

# Section 9

## PISTONS — RINGS — RODS

### Remove Piston and Connecting Rod

To remove the piston and connecting rod from the engine, bend down connecting rod lock. Fig. 1. Remove the connecting rod cap. Remove any carbon or ridge at the top of the cylinder bore; this will prevent breaking of the rings. Push the piston and rod out through the top of the cylinder.

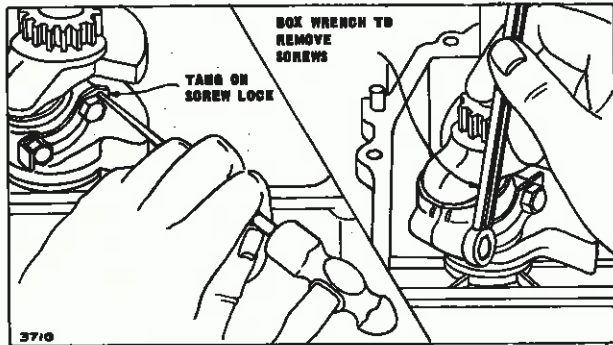


Fig. 1 — Bending Rod Lock

Pistons used in sleeve bore aluminum alloy engines are marked with an "L" on top of the piston. Fig. 2. Illus. 1. These pistons are tin plated. This piston assembly is **NOT INTERCHANGEABLE** with the piston used in aluminum bore (KOOL BORE) engines.

Pistons used in aluminum bore (KOOL BORE) engines are **NOT** marked on top of the piston.

Fig. 2. Illus. 2. The piston is chrome plated and is not to be used in a sleeve bore engine.

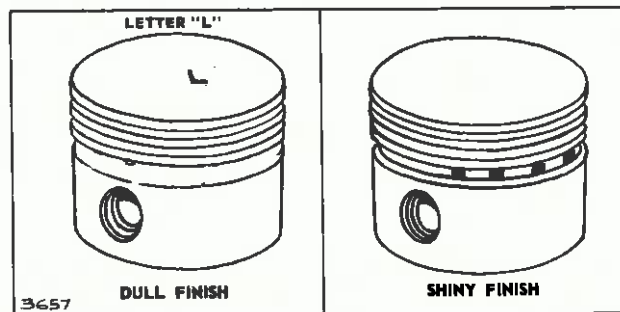


Fig. 2 — Piston Variations

### Remove Connecting Rod

To remove connecting rod from piston, remove piston pin lock with thin nose pliers. One end of the pin is drilled to facilitate removal of the lock. Fig. 3.

Remove rings one at a time as shown in Fig. 4, slipping them over the ring lands. Use a ring expander to prevent damage to rings and piston.

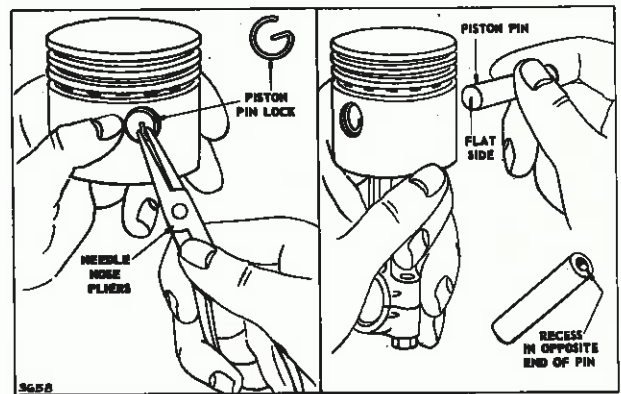


Fig. 3 — Removing Rod

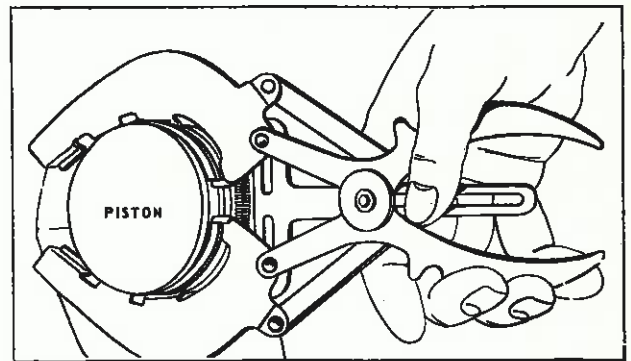


Fig. 4 — Removing Rings

### Check Piston

If the cylinder is to be resized, there is no reason to check the piston, since a new oversized piston assembly will be used.

