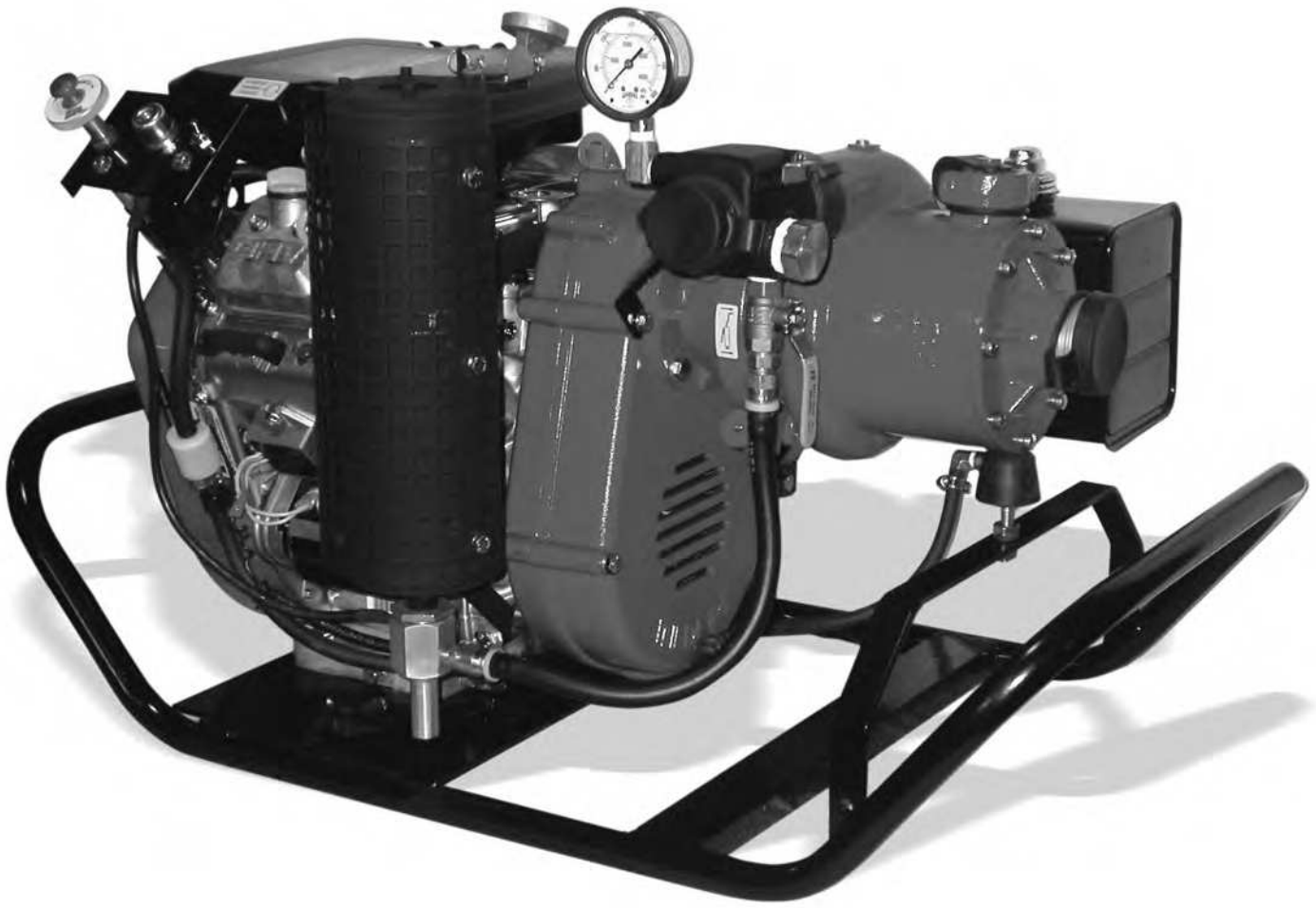
WATERAX | wildfire

BB-4®

Portable 4-Stage Fire Pump

Instruction & Service Manual



WE MOVE WATER

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GENERAL INFORMATION

This handbook includes specifications, performance data, operating instructions, normal servicing information, and the parts list for the **BB-4®** centrifugal fire pump.

SPECIFICATIONS

The Wildfire model **BB-4®** portable fire pump is an ideal unit for high volume remote watering, brush truck and slip-on fire fighting systems in forestry and rural fire environments. High pressure up to 425 PSI (2930 kPa) is provided to operate very long hose lays and overcome pressure losses due to large elevation changes often encountered in rugged wildland fire operations. The higher power makes it ideal for pumping at high altitudes. A unique feature of the **BB-4®** pump is the quick release pump end that is inter-changeable with our Mark-3® pump. This standardization allows for in-field pump end exchanges eliminating long equipment down time and greatly reduces the inventory of parts at equipment service shops.

The **BB-4** is powered by a 23 HP, V-Twin cylinder, 4-stroke, air-cooled Briggs & Stratton® Vanguard™ engine. Ball bearings used throughout, it is equipped with an electric starter and a backup rewind starter.

WARNING

CAUTION:
Always use proper unleaded gasoline with a pump octane rating of 86 or higher.

- The improper use of this pump could result in serious injuries. Please read this entire manual before using your **BB-4** pump unit.
- Always wear eye and ear protection when operating the pump unit.
- Always check for sufficient oil quantity in crankcase before use.
- Be alert and never touch the muffler guard when the engine is running. Always allow enough time, after stopping the unit, for proper cooling of the muffler and surrounding parts.
- Always use the proper unleaded gasoline with a pump octane rating of 86 or higher to assure suitable operation of the 4 cycle engine.
- Refuel engine with care. Gasoline is extremely flammable, and gasoline vapor can explode. Refuel in a well-ventilated area, with the engine stopped.

BB-4-VG 23	**Characteristics**		**Maximum Performance**				
Complete unit	171 lbs	77 kg	**Pressure**		**Discharge Flow**		
Height	21″	54 cm	**Psi**	**kPa**	**US GPM**	**L/min**	**IMP GPM**
Width	22 ½″	57 cm	0	0	105	397	87
Length	35"	89 cm	116	800	99	373	82
Pump end only	15 lbs	6.8 kg	201	1386	87	331	73
Max. engine power @ 4000 rpm	23	17.2 kW	288	1986	72	272	60
Ignition	Magnetron® electronic		354	2441	56	210	46
Spark plug	RJ19LM (Champion)		397	2737	38	142	31
	A11LM (Autolite)		420	2896	9	33	7
	AR10 (Motorcraft)		425	2930	0	0	0
Consumption approx.	2.0 US gals/hour (7.6 L, 1.7G IMP gals)						

DIRECTIONAL REFERENCES

All references to the right and left side of the unit are made as they appear to the operator when facing the rewind starter.

SERIAL NUMBERS

The **Pump End's** serial number is located on the pump end label, the **Engine's** serial number is located on the engine block and the **Pump Unit's** identification label is located on the left side of the engine.

These serial numbers are the key to various design details pertaining to the original fabrication of each unit. Therefore it is important to specify serial numbers whenever ordering parts and tools or when requesting information.

IMPORTANT

DO NOT run engine at full speed until thoroughly warmed up.
DO NOT run pump when dry (must be primed).
DO NOT use suction hose without foot valve strainer.
Drain pump after every use.

STARTER

Electric with a backup recoil starter.

Should the electric starter not work, grasp recoil starter handle firmly and pull. When engine starts, retain grip on handle, and allow rope to rewind slowly.

Note: The rope should be replaced when wear is apparent.

