

## SECTION 5 - ENGINE MECHANICAL

***MERCURY***  
**SNOWMOBILES**

**PART H - 340 S/T and 440 S/T**



A BRUNSWICK COMPANY

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A PRUNCE CORP. COMPANY



# 340 S/T and 440 S/T

## GENERAL

Engine "Disassembly" and "Reassembly" instructions are printed in a sequence that should be followed to assure best results when removing or replacing engine components. If complete disassembly is not necessary, start reassembly at point disassembly was stopped. (Refer to "Index", preceding.)

If major engine repairs are to be performed, remove engine from snowmobile. It is not necessary to remove engine for minor repairs on components, such as cylinder heads, cylinders, pistons, flywheel, stator, trigger, flywheel bell housing and outer crankshaft oil seals.

An engine repair bracket can be fabricated from angle iron with holes and dimensions as shown in Figure 1. Install repair bracket to mounting plate holes of bottom crankcase half. Clamp repair bracket and engine in a vise or suitable holding fixture.

**IMPORTANT:** Refer to "Specifications" Section 8 for all torque values.

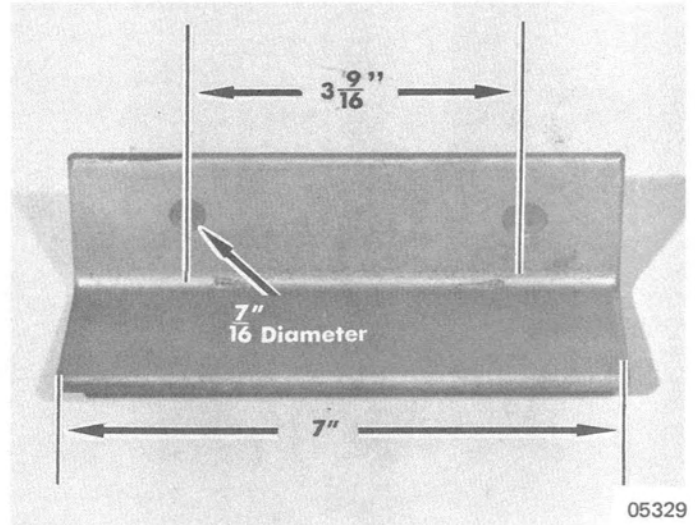


Figure 1. Engine Repair Bracket

## ENGINE REMOVAL

1. Remove top cowl assembly from snowmobile.
2. Remove carburetor air intake from carburetors.
3. Close fuel shut-off valve on fuel tank. Remove carburetor fuel hoses from fuel pump. Disconnect fuel pump pulse hose from crankcase.
4. Disconnect engine harness from chassis harness by separating 3-wire connector. Remove 2 black ground wires from rewind attaching bolt.
5. Remove drive belt guard and variable speed drive belt.
6. Remove exhaust pipes. (Refer to Section 7, Part B, "Exhaust Systems".)
7. Remove rewind rope from rope guide which is attached to chaincase.

**IMPORTANT:** For ease of removal, flywheel should be removed at this time, if repairs being performed will require removal of flywheel. If flywheel removal is not necessary, refer to "Step 9", following, and remove engine.

### Flywheel Removal

8. If flywheel removal will be necessary, remove flywheel as outlined, following:
  - a. Remove rewind starter assembly from flywheel bell housing.
  - b. Remove starter cup and flywheel sheave plate from flywheel.
  - c. Straighten tab on flywheel nut tab washer.

**NOTE:** For ease of removal, an air or electric impact wrench may be used to remove flywheel nut.

**WARNING:** If an impact wrench is used, DO NOT use belt wrench to keep crankshaft from turning. If necessary, hold drive sheave by hand.

- d. Prevent engine crankshaft from rotating by holding drive sheave with Belt Wrench (C-91-24937A1). (Figure 2) Remove flywheel nut and tab washer.

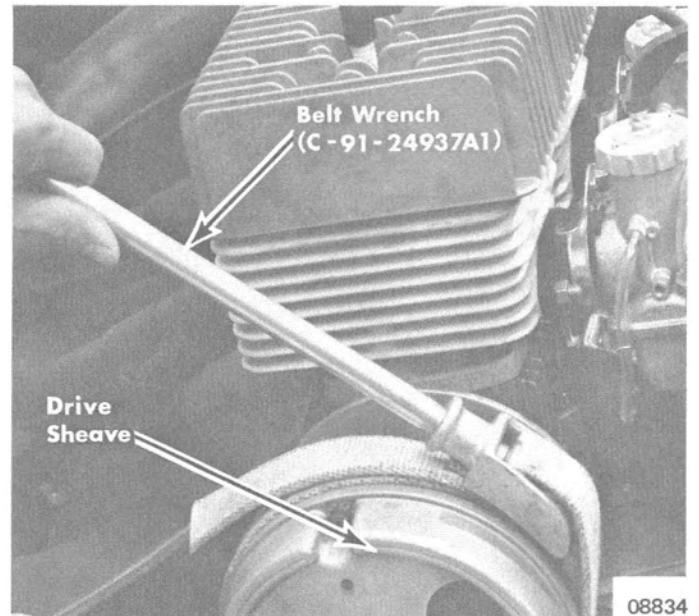
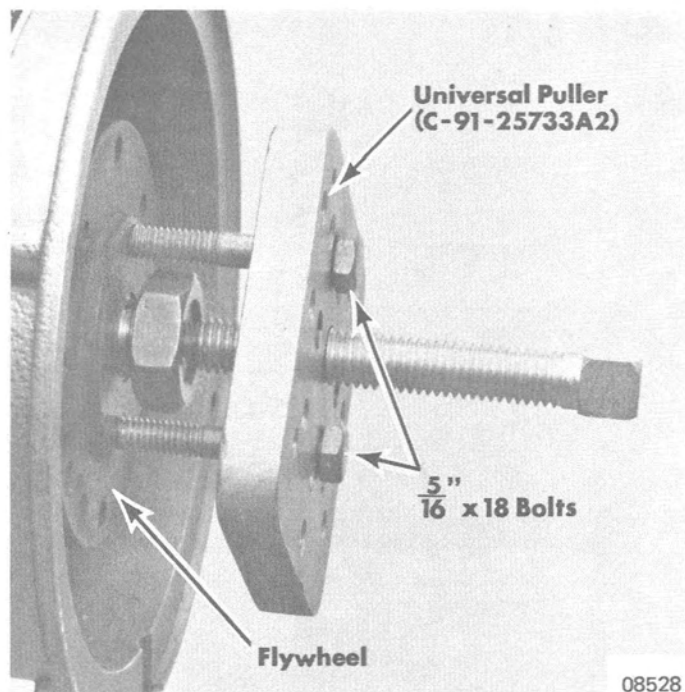


Figure 2. Holding Crankshaft

- e. Install modified (refer to template, Section 9) Universal Puller (C-91-25733A2) on flywheel. (Figure 3) Use crankshaft protector or reinstall flywheel nut to protect crankshaft from damage.

**CAUTION:** Crankshaft damage may result if a protector cap is not used between crankshaft and puller.



**Figure 3. Flywheel Removal**

- f. Prevent engine crankshaft from rotating by holding drive sheave with belt wrench. Tighten center bolt of puller to 50 ft. lbs. (7mkg) maximum.

**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.**

- g. Using a hammer and hardwood block, tap each side of flywheel alternately (while maintaining torque on center bolt) until flywheel is free. Remove flywheel from crankshaft and puller from flywheel.
9. Refer to Section 2, Part C, and remove drive sheave from crankshaft taper.
10. Remove throttle cable from carburetors by removing cover from top of each carburetor and pull throttle valve assembly from each carburetor.

**IMPORTANT: Throttle valve assemblies MUST BE kept clean and protected.**

11. Remove locknuts and washers which secure engine mounting plate to engine mounts.
12. Lift engine from snowmobile.
13. Remove engine mounting plate from crankcase and install engine in suitable holding fixture.



