



NOTE: This manual is an integral part of the pump package and MUST be read before operating the unit. This manual must be kept and regularly referred to throughout the lifetime of the equipment. Failure to do so could result in injury and damage to the equipment. Please ensure that any amendment received is incorporated in the text and that this manual is passed on to any subsequent holder or user of the equipment.

www.pslfireandsafety.co.nz

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Health and safety

WHEN ENGINE IS RUNNING DO NOT:

1. Run with any guard removed.
2. Attempt any work in the guarded area.
3. Attempt to move the unit.
4. Refill the fuel tank (without removing it from the frame into a safe area first)
5. Remove the pressure cap from the expansion tank (wait until the engine has cooled.)
6. Place hands inside the volute housing.
7. Place any part of body near suction inlet. (If running with no suction hose connected, always connect the end cap.)

WHEN ENGINE IS RUNNING DO:

8. Run the unit on level ground wherever possible. Inclination must never exceed 45°.
9. Check all couplings are secure before increasing pressure.
10. Wear ear protection when working near a running pump. It is also advised that eye protection is used. Loose fitting clothing should not be worn whilst operating the pump.

WARNING: The exhaust gas reaches extreme temperatures.

WARNING: This pump weighs 87Kg (dry).

WARNING: The pump should not be run in underground or poorly ventilated spaces.

WARNING: The guards on the exhaust side of the engine can become hot after prolonged running at high speed.

WARNING: Noise levels over 85dB can be emitted by this pump and ear protectors should be worn at all times when running the pump.

WHEN ENGINE IS NOT RUNNING:

1. Do not place any heavy or loose items on the unit.
2. Do not drop the unit from any height.

MAINTENANCE

1. Allow the unit to cool before attempting to remove any part.
2. Before starting any maintenance ensure the ignition switch is off and disconnect one battery lead or remove the battery.
3. Use only authorised spare parts supplied by Vortex or Briggs & Stratton.

WARNING

The pump body, when delivering water under pressure, is a pressure vessel. Failure to assemble the pump body correctly can lead to leaks or in extreme cases failure of the pump body. Ensure that the body is correctly positioned and that all bolts are tightened using a spanner of the correct size and length.

DISPOSAL OF PETROL AND OIL

Always dispose of surplus petrol and oil from the engine in a safe and environmentally safe way. Only use receptacles specifically provided for petrol and oil.
Only dispose of surplus petrol and oil at authorised sites

TO THE OPERATORS OF THE FIREMASTER 23 ARV PORTABLE FIRE PUMP

Your new Firemaster 23 ARV fire pump will deliver years of efficient and trouble free service if given reasonable care and properly operated.

A study of the following pages should enable you to overcome any difficulties which might arise in the operation of this equipment. We request that you read this manual carefully before placing this fire pump into service.

Several pages of useful data are contained herein to help you answer many of the questions that may arise relative to the hydraulics of fire fighting.

PLEASE RETAIN THIS MANUAL FOR FUTURE REFERENCE

WARRANTY

Phillips and Smith Ltd unconditionally guarantees to replace, for a period of one year, any defective part or parts in the Firemaster 23 ARV pump.

Every new Firemaster 23 ARV pump is guaranteed to deliver performance as specified in our sales brochure.

This warranty does not obligate us to bear costs of labour or transportation charges incurred in the replacement of parts.

We shall not be responsible, under the terms of this warranty, for the cost of repairs or alterations not authorised by us.

We shall not be responsible for damages or contingent liabilities resulting from failures of any Supajet pump.

We make no warranty of any trade accessories incorporated in the assembly or employed in conjunction with any Firemaster pump.

Excessive overloading of this pump beyond our recommended limits of capacity and pressure shall void this warranty.

FIREMASTER 23 ARV DESCRIPTION

The Firemaster 23 ARV Portable Fire Pump is a low speed, single stage, single suction, single outlet centrifugal pump.

The pump is mounted directly to the motor and driven directly from the crankshaft.

The pump is powered by a twin cylinder, overhead valve, air cooled engine, Briggs & Stratton model 350447 series.

Bore..... 2.83 in. (72mm) Displacement..... 38.26 cu. in. (627cc)
Stroke..... 2.76 in. (70mm) Torque (max)..... 33.0 ft. lbs. @ 2600 rpm
Output @ 3 metres, 700 litres per min @ 7 bar (700 kPa)

NOTE:

Engines operated at approximately 900 to 1500 metres (3,000 to 5,000 feet) above sea level may require a high altitude carburetor main jet. If erratic performance is observed, contact a Briggs & Stratton Authorized Service Dealer for a high altitude carburetor main jet.

