JOHNSON

JOHNSON MOTORS
2600 Pershing Rd.
Waukegan, Illinois

CONDENSED SERVICE DATA

Series / Year Produced	JW	CD	AD	QD	FD	FD
1955	JW-11	CD-12	.....	QD-16	.....	.....
1956	JW-12	CD-13	AD-10	QD-17	FD-10	.....
1957	JW-13	CD-14	AD-11	QD-18	.....	FD-11
1958	JW-14	CD-15	AD-12	QD-19	.....	FD-12
1959	JW-15	CD-16	.....	QD-20	.....	FD-13
1960	JW-16	CD-17	.....	QD-21	.....	FD-14
1961	JW-17	CD-18	.....	QD-22	.....	FD-15
1962	JW-17R	CD-19	.....	QD-23	.....	FD-16
1963	JW-18R	CD-20C	.....	QD-24M	.....	FD-17M
TUNE-UP						
Hp @ rpm	3.0 @ 4000	5.5 @ 4000	7.5 @ 4000	10 @ 4000	15 @ 4000	18 @ 4000
Bore—Inches	1.5636	1.9375	2.125	2.375	2.375	2.500
Stroke—Inches	1⅜	1½	1¾	1⅞	2¼	2¼
Number of Cylinders	2	2	2	2	2	2
Displacement—Cu. In.	5.28	8.84	12.40	16.60	19.94	22.00
Spark Plug						
Champion	J4J	J4J	J4J	J4J	J4J	J4J
AC	M42K	M42K	M42K	M42K	M42K	M42K
Auto-Lite	A21X	A21X	A21X	A21X	A21X	A21X
Electrode Gap	0.030	0.030	0.030	0.030	0.030	0.030
Magneto Point Gap	0.020	0.020	0.020	0.020	0.020	0.020
Magneto Timing	See Text	See Text	See Text	See Text	See Text	See Text
Carburetor Make	Own	Own	Own	Own	Own	Own
Carburetor Adjustment	See Text	See Text	See Text	See Text	See Text	See Text
Fuel-Oil Ratio:						
Before 1959	16:1	16:1	16:1	16:1	16:1	16:1
After 1958	24:1	24:1	24:1	24:1	24:1	24:1
SIZES — CLEARANCES POWER HEAD						
Piston Rings						
End Gap	0.005-0.015			0.007-0.017		
Side Clearance	0.001-0.0035					
Piston Skirt Clearance	0.0013-0.0020			0.002-0.0035	0.003-0.0045	
Crankshaft Bearing Diameters:						
Top Main Bearing	0.6849-0.6854	0.8080-0.8085	0.8120-0.8125		0.9995-1.0000	
Center Main Bearing	0.6849-0.6854	0.8080-0.8085	0.8120-0.8125	0.9985-0.9990	0.9995-1.0000	
Lower Main Bearing	0.6849-0.6854	0.8080-0.8085	0.8120-0.8125	0.8120-0.8125	0.9995-1.0000	
Crankpin	0.6250-0.6255	0.8100-0.8105	0.8120-0.8125	0.8145-0.8150	1.000-1.0005	
Crankshaft Bearing Diametral Clearance:						
Top Main Bearing	0.0013-0.0023	0.001-0.002	0.0025-0.0035	Roller Bearing		
Center Main Bearing	0.0013-0.0023	0.001-0.002	0.0025-0.0035	0.003-0.004	Roller Bearing	
Lower Main Bearing	0.0013-0.0023	0.001-0.002	0.0025-0.0035	Roller Brng.	0.0025-0.0035	Roller Bearing
Crankpin	0.0007-0.0017	0.0005-0.0015	0.001-0.002	Roller Bearing		
Piston Pin Diametral Clearance in Rod	0.0004-0.0011	0.0003-0.0010	0.0003-0.0010	0.0007-0.0014	0.0007-0.0014	Roller Bearing
LOWER UNIT						
Drive Shaft Bearing Diametral Clearance	0.002-0.004	0.0015-0.0035	0.001-0.0025		0.002-0.0035	
Propeller Shaft Bearing Diametral Clearance						
Front	0.001-0.002			0.001-0.002		
Rear	0.001-0.002	0.0005-0.0015		0.001-0.002		0.0005-0.0015
Propeller to Shaft Diametral Clearance	0.003-0.0043	0.004-0.006		0.007-0.0095		0.0045-0.009
TIGHTENING TORQUES (All Values In Inch Pounds)						
Connecting Rod	60-66	60-66	60-66	180-186	180-186	180-186
Crankcase Halves	60-84	60-84	60-84	144-168	144-168	120-144
Cylinder Head	60-84	60-84	60-84	96-120	96-120	96-120
Inlet Manifold	36-48	36-48	36-48	36-48	36-48	36-48
Exhaust Manifold	24-36	24-36	24-36	24-36	24-36	24-36
Flywheel	480-540	480-540	480-540	480-540	480-540	480-540
Spark Plug	240-246	240-246	240-246	240-246	240-246	240-246
Power Head to Lower Unit	60-84	60-84	60-84	60-84	60-84	60-84

LUBRICATION

The power head is lubricated by oil mixed with the fuel. On motors produced before 1959, mix ½-pint outboard motor oil with each gallon of unleaded gasoline. On 1959 and later motors, use ⅓-pint oil with each gallon of gasoline. If outboard motor oil is not available use a good grade of regular "type MM" SAE 30 motor oil. Mix gasoline and oil thoroughly, using a separate container, before pouring mixture into fuel tank.

The lower unit gears and bearings are lubricated by oil contained in the gear case. Special "Outboard Marine Corporation, Type 'C' Lubricant" should be used. This lubricant is supplied in a tube and filling procedures are as follows: Remove lower plug from gear case and attach tube. Remove upper (vent) plug from case and, with motor in upright position, fill gear case until lubricant reaches level of upper (vent) plug hole. Reinstall vent plug; then remove lubricant tube and reinstall lower plug. Tighten both plugs securely, using new gaskets if necessary, to provide a water tight seal. If OMC Type C Lubricant is not available, gear case may be temporarily filled with outboard motor oil through vent (top) plug opening. If outboard oil is used, drain and refill with OMC Type C Lubricant as soon as possible. Lower gear lubricant should be maintained at level of vent plug, and drained and renewed every 100 hours of operation.

FUEL SYSTEM

CARBURETOR. Float type carburetors are used on all models. Refer to the appropriate following paragraphs for adjustment and overhaul notes.

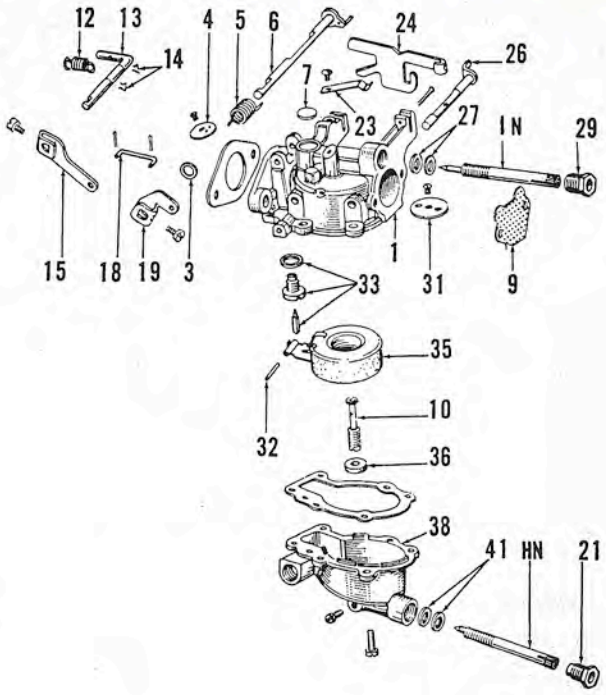
Series JW Motors are equipped with a carburetor of the type shown in Fig. J1. Normal initial setting for the low speed needle (IN) is 1⅛ turns open. Initial setting for high speed needle (HN) is ½-turn open. Final adjustment must be made when motor is in operation, by turning knobs on control panel. Clockwise rotation of both needles leans the mixture.

To set the carburetor float level, remove the lower shroud; then unbolt and remove

Fig. J1 — Exploded view of carburetor used on series JW motors.

1. Body
3. Washer
4. Throttle valve
5. Spring
6. Shaft & lever
7. Plug
9. Screen
10. Nozzle
12. Spring
13. Follower
14. Spring clip
15. Lever
18. Link
19. Lever
21. Nut
23. Spring
24. Choke rod
26. Choke shaft
27. Packing
29. Nut
31. Choke valve
32. Float shaft
33. Needle valve & seat
35. Float
36. Gasket
38. Float chamber
41. Packing

HN. High speed needle
IN. Low speed needle



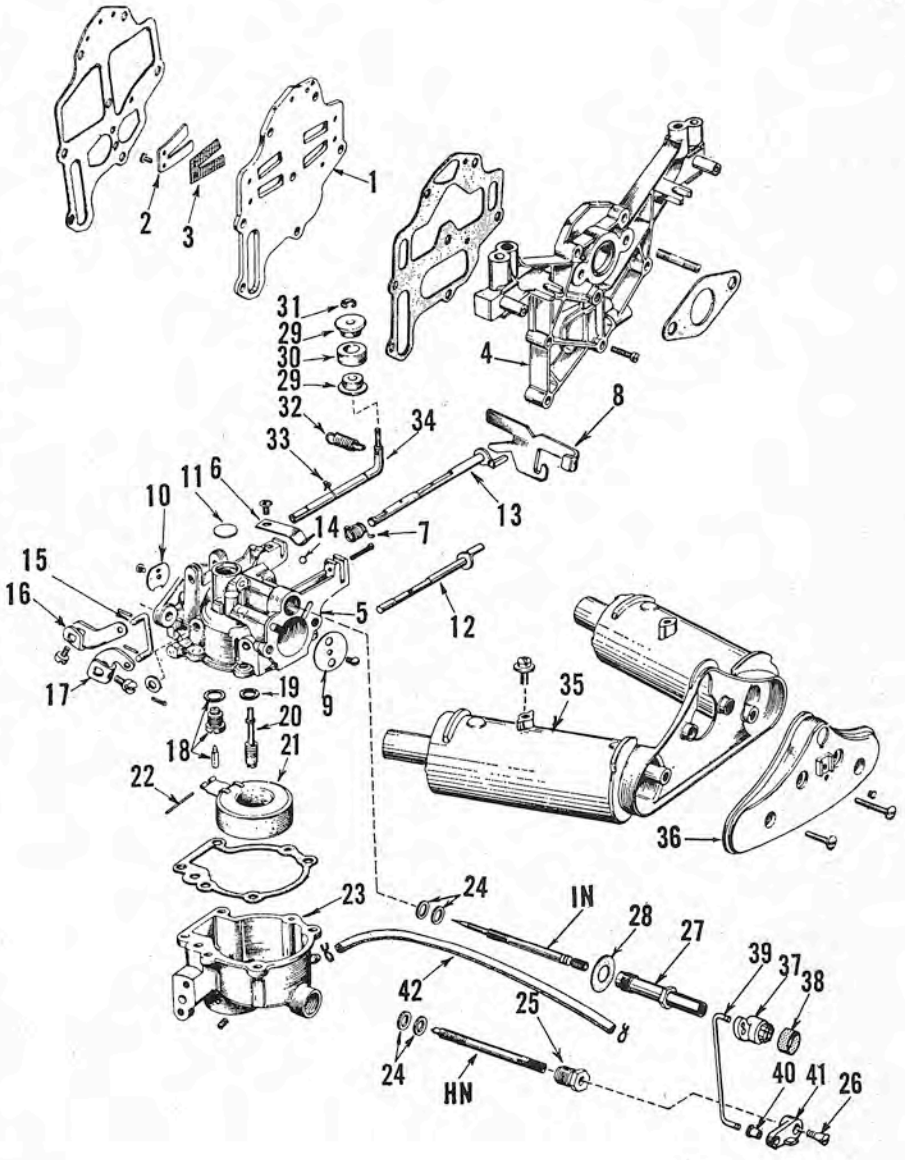


Fig. J2—Exploded view of CD-16 and CD-17 carburetor, silencer and reed valve assembly. Earlier models are similar.