# ENGINE DISASSEMBLY

## Cylinder Heads and Cylinders

### REMOVAL

1. Disconnect high tension wires from spark plugs.
2. Remove spark plugs from cylinder heads.
3. Remove cylinder head attaching nuts, lockwashers and flat washers. Lift cylinder heads from cylinder studs.
4. Remove cylinder head gaskets from cylinders.
5. Remove carburetors from cylinders.
6. Scribe a mark on cylinders and exhaust headers to indicate which parts are for No. 1 cylinder (PTO side) and which parts are for No. 2 cylinder (rewind side).
7. Remove exhaust headers from cylinders. Exhaust headers are not the same and **MUST NOT** be interchanged during reassembly.
8. Remove nuts, lockwashers and wave washers from thru bolts which secure cylinders to crankcase. Remove thru bolts from crankcase.
9. Lift cylinders off crankcase and pistons. (Figure 1)

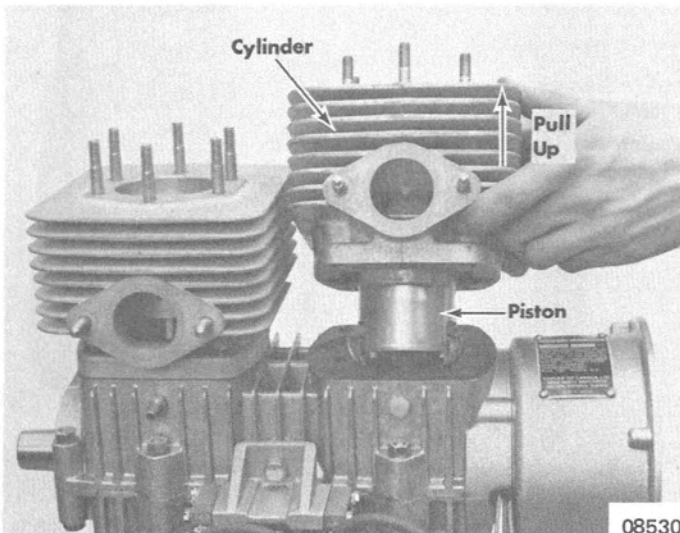


Figure 1. Removing Cylinder

### CLEANING and INSPECTION

1. Thoroughly clean cylinder heads, cylinder head gaskets and gasket surfaces. Remove carbon deposits and "varnish" from cylinder heads.

*NOTE: Cylinder head(s) should be replaced if badly damaged or if carbon deposits cannot be removed.*

2. Inspect cylinder heads and cylinder head gaskets. Check for broken cooling fins and deep grooves, cracks and distortion which could cause compression leakage.

*NOTE: One or 2 broken cooling fins will not affect engine cooling nor engine performance.*

3. Check spark plug holes for stripped or damaged threads.
4. Inspect internal surface of cylinder heads for possible damage as a result of pistons striking cylinder heads. (Figure 2)

*NOTE: Piston striking cylinder head could be an indication of a defective or improperly positioned cylinder head, connecting rod bearing(s) going "out", "stretched" con-*

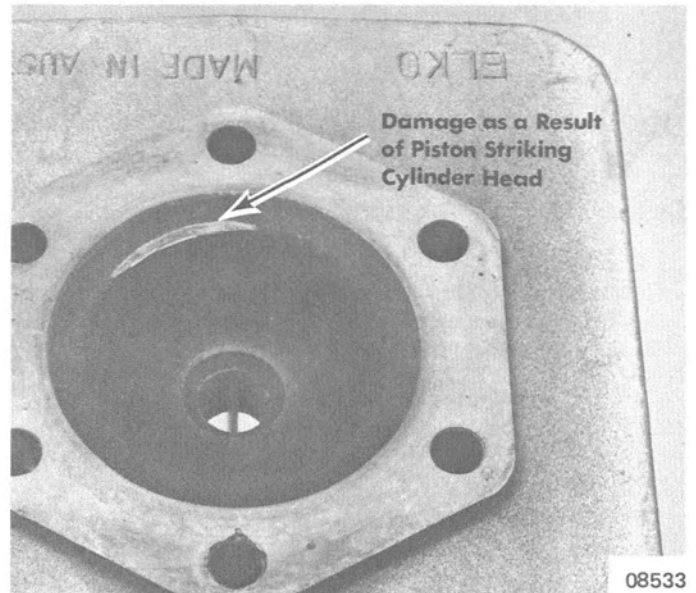


Figure 2. Damaged Cylinder Head

*necting rod and/or engine was assembled with improper cylinder gasket(s).*

5. Replace cylinder head(s) as necessary.
6. Thoroughly clean cylinders and gasket mating surfaces.
7. Check cylinder studs for stripped or damaged studs. Replace damaged studs and secure with Loctite Type A (C-92-32609).
8. Inspect threads in exhaust header bolt holes.
9. Check gasket surfaces for nicks, deep grooves, cracks and distortion which could cause compression leakage. Check cylinders for badly chipped or broken cooling fins.
10. Carefully inspect cylinder bores for signs of scoring, "flaking" (Figure 3) and grooves. If chrome surfacing is "flaking", grooved, scratched or worn thru, cylinder must be replaced.

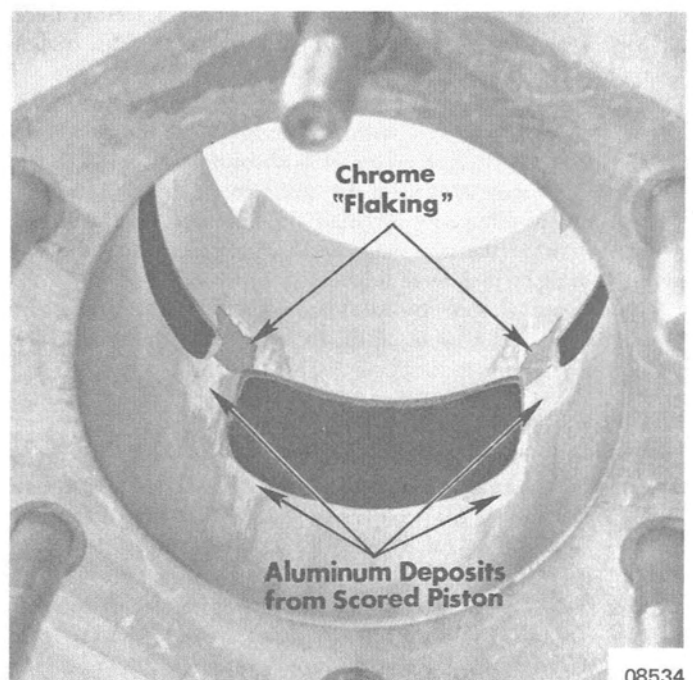


Figure 3. Chrome "Flaking"

**IMPORTANT:** Cylinder bores are surfaced with chrome. If chrome surfacing is "flaking" (Figure 3), grooved or damaged in any other manner, cylinder(s) must be replaced. If pistons have scored and transferred aluminum to cylinder bores, honing usually will "clean up" the cylinder bores.

11. Refer to "Cylinder Honing Procedure", following, and hone cylinder bores.

### Cylinder Honing Procedure

**IMPORTANT:** ALWAYS hone cylinder bores before installation. Honing of chrome cylinders is intended only as a method for removal of metal which has transferred from pistons and piston rings to cylinder bores.

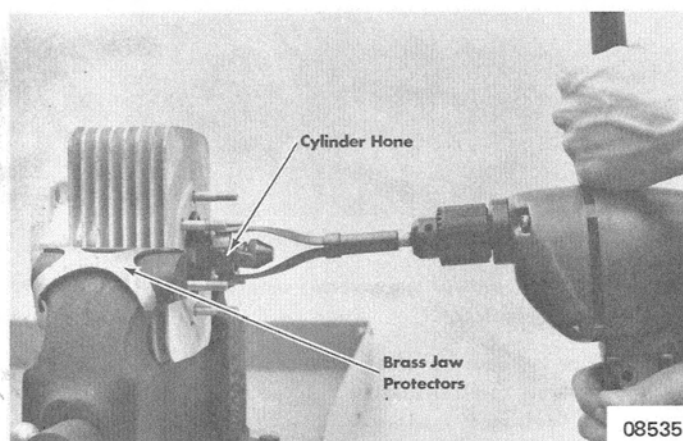


Figure 4. Honing Cylinder

1. Follow recommendations of the hone manufacturer for correct usage of hone and proper cleaning and lubrication during honing. (Figure 4)
2. Hone cylinder bore until aluminum deposits (a result of piston scoring) have been removed from cylinder wall.
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 crosshatch pattern of approximately 45° to 65° included angle. Cylinder bore MUST BE free from embedded particles and torn or folded metal after honing.
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 essential 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 which were 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.

