OB 1565

CHRYSLER Outboard

SERVICE MANUAL

THREE AND FOUR CYLINDER OUTBOARD MOTORS

CHRYSLER OUTBOARD CORPORATION
HARTFORD, WISCONSIN, U. S. A.

CHRYSLER CANADA OUTBOARD LTD.
BARRIE, ONTARIO, CANADA

Printed in U.S.A.

DGD

LIST OF EFFECTIVE PAGES

Total number of pages in this manual is 150 consisting of the following:

Page No.	Change No.*
Cover	0
List of Effective Pages	3
Index	3
1	3
2	2
3, 4, 4a, 4b, 4c	3
5	3
6 through 9	0
10, 11, 12	1
12a	3
12b, 12c	2
13 through 16	0
17, 18, 19	1
19a, 19b	2
20 through 37	0
38, 39, 40, 40a, 41, 41a	3
41b, 41c, 41d, 41e, 41f, 41g, 41h, 41i, 41j, 41k	2
42, 42a	3
43 through 48	0
48a	2
48b, 48c, 48d	3
49, 50, 51, 51a, 51b	1
52 through 56	0
57, 58, 59	1
60 through 64	0
64a through 64m	3
65	0
66, 67	1
68, 69, 69a	3
70 through 72	0
73, 74, 75, 75a	3
76 through 86	3
87, 88	3
89 through 102	2

*Zero (0) in this column indicates an original page.

INDEX

SECTION X—ELECTRICAL COMPONENTS - MOTOROLA SYSTEM

SECTION XA—ELECTRICAL COMPONENTS - MAGNAPOWER II

SECTION XI—ELECTRIC STARTER

SECTION XII—DISTRIBUTOR

SECTION XIIA—DISTRIBUTOR - BREAKERLESS

SECTION XIII—FUEL SYSTEM

SECTION XIV—GEAR HOUSING

SECTION XIVA—GEAR HOUSING

SECTION XV—MOTOR LEG - THREE CYLINDER ENGINES

SECTION XVI—MOTOR LEG - FOUR CYLINDER ENGINES

SECTION XVII—POWER HEAD - 3 CYLINDER ENGINES

SECTION XVIII—POWERHEAD - 4 CYLINDER ENGINES

SECTION I — INTRODUCTION

This service manual covers the repair and disassembly of all 1969 and later, 70 H.P., 75 H.P., 85 H.P., 90 H.P., 105 H.P., 115 H.P., 120 H.P., 130 H.P., 135 H.P. and 150 H.P. outboard motors manufactured by Chrysler Outboard Corporation, Hartford, Wisconsin.

The following publications should be used to supplement the information contained in this manual:

RACING LOWER UNIT SERVICE MANUAL — (Part Number OB1002-1) Refer to this publication for repair procedures on racing lower units.

PARTS MANUAL — Refer to the parts manual for the specific model being worked on for a parts breakdown and description.

OWNERS MANUAL — This manual covers general operating instructions, lubrication requirements and maintenance procedures.

WIRING DIAGRAM COLLECTION — This manual gives pictorial representation of electrical components on engine.

SECTION II — ENGINE SPECIFICATIONS

	70 H.P.	75 H.P.
Horsepower, BIA Rated @	4750 R.P.M.	4750 R.P.M.
Recommended Operating Range	4400-5100 R.P.M.	4400-5100 R.P.M.
Engine — Two Cycle	3 Cylinder Firing Order — 1, 2, 3	3 Cylinder Firing Order — 1, 2, 3
Bore and Stroke	3-5/16" x 2.8"	3-5/16" x 2.8"
Cubic Inch Displacement	72.39 Cubic Inches	72.39 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 12" Dia. x 15" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 17" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt — Negative Ground
Alternator — Output Maximum	10 Amps at 4750 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 4750 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V	Champion L20V
Breaker Point Gap	.014"	.014"
Compression Average Lbs.	130-140 P.S.I.	145-155 P.S.I.
Oil Ratio per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio per Gallon of Gas AFTER BREAK-IN	1/6 Pint	1/6 Pint

	75 H.P. (Electronic)	85 H.P.
Horsepower, BIA Rated @	4750 R.P.M.	5000 R.P.M.
Recommended Operating Range	4400-5100 R.P.M.	4500-5500 R.P.M.
Engine — Two Cycle	3 Cylinder Firing Order — 1, 2, 3	3 Cylinder Firing Order — 1, 2, 3
Bore and Stroke	3-5/16" x 2.8"	3-5/16" x 2.8"
Cubic Inch Displacement	72.39 Cubic Inches	72.39 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 17" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 15" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt — Negative Ground
Alternator — Output Maximum	10 Amps at 4750 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V	Champion L20V
Breaker Point Gap	**Breakerless**	.014"
Compression Average Lbs.	145-155 P.S.I.	145-155 P.S.I.
Oil Ratio per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio per Gallon of Gas AFTER BREAK-IN	1/6 Pint	1/6 Pint

	85 H.P. (Charger)	90 H.P.
Horsepower, BIA Rated @	5000 R.P.M.	5000 R.P.M.
Recommended Operating Range	4500-5500 R.P.M.	4500-5500 R.P.M.
Engine — Two Cycle	3 Cylinder Firing Order — 1, 2, 3	3 Cylinder Firing Order — 1, 2, 3
Bore and Stroke	3-5/16" x 2.8"	3-5/16" x 2.8"
Cubic Inch Displacement	72.39 Cubic Inches	72.39 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 21" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 19" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt — Negative Ground
Alternator — Output Maximum	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V	Champion L20V
Breaker Point Gap	Breakerless	.014"
Compression Average Lbs.	150-165 P.S.I.	155-165 P.S.I.
Oil Ratio Per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio Per Gallon of Gas AFTER BREAK-IN	1/6 Pint	1/6 Pint

	90 H.P. (Electronic)	105 H.P.
Horsepower, BIA Rated @	5000 R.P.M.	5000 R.P.M.
Recommended Operating Range	4500-5500 R.P.M.	4500-5500 R.P.M.
Engine — Two Cycle	3 Cylinder Firing Order — 1, 2, 3	4 Cylinder Firing Order — 1, 3, 2, 4
Bore and Stroke	3-5/16" x 2.8"	3-5/16" x 2.8"
Cubic Inch Displacement	72.39 Cubic Inches	96.55 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 19" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 17" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt - Negative Ground
Alternator — Output Maximum	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V	Champion L20V
Breaker Point Gap	Breakerless	.010"
Compression Average Lbs.	155-165 P.S.I.	130-140 P.S.I.
Oil Ratio per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio per Gallon of Gas AFTER BREAK-IN	1/6 Pint	1/6 Pint

	105 H.P. (Magnapower II)	105 H.P. (Electronic)
Horsepower, BIA Rated @	5000 R.P.M.	5000 R.P.M.
Recommended Operating Range	4500-5500 R.P.M.	4500-5500 R.P.M.
Engine — Two Cycle	4 Cylinder Firing Order — 1, 3, 2, 4	4 Cylinder Firing Order — 1, 3, 2, 4
Bore and Stroke	3-5/16" x 2.8"	3-5/16" x 2.8"
Cubic Inch Displacement	96.55 Cubic Inches	96.55 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 17" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 17" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt — Negative Ground
Alternator — Output Maximum	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion UL18V	Champion L20V
Breaker Point Gap	Breakerless	Breakerless
Compression Average Lbs.	130-140 P.S.I.	105-165 P.S.I.
Oil Ratio per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio per Gallon of Gas AFTER BREAK-IN	1/6 Pint	1/6 Pint

	105 H.P. (Charger)	115 H.P. (Charger)
Horsepower, BIA Rated @	5000 R.P.M.	5250 R.P.M.
Recommended Operating Range	4500-5500 R.P.M.	5000-5500 R.P.M.
Engine — Two Cycle	4 Cylinder Firing Order — 1, 3, 2, 4	4 Cylinder Firing Order — 1, 3, 2, 4
Bore and Stroke	3-5/16" x 2.8"	3-5/16" x 2.8"
Cubic Inch Displacement	96.55 Cubic Inches	96.55 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 21" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 21" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt — Negative Ground
Alternator — Output Maximum	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V	Champion L20V
Breaker Point Gap	Breakerless	Breakerless
Compression Average Lbs.	150-165 P.S.I.	150-165 P.S.I.
Oil Ratio per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio Per Gallon of Gas AFTER BREAK-IN	1/6 Pint	1/6 Pint

	120 H.P.	120 H.P. (Magnapower II)
Horsepower, BIA Rated @	5250 R.P.M.	5250 R.P.M.
Recommended Operating Range	5000-5500 R.P.M.	5000-5500 R.P.M.
Engine — Two Cycle	4 Cylinder Firing Order — 1, 3, 2, 4	4 Cylinder Firing Order — 1, 3, 2, 4
Bore and Stroke	3-5/16" x 2.8"	3-5/16" x 2.8"
Cubic Inch Displacement	96.55 Cubic Inches	96.55 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 17" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 17" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt — Negative Ground
Alternator — Output Maximum	10 Amps at 5250 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 5250 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V	Champion UL18V
Breaker Point Gap	.010"	Breakerless
Compression Average Lbs.	145-155 P.S.I.	145-155 P.S.I.
Oil Ratio Per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio Per Gallon of Gas AFTER BREAK-IN	1/6 Pint	1/6 Pint

	120 H.P. (Electronic)	130 H.P.
Horsepower, BIA Rated @	5250 R.P.M.	5250 R.P.M.
Recommended Operating Range	5000-5500 R.P.M.	5000-5500 R.P.M.
Engine — Two Cycle	4 Cylinder Firing Order — 1, 3, 2, 4	4 Cylinder Firing Order — 1, 3, 2, 4
Bore and Stroke	3-5/16" x 2.8"	3-5/16" x 2.8"
Cubic Inch Displacement	96.55 Cubic Inches	96.55 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 17" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 19" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt - Negative Ground
Alternator — Output Maximum	10 Amps at 5250 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 5250 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V	Champion L20V
Breaker Point Gap	Breakerless	.010"
Compression Average Lbs.	150-165 P.S.I.	155-165 P.S.I.
Oil Ratio per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio per Gallon of Gas AFTER BREAK-IN	1/6 Pint	1/6 Pint

	135 H.P.	135 H.P. (Magnapower II)
Horsepower, BIA Rated @	5000 R.P.M.	5000 R.P.M.
Recommended Operating Range	4500-5500 R.P.M.	4500-5500 R.P.M.
Engine — Two Cycle	4 Cylinder Firing Order — 1, 3, 2, 4	4 Cylinder Firing Order — 1, 3, 2, 4
Bore and Stroke	3-3/8" x 2.8"	3-3/8" x 2.8"
Cubic Inch Displacement	99.8 Cubic Inches	99.8 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 19" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 19" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt — Negative Ground
Alternator — Output Maximum	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V	Champion UL18V
Breaker Point Gap	.010"	Breakerless
Compression Average Lbs.	155-165 P.S.I.	155-165 P.S.I.
Oil Ratio per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio per Gallon of Gas AFTER BREAK-IN	1/6 Pint	1/6 Pint

	135 H.P. (Racing)	135 H.P. (Electronic)
Horsepower, BIA Rated @	5400 R.P.M.	5000 R.P.M.
Recommended Operating Range	5200-5600 R.P.M.	4500-5500 R.P.M.
Engine — Two Cycle	4 Cylinder Firing Order — 1, 3, 2, 4	4 Cylinder Firing Order — 1, 3, 2, 4
Bore and Stroke	3-5/16" x 2.8"	3-3/8" x 2.8"
Cubic Inch Displacement	96.55 Cubic Inches	99.8 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 19" Pitch Right Hand Rotation	Aluminum Alloy 13" Dia. x 19" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground	12 Volt — Negative Ground
Alternator — Output Maximum	10 Amps at 5400 R.P.M. Alternator Cut In Speed 1000 R.P.M.	10 Amps at 5000 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V	Champion L20V
Breaker Point Gap	.010"	Breakerless
Compression Average Lbs.	175-185 P.S.I.	150-165 P.S.I.
Oil Ratio per Gallon of Gas BREAK-IN	1/3 Pint	1/3 Pint
Oil Ratio Per Gallon Gas AFTER BREAK-IN	1/3 Pint	1/6 Pint

	150 H.P. (Racing)
Horsepower, BIA Rated @	5400 R.P.M.
Recommended Operating Range	5200-5600 R.P.M.
Engine — Two Cycle	4 Cylinder Firing Order — 1, 3, 2, 4
Bore and Stroke	3-5/16" x 2.8"
Cubic Inch Displacement	96.55 Cubic Inches
Cooling	Water Cooled Displacement Type Water Pump
Propeller — Standard	Aluminum Alloy 13" Dia. x 19" Pitch Right Hand Rotation
Electric System	12 Volt — Negative Ground
Alternator — Output Maximum	10 Amps at 5400 R.P.M. Alternator Cut In Speed 1000 R.P.M.
Spark Plug Type	Champion L20V
Breaker Point Gap	.010"
Compression Average Lbs.	185-195 P.S.I.
Oil Ratio per Gallon of Gas BREAK-IN	1/3 Pint
Oil Ratio per Gallon of Gas AFTER BREAK-IN	1/3 Pint

★IMPORTANT

When pistons, piston rings, piston pins, connecting rods, connecting rod bearings, crankshaft and crankshaft bearings are replaced, the break-in oil ratio and procedure for new engines must be used. Refer to the appropriate Owners Guide for details.

SECTION III — TORQUE SPECIFICATIONS

(Values in inch-pounds unless stated otherwise)

SPECIAL ITEMS

H.P.	70, 75, 85, 90	105, 115, 120, 130, 135	135, 150 (Racing)
*CYLINDER HEAD	270—3/18-16 bolts 225—5/16-18 bolts	270—3/8-16 bolts 225—5/16-18 bolts	225
FLYWHEEL	90 Ft. Lbs.	90 Ft. Lbs.	90 Ft. Lbs.
MAIN BEARING BOLTS	270	270	270
CONNECTING ROD SCREWS	170	170	170
NOSE CONE NUT (Racing Engines)		325	325
DRIVE SHAFT NUT (Racing Engines)		50 Ft. Lbs.	50 Ft. Lbs.
PROPELLER SHAFT NUT (Racing Engines)		50 Ft. Lbs.	50 Ft. Lbs.
STEERING SUPPORT TUBE	65 Ft. Lbs.	65 Ft. Lbs.	
C-D MOUNTING NUTS (523301)	90	90	
C-D SHOCK MOUNT	40	40	

STANDARD HARDWARE

Screw Size	Torque
10-24	30
10-32	35
12-24	45
1/4-20	70
5/16-18	160
3/8-16	270
Gear Housing Plug	90-115
Spark Plug 14MM	120-180

*Torque from center out. Re-torque after engine has been run in.

SECTION IV — TUNE-UP — THREE CYLINDER ENGINES

1. MECHANICAL

1-1. Checking Compression

A. Remove spark plugs from cylinder head.

B. Engine should be cooled down and throttle control set at wide open throttle.

NOTE

Do not take compression readings with rust preventative oils squirted in engine. This will make readings unreliable.

C. Check compression of each cylinder. Each cylinder should be within specifications listed below:

1. 70 H.P. - 130-140 p.s.i.
2. 85 H.P. - 145-155 p.si.i.

NOTE

Add 5 pounds to compression range of engine tested with 15 hours or more running time.

1-2. Cylinder Head Bolt Torque

A. To properly re-torque cylinder head bolts, first loosen bolt then tighten or torque bolt to the following specifications:

1. For engines with 3/8" head bolt, torque bolt to 270 $\pm$ 5 in. lbs.
2. For engines with 5/16" head bolt, torque bolt to 225 $\pm$ 5 in. lbs.

CAUTION

Do not over torque cylinder head bolts or distortion of cylinder bores or cylinder head may occur.

Do not under torque or leakage of cylinder head gasket may occur.

B. Follow torquing sequence as shown in figure 1.

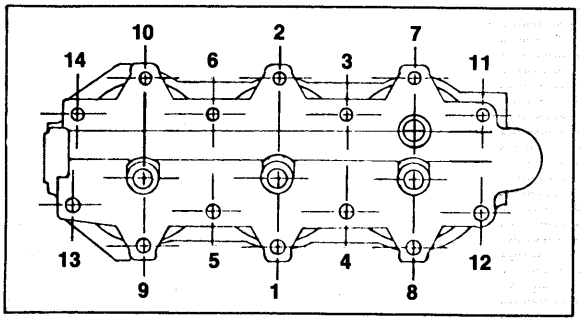


Figure 1–Torquing Sequence

1-3. Checking Lower Unit Grease

A. While engine is in a vertical plane (running position) remove plug from "grease fill" hole of lower gear housing. Allow a small amount of grease to flow from "fill" hole.

NOTE

Do not check gear housing grease immediately after engine has been run. Allow engine to stand in the running position for at least two (2) hours before checking gear grease. If water is present in lower unit, this time will allow water to settle down to the bottom of lower unit.

B. If no water is present, proceed as follows:

1. Turn fill plug back in two (2) turns.
2. Remove vent plug, then remove fill plug.
3. Quickly insert nozzle of gear lube tube in fill hole and add gear lube until it appears at vent hole.
4. Re-install vent plug and nylite washer.
5. Remove nozzle of gear lube tube and install fill plug and nyltite washer.

C. If water is present and it will drain prior to gear lube, proceed as follows:

1. Tighten fill plug in gear housing securely and remove vent screw from gear housing.
2. Thread adapter of pressure tester (Special Tool T8950) into vent hole of gear housing. Tighten adapter securely.

CAUTION

Do not pressurize gear housing beyond 10 p.s.i. as this may damage the seals.

3. Pump pressure up until gauge reads 10 p.s.i. Observe gauge for one (1) minute. If there is no pressure drop, proceed to the next step.

NOTE

If pressure drop is noted, remove lower unit from engine. Immerse lower unit in water and re-pressurize to 10 p.s.i. Observe for air bubbles. Replace any seal observed to be leaking.

4. Shift engine from forward to reverse gear positions several times. Observe pressure gauge. If pressure drop is noted, gear shift rod seal is failed and must be replaced.

5. Shift engine in neutral position. Rotate propeller shaft several revolutions. Observe pressure gauge. If pressure drop is noted, propeller shaft seal has failed and must be replaced.

6. If there is no pressure drop, then assume the lower unit is o.k. and water was from condensation in lower unit.

7. Remove pressure test adapter from gear housing.

8. Install vent plug in gear housing and tighten securely.

2. ELECTRICAL

2-1. Spark Plugs

A. Remove spark plugs with 13/16″ box end wrench or socket.

B. Inspect plugs for condition. Clean or replace plugs if necessary.

C. Re-install plugs and torque to 120 to 180 In. Lbs.

2-2. Points

A. Disconnect battery leads from battery.

B. Remove distributor cap by loosening two (2) screws on cap retaining clips as shown in figure 2.

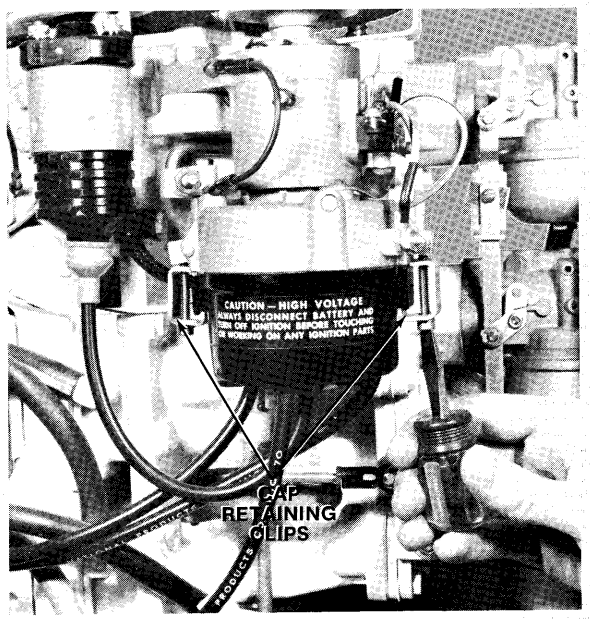


Figure 2–Removing Distributor Cap

C. Remove two (2) screws securing distributor to powerhead as shown in figure 3.

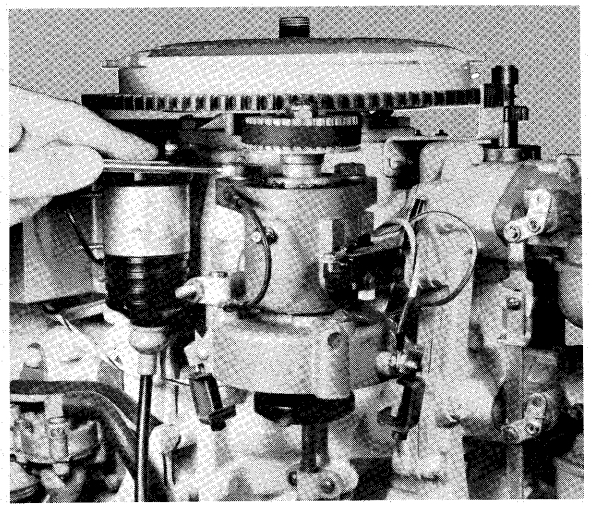


Figure 3–Removing Distributor

Slip off distributor belt and remove distributor.

D. Inspect breaker point contacts surfaces visually. If they are burnt or pitted, they should be replaced. Do not file breaker points. Replace with new parts.

E. Breaker points are adjusted using feeler gauge set (Special Tool T8930-1) to .014.

NOTE

Correct spacing or gap will be closely approximated when a feeler gauge has a slight drag when slipped between the points. Only a steel gauge which is smooth and unworn must be used.

When setting breaker point gap, be certain follower arm of breaker point is on high point of one of the lobes on rotor shaft.

F. After setting breaker point gap, clean the breaker point contacts to remove any oily film which may have been left by the feeler gauge set. Insert a clean piece of hard surface cardboard between the contact surfaces and hold the points closed on the cardboard. Rotate the cardboard using the points as a pivot. The cardboard should be used in several spots until no oily spots can be seen.

G. Install distributor cap on distributor housing by aligning locating pin in distributor housing with hole in distributor cap. Secure distributor cap to housing as shown in figure 2.

H. Install distributor housing on powerhead as shown in figure 3. Do not tighten screws at this time.

I. Proceed to the following paragraph for completion of timing engine and assembly.

2-3. Timing Engine

A. Check to see that battery leads are disconnected from battery. If not, disconnect battery leads from battery.

B. Remove all spark plugs from cylinder head.

C. Install barrel of timing tool (Special Tool T2937-1) in top cylinder spark plug hole. Screw barrel completely in spark plug hole.

D. Insert rod portion (Special Tool T2937A) of timing tool in barrel with two (2) marks identified as "70 H.P. and Up" towards the outside.

E. Holding the rod tight against the piston, rotate crankshaft in direction of engine rotation and locate top dead center (point at which piston is closest to cylinder head or point at which marks on rod extend furthest away from barrel). See figure 4.

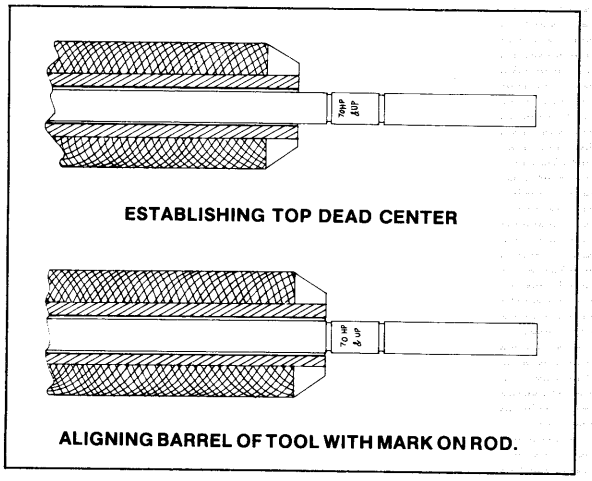


Figure 4–Location Top Dead Center

Screw barrel of the timing tool in or out as required until inside line of the timing rod lines up with edge of barrel as shown in figure 4.

F. Apply slight pressure to end of rod with finger and turn crankshaft clockwise in direction of engine rotation until outer line of rod lines up with edge of barrel as shown in figure 5.

NOTE

Rod will go completely in barrel of timing tool. Continue to hold finger over hole in barrel until rod comes back out. If finger is removed, rod will shoot out of barrel on compression stroke of piston. As rod is coming out of barrel, periodically check to find location of outer line in relationship to end of barrel because if outer line goes beyond edge of barrel engine must be rotated clockwise again.

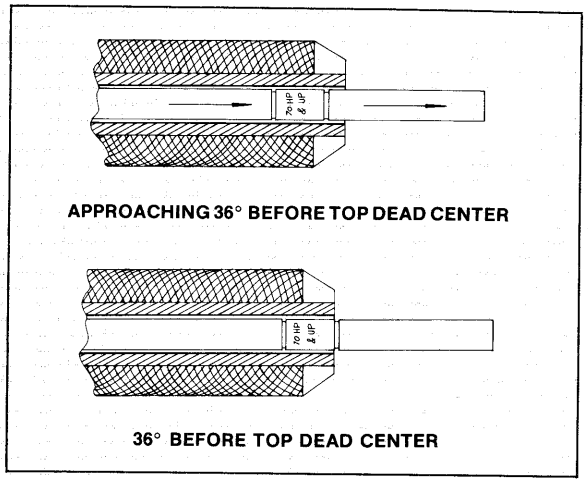


Figure 5–Establishing 36° Before Top Dead Center

The piston is now positioned at 36° before top dead center.

G. The 36° mark on flywheel and the index line (I) on the timing pointer must be in alignment with each other; if not, shift timing pointer by loosening the two (2) screws securing pointer to powerhead and align these two (2) points.

H. Turn flywheel to align 0° mark on flywheel with pointer index line (I). Turn distributor pulley to match the index mark on distributor pulley with outside diameter of flywheel. See figure 6.

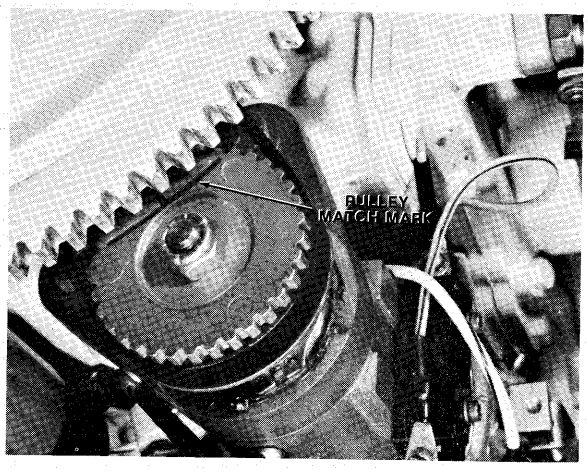


Figure 6–Aligning Distributor Pulley Match Mark With Flywheel

When the match mark on the distributor pulley is aligned with the outside diameter of flywheel, install distributor belt over pulley and adjust distributor to obtain a slight deflection (1/4 inch with one (1) pound force exerted). Tighten two (2) screws securing distributor bracket to powerhead as shown in figure 3.

NOTE

One method of adjusting distributor belt tension is to use a .008" thickness feeler gauge from T8930 or T8930-1 gauge set. Position tip of feeler gauge against middle of belt length and push against belt until feeler gauge bends with no further movement of belt. Belt should deflect from 3/16" to 1/4" or proper tension. Belt should not deflect more than 1/4" or it will be too loose and variation of timing may occur. Belt should not deflect less than 3/16" or it may cause towershaft linkage to bind and/or excessive wear on towershaft bearings. See figure 7.

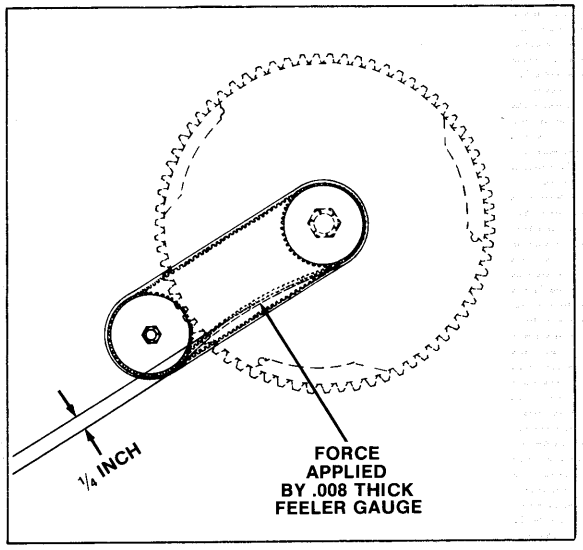


Figure 7–Measuring Belt Deflection Using .008" Thick Feeler Gauge

I. Remove throttle link from towershaft. Set towershaft at wide open throttle position (towershaft turned until nylon stop of middle towershaft arm is against crankcase cover of cylinder).

J. Turn flywheel clockwise (same as engine rotation) to line up 36° mark on flywheel with the -4 mark (32° before top dead center) on timing pointer. See figure 8.

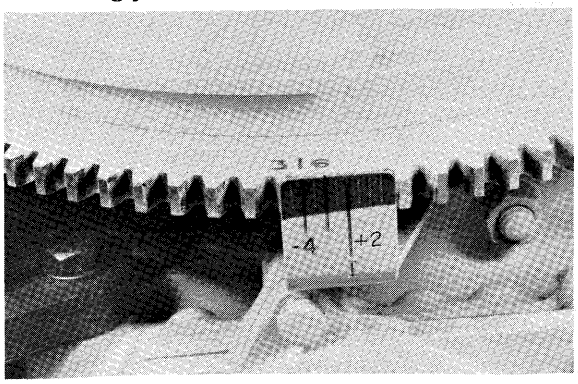


Figure 8–Aligning 36° Mark on Flywheel With Timing Pointer

K. Connect lead of test light (Special Tool T2938-1) to distributor primary lead wire post and to ground (ground post on coil) as shown in figure 9.

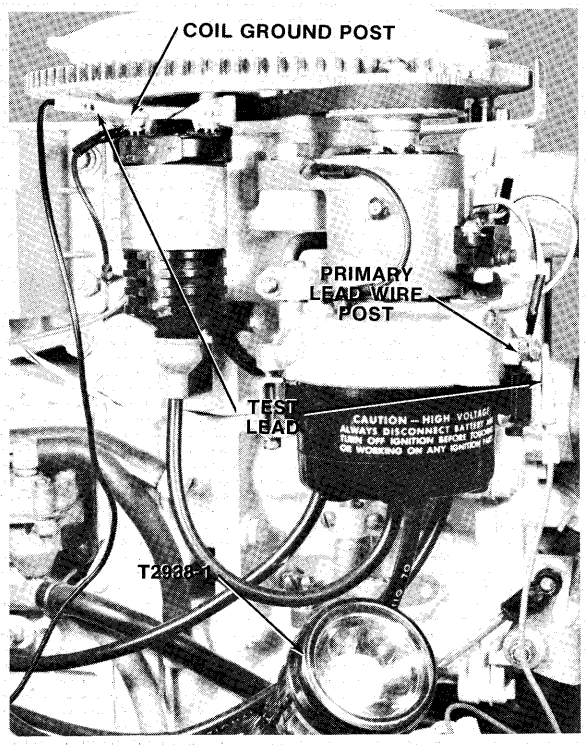


Figure 9–Connecting Leads of Test Light

L. Loosen lock nut on distributor control rod. If test light is on, turn distributor control rod counterclockwise until light just goes off or dims.

If test light is off, turn distributor control rod clockwise until light just comes on.

Check for proper adjustment by pushing lightly on distributor belt. Light should go on and off with each push.

NOTE

Distance between nylon swivels should be between 3/8 and 1/2 inch when timing is properly adjusted. If it is more or less than specification, check the following:

1. Flywheel turned to align 36° mark on flywheel and pointer from wrong direction (counterclockwise instead of clockwise).
2. Breaker point gap not within specification.
3. Distributor belt not properly installed on distributor pulley (belt installed on distributor pulley when flywheel was not at top dead center). See steps D through I.

M. While holding distributor control rod, tighten lock nut to secure rod in position.

2-4. Adjusting Neutral Interlock Switch Cam (distributor)

A. Shift engine in neutral gear position.

B. Advance towershaft to neutral stop arm as shown in figure 10.

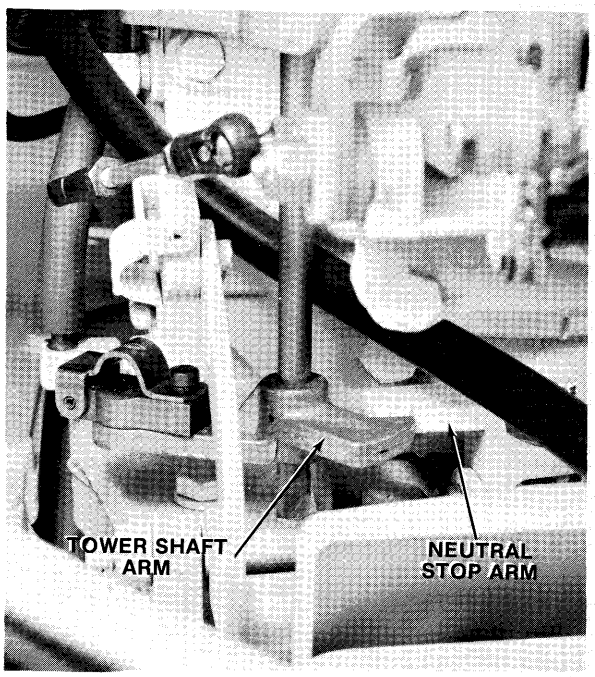


Figure 10–Towershaft Positioned Against Neutral Stop Arm

C. Connect leads of test light (Special Tool T2938-1) to neutral interlock switch as shown in figure 11.

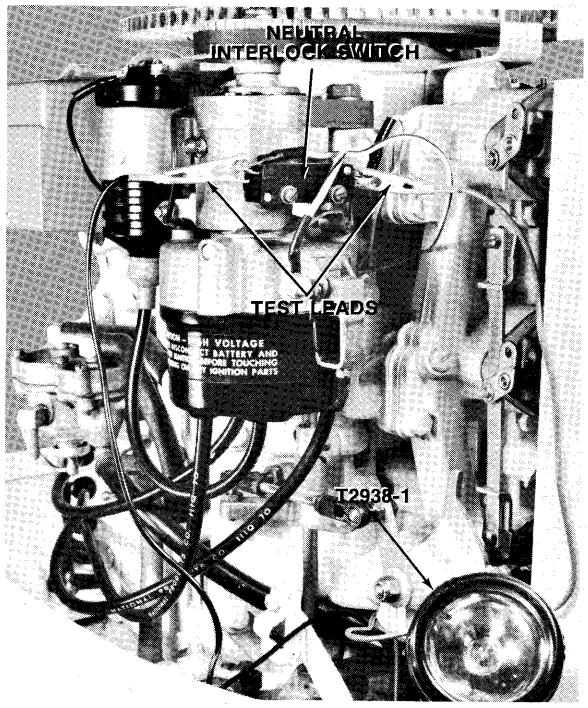


Figure 11–Connection of Test Light Lead Wires

D. Loosen screws securing cam to distributor housing.

E. Shift cam forcing button on switch upward until test light just comes on.

F. Tighten screws on cam to secure position.

2-5. Adjusting Neutral Interlock Switch Cam (Shift Arm)

A. Shift engine in neutral gear position.

B. Advance towershaft to neutral stop as shown in figure 10.

C. Connect leads of test light (Special Tool T29384) to neutral interlock switch as shown in figure 11A.

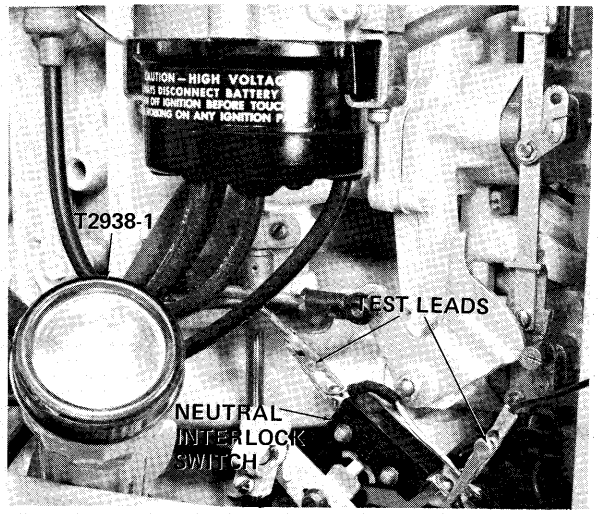


Figure 11A—Connection of Test Light Lead Wires

D. Loosen screws securing cam to distributor housing.

E. Shift cam forcing button on switch upward until test light just comes on.

F. Tighten screws on cam to secure position.

3. CARBURETOR

3-1. Synchronizing Throttle Shutters

A. Snap throttle link off towershaft and pivot throttle cam away from throttle roller on carburetor.

B. Loosen throttle tie bar screws as shown in figure 12.

C. Check to be sure that throttle shutters are closed.

D. Tighten throttle tie bar screws (see figure 12).

E. Snap throttle link on towershaft.

F. Set engine at wide open throttle position and check throttle shutters to see if they are in horizontal position. Adjust link between throttle cam and towershaft if necessary.

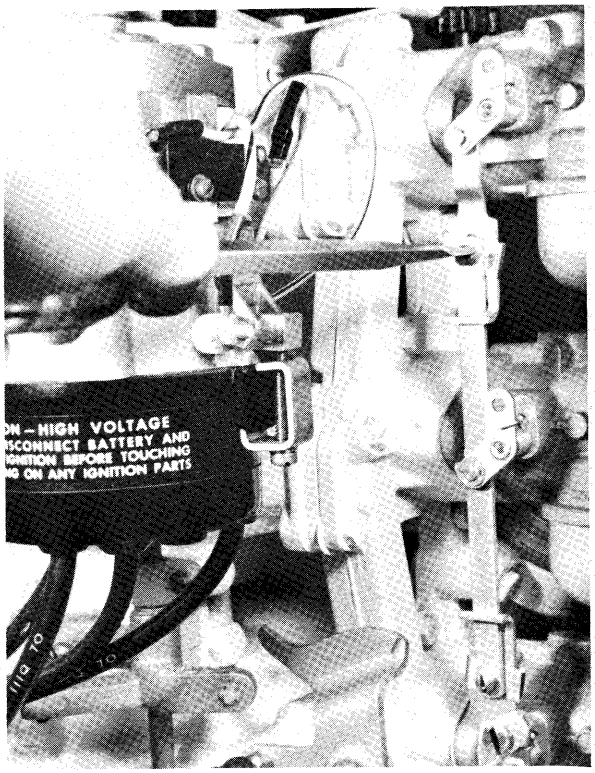


Figure 12–Loosening Throttle Tie Bar Screw

3-2. Adjusting Throttle Pick-Up

A. Disconnect throttle link at towershaft.

B. Adjust throttle roller shaft by loosening stop nut and turn shaft until throttle roller just contacts the throttle cam at index line as shown in figure 13.

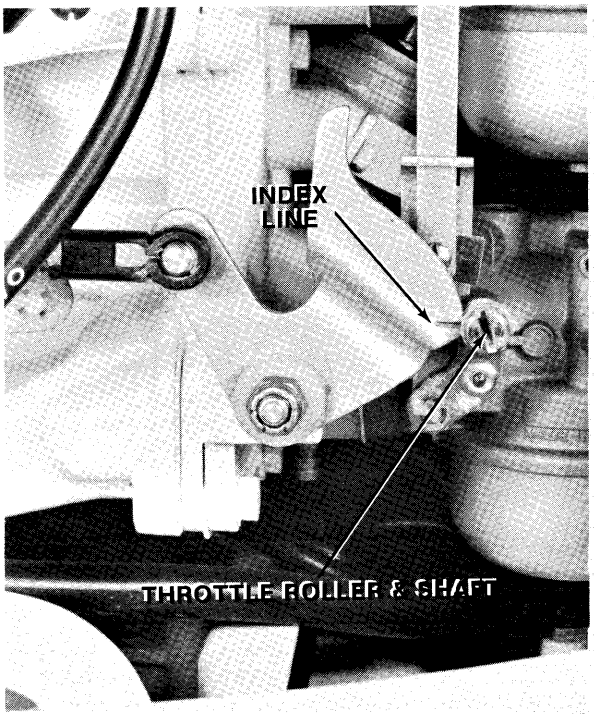


Figure 13–Adjusting Point of Throttle Opening

C. Secure roller position by tightening stop nut.

D. Install throttle link on towershaft.

E. Move towershaft to wide open throttle stop.

F. Loosen jam nuts on throttle link between towershaft and throttle cam.

G. Adjust throttle link until throttle shutters are horizontal.

H. Tighten jam nuts on throttle link to secure throttle link position.

3-3. Adjusting Carburetor

A. Turn idle adjustment screw clockwise until it seats in the carburetor.

CAUTION

Do not force idle adjustment screw or the tip will be damaged.

B. Open idle adjustment screw one (1) turn counterclockwise.

C. Shift engine to neutral gear position and start motor. Allow engine to warm up to operating temperature.

D. Shift engine to forward gear. Throttle engine back to lowest reliable throttle setting.

E. Turn idle adjustment screw on top carburetor clockwise 1/8 turn with at least ten (10) seconds between each adjustment until the engine begins to "pop" from the lean fuel/air setting. Note position of screwdriver slot on idle adjustment screw.

F. Turn idle adjustment screw counterclockwise to original position. Turn idle adjustment screw counterclockwise 1/8 turn at a time with periods of at least ten (10) seconds between each adjustment until the engine begins to "roll or gallop" from the rich fuel/air setting. Note idle adjustment screw setting.

G. Turn idle adjustment screw to midpoint between the settings noted in steps E and F.

H. Follow steps E and F for adjustment of middle carburetor.

I. After top and middle carburetors have been adjusted, turn engine off. Turn each idle adjustment needle clockwise until it seats in carburetor noting number of turns on each carburetor. Average the two carburetors and set all three carburetors at this average. For example: Top carburetor is set at 7/8 turn and middle carburetor at 5/8 turn. Set all three carburetors at 3/4 turn.

J. Adjust idle stop screw on towershaft as necessary until engine idles between 700-900 R.P.M.'s in neutral gear position.

3-4. Synchronizing Choke Shutters

A. Remove carburetor intake cover.

B. Loosen screws on choke swivels freeing choke link.

C. Position top end of link approximately 1/16 to 1/8 inch beyond top of top carburetor choke swivel. Tighten screw to secure link in swivel.

D. Close top carburetor choke shutter fully. While holding top carburetor choke shutter closed, close middle carburetor choke shutter and tighten middle carburetor choke swivel screw to secure link to swivel. Use same procedure for bottom carburetor choke shutter.

E. Loosen two (2) screws securing choke solenoid just enough so that solenoid can be moved easily.

F. Slip a piece of paper approximately 1/2 inch wide in both carburetor air horns.

NOTE

The purpose of the paper is to insure proper clearance between choke shutter and air horn of carburetor to prevent shutters from sticking in the closed position.

G. With pieces of paper in air horns of carburetors, close choke shutters fully against the pieces of paper by pushing only on choke solenoid plunger as shown in figure 14.

H. While holding choke shutters closed by the choke plunger, slide choke solenoid against plunger. Tighten screws to secure choke solenoid in position.

I. Release choke solenoid plunger and push plunger back in solenoid. Pull paper out of carburetor air horns; paper must slide out of carburetor easily or with a slight drag. If not, adjust solenoid position as outlined in step G.

J. Release choke solenoid plunger and check to see that choke shutters are horizontal. If they are not and are tilted upward, bend groove pin (shutter stop) in air horn of carburetor.

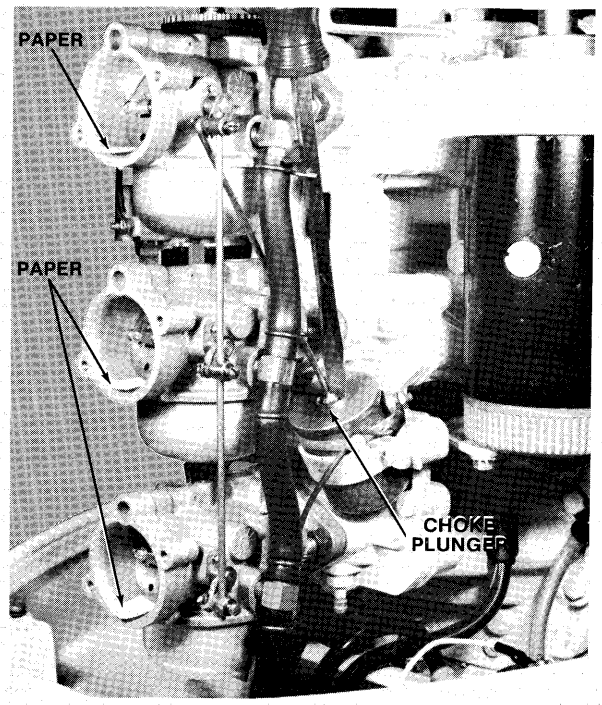


Figure 14–Closing Choke Shutters

SECTION IVA — TIMING — BREAKERLESS IGNITION

1. TIMING

A. Disconnect battery leads from battery terminals.

B. Remove all spark plugs from cylinder head.

C. Check position of timing decal on flywheel ring gear. If decal is not positioned properly install new decal aligning 0° and 36° with marks on flywheel ring gear.

D. Install barrel of timing tool (Special Tool T2937-1) in top cylinder spark plug hole. Screw barrel completely in spark plug hole.

E. Insert rod portion (Special Tool T2937A) of timing tool in barrel with two (2) marks identified as 25 thru 55 H.P. towards the outside.

F. Holding the rod tightly against the piston, rotate crankshaft in direction of engine rotation and locate top dead center (point at which piston is closest to cylinder head or point at which marks on rod extend furthest away from barrel). See figure 1.

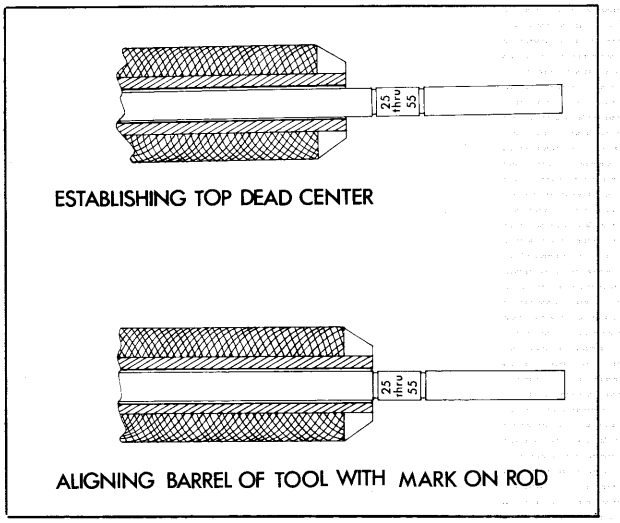


Figure 1 - Locating Top Dead Center

Screw barrel of the timing tool in or out as required until inside line of the timing rod lines up with edge of barrel as shown in figure 1.

G. Apply slight pressure to end of rod with finger and turn crankshaft clockwise in direction of engine rotation until outer line of rod lines up with edge of barrel as shown in figure 2.

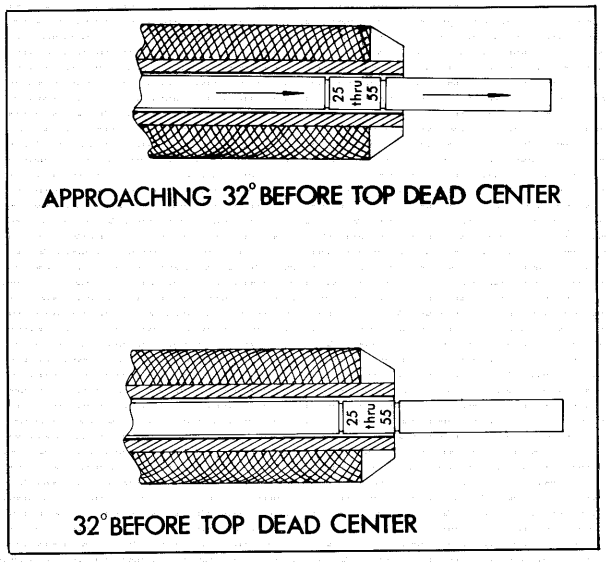


Figure 2 - Establishing 32° BTDC

NOTE

Rod will go completely in barrel of timing tool. Continue to hold finger over hole in barrel until rod comes back out. If finger is removed, rod will shoot out of barrel on compression stroke of piston. As rod is coming out of barrel, periodically check to find location of outer line in relationship to end of barrel. If outer line goes beyond edge of barrel, engine must be rotated clockwise again.

The piston is now positioned at 32° before top dead center.

H. Check decal on ring gear of flywheel for alignment with index mark on timing pointer. 32° BTDC mark on decal must line up with index mark on timing pointer. If marks do not align, adjust timing pointer.

I. Remove timing tool from cylinder head.

J. Turn flywheel to align TDC mark on decal with index mark on timing pointer. Turn distributor pulley to match the index mark on pulley with outside diameter of flywheel. See figure 3.

When the match mark on the distributor pulley is aligned with the outside diameter of flywheel, install distributor belt over pulley and adjust distributor belt tension. See figure 4.

NOTE

One method of adjusting distributor belt tension is to use a .008" thickness feeler gauge. Position tip of feeler

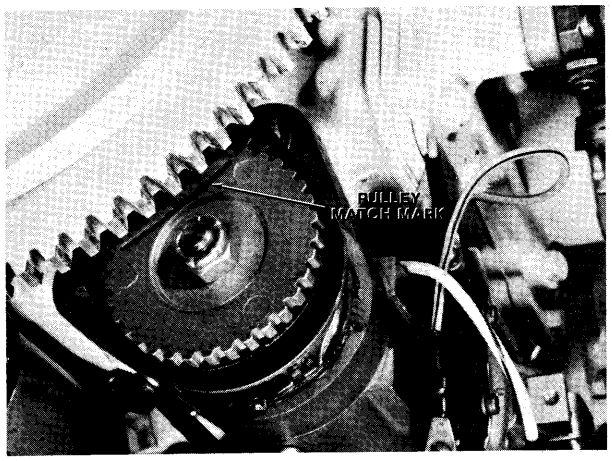


Figure 3 - Aligning Distributor Pulley Match Mark With Flywheel

gauge against middle of belt length and push against belt until feeler gauge bends with no further movement of belt. Belt should deflect from 3/16" to 1/4" for proper tension. Belt should not deflect more than 1/4" or it will be too loose and variation of timing will occur. Belt should not deflect less than 3/16" or it may cause towershaft linkage to bind and/or excessive wear on towershaft bearings.

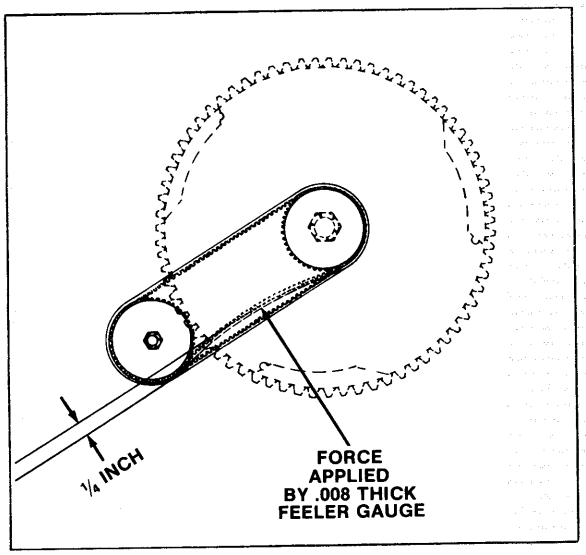


Figure 4 - Measuring Belt Deflection Using .008" Thick Feeler Gauge

K. Adjust distributor control rod so that distance between nylon swivels is 3/8 to 1/2 inch. See figure 5.

L. There are two methods to set timing: Method No. 1 with voltmeter (static) and method No. 2 with timing light (running). After completing steps A through K, timing may be checked using either method as outlined below.

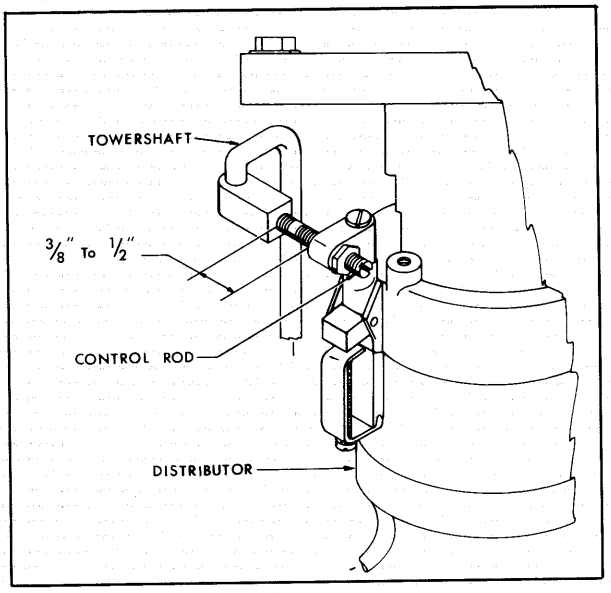


Figure 5 - Adjusting Distributor Control Rod

Method No. 1 - Voltmeter

1. Disconnect battery leads from battery terminals.
2. Disconnect white/black stripe wire from terminal on distributor housing.
3. Advance towershaft to wide open throttle.
4. Rotate flywheel to align 32° mark on decal with index mark on timing pointer.
5. Connect positive (+) voltmeter lead to distributor terminal where white/black stripe lead was removed and negative (—) voltmeter lead to a good ground.
6. Connect battery leads to battery terminals.
7. Turn ignition switch to "on" or "run" position.
8. Loosen lock nut on distributor control rod. (See figure 5). Turn control rod ununtil reading on voltmeter goes from A voltage to NO voltage. While holding control rod, tighten lock nut to secure rod in position.
9. Recheck for proper adjustment by touching distributor belt and watch reading on voltmeter. Needle on voltmeter should go from A voltage to NO voltage.

Method No. 2 - Timing Light

1. Connect timing light to No. 1 cylinder spark plug lead wire.
2. Start engine and accelerate to WOT. Observe alignment of timing marks (32° mark on decal to index mark on timing pointer). If marks are not aligned, retard engine and shut engine off.

3. Adjust control rod between towershaft and distributor. (See figure 5). Re-start engine and check timing at WOT. Repeat above procedure until 32° mark on flywheel aligns with index mark on timing pointer.

SECTION V — TUNE-UP — FOUR CYLINDER ENGINES

1. MECHANICAL

1-1. Checking Compression

A. Remove spark plugs from cylinder head.

B. Engine should be cooled down and throttle control set at wide open throttle.

NOTE

Do not take compression readings with rust preventative oils squirted in engine. This will make readings unreliable.

C. Check compression of each cylinder. Each cylinder should be within specifications listed below:

1. 105 H.P. — 130-140 p.s.i.
2. 120 H.P. — 145-155 p.s.i.
3. 130 H.P. — 155-165 p.s.i.
4. 135 H.P. — 175-185 p.s.i.
5. 150 H.P. — 185-195 p.s.i.

NOTE

Add 5 pounds to compression range of engine tested with 15 hours or more running time.

1-2. Cylinder Head Bolt Torque

A. To properly re-torque cylinder head bolts, first loosen bolt then tighten or torque bolt to the following specifications:

1. For 105 H.P. with 3/8" head bolt, torque bolt to 270 ± 5 in. lbs.

   For 105 H.P. with 5/16" head bolt, torque bolt to 225 ± 5 in. lbs.

2. For 120 H.P. and 130 H.P., torque bolt to 225 ± 5 in. lbs.
3. For 135 H.P. with 3/8-16 studs, torque nuts to 270 ± 5 in. lbs.
4. For 135 H.P. and 150 H.P. with 5/16-18 studs, torque nuts to 225 ± 5 in. lbs.

CAUTION

Do not over torque cylinder head bolts or distortion of cylinder bores or cylinder head may occur.

Do not under torque or leakage of cylinder gasket may occur.

B. Follow torquing sequence as shown in figure 1.

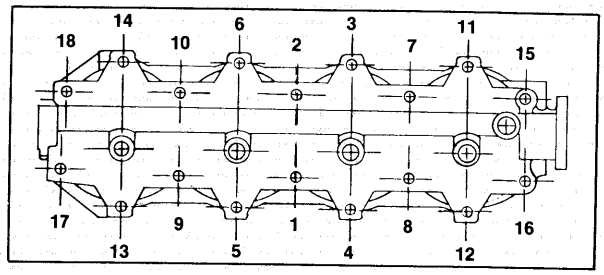


Figure 1–Torquing Sequence

1-3. Checking Lower Unit Grease

A. While engine is in a vertical plane (running position) remove plug from "grease fill" hole of lower gear housing. Allow a small amount of grease to flow from "fill" hole.

NOTE

Do not check gear housing grease immediately after engine has been run. Allow engine to stand in the running position for at least two (2) hours before checking gear grease. If water is present in lower unit, this time will allow water to settle down to the bottom of lower unit.

B. If no water is present, proceed as follows:

1. Turn fill plug back in two (2) turns.
2. Remove vent plug, then remove fill plug.
3. Quickly insert nozzle of gear lube tube in fill hole and add gear lube until it appears at "vent" hole.
4. Re-install vent plug and nyltite washer.
5. Remove nozzle of gear lube tube and install fill plug and nyltite washer.

C. If water is present and it will drain prior to gear lube, proceed as follows:

1. Tighten fill plug in gear housing securely and remove vent screw from gear housing.
2. Thread adapter of pressure tester (Special Tool T8950) into vent hole of gear housing. Tighten adapter securely.

CAUTION

Do not pressurize gear housing beyond 10 p.s.i. as this may damage the seals.

3. Pump pressure up until gauge reads 10 p.s.i. Observe gauge for one (1) minute. If there is no pressure drop, proceed to the next step.

NOTE

If pressure drop is noted, remove lower unit from engine. Immerse lower unit in water and re-pressurize to 10 p.si.i. Observe for air bubbles. Replace any seal observed to be leaking.

4. Shift engine from forward to reverse gear positions several times. Observe pressure gauge. If pressure drop is noted, gear shift rod seal has failed and must be replaced.
5. Shift engine in neutral position. Rotate propeller shaft several revolutions. Observe pressure gauge. If pressure drop is noted, propeller shaft seal is failed and must be replaced.
6. If there is no pressure drop, then assume the lower unit is o.k. and water was from condensation in lower unit.
7. Remove pressure test adapter from gear housing.
8. Install vent plug in gear housing and tighten securely.

2. ELECTRICAL

2-1. Spark Plugs

A. Remove spark plugs with 13/16" box end wrench or socket.

B. Inspect plugs for condition. Clean or replace plugs if necessary.

C. Re-install plugs and torque to 120 to 180 in lbs.

2-2. Points

A. Disconnect battery leads from battery.

B. Remove distributor cap by loosening two (2) screws on cap retaining clips as shown in figure 2.

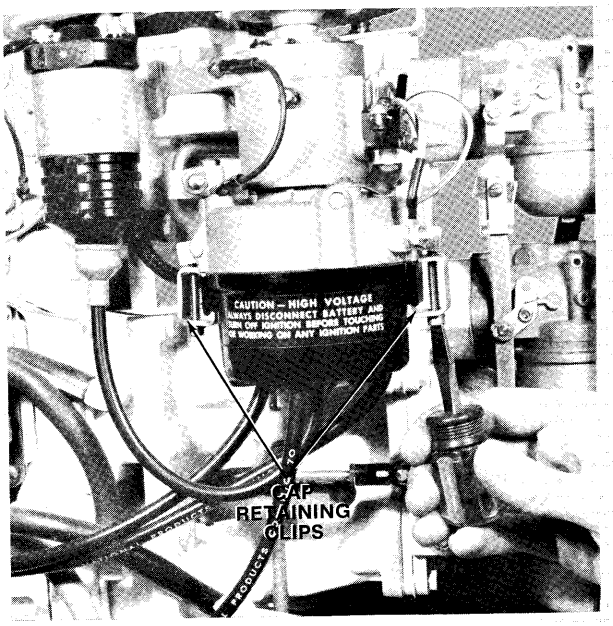


Figure 2–Removing Distributor Cap

C. Remove two (2) screws securing distributor to powerhead as shown in figure 3.

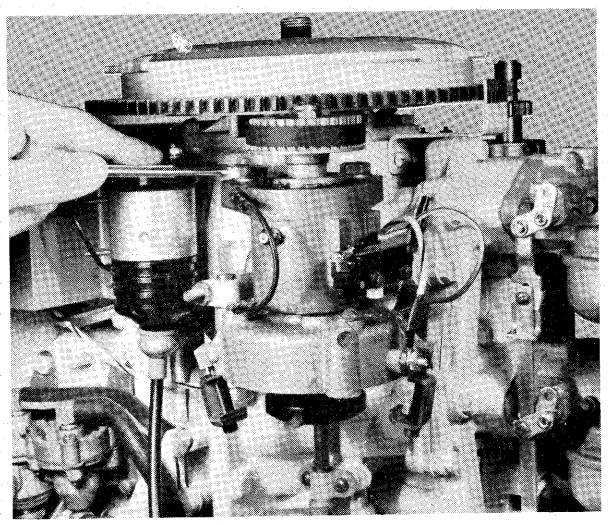


Figure 3–Removing Distributor

Slip off distributor belt and remove distributor.

D. Inspect breaker point contacts surfaces visually. If they are burnt or pitted, they should be replaced. Do not file breaker points. Replace with new parts.

E. Breaker points are set using feeler gauge set (Special Tool T8930-1) to specifications as follows:

.010" for 4 cylinder engines.

NOTE

Correct spacing or gap will be closely approximated when a feeler gauge has a slight drag when slipped between the points. Only a steel gauge which is smooth and unworn must be used.

When setting breaker point gap, be certain follower arm of breaker point is on high point on one of the lobes on rotor shaft.

F. After setting breaker point gap, clean the breaker point contacts to remove any oily film which may have been left by the feeler gauge set. Insert a clean piece of hard surface cardboard between the contact surfaces and hold the points closed on the cardboard. Rotate the cardboard using the points as a pivot. The cardboard should be used in several spots until no oily spots can be seen.

G. Install distributor cap on distributor housing by aligning locating pin in distributor housing with hole in distributor cap. Secure distributor cap to housing as shown in figure 2.

H. Install distributor housing on powerhead as shown in figure 3. Do not tighten screws at this time.

I. Proceed to the following paragraph for completion of timing engine and assembly.

2-3. Timing Engine

A. Check to see that battery leads are disconnected from battery. If not, disconnect battery leads from battery.

B. Remove all spark plugs from cylinder head.

C. Install barrel of timing tool (Special Tool T2937-1) in top cylinder spark plug hole. Screw barrel completely in spark plug hole.

D. Insert rod portion (Special Tool T2937A) of timing tool in barrel with two (2) marks identified as "70 H.P. and Up" towards the outside.

E. Holding the rod tight against the piston, rotate crankshaft in direction of engine rotation and locate top dead center (point at which piston is closest to cylinder head or point at which marks on rod extend furthest away from barrel). See figure 4.

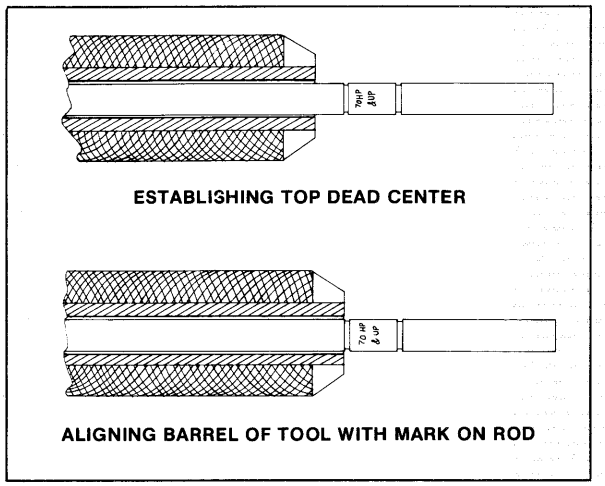


Figure 4–Location Top Dead Center

Screw barrel of the timing tool in or out as required until inside line of the timing rod lines up with edge of barrel as shown in figure 4.

NOTE

Rod will go completely in barrel of timing tool. Continue to hold finger over hole in barrel until rod comes back out. If finger is removed, rod will shoot out of barrel on compression stroke of piston. As rod is coming out of barrel, periodically check to find location of outer line in relationship to end of barrel because if outer line goes beyond edge of barrel engine must be rotated clockwise again.

F. Apply slight pressure to end of rod with finger and turn crankshaft clockwise in direction of engine rotation until outer line of rod lines up with edge of barrel as shown in figure 5.

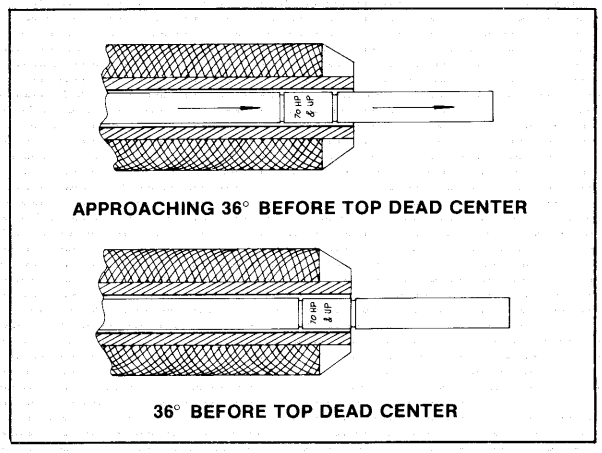


Figure 5–Establishing 36° Before Top Dead Center

The piston is now positioned at 36° before top dead center.

G. The 36° mark on flywheel and the index line (I) on the timing pointer must be in alignment with each other; if not, shift timing pointer by loosening the two (2) screws securing pointer to powerhead and align these two (2) points.

H. Turn flywheel to align 0° mark on flywheel with pointer index line (I). Turn distributor pulley to match the index mark on distributor pulley with outside diameter of flywheel. See figure 6.

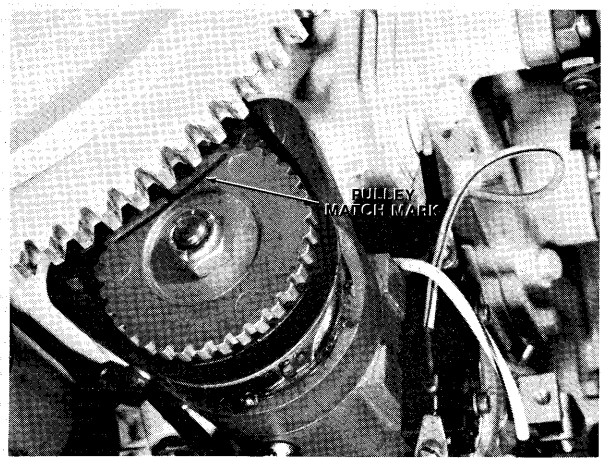


Figure 6–Aligning Distributor Pulley Match Mark With Flywheel

When the match mark on the distributor pulley is aligned with the outside diameter of flywheel, install distributor belt over pulley and adjust distributor to obtain a slight deflection (1/4 inch with one (1) pound force exerted). Tighten two (2) screws securing distributor bracket to powerhead as shown in figure 3.

NOTE

One method of adjusting distributor belt tension is to use a .008" thickness feeler gauge from T8930 or T8930-1 gauge set.

Position tip of feeler gauge against middle of belt length and push against belt until feeler gauge bends with no further movement of belt. Belt should deflect from 3/16" to 1/4" for proper tension. Belt should not deflect more than 1/4" or it will be too loose and variation of timing may occur. Belt should not deflect less than 3/16" or it may cause towershaft linkage to bind and/or excessive wear on towershaft bearings. See figure 7.

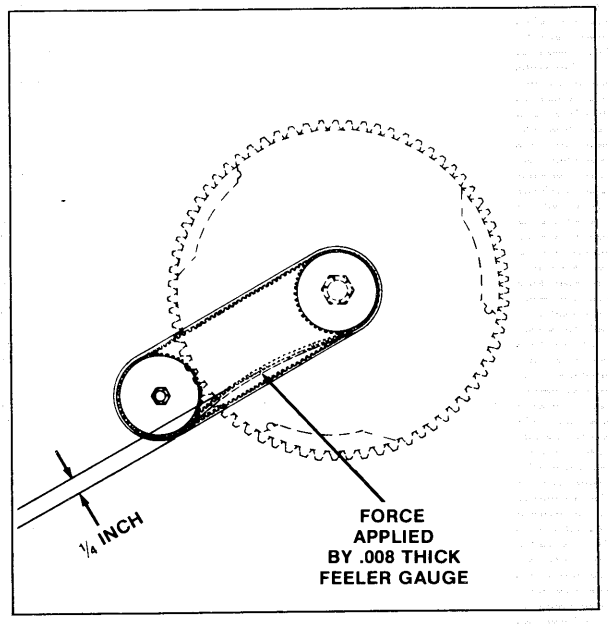
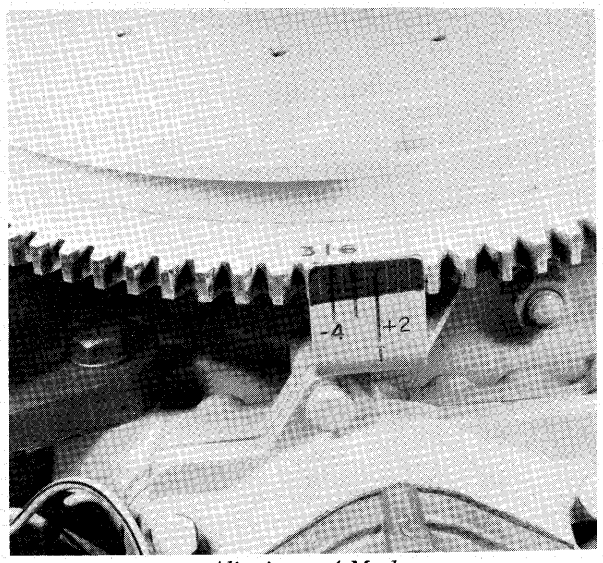


Figure 7–Measuring Belt Deflection Using .008" Thick Feeler Gauge

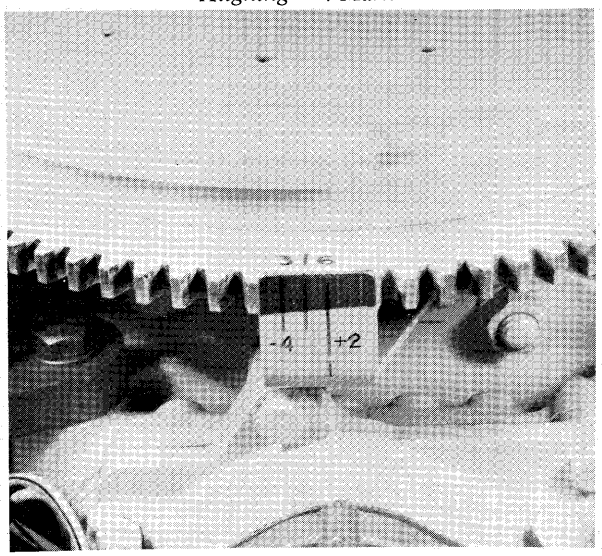
I. Remove throttle link from towershaft. Set towershaft at wide open throttle position (towershaft turned until nylon stop of middle towershaft arm is against crankcase cover of cylinder).

J. Turn flywheel clockwise (same as engine rotation) to line up 36° mark on flywheel with the appropriate mark on timing pointer as follows:

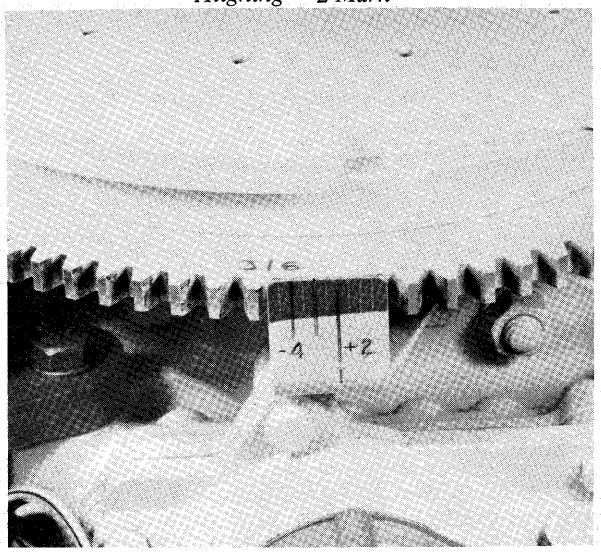
1. -4 mark (32° before top dead center) for 105 H.P. See figure 8.
2. -2 mark (2nd mark to left of "I" index mark or 34° BTDC) for 120 and 130 H.P. See figure 8.
3. -6 mark (6th mark to left of "I" index mark or 30° BTDC) for 135 and 150 H.P. See figure 8.



Aligning – 4 Mark



Aligning – 2 Mark



Aligning – 6 Mark

Figure 8–Aligning 36° Mark on Flywheel With Timing Pointer

K. Connect leads of test light (Special Tool T2938-1) to distributor primary lead wire post and to ground (ground post on coil) as shown in figure 9.

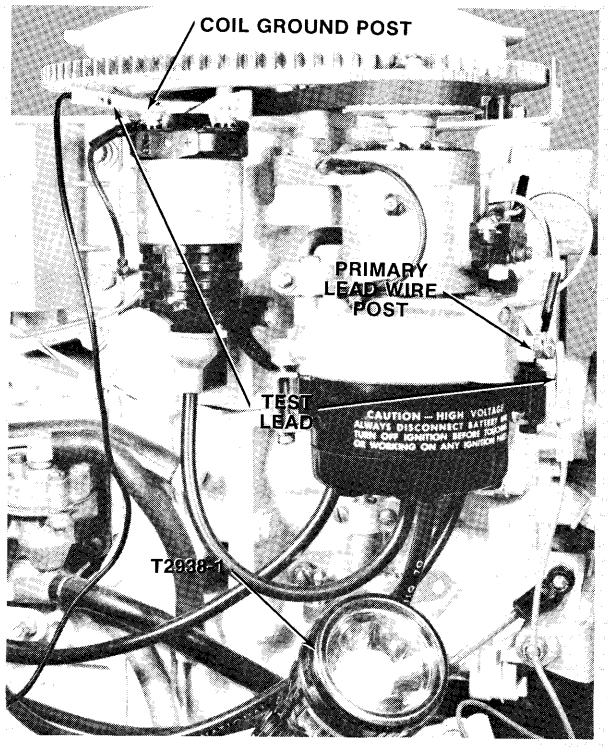


Figure 9–Connecting Leads of Test Light

L. Loosen lock nut on distributor control rod. If test light is on, turn distributor control rod counterclockwise until light just goes off or dims.

If test light is off, turn distributor control rod clockwise until light just comes on.

Check for proper adjustment by pushing lightly on distributor belt. Light should go on and off with each push.

NOTE

Distance between nylon swivels should be between 3/8 and 1/2 inch when timing is properly adjusted. If it is more or less than specification, check the following:

1. Flywheel turned to align 36° mark on flywheel and pointer from wrong direction (counterclockwise instead of clockwise).
2. Breaker point gap not within specification.
3. Distributor belt not properly installed on distributor pulley (belt installed on distributor pulley when flywheel was not at top dead center). See steps D through I.

