

SECTION 5 - ENGINE MECHANICAL



**PART C - ROCKET (339cc)
LIGHTNING (398cc)**



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ROCKET (339cc) and LIGHTNING (398cc)

GENERAL

If major engine repairs are to be completed, remove engine from snowmobile. An engine repair bracket can be erected from angle iron, with holes and dimensions as shown in Figure 1. Install repair bracket as shown in Figure 2. Some metric tools are required, since all nuts, bolts and allen screws are metric.

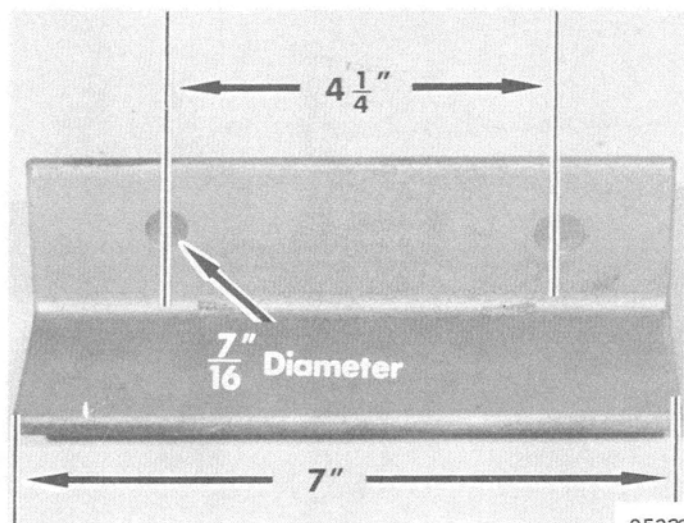


Figure 1. Engine Repair Bracket

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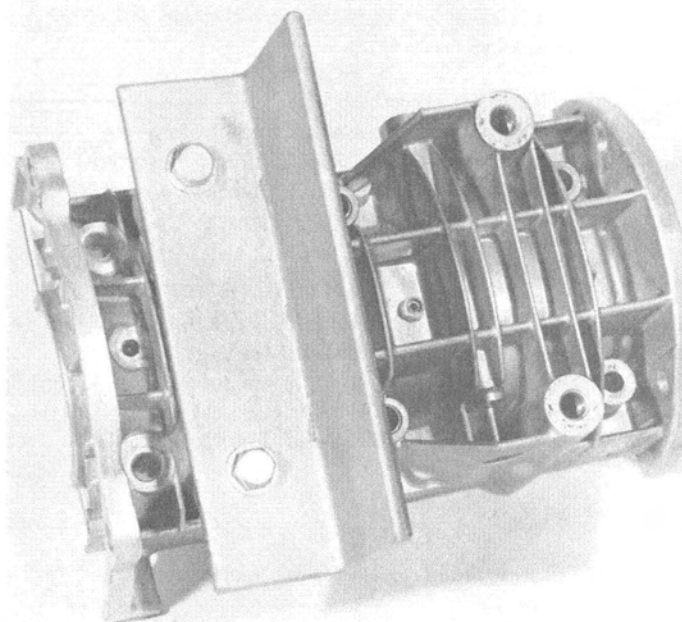


Figure 2. Engine Mounting Bracket Installed

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ENGINE COMPLETE REMOVAL

1. Open top cowl. Disconnect spark plug lead wires.
2. Remove battery leads and unplug wiring harness quick disconnect (if so equipped).
3. Remove handlebar and dash assembly.
4. Remove clutch shroud and drive belt.
5. Close fuel shut-off at tank and disconnect fuel line and primer hoses at carburetor.
6. Disconnect exhaust pipe.
7. Remove 4 flex-loc nuts from engine mounting carriage bolts and lift out engine.
8. Remove engine mounting plate.

INSTALLATION

1. Install engine mounting plate. Set engine on mounting rails and secure with 4 flex-loc nuts & carriage bolts.

NOTE: Engine location must be changed, if sprocket is replaced, since driven sheave location changes when jackshaft adjustment tightens drive chain. Install locating bolt in one end of mounting plate either in hole in front (stamped "11") or in rear (stamped

"13"), depending upon number of teeth in sprocket being used. (Figure 2A)

2. Connect exhaust pipe.
3. Connect fuel line and primer hoses. Open fuel shut-off.
4. Install drive belt and clutch shroud.
5. Install dash assembly and handlebar.
6. Plug in wiring harness quick-disconnect and connect battery leads.
7. Connect spark plug lead wires. Close top cowl.

