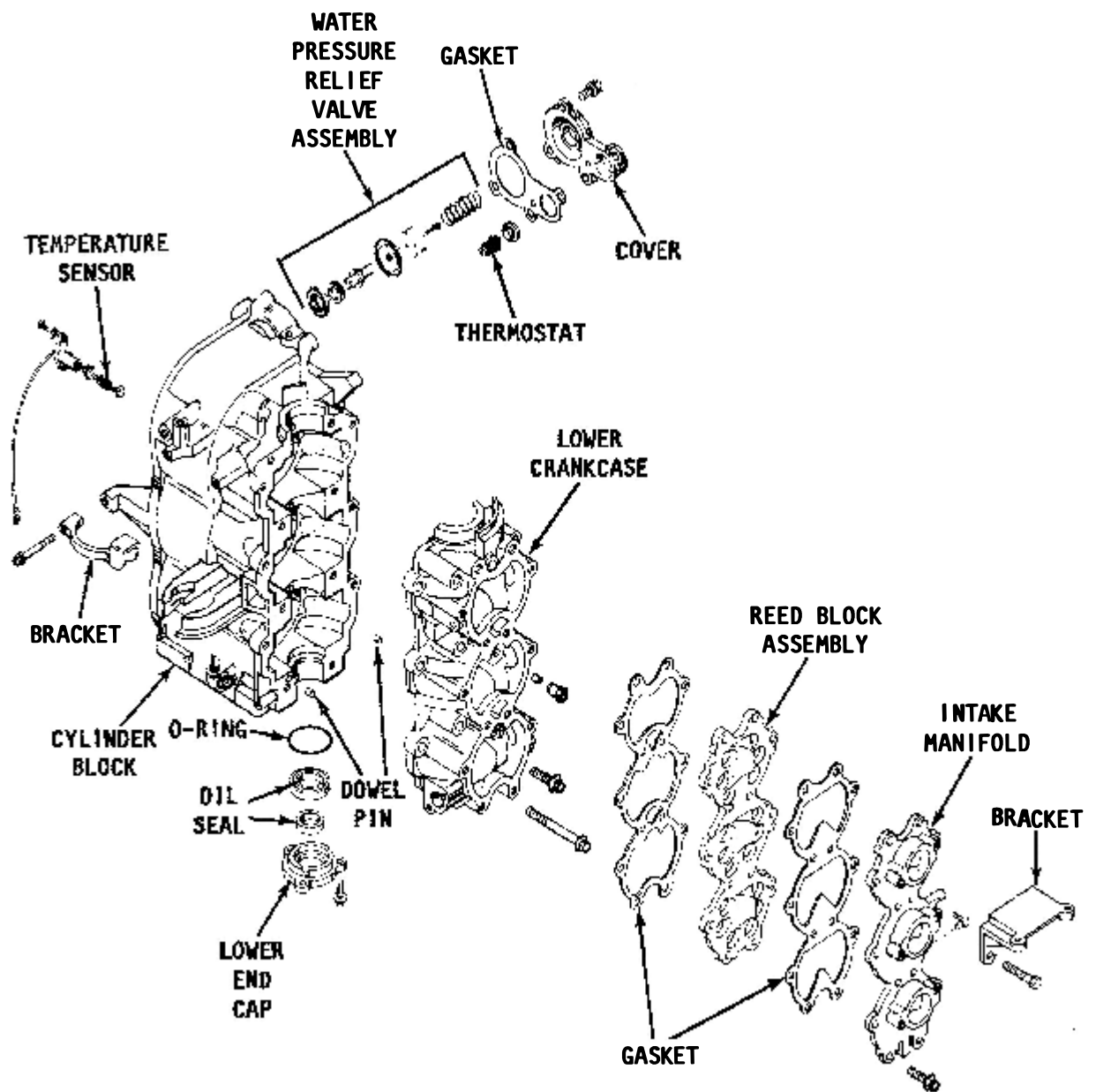
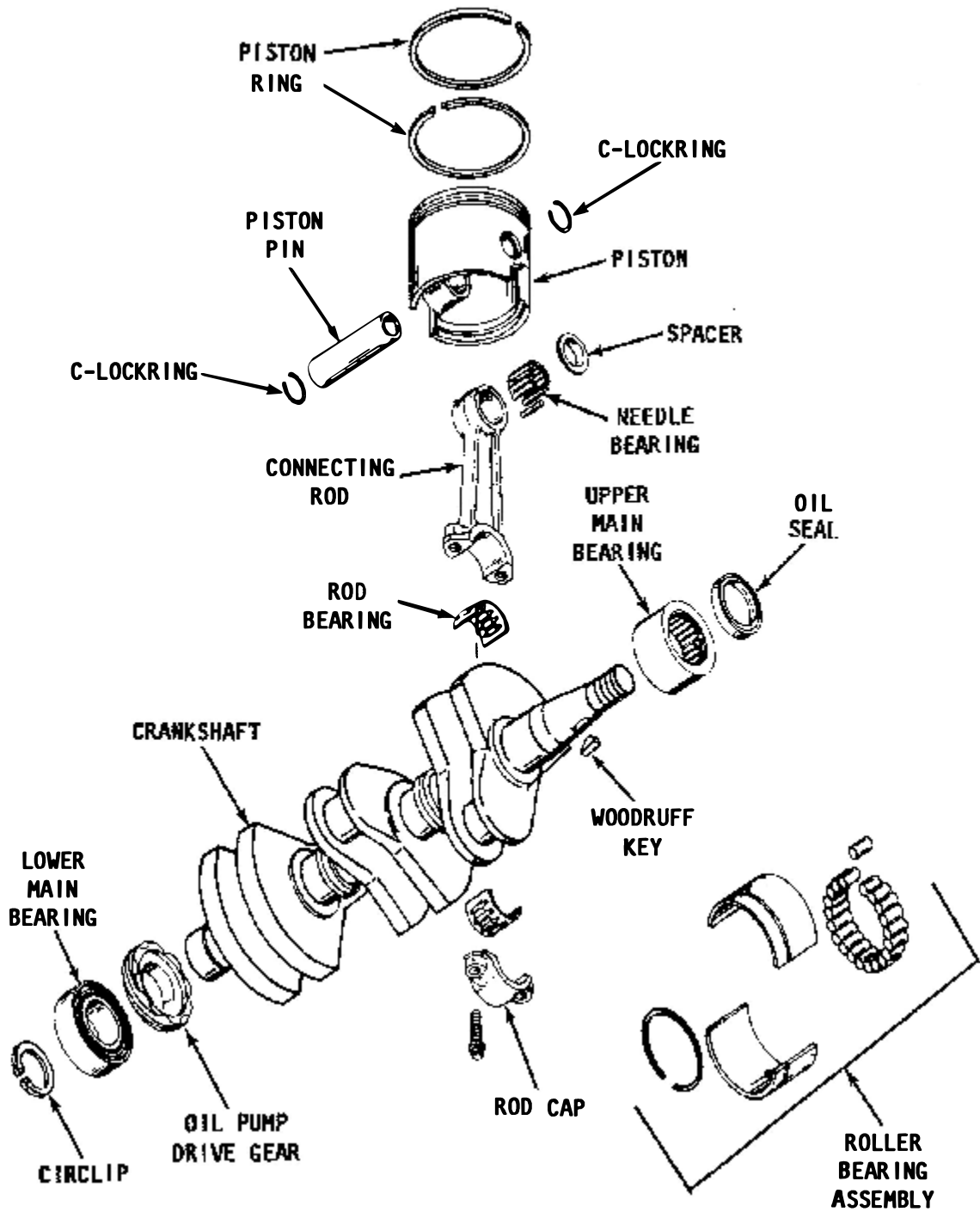


Exploded drawing of the redesigned, large bore 3-cylinder, Models 70hp and larger, crankshaft assembly, with major parts identified.

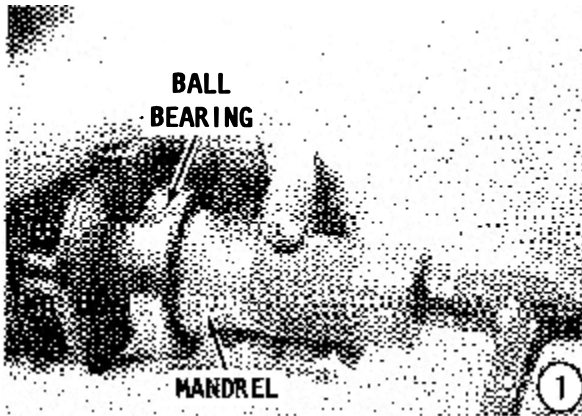
3-44 POWERHEAD



Exploded drawing of the redesigned, mid-sized bore 3-cylinder block, Models 50hp and 60hp, with major parts identified.



Exploded drawing of the redesigned, mid-sized bore 3-cylinder, Models 50hp and 60hp, crankshaft assembly, with major parts identified.



ASSEMBLING

FIRST, THESE WORDS

Be sure all parts to be reused have been carefully cleaned and thoroughly inspected. Parts not properly cleaned, or parts not suitable for service can damage a good powerhead within a few minutes after starting the engine.

NEW gaskets **MUST** always be used during an overhaul.

A torque wrench is essential to correctly assemble the powerhead. **NEVER** attempt to assemble a powerhead without a torque wrench. Attaching bolts for covers **MUST** be tightened to the required torque value in three progressive stages, following the specified tightening sequence. On the first stage, tighten to 1/3 the torque value. On the second stage, tighten to 2/3 the total torque value. Finally, on the third and last stage, tighten to the full torque value.

Crankshaft Assembling

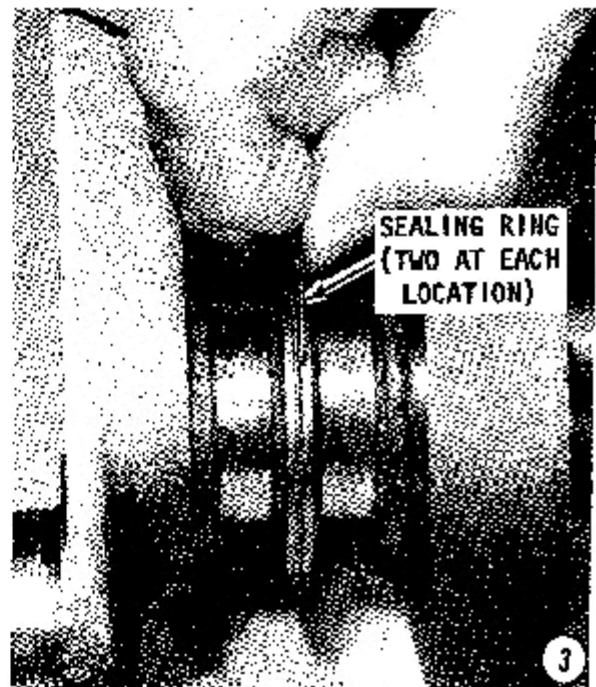
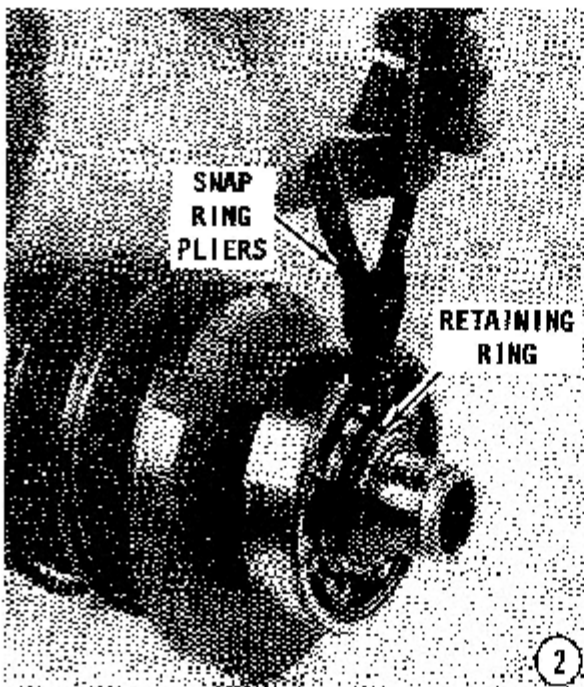
1- If the ball bearing on the driveshaft end of the crankshaft was removed, install the bearing as follows: Support the crankshaft assembly in a press with the support between the counterweights and directly under the lower crankshaft end. Press the lower ball bearing onto the crankshaft, using a piece of tubing as a mandrel. **BE SURE** the tubing is the proper size so the force is only applied onto the inner race of the bearing. Continue to press the bearing into place until it is firmly seated against the counterweight. Remove the crankshaft assembly from the press. Using a press is the preferred method as a precaution against damaging the bearing, however, an installer and hammer may be used, as shown.

