# Service Manual Outline


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- C - Service Procedures
- D - Emissions

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# Notice

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

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

**⚠ DANGER**

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

**⚠ WARNING**

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

**⚠ CAUTION**

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

# Notice to Users of This Manual

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

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

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

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

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

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



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

# Cleanliness and Care of Outboard Motor

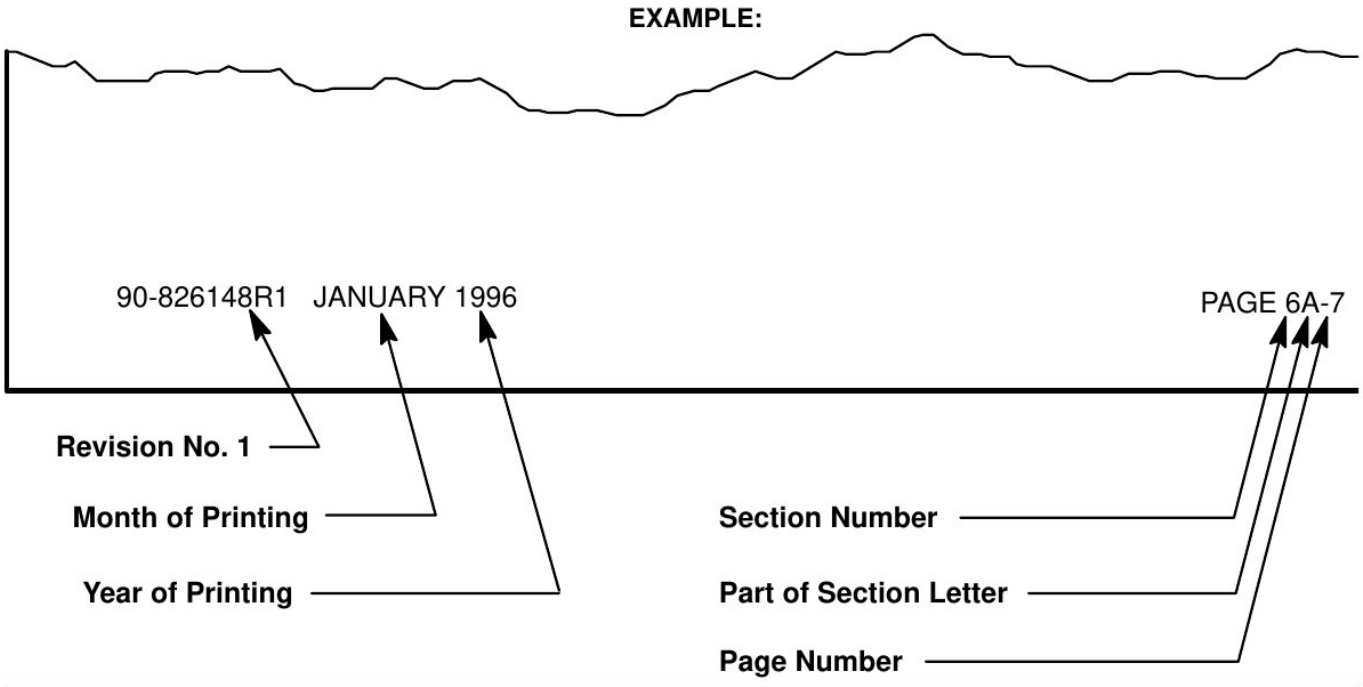
A marine power product is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten thousands of an inch/mm. When any product component is serviced, care and cleanliness are important. Throughout this manual, it should be understood that proper cleaning,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

