



POWERHEAD

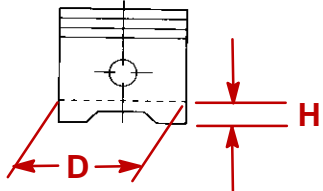
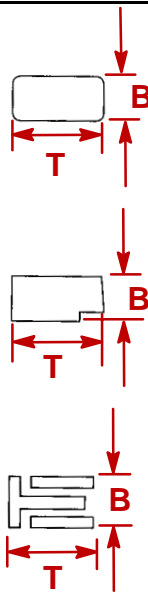
Section 4B - Cylinder Block/Crankcase

Table of Contents

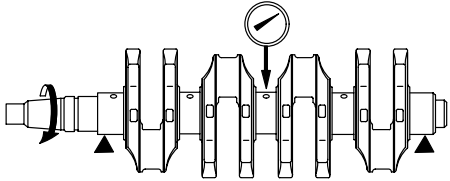
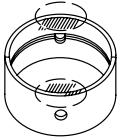
Specifications	4B-2	Cleaning/Inspection/Repair	4B-23
Special Tools	4B-4	Cylinder	4B-23
Cylinder Block And Crankcase	4B-6	Piston	4B-24
Crankshaft, Pistons And Connecting Rods	4B-8	Piston Rings	4B-25
Torque Sequence	4B-10	Crankshaft	4B-26
Crankcase Cover Bolts	4B-10	Crankcase and Bearings	4B-26
Exhaust Cover Screws	4B-11	Connecting Rod Oil Clearance	4B-31
Powerhead Mounting Bolts/Nuts	4B-11	Powerhead Assembly	4B-35
Preparing Powerhead for Removal	4B-12	Piston Ring/Piston Installation	4B-35
Powerhead Removal	4B-15	Crankcase and Crankshaft Installation ...	4B-36
Removing Powerhead Components	4B-16	Exhaust Cover Installation	4B-40
Ignition Components	4B-16	Drive Sprocket Installation	4B-42
Charging and Starting System		Installing Powerhead Components	4B-43
Components	4B-16	Cylinder Head Installation	4B-43
Fuel Components	4B-16	Harness and Battery Cable Removal	4B-43
Harness and Battery Cable Removal	4B-16	Fuel Components	4B-43
Cylinder Head Removal	4B-16	Charging and Starting System	
Powerhead Disassembly	4B-17	Components	4B-43
Drive Sprocket Removal	4B-17	Ignition Components	4B-43
Exhaust Cover Removal	4B-18	Powerhead Installation	4B-44
Crankcase and Crankshaft Removal	4B-20	Following Powerhead Installation	4B-46
Piston Ring Removal	4B-22		



Specifications

CYLINDER BLOCK	Type Displacement Number of Cylinders	In-Line, 4 Stroke – DOHC, 16 Valves 97.4 cid (1,596 cc) 4
STROKE	Length	3.205 in. (81.4 mm)
CYLINDER BORE	Diameter Standard Oversize-0.010 in. (0.25 mm) Taper/Out of Round Maximum Bore Type	3.110 - 3.111 in. (79.000 - 79.020 mm) 3.120 - 3.121 in. (79.250 - 79.270 mm) 0.003 in. (0.08 mm) Cast Iron
PISTON	Piston Type Measure Point (H) O.D. at Skirt (H) Standard (D) Oversize-0.010 in. (0.25 mm) Pin Boss Inside Diameter 	Aluminum 0.51 in. (13 mm) 3.1073 - 3.1082 in. (78.928 - 78.949 mm) 3.1174 - 3.1182 in. (79.178 - 79.199 mm) 0.7090 - 0.7093 in. (18.008 - 18.015 mm)
PISTON CLEARANCE	Piston to Cylinder Clearance	0.0028 - .0031 in. (0.070 - 0.080 mm)
RINGS	Top Ring Dimension "B" Dimension "T" End Gap (Installed) Side Clearance Middle Ring Dimension "B" Dimension "T" End Gap (Installed) Side Clearance Bottom (Oil Ring) Dimension "B" Dimension "T" End Gap (Installed) Side Clearance 	0.046 - 0.047 in. (1.17 - 1.19 mm) 0.114 - 0.115 in. (2.89 - 2.91 mm) 0.006 - 0.012 in. (0.15 - 0.30 mm) 0.001 - 0.003 in. (0.02 - 0.08 mm) 0.058 - 0.059 in. (1.47 - 1.49 mm) 0.118 - 0.126 in. (3.00 - 3.20 mm) 0.028 - 0.035 in. (0.70 - 0.90 mm) 0.001 - 0.003 in. (0.03 - 0.07 mm) 0.094 - 0.098 in. (2.38 - 2.48 mm) 0.094 in. (2.40 mm) 0.008 - 0.028 in. (0.20 - 0.70 mm) 0.001 - 0.006 in. (0.03 - 0.15 mm)
COMPRESSION RATIO	Compression Ratio Cylinder Compression (Minimum)	9.6:1 138 psi (950 kPa)
PISTON PIN	Piston Pin Outside Diameter	0.7083 - 0.7087 in. (17.997 - 18.000 mm)

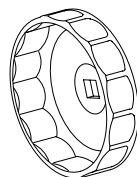


CONNECTING ROD	Small End Inside Diameter Big End Inside Diameter Oil Clearance (Big End) Big End Bearing Thickness Yellow Green Blue Red	0.7073 - 0.7081 in. (17.965 - 17.985 mm) 1.8514 - 1.8518 in. (47.025 - 47.035 mm) 0.0009 - 0.0014 in. (0.023 - 0.035 mm) 0.0590 - 0.0593 in. (1.499 - 1.506 mm) 0.0593 - 0.0596 in. (1.506 - 1.513 mm) 0.0596 - 0.0598 in. (1.513 - 1.520 mm) 0.0598 - 0.0601 in. (1.520 - 1.527 mm)
CRANKSHAFT	Crankshaft Journal Diameter Minimum Diameter Crankshaft Pin Diameter Minimum Diameter Crankshaft Run-out 	1.8892 - 1.8898 in. (47.985 - 48.000 mm) 1.8887 in. (47.972 mm) 1.7316 - 1.7323 in. (43.982 - 44.000 mm) 1.7311 in. (43.971 mm) 0.001 in. (0.03 mm)
CRANKCASE	Crankcase Main Journal Inside Diameter Crankshaft Journal Oil Clearance Upper Crankcase Main Journal Bearing Thickness Green Blue Red Lower Crankcase Main Journal Bearing Thickness Yellow Green Blue Red No. 3 Main Journal Bearing Thickness Green Blue Red 	2.1269 - 2.1276 in. (54.023 - 54.042 mm) 0.0009 - 0.0017 in. (0.024 - 0.044 mm) 0.1178 - 0.1181 in. (2.992 - 2.999 mm) 0.1181 - 0.1183 in. (2.999 - 3.006 mm) 0.1183 - 0.1186 in. (3.006 - 3.013 mm) 0.1185 - 0.1188 in. (3.010 - 3.017 mm) 0.1188 - 0.1191 in. (3.017 - 3.024 mm) 0.1191 - 0.1193 in. (3.024 - 3.031 mm) 0.1193 - 0.1196 in. (3.031 - 3.038 mm) 0.1178 - 0.1181 in. (2.992 - 2.999 mm) 0.1181 - 0.1183 in. (2.999 - 3.006 mm) 0.1183 - 0.1186 in. (3.006 - 3.013 mm)

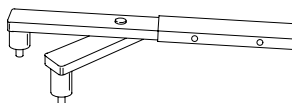


Special Tools

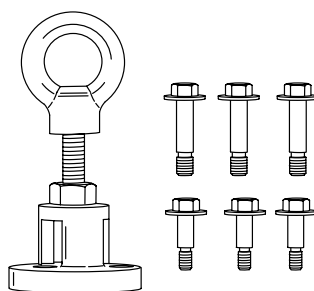
1. Oil Filter Wrench (P/N 91-802653)



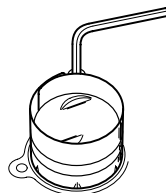
2. Flywheel Holder (P/N 91-83163M)



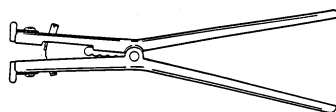
3. Flywheel Puller (P/N 91-83164M)



4. Piston Ring Compressor (P/N FT2997)



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



6. Crankshaft Holder (P/N 91-804770A1)

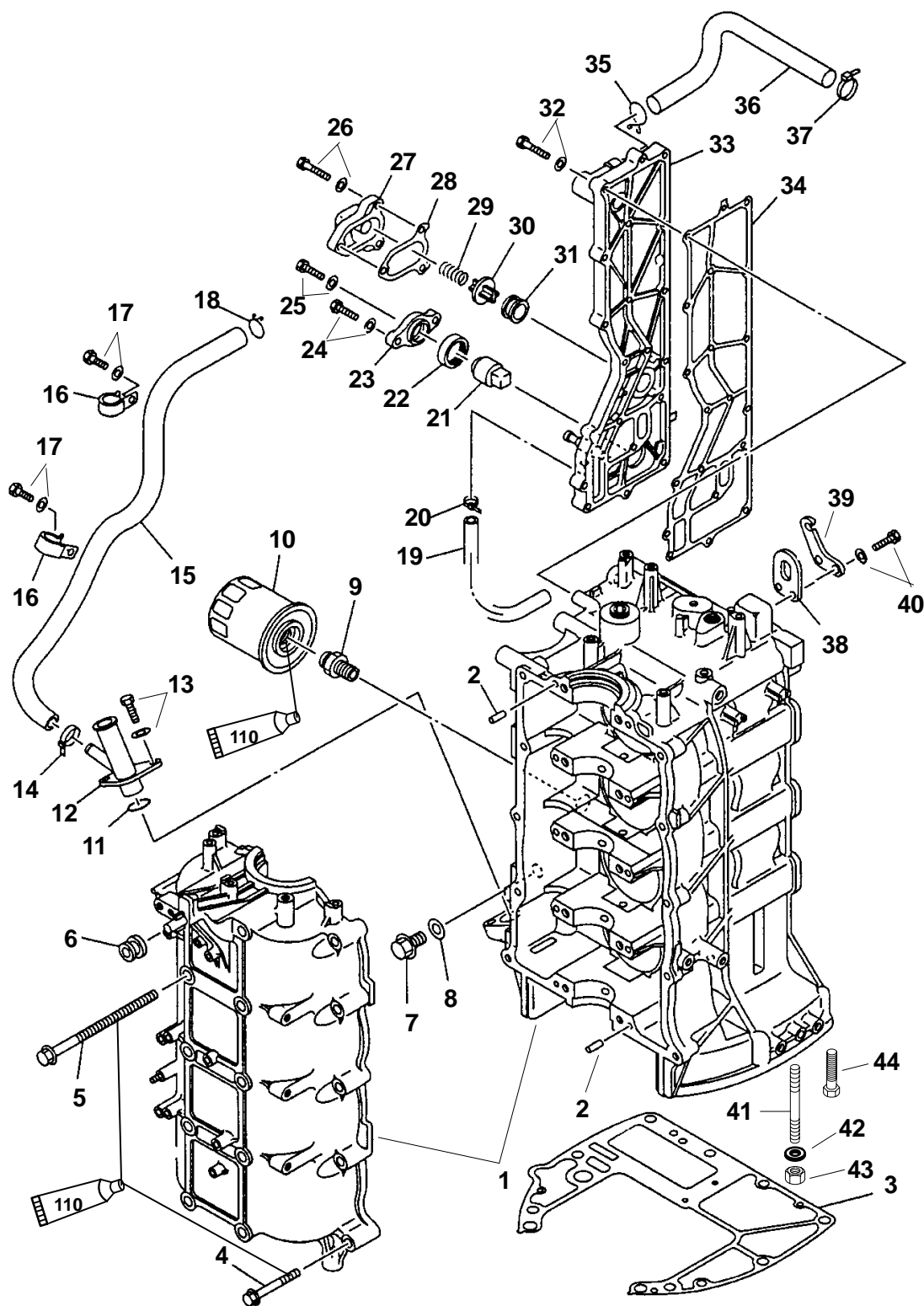




Notes:



Cylinder Block And Crankcase



 4-Stroke Outboard Oil (92-828000A12)



Cylinder Block And Crankcase

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	CYLINDER BLOCK			
2	10	DOWEL PIN			
3	1	GASKET			
4	10	SCREW (M8 x 55 mm)	120	20	14
		1st Torque			28
		2nd Torque			
5	10	SCREW (M10 x 135 mm)		14	19
		1st Torque			
		2nd Torque		+60°	
6	1	GROMMET			
7	1	PLUG			
8	1	GASKET			
9	1	NIPPLE			
10	1	OIL FILTER			
11	1	O RING			
12	1	BRACKET			
13	2	SCREW (M6 x 13 mm)	70		8
14	1	STA-STRAP			
15	1	BREATHER PIPE			
16	2	CLAMP			
17	2	SCREW (M6 x 12 mm)	70		8
18	1	CLIP			
19	1	HOSE			
20	2	STA-STRAP			
21	1	ANODE			
22	1	GROMMET			
23	1	COVER			
24	2	SCREW (M8 x 25 mm)	156		18
25	1	SCREW (M6 x 20 mm)	70		8
26	3	SCREW (M6 x 20 mm)	70		8
27	1	COVER			
28	1	GASKET			
29	1	SPRING			
30	1	PRESSURE CONTROL VALVE			
31	1	GROMMET			
32	18	SCREW (M6 x 30 mm)	106		12
33	1	OUTER EXHAUST COVER			
34	1	GASKET			
35	1	CLIP			
36	1	HOSE			
37	1	STA-STRAP			
38	2	LIFTING EYE			
39	1	VALVE PLATE			
40	4	SCREW (M6 x 20 mm)	70		8
41	6	STUD			
42	6	WASHER			
43	6	NUT		35	47.5
44	2	SCREW (M8 x 35 mm)		20	27

NOTE: TORQUE TOLERANCE +/- 10%

[illegible]



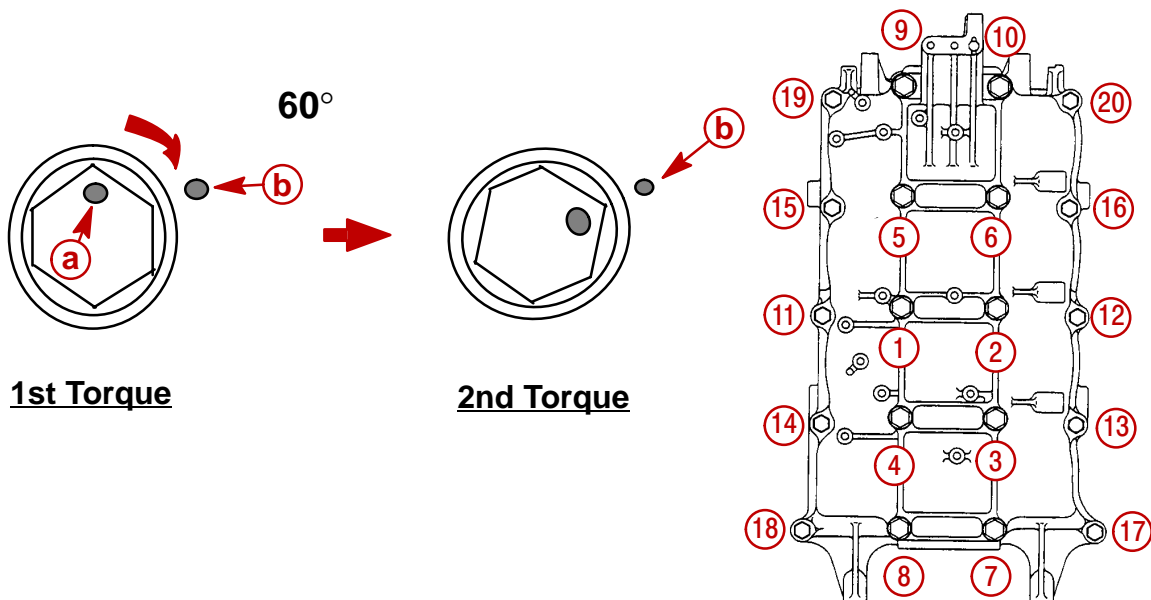
Crankshaft, Pistons And Connecting Rods

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	CRANKSHAFT			
2	1	OIL SEAL			
3	1	OIL SEAL			
4	4	BEARING (GREEN)			
	4	BEARING (BLUE)			
	4	BEARING (RED)			
5	5	BEARING (YELLOW)			
	5	BEARING (GREEN)			
	5	BEARING (BLUE)			
	5	BEARING (RED)			
6	1	BEARING (GREEN)			
	1	BEARING (BLUE)			
	1	BEARING (RED)			
7	4	PISTON & CONNECTING ROD (STANDARD)			
	AR	PISTON & CONNECTING ROD (.25MM O/S)			
8	2	BOLT	1st Torque 2nd Torque	70 +90°	8
9	8	BEARING (YELLOW)			
	8	BEARING (GREEN)			
	8	BEARING (BLUE)			
	8	BEARING (RED)			
10	4	PISTON RING SET (STANDARD)			
	AR	PISTON RING SET (.25MM O/S)			
11	1	KEY			
12	1	KEY			



Torque Sequence

Crankcase Cover Bolts



a - Center Bolt (10) 1st Torque

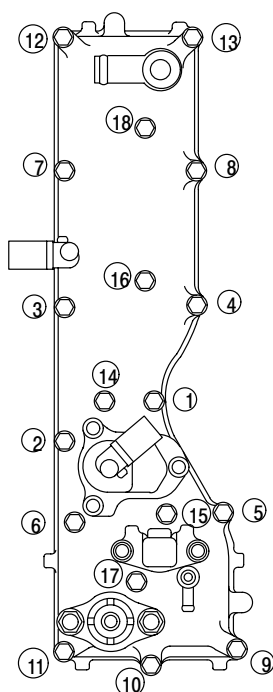
b - Center Bolt (10) 2nd Torque (60° Torque)

Crankcase Cover Bolt Torque		
Outer Bolts Qty. 10 (M8 x 55 mm)	1st Torque:	120 lb-in. (14 Nm)
	2nd Torque:	20 lb-ft (28 Nm)
Center Bolts Qty. 10 (M10 x 135 mm)	1st Torque:	168 lb-in. (19 Nm)
	2nd Torque:	60° 37 lb-ft (50 Nm)*

*Torque value for reference only.