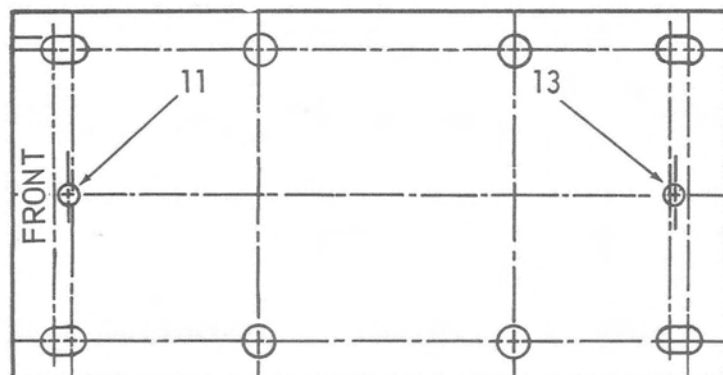


Figure 2A.

Engine Mounting Plate

CYLINDER HEAD

REMOVAL

1. Remove spark plug lead wires, spark plugs and engine shroud.
2. Remove cylinder head attaching nuts and lift head from cylinder studs.

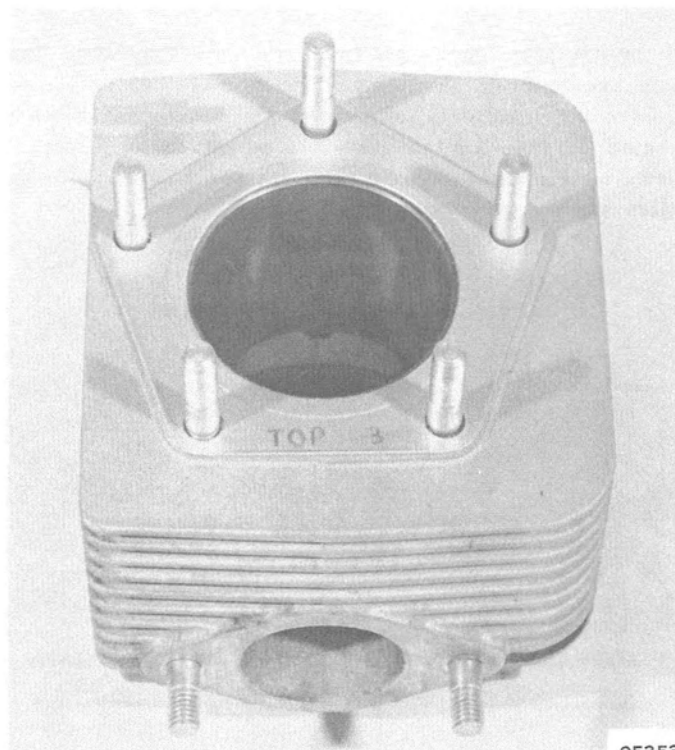
NOTE: Mark location of special engine shroud and upper steering support retaining nuts. Steering support nuts have a grooved end which receives support bolts. DO NOT invert nuts, since one end has a metric thread and other end employs SAE standard.

CLEANING and INSPECTION

1. Clean gasket sealing surfaces. Check for deep grooves which could cause compression leakage.
2. Check spark plug hole for stripped threads. If stripped, use Heli-Coil Insert Tool Set (C-91-24133A4) to re-new threads. For best results use Insert C-91-45831 from kit.

INSTALLATION

1. Install a new head gasket with marking "Top" facing up. (Figure 1)
2. Set cylinder head on studs and secure with attaching nuts and washers.
3. Torque nuts to specifications.
4. Install engine shroud, spark plugs and spark plug lead wires.



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Figure 1. Head Gasket Installation

CYLINDER

REMOVAL

1. Remove spark plug lead wires, spark plugs and engine shroud.
2. Remove intake and exhaust manifolds.
3. Remove attaching nuts from bottom of cylinder.

NOTE: A box end wrench can be ground thinner to permit easier access to cylinder base nuts.