### Fitting Cylinders to Pistons

Cylinders and pistons are a "select" fit (identified by a painted dot and a stamped letter). (Figures 5 and 6) Parts are identified by a "RED" (stamped "A"), "BLUE" (stamped "B") or "YELLOW" (stamped "C") painted dot. Color coding and lettering of pistons and cylinders indicates its size. "RED" denotes small parts, "BLUE" indicates medium parts [approximately .0005" (.013mm) larger than "RED" parts] and "YELLOW" denotes large parts (approximately .0005" larger than "BLUE" parts). A red piston should be used in a red cylinder, blue with blue and yellow with yellow.

If correct piston or cylinder is not available, parts may be substituted as outlined in "Cylinder and Piston Substitution Chart", following:

### CYLINDER and PISTON SUBSTITUTION CHART

Cylinder Code	Piston Code
"RED" (Stamped "A")	Use with "RED" (Stamped "A")
"BLUE" (Stamped "B")	Use with "RED" (Stamped "A") or "BLUE" (Stamped "B")
"YELLOW" (Stamped "C")	Use with "RED" (Stamped "A") or "BLUE" (Stamped "B") or "YELLOW" (Stamped "C")

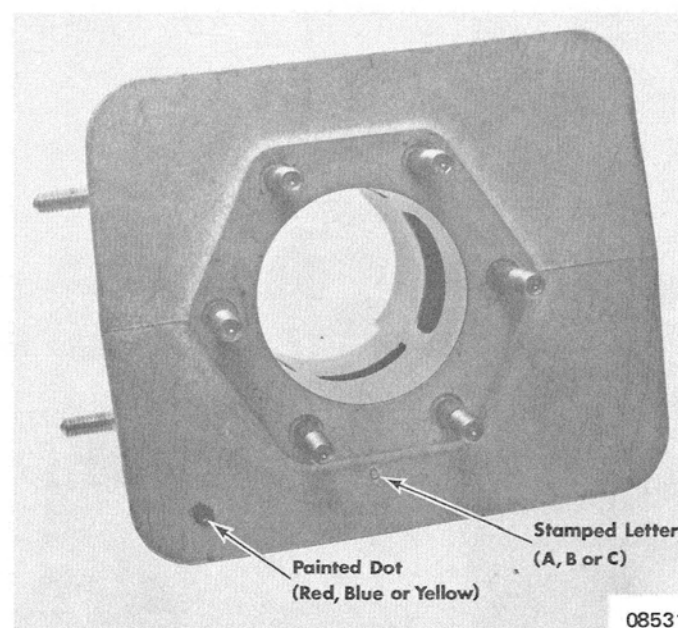


Figure 5. Cylinder Identification

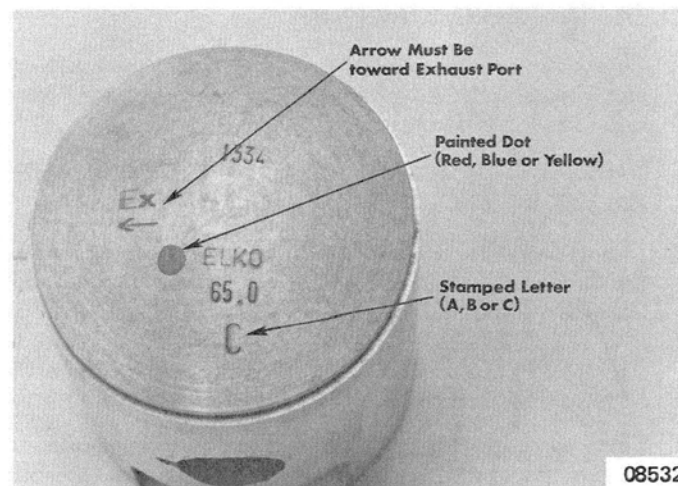


Figure 6. Piston Identification

1. Hone cylinder (as outlined, preceding) to clean up any score marks, scuffs or aluminum deposits in cylinder bore.
2. Measure cylinder bore diameter (with an inside micrometer) at top of cylinder bore, JUST ABOVE EXHAUST

PORT. (Figure 7) Take measurements at right angles (90°) to each other and check for an out-of-round ("egg shaped") condition.

3. Measure piston at MIDDLE of piston skirt, just below piston pin, and at a right angle (90°) to piston pin. (Figure 8)

**IMPORTANT:** When checking piston-to-cylinder clearance, be sure that No. 1 piston is mated with No. 1 cylinder and No. 2 piston with No. 2 cylinder.

4. Subtract piston skirt diameter from cylinder bore diameter to determine "Piston Skirt Clearance".
5. If clearance exceeds specifications (refer to "Specifications" Section 8) after honing, replace part(s).

**IMPORTANT:** If "Piston Skirt Clearance" exceeds specifications, this usually will indicate a worn piston. Installation of a new piston should result in correct clearance. The chrome surfacing inside the cylinder bore is very hard and usually will show little wear.