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

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

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

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



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# IMPORTANT INFORMATION

## Section 1A - Specifications

1 A

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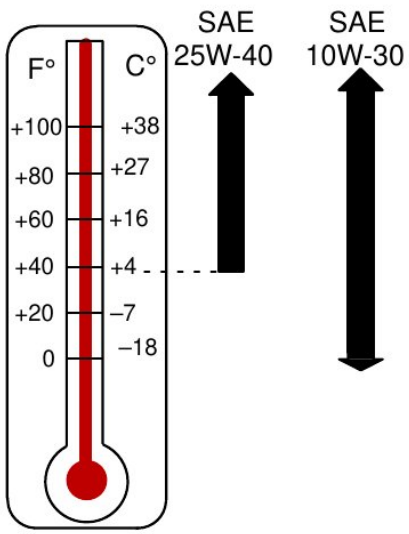
## Specifications

| Models 40/50/60 EFI (4-Stroke) | | |
|---|---|---|
| **HORSEPOWER (kW)** | **Model 40**<br>**Model 50**<br>**Model 60** | 40 hp (29.8 Kw) @ 5750 rpm<br>50 hp (37.7 Kw) @ 5750 rpm<br>60 hp (44.7 Kw) @ 5750 rpm |
| **OUTBOARD WEIGHT** | **Electric**<br>**40/50/60 ELPT**<br>**40/50/60 ELPT BIGFOOT** | <br>248 lb (112.7 kg)<br>264 lb (119.9 kg) |
| **FUEL** | **RECOMMENDED GASOLINE** | Automotive Unleaded with a Minimum Pump Posted Octane Rating of 87 |
| **OIL** | **OIL FILTER**<br>**OIL FILTER WRENCH**<br>**ENGINE OIL CAPACITY**<br>**ENGINE OIL**<br> | p/n 35-822626A2<br>p/n 91-802653Q1<br>Either 3 Quarts or 3 Liters<br>SAE 10W-30 viscosity oil is recommended for use in all temperatures. SAE 25W-40 viscosity oil may be used at temperatures above 40° F (4° C).<br><br>Use Quicksilver 4-Cycle Marine Oil with the proper viscosity for the expected temperature in your area (see range thermometer on left). If not available, use a premium quality 4-cycle engine oil, certified to meet or exceed anyone of the following American Petroleum Institute (API) service classifications SH, SG, SF, CF-4, CE, CD, CDII. |



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| | | |
|---|---|---|
| **IGNITION SYSTEM**<br>**Readings taken @ 68°F (20°C).** | **Type** | Capacitor Discharge Ignition |
| | **Spark Plug:** | |
| | **Type** | Champion RA8HC |
| | **Gap** | 0.040 in. (1.0 mm) |
| | **Hex Size** | 5/8 in. (16 mm) |
| | **Torque** | 150 lb-in. (17 Nm) |
| | **Hole Size** | 12 mm |
| | **Firing Order** | 1-3-4-2 |
| | **Ignition Timing:** | |
| | **@Idle** | Controlled by ECM |
| | **@1500-1800** | 14° B.T.D.C |
| | **@ WOT (6000 rpm)** | 28° B.T.D.C |
| | **Stator Resistance** | 0.20 - 0.30 Ω (YEL-YEL) |
| | **Crank Position Sensor (CPS) Resistance** | 300 - 350 Ω (RED - WHT) |
| | **Ignition Coil Resistance:** | |
| | **Internal Shielding** | 0 - 10.0 KΩ (Pin A - Mounting Bracket) |
| | **Electronic Spark Trigger (EST) Secondary** | 8.5 - 12KΩ (Pin B - Pin C) |
| | **High Tension Lead/Boot Resistance** | 3.0 - 7.0 kΩ (Pin A - Coil Tower)<br>0.600 - 1.100 KΩ |
| | **ECM Engine Speed Limiter** | |
| | **Fuel/Spark Cut-out on Cylinders #2 and #3** | 6225 rpm |
| | **Fuel/Spark Cut-out on All Cylinders** | 6350 rpm |
| | **ECM Overheat Speed Control** | Guardian System is activated. Power limit will vary with level of overheat. |
| | **ECM Low Oil Pressure Speed Control** | Guardian System is activated. Engine power is limited to 10% of maximum (Approximately 2000 RPM) |
| | **MAT/ECT Temperature Sensor** | See Graph Section 3B - EFI |
| | **Manifold Absolute Pressure (MAP) Sensor Resistance** | See Table Section 3B - EFI |
| | **Fuel Injector Resistance** | 10.0 - 13.5Ω |
| | **Main Power Relay** | 81-99 Ω (Pin 85 - Pin 86) |
| | **Idle Air Control (IAC)** | 24-30 Ω (Between Pins) |
| | **Throttle Position Sensor Typical Range** | |
| | **Output Voltage @Idle** | 0.39-1.00 Volts |
| | **Output Voltage @WOT (6000)** | 3.66-4.80 Volts |
| **CHARGING SYSTEM**<br>**Readings taken @ 68°F (20°C).** | **Alternator Type:**<br>**20 Amp. Electric Alternator Output** | Single Phase (12 Pole)<br>12.6 V-20 Amps. (252 Watts) (Rectified/Regulated) |
| | **Stator Resistance** | 0.20 - 0.30 Ohms (YEL-YEL) |
| | **Quicksilver Tachometer Setting** | “6P” or “4” |
| **STARTING SYSTEM** | **Electric Start:** | |
| | **Starter Type** | Bendix |
| | **Output** | 1.1 kW |
| | **Ampere Draw Under:** | |
| | **(Load)** | 174.0 Amps |
| | **(No Load)** | 23.7 Amps |



