ESKA 3, 3.5, 4.5, 5, 5.5, 7 AND 7.5 HP (1969-1985)

Year Produced	Model No.	HP	Tecumseh Power Head
1969	1188, 1700, 1703, 1703A, 1704, 1709, 1713, 1713A	3.5	AV-520
	1189, 1194, 1701, 1705, 1706, 1710, 1715	5	AV-600
	1186, 1199, 1702, 1707, 1708, 1711, 1717	7	AV-750
1970	1188, 1703B, 1704B, 1709B, 1713B, 1723B	3.5	AV-520
	1189B, 1194B, 1701B, 1705B, 1706B, 1715B, 1733B	5	AV-600
	1199, 1702B, 1707B, 1708B, 1717B, 1723B, 1734B	7	AV-750
1971	1703C, 1713C, 1770A	3.5	AV-520
	1701C, 1705C, 1706C, 1715C, 1733C, 1766A, 1771A	5	AV-600
	1702C, 1708C, 1721A, 1727A, 1745A, 1747A, 1767A, 1772A, 1777A	7	AV-750
1972	1703D, 1713D, 1770B, 1788A, 1791A	3.5	AV-520
	1705D, 1706D, 1715D, 1766B, 1771B, 1784A, 1789A	5	AV-600
	1727B, 1746A, 1747B, 1756A, 1767B, 1772B, 1776A, 1790A	7	AV-817
1973	1929A, 1945A	3.5	AV-520
	1903A	4.5	AV-520
	1705E, 1908A, 1913A, 1928A, 1930A	5	AV-600
	1747C, 1931A	7	AV-817
	1905A, 1909A, 1914A, 1932A, 1966A	7.5	AV-817
1974	1929B, 1945B	3.5	AV-520
	1903B	4.5	AV-520
	1705F, 1908B, 1913B, 1928B, 1930B	5	AV-600
	1747D, 1931B	7	AV-817
	1905B, 1909B, 1914B, 1932B, 1944B	7.5	AV-817
1975	1973A	3	AV-520
	1903C, 1941B, 1974A	4.5	AV-520
	1997A	5	AV-600
	1904A, 1904B, 1910A, 1969A, 1970A, 1975A	5.5	AV-600
	1905C, 1909C, 1914C, 1944C, 1966C, 1967C, 1976A	7.5	AV-817
1976	1973B	3	AV-520
	1974B	4.5	AV-520
	1975B	5.5	AV-600
	1944D, 1976B	7.5	AV-817
1977	1403B	3.5	AV-520
	14035B, 14036B	5	AV-600
	14037B, 14038A, 14059A	7.5	AV-817
1978	14034C	3.5	AV-520
	14035C, 14106A	5	AV-600
	14107A, 14108A	7.5	AV-817
1979	14034D	3.5	AV-520
	14035D, 14106B	5	AV-600
	14107B, 14108B	7.5	AV-817
1980	14139A	3.5	AV-520
	14140A	5	AV-600
	14141A	7.5	AV-817
1981	14178A, 14183A	3.5	AV-520
	14035E, 14140B, 14179B, 14189A	5	AV-600
	14141B, 14180A	7.5	AV-817
1982	14178B, 14183B	3.5	AV-520
	14140C, 14179B	5	AV-600
	14141C, 14180B	7.5	AV-817
1983	14207	3.5	AV-520
	14208	5	AV-600
	14209	7.5	AV-817
1984	14207	3.5	AV-520
	14208	5	AV-600
	14209	7.5	AV-817
1985	14207	3.5	AV-520
	14208	5	AV-600
	14209	7.5	AV-817

These motors are also sold as Explorer, Federal, Goldenjet, Hanimex, Hiawatha, Pathfinder, Seaco, Seacruiser-Grant, Sea King, Sea Hawk, Sears, Skipper, Sportfisher and Wizard models.

CONDENSED SERVICE DATA

TUNE-UP	AV520	AV600	AV750	AV817
Bore	2.09 in. (53 mm)	2.09 in. (53 mm)	2.375 in. (60.3 mm)	2.437 in. (61.9 mm)
Stroke	1.50 in. (38.1 mm)	1.76 in. (44.7 mm)	1.68 in. (42.7 mm)	1.75 mm (44.4 mm)
Number of Cylinders	1	1	1	1
Displacement	5.16 cu. in. (84.6 cc)	6.05 cu. in. (99.1 cc)	7.50 cu. in. (122.9 cc)	8.17 cu. in. (133.9 cc)
Spark Plug–				
Champion	J13Y*	J13Y*	J13Y*	J13Y*
AC	45S	45S	45S	45S
Electrode gap	0.030 in. (0.76 mm)	0.030 in. (0.76 mm)	0.030 in. (0.76 mm)	0.030 in. (0.76 mm
Conventional Magneto–				
Breaker Point Gap	See Text	See Text	See Text	See Text
Piston Position Max. Advance Timing	See Text	See Text	See Text	See Text
Solid State Magneto–				
Max. Advance Timing	See Text	See Text	See Text	See Text
Fuel:Oil Ratio	See Text	See Text	See Text	See Text
SIZES–CLEARANCES				
Piston Rings–				
End gap	See Text	See Text	0.005-0.013 in. (0.13-0.33 mm)	0.007-0.017 in. (0.18-0.43 mm)
Side clearance	See Text	See Text	See Text	See Text
Piston Pin Diameter	0.4997-0.4999 in. (12.692-12.697 mm)	0.4997-0.4999 in. (12.692-12.697 mm)	0.4997-0.4999 in. (12.692-12.697 mm)	0.4997-0.4999 in. (12.692-12.697 mm)
Piston Skirt Clearance	0.005-0.007 in. (0.13-0.18 mm)	0.005-0.007 in. (0.13-0.18 mm)	0.0055-0.0075 in. (0.14-0.19 mm)	0.0058-0.0078 in. (0.147-0.198 mm)
Crankshaft Clearance–				
Top main bearing	Ball or Needle	Ball or Needle	Needle	Needle
Bottom main bearing	Needle	Needle	Ball	Ball or Needle
Crankpin	See Text	See Text	Needle	Needle
End play	See Text	0.003-0.016 in. (0.07-0.40 mm)	Zero	Zero
TIGHTENING TORQUES				
Connecting Rod–				
Plain bearing (Aluminum)	50-57 in.-lbs. (5.6-6.4 N·m)	50-57 in.-lbs. (5.6-6.4 N·m)	.....	50-57 in.-lbs. (5.6-6.4 N·m)
Needle bearing (Steel)	70-80 in.-lbs. (7.9-9 N·m)	70-80 in.-lbs. (7.9-9 N·m)	70-80 in.-lbs. (7.9-9 N·m)	70-80 in.-lbs. (7.9-9 N·m)
Cylinder Head	80-100 in.-lbs. (9-11.3 N·m)	80-100 in.-lbs. (9-11.3 N·m)	80-100 in.-lbs. (9-11.3 N·m)	80-100 in.-lbs. (9-11.3 N·m)
Flywheel	25 ft.-lbs. (34 N·m)	25 ft.-lbs. (34 N·m)	25 ft.-lbs. (34 N·m)	25 ft.-lbs. (34 N·m)
Shroud Base to Crankcase	70-75 in.-lbs. (7.9-8.4 N·m)	70-75 in.-lbs. (7.9-8.4 N·m)	70-75 in.-lbs. (7.9-8.4 N·m)	70-75 in.-lbs. (7.9-8.4 N·m)

*Recommended spark plug for models after 1976 is Champion RJ13Y.

The engine model number (AV-520, AV-600, AV-750 or AV-817) is for easy reference only to the general construction. If service parts are required, the type number MUST be used. The type number is stamped in the blower housing or on a tag attached to engine. A correct type number will usually consist of three numbers, a dash followed by two more numbers (such as 643-09). When servicing power head, make certain that identification tag is reinstalled.

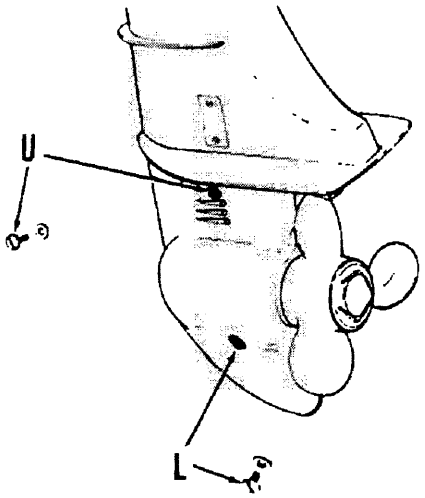


Fig. E2-1—View of gearcase showing upper (vent) plug (U) and lower (drain/fill) plug (L). Non-gear shift type units have drain/fill plug on opposite side of gearcase.

LUBRICATION

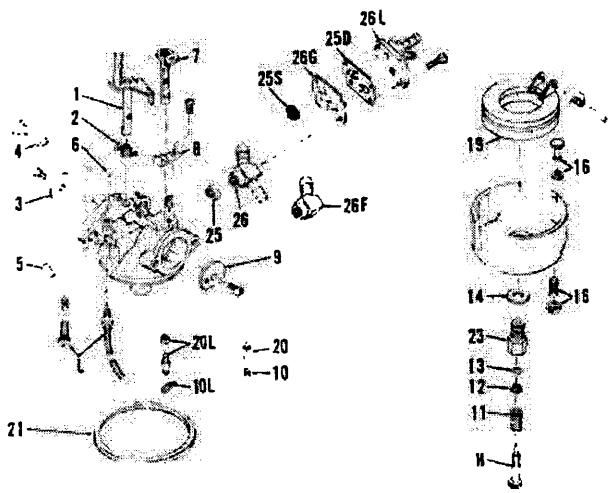
The power head is lubricated by oil mixed with regular grade gasoline. Recommended fuel to oil ratio is 16:1 for 1969 model motors. Oil used should be a good grade of oil intended for use in outboard motors. Fuel and oil should be mixed in a ratio of 24:1 for 1970 through 1973 model motors. Fuel:oil ratio of 32:1 may be used on 1974 and later models if oil used is BIA certified TC-W. If BIA certified TC-W oil is not available, use a good grade of outboard motor oil in a 24:1 fuel to oil mixture on 1974 and later models.

The lower unit gears and bearings are lubricated by oil contained in the gearcase. SAE 90 outboard gear lubricant should be used. Lubricant should be checked at least every 20 hours of operation and maintained at level of the upper vent plug (U–Fig. E2-1), when motor is in upright position. The gearcase should be drained and filled with new oil at least once each season. Remove both plugs (U & L) and lay motor on side to drain the gearcase. If excessive water is noted when draining, seals and gaskets should be renewed as outlined in the LOWER UNIT section. Motor should be in upright position when filling gearcase with lubricant. Insert filler tube in lower plug (L) opening and fill until lubricant is at level of upper plug (U) opening. Install upper plug, then remove filler tube and install lower plug. Use new gaskets on plugs if necessary to provide a water tight seal.

FUEL SYSTEM

CARBURETOR. The Tecumseh float type carburetor is shown in Fig. E2-2. Idle mixture is adjusted at needle (L) and high speed mixture is adjusted at needle (H). Clockwise rotation of both needles leans the mixture. Initial setting is approximately 1 turn open for both needles.

Carburetor adjustments should only be made with motor in water so a load is placed on engine. Start and run motor until it reaches operating temperature, then adjust to provide smoothest operation in gear. The high speed mixture needle (H) should be adjusted first. Idle mixture (L) should be set rich enough to provide smooth acceleration from idle to high speed. Use caution when setting needles to prevent mixture from being too lean and causing engine damage.



H. High speed mixture needle
L. Idle mixture needle
1. Throttle shaft
2. Throttle spring
3. Throttle plate
4. Pumping element
5. Welch plug
6. Lead shot
7. Choke shaft
8. Detent
9. Choke plate
10. Spring
10L. Clip
11. Spring
12. Washer
13. "O" ring
14. Washer
16. Bowl drain
19. Float
20. Inlet needle
20L. Inlet needle & seat
21. Seating ring
23. Bowl retainer
26. Outlet check valve
25D. Check valves
25S. Screen
26. Inlet check valve & fitting
26F. Inlet fitting
26G. Gasket
26L. Inlet cover

Fig. E2-2—Exploded view of Tecumseh carburetor. On gravity feed models, fitting (26F) is used. On early fuel pump models, pumping element (4), outlet check valve (25), inlet check valve and fitting (26) are used. On latest models with fuel pump, check valves (25D), inlet cover (26L) and screen (25S) are used.

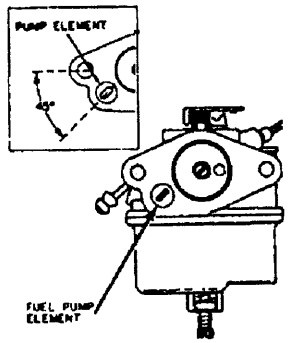


Fig. E2-3—Fuel pump element (4–Fig. E2-2) should be installed at a 45° angle as shown.

CAUTION: Do not attempt to remove carburetor from AV750 models without removing the reed valve assembly.

NOTE: Several variations of this carburetor have been used and differences in servicing procedure will be noted.

Disassembly of carburetor will depend upon extent of service required. Parts (4, 13, 16, 20, 20L, 21, 25, 25D, 26, 26F and 26G) may be damaged by most commercial carburetor cleaning solvents and must be removed. The gravity feed inlet fitting (26F) and early type check valves (25 and 26) are pressed into carburetor body. The fitting (26 or 26F) should be pulled out of bore, then carefully drill outlet check valve (25) with a 9/64 inch (3.57 mm) drill to a depth of 1/8 inch (3.17 mm) as shown in Fig. E2-4.

CAUTION: Do not drill too far or carburetor body will be damaged.

Thread an 8-32 tap into the outlet check valve, then use the proper size nut and flat washer to convert tap into a puller as shown in Fig. E2-5. Pull check valve out by tightening nut.

Inlet needle (20–Fig. E2-2) has a Viton tip that seats directly into carburetor body on some models or into a renewable Viton seat (20L) on later models. Seat (20L) may be removed by inserting a small wire hook through hole and pulling seat out of brass liner. Viton seat should be renewed if removed from carburetor body. New seat should be installed with grooved side toward carburetor body, away from needle (20).

On all models, install throttle plate (3) with stamped lines facing out (toward engine) and at 12 and 3 o'clock positions. If the choke plate (9) is provided with stamped mark, the mark should be toward inside of carburetor and flat should be toward fuel inlet fitting (26, 26F or 26L). If choke plate is not marked, the flat side should be down toward float bowl. Float setting should

be 0.200-0.220 inch (5.08-5.58 mm), measured with body and float assembly inverted, between free end of float and rim of carburetor body. Preferred method for checking float level is to place a number 4 drill bit shank (0.209 inch or 5.30 mm) between float and carburetor body (Fig. E2-6). When installing fuel bowl, the flat under side should be located below the fuel inlet (26, 26F or 26L – Fig. E2-2).

The fuel pumping element (4) is a rubber boot which expands and contracts due to changes in crankcase pressure. The pumping element should be installed at 45° angle as shown in Fig. E2-3. Incorrect installation may interfere with pumping action.

On AV750 models, coat threads of carburetor retaining screws with "Loctite" before assembling.

SPEED CONTROL LINKAGE. The ignition timing is advanced by the speed control lever and the throttle is operated by a cam attached to the magneto stator plate. The ignition timing and throttle opening must be synchronized to provide correct operation. Refer to the appropriate following paragraphs for timing the ignition and synchronizing the throttle opening.

MODELS WITH BREAKER POINT MAGNETO. Before attempting to set ignition timing, make certain that breaker points are in good (or new) condition and gap at maximum opening is correct as described in the IGNITION paragraphs. The flywheel must be removed and wires from coil and condenser must be disconnected from breaker point terminal (1 – Fig. E2-7 or E2-8).

On models with fuel inlet fitting pressed into carburetor (26 & 26F – Fig. E2-2), check throttle pickup as follows:

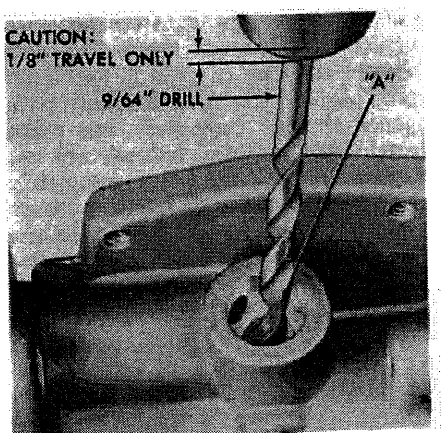


Fig. E2-4 – View showing method of removing early type check valve (25 – Fig. E2-2).