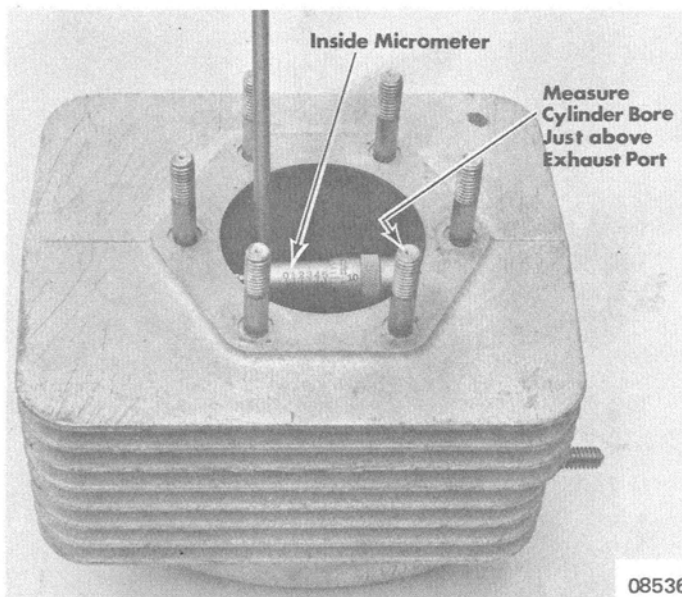


Figure 7. Measuring Cylinder

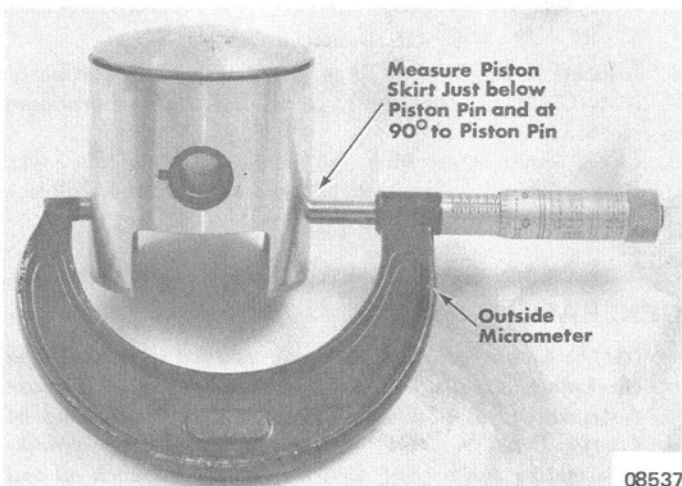


Figure 8. Measuring Piston Skirt

## Piston and Piston Rings

### REMOVAL

**NOTE:** It is not necessary to remove the opposite cylinder prior to removal of either piston.

1. Place a clean rag around crankcase openings to prevent entrance of foreign objects.

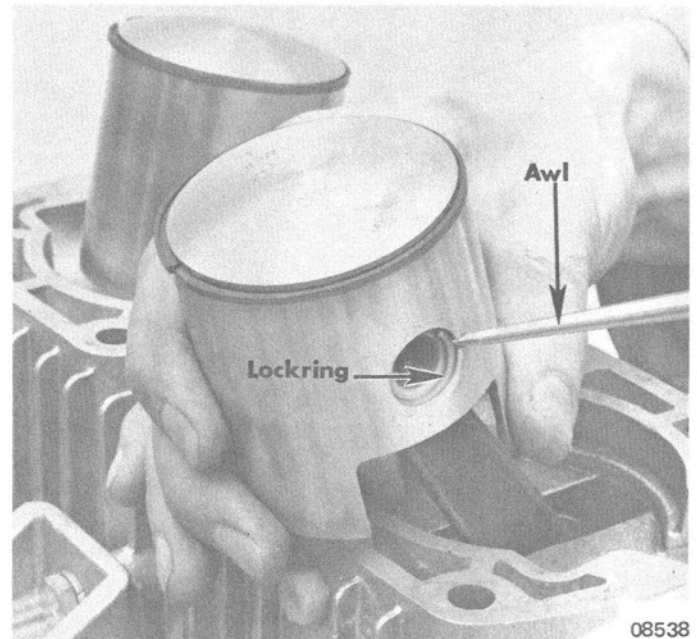


Figure 9. Removing Piston Pin Lockrings

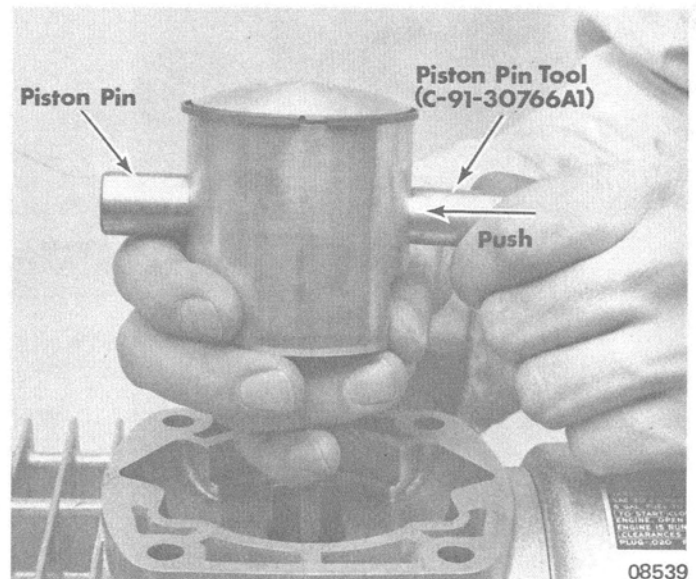


Figure 10. Piston Pin Removal

2. Remove piston pin lockrings from pistons with an awl or other suitable tool. (Figure 9) Use caution not to mar piston skirt during removal of lockrings.

**IMPORTANT:** If piston skirts are marred during removal of lockrings, BE SURE that skirts are smoothed-off with 320 grit carborundum cloth before installation of pistons in cylinders.



3. Remove piston pins with Piston Pin Tool (C-91-30766A1). (Figure 10) Remove pistons from connecting rods and reinsert piston pins into respective pistons. Mark each piston to designate to which cylinder it is "fitted".
4. Remove piston pin bearings from connecting rods.

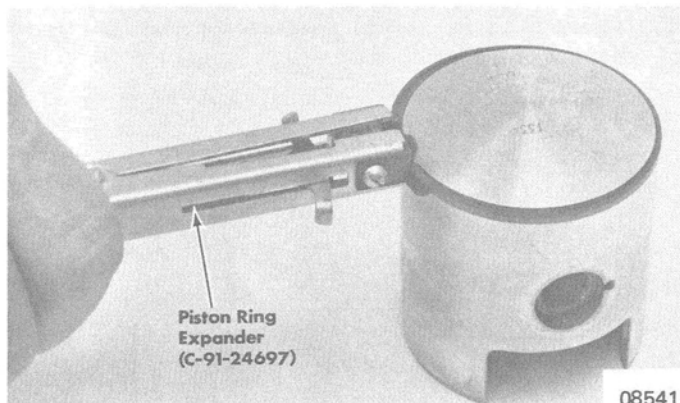


Figure 11. Piston Ring Replacement

5. Use Piston Ring Expander (C-91-24697) to remove piston ring from each piston. (Figure 11)

## CLEANING and INSPECTION

1. Replace piston(s) if scoring, pitting or metal damage is present.

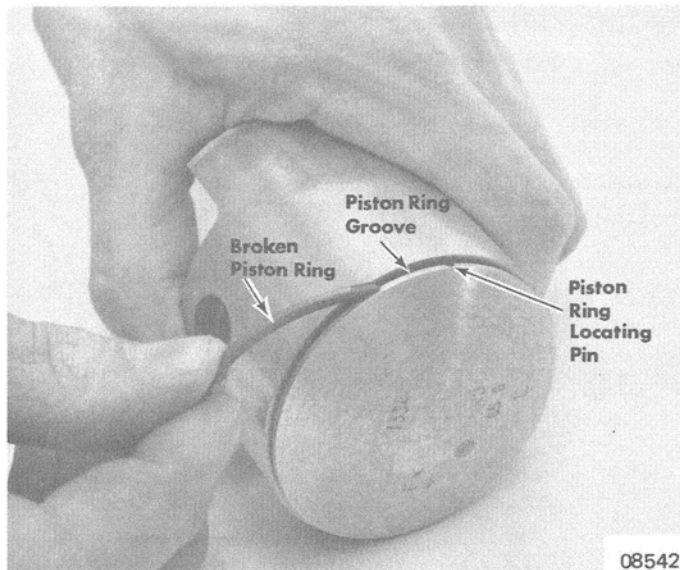


Figure 12. Cleaning Piston Ring Groove

2. Thoroughly clean pistons. Remove carbon deposits and "varnish" from pistons with a soft wire brush or carbon remover solution. Clean ring grooves with recessed end of a broken ring. (Figure 12) Do not burr or round machined edges.
3. Inspect piston domes for damage as a result of pistons striking cylinder heads. (Figure 13)

*NOTE: Piston striking cylinder head could be an indication of a defective or improperly positioned cylinder head, connecting rod bearing(s) going "out", "stretched" connecting rod and/or engine was assembled with improper cylinder gasket(s).*

4. Inspect piston ring grooves for wear, burn and distortion. Piston ring locating pins (located in ring grooves - Figure

12) prevent rings from rotating. Locating pins must be tight in ring grooves.

5. Check piston pin "fit". Piston pins are not sold separately. Each piston pin is mated to only one piston. The piston and pin must be replaced as an assembly if pin is loose.
6. Refer to "Fitting Cylinders to Pistons", preceding (Figure 8), and check "fit" between piston and cylinders. If "Piston Skirt Clearance" exceeds specifications, piston may be worn and replacement will be necessary.

**IMPORTANT:** If piston replacement is necessary, **BE SURE** that replacement piston is compatible with its respective cylinder. (Refer to "Cylinder and Piston Substitution Chart", preceding.)

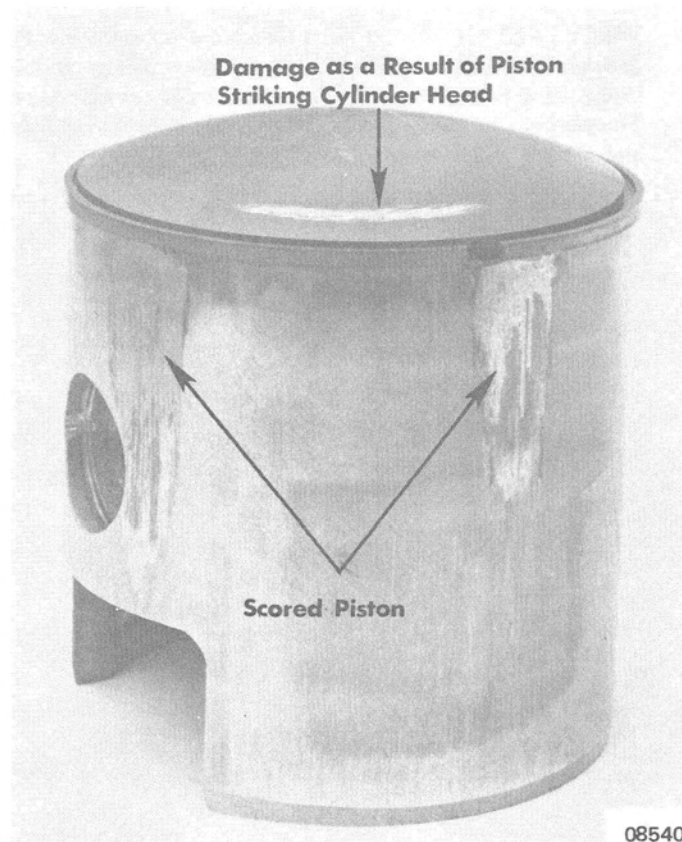


Figure 13. Damaged Piston

7. Inspect piston pin end of connecting rod for pitting or rust. Clean (if necessary), using 320 grit carborundum cloth.
8. Check outer connecting rod bearings (piston pin end). Bearings must be smooth and should not bind. Replace bearings as necessary.