1. Reed plate
2. Reed stop
3. Reed petals
4. Inlet manifold
5. Body
6. Spring
7. Throttle return spring
8. Choke rod
9. Choke valve
10. Throttle valve
11. Plug
12. Choke shaft
13. Throttle shaft
14. Lead shot
15. Link
16. Lever
17. Lever
18. Inlet needle & seat
19. Gasket
20. Main nozzle
21. Float
22. Float shaft
23. Float chamber
24. Packing
25. Nut
26. Lock screw
27. Nut
28. Washer
29. Bushings
30. Roller
31. Snap ring
32. Spring
33. Clip
34. Cam follower
35. Air silencer
36. Cover
37. Bellcrank
38. Sleeve
39. Link
40. Bushing
41. Bellcrank
42. Fuel line

IN. Low speed needle
HN. High speed needle

the carburetor. Refer to Fig. J1 and unbolt and remove float chamber (38). Invert the carburetor body (1) and check the natural position of the float while carburetor is inverted. Upper surface of float (lower when assembly is inverted) should be level and flush with gasket surface of carburetor body. If it is not, carefully bend float lever; then check after assembly to be sure float does not bind or rub.

Series CD, AD, QD and FD Motors are equipped with a carburetor of the type shown in Fig. J2, J3 or J4. On motors built before 1959, knobs on control panel were attached directly to the high and low speed needles (HN & IN). In 1959 and later motors, a double knob (such as commonly used on radios to control the volume and the bass and treble) protrudes through the control panel. The outside (larger) knob is attached to bellcrank (37) and turns the high speed needle (HN) by means of rod (39) and bellcrank (41). The inner (smaller) knob is connected directly to low speed mixture adjustment needle (IN).

Normal initial setting for the low speed needle (IN) is 1⅛ turns open. Initial adjustment for high speed needle (HN) is ½-turn open. Final adjustment must be made after motor is in operation.

Late model QD and FD motors are equipped with a slow idle stop screw (Fig. J6) to adjust idle speed. This adjustment should only be made with engine at operating temperature. NOTE: Screw is located on port side of motors below the shroud.

To set the carburetor float level, remove the shroud; then unbolt and remove the carburetor. Remove the float chamber (23—Fig. J2, J3 or J4) and invert the carburetor body (5). The upper surface of float (lower, when assembly is inverted) should be level and flush with gasket surface of body. If it is not, carefully bend float lever; then, check after assembly to make sure float does not bind or rub.

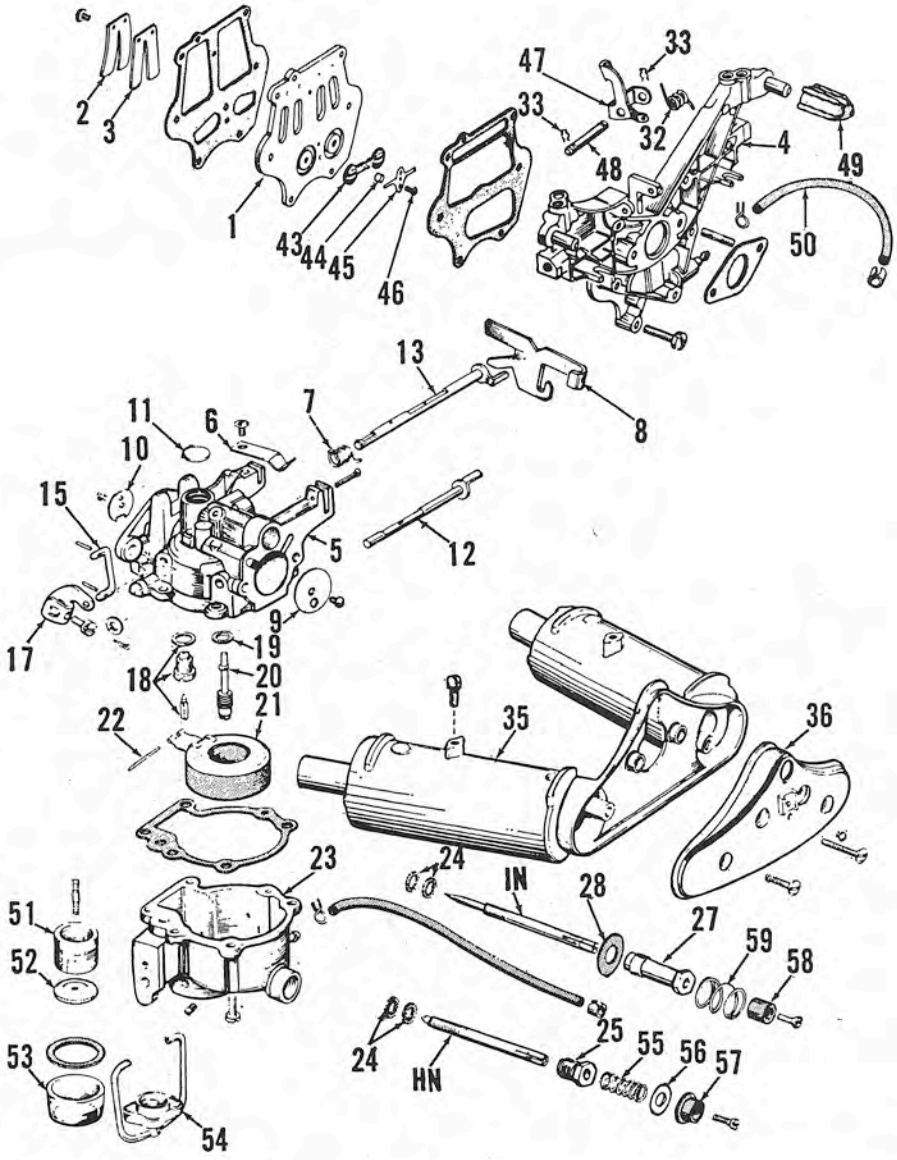


Fig. J3—Exploded view of series AD carburetor, silencer and reed valve assembly. Fuel tank pressurizing check valves are shown at (43). Refer to legend under Fig. J2 except for the following.

43. Check valve petals
44. Spacer
45. Spring
46. Screw
47. Cam follower
48. Shaft
49. Bumper
50. Pressure hose
51. Filter element
52. Nut
53. Bowl
54. Ball
55. Spring
56. Washer
57. Grommet
58. Sleeve
59. Spring

SPEED CONTROL LINKAGE. The speed control lever on all models rotates the magneto armature plate to advance the timing. The throttle valve is synchronized with the plate to open throttle the proper amount as timing is advanced. To synchronize the speed control linkage, refer to the appropriate following paragraphs:

Series JW Motors. A cam, attached to bottom of magneto armature plate (Fig. J8), actuates follower (13—Fig. J1) which works through levers (15 & 19) to open the throttle valve. To synchronize the speed linkage, remove the lower shroud and proceed as follows: Slightly loosen both screws that attach the speed control cam to underside of magneto armature plate. Move speed control lever to position between the dots on control quadrant (approximately the "Slow" position). Move free end of cam until it contacts follower at index mark as shown in Fig. J9, and just begins to open carburetor throttle valve. Tighten the cam retaining screws; then, recheck to make sure that throttle valve starts to open as speed control lever moves past the dots on quadrant.

Series CD, AD, QD and FD. Hand grip rotates shaft (70—Fig. J10) and pinion (72) which is meshed with gear (75). Link (L) is connected to gear (75) and armature plate (A). Rotation of hand grip thus moves armature shaft to advance or retard ignition timing. Cam (C) is attached to lower side of armature plate and is contacted by cam follower roller (30). Movement of the armature plate acts through linkage (15, 16 & 17) to open or close throttle shaft (13). Synchronization is correct when throttle valve just starts to open when index mark on cam is aligned with cam follower (See Fig. J9) and is completely open when timing is fully advanced.

To make the adjustment, remove the cowl and rotate the hand grip until index mark on cam is aligned with follower arm as shown in Fig. J9, then slightly loosen the cam retaining screws on underneath side of armature plate. Move the cam in or out until all slack is removed from throttle linkage and throttle shaft (13—Fig. J10) just starts to move. Tighten the cam retaining screws at this point. To further check the

Fig. J6—Idle speed stop screw used on late model QD and FD motors. Screw is on port side of motor.

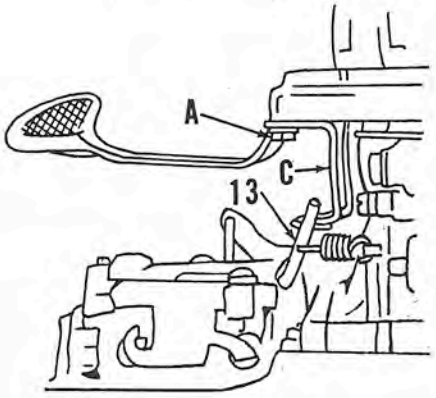


Fig. J8—On series JW motors, cam (C) is attached to bottom of armature plate as shown. When speed control lever is moved, cam follower (13) is actuated to open carburetor throttle valve. To synchronize, loosen screws (A) and proceed as outlined in text.

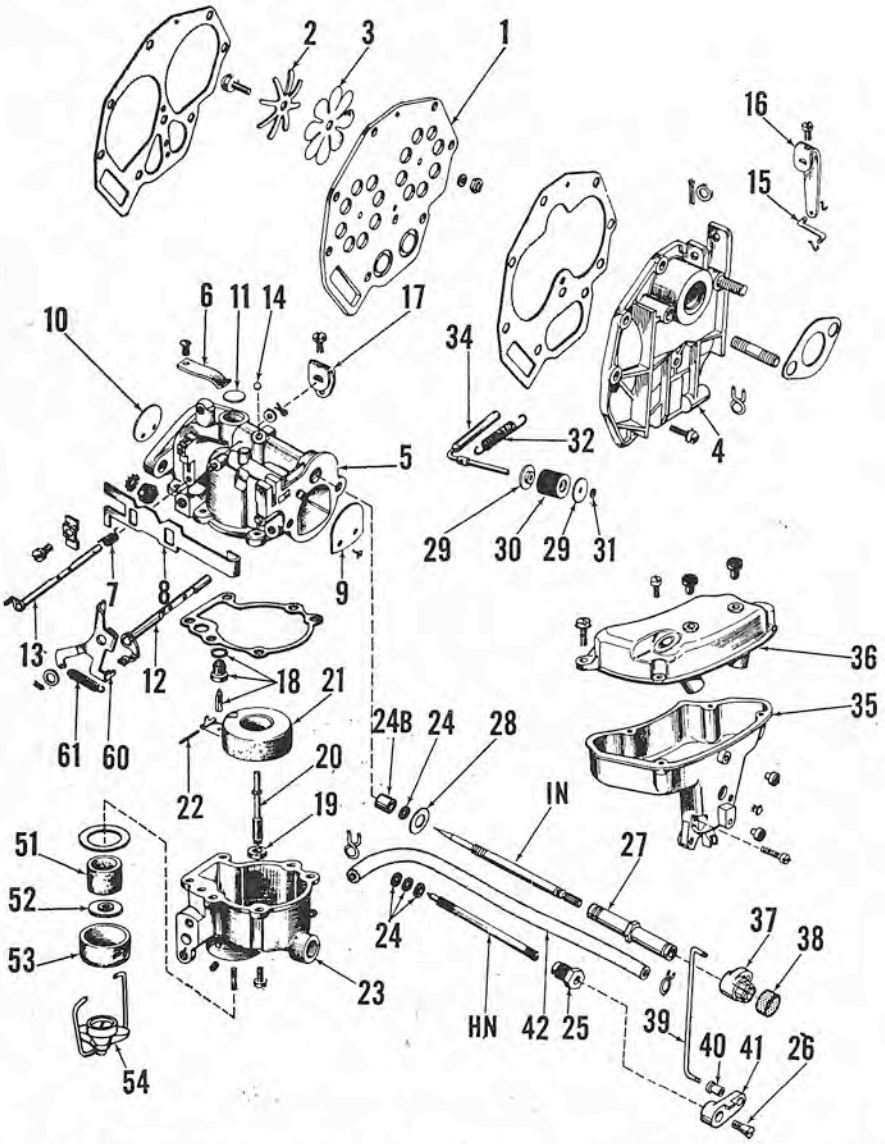


Fig. J4—Exploded view of series QD carburetor, silencer and reed valve assembly. Series FD is similar. Refer to legend under Fig. J2 except for the following.

24B. Bushing
51. Filter element
52. Nut
53. Bowl
54. Bail
60. Bellcrank
61. Spring

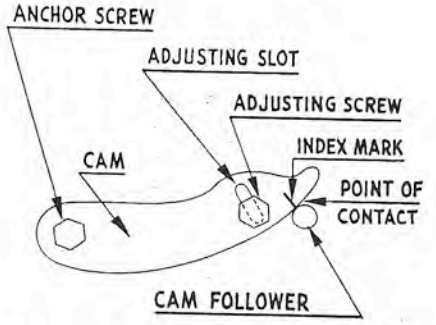


Fig. J9—To synchronize the throttle linkage with magneto advance, index mark on cam must register with cam follower as throttle valve starts to open.

adjustment, rotate the hand grip to the "Fast" position and check to make sure that throttle valve is fully open.