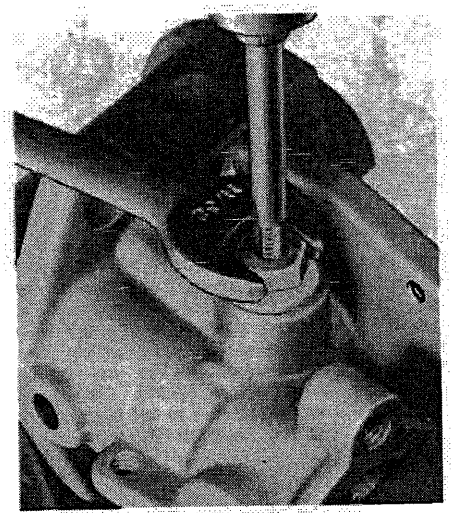


Fig. E2-5 – The 8-32 tap can be used as a puller to remove the outlet check valve from early fuel pump carburetors.

Move speed control lever until side is aligned with edge of shroud base (2 – Fig. E2-7). The follower (F) should be almost touching the cam.

NOTE: There should be slight clearance (thickness of paper) between cam and follower.

If clearance between follower and cam is incorrect, loosen screw (3), move idle end of cam as required, then tighten screw (3). Make certain that there is only a slight amount of clearance.

On models with fuel inlet fitting on carburetor plate (26L – Fig. E2-2), check the throttle pickup as follows: Set the piston at 0.003 inch **After** Top Dead Center as described in Fig. E2-9. Attach a timing light with battery (B – Fig. E2-8) or continuity meter to the breaker point terminal (1) and to magneto stator (ground). Move the speed control lever to starboard (clockwise) until the timing light glows (continuity exists through breaker points). Move the speed control lever toward fast position until the breaker points just open (light goes out).

NOTE: Do not move speed control lever too far. The cam follower (F) should just contact cam as the timing light goes out (breaker points open). If follower contacts cam before breaker points open or if there is clearance between follower and cam when breaker points open, loosen screw (3) and move the idle end of cam as required, then tighten screw (3).

On all models, refer to the following table and locate piston at correct timing position:

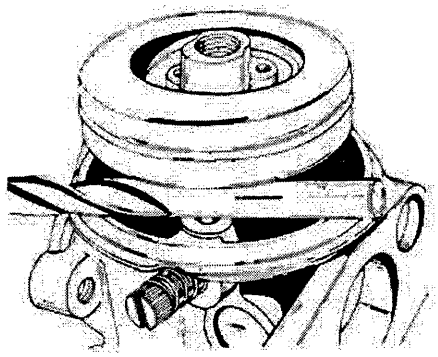


Fig. E2-6 – Float level may be checked by placing a number 4 drill bit (0.209 inch or 5.30 mm) between float and carburetor body.

TYPE NUMBER	TIMING BTDC
639-06	0.095 in. (2.41 mm)
640-12 thru 640-19A	0.115 in. (2.92 mm)
642-01 thru 642-07B	0.100 in. (2.54 mm)
642-07C	0.085 in. (2.15 in.)
642-08	0.110 in. (2.79 mm)
642-08A thru 642-10	0.100 in. (2.54 mm)
642-13 thru 642-16C	0.085 in. (2.15 mm)
642-16D	0.078 in. (1.98 mm)
642-17 thru 642-19	0.085 in. (2.15 mm)
642-19A	0.078 in. (1.98 mm)
642-20	0.085 in. (2.15 mm)
642-20A thru 642-22	0.078 in. (1.98 mm)
642-23	0.085 in. (2.15 mm)
642-24	0.085 in. (2.15 mm)
642-25	0.078 in. (1.98 mm)
642-26	0.085 in. (2.15 mm)
642-27 thru 642-28A	0.078 in. (1.98 mm)
642-29	0.085 in. (2.15 mm)
642-30 thru 642-35	0.078 in. (1.98 mm)
643-01 thru 643-14	0.090 in. (2.28 mm)
643-14A, 643-14B, 643-14C	0.085 in. (2.15 mm)
643-15	0.090 in. (2.28 mm)
643-15A thru 643-32A	0.085 in. (2.15 mm)

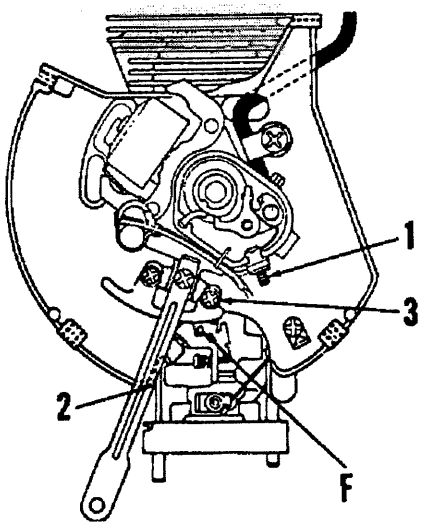


Fig. E2-7—View showing speed controls and points of adjustment for motors with pressed in fuel inlet type carburetors and breaker point magneto. Refer to text.

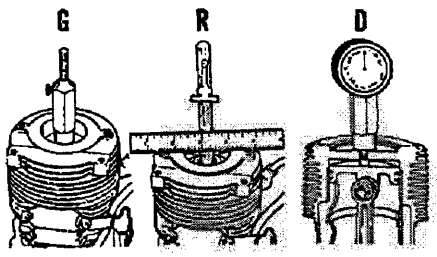


Fig. E2-9—Piston position can be measured through the spark plug opening using the timing gage (G) available from Tecumseh Products Co. (part number 670124), a ruler (R) or dial indicator (D). After determining top dead center, turn crankshaft counterclockwise to set piston before top dead center (BTDC). Crankshaft should be turned clockwise to set piston after top dead center (ATDC).

Refer to Fig. E2-9. Attach a timing light with battery (B–Fig. E2-10) or continuity meter to the breaker point terminal (1) and to magneto stator plate (ground). Move the speed control lever clockwise until the timing light glows (breaker points closed). Move the speed control lever toward fast position (counterclockwise) until the breaker points just open (light goes out).

NOTE: It may be necessary to loosen the stop bracket (4) in order to allow enough movement to open breaker points. Also, make certain that follower (F) is not binding against cam.

The speed control lever should contact stop bracket (4) just as breaker points open. If incorrect, loosen the retaining screw and reposition stop bracket (4).

After the maximum advance stop (4) is correctly set, move the speed control lever against stop bracket (4) and check the cam follower (F). The follower should have opened the throttle completely, but make certain that cam and follower are not binding. If throttle is not completely open or if follower is binding, loosen screw (5), reposition the high speed end of cam as required then tighten screw (5).

The low speed (throttle pickup) adjustments should be checked again after setting the high speed adjustments. Changes at either end of the throttle cam will affect the location of the other end slightly. Position of cam is correct only after both low and high speed ends check satisfactory.

MODELS WITH SOLID STATE MAGNETOS. The flywheel must be removed and a special tool (part number 670236A for AV600 and AV750 models and part number 670238A for AV817 models) available from Tecumseh Products Co. must be used.

To set the maximum ignition advance, refer to following table and set the piston to the proper BTDC position as per instructions in Fig. E2-9.

MODEL NUMBER	TIMING BTDC
AV600	0.085 in. (2.15 mm)
AV750	0.095 in. (2.41 mm)
AV817	
Type 640-02 thru 640-06B	0.118 in. (2.99 mm)
Type 640-07 thru 640-21	0.115 in. (2.92 mm)

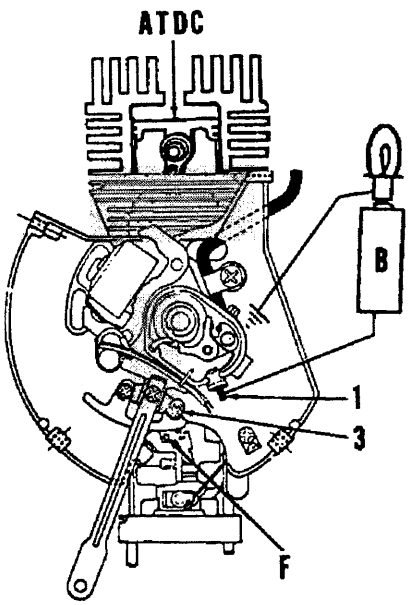


Fig. E2-8—View showing speed controls and points of adjustments for motors with fuel inlet located on cover plate and breaker point magneto. Piston position (ATDC) should be set as described in Fig. E2-9.

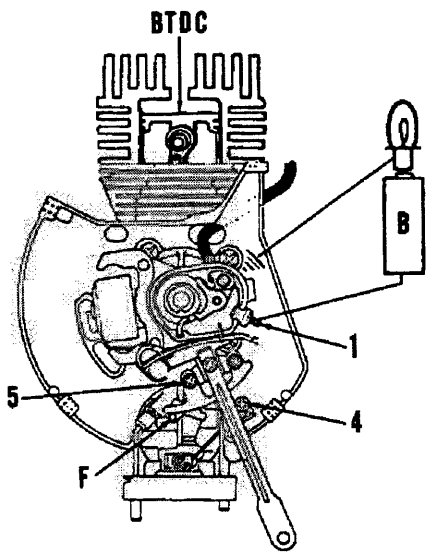


Fig. E2-10—View showing controls and points of adjustment for adjusting maximum ignition advance and maximum throttle opening. The cam and/or carburetor may be damaged if cam attempts to open throttle further than possible.

Position the proper Tecumseh special tool over the flywheel key in crankshaft as shown in Fig. E2-11, then move controls to maximum speed position (counterclockwise). The run trigger (R) should be aligned with edge "1" of special tool as shown in the inset. If incorrect, loosen stop bracket (4) and reposition as necessary to stop movement of speed control when run trigger is aligned with edge "1". After stop (4) is correctly positioned, check the cam follower (F) with controls in maximum speed position. The follower should have opened throttle completely, but make certain that cam and follower are not binding. If throttle is not completely open or if follower is binding, loosen screw (5), reposition the high speed end of cam as required then tighten screw (5).

To check the throttle pickup point, set the piston to the same BTDC position as for high speed adjustment (see previous ignition timing table). Move the speed control until the run trigger (R–Fig. E2-12) is aligned with the "2" mark on the special tool for AV750 models or the

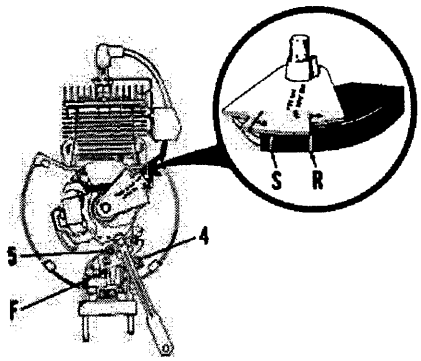


Fig. E2-11—Refer to text for adjustment of controls. View shows high speed position. Insert shows location of starting trigger (S) and run trigger (R) in relation to the special tool.

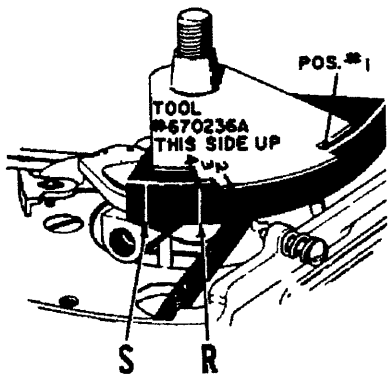


Fig. E2-12—Refer to text for adjustment of the idle pickup. Changing the position of idle speed end of cam will affect high speed adjustment which should be rechecked.

"4" mark on the tool for AV600 models. Special tool 670238A, used to check AV817 models, has only "2" mark for throttle pickup point check. With speed control in this position, the cam should be just touching the follower (F–Fig. E2-11). Make certain that throttle has not yet moved, but is touching cam. If incorrect loosen screw and reposition the idle speed end of cam as required.

The throttle cam should be rechecked for full throttle opening after adjusting idle pickup. Changes at either end of cam will affect the location of the other end slightly. Position of cam is correct only after both low and high speed ends check satisfactorily.

After the high speed stop and throttle cam are accurately adjusted, move the speed control lever clockwise until lever is past the shroud bracket (2–Fig. E2-13). Turn the ground (stop) screw (1) in until it contacts the stop plate on stator. The ignition will be grounded and motor will stop when the stop plate touches screw (1).

REED VALVES. The reed valves are located between the carburetor and the crankcase and should be checked each time the carburetor is removed for service.

On AV520, AV600 and AV817 models, the carburetor may be removed before removing reed valves. Reeds and reed plates may be renewed separately on most models but must be renewed as an assembly on certain early models. Check reeds for proper seating and damage. Reed petals should not bend away from plate more than 0.010 inch (0.25 mm).

On AV750 models, the reed valve assembly and carburetor must be removed as a unit by removing four screws that secure reed plate (6–Fig. E2-15). Removal of the carburetor and disassembly of the reed valve can be accomplished by removing the two screws (5) and nuts (12). The reed petals can be renewed without renewing reed plate (6); however, make certain that seating surface is not damaged. The rough edge of reed petals must be away from reed plate. New reed petals (3) are marked on the smooth side and the marked surface should be against the reed plate (6). When assembling, coat threads of screw (5) with Loctite and tighten to 50-60 in.-lbs. (5.6-6.7 N·m) torque.

IGNITION

Solid state, breakerless magnetos and conventional, breaker-point timed, magnetos are used on these motors. Refer to the appropriate following paragraphs for service.

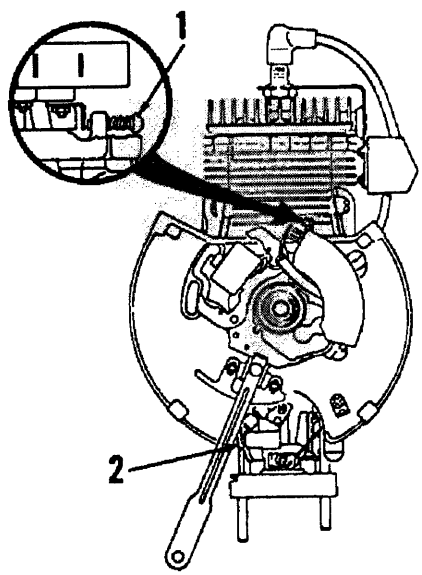


Fig. E2-13—The stop (ground) screw (1) should be adjusted as described in text to stop motor after lever is past shroud bracket (2).

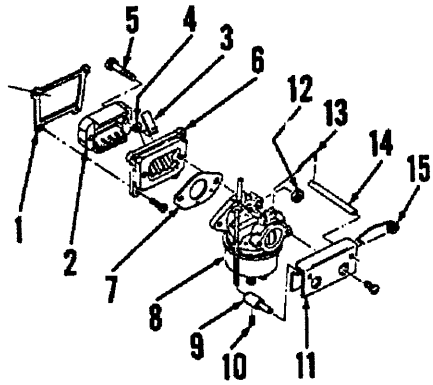


Fig. E2-15—Exploded view of the reed valve used on AV750 models. Carburetor and reed valve must be removed and installed as a unit.

1. Gasket
2. Reed stop
3. Reed petals
4. Washer
5. Carburetor attaching screw
6. Reed plate
7. Gasket
8. Carburetor
9. Idle adjustment knob
10. Set screw
11. Bracket
12. Nut
13. Choke link
14. Choke rod
15. Stop spring

BREAKER POINT MAGNETO. Breaker point gap should be 0.018 inch (0.45 mm) for type numbers 642-01 through 642-07B, 642-08A through 642-10, 643-01 through 643-05A, 643-06 through 643-09, and 643-15. Breaker point gap for all other engines should be 0.020 inch (0.5 mm). It is important that breaker point gap is correct and breaker points are in good (or new) condition before adjusting the speed control linkage. Ignition timing and throttle opening must be synchronized correctly to provide best operation. Refer to SPEED CONTROL LINKAGE paragraphs in the FUEL SYSTEM section for checking ignition timing.

If the magneto mounting plate must be removed, loosen friction screw then lift assembly off. When installing, apply a small amount of grease to friction screw, then install and tighten screw to 12-15 in.-lbs. (1.3-1.7 N·m) torque. Make certain that cam follower (F–Fig. E2-10) is on outside of cam.

SOLID STATE MAGNETO. The Tecumseh solid state magneto does not use breaker points. The only moving part of the system is the rotating flywheel with the magnets. Refer to Fig. E2-16. Refer to the SPEED CONTROL LINKAGE paragraphs in the FUEL SYSTEM section for synchronizing ignition timing to carburetor opening.

If the system fails to produce a spark at the spark plug, first check the condition of wire terminals and ground connections. Check condition of high tension lead (5) and if questionable, renew pulse transformer (4) and lead (5). Make certain that low tension lead (3) is not shorted against motor and renew if in-

sulation is faulty. The ignition charging coil (1), electronic triggering system and mounting plate are available only as an assembly. If the mounting plate must be removed, loosen friction screw, then lift assembly off. When installing, apply a small amount of grease to friction screw, then install and tighten screw to 12-15 in.-lbs. (1.3-1.7 N·m) torque. Make certain that cam follower (F) is on outside of cam.