OPERATION OF FIREMASTER 23 ARV FIRE PUMPS

SUMMARY OF WHAT TO REMEMBER

1. Close delivery valves and drain valves, before attempting to prime pump.
2. Always keep suction inlet primer valve closed when working from hydrants, tanks or when relay pumping.
3. Open suction inlet primer valve fully when priming from open water.
4. Set throttle to prime position for best priming results.
5. Do not operate the primer for longer than 45 seconds. If the pump has not primed by then there is a problem. Follow the priming steps and trouble-shooting guide on page eight.
6. Never run pump without water for periods exceeding two minutes.
7. Accelerate and retard speed of engine gradually.
8. Watch gauges periodically to ensure pump is operating normally.
9. Keep good gaskets in suction hose, and handle carefully to avoid damage to coupling threads.
10. Air leakage into suction line is the most frequent source of trouble when pumping from a suction lift.
11. Always use a suction strainer when pumping from open water.
12. Foreign matter in impellers is a result of failure to use adequate strainers and a common source of trouble.
13. Drain pump immediately after each run.
14. Check oil level in motor after each pumping run.
15. Do not run the pump for long with the discharge valves completely shut off.
16. Do not close a "shutoff" type nozzle when pumping with throttle wide open.

Engine Operation

General information

The Firemaster 23 pump uses the Briggs & Stratton Vanguard engine. This is a twin cylinder, overhead valve, air-cooled engine. All drilled/tapped holes and fasteners on this engine are ISO metric. However, where the pump attaches to the engine, SAE standards apply.

This engine will operate satisfactorily at any angle at which the operator and pump can function safely.

Engine power will decrease 3.5% for each 300 metres (1,000 ft) above sea level and 1% for each 5.6°C above 25°C. The pump unit has been designed to ensure that no perceptible loss of pumping will be noticed at altitudes up to 1500 metres (5,000ft) above sea level.

Starting and stopping

Choke operation/engine warm-up

This is a low emissions engine, which operates differently from previously built engines. It is designed for maximum performance and life if operated with choke fully open (control pushed in) and throttle fully open (in FAST). To open the choke fully requires an engine warm up period of several seconds to several minutes, depending on the ambient temperature.

After starting the engine, first open the choke (pushing in control) until the engine just begins to run smoothly. Then open the choke in small steps, allowing the engine to accept small changes in speed and load, until the choke is full open (control fully pushed in).

To obtain best starting results

Start, store and refuel pump in level position.



Do not use a pressurized starting fluid. Starting fluid is flammable. Severe engine damage or fire may result.

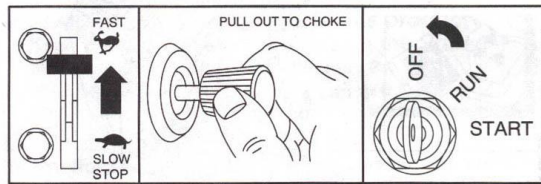
A warm engine requires less choking than a cold engine.

Starting in cold weather

- Use the correct oil for the starting temperature expected.
- Set speed control at part throttle position.
- A warm battery has more starting capacity than a cold battery.
- Use fresh 96 or alternatively fresh 91 octane petrol to improve starting.

Before starting engine

- Pull choke control out fully.
- Move throttle control to mid position.
- Turn key to start.



Note: Choke must be fully closed shortly after the engine has started. (If engine does not start, see control adjustments on Page 12.)

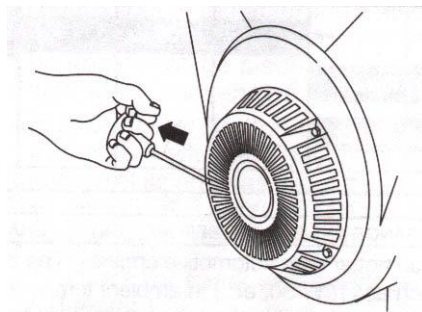
Note: Charge battery before attempting to start engine - see battery maintenance on Page 21. Use short starting cycles (15 sec. per min.) to prolong starter life. Extended cranking can damage starter motor.

- Once engine has started throttle back to idle position.

Hand starter

Should the engine fail to crank either from an electrical fault or from a flat battery, the following procedure should be followed:

- Follow starting procedure as previously detailed.
- Grasp rope handle as illustrated and pull slowly until resistance is felt. Pull cord rapidly to overcome compression and prevent kickback.



Do not operate with battery disconnected without ensuring that battery + cables are fully insulated to prevent accidental arcing.

Stopping the engine

Do not pull choke control to choke position to stop engine. A backfire or engine damage may occur. Move the throttle control to the SLOW position then turn the key to OFF.



Close fuel shutoff valve when transporting to prevent fuel leakage.

Priming the Firemaster 23 ARV Pump

Operating the primer

The Firemaster 23 ARV primer should typically develop up to – 0.7 bar an airtight pumping system.

The primer is a Rotary Vane type, extremely reliable and requires only minimal maintenance.

The Rotary Vane Primer is a Dry type that uses high density carbon vanes and therefore needs no lubrication. The primer is belt driven through a pulley connected to the engine flywheel and is operated via an electric clutch connected to the Rotary Vane Primer. The primer is activated by a push button switch located on the control panel.

A ball valve is located on the pump suction inlet immediately after the one way valve and this valve should only be closed if the pump inlet is under pressure, i.e. when pumping in closed circuit relays or from a hydrant supply. The ball valve prevents water running through the primer when under pressure.