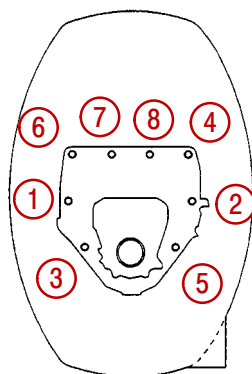


Exhaust Cover Screws



Exhaust Cover Screw Torque	
1st Torque:	53 lb-in. (6 Nm)
2nd Torque:	106 lb-in. (12 Nm)

Powerhead Mounting Bolts/Nuts



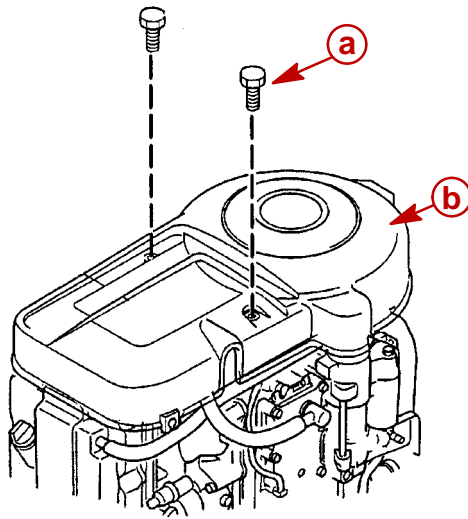
Powerhead Mounting Nut Torque
35 lb-ft (47.5 Nm)

Powerhead Mounting Bolt Torque
20 lb-ft (27 Nm)



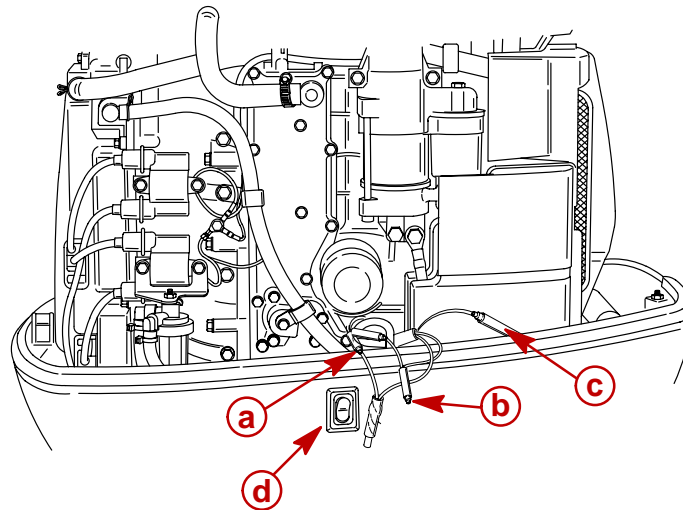
Preparing Powerhead for Removal

1. Remove top cowl.
2. Remove flywheel cover.



- a** - Screw (2) M6 x 20
b - Flywheel Cover

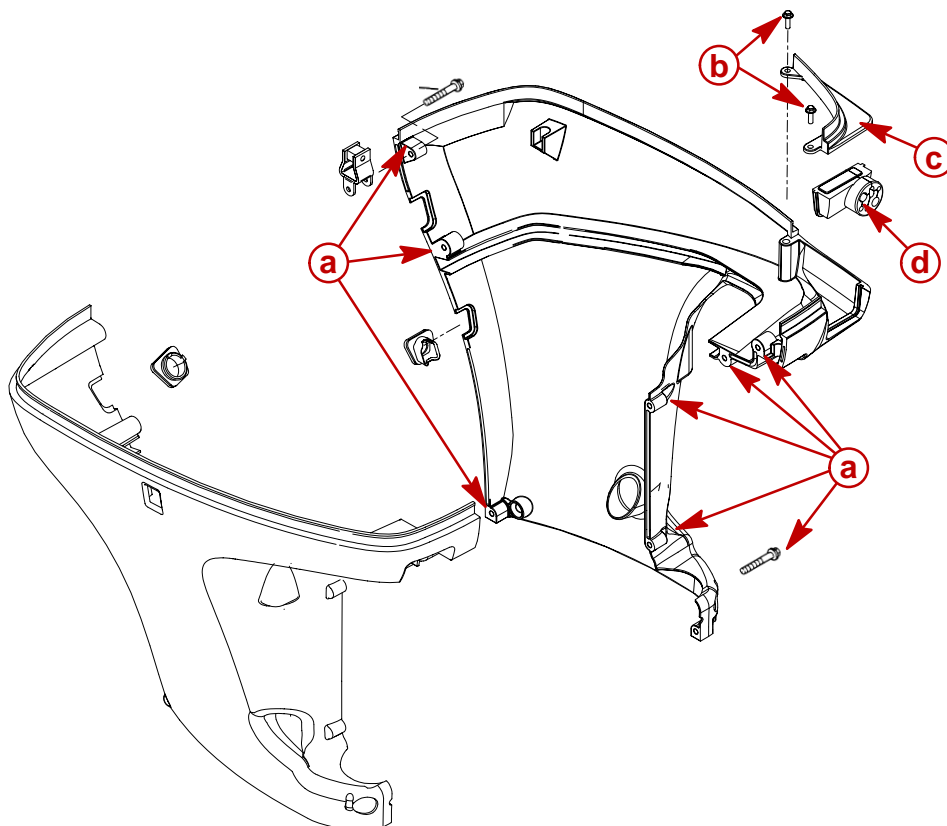
3. Disconnect cowl switch power trim wires.



- a** - Green/White
b - Lt. Blue/White
c - Red
d - Cowl Switch



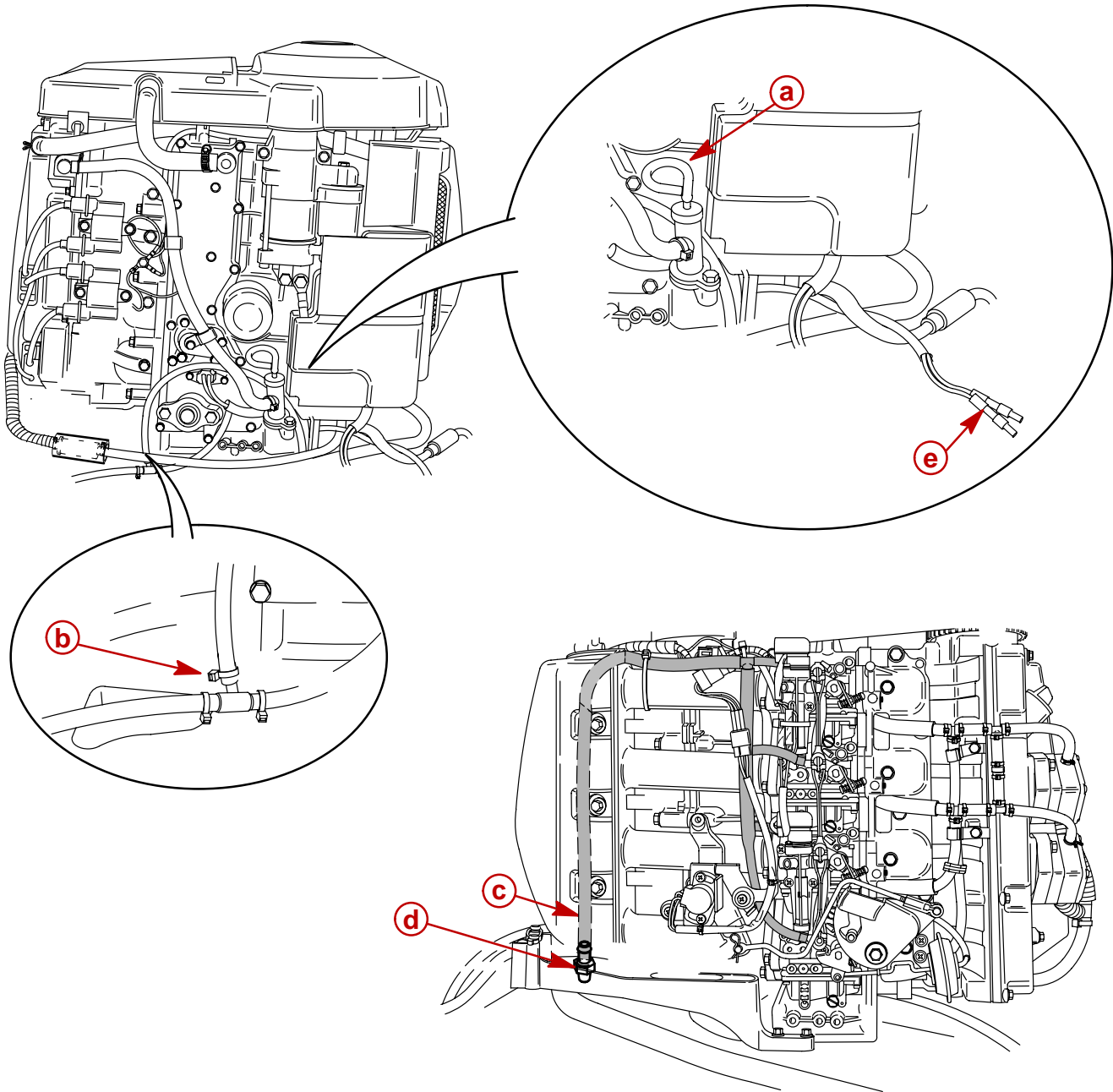
4. Remove 2 screws from grommet cover to free grommet.
5. Remove 8 screws holding cowl halves together.



- a** - Cowl Screws (8) M6 x 40
- b** - Screws (2) M6 x 20
- c** - Cover
- d** - Grommet



6. Remove dipstick and drain oil.
7. Remove drive shaft bushing coolant hose.
8. Remove carburetor vent hose from adaptor.
9. Disconnect power trim pump wires.

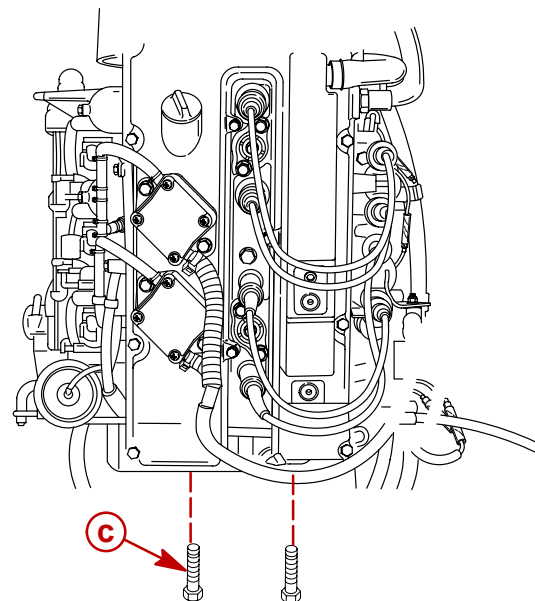
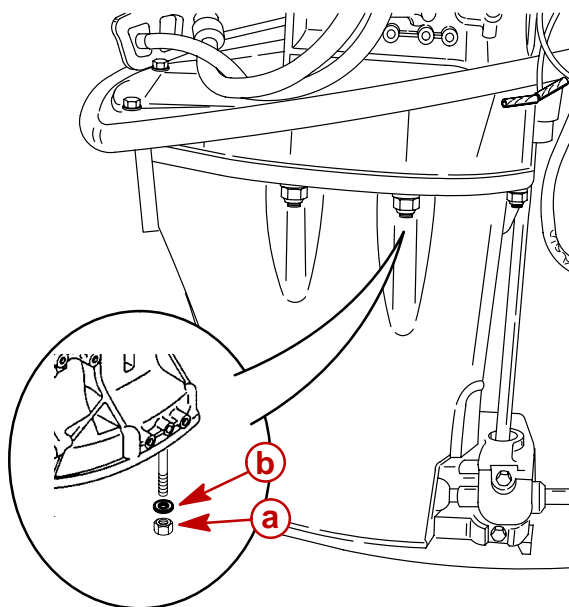


- a** - Dipstick
- b** - Coolant Hose For Drive Shaft Bushing
- c** - Carburetor Vent Hose (Hidden)
- d** - Vent Hose Adaptor (Hidden)
- e** - Power Trim Pump Wires



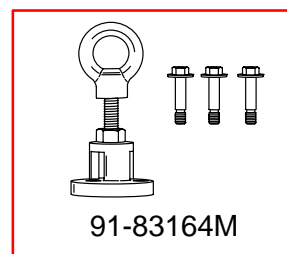
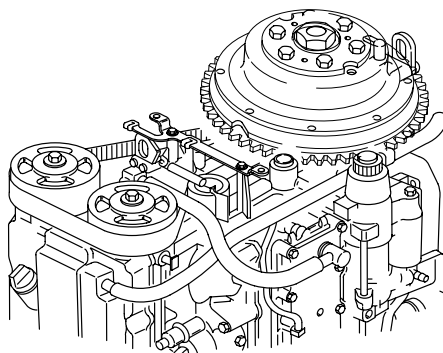
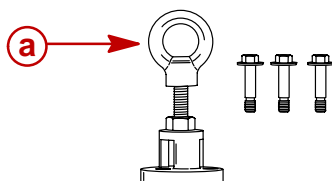
Powerhead Removal

1. Remove nuts (6) and bolts (2) to free powerhead from drive shaft housing.



- a** - Nuts (6)
- b** - Washers (6)
- c** - Bolts (2) M8 x 35

2. Lift powerhead from driveshaft housing using flywheel puller/lifting eye (91-83164M).
3. Place powerhead on suitable stand.