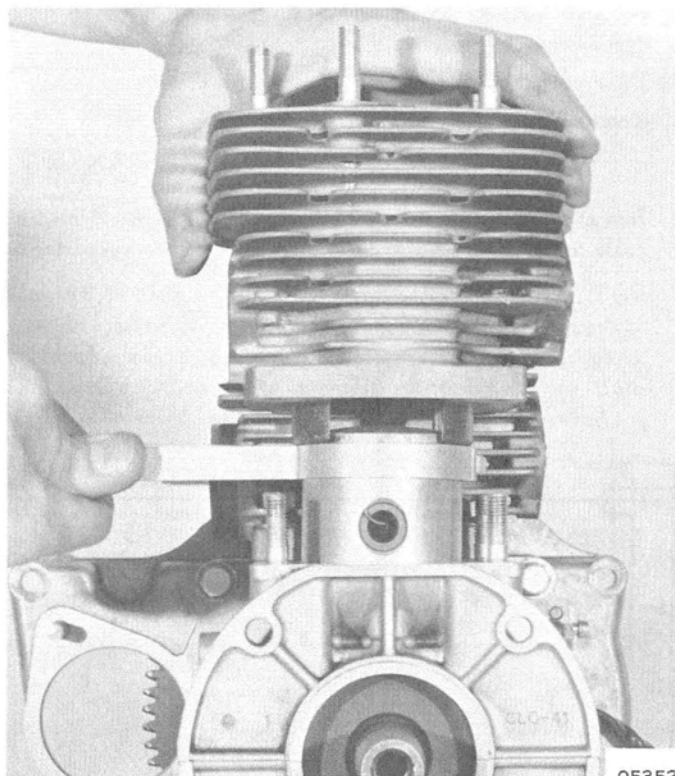
4. Lift cylinder off crankcase studs.

CLEANING and INSPECTION

1. Clean gasket surfaces.
2. If sleeve damage is evident, see cylinder sleeve repairs, following.

INSTALLATION

1. Lubricate cylinder sleeves and pistons with clean oil.
2. Place new cylinder base gaskets on crankcase.
3. Compress piston rings with C-91-54072 tool.
4. Be sure that cylinder being installed is on correct side and insert piston assembly into cylinder. (Figure 2)
5. Secure cylinder to crankcase with attaching nuts and lockwashers.
6. Torque attaching nuts to specifications.
7. Rotate crankshaft until piston rings can be viewed thru exhaust port. Depress ring with small punch (it will not "spring back" if broken).



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Figure 2. Piston Ring Compressor

CYLINDER SLEEVE REPAIRS

Repairs to cylinder sleeve depend upon amount of wear present. If inspection revealed that cylinder sleeve was slightly worn, honing may clean up the cylinder. If not, cylinder should be bored oversize to resurface the sleeve.

HONING

1. Follow recommendations of the hone manufacturer for correct usage of hone and proper cleaning and lubrication during honing. (Figure 3)

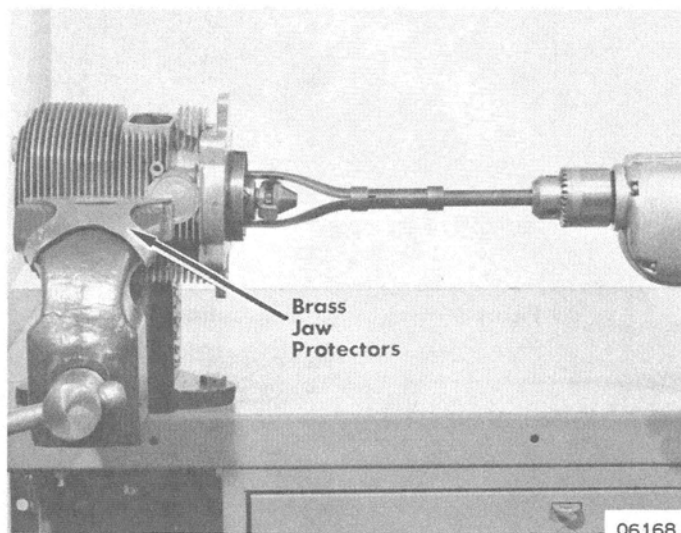


Figure 3. Honing Cylinder

2. Occasionally, during honing operation, cylinder bore should be cleaned thoroughly and piston (selected for the individual cylinder) checked for correct fit per specified clearance.
3. When finish-honing a cylinder bore, hone should be moved up-and-down at a sufficient speed to obtain very fine uniform surface finish marks in a cross-hatch pattern of approximately 45°-to-65° included angle. Finish marks should be clean but not sharp, free from inbedded particles and torn or folded metal.
4. Thoroughly clean cylinder bores with hot water and detergent. Scrub well with a stiff bristle brush and rinse thoroughly with hot water. It is absolutely es-

sential that a good cleaning operation be performed. If any abrasive material is allowed to remain in cylinder bores, it will rapidly wear the new rings and cylinder bores in addition to bearings lubricated by the contaminated oil. The bores should be swabbed several times with light engine oil and a clean cloth, then wiped with a clean dry cloth. DO NOT clean cylinder with kerosene or gasoline.