M. While holding distributor control rod, tighten lock nut to secure rod in position.

2-4. Adjusting Neutral Interlock Switch Cam (distributor)

A. Shift engine in neutral gear position.

B. Advance towershaft to neutral stop arm as shown in figure 10.

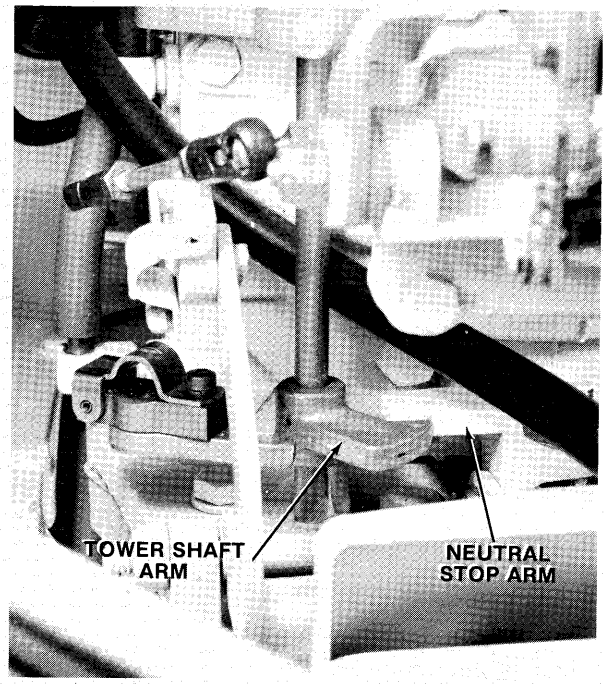


Figure 10–Towershaft Positioned Against Neutral Stop Arm

C. Connect leads of test light (Special Tool T2938-1) to neutral interlock switch as shown in figure 11.

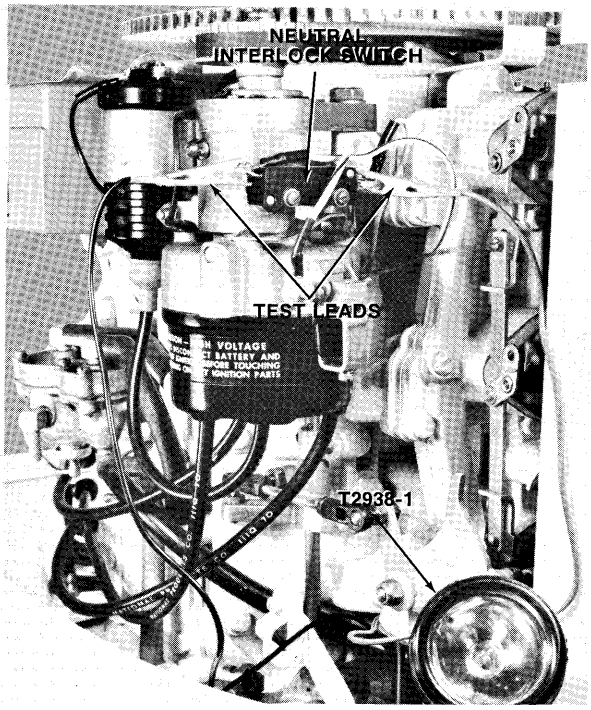


Figure 11–Connection of Test Light Lead Wires

D. Loosen screws securing cam to distributor housing.

E. Shift cam forcing button on switch upward until test light just comes on.

F. Tighten screws on cam to secure position.

2-5. Adjusting Neutral Interlock Switch Cam (Shift Arm)

A. Shift engine in neutral gear position.

B. Advance towershaft to neutral stop as shown in figure 10.

C. Connect leads of test light (Special Tool T29384) to neutral interlock switch as shown in figure 11A.

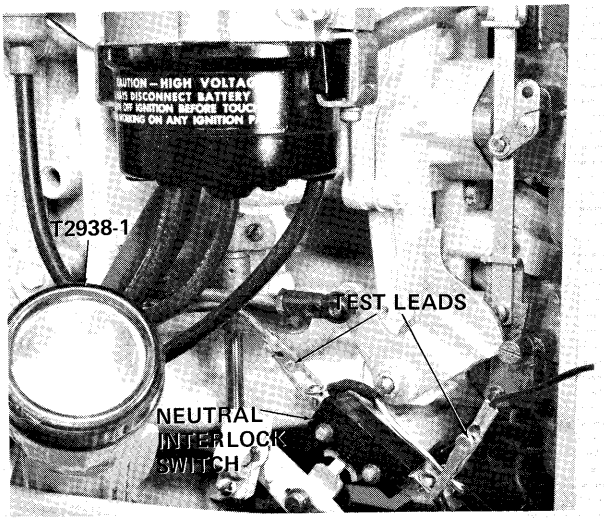


Figure 11A—Connection of Test Light Lead Wires

D. Loosen screws securing cam to shift arm.

E. Slide cam forcing button on interlock switch upward until test light just comes on.

F. Tighten screws on cam to secure position.

3. CARBURETOR

3-1. Synchronizing Throttle Shutters

A. Snap throttle link off towershaft and pivot throttle cam away from throttle roller on carburetor.

B. Remove retaining ring securing throttle tie bar to top carburetor throttle arm.

C. Loosen throttle tie bar screw as shown in figure 12.

D. Check to be sure that throttle shutters are closed.

E. Tighten throttle tie bar screw (see figure 12) and check to see that throttle tie bar end pivot goes in and out of throttle arm of carburetor freely.

F. Install retaining ring to secure throttle tie bar to top carburetor throttle arm.

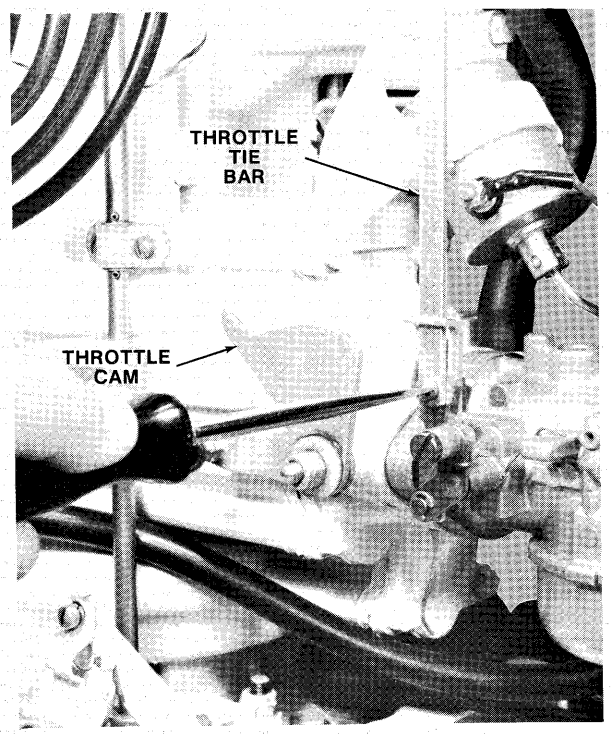


Figure 12—Loosening Throttle Tie Bar Screw

G. Snap throttle link on towershaft.

3-2. Adjusting Throttle Pick-Up

A. Disconnect throttle link at towershaft.

B. Adjust throttle roller shaft by loosening stop nut and turn shaft until throttle roller just contacts the throttle cam at index line as shown in figure 13.

C. Secure roller position by tightening stop nut.

D. Install throttle link on towershaft.

E. Move towershaft to wide open throttle stop.

F. Loosen jam nuts on throttle link between towershaft and throttle cam.

G. Adjust throttle link until throttle shutters are horizontal.

H. Tighten jam nuts on throttle link to secure throttle link position.

3-3. Adjusting Carburetor

A. Turn idle adjustment screw clockwise until it seats in the carburetor.

CAUTION

Do not force idle adjustment screw or the tip will be damaged.

B. Open idle adjustment screw one (1) turn counterclockwise.

C. Shift engine to neutral gear position and start motor. Allow engine to warm up to operating temperature.

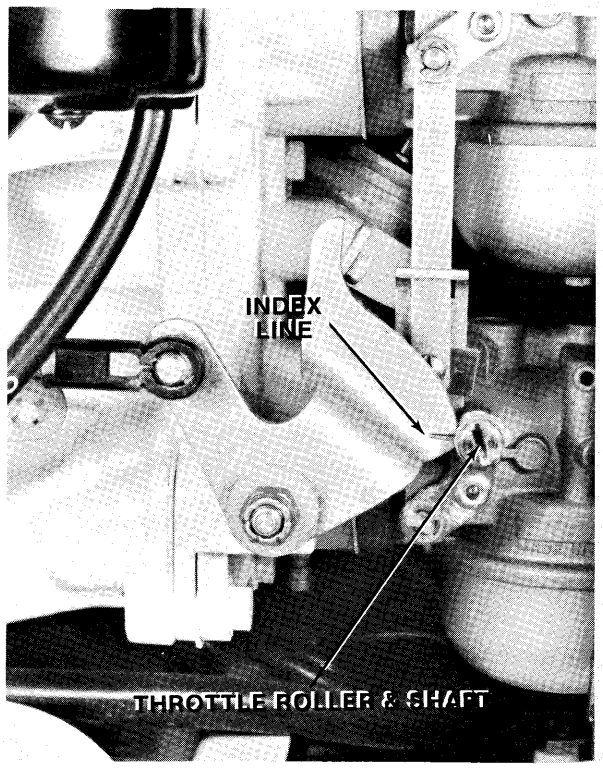


Figure 13–Adjusting Point of Throttle Opening

D. Shift engine to forward gear. Throttle engine back to lowest reliable throttle setting.

E. Turn idle adjustment screw on carburetor clockwise 1/8 turn with at least ten (10) seconds between each adjustment until the engine begins to "pop" from the lean fuel/air setting. Note position of screwdriver slot on idle adjustment screw.

F. Turn idle adjustment screw counterclockwise to original position. Turn idle adjustment screw counterclockwise 1/8 turn at a time with periods of at least ten (10) seconds between each adjustment until the engine begins to "roll or gallop" from the rich fuel/air setting. Note idle adjustment screw setting.

G. Turn idle adjustment screw to midpoint between the settings noted in steps E and F.

H. Adjust idle stop screw on towershaft as necessary until engine idles between 700-900 RPM's in neutral gear position.

3-4. Synchronizing Choke Shutters

A. Loosen screws on both choke swivels freeing choke link.

B. Position top end of link approximately 1/16 to 1/8 inch beyond top of top carburetor choke swivel. Tighten screw to secure link in swivel.

C. Close top carburetor choke shutter fully. While holding top carburetor choke shutter closed, close bottom carburetor choke shutter and tighten bottom carburetor choke swivel screw to secure link to swivel.

D. Loosen two (2) screws securing choke solenoid just enough so that solenoid can be moved easily.

E. Slip a piece of paper approximately 1/2 inch wide in both carburetor air horns.

NOTE

The purpose of the paper is to insure proper clearance between choke shutter and air horn of carburetor to prevent shutters from sticking in the closed position.

F. With pieces of paper in air horns of carburetors, close choke shutters fully against the pieces of paper by pushing only on choke solenoid plunger as shown in figure 14.

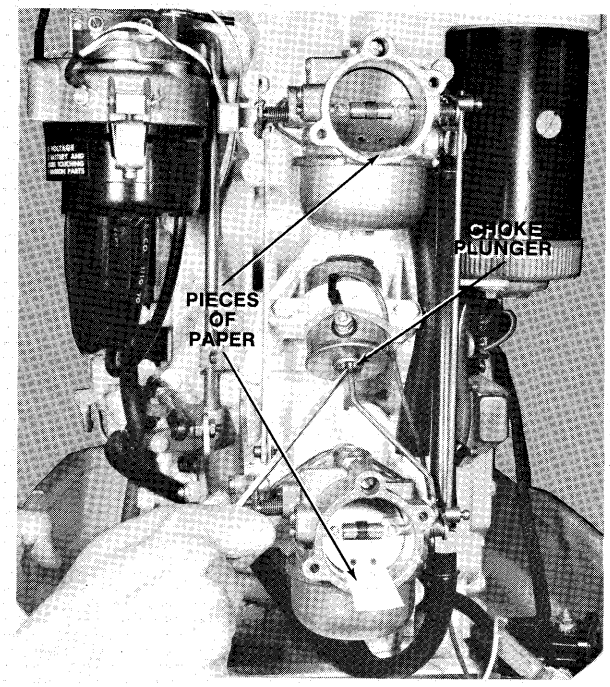


Figure 14–Closing Choke Shutters

G. While holding choke shutters closed by the choke plunger, slide choke solenoid against plunger. Tighten screws to secure choke solenoid in position.

H. Release choke solenoid plunger and push plunger back in solenoid. Pull paper out of carburetor air horns; paper must slide out of carburetor easily or with a slight drag. If not, adjust solenoid position as outlined in step G.

I. Release choke solenoid plunger and check to see that choke shutters are horizontal. If they are not and are tilted upward, bend groove pin (shutter stop) in air horn of carburetor.

SECTION VA — TIMING — MAGNAPOWER II IGNITION SYSTEM

1. TIMING

A. Disconnect battery leads from battery terminals.

B. Remove all spark plugs from cylinder head.

C. Install timing tool (Special Tool T2937-1) in top cylinder spark plug hole. Insert rod portion of timing tool in barrel with two marks identified as "25 - 55 H.P." outside of barrel.

D. Holding rod tight against piston, slowly rotate flywheel in direction of engine to locate top dead center (TDC) or point at which marks on rod extend furthest away from barrel. Screw barrel of the timing tool in or out as required until inside line of the timing rod lines up with edge of barrel. See figure 1.

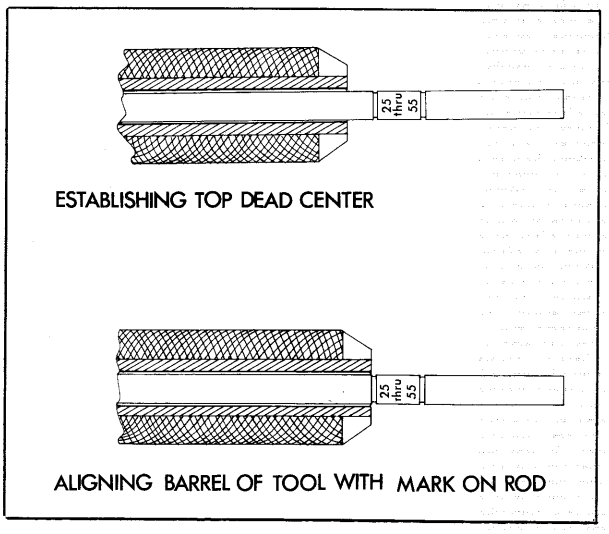


Figure 1 - Locating TDC

E. Apply slight pressure to end of rod with finger and turn flywheel clockwise in direction of engine rotation approximately three-quarters of the way around until outer line of rod lines up with edge of barrel. This line represents 32° before top dead center (BTDC). See figure 2.

F. Check decal on ring gear of flywheel for alignment with index mark on timing pointer. 32° BTDC mark on decal must line up with index mark. If marks do not align, install new decal.

G. Remove timing tool from cylinder head.

H. Rough set control rod to 5/8" as shown in figure 3.

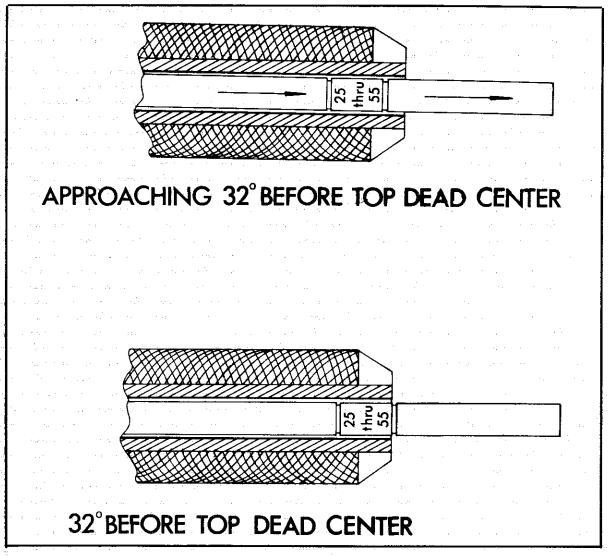


Figure 2 - Establishing 32° BTDC

I. With engine in test tank or on water, check timing by cranking engine over with timing light (Special Tool T8978) connected to top spark plug and engine at full retard position. Timing must be relatively close (TDC mark on decal in relationship to index mark on timing pointer).

NOTE

If TDC mark on decal is not close or within 3° of index mark, recheck timing as outlined in steps B through E.

J. Start engine and accelerate to WOT. (Minimum 4500 RPM's). With timing light connected to top cylinder spark plug lead wires, observe alignment of timing marks (32° mark on decal to index mark on timing pointer). If marks are not aligned, retard engine and shut off engine. Adjust link between towershaft and timing ring under flywheel until 32° mark on decal lines up with index mark on timing pointer. To advance timing, turn link counter-clockwise (as viewed from front of engine). To retard timing, turn link clockwise. See figure 3.

CAUTION

Do not attempt to adjust link while engine is running.

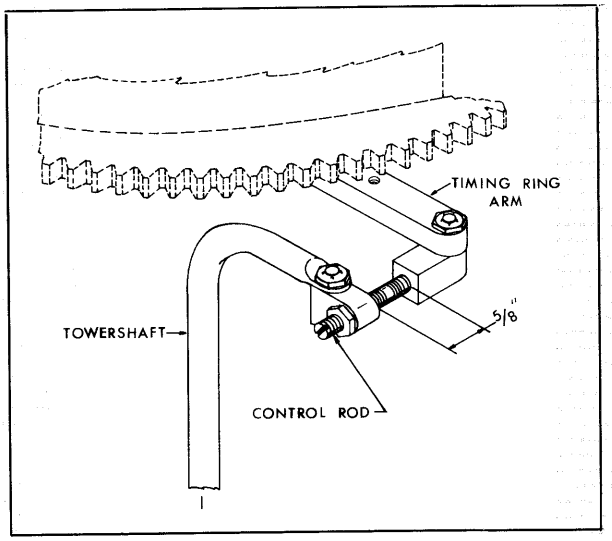


Figure 3 - Adjusting Control Rod

SECTION VI — CARBURETOR — WB TYPE

1. TOP CARBURETOR COMPLETE — 3 CYLINDER ENGINES 01-21

1-1. Removing Top Carburetor Complete

A. Remove carburetor intake with cover by removing six (6) screws as shown in figure 1. Also remove carburetor intake gaskets (1 per carburetor).

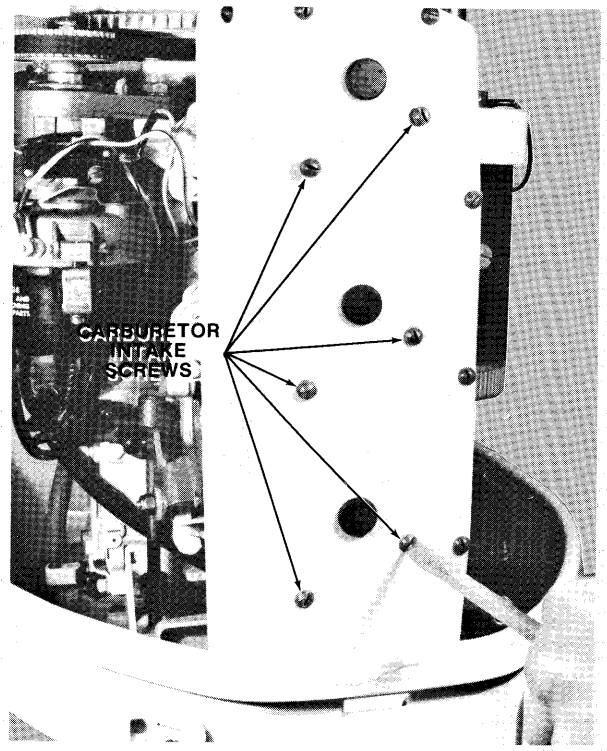


Figure 1—Removing Carburetor Intake

B. Remove retaining ring securing throttle tie bar to carburetor throttle arm. Remove tie bar end by removing fillister head screw securing end to tie bar.

C. Loosen each screw of each choke swivel and allow choke link to slide down.

D. Remove cotter pin securing choke swivel to choke lever arm of carburetor. Remove plain washer, choke rod, one (1) "O" ring and choke swivel from choke lever arm.

E. Using hose clamp pliers (Special Tool T8900), slide hose clamp down and pull fuel hose from inlet fitting on carburetor.

F. Remove two (2) hex nuts securing carburetor to carburetor adapter flange.

G. Remove carburetor inlet fitting from carburetor.

1-2. Installing Top Carburetor Complete

A. Apply sealant (Special Tool T8955) to threads of fuel inlet fitting. Install fitting on carburetor and position barb at 6 o'clock position.

B. Install carburetor on carburetor adapter flange studs and secure with two (2) hex nuts.

C. Install choke swivel with one (1) "O" ring on choke swivel through choke shutter arm. Install another "O" ring on choke swivel, then rod end of choke solenoid plunger assembly, plain washer and secure swivel with cotter pin.

D. Slide choke rod up through choke swivel and secure with screw. Tighten other screws on choke swivel for both the middle and lower carburetors. Synchronize choke shutters as outlined in Section IV, paragraph 3-4.

E. Install tie bar end on throttle tie bar. Secure tie bar end to throttle tie bar with fillister head screw, but do not tighten. Position tie bar end pivot through bottom hole on throttle shaft arm and secure with retaining ring. Synchronize carburetor shutters as outlined in Section IV, paragraph 3-1.

F. Connect fuel line to inlet fuel fitting and secure with hose clamp using hose clamp pliers (Special Tool T8900).

G. Install carburetor intake with cover being sure that gaskets are in place and secure with six (6) screws. See figure 1.

2. MIDDLE CARBURETOR COMPLETE — 3 CYLINDER ENGINES 01-21

2-1. Removing Middle Carburetor Complete

A. Remove carburetor intake with cover as outlined in Section VI, paragraph 1-1, step A.

B. Remove retaining ring securing throttle tie bar assembly on both top and middle carburetors. Swing tie bar assembly away to expose hex nut securing carburetor to carburetor adapter flange.

C. Loosen screw on each choke swivel of each carburetor and remove choke rod.

D. Slide hose clamp from each barb on fuel inlet fitting and remove fuel hoses from each barb.

E. Remove two (2) hex nuts securing carburetor to carburetor adapter flange and remove carburetor.

F. Remove cotter pin securing choke swivel to choke lever arm of carburetor. Remove plain washer and "O" ring and then remove choke swivel with "O" ring from choke lever arm.

G. Remove fuel inlet fitting from carburetor.

2-2. Installing Middle Carburetor Complete

A. Apply sealant (Special Tool T8955) to threads of fuel inlet fitting. Install fitting on carburetor and position barbs at 12 o'clock and 6 o'clock position.

B. Install choke swivel with one (1) "O" ring on choke lever arm of carburetor. Install another "O" ring, then washer and secure choke swivel to choke lever arm with cotter pin.

C. Install carburetor on carburetor adapter flange and secure with two (2) nuts.

D. Position throttle tie bar assembly aligning pivots with lower holes of throttle shaft arms of both top and middle carburetors. Secure pivots to throttle shaft arms with retaining rings. Synchronize carburetor shutters as outlined in Section IV, paragraph 3-1.

E. Connect fuel lines to each barb of inlet fuel fitting and secure with hose clamps using hose clamp pliers (Special Tool T8900).

F. Install choke rod through each swivel of each carburetor and secure with fillister head screws. Synchronize choke shutters as outlined in Section IV, paragraph 3-4.

G. Install carburetor intake with cover and secure with six (6) screws as shown in figure 1.

3. BOTTOM CARBURETOR COMPLETE — 3 CYLINDER ENGINES 01-21

3-1. Removing Bottom Carburetor Complete

A. Remove carburetor intake with cover as outlined in Section VI, paragraph 1-1, step A.

B. Disconnect throttle link assembly from ball joint on tower shaft as shown in figure 2.

Pivot throttle cam to expose fillister head screw securing throttle tie bar end to throttle tie bar.

C. Remove fillister head screw securing throttle tie bar end to throttle tie bar. Remove retaining ring securing pivot of tie bar end to throttle shaft arm of carburetor and remove tie bar end.

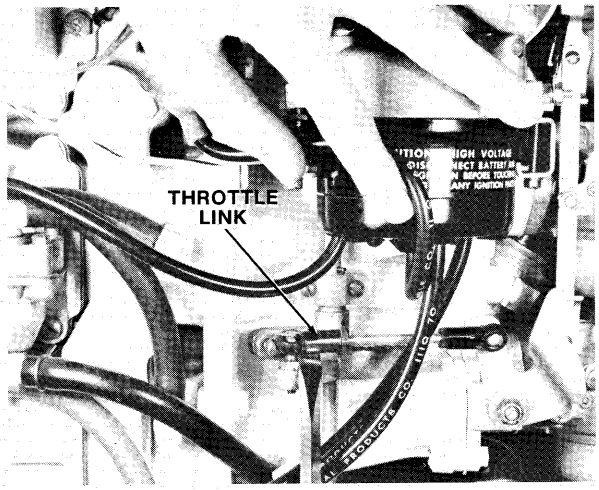


Figure 2–Disconnecting Throttle Link Assembly

D. Loosen fillister head screw on choke swivel. Move swivel down to disconnect choke rod.

E. Slide hose clamps from barbs of inlet fuel fitting using hose clamp pliers (Special Tool T8900) and disconnect hoses from inlet fuel fitting.

F. Remove two (2) hex nuts securing carburetor to carburetor adapter flange. Remove carburetor from carburetor adapter flange.

G. Remove cotter pin securing choke swivel to choke lever arm of carburetor. Remove plain washer, one (1) "O" ring and choke swivel with another "O" ring from choke lever arm.

H. Remove throttle roller shaft and roller from throttle shaft arm of carburetor by removing hex stop nut from roller shaft.

I. Remove carburetor inlet fuel fitting from carburetor.

3-2. Installing Bottom Carburetor Complete

A. Apply sealant (Special Tool T8955) to threads of fuel inlet fitting. Install fitting on carburetor and position barbs at 12 o'clock and 6 o'clock positions.

B. Install throttle roller shaft and roller in top hole of throttle shaft arm. Secure roller shaft assembly to throttle shaft arm with hex stop nut, but do not tighten. Refer to Section IV, paragraph 3-2, for adjustment of throttle pick-up after completion of assembly.

C. Install choke swivel with one (1) "O" ring on choke swivel through choke shutter arm. Install another "O" ring, plain washer and secure assembly to choke lever arm with cotter pin.

D. Install carburetor on carburetor adapter flange studs and secure with hex nuts.

E. Connect fuel lines to barbs of inlet fuel fitting. Secure fuel lines with hose clamps using hose clamp pliers (Special Tool T8900).

F. Connect choke rod to choke swivel and secure with fillister head screw. Synchronize choke shutters as outlined in Section IV, paragraph 3-4.

G. Install throttle tie bar end to throttle tie bar. Align pivot of tie bar end with bottom hole of throttle shaft arm of carburetor and secure pivot with retaining ring. Synchronize carburetor shutters as outlined in Section IV, paragraph 3-1.

H. Connect throttle link assembly to stud on tower shaft.

I. Install carburetor intake with cover and gaskets and secure with six (6) screws as shown in figure 1.

4. TOP CARBURETOR COMPLETE — 4 CYLINDER ENGINES 01-21

4-1. Removing Top Carburetor Complete

A. Remove retaining ring securing throttle shaft tie bar to throttle shaft arm. Remove tie bar from throttle shaft arm.

B. Loosen screw securing choke rod to swivel on choke shaft arm. Remove rod from swivel.

C. Slide hose clamp from inlet fuel fitting on carburetor and disconnect hose from fuel fitting.

D. Remove two (2) nuts securing carburetor to carburetor adapter plate and remove carburetor.

E. Remove choke rod swivel by removing cotter pin retaining same to choke shaft arm.

F. Remove fuel inlet fitting from carburetor.

4-2. Installing Top Carburetor Complete

A. Install choke swivel on arm of choke shaft using "O" ring on each side of shaft arm. Install plain washer and secure swivel to shaft arm with cotter pin.

B. Apply sealant (Special Tool T8955) to threads of fuel inlet fitting. Install fitting on carburetor and position barb at 5 o'clock.

C. Install new carburetor gasket on studs of carburetor adapter.

D. Install carburetor on carburetor adapter and secure with two (2) hex nuts.

E. Connect fuel line from bottom carburetor to inlet fitting on top carburetor. Secure hose with clamp.

F. Synchronize carburetor shutters as outlined in Section V, paragraph 3-1.

G. Connect choke link in choke swivel and synchronize choke shutters as outlined in Section V, paragraph 3-4.

5. BOTTOM CARBURETOR COMPLETE — 4 CYLINDER ENGINES 01-21

5-1. Remove Bottom Carburetor Complete

A. Remove retaining ring securing throttle shaft tie bar to throttle shaft arm. Remove tie bar from throttle shaft arm.

B. Slide hose clamps from each barb on inlet fitting. Remove fuel lines from each barb.

C. Loosen screw on choke swivel and remove choke link from swivel.

D. Remove two (2) hex nuts securing carburetor to carburetor adapter and remove carburetor from engine with choke solenoid plunger assembly.

E. Remove cotter pin securing choke swivel to choke arm of carburetor. Remove plain washer, seal and another plain washer from swivel. Remove choke solenoid plunger assembly and choke swivel from choke arm of carburetor.

F. Remove throttle roller shaft and throttle roller from throttle arm of carburetor by removing stop nut from throttle roller shaft.

G. Remove inlet fitting from carburetor.

5-2. Installing Bottom Carburetor Complete

A. Install "O" ring on choke swivel. Install choke swivel with "O" ring on choke shaft arm. Install choke solenoid plunger assembly, plain washer, "O" ring, plain washer and secure choke swivel with cotter pin.

B. Apply sealant (Special Tool T8955) to threads of fuel inlet fitting. Install fitting on carburetor and position fitting with barbs pointing at 1 o'clock and 7 o'clock.

C. Install throttle roller on throttle roller shaft. Install assembly on throttle shaft arm of carburetor. Secure throttle roller shaft to throttle shaft arm with stop nut, but do not tighten. Final adjustment of throttle roller will be made after the carburetor is assembled to the carburetor adapter flange.

D. Install carburetor on carburetor adapter flange installing choke solenoid plunger in choke solenoid then slipping carburetor on the studs of the carburetor adapter flange. Secure carburetor to carburetor adapter flange studs with two (2) hex nuts and tighten securely.

E. Install choke rod in choke swivel by pushing choke rod up and through choke swivel. Secure choke rod by tightening screw on swivel against rod. Synchronize choke shutters as outlined in Section V, paragraph 3-4.

F. Install throttle shaft tie bar in lower hole of throttle shaft arm of carburetor and secure with retaining ring.

G. Synchronize throttle shutters as outlined in Section V, paragraph 3-1. Adjust throttle pick-up as outlined in same section.

H. Connect fuel lines to inlet fuel fitting and retain with clamps.

6. THROTTLE SHAFT 01-11
THROTTLE SHUTTER 01-13

6-1. Removing Throttle Shaft and Shutter

A. Remove carburetor as outlined in appropriate paragraph.

B. Remove two (2) screws securing shutter to throttle shaft. Position shutter to wide open throttle (shutter in horizontal position). Pull throttle shutter out — DO NOT FORCE SHUTTER OUT. Shutter should be pulled out with a minimum of force.

C. Remove screw, lockwasher and plain washer from end of throttle shaft.

D. Unhook small end of spring from drive pin on carburetor and pull shaft out of carburetor.

6-2. Installing Throttle Shaft and Shutter

A. Install return spring on throttle shaft with large hook end of throttle shaft arm. Install throttle shaft with return spring in carburetor from right side of carburetor when looking at carburetor from back. Secure throttle shaft to carburetor with screw, lockwasher and plain washer.

B. Connect small hook end on drive pin of carburetor. Turn throttle shaft arm clockwise until smaller hole portion of shaft arm is at 2 o'clock position (approximately 1/2 turn tension on return spring).

C. Note that edge of shutter is angled and a mark stamped on one side. When installing, install shutter with cut out portion in first and marked side up as shown in figure 3. Slip shutter in through slot in throttle shaft. Release throttle shaft arm and seat shutter in bore of carburetor. Shutter must seat in bore of carburetor with no air gaps. Install screws to secure shutter.

D. Install carburetor complete as outlined in appropriate paragraph.

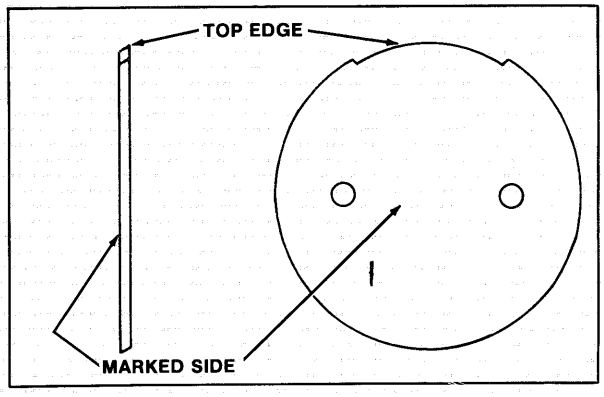


Figure 3–Installing Shutter

7. CHOKE SHAFT 01-12
CHOKE SHUTTER 01-14

7-1. Removing Choke Shaft and Shutter

A. Remove carburetor intake and cover as outlined in Section VI, paragraph 1-1, step A (for 3 cylinder engines only).

B. Remove two (2) screws securing choke shutter to choke shaft and remove choke shutter.

NOTE

For carburetors with choke relief valves, only the lower half of choke shutter can be removed at this time.

C. Remove choke link by loosening each screw on each choke swivel and pull choke link out.

D. Remove choke swivel assembly from choke lever arm by removing cotter pin.

E. Remove screw with lockwasher securing choke shaft retainer and remove retainer (4 cylinder engines only).

F. Disconnect small hook end of return spring from drive pin on carburetor and remove choke shaft from carburetor.

NOTE

For carburetors with choke relief valves, relief valve and spring are removed at this time.

7-2. Installing Choke Shaft and Shutter

A. Install return spring on choke shaft with large hook end on choke lever arm.

B. Install choke shaft in carburetor from right side of carburetor (when looking at carburetor from front).

NOTE

For carburetors with choke relief valves, install relief valve and spring on choke shaft with spring between two (2) pivots of relief valve. Push shaft remainder of way through carburetor.

C. For 4 cylinder engines, install screw, lockwasher and retainer to secure choke shaft to carburetor.

D. Connect small hook end of return spring on drive pin of carburetor and turn choke shaft counterclockwise until slot is positioned for installation of choke shutter.

E. Install choke shutter through slot in choke shaft and secure with two (2) screws.

NOTE

For carburetors with choke relief valves, position one (1) end of spring under relief valve. Position other end of spring under choke shutter and insert choke shutter in slot and secure with two (2) screws.

F. Install choke swivel assembly as covered in appropriate carburetor complete paragraph.

G. For 3 cylinder engines, install carburetor intake and cover as shown in figure 1.

8. FUEL BOWL 01-15 FUEL BOWL GASKET 01-19

8-1. Removing Fuel Bowl and Gasket

A. Remove carburetor intake with cover as outlined in Section VI, paragraph 1-1, step A (for 3 cylinder engines only).

B. Remove hex head screw securing fuel bowl to carburetor at bottom of bowl and remove screw with gasket from bowl.

C. Remove fuel bowl from carburetor.

D. Remove fuel bowl gasket from groove in carburetor.

8-2. Installing Fuel Bowl and Gasket

A. Install new fuel bowl gasket in groove of carburetor.

B. Install hex head screw with gasket under head through hole in bowl.

C. Install another gasket in bowl around threads of hex screw.

D. Install bowl with screw and gaskets on carburetor and tighten screw securely to carburetor (20 to 25 in. lbs. torque).

E. For 3 cylinder engines, install carburetor intake with cover as shown in figure 1.

9. MAIN FUEL JET 01-18

9-1. Removing Main Fuel Jet

A. Remove carburetor as outlined in appropriate paragraph.

B. Remove fuel bowl as outlined in Section VI, paragraph 8-1.

C. Remove main fuel jet as shown in figure 4.

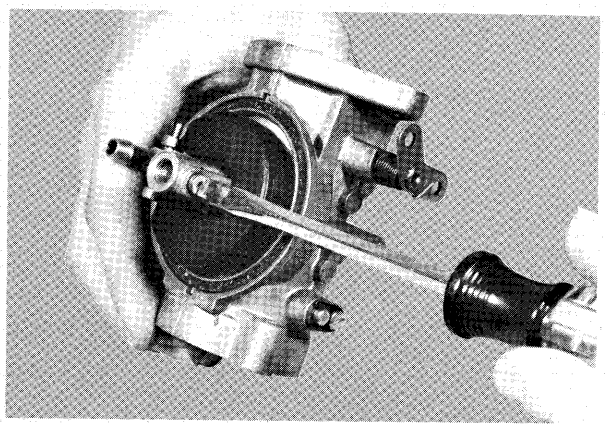


Figure 4–Removing Main Fuel Jet

9-2. Installing Main Fuel Jet

A. Install main fuel jet as shown in figure 4.

B. Install fuel bowl as outlined in Section VI, paragraph 8-2.

C. Install carburetor as outlined in appropriate paragraph.

10. FLOAT 01-16

10-1. Removing Float

A. Remove carburetor as outlined in appropriate paragraph.

B. Remove fuel bowl as outlined in Section VI, paragraph 8-1.

C. Remove float by removing groove pin as shown in figure 5 and lift float from carburetor.

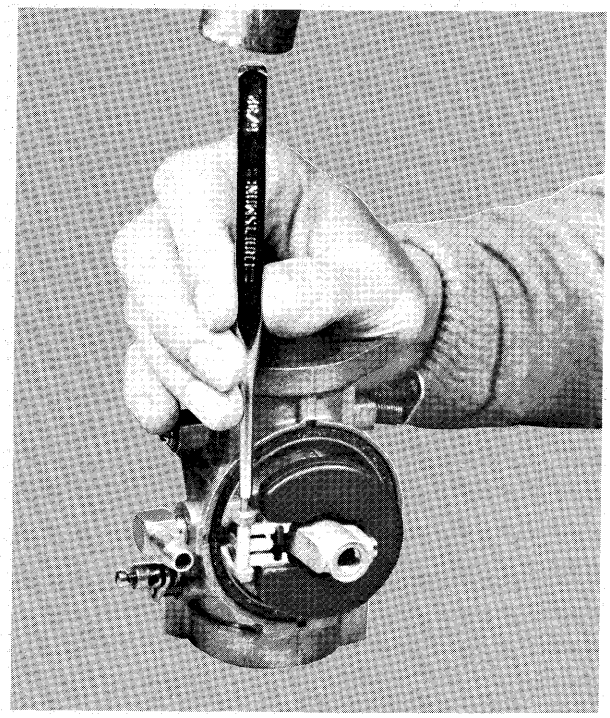


Figure 5–Removing Groove Pin

10-2. Installing Float

A. Position float in carburetor (refer to figure 5).

B. Examine groove pin and note that there are grooves only at one (1) end of pin. Install groove pin as shown in figure 6.

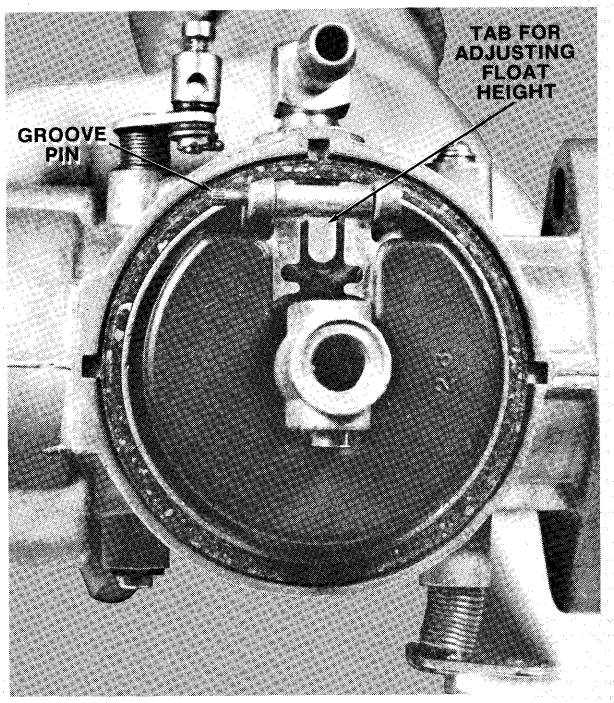


Figure 6–Installing Groove Pin

Drive groove pin in until no grooves are visible.

C. Measure float height as shown in figure 7.

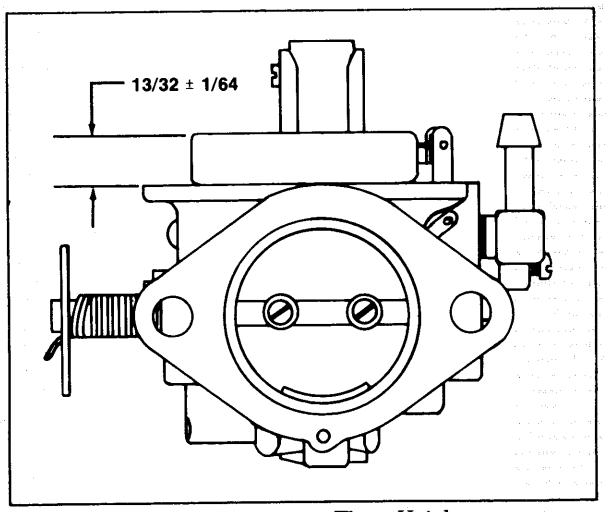


Figure 7–Measuring Float Height

If adjustment is necessary, bend tab on float as shown in figure 6.

D. Install fuel bowl as shown in Section VI, paragraph 8-2.

E. Install carburetor as outlined in appropriate paragraph.

11. INLET NEEDLE AND SEAT 01-20

11-1. Removing Inlet Needle and Seat

A. Remove carburetor as outlined in appropriate paragraph.

B. Remove float as outlined in Section VI, paragraph 10-1.

C. Remove inlet needle as shown in figure 8.

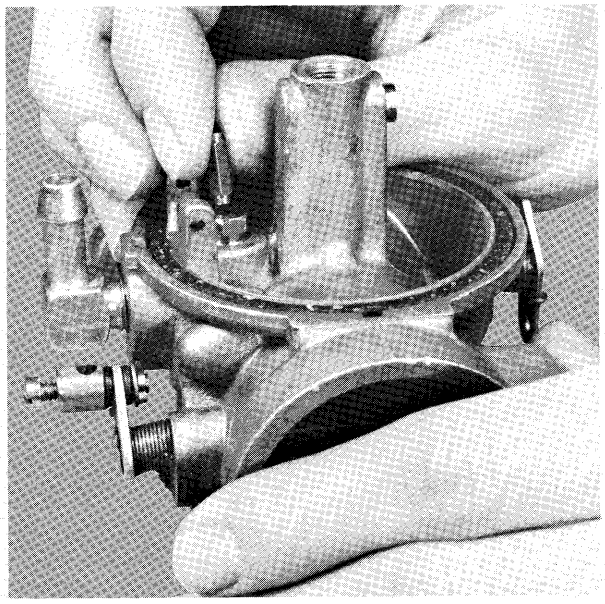


Figure 8–Removing Inlet Needle

D. Remove inlet needle seat and gasket by turning seat counterclockwise with wrench or socket.

11-2. Installing Inlet Needle and Seat

A. Install gasket on inlet needle seat.

B. Install inlet needle seat with gasket in carburetor and tighten securely.

C. Install inlet needle as shown in figure 8.

D. Install float as outlined in Section VI, paragraph 10-2.

E. Install carburetor as outlined in appropriate paragraph.

SECTION VII — CARBURETOR — TC TYPE

1. TOP CARBURETOR COMPLETE 01-21

1-1. Removing Top Carburetor Complete

A. Remove retaining ring securing throttle shaft tie bar to throttle shaft arm. Remove tie bar from throttle shaft arm.

B. Remove three (3) screws securing carburetor cover to cover studs and remove carburetor cover.

C. Remove carburetor cover studs from carburetor.

D. Loosen screw securing choke rod to swivel on choke shaft arm. Remove rod from swivel.

E. Slide hole clamp from inlet fuel fitting on carburetor and disconnect hose from fuel fitting.

F. Remove two (2) nuts securing carburetor to carburetor adapter plate and remove carburetor.

G. Remove choke rod swivel by removing cotter pin retaining same to choke shaft arm.

H. Remove fuel inlet fitting from carburetor.

1-2. Installing Top Carburetor Complete

A. Install choke swivel on arm of choke shaft using "O" ring on each side of shaft arm. Install plain washer and secure swivel to shaft arm with cotter pin.

B. Apply sealant (Special Tool T8955) to threads of fuel inlet fitting. Install fitting on carburetor and position barb at 5 o'clock.

C. Install new carburetor gasket on studs of carburetor adapter.

D. Install carburetor on carburetor adapter and secure with two (2) hex nuts.

E. Connect fuel line from bottom carburetor to inlet fitting on top carburetor. Secure hose with clamp.

F. Install carburetor cover studs on carburetor. Install carburetor cover on carburetor cover studs and secure with three (3) screws.

G. Synchronize carburetor shutters as outlined in Section V, paragraph 3-1.

2. BOTTOM CARBURETOR COMPLETE 01-21

2-1. Removing Bottom Carburetor Complete

A. Remove retaining ring securing throttle shaft tie bar to throttle shaft arm. Remove tie bar from throttle shaft arm.

B. Remove three (3) screws securing carburetor cover to cover studs and remove carburetor cover.

C. Remove carburetor cover studs from cover.

D. Slide hose clamps from each barb on inlet fitting. Remove fuel lines from each barb.

E. Loosen screw on choke swivel and remove choke rod from swivel.

F. Remove two (2) hex nuts securing carburetor to carburetor adapter and remove carburetor from engine with choke solenoid plunger assembly.

G. Remove cotter pin securing choke swivel to choke arm of carburetor. Remove plain washer, seal and another plain washer from swivel. Remove choke solenoid plunger assembly and choke swivel from choke arm of carburetor.

H. Remove throttle roller shaft and throttle roller from throttle arm of carburetor by removing stop nut from throttle roller shaft.

I. Remove inlet fitting from carburetor.

2-2. Installing Bottom Carburetor Complete

A. Install "O" ring on choke swivel. Install choke swivel with "O" ring on choke shaft arm. Install choke solenoid plunger assembly, plain washer, "O" ring, plain washer and secure choke swivel with cotter pin.

B. Apply sealant (Special Tool T8955) to threads of fuel inlet fitting. Install fitting on carburetor and position fitting with barbs pointing at 1 o'clock and 7 o'clock.

C. Install throttle roller on throttle roller shaft. Install assembly on throttle shaft arm of carburetor. Secure throttle roller shaft to throttle shaft arm with stop nut, but do not tighten. Final adjustment of throttle roller will be made after the carburetor is assembled to the carburetor adapter flange.

D. Install carburetor on carburetor adapter flange installing choke solenoid plunger in choke solenoid then slipping carburetor on the studs of the carburetor adapter flange. Secure carburetor to carburetor adapter flange studs with two (2) hex nuts and tighten securely.

E. Install choke rod in choke swivel by pushing choke rod up and through choke swivel. Secure choke rod by tightening screw on swivel against rod.

F. Install throttle shaft tie bar in lower hole of throttle shaft arm of carburetor and secure with retaining ring.

G. Install carburetor cover studs on carburetor. Install carburetor cover on cover studs and secure with three (3) screws.

H. Synchronize throttle shutters as outlined in Section V, paragraph 3-1. Adjust throttle pick-up as outlined in same section.

I. Connect fuel lines to inlet fuel fitting and retain with clamps.

3. THROTTLE SHAFT 01-11 THROTTLE SHUTTER 01-13

3-1. Removing Throttle Shaft and Shutter

A. Remove carburetor as outlined in appropriate paragraph.

B. Remove two (2) screws securing shutter to throttle shaft. Position shutter to wide open throttle (shutter in horizontal position). Pull shutter out of carburetor.

C. Remove screw, lockwasher and plain washer from end of throttle shaft.

D. Unhook large hook end of spring from boss on carburetor and pull shaft out of carburetor.

3-2. Installing Throttle Shaft and Shutter

A. Install return spring on throttle shaft with smaller hook end of throttle shaft arm. Install throttle shaft with return spring in carburetor from right side of carburetor when looking at carburetor from back. Secure throttle shaft to carburetor with screw, lockwasher and plain washer.

B. Connect larger hook end on boss of carburetor. Turn throttle shaft arm clockwise until marked arm portion of shaft arm is at 3 o'clock position (approximately 1/2 turn tension on return spring).

C. Note that edge of shutter is angled. When installing, install shutter with radial cut out portion in first and marked side up as shown in figure 1. Slip shutter in through slot in throttle shaft. Release throttle shaft arm and seat shutter in bore of carburetor. Shutter must seat in bore of carburetor with no air gaps. Install screws to secure shutter.

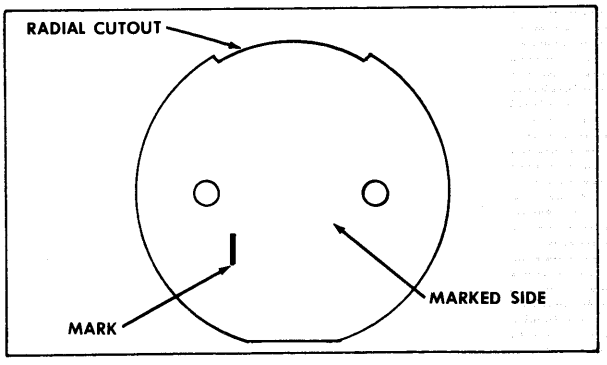


Figure 1--Installing Shutter

D. Install carburetor complete as outlined in appropriate paragraph.

4. CHOKE SHAFT 01-12 CHOKE SHUTTER 01-14

4-1. Removing Choke Shaft and Shutter

A. Remove two (2) screws securing choke shutter to choke shaft and remove choke shutter.

NOTE

For carburetors with choke relief valves, only the lower half of choke shutter can be removed at this time.

B. Remove choke link by loosening each screw on each choke swivel and pull choke link out.

C. Remove choke swivel assembly from choke lever arm by removing cotter pin.

D. Remove screw with lockwasher securing choke shaft retainer and remove retainer.

E. Disconnect right angle end of return spring from hole in carburetor and remove choke shaft from carburetor.

NOTE

For carburetors with choke relief valves, relief valve and spring are removed at this time.

4-2. Installing Choke Shaft and Shutter

A. Install return spring on choke shaft with hook end on choke lever arm.

B. Install choke shaft in carburetor from right side of carburetor (when looking at carburetor from front).

NOTE

For carburetors with choke relief valves, install relief valve and spring on choke shaft with spring between two (2) pivots of relief valve. Push shaft remainder of way through carburetor.

C. Install screw, lockwasher and retainer to secure choke shaft to carburetor.

D. Insert right angle end of return spring in hole of carburetor and turn choke shaft counterclockwise until slot in shaft is positioned for installation of choke shutter.

E. Position one (1) end of spring under relief valve. Position other end of spring under choke shutter and insert choke shutter in slot and secure with two (2) screws.

F. Install choke swivel assembly as covered in appropriate carburetor complete paragraph.

5. FUEL BOWL 01-15
FUEL BOWL GASKET 01-19

5-1. Removing Fuel Bowl and Gasket

A. Remove hex head screw securing fuel bowl to carburetor at bottom of bowl and remove screw with gasket from bowl.

B. Remove fuel bowl from carburetor.

C. Remove fuel bowl gasket from groove in carburetor.

5-2. Installing Fuel Bowl and Gasket

A. Install new fuel bowl gasket in groove of carburetor.

B. Install hex head screw with gasket under head through hole in bowl.

C. Install bowl with screw and gasket on carburetor and tighten screw securely to carburetor (20 to 25 In. Lbs. torque).

6. MAIN FUEL JET 01-18

6-1. Removing Main Fuel Jet

A. Remove fuel bowl as outlined in Section VII, paragraph 5-1.

B. Remove main fuel jet as shown in figure 2.

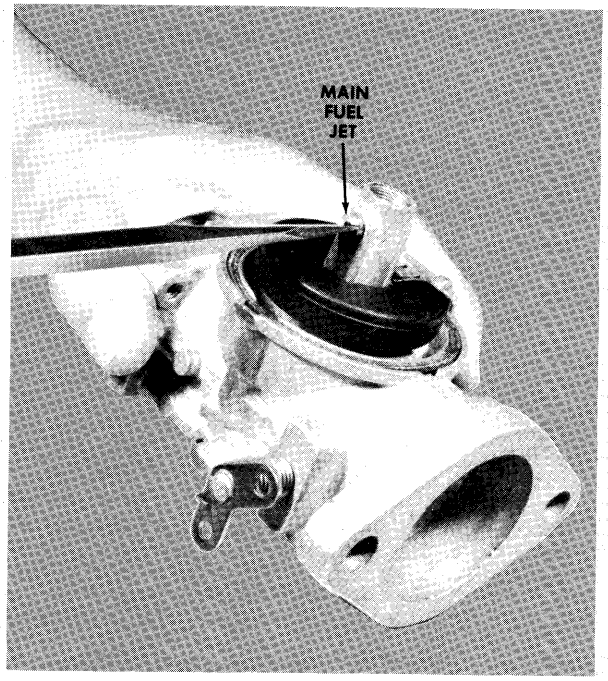


Figure 2–Removing Main Fuel Jet

6-2. Installing Main Fuel Jet

A. Install main fuel jet as shown in figure 2.

B. Install fuel bowl as outlined in Section VII, paragraph 5-2.

7. FLOAT 01-16

7-1. Removing Float

A. Remove carburetor as outlined in appropriate paragraph.

B. Remove fuel bowl as outlined in Section VII, paragraph 5-1.

C. Remove float by removing groove pin as shown in figure 3 and lift float from carburetor.

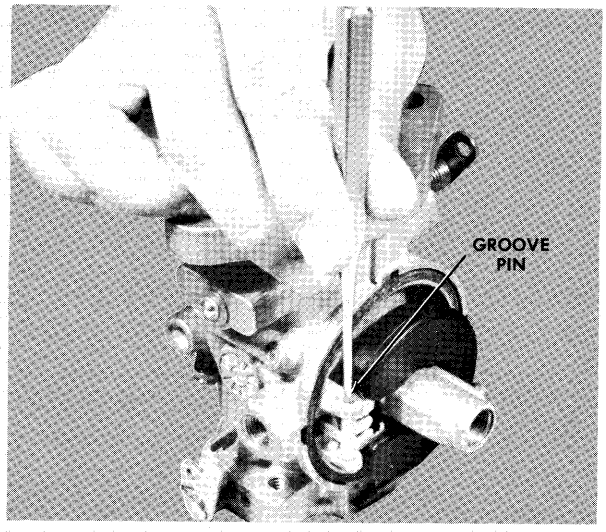


Figure 3–Removing Groove Pin

7-2. Installing Float

A. Position float in carburetor (refer to figure 3).

B. Examine groove pin and note that there are grooves only at one (1) end of pin. Install groove pin as shown in figure 4.

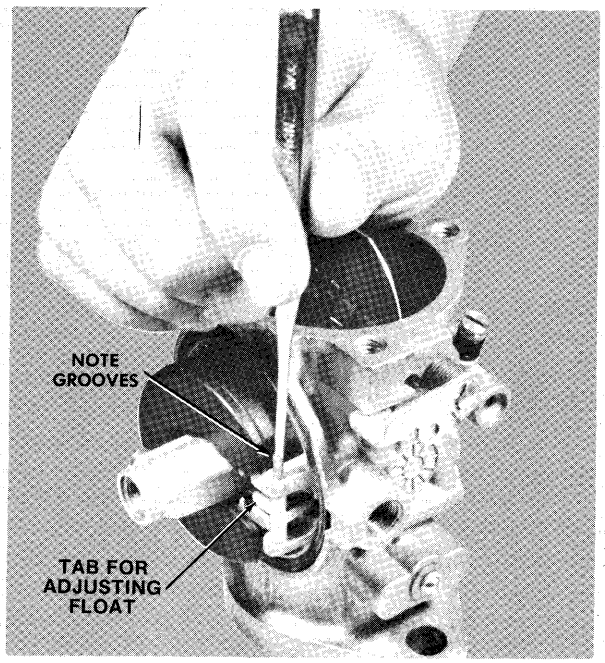


Figure 4–Installing Groove Pin

Drive groove pin in until no grooves are visible.

C. Measure float height as shown in figure 5.

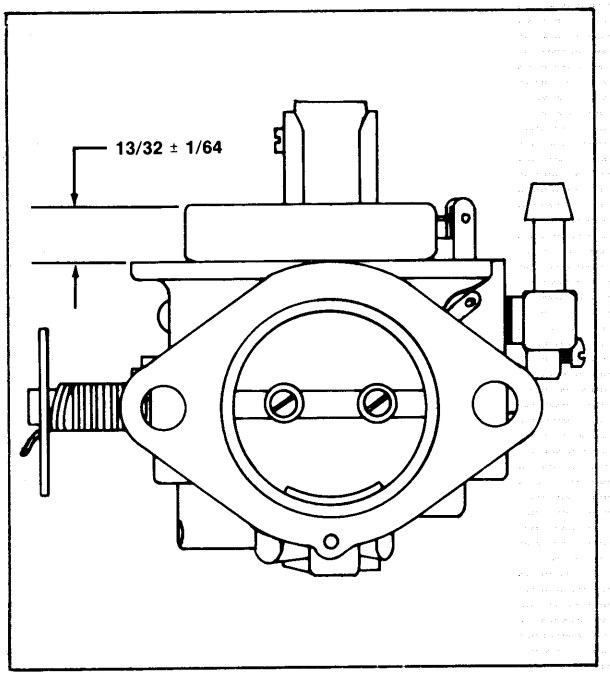


Figure 5–Measuring Float Height

If adjustment is necessary, bend tab on float as shown in figure 4.

D. Install fuel bowl as shown in Section VII, paragraph 5-2.

E. Install carburetor as outlined in appropriate paragraph.

8. INLET NEEDLE AND SEAT 01-20

8-1. Removing Inlet Needle

A. Remove carburetor as outlined in appropriate paragraph.

B. Remove float as outlined in Section VII, paragraph 7-1.

C. Remove inlet needle as shown in figure 6.

8-2. Installing Inlet Needle and Seat

A. Install inlet needle as shown in figure 6.

B. Install float as outlined in Section VII, paragraph 7-2.

C. Install carburetor as outlined in appropriate paragraph.

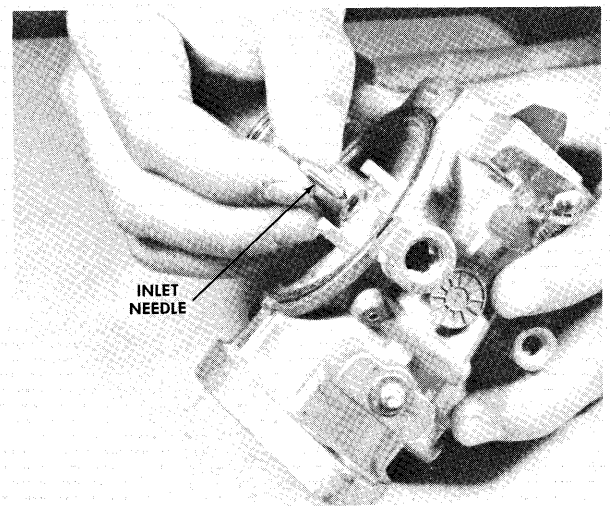


Figure 6–Removing Inlet Needle

SECTION VIII — ALTERNATOR

1. FLYWHEEL 02-51
FLYWHEEL KEY 02-53
LAPPING FLYWHEEL 02-54

1-1. Removing Flywheel

A. Remove flywheel nut securing flywheel to crankshaft.

B. Install flywheel puller (Special Tool T8948) on flywheel selecting proper length screws (quantity — 3) to use through plate and in flywheel.

C. Turn forcing screw as tight as possible against crankshaft while holding bar to prevent puller plate from turning as shown in figure 1.

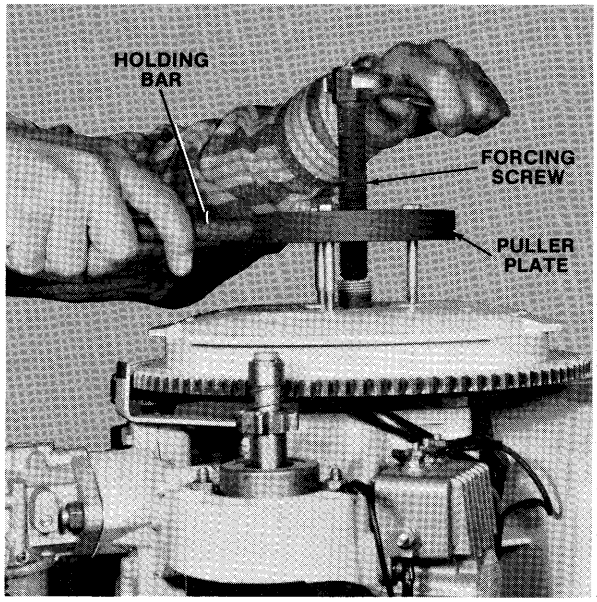


Figure 1 – Flywheel Puller

D. While using large screwdriver or wedge to apply an upward force on flywheel strike top of forcing screw with hammer. Flywheel will loosen from taper on crankshaft.

CAUTION

Do not strike forcing screw with excessive force as this may damage crankshaft and crankshaft bearings.

E. Remove flywheel puller and flywheel from crankshaft.

F. Remove distributor belt.

G. Pry flywheel key out of slot in crankshaft.

H. Carefully inspect flywheel for cracks or breaks.

WARNING

Cracked or chipped flywheel must be replaced. At high R.P.M., a damaged flywheel may fly apart throwing shrapnel over a large area.

I. Inspect tapered bore of flywheel and taper on crankshaft for fretting or working. If there is evidence of this condition or if the engine has had 25 or more hours of operation, the flywheel bore must be lapped. Lap flywheel as follows:

1. Apply a light coating of a water base valve lapping compound of 240 grit or finer to tapered portion of crankshaft.
2. Install flywheel on crankshaft and rotate flywheel gently back and forth about 1/4 turn — do not spin flywheel completely around crankshaft.
3. Rotate flywheel 90° and repeat above operation.
4. Remove flywheel, wipe compound off crankshaft and flywheel. Taper in bore of flywheel should have a minimum of 80% surface contact with taper on crankshaft.

NOTE

To check percentage of contact, use a lead pencil (#2 or 2B grade lead) and draw three (3) vertical lines on crankshaft taper 120° apart. Mount flywheel on crankshaft and rotate the flywheel 360° or one (1) full turn exerting light downward pressure. Remove flywheel and check percentage of pencil lines that have been rubbed off. If 80% or more of the pencil lines have been removed and no rocking is evident, then clean the tapers and re-install the flywheel. Repeat the above procedure if less than 80% of lines have been removed. If three (3) lappings cannot correct taper contact to crankshaft, replace the flywheel. If new flywheel does not lap in, then replacement of crankshaft will be necessary.

5. Thoroughly clean compound from flywheel, crankshaft and key ways.

1-2. Installing Flywheel

A. Install flywheel key in slot of crankshaft.

B. Install distributor belt as outlined in Section XII, paragraph 2-2.

C. Install flywheel on crankshaft and torque flywheel to 90 Ft. Lbs.

2. STATOR 02-52

2-1. Removing Stator

A. Remove flywheel as outlined in Section VIII, paragraph 1-1.

B. Remove four (4) screws securing stator to crankshaft bearing cage.

C. Remove stator leads from rectifier.

2-2. Installing Stator

A. Install stator on bearing cage aligning holes in stator with holes in bearing cage and secure with four (4) screws.

B. Connect stator leads to rectifier.

C. Install flywheel as outlined in Section VIII, paragraph 1-2.

SECTION IX — ELECTRICAL COMPONENTS — DELTA SYSTEM

1. CHOKE SOLENOID 03-51

1-1. Removing Choke Solenoid

A. Remove hex nut securing green wire to terminal post on choke solenoid.

B. Remove two (2) hex head screws securing solenoid to bracket and remove clamp. Remove choke solenoid from engine by pulling same from choke solenoid plunger.

C. Remove band securing wire to solenoid.

1-2. Installing Choke Solenoid

A. Install solenoid on choke plunger and position solenoid cn bracket with terminal post at approximately one o'clock.

B. Install clamp on solenoid and secure clamp with two (2) screws—do not tighten at this time.

C. Adjust choke solenoid position in bracket as outlined in Section IV, paragraph 3-4, steps E, F, G and H for 3 cylinder engines or Section V, paragraph 3-4, steps E, F, G and H for 4 cylinder engines.

D. Connect green wire to terminal post on solenoid and secure wire to post with lockwasher and nut.

E. Install ty-rap around solenoid and over wire to secure wire to the body of solenoid.

2. STARTER SOLENOID (RELAY) 03-52

2-1. Removing Starter Relay

A. Disconnect battery leads from battery.

B. Remove nut securing "POS" battery lead wire and red and white striped lead wire to forward side post of starter relay and remove both leads as shown in figure 1.

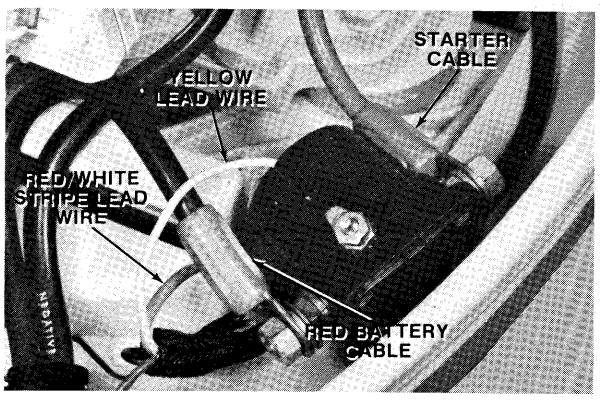


Figure 1–Removing Leads from Starter Relay

C. Remove nut securing yellow lead wire to top post on starter relay and remove lead wire.

D. Remove nut securing red lead wire (relay to starter motor) to rear side post of starter relay and remove lead wire.

E. Remove two (2) screws securing starter relay to support plate and remove starter relay.

NOTE

1971 and later models have a ground wire under head of forward screw.

2-2. Installing Starter Relay

A. Install starter relay on bosses provided in support plate and secure with two (2) screws.

NOTE

1971 and later models have a ground wire under head of forward attaching screw.

B. On forward side post of relay, install red and white striped lead wire, then spring lockwasher, and then "POS" battery lead wire. Secure wires to post with hex nut.

C. Install spring lockwasher then yellow lead wire to top post of relay and secure with nut.

D. Install spring lockwasher then red lead wire from starter motor to rear side post of relay and secure with nut.

3. INTERLOCK SWITCH 03-54

3-1. Removing Interlock Switch

A. Remove screw securing yellow with black stripe lead wire to starboard side terminal of interlock switch as shown in figure 2.

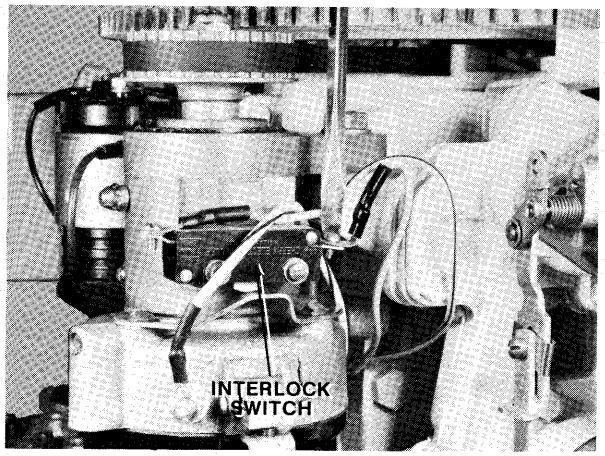


Figure 2–Removing Lead Wire from Interlock Switch

B. Remove screw securing yellow lead wire to port side terminal of interlock switch.

C. Remove two (2) screws securing interlock switch to distributor bracket and remove interlock switch.

3-2. Installing Interlock Switch

A. Install interlock switch to distributor bracket with white button positioned down. Secure switch to distributor bracket with two (2) screws.

B. Connect yellow lead wire to port side terminal of switch and secure with screw.

C. Connect yellow with black stripe lead wire to starboard side terminal and secure with screw.

D. Adjust interlock cam as outlined in Section IV, paragraph 2-4 for 3 cylinder engines or Section V, paragraph 2-4 for 4 cylinder engines.

4. RECTIFIER (SILICONE BRIDGE) 03-55

4-1. Removing Rectifier

A. Disconnect battery leads from battery.

B. Disconnect black lead wire from top left terminal post (-) by removing hex nut. See figure 3.

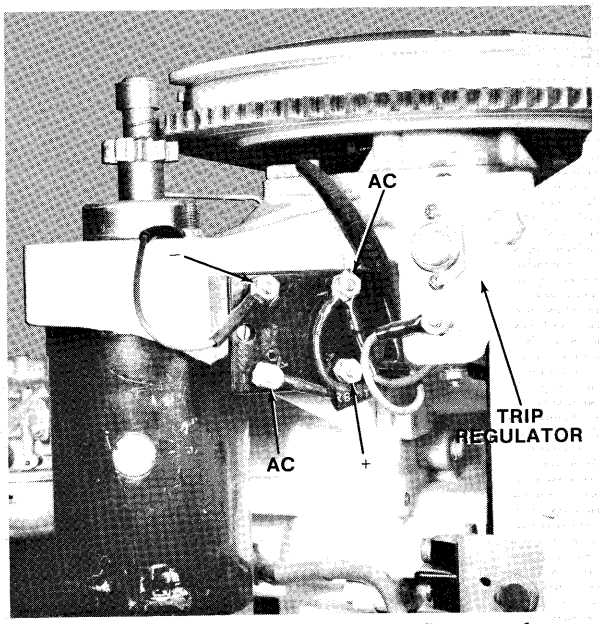


Figure 3–Rectifier with Wires Connected

C. Disconnect black lead wire and purple lead wire from top right terminal post (AC) by removing nut.

D. Disconnect black lead wire from bottom left terminal post (AC) by removing nut. See figure 3.

E. Disconnect red lead wire from bottom right terminal post (+) by removing nut. See figure 3.

F. Remove two (2) screws securing rectifier to powerhead and remove rectifier.

4-2. Installing Rectifier

A. Install rectifier on powerhead as shown in figure 3 and secure with two (2) screws.

B. Connect red lead wire to bottom right terminal post (+) and secure with hex nut and spring lockwasher.

C. Connect black lead wire to bottom left terminal post (AC) and secure with spring lockwasher and nut. See figure 3.

D. Connect black lead wire and purple lead wire to top right terminal post (AC) and secure with spring lockwasher and nut. See figure 3.

E. Connect black lead wire to top left terminal post (-) and secure with spring lockwasher and nut. See figure 3.

5. RECTIFIER (SELENIUM)

5-1. Removing Rectifier

A. Disconnect black lead wire and purple lead wire from inside terminal (marked with yellow paint) by removing screw securing same. See figure 4.

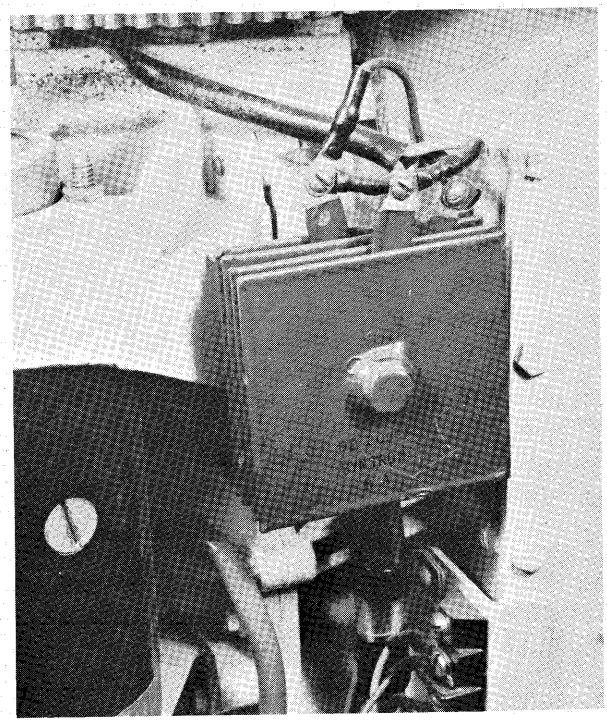


Figure 4–Selenium Type Rectifier

B. Remove red lead wire from middle terminal (marked with red paint) by removing screw securing same.

C. Disconnect black lead wire from outside terminal (marked with yellow paint) by removing screw securing same.

D. Remove two (2) screws securing rectifier bracket to powerhead.

E. Remove nut securing rectifier and trip regulator to rectifier bracket and remove rectifier.

CAUTION

When removing rectifier, do not use wrench on outside hex head in middle of rectifier. Hold rectifier on inside hex (large). Failure to do this can result in a failure of the rectifier.

5-2. Installing Rectifier

A. Install trip regulator on stud of rectifier with body of regulator away from rectifier and red washer stud terminal of regulator on same side as rectifier terminals.

B. Install both rectifier and regulator on rectifier bracket and secure both to bracket with hex nut.

CAUTION

When installing rectifier, do not use wrench on outside hex head in middle of rectifier. Hold rectifier on inside hex (large). Failure to do this can result in a failure of the rectifier.

C. Install bracket assembly to powerhead and secure with two (2) screws.

D. Connect black lead wire and purple lead wire to inside terminal of rectifier (marked with yellow paint) and secure with screw and lockwasher. See figure 4.

E. Connect red lead wire to middle terminal of rectifier (marked with red paint) and secure with screw and lockwasher.

F. Connect black lead wire to outside terminal of rectifier (marked with yellow paint) and secure with screw and lockwasher.

6. TRIP REGULATOR 03-56

6-1 Removing Trip Regulator

A. When trip regulator is used with a silicone bridge type rectifier, proceed as follows:

1. Remove rectifier by removing hex head screw securing same to cylinder exhaust cover. See figure 5.

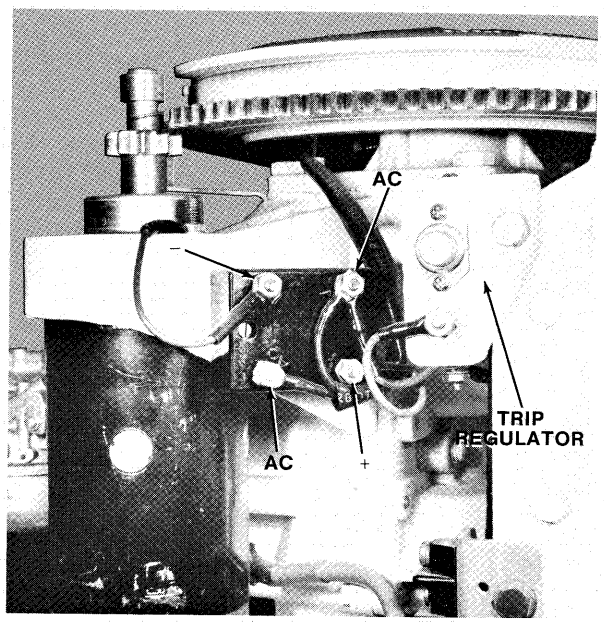


Figure 5–Trip Regulator

2. Disconnect red lead wire (from + terminal of rectifier) from yellow washer stud terminal by removing hex nut securing same.

3. Disconnect red lead wire (from wiring harness) from red washer stud terminal by removing hex nut securing same.

B. When trip regulator is used with a selenium type rectifier, proceed as follows:

1. Remove rectifier as outlined in Section IX, paragraph 5-1.

2. Disconnect red lead wire (from + terminal of rectifier) from yellow washer stud terminal by removing hex nut securing same.

