gear Lubricant. In order to position the bearing at the proper height on the driveshaft, fabricate a driver tool to the following dimensions:

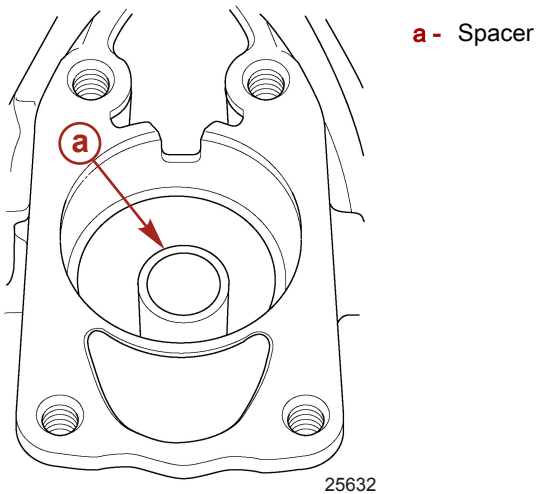


- Place the crankshaft end of the driveshaft on a padded surface. Place the upper driveshaft bearing on the pinion end of the driveshaft. Using the fabricated driver tool, tap the bearing down the driveshaft until the tool is flush with the pinion end of the driveshaft.



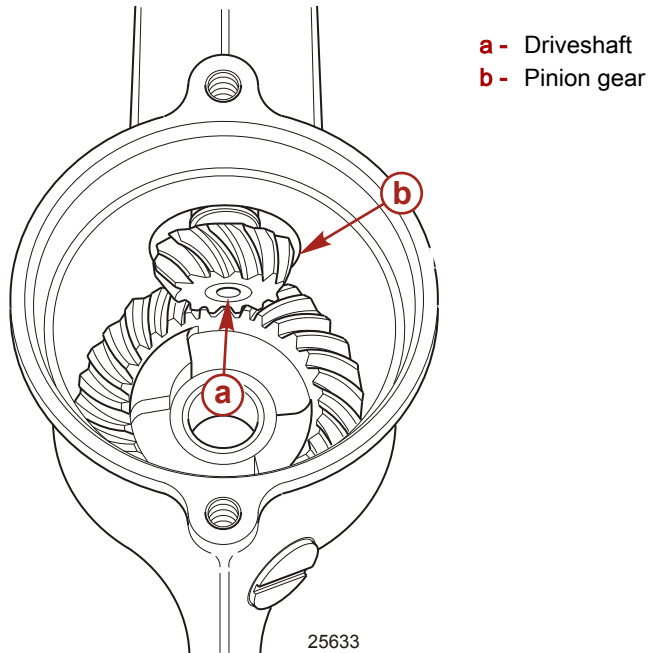
Tube Ref No.	Description	Where Used	Part No.
 82	Premium Gear Lubricant	Inside diameter of the upper driveshaft bearing	92-858058K01

- Place the spacer into the gear housing.



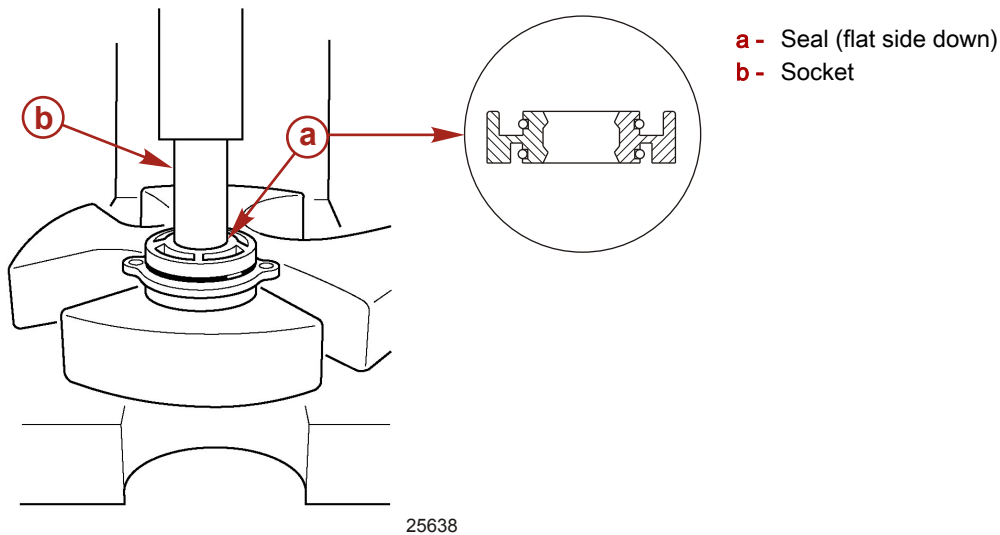
Gear Housing


- Slide the driveshaft assembly through the spacer into the gear housing while installing the pinion gear onto the lower driveshaft splines.



Bearing Carrier Assembly

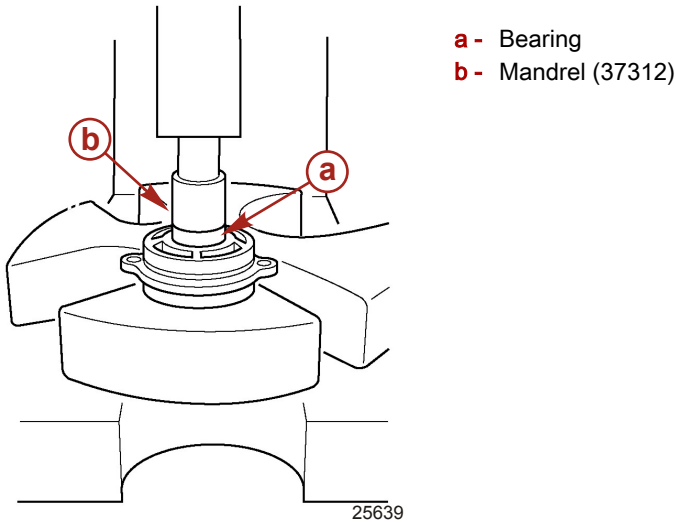
- Apply 2-4-C with PTFE to the new seal lips. Press the new seal (flat side down) into the carrier with a 13/16 in. socket.




Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Seal lips	92-802859A 1

- Apply 2-4-C with PTFE to the outside diameter of the new carrier bearing.

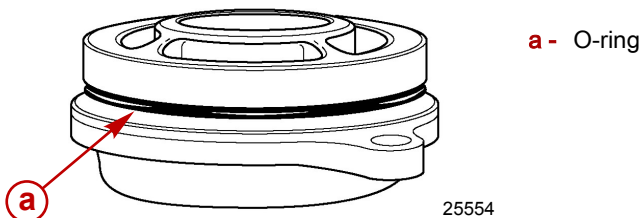
- Press the new ball bearing (number side up) into the carrier until the bearing seats. Use a press with a driver and mandrel from the bearing removal and installation kit.




Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Outside diameter of carrier bearing	92-802859A 1

Bearing Removal and Installation Kit	91-31229A7
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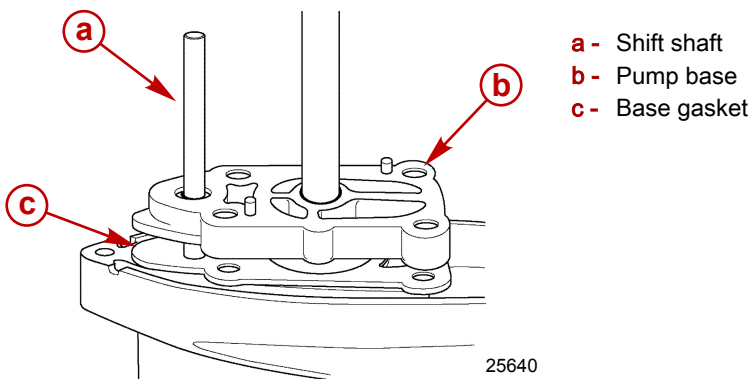
- Install the carrier O-ring. Apply 2-4-C with PTFE to the O-ring surface.



Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Bearing carrier O-ring surface	92-802859A 1

Shift Shaft

- Install the shift shaft into the gear housing. Apply a light coat of 2-4-C with PTFE on the shift shaft to lubricate the O-ring in the water pump base.
- Install the water pump base and a new base gasket.



Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Shift shaft surface	92-802859A 1

Forward Gear Backlash

Check forward gear backlash as follows:

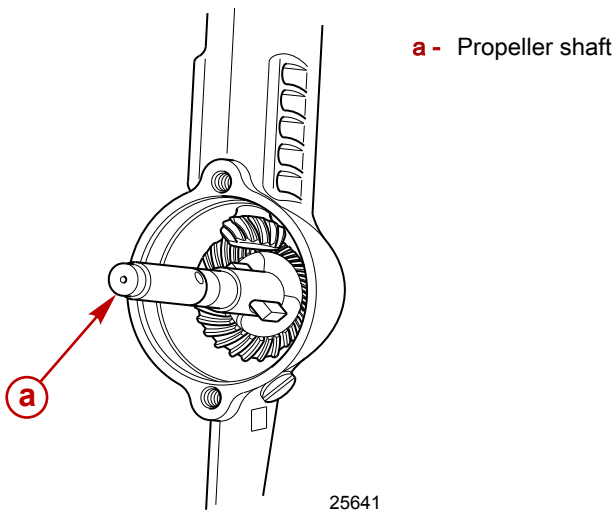
- Apply down pressure on the driveshaft
- Push up on the pinion gear (gear floats on the driveshaft)
- Rock the forward gear back and forth

A light clicking sound (0.050–0.152 mm [0.002–0.006 in.]) should be heard. If excessive freeplay exists (over 0.30 mm [0.012 in.]), the gear housing components should be inspected for wear. If no freeplay exists, either the forward gear or forward gear bearing are not seated properly in the gear housing or the lower driveshaft bearing (above the pinion gear) is positioned too low in the driveshaft housing.

Propeller Shaft

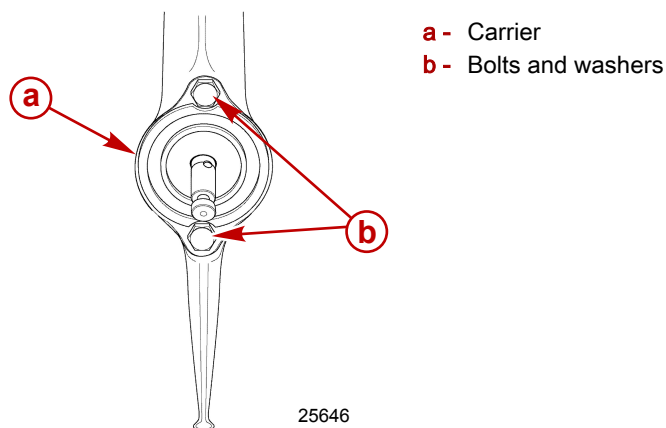
NOTE: Verify the shift cam is aligned properly in the gear housing.

Install the propeller shaft assembly into the forward gear/bearing assembly.



Bearing Carrier

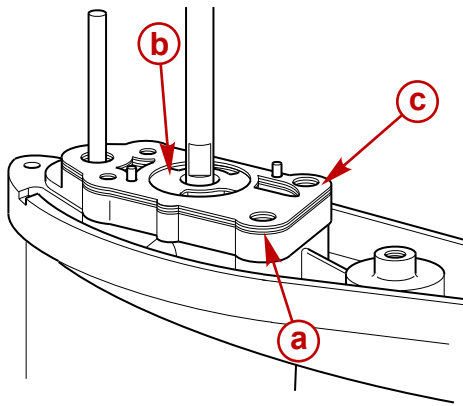
Slide the bearing carrier assembly over the propeller shaft. Secure the carrier to the gear housing with two bolts and flat washers. Tighten the bolts to the specified torque.



Description	Nm	lb-in.	lb-ft
Bolts with washers	5.6	50	

Water Pump

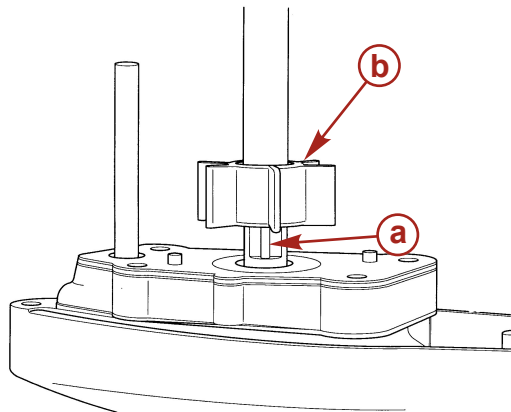
1. Install a new base gasket, base plate (if required), and a pump cover gasket.