If, however, the cylinder is not to be resized, and the piston shows no signs of wear or scoring, the piston should be checked.

# PISTONS — RINGS — RODS

## Checking

To do so, clean carbon from top ring groove. Place a NEW ring on the groove, check the remaining space in the groove with a feeler gauge. Fig. 5. If a .007" (0.18 mm) feeler gauge can be inserted (all models), the piston is worn and should be replaced.

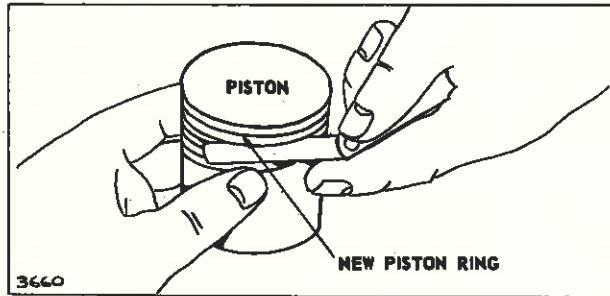


Fig. 5 — Checking Ring Grooves

### Check Rings

To check rings, first clean all carbon from the ends of the rings and from the cylinder bore. Insert old rings one at a time one inch down into the cylinder. Check gap with feeler gauge. Fig. 6. If ring gap is greater than shown in Table No. 1, the ring should be rejected.

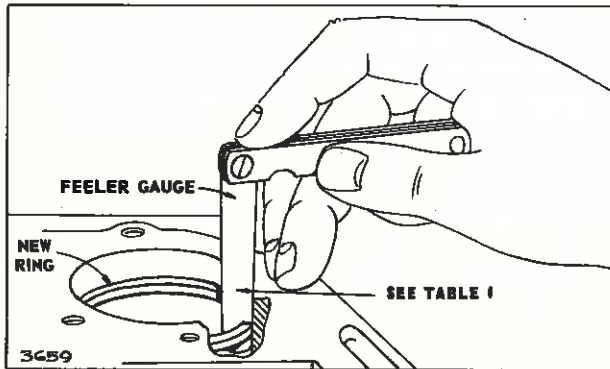


Fig. 6 — Checking Ring Gap

NOTE: Do not deglaze cylinder walls when installing piston rings in aluminum cylinder engines.

### Chrome Rings

NOTE: Chrome ring sets are available for all current aluminum and cast iron cylinder models, no honing or deglazing is required. The cylinder bore can be a maximum of .005" (0.13 mm) oversize when using chrome rings. See Service Bulletin 479 or Engine Parts List.

TABLE NO. 1  
RING GAP REJECTION SIZE

BASIC MODEL SERIES	COMP. RING		OIL RING	
	Inches	Milli-meter	Inches	Milli-meter
<b>ALUMINUM CYLINDER</b>				
6B, 60000, 8B, 80000	.035	0.80	.045	1.14
82000, 92000, 110000, 111000				
100000, 130000				
140000, 170000, 190000, 250000				
<b>CAST IRON CYLINDER</b>				
5, 6, 8, N, 9	.030	0.75	.035	0.90
14, 19, 190000				
200000, 23				
230000, 240000				
300000, 320000				