Before the pump can be primed, delivery valves, drain valves, and other openings to the pump must be closed and absolutely air tight.

When operating from draft, suction hose connections must be tight and free of air leaks.

Make certain the suction hose strainer is properly submerged and free from foreign material.

Open throttle to the “Prime” position on the throttle control and push the prime button to start the priming sequence. Keep the primer running until water discharges from the primer exhaust port and a positive reading shows on the delivery gauge. Do not run the primer longer than 45 seconds. Crack open a delivery valve to flow water. Release the button to shut off primer and set the throttle to the desired pumping pressure.

If water does not discharge from primer exhaust within about 45 seconds, stop priming and check for air leaks. Perform a drop down vacuum test on the pump by connecting a blank cap to the inlet and operate the primer for 10 seconds. If the pump compound gauge pulls down to - 0.6 to -0.7 bar and holds the vacuum then the pump is OK and the problem is with the suction hose.

If the compound gauge does not read a vacuum check that the ball valve on the suction inlet is open. Check delivery valves are closed and the pump drain valve is closed. Check the primer is working by removing the primer hose and feeling for suction when the primer is operating. If there is no suction felt then check the inlet filter is not blocked at the primer.

The primer should achieve a 1 metre lift within 8 seconds and a 3 metre lift within 15 seconds using 4” (100mm) suction hose.

When pumping from hydrants or tank supply the primer is not needed and the ball valve on the suction inlet must be kept closed.

PUMP OPERATION

Source of water supply

Water may be drafted from a pond, lake, stream, cistern, stock tank, or well but, whatever the source, the static lift must not exceed 6 metres (20ft) from the center of the pump to the surface of the water, and a lift not exceeding 3 metres (10 ft) is recommended. The source of supply should be reasonably clear and free from foreign matter. It is recommended that all water holes, which may be needed for fire protection, be deepened if necessary and kept free from weeds and refuse. In many fire protection areas, cisterns or reservoirs are built and allowed to fill up with rain water to allow them to be used in emergencies.

Pumping in cold weather

The first insurance against cold weather trouble is to keep fire apparatus stored in heated quarters. All water must be eliminated from pump casing and primer line between periods of operation.

When setting up for pumping, unnecessary delays should be avoided by having thoroughly trained pump operators. Be sure that the primer and hose lines are kept closed until ready for use. Have hose lines ready so that the pump may be started as soon as it has become primed. Do not stop flow of water through the pump until ready to drain and return to station.

When finished pumping

Drain water out of pump casing immediately. (Drain valve is located at lowest point in pump casing).

Do not forget to close the drain valve after all water has been drained out. Trouble in priming will follow on the next run if this is forgotten.

Pumps not often used for fire service should be inspected and run periodically to ensure that they will be in readiness for an emergency.

Pumping salt water

The pump should be flushed out with fresh water immediately after pumping salt water to prevent excessive corrosion.

A centrifugal pump will show 2½ % higher pressure and require 2½ % more power when handling seawater than when handling fresh water, if operated at the same speed and capacity.

Use of pump for emergency practices

It frequently happens that operators of a portable fire pump, who are not thoroughly familiar with its operation, become confused under the stress of an emergency and neglect some small detail that may cause trouble or delay in getting the equipment into operation. Therefore, we strongly urge that practice tests be conducted repeatedly until operators are thoroughly trained. More than one person in the brigade should be a competent operator.

Practice should include pumping from low lifts, high lift with short and long suction lines, with suction line elevated to form an air trap, and from hydrants, at large and small capacities.

It is well, also, to note the effects of air leaks in hose, insufficient submergence and restriction of suction line (suction line can be restricted by placing a can or strong closure around the suction strainer).

NEVER BREAK OR RESTRICT SUCTION OR ADMIT AIR INTO SUCTION LINE WHILE MOTOR IS OPERATING WITH THROTTLE OPEN this will release the load and could allow the motor to over speed.

PUMP TESTING

Measurement of pump performance

Pump performance is measured by the quantity of water it can deliver per minute against a certain pressure called “Total Head”, or “Net Pump Pressure” as it is usually termed in fire pump testing.

The Net Pump Pressure is the sum of the pump discharge pressure as shown on the pressure gauge with which the pump is equipped, and the total suction lift converted to equivalent kPa. If a pump is operating from a hydrant, the Net Pump Pressure is the discharge pressure less the incoming pressure from the hydrant measured at the suction entrance to the pump.

Capacity of a fire pump is measured in litres per minute. The usual method of measurement is to determine the pressure of the jet of water leaving a given size nozzle by means of a “Pitot Gauge” from which the capacity is computed mathematically.

A Pitot Gauge consists of a small tube adapted so as to point directly into the nozzle from the center of the issuing stream, the other end of the tube being connected to an accurate pressure gauge.

The nozzle jet drives straight into the Pitot tube and converts the velocity of the jet into pressure, which is an accurate measure of the velocity of the water as it leaves the nozzle. The tip of the Pitot tube should be one-half the diameter of the nozzle away from the nozzle tip while taking readings.