- a - Base gasket
- b - Base plate
- c - Pump cover gasket

25642

2. Install the drive key and the impeller onto the driveshaft. If reusing the old impeller, do not reverse the impeller vanes or premature failure will occur.

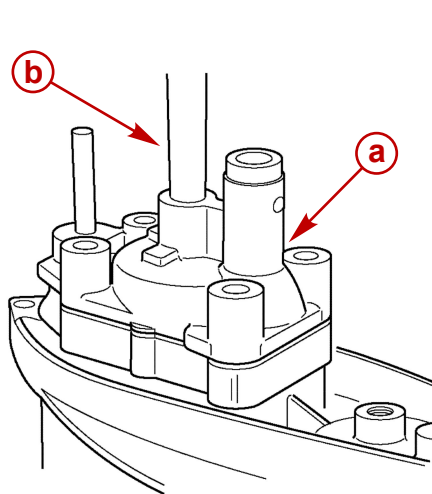


- a - Drive key
- b - Impeller

25538


NOTE: Apply a light coat of 2-4-C with PTFE to the shaft to lubricate the O-ring in the pump housing.

3. Apply a light coat of 2-4-C with PTFE to the inside of the pump cover insert. Slide the pump cover assembly down over the driveshaft. Rotate the driveshaft clockwise as the pump cover is pressed down over the impeller.



- a - Pump cover
- b - Driveshaft

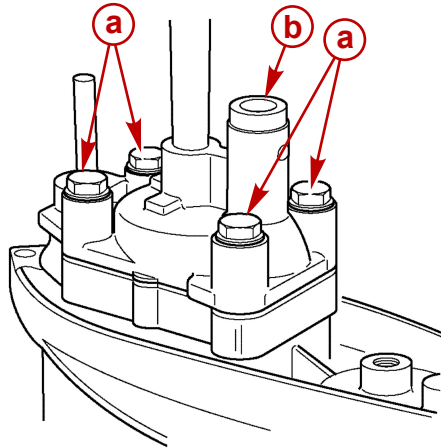
25644

Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Inside of pump cover insert	92-802859A 1

4. Apply Loctite 242 Threadlocker to the threads of the water pump cover bolts.

Gear Housing

- Secure the water pump cover to the gear housing with four bolts. Tighten the bolts to the specified torque.
- Lubricate the I.D. of the water tube seal with a light coat of 2-4-C with PTFE.



a - Bolts
b - Seal

25645

Tube Ref No.	Description	Where Used	Part No.
95	2-4-C with PTFE	Inside diameter of water tube seal	92-802859A 1
66	Loctite 242 Threadlocker	Water pump cover bolt threads	92-809821

Description	Nm	lb-in.	lb-ft
Pump cover bolts	5.6	50	

Gear Housing

Filling the Gear Housing with Lubricant

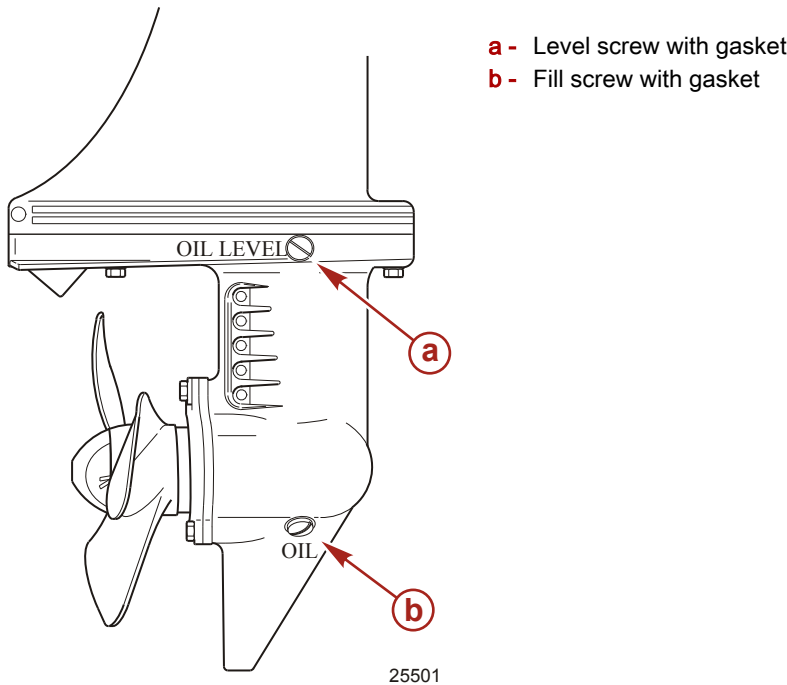
NOTE: The gear housing lubricant capacity is approximately 180 mL (6.1 fl oz). Use Premium or High Performance Gear Lubricant in the gear housing.

⚠ WARNING

Rotating propellers can cause serious injury or death. Never operate the boat out of the water with a propeller installed. Before installing or removing a propeller, place the drive unit in neutral and engage the lanyard stop switch to prevent the engine from starting. Place a block of wood between the propeller blade and the anti-ventilation plate.

- Remove the oil fill screw and gasket.
IMPORTANT: Do not add lubricant without removing the oil level screw. The gear housing cannot be filled because of trapped air. Fill the gear housing when the driveshaft is in the vertical position.
- Remove any gasket material from the oil fill screw, oil level screw, and the gear housing. Install new gaskets on the oil fill screw and the oil level screw.

- Using Premium Gear Lubricant, insert the lubricant tube into the oil fill hole and then remove the oil level screw and gasket.



Tube Ref No.	Description	Where Used	Part No.
82	Premium Gear Lubricant	Gear housing cavity	92-858058K01
87	High Performance Gear Lubricant	Gear housing cavity	92-858064K01

- Add lubricant until it appears at the vent hole.
- Stop adding lubricant. Install the vent screw with a gasket before removing the lubricant tube.
- Remove the lubricant tube and install the fill screw with a gasket.

Gear Housing Installation

⚠ WARNING

Accidental starting can cause serious injury. Before removing or installing the gear housing, disconnect and isolate the spark plug leads. Disable the ignition system by removing the keys from the ignition (if equipped) and engaging the lanyard stop switch to prevent the engine from starting.

- Place the gear shift lever in the neutral position.
- Tilt the engine to the full up position.
- Shift the gear housing into neutral. The propeller will rotate freely in either position.

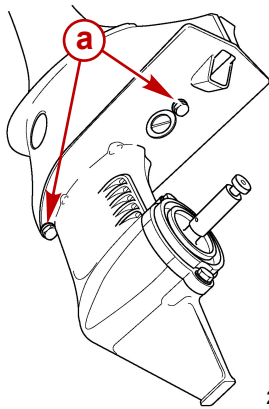
NOTICE

Installing the gear housing to the powerhead without adequately cleaning the top of the driveshaft can result in severe product damage. Any lubricant trapped in the space between the driveshaft and the crankshaft prevent the two from properly engaging. Always clean the top of the driveshaft before installing the gear housing.

- Apply a light coat of 2-4-C with PTFE to the driveshaft splines.
 - Position the driveshaft into the driveshaft housing. Move the gear housing upwards into the driveshaft housing while aligning the shift shaft, water tube, and driveshaft splines.
- NOTE:** If the driveshaft splines will not align with the crankshaft splines, rotate the flywheel slightly while pushing the gear housing into the driveshaft housing.

Gear Housing

6. Secure the gear housing to the driveshaft housing with two bolts. Tighten the bolts to the specified torque.



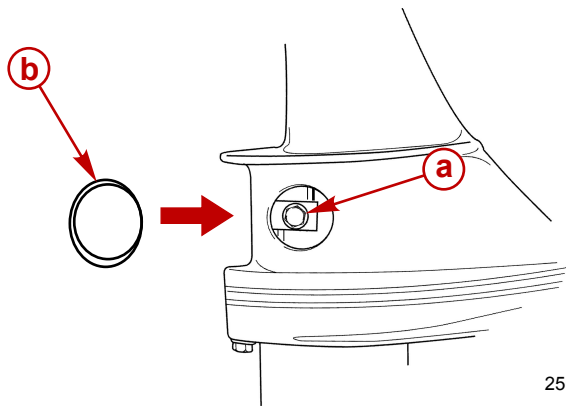
a - Bolts, flat washers, and lockwashers

25534

Tube Ref No.	Description	Where Used	Part No.
95	2-4-C with PTFE	Driveshaft splines	92-802859A 1

Description	Nm	lb-in.	lb-ft
Bolt	5.6	50	

7. Tighten the bolt clamping the upper and lower shift shafts. With the outboard in neutral, the propeller shaft should turn freely. If the propeller shaft does not turn freely in neutral, loosen the clamping bolt and verify the shift lever and gear housing are both in neutral. Tighten the bolt. Install the access cover.



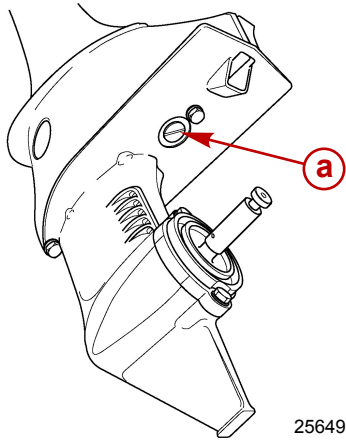
a - Bolt
b - Access cover

25670

Description	Nm	lb-in.	lb-ft
Upper and lower shift shaft clamp bolt	5.6	50	

8. Verify the correct shift operation. The propeller shaft should turn freely in either direction in neutral. In forward, the propeller shaft should turn approximately 90 degrees in either direction before stopping. If the shift operation is not as described, remove the gear housing and inspect the shift cam and clutch for proper assembly.

- Inspect the sacrificial anode on the bottom of the anti-ventilation plate for erosion. If it is 50% or more consumed, replace the anode. Do not paint or apply a protective coating to the anode or corrosion protection will be lost.



a - Anode

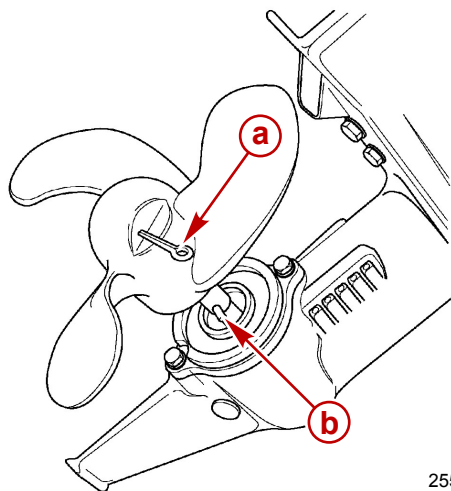
Description	Nm	lb-in.	lb-ft
Anode bolt	5.6	50	

Propeller Installation

⚠ WARNING

Rotating propellers can cause serious injury or death. Never operate the boat out of the water with a propeller installed. Before installing or removing a propeller, place the drive unit in neutral and engage the lanyard stop switch to prevent the engine from starting. Place a block of wood between the propeller blade and the anti-ventilation plate.