2- Use a pair of expanding type snap ring pliers and install the retaining ring to secure the lower crankshaft ball bearing in place.

3- Spread the ends of a crankshaft sealing ring and install it around the crankshaft main bearing. **TAKE CARE** not to scratch the highly polished bearing surface. Install two rings at each location and position their end gaps at 180° to each other. Continue, until all rings are in place. Lubricate the crankshaft sealing rings with light weight oil.

SPECIAL WORDS

The following paragraphs describe procedures to install a large number of small

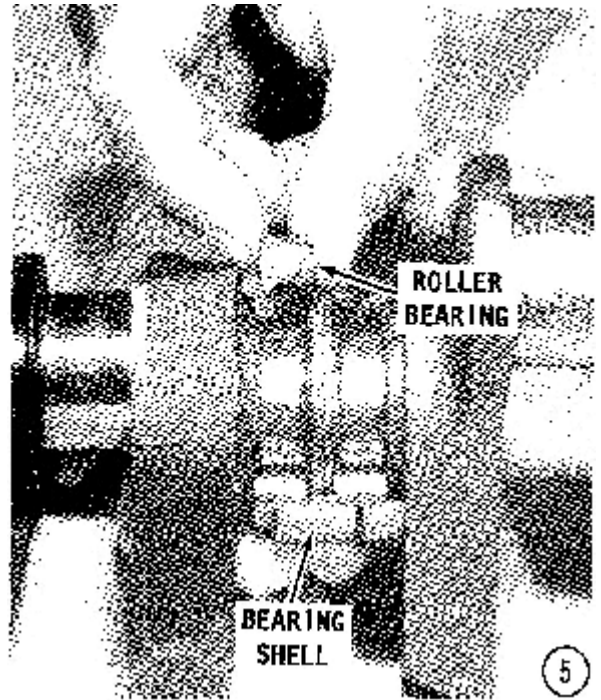


roller bearings around a bearing surface. In order for the installed bearings to stay "put" apply a coating of Quicksilver Needle Bearing Assembly Lubricant C-92-42649A-1 and **NO** other type "goopus".

Any lubricant applied on the crankshaft bearing surface **MUST** be soluble in gasoline. Unfortunately, most lubricants are not.

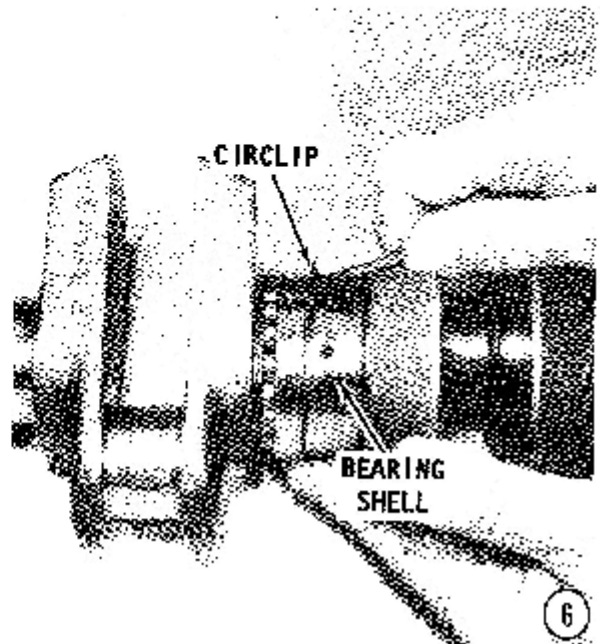
4- Apply a liberal coat of Quicksilver Needle Bearing Assembly Lubricant to the crankshaft journal to hold the roller bearings in place. Hold a bearing shell up against the crankshaft sealing ring, with the groove for the circlip facing toward the top (tapered) end of the crankshaft. Insert the bearings around the two crankshaft grooves, pushing them in between the bearing shell and the crankshaft.

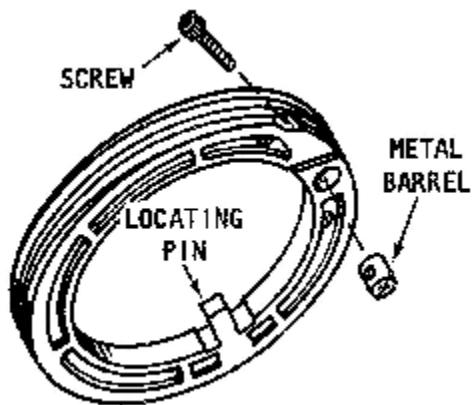
5- Continue installing the roller bearings around the crankshaft until a total of 32 -- two sets of 16 -- are in place. Install the other matching bearing half over the half already in place, with the groove for the circlip facing toward the top (tapered) end of the crankshaft. Check to be sure the circlip groove is matched on the two bearing shell halves.



6- Secure the bearing halves in place with the circlip. Lubricate the crankshaft main roller bearings by injecting light-weight oil through one of the holes in the bearing race.

7- Soak the oil pump drive gear in hot water for approximately four minutes, until it is somewhat pliable. Separate the two ends of the gear and install the gear over the crankshaft journal next to the main bearing, with the lip facing toward the upper (tapered) end of the crankshaft. Slide the gear lip into the groove in the crankshaft. The locating pin **MUST** index into the crankshaft slot.

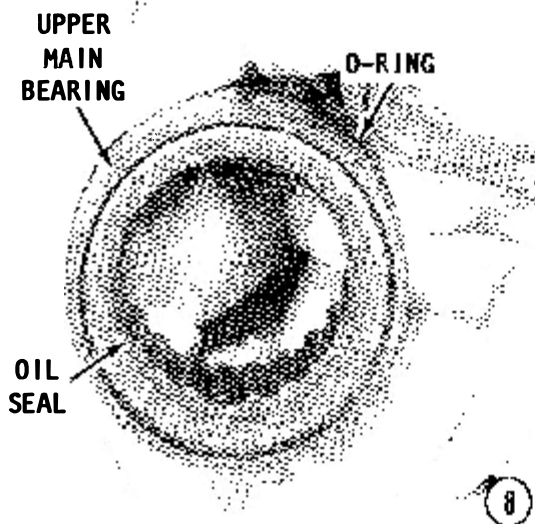




Insert the metal barrel into the center hole of the gear and align the threaded hole with the hole for the screw in the gear. Thread the screw into the hole in the gear teeth and into the metal barrel. Tighten the screw to 8 in lb (.9Nm). The two ends of the gear should now be tightly together and the gear mismatch at the joint line must not exceed .030" (.76mm). Excess mismatch will result in premature gear failure. Excess mismatch may be caused by the gear lip not being properly seated in the crankshaft groove.

8- If the upper main bearing oil seal was removed in Step 20 of disassembling, pack the lip of a new oil seal with 2-4-C Quick-silver Marine Lubricant C-92-90018A12 and install the seal into the top (closest to the groove) end of the bearing with the lip facing **DOWN**. Apply the same lubricant to a new O-ring and install the O-ring into the bearing groove.

9- Slide the upper main bearing over the top of the crankshaft with the oil seal facing **UP** -- toward the threads of the crankshaft.



SPECIAL WORDS ON PISTON RINGS

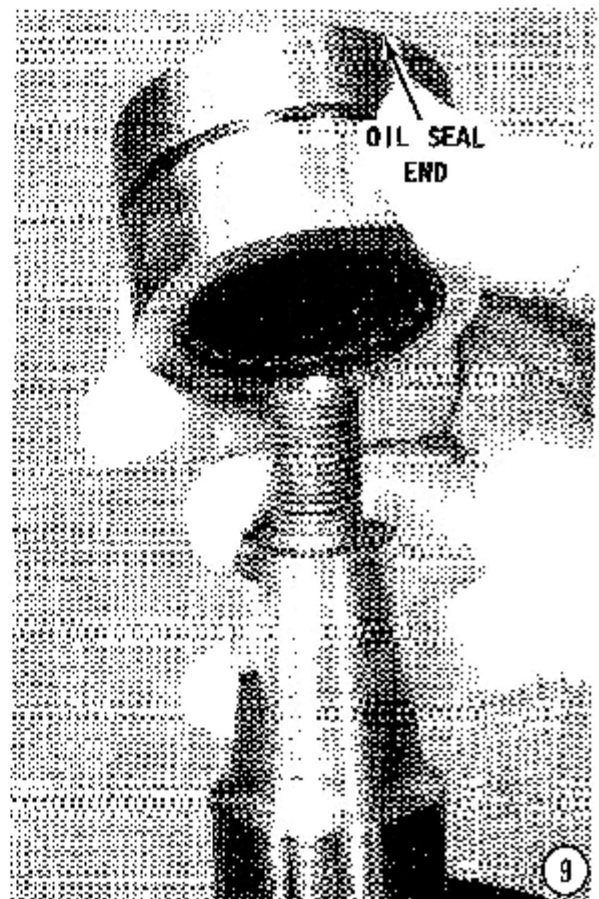
All powerheads covered in this section, with the new redesigned in-line block, are equipped with 2-ring pistons. Both rings are tapered on the top side and rectangular on the under side, which designates them as semi-keystone rings. The only critical part of the installation procedure is to be sure the "T" on the side of each ring is facing **UPWARD, TOWARD** the piston crown. Installation procedures are the same as for other standard pistons.

Upsize Pistons and Rings:

All oversize pistons for these powerheads are manufactured to use two semi-keystone rings. Again, the only critical procedure during installation is to be sure the "T" on the side of the ring faces **TOWARD** the piston crown.

GOOD WORDS

OBSERVE the pin in each ring groove of the piston. The ends of the ring **MUST** straddle this pin. The pin prevents the ring from rotating while the powerhead is operating. This fact is the direct opposite of a four-cycle engine where the ring must ro-



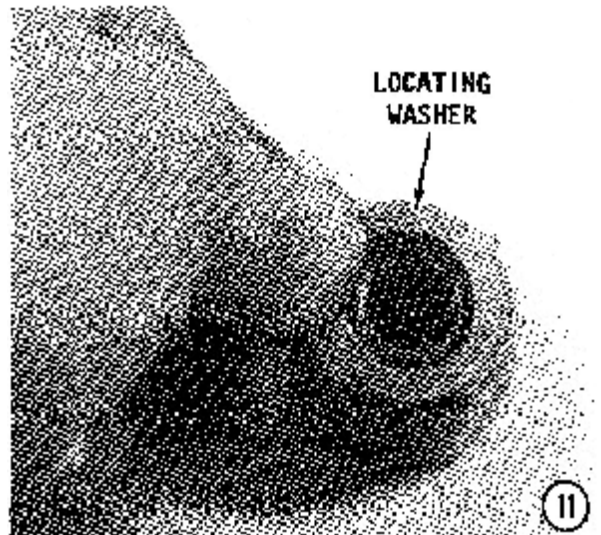
tate. In a two-cycle engine, if the ring is permitted to rotate, at one point, the opening between the ring ends would align with either the intake or exhaust port in the cylinder. At that time, the ring would expand slightly, catch on the edge of the port, and **BREAK**.

