

Technical Manual

Evinrude 30 MFE
2-Cylinder (576cc)

Starting with serial number 5442808

EVINRUDE®



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MFE



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<i>HPF PRO</i> ™ Gearcase Lubricant	<i>2+4</i> ® Fuel Conditioner
	<i>Carbon Guard</i> ™

Original Instructions

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Safety Notice

Before working on any part of the outboard, read the **SAFETY** section at the end of this manual.

This publication is written for qualified, factory-trained technicians who are already familiar with the use of *Evinrude* Special Tools. The included information is not a substitute for work experience. It is an organized guide for reference, repair, and/or maintenance.

The following symbols and/or signal words may be used in this document:

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 personal injury.

NOTICE

Indicates an instruction which, if not followed, could severely damage engine components or other property.

These safety alert signal words mean:

ATTENTION!
BECOME ALERT!
YOUR SAFETY IS INVOLVED!

IMPORTANT: Identifies information that controls correct assembly and operation of the product.

DO NOT perform any work until you have read and understood these instructions completely.

Torque wrench tightening specifications must strictly be adhered to.

Should removal of any locking fastener (lock tabs, locknuts, or patch screws) be required, always replace with a new one.

When replacement parts are required, use *Evinrude Genuine Parts* or parts with equivalent characteristics, including type, strength and material. Use of substandard parts could result in injury or product malfunction.

Always wear EYE PROTECTION AND APPROPRIATE GLOVES when using power tools.

Unless otherwise specified, engine must be OFF when performing this work.

Always be aware of parts that can move, such as flywheels, propellers, etc.

Some components may be HOT. Always wait for engine to cool down before performing work.

If you use procedures or service tools that are not recommended in this manual, YOU ALONE must decide if your actions might injure people or damage the outboard.

This document may be translated into other languages. In the event of any discrepancy, the English version shall prevail.

⚠ DANGER

Contact with a rotating propeller is likely to result in serious injury or death. Assure the engine and prop area is clear of people and objects before starting engine or operating boat. Do not allow anyone near a propeller, even when the engine is off. Blades can be sharp and the propeller can continue to turn even after the engine is off. Remove propeller before servicing and when running the outboard on a flushing device.

DO NOT run the engine indoors or without adequate ventilation or permit exhaust fumes to accumulate in confined areas. Engine exhaust contains carbon monoxide which, if inhaled, can cause serious brain damage or death.

⚠ WARNING

Wear safety glasses to avoid personal injury, and set compressed air to less than 25 psi (172 kPa).

The motor cover and flywheel cover are machinery guards. Use caution when conducting tests on running outboards. DO NOT wear jewelry or loose clothing. Keep hair, hands, and clothing away from rotating parts.

During service, the outboard may drop unexpectedly. Avoid personal injury; always support the outboard's weight with a suitable hoist or the tilt support bracket during service.

To prevent accidental starting while servicing, disconnect the battery cables at the battery. Twist and remove all spark plug leads.

The electrical system presents a serious shock hazard. DO NOT handle primary or secondary ignition components while outboard is running or flywheel is turning.

Gasoline is extremely flammable and highly explosive under certain conditions. Use caution when working on any part of the fuel system.

Protect against hazardous fuel spray. Before starting any fuel system service, carefully relieve fuel system pressure.

Do not smoke, or allow open flames or sparks, or use electrical devices such as cellular phones in the vicinity of a fuel leak or while fueling.

Keep all electrical connections clean, tight, and insulated to prevent shorting or arcing and causing an explosion.

Always work in a well ventilated area.

Replace any locking fastener (locknut or patch screw) if its locking feature becomes weak. Definite resistance to tightening must be felt when reusing a locking fastener. If replacement is indicated, use only authorized replacement or equivalent.

Reference Information

Abbreviations Used In This Manual

Abbreviations Used In This Manual

Units of Measurement

A	Amperes
amp-hr	Ampere hour
fl. oz.	fluid ounce
ft. lbs.	foot pounds
HP	horsepower
in.	inch
in. Hg	inches of mercury
in. lbs.	inch pounds
kPa	kilopascals
ml	milliliter
mm	millimeter
N·m	Newton meter
P/N	part number
psi	pounds per square inch
RPM	revolutions per minute
°C	degrees Celsius
°F	degrees Fahrenheit
ms	milliseconds
μs	microseconds
Ω	Ohms
V	Volts
VAC	Volts Alternating Current
VDC	Volts Direct Current

List of Abbreviations

ABYC	American Boat & Yacht Council
ATDC	after top dead center
AT	air temperature sensor
BPS	barometric pressure sensor
BTDC	before top dead center
CCA	cold cranking amps
CFR	Code of Federal Regulations
CPS	crankshaft position sensor
EMM	Engine Management Module
EPA	Environmental Protection Agency
ICOMIA	International Council of Marine Industry Associations
ID	Inside dimension
MCA	marine cranking amps
MWS	modular wiring system
NMEA	National Marine Electronics Assoc.
ROM	read only memory
S.A.F.E.	speed adjusting failsafe electronics
SAC	start assist circuit
SAE	Society of Automotive Engineers
SYNC	synchronization
TDC	top dead center
TPS	throttle position sensor
USCG	United States Coast Guard
WOT	wide open throttle
WTS	water temperature sensor

Standard Torque Specifications

Size	In. Lbs.	Ft. Lbs.	N·m
No. 6	7–10	0.58–0.83	0.8–1.1
No. 8	15–22	1.25–1.83	1.7–2.5
No. 10	24–36	2–3	2.7–4.0
No. 12	36–48	3–4	4.0–5.4
1/4 in.	60–84	5–7	7–9.5
5/16 in.	120–144	10–12	13.5–16.5
3/8 in.	216–240	18–20	24.5–27
7/16 in.	336–384	28–32	38–43.5
M3	15–22	1.25–1.83	1.7–2.5
M4	24–35	2–2.9	2.7–4.0
M5	35–60	2.9–5	4.0–6.8
M6	84–106	7–8.8	9.5–12
M8	177–204	14.7–17	20–23
M10	310–336	25.8–28	35–38

IMPORTANT: These values apply only when a specific torque for a specific fastener is not listed in the appropriate section. When tightening two or more screws on the same part, DO NOT tighten screws completely, one at a time.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to. Replace any locking fastener (locknut or patch screw) if its locking feature becomes weak. Definite resistance to turning must be felt when reusing a locking fastener.

If replacement is specified or required because the locking fastener has become weak, use only authorized *Evinrude Genuine Parts*.

Product Reference and Illustrations

1

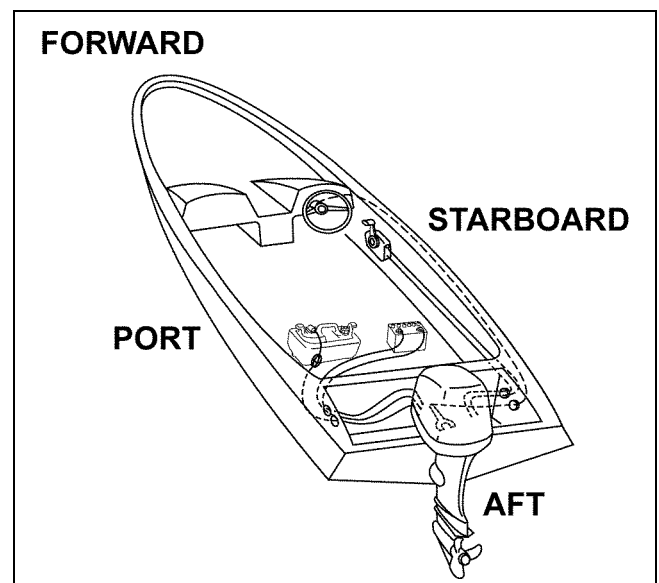
BRP US Inc. reserves the right to make changes at any time, without notice, in specifications and models and also to discontinue models. The right is also reserved to change any specifications or parts, at any time, without incurring any obligation to equip same on models manufactured prior to date of such change. Specifications used are based on the latest product information available at the time of publication.

The continuing accuracy of this manual cannot be guaranteed.

All photographs and illustrations used in this manual may not depict actual models or equipment, but are intended as representative views for reference only.

Certain features or systems discussed in this manual might not be found on all models in all marketing areas.

All service technicians must be familiar with nautical orientation. This manual often identifies parts and procedures using these terms.



Nautical Orientation

006411

Emission-Related Installation Instructions

Failing to follow these instructions when installing a certified engine in a vessel violates federal law (40 CFR 1068.105 (b)), subject to fines or other penalties as described in the Clean Air Act.

A repair shop or person of the owner's choosing may maintain, replace, or repair emission control devices and systems. These instructions do not require components or service by BRP or authorized Evinrude dealers. Although an authorized Evinrude dealer has the in-depth technical knowledge and tools to service Evinrude outboard engines, the emission-related warranty is not conditioned on the use of an authorized Evinrude dealer or any other establishment with which BRP has a commercial relationship.

For emission-related warranty claims, BRP is limiting the diagnosis and repair of emission-related parts to authorized Evinrude dealers. For more information, please refer to the US EPA EMISSION-RELATED WARRANTY contained in the ***Operator's Guide***. Proper maintenance is the owner's responsibility. A warranty claim may be denied if, among other things, the owner or operator caused the problem through improper maintenance or use.

You must follow the instructions for fuel requirements in the FUEL REQUIREMENTS section of this manual. Even if gasoline containing greater than ten volume percent ethanol is readily available, the US EPA has issued a prohibition against the use of gasoline containing greater than 10 vol% ethanol that applies to this engine. The use of gasoline containing greater than 10 vol% ethanol with this engine may harm the emission control system.

Manufacturer's Responsibility

Beginning with 1999 model year outboards, manufacturers of marine outboards must determine the exhaust emission levels for each outboard horsepower family and certify these outboards with the United States of America Environmental Protection Agency (EPA). An emissions control information label, showing emission levels and outboard specifications, must be placed on each outboard at the time of manufacture.

Dealer's Responsibility

When performing service on all 1999 and more recent *Evinrude* outboards that carry an emissions control information label, 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 outboard 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 altitude adjustments, for example.

Owner's Responsibility

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

The owner/operator is not to, and should not allow anyone to, modify the outboard in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

Tampering with the fuel system to change horsepower or modify emission levels beyond factory settings or specifications will void the product warranty.

EPA Emission Regulations

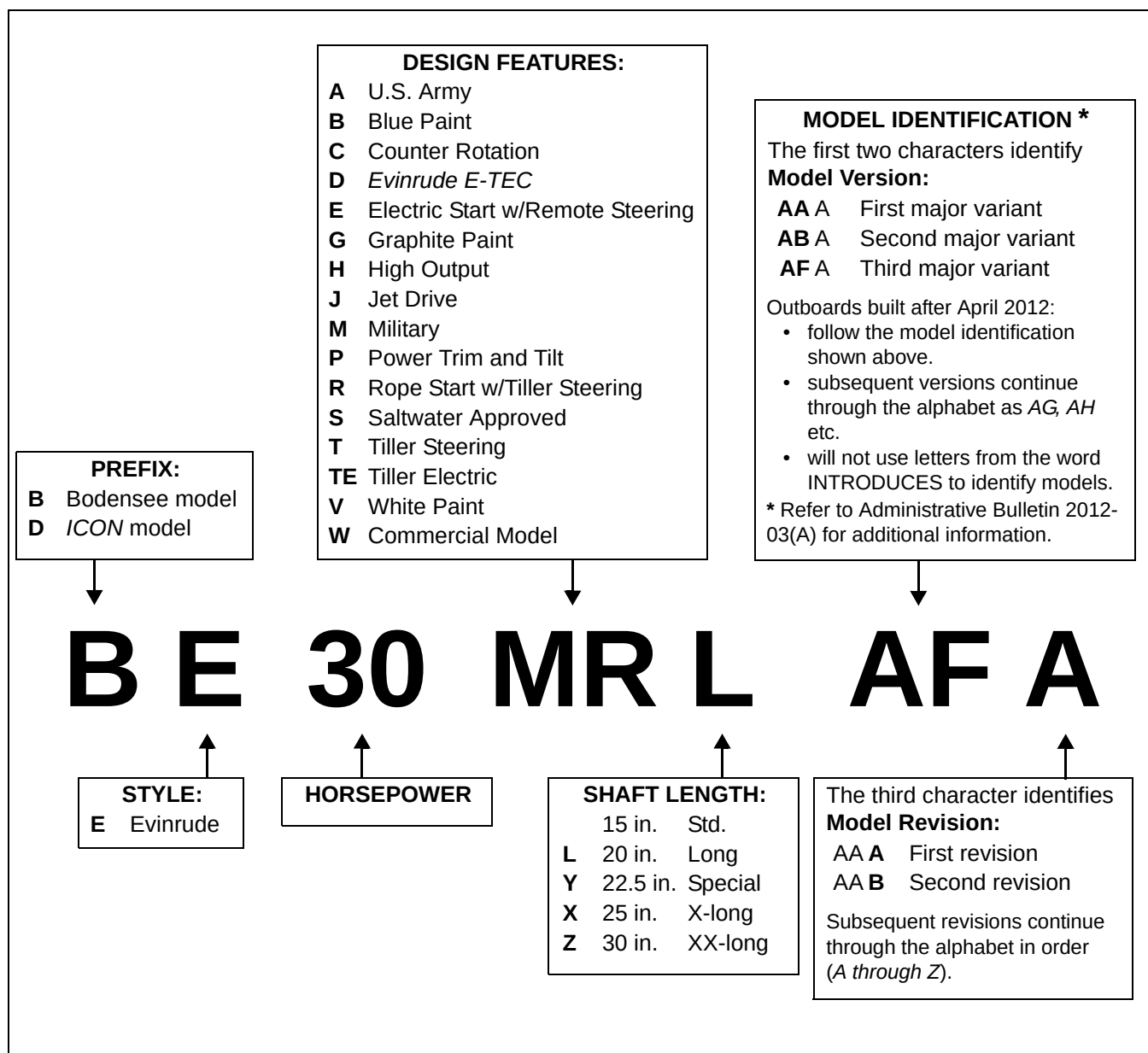
All new 1999 and more recent *Evinrude* outboards are certified to the EPA as conforming to the requirements of the regulations for the control of air pollution from new watercraft marine spark ignition outboards. This certification is contingent on certain adjustments being set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, whenever practical, returned to the original intent of the design. The responsibilities listed above are general and in no way a complete listing of the rules and regulations pertaining to the EPA requirements on exhaust emissions for marine products. For more detailed information on this subject, you may contact the following locations:

U.S. Environmental Protection Agency
Office of Transportation and Air Quality
1200 Pennsylvania Ave. NW
Mail Code 6403J
Washington D.C. 20460

EPA Internet Web Site:

www.epa.gov/otaq

Model Designation



Models Covered In This Manual

This manual covers service information on the following *Evinrude MFE 30* models:

- 35.1 cubic inch (.57 L), 2-Cylinder, starting with serial number 5442808.

Model Number	Start	Shaft	Drive
E30MRLAFA	Rope	20"	Propeller
B30MRLAFA	Rope	20"	Propeller
E30MALAFA	Rope	20"	Propeller

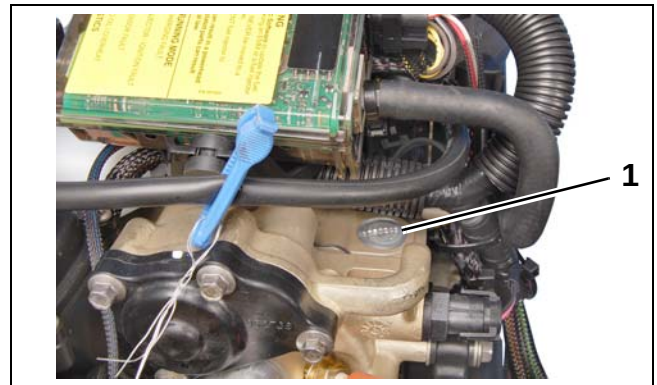
Identifying Model and Serial Numbers

Model and serial numbers are located on the swivel bracket and on the powerhead.



1. Model and serial number

007445



1. Serial number

007446

Reference Information

Service Specifications

Service Specifications

		30 MFE Models
ENGINE	Full Throttle Operating Range RPM	30 HP – 5500 to 6100 RPM
	Power	30 HP (22.1 kw) @ 5800 RPM
	Idle RPM in Gear	750 ± 50 EMM Controlled
	Idle RPM in Neutral	700 ± 50 EMM Controlled
	Weight (may vary depending on model)	(MRL) Models: 160.5 lbs. (72.8 kg)
	Lubrication	Evinrude XD100
	Engine Type	In-line, 2 Cylinder, Two-Cycle
	Displacement	35.1 cu. in. (575 cc)
	Bore	2.992 in (76 mm)
	Stroke	2.500 in. (63.50 mm)
	Standard Bore	2.9916 to 2.9931 in. (75.989 to 76.026 mm) To bore oversize, add piston oversize dimension to standard bore
	Top Crankshaft Journal	1.6235 to 1.6245 in. (41.237 to 41.262 mm)
	Center Crankshaft Journal	1.7461 to 1.7470 in. (44.350 to 44.375 mm)
	Bottom Crankshaft Journal	2.0450 to 2.0459 in. (51.942 to 51.967 mm)
	Rod Crankpin	1.1815 to 1.1817 in. (30.011 to 30.016 mm)
	Piston Ring End Gap, Both	0.011 to 0.019 in. (0.30 to 0.50 mm)
FUEL	Fuel/Oil Control	EMM Controlled
	Starting Enrichment	EMM Controlled
	Minimum (High) Fuel Pressure	28 to 32 psi (193 to 220 kPa)
	Minimum Fuel Lift Pump Pressure	2 psi (14 kPa)
	Maximum Fuel Inlet Vacuum	4 in. Hg.
	Heavy Fuels	JP5, JP8, Jet A, Kerosene
	Gasoline Based Fuels	Gasoline, Gasohol, 87AKI (R+M)/2 or 90 RON minimum
	Emergency Fuel	Diesel DFM-F76, BioDiesel IMPORTANT: If outboard must be run on diesel, afterwards it should then be run on gasoline to clean internal components. See Fuel Requirements on p. 41 for additional information
	Additives	2+4 [®] Fuel Conditioner, Fuel System Cleaner Use of other additives may result in engine damage.

		30 MFE Models
ELECTRICAL	Tachometer Setting	6 pulse (12 pole)
	Thermostat	143°F (62°C)
COOLING	Maximum Temperature	212°F (100°C)
	Type	IDI Inductive Ignition
IGNITION	Firing Order	1-2
	Ignition Timing	EMM Controlled
	RPM Limit in Gear	6500
	RPM Limit in Neutral	1100
	Crankshaft Position Sensor Air Gap	Fixed
	Spark Plug	Refer to the Electronic Parts Catalog (EPC), or the Service Parts section of this manual
		Champion [†] QC10WEP @ 0.028 ± 0.003 in. (0.71 mm)
GEARCASE	Gear Ratio	13:28 / 0.465 / 2.15:1
	Lubricant	HPF Pro Gearcase Lube
	Capacity	11 fl. oz. (325 ml)
	Shift Rod Height	fixed
	Shift Cable Stroke	1.125 to 1.330 in. (28.6 to 33.8 mm) measured between NEUTRAL and FORWARD

Reference Information

Wire Size Table

Wire Size Table

This table provides closest equivalent size cross references between American and metric wire sizes.

American Wire Gauge (AWG) is a standardized wire gauge system used in North America to identify the diameter of round, electrically conducting wire. Increasing gauge numbers result in decreasing wire diameters.

The AWG of a stranded wire is determined by the total cross sectional area of the conductor. Because there are small gaps between the

strands, stranded wire will always have a slightly larger overall diameter than a solid wire of the same AWG.

Metric wire size is also standardized. Metric wire size is determined by the number of strands of wires expressed in millimeters (mm) and the total cross sectional area of the conductor, expressed as square millimeters (mm²).

Example: 41/1.63 means forty-one strands of wire, each with a 1.63 mm diameter. This example has a cross sectional area of 2.08 mm².

AWG	Number of Wire Strands ⁽¹⁾	Conductor		
		Wire Strand Diameter ⁽²⁾		Cross Section ⁽³⁾
		(in.)	(mm)	(mm ²)
6/0	3335	0.58	14.73	170.3
5/0	2646	0.517	13.12	135.1
4/0	2109	0.46	11.7	107
3/0	1665	0.41	10.4	85
2/0	1330	0.365	9.26	67.4
1/0	1064	0.325	8.25	53.5
1	836	0.289	7.35	42.4
2	664	0.258	6.54	33.6
3	523	0.229	5.83	26.7
4	420	0.204	5.19	21.1
5	329	0.182	4.62	16.8
6	266	0.162	4.11	13.3
7	206	0.144	3.66	10.5
8	168	0.128	3.26	8.36
9	130	0.114	2.91	6.63
10	105	0.102	2.59	5.26
11	82	0.0907	2.3	4.17

AWG	Number of Wire Strands ⁽¹⁾	Conductor		
		Wire Strand Diameter ⁽²⁾		Cross Section ⁽³⁾
		(in.)	(mm)	(mm ²)
12	65	0.0808	2.05	3.31
13	52	0.072	1.83	2.62
14	41	0.0641	1.63	2.08
15	32	0.0571	1.45	1.65
16	26	0.0508	1.29	1.31
17	21	0.0453	1.15	1.04
18	16	0.0403	1.02	0.823
19	13	0.0359	0.912	0.653
20	10	0.032	0.812	0.518
21	8	0.0285	0.723	0.41
22	6	0.0253	0.644	0.326
23	5	0.0226	0.573	0.258
24	4	0.0201	0.511	0.205
25	3	0.0179	0.455	0.162
27	2	0.0142	0.361	0.102
30	1	0.01	0.255	0.0509

- Notes:** (1) 30 AWG (0.255 mm) conductor diameter
 (2) Single wire strand diameter
 (3) Total area cross section of all wire strands

Service Tools and Shop Aids

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Diagnostic Tools



Diagnostic Software,
P/N 5008689

5008689

Windows[†] based software for use with 2004 and newer Evinrude E-TEC and Evinrude MFE outboards

Computer Requirements for Diagnostic Software:

- Any PC must be an IBM-compatible type.
- A battery powered laptop PC is strongly recommended to avoid electric shock hazards.
- Operating system: Microsoft Windows 7, Vista, XP, 2008 or 2003.
- Processor: Pentium[†] 133 Mhz or higher.
- Memory: 64 megabyte or more.
- Hard drive free space: 40 megabyte or more.
- Display resolution: 800 x 600 pixel, 96 dpi.
- Media drives: CDROM drive.
- Use Serial Interface Communication Cable, P/N 437955 to connect to PC.
- Select Interface Port Type, and correct adapter if needed:
 - Computer RS-232 (9-pin) Serial Port.
 - USB to RS-232 (9-pin) Serial Adapter.
 - PCMCIA to RS-232 (9-pin) Serial Adapter.



USB to Serial Adapter,
P/N 587214

008790

Use with interface cable, P/N 437955, and computer that does not have serial port connection.



Diagnostic Power Supply, P/N 587005

587005

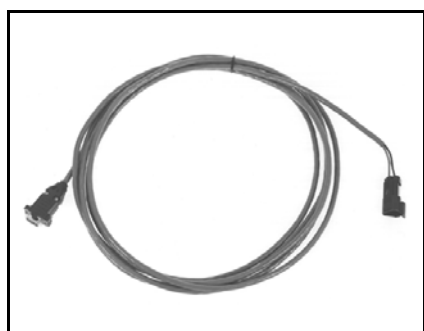
Use on 2004 and newer Evinrude E-TEC and Evinrude MFE rope-start outboards



Accessory power cable kit, P/N 5008092

5008092

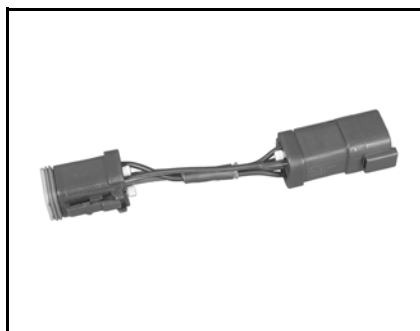
Use with Diagnostic Power Supply, P/N 587005, to update engine management software and perform static tests.



Interface cable,
P/N 437955

45583

Use to connect computer serial port or USB to serial adapter to outboard communication connector



Bootstrap tool,
P/N 5000901

002276

Use during engine management software upgrades.

Universal Tools



Universal puller set, P/N 378103

32885

Contents of kit:

P/N 307636, puller body

P/N 307637, pressing screw

P/N 307638, handle

P/N 307639, washer (3), 11/32 in I.D.

P/N 307640, washer (3), 13/32 in. I.D.

P/N 307641, screw (3), 1/4-20 x 2 1/8 in.

P/N 307642, screw (3), 5/16-18 x 2 3/4 in.

P/N 307645, center guide

P/N 309492, screw (3), 5/16-24 x 2 7/16 in.

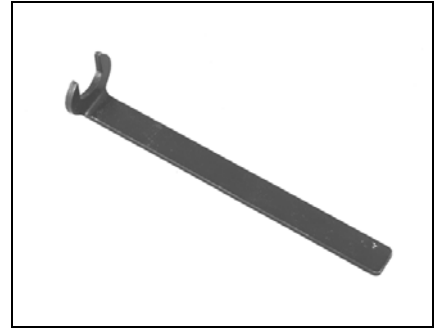
P/N 316982, screw (2), 5/16-18 x 8 in.



Lifting eye P/N 390898

001024

Use with Universal puller set, P/N 378103



Puller wrench, P/N 334359

23147



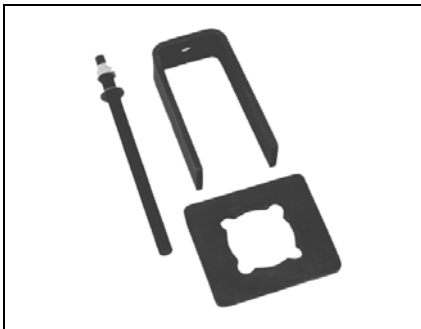
Slide hammer, P/N 432128

15345



Oetiker[†] pincers, P/N 350860

001081



Puller bridge, P/N 432127

23146

Use with puller jaws, P/N 432129, 432130, and 432131



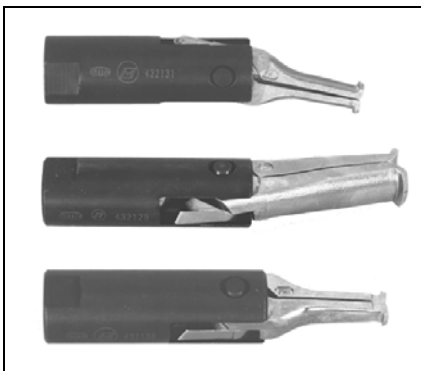
Slide hammer and adapter, P/N 391008

391008



Temperature gun, P/N 772018

45240



Small puller jaws, P/N 432131

Large puller jaws, P/N 432129

Bearing puller jaws, P/N 432130

23150



Adapter, P/N 334358

334358



Twist-Grip remover, P/N 390767

COA6017

Service Tools and Shop Aids

Fuel /Oil System Tools



Ball socket remover, P/N 342226

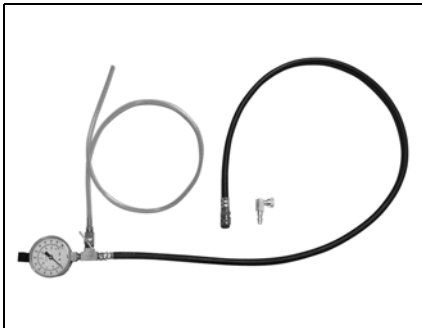
002584



Ball socket installer, P/N 342225

002583

Fuel /Oil System Tools



Fuel pressure gauge, P/N 5007100
(60 PSI)
90° fitting, P/N 353322

005339



Fuel pressure gauge, P/N 5006397
(15 PSI)
90° fitting, P/N 353322

004560



Plug, P/N 5005844

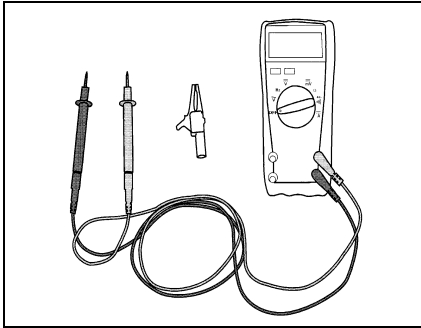
002465



Fuel vacuum tester, P/N 390954

23286

Electrical / Ignition Tools



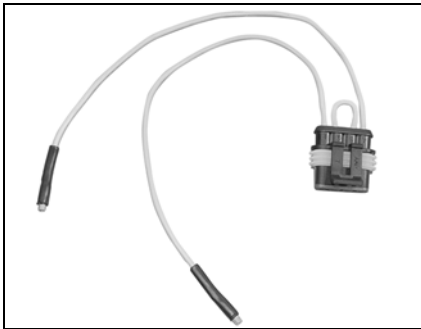
Digital multimeter
Ohms resolution 0.01
Purchase through local supplier
DRC7265



Peak reading voltmeter, P/N 507972 49799



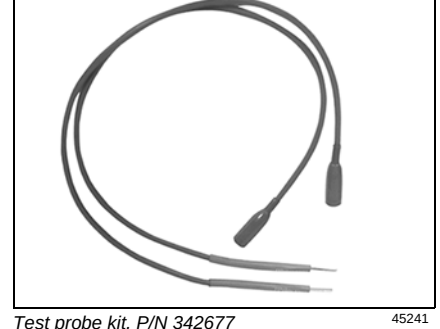
Tachometer/timing light P/N 775389 49789



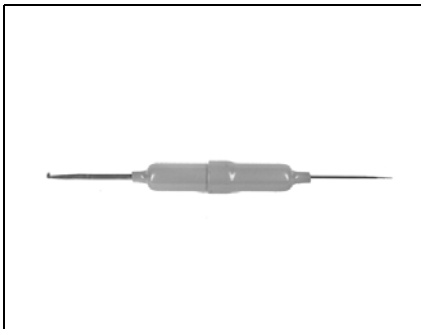
Stator test adapter, P/N 5005799 002273



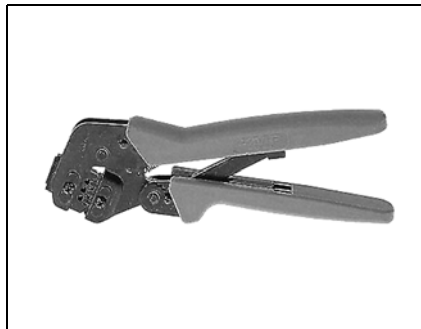
Crimping pliers, P/N 322696 30387



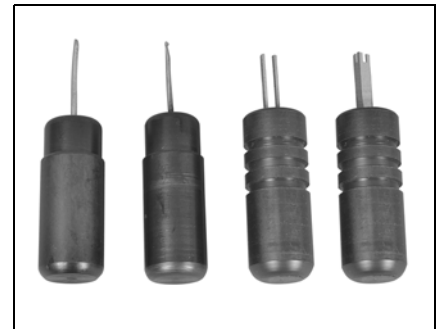
Test probe kit, P/N 342677 45241



Connector tool, P/N 342667 42004



AMP crimping tool, P/N 777281 005514
Replacement dies, P/N 777282



AMP⁺ connector tools:
Primary Lock Tool P/N 777077
Secondary Lock Tool P/N 777078
Release Tool P/N 351413
Lock Installer P/N 777079 002277



Flywheel holder, P/N 357623 357623

Powerhead Tools



*Cylinder bore gauge,
P/N 766314*

766314



Wrist pin retainer installer, P/N 354720

354720



*Crankshaft bearing/sleeve installer,
P/N 339749*

339749

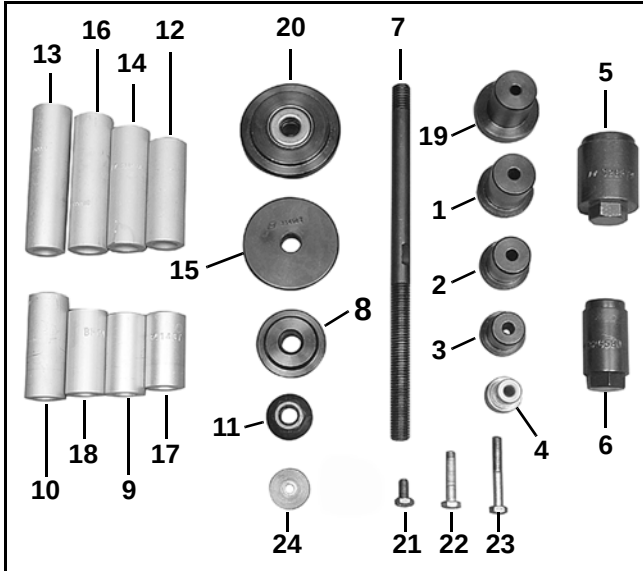


*Wrist pin pressing tool,
P/N 326356*

23668

Gearcase Tools

Pinion Bearing Remove/Install Kit (2-Stroke), P/N 5005927



Includes:

1. P/N 326574 Remover/installer
2. P/N 326575 Remover/installer
3. P/N 326577 Remover/installer
4. P/N 326578 Remover/installer
5. P/N 326579 Remover
6. P/N 326580 Remover
7. P/N 326582 Rod
8. P/N 326583 Pilot plate
9. P/N 326584 Spacer
10. P/N 326585 Spacer
11. P/N 326586 Nut
12. P/N 330067 Spacer
13. P/N 330068 Spacer
14. P/N 334986 Spacer
15. P/N 334987 Pilot plate
16. P/N 339753 Spacer
17. P/N 341437 Spacer
18. P/N 350932 Spacer
19. P/N 350958 Installer
20. P/N 391260 Pilot plate
21. 1/4 x 1/2 in. hex-head screw (1)
22. 1/4-20 x 1 1/4 in. hex-head screw (1)
23. 1/4-20 x 1 3/4 in. hex-head screw (1)
24. 1 in O.D. x 1/4 I.D. flat washer (1)

Pinion Bearing Remove/Install Tool Chart
Evinrude MFE Models

	30 MFE	55 MFE
Rod	326582	326582
Pilot plate	326583	391260
Nut		326586
Remover	326577	326580
Installer		326575
Washer		
Spacer(s)	330067	326584
	330068	

Propeller Shaft Seal Tools

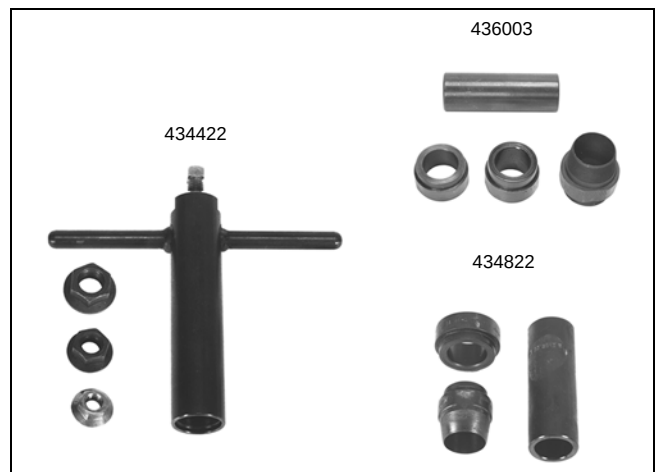
Use Propeller Shaft Seal Tools to remove and install propeller shaft seals without removing the propeller shaft bearing housing from the gearcase. Refer to Service Bulletin 2008-02(S) for Propeller Shaft Seal Tool instructions.

Propeller Shaft Seal Tool Chart
Evinrude MFE Models

	30 MFE	55 MFE
Handle Kit ⁽¹⁾	434422	
Remover Installer Kit ⁽²⁾	436003	434822
Remover End	T19629	T19613
Seal Installer	T19630	T19616
Spacer	T19631	T19619

(1) Use with specific Remover/Installer Kit

(2) Includes remover end, seal installer, and spacer



Service Tools and Shop Aids

Gearcase Tools



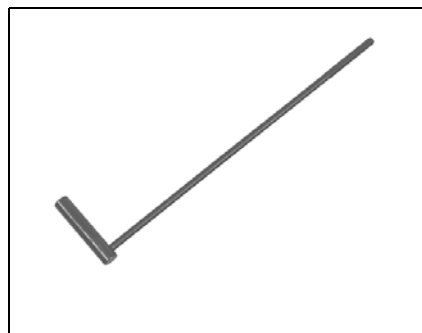
Gearcase filler, P/N 501882

49790



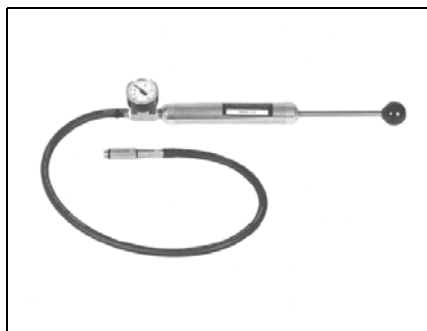
Shift rod bushing installer, P/N 304515

23563



Shift rod bushing remover, P/N 327693

23542



Gearcase pressure tester, P/N 507977

49794

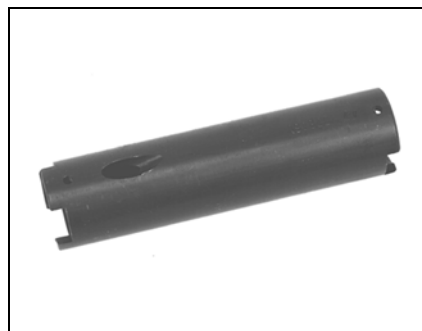
(Stevens P/N S-34)

Gearcase vacuum tester, P/N 507982
(Stevens P/N V-34)



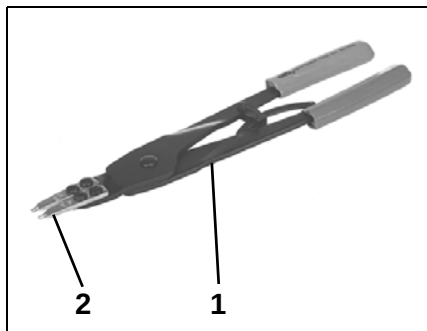
Driveshaft bearing installer, P/N 322923

21887A



Shift detent sleeve, P/N 328081

23544



1. Retaining ring pliers, P/N 331045
2. Replacement tip set, P/N 395967

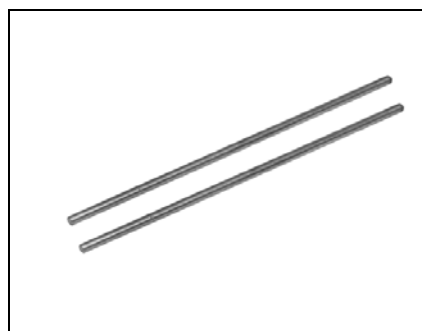
2036



Bearing Installer, P/N 321428

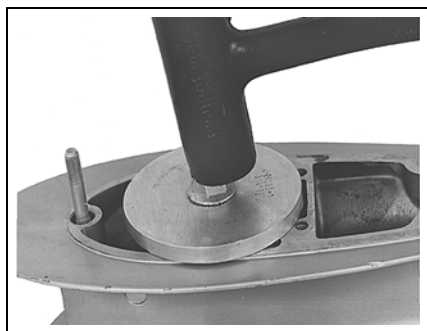
32999

Use to install forward propeller shaft bearing



Guide pin set, P/N 383175

2050



Plate, P/N 318122

21813



Seal installer, P/N 335821

22429

Use to install propeller shaft seals



Seal installer, P/N 335820

22420

Manual Starter Tools

2



Starter spring winder/installer, P/N 342682 50068

Shop Aids



Cleaning Solvent P/N 771087



Engine Tuner P/N 771185



Silicone spray P/N 775630



6 in 1 Multi-Purpose Lubricant P/N 777192



D.P.L. Spray P/N 777183



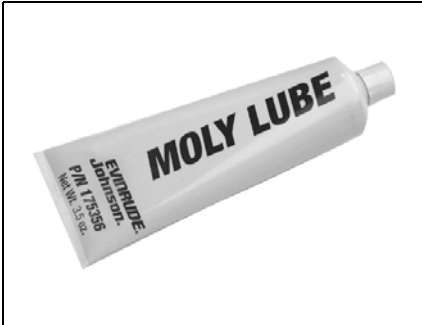
HPF PRO Gearcase Lube P/N 778755



Oil - XD100™ P/N 764357



Anti-Corrosion Spray P/N 777193



Moly Lube P/N 175356

Service Tools and Shop Aids

Shop Aids



Storage Fogging Oil P/N 777186



Black Neoprene Dip P/N 909570



Gel-Seal and Gasket Remover P/N 767243



Lubriplate† 777 P/N 317619



Starter Bendix Lube P/N 337016



Permatex† No. 2, P/N 910032



Triple-Guard® Grease P/N 508298



Electrical Grease P/N 503243



GE† RTV Silicone Sealant P/N 764811



Needle Bearing Grease, P/N 378642



2 + 4™ Fuel conditioner P/N 776216



Fuel System Cleaner P/N 764687



Gel-Seal II P/N 767242



Pipe Sealant with Teflon P/N 910048



Thermal Joint Compound P/N 322170



Carbon Guard™ P/N 775629



Locquic Primer P/N 772032



1. Screw Lock P/N 500417
(Loctite⁺ Purple 222 equivalent)
2. Nut Lock P/N 764804
(Loctite Blue 242 Equivalent)
3. Ultra Lock P/N 764805
(Loctite Red 271 Equivalent)



Gasket Sealing Compound P/N 508235



Adhesive 847 P/N 776964

Technician's Notes

[illegible]

Bulletins	
Instruction Sheets	
Other	

Installation and Predelivery

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Boat Rigging

Fuel System Requirements

Regulations and Guidelines

Vessel manufacturer, and/or installer of an EPA certified outboard, must meet minimum specifications for boat fuel systems established by:

- U.S. Environmental Protection Agency (EPA)
 - 40 CFR 1045.112
 - 40 CFR 1060
- U.S. Coast Guard (USCG)
 - 33 CFR 183
- American Boat & Yacht Council (ABYC)
 - Standard H-24
 - Standard H-25.

Permanent Fuel Tanks

Permanent fuel tanks must be properly vented outside of the hull.

Remote fuel tank gas fills must be grounded.

Fuel tank pickups should include an anti-siphon valve to prevent fuel flow if a leak occurs in the fuel distribution system.

Portable Fuel Tanks

⚠ WARNING

If engine is equipped with a quick-disconnect fuel hose, you MUST disconnect the fuel hose from the engine and the fuel tank to prevent fuel leaks:

- Whenever the engine is NOT being used
- Whenever the engine is being trailered
- Whenever the engine is in storage.

NOTE: A small amount of fuel may be released when the fuel connector is disconnected.

Store portable fuel tanks in well-ventilated areas, away from heat sources and open flames. Close the vent screw of the fuel tank cap, if equipped, to prevent escape of fuel or fuel vapors which could accidentally ignite. Do not allow disconnected fuel hoses to leak fuel.

Fuel Hose

All fuel hoses used for rigging outboards manufactured after January 1, 2009 must meet EPA permeation requirements for evaporative emissions.

- Use SAE J30R9, or USCG Type B1-15, fuel hose in motor well areas.
- Use USCG Type A1-15 fuel hose between permanent fuel tanks and motor well fittings in inaccessible routings.
- Compliant hoses are labeled with the applicable specification.



1. Specification
2. Date code

007944

Permanently installed fuel hoses should be as short and horizontal as possible.

Use corrosion-resistant metal clamps on permanently installed fuel hoses.

Multi-outboard applications require separate fuel tank pickups and hoses. (A fuel selector switch may be used for “kicker” motors as long as it has enough flow capacity for the larger outboard.)

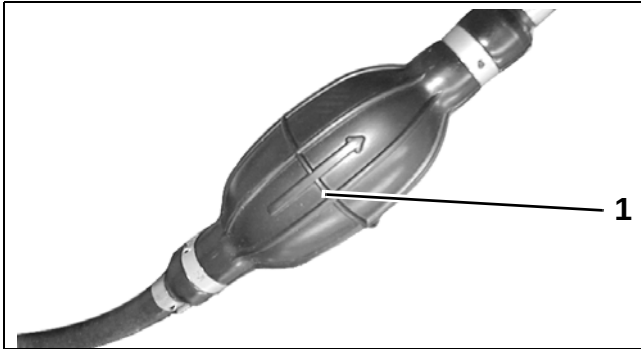
Use only fuel lines (or copper tubing) that meet the **Fuel Flow Requirements** for the outboard.

Fuel System Primer

Outboards require a priming system to refill the fuel system after periods of non-use. The most common priming system is a primer bulb in the fuel supply hose.

Install the primer bulb as follows:

- The primer bulb must meet the same **Fuel Flow Requirements** as the fuel hose.
- The primer bulb should be easily accessible.
- The arrow on the primer bulb must point in the direction of fuel flow.
- The fuel supply hose must allow the primer bulb to be held with the arrow pointing up during priming.



1. Arrow indicates direction of fuel flow

000124

An alternative to a primer bulb is a U.S. Coast Guard approved marine primer pump. Electric primer pumps offer the convenience of outboard priming from a dash-mounted momentary switch.

Fuel Filters

NOTICE

Avoid using in-line fuel filters external to the outboard. The filter area and flow characteristics may not be adequate for high horsepower outboards.

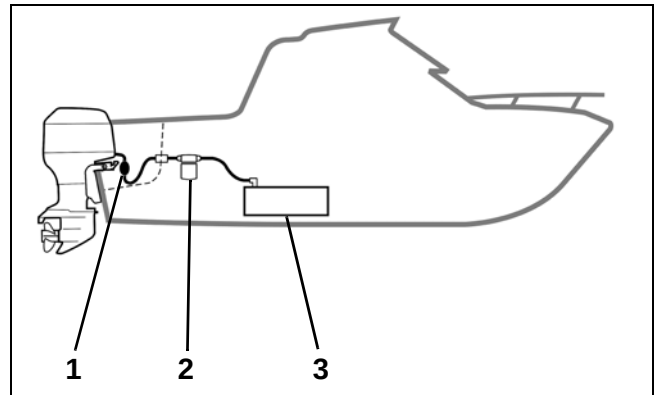
Boat-mounted fuel filters and water-separating fuel filter assemblies must meet the required fuel flow and filter specification. Refer to **Fuel Flow Requirements**.

The filter must be mounted to a rigid surface above the full level of the fuel tank and accessible for servicing.

Fuel Filter Assembly, P/N 174176, meets all requirements for a water-separating fuel filter.



174176



Typical Fuel Supply Configuration

DRC6797

1. Primer bulb
2. Water separating fuel filter
3. Anti-siphon valve, in fuel pick-up of tank

Installation and Predelivery

Boat Rigging

Fuel Flow Requirements

Component	<i>MFE 30 Models</i>
Fuel tank pickup tube	1/4 in. (6.4 mm) min. ID
Fuel fittings	5/32 in. (4.1 mm) min. ID
Fuel supply hoses	1/4 in. (6.4 mm) min. ID
Fuel tank pickup screen	100 mesh, 304 grade stainless steel wire, 0.0045 in. wire diameter, 1 in. (25 mm) long
Antisiphon valve	2.5 in. (63.5 mm) Hg maximum pressure drop at 20 gph (76 l/hr) flow
Remote fuel filter	0.4 in. Hg maximum pressure drop at 20 gph (76 l/hr) flow, 150 in. ² (1290 cm ²) of filter area
Maximum fuel pump lift height	Fuel pump should not be located more than 30 in. (76.2 cm) above bottom of fuel tank

Oetiker Clamp Servicing

⚠ WARNING

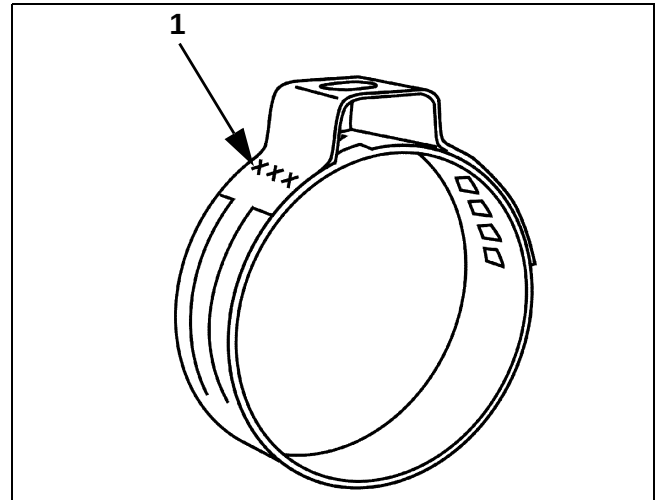
DO NOT re-use Oetiker clamps. Fuel leakage could contribute to a fire or explosion.

Clamp Identification

Use Oetiker clamps for making hose connections. These clamps provide corrosion resistance, minimize the potential for abrasion of rigging components, and provide solid, permanent connections.

The selection and installation of an Oetiker clamp is essential in the proper sealing of hose connections. The clamp identification numbers appear on

the side of the clamp, near the top of the ear. Refer to **Clamp Selection** chart for dimensions.



1. Clamp identification numbers

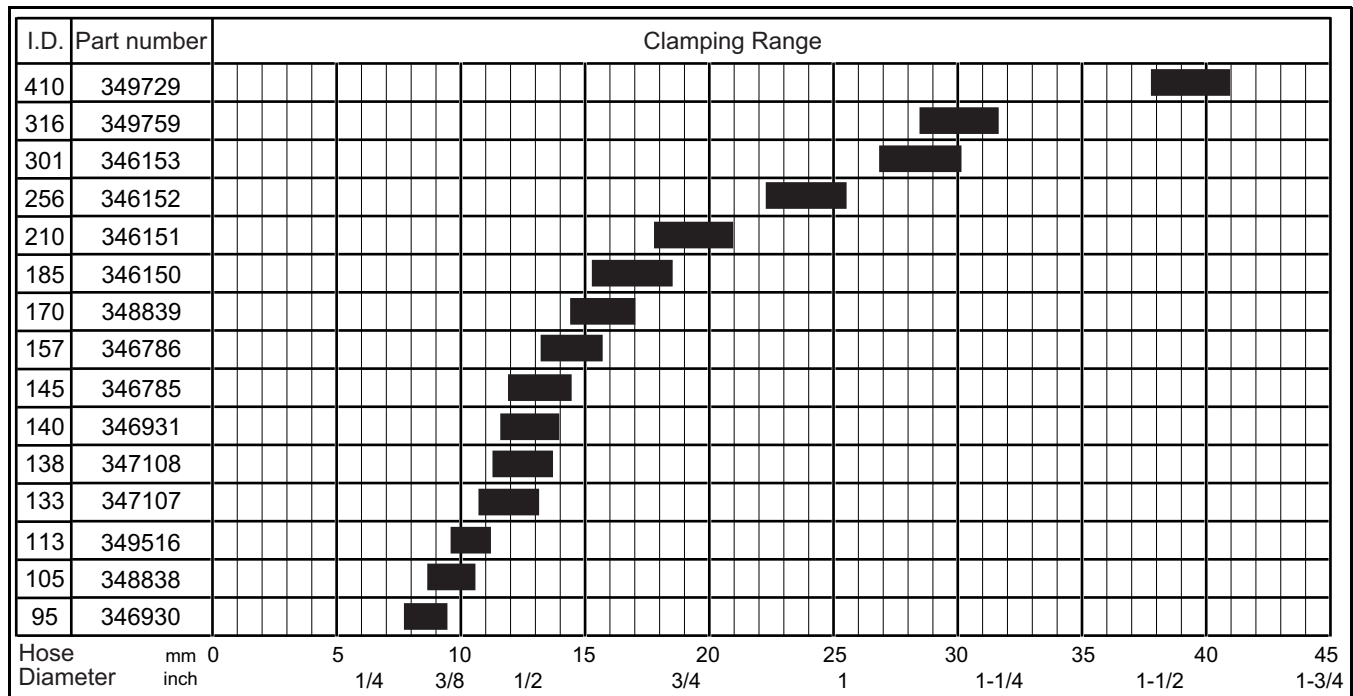
000093

3

Clamp Selection

To select the correct size Oetiker clamp, measure the outside diameter of the hose when installed on the fitting.

Choose a clamp so that the outside diameter of the hose is approximately in the middle of the clamping range of the clamp.



008052

Installation and Predelivery

Boat Rigging

Clamp Installation

A constant stress should be applied to close the ear clamps. This method ensures a positive stress on the hose and does not result in excessive compression or expansion of the band material.

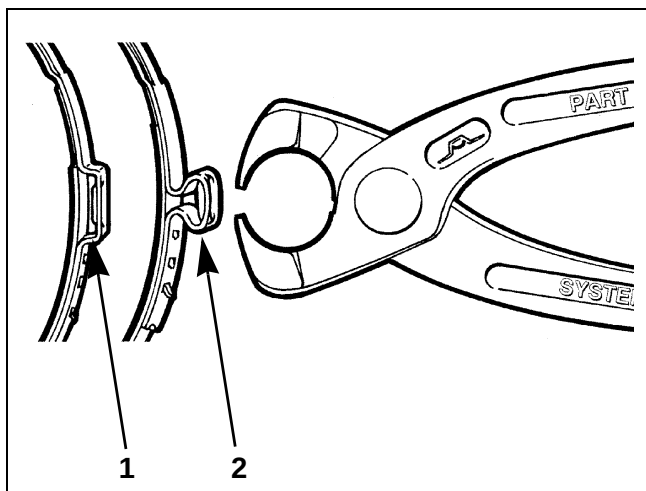
IMPORTANT: Use only *Oetiker* recommended tools to close *Oetiker* stepless clamps.

Oetiker pincers, P/N 350860, are available in the *Evinrude Genuine Parts and Accessories Catalog*.



DP0886

- Position correct size clamp over hose.
- Install hose on fitting.
- Close clamp ear fully with *Oetiker* pincers (pliers).

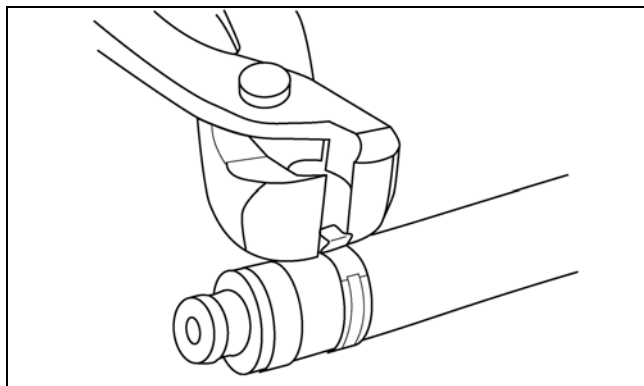


1. Open clamp
2. Closed clamp

000092

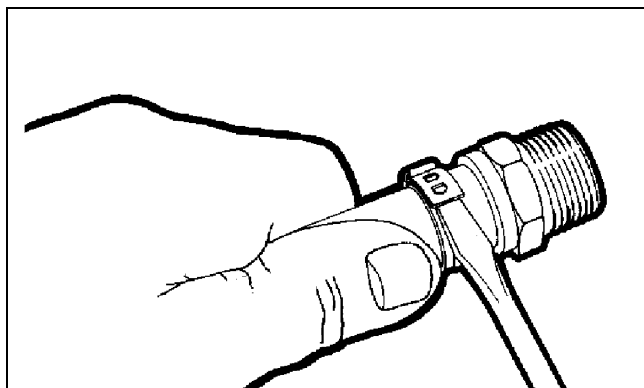
Clamp Removal

Method 1: Position *Oetiker* pincers across clamp ear and cut clamp.



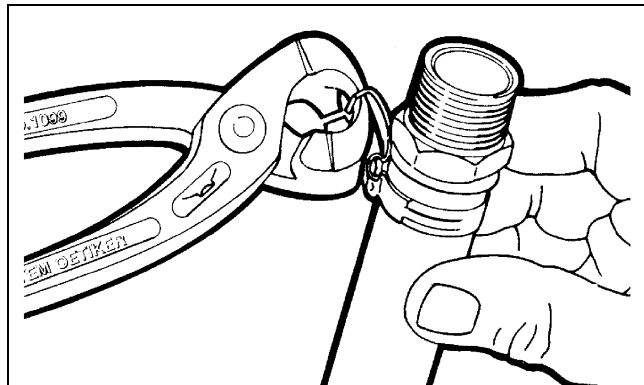
000108

Method 2: Lift end of stepless clamp with screwdriver.



000090

Method 3: Use *Oetiker* pincers (pliers) to grip clamp. Pull clamp off of connection and discard.



000091

Outboard Installation

Hull Preparation

Maximum Capacity

⚠ WARNING

Do not overpower the boat by installing an outboard that exceeds the horsepower indicated on the boat's capacity plate. Overpowering could result in loss of control.

Before installing outboard:

- Refer to the boat manufacturer's certification label for maximum horsepower rating.
- Refer to ABYC Standards to determine the maximum horsepower capacity for boats without certification labeling.



1029A

Mounting Surface

⚠ WARNING

DO NOT install an outboard on a curved or irregular surface. Doing so can wear, bind, and damage components, causing loss of control.

Inspect transom surface before mounting outboard.

- The transom should meet ABYC Standards.
- The transom must be flat and cannot have any protrusions.
- The transom angle should be approximately 14 degrees.
- Check transom strength and height.

The stern brackets must contact the flat surface of the transom. Modify trim that prevents the stern brackets from resting against the transom surface. Do not modify stern brackets.

Transom Clearances

Make sure the transom and splash well area provide adequate clearances.

- The top edge of the transom should be wide enough to allow full steering travel. The ABYC standard for most single outboard installations is 33 in. (84 cm).
- Check cable and hose routing clearances.
- Make sure there is clearance for mounting bolts and washers. Check the inside area of the transom for obstructions prior to drilling holes.

Water Flow

Inspect the hull area directly in front of the mounting location.

- Boat-mounted equipment should not create turbulence in the water flow directly in front of the outboard's gearcase. Turbulence or disruptions in the water flow directly in front of the gearcase will affect engine cooling and propeller/impeller performance.
- Avoid locating outboard centerlines within 3 in. (76 mm) of bottom strakes on dual-outboard installations.

Installation and Predelivery

Outboard Installation

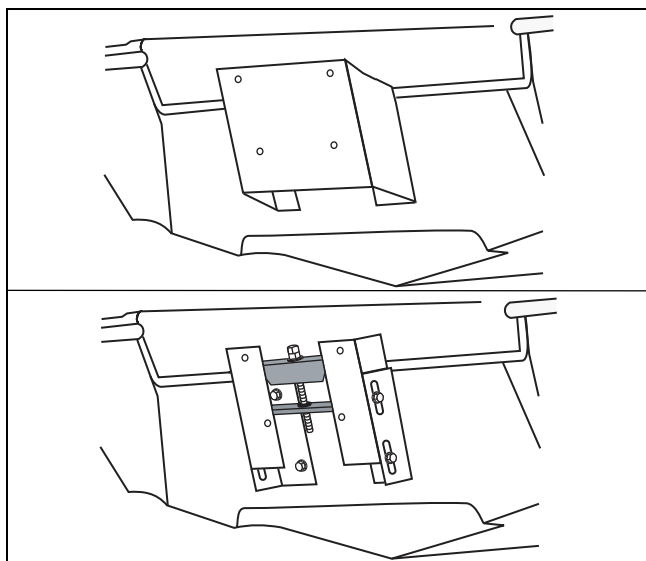
Transom Brackets and Jack Plates

When mounting an outboard on a jack plate:

- Refer to the manufacturer's recommendations for maximum weight and horsepower.
- The jack plate must provide a rigid, one-piece mounting assembly—either a solid surface, or surfaces adequately connected to prevent flexing or twisting.
- DO NOT use a jack plate constructed in two separate pieces—lack of support can twist the stern brackets, wear tilt tube bushings and thrust rollers, and bend or break components.

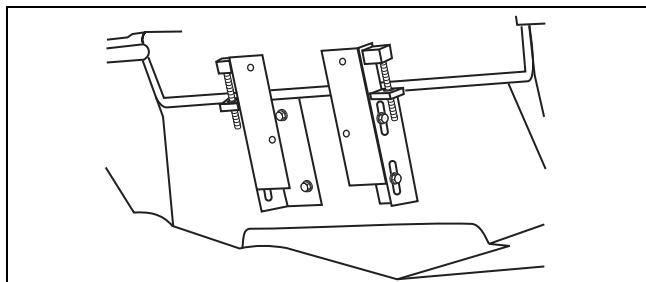
IMPORTANT: Damage caused by use of a two-piece jack plate or unstable mounting surface will not be covered by warranty.

Recommended Designs



007992 007991

Not Recommended



DR5703

Whenever possible, use mounting hardware supplied with the outboard to install jack plate on transom.

Mounting Hardware

⚠ WARNING

Use all mounting hardware supplied with the outboard to help ensure a secure installation. Substituting inferior hardware can result in loss of control.

Outboard mounting hardware must meet minimum specifications for material and strength.

Outboard mounting bolts, backing plates, washers, and nuts are used to attach the outboard to the shipping pallet. If alternate bolt lengths or replacement parts are required, use only *Evinrude Genuine Parts*.

IMPORTANT: Standard screws offered by local merchants may not provide the high strength required for outboard installations.

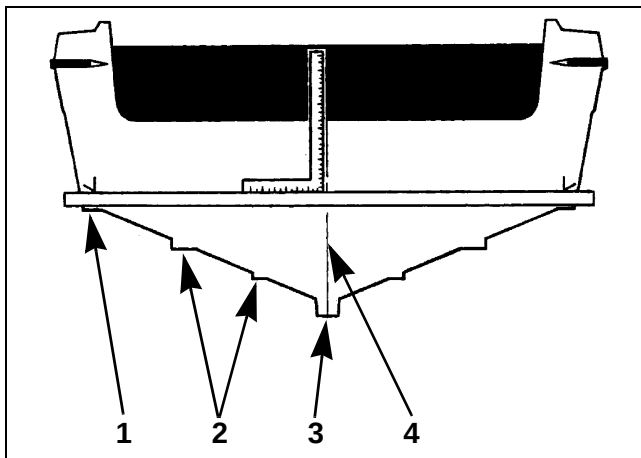
Transom Measuring and Drilling

Hull Centerline

Use the chines of the boat as reference points to locate the centerline of the boat transom.

Use a straightedge to draw a line connecting the port and starboard chines.

Use a framing square to accurately place a vertical line on the transom. The centerline of the hull should be in line with the keel, and perpendicular to the midpoint of the line connecting the chines.



1. Chine
2. Strake
3. Keel
4. Hull centerline

DR5568

Transom Height

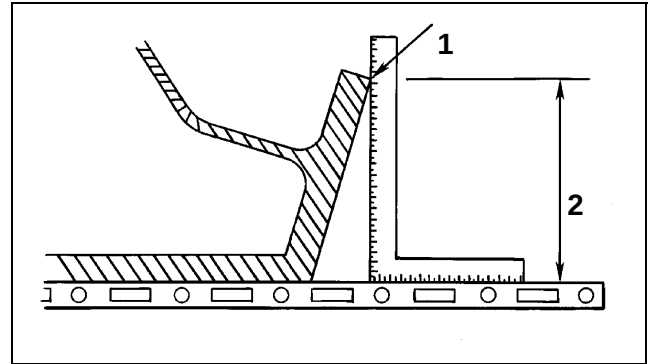
Make sure the transom height matches the length of the outboard to be installed.

- A 19 to 21 in. (48.3 to 53.3 cm) transom height uses a 20 in. (50.8 cm) shaft outboard.
- The shaft length of the outboard being installed should come close to matching the transom height of the boat.

Determine transom height by measuring from the top edge of the transom, along the centerline.

Use a straightedge as a reference to extend the bottom of the boat.

Position the straightedge along centerline. The distance from the top edge of the straightedge to the top edge of the transom is the actual transom height.



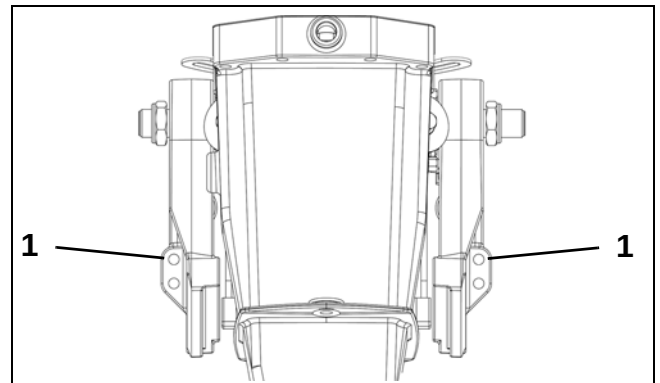
1. Top edge of transom
2. Actual transom height

DR5541

Transom Drilling Locations

Center the outboard on the transom (or mounting bracket) and tighten clamp screws by hand.

Use each stern bracket's mounting holes as a guide to drill four 11/32 in. (8.7 mm) holes through the transom.

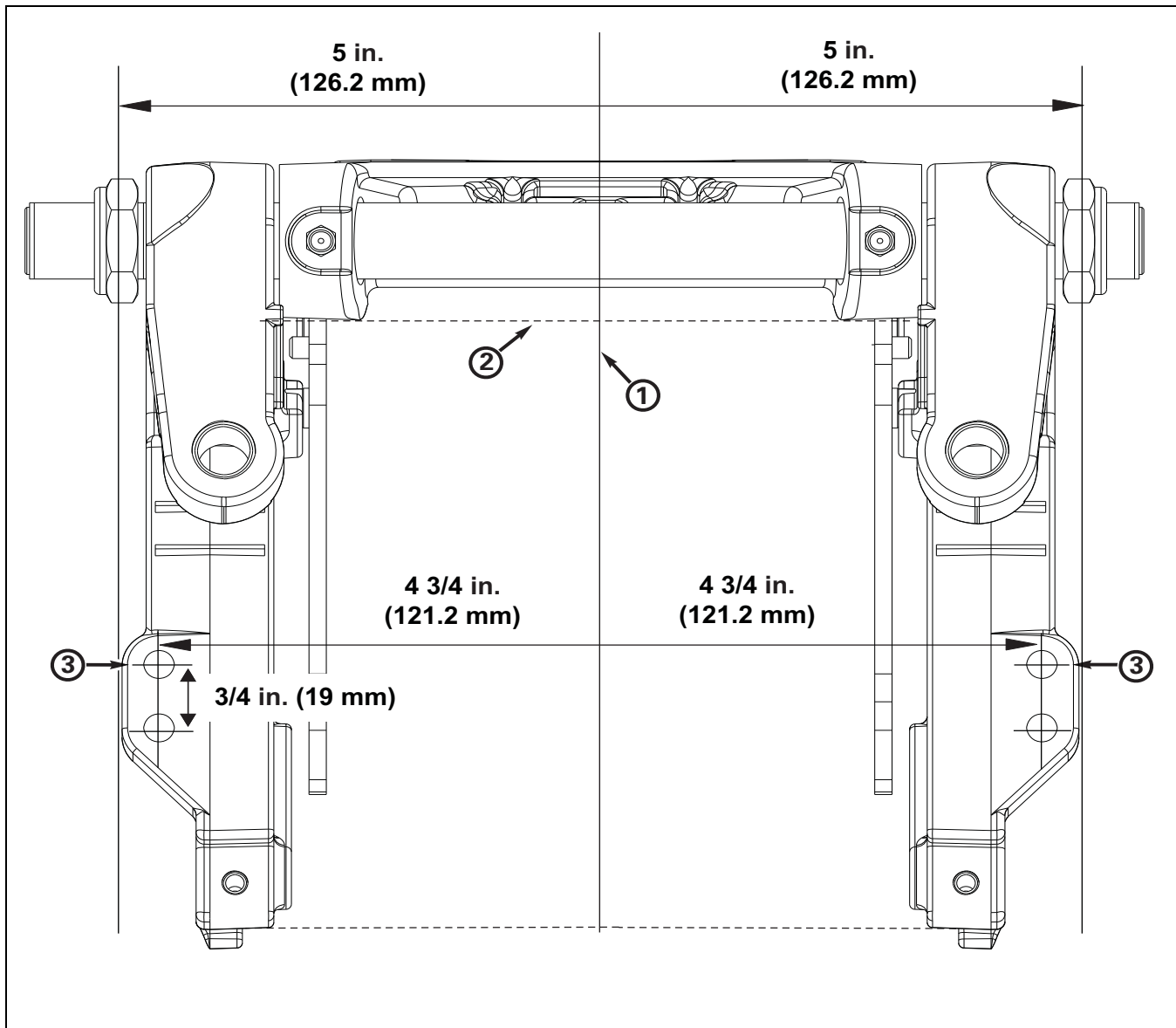


25 – 30 HP Models

007998

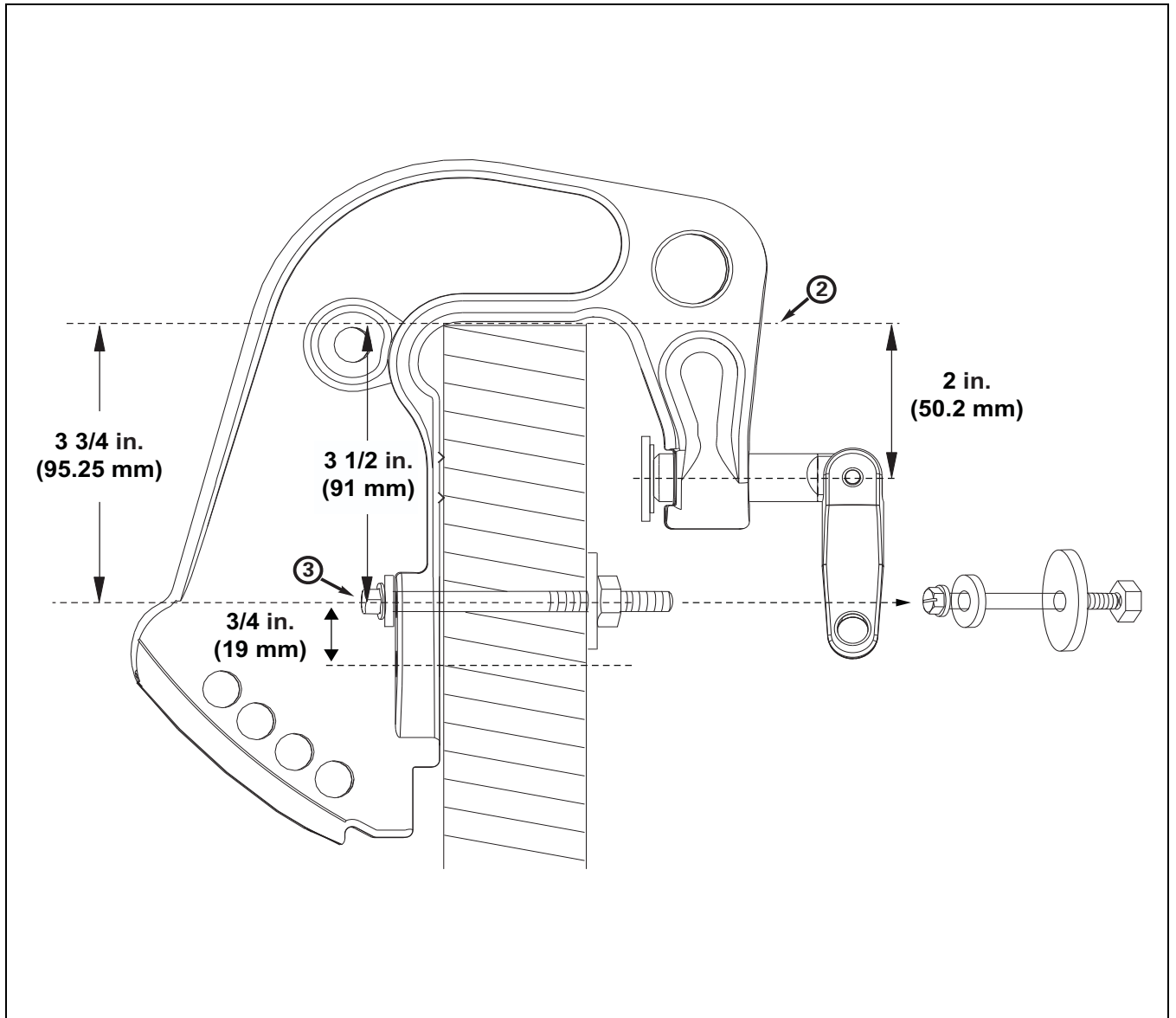
Drilling Diagram

IMPORTANT: This is not a template.



1. Center of Transom
2. Top of Transom
3. 5/16" Bolt Hole Locations

IMPORTANT: This is not a template.



Lifting the Outboard

Lifting Fixtures

⚠ WARNING

To avoid personal injury, make sure the lifting capacity of the hoist is at least twice the weight of the outboard.

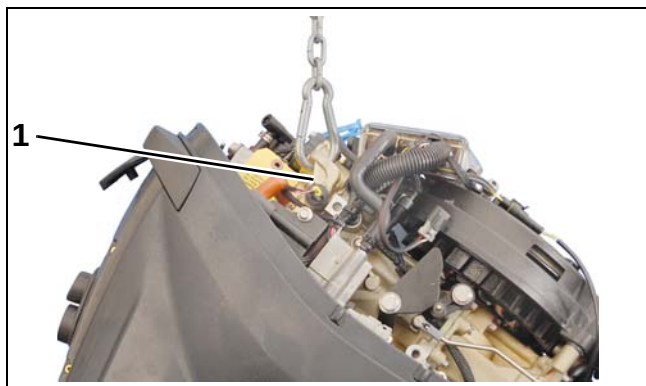
DO NOT allow the lift hook or chain from the hoist to come in contact with any part of the engine during lifting.

If the chain snap hooks are too large, the cast in lift eye could break causing the outboard to drop suddenly causing personal injury and damaging the outboard.

NOTICE

To avoid damage to the outboard, lift the outboard in one smooth motion. **DO NOT** allow the outboard to bounce.

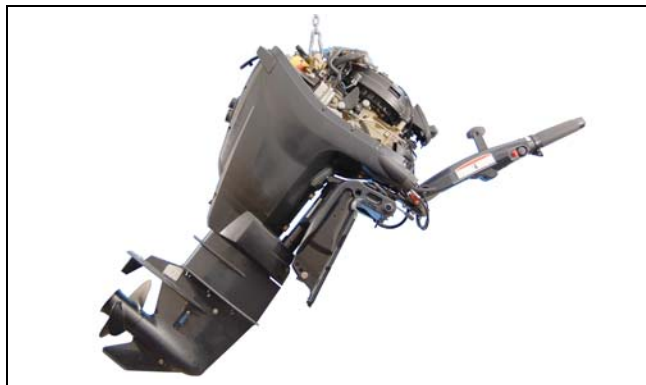
Attach chain to lift eye on back of engine block.



1. Lift eye

007212

Carefully lift engine with hoist.



007213

Outboard Mounting

Mounting Height

NOTICE

Be sure that outboard water pressure is not adversely affected by the mounting height of the outboard.

Boat performance depends on outboard mounting height.

Generally, the anti-ventilation plate of the gear-case should align with the bottom of the hull. Conventional V-hulls often perform well with the anti-ventilation plate approximately 1 in. (25 mm) above the bottom of the hull.

Boats that exceed 50 MPH may benefit from higher outboard heights. Consult the boat manufacturer for specific outboard mounting height information for a particular hull.

Test outboard and boat performance at different heights until the best performance is achieved.

Mounting Bolt Installation

NOTICE

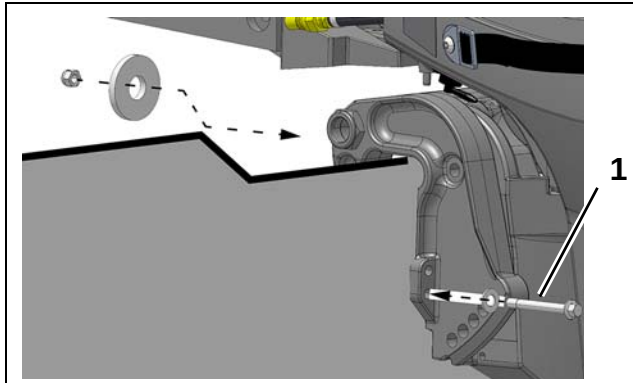
To prevent damage to outboard, check installation frequently for:

- Loose mounting bolts and nuts
- Loose tilt tube or steering cable nuts
- Elongated mounting holes
- Bent or deformed washers

Replace any hardware that fails to maintain torque specifications.

IMPORTANT: Use a marine sealant rated for above or below waterline use. RTV silicone is not approved for below waterline use. Polyurethane sealants are not easily removed and may damage outboard or boat mounting surfaces.

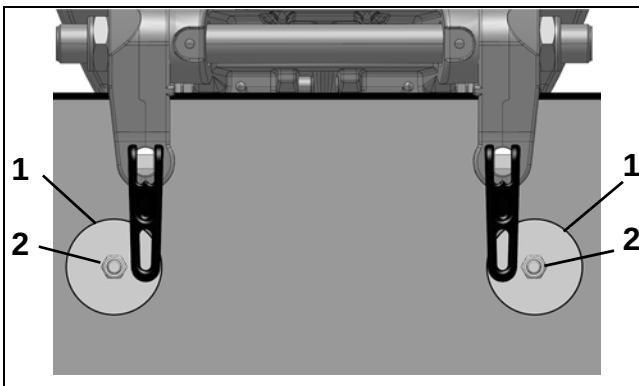
Apply marine sealer under hex heads of bolts, on the mounting plates, and to the bolt shanks.



1. Bolt

009480

Install the mounting bolts through the stern brackets and transom. Install round backing plates and locknuts onto the bolts and tighten securely.



1. Round backing plates
2. Locknuts

009481

Lanyard Installation

E30MAL models include a lanyard to prevent loss of the engine in the event the engine comes loose from the transom. Connect the eyelet of the lanyard to a secure point in the boat.

Fuel and Oil Priming

Fuel Requirements

⚠ WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Improper handling of fuel could result in property damage, serious injury or death.

Always turn off the outboard before fueling.

Never permit anyone other than an adult to refill the fuel tank.

Do not fill the fuel tank all the way to the top or fuel may overflow when it expands due to heating by the sun.

Remove portable fuel tanks from the boat before fueling.

Always wipe off any fuel spillage.

Do not smoke, allow open flames or sparks, or use electrical devices such as cellular phones in the vicinity of a fuel leak or while fueling.

ENVIRONMENTAL NOTE

Dispose of fuel contaminated shop towels in an environmentally responsible manner, or according to local regulations.

MFE models are designed to use several different fuel types. Refer to **Fuel Selector Switch** on p. 48.

Heavy Fuels:

Approved heavy fuels include:

- JP5, JP8
- Jet A,
- Kerosene

Gasoline:

Use unleaded automotive gasoline with an octane rating equal to or higher than:

- 87 (R+M)/2 AKI, or
- 90 RON.

Installation and Predelivery

Fuel and Oil Priming

Use unleaded gasoline that contains methyl tertiary butyl ether (MTBE) **ONLY** if the MTBE content does not exceed 15% by volume.

Use alcohol-extended fuels **ONLY** if the alcohol content does not exceed:

- 10% ethanol by volume
- 5% methanol with 5% cosolvents by volume

Emergency Fuels:

In an emergency situation when no other fuel is available, diesel DFM-F76 or BioDiesel can be used for a maximum of ten hours **ONLY**.

Idle and low speed operation (below 3000 RPM) should be avoided to prevent spark plug fouling when operating on diesel DFM-F76 or BioDiesel.

IMPORTANT: If the outboard **MUST** be run on diesel, it should then be run on gasoline for a minimum of 20 minutes to clean internal engine components. Refer to **De-Carboning Procedure** on p. 59.

Fuel Additives (gasoline only)

The only fuel additives approved for use are:

- Evinrude 2+4® fuel conditioner
- Evinrude Fuel System Cleaner

Use of other fuel additives can result in poor performance or engine damage.

Evinrude 2+4 Fuel Conditioner will help prevent gum and varnish deposits and will remove moisture from the fuel system. It can be used continuously and should be used during any period when the outboard is not being operated on a regular basis.

Evinrude Fuel System Cleaner helps keep fuel injectors in good condition.

Fuel System Priming

Vent Line Clamp

Federal Regulations require that all outboards with a fuel vapor separator must be shipped with a vent line clamp installed. This clamp must be removed before priming the fuel system or starting the outboard for the first time.



007131

IMPORTANT: Failure to remove the clamp may cause fuel starvation and poor running qualities.

Priming the Fuel System

⚠ WARNING

Fuel vapors are highly flammable. Perform the following procedure in a well ventilated area. Extinguish all smoking materials and make certain no ignition sources are present.

Connect the fuel hose connector to the quick connect fitting on the outboard.

Use the primer to fill the Vapor separator.

The high-pressure fuel circuits and injectors will prime as the outboard is cranked with the starter.

Observe all fuel lines, both in the boat and on the outboard. Repair any fuel leaks.

⚠ WARNING

Failure to check for fuel leaks could allow a leak to go undetected, resulting in fire or explosion and may cause personal injury or property damage.

Oil Requirements

IMPORTANT: Failure to follow these recommendations could void the outboard warranty if a lubrication-related failure occurs.

Evinrude XD100 is the only oil recommended for use with *MFE* models.

If *XD100* oil is not available, an oil that meets NMMA TC-W3 certification may be used in an emergency.

XD100 oil must be used when operating in temperatures under 32°F, (0°C).

Oil Injection Rate

The Engine Management Module (*EMM*) controls the rate of oil injection based on engine RPM. This rate can be adjusted for powerhead break-in. Use *Evinrude Diagnostics* software to access this feature.

Break-In Oiling

NOTICE

The operator must monitor the oil tank level to confirm oil consumption. This may require several hours of operation above idle.

IMPORTANT: DO NOT add oil in the fuel tank on *MFE* models.

The *EMM* automatically supplies extra oil to the engine during the first two hours of operation, above 2000 RPM.

Follow these steps for outboard set-up:

- Use *Evinrude Diagnostics* software to make sure the break-in program has been started. Refer to **Oil Control Settings** on p. 159.
- The oil tank should be filled and the oil level marked for reference.

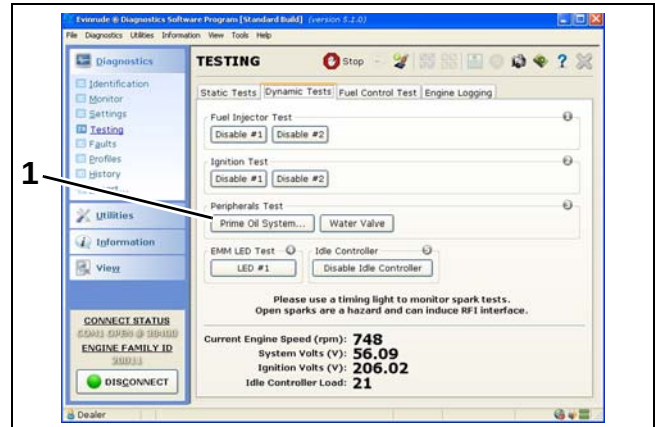
Oil Supply Priming

⚠ WARNING

Always use caution while working around machinery with moving parts. The following set-up procedures require running tests that are performed with the outboard's motor cover removed.

IMPORTANT: Refer to **Operation** section before running outboard.

Start the outboard and use the *Evinrude Diagnostics* software oil priming function for a minimum of 90 seconds to make sure the system is completely primed.



Dynamic Tests Screen

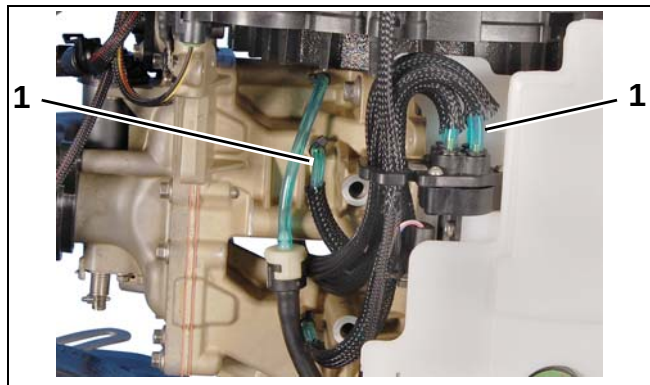
1. Prime oil button

008597

Installation and Predelivery

Before Start-Up

Observe oil flow through the oil distribution hoses.

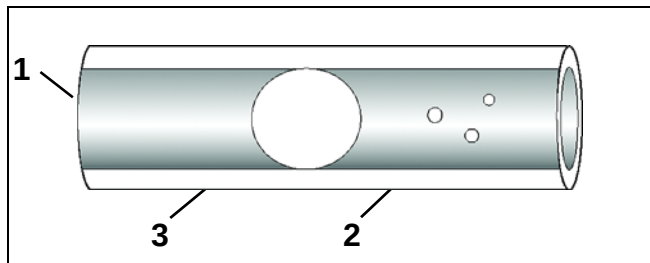


15 – 30 HP Models

007130

1. Oil distribution hoses

Small bubbles are acceptable. Large bubbles must be eliminated through continued priming.



004398

1. Oil distribution hose
2. Small bubbles
3. Large bubbles

IMPORTANT: All clear (blue) oil distribution hoses on the powerhead should fill with oil as the air is purged from the lines.

Repair any oil leaks.

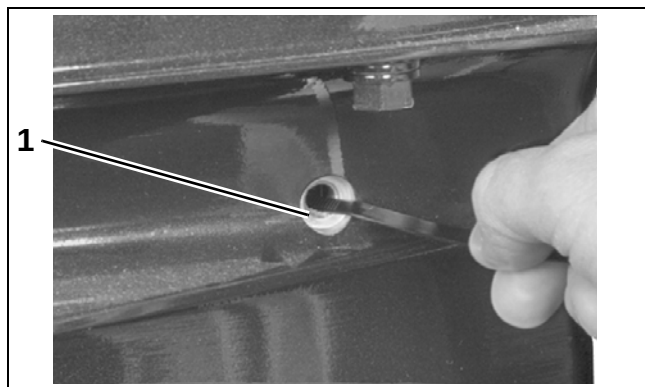
The oiling system can also be primed using the Self-Winterizing feature if diagnostics software is not available. Refer to **Storage** on p. 69.

Before Start-Up

Gearcase Lubricant

With outboard vertical, check the gearcase lubricant level:

- Remove the lubricant level plug. Lubricant must be even with the bottom of the threaded hole.
- A clean tie strap can be used as a “dip stick” if the lubricant level is not obvious.
- Add *HPF PRO* gearcase lubricant as needed. Refer to **Gearcase Lubricant** on p. 65.



1. Gearcase lubricant level

000072

Oil Level

Make sure oil tank contains an adequate supply of the correct lubricant for the outboard. Refer to **Oil Requirements** on p. 41.

When starting the outboard for the first time, refer to **Oil Supply Priming** on p. 41.

Operational Checks

⚠ WARNING

DO NOT run outboard without a water supply to the outboard's cooling system. Cooling system and/or powerhead damage could occur.

⚠ DANGER

DO NOT run the engine indoors or without adequate ventilation or permit exhaust fumes to accumulate in confined areas. Engine exhaust contains carbon monoxide which, if inhaled, can cause serious brain damage or death.

⚠ DANGER

Contact with a rotating propeller is likely to result in serious injury or death. Assure the engine and prop area is clear of people and objects before starting engine or operating boat. Do not allow anyone near a propeller, even when the engine is off. Blades can be sharp and the propeller can continue to turn even after the engine is off.

IMPORTANT: Refer to **Operation** section before running outboard.

Fuel System

Perform running checks of the fuel system by following these steps:

- Squeeze fuel primer bulb until hard or activate electric primer. Observe all fuel hoses and connections. Repair any leaks.
- Start outboard. Inspect all hoses and connections. Repair any leaks or misrouted hoses immediately.

Engine Cut-off Switch

Check emergency stop function. With outboard running at IDLE, pull the tether cord from the engine cut-off switch. Outboard must stop immediately.

Control Operation

Make sure that controls can be easily moved into all gear and throttle settings. Do not shift when outboard is not running.

Start-In-Gear Prevention

⚠ WARNING

Make certain that the outboard will not start when in gear. The start-in-gear prevention feature is required by the United States Coast Guard to help prevent personal injuries.

Start outboard and shift to FORWARD.

Turn outboard OFF while control is in FORWARD.

Try to restart the outboard. Outboard should not start.

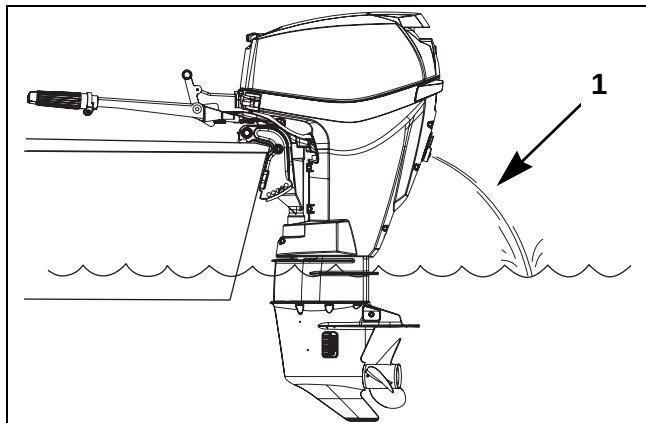
Shift back to NEUTRAL and restart outboard.

Shift to REVERSE. Turn outboard OFF while control is in REVERSE.

Try to restart the outboard. Outboard should not start.

Water Pump Overboard Indicator

A steady stream of water should flow from the overboard indicator.



1. Water pump overboard indicator

007011M

Operating Temperature

An outboard run at idle speed should achieve a temperature based on the engine's thermostatic control. In general, the powerhead temperature should reach at least 104°F (40°C) after five minutes of idling. Check that the powerhead reaches idle temperature. Refer to **Service Specifications** on p. 12 for details.

Idle Speed

Make sure the outboard idles within the specified idle RPM range. If the outboard is run on a flushing device, the idle speed and quality may not be representative of actual in water use.

Break-In

New *MFE* models are delivered ready to run from the factory and require no additional break-in by the operator.

The Engine Management Module (*EMM*) automatically supplies extra oil to the engine during the first two hours of operation, above 2000 RPM.

Use the diagnostics software program to confirm that the break-in program has been started. Refer to **Oil Control Settings** on p. 159.

Propellers

Propeller Selection

⚠ CAUTION

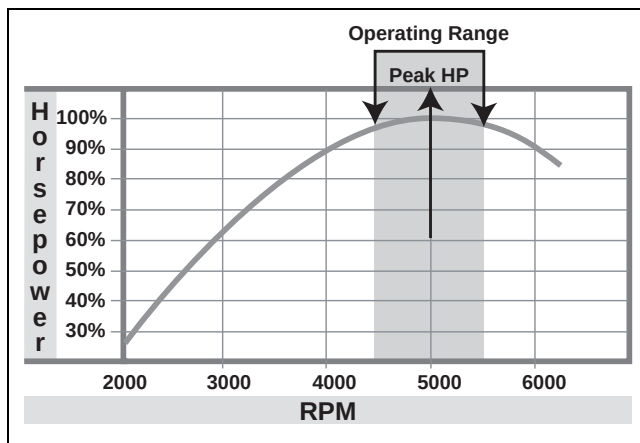
Selection of the wrong propeller could reduce engine service life, affect boat performance, or cause serious damage to the powerhead.

NOTICE

If the propeller blades have too much pitch, the engine will operate below its normal range at full throttle. Power will be lost, and powerhead damage could occur. If the propeller blades have too little pitch, the engine will operate above its normal range and damage from overspeeding could occur.

Water testing with various propeller designs and sizes is the best method of propeller selection.

The correct propeller, under normal load conditions, will allow the engine to run near the midpoint of the RPM operating range at full throttle. Refer to **Service Specifications** on p. 12.



008329

When selecting a propeller, consider the following:

- Use an accurate tachometer to determine the engine's full-throttle RPM.
- The outboard should be trimmed for top speed.
- Select a propeller that suits the application and allows the engine to run near the midpoint of the full-throttle operating range when the boat has a normal load.
- Occasionally, one propeller will not cover a wide range of boat applications — heavy loads to high speed performance boating. In such cases, it might be necessary to have a propeller for each situation.
- Refer to the *Evinrude Genuine Parts and Accessories Catalog* for propeller styles and sizes.

Propeller Hardware Installation

⚠ WARNING

To prevent accidental starting while servicing, disconnect the Crankshaft Position Sensor (CPS).

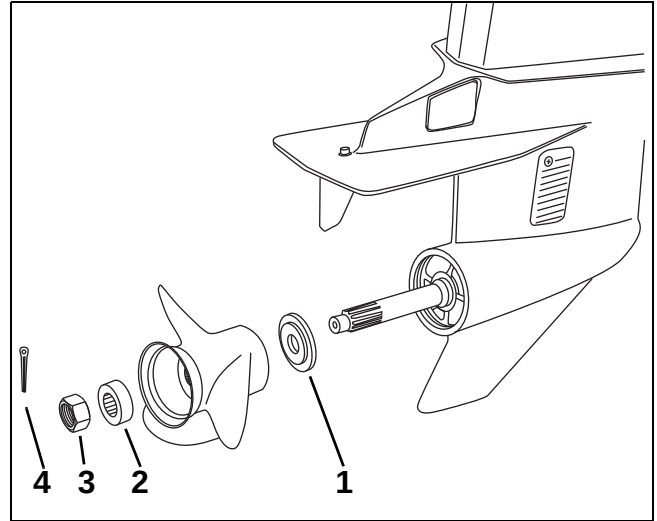
Apply *Triple Guard* grease to the entire propeller shaft before installing the propeller.

Install thrust bushing onto propeller shaft with taper of bushing matching taper of shaft.

If installing a propeller with an interchangeable hub, assemble the propeller following instructions provided with the propeller.

Align splines of propeller and shaft. Push propeller until seated on the thrust bushing.

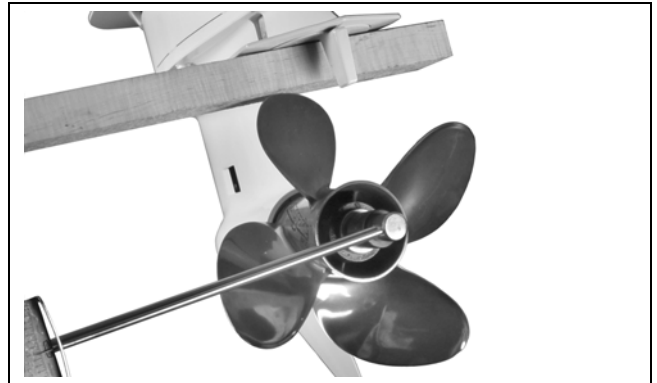
Install the spacer over the propeller shaft splines.



1. Thrust bushing
2. Spacer
3. Propeller Nut
4. Cotter pin

007055

Wedge a block of wood between propeller blade and the anti-ventilation plate.



001992

Install the propeller nut and tighten to a torque of:

- 120 to 144 in. lbs. (13.5 to 16.5 N·m)

If cotter pin holes in the nut and shaft do not align, tighten further. Do not loosen.

Install new cotter pin.

IMPORTANT: After installation, make sure outboard is in NEUTRAL and carefully spin propeller. Propeller must turn freely and should not spin off center. If propeller appears to wobble, check for possible bent propeller shaft.

Water Test and Final Adjustments

An in the water test is required to make sure the outboard(s) and boat are rigged correctly, propeller selection is correct, and that all accessories function properly.

Pay special attention to the following, especially if the boat is re-powered with new outboard(s):

- Engine mounting height
- Correct propeller selection and WOT RPM

Make all needed adjustments or repairs and retest before delivery.

Engine Mounting Height Adjustment

Goals include:

- Engine RPM within the full throttle operating range
- Best acceleration and top speed
- No excessive ventilation while boat is coming onto plane.

Start with the engine lower on the transom. Make a test run, taking note of engine RPM, water pressure, trim level and boat speed.

Raise the engine and repeat the process until the best acceleration and boat speed are achieved.

Fuel System Vacuum

Test boat fuel system vacuum. Refer to **Lift Pump Vacuum Test** on p. 138. The maximum inlet fuel vacuum should not exceed 4 in. Hg. (13.5 kPa) at the inlet to the fuel lift pump under any operating conditions (IDLE to WOT).

A higher vacuum indicates an excessive restriction in the fuel supply. Repair as needed.

Trim Tab Adjustment

⚠ WARNING

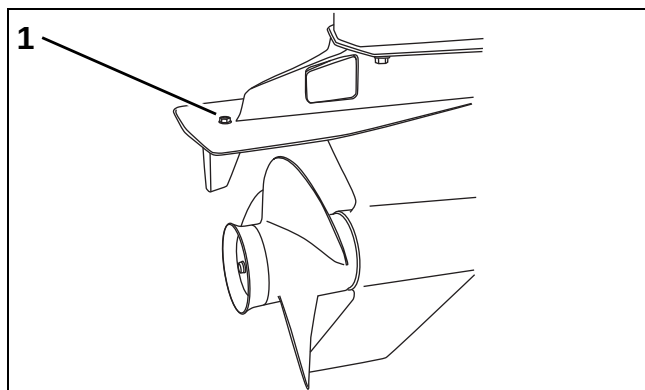
Improper trim tab adjustment can cause difficult steering and loss of control.

A propeller will generate steering torque when the propeller shaft is not running parallel to the water's surface. The trim tab is adjustable to compensate for this steering torque.

IMPORTANT: A single trim tab adjustment will relieve steering effort under only one set of speed, outboard angle and load conditions. No single adjustment can relieve steering effort under all conditions.

If the boat pulls to the left or right when its load is evenly distributed, adjust the trim tab as follows:

- With the engine OFF, loosen the trim tab screw. If the boat pulled to the right, move rear of the trim tab slightly to the right. If the boat pulled to the left, move rear of the trim tab slightly to the left.
- Tighten the trim tab screw to a torque of 60 to 80 in. lbs. (7 to 9 N·m).



1. Trim tab screw

007044

Test the boat and, if needed, repeat the procedure until steering effort is as equal as possible.

Outboards with High Transom Heights

The trim tab may be above the surface of the water when the outboard is trimmed out. Steering effort might increase. Lower the trim setting to submerge the trim tab and to reduce steering effort.

Operation

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Starting the Engine

⚠ WARNING

DO NOT run outboard without a water supply to the outboard's cooling system. Cooling system and/or powerhead damage could occur.

⚠ DANGER

DO NOT run the engine indoors or without adequate ventilation or permit exhaust fumes to accumulate in confined areas. Engine exhaust contains carbon monoxide which, if inhaled, can cause serious brain damage or death.

⚠ DANGER

Contact with a rotating propeller is likely to result in serious injury or death. Assure the engine and prop area is clear of people and objects before starting engine or operating boat. Do not allow anyone near a propeller, even when the engine is off. Blades can be sharp and the propeller can continue to turn even after the engine is off.

Fuel Requirements

IMPORTANT: Refer to:

- Fuel Requirements on p. 39
- Fuel System Priming on p. 40

Oil Requirements

IMPORTANT: Refer to:

- Oil Requirements on p. 41
- Oil Supply Priming on p. 41

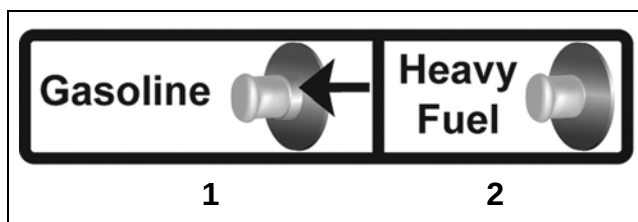
Fuel Selector Switch

⚠ CAUTION

Operation with the fuel selector switch in the wrong position could cause internal engine damage not covered by the outboard's limited warranty.

The Engine Management Module (*EMM*) includes programs to allowing the engine to run on several types of fuel. You **MUST** select the correct program for the fuel being used.

- To use gasoline, pull the fuel selector switch OUT to expose the red indicator ring.
- To use jet fuel or kerosene (Heavy Fuel), press the fuel selector switch IN.



1. Fuel selector switch OUT (red line showing)
2. Fuel selector switch IN

006550

When switching from one fuel to another:

- Connect the fuel supply hose to the desired fuel supply.
- Adjust the selector switch for the new fuel.
- Restart the engine to reset the *EMM*—changing the switch has no effect while the engine is running.
- The *EMM* calculates when the previous fuel remaining in the engine has been used and switches the program at that time.
- The engine may run noticeably rough during the transition period.

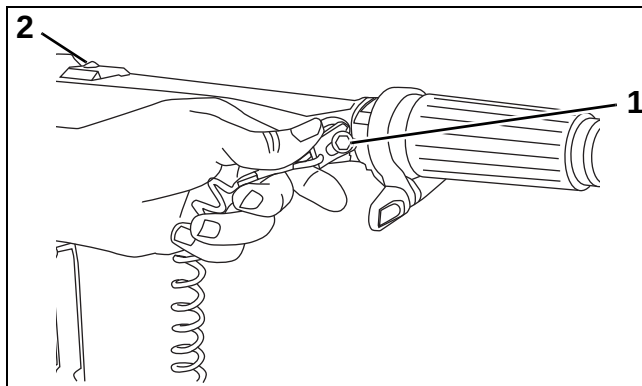
IMPORTANT: Diesel is an emergency fuel **ONLY**. If diesel must be used, the fuel selector switch should be in the Heavy Fuel position.

Starting Procedure

⚠ DANGER

Always use the tether cord when operating the boat to help prevent a runaway boat and reduce the risk of personal injury or death.

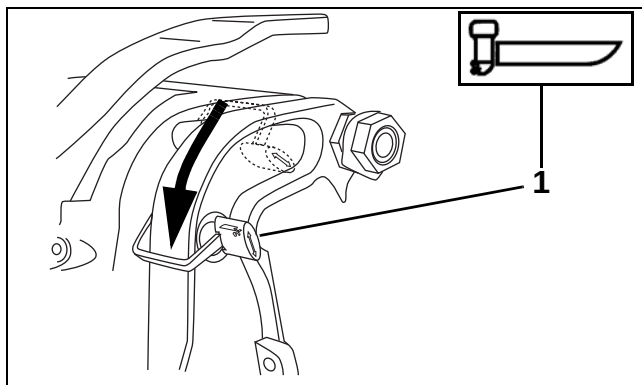
Connect the clip to the engine cut off switch. Clip must be installed to start engine. Snap the tether cord to a secure place on the operator's clothing. An extra clip is stored on the steering arm.



1. Engine cut-off switch
2. Extra clip

002405M

Move the tilt/run lever to RUN position. Place motor in normal operating position.

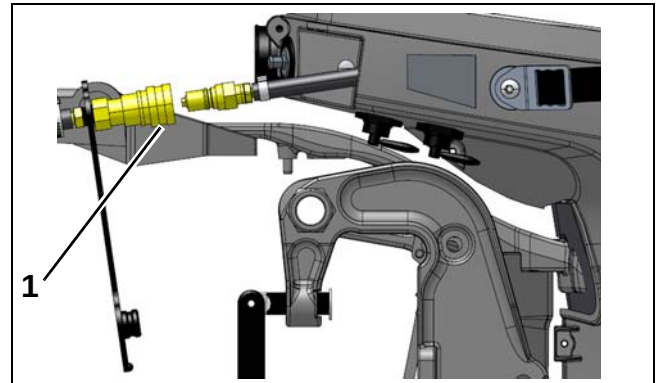


1. RUN position

007024M

Set the fuel selector switch for the fuel being used. Refer to **Fuel Selector Switch** on p. 48.

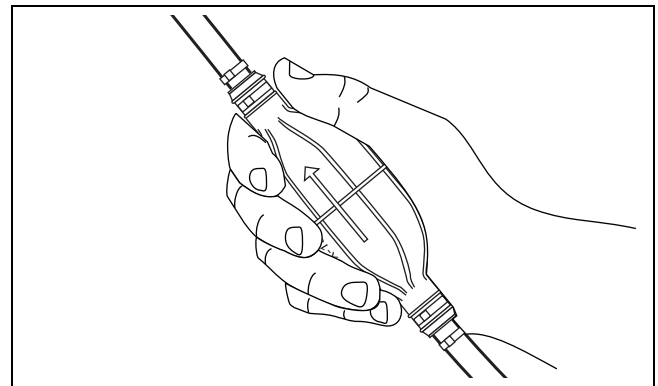
Snap fuel line connector onto engine connector.



1. Fuel connector

009476

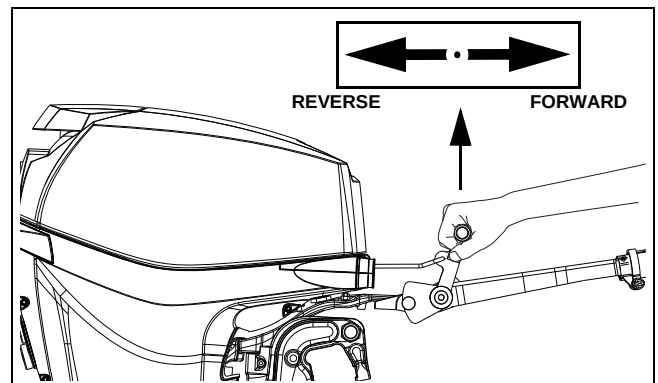
Squeeze fuel line primer bulb, outlet end up, until firm.



30924

IMPORTANT: If the fuel tank has a manual vent, be sure it is open.

Move the shift lever to NEUTRAL. The engine will NOT start in gear.

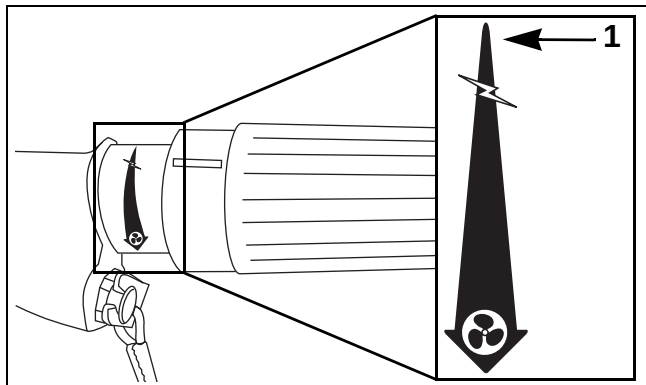


002415M

Operation

Starting the Engine

Twist throttle grip to the slowest idle position.

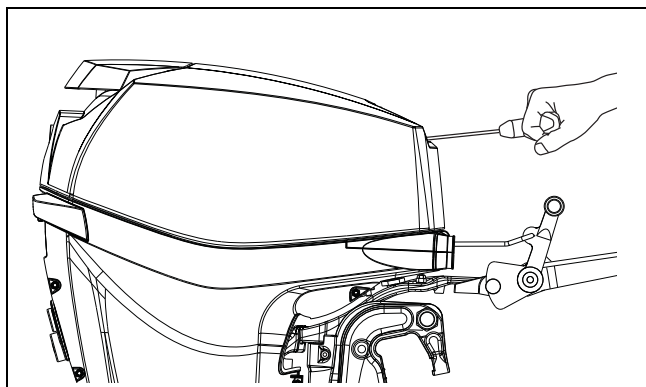


1. Slowest idle position

007067
008537

IMPORTANT: DO NOT move the throttle from the fully closed position until the engine starts. Advancing the throttle before starting sends the wrong throttle position sensor signal to the *EMM* and will cause starting or running problems—the outboard may not accelerate above idle.

Pull starter handle slowly until starter engages, then pull hard. Short or slow pulls may not provide enough current to the *EMM* to start the engine.

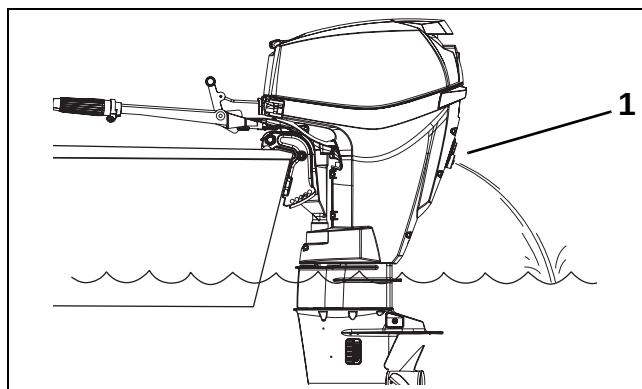


008927M

Repeat, if needed, until outboard starts. To prevent damage to starter assembly, allow starter cord to rewind before releasing starter handle.

After Engine Starts

Check the water pump indicator. A steady stream of water indicates the water pump is working. If there is NOT a steady stream, STOP the engine. Refer to **Water Intake Screens** on p. 61.



1. Water pump overboard indicator

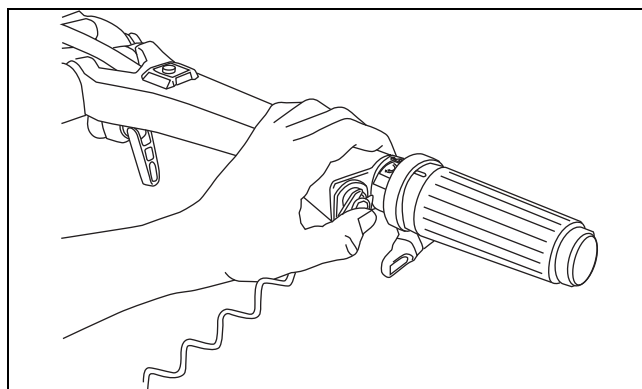
007011M

Stopping the Engine

Slow engine to idle speed.

Move shift lever to NEUTRAL.

Press the stop button on the tiller handle until the outboard stops running.



002413M

Shifting and Speed Control

Shifting

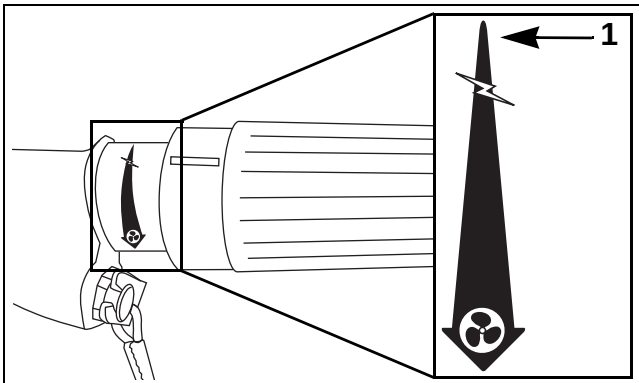
⚠ WARNING

Do not operate motor in REVERSE with the tilt/run lever in TILT. Motor may tilt out of the water, resulting in loss of control.

IMPORTANT: To avoid gearcase damage:

- DO NOT try to shift motor into gear when engine is not running.
- When shifting, always wait until boat has slowed and engine is at idle speed.

With the outboard running, twist the throttle grip to slowest idle position.

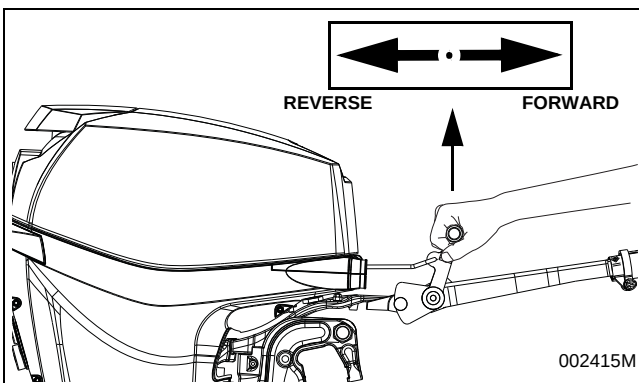


1. Slowest idle position

007067
008537

IMPORTANT: DO NOT shift motor with throttle control advanced beyond the slowest idle position.

Move the shift lever with a firm, quick motion to FORWARD or REVERSE.

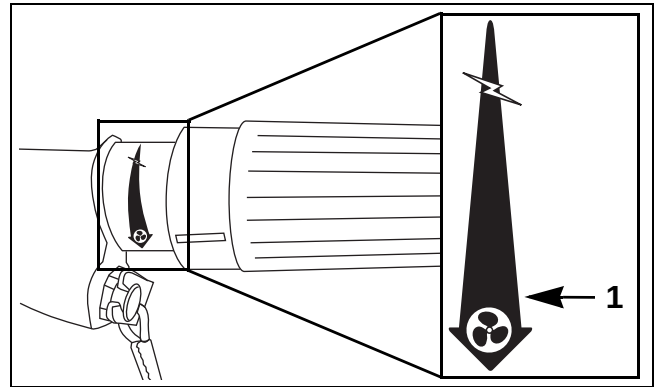


002415M

Speed Control

With the outboard running, turn the Twist-Grip throttle control to change engine speed.