Do not disconnect the ignition cable from the spark plug while engine is running, nor operate the starter with the ignition cable disconnected. To do so imposes a severe load on the coil and the possibility of rupturing the winding insulation.

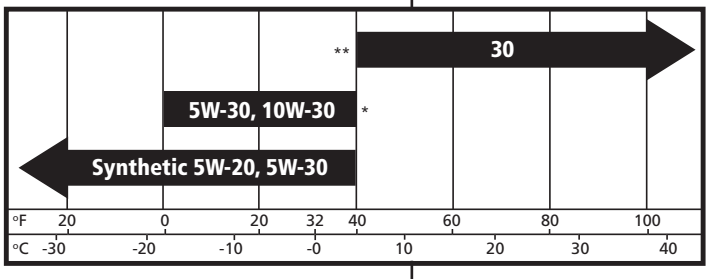
OPERATING INSTRUCTIONS

Fuel: Unleaded gasoline with an octane rating of 86 or higher.
Do not use stale or contaminated gasoline or an oil/gasoline mixture.

This engine is equipped with a full pressure lubrication system and oil filter. Change oil after first 5 hours of operation. Thereafter, change oil every 25 hours of operation and replace oil filter every 50 hours.

Occasionally you may hear a light "spark knock" or "pinging" while operating under heavy loads. This is no cause for concern. If you hear those noises at a steady engine speed, under normal load, change brand of gasoline. If spark knock or pinging persists, contact your Wildfire distributor or authorized Briggs & Stratton dealer.

Running the engine with persistent spark knock or pinging can cause engine damage. This is misuse and the warranty does not cover parts damaged by misuse.



Lubrication: Fill crankcase to the proper level indicated on the oil dipstick with good quality clean engine oil.

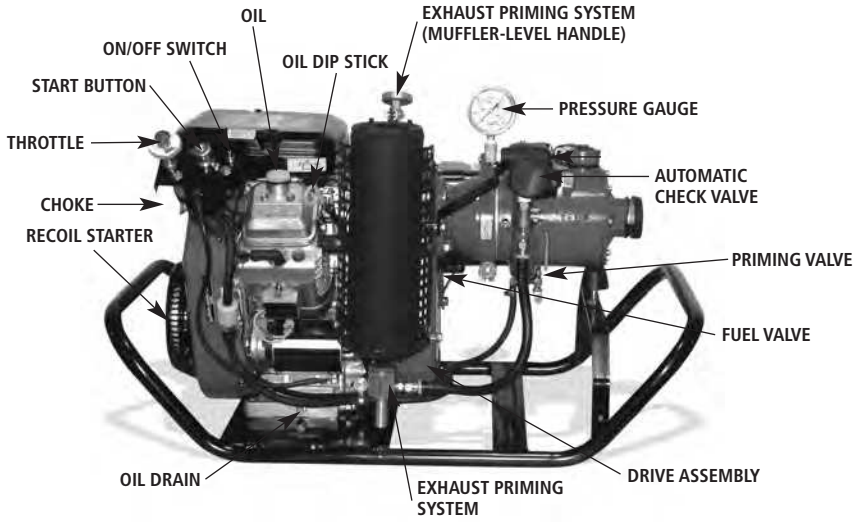
Oil recommendations: Use any 4-stroke high quality detergent oil having API service category "SE", "SF" or "SG" in this engine.

Recommended operating range: 5 °F to 104 °F (-15 °C to 40 °C).

SAE 10W-30 is recommended for general use. Other viscosity shown in the chart may be used when the average temperature in your area is within the recommended range.

PUMP UNIT

Controls:
There are only 6 controls which are used for normal operation: the FUEL VALVE, the ON/OFF SWITCH, the THROTTLE, the CHOKE, the START BUTTON, the MUFFLER-LEVER-HANDLE and the PRIMING VALVE.



WARNING:
Exhaust gas contains poisonous carbon monoxide. Avoid inhalation of exhaust gas. Never run this pump in a closed or confined area.

To start the BB-4 unit:

1. Fill fuel supply tank with recommended fuel grade.
2. Connect fuel supply line to fuel supply tank.
3. Attach fuel supply line to the adaptor located on right side of engine frame. Pump fuel to fill supply line.
   DO NOT use suction hose without foot valve strainer. DO NOT allow foot valve strainer to rest on bottom of lake or riverbed. Do not allow foot valve strainer to rest on bottom of lake or riverbed. Check strainer frequently to make sure that it is not clogged with moss, leaves, etc. Do not lift strainer from water while the pump is operating.
4. Connect foot valve strainer to male end of suction hose, then fill suction hose with water and connect to pump. Use universal hose coupling wrench to tighten coupling firmly.
5. Connect discharge hose, nozzles, etc., to pump. Use a rope or other means to keep strainer at proper height, approximately 1 foot (30 cm) below water surface. If strainer is too close to the water surface, it will draw air and pump may lose prime.
6. Turn the ON/OFF ignition switch to "ON" position.
7. Close choke, if engine is cold.
8. Pull the THROTTLE to 1/3.
9. Press and hold "START" button or give starter rope a quick steady pull until engine starts.
10. Open choke.
11. Open PRIMING VALVE (located just below check valve).
12. Pull THROTTLE to full speed position.
13. Close and press down firmly on MUFFLER-LEVER-HANDLE until a solid stream of water flows from priming ejector.
14. Close the PRIMING VALVE and re-open the MUFFLER-LEVER-HANDLE. The check valve will open automatically under the water pressure when priming occurs.
15. Reduce throttle setting to 1/2 full speed and allow engine to warm up for at least 2 minutes before using full throttle.

To stop the BB-4 unit:

1. Move throttle lever to allow engine to idle for 1-2 minutes.
2. Move FUEL VALVE to the "OFF" position and let the engine run for 15-20 seconds.
3. Turn IGNITION SWITCH to the "OFF" position.

When the **BB-4** engine is well maintained and operated within normal guidelines, the motor will maintain longevity with trouble-free service.

COLD WEATHER

Recommended Procedure for Cold Weather or Prolonged Storage

The following procedure is recommended to assure proper protection of the engine if the engine is to be left idle for prolonged periods between use or if there is a possibility that the engine may be stored in an unheated area where freezing temperatures may occur;

1. Move FUEL VALVE LEVER to the "OFF" position.
2. With pump unit running at approximately 1/2 throttle, allow engine to run until all fuel has left the carburetor and the engine comes to a stop.
3. Remove spark plug.
4. Rotate crankshaft until piston is at top dead center.
5. Pour 1 oz (30 ml) of oil into spark plug opening.

It is preferable to keep the pump unit in dry storage above freezing temperature. However, as this is not always possible, some slight rusting may occur, which should have no detrimental effect on the life or performance of the unit.

To Remove Pump from Engine:

1. Lift pump clamp lever.
2. Release tension-adjusting knob at bottom of clamp.
3. Remove clamp by tapping bottom end of each half clamp.
4. Remove pump from engine.

To Attach Pump to Engine:

1. Place flexible buffer coupling on engine coupling pins.
2. Align flexible buffer coupling holes to pump end coupling pins and install.
3. Carefully align clamp positioning pins with flange stub.
4. Adjust tension knob located at bottom of clamp to obtain a light pressure on clamp ring.

To Drain Pump:

It is recommended that the pump be drained after every use. **This is a MUST during cold weather, to prevent damage to the pump, due to freezing.**

1. Remove discharge hose, suction hose, and priming cap.
2. Drain pump by tilting and rotating pump unit several time.
3. Stand pump on suction nozzle end for several minutes to complete drainage.
4. Replace discharge, suction, and priming caps.

IMPORTANT:
In cold operation it is good practice to put a small amount of aluminium compatible antifreeze into the pump end through discharge immediately after use, to prevent damage from freezing.