3. Disconnect red lead wire (from wiring harness) from red washer stud terminal by removing hex nut securing same.

6-2. Installing Trip Regulator

A. When trip regulator is used with a silicone bridge type rectifier, proceed as follows:

1. Install trip regulator on exhaust cover and secure with hex head screw. See figure 5.

2. Connect red lead wire (from + terminal of rectifier) to yellow washer stud terminal and secure with nut and lockwasher.

3. Connect red lead wire (from wiring harness) to red washer stud terminal and secure with nut and lockwasher.

B. When trip regulator is used with a selenium type rectifier, proceed as follows:

1. Connect red lead wire (from + terminal of rectifier) to yellow washer stud terminal and secure with nut and lockwasher.

2. Connect red lead wire (from wiring harness) to red washer stud terminal and secure with nut and lockwasher.
3. Install trip regulator as outlined in Section IX, paragraph 6-2.

7. CIRCUIT BREAKER 03-57

7-1. Removing Circuit Breaker

A. Remove two (2) screws and plain washers securing circuit breaker bracket to terminal block bracket and remove circuit breaker with bracket.

B. Disconnect lead wires from stud terminals of circuit breaker by removing nuts securing same and remove circuit breaker from bracket.

7-2. Installing Circuit Breaker

A. Install circuit breaker on bracket so that longer stud terminal will be positioned up when bracket is installed on terminal block bracket.

B. Connect terminal with two (2) red lead wires to short terminal stud and secure with hex nut and lockwasher.

C. Connect red with white stripe lead wire to long terminal stud and secure with nut and lockwasher.

D. Install circuit breaker assembly on terminal block bracket and secure with two (2) screws and plain washers.

8. TERMINAL BLOCK 03-61

8-1. Removing Terminal Block

A. Disconnect battery leads from battery.

B. Disconnect all lead wires from terminal block.

C. Remove two (2) screws securing terminal block to terminal block bracket and remove terminal block.

8-2. Installing Terminal Block

A. Install terminal block on terminal block bracket and secure with two (2) screws.

NOTE

Under head of bottom screw (which attaches terminal block to bracket) is a special ground clip. Do not forget to install this clip.

B. Connect lead wires to terminal block as shown in figure 6.

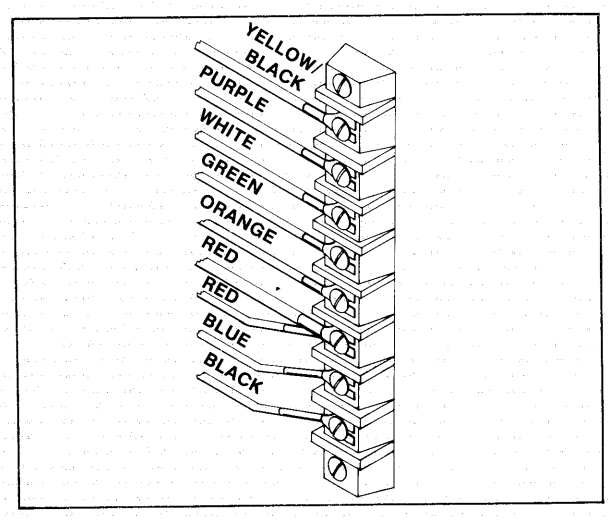


Figure 6 – Connecting Lead Wires to Terminal Block

C. Connect battery leads to battery.

9. C-D Unit 03-58

9-1. Removing C-D Unit

A. Disconnect blue wire from blue washer terminal stud by removing hex nut. See figure 7.

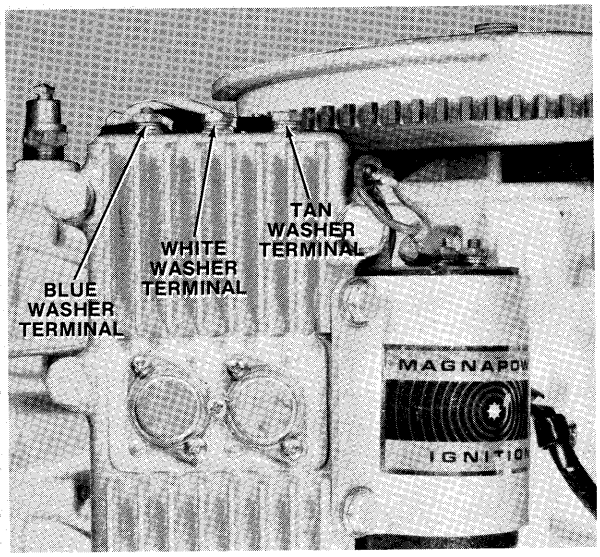


Figure 7 – C-D Unit

B. Disconnect white lead wire from white washer terminal stud by removing hex nut.

C. Disconnect white with black stripe lead wire from tan washer stud terminal by removing hex nut.

D. Disconnect black lead wire from coil from side terminal stud of C-D unit by removing hex nut.

E. Disconnect white lead wire from (-) terminal on ignition coil.

F. Disconnect blue lead wire from (+) terminal on ignition coil.

G. Remove three (3) hex head bolts securing C-D unit to powerhead and remove C-D unit with ignition coil.

H. Remove coil clamp and coil from C-D unit by removing two (2) hex head screws and two (2) flat head screws.

9-2. Installing C-D Unit

A. Install coil clamp and coil on C-D unit. Secure with two (2) flat head screws in back of C-D unit and two (2) hex head screws with steel washer, then phenolic washer under head of each screw and plastic washer between clamp and C-D unit.

B. Install assembly on powerhead and secure with three (3) hex head bolts and plain washers. Torque bolts to 160 in. lbs.

C. Connect blue lead wire from C-D unit to (+) terminal on ignition coil.

D. Connect white lead wire from C-D unit to (-) terminal on ignition coil.

E. Connect black lead wire from ignition coil to side terminal stud and secure with hex nut.

F. Connect white with black stripe lead wire to tan washer stud terminal and secure with hex nut.

G. Connect white lead wire to white washer terminal stud and secure with hex nut.

H. Connect blue lead wire to blue washer terminal stud and secure with hex nut.

10. IGNITION COIL 03-59

10-1. Removing Ignition Coil

A. Disconnect blue lead wire from (+) terminal stud on coil by removing hex nut. See figure 7.

B. Disconnect white lead wire from (-) terminal stud on coil by removing hex nut.

C. Disconnect black lead wire from (G) terminal stud on coil by removing hex nut.

D. Disconnect primary lead wire from bottom of coil by removing boot and pulling lead wire from coil.

E. Remove two (2) hex head screws securing coil clamp to C-D unit and pull coil down from clamp.

10-2. Installing Ignition Coil

A. Install coil in clamp and position coil as shown in figure 7.

B. Secure coil in clamp with two (2) hex head screws with steel washer, then fiber washer under head of screw. Install plastic washers between coil clamp and C-D unit and tighten screws.

CAUTION

It is important that the steel washer, fiber washer and plastic washer be correctly assembled or coil will not function properly causing a weak spark.

Also when checking coil on a tester, coil must be assembled to C-D unit with coil clamp using proper assembly sequence of washers. Washers isolate one end of coil clamp. Coil clamp is the ground part of built-in capacitor in the coil and should only be grounded at back side of C-D unit.

C. Connect black lead wire to (G) terminal stud on coil and secure with nut and spring lockwasher.

D. Connect white lead wire to (-) terminal stud on coil and secure with nut and spring lockwasher.

E. Connect blue lead wire to (+) terminal stud on coil and secure with nut and spring lockwasher.

F. Connect primary lead wire to bottom of coil by pushing lead wire in coil and install boot.

11. WIRING HARNESS 03-60

11-1. Removing Wiring Harness

A. Disconnect green lead wire from choke solenoid.

B. Disconnect red lead wire and yellow lead wire from starter relay.

C. Remove clamp and black lead wire from forward screw securing starter relay to support plate.

D. Disconnect all lead wires from terminal block.

E. Disconnect red lead wire and red with white stripe lead wire from circuit breaker.

F. Disconnect red lead wire from trip regulator.

G. Disconnect purple lead wire from rectifier.

H. Disconnect blue lead wire, white lead wire and white with black stripe lead wire from top of C-D unit.

I. Disconnect orange lead wire from overheat sensor.

J. Remove screw securing clamp to parting line.

K. Disconnect yellow lead wire and yellow with black stripe lead wire from interlock switch.

L. Disconnect white with black stripe lead wire from distributor.

M. Remove wiring harness from powerhead.

11-2. Installing Wiring Harness

A. Connect green lead wire to choke solenoid.

B. Connect red lead wire to forward side terminal of starter relay and yellow lead wire to top terminal stud of starter relay.

C. Install clamp and black lead wire to forward screw securing starter relay to support plate.

D. Connect all lead wires to terminal block as outlined in Section IX, paragraph 8-2.

E. Connect red lead wire and red with white stripe lead wire to circuit breaker as outlined in Section IX, paragraph 7-2.

F. Connect red lead wire to trip regulator as outlined in Section IX, paragraph 6-2.

G. Connect purple lead wire to rectifier as outlined in Section IX, paragraph 4-2 or 5-2.

H. Connect blue lead wire, white lead wire and white with black stripe lead wire to top of C-D unit as outlined in Section IX, paragraph 9-2.

I. Connect orange lead wire to overheat sensor and secure with nut and spring lockwasher.

J. Pull wiring harness tight against powerhead and secure position of wiring harness with clamp on parting line of cylinder and crankcase and secure with screw.

K. Connect yellow lead wire and yellow with black stripe lead wire to interlock switch as outlined in Section IX, paragraph 3-2.

L. Connect white with black stripe lead wire to distributor and secure with nut and spring lockwasher.

12. IGNITION SWITCH 03-53

12-1. Removing Ignition Switch

A. Remove ignition switch from control box or dashboard or boat.

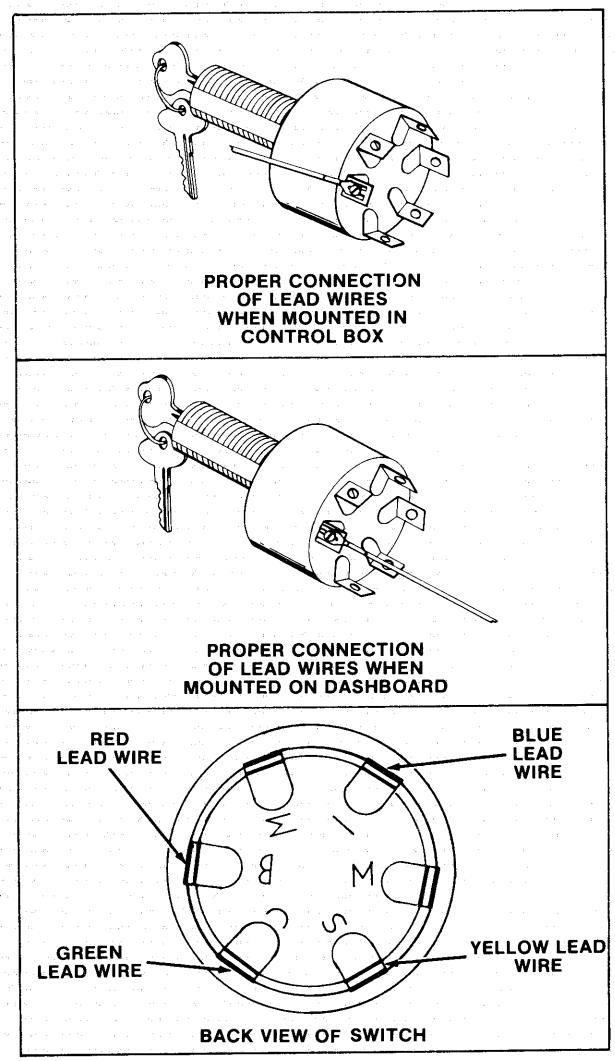


Figure 8–Connections of Lead Wire to Switch

B. Disconnect lead wires from ignition switch.

12-2. Installing Ignition Switch

A. Connect lead wires to ignition switch as shown in figure 8.

B. Install ignition switch to control box or dashboard of boat.

1. CHOKE SOLENOID 03-51

1-1. Removing Choke Solenoid

A. Remove hex nut securing green wire to terminal post on choke solenoid.

B. Remove two (2) hex head screws securing solenoid to bracket and remove clamp. Remove choke solenoid from engine by pulling same from choke solenoid plunger.

C. Remove band securing wire to solenoid.

1-2. Installing Choke Solenoid

A. Install solenoid on choke plunger and position solenoid on bracket with terminal post at approximately one o'clock.

B. Install clamp on solenoid and secure clamp with two (2) screws—do not tighten at this time.

C. Adjust choke solenoid position in bracket as outlined in Section IV, paragraph 3-4, steps E, F, G and H for 3 cylinder engines or Section V, paragraph 3-4, steps E, F, G and H for 4 cylinder engines.

D. Connect green wire to terminal post on solenoid and secure wire to post with lockwasher and nut.

E. Install ty-rap around solenoid and over wire to secure wire to the body of solenoid.

2. STARTER SOLENOID (RELAY) 03-52

NOTE

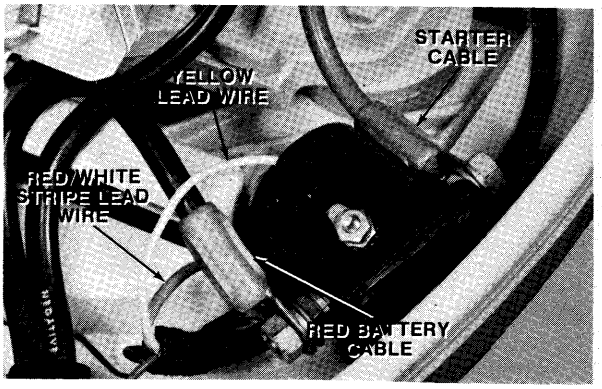
There are two types of starter relays used. Refer to figure 1 to determine which starter relay is being serviced.

2-1. Removing Starter Relay

A. Disconnect battery leads from battery.

B. Remove nut securing "POS" battery lead wire and red and white striped lead wire to forward side post of starter relay and remove both leads as shown in figure 1.

TYPE A STARTER RELAY



TYPE B STARTER RELAY

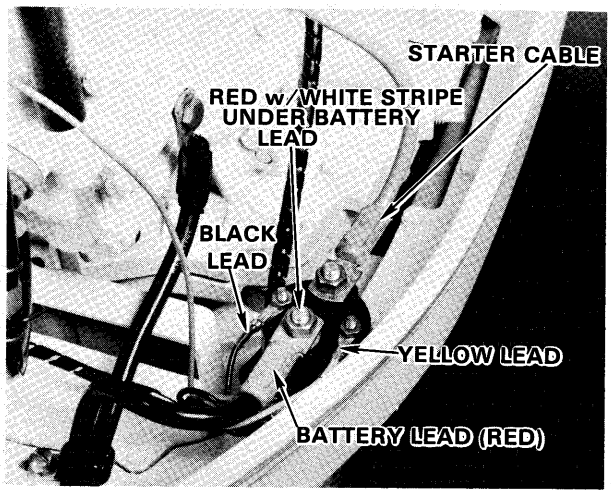


Figure 1—Removing Leads from Starter Relay

C. Remove nut securing yellow lead wire to top post on starter relay and remove lead wire.

D. Remove nut securing red lead wire (relay to starter motor) to rear side post of starter relay and remove lead wire.

E. Remove two (2) screws securing starter relay to support plate and remove starter relay.

NOTE

1971 and later models have a ground wire under head of forward screw.

2-2. Installing Starter Relay

A. Install starter relay on bosses provided in support plate and secure with two (2) screws.

NOTE

1971 and later models have a ground wire under head of forward attaching screw.

B. On forward side post of relay, install red and white striped lead wire, then spring lockwasher, and then "POS" battery lead wire. Secure wires to post with hex nut.

C. Install spring lockwasher then yellow lead wire to top post of relay and secure with nut.

D. Install spring lockwasher then red lead wire from starter motor to rear side post of relay and secure with nut.

3. INTERLOCK SWITCH 03-54

3-1. Removing Interlock Switch

A. The interlock switch is mounted in two different locations. Refer to figure 2 for location of switch being serviced.

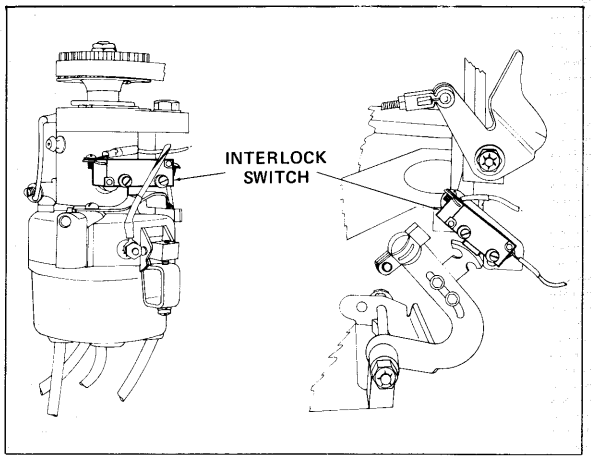


Figure 2—Location of Interlock Switch

B. Remove two (2) screws and lockwashers securing lead wires to each end of interlock switch.

C. Remove two (2) screws and plain washers securing interlock switch to distributor bracket or interlock switch mounting bracket and remove switch.

3-2. Installing Interlock Switch

A. Install interlock switch to distributor bracket or interlock switch mounting bracket with white button positioned down. Install two (2) screws and plain washers and tighten securely.

B. Install lead wires to terminals on each end of interlock switch and secure with two (2) screws and lockwashers.

C. Adjust interlock cam as outlined in Section IV, paragraph 2-4 or 2-5 for 3 cylinder engines or Section V, paragraph 2-4 or 2-5 for 4 cylinder engines.

4. REGULATOR — RECTIFIER 03-55

4-1. Removing Regulator — Rectifier

A. Disconnect red lead wire from (+) terminal stud on regulator—rectifier by removing hex nut securing same. See figure 3.

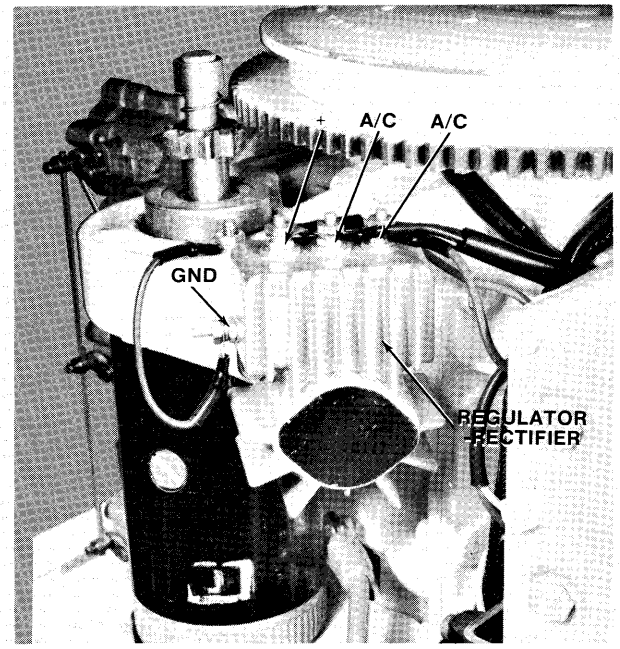


Figure 3–Regulator-Rectifier

B. Disconnect two (2) black lead wires and one (1) purple lead wire from two (2) "AC" terminal studs by removing hex nuts securing same.

C. Disconnect black lead wire from side "GND" terminal stud by removing nut.

D. Remove three (3) screws securing regulator—rectifier from powerhead and remove regulator—rectifier.

4-2. Installing Regulator—Rectifier

A. Install regulator—rectifier on powerhead and secure with three (3) screws.

B. Connect one (1) black lead wire and one (1) purple lead wire to top right side terminal stud (AC) and secure with lockwasher and nut. See figure 3.

C. Connect other black lead wire to middle minal stud (AC) and secure with lockwasher and nut.

D. Connect red lead wire to left side terminal stud (+) and secure with nut and spring lockwasher.

E. Connect black lead wire to side terminal stud (GND) and secure with nut and spring lockwasher.

5. CIRCUIT BREAKER 03-57

5-1. Removing Circuit Breaker

A. Remove two (2) screws and plain washers securing circuit breaker bracket to terminal block bracket and remove circuit breaker with bracket.

B. Disconnect lead wires from stud terminals of circuit breaker by removing nuts securing same and remove circuit breaker from bracket.

5-2. Installing Circuit Breaker

A. Install circuit breaker on bracket so that longer stud terminal will be positioned up when bracket is installed on terminal block bracket.

B. Connect terminal with two (2) red lead wires to short terminal stud and secure with hex nut and lockwasher.

C. Connect red with white stripe lead wire to long terminal stud and secure with nut and lockwasher.

D. Install circuit breaker assembly on terminal block bracket and secure with two (2) screws and plain washers.

6. TERMINAL BLOCK 03-61

6-1. Removing Terminal Block

A. Disconnect battery leads from battery.

B. Disconnect all lead wires from terminal block.

C. Remove two (2) screws securing terminal block to terminal block bracket and remove terminal block.

6-2. Installing Terminal Block

A. Install terminal block on terminal block bracket and secure with two (2) screws.

NOTE

Under head of bottom screw (which attaches terminal block to bracket) is a special ground clip. Do not forget to install this clip.

B. Connect lead wires to terminal block as as shown in figure 4.

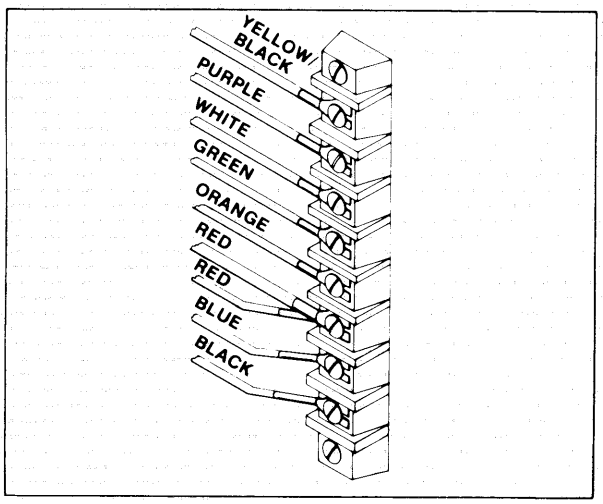


Figure 4–Connecting Lead Wires to Terminal Block

C. Connect battery leads to battery.

7. C-D UNIT 03-58

7-1. Removing C-D Unit (404301-1, 404301)

A. Disconnect blue lead wire and white lead wire (from C-D unit) from terminal block.

B. Disconnect grey lead wire from (+) terminal stud on coil. See figure 5.

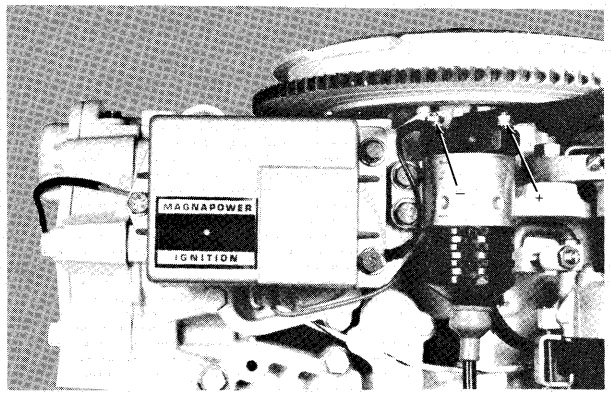


Figure 5–C-D Unit

C. Disconnect white with black stripe lead wire from distributor terminal stud.

D. Remove three (3) screws securing C-D unit to bracket and remove C-D unit.

7-2. Installing C-D Unit

A. Install C-D unit on bracket and secure with three (3) screws.

NOTE

Connect black coil ground wire under screw head of bottom right side screw.

B. Route blue lead wire and white lead wire behind C-D bracket and wrap around wiring harness to prevent wires from contacting flywheel.

C. Connect blue lead wire to second terminal screw from bottom of terminal block.

D. Connect white lead wire to third terminal screw from top of terminal block.

E. Connect grey lead wire to (+) terminal stud on coil.

F. Connect white with black stripe lead wire to terminal stud on distributor.

7-3. Removing C-D Unit (K404301-2)

A. Remove hex nut and lockwasher securing white wire with black stripe to terminal on distributor bracket and remove wire.

B. Remove blue lead, red lead and white lead (C-D unit to terminal block) from terminal block.

C. Remove three (3) screws securing C-D unit to powerhead and remove C-D unit.

7-4. Installing C-D Unit

A. Place C-D unit on powerhead. Install three (3) screws securing C-D unit to powerhead and tighten securely.

B. Route white wire with black stripe (from C-D unit) down behind towershaft and up to terminal on distributor and secure with hex nut.

C. Route remaining lead wires (blue, red, white) up over powerhead, under flywheel and down to terminal block. Connect leads to terminal block as specified on decal on exhaust port cover.

7A. C-D UNIT 03-58
IGNITION COIL 03-59

7A-1. Removing C-D Unit

A. Remove red, white and blue leads (C-D unit to terminal block) from terminal block.

B. Remove screw securing ground lead from ignition coil to distributor bracket.

C. Remove white/black stripe lead from terminal on distributor housing. See figure 5A.

D. Remove boot from coil and pull high tension lead wire from coil.

E. Remove three stop nuts securing C-D unit to shock mounts and remove C-D unit with ignition coil. See figure 5B.

F. Remove black leads from ground (-) terminal on ignition coil and gray lead from positive (+) terminal on ignition coil.

G. Remove three screws securing coil clamp and coil to C-D unit and remove coil and clamp.

H. Remove shock mounts from power head by installing two (2) nuts on stud of shock mount tighten nuts against one another and turn shock mounts out of powerhead with wrench on lower nut.

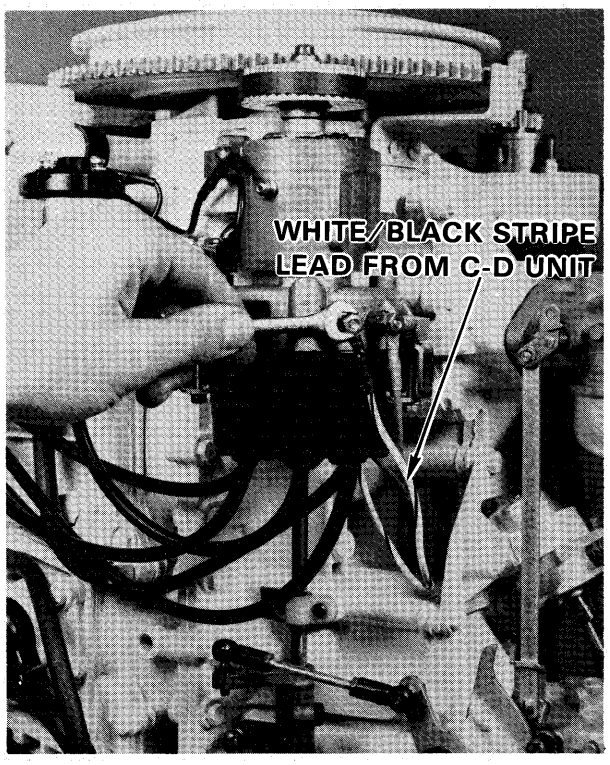


Figure 5A—Removing Lead from Distributor

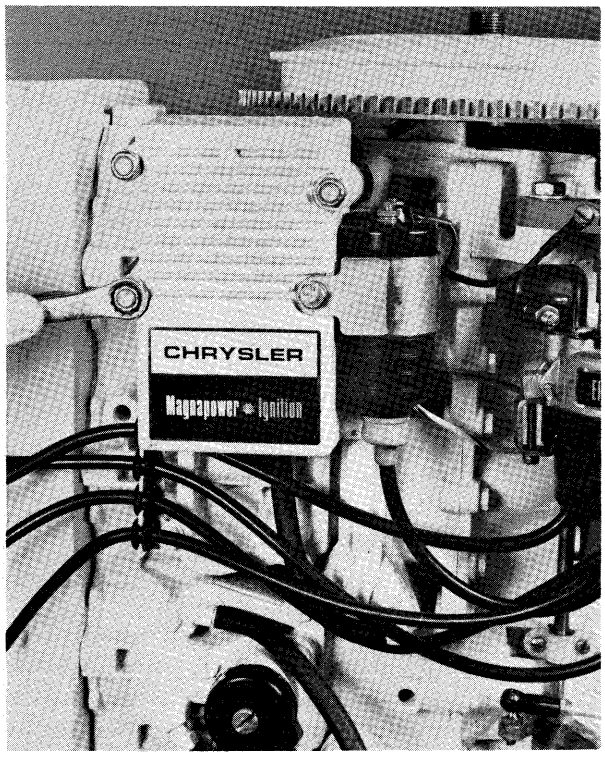


Figure 5B—Removing C-D Unit

7A-2. Installing C-D Unit

A. Install three shock mounts on powerhead and torque to 40 inch pounds.

B. Place coil on C-D unit, install coil clamp over coil and secure with three screws.

NOTE

Positive (+) terminal on coil should be positioned toward the outside and Ground (-) terminal toward the inside.

C. Place gray lead from C-D unit on positive (+) terminal on coil and secure with lockwasher and nut. Place black lead from C-D unit and black lead from distributor bracket to coil on Ground (-) terminal on ignition coil and secure with lockwasher and hex nut.

D. Place C-D unit with ignition coil on shock mounts, install three stop nuts and torque to 90 inch pounds.

E. Install high tension lead wire in coil and secure with boot.

F. Route white wire with black stripe down behind towershaft and up to white terminal on distributor, secure with hex nut.

G. Connect ground lead (from ignition coil) to distributor bracket.

H. Route remaining lead wires (red, white, blue) up and over power head, under flywheel and down to terminal block. Connect leads to terminal block as specified on decal on exhaust port cover. (See figure 5C).

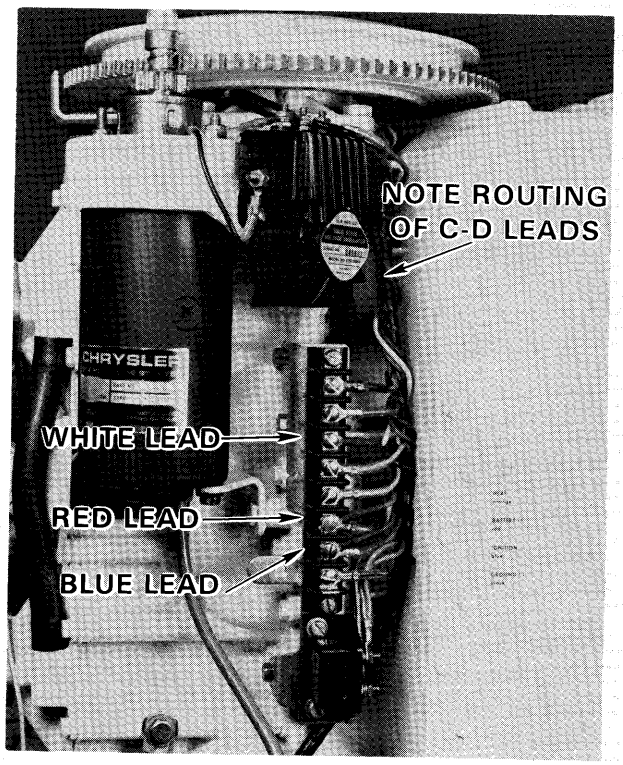


Figure 5C—Connecting C-D Leads To Terminal Block

8. IGNITION COIL 03-59

8-1. Removing Ignition Coil

A. Disconnect grey lead wire from (+) terminal stud on coil by removing nut.

B. Disconnect black lead wire from (GND) terminal stud on coil by removing nut.

C. Remove boot from coil and pull high tension lead wire from coil.

D. Remove two (2) hex head screws securing coil clamp to C-D bracket. Remove coil, coil clamp and spacer from powerhead.

E. Remove coil from coil clamp.

8-2. Installing Ignition Coil.

A. Install rubber band on top and bottom of coil. Install coil in coil clamp. Position spacer between two (2) ends of coil clamp and install assembly on powerhead. See figure 5 in C-D unit paragraph for positioning of coil.

B. Secure coil clamp assembly to powerhead using two (2) screws with steel plain washer then phenolic washer under head of each screw. Torque screws to 70 in. lbs.

C. Connect high tension lead wire to coil by pushing same up in coil, then push boot in place over coil end.

D. Connect grey lead wire to (+) terminal stud on coil and secure with spring lockwasher and nut.

E. Connect black lead wire to (GND) terminal stud on coil and secure with spring lockwasher and nut.

8-3. Removing Ignition Coil (K404301-2)

A. Remove C-D unit as outlined in Section X, paragraph 7-3.

B. Remove two (2) hex nuts and lead wires from terminals on ignition coil.

C. Remove three (3) screws and lockwashers securing coil and coil clamp to C-D unit and remove coil and coil clamp.

8-4. Installing Ignition Coil

A. Install ignition coil on C-D unit. Install coil clamp, three (3) screws and lockwashers securing coil clamp and coil to C-D unit.

B. Connect gray lead from C-D unit to "+" terminal on ignition coil and black lead from C-D unit to terminal marked "GND" on ignition coil.

C. Install C-D unit as outlined in Section X, paragraph 7-4.

9. WIRING HARNESS 03-60

9-1. Removing Wiring Harness

A. Disconnect green lead wire from choke solenoid.

B. Disconnect red lead wire and yellow lead wire from starter relay.

C. Remove clamp and black lead wire from forward screw securing starter relay to support plate.

D. Disconnect all lead wires from terminal block including blue lead wire and white lead wire from C-D unit.

E. Disconnect red lead wire and red with white stripe lead wire from circuit breaker.

F. Disconnect red lead wire and purple lead wire from regulator—rectifier.

G. Disconnect orange lead wire from overheat sensor.

H. Remove screw securing clamp to parting line.

I. Disconnect yellow lead wire and yellow with black stripe lead wire from interlock switch.

J. Remove wiring harness from powerhead.

9-2. Installing Wiring Harness

A. Connect green lead wire to choke solenoid as outlined in Section X, paragraph 1-2.

B. Connect red lead wire to forward side terminal of starter relay and yellow lead wire to top terminal stud of starter relay.

C. Install clamp and black lead wire to forward screw securing starter relay to support plate.

D. Connect all lead wires to terminal block as outlined in Section X, paragraph 6-2.

E. Connect red lead wire and red with white stripe lead wire to circuit breaker as outlined in Section X, paragraph 5-2.

F. Connect red lead wire and purple lead wire to regulator—rectifier as outlined in Section X, paragraph 4-2.

G. Wrap blue lead wire and white lead wire from C-D unit around wiring harness to prevent wires from contacting flywheel.

H. Connect orange lead wire to overheat sensor and secure with nut and nut and spring lockwasher.

I. Pull wiring harness tight against powerhead and secure position of wiring harness with clamp on parting line of cylinder and crankcase and secure with screw.

J. Connect yellow lead wire and yellow with black stripe lead wire to interlock switch as outlined in Section X, paragraph 3-2.

10. IGNITION SWITCH 03-53

10-1. Removing Ignition Switch

A. Remove ignition switch from control box or dashboard of boat.

B. Disconnect lead wires from ignition switch.

10-2. Installing Ignition Switch

A. Connect lead wires to ignition switch as shown in figure 6.

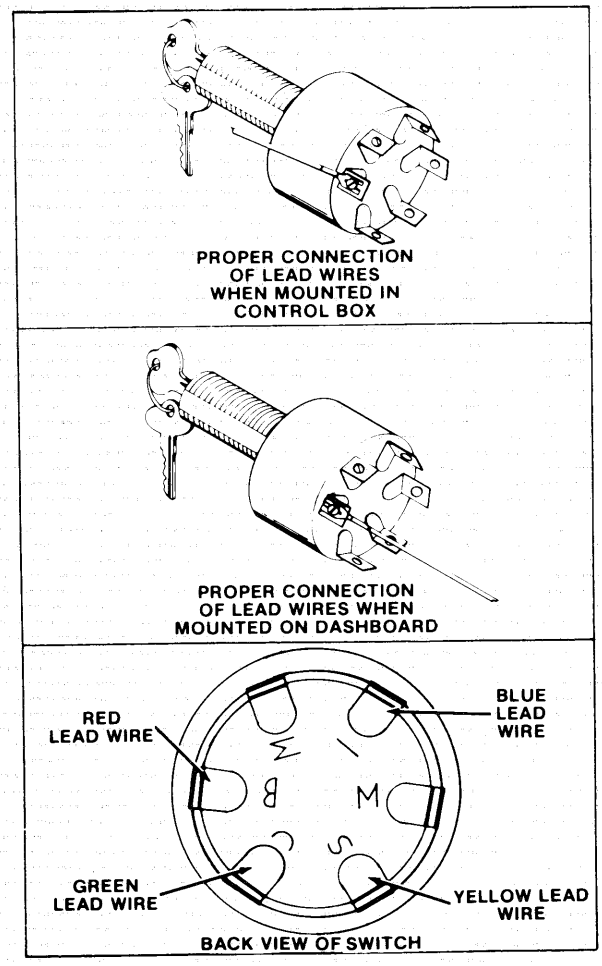


Figure 6–Connections of Lead Wire to Switch

B. Install ignition switch to control box or dashboard of boat.

SECTION XA — ELECTRICAL COMPONENTS — MAGNAPOWER II

1. INTERLOCK SWITCH

1-1. Removing Interlock Switch

A. Remove two (2) screws and lockwashers securing lead wires to each end of interlock switch.

B. Remove two (2) screws and plain washers securing interlock switch to interlock mounting bracket and remove switch. See figure 1.

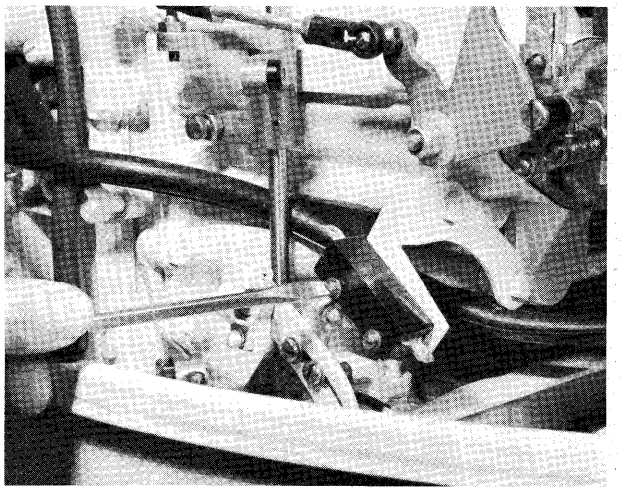


Figure 1 - Removing Interlock Switch

1-2. Installing Interlock Switch

A. Install interlock switch to interlock switch mounting bracket with white button positioned down. Install two (2) screws and plain washers securing interlock switch to bracket and tighten securely.

B. Install lead wires to terminals on each end of interlock switch and secure with two (2) screws and lockwashers. See figure 2.

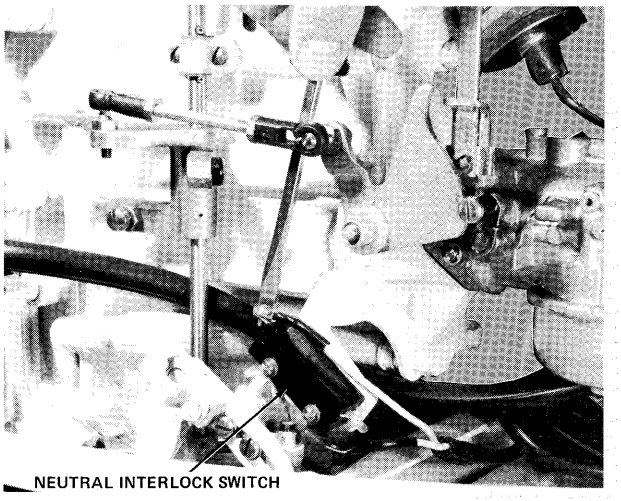


Figure 2 - Installing Interlock Switch Leads

C. Adjust interlock cam as outlined in Section V, paragraph 2-5.

2. CHOKE SOLENOID

2-1. Removing Choke Solenoid

A. Remove ty-rap securing green lead to choke solenoid.

B. Remove hex nut and lockwasher securing green lead to terminal post on choke solenoid.

C. Remove two (2) hex head screws and clamp securing choke solenoid to bracket. Remove choke solenoid from engine by pulling same from choke solenoid plunger. See figure 3.

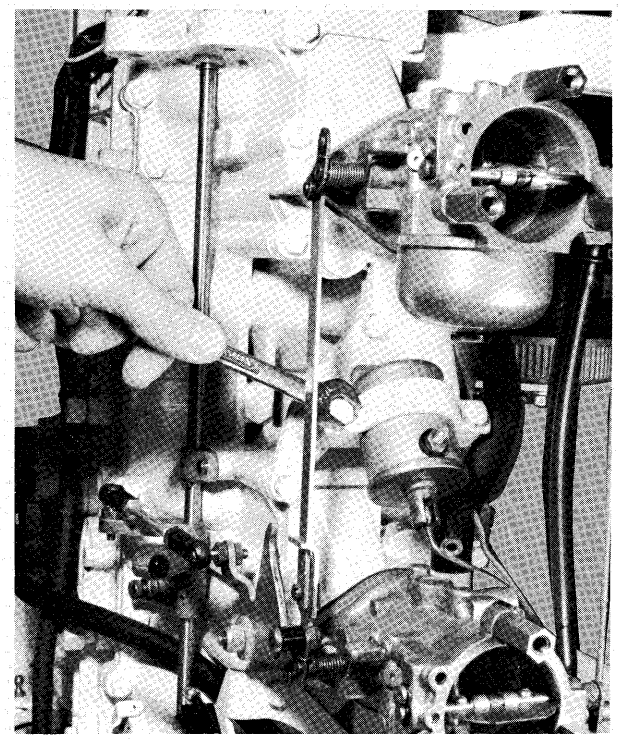


Figure 3 - Removing Choke Solenoid

2-2. Installing Choke Solenoid

A. Install choke plunger in choke solenoid and position solenoid on bracket with terminal post at approximately two o'clock.

B. Install clamp on solenoid and secure with two (2) screws — do not tighten at this time.

C. Adjust choke solenoid position in bracket as outlined in Section V, paragraph 3-4.

D. Connect green lead wire to terminal post on solenoid and secure with lockwasher and hex nut.

E. Install ty-rap around solenoid and over wire to secure wire to body of solenoid.

3. STARTER SOLENOID (RELAY)

3-1. Removing Starter Relay

A. Disconnect battery leads from battery terminals.

B. Remove nut securing positive battery lead wire (black with red end) and small red/white stripe lead wire to forward stud terminal of starter relay and remove both leads, as shown in figure 4.

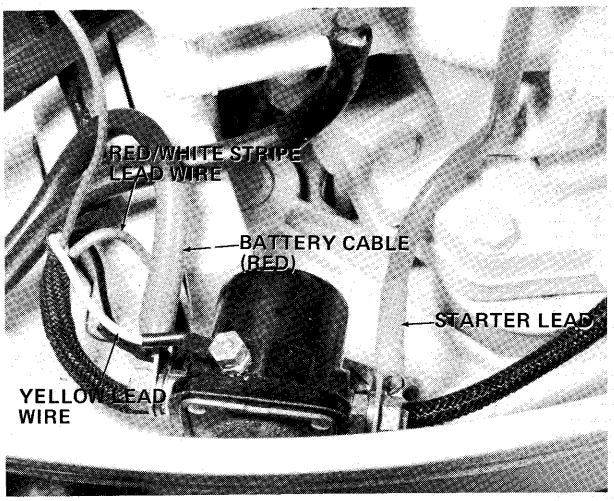


Figure 4 - Removing Leads from Starter Relay

C. Remove nut securing yellow lead wire to top stud terminal on starter relay and remove lead wire. See figure 4.

D. Remove nut securing red lead wire (relay to starter motor) to rear stud terminal of starter relay and remove lead wire. (See figure 4.)

E. Remove rear mounting screw and lockwasher securing starter relay to support plate.

F. Remove forward mounting screw, wiring harness clamp and ground lead securing starter relay to support plate and remove starter relay.

3-2. Installing Starter Relay

A. Install starter relay on bosses provided in support plate. Install rear mounting screw and lockwasher and tighten securely.

B. Install forward mounting screw, ground lead (from wiring harness) and wiring harness clamp and tighten securely. See figure 5.

C. Install red/white stripe lead wire, lockwasher and positive battery lead on forward stud terminal on starter relay and secure with hex nut.

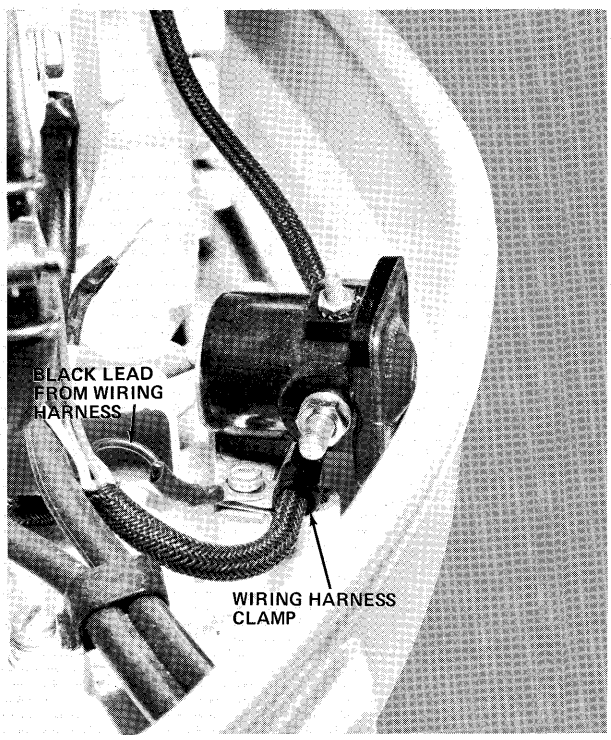


Figure 5 - Installing Starter Relay

D. Install lockwasher and yellow lead wire on top stud terminal of starter relay and secure with hex nut.

E. Install lockwasher and red starter lead to rear stud terminal on starter relay and secure with hex nut.

F. Connect battery leads to battery terminals.

4. CIRCUIT BREAKER

4-1. Removing Circuit Breaker

A. Disconnect battery leads from battery terminals.

B. Loosen two (2) screws and plain washers, securing circuit breaker bracket to terminal block bracket and remove circuit breaker with bracket as shown in figure 6.

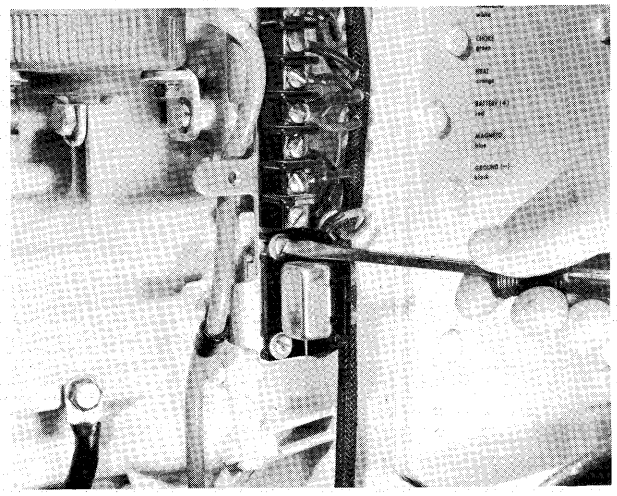


Figure 6 - Removing Circuit Breaker

C. Remove hex nut, lead wire and lockwasher from each terminal of circuit breaker.

D. Remove hex nuts securing circuit breaker to bracket. Separate circuit breaker from bracket.

4-2. Installing Circuit Breaker

A. Install circuit breaker on bracket so that long stud terminal will be positioned down when bracket is installed on engine. Secure circuit breaker to bracket with hex nuts.

B. Install circuit breaker assembly on terminal block bracket and secure with two (2) screws and plain washers.

C. Install lockwasher and red lead to top (short) stud terminal of circuit breaker and secure with hex nut. See figure 7.

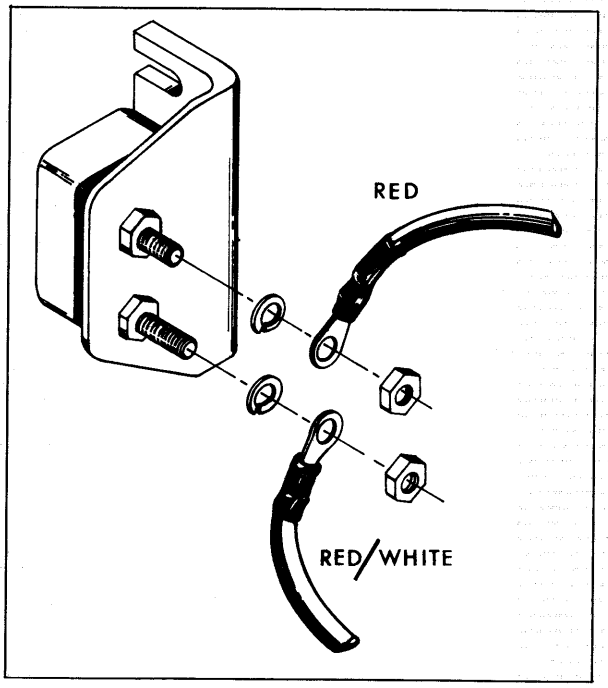


Figure 7 - Connecting Circuit Breaker Leads

D. Install lockwasher and red with white stripe lead to bottom (long) stud terminal of circuit breaker and secure with hex nut.

E. Connect battery leads to battery terminals.

5. TERMINAL BLOCK

5-1. Removing Terminal Block

A. Disconnect battery leads from battery terminals.

B. Disconnect all lead wires from terminal block.

C. Remove two (2) screws securing terminal block to terminal block bracket and remove terminal block.

5-2. Installing Terminal Block

A. Install terminal block on terminal block bracket and secure with two (2) screws.

B. Connect lead wires to terminal block as shown in figure 8.

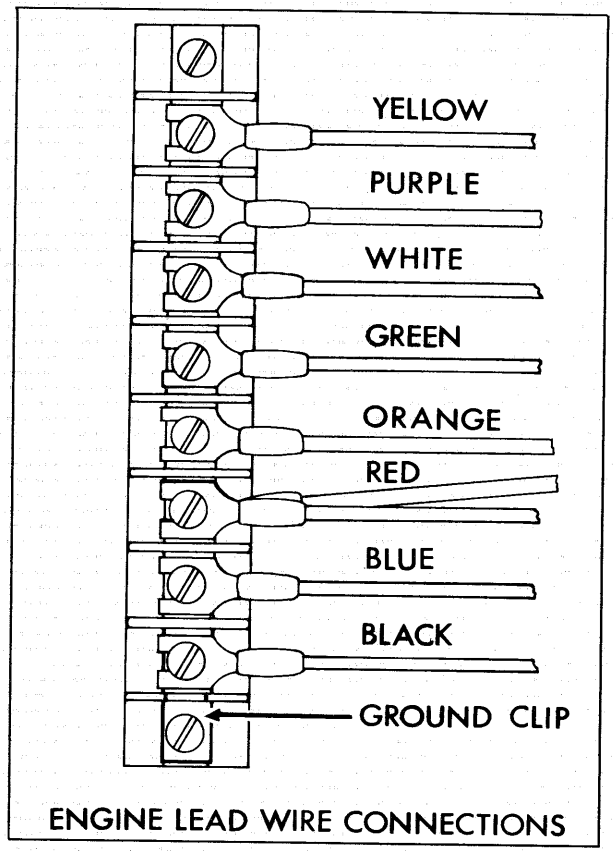


Figure 8 - Connecting Lead Wires to Terminal Block

C. Connect battery leads to battery terminals.

6. IGNITION COIL

6-1. Removing Ignition Coil

A. Disconnect battery leads from battery terminals.

B. Disconnect primary lead wire (coil to spark plug) from top of coil by removing boot and pulling lead from coil.

C. Remove three (3) screws and plain washers securing coil to cylinder head cover and remove coil. See figure 9.

D. Remove nuts, lockwashers and lead wires from bottom of coil and remove coil.

6-2. Installing Ignition Coils

A. Install lockwashers and lead wires on ignition coil terminals and secure with hex nuts. See figure 10.

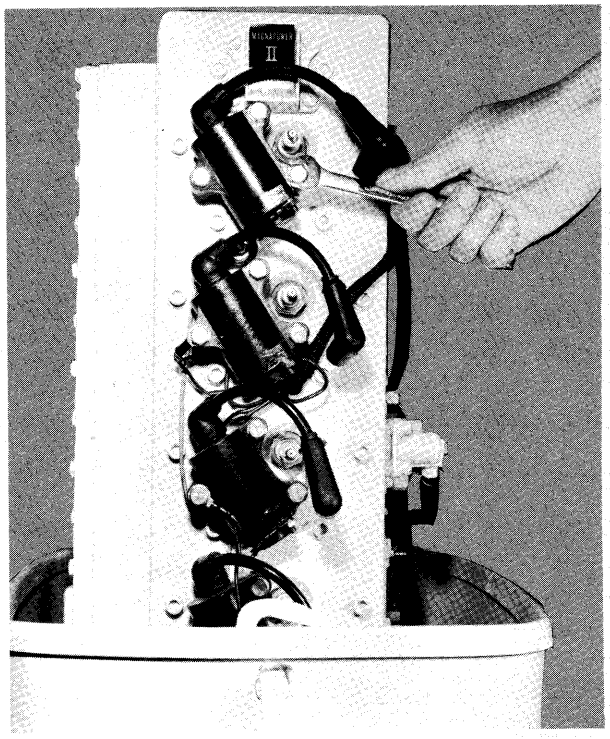


Figure 9 - Removing Ignition Coil

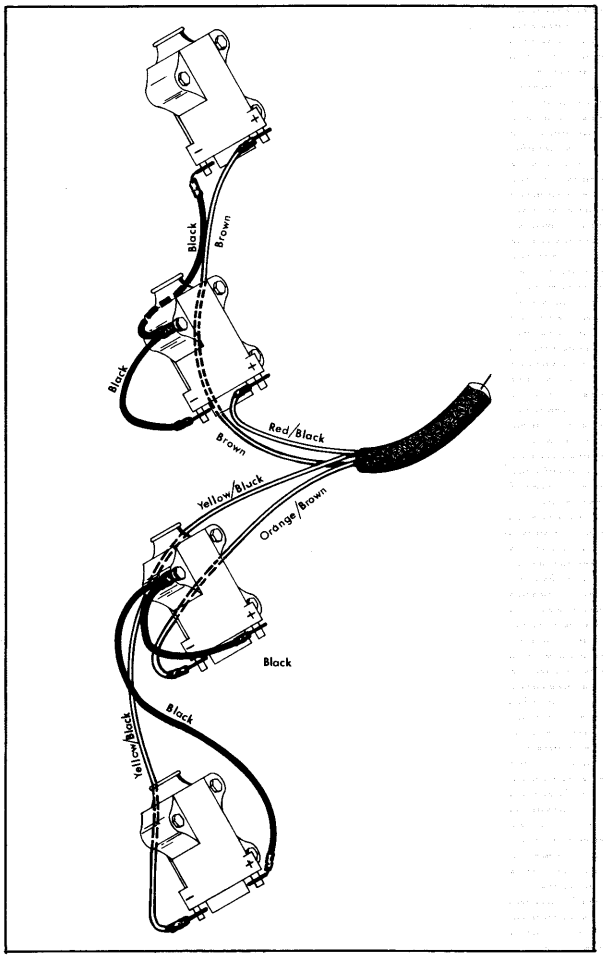


Figure 10 - Wiring Ignition Coils

B. Install ignition coil on cylinder head cover and secure with three (3) screws and plain washers. Torque screws to 70 in. lbs.

C. Connect high tension lead wire (from spark plug) to coil by pushing same in coil, then pushing boot in place on coil end.

D. Connect battery leads to battery terminals.

7. THERMOSWITCH

7-1. Removing Thermoswitch

A. Remove hex nut, lead wire and lockwasher from stud terminal on thermoswitch.

B. Remove top ignition coil as outlined in Section XA, paragraph 6-1.

C. Remove thermoswitch from cylinder head cover as shown in figure 11.

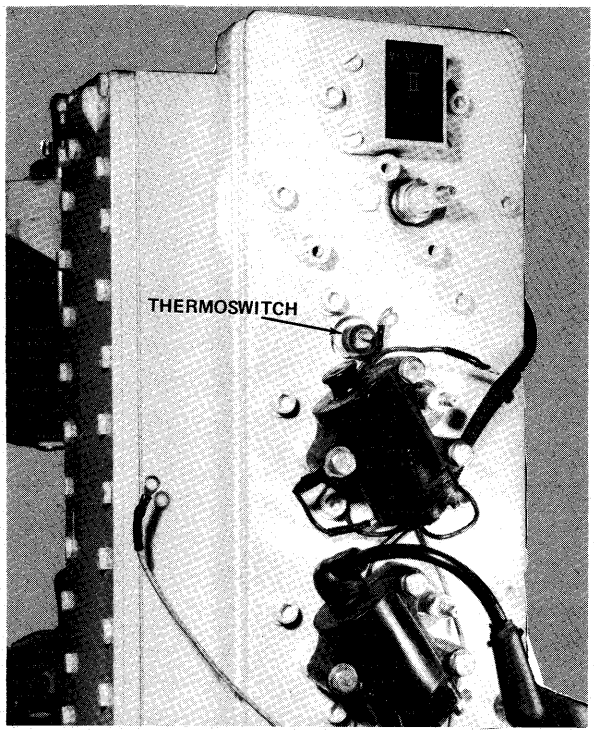


Figure 11 - Removing Thermoswitch

7-2. Installing Thermoswitch

A. Install thermoswitch on cylinder head cover and tighten securely.

B. Install lockwasher, lead wire and hex nut to terminal and tighten securely.

C. Install ignition coil as outlined in Section XA, paragraph 6-2.

8. C-D MODULE TIMING RING RETAINER

8-1. Removing Timing Ring Retainer and C-D Module

A. Disconnect battery leads from battery terminals.

B. Remove flywheel as outlined in Section VIII, paragraph 1-1.

C. Remove four (4) stop nuts, timing ring retainer and four bowed washers securing timing ring retainer to studs and remove timing ring retainer. Refer to figure 12.

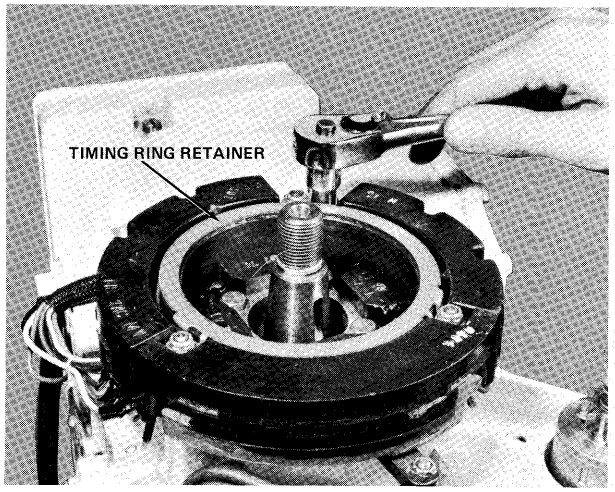


Figure 12 - Removing Timing Ring Retainer

D. Remove five (5) screws, lead wires and lockwashers from C-D module.

E. Remove two (2) studs securing C-D module to bearing cage and remove C-D module from engine as shown in figure 13.

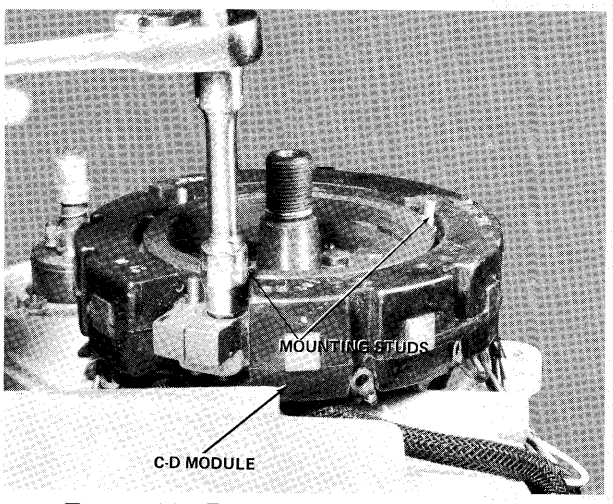


Figure 13 - Removing C-D Module

8-2. Installing C-D Module and Timing Ring Retainer

A. Place C-D module on bearing cage. Install two (2) studs and tighten securely.

NOTE

While tightening mounting studs, push in on module to seat it properly against the bearing cage.

B. Install screws, lead wires and lockwasher to C-D module and tighten securely. See figure 14 for proper connection of lead wires.

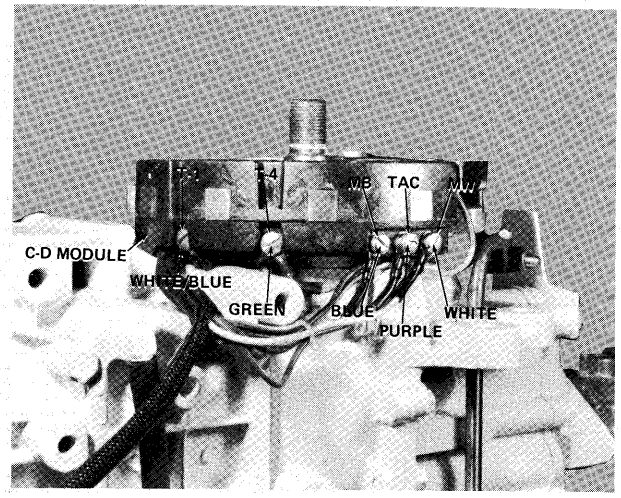


Figure 14 - Connection Lead Wires to C-D Module

C. Install four (4) bowed washers, timing ring retainer and four (4) stop nuts. Tighten stop nuts down evenly using a .003 feeler gauge between retainer and timing ring at retainer legs. There should be drag on feeler gauge. See figure 15.

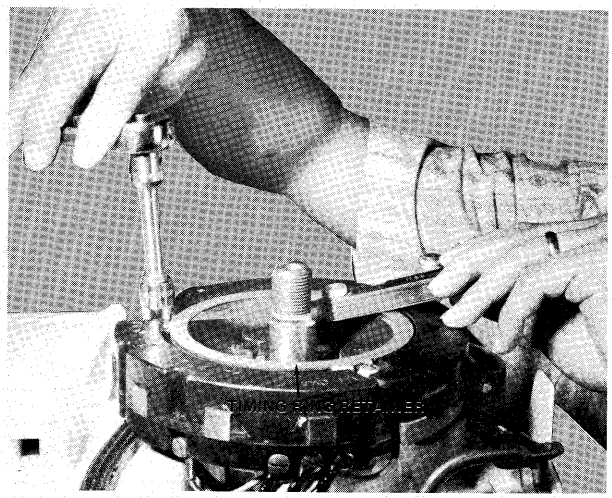


Figure 15 — Adjusting Timing Ring Retainer

D. Check friction of timing ring by rotating it using a spring scale attached to outside hole of pivot arm (with towershaft disconnected). Reading should be 3 to 5 lbs. Readjust stop nuts evenly, but no more than 1/8 turn to get proper friction. See figure 16.

E. Install flywheel as outlined in Section VIII, paragraph 1-2.

F. Connect battery leads to battery terminals.

9. ALTERNATOR STATOR MODULE

9-1. Removing Alternator Stator Module

A. Disconnect battery leads from battery terminals.

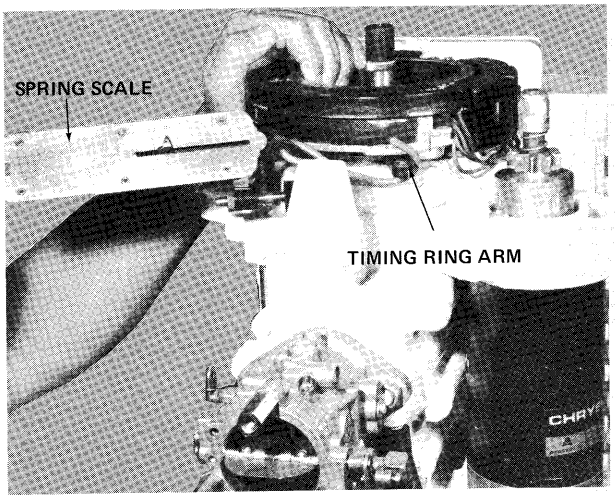


Figure 16 - Checking Timing Ring Friction

B. Remove flywheel as outlined in Section VIII, paragraph 1-1.

C. Remove two (2) screws and lockwashers securing lead wires to alternator stator module.

D. Remove timing ring retainer as outlined in Section XA, paragraph 8-1.

E. Remove two (2) studs securing alternator stator module to bearing cage and remove same from engine. See figure 17.

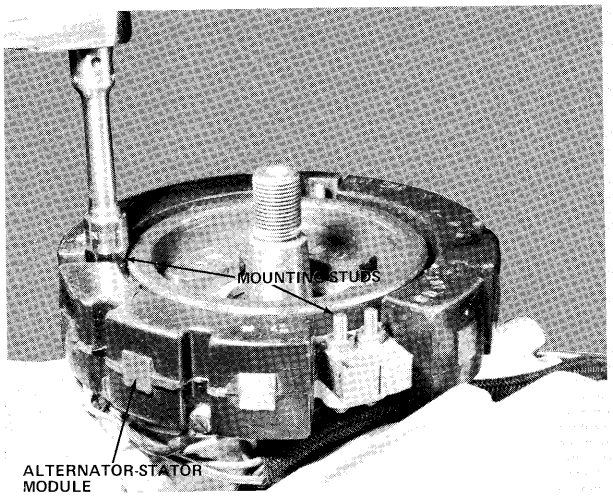


Figure 17 - Removing Alternator Stator Module

9-2. Installing Alternator Stator Module

A. Place alternator module on bearing cage. Install two (2) studs and tighten securely.

NOTE

While tightening mounting studs, push in on module to seat it properly against the bearing cage.

B. Install two (2) screws, lead wires and lockwashers to alternator stator module and tighten securely. See figure 18 for proper connection of leads.

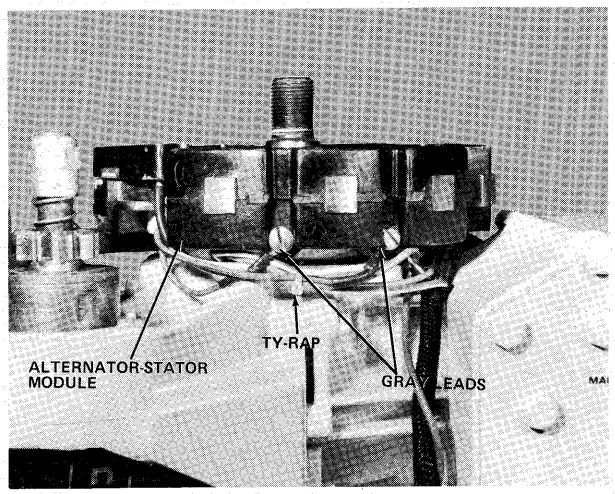


Figure 18 - Connecting Leads to Alternator Stator Module

C. Install timing ring retainer as outlined in Section XA, paragraph 8-2.

D. Install flywheel as outlined in Section VIII, paragraph 1-2.

E. Connect battery leads to battery terminals.

10. CAPACITOR MODULE

10-1. Removing Capacitor Module

A. Disconnect battery leads from battery terminals.

B. Remove flywheel as outlined in Section VIII, paragraph 1-1.

C. Remove timing ring retainer as outlined in Section XA, paragraph 8-1.

D. Remove two (2) screws and lockwashers securing capacitor leads to C-D module.

E. Remove two (2) studs securing capacitor module to bearing cage and remove capacitor from same. See figure 19.

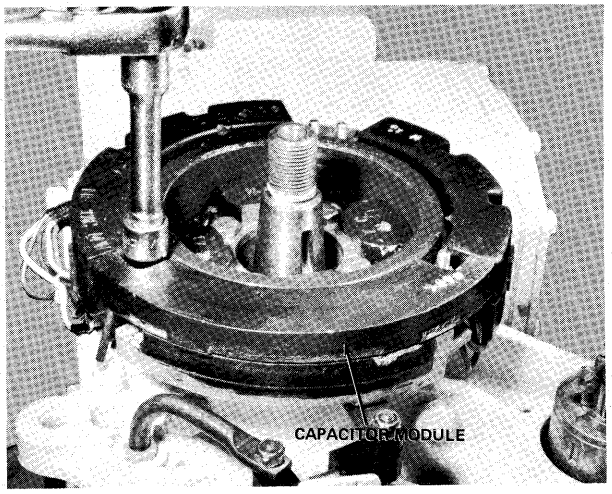


Figure 19 - Removing Capacitor Module

10-2. Installing Capacitor Module

A. Place capacitor module on bearing cage. Install two (2) studs and tighten securely.

NOTE

While tightening mounting studs, push in on module to seat it properly against the bearing cage.

B. Install two (2) screws, lead wires and lockwashers securing capacitor leads to C-D module. See figure 20 for location of leads.

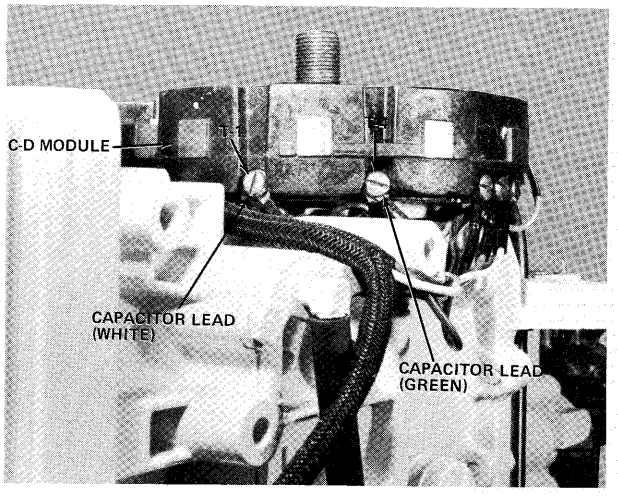


Figure 20 - Connecting Capacitor Leads to C-D Module

C. Install timing ring retainer as outlined in Section XA, paragraph 8-2.

D. Install flywheel as outlined in Section VIII, paragraph 1-2.

E. Connect battery leads to battery terminals.

11. REGULATOR-RECTIFIER MODULE

11-1. Removing Regulator-Rectifier Module

A. Disconnect battery leads from battery terminals.

B. Remove flywheel as outlined in Section VIII, paragraph 1-1.

C. Remove capacitor module as outlined in Section XA, paragraph 10-1.

D. Remove two (2) screws and lockwashers securing regulator-rectifier leads to alternator module and remove one screw securing regulator-rectifier lead to terminal block.

E. Remove two (2) screws and lockwashers securing regulator-rectifier to bearing cage as shown in figure 21 and remove same.

11-2. Installing Regulator-Rectifier Module

A. Place regulator-rectifier on bearing cage and secure with two (2) screws and lockwashers.

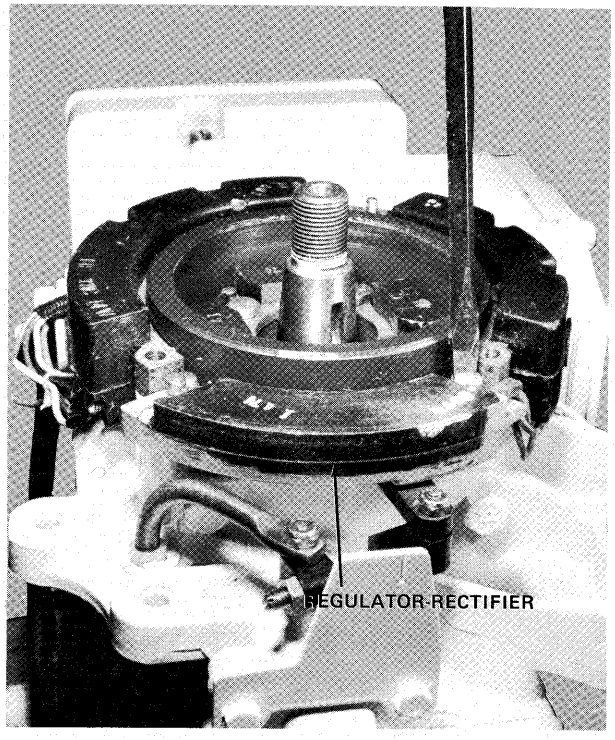


Figure 21 - Removing Regulator-Rectifier Module

NOTE

While tightening mounting screws, push in on module to seat it properly against the bearing cage.

B. Install two (2) screws and lockwashers securing regulator-rectifier leads to alternator module as shown in figure 22. Install one (1) screw securing (red) regulator-rectifier lead to terminal block and secure.

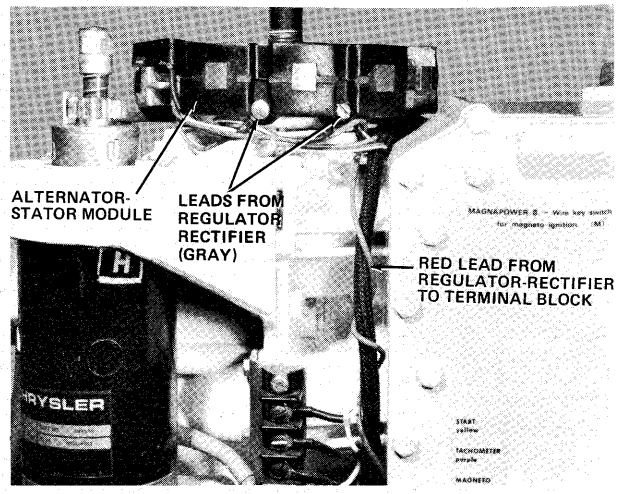


Figure 22 - Connecting Regulator-Rectifier Leads

C. Install capacitor module as outlined in Section XA, paragraph 10-2.

D. Install flywheel as outlined in Section VIII, paragraph 1-2.

E. Connect battery leads to battery terminals.

12. TRIGGER MODULE

12-1. Removing Trigger Module

A. Disconnect battery leads from battery terminals.

B. Remove flywheel as outlined in Section VIII, paragraph 1-1.

C. Remove eight (8) screws and lockwashers securing lead wires to trigger modules.

D. Remove four (4) screws securing trigger assembly to bearing cage as shown in figure 23 and remove same from bearing cage.

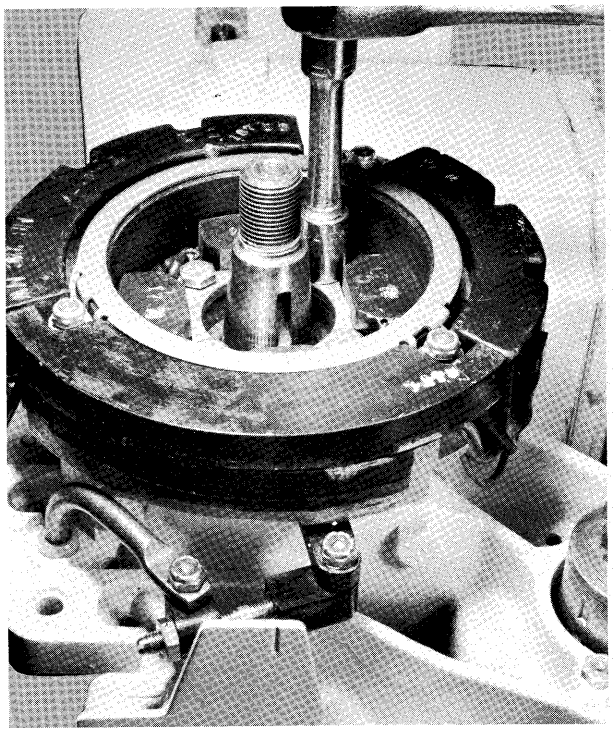


Figure 23 - Removing Trigger Assembly

E. Remove trigger module from mounting plate by bending metal clip down and sliding module from plate as shown in figure 24.