COOLING SYSTEM

The power head is air-cooled by a fan built into the flywheel. Make sure the shroud is in place and that cooling fins are kept clean.

The lower motor leg and exhaust gases are water-cooled. All models with more than 3 hp are equipped with a water pump. Coolant intake is located just below the antiventilation plate on each side of gearcase, and coolant is pumped to exhaust deflector at upper part of lower unit where it cools the exhaust housing.

Motors not equipped with a water pump use a coolant tube to aid in cooling motor leg. An open end of the coolant tube is located below antiventilation plate, facing forward. Forward motion and propeller wash force water up coolant tube to motor adapter plate. Make sure that coolant tube is free of obstructions.

Coolant outlet consists of a series of holes arranged vertically on each side of the lower unit upper leg, just below the swivel bracket. If a spray of water does not emerge from outlet holes when motor is running, first check coolant inlet for plugging, then if not corrected, remove gearcase from lower unit and overhaul the pump.

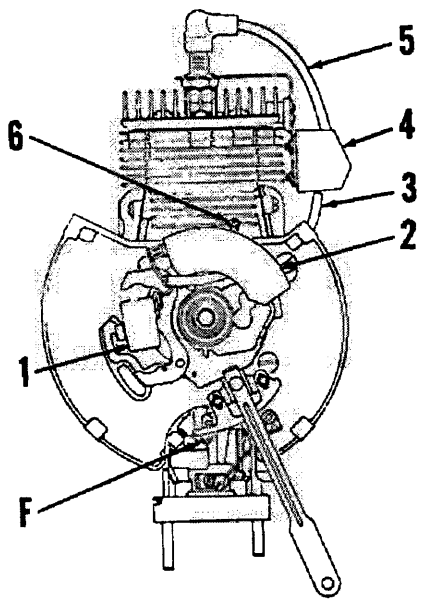


Fig. E2-16—View of the solid state ignition components with flywheel removed.

1. Charging coil
2. Trigger system
3. Low-tension lead
4. Pulse transformer
5. High tension lead
6. Ground (stop) screw

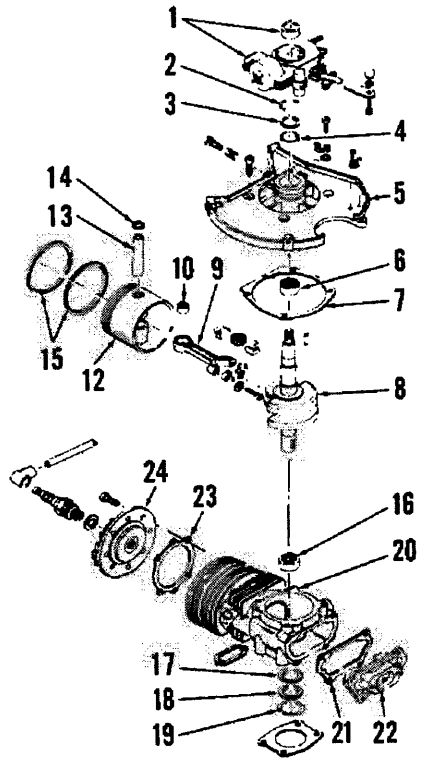


Fig. E2-20—Exploded view typical of Tecumseh AV520 and AV600 models. Early models were equipped with plain bearings at connecting rod large end.

1. Magneto
2. Snap ring
3. Retainer
4. Seal
5. Shroud bracket
6. Top main bearing
7. Gasket
8. Crankshaft
9. Connecting rod
10. Needle bearing
12. Piston
13. Piston pin
14. Snap ring
15. Piston rings
16. Lower main bearing
17. Seal
18. Retainer
19. Snap ring
20. Crankcase & cylinder
21. Gasket
22. Reed valve
23. Gasket
24. Cylinder head

POWER HEAD

DISASSEMBLY. Unbolt and remove cylinder shroud, flywheel, magneto, cylinder head, reed valve and covers. Remove connecting rod cap and push the rod and piston unit out through top of cylinder.

NOTE: On AV520 and AV600 models with plain rod bearing, lock tab must be bent away from connecting rod screws before loosening. On other models, make certain that bearing needles are not lost in crankcase. On all models, it may be necessary to remove ridge from top of cylinder before pushing piston and connecting rod assembly out.

The crankshaft can be removed from all models after removing shroud base (5—Fig. E2-20, Fig. E2-21 or Fig. E2-22). On AV750 (and ball bearing lower main AV817 models), it may be necessary to bump crankshaft out of lower main bearing (16—Fig. E2-21 or Fig. E2-22).

ASSEMBLY. Because of the two-stroke cycle design, the crankcase must be completely sealed against both pressure and vacuum. It is recommended that all gasket surfaces be carefully cleaned and checked for burrs, nicks or warped surfaces which may interfere with a tight seal.

Refer to the appropriate paragraphs for inspection and reassembly of power head components. Refer to the CONDENSED SERVICE DATA table for recommended tightening torques.

PISTON, PIN, RINGS AND CYLINDER. Before detaching rod from crankshaft, check the correlation marks on rod and cap. If rod and cap are not

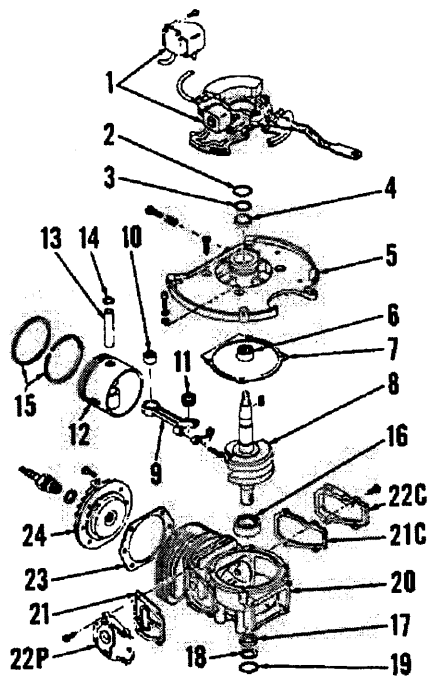


Fig. E2-21—Exploded view typical of AV750 models. Some models may have breaker point type magneto.

1. Solid state magneto
2. Snap ring
3. Retainer
4. Seal
5. Shroud bracket
6. Top main bearing
7. Gasket
8. Crankshaft
9. Connecting rod
10. Needle bearing
11. Needle bearing
12. Piston
13. Piston pin
14. Snap ring
15. Piston ring
16. Lower main bearing
17. Seal
18. Retainer
19. Snap ring
20. Crankcase & cylinder
21. Gasket
21C. Gasket
22C. Cover
22P. Cover
23. Gasket
24. Cylinder head

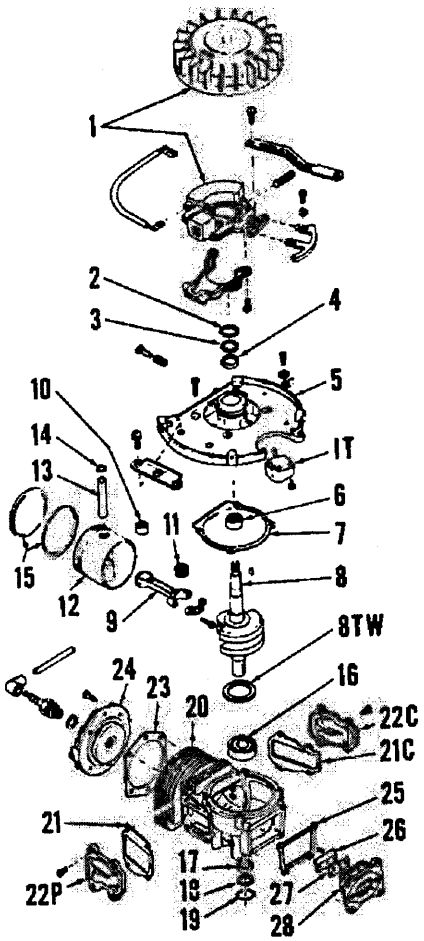


Fig. E2-22—Exploded view of typical AV817 engine. All models are equipped with a solid state magneto.

1. Magneto assy.
1T. Magneto transformer
2. Snap ring
3. Retainer
4. Seal
5. Shroud bracket
6. Top main bearing
7. Gasket
8. Crankshaft
8TW. Thrust washer
9. Connecting rod
10. Needle bearing
11. Needle rollers
12. Piston
13. Piston pin
14. Snap ring
15. Piston rings
16. Lower main bearing (ball or roller)
17. Seal
18. Retainer
19. Snap ring
20. Crankcase
21. Gasket
21C. Gasket
22C. Cover
22P. Cover
23. Head gasket
24. Cylinder head
25. Gasket
26. Reed stop
27. Reed
28. Reed plate

marked, scribe a line to indicate proper assembly. Refer to the following specification data:

AV520 AND AV600
Cylinder bore diameter ..... 2.093-2.094 in. (53.16-53.18 mm)
Piston-cylinder clearance ..... 0.005-0.007 in. (0.13-0.18 mm)
Ring end gap:
Type nos. 642-01 thru 642-07B, 642-08A thru 642-10, 643-01 thru 643-14 and 643-15 .... 0.007-0.017 in. (0.18-0.43 mm)
All other type nos. .... 0.006-0.016 in. (0.15-0.40 mm)
Ring side clearance:
Top ring ..... 0.003-0.005 in. (0.07-0.13 mm)
Bottom ring ..... 0.002-0.004 in. (0.05-0.10 mm)
Piston pin diameter ... 0.4997-0.4999 in. (12.692-12.697 mm)

AV750
Cylinder bore diameter ..... 2.375-2.376 in. (60.32-60.35 mm)
Piston-cylinder clearance ..... 0.0055-0.0075 in. (0.139-0.190 mm)
Ring end gap ..... 0.005-0.013 in. (0.13-0.33 mm)
Ring side clearance:
Top ring ..... 0.003-0.005 in. (0.07-0.13 mm)
Bottom ring ..... 0.002-0.004 in. (0.05-0.10 mm)
Piston pin diameter ... 0.4997-0.4999 in. (12.692-12.697 mm)

AV817
Cylinder hore diameter ..... 2.437-2.438 in. (61.89-61.92 mm)
Piston-cylinder clearance ..... 0.0058-0.0078 in. (0.147-0.198 mm)
Ring end gap ..... 0.007-0.017 in. (0.18-0.43 mm)
Ring side clearance:
Top ring ..... 0.003-0.005 in. (0.07-0.13 mm)
Bottom ring ..... 0.002-0.004 in. (0.05-0.10 mm)
Piston pin diameter ... 0.4997-0.4999 in. (12.692-12.697 mm)

Piston, rings and piston pin are available in standard size only. Piston rings should be installed on piston with beveled inside edge toward top of piston. The piston pin should be a press fit in heated piston on models with needle bearing in rod upper end. On models without needle bearing in rod upper end, the piston pin should be a palm push fit in piston and thumb push fit in rod. When assembling piston in connecting rod, observe the following. Open end of piston pin must be down, toward exhaust. The lubrication hole inside of connecting rod must be toward top of engine. On AV520 and AV600 models equipped with offset piston, make certain that "V" mark or "1111" mark stamped on top of piston is toward the right side as shown in Fig. E2-23.

A piston ring compressor should be used when installing piston in cylinder. Make certain that rings do not catch in recess at top of cylinder. The cylinder head retaining screws should be tightened to the torque listed in the CONDENSED SERVICE DATA table. Refer to the CONNECTING ROD paragraphs for installation of connecting rods.

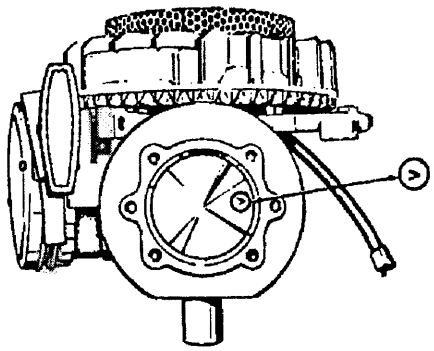


Fig. E2-23—The "V" mark or "1111" mark on top of piston must be toward side shown. Lubrication hole in side of rod must also be toward top.

CONNECTING ROD AND BEARINGS. Several types of connecting rods are used and it is important that the correct rod is installed.

On models with an aluminum connecting rod and plain bearing at crankpin end, clearance on crankpin should be 0.0011-0.0020 inch (0.0028-0.051 mm). Crankpin journal should be 0.6857-0.6865 inch (17.416-17.437 mm). Crankshaft should be renewed if crankpin taper or out-of-round exceeds 0.001 inch (0.02 mm). Only standard size parts are available.

On models with aluminum connecting rod with steel liners and bearing needles at crankpin, observe the following: Crankpin journal standard diameter is 0.8442-0.8450 inch (21.442-21.463 mm) on AV600 engines or 0.6919-0.6927 inch (17.574-17.594 mm) on AV817 engines. Be sure that none of the 74 bearing rollers are lost and that ends of liners correctly engage when match marks on rod and cap are aligned. Piston pin diameter is 0.4997-0.4999 (12.692-12.697 mm) inch and rides in cartridge needle bearing that is pressed into piston end of connecting rod.

All models with steel connecting rod are provided with loose needle rollers at crankpin end of connecting rod and a cartridge needle bearing at piston pin end. Standard crankpin journal diameter is 0.6259-0.6266 inch (15.897-15.915 mm). Model AV750 uses 33 needle rollers in the 0.7588-0.7592 inch (19.273-19.283 mm) diameter connecting rod bore. Model AV817 uses 66 short (half length) needle rollers placed in two rows in the 0.7588-0.7592 inch (19.273-19.283 mm) diameter connecting rod bore.

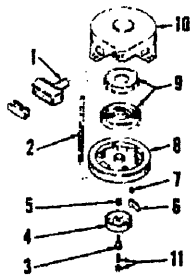


Fig. E2-26—Exploded view of starter. Refer to Fig. E2-27 for installation of parts (5, 6 & 7).

1. Handle
2. Rope
3. Retainer screw
4. Retainer housing
5. Brake spring
6. Starter dog
7. Dog return spring
8. Pulley
9. Spring & keeper
10. Housing
11. Centering pin

On models with short (half length) needle rollers, bearing needles are placed in two rows around crankpin with flat ends together toward center of crankpin. On all models equipped with needle bearing at crankpin, rollers should be renewed only as a set. Renew bearing set if any roller is damaged. If rollers are damaged, check condition of crankpin and connecting rod carefully and renew if bearing races are damaged. New rollers are serviced in a strip and can be installed by wrapping the strip around crankpin. After new needle rollers and connecting rod cap are installed, force lacquer thinner into needles to remove the beeswax, then lubricate bearings with SAE 30 oil.

On all models, make certain that match marks on rod and cap are aligned. Some AV520 and AV600 models are stamped with "V" or "1111" mark on piston as shown in Fig. E2-23. On models so equipped, make certain that mark stamped on top of piston is toward the right side as shown. On all models with aluminum connecting rod, tighten rod cap retaining screws to 40-50 in.-lbs. (4.5-5.6 N·m) torque and lock with the tab washer. On all models with a steel connecting rod, tighten the rod cap retaining screws (self locking) to 70-80 in.-lbs. (7.9-9 N·m) torque.

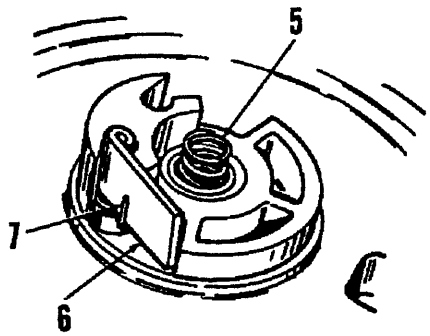


Fig. E2-27—When assembling, make certain that parts (5, 6 & 7) are assembled as shown. End of dog return spring (7) should pull dog in.

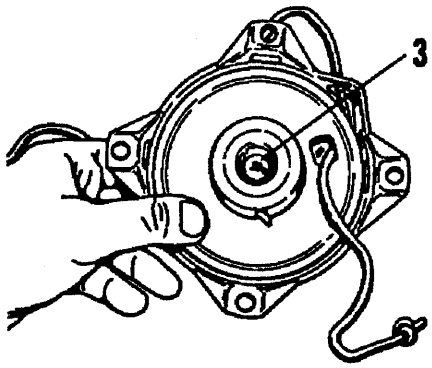


Fig. E2-28—Refer to text when removing or installing rope. Retainer screw (3) should be torqued to 45-55 in.-lbs. (5-6 N·m).

CRANKSHAFT. Crankshaft main bearings may be either ball type or cartridge needle roller. If ball type main bearings are used, it should be necessary to bump the crankshaft out of the bearing inner races. Ball and roller bearing outer races should be a tight fit in bearing bores. If new ball bearings are to be installed, heat the crankcase when removing old bearings and installing new ones.