- Insert the drive (shear) pin into the propeller shaft.
- Slide the propeller onto the propeller shaft and align with the drive (shear) pin.
- Secure the propeller to the propeller shaft with a new cotter pin.



a - Cotter pin
b - Drive (shear) pin

Notes:

Attachments


Section 7A - Shift Linkage

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Shift Linkage Removal and Installation.....	7A-6	Shift Linkage Installation.....	7A-7

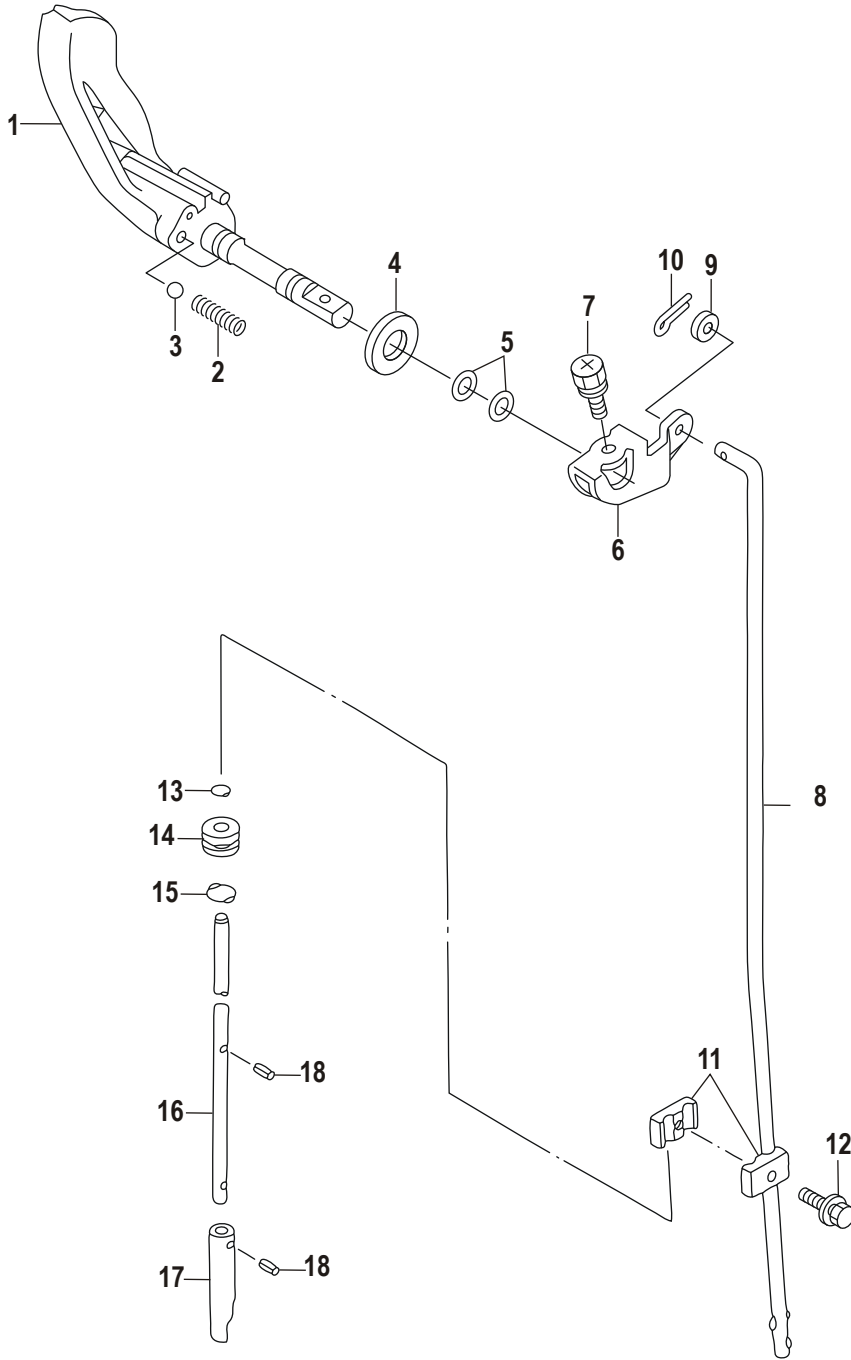


Lubricants, Sealants, Adhesives

Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Shift lever shaft and O-rings	92-802859A 1

Notes:

Shift Linkage Components



22474

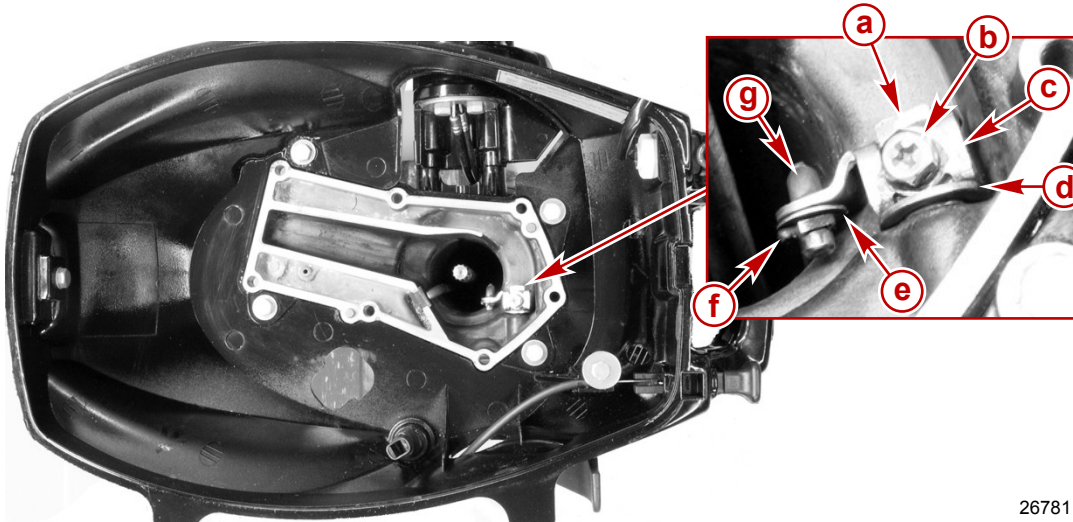
Shift Linkage Components

Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Shift lever			
2	1	Spring			
3	1	Detent ball			
4	1	Washer			
5	2	O-ring			
6	1	Shift shaft lever			
7	1	Screw (M5 x 12)	4	35	
8	1	Upper shift shaft			
9	1	Washer			
10	1	Cotter pin			
11	1	Joint			
12	1	Bolt (M6 x 16)	6	53	
13	1	O-ring			
14	1	Bushing			
15	1	O-ring			
16	1	Lower shift shaft			
17	1	Clutch cam			
18	2	Pin			

Shift Linkage Removal and Installation

Shift Linkage Removal

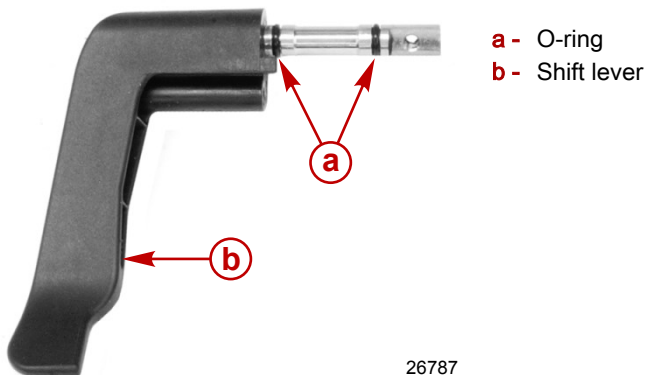
1. Remove the powerhead. Refer to **Section 4A - Powerhead Removal**.
2. Remove the screw retaining the shift lever.
3. Remove the shift lever from the driveshaft housing.
4. Remove the cotter pin from the upper shift shaft.
5. Remove the shift shaft lever from the upper shift shaft.



26781

- a - Shift lever
- b - Screw
- c - Shift shaft lever
- d - Washer
- e - Washer
- f - Cotter pin
- g - Upper shift shaft

6. Inspect the two O-rings on the shift lever. Replace if required.



- a - O-ring
- b - Shift lever

26787

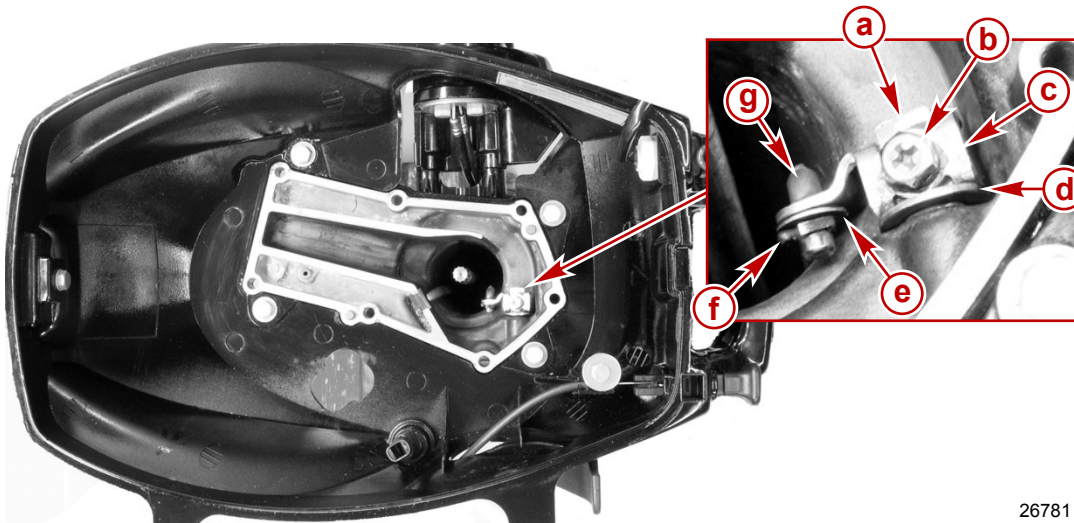
- Remove the detent ball and spring from the driveshaft housing.



26790

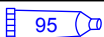
Shift Linkage Installation

- Install the spring and detent ball into the driveshaft housing.
- Lubricate the O-rings and shaft on the shift lever with 2-4-C with PTFE.
- Install the shift lever into the driveshaft housing.
- Install a washer onto the shift lever.
- Install the shift shaft lever onto the shift lever. Secure with the screw. Tighten the screw to the specified torque.
- Install the upper shift shaft into the shift shaft lever.
- Install a washer and cotter pin.



26781

- a - Shift lever
- b - Screw
- c - Shift shaft lever
- d - Washer
- e - Washer
- f - Cotter pin
- g - Upper shift shaft

Tube Ref No.	Description	Where Used	Part No.
 95	2-4-C with PTFE	Shift lever shaft and O-rings	92-802859A 1

Description	Nm	lb-in.	lb-ft
Screw (M5 x 12)	4	35	

8. Install the powerhead. Refer to **Section 4A - Powerhead Installation**.

Attachments


Section 7B - Tiller Handle

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Tiller Handle Components.....	7B-4	Tiller Handle Installation.....	7B-9
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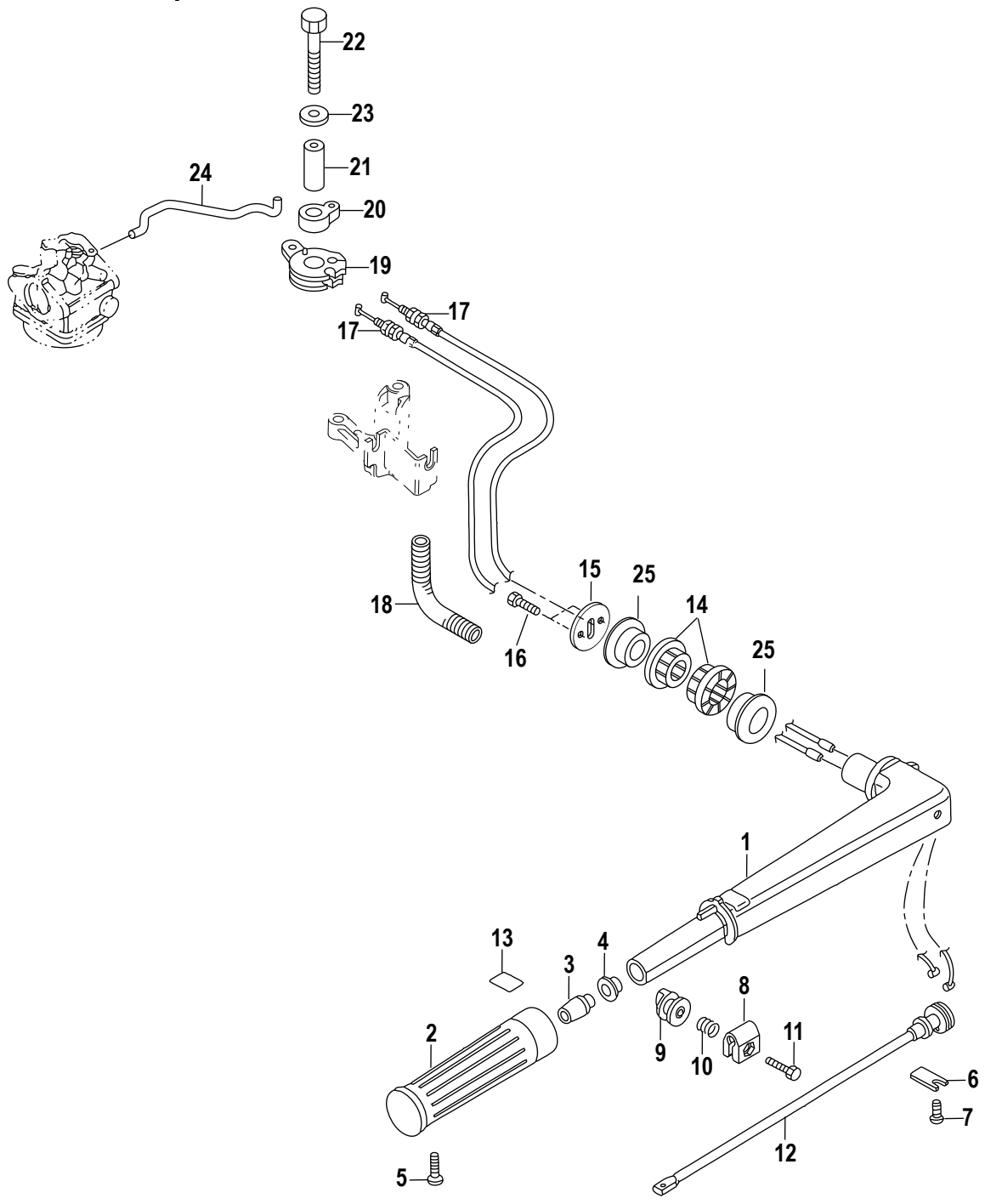