TROUBLESHOOTING CHART

ENGINE DOES NOT START OR STARTS MOMENTARILY THEN STOPS

Possible cause	Remedy
Fuel supply tank empty	Refill fuel tank
Leak in fuel supply system	Tighten or replace fittings
Spark plug fouled or defective	* Clean or replace
Stop switch or cable shorted	* Inspect and/or change
Weak or intermittent spark	* Inspect and/or change
Ignition coil faulty, or with incorrect air gap	* Inspect ignition coil and/or readjust
Dirty fuel filter	* Inspect and clean
Water or dirt in fuel system	* Drain; flush thoroughly
Carburetor mountings loose or misadjusted	* Tighten mountings and/or readjust

ENGINE RUNS IRREGULARLY OR MISSES

Possible cause	Remedy
Fuel supply tank empty	Refill fuel tank
Leak in fuel supply system	Tighten or replace fittings
Spark plug fouled or defective	* Clean or replace
Weak or intermittent spark	* Inspect and/or change
Ignition coil faulty, or with incorrect air gap	* Inspect ignition coil and/or readjust
Dirty fuel filter	* Inspect and clean
Water or dirt in fuel system	* Drain; flush thoroughly
Carburetor mountings loose or misadjusted	* Tighten mountings and/or readjust
Air filter dirty	* Clean or replace
Governor out of adjustment	* Readjust
Valve clearance incorrect	* Readjust
Excessive carbon deposits in the combustion chamber	Decarbonize

ENGINE DOES NOT IDLE PROPERLY

Possible cause	Remedy
Check whether the choke is open	Open the choke fully
Spark plug fouled or defective	* Clean or replace
Weak or intermittent spark	* Inspect and/or change
Carburetor mountings loose or misadjusted	* Tighten mountings and/or readjust
Idle mixture screw misadjusted	* Adjust mixture screw
Ignition coil faulty, or with incorrect air gap	* Inspect ignition coil and/or readjust
Governor out of adjustment	* Readjust
Excessive carbon deposits in the combustion chamber	Decarbonize

ENGINE DOES NOT DEVELOP NORMAL POWER AND/OR OVERHEATS

Possible cause	Remedy
Check whether the choke is open	Open the choke fully
Air filter dirty	* Clean or replace
Carburetor main jet clogged	Clean the main jet
Spark plug fouled or defective	* Clean or replace
Weak or intermittent spark	* Inspect and/or change
Carburetor mountings loose or misadjusted	* Tighten mountings and/or readjust
Idle mixture screw misadjusted	* Adjust mixture screw
Excessive carbon deposits in the combustion chamber	Decarbonize
Muffler blocked or dirty	* Clean and/or replace
Governor out of adjustment	* Readjust
Valve or valve seats worn or damaged	* Inspect and/or change
Cylinder, piston or piston ring worn	* Inspect and/or change

*Refer to **"Briggs & Stratton Repair Manual"** for more information.

PUMP TEST KIT

Ref. #	Part #	Description	Qty
—	A-2388	Pump test kit (incl. all the parts listed below)	1
1	A-2392	Pressure gauge 0-400 psi (0-2800 kPa)	1
2	F5095E	Hose SPEC 187-1 1/2" x 10' with brass coupling NPSH M/F 1 F5095E00F10RBALFS	1
3	A-2389	Pump test kit box	1
4	A-2391	Rubber hose assembly (incl. a set of 2 adaptors A-2391B)	1
5	A-2391B	Adaptor Female NPT-Swivel Female	2
6	A-2390A	Shut-off valve	1
7	A-2390	Pressure gauge adaptor 1 1/2" (38 mm) female NPSH to 1 1/2" (38 mm) male NPSH	1
8	A-2395	Brass calibrated nozzle tip set: 1/8", 1/4", 5/16", 3/8", 7/16" (3 mm, 6 mm, 8 mm, 9.5 mm, 11 mm)	1
9	C-1933	Calibrated nozzle, 1/2" (12.7 mm)	1

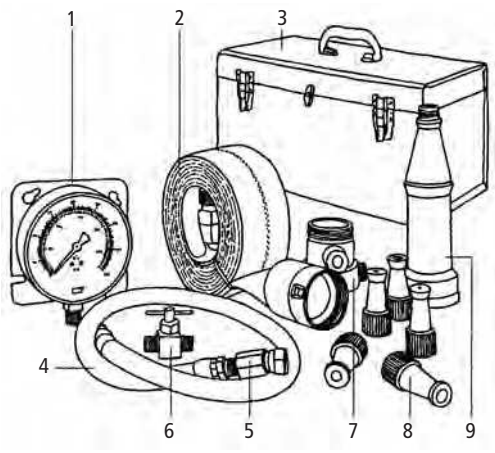
GOVERNOR SYSTEM

WARNING:
Should the pump lose its prime, the engine should be stopped as soon as possible. This will prevent the pump end from running dry and causing damage to the rotary seal.

Testing Procedure

The best way to to check that your pump unit is functioning properly is to make an actual performance test. A test kit consisting of pressure gauge, pressure gauge adapter, 3 m (10') length of discharge hose, a nozzle and a calibrated set of nozzle tips is available.

Your **BB-4** is in satisfactory running condition if, when using the various calibrated tips, the pressures are consistent with the values in the following chart:



BB-4

NOZZLE SIZE	1/2" (12.7 mm)	7/16" (11 mm)	3/8" (9.5 mm)	5/16" (8 mm)	1/4" (6 mm)	1/8" (3 mm)
MINIMAL PRESSURE RANGE	145-150 psi	215-220 psi	275-280 psi	330-335 psi	2275-2310 psi	405-410 psi
	1000-1034 kPa	1482-1517 kPa	1896-1931 kPa	2275-2310 kPa	2586-2620 kPa	2792-2827 kPa

Governor system (overspeeding) protection may occur if:

1. **Pump not primed properly.**
   - Suction hose and/or pump body not completely filled with water.
   - A bend in the suction hose located higher than the pump suction inlet, causing an air lock. (The suction hose between the pump and water supply source must have a downward slope).
2. **Loose suction hose coupling or priming cap.**
3. **Foot valve strainer clogged or too close to surface of water.**
4. **Pump loses prime.**
   - Due to lack of water, air lock may form in the suction hose when pump unit works against a high delivery head. If this happens, disconnect the discharge hose from the pump then reprime the pump in the normal manner.
   - Pump runs out of water, either because of lack of sufficient water supply or by attempting to pump water from a shallow water source.

The foot valve must remain at least one foot (30 cm) under the water surface while pump is operating.

All suction couplings, including foot valve, must be wrench tightened. Proper fitting gaskets must be used in all coupled joints. Worn or dried out gaskets should be replaced with new gaskets.

The governor system will not stop the engine. For engine damage protection, the governor will not allow the engine to exceed speeds higher than 4000 ± 100 RPM without load.

REGULAR MAINTENANCE

Regular maintenance is a schedule of continuous systematic maintenance designed to prevent frequent or major breakdowns before they occur.

Maintenance on a fire pump unit should not be done on the fireline. Therefore, check your pump unit immediately after use.

