

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G96.010.2
Issue 2, April, 1961
AT&T Co Standard

LP-GAS AIR-COOLED ENGINES

BRIGGS & STRATTON 4-CYCLE

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1. GENERAL

1.01 This section covers the general operation and maintenance of Briggs & Stratton 4-Cycle LP-Gas (Propane) Engines used principally to drive manhole pumps, blowers, generators, heater-ventilators, etc, used in outside plant construction and maintenance work.

1.02 This section has been reissued to include information on the oil-foam air cleaner, revise the engine maintenance intervals, and include information about the E pressure hose.

1.03 The information contained in this Practice applies specifically to either LP-Gas Engines obtained from Briggs & Stratton or to Briggs & Stratton Gasoline Engines that have been converted to LP-Gas operation with the AT-7889 Propane Carburetor Kit. However, most of the information contained herein can also be applied to Briggs & Stratton engines equipped with any type of LP-Gas conversion kit.

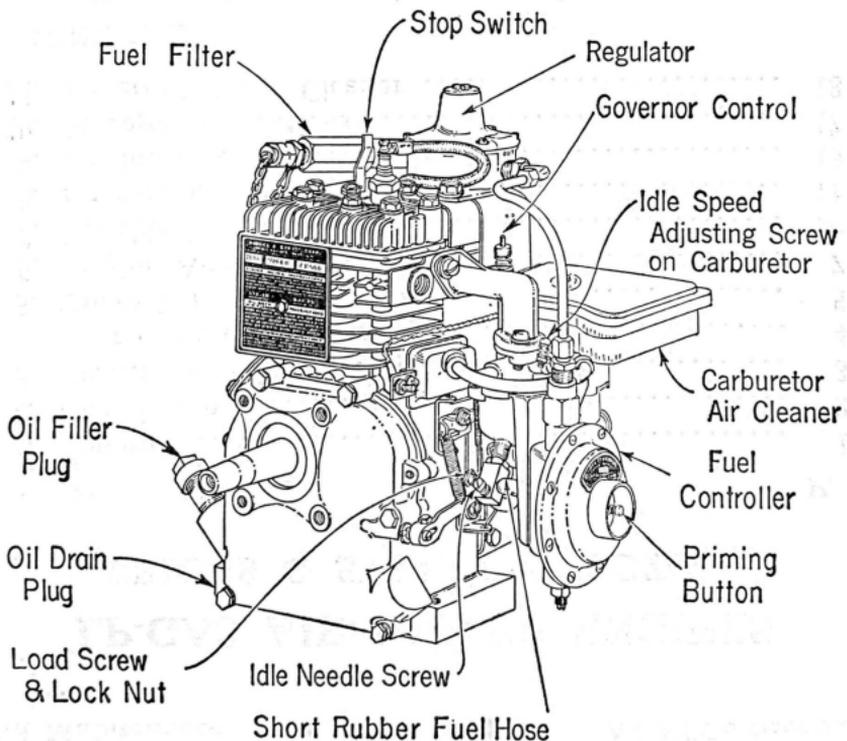
1.04 The operator should be familiar with Section G81.836.1 covering B and C Propane Cylinders prior to using an LP-Gas engine.

1.05 Information pertaining to the operation and maintenance of the equipment utilizing **4-cycle** engines is covered in other sections of the Practices.

1.06 As far as practicable, engine adjustments and trouble shooting are covered in this section; however, reference should be made to the manufacturer's operation and maintenance manuals supplied with the equipment for specific information relating to the make and model of engine used.