Lubricants, Sealants, Adhesives

Tube Ref No.	Description	Where Used	Part No.
 66	Loctite 242 Threadlocker	Fuel tank mounting bolts	92-809821

Notes:

Tiller Handle Components



22485

Tiller Handle Components

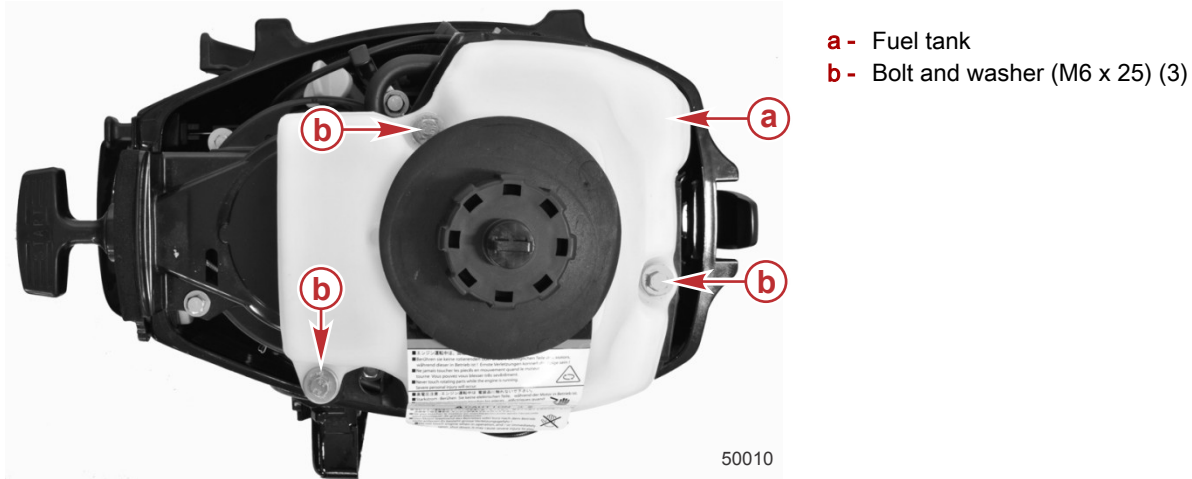
Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Tiller handle			
2	1	Grip			
3	1	Rubber shaft			
4	1	Bushing			
5	1	Screw	Drive tight		
6	1	Bracket			
7	1	Screw	Drive tight		
8	1	Throttle shaft friction device			
9	1	Throttle friction knob	As required		
10	1	Spring			
11	1	Bolt			
12	1	Throttle shaft			
13	1	Throttle decal			
14	2	Rubber isolator bushing			
15	1	Cover			
16	2	Bolt	6	53	
17	2	Throttle cable			
18	1	Sleeve			
19	1	Throttle drum			
20	1	Throttle opener			
21	1	Collar			
22	1	Bolt	6	53	
23	1	Washer			
24	1	Throttle rod			
25	2	Plastic bushing			

Tiller Handle Removal

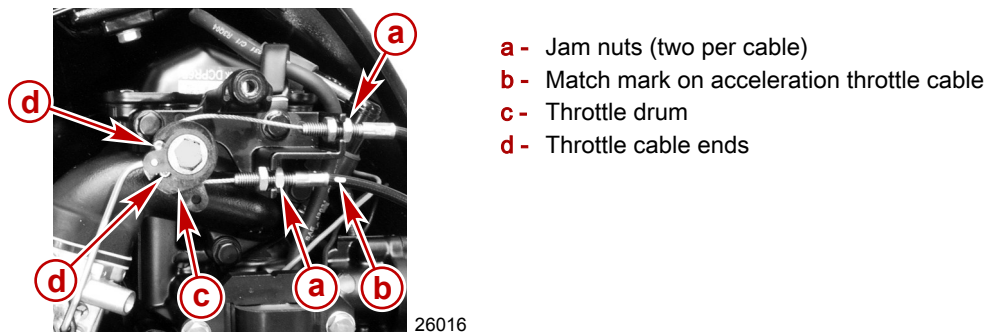
⚠ WARNING

Fuel is flammable and explosive. Ensure that the key switch is off and the lanyard is positioned so that the engine cannot start. Do not smoke or allow sources of spark or open flame in the area while servicing. Keep the work area well ventilated and avoid prolonged exposure to vapors. Always check for leaks before attempting to start the engine, and wipe up any spilled fuel immediately.

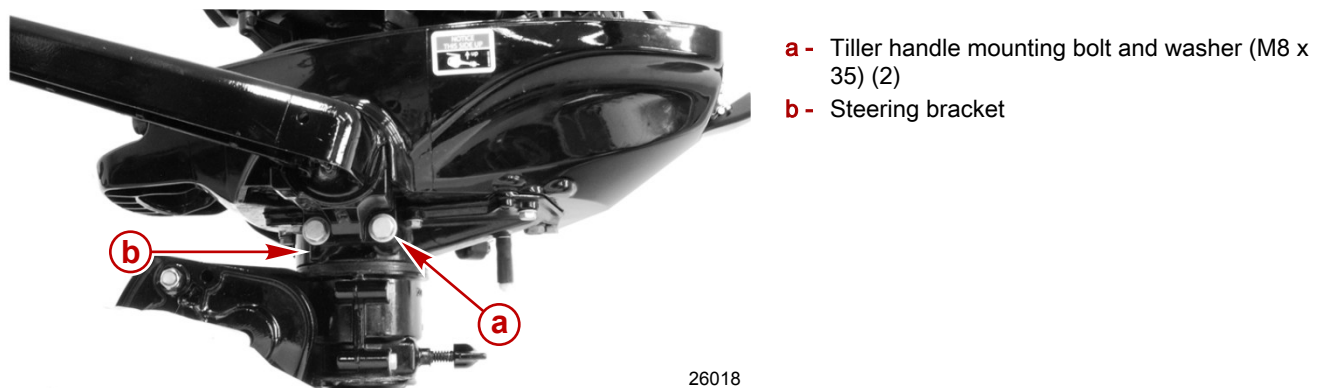
1. Remove the top cowl.
2. Drain the fuel tank.
IMPORTANT: Use an approved container to collect and store the fuel. Wipe up any spillage immediately. Materials used to contain spillage must be disposed of in an approved receptacle. Any fuel system service must be performed in a well-ventilated area.
3. Remove the three bolts and washers securing the fuel tank to the engine, and remove the fuel tank.



4. Place a match mark on the acceleration throttle cable as shown.
5. Loosen the throttle cable jam nuts and remove the throttle cable ends from the throttle drum.

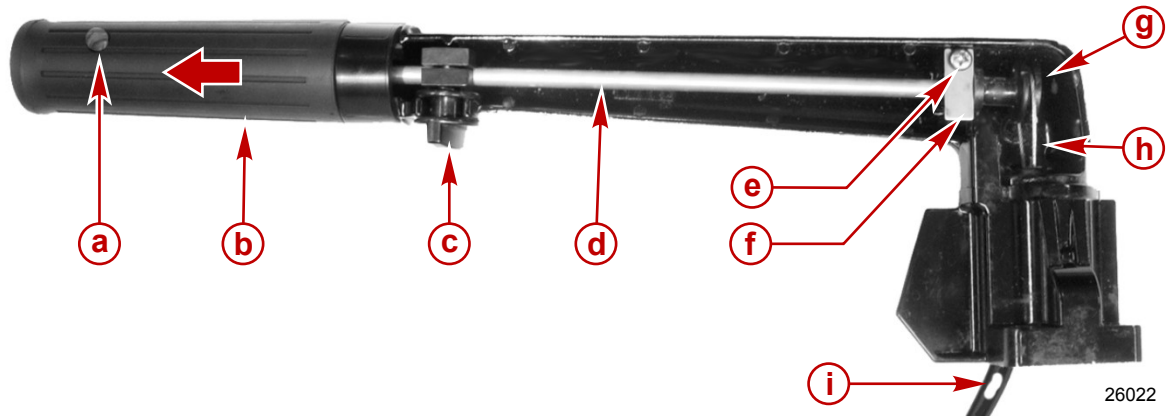


6. Remove the two bolts securing the steering bracket to the bottom cowl. Remove the steering bracket and tiller handle.



Tiller Handle Disassembly

1. Remove the screw from the tiller handle grip. Slide the grip off of the tiller handle.
2. Loosen the friction knob.
3. Remove the screw from the tiller handle bracket. Remove the throttle shaft from the tiller handle.
4. Place a match mark on the acceleration throttle cable and cable end.
5. Remove the cable ends from the pulley on the throttle shaft.
6. Remove the throttle shaft from the tiller handle.



- a - Tiller handle screw
- b - Grip
- c - Friction knob
- d - Throttle shaft
- e - Screw
- f - Bracket
- g - Pulley
- h - Acceleration throttle cable
- i - Match mark on acceleration cable

7. Remove the throttle cables from the handle.

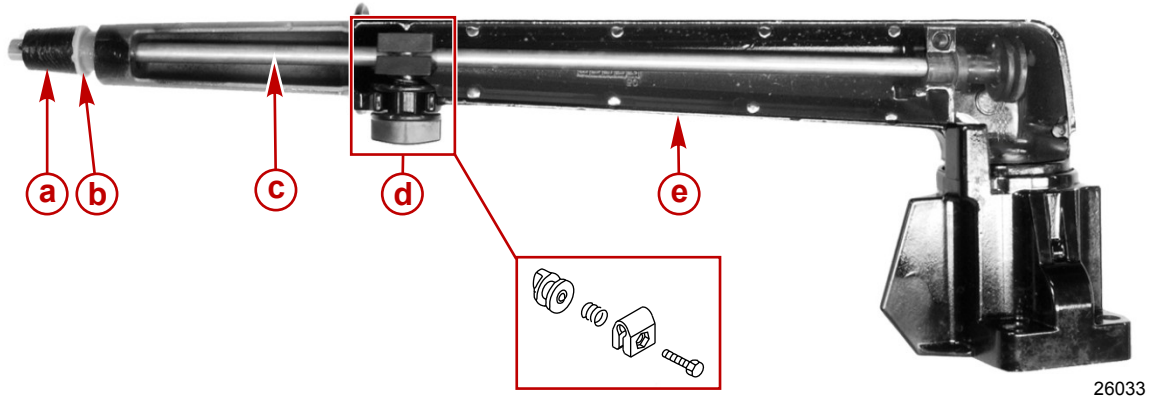
Tiller Handle Reassembly

NOTE: The deceleration and acceleration cables refer to the direction that the cable ends pull at the throttle drum on the powerhead.

1. Install the throttle friction components onto the throttle shaft.
2. Install the throttle shaft into the tiller handle.

Tiller Handle

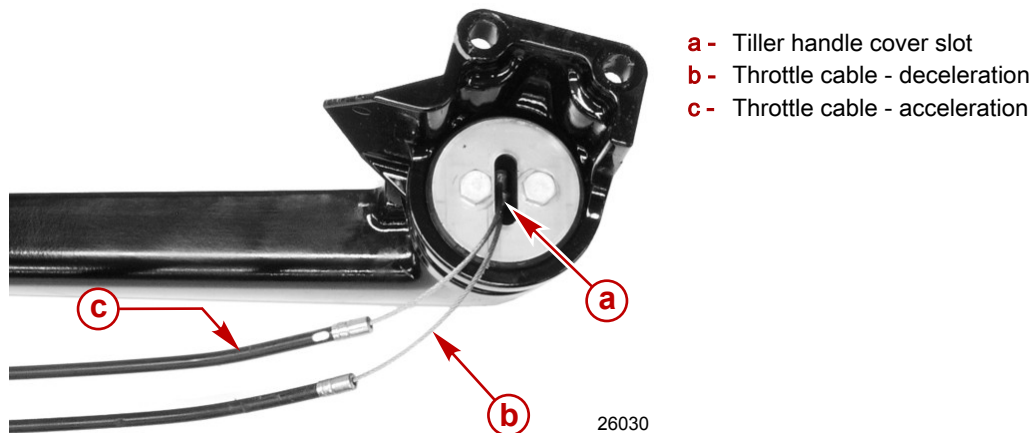
3. Install the bushing and rubber shaft onto the throttle shaft.