MAINTENANCE CHECK LIST

1. Clean unit thoroughly.
2. Check and clean air filter element, replace if damaged.
3. Remove any accumulated dirt or debris around the muffler and recoil starter.
4. Clean air intake casing and cover with compressed air.
5. Check the engine oil level.
6. Ensure cooling passages and cylinder fins are clean.
7. Ensure spark plug is cleaned and has proper gap setting.
8. Check start switch and ignition switch for proper operation.
9. Check throttle and choke control for proper operation.
10. Check fuel line and fittings for signs of wear, etc.
11. Check starter cable and mechanisms and replace if it shows excessive wear.
12. Check and grease pump end.
13. Check carburetor adjustments.
14. Operate pump unit and check general performance.
15. Note any performance irregularities of any abnormal mechanical sounds.
16. Make sure pump seal is not leaking.
17. Make sure all necessary tools, spares, and accessories are with the pump unit. It is strongly suggested to always have extra spark plugs on hand.

ENGINE MAINTENANCE

Perform at every indicated month or at operating hour interval recommended, whichever comes first.		Before use	After first 5 hrs	Every 3 months or 50 hrs	Every 6 months or 100 hrs	Every year or 300 hrs
Engine oil	Check – Refill	●				
	Replace		●	● (1)		
Oil filter	Replace				● (1)	
Air filter (foam & paper)	Check					
	Clean or replace			● (1)		
Fuel tank and filter	Clean – Replace				● (2)	
Fuel line	Inspect	Every year				
	Replace	Every year				
Spark plug	Check – Adjust	●				
	Replace				●	
Spark arrester	Clean or replace			●		
Valve clearance	Inspect – Adjust					●

NOTE:

(1) Service more frequently when used under heavy load, in high ambient temperature or in dusty areas.

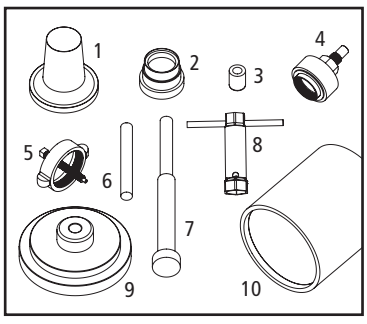
(2) Replace fuel filter if dirt or water are present. If filter is removed, install with flow in same direction as removed. When in doubt, use new filter.

PUMP OVERHAUL SERVICE PROCEDURE

PUMP END

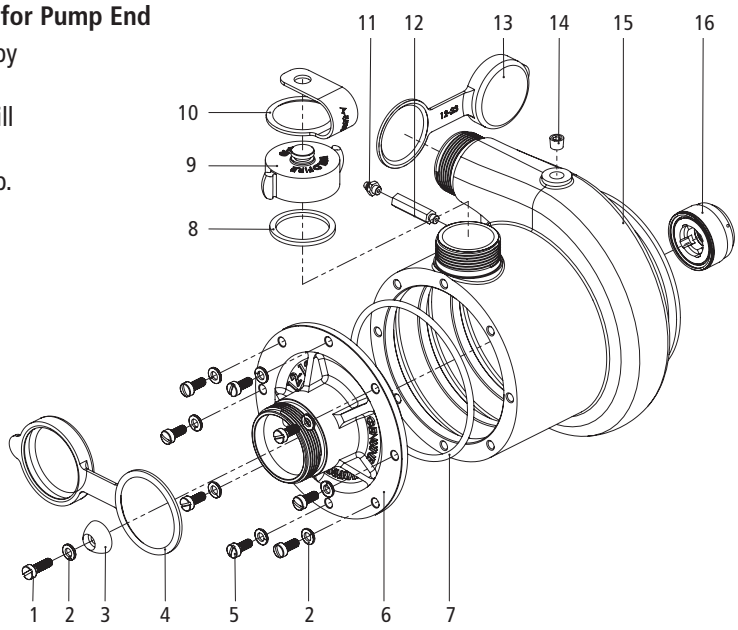
Ref. #	Part #	Description	Qty
1	12-42	Mach. screw, stainless steel, nylon insert	1
2	12-38	Lock washer, stainless steel	9
3	12-13	Nose for shaft	1
4	A-5537	Protective cap, suction	1
5	12-39	Mach. screw, stainless steel	8
6	12-12A	Suction cover with bronze bearing	1
7	12-27	O-ring	1
8	12-43	Gasket 1 1/2" (38 mm)	1
9	12-10	Cap for priming port	1
10	A-5538	Retainer for priming cap	1
11	12-29	Grease fitting	1
12	12-87	Extension for grease fitting	1
13	A-5536	Protective cap, discharge	1
14	12-73	Plug, 1/8" NPT, brass	1
15	12-8	Pump body, 12-16 (4-stage)	1
16	12-28NS	Mechanical rotary seal	1
--	A-2688	Thread protector 2" NPSH (suction) (incl. gasket)	Opt.
--	A-2161	Thread protector 1 1/2" NPSH (discharge) (incl. gasket)	Opt.
--	A-7465	Thread protector 1 1/2" NH (discharge) (incl. gasket)	Opt.
--	FA-4	1/4-turn quick-connect adaptor (discharge) (incl. gasket)	Opt.

TOOL KIT FOR PUMP END



Disassembly Procedure for Pump End

1. Remove shaft nose #3, by removing screw #1, and lockwasher #2. These will be visible upon removal of suction protective cap.
2. Remove screws #5, and lockwashers #2.
3. Using tool A-1888, remove suction cover #6.



4. Bend lockwasher #18 from locknut #17. Using tool R-904L or 19 mm (3/4") wrench, remove locknut and lockwasher.
5. Remove screws #27.
6. Using bench-press and tools A-1890, A-4097 and A-5297, press out shaft assembly.
7. Using seal puller A-7644, remove seal.
8. Using bench-press and tools A-1886 and A-5297, remove all impellers and distributors. Operation is done in jogging strokes of press ram, so that all parts will be removed in a group.

Assembly Procedure for Pump End

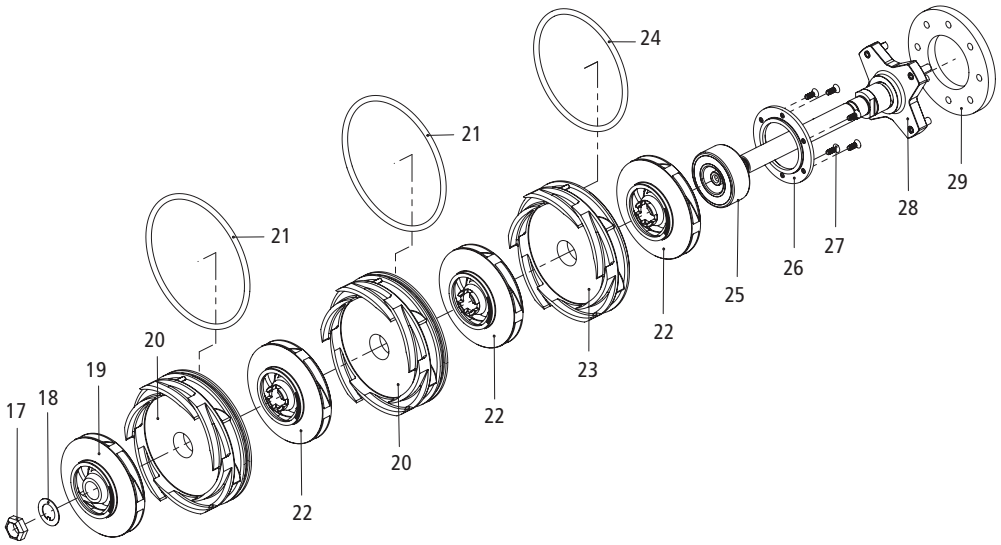
1. Slide bearing retaining ring #26 on shaft with plain face toward coupling collar.
2. Press bearing #25 on shaft.
3. Press rotary seal #16 in pump body using sleeve A-4329. **This should be done carefully.**
4. Carefully pass end of shaft assembly through rotary seal bore. Make sure that the flat sections of the shaft line up with the rotary seal flat sections. Gently press down the shaft until ball bearing rests firmly against shoulder in pump body.
5. Attach retaining ring #26 to pump body using six screws and tighten evenly and firmly.
6. Slide impeller #22 onto shaft, and engage with seal.
7. Place O-ring #24 in groove of distributor #23. It is important to smear the new O-rings with a suitable lubricant. This will facilitate the assembly.