Therefore, when checking the condition of the piston, **ALWAYS** check the pin in each groove to be sure it is tight. If one pin is the least bit loose, the piston **MUST** be replaced, without question. Never attempt to replace the pin, it is **NEVER** successful.

10- Use a ring expander and install the ring set identified for the No. 1 piston and cylinder onto the piston. Adjust the ring expander in small increments until the ring will just barely fit over the top of the piston. If the expander is adjusted to open the ring more than necessary, the ring may break. Work **SLOWLY**, and check each ring to be sure it is installed properly with the **"T"** on the side of the ring facing the top of the piston. After the rings are in place, attempt to rotate the ring in its groove. The attempt **MUST FAIL**. If the ring is free to rotate, the locating pin is not performing its function and the piston must be replaced.

Piston/Rod Assembling

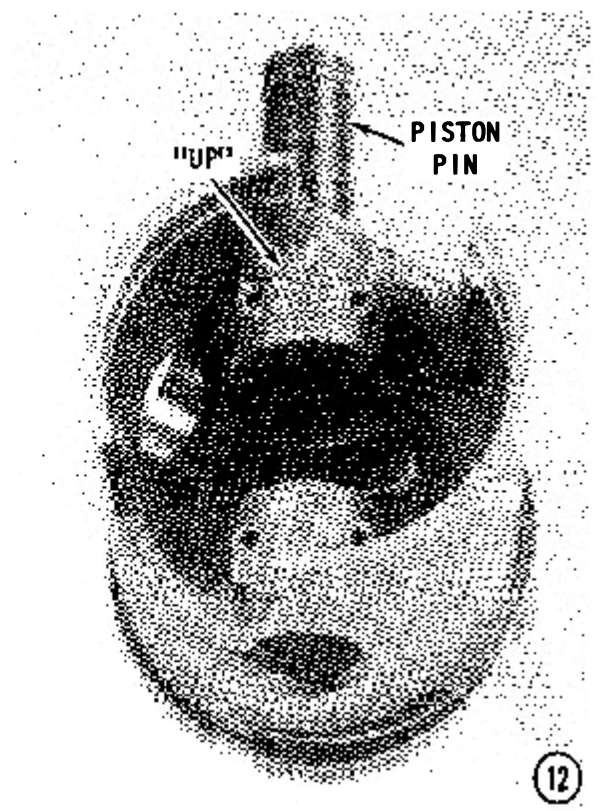
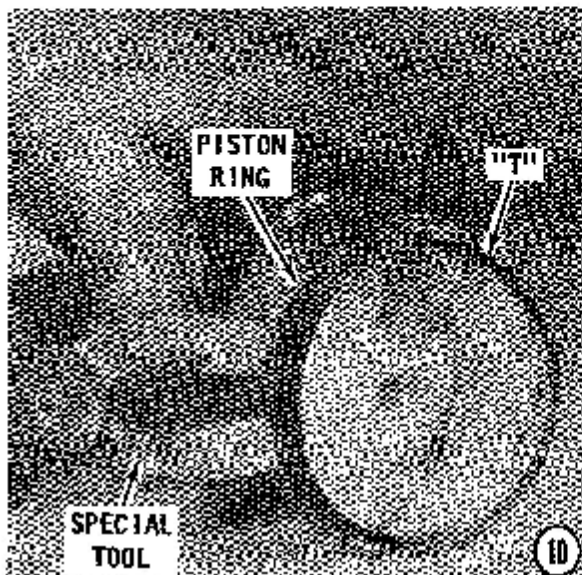
11- Lay a clean towel on the work surface. Lay out the 29 piston pin needle bearings in a line. **NEVER** intermix needle bearings from one piston assembly with those from another piston. **NEVER** intermix used needle bearings with new bearings. If just one bearing is unfit for service or is lost, the entire set **MUST** be replaced. Lay



down a bead of Quicksilver Needle Bearing Assembly Lubricant C-92-42649A-1 onto the sleeve portion of Piston Pin Tool C-91-74607A1.

Always handle pistons with great care because the skirt can be bent out of round if the piston is handled roughly. Place the lower locating washer onto the piston pin tool with the shoulder on the washer toward the bearings.

If a piston pin tool is not available, a drift slightly smaller in diameter than the pin, may be used. Install the retainer and the needle bearings onto the end of the tool. Push the bearings and the tool into the rod

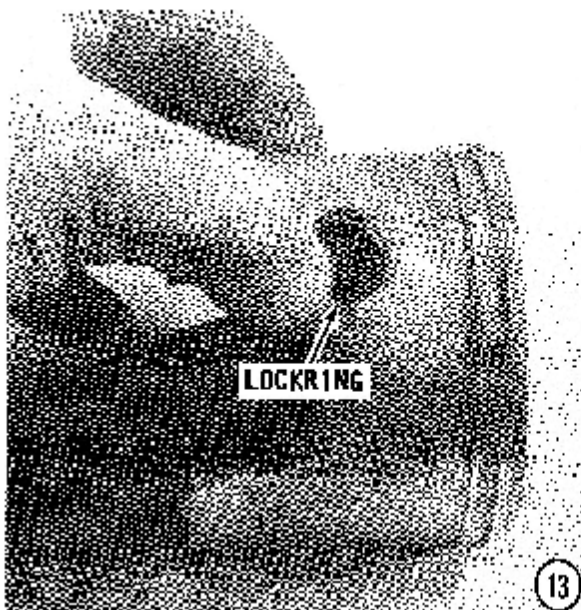


piston pin bore. Place the top retainer on the side of the rod. Ease the tool out of the rod, and at the same time hold onto the needle bearing retainer washers.

12- Notice the word "UP" on the piston pin boss inside the piston skirt. This word indicates the side of the piston that **MUST** face upward, toward the top of the powerhead, the tapered end of the crankshaft, when it is installed. The "UP" side of the piston **MUST** face downward on the support block when the piston pin is pressed in. Place the piston in a container of hot water, approximately 190°F. The piston may also be heated with a heat lamp to approximately 190°F.

Place the heated piston, in an arbor press, in position on the Piston Support Block, C-91-77005, with the side marked "UP" on the piston pin boss down against the block. Use one hand to hold the sleeve, bearings, and locating washers in place. At the same time, with the other hand, insert the connecting rod into position in the piston, with the two bumps on the crankshaft end of the rod **TOWARD** the word "UP" on the piston. Once the rod is in place, slide the handle portion of the piston pin tool up through the hole in the support block and on through the lower piston pin boss into the sleeve.

Hold the piston pin needle bearings in place with the piston pin tool, and press the piston pin into position as far as possible with the arbor press. Use the piston pin tool between the arbor press and the piston pin to position the piston pin the rest of the way into the piston.



SAFETY WORD

WEAR eye protection glasses while installing the piston pin lockrings, because the lockrings are made of spring steel and may slip out of the tool or pop out of the groove with considerable force. **DO NOT** use a lockring the second time. Use new lockrings and check to be sure they are properly seated in the piston grooves.

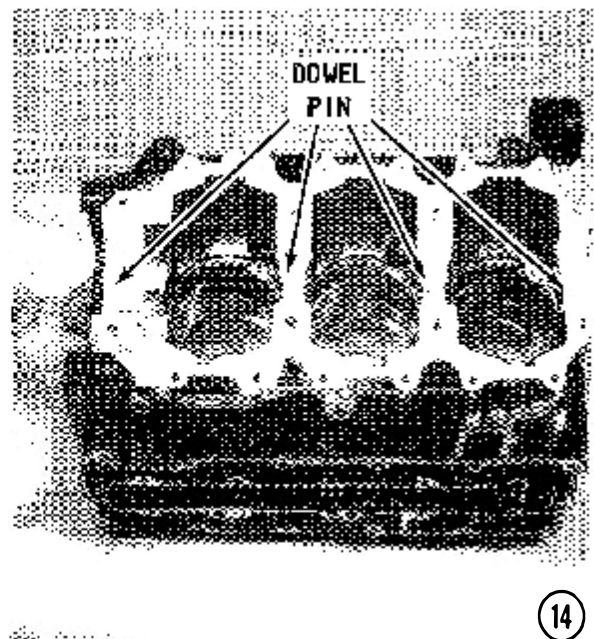
13- Install a G-type piston pin lockring at each end of the piston pin using Lockring Installation Tool, C-91-77109A1, or a pair of needle-nose pliers. Check and double check, to be sure each lockring is properly seated in the piston groove.

Lubricate the piston, the rings, and the cylinder bore with a good grade of 50-weight oil.

14- Check the cylinder block to be sure the crankshaft main bearing dowel pins are in place. If they are not in place, install new pins.

15- Check to be sure the number painted onto the connecting rod during disassembly matches the cylinder number into which the piston assembly is to be installed.

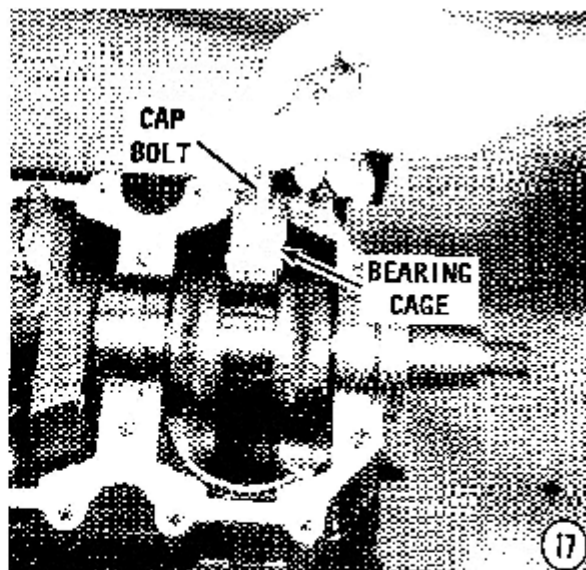
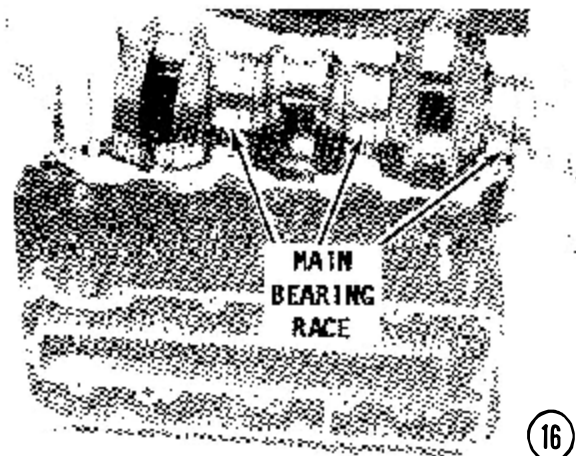
OBSERVE the identification marks on the crown of each piston. The word **UP** embossed on the crown, as shown in the accompanying illustration, indicates the side of the piston that **MUST** face upward, toward the top, the flywheel end, of the powerhead when it is installed. This position will place the large hole in the piston skirt directly opposite the exhaust port in the cylinder wall.





The piston can be inserted down through the bottom of the cylinder bore **WITHOUT** the use of any special tools. Position the piston squarely over the bore. Compress each ring, one at a time, and push down little by little until the piston slides easily into the cylinder bore.

If, after repeated attempts, the piston cannot be installed into the bore, pull the piston out and inspect the alignment of the rings with the locating pins. **DO NOT** use force to push the piston into the bore. A piston ring will easily break if the end has jumped over the locating pin and is forced against the cylinder wall. The installer may not even realize the ring has broken during piston installation. The ring tension is checked later in Step 27 to verify the rings have been correctly installed.