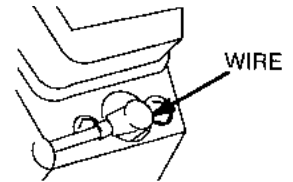
If a Pitot Gauge is not available, approximate pump capacities can be determined by reference to the following chart.

		Flow rate (litres/minute)							
Pump Pressure (KPa)	Nozzle Size (mm)	13	16	19	22	23	25	28	32
100		111.5	169	238	319	349	412	517	676
200		157	239	337	451	493	583	731	955
300		193	292	412	553	605	714	896	1170
400		223	338	476	638	698	825	1035	1351
500		249	378	532	714	780	922	1157	1511
600		273	414	583	782	855	1010	1267	1655
700		295	446	630	844	923	1091	1368	1787
800		315	477	673	903	987	1166	1463	1911

MAINTENANCE

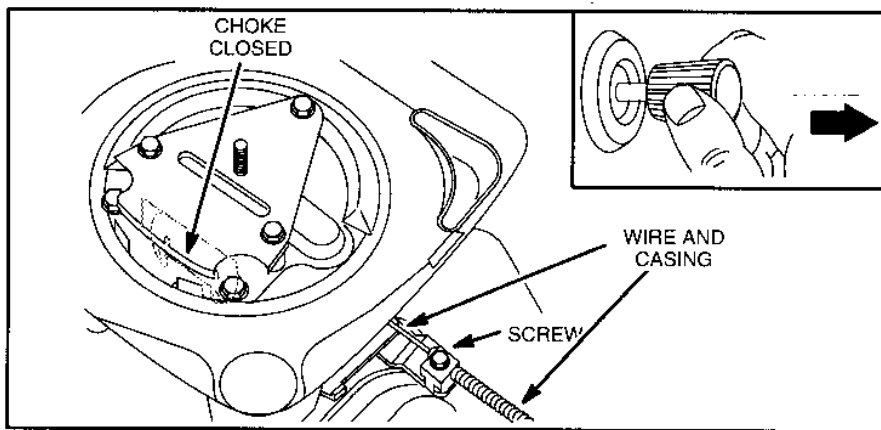
Control adjustments

To prevent accidental starting, remove spark plug leads from spark plugs and disconnect battery at negative terminal when servicing engine or pump.



To adjust choke control:

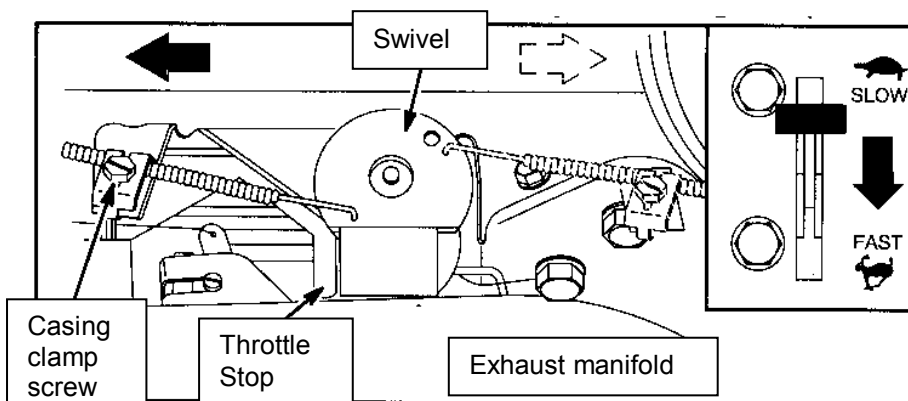
Remove air cleaner. Pull choke control to fully out position. Carburetor choke should be completely closed. If not, loosen case clamping screw then move casing, wire and engine choke lever in the direction shown until choke is completely closed. Tighten casing clamp screw. Replace air cleaner.



Choke Control Adjustment

To adjust throttle control

Remove air cleaner. Move throttle control to FAST position. Swivel should be against throttle stop. If not, loosen casing clamp screw. Move casing and wire in direction shown by arrow until swivel is against throttle stop. Tighten casing clamp screw.

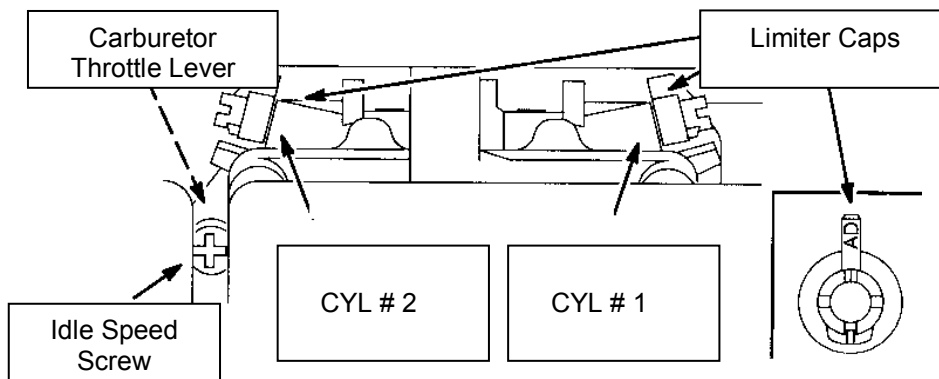


Carburetor

Differences in fuel, temperature, altitude or load may require minor carburetor adjustments. The air cleaner and air cleaner cover must be assembled to carburetor before starting engine. The carburetor on this engine is low emission. It is equipped with idle mixture valves with limiters, which allow some adjustment, and an idle speed adjustment screw.