Ref.#	Part #	Description	Qty
—	A-2356	Maintenance tools for 25-16 pump end (includes all parts listed below)	1
1	A-1884	Pressing sleeve for distributor	1
2	A-4329	Seal pressing sleeve	1
3	A-4097	Shaft protector	1
4	A-7644	Seal puller for 12-28NS	1
5	A-1888	Suction cover puller	1
6	A-1890	Pressing pin for shaft removal	1
7	A-1886	Pressing pin for distributor removal	1
8	R-904L	Wrench for lock nut	1
9	A-1887	Shaft installation aligning guide	1
10	A-5297	Pump support tool	1

PUMP END

Ref. #	Part #	Description	Qty
17	12-50**	Locknut stainless steel	1
18	12-49**	Lock washer, stainless steel	1
19	12-11**	Impeller	1
20	12-9	Distributor	2
21	12-27	O-ring	2
22	12-7**	Impeller	3
23	12-6	Distributor	1
24	12-26	O-ring	1
25	12-48*	Double row ball bearing	1
26	12-3*	Retaining ring for bearing	1
27	12-25	Mach. screw, stainless steel, nylon insert	6
28	12-2C*	Shaft and collar assembly, 4-stage	1
29	12-17	Coupling buffer	1
--	12-2D	Shaft sub-assembly, 4-stage, with impellers (incl. parts with * and **, 7 items)	
--	12-2E	Shaft sub-assembly, 4-stage (incl. parts with *, 3 items)	

IMPORTANT:
The pump bearing should be greased after every 8 hours of operation. The grease should be pumped slowly into bearing chamber until fresh grease appears around bearing retaining ring. Use only water repellent ball bearing grease, preferably grease that has a rust inhibitor. DO NOT use graphite grease, or a pressurized grease gun.



8. With open end of pump body in vertical position, carefully lower distributor #23 until it rests on bottom of body.
9. Slide impeller #22 into position, aligning with shaft.
10. Place O-ring #21 in groove of distributor #20.
11. Place distributor on open end of body, then using bench press and assembly tool A-1884, apply several light, downward strokes of press ram until distributor "drops" into body. Distributor must then be positioned by hand as before.
12. Slide impeller #22 into position, aligning with the other impeller.
13. Repeat operations #10 and #11 for remaining distributor.
14. Slide impeller #19 into position, aligning with previous impeller.
15. Place lockwasher #18 on shaft with locating tab in milled groove.
16. Screw locknut #17 onto shaft. When tightening the nut, do not use excessive force as this may result in failure of the seals or impellers. Do not forget to secure the shaft from rotating. Bend lockwasher up onto one flat of the hexagon locknut at a position approximately 180° from the milled slot in the shaft.
17. Place O-ring #7 in groove of suction cover #6, then bench press the cover into the pump body until it rests on face of first distributor. A gap of approximately 0.794 mm (1/32") between nozzle flange and end of body is normal.
18. Attach suction cover to body by using the #5 screws and lockwashers #2. Tighten screws evenly and firmly.
19. Attach shaft nose #3 using lockwasher #2 and screw #1. Tighten screw evenly and firmly.
20. Check gasket in the priming cap #9 and replace if damaged.
21. Reinstall the suction and discharge thread protectors (if equipped).
22. Reinstall caps on suction and discharge inlets.

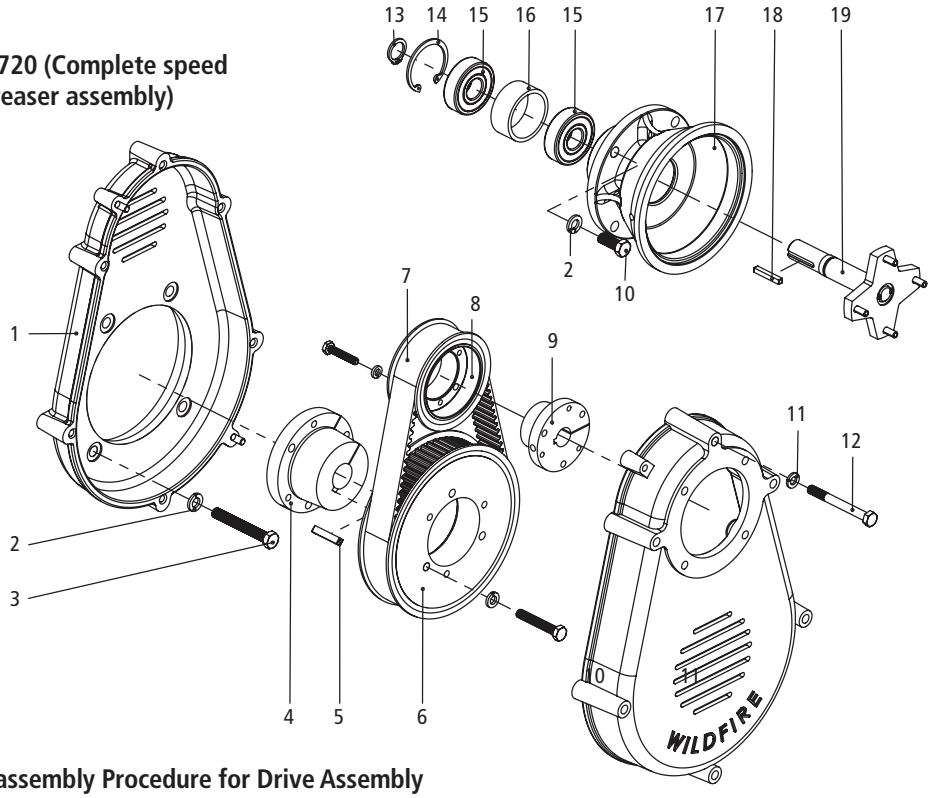
Use a clean gun filled with fresh grease. Remove dirt from grease fitting before applying grease gun. Grease should be pumped slowly into bearing chamber until fresh grease appears around bearing retaining ring. Wipe off excess grease.

A grease relief valve (old style only) has been provided to prevent pressure buildup on the rotary seal, should the fresh grease not be able to flow completely through the bearing, due to old grease being hard packed, etc.

DRIVE ASSEMBLY

Ref. #	Part #	Description	Qty
--	C-7720	Drive assembly (complete)	
1	C-7721	Drive cover assembly (sold as a set)	1
2	FAST-502	Lock washer, steel, plated	8
3	FAST-23	Bolt, engine mounting	4
4	PART-4	Bushing, 1" shaft (incl. 3 screws, 3 lock washers and set screw)	1
5	PART-7	Key, 1/4" sq., stainless steel	1
6	PART-2	Driving pulley	1
7	PART-1	Timing belt	1
8	PART-3	Driven pulley	1
9	PART-5	Bushing, 3/4" shaft (incl. 3 screws, 3 lock washers and set screw)	1
10	FAST-2	Bolt, drive hub assembly	4
11	FAST-501	Lock washer	6
12	FAST-1	Bolt, drive cover assembly	6
13	PART-8	Retaining ring, ext.	1
14	PART-9	Retaining ring, int.	1
15	PART-10	Bearing, drive hub	2
16	A-6956	Spacer, drive hub	1
17	C-6955	Drive hub body	1
18	PART-6	Key, 3/16" sq., stainless steel	1
19	A-7239	Shaft assembly, drive hub	1