REED VALVES. The inlet reed valve unit is located between carburetor and crankcase, and should be checked whenever the carburetor is removed for service. Refer to Figs. J16, J2, J3 and J4 for location of reed valves.

Reed petals (3) should seat very lightly against reed plate (1) throughout their entire length, with the least possible tension. Check seating visually and by blowing and drawing air through ports. Renew reed petals (3) if broken, cracked, warped, rusted or bent. A broken reed petal is sometimes caused by a bent or damaged reed stop. Seating surface of plate (1) should be smooth and flat. On the circular type used in series QD and FD, reed petals must be centered over holes in plate.

PRESSURIZED FUEL TANK. A pressurized fuel tank is used on series CD, AD, QD and FD motors manufactured before 1960. Pressure from the power head crankcase is conducted to the fuel tank through one of the passages in the dual passage hose (Fig. J11). The air pressure thus developed forces fuel back through the other hose passage to the carburetor float chamber. Check valves (43, 44 & 45—Fig. J3) are provided to prevent air pressure returning to crankcase. A hand operated, diaphragm type fuel pump (See Fig. J11) is used to provide starting fuel to the carburetor.

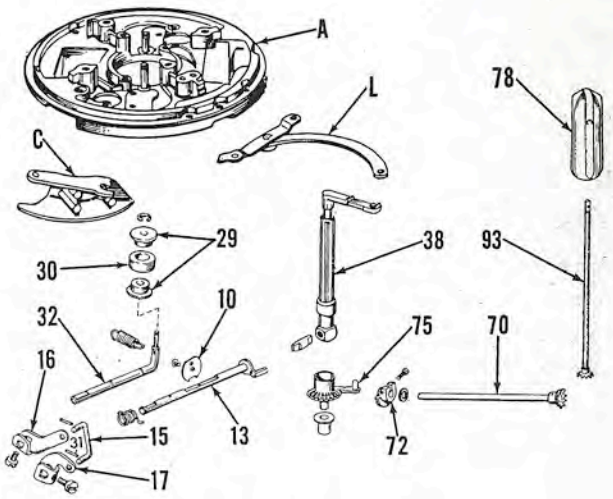
Overhaul of the fuel pumping system consists of renewal of the damaged parts; however, the following should be checked: The tank must maintain about 2 to 5 psi air pressure to force fuel to the carburetor. Any leak in the air hose, fuel tank (around screws), tank cap gasket (15) or pressure relief valve (46) would release pressure. In the event of failure, operate the engine by using the hand pump; then check these items by using a soap solution or light oil. Tank may also be pressurized by an outside source while checking for leaks. Use care, however, not to use excessive pressure. A further cause of lack of pressure could be failure of the check valves (43—Fig. J3). If the other items fail to correct the trouble, remove and visually examine these valves.

FUEL PUMP. Some late motors are equipped with a diaphragm type fuel pump as shown in Fig. J13. Pressure and vacuum pulsations in the upper crankcase are directed through a passage to one side of the pump diaphragm (11). Vacuum in the crankcase draws the diaphragm inward as shown in View "A," Fig. 12. This diaphragm movement draws fuel past the inlet check valve (5) as shown by arrow. As piston moves downward in cylinder (View "B") pressure is introduced to the back side of the diaphragm, forcing fuel out past the outlet check valve (4) as shown.

All defective or questionable parts should be renewed. Diaphragm (11—Fig. J13) should be renewed if air leaks or cracks are found, or if its condition is in any way questionable.

Fig. J10—Exploded view of speed control mechanism of the type used on all except series JW motors.

A. Armature plate
C. Throttle cam
L. Link
10. Throttle valve
13. Throttle shaft
15. Link
16. Lever
17. Lever
29. Bushings
30. Roller
32. Follower shaft
38. Lever
70. Shaft & gear
72. Pinion
75. Gear
78. Grip
93. Shaft & gear



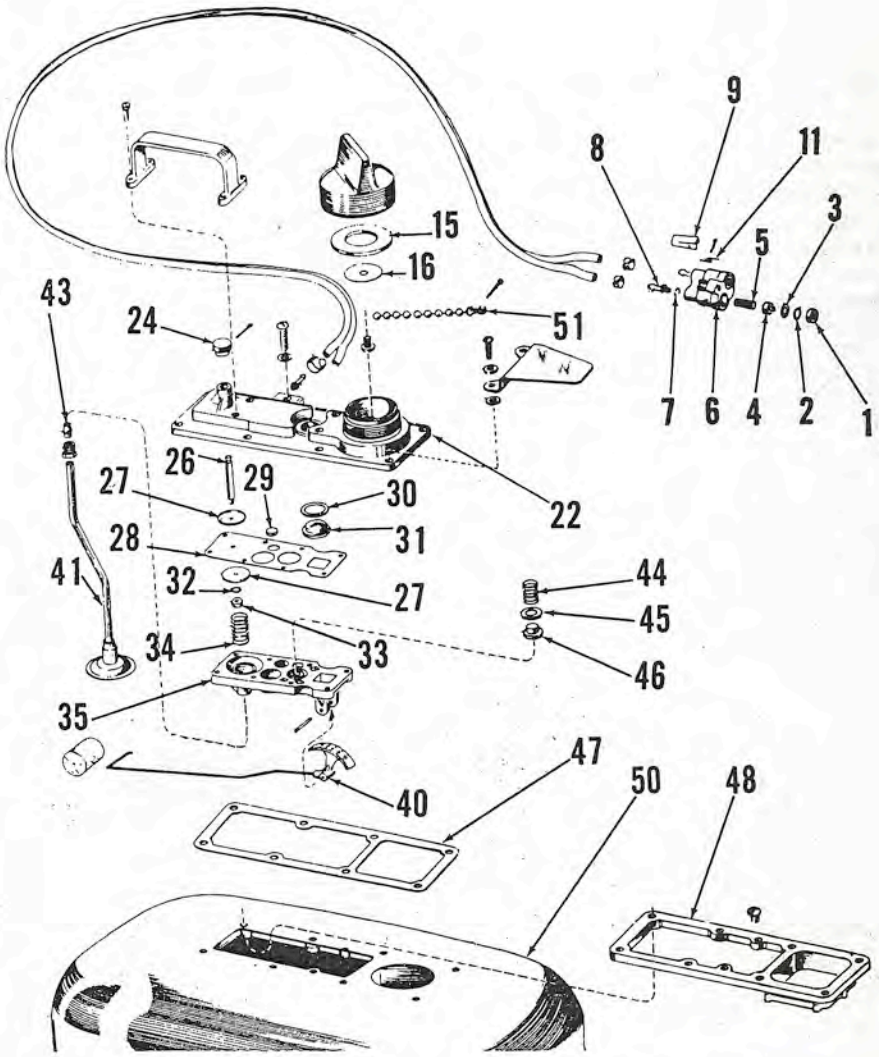


Fig. J11—Exploded view of pressurized fuel tank assembly.

1. Retainer
2. "O" ring
3. Washer
4. Valve
5. Spring
6. Connector
7. Washer
8. Nipple
9. Lock
11. Spring
15. Gasket
16. Plate
22. Housing
24. Primer button
26. Push rod
27. Support washers
28. Pump diaphragm
29. Disc valve
30. Seal
31. Glass
32. Lock washer
33. Nut
34. Spring
35. Lower housing
40. Fuel gage
41. Inlet tube
43. Gland
44. Spring
45. Washer
46. Valve

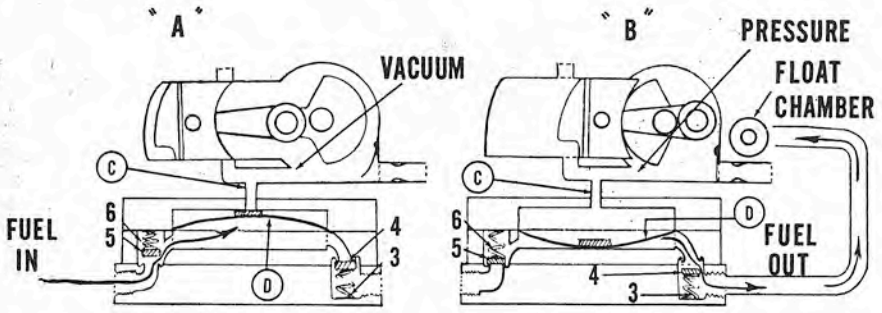


Fig. J12—Schematic view showing operation of the crankcase operated, diaphragm fuel pump. Pressure and vacuum pulsations from crankcase pass through connection (C) to rear of diaphragm (D) which induces a pumping action on fuel line as shown.

3. Valve spring
4. Outlet check valve
5. Inlet check valve
6. Valve spring

CRANKCASE BLEEDER VALVE. Models CD, AD, QD and FD are equipped with a reed type bleeder valve (56 & 57—Fig. J17, J19 or J20), designed to remove any liquid fuel or oil which might build up in crankcase. The bleeder valve thus provides smoother operation at all speeds and lessens the possibility of spark plug fouling during slow-speed operation.

There is a small passage leading from the bottom of each crankcase to the bleeder valve location at bottom of power head. Any condensed liquid thus accumulates in the bleeder pocket and passage until the piston travels its downward stroke. The crankcase pressure caused by the downward stroke of piston forces check valve (56) off its seat and blows the liquid out into the exhaust passage.

When engine is overhauled, bleeder passages should be blown out with compressed air. Valve (56) should exert slight pressure against its seat. Seating surface on crankcase should be smooth and flat. Valve reed (56) should be renewed if broken, cracked, warped, rusted or bent.

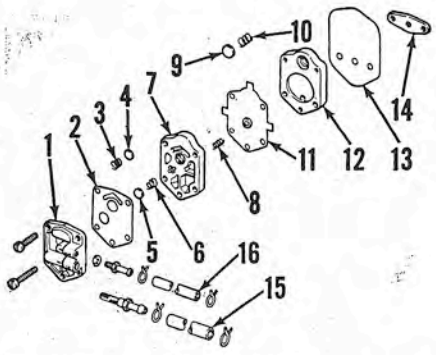


Fig. J13—Exploded view of fuel pump typical of the type used on some late motors.

1. Valve housing
2. Gasket
3. Spring
4. Outlet check valve
5. Inlet check valve
6. Spring
7. Inner housing
8. Spring
9. Support
10. Spring
11. Diaphragm
12. Outer housing
13. Deflector
14. Gasket
15. Inlet hose
16. Outlet hose

IGNITION

Breaker point gap should be 0.020 and can be adjusted through the inspection opening in flywheel after recoil starter assembly is removed.