- a** - Flywheel Puller/Lifting Eye (91-83164M)



Removing Powerhead Components

Ignition Components

1. Refer to **Section 2A** for removal of the following ignition components.
 - a. Flywheel - must use Crank Shaft Holder Tool (P/N 91-804770A1)
 - b. Stator/pick-up coils
 - c. Timing belt
 - d. Ignition coils
 - e. CDI unit
 - f. Crank position sensor
 - g. Temperature sensor

Charging and Starting System Components

1. Refer to **Section 2B** for removal of the following ignition components.
 - a. Starter motor/relay
 - b. Voltage regulator/rectifier

Fuel Components

1. Refer to **Section 3A and 3B** for removal of the following components.
 - a. Fuel pumps
 - b. Carburetor/Intake Assembly

Harness and Battery Cable Removal

1. Remove battery and harness cable assembly.

Cylinder Head Removal

1. See **Section 4A** for cylinder head removal.

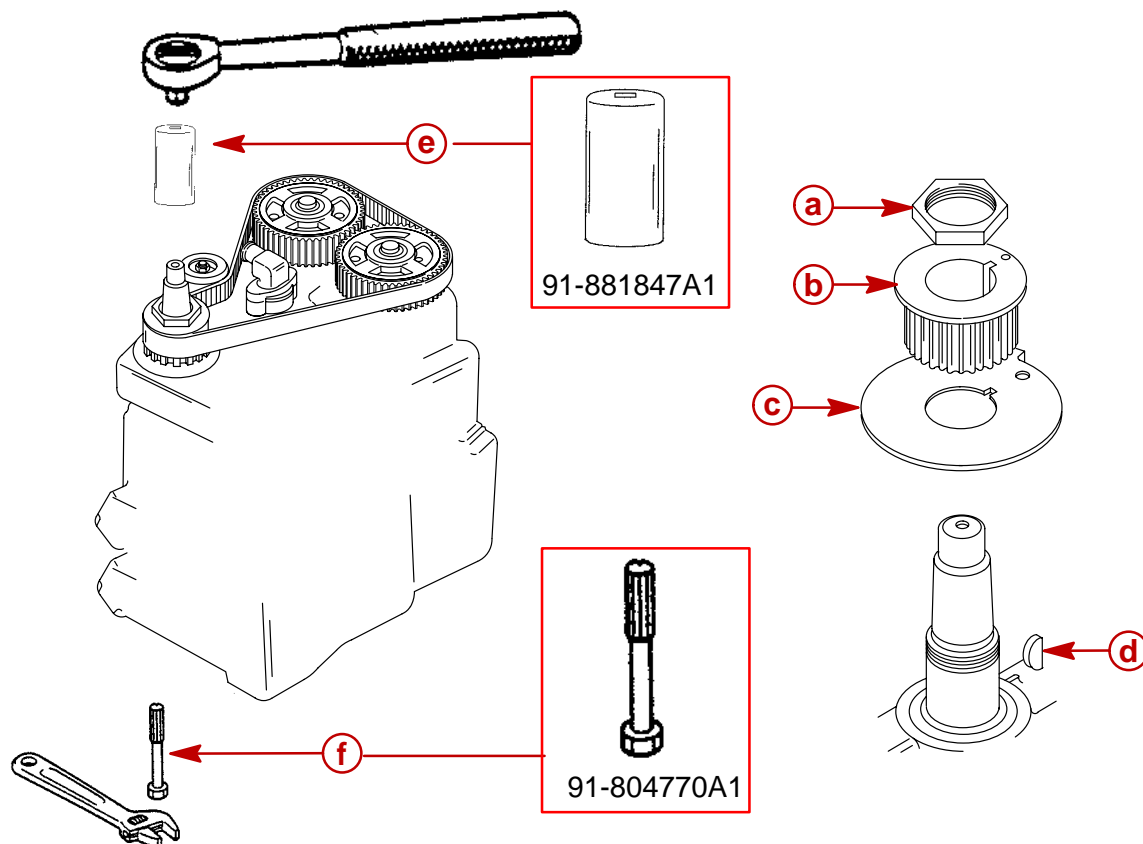


Powerhead Disassembly

Drive Sprocket Removal

1. Remove nut.

NOTE: Use 46 mm socket with an internal depth of 76 mm (p/n 91-881847A1) to hold drive sprocket nut. Use crankshaft holder tool (P/N 91-804770A1) to hold crankshaft.

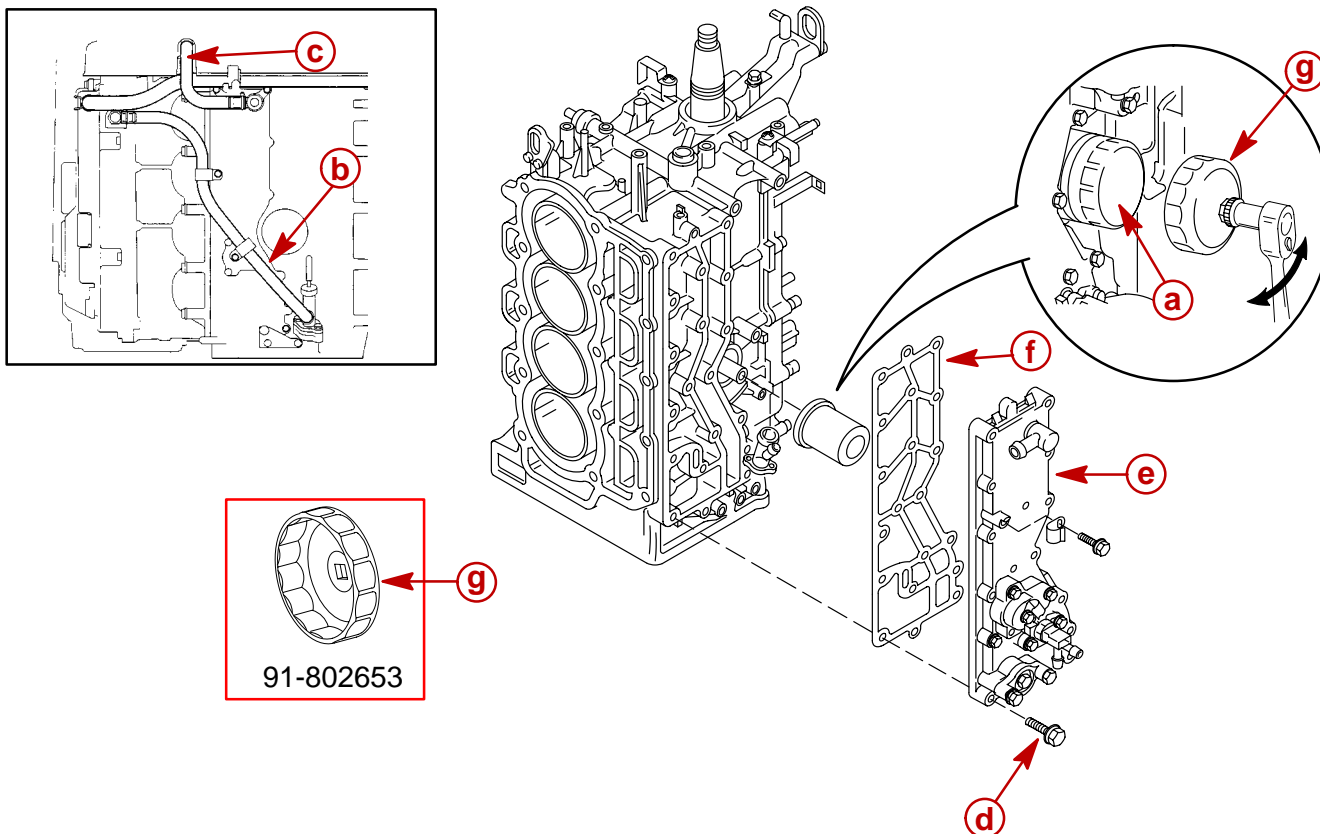


- a** - Drive Sprocket Nut
- b** - Drive Sprocket
- c** - Pick-up Coil Rotor
- d** - Key
- e** - 46 mm, 76 mm Deep Socket (P/N 91-881847A1)
- f** - Crankshaft Holder Tool (P/N 91-804770A1)



Exhaust Cover Removal

1. Remove oil filter and oil return hose.
2. Remove water hose and exhaust cover and gasket.



- a** - Oil Filter
- b** - Oil Return Hose
- c** - Water Hose
- d** - Screw (18) M6 x 30
- e** - Exhaust Cover
- f** - Gasket (Discard)
- g** - Oil Filter Wrench (p/n 91-802653)

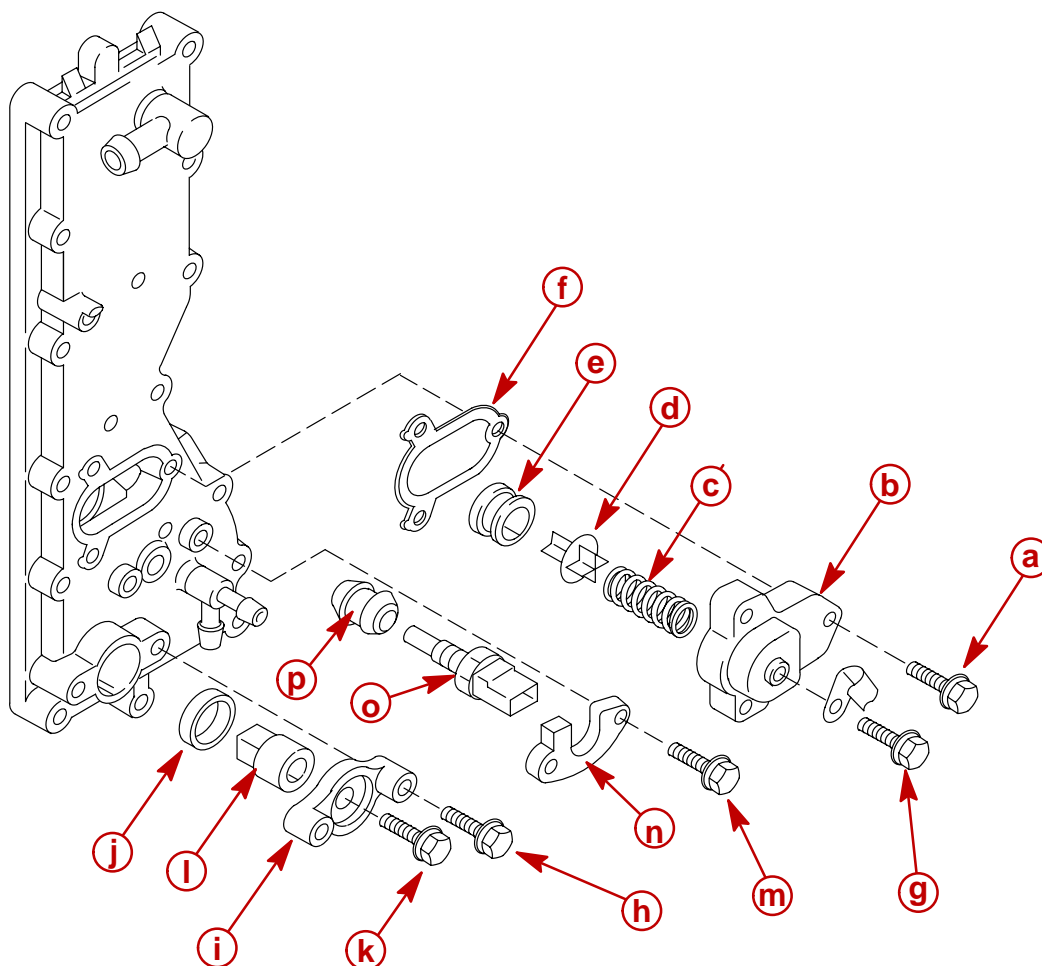


3. Remove Pressure Control Valve (PCV) Cover.
4. Remove anode and engine temperature sensor.

IMPORTANT: If removing anode from outboard with exhaust plate installed use the following procedure to prevent anode from falling into water jacket:

ANODE REMOVAL PROCEDURE

1. Remove anode cover screw "h".
2. Remove anode assembly from cylinder block.
3. Remove anode screw "k" to separate anode from anode cover.



a - Screw (3) M6 x 20

b - PCV Cover

c - Spring

d - Pressure Control Valve (PCV)

e - Grommet

f - Gasket (Discard)

g - Screw M6 x 12

h - Screw (2) M8 x 25

i - Anode Cover

j - O-Ring

k - Screw M6 x 20

l - Anode

m - Screw (2) M6 x 16

n - Engine Temperature Sensor Retainer

o - Engine Temperature Sensor

p - Gasket (Discard)

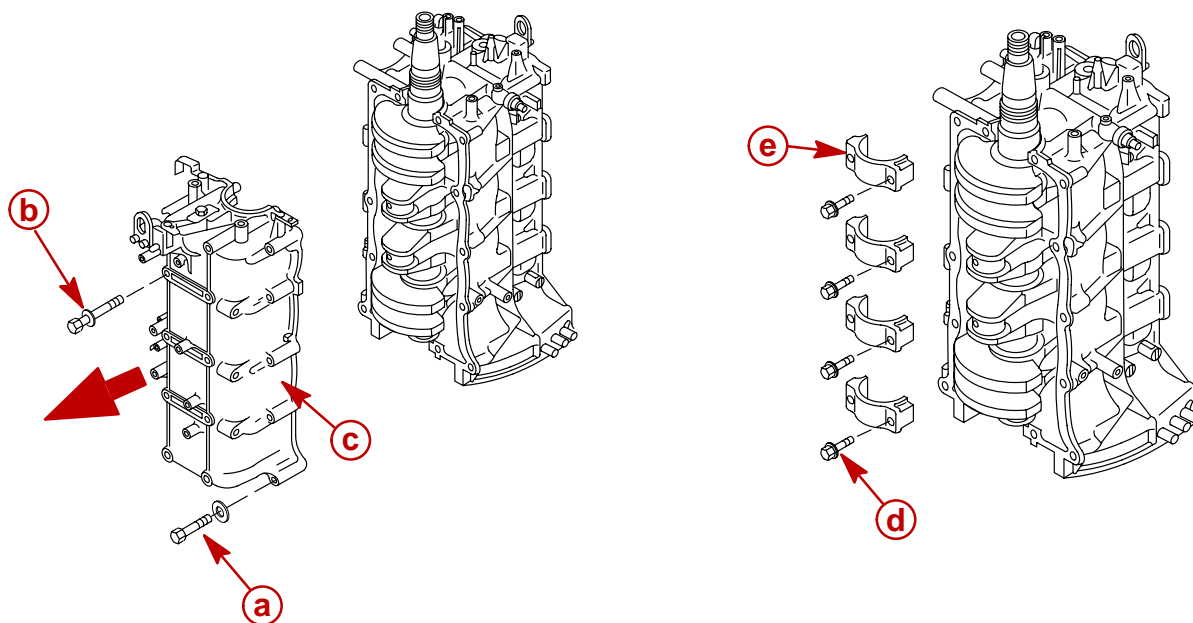


Crankcase and Crankshaft Removal

1. Remove crankcase and connecting rod caps.

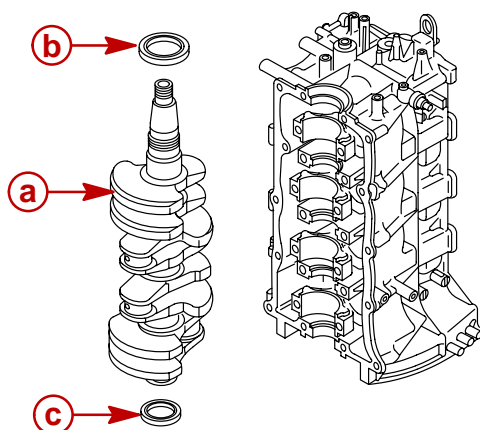
IMPORTANT: Note locations of connecting rod caps for re-assembly.

NOTE: Use torx® E10 socket for removal of connecting rod bolts.



- a** - Screw (10) M8 x 55
- b** - Screw (10) M10 x 135
- c** - Crankcase
- d** - Connecting Rod Bolt (Discard) (8) M8 x 38
- e** - Connecting Rod Cap (4)

2. Remove crankshaft and oil seals.

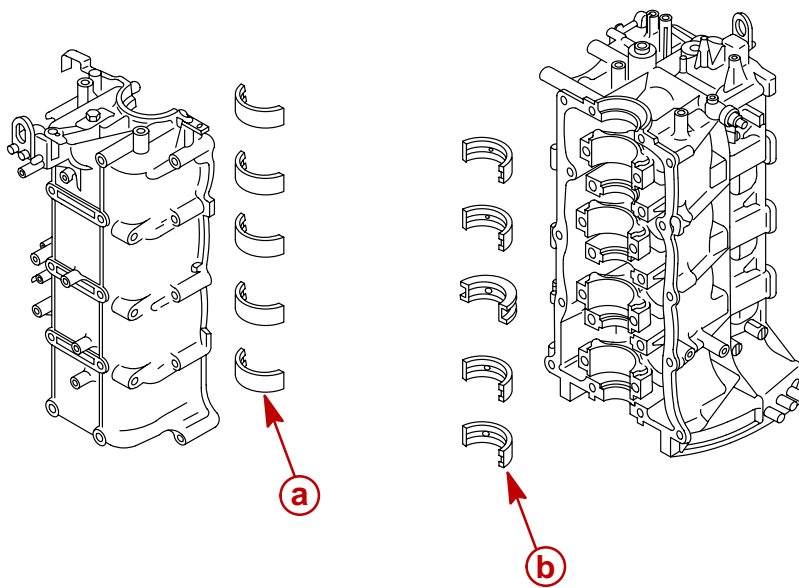


- a** - Crankshaft
- b** - Upper Oil Seal
- c** - Lower Oil Seal



IMPORTANT: Do not interchange main bearings, re-install in their original locations.