## Crankcase and Crankshaft Assembly

### GENERAL

*NOTE: Crankshaft removal is not required when replacing crankshaft oil seals. Lubricate inner lips with Multipurpose Lubricant (C-92-63250-12) and place a THIN bead of Loctite Type "A" (C-92-32609-1) on outer edge (crankcase mating surface) of each oil seal. Install each oil seal (lip of seal inward) flush with crankcase.*

The crankcase halves are a matched set and **MUST NOT** be interchanged.

The crankshaft is sold as a complete assembly with connecting rods, centermain "O" rings, centermain bearings and distance ring. Components, which are included in the crankshaft

assembly (except "O" rings), cannot be purchased separately. If an internal crankshaft component fails, the entire crankshaft assembly must be replaced. The outer crankshaft ball bearings, "O" rings and oil seals can be replaced without replacing crankshaft assembly.

## REMOVAL

1. Disconnect switch box wires from stator and trigger wires by separating large, black plug-in connector.
2. Remove 2 white wires from bottom switch box attaching bolt.
3. Disconnect red and white switch box wires from terminals of secondary ignition coils. Remove wires from "J" clip (attached to top coil bracket mounting bolt).
4. Remove 4 bolts and washers which secure flywheel bell housing to crankcase. Remove bell housing and switch box as an assembly.
5. Remove stator attaching bolts and trigger attaching screws. Pull stator, trigger and wiring from crankcase.
6. Remove secondary ignition coils and bracket from crankcase.
7. Remove nuts and washers from thru bolts which secure crankcase halves together. Remove thru bolts from crankcase.
8. Separate crankcase halves. Be careful not to damage crankcase sealing surfaces or crankshaft.

*NOTE: A sealant is used between the crankcase halves. It may be necessary to GENTLY TAP on crankshaft with a soft lead hammer until crankcase halves separate.*

9. Remove and discard oil seal from each end of crankshaft.
10. Remove crankshaft end bearing snap ring from each end of crankcase. (Figure 14)
11. Remove shims from PTO side of crankshaft. (Figure 14) Note number and position of shims to aid in reassembly.
12. Remove shims from rewind side of crankshaft. (Figure 14) Note number and position of shims to aid in reassembly.
13. Lift crankshaft assembly from crankcase half.
14. Remove and discard 4 crankshaft end bearing "O" rings (2 each end) and crankcase sealing "O" ring. (Figure 14)
15. Remove and discard 2 crankshaft inner bearing "O" rings (one on each bearing) and "O" ring from distance ring. (Figure 14)

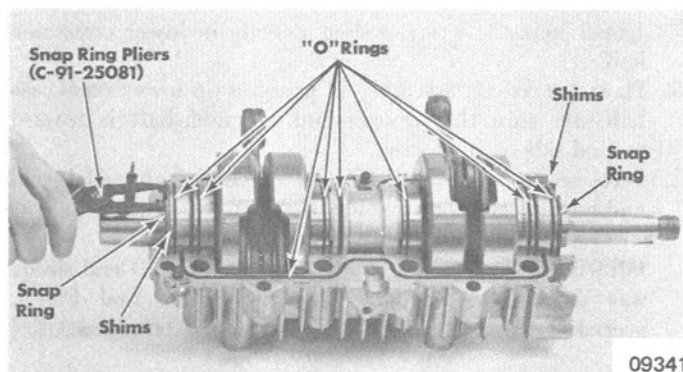


Figure 14. Removing Crankshaft

## CLEANING and INSPECTION

1. Thoroughly clean all surfaces of crankcase halves. Be sure that crankcase sealer is removed from crankcase mating surfaces.
2. Inspect oil passages in upper crankcase half. Oil passages allow fuel to lubricate outer crankshaft ball bearings. If

these passage(s) are plugged or restricted, bearing failure may result from lack of lubrication.

3. Inspect crankcase mating surfaces for cracks, scratches or grooves. Check crankcase halves for stripped threads.
4. Clean and dry crankshaft assembly.

**WARNING: DO NOT spin-dry ball bearings with compressed air.**

5. Grasp outer race of each ball bearing firmly and attempt to work race back-and-forth (there should not be excessive play).
6. Lubricate bearings with light oil. Rotate outer race of each ball bearing. Bearings should have smooth action and no rust stains. If outside bearing(s) sound or feel "rough", replace bearing(s). If an inside bearing is "rough", replace crankshaft assembly.
7. Check connecting rod roller bearings (located on crankshaft end of rod). Connecting rods should roll smoothly on bearings and not have excessive side play.

*NOTE: A roller bearing, which is starting to fail, could result in piston hitting cylinder head.*

8. Inspect oil seal surfaces of crankshaft. If crankshaft is grooved, pitted or scratched, replace crankshaft assembly.
9. Check crankshaft assembly for straightness.

## DISASSEMBLY

1. Install Puller Plate (C-91-37241) between inner and outer end bearings. (Figure 15)

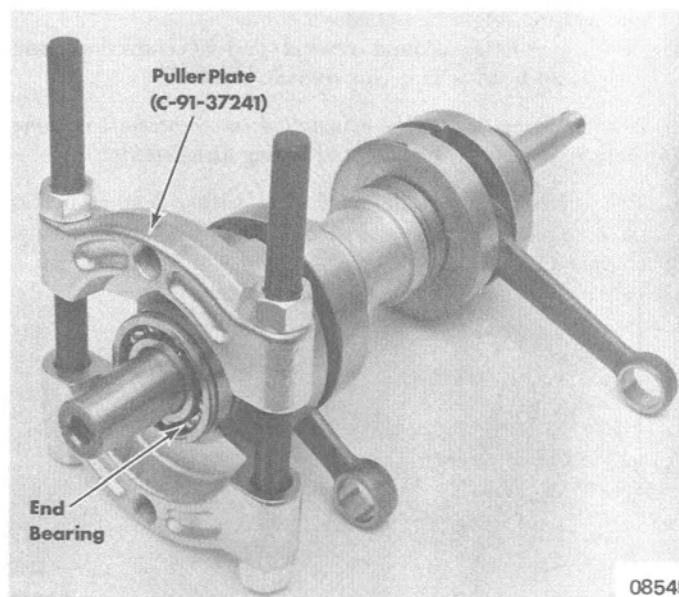


Figure 15. Bearing Removal

2. Place crankshaft in press and support under Puller Plate.
3. Press crankshaft out of bearing.
4. Remove spacers from between bearings. Note number and position of spacers for reference during reassembly.
5. Reinstall Puller Plate between inner end bearing and crankshaft counterweight.
6. Place crankshaft in press and support under Puller Plate. Press crankshaft out of inner bearing.
7. If desired, remove end bearings from opposite end of crankshaft with Puller Plate and press.

# ENGINE REASSEMBLY

## Crankshaft Assembly and Crankcase

### REASSEMBLY

1. Support crankshaft in press between counterweights and directly under the crankshaft end (where end bearings are being reinstalled).
2. Install inner end bearing with "lettered side" up and "O" ring groove away from counterweight. Using tubing as a mandrel, press inner bearing on crankshaft. Press only on inner race of bearing. Be sure that bearing is seated firmly against counterweight.
3. Place spacer(s) around crankshaft and against inner end bearing.