For a quick test of magneto condition, remove the spark plugs and hold spark plug wires about ⅛-inch away from cylinder head. Have someone spin the motor and note the condition of spark. Although in bright daylight, the spark may not be visible, a distinct snap will be noted as spark jumps the gap. If spark is weak or erratic, adjust the points as outlined above. Be sure to note point condition. If points are in good condition and properly adjusted, re-

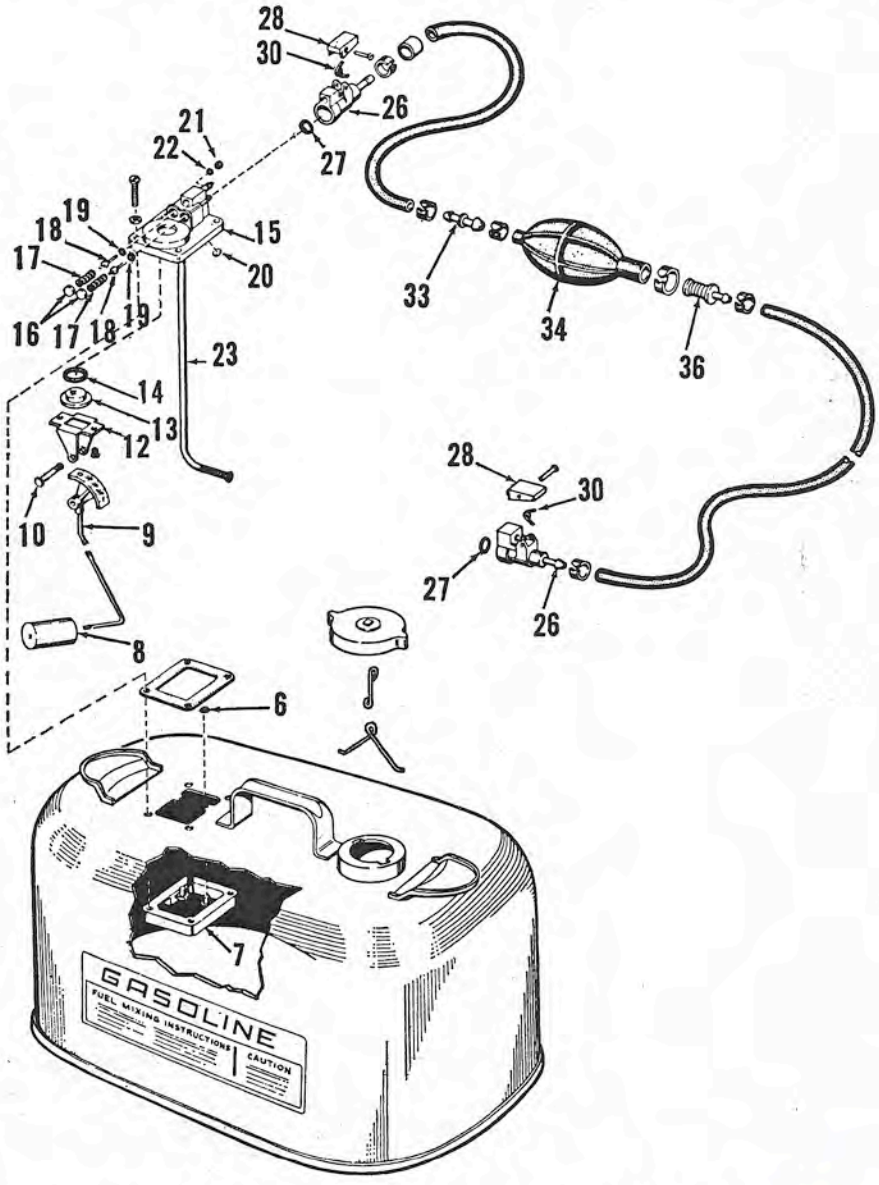


Fig. J14—Exploded view of fuel tank assembly used on motors with diaphragm type fuel pump.

6. Fastener
7. Plate
8. Float
9. Gage
10. Pivot
12. Bracket
13. Plugs
14. Seal
15. Upper housing
16. Plug
17. Spring
18. Valve
19. "O" ring
20. Plug
21. Retainer
22. "O" ring
23. Fuel line
26. Nipple
27. "O" ring
28. Lock
30. Spring
33. Nipple
34. Primer bulb
36. Nipple

move the flywheel and carefully examine the condition of the points, condenser and coil wiring and the insulation on the magneto coils. Look for broken or worn insulation or broken wires. Also check for loose or corroded connections. Check the stop button and wire for shorts. Renew any parts which are damaged or in poor condition. Renew crankshaft upper seal whenever magneto is overhauled.

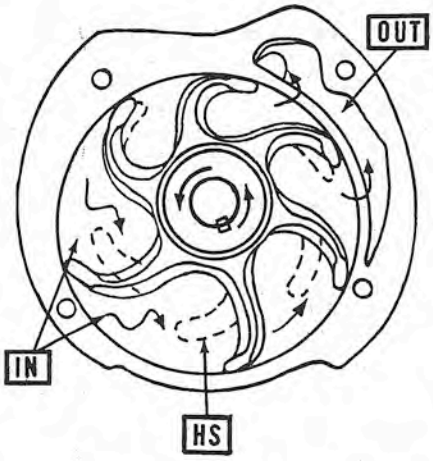


Fig. J15—Schematic view of the rubber impeller type water pump used on all models. Impeller mounts on lower unit drive shaft and rotates in offset pump housing. At slow speeds impeller blades follow the outline of housing. Water is drawn into pump (IN) as area between blades increases, and is forced into power head (OUT) as area narrows. At high speeds blades remain curved as shown by broken lines (HS) and pump operates by centrifugal action.

COOLING SYSTEM

WATER PUMP. All models are equipped with a rubber impeller type water pump. Impeller is mounted on and driven by the drive shaft in the lower unit. Refer to Fig. J15.

On Model JW motors, water enters the lower unit through slots in the forward and side areas of gear case. On all other motors, the main water scoop is located below the exhaust outlet above and aft of the propeller.

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, gaskets and sealing surfaces. On motors so equipped, also check the thermostat as outlined in the following paragraph.

THERMOSTAT. All 1959 and later motors except JW series are equipped with a cooling system thermostat. Refer to (27—Fig. J17 and J19). Thermostat opening temperature should be 130-150 degrees F.

POWER HEAD

R&R AND DISASSEMBLE. Series JW Motors. Overhaul service on the power head is best performed by first removing the power head from the lower unit.

First remove the starter unit, shroud, flywheel and magneto. Remove carburetor and manifold; then, unbolt and remove the power head from lower unit. Refer to Fig. J16.

Remove armature plate support (5), retainer (7) and crankcase lower flange (14). Remove cylinder head and the two tapered aligning pins (12); then unbolt and remove crankcase from cylinder assembly.

Pistons, rods and crankshaft are now accessible for removal and overhaul as outlined in the appropriate following paragraphs.

When reassembling, follow the procedures outlined in ASSEMBLY paragraph at end of this section and observe the following special precautions:

When installing lower flange (14), make sure that water passages in flange and gasket (13) are properly aligned, and installed toward forward (carburetor) side of engine as shown.

Series CD Motors. Clamp the motor to a convenient support and remove the shroud, control panel and intake silencer. Remove starter unit, flywheel, magneto armature plate, carburetor and inlet manifold. Refer to Fig. J17.

Remove armature plate support (5) and retainer (7), speed control lever (38) and

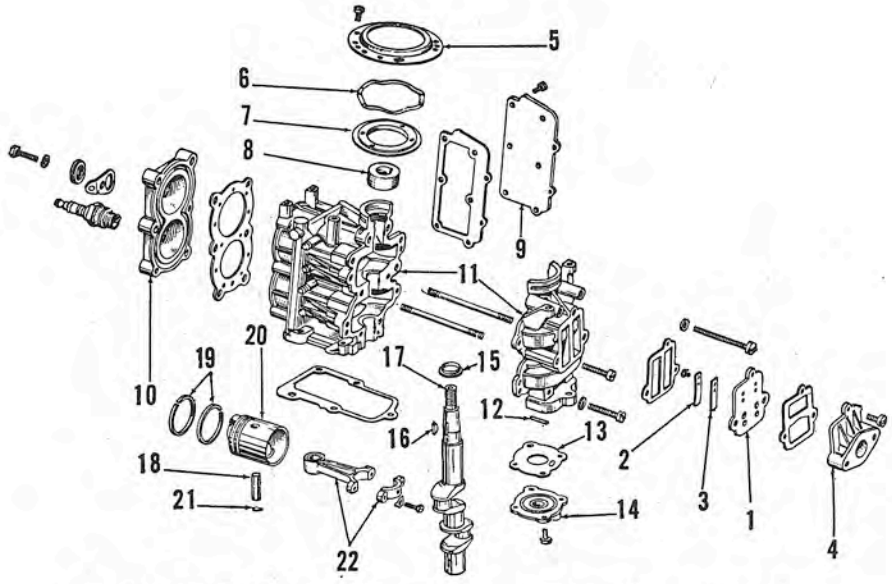


Fig. J16—Exploded view of series JW power head assembly and reed valves.

1. Reed plate
2. Reed stop
3. Reed valve
4. Manifold
5. Support
6. Wave washer
7. Retainer
8. Cam
9. Exhaust passage cover
10. Cylinder head
11. Cylinder & crankcase
12. Dowel pin
13. Gasket
14. Lower flange
15. Slinger
16. Woodruff key
17. Crankshaft
18. Piston pin
19. Piston rings
20. Piston
21. Retaining ring
22. Connecting rod

outer and inner exhaust covers (31 & 9). Before power head can be detached from lower unit, it is necessary to remove exhaust silencer (rear cover) from exhaust housing on lower unit to obtain access to power head retaining screw. Remove the silencer, then unbolt and remove power head from lower unit.

Remove cylinder head and tap out the two tapered aligning pins (12); then, unbolt and remove crankcase from cylinder assembly.

Pistons, rods and crankshaft are now accessible for removal and overhaul as outlined in the appropriate following paragraphs.

When reassembling, follow the procedures outlined in ASSEMBLY paragraph at end of this section, and observe the following special precautions.

Remove crankcase bleeder valve (57) and oil line (25) and blow out oil line, oil passages and bleed passages using compressed air. Refer to CRANKCASE BLEEDER VALVE paragraph in previous FUEL SYSTEM section for further information concerning bleeder valve.

Series AD Motors. Clamp the motor to a convenient support and remove the shroud, control panel and intake silencer. Remove starter unit, flywheel, magneto armature plate, carburetor and intake manifold. Refer to Fig. J18.

Remove armature plate support (5) and retainer (7), speed control lever (38) and outer and inner exhaust covers (31 & 9). Unbolt and remove power head from lower unit.

Use a small punch to tap out the crankcase aligning pins (not shown), then unbolt and remove crankcase and cylinder head.

Pistons, rods and crankshaft are now accessible for removal and overhaul as outlined in the appropriate following paragraphs.

When reassembling, follow the procedures outlined in ASSEMBLY paragraph at

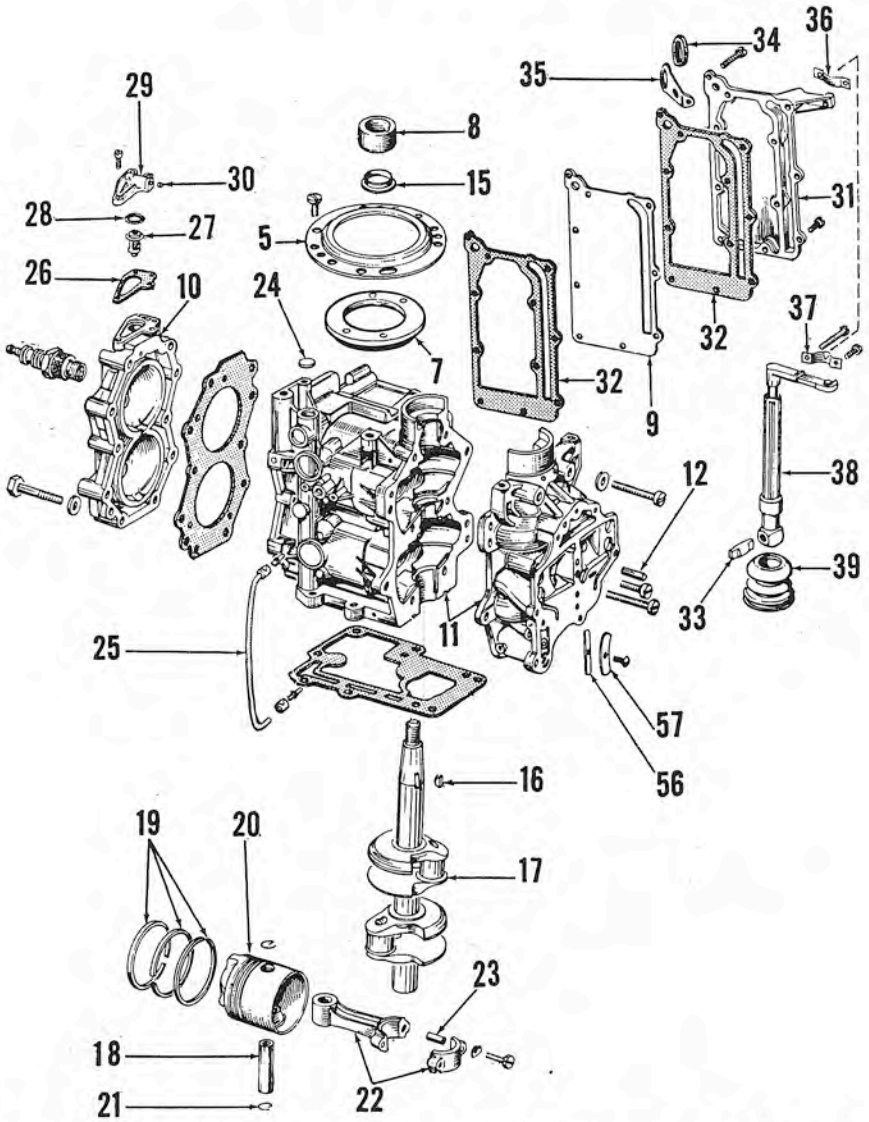


Fig. J17—Exploded view of series CD power head. Coolant thermostat (26 through 30) is not used on motors before 1959.