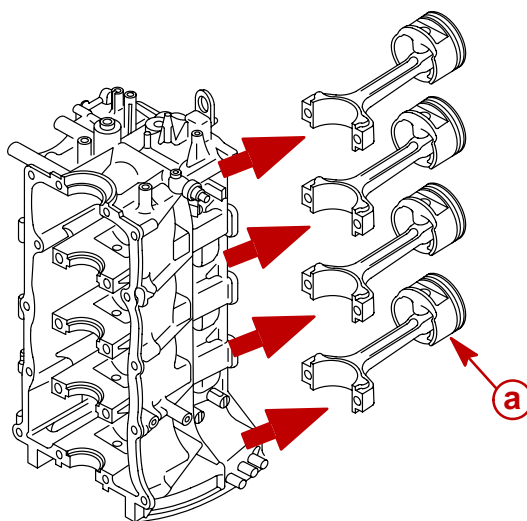
3. Remove main bearing halves from the crankcase cover and cylinder block.



a - Main Bearing Halves-Crankcase Cover (5)

b - Main Bearing Halves-Cylinder Block (5)

4. Remove piston/connecting rod assembly.



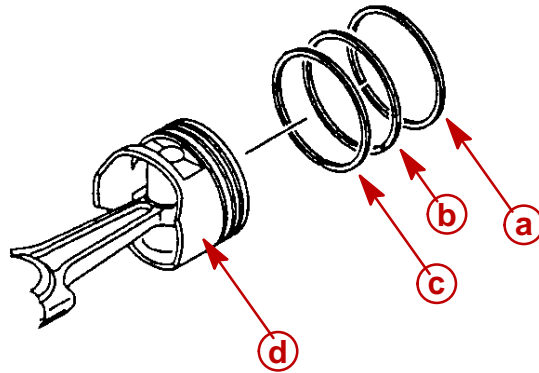
a - Piston/Connecting Rod Assembly



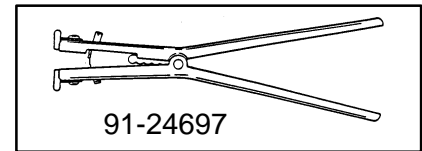
Piston Ring Removal

1. Remove top and second ring.
2. Remove oil ring (bottom rail, top rail, and scraper).

NOTE: Use piston ring expander tool (P/N 91-24697) to prevent rings from breaking. If re-using rings mark their location for re-installation.



- a** - Top Ring
- b** - Second Ring
- c** - Oil Ring
- d** - Piston





Cleaning/Inspection/Repair

Cylinder

MEASURING CYLINDER BORE

1. Measure the cylinder bore diameter at three locations in both X and Y axis.
2. If the cylinder bore is beyond the standard limits listed in the tables below, it will be necessary to re-bore the cylinder to accept the oversize piston.

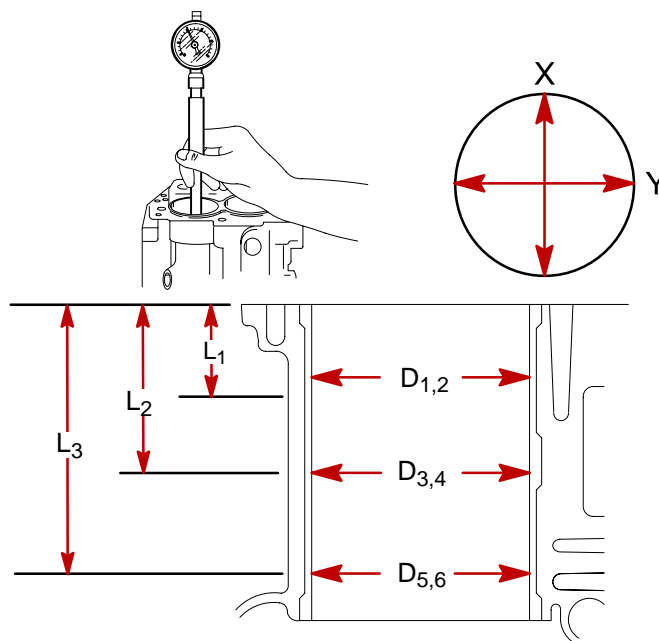
NOTE: Measure at three locations (L_1 , L_2 , and L_3) in both X and Y axis (D_{1-6}).

$L_1=0.8$ in. (20 mm)

$L_2=2.8$ in. (70 mm)

$L_3=4.7$ in. (120 mm)

3. Measure bore diameter with a cylinder gauge. Re-bore or replace if necessary.



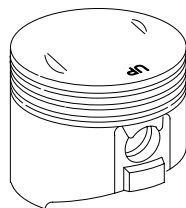
Cylinder Bore Specifications	
Bore Size	Maximum Taper/Out-of-Round
Standard Bore 3.110-3.111 in. (79.000-79.020 mm)	0.003 in. (0.08 mm)
Oversize Bore-0.010 in. (0.25 mm) 3.120-3.121 in. (79.250-79.270 mm)	0.003 in. (0.08 mm)

NOTE: Taper=(Maximum of D_1 or D_2)–(Minimum of D_5 or D_6)

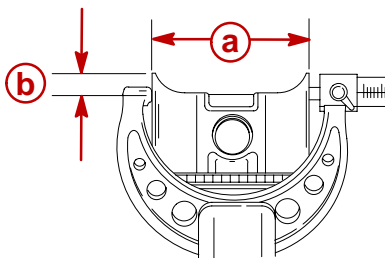


Piston

1. Inspect piston wall wear/damage. Replace piston/connecting rod assembly if necessary.



2. Measure the piston at a point 0.51 in (13 mm) from the bottom. Replace piston/connecting rod assembly if out of specification.



a - Piston Diameter

b - 0.51 in. (13 mm)

Piston Diameter "a"	
Piston Size	Diameter
Standard	3.1074-3.1082 in. (78.928-78.949 mm)
Oversize-0.010 in. (0.25 mm)	3.1174-3.1182 in. (79.178-79.199 mm)

3. Measure piston to cylinder clearance. If out of specification, examine piston and cylinder bore further to determine repair/replacement.

a. Piston to Cylinder Clearance can be defined by:

MBM-MPM=PCC where:

MBM=Minimum Bore Measurement

MPM=Maximum Piston Measurement

PCC=Piston to Cylinder Clearance

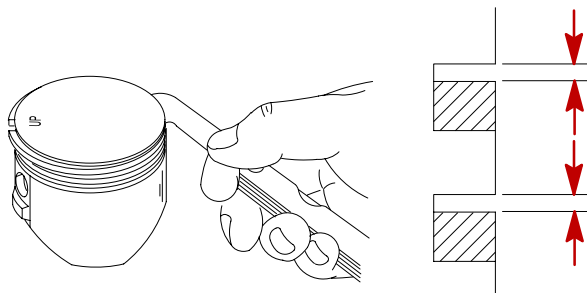
Piston to Cylinder Clearance
0.0028-0.0031 in. (0.070-0.080 mm)



Piston Rings

PISTON RIND SIDE CLEARANCE

1. Measure piston ring side clearance. Replace piston rings as a set if out of specification.



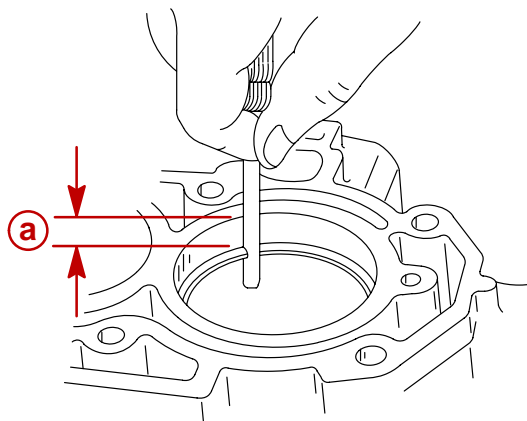
Piston Ring Side Clearance	
Top	0.001-0.003 in. (0.020-0.080 mm)
Middle	0.001-0.003 in. (0.03-0.07 mm)
Oil	0.001-0.006 in. (0.03-0.15 mm)

PISTON RIND END GAP CLEARANCE

1. Measure piston ring end gap clearance. Replace piston rings as a set if out of specification.

NOTE: Ring should be level for measurement, push ring into bore with crown of piston.

NOTE: Measure end gap clearance at a depth of 0.8 in. (20 mm).



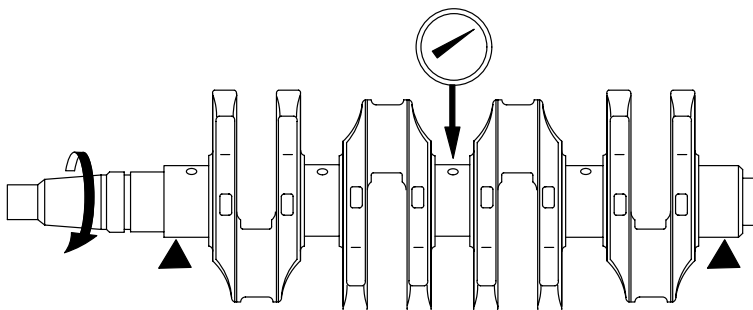
a - Measurement Depth

Piston Ring End Gap	
Top	0.006 - 0.012 in. (0.15 - 0.30 mm)
2nd	0.028 - 0.035 in. (0.70 - 0.90 mm)
Oil	0.008 - 0.028 in. (0.20 - 0.70 mm)



Crankshaft

1. Thoroughly clean crankshaft and inspect bearing surfaces. Replace crankshaft if bearing surfaces are pitted, scored, or discolored.
2. Measure run-out. Replace crankshaft if out of specification.
3. Clean oil holes in crankshaft.



Crankshaft Run-out
0.001 in. (0.03 mm)

4. Measure crankshaft journal diameter and crank pin diameter. Replace if out of specification.

Crankshaft Journal Diameter Limit
1.8887 in. (47.972 mm)
Crankpin Diameter Limit
1.7311 in. (43.971 mm)

Crankcase and Bearings

1. Measure crankshaft main bearing clearance using the test below. Replace the upper and lower bearings as a set if out of specification (see **Crankcase and Bearing Indication Marks**).

NOTE: Measure the main oil bearing clearance at room temperature 68° F (20° C).

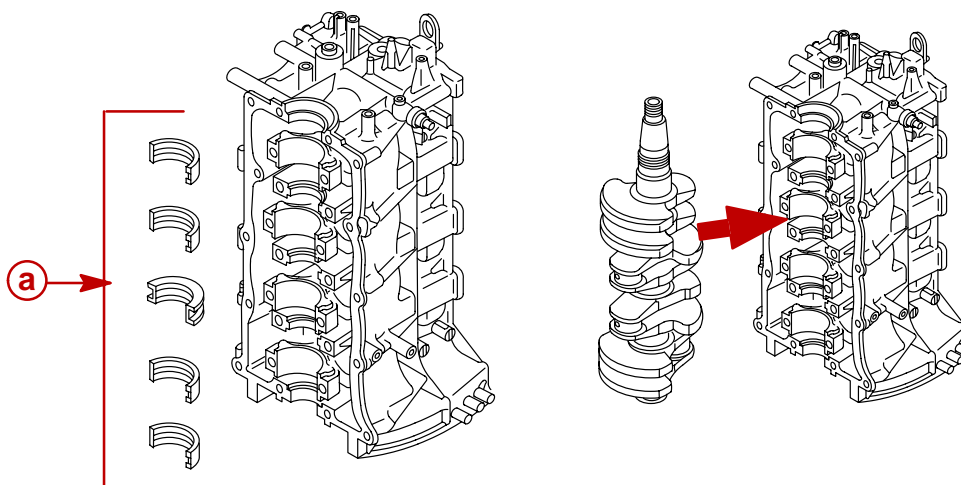
Main Bearing Clearance
0.0009 - 0.0017 in. (0.024 - 0.044 mm)



CRANKSHAFT MAIN BEARING CLEARANCE MEASUREMENT

IMPORTANT: Do not interchange the main bearings. Re-install in their original position.

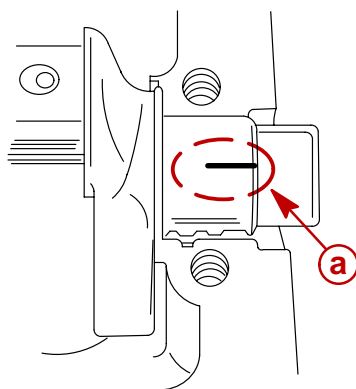
1. Clean all the old sealing material from the split line on the crankcase cover and cylinder block.
2. Clean all the oil from the following areas:
 - a. Main bearing surfaces on the cylinder block and crankcase cover.
 - b. Main bearings.
 - c. Crankshaft bearing surfaces.
3. Install main bearing halves into the cylinder block.
4. Install crankshaft.



a - Main Bearing Halves-Cylinder Block (5)

5. Place a piece of plastigauge onto each crankshaft bearing surface.

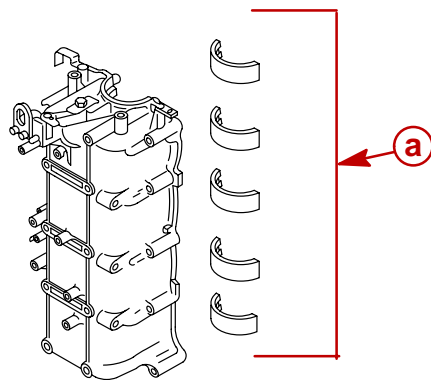
NOTE: Do not put plastigauge over the oil hole on the bearing surface of the crankshaft.



a - Plastigauge



6. Install main bearing halves into the crankcase.

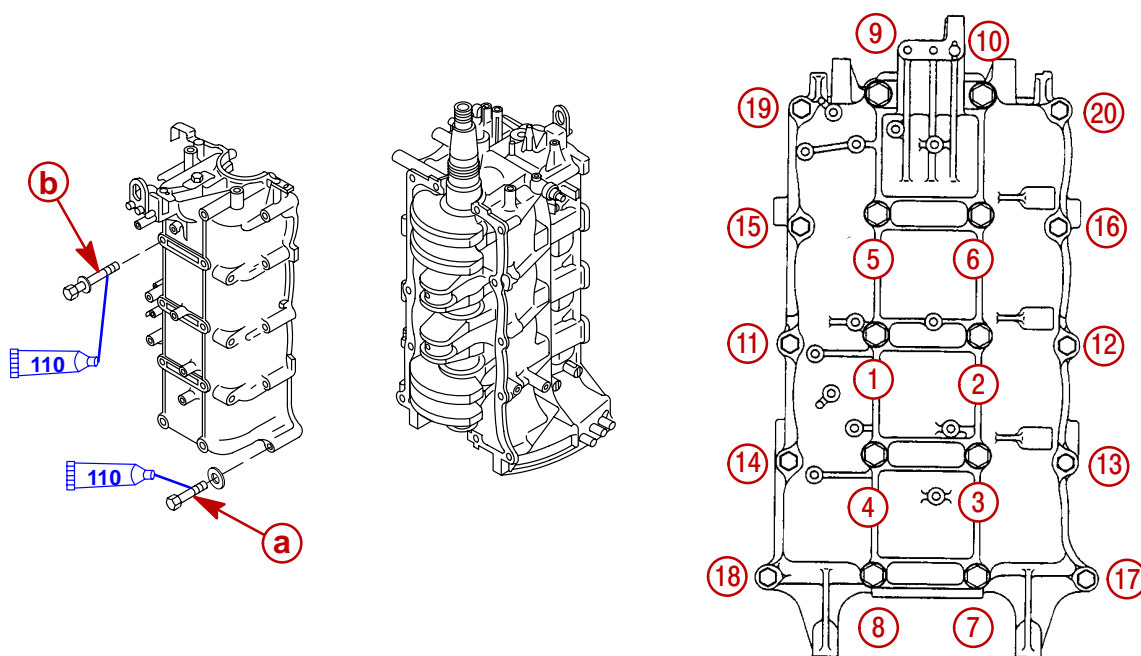


a - Main Bearing Halves-Crankcase (5)

7. Install crankcase onto cylinder block.

8. Apply oil to the cover bolts and torque cover bolts in sequence and in two steps.

IMPORTANT: Do not move crankshaft until measurement has been completed.