2. DESCRIPTION

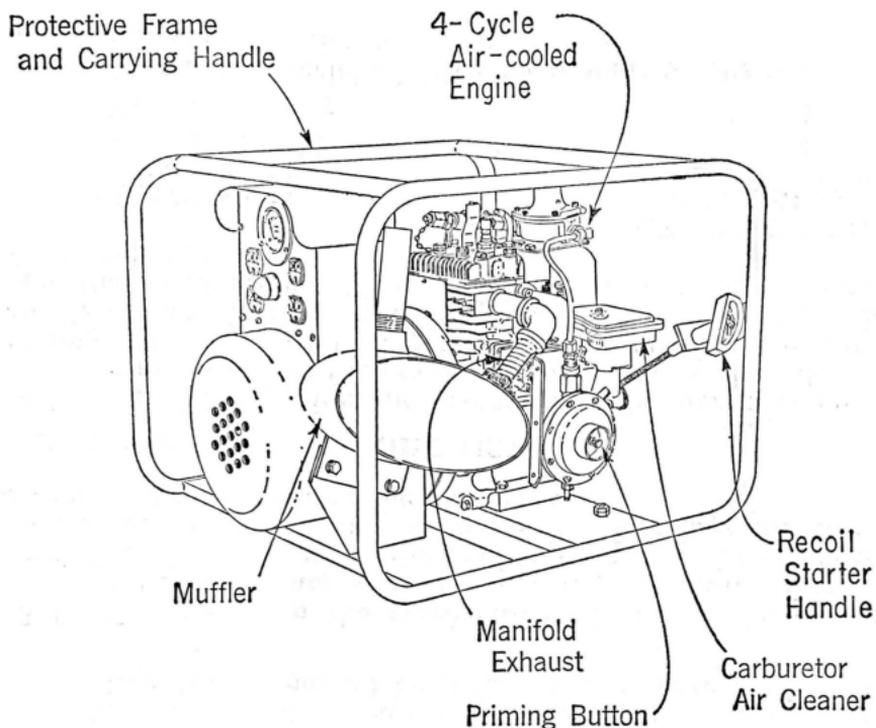
2.01 The engines covered in this section are small air-cooled, single-cylinder, 4-cycle type. Lubrication of the crankshaft, connecting rod, bearings, etc, is provided by means of a splash system in the engine crankcase. The spark for ignition of the air-fuel mixture in the cylinder is supplied by a high-tension magneto of the flywheel type. Rewind starters are used to crank the engines for starting. Fig. 1 illustrates a Briggs & Stratton engine that is equipped to operate on LP-Gas, and indicates the principal parts referred to in this Practice.



4 CYCLE LP-GAS ENGINE

Fig. 1

2.02 Fig. 2 illustrates a complete engine-driven generator.



ENGINE DRIVEN GENERATOR

Fig. 2

2.03 The construction tools (pumps, generators, blowers, etc.) do not come equipped with the E pressure hose. The E pressure hose must be ordered separately as required.

3. PRECAUTIONS

3.01 Before pulling the starting rope, observe that there are no objects in the immediate vicinity which will interfere with free movement.

3.02 To stop the engine, turn off the valve at the propane cylinder. **Do not stop the engine by pushing the stop switch against the end of the spark plug.**

- 3.03 Only approved propane cylinders should be used as a source of fuel for the LP-Gas engines.
- 3.04 When filling the engine crankcase, precautions should be taken to avoid entrance of foreign matter because it will result in wear and damage to the engine.
- 3.05 Care should be exercised to avoid burns from contact with heated parts, particularly the muffler and exhaust pipe.
- 3.06 The engine should be kept as level as possible during operation in order that the crankshaft, connecting rod, bearings, etc, receive proper lubrication.
- 3.07 **Do not operate an engine in an enclosure unless there is adequate ventilation and never operate or store it in a manhole. When operating an engine in the vicinity of a manhole, locate it so that the exhaust fumes will not blow into the manhole opening.**
- 3.08 Check the oil level in the crankcase before starting the engine and after every five hours of operation.
Caution: More engines are damaged by failure to maintain the proper oil level in the crankcase than by any other cause.
- 3.09 **Change oil in the crankcase and service the oil-foam[↑] air cleaner once a month or every 100 hours, whichever comes first.** Drain oil while the engine is warm and replace with clean oil as covered in Part 8. Part 8 also describes the method of removing and cleaning the air cleaner.