**IMPORTANT:** BE SURE that same spacer(s), which were removed from this position, are reinstalled between bearings.

4. Install outer end bearing with "lettered side" up and "O" ring groove away from counterweight. Using tubing as a mandrel, press outer bearing on crankshaft. Press only on inner race of bearing. Be sure that bearing is seated against spacer(s).
5. If removed, reinstall end bearings and spacers on opposite end of crankshaft with mandrel and press.
6. Remove crankshaft assembly from press.

### CHECKING CRANKSHAFT END PLAY

1. Place crankshaft assembly (without "O" rings) in position on lower crankcase half.
2. Place shim(s) around PTO end of crankshaft and install end bearing snap ring outside of shims.
3. Position shim(s) around rewind end of crankshaft and install end bearing snap ring outside of shims.

*NOTE: Shims should be reinstalled on crankshaft in same quantity and location as noted during disassembly.*

4. Tap on rewind end of crankshaft with a leather mallet until crankshaft is firmly seated against PTO side snap ring. (Figure 1)

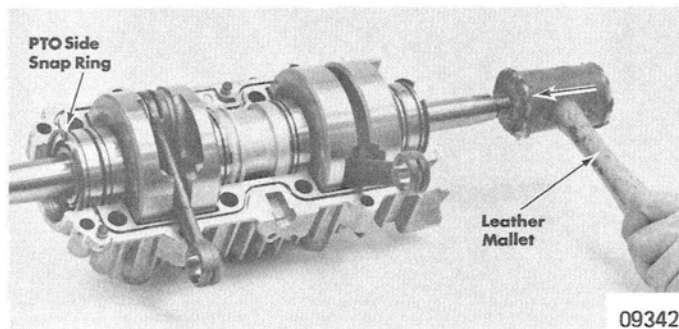


Figure 1. Seating Crankshaft

5. Use feeler gauge to measure crankshaft end play. Measure end play between outer crankshaft bearing and shims on rewind end. (Figure 2) Crankshaft end play of .006"-.012" (.15mm-.30mm) is permissible. Add shim(s) to decrease amount of end play or remove shim(s) to increase amount of end play.

**IMPORTANT:** Position an equal number of shims at each end of crankshaft so that counterweights are "centered" in lower crankcase openings.

6. Recheck crankshaft end play (as outlined preceding), if shim(s) were added or removed from crankshaft.
7. Remove snap ring and shim(s) from rewind side of crankcase. (Figure 2)

**IMPORTANT:** Keep rewind side shims together to assure proper crankshaft end play during reassembly.

8. Remove snap ring and shim(s) from PTO side of crankcase. (Figure 2)

**IMPORTANT:** Keep PTO side shims together to assure proper crankshaft end play during reassembly.

9. Lift crankshaft assembly from crankcase half.

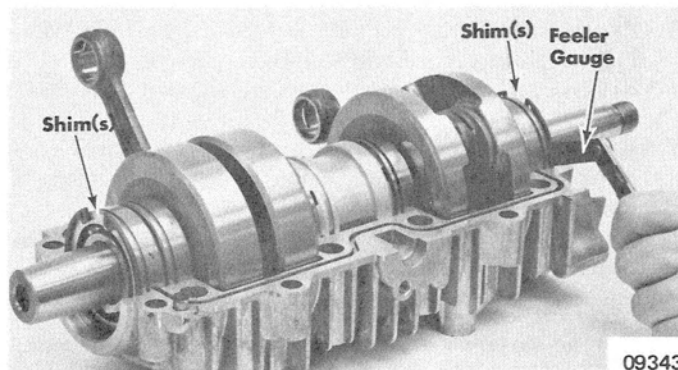


Figure 2. Checking Crankshaft End Play

### INSTALLATION

1. Lubricate 6 new crankshaft bearing "O" rings and one new distance ring "O" ring with Multipurpose Lubricant (C-92-63250).
2. Install large "O" ring around distance ring by stretching over counterweight and connecting rod.
3. Install an "O" ring on each of the inner crankshaft bearings by stretching over counterweight and connecting rod and positioning "O" rings in ring grooves of bearings.
4. Install 4 remaining "O" rings in ring grooves of crankshaft end bearings (2 each end).
5. Install new "O" ring sealing gaskets in lower crankcase half.
6. Place crankshaft assembly in position on lower crankcase half. Be sure that rewind end of crankshaft is toward rewind side of crankcase.
7. Place shim(s) around PTO end of crankshaft and install end bearing snap ring outside of shims.

**IMPORTANT:** Thickness and quantity of PTO end shims was determined in "Checking Crankshaft End Play", preceding. Reinstall shim(s) as previously determined.

8. Tap on rewind end of crankshaft with a leather mallet until crankshaft is LIGHTLY seated against PTO side snap ring.
9. Place shim(s) around rewind end of crankshaft and install end bearing snap ring outside of shims.

**IMPORTANT:** Thickness and quantity of rewind end shims was determined in "Checking Crankshaft End Play", preceding. Reinstall shims as previously determined.



10. Lubricate lips of new crankcase oil seals with Multipurpose Lubricant. Install an oil seal on each end of crankshaft, with lips facing toward end bearings (inward) and flush against snap rings.

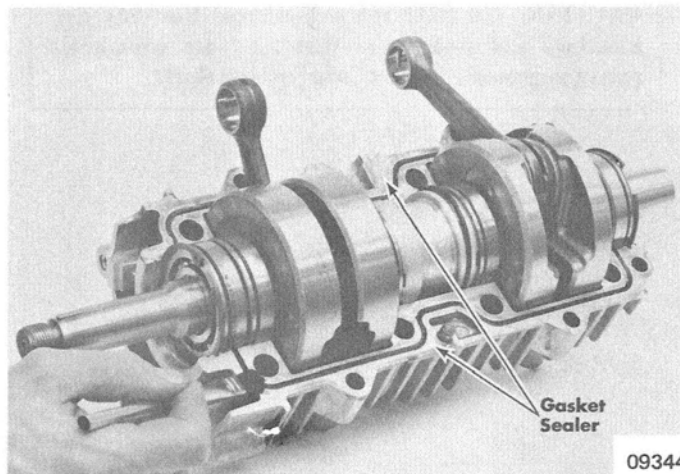


Figure 3. Applying Crankcase Sealer

11. Apply a THIN coat of Gasket Sealer (C-92-72592-1) to crankcase halves. (Figure 3)
12. Place crankcase halves together and secure with attaching thru bolts, washers and nuts. Be sure that crankshaft seals are properly positioned between crankcase halves.

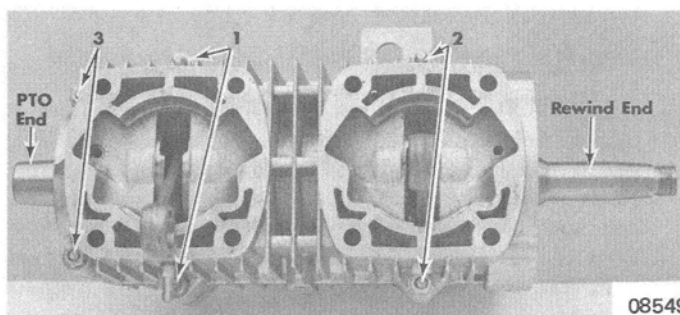


Figure 4. Crankcase Torquing Sequence

13. Torque crankcase attaching nuts in sequence shown in Figure 4. Refer to Section 8, "Specifications", for torque value.
14. Install secondary ignition coils and bracket on crankcase.
15. Secure trigger assembly and stator assembly to crankcase with attaching screws. Do not tighten attaching screws at this time. Engine timing must be adjusted during "Engine Installation", following.