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

a - Bolt (10) M10x135mm

b - Bolt (10) M8x55mm

Crankcase Cover Bolt Torque		
Outer Bolts Qty. 10 (M8x55)	1st Torque:	120 lb-in (14 Nm)
	2nd Torque:	20 lb-ft (28 Nm)
Center Bolts Qty. 10 (M10x135)	1st Torque:	168 lb-in. (19 Nm)
	2nd Torque:	60° 37 lb-ft (50 Nm)*

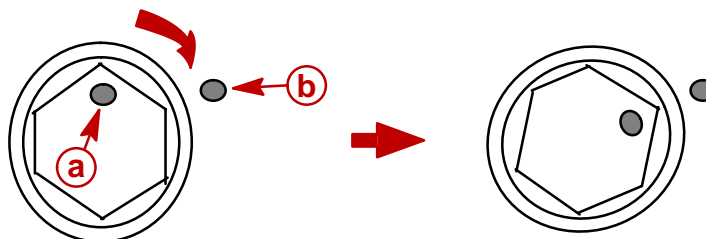
*Torque value for reference only.



SERVICE TIP

1. To obtain 60° rotation of crankcase cover bolts (after initial torque has been set) put a paint mark on corner point of the bolt head and a second paint mark one corner point clockwise on crankcase cover as shown. Rotate bolt until paint marks align.

NOTE: When using this procedure for final assembly use different color paint on crankcase cover to avoid confusion with previous paint marks.

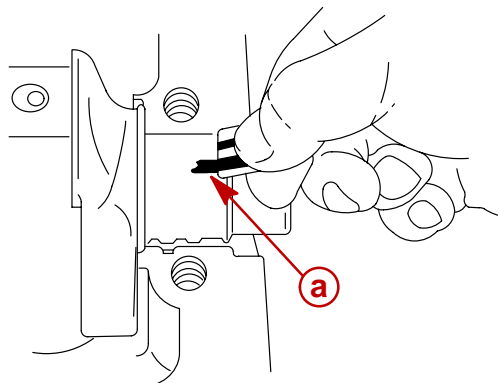


a - Paint Mark On Bolt Head

b - Paint Mark On Crankcase Cover

MAIN BEARING CLEARANCE

1. Remove the bolts and crankcase.
2. Measure the width of the compressed plastigauge to check the main bearing clearance. Replace bearings if clearance is not within specification (see **Selecting New Main Bearings** following).



a - Compressed Plastigauge

Main Bearing Clearance
0.0009 - 0.0017 in. (0.024 - 0.044 mm)



SELECTING NEW MAIN BEARINGS

1. Subtract the crankshaft journal diameters (#1-#5) from the cylinder block journal diameters (#1-#5).
2. Select a suitable bearing from the table below according to the calculated values.

NOTE: The cylinder block journal diameters (#1-#5) and the crankshaft journal diameters, (#1-#5) can be determined by the stamped value as described below.

Crankshaft journal diameter=47.900+(stamped value/1000)

Example:

If the stamped value of position #1 reads 92 then using the previous formula would yield a crankshaft journal diameter of:

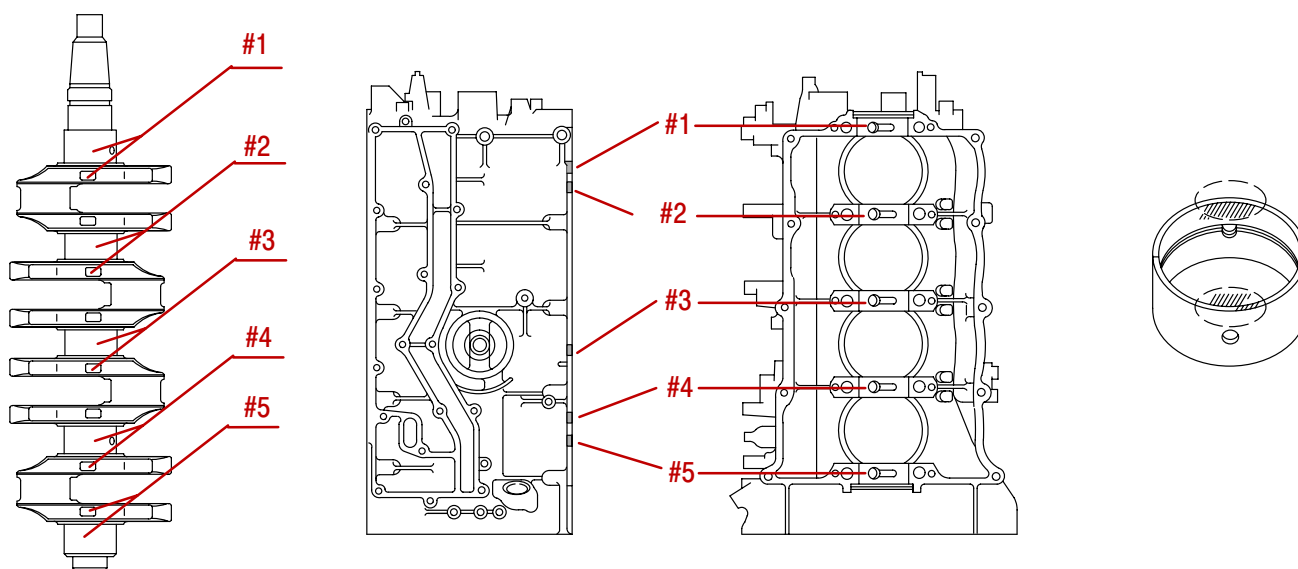
$$47.900+(92/1000)=47.992$$

Cylinder block journal diameter=54.000+(stamped value/1000)

Example:

If the stamped value of position #1 reads 32 then using the previous formula would yield a cylinder block journal diameter of:

$$54.000+(32/1000)=54.032$$



3. Refer to the following reference table to select the correct main bearings.

Crankshaft Bearing Selection Table		
Cylinder Block journal diameters—crankshaft journal diameters (mm)	Bearing (cylinder side) (with oil groove)	Bearing (crankcase side) (w/o oil groove)
6.023-6.026	Green	Yellow*
6.027-6.034	Blue	Green*
6.035-6.042	Blue	Blue
6.043-6.049	Red	Blue*
6.050-6.058	Red	Red

**⚠ CAUTION**

The (*) mark indicates that the color of the upper and lower bearings are different. Install the main bearings in the middle of the cylinder block and crankcase journals so they do not block the oil holes.

NOTE: Crankshaft bearing #3 is a thrust bearing.

NOTE: If the difference between the cylinder block journal diameter and crankshaft journal diameter is more than the maximum value (6.058mm), replace the crankshaft, cylinder block, or both.

Connecting Rod Oil Clearance

1. Measure the connecting rod oil clearance using the **Connecting rod Oil Clearance Measurement** steps below, replace the upper and lower bearings as a set, if out of specification.

Connecting Rod Oil Clearance
0.0009 - 0.0014 in. (0.023 - 0.035 mm)

CONNECTING ROD OIL CLEARANCE MEASUREMENT

IMPORTANT: Mark the original connecting rod bolts to avoid confusion with new bolts.

⚠ CAUTION

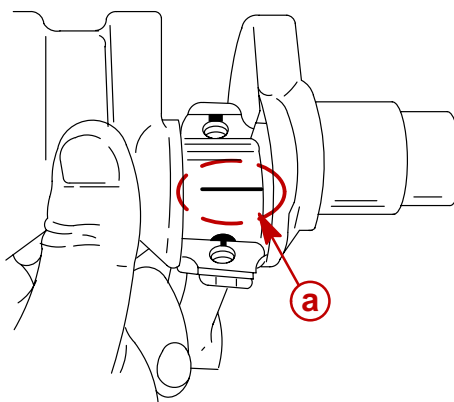
The original connecting rod bolts are to be used for measurement and adjustment of the oil clearance only. Do not use the original connecting rod bolts for reassembly of the engine.

NOTE: Clean all the oil from the connecting rod bearing surfaces and connecting rod journals on the crankshaft.

⚠ CAUTION

Install the bearings in their original positions. Incorrect oil clearance measurements can result in engine damage.

1. Install the upper half of the bearing into the connecting rod and the lower half of the bearing into the connecting rod cap.
2. Place a piece of Plastigauge onto the crank pin parallel to the crankshaft.



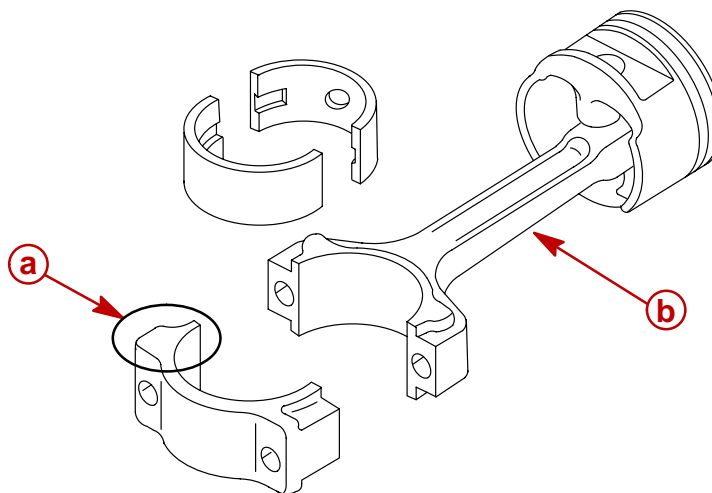
a - Plastigauge



3. Assemble the connecting rod onto their respective crankpins.

IMPORTANT: Make sure the large flat side “a” on the connecting rod faces toward the flywheel side.

NOTE: Do not move the crankshaft until the big end oil clearance measurement has been completed.

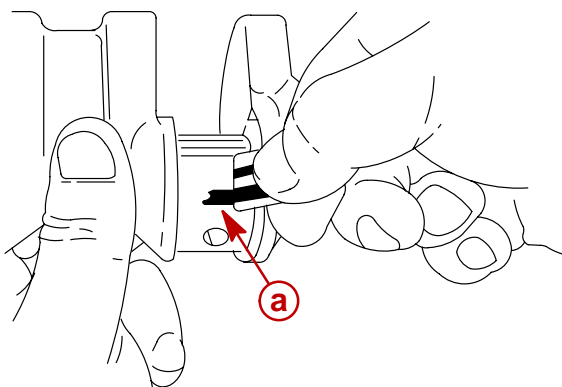


- a - Connecting Rod Cap-Flat side
- b - Connecting Rod/Piston Assembly

4. Apply engine oil onto the threads and seat of the **original** connecting rod bolts.
5. Tighten the original connecting rod bolts in alternating sequence and in two stages.

Connecting Rod Bolt Torque	
1st Torque:	70 lb-in. (8 Nm)
2nd Torque:	90°

6. Remove the connecting rod cap.
7. Measure the width of the compressed plastigauge on each crankpin to check the connecting rod oil clearance. Refer to **Connecting Rod Oil Clearance Adjustment** below if oil clearance is not within specification.



- a - Compressed Plastigauge

Connecting Rod Oil Clearance
0.0009 - 0.0014 in. (0.023 - 0.035 mm)



CONNECTING ROD OIL CLEARANCE ADJUSTMENT

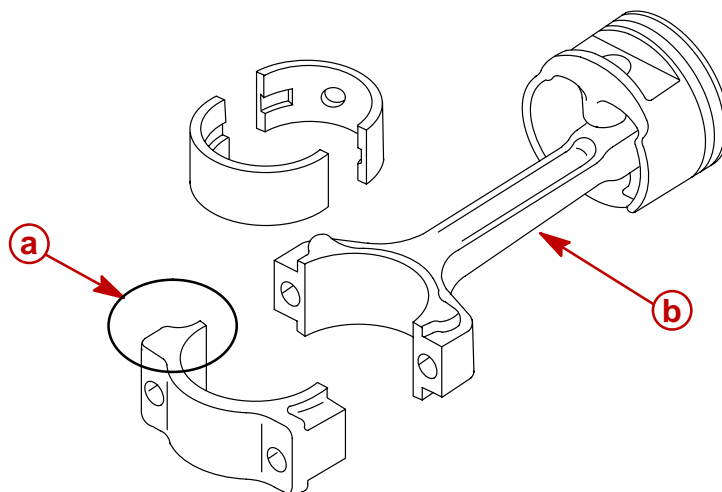
1. Install new yellow bearings into the connecting rods and connecting rod caps.

NOTE: Yellow bearings are used as a “reference” bearing to help determine clearance.

2. Place a piece of Plastigauge onto the crank pin parallel to the crankshaft.
3. Assemble the connecting rod caps onto their respective crankpins.

IMPORTANT: Make sure the large flat side “a” on the connecting rod faces toward the flywheel side.

NOTE: Do not move the crankshaft until the big end oil clearance measurement has been completed.



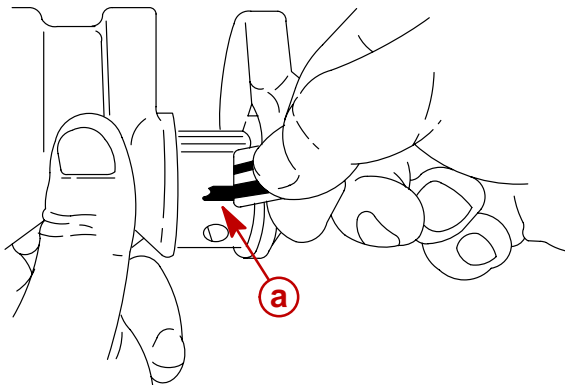
- a** - Connecting Rod Cap-Flat side
b - Connecting Rod/Piston Assembly



4. Apply engine oil onto the threads and seat of the **original** connecting rod bolts.
5. Tighten the original connecting rod bolts in alternating sequence and in two stages.

Connecting Rod Bolt Torque	
1st Torque:	70 lb-in. (8 Nm)
2nd Torque:	90°

6. Remove the connecting rod cap.
7. Measure the width of the compressed plastigauge on each crankpin to check the connecting rod oil clearance.
8. Select a suitable bearing from the table below according to the measurement values.



a - Compressed Plastigauge

Connecting Rod Bearing Selection Table		
Measurement value with new yellow bearing using plastigauge (mm)	Upper Bearing (Piston)	Lower Bearing (Cap)
0.023-0.035	Yellow	Yellow
0.036-0.042	Yellow	Green*
0.043-0.049	Green	Green
0.050-0.057	Green	Blue*
0.058-0.065	Blue	Blue
0.066-0.071	Blue	Red*

⚠ CAUTION

The (*) mark indicates that the color of the upper and lower bearings are different.

NOTE: If the measurement value is more than the maximum value (0.071 mm), replace the crankshaft, cylinder block, or both.