INSPECTION

1. Hone cylinder to clean up any score marks or scuffs in cylinder bore.
2. Measure piston diameter with a micrometer at center of piston skirt.
3. Measure cylinder sleeve diameter with any inside micrometer at approximate center of sleeve. (Figure 4)
4. Subtract piston diameter from cylinder bore diameter to determine "Piston to Bore Clearance".
5. If clearance exceeds specifications after honing, replace parts or bore cylinder oversize.

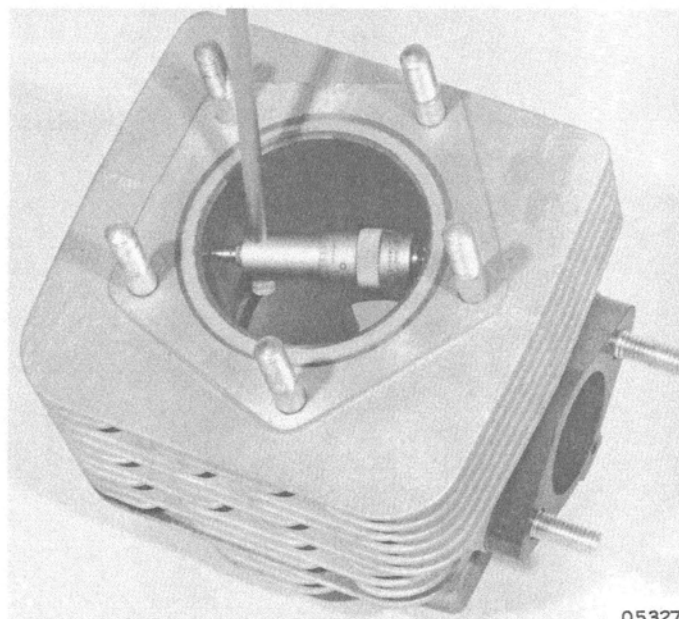


Figure 4. Measuring Cylinder

LIGHTNING (398cc) MODEL CYLINDER HEAD GASKET IDENTIFICATION

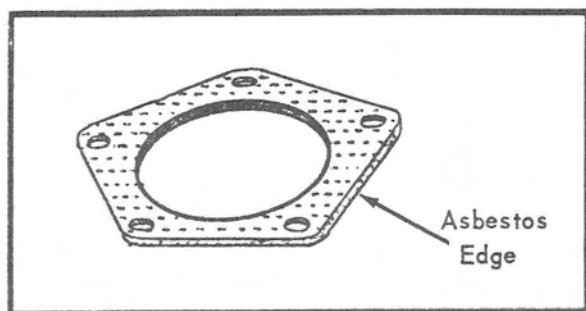


Figure 5. Asbestos Gasket

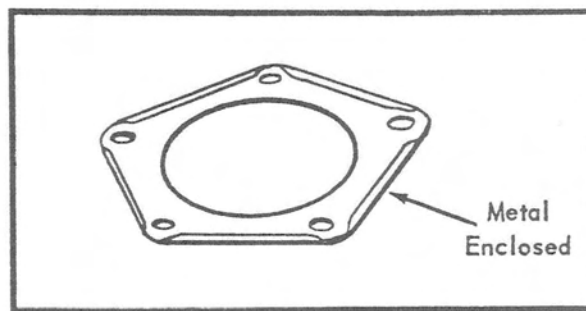


Figure 6. Metal Gasket

1. Asbestos cylinder head gasket (Figure 5) should be installed in all CCW engines with ENGINE Serial No. 2899999 and below.

2. Metal cylinder head gasket (Figure 6) should be installed in all CCW engines with ENGINE Serial No. 3800000 and above.

PISTON and RING ASSEMBLY

REMOVAL

1. Remove cylinder assembly.

NOTE: Place a clean rag around crankcase opening to prevent entrance of foreign objects.

2. Remove piston pin lock rings from piston. (Figure 7)

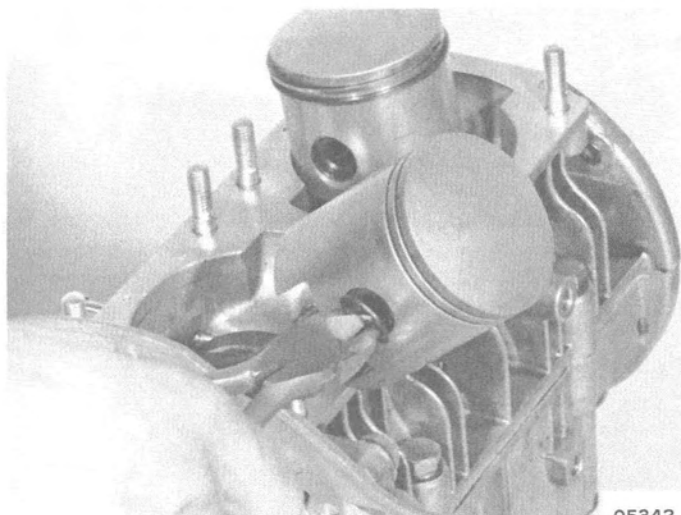


Figure 7. Piston Lock Rings

NOTE: Prior to removal of piston, scribe an arrow in dome of piston in direction of exhaust port of cylinder.