TABLE NO. 2  
CONNECTING ROD REJECT SIZES

BASIC MODEL SERIES	CRANK PIN BEARING		PISTON PIN BEARING	
	Inches	Milli-meter	Inches	Milli-meter
<b>ALUMINUM CYLINDER</b>				
6B, 60000	.876	22.25	.492	12.50
8B, 80000	1.001	25.43	.492	12.50
82000, 92000, 110000	1.001	25.43	.492	12.50
100000	1.001	25.43	.555	14.10
130000	1.001	25.43	.492	12.50
140000, 170000	1.095	27.81	.674	17.12
190000	1.127	28.63	.674	17.12
220000, 250000	1.252	31.80	.802	20.37
<b>CAST IRON CYLINDER</b>				
5	.752	19.10	.492	12.50
6, 8, N	.751	19.08	.492	12.50
9	.876	22.25	.563	14.30
14, 19, 190000	1.001	25.43	.674	17.12
200000	1.127	28.63	.674	17.12
23, 230000	1.189	30.20	.736	18.69
240000	1.314	33.38	.674	17.12
300000, 320000	1.314	33.38	.802	20.37

### Check Connecting Rod

If the crankpin bearing in the rod is scored, the rod must be replaced. Rejection sizes of crankpin bearing hole and piston pin bearing hole are shown in table No. 2. Pistons pins .005" (0.13 mm) oversize are available in case the connecting rod and piston are worn at the piston pin bearing. If, however, the crankpin bearing in the connecting rod is worn, the rod should be replaced. Do not attempt to "file" or "fit" the rod.

### Check Piston Pin

If the piston pin is worn .0005" (.01 mm) out of round or below the rejection sizes listed below, it should be replaced. Table No. 3.

# PISTONS — RINGS — RODS Assembly

**TABLE NO. 3  
PISTON PIN REJECTION SIZE**

BASIC MODEL SERIES	PISTON PIN		PIN BORE	
	Inches	MMII-meter	Inches	MMII-meter
<b>ALUMINUM CYLINDER</b>				
6B, 60000	.489	12.42	.491	12.47
8B, 80000	.489	12.42	.491	12.47
82000, 92000, 110000	.489	12.42	.491	12.47
100000	.552	14.02	.554	14.07
130000	.489	12.42	.491	12.47
140000, 170000, 190000	.671	17.04	.673	17.09
220000, 250000	.799	20.29	.801	20.35
<b>CAST IRON CYLINDER</b>				
5, 6, 8, N	.489	12.42	.491	12.47
9	.561	14.25	.563	14.30
14, 19, 190000	.671	17.04	.673	17.09
200000	.671	17.04	.673	17.09
23, 230000	.734	8.64	.736	18.69
240000	.671	17.04	.673	17.09
300000, 320000	.799	20.29	.801	20.35

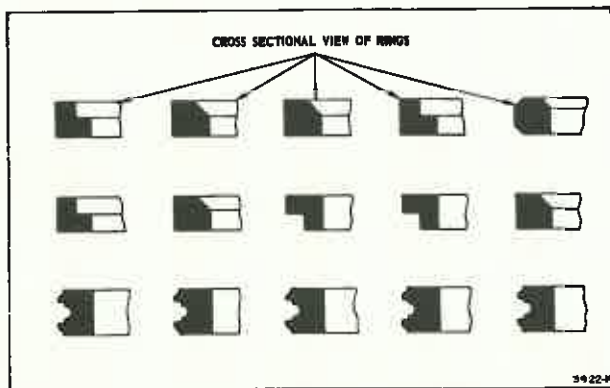
### Assemble Piston and Connecting Rod

The piston pin is a push fit in both piston and connecting rod. On models using a solid piston pin, one end is flat, the other end is recessed. Other models use a hollow pin.

Place a pin lock in the groove at one side of the piston. From the opposite side of the piston, insert the piston pin, flat end first with solid pin, either end with hollow pins, until it stops against the pin lock. Fig. 3. Use a thin nose pliers to assemble the pin lock in the recessed end of the piston. Be sure the locks are firmly set in the grooves.

### Assemble Rings to Piston

In Fig. 7, are shown the various rings and the proper position of each. Note especially the center compression ring. The scraper groove should always be down toward the piston skirt. Be sure the oil return holes are clean and carbon is removed from all grooves. NOTE: Install expander under oil ring, when required.