4. PREPARATION BEFORE USE

4.01 Level the engine and remove the oil filler plug on the crankcase. Fill the crankcase to the top of the filler hole opening with a clean high quality motor oil bearing the American Petroleum Institute classification, "For Service MS." Replace the oil filler plug. The following SAE viscosity grades of oil are recommended:

| <u>TEMPERATURE</u> | <u>GRADE OF OIL VISCOSITY</u> |
|---|-------------------------------|
| Above Freezing | SAE 30 |
| Below Freezing | SAE 10 |
| Never use special additive compounds or oils not labeled, "For Service MS." | |

5. OPERATION

5.01 To start the engine proceed as follows:

- (1) **Make certain there is a sufficient amount of clean oil in the crankcase.**
- (2) Connect one end of the E pressure hose to the propane furnace regulator on the propane cylinder, connect the other end of the fuel filter on the engine. Refer to the section covering propane cylinders for specific information on this matter. A typical setup is illustrated in Fig. 3.

Note: If engine is not equipped with a fuel filter, connect the E pressure hose to the Model 68 (primary) regulator on the engine.

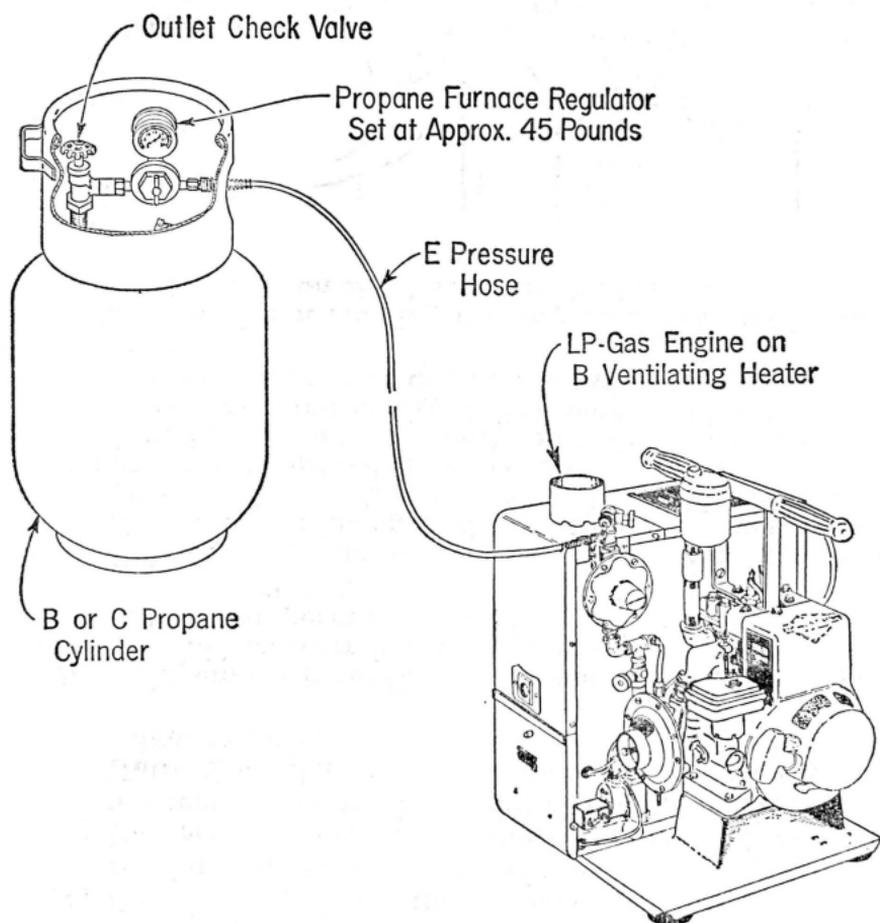


Fig. 3

- (3) Be certain the **stop switch** is away from the spark plug.
- (4) Open the valve on the propane cylinder and set the regulator at approximately 45 pounds.
- (5) Depress the priming button on the fuel controller momentarily or until the odor of propane is detected.

Note: The odor of propane should be detected within a few seconds.

Start the engine immediately. Do not use the choke. However, in cold weather it may be necessary to partially close the choke (to permit the engine to run smoothly) until the engine warms up.

- (6) Pull the rope on the rewind starter slowly until the starter clutch engages, then pull until the resistance of compression is felt. Continue to pull slowly about 2 or 3 inches until compression ceases. Allow the starter rope to recoil and again pull out slowly until the starter clutch engages as illustrated in Fig. 4. Pull with a quick steady pull to start the engine. The engine will usually start on the first or second pull.