C-7720 (Complete speed increaser assembly)



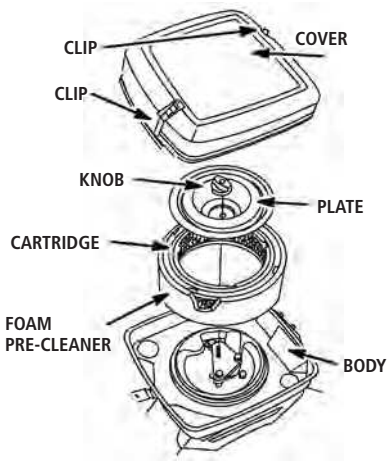
Disassembly Procedure for Drive Assembly

1. Remove pump end.
2. Remove bolts #12, lockwashers #11 and carefully pull drive front cover off.
3. Remove belt and check if worn.
4. Remove crankshaft bushing screws and reinstall in threaded holes. Tighten equally until the sprocket and the bushing separate. Repeat this procedure with the pump drive shaft bushing.
5. Remove bushing set screws to free the keys.
6. Remove bolts #10 and lockwashers #2 to separate drive hub.
7. Remove retaining ring #13 and press out the shaft assembly #19.
8. Remove retaining ring #14 and slide out the bearings and spacer #15 and 16.
9. Remove screws #3 and lock washers #2 to pull out back cover.

Reassembly Procedure

1. Insert bearings and spacer #15 and 16 inside drive hub housing.
2. Install retaining ring #14 in its groove inside drive hub.
3. Press pump shaft assembly #19 in drive hub and install retaining ring #13.
4. Ensure the drive hub drain hole is at the bottom.
5. Reassemble the drive hub to the drive front cover (tighten to specified torque).
6. Reassemble drive back cover on engine (tighten to specified torque).
7. Slide sprocket #6 over bushing #4 and slide on crankshaft
8. Insert key #5 in engine shaft and tighten the 3 bushing screws so the sprocket outer face is 19 mm (3/4") from drive back cover.
9. Push key #5 flush to crankshaft bushing face.
10. Apply Loc-Tite on bushing set screw and tighten.
11. Slide sprocket #6 over bushing #9 and slide on pump drive shaft #19.
12. Insert key #18 in drive shaft and tighten the 3 bushing screws so the sprocket outer face is 19 mm (3/4") from drive front cover.
13. Push key #18 flush to drive shaft bushing face.
14. If possible, apply Loc-Tite on bushing set screw and tighten. If not, this set screw is not required.
15. Reinstall belt over pulleys as you push drive front cover upper locating holes over the upper positioning pin. Rotate front cover clockwise to clear lower locating pin.
16. To tighten belt, rotate front cover CCW so the lower location hole will come in line with lower location pin.
17. Push front cover against back cover and tighten the screws #12.

ENGINE OVERHAUL SERVICE PROCEDURE



DUAL ELEMENT AIR CLEANER

Air Filter

A dirty air filter restricts airflow to the carburetor, causing the engine to run irregularly and lose power due to an over-rich mixture, entering the carburetor. Therefore, whenever the filter becomes dirty, or whenever any of the above conditions occur, remove the filter element as follows:

1. Remove the knob and plate. Remove the filters and separate them. Carefully check the foam and paper filters for holes or tears and replace if damaged.
2. Tap the paper filter lightly on a hard service to remove excess dirt or blow compressed air lightly through the filter from the inside out. Never try to brush the dirt off; brushing will force dirt into fibers.
3. Replace filter elements if damaged or cannot be cleaned thoroughly.
4. Reinstall the filters and the plate ensuring the seal is properly set.
5. Reinstall the cover ensuring cover seal is properly set in its groove.

IMPORTANT: Use warm soapy water to clean the foam filter.
DO NOT use gasoline, or petroleum solvents to clean the air filter.

SPARK PLUG

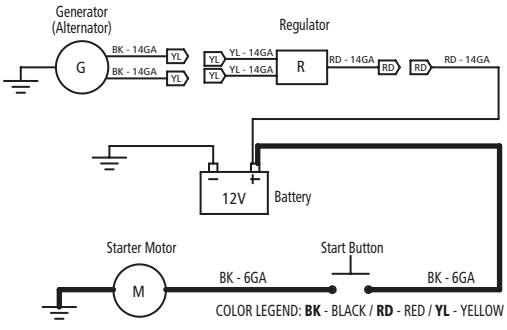
Operation with a defective or the wrong type of plug will be reflected in the engine performance: as indicated by hard starting, fouling, missing, overheating, pre-ignition or lack of normal power. Therefore, at each regular maintenance inspection or whenever the ignition system check indicates that the spark plug is in need of attention, remove for inspection and service.

If tip of insulator core is rough, cracked, broken or blistered, or if electrodes are burned away to the extent that they are too thin and cannot be satisfactorily adjusted to recommended gap, replace with new plug.

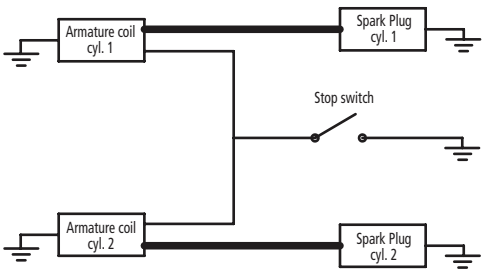
ALTERNATOR

The **BB-4** is equipped with 16 Amp alternator / regulator-rectifier.

Wiring Battery



Wiring Ignition



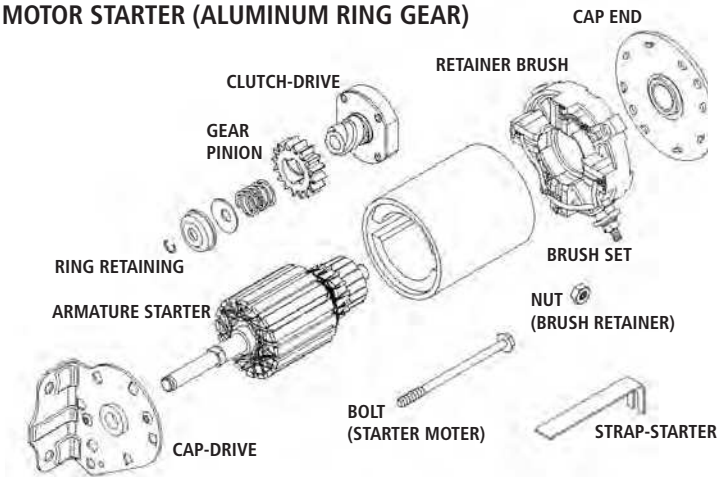
The above is a general guideline.
Always refer to the **"Briggs & Stratton Repair Manual"**

ELECTRIC STARTER

The **BB-4** is equipped with an electric starter with a backup rewind starter. When the starter is activated, the pinion gear should engage the flywheel ring gear and turn over the engine.

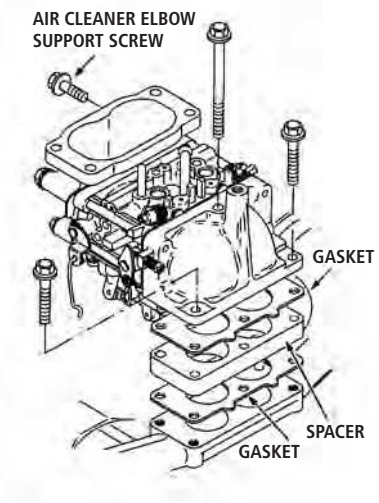
If the starter motor drive does not react properly, inspect the helix and pinion gear for freedom of operation. If sticking condition exists the parts may be washed in a solvent. DO NOT oil or grease helix or starter gear.