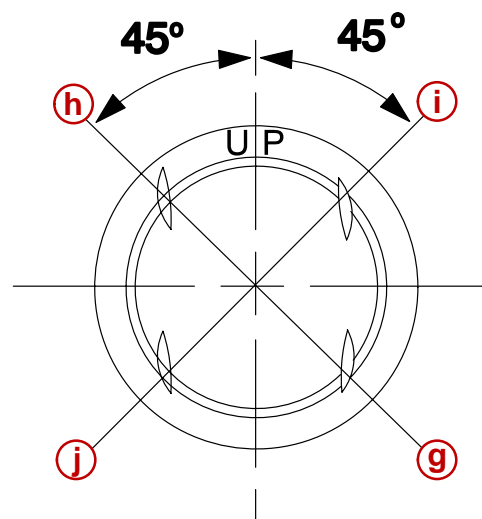
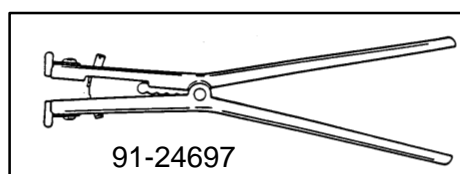
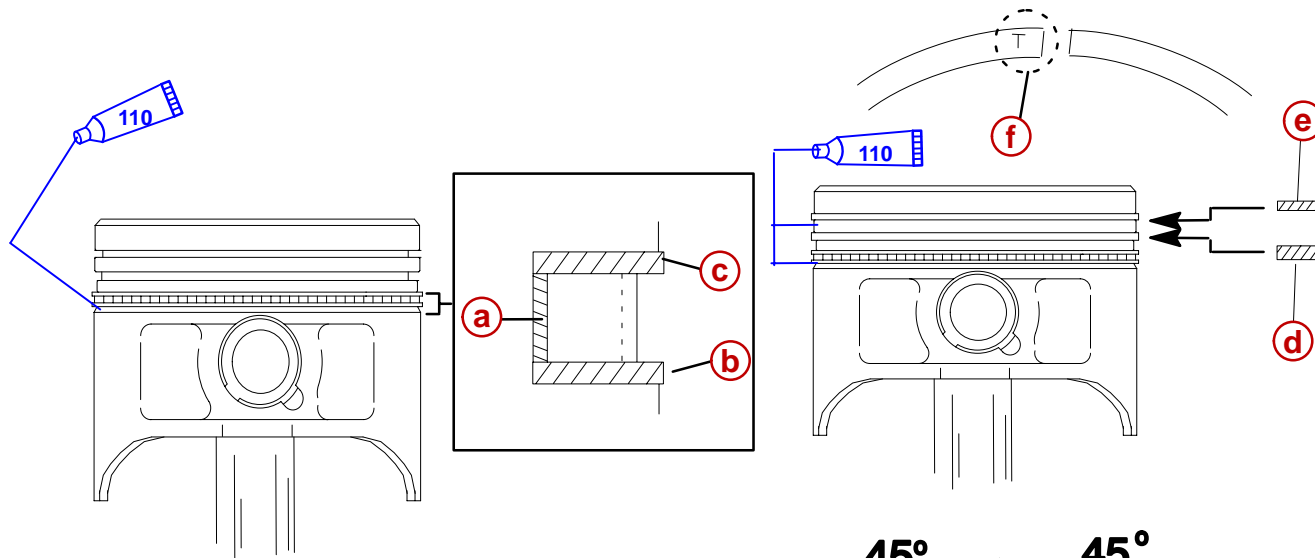
Powerhead Assembly

Piston Ring/Piston Installation

IMPORTANT: If re-using rings install in their original locations.

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

1. Install the oil ring components as shown. Spread rings just enough to slip over piston.
2. Install the second and top compression rings ("T" side up). Spread rings just enough to slip over piston.
3. Offset the piston ring end gaps.



 4-stroke Outboard Oil (92-828000A12)

- a** - Oil Ring Spacer
- b** - Bottom Rail
- c** - Top Rail
- d** - Second Compression Ring ("T" side up)
- e** - Top Compression Ring ("T" side up)

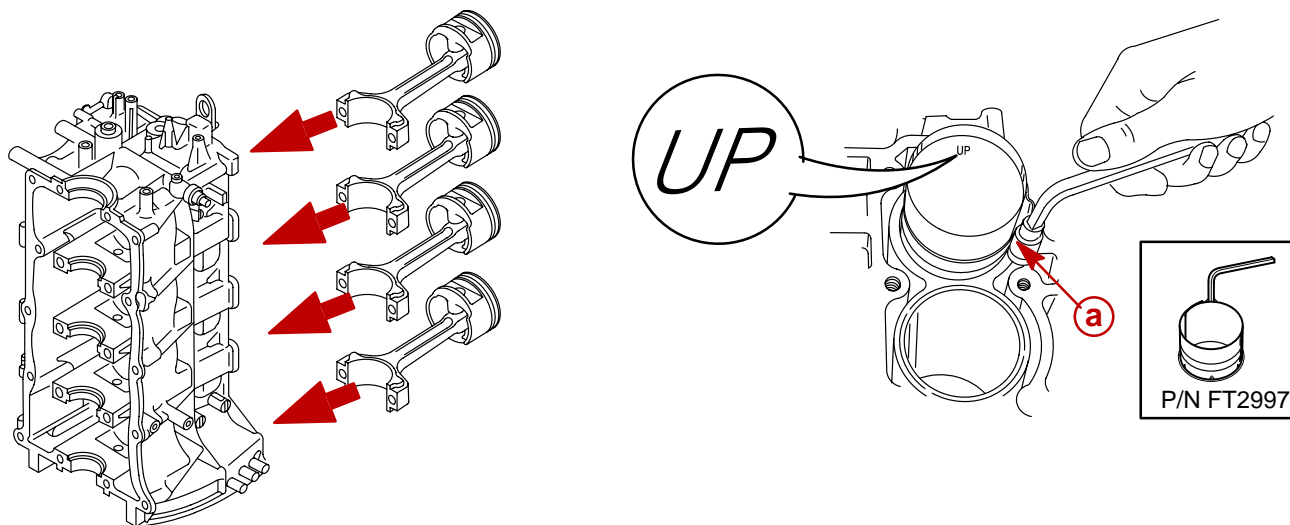
- f** - "T" Mark Should Face Piston Crown
- g** - End Gap – Lower Oil Ring Rail
- h** - End Gap – Upper Oil Ring Rail
- i** - End Gap – Second Compression Ring
- j** - End Gap – Top Compression Ring



NOTE: Cylinder bores must be clean before installing pistons. Clean with light honing, as necessary. After honing, clean cylinder bores with water and detergent. After cleaning, swab cylinder bores several times with engine oil and a clean cloth, then wipe with a clean dry cloth.

4. Lubricate pistons, rings, and cylinder walls with engine oil.
5. Install piston/connecting rod assembly using piston ring compressor tool.

NOTE: Install used pistons in their original locations (cylinders). Install piston with "UP" mark on piston crown facing toward the flywheel end of block.



a - Piston Ring Compressor (P/N FT2997)

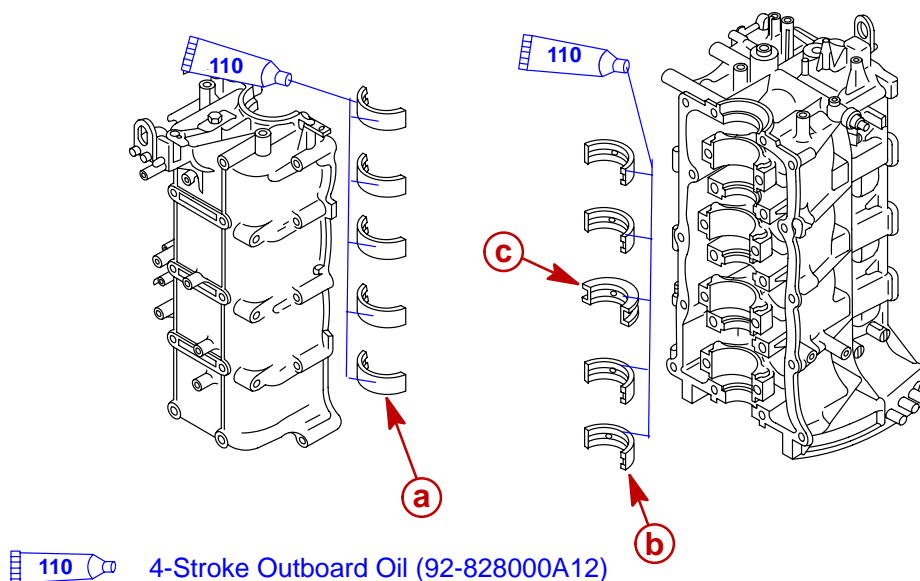
Crankcase and Crankshaft Installation

IMPORTANT: Do not interchange main bearings, re-install in their original locations.

NOTE: Apply oil to bearings before installing.

NOTE: Bearing #3 is a thrust bearing.

1. Install main bearing halves on the crankcase cover and cylinder block.



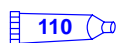
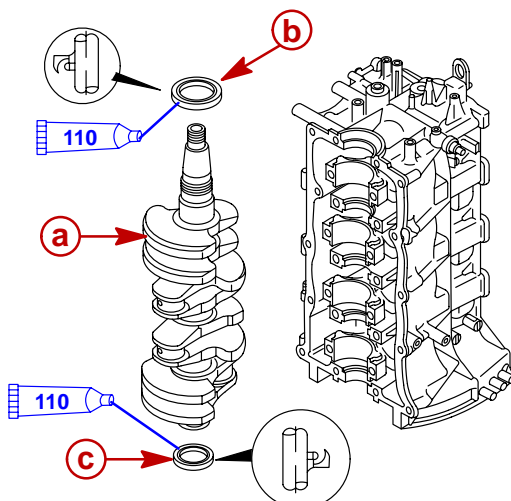
110 4-Stroke Outboard Oil (92-828000A12)

- a** - Main Bearing Halves-Crankcase Cover (5)
- b** - Main Bearing Halves-Cylinder Block (with holes) (5)
- c** - #3 Thrust Bearing



2. Install crankshaft and oil seals.

NOTE: Apply oil to seals before installation



4-Stroke Outboard Oil (92-828000A12)

- a** - Crankshaft
- b** - Upper Oil Seal
- c** - Lower Oil Seal

3. Lubricate connecting rod journals with engine oil.

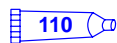
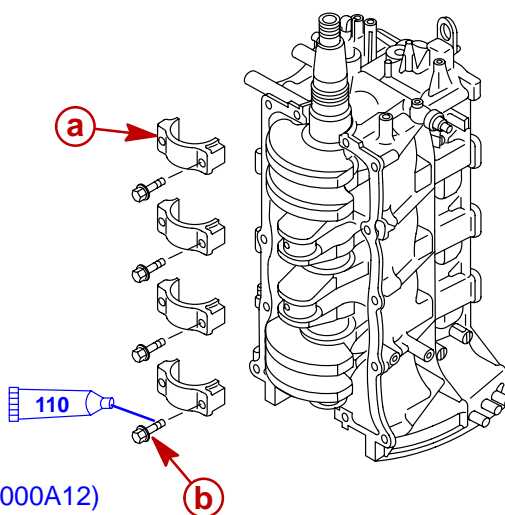
NOTE: Apply oil to connecting rod bolts before installing.

4. Install connecting rod cap and new bolts onto their respective crankpins.

5. Tighten connecting rod bolts in alternating sequence and in two stages.

NOTE: Use torx® E10 socket for installation of connecting rod bolts.

IMPORTANT: Assemble connecting rod caps in their original locations.



4-Stroke Outboard Oil (92-828000A12)

- a** - Connecting Rod Cap (4)
- b** - Connecting Rod Bolt (New) (8) M8 x 38

Connecting Rod Bolt Torque	
1st Torque:	70 lb-in. (8 Nm)
2nd Torque:	90°



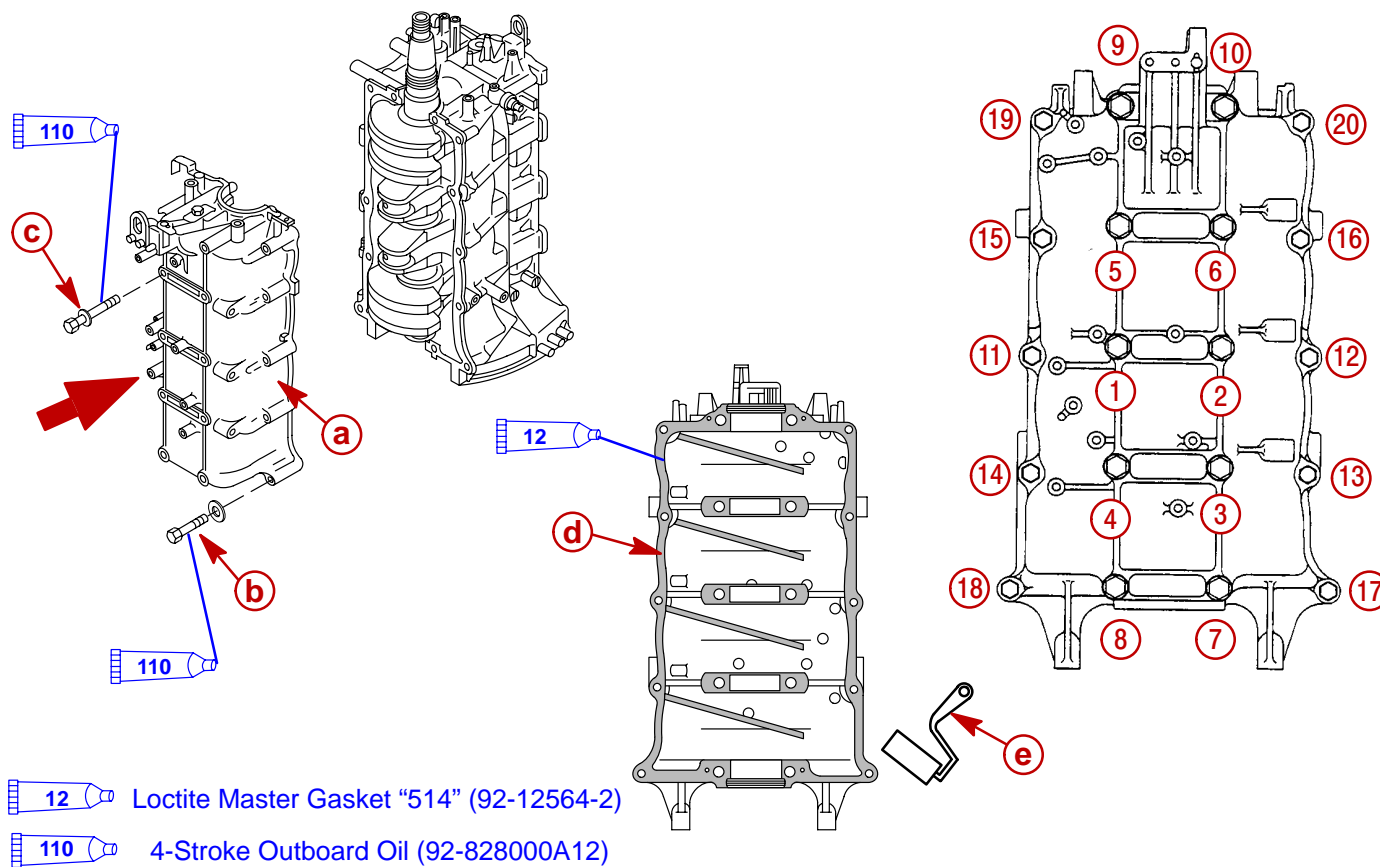
6. Clean off all oil from the contacting surfaces of the crankcase cover and cylinder block.

IMPORTANT: Make sure the contacting surface of the crankcase cover and cylinder block are clean before applying gasket sealant.

7. Apply a smooth even coat of Loctite Master Gasket Sealant to the contacting surfaces on the crankcase cover. Use a small (paint type) roller to spread out the sealant for a smooth even coverage. Instructions in gasket sealant kit must be followed exactly.

NOTE: Do not apply gasket sealant to the main bearings or the bolt holes.

8. Oil bolts and torque cover in sequence and in two steps.



- a - Crankcase
- b - Bolt (10) M8 x 55
- c - Bolt (10) M10 x 135
- d - Contact Surface of Crankcase
- e - Use Roller To Apply A Smooth Even Coat

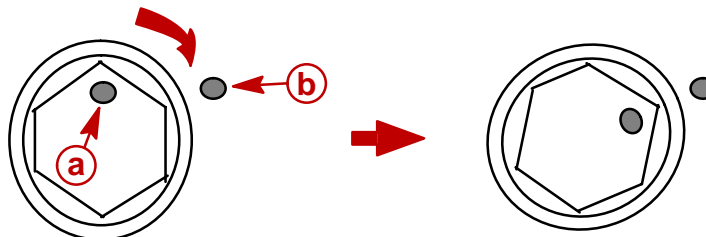
Crankcase Cover Bolt Torque		
Outer Bolts Qty. 10 (M8 x 55 mm)	1st Torque:	120 lb-in. (14 Nm)
	2nd Torque:	20 lb-ft (28 Nm)
Center Bolts Qty. 10 (M10 x 135 mm)	1st Torque:	168 lb-in. (19 Nm)
	2nd Torque:	60° 37 lb-ft (50 Nm)*

*Torque value for reference only.