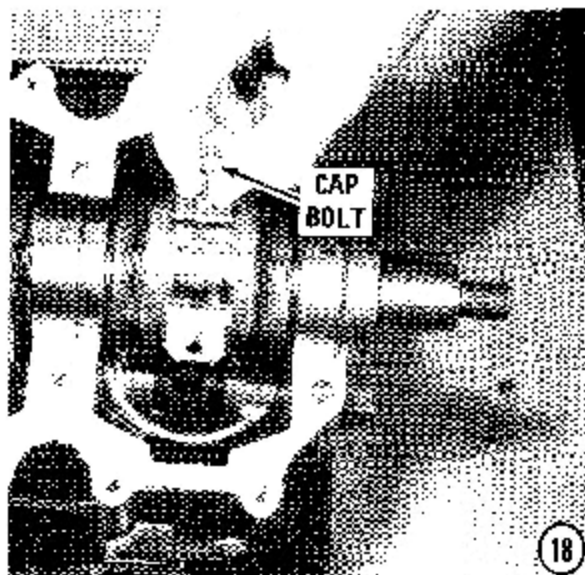


Crankshaft Installation

16- Lower the crankshaft assembly into the cylinder block, with the flywheel end toward the top of the powerhead. Rotate the main bearing races very slightly, until the dowel pin hole in each race indexes the dowel pins in the block. Gently push the crankshaft down into position.

Installing Rods to Crankshaft

17- Apply a coating of Quicksilver Needle Bearing Assembly Lubricant C-92-42649A-1 to the bearing surface of the connecting rod. Thread one of the cap bolts into the connecting rod. The bolt can then be used as a tool, to move the connecting rod around, while performing the delicate task of installing the needle bearings and race to the crankshaft. Install the bearing cage and the roller bearings into the lubricant.



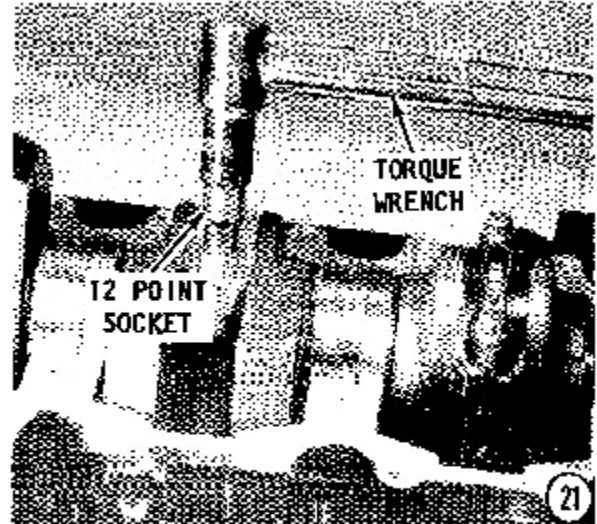


NEVER intermix roller bearings from one connecting rod cage with those from another rod cage. **NEVER** intermix used roller bearings with new bearings. If just one bearing is unfit for service or is lost, the entire set **MUST** be replaced.

18- Move the connecting rod up to the crankshaft journal. Support the rod in place with one hand and remove the cap bolt.

Apply a coating of Quicksilver Needle Bearing Assembly Lubricant C-92-42649A1 to the crankshaft journal. Install the other bearing cage and the remaining roller bearings into the lubricant.

19- Thread the cap bolts into the cap until the bolt end is flush with the mating surface of the cap. The manufacturer re-

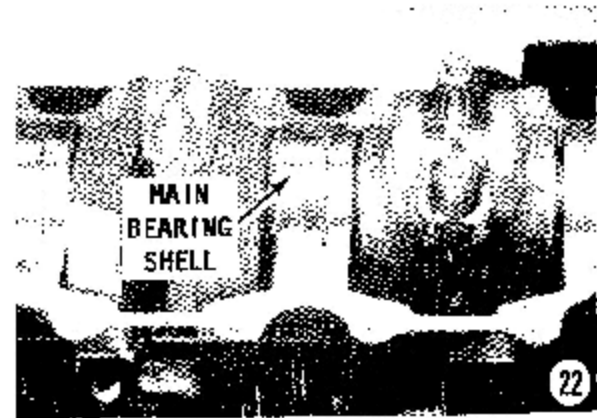


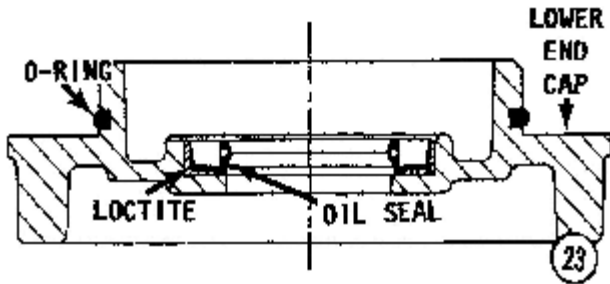
commends the connecting rod bolts be installed **DRY**, with no oil or sealer applied to the threads. Place the rod cap in position with the marks on the connecting rod and cap aligned. Hold the two halves of the connecting rod cap tightly together and thread the rod bolts as far as possible by hand.

20- Check the alignment between the rod cap and the rod by moving a scratch-all back and forth on the chamfered corners between the rod cap and the rod. If a ridge is felt, the rod cap is not aligned properly. The cap **MUST** be aligned before proceeding.

21- Use a 12-point socket and tighten the rod bolts alternately in three progressive stages to 15 ft. lbs. (20 Nm) for 1/4 inch bolts, 27 ft. lbs. (37 Nm) for 5/16 inch bolts on 50-60hp powerheads, or 30 ft. lbs. (41 Nm) for 70hp and larger powerheads. Tighten to 1/3 the torque value on the first sequence; to 2/3 the value on the second sequence; and to the full torque value on the third and final sequence. Again check the alignment between the cap and the rod.

22- Make a final inspection of the main bearings. All bearing shells **MUST** be firmly seated against the block -- indexed with lo-





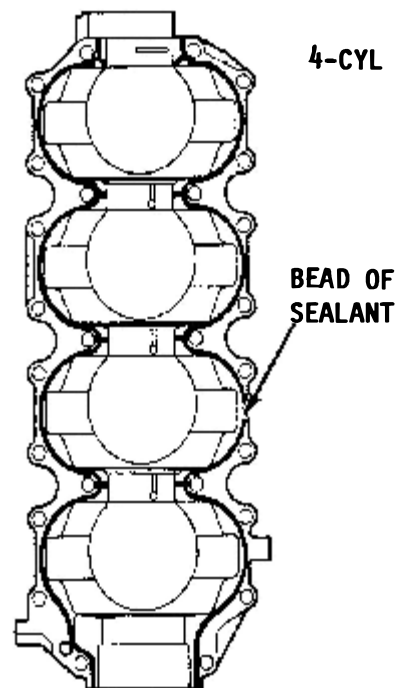
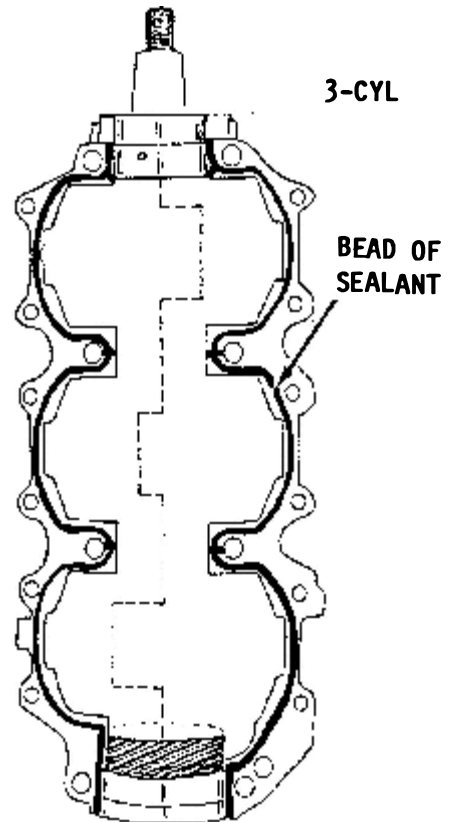
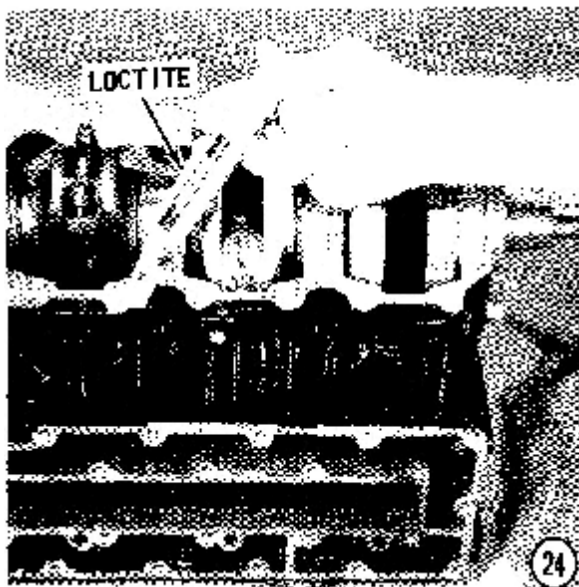
cating posts on the bearing mating surface. Do **NOT** attempt to rotate the crankshaft at this point, as the bearing shells may unseat. Exert a slight downward hand force on the crankshaft, and at the same time attempt to rotate the main bearing shells -- one at a time. The attempt should fail. If a shell can be rotated, the bearing is not seated properly -- the locating pin in the block is not indexed in the hole in the bearing shell.

Lower End Cap Assembling

23- Lay down a thin bead of Loctite "A", or equivalent, to the outer diameter of the lower end cap oil seal. This outer diameter is the area making contact with the end cap. Use a suitable driver and press the oil seal into the lower end cap with the lip of the seal **UP**. The lip will then face toward the cylinder block when it is installed. Continue to press the seal into place until the seal is firmly seated on the end cap shoulder. Clean away any excess Loctite.

Lubricate the surface of the end cap making contact with the cylinder block, and the lower end cap O-ring with light weight oil. Install the lubricated O-ring around the lower end cap.

Install the lower end cap over the crankshaft.

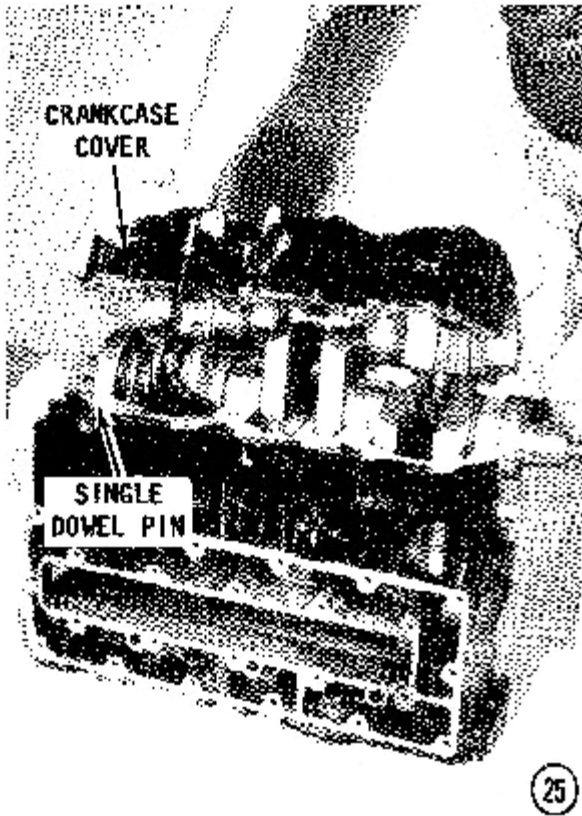


Lay down a bead of sealant around the perimeter of the crankcase, following the dark lines indicated. Extend the bead to each center main bearing journal to prevent "blow-by" between cylinders.