5. Support
7. Retainer
8. Cam
9. Exhaust cover
10. Cylinder head
11. Cylinder & crankcase
12. Dowel pins
15. Slinger
16. Woodruff key
17. Crankshaft
18. Piston pin
19. Piston rings
20. Piston
21. Retainer ring
22. Connecting rod
23. Guide dowel
24. Expansion plug
25. Oil line
26. Gasket
27. Thermostat
28. Seal
29. Cover
30. Plug
31. Exhaust cover
32. Gasket
33. Pin
34. Grommet
35. Anchor
36. Clamp
37. Clamp
38. Lever
39. Boot
56. Bleeder valve
57. Valve stop

end of this section, and observe the following special precautions.

Remove oil line (25) and blow out line and oil passages with compressed air. Remove transfer passage covers (40) and make sure passages and ports are clean. Use the same care in reinstalling covers (40) as is used in remainder of crankcase assembly. These transfer passages are subjected to crankcase vacuum and pressure.

Series QD Motors. Clamp the motor to a convenient support and remove the shroud, control panel and intake silencer. Remove starter unit, flywheel and magneto armature plate. Refer to Fig. J19.

Remove carburetor. Lift out speed control lever (38), unbolt and remove shifter lock (52) and unbolt and remove port and starboard brackets (54 & 55). Remove armature plate support (5) and retainer (7), then unbolt and lift off the power head.

Remove cylinder head (10), outer and inner exhaust covers (9 & 31) and upper and lower transfer passage covers (40U & 40L). Use a small punch to tap out the tapered crankcase aligning pins (12); then unbolt and remove the front crankcase half.

Pistons, rods and crankshaft are now accessible for removal and overhaul as outlined in the appropriate following paragraphs.

When reassembling, follow the procedure outlined in ASSEMBLY paragraph at end of this section, and observe the following special precautions:

Remove and blow out oil line (25) and oil line passages, using compressed air. Remove and check the crankcase bleeder valve (57) using procedures outlined in CRANKCASE BLEEDER VALVE paragraph of previous FUEL SYSTEM section of this manual. On model QD16, manufactured in 1955, a small coil spring is located in lower end of speed control lever (38). Make sure spring is in place when reassembling.

Series FD Motors. Clamp the motor to a convenient support and remove the shroud, control panel, air intake silencer and carburetor. Remove starter units, flywheel and magneto armature plate. Refer to Fig. J20.

Lift out speed control lever (38) and unbolt and remove shifter lock (52). Unbolt and remove starboard bracket (54), armature plate support (5) and retainer (7); then unbolt and lift off the power head.

Remove cylinder head (10), outer and inner exhaust covers (9 & 31) and transfer passage covers (40). Use a small punch to drive out the tapered crankcase aligning pins (12) and remove intake manifold; then unbolt and remove the crankcase front half.

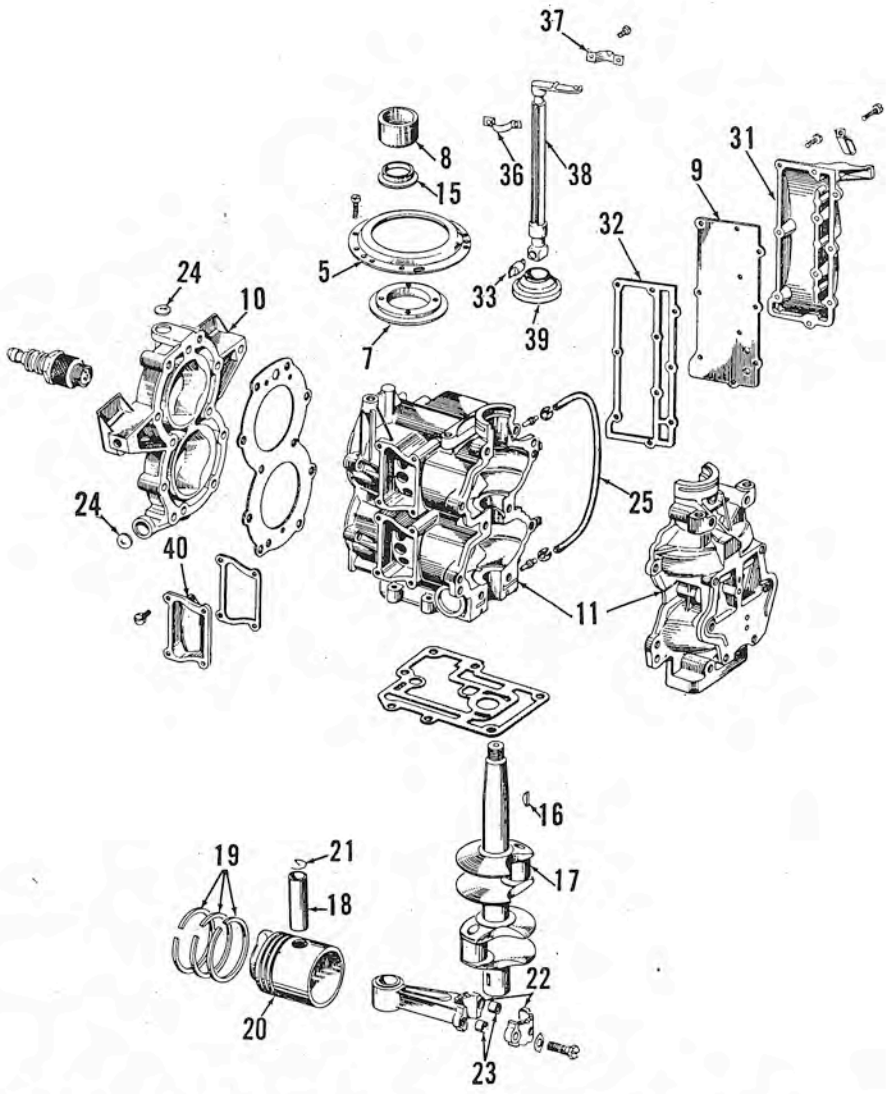


Fig. J18—Exploded view of series AD power head assembly. Tube (25) directs excess oil that has drained to bottom crankcase, up to top main bearing to provide lubrication. Refer to legend under Fig. J17 except for (40), which is one of the two transfer passage covers.

Pistons, rods and crankshaft are now accessible for removal and overhaul as outlined in the appropriate following paragraphs.

When reassembling, follow the procedure outlined in ASSEMBLY paragraph at end of this section, and observe the following special precautions:

Remove oil line (25) and blow out line and passages in crankcase with compressed air. Remove and check the crankcase bleeder valve (57), using the procedures outlined in CRANKCASE BLEEDER VALVE paragraph of previous FUEL SYSTEM section of this manual.

REASSEMBLE. Because of the two-cycle design, crankcase and intake manifold must be completely sealed against both vacuum and pressure. Exhaust manifold and cylinder head 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 surfaces of crankcase halves be carefully checked for nicks and burrs or warped surfaces which might interfere with a tight seal. The cylinder head, head end of cylinder block, or mating surfaces of mainfolds and crankcase 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 plate glass. Lay a sheet of No. 00 emery cloth on the lapping block, then place the surface to be lapped on the emery cloth. Apply 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 soapsuds and clean rags.

Mating surfaces of crankcase may be checked on the lapping block, and high spots or nicks removed; but surface must not be lowered. If extreme care is used, a slightly damaged crankcase can be sal-

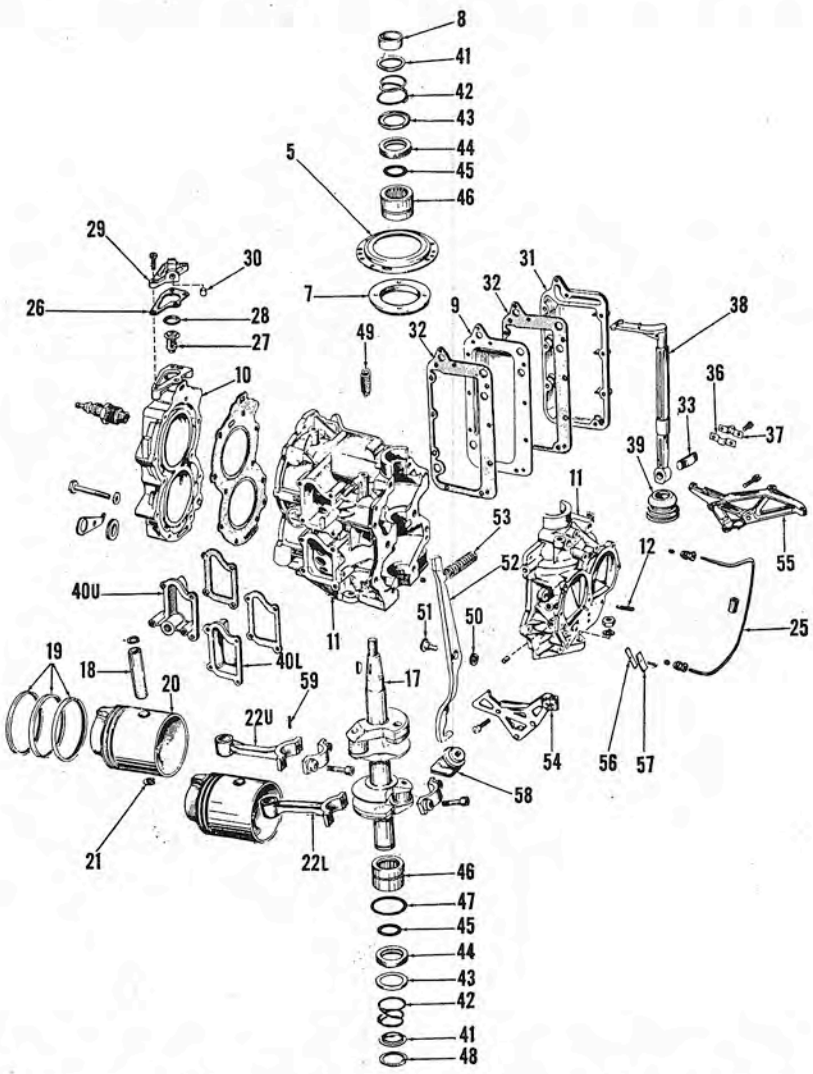


Fig. J19—Exploded view of series QD power head assembly. Thermostat (26 through 30) was not used on motors before 1959.

5. Support
7. Retainer
8. Cam
9. Exhaust cover
10. Cylinder head
11. Cylinder & crankcase
12. Dowel pin
17. Crankshaft
18. Piston pin
19. Piston rings
20. Piston
21. Retaining ring
22L. Lower rod
22U. Upper rod
25. Oil line
26. Gasket
27. Thermostat
28. Seal
29. Cover
30. Plug
31. Exhaust cover
32. Gasket
33. Pin
36. Clamp
37. Clamp
38. Lever
39. Boot
40L. Lower transfer passage cover
40U. Upper transfer passage cover
41. Retaining washer
42. Spring
43. Retaining washer
44. Seal
45. "O" ring
46. Needle bearing
47. "O" ring
48. Snap ring
49. Spring
50. Washer
51. Screw
52. Shifter lock
53. Spring
54. Bracket
55. Bracket
56. Bleeder valve
57. Reed stop
58. Boot
59. Bearing needles

vaged in this manner. In case of doubt renew the crankcase assembly.

The crankcase halves are positively located during assembly by the use of two tapered dowel pins. Check to make sure that the dowel pins are not bent, nicked or distorted, and that dowel holes are clean and true. When installing dowel pins, make sure they are fully seated, but do not use excessive force.

The mating surfaces of crankcase halves must be sealed during assembly by using a hardening cement such as "Sealer 1000" (available from Marprox Corporation, P. O. Box 955, Sheboygan, Wisconsin). Make sure that all old cement is removed and that surfaces are flat and free from nicks and burrs. Apply cement sparingly and evenly to cylinder half of crankcase only; then immediately install front half. Install the locating dowel pins; then install and tighten the crankcase screws and/or nuts. Tightening torques are as follows:

All Screws ..... 60- 84 Inch-lbs.
Crankcase Nuts .....120-144 Inch-lbs.

When installing gaskets, check to make sure correct gasket is used and that ALL water passage holes are open and not covered. On JW models, use extra caution, because it is possible to turn head gasket over or turn head end for end. On later models, aligning bosses are cast into cylinder and head, and an aligning tab is cut into gasket which, when aligned, insures proper installation.