26033

- a - Rubber shaft
- b - Bushing
- c - Throttle shaft
- d - Throttle friction components
- e - Tiller handle

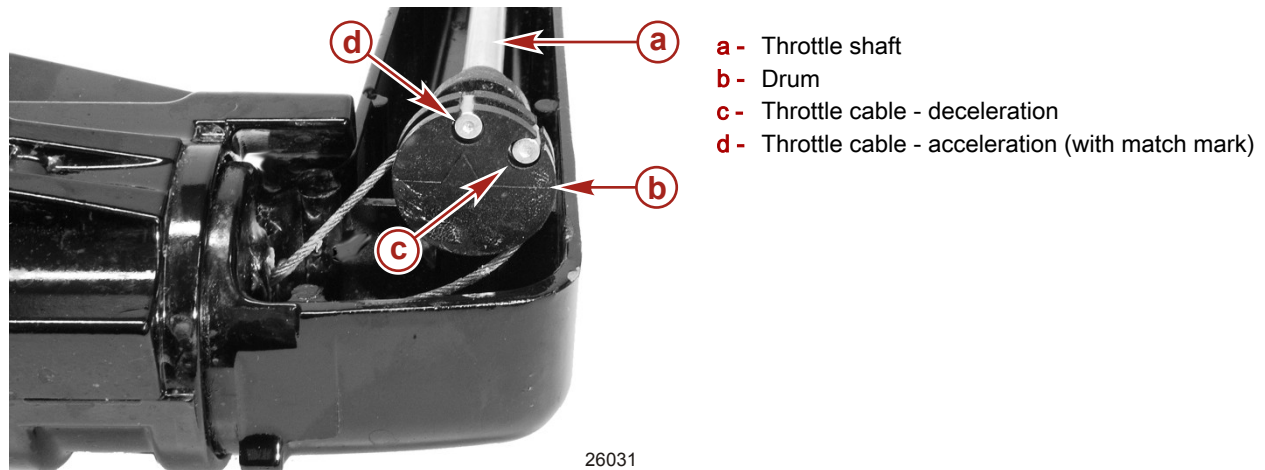
4. Install the throttle cables through the slot in the tiller handle cover.



- a - Tiller handle cover slot
- b - Throttle cable - deceleration
- c - Throttle cable - acceleration

26030

5. Install the throttle cable ends in the throttle shaft drum.

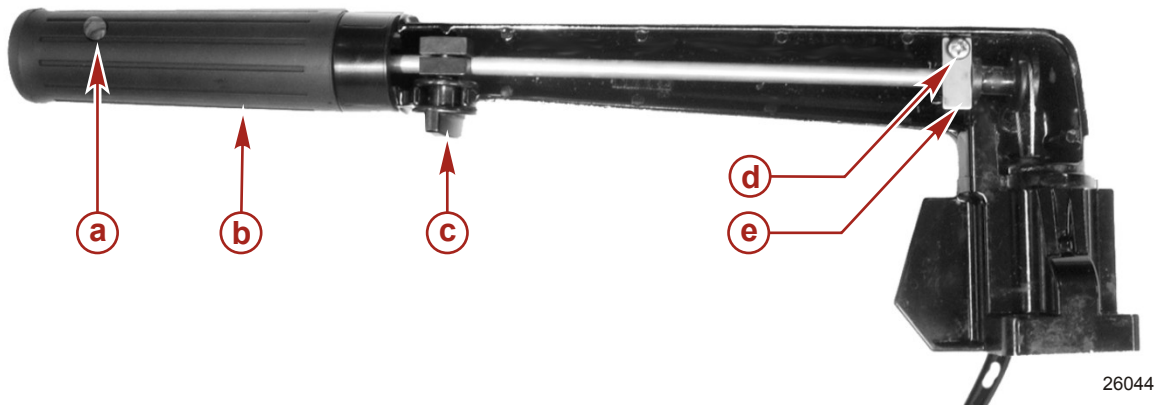


- a - Throttle shaft
- b - Drum
- c - Throttle cable - deceleration
- d - Throttle cable - acceleration (with match mark)

26031

6. Install the throttle shaft into the throttle handle.
7. Install the grip onto the tiller handle. Secure the grip with the screw.
8. Secure the throttle shaft with the bracket and screw.

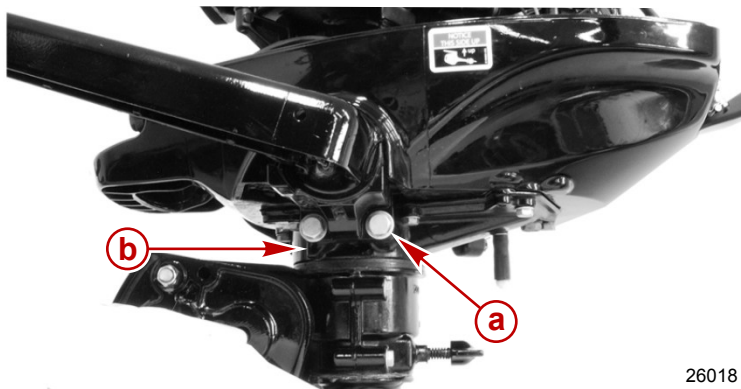
- Adjust the friction knob to the desired setting.



- a - Tiller handle grip screw
- b - Grip
- c - Friction knob
- d - Throttle shaft bracket screw
- e - Throttle shaft bracket

Tiller Handle Installation

- Install the tiller handle and steering bracket into the opening in the bottom cowl. Secure the tiller handle to the bottom cowl with two bolts and washers. Tighten the bolts to the specified torque.



- a - Tiller handle mounting bolt and washer (M8 x 35) (2)
- b - Steering bracket

26018

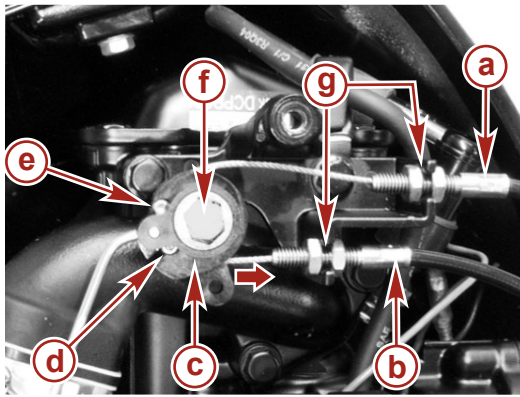
Description	Nm	lb-in.	lb-ft
Steering bracket mounting bolt (M8 x 35) (2)	15	132	

- Install the throttle cable ends into the slots in the throttle drum.
IMPORTANT: Throttle cable "B" is pulled in the direction of the arrow when the grip is rotated from the "START" position to the full throttle position.

NOTE: Loosen the throttle drum bolt slightly to aid in the installation of the throttle cable ends. Tighten the bolt to the specified torque.

Tiller Handle

3. Install the throttle cables into the slots on the throttle cable bracket.

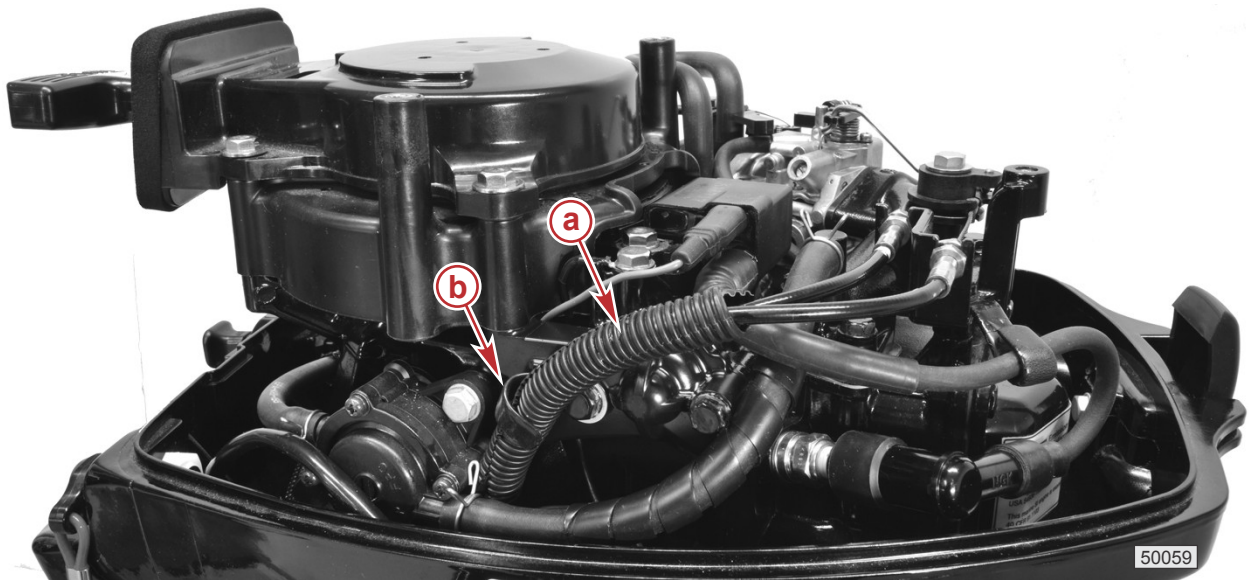


26047

- a - Throttle cable A
- b - Throttle cable B
- c - Throttle drum
- d - Throttle cable end of cable B
- e - Throttle cable end of cable A
- f - Throttle drum bolt
- g - Throttle cable bracket slots

Description	Nm	lb-in.	lb-ft
Throttle drum bolt	6	53	

4. Adjust the throttle cables. Refer to **Throttle Cable Adjustment**, following.
5. Install the sleeve around the throttle cables. Secure the sleeve with the J-clamp.



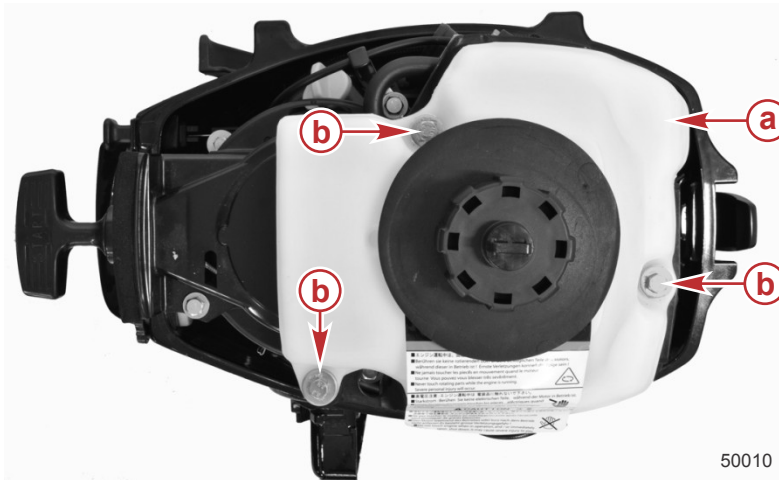
- a - Sleeve
- b - J-clamp

6. Install the fuel tank assembly. Attach the fuel line to the fuel tank and secure it with a hose clamp.

WARNING


Fuel is flammable and explosive. Ensure that the key switch is off and the lanyard is positioned so that the engine cannot start. Do not smoke or allow sources of spark or open flame in the area while servicing. Keep the work area well ventilated and avoid prolonged exposure to vapors. Always check for leaks before attempting to start the engine, and wipe up any spilled fuel immediately.

- Apply Loctite 242 Threadlocker to the fuel tank mounting bolts. Install the bolts and washers. Tighten the bolts to the specified torque.



- a** - Fuel tank
- b** - Bolt and washer (M6 x 25) (3)

50010

Tube Ref No.	Description	Where Used	Part No.
 66	Loctite 242 Threadlocker	Fuel tank mounting bolts	92-809821

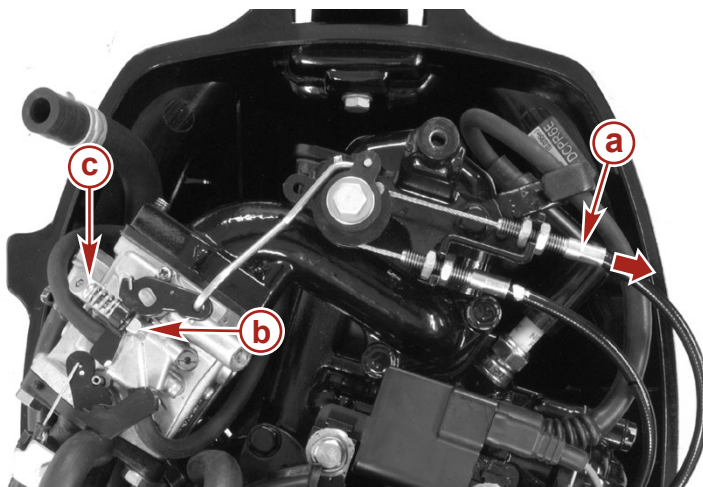
Description	Nm	lb-in.	lb-ft
Fuel tank mounting bolts (M6 x 25) (3)	6	53	

- Install the top cowl.