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|---|---|---|
| **BATTERY** | **Battery Rating**<br>**Minimum Requirement**<br><br>**For operation below 32° F (0° C)**<br><br>**Ampere-Hours (Ah) Minimum**<br>**For operation above 32° F (0° C)**<br>**For operation below 32° F (0° C)** | 465 Marine Cranking Amps (MCA)<br>or 350 Cold Cranking Amps (CCA)<br>1000 Marine Cranking Amps (MCA) or<br>775 Cold Cranking Amps (CCA)<br><br>70<br>105 |
| **FUEL SYSTEM** | **Fuel Pump Type**<br><br>**Fuel Pump:**<br>**Pressure**<br>**Fuel Tank Capacity** | Mechanical Water Cooled<br>(Plunger/Diaphragm)<br><br>3-6 psi<br>Accessory |
| **FUEL INJECTION** | **Fuel Injector System**<br>**Idle rpm (Out Of Gear)**<br>**Idle rpm (In Forward Gear)**<br>**Wide Open Throttle rpm (WOT)**<br>**Range**<br>**Fuel Pump Pressure - Electric** | Batch (1 & 4) - (2 & 3)<br>725 ± 25 rpm<br>725 ± 25 rpm<br><br>5500–6000<br>42-44 psi (290-303 kPa) |
| **CYLINDER BLOCK** | **Type**<br>**Displacement**<br>**Number of Cylinders** | 4 Stroke Cycle – Over Head Camshaft<br>60.8 cu. in. (995 cc)<br>4 |
| **STROKE** | **Length** | 2.953 in. (75 mm) |
| **CYLINDER BORE** | **Diameter**<br>**Standard**<br>**Oversize-0.010 in. (0.25 mm)**<br>**Oversize-0.020 in. (0.50 mm)**<br>**Taper/Out of Round Maximum**<br>**Bore Type** | <br>2.5591 in. (65 mm)<br>2.5689 in. (65.25 mm)<br>2.5787 in. (65.5 mm)<br>0.003 in. (0.08 mm)<br>Cast Iron |
| **PISTON** | **Piston Type**<br>**O.D. at Skirt**<br>**Standard**<br>**Oversize-0.010 in. (0.25 mm)**<br>**Oversize-0.020 in. (0.50 mm)** | Aluminum<br><br>2.5570 - 2.5578 in. (64.950 - 64.965 mm)<br>2.5669 - 2.5675 in. (65.2 - 65.215 mm)<br>2.5768 - 2.5774 in. (65.450 - 65.465 mm) |
| **PISTON CLEARANCE** | **Piston to Cylinder Clearance** | 0.0014 - .0026 in. (0.035 - 0.065 mm) |
| **RINGS** | **Ring End Gap (Installed)**<br>**Top**<br>**Middle**<br>**Bottom (Oil Ring)**<br>**Side Clearance:**<br>**Top**<br>**Middle** | <br>0.006 - 0.012 in. (0.15 - 0.03 mm)<br>0.012 - 0.020 in. (0.30 - 0.50 mm)<br>0.008 - 0.028 in. (0.20 - 0.70 mm)<br><br>0.0008 - 0.0024 in. (0.02 - 0.06 mm)<br>0.0008 - 0.0024 in. (0.02 - 0.06 mm) |
| **COMPRESSION RATIO** | **Compression Ratio**<br>**Cylinder Compression***<br>**(Electric Models Only, Cold Engine @ W.O.T.)** | 9.7:1<br>180 - 210 psi (Peak) |
| **PISTON PIN** | **Piston Pin Diameter** | 0.6285 - 0.6287 in. (15.965 - 15.970 mm) |
| **CONNECTING ROD** | **Oil Clearance (Big End)**<br>**Small End Inside Diameter** | 0.0008 - 0.0020 in. (0.020 - 0.052 mm)<br>0.6293 - 0.6298 in. (15.985 - 15.998 mm) |