Note: Idle speed is controlled by the EMM.



1. Fast speed position

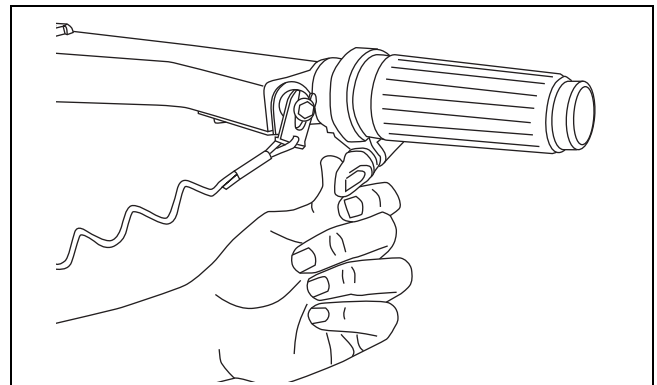
007067F
008537

Throttle Friction Adjustment

⚠ WARNING

Tighten knob only enough to hold throttle at a constant engine speed. Over tightening will prevent quick throttle changes in case of emergency.

Adjust the throttle friction knob to reduce the effort required to hold a throttle setting.



002412M

Manual Tilt

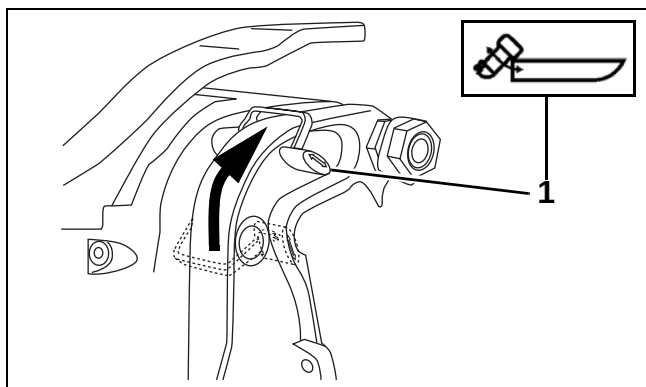
⚠ WARNING

While engine is tilted, leave tilt lever in the TILT position. When the tilt/run lever is in the RUN position, tilt support can release unexpectedly and allow motor to drop, creating a risk of serious personal injury or loss of control.

IMPORTANT: Use the tilt grip to tilt the outboard. Do not use the tiller handle as a lever.

Tilt UP

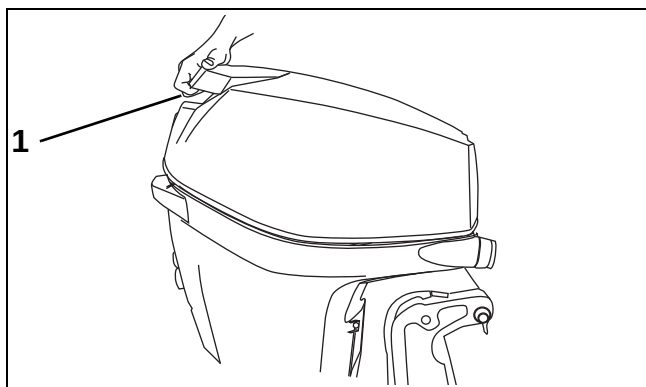
Move tilt/run lever to TILT position.



1. TILT position

007022M

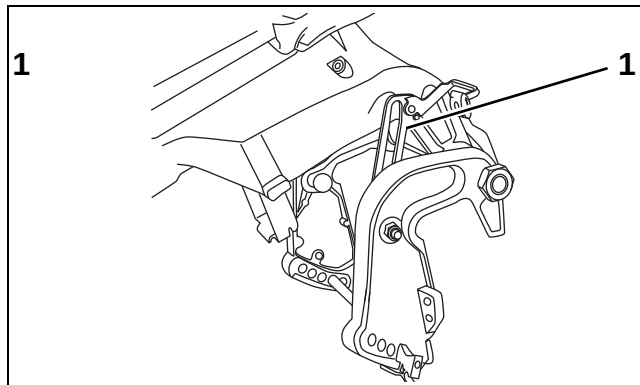
Grasp the tilt grip on engine cover and tilt outboard to the full tilt position.



1. Tilt grip

007001M

Tilt support will automatically engage.

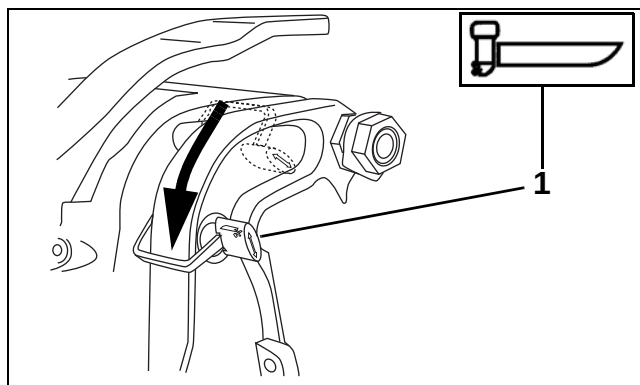


1. Tilt support bracket – lock position

007025M

Tilt DOWN

Move tilt/run lever to RUN position.



1. RUN position

007024M

Grasp tilt grip on engine cover and raise outboard slightly.

Tilt support will automatically disengage.

Slowly lower outboard to its normal operating position.

Trailer

Trailer your boat with the motor in a vertical position. If your trailer does not provide adequate road clearance, support the outboard with an accessory trailering bracket.

IMPORTANT: The outboard must be restrained when trailering. Bouncing during transport may damage the outboard and the boat's transom.

IMPORTANT: Use of the tilt support bracket when trailering may cause damage to the outboard.

Place motor in full tilt position. Refer to **Tilt UP** on page 52.

- Turn the angle adjusting rod handle up. Push in against spring so retainer will release, then slide rod assembly all the way out.
- Insert rod in desired position. Make sure rod passes through both stern brackets.
- Push in against spring and turn rod handle down. Make sure the retainer dropped into lock position.

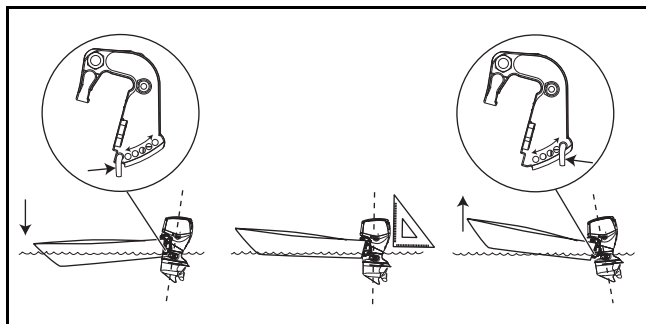
Motor Angle Adjustment

⚠ WARNING

In rough water or crossing a wake, excessive bow-up trim may result in the boat's bow suddenly rising upward, possibly ejecting or seriously injuring occupants.

Some boat/motor/propeller combinations may cause boat instability and/or high steering torque when operated at high speed at or near the outboard's trim range limits (full bow-up or bow-down). Boat stability and steering torque can also vary in changing water conditions. If any adverse conditions occur, reduce throttle and/or adjust trim angle to maintain control.

The outboard should be perpendicular to the water when the boat is underway at full speed. This adjustment can only be determined by water testing the boat. Set angle adjustment for your normal load.



007026

De-Water Procedure

The *MFE* outboard is **NOT** a submersible engine. However, due to the extreme operating conditions this engine may experience, a crankcase drain system has been provided to de-water the engine should water intrusion occur during deployment or accidental rollover.

This system allows the operator to quickly remove water and re-start the engine in an emergency situation. In most cases, the engine can be returned to normal operation without damage.

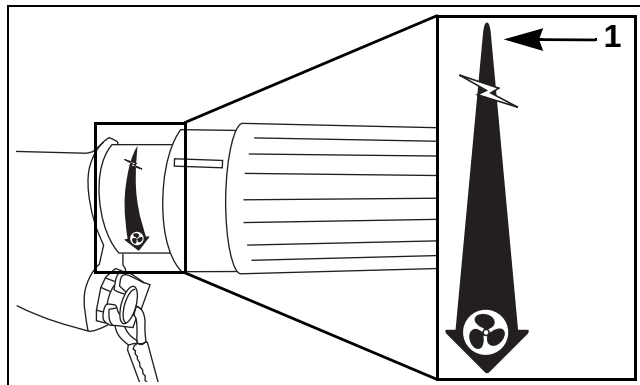
Avoid submersion of the outboard. Damage could occur to the engine wiring harness and water could contaminate the oiling system. Extended submersion, particularly in salt water, could result in corrosion of internal components such as piston rings, cylinder sleeves, and bearings.

Once an outboard has been under water (fresh or salt water), it must be serviced and started within three (3) hours of recovery. Immediate service can minimize the corrosive effect that air has on the polished surfaces of the crankshaft, connecting rods, and internal powerhead bearings.

IMPORTANT: If the outboard cannot be started or serviced immediately, it should be resubmerged in fresh water to avoid exposure to the atmosphere.

Place shift lever in NEUTRAL and remove the tether cord from the engine cut-off switch.

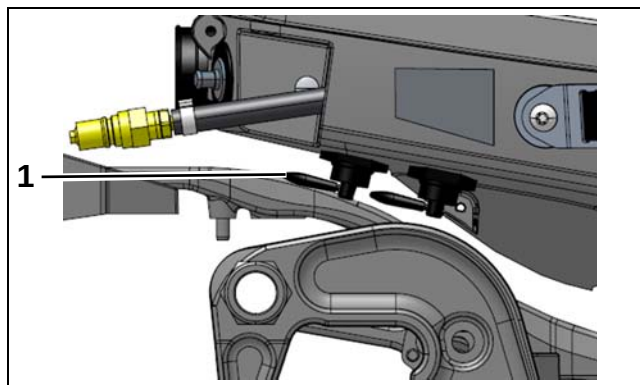
Twist throttle grip to slowest idle position.



1. Slowest idle position

007067
008537

Turn the drain valves forward to the DRAIN position.



1. Drain valves in drain position (forward)

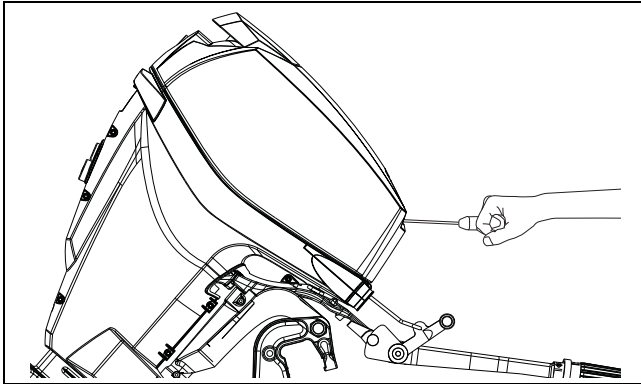
009478

Tilt outboard to the full tilt position and turn so the drain valves are on the lowest side.

⚠ CAUTION

To avoid outboard falling during de-water procedure, tilt/run lever MUST remain in the TILT position.

Pull starter handle slowly until starter engages. Continue pulling with firm pressure to force water out of the engine.



008927M

When the engine begins to turn freely, pull an additional 8-20 times. This will help drain water that might be trapped in the cylinders.

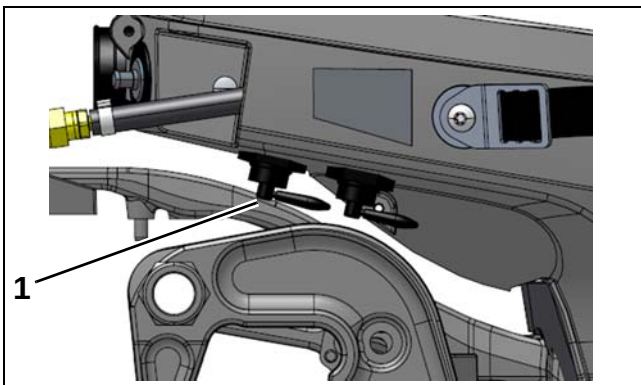
Tilt outboard to the normal running position.

Replace tether cord on the engine cut-off switch.

Squeeze primer bulb several times until definite resistance is felt.

With twist grip in the slowest position, pull starter handle to start engine.

After engine has run at IDLE speed for 30 to 60 seconds, turn drain valves to the RUN position.



1. Drain valves in run position (rear)

009477

IMPORTANT: DO NOT run the outboard with the drain valves in the DRAIN position for more than 3 minutes. Engine damage can result.

Continue to run under normal operating conditions (boat on plane) for at least 30 minutes (2500 RPM or above).

IMPORTANT: You **MUST** run the outboard after the de-water procedure to dry out internal moisture.

Stop engine and run the winterizing procedure to supply extra oil to the cylinders. Refer to **Internal Engine Treatment** on p. 69.

Post-Submersion Servicing

When an outboard has been submersed, it **MUST** be serviced before storage.

If the outboard has been in salt water:

- Run the engine for approximately five minutes in fresh water at full operating temperature. Refer to **Engine Flushing** on p. 62.
- Spray the entire engine with fresh water to remove salt deposits.

After five submersions, the flywheel must be removed and the valley between the crankshaft and the stator windings must be cleaned.

Prolonged Submersion

Prolonged submersion, or submersion at depths beyond one meter may cause engine damage.

If prolonged submersion occurs, even if the engine can be started, the engine must be disassembled and cleaned.

DO NOT attempt to start the outboard if sand or silt may have entered the engine. Disassemble and clean.

Refer to **Submerged Engines** on p. 71.

Special Operating Conditions

Cold and Freezing Weather

Before operating in freezing temperatures, check gearcase lubricant. If water is found, test gearcase for leaks and replace lubricant. Refer to gearcase **Gearcase Leak Test** on p. 233.

To avoid engine damage, keep the gearcase submerged in the water at all times.

When removing engine from water, keep in an upright position until the cooling system is completely drained.

IMPORTANT: Water that leaks into gearcase or is left in the cooling system can freeze when the engine is removed from the water. This can cause serious damage.

High Altitude

Your outboard's EMM will automatically compensate for changes in altitude. However, if operated above 3000 ft. (900 m), a slight loss of power due to reduced air density will occur.

If your engine drops below the recommended RPM operating range at full throttle, install a lower pitch propeller.

When returned to operation at sea level, have install the original propeller and verify correct RPM operating range.

Sea Water

Fresh water flushing is recommended after use in salt, polluted or brackish water to prevent deposits from clogging the cooling passages. Refer to **Engine Flushing** on p. 62.

Check gearcase anodes for deterioration and replace, if necessary.

Shallow Water

Gearcase damage can occur if the gearcase is allowed to drag on the waterway bottom. Use caution when operating in shallow water.

IMPORTANT: Impact damage is NOT covered by the outboard warranty.

Under Tow

Should you require a tow from another boat:

- Shift your engine to NEUTRAL;
- Tilt its gearcase out of the water;
- Off-load all persons into another boat; and
- Keep speed slower than planing speed.

Weedy Water

Weeds can block the water intakes and cause engine to overheat. Weeds on the propeller will cause engine to vibrate.

Run at slow speeds and reverse engine frequently to clear weeds from propeller/impeller. Check water pump indicator often.

Routine Service

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Routine Service

Inspection and Maintenance Schedule

Inspection and Maintenance Schedule

Routine inspection and maintenance is necessary to prolong outboard life. The following chart provides guidelines for inspection and maintenance to be performed by an authorized Dealer.

IMPORTANT: Outboards used in rental, commercial, or other high hour applications require more frequent inspections and maintenance. Adjust schedule for operating and environmental conditions.

Description	Engine Care Product	Routine Inspection	Every 100 hours or annually	Every 300 hours or every 3 years (1)
Engine cut-off circuit and tether cord, check operation		✓		
Controls, steering and tilting; check operation		✓		
Engine mounting hardware, re-tighten		✓		
Fasteners, tighten any loosened components		✓		
Water intake screens, check condition		✓		
Cooling system; check water pump indicator		✓		
Anticorrosion anodes, check condition		✓		
Gearcase, check condition		✓		
Propeller, check condition		✓		
Fuel and oil systems, inspect and repair leaks (2)		✓		
Fuel filter, replace			✓	
Air silencer, check for debris			✓	
Lubricate throttle plate (4)			✓	
De-carbon engine – Required with heavy fuel use (5)			✓	
Spark plugs, inspect or replace (2)			✓	
Grease fittings, lubricate (3)	B			✓
Propeller shaft splines, inspect and lubricate (3)	B			✓
Access EMM information, resolve any service codes				✓
Electrical and ignition wires, inspect for wear or chafing				✓
Gearcase lubricant, replace	A			✓
Thermostat, inspect and check operation (2)				✓
Throttle cable, inspect and adjust				✓
Water pump, inspect / replace (more often if water pressure loss or overheating occurs)				✓

(1) Average recreational use. Commercial use, heavy use, or use in salt or polluted water requires more frequent inspection and maintenance.

(2) Emission-related component

(3) Annually in salt water applications

(4) Every 20 hours in salt water

(5) Required after each use of heavy fuel (diesel)

A *HPF Pro* Gearcase Lubricant

B *Triple-Guard* Grease

De-Carboning Procedure

⚠ DANGER

DO NOT run the engine indoors or without adequate ventilation or permit exhaust fumes to accumulate in confined areas. Engine exhaust contains carbon monoxide which, if inhaled, can cause serious brain damage or death.

⚠ WARNING

To prevent injury from contact with rotating propeller; remove the propeller before de-carbon procedure (MRL).

⚠ CAUTION

DO NOT run outboard without a water supply to the outboard's cooling system. Cooling system and/or powerhead damage could occur.

This procedure is required every 100 hours or annually for *MFE 30* outboards operated using heavy fuels, including JP5, JP8, Jet A, or kerosene.

If the outboard has been operated on an emergency fuel, such as diesel, the de-carbon procedure **MUST** be performed immediately after return from the mission.

IMPORTANT: Diesel is an emergency fuel **ONLY**. If diesel must be used, the fuel selector switch should be in the Heavy Fuel position.

For maximum benefit, the outboard should be run on unleaded gasoline during this procedure if possible.

Outboard should be on the boat and in the water. If outboard cannot be run in the water, make sure to supply adequate cooling water.

Remove air silencer.

Set the fuel selector switch to the gasoline position and run the outboard on gasoline during the de-carboning procedure.

Start and run outboard long enough to reach normal operating temperature.

Set engine speed to approximately 1500 RPM.

Spray the entire contents of a can of *Engine Tuner*, P/N 777185, into the throttle body. Do not let the engine stall until the can is empty.



1. Throttle body

007149

STOP engine and allow *Engine Tuner* to soak in powerhead for a minimum of 8 hours to 16 hours maximum.

⚠ CAUTION

DO NOT allow *Engine Tuner* to stay in powerhead for more than 16 hours. Extended exposure can damage internal engine parts.

Restart engine and run at 1500 RPM for 15 minutes.

Next, run outboard on boat, at high speed, for 30 to 60 minutes. Boat should be on plane and outboard should be running at least 2500 RPM.

If outboard will not run at high RPM, make sure that spark plugs are not fouled. Replace spark plugs if necessary. Refer to **Spark Plugs** on p. 66.

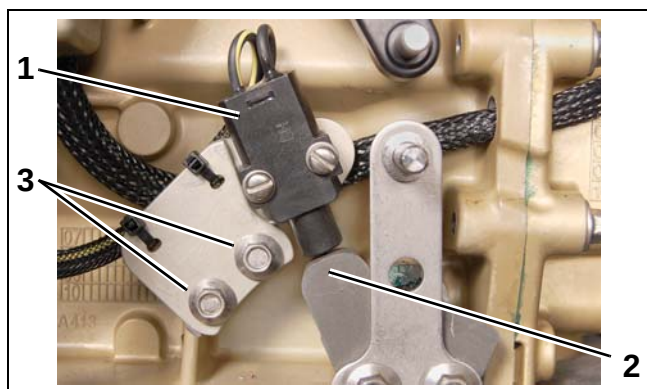
Adjustments

Neutral Switch Adjustment

Adjust neutral switch as follows:

Make sure neutral switch is centered on shift lever detent.

- Loosen two neutral switch bracket screws.
- Center the neutral switch on lobe of the shift lever detent.
- Hold neutral switch bracket in position and tighten screws to a torque of 35 to 60 in. lbs. (4 to 6.8 N·m).



1. Neutral switch
2. Lobe of shift lever detent
3. Neutral switch bracket screws

008462

Check Neutral Switch Operation

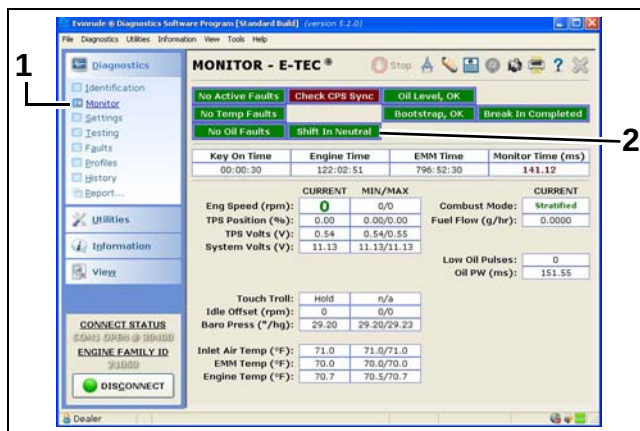
Use *Evinrude Diagnostics* software "Monitor" screen to confirm neutral switch operation.

Shift the engine from NEUTRAL to FORWARD gear. The Neutral/In Gear indicator must indicate "In Gear."

Shift the engine from FORWARD gear to NEUTRAL. The Neutral/In Gear indicator must indicate "Neutral."

Shift the engine from NEUTRAL to REVERSE gear. The Neutral/In Gear indicator must indicate "In Gear."

Shift the engine from REVERSE gear to NEUTRAL. The Neutral/In Gear indicator must indicate "Neutral."



1. Monitor screen
2. Neutral/In Gear indicator

008601

Readjust the neutral switch and confirm neutral switch operation if the Neutral/In Gear indicator does not match engine shift position.

Trim Tab Adjustment

WARNING

Improper trim tab adjustment can cause difficult steering and loss of control.

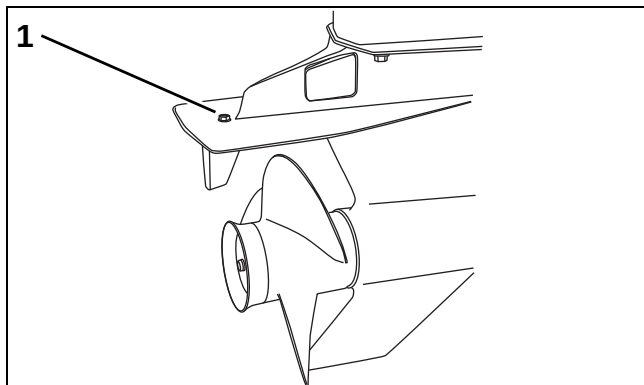
A propeller will generate steering torque when the propeller shaft is not running parallel to the water's surface. The trim tab is adjustable to compensate for this steering torque.

IMPORTANT: A single trim tab adjustment will relieve steering effort under only one set of speed, outboard angle and load conditions. No single adjustment can relieve steering effort under all conditions.

If the boat pulls to the left or right when its load is evenly distributed, adjust the trim tab as follows:

- With the remote control in NEUTRAL and the engine OFF, loosen the trim tab screw.
- If the boat pulled to the right, move rear of the trim tab slightly to the right.
- If the boat pulled to the left, move rear of the trim tab slightly to the left.

Tighten the trim tab screw to 60 to 80 in. lbs. (7 to 9 N·m).



1. Trim tab screw

007044

Test the boat and, if needed, repeat the procedure until steering effort is as equal as possible.

Outboards with High Transom Heights

The trim tab may be above the surface of the water when the outboard is trimmed out. Steering effort might increase. Lower the trim setting to submerge the trim tab and to reduce steering effort.

Cooling System

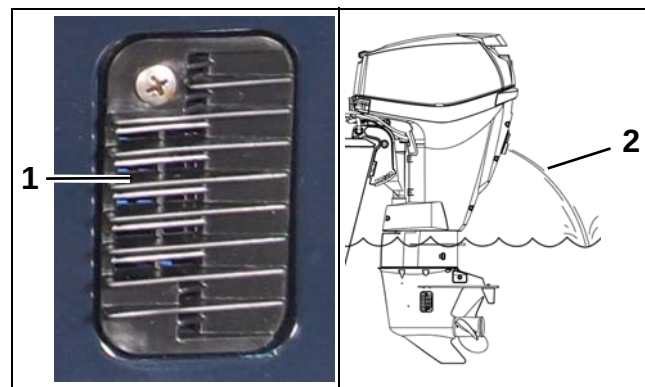
Check the condition of cooling system components regularly:

- water intake screens
- water pump
- all internal water passages
- thermostats
- all external water hoses and fittings
- vapor separator cooling passages and fittings
- *EMM* cooling passages and fittings
- overboard water pressure indicator.

Water Intake Screens

Inspect condition of water intake screens. Clean or replace as needed.

Confirm function of overboard water pressure indicator.



1. Water intake screen
2. Overboard indicator

007271
007016s

Engine Flushing

Flush the outboard with fresh water following each use in brackish, salt, or polluted water to minimize the accumulation of scale and silt deposits in cooling system passages.

The outboard can be flushed on the trailer or at dockside; running or not running.

IMPORTANT: The outboard must be located in a well ventilated area with appropriate ground drainage during the flushing procedures.

Keep water inlet pressure between 20 to 40 psi (140 to 275 kPa).

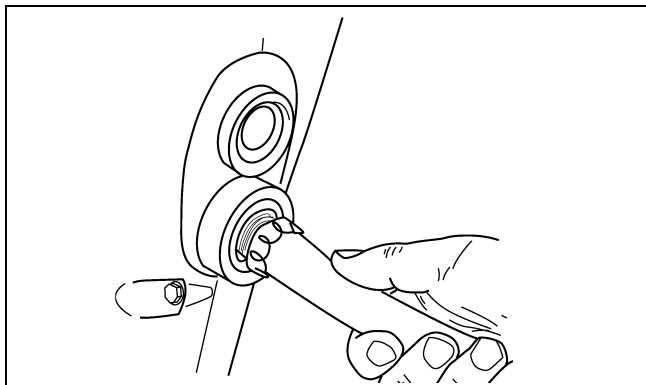
Flushing — Outboard Running

WARNING

To prevent injury from contact with rotating propeller, remove the propeller before flushing.

Place outboard in VERTICAL (DOWN) position in a well ventilated area.

Thread garden hose into flushing port.



002024

Turn water supply on.

Run outboard at IDLE only until full operating temperature is reached.

Leave the outboard in VERTICAL (DOWN) position long enough for the powerhead to drain completely.

Reinstall propeller.

Flushing — Outboard Not Running

Outboard can be in VERTICAL (DOWN) or TILTED (UP) position.

Thread garden hose into flushing port.

Turn water supply ON.

Flush outboard for at least five minutes.

Turn off water supply and remove garden hose.

Position outboard in VERTICAL position (DOWN) long enough to allow the powerhead to drain completely.

Running the Outboard Using a Hose and Flushing Adapter

⚠ WARNING

To prevent injury from contact with rotating propeller, remove the propeller before running engine with a flushing adapter.

A flushing adapter may be used to provide cooling water when running the outboard to:

- Flush the engine
- Run for an extended period of time, such as when performing diagnostic work
- Run the engine on a dynamometer
- Prepare the outboard for storage.

IMPORTANT: The outboard must be located in a well ventilated area with appropriate ground drainage.

Keep water inlet pressure between 20 to 40 psi (140 to 275 kPa).

Be sure water supply is sufficient to run the engine above idle speed.

Water Supply Requirements

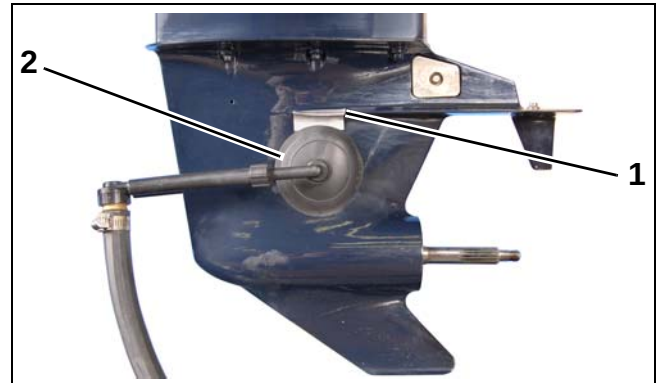
Model	Water Flow @ WOT
30 MFE	1.5 to 3 GPM ¹ (5 to 11 LPM ²)

1. GPM: Gallons per minute
2. LPM: Liters per minute

Install flushing adapter onto gearcase water inlet screens.

NOTICE

Temporarily cover the two small holes on each side of the gearcase with waterproof tape to make sure enough water travels to the powerhead. Water can drain from auxiliary inlets, resulting in engine overheat.



1. Water-proof tape
2. Flushing adapter

008355

A steady stream of water should flow from the overboard indicator while the engine is running.

Monitor engine water pressure gauge when:

- Engine speed is above 3000 RPM
- Running engine on a dynamometer.

Be sure to remove waterproof tape from auxiliary water inlets.

NOTICE

Engine will overheat if auxiliary water inlets are restricted when outboard is back in service.

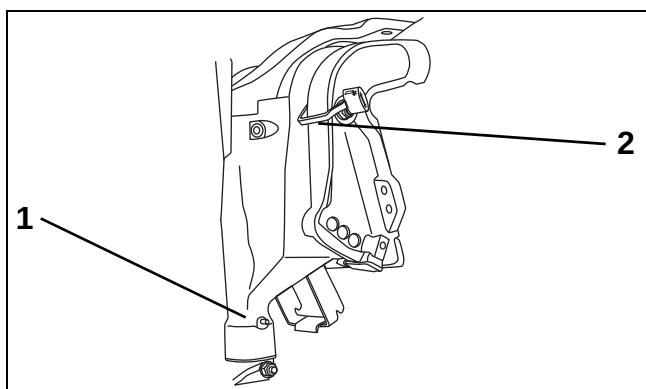
Lubrication

Swivel Bracket and Trailing Bracket

Lubricate the swivel bracket with *Triple-Guard* grease.

Apply grease until the grease begins to flow from the upper or lower swivel bracket areas.

Coat the pivot points of the trailing bracket with *Triple-Guard* grease.

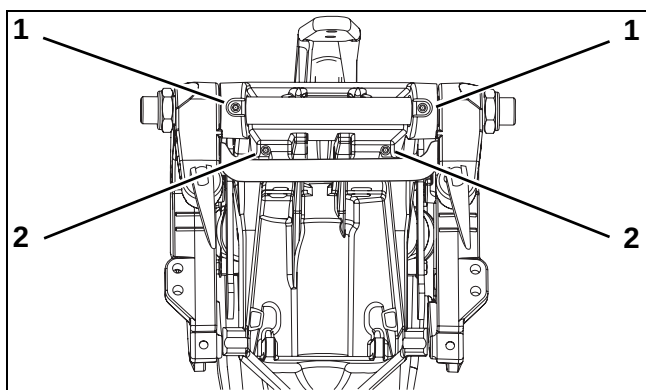


1. Grease fitting
2. Tilt support

007032

Tilt Tube

Lubricate the tilt tube grease fittings with *Triple-Guard* grease.



1. Tilt tube fittings
2. Swivel bracket fittings

007033

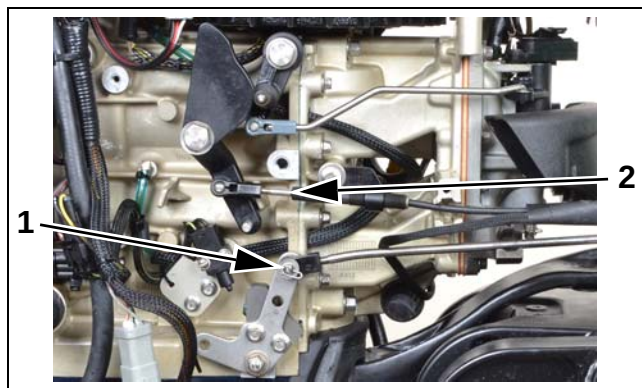
Throttle and Shift Linkage

Remove clip and washer from the shift lever pin. Remove shift lever rod from the pin.

Move the throttle twist grip into FULL THROTTLE position to fully extend the plastic casing guide.

Apply *Triple-Guard* grease to:

- Attachment pin of the shift lever
- Inner casing of the throttle cable



1. Attachment pin of the shift lever rod
2. Inner casing of throttle cable

008929A

Move the throttle twist grip to the slowest idle speed position.

Install shift lever rod on attachment pin. Install washer and clip the shift lever pin.

Check proper throttle and shift function.

Propeller Shaft

⚠ WARNING

When servicing the propeller, always shift the outboard to **NEUTRAL**, remove the tether cord from the engine cut-off switch, and disconnect the Crankshaft Position Sensor (CPS) to prevent the engine from starting accidentally.

Debris from the water can become lodged around propeller shaft. Frequent inspection can minimize potential gearcase damage.

Remove propeller. Refer to **Propeller Hardware Installation** on p. 232.

Inspect bushing and blade surfaces. Replace damaged or worn propellers.

Clean propeller shaft with shop towels. Inspect propeller shaft seals. Replace damaged or worn seals.

ENVIRONMENTAL NOTE

Dispose of old grease and contaminated shop towels in an environmentally responsible manner, or according to local regulations.

Apply *Triple-Guard* grease to entire length of propeller shaft prior to installing propeller.

Reinstall propeller hardware and propeller.

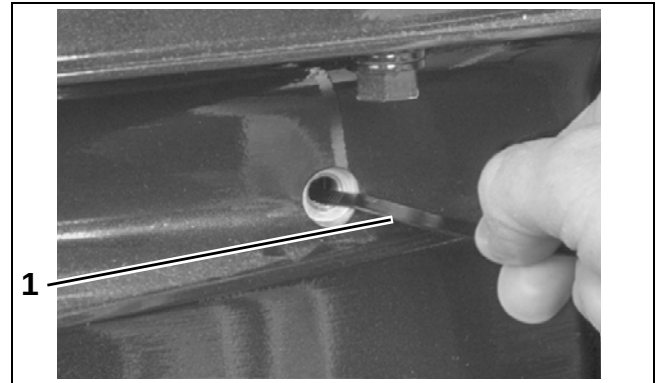
Gearcase Lubricant

Draining

⚠ WARNING

Gearcase lubricant may be under pressure and/or hot. If plug is removed from a recently operated outboard, take precautions to avoid injury.

IMPORTANT: Always check the fill level of the gearcase lubricant at the upper plug before removing the lower, drain/fill plug. A tie strap can be used to check lubricant level.



1. Tie strap

000072

If lubricant level is low, refer to **Gearcase Leak Test** on p. 233.

Remove the lubricant level plug, then the lubricant drain/fill plug, and drain the lube from the gearcase into a container.



1. Lubricant level plug

2. Lubricant drain/fill plug

007272

Inspection

Inspect the lube and the magnets on the plugs for metal chips. The presence of metal **fuzz** can indicate normal wear of the gears, bearings, or shafts within the gearcase. Metal **chips** can indicate extensive internal damage.

Inspect the lubricant for water contamination. Water can make the lubricant milky in appearance. However, normal aeration can also cause the same appearance.

To check for water contamination, put lubricant into a clear container. Allow the oil to settle for a minimum of one hour to determine if there is an abnormal amount of water in the oil.

Routine Service

Spark Plugs

If water is present, refer to **Gearcase Leak Test** on p. 233.

Overheated lubricant will have a black color and burned odor. Internal gearcase inspection is recommended when lubricant is contaminated or shows signs of failure.

ENVIRONMENTAL NOTE

Dispose of used oil in an environmentally responsible manner, or according to local regulations.

Filling

Refer to the **Inspection and Maintenance Schedule** on p. 58 for service frequency and recommended lubricants.

Secure the gearcase in a vertical position.

Remove the lubricant level plug and the lubricant drain/fill plug. Use Gearcase Filler, P/N 501882, to slowly fill the gearcase with *HPF PRO* lubricant through the drain/fill hole until it appears at the oil level hole.

IMPORTANT: Filling the gearcase too quickly can cause air pockets and the gearcase may not fill completely.

Clean plug seal area and install the lubricant level plug and **new** seal, then the lubricant drain/fill plug and **new** seal. Tighten plugs to a torque of 60 to 84 in. lbs. (7 to 9.5 N·m).



1. Lubricant level plug
2. Lubricant drain/fill plug

007270

IMPORTANT: The recommended gear lubricants are formulated for marine applications. Do not use automotive gear lubricants, engine oils, or any other oil or grease.

Spark Plugs

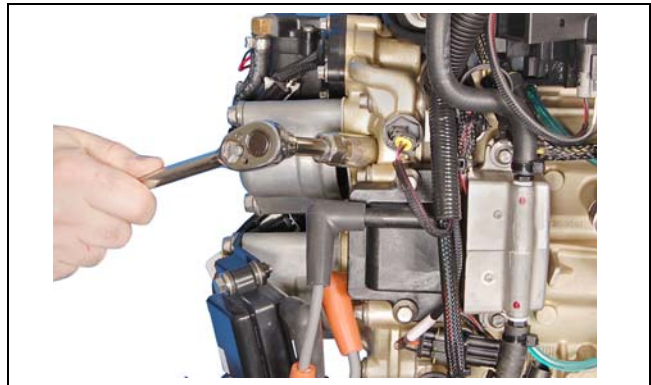
Spark plugs should be removed and examined periodically. Replace worn, fouled or damaged spark plugs.

Use only recommended spark plugs with the correct gap setting.

Spark Plug, *Champion*

QC10WEP @ 0.028 ± 0.003 in. (0.71 mm)

- Remove spark plugs and inspect condition.
- Set spark plug gap on new, replacement spark plugs.
- Mark spark plugs for ground electrode orientation.
- Apply *Electrical Grease* to the ribbed portion of the spark plug ceramic and to the opening of the spark plug cover to prevent corrosion.
- Install spark plugs using “indexing” procedure.



007275

Indexing

Spark plug indexing positions the ground electrode of the spark plug opposite the fuel injector nozzle.

Put an ink mark on the ceramic of the spark plug in line with the OPEN side of the ground electrode. This mark will be used to orient the spark

plug with the OPEN side of the ground electrode facing the fuel injector.

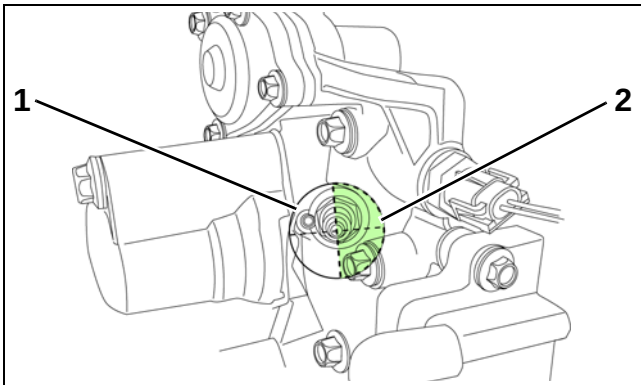


1. Ink mark
2. Open side

000758

Apply *Triple-Guard* grease to the gasket surface of the spark plug. Install spark plug and tighten to a torque of 15 ft. lbs. (20 N·m).

If the mark is in unshaded area do not tighten any more.



Spark Plug Indexing Diagram

007437

1. Unshaded area
2. Shaded area

If the mark is in the shaded area, reset torque wrench to 30 ft. lbs. (41 N·m) and continue to turn until the mark is in the unshaded area.

If the mark does not reach the unshaded area before the torque of 30 ft. lbs. (41 N·m) is reached, the spark plug cannot be indexed for that cylinder. Try another spark plug and repeat the steps above.

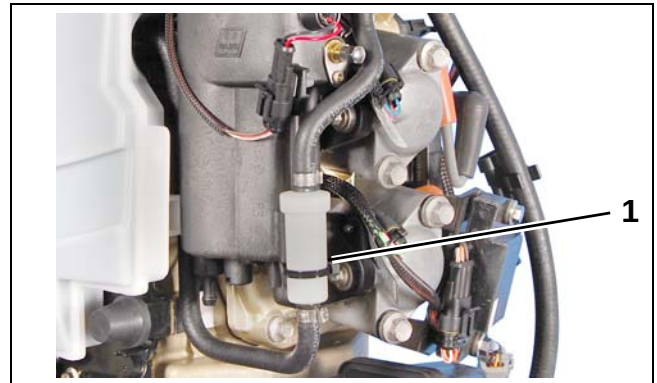
Fuel and Oil Systems

Routine replacement of filters reduces the possibility of foreign material restricting the incoming fuel or oil supplies.

Replacement filter elements are available through *Evinrude Genuine Parts*.

Fuel Filter

Evinrude MFE 30 HP outboards are equipped with an in-line fuel filter. Refer to **Fuel Component Servicing** on p. 140.



1. In-line fuel filter

007273

Oil Filters and Oil Reservoir

Perform visual inspections to identify oiling system leaks. Make certain the oil tank is filled and oil supply is not contaminated.

Air Silencer

The air silencer maximizes air flow while minimizing noise.



007274

Routine cleaning of the air silencer is recommended to remove any accumulation of debris.

Hoses and Connections

WARNING

Failure to check for fuel leakage could allow a leak to go undetected, resulting in fire or explosion.

Check condition of all hoses and connections in both the fuel and oil systems:

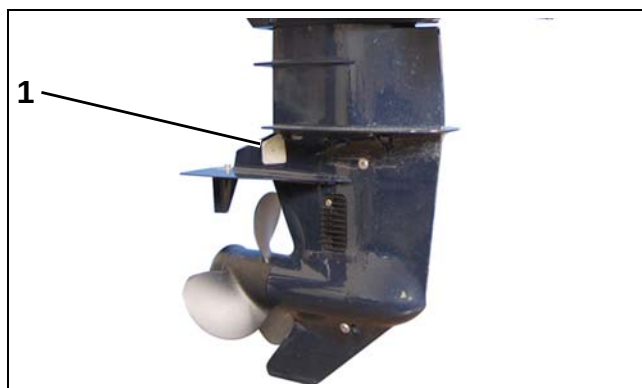
- Visually inspect all components.
- Observe all clamps, hoses, and connections while outboard is running.
- Replace all damaged components.
- Repair all leaks.

Anti-Corrosion Protection

Sacrificial Anodes

Galvanic corrosion occurs in fresh or salt water. Salt, brackish, and polluted water can accelerate corrosion. “Sacrificial” anodes are intended to protect the underwater metal components of the outboard from galvanic corrosion.

Manual tilt outboards are equipped with one sacrificial anode.



1. Stern bracket anode (Power tilt models only)
2. Gearcase housing anode

007436M

Visually inspect anodes and metal components below water level. Erosion of anodes is normal and indicates the anodes are functioning properly.

IMPORTANT: Anodes that are not eroding may not be properly grounded. Anodes and the mounting screws must be clean and tight for effective corrosion protection.

For best anode performance:

- Replace all anodes that have eroded or disintegrated to two-thirds of their original size
- Do not paint or apply protective coatings to anodes or anode fasteners
- Avoid using metal-based antifouling paint on the boat or outboard.

Testing Procedure – Continuity

Connect ohmmeter leads between engine ground and anode surface.



1. Meter lead to anode

007268

The meter should show little or no resistance. If resistance is high, check the following:

- Remove the anode and clean the area where the anode is installed
- Clean the mounting screws
- Install the anode and test again.

Metallic Component Protection

Protect metal components on outboards from corrosion. Use the following products to minimize corrosion:

- *Anti-Corrosion Spray* provides a heavy, waxy coating to protect components
- *“6 in 1” Multi-Purpose Lubricant* provides a thin film of anti-corrosion protection.

Storage

IMPORTANT: DO NOT start outboard without a water supply to the outboard's cooling system. Cooling system and/or powerhead damage could occur.

Fuel System Treatment

Stabilize the boat's fuel supply with *Evinrude 2+4 Fuel Conditioner* following the instructions on the container.

Internal Engine Treatment

Remove the propeller, attach garden hose to flushing port and turn on water.

Evinrude E-TEC models are designed to be self-winterizing using either of the following methods:

IMPORTANT: Engine MUST be in NEUTRAL throughout these procedures.

Throttle Control Method

- Fully advance throttle control and then start the outboard. The outboard will run at idle speed.
- After approximately 15 seconds, move throttle to IDLE position.
- Wait another 15 seconds. At this point, advance throttle to FULL (in neutral). *EMM* LEDs will flash, indicating that outboard is in winterize mode.
- Outboard will automatically go to fast idle and fog itself. Allow outboard to run until it shuts itself off (about one to two minutes).

IMPORTANT: If *EMM* LEDs do not flash, or outboard runs above fast idle, immediately turn off outboard and start the procedure again.

Routine Service

Storage

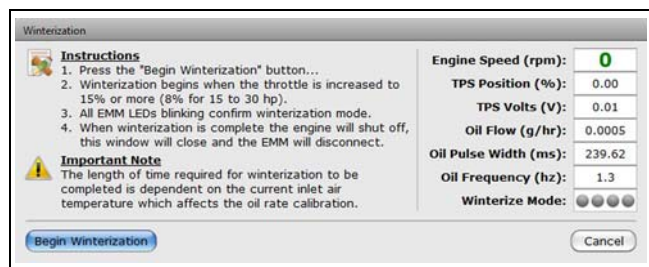
Software Control Method

Winterization can also be run using *Evinrude Diagnostics* software. With the outboard running, start the process at the *Settings/Adjustments* screen and follow the instructions.



1. Winterization start button

008564



008565

Additional Recommendations

- Fill oil reservoir.
- Inspect the fuel filter. If there is debris in the fuel filter, it must be replaced.
- Replace gearcase lubricant.
- Remove and inspect propeller.
- Clean and grease propeller shaft.
- Blow water from gearcase speedometer pickup system (gearcase speedometer models only).
- Lubricate all grease fittings and linkages.
- Inspect outboard, steering system, and controls. Replace all damaged and worn components. Refer to manufacturer's and lubrication recommendations.
- Touch up painted surfaces as needed. Coat outer painted surfaces with automotive wax.
- Store outboard in upright (vertical) position.
- Check for fuel leakage.

⚠ WARNING

Failure to check for fuel leakage could allow a leak to go undetected, resulting in fire or explosion.

After the outboard shuts itself off, remove the tether cord from the engine cut-off switch, then detach garden hose.

IMPORTANT: When finished, leave the outboard in vertical position long enough to completely drain the powerhead.

Pre-Season Service Submerged Engines

If the outboard was removed from the boat for storage, make sure it is reinstalled with factory specified hardware. Refer to the **Predelivery and Installation Guide**.

Outboard Mounting Bolts

- Check and re-tighten outboard mounting bolts to a torque of 40 ft. lbs. (54 N·m).

Gearcase Lubricant

- Check the lubricant level.
- Inspect gearcase for leaks. If leak is apparent, pressure and vacuum test gearcase.
- Repair gearcase as needed.

Operational Checks

- Refer to **Operational Checks** on p. 43
- Steering system
- Remote controls
- All other accessories and instrumentation

Check Oil Injection Tank

- Inspect the oil tank for leaks.

Check Fuel System

⚠ WARNING

Failure to check for fuel leakage could allow a leak to go undetected, resulting in fire or explosion.

- Inspect entire fuel system for leaks before starting outboard.
- Repair all leaks.

Water Pump

- Make sure a steady stream of water flows from overboard indicator.

Once an outboard has been submerged in fresh or salt water, it must be serviced within three (3) hours of recovery. Immediate service can minimize the corrosive affect that air has on the polished surfaces of the crankshaft, connecting rods, and internal powerhead bearings.

IMPORTANT: If outboard cannot be started or serviced immediately, it should be resubmerged in fresh water to avoid exposure to the atmosphere.

Engine Dropped Overboard (Not Running)

Rinse powerhead with clean water.

Remove spark plug leads and spark plugs.

Place outboard in horizontal position (cylinder heads down). Slowly rotate flywheel in a clockwise rotation to work all water out of powerhead.

IMPORTANT: If sand or silt may have entered the outboard, DO NOT attempt to start it. Disassemble and clean.

Disassemble all electrical connectors. Clean connectors and terminals, and treat with water displacing electrical spray. Apply *Electrical Grease* to terminals prior to reassembly. Coat all exposed solenoid terminals and engine grounds with *Black Neoprene Dip*.

Clean and inspect all electrical components. Replace damaged or corroded components prior to returning the outboard to service. Electric starters should be disassembled, cleaned, flushed with clean water, and treated with water displacing electrical spray prior to reassembly.

Disconnect fuel supply hose from outboard. Drain and clean all fuel hoses, filters, and fuel tanks.

Disconnect oil supply hose and oil return hose from outboard. Drain and clean all oil hoses, filters, and oil tank assemblies.

Routine Service

Submerged Engines

Refill fuel tank with fresh fuel and oil tank with recommended oil.

Prime oil system and fuel system. Refer to **Fuel System Priming** on p. 135 and **Oil Supply Priming** on p. 159. Make sure all oil injection hoses are clean and filled with oil.

Make sure high pressure fuel system does not contain water. Flush as needed.

Inject a small amount of outboard lubricant into spark plug holes and install new spark plugs. Refer to Spark Plug **Indexing** on p. 66.

Reinstall all removed or disconnected parts.

Use *Evinrude Diagnostics* software to:

- Initiate Break-in
- Check fuel pump operation
- Check injector operation (fuel and oil)
- Check timing (once outboard is running at full operating temperature)

Run outboard below 1500 RPM for one-half hour.

Engine Dropped Overboard (Running)

Follow the same procedures as **Engine Dropped Overboard (Not Running)**. However, if there is any binding when the flywheel is rotated, it may indicate a bent connecting rod and no attempt should be made to start the outboard. Powerhead must be disassembled and serviced immediately.

Engine Dropped Overboard (In Salt Water)

Follow the same procedures used for **Engine Dropped Overboard (Not Running)** and **Engine Dropped Overboard (Running)**. Disassemble and clean outboards that have been submerged in salt water for prolonged periods of time. Clean or replace electrical components as necessary.

Prolonged Submersion (Fresh or Salt Water)

Outboards that have been dropped overboard and not recovered immediately, must be serviced within three hours of recovery. Follow the same procedures used for **Engine Dropped Overboard (Not Running)** and **Engine Dropped Overboard (Running)**.

Engine Cover Service

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 Lower Cover Installation 76

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 Carry Strap Service 79

Upper Cover Service

Latch Hook Installation

Rear

Insert threaded bracket into pocket.



1. Bracket

007304

Apply *Ultra-Lock* to screw threads. Place latch into position with roller toward the front. Tighten screws securely.



1. Screws

007305

Front

Insert bracket into pocket.



1. Bracket

007306

Apply *Ultra-Lock* to screw threads. Place hook into position with opening toward the back. Tighten screws securely.



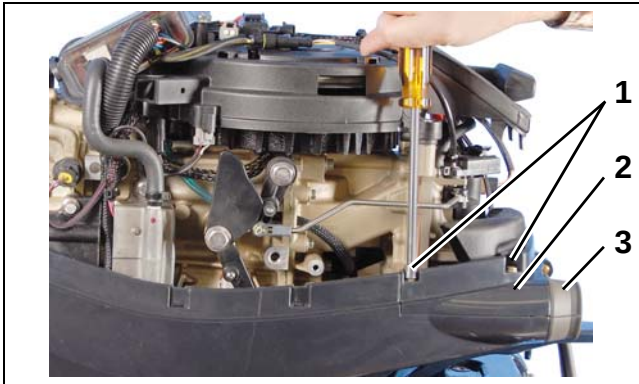
1. Screws

007307

Lower Cover Service

Lower Cover Removal

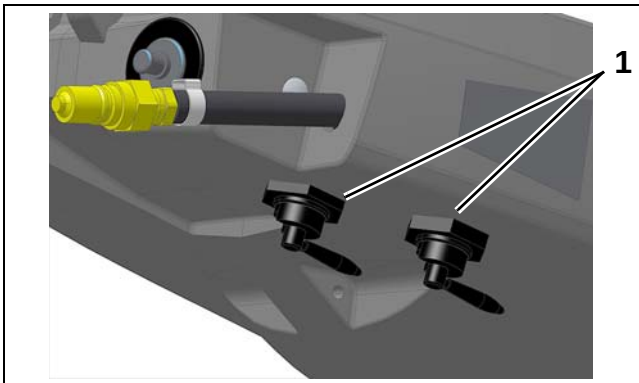
Remove cable entry cover screws, cover and cable entry grommets.



1. Cable entry cover screws
2. Cable entry cover
3. Cable entry grommets

007308

Remove nuts and washers from de-water valves.

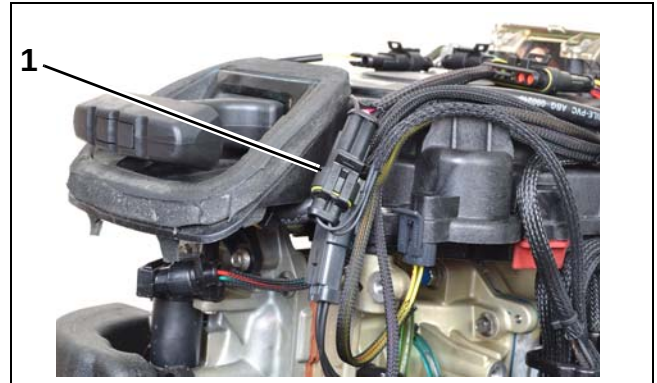


1. Washers and nuts

009475

Remove three tie straps from fuel selector switch harness and electrical connector

Disconnect fuel selector switch electrical connector.



1. Fuel selector switch electrical connector

008933

Remove nine lower engine cover screws.



1. Lower cover screws

007309

Remove port lower engine cover.

Remove *Oetiker* clamp from fuel hose.

Remove fuel hose from fuel connector.

Remove de-water valves from cover.

Remove starboard lower engine cover.

Engine Cover Service

Lower Cover Service

Lower Cover Installation

Installation of lower motor covers will be easier if the following steps are performed in order:

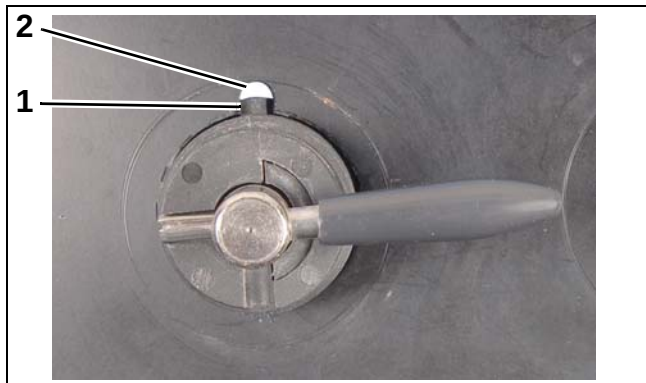
- If removed, install air silencer on throttle body.
- Place port cover into position on outboard.
- Place de-water valves into mounting holes.



1. De-water valves

008934

- Align tab of de-water valve with alignment notch as shown.

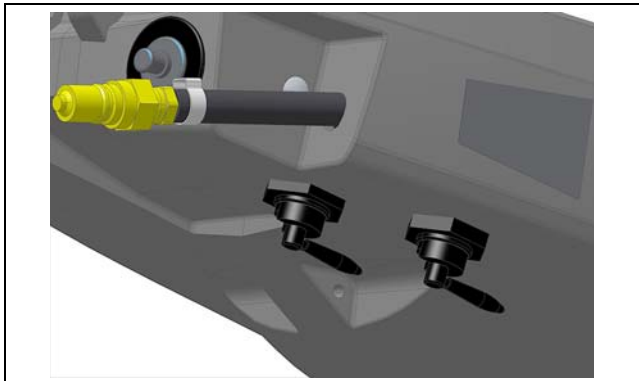


1. Tab
2. Alignment notch

008177

- Install washers and nuts. Tighten to a torque of 25 to 40 in. lbs. (3 to 4.5 N·m). Lever should

point to the rear of the outboard when the valve is closed.



008932

- Install fuel hose on fuel connector fitting. Secure with new *Oetiker* clamp.
- Place starboard side cover into position on outboard.

Start the screw below the exhaust relief grommet first. Tighten just enough to hold the exhaust relief grommet in place.



1. Start this screw first
2. Exhaust relief grommet

007311

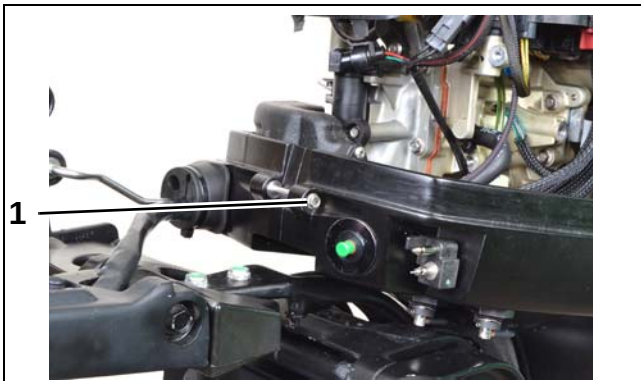
Start the bottom front screw next to draw cover halves together.



1. Start this screw second

007312

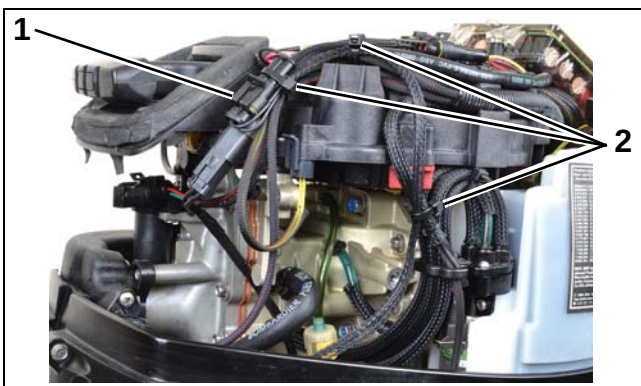
Install the front latch sleeve and start the top front screw next to draw cover halves together.



1. Start this screw third

008935

Connect fuel selector switch electrical connector. Secure wiring with three tie straps as shown.



1. Fuel selector switch electrical connector
2. Tie straps

008936

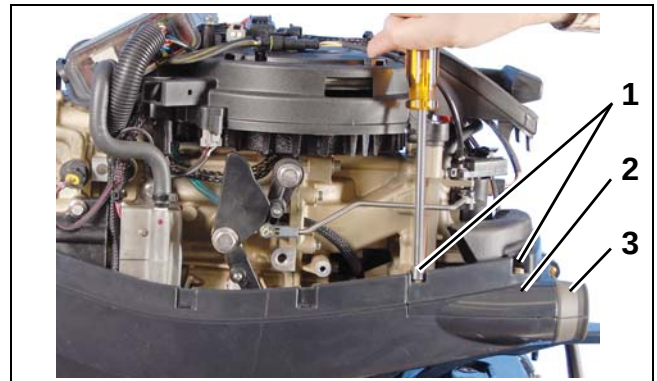
Install remaining cover screws and tighten nine screws to 24 to 36 in. lbs. (3 to 4 N·m).



1. Lower cover screws

007309

Install cable entry cover grommets, cable entry cover and cable entry cover screws. Tighten screws to 24 to 36 in. lbs. (3 to 4 N·m).



1. Cable entry cover screws
2. Cable entry cover
3. Cable entry grommets

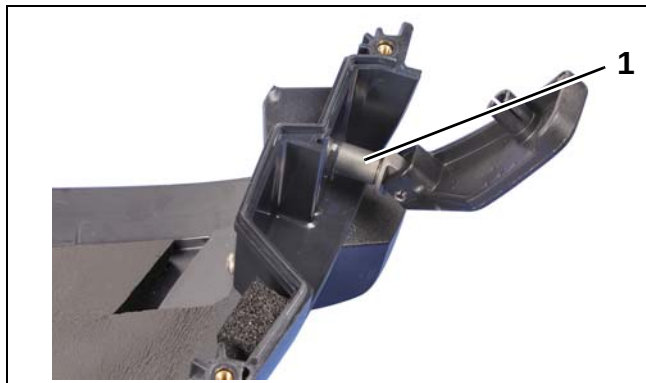
007308

Engine Cover Service

Lower Cover Service

Latch Handle Installation

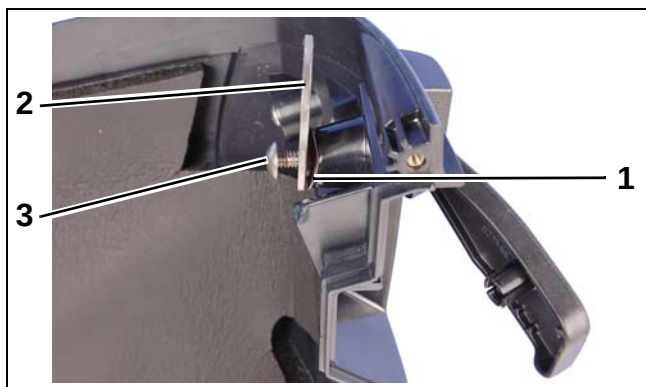
Apply a light coat of *Triple-Guard* grease to latch handle shaft. Insert handle into lower cover.



1. Triple-Guard grease

007314

Apply *Ultra-Lock* to screw threads. Place spring washer and hook into position and tighten screw to a torque of 180 in. lbs. (20 N·m).

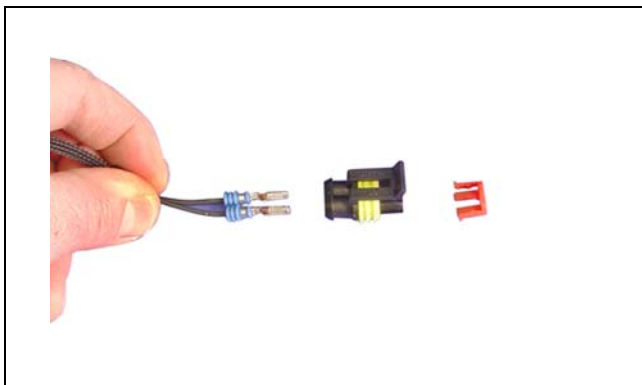


1. Spring washer
2. Hook
3. Screw

007315

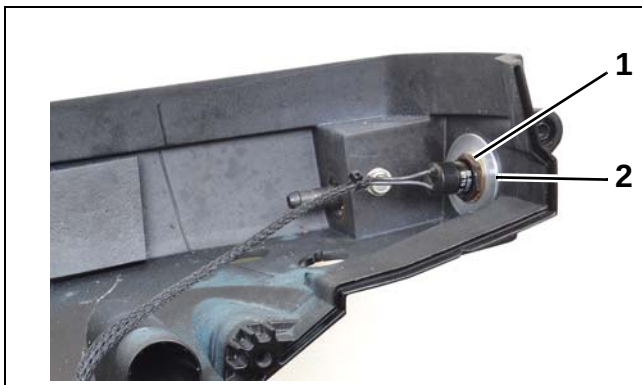
Fuel Selector Switch

Remove electrical connector from fuel selector switch. Refer to **AMP Connectors** on p. 132.



006472

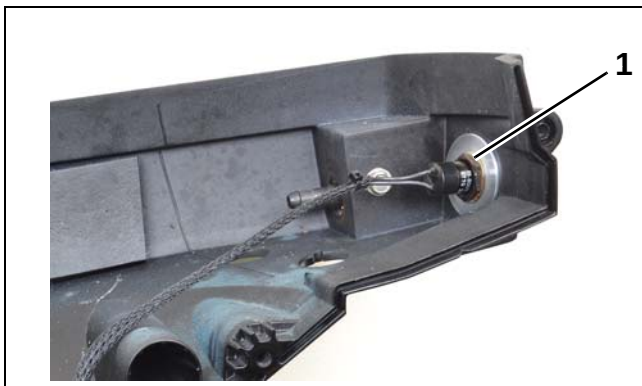
Remove nut and spacer, then remove switch from cover.



1. Fuel selector switch

008937

Installation is the opposite of removal. Tighten nut to a torque of 10 to 16 in. lbs. (1 to 2 N·m).



1. Nut

008937

De-Water Valve Service

Install drain valve hoses on reed plate and secure with tie straps.



1. Drain valve hoses

008938

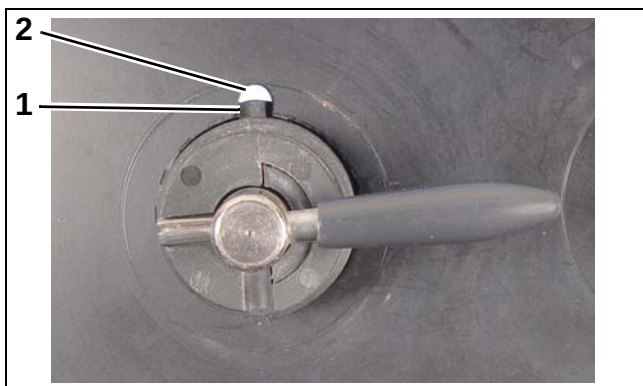
Place de-water valves into mounting holes.



1. De-water valves

008934

Align tab of de-water valve with alignment notch as shown.

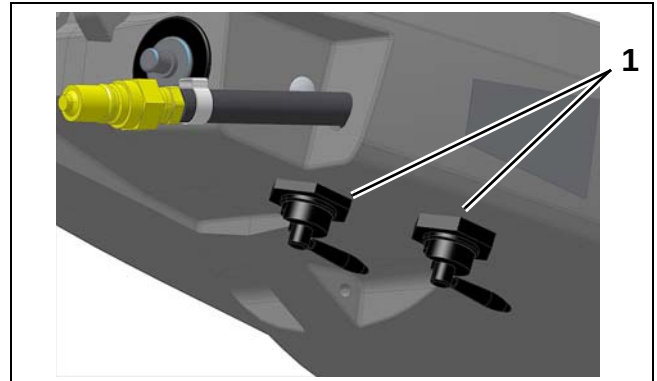


1. Tab
2. Alignment notch

008177

Install washers and nuts on de-water valves. Tighten to a torque of 25 to 40 in. lbs.

(3 to 4.5 N·m). Lever should point to the rear of the outboard when the valve is closed.



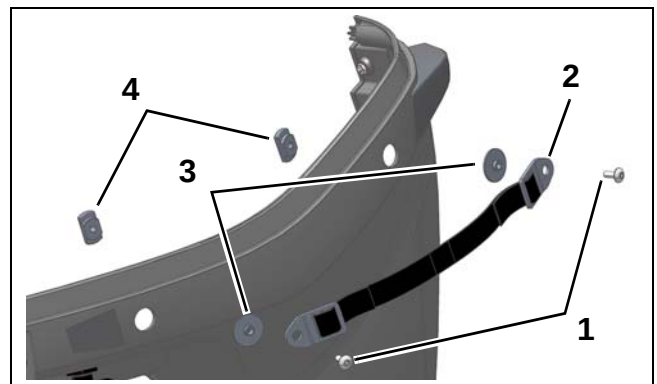
1. Washers and nuts

009475

Carry Strap Service

Use a *Torx* driver to remove the two screws from the carry strap assembly. Then remove the carry strap and two washers.

Remove the anchors from the inside of the lower cover.



1. Screws
2. Carry strap
3. Washers
4. Anchors

009474

Installation is the opposite of removal. Apply *Ultra Lock* to the threads of the screws. Install the screws and tighten to a torque of 60 to 84 In. Lbs. (7 to 10 N·m).

Technician's Notes

[illegible]

Bulletins	
Instruction Sheets	
Other	

Engine Management Module (*EMM*)

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Engine Management Module (EMM)

Description

Description

The Engine Management Module (EMM) is a water-cooled engine controller. It controls many outboard systems including alternator output for the 55 V circuits. Operating voltage is supplied to the *EMM* by the stator.

This section discusses the functions of the *EMM* and its various internal and external sensors. It also describes using *Evinrude Diagnostics* software to retrieve and adjust service information saved in the *EMM*.

EMM Functions

The *EMM* controls the following processes and functions:

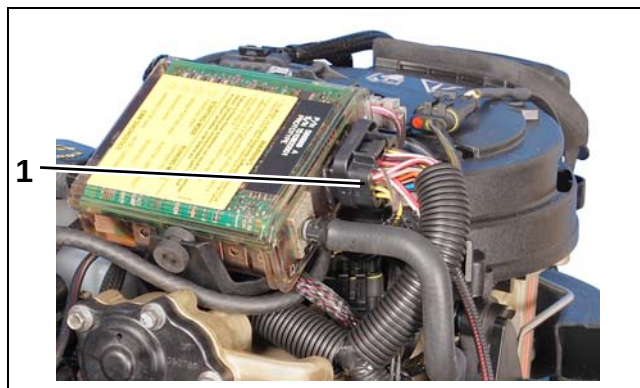
- Alternator output; 55 V
- Fuel and ignition timing and duration
- Fuel injector activation
- Oil injector pump activation
- Electric fuel pump control
- Idle speed control
- RPM limiter
- Electrical circuit monitoring
- Service code creation and storage
- Warning system activation
- ROM verification, self-test
- Choke-less cold starting
- Output of diagnostic data
- Tachometer signal
- RPM profile and engine hours
- Oiling ratios

EMM Connections

IMPORTANT: *EMM* connections and wiring must be clean and tight. Improper electrical connections can damage the *EMM*. DO NOT run the outboard with loose or disconnected wiring.

Make sure *EMM* connections are clean and tight.

- Engine wire harness to *EMM* connector; J1-A
- Stator to *EMM* connection; one 4-pin AMP connector.



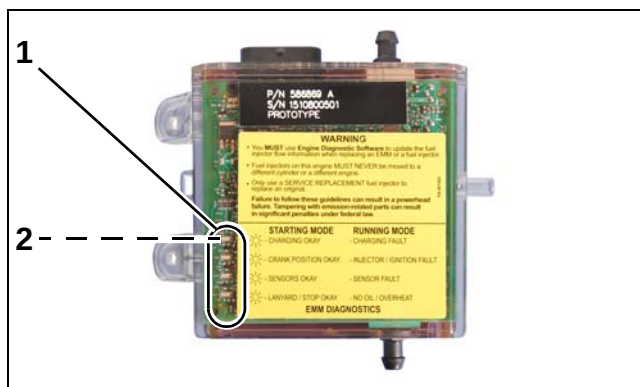
1. J1-A connector

007353

LED Indicators

The *EMM* has four LED indicators located on top of the circuit board that provide useful information about the status of the system.

IMPORTANT: LED 1 is toward the center of the outboard (closest to *EMM* J1-A connector).



1. LED indicators

2. LED 1

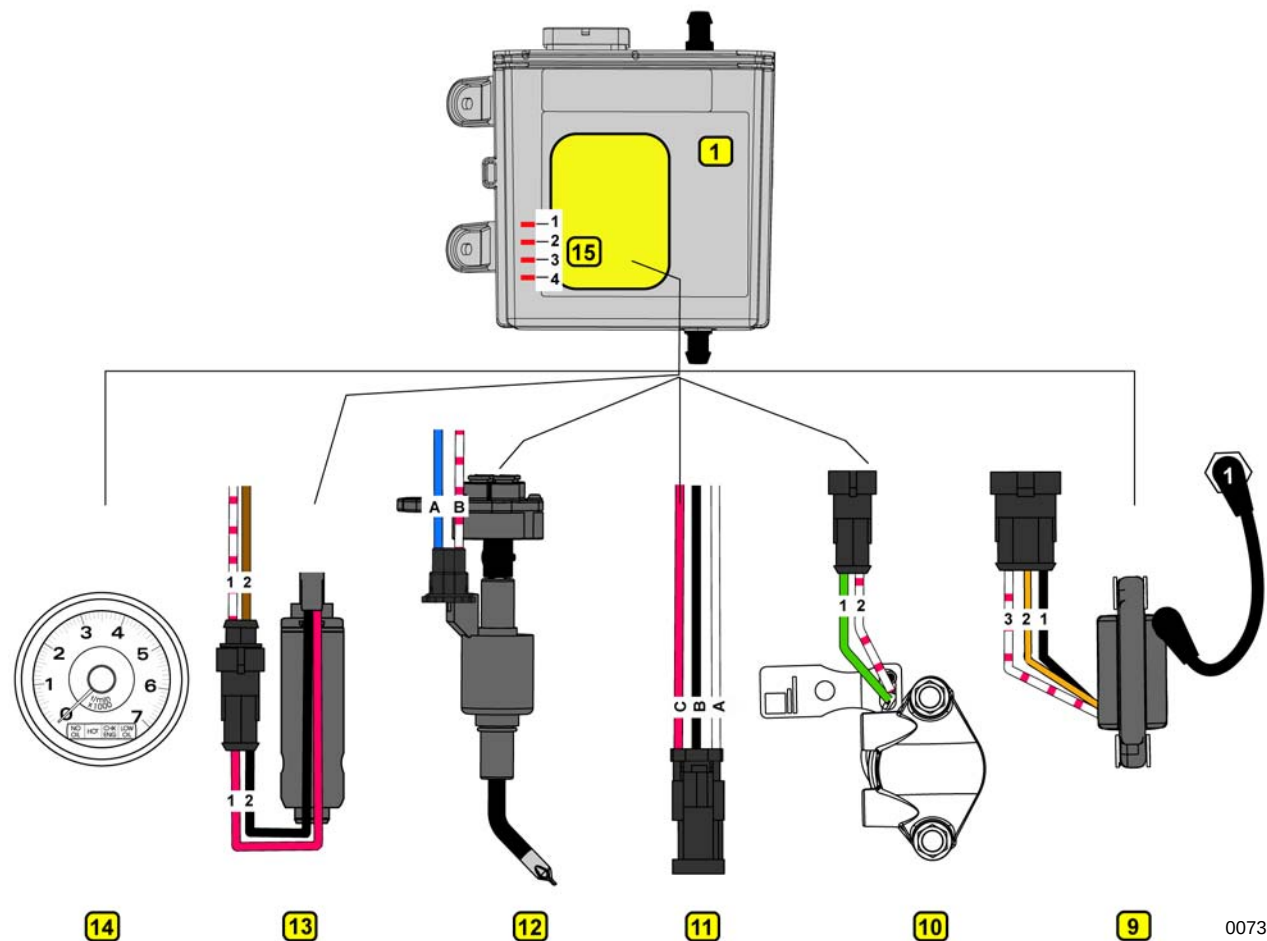
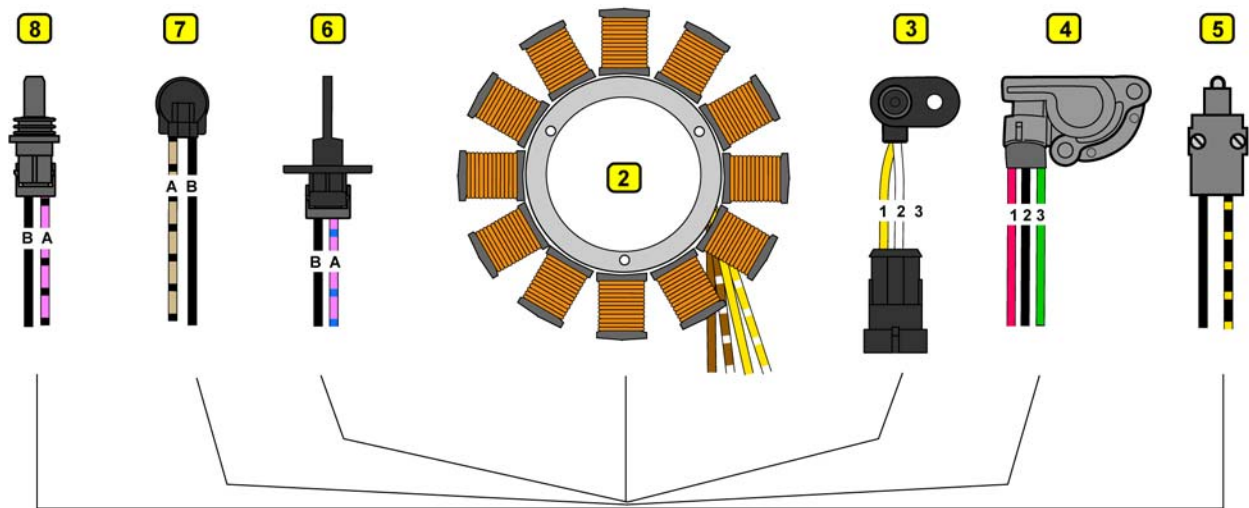
007382

When the ignition key is turned ON, LEDs 3 and 4 should light, indicating that sensor circuits and the stop circuit are working.

As the outboard is being started, all four LEDs should light and then go off in sequence. If any of the LEDs does NOT light during starting, refer to **EMM LED Indicators** on p. 101.

When the outboard is running, all LEDs should be off. If any LED is lighted while the outboard is running, refer to **EMM LED Indicators** on p. 101.

EMM Inputs and Outputs Diagram



1. Engine Management Module (EMM)
2. Stator
3. Crankshaft Position Sensor (CPS)
4. Throttle Position Sensor (TPS)
5. Neutral Switch

6. Air Temperature Sensor (AT)
7. Oil Level Switch
8. Engine Temperature Sensor
9. Ignition Coil
10. Fuel Injector

11. Diagnostic Connector
12. Oil Injection Pump and Manifold
13. Fuel Pump (high pressure)
14. Tachometer
15. LED Indicators

007383M

Internal Sensors

Sensor inputs and internal *EMM* controllers are used to control outboard operation. Use *Evinrude Diagnostics* software to troubleshoot the sensors. Refer to the **EMM Service Code Chart** at the back of this manual for a complete list of all engine fault codes.

Internal sensors are NOT serviceable. Reprogramming or replacement may be required to resolve internal *EMM* issues.

EMM Temperature Sensor

Monitors the temperature of the fuel injector driver circuits.

If the *EMM* temperature exceeds 194°F (90°C) or the circuit fails, the *EMM*:

Activates A.M.A.
Stores service code 25
EMM LED 4: ON (Running)

If *EMM* temperature exceeds 212°F (100°C) or the circuit fails, the *EMM*:

Activates S.A.F.E.
Stores service code 29
EMM LED 4: FLASHING

If *EMM* temperature is less than -22°F (-30°C) or the circuit fails, the *EMM*:

Stores service code 24
EMM LED 3: OFF (Cranking)
EMM LED 3: ON (Running)

If sensor reads less than -71°F (-57.4°C) or greater than 313°F (156°C), a sensor circuit fault is detected and the *EMM*:

Stores service code 23
EMM LED 3: OFF (Cranking)
EMM LED 3: ON (Running)

55 V Circuit Sensor

Monitors the *EMM*'s 55 V alternator circuit.

If system voltage exceeds 57 volts, the *EMM*:

Activates S.A.F.E.
Stores service code 18
EMM LED 1: ON (Running)

If system voltage is less than 45 V, the *EMM*:

Activates S.A.F.E.
Stores service code 17
EMM LED 1: ON (Running)

5 V Circuit Sensor

Monitors the *EMM*'s 5 V sensor circuit.

If sensor voltage is less than 4.75 volts, the *EMM*:

Stores service code 78
<i>EMM</i> LED 3: OFF (Cranking)
<i>EMM</i> LED 3: ON (Running)

Barometric Pressure Sensor

Supplies the *EMM* with barometric pressure reading to compensate for changes in altitude and air density.

If the BP sensor reads less than 13 KPa or greater than 119.0 KPa, or the sensor or circuit fails, the *EMM*:

Stores service code 44

If the BP sensor reads less than 70 KPa, the *EMM*:

Stores a service code 45

If the BP sensor reads greater than 105 KPa, the *EMM*:

Stores service code 46

External Sensors

Sensor inputs and internal *EMM* controllers are used to control outboard operation. Use *Evinrude Diagnostics* software to troubleshoot the sensors. Refer to the ***EMM* Service Code Chart** at the back of this manual for a complete list of all engine fault codes.

The *EMM* provides a 5 V DC signal for sensor circuits. It monitors all sensor voltage inputs and compares them to predetermined acceptable ranges. Inputs that fall outside of the acceptable range create service codes.

Air Temperature Sensor

The air temperature sensor monitors the air temperature at the throttle body.

If the AT sensor voltage is out of the expected range, or the sensor or circuit fails, the *EMM*:

Stores service code 47, 48, or 49
<i>EMM</i> LED 3: OFF (Cranking)
<i>EMM</i> LED 3: ON (Running)

Engine Management Module (EMM)

External Sensors

Engine Temperature Sensor

Monitors cylinder head temperature.

If cylinder head temperature exceeds 212° F (100° C) below 3500 RPM, the *EMM*:

Activates <i>S.A.F.E.</i>
Stores service code 40
<i>EMM</i> LED 4: ON (Running)

If cylinder head temperature exceeds 194° F (90° C) above 3500 RPM, the *EMM*:

Activates <i>S.A.F.E.</i>
Stores service code 43
<i>EMM</i> LED 4: ON (Running)

If cylinder head temperature exceeds 248°F (120°C), the *EMM*:

Activates <i>S.A.F.E.</i>
Stores service code 31
<i>EMM</i> LED 4: FLASHING

If sensor values are less than -15°F (-26.1°C) or greater than 332°F (166.5°C), the *EMM*:

Stores service code 41
<i>EMM</i> LED 3: OFF (Cranking)
<i>EMM</i> LED 3: ON (Running)

If sensor values are below -4°F (-20°C), the *EMM*:

Stores service code 42
<i>EMM</i> LED 3: OFF (Cranking)
<i>EMM</i> LED 3: ON (Running)

If cylinder head does not reach operating temperature (104°F / 40°C below 2300 RPM) in 10 minutes, the *EMM*:

Stores service code 58
<i>EMM</i> LED 3: OFF (Cranking)
<i>EMM</i> LED 3: ON (Running)

Low Oil Switch

The low oil switch monitors the oil level in the oil tank.

If the oil level falls below one-quarter capacity, the *EMM* begins counting oil pump pulse cycles. When it reaches 1000 pulses, the *EMM* signals:

Engine Monitor LOW OIL display: ON

After LOW OIL is displayed, the *EMM* counts oil pump pulse cycles again. When it reaches 6700 pulses, the *EMM*:

Activates A.M.A.
Stores service code 117
<i>EMM</i> LED 4: ON (Running)
Engine Monitor LOW OIL display: ON

To recover from A.M.A. mode:

- Oil level must be above one-quarter
- The warning resets after three oil pump pulse cycles when the outboard has been stopped and restarted.

If outboard has been run for more than 3 hours with NO OIL faults (codes 34 & 117), the *EMM*

Activates <i>S.A.F.E.</i>
Stores service code 33
<i>EMM</i> LED 4: FLASHING
Engine Monitor LOW OIL display: FLASHING

If the *EMM* detects the low oil sensor circuit is open, the *EMM*:

Activates <i>S.A.F.E.</i>
Stores service code 120
<i>EMM</i> LED 4: ON (Running)

Throttle Position Sensor

The throttle position sensor receives a voltage signal from the *EMM*. As the throttle lever is rotated, the *EMM* receives a return voltage signal through a second wire. This signal increases as the TPS lever is advanced. A third wire provides a ground circuit back to the *EMM*.

If TPS voltage is greater than 1.71 volts when the key is turned to ON, or the recoil starter is pulled, the *EMM*:

Creates service code 11

If the outboard starts, the code is saved.

If code 11 is present as both a Active Fault and a Occurred Fault, refer to **Throttle Cable Installation and Adjustment** on p. 226.

If the TPS or TPS circuit fails (below 0.14 volts or above 4.92 volts), the *EMM*:

Stores service code 12
Limits engine RPM to IDLE
<i>EMM</i> LED 3: OFF (Cranking)
<i>EMM</i> LED 3: ON (Running)

IMPORTANT: When a TPS circuit fault has been detected, the outboard will not accelerate above idle speed. To reset, stop the outboard and correct the fault.

If the TPS circuit reads below 0.2 volts, the *EMM*:

Stores service code 13
<i>EMM</i> LED 3: OFF (Cranking)
<i>EMM</i> LED 3: ON (Running)

If the TPS circuit reads above 4.85 volts, the *EMM*:

Stores service code 14
<i>EMM</i> LED 3: OFF (Cranking)
<i>EMM</i> LED 3: ON (Running)

Crankshaft Position Sensor

Ribs spaced on the flywheel mark crankshaft position. As the ribs pass the magnetic field of the CPS, an AC voltage signal is generated. The *EMM* uses this signal to identify crankshaft position and speed, generate a tachometer signal, and control fuel and ignition timing.

If the sensor is damaged or the signal is intermittent (10 occurrences), the *EMM*:

Stores service code 16
<i>EMM</i> LED 2: OFF (Cranking)
<i>EMM</i> LED 3: ON (Running)

Approximate air gap between CPS and flywheel encoder ribs is .073 (1.85 mm).

Use the *Evinrude Diagnostics* software *Monitor* screen to check CPS operation. The software should show an RPM reading while the outboard is cranking. If the CPS or its circuit fails, no RPM reading will appear and the outboard cannot run.

Neutral Switch

The powerhead mounted neutral switch controls a ground signal from the *EMM* to indicate shift linkage position. This allows the *EMM* to control idle speed variations and start in gear protection. Fuel and ignition functions are turned off if the neutral switch is not closed.

If the starter is cranked while the outboard is in gear, or if the switch fails, the *EMM*:

Stores service code 19
<i>EMM</i> LED 3: OFF (Cranking)

The *Monitor* screen of the diagnostics software displays switch position, NEUTRAL or IN GEAR. Make sure switch is operating properly.

Internal *EMM* Functions

ROM Verification

The *EMM* performs a self-test of programming every time it is turned ON. Service code 15 indicates a programming (software) issue. Reprogram the *EMM* with the correct software program to correct the problem.

Idle Controller

The idle controller reacts to engine operating conditions. Fuel and ignition timings are altered to maintain a specific RPM when engine is cold or warm. The controller is inactive when TPS is advanced from idle position.

RPM Limiter

This feature of *EMM* programming prevents engine damage due to excessive RPM. At 6250 RPM, fuel and ignition to the cylinders is shut off. Normal operation resumes when engine RPM returns to the specified range.

Neutral RPM Limiter

This feature prevents engine damage due to excessive RPM if accelerated in NEUTRAL. Neutral engine speed is limited to 1100 RPM.

Engine Monitor and Warning Systems

Refer to **Engine Monitoring** on p. 88.

Fault Code Creation and Storage

Refer to the ***EMM* Service Code Chart** at the back of this manual for a complete list of all engine fault codes.

Engine Monitoring

Engine Warning System

This outboard is equipped with an Audible Misfire Alert (A.M.A.) and Speed Adjusting Failsafe Electronics (S.A.F.E.).

A.M.A. / S.A.F.E. Mode Recovery

The engine will operate in A.M.A. or S.A.F.E. modes as long as the fault condition exists. To recover normal operation, the sensor or switch readings must return to normal limits.

A.M.A. and S.A.F.E. are engine warning systems controlled by the Engine Management Module (*EMM*). The *EMM* monitors engine sensors. If the *EMM* detects conditions which could cause:

- engine damage it activates A.M.A., which alerts the operator that a fault condition exists.
- permanent engine damage, the *EMM* activates S.A.F.E. which limits engine torque output and reduces engine RPM.

Diagnostic Software Functions

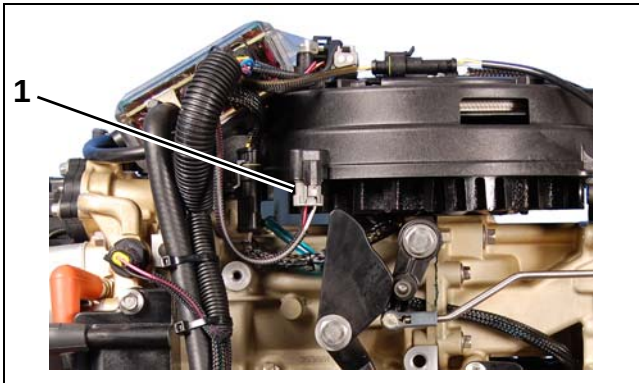
The *EMM* stores valuable information about the outboard and its running history. This information can be used for troubleshooting, for checking parts information, and for making adjustments to the system.

Use *Evinrude Diagnostics* software, version 5.1 or higher, and a laptop computer to access program information.

IMPORTANT: For software help, refer to the “Help” menu in the software.

Communication

Locate the diagnostic connector on the engine. Remove the cover and install the Diagnostic Interface Cable, P/N 437955.



1. Diagnostic connector

007405

Connect the 9-pin connector of the interface cable directly to the computer's serial port.

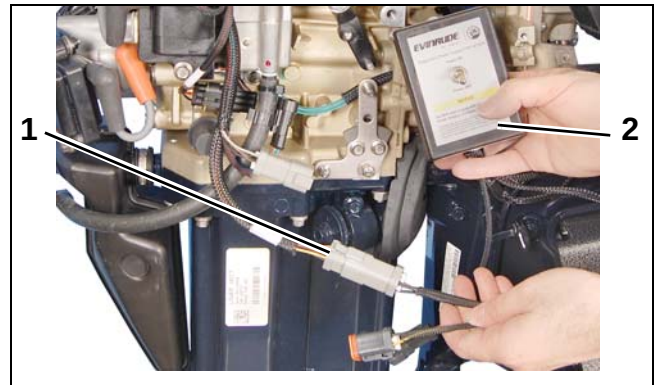
The *EMM* must turn ON before it will communicate with the computer.

Diagnostic Power Supply Tool

Diagnostic communications on non-running rope start models requires that power is supplied to the *EMM*.

Use Diagnostic Power Supply Tool, P/N 587005, to supply power to the *EMM*. The power supply uses internal 9-volt batteries.

Connect Power Supply Tool to the engine harness key/stop switch connector. Turn toggle switch to the ON position to power the *EMM*.



1. Engine harness key switch connector
2. Power supply tool

007385

IMPORTANT: Static tests require more power than the internal batteries of the tool can provide. Static tests performed using only the internal power supply batteries will produce false results.

Use Accessory Power Cable Kit, P/N 5008092, to connect an external 12 volt battery to the Power Supply Tool when performing these static tests:

- Fuel pump
- Fuel injector
- Ignition coil
- Oil injector



Accessory power cables

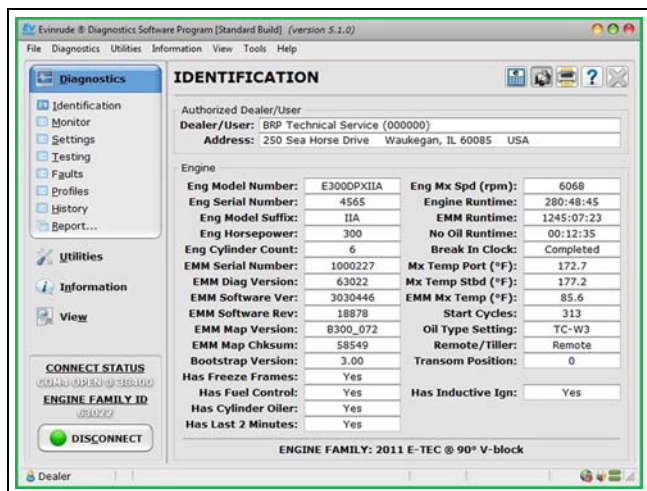
007386

Static Information

Static information is viewed when the outboard is NOT running. This includes manufacturing information.

Engine Management Module (EMM) Diagnostic Software Functions

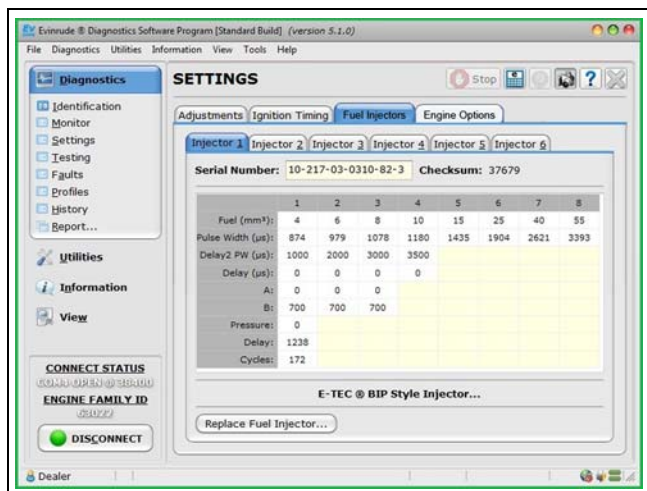
The outboard model and serial numbers displayed on the *Identity* screen must match the identification label on the outboard swivel bracket.



Identity Screen

008567

The serial number and cylinder location displayed on the *Injector Coefficients* screen must match the actual cylinder placement for each injector.

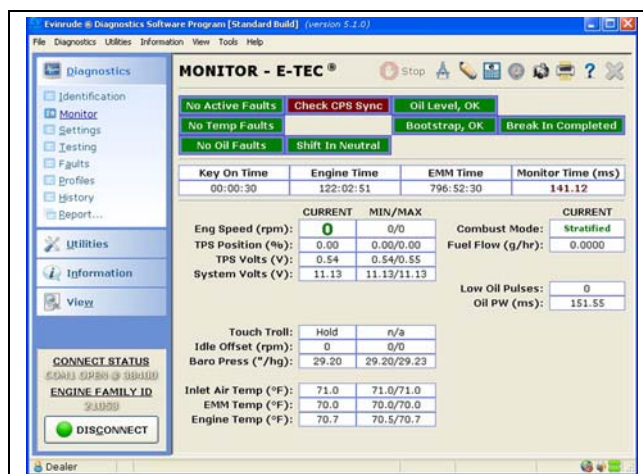


Injector Coefficients Screen

008565

Dynamic Information

Dynamic information is viewed while the outboard is running. Changes in data, such as voltages or temperatures, are shown as they happen.



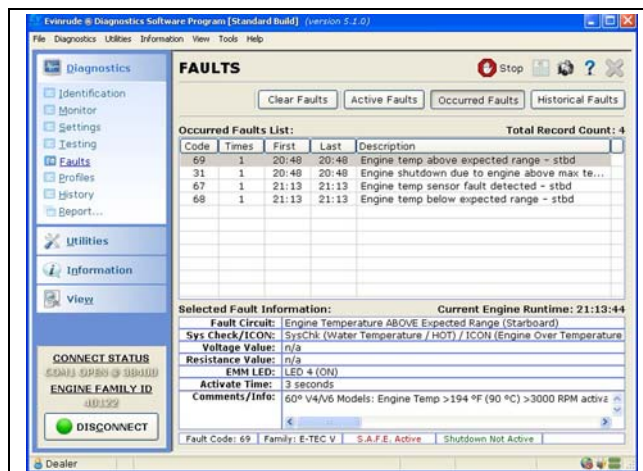
Monitor Screen

008601

Occurred Service Codes (Faults)

Service codes are saved if an abnormal condition occurs while the outboard is running.

The *Occurred Faults* screen of the diagnostics software shows the code number, the number of times the event occurred, and operating hours of first and last occurrences.

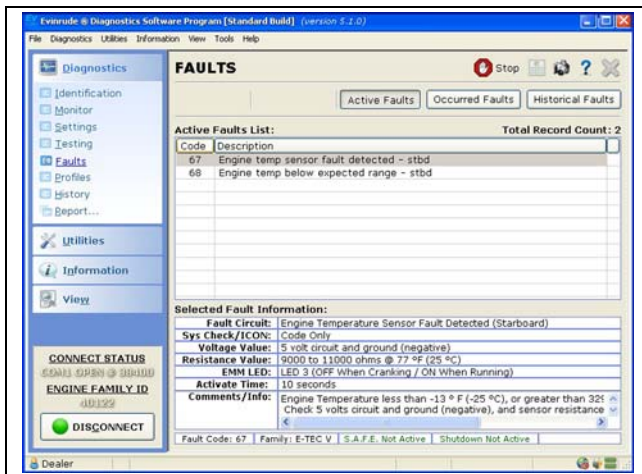


Occurred Faults Review Screen

008584

Active Faults

An active fault is a service code that currently exists. Active faults become occurred faults only if the outboard is running.



Active Faults Review Screen

008585

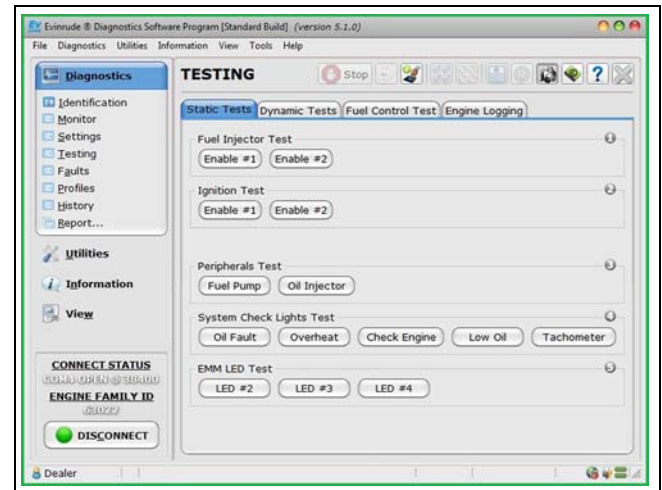
Historical Faults

The *Historical Faults* screen keeps a history of all previously occurred codes, including code number, the number of times the event occurred, and operating hours of the last occurrence.

Historical faults cannot be erased.

Static Tests

Static Tests allow diagnostic testing of system components while the outboard is NOT running.



Static Tests Screen

008569A

Ignition Test

Use the diagnostics software to test each ignition circuit. Refer to **Static Ignition Test** on p. 105.

Fuel Test

Use the diagnostics software to test each fuel injector circuit. Refer to **Fuel Injector Static Test** on p. 109.

Oil Injector

Use the diagnostics software to test the oil injection pump circuit. Refer to **Oiling System Tests** on p. 160.

Fuel Pump

Use the diagnostics software to test the fuel pump circuit. Refer to **Fuel Pump Static Test** on p. 108.

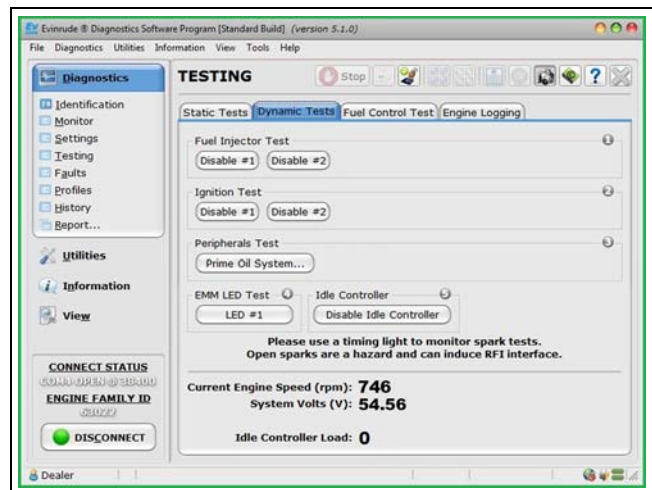
Tachometer

This test is used to check operation of the tachometer circuit.

Engine Management Module (EMM) Diagnostic Software Functions

Dynamic Tests

Dynamic tests are performed with the outboard running.



Dynamic Tests Screen

008570A

Ignition Test

This test momentarily disables the ignition and fuel injection circuits to one cylinder. By dropping one cylinder, RPM and running quality changes can be observed. Refer to **Dynamic Tests** on p. 100.

Fuel Test

This test momentarily disables one fuel injector circuit. By dropping one cylinder, RPM and running quality changes can be observed. Refer to **Dynamic Tests** on p. 100.

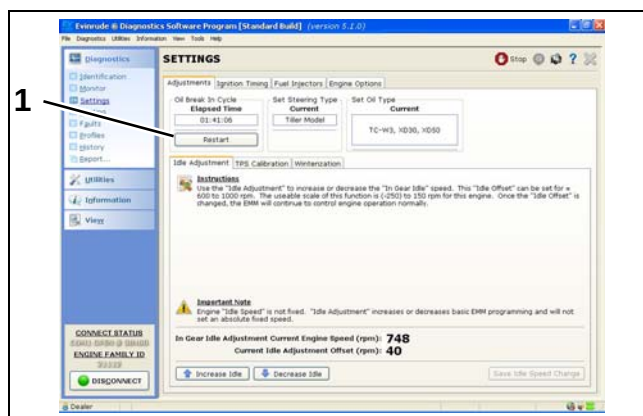
Prime Oil

This test is used to cycle the oil injection pump for priming the oiling system. Perform this test with outboard running to activate oil injection pump.

Oil Control Settings

Powerhead Break-In

Use the diagnostics software to start break-in oiling after a powerhead rebuild. The break-in oiling program runs for two hours of outboard operation, above 2000 RPM.



1. Break-in oil setting

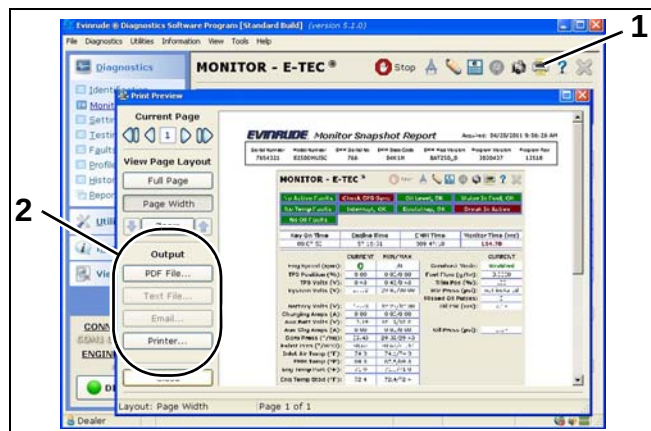
008662

Engine Management Module (EMM) Diagnostic Software Functions

Reports

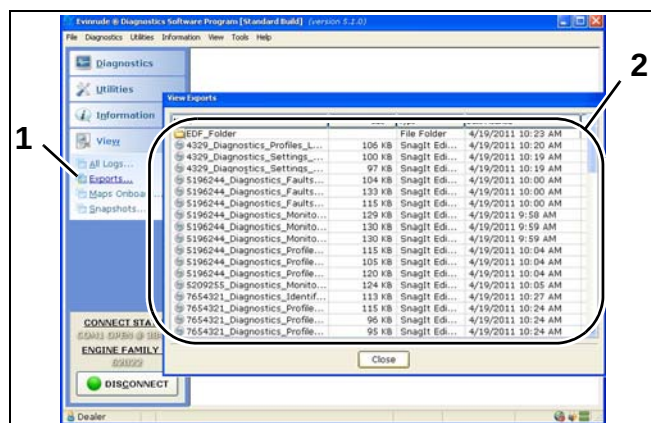
Engine reports provide service records and can be used to document the running history of an outboard. Reviewing this information can help identify or resolve some service issues.

Click the print button in a window of the diagnostics software to print engine data, or to export the information to a computer file.



1. Print button
2. Print/Export options

008592



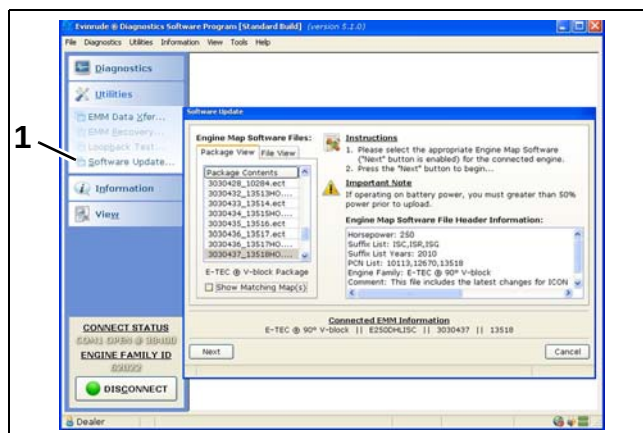
Engine Report data files

1. Exports button
2. Data files

008593

Software Replacement

Engine Management Software programs are loaded into the *EMM* at the factory. Periodically, a new program may be available to enhance the operation of an outboard. Select *Engine Software Update* from the *Utilities* menu and refer to the instructions provided with the program.



1. Software Update button

008594

Use Diagnostic Power Supply Tool, P/N 587005, to supply power to the *EMM*.

IMPORTANT: Use Accessory Power Cable Kit, P/N 5008092, to connect an external 12 volt battery to the Power Supply Tool.

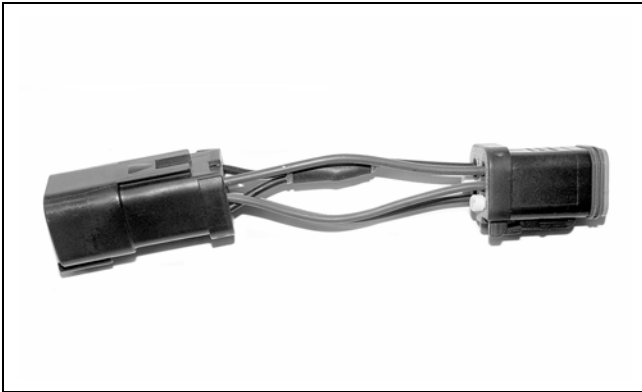
If the internal batteries of the Power Supply Tool have a low voltage condition the *EMM* could turn OFF during the software upload, resulting in a failed software update.



1. Power supply tool

007385

IMPORTANT: Software replacement requires a Bootstrap Tool, P/N 586551.



002383

EMM Transfer

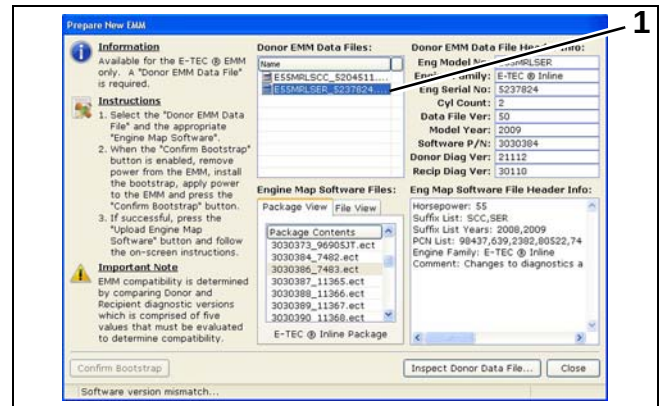
EMM Transfer is used to save engine history data when the *EMM* must be replaced. Select *EMM Data Transfer* from the *Utilities* menu. Select the Collect *EMM* data to FILE option and follow the instructions provided with the program.

IMPORTANT: Whenever the *EMM* is replaced, *EMM* timing must be synchronized to crankshaft position. Refer to **Timing Adjustments** on p. 122.

EMM Replacement

Before installing a new *EMM*, program information from the original *EMM* must be saved to a computer data file. Refer to **EMM Transfer** on p. 95.

After the new *EMM* is installed on the outboard, apply power to *EMM*. Select Prep New *EMM* from the *Utilities* Menu. Follow the instructions provided with the program to load engine software and transfer *EMM* data.



1. Select engine serial number file

008663

If more than one file is listed, be sure to select the engine data file (.edf) that matches the engine serial number.

EMM Servicing

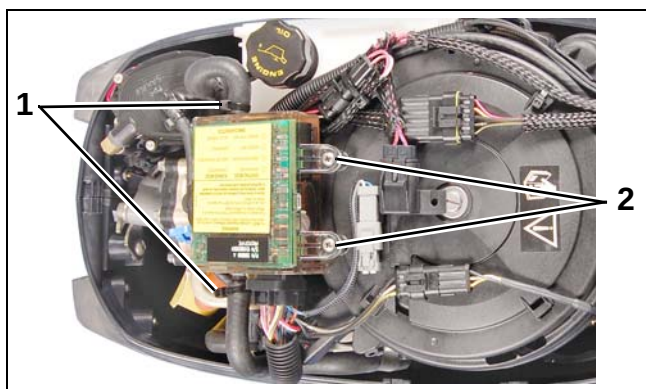
IMPORTANT: If a new *EMM* is being installed, refer to **EMM Transfer** on p. 95.

Removal

Disconnect cooling hoses from *EMM*.

Disconnect J1-A connector.

Remove two *EMM* retaining screws. Remove *EMM*.



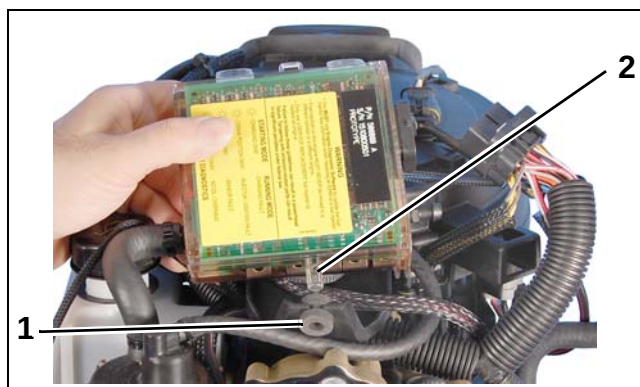
1. Cooling hose connections
2. EMM mounting screws

007396

Installation

Installation is the reverse of removal. Pay close attention when performing the following tasks.

Make sure isolator mount is in place on recoil starter housing. Slide pin at rear *EMM* into position on isolator mount.



1. Isolator mount
2. Pin

007397

IMPORTANT: Turn self-tapping screws counter clock-wise to start the threads and clockwise to tighten. Failure to follow this procedure can damage the threads of the housing.

Tighten screws securely.

Install harness connector and cooling hoses. Secure hoses with tie straps.

System Analysis

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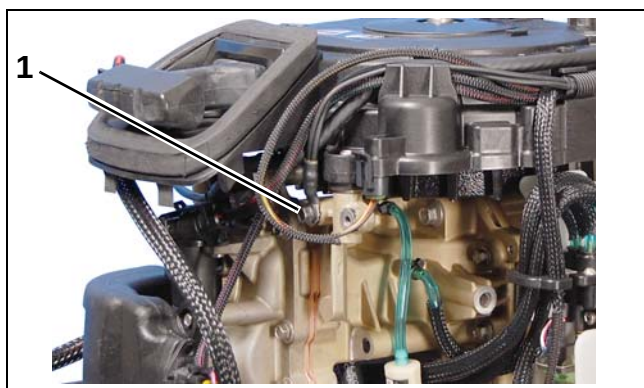
Diagnostic Procedures

Visual Inspections

Inspect wiring and electrical connections. Disassemble and clean all corroded connections. Replace damaged wiring, connectors, or terminals. Repair any shorted electrical circuits.

- Refer to **Electrical Harness Connections** on p. 114.
- Refer to **WIRING DIAGRAM** at the back of this manual.
- Refer to **Connector Servicing** on p. 123.

Make sure all ground connections are clean and tight. Refer to **Ground Circuits** on p. 115.



1. Main engine harness ground

007343

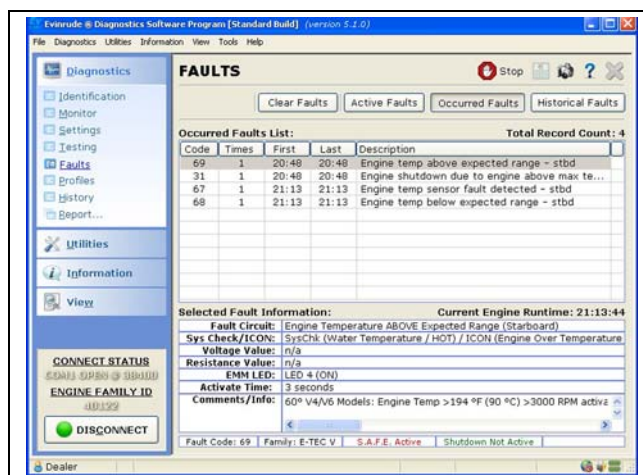
Inspect spark plugs for wear, oil fowling, or damage. A rich or lean running condition or evidence of internal engine damage could be identified by the appearance of the spark plugs.

Check the tether cord and engine cut-off switch.

Operational Inspections

Run the outboard to confirm actual symptoms before performing any unnecessary procedures. Inspection should include the following:

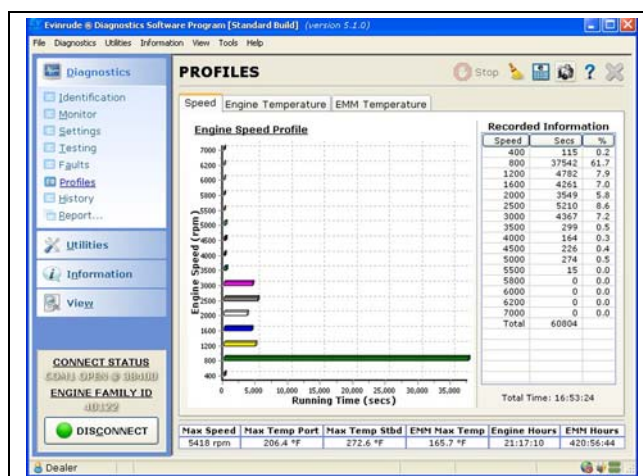
- Make sure the outboard can be cranked easily, with no mechanical binding.
- Check the *EMM* LED Indicators for system status information. Refer to **EMM LED Indicators** on p. 101.
- Check the *Evinrude Diagnostics* software *Active Faults* and *Occurred Faults* screens for current service codes. Correct any problems and clear the codes before further troubleshooting. Refer to **Occurred Service Codes (Faults)** on p. 90.