NOTE: Do not use an open flame.

On all models, bearings should be installed with printed face on race toward center of engine.

If the crankshaft is equipped with thrust washers at ends, make certain that they are installed when assembling.

Crankshaft end play should be ZERO for all AV750 and AV817 models. Crankshaft end play should be 0.003-0.016 inch (0.07-0.40 mm) for Models AV520 and AV600 equipped with two needle roller main bearings.

It is important to exercise extreme care when renewing crankshaft seals to prevent their being damaged during installation. If a protector sleeve is not available, use tap to cover any splines, keyways, shoulders or threads over which the seal must pass during installation. Seals should be installed so lip of the lower seal is towards outside (bottom) and the top (magneto end) seal is towards inside (center) of engine.

MANUAL STARTER

The rope for the recoil starter can be renewed without disassembling the starter. Remove the starter assembly from motor, pull rope out fully and hold pulley to prevent rewinding. Refer to Fig. E2-28. Remove old rope and install new rope, making certain that the inner knot is in pocket on underside of pulley. If the old rope was broken, preload the recoil spring by turning the pulley approximately 6 turns before installing new rope.

If the starter does not engage immediately when rope is pulled, make certain that retainer screw (3—Fig. E2-26) is tightened to 44-55 in.-lbs. (4.9-6.2 N·m) torque.

To overhaul the starter, first remove the rope, then allow the pulley (8) to un-

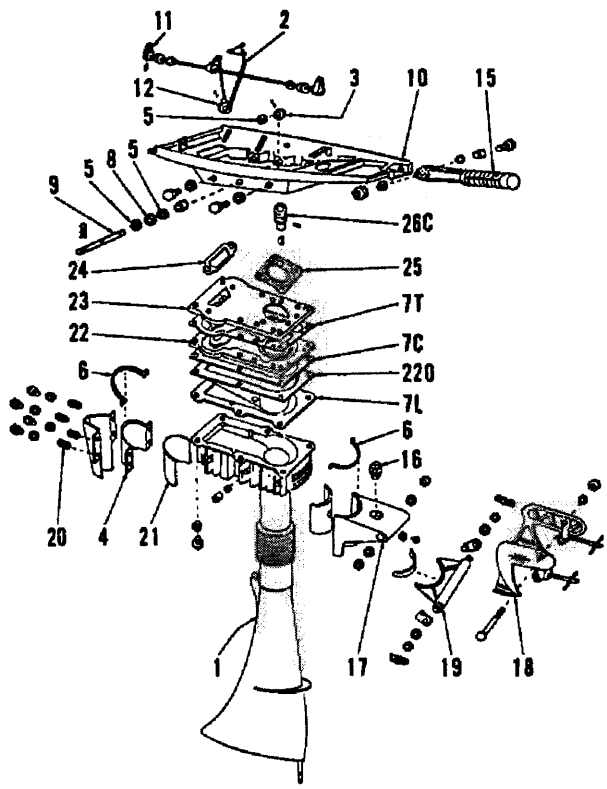


Fig. E2-29—Exploded view of lower motor leg typical of models with neutral clutch. Lever (12) is attached to shift shaft (9) with spirol pin.

1. Lower motor leg
2. Neutral speed advance stop rod
3. Neutral shift cam
4. Swivel bracket cap
5. Flat washers
6. Brass collar
7. Gaskets
8. Spring washer
9. Shift shaft
10. Carrying handle
11. Neutral clutch knobs
12. Lever
15. Steering handle
16. Shear pin holder
17. Swivel bracket
18. Stern clamps
19. Thrust bracket
20. Springs
21. Brass liner
22. Lower adapter plate
22D. Exhaust deflector plate
23. Upper adapter plate
24. Exhaust port gasket
25. Power head mount gasket
26C. Neutral clutch

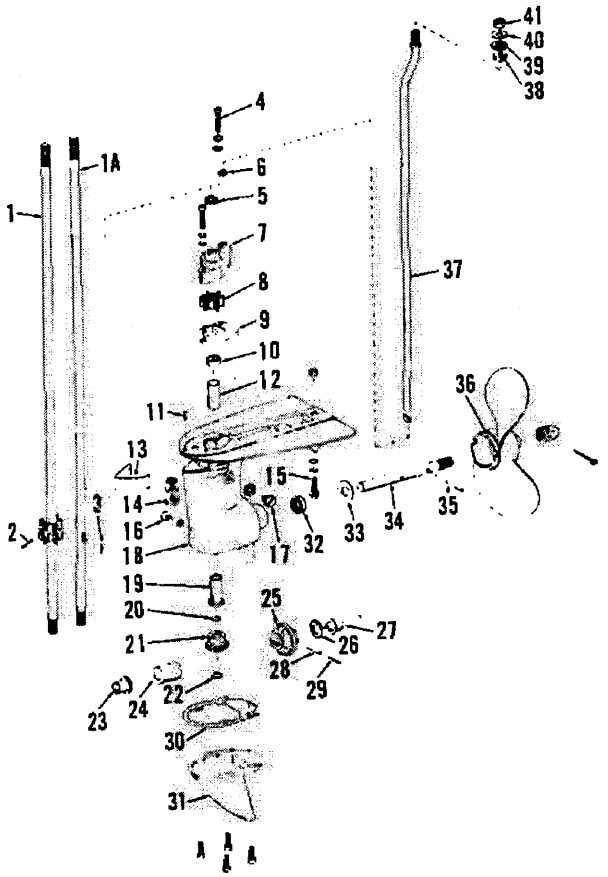


Fig. E2-30—Exploded view of typical, nongear shift, lower unit. Note that water pump impellar may be driven with a needle (3) or a roll pin (2). Water tube (37) extends through exhaust opening on motors without water pump.

wind slowly. Remove retainer screw (3), then lift parts out of housing (10).

NOTE: Spring and keeper (9) are available only as a unit.

When assembling, grease spring (9) lightly then position spring and keeper (9) and pulley (8) in housing (10). Install brake spring (5), starter dog return spring (7) and starter dog (6) as shown in Fig. E2-27. Install retainer screw (3—Fig. E2-26) and tighten to 45-55 in.-lbs. (5-6.2 N·m) torque. Preload the recoil spring by turning the pulley approximately six turns counterclockwise before installing the rope. Refer to Fig. E2-28.

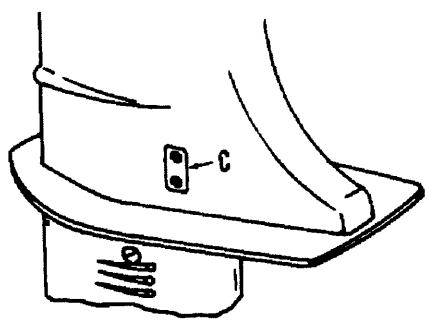


Fig. E2-31—Remove inspection cover (C) for access to shift linkage screw.

PROPELLER

A three-blade propeller is used on 7 and 7.5 hp motors. All others are equipped with a two-blade unit. Various diameter and pitch propellers have been used. Steel shear pin, part 96284, is used on propeller of models not equipped with a forward/neutral or full gear shift lower unit. Models with forward/neutral lower unit use shear pin 95718. Motors equipped with full gear shift lower unit (Fig. E2-32) use shear pin part 96683.

LOWER UNIT

Three types of lower units are used. Some motors are equipped with a non-shifting lower unit (Fig. E2-30) while others are equipped with a full gear shift lower unit (Fig. E2-33) or forward/neutral lower unit (Fig. E2-36). Refer to the appropriate following paragraphs for servicing procedure.

Non-Shifting Lower Unit

R&R AND OVERHAUL. Most service on the lower unit can be performed by removing gearcase assembly from lower motor leg; or by removing gearcase housing lower cover (31—Fig. E2-30). To remove the gearcase, remove clip (13); then remove gearcase retaining nut and screw. The front gearcase retaining stud nut (14) is behind clip (13) and the rear gearcase housing cap screw is accessible from inside exhaust outlet. On later models, the front stud nut is located at front of motor leg.

To remove the propeller shaft or disassemble gearcase, drive the gear retaining roll pins (28 & 29) a short distance into gear hub, rotate propeller shaft ½-turn and pull the roll pins out with vise grip pliers. Gearcase must be completely sealed against water or grease leakage when reassembling.

Drive shaft should have a diametral clearance of 0.002-0.0035 inch (0.05-0.088 mm) in bushings (12 & 19). Propeller shaft should have a clearance of 0.0025-0.004 inch (0.063-0.10 mm) in bushings (23 & 27). Renew any parts which are worn or damaged. Backlash and mesh position of gears is fixed and not adjustable. If backlash is excessive, renew the worn parts. Renew seals (5 & 32) whenever unit is disassembled or whenever water or grease leaks are apparent.

Gear (25) is secured to propeller shaft by a small diameter roll pin (29) pressed into roll pin (28). A steel shear pin (35), part number 96284 should be used. When assembling gearcase to motor lower leg, make certain that water tube is correctly installed and not damaged. Tighten the (front) retaining stud nut to a torque of 50-60 in.-lbs. (5.6-6.7 N·m) and the (rear) retaining screw to a torque of 75-90 in.-lbs. (8.4-10.1 N·m).

Full Gear Shift Lower Unit

R&R AND OVERHAUL. To remove lower unit from motor leg, remove inspection cover (Fig. E2-31) and shift linkage screw (2—Fig. E2-33). Be

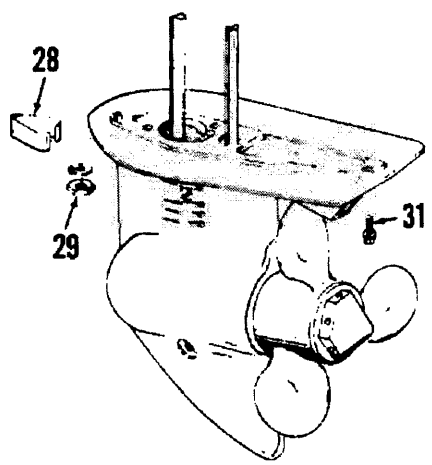


Fig. E2-32—Lower unit may be removed from motor leg after removal of nut (29) and screw (31).

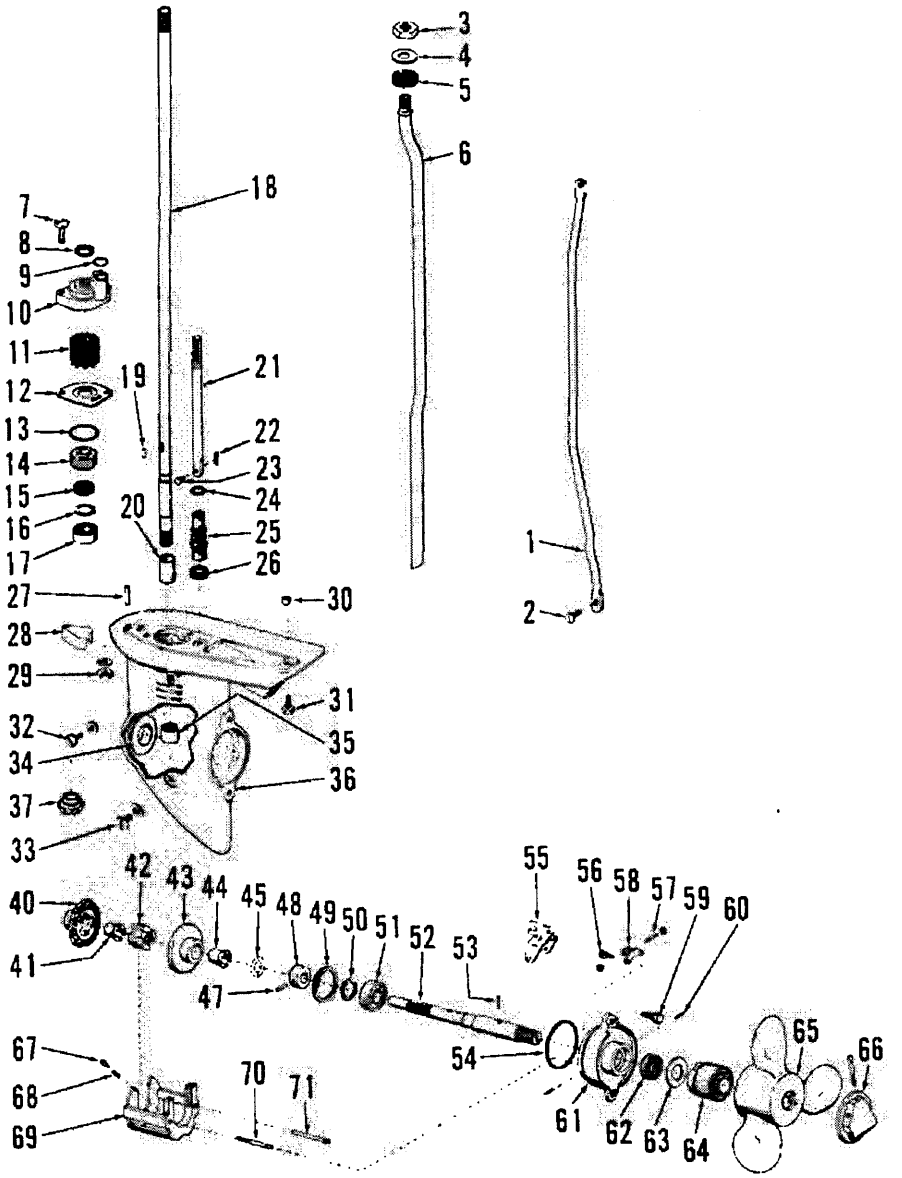


Fig. E2-33 – Exploded view of full gear shift lower unit. When assembling lower unit, use petroleum jelly to lubricate water pump impeller (11) and water tube seal (9).

1. Shift link
2. Screw
3. Nut
4. Washer
5. Seal
6. Water tube
7. Screw
8. Seal
9. Seal
10. Pump body
11. Impeller
12. Base plate
13. "O" ring
14. Retainer plate
15. Seal
16. Snap ring
17. Shielded ball bearing
18. Drive shaft
19. Pin
20. Spacer
21. Shift rod
22. Cotter pin
23. Clevis pin
24. "O" ring
25. Rubber boot
26. Seal
27. Roll pin
28. Clip
29. Stud nut
30. Pilot bushing
31. Screw
32. Vent
33. Drain fill plug
34. Bushing
35. Needle bearing
36. Gearcase
37. Pinion gear
40. Forward gear
41. Bushing
42. Shift dog
43. Reverse gear
44. Bushing
45. Shim washer
47. Roll pin
48. Collar
49. Snap ring
50. Snap ring
51. Ball bearing
52. Propeller shaft
53. Shear pin
54. "O" ring
55. Fork lever
56. Screw
57. Pin
58. Lever bracket
59. Screw
60. Roll pin
61. Cover
62. Seal
63. Washer
64. Cushion hub
65. Propeller
66. Nut
67. Detent
68. Spring
69. Shifter bracket
70. Left guide pin
71. Right guide pin

careful not to drop screw in motor leg. Remove clip (28 – Fig. E2-32). Remove screw (31) and stud nut (29). Pull lower unit from motor leg.

Shift lower unit into neutral position. Remove water pump assembly. Be careful not to lose impeller drive pin (19 – Fig. E2-33). Remove propeller, shear pin and screw (59) that secure gear cover (61). Pull propeller shaft assembly from gear box while pulling up lightly on shift rod (21). Place thumb over detent hole in shifter bracket (69) while pulling bracket away from cover (61). Detent (67) and spring (68) will be released as bracket is pulled away.

Remove screws (56) securing fork lever bracket (58) to cover. Remove large snap ring (49) then gently tap propeller shaft (52) out of cover. Small roll pins (60) secure left (70) and right (71) shift bracket guide pins in cover (61). To remove bearing (51) from propeller shaft, clamp collar (48) in vise jaws, drive roll pin (47) out then remove collar and snap ring (50). Place propeller shaft in a vise so that inner race of ball bearing (51) is supported but jaws are not touching propeller shaft. Use a soft faced hammer to drive shaft out of bearing.

To remove drive shaft (18), remove retainer plate (14) and snap ring (16). Hold onto drive shaft and use a soft faced hammer to drive gearcase off shaft. Remove drive pinion (37) and forward gear (40). Ball bearing (17) may be removed from drive shaft by placing shaft in a vise so inner race of bearing is supported but jaws are not touching shaft. Use a soft faced hammer to drive shaft out of bearing. When installing ball bearing (17), make sure that shielded side of bearing is facing water pump.

Needle bearing (35) and bushing (34) should only he serviced with proper tools as improper service procedures may damage gearcase. A combination removal/installation tool for drive shaft needle bearing (35) may be constructed using drawing in Fig. E2-34.