Caution: When starting the engine, do not hold unit by placing foot on air cleaner, spark plug, etc.

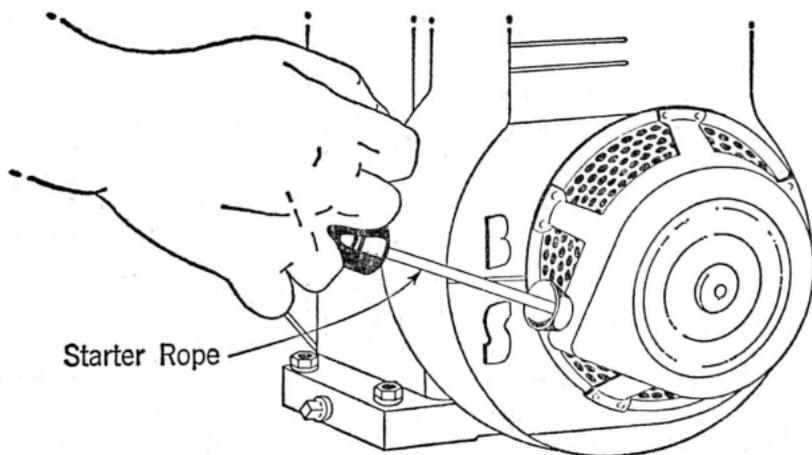


Fig. 4

5.02 If the engine fails to start after being cranked four or five times, see Part 6 of this section on Engine Adjustments and Part 7 on Trouble Shooting.

- 5.03 Permit the engine to run until it warms up before operating it at full speed or placing it under load.
- 5.04 **To stop the engine—turn off the valve at the propane cylinder.**

6. ENGINE ADJUSTMENTS

6.01 Engine speed and carburetor adjustments are regulated by the manufacturer for most efficient operation of the associated engine-driven equipment and under normal work conditions require no field adjustments. However, due to engine repair, previous adjustment attempts by an inexperienced operator, etc, it may be necessary to make certain engine adjustments.

6.02 A float-type carburetor (modified for LP-Gas) is illustrated in Fig. 5.

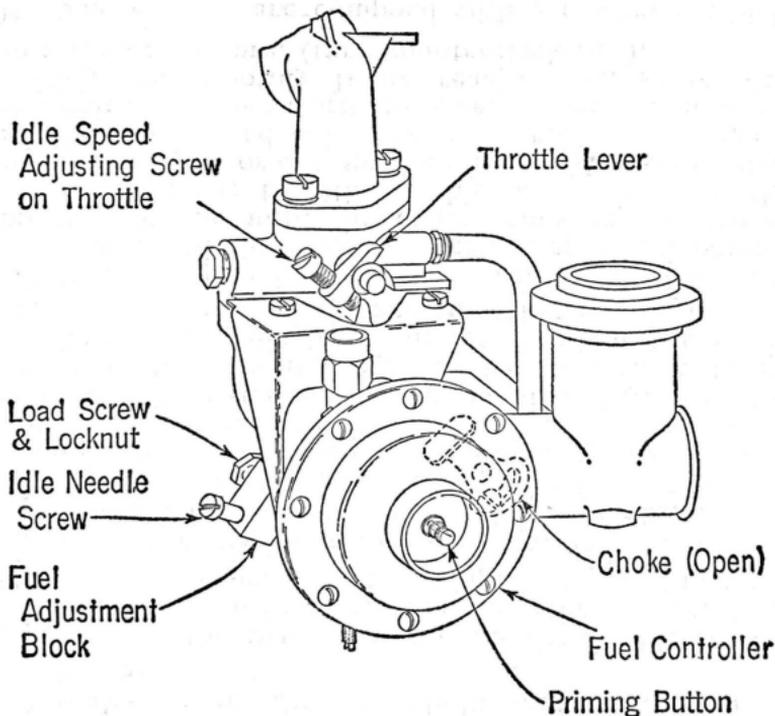


Fig. 5

6.03 If the engine is not operating properly and it appears that the carburetor is out of adjustment, stop the engine and proceed as follows, **WITH NO LOAD ON THE EQUIPMENT:**