Occurred Faults Review Screen

008584

Check the diagnostics software *Profiles*, *Occurred*, and *Historical Faults* screens for evidence of abnormal operation.



Profiles Screen

008587

Troubleshooting

Outboard will not start:

- Check the engine cut-off switch and tether cord
- Check powerhead mounted neutral switch
- Check the *EMM* LED Indicators for system status information. Refer to **EMM LED Indicators** on p. 101.
- Use the *Evinrude Diagnostics* software *Occurred Faults* screen to check for current service codes. If there are multiple occurred sensor codes, inspect all 5 V sensor circuits for broken or grounded wiring.
- Perform a Static Ignition test using *Evinrude Diagnostics* software and an inductive timing light. Refer to **Static Ignition Test** on p. 105.
- If ignition test indicates steady spark, refer to **Fuel Delivery Tests** on p. 108.

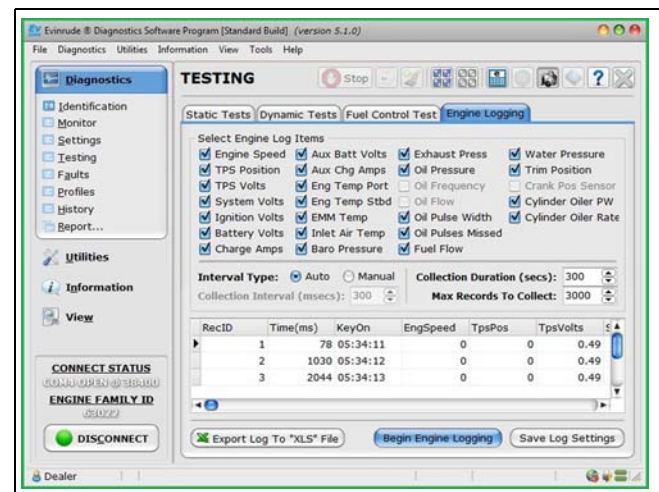
Outboard runs, low on power, misfires:

- Check the *EMM* LED Indicators for system status information. Refer to **EMM LED Indicators** on p. 101.
- Use the *Evinrude Diagnostics* software *Monitor* screen to check system (55 V) and TPS voltages. System voltage should be steady, and TPS voltage should be between 0.2 and 4.85 V.

IMPORTANT: Use a digital multimeter to check voltage on external circuits only when necessary. All *EMM* output currents are DC current.

- Use the diagnostics software *Dynamic Tests* to isolate a faulty cylinder. See **Dynamic Tests** on p. 100.
- Use an inductive timing light to check ignition and fuel injector circuits. Refer to **Running Ignition Tests** on p. 106 and **Running Fuel System Tests** on p. 109.

- Use the diagnostics software *Fuel Control Adjustment* test to help identify a cylinder that may be too rich or too lean. Refer to **Fuel Control Adjustment** on p. 100.
- Use an inductive amp meter to monitor injector circuit current. Compare readings of all circuits to identify possible failure.
- Check fuel quality and that fuel is present at injectors.
- Use the diagnostics software *Logging* function to record engine data as a problem is occurring.



Logging Screen

008574

- AFTER all the above inspections, if the cause of a running quality problem still cannot be identified, perform a compression test to check for internal powerhead damage.

IMPORTANT: Remove a cylinder head or disassemble the engine only as a last resort.

Dynamic Tests

Cylinder Drop Tests

Use the *Evinrude Diagnostics* software *Dynamic Tests* to momentarily disable one cylinder while the outboard is running.

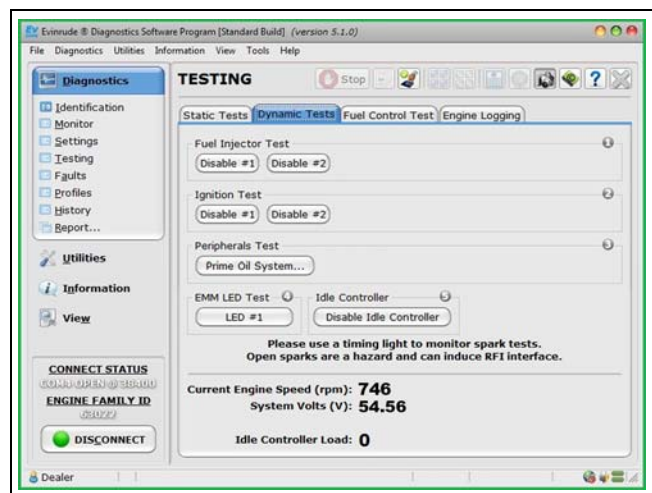
- The Dynamic Ignition test disables the ignition and fuel injection circuits to a cylinder.
- The Dynamic Fuel test momentarily disables one fuel injector circuit.

By dropping one cylinder, RPM and running quality changes can be compared for each cylinder.

IMPORTANT: Test the outboard at the RPM where the problem is occurring. Use the test procedures to identify inconsistencies in voltages and cylinder performance. Once a circuit has been identified as malfunctioning, inspect all related wiring and connections. Check all voltage inputs and grounds; and perform resistance tests for all circuits before replacing any suspect components.

Dynamic Tests can be used with:

- A timing light to determine how other cylinders are affected by one cylinder being “dropped”; or
- A digital multimeter to check voltage changes on electrical circuits.



Dynamic Test Screen

008570A

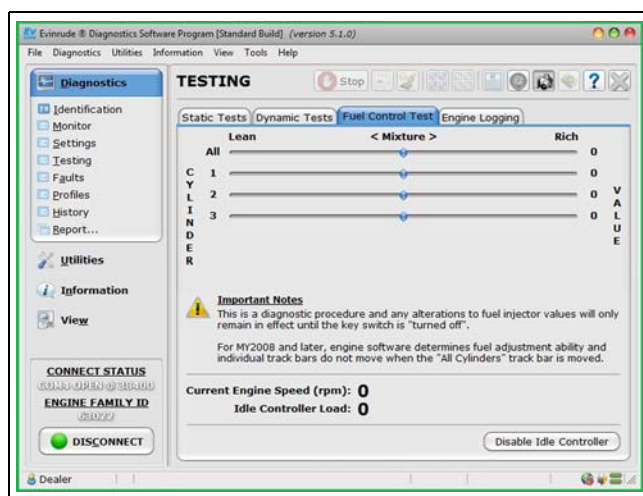
IMPORTANT: DO NOT misinterpret tests run at IDLE. The idle speed controller in the *EMM* compensates to maintain a constant IDLE speed. The *Dynamic Tests* screen includes a function to temporarily disable the idle controller.

Fuel Control Adjustment

Use this test is to help identify a cylinder that may be too rich or too lean. This feature should not be used by itself to identify a faulty injector.

Evinrude Diagnostics software allows temporary adjustments to the fuel flow characteristics of the injectors. Factory fuel flow settings are restored when power to the *EMM* is returned to OFF.

Test the outboard at the RPM where the problem is occurring.



008575A

If the outboard run quality improves with a fuel control adjustment, eliminate other possibilities before replacing an injector:

- Refer to **Fuel System Pressure Test** on p. 135.
- Refer to **Running Fuel System Tests** on p. 109.

IMPORTANT: DO NOT misinterpret tests run at IDLE. The idle speed controller in the *EMM* compensates to maintain a constant IDLE speed.

Inductive Amp Meter Test

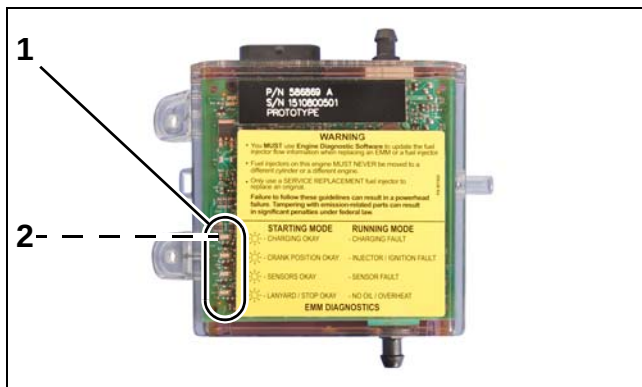
Use an inductive amp meter to monitor current flow. Identifying erratic amperage in a circuit can be used to isolate a problem component.

EMM LED Indicators

The *EMM* LED indicators provide a quick reference to the status of several outboard systems. Checking the LEDs **FIRST** when diagnosing an engine problem can save time.

For detailed code information, refer to the **EMM Service Code Chart** at the back of this manual.

IMPORTANT: LED 1 is closest to the center of the *EMM* (closest to *EMM* J1-A connector).



1. LED indicators
2. LED 1

007382

Power ON

IMPORTANT: Diagnostic communications on non-running rope start models requires that power is supplied to the *EMM*. Refer to **Communication** on p. 89.

When the *EMM* is ON (engine not running), the following LEDs should light:

LED 3 – Sensor Circuits working.

LED 4 – Stop Circuit not grounded—okay to start. FLASHING LIGHT indicates severe overhear or no oil – engine in SHUTDOWN mode.

Starting

Starting mode occurs from the time the flywheel begins to turn until the outboard is running for 2 seconds. During starting, all four LEDs should light and then go off in sequence.

LED 1 – CHARGING OKAY – Stator signal 30 V or higher.

LED 2 – CRANK POSITION OKAY – input from CPS, *EMM* powered ON. For NO LIGHT, check for:

- Code 16 – CPS, intermittent loss of sync

LED 3 – SENSORS OKAY (5 V). For NO LIGHT, check for:

- Code 12 – TPS circuit fault
- Code 13 – TPS below expected range
- Code 14 – TPS above expected range
- Code 19 – In Gear (tiller models)
- Code 23 – *EMM* temp. sensor circuit fault
- Code 24 – *EMM* temp. below expected range
- Code 41 – temp. sensor circuit fault
- Code 42 – temp. below expected range
- Code 47 – AT sensor circuit fault
- Code 48 – AT sensor below expected range
- Code 49 – AT sensor above expected range
- Code 58 – Operating temperature not reached
- Code 78 – Sensor supply voltage fault

LED 4 – LANYARD/STOP OKAY. For NO LIGHT, check for:

- Grounded stop circuit.

For FLASHING LIGHT, check for:

- Code 29 – *EMM* temp. OVER range (flashing)
- Code 31 – Engine temp. OVER range (flashing)
- Code 33 – Engine shutdown, excessive no oil condition

Running

When the outboard is running, all of the LEDs should be off. If a light is on, check for:

LED 1 – CHARGING FAULT:

- Code 17 – system voltage (55 V) below range
- Code 18 – system voltage (55 V) above range

LED 2 – INJECTOR/IGNITION FAULT:

- Code 51 – cylinder no. 1 injector circuit open
- Code 52 – cylinder no. 2 injector circuit open
- Code 61 – cylinder no. 1 injector circuit short
- Code 62 – cylinder no. 2 injector circuit short
- Code 81 – no. 1 ignition primary circuit open
- Code 82 – no. 2 ignition primary circuit open
- Code 91 – fuel pump open circuit
- Code 94 – fuel pump circuit short
- Code 101 – cylinder no. 1 ignition circuit short
- Code 102 – cylinder no. 2 ignition circuit short

LED 3 – Sensor circuits (5 V), SENSOR FAULT. For LIGHT ON, check for possible fault codes:

- Code 12 – TPS circuit fault
- Code 13 – TPS below expected range
- Code 14 – TPS above expected range
- Code 16 – CPS, intermittent loss of sync
- Code 23 – *EMM* temp. sensor circuit fault
- Code 24 – *EMM* temp. below expected range
- Code 41 – temp. sensor circuit fault
- Code 42 – temp. below expected range
- Code 47 – AT sensor circuit fault
- Code 48 – AT sensor below expected range
- Code 49 – AT sensor above expected range
- Code 58 – operating temp. not reached
- Code 78 – Sensor supply voltage fault

LED 4 – Engine overheat, *EMM* temperature or sensor, oil injection pump or sensor, NO OIL / OVERHEAT. For LIGHT ON, check for possible fault codes:

- Code 25 – *EMM* overheat
- Code 29 – *EMM* overheat, critical (flashing)
- Code 31 – engine overheat, critical (flashing)
- Code 33 – excessive NO OIL faults
- Code 34 – oil injection pump circuit open
- Code 40 – engine temp over range, low speed
- Code 43 – temp. above expected range
- Code 117 – Critical NO OIL detected
- Code 120 – Low Oil Switch circuit OPEN

Ignition Output Tests

⚠ DANGER

The electrical system presents a serious shock hazard. Allow outboard to sit for two minutes after running before handling DO NOT handle primary or secondary ignition components while outboard is running or fly-wheel is turning.

Use the *Evinrude Diagnostics* software *Occurred Faults* screen to check for current service codes before troubleshooting. Correct any problems and clear the codes FIRST.

Required Ignition Systems

Following is a complete list of circuits required for ignition output:

Stop Circuit

- Black/yellow wire NOT grounded (tether cord in place).

Neutral Switch

- Powerhead mounted neutral switch provides a switched ground circuit to *EMM*. The circuit enables specialized control functions such as neutral start protection and RPM limiting in NEUTRAL.

Stator Output Voltage

- Provides A/C voltage to *EMM* J1A connector: Outboard cranking, typical range is 20-40 VAC (AC output voltage is related to cranking RPM); Outboard running, approximately 55 VAC.

EMM

- Controls ignition grounds, injector grounds, and engine timing.

Crankshaft Position Sensor

- Provides *EMM* with input.
- Outboard cranking speed exceeds 300 RPM and a steady CPS signal is generated.

Alternator Output/System Voltage

- System voltage from *EMM* (white/red) provides 55 VDC to the high pressure fuel pump, the oil injection pump, the fuel injectors, and the ignition coils.

Ignition Coil

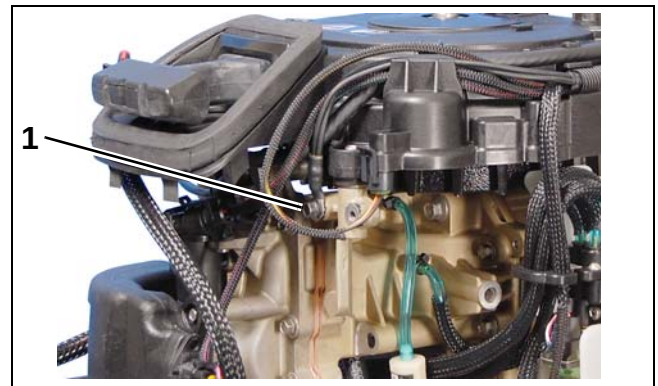
- Primary circuits are powered by system (55 V) voltage
- *EMM* provides control signal to ignition coil
- Output from ignition coil secondary winding and high tension spark plug wire.

Wiring Inspection

Visually inspect all wiring, connections, and grounds.

Use a digital ohmmeter to test resistance on all ground circuits and connections. Ohmmeter readings should be approximately 0.0 W.

Check that all engine wire harness grounds have continuity to the cylinder/crankcase.



1. Main engine harness ground

007343

Clean or repair all ground circuits, wiring, and connections as needed.

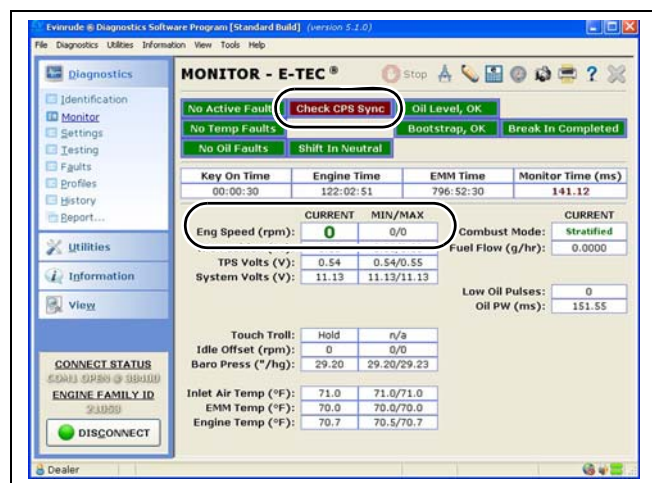
System Analysis

Ignition Output Tests

Crankshaft Position Sensor (CPS) Test

When the CPS is working properly, *EMM* LED 2 turns on while the outboard is being started.

Use the *Evinrude Diagnostics* software CPS Sync and engine RPM displays to confirm a valid CPS signal while the outboard is cranking or running. An RPM display higher than zero indicates a CPS signal to the *EMM*.



Engine RPM and CPS Sync displays

008601L

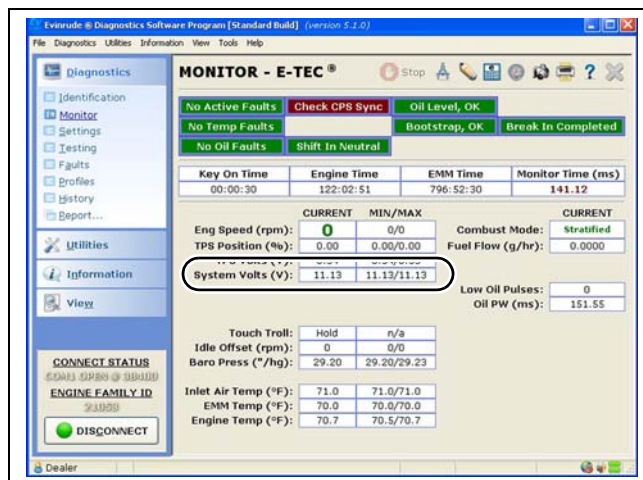
If the *Monitor* screen says “Check CPS Sync,” refer to **Crankshaft Position Sensor (CPS) Test** on p. 115.

System Voltage Test

The ignition system is powered by the 55 V system.

IMPORTANT: Use the Diagnostic Power Supply Tool, P/N 587005, with Accessory Power Cable Kit, P/N 5008092, to supply power to the *EMM*. Using Diagnostic Power Supply Tool, with internal 9 volt batteries only will produce false results. Refer to **Diagnostic Power Supply Tool** on p. 89.

Use the *Evinrude Diagnostics* software *Monitor* screen to check system voltage.



Monitor Screen, System voltage

008601L

Results:

- *EMM* ON (not running) - approximately 1 V less than battery voltage, system voltage is GOOD.
- *EMM* ON (not running) - no voltage, check 12 V power to *EMM*. Repair connection or wiring.
- RUNNING - 55 V $\pm$ 2, system voltage is GOOD.
- RUNNING - less than 55 V $\pm$ 2, check stator output to *EMM*. Repair connection or wiring. Possible faulty stator or *EMM*. Refer to **Stator Tests** on p. 117.

IMPORTANT: The *EMM* must be ON for voltage to be present on the system voltage (55 V) circuit. Power is normally supplied to the *EMM* when the key switch is turned ON. On a non-running rope start engine, power is supplied to the *EMM* by Diagnostic Power Supply Tool, P/N 587005. The *EMM* is also turned ON when it begins to receive AC voltage from the stator while the outboard is being cranked.

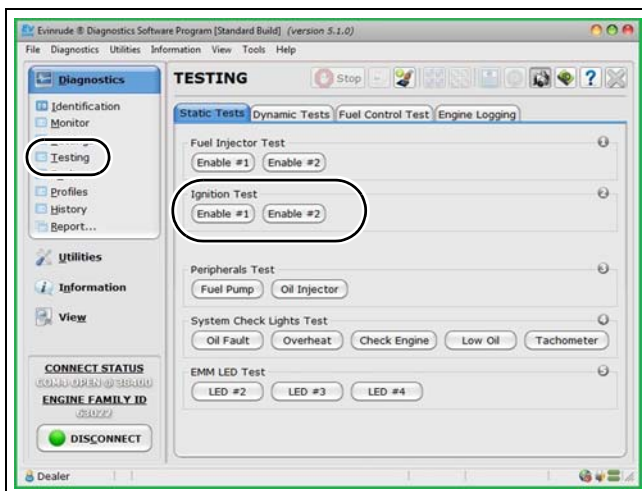
Static Ignition Test

Use the Diagnostic Power Supply Tool, P/N 587005, *Evinrude Diagnostics* software and an inductive timing light to perform the static ignition test.

IMPORTANT: Use Accessory Power Cable Kit, P/N 5008092, to connect an external 12 volt battery to the Power Supply Tool. Static tests performed using only the internal power supply batteries will produce false results. Refer to **Diagnostic Power Supply Tool** on p. 89.

IMPORTANT: DO NOT use a spark checker tool. Radio Frequency Interference (RFI) generated by the arcing current can cause erratic *EMM* operation.

The outboard must NOT be running and the tether cord must be installed on the engine cut-off switch.

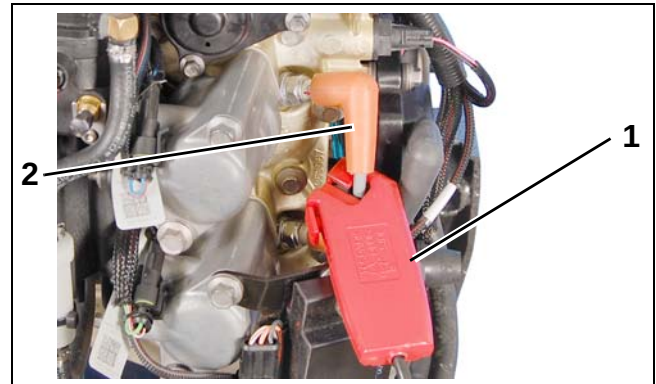


Static Tests Screen

008569L

Connect timing light pickup to the secondary circuit (spark plug lead) of the cylinder being tested. Activate test and observe timing light strobe for consistent flash.

IMPORTANT: This test is operating the ignition coil with 12 V battery power on the system voltage (55 V) circuit. An inductive probe with low sensitivity may not be able to detect the signal.



1. Timing light pick-up
2. Spark plug lead

007398

Results:

No spark on one or more cylinders:

- Inspect or replace spark plugs
- Refer to **Ignition Control Circuit Tests** on p. 107
- Refer to **Ignition Coil Tests** on p. 107

Steady spark on all cylinders:

- Refer to **Running Ignition Tests** on p. 106 and **Dynamic Tests** on p. 100.

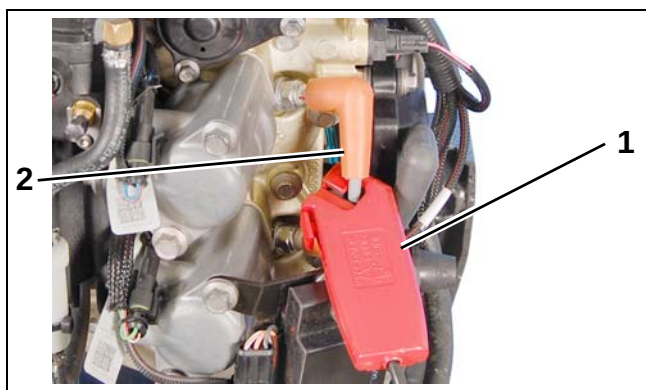
Running Ignition Tests

Use *Evinrude Diagnostics* Software to monitor system voltage (55 V).

- Voltage readings at a specific speed (RPM) should be steady.
- Refer to **System Voltage Test** on p. 104.

Use an inductive timing light to monitor the spark signal through each of the secondary circuit (spark plug lead) wires.

Start outboard and observe timing light strobe. Look for a consistent flash and only one flash per revolution. The strobe of the timing light should be the same for each cylinder.



1. Timing light pick-up
2. Spark plug lead

007398

Results:

Steady voltage and strobe, engine misfires:

- Inspect or replace spark plugs
- Refer to **Fuel Delivery Tests** on p. 108
- Inspect for internal engine damage.

Steady voltage, erratic strobe, engine misfires:

- Inspect or replace spark plugs
- Check CPS air gap and resistance.
- Refer to **Ignition Control Circuit Tests** on p. 107
- Refer to **Ignition Coil Tests** on p. 107.

Voltages fluctuate, engine misfires:

- Inspect electrical connections
- Test capacitor and all ground connections.
- Refer to **System Voltage Test** on p. 104
- Refer to **Ignition Control Circuit Tests** on p. 107
- Refer to **Ignition Coil Tests** on p. 107.

IMPORTANT: If a running problem occurs at about 1200 RPM, the outboard may be in *S.A.F.E.* Refer to **Engine Monitoring** on p. 88.

Ignition Control Circuit Tests

Use a digital multimeter to test the following:

- System voltage supply to ignition coil.
- Ignition control signal from *EMM*.
- Engine harness resistance.

Disconnect ignition coil connector.

Supply voltage test:

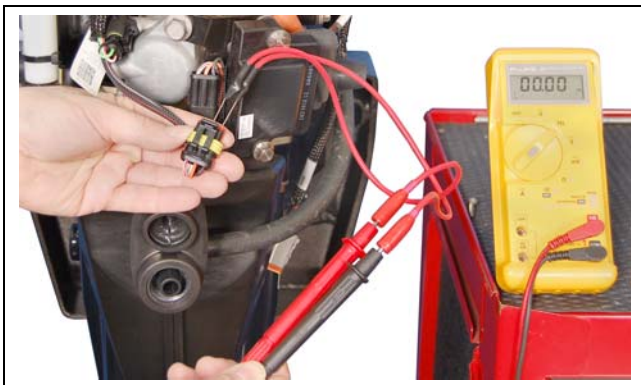
Use an appropriate adapter to connect the red meter lead to pin 3 (white/red) of the engine harness connector and the black lead to ground. With *EMM* ON, voltage should be approximately 1 V less than battery voltage.

Control signal test:

Set meter to the Hz scale to check ignition control signal.

Use an appropriate adapter to connect the red meter lead to pin 2 (orange) of the engine harness connector and the black lead to ground. Activate diagnostics software *Static Ignition* test and observe meter for consistent reading (approximately 2 Hz).

If control signal is present, connect black meter lead to pin 1 and repeat test to confirm harness ground.



007399

Harness resistance test:

If control signal is NOT present, calibrate multimeter to low ohms scale. Use appropriate adapters on meter leads to avoid damaging harness connectors.

With *EMM* OFF, remove the *EMM* J1-A connector and test the continuity of each ignition control circuit (orange). Check resistance between J1-A connector and ignition coil connector. Refer to engine wiring diagram.

If circuits test good, replace *EMM*.

Ignition Coil Tests

There are no simple ignition coil tests available. Before replacing an ignition coil, be sure:

- 55 V is supplied to the white/red wire of the ignition coil connector
- A control signal is present on the orange wire of the ignition coil connector. Refer to **Ignition Control Circuit Tests** on p. 107.
- The black wire of the ignition coil connector provides continuity to ground.
- The secondary spark plug lead provides continuity.

If all of the above tests are good, and a cylinder does not have spark, replace the ignition coil with a known good coil.

Fuel Delivery Tests

⚠ WARNING

Protect against hazardous fuel spray. Before starting any fuel system service, carefully relieve fuel system pressure.

Refer to **Relieving Fuel System Pressure** on p. 140.

Check the *Evinrude Diagnostics* software *Occurred Faults* screen for current service codes before troubleshooting. Correct any problems and clear the codes FIRST.

Inspect all fuel hoses, filters, and connections. Check quality of fuel supply.

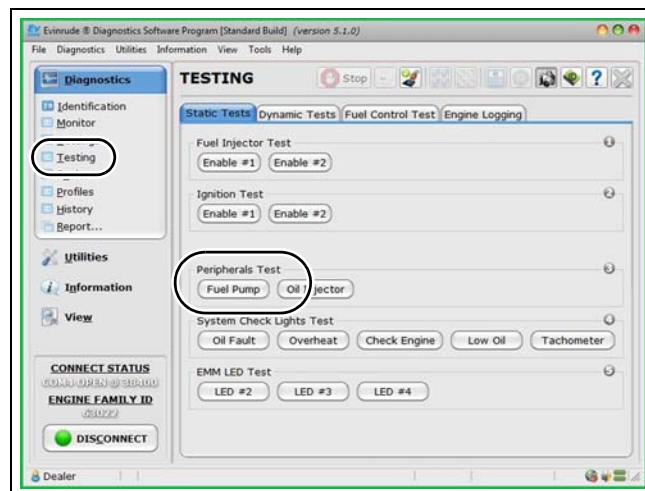
Fuel Pump Static Test

Use the Diagnostic Power Supply Tool, P/N 587005, *Evinrude Diagnostics* software to perform static tests.

IMPORTANT: Use Accessory Power Cable Kit, P/N 5008092, to connect an external 12 volt battery to the Power Supply Tool. Static tests performed using only the internal power supply batteries will produce false results. Refer to **Diagnostic Power Supply Tool** on p. 89.

Use the *Evinrude Diagnostics* software Fuel Pump test to activate the electric fuel pump. If the pump

runs, the *EMM* and fuel pump circuit are not at fault.



Static Tests Screen

008569L

If the pump does not run:

- Check voltage at pin 1 of fuel pump connector. Voltage should be slightly less than 12 V with KEY ON, or when fuel pump test is activated. Voltage should be 55 V when the outboard is cranking or running.
- The *EMM* controls the fuel pump ground (brown wire). Use an ohmmeter to check continuity between pin 2 of fuel pump connector and ground. Use the fuel pump static test to activate the control function of the *EMM*. Resistance should drop as *EMM* connects the control circuit to ground.
- Refer to **Circulation Pump Resistance Test** on p. 137.

If the pump runs:

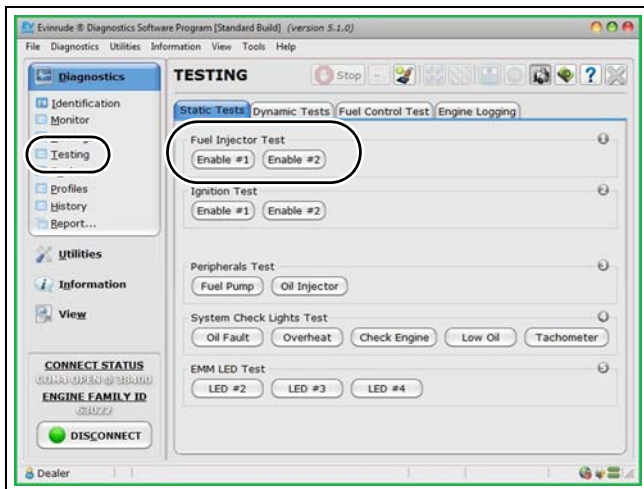
- Refer to **Fuel System Pressure Test** on p. 135.
- Refer to **Running Fuel System Tests** on p. 109.

Fuel Injector Static Test

Use the Diagnostic Power Supply Tool, P/N 587005, *Evinrude Diagnostics* software to perform static tests.

IMPORTANT: Use Accessory Power Cable Kit, P/N 5008092, to connect an external 12 volt battery to the Power Supply Tool. Static tests performed using only the internal power supply batteries will produce false results. Refer to **Diagnostic Power Supply Tool** on p. 89.

Use the *Evinrude Diagnostics* software Fuel Injector Static Test to activate each fuel injector. Listen for an audible click from each injector when it is actuated. If the injector activates, the *EMM* and injector circuits are not at fault.



Static Tests Screen

008569L

IMPORTANT: This test is operating the injectors with 12 V battery power on the system voltage (55 V) circuit. Battery must be fully charged and connections must be clean and tight. Injector activation should be carefully confirmed.

Results:

No injectors actuate:

- Use the *Monitor* screen of the diagnostics software to make sure voltage is present on the system voltage circuit.
- Refer to **Running Fuel System Tests** on p. 109.

Some injectors actuate; some do not:

- For non-working injectors, test the resistance of injector circuit between the injector connector and injector control wire at the *EMM*.
- See **Fuel Injector Resistance Test** on p. 137.

All injectors actuate:

- Refer to **Running Fuel System Tests** on p. 109.

Running Fuel System Tests

Run or crank the outboard.

Use the *Evinrude Diagnostics* software *Monitor* screen to check system voltage. If voltage is low, or drops as RPM increases, refer to **Stator Voltage Output Test** on p. 118.

Use an inductive timing light to monitor the injector control wire (connector pin 2) for each injector. Make sure the pickup is attached to only one wire. Flashes on the timing light indicate current in the circuit is being switched by the *EMM*. The *Dynamic Tests* screen allows the control signal to be turned off to a particular injector.

IMPORTANT: Some timing lights may not flash consistently at cranking speeds. Always check the orientation of the timing light pickup and the operation of the timing light.

System Analysis

Fuel Delivery Tests

Results:

No light activation on any injector wires (outboard cranks and starter turns flywheel):

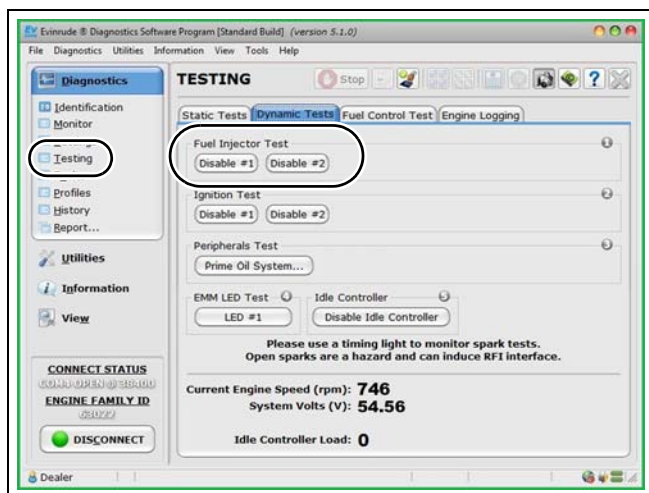
- Check stator input to *EMM*, CPS operation, and all grounds and wiring connections.
- Eliminate all other possibilities to isolate a faulty *EMM*.

Irregular or no light activation on some injector wires:

- Test the resistance of individual injector circuits between the injector connector and injector control wire at the *EMM*.
- Make sure all grounds are clean and tight.
- See **Fuel Injector Resistance Test** on p. 137.

Steady light activation on all injector wires and consistent voltage readings, *EMM* injector control function is good:

- Use the diagnostics software *Dynamic Fuel Test* to isolate a faulty cylinder. See **Dynamic Tests** on p. 100.



Dynamic Tests Screen

008570A

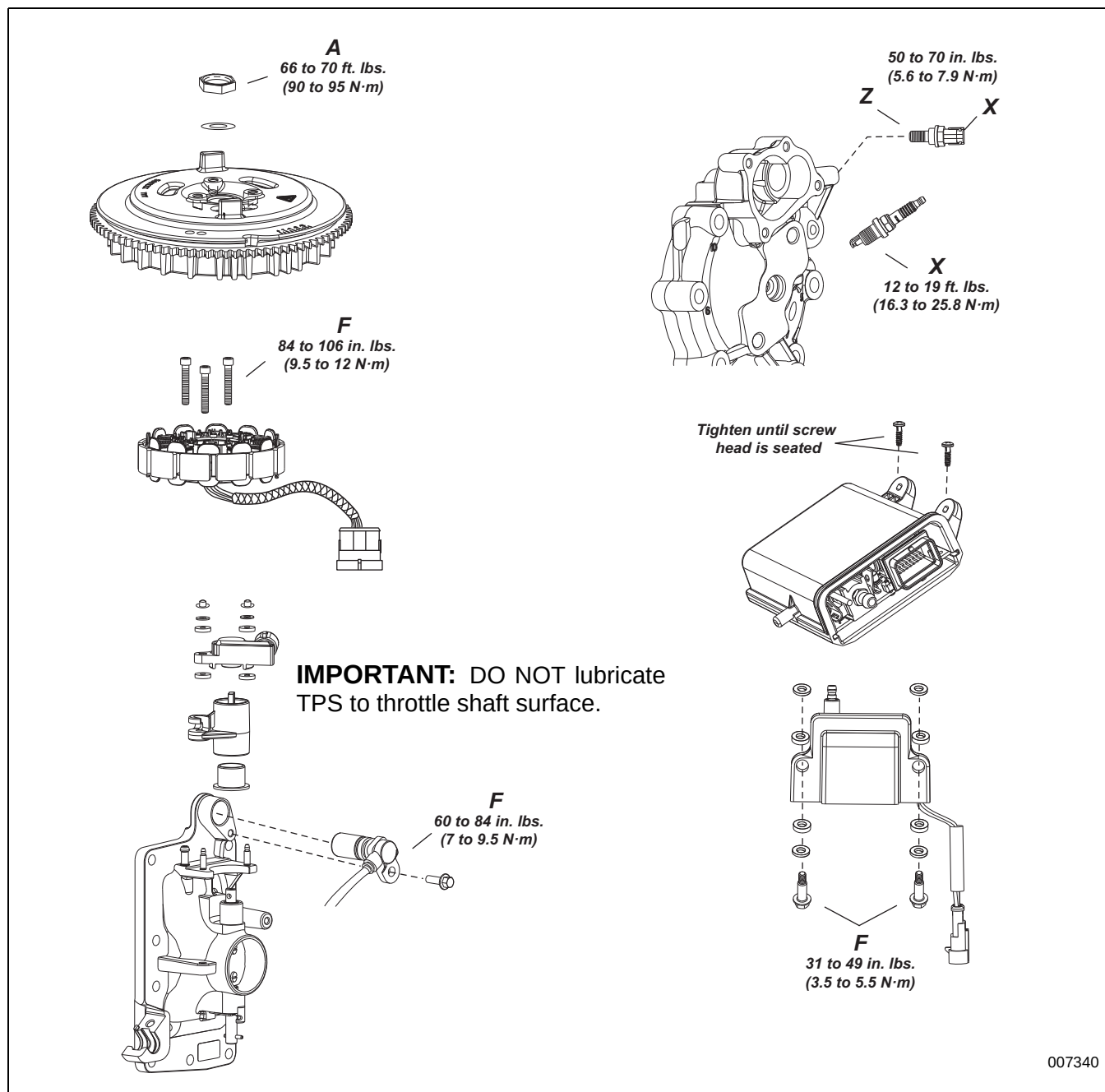
- Refer to **Fuel Injector Pressure Test** on p. 136.
- Refer to
- .

Electrical and Ignition

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Service Chart



007340

A Triple-Guard Grease
Z Thermal Grease

F Blue Nut Lock

X See Service Manual Text

008357M

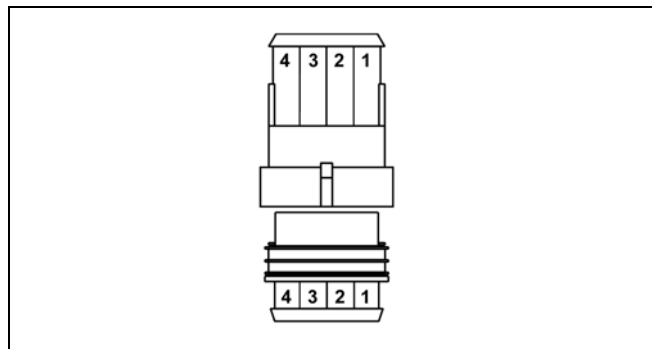
- 008357M

Electrical Harness Connections

Inspect wiring and electrical connections. Disassemble and clean all corroded connections. Replace damaged wiring, connectors, or terminals. Repair any shorted electrical circuits. Refer to wiring diagrams and reference charts for specific wiring details.

Refer to **Connector Servicing** on p. 123.

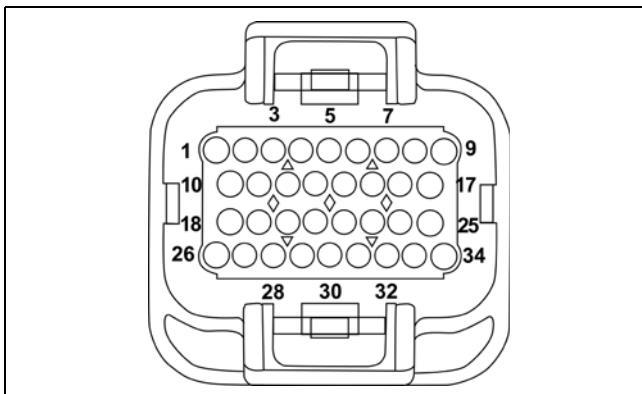
Engine Harness to Stator Connector



007444

Pin No.	Description of Circuit	Wire Color
1	Stator winding (yellow)	Yellow/White
2	Stator winding (yellow)	Yellow
3	Stator winding (brown)	Brown/White
4	Stator winding (brown)	Brown

EMM J1-A Connector



001875

Pin No.	Description of Circuit	Wire Color
1	Ignition, cylinder 1	Orange/Blue
2	Oil solenoid	Blue
3	Switched B+ to EMM	Purple
4	Crankshaft position sensor (CPS)	Yellow
5	Injector, cylinder 2	Green
6	Injector, cylinder 1	Blue
7	System Ground	Black
8	System Ground	Black
9	Stator winding, 1S	Yellow
10	CANbus, NET-H	White
11	Stop circuit	Blk/Yellow
12	Ground, CPS (digital)	White
13	Touch Troll	Pink
14	Bootstrap connector (programming)	Blk/Orange
15	Ignition, cylinder 2	Orange/Green
16	LOW OIL signal, <i>SystemCheck</i>	Tan/Black
17	Stator winding, 1F	Yellow/White
18	CANbus, NET-L	Blue
19	Air temperature sensor	Pink/Blue
20	Engine temperature sensor	Pink/Black
21	TPS	Green
22	Diagnostic connector	Red
23	Diagnostic connector	White
24	Tachometer	Gray
25	Stator winding, 2S	Brown
26	Fuel pump control	Brown
27	Neutral switch	Yellow/Black
28	+55 V, out	White/Red
29	System ground	Black
30	+5 V, out	Red
31	Low oil switch	Tan/Black
32	Stator winding, 2F	Brown/White
33	+55 V, out	White/Red
34	+55 V, out	White/Red

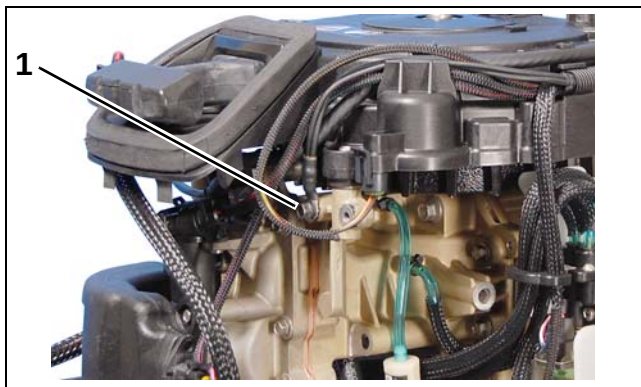
Ground Circuits

All ground circuits are essential to reliable outboard performance. Make sure all ground connections are clean and tight. Refer to wiring diagrams for specific wiring details.

EMM Ground Tests

Use an ohmmeter to check continuity of ground circuits. Calibrate the ohmmeter on the high ohms scale. Resistance readings for all ground circuits should be 0 W.

- System/power supply grounds: Check continuity between terminal pins 7, and 8 of *EMM* connector and the main harness ground.
- Injector circuit grounds: Check continuity between terminal pins 7 and 8 of the *EMM* connector and the main harness ground.
- Sensor circuit grounds: Check continuity between terminal pin 29 of the *EMM* connector and the appropriate sensor ground connections. Refer to wiring diagrams.



1. Main harness ground

007343

Additional Ground Tests

Check connections and continuity at the following locations:

- Starter solenoid terminal B and main harness ground.
- Trim and Tilt module ground at main harness ground.

Sensor Tests

All sensor circuits are dependent on wiring and connections, *EMM* supplied current (5 V), and sensor resistance. The supplied current flows through the wiring circuit and sensor before returning to the *EMM*.

IMPORTANT: Use *Evinrude Diagnostics* software to monitor sensor circuit voltages or values.

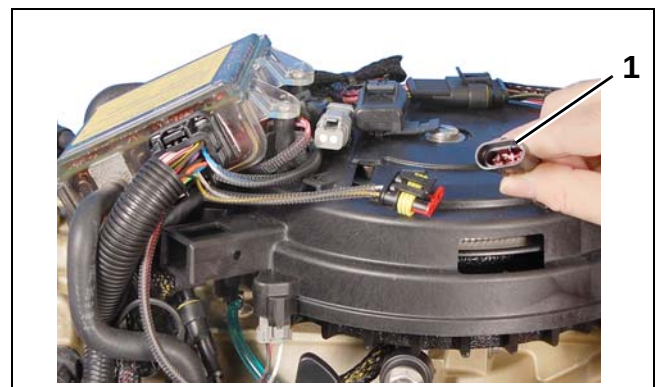
Crankshaft Position Sensor (CPS) Test

Use the *Evinrude Diagnostics* software CPS Sync and engine RPM displays to confirm a valid CPS signal while the outboard is cranking or running. An RPM display higher than zero indicates a CPS signal to the *EMM*.

Remove the electrical connector from its retainer on the recoil starter housing. Disconnect the crankshaft position sensor.

Use a digital multimeter to measure sensor resistance between the yellow and white wires. The complete circuit can be tested by measuring between pins 4 and 12 of the *EMM* connector.

Sensor Resistance
560 Ω $\pm$ 10% @ 77°F (25°C)



1. CPS Connector

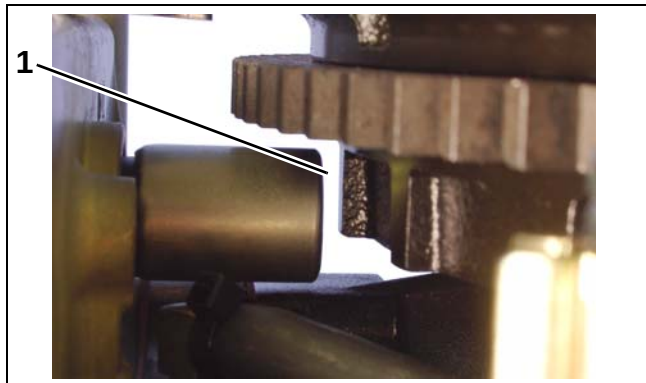
007345

The CPS is mounted to throttle body housing and requires no adjustment. Air gap or clearance to flywheel is fixed at approximately 0.054 in.

Electrical and Ignition

Sensor Tests

(1.37 mm). The acceptable clearance is 0.018 to 0.091 in. (0.45 to 2.38 mm).



1. CPS gap

006527

Throttle Position Sensor (TPS) Test

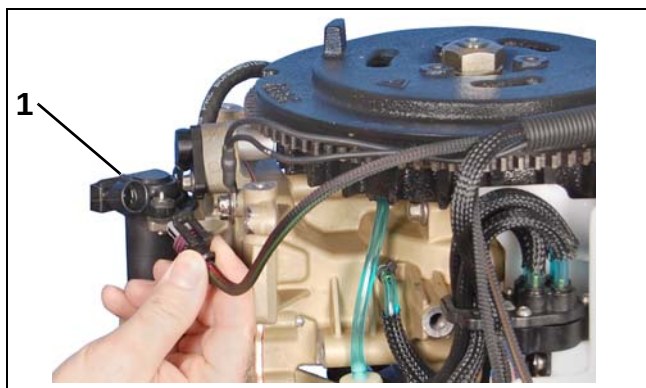
Use *Evinrude Diagnostics* software to monitor TPS voltage while the outboard is running. Voltage should change evenly as sensor lever is moved.

Remove the electrical connector from the throttle position sensor.

Use a digital multimeter to measure sensor resistance.

Sensor Resistance between "A" and "B"
3000 to 7000 Ω @ 77°F (25°C)

Sensor Resistance between "A" and "C"
4000 to 8000 Ω @ 77°F (25°C)



1. TPS

007346

Connect red meter lead to terminal "A" and black meter lead to terminal "C." Rotate the sensor lever through its range of travel. Resistance reading must change evenly as the sensor lever is moved.

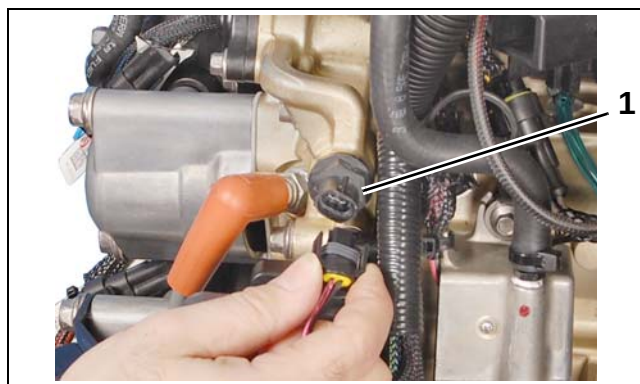
Connect red meter lead on terminal "B" and black meter lead to terminal "C." Rotate the sensor lever. Resistance reading must change evenly as the sensor lever is moved.

Engine Temperature Sensor Test

Remove the electrical connector from the engine temperature sensor.

Use a digital multimeter to measure sensor resistance.

Engine Temperature Sensor Resistance
680 Ω $\pm$ 5% @ 212°F (100°C)
10000 Ω $\pm$ 1% @ 77°F (25°C)
32654 Ω $\pm$ 2.5% @ 32°F (0°C)



1. Engine temperature sensor

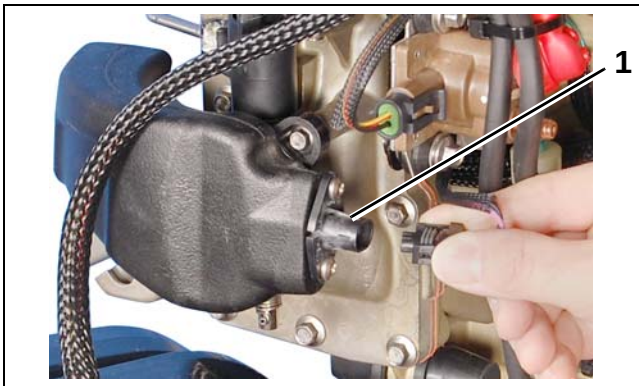
007347

Air Temperature Sensor (AT) Test

Remove the electrical connector from the air temperature sensor.

Use a digital multimeter to measure sensor resistance.

AT Sensor Resistance
$680\ \Omega \pm 5.25\% @ 212^{\circ}\text{F} (100^{\circ}\text{C})$
$10000\ \Omega \pm 1.5\% @ 77^{\circ}\text{F} (25^{\circ}\text{C})$
$32654\ \Omega \pm 3.0\% @ 32^{\circ}\text{F} (0^{\circ}\text{C})$



1. AT sensor

007348

Stator Tests

The stator consists of 2 windings (6 poles each) on a 5 inch diameter core and generates an output voltage of 55 VAC (700 watts maximum). This voltage is for fuel injector, fuel pump and oil pump operation.

Stator Resistance Tests

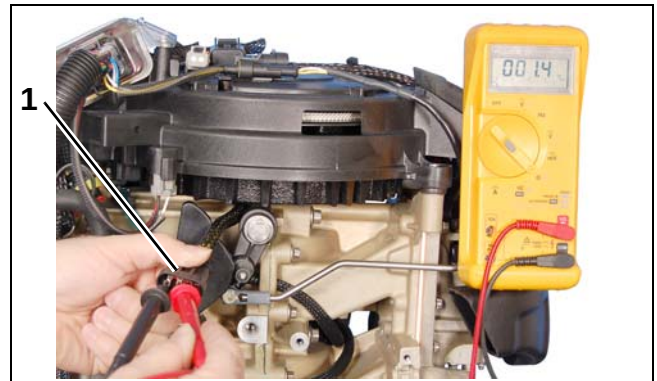
Use a digital multimeter to check resistance of stator windings.

Disconnect stator (4-pin) connector from the engine harness (4-pin) connector.

Stator Winding Resistance Specification

Yellow & Yellow / white
 $1.0 \pm 0.020\ \Omega @ 73^{\circ}\text{F} (23^{\circ}\text{C})$

Brown & Brown / white
 $1.0 \pm 0.020\ \Omega @ 73^{\circ}\text{F} (23^{\circ}\text{C})$



1. Stator connector

007349

Connect meter leads to the following pins:

- Yellow/white and yellow (pins 1 and 2)
- Brown/white and brown (pins 3 and 4)

IMPORTANT: A reading of less than 2 ohms is acceptable. Make sure meter is calibrated to read 1 ohm or less.

Electrical and Ignition

Stator Tests

To check for a grounded winding, connect one meter lead to ground and alternately connect the other meter lead to each stator wire. Meter should read no continuity. If meter reads continuity, replace stator.

Stator Voltage Output Test

⚠ WARNING

To prevent accidental starting of outboard, disconnect crankshaft position sensor (CPS).

Electric Start Models

Use a digital multimeter to check stator output voltage. Set meter to read 110 VAC output.

Disconnect CPS.

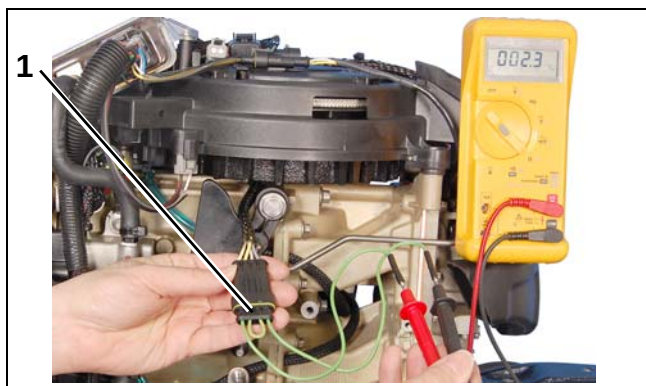
Disconnect stator (4-pin) connector from the engine harness (4-pin) connector.

Connect Stator Test Adaptor tool, P/N 354719, to stator connector.

Connect meter leads to terminals of adaptor tool.

Use the manual starter to crank outboard (300 RPM minimum) and observe meter reading:

- 55 VAC above 500 RPM



1. Stator Test Adaptor

007350

Rope Start Models

⚠ WARNING

To prevent accidental starting of outboard, disconnect crankshaft position sensor (CPS).

Use a Peak Reading Voltmeter, P/N 507972, to check stator output voltage. Set meter to the 50 VAC scale.

Disconnect CPS. Remove spark plugs. Make sure outboard is in NEUTRAL. Refer to **Spark Plugs** on p. 66.

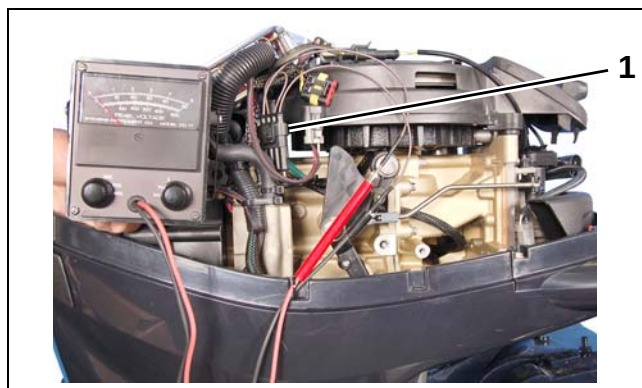
Disconnect stator (6-pin) connector from the engine harness (6-pin) connector.

Connect Stator Test Adaptor tool, P/N 354719, to stator connector.

Connect meter leads to terminals of adaptor tool.

Rotate the flywheel with the starter rope, using a long, steady pull.

Stator output voltage should be approximately 30 VAC.



1. Stator Test Adapter

008674

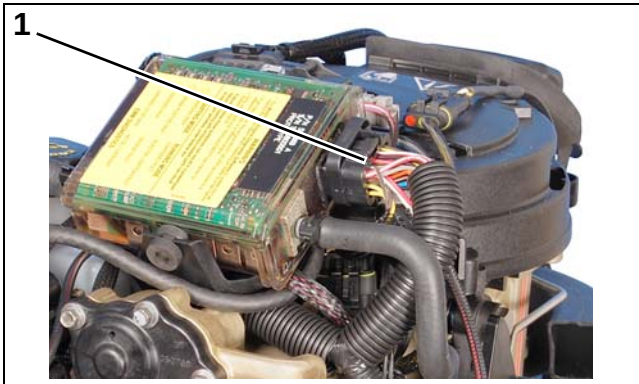
IMPORTANT: Index all spark plugs. Refer to Spark Plug **Indexing** on p. 66.

55 V Alternator Circuit

IMPORTANT: Use the Diagnostic Power Supply Tool, P/N 587005, with Accessory Power Cable Kit, P/N 5008092, to connect an external 12 volt battery to the Power Supply Tool. Refer to **Diagnostic Power Supply Tool** on p. 89.

With the power switch ON, check battery voltage at battery (12 V).

Then, use Electrical Test Probe Kit, P/N 342677, and a digital multimeter set to read 55 VDC to check voltage on white/red wires at the *EMM* connector. Voltage at *EMM* connector should be 0.5 to 1 V less than battery.



1. *EMM* connector

007353

With outboard running at 1000 RPM, voltage on white/red wires should be 55 V. Voltage readings at a specific speed (RPM) should be steady.

If there is any other reading, refer to **Stator Tests** on p. 117. Inspect the stator wiring and connections. Repair the wiring or replace a faulty stator, or *EMM*.

Flywheel and Stator Servicing

IMPORTANT: Weak flywheel magnets can cause low alternator output and affect outboard performance. Weak flywheel magnets can also cause low readings on ignition test equipment, such as a peak-reading voltmeter, which might cause unnecessary parts replacement.

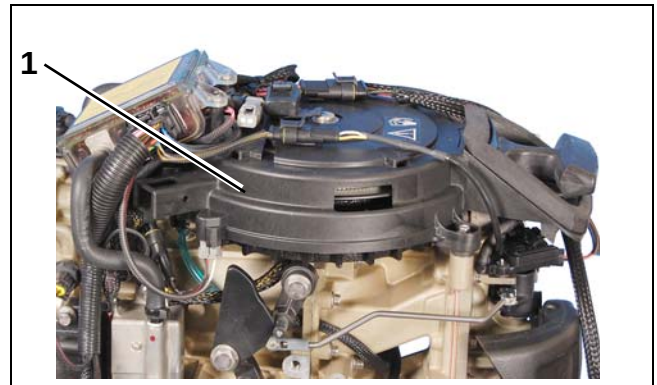
An accurate test of alternator output can help determine the flywheel's condition. Refer to **Stator Tests** on p. 117.

Flywheel Removal

WARNING

To prevent accidental starting while servicing, disconnect the Crankshaft Position Sensor (CPS).

Remove the recoil starter assembly. Refer to **Recoil Starter Removal** on p. 255.



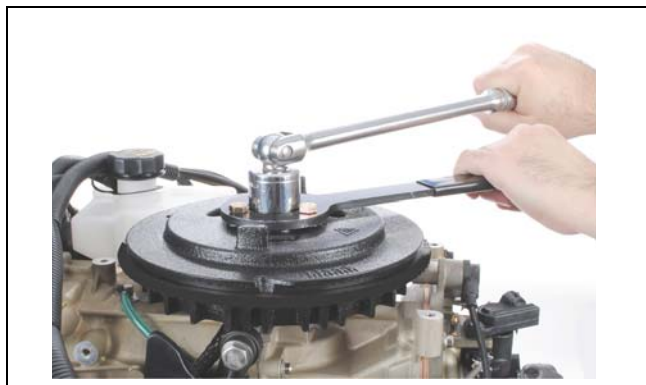
1. *Recoil Starter*

007358

Electrical and Ignition

Flywheel and Stator Servicing

Use Flywheel Holder, P/N 357623, and a 28 mm socket to remove flywheel nut.



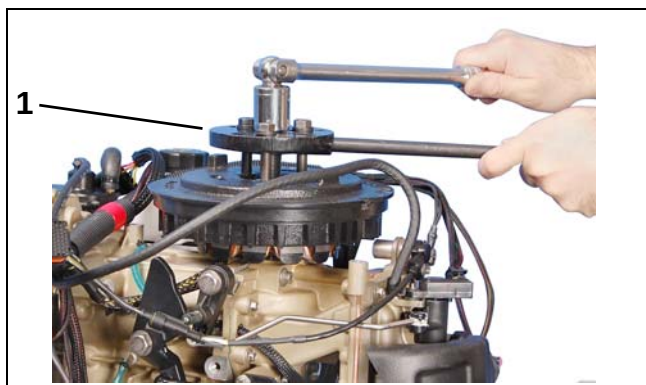
009037

Apply *Moly Lube* grease to the threads of the puller pressing screw, P/N 307637, and the center hole of the crankshaft.

Assemble the following components from Universal Puller Set, P/N 378103:

- Body, P/N 307636
- Screw, P/N 307637
- Handle, P/N 307638
- Three screws P/N 309492
- Three washers, P/N 307640

Put the puller on flywheel with body flat side up. Attach the puller body with the three shoulder screws and washers. Hold puller body with handle, and tighten pressing screw until flywheel releases. Turn the center screw and lift the flywheel off of the crankshaft.



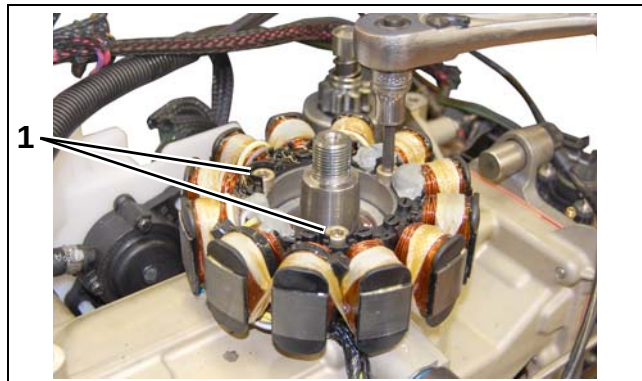
1. Universal puller

007360

Stator Service

Disconnect stator harness connector.

Remove three allen head screws to remove stator.



1. Stator screws

007443

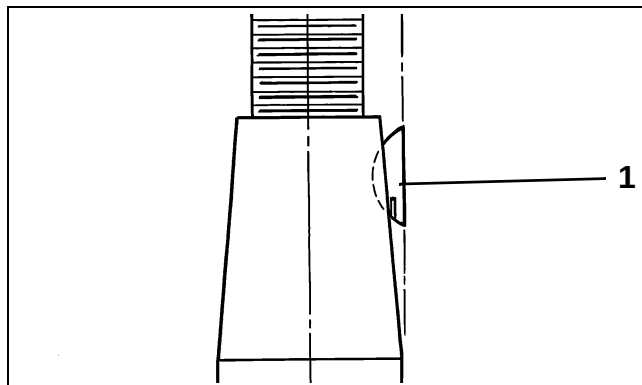
To install stator, position stator on cylinder block. Apply *Nut Lock* to screw threads. Install screws and tighten in crossing pattern to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).

Flywheel Installation

⚠ CAUTION

To avoid injury, keep hands and fingers clear from underside of flywheel. Flywheel can snap toward stator with great magnetic force.

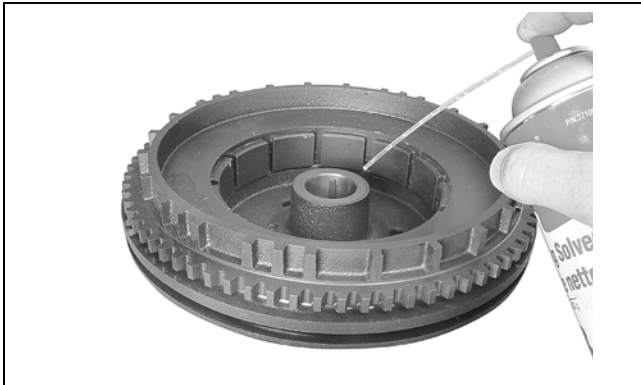
Install the outer edge of flywheel key parallel with centerline of crankshaft.



1. Flywheel key

DRC2116

Thoroughly clean the crankshaft and flywheel tapers with *Cleaning Solvent™* and let dry.



002093

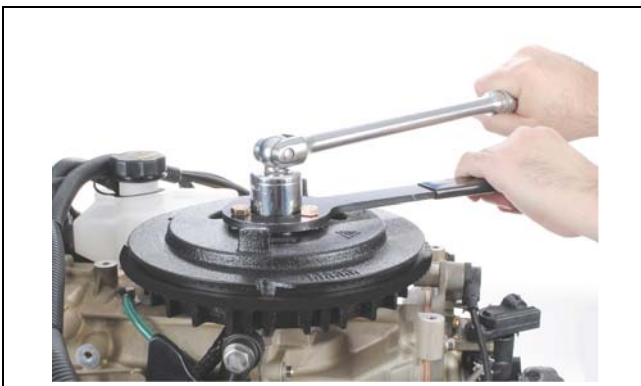
Align the flywheel keyway and install flywheel.

Coat the threads of the flywheel nut with *Triple-Guard* grease.

Install the washer and nut and tighten to a torque of 66 to 70 ft. lbs. (90 to 95 N·m).

NOTICE

To prevent damage to crankcase or cylinder block, DO NOT allow Flywheel Holder to rest against recoil starter mounting boss.



007361

Replace recoil starter.

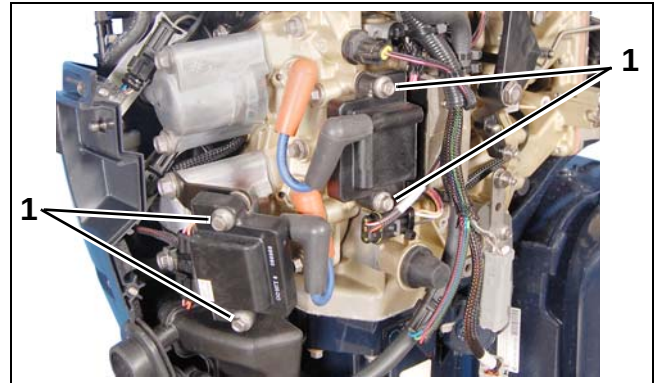
IMPORTANT: Check ignition timing after flywheel removal or replacement. Refer to **Timing Adjustments** on p. 122.

Ignition Coil Servicing

Ignition Coil Removal

Remove spark plug lead from ignition coil and disconnect ignition coil electrical connector.

Remove two ignition coil retaining screws. Do not lose the rubber washers between coil and bracket.



1. Screws

008193

Ignition Coil Installation

Install one rubber washer on each screw and install screw through ignition coil.

Install remaining rubber washers on screws between coil and bracket.



1. Rubber washers

008188

Install coil on bracket. Tighten screws to a torque of 31 to 49 in. lb. (3.5 to 5.5 N·m).

Install spark plug lead on ignition coil and connect ignition coil electrical connector.

Timing Adjustments

Timing Pointer

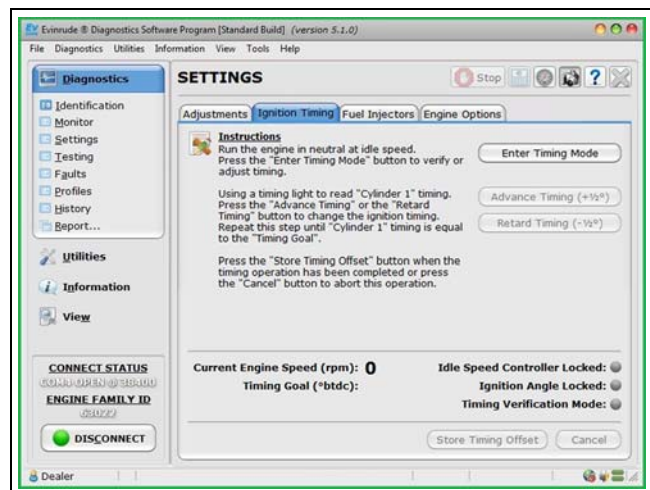
The timing pointer on *Evinrude E-TEC 15 – 30 HP* models is not adjustable.

Timing Verification

Use *Evinrude Diagnostics* software to synchronize the mechanical timing of the outboard with the electronic timing of the *EMM*.

Start the outboard.

Use the *Settings/Ignition Timing* screen of the diagnostics software and follow the on-screen instructions.



Ignition Timing Screen

008572

Check ignition timing after any of the following procedures:

- Powerhead replacement
- Crankshaft replacement
- Flywheel removal or replacement
- CPS replacement
- *EMM* replacement
- *EMM* software replacement (reprogramming)

IMPORTANT: Make sure the timing pointer is set and the outboard reaches operating temperature before making any timing adjustments.

TPS Calibration

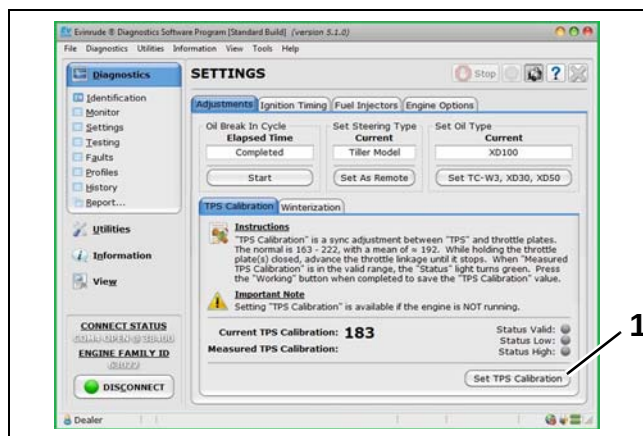
Use *Evinrude Diagnostics* software to tell the *EMM* what throttle position sensor voltage is when the throttle plates begin to open.

Set TPS Calibration after replacing or adjusting any throttle body or throttle linkage parts.

Remove the air silencer.

Do NOT start the outboard.

On the *Settings/Adjustments* screen of the diagnostics software, click the “Set TPS Calibration” button.



1. TPS Calibration button

008571

While holding the throttle plates closed, advance the throttle linkage until it stops. The *Measured TPS Calibration* field on the screen will increase.

Click the *Working* button in the software to calibrate the TPS.

Install the air silencer.

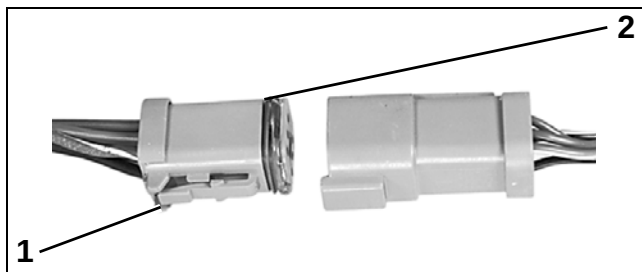
Connector Servicing

Deutsch Connectors

IMPORTANT: *Electrical Grease* is recommended. Incorrect grease application can cause electrical or warning system problems.

To disconnect the connector, press the latch and pull the connectors apart.

To connect the connector, confirm that the seal is in place. Clean off any old grease and dirt from connectors. Apply a light coat of *Electrical Grease* to seal only. Push connectors together until latched.

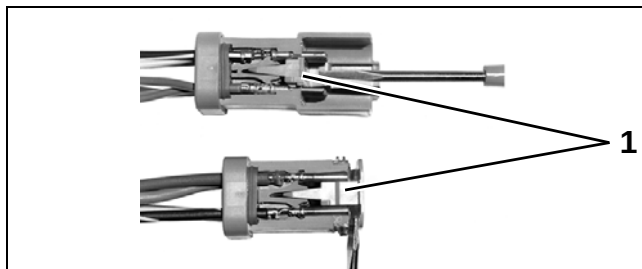


1. Latch
2. Seal

42079A

Terminal Removal

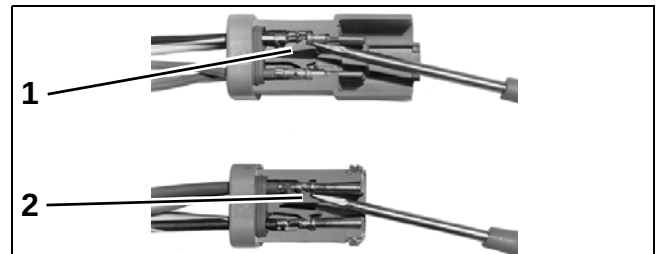
Use hook-end of Connector Service Tool, P/N 342667, to pull out wedge from receptacle, or use other end of tool to pry out wedge from plug. Use needle-nose pliers to remove wedge from 3-pin receptacle.



1. Wedge

42327

Release terminal latch and gently pull on wire.

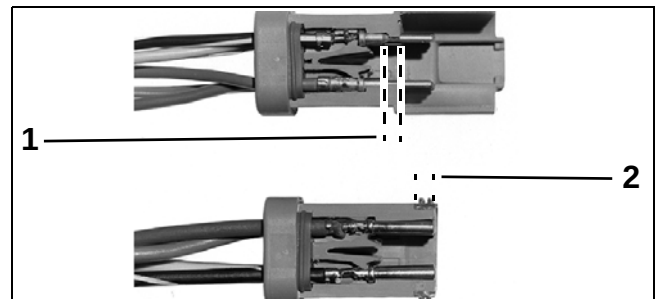


1. Terminal latch (plug)
2. Terminal latch (receptacle)

42329

Terminal Installation

Push terminal through seal until it locks into place. Fill connector with *Electrical Grease* to 1/32 in. (0.8 mm) below ledge or end of plug.



1. Ledge of plug
2. End of plug

42330

Push wedge in until latched. Wedge in 2-pin receptacle is not symmetrical; position latch shoulders next to terminals.

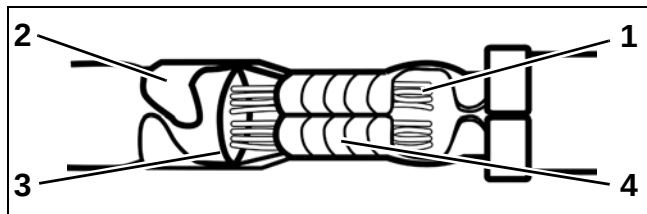
Crimping Terminals

Strip insulation back 3/16 in. (5 mm). Place terminal in 18-gauge notch of Crimping Pliers, P/N 322696. Position end of wire strands in terminal past wire crimp area, and position end of insulation past insulation crimp area. Capture all wire strands in crimp; leave no loose strands. Crimp

Electrical and Ignition

Connector Servicing

wire securely. Do not solder. Crimp insulation in 14/16-gauge notch of crimping pliers.



1. End of wire strands
2. Insulation crimp area
3. End of insulation
4. Wire crimp area

DRC6205

AMP Connectors

IMPORTANT: Always use the appropriate meter test probes and adapters when testing components fitted with these terminals. Electrical grease is NOT used on AMP connectors.

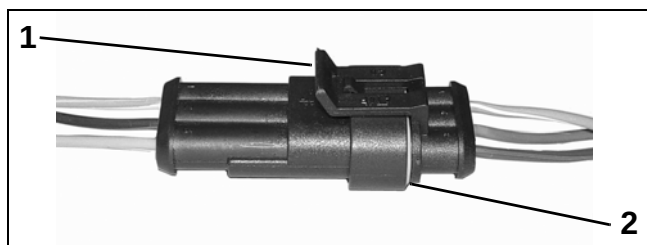
Superseal 1.5

Disconnect

Lift latch. Pull connectors apart.

Connect

Confirm the seal is in place. Push connectors together until latched.



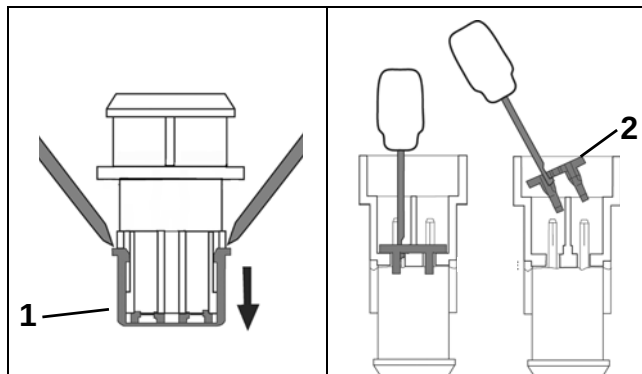
1. Latch
2. Seal

002448

Terminal Removal

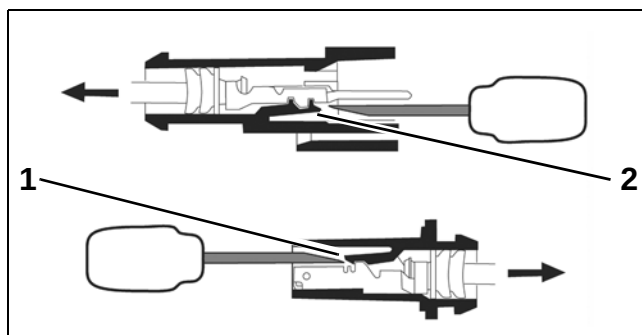
Use Secondary Lock Tool, P/N 777078, to release anti-backout device of connector housing. Next, use Primary Lock Tool, P/N 777077, to release locking tab of connector housing. Release locking

tab and pull on wire to remove from connector housing.



1. Anti backout device, plug
2. Anti backout device, receptacle

002449
002450



1. Locking tab, plug
2. Locking tab, receptacle

002447

Terminal Installation

Align terminal with connector housing. Push connector and seal into housing until seated.



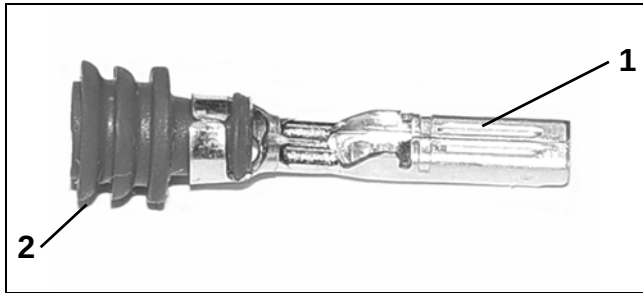
1. Terminal and seal

002451

Align anti-backout device with connector housing and terminals. Use Secondary Lock Installer, P/N 777079, to seat device in connector.

Crimping Terminals

Crimping *Superseal 1.5* terminals requires *AMP Crimp Tool* with dies, P/N 777281.



1. Terminal
2. Seal
002452

Super Seal

The J1-A connector of the *EMM* is an *AMP Super Seal* connectors.

Disconnect

Depress BOTH latches and pull connector from plug.

Connect

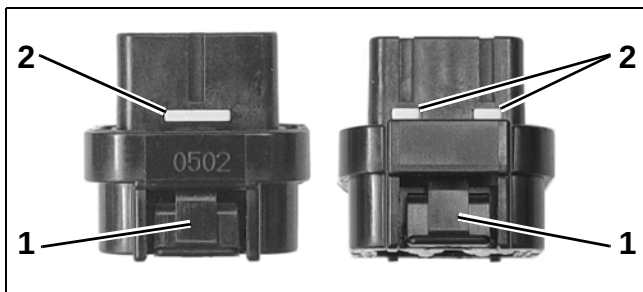
Push connector into plug until latches engage.



1. Latch
007353

Terminal Removal

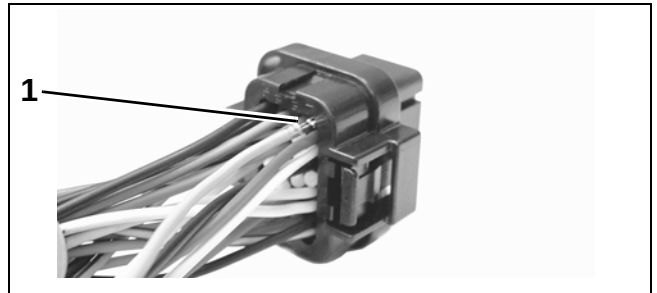
Open lock mechanism and remove terminal from connector housing.



1. Latch
2. Lock mechanism
002453

Terminal Installation

Push terminal through seal until it is seated in connector housing. Close lock mechanism.



1. Terminal
002454

Packard Connectors

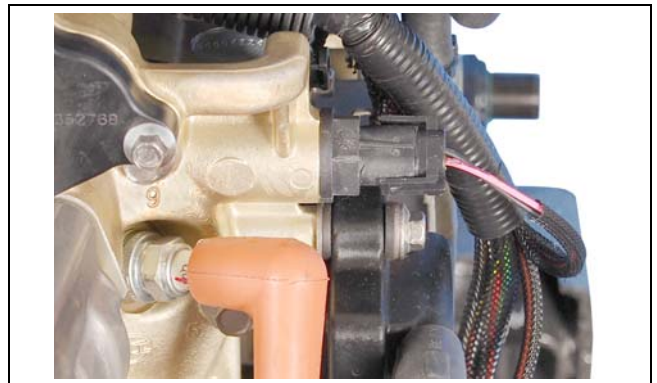
IMPORTANT: Always use the appropriate meter test probes and adapters when testing components fitted with these terminals.

Disconnect

Lift latch(s). Remove connector.

Connect

Confirm the seal is in place. Push connector onto housing until latched.



007364

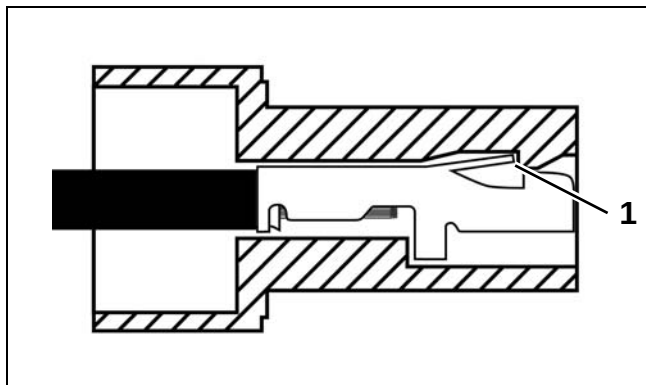
Terminal Removal

A tab on the back side of the terminal engages a shoulder in the connector housing to hold the terminal in place. The terminal is removed by releasing the tab and then pushing the terminal and wire through connector housing.

Electrical and Ignition

Connector Servicing

Insert a thin tool into the connector above the terminal to release tab.



1. Tab

DRC5940a

Terminal Installation

Install wire gasket on wires and feed wires through the correct terminal position of the connector housing. Terminal is crimped onto wire and then pulled back into connector housing until locking tab engages and terminal is seated.



002304

Crimping Terminals

Strip insulation back 3/16 in. (5 mm). Position end of wire strands in terminal past the wire crimp area and the end of insulation in the insulation crimp area of the terminal.

Capture all wire strands in crimp; leave no loose strands. Crimp wire and insulation securely using crimping pliers.

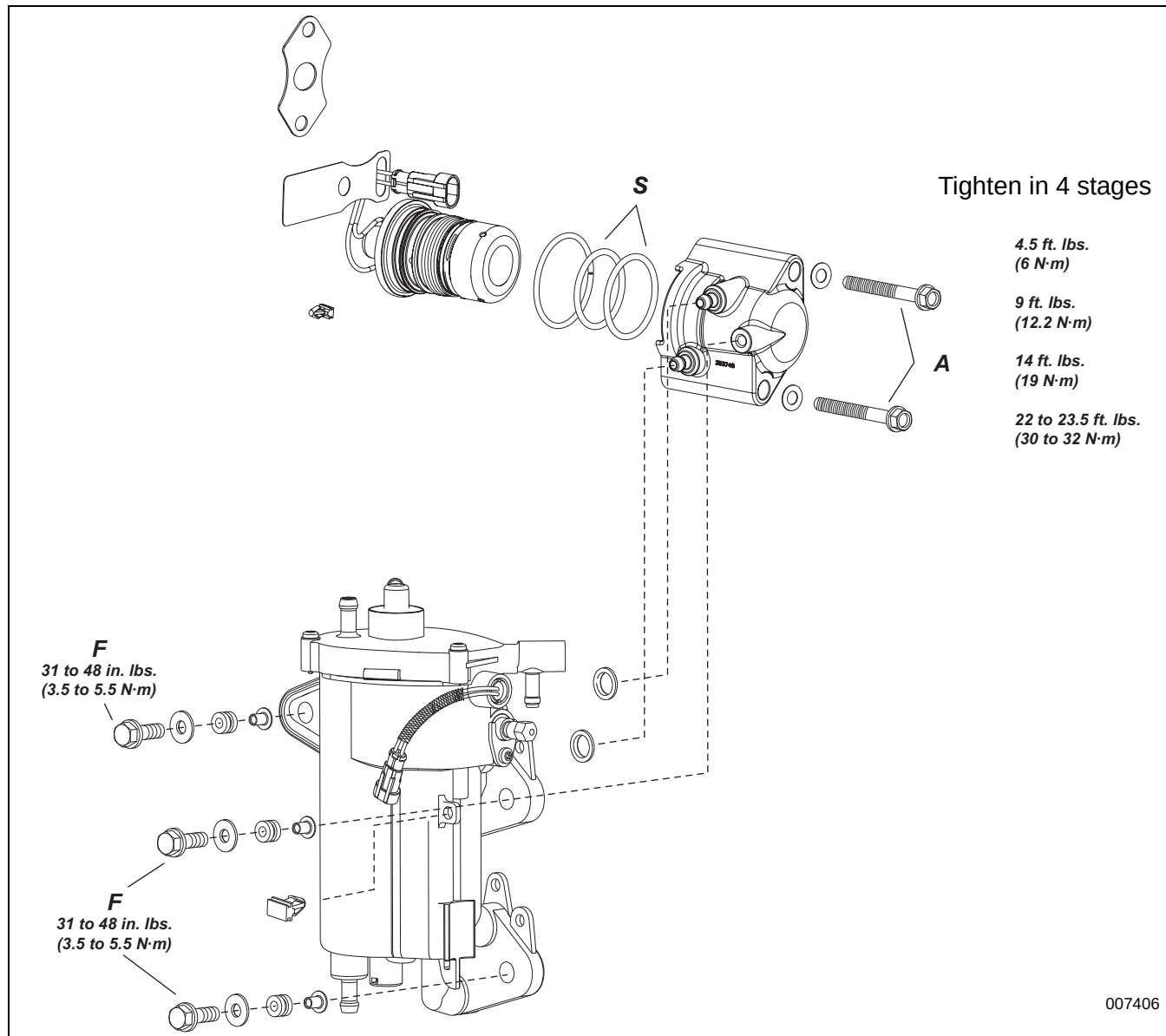
Fuel System

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Service Charts

Injectors, Vapor Separator, Fuel Pump

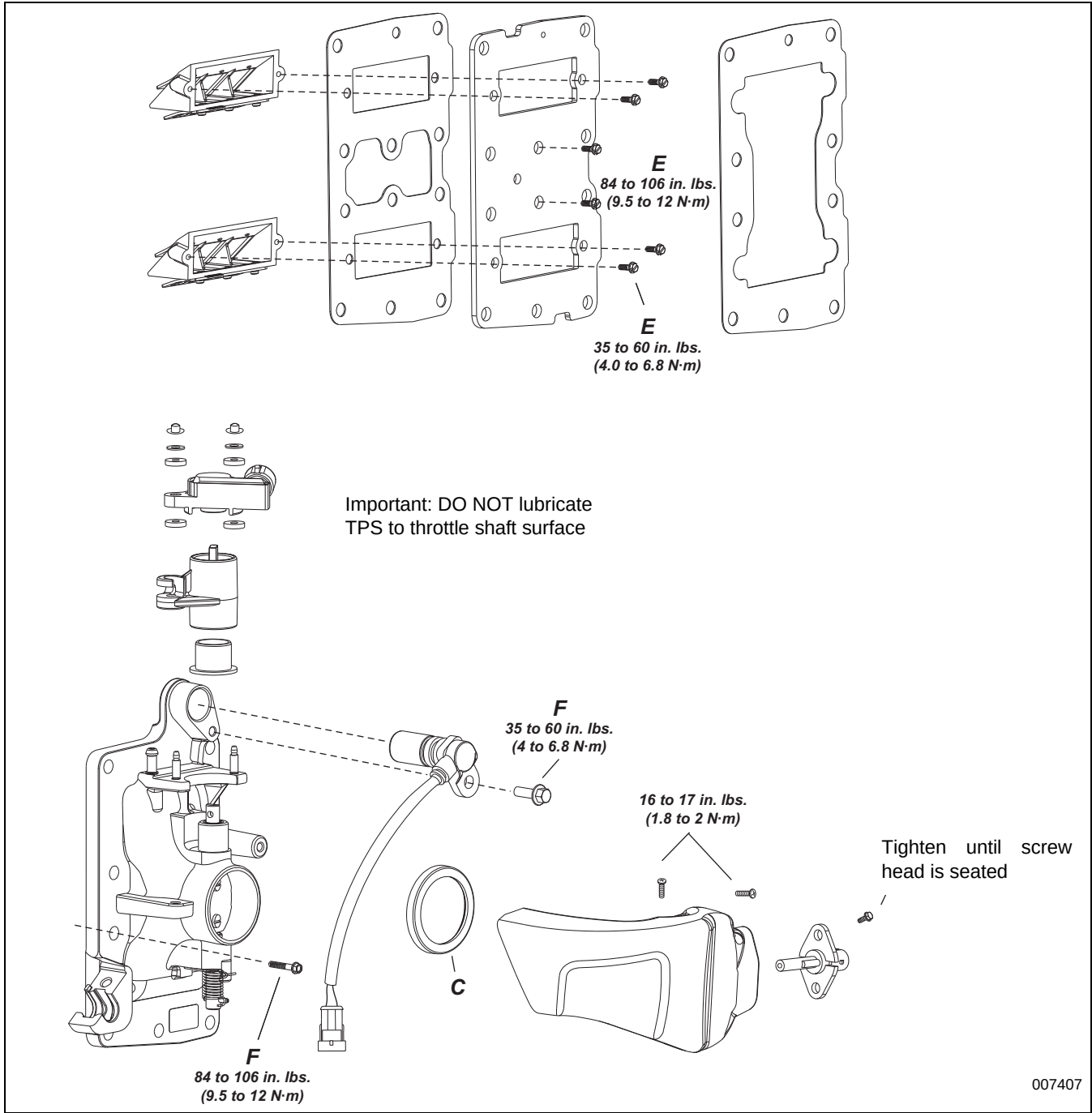


A Triple-Guard Grease
S STP† Oil Treatment

F Blue Nut Lock
X See Service Manual Text

H Outboard Engine Lubricant

Reed Plate Assembly and Throttle Body

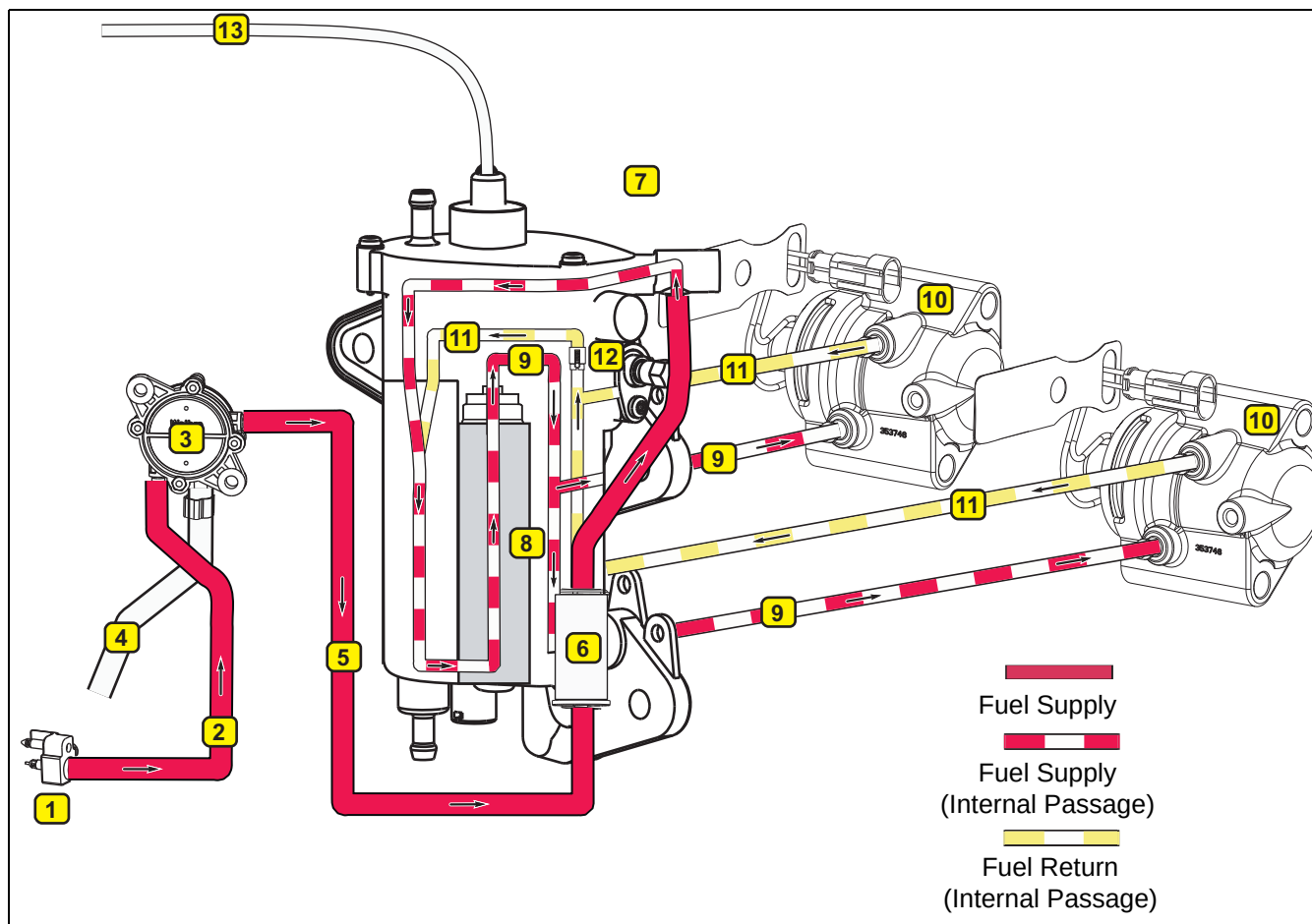


C Adhesive 847

E Red Ultra Lock

F Blue Nut Lock

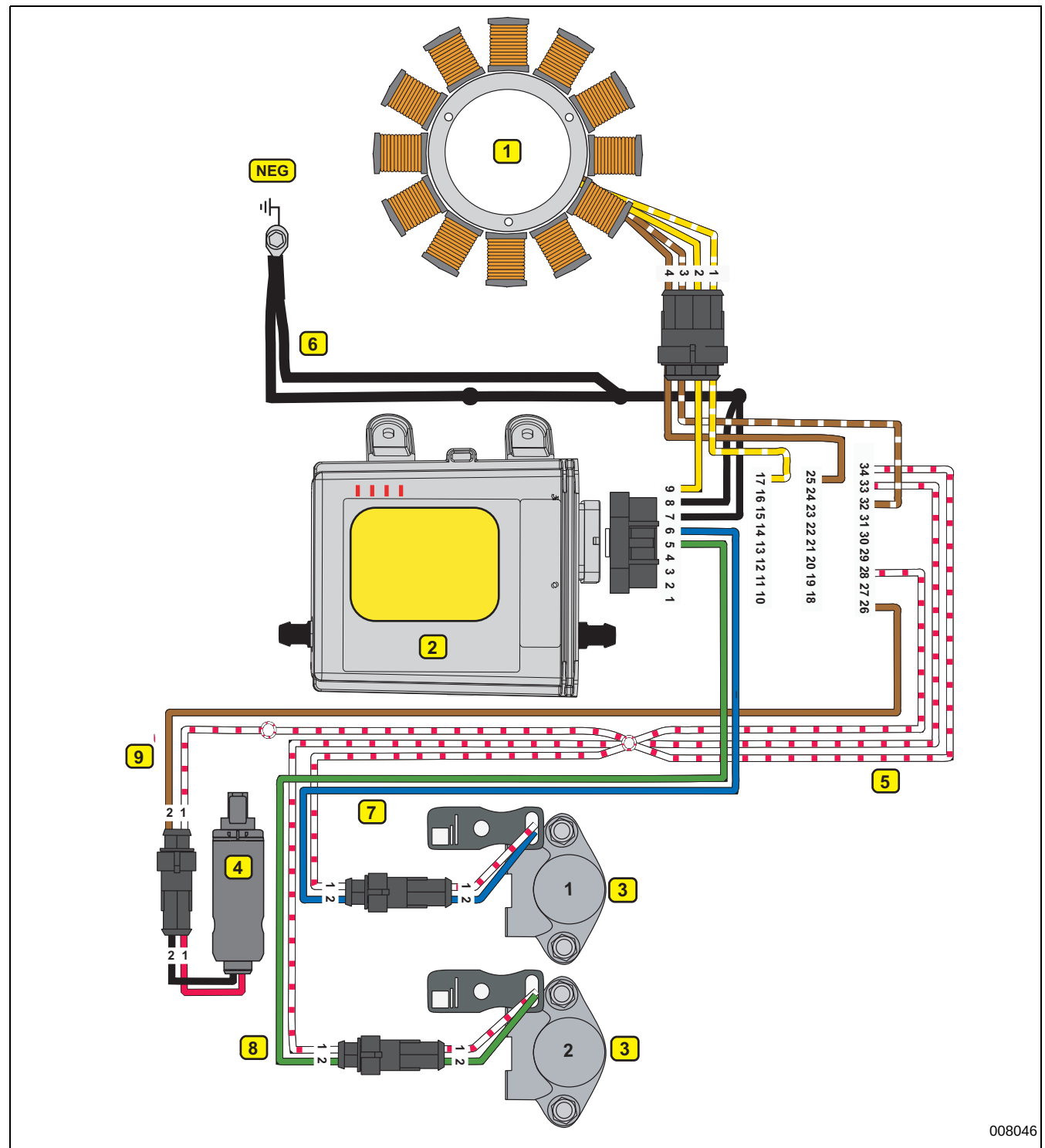
Fuel System Hose Routing



007408

1. Fuel fitting on outboard
2. Fuel supply from boat fuel system
3. Fuel lift pump (2 to 8 psi)
4. Pulse hose from cylinder/crankcase
5. Fuel supply to vapor separator
6. Fuel filter
7. Vapor separator
8. Electric fuel circulation pump (20 to 30 psi)
9. Fuel supply to injectors (internal passage)
10. Fuel injector(s)
11. Fuel return to vapor separator (internal passage)
12. Pressure regulator (high pressure)
13. Vent hose to intake manifold

Fuel System Circuit Diagram



1. Stator
2. EMM
3. Fuel injector

4. Fuel circulation pump
5. WHITE/RED (55 V)
6. BLACK ground wires

7. BLUE
8. GREEN
9. BROWN

008046

Components

The fuel system includes the following components:

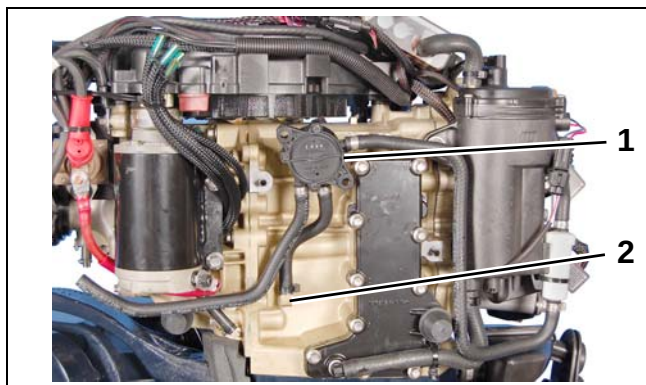
- Fuel Lift Pump
- Fuel Filter
- Vapor Separator
- Fuel Circulation Pump
- Fuel Injectors

Fuel Lift Pump

The fuel lift pump is a mechanical, pressure-pulse pump. The diaphragm of the pump is driven by a pulse hose that connects to the cylinder/crank-case assembly.

Fuel lift pump pulse hose location:

- Number 2 cylinder



1. Fuel lift pump
2. Pulse hose fitting

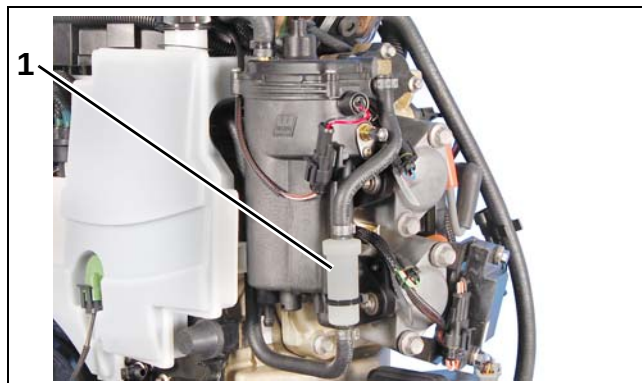
007410

Vacuum from the fuel lift pump pulls fuel from the fuel tank. Once fuel reaches the pump, internal pump pressure forces the fuel from the pump through the fuel filter and into the vapor separator.

Fuel Filter

The fuel filter protects the vapor separator and the high-pressure components of the fuel system from contaminants.

Refer to **Inspection and Maintenance Schedule** on p. 58 for service frequency.



1. Filter

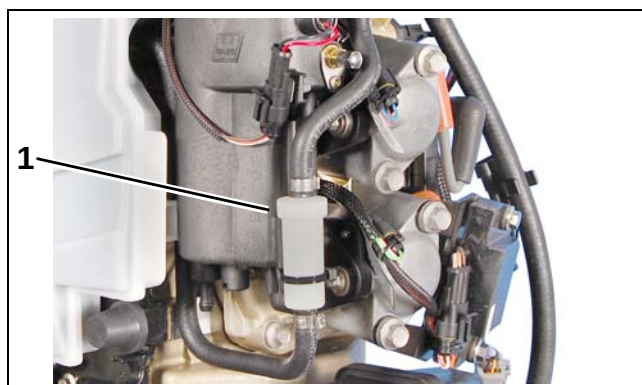
007273

Vapor Separator

The vapor separator:

- Serves as a water-cooled fuel reservoir to accumulate incoming fuel from the fuel lift pump and from the fuel return.
- Contains a float controlling the venting of fuel vapors.
- Contains a fuel pressure regulator for the high pressure fuel system.

The vapor separator is serviced as an assembly and includes the fuel circulation pump.



1. Vapor separator assembly

007273

Fuel Reservoir

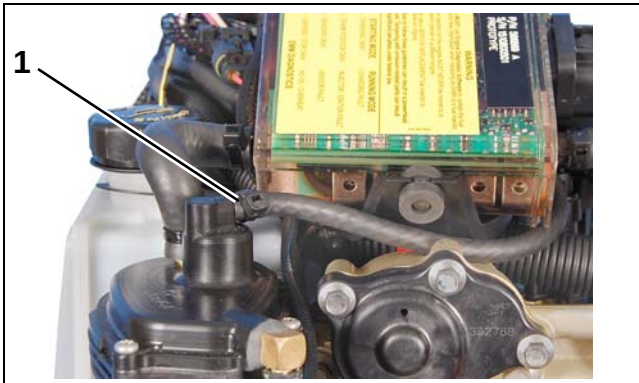
The vapor separator accumulates fuel in an internal fuel reservoir and supplies fuel to the electric circulation pump. It is water-cooled to enhance vapor separating capabilities.

Cooling

Water is used to cool the fuel as it flows through the vapor separator. The cooling passage of the separator self-drains when the outboard is stored vertically. Refer to **Hose Routing and Water Flow Diagrams** on p. 168.

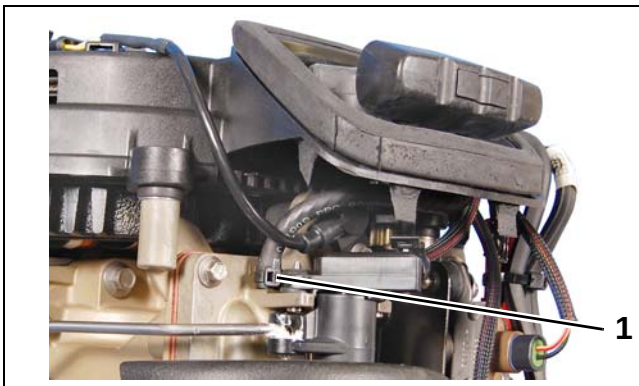
Venting

The fuel vapor vent regulates fuel vapor pressure in the reservoir.



1. Vent

007411



1. Vent hose connection to intake

007412

The vapor separator vent is opened and closed by a float valve. The float valve moves with the fuel level in the fuel chamber. Hot fuel causes an increase in vapor pressure. This results in a lower fuel level in the vapor separator. The float valve drops and the vent opens. This allows fuel vapor to flow to the intake manifold through the vent hose.

As the vapor pressure in the vapor separator decreases, the fuel level begins to increase. An increase in the fuel level raises the float valve and the vent closes.

Pressure Regulator

The fuel pressure regulator helps maintain consistent fuel pressure in the fuel system.

Fuel returning from the injectors enters the fuel chamber of the vapor separator through a pressure regulator. The pressure regulator maintains approximately 28 to 32 psi (193 to 220 kPa) of fuel pressure in the high pressure side of the fuel system.

Fuel Circulation Pump

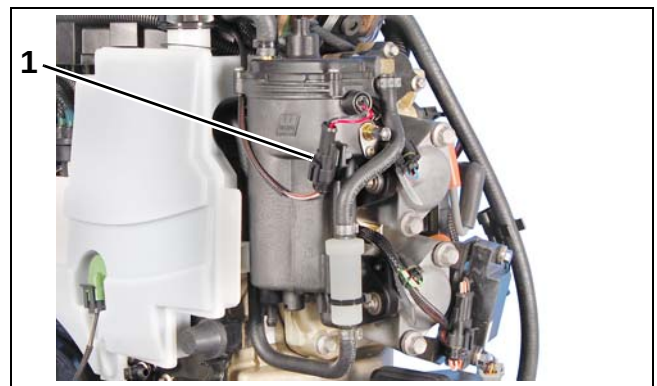
The fuel circulation pump is an electric high pressure fuel pump.

Fuel Supply

The pump is mounted in the vapor separator and draws fuel from the fuel chamber. It pumps pressurized fuel through an internal fuel supply passage connected to the fuel injectors.

Electrical Circuit

The circulation pump is controlled by the *EMM* and operates on the 55 V circuit. The outboard must be cranking or running (CPS input to *EMM*) for the circulation pump to be activated. The *EMM* controls pump operation by rapidly connecting and disconnecting the pump's internal coil to ground.



1. Fuel pump electrical connector

007273

Fuel Manifold

The vapor separator uses molded internal passages to route fuel directly to and from the injectors. Refer to **Fuel System Hose Routing** on p. 130.

Fuel System Components

Fuel Injectors

Fuel injectors are fuel metering, electric solenoids (55 V) bolted directly to the cylinder head. The *EMM* controls the activation of each injector by rapidly connecting and disconnecting the injector's internal coil to ground.

Fuel Flow Compensation

The flow rate of each injector is measured as part of the manufacturing process. This information is recorded and assigned to the injector by serial number.

The *EMM* is programmed to compensate for variations in fuel flow. Each injector and its location on the outboard is identified by the *EMM*. DO NOT install an injector without updating the compensation software.

Each service injector includes its fuel flow information on a 3.5 in. floppy disk. This software allows the *EMM* to be reprogrammed for this injector's unique fuel flow characteristics.

NOTICE

Fuel injectors MUST NOT be moved from one cylinder to another. EMM programming is associated with the cylinder location of each injector. Installing an injector on the wrong cylinder can result in powerhead failure.

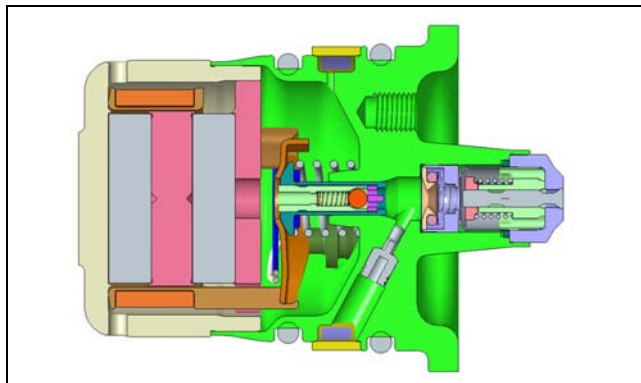
Injector Fuel Supply

Fuel is supplied to the injectors by the fuel circulation pump and the fuel supply manifold.

Each injector has internal fuel passages. These passages are designed to:

- Provide fuel to the injector's injection chamber

- Route fuel through the injector housing to cool the injector coil and armature



006619

Fuel System Priming

Vent Line Clamp

Federal Regulations require that all outboards with a fuel vapor separator must be shipped with a vent line clamp installed. This clamp must be removed before priming the fuel system or starting the outboard for the first time.



007131

IMPORTANT: Failure to remove the clamp may cause fuel starvation and poor running qualities.

Priming the Fuel System

⚠ WARNING

Fuel vapors are highly flammable. Perform the following procedure in a well ventilated area. Extinguish all smoking materials and make certain no ignition sources are present.

Connect the fuel hose connector to the quick connect fitting on the outboard.

Use the primer to fill the vapor separator.

The high-pressure fuel circuits and injectors will prime as the outboard is cranked with the starter.

Observe all fuel lines, both in the boat and on the outboard. Repair any fuel leaks.

⚠ WARNING

Failure to check for fuel leaks could allow a leak to go undetected, resulting in fire or explosion and may cause personal injury or property damage.

Fuel System Tests

⚠ WARNING

Use caution when working on any pressurized fuel system. Wear safety glasses and work in a well ventilated area. Extinguish all smoking materials and make certain no open flames or ignition sources exist. Before starting any fuel system service, carefully relieve fuel system pressure. Failure to properly relieve fuel system pressure can result in spraying fuel and/or excessive fuel spillage during servicing. Fuel is flammable and can be explosive under certain conditions.

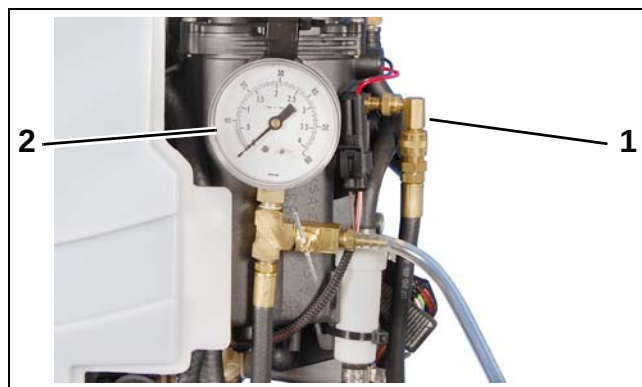
Fuel System Pressure Test

⚠ WARNING

Protect against hazardous fuel spray. Before starting any fuel system service, carefully relieve fuel system pressure.

Relieve fuel system pressure. Refer to **Relieving Fuel System Pressure** on p. 140.

After relieving fuel system pressure, install a 0 to 60 psi (0 to 415 kPa) Fuel Pressure Gauge, P/ N 5007100 or equivalent, to the fuel pressure test fitting.



1. Test fitting
2. Fuel pressure gauge

007413

Fuel System

Fuel System Tests

START outboard and check pressure. System pressure should be 28 to 32 psi (193 to 220 kPa).

Shut OFF outboard. Monitor pressure gauge. Pressure should not drop below 15 psi (103 kPa).

IMPORTANT: If outboard does not run, prime fuel system and crank outboard; check circulation pump operation; check fuel system pressure.

Results:

Normal pressure:

- Observe pressure reading after outboard is shut OFF
- Refer to **Lift Pump Pressure Test** on p. 137

Pressure drops after outboard is shut OFF:

- Check for leaking fuel injector.
- Check for leaking pressure regulator.
- Check for external fuel system leak.

High pressure:

- Replace vapor separator.

Low pressure:

- Check fuel supply to fuel lift pump. Refer to **Lift Pump Vacuum Test** on p. 138. Higher vacuum readings indicate restrictions in the fuel supply. Repair or replace as needed.
- Restricted fuel filter/water separator assembly.
- Lift pump not supplying enough fuel to vapor separator. Refer to **Lift Pump Pressure Test** on p. 137.
- If the above tests are good and vapor separator remains full of fuel, check for damaged circulation pump. Replace vapor separator assembly.

No pressure:

- Check electrical circuit and ground connections for circulation pump.
- If voltage is present and pump does not run, repair connection or replace vapor separator assembly.

Relieve fuel system pressure before removing fuel pressure gauge. Refer to **Relieving Fuel System Pressure** on p. 140.