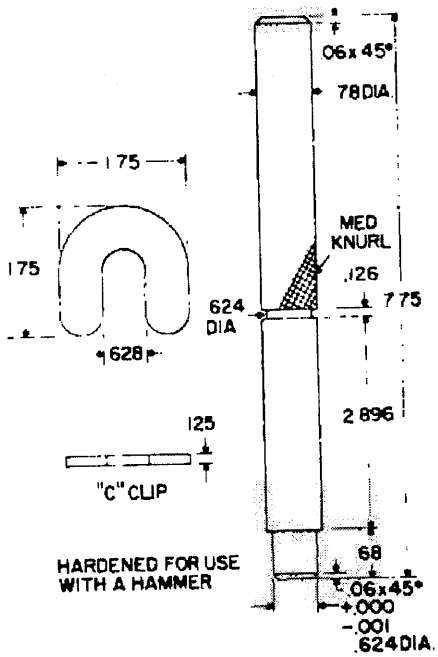


Fig. E2-34 – Drawing of a special tool that should be used for removal and installation of needle bearing (35 – Fig. E2-33).

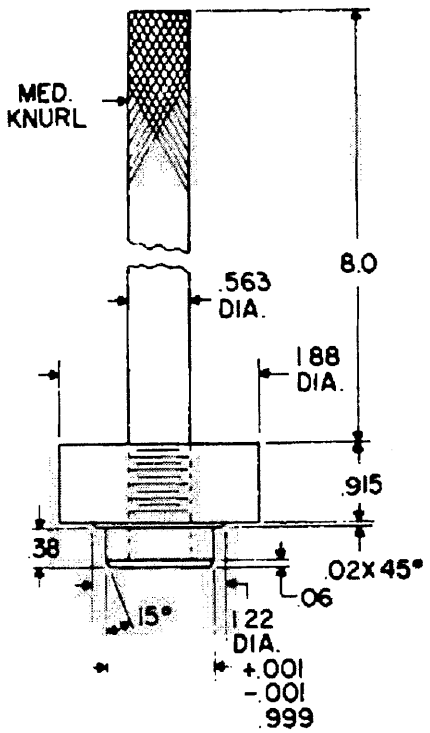


Fig. E2-35—Drawing of special tool which may be used to install bushing (34—Fig. E2-33) in gearcase.

To remove bearing (35—Fig. E2-33), place tool, without "C" clip, in bearing from top of gearcase and pound on end of tool. To install bearing (35), place "C" clip on tool so that new bearing will be properly positioned in bore when driven in from top of gearcase.

A blind hole bearing puller should be used to pull propeller shaft bushing (34). A special driver (Fig. E2-35) should be used to install new bushing.

Bushings (41 & 44—Fig. E2-33) may be removed and reinstalled with the aid of an arbor press.

When reassembling lower unit, make sure that oil seals (15, 26 and 62) are installed with lips facing inside of gearcase. Shift bracket guide pin (70) with detent grooves must be installed on left. Shift shaft (21) is installed with flat on end facing left side. Install retainer plate (14) so notches align with cutouts in water pump base plate (12).

When assembling gearcase to motor leg, use a flashlight to observe through exhaust outlet that water tube (6) is properly seating in water pump. Install washer and stud nut (29) before installing screw (31). Check shift mechanism for proper engagement. Detents in shift mechanism in lower units should be felt when operating shift lever.

Forward/Neutral Lower Unit

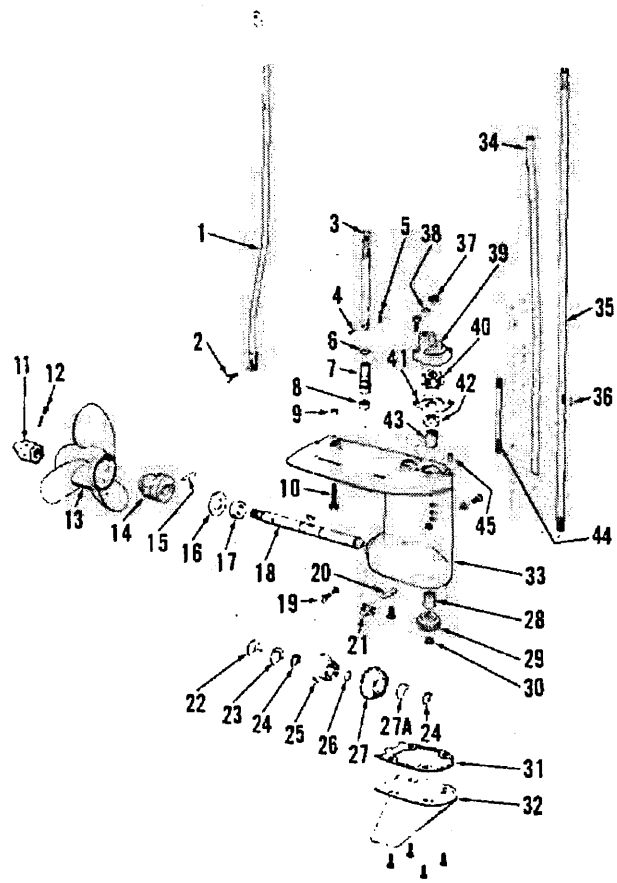
R&R AND OVERHAUL. Refer to Fig. E2-36 for an exploded view of lower unit. To remove lower unit from motor leg, remove inspection cover (Fig. E2-31) and shift linkage screw (2—Fig. E2-36). Be careful not to drop screw in motor leg. Remove retaining screw (10) and stud nut in front edge of motor leg and separate lower unit from motor leg. Drain lubricant and remove propeller and shear pin. Remove water pump assembly. Remove lower cover (32). Remove propeller shaft assembly and disassemble as required. Detach snap ring (30) and withdraw drive shaft (35).

Inspect components and renew any which are excessively worn or damaged. Backlash and mesh position are fixed and not adjustable. If backlash is excessive, renew the worn parts.

Reverse disassembly procedure when assembling lower unit. Be sure clutch lever (21) properly engages clutch (25) flange.

Fig. E2-36—Exploded view of forward/neutral lower unit used on some models. Spacer (27A) is used on later models.

1. Shift link
2. Screw
3. Shift rod
4. Clevis pin
5. Cotter pin
6. "O" ring
7. Rubber boot
8. Seal
9. Pilot bushing
10. Screw
11. Nut
12. Cotter pin
13. Propeller
14. Cushion hub
15. Shear pin
16. Washer
17. Seal
18. Propeller shaft
19. Vent plug
20. Pin
21. Clutch lever
22. Shim
23. Washer
24. "E" ring
25. Clutch
26. Snap ring
27. Gear
27A. Spacer
28. Needle bearing
29. Pinion gear
30. Snap ring
31. Gasket
32. Lower cover
33. Gearcase
34. Water tube
35. Drive shaft
36. Pin
37. Seal
38. Seal
39. Pump body
40. Impeller
41. Base plate
42. Seal
43. Needle bearing
44. Stud
45. Roll pin



ESKA TWO-CYLINDER MODELS (1973-1985)

Year Produced	Model No.	HP
1973	1925A	9.5
	1906A, 1911A, 1916A, 1933A, 1967A	9.9
	1926A, 1934A	14.0
	1907A, 1912A, 1917A, 1968A	15.0
1974	1925B	9.5
	1960B, 1911B, 1916B, 1933B	9.9
	1926B	14.0
	1907B, 1912B, 1917B, 1967A	15.0
1975	1906C, 1906D, 1978A, 1978B	9.9
	1907C, 1968C, 1979A	15.0
1976	1978C	9.9
	1979C	15.0
1977	14039	9.9
	14040	15.0
1978	14109A	9.9
	14110A	15.0
1979	14109B, 14136B	9.9
	14110B, 14137B	15.0
1980	14152A	9.9
	14153A	15.0
1981	14152B, 14181B	9.9
	14153B, 14182A	15.0
1982	14152C, 14181A, 14199A, 14204A	9.9
	14153C, 14182C	15.0
1983	14210	9.9
	14211	15.0
1984	14210	9.9
	14211	15.0
1985	14210	9.9
	14211	15.0

These motors are also sold as Explorer, Hanimex, Seaco, Seacruiser-Grant, Sea Hawk, Sears and Wizard models.

CONDENSED SERVICE DATA

TUNE-UP

Bore ..... 2.37 in. (60.3 mm)
Stroke ..... 1.68 in. (42.7 mm)
Number of Cylinders 2
Displacement ..... 14.82 cu. in. (242.8 cc)
Spark Plug:
  Champion J13Y*
  AC 45S
  Electrode Gap ..... 0.030 in. (0.76 mm)
Ignition Type ..... Solid State
Max. Advance Timing – BTDC ..... 0.125 in. (3.18 mm)
Fuel:Oil Ratio ..... 50:1†

SIZES–CLEARANCES

Piston Rings:
  End Gap ..... 0.005-0.013 in. (0.13-0.33 mm)

SIZES–CLEARANCES CONT.

Side Clearance–
  Top Ring ..... 0.003-0.005 in. (0.07-0.13 mm)
  Lower Ring ..... 0.002-0.004 in. (0.05-0.10 mm)
Piston Skirt Diameter ..... 2.371-2.372 in. (60.223-60.248 mm)
Piston Pin Diameter ..... 0.4997-0.4999 in. (12.692-12.697 mm)
Crankshaft Diameter:
  Top Main ..... 0.9995-1.000 in. (25.387-25.4 mm)
  Lower Main ..... 0.9841-0.9845 in. (24.996-25.006 mm)
  Crankpin ..... 0.7522-0.7530 in. (19.105-19.126 mm)
Crankpin Needle Diameter ..... 0.0944-0.0945 in. (2.397-2.400 mm)

TIGHTENING TORQUES

Carburetor Mounting Stud Nuts	65-75 in.-lbs. (7.3-8.5 N·m)
Connecting Rod Bolts	70-80 in.-lbs. (7.9-9 N·m)
Crankcase Screws	70-80 in.-lbs. (7.9-9 N·m)
Cylinder Head Cover Screws	70-80 in.-lbs. (7.9-9 N·m)
Exhaust Cover Screws	70-80 in.-lbs. (7.9-9 N·m)
Flywheel Nut	30-35 ft.-lbs. (40.8-47.6 N·m)
Lower Bearing Cap Screws	40-50 in.-lbs. (4.5-5.6 N·m)
Starter Bracket Nuts	70-80 in.-lbs. (7.9-9 N·m)
Stator Screws	40-50 in.-lbs. (4.5-5.6 N·m)

TIGHTENING TORQUES CONT.

Spark Plugs	18-22 ft.-lbs. (24.5-29.9 N·m)
Transformer Coil Screws	40-50 in.-lbs. (4.5-5.6 N·m)

*Recommended spark plug for models after 1976 is Champion RJ13Y.

†Fuel:oil ratio should be increased to 32:1 if BIA certified TC-W oil is not used.

The engine model number, BV-1500, indicates basic engine configuration and displacement; B-Two cylinder, V-vertical crankshaft, 1500-15.00 cubic inch displacement. If service parts are required, the type number MUST be used. The type number is on a metal tag attached to one of the exhaust cover screws. Typical type numbers are 380 or 380A. When servicing power head, make certain that identification tag is reinstalled.

LUBRICATION

The power head is lubricated by oil mixed with regular grade, leaded, gasoline. Recommended fuel to oil ratio is 50:1 when using oils that are BIA certified TC-W. If BIA certified TC-W oil is not available, use a good grade of oil intended for use in outboard motors mixed in a 32:1 ratio with regular grade gasoline.

The lower unit gears and bearings are lubricated by approximately 6 oz. (177 mL) of oil contained in gearcase. SAE90 outboard gear lubricant should be used. Lubricant should be maintained at level of (vent) plug (U–Fig. E3-1) when motor is in upright position. The gearcase should be drained and filled with new lubricant at least once each year. Remove both plugs (U and L) to drain gearcase. If excessive water is noted when draining, seals and gaskets should be renewed as outlined in LOWER UNIT section. Motor should be in upright position when refilling gearcase. Insert filler tube in fill/drain plug opening (L) and squeeze tube until lubricant reaches level of vent plug opening (U). Install and tighten upper plug then remove filler tube and install lower plug. Make sure that gaskets on plugs are in good condition.

FUEL SYSTEM

CARBURETOR. Tecumseh float type carburetors (Fig. E3-2) with fixed high speed jet are used on all models. Carburetors used on all engines except type 381, 381A, 381B and 381C have a built in type fuel pump (4, 21, 22 and 23). Carburetors used on type 381, 381A, 381B and 381C engines use a separate fuel pump assembly (Fig. E3-3). Differences in service procedures will be noted when necessary.

Carburetor adjustments should be made with engine at normal operating temperature. Do not run engine unless lower unit is in water. Water pump is easily damaged by dry operation. To adjust idle mixture, press star wheel (11–Fig. E3-2) in and hold it in this position while adjusting screw (12). Turn mixture screw (12) in until it is lightly seated then back out one turn. Hold star wheel (11) in and turn it so projection is on 12 o'clock position (straight up) then let it out to engage screw (12). Start and run motor until operating temperature is reached. Place motor in forward gear

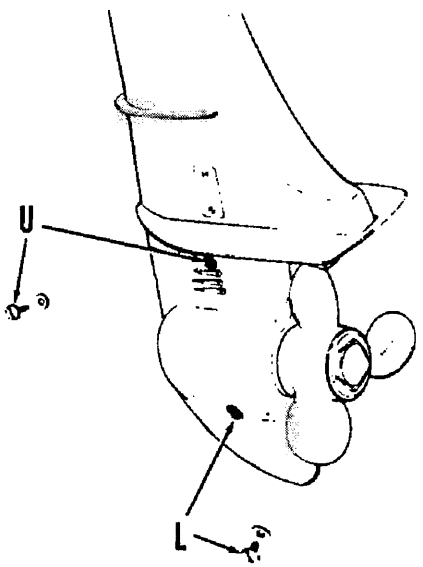
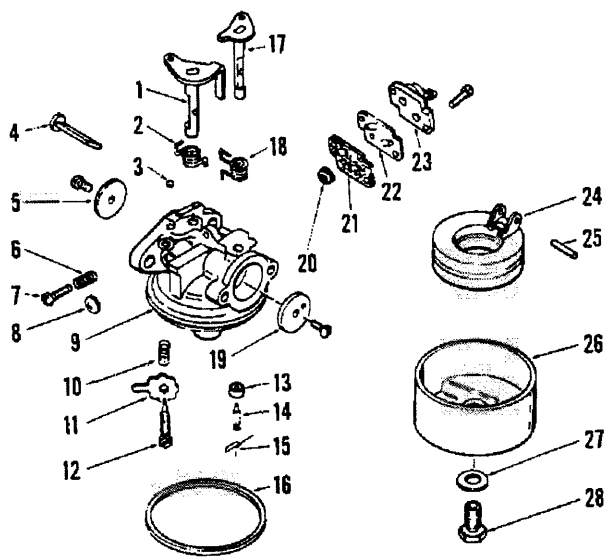


Fig. E3-1—View of gearcase showing upper (vent) plug (U) and lower (drain/fill) plug (L).

Fig. E3-2—Exploded view of carburetor typical of unit used on type 380 engines. Fuel pump components (4, 21, 22 and 23) are not used on carburetors for type 381 engines.

1. Throttle shaft
2. Return spring
3. Lead shot
4. Pump element
5. Throttle shutter
6. Spring
7. Idle speed screw
8. Welch plug
9. Throttle body
10. Spring
11. Star wheel
12. Mixture needle
13. Viton needle seat
14. Inlet needle
15. Clip
16. Gasket
17. Choke shaft
18. Return spring
19. Choke shutter
20. Screen
21. Gasket
22. Check valve
23. Cover
24. Float
25. Pin
26. Float bowl
27. Gasket
28. Main jet



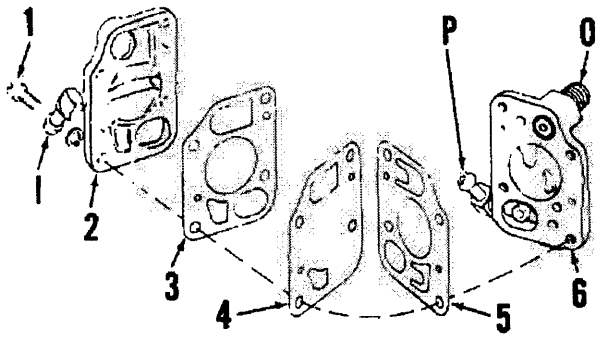


Fig. E3-3—Exploded view of fuel pump assembly used on type 381 engines.