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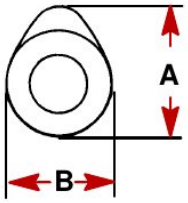
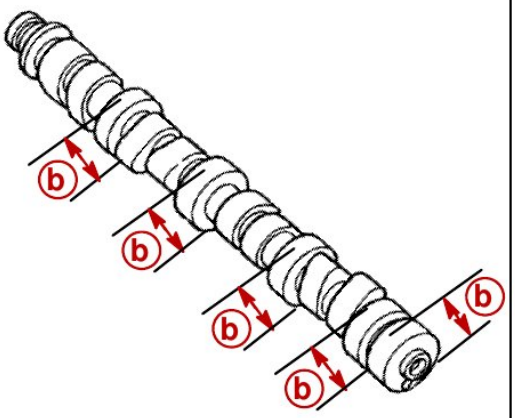
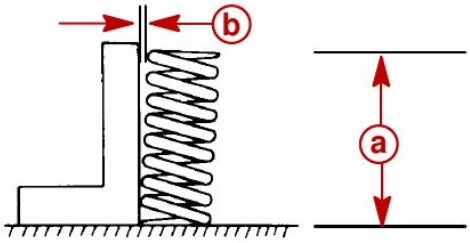
| | | |
|---|---|---|
| **CRANKSHAFT** | **Main Bearing Clearance**<br>**Crankshaft Run-out** | 0.0005 - 0.0017 in. (0.012 - 0.044 mm)<br>0.0018 in. (0.046 mm) |
| **CAMSHAFT** | **Camshaft Dimensions**<br>**Intake "A"**<br>**Exhaust "A"**<br>**Intake "B"**<br>**Exhaust "B"**<br><br>**Run-out Limit**<br>**Camshaft Bearing Diameter "b"**<br> | <br>1.214 - 1.222 in. (30.83 - 31.03 mm)<br>1.214 - 1.222 in. (30.83 - 31.03 mm)<br>1.020 - 1.028 in. (25.90 - 26.10 mm)<br>1.020 - 1.028 in. (25.90 - 26.10 mm)<br><br>0.0039 in. (0.1 mm)<br>1.4541 - 1.4549 in.<br>(36.935 - 36.955 mm) |
| **VALVE SPRING** | **Free Length "a"**<br>**Tilt Limit "b"**<br><br>**Compressed Pressure (Installed)**<br>**Intake**<br>**Exhaust**<br>**Tilt Limit (Intake & Exhaust)**<br>**Dir. of Winding (Intake & Exhaust)** | 1.491-1.569 in. (37.85-39.85 mm)<br>Less than 0.060 in. (1.7 mm)<br><br><br><br>19.8 - 22.0 lbs. (9.0 - 10.0 kg)<br>19.8 - 22.0 lbs. (9.0 - 10.0 kg)<br>0.043 in. (1.1 mm)<br>Left Hand |