- (1) Close the load and idle needle screws on the **fuel adjustment block** by turning them clockwise until they rest lightly against their seats. Do not force the screws too firmly against the seats or they may be damaged.
- (2) Open the load screw about five turns counterclockwise.
- (3) Open the idle needle screw about one turn.
- (4) Make certain that the choke lever is fully open (see Fig. 5).
- (5) Depress the primer button on the Model S fuel controller for an instant, then start the engine. Allow the engine to warm up before making final adjustments.
- (6) With the engine running at normal operating speed, turn the load screw in (clockwise) until the engine starts to miss (**lean mixture**). Then turn the load screw out past the point of best operation until the engine begins to run unevenly (**rich mixture**). Then turn the load screw in just enough so that the engine will run smoothly. Hold the load screw in position and tighten the locknut. Hold throttle at idle position (illustrated in Fig. 5), then release. Engine should accelerate quickly and smoothly.
- (7) If the engine is required to run at idle (for example pumps and blowers), turn the idle speed adjusting screw on the throttle until the engine runs at the proper idle speed. Hold the throttle at this point and turn the idle needle slowly in or out until the engine idles smoothly. Then readjust idle speed adjusting screw until proper idle speed is obtained. Allow throttle to open. Engine should accelerate quickly and smoothly. If not, readjust load screw — usually to a richer mixture, (turn counterclockwise).

6.04 The engines are equipped with a governor which performs two important functions:

- (1) Prevents overspeeding or running away under varying load conditions.
- (2) Maintains automatically, under varying loads, the speed at which the governor is set.

In the case of installations, provided with remote hand throttle control, the governor also maintains the speed selected by the operator. Engine speed adjustments should conform to the manufacturer's recommendations. In general, the desired speed setting is the lowest RPM which will satisfactorily operate the driven equipment.

6.05 An air vane governor is supplied on the engines used for driving pumps, heater-ventilator units and blowers. This type of governor is illustrated in Fig. 6.

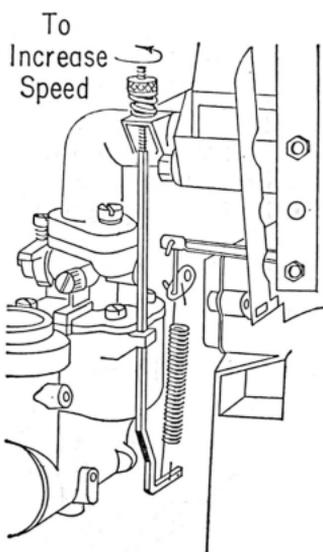


Fig. 6

6.06 A mechanical governor is supplied on the engines used on the portable generators and Gen-Air units. This type of governor is illustrated in Fig. 7.

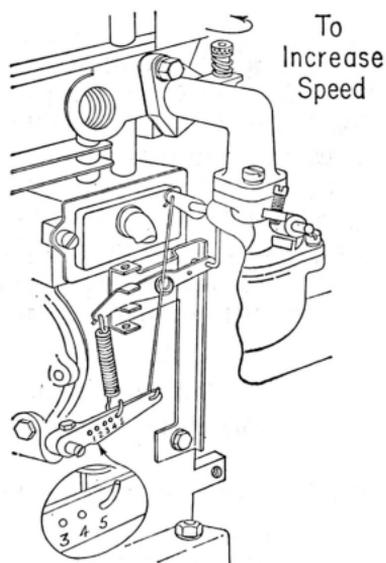


Fig. 7

7. TROUBLE SHOOTING

- 7.01 The most common causes of failure of the engine to start are lack of fuel and/or lack of spark.
- 7.02 **Lack of Fuel**—One or more of the following may be the cause:
- (1) Propane cylinder valve is closed.
 - (2) Propane cylinder is empty.
 - (3) Fuel filter may be dirty.
- 7.03 **Lack of Spark**—Check the strength of the electric spark and condition of the spark plug as follows:
- (1) Remove the ignition cable from the spark plug.
 - (2) Grasp the ignition cable well back from the metal cable terminal to avoid shock and hold the tip about 1/8 inch from the cylinder head as illustrated in Fig. 8.
 - (3) Crank the engine and if a good spark jumps the 1/8-inch gap, the ignition system up to the spark plug is in good condition. If a good spark is not observed, proceed with Step (4).