Crankcase Cover Installation

24- Obtain Loctite Master Gasket Sealant kit, C-92-12564-1.

Before mating the crankcase cover and the cylinder block, check to be sure:



- a- The mating surfaces are clean. **NEVER** use any kind of tool or abrasive material to clean the surfaces. Use only solvent and "elbow grease".
- b- The crankshaft is properly seated.
- c- The rod caps have been correctly installed.

d- The single dowel pin is in place on the block mating surface.

Follow the directions in the kit and lay a bead of sealant onto the contact surface of the crankcase, as indicated by the dark line, in the accompanying illustrations. Extend the bead of sealer to each center main journal to prevent "blow-by" between cylinders.

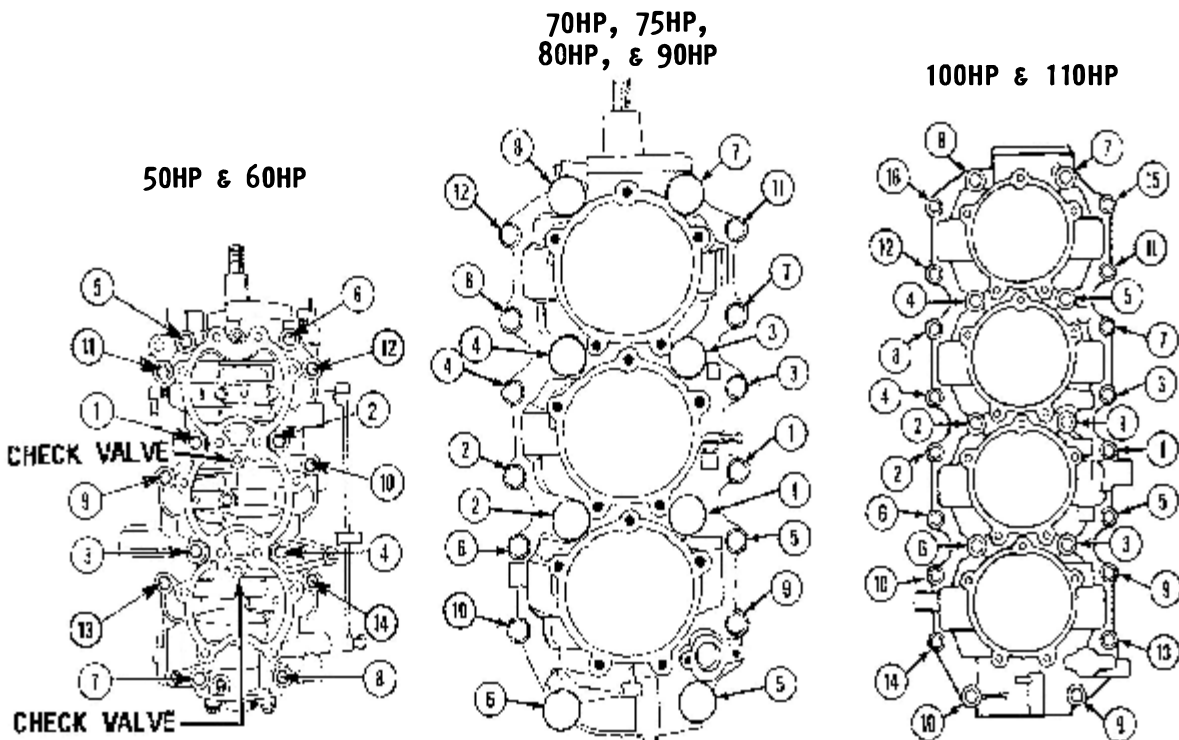
25- Lower the crankcase cover over the block, indexing the single dowel pin. Align the holes, before the sealant has time to set.

26- If working on a 50hp or 60hp powerhead, install the two check valves and holders in the locations indicated in illustration #26.

Notice the bolts are of two different sizes, with the larger bolts located in the two center rows and the smaller bolts on the outer edges of the crankcase. Insert and hand tighten the bolts to be sure all are accounted for. There is a torquing sequence for each size bolt, as shown in the accompanying illustration.

First, tighten the larger bolts of the crankcase cover in the pattern shown to the required torque value. Tighten in two stages, to a final torque value of 25 ft lb (34Nm).

Next, tighten the smaller bolts of the crankcase cover in the pattern shown to the required torque value. Tighten in two sta-



ges, to a final torque value of 18 ft lb (24Nm) for 50hp or 60hp powerheads, or 12 ft lb (17Nm) for 70hp, 75hp, 80hp, and 90hp powerheads, or 15 ft lb (20Nm) for 100hp and 110hp powerheads.

Finally, tighten the bolts securing the lower end cap to a torque value of 18 ft lb (24Nm) for 50hp or 60hp powerheads, or 150 in lb (16Nm) for 70hp, 75hp, 80hp, and 90hp powerheads, or 180 in lb (20Nm) for 100hp and 110hp powerheads.

70hp and Larger Powerheads

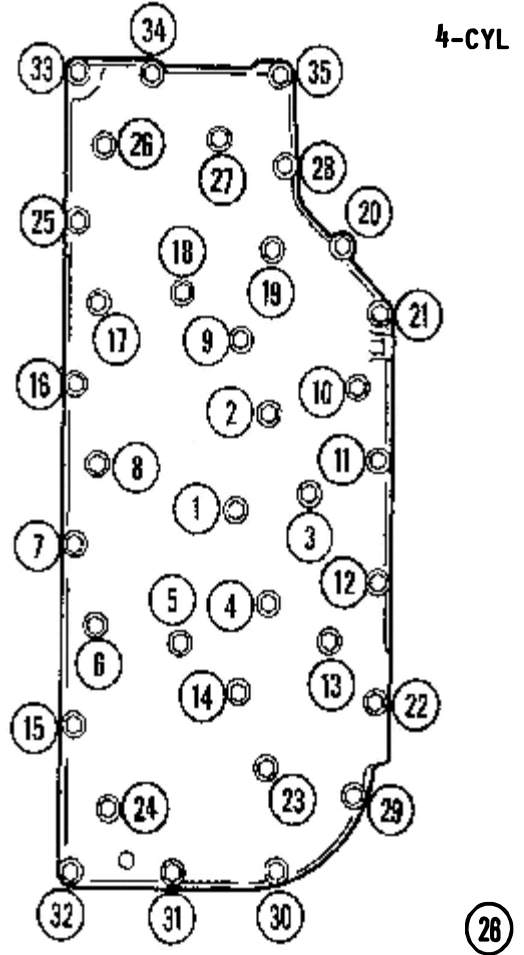
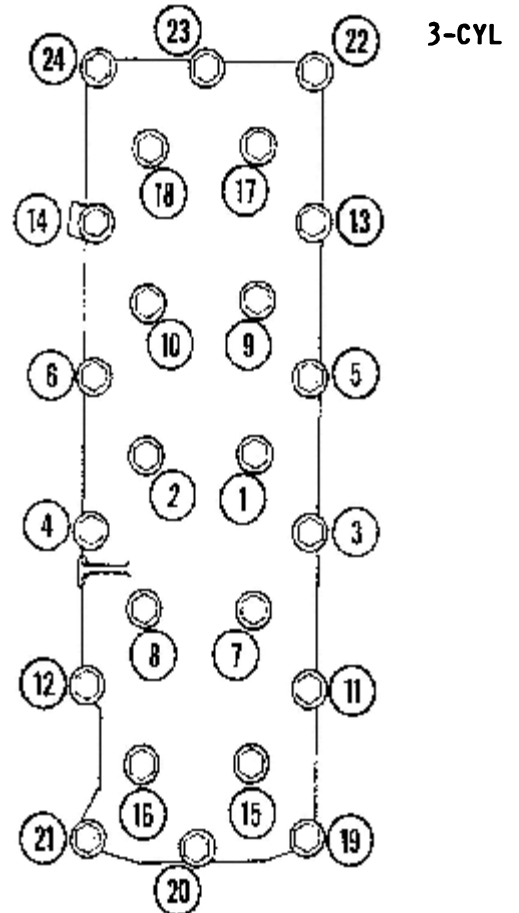
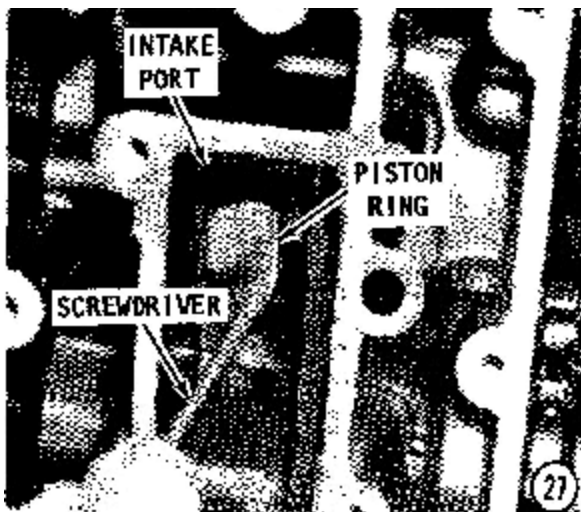
27- Check to be sure each piston ring has spring tension. This is accomplished by **CAREFULLY** pressing on each ring with a screwdriver extended through the intake ports. If spring tension cannot be felt (the spring fails to return to its original position) the ring was probably broken during the piston installation process. **TAKE CARE** not to "burr" the piston rings while checking for spring tension. Thread the flywheel nut onto the end of the crankshaft. Rotate the crankshaft several times with a wrench on the nut and check the installation work thus far. The crankshaft should turn freely with no indication of binding or "rough" spots.

Exhaust Cover Installation

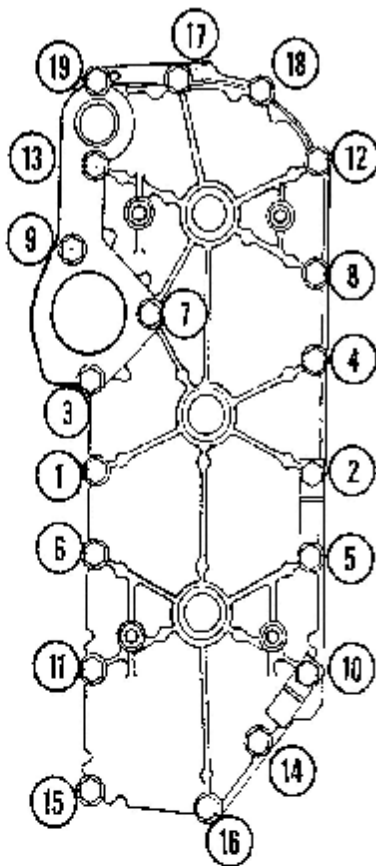
CRITICAL CAUTION

New gaskets must be used and must be properly installed to allow adequate water flow through the powerhead. If the water flow is restricted or blocked by a gasket improperly installed, the powerhead will be severely damaged in a matter of minutes after startup.