1. Fuel Inlet
O. Fuel Outlet
P. Crankcase pressure line
1. Screw
2. Cover
3. Gasket
4. Diaphragm
5. Check valve
6. Body

and turn speed control grip fully to slow speed position. Turn star wheel, without pushing in, slowly out (counterclockwise) until engine speed decreases from rich mixture. Turn star wheel back until engine is idling smoothly. Adjust idle speed screw (7—Fig. E3-4) to obtain slowest possible smooth idle speed (approximately 750-1000 rpm). Mixture should be rich enough to provide smooth acceleration from idle to full throttle and not misfire when decelerating.

To adjust fast idle speed, shift motor to neutral and turn speed control grip until throttle bracket is touching locknut lever (L—Fig. E3-5). Engine speed should be 2500-3500 rpm. If engine speed is not within limits, loosen set screw and reposition lever (A).

When disassembling carburetor for service note location of identification marks on choke shutter (19—Fig. E3-2) and throttle shutter (5). Carburetors may be cleaned in commercial solvents after complete disassembly and removal of all rubber or nylon parts and gaskets. After cleaning, all passages should be cleared with compressed air.

Viton inlet needle seat (13),should not be removed unless renewal is intended. To remove seat (13), fashion a small hook from a paper clip, insert hook through seat and pull seat out of brass sleeve (Fig. E3-6). Do not try to remove brass sleeve. New Viton inlet needle seat may be driven into brass sleeve with a 5/32 inch (3.9687 mm) flat punch after lubricating sleeve with a drop of light oil. Seat must be installed with grooved side (G—Fig. E3-7) down. Make sure the needle seat is completely seated in brass sleeve (S).

Float setting should be 0.185-0.235 inch (4.70-5.97 mm) for carburetors used on type 380 through 380C and 382 through 382D engines and 0.155-0.217 inch (3.94-5.51 mm) for carburetors used on type 381 through 381C, 383 through 383C and 385 engines. Preferred method for checking float setting is to place an appropriate size drill bit between carburetor body and float assembly (Fig. E3-8). Recommended drill bit sizes are number 4 (0.209 inch or 5.308 mm) for carburetor used on type 380 through 380C and 382 through 382D engines and number 13 (0.185 inch or 4.699 mm) for carburetor used on type 381 through 381C, 383 through 383C and 385 engines.

When installing carburetor with built-in fuel pump, make sure that hole in mount gasket is correctly positioned over pump element (4—Fig. E3-2). When installing fuel pump on carburetor of units with separate fuel pump (Fig. E3-3), coat pipe threads of fuel pump outlet with an antiseize compound.

SPEED CONTROL LINKAGE

Speed control grip operates carburetor throttle linkage only. A centrifugal ignition advance mechanism is used.

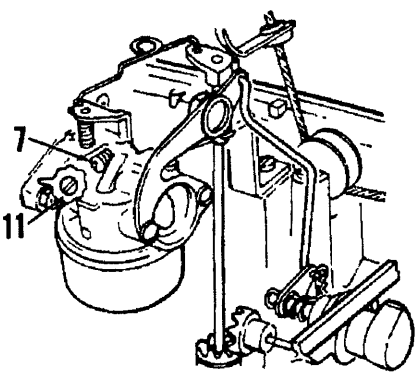


Fig. E3-4—View of throttle and choke linkage. Refer to Fig. E3-2 for legend.

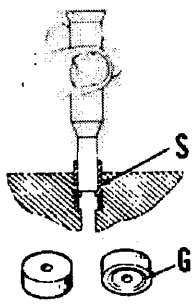


Fig. E3-7—Use a 5/32 inch (3.9687 mm) flat punch to install new inlet needle seat. Install seat with grooved side (G) down.

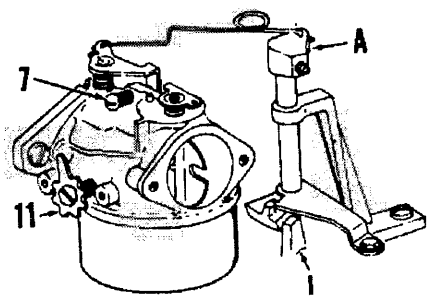


Fig. E3-5—Maximum speed in neutral should be 2500-3500 rpm. Speed is adjusted by repositioning lever (A) when throttle bracket is against lockout lever (L).

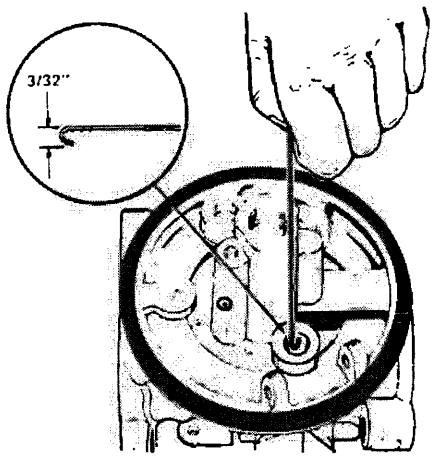


Fig. E3-6—Viton inlet needle seat (13—Fig. E3-2) may be removed by pushing a small hook through seat and pulling.

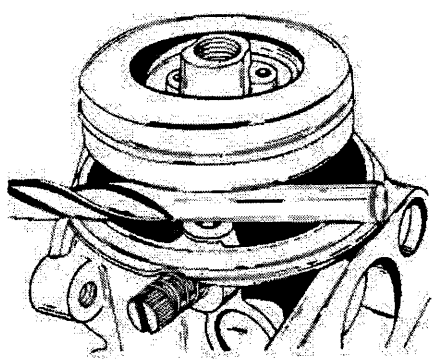


Fig. E3-8—Float level should be checked by placing an appropriate size drill bit between float and carburetor body. Refer to text for proper size drill bit.

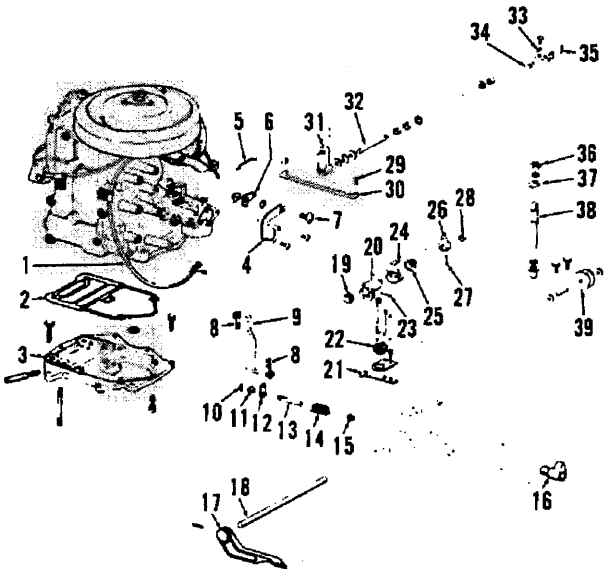


Fig. E3-11—View of gear shift and choke control linkage typical of all models.

1. Stop button leads
2. Gasket
3. Top adapter plate
4. Choke link bracket
5. Link
6. Lever
7. Shoulder screw
8. Clips
9. Choke link
10. Pin
11. Flat washer
12. Lever
13. Shaft
14. Spring
15. Nylon bushing
16. Knob
17. Shift lever
18. Shaft
19. Flanged bushing
20. Lever
21. Detent spring
22. Shear pin holder
23. Spirol pin
24. Detent cam
25. Flanged bushing
26. Lockout lever
27. Spirol pin
28. Bushing
29. Clip
30. Link
31. Lever
32. Shaft
33. Lever
34. Pin
35. Cotter pin
36. Nut
37. Hood lock
38. Shaft
39. Rope guide pulley

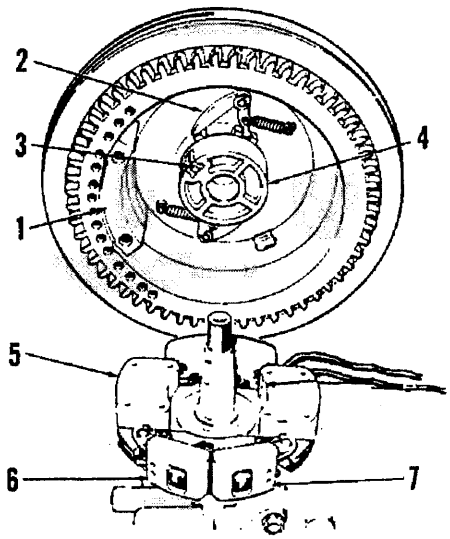


Fig. E3-13—View of solid state magneto assembly typical of all models.

1. Magnet
2. Flyweight
3. Trigger magnet
4. Sleeve assy.
5. Ignition module
6. High speed coil
7. Low speed coil

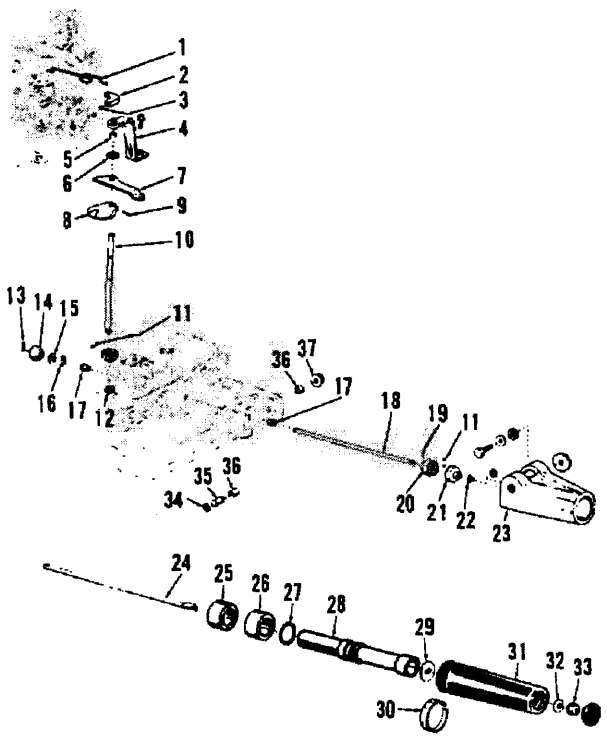


Fig. E3-12—View of throttle control linkage.

1. Link wire
2. Lever
3. Set screw
4. Bracket
5. Bushing
6. Retaining clip
7. Throttle stop
8. Throttle bracket
9. Spirol pin
10. Shaft
11. Pin
12. Bushing
13. Pin
14. Gear
15. Flat washer
16. Spring washer
17. Flanged bushing
18. Rod
19. Spirol pin
20. Gear
21. Gear
22. Nylon bushing
23. Bracket
24. Shaft
25. Rubber bushing
26. Rubber bushing
27. "O" ring
28. Handle
29. Special flat washer
30. Decal
31. Twist grip
32. Flat washer
33. Flanged nut

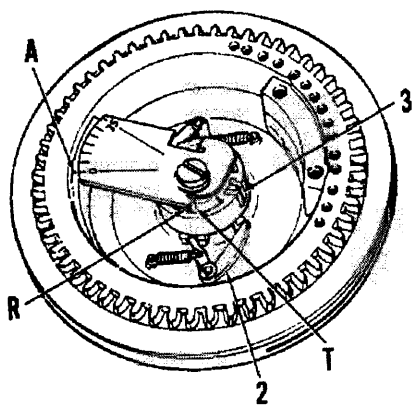


Fig. E3-14—Advancer sleeve movement may be checked with special tool. Refer to text for inspection procedure.

If control linkage has been disassembled, note that word "START" on twist grip decal should be aligned with arrow on bracket (23—Fig. E3-12) with motor in Neutral and grip turned counterclockwise as far as it will go. Linkage should be set as described to install a new decal (30).

IGNITION

A solid state, magnetically triggered magneto is used on all models. Magneto consists of one permanent magnet in flywheel, a small trigger magnet and sleeve assembly in center of flywheel, two ignition modules in stator assembly, two high speed ignition coils in stator, two low speed ignition coils in stator, two ignition transformer coils mounted on cylinder head and two spark plugs. Trigger magnet and sleeve assembly is linked to flywheel with a set of centrifugal advance weights so increasing engine speed will advance ignition timing.

Ignition timing should not change through normal use; however, if stator is removed without being marked for reinstallation or if stator, flywheel, advance weights or trigger magnet assembly are renewed, it will be necessary to retime ignition.

Flywheel must be removed to adjust ignition timing. Two special tools, available from Tecumseh Products Company, should be used to properly time ignition. Full movement range of advancer mechanism must be checked first. Position special tool, Tecumseh part number 670243, in trigger sleeve assembly in flywheel. Tabs (T—Fig. E3-14) of tool should engage ribs (R) in trigger sleeve. Place a pencil mark (A) on flywheel adjacent to "O" degree mark on tool. Grasp advancer mechanism flyweights (2) and pull them out fully against their stop. Do not use tool to

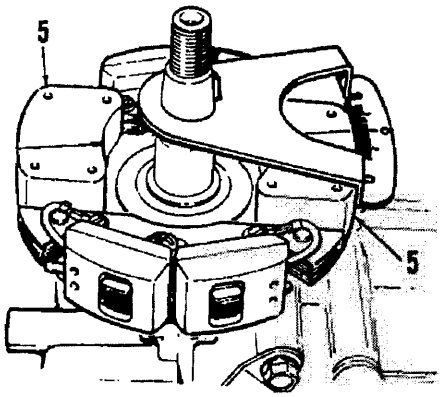


Fig. E3-15—Stator assembly is timed using special tool. Refer to text for proper timing procedure.

turn trigger assembly. Observe and record degree mark on special tool adjacent to pencil mark on flywheel.

To adjust position of stator assembly, set number one (top) piston to 0.125 inch (3.175 mm) BTDC. Position special tool, Tecumseh part number 670244, on crankshaft. Make sure tool is fully seated on crankshaft and Woodruff key (Fig. E3-15). Make sure that crankshaft is not moved from desired position during timing operation. Refer to degree measurement taken in previous paragraph. If trigger sleeve assembly movement was 30°, set stator so mark on ignition module is aligned with 0° mark on tool. If trigger sleeve movement was greater than 30°, turn stator **clockwise** past 0° mark, the number of degrees that trigger sleeve assembly moved more than 30. For example; if trigger sleeve movement was 33°, stator should be turned clockwise until 3° mark on timing tool is aligned with mark on ignition module. If trigger sleeve movement was only 28°, turn stator 2° counterclockwise from point when line on ignition module and 0° mark on timing tool align.

When assembling components, put a small amount of EP lithium grease on portion of crankshaft adjacent to trigger sleeve assembly. Make sure that no grease is on crankshaft taper when reassembling unit. Tighten flywheel nut to 30-35 ft.-lbs. (40.8-47.6 N·m) torque.

COOLING SYSTEM

All models are equipped with a rubber impeller type water pump. Pump is mounted on top of lower unit gearbox, between gearbox and motor leg. Water inlet holes are forward, on each side of gearbox, just below antiventilation plate.

When cooling system problems are encountered, first check the water inlet for plugging or partial stoppage; then if not corrected, remove the lower unit as outlined in the appropriate section and check the condition of the water pump, water passages, gasket and sealing surfaces.

POWER HEAD

R&R AND DISASSEMBLE. Mount motor on a convenient support and remove the hood. Tie a slip knot in starter rope at starter and remove pull handle. Disconnect fuel line, choke linkage, throttle linkage and wiring to STOP switch. Remove the six screws securing engine to base assembly. Remove stud nut from bottom of base assembly, near carrying handle. Remove engine assembly. Remove six Allen head screws securing base plate to engine.