Vapor Separator Vent Check

Monitor the vapor separator vent hose. No fuel or a trace of fuel is acceptable. Excessive fuel discharge indicates a vapor separator vent malfunction. Monitor vent for presence of fuel during testing. Temporarily install clear tubing for monitoring. Replace vapor separator if the venting of fuel is continuous.

Fuel Injector Pressure Test

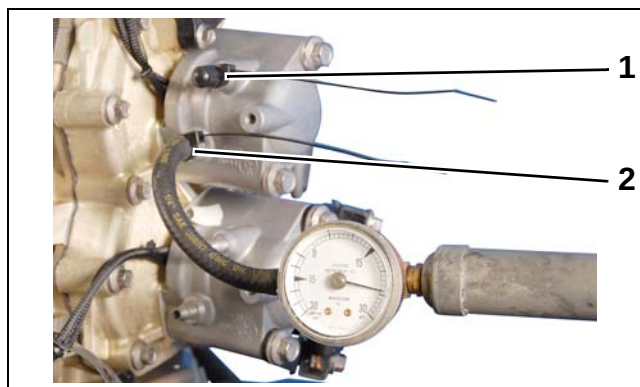
Remove vapor separator assembly. Refer to **Vapor Separator Removal** on p. 142.

IMPORTANT: Perform test with injector mounted to cylinder head.

Seal injector outlet fitting with a cap, such as Plug, P/N 315391, and a tie strap.

Connect a 0 to 30 psi (0 to 207 kPa) pressure tester to the inlet fitting. Secure with tie strap.

Pressurize the injector to 30 psi (207 kPa). Pressure must hold for at least five minutes.



1. Outlet fitting
2. Inlet fitting

007414

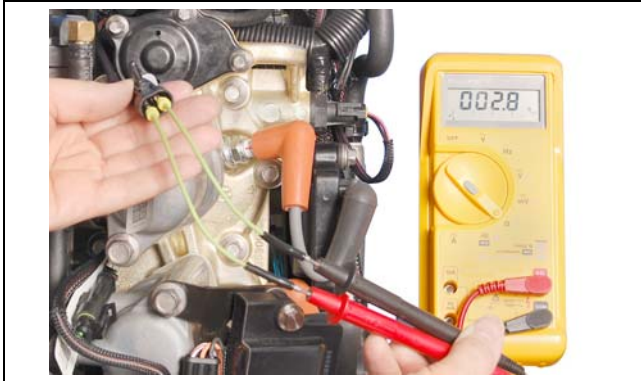
Refer to **Fuel Delivery Tests** on p. 108 for additional test procedures.

Fuel Injector Resistance Test

Use a digital multimeter to measure the injector coil resistance.

Fuel Injector Coil Resistance

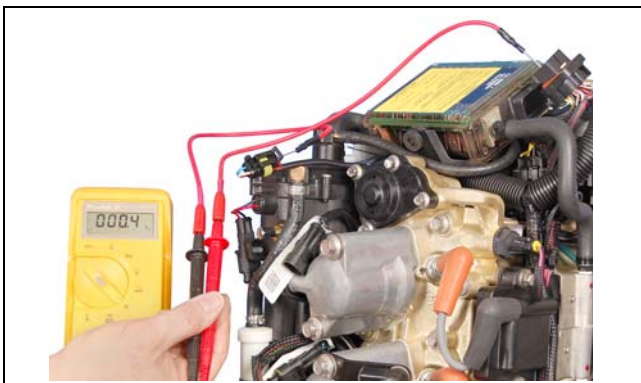
2 to 3 Ω @ 72°F (22°C)



007415

Use a digital multimeter with appropriate adapter leads to measure resistance of the complete injector circuit, including injector and associated wiring.

Measure resistance between pin 1 (white/red) of injector connector (connected) and the appropriate pin location of EMM J1-B connector (disconnected). Refer to engine wiring diagram for specific EMM J1-B connector pin location for the injector circuit being tested (blue or green).



007416

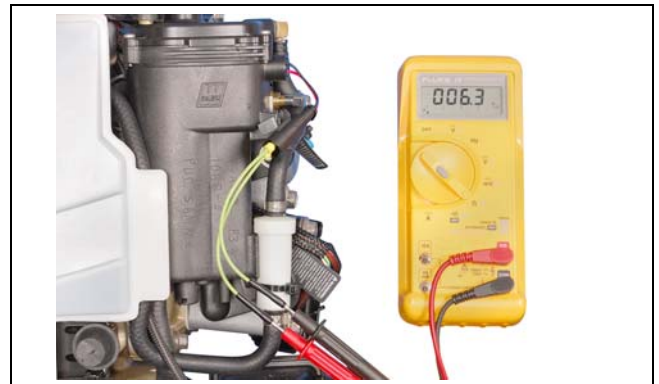
Resistance should be the same as, or slightly higher than, the injector alone.

Circulation Pump Resistance Test

Use a digital multimeter with appropriate adapter leads to measure the fuel pump circuit and coil resistance.

Fuel Pump Resistance

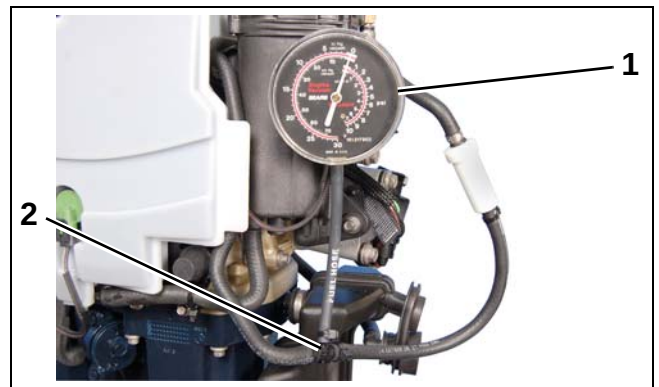
2 to 8 Ω @ 77°F (25°C)



007417

Lift Pump Pressure Test

Install a 0 to 15 psi (0 to 103 kPa) Fuel Pressure Gauge. Tee into the fuel supply line before the fuel filter.



1. Fuel pressure gauge
2. Tee fitting

007418

Fuel System

Fuel System Tests

Prime the fuel system and check for leaks. START outboard and run at idle speed. Hold gauge level with inlet fitting and monitor gauge for pressure reading.

Pressure should stabilize at a reading greater than 2 psi (14 kPa).

Results:

Normal pressure:

- Perform the **Lift Pump Vacuum Test** on p. 138. Make sure no air leaks or restrictions exist in the fuel supply hose or boat fuel system.

Low pressure:

- Check pulse hoses and fittings for restrictions.
- Perform the **Lift Pump Vacuum Test** on p. 138. Make sure no air leaks or restrictions exist in the fuel supply hose or boat fuel system.
- Check fuel flow through fuel lift pump. Use fuel primer bulb to force fuel through pump.

No pressure:

- Check pulse hoses and fittings restrictions.
- Check fuel flow through fuel lift pump. Use fuel primer or primer bulb to force fuel through pump.
- Momentarily prime or squeeze primer bulb to check gauge operation.
- Check pulse hose and fittings for restrictions.

Lift Pump Vacuum Test

NOTICE

Do not use fuel primer bulb, manual fuel primer, or electric fuel pump primer to restart outboard. A positive pressure in the fuel supply could damage some vacuum gauges.

Confirm fuel supply to the fuel lift pump.

Temporarily install a vacuum gauge, T-fitting, and 8 in. (20.3 cm) of clear vinyl hose between the fuel supply hose and fuel lift pump (inlet). Secure connections with tie straps to prevent fuel or air leaks.



007419

START outboard and run at FULL THROTTLE for at least two minutes. Monitor clear vinyl hose for the presence of air. Air bubbles indicate a faulty hose, connection, or fuel tank pick-up. Repair, if necessary, before proceeding.

There should be no air or vapor bubbles visible in the clear hose. The maximum inlet fuel vacuum should not exceed 4 in. Hg. (13.5 kPa) at the inlet to the fuel lift pump under any operating conditions (IDLE to WOT).

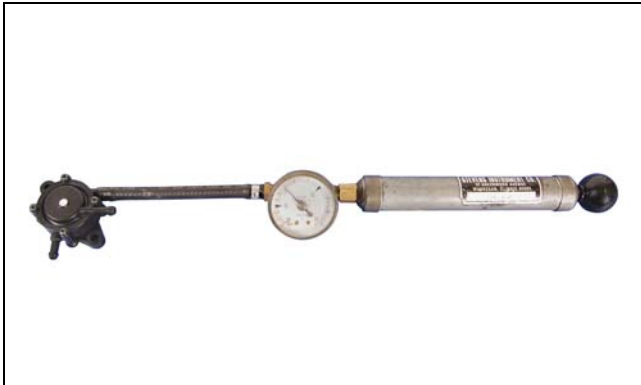
A higher vacuum indicates an excessive restriction in the fuel supply. Repair as needed. Refer to **Fuel System Requirements** on p. 28 for fuel supply component requirements.

Lift Pump Diaphragm Test

Perform this test only if a damaged pump is suspected. This test does not confirm the performance of the internal fuel pump check valves.

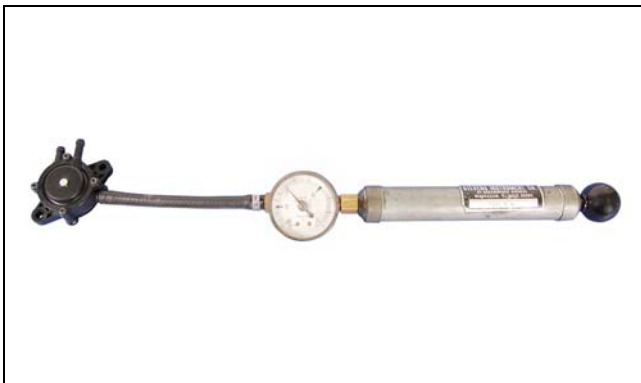
Remove the fuel inlet and outlet hoses from the fuel pump housing.

Attach gearcase pressure tester to the fuel outlet. Apply 3 psi (20 kPa). Replace lift pump if pump fails to hold pressure.



007420

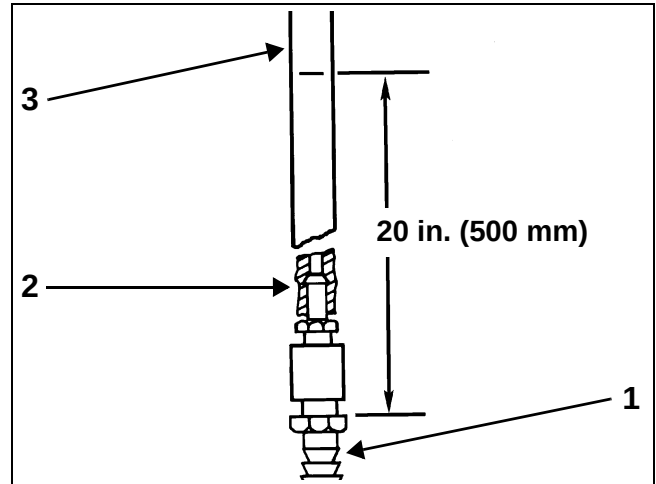
Attach gearcase vacuum tester to the fuel inlet. Apply 3 in. Hg. (-10 kPa). Replace lift pump if pump fails to hold vacuum.



007421

Anti-Siphon Valve Test

Remove anti-siphon valve from fuel tank. Install adapter fittings and a 36 in. (91.4 cm) length of clear hose to the inlet side (tank end) of valve.



1. Anti-siphon valve
2. Adapter fitting
3. Clear hose

DR2277

Fill clear hose with water to a height of 20 in. (500 mm). Water must NOT flow through valve. An occasional drip is acceptable. Replace valve if water drips continuously.

Increase height of water to 25 in. (630 mm). Water should flow through valve as water level reaches 25 in. (630 mm). Replace the anti-siphon valve if test results are different.

Fuel Component Servicing

⚠ WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Use caution when working on any part of the fuel system.

Protect against hazardous fuel spray. Before starting any fuel system service, carefully relieve fuel system pressure. Refer to Relieving Fuel System Pressure.

Always work in a well ventilated area and wipe off any fuel spillage.

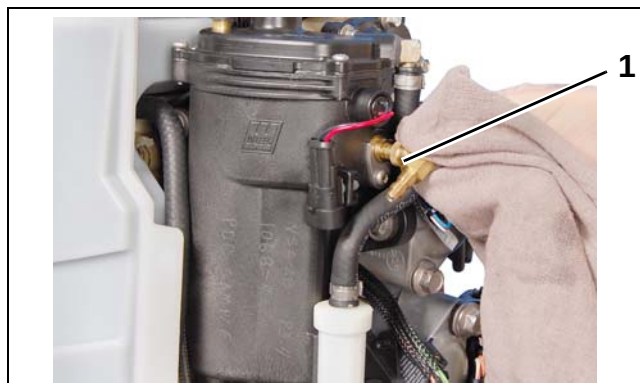
DO NOT smoke and make certain no open flames or ignition sources exist.

After servicing the fuel system check for leaks. Failure to check for fuel leakage could allow a leak to go undetected, resulting in fire or explosion.

Relieving Fuel System Pressure

IMPORTANT: Minimize fuel system pressure before disassembly. Disconnect the fuel supply hose from outboard. Remove propeller and disconnect circulation fuel pump electrical connector. If outboard runs, start and run at IDLE for 5 seconds and STOP outboard. If outboard does NOT run, crank for 10 seconds.

Wrap a shop towel completely around the pressure test valve while connecting fitting from Fuel Pressure Gauge, P/N 5007100, to test fitting of fuel pump/vapor separator assembly.



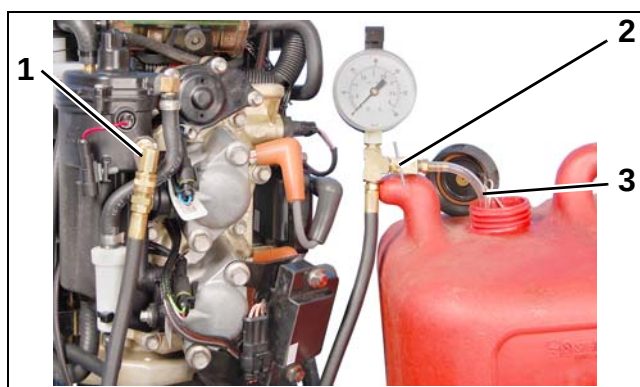
1. Test fitting

007096

Insert venting hose of gauge into a suitable container.

Slowly open gauge's venting valve.

Clean up any spilled fuel with shop towels.



1. Test fitting
2. Venting valve
3. Venting hose

007097

ENVIRONMENTAL NOTE

Dispose of fuel contaminated shop towels in an environmentally responsible manner, or according to local regulations.

Fuel Filter Service

Removal

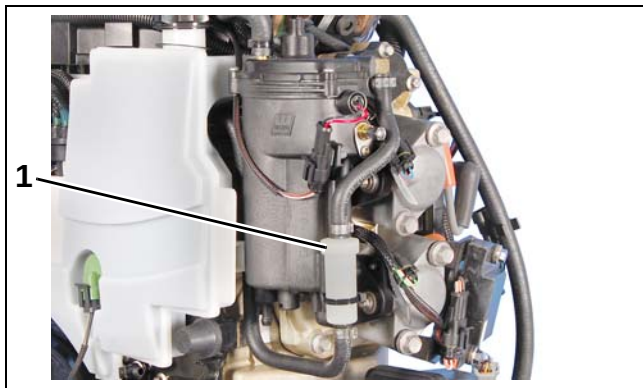
Remove filter carefully to prevent spilling contents.

Clean up any spilled fuel with shop towels.

ENVIRONMENTAL NOTE

Dispose of fuel and fuel contaminated shop towels in an environmentally responsible manner, or according to local regulations.

Inspect contents for any presence of water. If water is present, identify the source and correct the problem. Take additional fuel samples and drain fuel tank(s) if necessary.



1. Fuel filter flange

007273

Installation

Install filter in fuel supply hoses. Flanged part of filter is up. Secure filter with appropriate clamps.

Squeeze primer bulb to prime fuel system. Hold pressure on bulb and check for fuel leaks.

Run outboard and check for fuel leaks.

Fuel Lift Pump Service

The fuel lift pump is serviceable as a complete assembly. Refer to parts catalog for service parts.

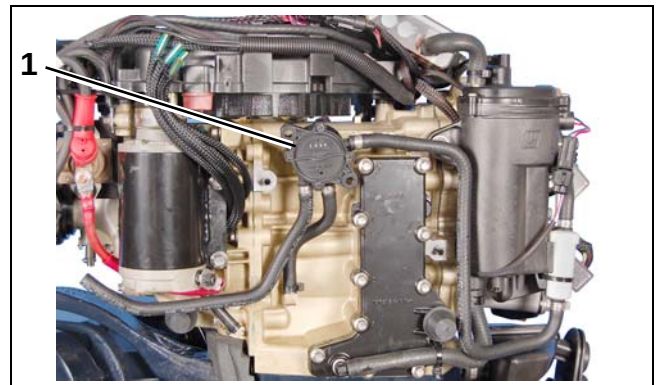
Removal

Remove port lower motor cover. Refer to **Lower Cover Removal**.

Remove the oil tank. Refer to **Oil Tank Assembly** on p. 156.

Use an appropriate tool to remove the push nuts that retain fuel pump to oil tank.

Remove the fuel hoses from the fuel pump housing.



1. Fuel pump housing

007410

Remove the fuel lift pump.

Clean up any spilled fuel with shop towels.

ENVIRONMENTAL NOTE

Dispose of fuel and fuel contaminated shop towels in an environmentally responsible manner, or according to local regulations.

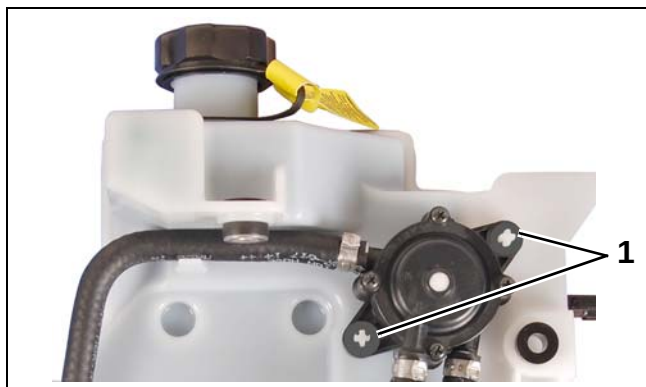
Fuel System

Fuel Component Servicing

Installation

Connect the fuel hoses to the fuel pump. Secure with *Oetiker* clamps.

Place fuel pump in position on the oil tank. Secure the fuel pump with new pushnuts, P/N 354365.



1. Push nuts

007422

Be sure fuel hoses are routed in channels on oil tank. Install the oil tank. Refer to **Oil Tank Assembly** on p. 156.

Squeeze primer bulb to prime fuel system. Hold pressure on bulb and check for fuel leaks.

Run outboard and check for fuel leaks.

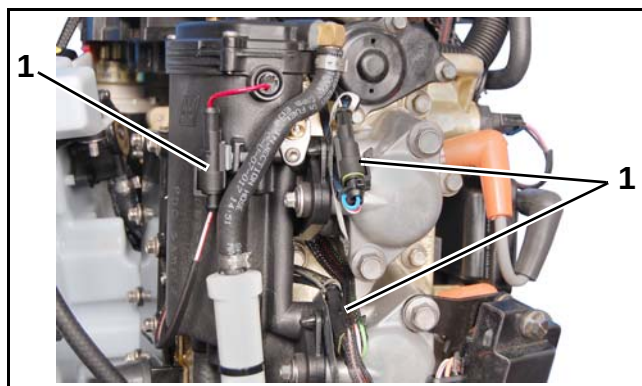
Vapor Separator and Fuel Injector Service

Vapor Separator Removal

Relieve fuel system pressure. Refer to **Relieving Fuel System Pressure** on p. 140.

Remove oil tank. Refer to **Oil Tank Assembly** on p. 156.

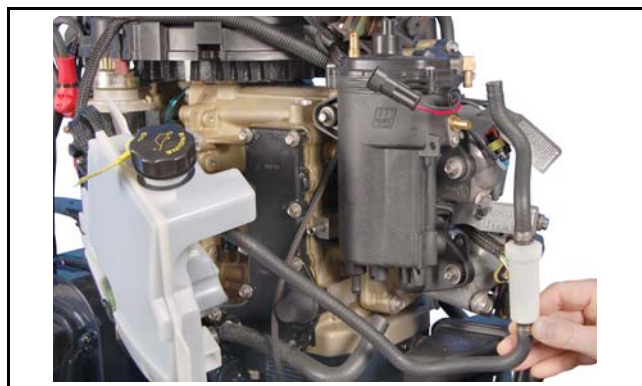
Disconnect vapor separator and fuel injector electrical connectors. Remove connectors from retainers.



1. Electrical connectors

007423

Remove clamps and fuel supply hose, vapor separator vent hose and cooling water hoses.

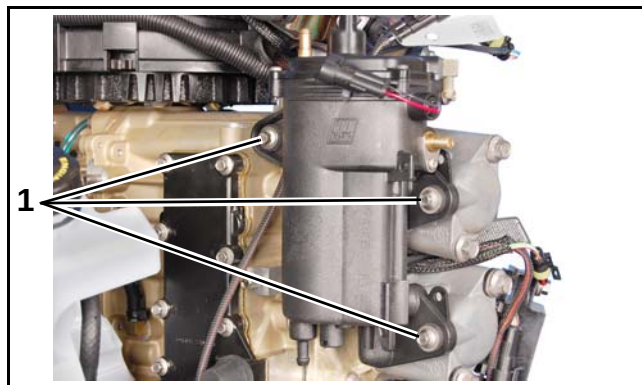


007285

Loosen four injector screws.

Remove three vapor separator retaining screws.

Remove vapor separator.



1. Retaining screws

007098

Clean up any spilled fuel with shop towels.

ENVIRONMENTAL NOTE

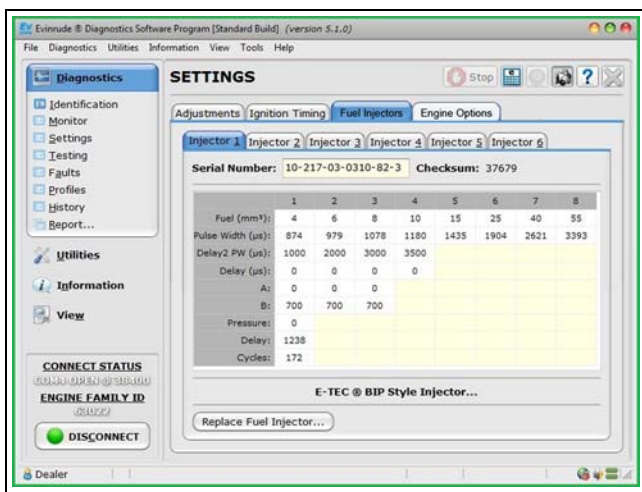
Dispose of fuel and fuel contaminated shop towels in an environmentally responsible manner, or according to local regulations.

Fuel Injector Removal

NOTICE

Fuel injectors must be installed in the correct cylinder locations. Use Evinrude Diagnostics Software to make sure that EMM programming matches injector positioning. The Injector Coefficients screen displays injector serial numbers for each cylinder.

Mark fuel injectors to show cylinder locations.

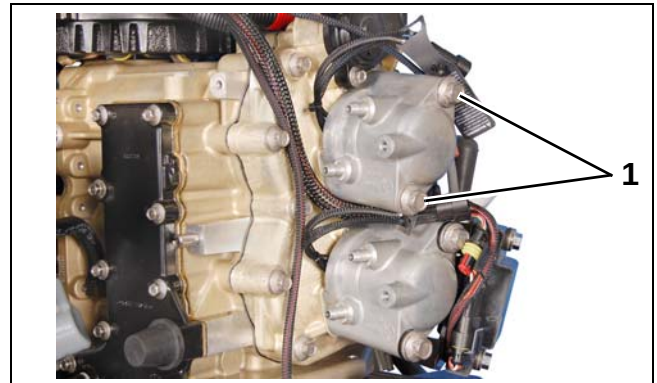


Injector Coefficients Screen

008568

Use caution when handling fuel injectors. Prevent dirt and debris from entering fuel inlet and outlet ports of injectors. Cover the injector nozzle port in cylinder head to prevent contamination of combustion chamber.

Remove injector screws.



1. Injector screws

007100

Remove fuel injector and insulator.

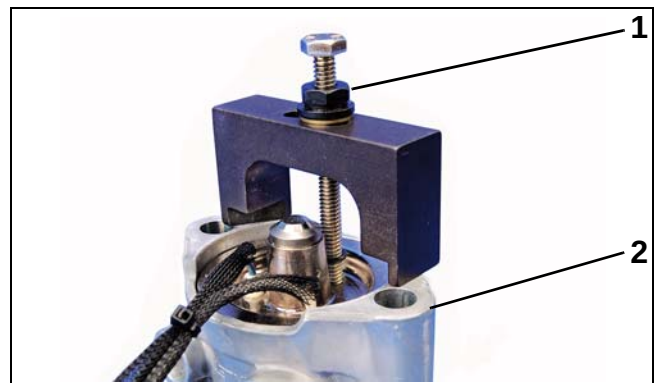
Crush Ring Replacement

NOTICE

Injector crush rings must be replaced if injector is installed in a different head or cylinder location.

Use Injector Puller Kit, P/N 356461, to remove injector from mounting cup.

Turn the nut of the fuel injector puller counter-clockwise several turns. Place the fuel injector puller on the fuel injector housing.



1. Puller nut

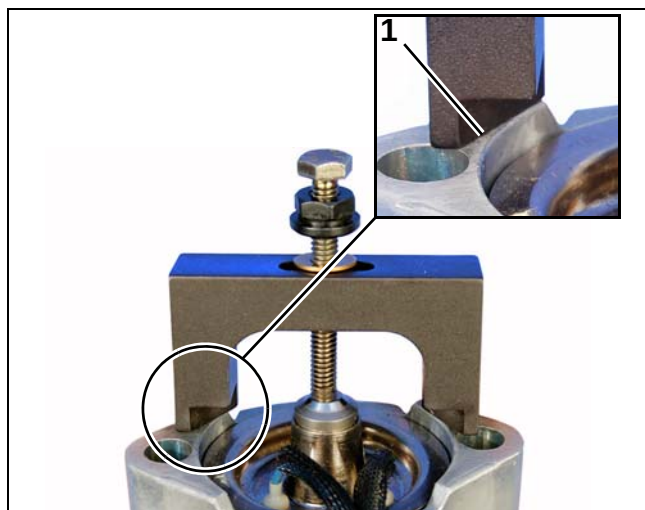
2. Fuel injector housing

008795

Fuel System

Fuel Component Servicing

Align the angled edges of both sides of the tool base with the edge of the fuel injector housing as shown.



1. Angled edge of the tool base

008796
008797

Thread the puller screw into the fuel injector 1/4-20 threaded hole until it seats.



1. 1/4-20 threaded hole

008798

Turn puller nut clockwise until it contacts the puller base.

Use a 1/2 inch (13 mm) wrench to continue turning the puller nut clockwise.

Turn the puller nut until the fuel injector is removed from the fuel injector housing.



1. Fuel injector removed from fuel injector housing

008799

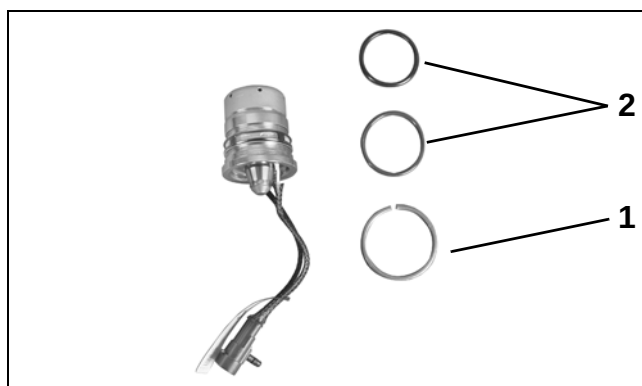
Remove fuel injector puller from injector. Remove crush ring and O-rings from injector. Inspect and clean the injector filter and injector housing.

Install new crush ring and O-rings. Lubricate O-rings with *STP⁺ Oil Treatment*.



1. Adaptor

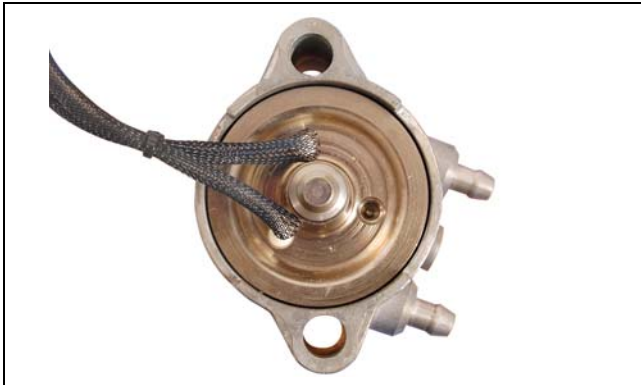
007424



1. Crush ring
2. O-rings

002317

Install injector into mount housing. Press on injector face until injector seats in mount housing.



007425

Fuel Injector Installation

NOTICE

All injectors must be installed in the correct cylinder by serial number. Improper injector installation can result in powerhead failure.

Installation of a replacement injector requires that coefficient data for the new injector is uploaded to the *EMM*.

Coefficient data for some replacement injectors is supplied on a computer disk shipped with the injector. If a disk is not included with the injector, coefficient data can be downloaded from the *Evinrude* dealer website. Refer to the instructions provided with the injector kit.

Upload Coefficient Files to *EMM*

IMPORTANT: Use the Diagnostic Power Supply Tool, P/N 587005, with Accessory Power Cable Kit, P/N 5008092, to supply power to the *EMM*. Refer to **Diagnostic Power Supply Tool** on p. 89.

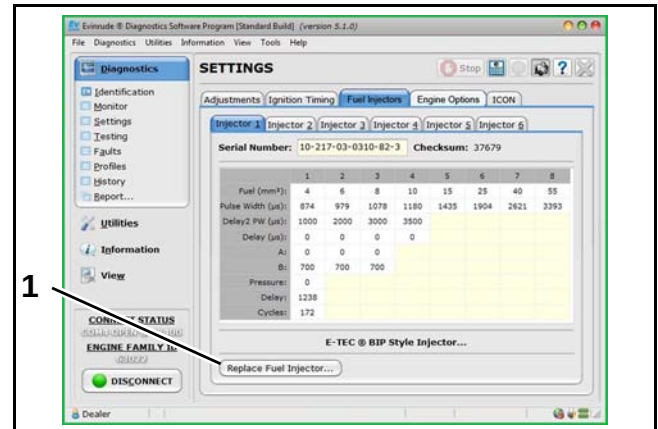
If the internal batteries of the Power Supply Tool have a low voltage condition the *EMM* could turn OFF during the coefficient upload, resulting in a failed update.

Use the *Evinrude Diagnostics* software *Settings* screen to upload the coefficient file to the *EMM*.

Select the *Injectors* tab.

Select the cylinder tab for injector being replaced.

Select the *Replace Injector* button.



1. "Replace Injector" button

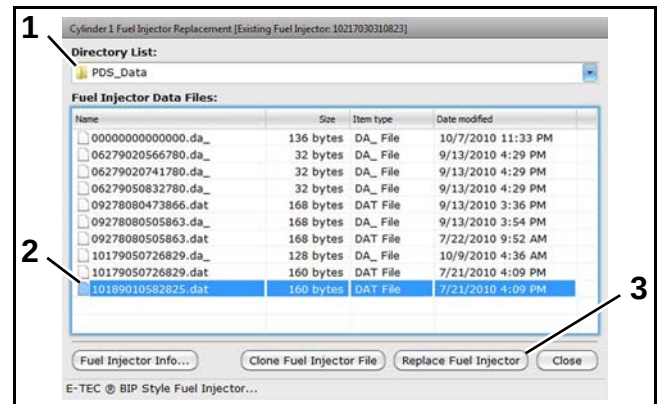
008568A

Use the drop down menu to navigate to the saved coefficient file location.

The coefficient file name must match the serial number of the injector.

Select the correct file for the injector.

Select the *Replace Injector* button.



1. Navigation menu
2. Injector coefficient file
3. "Replace Injector" button

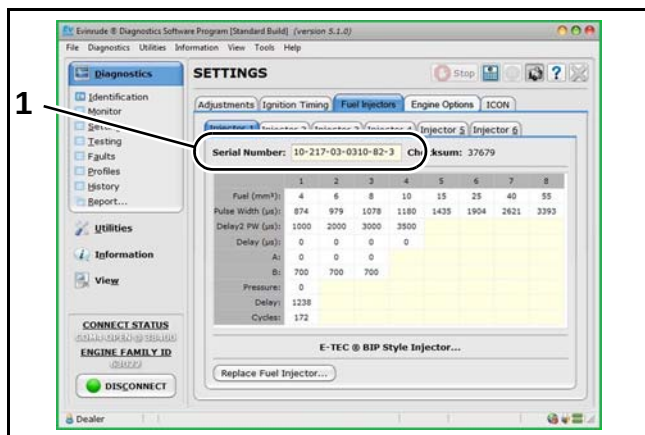
008573

After the upload is complete, the program will return to the *Cylinder* tab.

Fuel System

Fuel Component Servicing

Make sure the serial number displayed on the screen matches the serial number printed on the serial number label of the replacement injector.



1. Serial number

008568A

Install Injector

⚠ CAUTION

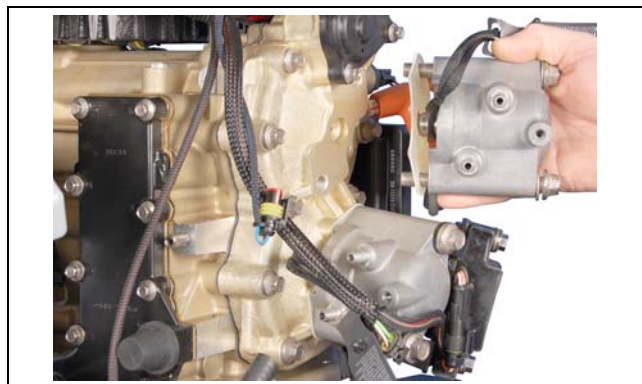
All injector components must be clean to ensure correct torque tightening specifications. To prevent fuel leakage, carefully follow these installation instructions.

The following items and their mating surfaces must be cleaned prior to reassembly:

- Injector
- Cylinder head
- Adapter
- Screws
- Threaded areas.

Lubricate mounting screw threads and under the head of the screw with a light coat of *Triple-Guard* grease. Install washers (one per screw) on injector retaining screws.

Install screws and washers through mounting flange of injector. Lower cylinder screws go through the coil mounting bracket.



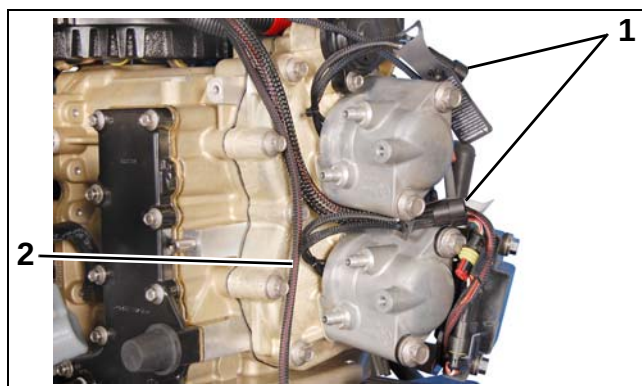
007286

IMPORTANT: Be careful not to pinch any wiring during assembly.

Place injector and insulator in the proper cylinder location.

Temporarily install injector screws finger tight.

Position fuel injector wiring, vapor separator wiring and electrical connectors as shown.



1. Fuel injector wiring and connectors
2. Vapor separator wiring

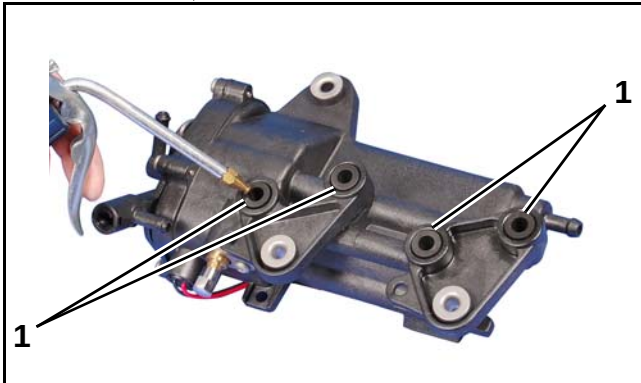
007100

IMPORTANT: Fuel injectors MUST be able to rotate slightly during installation of vapor separator.

Vapor Separator Installation

Install new injector seals in vapor separator.

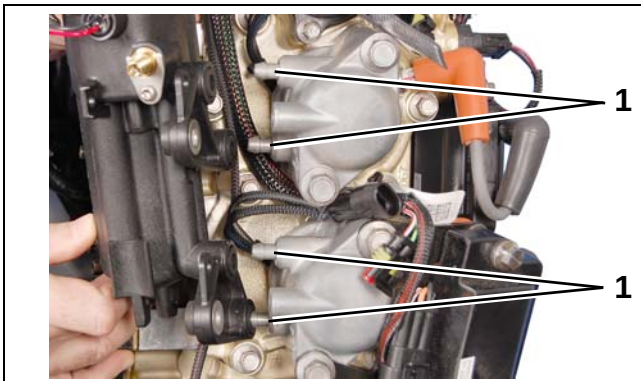
Lightly lubricate seals with a drop of outboard lubricant.



1. Injector seals

007099

Install vapor separator assembly onto the four fuel injector fittings.

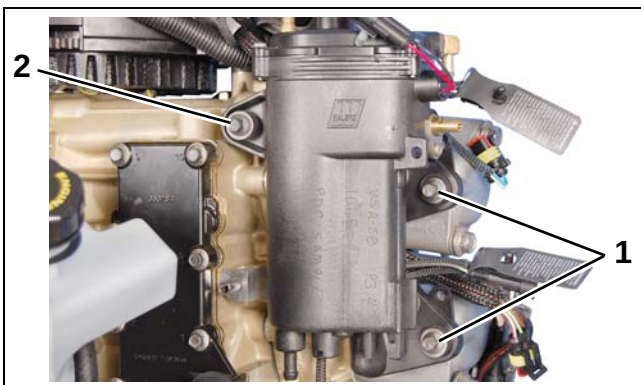


1. Fuel injector fittings

007101

Install three vapor separator retaining screws.

Tighten two vapor separator to fuel injector mounting screws to a torque of 31 to 48 in. lbs. (3.5 to 5.5 N·m).



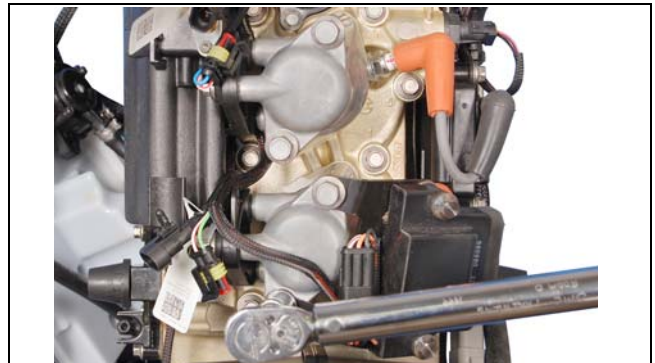
1. Vapor separator to fuel injector mounting screws
2. Vapor separator to powerhead mounting screw – Leave LOOSE at this time

007102

IMPORTANT: Fuel injector screws must be tightened before vapor separator to powerhead mounting screw.

Tighten injector screws in stages, starting with the lower screw.

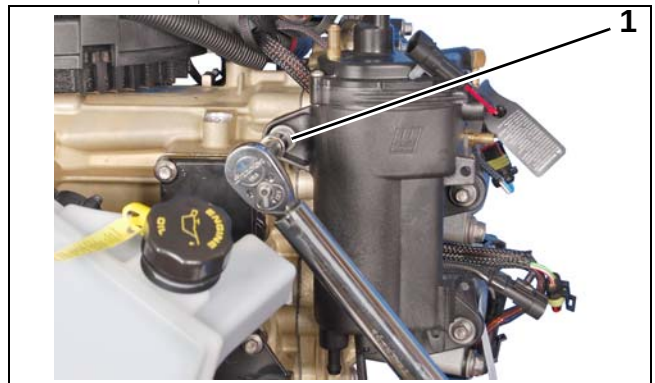
- First torque is 4.5 ft. lbs. (6 N·m).
- Second torque is 9 ft. lbs. (12.2 N·m).
- Third torque is 14 ft. lbs. (19 N·m).
- Final torque is 22 to 23.5 ft. lbs. (30 to 32 N·m).



Tighten Screws in Stages

007103

Tighten vapor separator to powerhead mounting screw to 31 to 48 in. lbs (3.5 to 5.5 N·m).



1. Vapor separator to powerhead mounting screw

007104

Install fuel supply hose. Secure with Oetiker clamps. Reinstall vapor separator vent hose and

Fuel System

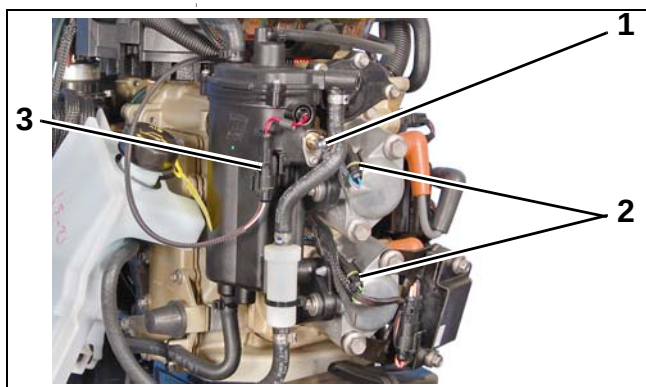
Fuel Component Servicing

cooling water hoses. Secure with tie straps. Attach fuel filter to vapor separator with tie strap.



007287

Reinstall protective cap on the pressure test fitting. Reconnect fuel injector electrical connectors. Reconnect circulation fuel pump electrical connector.



1. Protective cap
2. Fuel injector electrical connectors
3. Circulation fuel pump electrical connector

007105

Reinstall the oil tank. Refer to **Oil Tank Assembly** on p. 156.

Reconnect fuel hose connector to outboard.

IMPORTANT: Install injector service data (3.5 in. floppy disk) by using the Injector Replacement Utility of *Evinrude Diagnostics* software. Check the *Injector Coefficients* screen to make sure that all injectors are positioned properly.

Squeeze primer bulb to prime fuel system. Hold pressure on bulb and observe for fuel leaks.

Use static test screen of *Evinrude Diagnostics* software to run fuel pump. Observe for fuel leaks.

Run outboard and check for fuel leaks.

IMPORTANT: Pay close attention to fuel vapor separator / fuel injector connection for leaks.

Repair any leaks before returning outboard to service.

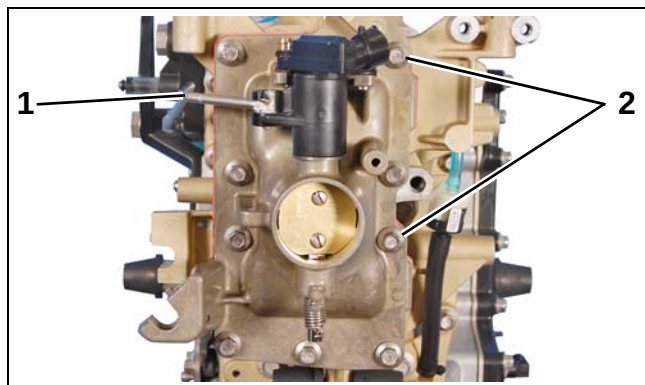
Intake Manifold Service

Removal

Disconnect vapor separator vent hose, main bearing vent hose, air temperature sensor, crankshaft position sensor, and throttle position sensor.

Use Ball Socket Remover Tool, P/N 342226, to remove throttle link arm.

Remove throttle body screws and throttle body assembly.

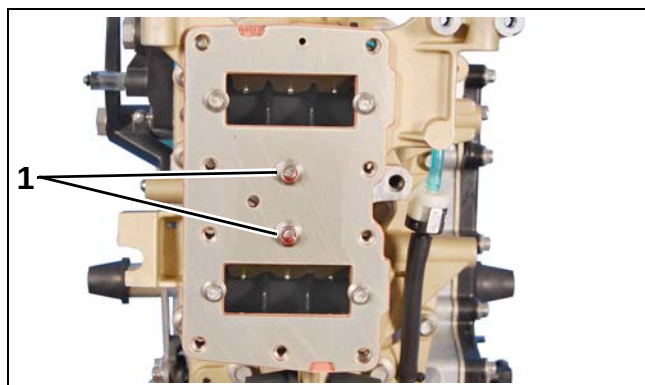


1. Link arm
2. Throttle body screws

007426

Remove gasket from throttle body.

Remove screws and reed plate assembly from the crankcase.



1. Screws

007427

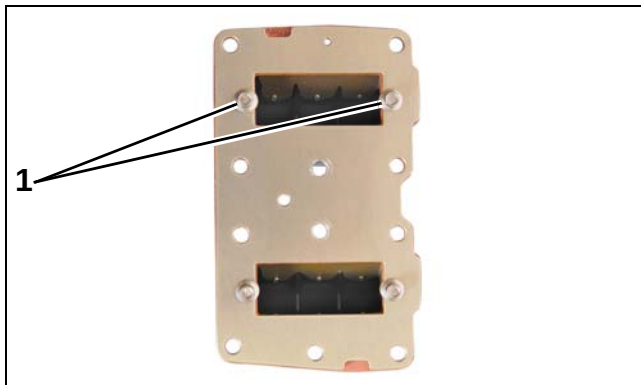
Disassembly

NOTICE

DO NOT disassemble reed valve assemblies. Damaged reed plates are not serviceable and are replaced as an assembly.

All reed plate assembly and reed valve assemblies must be cleaned prior to reassembly. DO NOT use strong carburetor cleaner or the hot soaking tank method for cleaning.

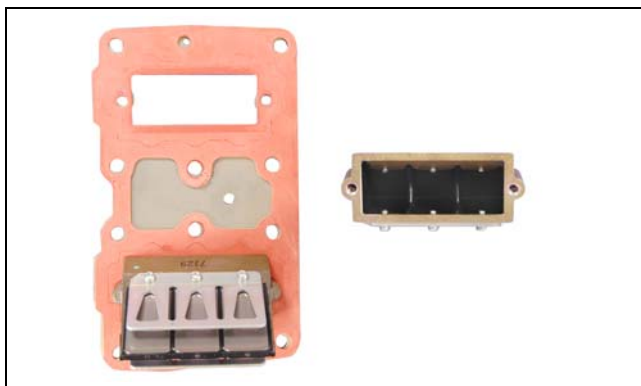
Remove the reed valve retainer screws and remove the assembly.



1. Screws

007428

Use caution to prevent damaging reed valve assemblies.



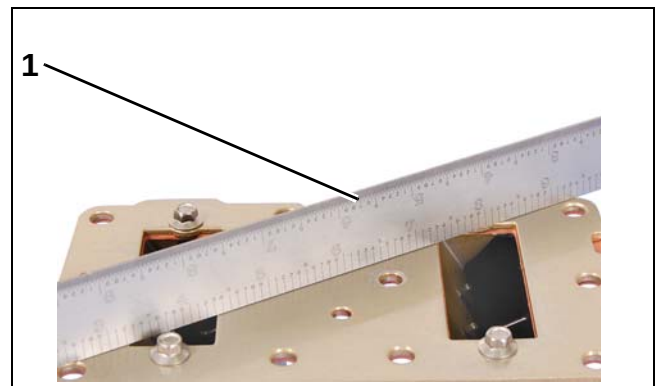
007429

Inspection

Inspect the leaf plate assemblies for damage or contamination:

- Leaf plates must not be distorted.
- Leaf valve must not be cracked or chipped.
- Leaf plate stops must not be distorted or loose.
- Leaf plate assemblies must be clean.

Inspect the intake manifold. All gasket surfaces must be cleaned, smooth, and free of nicks. Use a machinist's straight-edge and a feeler gauge to check flatness in all directions. Surface must be flat, ± 0.004 in. (0.10 mm).



1. Straight-edge

007430

Assembly

Remove old adhesive from reed valve retaining screws.

Install gasket on reed plate assembly. DO NOT use sealer on the gasket.

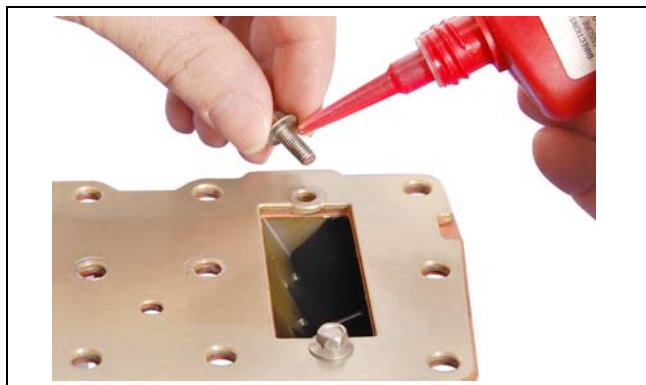


007431

Fuel System

Fuel Component Servicing

Prime screw threads with *Locquic Primer* and let dry. Apply *Ultra Lock* to threads. Position reed valve on reed plate and install screws. Tighten screws to a torque of 35 to 60 in. lbs. (4.0 to 6.8 N·m).

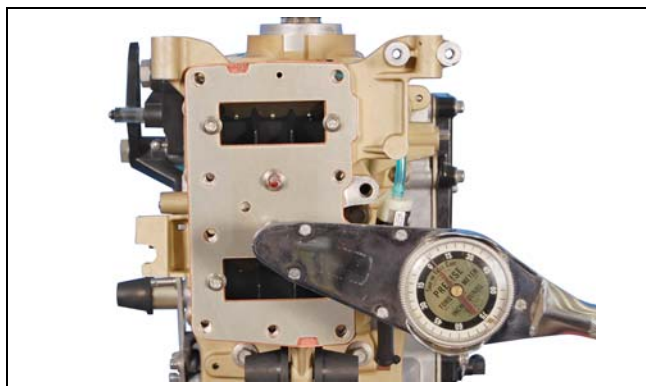


007432

Installation

Place reed plate assembly on cylinder/crankcase.

Apply *Nut Lock* to reed plate screws. Install and tighten screws to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).

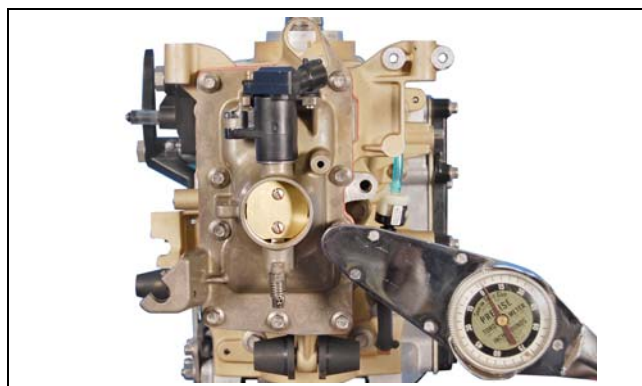


007433

Place gasket on throttle body. Install throttle body on reed plate and install **new** screws.

IMPORTANT: If old screws must be re-used, make sure all previous thread locking material is removed and apply *Nut Lock* to threads.

Tighten the center screws first and expand outward. Tighten in stages to a final torque of 84 to 106 in. lbs. (9.5 to 12 N·m).



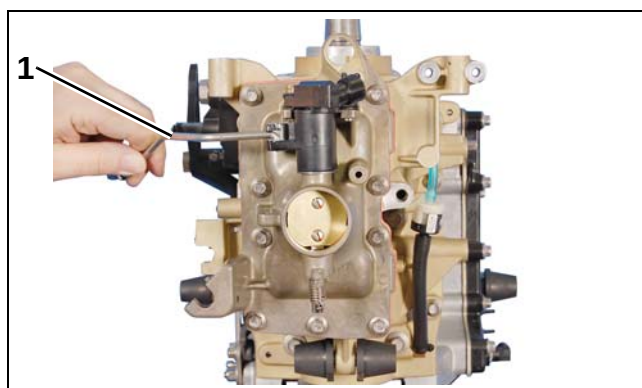
007434

Install vapor separator vent hose and main bearing vent hose. Secure with tie straps.

Install crankshaft position sensor, and throttle position sensor electrical connectors.

Connect throttle linkage.

IMPORTANT: DO NOT lubricate throttle linkages.



1. Throttle linkage

007435

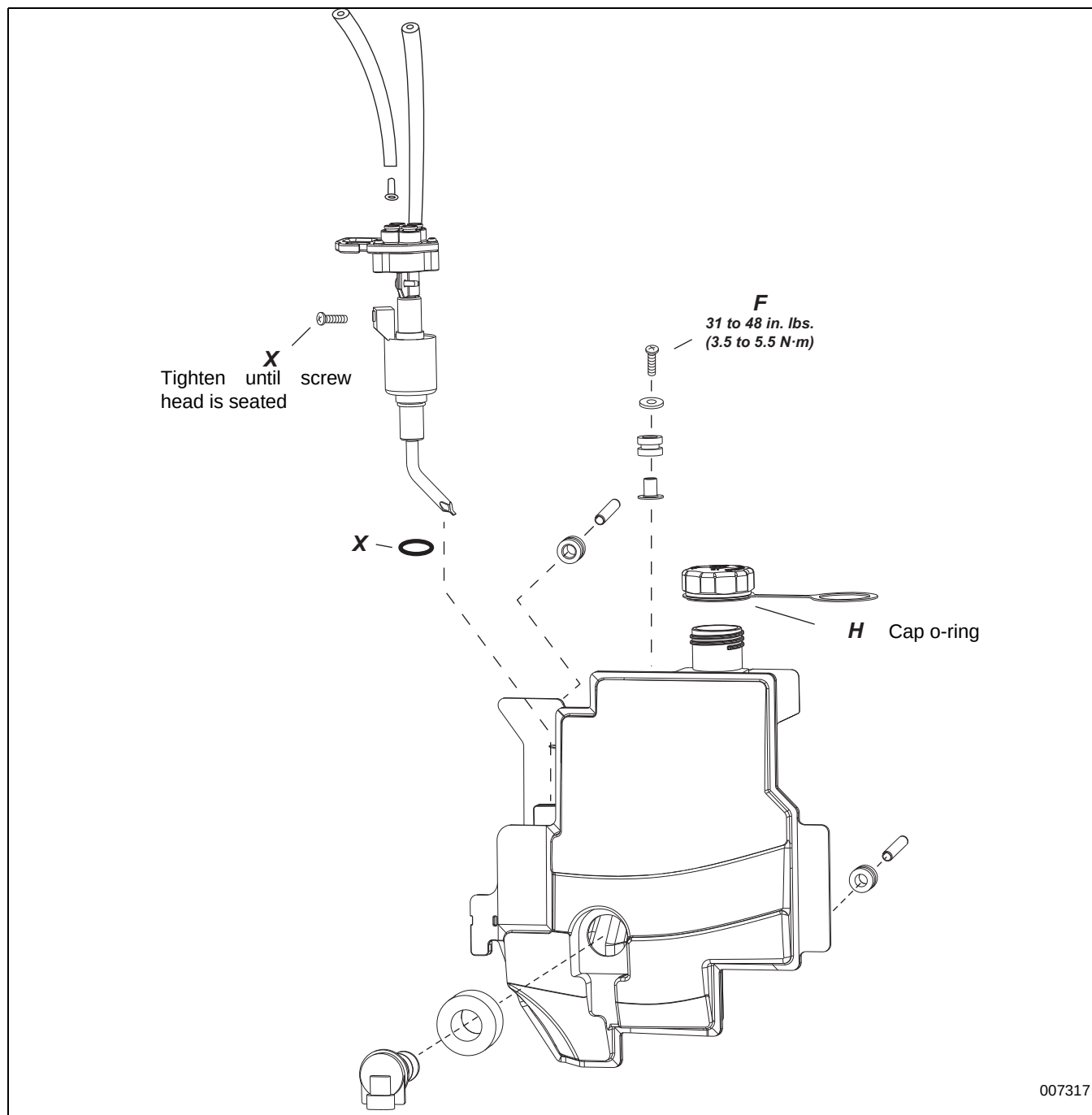
Refer to **TPS Calibration** on p. 122.

Oiling System

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Oil Tank Assembly	164
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Service Chart

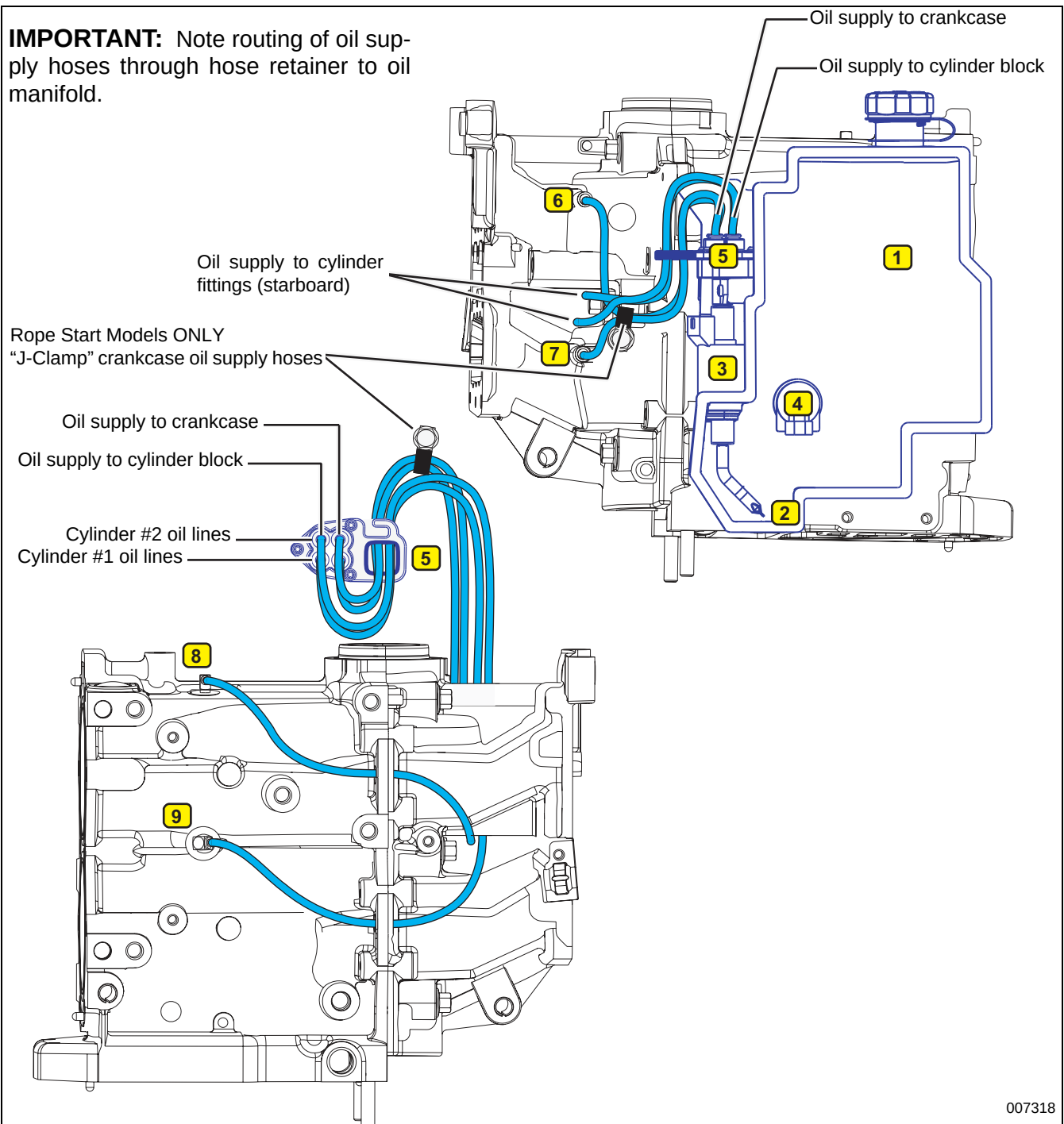


007317

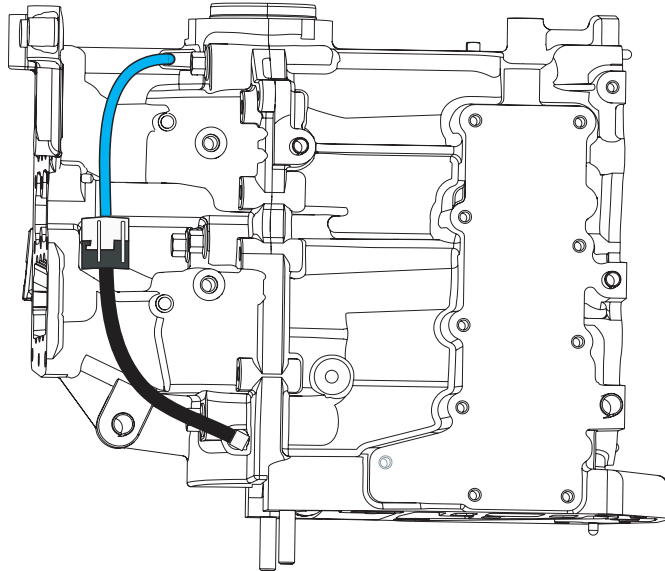
F Blue Nut Lock **H** Outboard Engine Lubricant **X** See Service Manual Text

Oil Supply Diagram

IMPORTANT: Note routing of oil supply hoses through hose retainer to oil manifold.

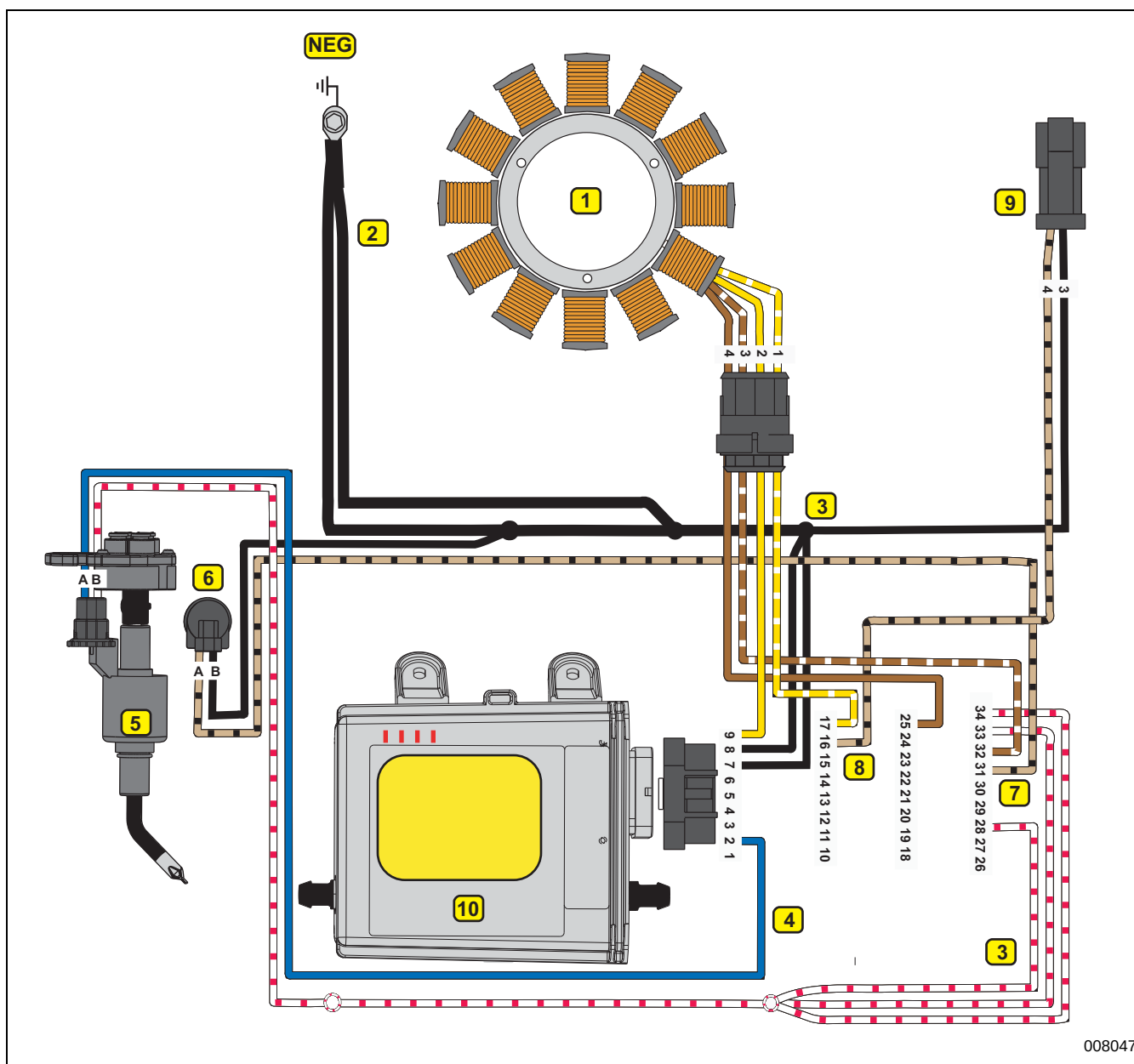


Oil Recirculation Diagram



007316

Oiling System Circuit Diagram



1. Stator
2. Main harness ground (BLACK)
3. WHITE / RED wires (55 V)
4. EMM injector control (BLUE)
5. Oil injection pump
6. Low oil switch
7. Low oil switch to EMM (TAN/BLACK)
8. Low oil signal to SystemCheck gauge (TAN/BLACK)
9. MWS Connector
10. EMM

Oil System Requirements

NOTICE

Failure to follow these recommendations could void the outboard warranty if a lubrication-related failure occurs.

Recommended Lubricants

Evinrude XD100 is the only outboard oil are recommended for use in *Evinrude MFE* outboards. If *XD100* oils is not available, an oil that meets NMMA TC-W3 certification may be used in an emergency.

Evinrude XD100 outboard oil is highly recommended for all conditions and applications.

Engine Lubricant Below 32°F (0°C)

XD100 oil must be used when operating in temperatures under 32°F, (0°C).

IMPORTANT: For new outboards, test low oil warning before filling oil tank.

Use Diagnostic Power Supply Tool, P/N 587005, to supply power to the *EMM*. Turn the switch to the ON position.

Use the *Evinrude Diagnostics* software *Monitor* screen. The engine monitor warning display should show “LOW OIL.”

Add enough oil to raise level to at least one-quarter capacity.

Prime the oil system to turn OFF the “LOW OIL” warning.

Components

The oiling system includes the following components:

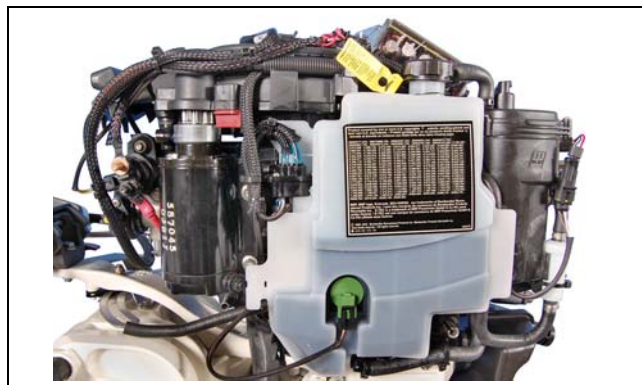
- Oil tank
- Oil injection pump and manifold assembly
- Electrical circuit
- LOW OIL and NO OIL warning systems
- Cylinder and crankcase
- Oil recirculation system.

Oil Tank Assembly

The oil tank is mounted on the powerhead under the engine cover. Oil level must be monitored.

Oil Tank Components:

- Tank, 1.5 quarts. (1.4 liter) capacity
- Oil pickup and filter assembly
- Oil injection pump and manifold assembly
- LOW OIL switch
- Oil distribution hoses

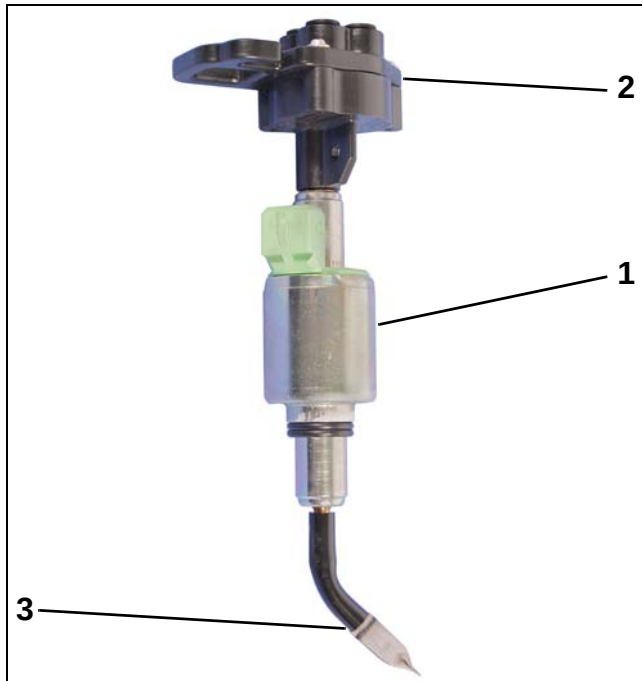


008359A

Oil Injection Pump

The oil injection pump is an electric (55 V) actuator style pump. It draws oil from the oil tank and supplies pressurized oil to the oil manifold. The *EMM* supplies 55 V and controls activation of the pump.

The oil manifold distributes the oil supplied by the pump.



1. Oil injector pump
2. Oil distribution manifold
3. Pickup tube and filter

007321

Electrical Circuit (55 V)

The oil injector is powered by the 55 V electrical circuit. The *EMM* controls pump operation by rapidly connecting and disconnecting the pump's internal coil to ground.

The *EMM* monitors the oil injection pump electrical circuit. If circuit voltage is beyond the specified range, or the circuit is open, the *EMM*:

Activates S.A.F.E.
Stores a service code 34
<i>EMM</i> LED 4: ON (Running)
Engine Monitor LOW OIL display: ON

LOW OIL Warning

A switch in the oil tank assembly monitors the oil level in the oil tank.

If the oil level falls below one-quarter capacity, the *EMM* begins counting oil pump pulse cycles. When it reaches 1000 pulses, the *EMM* signals:

Engine Monitor LOW OIL display: ON

Approximate oil reserve at Low Oil activation:

- 0.375 qt. (0.35 l).

NO OIL Warning

After LOW OIL is displayed, the *EMM* counts oil pump pulse cycles again. When it reaches 6700 pulses, the *EMM*:

Activates S.A.F.E.
Stores service code 117
<i>EMM</i> LED 4: ON (Running)
Engine Monitor LOW OIL display: ON

To recover from S.A.F.E. mode:

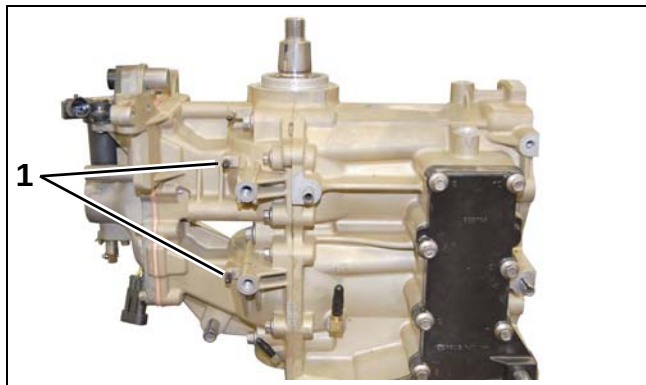
- Oil level must be above one-quarter
- The warning resets after three oil pump pulse cycles when the outboard has been stopped and restarted.

If outboard has been run for more than 3 hours with NO OIL faults (codes 34 & 117), the *EMM*

Activates SHUTDOWN
Stores service code 33
<i>EMM</i> LED 4: FLASHING
Engine Monitor LOW OIL display: FLASHING

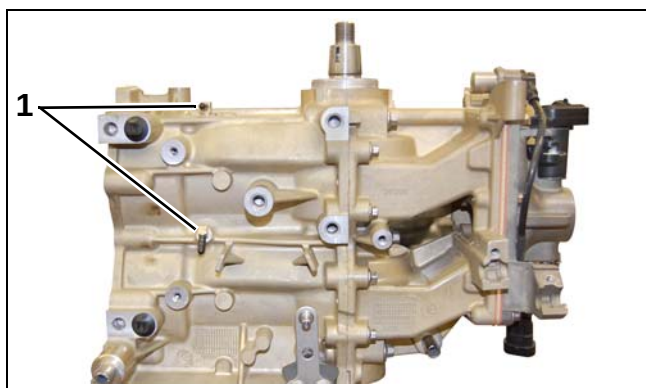
Cylinder and Crankcase

The oil distribution manifold provides crankcase lubrication through oil distribution hoses and pressed-in fittings on the crankcase and cylinder block.



1. Crankcase oil fittings

007322



1. Cylinder block oil fittings

007323

Oil Recirculation System

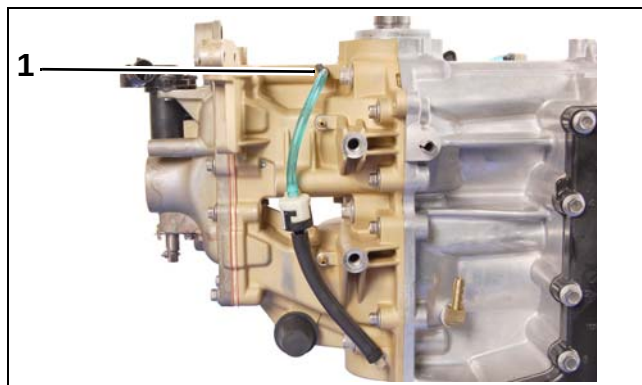
External hoses and fittings, and intake manifold passages are used to recirculate any accumulation of oil from various locations in the powerhead. The movement of oil is controlled by check valves.

Crankcase / Main Bearing Recirculation

The movement of oil through the main bearings is controlled by internal passages, external fittings and hoses, and check valves.

Lower to upper main bearing oil flow:

- Lower main bearing cavity to internal crankcase passage to external fitting, external hoses with in-line check valve to external fitting at upper main bearing, and into upper main bearing through internal crankcase passage.



1. Upper main bearing vent

007324

Refer to the **Oil Recirculation Diagram** on p. 154.

Oil Control Settings

Oil Injection Rate

EMM programming controls the rate of oil injection based on engine RPM. This rate can be adjusted for powerhead break-in. Use *Evinrude Diagnostics* software to access these features.

Break-In Oiling

NOTICE

The operator must monitor the oil tank level to confirm oil consumption. This may require several hours of operation above idle.

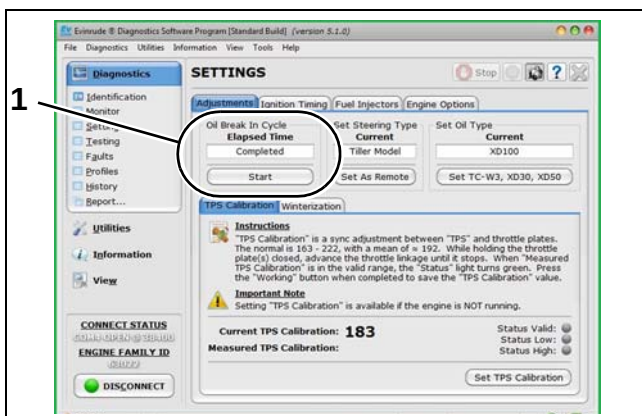
IMPORTANT: DO NOT add oil in the fuel tank on *Evinrude E-TEC* models.

The EMM automatically supplies extra oil to the engine as follows:

- 15 – 30 HP: First two hours above 2000 RPM

Follow these steps for outboard set-up:

- Use *Evinrude Diagnostics* software to make sure the break-in program has been started on a new outboard.
- Use the diagnostics software to start break-in oiling after a powerhead rebuild.



1. Break-in oil setting

008571

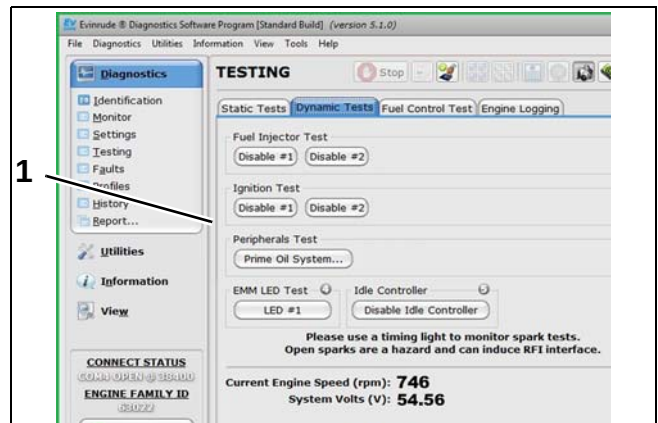
Oil Supply Priming

⚠ WARNING

Always use caution while working around machinery with moving parts. The following set-up procedures require running tests that are performed with the outboard's motor cover removed.

Start the outboard. Use the oil priming function in the software to make sure the system is completely primed.

Use the *Prime Oil System* button of the *Dynamic Test* screen to prime the oil pump.



Dynamic Test Screen

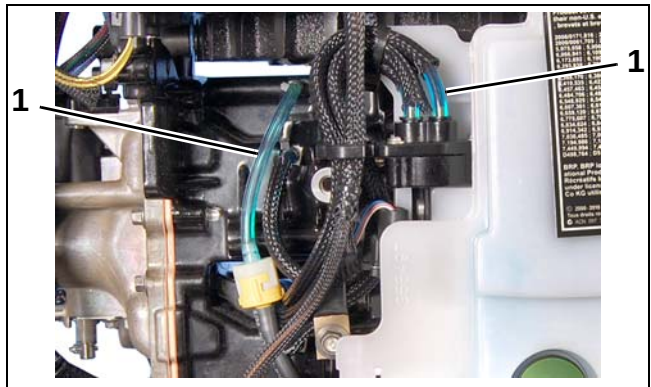
1. Prime Oil System button

008570A

Oiling System

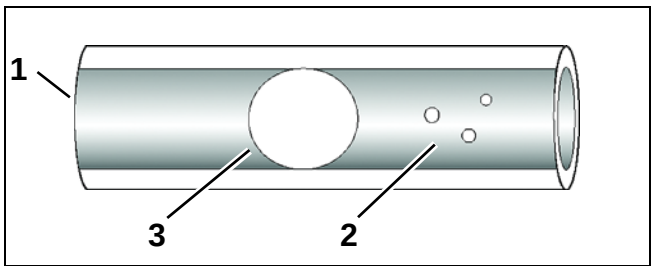
Oiling System Tests

Observe oil flow through all oil distribution hoses. Air must be purged during the priming procedure.



1. Oil distribution hoses 008582

Small bubbles are acceptable. Large bubbles must be eliminated through continued priming.



1. Oil distribution hose
2. Small bubbles
3. Large bubbles 004398

Repair any fuel or oil leaks.

The oiling system on these models can also be primed using the Self-Winterizing feature if diagnostics software is not available. Refer to **Storage** on p. 69.

Oiling System Tests

IMPORTANT: Always perform visual inspections to identify oiling system leaks. Make sure the oil tank is filled and oil supply is not contaminated.

Oil Injection Pump Voltage Test

IMPORTANT: Use the Diagnostic Power Supply Tool, P/N 587005, with Accessory Power Cable Kit, P/N 5008092, to supply power to the *EMM*. Using Diagnostic Power Supply Tool, with internal 9 volt batteries only will produce false results. Refer to **Diagnostic Power Supply Tool** on p. 89.

The *EMM* controls the pump by providing ground through pin 2 (blue wire) of the J1-A connector and pin A (blue wire) of the oil pump connector.

Acceptable Oil Injection Pump Test Readings	
<i>EMM</i> ON / Engine OFF	approximately 12 VDC
Control signal	approximately 1.2 Hz
Engine running	approximately 55 VDC

Use a digital multimeter calibrated to a scale that reads 12 V (DC) to measure voltage between the oil pump electrical connector and engine ground.

Connect negative meter lead to ground.

Use an appropriate test probe to connect positive meter lead to pin A (blue wire) of oil injection pump electrical connector.



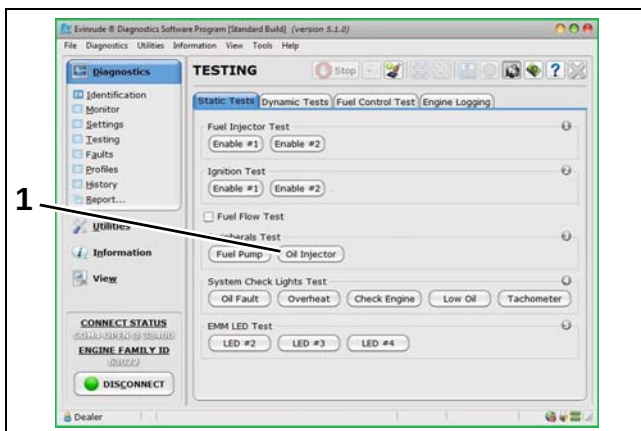
1. Oil injection pump electrical connector

008425

Turn the diagnostic power supply tool to the ON position. Observe voltage at pin A.

- Voltage at pin A should be approximately 12 V.

Use the *Oil Injector* test of *Evinrude Diagnostic* software *Static Test* screen to activate the oil pump.



Static Tests Screen

1. Oil injector test button

008569

IMPORTANT: This test is operating the pump with 12 V battery power on the system voltage (55 V) circuit. The oil injection pump will not pump oil when operating on 12 V.

Observe voltage at pin A.

- Voltage at pin A should drop as the oil pump cycles.

Check the control signal while the *Oil Injector* test is running. Set the digital multimeter to the Hertz (Hz) scale.

- Meter should read approximately 1.2 Hz.

Results:

- If voltage and control signal readings at pin A are within range, the *EMM* and wiring are not at fault.
- If voltage at pin A is not within range, check voltage at pin B (white/red wire) of oil pump electrical connector.

Connect positive meter lead to pin B (white/red wire) of oil injection pump electrical connector. Observe voltage at pin B.

- Voltage at pin B should be approximately 12 V.

Set digital multimeter to a scale that reads 55 V (DC).

Start the engine. Observe voltage at pin B.

- Voltage at pin B should be approximately 55 V.
- If voltage at pin B is within range, refer to **Oil Injection Pump Resistance Test** on p. 161.
- No voltage reading at pin A, refer to **System Voltage Test** on p. 104.

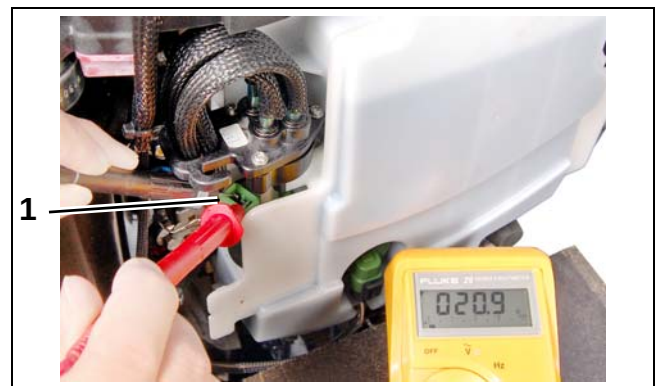
Oil Injection Pump Resistance Test

Disconnect the electrical connector from the oil injection pump.

Use a digital multimeter to measure the resistance between the pins of the oil injection pump connector. Calibrate the meter to the LOW OHMS scale.

Oil Injection Pump Resistance

22 Ω



1. Oil injection pump connector

008426

Oiling System

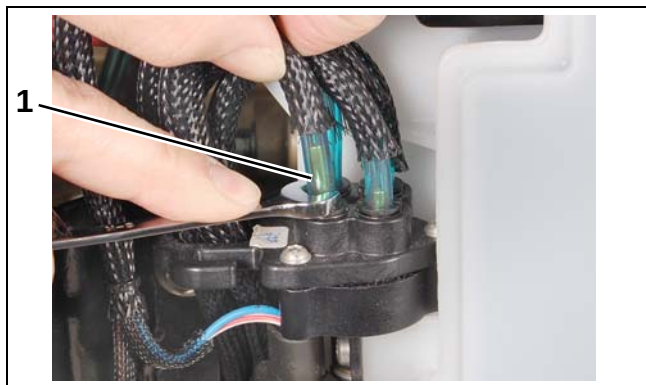
Oiling System Tests

Results:

- An infinite reading (∞) indicates an open circuit of the injection pump winding. Replace faulty pump.

Oil Injection Pump Function Test

Remove oil distribution hose from fitting at oil distribution manifold. Do not lose the brass hose support.



1. Oil distribution hose

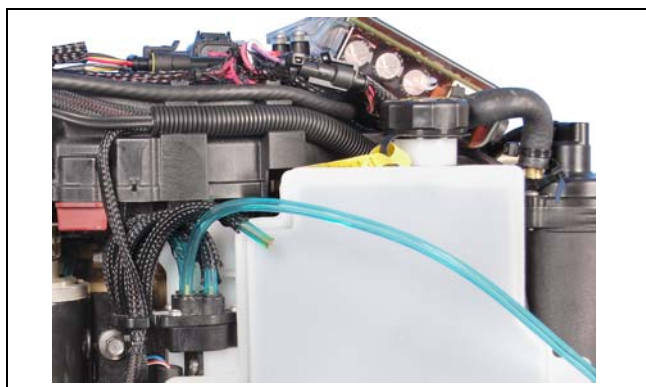
007330

Clean up any spilled oil with shop towels.

ENVIRONMENTAL NOTE

Dispose of oil contaminated shop towels in an environmentally responsible manner, or according to local regulations.

Temporarily install a length of oil hose.



007331

Start the outboard and observe oil flow:

- Oil flows from hose, compare to oil flow at other distribution fittings
- If one or more fittings fail to flow oil, replace the oil injection pump assembly.

Reinstall hose into manifold.

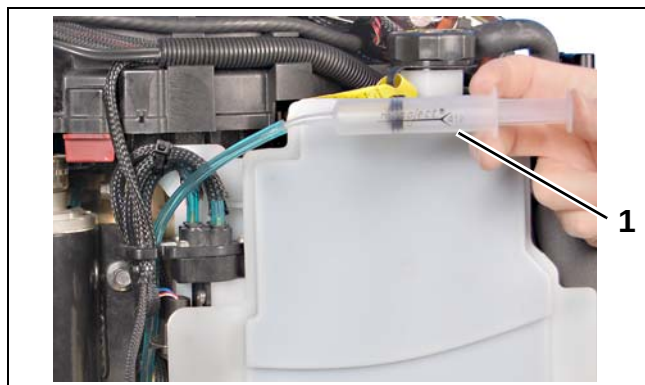
IMPORTANT: Make sure hose support is in hose and hose is fully inserted into manifold. Refer to **Oil Distribution Hoses** on p. 163.

Oil Injection Fittings Flow Test

Make sure the oil injection fittings of the cylinder and crankcase assembly allow fluid to move.

Remove oil distribution hose from oil distribution manifold.

Use a Syringe, P/N 346936, filled with isopropyl alcohol to force fluid through hose and fitting.



1. Syringe

007332

LOW OIL Sending Unit Test

Remove oil from the oil tank.

Turn the diagnostic power supply tool ON. Use the *Evinrude Diagnostics* software *Monitor* screen. The engine monitor warning display should show "LOW OIL."

Once the warning has been confirmed, refill the oil tank and start the outboard. The LOW OIL warning should stop after the oil pump cycles 3 times.

Oil Component Servicing

⚠ WARNING

To prevent accidental starting while servicing, disconnect the Crankshaft Position Sensor (CPS).

Oil Distribution Hoses

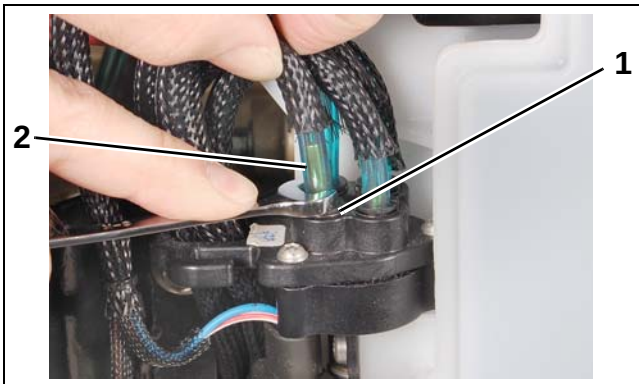
Oil distribution hoses are different lengths. DO NOT alter the length of any hoses.

Oil Distribution Hose Length:

- Cylinder – 20 in. (508 mm)
- Crankcase – 10.5 in. (267 mm)

Removal

Release the hose by depressing the outer ring of the hose retaining mechanism.



1. Retainer mechanism
2. Hose support

007330

Clean up any spilled oil with shop towels.

ENVIRONMENTAL NOTE

Dispose of oil contaminated shop towels in an environmentally responsible manner, or according to local regulations.

Once hose is removed from the manifold, make sure hose support is in the end of the hose.



1. Hose support

007333

Installation

Cut Replacement Oil Hose, P/N 778708, to the correct length. Insert hose support in manifold end of hose.

IMPORTANT: DO NOT insert distribution hoses into manifold without a hose support.

Be sure the hose is fully inserted into manifold. Insertion depth is 5/8 in. (16 mm). Visually inspect for hose supports.

Oil distribution hoses have specific locations and routing. DO NOT alter the location of any hoses.

The oil distribution manifold includes a built-in hose retainer. Route oil distribution hoses up through the retainer.

Install crankcase oil distribution hoses to the forward oil manifold ports.

Install cylinder #1 oil hose to the inner (closest to powerhead) oil manifold port.

Install cylinder #2 oil hose to the outer (furthest from powerhead) oil manifold port.

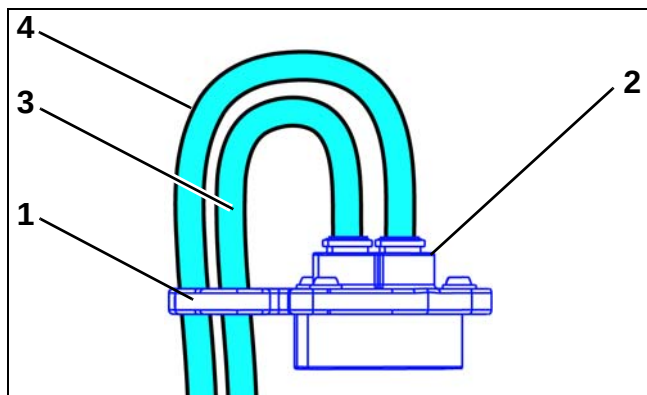
Loop the cylinder block oil distribution hose over the crankcase oil distribution hose and install to the rear oil manifold port.

Install cylinder #1 oil distribution hose to the inboard (closest to powerhead) oil manifold port.

Oiling System

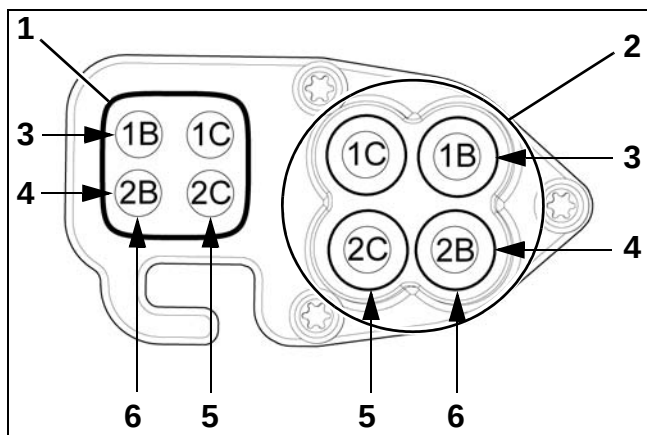
Oil Component Servicing

Install cylinder #2 oil distribution hose to the out-board (furthest from powerhead) oil manifold port.



1. Hose retainer
2. Oil distribution manifold
3. Crankcase oil supply hose
4. Cylinder block oil supply hose

007334



1. Hose retainer
2. Oil distribution manifold
3. #1 Cylinder
4. #2 Cylinder
5. Crankcase
6. Cylinder block

007335

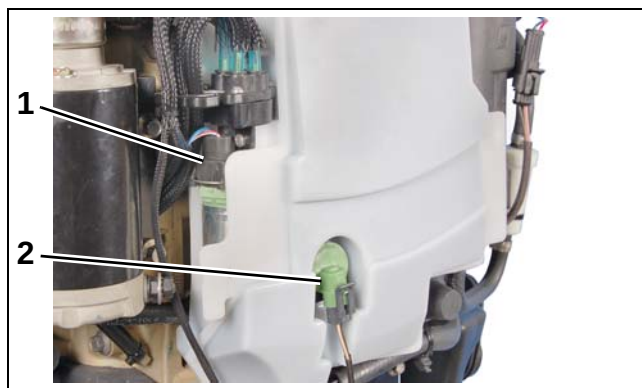
Refer to **Oil Supply Diagram** on p. 153.

Oil Tank Assembly

Removal

Disconnect the electrical connector to the oil injection pump.

Disconnect the electrical connector to the low oil switch.



1. Oil pump connector
2. Low oil switch

007336

IMPORTANT: Note oil distribution hose routings before proceeding with disassembly.

Remove oil distribution hoses from the manifold.

Clean up any spilled oil with shop towels.

ENVIRONMENTAL NOTE

Dispose of oil contaminated shop towels in an environmentally responsible manner, or according to local regulations.

Remove oil tank retaining screw.



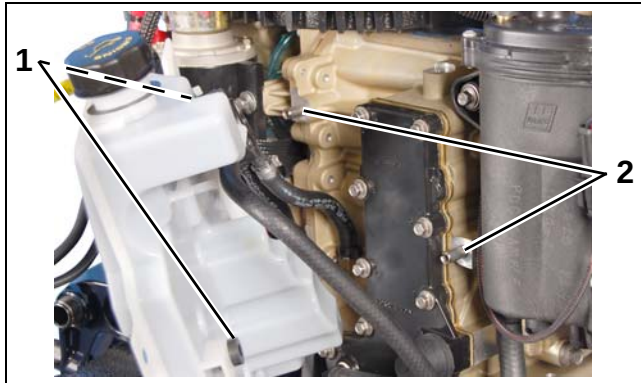
1. Screw

007288

Installation

Align grommets with pins on powerhead. Install oil tank assembly on powerhead. Clean mounting screw and apply *Nut Lock* to threads.

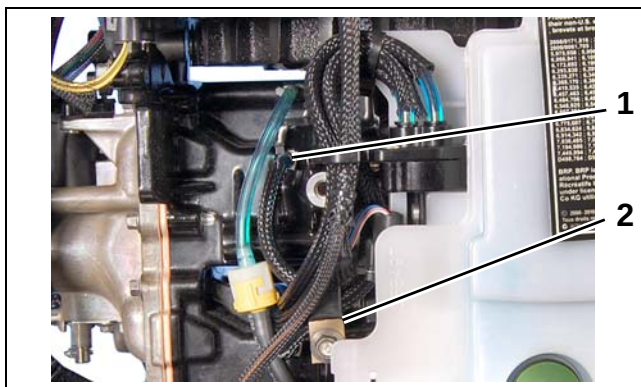
Install screws and tighten to a torque of 30 to 42 in. lbs. (3.5 to 5 N·m).



1. Grommets
2. Pins

007107

Install protective sleeves and route oil distribution hoses from the oil distribution manifold to the crankcase and cylinder block oil delivery fittings. Refer to **Oil Supply Diagram** on p. 153. Secure oil hoses to crankcase and cylinder block fittings with tie straps. On rope start models, install J-clamp to retain two crankcase oil supply hoses.



1. Tie strap
2. Clamp

008582

Run outboard and check for leaks. Use *Evinrude Diagnostics* software to activate "Oil Prime." Check oil flow through oil distribution hoses. Check oil system operation and routing of oil system hoses.

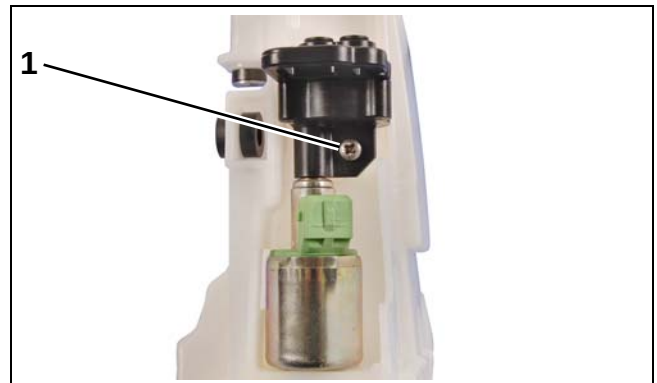
Repair any oil leaks and kinked or misrouted hoses. Install engine covers.

Oil Injection Pump

Removal

Remove oil distribution hoses from oil manifold. Refer to **Oil Distribution Hoses** on p. 163.

Remove oil from oil tank. Remove oil tank. Refer to **Oil Tank Assembly** on p. 164. Remove retaining screw from oil pump assembly. Twist and pull up on oil pump to remove from tank.



1. Screw

007338

Clean up any spilled oil with shop towels.

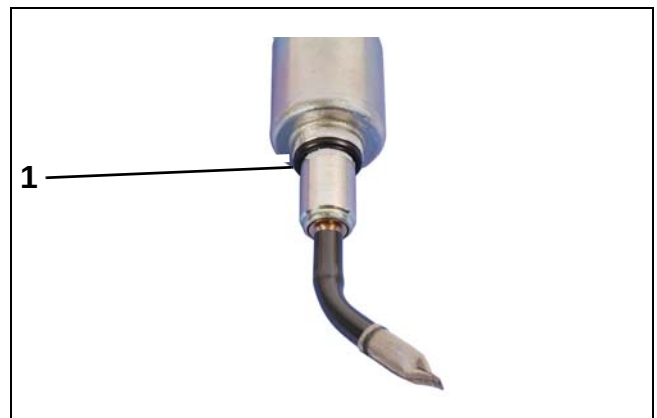
ENVIRONMENTAL NOTE

Dispose of oil contaminated shop towels in an environmentally responsible manner, or according to local regulations.

Installation

Apply a drop of outboard lubricant to new oil pump o-ring(s). Install o-ring(s) on oil pump flange.

Installation is the reverse of removal.



1. O-ring

007339

Oiling System

Oil Component Servicing

Install oil pump retainer screw. Tighten securely.

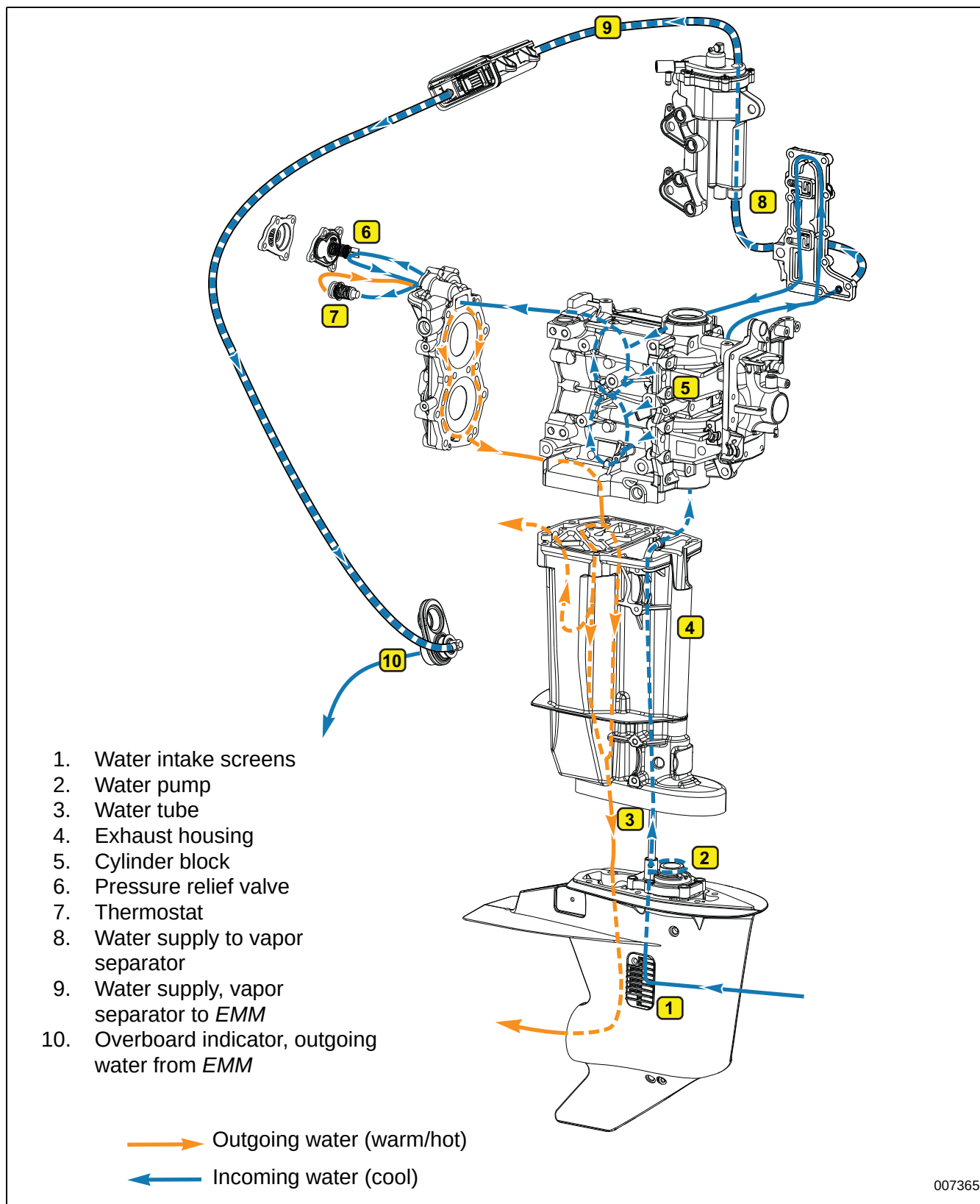
IMPORTANT: Turn self-tapping screws counter clock-wise to start the threads and clockwise to tighten. Failure to follow this procedure can damage the threads of the oil tank.

Cooling System

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Hose Routing and Water Flow Diagrams



007365

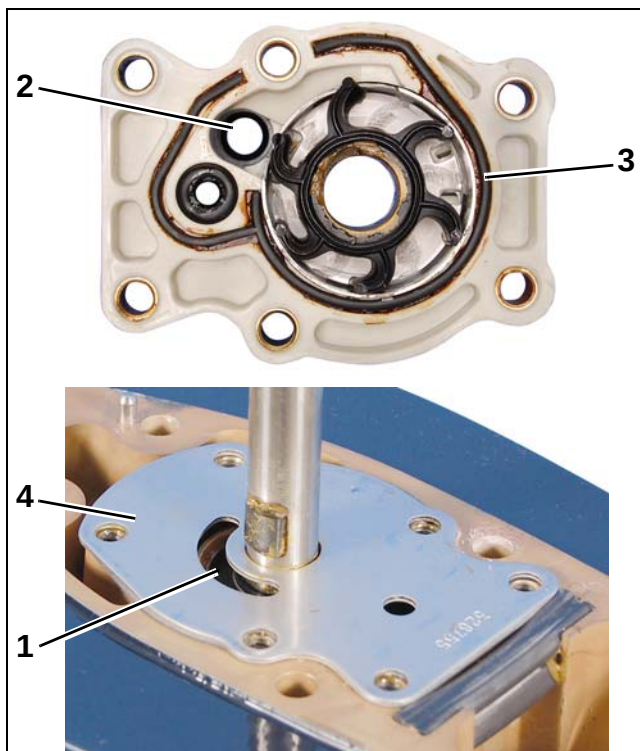
Components

Water Pump and Intakes

External water intakes mounted in the gearcase housing collect water and must supply the inlet side of the water pump with an unrestricted and unaerated water supply. Water is drawn into the water pump through a hole in the lower plate of the water pump assembly. All cooling water to the powerhead is provided by the water pump.

- A nylon wedge (impeller key) is used to engage the impeller bushing and driveshaft.
- The nylon impeller housing with liner must seal against a separate water pump plate.
- The bottom plate **MUST** seal to gearcase.

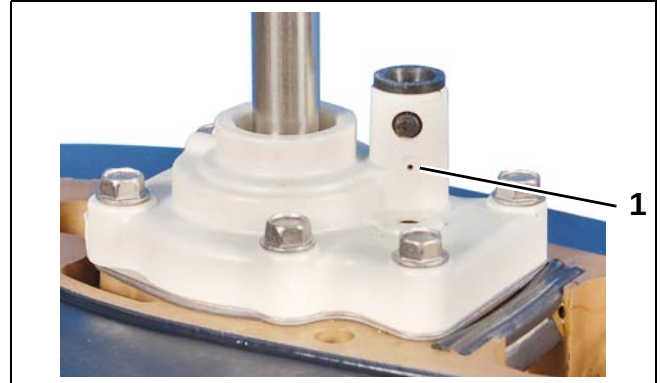
Refer to **Water Pump Service** on p. 236 for servicing.



1. Water inlet
2. Water outlet
3. Seal
4. Plate

007366
007367

IMPORTANT: The water pump housing includes a small vent hole to the side of the water outlet. Be sure to use the correct parts when replacing the water pump.



1. Hole

007368

Exhaust Housing

The water pump outlet connects with a water tube and passages located in the outboard's midsection. Grommets seal the water pump housing to the water tube and the water tube to the exhaust housing.

Water supplied to the exhaust housing provides all cooling water to the cylinder block.

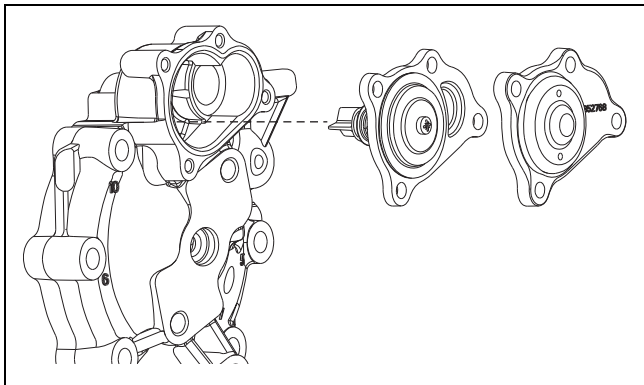
Cooling System Components

Pressure Relief Valve

A pressure relief valve is used to control water flow and operating temperature at higher speeds (above approximately 2800 RPM). The pressure relief valve opens as water pressure increases. Spring tension sets the opening pressure.

Overheating: A restricted or faulty valve typically results in HIGH SPEED overheating.

Overcooling: Debris may prevent the valve from closing completely.



Pressure relief valve components

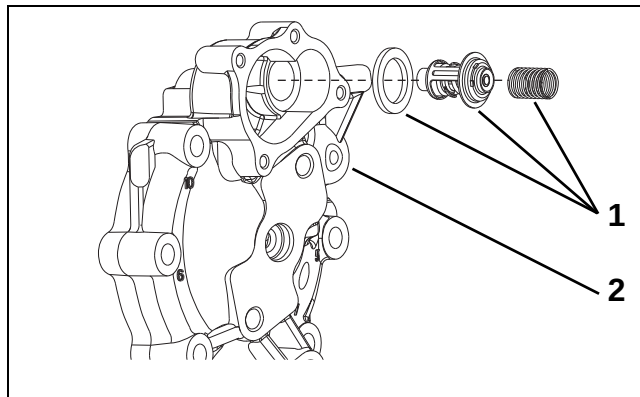
007369

Thermostat

The thermostat controls water flow and operating temperature at lower speeds (below 1800 RPM).

Overheating: A restricted or faulty thermostat typically results in LOW SPEED overheating.

Overcooling: Debris may prevent the thermostat from closing completely.



1. Spring, thermostat and gasket
2. Cylinder head

007370

Operation

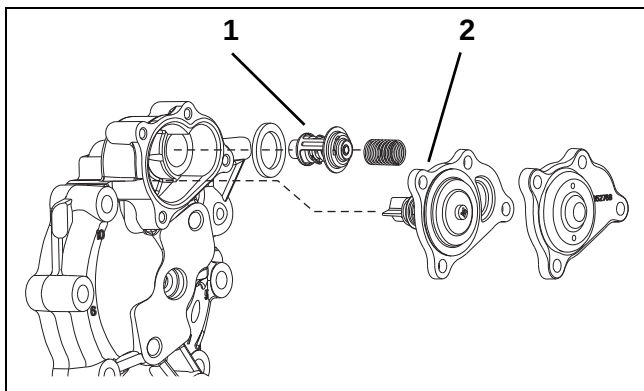
NOTICE

Restricted or inadequate water flow through the outboard reduces cooling system performance and may lead to severe powerhead damage.

All models use a two-stage cooling system design. The cooling system is dependent on water pump pressure and controlled by thermostat and pressure valve operation.

Cylinder Block / Cylinder Head Cooling

The flow of water through the cylinder block and cylinder head is controlled by a thermostat and a pressure relief valve. The thermostat and pressure valve are located in the top of the cylinder-head.



1. Thermostat
2. Pressure valve assembly

007371

The thermostat and pressure valve control the flow of water entering the vertical water passages of the cylinder head.

At low speed, the pressure valve is against the seat and the thermostat is closed. Warm water from the cylinder block gradually migrates to the thermostat pocket at the top of the cylinder head.

The thermostat opens when the water temperature reaches approximately 143°F (62°C).

When the thermostat opens, water flows down through the cylinder head to a passage in the cylinder block. Water flows through the block to the exhaust housing and then out of the outboard.

At higher speeds, water pressure opens the pressure relief valve at approximately 2800 RPM. Water flows through the valve to the cylinder head and bypasses the thermostat. All water flows through the cylinder head to the outlet passage of the block and then exits through the exhaust housing.

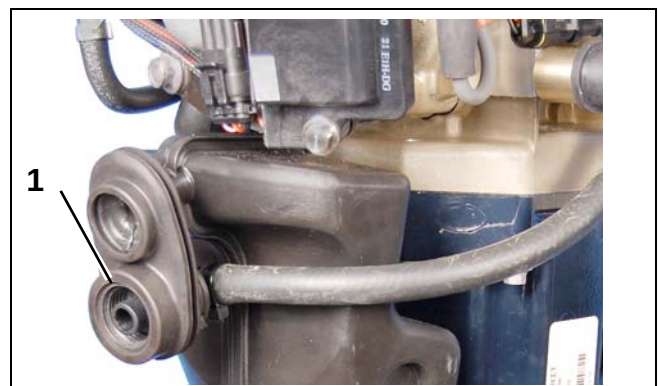
Vapor Separator and EMM Cooling

Cooling water is routed from the exhaust cover to the inlet fitting of vapor separator water cavity. Cooling the vapor separator fuel chamber minimizes fuel vaporization.

Cooling water from the vapor separator is routed to the water inlet fitting of the *EMM* water cavity. Cooling of the *EMM* helps to stabilize the temperatures of internal components.

IMPORTANT: Improper *EMM* cooling will activate service codes 25 and 29 and the Engine Monitor warning system. Refer to the **EMM Service Code Chart** at the back of this manual for specific service code information.

Cooling water from the *EMM* is routed to the overboard indicator.



1. Overboard indicator

007372

Engine Temperature Check

⚠ CAUTION

When servicing the propeller, always shift the outboard to NEUTRAL, remove the tether cord from the engine cut-off switch, and disconnect the Crankshaft Position Sensor (CPS) so the engine cannot be started accidentally.

IMPORTANT: The engine temperatures listed below are based on an intake water temperature of $70^{\circ} \pm 10^{\circ}\text{F}$ ($21^{\circ} \pm 3^{\circ}\text{C}$).

Install correct propeller and place outboard in a test tank or in the water. Start outboard and run at 3000 RPM in FORWARD gear for at least five minutes. Remember, running outboards at high speeds in test tanks may disrupt water flow to gearcase water intakes. Make sure the outboard has adequate water flow.