All gasket surfaces must be sealed, using a non-hardening type cement such as "Perfect Seal No. 4." Tightening torques for each model and application are given in the CONDENSED SERVICE DATA section of this manual.

PISTONS, PINS, RINGS AND CYLINDERS Before detaching connecting rods from crankshaft, make certain rod and cap are properly marked for correct assembly to each other and in the correct cylinder.

Each aluminum piston is fitted with three rings which are interchangeable and may be installed either side up. Pistons, pins and rings are available in standard size and oversizes of 0.020 for all motors. Oversizes of 0.040 are available for QD and FD motors only. The recommended piston ring end gap is 0.005-0.015 on Series JW, CD and AD; and 0.007-0.017 on other models. Ring to groove clearance is 0.001-0.0035 on all models. Piston to cylinder wall clearance is 0.0013-0.002 for Series JW, CD and AD; and 0.002-0.0035 for other models. Renew piston, rings and/or cylinder assembly if clearance is excessive.

When reassembling, piston should be installed with long tapering side of piston head toward exhaust port side of cylinder as shown in Fig. J21. On QD models, straight side of rods should face each other (toward center main bearing). Refer to (22L & 22U—Fig. J19). When installing connecting rods, tighten the cap screws to 60-66 inch-lbs. on Series JW, AD and CD; and 180-186 inch-lbs. on other models.

Thoroughly lubricate all friction surfaces during assembly.

CONNECTING RODS, BEARINGS AND CRANKSHAFT. Before detaching connecting rods from crankshaft, make sure rod and cap are properly marked for correct assembly to each other and in the correct cylinder.

On JW, CD and AD models, the connecting rod rides directly on the crankshaft crankpin. The crankshaft is carried in three bronze bushings which are cast into the crankcase halves.

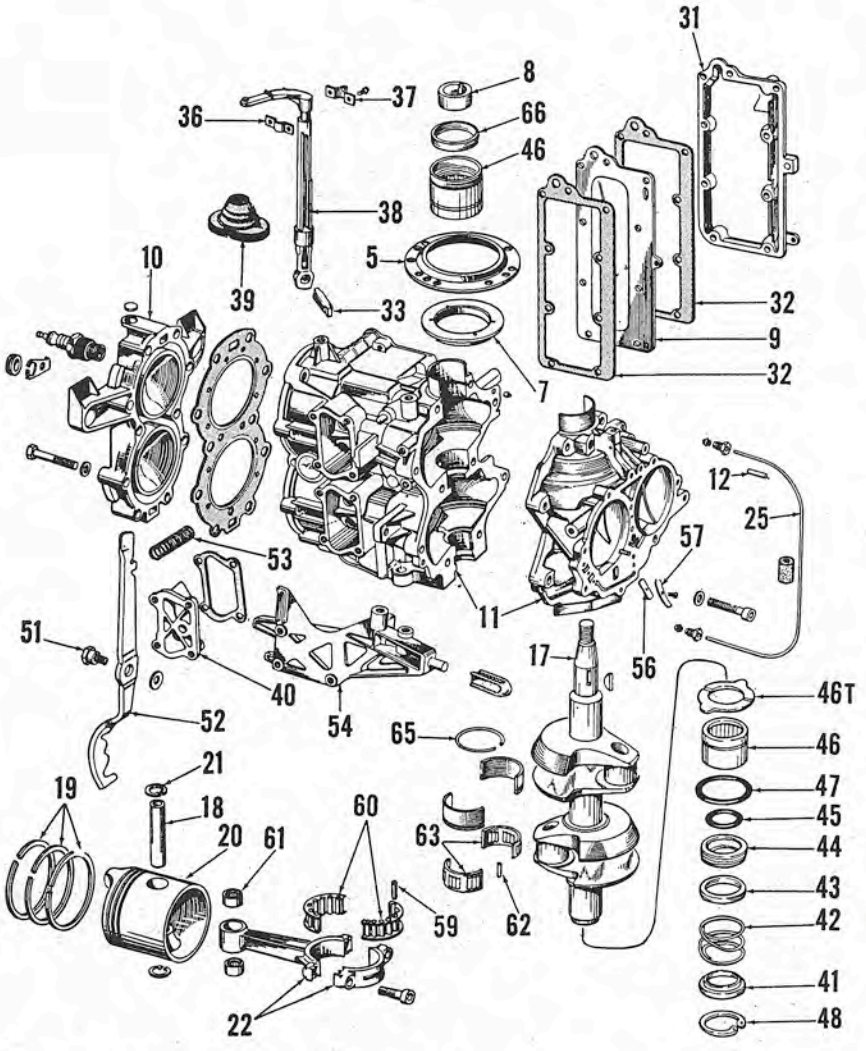


Fig. J20—Exploded view of series FD power head assembly. On early models, lower main bearing (46) is bushing type cast into crankcase halves. Late models are equipped with a thermostat assembly similar to that shown (26 through 30) in Fig. J19. Refer to Fig. J19 for legend except for the following.

46T. Thrust bearing
60. Bearing cage
61. Needle bearing
62. Bearing needles
63. Bearing cage
65. Retaining ring
66. Seal

Fig. J21—Baffle on top of piston head directs flow of incoming fuel mixture for proper scavenging of exhaust gases.

Model QD motors are fitted with a forged steel connecting rod with 29 individual uncaged needle rollers at crankpin end of rod. Caged needle bearings are used at each end main bearing, while center bearing is a bronze bushing cast into the crankcase halves. Straight side of rods should face each other (toward center main bearing). Refer to (22L & 22U—Fig. J19).

Model FD motors are fitted with 15 needle rollers installed in a two-piece bearing cage at crankpin end of each rod. Motors after 1956 use a caged (cartridge) needle bearing at piston end of rod. On 1956 models, the lower main bearing is a bronze bushing cast into crankcase halves. The top and center main bearings on all models, and the lower main bearing on 1957 and later motors are all of the needle roller type.

On all models, refer to the CONDENSED SERVICE DATA table for dimensional data and recommended torque values. If bearing surface of rod and cap is rough, scored, worn, or shows evidence of overheating, renew the connecting rod. Inspect crankpin and main bearing journals. If scored, out-of-round, or worn, renew the crankshaft. All bearings and friction surfaces should be lubricated during assembly. Renew crankshaft seals whenever power head is disassembled.

MANUAL STARTER

Figs. J22, J23 and J24 show starters typical of those used. When installing a new starter cord or spring, invert the assembly in a vise and wind the spring by turning the starter pulley counter-clockwise until spring is completely wound. Reverse the pulley one complete turn and install the cord.

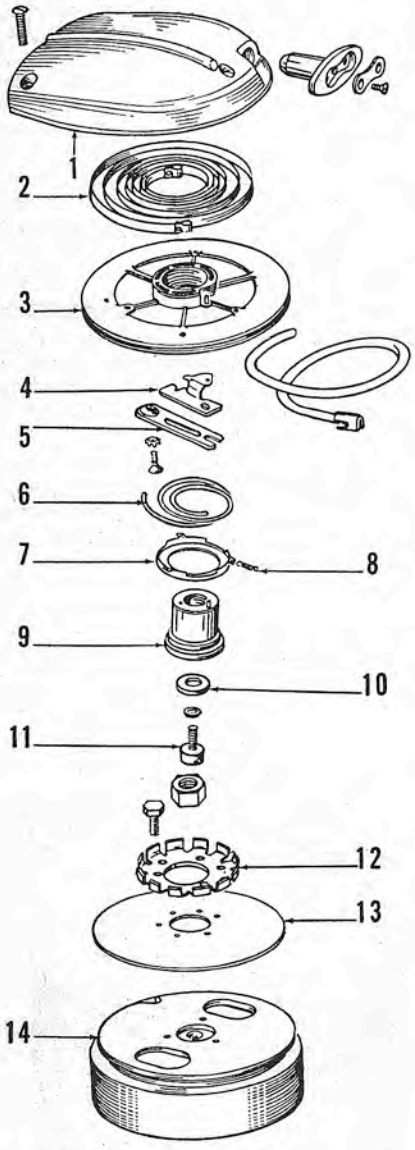


Fig. J22—Exploded view of starter assembly used on early series JW motors. Except for housing (1), parts are similar for early CD and QD motors.

1. Starter housing
2. Recoil spring
3. Pulley
4. Pawl (3 used)
5. Retainer (3 used)
6. Friction spring
7. Equalizer cup
8. Spring (3 used)
9. Spindle & pin
10. Washer
11. Screw
12. Ratchet
13. Cover
14. Flywheel

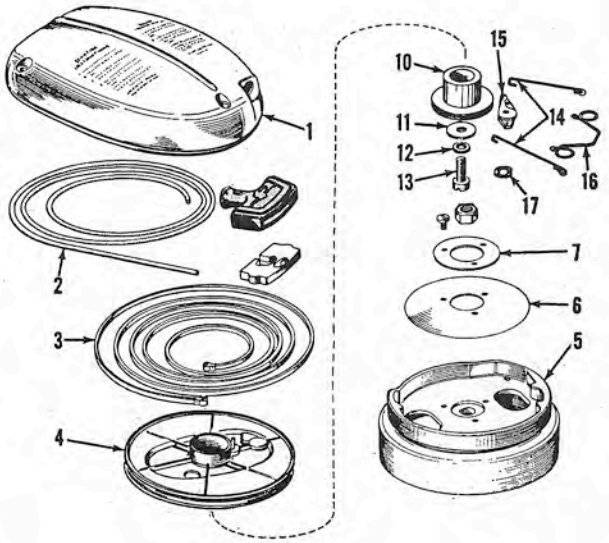


Fig. J23—Exploded view of late series JW starter.

1. Starter housing
2. Rope
3. Recoil spring
4. Starter pulley
5. Flywheel
6. Cover
7. Plate
10. Spindle
11. Washer
12. Lockwasher
13. Screw
14. Links (2 used)
15. Pawl
16. Friction spring
17. Retaining ring

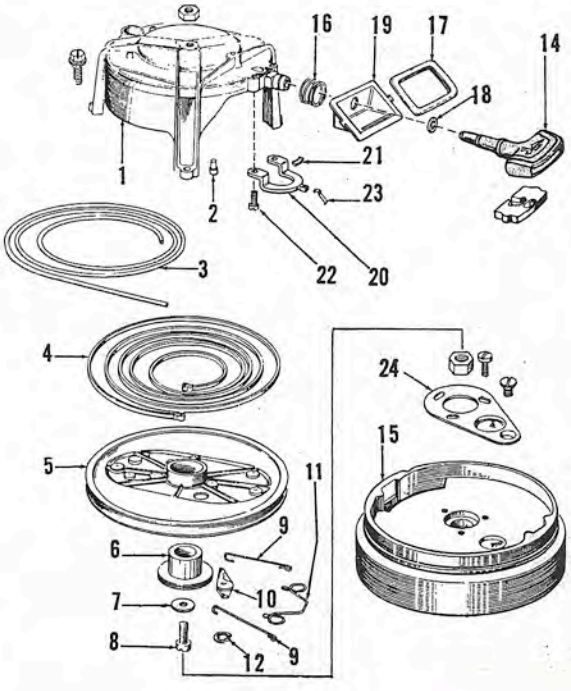


Fig. J24—Exploded view of manual starter used on late series CD motors. Starters are similar for late QD and all AD and FD motors.

1. Starter housing
2. Dowel pins
3. Rope
4. Recoil spring
5. Starter pulley
6. Spindle
7. Washer
8. Screw
9. Links
10. Pawl (2 used)
11. Friction spring
12. Snap ring
14. Handle
15. Flywheel
16. Spring
17. Seal
18. "O" ring
19. Cover
20. Bracket
21. Pad
22. Screw
23. Spring
24. Inspection cover

LOWER UNIT

PROPELLER AND DRIVE PIN. Cushioning protection of propeller and drive unit is provided by a shock absorber unit built into drive shaft unit on series CD and AD motors; and into propeller hub on all other models. Service consists of renewing rubber clutch ring (27—Fig. J28) on series JW; the pinion shaft (10—Fig. J30) on series CD and AD; or the propeller on other models. The lower drive shaft clutch on series CD and AD should release at a torque of 155-225 inch-pounds. The propeller slip clutch should release at a torque load of 84-104 ft.-lbs. on series QD motors; or 65-100 ft.-lbs. on series FD.