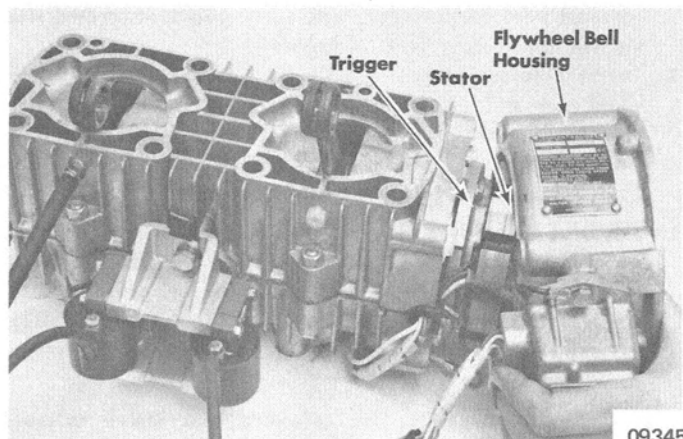


Figure 5. Installing Flywheel Bell Housing

16. Position stator wires, trigger wires and grommet in crankcase notch.
17. Reinstall flywheel bell housing and switch box as an assembly. Secure housing to crankcase with washers and bolts. (Figure 5)
18. Install red and white switch box wires in "J" clip (attached to top coil bracket mounting bolt).
19. Connect white switch box wire to primary terminal stud of No. 2 cylinder (rewind side) ignition coil.
20. Connect red switch box wire to primary terminal stud of No. 1 cylinder (PTO side) ignition coil.
21. Reinstall 2 white wires (one from stator and one from engine harness) on bottom switch box attaching bolt.
22. Connect switch box wires to stator and trigger wires by reconnecting large, black plug-in connector.

## Pistons and Piston Rings

### CHECKING PISTON RING END GAP

1. Insert a new piston ring into each cylinder bore. Rings should be inserted at top of cylinder bore, JUST ABOVE EXHAUST PORTS and square with piston.

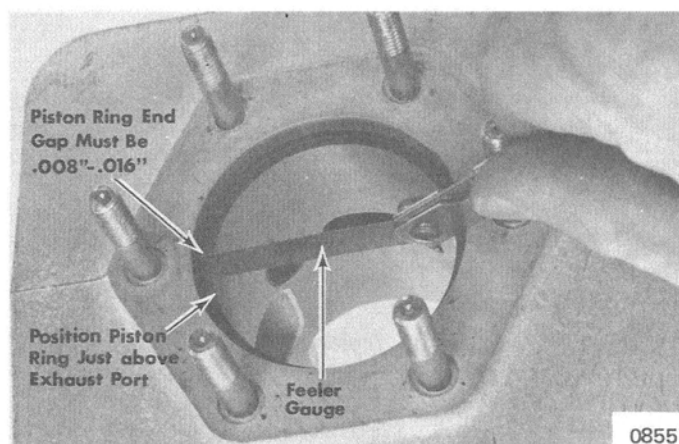


Figure 6. Checking Piston Ring End Gap

2. Check end gap of each piston ring with a feeler gauge. (Figure 6) The end gap must be within .008"-.016" (.20mm-.41mm). If end gap is in excess of these tolerances, check other new piston rings in cylinder bore until one within tolerance is found.
3. Remove piston rings from cylinder bores.

**IMPORTANT:** The piston ring, that is checked in No. 1 cylinder, **MUST BE** installed on No. 1 piston and the ring, that is checked in No. 2 cylinder, **MUST BE** installed on No. 2 piston.

### CHECKING PISTON RING SIDE CLEARANCE

**IMPORTANT:** Before checking piston ring side clearance, piston ring end gap must be checked as outlined, preceding. **BE SURE** to install piston rings on their respective pistons; i.e., install ring, which was "fitted" to No. 1 cylinder, on No. 1 piston, etc.

1. Using Piston Ring Expander (C-91-24697), install No. 1 piston ring on No. 1 piston and No. 2 piston ring on No. 2 piston. (Figure 11 in "Engine Disassembly", preceding)

**CAUTION:** Piston rings must be properly installed with edge of "L" ring "up" and with piston locating pins between ring gaps. Rings fit only one way and must not be forced during installation in cylinders.

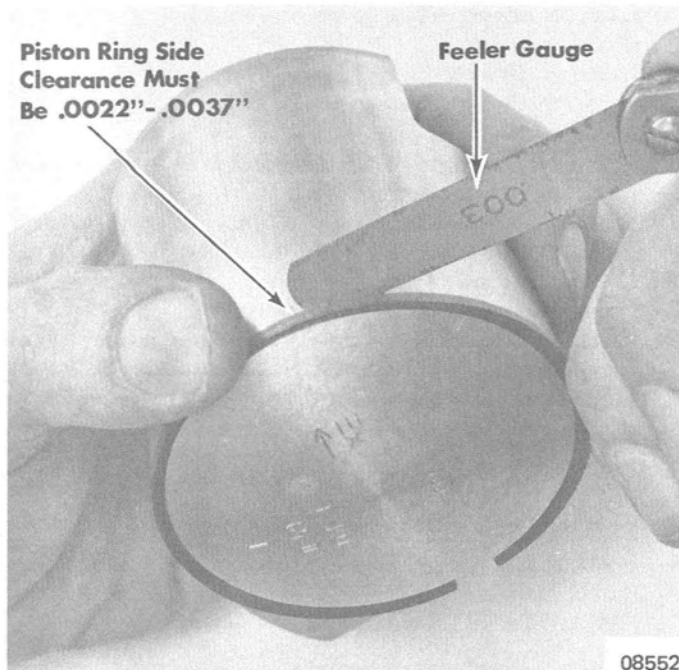


Figure 7. Checking Piston Ring Side Clearance

2. With piston ring seated in ring groove, check piston ring side clearance with a feeler gauge. Insert feeler gauge between lower edge of piston ring and ring groove. (Figure 7) Side clearance must be within .0022"-.0037" (.056mm-.094mm). If side clearance is in excess of these tolerances, ring groove is worn beyond limits, and piston(s) must be replaced.

**CAUTION:** If piston replacement is necessary, BE SURE that replacement piston is compatible with its respective cylinder. (Refer to "Cylinder and Piston Substitution Chart", preceding.) Reinstall new piston ring, which was "fitted" to its proper cylinder bore, on replacement piston.

## INSTALLATION

1. Insert piston pin bearing in connecting rod.
2. Position each piston on its connecting rod with arrow on dome of piston (Figure 6 in "Engine Disassembly", preceding) toward exhaust port side of engine.

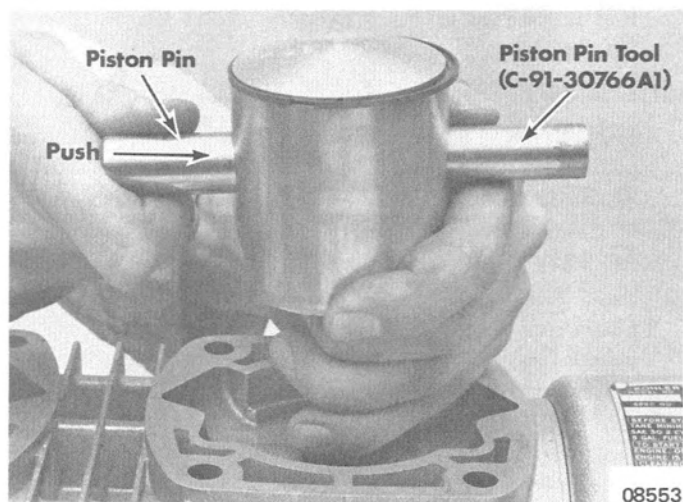


Figure 8. Installing Pistons

3. Install each piston pin, using Piston Pin Tool (C-91-30766A1) as a guide. (Figure 8)
4. Install new piston pin lockrings. (Figure 9)

**CAUTION:** DO NOT re-use lockrings. Use only new lockrings and make sure that they are completely seated in grooves. Do not "mar" piston skirt.