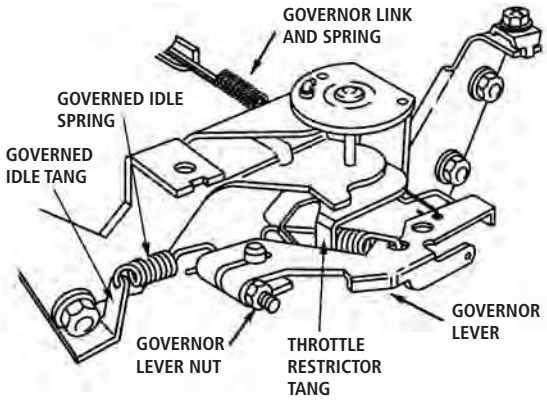
MOTOR STARTER (ALUMINUM RING GEAR)



CARBURETOR

Operation with a defective carburetor is reflected in engine performance: as indicated by engine not starting, momentarily starting then stopping, running irregularly or missing, backfiring, not properly idling or not developing normal power and/or overheating. Therefore, at each regular maintenance inspection or whenever check of carburetor indicates it is in need of attention proceed as follows:





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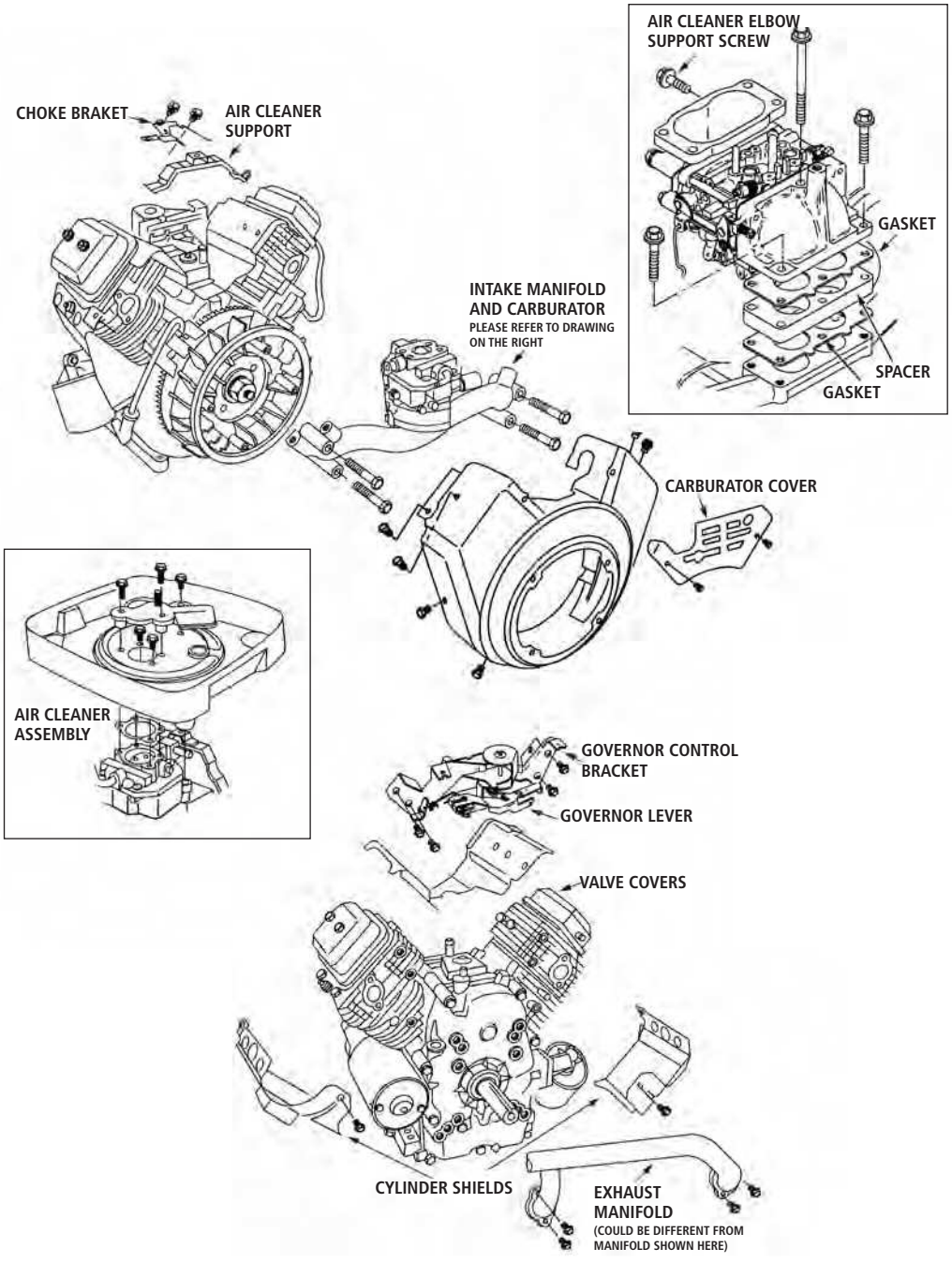
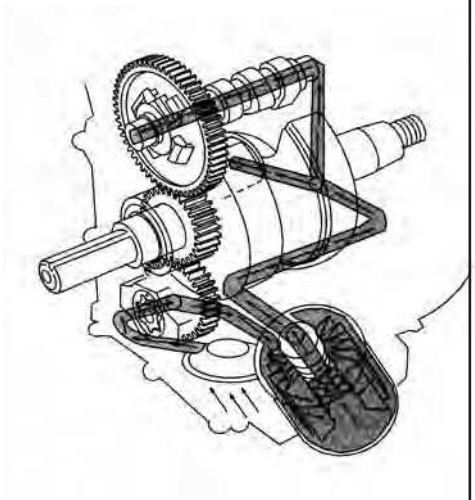
VALVES

Operation with misadjusted valve clearance is reflected in engine performance: as indicated by engine not starting, momentarily starting then stopping, running irregularly or missing, backfiring, not properly idling or not developing normal power and/or overheating. Therefore, at each regular maintenance inspection and whenever check of valve clearance indicates that it is in need of attention, remove for inspection and service.



Note: Recoil starter and starter pulley are missing from diagram.

OIL PUMP



Efficient engine lubrification is accomplished by a full pressure lubrication system. The oil pump draws oil through a screened pick up in the engine base and pumps the oil through the oil galleries in the crankcase cover or sump where it is distributed to the PTO bearing and cam gear bearing. An oil gallery in the cam gear connects to the oil gallery on the magneto side of the cylinder, lubricating the magneto bearing.

NOTE: The oil pump is virtually trouble free and requires very little service.

An oil pressure switch is installed in the oil filter adapter. When the oil pressure drops below approximately 5 psi (35 Pa), the switch activates a warning light.

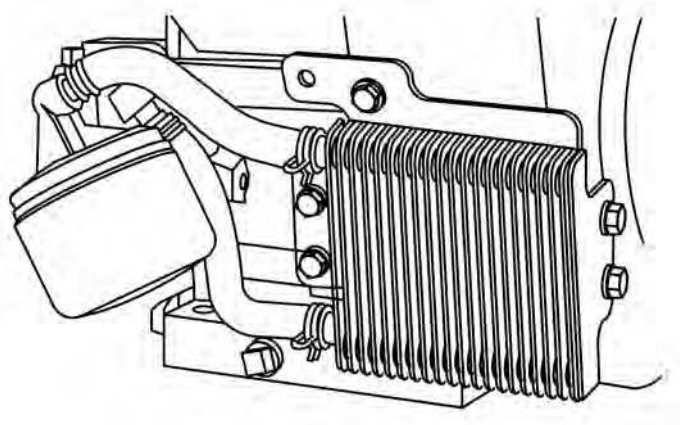
The following chart can be used as a troubleshooting guide for diagnosing the pressure lube system.