Throttle Cable Adjustment

Deceleration Cable

- Rotate the grip to the "START" position.
- Loosen the jam nuts on both throttle cables.
- Pull the choke knob out completely.
- Pull the outer cable jacket in the direction of the arrow.
- Tighten the deceleration throttle cable jam nuts.
- Gently push the inner wire. The wire should deflect approximately 1 mm (0.040 in.).
- Push the choke knob in completely.
- The idle screw must contact the throttle stop.

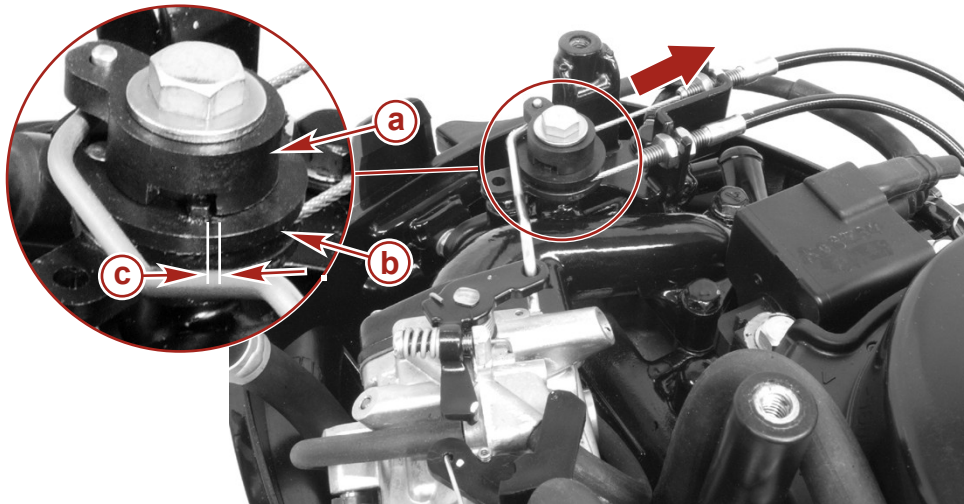


- a** - Deceleration cable
- b** - Throttle stop
- c** - Idle screw

41820

Tiller Handle

9. Ensure the gap between the tab on the throttle drum and the edge of the notch on the throttle opener is within specification.



41821

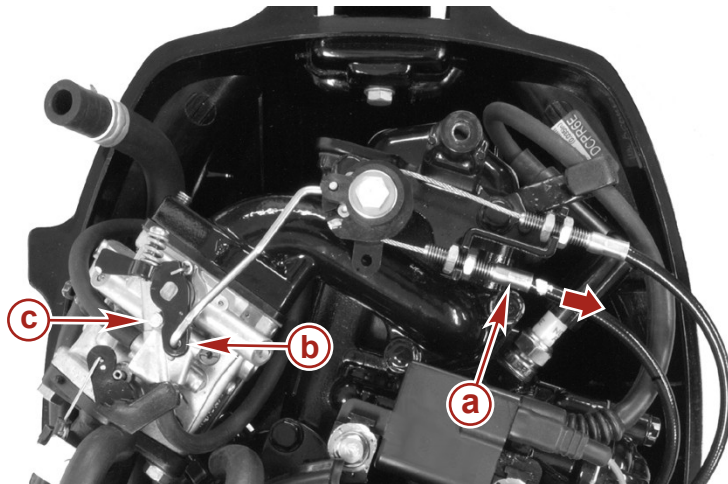
Deceleration cable adjustment

- a - Throttle opener
- b - Throttle drum
- c - Gap measurement

Gap measurement	
Throttle drum/throttle opener	0.5–1.0 mm (0.020–0.040 in.)

Acceleration Cable

1. Rotate the grip to the WOT position.
2. Loosen the acceleration cable jam nuts.
3. Pull the outer cable jacket in the direction of the arrow.
4. Tighten the acceleration cable jam nuts.
5. Gently push the inner wire. The wire should deflect approximately 1 mm (0.040 in.).
6. The carburetor throttle actuator lever should contact the throttle stop.



41822

Acceleration cable adjustment

- a - Acceleration throttle cable
- b - Carburetor throttle actuator lever
- c - Throttle stop


Manual Starter

Section 8A - Recoil Starter

Table of Contents

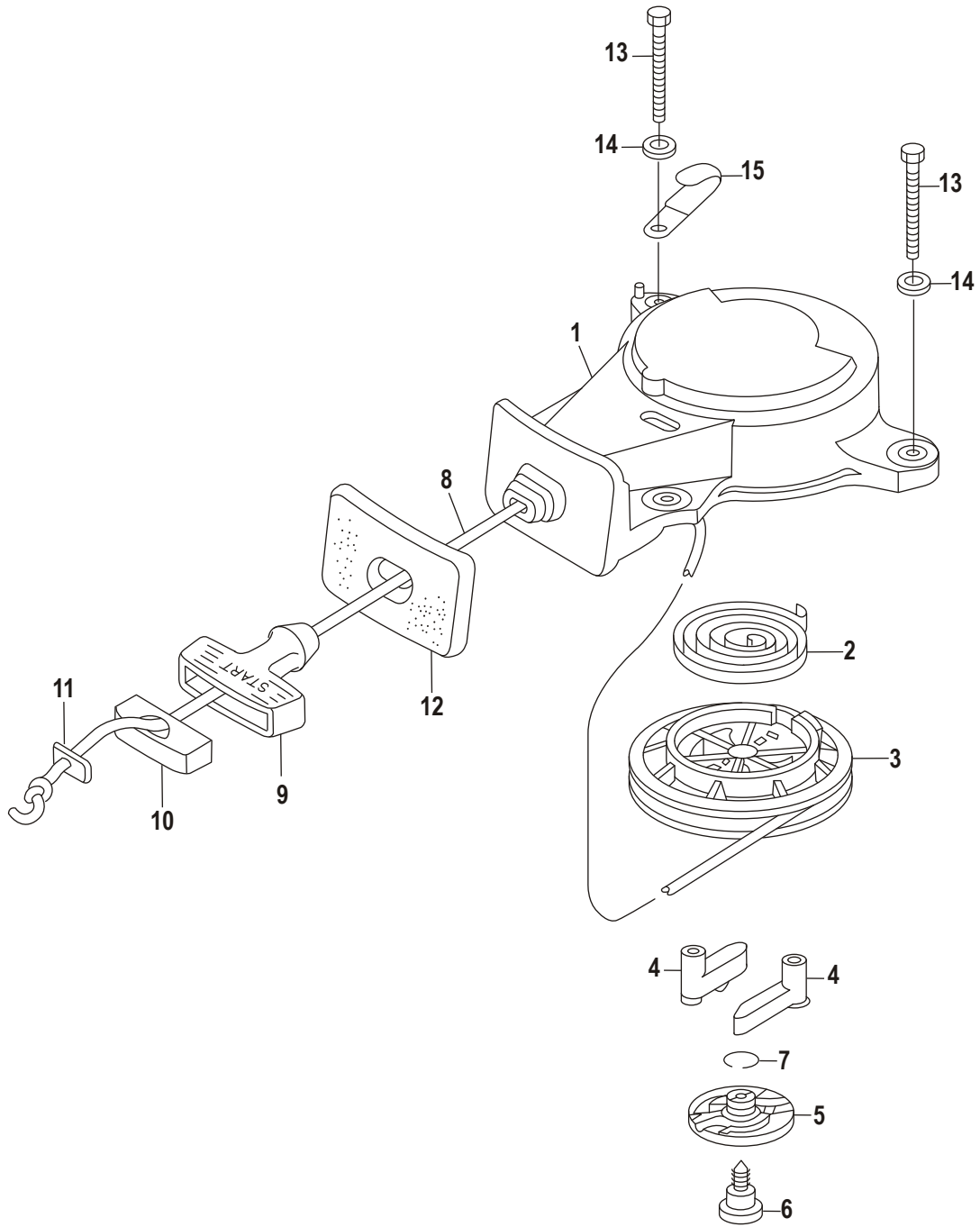
Recoil Starter Components.....	8A-4	Recoil Starter Rope Replacement.....	8A-9
Recoil Starter Removal.....	8A-6	Removal.....	8A-9
Recoil Starter Spring Replacement.....	8A-7	Reassembly.....	8A-10
Removal.....	8A-7	Recoil Starter Installation.....	8A-11
Reassembly.....	8A-8		

Lubricants, Sealants, Adhesives

Tube Ref No.	Description	Where Used	Part No.
 66	Loctite 242 Threadlocker	Recoil starter assembly mounting bolts	92-809821
		Fuel tank mounting bolts	

Notes:

Recoil Starter Components



22484

Recoil Starter Components

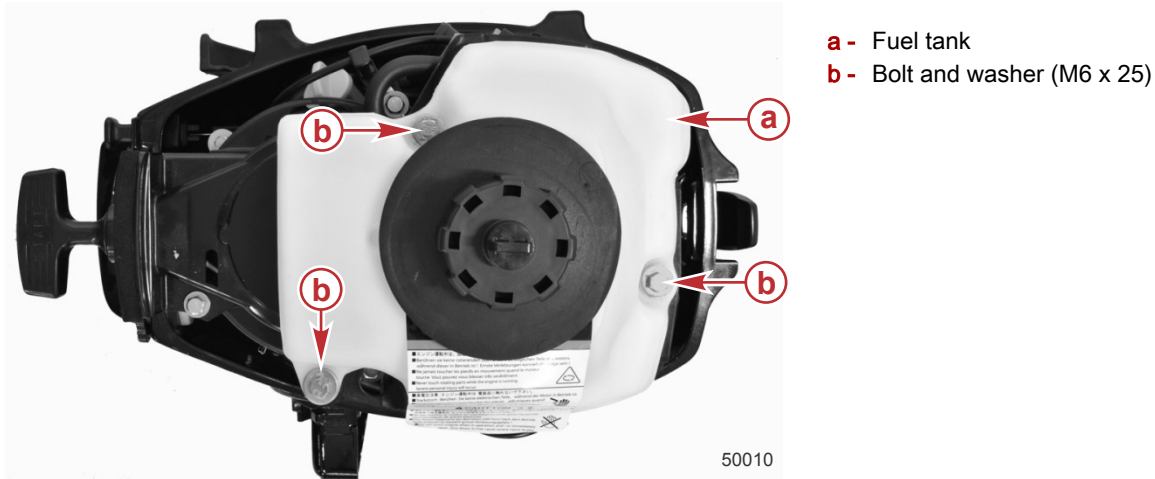
Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Recoil starter assembly			
2	1	Spring			
3	1	Reel			
4	2	Ratchet pawl			
5	1	Friction plate			
6	1	Screw	Drive tight		
7	1	Friction spring			
8	1	Rope			
9	1	Starter handle			
10	1	Rope anchor			
11	1	Rope anchor plate			
12	1	Starter seal			
13	3	Bolt (M6 x 60)	6	53	
14	3	Washer			
15	1	Clamp			

Recoil Starter Removal

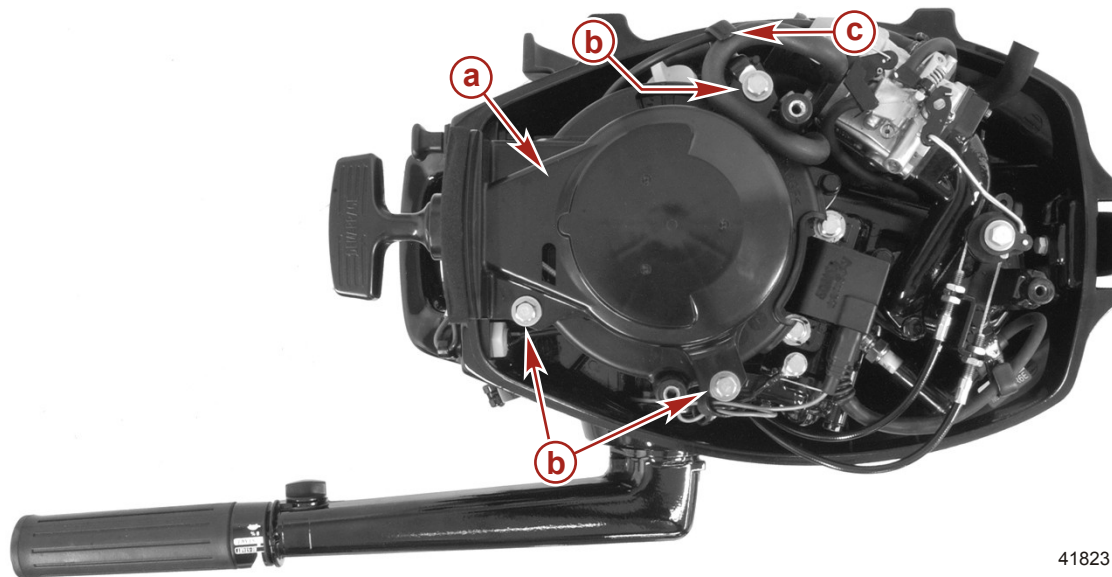
⚠ WARNING

Fuel is flammable and explosive. Ensure that the key switch is off and the lanyard is positioned so that the engine cannot start. Do not smoke or allow sources of spark or open flame in the area while servicing. Keep the work area well ventilated and avoid prolonged exposure to vapors. Always check for leaks before attempting to start the engine, and wipe up any spilled fuel immediately.