28- Position a **NEW** gasket on each side of the exhaust inner plate with the holes in



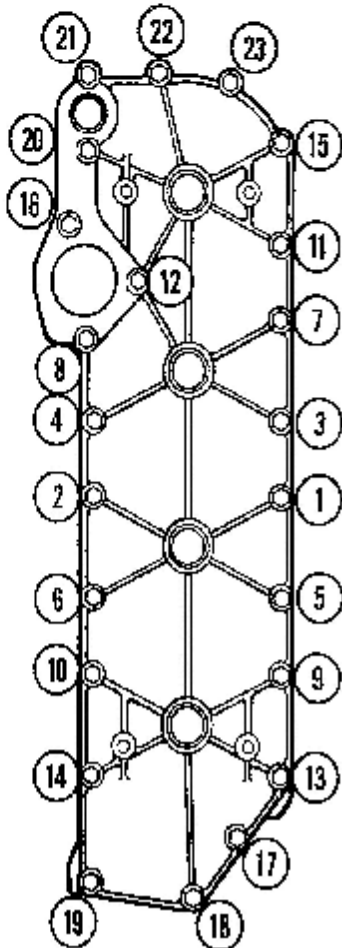
3-CYL



the gasket aligned with the holes in the inner plate. Install the plate and gaskets onto the cylinder block.

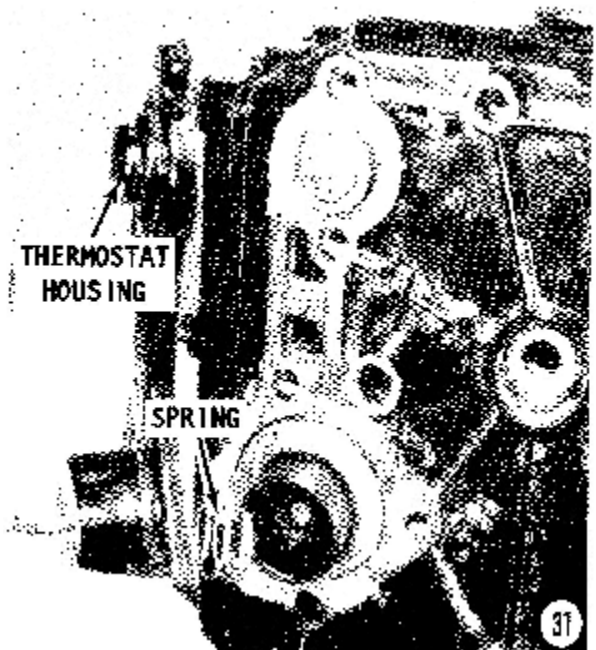
Install the exhaust manifold cover over the inner plate gasket and secure it in place with the attaching bolts. Tighten the bolts to a torque value of 165 in lb (17Nm) for 3-cylinder models or 180 in lb (20Nm) for 4-cylinder models. Follow the sequence pattern given in the accompanying illustration.

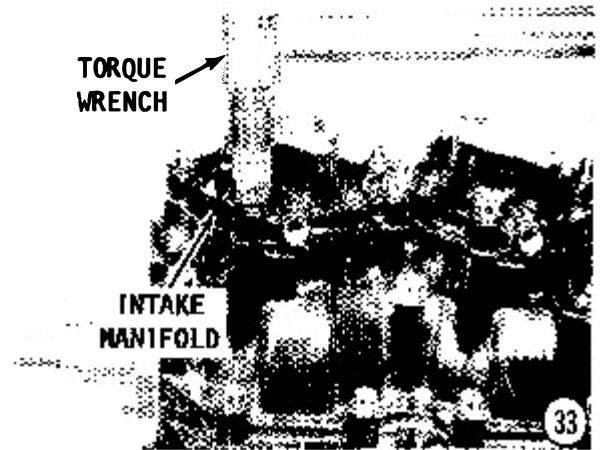
4-CYL



Cylinder Cover Installation

29- Position a new gasket over the water jacket. Install the cylinder cover and position the two retaining clips in the lo-





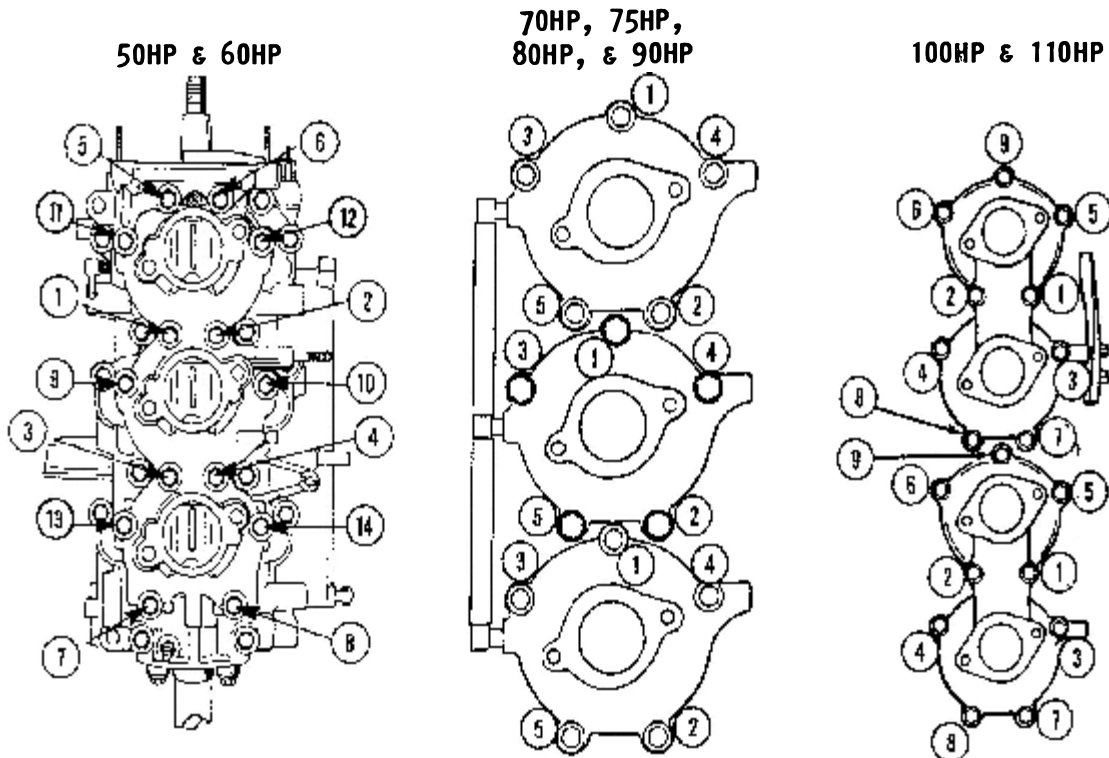
cations indicated in the accompanying illustration. Install and hand tighten the bolts. Tighten the bolts to a torque value of 165 in lb (17Nm) for 3-cylinder models or 180 in lb (20Nm) for 4-cylinder models in the sequence shown.

**All Models
Thermostat and Water Pressure
Relief Valve Installation**

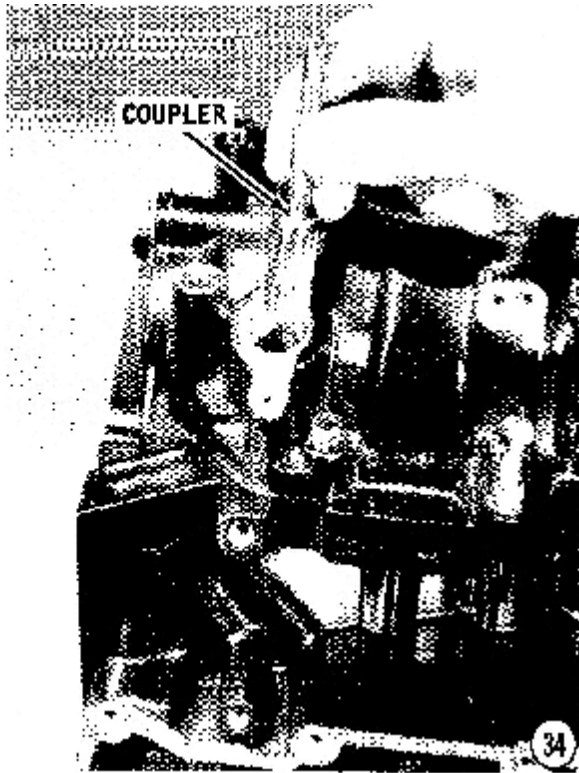
30- Install the water pressure relief valve into the recess in the block and secure it with the Phillips head screw. Install the thermostat into the block with the spring end going in first.

31- Install the spring over the water pressure relief valve, the rubber sealing ring around the thermostat, the larger thermostat gasket and the housing. Hold the housing down against the spring pressure, while installing and tightening the bolts.

Tighten the bolts to a torque value of 15 ft lb (20Nm).



Tightening sequence for the intake manifold bolts on 3- and 4-cylinder powerheads.



Reed Block Housing Installation

32- Position a new gasket on both sides of the reed housing. Place the intake manifold over the upper gasket. Check to be sure all bolt holes are aligned.

33- Install and tighten the securing bolts alternately and evenly to a torque value of 18 ft lb (24Nm) for 50hp or 60hp powerheads, or 150 in lb (16Nm) for 70hp, 75hp, 80hp, and 90hp powerheads, or 180 in lb (20Nm) for 100hp and 110hp powerheads.

Oil Pump Installation

34- Insert the oil pump shaft into the block with a **COUNTERCLOCKWISE** rotation to ensure the splines on the shaft index with the teeth of the oil pump gear on the crankshaft. The top of the shaft has a flat edge to mate with the coupler. If the plug and magnet were removed from the coupler, a directional compass is required for assembly. Identify the **SOUTH** end of the magnet. Apply a thin coating of Multi-purpose Lubricant to the magnet and the plug, to hold them in place during installation of the coupler. Now, insert the magnet into the coupler with the **SOUTH** end of the magnet going in first. Insert the plug into the opening with the flat side of the plug going in first to bear against the magnet.

Lower the coupler onto the oil pump shaft. When the coupler has mated with the shaft correctly, the coupler cannot be rotat-

ed. Place the O-ring over the coupler and index the shaft of the oil pump into the top recess of the coupler. Secure the oil pump to the block with the attaching hardware. Tighten the bolts to a torque value of 60 in lb (7Nm).

POWERHEAD INSTALLATION ALL MODELS

Install the trigger plate assembly in the upper end cap, and then insert the link rod swivel into the vertical throttle lever. Secure the link rod to the throttle lever. Apply a drop of Loctite Type "A" onto the threads of the stator attaching screws. Install the stator assembly in the upper end cap. Tighten the attaching Allen head screws to a torque value of 60 in lb (7Nm).

Insert the flywheel key in the crankshaft keyway. Check the inside rim of the flywheel to be sure metal particles are not stuck to the flywheel magnets. Check to be sure the inside taper of the flywheel and the taper on the crankshaft are clean of dirt or oil, to prevent the flywheel from "walking" on the crankshaft during operation. Slide the flywheel down the crankshaft with the keyway in the flywheel aligned with the key on the crankshaft. Rotate the flywheel **CLOCKWISE** and check to be sure the flywheel does not contact any component or any of the wiring. Slide a flat washer onto the crankshaft, and then thread the flywheel nut onto the crankshaft. Hold the flywheel with a flywheel strap and tighten the nut to a torque value of 120 ft lb (163Nm).

Thread a lifting eye onto the end of the crankshaft as far as it will go. For **SAFETY**, check to be sure the lifting eye is properly installed. Using a suitable hoist, lift the powerhead. Place a **NEW** gasket around the powerhead studs and into position on the base of the intermediate housing. Lubricate the driveshaft splines with Multi-purpose Lubricant. Slowly lower the powerhead down onto the intermediate housing. It may be necessary to rotate the flywheel slightly to index the crankshaft splines with the driveshaft splines. Once the splines index, lower the powerhead fully into place on the intermediate housing.

**50hp and 60hp Powerheads
Installation and Build-up**

Secure the powerhead to the intermediate housing with the six bolts. Tighten the bolts in three stages to a torque value of 28 ft lb (38Nm).

Install the lower cover around the intermediate housing and secure the cover in place with the four bolts. Tighten the bolts to a torque value of 80 in lb (9Nm).