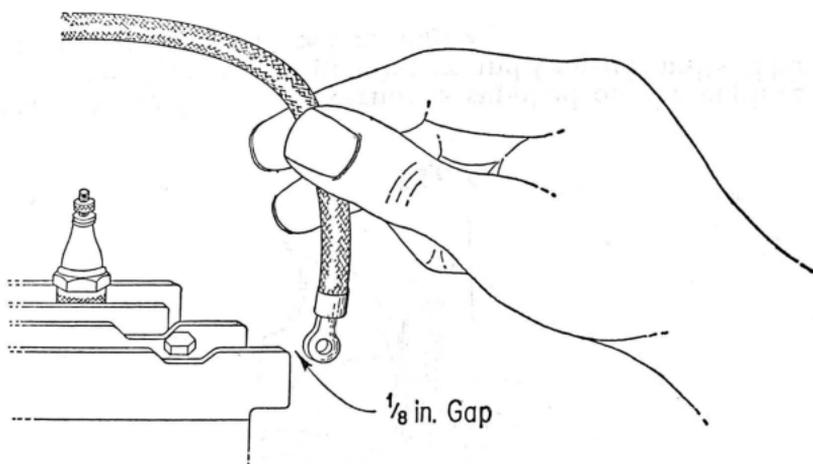


Fig. 8

- (4) Check the spark plug for proper gap (.025") and clean if necessary. If the porcelain insulator is cracked, replace the plug with a Champion No. XJ8, or equivalent. (The XJ8 is a resistor-type spark plug.)

Note: Do not clean spark plugs on an abrasive blast cleaning machine. The abrasive used is highly injurious to the cylinder wall if it gets in the engine.

Spark plugs should be cleaned only with solvents, by scraping, or wire brushing. Regap a spark plug after cleaning. It is a good practice to clean the spark plug and reset the gap at .025" after every 100 hours of operation.

- (5) If a good spark is still not obtained, return the unit for repairs in accordance with local instructions.

7.04 Engine power is reduced when the muffler becomes clogged with carbon. This condition can be checked by removing the muffler and noting whether the engine develops more power. Some mufflers can be cleaned; others may be so badly clogged that replacement is necessary.

7.05 Ignition cable with cracked or otherwise damaged insulation will interfere with good ignition. Defective ignition cable should be replaced.

8. LUBRICATION AND MAINTENANCE

8.01 On a new engine the oil should be changed after the first five hours of operation. Thereafter, check the crankcase oil level regularly after every five hours of operation. Add oil as required (see Par. 4.01).