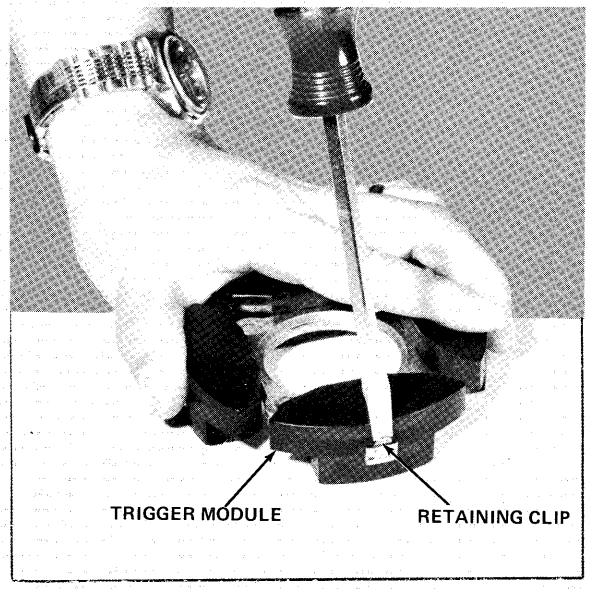


Figure 24 - Removing Trigger Module

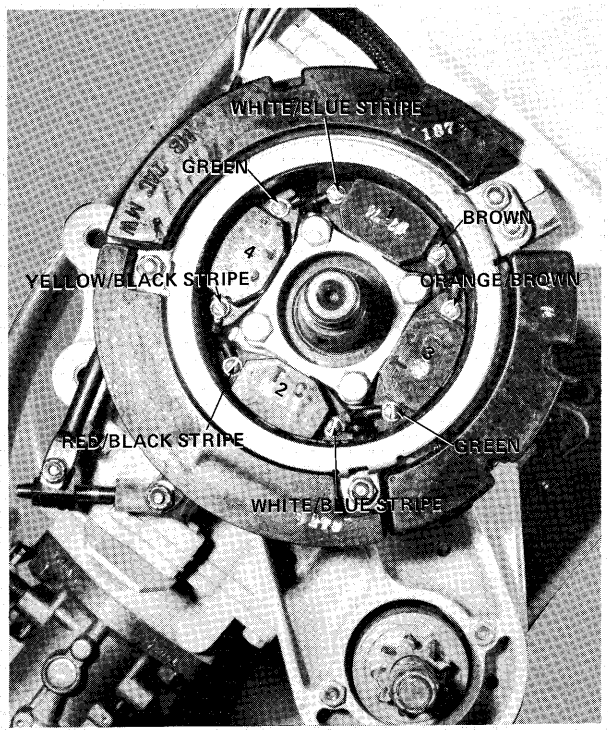


Figure 25 - Connecting Leads to Trigger Modules

12-2. Installing Trigger Module

A. Install trigger module on mounting plate terminals up and secure by bending metal clip down. Refer to figure 24.

B. Place trigger assembly on bearing cage (8 terminals up), install four (4) screws and tighten securely.

C. Install eight (8) screws, lockwashers and lead wires on trigger modules as shown in figure 25.

D. Install flywheel as outlined in Section VIII, paragraph 1-2.

E. Connect battery leads to battery terminals.

13. TIMING RING

13-1. Removing Timing Ring

A. Remove flywheel as outlined in Section VIII, paragraph 1-1.

B. Remove screw, stop nut and bowed washer securing spark control link to timing ring arm as shown in figure 26.

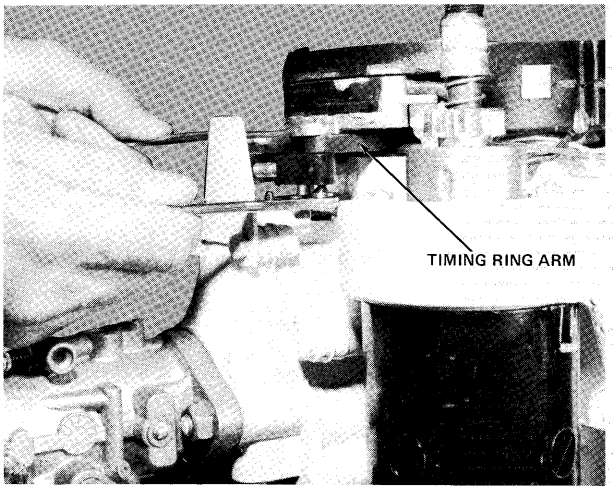


Figure 26 - Removing Spark Control Link from Timing Ring Arm

C. Remove trigger module assembly as outlined in Section XA, paragraph 12-1, steps C and D.

D. Remove regulator-rectifier module as outlined in Section XA, paragraph 11-1 and remove timing ring.

13-2. Installing Timing Ring

A. Apply grease (Special Tool T2961) to bearing cage. Lay timing ring in bearing cage with timing ring arm to port side as shown in figure 27.

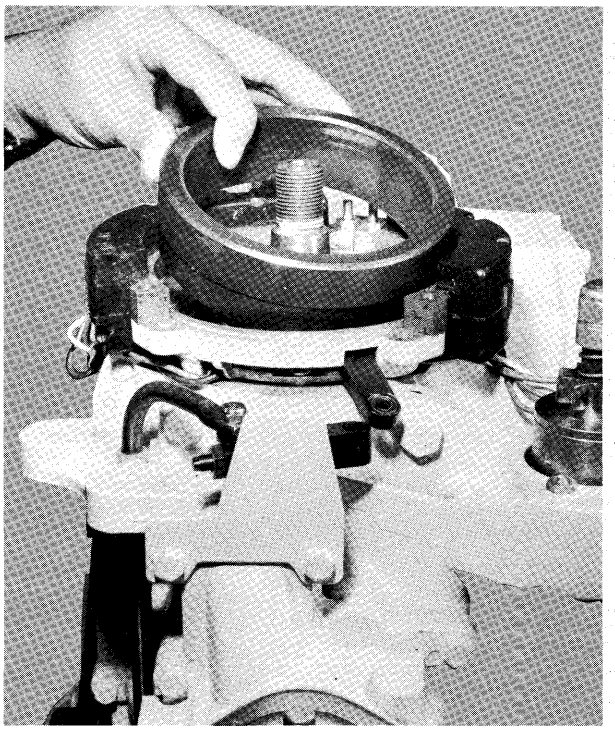


Figure 27 - Installing Timing Ring

B. Install regulator-rectifier as outlined in Section XA, paragraph 11-2.

C. Apply grease (Special Tool T2961) to timing ring retainer. Install timing ring retainer as outlined in Section XA, paragraph 8-2.

D. Install trigger module assembly as outlined in Section XA, paragraph 12-2.

E. Install screw, stop nut and bowed washer securing spark control link to timing ring arm. (See figure 26)

F. Install flywheel as outlined in Section VIII, paragraph 2-2.

14. WIRING HARNESS

14-1. Removing Wiring Harness

A. Disconnect battery leads from battery terminals.

B. Remove flywheel as outlined in Section VIII, paragraph 1-1.

C. Remove lead wires from terminals on interlock switch.

D. Remove green lead from terminal on choke solenoid.

E. Remove lead wires from starter relay as outlined in Section XA, paragraph 3-1.

F. Disconnect lead wires from circuit breaker as outlined in Section XA, paragraph 4-1.

G. Disconnect all lead wires from terminal block.

H. Remove lead wires from ignition coils as outlined in Section XA, paragraph 6-1.

I. Remove orange lead from stud terminal on thermoswitch.

J. Remove eight (8) lead wires from trigger modules as outlined in Section XA, paragraph 12-1.

K. Remove five lead wires from C-D module as outlined in Section XA, paragraph 8-1 and remove wiring harness.

NOTE

It will be necessary to remove C-D module to allow clearance for removal of wiring harness. See figure 28.

14-2. Installing Wiring Harness

A. Connect lead wires to terminal block and circuit breaker as outlined in appropriate sections.

B. Route wiring harness down and toward front of engine. Secure wiring harness to forward mounting boss of starter relay with clamp. Connect leads to starter relay as outlined in Section XA, paragraph 3-2.

C. Connect green lead to terminal stud on choke solenoid and secure with lockwasher and hex nut.

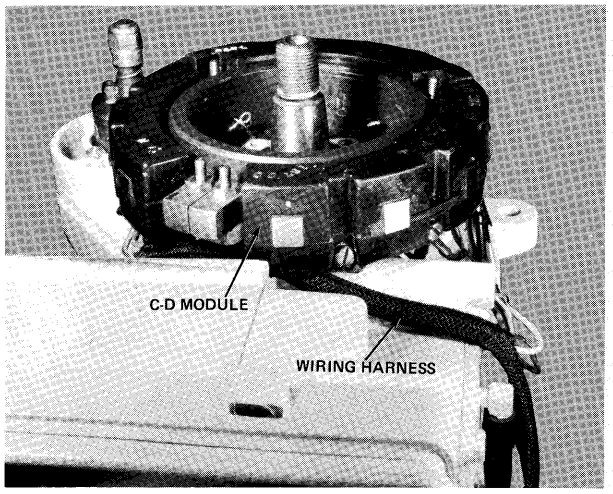


Figure 28 - Routing of Wiring Harness

D. Route remaining yellow leads under carburetor toward starboard side of engine and connect leads to terminals on interlock switch.

E. Route wiring harness up and over cylinder as shown in figure 28. At first break out from terminal block route the orange/brown stripe and brown wires through rear hole (port side) in bearing cage, connect orange/brown to No. 3 trigger coil rear terminal — connect brown wire to No. 1 trigger coil terminal port side. Route the green and white/blue stripe wire to the front hole (port side) in bearing cage — connect green wire to forward terminal of No. 3 trigger coil — connect white/blue stripe wire to port side terminal, No. 2 trigger coil. From 2nd breakout in wiring harness from terminal block route yellow/black and red/black stripe wire to front hole in bearing cage (starboard side). Connect red/black stripe wire to No. 2 trigger coil starboard side terminal, connect yellow/black stripe wire to front terminal of trigger coil No. 4. The two (2) short double jumper wires, white/blue stripe and green wires go in rear hole of bearing cage (starboard), green wires go to rear terminal of trigger No. 4 — white/blue stripe wire goes to starboard side of trigger coil No. 4.

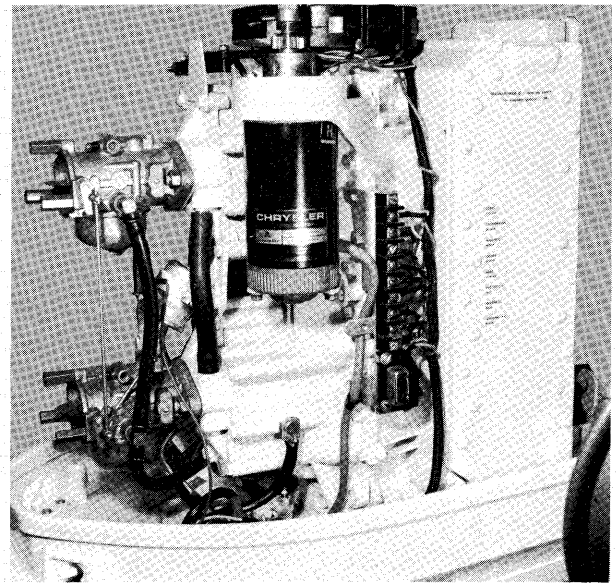


Figure 29 - Position of Wiring Harness

F. Install C-D module and connect lead wires to same as outlined in Section XA, paragraph 8-2. Install ty-rap around lead wires from harness to C-D module.

NOTE

Wires around the flywheel area must be routed downward and away from flywheel to prevent rubbing on flywheel.

G. Connect lead wires to ignition coils as outlined in Section XA, paragraph 6-2.

H. Connect orange lead to stud terminal on thermoswitch and secure with lockwasher and hex nut.

I. Install flywheel as outlined in Section VIII, paragraph 1-2.

J. Connect battery leads to battery terminals.

SECTION XI — ELECTRIC STARTER

1. STARTER MOTOR COMPLETE 02-19
BENDIX DRIVE 02-17
STARTER BRACKET — LOWER 02-18
HEAD ASSEMBLY — COMMUTATOR END 02-14

1-1. Removing Starter Motor Assembly (Type A)

A. Disconnect battery leads from battery.

B. Remove two (2) bolts securing starter bracket — lower to powerhead.

C. Remove lock nuts on two (2) thru bolts which secure starter bracket — lower to starter to powerhead.

D. Disconnect lead wire (starter relay to starter motor) by removing hex nut and spring lockwasher.

E. Thread two (2) thru bolts out of flange on powerhead and remove starter motor assembly. Pull thru bolts out of starter motor and remove starter bracket — lower.

F. Remove head assembly — commutator end from starter being careful not to loose any thrust washers at bottom of commutator.

G. To remove bendix drive, pull down on sleeve compressing spring and exposing retaining ring as shown in figure 1. Remove retaining ring and turn bendix off starter motor.

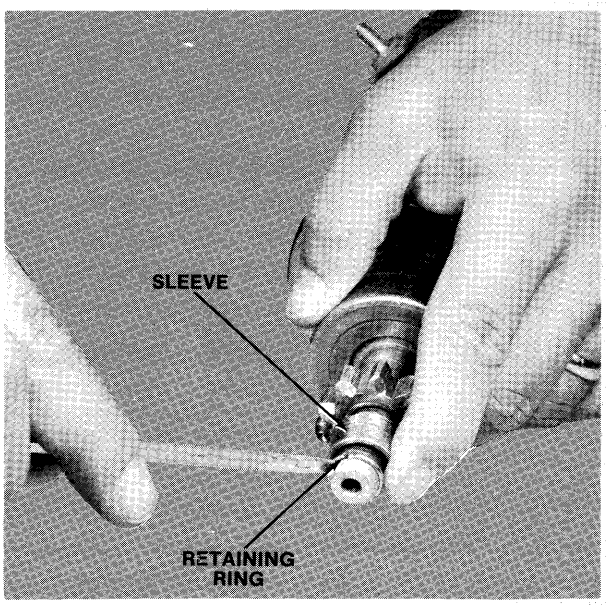


Figure 1–Removing Retaining Ring

1-2. Installing Starter Motor Assembly

A. Install bendix drive on starter motor shaft and turn bendix drive on shaft.

B. Install spring on starter motor shaft. Install sleeve on shaft with deeper counterbore in sleeve towards spring. Compress spring using sleeve exposing groove on starter shaft. Install retaining ring in groove on shaft to secure bendix drive.

C. Be certain all thrust washers are on commutator end of starter shaft. Install head assembly — commutator end on starter motor aligning three (3) locating pins on head assembly with corresponding holes in brush plate.

D. Install starter bracket — lower on starter motor positioning starter motor so that terminal stud is towards one of the powerhead mounting legs on bracket — lower. Install two (2) thru bolts through starter bracket — lower and starter motor.

E. Connect lead wire (starter relay to starter motor) on terminal stud of starter motor and secure with nut.

F. Install starter motor assembly on powerhead and thread two (2) thru bolts of starter motor to flange on powerhead. Secure bolts with two (2) lock nuts.

NOTE

Some models have a ground wire which should be attached under one (1) of these nuts.

G. Install two (2) bolts to secure starter bracket — lower to powerhead. Torque large bolt to 270 In. Lbs. and smaller bolt to 70 In. Lbs.

H. Connect battery leads to battery.

1A. STARTER MOTOR COMPLETE 02-19
BENDIX DRIVE 02-17
STARTER BRACKET - LOWER 02-18

1A-1. Removing Starter Motor Assembly (Type B)

A. Disconnect battery leads from battery.

B. Remove two stop nuts securing starter to starter bracket (crankcase cover) upper. See figure 1A.

C. Remove one screw securing starter bracket lower to crankcase cover and remove starter from engine.

D. Disconnect lead wire (starter relay to starter motor) by removing hex nut from starter terminal.

E. Clamp bendix drive in a vise (with protective jaws) and remove stop nut from end of shaft.

F. Remove spacer, spring and bendix drive from starter.

G. Remove one thru bolt securing starter bracket lower to starter and remove starter bracket.

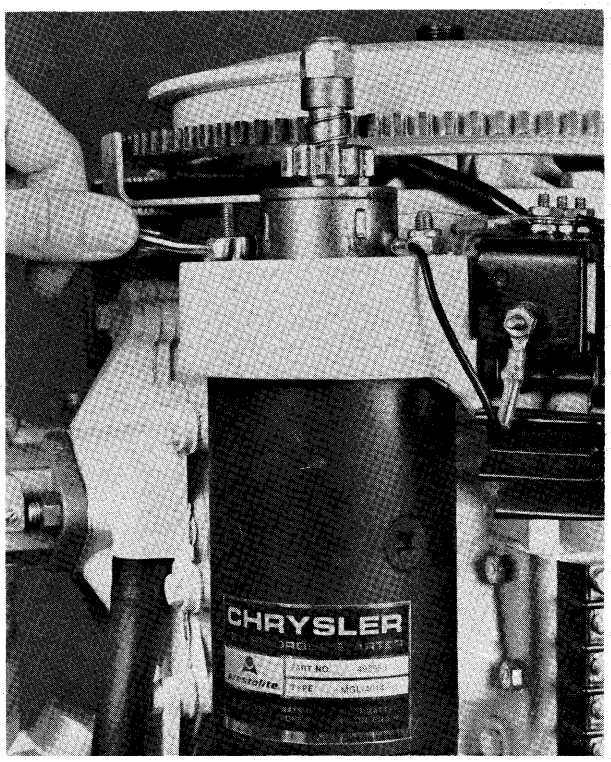


Figure 1A—Removing Starter

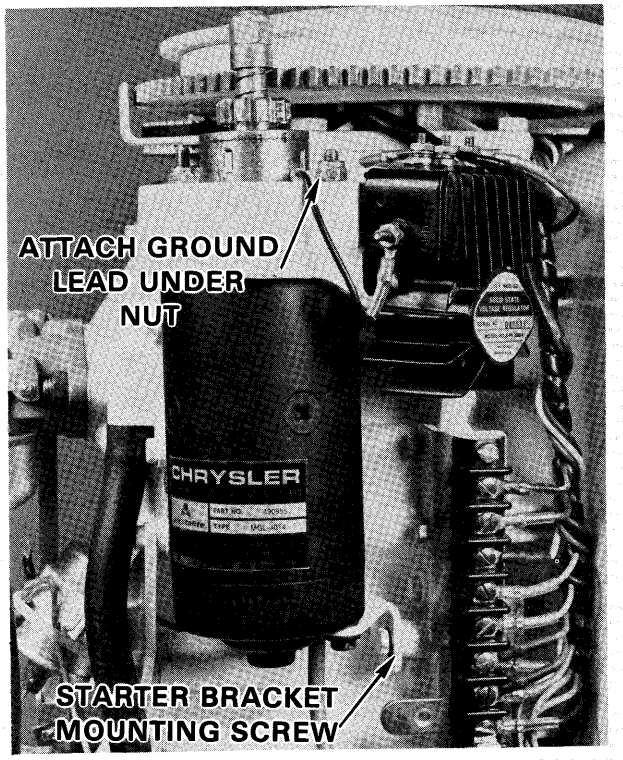


Figure 1B—Position of Starter Bracket

1A-2. Installing Starter Motor Assembly

A. Position starter bracket on starter as shown in figure 1B. Install thru bolt and tighten securely.

CAUTION

Threads may be stripped from Head assembly drive end if screws are over-tightened.

B. Place bendix drive, spring and spacer on starter motor shaft. Install stop nut and tighten securely.

C. Connect lead wire (from starter relay) to terminal on starter motor.

D. Install starter on engine aligning starter thru bolts with holes in starter bracket upper. Place ground lead from regulator on rear thru bolt. Install stop nuts on thru bolts and torque to 70 in. lbs.

E. Install screw securing starter bracket lower to crankcase and tighten securely.

F. Connect battery leads to battery.

1B. HEAD ASSEMBLY - COMMUTATOR END 02-14

1B-1. Removing Head Assembly

A. Remove starter motor assembly as outlined in Section XI paragraph 1A-1, Steps A through D.

B. Remove two thru bolts and starter bracket lower from starter.

C. Remove head assembly - commutator end from starter being careful not to lose any thrust washers at bottom of commutator.

NOTE

Pull commutator end from starter slowly while holding on to upper cover on starter. This is necessary to prevent armature from being pulled back and releasing brushes and springs from their holders.

1B-2. Installing Head Assembly

A. Place thrust washers on end of armature shaft - lower. Install head assembly - commutator end on starter motor aligning three (3) locating pins on head assembly with corresponding holes in brush plate.

B. Install two thru bolts and starter bracket lower and tighten thru bolts.

C. Install starter motor assembly as outlined in Section XI paragraph 1A-2, steps C through F.

2. FRAME AND FIELD 02-12 BRUSH PLATE 02-15 BRUSH SET 02-16

2-1. Removing Frame and Field Assembly

A. Remove head assembly — commutator end as outlined in Section XI, paragraph 1-1.

B. Pull frame — field with brush plate from armature.

C. Remove brushes and springs from holders on brush plate. Remove brush plate.

D. Drive out armature brush terminal assembly from frame — field assembly as shown in figure 2.

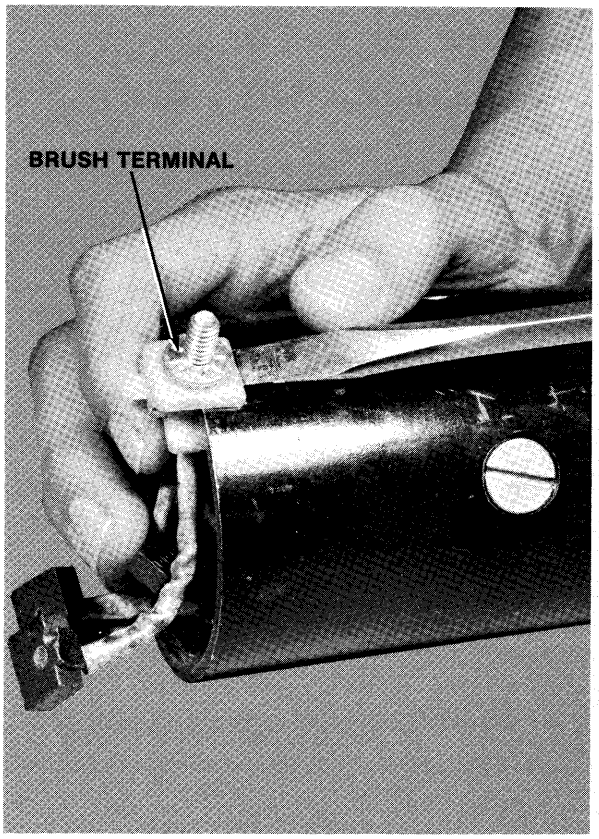


Figure 2–Removing Armature Brush Terminal Assembly

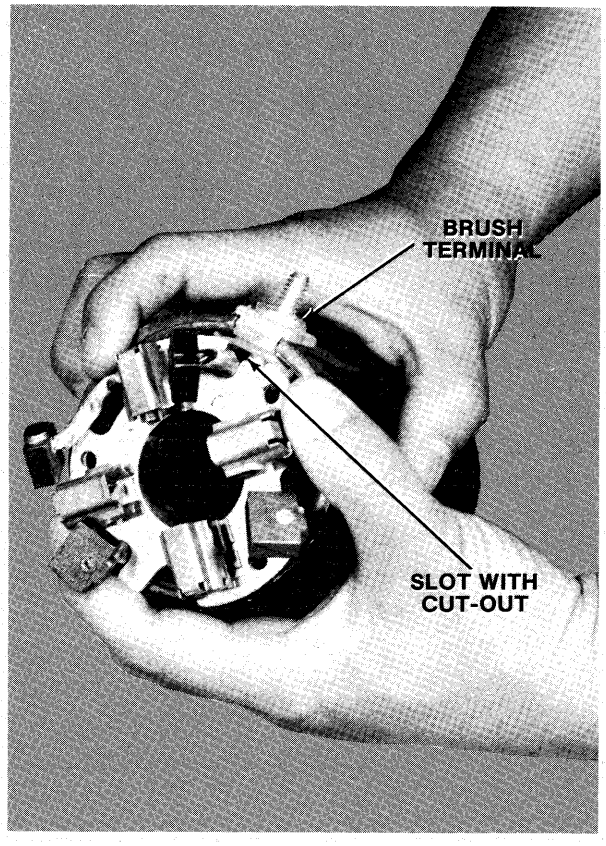


Figure 3–Installing Brush Plate

E. If necessary, remove brushes from terminals on field coils.

2-2. Installing Frame and Field Assembly

A. To replace field brushes (brushes attached to terminals on field coils inside of frame — field assembly), wire ends of brushes must be silver soldered to terminals on field coils or sent to nearest Prestolite service center.

CAUTION

Field coils must not be removed when silver soldering wire end of brush to terminal. Field coils are highly torqued to prevent them from loosening. If coils loosen, severe damage to starter motor will occur.

B. Install armature brush terminal assembly on frame — field assembly. Refer to figure 2 for positioning.

C. Install brush plate aligning slot with cut out portion beside armature brush terminal as shown in figure 3.

D. Install spring in brush holder and install brush on spring. Compress brush with spring in holder. Secure brush in holder with fabricated brush retaining clip as shown in figure 4. Follow above procedure for remaining brushes.

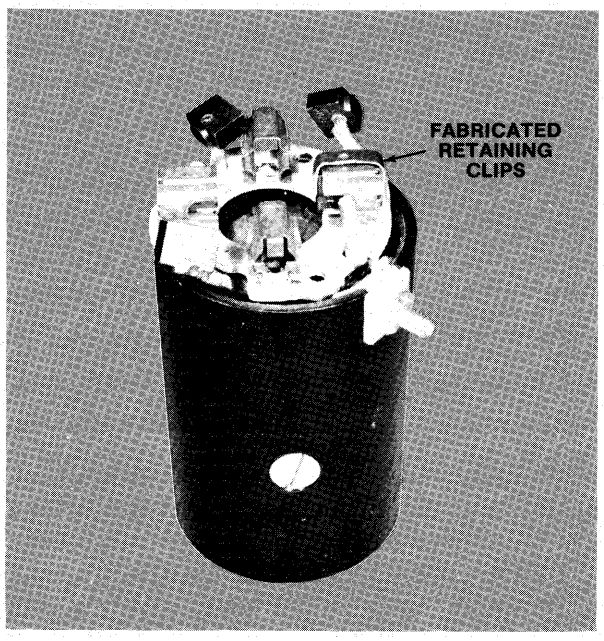


Figure 4–Retaining Brush in Holder

E. Install armature in frame — field assembly as shown in figure 5. Once armature is past brushes, remove retaining clips.

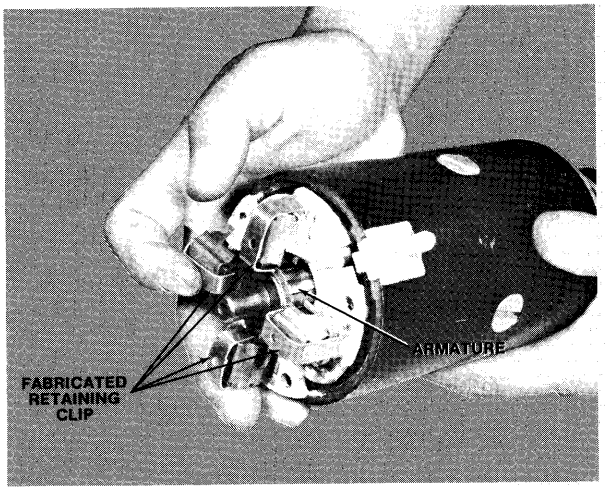


Figure 5–Installing Armature

F. Install head assembly — commutator end as outlined in Section XI, paragraph 1-2.

3. ARMATURE 02-11 HEAD ASSEMBLY — DRIVE END 02-13

3-1. Removing Armature and Head Assembly — Drive End

A. Remove bendix drive as outlined in Section XI, paragraph 1-1.

B. Remove frame — field as outlined in Section XI, paragraph 2-1.

C. Remove head assembly — drive end and two (2) thrust washers from armature.

3-2. Installing Armature and Head Assembly — Drive End

A. Install two (2) thrust washers on bendix drive end of armature. Install head assembly — drive end.

B. Install frame — field assembly as outlined in Section XI, paragraph 2-2.

C. Install bendix drive and complete assembly of starter as outlined in Section XI, paragraph 1-2.

SECTION XII — DISTRIBUTOR

1. BREAKER POINT SET 03-16

1-1. Removing Breaker Point Set

A. Remove battery leads from battery.

B. Loosen two (2) screws on cap retaining clips which secure distributor cap assembly to the distributor housing. Separate cap assembly from distributor housing.

C. Remove two (2) bolts securing distributor belt to powerhead. Slip distributor belt off pulley and pull distributor assembly away from powerhead.

D. Turn distributor over to expose breaker point set.

E. Remove two (2) screws securing breaker point set to distributor housing.

F. Lift points out of housing and remove screws securing lead wire to point set. Remove breaker point set.

1-2. Installing Breaker Point Set

A. Connect lead wire to breaker point set and secure with screw.

B. Install breaker point set in distributor housing aligning pivot of breaker point set in pivot hole of distributor housing.

C. Secure breaker point set to distributor housing with two (2) screws but do not tighten securely — just enough to be able to adjust breaker point gap.

D. Adjust breaker point gap and complete assembly and tune-up procedures as outlined in appropriate tune-up section.

2. DISTRIBUTOR BELT 03-13

2-1. Removing Distributor Belt

A. Loosen two (2) bolts securing distributor to powerhead and slip distributor belt off pulley.

B. Remove flywheel as outlined in Section VIII, paragraph 1-1 and remove distributor belt.

2-2. Installing Distributor Belt

A. Slip distributor belt over crankshaft of powerhead and install flywheel as outlined in Section VIII, paragraph 1-2.

B. Complete assembly and adjust belt tension as outlined in appropriate tune-up section.

3. DISTRIBUTOR CAP 03-18
DISTRIBUTOR COVER 03-19
LEAD WIRES 03-20

3-1. Removing Distributor Cap Assembly

A. Loosen two (2) screws on distributor retaining clips and remove distributor cap assembly from distributor.

B. Disconnect high tension lead wire from coil by pulling boot away from coil and pulling lead wire from coil.

C. Remove spark plug lead wires from spark plugs and retaining clips.

D. Remove distributor cap assembly from engine.

E. Remove two (2) screws on distributor cover securing cover to cap and pull cover with lead wires from cap.

F. Pull seal away from cover and pull lead wires from seal. Pull lead wires from cover.

3-2. Installing Distributor Cap Assembly

A. Insert lead wires in through cap cover and through seal being certain to align screw holes (cover to cap) and vent hole in cover with vent screen in seal. Allow at least one (1) inch of lead wire to extend through cap seal as shown in figure 1.

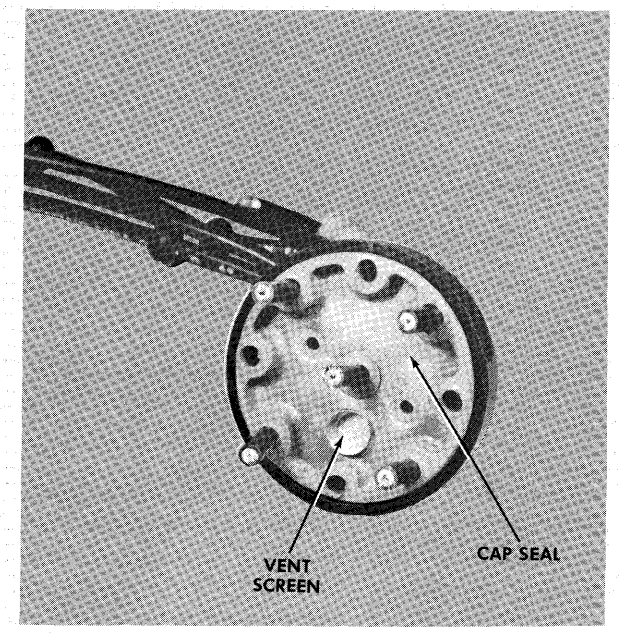


Figure 1 – Installing Lead Wires Through Seal

B. Insert lead wire ends in distributor cap against pointed contacts again aligning screw holes (distributor cover to cap) and vent holes.

C. Draw distributor cover against cap using two (2) screws and tighten until screws are bottomed.

D. Check each lead wire continuity by using test light (Special Tool T2938-1) as shown in figure 2.

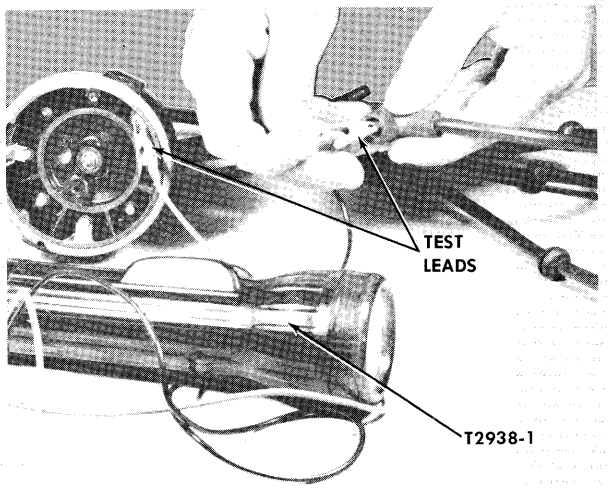


Figure 2 – Checking Lead Wire Continuity

If test light does not light when checking continuity of a specific wire, remove distributor cover and repeat steps A through D.

E. Install distributor cap assembly on distributor by aligning hole in cap wall with locating pin in distributor housing. Secure cap assembly to distributor with retaining clips.

F. Route center lead wire from cap assembly to coil and insert lead wire end firmly in coil. Push boot over end of coil.

G. Route spark plug lead wires to respective spark plugs. See figures 3 and 4 for identification of lead wires.

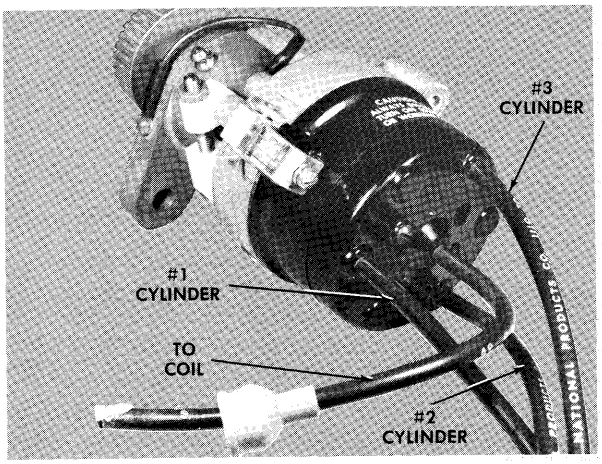


Figure 3 – 3-Cylinder Engines

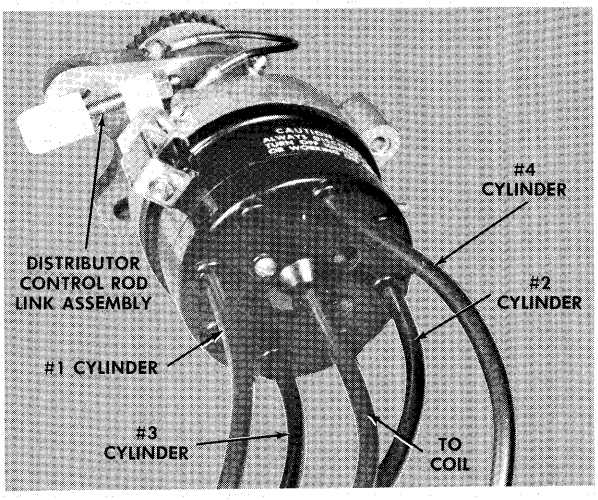


Figure 4 – 4-Cylinder Engines

4. DISTRIBUTOR PULLEY 03-14
DISTRIBUTOR SHAFT 03-15

4-1. Removing Distributor Pulley and Shaft

A. Remove two (2) screws securing interlock switch to distributor bracket and remove switch with wires from distributor.

B. Disconnect white with black stripe lead wire from terminal stud on distributor by removing nut and spring lockwasher securing same.

C. Remove distributor cap assembly from distributor by loosening screws on retaining clip.

D. Remove two (2) bolts securing distributor bracket to powerhead and remove distributor from powerhead.

E. Clamp distributor pulley lightly in a vise using protective jaws to prevent damage to pulley teeth. Remove stop nut from end of distributor shaft and pull distributor from pulley.

F. Remove thick spacer, large diameter washer and then smaller diameter washer from top of bearing in distributor.

G. Pull distributor shaft from distributor from rotor end of shaft and remove bronze spacer from underneath cam lobes on shaft.

4-2. Installing Distributor Pulley and Shaft

A. Install woodruff key in slot of distributor shaft and bronze spacer under cam lobes on shaft.

B. Install distributor shaft in distributor from breaker point side of distributor until bronze spacer on shaft bottoms against distributor housing.

C. Install small diameter washer on top of bearing in distributor (pulley end of shaft). Then install larger diameter washer on top of smaller diameter washer and then install thick spacer.

D. Install distributor pulley on end of distributor shaft. Clamp distributor pulley in a vise using protective jaws to prevent damage to pulley teeth. Install stop nut on end of distributor shaft and tighten securely. Install distributor on powerhead and secure with two (2) bolts. Do not tighten these bolts securely at this time.

E. Install distributor cap assembly on distributor and secure with retainers.

F. Connect white with black stripe lead wire to terminal stud on distributor and secure with nut and spring lockwasher.

G. Install interlock switch to distributor bracket and secure with two (2) screws. Check interlock switch adjustment as outlined in appropriate tune-up section.

H. Install distributor belt as outlined in Section XII, paragraph 2-2.

5. DISTRIBUTOR BRACKET 03-12

5-1. Removing Distributor Bracket

A. Disconnect ground lead (distributor housing to distributor bracket) from distributor bracket by removing screw securing same.

B. Remove interlock switch by removing two (2) screws securing same to distributor bracket.

C. Remove distributor pulley as outlined in Section XII, paragraph 4-1.

D. Remove retaining ring using retaining ring pliers (Special Tool T1082) as shown in figure 5.

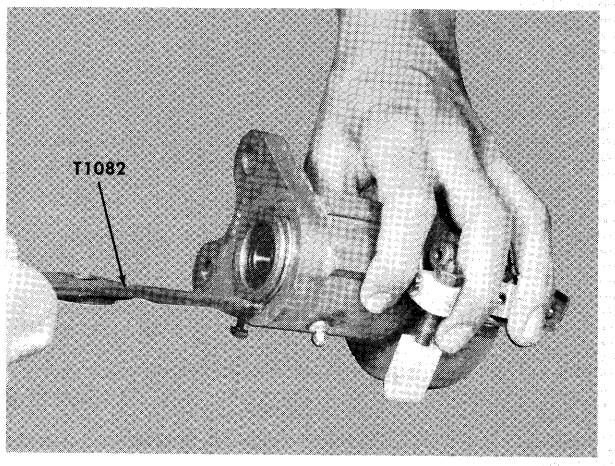


Figure 5 – Removing Retaining Ring

E. Slide distributor bracket off distributor housing.

F. Remove shims, if any, from distributor housing.

5-2. Installing Distributor Bracket

A. Install new distributor bracket on distributor housing as shown in figure 6.

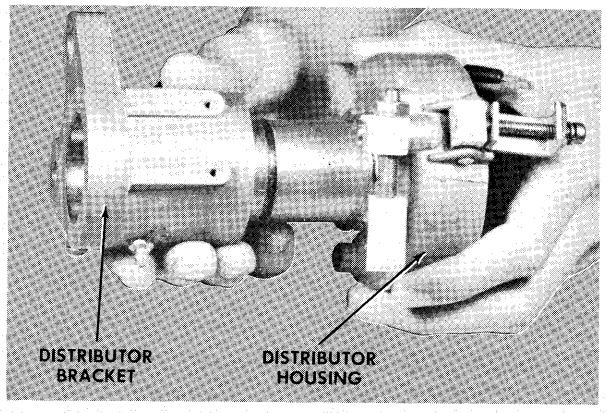


Figure 6 – Installing Distributor Bracket

B. Install retaining ring to secure distributor bracket to housing. See figure 5.

C. Using feeler gauge set (Special Tool T8930-1), determine clearance between distributor housing and distributor bracket as shown in figure 7. Clearance must not be more than .005 or less than .001.

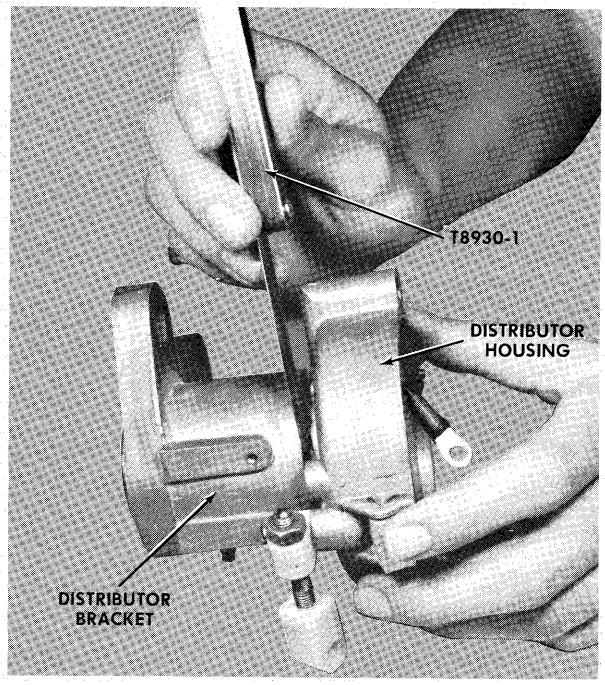


Figure 7 – Measuring Clearance Between Housing and Bracket

D. If shims are required, remove retaining ring and add necessary shims. Re-install distributor bracket on housing and secure with retaining ring.

E. Install distributor pulley as outlined in Section XII, paragraph 4-2.

F. Install interlock switch on distributor bracket and secure with two (2) screws. Adjust interlock switch as outlined in appropriate tune-up section.

G. Connect ground lead wire to distributor bracket and secure with spring lockwasher and screw.

6. DISTRIBUTOR HOUSING 03-11

6-1. Removing Distributor Housing

A. Remove distributor bracket, pulley and shaft as outlined in Section XII, paragraphs 4-1 and 5-1.

B. Remove breaker points as outlined in Section XII, paragraph 1-1.

C. Remove terminal screw post and insulators as shown in figure 8.

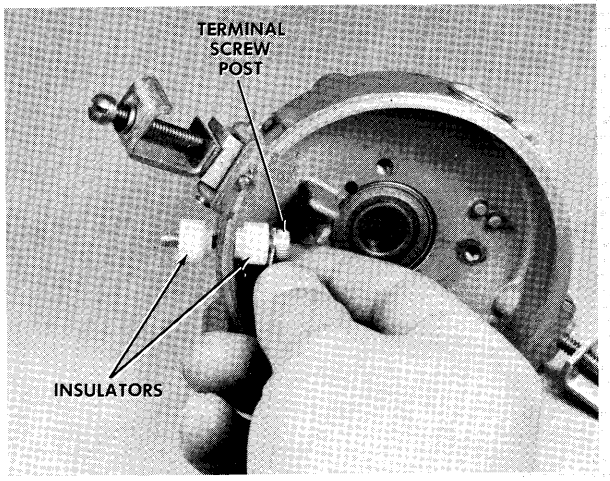


Figure 8 – Removing Terminal Screw Post

D. Remove distributor control rod link assembly by removing screw securing same to distributor housing as shown in figure 9.

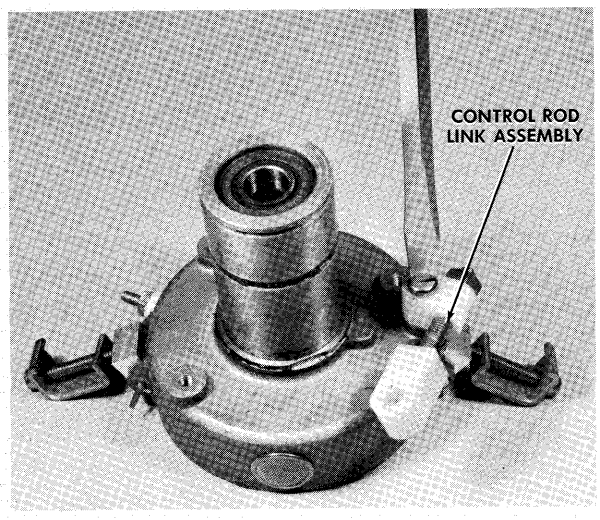


Figure 9 – Removing Distributor Control Rod Link Assembly

E. Remove interlock cam by removing two (2) screws securing cam to housing.

F. Disconnect ground wire from housing by removing screw securing same to housing.

6-2. Installing Distributor Housing

A. Install distributor bracket as outlined in Section XII, paragraph 5-2.

B. Install terminal screw post and insulators on distributor housing. See figure 8.

C. Install breaker points as outlined in Section XII, paragraph 1-2.

D. Install distributor pulley and shaft as outlined in Section XII, paragraph 4-2.

E. Install interlock cam on distributor housing and secure with two (2) screws. Adjust interlock cam as outlined in appropriate tune-up section.

F. Connect ground lead wire from distributor bracket to distributor housing and secure with screw.

SECTION XIIA – DISTRIBUTOR (BREAKERLESS)

1. DISTRIBUTOR BELT

1-1. Removing Distributor Belt

A. Loosen two (2) bolts securing distributor to powerhead and slip distributor belt off pulley.

B. Remove flywheel as outlined in Section VIII, paragraph 1-1 and remove belt.

1-2. Installing Distributor Belt

A. Slip distributor belt over crankshaft and install flywheel as outlined in Section VIII, paragraph 1-2.

B. Slip belt over pulley on distributor and adjust belt tension as outlined in appropriate tune-up section.

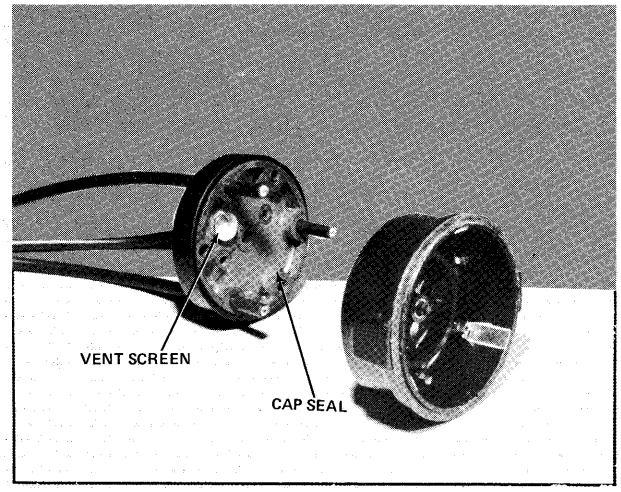


Figure 1 - Installing Lead Wires

2. DISTRIBUTOR CAP DISTRIBUTOR COVER LEAD WIRES

2-1. Removing Distributor Cap Assembly

A. Loosen two (2) screws on distributor retaining clips and remove distributor cap assembly from distributor.

B. Disconnect high tension lead wire from ignition coil by pulling boot away from coil and pulling lead wire from coil.

C. Remove spark plug lead wires from spark plugs.

D. Remove distributor cap assembly from engine.

E. Remove two (2) screws securing distributor cover to cap and pull cover with lead wires from cap.

F. Pull lead wires from cover and seal. Remove seal from cover.

2-2. Installing Distributor Cap Assembly

A. Insert lead wires in through cap cover and seal being certain to align screw holes (cover to cap) and vent hole in cover with vent screen in seal. Allow at least one (1) inch of lead wire to extend through cap seal as shown in figure 1.

B. Insert lead wire ends in distributor cap against pointed contacts again aligning screw holes (distributor cover to cap) and vent holes.

C. Draw distributor cover against cap using two (2) screws and tighten until screws are bottomed.

D. Check each lead wire continuity by using test light (Special Tool T2938-1) as shown in figure 2.

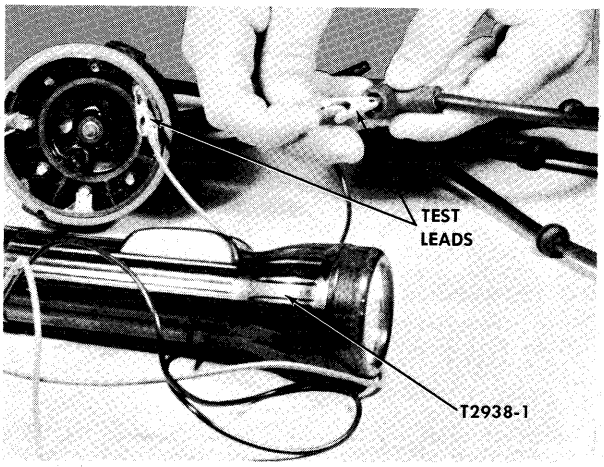


Figure 2 - Checking Lead Wire Continuity

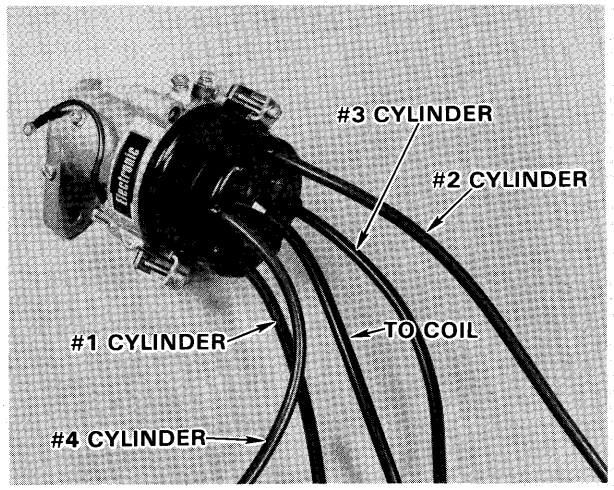
If test light does not light when checking continuity of a specific wire, remove distributor cover and repeat steps A through D.

E. Install distributor cap assembly on distributor, aligning hole in cap wall with locating pin in distributor housing. Secure cap assembly to distributor with retaining clips.

F. Route center lead wire from cap assembly to coil and insert lead wire end firmly in coil. Push boot over end of coil.

G. Route spark plug lead wires to respective spark plugs. See figure 3 for identification of lead wires.

4 CYLINDER



3 CYLINDER

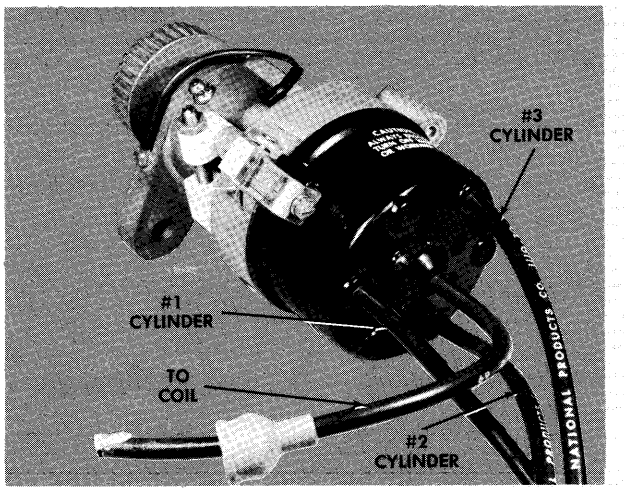


Figure 3 - Location of Leads

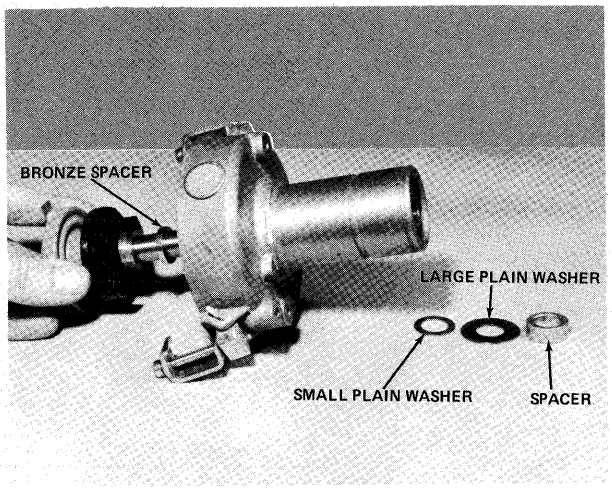


Figure 4 - Removing Distributor Shaft

3. DISTRIBUTOR PULLEY DISTRIBUTOR SHAFT

3-1. Removing Distributor Pulley and Shaft

A. Disconnect white/black striped lead and blue lead from stud terminals on distributor housing.

B. Remove distributor cap assembly from distributor by loosening screws on retaining clip.

C. Remove two (2) bolts securing distributor bracket to powerhead and remove distributor from powerhead.

D. Clamp distributor pulley lightly in a vise using protective jaws to prevent damage to pulley. Remove stop nut from end of distributor shaft and pull distributor from pulley.

E. Remove spacer, large plain washer and small plain washer from pulley end of distributor shaft. Pull distributor shaft from distributor housing and remove bronze spacer from same. See figure 4.

3-2. Installing Distributor Shaft and Pulley

A. Install bronze spacer on distributor shaft. Install distributor shaft in distributor housing until bronze spacer on shaft bottoms against distributor housing.

B. Install small plain washer, large plain washer and spacer on pulley end of distributor shaft.

C. Install woodruff key in slot on pulley end of distributor shaft. Install pulley on end of shaft. Clamp distributor pulley in a vise using protective jaws to prevent damage to pulley teeth. Install stop nut on end of shaft and tighten securely. Install distributor on powerhead and secure with two (2) bolts. Do not tighten bolts securely at this time.

D. Install distributor cap assembly and secure with retainers.

E. Connect white/black striped lead and blue lead to stud terminals on distributor housing and secure with lockwasher and hex nut.

F. Install distributor belt as outlined in Section XIIA, paragraph 1-1.

4. PREAMPLIFIER

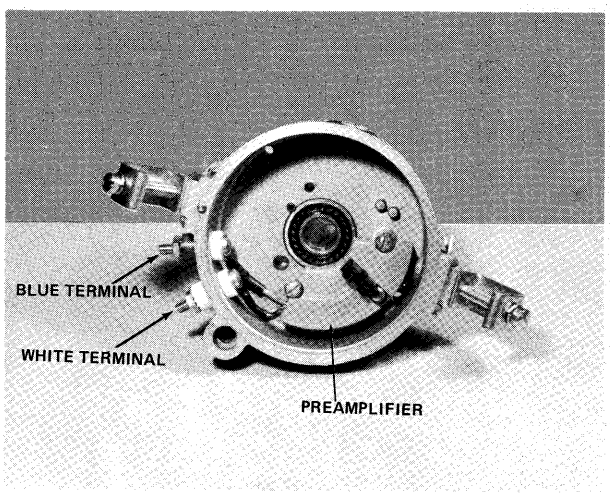
4-1. Removing Preamplifier

A. Disconnect battery leads from battery terminals.

B. Remove distributor shaft as outlined in Section XIIA, paragraph 3-1.

C. Remove preamplifier leads from terminals on distributor housing. See figure 5.

TYPE A



TYPE B

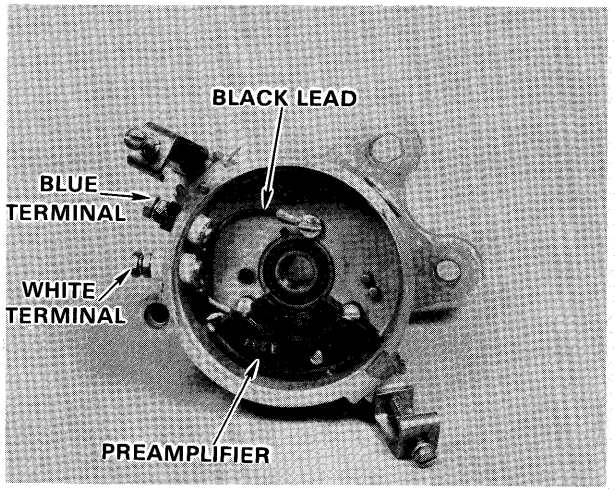


Figure 5 - Removing Preamplifier Leads

D. Remove two (2) screws and lockwashers securing preamplifier to distributor housing and remove same from housing.

4-2. Installing Preamplifier

A. Install preamplifier on distributor housing and secure with two (2) screws and lockwashers as shown in figure 6.

B. Connect preamplifier leads to terminals on distributor housing as shown in figure 5.

C. Install distributor shaft as outlined in Section XIIA, paragraph 3-2.

D. Connect battery leads to bat' ' terminals.

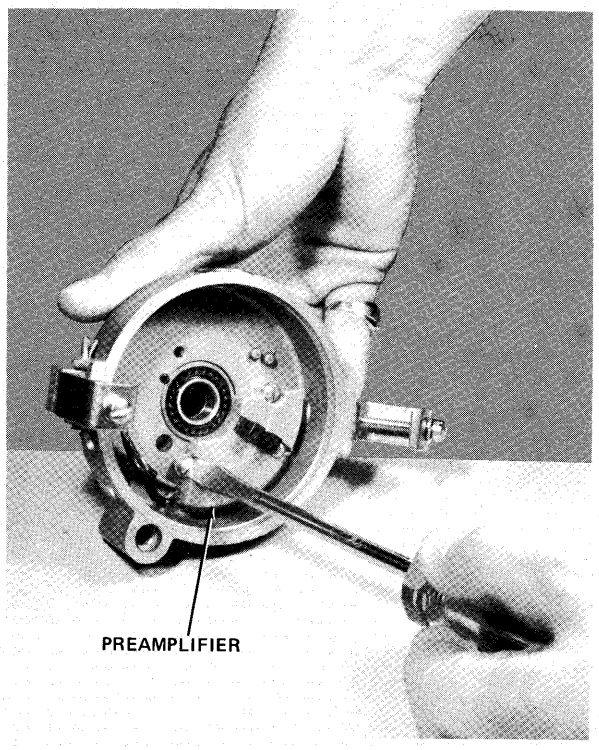


Figure 6 - Installing Preamplifier

5. DISTRIBUTOR BRACKET

5-1. Removing Distributor Bracket

A. Disconnect battery leads from battery terminals.

B. Remove distributor pulley and shaft as outlined in Section XIIA, paragraph 3-1.

C. Remove screw and lockwasher securing ground lead to distributor bracket.

D. Remove retaining ring using retaining ring pliers (Special Tool T1082) as shown in figure 7, and slide distributor bracket and thrust washer off distributor housing.

E. Remove shims, if any, from distributor housing.

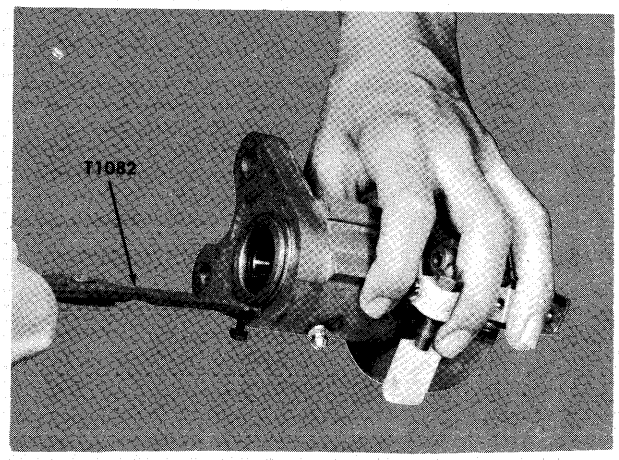


Figure 7 - Removing Retaining Ring

5-2. Installing Distributor Bracket

A. Install distributor bracket on distributor housing. Install thrust washer and retaining ring to secure distributor bracket to housing.

B. Using feeler gauge set (Special Tool T8930-1) determine clearance between distributor housing and distributor bracket as shown in figure 8. Clearance must not be more than .005 or less than .001.

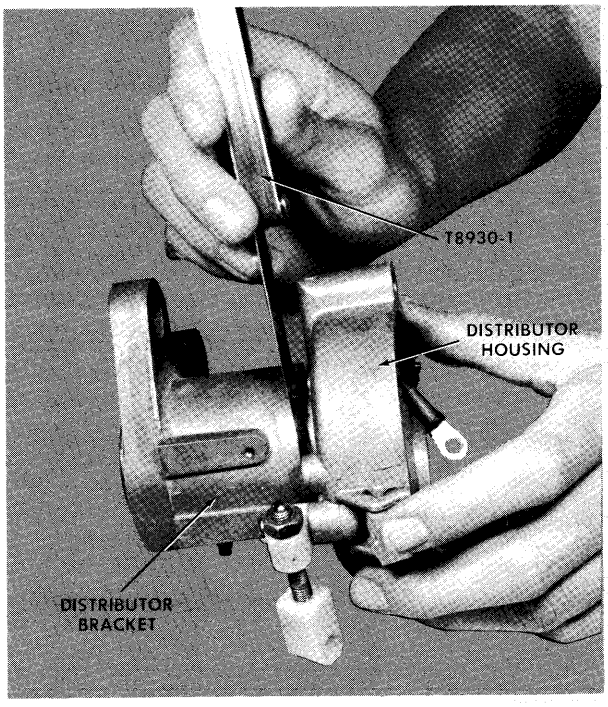


Figure 8 - Checking Clearance Between Housing and Bracket

C. If shims are required, remove retaining ring, thrust washer and bracket and add necessary shims. Re-install distributor bracket on housing and secure with retaining ring.

D. Install screw and lockwasher to secure ground lead to distributor bracket.

E. Install distributor pulley and shaft as outlined in Section XIIA, paragraph 3-2.

F. Connect battery leads to battery terminals.

6. DISTRIBUTOR HOUSING

6-1. Removing Distributor Housing

A. Remove distributor bracket, pulley and shaft as outlined in Section XIIA, paragraphs 3-1 and 5-1.

B. Remove preamplifier as outlined in Section XIIA, paragraph 4-1.

C. Remove terminal screw posts and insulators from distributor housing.

D. Remove distributor control rod link assembly by removing screw securing same to distributor housing as shown in figure 9.

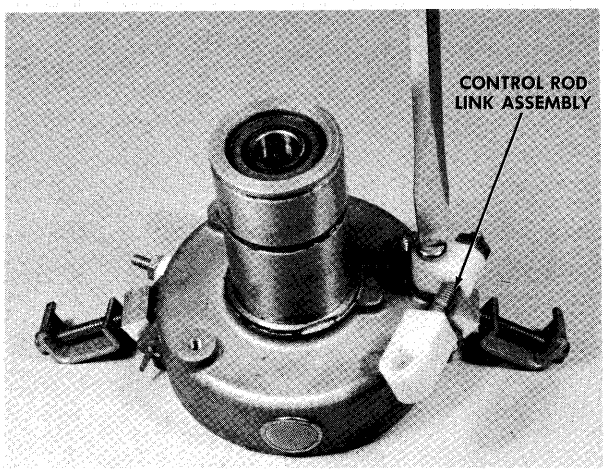


Figure 9 - Removing Distributor Control Rod Link Assembly

E. Remove ground wire from housing by removing screw and lockwasher securing same to housing.

6-2. Installing Distributor Housing

A. Install distributor control rod link assembly as shown in figure 9.

B. Install terminal screw posts and insulators on distributor housing.

C. Install preamplifier as outlined in Section XIIA, paragraph 4-2.

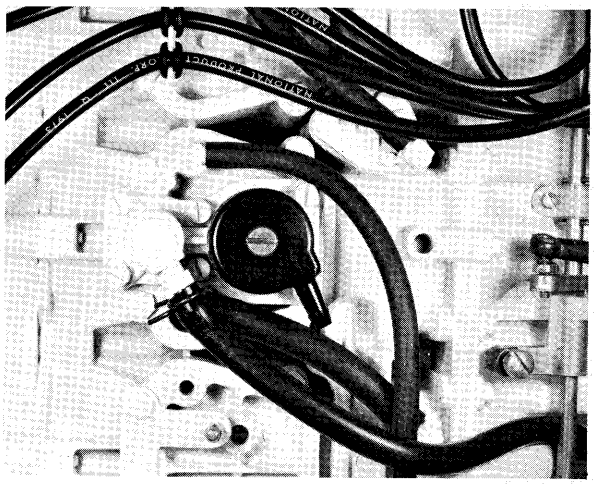
D. Install distributor bracket, pulley and shaft as outlined in Section XIIA, paragraphs 3-2 and 5-2.

E. Install screw and lockwasher securing ground lead to distributor housing.

SECTION XIII - FUEL SYSTEM

NOTE

There are two different types of fuel pumps used. Refer to Figure 1 to determine which fuel pump is being serviced. Type "A" is contained in paragraphs 1 through 4. Type "B" is contained in paragraphs 5 through 8.



Type "A" Fuel Pump

Type "B" Fuel Pump

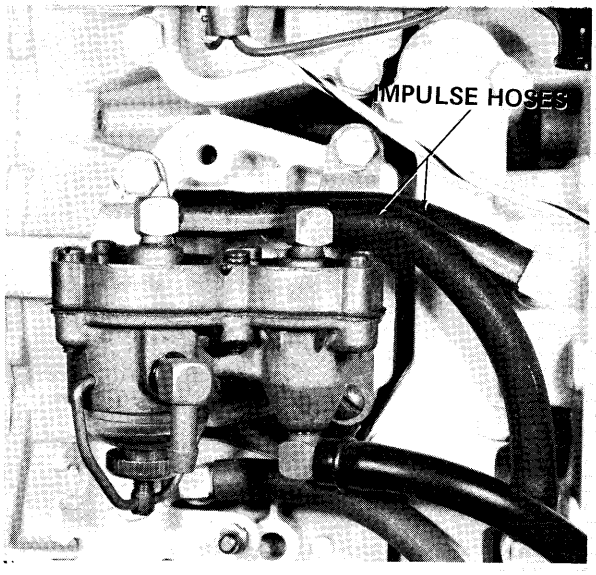


Figure 1—Types of Fuel Pumps

1. SEDIMENT BOWL 04-17 FILTER (SCREEN) 04-14

1-1. Removing Sediment Bowl and Screen

A. Loosen knurled screw on sediment bowl and remove bowl.

B. Remove gasket and screen.

C. Use hose clamp pliers (Special Tool T-8900) to slide hose clamp about one inch down hose from sediment bowl. Pull hose off sediment bowl.

CAUTION

Do not use hose clamp pliers to pull hose off fitting because pliers can puncture hose.

1-2. Installing Sediment Bowl and Screen

A. Install fuel intake hose on sediment bowl and secure with hose clamp.

B. Install screen in sediment bowl with turned over edge towards cylinder. See figure 2.

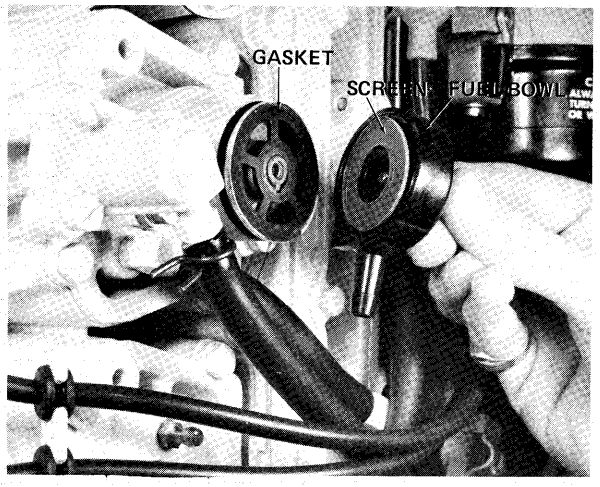


Figure 2.—Sediment Bowl, Screen and Gasket

C. Place gasket on pump body so that slot in gasket is over key on pump body.

D. Position sediment bowl on pump body with hose fitting at 4 o'clock. Use knurled screw to secure sediment bowl to pump body.

2. FUEL PUMP BODY 04-15 FUEL PUMP DIAPHRAGM 04-12

2-1. Removing Fuel Pump Body, Gasket and Diaphragm

A. Remove sediment bowl as outlined in Section XIII, paragraph 1-1.

B. Use hose clamp pliers (Special Tool T8900) to slide hose clamp about one inch down fuel pump outlet hose. Remove hose from fitting.

CAUTION

Do not use T8900 hose clamp pliers to pull hose off fitting because pliers can puncture hose.

C. Remove six (6) screws securing fuel pump body to fuel pump cover. Remove fuel pump body, gasket and diaphragm.

2-2. Installing Fuel Pump Body, Gasket and Diaphragm

A. Position fuel pump gasket and diaphragm on fuel pump body as shown in figure 3. Install fuel pump body on fuel pump cover and secure with six (6) screws.

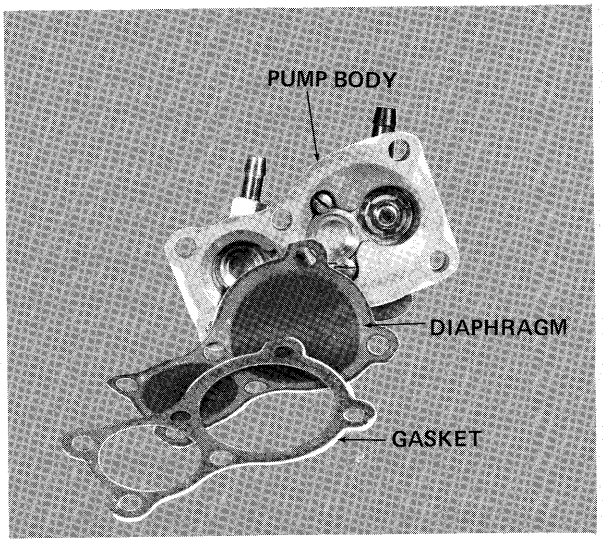


Figure 3—Fuel Pump Body, Gasket and Diaphragm

B. Push fuel line (from carburetor) on outlet fitting on fuel pump body and secure with hose clamp.

C. Install sediment bowl as outlined in Section XIII, paragraph 1-2.

3. FUEL PUMP VALVE 04-13

3-1. Removing Fuel Pump Valve

A. Remove fuel pump body as outlined in Section XIII, paragraph 2-1.

B. Remove two (2) screws securing central valve to fuel pump body as shown in Figure 4. Remove fuel pump valve and gasket from body.

C. Remove outlet fuel line fitting from fuel pump body.

3-2. Installing Fuel Pump Valve

A. Apply Sealant (Special Tool T8955) to threads of fuel line fitting. Install fitting in fuel pump body and tighten securely.

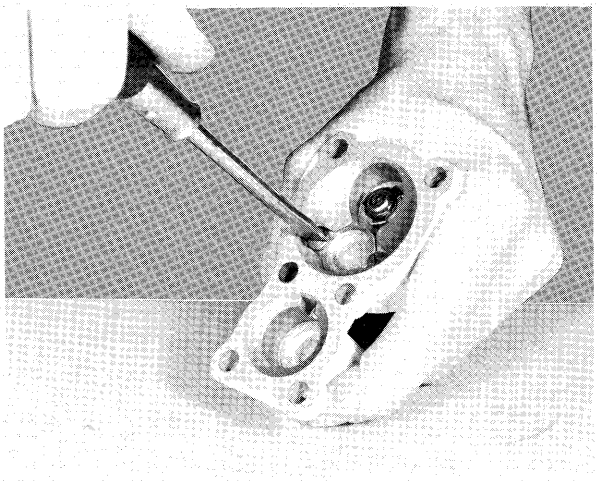


Figure 4—Removing Central Fuel Pump Valve

B. Place fuel pump valve gasket on valve seat in fuel pump body. Place valve on valve seat so that brass ring on valve is towards powerhead. Install two (2) screws and tighten securely.

C. Install fuel pump body as outlined in Section XIII, paragraph 2-2.

4. FUEL PUMP COVER 04-11

4-1. Removing Fuel Pump Cover

A. Remove fuel pump body as outlined in Section XIII, paragraph 2-1.

B. Remove impulse hose from lower fitting on fuel pump cover.

NOTE

On four cylinder engines remove recirculating hose from upper fitting on fuel pump cover.

C. Remove four (4) screws securing fuel pump cover to powerhead and remove cover and gasket. See figure 5.

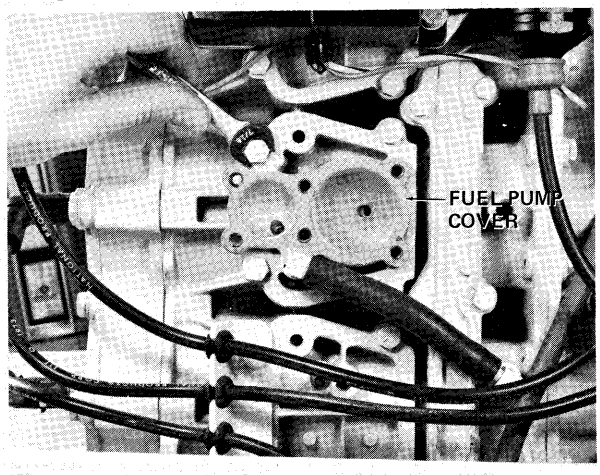


Figure 5—Removing Fuel Pump Cover

D. Remove impulse hose fitting from fuel pump cover. On four cylinder models remove recirculating hose fitting from fuel pump cover.

4-2. Installing Fuel Pump Cover

A. Apply sealant (Special Tool T8955) to threads of impulse hose fitting. Install fitting in fuel pump cover and tighten securely. On four cylinder models apply sealant to threads of recirculating hose fitting. Install fitting in fuel pump cover and tighten securely.

B. Install gasket and fuel pump cover on powerhead and secure with four (4) screws.

C. Install impulse hose on lower fitting on fuel pump cover.

D. Install fuel pump body as outlined in Section XIII, paragraph 2-2.

NOTE

On four cylinder engines install recirculating hose on upper fitting on fuel pump cover.

5. SEDIMENT BOWL 04-17 FILTER (SCREEN) 04-14

5-1. Removing Sediment Bowl and Screen

A. Remove three (3) screws securing fuel pump bracket to powerhead and pull fuel pump bracket with fuel pump away from powerhead.

NOTE

The reason for pulling fuel pump away from powerhead is to facilitate proper installation of bowl gasket and screen.