1. Remove the top cowl.
2. Remove the three bolts and washers securing the fuel tank to the engine.
3. Drain the fuel tank.
IMPORTANT: Use an approved container to collect and store the 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.
4. Remove the fuel tank from the engine. Position the fuel tank to prevent fuel leakage.



5. Remove the three bolts securing the recoil starter assembly. Remove the recoil starter assembly from the outboard.



- a - Recoil starter assembly
- b - Bolts and washers
- c - J-clamp

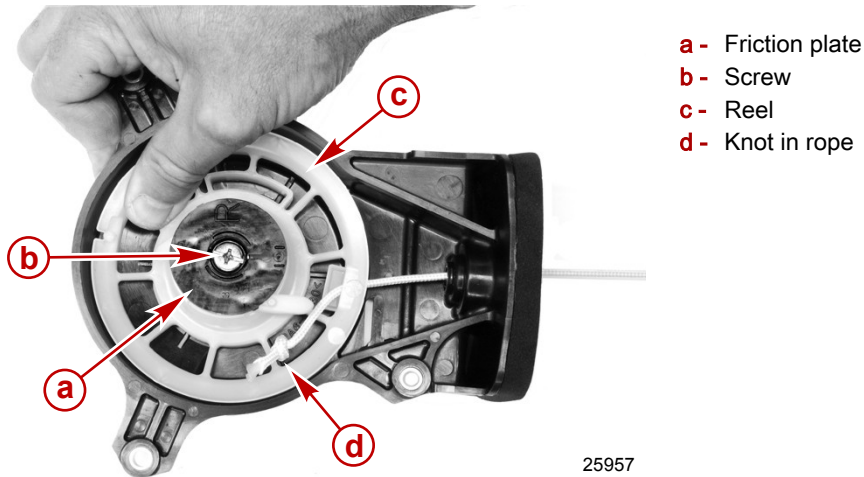
Recoil Starter Spring Replacement

⚠ WARNING

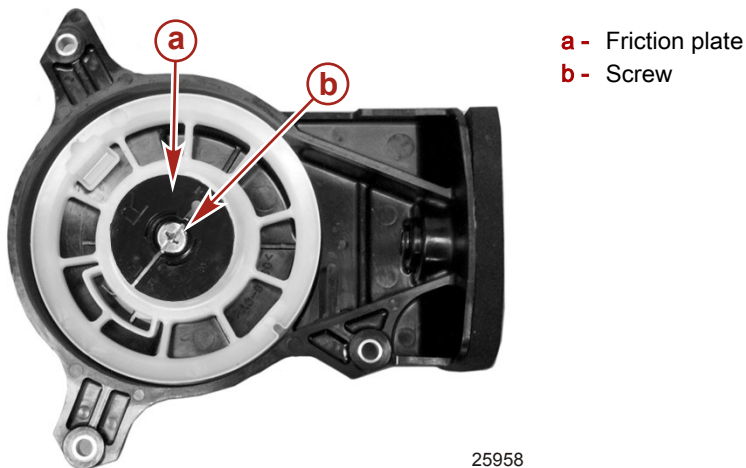
Uncontrolled release of the rewind spring can cause serious injury. Wear eye protection when servicing the rewind starter in case spring should uncoil.

Removal

1. Pull the starter rope until it is fully unwound from the reel. Hold the reel in this position.
2. Untie or cut the knot from the rope. Remove the rope from the recoil starter assembly.

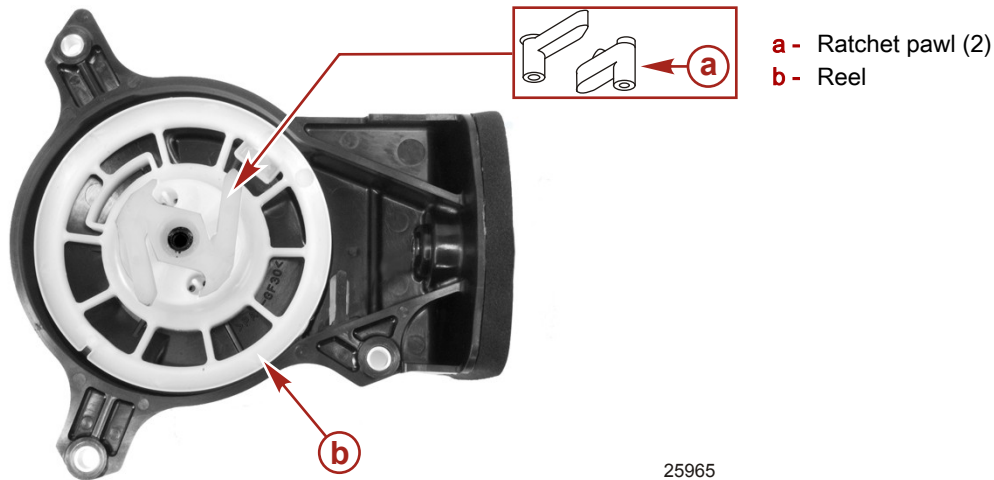


3. Allow the spring and reel to slowly unwind to release spring tension.
4. Remove the screw and friction plate from the recoil starter assembly.



Recoil Starter

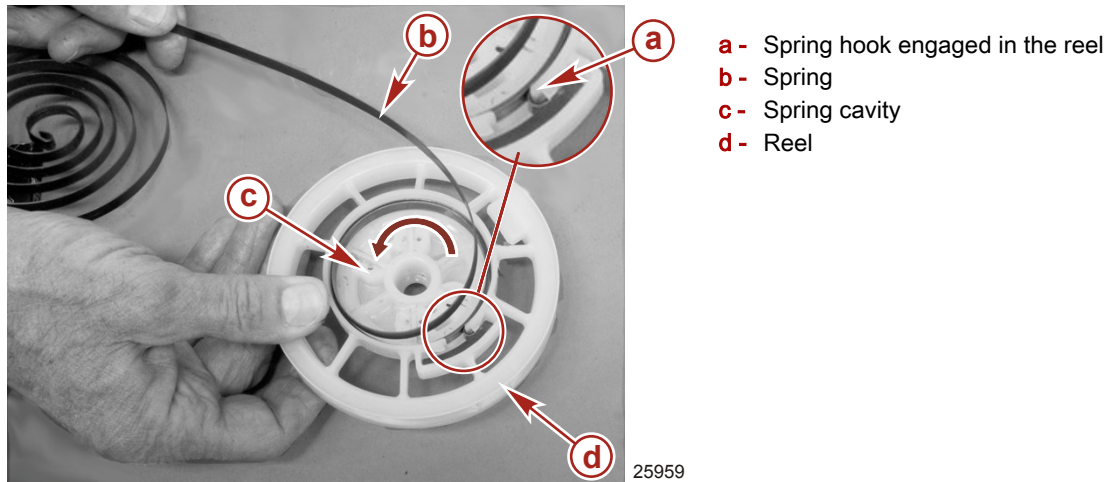
5. Remove the ratchet pawls from the reel.



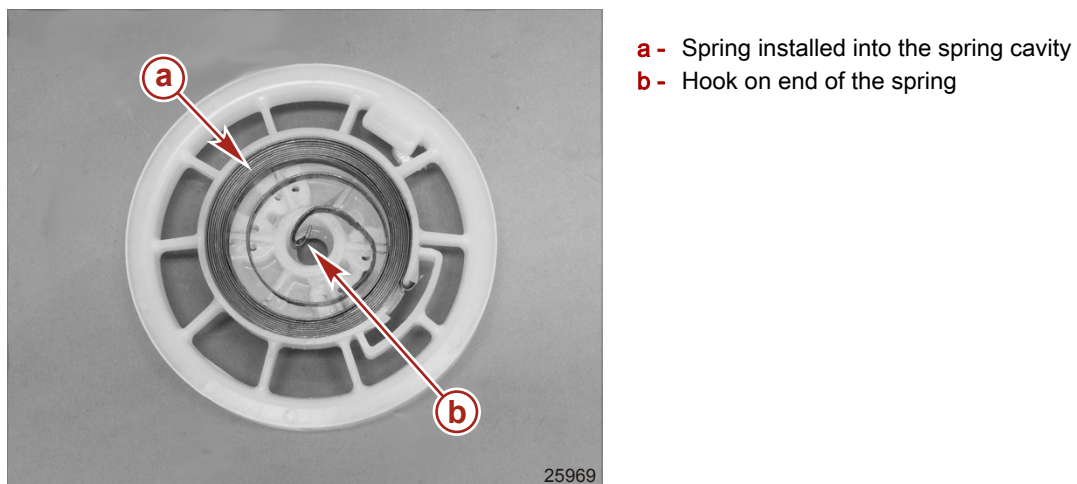
6. Carefully remove the reel (with spring) from the recoil starter housing.
NOTE: The spring may unwind as the reel is removed from the housing.
7. Remove the spring from the reel spring cavity.

Reassembly

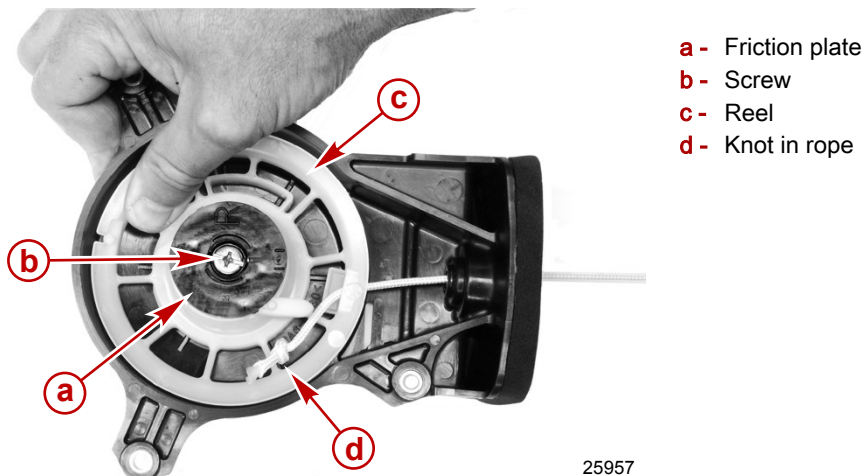
1. Install the hook on the end of the spring into the reel.
2. Rewind the spring in a counterclockwise direction into the reel spring cavity.



3. Install the reel with spring into the housing. Rotate the reel until the hook on the spring engages in the slot on the housing.

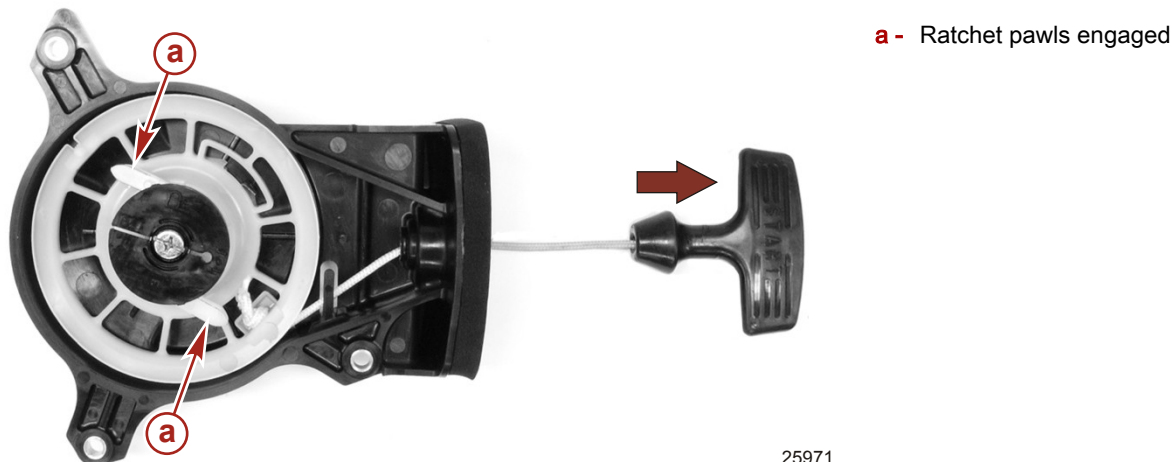


4. Install the ratchet pawls into the holes marked "R".
5. Install the friction plate and screw into the reel and housing. Drive the screw tight.
6. Rotate the reel counterclockwise four to five turns and hold the reel in this position.
7. Route the rope through the recoil starter housing and through the small hole in the reel.
8. Tie a knot in the end of the rope.