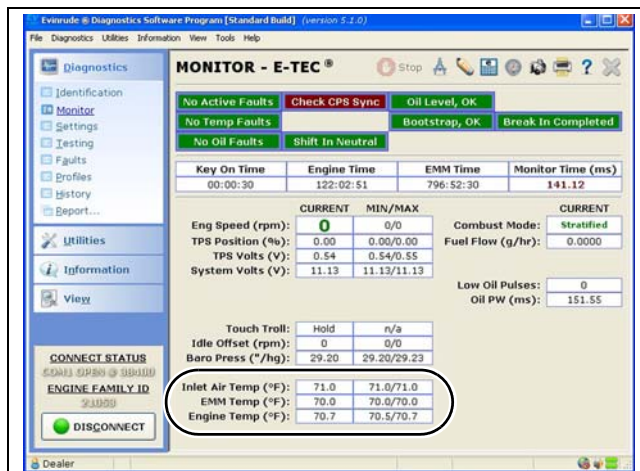
Reduce speed to IDLE for five minutes. Check IDLE operating temperature.

Increase speed to 5000 RPM and check temperature.

If engine temperatures are not within range, troubleshoot cooling system.

Software Method

Use *Evinrude Diagnostics* software to read temperature displays.



Monitor Screen

008601

Typical temperature sensor readings at IDLE speed should be $167^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($73^{\circ}\text{C} \pm 3^{\circ}\text{C}$).

Typical temperature sensor readings at WOT speed should be $122^{\circ}\text{F} \pm 10^{\circ}\text{F}$ ($50^{\circ}\text{C} \pm 5^{\circ}\text{C}$).

Operating temperature must not exceed 212°F (100°C).

Pyrometer Method

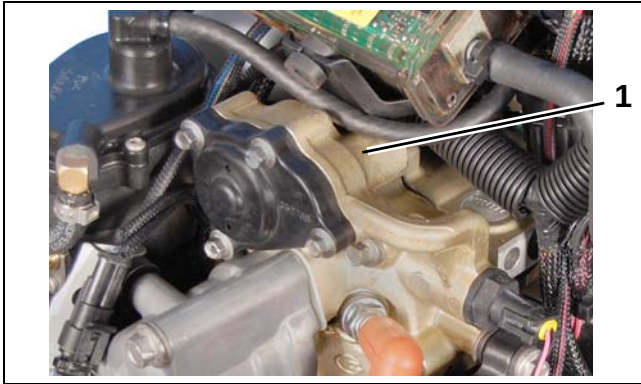
Use a Temperature Gun, P/N 772018, or a digital pyrometer to measure the outboard's operating temperatures.

Measure temperature of the thermostat housing at the top of cylinder head.

Typical pyrometer readings at IDLE speed should be $135^{\circ}\text{F} \pm 10^{\circ}\text{F}$ ($57^{\circ}\text{C} \pm 5^{\circ}\text{C}$).

Typical pyrometer readings at WOT speed should be $110^{\circ}\text{F} \pm 10^{\circ}\text{F}$ ($43^{\circ}\text{C} \pm 5^{\circ}\text{C}$).

IMPORTANT: If you get low or inaccurate readings with a digital pyrometer, coat the probe location with *Thermal Joint Compound*, P/N 322170.



1. Thermostat housing

007374

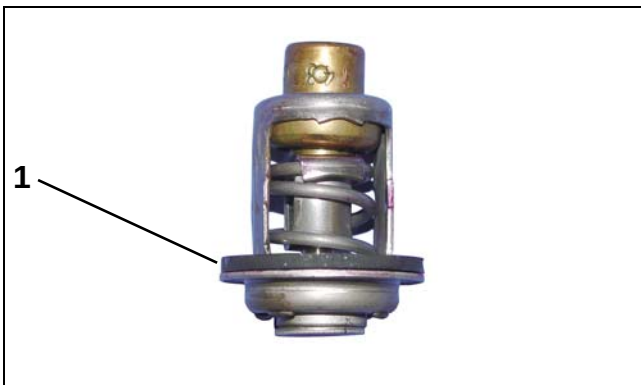
IMPORTANT: Digital pyrometer or temperature gun measurements may be slightly lower than software temperature readings.

Idle Operating Temperature Troubleshooting (Below Range)

If engine IDLE temperature is below operating range, $167^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($73^{\circ}\text{C} \pm 3^{\circ}\text{C}$), check thermostat and pressure relief valve operation.

Thermostat Inspection

Check position of thermostat seal and how thermostat seals against cylinder head. Seal must be properly fitted to flange of thermostat.



1. Thermostat seal

006401

Check thermostat for cracks, heat damage, or signs of corrosion. Check for proper operation. Thermostat opens at 143°F (62°C).

Refer to **Thermostat and Pressure Relief Valve Servicing** on p. 174.

Pressure Relief Valve Inspection

The pressure relief valve should be closed at IDLE speed. Water should not flow past the plunger and seal.

Start the outboard and check IDLE operating temperature.

If IDLE temperature is too low, check pressure relief valve plunger and seal for damage or debris that could prevent the valve from closing completely.

If IDLE temperature is still below operating range, replace pressure relief valve assembly and plunger seal.

To test pressure relief valve operation, monitor temperature at the thermostat housing with Temperature Gun, P/N 772018, or digital pyrometer.

Confirm normal IDLE operating temperature.

Slowly increase engine speed from IDLE, up through 3500 RPM.

Engine temperature should decrease from normal IDLE temperatures as pressure relief valve opens. Valve should open between 2800-3200 RPM.

If temperature decreases at a lower RPM, replace pressure relief valve assembly.

Refer to **Thermostat and Pressure Relief Valve Servicing** on p. 174.

Temperature Sender Servicing

Removal

Loosen sensor and remove by hand. Use care to avoid breaking threads.



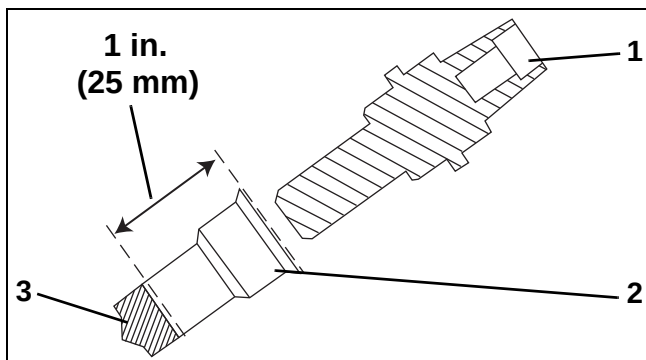
007375

Clean sensor threads, sensor, and sensor cavity.

Installation

Fill bottom of sensor cavity with 0.7 cc of *Thermal Joint Compound*, P/N 322170. Sensor cavity should be filled to 1 inch (25 mm) below the top edge of the cavity.

Install sensor. DO NOT use gasket sealing compound. SLOWLY tighten temperature sensor to a torque of 50 to 70 in. lbs. (5.6 to 8.0 N·m).



1. Temperature sensor
2. Sensor cavity
3. Thermal joint compound

007049

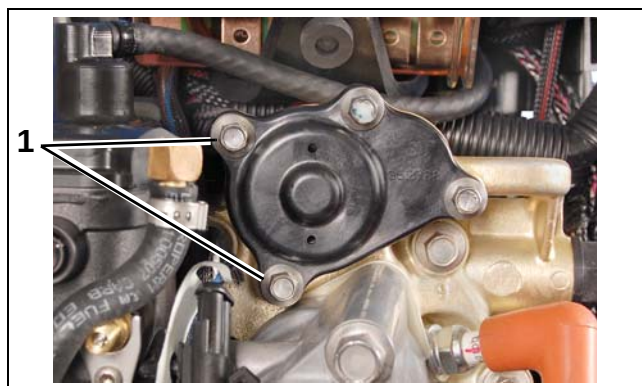
Wait 10 minutes for trapped air to bleed from cavity. Thermal compound may seep past threads. Retighten sensor.

Thermostat and Pressure Relief Valve Servicing

The thermostat and pressure relief valve should be serviced at the same time.

Disassembly

Remove four screws.

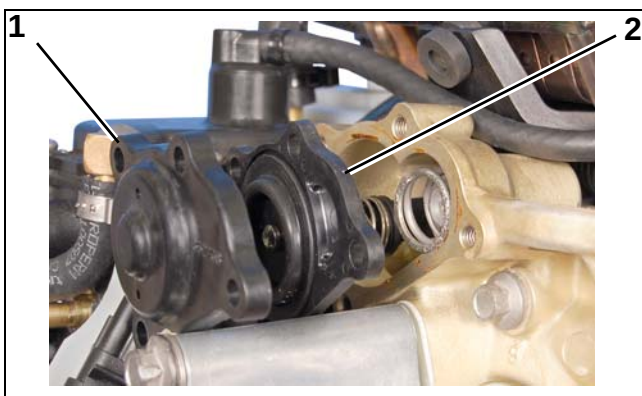


1. Screws

007376

Remove thermostat and pressure valve cover from cylinder head.

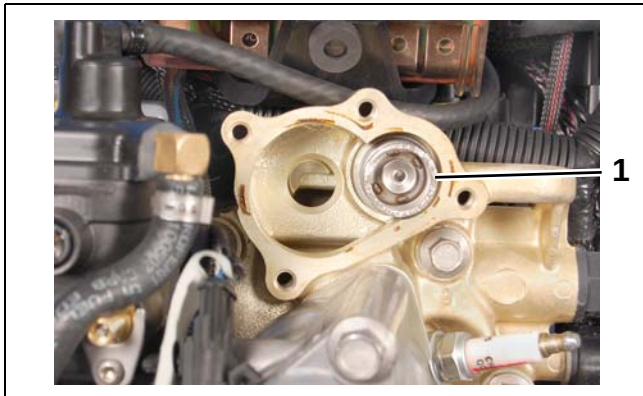
Remove pressure valve assembly.



1. Thermostat and pressure valve cover
2. Pressure valve assembly

007377

Remove spring, thermostat, and gasket.

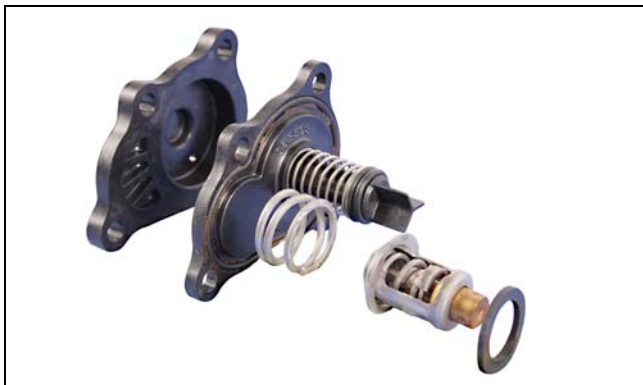


1. Spring, thermostat and gasket

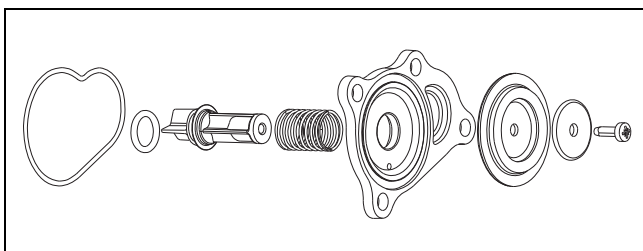
007378

Inspection

Inspect all parts for cracks, heat damage, or signs of corrosion. Replace damaged parts. Clean debris from housing and parts.



007379



Pressure Relief Valve Assembly Components

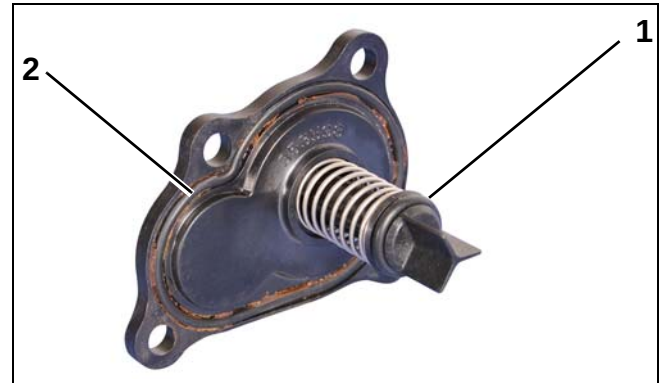
007380

Assembly

Assembly is the reverse of disassembly. Pay close attention when performing the following **additional** tasks.

Install a **new** plunger seal on plunger.

Apply a light coat of *Gasket Sealing Compound* to a **new** o-ring and place in groove in plate.



1. Plunger seal
2. Plate o-ring

007381

Install thermostat gasket, thermostat and spring into thermostat housing.

Install pressure valve assembly into housing.

Apply *Nut Lock* to screw threads. Tighten screws to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).

Notes

Technician's Notes

[illegible]

Related Documents

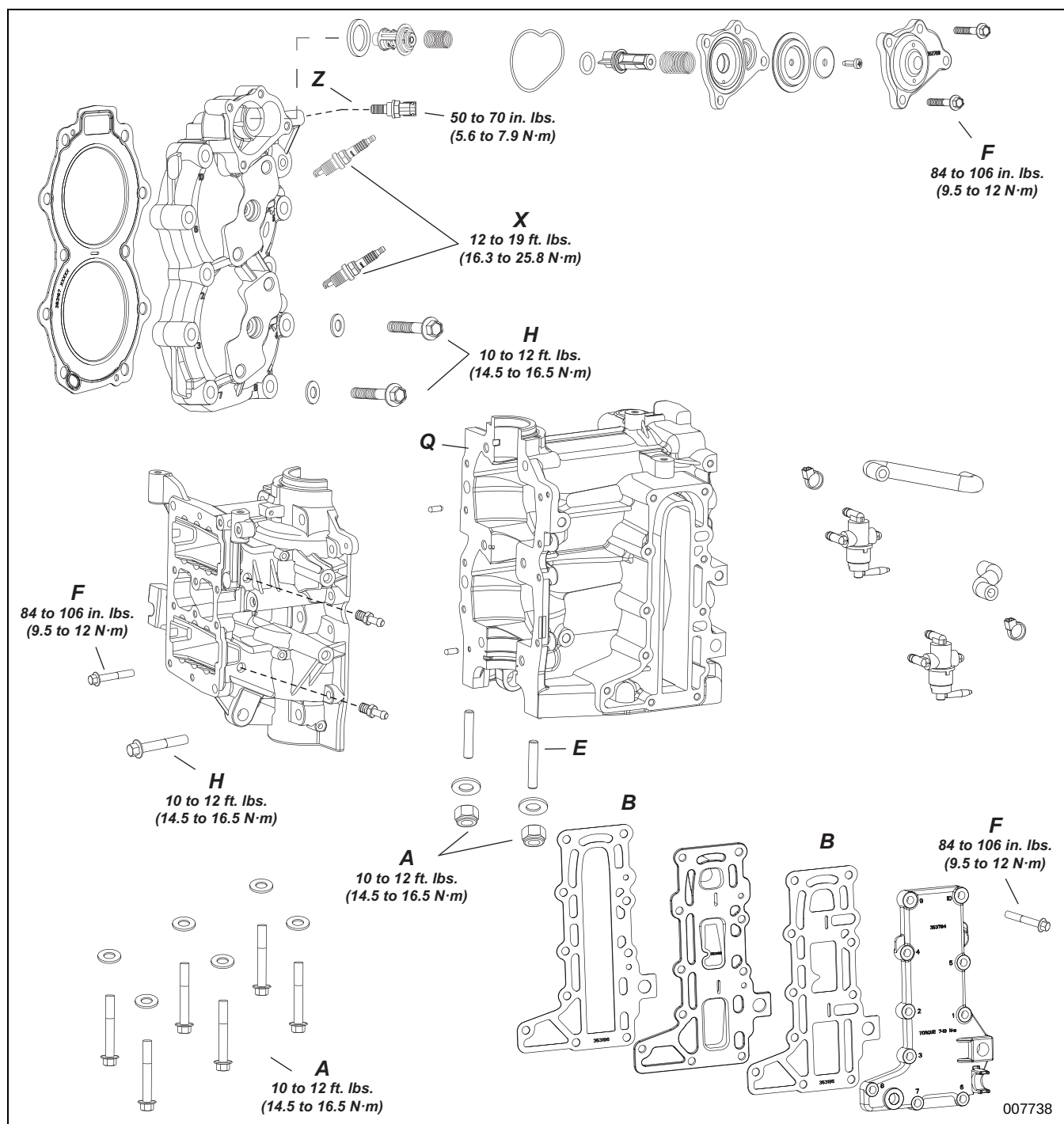
Bulletins	
Instruction Sheets	
Other	

Powerhead

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Service Charts



A Triple-Guard Grease

B Gasket Sealing Compound

E Red Ultra Lock

F Blue Nut Lock

H Outboard Engine Lubricant

Q Gel Seal II

Z Thermal Grease



D Moly Lube

Compression Testing

Start and run outboard until it achieves operating temperature, then shut OFF.

Disconnect crankshaft position sensor (CPS) connector. Remove all spark plugs.

Advance throttle linkage to WOT.

Install compression tester's hose attachment into spark plug hole (14 mm threads).

While cranking outboard with starter, note maximum pressure reading on gauge. Repeat procedure for each cylinder.

If engine shows a variation greater than 15 psi (100 kPa) between cylinders, check for:

- damaged cylinder head
- damaged pistons
- broken or stuck piston rings
- scored cylinder walls

Return throttle to idle position and reconnect CPS connector. Replace spark plugs. Refer to Spark Plug **Indexing** on p. 66.

Powerhead Removal

⚠ WARNING

Protect against hazardous fuel spray. Before starting any fuel system service, carefully relieve fuel system pressure. Refer to Relieving Fuel System Pressure on p. 14.

To prevent accidental starting while servicing, disconnect the Crankshaft Position Sensor (CPS).

Remove lower motor covers. **Lower Cover Removal** on p. 75.

Remove the recoil starter housing. Refer to **Recoil Starter Removal** on p. 255.

Remove exhaust relief muffler. Refer to **Exhaust Relief Muffler** on p. 210.

Remove water intake screens.



1. Water intake screen

007649

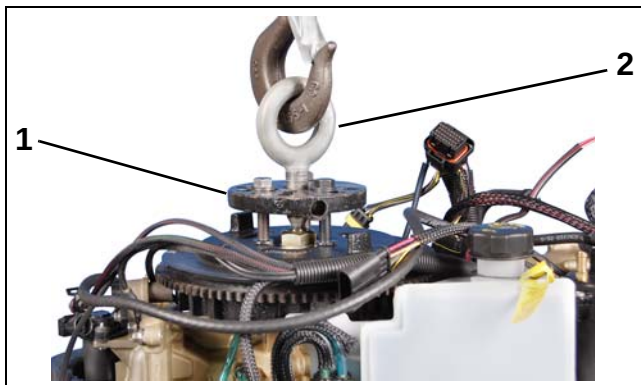
Remove the upper shift rod connector screw.



1. Shift rod connector screw

007650

Install Universal Puller Set, P/N 378103 and Lifting Eye, P/N 321537, on flywheel and seat the three screws completely.

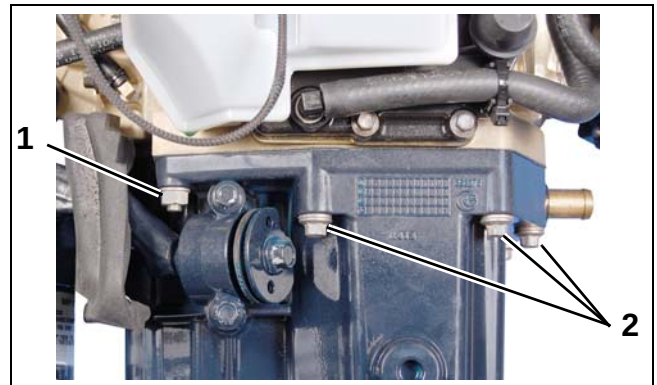


1. Universal puller set
2. Lifting eye

007740

Fasten appropriate chain hook to eye of tool and support weight of powerhead with hoist.

Remove the two exhaust housing to powerhead nuts and six exhaust housing to powerhead screws.



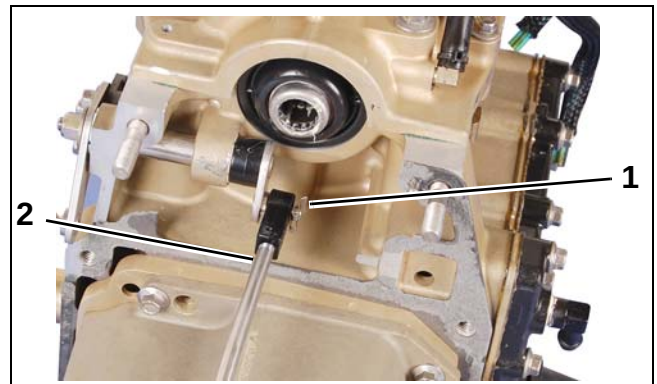
1. Powerhead nuts
2. Powerhead screws

007741

Use a suitable tool to carefully separate the powerhead from exhaust housing.

IMPORTANT: Do not damage the powerhead or exhaust housing mating surfaces.

Remove clip from upper shift rod and remove shift rod.



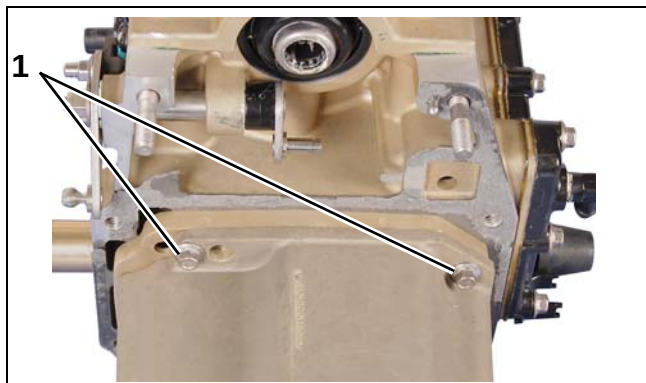
1. Clip
2. Shift shaft

007742

Powerhead

Powerhead Disassembly

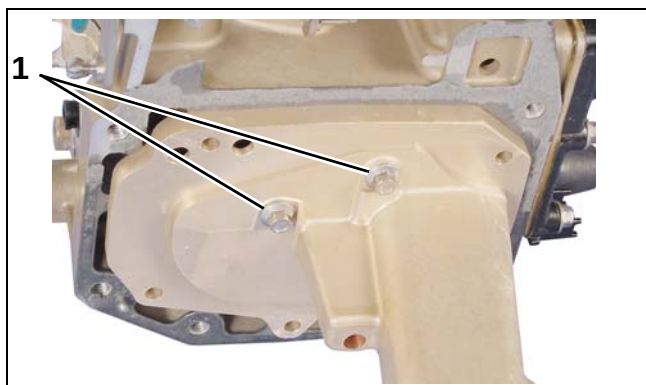
Remove five inner exhaust housing screws and inner exhaust housing.



1. Screws

007743

Remove three exhaust megaphone screws and exhaust megaphone.



1. Screws

007744

Powerhead Disassembly

Systems Removal

To simplify reassembly and wiring installation, lay out the various screws and clamps in the order of their proper location.

Remove the oil tank. Refer to **Oil Tank Assembly** on p. 156.

Remove fuel pump assemblies, filter and fuel injectors. Refer to **Fuel Component Servicing** on p. 140.

IMPORTANT: Mark injectors for cylinder location before removal. All injectors must be installed in their original location. Improper injector installation can result in powerhead failure.

Remove ignition coils.

Remove *EMM* and electrical harness assembly. Refer to **EMM Servicing** on p. 96.

Remove flywheel and stator. Refer to **Flywheel and Stator Servicing** on p. 119.

Remove throttle linkage. Refer to **Throttle Linkage Removal** on p. 183.

Remove shift linkage. Refer to **Shift Linkage Removal** on p. 183.

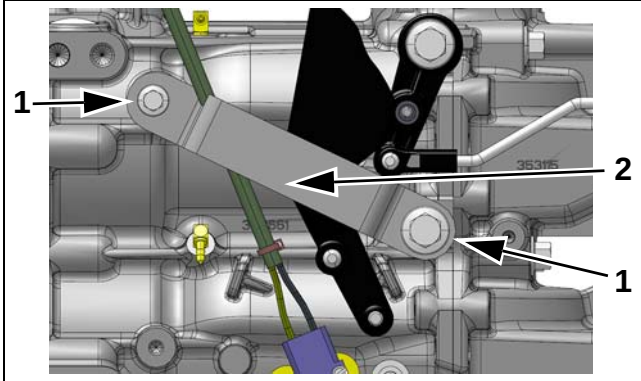
Remove the throttle body and reed plate assemblies. Refer to **Intake Manifold Service** on p. 148.

Remove thermostat and pressure valve assembly. Refer to **Thermostat and Pressure Relief Valve Servicing** on p. 174.

Remove oil supply and recirculation hoses.

Throttle Linkage Removal

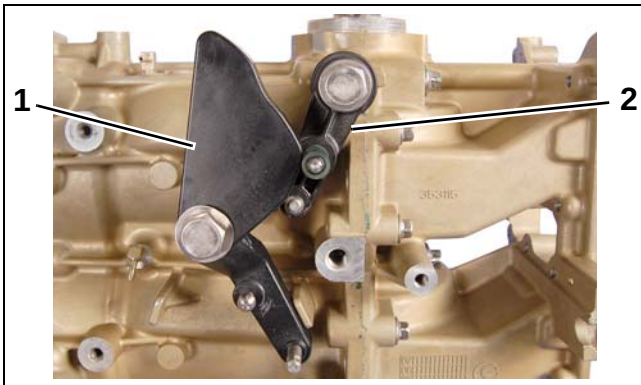
Remove the two screws, spacer and throttle cam guard.



1. Screws
2. Throttle cam guard

008929A

Remove throttle cam and throttle lever.

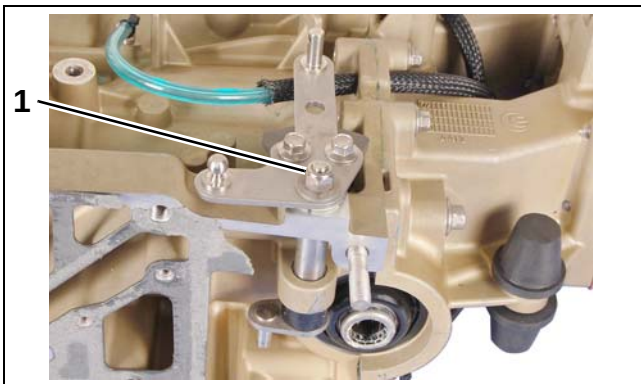


1. Throttle cam
2. Throttle lever

007785

Shift Linkage Removal

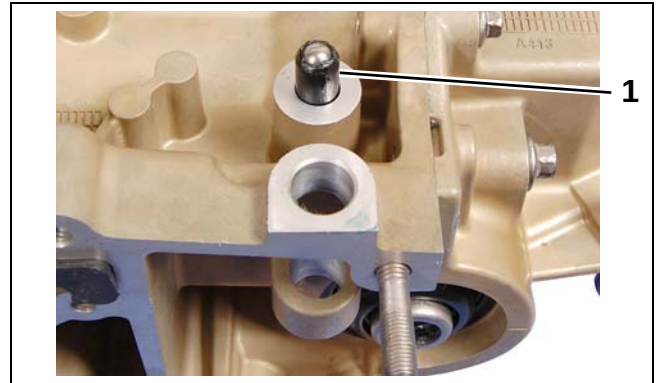
Remove nut from shift lever. Remove shift lever and shaft assembly.



1. Nut

007745

Remove the ball, guide, and spring of the shift detent assembly from the crankcase.

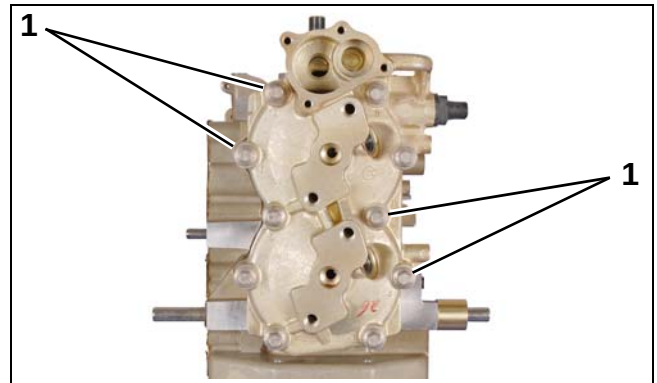


1. Shift detent assembly

007786

Cylinder Head Removal

Loosen **in stages** and remove cylinder head retaining screws. Remove the cylinder head. Discard cylinder head gasket.

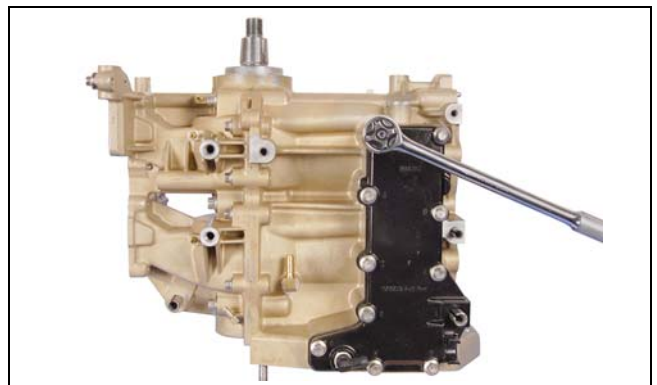


1. Cylinder head screws (10 total)

007746

Crankcase Disassembly

Remove screws and exhaust side water covers.

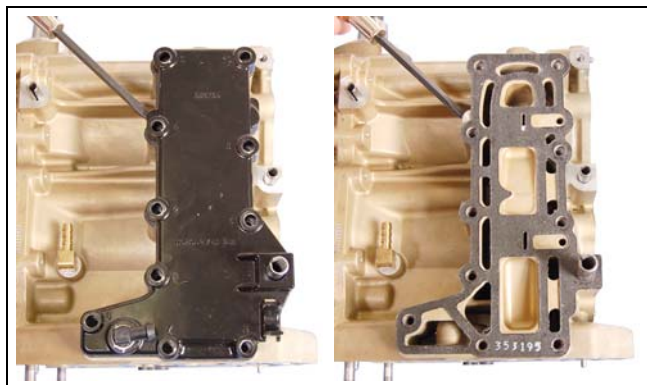


007747

Powerhead

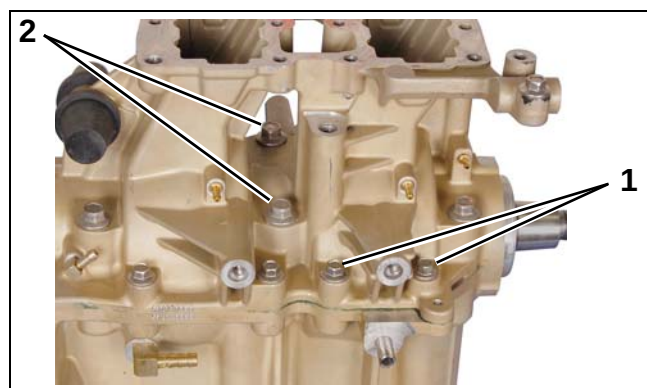
Powerhead Disassembly

IMPORTANT: Use care to avoid bending or damaging inner exhaust side cover.



007787
007788

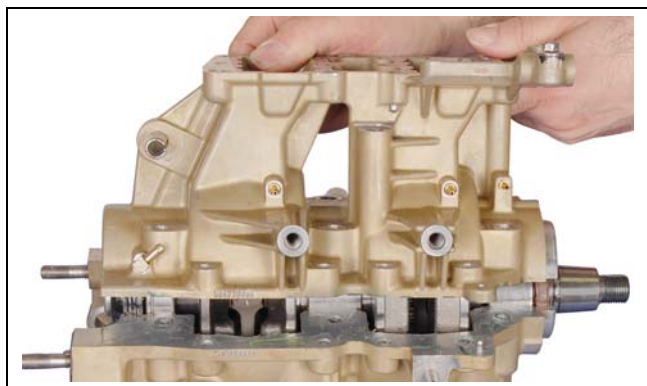
Remove crankcase flange screws. Loosen in stages and remove the main bearing screws.



1. Flange screws
2. Main bearing screws

007748

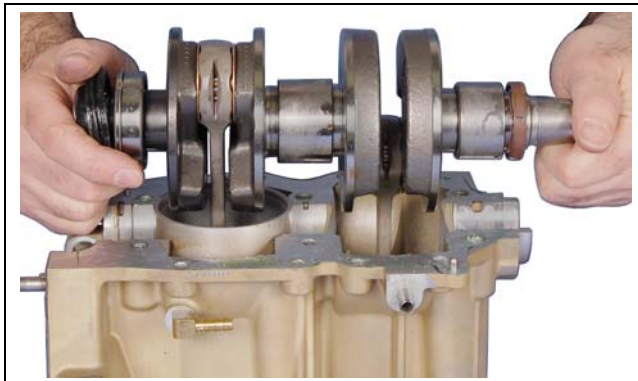
Separate crankcase and cylinder block. It may be necessary to tap on crankshaft with a rawhide or rubber mallet to loosen.



007749

Crankshaft Assembly Removal

Carefully lift crankshaft straight up and remove from crankcase.



007750

Connecting Rods and Pistons

⚠ WARNING

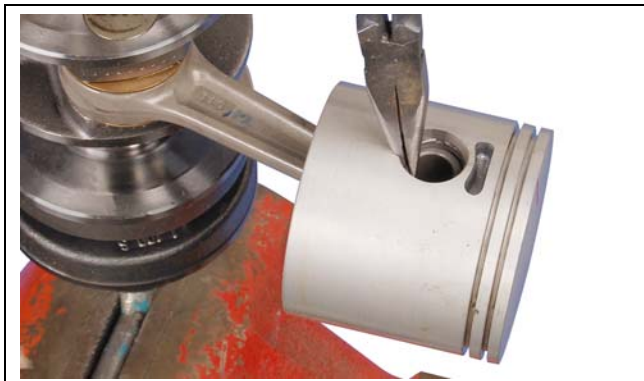
Wear safety glasses to avoid injury.

Use an appropriate ring expander to remove all piston rings from pistons. Discard the rings.



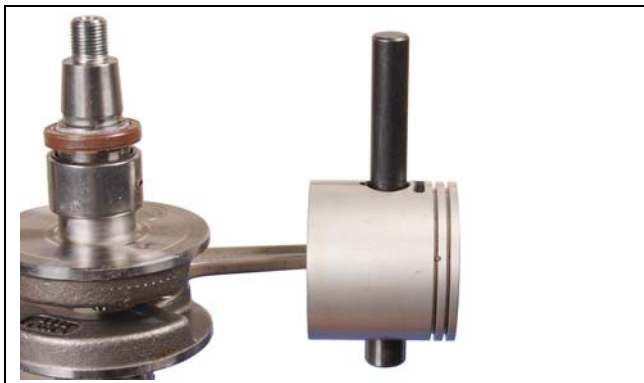
007751

Remove wrist pin retaining rings. Discard retaining rings.



007752

The wrist pin fit is loose on both sides. Push the wrist pin through to free the piston from the connecting rod. If necessary, use Wrist Pin Pressing Tool, P/N 326356, to remove the wrist pin.

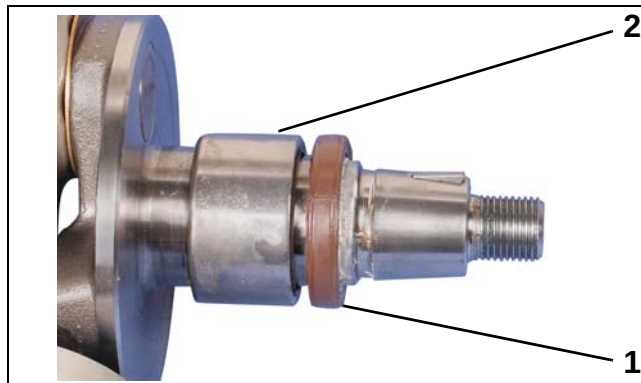


007753

Crankshaft Service

Remove upper seal from crankshaft. Discard the seal. A new upper seal must be installed on assembly.

Remove the upper main bearing.



1. Upper oil seal
2. Upper main bearing

007754

Remove the lower bearing seal housing.



007755

Remove the housing O-ring. Discard O-ring.

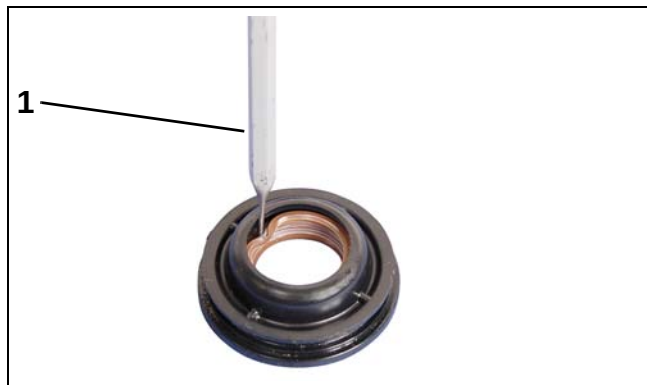


007789

Powerhead

Powerhead Disassembly

Use a punch to remove the housing seal. Discard seal.

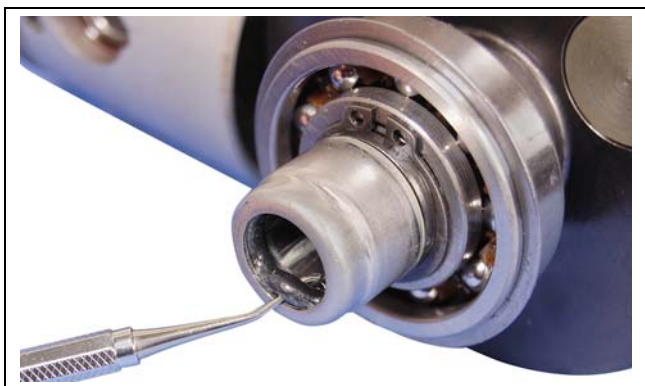


1. Punch

007790

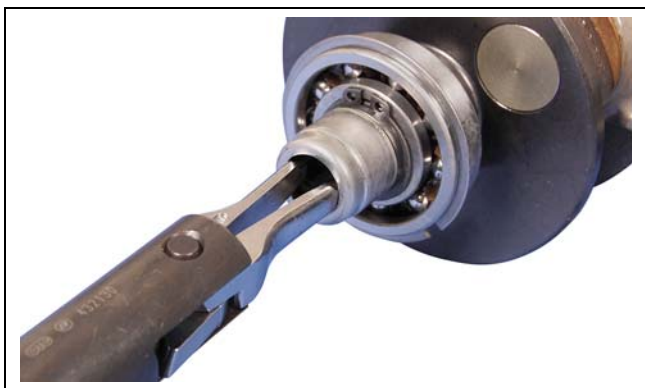
Inspect housing and replace if necessary.

Remove the O-ring from crankshaft sleeve and inspect it. Replace the O-ring if it is not in good condition.



007791

Inspect the crankshaft sleeve and replace if necessary. To remove the sleeve, use Slide Hammer, P/N 432128, and Puller Jaws, P/N 432130.



007792

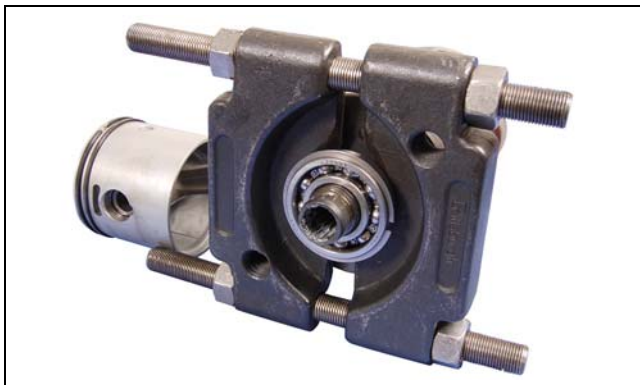
Remove the lower main bearing only if it needs to be replaced. Use external retaining ring pliers to remove the lower bearing retaining ring.



007756

IMPORTANT: If the lower main bearing is removed from the crankshaft, it must be discarded. DO NOT reuse it.

Use a bearing separator to support the bearing, and press off the crankshaft.



007793

Cylinder Block Cleaning

⚠ WARNING

To avoid personal injury, wear eye protection and rubber gloves when using *Gel Seal and Gasket Remover*.

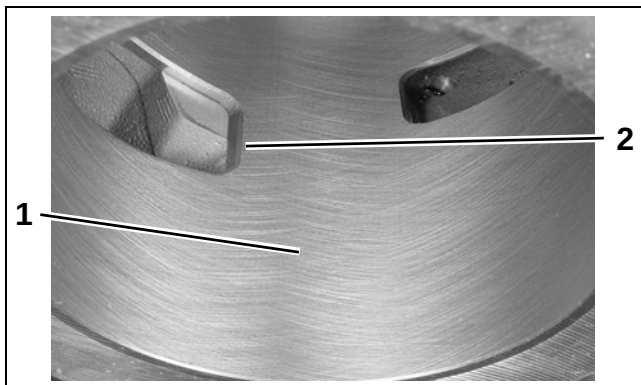
IMPORTANT: Before inspecting or assembling powerhead, all internal components must be completely clean and free of contaminants. Be careful to avoid damaging any machined surfaces.

Remove any carbon accumulation from exhaust port areas.

Remove any carbon accumulation from cylinder head combustion chambers.

If cylinder walls are glazed from extended use, use a rigid, medium grit cylinder hone to resurface walls. Use slow RPM for best oil retention and ring sealing. When finished, a cross hatch pattern of 22 to 32° should be visible in the cylinder wall. The pattern should be uniform in both directions.

IMPORTANT: To avoid piston or cylinder block damage, restore the chamfer to all port edges using a ball hone or other suitable tool.

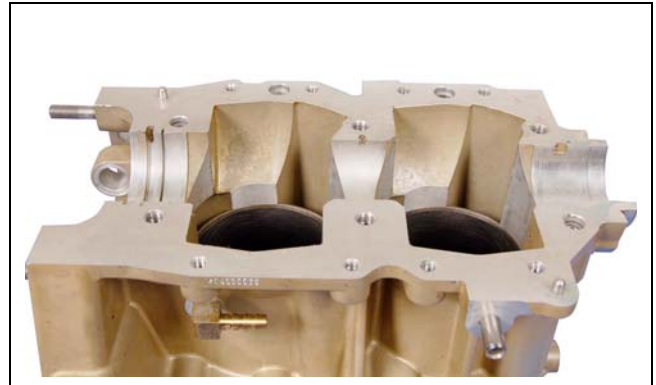


1. Crosshatch pattern in cylinder wall
2. Chamfered port edge

002067

Use *Gel Seal and Gasket Remover* to remove all traces of gaskets, adhesives, and *Gel-Seal II™*

sealant from the cylinder block, crankcase, cylinder head, and water cover.



007794

Carefully remove any carbon accumulation from the tops and ring grooves of the piston using *Engine Tuner*. A ring groove cleaning tool can be made by breaking an old ring and grinding an angle on its end. Do not damage ring grooves while cleaning.

Thoroughly wash entire cylinder block and crankcase with warm, soapy water to remove all traces of contaminants.

Clean up any spilled solvents with shop towels.

ENVIRONMENTAL NOTE

Dispose of solvents and contaminated cleaning materials in an environmentally responsible manner, or according to local regulations.

Air dry cylinder block and crankcase. Blow all holes and passageways with compressed air.

⚠ WARNING

To avoid personal injury, wear eye protection and set compressed air pressure at less than 25 psi (172 kPa).

Cover the cylinder walls with a liberal amount of outboard lubricant to prevent corrosion.

Powerhead Inspection

For dimensions, refer to **Service Specifications** on p. 12.

IMPORTANT: Before any inspection process can begin, all internal components must be completely clean and free of contaminants.

Visually inspect all parts. Check for unusual wear patterns, scuffing, or deterioration of aluminum parts, heat-related discoloration of bearings and bearing surfaces, and broken components.

Cylinder Head

Check for cylinder head warpage using a piece of bar stock or machinist's straightedge and a feeler gauge set.

Cylinder head warpage must not exceed 0.006 in. (0.15 mm) per inch of measurement. Replace head if warpage exceeds this dimension.



007757

Check fuel deflector pins for damage.

Bearings

Inspect upper and lower main bearings for excess wear, nicks, or scratches. Replace if necessary.

Cylinder Bore

Use a Cylinder Bore Gauge to inspect each cylinder bore for an out-of-round, oversize, or tapered condition. Be sure the gauge is perfectly square in the bore when measuring.



TYPICAL

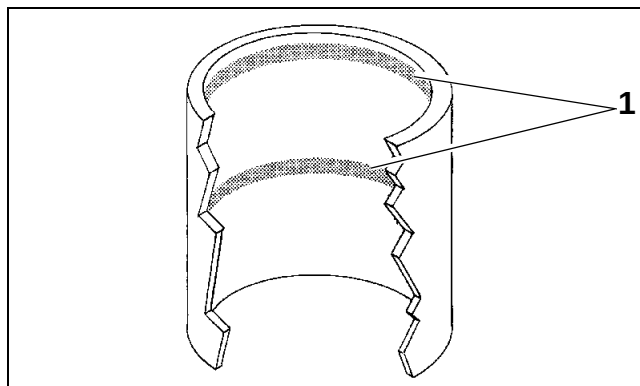
007758

Measure each cylinder in at least two areas. Each area should be measured twice. The difference between the two measurements in each area is the cylinder out-of-round dimension.

- The cylinder must not be out-of-round by more than 0.004 in. (0.10 mm).

The dimensional difference between the two areas is cylinder taper.

- The cylinder taper must not exceed 0.002 in. (0.05 mm).



1. Measurement areas

DR3482

The difference between the measurements and standard bore is cylinder oversize. For dimensions, refer to **Service Specifications** on p. 12.

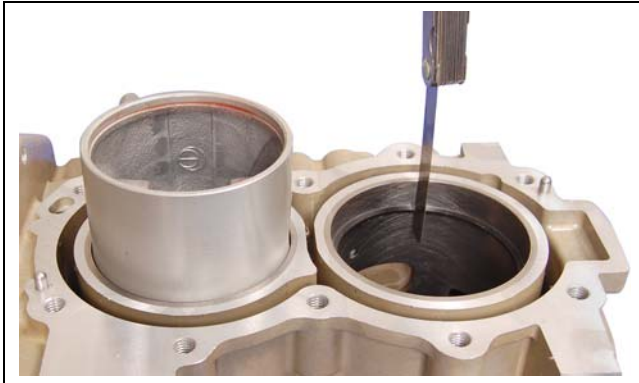
- The cylinder must not be oversized by more than 0.003 in. (0.08 mm).

Pistons

Visually inspect pistons for signs of abnormal wear, scuffing, cracks, or burning.

Piston Rings

For new ring sets, place each ring separately in its respective bore. Use a piston to square the ring in the cylinder. Use a feeler gauge to measure the ring end gap.



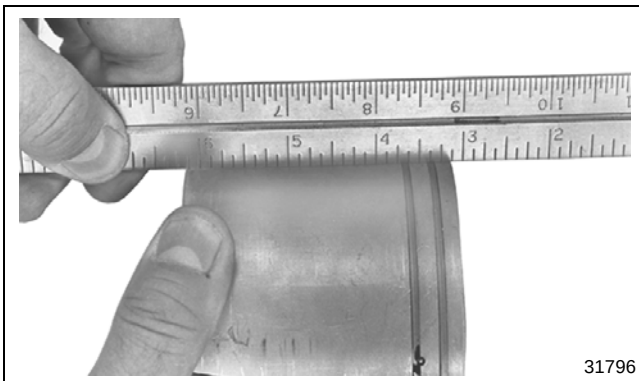
007759

Ring end gap should be:

- 0.011 to 0.019 in. (0.30 to 0.50 mm)

IMPORTANT: Ring end gap increases approximately 0.003 in. (0.076 mm) for each 0.001 in. (0.025 mm) increase in cylinder bore diameter. DO NOT exceed cylinder oversize dimension.

Use a machinist's straightedge to check for proper ring clearance. Position piston rings on piston. Push rings into groove and hold straightedge against the side of the piston. Rings must be even or just below the surface of piston. Rings must move freely in piston ring groove.



31796

Powerhead Assembly

IMPORTANT: Proceed slowly. Make no forced assemblies unless a pressing operation is called for. All internal components must be perfectly clean and lightly coated with outboard lubricant.

IMPORTANT: Use new wrist pin retaining rings, gaskets, seals, and O-rings during assembly.

Crankshaft Assembly

Oil the end of the crankshaft. Use Crankshaft Bearing/Sleeve Installer, P/N 339749, and place a new lower main bearing onto crankshaft with lettered side facing the tool. Install bearing until it seats on the crankshaft.



007795

Oil the end of the crankshaft. Use Crankshaft Bearing/Sleeve Installer, P/N 339749, to drive a new sleeve onto the crankshaft until the installer contacts the lower main bearing.



007796

Powerhead

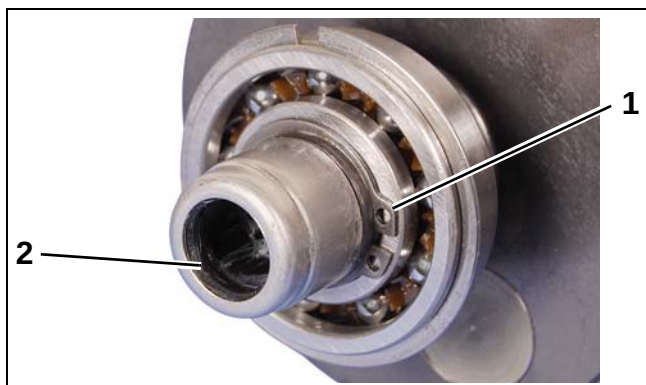
Powerhead Assembly

If the installer sticks on the sleeve after installation, thread Slide Hammer, P/N 391008, into installer and pull it off.

IMPORTANT: Inspect sleeve after installation. Sleeve must not be used if surface is damaged.

Use retaining ring pliers to install bearing retaining ring with sharp edge facing away from bearing.

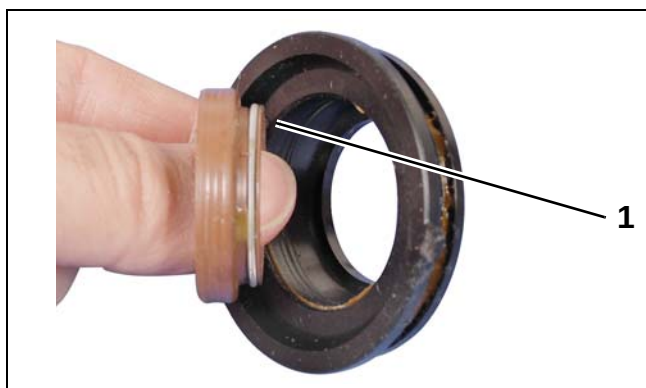
Lubricate a new driveshaft O-ring and lightly lubricate crankshaft splines with *Moly Lube*. Install O-ring in sleeve.



1. Bearing retaining ring
2. O-ring

007797

Lightly coat the outside edge of a new lower housing seal with *Gasket Sealing Compound*. Press against outer case of the seal to install seal in the lower housing with extended lip facing down. Lubricate seal lip with *Moly Lube*.

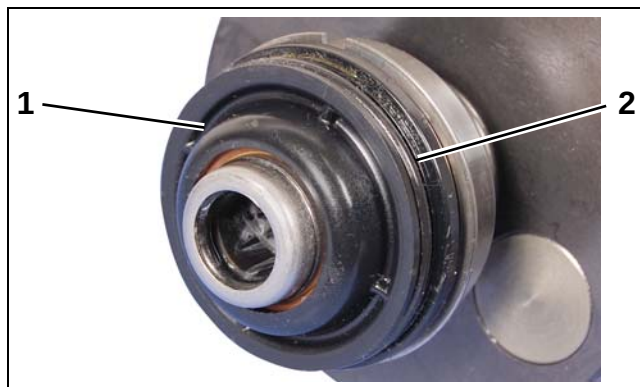


1. Seal lip

007798

Install a new O-ring on the lower housing. Before installing crankshaft into cylinder block, apply a thin coat of *Gasket Sealing Compound* to outer edge of O-ring.

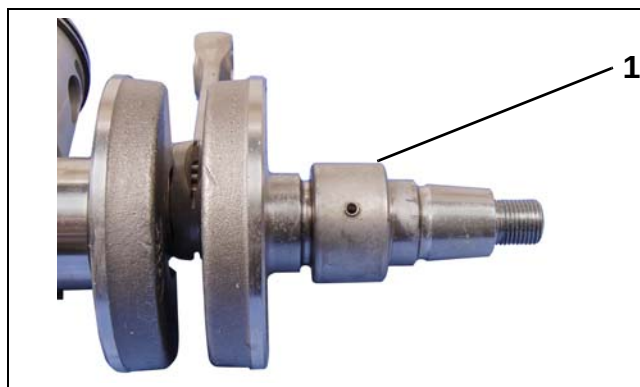
Place lower seal housing on crankshaft.



1. Lower seal housing
2. O-ring

007799

Lubricate upper main bearing with outboard lubricant and install on crankshaft.

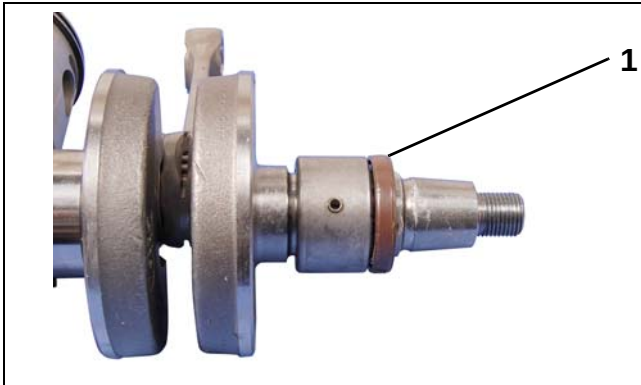


1. Upper main bearing

007760

Pack lip of upper oil seal with *Moly Lube*. Place seal on crankshaft with lip toward driveshaft and

enclosed face toward flywheel. Do not apply sealer to outside edge of the seal.



1. Upper oil seal

007761

Pistons and Connecting Rods

NOTICE

It is very important that the pistons in this engine are installed in the correct location and direction. Engine damage will occur if installed incorrectly.

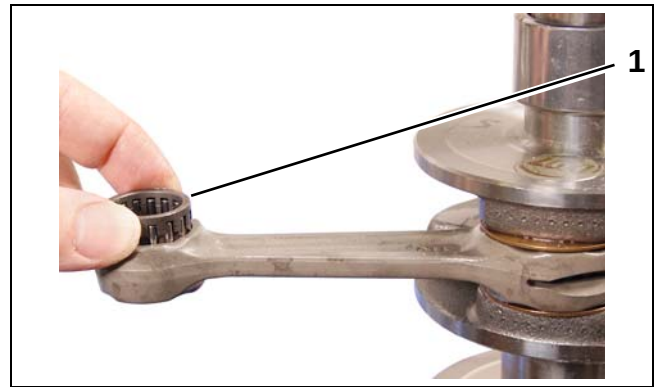
New pistons are stamped "UP." This marking should be turned toward the top of the crankshaft.



1. Stamped marking

007800

Apply outboard lubricant to the wrist pin bearings, wrist pin and wrist pin bore. Install the bearings in the small end of the connecting rod.



1. Wrist pin bearings

007762

Place the piston over the connecting rod and bearings.

Install wrist pin through piston and connecting rod.



007763

Use Wrist Pin Retainer Installation Tool, P/ N 354720, to install new wrist pin retaining rings in each wrist pin hole. Place one retaining ring into tool base. Insert driver into base and through retaining ring. Align tool on piston. Support piston

Powerhead

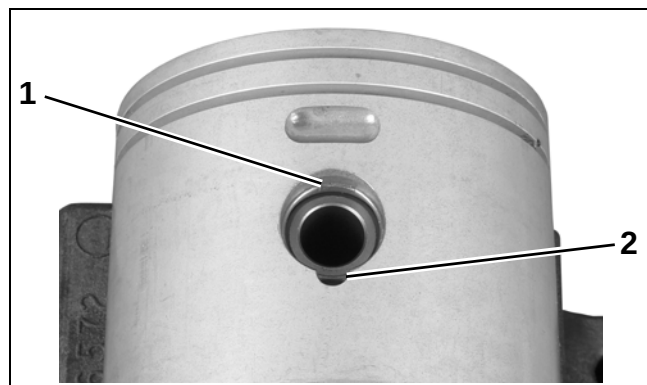
Powerhead Assembly

and tool. To seat retaining ring, swiftly strike the driver.



007764

Gap of retaining ring faces up, away from notch in piston.



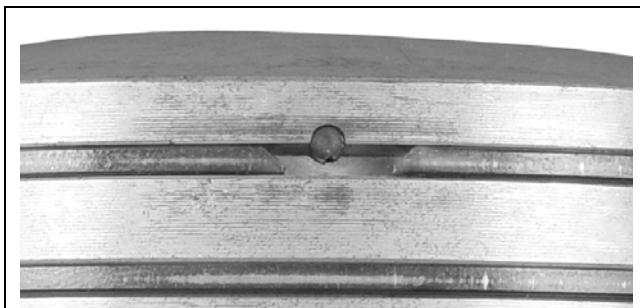
1. Gap of retaining ring
2. Notch in piston

002050

Installing Pistons

When all pistons and connecting rods are assembled, install piston ring sets. Be sure rings are installed in the cylinder used to test ring end gap. Refer to **Powerhead Inspection** on p. 188.

IMPORTANT: Be sure gap of ring fits squarely around dowel pin.



002048

IMPORTANT: Before continuing, make sure that all *Gel-Seal II* has been removed from the cylinder block and crankcase mating flanges. If traces of hardened *Gel-Seal II* are left, main bearings could be misaligned. Refer to **Cylinder Block Cleaning** on p. 187.

Crankshaft Assembly Installation

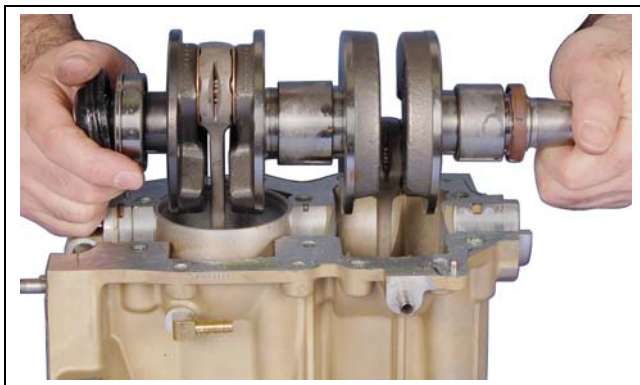
Rotate cylinder block so crankcase mating flange is facing up.

Apply *Gasket Sealing Compound* to lower oil seal groove in cylinder block. DO NOT put any sealer in upper seal groove.

Coat pistons, rings and cylinder walls with out-board lubricant.

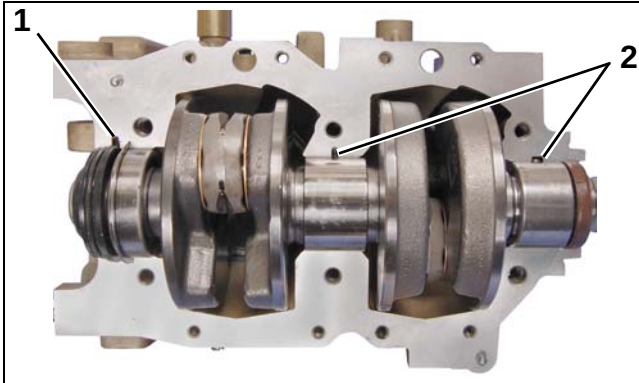
Locate piston rings on dowel pins.

Carefully lower crankshaft assembly into the cylinder block.



007750

- Align tab on lower bearing seal housing with slot in crankcase.
- Align upper oil seal in groove.
- Locate center and upper main bearing dowel pin with slot in crankcase.



1. Lower bearing seal housing tab and slot
2. Center and upper main bearing dowel pin and slots

007765

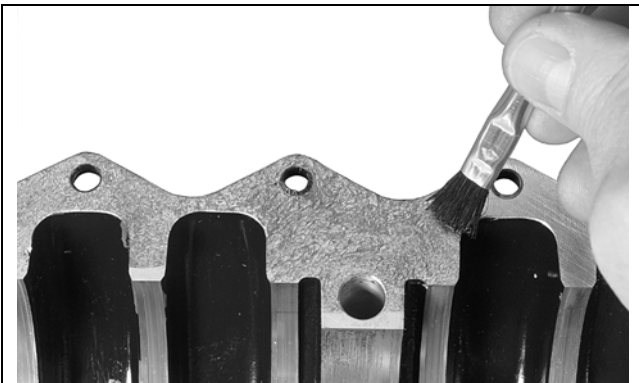
Crankcase Assembly

Thoroughly clean and degrease the mating flanges of the crankcase and cylinder block with a non-petroleum based solvent, such as isopropyl alcohol or acetone, and let air dry.

IMPORTANT: DO NOT allow solvent to get on internal components. Clean only the mating flanges.

Apply *Gasket Sealing Compound* to lower oil seal groove in crankcase. DO NOT put any sealer in upper seal groove.

Use a small brush with a tapping motion to apply a thin, even coat of *Gel-Seal II* sealant to the crankcase mating flange. The sealer must not come within 1/4 in. (6.4 mm) of bearings.



TYPICAL

003874

IMPORTANT: *Gel-Seal II* has a shelf life of at least one year when stored at room temperature. Test the *Gel-Seal II* or replace it if the age of the tube cannot be determined. Using old *Gel-Seal II* could cause crankcase air leaks.

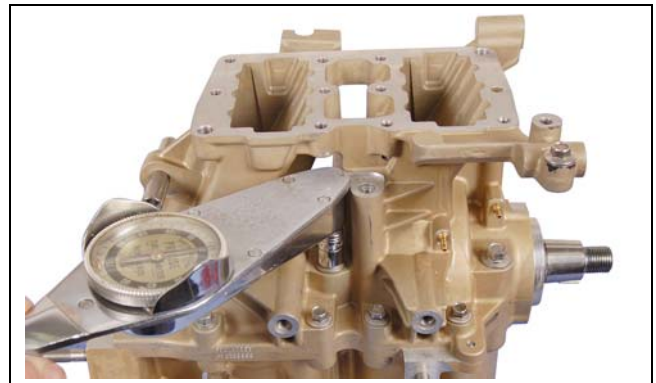
IMPORTANT: The use of *Locquic Primer* is NOT recommended. If primer is used, crankcase halves must be assembled and tightened within ten minutes after the *Gel-Seal II* has been applied.

Lower the crankcase into place. Make sure that upper oil seal and lower seal housing are seated in grooves.

Apply outboard lubricant to the main bearing screws. Tighten main bearing screws **in stages** to a final torque of:

- 10 to 12 ft. lbs. (14.5 to 16.5 N·m).

Start in the center and work outward in a spiral pattern.



007766

Apply *Nut Lock* to crankcase flange screws. Install crankcase flange screws and tighten to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).



007767

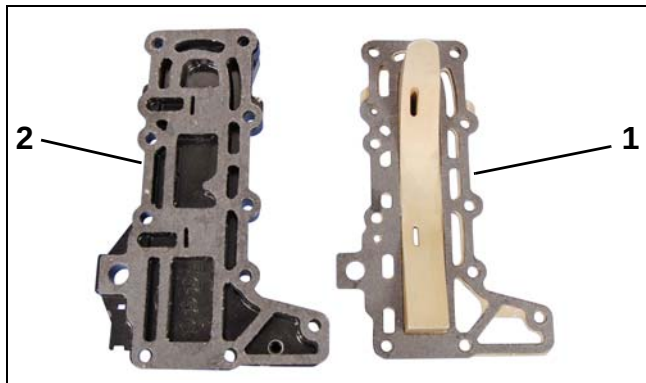
Powerhead

Powerhead Assembly

Test that the crankshaft spins freely without binding.

IMPORTANT: After powerhead has been assembled, allow at least two hours for *Gel-Seal II* to cure before running outboard.

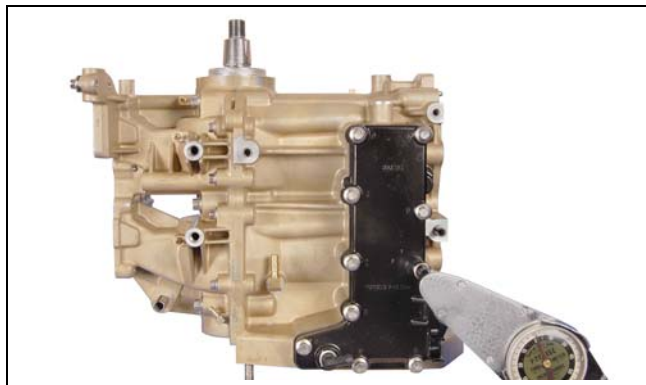
Apply *Gasket Sealing Compound* to both sides of new inner and outer exhaust cover gaskets. Position gaskets and covers on cylinder block.



1. Inner exhaust cover
2. Outer exhaust cover

007768

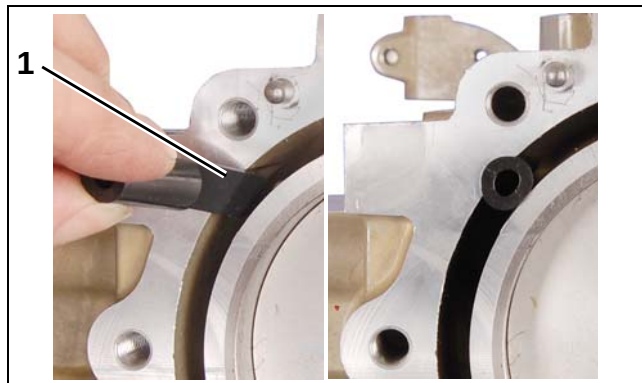
Apply *Nut Lock* to cover screws. Tighten all screws in sequence, to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).



007769

Cylinder Head Installation

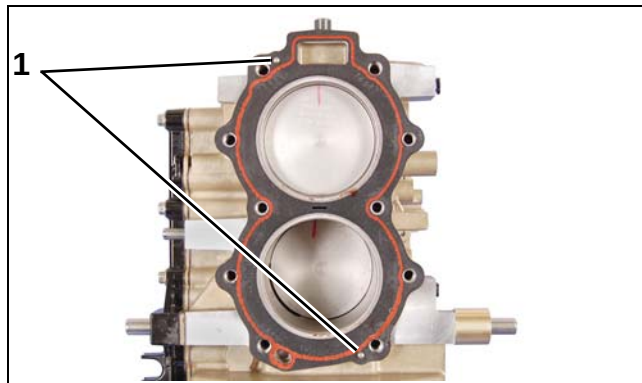
Apply soapy water to water dam and insert into block.



1. Water dam tab

007770
007771

Place a new cylinder head gasket on alignment pins.

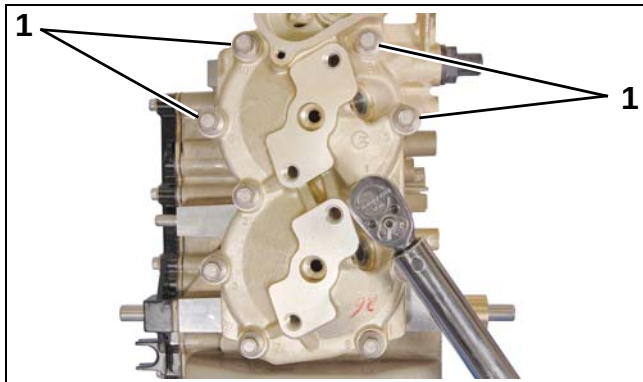


1. Alignment pins

007772

Install cylinder head with the thermostat toward the top. Apply *Triple-Guard* grease to the threads and install the cylinder head screws. DO NOT use any sealant on threads

Following sequence on cylinder head, tighten all screws in stages to a torque of 10 to 12 ft. lbs. (14.5 to 16.5 N·m)

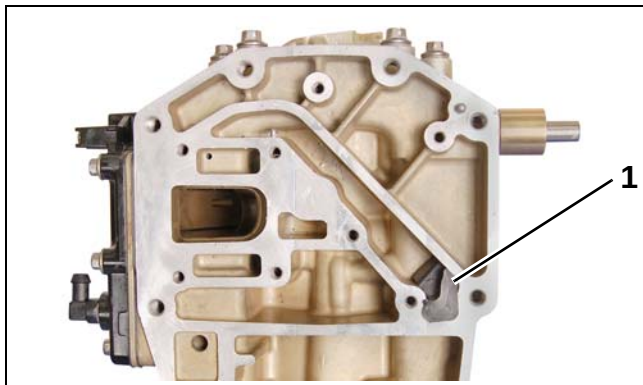


1. Cylinder head screws (10 total)

007773

Megaphone and Inner Exhaust Housing Installation

Install water plug in cylinder block as shown.

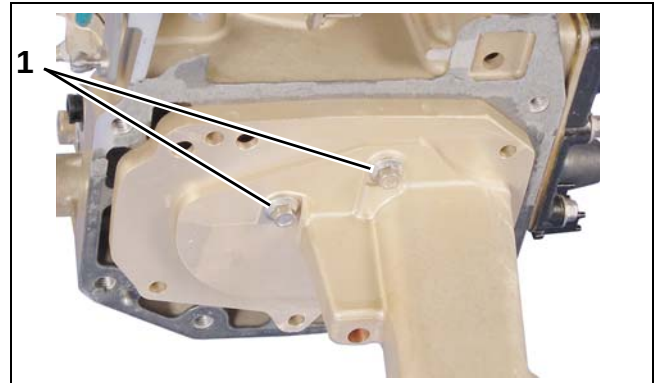


1. Water plug

007775

Place a new gasket on the powerhead. Apply *Nut Lock* to screws. Install exhaust megaphone and

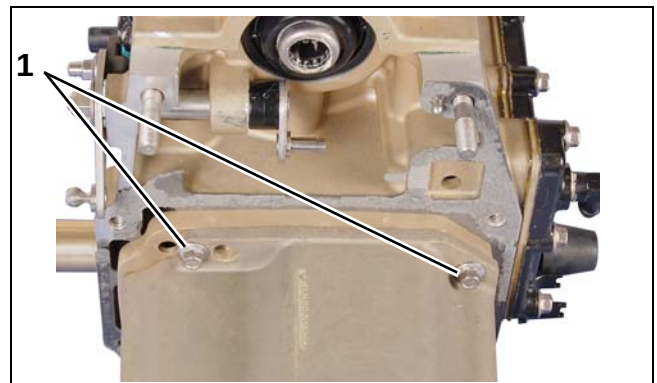
secure with three screws. Tighten screws to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).



1. Screws

007744

Apply *Nut Lock* to screws. Install inner exhaust housing and secure with five screws. Tighten screws to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).

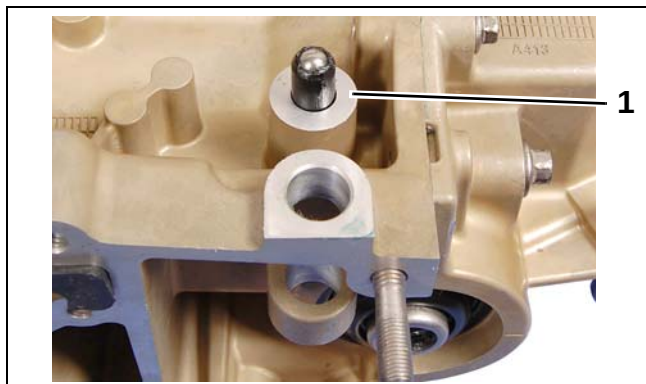


1. Screws

007743

Shift Linkage Installation

Place the spring, guide, and ball of the shift detent assembly into the crankcase. Lubricate with *Triple-Guard* grease.



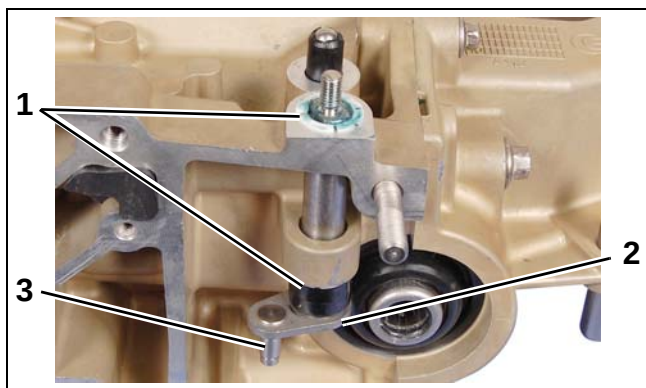
1. Shift detent assembly

007786

Lubricate shift linkage bosses at the base of the cylinder block with *Triple-Guard* grease. Insert bushings into bosses.

Apply *Triple-Guard* grease to the shift lever and shaft assembly. Guide shaft through bushings in crankcase.

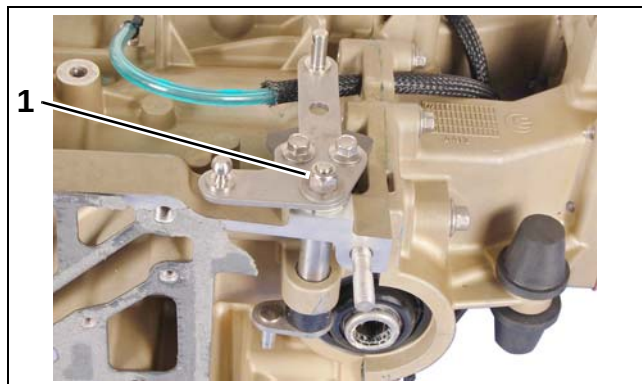
IMPORTANT: Shift lever and shaft must be positioned with pin toward the rear of the cylinder block.



1. Bushings
2. Shift lever and shaft assembly
3. Pin

007801

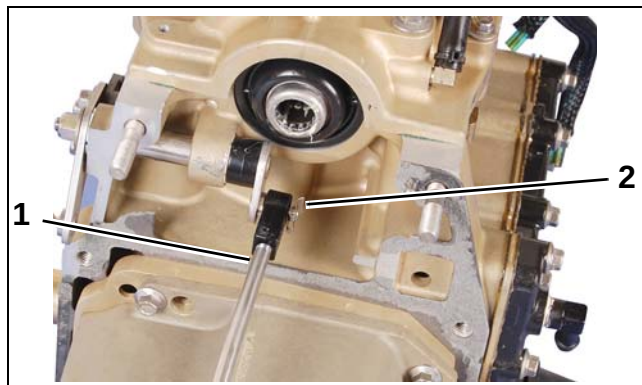
Install shift lever and detent on shaft assembly. Install nut and tighten nut to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).



1. Nut

007745

Be sure the shift rod connector is fully seated. Install the shift shaft on the pin and secure with clip.



1. Shift shaft
2. Clip

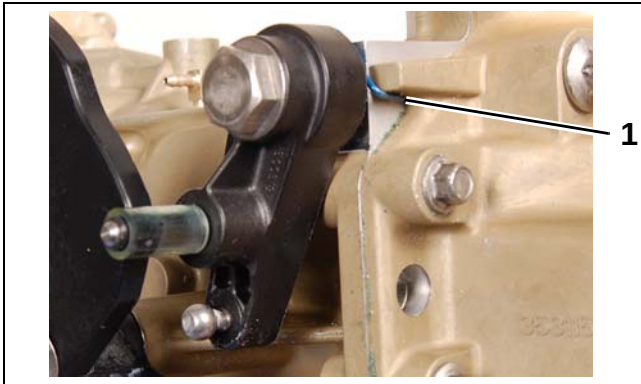
007742

Throttle Linkage Installation

Apply *Nut Lock* to threads of throttle lever screw.

Insert spring into cavity of throttle return lever.

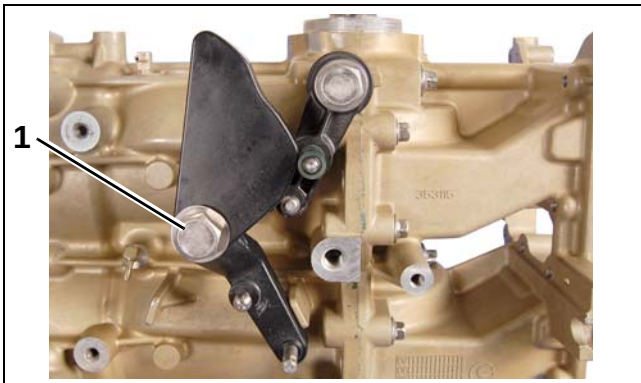
Install lever, screw, and washer on crankcase and hook spring on rib as shown. Tighten screw to a torque of 120 to 144 in. lbs. (13.5 to 16 N·m).



1. Hook spring here

007802

Apply *Nut Lock* to threads of throttle cam screw. Install cam, screw, and washer on cylinder block and tighten screw to a torque of 120 to 144 in. lbs. (13.5 to 16 N·m).



1. Throttle cam screw

007785

IMPORTANT: Do not lubricate throttle levers or shoulder screws.

Final Powerhead Assembly

WARNING

To prevent fire and explosion hazard, make sure all electrical and ignition wiring is routed and clamped in original positions.

Install the reed plate and throttle body assemblies. Refer to **Intake Manifold Service** on p. 148.

Install oil recirculating hoses and check valves. Refer to **Oil Recirculation Diagram** on p. 154, or **Powerhead Views** on p. 201.

Install thermostat and pressure valve assembly. Refer to **Thermostat and Pressure Relief Valve Servicing** on p. 174.

Install electrical harness.

Install fuel injectors and ignition coils. Refer to Fuel Injector **Vapor Separator and Fuel Injector Service** on p. 142.

IMPORTANT: All injectors must be installed in their original location. Improper injector installation can result in powerhead failure.

Install stator and flywheel. Refer to **Flywheel and Stator Servicing** on p. 119.

Install fuel pump assemblies, fuel manifolds, and filter. Refer to **Fuel Component Servicing** on p. 140.

Install the oil tank and oil injection hoses. Refer to **Oil Tank Assembly** on p. 156.

Install *EMM*. Refer to **EMM Servicing** on p. 96.

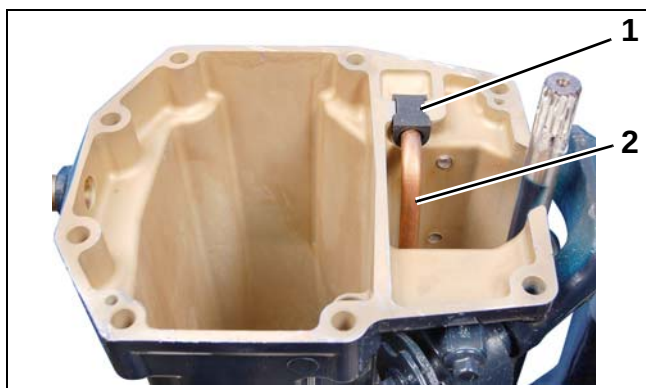
Install spark plugs. Refer to Spark Plug **Indexing** on p. 66.

Powerhead Installation

Powerhead Mounting

Coat the driveshaft splines with *Moly Lube*. Do not apply lubricant to end of driveshaft splines.

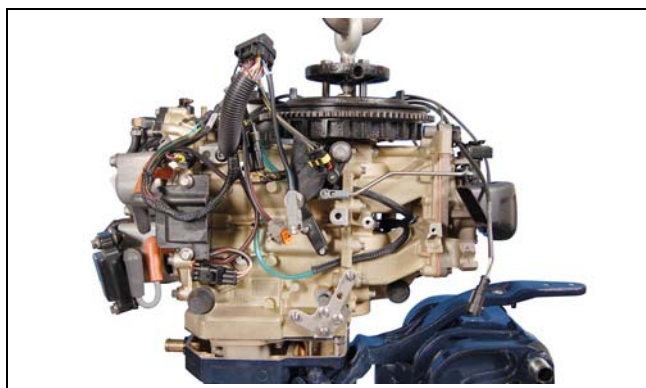
Be sure water tube is placed in upper and lower grommets.



1. Water tube
2. Grommet

007803

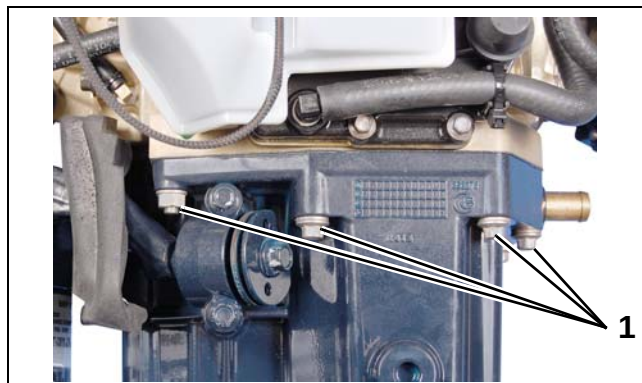
Slowly lower powerhead onto exhaust housing. If necessary, rotate flywheel in a clockwise direction to align crankshaft and driveshaft splines.



007804

Apply *Triple-Guard* grease to the threads of the powerhead screws.

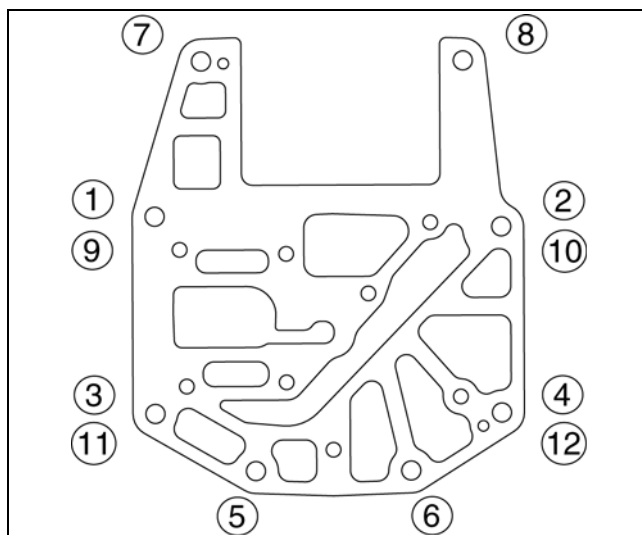
Loosely install all powerhead screws before tightening:



1. Powerhead screws

007741

Tighten the eight powerhead screws to a torque of 18 to 20 ft. lbs. (24 to 27 N·m) in the sequence shown.



Large screw torque sequence, 1 – 12

007774

IMPORTANT: Retighten powerhead mounting screws after outboard has been run at full operating temperature and allowed to cool.

Place the upper shift rod in the shift rod connector. Install the retaining screw and lock washer. Tighten screw to a torque of 60 to 84 in. lbs. (7 to 9.5 N·m).

Install water screens.



1. Shift rod screw

7650

Check shift linkage adjustment. Refer to **Shift Linkage Adjustment** on p. 199.

IMPORTANT: Make sure the gearcase shifts solidly into both forward and reverse and that propeller shaft spins freely in neutral.

Connect the power trim connectors. Secure cables in clamps.

Install recoil starter ratchet and housing on outboard. Refer to **Recoil Starter Installation** on p. 256.

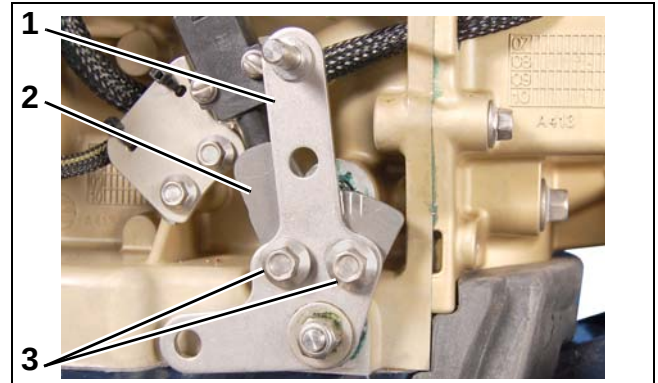
Install the lower engine covers. Refer to **Lower Cover Installation** on p. 76.

Shift Linkage Adjustment

Adjust shift linkage as follows:

STEP 1: Move shift lever into neutral position.

- Make sure shift lever detent is in neutral position.
- Make sure gearcase is in neutral.
- Loosen two shift lever screws.

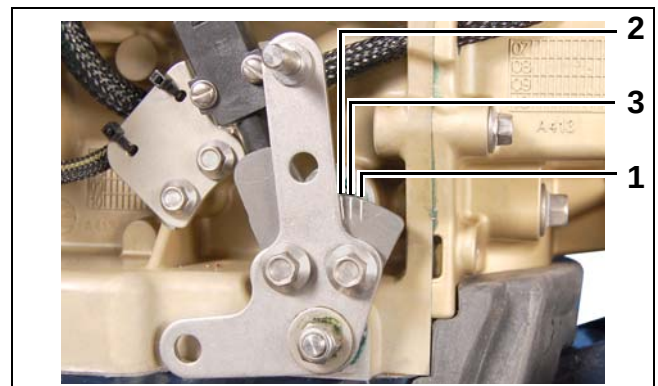


1. Shift lever
2. Shift lever detent
3. Shift lever screws

008461

STEP 2: Find shift lever midpoint.

- Move the shift lever forward to the limit of free play. Mark this as forward line on the neutral detent.
- Move the shift lever rearward to the limit of free play. Mark this as rearward line on the neutral detent.
- Measure the midpoint between the forward and rearward lines. Make a third line on the on the neutral detent. Mark this as midpoint line.
- Align the shift lever to the midpoint line.



1. Forward line
2. Rearward line
3. Midpoint line

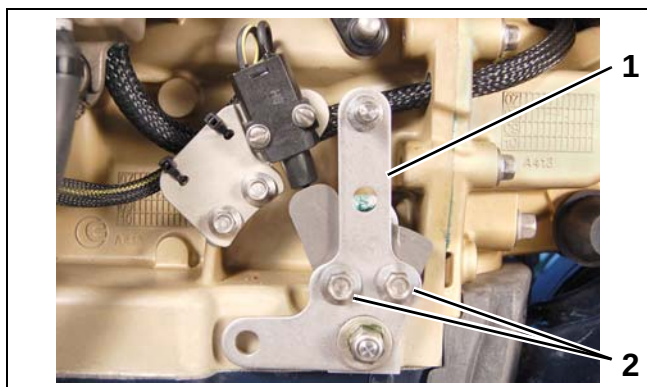
008461

Powerhead

Powerhead Installation

STEP 3: Secure shift lever to shift lever detent.

- Remove one shift lever screw. Clean screw and apply *Nut Lock* to threads.
- Reinstall the shift lever screw.
- Hold shift lever on midpoint line and tighten screw to a torque of 80 to 106 in. lbs. (9 to 12 N·m).
- Remove remaining shift lever screw. Clean screw and apply *Nut Lock* to threads. Reinstall and tighten screw to a torque of 80 to 106 in. lbs. (9 to 12 N·m).

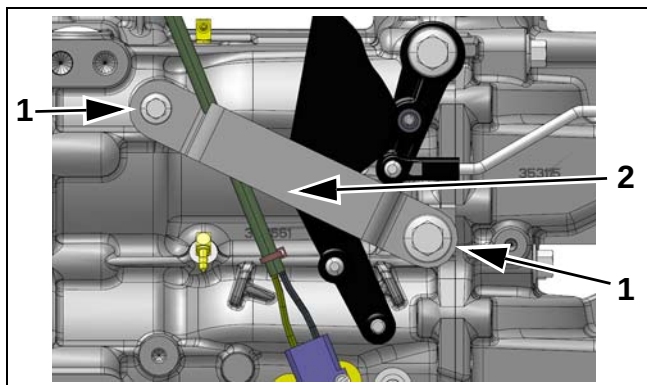


1. Shift lever
2. Shift lever screws

008463

Adjust neutral switch. Refer to **Neutral Switch Adjustment** on p. 60.

Install the throttle cam guard with spacer and two screws.



1. Screws
2. Throttle cam guard

008929A

Final Adjustments

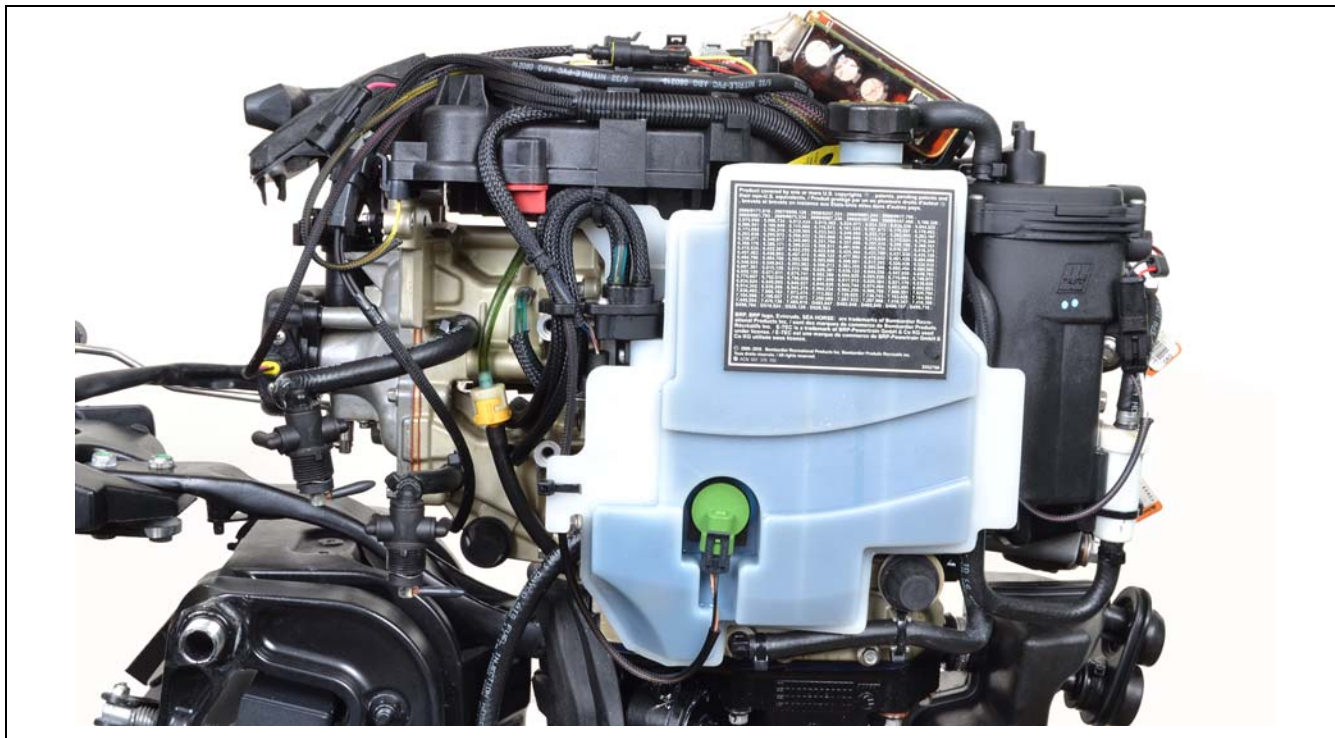
NOTICE

After installing a new or rebuilt powerhead, perform the following procedures before returning outboard to service:

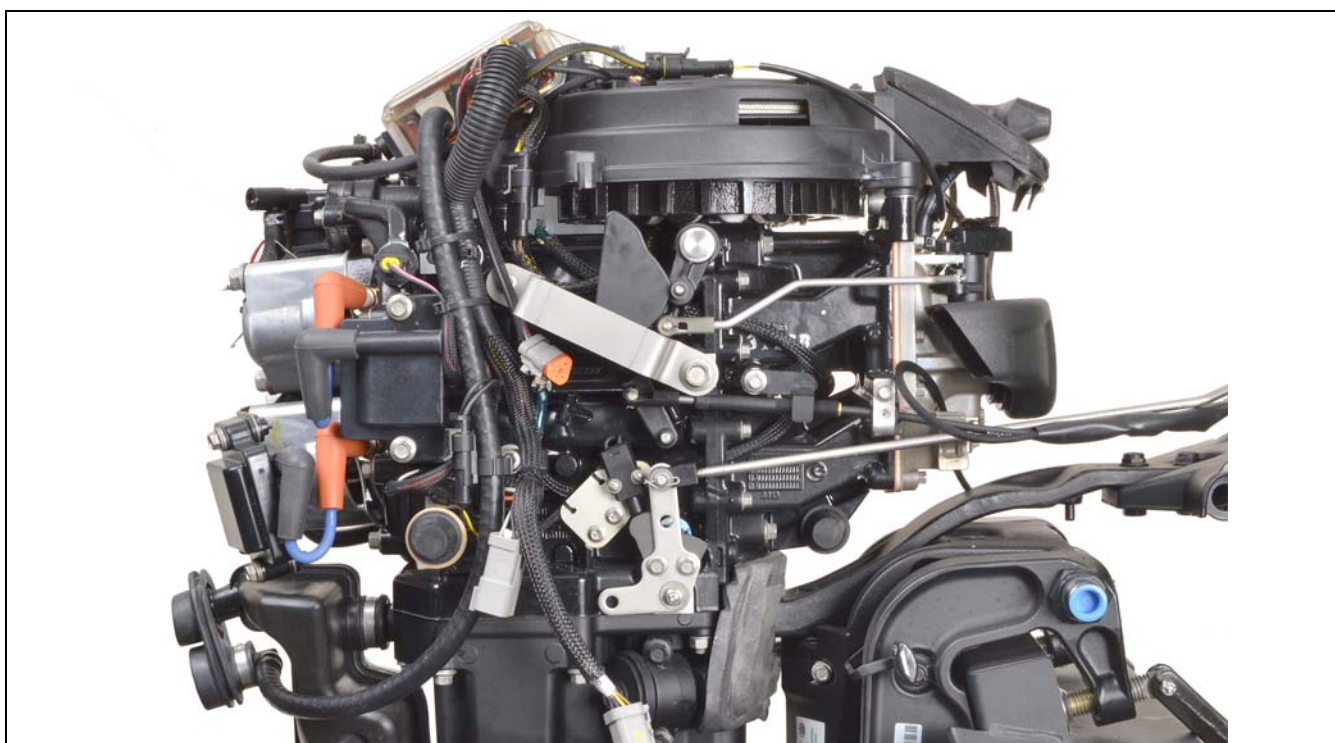
- Index all spark plugs. Refer to **Spark Plug Indexing** on p. 66.
- Use *Evinrude Diagnostics* software to start powerhead break-in oiling. Refer to **Powerhead Break-In** on p. 92.
- Use *Evinrude Diagnostics* software to make sure engine management software version and revision are current. Update as required.
- Use *Evinrude Diagnostics* software to set TPS calibration. Refer to **TPS Calibration** on p. 122.
- Use *Evinrude Diagnostics* software to confirm neutral switch operation. Refer to **Neutral Switch Adjustment** on p. 60.
- Prime fuel system.
- Prime oiling system. Refer to **Oil Supply Priming** on p. 159.
- Use *Evinrude Diagnostics* software to check engine timing. Refer to **Timing Adjustments** on p. 122.
- Run outboard and check for water, fuel, or oil leaks.
- Make sure engine reaches correct operating temperature and does not overheat.

Powerhead Views

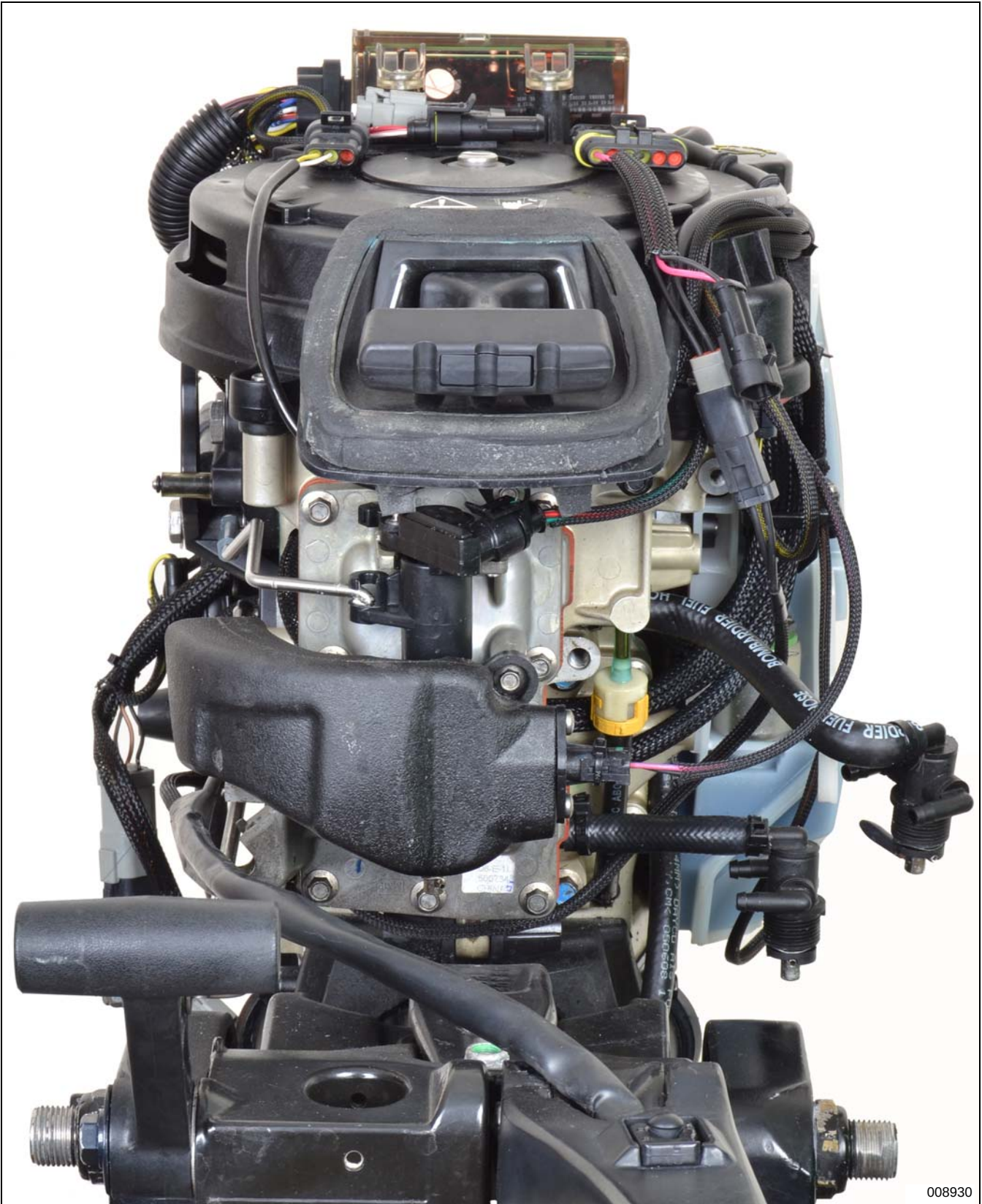
Port



Starboard



Front



008930

007810



Top



008931

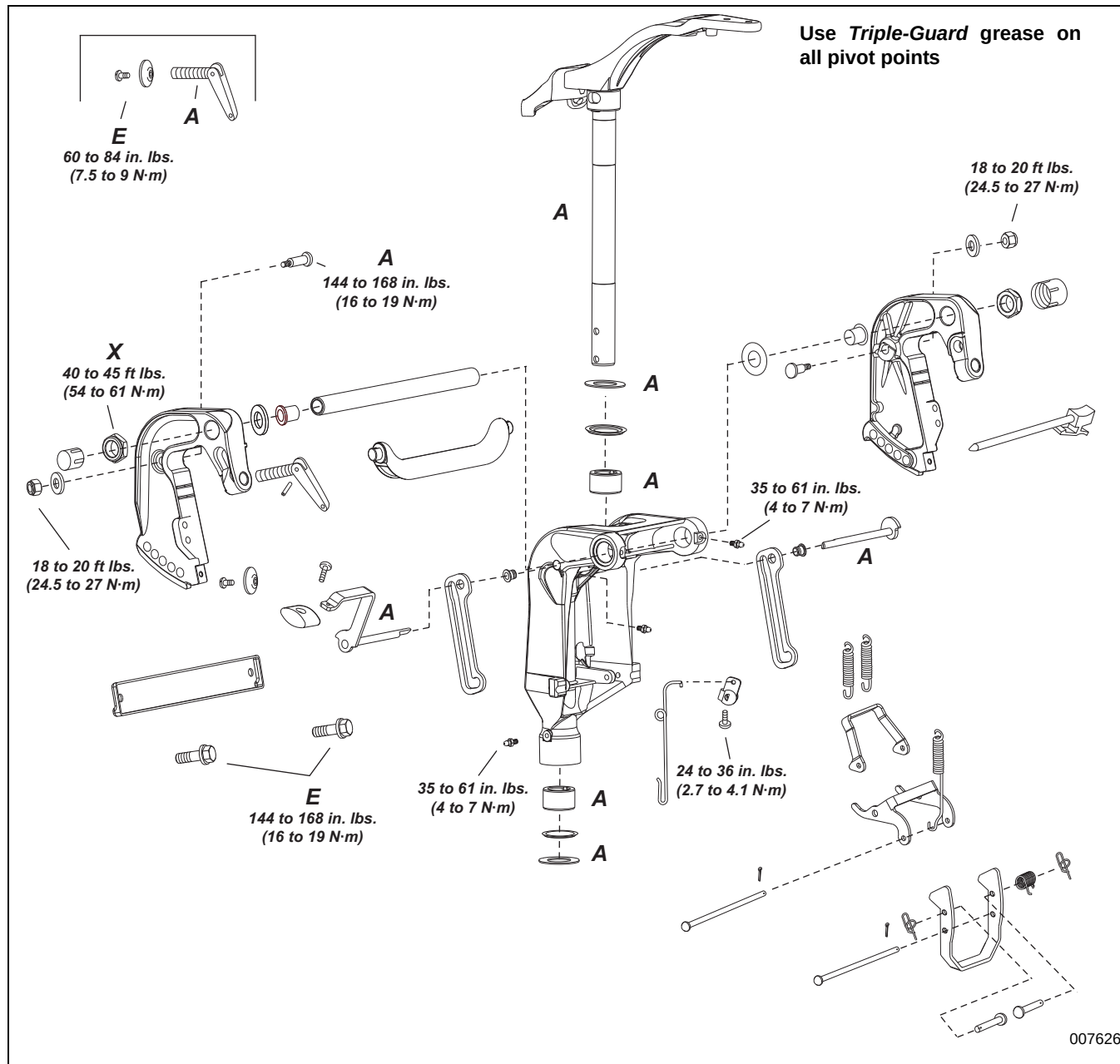
Midsection

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Service Charts

Stern Bracket



A Triple-Guard Grease

E Red Ultra Lock

X See Service Manual

Exhaust Housing Service

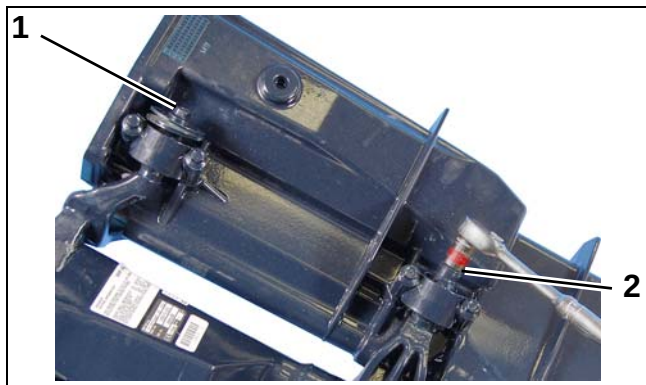
The exhaust housing contains no serviceable internal parts. The exhaust relief muffler and motor mounts can be serviced without removing the exhaust housing.

Exhaust Housing Removal

Before removing the exhaust housing:

- Remove the gearcase. Refer to **Gearcase Removal and Installation** on p. 234.
- Remove the powerhead. Refer to **Powerhead Removal** on p. 180.

Remove two upper mount and two lower mount screws.

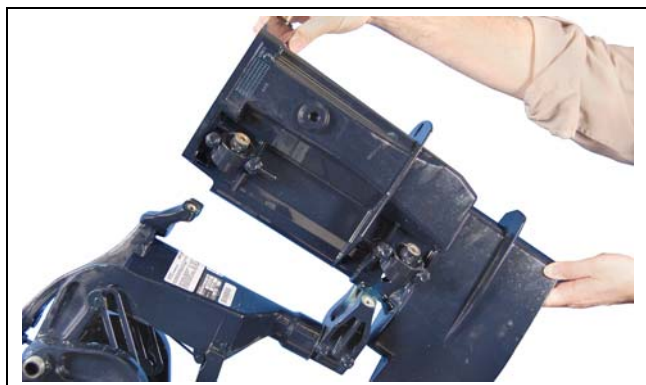


1. Upper mount screw
2. Lower mount screw

007566

Remove bumpers and bumper stops from upper mounts. Remove washers from lower mounts.

Remove the exhaust housing.

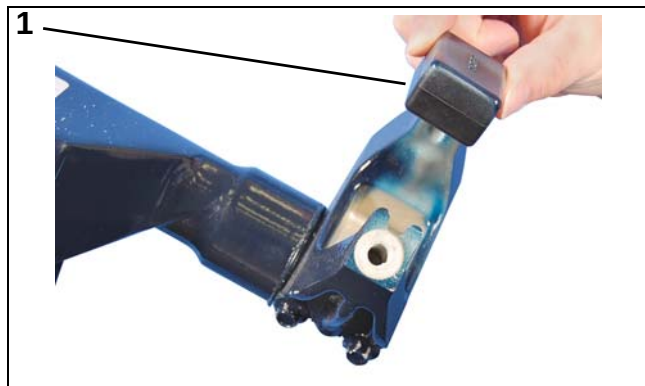


Exhaust Housing

007567

Remove lower mount bracket rubber mount.

Check condition of the lower front mount. Replace if deteriorated or damaged.



1. Rubber mount

007568

Exhaust Housing Installation

Install lower mount bracket rubber mount.

Bring the exhaust housing into position with the stern bracket.



Exhaust Housing

007567

Install bumpers, bumper stops and screws on upper mounts. Install washers and screws on lower mounts. Refer to **Mount Service** on p. 209.

Install gearcase. Refer to **Gearcase Removal and Installation** on p. 234.

Install powerhead. Refer to **Powerhead Removal** on p. 180.

Mount Service

Individual upper and lower motor mounts can be serviced without removing the exhaust housing.

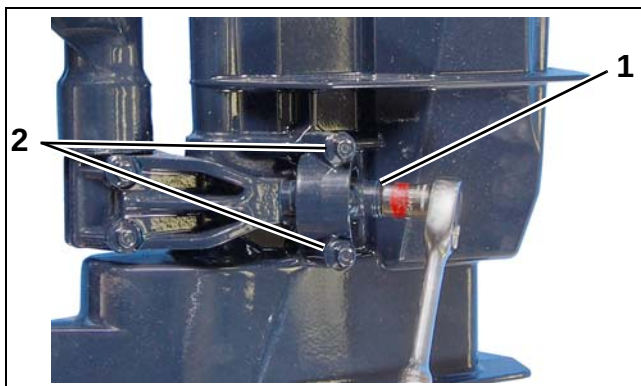
Remove the lower motor covers. Refer to **Lower Cover Removal** on p. 75.

Removal

Remove mount screw and washer(s).

Remove two mount to exhaust housing screws.

Remove mount.



1. Mount screw
2. Mount to exhaust housing screws

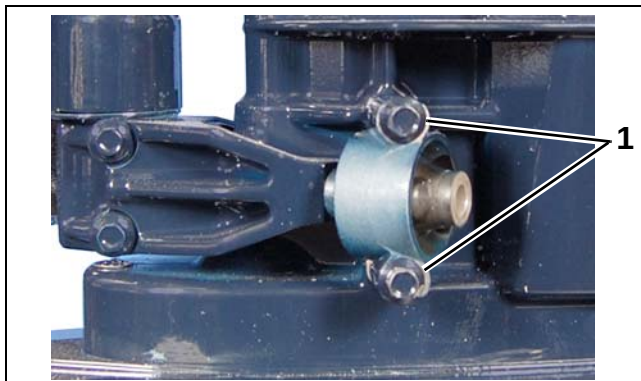
007569

Check condition of the mounts. Replace if deteriorated or damaged.

Installation

Apply *Triple-Guard* grease to threads of the two mount to exhaust housing screws.

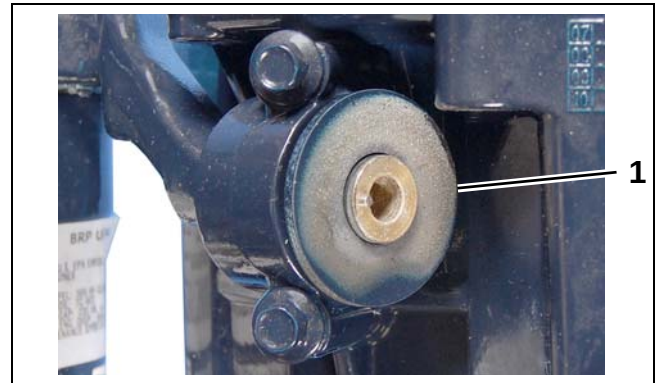
Install mount to exhaust housing with two mount to exhaust housing screws. Install screws finger tight at this time.



1. Mount to exhaust housing screws

007570

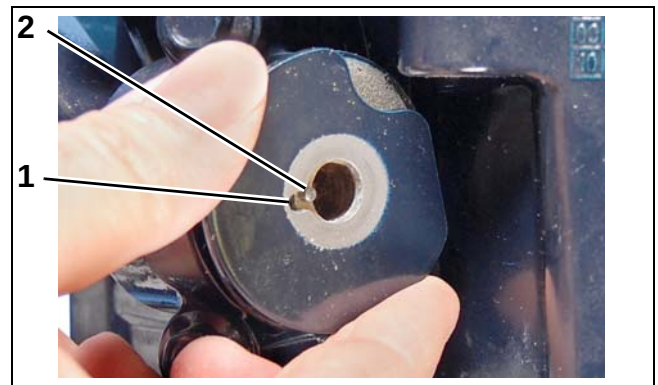
Upper mount: Install rubber bumper.



1. Rubber bumper

007571

Install washer. Align slot with pin as shown.

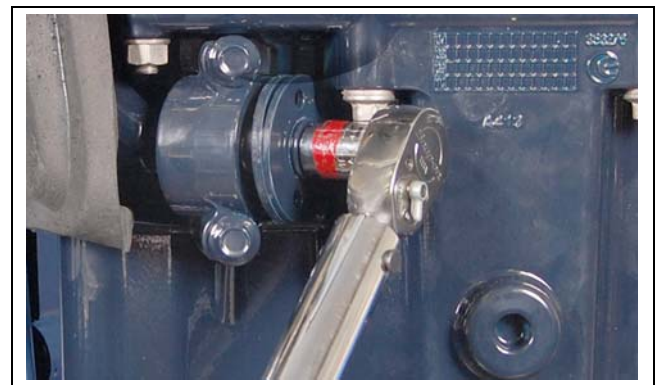


1. Slot
2. Pin

007572

Apply *Triple-Guard* grease to threads of the upper mount screw. Install screw through upper mount.

Tighten screw to a torque of 22 to 23 ft. lbs. (30 to 32 N·m).



007573

Midsection

Exhaust Housing Service

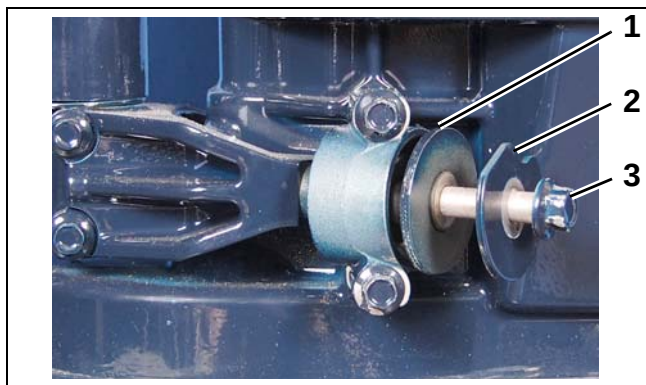
IMPORTANT: Make sure upper mount bumper stop slot stays aligned with pin as screw is tightened.

Lower mount: Apply *Triple-Guard* grease to threads of the lower mount screws.

Install rubber bumper and washer.

Install screw through lower mount.

Tighten screw to a torque of 22 to 23 ft. lbs. (30 to 32 N·m).



1. Rubber bumper
2. Washer
3. Screw

008427

Tighten two mount to exhaust housing screws to a torque of 10 to 12 ft. lbs. (14.5 to 16.5 N·m).



007575

Install lower motor covers. Refer to **Lower Cover Installation** on p. 76.

Exhaust Relief Muffler

The exhaust relief muffler has no serviceable parts, replace as needed.

Remove lower motor covers. Refer to **Lower Cover Removal** on p. 75

Remove overboard indicator grommet from muffler. Remove *Oetiker* clamp.