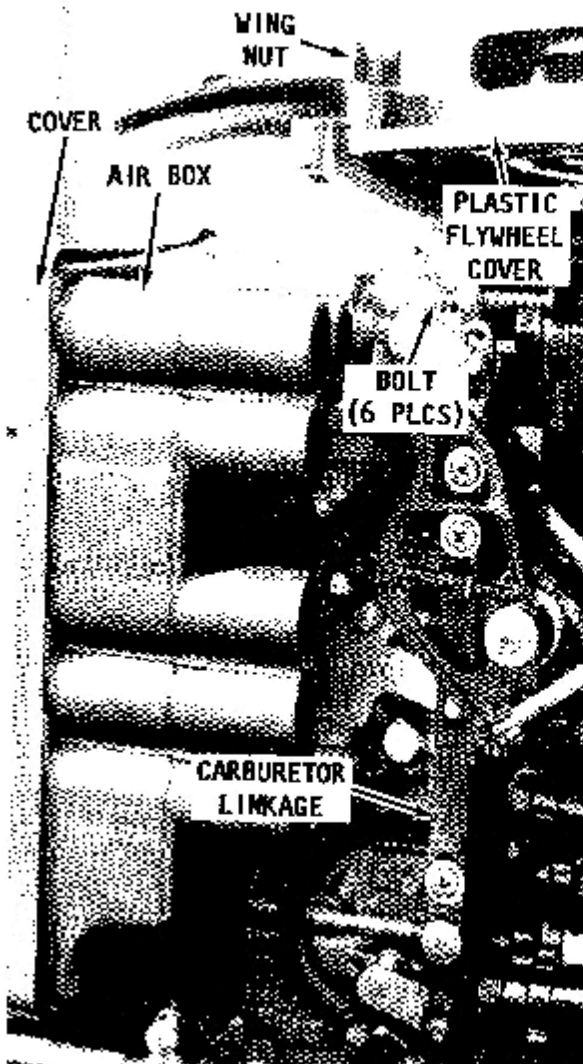
Disconnect the hoist from the lifting eye, and then remove the eye from the crankshaft. Install the plastic cap onto the end of the crankshaft. Install the flywheel cover and secure it in place with flat washers and wingnuts.

Install the throttle lever to the block with the flat washer between the lever and the block. Secure the lever with the 17mm nut. The manufacturer does not give a torque value for this nut, but states "the nut

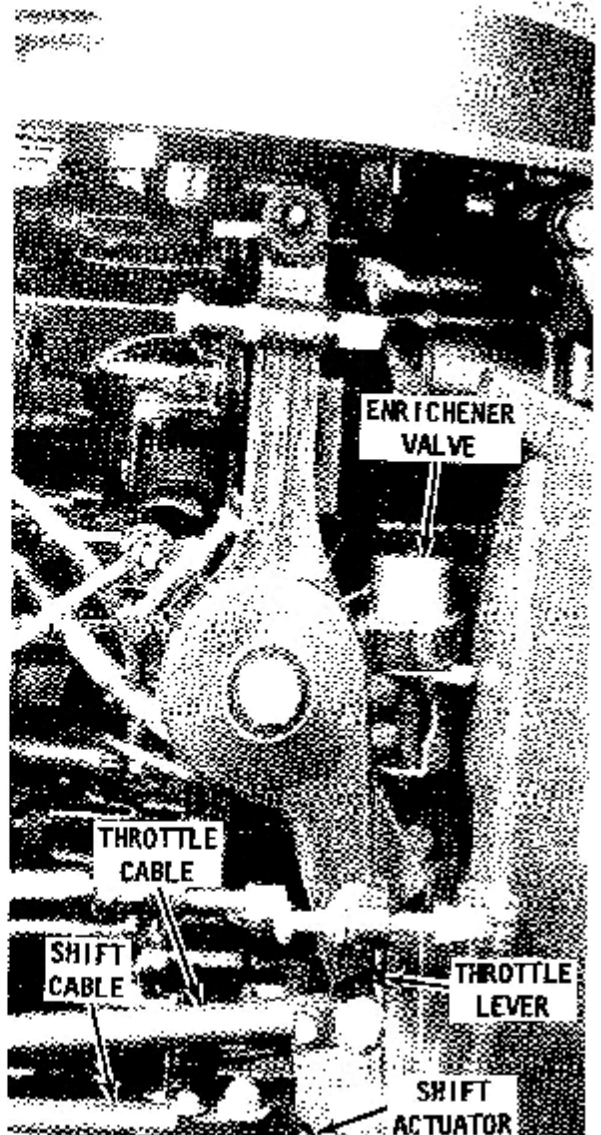
must be tight, but the joint must still be free to pivot".

Slide the control cable barrels into the receptacles cast into the side of the block. Attach the throttle cable to the shift lever, and then attach the shift cable to the stud on the shift actuator. Tighten both nuts securely. Swing the barrel retainer over the barrels. Install the lower bolt. Tighten both mounting bolts securely.

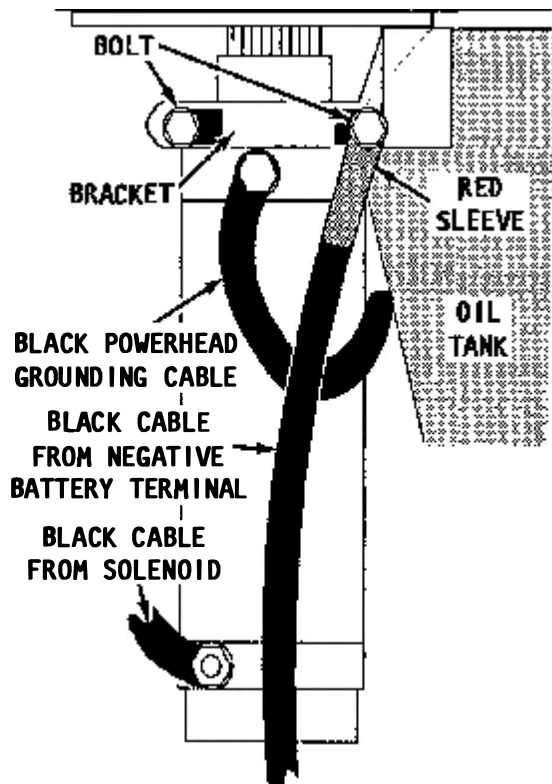
Position a **NEW** gasket against the port area on the back of the fuel pump. Install the pump against the block with the two securing screws. Tighten the screws to a torque value of 40 in lb (4.5Nm). Connect the fuel outlet line to the upper fitting. Connect the pulse line from the crankcase to the fitting on the front face of the pump. Finally, connect the inlet fuel line, with the 2 psi check valve attached, to the lower



The three carburetors, air box with cover, linkage and fuel lines are installed onto the powerhead as an assembly.



Fuel system and control cable components on the portside of a 60hp powerhead.



Identification of the three Black cables connected to the cranking motor on a 50hp or 60hp powerhead since 1991. One of the bracket securing bolts also secures the oil tank to the powerhead.

fitting. Install the three lines to the fuel pump using **NEW** tie wraps.

Install **NEW** large and small **O**-rings over the oil pump. Index the oil pump over the drive shaft in the block. Secure the pump to the block with the two Philips head screws. Tighten the screws to a torque value of 45 in lb (5Nm). Connect the oil outlet line between the horizontal fitting on the pump and 2 psi check valve next to the fuel pump. Connect the oil supply line between the tank and the vertical fitting on the pump. Secure both lines with **NEW** tie wraps.

Position new carburetor gaskets onto the carburetor mounting flanges of the reed block housing. Secure the carburetors, as an assembly, to the intake manifold using the six long bolts. Tighten the bolts to a torque value of 100 in lb (11Nm). Install the enrichment valve onto the portside of the block and connect the shorter line from the valve to the fitting on the top carburetor bowl. Connect the longer line from the valve to the fitting at the oil pump base.

Install the air box and cover over the carburetors.

Connect the Blue/White, Green/White, and Red/Black leads at the trim switch

located on the side of the lower powerhead cover.

Install the electrical box to the powerhead with the securing hardware. Install the low oil warning module to the inside of the lower powerhead cover, securing the Black ground eyelet lead under one of the mounting bolts. Connect the Tan, Purple, and two Light Blue leads at their quick disconnect fittings inside the electrical box. Connect the main wiring harness connector. Connect the White/Black, Purple, Brown, and White leads between the stator and trigger harness and the components inside the electrical box, at their quick disconnect fittings. Refer to the wiring diagram in the Appendix to make certain the connections are made correctly. Install the cover over the electrical box, make sure the cover fits into the groove in the lower powerhead cover. Install and tighten the six bolts securing the cover to the box.

Install the cranking motor to the powerhead. Install the oil tank and align the mounting bolt with the hole on the right side of the cranking motor. Position the bracket across the motor and tank. Place the Black cable, with the Red sleeve, -- from the negative battery terminal -- over the right hole. Install and tighten the two bolts securely.

Connect the Black cable from the solenoid to the lower terminal on the cranking motor and the Black powerhead grounding cable to the upper terminal on the motor.

Connect the two Light Blue leads from the oil sensor at the base of the oil tank, to the Light Blue leads from the low oil warning module harness, at their quick disconnect fittings.

Install the spark plugs and spark plug leads. Connect the battery cables to the battery. Notice both cables are Black. The Black cable with the Red sleeve is the positive cable. The Black cable with no sleeve is the negative battery cable.

70hp and Larger Powerheads Installation and Build-up

Secure the powerhead to the intermediate housing with the eight flat washers and locknuts. Tighten the locknuts in three stages to the following torque value: 165 ft lb (19Nm) for 70hp, 75hp, 80hp, and 90hp powerheads or 350 ft lb (40Nm) for 100hp and 110hp powerheads.

Disconnect the hoist from the lifting eye, and then remove the eye from the crankshaft. Install the plastic cap onto the end of the crankshaft. Install the flywheel cover and secure it in place with flat washers and wingnuts.

Install the throttle lever to the reed housing, with the flat washer between the lever and the housing. Secure the lever with the 17mm nut. The manufacturer does not give a torque value for this nut, but states "the nut must be tight, but the joint must still be free to pivot".

Attach the ignition plate, with the electrical components, to the starboard side of the powerhead with the four bolts and flat washers. Check to be sure the ground wires are properly installed, and then tighten the bolts securely.

Connect the stator wires and trigger wires to the proper terminals of the switch boxes.

Push the temperature sender into the sealing grommet under the thermostat housing. Secure the sender retainer with a single Phillips head screw. Connect the Black lead to the terminal block.

Connect the Purple and Light Blue leads at their quick disconnect fittings. Connect the Tan and Black leads from the oil level warning horn to the terminal block on the ignition plate.

Install the oil level warning module, if so equipped, under the ignition plate. Tighten the two securing bolts to a torque value of 80 in lb (4.5Nm).

Install the shift bracket to the powerhead. Tighten the two bolts to a torque value of 180 in lb (20Nm).

Attach the shift arm to the under side of the shift bracket. Connect the throttle cable to the throttle lever.

Install the cranking motor to the powerhead. Tighten the four attaching bolts to a torque value of 165 ft lb (18.6Nm) for 3-cylinder powerheads or 180 ft lb (20Nm) for 4-cylinder powerheads.

Position new carburetor gaskets onto the carburetor mounting flanges of the reed block housing. Install the carburetors, and then the air box onto the powerhead as an assembly. Secure the assembly with locknuts to the intake manifold. Tighten the nuts to a torque value of 100 in lb (11Nm). Install the fuel filter and connect the inlet fuel hose to the top carburetor. Connect the fuel hose from the enrichener valve to

the "T" fitting between carburetor No. 1 and carburetor No. 2.