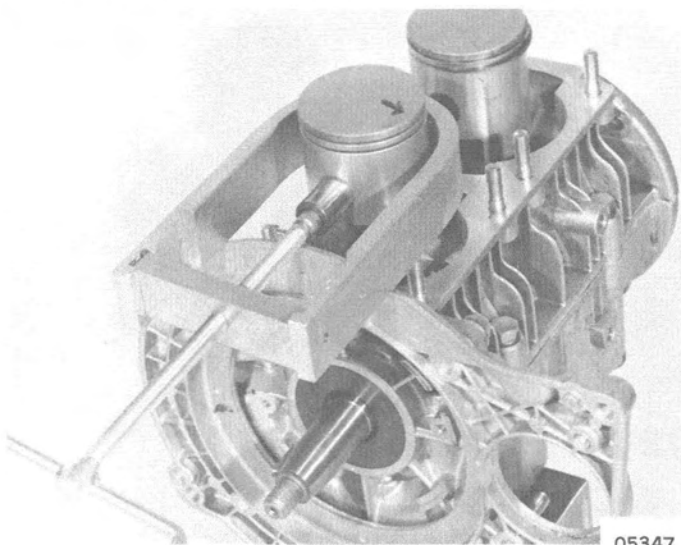


Figure 8. Piston Pin Removal/Installation

3. Use Tool C-91-31400A2 to remove piston pin. (Figure 8)
4. Remove piston rings with Tool C-91-24697. (Figure 9)

NOTE: Remove opposite cylinder prior to removal of either piston.

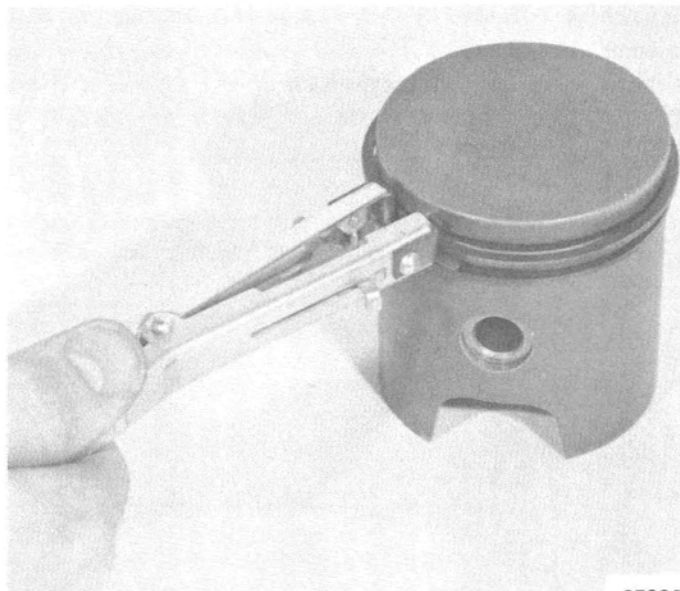


Figure 9. Piston Ring Replacement

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CLEANING and INSPECTION

1. Replace pistons if scoring or metal damage is present.
2. Inspect piston ring grooves for wear, burn and distortion. Pins (located in ring groove) prevent rings from rotating.
3. Before installing rings, clean grooves, using recessed end of a broken ring. Also clean carbon and varnish deposits from top sides of piston with soft wire brush or carbon remover solution. Do not burr or round machined edges.
4. Piston pins are not sold separately because of slight variation in sizes and correct "fit" to piston.

INSTALLATION

1. Insert piston pin bearing in connecting rod.
2. Position piston on connecting rod, with arrow in dome of piston toward exhaust port of cylinder. (Figure 8)
3. Install piston pin with Tool C-91-31400A2. (Figure 8)
4. Install new lock rings.
5. Install new piston rings.

NOTE: Chrome ring must be installed in top ring groove and other ring in bottom ring groove. Piston rings must be properly installed to locate below locating pins in ring grooves. Rings fit only one way and must not be forced during installation in cylinder.