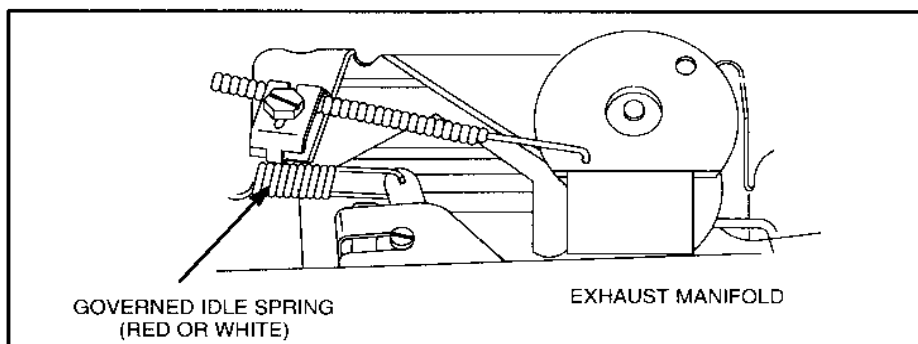
Adjustments

Start engine and warm up for approximately 5 minutes before adjusting. With engine running, place throttle control in SLOW position. Rotate carburetor throttle lever against the idle speed screw and hold it. Turn idle speed screw to obtain 1200 rpm. While holding carburetor throttle lever against idle speed screw, set cylinder #1 idle mixture valve midway between limits then set #2 idle mixture valve midway between limits.



Readjust the idle speed to 1200 rpm if the governed idle spring is red, or 900 rpm if governed idle spring is white. Release carburetor throttle lever. Move throttle control to FAST position. Engine should accelerate smoothly. If it does not, readjust idle mixture valves slightly counterclockwise.

DO NOT remove limiter caps. DO NOT force beyond limits.



Governed idle spring

Oil and Fuel Recommendations

Oil

Check oil level regularly. See oil chart, capacity, checking and filling procedures.

Maintain correct oil level. Check daily before starting engine.

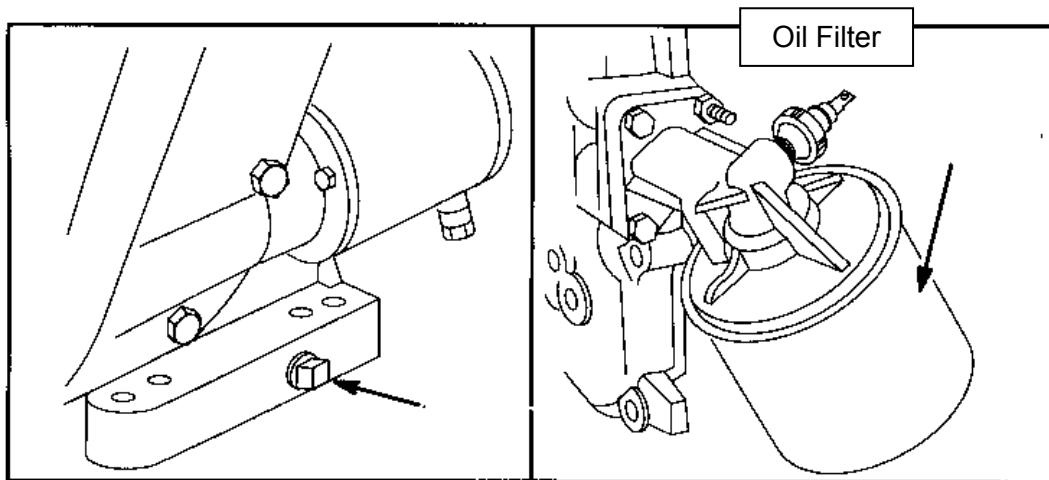
Change oil

Change oil after the first 8 hours of operation. Drain oil while engine is warm.