Remove recoil starter assembly. Remove flywheel, mark stator for reinstallation and remove stator assembly. Lower main bearing cap (28–Fig. E3-17) must be removed before crankcase cover (43) can be removed. Remove screws securing crankcase cover to crankcase. Three pry points (P–Fig. E3-18) are provided to aid in separating the crankcase cover from crankcase. Do not pry at any other points as mating surfaces will be damaged and crankcase

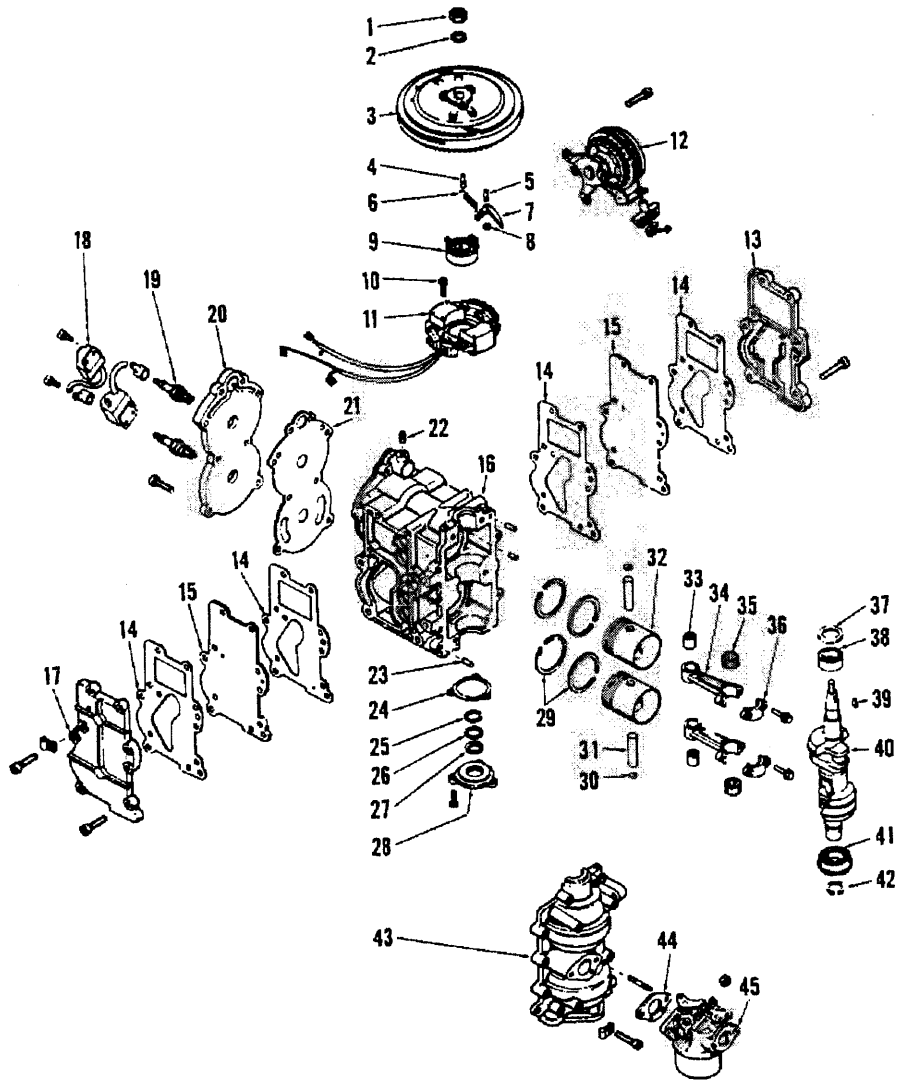


Fig. E3-17—Exploded view of power head assembly.

1. Nut
2. Lockwasher
3. Flywheel
4. Anchor pin
5. Pivot pin
6. Spring
7. Flyweight
8. Clip
9. Advancer sleeve
10. Screw
11. Stator
12. Recoil starter
13. Exhaust/transfer cover
14. Gaskets
15. Plates
16. Crankcase/cylinder block
17. Exhaust/transfer cover
18. Transformer coil
19. Spark plug
20. Cylinder head cover
21. Gasket
22. Pipe plug
23. Dowel
24. Gasket
25. Snap ring
26. Retaining ring
27. Seal
28. Bearing cup
29. Piston rings
30. Piston pin clip
31. Piston pin
32. Piston
33. Needle bearing cartridge
34. Connecting rod
35. Bearing needles (28 each rod)
36. Connecting rod cap
37. Seal
38. Needle bearing cartridge
39. Woodruff key
40. Crankshaft
41. Main bearing
42. Snap ring
43. Crankcase cover
44. Gasket
45. Carburetor

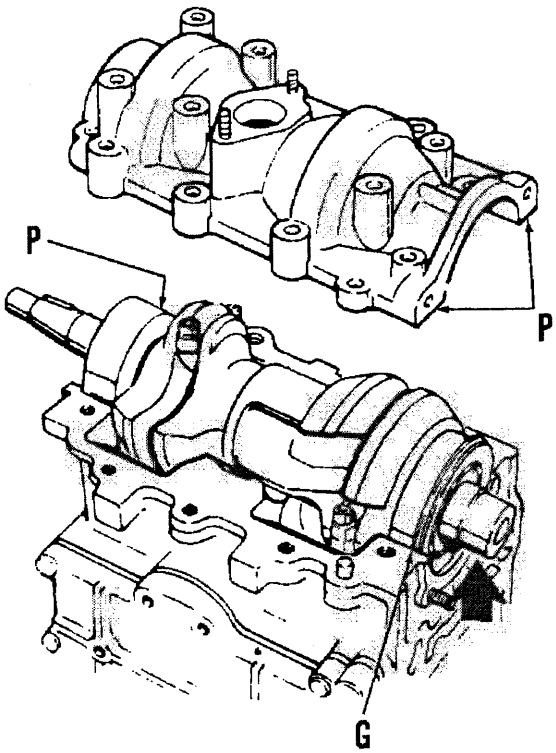


Fig. E3-18—Pry only at three points (P) indicated when removing crankcase cover. Crankshaft should be broken loose from crankcase by tapping with a soft faced hammer in direction of large arrow.

cover may be bent or fractured. Crankcase cover and crankcase are a matched set and cannot be purchased separately.

Crankshaft may be removed with or without connecting rods and pistons. If pistons are to remain in cylinders, use caution to prevent loss of bearing needles when connecting rod caps are removed. Identify rod caps so they can be reinstalled in original location. To remove crankshaft, use a mallet or soft faced hammer to tap up on **pto end** of crankshaft (Fig. E3-18). Do not tap magneto end of crankshaft up first as pto bearing lock ring groove (G) in crankcase may be damaged. After crankshaft has been broken loose from crankcase, lift each end evenly to remove crankshaft without damaging components.

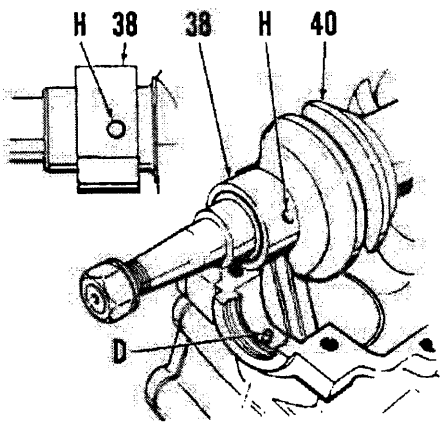


Fig. E3-19—Hole (H) in magneto end main bearing case (38) must be positioned over dowel (D) in crankcase.

Refer to the appropriate following paragraphs for overhaul or repair procedures.

REASSEMBLE. Because of the two-stroke design, crankcase and transfer port covers must be completely sealed against both vacuum and pressure. Exhaust covers, engine base plate and cylinder head cover must be sealed against water leakage and pressure. Mating surfaces of water intake and exhaust areas between power head and lower unit must form a tight seal.

Whenever the power head is disassembled, it is recommended that all gasket surfaces and the mating surface of the crankcase and crankcase cover be carefully checked for nicks and burrs or warped surfaces which might interfere with a tight seal. The mating surfaces on crankcase and covers may be checked and lapped, if necessary, to provide a smooth surface. For lapping, use a regular lapping block or a sufficiently large piece of smooth glass. Lay a sheet of No. 00 emery cloth on the lapping plate then place the surface to be lapped on the emery cloth. Apply a very light pressure and use a figure eight motion, checking frequently to determine progress. Do not remove any more metal than is necessary. Finish lap using lapping compound or worn emery cloth. Thoroughly clean the parts with new oil on a clean, soft rag then wash with soap suds and clean rags.

Mating surface between crankcase and crankcase cover must not be lowered by lapping. Both portions of crankcase must be renewed if either is damaged beyond repair.

Bronze liner cast in center of crankcase sections acts as a seal between cylinders and as a center main bearing. Crankcase sections should be renewed if bronze center bearing is heavily scored or otherwise damaged.

Burrs caused by staking crankshaft seal in place at magneto end of crankcase should be removed before reassembling crankcase sections.

Make sure that hole (H—Fig. E3-19) in top main bearing (38) is correctly positioned over dowel pin (D) in crankcase.

A nonhardening type gasket sealer should be used between crankcase and crankcase cover. Apply sealer in a thin bead, making sure that entire length of crankcase is sealed. Sealer should be kept at least ½ inch (12.7 mm) away from center main bearing liner to prevent excess sealer from squeezing into bearing when crankcase cover is installed. Install crankcase cover and tighten screws using torque sequence shown in Fig. E3-20. Screws should be tightened to 70-80 in.-lbs. (7.9-9 N·m) torque in increments of 20 in.-lbs. (2.3 N·m).

Magneto end crankshaft seal (37—Fig. E3-17) may be installed after crankcase sections are assembled. Seal should be pressed into crankcase, using an appropriate size driver, until it is flush or no more than 1/32 inch (0.79 mm) below end of crankcase (Fig. E3-21). Crankcase should be staked to help retain seal.

Lower bearing cap seal (27—Fig. E3-17) may be renewed after removal of snap ring (25) and retaining ring (26). Seal (27) should be installed with lip facing down (Fig. E3-22).

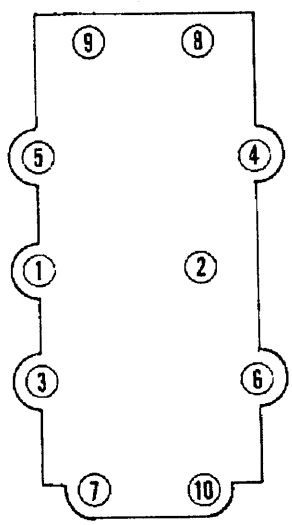


Fig. E3-20—Crankcase cover screws should be tightened to 70-80 in.-lbs. (7.9-9 N·m) torque in increments of 20 in.-lbs. (2.3 N·m) using sequence shown.

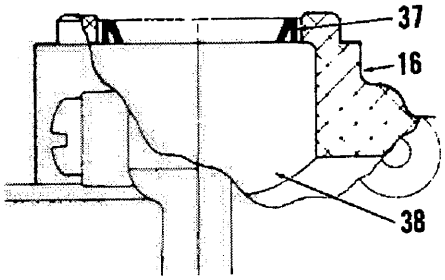


Fig. E3-21—Seal (37) at magneto end of crankcase (16) should be pressed in until it is flush or no more than 1/32 inch (0.8 mm) below surface. Refer to Fig. E3-19 for proper installation of bearing (38).

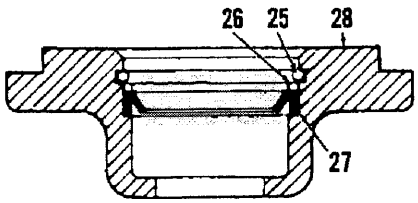


Fig. E3-22—Lower main bearing cap seal (27) must be installed with lip down, away from main bearing. Refer to Fig. E3-17 for legend.

PISTONS, PINS, RINGS AND CYLINDERS. Before removing connecting rod caps, make certain that caps and rods are marked for reinstallation in original position. Use caution to prevent loss of crankpin bearing needles as rod cap is removed.

Standard piston skirt diameter is 2.371-2.372 inch (60.22-60.25 mm). Piston ring end gap should be 0.005-0.013 inch (0.13-0.33 mm). Side clearance of piston rings in grooves should be 0.003-0.005 inch (0.07-0.13 mm) for top piston ring and 0.002-0.004 inch (0.05-0.10 mm) for bottom piston ring. Pistons and rings are available in standard size only. If cylinder bores are damaged or worn excessively, cylinder block/crankcase assembly must be renewed.

When installing pistons, arrow on dome should point to port (left) side of engine. Match marks (MM—Fig. E3-24) on rod and rod cap should be toward magneto end of crankcase. Closed end of piston pin should also be facing magneto end of crankcase. Make certain that ring end gaps remain at locating pins (LP) as pistons are placed in cylinder bores. Rod cap screws should be tightened to 70-80 in.-lbs. (7.9-9 N·m) torque.

Components should be lubricated with two-stroke engine oil while being assembled.

CONNECTING RODS, BEARINGS AND CRANKSHAFT. Crankshaft may be removed with connecting rods attached or by removing rod caps and allowing pistons to remain in cylinder bores. Before removing rod caps, make certain that rods and caps are marked for reinstallation in original position.

After crankcase cover has been removed, crankshaft may be removed by tapping pto end of crankshaft up, out of crankcase (Fig. E3-18). Do not tap on magneto end of crankshaft as snap ring groove (G) at pto end of crankcase may be damaged. Once crankshaft has been broken loose from crankcase, it should be lifted straight up, out of engine.

Connecting rods use an encased needle bearing pressed into piston pin end and have 28 loose bearing needles at crankpin end. Inspect bearing surface in large end of connecting rod for scoring. Check rod for cracks and for discoloration caused by overheating. Piston pin and small end needle bearings should be renewed if piston pin appears worn in bearing contact area.

To assemble piston and connecting rod, install piston pin retaining clip on side of piston with ring locating pins (LP—Fig. E3-24). Heat piston in a container of oil, to approximately 300° F. Install piston pin, closed end first, with connecting rod positioned so that match mark (MM) is toward same side of piston as ring locating pins (LP). Install second piston pin retaining clip.

To install used bearing needles at crankpin, use a light, nonfibrous grease to hold half of the bearings in connecting rod. Position crankshaft in rod and use grease to hold remaining bearing needles on crankpin. Install rod cap. To install new bearing needles at crankpin, leave beeswax on bearings. Wrap bearing strip around crankpin and assemble connecting rod. Flush beeswax from bearing with lacquer thinner and lubricate with two-stroke engine oil. Tighten rod-cap screws to 70-80 in.-lbs. (7.9-9 N·m) torque.

Crankshaft is supported by an encased needle bearing at magneto end, a ball bearing at pto end and a bronze plain bearing at center main journal. Bronze bearing liner for center main is cast into crankcase sections. Cutouts in center main journal of crankshaft act as timed passages for fuel:air mixture from carburetor.

Main bearing at pto end of crankshaft should not be removed unless renewal is intended. To remove bearing, remove small snap ring (42—Fig. E3-17). Use a bearing splitter to grasp bearing by

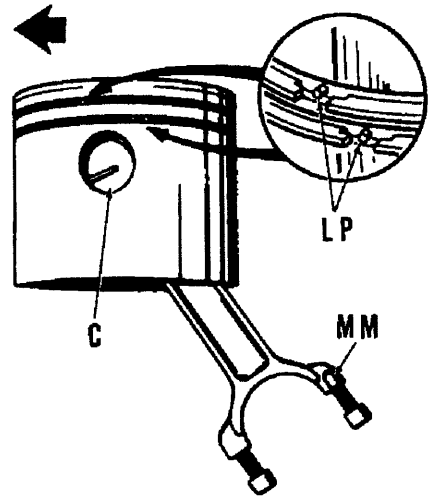


Fig. E3-24—Closed end (C) of piston pin should be on same side of piston as ring locating pins (LP). Connecting rod should be assembled to piston with match mark (MM) on same side of piston as ring locating pins. Arrow on piston dome should be toward port (left) side of engine. Closed end (C) of piston pin will be toward top.

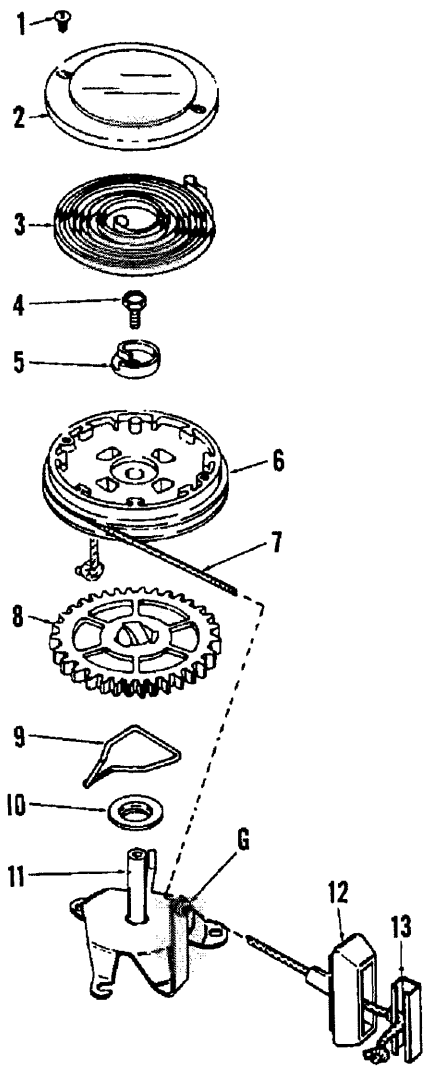


Fig. E3-26—Exploded view of recoil starter assembly typical of all models.