6. Install cylinder assembly.

FAN BELT and FLYWHEEL HOUSING

REMOVAL

1. Remove rewind starter.
2. Remove fan belt.
 - a. Hold fan assembly.
 - b. Remove pulley attaching nut and slide off pulley half. Note position of spacers and washers for reinstallation.
 - c. Remove fan belt from flywheel pulley.
3. Remove harness connector from housing.
4. Remove attaching bolts and pull off flywheel housing.

CLEANING and INSPECTION

1. Check fan belt for cracks or wear. (See Owners Guide)
2. Check flywheel housing for cracks.

INSTALLATION

1. Transfer ignition coils, if flywheel housing is being replaced.
2. Position flywheel housing on backing plate and secure with attaching bolts.

3. Install harness connector on flywheel housing.
4. Install fan belt.
 - a. Position belt on flywheel pulley.
 - b. Route belt over fan shaft and secure with outer pulley half. Position washers and spacers the same as removal.

CAUTION: Be certain that fan belt is not pinched between pulley halves.

5. Check fan belt tension. When properly adjusted, fan belt will have a total deflection of about $\frac{1}{4}$ " at center of belt between pulleys. Tension may be adjusted by removing spacer(s), as required, from between top pulley halves.

NOTE: Retain spacers to use when new belt is installed.

6. Install rewind starter assembly.

FAN ASSEMBLY

REMOVAL

1. Remove fan attaching nut and remove pulley half. Note position of spacers and washers for reinstallation.
2. Drive out fan assembly with soft hammer. (Figure 1)
3. Replace snap ring, if removed, in flywheel housing between fan bearings.

CLEANING and INSPECTION

1. Clean and inspect all parts for damage.
2. Check fan bearings for roughness.

INSTALLATION

1. Insert fan assembly into flywheel housing.
2. Place bearings, spacers and washers as removed.
3. Install fan belt and secure with pulley half. Torque retaining nut to specifications.

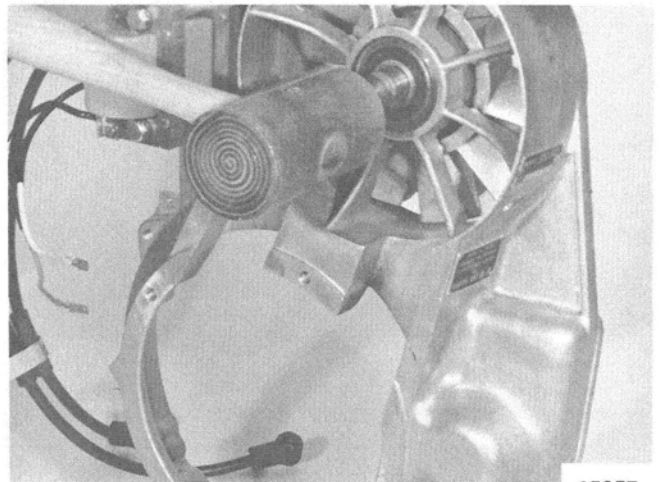


Figure 1. Fan Removal

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FLYWHEEL

REMOVAL

1. Remove flywheel housing.
2. Remove rewind starter ratchet and fan belt pulley.
3. Remove flywheel retaining nut, holding flywheel with Tool C-91-45246. (Figure 2)