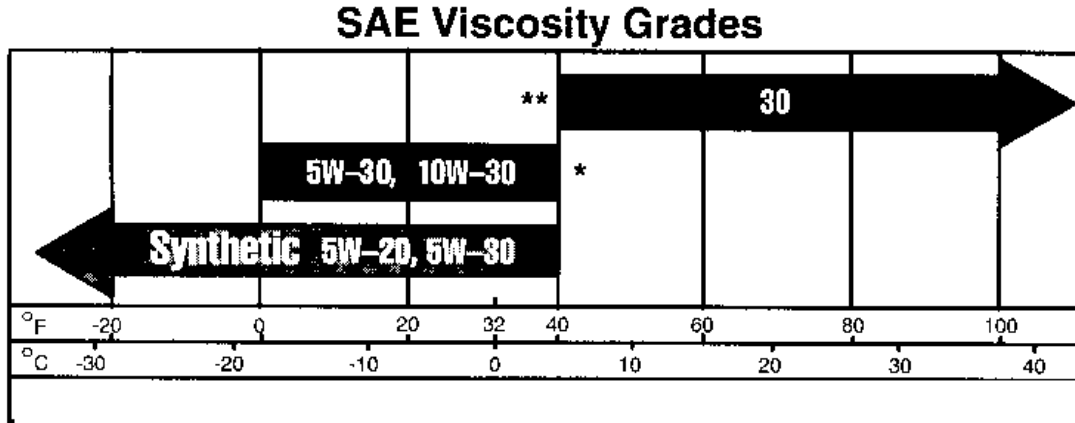
Note: Change oil thereafter every 25 hours of operation or yearly.

Change oil filter

Replace oil filter after every 100 hours of operation or yearly. Drain engine oil and change filter. Before installing new filter, lightly oil filter gasket with fresh, clean oil. Screw filter on by hand until gasket contacts filter adapter. Tighten $\frac{1}{2}$ to $\frac{3}{4}$ turn more.



Change and add oil according to the chart below. Do not overfill.



Use a high quality detergent oil classified “For Service SF, SG, SH,” such as Briggs & Stratton “warranty certified” SAE 30 oil, Part No 100005. Use no special additives with recommended oils. Do not mix oil with petrol.

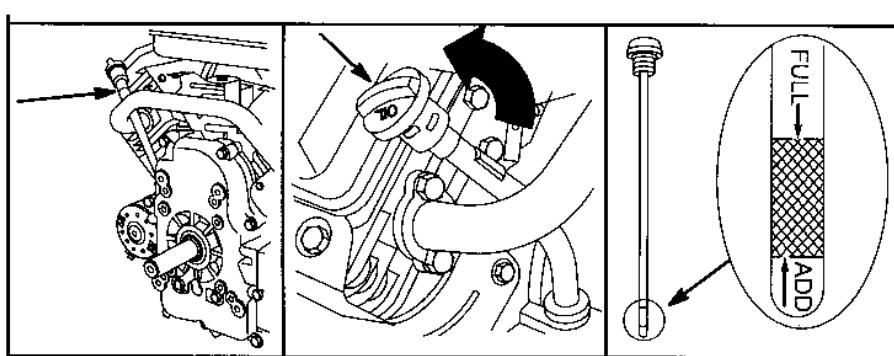
- Air-cooled engines run hotter than automotive engines. The use of multi-viscosity oil such as 10W-30, etc. in ambient temperatures above 4°C will result in higher than normal oil consumption. If multi-viscosity oil is used, check the oil level more frequently to prevent any possible engine damage due to lack of lubrication.
- Use of SAE 30 oil below 4°C will result in hard starting and possible engine damage due to lack of lubrication.

Oil capacity

Approximately 1.6 Litres when changing oil and filter

Oil checking procedure:

Before starting engine, check oil level.



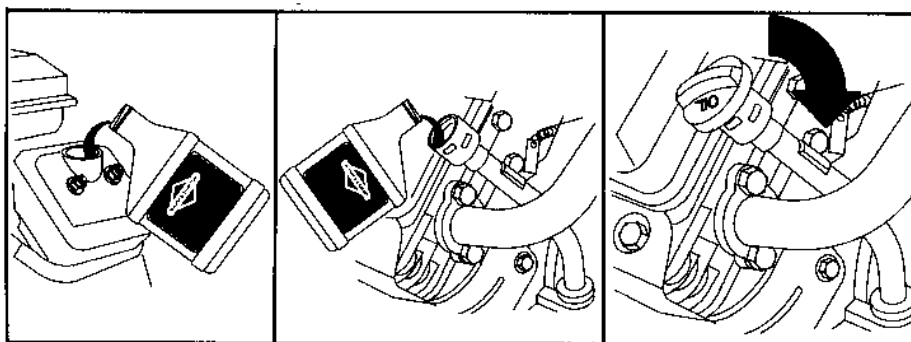
Place engine level.
Clean around oil fill
and/or dipstick.

Remove dipstick.
Wipe with a clean
cloth.

Tighten dipstick
remove and check.

Oil filling procedure:

First, add 1 litre of the correct oil. Start and run engine at idle for 30 seconds. Shut engine off and wait 30 seconds. Then add more oil slowly to bring level to the full mark on dipstick.



Fill to full mark on dipstick. Pour oil slowly.
Check oil level and add if required.

Tighten dipstick
before starting engine.

Oil pressure

If the oil pressure drops below 0.1 – 0.2 kg/cm² on the gauge, stop pump immediately. Check oil level with dipstick. If oil level is between ADD and FULL marks on the dipstick, **do not try to restart engine**. Contact an Authorized Briggs & Stratton Dealer.

Do not operate engine until oil pressure is corrected.