B. Loosen knurl nut on bail and remove fuel bowl.

C. Remove gasket and screen.

5-2. Installing Sediment Bowl and Screen

A. Position screen in counter-bore on fuel pump.

B. Install bowl gasket and sediment bowl and secure with knurled nut on bail.

C. Position pump bracket with fuel pump on powerhead and secure with three (3) screws.

6. PUMP COVER 04-11 DIAPHRAGM 04-12

6-1. Removing Pump Cover and Diaphragm

A. Remove inlet fuel line from inlet fitting. See figure 6.

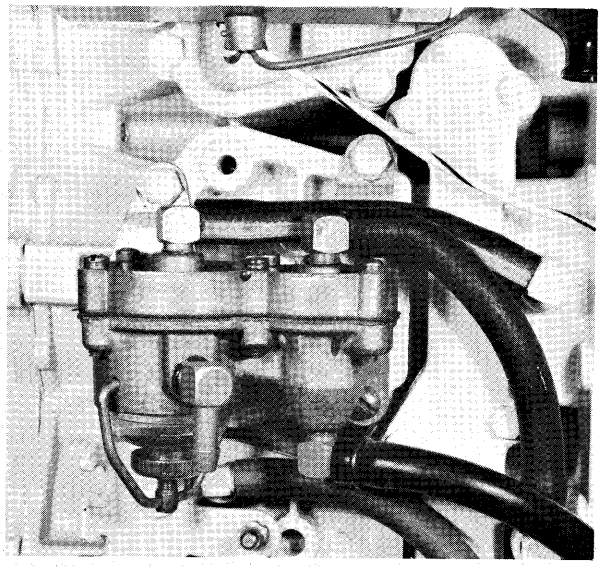


Figure 6 - Fuel Pump

B. Remove three (3) screws securing fuel pump bracket to powerhead.

C. Remove impulse line from fitting on cover and remove pump assembly.

D. Remove two (2) fittings from pump cover.

E. Remove six (6) screws securing pump cover to pump body and remove pump cover.

F. Remove pump gasket and diaphragm.

6-2. Installing Pump Cover and Diaphragm

A. Apply Loctite H (Special Tool T2962) to threads of two (2) fittings and install on fuel pump cover. See figure 6 for positioning of barbs.

B. Install gasket on pump body then diaphragm.

C. Install fuel pump cover and secure with six (6) screws.

D. Connect impulse line from lower cylinder to forward fitting on cover and connect impulse line from upper cylinder to rear fitting on cover.

E. Install pump assembly on powerhead and secure with three (3) screws.

F. Connect inlet fuel line to inlet fuel fitting on fuel pump.

7. FUEL PUMP BODY 04-15

7-1. Removing Fuel Pump Body

A. Remove fuel pump cover as outlined in Section XIII, paragraph 2-1.

B. Remove inlet fuel fitting from pump body.

C. Remove fitting (fuel pump to carburetor) from pump body.

D. Remove pump body from bracket by removing three (3) screws.

E. Remove fuel bowl, screen and gasket as outlined in Section XIII, paragraph 1-1.

F. Remove bail and nut assembly from pump body by pulling bail ends out of counter-bores in body.

7-2. Installing Fuel Pump Body

A. Snap bail and nut assembly in place on fuel pump body.

B. Install screen, gasket and fuel bowl as outlined in Section XIII, paragraph 1-2.

C. Install fuel pump body assembly to bracket and secure with three (3) screws.

D. Apply Loctite H (Special Tool T2962) to threads of inlet fuel fitting and install fitting on body. See figure 6.

E. Apply Loctite H (Special Tool T2962) to threads of fitting (fuel pump to carburetor) and install fitting on body. See figure 6.

F. Complete assembly as outlined in Section XIII, paragraph 2-2.

8. FUEL PUMP VALVES 04-13

8-1. Removing Fuel Pump Valves

A. Follow disassembly procedures as outlined in Section XIII, paragraph 3-1.

B. Press out the two (2) outside valves

C. Remove two (2) screws securing middle valve to pump body. Remove middle valve.

8-2. Installing Fuel Pump Valves

A. Install a gasket in each counter-bore for check valves.

B. Press two (2) outside valves in counter-bores of pump body. See figure 7 for position of each valve.

C. Install middle valve in middle counter-bore of pump body and secure with two (2) screws. See figure 7 for position of valve.

D. Complete assembly of fuel pump as outlined in Section XIII, paragraph 3-2.

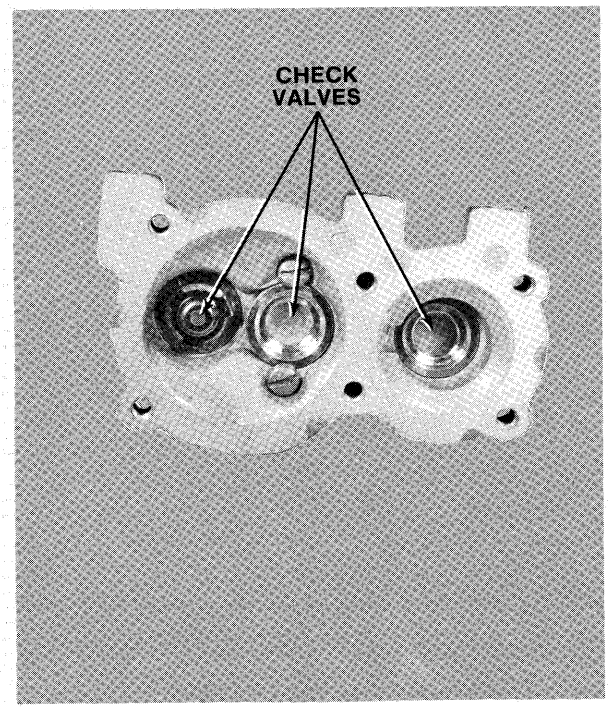


Figure 7–Position of Valves in Pump Body

9. PRIME BULB 04-18

9-1. Removing Prime Bulb

A. Dip prime bulb portion of fuel line in hot water (180-200°F.) for a few minutes until hose becomes soft and pliable.

B. Pull hose and ferrule from adapter on each end of prime bulb.

9-2. Installing Prime Bulb

A. Dip ends of fuel line which will be connected to adapters on prime bulb in hot water (180-200°F.) until they become soft and pliable.

B. Install ferrule on ends of each hose and push on adapters of prime bulb.

10. PUDDLE DRAIN HOSE ASSEMBLY 04-19

10-1. Removing Puddle Drain Assembly

A. Slide hose clamps down from each fitting on crankcase cover and remove hoses from same.

NOTE

This section applies only to four (4) cylinder engines — 1970 and prior models.

B. Slide hose clamp from fitting on spacer plate and remove cylinder drain hose assembly.

C. Check hose (lower crankcase fitting to "Y" fitting) by blowing through then sucking through hose. If check valve is functioning properly, blowing through hose will provide no restrictions but sucking on hose there will be a restriction. If this condition does not exist, replace check valve or hose assembly.

D. Use same procedure for checking hose (upper crankcase to "Y" fitting).

10-2. Installing Puddle Drain Hose Assembly

A. If check valve is to be replaced, install check valve with small diameter hole end against direction of fuel flow. See figure 8.

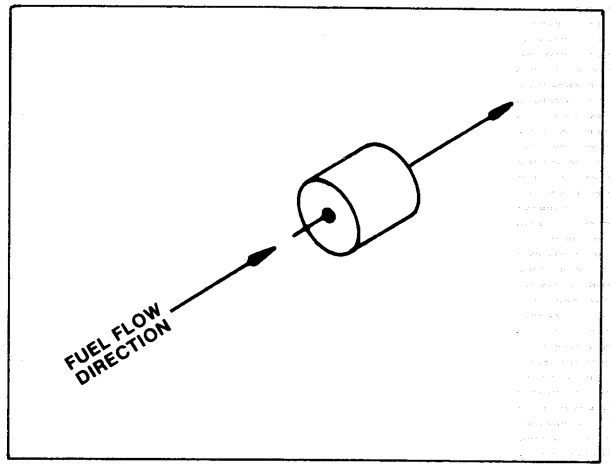


Figure 8–Proper Installation of Check Valve

Always install check valve in hoses approximately one (1) inch in from end of hose where it attaches to "Y" fitting with large diameter hole end of check valve towards the short end of hose.

B. Install single hose end of "Y" fitting assembly on fitting on spacer plate. Secure hose with hose clamp.

C. Install one of the longer hoses to the upper crankcase cover fitting and secure with clamp.

D. Install the shorter hose to the lower cylinder crankcase cover fitting and secure with clamp.

SECTION XIV — GEAR HOUSING

1. LOWER UNIT

1-1. Removing Lower Unit

A. Remove cotter pin securing shift rod pin to coupler of shift rod — upper. Remove shift rod pin to free shift rod — lower from coupler.

B. Remove six (6) hex head screws and lockwashers securing gear housing — upper to motor leg.

C. Remove rear screw and washer of exhaust snout and pull lower unit from motor leg.

1-2. Installing Lower Unit

A. Apply Anti-Seize (Special Tool T2987-1) to crankshaft splines of driveshaft.

B. Install lower unit to motor leg aligning shift rod—lower through seal and gear shift rod coupling in motor leg, aligning water line in seal of water pump and engaging driveshaft splines in crankshaft of powerhead.

C. Apply Anti-Seize (Special Tool T2987-1) to threads of screws which secure gear housing —upper to motor leg with spring lockwashers and screws.

D. Align shift rod—lower through coupler of shift rod—upper and secure with shift rod pin and cotter pin.

2. WATER PUMP BODY 05-13
WATER PUMP PLATES 05-14
WATER PUMP IMPELLER 05-15
WATER LINE SEAL 05-16
WATER PUMP DRIVESHAFT SEAL

2-1. Removing Water Pump

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Remove water line seal from body by depressing tabs on seal then pulling seal from pump body.

C. Remove four (4) screws securing water pump body assembly to gear housing upper and lift pump body assembly from lower unit.

D. Remove water pump impeller from pump body.

E. Remove driveshaft seal from pump body by driving same out from inside pump body.

F. Remove water pump back plate and gasket from lower unit.

2-2. Installing Water Pump

A. Place water pump body on wood block which supports inside top surface of pump body to prevent top surface of pump body from collapsing when installing driveshaft seal. Press driveshaft seal (garter spring on major sealing lip positioned out) in seal bore of pump body using seal installer (Special Tool T3012) as shown in figure 1.

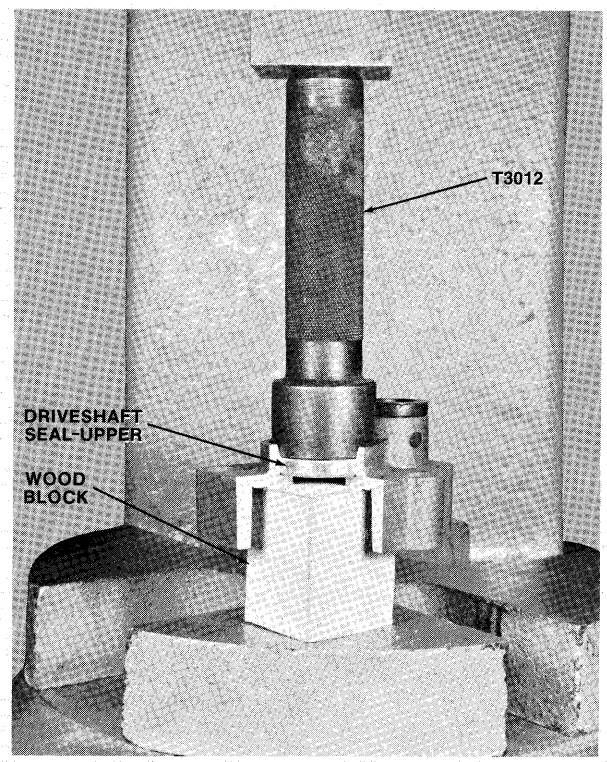


Figure 1–Installing Driveshaft Seal

B. Install water pump impeller by turning impeller in pump body in a counterclockwise direction.

C. Clean gasket surfaces on gear housing —upper. Install pump back plate and new gasket on gear housing—upper so that holes in plate and gasket line up exactly with holes in gear housing—upper.

NOTE

Holes in back plate will not line up exactly if plate is installed upside down. It is important to install plate correctly or water pump will not supply engine with sufficient cooling water.

D. Install pump assembly down driveshaft on back plate aligning slot of impeller with drive key on driveshaft.

E. Install water pump centering tool (Special Tool T2992) down driveshaft to center pump body in relationship to driveshaft. See figure 2.

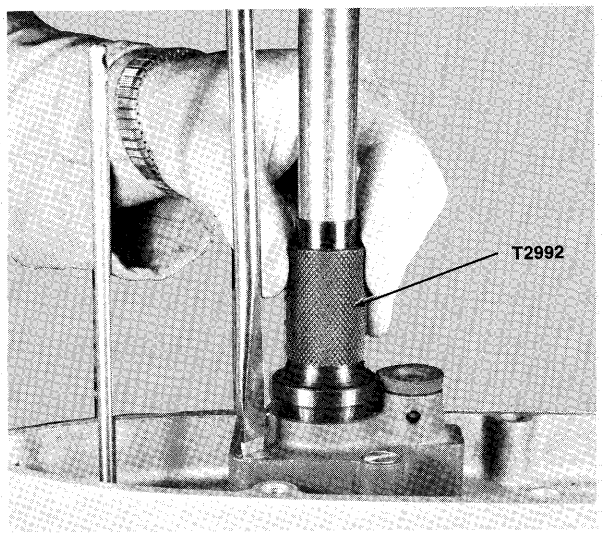


Figure 2–Centering Water Pump Body

NOTE

For water pump bodies without driveshaft seal, use end of centering tool opposite large tapered end.

F. Apply Anti-Seize (Special Tool T2987-1) to threads of four (4) flat head screws which secure pump body to gear housing—upper. While applying downward force on centering tool, install and tighten four (4) flat head screws on pump body. Torque screws to 70 in. lbs. Remove centering tool.

G. Install water line seal in seal bore of pump body making sure that tabs on seal are seated in holes in seal bore of pump body.

H. Install lower unit as outlined in Section XIV, paragraph 1-2.

3. SHIFT ROD — LOWER 05-20

3-1. Removing Shift Rod — Lower

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Turn shift rod—lower counterclockwise until shift rod threads out of shift arm coupling. Pull shift rod from lower unit.

3-2. Installing Shift Rod — Lower

A. Apply grease (Special Tool T2961) to threads of shift rod—lower.

B. Install shift rod—lower through shift rod seal. Slowly push rod down until it just makes contact with shift arm coupling. Turn shift rod clockwise to engage thread of rod with coupling. Turn rod until threads are bottomed in coupling. Turn rod counterclockwise until hole at top end of rod is facing port and starboard sides.

C. Install lower unit as outlined in Section XIV, paragraph 1-2.

D. Check shift adjustment as outlined in appropriate powerhead section

4. GEAR HOUSING — UPPER 05-12 DRIVESHAFT SEAL 05-17 SHIFT ROD SEAL 05-18 GEAR HOUSING SEAL 05-19 DRIVESHAFT BEARING CUP

4-1. Removing Gear Housing — Upper Assembly

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Remove stop nuts from studs securing gear housing—upper to gear housing—lower. Remove plain washers from front and rear studs. Remove spacer and "O" ring seal from middle stud.

C. Lift gear housing—upper from gear housing —lower.

D. Remove shift rod seal by threading a 5/16" diameter lag screw in shift rod seal. Insert 1/4" diameter rod from opposite side and press both seal and lag screw out of seal bore as shown in figure 3.

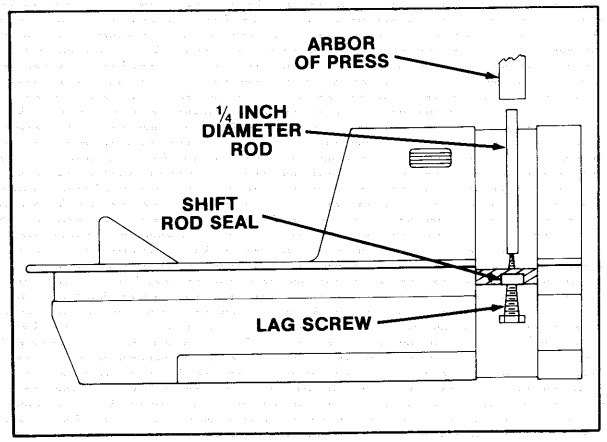


Figure 3–Removing Shift Rod Seal

E. Remove bevel pinion nut and washer. Remove bevel pinion with bearing and cup.

F. Install knock-off nut (Special Tool T8911) over threaded portion of driveshaft and press driveshaft out of gear housing—upper as shown in figure 4. This operation will also remove driveshaft seal.

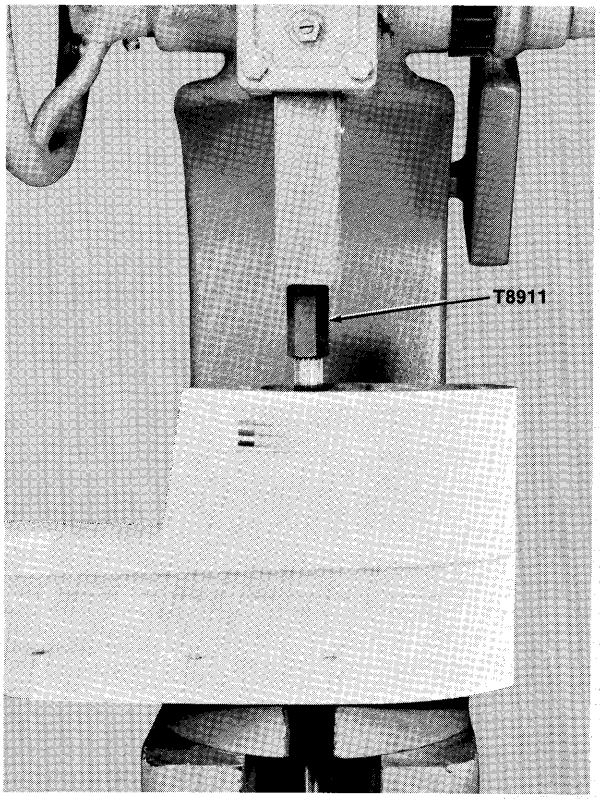


Figure 4–Removing Driveshaft

G. Remove upper driveshaft bearing cup from gear housing—upper by tapping lightly from gear housing—lower side using spring pin punch (Special Tool T8919) and hammer.

NOTE

Bearing cup is not a press fit in bore of gear housing—upper.

H. Remove exhaust snout from gear housing by removing flat head screw securing same and remove lockwasher.

4-2. Installing Gear Housing — Upper Assembly

A. Apply Loctite "H" (Special Tool T2962) on outside diameter of shift rod seal. Install seal on seal installer (Special Tool T8957) with raised bead on seal in cavity machined in tool. Drive seal in seal bore until tool bottoms on top of seal bore as shown in figure 5.

B. Install upper driveshaft bearing cup (with large diameter end of cup up) in gear housing —upper by tapping lightly around circumference of bearing cup with punch and hammer until cup is bottomed completely in bore.

C. Install driveshaft with bearing cone in gear housing—upper.

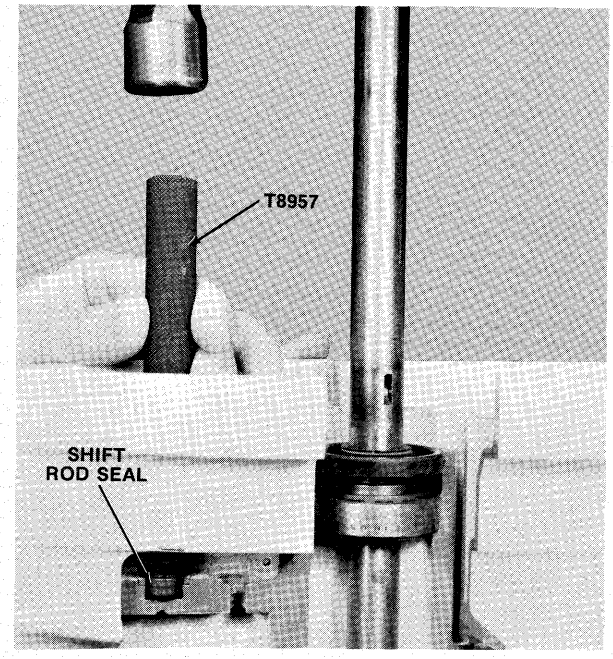


Figure 5–Installing Shift Rod Seal

D. Clean bevel pinion bearing cup bore in gear housing—upper. Install bearing cup and bevel pinion as outlined in Section XIV, paragraph 5-2.

E. Apply grease (Special Tool T2961) between sealing lips of driveshaft seal. Slide seal down driveshaft with garter spring out or towards water pump, on top of seal bore in gear housing—upper. Slide seal installer (Special Tool T8925) down driveshaft. Using seal installer as a slide hammer, press seal in bore until top of seal is flush with top of seal bore as shown in figure 6.

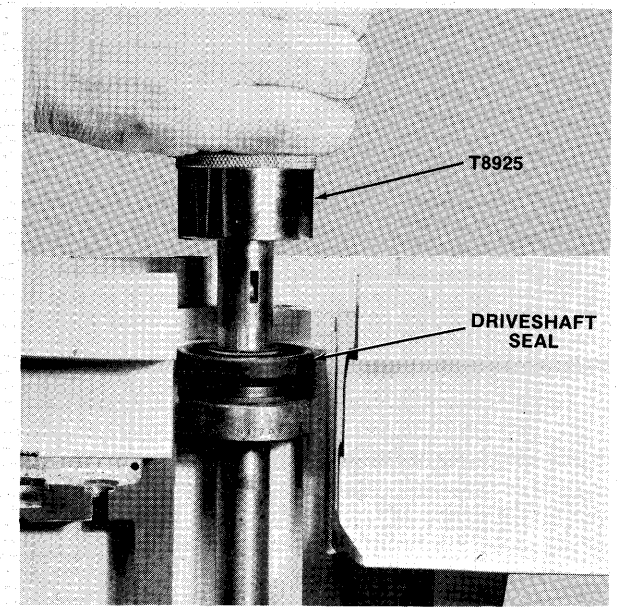


Figure 6–Installing Driveshaft Seal

F. Clean mating surfaces of both gear housing —upper and—lower.

G. Apply sealant (Special Tool T8955) to gear housing—lower in area where groove around pinion bearing cup meets seal groove. Just a little amount of sealant is required to hold seal in place until gear housing—upper is installed. See figure 7.

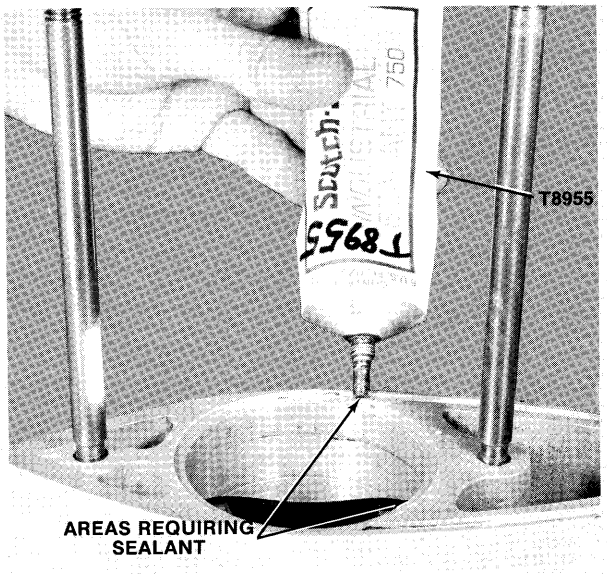


Figure 7–Areas to Have Sealant

H. Install new gear housing seal in groove of gear housing—lower.

I. Install gear housing—upper on housing —lower aligning studs and shift rod—lower through gear housing—upper and making sure "O" ring seal stays in groove in gear housing—lower.

J. Secure gear housing—upper to—lower by installing washers and new stop nuts to front and rear studs. Install new "O" ring, spacer and new stop nut on middle stud. Torque stop nuts to 270 in. lbs.

NOTE

Torque each nut up to 100 in. lbs. first, then gradually increase torque in increments of 50 in. lbs. on each nut until the specified torque is reached.

K. Install exhaust snout and adjust as outlined in Section XIV, paragraph 16-2.

L. Install lower unit as outlined in Section XIV, paragraph 1-2.

5. BEVEL PINION 05-32

5-1. Removing Bevel Pinion

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Remove gear housing—upper as outlined in Section XIV, paragraph 4-1.

C. Remove retaining nut and washer securing bevel pinion to driveshaft and remove bevel pinion and bearing cup.

5-2. Installing Bevel Pinion

A. Clean threads on drive shaft end and prime with Locquic (Special Tool T8935). Apply Loctite "D" (Special Tool T2963) to threads.

B. Install bearing cup and bevel pinion on driveshaft aligning cup in bore of gear housing—upper.

C. Install bevel pinion retaining washer on driveshaft and then a new retaining nut—do not tighten nut at this time.

CAUTION

Do not reuse old retaining nut because once retaining nut is installed and removed, the locking feature is reduced to a point where it is not sufficient to retain bevel pinion and may loosen during operation of engine. If this occurs, considerable damage to lower unit may result.

D. After installing nut loosely on driveshaft, clamp driveshaft in vise (with protective jaws) with driveshaft in a horizontal plane.

E. Swing gear housing—upper on driveshaft. Note how freely gear housing swings.

F. Tighten retaining nut while swinging gear housing as shown in figure 8 until gear housing just starts to bind.

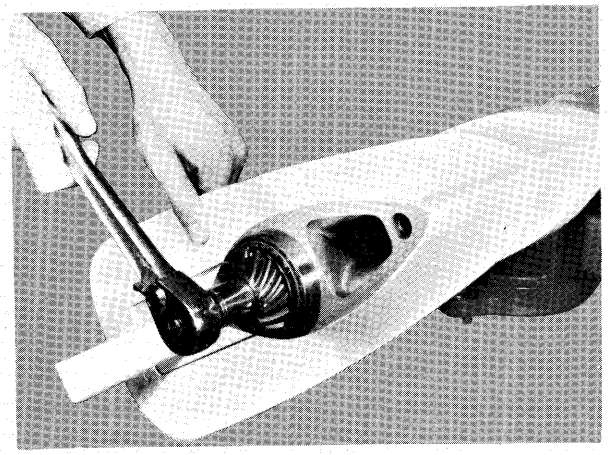


Figure 8–Tightening Retaining Nut

G. Seat bearings (driveshaft and bevel pinion) by tapping knock-off nut (Special Tool T8911) with hammer two (2) times on end of driveshaft as shown in figure 9.

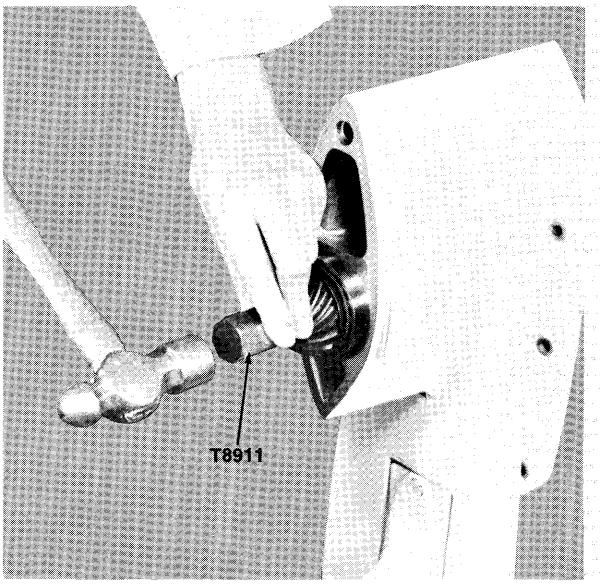


Figure 9–Seating Gear Housing Bearings

H. Swing gear housing—upper again and check to see that gear housing swings freely. If it still binds slightly, loosen nut just enough so that gear housing swings freely.

I. Install gear housing—upper on gear housing —lower and complete assembly as outlined in Section XIV, paragraph 4-2.

6. DRIVESHAFT 08-28 DRIVESHAFT BEARING

6-1. Removing Driveshaft and Bearing

A. Remove driveshaft with bearing as outlined in Section XIV, paragraph 4-1.

B. Remove retaining ring positioning bearing on driveshaft using retaining ring pliers (Special Tool T1081) as shown in figure 10.

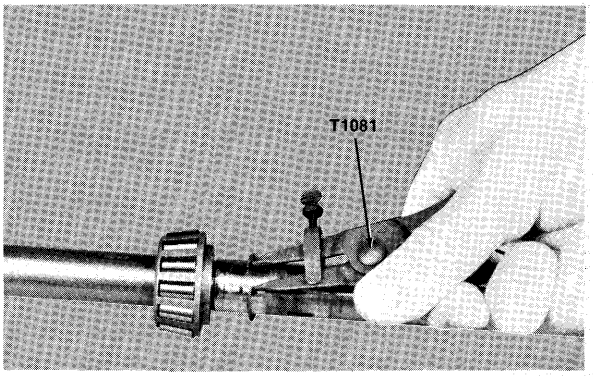


Figure 10–Removing Retaining Ring

C. Press bearing off driveshaft using bearing remover (Special Tool T8905) and knock-off nut (Special Tool T8911) as shown in figure 11.

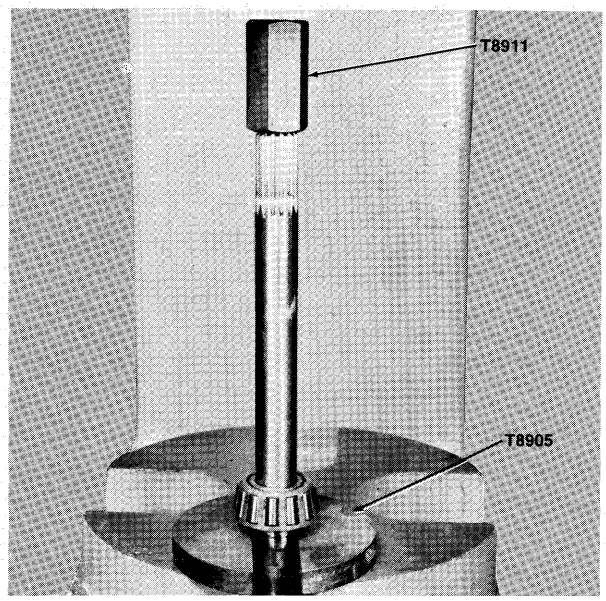


Figure 11–Pressing Bearing Off Driveshaft

6-2. Installing Driveshaft and Bearing

A. Clean and degrease area of driveshaft where bearing is to be positioned. Spray this area with Locquic Primer (Special Tool T8935) and apply Loctite retaining compound (Special Tool T8936).

B. Install retaining ring in groove of driveshaft using retaining ring pliers (Special Tool T1081).

C. Clamp driveshaft in vice (using protective jaws or rag) and drive bearing on driveshaft using bearing installer (Special Tool T8920) until bearing just bottoms against retaining ring as shown in figure 12.

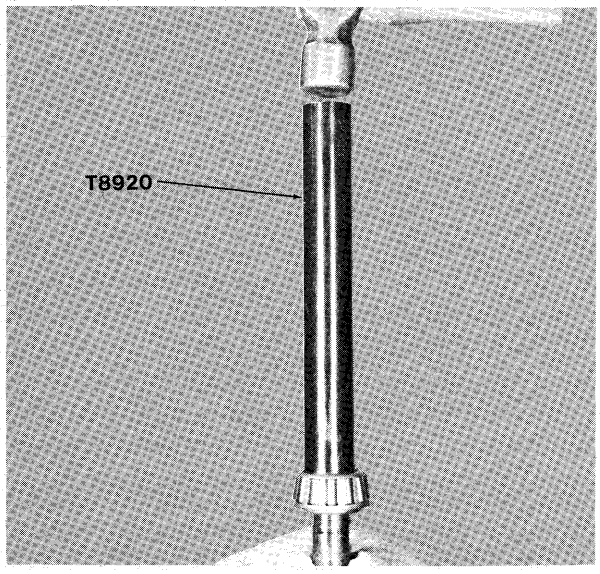


Figure 12–Installing Driveshaft Bearing

D. Complete assembly as outlined in Section XIV, paragraph 4-2.

7. SETTING PROPER BEVEL PINION/ BEVEL GEAR—REAR CLEARANCE

7-1. General Information

A. The importance of setting bevel pinion/ bevel gear—rear clearance is that this relationship determines the proper gear engagement between gears. If this relationship is not held within tolerance, premature gear wear and/or bearing failure may occur.

B. The bevel pinion position is fixed; therefore, the adjustment is made by holding a set dimension from bevel gear—rear to the machined surface under screw bosses of prop shaft bearing cage. This is accomplished by proper use of a checking gauge. The distance from point A to point B is this dimension with a tolerance of ± .001. See figure 13.

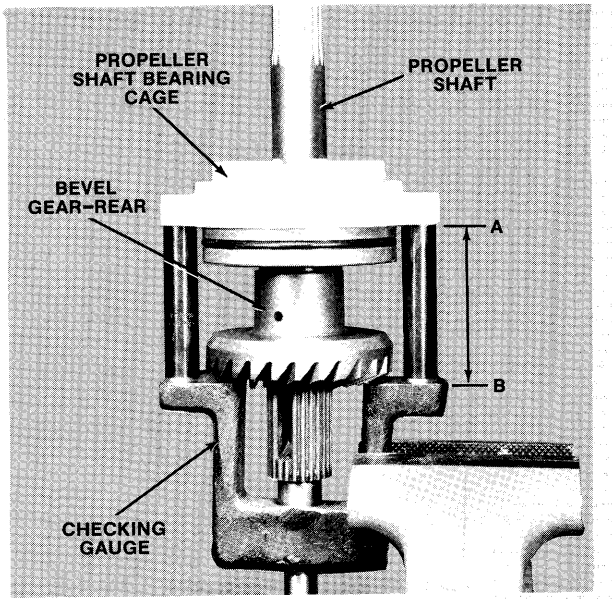


Figure 13–Checking Gauge

C. There are presently four (4) versions of this checking gauge in the field. Described below is a brief description of them.

1. Special Tool J9362: Designed primarily for lower units with 16:25 gear ratio. This tool can be adapted for use on units with 15:26 gear ratio by simply adding a shim set (Special Tool T2994A).

NOTE

Gear ratio can be determined by counting number of teeth on bevel pinion and gear—forward. For example, on a 16:25 gear ratio, there are 16 teeth on bevel pinion and 25 teeth on bevel gear —forward.

2. Special Tool T8924: Basically same as J9362 but has shim set (Special Tool T2994A) included with it for use on either the 15:26 gear ratio lower unit or the 16:25 gear ratio lower unit.

3. Special Tool T8924-1: Basically same as T8924 but has .005" longer spacers to provide a means of double checking after shims are installed behind bearing cup to insure against addition of too many shims. Too many shims would preload bearings causing premature bearing failure.

NOTE

These .005" longer spacers are available to update J9362 and T8924 checking gauges and can be ordered by part number T8924A-1.

4. Special Tool T8981 (Spacer Set) is used to update T8924, T8924-1 and J9362. This kit contains three sets of spacers which are color coded for easy identification. The black spacers are used on the 16:25 gear ratio lower unit, the copper spacers on the 15:26 gear ratio lower unit and the silver on the 15:30 gear ratio lower unit.

D. Checking bevel pinion/bevel gear—rear clearance must be done when any of the following components are replaced: bevel gear—rear, bevel gear—rear bearing cone, gear bearing, bearing cup or prop shaft bearing cage.

E. Always check propeller shaft end float after setting bevel pinion/bevel gear—rear clearance as outlined in Section XIV, paragraph 12-1.

7-2. Setting Bevel Pinion/Bevel Gear—Rear Clearance

A. Remove bevel gear—rear bearing cup from prop shaft bearing cage as outlined in Section XIV, paragraph 8-1 and remove shims. Clean bearing cup bore in bearing cage.

B. Remove prop shaft seal from bearing cage as outlined in Section XIV, paragraph 8-1.

NOTE

Prop shaft seal prevents free movement of propeller shaft. Prop shaft must be free to attain accurate readings.

C. Press bearing cup back in bore of bearing cage without any shims as outlined in Section XIV, paragraph 8-2. Bearing cup must be bottomed in bore of bearing cage.

D. Remove clutch from prop shaft as outlined in Section XIV, paragraph 9-1.

NOTE

Clutch may prevent full bevel gear—rear movement when it is positioned close to it. To eliminate this possibility, clutch should be removed.

E. Clamp checking gauge (Special Tool T8924-1) in vise.

CAUTION

Do not clamp gauge in vise in area of bored hole used as a guide for prop shaft. This may cause bore in gauge to collapse enough to bind against prop shaft. Prop shaft must slide freely in bore to attain accurate readings.

F. Install prop shaft assembly in checking gauge with gear teeth resting on machined surface of checking gauge.

G. Install bearing cage on prop shaft with bearing cup against bearing cone on prop shaft.

H. Install proper spacers (and shim set - Special Tool T2994A if required) between base of checking gauge and screw flanges of bearing cage.

I. Install screws (supplied with tool) through flanges on bearing cage spacers (and shim set if required) and thread into checking gauge. Tighten screws while rotating spacers with fingers until spacers cannot be rotated as shown in figure 14. Then torque screws to 25 in. lbs. or tighten screws 1/8 of a turn with wrench.

J. Install dial indicator (Special Tool T8902) in holder (Special Tool T8901).

K. Install indicator with holder on post provided on checking gauge positioning foot of dial indicator squarely on flat of bevel gear.

L. Raise or lower indicator holder so that dial indicator pointer is visible, has a visible range of at least 20 increments on the dial, and has a maximum of 1-1/2 turns preload. Tighten holder on post. Check to see that indicator is secured to post by tapping on shaft of indicator with finger as shown in figure 15. Indicator pointer must always return to original position.

M. Set dial by turning same so that "0" mark is aligned with pointer.

N. Move gear back and forth while applying downward pressure to same to insure that gear is seated against machined surface of checking gauge. Realign "0" mark if necessary.

O. Lift gear up using equal pressure on opposite sides of gear and without rotating gear. Note amount of movement on pointer on dial indicator. Allow gear to drop down. Pointer should go back to "0" on dial indicator. Repeat above procedure to verify readings. Readings should be consistent.

P. Each increment on dial face of indicator represents .001". The amount of travel (from 0 to highest reading) dictates the thickness of shim or shims required for correct alignment of bevel gear—rear to bevel pinion.

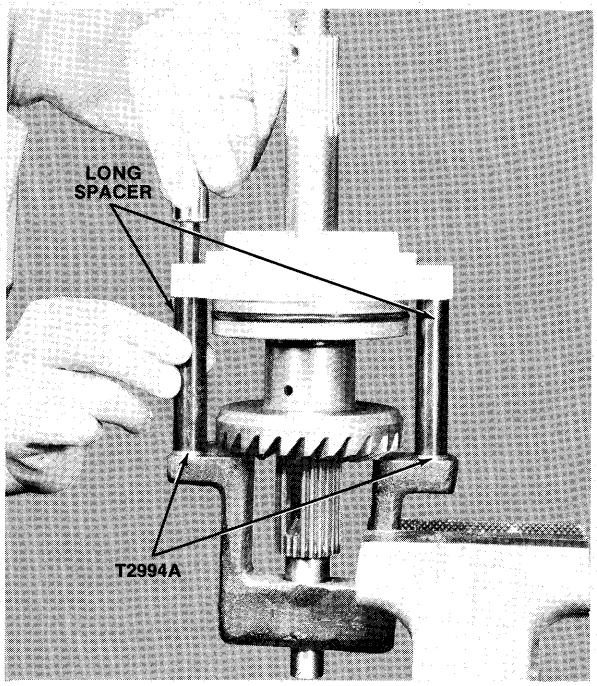


Figure 14–Tightening Spacer Screws

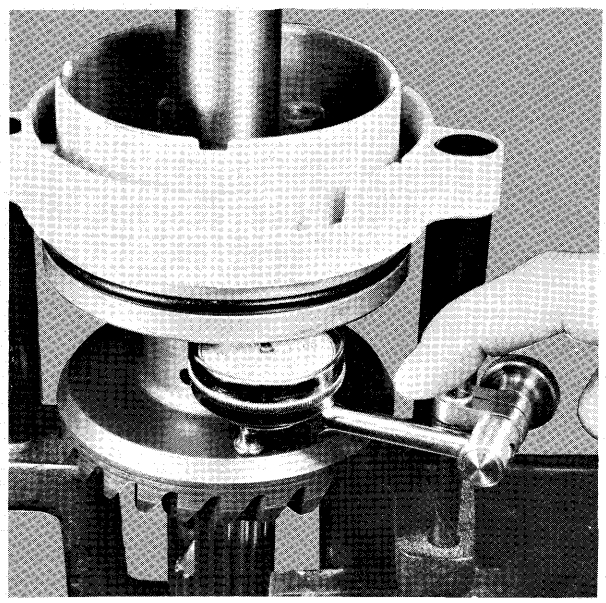


Figure 15–Checking Tightness of Indicator Holder

Refer to appropriate parts book for selection of shims required.

1. If long spacers marked J9362-4, T8924A, or T8924-2-A are used with shim set, the amount of travel indicated is the thickness shim or shims required. For example: if amount of travel is .016" (pointer moves 16 increments from 0 mark), a .010" shim and .006" shim are required.

2. If long spacers marked T8924A-1 with shim set (T2994A) are used, the amount of travel indicated minus .005" is the thickness shim

or shims required. The same information applies to spacer sets T8981A, T8981B, T8981C except the use of the shim set (T2994A) is not necessary. For example: if the amount of travel is .015" (pointer moves 15 increments from 0 mark). .015 minus .005 equals .010. A .010" shim is required.

NOTE

T8924A-1 spacers are .005" longer than the J9362-4, T8924A and T8924-2-A spacers to provide a means of double checking after shims are installed. Also, spacers T8981A, T8981B and T8981C provide a means of double checking.

After shims are installed, use same checking procedures. The amount of travel indicated should be .005 ± .001.

Q Always check propeller shaft end float after setting bevel pinion/bevel gear—rear clearance as outlined in Section XIV, paragraph 12-1.

8. PROPELLER SHAFT BEARING CAGE 05-24 PROPELLER SHAFT BEARING CAGE SEAL 05-25 BEVEL GEAR—REAR BEARING CUP 05-33 PROPELLER SHAFT SEAL 05-26

8-1. Removing Propeller Shaft Bearing Cage Assembly

A. Remove propeller, prop nut, cotter pin, seal and drive pin.

B. Remove two (2) hex socket head cap screws securing bearing cage assembly to gear housing—lower.

C. Install puller (Special Tool T8948) as shown in figure 16 and remove bearing cage assembly.

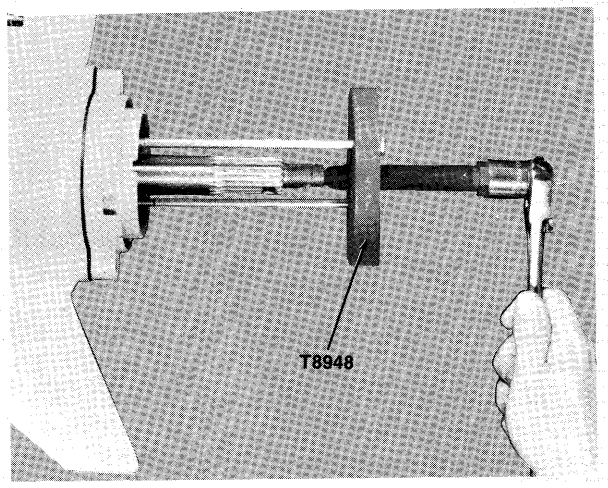


Figure 16–Removing Bearing Cage Assembly

D. Remove bearing cage seal from groove in outer diameter of bearing cage.

E. Remove bearing cup from bearing cage using cup remover (Special Tool T8917) and slide hammer (Special Tool T8922) as shown in figure 17 and remove shims.

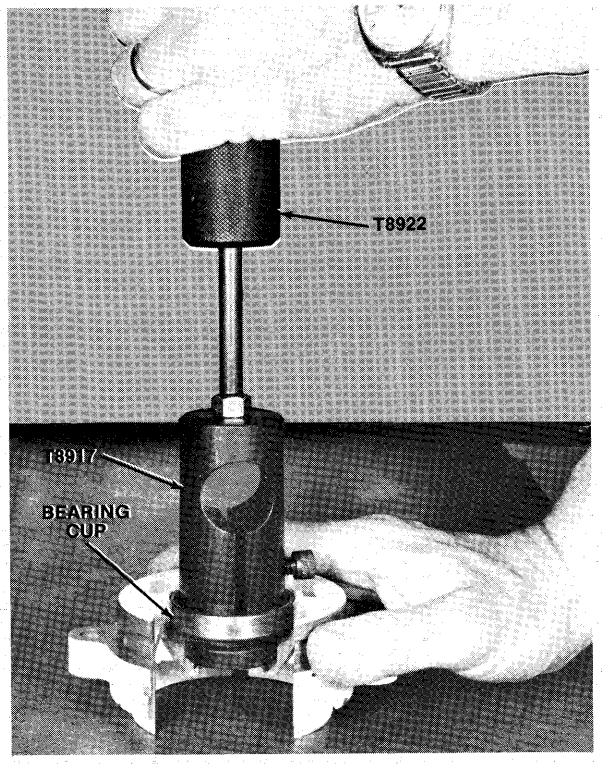


Figure 17–Removing Bearing Cup

F. Remove propeller shaft seal by threading seal remover (Special Tool T8914) in seal as shown in figure 18.

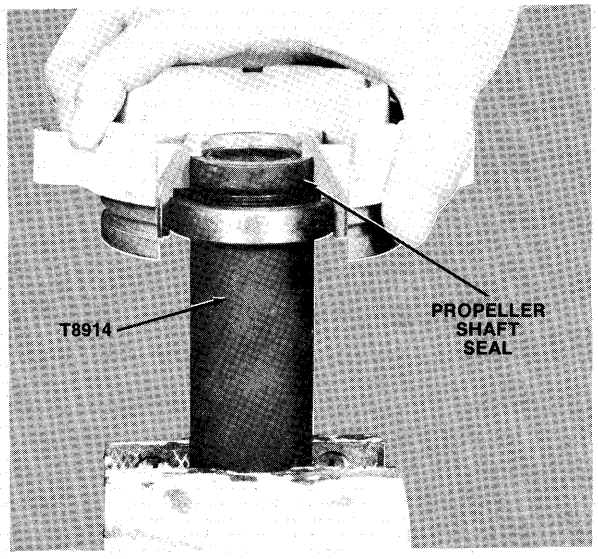


Figure 18–Installing Seal Remover

G. Take this assembly to a press and press seal out as shown in figure 19.

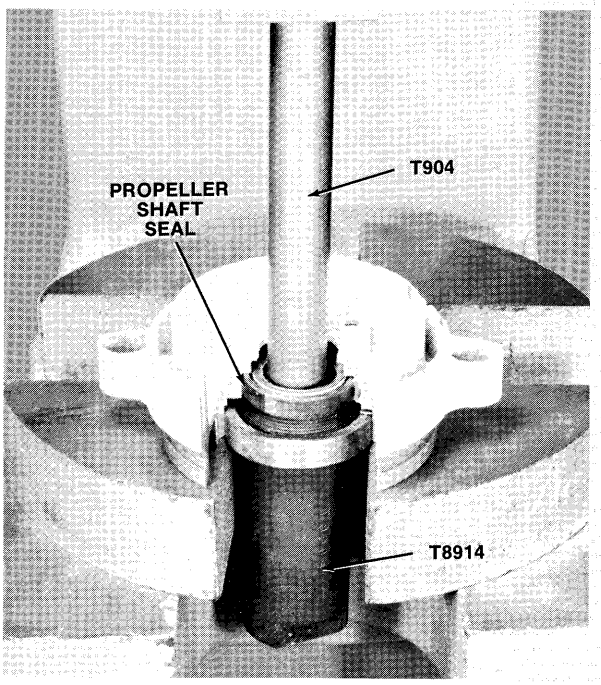


Figure 19–Pressing Out Seal

8-2. Installing Propeller Shaft Bearing Cage Assembly

A. If propeller shaft bearing cage or bearing cup is replaced, bevel pinion/bevel gear—rear clearance must be checked. Follow the procedure as outlined in Section XIV, paragraph 7-1 and 7-2.

B. Install proper thickness of shims determined in Section XIV, paragraph 7-2. Install bearing cup in bearing cage using cup installer (Special Tool T8910) with driver handle (Special Tool T8907) as shown in figure 20.

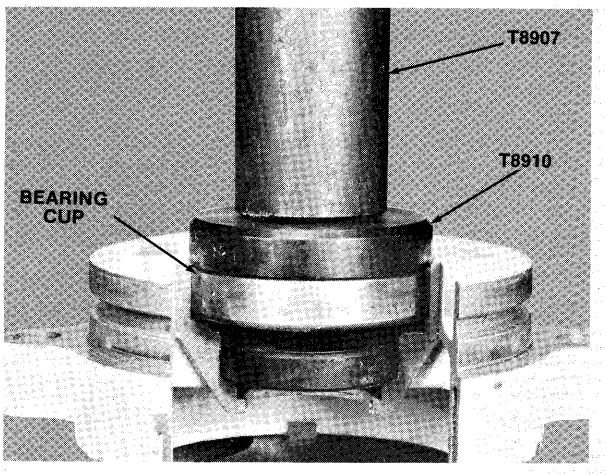


Figure 20–Installing Bearing Cup

C. After installing bearing cup, install propeller shaft seal using seal installer (Special Tool T8908) and driver handle (Special Tool T8907) as shown in figure 21.

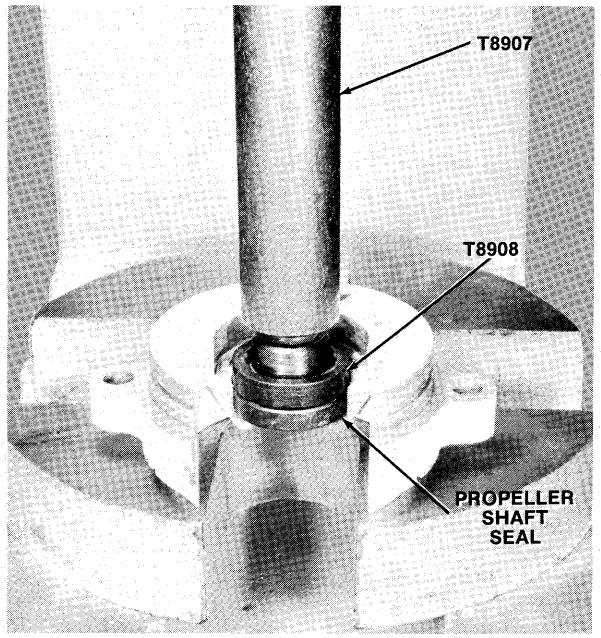


Figure 21–Pressing in Propeller Shaft Seal

D. Apply grease (Special Tool T2961) to bearing cage seal and install in groove of bearing cage.

E. Apply grease (Special Tool T2961) to sealing lips of propeller shaft seal and install bearing cage assembly on propeller shaft.

F. Lightly tap around edge of bearing cage to seat bearing cage in gear housing—lower.

G. Apply Anti-Seize (Special Tool T2987-1) to threads of two (2) hex socket head cap screws. Secure bearing cage assembly to gear housing—lower using same.

H. Install propeller, drive pin, seal, propeller nut and cotter pin.

9. YOKE ASSEMBLY 05-23
CLUTCH 05-30
SHIFT PIN 05-31

9-1. Removing Yoke, Clutch and Shift Pin.

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Remove propeller shaft bearing cage assembly as outlined in Section XIV, paragraph 8-1.

C. Pull shift rod—lower up as far as possible and then pull propeller shaft out of gear housing—lower.

D. Remove yoke from shift pin.

E. Drive out spring pin securing clutch and shift pin to propeller shaft using spring pin punch (Special Tool T8919). Remove shift pin and clutch from propeller shaft.

9-2. Installing Yoke, Clutch and Shift Pin

A. Install clutch on propeller shaft aligning spring pin holes with slot in propeller shaft.

B. Install shift pin in propeller shaft aligning hole with spring pin holes in clutch.

C. Drive spring pin through clutch, prop shaft and shift pin using spring pin punch (Special Tool T8919).

D. Apply heavy grease (Special Tool T2961) to groove in shift pin to hold yoke in position. Install yoke in groove of shift pin.

E. Carefully install propeller shaft assembly in gear housing while being sure that shift rod—lower is up as far as possible and pins on each side of yoke are horizontal. Push propeller shaft assembly in until pins of yoke are aligned in slots of shift arm assembly as shown in figure 22.

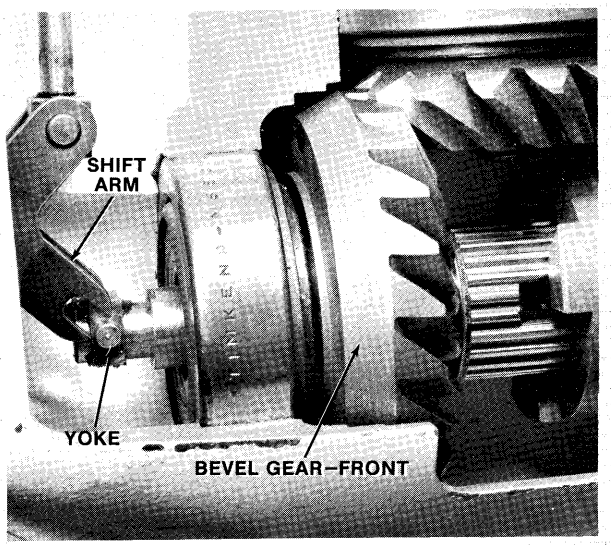


Figure 22–Installing Propeller Shaft Assembly

F. Install bearing cage as outlined in Section XIV, paragraph 8-2.

G. Install lower unit as outlined in Section XIV, paragraph 1-2.

10. PROPELLER SHAFT 05-27
BEVEL GEAR—REAR 05-29
BEVEL GEAR—REAR BEARING 05-11

10-1. Removing Propeller Shaft Assembly

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Remove propeller shaft bearing cage assembly as outlined in Section XIV, paragraph 8-1.

C. Remove clutch, shift pin and yoke as outlined in Section XIV, paragraph 9-1.

D. Press bevel gear—rear and bearings off propeller shaft using guide plate from bearing guide set (Special Tool T8918) as shown in figure 23.

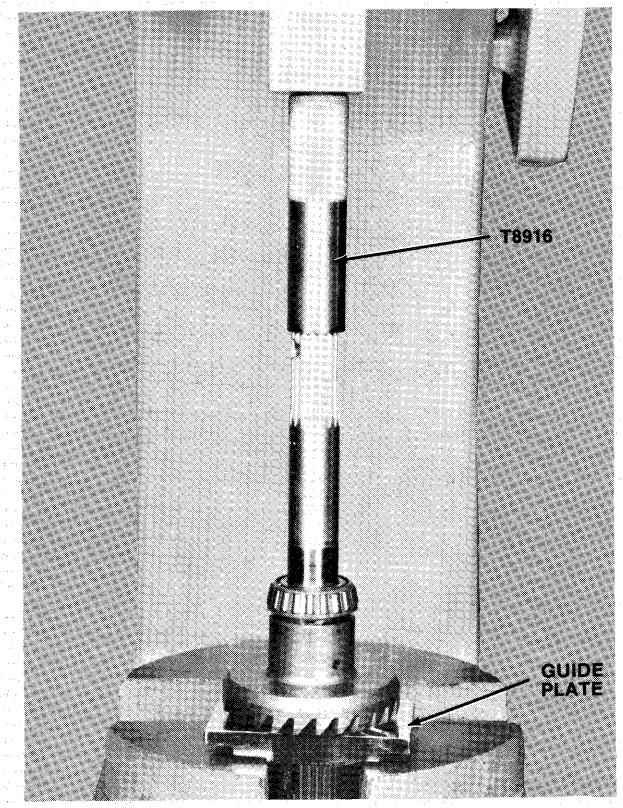


Figure 23–Removing Bevel Gear and Bearings

E. Remove bronze bearing from bevel gear—rear.

10-2. Installing Propeller Shaft Assembly

A. Install bronze bearing in bevel gear with flange of bearing on side opposite gear teeth (flange of bearing will be between gear and inner race of roller bearing when roller bearing is pressed on propeller shaft).

B. Slide bevel gear—rear thrust washer on propeller shaft.

C. Slide bevel gear—rear assembly on propeller shaft.

D. Slide roller bearing on propeller shaft with large end of taper towards bevel gear—rear. Press bearing on propeller shaft using bearing installer (Special Tool T8906) and driveshaft installer (Special Tool T8920) as shown in figure 24.

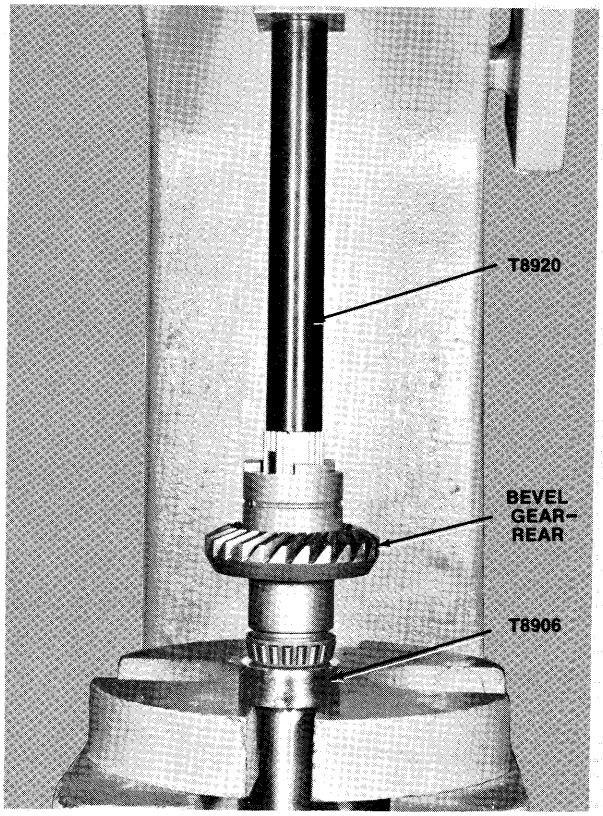


Figure 24–Installing Propeller Shaft Bearing

E. Press bearing on shaft until it bottoms against bearing flange of bevel gear—rear.

F. Check bevel pinion/bevel gear—rear clearance as outlined in Section XIV, paragraphs 7-1 and 7-2.

G. Install clutch, shift pin and yoke as outlined in Section XIV, paragraph 9-2.

H. Install propeller shaft bearing cage assembly as outlined in Section XIV, paragraph 8-2.

I. Install lower unit as outlined in Section XIV, paragraph 1-2.

11. BEVEL GEAR—FRONT 05-28 BEVEL GEAR—FRONT BEARING CUP

11-1. Removing Bevel Gear—Front and Bearing Cup

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Separate gear housing—upper from lower as outlined in Section XIV, paragraph 4-1.

C. Remove propeller shaft as outlined in Section XIV, paragraph 10-1.

D. Remove bevel gear—front assembly and thrust washer from gear housing—lower.

E. Remove bevel gear—front bearing cup using cup remover (Special Tool T2995) with bearing guide set (Special Tool T8918) as shown in figure 25.

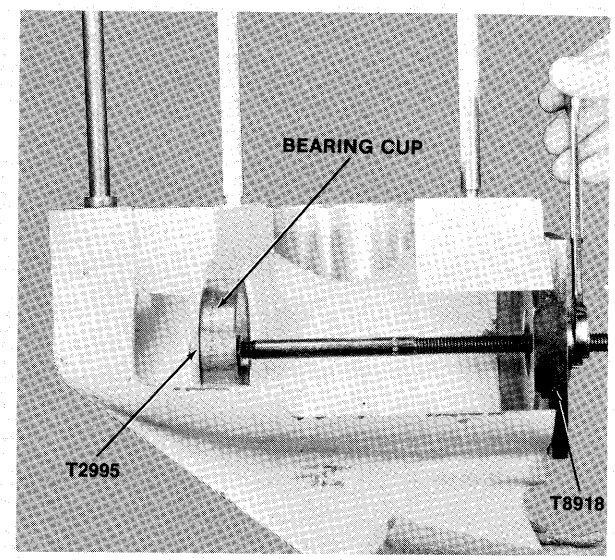


Figure 25–Removing Bearing Cup

11-2. Installing Bevel Gear—Front and Bearing Cup

A. Press bearing cup in gear housing—lower using cup installer (Special Tool T8909) with driver handle (Special Tool T8907) and guide plate from bearing guide set (Special Tool T8918) as shown in figure 26.

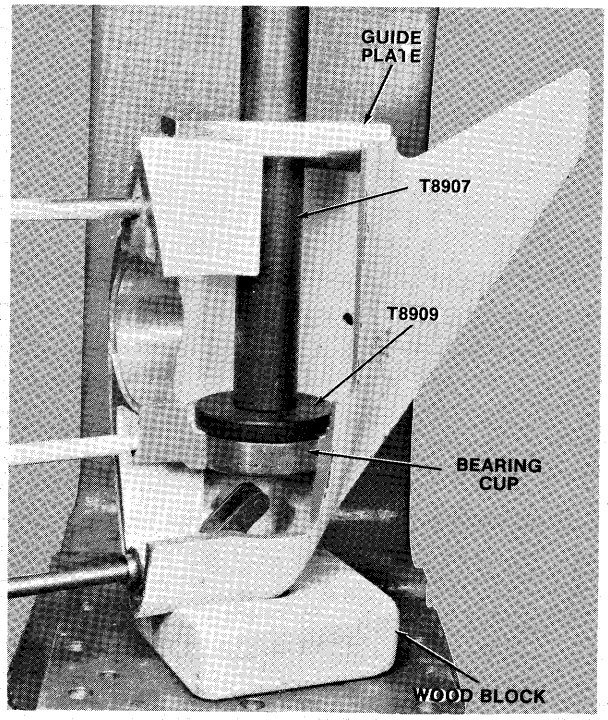


Figure 26–Installing Bearing Cup

B. Install bevel gear—forward assembly with a .059" thick bevel gear—front spacer. Complete gear housing—lower assembly only as outlined in Section XIV, paragraph 10-2. Do not assemble gear housing—upper at this time.

C. Check propeller shaft end float as outlined in Section XIV, paragraph 12-1.

D. After checking propeller shaft end float, install proper thickness spacer and complete assembly as outlined in Section XIV, paragraph 10-2 and 4-2.

12. PROPELLER SHAFT END FLOAT

12-1. Checking Propeller Shaft End Float

A. Install a .059" thick spacer on propeller shaft (bevel gear—front side).

B. Install propeller shaft in gear housing—lower as outlined in Section XIV, paragraph 10-2.

C. Install propeller shaft bearing cage on gear housing—lower.

NOTE

Leave propeller shaft bearing cage seal (large "O" ring) off of bearing cage for easy installation and removal after checking end float.

D. Install dial indicator post in one of the bearing cage screw holes and tighten securely. Install hex socket head screw in other screw hole and tighten securely.

E. Install dial indicator (Special Tool T8902) with holder (Special Tool T8901) on post.

F. Preload dial indicator at least 1/2 turn on indicator needle. Secure indicator to post. Tap indicator shaft with finger to be certain indicator is tightened securely to post.

G. Rotate propeller shaft clockwise and counterclockwise while applying force to seat propeller shaft bearings.

H. Set dial on indicator to align "0" with needle.

I. Lift propeller shaft up and read total indicated movement of needle as shown in figure 27. This reading is the total propeller shaft end float. Propeller shaft end float should be .005" ± .001".

For Example:	Example A	Example B
Total Indicated Reading	.017	.018
End Float Allowed	− .005	− .005
Difference	.012	.013
Thickness Spacer in Gear Housing	+ .059	+ .059
Thickness Spacer Required	.071	.072

After checking parts book for selection of spacers, spacer available from factory for above examples which fall within tolerance is .071.

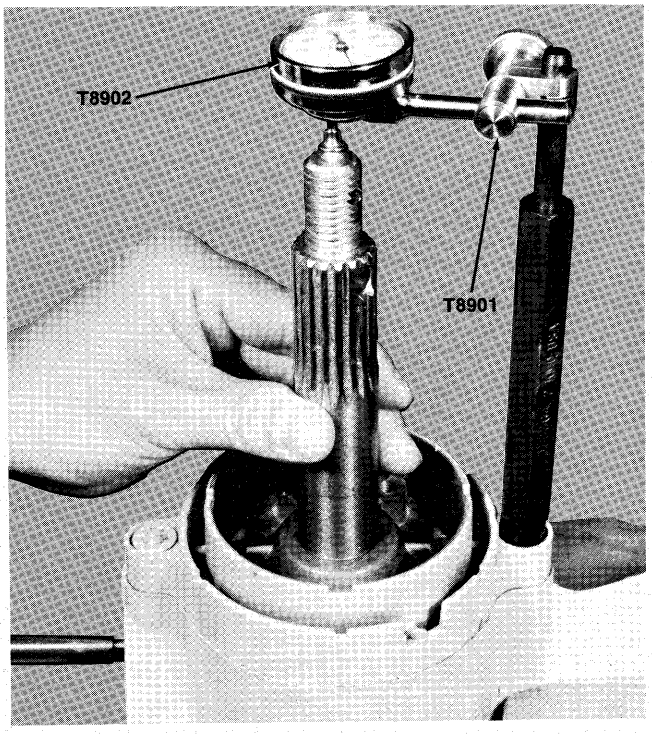


Figure 27—Checking Propeller Shaft End Float

13. SHIFT ARM 05-22

13-1. Removing Shift Arm

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Remove gear housing—upper assembly as outlined in Section XIV, paragraph 4-1.

C. Remove propeller shaft assembly as outlined in Section XIV, paragraph 10-1.

D. Remove shift rod from shift arm.

E. Remove pivot screw securing shift arm to gear housing—lower.

F. Remove shift arm from gear housing—lower.

13-2. Installing Shift Arm

A. Install shift arm in gear housing—lower with forked ends in first.

B. Align pivot hole in shift arm with hole in gear housing—lower and install pivot screw with new nyltite washer to secure shift arm.

C. Install shift rod—lower in shift arm. Bottom threads of shift rod—lower in shift arm.

D. Install propeller shaft assembly as outlined in Section XIV, paragraph 10-2.

E. Install gear housing—upper assembly as outlined in Section XIV, paragraph 4-2.

F. Install lower unit as outlined in Section XIV, paragraph 1-2.

14. GEAR HOUSING—LOWER 05-21

14-1. Removing Gear Housing—Lower

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Remove gear housing—upper as outlined in Section XIV, paragraph 4-1.

C. Remove propeller shaft assembly as outlined in Section XIV, paragraph 10-1.

D. Remove bevel gear—front as outlined in Section XIV, paragraph 11-1.

E. Remove shift arm as outlined in Section XIV, paragraph 13-1.

F. Remove three (3) studs from gear housing—lower using stud remover or by installing two (2) nuts on stud, jam nuts against one another and turn studs out of body with wrench on lower nut.

G. Remove pilot from forward stud hole in gear housing—lower.

14-2. Installing Gear Housing—Lower

A. Install pilot in forward stud hole of gear housing—lower.

B. Apply Loctite D (Special Tool T2963) to necked down end of studs. Install studs in gear housing with necked down end of stud in gear housing—lower.

C. Install shift arm in gear housing—lower as outlined in Section XIV, paragraph 13-2.

D. Install bevel gear—front as outlined in Section XIV, paragraph 11-2.

E. Install propeller shaft assembly as outlined in Section XIV, paragraph 10-2.

F. Install gear housing—upper as outlined in Section XIV, paragraph 4-2.

G. Install lower unit as outlined in Section XIV, paragraph 1-2.

15. GEAR HOUSING—LOWER COMPLETE 05-34

15-1. Removing Gear Housing—Lower Complete

A. Remove lower unit as outlined in Section XIV, paragraph 1-1.

B. Remove gear housing—upper assembly as outlined in Section XIV, paragraph 4-1 and remove gear housing—lower complete.

C. Remove bevel pinion and bearing cup from gear housing—upper as outlined in Section XIV, paragraph 4-1.

15-2. Installing Gear Housing—Lower Complete

A. Install new bevel pinion and bearing cup in gear housing—upper as outlined in Section XIV, paragraph 4-2.

B. Install gear housing—upper assembly on gear housing—lower complete as outlined in Section XIV, paragraph 4-2.

C. Install lower unit as outlined in Section XIV, paragraph 1-2.

16. EXHAUST SNOUT

16-1. Removing Exhaust Snout

A. Remove long screw (rear screw) with washer and short screw (forward screw) with lockwasher securing snout to gear housing—upper.

B. Remove snout from gear housing—upper.

16-2. Installing Exhaust Snout

A. Apply Loctite D (Special Tool T2963) to threads of exhaust snout screws.

B. Install long screw in rear exhaust snout screw hole. Do not tighten securely at this time.

C. Install short screw in forward exhaust snout screw hole. Do not tighten at this time.

D. While looking at engine from rear, move exhaust snout all the way to the left. Then move exhaust snout 1/16" back to the right.

E. Hold position of exhaust snout and torque forward screw to 70 in. lbs. and rear screw to 160 in. lbs.

SECTION XIVA — GEAR HOUSING

1. GEAR HOUSING COMPLETE 05-40

1-1. Removing Gear Housing Complete

A. Remove cotter pin securing shift rod pin to coupler on shift rod - upper. Remove shift rod pin to free shift rod - lower from coupler. See figure 1.

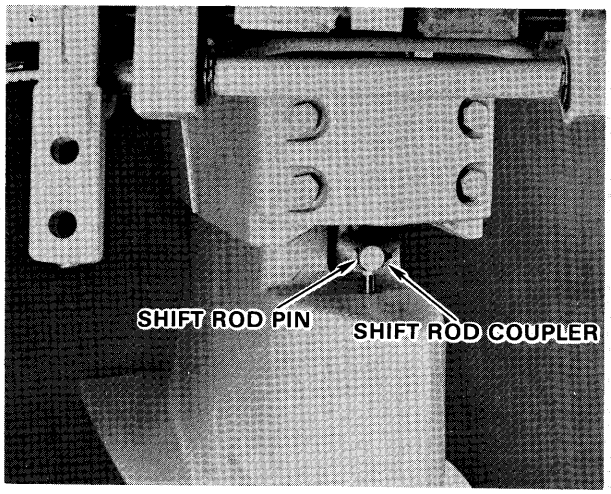


Figure 1—Location of Shift Rod Pin

B. Remove six (6) hex head screws and lockwashers securing gear housing to motor leg.

C. Remove two screws securing exhaust snout to gear housing and remove snout from gear housing.

D. Remove one screw and lockwasher securing gear housing - rear to motor leg and pull gear housing from motor leg.

E. Remove screw securing prop nut to prop shaft and remove prop nut. Remove stop nut and plain washer from prop shaft. Pull propeller and washer from prop shaft and remove propeller spacer from prop shaft.

F. Remove driveshaft spline seal and retainer from end of driveshaft.

1-2. Installing Gear Housing Complete

A. Apply Anti-Seize (Special Tool T2987-1) to driveshaft splines. Install driveshaft spline seal and retainer on driveshaft.

B. Position gear housing on motor leg aligning shift rod lower with hole in motor leg and shift rod coupling on upper gear shift rod. Align water line with seal in water pump and engage driveshaft splines with crankshaft splines.

C. Apply sealant (Special Tool T8983) to threads of seven (7) gear housing to motor leg screws, install screws with lockwashers and tighten securely.

D. Place exhaust snout on gear housing. Apply Loctite (Special Tool T2963-1) to threads of exhaust snout screws, install screws and tighten securely.

NOTE

Snout is to be positioned in the center of the bolt slot.

E. Install shift rod pin through coupler and gear shift rod lower and secure with cotter pin.

F. Install propeller as shown in figure 2.

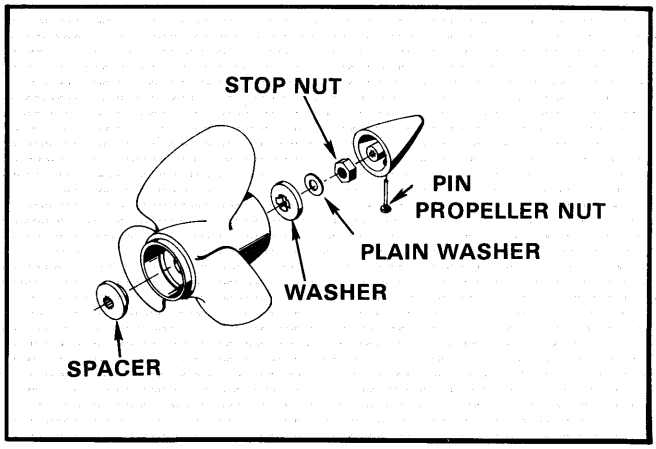


Figure 2—Propeller Order of Assembly

2. DRIVESHAFT SPLINE SEAL 05-11 SPLINE SEAL RETAINER

2-1. Removing Driveshaft Spline Seal

A. Remove gear housing complete as outlined in Section XIVA paragraph 1-1.

B. Remove driveshaft spline seal and retainer from end of driveshaft.

2-2. Installing Driveshaft Spline Seal

A. Place retainer and spline seal on driveshaft as shown in figure 3.

B. Install gear housing complete as outlined in Section XIVA paragraph 1-2.

3. INLET WATER LINE SEAL 05-12

3-1. Removing Inlet Water Line Seal

A. Remove gear housing complete as outlined in Section XIVA paragraph 1-1.

B. Remove water line seal from water pump body.

3-2. Installing Inlet Water Line Seal

A. Place water line seal in water pump body.

NOTE

If a new seal is being installed apply a soapy solution to base of seal and press seal in bore on water pump body.

B. Install gear housing complete as outlined in Section XIVA paragraph 1-2.

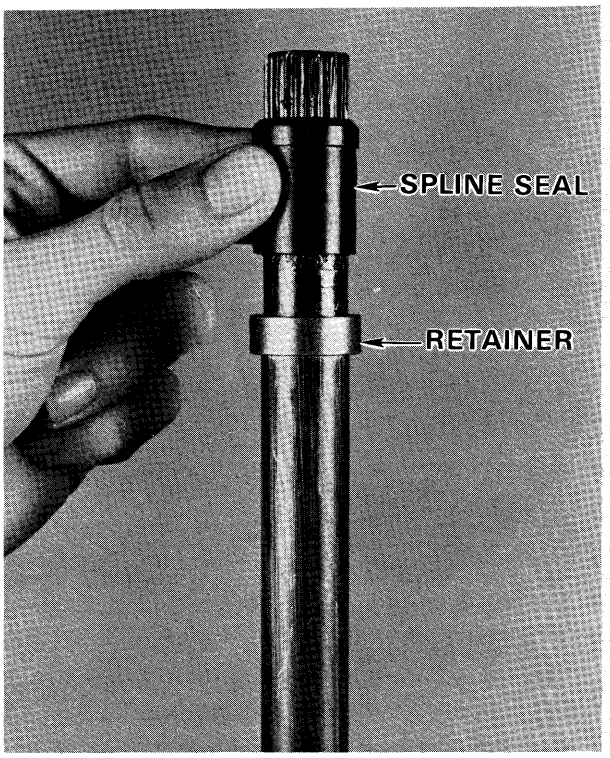


Figure 3—Installing Driveshaft Spline Seal

4. WATER PUMP BODY 05-14
WATER PUMP
DRIVESHAFT SEAL 05-13
WATER PUMP IMPELLER 05-15
WATER PUMP PLATE 05-16
WATER PUMP GASKET
WATER PUMP DRIVE KEY 05-23

4-1. Removing Water Pump

A. Remove gear housing complete as outlined in Section XIVA paragraph 1-1.

B. Remove water line seal from water pump body.

C. Remove four (4) screws securing water pump body to gear housing and lift water pump body assembly from gear housing. See figure 4.