On 4-cylinder powerheads: Install the accelerator pump to the block and tighten the attaching bolts securely. Connect the inlet hose to the forward fitting on the pump and route the aft hose to the "T" fitting on the starboard side of the powerhead to supply fuel to the check valves on the No. 3 and No. 4 cylinders. Connect the fuel inlet hose from the accelerator pump to the "T" fitting between carburetors No. 2 and No. 3. Connect the vapor return hose from the accelerator pump to the "T" fitting next to the fuel pump.

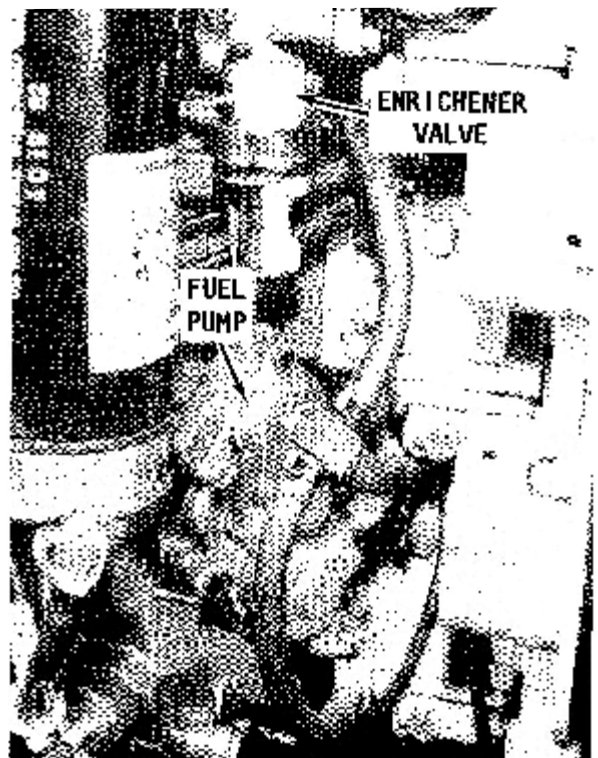
All models: Connect the bleed hose from the No. 1 cylinder fitting to the check valve located at the lower end cap.

Install the fuel pump gaskets and diaphragm. Assemble the fuel pump to the reed block housing. Secure the fuel pump assembly in place with the five screws tightened to a torque value of 40 in lb (4.5Nm).

Snap the oil control link rod onto the ball joint of the No. 2 carburetor throttle lever.

Connect the throttle control link rod between the throttle cam and the throttle lever.

Install the oil tank, first securing it to the powerhead with the bottom oil tank support bracket. Hold the tank to prevent it



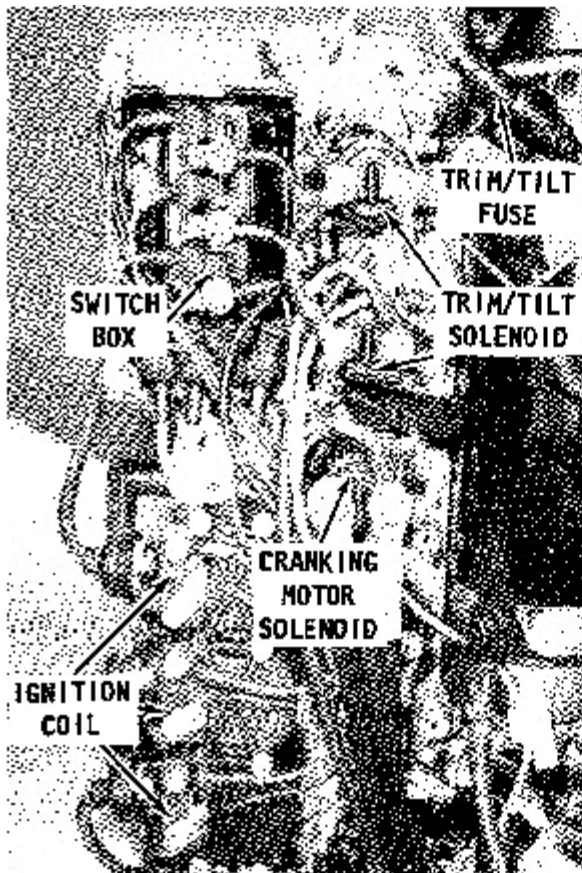
Location of the enrichener valve and fuel pump, showing hose routing.

from tipping over until the upper air box mount plate can be installed and secured. Install the mount plate with the attaching hardware and tighten the bolts to a torque value of 100 in lb (11Nm). Then install the upper tank support bracket across the filler cap. Connect the oil supply hose to the oil pump.

Install the air box cover and tighten the attaching screws securely. Install the fuel joint connector to the front lower cowling bracket with the single bolt. Secure the front cowl mount bracket to the air box mount plate. Tighten the two attaching bolts to a torque value of 150 in lb (17Nm).

Connect the large Red battery cable to the cranking motor solenoid. Connect the large Black battery cable to the lower front cranking motor mount bracket. Tighten this grounding bolt to a torque value of 180 in lb (20Nm). Connect the large Yellow cable from the solenoid to the cranking motor. Connect the two halves of the power trim fuse mounted on the cranking motor.

Check to see all connections to the terminal block on the ignition plate have been



Hopefully, wire leads were tagged prior to being disconnected. If not, refer to the wiring diagrams in the Appendix to make the correct connections on the ignition plate.

made. Refer to the diagram in the Appendix, if necessary, and then install the ignition plate cover. Secure the control box wiring harness to the side of the powerhead cowling mount bracket with the retaining strap and two Phillips head screws.

Install the aft cowling bracket and tighten the securing bolts to a torque value of 150 in lb (17Nm). Attach the tattle-tale hose to the aft cowling support bracket.

Install and tighten the spark plugs to a torque value of 20 ft lb (27Nm).

Connect the ignition coil high tension leads to their respective spark plugs. Connect the remote control cables to the powerhead. Connect the engine battery cables to the battery terminals. Check to be sure the system polarity is maintained.

Connect the powerhead and fuel tank lines.

For complete detailed timing and synchronizing procedures, see Chapter 6.

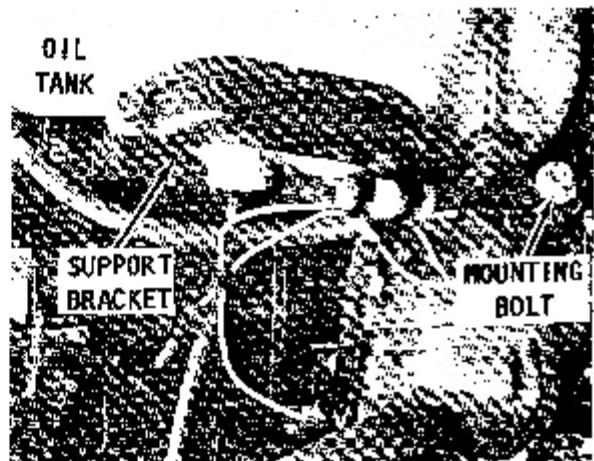
Mount the outboard unit in a test tank or on a boat in a body of water. Turn the fuel shut off valve to the ON position. Start the powerhead and follow the break in procedures given after the Caution.

CAUTION

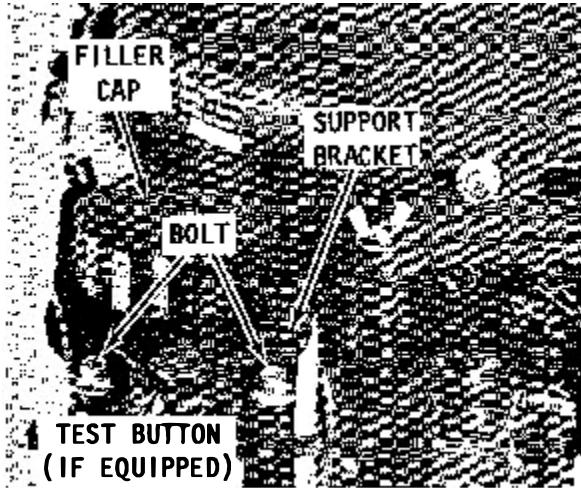
Water must circulate through the lower unit to the powerhead anytime the powerhead is operating to prevent damage to the water pump in the lower unit. Just five seconds without water will damage the water pump impeller.

Break In Procedures

As soon as the powerhead starts, CHECK to be sure the water pump is operating. If



The oil tank is first secured to the powerhead with the lower support bracket. The tank must be supported while the upper bracket is installed.



Upper oil tank support bracket installation.

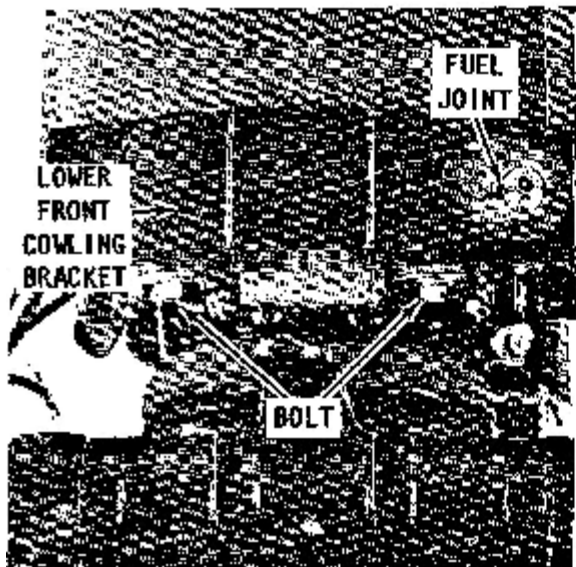
the water pump is operating, a water mist will be discharged from the exhaust relief holes at the rear of the intermediate housing.

Check the cylinder cover, the exhaust manifold cover, and the thermostat cover for water leaks. Make a thorough check for fuel and exhaust leaks. If a powerhead leak is detected, the problem area **MUST** be corrected before placing the engine in service.

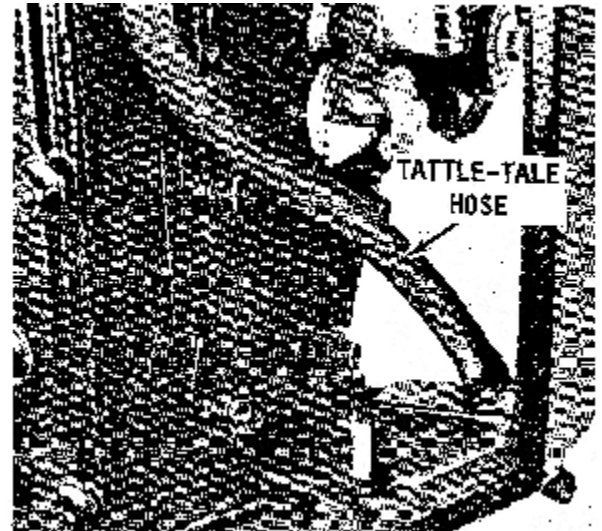
During the first 10 hours of operation, **DO NOT** operate the powerhead at full throttle (except for **VERY** short periods) as follows:

a- Operate at 1/2 throttle, approximately 2500 to 3500 rpm, for 2 hours.

b- Operate at any speed after 2 hours **BUT NOT** at sustained full throttle until another 8 hours of operation.



Installation of the lower front cowling bracket with the fuel joint installed.



The tattle-tale hose attached to the aft cowling support bracket.

c- Mix gasoline and oil during the break in period, total of 10 hours, at a ratio of 50:1 for **ALL** units including powerheads with oil injection.

d- While the engine is operating during the initial period, check the fuel, exhaust, and water systems for leaks.

e- Refer to Chapter 6 for synchronizing procedures.

After the test period, disconnect the fuel line. Remove the engine from the test tank. Install the engine cowling.



Make a final check of hoses, link rods, and electrical connections before starting up the powerhead.