If the oil level is below the ADD mark on the dipstick, add oil to bring level to FULL mark. Restart engine and check oil pressure. If pressure is normal, continue to operate pump.



Fuel

Use clean, fresh unleaded petrol with a minimum of 91 octane. Better performance will be achieved using 96 octane. Do not mix oil with petrol. Fresh fuel prevents gum deposits from forming in fuel system or on essential carburetor parts. Purchase fuel in quantity that can be used in 30 days.

We recommend the use of Briggs & Stratton Gasoline Additive if fuel is stored longer than 30 days. See storage instructions on Page 20.

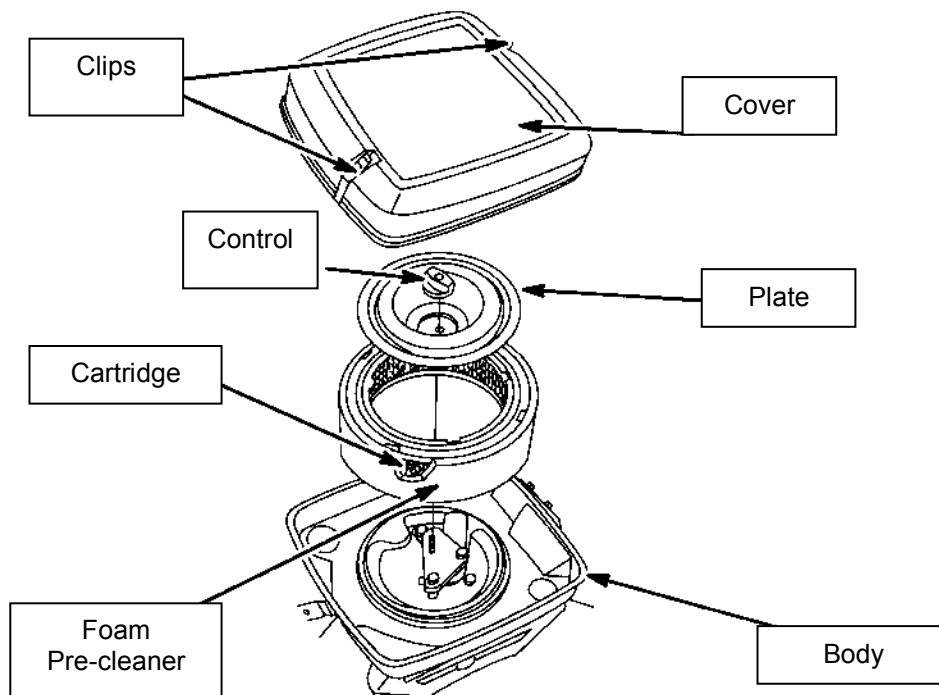
Do not overfill fuel tank.

Always allow space for expansion.

Note: Some fuels called oxygenated or reformulated gasolines/petrols are gasolines/petrols blended with alcohols or ethers. Excessive amounts of these blends can damage the fuel system or cause performance problems. Do not use petrol that contains methanol.

Air cleaner

Dual element air cleaner



1. Lift fuel tank.
2. Unhook clips on both sides of cover and remove cover.
3. Carefully slide pre-cleaner off cartridge.

To service pre-cleaner, wash in liquid detergent and water. Squeeze dry in a clean cloth. Saturate in clean engine oil. Squeeze in clean absorbent cloth to remove all excess oil. Replace if very dirty or damaged.

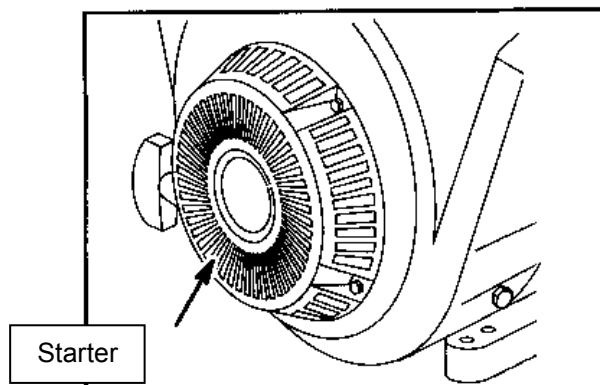
4. Remove control and plate. Carefully remove cartridge to prevent debris from entering carburetor.
To service the cartridge, clean by tapping gently on a flat surface. Do not oil the cartridge. Replace if very dirty or damaged.

Note: Do not use petroleum solvents, e.g. kerosene, which will cause the cartridge to deteriorate. Do not use pressurized air to clean cartridge. Pressurised air can damage the cartridge.

5. Reinstall cartridge, plate and control.
6. Reassemble pre-cleaner on cartridge.
7. Replace cover and reattach clips to body.
8. Lower and secure fuel tank.