D. Remove impeller drive key from slot in driveshaft.

E. Remove water pump plate and gasket from gear housing cover.

F. Remove impeller from water pump body.

G. Remove driveshaft seal and water pump centering disc from pump body by driving same out from inside pump body.

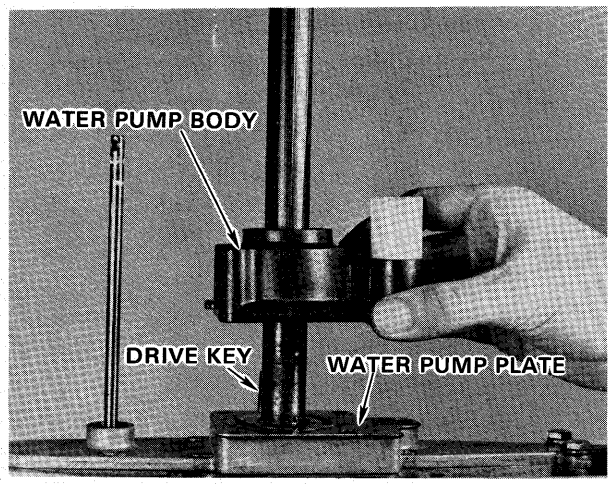


Figure 4—Removing Water Pump

4-2. Installing Water Pump

A. Place water pump body on a wood block which supports inside top surface of pump body to prevent it from collapsing when installing driveshaft seal. Place water pump centering disc in seal bore in water pump body. Place driveshaft seal in seal bore on top of centering disc (with major sealing lip up) press seal in bore (using Special Tool T3012) until seal bottoms out. See figure 5.

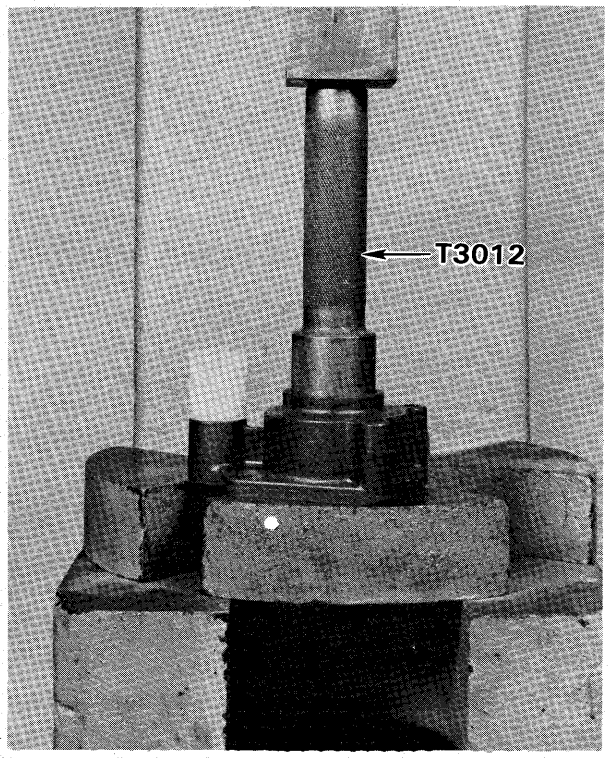


Figure 5—Installing Driveshaft Seal

B. Install water pump impeller in pump body.

C. Clean gasket surface on gear housing cover. Install water pump gasket and plate on gear housing cover.

D. Place impeller drive key in slot in driveshaft.

E. Slide water pump body assembly down driveshaft aligning slot in impeller with drive key in driveshaft.

F. Apply Sealant (Special Tool T8983) to threads of four (4) water pump screws. Install screws and torque to 70 inch pounds.

G. Install waterline seal in bore of pump body.

H. Install gear housing complete as outlined in Section XIVA paragraph 1-2.

5. GEAR HOUSING COVER WITH SEALS 05-18 DRIVESHAFT BEARING CAGE SEAL 05-20 GEAR HOUSING COVER SEAL 05-21

5-1. Removing Gear Housing Cover

A. Remove gear housing complete as outlined in Section XIVA paragraph 1-1.

B. Remove water pump as outlined in Section XIVA paragraph 4-1.

C. Remove three (3) screws and lockwashers securing gear housing cover to gear housing.

D. Rotate gear housing cover as shown in figure 6, grasp ends of cover, pull up on cover while rocking cover back and forth until free from bore in gear housing. Lift cover up and off driveshaft. Remove crush ring from bore in gear housing.

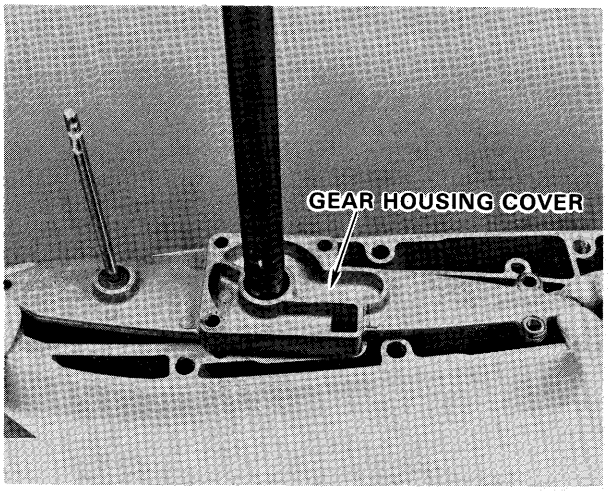


Figure 6—Removing Gear Housing Cover

E. Remove "O" ring seal from groove in gear housing cover and "O" ring seal from groove in driveshaft bearing cage. Inspect seals for cuts or nicks.

5-2. Installing Gear Housing Cover

A. Place "O" ring seals on gear housing cover as shown in figure 7.

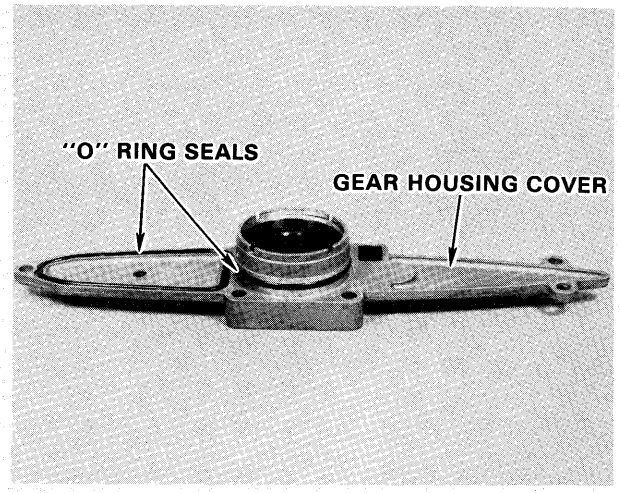


Figure 7—Location of "O" Ring Seals

B. Slide gear housing cover w/seals down driveshaft aligning shift rod lower with shift rod seal in cover. Push down on cover until bearing cage seats properly in gear housing bore.

C. Apply sealant (Special Tool T8983) to threads of three (3) cover screws, install screws and torque to 70 inch pounds.

D. Install water pump as outlined in Section XIVA paragraph 4-2.

E. Install gear housing complete as outlined in Section XIVA paragraph 1-2

6. DRIVESHAFT SEAL 05-19 GEAR SHIFT ROD SEAL 05-17

6-1. Removing Driveshaft and Gear Shift Rod Seals

A. Remove gear housing cover as outlined in Section XIVA paragraph 5-1.

B. Pry driveshaft seal from bore in gear housing cover as shown in figure 8.

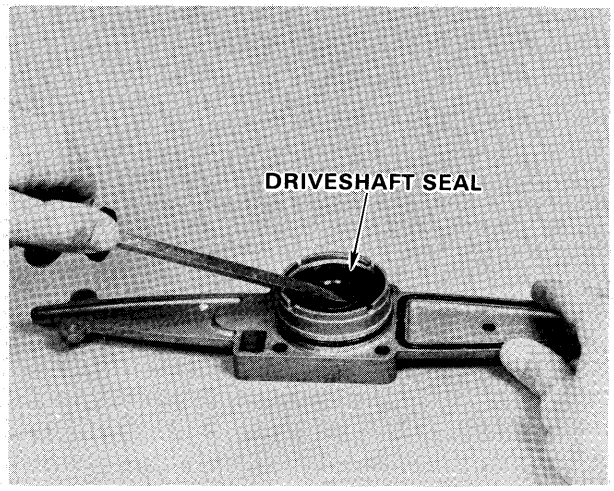


Figure 8—Removing Driveshaft Seal

C. Remove shift rod seal by threading a 5/16" diameter lag screw in shift rod seal. Press seal and lag screw out of cover by using a press and 1/4" diameter rod as shown in figure 9.

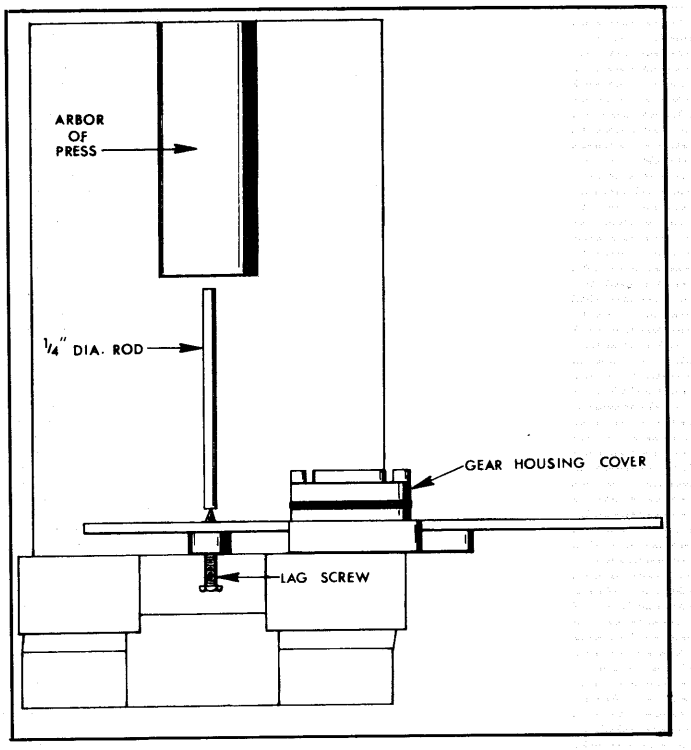


Figure 9—Removing Shift Rod Seal

6-2. Installing Driveshaft and Gear Shift Rod Seals

A. Place shift rod seal in bore on gear housing cover with chamfered end of seal facing down in seal bore. Press seal in bore until seated .070 below surface of machined spot face.

B. Place driveshaft seal in gear housing cover with metal case of seal facing toward lube side. Press seal in bore using special tool T8925 until seal is flush with outer face of seal bore cavity. See figure 10.

C. Install gear housing cover as outlined in Section XIVA paragraph 5-2.

7. GEAR SHIFT ROD LOWER 05-25

7-1. Removing Gear Shift Rod Lower

A. Remove gear housing complete as outlined in Section XIVA paragraph 1-1.

B. Remove gear housing cover as outlined in section XIVA paragraph 5-1.

C. Turn shift rod - lower counterclockwise until shift rod threads out of shift arm coupling. Pull shift rod from gear housing.

7-2. Installing Gear Shift Rod Lower

A. Apply grease (Special Tool T2961) to threads of shift rod - lower. Thread shift rod lower in shift arm coupling. Turn shift rod clockwise until threads are bottomed in coupling. Turn rod counterclockwise until hole at top of rod is facing port and starboard.

B. Install gear housing cover as outlined in Section XIVA paragraph 5-2.

C. Install gear housing complete as outlined in Section XIVA paragraph 1-2.

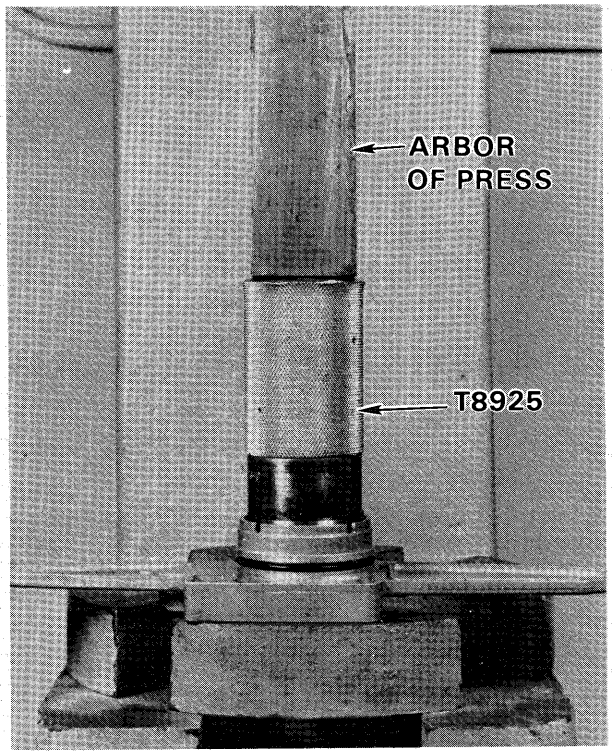


Figure 10—Installing Driveshaft Seal

8. ANTICORROSION ANODE 05-39

8-1. Removing Anticorrosion Anode

A. Remove propeller and components as outlined in Section XIVA paragraph 1-1.

B. Remove two (2) screws securing anode to propeller shaft spool and remove anode. See figure 11.

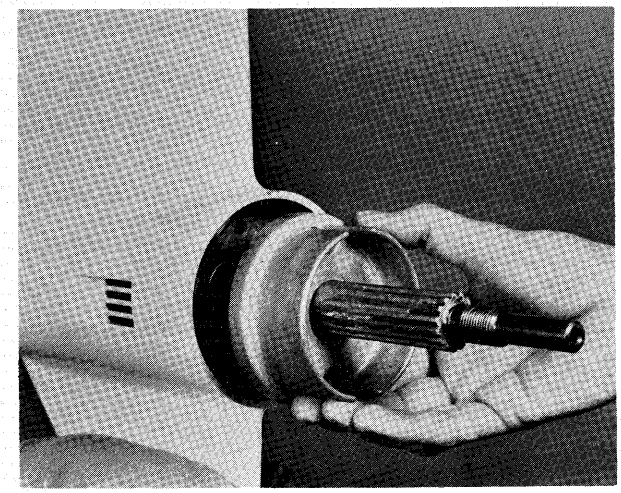


Figure 11—Removing Anticorrosion Anode

8-2. Installing Anticorrosion Anode

A. Place anticorrosion anode on gear housing as shown in figure 11. Apply Loctite (Special Tool T2963-1) to threads of two anode screws, install screws and tighten securely.

NOTE

Never paint anticorrosion anode.

B. Install propeller and components as outlined in Section XIVA paragraph 1-2.

9. PROPELLER SHAFT BEARING SPOOL 05-37 PROPELLER SHAFT SEAL 05-38 "O" RING SEALS - SPOOL 05-36

9-1. Removing Propeller Shaft Bearing Spool

A. Drain gear lube from gear housing by removing lower drain plug and both fill and vent screw.

B. Remove anticorrosion anode as outlined in Section XIVA paragraph 8-1.

C. Remove water pump body as outlined in appropriate section.

D. Remove four (4) screws securing propeller shaft bearing spool to bearing cage. Install puller (Special Tool T8948-1) as shown in figure 12. Thread puller all the way on prop shaft.

NOTE

Prop shaft spool screws have "O" ring seals and should be replaced whenever screws are removed.

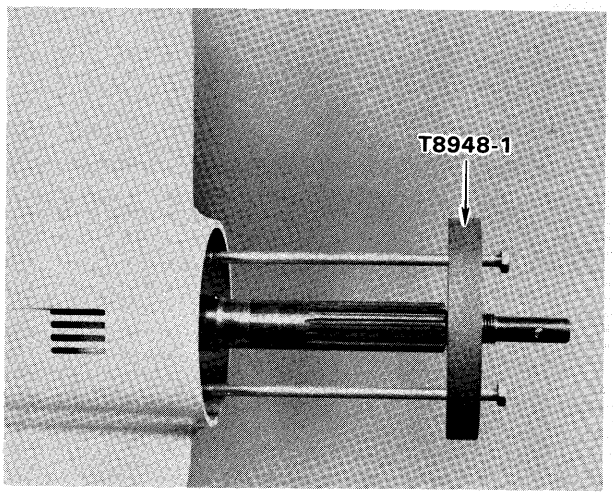


Figure 12—Installing Puller

E. Shift unit into either forward or reverse gear and turn driveshaft so that the puller unthreads itself from the prop shaft. As this happens, it pulls the spool out of the gear housing. See figure 13.

F. Remove "O" Ring seals from propeller shaft spool. Inspect seals for cracks or cuts.

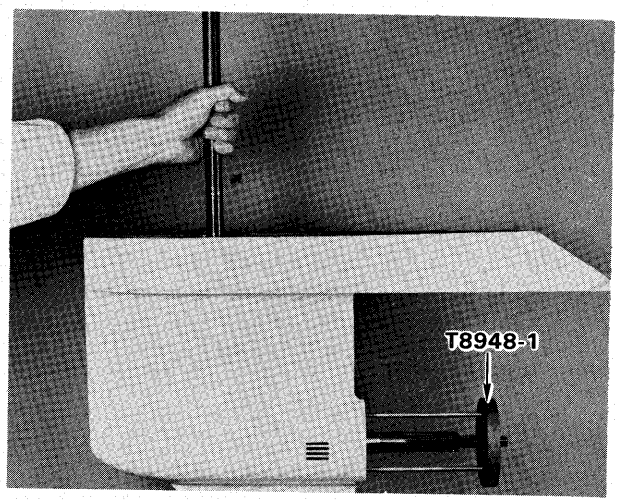


Figure 13—Removing Propeller Shaft Spool

NOTE

The "O" ring seals have different diameters. The smaller diameter seal goes on the forward end of spool and the larger one on the rear of spool.

G. Remove propeller shaft seal from spool using spring pin punch (Special Tool T8919) as shown in figure 14.

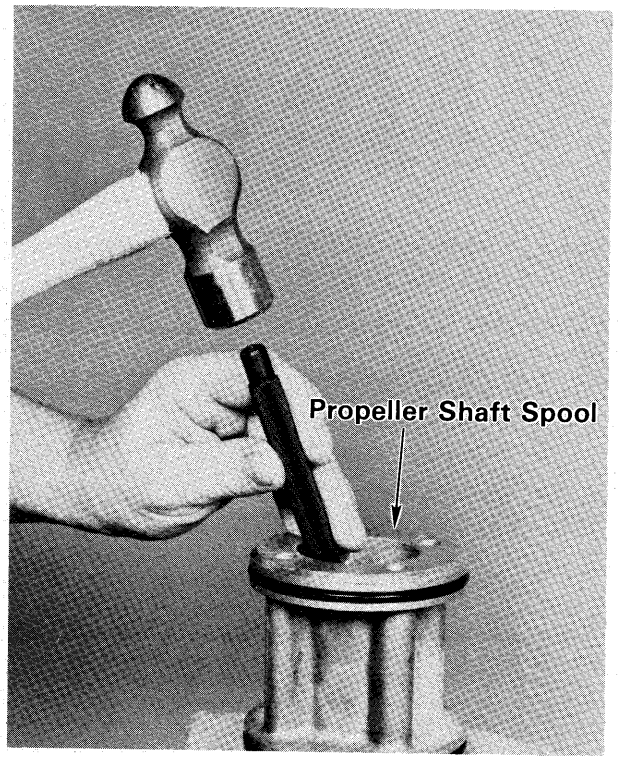


Figure 14—Removing Propeller Shaft Seal

9-2. Installing Propeller Shaft Bearing Spool

A. Press propeller shaft seal in spool with larger metal lip on outside diameter of seal toward water side using special tool T8985 as shown in figure 15.

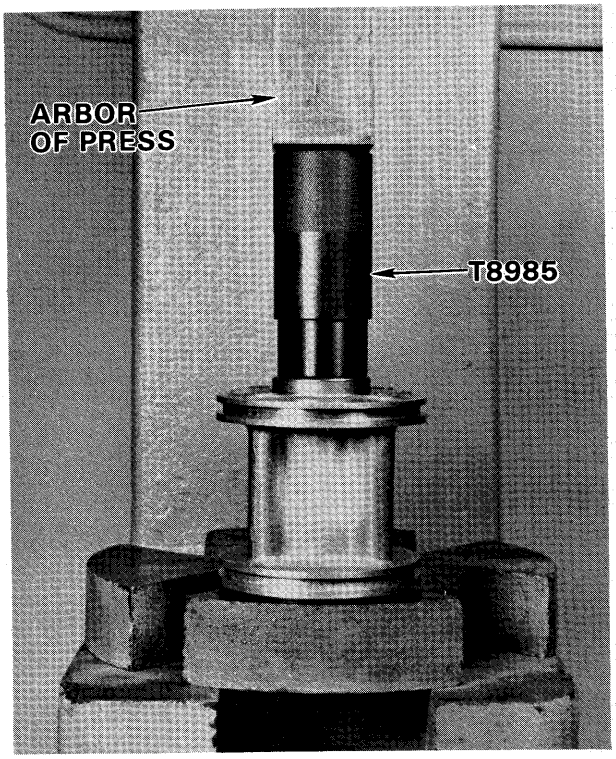


Figure 15—Installing Propeller Shaft Seal

B. Place "O" ring seals in grooves on propeller shaft spool.

C. Slide spool with "O" rings in gear housing aligning holes in spool with holes in bearing cage. Install four (4) screws securing spool to bearing cage. Torque screws to 150 in. lbs.

NOTE

Chamfered end of spool goes towards front of gear housing.

D. Install anticorrosion anode as outlined in Section XIVA paragraph 8-2.

E. Install water pump body as outlined in Section XIVA paragraph 4-2.

F. Fill gear housing with Chrysler Outboard Gear Lube.

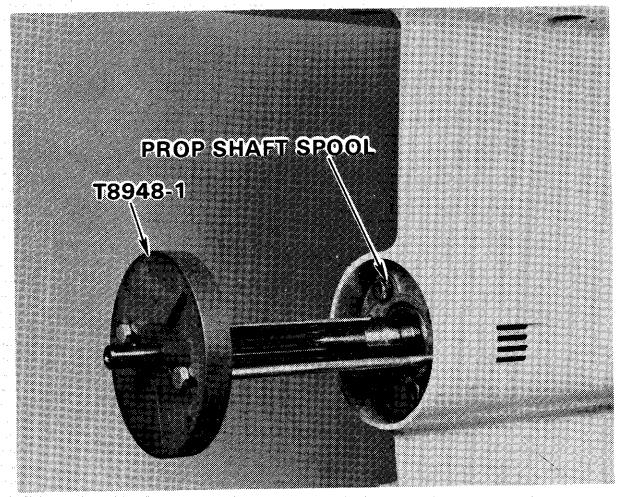
10. BEVEL GEAR REAR WITH BEARING CAGE 05-34 RETAINING RINGS 05-35

10-1. Removing Bevel Gear Rear And Bearing Cage

A. Remove propeller shaft bearing spool as outlined in Section XIVA paragraph 9-1.

B. Remove two (2) retaining rings from gear housing by placing the blade of a screwdriver on end of retaining ring which has beveled cut-out, tap handle of screwdriver with your hand, retaining rings will release from grooves in gear housing.

C. Install prop shaft bearing spool in gear housing (with "O" ring seals removed) and secure spool to bearing cage with two (2) screws. Install puller (Special Tool T8948-1) as shown in figure 16, with unit in either forward or reverse gear, turn driveshaft so that the puller unthreads itself from the prop shaft. As this happens it pulls the spool and bearing cage assembly from gear housing.



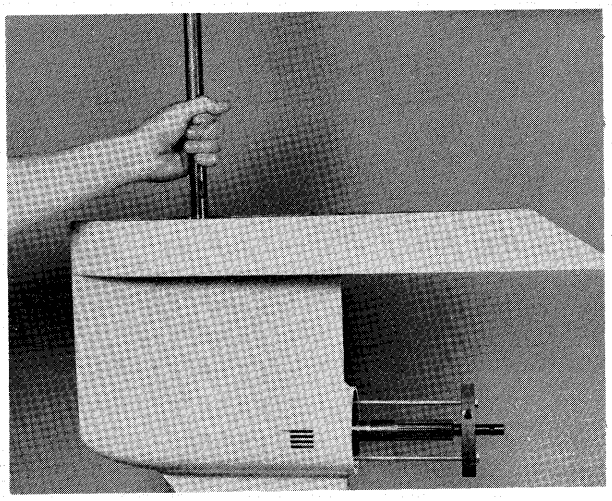


Figure 16—Removing Bearing Cage

D. Remove bevel gear rear from prop shaft. Inspect all parts for physical damage or fatigue.

10-2. Installing Bevel Gear Rear and Bearing Cage

A. Place bevel gear rear and bearing cage on propeller shaft slide assembly in gear housing. See figure 17 for correct order of assembly.

NOTE

If a new Bevel Gear Assembly is being installed, propeller shaft end float must be checked. Follow the procedures outlined in Section XIVA paragraph 18-1 for checking end float.

B. Install retaining rings in grooves in gear housing to secure bevel gear rear and bearing cage.

C. Install propeller shaft bearing spool as outlined in Section XIVA paragraph 9-2.

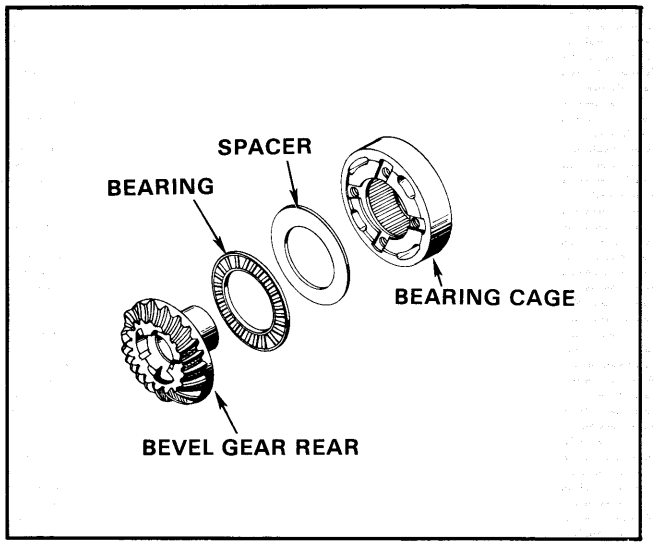


Figure 17—Bevel Gear Rear Assembly

11. PROPELLER SHAFT 05-33
CLUTCH 05-31
SHIFT PIN w/YOKE 05-32

11-1. Removing Propeller Shaft

A. Remove anti corrosion anode as outlined in Section XIVA paragraph 8-1.

B. Remove propeller shaft bearing spool as outlined in Section XIVA paragraph 9-1.

C. Remove bevel gear rear and bearing cage as outlined in Section XIVA paragraph 10-1.

D. Pull prop shaft assembly from gear housing.

E. Remove bevel gear spacer from prop shaft.

F. Remove yoke from end of shift pin, drive out spring pin securing clutch to shift pin and remove clutch and shift pin from prop shaft. See figure 18.

11-2. Installing Propeller Shaft

A. Place clutch on prop shaft with counterbore in clutch positioned toward forward gear end of shaft. Install shift pin in prop shaft, align hole in clutch with hole in shift pin. Install spring pin in clutch so that one end is flush with outside diameter of clutch. Clutch must move freely on spline after assembly of spring pin.

B. Place bevel gear spacer on prop shaft.

C. Place yoke on end of shift pin. Install prop shaft in gear housing aligning ears on shift yoke with forks on shift arm.

NOTE

If a new propeller shaft is being installed prop shaft end float must be checked. Follow the procedures outlined in Section XIVA paragraph 18-1 for checking end float.

D. Install bevel gear - rear and bearing cage as outlined in Section XIVA paragraph 10-2.

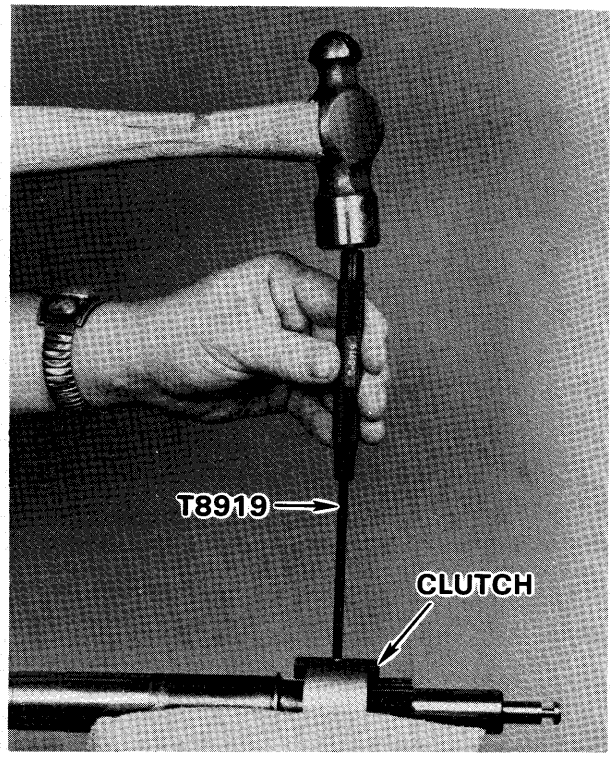


Figure 18—Removing Clutch

E. Install propeller shaft bearing spool as outlined in Section XIVA paragraph 9-2.

F. Install anti corrosion anode as outlined in Section XIVA paragraph 8-2.

12. DRIVESHAFT 05-22
PINION GEAR 05-28

12-1. Removing Driveshaft

A. Remove propeller shaft as outlined in Section XIVA paragraph 11-1. Clamp gear housing in a vise or holding fixture.

B. Remove pinion nut using a 3/4" socket and torque wrench (Special Tool T2998). Place socket over pinion nut, and spline adapter (Special Tool T7848) over end of driveshaft spline, rotate driveshaft to remove pinion nut. See figure 19.

C. Remove gear housing from vise or holding fixture. Hold gear housing and clamp driveshaft into a vise with protective jaws. Pull gear housing towards yourself to remove excess driveshaft play and using a **PLASTIC** or **RUBBER** mallet strike the area surrounding the driveshaft counterbore. This shock should separate the spline engagement of the pinion gear and driveshaft.

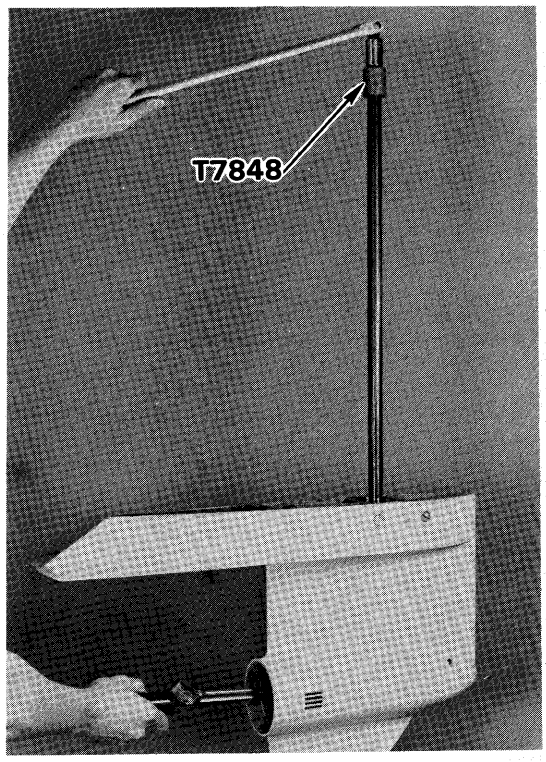


Figure 19—Removing Bevel Pinion Nut

D. Remove driveshaft with bearing - upper from gear housing. Remove shims from bore in gear housing. See figure 20.

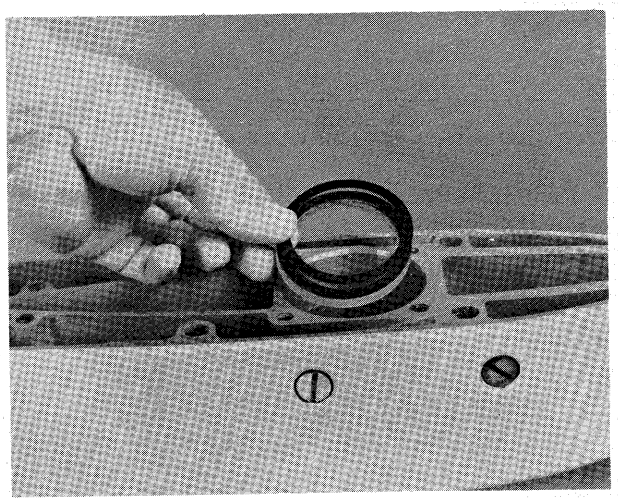


Figure 20—Removing Shims

12-2. Installing Driveshaft

A. Place shims in bore in gear housing. Install driveshaft with bearing in gear housing.

B. Place bevel pinion gear on end of driveshaft spline. Be sure gear is completely engaged with spline. Place a NEW pinion nut on driveshaft thread on until finger tight.

C. Place foot pound torque wrench with socket over pinion nut. Secure end of driveshaft with spline adapter and torque the pinion nut to 85 ft. lbs.

NOTE

If the driveshaft or pinion gear is being replaced the unit must be shimmed. Follow shimming procedures as outlined in Section XIVA paragraph 17-1.

D. Install propeller shaft as outlined in Section XIVA paragraph 11-2.

13. BEVEL GEAR FRONT 05-30

13-1. Removing Bevel Gear Front

A. Remove driveshaft as outlined in Section XIVA paragraph 12-1.

B. Remove bevel gear - front with bearing from gear housing. Inspect assembly for wear or damage.

13-2. Installing Bevel Gear Front

A. Place bevel gear - front with bearing in gear housing.

NOTE

If a new bevel gear assembly is being installed, prop shaft end float must be checked. Follow the procedures for checking end float as outlined in Section XIVA paragraph 18-1.

B. Install driveshaft as outlined in Section XIVA paragraph 12-2.

14. SHIFT ARM

14-1. Removing Shift Arm

A. Remove bevel gear front as outlined in Section XIVA paragraph 13-1.

B. Remove gear shift arm pin from gear housing as shown in figure 21.

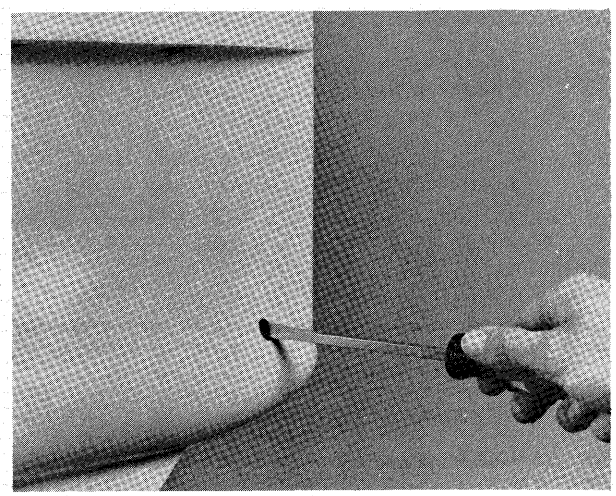


Figure 21—Removing Shift Arm Pin

C. Remove gear shift arm from gear housing.

14-2. Installing Shift Arm

A. Install shift arm in gear housing with forked ends in first.

B. Align pivot hole in shift arm with hole in gear housing, install shift arm pin with new nyltite washer and torque to 70-80 in. lbs.

C. Install bevel gear - front as outlined in Section XIVA paragraph 13-2.

15. GEAR SHIFT ROD COUPLING 05-26

15-1. Removing Gear Shift Rod Coupling

A. Remove gear housing complete as outlined in Section XIVA paragraph 1-1.

B. Remove gear shift rod coupler from shift rod upper.

15-2. Installing Gear Shift Rod Coupling

A. Place shift rod coupling on gear shift rod - upper with small hole in coupler facing port and starboard.

B. Install gear housing complete as outlined in Section XIVA paragraph 1-2.

16. GEAR HOUSING 05-27

16-1. Removing Gear Housing

A. Remove gear hosuing complete as outlined in Section XIVA paragraph 1-1.

B. Remove water pump as outlined in Section XIVA paragraph 4-1.

C. Remove gear housing cover as outlined in Section XIVA paragraph 5-1.

D. Remove gear shift rod lower as outlined in Section XIVA paragraph 7-1.

E. Remove propeller shaft bearing spool as outlined in Section XIVA paragraph 9-1.

F. Remove propeller shaft as outlined in Section XIVA paragraph 11-1.

G. Remove driveshaft as outlined in Section XIVA paragraph 12-1.

H. Remove bevel gear - front as outlined in Section XIVA paragraph 13-1.

I. Remove shift arm as outlined in Section XIVA paragraph 14-1.

NOTE

If a new gear housing is being installed you must shim lower unit and check prop shaft end float. Follow the procedures outlined in Section XIVA paragraph 17-1 and paragraph 18-1.

16-2. Installing Gear Housing

A. Install shift arm as outlined in Section XIVA paragraph 14-2.

B. Install bevel gear - front as outlined in Section XIVA paragraph 13-2.

C. Install driveshaft as outlined in Section XIVA paragraph 12-2.

D. Install propeller shaft as outlined in Section XIVA paragraph 11-2.

E. Install propeller shaft as outlined in Section XIVA paragraph 9-2.

F. Install gear shift rod lower as outlined in Section XIVA paragraph 7-2.

G. Install gear housing cover as outlined in Section XIVA paragraph 5-2.

H. Install water pump as outlined in Section XIVA paragraph 4-2.

I. Install gear housing complete as outlined in Section XIVA paragraph 1-2.

17. SHIMMING PROCEDURES

General Information

Shimming must be done whenever you replace the driveshaft, bevel pinion gear or gear housing. Follow the procedures listed below for proper order of shimming.

17-1. Order Of Shimming

A. Remove driveshaft and shims as outlined in Section XIVA paragraph 12-1.

B. Place .050 master shim (part of T8997 shimming tool set) in counterbore in gear housing where original shims were removed from. See figure 22.

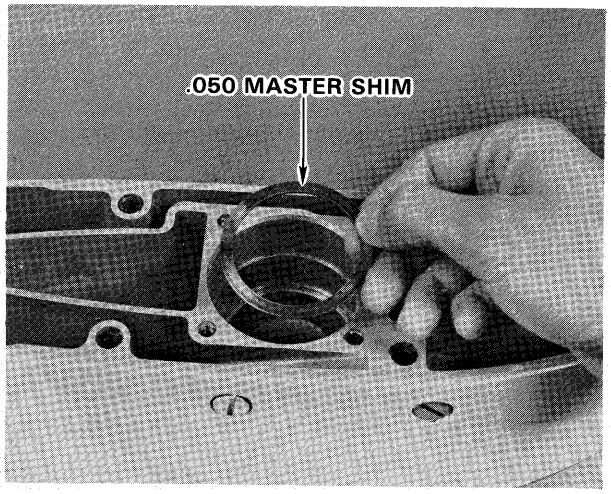


Figure 22—Installing Master Shim

C. Install driveshaft assembly in gear housing. Place bevel pinion gear on end of driveshaft spline. Be sure that gear is completely engaged with driveshaft splines.

D. Thread a new pinion nut on end of driveshaft. Place foot pound torque wrench with proper socket over pinion nut, and spline adapter over end of driveshaft. Torque nut to 85 ft. lbs. See figure 23.

CAUTION

Be sure socket is positioned properly over nut. If socket slips off nut during torquing it may round off edges of nut and become impossible to remove or tighten.

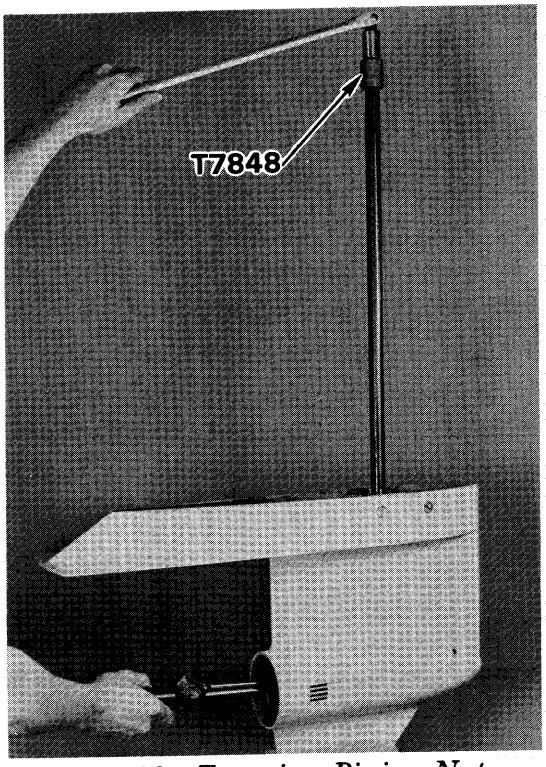


Figure 23—Torquing Pinion Nut

E. Place shimming plug (Special Tool T8997A) in forward gear. See figure 24. Rotate plug so that flat portion is facing up towards pinion gear. Install aluminum plug cradle between plug and bottom of gear housing.

F. Pull up on driveshaft to give maximum clearance between face of pinion gear and large diameter ring of shimming plug. Insert thickest blade of feeler gauge (preferably .035 or thicker) between bottom surface of pinion gear and large O.D. of shimming plug, being careful not to insert blade too far (1/4" maximum).

G. With feeler gauge blade(s) installed, push down on driveshaft using heavy force and try to remove feeler gauge. If feeler gauge is tight between pinion gear face and shimming plug, release force, remove feeler gauge and select a thinner blade. Insert blade(s) and repeat process. Keep doing this until you arrive at a blade thickness which can be pulled out freely when pressure is applied on the driveshaft. This blade thickness reading will be used in determining how many shims will be used in shimming of the pinion gear.

H. When the unit is properly shimmed, there should be .005 +/- .001 distance between the shimming plug and the face of the pinion gear. Compute thickness of shims required as shown in **EXAMPLE** below:

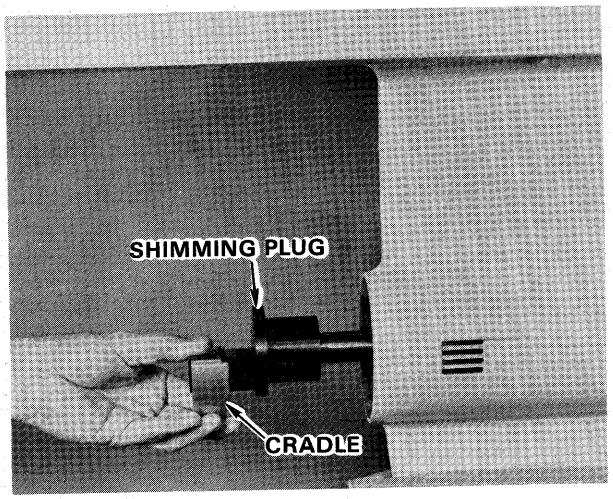
Feeler gauge blade (from step G)	.027
Final clearance required	-.005
	.022
Master Shim thickness	.050
Reading from above	-.022
Total thickness of shims required	.028

I. There are four (4) different thickness shims available. They are:

Part No.	Thickness	Color
9094	.003	Silver w/Blue
9095	.005	Silver
9096	.007	Brass
9097	.010	Black

NOTE

A combination of any of these shims can be used in order to obtain the proper thickness required.



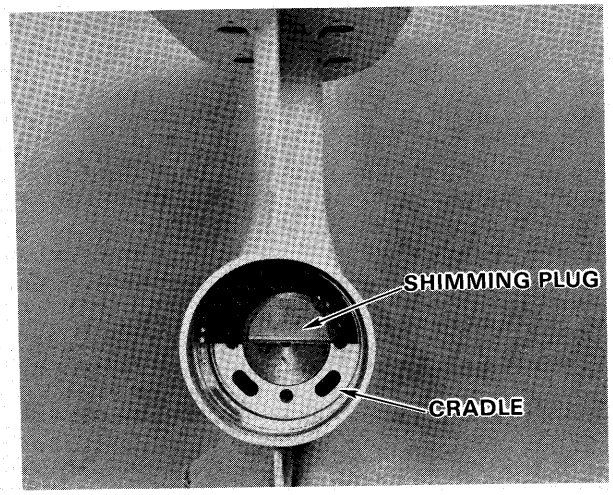


Figure 24—Position of Plug and Cradle

J. After determining correct number of shims required remove shimming plug and aluminum cradle from gear housing.

K. Remove pinion nut from driveshaft.

L. Remove driveshaft assembly from gear housing and remove .050 master shim.

M. Install required shims as determined in step H.

N. Re-install driveshaft assembly and pinion gear. Install pinion nut and torque to 85 ft. lbs.

O. Install shimming plug and aluminum cradle.

P. Recheck distance between large O.D. of shimming plug and face of pinion gear with feeler gauge while applying a downward force on driveshaft. Distance **must** range between .004 minimum to .006 maximum.

Q. After completing above procedures, remove shimming plug and cradle and reassemble gear housing as outlined in Section XIVA.

NOTE

Install a NEW crush ring in bore above driveshaft bearing whenever shimming procedures are completed.

18. PROPELLER SHAFT END FLOAT

General Information

Propeller shaft end float must be checked whenever you replace any of the following components: Gear housing, Propeller shaft, Reverse gear assembly, and Forward gear assembly. Follow the procedures listed below for checking propeller shaft end float.

18-1. Checking Propeller Shaft End Float

A. Remove propeller shaft as outlined in Section XIVA paragraph 11-1.

B. Reassemble reverse gear, radial bearing prop shaft bearing cage and spacer. See figure 25.

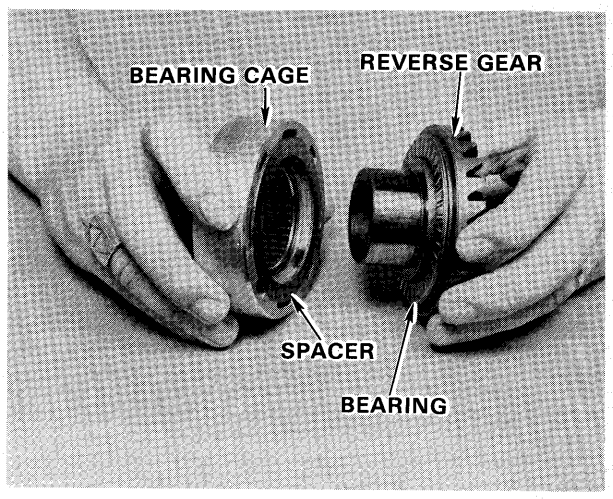


Figure 25—Reverse Gear Assembly

NOTE

Apply a small amount of grease to spacer before placing it in counterbore of bearing cage. This will keep the spacer from falling out during assembly.

C. Install reverse gear assembly on prop shaft as shown in figure 26.

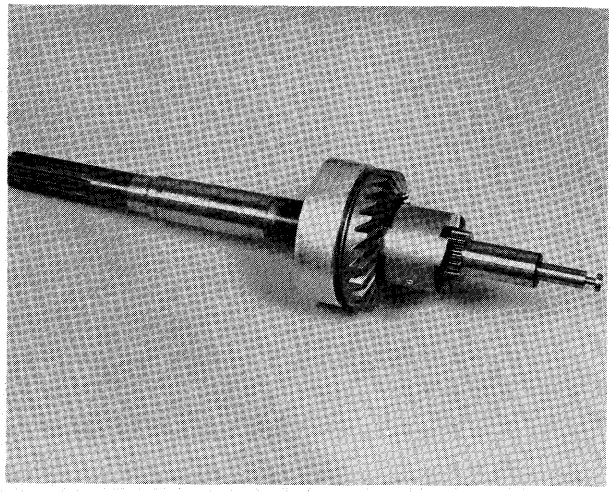


Figure 26—Installing Reverse Gear Assembly on Prop Shaft

D. Select the thinnest forward spacer available (.054) and place it in the forward gear, which is already in the gear housing. This will give a reference or starting point. Refer to the parts book for part number and size of spacers available.

E. Install prop shaft assembly in gear housing as shown in figure 27. (Shift yoke does not have to be installed at this time.) Prop shaft bearing cage should be seated in its counter bore so that the retaining ring grooves are completely exposed.

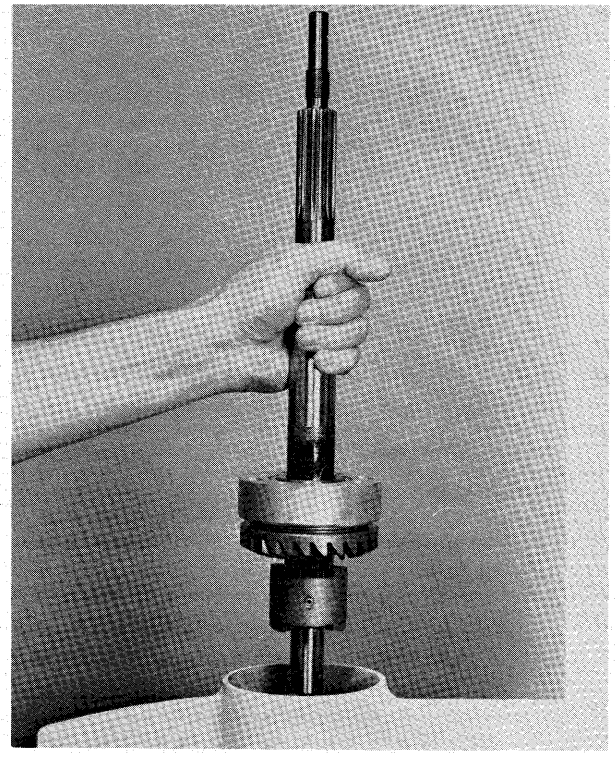


Figure 27—Installing Prop Shaft Assembly

CAUTION

Check to make sure that spacer in bearing cage has not shifted out of position. If this has happened, remove prop shaft assembly and reposition spacer in bearing cage. Failure to do this could cause serious damage to gear housing upon reassembly.

F. Install two (2) retaining rings in grooves in gear housing.

G. Remove two "O" ring seals from the prop shaft spool and install spool in gear housing as shown in figure 28.

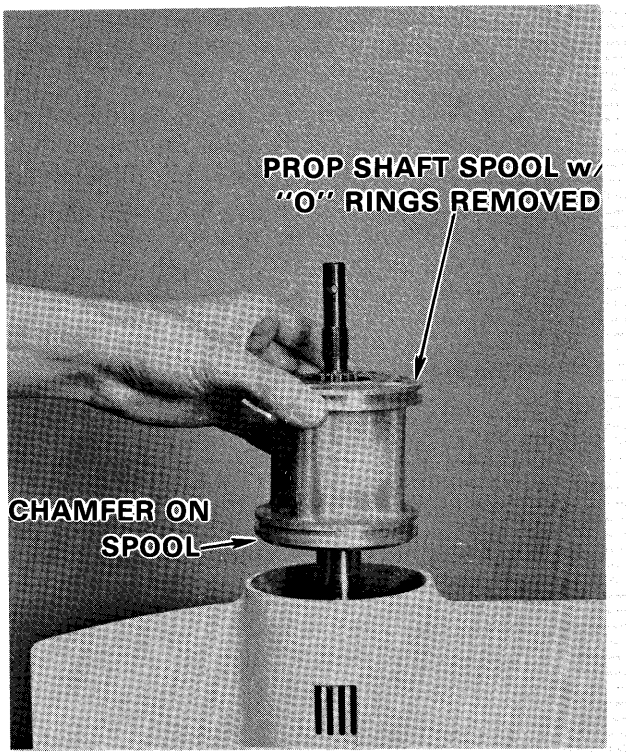


Figure 28—Installing Spool

H. Install four (4) spool bolts and torque evenly to 150 inch pounds.

I. Install dial indicator post (Special Tool T8997F) in one of the puller holes on the prop shaft spool as shown in figure 29.

J. Install dial indicator holder (Special Tool T8902) and dial indicator (Special Tool T8901) on dial indicator post. Set foot of dial indicator so that it contacts machined surface at end of prop shaft. See figure 30.

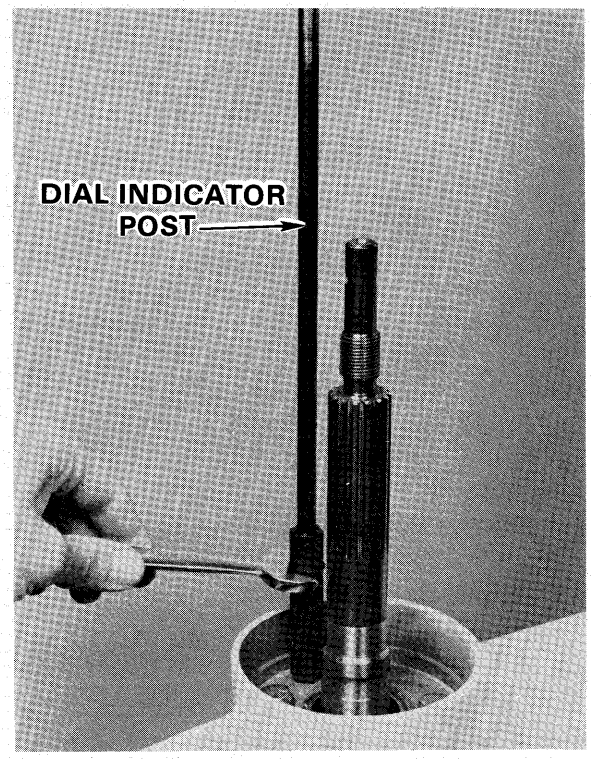


Figure 29—Installing Dial Indicator Post

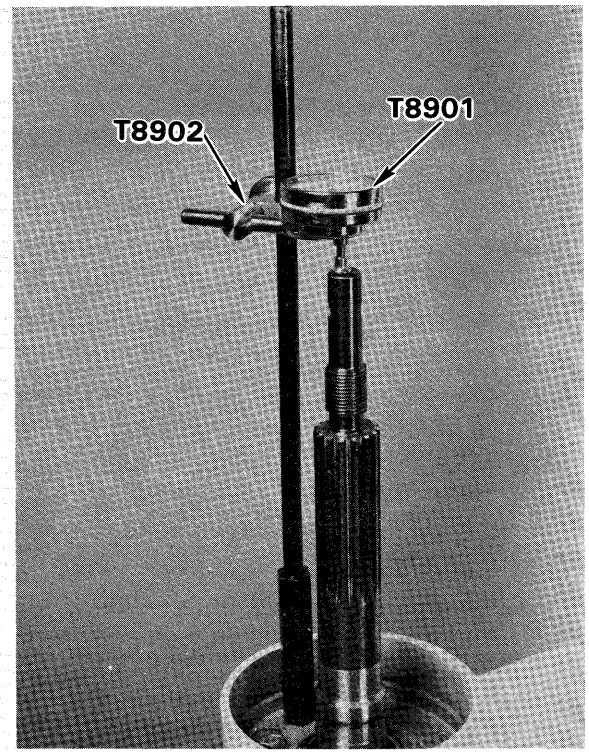


Figure 30—Position of Dial Indicator

K. Push down on prop shaft and rotate shaft back and forth to remove all forward bearing clearance, as shown in figure 31.

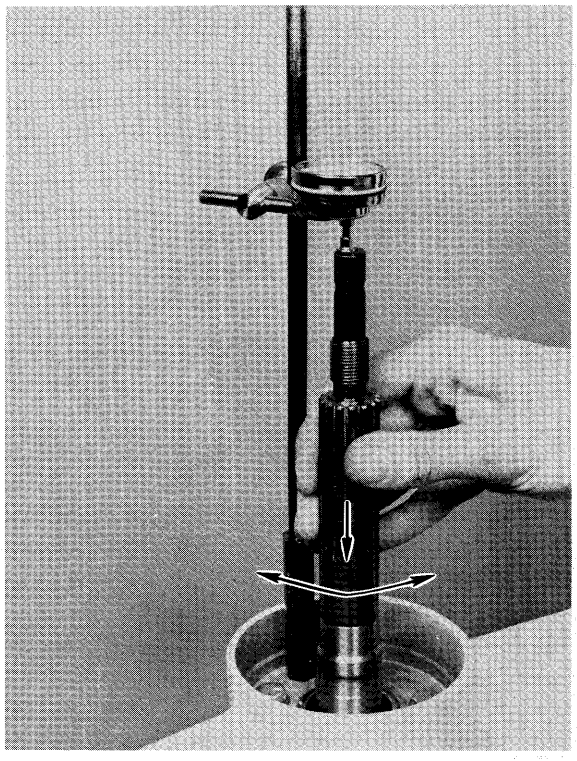


Figure 31—Seating Forward Bearing

L. Set dial indicator to zero.

M. Pull up on prop shaft with as much force as possible, note and record dial indicator reading. Repeat this procedure several times. Dial indicator reading should be consistent.

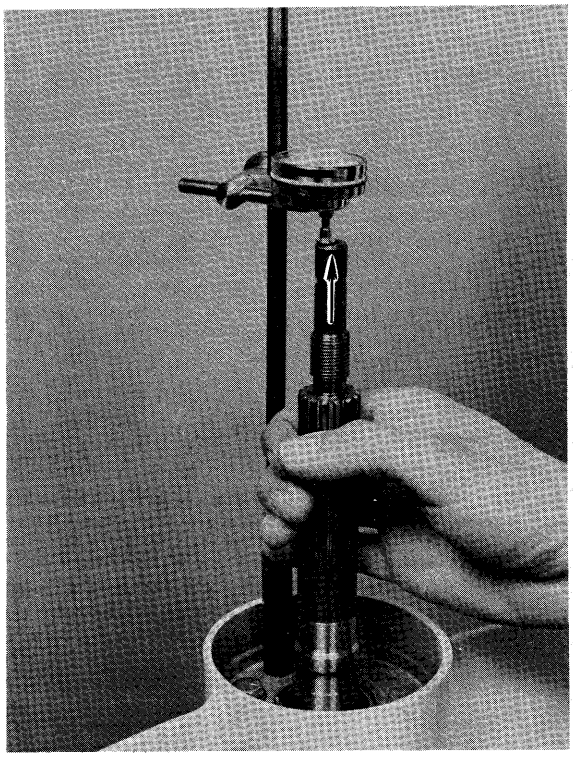


Figure 32—Checking End Float

N. To determine the correct spacer thickness required to give you .010 ± .001 end float the following formula is used.

EXAMPLE:

Dial indicator reading from step M	.027
Final end float required	-.010
	.017
Thickness of spacer installed in step D	.054
Additional spacing required	+.017
Thickness of spacer required to achieve .010 end float	.071

O. After determining thickness of spacer required remove dial indicator, holder and post from prop shaft spool.

P. Remove four (4) prop shaft spool bolts and remove spool from gear housing.

Q. Remove two retaining rings from gear housing and lift prop shaft assembly from same.

R. Remove forward spacer installed in step D and install correct spacer as determined in step N.

S. Install prop shaft assembly as outlined in step E.

NOTE

Gear shift yoke must be installed at this time. Be sure yoke is engaged with forks on shift arm before continuing assembly.

T. Install retaining rings in grooves in gear housing.

U. Install "O" rings on prop shaft spool. Apply a light coat of grease on "O" rings and install spool in gear housing until "O" rings contact their counterbore. Install four (4) spool bolts and hand thread them into bearing cage several turns until tight; then tighten bolts remainder of the way and torque to 150 inch pounds.

V. Repeat steps I through M. Dial indicator reading should be .010 ± .001.

W. Remove dial indicator, holder and post. Follow remainder of assembly procedures as outlined in Section XIVA.

19. PRESSURE TESTING GEAR HOUSING

A. Remove vent screw from starboard side of gear housing.

B. Thread adapter of pressure tester (Special Tool T8950) in vent hole of gear housing. Tighten adapter securely.

C. Pressurize housing to 10 p.s.i. Observe gauge for one minute. There must be no pressure drop. If pressure drop is noted immerse housing in water, re-pressurize to 10 p.s.i. and observe for air bubbles. Replace any seals seen to be leaking, then repeat pressure test.

CAUTION

Do not pressurize beyond 10 p.s.i. as this may damage seals.

D. Remove tester from gear housing and install vent plug.

SECTION XV — MOTOR LEG — THREE CYLINDER ENGINES

1. LEG COVER — REAR 08-13

1-1. Removing Leg Cover — Rear

A. Remove six (6) screws securing leg cover — rear to leg cover — forward (quantity three (3) on each side).

B. Remove six screws securing leg cover — rear to support plate.

C. Pull leg cover — rear from engine.

1-2. Installing Leg Cover — Rear

A. Install leg cover — rear aligning two (2) holes at bottom of cover — rear with two (2) spring pins protruding from leg cover — forward.

B. Apply Anti-Seize (Special Tool T2987-1) to threads of motor leg cover — front to — rear screws. Install screws (quantity three (3) per side) to secure motor leg cover — front to — rear.

C. Install six (6) screws to secure leg cover — rear to support plate.

2. WATER LINE — UPPER 08-26

2-1. Removing Water Line — Upper

A. Remove powerhead as outlined in Section XVII, paragraph 10-1.

B. Remove two (2) screws securing water line bracket to motor leg.

C. Lift water line with bracket out of motor leg.

D. Slide water line bracket off water line.

E. Slide seal off water line.

2-2. Installing Water Line — Upper

A. Install water line seal in water line bracket with large diameter of seal in counterbore in bracket.

B. Apply water to inner diameter of seal and slide water line seal with bracket up water line.

C. Install water line assembly in motor leg routing water line through grommet in motor leg and in seal of water pump body.

D. Apply Anti-Seize (Special Tool T2987-1) to threads of two (2) water line bracket screws and secure water line bracket to motor leg.

E. Install powerhead as outlined in Section XVII paragraph 10-2.

3. MOTOR LEG 08-28
SHOCK MOUNT — UPPER 08-14
SHOCK MOUNT — LOWER 08-15
SHOCK MOUNT — SIDE 08-16
SHIFT ROD — UPPER 08-24

3-1. Removing Motor Leg Assembly

A. Follow disassembly procedures as outlined in Section XV, paragraph 2-1.

B. Remove lower unit as outlined in Section XIV, paragraph 1-1.

C. Remove kingpin cap by removing four (4) screws securing cap to motor leg cover — front and shock mount — lower.

D. Remove two (2) screws (one (1) on each side) securing shock mount — upper to motor leg cover — front.

E. Remove motor leg with shift rod — upper, shock mount — lower, shock mount — side and shock mount upper from leg cover — front.

F. Remove shock mount — side from motor leg.

G. Remove shock mount — upper by removing screw, spring lockwasher and large plain washer securing same to motor leg.

H. Remove shock mount — lower by removing four (4) screws securing same to motor leg.

I. Remove motor leg seal and remove shift rod — upper.

J. Remove clamp securing idle exhaust boot to motor leg using hose clamp pliers (Special Tool T8900) and remove idle exhaust boot.

3-2. Installing Motor Leg Assembly

A. Install idle exhaust boot on motor leg and secure with clamp using hose clamp pliers (Special Tool T8900).

B. Apply Loctite H (Special Tool T2962) to outer diameter of shift rod seal. Install seal with bead up in bore of motor leg using seal installer (Special Tool T8957).

C. Spray motor leg seal surface on motor leg and motor leg seal with spray adhesive (Special Tool T2968).

D. Install shift rod — upper on motor leg and then install motor leg seal around motor leg.

E. Install shock mount — side (one (1) per side) on motor leg.

F. Apply Anti-Seize (Special Tool T2987-1) to threads of four (4) shock mount — lower screws. Install shock mount — lower on motor leg and secure with four (4) screws.

G. Install shock mount — upper on motor leg with lettering on shock mount upside down. Secure each shock mount — upper to motor leg with screws, spring lockwasher and large plain washer.

H. Install motor leg assembly on motor leg cover — front aligning motor leg seal and shock mount — upper in leg cover — front.

I. Apply Anti-Seize (Special Tool T2987-1) to threads of motor leg cover — front to shock mount — upper screws. Install screws to secure shock mount — upper to leg cover — front.

J. Install kingpin cap on kingpin and motor leg cover — front aligning top contour of cap with leg cover — front. Apply Anti-Seize (Special Tool T2987-1) to threads of four (4) kingpin cap screws and secure cap to leg cover — front and shock mount — lower with four (4) screws.

K. Install lower unit as outlined in Section XIV, paragraph 1-2.

L. Complete assembly as outlined in Section XV, paragraph 2-2.

4. SUPPORT PLATE 08-11

4-1. Removing Support Plate

A. Remove powerhead as outlined in Section XVII, paragraph 10-1.

B. Remove engine cover latch bracket with roller by removing two (2) screws securing same to support plate.

C. Remove deflection stop by removing four (4) screws and lockwashers securing same to support plate.

D. Remove battery cable grommet by removing screw securing same to support plate.

E. Remove remote control cable bushing and cap by removing three (3) screws securing them to support plate.

F. Remove starter relay from support plate by removing screw securing same.

NOTE

Other screw securing starter relay to support plate should have been removed when powerhead was removed.

G. Remove five (5) screws securing support plate to motor leg cover — front and remove support plate.

H. Remove identification plate from support plate by driving two (2) drive screws out.

I. On support plates with engine cover latch assembly, remove latch assembly as follows:

1. Remove one (1) screw, lockwasher and plain washer securing latch cam to latch shaft.
2. Remove latch cam, bushing and bowed washer from latch shaft.
3. Remove handle and shaft assembly from rear of support plate.
4. Remove two (2) nylon bearings from support plate.

4-2. Installing Support Plate

A. Install identification plate on support plate and secure with two (2) drive screws.

B. Install support plate on motor leg cover — front and secure with five (5) screws.

C. Install starter relay on support plate and secure with screw.

D. Install remote control cable bushing and cap on support plate and secure with three (3) screws.

E. Install battery cable grommet and secure with one (1) screw.

F. Install engine cover latch bracket with roller and secure with two (2) screws.

G. Install powerhead as outlined in Section XVII, paragraph 10-2.

H. Install deflection stop on support plate approximately 1/4 inch from cylinder head and secure with four (4) screws and spring lockwashers.

I. On support plates with engine cover latch assembly, install latch assembly as follows:

1. Install two (2) nylon bearings in support plate.
2. Install handle and shaft assembly in rear of support plate.
3. Install bowed washer, bushing and latch cam on latch shaft as shown in figure A-1.

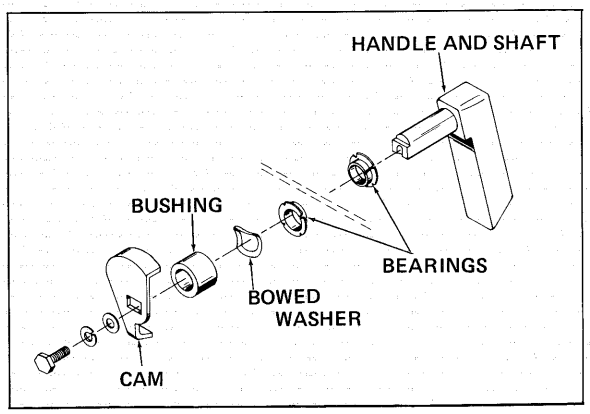


Figure A-1—Engine Cover Latch Assembly

4. Install plain washer, lockwasher and screw securing latch cam to latch shaft.

5. MOTOR LEG COVER — FRONT 08-12

5-1. Removing Motor Leg Cover — Front

A. Remove motor leg assembly as outlined in Section XV, paragraph 3-1.

B. Remove support plate as outlined in Section XV, paragraph 4-1.

C. Loosen steering friction set screw in swivel bracket.

D. Lightly tap top of kingpin down far enough to free motor leg cover — front and remove cover — front.

E. Pull kingpin from swivel bracket.

F. Remove four (4) securing air intake baffle from leg cover — front. Remove air intake baffle.

5-2. Installing Motor Leg Cover — Front

A. Install air intake baffle on motor leg cover — front and secure with four (4) screws.

B. Install kingpin in swivel bracket bore from bottom of bore until kingpin is flush with top of bore.

C. Install fiber washer on top of kingpin bore in swivel bracket.

D. Install leg cover — front on swivel bracket aligning kingpin bore in leg cover — front with kingpin bore in swivel bracket. Push kingpin up in bore of leg cover — front until kingpin is flush with top of bore in leg cover — front.

E. Tighten steering friction screw in swivel bracket to secure kingpin position.

F. Install support plate as outlined in Section XV, paragraph 4-2.

G. Complete assembly as outlined in Section XV, paragraph 3-2.

6. Reverse Lock 08-22
Reverse Lock Spring 08-23

6-1. Removing Reverse Lock and Spring

A. Remove hex stop nut securing reverse lock to reverse lock link as shown in figure 1.

B. Drive out spring pin securing reverse lock pin to swivel bracket as shown in figure 2.

C. Drive reverse lock pin out of swivel bracket far enough to remove reverse lock and spring. Remove reverse lock and spring.

6-2. Installing Reverse Lock and Spring

A. Install reverse lock spring on reverse lock with loop of spring over top of port side leg of reverse lock and ends of spring pointing up or towards top of swivel bracket.

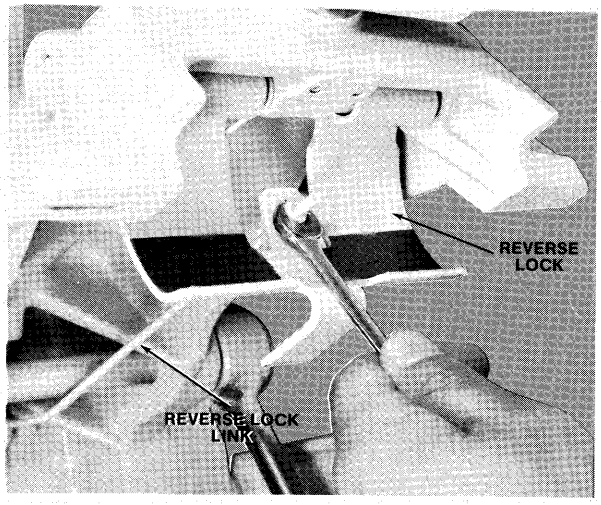


Figure 1–Removing Hex Stop Nut

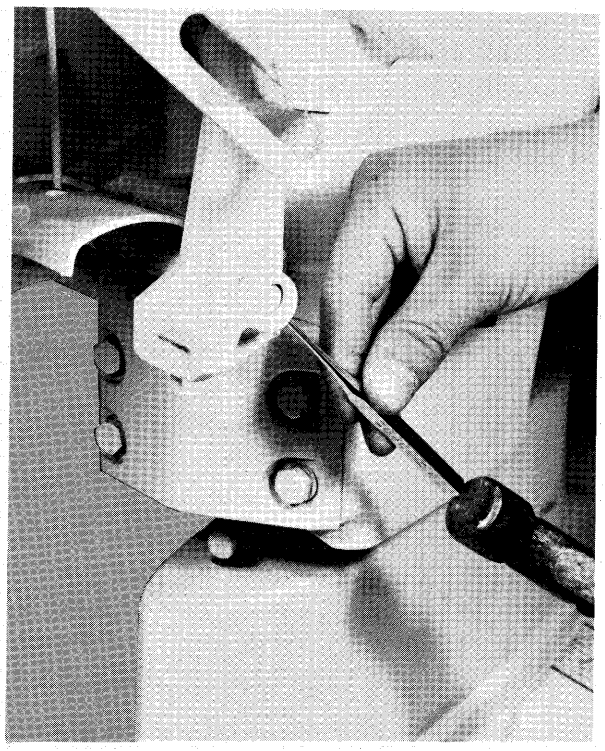


Figure 2–Driving Out Spring Pin

B. Align holes of spring and reverse lock with reverse lock pin. Drive pin through holes of spring and reverse lock aligning spring pin hole of reverse lock pin with hole in swivel bracket. Secure reverse lock pin to swivel bracket by driving in spring pin. See figure 2.

C. Align hole in reverse lock tab with reverse lock link and install link through hole in tab. Secure link to tab with hex stop nut. See figure 1.

D. Engage reverse lock with stern bracket lock bar. Adjust reverse lock position by tighten-

ing nut until there is no clearance in reverse lock handle. Then tighten nut 1/2 turn more.

7. CLAMP SCREW 08-18 CLAMP SCREW HANDLE 08-19

7-1. Removing Clamp Screw and Handle

A. Drive out spring pin securing clamp screw handle to clamp screw and remove handle.

B. Drive out spring pin securing clamp screw stud and foot to clamp screw as shown in figure 3 and remove stud and foot.

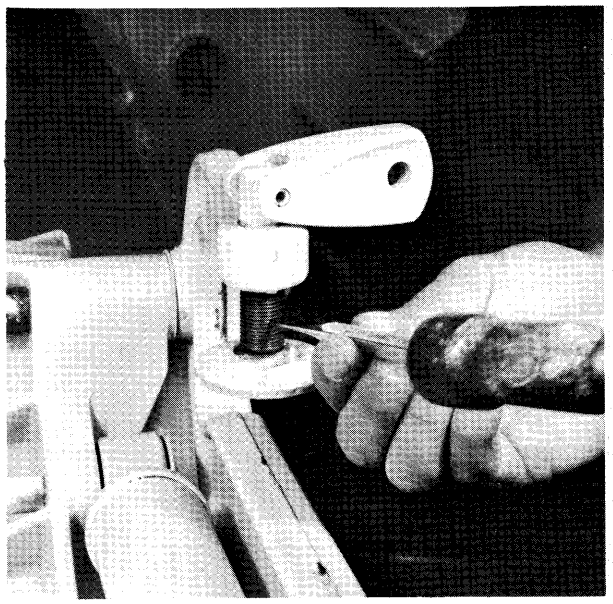


Figure 3–Driving Out Spring Pin

C. Thread clamp screw from stern bracket

7-2. Installing Clamp Screw and Handle

A. Install clamp screw handle on clamp screw and secure with spring pin.

B. Thread clamp screw on stern bracket.

C. Install clamp screw foot on stud. Insert stud in bore of clamp screw aligning hole in stud with hole in clamp screw.

D. Drive spring pin in through clamp screw and stud.

7A. CLAMP SCREW 08-18

7A-1. Removing Clamp Screw

A. Drive out spring pin securing clamp screw stud and foot to clamp screw.

B. Thread clamp screw from stern bracket.

7A-2. Installing Clamp Screw

A. Thread clamp screw in stern bracket.

B. Place clamp screw foot on stud. Insert stud in bore of clamp screw aligning hole in stud with hole in clamp screw. See figure 3A.

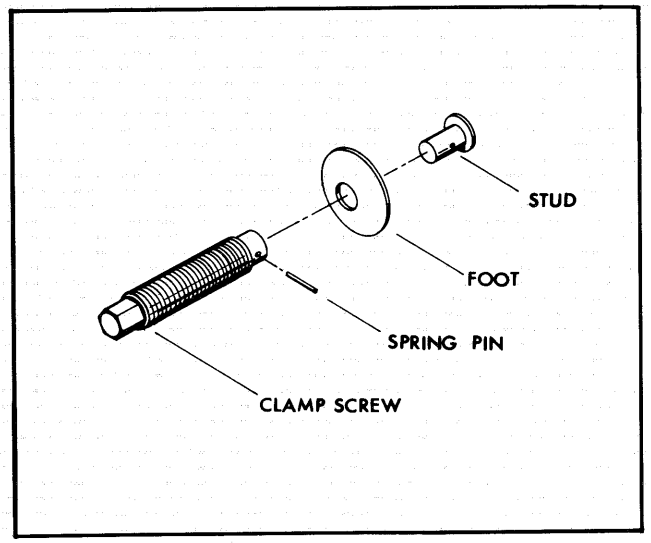


Figure 3A —Clamp Screw Assembly

C. Drive spring pin in through clamp screw and stud.

8. STERN BRACKET 08-17 PIVOT BOLT 08-29

8-1. Removing Stern Bracket — Port

A. Remove tilt lock pivot and wave washer securing tilt lock to stern bracket — port.

B. Remove pivot bolt nut and plain washer securing stern bracket — port to swivel bracket and remove stern bracket — port.

C. Remove stern bracket clamp screw and handle as outlined in Section XV, paragraph 7-1.

8-2. Installing Stern Bracket — Port

A. Install stern bracket clamp screw and handle as outlined in Section XV, paragraph 7-2.

B. Install stern bracket — port on swivel bracket aligning pivot bolt hole with pivot bolt.

C. Secure stern bracket — port to swivel bracket by installing plain washer and nut on pivot bolt.

D. Install wave washer under head of tilt lock pivot and secure tilt lock to stern bracket with pivot.

8-3. Removing Stern Bracket — Starboard and Pivot Bolt

A. Remove stern bracket lock bar.

B. Remove pivot bolt nut and plain washer.

C. Remove pivot bolt and stern bracket — starboard from swivel bracket being careful not to lose swivel friction washers which are between both stern brackets and swivel bracket.