G. Rope guide
1. Screw
2. Cover
3. Rewind spring
4. Screw
5. Spring anchor
6. Pulley
7. Rope
8. Gear
9. Drag clip
10. Thrust washer
11. Mount bracket
12. Handle
13. Rope anchor

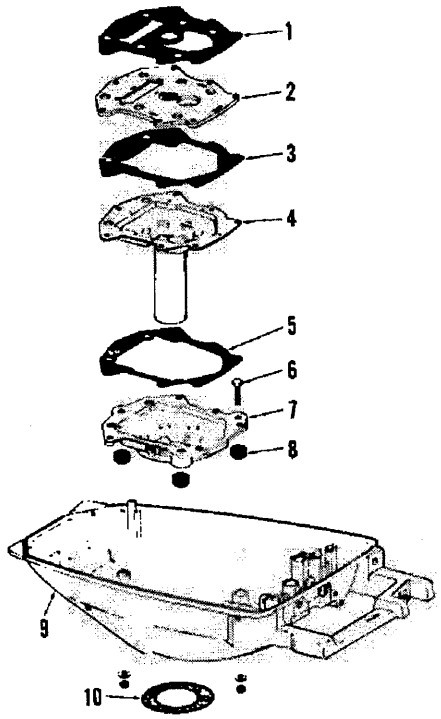


Fig. E3-28 — View of engine adapter plate and exhaust separator.

1. Gasket
2. Water tube adapter plate
3. Gasket
4. Exhaust separator plate
5. Gasket
6. Screw
7. Adapter housing
8. Mount grommet
9. Mount base
10. Gasket

large snap ring then use an appropriate puller to remove bearing from crankshaft. Bearing is distorted by this removal method. Once bearing is removed, it is considered ruined and must be renewed.

To install new pto end main bearing, place crankshaft in a vise with pto end up. Heat new bearing, in a container of oil, to approximately 300°F. Bearing should be supported in container so it is not laying in bottom, next to the heat source. Once bearing is removed from oil it should be installed as quickly as possible. Make sure that bearing is fully seated on crankshaft.

When installing magneto end main bearing (38) note that locating hole in bearing case is not centered. Bearing should be installed with side closest to locating hole toward crank throw (Fig. E3-19).

MANUAL STARTER

The majority of recoil starter service required may be done with starter still attached to power head; however, starter may be removed as an assembly if engine work is to be performed.

To remove recoil starter assembly, tie a slip knot in rope next to guide (G – Fig. E3-26) on starter bracket. Remove pull handle then remove screws securing mount bracket (11) to power head.

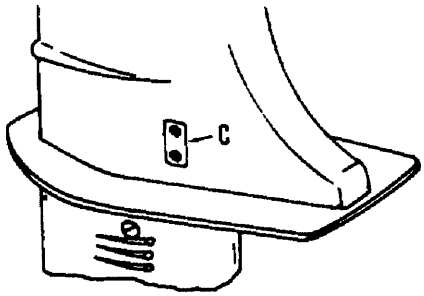


Fig. E3-31 — Remove inspection cover (C) for access to shift linkage screw.

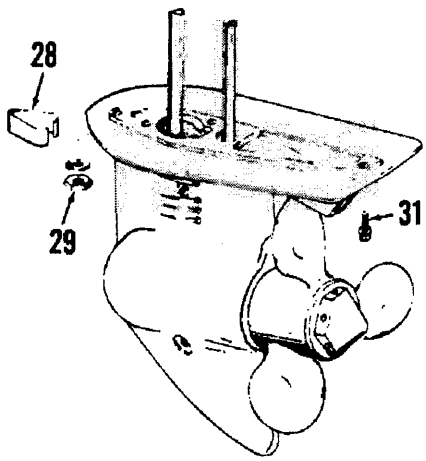


Fig. E3-32 — Lower unit gearbox may be removed from motor leg after removal of nut (29) and screw (31). On later models, stud nut (29) is located at front edge of motor leg.

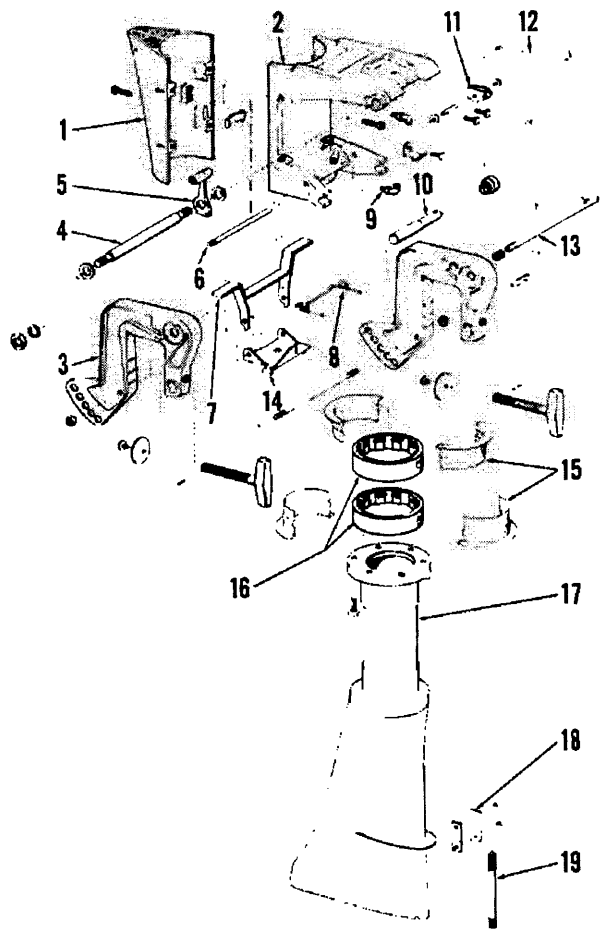


Fig. E3-29 — Exploded view of motor leg and stern bracket assembly.

1. Swivel bracket cap
2. Swivel bracket
3. Stern bracket
4. Tilt lock pin
5. Release lever
6. Pivot pin
7. Shallow drive prop bracket
8. Torsion spring
9. Grease fitting
10. Tilt lock pin
11. Lever
12. Link
13. Pin
14. Reverse tilt lock plate
15. Cushion liners
16. Cushion rings
17. Motor leg
18. Inspection cover
19. Stud

Stator should installed so teeth of starter gear are at least 1/16 inch (1.59 mm) below base of flywheel teeth. If starter is installed too close to flywheel, gears will bind and starter will be damaged by engine operation. Test installation of starter with spark plugs removed to be sure gears disengage completely. Starter mount bracket has a slotted hole to allow gear engagement adjustment.

To disassemble recoil starter for service, remove pull handle and allow rope to be pulled onto starter so rewind spring tension is relieved. Remove cover (2) only after spring tension has been released. Recoil spring can be renewed at this point. To remove pulley wheel (6), remove screw and spring hub (5).

Standard size pull rope is 5/32 inch (3.97 mm) in diameter and 69 inches (175.3 cm) in length.

Before assembling starter, lubricate both sides of thrust washer (10), axle portion of bracket (11) and pulley spirol with an EP lithium grease. Screw used

to retain spring anchor (5) should be tightened to 35-45 in.-lbs. (3.9-5 N·m) torque. Screw must be tight enough to prevent spring anchor from turning and releasing recoil spring tension.

LOWER UNIT

PROPELLER AND DRIVE PIN. Cushioning protection for propeller and lower unit is provided by a cushion hub (64–Fig. E3-33) and by shear pin (53). Shear pin, Eska part 96683, should be used.

R&R AND OVERHAUL. To remove lower unit from motor leg, remove inspection cover (C–Fig. E3-31) and shift linkage screw (2–Fig. E3-33). Be careful not to drop screw in motor leg. On early models, remove clip (28–Fig. E2-32), screw (31) and stud nut (29). On later models, unscrew stud nut at front edge of motor leg and screw (31–Fig. E2-32). Pull lower unit from motor leg.

Shift lower unit into neutral position. Remove water pump assembly. Be careful not to lose impeller drive pin (19–Fig. E3-33). Remove propeller, shear pin and screws (59) that secure

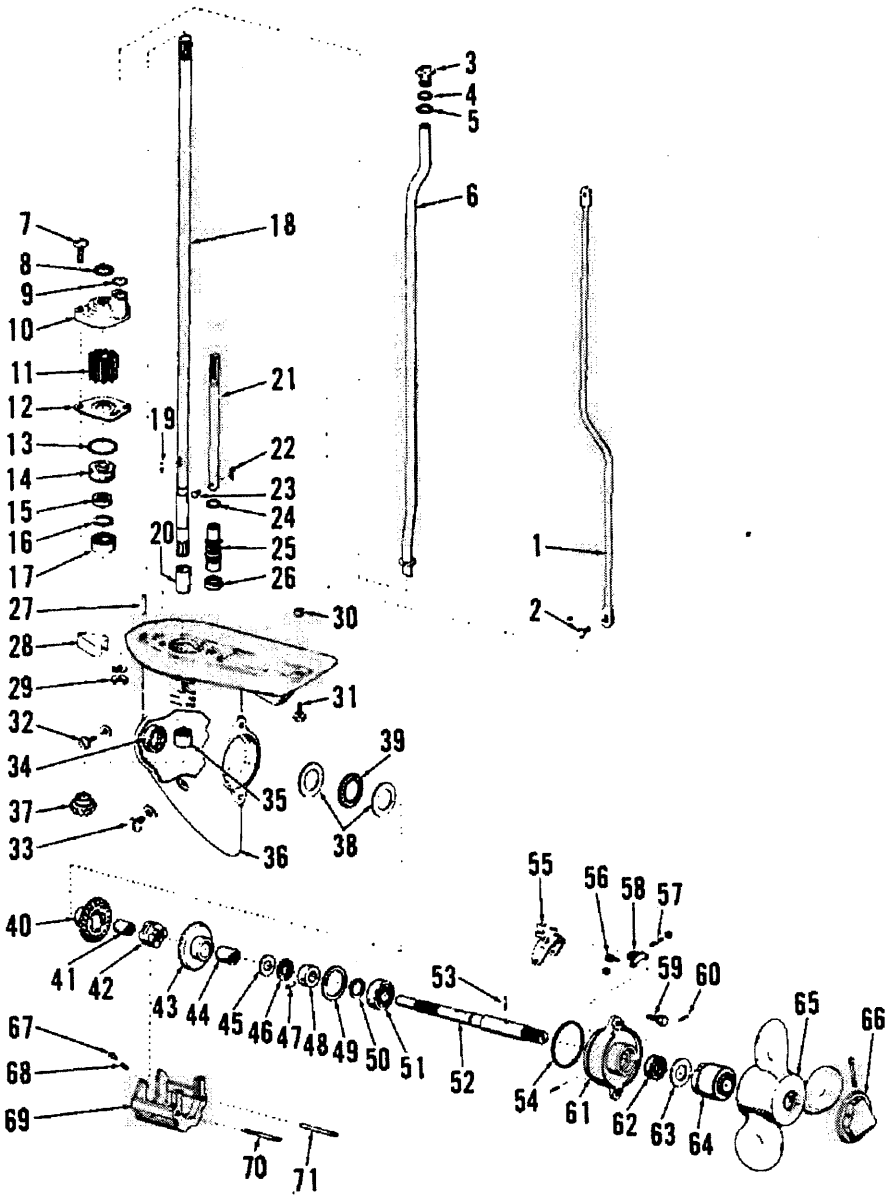
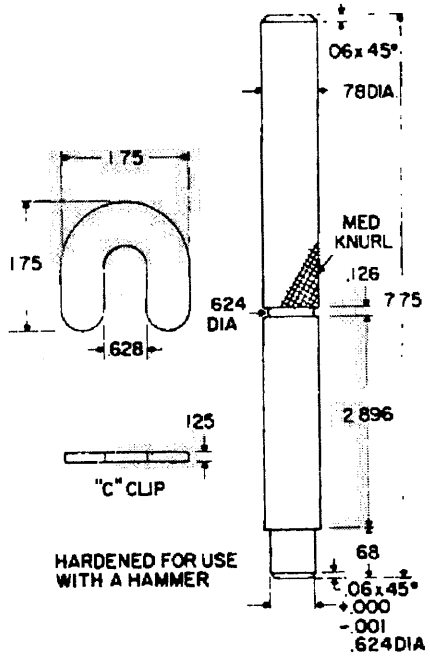


Fig. E3-33–Exploded view of lower unit gearbox assembly. Lubricate water pump impeller (11) and water tube seal (9) with petroleum jelly when reassembling.

1. Shift link
2. Screw
3. Nut
4. Washer
5. Seal
6. Water tube
7. Screw
8. Seal
9. Seal
10. Water pump body
11. Impeller
12. Base plate
13. "O" ring
14. Retainer plate
15. Seal
16. Snap ring
17. Shielded ball bearing
18. Drive shaft
19. Pin
20. Spacer
21. Shift rod
22. Cotter pin
23. Clevis pin
24. "O" ring
25. Rubber boot
26. Seal
27. Roll pin
28. Clip
29. Stud nut
30. Pilot bushing
31. Screw
32. Vent plug
33. Drain/fill plug
34. Needle bearing
35. Needle bearing
36. Gearcase
37. Pinion gear
38. Thrust washers
39. Thrust bearing
40. Forward gear
41. Bearing
42. Shift dog
43. Reverse gear
44. Bearing
45. Washer
46. Thrust bearing
47. Roll pin
48. Collar
49. Snap ring
50. Snap ring
51. Ball bearing
52. Propeller shaft
53. Shear pin
54. "O" ring
55. Fork lever
56. Screw
57. Pin
58. Lever bracket
59. Screw
60. Roll pin
61. Cover
62. Seal
63. Washer
64. Cushion
65. Propeller
66. Nut
67. Detent
68. Spring
69. Shifter bracket
70. Left guide pin
71. Right guide pin



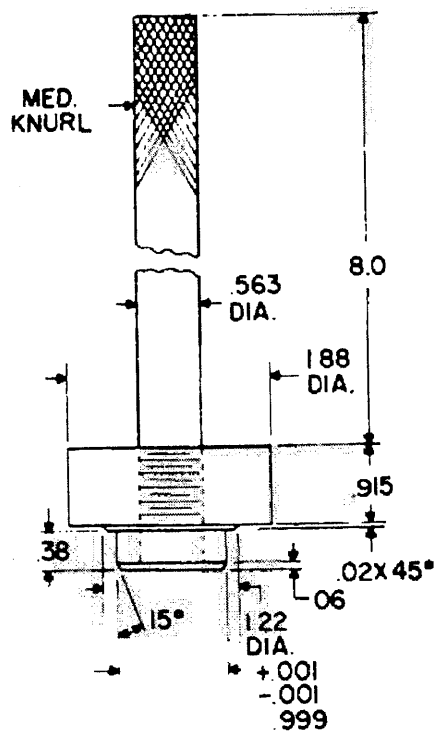


Fig. E3-35–Drawing of special tool that should be used to install needle bearing (34–Fig. E3-33).

gear cover (61). Pull propeller shaft assembly from gear box while pulling up lightly on shift rod (21). Place thumb over detent hole in shifter bracket (69) while pulling bracket away from cover (61). Detent (67) and spring (68) will be released as bracket is pulled away.

Remove screws (56) securing fork lever bracket (58) to cover. Remove large snap ring (49) then gently tap propeller shaft (52) out of cover. Small roll pins (60) secure left (70) and right (71) shift bracket guide pins in cover (61). To remove bearing (51) from propeller shaft, clamp collar (48) in vise jaws, drive roll pin (47) out then remove collar and snap ring (50). Place propeller shaft in a vise so that inner race of ball bearing (51) is supported but jaws are not touching propeller shaft. Use a soft faced hammer to drive shaft out of bearing.

To remove drive shaft (18), remove retainer plate (14) and snap ring (16). Hold onto drive shaft and use a soft faced hammer to drive gearcase off shaft. Remove drive pinion (37) and forward gear (40). Ball bearing (17) may be removed from drive shaft by placing shaft in a vise so inner race of bearing is supported but jaws are not touching shaft. Use a soft faced hammer to drive shaft out of bearing. When installing ball bearing (17), make sure that shielded side of bearing is facing water pump.

Needle bearings (34 and 35) should only be serviced with proper tools as improper service procedures may damage gearcase. A combination removal/installation tool for drive shaft needle bearing (35) may be constructed using drawing in Fig. E3-34.

To remove bearing (35–Fig. E3-33), place tool, without "C" clip, in bearing from top of gearcase and pound on end of tool. To install bearing (35), place "C" clip on tool so new bearing will be properly positioned in bore when driven in from top of gearcase.

A blind hole bearing puller should be used to pull propeller shaft needle bearing (34). A special driver (Fig. E3-35) should be used to install new bearing.

Needle bearings (41 & 44–Fig. E3-33) may be removed and reinstalled with the aid of an arbor press.

When reassembling lower unit, make sure that oil seals (15, 26 & 62) are installed with lips facing inside of gearcase. Shift bracket guide pin (70) with detent grooves must be installed on left side. Shift shaft (21) is installed with flat on end facing left side. Install retainer plate (14) so notches align with cutouts in water pump base plate (12).

When assembling gearcase to motor leg, use a flashlight to observe through exhaust outlet that water tube (6) is properly seating in water pump. Install washer and stud nut which retain lower unit to motor leg before installing screw (31). Check shift mechanism for proper engagement. Detents in shift mechanism in lower units should be felt when operating shift lever.