1. Overboard indicator grommet
2. Oetiker clamp

007576

Install muffler drain hose on new muffler with tie strap.



007577

Install muffler drain hose through hole.



007578

Secure muffler with new *Oetiker* clamp.

Install overboard indicator grommet on muffler.



007576

Install lower motor covers. Refer to **Lower Cover Installation** on p. 76

Stern Bracket

Clamp Screw Service

Inspect clamp screw assemblies. Replace swivel plate and shoulder screw if bent or loose.

Disassemble swivel plate and shoulder screw.

Inspect and clean clamp screw and shoulder bolt threads.

Install clamp screw and handle assembly in transom bracket.



1. Clamp screw and handle assembly

007579

Install swivel plate, onto shoulder screw.



1. Swivel plate
2. Shoulder screw

007580

Midsection

Stern Bracket

Apply *Locquic Primer* to the threads of the screw and allow it to dry four to five minutes. Then apply *Ultra Lock* to threads.

Install shoulder screw and swivel plate onto clamp screw and handle assembly.

Tighten screw to a torque of 60 to 84 in. lbs. (7.5 to 9 N·m).

Check for free movement of swivel plate on shoulder bolt.



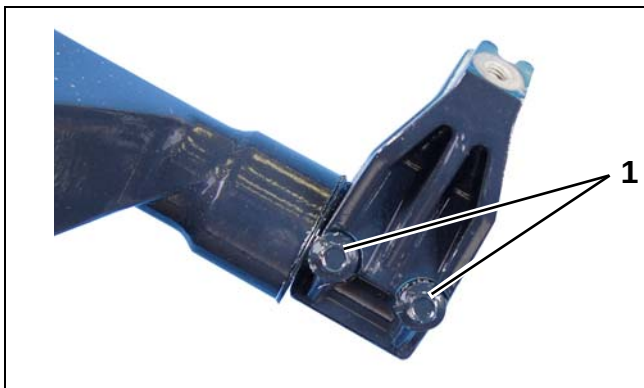
007581

Stern Bracket Disassembly

If outboard is equipped with a tiller arm, remove the tiller arm. Refer to **Tiller Handle Service** on p. 222.

Remove exhaust housing. Refer to **Exhaust Housing Service** on p. 208.

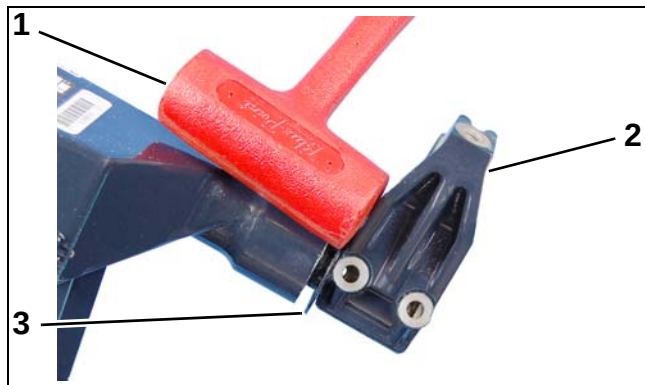
Remove lower mount bracket retaining screws.



1. Screws

007582

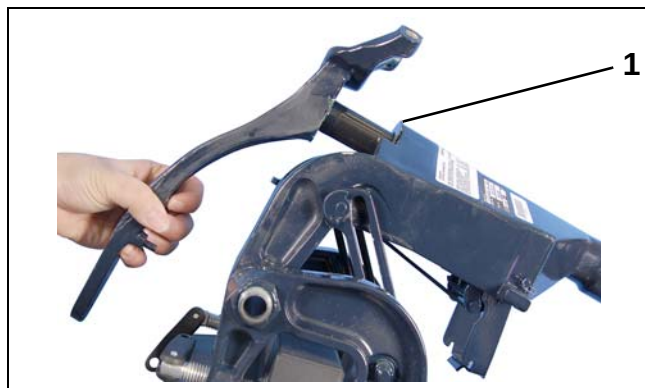
Use a soft mallet to remove lower mount bracket and thrust washer.



1. Mallet
2. Lower mount bracket
3. Thrust washer

007583

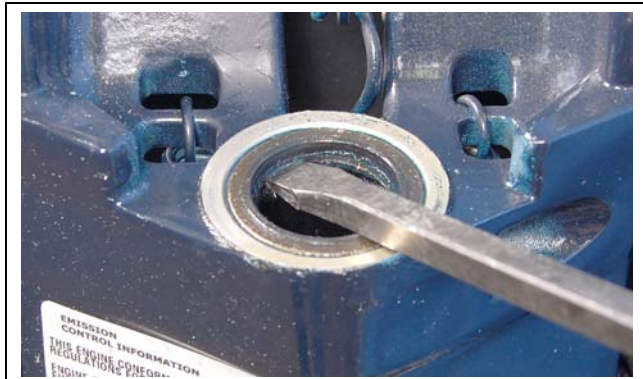
Slide the steering arm out of the swivel bracket and remove the thrust washer .



1. Upper thrust washer

007584

Use an appropriate tool to pry the upper and lower seals from the swivel bracket.



007585

Remove the friction screw and spring. Remove upper and lower bushings from the swivel bracket.



1. Friction plate
2. Friction screw

007618

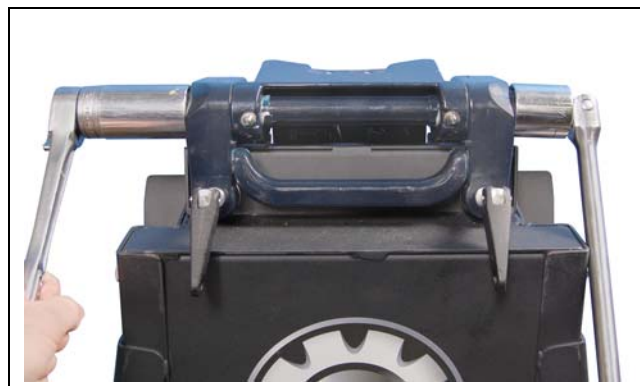


007586



007588

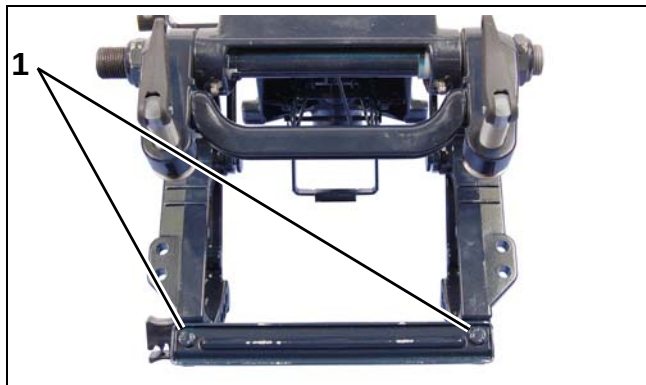
Loosen tilt tube nuts four to five turns.



007589

Midsection Stern Bracket

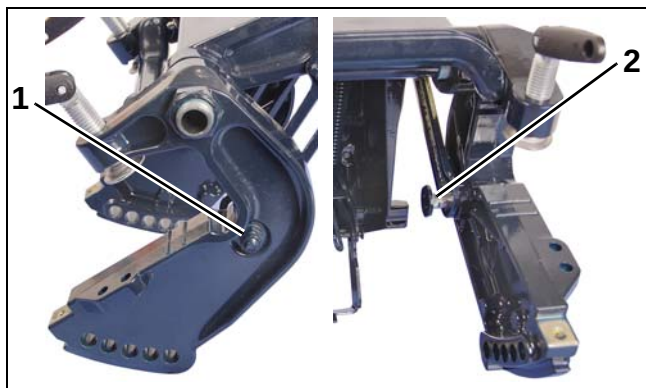
Remove the tilt pin, two tie bar screws and tie bar.



1. Tie bar screws

007590

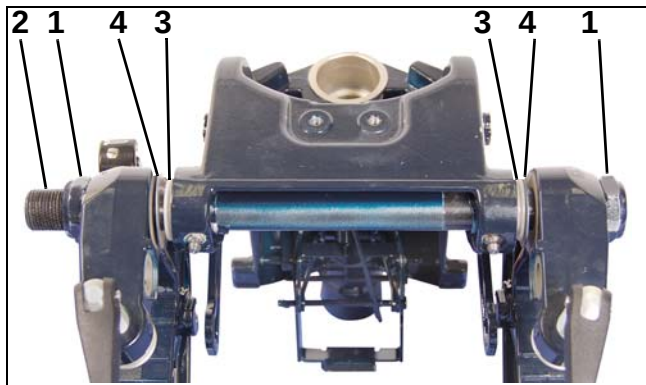
Remove nuts, washers and pins from stern brackets.



1. Nut and washer
2. Pin

007591
007592

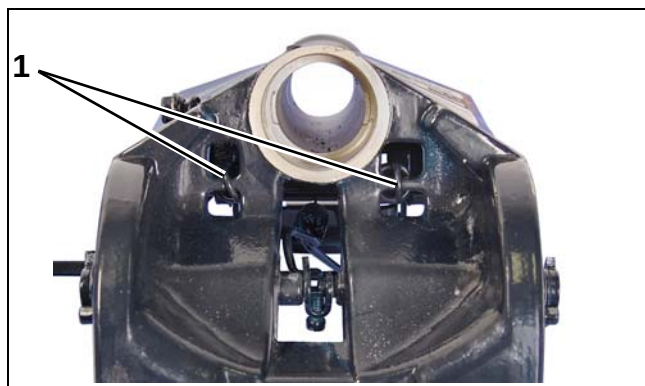
Remove tilt tube nuts, tilt tube, bushings, thrust washers, handle and stern brackets.



1. Tilt tube nuts
2. Tilt tube
3. Bushings
4. Thrust washers

007593

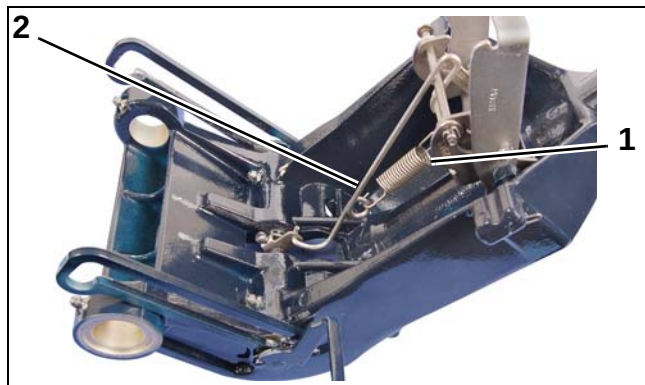
Use an appropriate tool to unhook the two springs from the top of the swivel bracket. Remove the springs.



1. Springs

007494

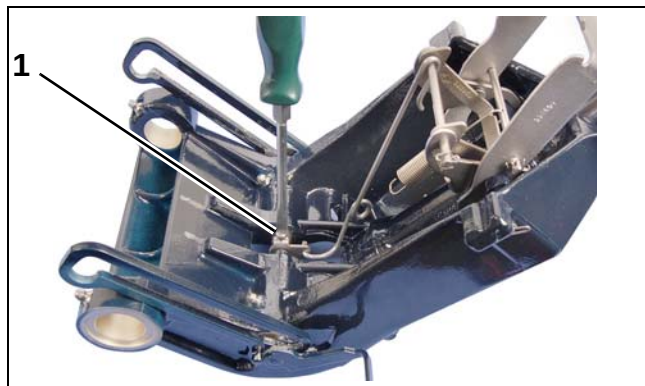
Unhook spring from reverse lock release rod.



1. Spring
2. Reverse lock release rod

007595

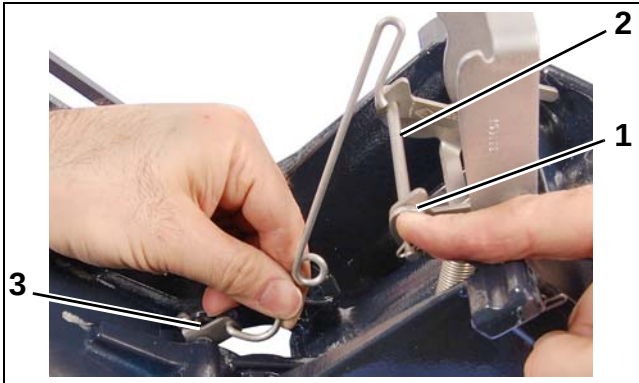
Place the tilt/run lever in the RUN position. Loosen the bellcrank setscrew.



1. Bellcrank setscrew

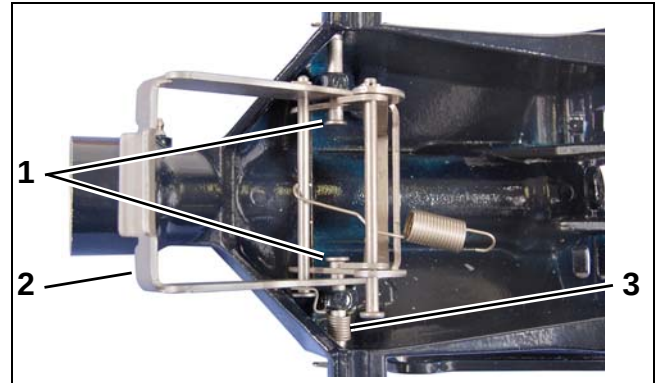
007596

Push down on link. Unhook reverse lock release rod from pin and remove rod from bellcrank.



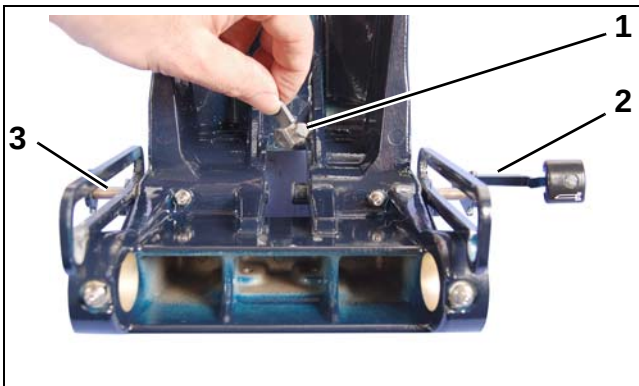
1. Link
 2. Pin
 3. Bellcrank
- 007597

Remove pins from shallow water drive link and swivel bracket. Use care not to lose spring.



1. Pins
 2. Shallow water drive link
 3. Spring
- 007600

Remove the bellcrank, tilt lock lever, and port stop link from the swivel bracket



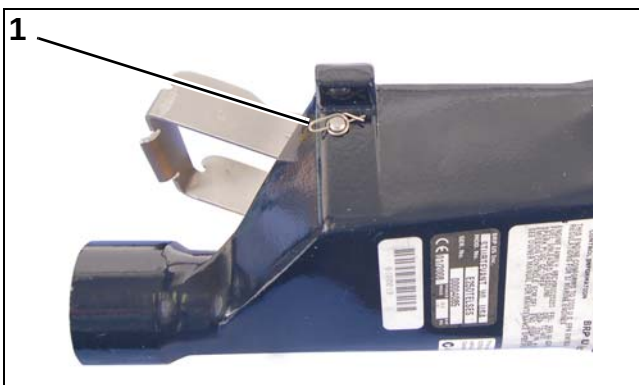
1. Bellcrank
 2. Tilt lock lever
 3. Stop link
- 007598

Remove the shallow water drive link and reverse lock assembly from the swivel bracket.



007601

Remove retaining clips from both sides of the swivel bracket.



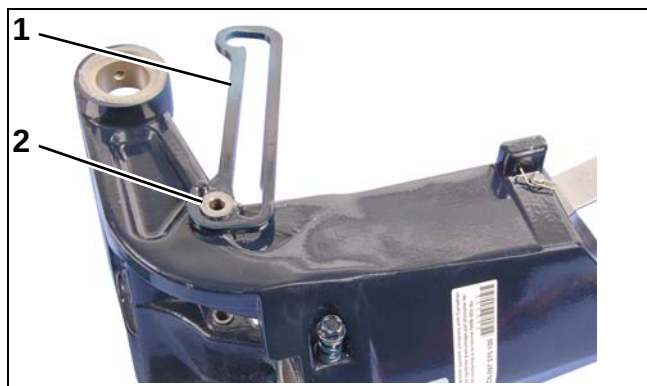
1. Clip
- 007599

Remove cotter pins and disassemble shallow water drive and reverse lock assembly as needed.

Midsection

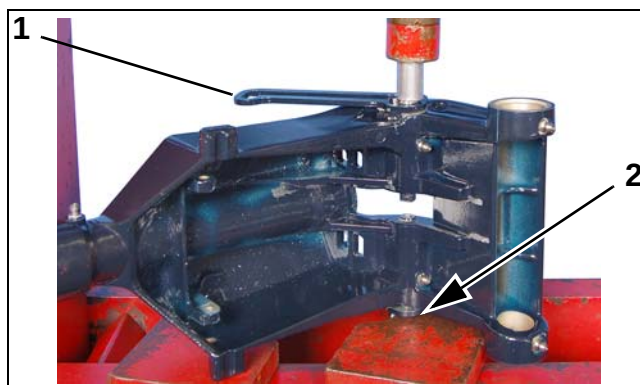
Stern Bracket

If tilt lock assembly requires replacement, use an appropriate tool to remove bushing from swivel bracket.



1. Tilt lock assembly
2. Bushing

007602



1. Tilt lock assembly
2. Correct support

007603

Assemble reverse lock link and reverse lock lever as shown. Install pin and secure with new cotter pin.

Stern Bracket Assembly

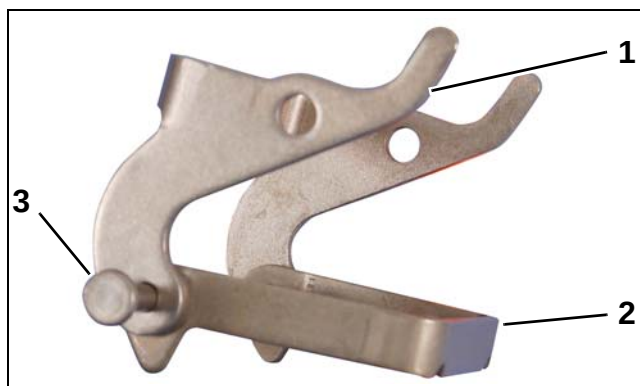
Install a new bushing through hole in tilt lock assembly. Press bushing into swivel bracket until fully seated. Make sure tilt lock assembly moves freely.

IMPORTANT: Prevent damage to the tilt lock assembly stop pin. Be sure to properly support the swivel bracket when pressing in bushings.



1. Stop pin

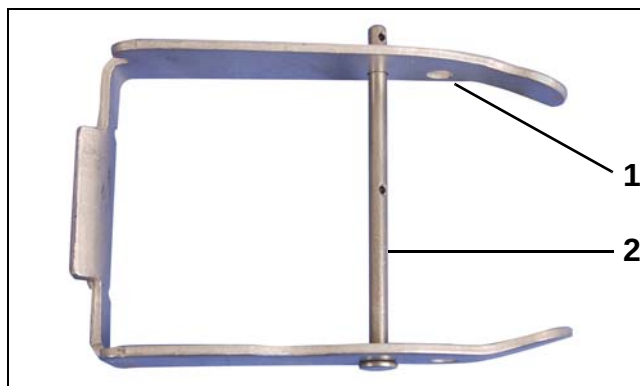
007629



1. Reverse lock link
2. Reverse lock lever
3. Pin

007604

Place pin through the shallow water drive link as shown. Secure with new cotter pin.



1. Shallow water drive link
2. Pin

007630

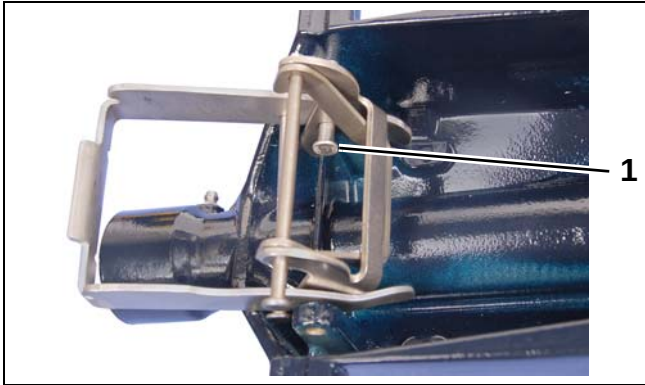
Align reverse lock link assembly with shallow water drive link as shown.



1. Reverse lock link assembly
2. Shallow water drive link

007605

Place the shallow water drive link and reverse lock assembly into the swivel bracket as shown. Install one pin as shown and secure pin with clip.

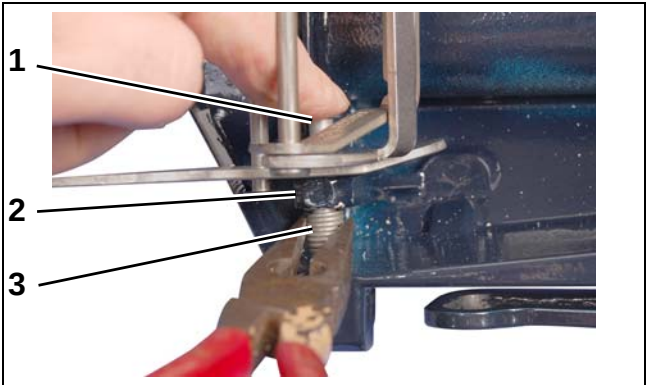


1. Pin

007606

Install remaining pin through reverse lock assembly and into boss. Use an appropriate tool to hold

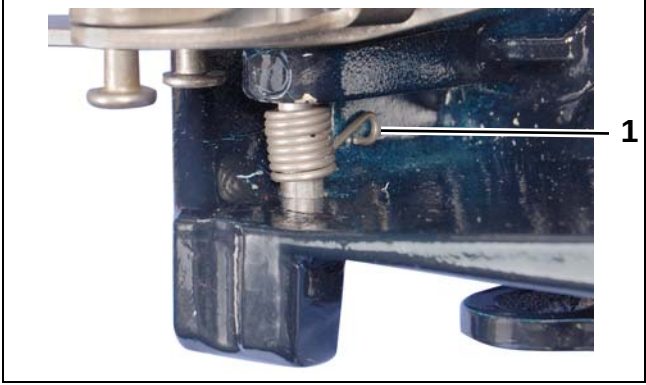
spring in alignment. Push pin through spring and swivel bracket. Secure pin with clip.



1. Pin
2. Boss
3. Spring

007607

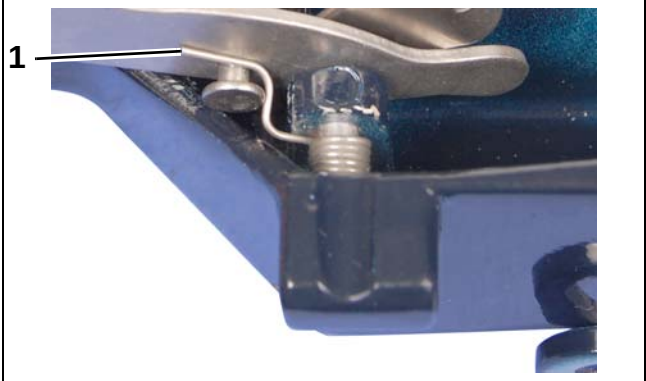
IMPORTANT: Make sure the rounded end of the spring is installed as shown.



1. Spring rounded end

007608

Use an appropriate tool to hook the straight end over the pin as shown.



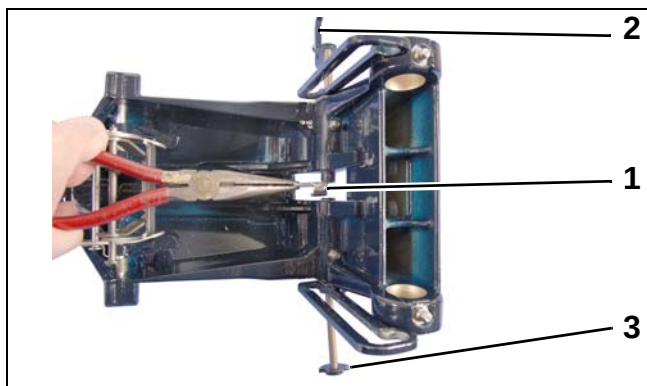
1. Spring straight end

007609

Midsection

Stern Bracket

Install the tilt lock lever and port stop link in the swivel bracket. Install the bellcrank, temporarily leave the bell crank screw loose.



1. Bellcrank
2. Tilt lock lever
3. Stop link

007610

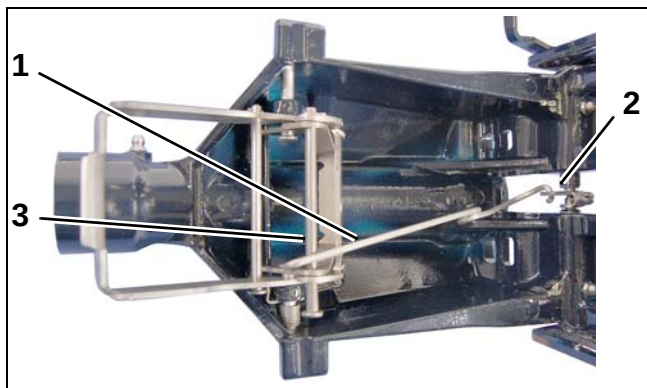
Be sure the tilt lock lever cam and port stop link cam are installed as shown.



1. Port stop link cam
2. Tilt lock lever cam

007611
007612

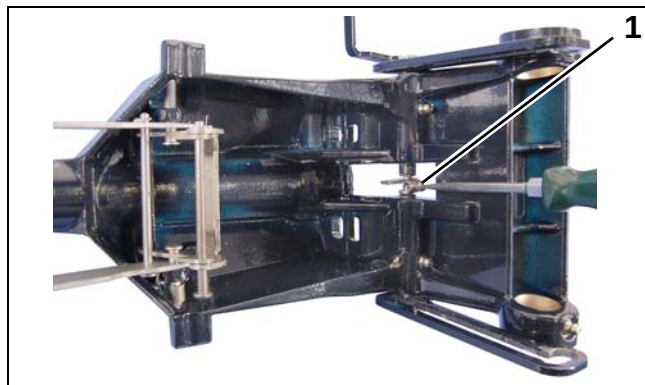
Install reverse lock release rod on bellcrank. Connect rod to pin as shown.



1. Reverse lock release rod
2. Bellcrank
3. Pin

007613

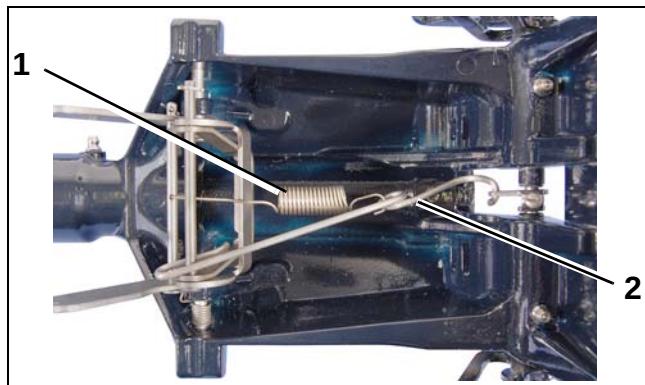
Tighten the bellcrank setscrew to a torque of 35 to 61 in. lbs. (4 to 7 N·m).



1. Bellcrank setscrew

007614

Connect the hook end of spring to the reverse lock release rod.

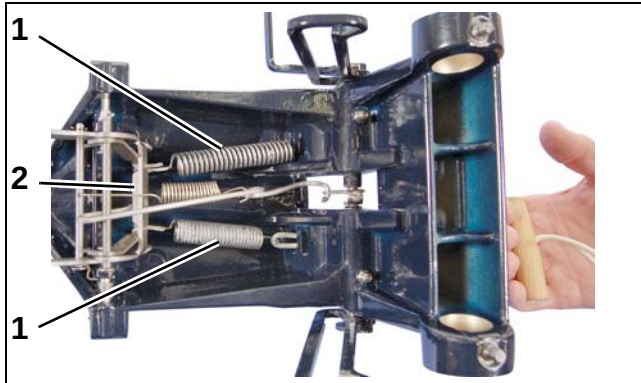


1. Spring
2. Reverse lock release rod

007615

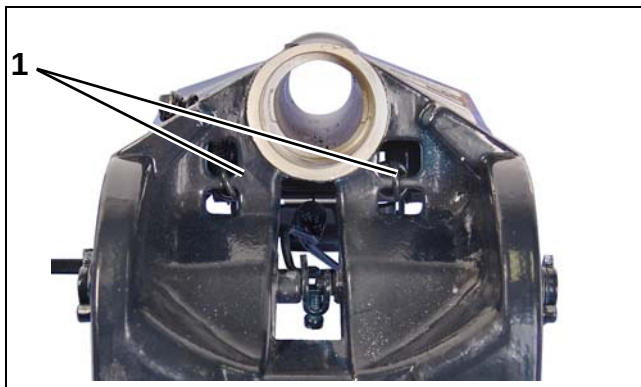
Attach the two reverse lock springs to the reverse lock lever.

Use an appropriate tool to connect the reverse lock springs to the top of the swivel bracket.



1. Springs
2. Reverse lock lever

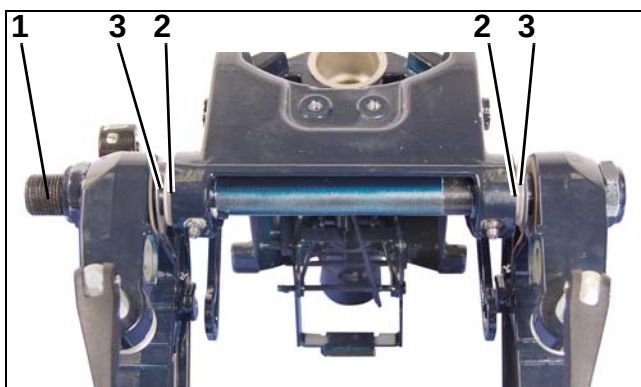
007616



1. Springs

007594

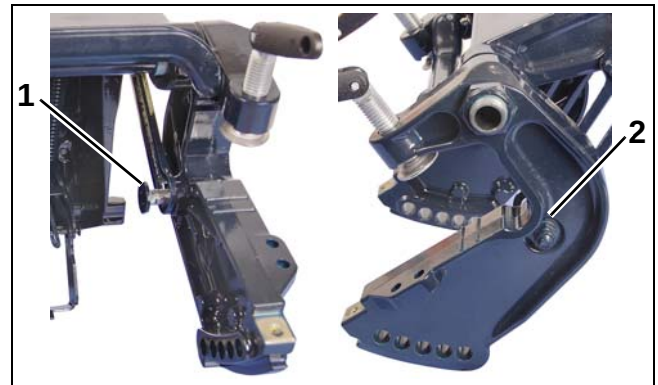
Install tilt tube, bushings, thrust washers, handle and stern brackets.



1. Tilt tube
2. Bushings
3. Thrust washers

007593

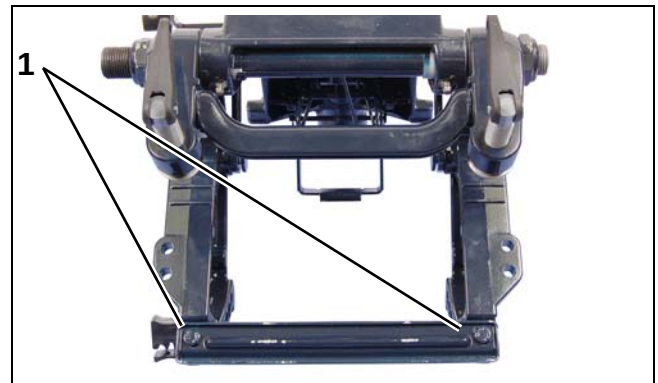
Install pin through each lock assembly and stern bracket. Install washers and nuts, and tighten to a torque of 18 to 20 ft. lbs. (24.5 to 27 N·m).



1. Pin
2. Nut and washer

007592
007591

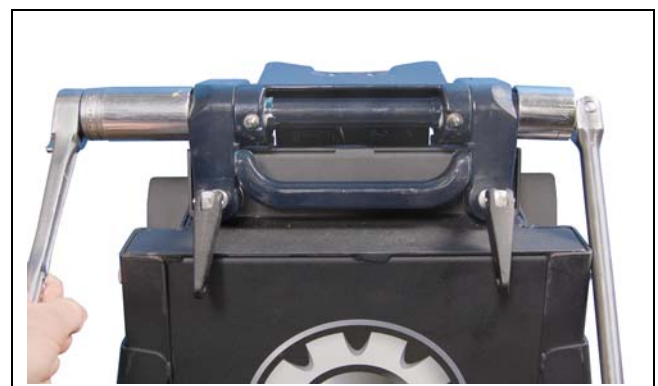
Apply *Ultra Lock* to the threads of the tie bar screws. Install the screws and tighten to a torque of 144 to 168 in. lbs. (16 to 19 N·m). Install the tilt pin.



1. Tie bar screws

007590

Tighten the tilt tube nuts to a torque of 40 to 45 ft. lbs. (54 to 61 N·m), then back off 1/8 to 1/4 turn.



007589

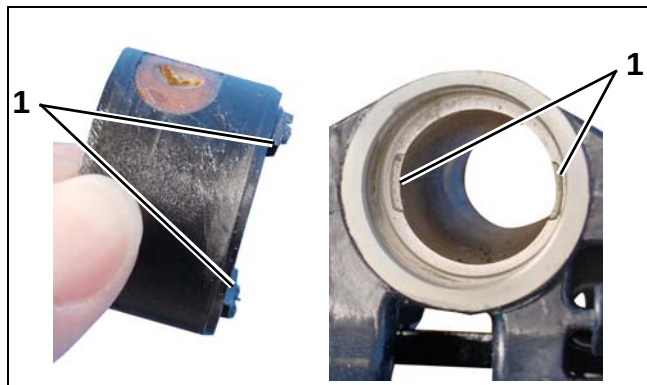
Midsection

Stern Bracket

Install friction screw and spring in swivel bracket.

Apply a light coat of *Triple-Guard* grease to the outside of the upper bushing.

Install upper bushing. Make sure bushing slots are aligned with slots in swivel bracket.



1. Slots

007619
007620

Make sure friction plate is aligned toward friction screw.



1. Friction plate
2. Friction screw

007618

Apply a light coat of *Triple-Guard* grease to the outside of the lower bushing. Install bushing in the swivel bracket.



1. Lower bushing

007588

Use Seal Installation tool, P/N 350958, to install new upper and lower seals in the swivel bracket. Install seals with lips of seals facing in.



1. Seal

007621
008527

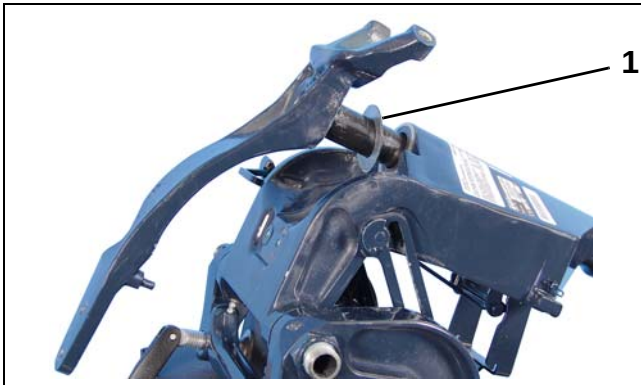
Apply *Triple-Guard* grease to both sides of thrust washer. Install thrust washer on steering arm.



1. Thrust washer

007617

Slide the steering arm through the swivel bracket.



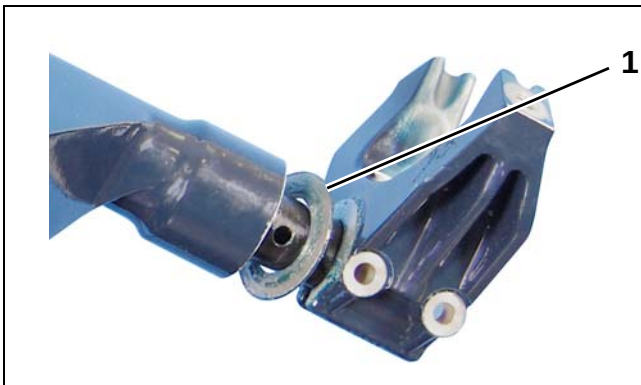
1. Thrust washer

007623

Lubricate the swivel bracket through the four lubrication fittings with *Triple-Guard* grease.

Apply *Triple-Guard* grease to both sides of thrust washer. Install thrust washer on steering arm.

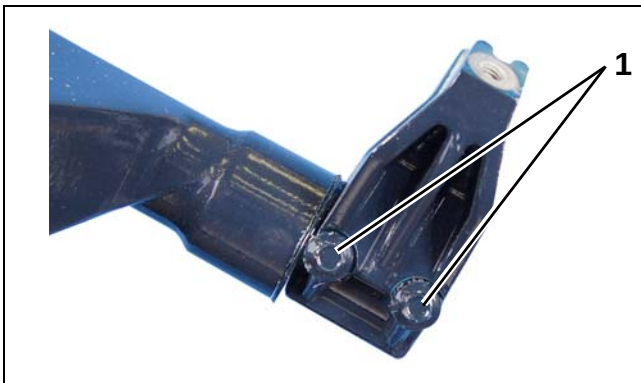
Install lower mount bracket on steering arm.



1. Thrust washer

007624

Install lower mount retaining screws. Tighten screws to a torque of 10 to 12 ft. lbs. (14.5 to 16.5 N·m).



1. Retaining screws

007582

Install exhaust housing. Refer to **Exhaust Housing Service** on p. 208.

Install tiller handle. Refer to **Tiller Handle Service** on p. 222.

Adjust tiller steering friction. Refer to **Steering Friction Adjustment** on p. 228.

Tiller Handle Service

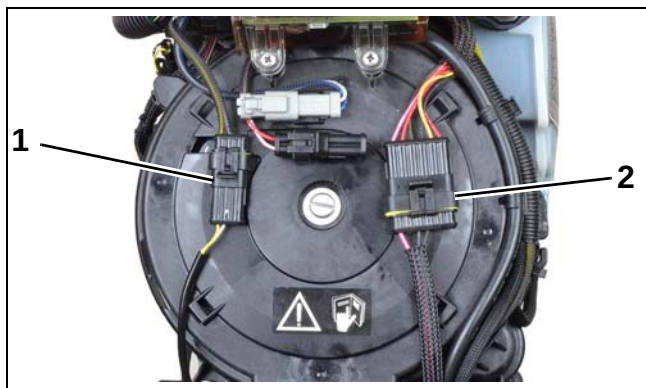
⚠ WARNING

To avoid accidental starting of engine while servicing, disconnect CPS electrical connector.

Removal

Remove lower engine covers. Refer to **Engine Cover Service** on p. 73.

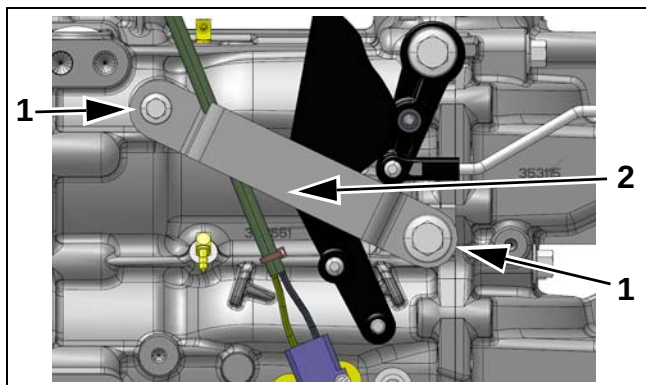
Disconnect the tiller handle electrical connector coming from the tiller handle.



1. CPS electrical connector
2. Tiller handle electrical connector

008941

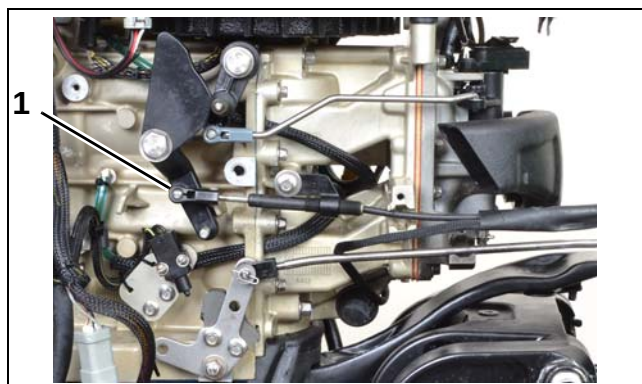
Remove the two screws, spacer and the throttle cam guard.



1. Screws
2. Throttle cam guard

008929A

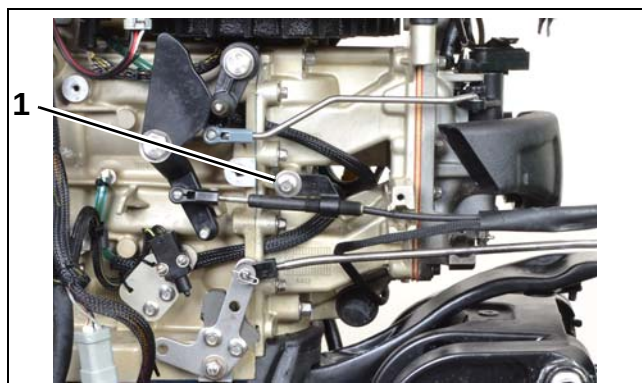
Use Ball Socket Remover tool, P/N 342226, to unsnap the throttle cable clip from the throttle lever.



1. Throttle cable clip

008940

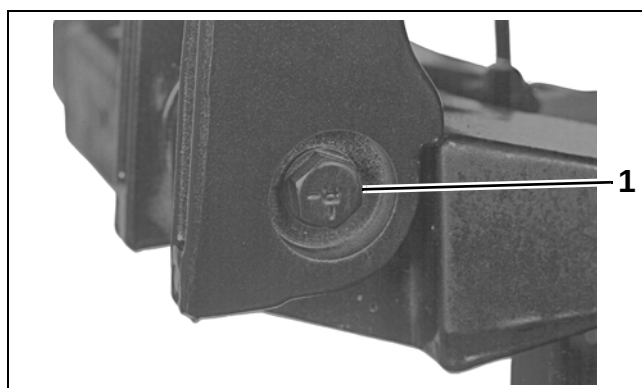
Remove the throttle cable anchor screw.



1. Cable anchor screw and washer

008940

Remove the screw attaching steering handle. Remove handle.



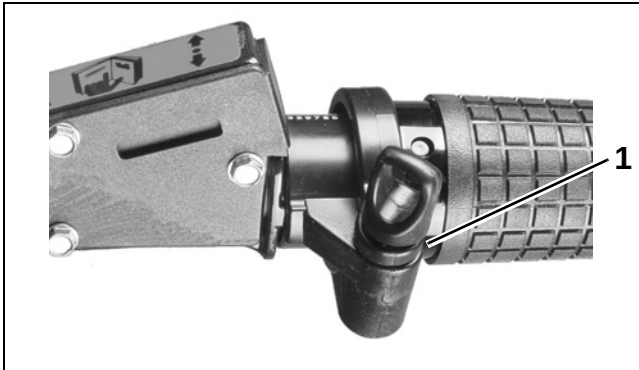
1. Screw

31194

Disassembly

Loosen throttle friction control so there is no restriction on grip.

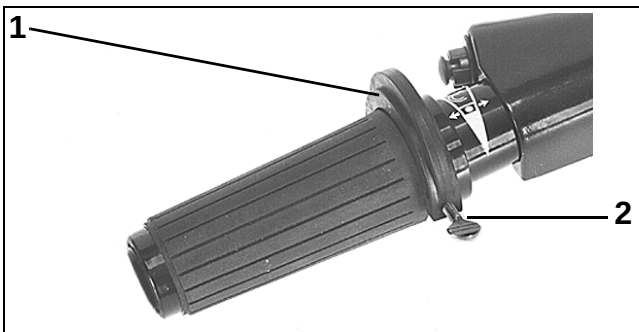
IMPORTANT: Do not back screw out completely. Nut is under spring tension.



1. Throttle friction control

001259

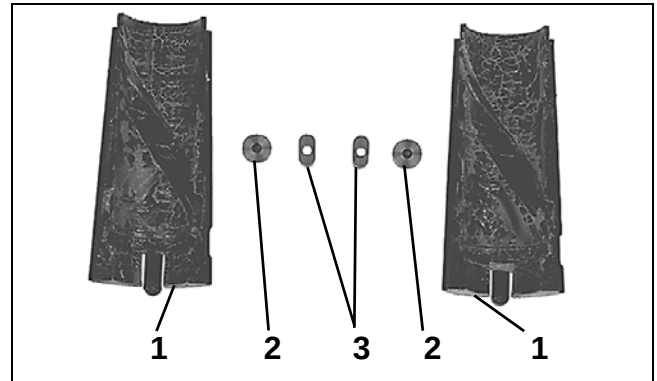
Use *Twist-Grip Remover*, P/N 390767, to depress the grip detents. Tighten screw and remove the grip by pulling grip.



1. Twist-Grip Remover
2. Screw

002189

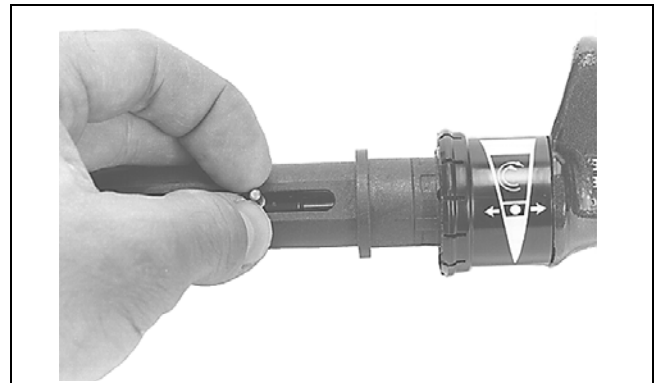
Remove the helix halves, rollers, and guides.



1. Helix halves
2. Rollers
3. Guides

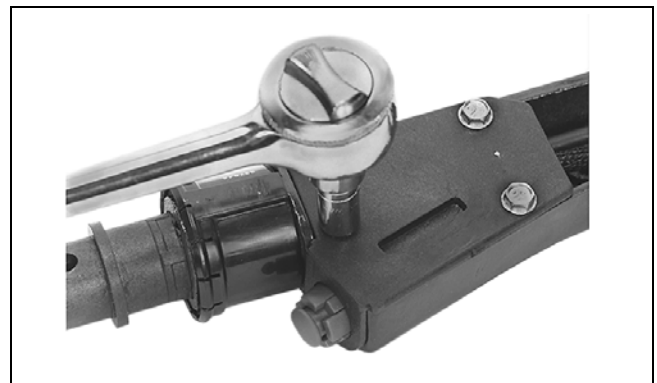
COA2674

Pull the throttle pin out of the cable.



24294

Remove stop switch cover screws and cover/stop switch assembly.

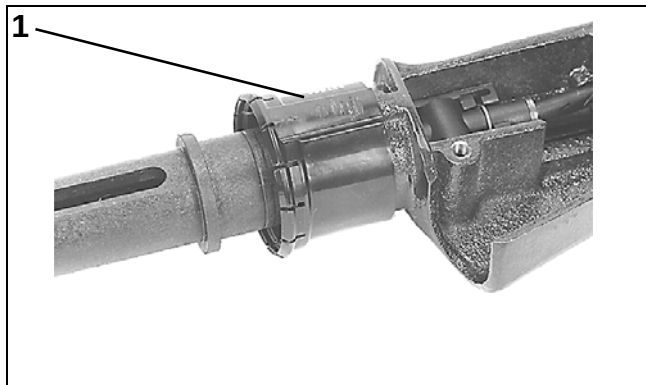


24288

Midsection

Tiller Handle Service

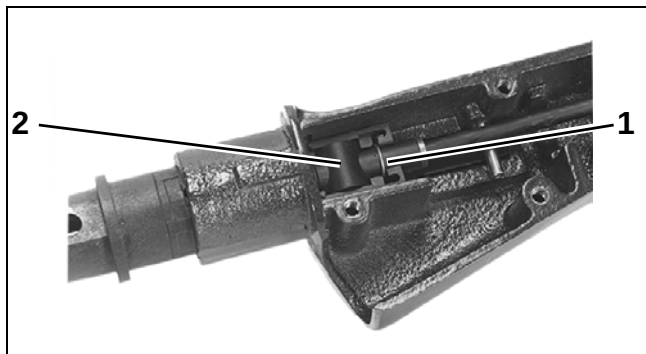
Remove the throttle control plate.



1. Throttle control plate

24287

Remove the throttle cable retaining clip. Pry the cable trunnion out of the steering handle and remove cable.

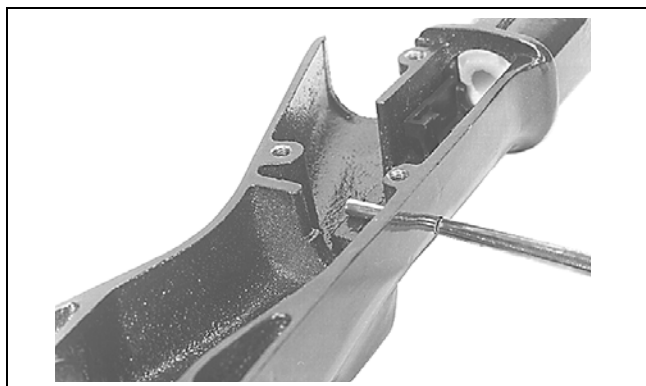


1. Retaining clip
2. Cable trunnion

24286

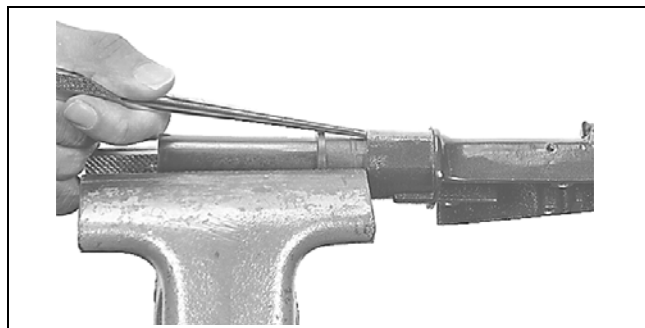
IMPORTANT: DO NOT remove the inner handle except to replace it.

Use a punch and mallet to drive out the steel pin holding the inner handle into the steering handle.



24285

Remove the plastic inner handle from the metal outer handle by driving the outer handle off with a mallet and a punch. Inner handle is bonded to the outer handle. After removing, chip away remnants of inner handle.



24284

Remove throttle cable seal from the inner handle.

Inspection

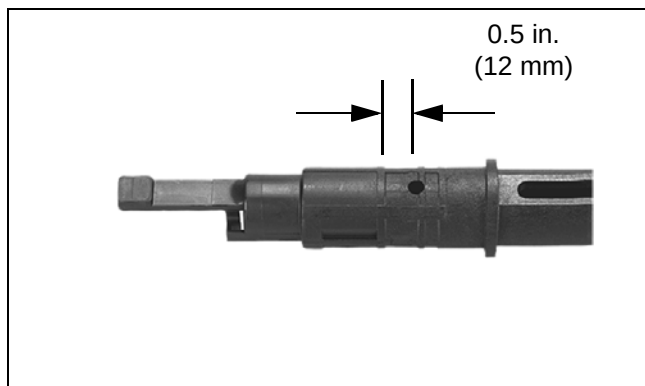
Inspect the throttle cable for kinks and wear. Replace if necessary.

Inspect the steering handle components for wear, cracks, or damage. Replace parts if necessary.

Assembly

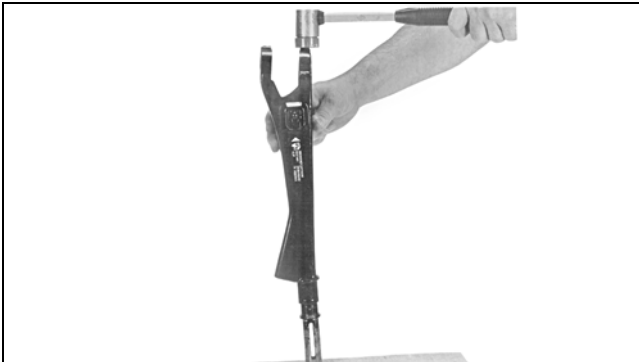
Install the throttle cable seal in inner handle.

If removed, apply *Loctite Depend 300* adhesive to inner handle at areas shown.



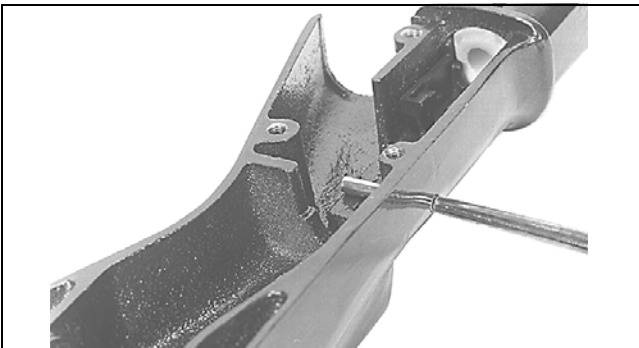
20849

Install the metal outer handle over the plastic inner handle and drive the outer handle into place.



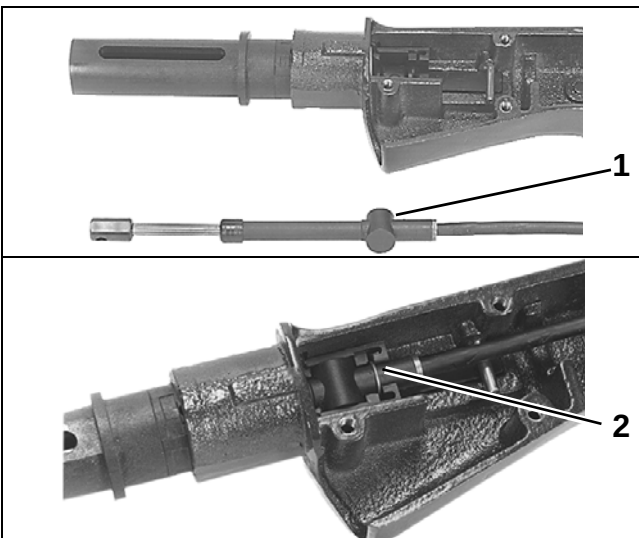
31202

Secure tab of the inner handle into recess of the outer handle with the steel pin.



24285

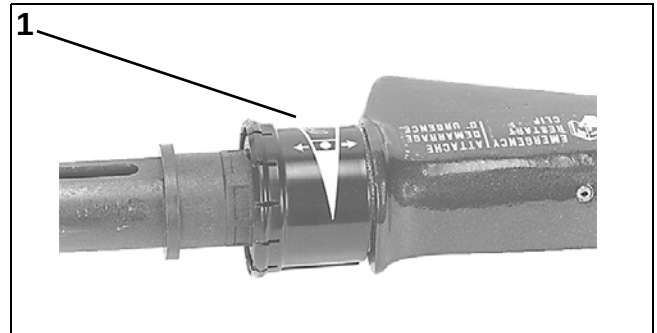
Install the handle end of the throttle cable. Snap the throttle cable trunnion into the recess in the handle. Install the retainer clip.



1. Throttle cable trunnion
2. Retainer clip

24282
24286

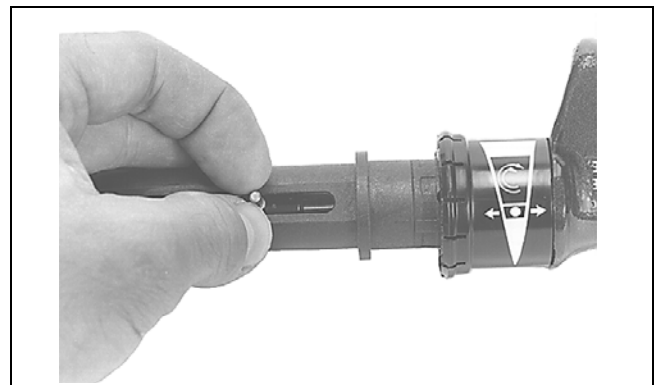
Install the throttle control plate on outer handle.



1. Throttle control plate

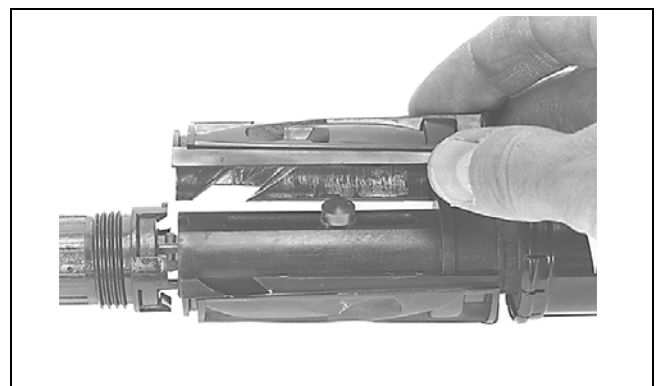
24295

Push the throttle cable pin through the end of the throttle cable.



24294

Lubricate end of the pin, guides, rollers, helix grooves, and inner handle guide slot with *Moly Lube*. Place the guides over the roller pin and into the slots of the inner handle. Place the rollers on the ends of the roller pin. Assemble the helix halves on the handle and slide the grip over the helix.

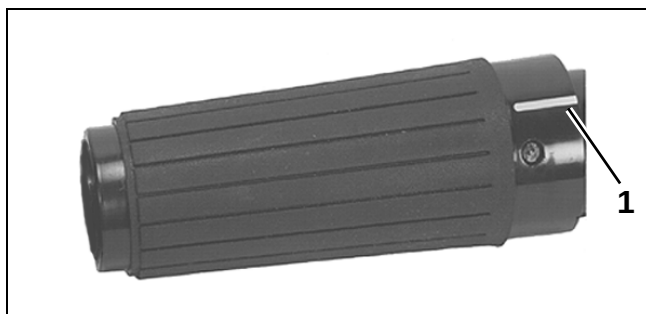


24293

Midsection

Tiller Handle Service

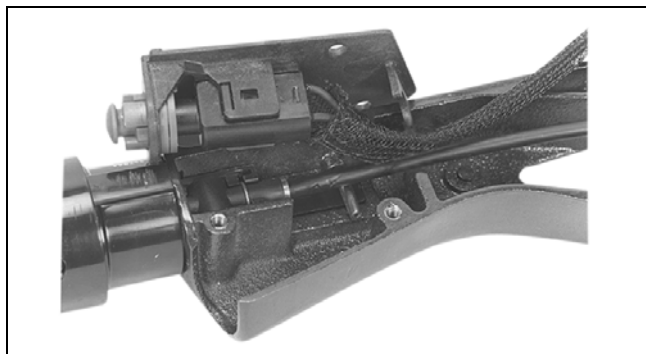
Be sure the twist-grip's speed indicator line is positioned with the speed range symbol on the handle. Snap the grip into place.



1. Indicator line

002190

Slide the protective sleeve over the stop switch leads and throttle cable and install stop switch cover.



24291



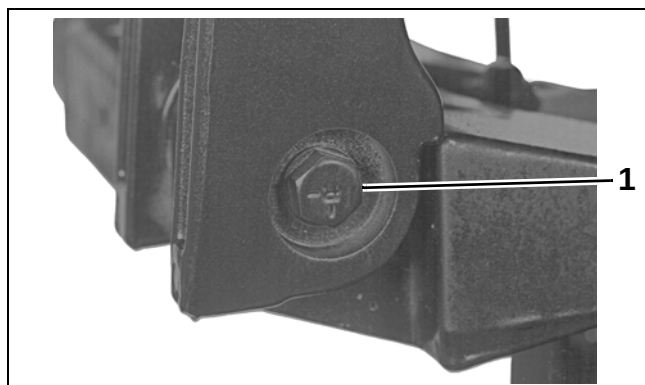
24288

Installation

⚠ CAUTION

The steering handle nut must have a nylon patch for locking. Replace the nut if it has lost its locking feature. Tighten the nut so the steering handle can be pivoted and maintained in any position.

Apply *Triple-Guard* grease to the two steering handle bushings. Place the bushings into the steering bracket. Attach the steering handle to the bracket. Tighten screw to a torque of 36 to 40 ft. lbs. (49 to 54 N·m).

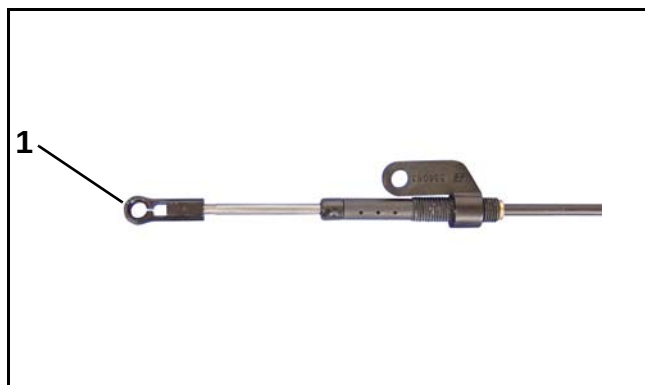


1. Screw

31194

Throttle Cable Installation and Adjustment

Make sure throttle cable end is fully seated.

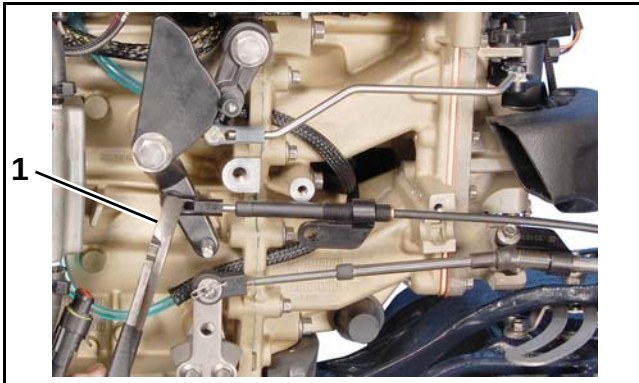


1. Throttle cable end

007473M

IMPORTANT: Do NOT use threaded cable end to make cable adjustments.

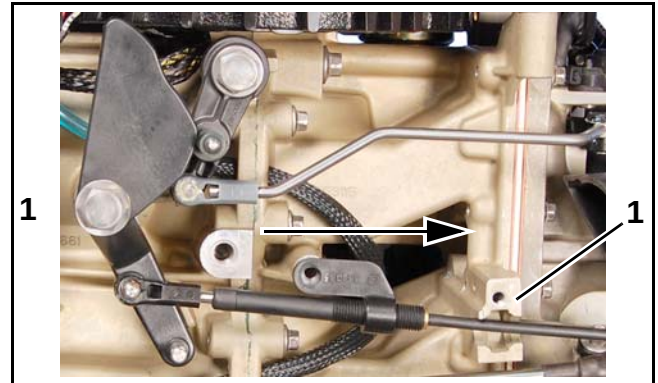
Install throttle cable connector with Ball Socket Installer tool, P/N 342225.



1. Installer tool, P/N 342225

007468

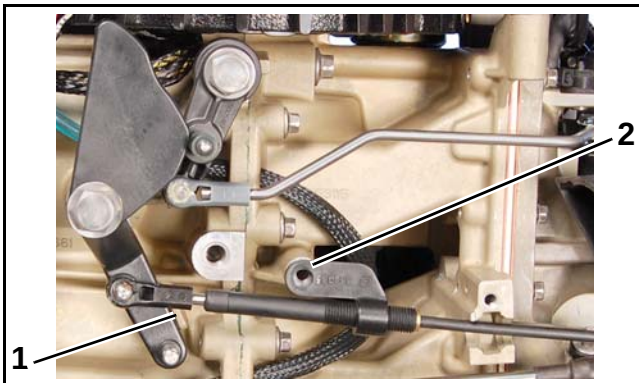
Rotate anchor one additional turn toward the trunnion pocket.



1. Trunnion pocket

007470

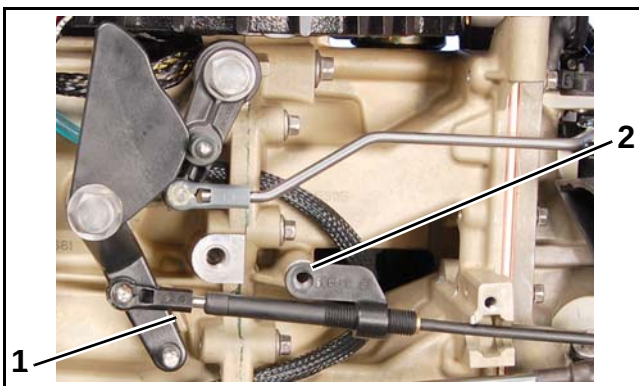
Hold twist grip in FULL THROTTLE position. Pull throttle cam to FULL THROTTLE stop.



1. FULL THROTTLE stop

007470

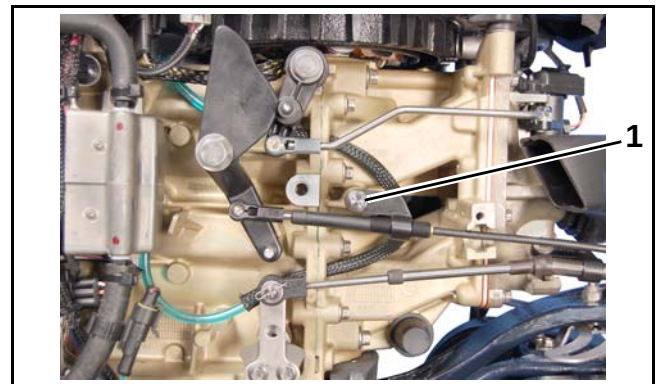
Adjust cable anchor so throttle cam is against FULL THROTTLE stop when anchor screw hole aligns with screw boss on block.



1. FULL THROTTLE stop
2. Anchor aligned with screw hole

007470

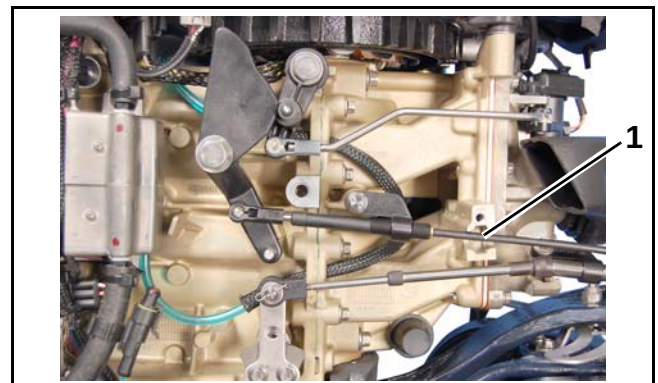
Install washer between anchor and boss. Install screw. Tighten screw to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).



1. Cable anchor screw

007471

Place throttle cable and bushing through upper trunnion pocket. Install retainer clip with screw. Tighten screw to a torque of 84 to 106 in. lbs. (9.5 to 12 N·m).



1. Bushing

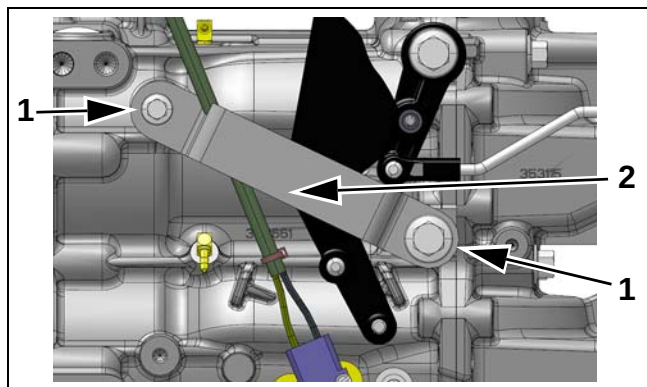
007471

Midsection

Tiller Handle Service

IMPORTANT: Rotate twist grip. Make sure throttle cam goes to full throttle without overloading cable, and still returns to IDLE stop.

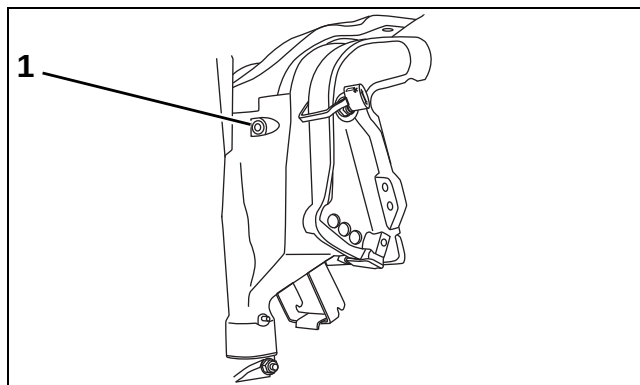
After completing adjustments, install the throttle cam guard with spacer and two screws.



1. Screws
2. Throttle cam guard

008929A

Adjust steering friction with outboard mounted to boat by loosening or tightening the adjustment screw. Steering friction should be adjusted so a slight drag is felt when turning.

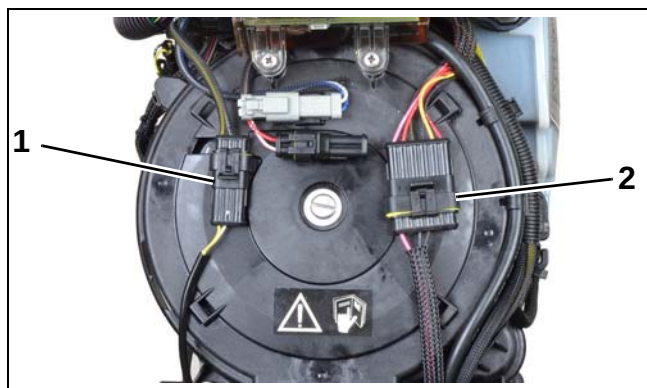


1. Steering friction screw

007032

Connect the CPS electrical connector.

Connect the tiller handle electrical connector coming from the tiller handle.



1. CPS electrical connector
2. Tiller handle electrical connector

008941

Steering Friction Adjustment

⚠ WARNING

Do not over tighten. The steering friction screw is not intended to allow “hands off” steering.

Tiller models are equipped with a steering friction adjustment. Steering friction is not required when remote steering is used.

Gearcase

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Propeller Service

⚠ WARNING

When servicing the propeller, always shift the outboard to NEUTRAL, remove the clip from the engine cut-off switch, and disconnect the Crankshaft Position Sensor (CPS) so the outboard cannot be started accidentally.

Inspection

Carefully examine propeller and outboard for the following:

- Damaged blades and signs of propeller cavitation (burned paint, etc.)
- Spun or overheated inner hub
- Worn or twisted splines and inadequate lubricant
- Damaged or missing converging ring (if applicable)
- Damage to outer hub area
- Worn, missing, or incorrect thrust washer and spacer
- Correct size and style
- Check for bent or damaged propeller shaft and twisted splines.

Refer to **Propeller Hardware Installation** on p. 232.

Propeller Selection

⚠ CAUTION

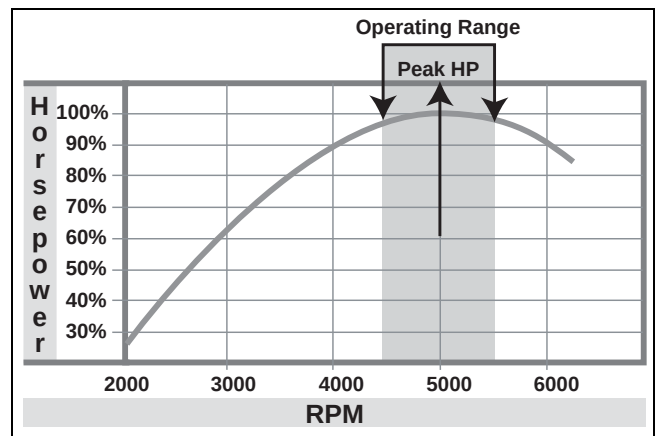
Selection of the wrong propeller could reduce engine service life, affect boat performance, or cause serious damage to the powerhead.

NOTICE

If the propeller blades have too much pitch, the engine will operate below its normal range at full throttle. Power will be lost, and powerhead damage could occur. If the propeller blades have too little pitch, the engine will operate above its normal range and damage from overspeeding could occur.

Water testing with various propeller designs and sizes is the best method of propeller selection.

The correct propeller, under normal load conditions, will allow the engine to run near the midpoint of the RPM operating range at full throttle. Refer to **Service Specifications** on p. 12.



008329

Gearcase

Propeller Service

When selecting a propeller, consider the following:

- Use an accurate tachometer to determine the engine's full-throttle RPM.
- The outboard should be trimmed for top speed.
- Select a propeller that suits the customer's application and allows the engine to run near the midpoint of the full-throttle operating range when the boat has a normal load.
- Occasionally, one propeller will not cover a wide range of boat applications — water skiing to high speed performance boating. In such cases, it might be necessary to have a propeller for each situation.
- Refer to the *Evinrude Genuine Parts and Accessories Catalog* for propeller styles and sizes.

Propeller Hardware Installation

WARNING

To prevent accidental starting while servicing, disconnect the Crankshaft Position Sensor (CPS).

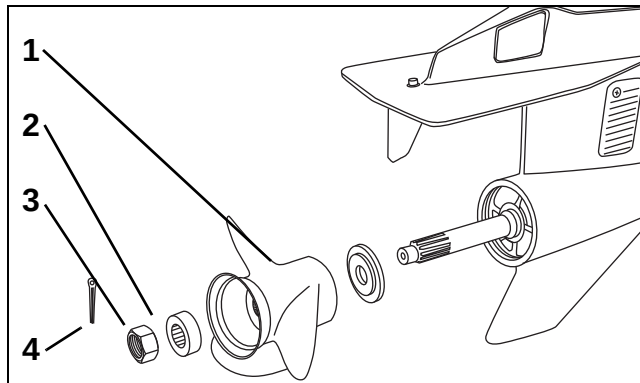
IMPORTANT: Depending on propeller style, different thrust bushings, spacers, and cotter pin keepers are used. See the *Evinrude Genuine Parts and Accessories Catalog* for correct propeller hardware.

Apply *Triple-Guard* grease to the entire propeller shaft before installing the propeller.

Install thrust bushing onto propeller shaft with taper of bushing matching taper of shaft.

Align splines of propeller and shaft. Push propeller until seated on the thrust bushing.

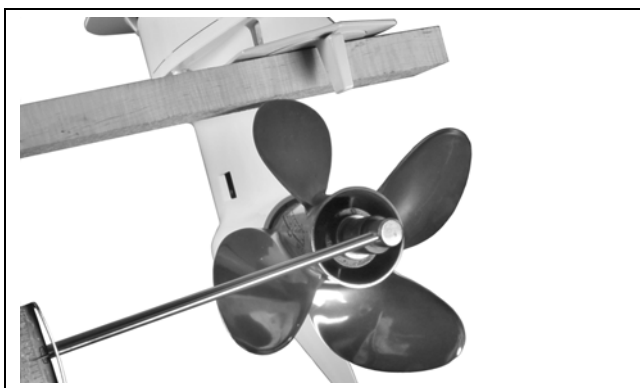
Install the spacer over the propeller shaft splines.



1. Thrust bushing
2. Spacer
3. Propeller Nut
4. Cotter pin

007055

Wedge a block of wood between propeller blade and the anti-ventilation plate.



001992

Install the propeller nut and tighten to a torque of:

- 120 to 144 in. lbs. (13.5 to 16.5 N·m)

If cotter pin holes in the nut and shaft do not align, tighten further. Do not loosen.

Install new cotter pin.

IMPORTANT: After installation, make sure outboard is in NEUTRAL and carefully spin propeller. Propeller must turn freely and should not spin off center. If propeller appears to wobble, check for possible bent propeller shaft.

Gearcase Leak Test Trim Tab Service

Drain lubricant before testing.

Use Gearcase Pressure Tester, P/N 507977. Install lubricant drain/fill plug and seal, thread pressure test gauge fitting and seal in lubricant level hole.

Pressurize 3 to 6 psi (21 to 42 kPa).

If pressure gauge indicates leakage, submerge the gearcase in water to determine source of leak.

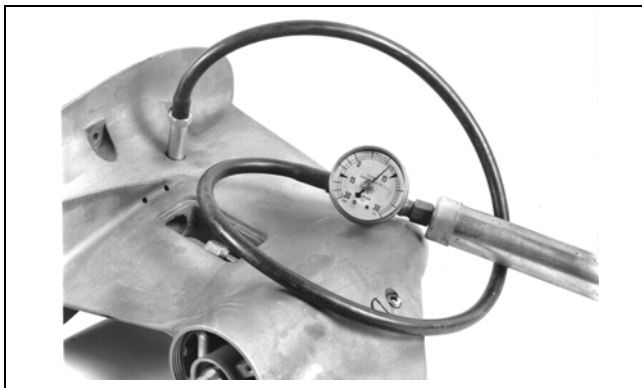
If the gauge does not indicate leakage, increase pressure to 16 to 18 psi (110 to 124 kPa). Check for leaks.

Make necessary repairs and repeat test.

Install Gearcase Vacuum Tester, P/N 507982. Apply 3 to 5 in. of vacuum (76 to 127 mm) Hg. with pump.

If vacuum gauge indicates leakage, apply oil around suspected seal. If leak stops or oil is drawn in, seal is defective.

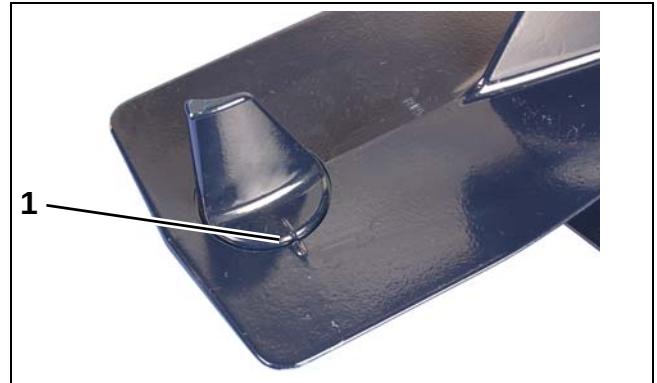
Repeat test, gearcase must hold minimum of 15 in. vacuum (381 mm) Hg.



38640

Removal

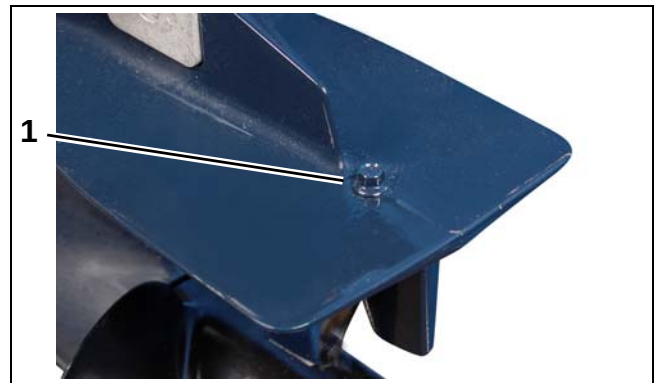
Note where the index mark on the gearcase aligns with the index mark of the adjustable trim tab so the trim tab can be installed in the same position.



1. Index marks

007651

Remove the trim tab retaining screw and trim tab from the gearcase.



1. Trim tab retaining screw

007652

Installation

Apply *Gasket Sealing Compound* to threads of the trim tab screw. Install and align the trim tab with the index marks noted prior to disassembly. Tighten the trim tab screw to a torque of 60 to 84 ft. lbs. (7 to 9.5 N·m). For adjustment, refer to **Trim Tab Adjustment** on p. 60.

Gearcase Removal and Installation

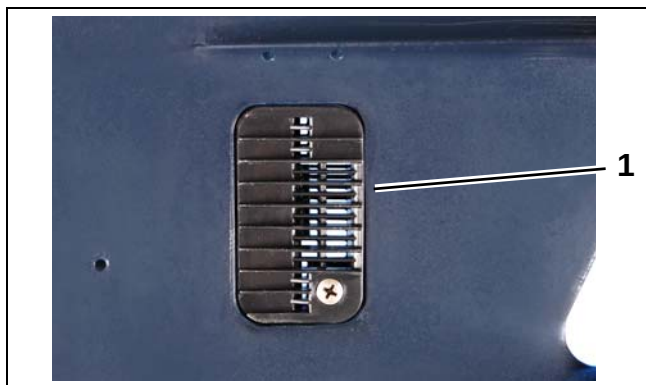
Gearcase Removal

WARNING

To prevent accidental starting while servicing, disconnect the Crankshaft Position Sensor (CPS).

During service, the outboard may drop unexpectedly. Avoid personal injury; always support the outboard's weight with a suitable hoist or the tilt support bracket during service.

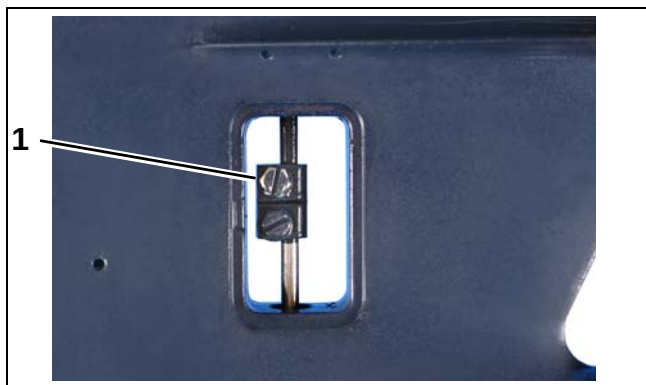
Remove water intake screens.



1. Water intake screen

007649

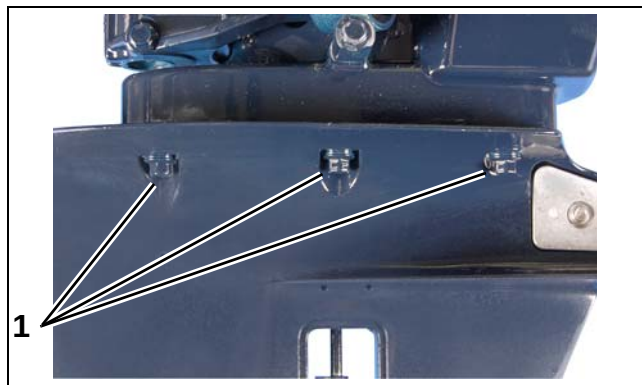
Remove the upper shift rod connector screw.



1. Shift rod connector screw

007650

Remove the six gearcase retaining screws or nuts (25 inch models).



1. Gearcase retaining screws

007653

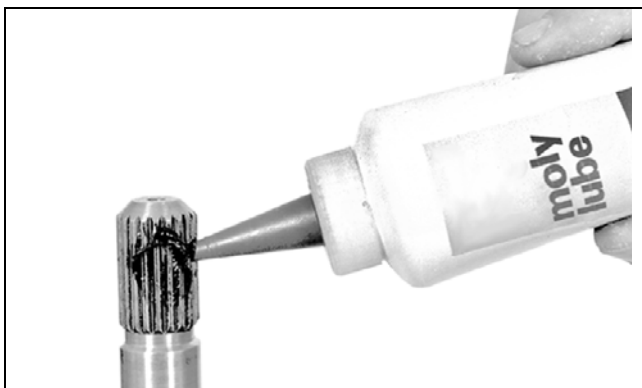
Remove the gearcase assembly from the exhaust housing, being careful not to bend the shift rod.

Gearcase Installation

WARNING

During service, the outboard may drop unexpectedly. Avoid personal injury; always support the outboard's weight with a suitable hoist or the tilt support bracket during service.

Coat the driveshaft splines with *Moly Lube*. DO NOT coat top surface of the driveshaft because lubricant may prevent seating of the driveshaft in the crankshaft.

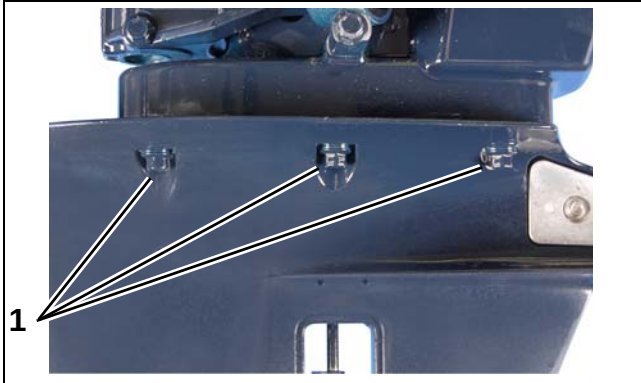


30385

Slide the gearcase into place, making sure that:

- Driveshaft engages the crankshaft
- Water tube enters grommet on water pump
- Upper shift rod enters the shift rod connector.

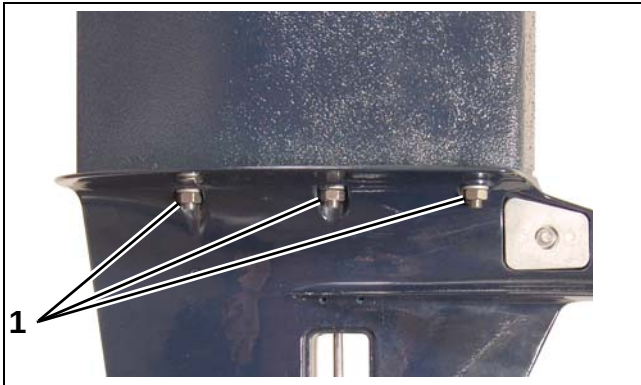
Apply *Gasket Sealing Compound* to threads of the gearcase retaining screws. Install and tighten the screws to a torque of 128 to 146 in. lbs. (14.5 to 16.5 N·m).



1. Gearcase retaining screws

007653

For 25 inch models, apply *Triple-Guard* grease to threads of the studs. Install washers and gearcase retaining nuts. Tighten nuts to a torque of 128 to 146 in. lbs. (14.5 to 16.5 N·m).

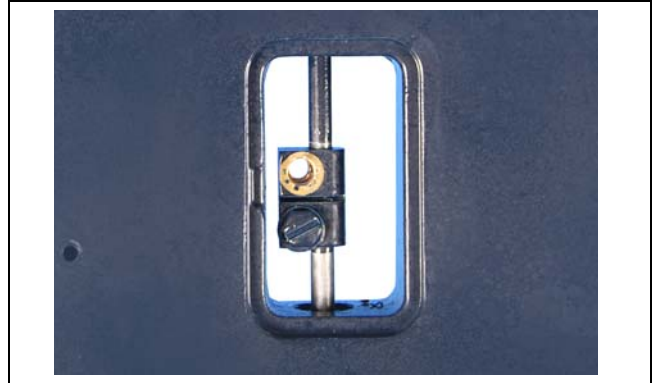


1. Gearcase retaining nuts

008371

Align the groove in the upper shift rod with the screw hole in the connector. Apply *Gasket Sealing Compound* to threads of the shift rod connector

screw. Tighten screw, with washer, to a torque of 60 to 84 in. lbs. (7 to 9.5 N·m).



007654

Install the port and starboard water intake screens with water intake holes positioned at the rear of gearcase. Tighten screws to a torque of 10 to 14 in. lbs. (1.1 to 1.6 N·m).



1. Water intake screen

007649

⚠ WARNING

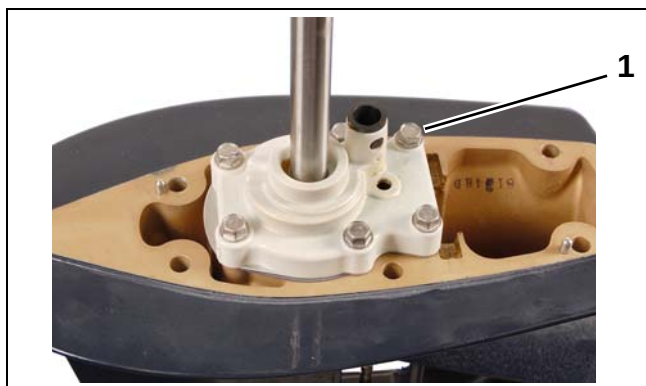
To prevent loss of operator control, check for proper shifting operation and adjust, if necessary.

IMPORTANT: During break-in period of a reassembled gearcase, change the gearcase lubricant between 10 to 20 hours of operation.

Water Pump Service

Disassembly

Remove the impeller housing screws.

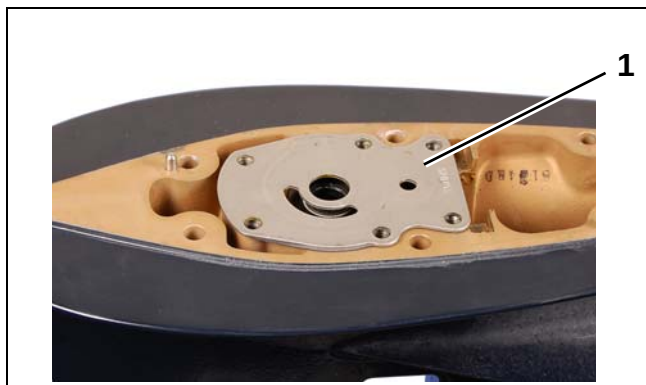


1. Screws

007655

Pull up on the driveshaft and remove the driveshaft with the water pump assembly from the gearcase. Remove the water pump assembly from the driveshaft.

Remove the impeller plate and gasket. Discard the gasket.



1. Impeller plate

007656

Remove the water pump grommet, all O-rings, and the shift rod bushing from the impeller housing.

Inspection

Check impeller for overheating, hub separation, and other wear or damage.

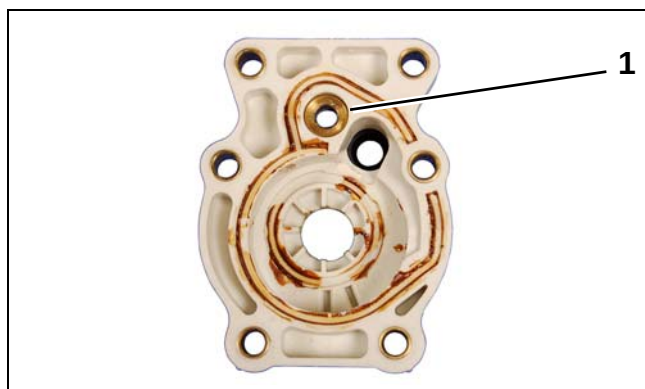
Check liner and wear plate for scoring, distortion, and impeller material transfer.

Inspect the housing for cracks or melting.

Make sure gasket surface is clean and smooth.

Assembly

Oil and install the shift rod bushing into the impeller housing.

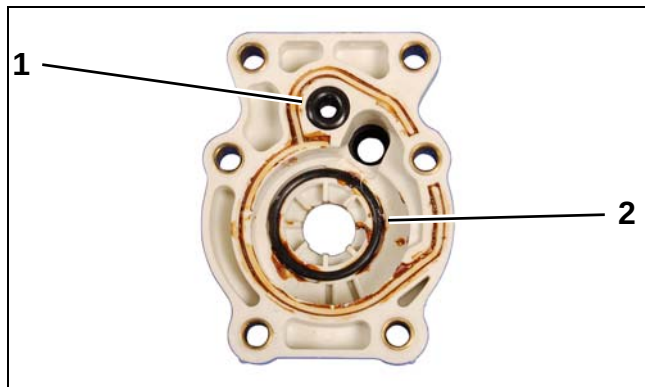


1. Shift rod bushing

007657

Apply *Triple-Guard* grease to the shift rod O-ring and install below bushing.

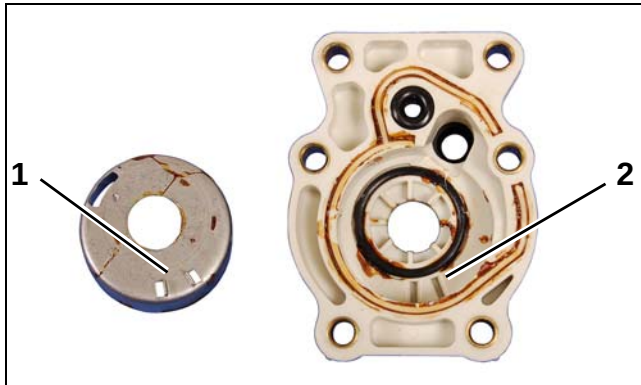
Apply a thin bead of *Adhesive 847* in the inner groove of the impeller housing and install a new impeller cup O-ring.



1. Shift rod O-ring
2. Impeller cup O-ring

007658

Lightly coat the exterior of the impeller cup with *Gasket Sealing Compound*. Align tabs of impeller cup with location holes of impeller housing and install the impeller cup into the impeller housing.

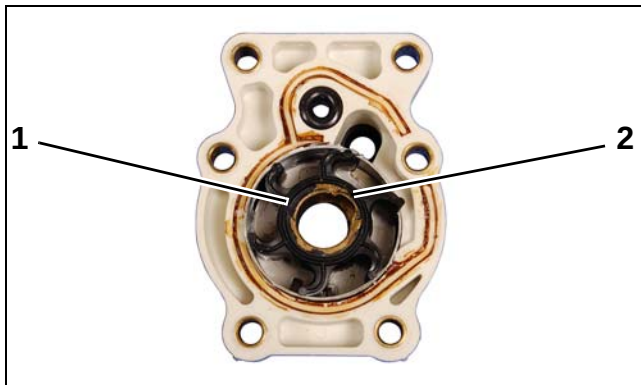


1. Tabs, impeller cup
2. Location holes

007659

Lightly coat the inside of the impeller cup with oil. With a counterclockwise rotation, install the impeller into the impeller cup.

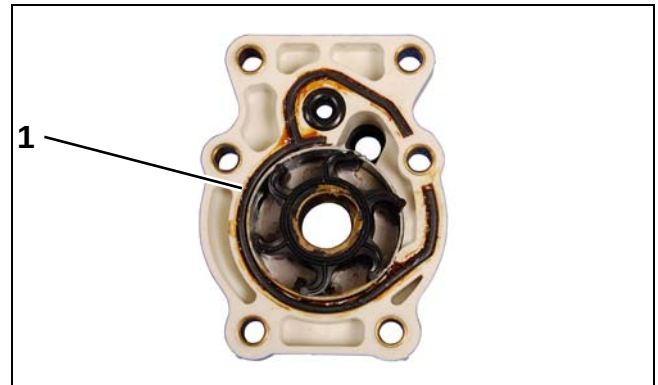
IMPORTANT: The sharp edge of key slot in the impeller is the leading edge during rotation.



1. Impeller
2. Sharp edge

007660

Apply *Adhesive 847* to the outer seal groove of the impeller housing. Install a new seal into the groove.



1. Seal

007661

Lightly oil pinion splines of the driveshaft. Slide the driveshaft through the impeller housing and impeller until drive key flat of the driveshaft is below the impeller. Align drive key flat with groove of the impeller. Install the impeller drive key.



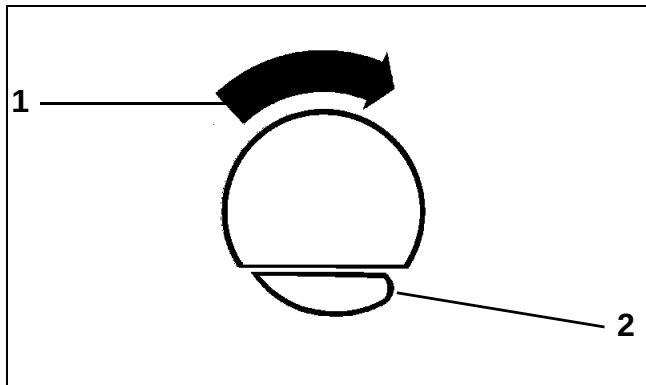
1. Drive key

007662

Gearcase

Water Pump Service

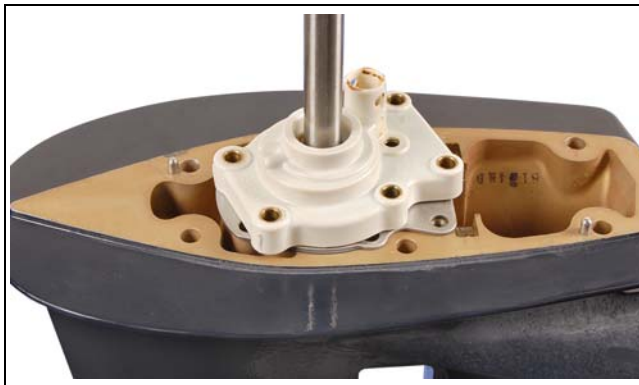
Sharp edge of the key is leading edge during driveshaft rotation. Slide the impeller housing down the driveshaft. Engage the impeller with the key.



1. Driveshaft rotation
2. Drive key

CO2995

Turn the driveshaft until holes of the impeller housing are aligned with holes of the gearcase. Apply *Gasket Sealing Compound* to threads of the impeller housing screws. Tighten the screws to a torque of 60 to 84 in. lbs. (7 to 9.5 N·m).



007663

NOTICE

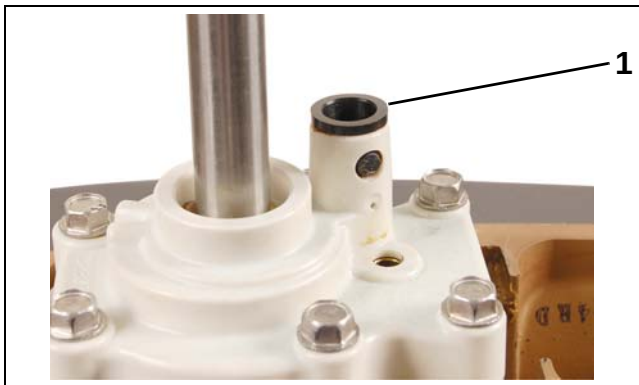
Make sure the impeller engages the impeller key. Serious powerhead damage will result if impeller key is not in place.

Lightly coat both sides of a new impeller plate gasket with *Gasket Sealing Compound*. Place gasket on the gearcase.

Place the impeller plate over the gasket.

Slide the driveshaft down into the gearcase and engage the pinion.

Apply *Adhesive 847* to outside of water tube grommet. Install grommet and locate grommet bosses into holes of impeller housing.



1. Grommet

007664

Gearcase Disassembly

Pre-Disassembly Inspection

⚠ WARNING

Wear safety glasses to avoid personal injury, and set compressed air pressure to less than 25 psi (172 kPa).

IMPORTANT: Clean and inspect all parts during disassembly. Replace any damaged parts, seals, O-rings, and gaskets.

ENVIRONMENTAL NOTE

Dispose of used oil and contaminated cleaning materials in an environmentally responsible manner, or according to local regulations.

Remove the propeller and mounting hardware.

Drain and inspect oil as described in **Gearcase Lubricant** on p. 65.

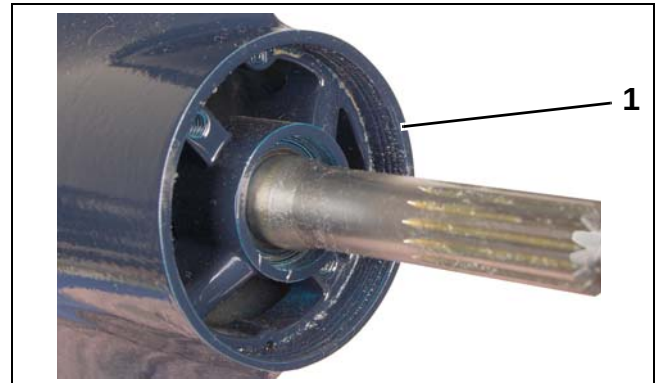
Remove gearcase. Refer to **Gearcase Removal and Installation** on p. 234.

Remove water pump. Refer to **Water Pump Service** on p. 236.

Before disassembling the gearcase, examine the following:

- **Gearcase Housing** — Check for visible damage to skag, strut, anti-ventilation plate, bullet, and mating surface. Check seal areas for visible signs of lubricant leakage.
- **Propeller Shaft** — Check for bent or damaged shaft. Check for twisted splines and damaged threads.
- **Shift Rod** — Check for bent, or binding rod.

- **Hydrostatic Seal Grooves** — Must be in good condition to help prevent propeller ventilation.



1. Hydrostatic seal grooves

007665

- **Gearcase Anodes** — If anodes have eroded to two-thirds their original size, they must be replaced.

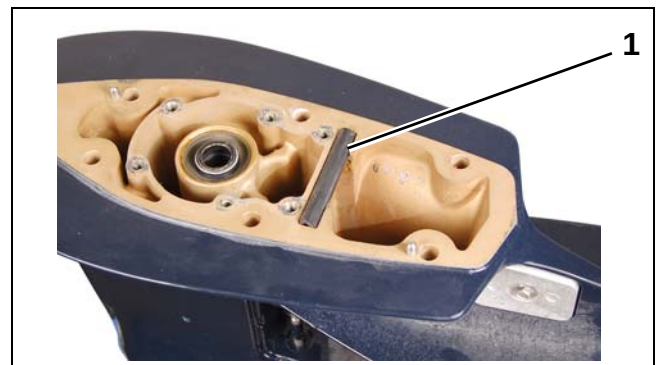


1. Gearcase anode

007666

- **Drive Shaft** — Check splines for visible damage, twisting and wear. Severe spline wear indicates the exhaust housing or gearcase has been distorted, possibly by impact damage.

Remove and discard exhaust seal assembly.



1. Seal assembly

007667

Gearcase

Gearcase Disassembly

Propeller Shaft Bearing Housing Removal

Remove the two propeller shaft bearing housing screws.

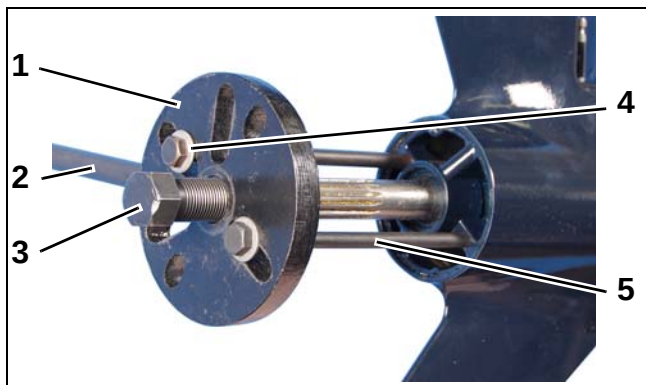


1. Screws

007668

Remove the propeller shaft bearing housing from the gearcase using the Universal Puller Set, P/N 378103:

- Puller body, P/N 307636
- Handle, P/N 307638
- Pressing screw, P/N 307637
- Two flat washers, P/N 307639
- Two 1/4-20 x 6 in. screws (obtain locally)



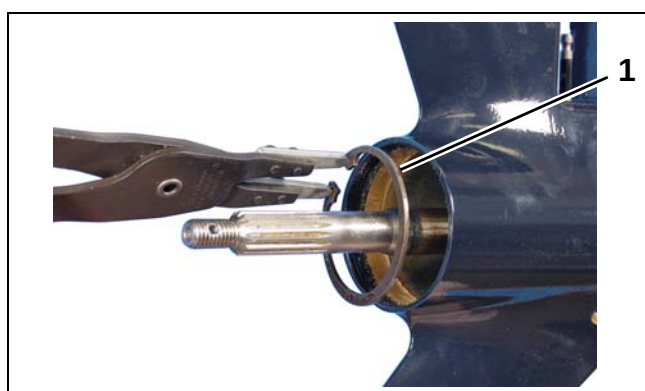
1. Body
2. Handle
3. Pressing screw
4. Washers
5. Screws (obtain locally)

007669

Remove the retaining ring using Retaining Ring Pliers, P/N 331045.

⚠ CAUTION

Retaining ring is under extreme pressure during removal and installation. To prevent personal injury, wear safety glasses and proceed with care to avoid unsnapping the ring from the pliers. After the retaining ring is removed far enough from the gearcase to clear the housing, release the tension on the pliers while retaining ring is still around the propeller shaft.



1. Retaining ring

007670

Remove the retainer plate from the gearcase.

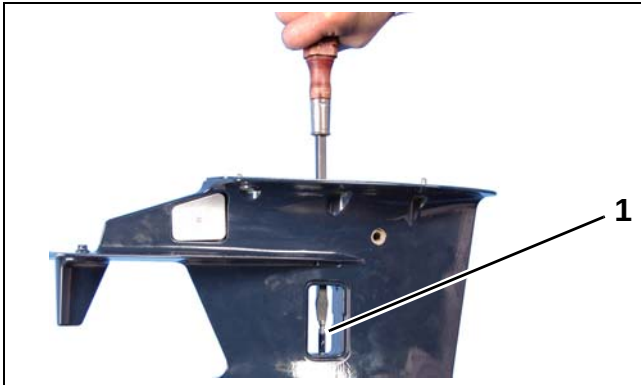


1. Retainer plate

007671

Shifter, Gear and Propeller Shaft Removal

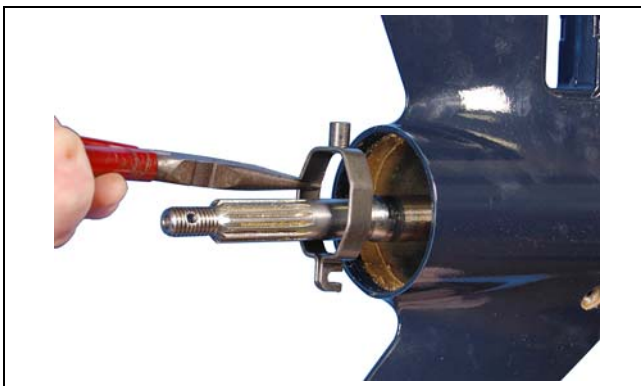
Unscrew the lower shift rod from the shifter yoke and remove the shift rod from the gearcase.



1. Lower shift rod

007672

Use long-nose pliers to remove the shift yoke.



007673

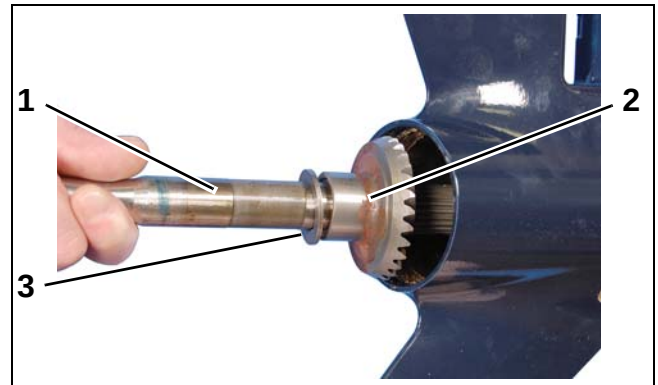
Remove the shifter lever pivot pin. Discard the pivot pin O-ring.



1. Shift lever pivot pin

007674

Remove the propeller shaft and reverse gear components from the gearcase.

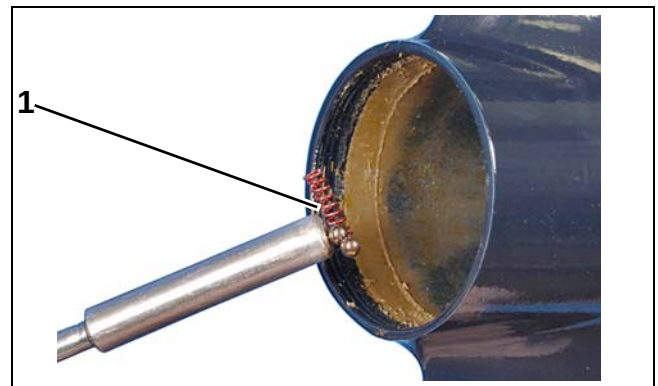


- 1. Propeller shaft
- 2. Reverse gear
- 3. Thrust washer

007675

IMPORTANT: Shifter detent balls and spring will pop out of the clutch when the propeller shaft is removed.

Use a magnet to locate and remove the two shifter detent balls and one detent spring from the gearcase.



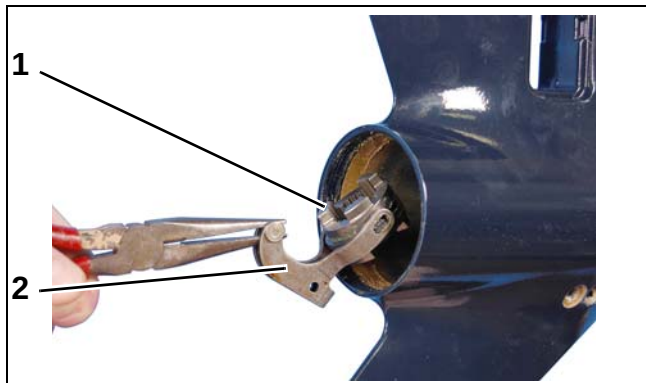
1. Spring and balls

007676

Gearcase

Bearing and Seal Removal

Use long-nose pliers to remove the clutch and shifter lever assembly. Use no force. Tilting the shifter lever slightly will allow you to remove it from the gearcase.



1. Clutch
2. Shifter lever assembly

007677

Remove the forward bearing, forward gear, pinion, pinion thrust bearing, and two pinion thrust washers.



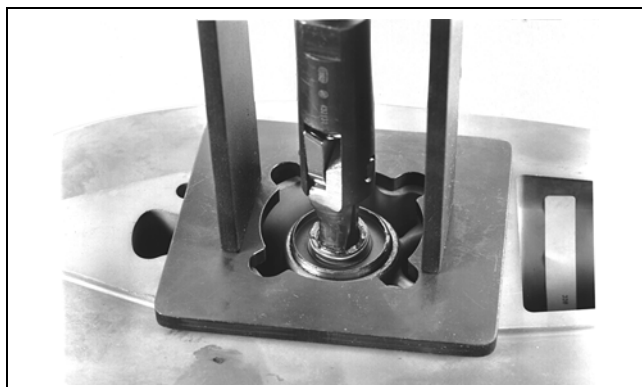
007678

Bearing and Seal Removal

IMPORTANT: Inspect bearings for damage while in place. If bearing is damaged, remove and discard. If the bearing is removed for any reason, it must be replaced.

Driveshaft Seals

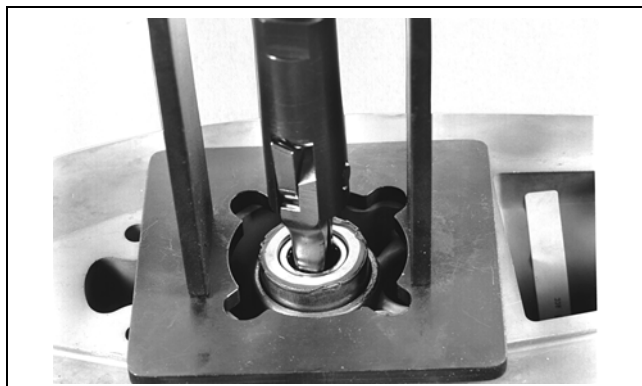
Use Puller Bridge, P/N 432127, and Small Puller Jaws, P/N 432131, to remove the two driveshaft seals. Discard the seals.



38633

Driveshaft Bearing

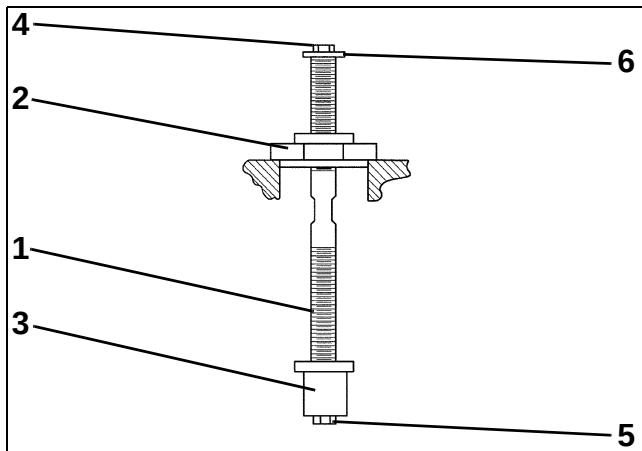
Use Puller Bridge, P/N 432127, and Small Puller Jaws, P/N 432131 to remove the driveshaft bearing and sleeve from the gearcase. Discard the bearing.



38634

Pinion Bearings

Assemble the following components from Universal Pinion Bearing Remover and Installer, P/N 5005927.