**SERVICE TIP**

1. To obtain 60° rotation of crankcase cover bolts (after initial torque has been set) put a paint mark on corner point of the bolt head and a second paint mark one corner point clockwise on crankcase cover as shown. Rotate bolt until paint marks align.

NOTE: When using this procedure for final assembly use different color paint on crankcase cover to avoid confusion with previous paint marks.

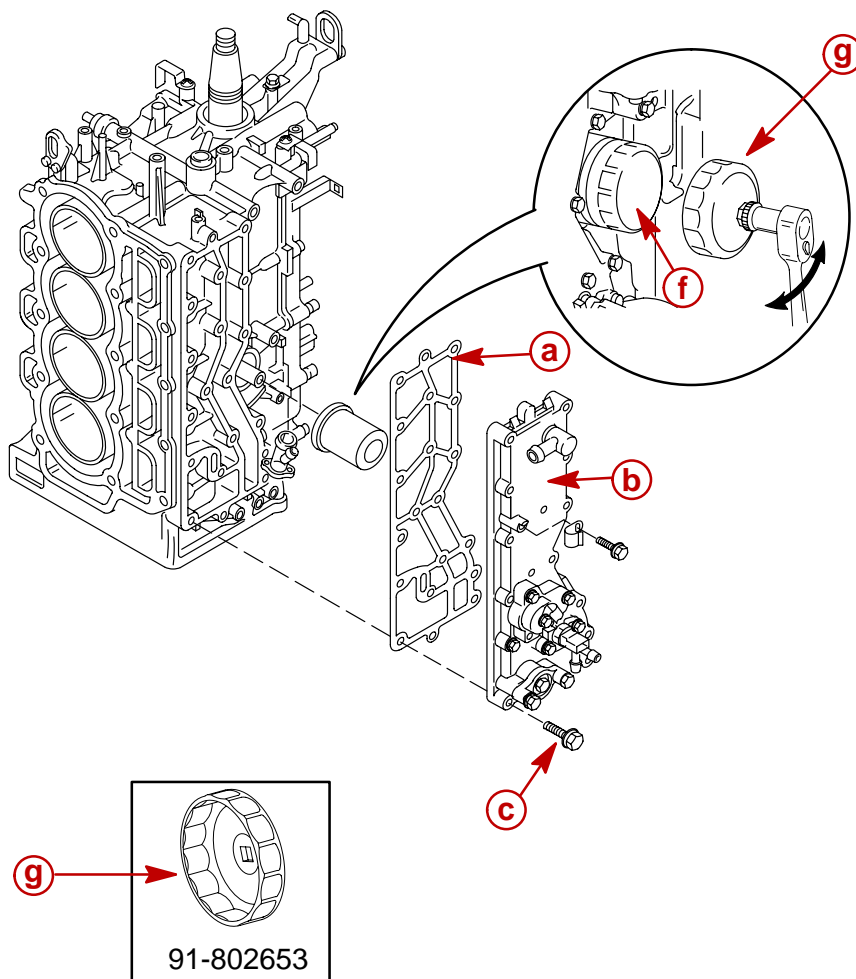
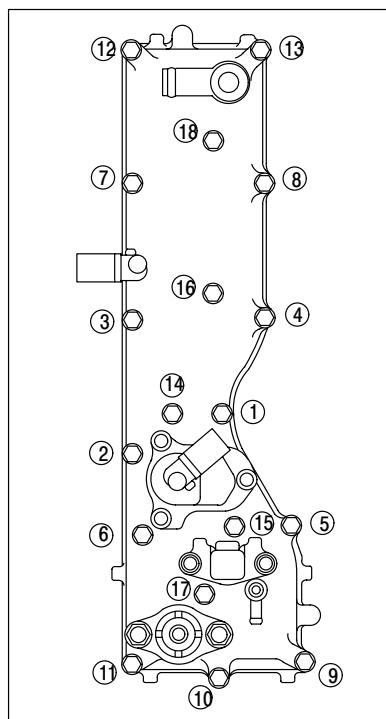
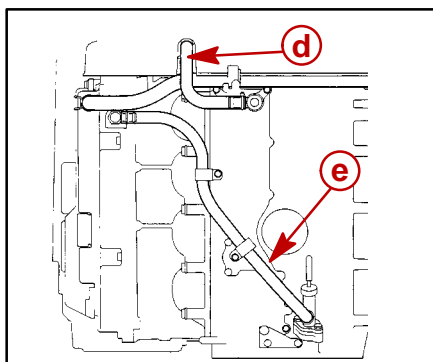


- a** - Paint Mark On Bolt Head
b - Paint Mark On Crankcase Cover



Exhaust Cover Installation

1. Install gasket, exhaust cover, and water hose. Torque exhaust cover in sequence.
2. Install oil filter and oil return hose.



- a** - Gasket (New)
- b** - Exhaust Cover
- c** - Screw (18) M6 x 30
- d** - Water Hose

- e** - Oil Return Hose
- f** - Oil Filter
- g** - Oil Filter Wrench

Exhaust Cover Screw Torque	
1st Torque:	53 lb-in. (6 Nm)
2nd Torque:	106 lb-in. (12 Nm)

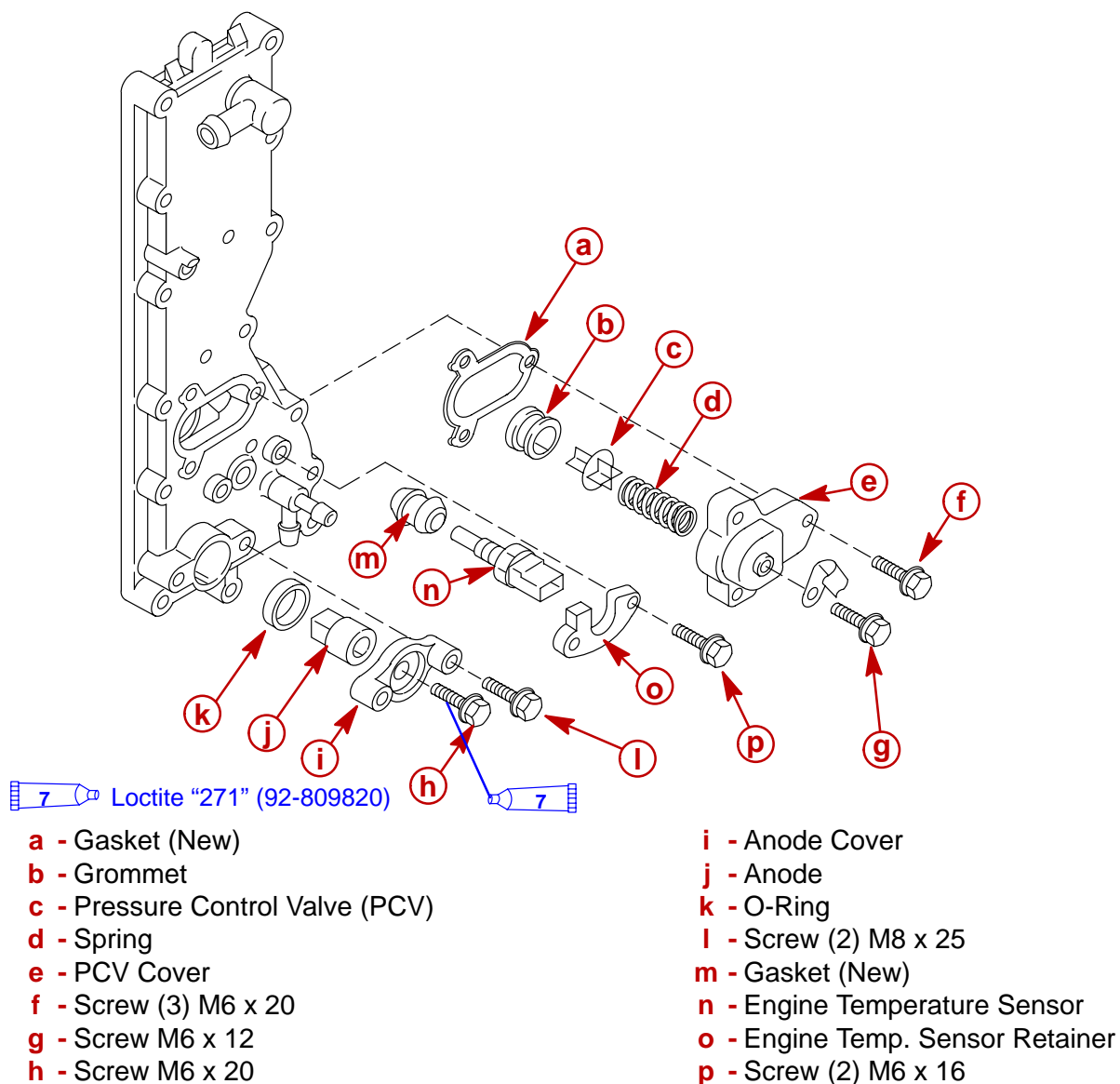
3. Install Pressure Control Valve (PCV) Cover.
4. Install anode and engine temperature sensor.

IMPORTANT: To prevent anode from falling into water jacket use the following procedure for anode installation:



ANODE INSTALLATION

1. Install anode bolt “h” securing cover to anode.
2. Install anode assembly onto cylinder block.
3. Install anode cover bolts “l”.



- a** - Gasket (New)
- b** - Grommet
- c** - Pressure Control Valve (PCV)
- d** - Spring
- e** - PCV Cover
- f** - Screw (3) M6 x 20
- g** - Screw M6 x 12
- h** - Screw M6 x 20
- i** - Anode Cover
- j** - Anode
- k** - O-Ring
- l** - Screw (2) M8 x 25
- m** - Gasket (New)
- n** - Engine Temperature Sensor
- o** - Engine Temp. Sensor Retainer
- p** - Screw (2) M6 x 16

Anode Screw Torque
70 lb-in. (8 Nm)

Anode Cover Screw Torque
156 lb-in. (18 Nm)

Temperature Sensor Screw Torque
70 lb-in. (8 Nm)

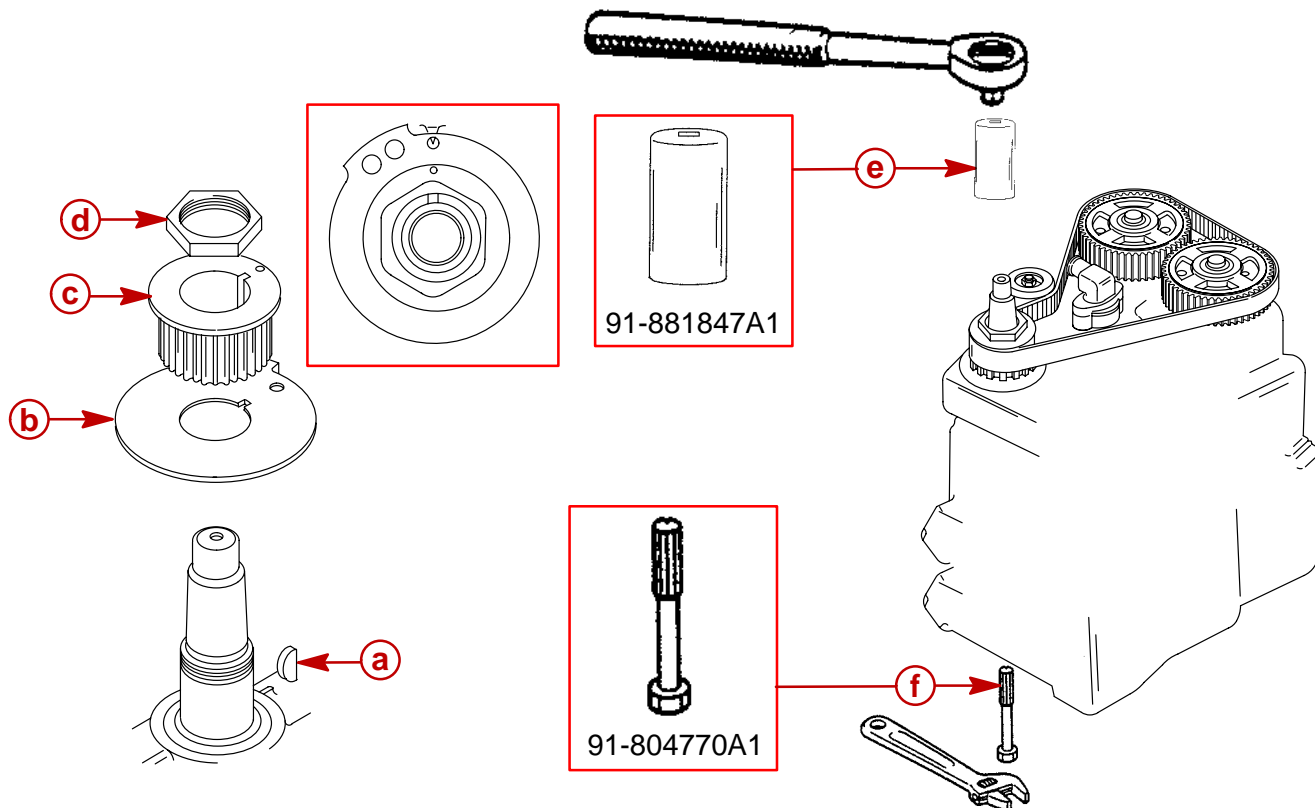
PCV Cover Screw Torque
70 lb-in. (8 Nm)



Drive Sprocket Installation

1. Install drive sprocket nut.

NOTE: Use 46 mm, 76 mm deep socket to hold drive sprocket nut and crankshaft holder tool (P/N 91-804776A1) to hold crankshaft.



- a** - Key
- b** - Pick-up Coil rotor
- c** - Drive Sprocket
- d** - Drive Sprocket Nut
- e** - 46 mm, 76 mm Deep Socket (91-881847A1)
- f** - Crankshaft Holder Tool (P/N 91-804770A1)

Drive Sprocket Nut Torque

195 lb-ft (265 Nm)



Installing Powerhead Components

Cylinder Head

1. See **Section 4A** for cylinder head installation.

Harness and Battery Cable

1. Install battery and harness cable assembly.

Fuel Components

1. Refer to **Section 3A and 3B** for installation of the following components.
 - a. Fuel pump
 - b. Carburetor/Intake Assembly

Charging and Starting System Components

1. Refer to **Section 2B** for installation of the following ignition components.
 - a. Starter motor
 - b. Voltage rectifier/regulator