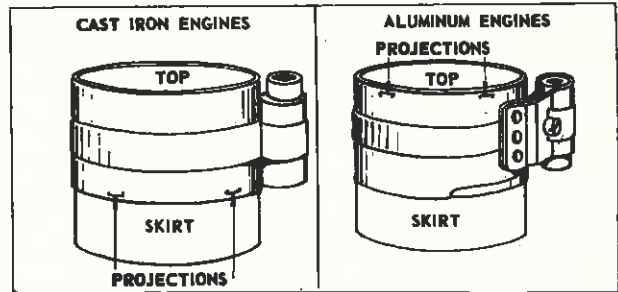


**Fig. 7 — Position of Rings**

Oil the rings and piston skirt, then compress rings with ring compressor (part 19070 or 19230). On all cast iron models, use ring compressor (19070) as illustrated in Fig. 8. Illustration 1.

On all aluminum engines, use compressor (19070) as illustrated in Fig. 8. Illustration 2.

NOTE: When using 19230 (2 band) ring compressor, use as shown in Fig. 8, Illus. 1 on all engines.



Illus. 1

Illus. 2

**Fig. 8 — Compression Rings**

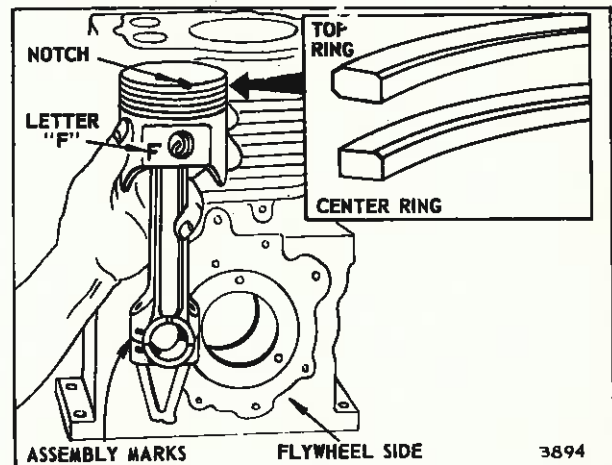
Turn the piston and compressor upside down on the bench and push downward, so the piston head and edge of compressor band are even while tightening the compressor. Draw the compressor up tight to fully compress the rings, then loosen the compressor very slightly.

Do not attempt to install piston and ring assembly without ring compressor.

NOTE: The pistons used in the 220000 and 250000 engines have a notch as shown in Fig. 9. The notch must face the flywheel side of the cylinder when installed.

### Installing Piston and Connecting Rod Models 300000 and 320000

The piston has an identification mark "F" located next to piston pin bore. When assembling piston to the connected rod, the letter "F" on the piston must appear on the same side as the assembly mark on the connecting rod. Assembly mark on rod is also used to identify rod and cap alignment. Install piston rings as illustrated in Fig. 9.



**Fig. 9 — Assemble Piston to Rod**

# PISTONS — RINGS — RODS Assembly

Install piston, connecting rod, and dipper. Piston identification mark "F" and notch at top of piston must be toward flywheel side. Torque connecting rod screw per Table No. 4. Move connecting rod back and forth on crankpin to be sure it is free.

## Install Piston and Rod Assembly All Models Except 300000 and 320000

Place the connecting rod and piston assembly with rings compressed into the cylinder bore, Fig. 10. Push piston and rod down into the cylinder. Oil the crankpin of the crankshaft. Pull the connecting rod against the crankpin and assemble the rod cap so assembly marks align. Fig. 11.

NOTE: Some rods do not have assembly marks as rod and cap will fit only in one position. Use care to insure proper installation.