1. Rod, P/N 326582
2. Pilot Plate, P/N 326583
3. Remover and Installer, P/N 326577
4. 1/4-20 x 1/2 in. hex head screw
5. 1/4-20 x 11/4 in. hex head screw
6. 1 in. O.D. flat washer

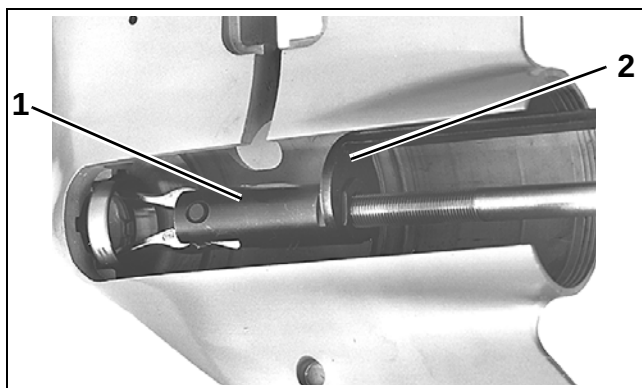
CO3125

Place the tool in gearcase. using a mallet, drive the pinion bearings into the gearcase propeller shaft cavity. Discard the bearings.

Forward Bearing

Use Slide Hammer, P/N 432128, and Bearing Puller, P/N 432130, to remove the forward bearing cup from the gearcase.

Secure the puller jaws into grooves behind the cup. Use Wrench, P/N 334359, to hold the puller while tightening the jaws.



1. Bearing puller
2. Wrench

21789

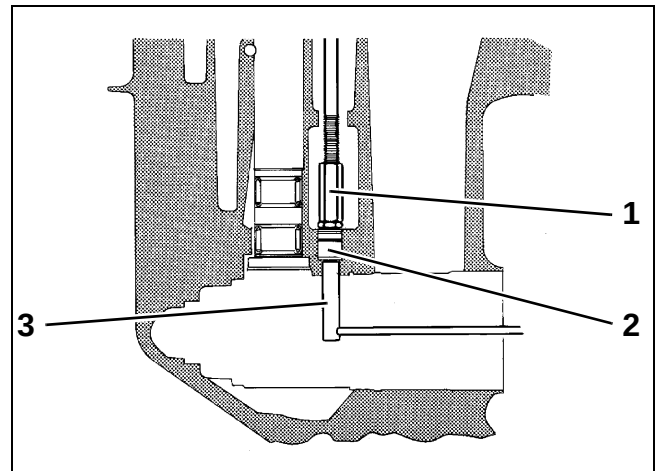
Shift Rod Bushing and O-ring

Position Shift Rod Bushing Remover, P/N 327693, under the shift rod bushing.

Thread the adapter of the Slide Hammer, P/N 391008, in the slide hammer. Place the adapter through the shift rod bushing and thread into the remover tool.

Remove the handle from the remover tool. Then remove the bushing from the gearcase.

Once the bushing has been removed from the gearcase, examine the bushing for damage. If damaged, replace the bushing on reassembly. Remove and discard the O-ring(s) and washer from the bushing.



1. Adapter
2. Shift rod bushing
3. Remover tool, P/N 327693

DRC1505

Gearcase

Bearing and Seal Removal

Propeller Shaft Bearing Housing Seals and O-ring

Remove and discard the propeller shaft bearing housing O-ring.



1. O-ring

007680

Use Puller Bridge, P/N 432127, and Small Puller Jaws, P/N 432131, to remove seals. Discard seals.

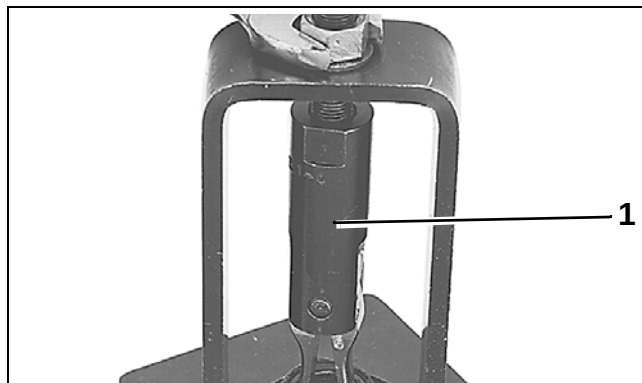


1. Small puller jaws

32555

Use Puller Bridge, P/N 432127, and Small Puller Jaws, P/N 432131, to remove both propellers

shaft bearings from the bearing housing. Discard both bearings.



1. Small puller

21795

Bearing and Seal Installation

IMPORTANT: Make no dry assemblies. Lubricate all bearings, shafts, and gears with gearcase lubricant.

Press the bearings into the housings until the tools are seated on the housing.

Propeller Shaft Bearing Housing Bearings

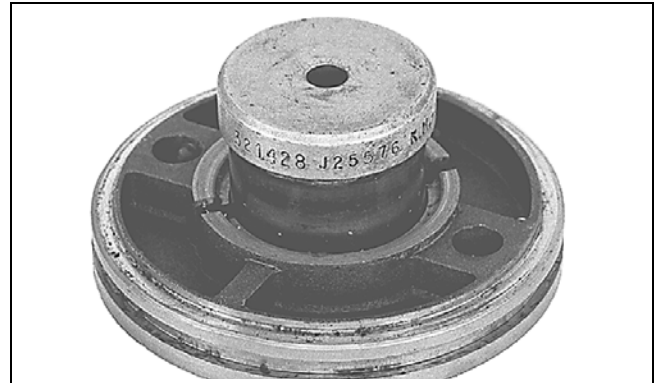
Use Bearing Installer, P/N 335820, to install a new bearing in the rear end of bearing housing. Position installer against the lettered side of bearing. Press the bearing into the housing until the tool is seated on the housing.



21793

Use Bearing Installer, P/N 321428, to install a new bearing in the forward end of the bearing housing.

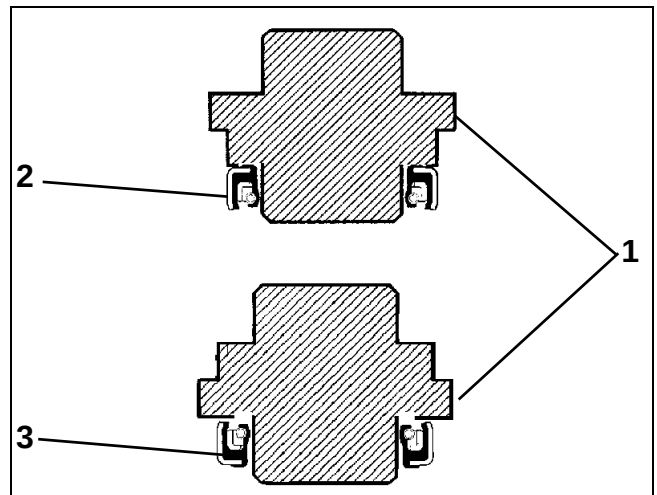
Position installer against the lettered side of bearing.



21794

Propeller Shaft Bearing Housing Seals and O-Ring

Install new seals back to back in aft end of the propeller shaft bearing housing using Seal Installer, P/N 335821. Apply *Gasket Sealing Compound* to the metal casing of the seals before installing. Install the inner seal with lip facing into the bearing housing and install the outer seal with lip facing away from the bearing housing. Apply *Triple-Guard* grease to seal lips after installing.



1. Seal installer
2. Inner seal
3. Outer seal

DR2061
DR2062

Gearcase

Bearing and Seal Installation

Apply *Triple-Guard* grease to a new bearing housing O-ring. Place the O-ring in the bearing housing groove.



1. O-ring

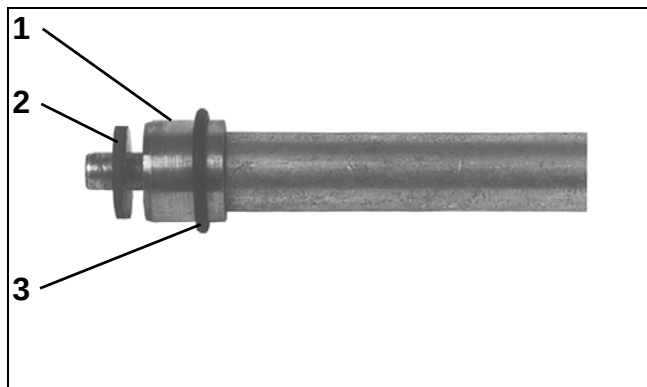
007680

Shift Rod Bushing and O-Ring

Coat the shift rod O-ring with *Triple-Guard* grease and install in shift rod bushing.

Place a new washer and bushing on Shift Rod Bushing Installer, P/N 304515. Apply *Gasket Sealing Compound* to the outside diameter of the shift rod bushing.

Install new bushing O-ring in outer groove of bushing.



1. Bushing
2. Washer
3. O-ring, outer groove

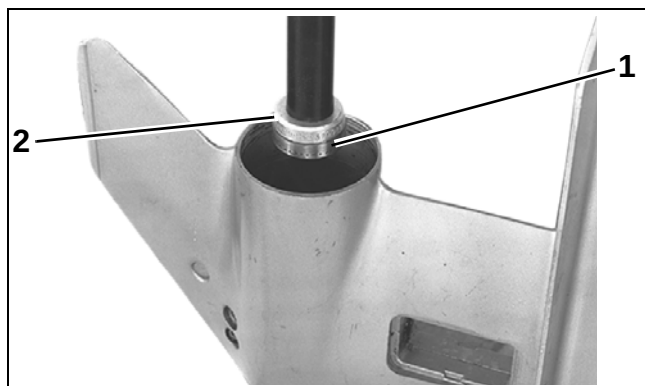
COA3319

Use a mallet to drive the bushing into the gearcase housing.

Forward Bearing

Place the nose of the gearcase on a wooden block on the floor. Use Drive Handle, P/N 311880, Bearing Cup Installer, P/N 319929, and a mallet to

drive the bearing cup into position in the gearcase housing. Oil the forward bearing cup and seat it firmly in the housing.

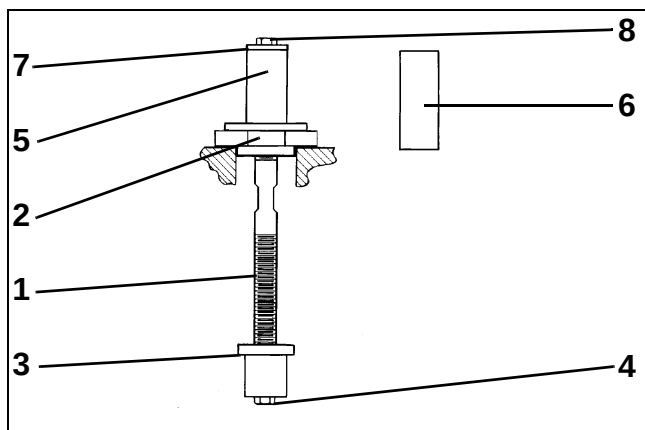


1. Forward bearing cup
2. Bearing cup installer

21791

Pinion Bearings

Install the pinion bearings using the following components of the Universal Pinion Bearing Remover and Installer, P/N 5005927, and two tool spacers.



1. Rod, P/N 326582
2. Plate, P/N 326583
3. Remover/Installer, P/N 326577
4. 1/4-20 x 1 1/4 in. screw
5. Spacer, Short, P/N 330067
6. Spacer, Long, P/N 330068
7. 1 in. flat washer
8. 1/4-20 x 1/2 in. screw

DR4692

IMPORTANT: To ensure accurate bearing location, washer must be flat and screw must be tight.

Install **lower** pinion bearing. Assemble tool using **short** spacer, P/N 330067, and remover/installer, P/N 326577. Position installer against the lettered

side of bearing. Drive bearing into gearcase housing until washer contacts spacer.

Install **upper** pinion bearing. Assemble tool using **long** spacer, P/N 330068.

Driveshaft Bearing

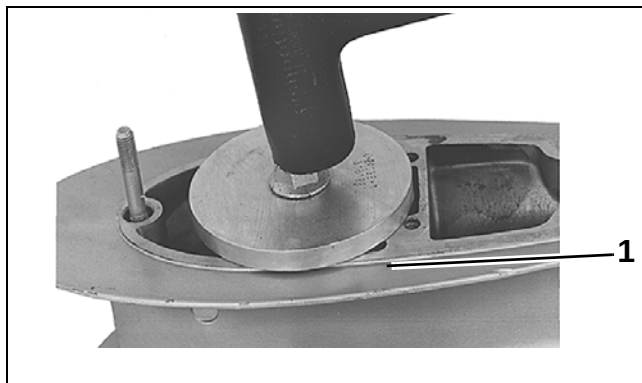
Oil and install a new driveshaft bearing in the bearing sleeve using Bearing Installer, P/N 322923. Press against the lettered side of the bearing until the tool is seated in the bearing sleeve.



- 1. Driveshaft bearing
- 2. Bearing sleeve
- 3. Bearing installer

21887

Use the same tool, attached to Plate, P/N 318122, to press the bearing sleeve assembly into the gearcase until the plate contacts the gearcase. Position the lettered side of the bearing against the tool.



- 1. Plate

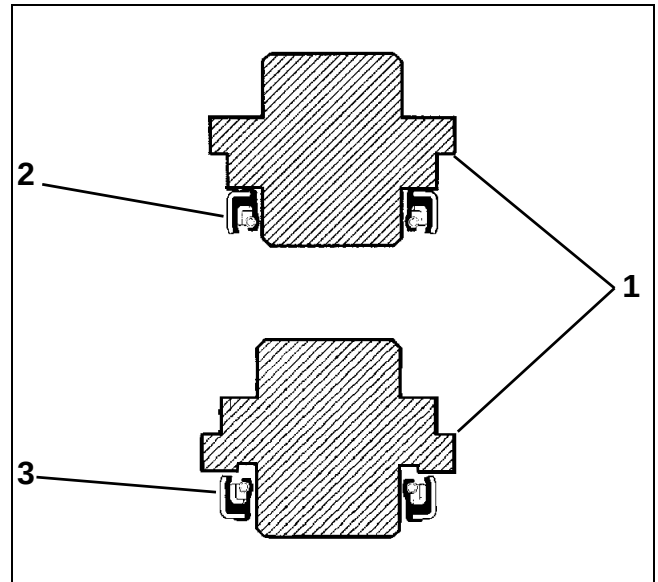
21813

Driveshaft Seals

Apply *Gasket Sealing Compound* to the metal casing of the seals before installing.

Use Seal Installer, P/N 326552, to install the inner seal with flush lip facing into the gearcase, then the outer seal with extended lip facing out of the gearcase.

Apply *Triple-Guard* grease to the seal lips after installing.



- 1. Seal Installer, P/N 326552
- 2. Inner seal
- 3. Outer seal

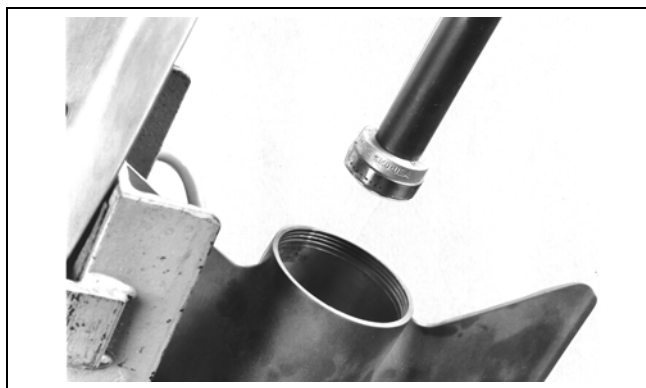
DR2061
DR2062

Gearcase Assembly

Propeller Shaft, Gear and Shifter Installation

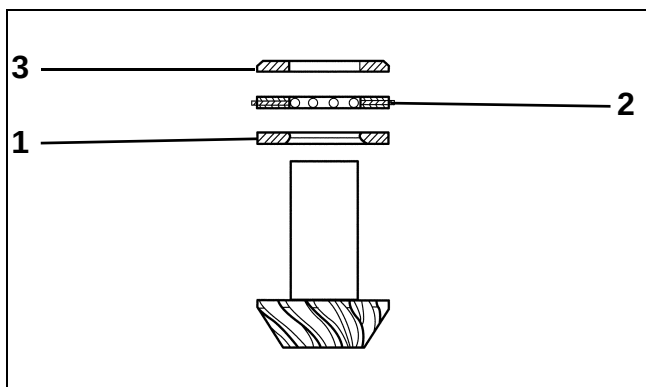
IMPORTANT: Make no dry assemblies. Lubricate all bearings, shafts, and gears with gearcase lubricant.

Oil and place the forward bearing cone and roller assembly in the forward bearing cup.



38635

Install the small thrust washer with the chamfered inside diameter facing the pinion gear. Oil and install the thrust bearing. Install the large thrust washer with chamfered outside edge facing up.



1. Small thrust washer, chamfered inside diameter
2. Thrust bearing
3. Large thrust washer, chamfered outside edge

803051

Use a right angled rod to install the pinion assembly in the gearcase.



COA3290

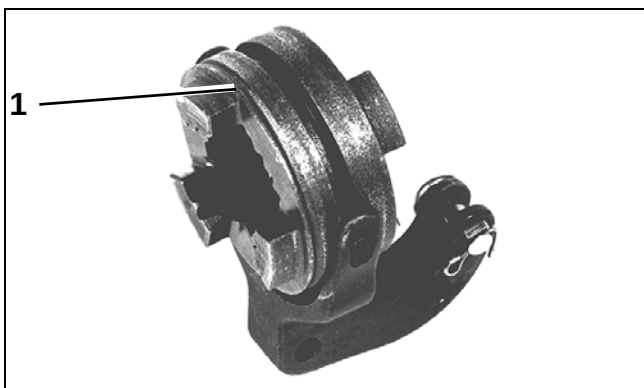
Place the forward gear into the gearcase.



1. Forward gear

COB3057

Install the shifter cradle on clutch dog. Grooved end of clutch dog must face forward gear end of the propeller shaft.



1. Grooved end

COB3065

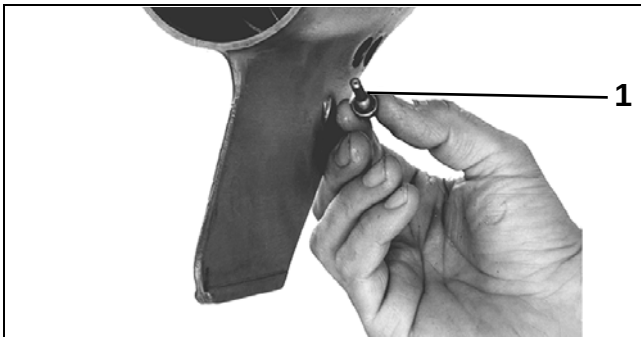
IMPORTANT: Apply *Needle Bearing* grease to clutch dog and shifter cradle to hold in place while assembling.

Install the shifter cradle and clutch dog in the gearcase using long-nose pliers.



38637

Apply *Triple-Guard* grease to a new pivot pin O-ring. Install O-ring on the pivot pin. Apply *Nut Lock* to threads of the pin. Align hole of shifter lever with hole in gearcase. Install and tighten pivot pin to a torque of 60 to 84 in. lbs. (7 to 9.5 N·m).



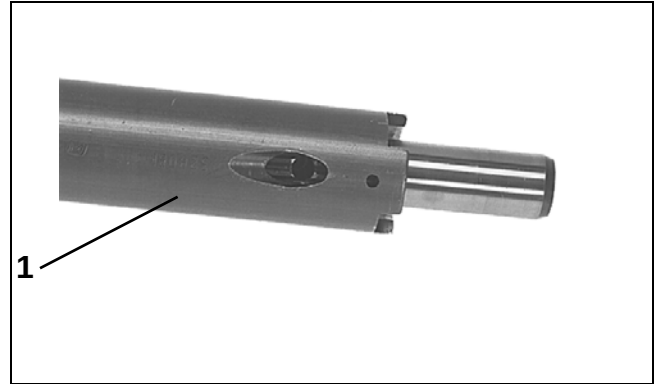
1. Pivot pin

COA3236

⚠ WARNING

Wear safety glasses for eye protection. Detent balls can pop out with great force.

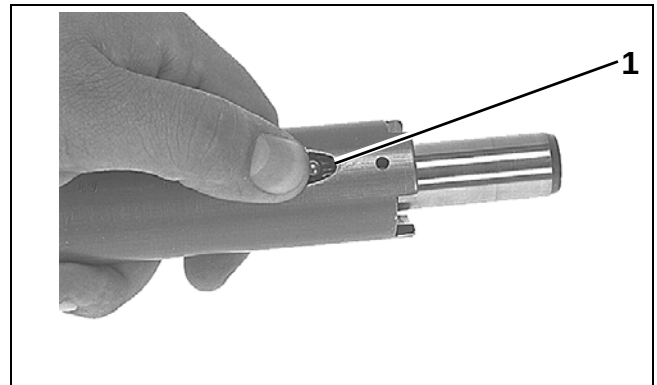
Slide the Shift Detent Sleeve, P/N 328081, over the propeller shaft. Align slot in the tool with hole in the propeller shaft.



1. Shift detent sleeve

26727

Insert one detent ball, then the spring, then the other detent ball. Push down on the ball and slide the tool back until you feel the ball slip into the detent.



1. Detent ball

26728

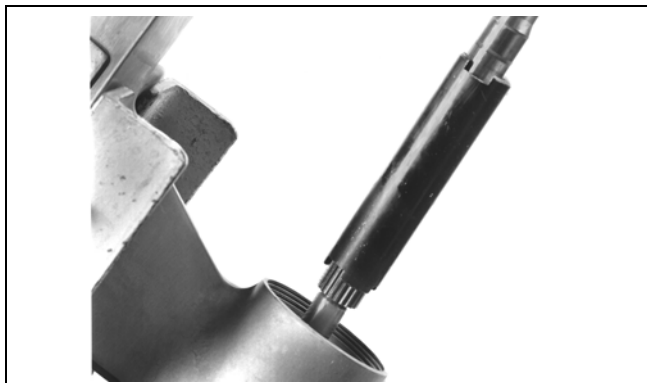
Install the propeller shaft and detent tool in gearcase. Make sure the following occurs:

- Propeller shaft must engage forward bearing.
- Tool ramps must engage clutch dog ramps.
- Hold tool firmly against clutch dog.

Gearcase

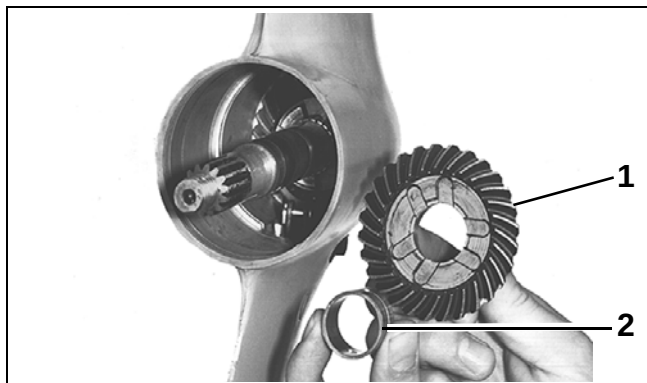
Gearcase Assembly

- Gently tap propeller shaft with a rawhide mallet to seat detent assembly.



38638

Remove detent tool. Slide the reverse gear down the propeller shaft and into the gearcase.

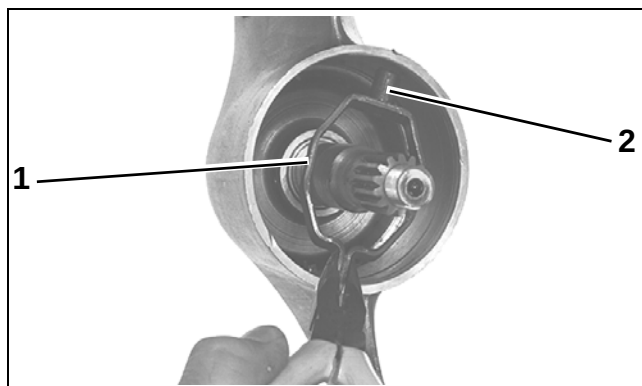


1. Reverse gear
2. Bushing

COB3051

Coat the reverse gear bushing with oil. Slide the bushing down the propeller shaft, seating the bushing into the reverse gear.

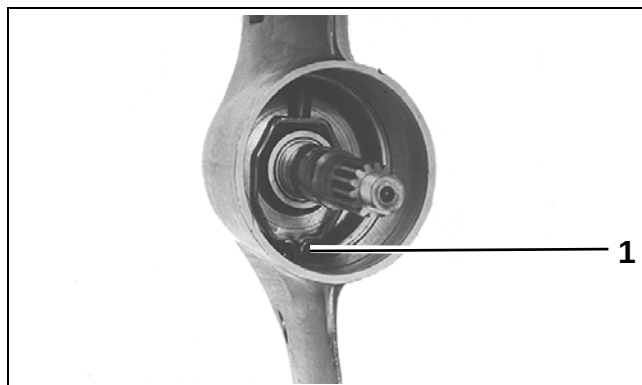
Holding the shifter yoke a with long-nose pliers, install the yoke at a tilted position, locating top of yoke into upper gearcase cavity.



1. Shifter yoke
2. Top of yoke

COA3229

Engage the shifter yoke hook onto the shifting lever clevis pin in bottom of the gearcase cavity.



1. Shifter yoke hook

COA3230

Apply *Triple-Guard* grease to threads of lower shift rod and install into gearcase through the water intake opening and engage the shifter yoke.

Thread the shift rod into the shifter yoke until the rod bottoms in the yoke.

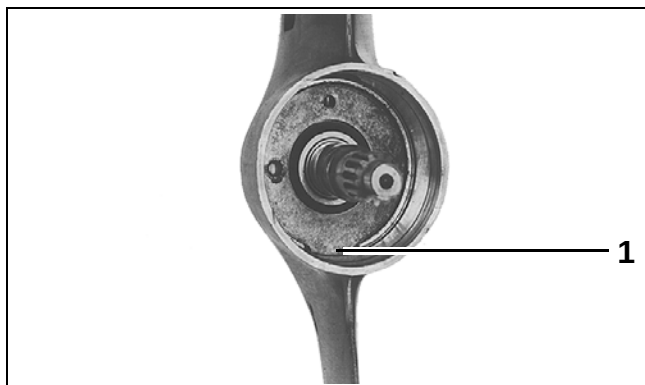


1. Lower shift rod

007672

Propeller Shaft Bearing Housing Installation

Slide the retainer plate down the propeller shaft and into the gearcase with tab facing down.



1. Tab, retainer plate

COA3238

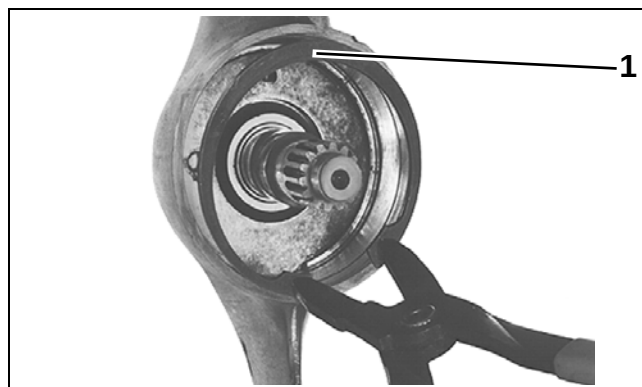
⚠ WARNING

Wear safety glasses and proceed with care to avoid unsnapping the ring from the pliers.

Using Retaining Ring Pliers, P/N 331045, install the retaining ring into groove in gearcase with sharp outside edge facing aft.

NOTICE

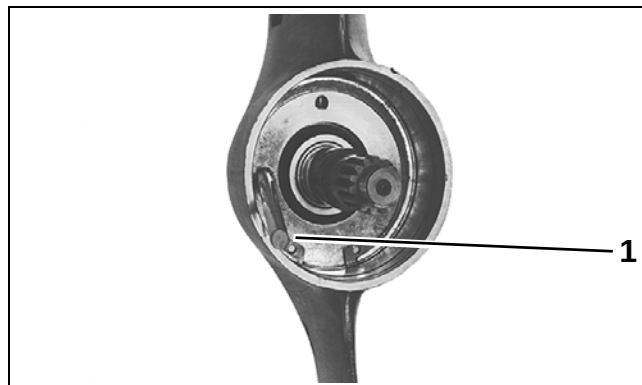
The retaining ring is under extreme pressure during installation. Make sure that the ring is seated in groove.



1. Retaining ring

COA3239

Thread one Guide Pin, P/N 383175, into the retainer plate.



1. Guide pin

COA3240

Gearcase

Gearcase Assembly

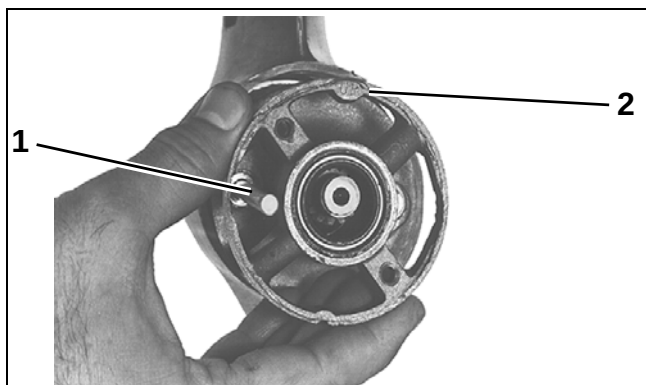
Use *Needle Bearing* grease to temporarily hold the reverse gear thrust washer on the back of the propeller shaft bearing housing.



1. Reverse gear thrust washer

COA3309

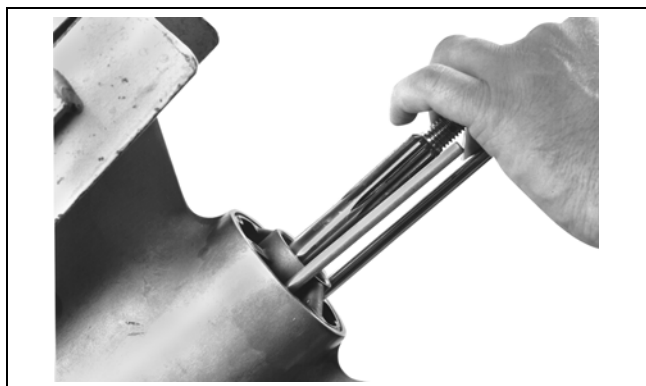
Lightly apply *Gasket Sealing Compound* to the aft support flange of the bearing housing. Align the propeller shaft bearing housing on the guide pin with the word "UP" toward the top.



1. Guide pin
2. "UP"

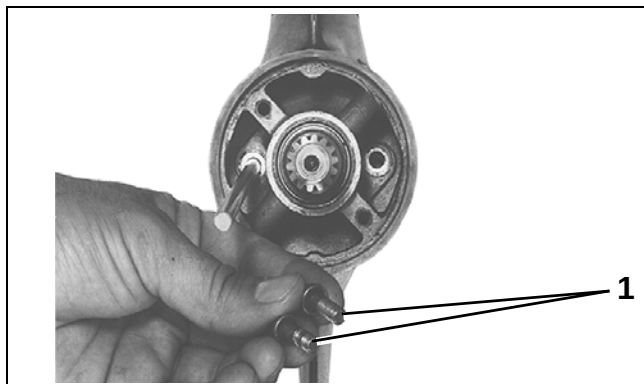
COA3241

Using a brass punch and a mallet, seat the bearing housing in the gearcase.



38639

Place new O-rings on the bearing housing retaining screws. Apply *Gasket Sealing Compound* to the O-rings and threads of the screws.

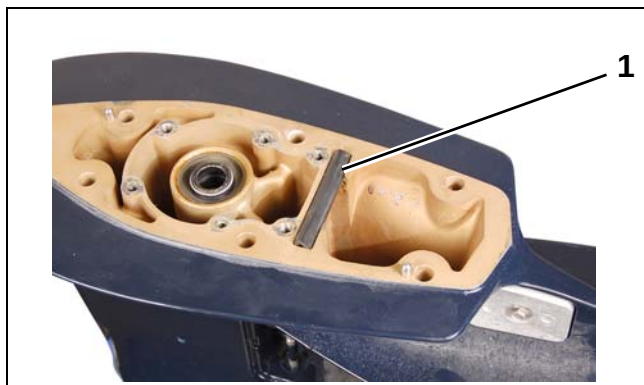


1. Screws

COA3243

Install one screw in the bearing housing. Remove the guide pin and install the second screw. Tighten screws to a torque of 124 to 142 in. lbs. (14 to 16 N·m).

Apply *Adhesive 847* to the bottom of a new exhaust seal assembly and install it into the slot in the gearcase.



1. Seal assembly

007667

To complete gearcase assembly, refer to:

- **Water Pump Service** on p. 236
- **Gearcase Leak Test** on p. 233
- **Gearcase Removal and Installation** on p. 234
- **Gearcase Lubricant** on p. 65
- **Propeller Hardware Installation** on p. 232
- **Trim Tab Adjustment** on p. 60.

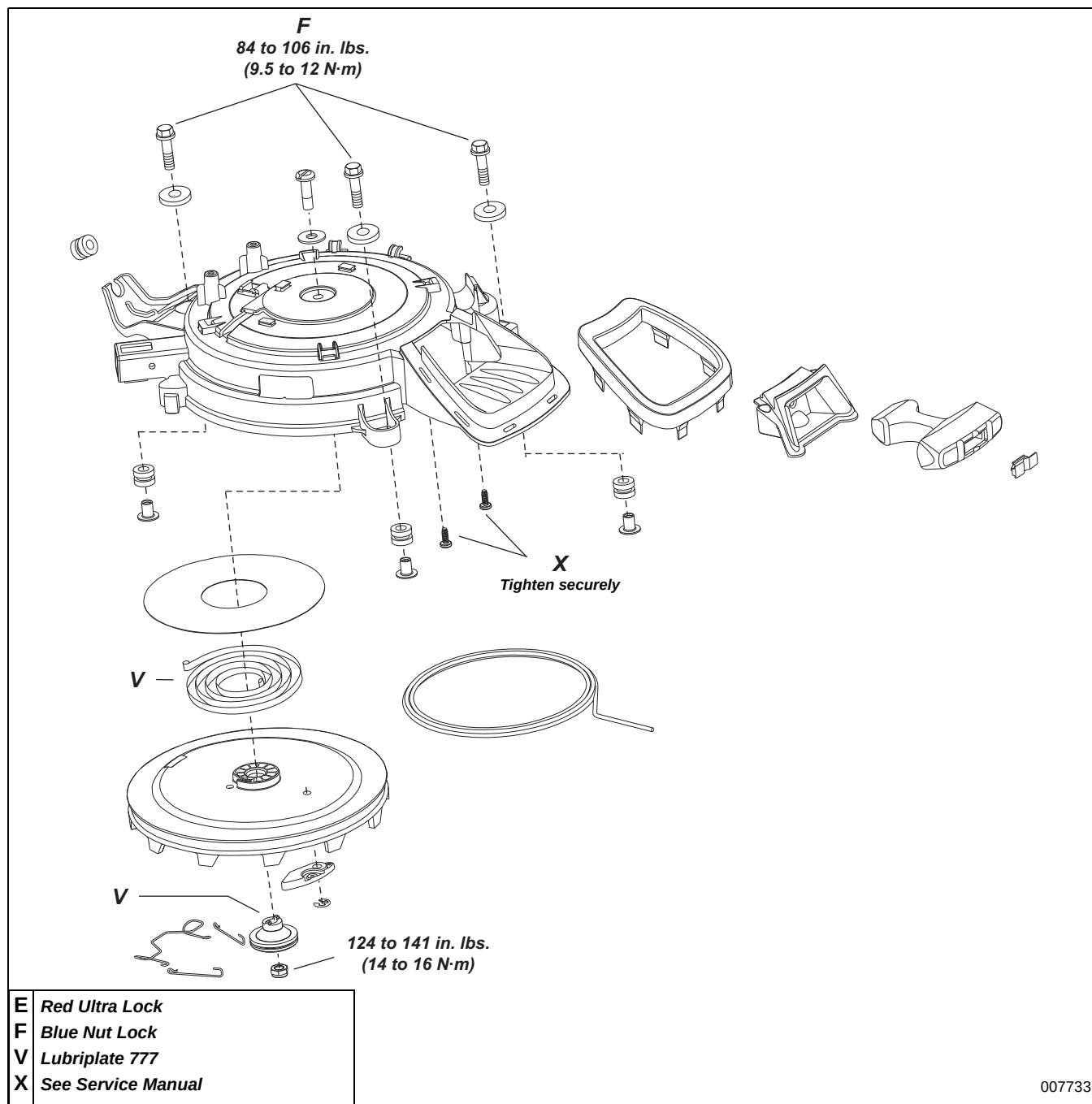
During break-in period of a reassembled gearcase, change the gearcase lubricant between 10 to 20 hours of operation.

Manual Starter

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Recoil Starter Removal	255
Recoil Starter Installation	256
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Recoil Starter Assembly	260

Service Chart

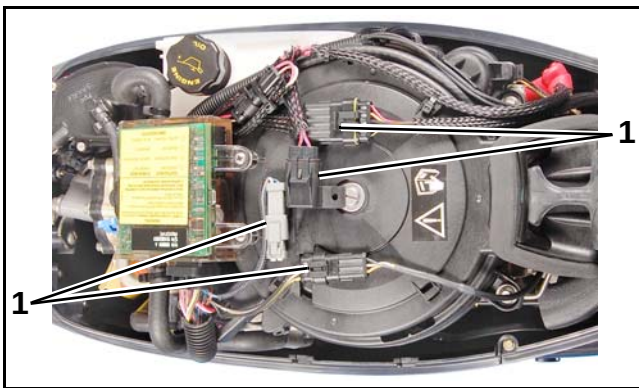


Recoil Starter Removal

⚠ WARNING

To prevent accidental starting while servicing, disconnect the Crankshaft Position Sensor (CPS).

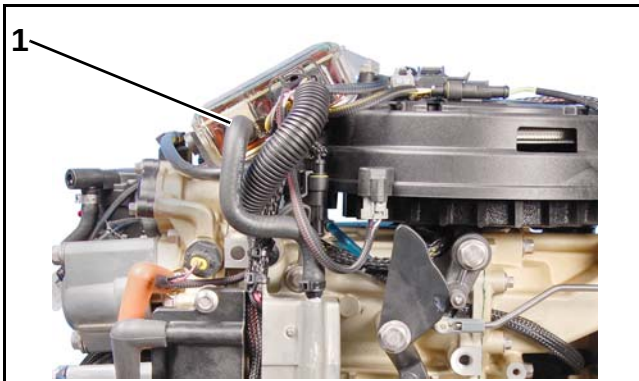
Remove all electrical connectors from the recoil starter housing.



1. Electrical connectors

007241

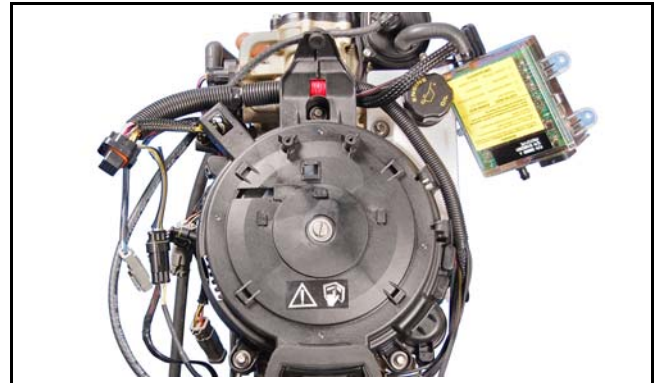
Remove cooling hose from the *EMM*.



1. Cooling hose

007222

Remove two *EMM* mounting screws and move the *EMM* to the side.



007223

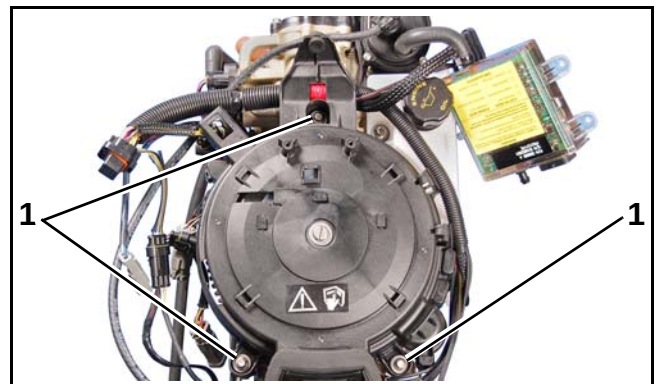
Remove the vapor separator vent hose and wiring from the retainers on the recoil starter housing.



1. Vapor separator vent hose
2. Wiring

007220

Remove three recoil starter mounting screws. Remove recoil starter assembly.

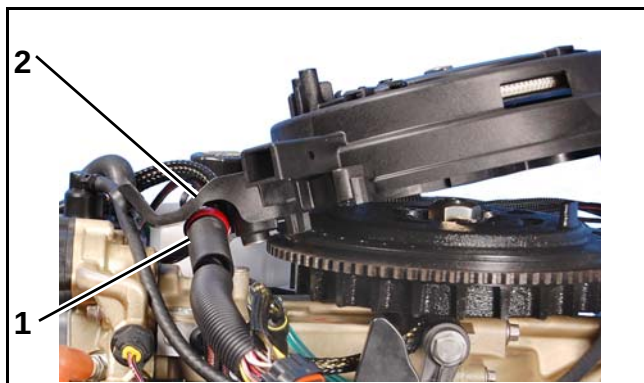


1. Screws

007223

Recoil Starter Installation

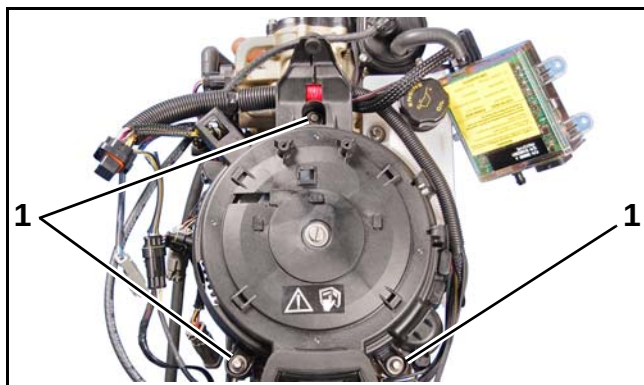
Position the wiring in the retaining bracket of recoil starter housing.



1. Wiring
2. Retaining bracket

007227

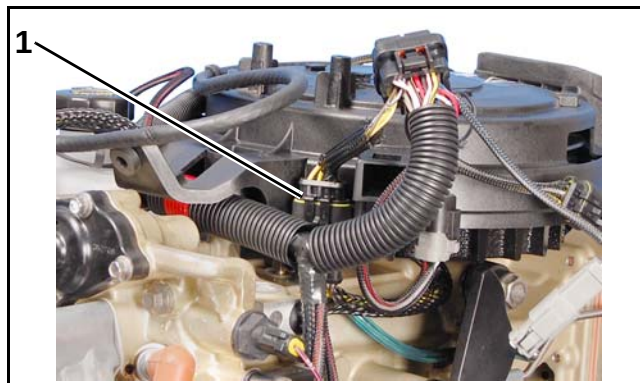
Install recoil starter assembly. Tighten mounting screws to a torque of 31 to 48 in. lbs. (3.5 to 5.5 N·m).



1. Screws

007223

Install stator connector in retainer groove of starter housing.



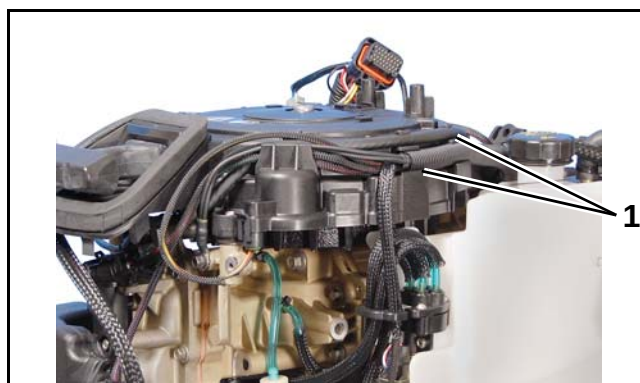
1. Stator connector

007229

NOTICE

To prevent damage to wiring from rotating flywheel, make sure stator connector is securely fastened to the starter housing.

Position the vapor separator vent hose and wiring in the retainers on the recoil starter housing as shown.

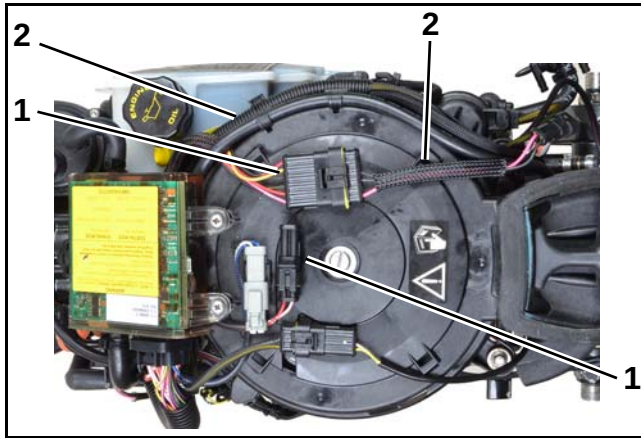


1. Retainers

007230

Position the electrical connectors and wiring harnesses as shown.

Attach remaining connectors to retainers on recoil housing as shown.

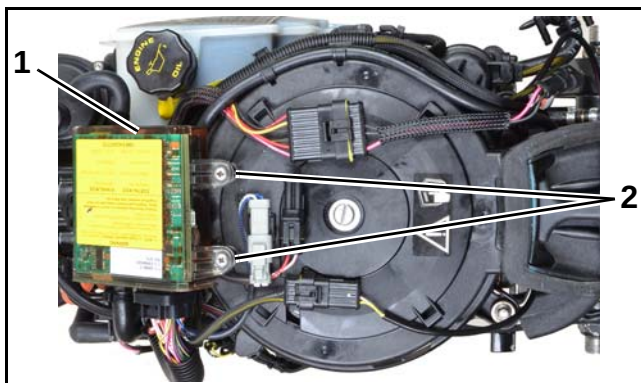


1. Electrical connectors
2. Wire harnesses

008931A

Position the *EMM* on the starter housing. Install and tighten self-tapping screws carefully.

IMPORTANT: Turn self-tapping screws counter clock-wise to start the threads and clockwise to tighten. Failure to follow this procedure can damage the threads of the housing.



1. EMM
2. Self-tapping screws

008931A

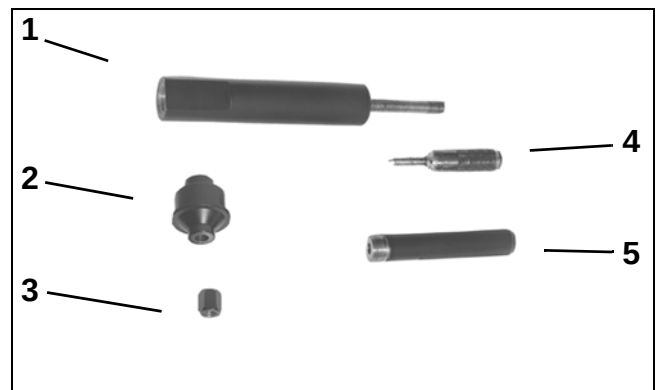
Connect the cooling hose to the *EMM*. Secure with tie strap.

Recoil Starter Disassembly

⚠ WARNING

Wear safety glasses while disassembling and assembling manual starters because of rewind spring tension.

Use Starter Spring Winder and Installer, P/N 342682, to service the recoil starter assembly.



1. Base
2. Retainer
3. Left-hand threaded nut
4. Stop tool
5. Handle

50068A

Pull the starter rope out completely. Retain pulley in position by placing the stop tool from Starter Spring Winder and Installer, P/N 342682 through the hole in the pulley.



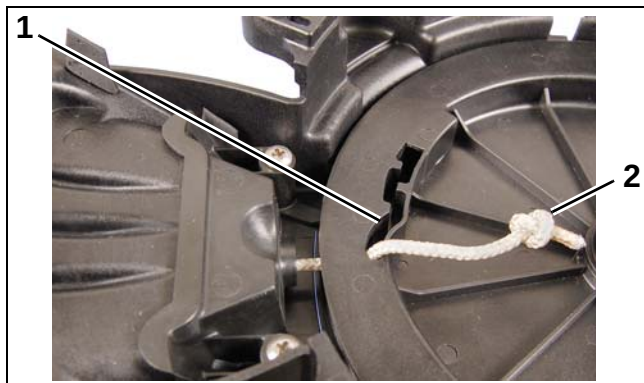
1. Stop tool

007708

Manual Starter

Recoil Starter Disassembly

Remove rope from pulley rope channel and untie knot. Remove rope from starter assembly.



1. Rope channel
2. Knot

007709

Remove stop tool and slowly unwind pulley until tension is released from spring.



007710

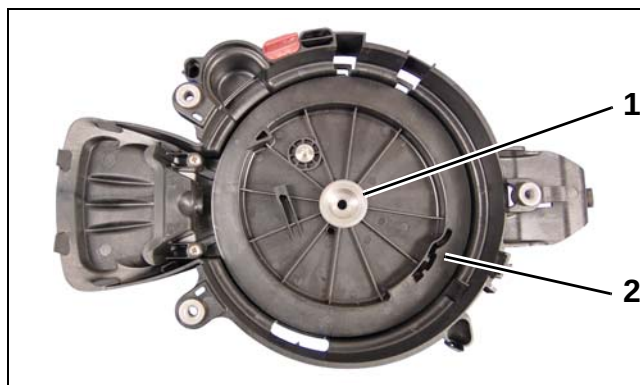
Remove starter spindle screw and lock nut.



1. Lock nut

007711

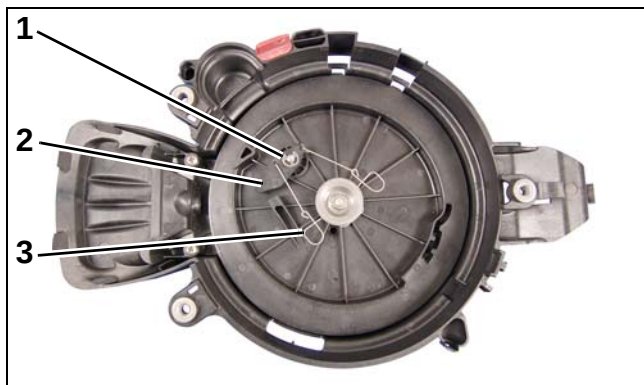
IMPORTANT: Hold pulley down in housing and lift out spindle. Carefully lift out the pulley, LEAVE the spring in the housing.



1. Spindle
2. Pulley

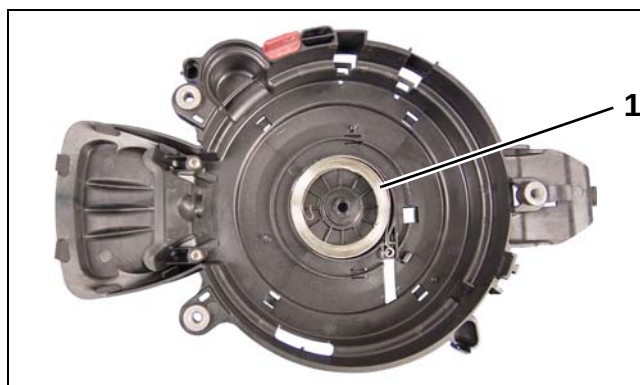
007712

Remove retaining ring, pawl and linkage.



1. Retaining ring
2. Pawl
3. Linkage

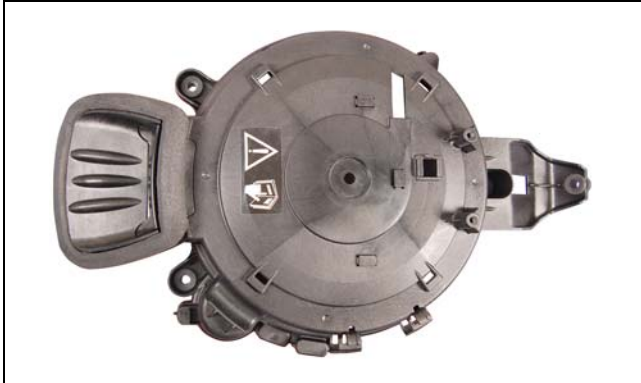
007710



1. Spring

007713

Turn housing over and tap on bench to remove spring.



007714

⚠ WARNING

Keep fingers away from uncoiling spring.
Do NOT remove spring with housing facing up. Do NOT lift spring out of housing by hand or with pliers.
Spring is under tension and will cause injury if accidentally released.

Remove two screws. Remove the rope guide.



1. Screws

007715

Recoil Starter Cleaning and Inspection

Wash metal components in solvent and dry with compressed air.

Inspect the rewind spring for broken end loops and weak tension.

Examine the starter pawl for wear.

Inspect the starter components for wear. Replace as necessary.

Inspect starter rope. Replace rope if frayed. Cut new rope 80 in. (203 cm) in length. Fuse ends of rope to a length of 1/2 in. (12 mm).

Examine the pulley and the starter housing. Look for sharp edges and rough surfaces that could fray the starter rope. File and polish to remove.

Examine the starter. Replace any worn or damaged parts.

Recoil Starter Assembly

⚠ WARNING

Wear safety glasses while disassembling and assembling manual starters because of rewind spring tension.

If removed, install the rope guide to the starter housing. Tighten screws securely.



1. Rope guide

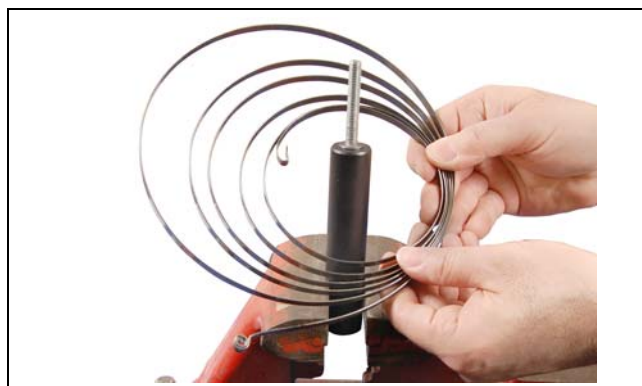
007715

Apply *Moly Lube* to both sides of pulley spring shield. Place shield on pulley as shown.



007718

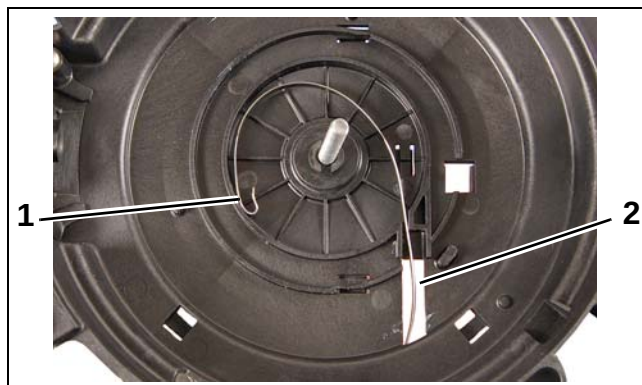
Clamp base of Starter Spring Winder and Installer, P/N 342682, in a vise. Place spring around base as shown.



007716

Place starter housing over base.

Route the hook end of spring through the starter housing opening as shown. To keep spring in position, hold up on portion of spring that is outside of the housing.



1. Spring hook end
2. Opening

007717

Place pulley over base and place retainer over pulley. Be sure tapered end of retainer is toward

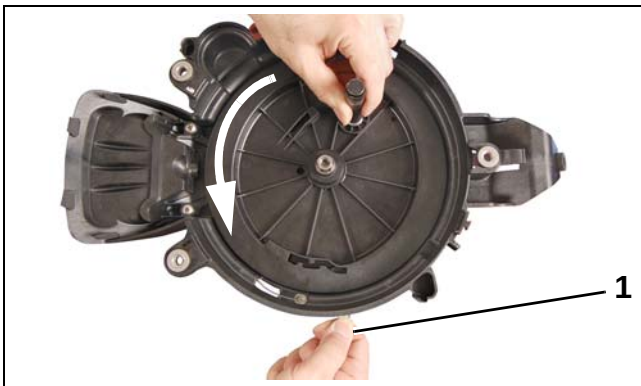
pulley. Secure retainer with left-hand threaded nut.



1. Retainer tapered end

007719

Install handle on pulley pin. Pull lightly on spring and turn pulley counterclockwise with handle until hook end of spring engages the pulley.



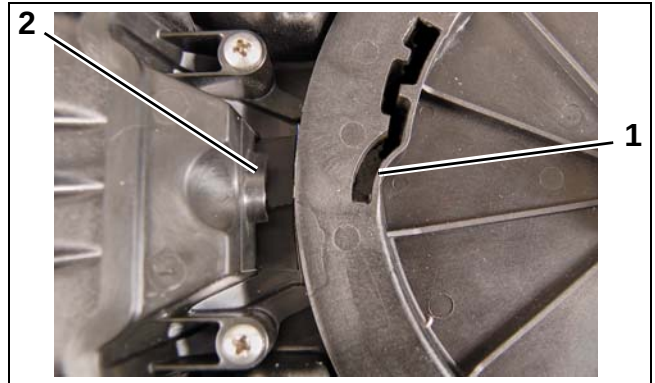
1. Pull on spring

007720

Turn pulley counterclockwise until spring is completely pulled into housing.

Allow pulley to slowly unwind until tension is relieved.

Turn pulley counterclockwise 3.5 turns, until the pulley rope channel aligns with the rope guide.



1. Rope channel
2. Rope guide

007734

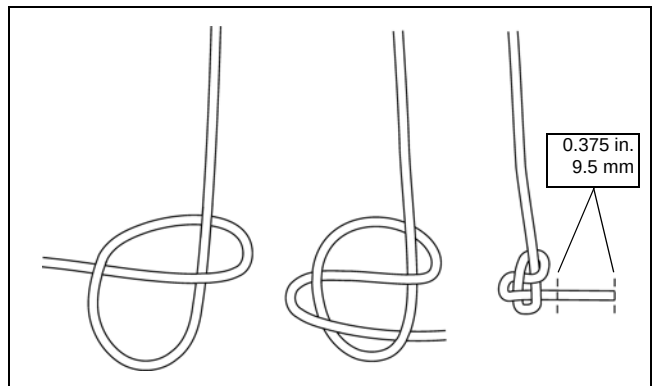
Secure pulley by placing stop tool through the holes in the pulley and housing.



1. Stop tool

007721

If replacing rope, pull new rope through handle. Tie a knot as shown.

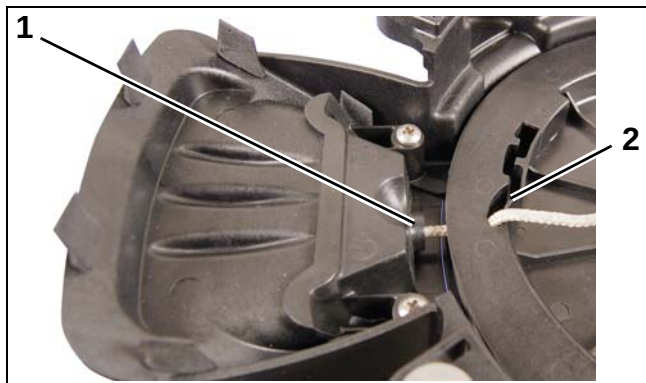


Handle Knot Detail

007722

Manual Starter Recoil Starter Assembly

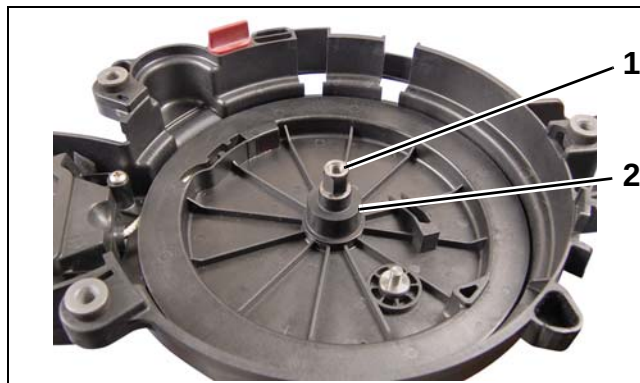
Route rope through the rope guide and into the pulley rope channel.



1. Rope guide
2. Rope channel

007723

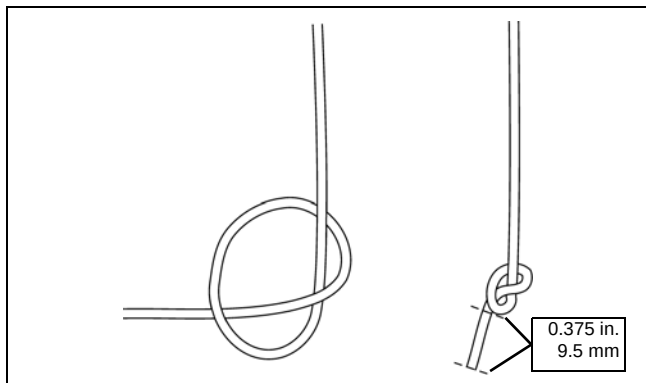
Remove left-hand threaded nut and retainer from tool base. Remove starter assembly.



1. Left-hand threaded nut
2. Retainer

007727

Tie a knot in the end of the rope as shown.



Pulley Knot Detail

007724

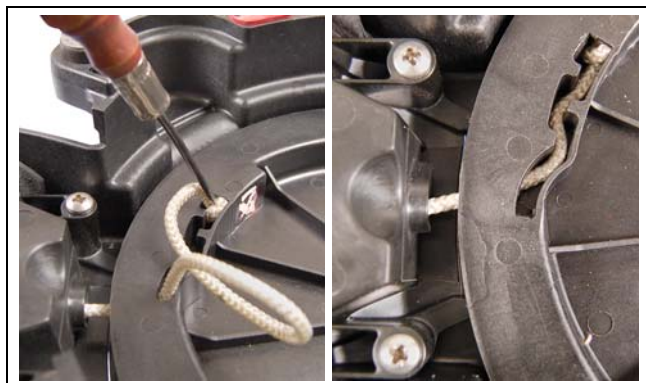
Install spindle, screw and lock nut. Tighten nut to a torque of 124 to 141 in. lbs. (14 to 16 N·m).



1. Lock nut

007711

Use an appropriate tool to place the knot in the channel.



007725
007726

Install pawl, linkage and retaining ring.



1. Retaining ring

007710

Pull rope taut and remove stop tool. Allow rope to slowly wind into starter.

Trouble Check Chart

Outboard Will Not Start

OBSERVATION	POSSIBLE CAUSE	PROCEDURE
Outboard does not turn over	Seized powerhead or gearcase	Check and repair as needed
Outboard turns slowly	Powerhead hydro-locked	Check cylinders for water
	Partially seized powerhead or gearcase	Check and repair as needed

Outboard Will Not Start

OBSERVATION	POSSIBLE CAUSE	PROCEDURE
Outboard turns over	Stop circuit grounded	Check wiring and engine cut-off switch. Check the tether cord is installed and stop circuit is not grounded.
	In gear	Make sure outboard is in neutral
	No fuel	Check for fuel in fuel tank
	Water in fuel	Check fuel filter, sample fuel from fuel return manifold.
	Contaminated or poor fuel quality	Check or replace fuel supply
	Fuel supply restricted	Check primer, anti-siphon valve, and fuel pick-up. Use primer to fill vapor separator with fuel.
	Air in fuel system	Check for air in fuel supply manifold, refer to FUEL SYSTEM (vapor separator venting and fuel supply)
	Low or no fuel pressure to injectors	Check fuel manifold pressure, refer to FUEL SYSTEM
	Incorrect, fouled, or worn spark plugs	Replace spark plugs
	Fuel injectors not working	Check voltage at injectors
	Excessive fuel or oil, engine flooded	Check for leaking injectors, leaking fuel or oil lift pump, or leaking vapor separator vent, refer to FUEL SYSTEM
	Low or no 55 V alternator output	Check voltage on 55 V circuit, refer to SYSTEM ANALYSIS and ELECTRICAL AND IGNITION
	Capacitor or 55 V circuit wiring	Check capacitor and 55 V circuits, refer to SYSTEM ANALYSIS
	Ignition	Check ignition, refer to SYSTEM ANALYSIS
	CPS input to <i>EMM</i> , no sync	Check RPM reading while cranking
	No ignition system primary voltage output from <i>EMM</i> to ignition coils	Check cranking RPM (300 minimum), refer to SYSTEM ANALYSIS
	Water in engine	Check condition of spark plugs and cylinders
	Internal powerhead damage	Check and repair as needed
	Leaking cylinder/crankcase, intake manifold, or reed valves	Check and repair as needed
	<i>EMM</i> program, timing, or operation	Check <i>EMM</i> program and timing; check injector information (by location and serial number)
	Neutral switch, tiller models	Check neutral switch operation

Outboard Hard To Start

OBSERVATION	POSSIBLE CAUSE	PROCEDURE
Outboard eventually starts, may or may not run properly once started	Water in fuel system	Check water separator/fuel filter, sample fuel from fuel return manifold test port
	Contaminated or poor fuel quality	Check or replace fuel supply
	Air in fuel system	Check for air in fuel supply manifold, refer to FUEL SYSTEM (vapor separator venting and fuel supply)
	Incorrect, fouled, or worn spark plugs	Replace spark plugs
	Low fuel pressure	Check pressure, refer to FUEL SYSTEM
	Fuel supply restricted	Check primer bulb, anti-siphon valve, and fuel pick-up, check for fuel system air leaks
	Low or no alternator output (55 V)	Check voltage on 55 V circuit, refer to SYSTEM ANALYSIS and ELECTRICAL AND IGNITION
	Capacitor or 55 V circuit wiring	Check capacitor and 55 V circuit (white/red), refer to SYSTEM ANALYSIS
	Restricted or leaking fuel injector(s)	Check injectors, refer to FUEL SYSTEM
	Weak or erratic ignition operation	Check ignition, refer to SYSTEM ANALYSIS
	Crankshaft Position Sensor (CPS)	Check CPS air gap and <i>EMM</i> LED indicators
	Excessive fuel or oil, engine flooding	Check for leaking injectors, leaking fuel or oil lift pump, or leaking vapor separator vent. Refer to FUEL SYSTEM .
	<i>EMM</i> program, timing, or operation	Check <i>EMM</i> program and timing; check injector coefficients; and monitor injector circuits and ignition primary outputs
	Internal powerhead damage	Check and repair as needed
	Low compression	Check compression, refer to POWERHEAD
	Leaking cylinder/crankcase, intake manifold, or reed valves	Check and repair as needed

Outboard Will Not Shut Off

OBSERVATION	POSSIBLE CAUSE	PROCEDURE
Outboard starts and runs, normal performance while running	Stop circuit wiring	Check <i>EMM</i> LED indicators. Check wire harness (black/yellow) and stop switch(s).
	<i>EMM</i> failure	Check <i>EMM</i> LED indicators and eliminate stop circuit as possible cause. Stop wire (black/yellow) has 4.0 VDC from <i>EMM</i> with key on or outboard running.

Outboard Starts And Stalls

OBSERVATION	POSSIBLE CAUSE	PROCEDURE
Outboard may not run for more than a few seconds	Faulty wiring, connections, or grounds	Check all grounds, connections, and wiring
	Incorrect, fouled, or worn spark plugs	Replace spark plugs
	Low or no alternator output (55 V)	Check voltage on 55 V circuits, refer to SYSTEM ANALYSIS and ELECTRICAL AND IGNITION
	Capacitor or 55 V circuit wiring	Check capacitor and 55 V circuit, refer to SYSTEM ANALYSIS
	Contaminated or poor fuel quality	Check or replace fuel supply
	Low fuel pressure	Check pressure, refer to FUEL SYSTEM
	Air in fuel system	Check for air in fuel supply manifold, refer to FUEL SYSTEM (vapor separator venting and fuel supply)
	Fuel supply restricted	Check primer bulb, anti-siphon valve, and fuel pick-up, check for fuel system air leaks
	Injector electrical circuit or control function	Check voltage at injectors, refer to SYSTEM ANALYSIS
	Restricted or leaking fuel injector(s)	Check injectors, refer to FUEL SYSTEM
	<i>EMM</i> program, timing, or operation	Check <i>EMM</i> program and timing; check injector coefficients; and monitor injector control wires and ignition primary outputs
	Weak or erratic ignition output	Check ignition, refer to SYSTEM ANALYSIS
	Internal powerhead damage	Check and repair as needed

Outboard Starts, Low Maximum Rpm

OBSERVATION	POSSIBLE CAUSE	PROCEDURE
Setup or rigging change	Incorrect propeller	Refer to specifications, check recommended WOT RPM; water test and install correct pitch propeller
	Incorrect outboard mounting height	Refer to INSTALLATION AND PREDELIVERY
Performance of outboard at lower speeds appears normal	Incorrect, fouled, or worn spark plugs	Replace spark plugs
	Contaminated or poor quality fuel	Check or replace fuel supply
	Fuel supply restricted	Check primer bulb, anti-siphon valve, and fuel pick-up, check for fuel system air leaks
	Low alternator output (55 V)	Check voltage on 55 V circuits, refer to SYSTEM ANALYSIS and ELECTRICAL AND IGNITION
	Weak or erratic ignition operation	Check ignition, refer to SYSTEM ANALYSIS
	Fuel injector electrical circuit or control function	Check voltage at injectors, refer to FUEL SYSTEM
	Restricted or leaking fuel injectors	Check injectors, refer to FUEL SYSTEM
	Low fuel pressure	Check circulation pump operation, refer to FUEL SYSTEM
	EMM programming, timing, or operation	Check EMM program and timing; check injector coefficients; and monitor injector circuits and ignition primary outputs
	Restricted engine exhaust	Check and repair as needed

Excessive Smoking

OBSERVATION	POSSIBLE CAUSE	PROCEDURE
May coincide with increased oil consumption (normal if occurs after winterization)	Contaminated or poor fuel quality	Check or replace fuel supply
	Excessive fuel or oil consumption	Check fuel system for fuel supply air leaks or leaking fuel injectors
	Outboard in break-in mode	Use diagnostics program to check
	Outboard mounted too low	Check installation height of outboard
	Vapor separator vent	Check vapor separator assembly for proper venting/float valve operation
	Faulty/leaking fuel injector(s)	Check injectors, refer to FUEL SYSTEM
	Damaged fuel lift pump	Check for internal leaks

Outboard Surges, Runs Rough

OBSERVATION	POSSIBLE CAUSE	PROCEDURE
1200 RPM and above	Incorrect, fouled, or worn spark plugs	Replace spark plugs
May be erratic or inconsistent	Water in fuel system	Check water separator/fuel filter, sample fuel from fuel return manifold test port
	Contaminated or poor fuel quality	Check and replace fuel supply
	Low or erratic fuel pressure	Check pressure, refer to FUEL SYSTEM
	Air in fuel system	Check for air in fuel supply manifold, refer to FUEL SYSTEM (vapor separator venting and fuel supply)
	Fuel supply restricted	Check primer bulb, anti-siphon valve, and fuel pick-up, check for fuel system air leaks
	Restricted or leaking fuel injector(s)	Check injectors, refer to FUEL SYSTEM
	Faulty wiring, connections, grounds, or CPS air gap	Check all grounds, connections, and wiring. Check CPS air gap.
	Low alternator output (55 V)	Check voltage on 55 V circuit, refer to SYSTEM ANALYSIS and ELECTRICAL AND IGNITION
	<i>EMM</i> program, timing, or operation	Check <i>EMM</i> program and timing; check injector coefficients; and monitor injector circuits and ignition primary outputs
	Weak or erratic ignition operation	Check ignition, refer to SYSTEM ANALYSIS
	Capacitor or 55 V circuit wiring	Check capacitor and 55 V circuit (white/red), refer to SYSTEM ANALYSIS
	Restricted engine exhaust	Check and repair as needed
Audible noise	Internal powerhead damage	Check and repair as needed
	Damaged gearcase	Inspect gearcase and lubricate

Service Parts

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About This Catalog

BRP US Inc. reserves the right to make changes at any time, without notice, to features, specifications, and model availability. The right is also reserved to change any specification or part, at any time, without incurring any obligation to update older models. The information in this catalog is based on the latest specifications available at the time of publication.

The most up to date service part number information is available online.

Visit the Electronic Parts Catalog (EPC) on one of the following web sites:

- **BOSSWeb™** (<https://bossweb.brp.com>) – access requires a valid government agency account or a valid dealer account
- **Evinrude** e-commerce site (www.shop.evinrude.com) – available to the public

Illustrations used in this catalog may not depict actual models or equipment, but are intended as representative views for reference only. Certain features, equipment or accessories shown in this catalog might not be found on or included with all models in all marketing areas.

IMPORTANT: This catalog is a part reference. Use the appropriate Service Manual for service and maintenance information. Use the engine model number, including any suffix letter, when identifying parts in this catalog.

Parts List Reference

Following Example for Reference Only					
Ref	P/N	Name of Part	Qty	Note	
	1	0584348 BATTERY CABLE, 10ft. (3.0M)	1	DP, DS models only	d
a	2	0351839 SCREW, Starter to crankcase	1	New	e
	3	0586774 STARTER SOLENOID ASSEMBLY	1	Included on DR, DE & DP models	
b	4	0586101 *DRIVE KIT	1		
	5	– **GROMMET, Starter solenoid mount	2	Optional	f
c	NS	0320107 TIE STRAP, Cable	2		

a	“*” Indicates parts are included in the preceding assembly. EXAMPLE SHOWN: (Ref #3), P/N 586774 includes (Ref #4) P/N 586101 “DRIVE KIT” and (Ref #5) – “GROMMET.” Also, (Ref #4) P/N 586101 includes (Ref #5) – “GROMMET.”
b	A “–” Indicates the part is not available or not sold individually.
c	“NS” Indicates part is Not Shown in the illustration.
d	Note indicates additional part information.
e	“New” Indicates part and/or part number has been added or changed from previous model year.
f	“Optional” Indicates part is an OPTIONAL or ACCESSORY part.

⚠ WARNING

When replacement parts are required, use **Evinrude Genuine Parts** or parts with equivalent characteristics, including type, strength, and material. Using substandard parts could result in injury or product malfunction.

Publications

P/N	Name of Part	Note
0216331	Operator's Guide 30 MFE – English	
5009840	Service Manual 30 MFE – English	Not included in Service Manual Set
5009841	Service Manual 30 MFE – French	Not included in Service Manual Set

30 HP MFE Multi-Fuel Engine, 2-Cylinder, In-line, .57 L, (35.1 cu.in.)							
Model	Gearcase	Gear Ratio	Shaft Length	Color	Tilt	Steering	Starting
E30MALAFA	H-Type	13:28 / 0.465 / 2.15:1	20 in.	Black	Manual	Tiller	Rope
E30MRLAFA	H-Type	13:28 / 0.465 / 2.15:1	20 in.	Black	Manual	Tiller	Rope
B30MRLAFA	H-Type	13:28 / 0.465 / 2.15:1	20 in.	Black	Manual	Tiller	Rope

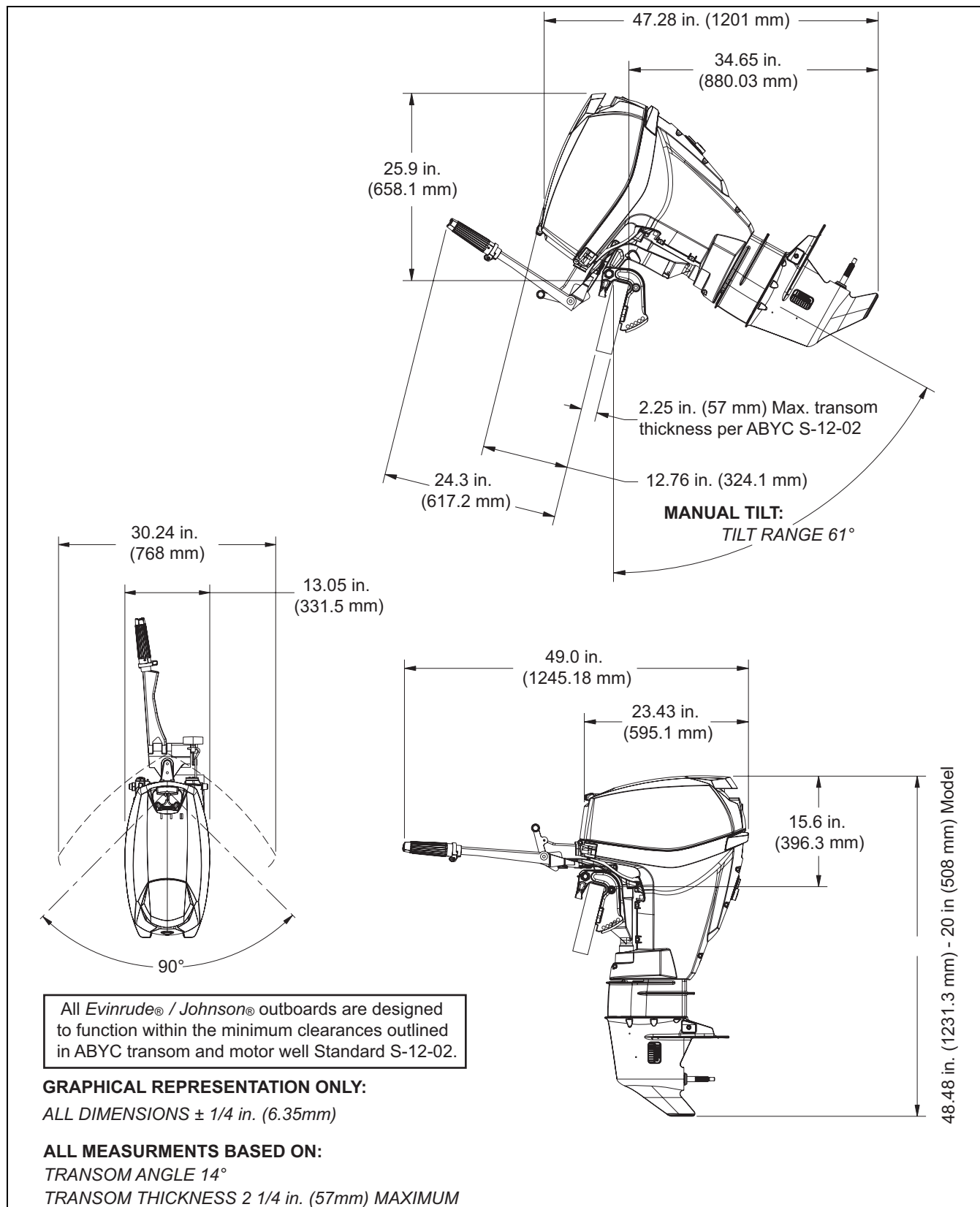
Parts Shipped with Engine “In Box”

P/N	Name of Part	Qty	Note
–	NOTE: This list includes only items packaged with the engine at the factory.		
0216331	OPERATOR'S GUIDE - ENGLISH	1	30 MFE
0355625	OIL PROGRAM TAG, XD 100 oil	1	All Models
0354709	DECAL, Blank	2	Use to seal starboard lower engine cover
0320107	TIE STRAP, Harness to lower cover	2	
5008612	FUEL HOSE & PRIMER BULB	1	30MRL models
5008612	FUEL HOSE & PRIMER BULB	2	30MAL models only
5008621	FUEL TANK	1	
5008624	*FUEL CAP ASSEMBLY	1	
0355977	**GASKET	1	
–			
0765049	PROPELLER, Aluminum, 3 x 10.5 in. x 11 P	1	Installed on engine, all models
0765048	PROPELLER, Aluminum, 3 x 11 in. x 9 P	1	Spare, in box, 30MRL models only
0175268	PROPELLER HARDWARE KIT	1	All Models
0335420	BUSHING, THRUST	1	All Models
–			
–	TRANSOM MOUNTING HARDWARE		
0309543	WASHER	2	
0310702	NUT, LOCK	2	
0334427	SCREW	2	
0315776	WASHER	2	

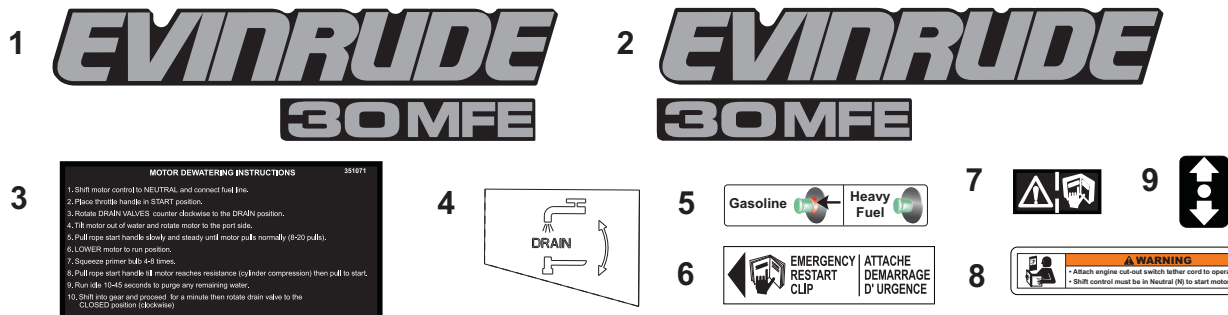
Paint

P/N	Paint Color	Note
0777172	PRIMER	Use: Midsection & Gearcase
–	PRIMER (Gray)	Use: White engines. PPG Paint Code: W42650 / Catalyst: W29741
–	PRIMER (Black)	Use: Blue engines PPG Paint Code: SEP61993 / Catalyst: W29585
0777179	BLACK (Gloss)	Use: Engine cylinder/crankcase PPG Paint Code: W28610 / Catalyst: W28792
0351066	BLACK (Military)	Use: Exhaust Housing, & Gearcase PPG Paint Code: W43653 / Catalyst: W26790
–	BLACK (Military)	Use: Plastic Engine Covers BASF Paint Code: 33232 / Catalyst: -
0777171	WHITE	Use: Base coat PPG Paint Code: W28502 / Catalyst: W45315
0772414	CLEARCOAT	Use: Base coat on upper & lower engine covers. PPG Paint Code: W29461 / Catalyst: W26790
0351907	BLUE (Evinrude E-TEC)	Use: Base coat PPG Paint Code: SAC61243 / Catalyst: W45315
–	SILVER (Full Moon)	Use: Engine cover top cap (H.O. models). PPG Paint Code: - / Catalyst: -
0777177	GRAPHITE	Use: Base coat PPG Paint Code: W29870 / Catalyst: W45315
0351061	GREEN (Military)	Use: Base coat PPG Paint Code: SAC60321 / Catalyst: W45315

Profile Drawing



EPC4736



EPC4736

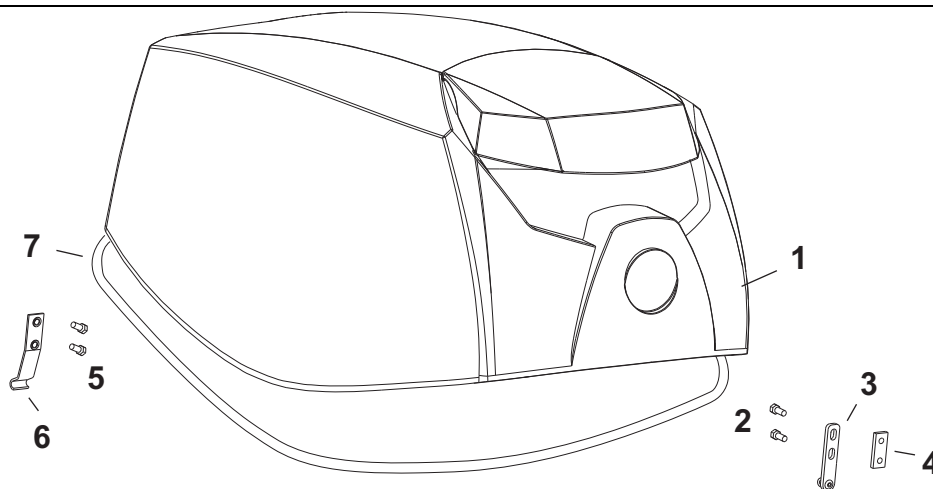
Ref	P/N	Name of Part	Qty	Note
1	*	EVINRUDE 30 MFE - Port, Black	1	Included with "Engine Cover Assembly"
2	*	EVINRUDE 30 MFE - Starboard, Black	1	Included with "Engine Cover Assembly"
3	*	DECAL, De-water instructions	1	Included with "Engine Cover Assembly"
4	*	DECAL, De-water valve	1	Included with "Engine Cover Assembly"
5	0352948	DECAL, Fuel selector switch	1	
6	0335299	DECAL, Restart clip		
7	0355633	DECAL, Owner Attention	1	
8	0355620	DECAL, Start warning		
9	0333979	DECAL, Gear shift	1	

* Note: These items not sold separately, available only with Engine Cover Assembly

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Engine Cover

EPC4357

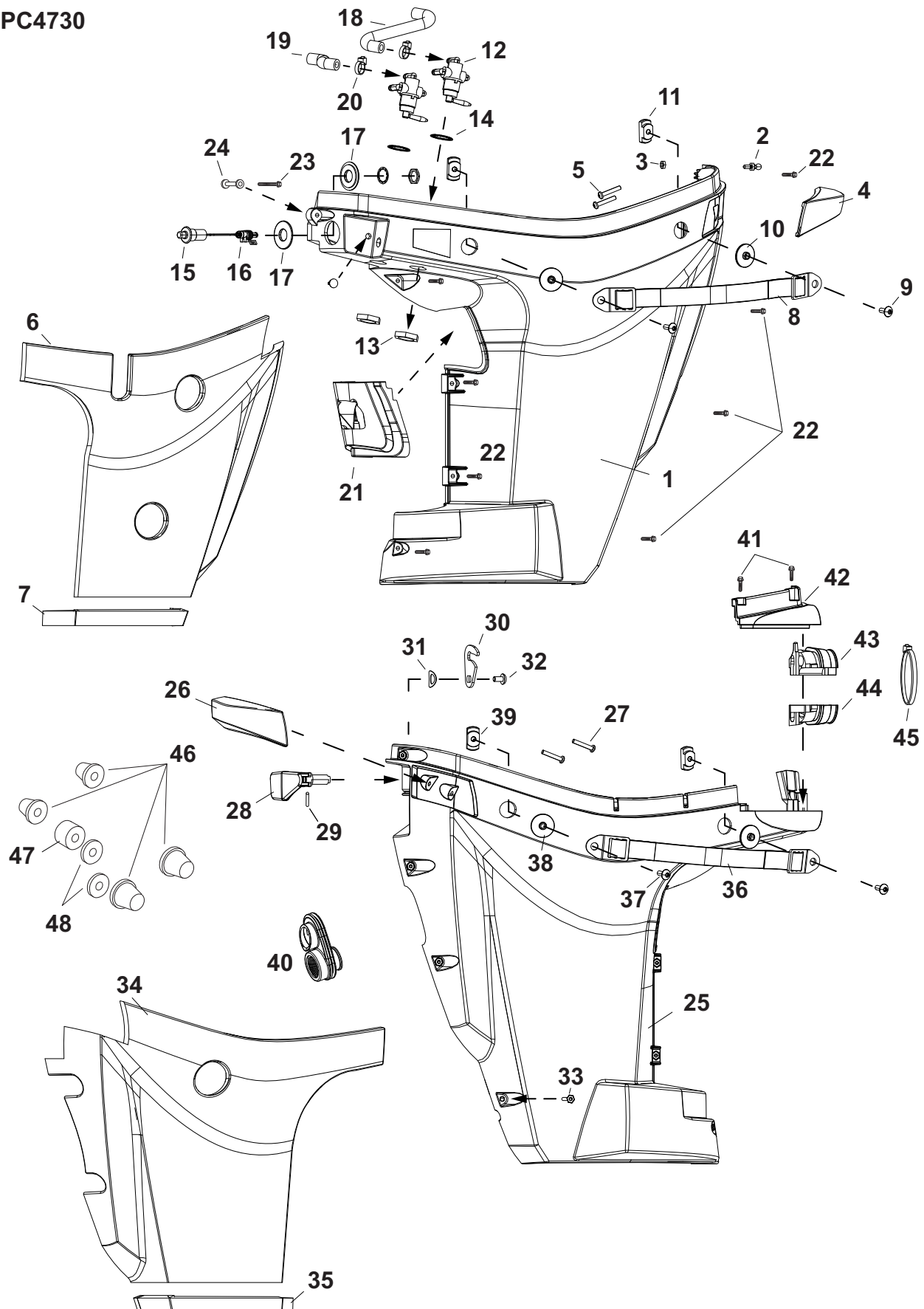


EPC4357

Ref	P/N	Name of Part	Qty	Note
1	0285800	ENGINE COVER, Black	1	Includes decals
2	0328744	*SCREW, Rear latch	2	
3	0353376	*HOOK, Latch-Rear	1	
4	0353948	*BRACKET, Latch	1	
5	0353940	*SCREW, Front latch	2	
6	5005886	*HOOK ASSEMBLY	1	
7	0354402	*SEAL	1	
NS	0353937	*INSULATION, Sound port	1	
NS	0353938	*INSULATION, Sound starboard	1	
NS	0353939	*INSULATION, Sound top	1	
NS	0323229	*SCREW, Cap to upper cover	5	
NS	0343245	*SCREW, Baffle to cover	5	
NS	0353673	*BAFFLE	1	

Lower Engine Cover

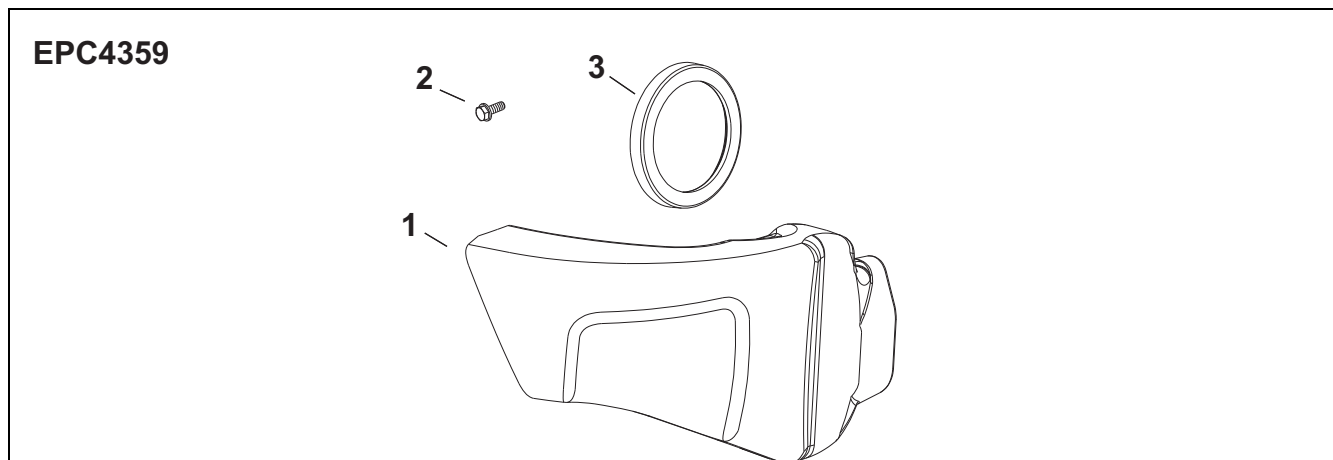
EPC4730



EPC4730

Ref	P/N	Name of Part	Qty	Note
1	5009737	LOWER COVER ASSEMBLY, Port - Black	1	Includes de-water valves & fuel selector switch
2	0339575	*SCREW, Ball joint	1	
3	0309485	*NUT, Ball joint	1	
4	0353671	*BUMPER	1	
5	0337358	*SCREW, Bumper	2	
6	0353088	*INSULATION, Sound-Port center	1	
7	0353808	*INSULATION, Sound-Port lower	1	
8	5009740	*CARRY-STRAP ASSEMBLY	1	
9	0358260	*SCREW, Carry-strap	2	
10	0357790	*WASHER, Carry-strap	2	
11	0357789	*ANCHOR, Carry-strap	2	
12	5009240	*VALVE, De-watering	2	
13	—	**NUT	1	Not sold separately
14	0349889	*WASHER, Retaining	1	
15	5006330	*SWITCH, Fuel selector	1	Includes nut & lock-washer
16	3011153	**CONNECTOR, 2-Position	1	
17	0356833	*SPACER, Fuel selector switch	2	
18	0356291	HOSE, Drain	1	Lower crankcase to dewater valve
19	0356292	HOSE, Drain	1	Water drain cylinder 2
20	0320107	TIE STRAP	3	
21	0353681	SEAL, Steering arm	1	
22	0351152	SCREW, PORT to STARBOARD cover	8	
23	0353986	SCREW, Front latch sleeve	1	
24	0353895	SLEEVE, SCREW, Front latch	1	
25	5009738	LOWER COVER ASSEMBLY, Starboard - Black	1	
26	0353672	*BUMPER	1	
27	0337358	*SCREW, Bumper	2	
28	5005709	*LATCH, Handle and shaft assembly	1	
29	0344630	**PIN, Roll	1	
30	0343578	*HOOK, Latch	1	
31	0330234	*WASHER, Spring	1	
32	0342191	*SCREW, Latch	1	
33	0353002	*INSERT, Nut	9	
34	0353810	*INSULATION, Sound - Starboard center	1	
35	0353813	*INSULATION, Sound - Starboard lower	1	
36	5009740	*CARRY-STRAP ASSEMBLY	1	
37	0358260	*SCREW, Carry-strap	2	
38	0357790	*WASHER, Carry-strap	2	
39	0357789	*ANCHOR, Carry-strap	2	
40	0354162	GROMMET, Muffler to lower motor cover	1	See COOLING HOSES
41	0351152	SCREW, Retainer Cover	2	
42	0356879	RETAINER, COVER, Cable entry - Black	1	
43	0356830	GROMMET, Cable entry, upper	1	
44	0356831	GROMMET, Cable entry, lower	1	
45	0320107	TIE STRAP, Cable entry grommet		
46	0332413	MOUNT, Lower cover	4	
47	0353805	SPACER, Rear mount to block - Starboard	1	
48	0349556	WASHER, Lower cover to crankcase	2	
NS	0354709	DECAL, Blank - tie strap openings	2	

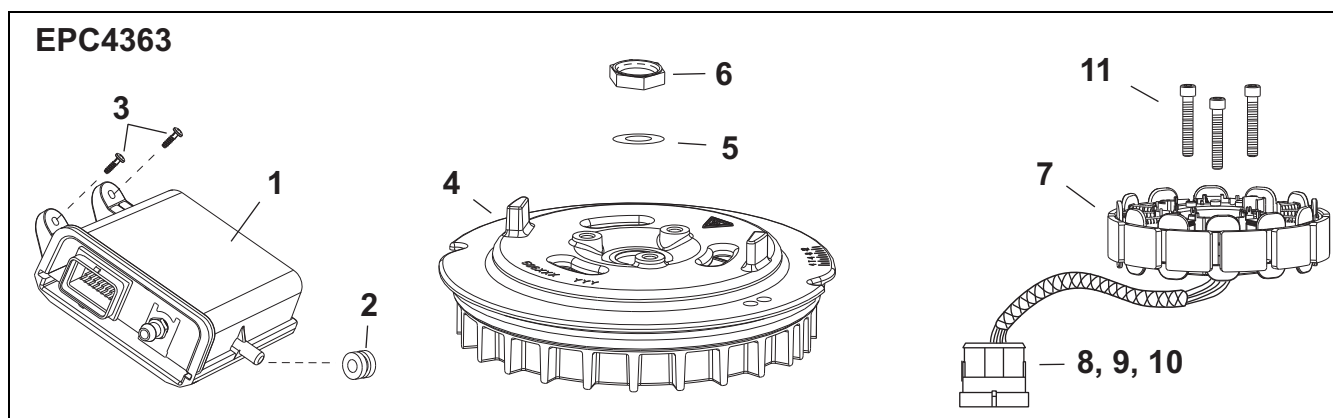
Air Silencer



EPC4359

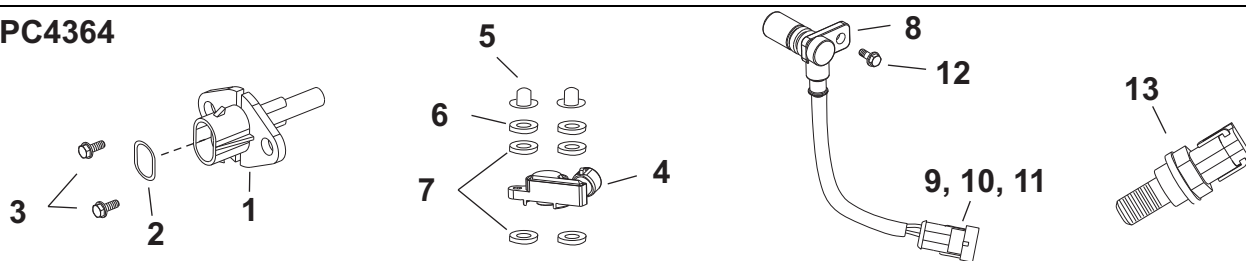
Ref	P/N	Name of Part	Qty	Note
1	5007320	AIR SILENCER ASSEMBLY	1	
2	0353753	SCREW, Air silencer mounting	2	
3	0352208	SEAL, Air silencer to throttle body	1	

EMM, Flywheel & Stator



EPC4363M

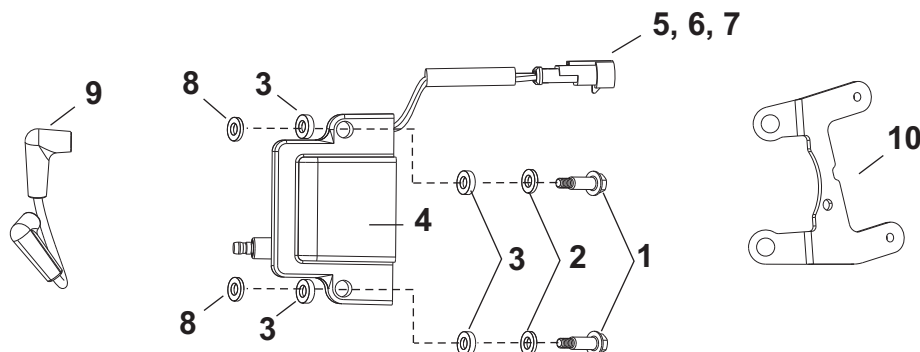
Ref	P/N	Name of Part	Qty	Note
1	0587126	EMM	1	Call Dealer Support Services
2	0333040	ISOLATOR, Mounting, EMM	1	
3	0315656	SCREW, EMM to rope start housing	2	
4	0587103	FLYWHEEL	1	30 MFE, Rope start models
5	0352951	WASHER, Flywheel nut	1	
6	0353602	NUT, Flywheel	1	
7	0587267	STATOR ASSEMBLY	1	
8	3011148	*CONTACT, Tab	4	
9	3011149	*SEAL, Wire	4	
10	3011421	*CONNECTOR, 4 position	1	
11	0350992	SCREW, Stator to Crankcase	3	

EPC4364

EPC4364

Ref	P/N	Name of Part	Qty	Note
1	3010673	SENSOR, Air temperature	1	See "INTAKE MANIFOLD ASSEMBLY"
2	0343585	O-RING	1	
3	0315656	SCREW, Air temperature sensor	2	
4	5006484	SENSOR, Throttle position (TPS)	1	See "INTAKE MANIFOLD ASSEMBLY"
5	0352129	*NUT, TPS push	2	
6	0336197	*WASHER, TPS	2	
7	0352122	*WASHER, TPS Isolation	4	
8	0587014	SENSOR, Crankshaft position (CPS)	1	See "INTAKE MANIFOLD ASSEMBLY"
9	3011148	*CONTACT TAB	1	
10	3011149	*SEAL, Wire	2	
11	3011156	*CONNECTOR, 3 position	1	
12	0353588	SCREW, CPS	1	
13	3010674	ENGINE TEMPERATURE SENSOR	1	See "CYLINDER HEAD"
NS	0317893	TIE STRAP, Air temp sensor leads	1	

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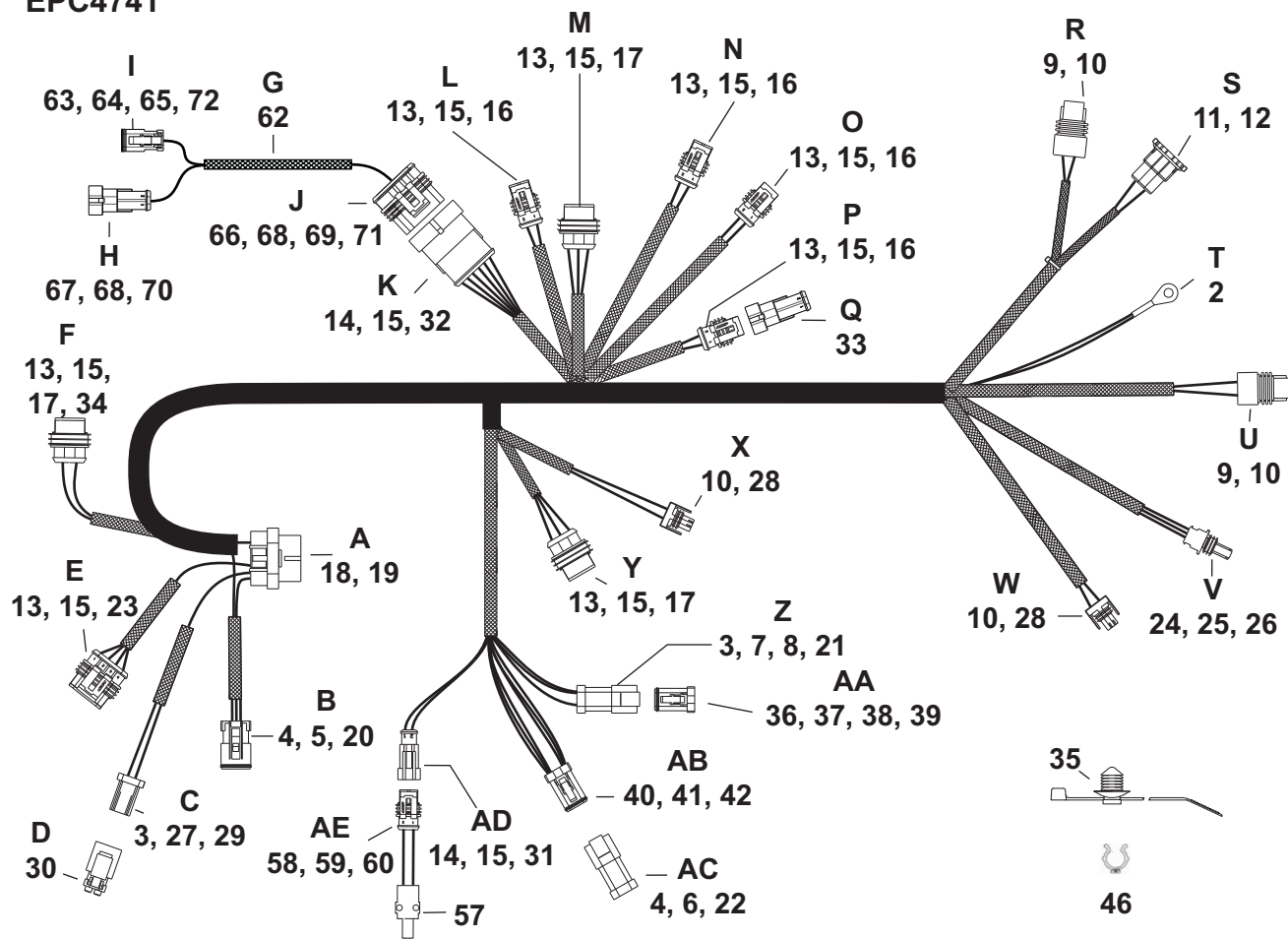
Ignition Coil**EPC4365**

EPC4365

Ref	P/N	Name of Part	Qty	Note
1	0353975	SCREW, Shoulder, Ignition coil	4	
2	0353735	WASHER, Shoulder screw	4	
3	0353540	WASHER, Ignition coil, rubber	8	
4	0587275	IGNITION COIL	2	
5	3011148	*CONTACT, Tab	3	
6	3011149	*SEAL, Wire	3	
7	3011156	*CONNECTOR, 3 Position	1	
8	0353761	WASHER, Ignition coil screw	4	
9	5007988	HIGH TENSION LEAD ASSEMBLY	2	
10	0354435	BRACKET, Lower ignition coil	1	
NS	0320107	TIE STRAP, Connector to bracket	1	
NS	3011292	CLIP, Connector to bracket	1	
NS	5007419	SPARK PLUG (QC10WEP)	2	

Engine Electrical Harness Assembly

EPC4741



Connector Legend

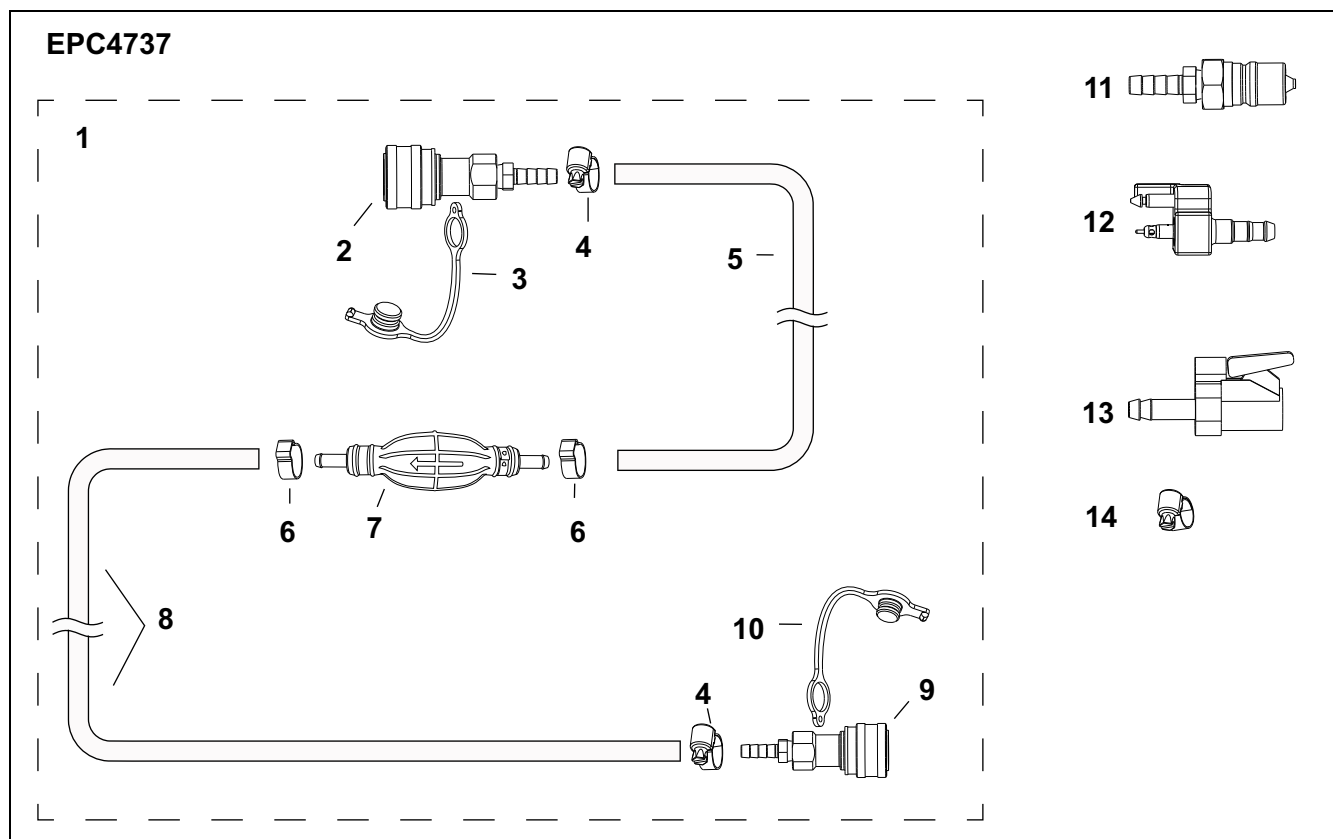
A	EMM CONNECTOR	Q	SEAL ASSEMBLY, Battery charge module
B	DIAGNOSTIC CONNECTOR	R	LOW OIL SWITCH CONNECTOR
C	CANbus CONNECTOR	S	OIL PUMP CONNECTOR
D	SEAL ASSEMBLY, CANbus connector	T	CYLINDER BLOCK GROUND
E	STATOR CONNECTOR	U	STARTER SOLENOID CONNECTOR
F	CRANKSHAFT POSITION SENSOR	V	THROTTLE POSITION SENSOR CONNECTOR
G	TILLER ARM ADAPTER HARNESS	W	AIR TEMPERATURE SENSOR
H	FUEL SELECTOR SWITCH	X	CYLINDER HEAD TEMPERATURE SENSOR
I	STOP SWITCH	Y	IGNITION COIL #1 CONNECTOR
J	ADAPTER HARNESS TO ENGINE HARNESS	Z	SYSTEM CHECK CONNECTOR
K	ENGINE HARNESS TO ADAPTER HARNESS	AA	SEAL ASSEMBLY, SystemCheck CONNECTOR
L	FUEL INJECTOR #1 CONNECTOR	AB	KEY SWITCH CONNECTOR
M	IGNITION COIL #2 CONNECTOR	AC	SEAL ASSEMBLY, Key switch connector
N	FUEL INJECTOR #2 CONNECTOR	AD	NEUTRAL SWITCH CONNECTOR
O	FUEL PUMP CONNECTOR	AE	NEUTRAL SWITCH CONNECTOR
P	BATTERY CHARGE MODULE CONNECTOR		