LOW OIL PRESSURE	HIGH OIL PRESSURE
1. Low engine RPM	Incorrect viscosity
2. Low oil level	Defective oil pressure gauge
3. Incorrect viscosity	Stock pressure relief plunger
4. Incorrect oil filter	Plugged oil galleries
5. Defective oil pressure gauge	
6. Broken or incorrect length pressure relief spring	
7. Missing pressure relief plunger	
8. Worn bearings	
9. Damaged or defective oil pump	

OIL COOLER

The 23HP engine is equipped with an oil cooler. The oil cooler is mounted on the blower housing. Filtered oil is routed through the oil cooler through two oil lines from a special oil filter adapter. Forced air from the flywheel fan blows through the oil cooler fins dissipating heat from the engine oil.

The oil cooler fins should be cleaned every on a regular basis or as required.



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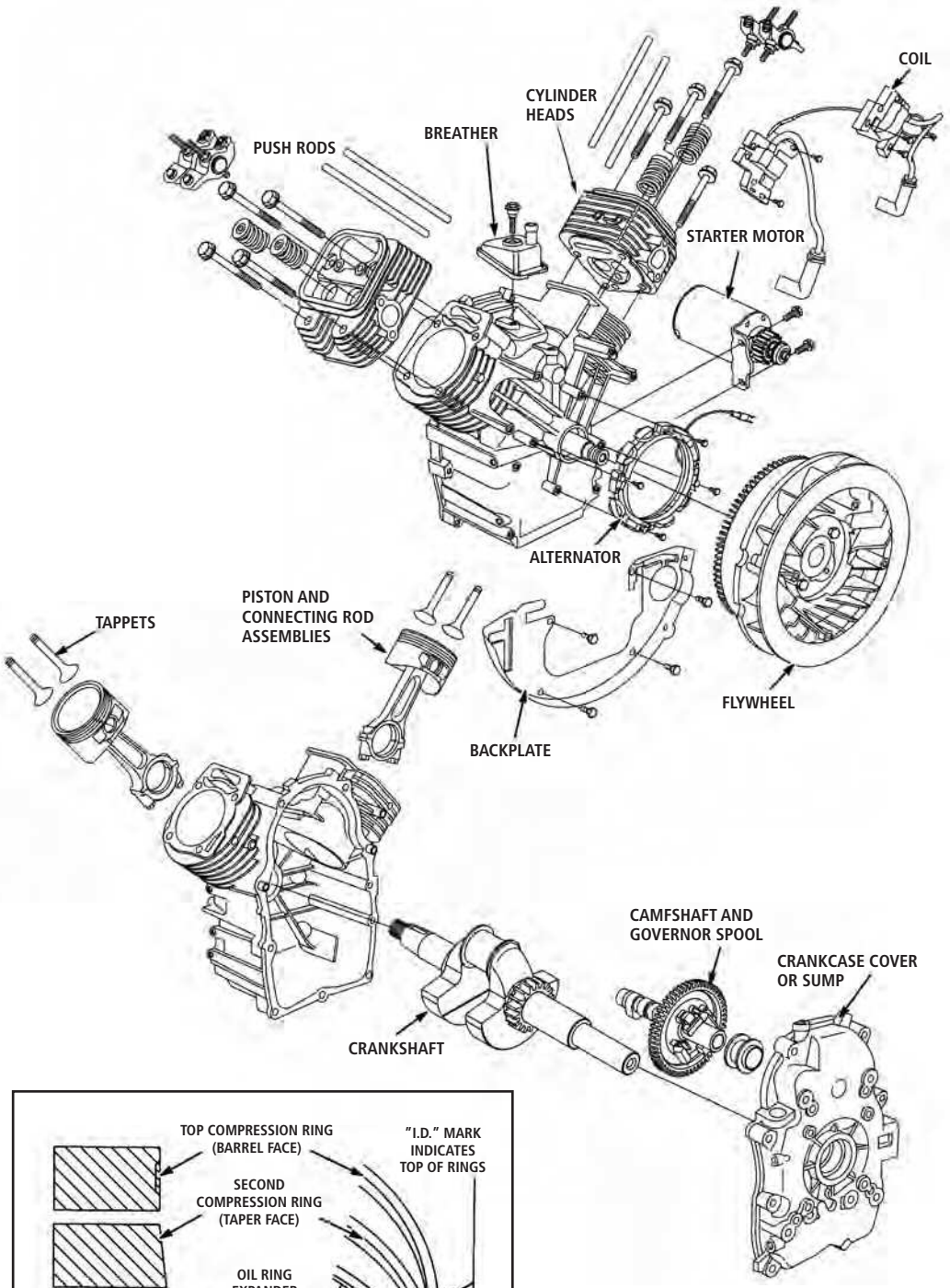
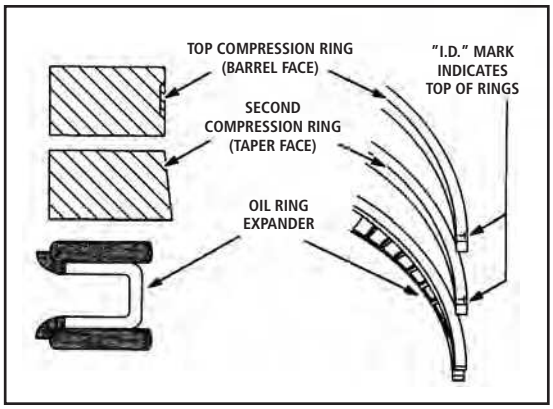
PISTON RINGS, RODS AND CRANKSHAFT





The above is a general guideline.
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TORQUE VALUES
(PUMP END)

PUMP END	
Nut #12-50	28 – 29 N•m / 250-260 inch-lbs
Retaining ring screws	6.7 – 7.3 N•m / 60-65 inch-lbs
Shaft nose screws	7.9 – 8.5 N•m / 70-75 inch-lbs
Suction nozzle screws	7.9 – 8.5 N•m / 70-75 inch-lbs

CLEARANCE DATA AND LIMIT
(PUMP END)

PART	STANDARD AND SERVICE LIMIT
Buffer #12-17 thickness	9.27 – 9.65 mm (0.365 – 0.380 in)
Impeller #12-11 diameter Impeller #12-11 width	93.22 ± 0.13 mm (3.670 ± 0.005 in) 34.11 ± 0.05 mm (1.343 ± 0.002 in)
Impeller #12-7 diameter Impeller #12-7 width	93.22 ± 0.13 mm (3.670 ± 0.005 in) 38.86 ± 0.05 mm (1.530 ± 0.002 in)
Distributor #12-6 diameter Distributor #12-6 width	123.39 – 123.47 mm (4.858 – 4.861 in) 28.75 ± 0.05 mm (1.132 ± 0.002 in)
Pump inside depth	108.11 ± 0.05 mm (4.256 ± 0.002 in)
Pump ball bearing housing	51.99 – 52.02 mm (2.047 – 2.048 in)
Nozzle bushing bearing housing	19.037 – 19.063 mm (0.7495 – 0.7505 in)
Shaft ball bearing support	25.004 – 25.011 mm (0.9844 – 0.9847 in)
Shaft bushing bearing support	12.687 – 12.700 mm (0.4995 – 0.5000 in)
Shaft maximum run-out	0.05 mm (0.002 in)

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