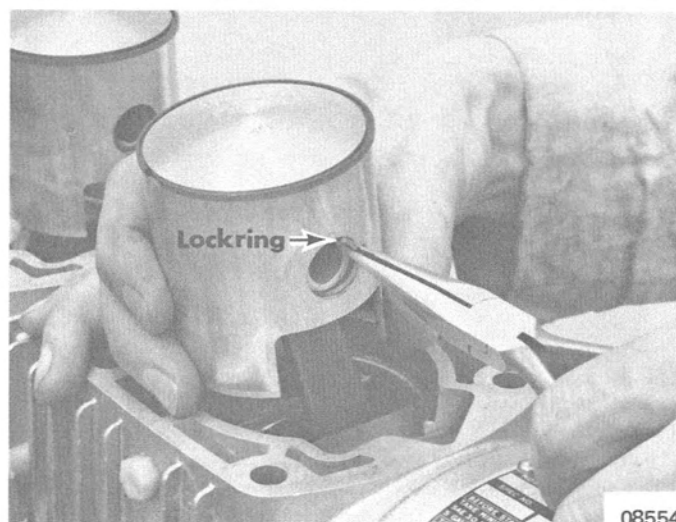


Figure 9. Installing Lockrings

## Cylinders and Cylinder Heads

**IMPORTANT:** If piston has been hitting cylinder head, it may be helpful to install cylinder head and cylinder head gasket on cylinder BEFORE installing cylinder over piston. Place cylinder head gasket and cylinder head on cylinder and, making sure that combustion chamber of cylinder head is centered in cylinder bore, secure cylinder head with flat washers, lockwashers and nuts. Install cylinder assembly as outlined, following.

1. Lubricate cylinder bores, piston skirts and piston rings with CLEAN Quicksilver Formula 50 Oil (C-92-65183).
2. Place new cylinder base gaskets on crankcase.
3. Install No. 1 cylinder over No. 1 piston and No. 2 cylinder over No. 2 piston. Compress piston ring with fingers while installing cylinder over piston. (Figure 10) Piston ring must be properly positioned with (piston) ring locating pin at piston ring gap. Cylinders are properly positioned when intake ports of cylinders are toward ignition coils. Rotate crankshaft until piston ring can be viewed thru exhaust port. Depress ring with small punch or screwdriver (it will not "spring back" if broken).
4. Insert cylinder attaching bolts (with wave washers) thru crankcase and cylinders flanges. Secure bolts with wave washers, lockwashers and nuts. Tighten cylinder attaching bolts evenly until specified torque is reached. (Refer to "Specifications" Section 8 for torque values.)

**IMPORTANT:** Be sure that left exhaust header is installed on No. 1 cylinder (PTO side) and right exhaust header on No. 2 cylinder (rewind side). Exhaust header attaching screws can be secured with Loctite Type A (C-92-32609), or screw heads can be drilled and safety-wired to prevent loosening.

5. Place exhaust gaskets on cylinders and install exhaust headers. Secure exhaust headers with lockwashers and allen screws. Torque allen screws to specification.

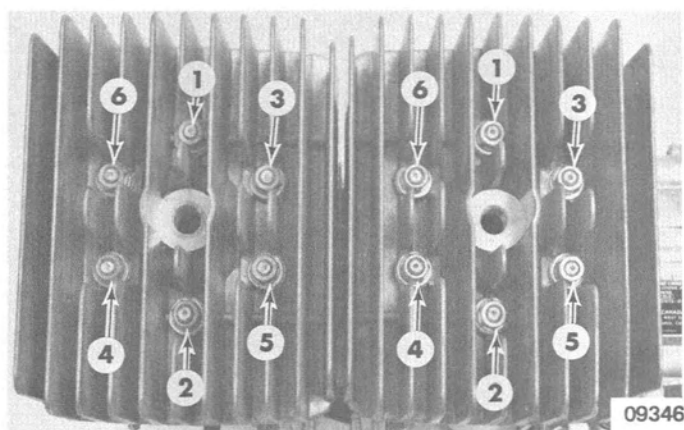
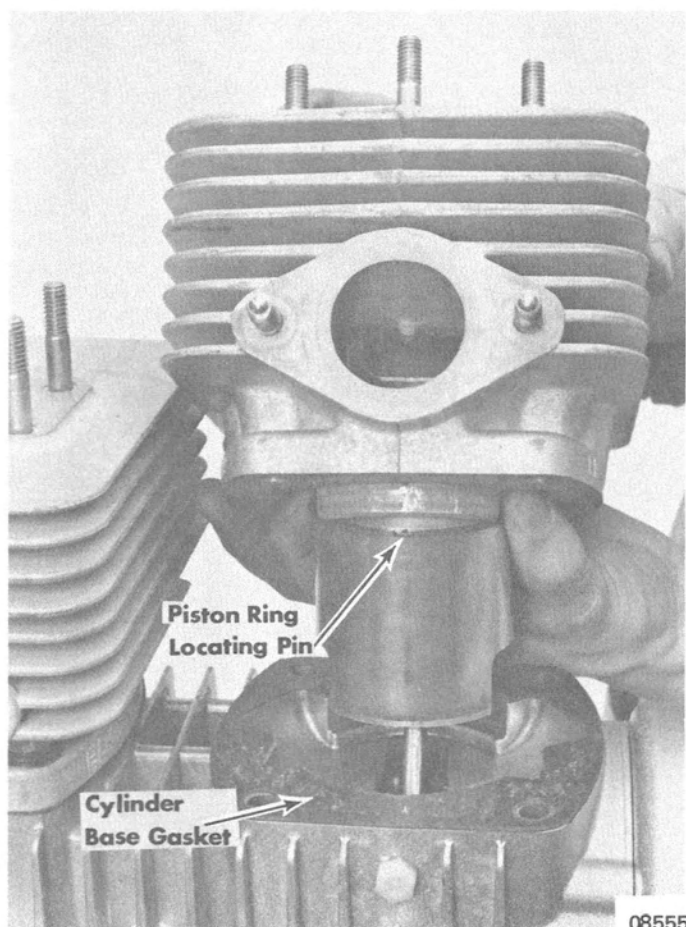


Figure 11. Cylinder Head Torquing Sequence

6. Place cylinder head gaskets on cylinders.
7. Set cylinder heads on studs and secure with flat washers, lockwashers and nuts. Torque cylinder head attaching nuts in sequence shown in Figure 11. Refer to Section 8, "Specifications", for torque value.
8. Install carburetors on cylinders.
9. Install spark plugs in cylinder heads.
10. Connect high tension wires from secondary ignition coils to proper spark plugs.



Figure 10. Installing Cylinder

## ENGINE INSTALLATION

1. Install engine mounting plate on crankcase and secure with washers and bolts. Torque bolts to specification. (Refer to "Specifications" Section 8.)
2. Set engine assembly on engine mounts.
3. Reinstall throttle valve and throttle cable assemblies in carburetors. Tighten cover assemblies securely and safety-wire in place.

**WARNING: BE SURE** that throttle valve is installed all the way into carburetor throat. If throttle valve is improperly installed, guide pin will hold throttle valve open, resulting in a full-throttle condition. Serious damage may result if snowmobile engine is started when carburetors are improperly assembled.

4. Refer to Section 2, Part C, and install drive sheave on crankshaft.
5. Install variable speed drive belt.
6. Secure engine mounting plate to engine mounts with washers and locknuts. Torque locknuts to specification.
7. Check drive belt tension as outlined in Section 2, Part B. Install drive belt guard.
8. Connect engine harness to chassis harness.
9. Connect fuel pump pulse hose to crankcase fitting.
10. Connect carburetor fuel hoses to fuel pump. Clamp hoses securely. Open fuel shut-off valve on fuel tank.

## Flywheel Installation

11. Install flywheel as outlined following:
  - a. If trigger was loosened or removed from engine, refer to Section 3, Part C, and adjust ignition timing.
  - b. Place flywheel key in crankshaft keyway, if removed.
  - c. Align flywheel keyway and crankshaft key and install flywheel. Secure with tab washer and attaching nut.
  - d. Keep engine crankshaft from rotating by holding drive sheave with Belt Wrench (C-91-24937A1). (See Figure 2 in "Engine Removal", preceding.)
  - e. Torque flywheel nut to specifications. (Refer to "Specifications" Section 8.)
  - f. Bend tab on tab washer to secure flywheel nut.
  - g. Install flywheel sheave plate and starter cup.
  - h. Install rewind starter assembly on flywheel bell housing. Be sure that 2 black ground wires are attached to one of the rewind starter attaching bolts.
12. Install carburetor air intake on carburetors.
13. Pull rewind rope from starter assembly and install in rope guide attached to chaincase.
14. Install exhaust pipes. (Refer to Section 7, Part B, "Exhaust Systems".)
15. Install top cowl assembly.