Keeping engine parts clean

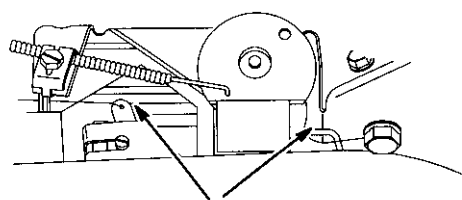
With a brush or cloth, remove debris from debris guard daily or more often if needed to prevent engine damage caused by overheating. Do not clean with a forceful spray of water as damage to the fan blades could result if the engine is running.



Hand pull start guard

To ensure smooth operation, keep governor linkage, springs and controls free of debris.

Linkage, springs and controls



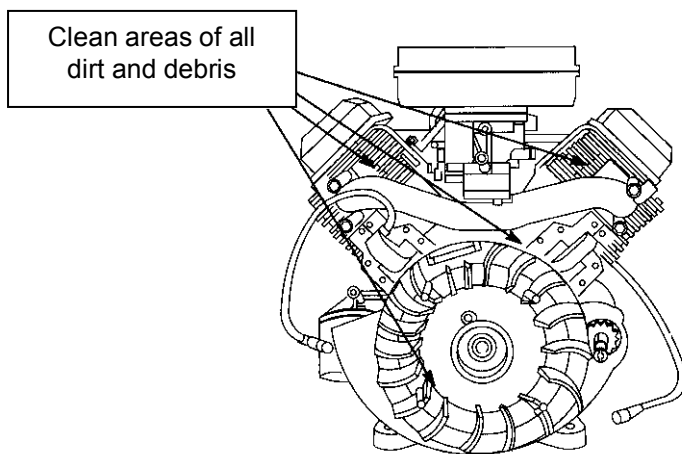
Fuel filter

Replace the in-line fuel filter yearly or if fuel has been contaminated. See an Authorized Briggs and Stratton Service Dealer for correct replacement.



Air cooling system

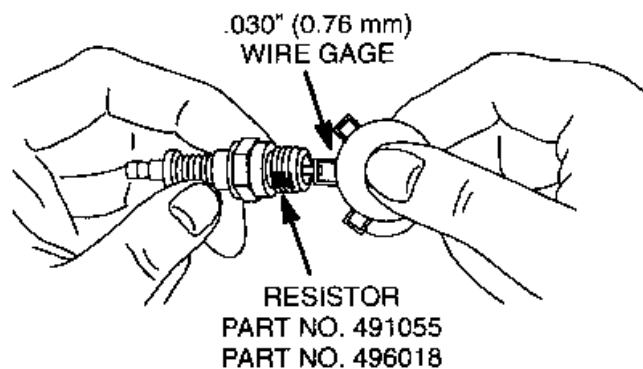
Chaff or debris may clog the air cooling system especially after prolonged operation. Clean the area shown to prevent overheating and resultant engine damage.



Spark plug service

Replace or clean spark plugs every year. Do not blast clean. Clean by scraping or wire brushing and washing with a commercial solvent.

Use only a Briggs & Stratton Spark tester to check for spark.



Electrical systems

Battery

- Check battery condition using the fitted voltmeter, voltage should not be below 10 volts. If voltage is below 10 Volts, recharge the battery by connecting battery charger through the 12 Volts accessory socket on the dash.
- Clean battery terminals from time to time.
- Always maintain battery in good charged condition.
- Battery should be charged once a month when not in use.
- Add distilled water regularly.

Battery Charging

- The engine has a built in alternator with an output of 16 Amps.

Fuses

- A main fuse is located on the wiring loom near the battery.

Lighting

- A flexible quartz halogen light is provided for night time operation.



If running pump without the battery, positive terminal must be taped securely to prevent accidental arcing.

Engine clearances

Armature air gap	0.008 - 0.012 in. (0.20 - 0.30 mm)
Spark plug gap	0.030 in. (0.76 mm)
Valve clearance cold; intake and exhaust	0.004 - 0.006 in. (0.10 - 0.15 mm)

Service and storage

For engine service:

See an Authorized Briggs & Stratton Service Dealer. Each one carries a stock of Genuine Briggs & Stratton Parts and is equipped with special service tools. Trained mechanics ensure expert repair service.

Only dealers advertising as "Authorized Briggs & Stratton" are required to meet Briggs & Stratton standards.

For pump service

Most Authorized Briggs & Stratton Dealers are capable of performing minor repairs and adjustments to the pump components. Any major repairs or overhauls should be returned to the factory.

Storage instructions

Engines stored for over 30 days need to be protected or drained of fuel to prevent gum deposits forming in the fuel system or on essential carburetor parts.

1. For engine protection, we recommend the use of Briggs & Stratton Gasoline Additive, Part No. 5041, available from an Authorized Briggs & Stratton Dealer. Mix additive with fuel in fuel tank or storage container. Run engine for a short time to circulate additive through carburetor. Engine and fuel can be stored for up to 24 months.
2. While engine is still warm, drain oil from crankcase. Refill with fresh oil of the recommended grade.
3. Remove spark plugs and pour about 30 ml. of engine oil into cylinders. Replace spark plugs and crank slowly to distribute oil.
4. Clean dirt and chaff from cylinders, cylinder head fins, blower housing and muffler area.
5. Store in a clean dry area.

END