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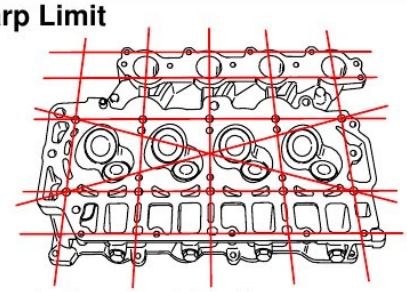
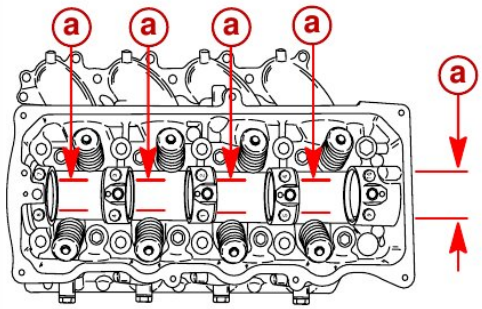
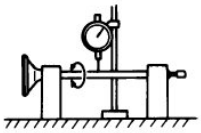
| | | |
|---|---|---|
| **CYLINDER HEAD** | **Warp Limit**<br><br>*** Lines indicate straight edge measurement**<br>**Camshaft Bore Inside Diameter "a"**<br> | 0.004 in. (0.1 mm)<br><br>1.4567 - 1.4577 in.<br>(37.000 - 37.025 mm) |
| **VALVES** | **Valve/Valve Seat/Valve Guides:**<br>**Valve Clearance (cold)**<br>**Intake**<br>**Exhaust**<br>**Valve Dimensions:**<br>**"A" Head Diameter**<br>**Intake**<br>**Exhaust**<br>**"B" Face Width**<br>**Intake**<br>**Exhaust**<br>**"C" Seat Width**<br>**Intake**<br>**Exhaust**<br>**"D" Margin Thickness**<br>**Intake**<br>**Exhaust**<br>**Stem Outside Diameter**<br>**Intake**<br>**Exhaust**<br>**Guide Inside Diameter**<br>**Intake**<br>**Exhaust**<br>**Stem To Guide Clearance**<br>**Intake**<br>**Exhaust**<br>**Stem Run-out Limit (max.)**<br> | <br><br>0.006 - 0.010 in. (0.15 - 0.25 mm)<br>0.010 - 0.014 in. (0.25 - 0.35 mm)<br><br><br>1.256 - 1.264 in. (31.9 - 32.1 mm)<br>1.020 - 1.028 in. (25.9 - 26.1 mm)<br><br>0.079 - 0.124 in. (2.00 - 3.14 mm)<br>0.079 - 0.124 in. (2.00 - 3.14 mm)<br><br>0.035 - 0.043 in. (0.9 - 1.1 mm)<br>0.035 - 0.043 in. (0.9 - 1.1 mm)<br><br>0.020 - 0.035 in. (0.5 - 0.9 mm)<br>0.020 - 0.035 in. (0.5 - 0.9 mm)<br><br>0.2156 - 0.2161 in. (5.475 - 5.490 mm)<br>0.2150 - 0.2156 in. (5.460 - 5.475 mm)<br><br>0.2165 - 0.2170 in. (5.500 - 5.512 mm)<br>0.2165 - 0.2170 in. (5.500 - 5.512 mm)<br><br>0.0004 - 0.0015 in. (0.010 - 0.037 mm)<br>0.0010 - 0.0020 in. (0.025 - 0.052 mm)<br>0.0006 in. (0.016 mm) |



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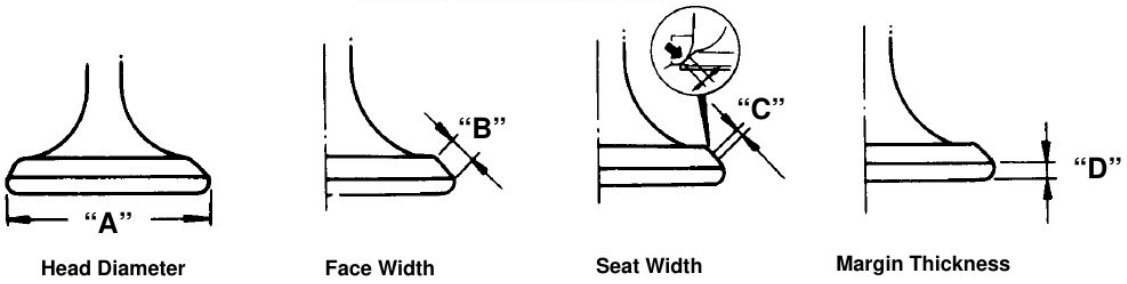
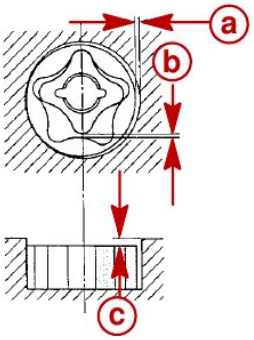
## Valve Dimensions