Model	Propeller Dia.	Propeller Pitch	Propeller No. Blades	Drive Pin Dia.	Drive Pin Length	Drive Pin Material	Part No.
JW (All)	6⅛	6¼	2	⅛	13/16	Stainless Steel	203230
AD (All)	8	8½	2	3/16	⅞	Monel	302333
CD (All)	8	7¼	2	3/16	⅞	Monel	302333
QD 16-17	9	8	3	3/16	1 3/16	Stainless Steel	203663
QD 17R-18	9	8	3	3/16	1 3/16	Stainless Steel	203663
QD 19-22	8¼	8½	3	3/16	1 3/16	Stainless Steel	203663
FD 10	9	11	3	3/16	1 3/16	Stainless Steel	203663
FD (All Other)	9¼	11	3	3/16	1 3/16	Stainless Steel	203663

REMOVE AND REINSTALL. Most service on the lower unit can be performed by detaching the gearcase housing from driveshaft housing. When servicing lower unit, pay particular attention to water pump and water tubes with respect to air or water leaks. Leaky connections may interfere with proper cooling of the motor. Water leaks also may permit the inside of driveshaft casing to fill up with water which can eventually find its way into motor crankcase through the lower bearing, and/or into the gearcase where it washes out the lubricant. Look for water leaks if the gearcase requires an abnormal amount of lubricant.

Use the appropriate exploded views (Fig. J27 through J34) as a guide when overhauling the lower unit, together with the special precautions listed below. All gasket surfaces must be smooth, free from nicks and burrs, and assembled using a non-hardening type sealer such as Perfect Seal No. 4. All joints without gaskets must be smooth and free from nicks and burrs and old cement, and sealed with a hardening sealer such as "Sealer 1000" available from Marprox Corporation, P. O. Box 955, Sheboygan, Wisconsin. Refer to the CONDENSED SERVICE DATA table for repair specifications and recommended tightening torques.

Series JW Motors. When reassembling lower unit, check "O" ring seal (21—Fig. J28) to make sure it and seating surface is in good condition. Renew oil seal (10) whenever unit is disassembled. Coat splined upper end of drive shaft (2) with water resistant grease and renew "O" ring (1) in groove in upper end of shaft. The grease and the "O" ring prevents water from corroding splines which would make later disassembly difficult.

NOTE: Propeller shaft (20) does not operate in a position parallel to direction of travel on these motors. Adjust tilt angle so that anti-cavitation plate is parallel to water surface.

Series CD-AD Motors. The propeller shaft (53—Fig. J30) and drive gears (47 & 54) can be removed after first draining lubricant from gear housing, removing pivot screw (38) (or pin) and unbolting and removing gearcase lower housing (21S). To separate gearcase from drive shaft housing, it is first necessary to remove power head, remove nuts (39) and connector (42). Remove power head seal assembly (1 through 6) and pin (8); then, unbolt and detach gearcase.

When assembling, use new sealing strip (29) with ends trimmed to extend 1/16-inch from housing groove, and coat surfaces with hardening type sealer.

Series FD-QD Motors. The propeller shaft (53—Fig. J33 or J34) and drive gears (47 & 54) can be removed after first draining lubricant from gear housing, removing pivot screw (38) and unbolting and removing gearcase lower housing (21S). To separate the gearcase from exhaust housing, remove cover (7—Fig. J31 or J32) and loosen screw in shifter rod coupling (43C—Fig. J33 or J34). Reassembly can be simplified if the shift rod coupling (43C) is attached to lower shift rod (43L), and water tube (20—Fig. J31 or J32) is installed in pump housing. Coat upper end of water tube with oil or liquid soap for easier installation in grommet (19). Be sure "O" ring (9—Fig. J33 or 24—Fig. J34) is in place on upper end of drive shaft (7).

STEERING TENSION. Steering tension can be adjusted by turning screw (Fig. J37) until motor is easy to steer, but will maintain a set course.

ELECTRICAL SYSTEM

Some motors are optionally equipped with an electrical starting system. Refer to Fig. J38 for wiring diagram, and to ELECTRICAL SYSTEM at end of JOHNSON Section, for overhaul data.

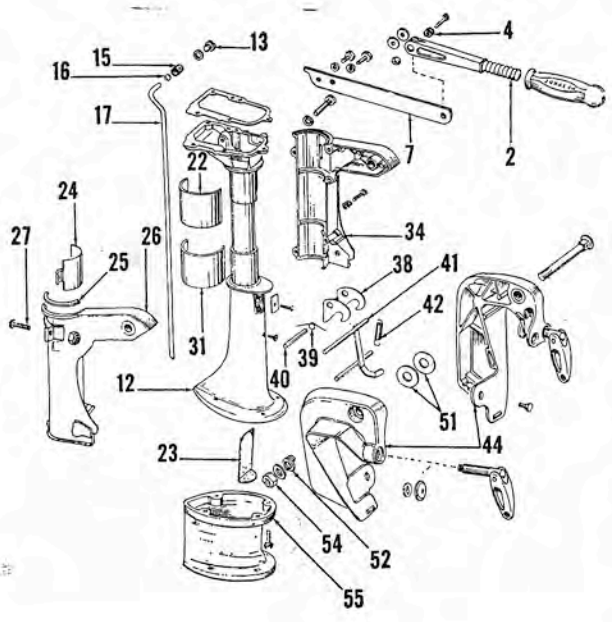


Fig. J27—Exploded view of series JW stern bracket, drive shaft housing and associated parts. Spacer (55) is used on "Long" models.

2. Steering handle
4. Spring
7. Support
12. Drive shaft housing
13. Screw
15. Nut
16. Packing gland
17. Water tube
22. Upper lining
23. Baffle
24. Clamp
25. Thrust washer
26. Swivel bracket
27. Tension screw
31. Lower lining
34. Swivel bracket
38. Reverse lock
39. Spring
40. Pin
41. Tilting lever
42. Spring
44. Stern bracket
51. Friction washer
52. Spring
54. Nut
55. Spacer

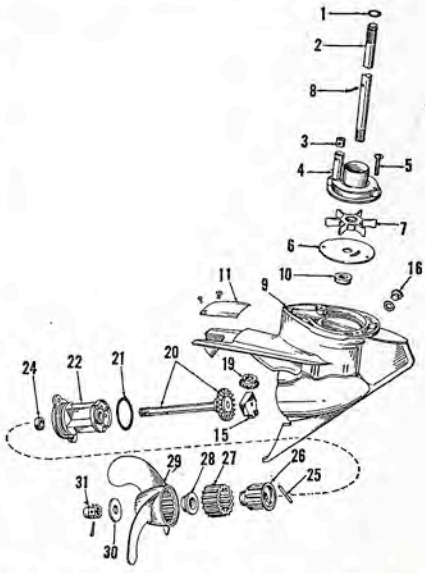
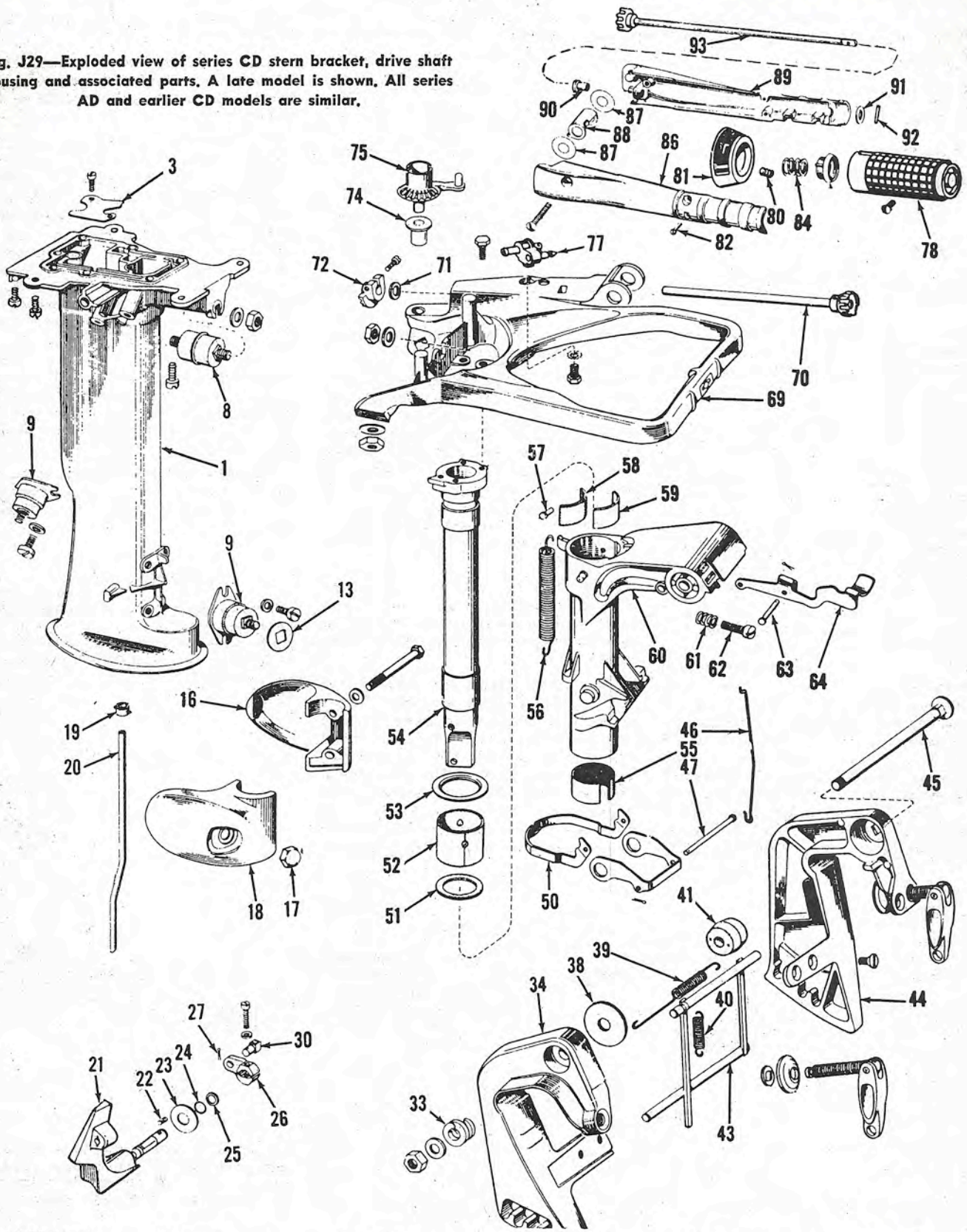


Fig. J28—Exploded view of lower unit gear case, propeller and water pump assembly used on series JW motors. "O" ring (1) seals upper drive shaft splines.

1. "O" ring
2. Drive shaft
3. Grommet
4. Pump housing
5. Screw
6. Plate
7. Impeller
8. Drive pin
9. Gear case
10. Oil seal
11. Cover
15. Thrust bearing
19. Pinion gear
20. Propeller shaft
21. "O" ring
22. Gear case head
24. Seal
25. Drive pin
26. Clutch hub
27. Ring
28. Bushing
29. Propeller
30. Washer
31. Nut

Fig. J29—Exploded view of series CD stern bracket, drive shaft housing and associated parts. A late model is shown. All series AD and earlier CD models are similar.



1. Exhaust housing
3. Cover plate
8. Rubber mount
9. Rubber mounts
13. Gasket
16. Housing
17. Acorn nut
18. Housing
19. Seal
20. Water tube
21. Shift lever
22. Spring
23. Washer
24. "O" ring
25. Washer
26. Lever
27. Cotter pin
30. Connector
33. Spring
34. Stern bracket
38. Washer
39. Spring
40. Spring
41. Cone washer
43. Tilting lever
44. Stern bracket
45. Pivot bolt
46. Link
47. Rod
50. Lever
51. Thrust washer
52. Upper liner
53. Thrust washer
54. Pilot shaft
55. Shock absorber
56. Spring
57. Pin
58. Spacer
59. Plate
60. Swivel bracket
61. Spring
62. Adjusting screw
63. Pivot
64. Arm
69. Steering bracket
70. Gear & shaft
71. Washer
72. Pinion
74. Bushing
75. Gear
77. Connector
78. Control grip
80. Set screw
81. Indicator
82. Screw
84. Spring
86. Handle
87. Washer
88. Cover
89. Handle
90. Bushing
91. Washer
92. Pin
93. Gear & Shaft

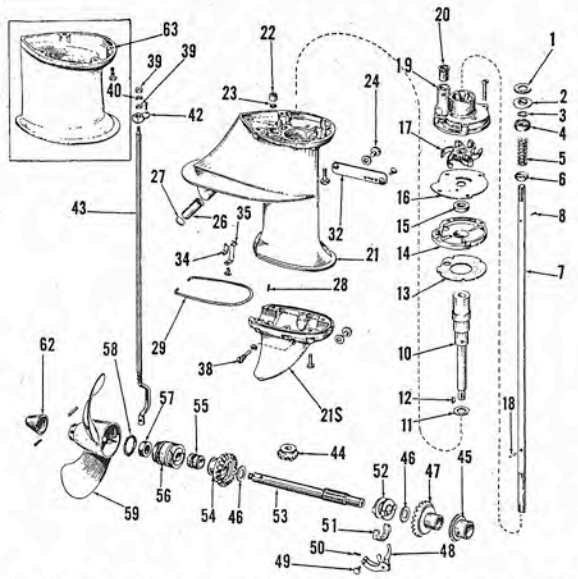


Fig. J30—Lower gear case and water pump assembly used on series CD. Series AD is similar.