25957

9. Continue to hold the reel and slowly let the reel unwind, pulling the rope and handle into the housing.
10. Pull the starter handle out to ensure that the ratchet pawls engage.



25971

11. If the ratchet pawls do not engage, loosen the friction plate screw and reposition the friction plate. Retighten the screw.

Recoil Starter Rope Replacement

⚠ WARNING

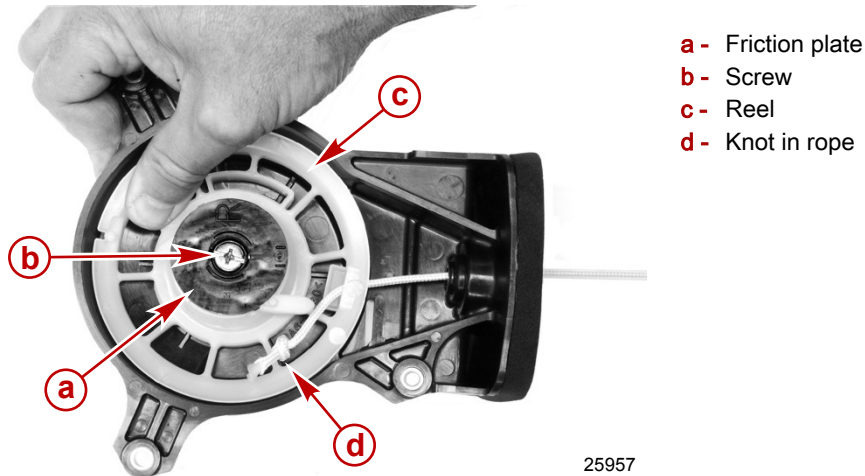
Uncontrolled release of the rewind spring can cause serious injury. Wear eye protection when servicing the rewind starter in case spring should uncoil.

Removal

1. Remove the recoil starter assembly from the powerhead. Refer to **Recoil Starter Removal**, preceding.
2. If the starter rope is frayed and still attached, pull the starter rope until it is fully unwound from the reel. Hold the reel in this position.

Recoil Starter

- Untie or cut the knot from the rope.

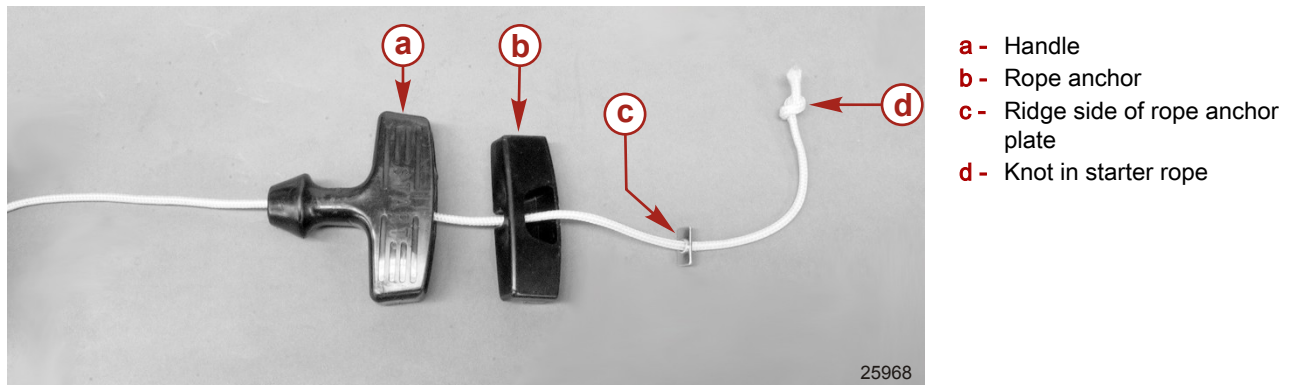


- Slowly allow the reel to unwind to release spring tension.
- Remove the rope anchor from the handle.
- Remove the starter rope from the handle.

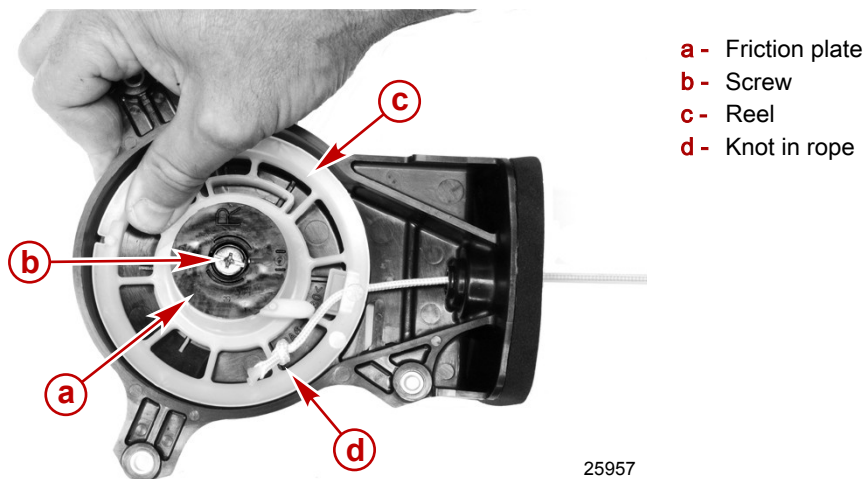
Reassembly

- Tie a knot onto one end of the starter rope.
- Thread the rope through the rope anchor plate, rope anchor, and the handle.

NOTE: The ridge on the anchor plate faces the handle.



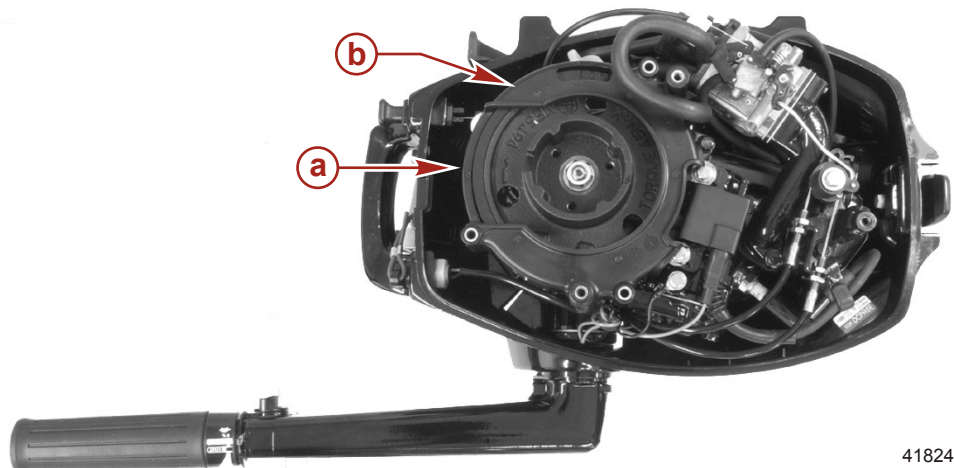
- Rotate the reel counterclockwise four to five turns and hold the reel in this position.
- Route the rope through the recoil starter assembly housing and through the small hole in the reel.
- Tie a knot in the end of the rope.



- Continue to hold the reel and slowly let the reel unwind, pulling the rope and handle into the housing.

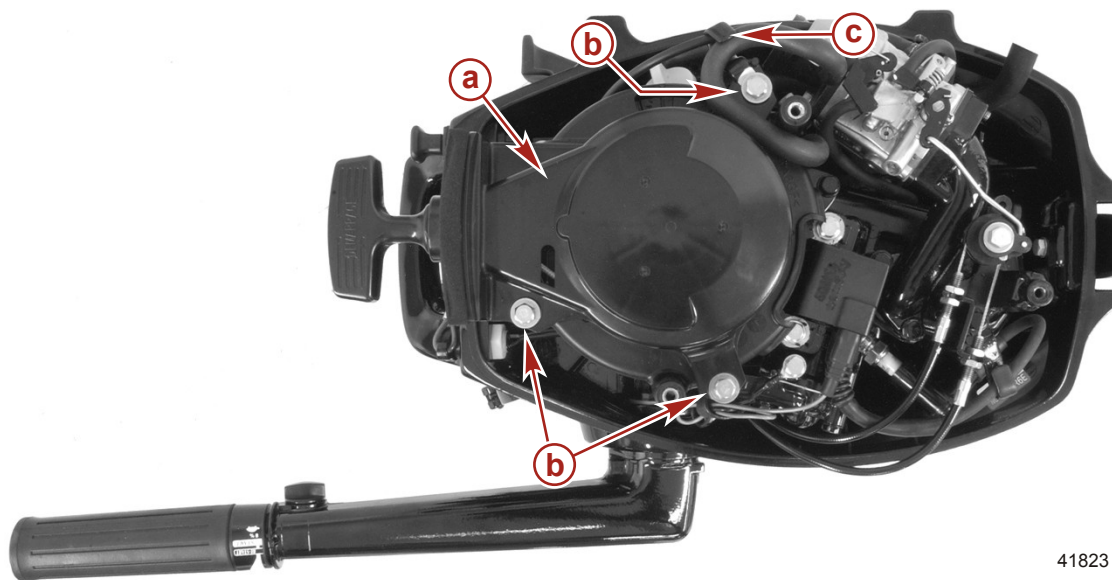
Recoil Starter Installation

- Ensure the flywheel cover is in place.




- a - Flywheel
- b - Flywheel cover

- Secure the fuel hose and choke cable with the J-clamp.
- Apply Loctite 242 Threadlocker to the recoil starter assembly mounting bolts.
- Attach the recoil starter assembly onto the flywheel cover and secure with three bolts and washers.
- Tighten the bolts to the specified torque.



- a - Recoil starter assembly
- b - Bolts and washers (M6 x 60) (3)
- c - J-clamp

Tube Ref No.	Description	Where Used	Part No.
 66	Loctite 242 Threadlocker	Recoil starter assembly mounting bolts	92-809821

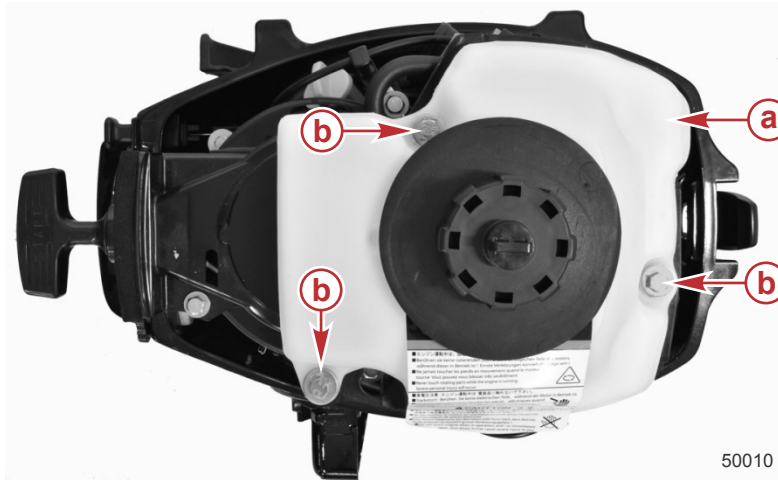
Description	Nm	lb-in.	lb-ft
Recoil starter assembly mounting bolts (M6 x 60) (3)	6	53	

- Install the fuel tank assembly. Attach the fuel line to the fuel tank and secure it with a hose clamp.

⚠ WARNING


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- Apply Loctite 242 Threadlocker to the fuel tank mounting bolts. Install the bolts and washers and tighten the bolts to the specified torque.



- a** - Fuel tank
- b** - Bolt and washer (M6 x 25)

50010

Tube Ref No.	Description	Where Used	Part No.
 66	Loctite 242 Threadlocker	Fuel tank mounting bolts	92-809821

Description	Nm	lb-in.	lb-ft
Fuel tank mounting bolts (M6 x 25) (3)	6	53	

- Install the top cowl.