Head Diameter | Face Width | Seat Width | Margin Thickness

| | | |
|---|---|---|
| **ROCKER SHAFT** | **Outside Diameter** | 0.6288 - 0.6296 in.<br>(15.971 - 15.991 mm) |
| **ROCKER ARM** | **Inside Diameter of Bore** | 0.6299 - 0.6306 in.<br>(16.000 - 16.018 mm) |
| **THERMOSTAT** | **Valve Opening Temperature**<br>**Full Open Temperature** | 118° F - 123° F (48° C - 51° C)<br>145° F (63° C) |
| **LUBRICATION SYSTEM** | **Pump Type**<br>**Engine Oil Pressure (Warm Engine)**<br>**@ 3000 rpm**<br>**Engine Oil Pan Capacity**<br>**Oil Pump:**<br>**Outer Rotor to Housing "a"**<br>**Inner Rotor to Outer Rotor "b"**<br>**Rotor to Housing "c"**<br> | Trochoid<br><br>30-40 psi (207-278 kPa)<br>Either 3 Qts. **or** 3 Liters<br><br>0.0045 - 0.009 in. (0.11 - 0.23 mm)<br>0.005 in. (0.12 mm)<br>0.0015 - 0.003 in. (0.04 - 0.08 mm) |
| **MID-SECTION** | **Transom Height:**<br>**Long Shaft**<br>**Steering Pivot Range:**<br>**Tiller**<br>**Remote**<br>**Full Tilt Up Angle**<br>**Allowable Transom Thickness** | <br>20 in. (51 cm)<br><br>90°<br>60°<br>71°<br>2-3/4 in. (69.8 mm) |



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|---|---|---|
| **GEAR HOUSING (1.83:1)** | **Gear Ratio**<br>**Gearcase Capacity**<br>**Lubricant Type**<br>**Forward Gear**<br>**Number of Teeth**<br>**Pinion Gear**<br>**Number of Teeth**<br>**Pinion Height**<br><br><br>**Forward Gear Backlash**<br><br><br>**Water Pressure (Warm Engine)**<br>**@ 800 rpm**<br>**@ 6000 rpm (WOT)**<br>**Leak Test Pressure** | 1.83:1<br>11.5 fl oz (340 mL)<br>Quicksilver Gear Lube-Premium Blend<br><br>22 Spiral/Bevel<br><br>12 Spiral/Bevel<br>0.025 in. (0.64 mm)<br>Pinion Gear Locating Tool<br>(91-817008A2)<br>0.011-0.017 in. (0.28-0.43 mm)<br>Backlash Indicator Tool (91-19660--1)<br>MARK #4 or 0.366 in. (9.3 mm)<br><br>1–3 psi (7-21 kPa)<br>12–25 psi (83-172 kPa)<br>10-12 psi (68-83 kPa)<br>for 5 Minutes |
| **GEAR HOUSING BIGFOOT (2.3:1)** | **Gear Ratio**<br>**Gearcase Capacity**<br>**Lubricant Type**<br>**Forward Gear**<br>**Number of Teeth**<br>**Pinion Gear**<br>**Number of Teeth**<br>**Pinion Height**<br>**Pinion Gear Locating Tool**<br>**Flat Number**<br>**Disc Number**<br>**Forward Gear Backlash**<br>**Backlash Indicating Tool**<br>**Mark Number**<br>**Water Pressure**<br>**@ 800 rpm (Idle)**<br>**@ 6000 rpm (WOT)**<br>**Leak Test Pressure** | 2.31:1<br>24 fl oz (710 mL)<br>Quicksilver Gear Lube-Premium Blend<br><br>30 Spiral/Bevel<br><br>13 Spiral/Bevel<br>0.025 in. (0.64 mm)<br>91-12349A2<br>#8<br>#3<br>0.012-0.019 in. (0.30-0.48 mm)<br>91-78473<br>#4<br><br>2-6 psi (14-41 kPa)<br>12-25 psi (83-172 kPa)<br>10-12 psi (69-83 kPa)<br>for 5 Minutes |



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