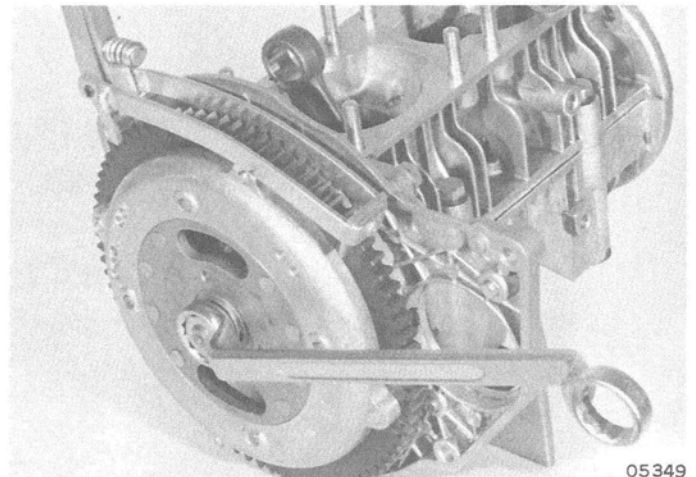


Figure 2. Flywheel Nut Removal

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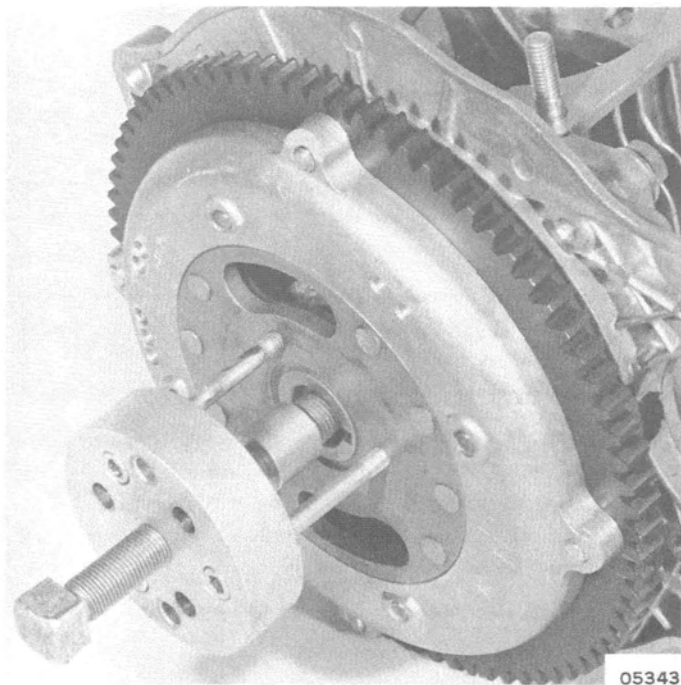


Figure 3. Flywheel Removal

4. Remove ignition point dust cover from flywheel.
5. Install Puller Tool C-91-24695 (use three 2½" x 6mm bolts C-10-58174) to attach puller to flywheel. (Figure 3)

6. Hold flywheel with Tool C-91-45246 and tighten center bolt of puller to 40 ft. lbs. maximum.
7. Using a wood block and hammer, tap each side of flywheel alternately (while maintaining torque on center bolt) until flywheel is free.

CAUTION: DO NOT hammer on end of puller center bolt to remove flywheel, or damage may result to crankshaft or bearings. DO NOT use heat to aid flywheel removal, as excessive heat may seize flywheel to crankshaft.

CLEANING and INSPECTION

1. Check ring gear of flywheel for chipped or broken teeth.
2. Automatic spark advance inside flywheel may be checked in "Spark Advance", following.
3. Replace all damaged parts.

INSTALLATION

1. Place key in crank shaft keyway.
2. Align flywheel keyway and crankshaft key and install flywheel. Secure with attaching nut and lockwasher.
3. Torque nut to specifications.
4. Install ignition point dust cover, fan belt pulley and starter ratchet.
5. Install flywheel housing.

CRANKSHAFT

GENERAL

The crankshaft is sold as a complete assembly with connecting rods, center main seals and bearings. The components included in the crankshaft assembly can not be purchased separately. If a crankshaft component fails, the entire crankshaft assembly must be replaced.

REMOVAL

1. Remove cylinders and clutch assembly.
2. Remove flywheel.
3. Remove starter housing.
4. Remove stator and wiring harness.
5. Remove 10 crankcase attaching bolts.
6. Pry crankcase apart. Be careful not to damage crankcase sealing surfaces.

NOTE: Locating dowels align crankcase halves.

7. Remove crankshaft from crankcase half. It may be necessary to pry crankshaft out to overcome resistance of seals.

INSTALLATION

1. Be sure that mating surfaces of crankcase halves are clean and free of foreign material.
2. Place bearing retainers in grooves of lower crankcase (smooth side toward bearing). (Figure 1)
3. Install crankshaft in lower half of crankcase. (Figure 2)
4. Install end seals.
5. Apply Sealer C-91-28804-1 to crankcase halves.
6. Place crankcase halves together and secure with attaching bolts. Be sure that correct length bolt for each hole is used, or crankcase breakage can occur.
7. Torque crankcase bolts to specifications.
8. Install cylinders and starter housing.
9. Install flywheel and clutch assembly.