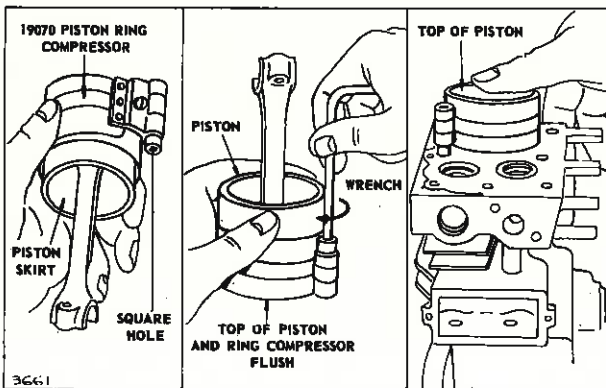


Fig. 10 — Install Piston Assembly

NOTE: Some rods may have flat washers under cap screws; remove and discard prior to installing rod.

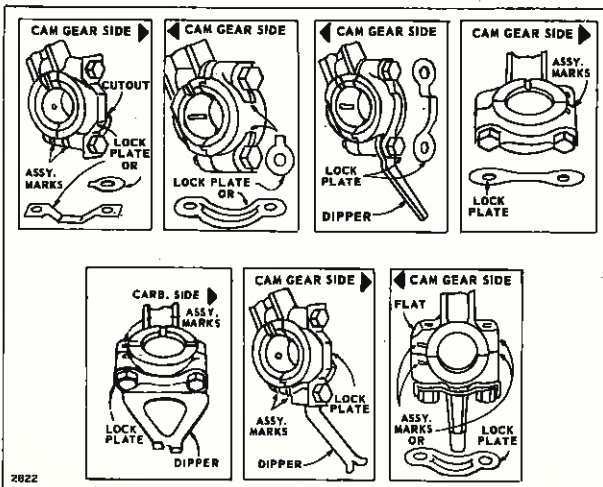


Fig. 11 — Connecting Rod Installation

Assemble the cap screws and screw locks with oil dipper (if used). Tighten cap screws to torque shown in Table No. 4. Fig. 12. Rotate the crankshaft two revolutions to be sure rod is correctly installed. If rod strikes, connecting rod has been installed wrong or cam gear is out of time. If crankshaft operates freely bend screw locks against screw heads. Fig. 12.

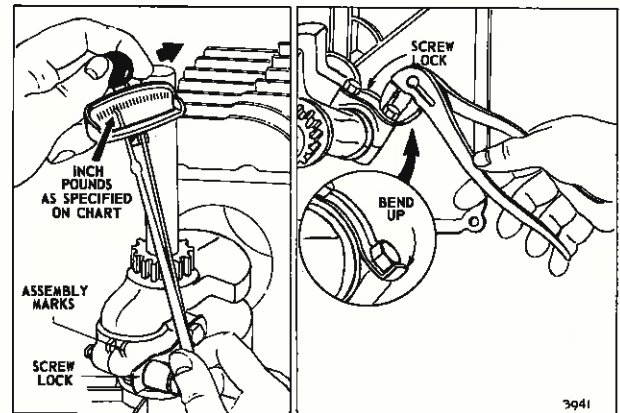


Fig. 12 — Bending Screw Locks

TABLE NO. 4  
CONNECTING ROD CAP SCREW TORQUE

BASIC MODEL SERIES	AVERAGE TORQUE		
	Inch Pounds	Kilo-gram Meter	Newton Meter
<b>ALUMINUM CYLINDER</b>			
6B, 60000	100	1.2	11.3
8B, 80000	100	1.2	11.3
82000, 92000, 110000, 111000	100	1.2	11.3
100000, 130000	100	1.2	11.3
140000, 170000, 190000	165	1.9	18.7
250000	185	2.1	21.0
<b>CAST IRON CYLINDER</b>			
5, 6, N, 8	100	1.2	11.3
9	140	1.6	15.8
14	190	2.2	21.5
19, 190000, 200000	190	2.2	21.5
23, 230000	190	2.2	21.5
240000, 300000, 320000	190	2.2	21.5

NOTE: Tighten rod screws securely. After tightening rod screws, rod should be able to move sideways on crankpin of shaft. A torque wrench must be used to prevent loose or overtight cap screws which results in breakage and/or scoring of rod. Fig. 12.