1. Gasket
2. Plate
3. "O" ring
4. Seal
5. Spring
6. Washer
7. Drive shaft
8. Pin
10. Pinion shaft
11. Thrust washer
12. Woodruff key
13. Gasket
14. Bearing housing
15. Seal
16. Plate
17. Impeller
18. Pin
19. Housing
20. Seal
21. Gear case
21S. Lower housing
22. Bushing
23. "O" ring
26. Screen
27. Plug
28. Dowel pin
29. Seal
32. Cover
34. Spring
35. Spring
38. Pivot pin
39. Nut
40. Lock washer
42. Connector
43. Shift rod
44. Pinion gear
45. Bearing
46. Thrust washer
47. Forward gear
48. Shift yoke
49. Pin
50. Cotter pin
51. Cradle
52. Clutch dog
53. Propeller shaft
54. Reverse gear
55. Gear bushing
56. Gearcase head
57. Seal
58. "O" ring
59. Propeller

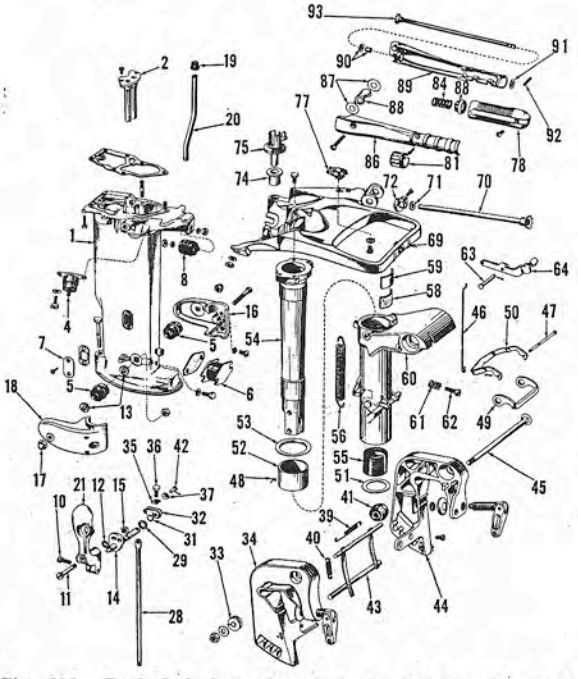


Fig. J31—Exploded view of early series QD stern bracket and drive shaft housing assembly. Early FD motors are similar. Refer to Fig. J29 for legend except for the following.

2. Exhaust tube
4. Rubber mount
5. Rubber mount
6. Rubber mount
7. Cover plate
10. Clamp screw
11. Screw
12. Star washer
14. Adjusting lever
15. Nut
28. Shift rod
29. Washer
31. "O" ring
32. Lever
35. Clip
36. Screw
37. Spring washer
42. Pin
48. Pin

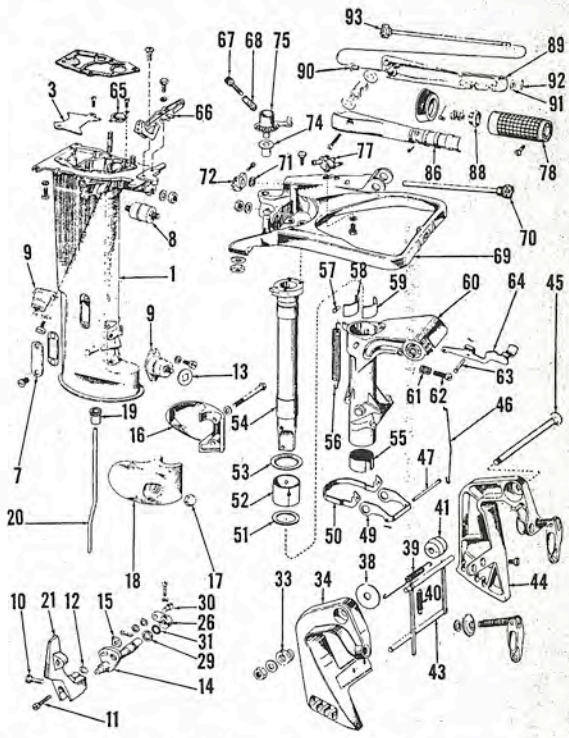


Fig. J32—Exploded view of late series QD stern bracket, drive shaft housing and associated parts. Late FD motors are similar. Refer to Fig. J29 for legend except for the following.

7. Cover plate
10. Clamp screw
11. Screw
12. Star washer
14. Adjusting lever
15. Nut
29. Washer
31. "O" ring
65. Baffle plate
66. Bracket
67. Idle stop screw
68. Spring

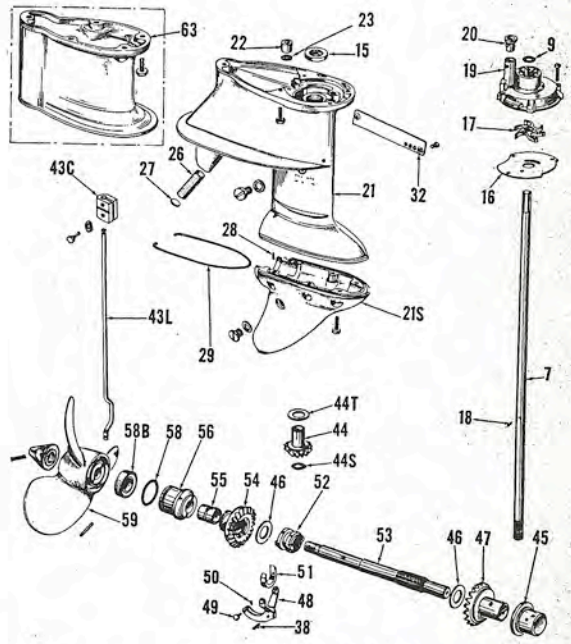
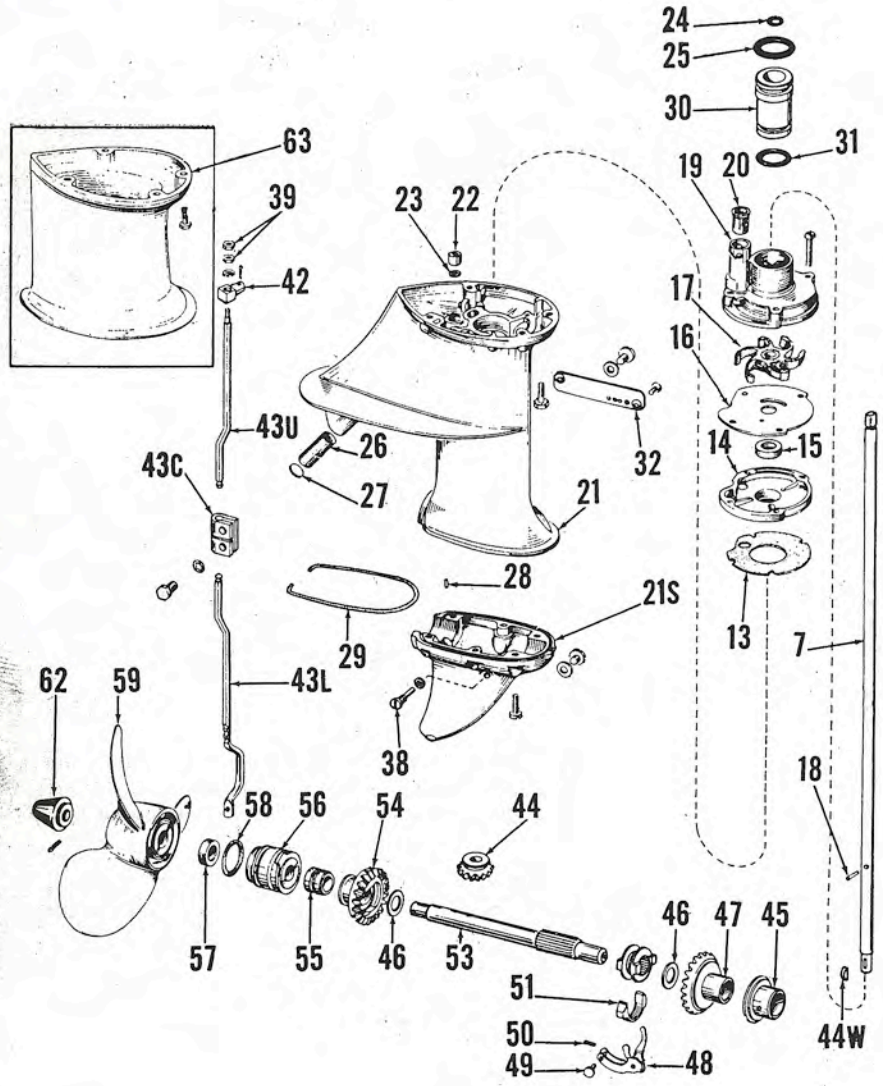


Fig. J33—Exploded view of early QD gear case assembly and water pump. All series FD motors are similar. Refer to Fig. J30 for legend except for the following.

9. "O" ring
43C. Coupling
43L. Lower rod
44S. Snap ring
44T. Thrust washer
58B. Seal



24. "O" ring
25. "O" ring
30. Spacer
31. "O" ring
43C. Coupling
43L. Lower rod
43U. Upper rod
44W. Woodruff key

Fig. J34 — Exploded view of late series QD gear case assembly and water pump. Refer to Fig. J30 for legend except for the following.

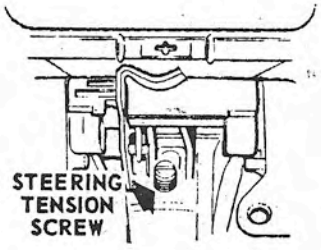


Fig. J37—On all models except series JW, the steering tension adjusting screw is located in front of motor below the power head as shown.

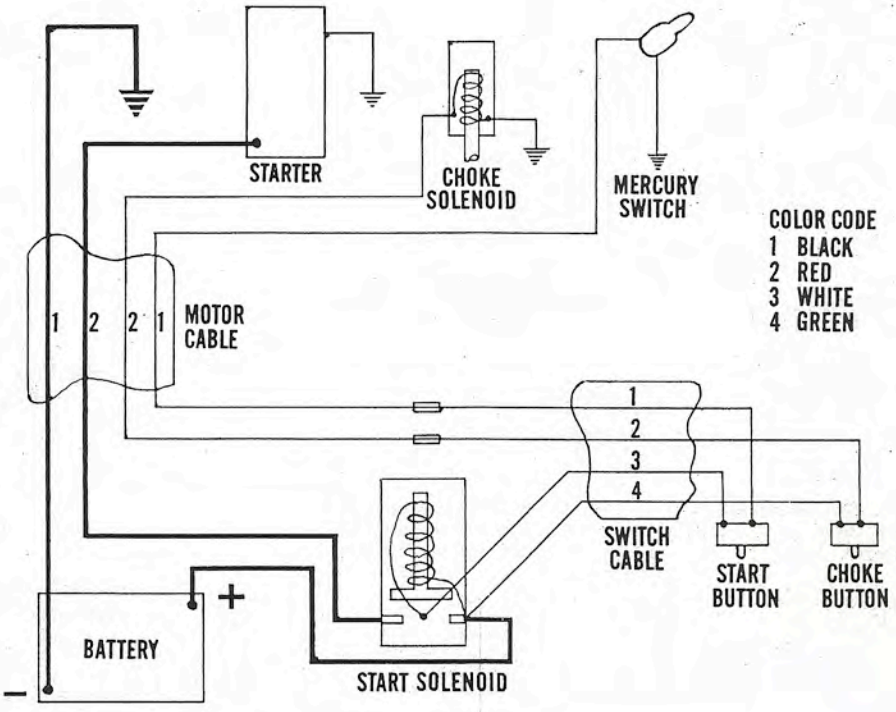


Fig. J38—Wiring diagram used on models with electric starter.