D. Remove stern bracket clamp screw and handle as outlined in Section XV, aragraph 7-1.

8-4. Installing Stern Bracket — Starboard and Pivot Bolt

A. Install clamp screw and handle on stern bracket — starboard as outlined in Section XV, paragraph 7-2.

B. Install pivot bolt on stern bracket — starboard and then install one (1) friction washer.

C. Install pivot bolt through swivel bracket and install other friction washer between stern bracket — port and swivel bracket. Push pivot bolt through friction washer and stern bracket — port.

D. Secure pivot bolt with plain washer and nut.

E. Install stern bracket lock bar.

8A. STEERING TUBE 08-34

8A-1. Removing Steering Tube

A. Remove nut securing steering tube to stern bracket - starboard.

B. Slide steering tube through stern bracket - port until threaded end on tube clears stern bracket - starboard.

C. Remove remianing nut from steering tube and pull tube from stern bracket.

8A-2. Installing Steering Tube

A. Slide threaded end of steering tube through stern bracket - port. Thread one nut on end of tube as far as it will go.

B. Slide tube through stern bracket - starboard and adjust nut until port end of steering tube is flush with stern bracket - port. See figure 3B.

C. Install remaining nut on steering tube and torque to 65 ft. lbs.

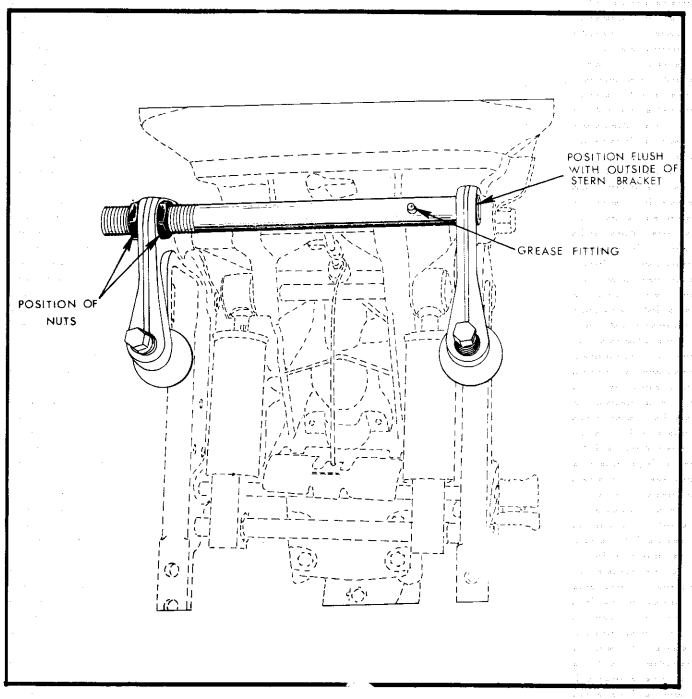


Figure 3B —Installing Steering Tube

9. SWIVEL BRACKET 08-20 SWIVEL BRACKET BEARING 08-21 KINGPIN 08-25

9-1. Removing Swivel Bracket Assembly and Kingpin

A. Suspend engine from hoist or lay engine on floor.

B. Remove stern brackets as outlined in Section XV, paragraph 8-3.

C. Remove reverse lock as outlined in Section XV, paragraph 6-1.

D. Remove reverse lock link from reverse lock arm. Drive out spring pin securing reverse lock arm to reverse lock release handle and shaft as shown in figure 4.

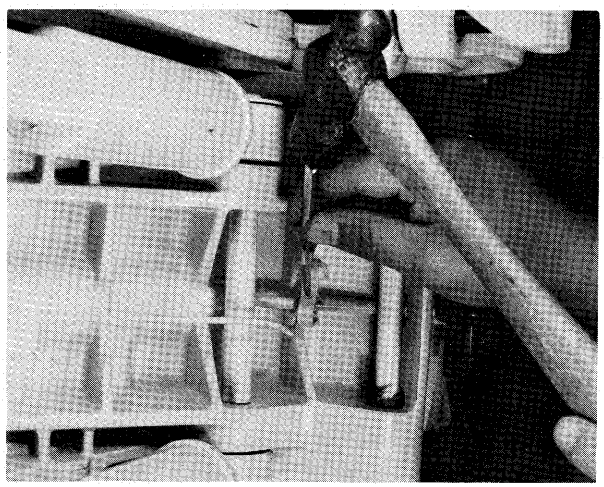


Figure 4—Driving Out Spring Pin

Remove cotter pin securing reverse lock release handle and shaft to swivel bracket and remove handle and shaft, plain washer, reverse lock arm, two (2) nyliner bearings and shaft bearing from swivel bracket.

E. Remove swivel bracket friction set screw from swivel bracket.

F. Remove kingpin cap by removing four (4) screws securing kingpin cap to motor leg cover — front.

G. Using spring pin punch (Special Tool T8919), drive kingpin down from inside of support plate until kingpin is freed from kingpin bore in motor leg cover — front.

NOTE

Do not drive on king pin assembly in area of welch plug. Use spring punch on kingpin proper as shown in figure 5.

H. Remove swivel bracket assembly and kingpin from engine. Slide kingpin out of kingpin bore in swivel bracket.

I. Remove swivel bracket bearings (quantity — 4) from kingpin bore in swivel bracket.

9-2. Installing Swivel Bracket Assembly and Kingpin

A. Install swivel bracket bearings in kingpin bore of swivel bracket. Install long bearings (one on each end) in first then install short bearings (one on each end).

B. Install swivel bracket friction set screw in swivel bracket.

C. Install nyliner bearing on each end of reverse lock release handle and shaft bore. Insert handle and shaft through bearings, then install plain washer and reverse lock arm on shaft. Install long bearing in swivel bracket to retain end of handle shaft. Align hole in reverse lock arm and hole in shaft (see figure 4 for positioning of reverse lock arm) and drive in spring pin to secure arm to shaft. Push washer against flange of inner nyliner bearing and install cotter pin to secure handle and shaft to swivel bracket.

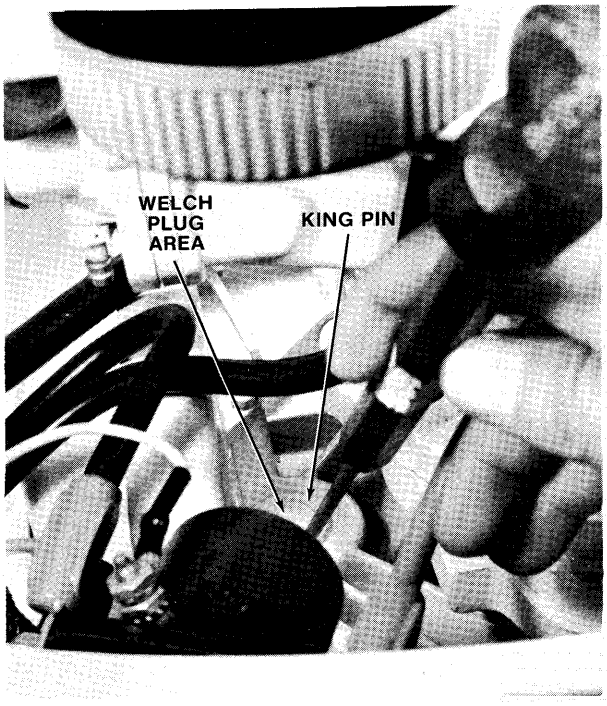


Figure 5–Driving Out Kingpin

D. Install kingpin in swivel bracket with welch plug end up. Install swivel bracket assembly with kingpin on engine and force kingpin up through bore in motor leg cover — front until top of kingpin is flush with top of kingpin bore in motor leg cover — front.

E. Install kingpin cap and secure with four (4) screws.

NOTE

Before installing kingpin cap screws, apply Anti-Seize (Special Tool T2987-1) to threads of kingpin cap screws.

F. Install reverse lock and spring as outlined in Section XV, paragraph 6-2.

G. Install stern brackets as outlined in Section XV, paragraph 8-4.

H. Tighten swivel bracket friction screw in swivel bracket.

I. Using grease gun, insert grease through the three (3) grease fittings in swivel bracket.

SECTION XVI — MOTOR LEG — FOUR CYLINDER ENGINES

1. LEG COVER — REAR 08-13

1-1. Removing Leg Cover — Rear

A. Remove six (6) screws securing leg cover — rear to leg cover — forward (quantity three (3) on each side).

B. Remove six screws securing leg cover — rear to support plate.

C. Pull leg cover — rear from engine.

1-2. Installing Leg Cover — Rear

A. Install leg cover — rear aligning two (2) holes at bottom of cover — rear with two (2) spring pins protruding from leg cover — forward.

B. Apply Anti-Seize (Special Tool T2987-1) to threads of motor leg cover — front to — rear screws. Install screws (quantity three (3) per side) to secure motor leg cover — front to — rear.

C. Install six (6) screws to secure leg cover — rear to support plate.

2. WATER LINE — UPPER 08-27

2-1. Removing Water Line — Upper

A. Remove powerhead as outlined in Section XVIII, paragraph 10-1.

B. Remove two (2) screws securing water line bracket to motor leg.

C. Lift water line with bracket out of motor leg.

D. Slide water line bracket off water line.

E. Slide seal off water line.

2-2. Installing Water Line — Upper

A. Install water line seal in water line bracket with large diameter of seal in counterbore in bracket.

B. Apply water to inner diameter of seal and slide water line seal with bracket up water line.

C. Install water line assembly in motor leg routing water line through grommet in motor leg and in seal of water pump body.

D. Apply Anti-Seize (Special Tool T2987-1) to threads of two (2) water line bracket screws and secure water line bracket to motor leg.

E. Install powerhead as outlined in Section XVIII, paragraph 10-2.

3. MOTOR LEG 08-29
SHOCK MOUNT — UPPER 08-14
SHOCK MOUNT — LOWER 08-15
SHOCK MOUNT — SIDE 08-16
SHIFT ROD — UPPER 08-25

3-1. Removing Motor Leg Assembly

A. Follow disassembly procedures as outlined in Section XVI, paragraph 2-1.

B. Remove lower unit as outlined in Section XIV, paragraph 1-1.

C. Remove kingpin cap by removing four (4) screws securing cap to motor leg cover — front and shock mount — lower.

D. Remove two (2) screws (one (1) on each side) securing shock mount — upper to motor leg cover — front.

E. Remove motor leg with shift rod — upper, shock mount — lower, shock mount — side and shock mount upper from leg cover — front.

F. Remove shock mount — side from motor leg.

G. Remove shock mount — upper by removing screw, spring lockwasher and large plain washer securing same to motor leg.

H. Remove shock mount — lower by removing four (4) screws securing same to motor leg.

I. Remove motor leg seal and remove shift rod — upper.

J. Remove clamp securing idle exhaust boot to motor leg using hose clamp pliers (Special Tool T8900) and remove idle exhaust boot.

3-2. Installing Motor Leg Assembly

A. Install idle exhaust boot on motor leg and secure with clamp using hose clamp pliers (Special Tool T8900).

B. Apply Loctite H (Special Tool T2962) to outer diameter of shift rod seal. Install seal with bead up in bore of motor leg using seal installer (Special Tool T8957).

C. Spray motor leg seal surface on motor leg and motor leg seal with spray adhesive (Special Tool T2968).

D. Install shift rod — upper on motor leg and then install motor leg seal around motor leg.

E. Install shock mount — side (one (1) per side) on motor leg.

F. Apply Anti-Seize (Special Tool T2987-1) to threads of four (4) shock mount — lower screws. Install shock mount — lower on motor leg and secure with four (4) screws.

G. Install shock mount — upper on motor leg with lettering on shock mount upside down. Secure each shock mount — upper to motor leg with screws, spring lockwasher and large plain washer.

H. Install motor leg assembly on motor leg cover — front aligning motor leg seal and shock mount — upper in leg cover — front.

I. Apply Anti-Seize (Special Tool T2987-1) to threads of motor leg cover — front to shock mount — upper screws. Install screws to secure shock mount — upper to leg cover — front.

J. Install kingpin cap on kingpin and motor leg cover — front aligning top contour of cap with leg cover — front. Apply Anti-Seize (Special Tool T2987-1) to threads of four (4) kingpin cap screws and secure cap to leg cover — front and shock mount — lower with four (4) screws.

K. Install lower unit as outlined in Section XIV, paragraph 1-2.

L. Complete assembly as outlined in Section XVI, paragraph 2-2.

4. SUPPORT PLATE 08-11

4-1. Removing Support Plate

A. Remove powerhead as outlined in Section XVIII, paragraph 10-1.

B. Remove engine cover latch bracket with roller by removing two (2) screws securing same to support plate.

C. Remove deflection stop by removing four (4) screws and lockwashers securing same to support plate.

D. Remove battery cable grommet by removing screw securing same to support plate.

E. Remove remote control cable bushing and cap by removing three (3) screws securing them to support plate.

F. Remove starter relay from support plate by removing screw securing same.

NOTE

Other screw securing starter relay to support plate should have been removed when powerhead was removed.

G. Remove five (5) screws securing support plate to motor leg cover — front and remove support plate.

H. Remove identification plate from support plate by driving two (2) drive screws out.

4-2. Installing Support Plate

A. Install identification plate on support plate and secure with two (2) drive screws.

B. Install support plate on motor leg cover — front and secure with five (5) screws.

C. Install starter relay on support plate and secure with screw.

D. Install remote control cable bushing and cap on support plate and secure with three (3) screws.

E. Install battery cable grommet and secure with one (1) screw.

F. Install engine cover latch bracket with roller and secure with two (2) screws.

G. Install powerhead as outlined in Section XVIII, paragraph 10-2.

H. Install deflection stop on support plate approximately 1/4 inch from cylinder head and secure with four (4) screws and spring lockwashers.

5. MOTOR LEG COVER — FRONT 08-12

5-1. Removing Motor Leg Cover — Front

A. Remove motor leg assembly as outlined in Section XVI, paragraph 3-1.

B. Remove support plate as outlined in Section XVI, paragraph 4-1.

C. Loosen steering friction set screw in swivel bracket.

D. Lightly tap top of kingpin down far enough to free motor leg cover — front and remove cover — front.

E. Pull kingpin from swivel bracket.

F. Remove four (4) securing air intake baffle from leg cover — front. Remove air intake baffle.

5-2. Installing Motor Leg Cover — Front

A. Install air intake baffle on motor leg cover — front and secure with four (4) screws.

B. Install kingpin in swivel bracket bore from bottom of bore until kingpin is flush with top of bore.

C. Install fiber washer on top of kingpin bore in swivel bracket.

D. Install leg cover — front on swivel bracket aligning kingpin bore in leg cover — front with kingpin bore in swivel bracket. Push kingpin up in bore of leg cover — front until kingpin is flush with top of bore in leg cover — front.

E. Tighten steering friction screw in swivel bracket to secure kingpin position.

F. Install support plate as outlined in Section XVI, paragraph 4-2.

G. Complete assembly as outlined in Section XVI, paragraph 3-2.

6. REVERSE LOCK 08-23 REVERSE LOCK SPRING 08-24

6-1. Removing Reverse Lock and Spring

A. Remove hex stop nut securing reverse lock to reverse lock link as shown in figure 1.

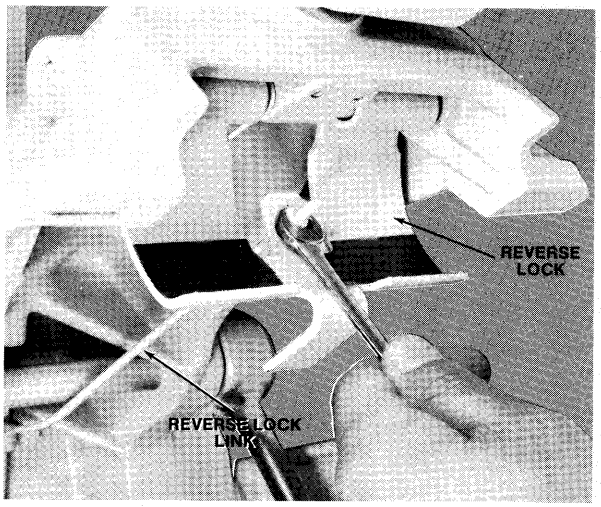


Figure 1–Removing Hex Stop Nut

B. Drive out spring pin securing reverse lock pin to swivel bracket as shown in figure 2.

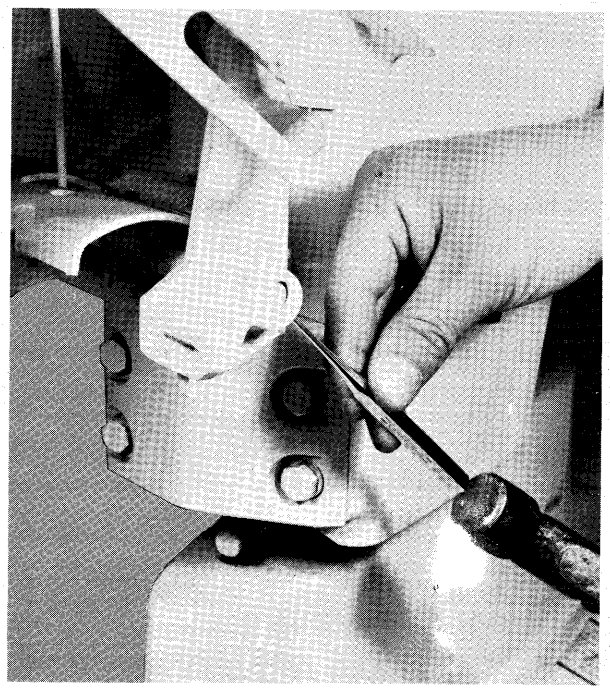


Figure 2–Driving Out Spring Pin

C. Drive reverse lock pin out of swivel bracket far enough to remove reverse lock and spring. Remove reverse lock and spring.

6-2. Installing Reverse Lock and Spring

A. Install reverse lock spring on reverse lock with loop of spring over top of port side leg of reverse lock and ends of spring pointing up or towards top of swivel bracket.

B. Align holes of spring and reverse lock with reverse lock pin. Drive pin through holes of spring and reverse lock aligning spring pin hole of reverse lock with hole in swivel bracket. Secure reverse lock pin to swivel bracket by driving in spring pin. See figure 2.

C. Align hole in reverse lock tab with reverse lock link and install link through hole in tab. Secure link to tab with hex stop nut. See figure 1.

D. Engage reverse lock with stern bracket lock bar. Adjust reverse lock position by tightening nut until there is no clearance in reverse lock handle. Then tighten nut 1/2 turn more.

7. SHOCK ABSORBER 08-17

7-1. Removing Shock Absorber

A. Remove retaining ring securing large washer and shock absorber shaft — upper to top of starboard shock absorber using retaining ring pliers (Special Tool T1081) as shown in figure 3.

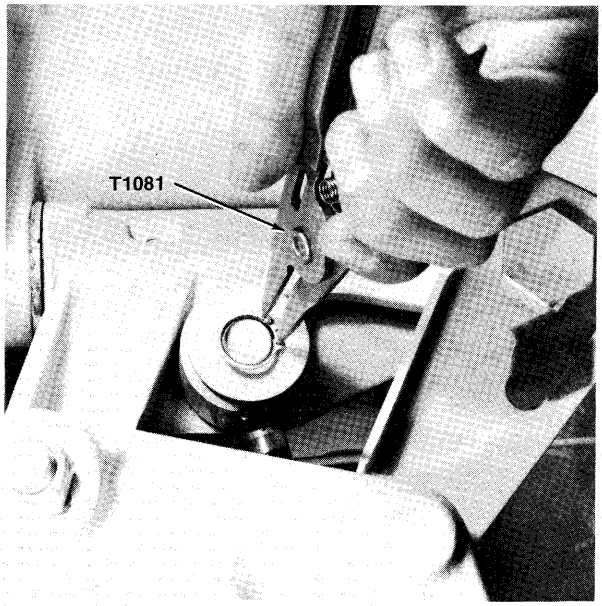


Figure 3–Removing Retaining Ring

B. Drive shock absorber shaft — upper out freeing top end of shock absorber.

C. Remove retaining ring securing shock absorber shaft — lower to starboard stern bracket using retaining ring pliers (Special Tool T1081).

D. Using retaining ring pliers (Special Tool T1081), remove retaining ring securing bottom end of port shock absorber out of groove in shock absorber shaft — lower and reposition retaining ring toward starboard shock mount as shown in figure 4.

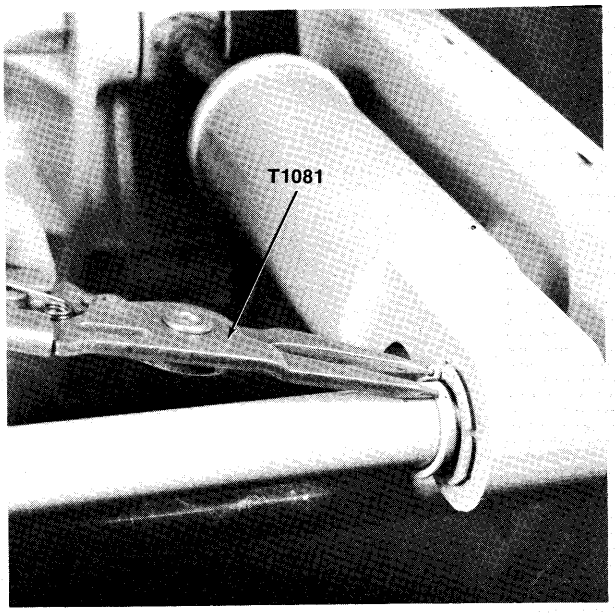


Figure 4–Repositioning Retaining Ring

E. Drive shaft out (towards port side) enough to free starboard shock absorber and remove shock absorber.

F. Remove nyliner bearing from bottom end of shock absorber.

7-2. Installing Shock Absorber

A. Install nyliner bearing in bottom end of shock absorber so that when shock absorber is installed, flange of bearing is towards the inside. See figure 4.

B. Install shock absorber aligning hole in top end with hole in swivel bracket for shock absorber shaft — upper.

C. Drive shaft through swivel bracket and top end of shock absorber.

D. Install large washer and then retaining ring to secure washer and shock absorber to shaft using retaining ring pliers (Special Tool T1081).

E. Position bottom end of shock absorber so that contoured side of shock absorber is towards stern bracket lock bar. See figure 4.

F. Align hole at bottom of shock absorber with shock absorber shaft — lower.

G. Drive shaft through hole in shock absorber and starboard stern bracket Secure shaft to stern bracket with retaining ring using retaining ring pliers (Special Tool 1081). See figure 4.

H. Replace retaining ring against nyliner of port shock absrober using retaining ring pliers (Special Tool 1081). See figure 4.

8. CLAMP SCREW 08-19 CLAMP SCREW HANDLE 08-20

8-1. Removing Clamp Screw and Handle

A. Drive out spring pin securing clamp screw handle to clamp screw and remove handle.

B. Drive out spring pin securing clamp screw stud and foot to clamp screw as shown in figure 5 and remove stud and foot.

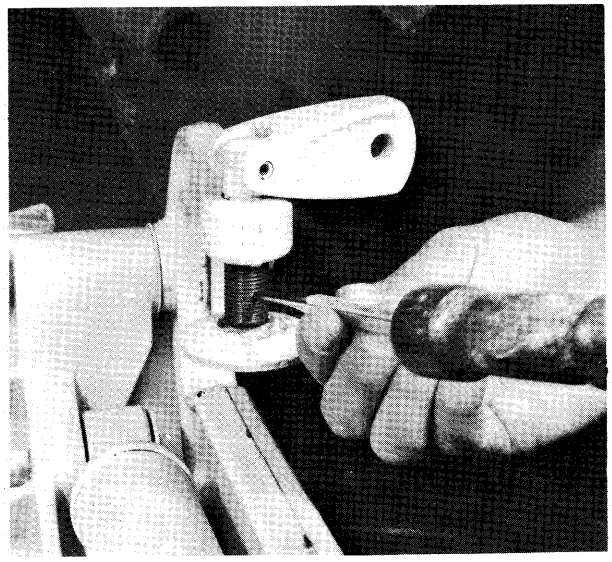


Figure 5–Driving Out Spring Pin

C. Thread clamp screw from stern bracket.

8-2. Installing Clamp Screw and Handle

A. Install clamp screw handle on clamp screw and secure with spring pin.

B. Thread clamp screw on stern bracket.

C. Install clamp screw foot on stud. Insert stud in bore of clamp screw aligning hole in stud with hole in clamp screw.

D. Drive spring pin in through clamp screw and stud.

8A. CLAMP SCREW 08-19

8A-1. Removing Clamp Screw

A. Drive out spring pin securing clamp screw stud and foot.

B. Thread clamp screw from stern bracket.

8A-2. Installing Clamp Screw

A. Thread clamp screw in stern bracket.

B. Place clamp screw foot on stud. Insert stud in bore of clamp screw aligning hole in stud with hole in clamp screw. See figure 5A.

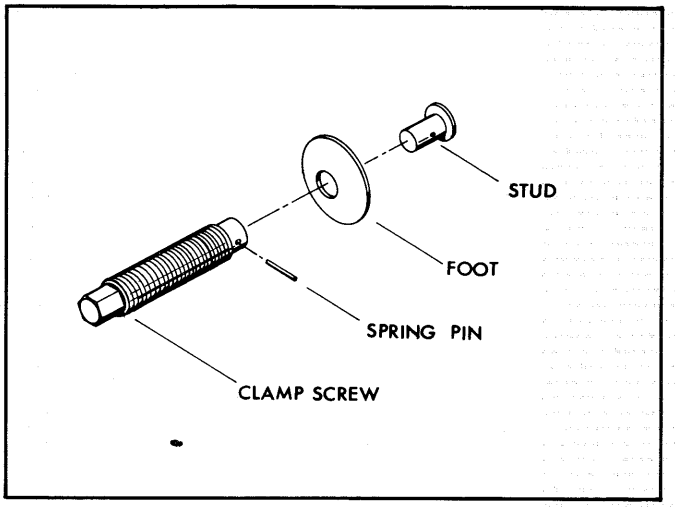


Figure 5a — Clamp Screw Assembly

C. Drive spring pin in through clamp screw and stud.

9. STERN BRACKET 08-18 PIVOT BOLT 08-30

9-1. Removing Stern Bracket — Port

A. Remove tilt lock pivot and wave washer securing tilt lock to stern bracket — port.

B. Remove retaining ring securing shock absorber shaft — lower to stern bracket — port using retaining ring pliers (Special Tool T1081).

C. Remove pivot bolt nut and plain washer securing stern bracket — port to swivel bracket and remove stern bracket — port.

D. Remove stern bracket clamp screw and handle as outlined in Section XIV, paragraph 8-1.

9-2. Installing Stern Bracket — Port

A. Install stern bracket clamp screw and handle as outlined in Section XIV, paragraph 8-2.

B. Install stern bracket — port on swivel bracket aligning pivot bolt hole with pivot bolt and shock absorber — lower hole with shaft.

C. Secure stern bracket to shock absorber shaft — lower with retaining ring using retaining ring pliers (Special Tool T1081).

D. Secure stern bracket — port to swivel bracket by installing plain washer and nut on pivot bolt.

E. Install wave washer under head of tilt lock pivot and secure tilt lock to stern bracket with pivot.

9-3. Removing Stern Bracket — Starboard and Pivot Bolt

A. Remove stern bracket lock bar.

B. Remove retaining ring securing shock absorber shaft — lower to stern bracket — port using retaining ring pliers (Special Tool T1081).

C. Remove pivot bolt nut and plain washer.

D. Remove pivot bolt and stern bracket — starboard from swivel bracket being careful not to lose swivel friction washers which are between both stern brackets and swivel bracket.

E. Remove stern bracket clamp screw and handle as outlined in Section XVI, paragraph 8-1.

9-4. Installing Stern Bracket — Starboard and Pivot Bolt

A. Install clamp screw and handle on stern bracket — starboard as outlined in Section XVI, paragraph 8-2.

B. Install pivot bolt on stern bracket — starboard and then install one (1) friction washer.

C. Install pivot bolt through swivel bracket and install other friction washer between stern bracket — port and swivel bracket. Push pivot bolt through friction washer and stern bracket — port.

D. Secure pivot bolt with plain washer and nut.

E. Align stern bracket — starboard with shock absorber shaft — lower and secure shaft — lower to stern bracket with retaining ring using retaining ring pliers (Special Tool T1081).

F. Install stern bracket lock bar.

9A. STEERING TUBE 08-34

9A-1. Removing Steering Tube

A. Remove nut securing steering tube to stern bracket - starboard.

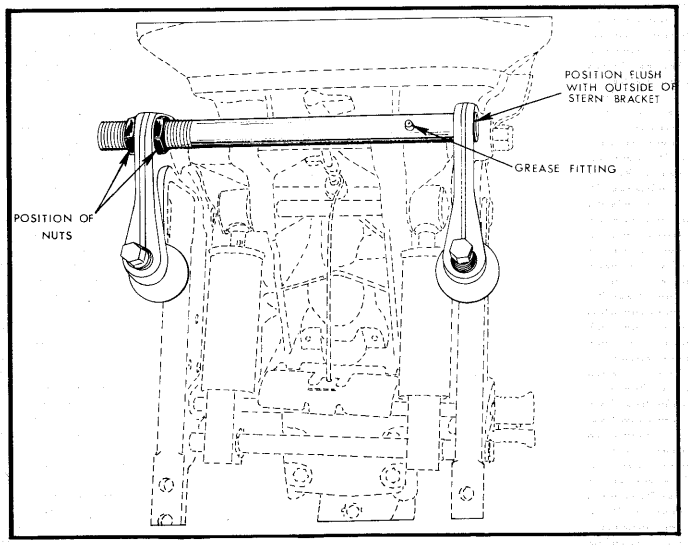
B. Slide steering tube through stern bracket - port until threaded end on tube clears stern bracket - starboard.

C. Remove remaining nut from steering tube and pull tube from stern bracket.

9A-2. Installing Steering Tube

A. Slide threaded end of steering tube through stern bracket - port. Thread one nut on end of tube as far as it will go.

B. Slide tube through stern bracket - starboard and adjust nut until port end of steering tube is flush with stern bracket - port. See figure 5B.



1. Figure 5B - Installing Steering Tube

C. Install remaining nut on steering tube and torque to 65 ft. lbs.

10. SWIVEL BRACKET 08-21 SWIVEL BRACKET BEARING 08-22 KINGPIN 08-26

10-1. Removing Swivel Bracket Assembly and Kingpin

A. Suspend engine from hoist or lay engine on floor.

B. Remove shock absorber shaft — upper as outlined in Section XVI, paragraph 7-1 and remove tilt lock pivot securing tilt lock to swivel bracket. Remove stern bracket. Pivot bolt as outlined in Section XVI, paragraph 9-3. Remove stern brackets and shock absorbers from swivel bracket.

C. Remove reverse lock as outlined in Section XVI, paragraph 6-1.

D. Remove reverse lock link from reverse lock arm. Drive out spring pin securing reverse lock arm to reverse lock release handle and shaft as shown in figure 6.

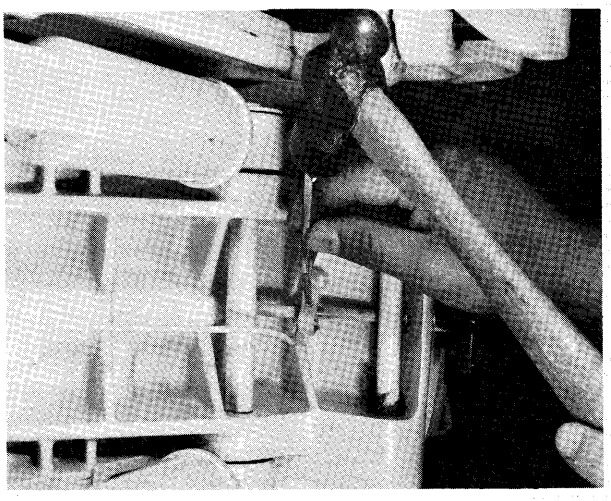


Figure 6–Driving Out Spring Pin

Remove cotter pin securing reverse lock release handle and shaft to swivel bracket and remove handle and shaft, plain washer, reverse lock arm, two (2) nyliner bearings and shaft bearing from swivel bracket.

E. Remove swivel bracket friction set screw from swivel bracket.

F. Remove kingpin cap by removing four (4) screws securing kingpin cap to motor leg cover — front.

G. Using spring pin punch (Special Tool T8919), drive kingpin down from inside of support plate until kingpin is freed from kingpin bore in motor leg cover — front.

NOTE

Do not drive on kingpin assembly in area of welch plug. Use spring punch on kingpin proper as shown in figure 7.

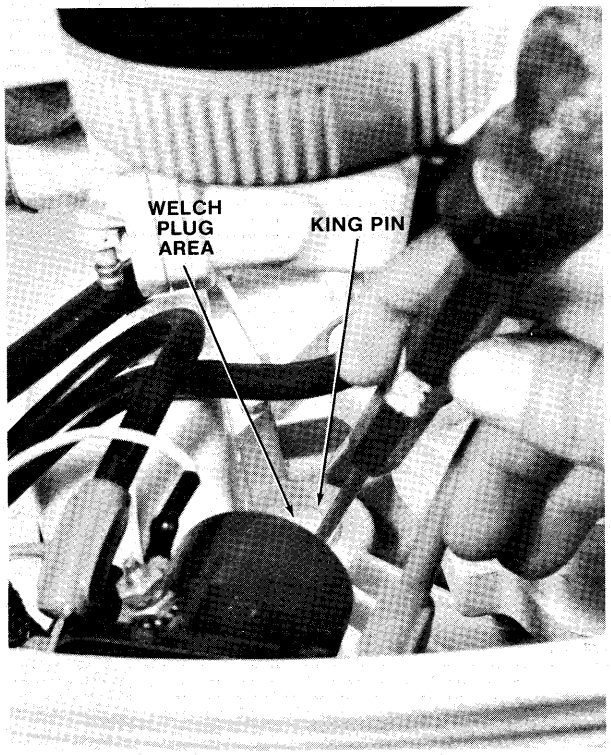


Figure 7–Driving Out Kingpin

H. Remove swivel bracket assembly and kingpin from engine. Slide kingpin out of kingpin bore in swivel bracket.

I. Remove swivel bracket bearings (quantity — 4) from kingpin bore in swivel bracket.

10-2 Installing Swivel Bracket

A. Install swivel bracket bearings in kingpin bore of swivel bracket. Install long bearings (one on each end) in first then install short bearings (one on each end).

B. Install swivel bracket friction set screw in swivel bracket.

C. Install nyliner bearing on each end of reverse lock release handle and shaft bore. Insert handle and shaft through bearings, then install plain washer and reverse lock arm on shaft. Install long bearing in swivel bracket to retain end of handle shaft. Align hole in reverse lock arm and hole in shaft (see figure 4 for positioning of reverse lock arm) and drive in spring pin to secure arm to shaft. Push washer against flange of inner nyliner bearing and install cotter pin to secure handle and shaft to swivel bracket.

D. Install kingpin in swivel bracket with welch plug end up. Install swivel bracket assembly with kingpin on engine and force kingpin up through bore in motor leg cover — front until top of kingpin is flush with top of kingpin bore in motor leg cover — front.

E. Install kingpin cap and secure with four (4) screws.

NOTE

Before installing kingpin cap screws, apply Anti-Seize (Special Tool T2987-1) to threads of kingpin cap screws.

F. Install reverse lock and spring as outlined in Section XVI, paragraph 6-2.

G. Install stern brackets and shock absorbers on swivel bracket. Install stern bracket pivot bolt as outlined in Section XVI, paragraph 9-4. Secure tilt lock to swivel bracket with tilt lock pivot.

H. Tighten swivel bracket friction screw in swivel bracket.

I. Using grease gun, insert grease through the three (3) grease fittings in swivel bracket.

NOTE

Apply Anti-Seize (Special Tool T29871-) to threads of tilt lock pivot before installation.

Install shock absorber shaft — upper to secure shock absorbers to swivel bracket as outlined in Section XVI, paragraph 7-2.

SECTION XVII — POWER HEAD — 3 CYLINDER ENGINES

1. CYLINDER HEAD 09-11
CYLINDER HEAD GASKET 09-12
THERMOSTAT 09-28

1-1. Removing Cylinder Head Assembly

A. Remove spark plugs from cylinder head.

B. Remove 14 cylinder head bolts and plain washers securing cylinder head assembly to cylinder. Remove cylinder head assembly and cylinder head gasket from cylinder.

C. Remove thermoswitch (located next to #1 spark plug) and two (2) screws. Remove cylinder head cover and gasket from cylinder head.

D. Remove thermostat from cavity in cylinder head.

1-2. Installing Cylinder Head Assembly

A. Clean all gasket surfaces.

NOTE

When cleaning gasket surfaces, be careful not to scratch or groove same.

B. Install thermostat in cavity of cylinder head with by-pass slot in thermostat positioned up.

C. Install new cylinder head cover and gasket on cylinder head and secure with thermoswitch in hole next to #1 spark plug and two (2) screws.

D. Install cylinder head assembly and new head gasket on powerhead. Secure cylinder head assembly and gasket to powerhead with 14 head bolts and plain washers. First torque all cylinder head bolts to 75 In. Lbs. following torquing sequence as shown in figure 1. Then increase torque in increments of 50 In. Lbs. to specified torque.

NOTE

Refer to parts books for size head bolts used. Torque for 5/16 — 18 thread head bolts is 225 ± 5 In. Lbs. Torque for 3/8 — 16 thread bolts is 270 ± 5 In. Lbs.

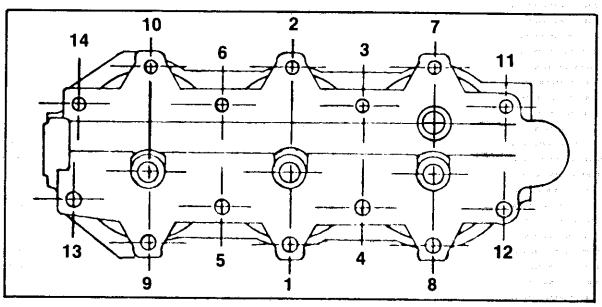


Figure 1–Torquing Sequence

E. Install spark plugs on cylinder head.

F. Run engine for 15 minutes. Allow engine to cool then re-torque cylinder head bolts.

2. EXHAUST PORT COVER 09-13
EXHAUST PORT COVER PLATE 09-14
EXHAUST PORT GASKETS 09-15

2-1. Removing Exhaust Port Cover, Plate and Gaskets

A. Remove screw securing exhaust port cover, plate and gaskets to powerhead.

B. Remove exhaust port cover, plate and gaskets from powerhead.

2-2. Installing Exhaust Port Cover, Plate and Gaskets

A. Clean gasket surfaces on powerhead.

B. Apply Anti-Seize (Special Tool T2987-1) to threads of exhaust port cover screws.

C. Install new gaskets, plate and exhaust port cover to powerhead and secure with screws.

3. TRANSFER PORT COVER 09-16
TRANSFER PORT COVER GASKET 09-17

3-1. Removing #1 Cylinder Transfer Port Cover and Gasket

A. Remove C-D unit covering transfer port cover.

B. Remove four (4) screws securing transfer port cover to powerhead and remove transfer port cover and gasket from powerhead.

3-2. Installing #1 Cylinder Transfer Port Cover and Gasket

A. Clean gasket surfaces on powerhead.

B. Install transfer port cover and new gasket on powerhead. Secure transfer port cover and gasket with four (4) screws.

C. Install C-D unit to powerhead.

NOTE

Refer to electrical components section for detailed procedures to be followed when installing C-D unit.

3-3. Removing #2 Cylinder Transfer Port Cover and Gasket

A. Remove three (3) screws securing fuel pump to transfer port cover and powerhead. Swing fuel pump assembly from transfer port cover.

B. Remove remaining screw from transfer port cover and remove transfer port cover and gasket from powerhead.

3-4. Installing #2 Cylinder Transfer Port Cover and Gasket

A. Clean gasket surfaces on powerhead.

B. Install transfer port cover with new gasket on powerhead.

C. Install one (1) screw (shortest screw) to lower rear corner.

D. Swing fuel pump assembly over transfer port cover and secure fuel pump assembly and transfer port cover to powerhead with three (3) screws.

3-5. Removing #3 Cylinder Transfer Port Cover and Gasket

A. Remove spark plug lead wires from remote control connector stud bracket.

B. Remove fuel sediment bowl and bail and nut assembly from fuel pump.

C. Remove four (4) screws securing bracket and transfer port cover to powerhead.

D. Remove bracket, transfer port cover and gasket from powerhead.

E. For 1971 and later models, disconnect recirculating hose (cylinder drain cover to transfer port cover) from transfer port cover. Remove fitting from transfer port cover.

3-6. Installing #3 Cylinder Transfer Port Cover and Gasket

A. Apply sealant (Special Tool T2962) to threads of fitting. Install fitting on transfer port cover and position end of barb at 3 o'clock (for 1971 and later models).

B. Connect recirculating hose to fitting on transfer port cover (for 1971 and later models).

C. Install transfer port cover and new gasket on powerhead.

D. Install remote control connector stud bracket on rear two (2) screw bosses of transfer port cover.

E. Install four (4) screws to secure bracket and transfer port cover to powerhead.

F. Connect spark plug lead wires to bracket.

4. CYLINDER DRAIN COVER 09-18 CYLINDER DRAIN COVER GASKET 09-19

4-1. Removing Cylinder Drain Cover and Gasket

A. For 1971 and later models, disconnect recirculating hose (cylinder drain cover to transfer port cover) from fitting on cylinder drain cover.

B. Disconnect fuel pump impulse hoses from fittings on cylinder.

C. Remove six (6) screws securing cylinder drain cover to powerhead and remove cylinder drain cover and gasket from powerhead.

D. Remove fitting from cylinder drain cover (for 1971 models and later).

4-2. Installing Cylinder Drain Cover and Gasket

A. Apply Loctite H (Special Tool T2962) to threads of fitting. Install fitting on cylinder drain cover and position end of barb at 12 o'clock.

NOTE

Steps "A" and "C" apply to 1971 and later models only.

B. Install cylinder drain cover and new gasket on powerhead and secure with six (6) screws.

C. Connect recirculating hose from transfer port cover to fitting on cylinder drain cover.

D. Connect fuel pump impulse hoses to fittings on cylinder.

5. CARBURETOR ADAPTER FLANGE 09-20 REED PLATE ASSEMBLY 09-21 REED PLATE GASKET 09-23

5-1. Removing Carburetor Adapter Flange and Reed Plate Assemblies

A. Disconnect fuel line (fuel pump to bottom carburetor) from bottom carburetor and carburetor intake cover drain hose from carburetor adapter flange.

B. Remove throttle tie bar from throttle shutter arm of carburetors by removing retaining rings securing same.

C. Disconnect throttle cam link end connector from towershaft. Remove six (6) nuts (two per carburetor) securing carburetors to carburetor adapter flange.

D. Remove carburetors and intake cover as an assembly from powerhead.

E. Remove choke solenoid and clamp by removing two (2) screws securing same to carburetor adapter flange.

F. Remove twelve (12) screws securing carburetor adapter flange deflector plate and reed plate to powerhead as shown in figure 2. Remove carburetor adapter flange assembly.

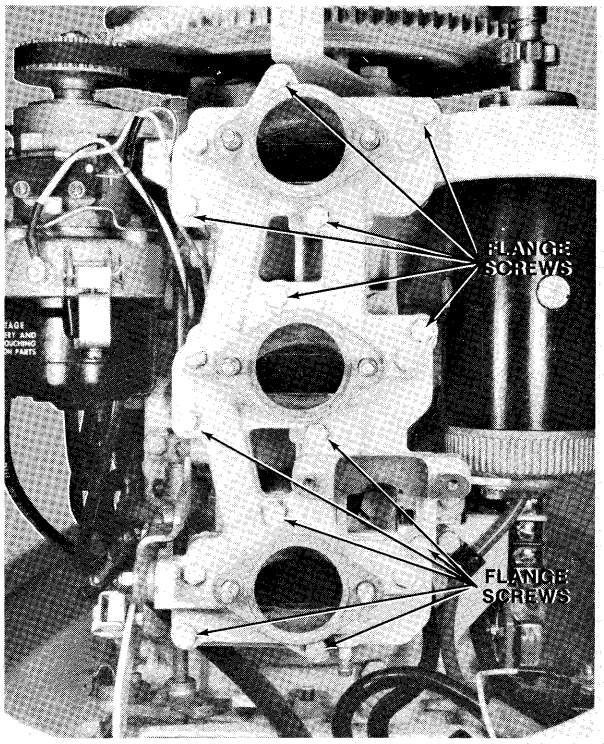


Figure 2- Carburetor Adapter Flange Screws

G. Remove stop nut securing throttle cam to carburetor adapter flange and remove throttle cam assembly with two (2) nylon washers.

H. Remove six (6) screws securing reed plate assemblies and deflector plate to carburetor adapter flange and remove deflector plate and reed plate.

I. Remove fitting (carburetor intake cover drain) from carburetor adapter flange.

5-2. Installing Carburetor Adapter Flange and Reed Plate Assemblies

A. Clean all gasket surfaces being careful not to scratch or groove same.

B. Apply Loctite H (Special Tool T2962) to threads of fitting (carburetor intake cover drain) and install on carburetor adapter flange.

C. Install new gaskets between reed plates and deflector plate. Install new gasket between deflector plate and carburetor adapter flange.

D. Secure reed plate assemblies and deflector plate to carburetor adapter flange with six (6) screws.

E. Install throttle cam assembly with nylon washer on each side on stud of carburetor adapter flange. Secure throttle cam on stud with stop nut. Tighten stop nut until throttle cam pivots freely on stud but with no side play.

F. Install carburetor adapter flange assembly on powerhead and secure with twelve (12) screws as shown in figure 2.

NOTE

There are two (2) longer screws used and they are positioned under top carburetor flange and middle carburetor flange.

G. Install choke solenoid and clamp and secure with two (2) screws. Adjust choke solenoid position after carburetors are installed as outlined in Section IV, paragraph 3-4.

H. Install carburetors and intake cover assembly on powerhead inserting choke solenoid plunger in solenoid and aligning carburetors on studs on adapter flange. Secure carburetors to adapter flange with six (6) nuts.

I. Install throttle tie bar and secure with retaining clips. Synchronize carburetor shutters as outlined in Section IV, paragraph 3-1.

J. Adjust throttle pick-up as outlined in Section IV, paragraph 3-2.

K. Connect fuel line (fuel pump to bottom carburetor) to fitting on bottom carburetor. Connect drain hose from carburetor intake cover to fitting on carburetor adapter flange.

6. REED PLATE REEDS 09-22

6-1. Removing Reed Plate Reeds

A. Remove reed plate assembly as outlined in Section XVII, paragraph 5-1.

B. Remove five (5) screws securing reed stop and reeds on each side of reed plate.

C. Remove reed stops and reeds.

6-2. Installing Reed Plate Reeds

A. Install one (1) 4 petal and one (1) single petal reed set on each side of reed plate.

B. Position reeds over reed plate openings so that reeds overlap openings by at least .040".

C. Install reed stops and secure reeds and reed stops to reed plate with five (5) screws on each side of reed plate.

D. Check reed stop openings. Reed stop opening is .28 $\pm$ .010".

E. Check reeds for warpage. Reeds are allowed to stand open a maximum of .010". If reeds are standing open more than .010" remove and straighten reeds.

F. Install reed stop assembly as outlined in Section XVII, paragraph 5-2.

7. CRANKSHAFT BEARING CAGE 09-24
CRANKSHAFT BEARING SEAL 09-25

7-1. Removing Crankshaft Bearing Cage Assembly

A. Remove flywheel and stator plate as outlined in Section VIII.

B. Remove crankshaft bearing cage assembly by removing screws securing same to powerhead.

C. Press crankshaft bearing seal out of bearing cage.

D. Remove bearing cage seal from groove on top of powerhead.

7-2. Installing Crankshaft Bearing Cage Assembly

A. Clean gasket surfaces on bearing cage and powerhead.

B. Position crankshaft bearing seal on bore of crankshaft bearing cage with major sealing lip with garter spring towards inside of crankcase. Press seal in bore of bearing cage using seal installer (Special Tool T8903) as shown in figure 3.

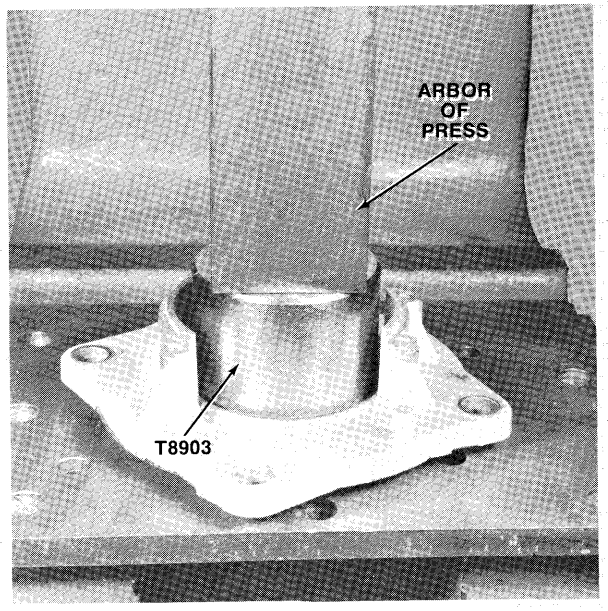


Figure 3–Installing Crankshaft Bearing Seal

C. Install new bearing cage seal ("O" ring seal) on bearing cage assembly.

D. Apply a bead of sealant (Special Tool T8955) around surface of bearing cage halfway between screw holes and "O" ring seal.

E. Install seal protector (Special Tool T8915) on top of crankshaft. Apply grease (Special Tool T2961) between lips of crankshaft seal. Install bearing cage assembly on seal protector. Slide bearing cage down crankshaft on powerhead.

F. Align holes of bearing cage with holes in powerhead. Apply sealant (Special Tool T8955) to threads of bearing cage screws. Install screws to secure bearing cage to powerhead.

G. Install stator and flywheel as outlined in Section VIII.

8. THROTTLE TOWERSHAFT 09-26

8-1. Removing Towershaft

A. Remove distributor complete as outlined in Section XII, paragraph 4-1.

B. Disconnect throttle link from rod end connector stud on towershaft.

C. Remove four (4) screws securing towershaft to powerhead and lift towershaft from powerhead.

8-2. Installing Towershaft

A. Install towershaft with bottom end in bearing in spacer plate.

B. Align holes in nylon bearings with holes on powerhead and secure towershaft to powerhead with four (4) screws.

C. Connect throttle link to towershaft and check throttle shutters to see that they are horizontal at wide open throttle. Readjust if necessary.

D. Install distributor as outlined in Section XII, paragraph 4-2.

9. BY-PASS COVER
BY-PASS VALVE 09-29
BY-PASS SPRING 09-30

9-1. Removing By-Pass Cover, Valve and Spring

A. Remove two (2) screws securing by-pass cover to powerhead.

B. Remove by-pass cover, valve and spring from powerhead.

9-2. Installing By-Pass Cover, Valve and Spring

A. Clean gasket surfaces on all parts.

B. Install new gasket on by-pass cover.

C. Install spring on by-pass cover, then valve on end of spring.

IMPORTANT

Note which type of by-pass valve cover, spring and cylinder being used. See figure 4 for identification of same. It is important that the correct combination be used or overheating problems may occur.

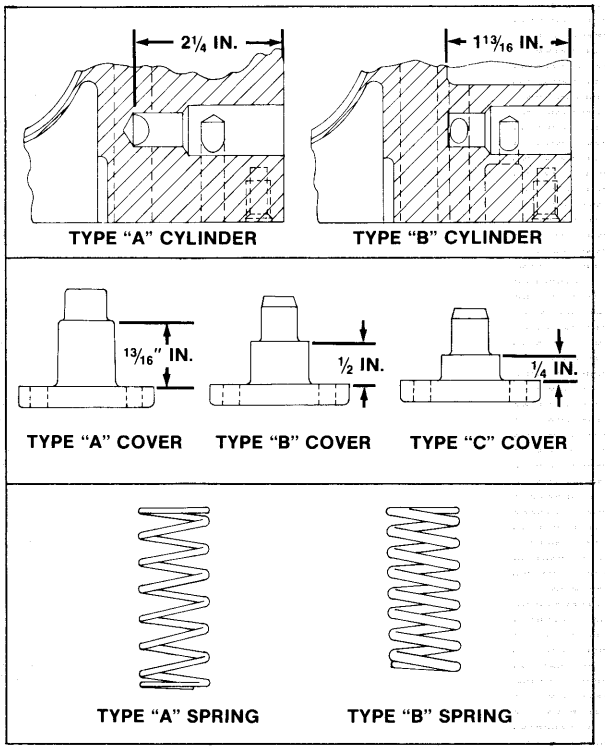


Figure 4—Water By-pass Components

Type "A" cylinder uses type "A" cover with only type "A" spring.

Type "A" cylinder also uses type "B" cover with only type "B" spring.

Type "B" cylinder uses only type "C" cover and type "B" spring.

D. Install assembly on powerhead and secure with two (2) screws.

10. POWERHEAD EXHAUST TUBE 08-31 SPACER PLATE 08-33 CYLINDER EXHAUST GASKET — UPPER 09-31 CYLINDER EXHAUST GASKET — LOWER 09-32

10-1. Removing Powerhead

A. Remove motor leg cover — rear as outlined in Section XV, paragraph 1-1.

B. Remove six (6) elastic stop nuts securing powerhead to motor leg.

C. Remove fuel pump assembly from transfer port cover as outlined in Section XIII, paragraph 1-1.

D. Remove distributor from powerhead as outlined in Section XII, paragraph 4-1.

E. Remove towershaft as outlined in Section XVII, paragraph 8-1.

F. Remove top elastic stop nut securing shift rod — upper to interlock arm.

G. Remove nut securing lead wire to choke solenoid and remove lead wire from solenoid.

H. Remove all lead wires from starter relay and clamp holding wiring harness at base of starter relay.

I. Remove battery "ground" lead wire from crankcase cover.

J. Remove "ground" lead wire from powerhead.

K. Remove remote electric cable lead wires from terminal block and clamp.

L. Remove six (6) hex head bolts securing spacer plate to motor leg.

M. Lift powerhead, spacer plate and exhaust tube from motor leg using hoist and lifting hook (Special Tool T8933) on end of crankshaft.

N. Remove cylinder exhaust gasket — lower.

O. Remove four (4) screws securing exhaust tube to spacer plate.

P. Remove four (4) elastic stop nuts securing spacer plate to base of powerhead and remove spacer plate.

Q. Remove cylinder exhaust gasket — upper.

10-2. Installing Powerhead

A. Clean all gasket surfaces.

B. Apply Sealant (Special Tool T8955) to both sides of cylinder exhaust gasket — upper in area between two (2) forward stud holes. Install cylinder exhaust gasket — upper on powerhead.

C. Install spacer plate on cylinder exhaust — upper and secure with four (4) elastic stop nuts. Torque nuts to 270 In. Lbs.

D. Install exhaust tube to spacer plate and secure with four (4) screws. Before installing screws, apply Anti-Seize (Special Tool T2987-1) to threads of screws. Torque screws to 70 In. Lbs.

E. Install cylinder exhaust gasket — lower to top of motor leg aligning holes of gasket with holes in motor leg.

F. Install powerhead on motor leg aligning studs with holes in motor leg and driveshaft splines with crankshaft.

G. Secure powerhead to motor leg with six (6) screws through spacer plate and six (6) stop nuts on studs on powerhead. Torque bolts and nuts to 270 In. Lbs.

H. Connect lead wires of remote electric cable to terminal block.

I. Connect "ground" lead wire from support plate to exhaust port cover screw (Delta system only).

J. Connect lead wires to starter relay as outlined in appropriate section and paragraph.

K. Connect battery cable "ground" lead to crankcase cover.

L. Connect choke lead wire to choke solenoid and secure with hex nut and spring lockwasher. Retain lead wire to body of solenoid with ty-rap or retaining band.

M. Install elastic stop nut to secure shift rod — upper to interlock arm. Check adjustment of interlock arm as follows:

1. Set engine in exact neutral gear position (middle of shift rod — upper travel between forward and reverse gear position).
2. Adjust interlock arm position so that top of interlock arm is even with top of neutral stop on towershaft. Adjustment is made by turning stop nut above interlock arm and nut below interlock arm.

N. Install towershaft as outlined in Section XVII, paragraph 8-2.

O. Install distributor as outlined in Section XII, paragraph 4-2.

P. Install fuel pump assembly as outlined in Section XIII, paragraph 1-2.

Q. Install motor leg cover — rear as outlined in Section XV, paragraph 1-2.

11. SHORT BLOCK 09-33

11-1. Removing Short Block

A. Remove flywheel and stator plate as outlined in Section VIII.

B. Remove crankshaft bearing cage as outlined in Section XVII, paragraph 7-1.

C. Remove carburetor adapter flange and reed plate assemblies as outlined in Section XVII, paragraph 5-1.

D. Remove distributor as outlined in Section XII, paragraph 4-1.

E. Remove towershaft as outlined in Section XVII, paragraph 8-1.

F. Remove fuel pump as outlined in Section XIII, paragraph 1-1.

G. Remove C-D unit as outlined in appropriate section and paragraph.

H. Remove cylinder drain covers as outlined in Section XVII, paragraph 4-1.

I. Remove transfer port covers as outlined in Section XVII, paragraphs 3-1, 3-3 and 3-5.

J. Remove cylinder head as outlined in Section XVII, paragraph 1-1.

K. Remove cylinder exhaust port cover, plate and gaskets as outlined in Section XVII, paragraph 2-1.

L. Remove wiring harness as outlined in appropriate section and paragraph.

M. Remove terminal block bracket assembly as outlined in appropriate section and paragraph.

N. Remove rectifier as outlined in appropriate section and paragraph.

O. Remove starter as outlined in Section XI, paragraph 1-1.

P. Remove powerhead, exhaust tube and spacer plate as outlined in Section XVII, paragraph 10-1.

11-2. Installing Short Block

A. Install spacer plate and exhaust tube on short block and install on motor leg as outlined in Section XVII, paragraph 10-2.

B. Install starter as outlined in Section XI, paragraph 1-2.

C. Install rectifier as outlined in appropriate section and paragraph.

D. Install terminal block bracket assembly as outlined in appropriate section and paragraph.

E. Install wiring harness as outlined in appropriate section and paragraph.

F. Install cylinder exhaust port cover, plate and gaskets as outlined in Section XVII, paragraph 2-2.

G. Install cylinder head as outlined in Section XVII, paragraph 1-2.

H. Install transfer port covers as outlined in Section XVII, paragraphs 3-2, 3-4, and 3-6.

I. Install cylinder drain covers as outlined in Section XVII, paragraph 4-2.

J. Install fuel pump assembly as outlined in Section XIII, paragraph 1-2.

K. Install towershaft as outlined in Section XVII, paragraph 8-2.

L. Install distributor as outlined in Section XII, paragraph 4-2.

M. Install carburetor adapter flange and reed plate assemblies as outlined in Section XVII, paragraph 5-2.

N. Install crankshaft bearing cage assembly as outlined in Section XVII, paragraph 7-2.

O. Install flywheel and stator plate as outlined in Section VIII.

12. CRANKSHAFT 09-36
CRANKCASE SEAL 09-35
CENTER MAIN BEARING 09-37
LOWER MAIN BEARING 09-38
CRANKSHAFT LOWER SEAL 09-44
CONNECTING ROD NEEDLE BEARINGS 09-39

12-1. Removing Crankshaft Assembly

A. Remove powerhead as outlined in Section XVII, paragraph 10-1.

B. Remove carburetor, carburetor adapter flanges and deflector plate assemblies as outlined in Section XVII, paragraph 5-1.

C. Remove crankshaft bearing cage assembly as outlined in Section XVII, paragraph 7-1.

D. Remove main bearing bolts and crankcase parting line screw.

NOTE

As bolts and screws are being removed, note different lengths. Longer length bolts or screws are a result of different boss heights and/or because they are securing brackets. Also note that two (2) top crankcase parting line screws (one (1) on each side) are assembled from the opposite side.

E. Drive two (2) dowel pins positioning crankcase cover on cylinder out as shown in figure 5.

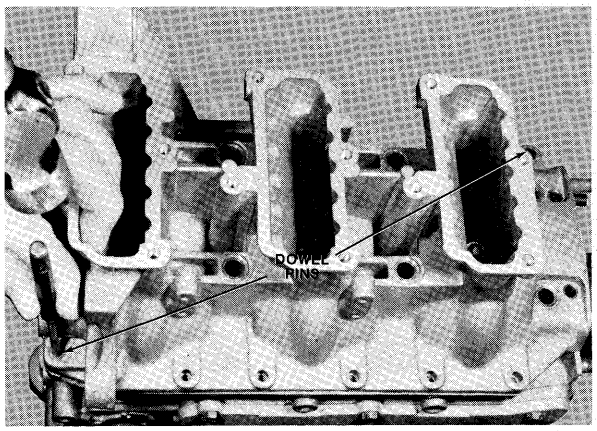


Figure 5–Driving Out Dowel Pins

F. Pry crankcase cover from cylinder using large screwdriver at each pry point as shown in figure 6.

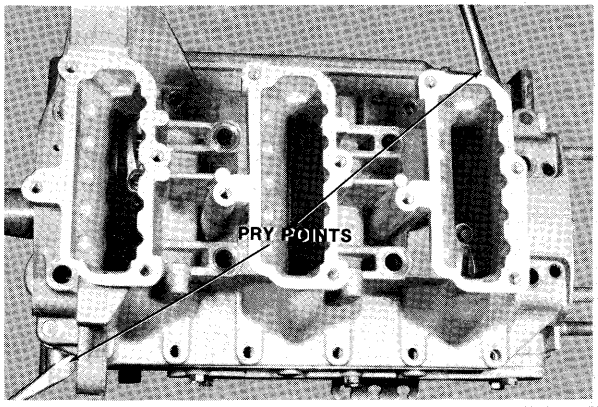


Figure 6–Prying Crankcase Cover

Lift crankcase cover from cylinder exposing crankshaft and main bearings.

G. Remove crankcase parting line seal from groove in cylinder.

H. Remove connecting rod cap screws using 12 point socket (Special Tool T2953) as shown in figure 7.

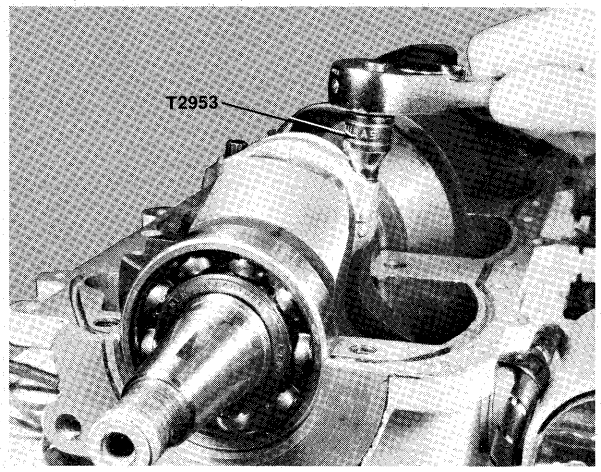


Figure 7–Removing Rod Cap Screws

Mark each rod cap showing position in cylinder as rod caps are removed.

I. Remove crank pin needle bearings and cages from crankshaft throws.

NOTE

Be sure to group rollers and cages with respective rod cap. Do not at any time mix needles and/or cages of one rod cap with another.

J. Lift crankshaft with main bearings from cylinder.

K. Remove snap ring from groove in main bearing as shown in figure 8. Remove center main bearing race and caged rollers.

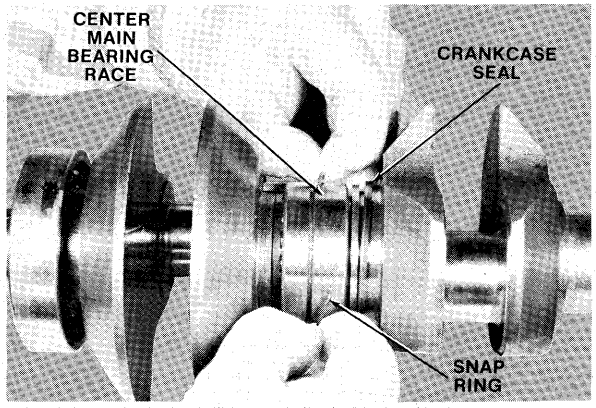


Figure 8–Removing Main Bearings

L. Remove crankcase seal from groove in crankshaft next to main bearing. See figure 8. Be sure to group all components of each main bearing group together — do not mix.

M. Slide lower main bearing with seal off bottom end of crankshaft.

N. To remove crankshaft lower seal, re-install lower main bearing assembly on end of crankshaft and insert screwdriver between seal and bearing. Twist screwdriver and pry seal out of bearing case as shown in figure 9.

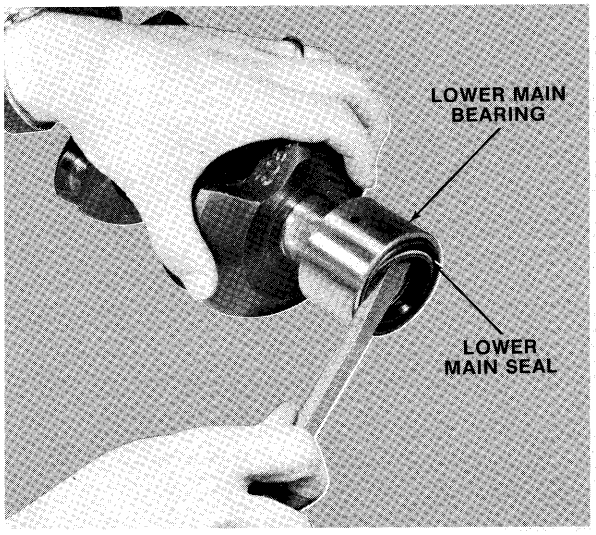


Figure 9–Prying Seal Out of Bearing

12-2. Installing Crankshaft Assembly

A. Clean all gasket surfaces and crankcase parting line surfaces.

B. Press seal in lower main bearing case positioning garter spring out using seal installer (Special Tool T8925). Press seal in until tool bottoms on bearing case.

C. Apply grease (Special Tool T2961) between lips of crankshaft lower seal. Install lower main bearing assembly on bottom of crankshaft.

D. Install center main bearings on crankshaft with holes in bearing race between groove of snap ring on race and groove of crankcase seal on crankshaft. Secure race on crankshaft with snap ring being certain not to have gap of snap ring over fracture in main bearing race.

E. Scrape old Loctite off outer diameter of upper main bearing. Clean bearing surface with Locquic (Special Tool T8935). Apply a bead of Loctite retaining compound around outer surface of bearing.

F. Apply grease (Special Tool T2961) to crankcase seal groove in crankshaft to retain seal in groove. Install crankcase seal in each groove in crankshaft.

G. Install crankshaft assembly on cylinder. Align large hole of each main bearing in locating pins in cylinder main bearing bores.

H. Examine crank pin needle bearing cages. Note that each cage is notched on one (1) side as shown in figure 10. Notched side is always toward upper main bearing.

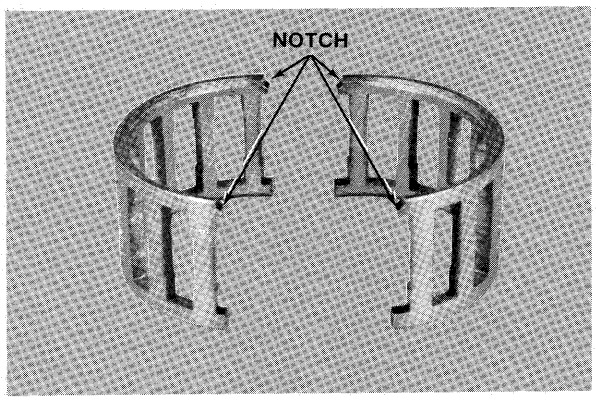


Figure 10–Crank Pin Needle Bearing Cage

Install crank pin needle bearing cage half in connecting rod with notched side towards upper main bearing. Apply a light coating of grease (Special Tool T2961) on cage half. Install seven (7) needles in cage half. Pull rod with cage half and needles up and against crank pin throw. Install crank pin needle bearing cage half on crank pin throw with notched side towards upper main bearing. Apply light coating of grease on cage half. Install remaining nine (9) needles.

I. Install rod cap over crank pin needle bearing and cage with match mark on rod shank aligned with match mark on rod cap as shown in figure 11.

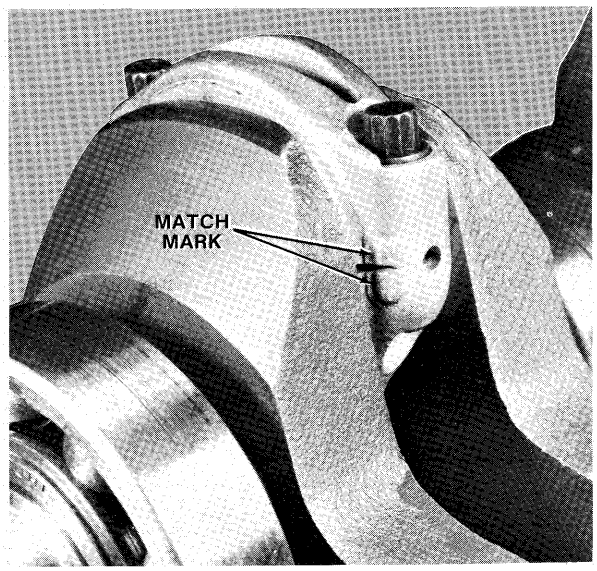


Figure 11–Match Marks on Connecting Rod

If connecting rod has a sanded surface across fracture joint on screw bosses, torque rod cap screw to 15 In. Lbs. maximum. Check for rod cap off set by lightly running a sharp lead pencil across sanded area. If offset is present, pencil will stop at fracture joint. Loosen rod cap screws. Reset rod cap on connecting rod and re-torque rod cap screws to 15 In. Lbs. Recheck for offset. If offset is still present, replace connecting rod.

J. Torque cap screws to 170 ± 5 In. Lbs. using torque wrench (Special Tool T2999) and 12 point socket (Special Tool T2953).

K. Follow steps H through J for remaining connecting rods.

L. Install new crankcase parting line seal in grooves of cylinder.

M. Apply sealant (Special Tool T8955) to areas between cylinders inside of seal groove and areas of both upper and lower main bearings on both sides of seal groove.

N. Install crankcase cover on cylinder. Drive in two (2) dowel pins to locate crankcase cover on cylinder. Apply sealant (Special Tool T8955) on threads of crankcase bolts. Install bolts as shown in figure 12. Torque bolts to 270 In. Lbs. from center of crankcase and outward.

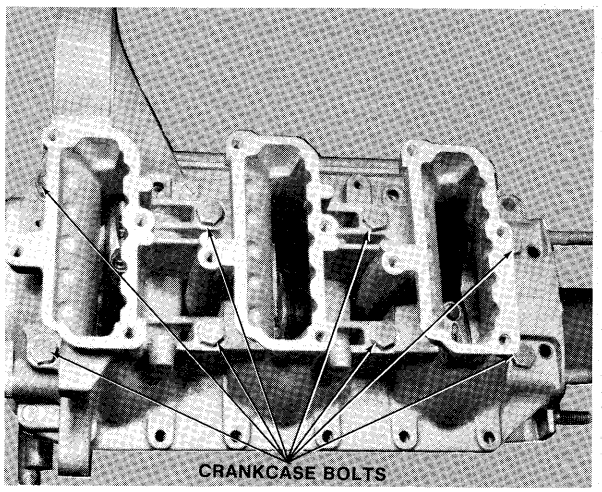


Figure 12–Crankcase Bolt Locations

O. Install crankcase parting line screws.

P. Install crankcase bearing cage assembly as outlined in Section XVII, paragraph 7-2.

Q. Install carburetors, carburetor adapter flanges and deflector plate assemblies as outlined in Section XVII, paragraph 10-2.

13. CONNECTING ROD 09-40 PISTON 09-41 PISTON PIN 09-42 PISTON RING 09-43

13-1. Removing Piston Assembly

A. Remove cylinder head as outlined in Section XVII, paragraph 1-1.

B. Follow disassembly procedures as outlined in Section XVII, paragraph 12-1.

C. Push piston assembly out of cylinder bore.

D. Remove piston rings from piston using piston ring expander (Special Tool T8926) as shown in figure 13.

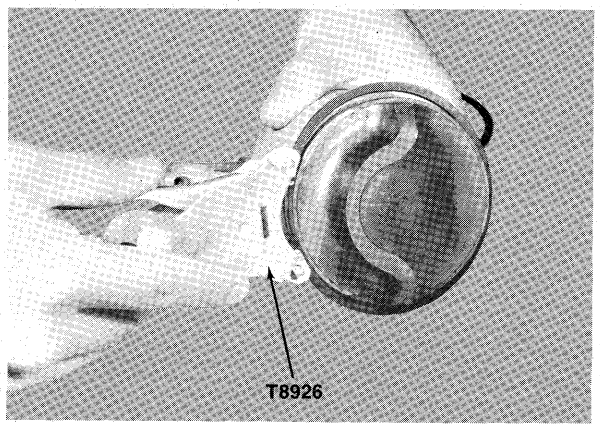


Figure 13–Removing Piston Rings

E. Remove piston pin from piston assembly using piston pin tool (Special Tool T2990) as outlined below:

1. Place piston on pillow block with piston pin aligned with hole in pillow block.
2. Install stepped end of drive pin in I.D. of piston pin.
3. Insert end of shim bar marked "295" between large diameter of spacer and needles.

NOTE

The shim bar has two (2) slots which are marked "310" and "295". The "310" marked end is used for installation of piston pin. The "295" marked end is used primarily for removal of piston pin because it will readily slide between spacer and connecting rod. In very rare cases, it may be necessary to use the "295" end for installation of piston pin if the "310" end will not slide in.

4. Press piston pin out as shown in figure 14.

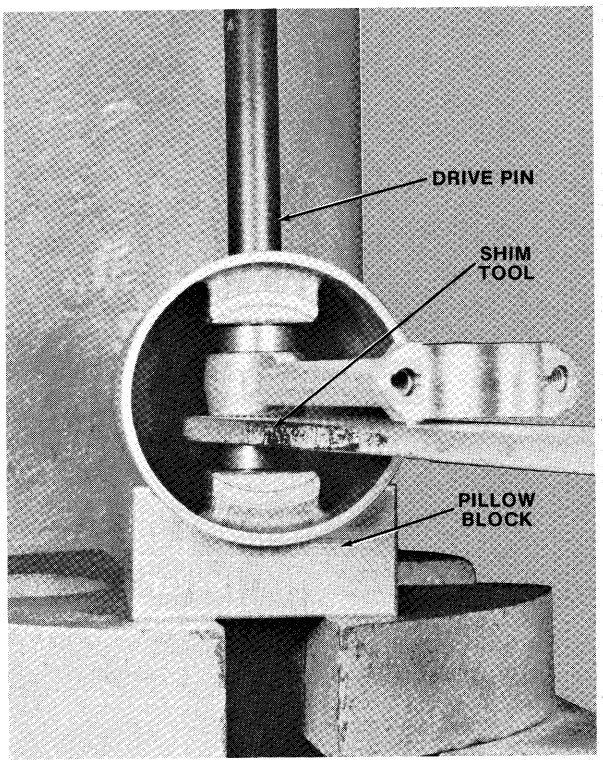


Figure 14–Pressing Out Piston Pin

Remove connecting rod, piston pin spacers and needles from piston exercising care so as not to lose any needles from connecting rod.