Ignition Components

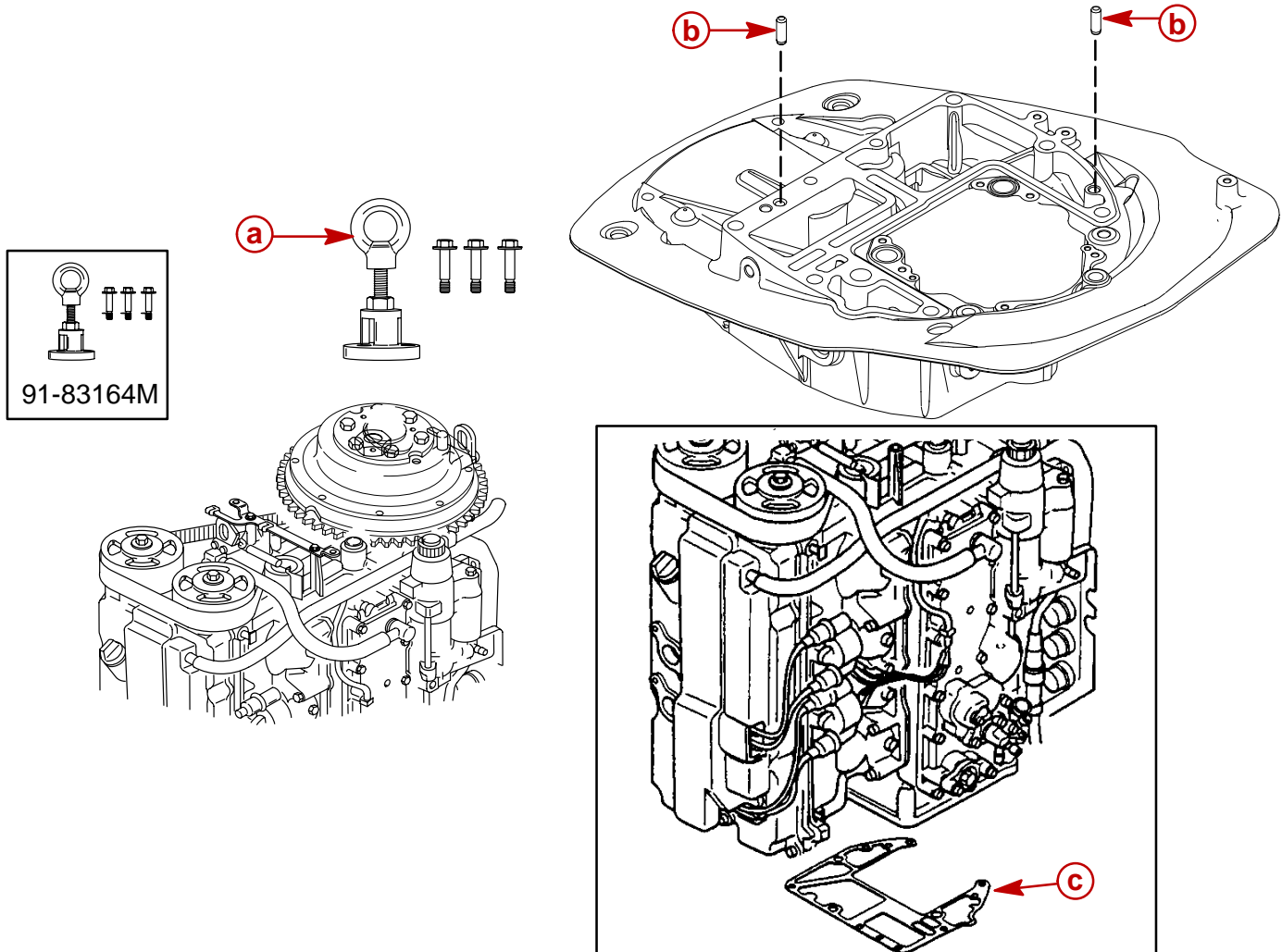
1. Refer to **Section 2A** for installation of the following ignition components.
 - a. Flywheel - must use Crank Shaft Holder Tool (P/N 91-804770A1)
 - b. Stator/Pick-up coils
 - c. Timing belt
 - d. Ignition coils
 - e. CDI unit
 - f. Crank position sensor
 - g. Temperature sensor



Powerhead Installation

NOTE: Carburetor vent hose should be attached as powerhead is being lowered onto drive shaft housing. Refer to **Following Powerhead Installation** for proper hose and adapter connections.

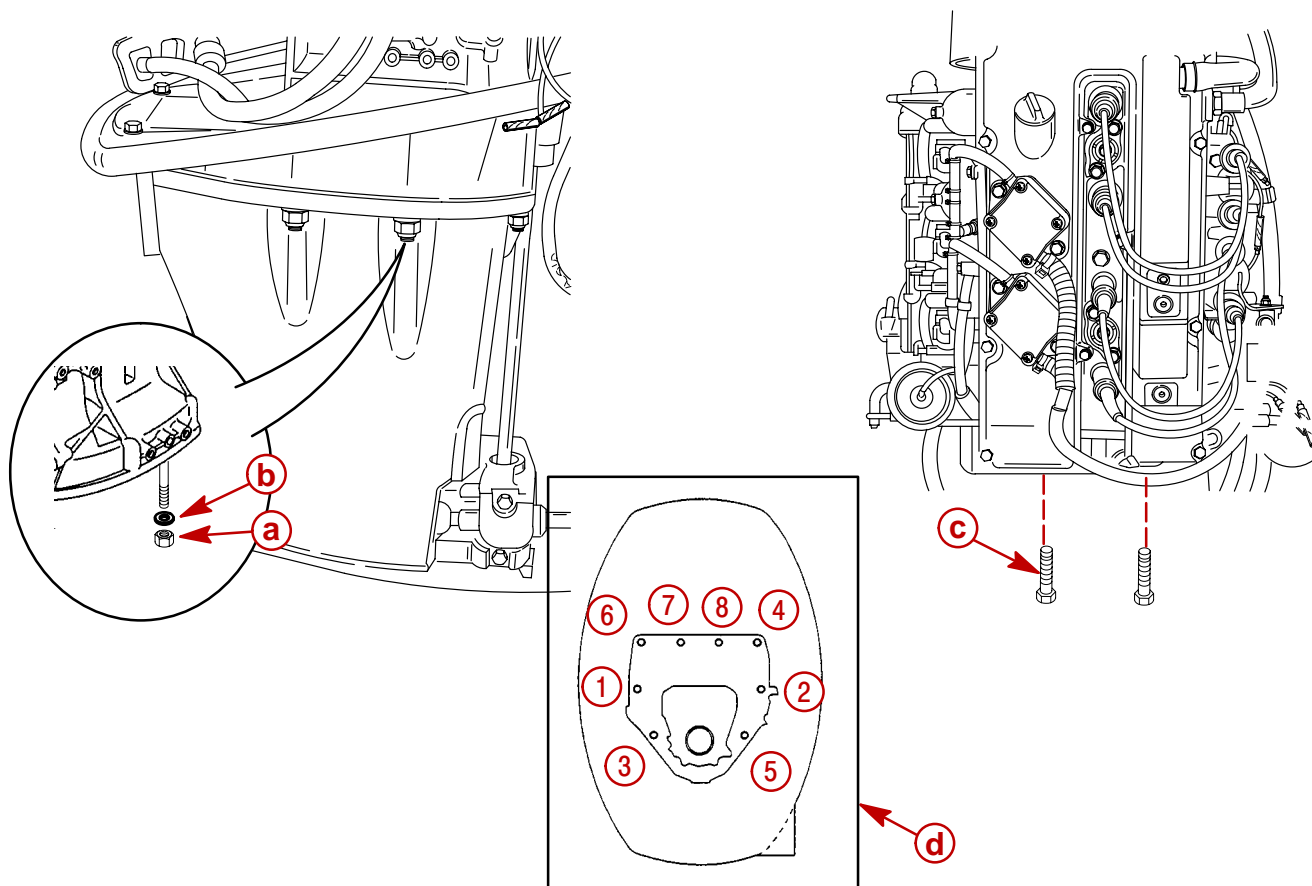
1. Lift powerhead using flywheel puller/lifting eye (91-83164M).
2. Install new powerhead gasket and dowel pins.
3. Place powerhead onto driveshaft housing.



- a** - Flywheel Puller/Lifting Eye (91-83164M)
- b** - Dowel Pins (2)
- c** - Powerhead Gasket (New)



4. Secure powerhead to drive shaft housing with nuts (6) and bolts (2). Torque in sequence.



- a** - Nut (6)
- b** - Washer (6)
- c** - Bolts (2) M8 x 35
- d** - Torque Sequence

Powerhead Mounting Nut Torque
35 lb-ft (47.5 Nm)

Powerhead Mounting Bolt Torque
20 lb-ft (27 Nm)

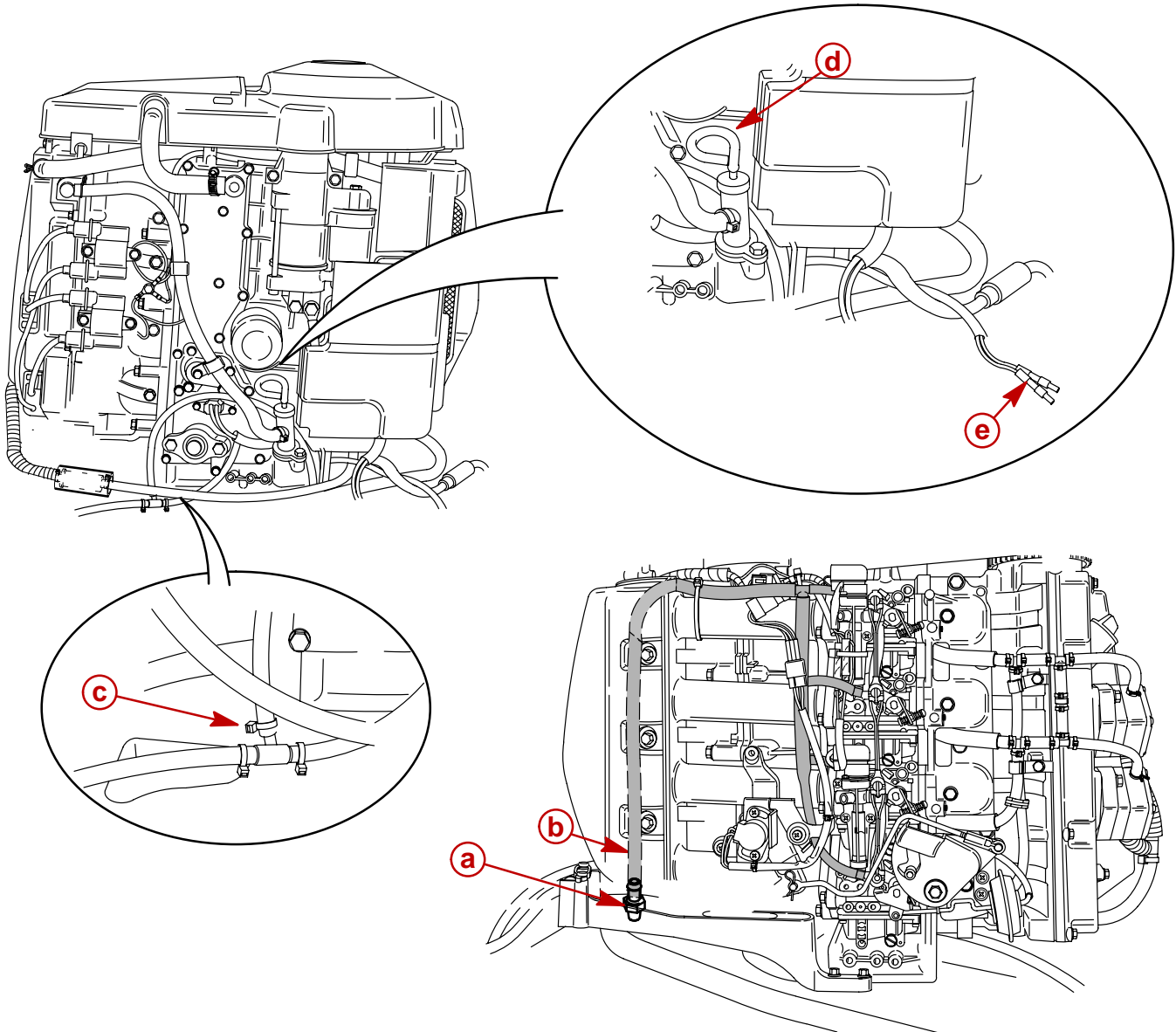


Following Powerhead Installation

1. Install carburetor vent hose on adaptor.

NOTE: Carburetor vent hose should be attached to adapter just before powerhead is lowered onto drive shaft housing.

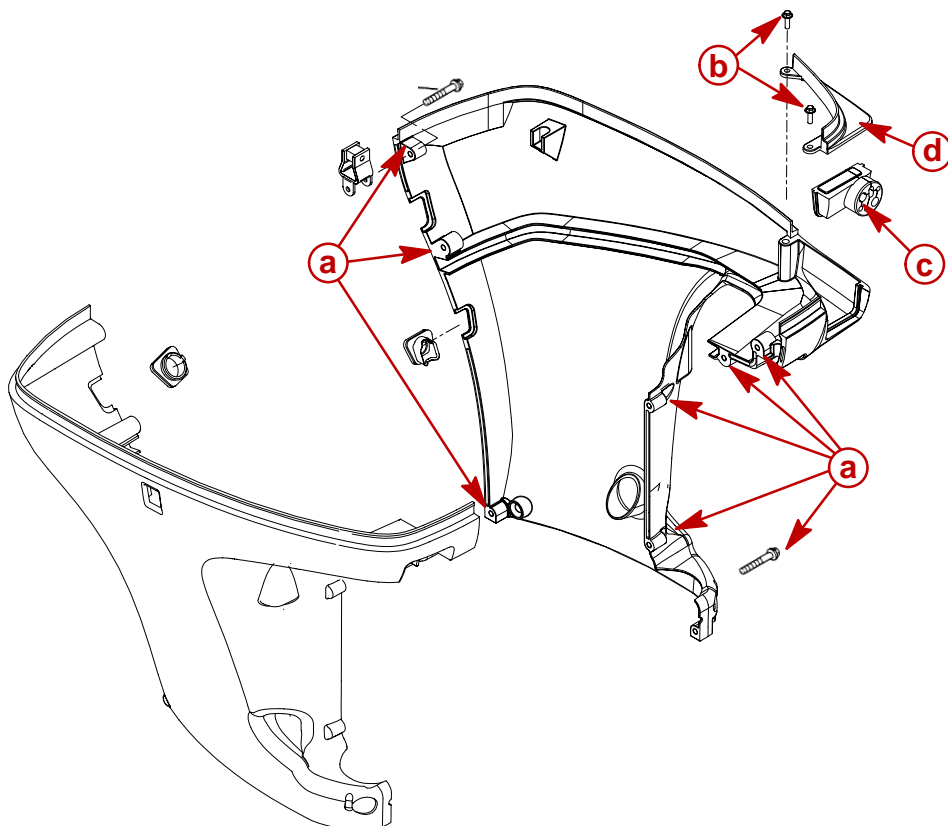
2. Install drive shaft bushing coolant hose.
3. Fill oil tank (refer to **Section 1B-Maintenance**) and install dipstick.
4. Connect power trim wires.



- a** - Vent Hose Adaptor (Hidden)
- b** - Carburetor Vent Hose (Hidden)
- c** - Coolant Hose For Drive Shaft Bushing
- d** - Dipstick
- e** - Power Trim Wires



5. Install 8 screws holding cowl halves together.
6. Install grommet and grommet cover.



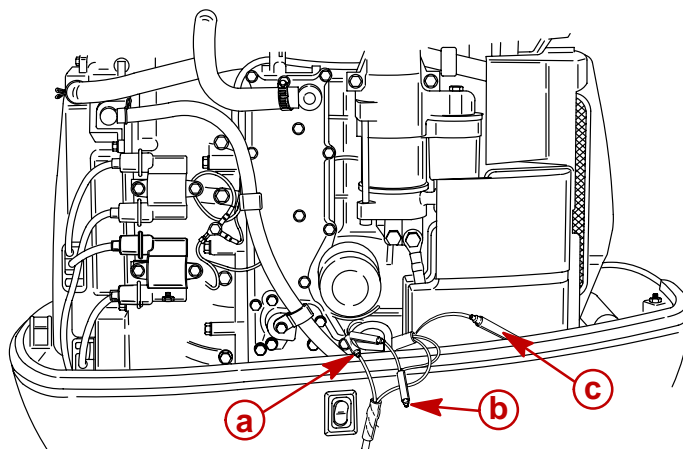
- a** - Cowl Screws (8) M6 x 40
- b** - Screws (2) M6 x 20
- c** - Grommet
- d** - Cover

Bottom Cowl Screw Torque
65 lb-in. (7.5 Nm)

Grommet Cover Screw Torque
65 lb-in. (7.5 Nm)



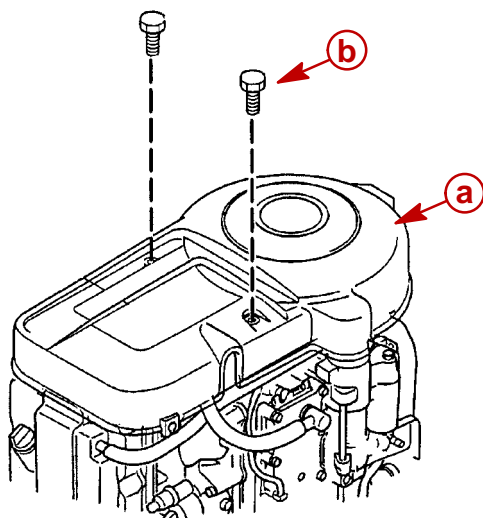
7. Connect trim wires.



- a** - Green/White
b - Lt. Blue/White
c - Red

8. Install flywheel cover.

9. Install top cowl.



- a** - Flywheel Cover
b - Screw (2) M6 x 20

Flywheel Cover Screw Torque

65 lb-in. (7.5 Nm)