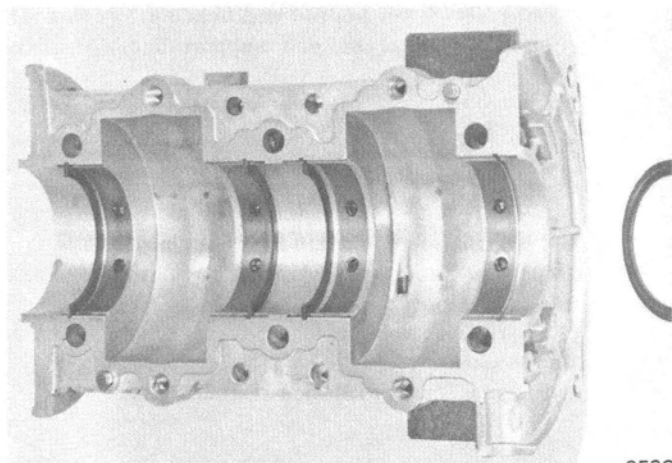


Figure 1. Bearing Retainer

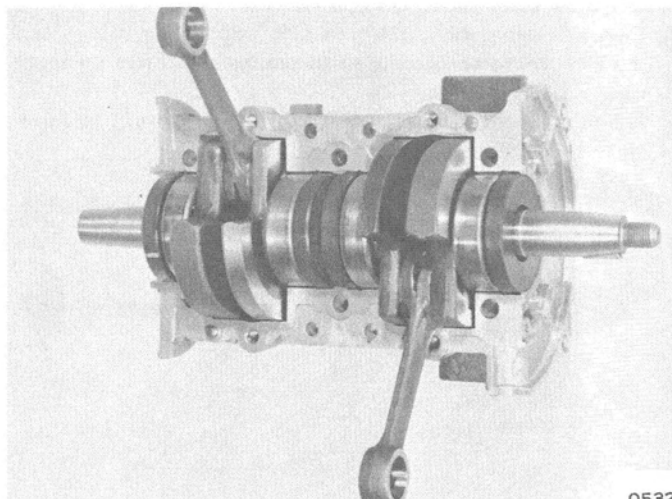


Figure 2. Crankshaft Installation

CRANKSHAFT END BEARINGS and SEALS

REMOVAL

1. Pull off seal.
2. Install Tool C-91-37241 behind end bearing. (Figure 3)
3. Place crankshaft in press and support under removal tool.
4. Press crankshaft out of bearing. **DO NOT DROP CRANKSHAFT.**

CLEANING and INSPECTION

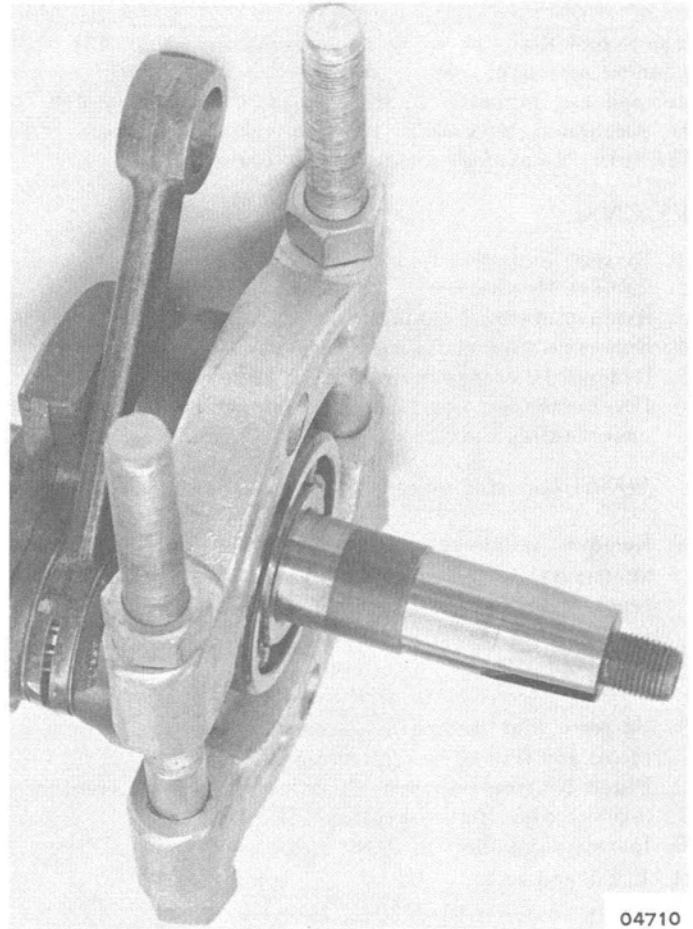
1. Clean and dry ball bearings before checking.
2. Move inner race in-and-out of outer race (there should not be excessive play).
3. Lubricate bearing and open outer race. Replace, if bearing sounds or feels "rough".
4. Check seal for wear and replace if necessary.

INSTALLATION

1. Support crankshaft directly under crankshaft counterweight of end bearing being replaced.
2. Install bearing with "lettered side" up, using tubing as a mandrel to press bearing onto crankshaft. Press on inner race of bearing only.
3. Install seal on crankshaft with lip facing toward counterweights of crankshaft.

NOTE: New oil seals will work on either end of crankshaft.

Figure 3. Bearing Removal



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