NOTE

There are 26 needles per bearing set.

13-2. Installing Piston Assembly

A. Install alignment pin from piston tool set through one (1) side of piston.

B. Install spacer on alignment pin with small diameter end of spacer towards inside of piston or towards connecting rod when installed.

C. Install piston pin needle bearings (quantity — 26 per set) in piston pin bore of connecting rod.

NOTE

If old needles are being used, coat bore of connecting rod with grease (Special Tool T2961) to retain needles. Then press needles firmly against bore of connecting rod.

D. Install connecting rod with needles on alignment pin with match mark on crank pin end of connecting rod towards intake side of piston. See figure 14. This will position match mark of connecting rod "up" or always toward flywheel end of crankshaft.

E. Push alignment pin through connecting rod. Then install other spacer with small diameter end of spacer towards connecting rod.

F. Push alignment pin through other spacer and in piston pin bore on other side of piston.

G. Install shim bar with end marked "310" between large diameter end of first spacer which was installed and connecting rod. See figure 15.

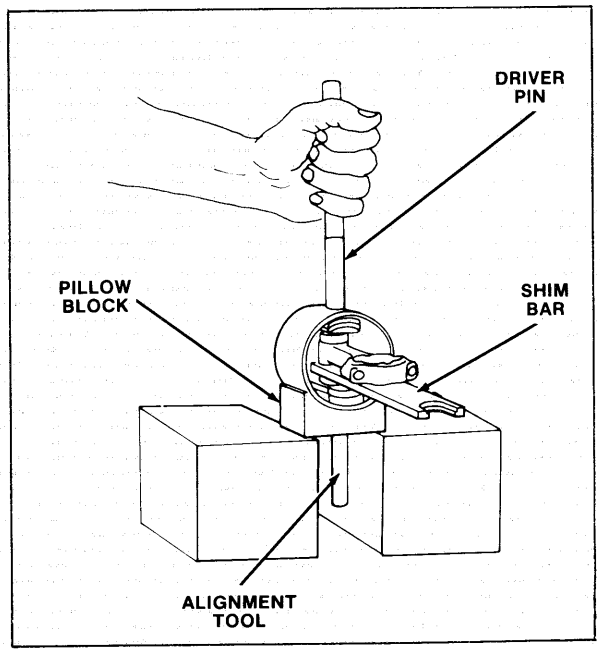


Figure 15–Piston With Components and Tools

Observe that slots each end of shim tool have a step. This step is clearance for piston pin needles.

NOTE

The "295" marked end is used primarily for removal of piston pin because it will readily slide between spacer and connecting rod. In very rare cases, it may be necessary to use the "295" end for installation of piston pin if the "310" end will not slide in.

H. Place above assembly on pillow block. Install piston pin on bore of piston. Install driver pin with stepped end in end of piston pin. Press piston pin in bore of piston while holding alignment tool as shown in figure 16. Press piston pin until it is centered in piston.

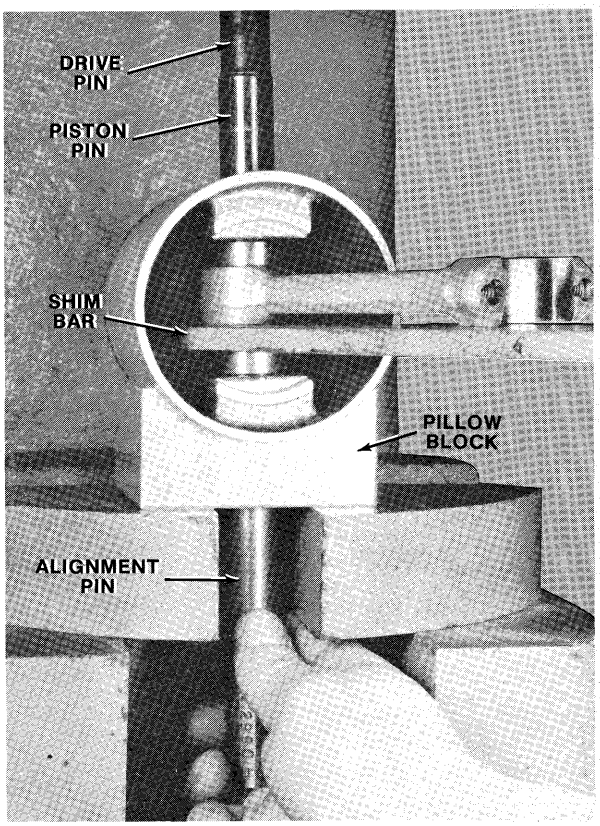


Figure 16–Installing Piston Pin

I. If a new piston pin needle bearings were installed, apply a liberal amount of motor oil on them. Connecting rod must slide easily between clearance of the two (2) spacers.

J. Install piston rings on piston with bevel on piston ring positioned up as shown in figure 17.

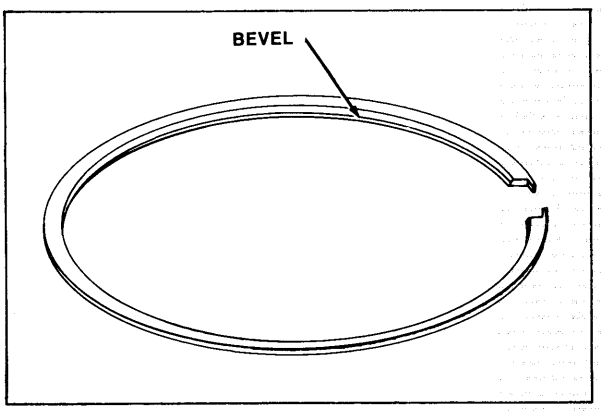


Figure 17–Bevel on Piston Ring

K. Install piston assemblies in cylinder using ring compressor (Special Tool T2996) as shown in figure 18. Position pistons in cylinder with intake baffle on piston on intake side of cylinder.

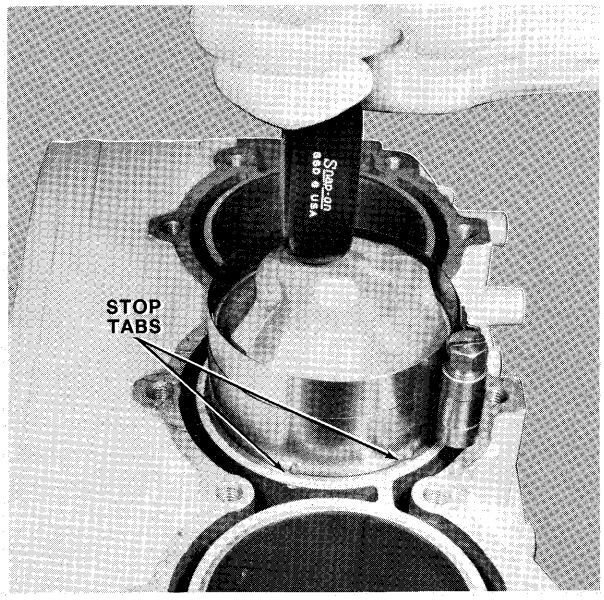


Figure 18–Installing Piston

L. Install crankshaft assembly and complete assembly of powerhead as outlined in Section XVII, paragraph 12-2.

M. Install cylinder head as outlined in Section XVII, paragraph 1-2.

14. CYLINDER ASSEMBLY 09-34

14-1. Removing Cylinder Assembly

A. Follow disassembly procedures as outlined in Section XVII, paragraph 11-1.

B. Remove crankshaft assembly as outlined in Section XVII, paragraph 12-1.

C. Remove piston assemblies as outlined in Section XVII, paragraph 13-1.

14-2. Installing Cylinder Assembly

A. Install piston assemblies as outlined in Section XVII, paragraph 13-2.

B. Install crankshaft assembly as outlined in Section XVII, paragraph 12-2.

C. Complete assembly as outlined in Section XVII, paragraph 11-2.

SECTION XVIII — POWERHEAD — 4 CYLINDER ENGINES

1. CYLINDER HEAD 09-11
CYLINDER HEAD GASKET 09-12
THERMOSTAT 09-28

1-1. Removing Cylinder Head Assembly

A. Remove four (4) screws securing thermostat cover to cylinder head. Remove thermostat cover and gasket.

B. Remove thermostat from cavity in cylinder head.

C. Remove spark plugs from cylinder head.

D. Remove eighteen (18) hex head bolts and plain washers securing cylinder head to powerhead. Remove cylinder head and gasket from powerhead.

1-2. Installing Cylinder Head Assembly

A. Install thermostat in cavity of cylinder head with by-pass slot in thermostat positioned up.

B. Install new gasket and thermostat cover on cylinder head.

NOTE

When cleaning gasket surfaces be careful not to scratch or groove same.

C. Install cylinder head and new head gasket on powerhead. Secure cylinder head and gasket to powerhead with head bolts and plain washers. First torque all cylinder head bolts to 75 In. Lbs. following torquing sequence as shown in figure 1. Then increase torque in increments of 50 in. lbs. to specified torque.

NOTE

Refer to parts books for size head bolts used. Torque for 5/16-18 thread head bolts is 225 ± 5 In. Lbs. Torque for 3/8-16 thread bolts is 270 ± 5 In. Lbs.

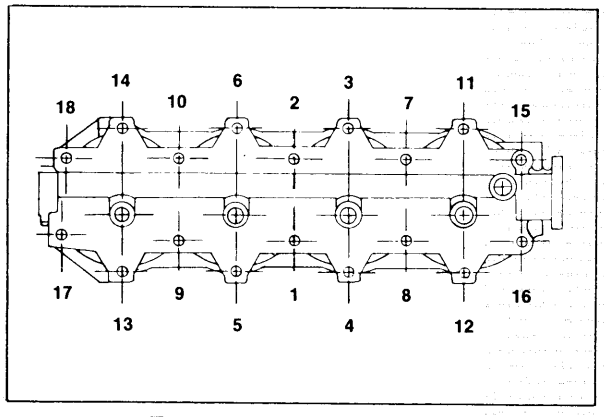


Figure 1–Torquing Sequence

D. Install spark plugs on head.

E. Run engine for 15 minutes. Allow engine to cool then re-torque cylinder head bolts.

1A. THERMOSTAT
CYLINDER HEAD COVER
CYLINDER HEAD
CYLINDER HEAD GASKET

1A-1. Removing Cylinder Head Assembly

A. Remove four (4) screws securing thermostat cover to cylinder head. Remove thermostat cover and gasket. See figure 1A.

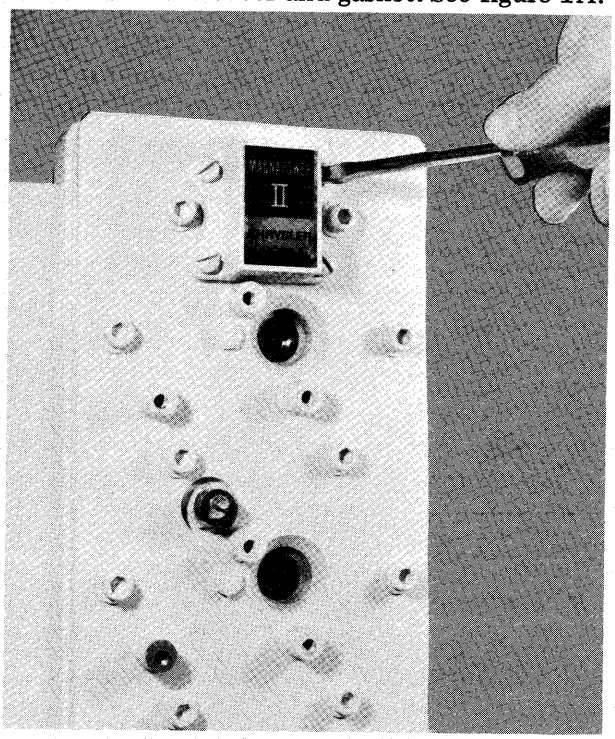


Figure 1A - Removing Thermostat

B. Remove thermostat from cavity in cylinder head.

C. Remove ignition coils as outlined in Section XA, paragraph 6-1. (Magnapower II Models)

D. Remove spark plugs from cylinder head.

E. Remove eighteen (18) bolts and plain washers securing cylinder head assembly to powerhead. Remove cylinder head assembly and gasket from powerhead.

F. Remove four (4) hex head screws and thermoswitch securing cylinder head cover to cylinder head. See figure 1B. Remove cylinder head cover and cylinder head plate from cylinder head.

1A-2. Installing Cylinder Head Assembly

A. Assemble cylinder head cover and cylinder

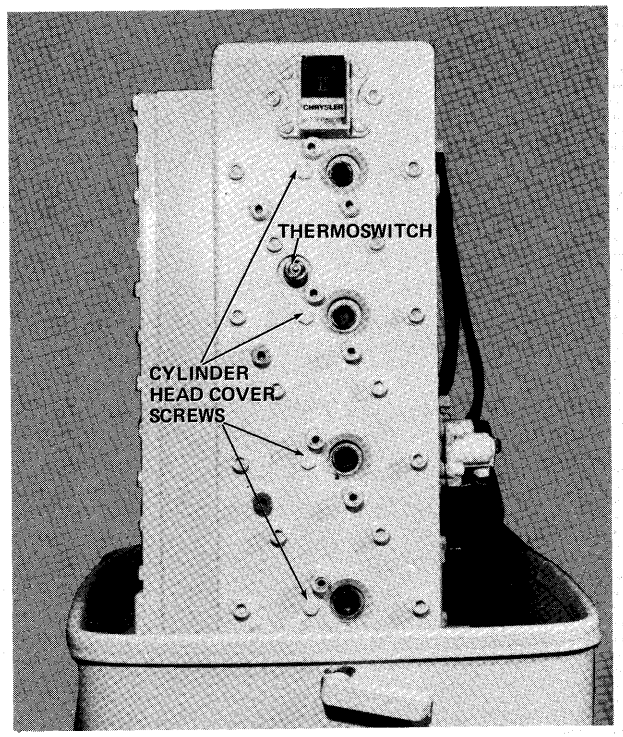


Figure 1B - Location of Cylinder Head Cover Screws

head plate to cylinder head. Apply an adequate sealing bead of silicone rubber, form in place gasket (Special Tool T8983) to both the cylinder head and cylinder head cover milled surfaces as shown in figure 1C.

B. Install four (4) screws and thermoswitch securing cylinder head cover to cylinder head.

C. Install cylinder head gasket and cylinder head assembly on powerhead. Install eighteen (18) bolts and plain washers, torque all cylinder head bolts to 75 in. lbs. following torquing sequence shown in figure 1. Then increase torque in increments of 50 in. lbs. to specified torque.

D. Install spark plugs on head.

E. Install ignition coils as outlined in Section XA, paragraph 6-2. (Magnapower II Models)

F. Install thermostat in cavity of cylinder head.

G. Install new gasket and thermostat cover on cylinder head and secure with four (4) screws.

2. EXHAUST PORT COVER 09-13
EXHAUST COVER PLATE 09-14
EXHAUST PORT GASKETS 09-15

2-1. Removing Exhaust Port Cover, Plate and Gaskets

A. Remove screws securing exhaust port cover, plate and gaskets to powerhead.

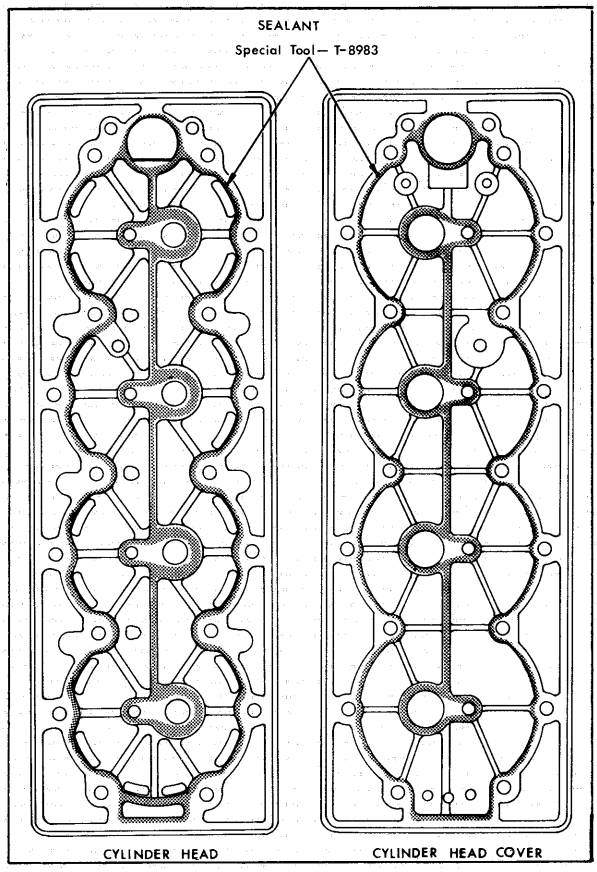


Figure 1C - Areas Requiring Sealant

B. Remove exhaust port cover, plate and gaskets from powerhead.

2-2. Installing Exhaust Port Cover, Plate and Gaskets

A. Clean gasket surfaces on powerhead.

B. Apply Anti-Seize (Special Tool T2987-1) to threads of exhaust port cover screws.

C. Install new gaskets, plate and exhaust port cover to powerhead and secure with screws.

3. TRANSFER PORT COVER 09-16
TRANSFER PORT COVER GASKET 09-17

3-1. Removing #1 Cylinder Transfer Port Cover and Gasket

A. Remove C-D unit covering transfer port cover.

B. Disconnect hose from fitting on transfer port cover (1971 models and later).

C. Remove four (4) screws securing transfer port cover to powerhead and remove transfer port cover and gasket from powerhead.

D. Remove fitting from transfer port cover.

3-2. Installing #1 Cylinder Transfer Port Cover and Gasket

A. Apply Loctite H (Special Tool T2962) to threads of fitting. Install fitting on transfer port cover with end of barb pointing at 6 o'clock (1971 models and later).

B. Clean gasket surfaces on powerhead.

C. Install transfer port cover and new gasket on powerhead. Secure transfer port cover and gasket with four (4) screws.

D. Install C-D unit to powerhead.

NOTE

Refer to "Electrical Components" section for detailed procedures to be followed when installing C-D unit.

3-3. Removing #2 Cylinder Transfer Port Cover and Gasket

A. Disconnect hose from top cylinder drain cover and swing hose away from transfer port cover (1971 models and later).

B. Disconnect spark plug lead wires from clip on bottom rear screw.

C. Remove four (4) screws securing transfer port cover to powerhead and remove transfer port cover, gasket and lead wire retaining clip.

3-4. Installing #2 Cylinder Transfer Port Cover and Gasket

A. Clean gasket surfaces on powerhead.

B. Install transfer port cover and new gasket on powerhead.

C. Secure transfer port cover and gasket with four (4) screws.

NOTE

Spark plug lead wire clip is positioned under head of bottom rear screw.

3-5. Removing #3 Cylinder Transfer Port Cover and Gasket

A. Disconnect spark plug lead wires from retaining clip on top rear screw.

B. Disconnect hose from bottom cylinder drain cover (1971 models and later).

C. Remove three (3) screws securing fuel pump to transfer port cover and powerhead. Swing fuel pump assembly from transfer port cover.

D. Remove remaining screw from transfer port cover and remove transfer port cover and gasket from powerhead.

E. Disconnect hose from fitting on transfer port cover and remove fitting.

3-6. Installing #3 Cylinder Transfer Port Cover and Gasket

A. Apply Loctite H (Special Tool T2962) to threads of fitting.

B. Install fitting on transfer port cover with barb pointing at 3 o'clock.

C. Connect hose to fitting on transfer port cover.

D. Install transfer port cover assembly with new gasket on powerhead.

E. Install one (1) screw (shortest screw) to lower rear corner.

F. Swing fuel pump assembly over transfer port cover and secure fuel pump assembly and transfer port cover to powerhead with three (3) screws.

NOTE

Top rear screw has spark plug lead wire retaining clip under head of screw.

G. Connect spark plug lead wires to retaining clip.

H. Connect hose to bottom cylinder drain cover fitting.

3-7. Removing #4 Cylinder Transfer Port Cover and Gasket

A. Remove fuel sediment bowl and bail and nut assembly from fuel pump.

B. Remove four (4) screws securing bracket and transfer port cover to powerhead.

C. Remove bracket, transfer port cover and gasket from powerhead.

3-8. Installing #4 Cylinder Transfer Port Cover and Gasket

A. Install transfer port and new gasket to powerhead.

B. Install bracket on rear two (2) screw bosses of transfer port cover.

C. Install four (4) screws to secure bracket and port cover to powerhead.

4. CYLINDER DRAIN COVER 09-18 CYLINDER DRAIN COVER GASKET 09-19

4-1. Removing Upper Cylinder Drain Cover and Gasket

A. Disconnect hose from fitting on cylinder drain cover.

B. Remove four (4) screws securing cylinder drain cover to powerhead.

C. Remove cylinder drain cover and gasket from powerhead.

D. Remove fitting from cylinder drain cover.

4-2. Installing Upper Cylinder Drain Cover and Gasket

A. Apply Loctite H (Special Tool T2962) to threads of fitting. Install fitting on cylinder drain cover as follows:

1. For 1971 and later models, position end of barb at 10 o'clock.
2. For 1970 and earlier models, position end of barb at 4 o'clock.

B. Install cylinder drain cover and new gasket on powerhead and secure with four (4) screws.

C. Connect hose to fitting on cylinder drain cover.

4-3. Removing Lower Cylinder Drain Cover and Gasket

A. Disconnect hose from fitting on cylinder drain cover.

B. Remove four (4) screws securing cylinder drain cover to powerhead.

C. Remove cylinder drain cover and gasket from powerhead.

D. Remove fitting from cylinder drain cover.

4-4. Installing Lower Cylinder Drain Cover and Gasket

A. Apply Loctite H (Special Tool T2962) to threads of fitting. Install fitting to cylinder drain cover as follows:

1. For 1971 and later models, position end of barb at 12 o'clock.
2. For 1970 and earlier models, position end of barb at 1 o'clock.

B. Install cylinder drain cover and gasket on powerhead and secure with four (4) screws.

C. Connect hose to fitting on cylinder drain cover.

5. CARBURETOR ADAPTER FLANGE 09-20 REED PLATE ASSEMBLY 09-21 REED PLATE GASKET 09-23

5-1. Removing Top Carburetor Adapter Flange and Reed Plate Assemblies

A. Remove carburetor as outlined in appropriate section and paragraph.

B. Remove choke solenoid with bracket by removing four (4) screws securing bracket to powerhead.

C. Disconnect balance tube from carburetor adapter flange.

D. Remove remaining six (6) screws securing carburetor adapter flange to powerhead. Remove both carburetor adapter flange and deflector plate with reed plate assemblies.

E. Separate carburetor adapter flange from deflector plate assembly and remove adapter flange gasket.

F. Remove each reed plate from deflector plate by removing two (2) flat head screws securing same.

G. Remove reed plate gasket from deflector plate.

5-2. Installing Top Carburetor Adapter Flange and Reed Plate Assemblies

A. Clean gasket surfaces on all parts.

B. Install reed plate gasket on deflector plate and install reed plate assembly.

C. Secure each reed plate assembly with two (2) flat head screws.

D. Install carburetor adapter flange gasket on deflector plate assembly and install carburetor adapter flange.

E. Install adapter flange with deflector plate assembly on powerhead and connect balance tube to fitting on adapter flange.

F. Secure adapter flange and deflector plate assembly to powerhead with six (6) screws (short) leaving lower two (2) holes for choke solenoid bracket.

G. Install choke solenoid bracket with choke solenoid on adapter flange and secure with four (4) screws (long).

H. Install carburetor as outlined in appropriate section and paragraph.

I. Adjust choke solenoid as outlined in Section V, paragraph 3-4.

5-3. Removing Bottom Carburetor Adapter Flange and Reed Plate Assembly

A. Remove bottom carburetor as outlined in appropriate section and paragraph.

B. Remove choke solenoid bracket by removing four (4) screws securing bracket to powerhead.

C. Disconnect balance tube from carburetor adapter flange.

D. Remove elastic stop nut securing throttle cam to carburetor adapter flange. Remove throttle cam and two (2) nylon bearings.

E. Remove remaining screws securing carburetor adapter flange and deflector plate to powerhead and remove carburetor adapter flange and deflector plate with reed plate assemblies.

F. Separate carburetor adapter flange from deflector plate and remove carburetor adapter flange gasket.

G. Remove each reed plate assembly from deflector plate by removing two (2) flat head screws securing same.

H. Remove reed plate gasket from deflector plate.

5-4. Installing Bottom Carburetor Adapter Flange and Reed Plate Assembly

A. Clean gasket surfaces on all parts.

B. Install reed plate gasket on deflector plate.

C. Install reed plate assemblies on deflector plate and secure each reed plate assembly with two (2) flat head screws.

D. Install carburetor adapter flange gasket on deflector plate and install carburetor adapter flange on deflector plate.

E. Install above parts on powerhead.

F. Secure carburetor adapter flange and deflector plate assembly to powerhead with six (6) screws leaving upper two holes for choke solenoid bracket. Connect balance tube to fitting on adapter flange.

G. Install choke solenoid bracket with choke solenoid on adapter flange and secure with four (4) screws (long).

H. Install carburetor as outlined in appropriate section and paragraph.

I. Adjust choke solenoid as outlined in Section V, paragraph 3-4.

J. Install throttle cam with nylon bearing on each side of cam on stud of carburetor adapter flange and secure with elastic stop nut. Tighten elastic stop nut enough so that throttle cam pivots freely but with no side play on stud of carburetor adapter flange.

K. Adjust throttle pick-up as outlined in Section V, paragraph 3-2.

6. REED PLATE REEDS 09-22

6-1. Removing Reed Plate Reeds

A. Remove reed plate assembly as outlined in Section XVIII, paragraph 5-1.

B. Remove five (5) screws securing reed stop and reeds on each side of reed plate.

C. Remove reed stops and reeds.

6-2. Installing Reed Plate Reeds

A. Install one (1) 4 petal and one (1) single petal reed set on each side of reed plate.

B. Position reeds over reed plate openings so that reeds overlap openings by at least .040".

C. Install reed stops and secure reeds and reed stops to reed plate with five (5) screws on each side of reed plate.

D. Check reed stop openings. Reed stop opening is .28 $\pm$ .010".

E. Check reeds for warpage. Reeds are allowed to stand open a maximum of .010". If reeds are standing open more than .010" remove and straighten reeds.

F. Install reed stop assembly as outlined in Section XVIII, paragraph 5-2.

7. CRANKSHAFT BEARING CAGE 09-24 CRANKSHAFT BEARING SEAL 09-25

7-1. Removing Crankshaft Bearing Cage Assembly

A. Remove flywheel and stator plate as outlined in Section VIII.

B. Remove crankshaft bearing cage assembly by removing screws securing same to powerhead.

C. Press crankshaft bearing seal out of bearing cage.

D. Remove bearing cage seal from groove on top of powerhead.

7-2. Installing Crankshaft Bearing Cage Assembly

A. Clean gasket surfaces on bearing cage and powerhead.

B. Position crankshaft bearing seal on bore of crankshaft bearing cage with major sealing lip with garter spring towards inside of crankcase. Press seal in bore of bearing cage using seal installer (Special Tool T8903) as shown in figure 2.

C. Install new bearing cage seal ("O" ring seal) on bearing cage assembly.

D. Apply a bead of sealant (Special Tool T8955) around surface of bearing cage halfway between screw holes and "O" ring seal.

E. Install seal protector (Special Tool T8915) on top of crankshaft. Apply grease (Special Tool T2961) between lips of crankshaft seal. Install bearing cage assembly on seal protector. Slide bearing cage down crankshaft on powerhead.

F. Align holes of bearing cage with holes in powerhead. Apply sealant (Special Tool

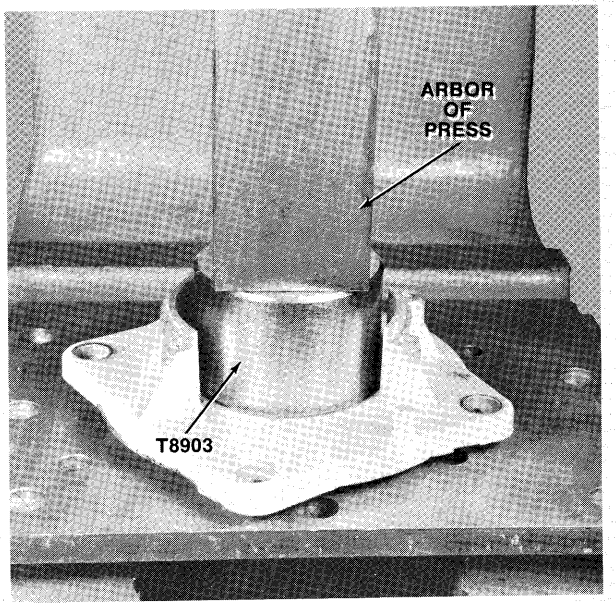


Figure 2–Installing Crankshaft Bearing Seal

T8955) to threads of bearing cage screws. Install screws to secure bearing cage to powerhead.

G. Install stator and flywheel as outlined in Section VIII.

7A. CRANKSHAFT BEARING CAGE CRANKSHAFT BEARING CAGE SEAL (Magnapower II Ignition System)

7A-1. Removing Crankshaft Bearing Cage Assembly

A. Remove flywheel as outlined in Section VIII, paragraph 1-1.

B. Remove timing ring retainer and C-D module as outlined in Section XA, paragraph 8-1.

C. Remove alternator stator module as outlined in Section XA, paragraph 9-1.

D. Remove regulator-rectifier module as outlined in Section XA, paragraph 11-7.

E. Remove trigger modules as outlined in Section XA, paragraph 12-1.

F. Remove timing ring as outlined in Section XA, paragraph 13-1.

G. Remove five (5) screws securing bearing cage to powerhead and remove same from engine.

H. Press crankshaft bearing cage seal out of bearing cage.

7A-2. Installing Crankshaft Bearing Cage Assembly

A. Clean gasket surfaces on bearing cage and powerhead.

B. Position bearing cage seal on bore of bearing cage with major sealing lip down towards inside of crankcase. Press seal in bore of bearing cage using seal installer (Special Tool T8903).

C. Apply a bead of sealant (Special Tool T8983) around surface of bearing cage as shown in figure 2A.

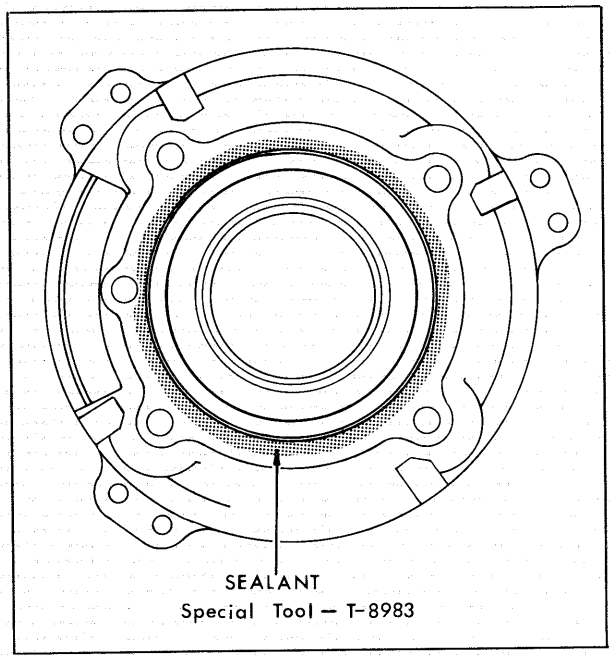


Figure 2A - Area Requiring Sealant

D. Install seal protector (Special Tool T8915) on top of crankshaft. Apply grease (Special Tool T2961) between lips of crankshaft seal. Install bearing cage assembly on seal protector. Slide bearing cage down crankshaft on powerhead.

E. Align holes in bearing cage with holes on powerhead. Apply sealant (Special Tool T8955) to threads of bearing cage screws. Install screws and tighten securely.

F. Install timing ring as outlined in Section XA, paragraph 13-2.

G. Install trigger modules as outlined in Section XA, paragraph 12-2.

H. Install regulator-rectifier as outlined in Section XA, paragraph 11-2.

I. Install alternator stator module as outlined in Section XA, paragraph 9-2.

J. Install timing ring retainer and C-D module as outlined in Section XA, paragraph 8-2.

K. Install flywheel as outlined in Section VIII, paragraph 1-2.

8. THROTTLE TOWERSHAFT 09-26

8-1. Removing Towershaft

A. Remove distributor complete as outlined in Section XII, paragraph 4-1.

B. Disconnect throttle link from rod end connector stud on towershaft.

C. Remove four (4) screws securing towershaft to powerhead and lift towershaft from powerhead.

8-2. Installing Towershaft

A. Install towershaft with bottom end in bearing in spacer plate.

B. Align holes in nylon bearings with holes on powerhead and secure towershaft to powerhead with four (4) screws.

C. Connect throttle link to towershaft and check throttle shutters to see that they are horizontal at wide open throttle. Readjust if necessary.

D. Install distributor as outlined in Section XII, paragraph 4-2.

8A. THROTTLE TOWERSHAFT (Magnapower II Ignition System)

8A-1. Removing Towershaft

A. Remove flywheel as outlined in Section VIII, paragraph 1-1.

B. Remove screw, bowed washer and stop nut securing towershaft to towershaft control rod end as shown in figure 2B.

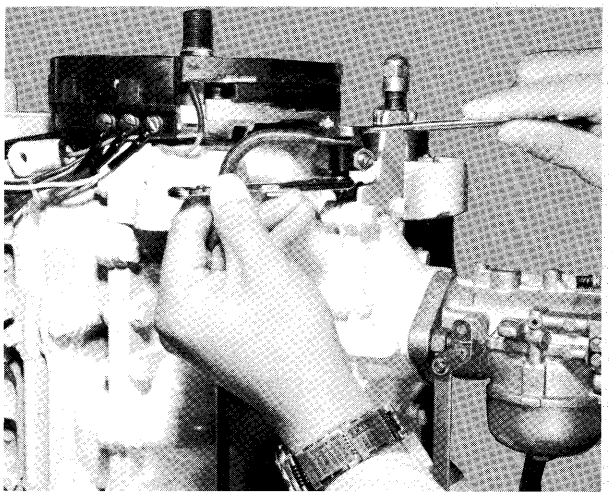


Figure 2B - Disconnecting Towershaft from Control Rod End

C. Remove retaining ring from towershaft as shown in figure 2C.

D. Unsnap throttle link from rod end connector stud on towershaft.

E. Remove two (2) screws securing towershaft and towershaft bearing to powerhead.

F. Remove regulator-rectifier as outlined in Section XA, paragraph 11-1.

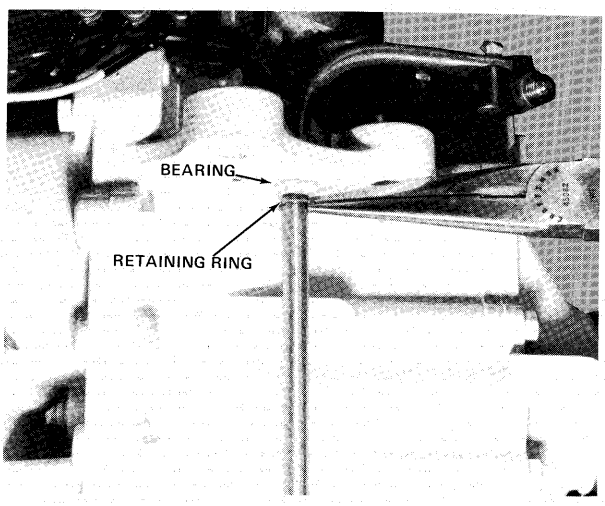


Figure 2C - Removing Retaining Ring

G. Slide bearing from upper towershaft mounting hole. Lift towershaft assembly up and away from powerhead and remove same from engine. See figure 2D.

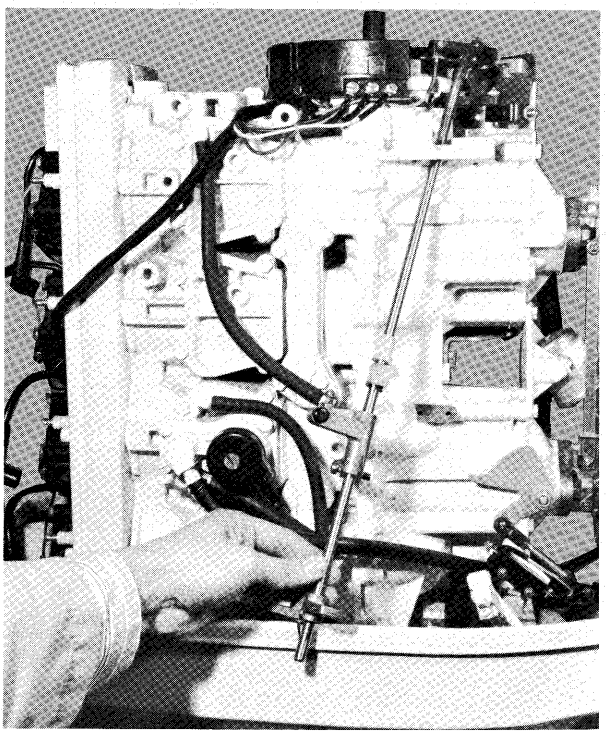


Figure 2D - Removing Towershaft

8A-2. Installing Towershaft

A. Install curved end of towershaft in upper mounting hole, lift towershaft assembly up and position lower end of towershaft in lower mounting hole.

B. Slide upper towershaft bearing in upper mounting hole. Position lower bearing over mounting bosses, install two (2) screws and tighten securely.

C. Install retaining ring as shown in figure 2C.

D. Install regulator-rectifier as outlined in Section XA, paragraph 11-2.

E. Connect throttle link to rod end connector stud on towershaft.

F. Install screw, bowed washer and hex nut securing towershaft to towershaft control rod end.

G. Install flywheel as outlined in Section VIII, paragraph 1-2.

9. BY-PASS COVER
BY-PASS VALVE 09-29
BY-PASS SPRING 09-30

9-1. Removing By-Pass Cover, Valve and Spring

A. Remove two (2) screws securing by-pass cover to powerhead.

B. Remove by-pass cover, valve and spring from powerhead.

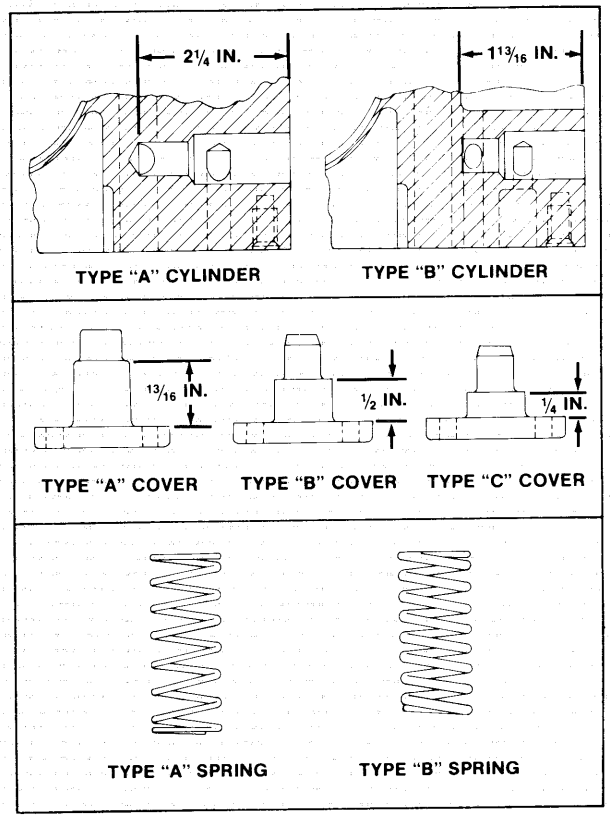


Figure 3–Water By-pass Components

9-2. Installing By-Pass Cover, Valve and Spring

A. Clean gasket surfaces on all parts.

B. Install new gasket on by-pass cover.

C. Install spring on by-pass cover, then valve on end of spring.

IMPORTANT

Note which type of by-pass valve cover, spring and cylinder being used. See figure 3 for identification of same. It is important that the correct combination be used or overheating problems may occur.

Type "A" cylinder uses type "A" cover with only type "A" spring.

Type "A" cylinder also uses type"B" cover with only type "B" spring.

Type "B" cylinder uses only type "C" cover and type "B" spring.

D. Install assembly on powerhead and secure with two (2) screws.

10. POWERHEAD
EXHAUST TUBE 08-31
SPACER PLATE 08-33
CYLINDER EXHAUST GASKET — UPPER 09-31
CYLINDER EXHAUST GASKET — LOWER 09-32

10-1. Removing Powerhead

A. Remove motor leg cover—rear as outlined in Section XVI, paragraph 1-1.

B. Remove six (6) elastic stop nuts securing powerhead to motor leg.

C. Remove fuel pump assembly from transfer port cover as outlined in Section XIII, paragraph 1-1.

D. Remove distributor from powerhead as outlined in Section XII, paragraph 4-1.

E. Remove towershaft as outlined in Section XVIII, paragraph 8-1.

F. Remove top elastic stop nut securing shift rod—upper to interlock arm.

G. Remove nut securing lead wire to choke solenoid and remove lead wire from solenoid.

H. Remove all lead wires from starter relay and clamp holding wiring harness at base of starter relay.

I. Remove battery "ground" lead wire from crankcase cover.

J. Remove "ground" lead wire from powerhead.

K. Remove remote electric cable lead wires from terminal block and clamp.

L. Remove six (6) hex head bolts securing spacer plate to motor leg.

M. Lift powerhead, spacer plate and exhaust tube from motor leg using hoist and lifting hook (Special Tool T8933) on end of crankshaft.

N. Remove cylinder exhaust gasket—lower.

O. Remove four (4) screws securing exhaust tube to spacer plate.

P. Remove four (4) elastic stop nuts securing spacer plate to base of powerhead and remove spacer plate.

Q. Remove cylinder exhaust gasket—upper.

10-2 Installing Powerhead

A. Clean all gasket surfaces.

B. Apply Sealant (Special Tool T8955) to both sides of cylinder exhaust gasket—upper in area between two (2) forward stud holes. Install cylinder exhaust gasket—upper on powerhead.

C. Install spacer plate on cylinder exhaust—upper and secure with four (4) elastic stop nuts. Torque nuts to 270 In. Lbs.

D. Install exhaust tube to spacer plate and secure with four (4) screws. Before installing screws, apply Anti-Seize (Special Tool T2987-1) to threads of screws. Torque screws to 70 In. Lbs.

E. Install cylinder exhaust gasket—lower to top of motor leg aligning holes of gasket with holes in motor leg.

F. Install powerhead on motor leg aligning studs with holes in motor leg and driveshaft splines with crankshaft.

G. Secure powerhead to motor leg with six (6) screws through spacer plate and six (6) stop nuts on studs on powerhead. Torque bolts and nuts to 270 in. lbs.

H. Connect lead wires of remote electric cable to terminal block.

I. Connect "ground" lead wire from support plate to exhaust port cover screw (Delta system only).

J. Connect lead wires to starter relay as outlined in appropriate section and paragraph.

K. Connect battery cable "ground" lead to crankcase cover.

L. Connect choke lead wire to choke solenoid and secure with hex nut and spring lockwasher. Retain lead wire to body of solenoid with ty-rap or retaining band.

M. Install elastic stop nut to secure shift rod—upper to interlock arm. Check adjustment of interlock arm as follows:

1. Set engine in exact neutral gear position (middle of shift rod—upper travel between forward and reverse gear position).
2. Adjust interlock arm position so that top of interlock arm is even with top of neutral stop on towershaft. Adjustment is made by turning stop nut above interlock arm and nut below interlock arm.

N. Install towershaft as outlined in Section XVIII, paragraph 8-2.

O. Install distributor as outlined in Section XII, paragraph 4-2.

P. Install fuel pump assembly as outlined in Section XIII, paragraph 1-2.

Q. Install motor leg cover—rear as outlined in Section XVI, paragraph 1-2.

11. SHORT BLOCK 09-33

11-1. Removing Short Block

A. Remove flywheel and stator plate as outlined in Section VIII.

B. Remove crankshaft bearing cage as outlined in Section XVIII, paragraph 7-1.

C. Remove carburetors as outlined in appropriate sections and paragraphs.

D. Remove carburetor adapter flange and reed plate assemblies as outlined in Section XVIII, paragraph 5-1.

E. Remove distributor as outlined in Section XII, paragraph 4-1.

F. Remove towershaft as outlined in Section XVIII, paragraph 8-1.

G. Remove fuel pump as outlined in Section XIII, paragraph 1-1.

H. Remove C-D unit as outlined in appropriate section and paragraph.

I. Remove cylinder drain covers as outlined in Section XVIII, paragraph 4-1 and 4-3.

J. Remove transfer port covers as outlined in Section XVIII, paragraphs 3-1, 3-3, 3-5 and 3-7.

K. Remove cylinder head as outlined in Section XVIII, paragraph 1-1.

L. Remove cylinder exhaust port cover, plate and gaskets as outlined in Section XVIII, paragraph 2-1.

M. Remove wiring harness as outlined in appropriate section and paragraph.

N. Remove terminal block bracket assembly as outlined in appropriate section and paragraph.

O. Remove rectifier as outlined in appropriate section and paragraph.

P. Remove starter as outlined in Section XI, paragraph 1-1.

Q. Remove powerhead, exhaust tube and spacer plate as outlined in Section XVIII, paragraph 10-1.

11-2. Installing Short Block

A. Install spacer plate and exhaust tube on short block and install on motor leg as outlined in Section XVIII, paragraph 10-2.

B. Install starter as outlined in Section XI, paragraph 1-2.

C. Install rectifier as outlined in appropriate section and paragraph.

D. Install terminal block bracket assembly as outlined in appropriate section and paragraph.

E. Install wiring harness as outlined in appropriate section and paragraph.

F. Install cylinder exhaust port cover, plate and gaskets as outlined in Section XVIII, paragraph 2-2.

G. Install cylinder head as outlined in Section XVIII, paragraph 1-2.

H. Install transfer port covers as outlined in Section XVIII, paragraphs 3-2, 3-4, 3-6 and 3-8.

I. Install cylinder drain covers as outlined in Section XVIII, paragraphs 4-2 and 4-4.

J. Install fuel pump assembly as outlined in Section XIII, paragraph 1-2.

K. Install towershaft as outlined in Section XVIII, paragraph 8-2.

L. Install distributor as outlined in Section XII, paragraph 4-2.

M. Install carburetor adapter flange and reed plate assemblies as outlined in Section XVIII, paragraph 5-2.

N. Install carburetors as outlined in appropriate sections and paragraphs.

O. Install crankshaft bearing cage assembly as outlined in Section XVIII, paragraph 7-2.

P. Install flywheel and stator plate as outlined in Section VIII.

12. CRANKSHAFT 09-44
CRANKCASE SEAL 09-35
CENTER MAIN BEARING 09-36
LOWER MAIN BEARING 09-37
CRANKSHAFT LOWER SEAL 09-45
CONNECTING ROD NEEDLE BEARINGS 09-38

12-1. Removing Crankshaft Assembly

A. Remove powerhead as outlined in Section XVIII, paragraph 10-1.

B. Remove carburetor, carburetor adapter flanges and deflector plate assemblies as outlined in Section XVIII, paragraph 5-1.

C. Remove crankshaft bearing assembly as outlined in Section XVIII, paragraph 7-1.

D. Remove main bearing bolts and crankcase parting line screw.

NOTE

As bolts and screws are being removed, note different lengths. Longer length bolts or screws are a result of different boss heights and/or because they are securing brackets. Also note that two (2) top crankcase parting line screws (one (1) on each side) are assembled from the opposite side.

E. Drive two (2) dowel pins positioning crankcase cover on cylinder out as shown in figure 4.

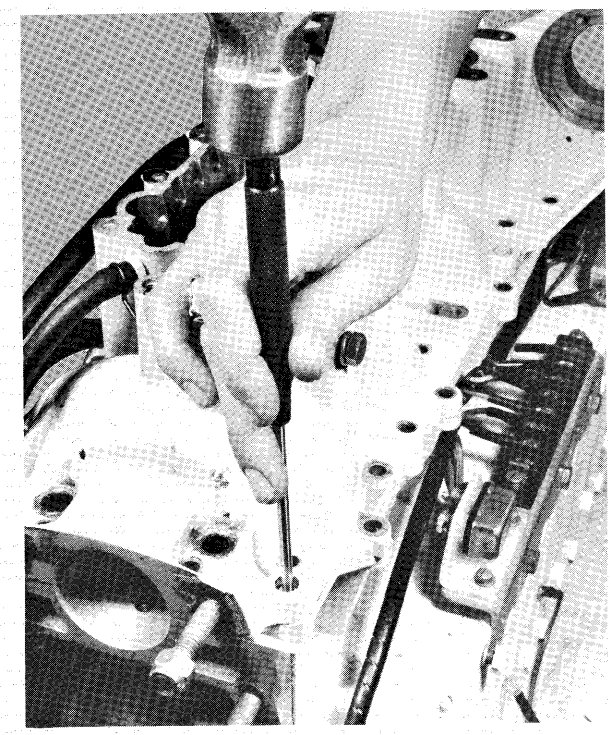


Figure 4–Driving Out Dowel Pins

F. Pry crankcase cover from cylinder using large screwdriver at each pry point as shown in figure 5.

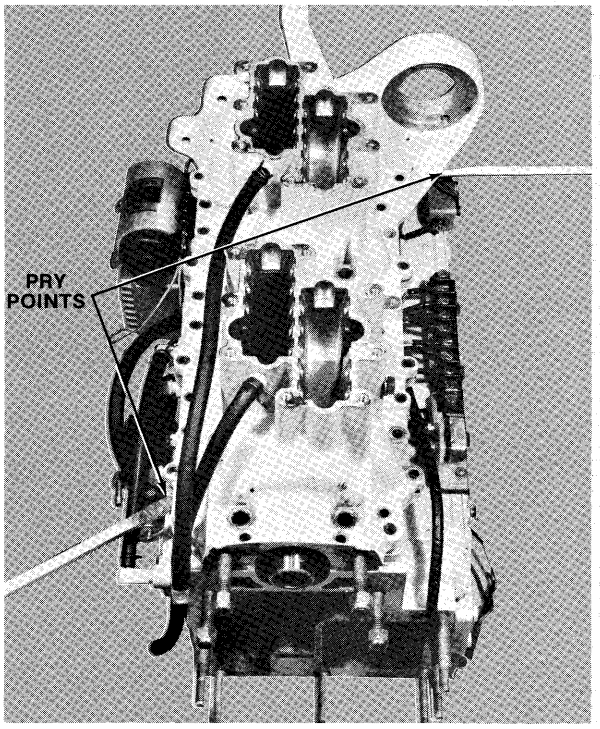


Figure 5–Prying Crankcase Cover

Lift crankcase cover from cylinder exposing crankshaft and main bearings.

G. Remove crankcase parting line seal from groove in cylinder.

H. Remove connecting rod cap screws using 12 point socket (Special Tool T2953) as shown in figure 6.

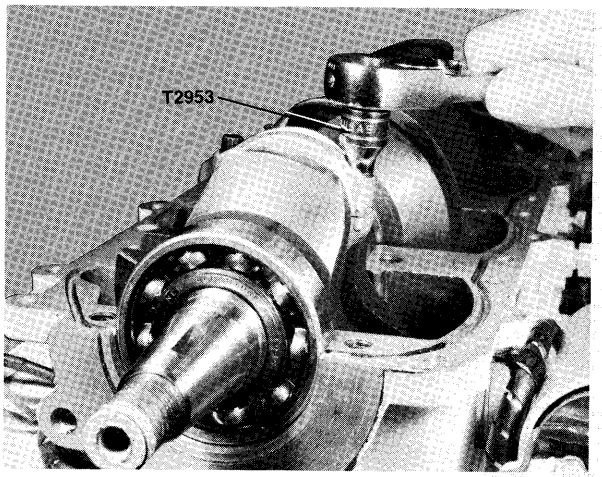


Figure 6–Removing Rod Cap Screws

Mark each rod cap showing position in cylinder as rod caps are removed.

I. Remove crank pin needle bearings and cages from crankshaft throws.

NOTE

Be sure to group rollers and cages with respective rod cap. Do not at any time mix needles and/or cages of one rod cap with another.

J. Lift crankshaft with main bearings from cylinder.

K. Remove snap ring from groove in main bearing as shown in figure 7. Remove center main bearing race and caged rollers.

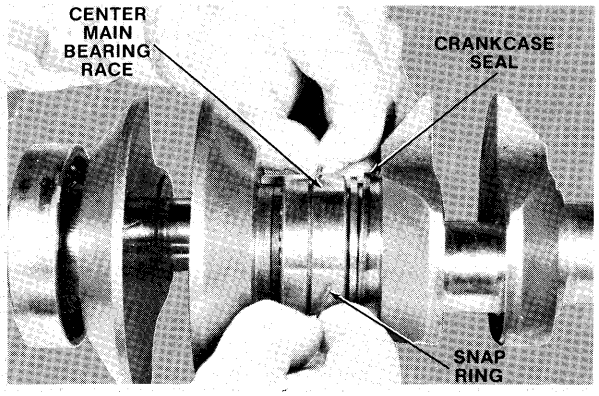


Figure 7–Removing Main Bearings

L. Remove crankcase seal from groove in crankshaft next to main bearing. See figure 7. Be sure to group all components of each main bearing group together — do not mix. See figure 8.

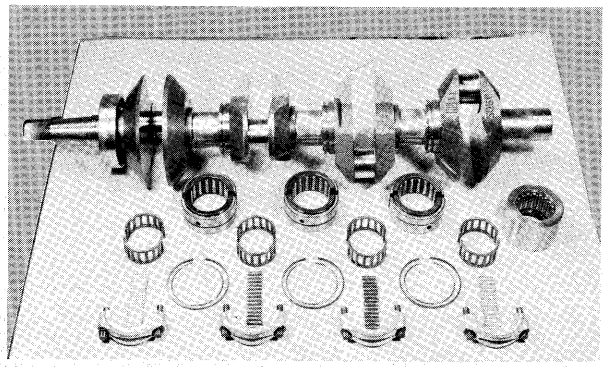


Figure 8–Grouping Parts

M. Slide lower main bearing with seal off bottom end of crankshaft.

N. To remove crankshaft lower seal, re-install lower main bearing assembly on end of crankshaft and insert screwdriver between seal and bearing. Twist screwdriver and pry seal out of bearing case as shown in figure 9.

12-2. Installing Crankshaft Assembly

A. Clean all gasket surfaces and crankcase parting line surfaces.

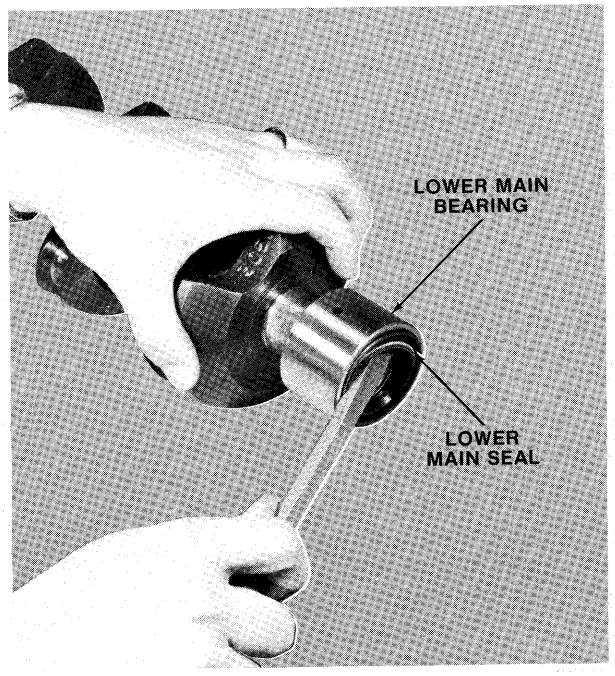


Figure 9–Prying Seal Out of Bearing

B. Press seal in lower main bearing case positioning garter spring out using seal installer (Special Tool T8925). Press seal in until tool bottoms on bearing case.

C. Apply grease (Special Tool 2961) between lips of crankshaft lower seal. Install lower main bearing assembly on bottom of crankshaft.

D. Install center main bearings on crankshaft with holes in bearing race between groove of snap ring on race and groove of crankcase seal on crankshaft. Secure race on crankshaft with snap ring being certain not to have gap of snap ring over fracture in main bearing race.

E. Scrape old Loctite off outer diameter of upper main bearing. Clean bearing surface with Locquic (Special Tool T8935). Apply a bead of Loctite retaining compound around outer surface of bearing.

F. Apply grease (Special Tool T2961) to crankcase seal groove in crankshaft to retain seal in groove. Install crankcase seal in each groove in crankshaft.

G. Install crankshaft assembly on cylinder. Align large hole of each main bearing in locating pins in cylinder main bearing bores.

H. Examine crank pin needle bearing cages. Note that each cage is notched on one (1) side as shown in figure 10. Notched side is always toward upper main bearing.

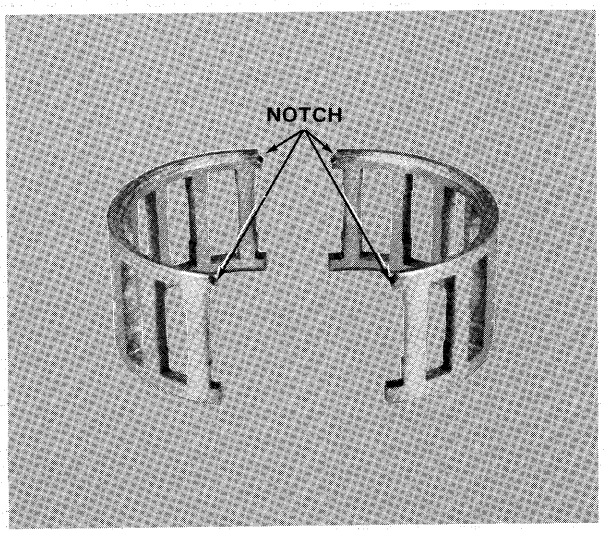


Figure 10–Crank Pin Needle Bearing Cage

Install crank pin needle bearing cage half in connecting rod with notched side towards upper main bearing. Apply a light coating of grease (Special Tool T2961) on cage half. Install seven (7) needles in cage half. Pull rod with cage half and needles up and against crank pin throw. Install crank pin needle bearing cage half on crank pin throw with notched side towards upper main bearing. Apply light coating of grease on cage half. Install remaining nine (9) needles.

I. Install rod cap over crank pin needle bearing and cage with match mark on rod shank aligned with match mark on rod cap as shown in figure 11.

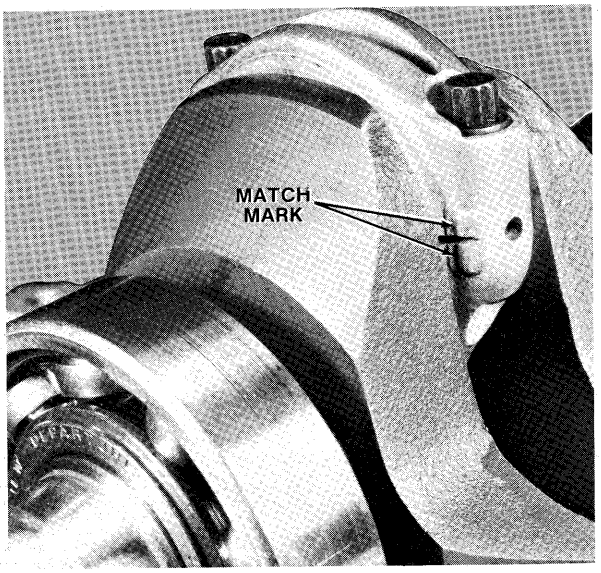


Figure 11–Match Marks on Connecting Rod

If connecting rod has a sanded surface across fracture joint on screw bosses, torque rod

cap screw to 15 In. Lbs. maximum. Check for rod cap off set by lightly running a sharp lead pencil across sanded area. If offset is present, pencil will stop at fracture joint. Loosen rod cap screws. Reset rod cap on connecting rod and re-torque rod cap screws to 15 In. Lbs. Recheck for offset. If offset is still present, replace connecting rod.

J. Torque cap screws to 170 ± 5 In. Lbs. using torque wrench (Special Tool T2999) and 12 point socket (Special Tool T2953).

K. Follow steps H through J for remaining connecting rods.

L. Install new crankcase parting line seal in grooves of cylinder.

M. Apply sealant (Special Tool T8955) to areas between cylinders inside of seal groove and areas of both upper and lower main bearings on both sides of seal groove.

N. Install crankcase cover on cylinder. Drive in two (2) dowel pins to locate crankcase cover on cylinder. Apply sealant (Special Tool T8955) on threads of crankcase bolts. Install bolts as shown in figure 12. Torque bolts to 270 In. Lbs. from center of crankcase and outward.

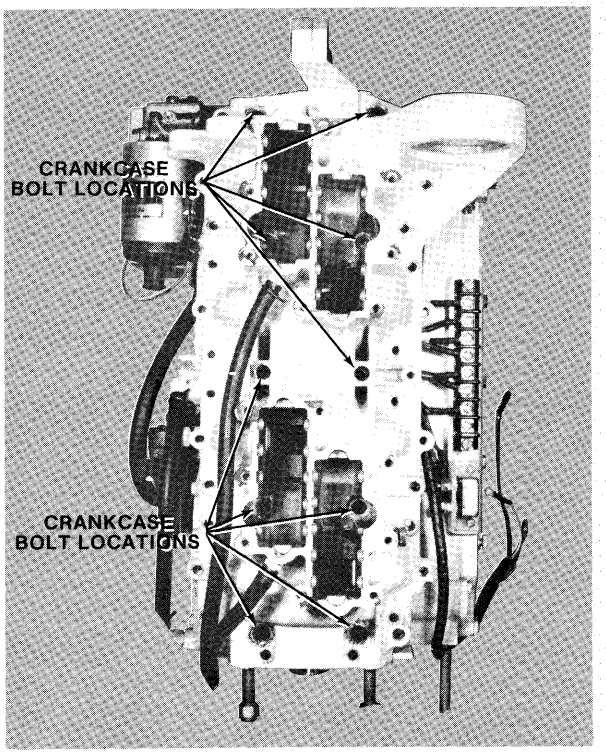


Figure 12–Crankcase Bolt Locations

O. Install crankcase parting line screws.

P. Install crankcase bearing cage assembly as outlined in Section XVIII, paragraph 7-2.

Q. Install carburetors, carburetor adapter flanges and deflector plate assemblies as outlined in Section XVIII, paragraph 5-2.

R. Install powerhead as outlined in Section XVIII, paragraph 10-2.

13. CONNECTING ROD 09-39 PISTON 09-40 PISTON PIN 09-41 PISTON RING 09-42

13-1. Removing Piston Assembly

A. Remove cylinder head as outlined in Section XVIII, paragraph 1-1.

B. Follow disassembly procedures as outlined in Section XVIII, paragraph 12-1.

C. Push piston assembly out of cylinder bore.

D. Remove piston rings from piston using piston ring expander (Special Tool T8926) as shown in figure 13.

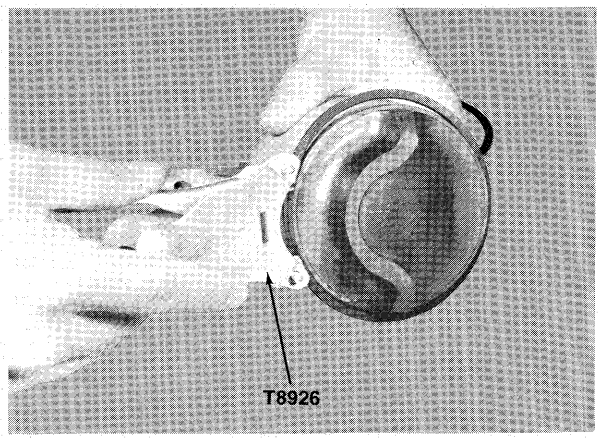


Figure 13–Removing Piston Rings

E. Remove piston pin from piston assembly using piston pin tool (Special Tool T2990) as outlined below:

1. Place piston on pillow block with piston pin aligned with hole in pillow block.
2. Install stepped end of drive pin in I.D. of piston pin.
3. Insert end of shim bar marked "295" between large diameter of spacer and needles.

NOTE

The shim bar has two (2) slots which are marked "310" and "295." The "310"

marked end is used for installation of piston pin. The "295" marked end is used primarily for removal of piston pin because it will readily slide between spacer and connecting rod. In very rare cases, it may be necessary to use the "295" end for installation of piston pin if the "310" end will not slide in.

4. Press piston pin out as shown in figure 14.

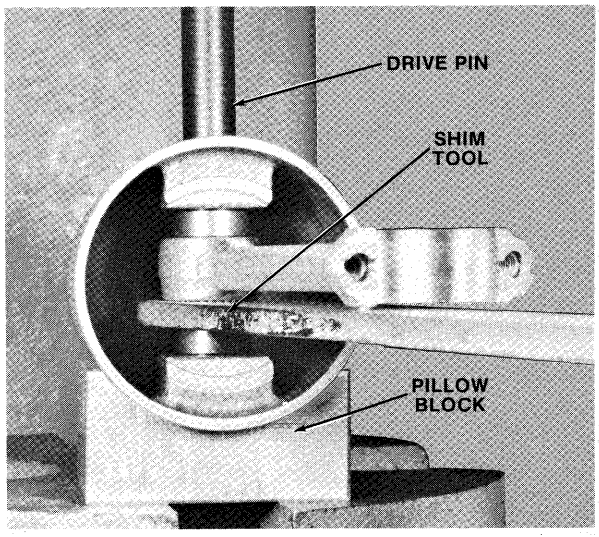


Figure 14–Pressing Out Piston Pin

F. Remove connecting rod, piston pin spacers and needles from piston exercising care so as not to lose any needles from connecting rod.

NOTE

There are 26 needles per bearing set.

13-2. Installing Piston Assembly

A. Install alignment pin from piston tool set through one (1) side of piston.

B. Install spacer on alignment pin with small diameter end of spacer towards inside of piston or towards connecting rod when installed.

C. Install piston pin needle bearings (quantity—26 per set) in piston pin bore of connecting rod.

NOTE

If old needles are being used, coat bore of connecting rod with grease (Special Tool T2961) to retain needles. Then press needles firmly against bore of connecting rod.

D. Install connecting rod with needles on alignment pin with match mark on crank pin end of connecting rod towards intake side of piston. See figure 14. This will position match mark of connecting rod "up" or always toward flywheel end of crankshaft.

E. Push alignment pin through connecting rod. Then install other spacer with small diameter end of spacer towards connecting rod.

F. Push alignment through other spacer and in piston pin bore on other side of piston.

G. Install shim bar with end marked "310" between large diameter end of first spacer which was installed and connecting rod. See figure 15.

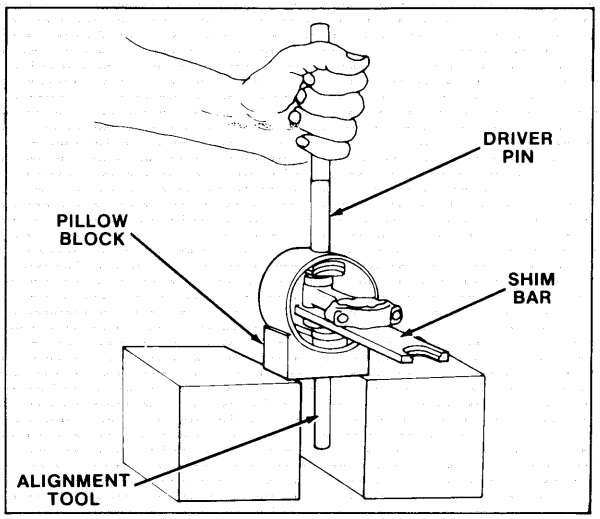


Figure 15–Piston With Components and Tools

H. Observe that slots each end of shim tool have a step. This step is clearance for piston pin needles.

NOTE

The "295" marked end is used primarily for removal of piston pin because it will readily slide between spacer and connecting rod. In very rare cases, it may be necessary to use the "295" end for installation of piston pin if the "310" end will not slide in.

I. Place above assembly on pillow block. Install piston pin on bore of piston. Install driver pin with stepped end in end of piston pin. Press piston pin in bore of piston while holding alignment tool as shown in figure 16. Press piston pin until it is centered in piston.

J. If a new piston pin needle bearings were installed, apply a liberal amount of motor oil on them. Connecting rod must slide easily between clearance of the two (2) spacers.

K. Install piston rings on piston with bevel on piston ring positioned up as shown in figure 17.

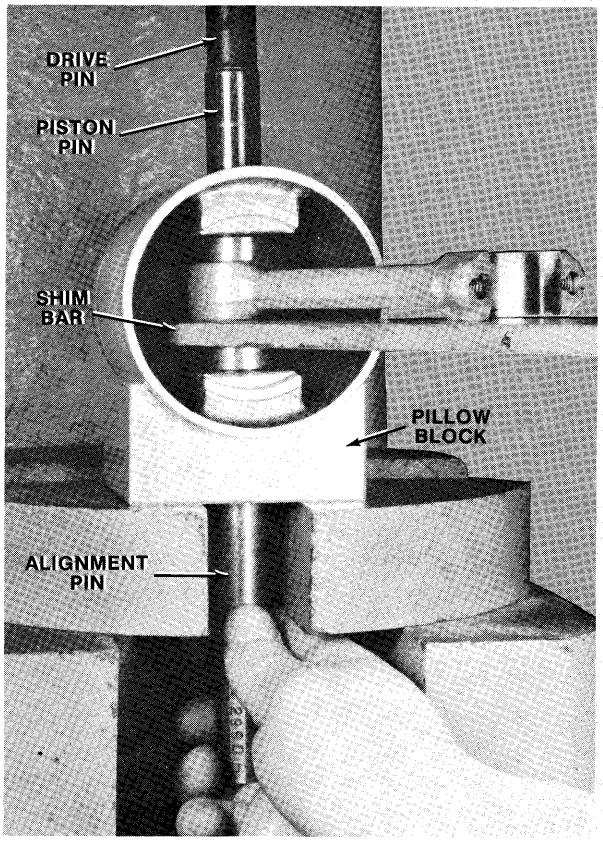


Figure 16–Installing Piston Pin

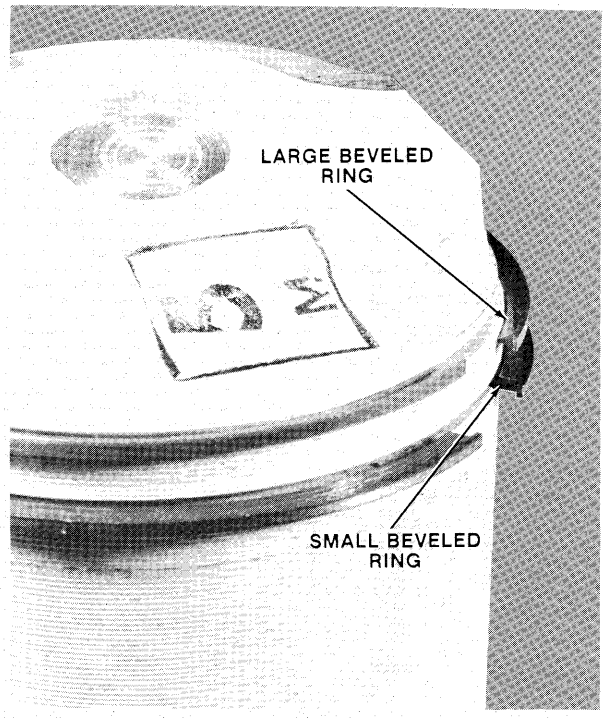


Figure 18–Piston Rings for 130 and 150 H.P. Models

L. Install piston assemblies in cylinder using ring compressor (Special Tool T2996) as shown in figure 19. Position pistons in cylinder with intake baffle on piston on intake side of cylinder.

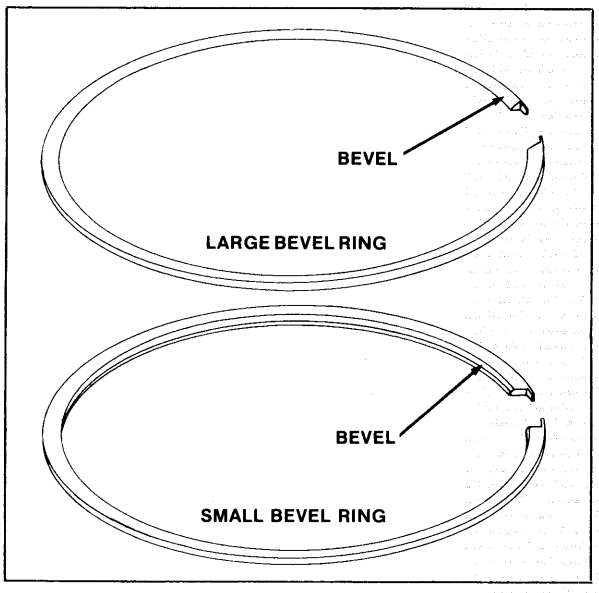


Figure 17–Bevel on Piston Ring

NOTE

On 130 H.P. and 150 H.P. models, there are two (2) different rings used per piston. The small beveled ring is positioned in the bottom ring groove. The large beveled ring is positioned in the top ring groove as shown in figure 18.

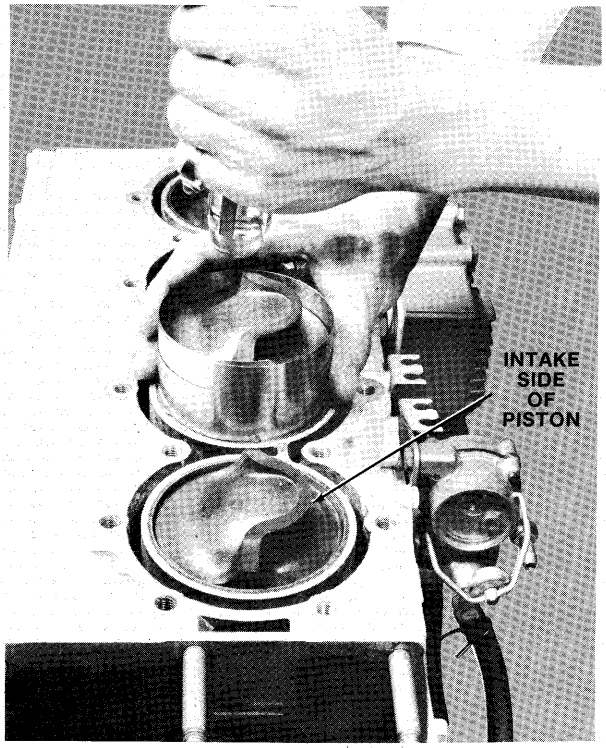


Figure 19–Installing Piston

M. Install crankshaft assembly and complete assembly of powerhead as outlined in Section XVIII, paragraph 12-2.

N. Install cylinder head as outlined in Section XVIII, paragraph 1-2.

14. CYLINDER ASSEMBLY 09-34

14-1. Removing Cylinder Assembly

Follow disassembly procedures as outlined in Section XVIII, paragraph 11-1.

B. Remove crankshaft assembly as outlined in Section XVIII, paragraph 12-1.

C. Remove piston assemblies as outlined in Section XVIII, paragraph 13-1.

14-2. Installing Cylinder Assembly

A. Install pistons assemblies as outlined in Section XVIII, paragraph 13-2.

B. Install crankshaft assembly as outlined in Section XVIII, paragraph 12-2.

C. Complete assembly as outlined in Section XVIII, paragraph 11-2.