Engine Electrical Harness Assembly

EPC4741

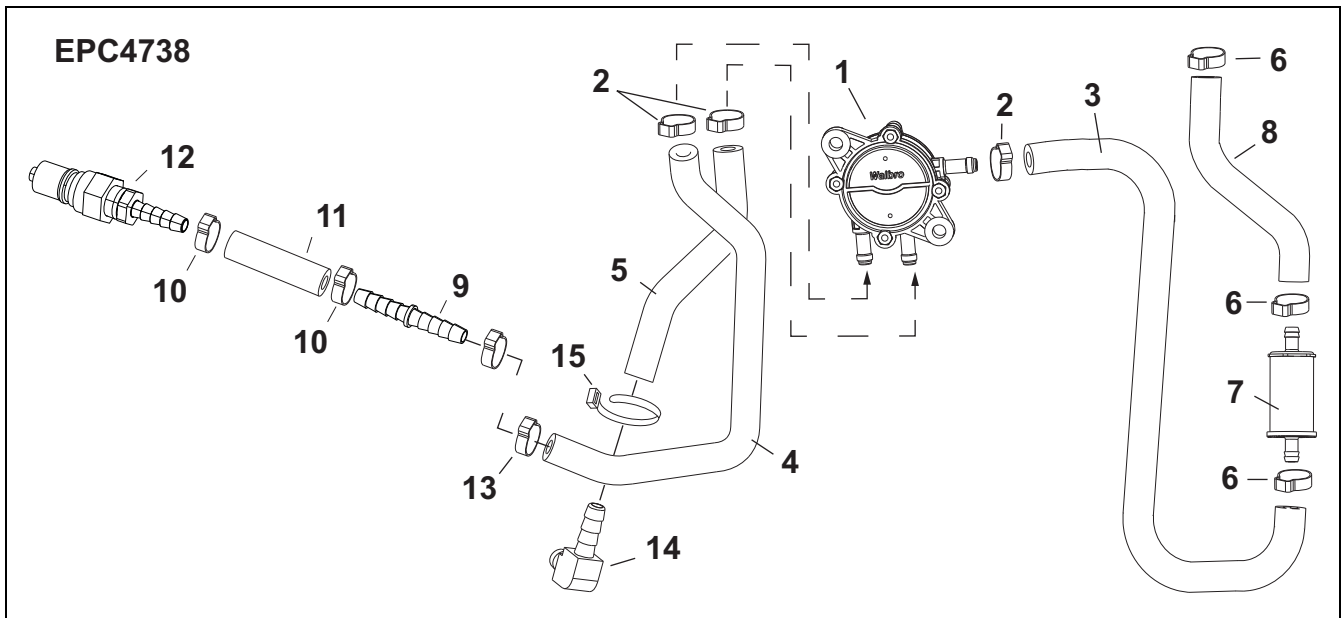
Ref	P/N	Name of Part	Qty	Note
–	0587061	ENGINE HARNESS ASSEMBLY	1	
2	0204363	*TERMINAL, Ring	1	0.250 in. (6,3 mm) diameter
3	0514679	*TERMINAL, Pin	5	
4	0514680	*TERMINAL, Socket	11	
5	0514681	*LOCKWEDGE, 3 Socket plug	1	
6	0514683	*LOCKWEDGE, 6 Socket plug	1	
7	0514684	*LOCKWEDGE, 6 Socket receptacle	1	
8	0514690	*PLUG, Sealing	3	
9	3010123	*CONNECTOR & SEAL, 2-Socket plug	2	
10	3010125	*TERMINAL, Socket	8	
11	0514582	*CONNECTOR, 2 Pin plug	1	
12	0514583	*TERMINAL	2	
13	3011147	*CONTACT, Female - receptacle	20	Included in Terminal Service Kit P/N 777283
14	3011148	*CONTACT, Male - tab	8	Included in Terminal Service Kit P/N 777283
15	3011149	*SEAL,WIRE	28	
16	3011153	*CONNECTOR & SEAL, 2 Position plug	4	
17	3011155	*CONNECTOR & SEAL, 3 Position plug	3	
18	3011170	*CONNECTOR & SEAL, 34 Position plug	1	
19	3011171	*TERMINAL	34	
20	3011326	*CONNECTOR & SEAL, 3 Socket plug	1	
21	3011327	*CONNECTOR & SEAL, 6 Receptacle	1	
22	3011328	*CONNECTOR & SEAL, 6 Plug	1	
23	3011420	*CONNECTOR & SEAL, 4 Position plug	1	
24	3011446	*CONNECTOR & SEAL, 3 Position plug	1	
25	3011447	*SEAL,WIRE	3	
26	3011448	*TERMINAL	3	
27	3011469	*CONNECTOR & SEAL, 2 Receptacle	1	
28	3011523	*CONNECTOR & SEAL, 2-Pin plug	2	
29	0514697	*LOCKWEDGE-2 Socket receptacle	1	
30	0586078	*CONNECTOR & SEAL, 2 Position plug	1	
31	3011154	*CONNECTOR, 2 Position cap	1	
32	3011158	*CONNECTOR, 6 Position cap	1	
33	0586812	*SEAL ASSEMBLY, Battery charge module	1	Rope Start Models
34	3011150	*PLUG, Cavity	1	
NS	0317893	*TIE STRAP	5	
35	5007748	PLUG & TIE STRAP ASSEMBLY	2	
NS	0320107	*TIE STRAP	5	
36	0586076	SEAL ASSEMBLY, System check	1	Tiller Models
37	0514683	*LOCKWEDGE, 6 Socket plug	1	
38	0514687	*CONNECTOR, 6 Socket plug	1	
39	0514690	*SEAL, Plug	6	
40	0586077	SEAL ASSEMBLY, Key switch	1	Tiller Models
41	0514688	*CONNECTOR, 6 Socket receptacle	1	
42	0514690	*SEAL, Plug	1	
46	3011450	CLIP, Connector to hose	1	
57	0586780	SWITCH, Neutral - All Models	1	
58	3011153	*CONNECTOR, 2 Position plug	1	
59	3011147	*CONTACT, Receptacle	2	Included in Terminal Service Kit P/N 777283
60	3011225	*SEAL, Wire	2	
62	0587221	HARNESS, Adapter	1	Stop switch & fuel selector switch
63	0514680	TERMINAL, Socket	2	
64	0514683	LOCKWEDGE, 6 Socket plug	1	
65	0514690	PLUG, Sealing	4	
66	3011147	CONTACT, Receptacle	3	
67	3011148	CONTACT, Tab	2	
68	3011149	SEAL, Wire	5	
69	3011150	PLUG, Cavity	3	
70	3011154	CONNECTOR, 2 Position cap	1	Fuel selector switch
71	3011157	CONNECTOR, 6 Position plug	1	Adapter harness to engine harness
72	3011328	CONNECTOR, 6 Socket plug	1	Stop switch

Fuel Hose & Primer Bulb



EPC4737

Ref	P/N	Name of Part	Qty	Note
-	5008612	FUEL HOSE & CONNECTOR KIT	1	
1	5008604	*FUEL HOSE & PRIMER ASSEMBLY	1	
2	5006363	** CONNECTOR, Female, fuel	1	1.4 in. (35.56 mm) O.D.
3	352397	** PLUG, Dust	1	0.8 in. (20 mm) O.D.
4	123112	** CLAMP	2	
5	772564	** HOSE, 5/16 in. (8 mm) dia. Bulk roll, 25 ft. (7.62	1	Cut to length 19.5 in. (495.3 mm)
6	346786	** CLAMP	2	
7	5008605	** BULB, Primer	1	
8	772564	** HOSE, 5/16 in. (8 mm) dia. Bulk roll, 25 ft. (7.62	1	Cut to length 108 in. (2.74 m)
9	5005527	** CONNECTOR, Female, fuel	1	1.14 in. (28.95 mm) O.D.
10	349776	** PLUG, Dust	1	0.78 in. (19.8 mm) O.D.
11	5007579	*CONNECTOR, Male, fuel tank	1	
12	438793	CONNECTOR, Outboard	1	
13	775640	CONNECTOR, Fuel hose	1	
14	982115	CLAMP	1	

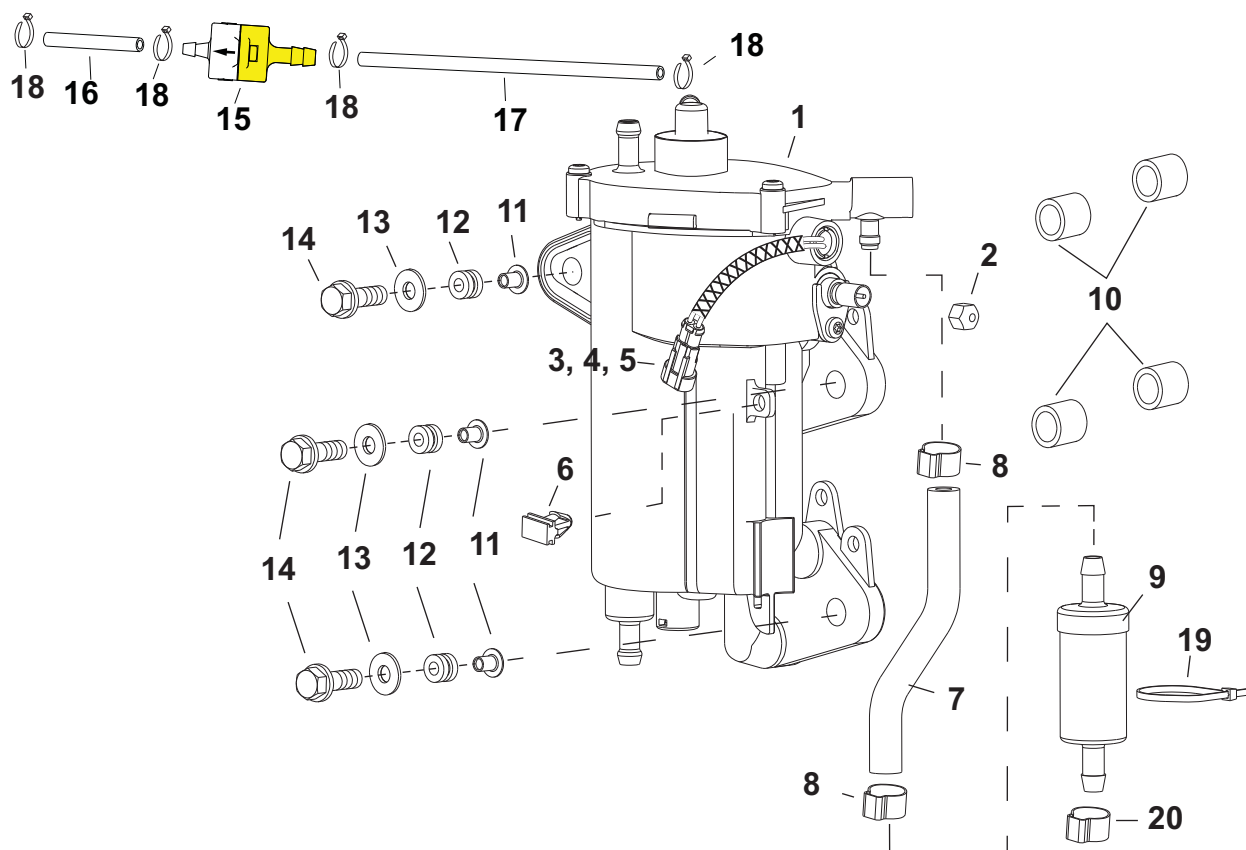


EPC4738

Ref	P/N	Name of Part	Qty	Note
-	5007184	FUEL LIFT PUMP ASSEMBLY	1	
1	0353902	*LIFT PUMP	1	
2	0347108	*CLAMP, 13,8 mm	3	
3	0353905	*HOSE, Fuel pump to filter	1	
4	0353903	*HOSE, Fuel connector to pump	1	
5	0353904	*HOSE, Pulse	1	
6	0346785	CLAMP, 14,5 mm	3	
7	0354016	FILTER, Fuel	1	included with vapor separator assembly
8	0354015	HOSE, Fuel filter to vapor separator	1	included with vapor separator assembly
9	0358042	FITTING, Fuel hose	1	
10	0346785	CLAMP, 14,5 mm	2	
11	0772572	HOSE, 1/4 in. (6 mm) dia. Bulk roll, 25 ft. (7.62 m)	1	Cut to length 5 in. (127 mm)
12	5009585	CONNECTOR, Fuel	1	
13	0346785	CLAMP, 14,5 mm	1	
14	0345854	FITTING, Crankcase pulse hose to fuel pump	1	
15	0320107	TIE STRAP	1	
NS	0354365	PUSH NUT, Fuel pump to oil tank	2	

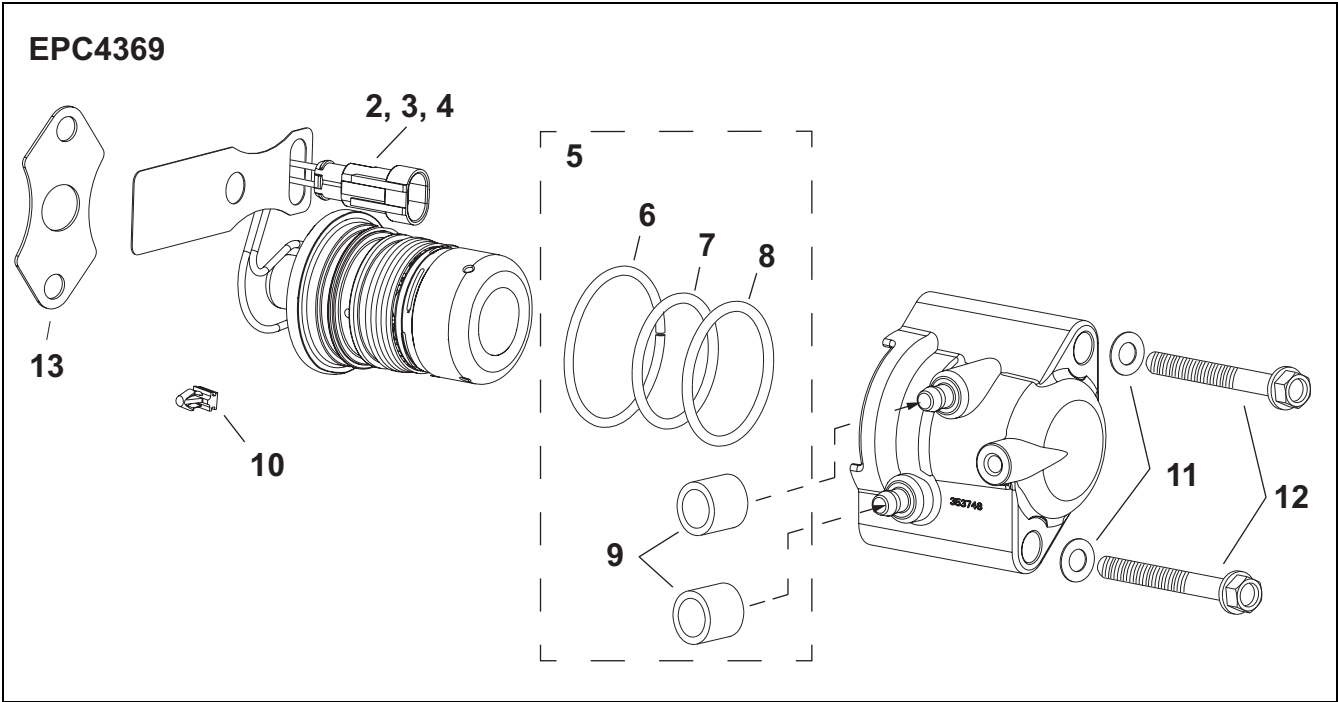
Fuel Pump & Vapor Separator

EPC4734



EPC4734

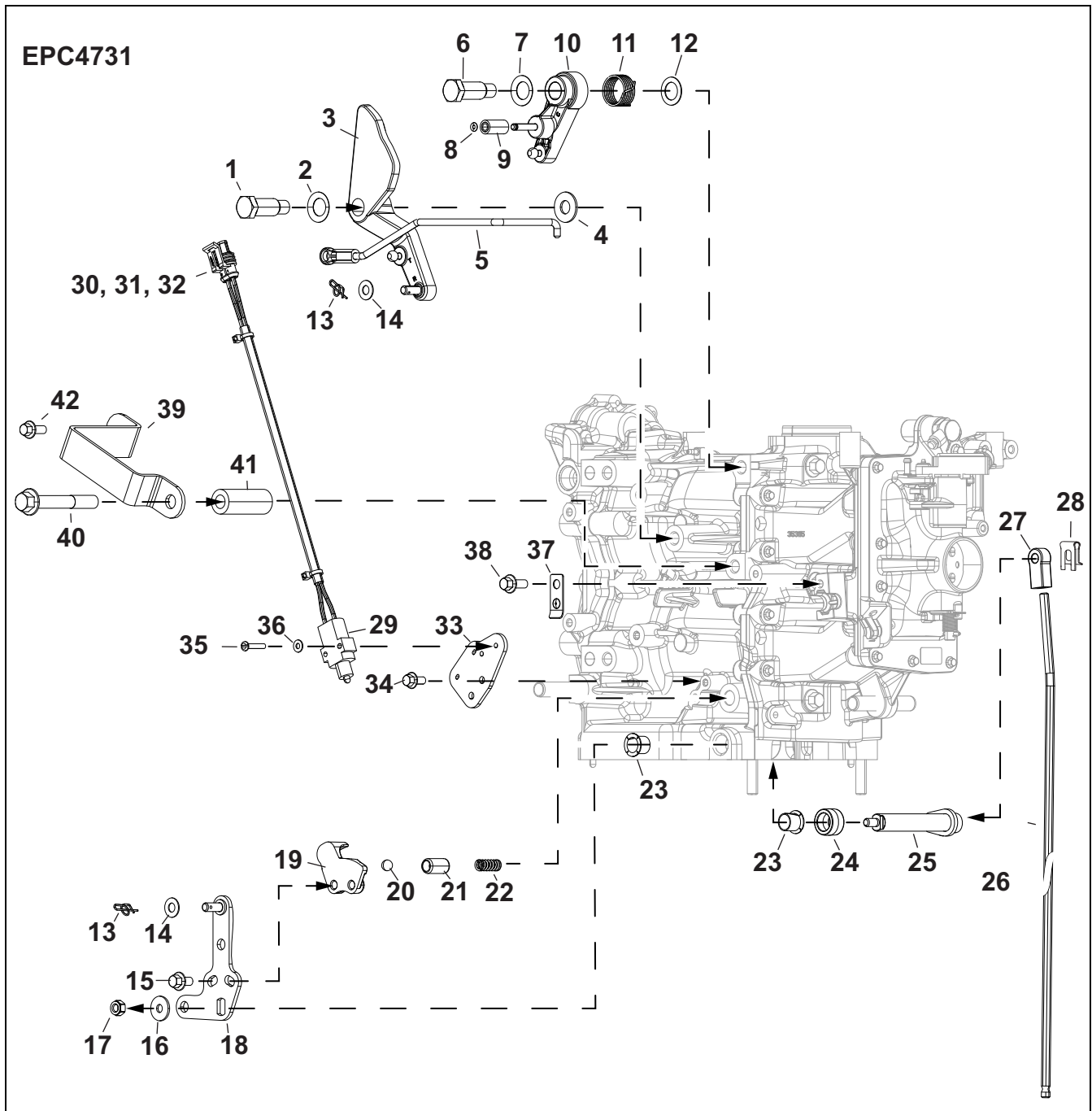
Ref	P/N	Name of Part	Qty	Note
1	5007896	FUEL VAPOR SEPARATOR & PUMP	1	
2	0126341	*CAP, Pressure test fitting	1	
3	3011154	*CONNECTOR, 2 Position plug	1	
4	3011148	*CONTACT, Male - tab	2	
5	3011149	*SEAL, Wire	2	
6	3011292	*CLIP, Connector to bracket	1	
7	0354015	*HOSE, Fuel filter to vapor separator	1	
8	0346785	*CLAMP, 14,5 mm	2	
9	0354016	*FILTER, Fuel	1	
10	5007913	*SEAL Kit, Injector to vapor separator	1	Included with Powerhead Gasket and Seal Kit
11	0338558	SPACER, Flanged	3	
12	0333040	ISOLATOR, Mounting	3	
13	0353761	WASHER, Mounting screw	3	
14	0353590	SCREW, Vapor separator mounting	3	
15	5009201	CHECK VALVE	1	
16	0772571	HOSE, Vapor separator - vent to Intake Manifold Cut to length 3.75 in (95 mm)	AR	5/32 in. (3,96 mm) diameter, Bulk Roll – 25 ft. (7,62 m)
17	0772571	HOSE, Vapor separator - vent to Intake Manifold Cut to length 27 in (685.8mm)		5/32 in. (3,96 mm) diameter, Bulk Roll – 25 ft. (7,62 m)
18	0317893	TIE STRAP	4	
19	0320107	TIE STRAP	1	
20	0346785	CLAMP, 14,5 mm	1	
NS	0351633	CLAMP, Vapor separator shipping	1	



EPC4737

Ref	P/N	Name of Part	Qty	Note
-	5008612	FUEL HOSE & CONNECTOR KIT	1	
1	5008604	*FUEL HOSE & PRIMER ASSEMBLY	1	
2	5006363	** CONNECTOR, Female, fuel	1	1.4 in. (35.56 mm) O.D.
3	352397	** PLUG, Dust	1	0.8 in. (20 mm) O.D.
4	123112	** CLAMP	2	
5	772564	** HOSE, 5/16 in. (8 mm) dia. Bulk roll, 25 ft. (7.62	1	Cut to length 19.5 in. (495.3 mm)
6	346786	** CLAMP	2	
7	5008605	** BULB, Primer	1	
8	772564	** HOSE, 5/16 in. (8 mm) dia. Bulk roll, 25 ft. (7.62	1	Cut to length 108 in. (2.74 m)
9	5005527	** CONNECTOR, Female, fuel	1	1.14 in. (28.95 mm) O.D.
10	349776	** PLUG, Dust	1	0.78 in. (19.8 mm) O.D.
11	5007579	*CONNECTOR, Male, fuel tank	1	
12	438793	CONNECTOR, Outboard	1	
13	775640	CONNECTOR, Fuel hose	1	
14	982115	CLAMP	1	

Throttle & Shift Linkage

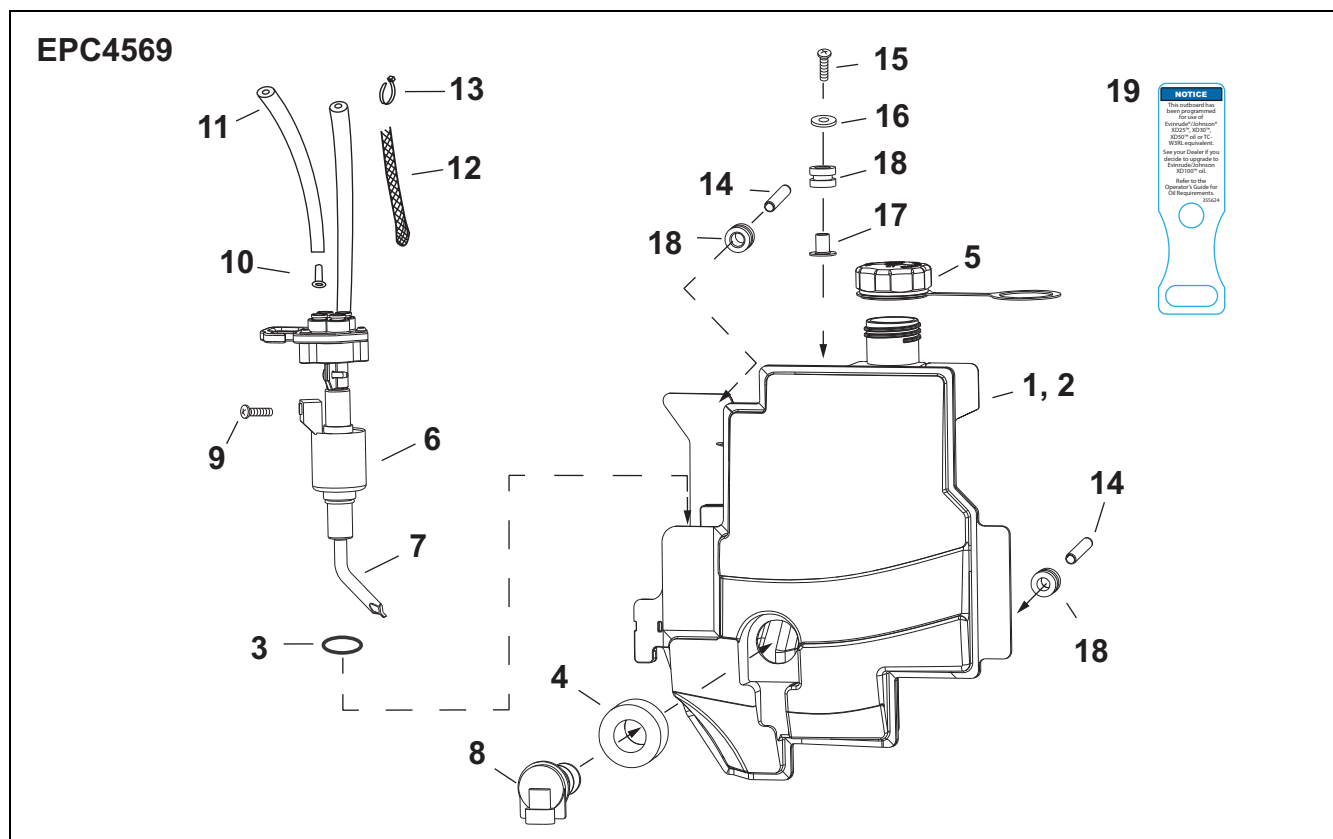


Throttle & Shift Linkage

EPC4731

Ref	P/N	Name of Part	Qty	Note
1	0353592	SCREW, Throttle cam	1	
2	0553766	WASHER, SPRING, Throttle cam	1	
3	5006475	THROTTLE CAM – 25-30 HP	1	
4	0908398	WASHER, Throttle cam	1	
5	5006478	LINK, Cam to shaft-TPS	1	
6	0353592	SCREW, Throttle lever	1	
7	0127386	WASHER, Screw to throttle lever	1	
8	0324678	O-RING, Roller sleeve	1	
9	0432639	ROLLER, Cam	1	
10	5005187	THROTTLE LEVER	1	
11	0353036	SPRING, Throttle lever return	1	
12	0908398	WASHER, Throttle lever to Crankcase	1	
13	0333774	CLIP, Shift cable	1	
14	0328702	WASHER, Shift cable	1	
15	0353897	SCREW, Detent to shift lever	2	
16	0353761	WASHER, Shift lever to shift shaft	1	
17	0353694	NUT, M6 Shift lever to shift shaft	1	
18	5007059	LEVER & PIN ASSEMBLY, Shift shaft	1	
19	0353968	DETENT, Shift lever	1	
20	0315164	BALL, Shift detent	1	
21	0334241	GUIDE, Shift detent ball	1	
22	0334338	SPRING, Detent guide	1	
23	0315081	BUSHING, Shift shaft to cylinder block	2	
24	0353804	SPACER, Shift lever to block	1	
25	5007060	LEVER & SHAFT ASSEMBLY, Shift	1	
26	0353706	SHIFT ROD, 20 inch	1	
27	0334119	CONNECTOR, Shift rod	1	
28	0338630	CLIP, SPRING Shift rod to bellcrank	1	
29	0586780	SWITCH, Neutral	1	
30	3011153	*CONNECTOR, 2 Position plug	1	
31	3011147	*CONTACT, Receptacle	2	
32	3011225	*SEAL, Wire	2	
33	0354619	BRACKET, Neutral switch	1	
34	0353753	SCREW, Bracket to block	2	
35	0334192	SCREW, Neutral switch to bracket	2	
36	0353740	WASHER, Neutral switch to bracket	2	
37	0351928	RETAINER, Trunnion	1	
38	0353589	SCREW, Retainer	1	
NS	0317893	TIE STRAP, Safety switch leads	2	
NS	0320107	TIE STRAP, Safety switch leads	4	
39	0358348	GUARD, Throttle cam	1	
40	0353676	SCREW, Guard to crankcase	1	Front
41	0358349	STANDOFF, Guard to crankcase	1	Front
42	0353589	SCREW, Guard to crankcase	1	Rear

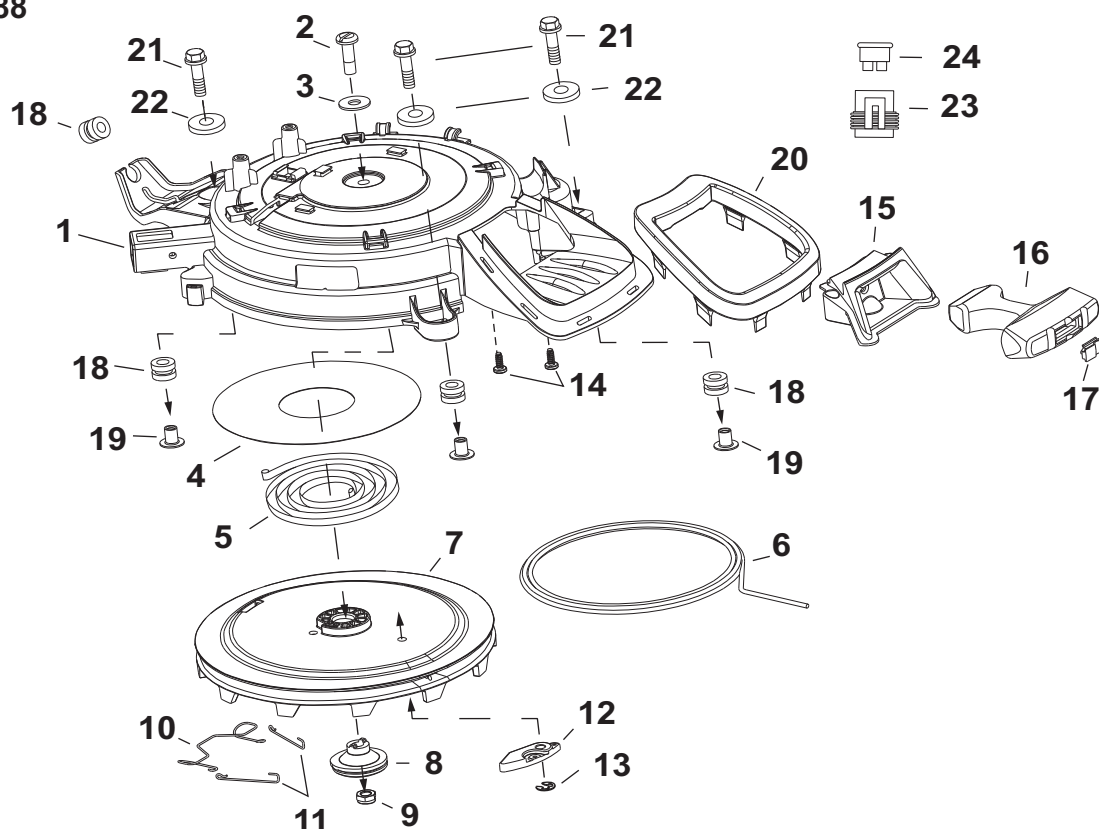
Oil Tank & Pump



EPC4569M

Ref	P/N	Name of Part	Qty	Note
1	5008994	OIL TANK ASSEMBLY, Complete	1	
2	5008995	*OIL TANK KIT	1	
3	0338513	*O-RING, Oil pump to oil tank	1	
4	0353920	**GROMMET, Oil switch	1	
NS	0354365	**PUSH NUT, Fuel pump to oil tank	2	
5	5008406	*OIL CAP ASSEMBLY	1	
6	5009036	*PUMP & MANIFOLD ASSEMBLY	1	
7	5007719	**SCREEN ASSEMBLY	1	
8	0352874	*SWITCH, Oil level	1	
9	0343245	*SCREW, Oil pump retainer	1	
10	0349898	*SUPPORT, Hose	4	
11	0778708	HOSE, Oil	AR	0.093 in. (2,36 mm) diameter, Bulk Roll 25 ft. (7,62 m)
12	0508363	SLEEVE, Braided	AR	3/16 in. (4,76 mm) diameter, Bulk Roll 25 ft. (7,62 m)
13	0317893	TIE STRAP, Oil hoses to fittings	4	
14	0353642	PIN, Oil tank mounting	2	
15	0353590	SCREW, Oil tank mounting	1	
16	0353761	WASHER, Oil tank mount	1	
17	0338558	SPACER, Flanged	1	
18	0333040	ISOLATOR, Mounting	3	
19	0355625	EMM Oil program tag, XD100 oil	1	
NS	0333440	CLAMP, Loop - Oil hose to block	1	
NS	0353589	SCREW, Loop clamp	1	
NS	0314254	CLAMP, Oil hoses to crankcase	1	
NS	0354818	SCREW, Clamp	1	
NS	0320107	TIE STRAP, Oil level switch lead	1	

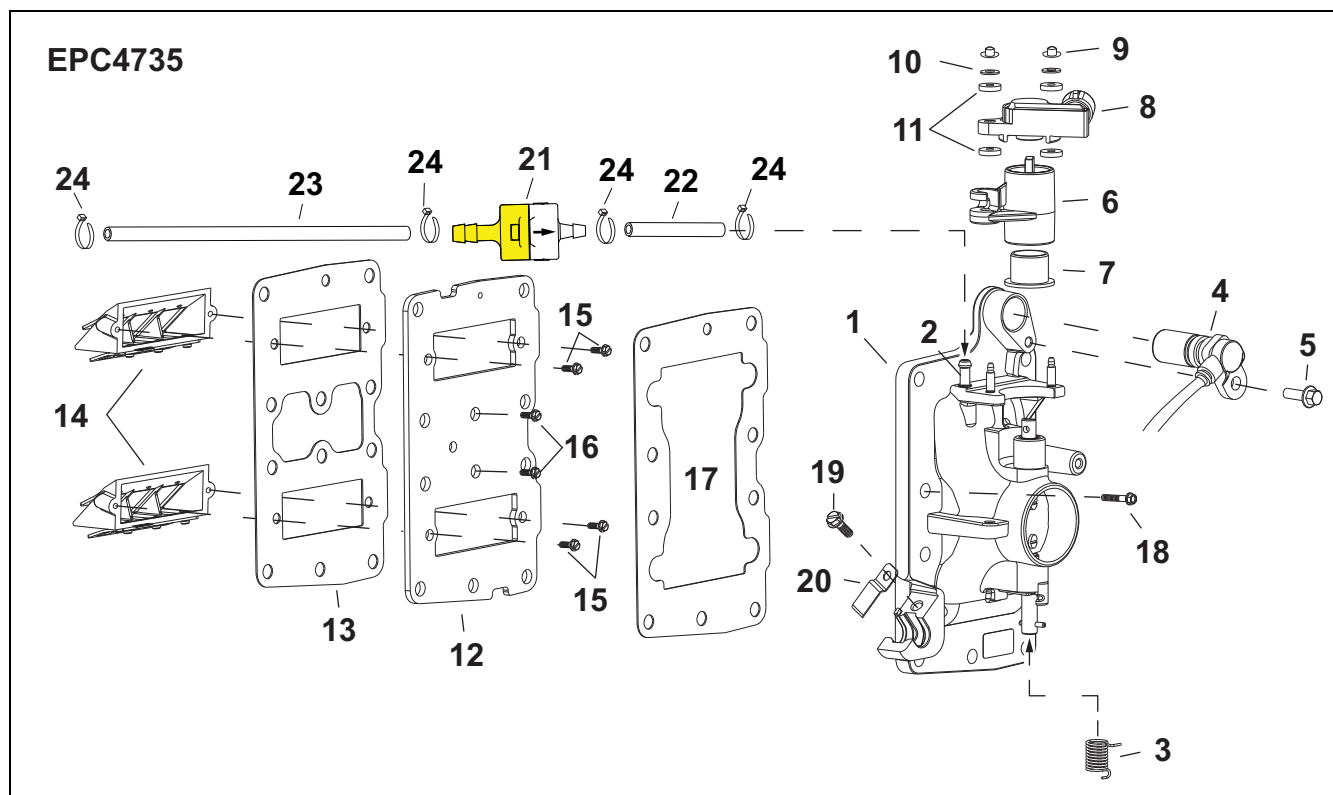
EPC4388



EPC4388

Ref	P/N	Name of Part	Qty	Note
-	5009238	RECOIL STARTER ASSEMBLY	1	
1	0352559	*HOUSING-BASE	1	
2	0339043	*SCREW, Housing to spindle	1	
3	0911201	*WASHER, Starter housing to spindle	1	
4	0326131	*SHIELD, Pulley spring	1	
5	0336681	*SPRING, Starter	1	
6	0357481	*ROPE, Starter	1	5/32 in. (3,96 mm) diameter
6	0772577	*ROPE, Starter - Bulk Roll 100 ft. (30,48 m)	AR	Cut to length 80 in. (2,03 m)
7	5009030	*PULLEY & PIN ASSEMBLY, Starter	1	
8	0357482	*SPINDLE, Starter pulley	1	
9	0121674	*NUT,	1	
10	0338341	*SPRING, FRICTION, Starter	1	
11	0335905	*LINK, Friction spring	2	
12	0338335	*PAWL, Starter pulley	1	
13	0203470	*RING, RETAINING	1	
14	0315656	*SCREW, Rope guide	2	
15	0356908	*GUIDE, Rope	1	
16	5007562	*HANDLE ASSEMBLY, Starter	1	
17	0353698	*CAP, Starter handle	1	
18	0333040	*ISOLATOR, Mounting	4	
19	0338558	*SPACER, FLANGED, Starter housing	3	
20	0353987	SEAL, Rope housing to engine cover	1	
21	0353553	SCREW, Starter to Crankcase	3	
22	0353761	WASHER, Starter mounting screw	3	
23	0514022	RETAINER, Spare fuse	1	
24	0967545	FUSE, Spare 10 AMP	1	
NS	0355633	DECAL, Owner Attention	1	
NS	0357484	DECAL, MFE	1	

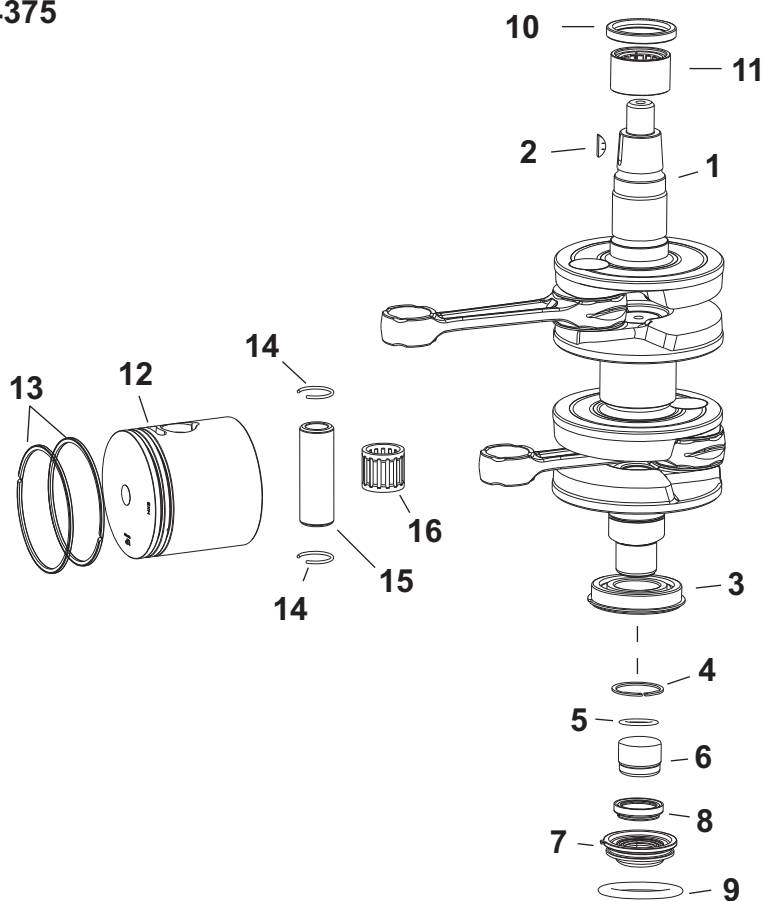
Intake Manifold Assembly



EPC4735

Ref	P/N	Name of Part	Qty	Note
1	5008992	THROTTLE BODY ASSEMBLY	1	
2	0349181	*FITTING, Vapor separator vent	1	
3	0352540	*SPRING, Throttle return	1	
4	0587014	*SENSOR, Crankshaft position (CPS)	1	See "Sensors"
5	0353588	*SCREW, CPS	1	
6	5005188	*THROTTLE LEVER	1	
7	0350970	*BUSHING, Throttle lever	1	
8	5006484	*SENSOR, Throttle position (TPS)	1	See "Sensors"
9	0352129	**NUT, TPS push	2	
10	0336197	**WASHER, TPS	2	
11	0352122	**WASHER, TPS Isolation	4	
12	0353266	REED PLATE ASSEMBLY	1	
13	0353316	GASKET, Reed plate to crankcase	1	Included with Powerhead Gasket and Seal Kit
14	5007349	REED VALVE ASSEMBLY	2	
15	0353753	SCREW, Reed valve to reed plate	4	
16	0353589	SCREW, Reed plate to crankcase	2	
17	0353317	GASKET, Throttle body to reed plate	1	Included with Powerhead Gasket and Seal Kit
18	0353553	SCREW, Throttle body to crankcase	9	
19	0353589	SCREW, Retainer	1	
20	0351928	RETAINER, Trunnion	1	
21	5009201	CHECK VALVE	1	
22	0772571	HOSE, Vapor separator - vent to Intake Manifold Cut to length 3.75 in (95 mm)	AR	5/32 in. (3,96 mm) diameter, Bulk Roll – 25 ft. (7,62 m)
23	0772571	HOSE, Vapor separator - vent to Intake Manifold Cut to length 27 in (685.8mm)		5/32 in. (3,96 mm) diameter, Bulk Roll – 25 ft. (7,62 m)
24	0317893	TIE STRAP	4	

EPC4375

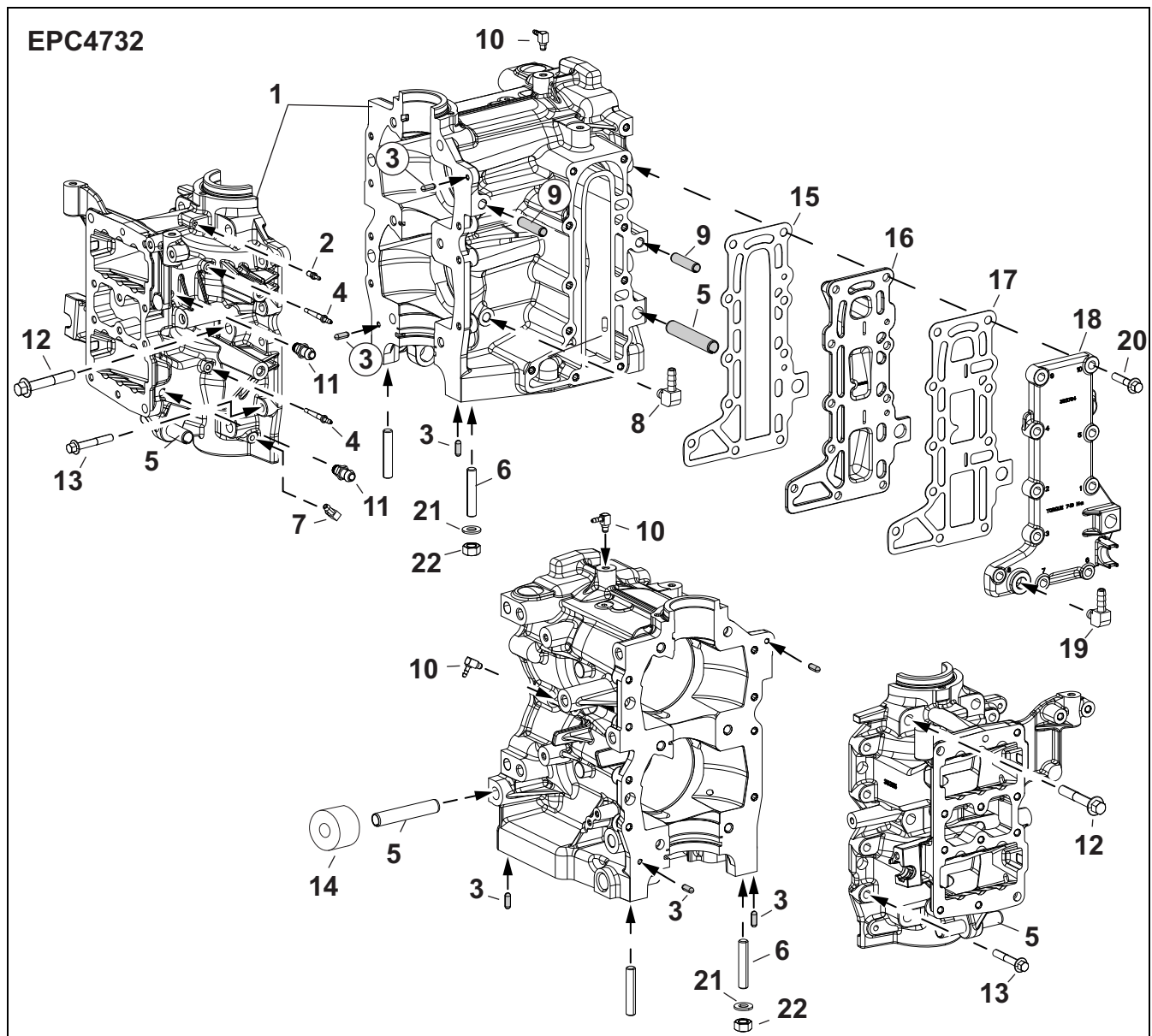


18

EPC4375

Ref	P/N	Name of Part	Qty	Note
1	5008299	CRANKSHAFT & CON ROD ASSEMBLY	1	
2	0307480	*KEY, Flywheel to crankshaft	1	
3	5006529	*BEARING, Ball, lower crankshaft	1	
4	0353754	*RETAINING RING, Brg to crank-lower	1	
5	0338513	*O-RING, Sleeve to crankshaft	1	Included with Powerhead Gasket and Seal Kit
6	0339658	*SLEEVE, Crankshaft	1	Included with Powerhead Gasket and Seal Kit
7	5007015	HOUSING, Lower seal	1	
8	0398051	*SEAL KIT, Lower crankshaft housing	1	Included with Powerhead Gasket and Seal Kit
9	0319662	O-RING, Seal housing to cylinder & crankcase	1	
10	0353230	SEAL OIL, Crankshaft-upper	1	Included with Powerhead Gasket and Seal Kit
11	0393896	BEARING, Upper crankshaft	1	
12	5007899	PISTON & RING ASSEMBLY	2	
13	5007902	*PISTON RING SET-Standard	1	
14	0353369	*RING RETAINING, Wrist pin to piston	2	
15	0353341	*WRIST PIN	1	
16	5007457	*BEARING, Wrist pin	1	

Cylinder & Crankcase



EPC4732

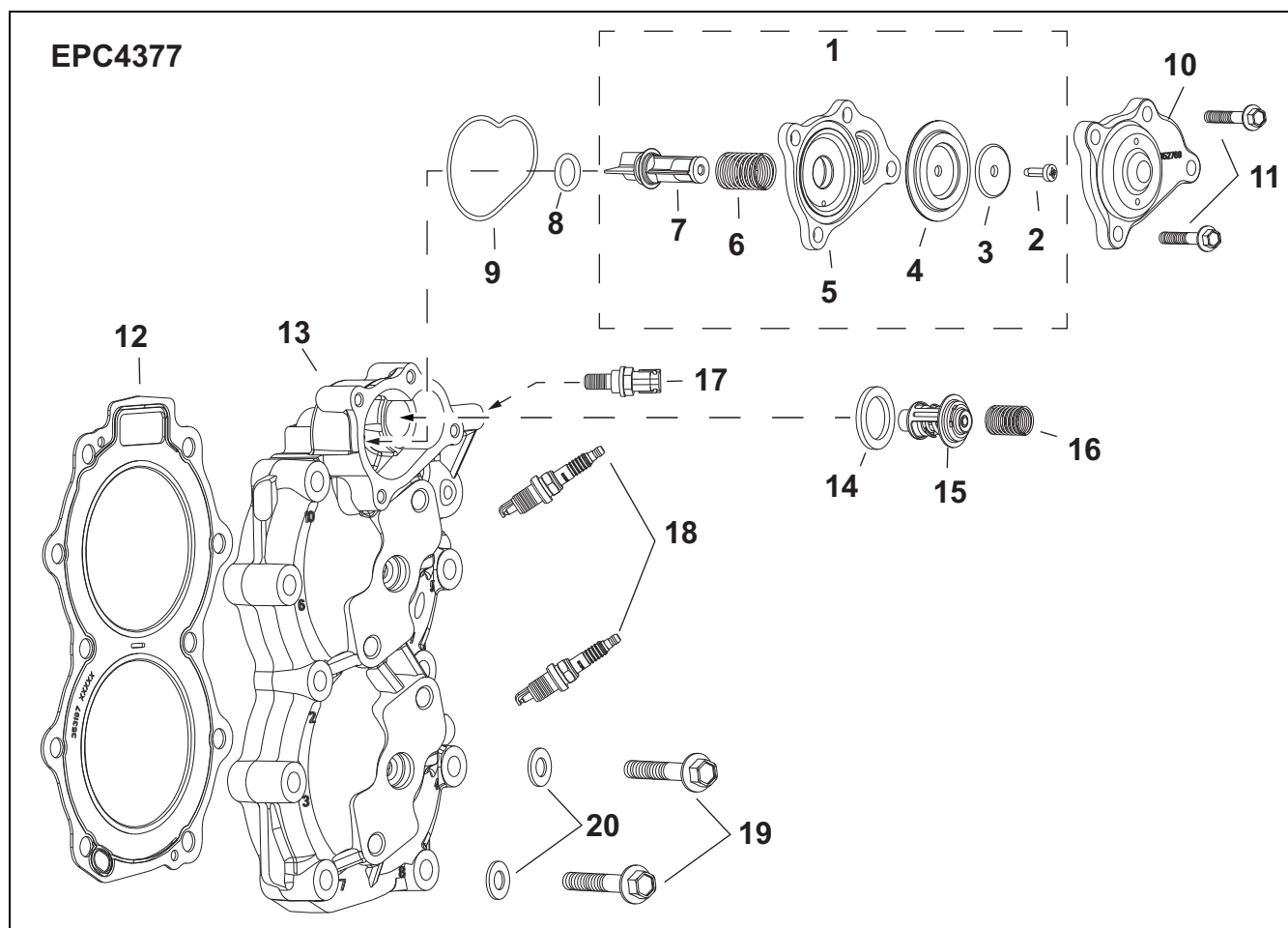
Ref	P/N	Name of Part	Qty	Note
1	5009108	CYLINDER/CRANKCASE ASSEMBLY, 30MFE	1	De-water drain fittings
2	0328932	* FITTING, Oil recirculation-upper	1	See Cylinder/Crankcase Fittings
3	0353931	* PIN, Alignment	6	See Cylinder/Crankcase Fittings
4	0344821	* FITTING, Crankcase Oil inlet	2	
5	0353806	* PIN, Lower cover mount	3	
6	0353703	* STUD Cyl & Crankcase to exhaust housing (front	2	
7	0348471	* FITTING, Oil recirculation elbow	1	See Cylinder/Crankcase Fittings
8	0345854	* FITTING, Fuel pulse	1	See Cylinder/Crankcase Fittings
9	0353642	* PIN, Oil tank mounting	2	
10	0346137	* FITTING, Cylinder Oil inlet	2	See Cylinder/Crankcase Fittings
11	0356999	* FITTING, De-water drain	2	30MRL models only
12	0353556	SCREW, Crankcase to block	6	
13	0353553	SCREW, Crankcase to block	8	
14	0353805	SPACER, Rear mount to block - Starboard	1	
15	0353196	GASKET, Inner cover to block	1	Included with Powerhead Gasket and Seal Kit
16	0355132	COVER, EXHAUST, Inner	1	
17	0353195	GASKET, Outer cover to inner cover	1	Included with Powerhead Gasket and Seal Kit
18	0355131	COVER, EXHAUST, Outer	1	
19	0331894	FITTING, Water to vapor separator	1	
20	0353553	SCREW, Outer exhaust cover to block	10	
21	0353735	WASHER, Stud exhaust housing to block	2	
22	0353704	NUT, exhaust housing to powerhead front	2	
NS	0354666	DAM, Water	1	
NS	0317893	TIE STRAP, Hoses & check valves	4	
NS	0320107	TIE STRAP, Water hoses	2	
NS	0354416	PLUG, Water, Cyl block - lower	1	
NS	0353589	SCREW, Harness ground	1	
NS	0328701	LOCK WASHER, Harness ground	1	
NS	0333440	CLAMP, Loop - Oil hose to block	1	Rope start models
NS	0353589	SCREW, Loop clamp	1	Rope start models
NS	0314254	CLAMP, Oil hoses to crankcase	1	Rope start models
NS	0354818	SCREW, Clamp	1	Rope start models
NS	5007900	POWERHEAD GASKET & SEAL KIT	1	

Gasket & Seal Kit

No Image

Ref	P/N	Name of Part	Qty	Note
-	5007900	POWERHEAD GASKET & SEAL KIT	1	
-	5007895	*INJECTOR SEAL KIT	2	
-	0352809	**RING, Crush	1	
-	-	**O-RING, Outer injector	1	Not available individually
-	-	**O-RING, Inner injector	1	Not available individually
-	5007913	**SEAL Kit, Injector to vapor separator	1	
-	-	* SEAL, Lower crankshaft housing	1	Not available individually
-	0353316	* GASKET, Reed plate to crankcase	1	
-	0353317	* GASKET, Throttle body to reed plate	1	
-	0353230	* SEAL OIL, Crankshaft-upper	1	
-	0339658	* SLEEVE, Lower crankshaft	1	
-	0338513	* O-RING, Sleeve to crankshaft	1	
-	0353196	* GASKET, Inner exhaust cover to block	1	
-	0353195	* GASKET, Outer exhaust cover to inner cover	1	
-	0353197	* GASKET, Cylinder head	1	
-	0339044	* GASKET, Thermostat to cylinder head	1	
-	0352773	* SEAL, Thermostat cover	1	
-	0339543	* O-RING, Plunger	1	
-	0353298	* GASKET, Exhaust housing to powerhead	1	

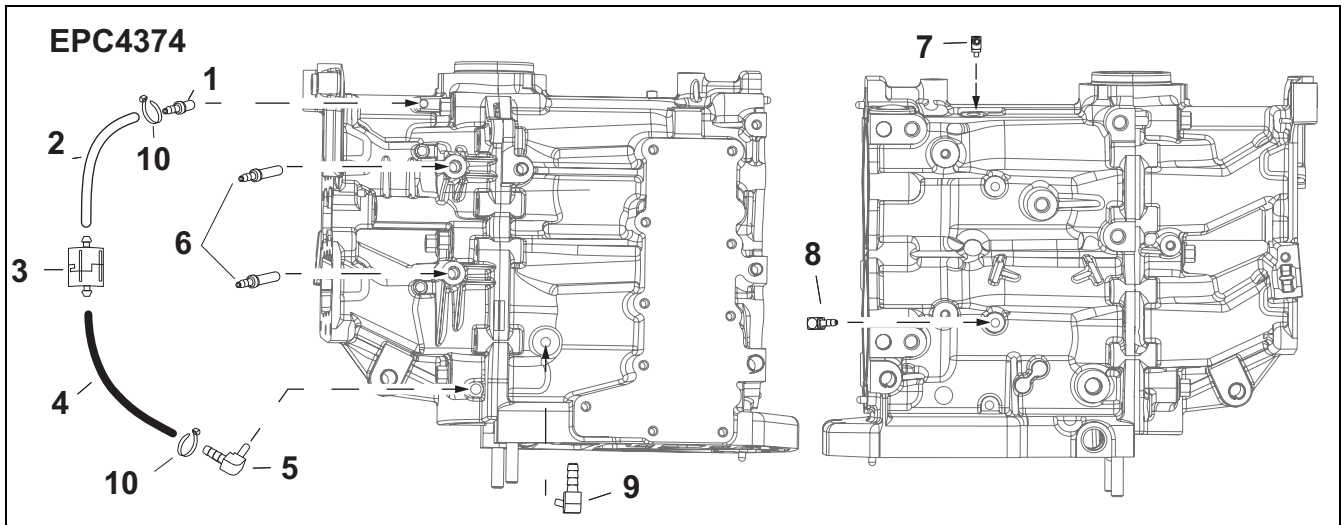
Cylinder Head & Thermostat



EPC4377

Ref	P/N	Name of Part	Qty	Note
1	5008181	VALVE ASSEMBLY, Cooling pressure relief	1	
2	0343245	*SCREW, Support	1	
3	0353597	*SUPPORT, Diaphragm	1	
4	0353596	*DIAPHRAGM	1	
5	0353598	*PLATE, Housing	1	
6	0355169	*SPRING, Valve	1	
7	0353593	*PLUNGER, Valve	1	
8	0339543	O-RING, Plunger	1	Included with Powerhead Gasket and Seal Kit
9	0352773	SEAL, Thermostat cover	1	Included with Powerhead Gasket and Seal Kit
10	0352768	COVER, Thermostat & pressure relief	1	
11	0353590	SCREW, Thermostat / pressure relief cover	4	
12	0353197	GASKET, Cylinder head	1	Included with Powerhead Gasket and Seal Kit
13	0355133	CYLINDER HEAD	1	
NS	0352881	PIN, Fuel deflecting	2	
14	0339044	GASKET, T-Stat to cylinder head	1	Included with Powerhead Gasket and Seal Kit
15	5005440	THERMOSTAT ASSEMBLY	1	
16	0355209	SPRING, T-Stat cover to T-Stat	1	
17	3010674	ENGINE TEMPERATURE SENSOR	1	
18	5007419	SPARK PLUG (QC10WEP)	2	
19	0356278	SCREW, Cylinder head	10	
20	0353735	WASHER, Cylinder head screw	10	

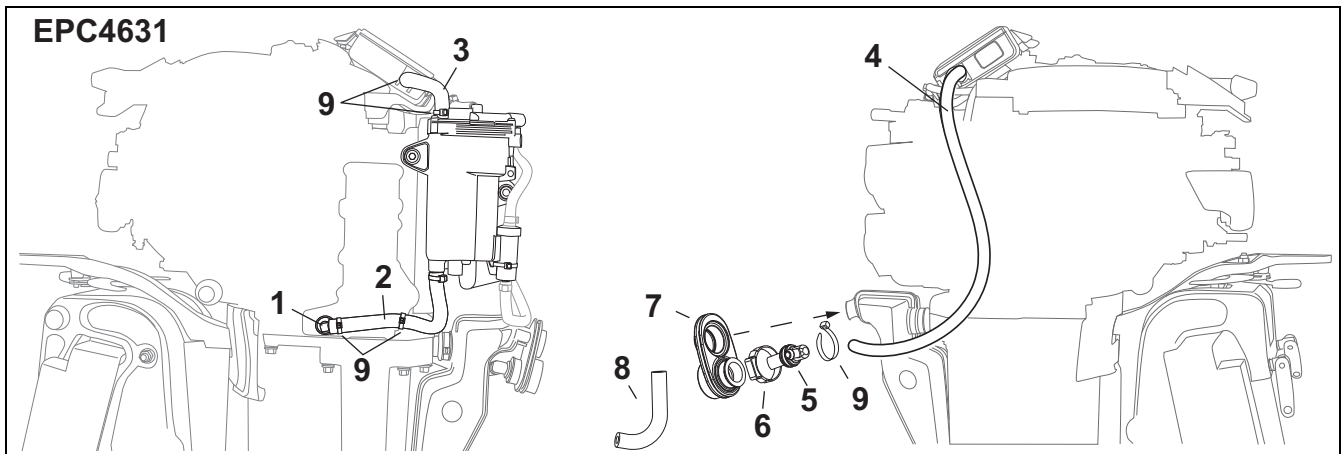
Cylinder/crankcase Fittings & Oil Recirculation System



EPC4374

Ref	P/N	Name of Part	Qty	Note
1	0328932	FITTING, Oil recirculation-upper	1	
2	0778708	HOSE, Oil – 0.093 in. (2,36 mm) diameter	1	Bulk Roll – 25 ft. (7,62 m)
3	0348478	CHECK VALVE, In line oil recirculation	1	
4	0772571	HOSE, Oil – 5/32 in. (3,96 mm) diameter	1	Bulk Roll – 25 ft. (7,62 m)
5	0348471	FITTING, Oil recirculation elbow, crankcase	1	
6	0344821	FITTING, Crankcase oil inlet	2	
7	0346137	FITTING, Cylinder #1 oil inlet	1	
8	0346137	FITTING, Cylinder #2 oil inlet	1	
9	0345854	FITTING, Fuel pulse	1	
10	0317893	TIE STRAP	4	

Cooling Hoses

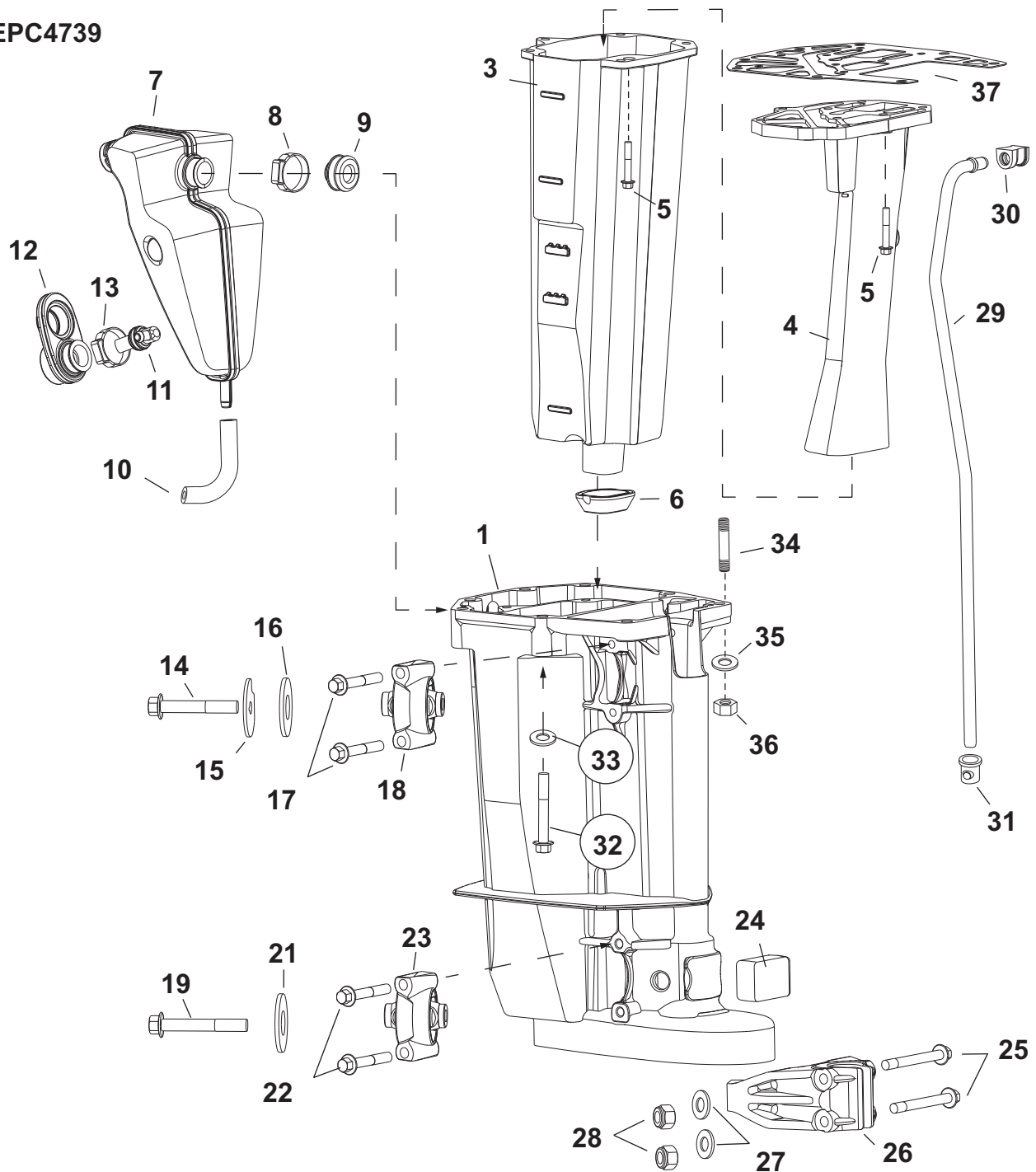


EPC4631

Ref	P/N	Name of Part	Qty	Note
1	0331894	FITTING, Water to vapor separator	1	
2	0353901	HOSE, Exhaust cover to vapor separator	1	
3	0353913	HOSE, Vapor separator to EMM	1	
4	0353912	HOSE, EMM to exhaust grommet	1	
5	0353756	FITTING, Exhaust grommet	1	
6	0349759	CLAMP, 31,6 mm	1	Exhaust grommet to overboard indicator
7	0354162	GROMMET, Muffler to lower motor cover	1	
8	0354116	HOSE, Muffler to lower motor cover	1	See EXHAUST HOUSING & MUFFLER
9	0320107	TIE STRAP	AR	

Exhaust Housing & Muffler

EPC4739



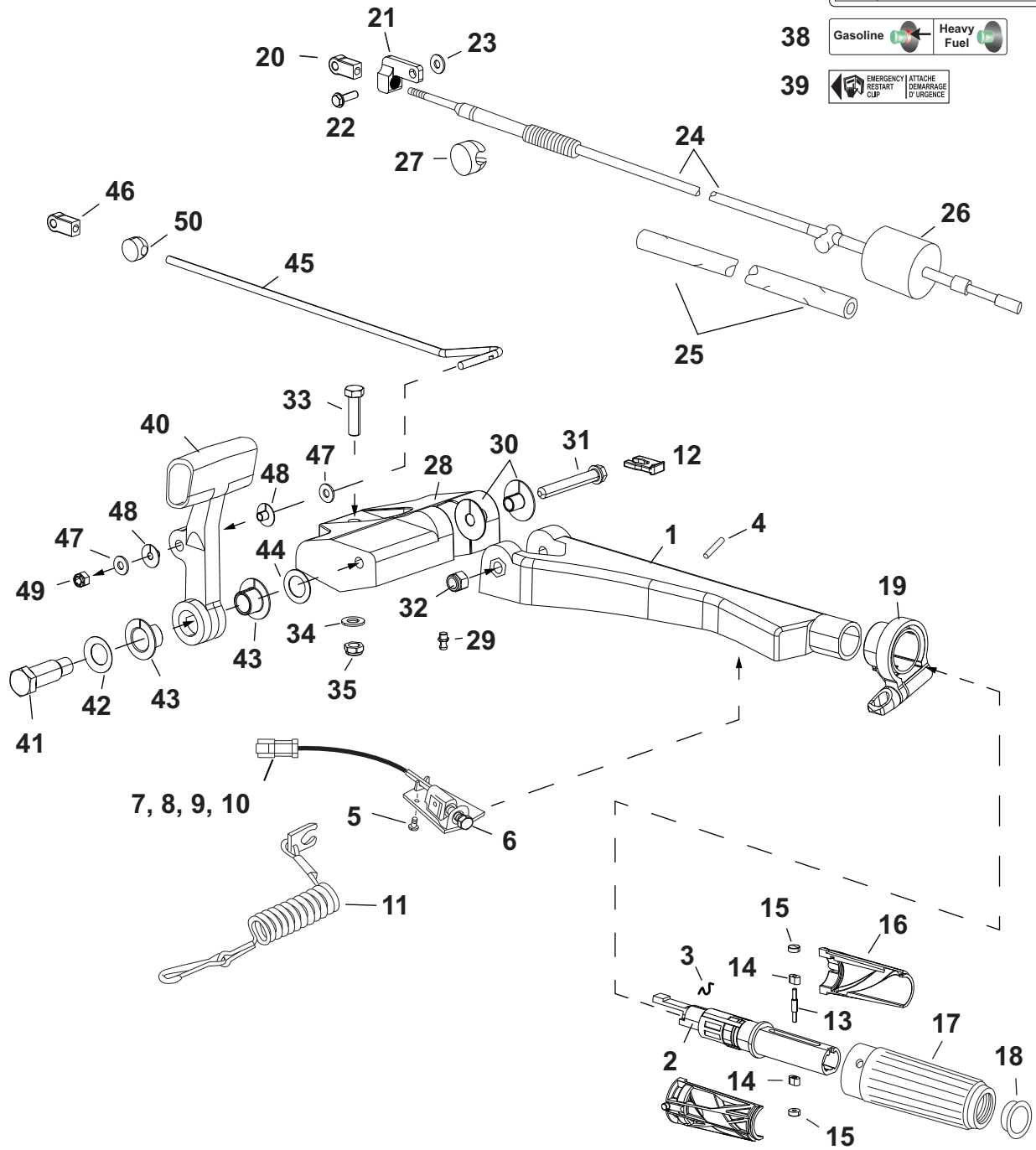
Exhaust Housing & Muffler

EPC4739

Ref	P/N	Name of Part	Qty	Note
1	5008164	EXHAUST HOUSING	1	
3	0355128	HOUSING, Inner exhaust	1	
4	0355927	MEGAPHONE, Exhaust housing	1	
5	0353553	SCREW, Inner exhaust & megaphone to block	8	
6	0353330	SEAL, Inner exhaust, lower	1	
7	5007443	MUFFLER, Exhaust	1	
8	0351685	CLAMP, EAR-34,6 mm Muffler to block	1	
9	0353495	GROMMET, Muffler to exhaust housing	1	
10	0354116	HOSE, Muffler to lower motor cover	1	
11	0353756	FITTING, Overboard indicator	1	
12	0354162	GROMMET, Muffler to lower motor cover	1	
13	0349759	CLAMP, 31,6 mm	1	Exhaust grommet to overboard indicator
14	0353676	SCREW, Upper mount to steering arm	2	
15	0353674	WASHER, Bumper stop, upper mount	2	
16	0354437	WASHER, Bumper upper mount	2	
17	0353556	SCREW, Upper mount to exhaust housing	4	
18	5007920	MOUNT ASSEMBLY, Upper	2	
19	0353676	SCREW, Lower mount to bracket	2	
21	0354437	WASHER, Bumper lower mount	2	
22	0353556	SCREW, Lower mount to exhaust housing	4	
23	5007508	MOUNT ASSEMBLY, Lower	2	
24	0352787	MOUNT, RUBBER, Lower mount bracket	1	
25	0353557	SCREW, Lower mount bracket	2	
26	0355129	MOUNT BRACKET, Lower	1	
27	0353741	WASHER, Screw lower mount bracket	2	
28	0353728	NUT, Lower mount bracket	2	
29	0353306	TUBE, Water	1	
30	0353319	GROMMET, Water tube to exhaust housing	1	
31	0302497	GROMMET, Lower water tube	1	
32	0353556	SCREW, exhaust housing to block	6	
33	0353735	WASHER, exhaust housing to block	6	
34	0353703	STUD Cylinder & Crankcase to exhaust housing (fr	2	
35	0353735	WASHER, Stud exhaust housing to block	2	
36	0353704	NUT, Exhaust housing to block front	2	
37	0353298	GASKET, Exhaust housing to powerhead	1	Included with Powerhead Gasket and Seal Kit
NS	0320107	TIE STRAP	3	

Tiller Handle & Shift Lever

EPC4733

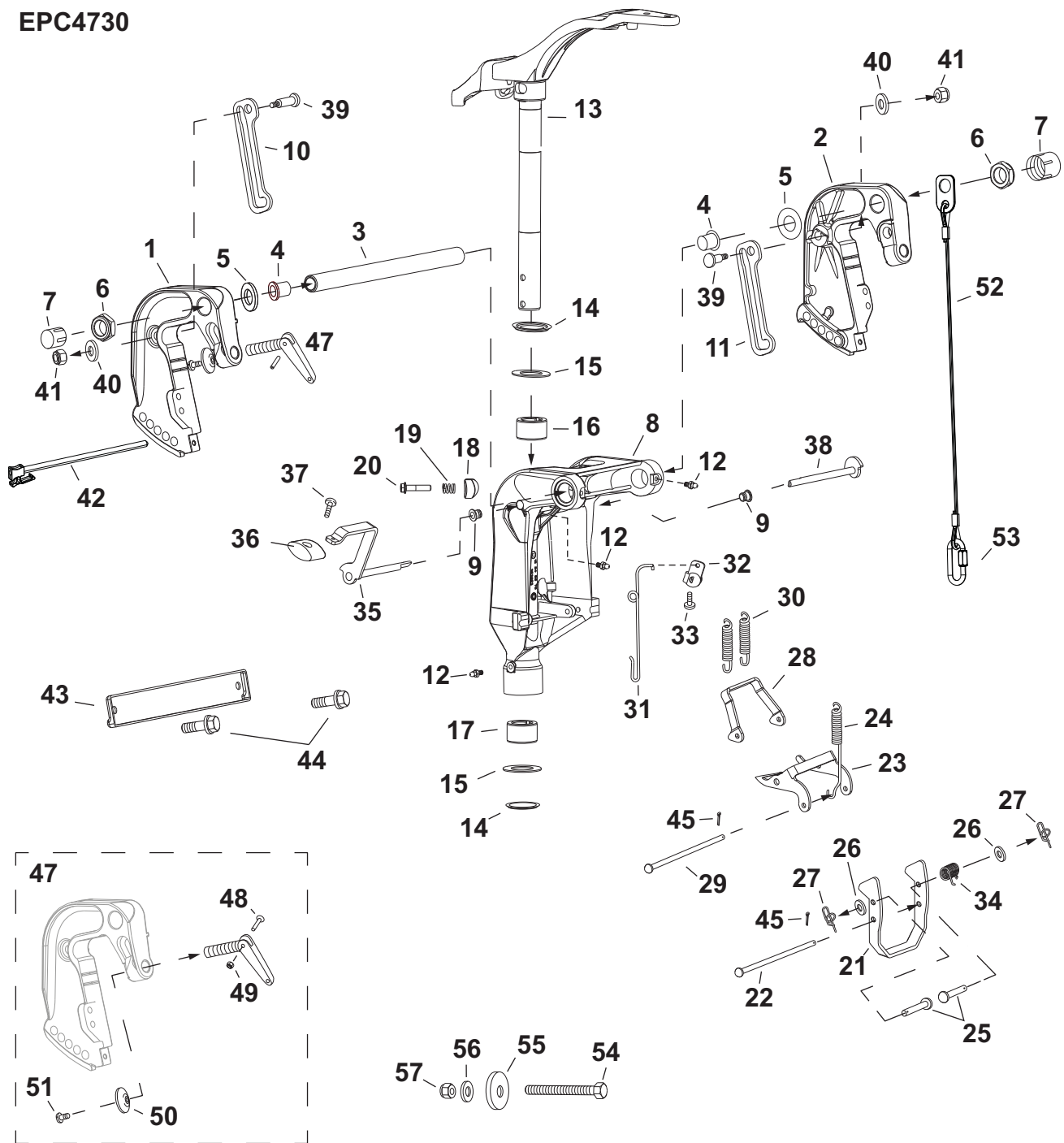


EPC4733

Ref	P/N	Name of Part	Qty	Note
1	0437144	HANDLE ASSEMBLY, Tiller steering	1	
2	0397001	*INNER HANDLE	1	
3	0332089	**CLIP, Retainer	1	
4	0334960	*PIN, Inner steering handle	1	
5	0336481	*SCREW	3	
6	0586792	STOP SWITCH ASSEMBLY	1	
7	0514679	*TERMINAL	2	
8	0514688	CONNECTOR, 6 Pin	1	
9	0514684	LOCKWEDGE, 6 Pin	1	
10	0514690	PLUG, Sealing	4	
11	0398602	CLIP & LANYARD ASSEMBLY	1	
12	0333499	CLIP, Emergency start	1	
13	0329880	PIN	1	
14	0329879	GUIDE	2	
15	0329881	ROLLER	2	
16	0339722	HELIX	2	
17	0436216	TWIST GRIP	1	
18	0342933	PLUG, Twist grip cap	1	
19	5008076	THROTTLE FRICTION ASSEMBLY	1	
20	0334153	CONNECTOR, Throttle cable	1	
21	0357357	ANCHOR, Throttle cable	1	
22	0353871	SCREW, Shoulder	1	Throttle cable anchor
23	0328703	WASHER, Anchor	1	
24	5009152	THROTTLE CABLE	1	
25	0323912	TUBING, Cable	1	
26	0329063	SEAL, Throttle cable	1	
27	0357364	BUSHING, Throttle cable	1	
28	0355221	STEERING ARM BRACKET, Tiller	1	
29	0313607	FITTING, Lube	1	
30	0325452	BUSHING	2	
31	0350989	SCREW	1	
32	0307160	LOCK NUT	1	
33	0325729	SCREW, Bracket to steering arm - front & rear	2	
34	0319453	WASHER, Bracket to steering arm	4	
35	0315077	LOCK NUT	2	
36	0333979	DECAL, Gearshift	1	
37	0355620	DECAL, Start warning	1	
38	0352948	DECAL, Fuel selector	1	
39	0335299	DECAL, Emergency clip	1	
40	0341384	LEVER, Shift	1	
41	0357990	SCREW, Shift lever	1	
42	0127386	WASHER	1	
43	0308532	BUSHING, Shift lever	2	
44	0908398	WASHER	1	
45	0356357	SHIFT ROD	1	
46	0334119	CONNECTOR, Shift rod	1	
47	0329241	WASHER	2	
48	0315101	BUSHING, Shift rod to shift lever	2	
49	0313022	NUT, Lock	1	
50	0334373	BUSHING, Shift rod trunnion	1	

Stern & Swivel Bracket

EPC4730

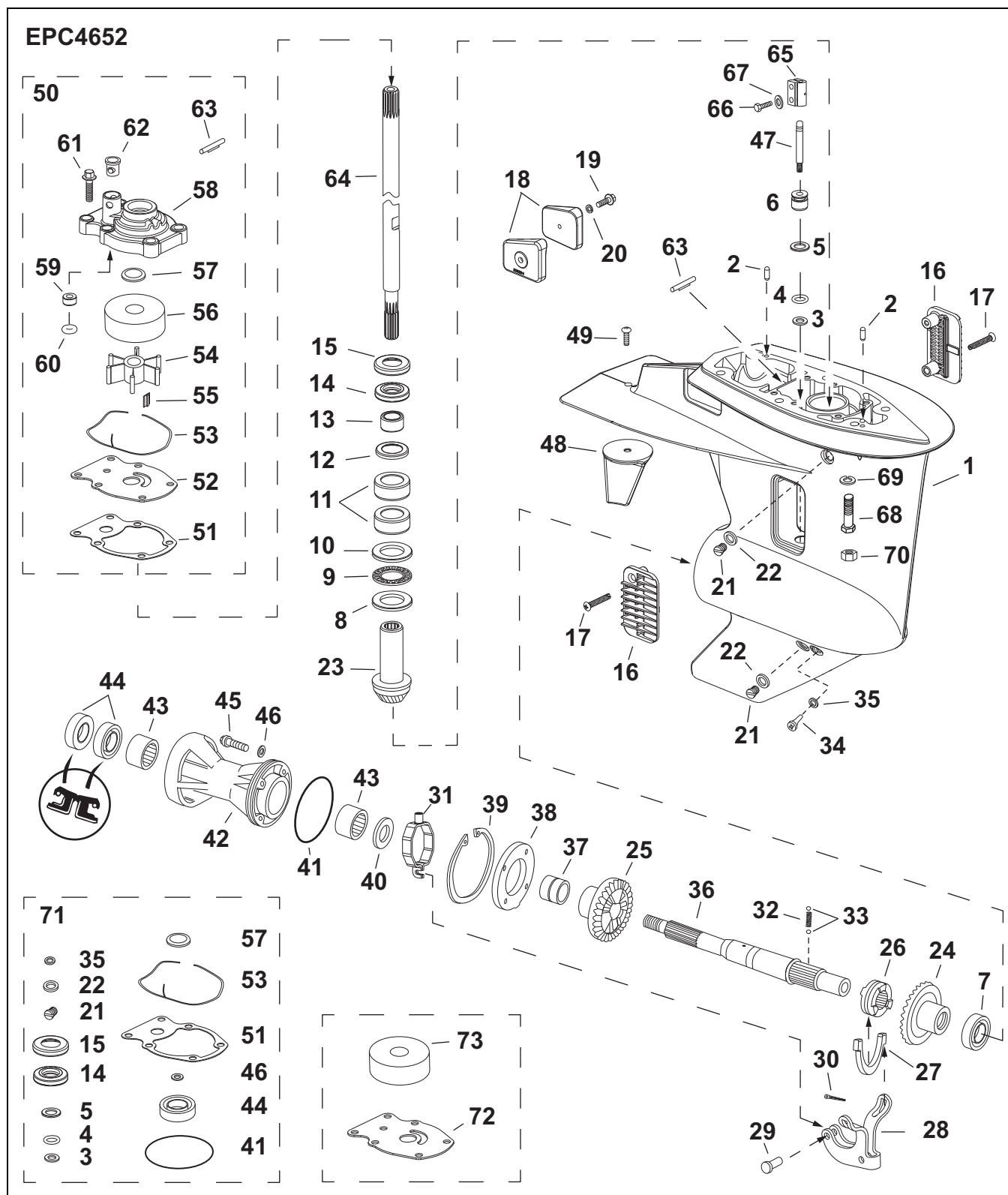


EPC4740

Ref	P/N	Name of Part	Qty	Note
1	0353548	STERN BRACKET, Starboard	1	
2	0353547	STERN BRACKET, Port	1	
3	0351896	TILT TUBE	1	
4	0319787	BUSHING, Swivel bracket to tilt tube	2	
5	0319699	THRUST WASHER, Stern bracket	2	
6	0335554	NUT, Tilt tube	2	
7	0317894	CAP	2	
8	5007080	SWIVEL BRACKET	1	
9	0342525	BUSHING, Tilt lock shaft to swivel	2	
10	0437875	*LOCK ASSEMBLY, Tilt - starboard	1	
11	0437876	*LOCK ASSEMBLY, Tilt - port	1	
12	0313607	FITTING, Lube	5	
13	5009612	STEERING ARM & SHAFT ASSEMBLY	1	
14	0330137	SEAL, Upper & lower	2	
15	0318295	THRUST WASHER, Upper & lower	2	
16	0342914	BUSHING, Swivel bracket upper	1	
17	0339489	BUSHING, Swivel bracket lower	1	
18	0342397	BLOCK, Steering friction	1	
19	0551113	SPRING, Steering friction	1	
20	0333676	SCREW, Steering friction	1	
21	0338657	LINK, Shallow water drive	1	
22	0322945	PIN, Shallow water drive	1	
23	0322949	LINK, Reverse lock	1	
24	0319697	SPRING, Shallow water drive	1	
25	0322947	PIN, Reverse lock link to swivel bracket	2	
26	0303887	WASHER, Rev lock link to swivel	2	
27	0333774	CLIP, Reverse lock link pin	2	
28	0322950	LEVER, Reverse lock	1	
29	0326943	PIN, Reverse lock link to lever	1	
30	0315078	SPRING, Reverse lock	2	
31	0319696	ROD, Reverse lock release	1	
32	0319695	BELLCRANK, Reverse lock	1	
33	0319108	SET SCREW, Reverse lock bellcrank	1	
34	0322946	SPRING, Shallow water drive link	1	
35	0436897	LEVER & SHAFT ASSEMBLY, Tilt lock	1	
36	0328048	KNOB, Tilt lock handle	1	
37	0319227	SCREW, Knob	1	
38	0388661	CAM & SHAFT ASSEMBLY, Tilt lock	1	
39	0342507	PIN, Tilt lock to stern brackets	2	
40	0303884	WASHER, Pin tilt lock	2	
41	0313990	NUT, Tilt lock pin	2	
42	0436387	TILT PIN	1	
43	0357240	TIE BAR, Stern bracket	1	
44	0908158	SCREW, Tie bar	2	
45	0305650	COTTER PIN	2	
46	0339992	HANDLE, Carry	1	
47	5009161	CLAMP SCREW & HANDLE KIT	1	
48	0353382	*SCREW, Handle	1	
49	0121470	*NUT, Handle screw	1	
50	0337017	*SWIVEL PLATE	1	
51	0321922	*SCREW, Swivel plate to handle	1	
52	5009157	LANYARD ASSEMBLY	1	E30MAL models only
53	0358044	CARABINER	1	
—	—	TRANSOM MOUNTING HARDWARE		
54	0334427	SCREW	2	
55	0315776	WASHER	2	
56	0309543	WASHER	2	
57	0310702	NUT, LOCK	2	

Gearcase – MAL/MRL Models

EPC4652

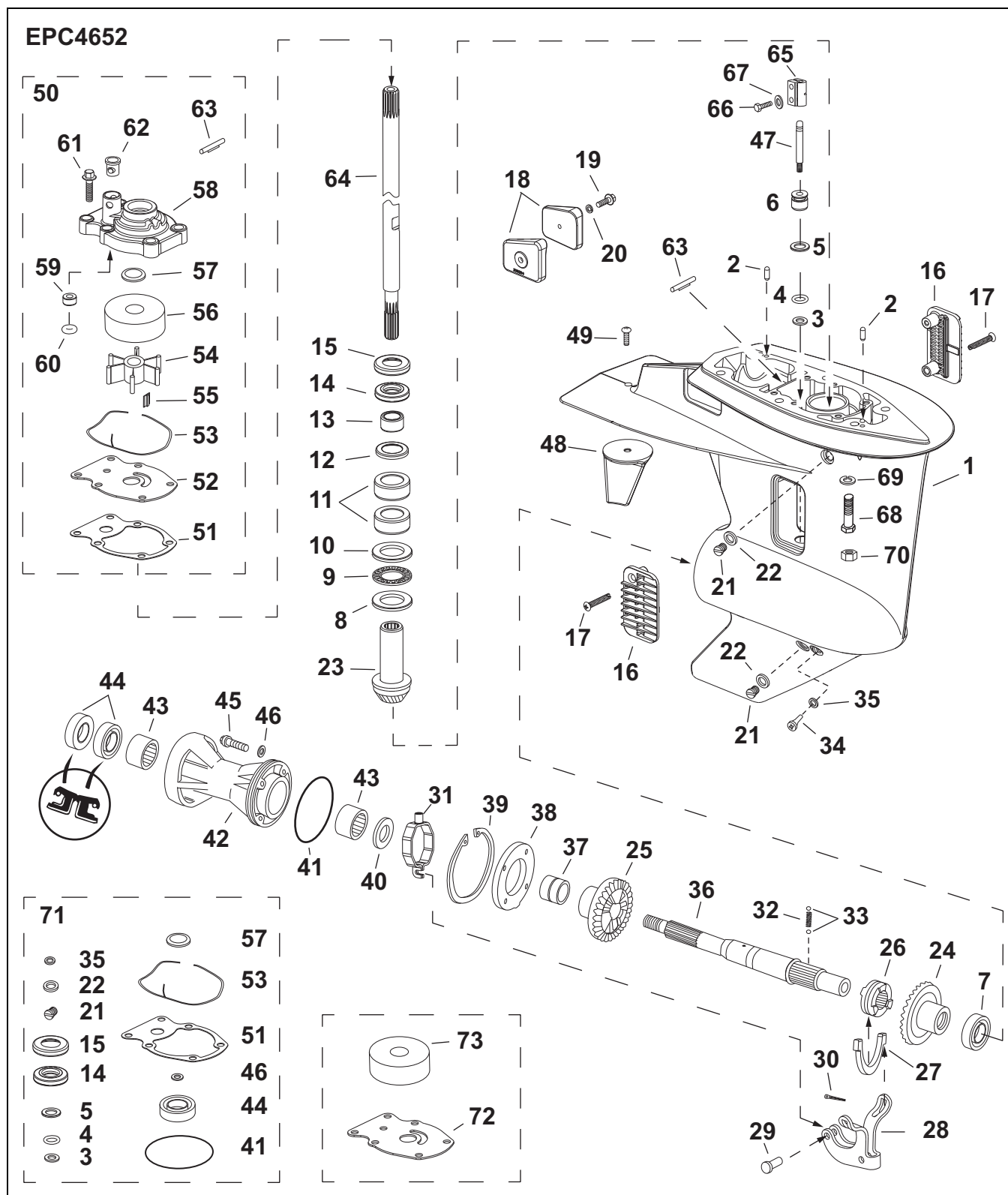


Gearcase – MAL/MRL Models

EPC4652

Ref.	P/N	Name of Part	Qty	Note
-	5009356	GEARCASE ASSEMBLY, Complete	1	Less Driveshaft
1	5009360	*GEARCASE Housing ASSEMBLY	1	
2	0353931	**PIN, Gearcase to exhaust housing	2	
3	0321738	**WASHER, Shift rod bushing	1	Contents of Gearcase Seal Kit
4	0301877	**O-RING, Shift rod	1	Contents of Gearcase Seal Kit
5	0303347	**O-RING, Scraper	1	Contents of Gearcase Seal Kit
6	0326361	**BUSHING, Shift rod, lower	1	
7	0386186	**ROLLER BEARING, Forward gear	1	
8	0330441	**THRUST WASHER, Lower	1	
9	0388027	**THRUST BEARING, Pinion	1	
10	0327716	**THRUST WASHER, Upper	1	
11	0376856	**BEARING ASSEMBLY, Pinion	2	
12	0322018	**HOUSING, Bearing	1	
13	0386473	**BEARING ASSEMBLY	1	
14	0321928	**SEAL, Driveshaft, lower	1	Contents of Gearcase Seal Kit
15	0332261	**SEAL, Driveshaft, upper	1	Contents of Gearcase Seal Kit
16	0336206	**SCREEN, Intake	2	
17	0325539	**SCREW, Screen to gearcase	2	
18	5007582	**ANODE KIT	1	
19	0353588	***SCREW, Anode mounting	1	
20	0304454	***LOCK WASHER, Anode	1	
21	0307551	*SCREW, Drain & fill	2	Contents of Gearcase Seal Kit
22	0311598	**WASHER	1	
23	0351147	*GEAR, Pinion, driveshaft	1	
24	0392475	*GEAR & BUSHING ASSEMBLY, Forward	1	Ratio – 13:28 / 0.465 / 2.15:1
25	0327655	*GEAR, Reverse	1	
26	0337020	*SHIFTER, Clutch dog	1	
27	0328311	*CRADLE, Clutch dog	1	
28	0337019	*LEVER, Shifter	1	
29	0302504	*PIN, Yoke & connector to shifter lever	1	
30	0303049	*COTTER PIN, Shifter lever	1	
31	0390023	*YOKE AND CONNECTOR ASSEMBLY	1	
32	0327070	*SPRING, Detent, propeller shaft	1	
33	0316506	*BALL, Detent, propeller shaft	2	
34	0308376	*PIVOT PIN, Shifter lever	1	
35	0332584	**WASHER, Seal ring, pivot pin	1	Contents of Gearcase Seal Kit
36	0439143	*PROPELLER SHAFT	1	
37	0319635	*BUSHING, Reverse gear	1	
38	0319746	*RETAINER PLATE, Housing	1	
39	0319747	*RETAINING RING	1	
40	0319684	*THRUST WASHER	1	
41	0338518	*O-RING, Bearing housing	1	
42	5008160	*BEARING HOUSING & SEAL	1	
43	0437288	**BEARING ASSEMBLY, Propeller shaft	2	
44	0321453	**SEAL, Propeller shaft	2	Contents of Gearcase Seal Kit
45	0319743	*SCREW, Propeller shaft bearing housing	2	
46	0332584	**WASHER, Seal ring	1	Contents of Gearcase Seal Kit
47	0353714	*SHIFT ROD, Lower	1	See THROTTLE AND SHIFT LINKAGE
48	5008161	TRIM TAB ASSEMBLY	1	
49	0353589	*SCREW, Trim tab	1	
-	-	Continued on next page		

Gearcase – MAL/MRL Models

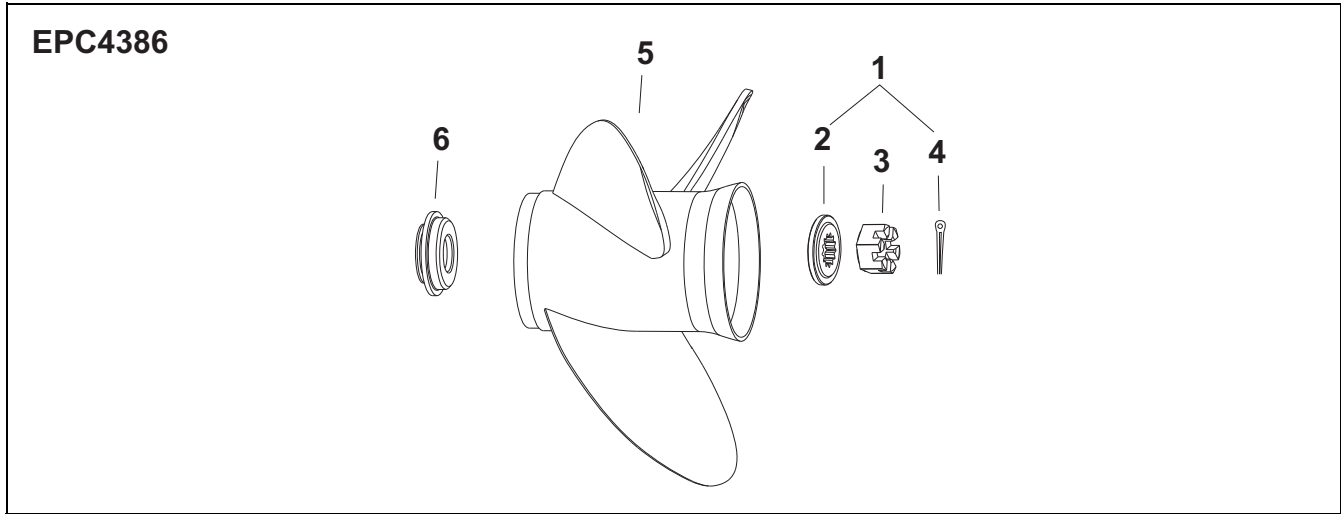


Gearcase – MAL/MRL Models

EPC4652

Ref.	P/N	Name of Part	Qty	Note
50	5008972	WATER PUMP REPAIR KIT	1	
51	0325537	*GASKET, Plate to gearcase	1	
52	0328755	*PLATE, Impeller housing	1	
53	0328753	*SEAL, Impeller housing to plate	1	Contents of Gearcase Seal Kit
54	5008968	*IMPELLER ASSEMBLY	1	
55	0344470	**KEY, Impeller	1	
56	0328751	*CUP, Impeller housing	1	
57	0554545	*O-RING, Cup to impeller housing	1	Contents of Gearcase Seal Kit
58	0393632	*IMPELLER HOUSING	1	
59	0328754	**BUSHING, Impeller housing	1	
60	0301877	*O-RING, Impeller housing	1	
61	0353590	*SCREW, Impeller housing	6	
62	0302497	*GROMMET, Lower water tube	1	
63	5007770	*SEAL & PIN ASSEMBLY	1	
64	0352899	DRIVESHAFT	1	20 in. Models
65	0303794	CONNECTOR, Shift rod	1	
66	0304024	SCREW, Shift rod connector	2	
67	0301551	LOCK WASHER	2	
68	0353554	SCREW, Gearcase mounting	6	
69	0353735	WASHER, Gearcase mounting screw	6	
71	5007987	GEARCASE SEAL KIT	1	
72	0328772	PLATE, Impeller housing – Chrome	1	Optional accessory
73	0328773	CUP, Impeller housing – Chrome	1	Optional accessory

Propeller, Propeller Hardware



EPC4386M

Ref	P/N	Name of Part	Qty	Note
1	0175268	PROPELLER HARDWARE KIT	1	
2	0323943	*SPACER,PROPELLER NUT	1	
3	0319891	*NUT, PROPELLER	1	
4	0320785	*PIN,COTTER	1	
5	0765049	PROPELLER, Aluminum, 3 x 10.5 in. x 11 P	1	Installed on engine, all models
5	0765048	PROPELLER, Aluminum, 3 x 11 in. x 9 P	1	Spare, in box, E30MAL models only
6	0335420	BUSHING,THRUST	1	

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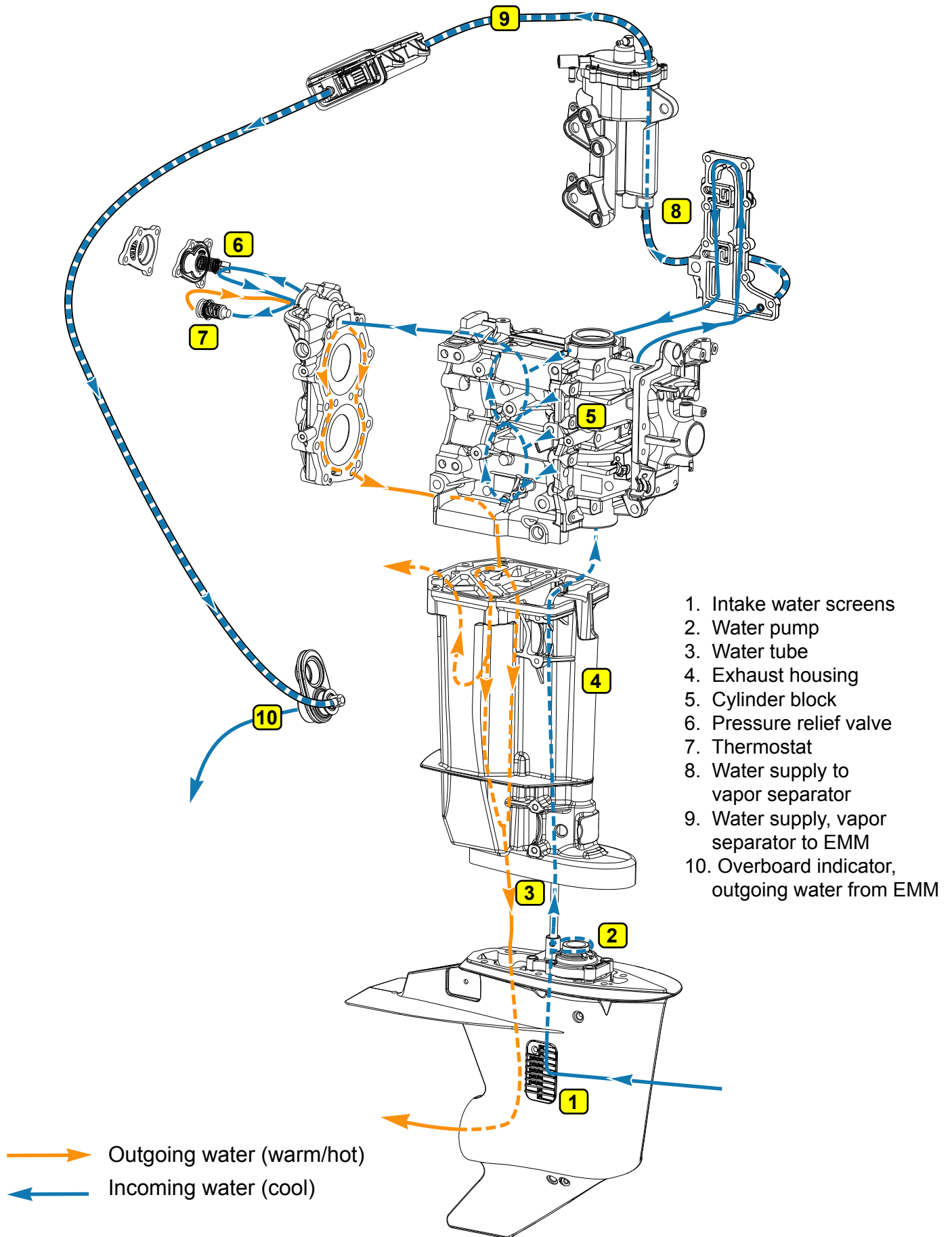
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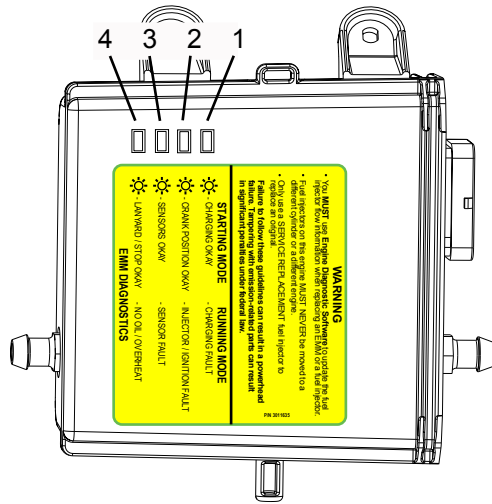
Hose Routing and Cooling Water Flow Diagram 30 MFE Inline 2 Cylinder



Evinrude E-TEC

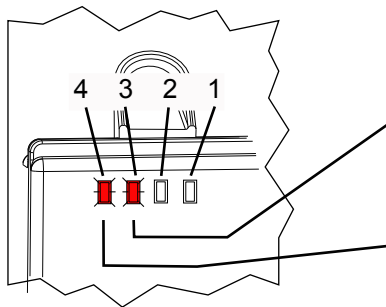
EMM LED Diagnostic Indicators

In-line 15–30HP Models



- 1  — Charging / 55V Circuit
- 2  — CPS OK - Injection/Ignition/Fault
- 3  — Sensors / 5V Circuits
- 4  — Stop Circuit - No Oil/Overheat

For more information, refer to **SYSTEM ANALYSIS** in the Service Manual.

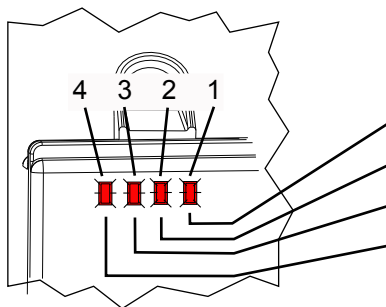


KEY ON: LED's illuminate to indicate circuit function

Sensors / 5V Circuits OK
FLASHING LED – URGENT condition – Code 57
Engine will not start – Correct problem and clear codes

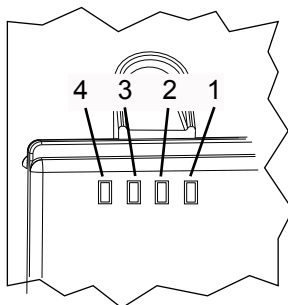
Stop circuit OK (not grounded)
FLASHING LED – URGENT overhear or no oil condition
Engine will not start – Correct problem and clear codes

Note: No LED's ON indicates EMM not receiving battery voltage or Recoil Start model.



STARTING : LED's illuminate to indicate circuit function

Indicates 30V (or higher) on 55V circuit
Indicates CPS working and EMM SYNC
Sensor circuits working
Stop circuit OK

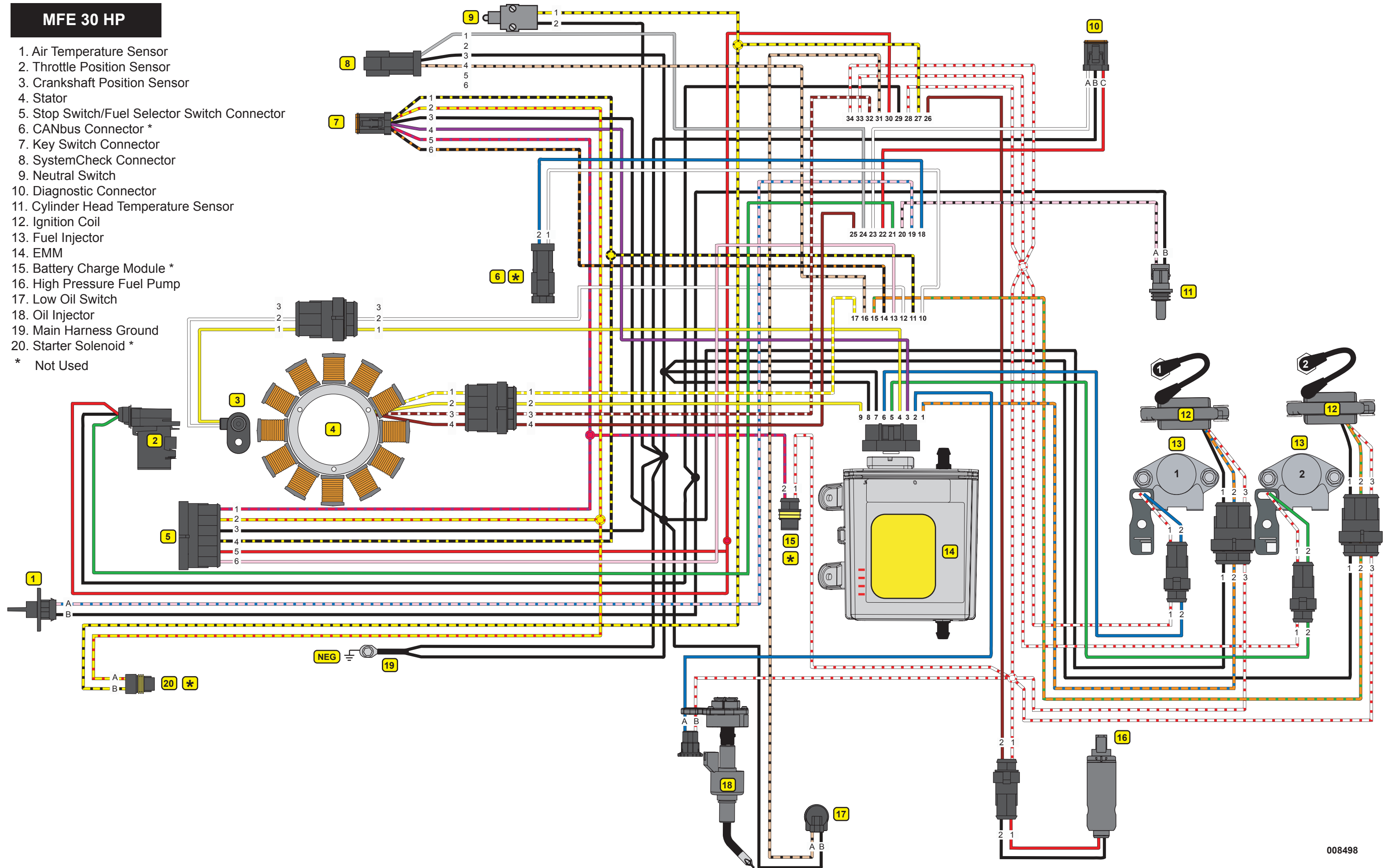


RUNNING : LED's illuminate to indicate circuit fault

Exception: ALL LED's ON / FLASHING indicates Winterization Mode

MFE 30 HP

1. Air Temperature Sensor
 2. Throttle Position Sensor
 3. Crankshaft Position Sensor
 4. Stator
 5. Stop Switch/Fuel Selector Switch Connector
 6. CANbus Connector *
 7. Key Switch Connector
 8. SystemCheck Connector
 9. Neutral Switch
 10. Diagnostic Connector
 11. Cylinder Head Temperature Sensor
 12. Ignition Coil
 13. Fuel Injector
 14. EMM
 15. Battery Charge Module *
 16. High Pressure Fuel Pump
 17. Low Oil Switch
 18. Oil Injector
 19. Main Harness Ground
 20. Starter Solenoid *
- * Not Used



CODE	EMM CIRCUIT/SENSOR	INTERNAL SENSOR	ACTIVE WARNING	S.A.F.E.	EMM LED DISPLAY	TIME TO ACTIVATE	SENSOR: CIRCUIT VOLTAGE / RESISTANCE (Ω) / INFORMATION
11	Throttle Position Sensor (TPS) out of idle range				-	2 seconds	TPS Voltage > 1.71 V with key ON (or cranking). Becomes stored fault when outboard starts. When both hard and stored faults are present, check for improperly adjusted throttle cable.
12	Throttle Position Sensor (TPS) circuit fault				LED 3: OFF (Cranking) / ON (Running)	0.8 seconds	TPS Voltage: < 0.14 V, or > 4.92 V. Engine limited to idle speed. Check sensor resistance—3000 Ω(between pins A and B) & 4000 Ω (between pins A and C)
13	TPS below range				LED 3: OFF (Cranking) / ON (Running)	8 seconds	TPS Voltage < 0.2 V. Check linkage and IDLE stop.
14	TPS above range				LED 3: OFF (Cranking) / ON (Running)	8 seconds	TPS Voltage > 4.85 V. Check linkage and WOT stop.
15	ROM (EMM program)	✓			-	-	ROM “CHECKSUM” failure. Check software program number in <i>EMM</i> . Reload or replace with proper program.
16	Crankshaft Position Sensor (CPS) Intermittent loss of SYNC				LED 2: OFF (Cranking) LED 3: ON (Running)	10 instances	<i>EMM</i> counts losses of synchronization with crankshaft speed. Check CPS mounting and resistance. Air gap range: 00.036 to 0.110 in. (1 to 2.8 mm), nominal 0.073 in. (1.85 mm) Resistance: 560 Ω ± 10% @ 77°F (25°C)
17	55 V circuit BELOW range	✓			LED 1: ON (Running)	1 minute	System Voltage < 45 V. Perform stator/charging tests.
18	55 V circuit ABOVE range	✓			LED 1: ON (Running)	1 minute	System Voltage > 57 V. Perform stator/charging tests. Check for loose connections in 55 V circuit. Check capacitor.
19	Start-in-gear				LED 3: OFF (Cranking)	-	Attempted engine start while in gear (<i>EMM</i> in tiller mode). Engine will not start.
21	Winterization activated				All LEDs FLASHING	-	Engine is speed limited, and stops after 360 oil pulses. Refer to Maintenance or Operator’s Guide.
23	EMM Temperature Sensor circuit fault	✓			LED 3: OFF (Cranking) / ON (Running)	8 seconds	EMM Temperature < -71° F (-57.4° C), or > 313° F (156° C).
24	EMM Temperature BELOW range	✓			LED 3: OFF (Cranking) / ON (Running)	8 seconds	EMM Temperature < -22 ° F (-30° C).
25	EMM Temperature ABOVE range	✓	✓		LED 4: ON (Running)	8 seconds	EMM Temperature > 194°F (90°C). Engine misfires once per 50 crankshaft revolutions. See Code 29.
26	12 V circuit BELOW range	✓			LED 1: ON (Running)	5 minutes	Battery voltage < 12.5 V. Perform stator/charging tests.
27	12 V circuit ABOVE range	✓			LED 1: ON (Running)	5 minutes	Battery voltage > 15.5 V. Check battery connections and wiring.
29	EMM Temperature OVER range	✓		✓	LED 4: FLASHING	4 seconds	EMM Temperature > 212° F (100° C). Engine limited to 2500 RPM. Check outboard and <i>EMM</i> cooling systems.
31	Engine temperature OVER range			✓	LED 4: FLASHING	8 seconds	Engine Temperature > 230° F (110° C). Engine torque and RPM limited. Check cooling system. Check temperature sensor resistance—9000 to 11000 Ω @ 77°F (25°C).
33	Critical NO OIL detected	✓		✓	LED 4: FLASHING	3 hours	Outboard has run three hours with code 34 or 117. Engine torque and RPM limited. Failure is imminent.
34	Oil injection pump circuit OPEN			✓	LED 4: ON (Running)	4 seconds	Engine torque and RPM limited. Check oil injection pump circuit resistance—22 Ω.
40	Engine temperature ABOVE range – Low speed				LED 4: ON (Running)	8 seconds	Engine Temperature > 212° F (100° C) below 3500 RPM.
41	Engine Temperature Sensor circuit fault				LED 3: OFF (Cranking) / ON (Running)	8 seconds	Engine Temperature < -15° F (-26.2° C), or > 332° F (166.5° C). Check sensor and circuit resistance—9000 to 11000 Ω @ 77°F (25°C).
42	Engine Temperature BELOW range				LED 3: OFF (Cranking) / ON (Running)	8 seconds	Engine Temperature < -4° F (-20° C). Check thermostat and pressure relief valve.
43	Engine Temperature ABOVE range		✓		LED 4: ON (Running)	8 seconds	Engine Temperature > 194° F (90° C). Engine misfires once per 50 crankshaft revolutions. Check cooling system.
44	Barometric Pressure (BP) Sensor circuit fault	✓			-	8 seconds	Pressure < 3.9 in. Hg (13.3 kPa), or > 35.1 in. Hg (119.0 kPa). Make sure <i>EMM</i> BP sensor tube is NOT plugged. Check atmospheric condition for comparison. Clear code and retest.
45	BP Sensor BELOW range	✓			-	8 seconds	Pressure < 20.7 in. Hg (70 kPa).
46	BP Sensor ABOVE range	✓			-	8 seconds	Pressure > 31 in. Hg (105 kPa).
47	Air Temperature (AT) circuit fault				LED 3: OFF (Cranking) / ON (Running)	8 seconds	Air temperature < -58° F (-49.9° C), or > 218° F (103.2° C). Check sensor and circuit resistance—9000 to 11000 Ω @ 77°F (25°C).
48	Air Temperature BELOW range				LED 3: OFF (Cranking) / ON (Running)	8 seconds	Air temperature < -22° F (-30° C).
49	Air Temperature ABOVE range				LED 3: OFF (Cranking) / ON (Running)	8 seconds	Air temperature > 158° F (70° C).
51	Fuel injector circuit #1 OPEN				LED 2: ON (Running)	2 seconds	Check injector/circuit resistance—2 to 3 Ω @ 72°F (22°C).
52	Fuel injector circuit #2 OPEN				LED 2: ON (Running)	2 seconds	
58	Operating temperature not reached				LED 3: OFF (Cranking) / ON (Running)	10 minutes	Engine temperature < 104° F (40° C) with engine speed < 2300 RPM. Check thermostat and pressure relief valve.
61	Fuel injector circuit #1 SHORTED				LED 2: ON (Running)	8 seconds	Check injector/circuit resistance—2 to 3 Ω @ 72°F (22°C).
62	Fuel injector circuit #2 SHORTED				LED 2: ON (Running)	8 seconds	
78	Sensor supply voltage fault	✓			LED 3: OFF (Cranking) / ON (Running)	10 seconds	Sensor voltage < 4.75 V. Check sensors and related wiring. Check for pinched or chafed wiring.
81	Ignition timing circuit #1 OPEN				LED 2: ON (Running)	10 instances	EMM counts failed ignition events. Check wiring. Test with known good ignition coil.
82	Ignition timing circuit #2 OPEN				LED 2: ON (Running)	10 instances	
91	Fuel pump circuit OPEN				LED 2: ON (Running)	8 seconds	
94	Fuel pump circuit SHORTED				LED 2: ON (Running)	2 seconds	Check pump/circuit resistance—2 to 3 Ω @ 77°F (25°C).
101	Ignition timing circuit #1 SHORTED				LED 2: ON (Running)	5 events-low speed	EMM counts failed ignition events. Check wiring. Test with known good ignition coil.
102	Ignition timing circuit #2 SHORTED					2 events-high speed	
117	Critical LOW OIL detected	✓		✓	LED 4: ON (Running)	6700 Pulses	EMM counts oil pump pulses after LOW OIL switch closes. Engine torque and RPM limited. Stop outboard and add oil to tank. Warning resets after three oil pump pulses.
120	Oil level sensor OPEN		✓		LED 4: ON (Running)	4 seconds	Check switch continuity—open below 1/4 capacity, closed above 1/4 capacity.

NOTE: Always note service codes before clearing codes. Clear stored codes using diagnostic software. Clearing some codes requires turning EMM “OFF” and then “ON” again.

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Revision: Original