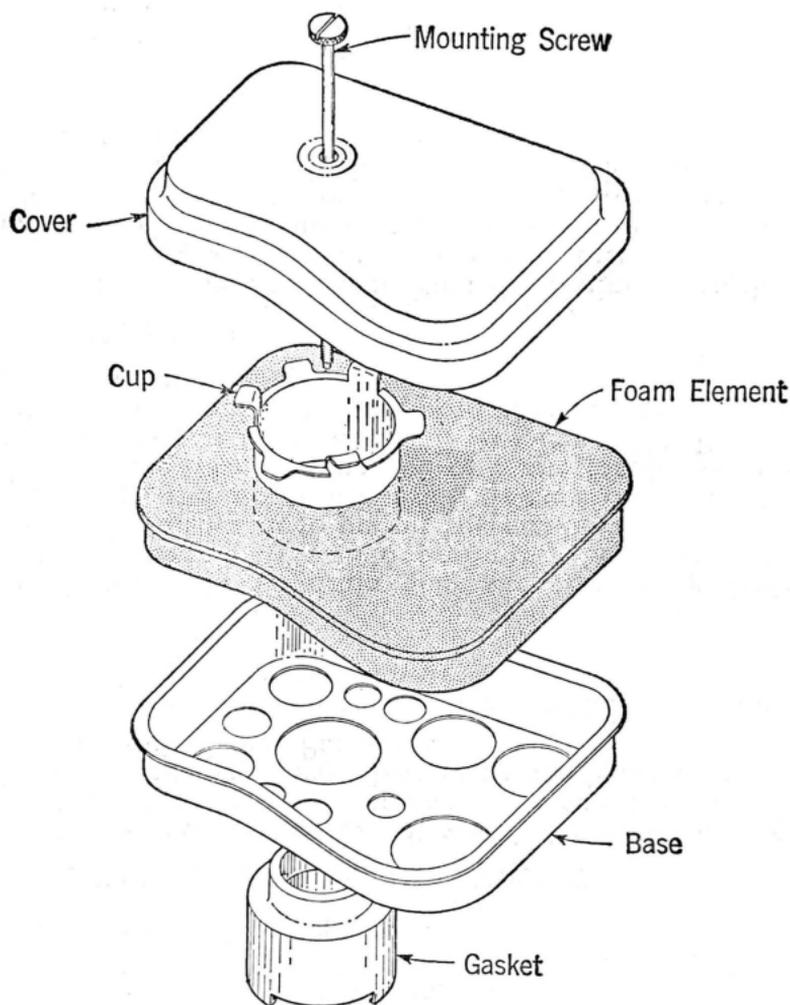
8.02 Once a month or every 100 hours, whichever comes first, service the unit as follows:

CRANKCASE

(1) Remove the oil drain plug and completely drain the crankcase. This should preferably be done while the engine is still warm to permit the maximum amount of old oil, sludge, and dirt to drain out. Replace the oil drain plug. Remove the oil filler plug and refill the crankcase with the proper grade of fresh motor oil (see Par. 4.01). Replace the oil filler plug and make sure both plugs are properly seated to avoid losing oil.

AIR CLEANER

(1) Remove the air cleaner from the engine by turning the mounting screw counterclockwise. Lift the air cleaner off the carburetor, and separate the cover from the base of the air cleaner. Do not remove the gasket from the carburetor. An exploded view of the oil-foam air cleaner is illustrated in Fig. 9.



OIL-FOAM AIR CLEANER

Fig. 9

- (2) Lift the support cup out of the foam element and remove the foam element.
- (3) Wash all parts in soap and water, kerosene, or an equivalent solvent. Wipe all metal parts dry with a clean cloth.
- (4) Squeeze the foam element dry, and reoil with approximately 3 tablespoons of engine oil (see Par. 4.01). Squeeze gently to spread the oil through the foam element.

(5) Place the foam element in the base of the air cleaner, insert the cup in the foam element, affix the cover to the base, and mount the air cleaner on the carburetor using the mounting screw.

Note: An air cleaner may require service more frequently than recommended if the engine is operated under extremely dusty conditions.

GENERAL

(1) Tighten any loose bolts or parts.

8.03 Two types of fuel filters are being used. They may be cleaned in the following manner:

(1) **Cleaning the Type A Fuel Filter**

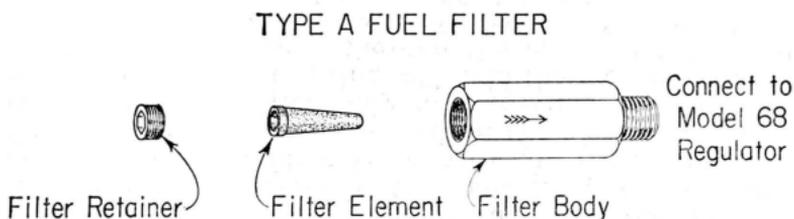


Fig. 10

Remove the fuel filter from the Model 68 regulator. Unscrew the filter retainer from the filter body, using a 1/4-inch bar hex head wrench. Remove the filter body and after washing it in a suitable commercial solvent, rinse in clean solvent and then dry it. If compressed air is used, direct flow of air from the inside-out of the element.

Note: A new filter element should be obtained if the old element cannot be cleaned properly.

Reassemble the fuel filter by inserting the filter element in the filter body as illustrated in Fig. 10, and screwing in the filter retainer until snug. **After the fuel filter has been reassembled to the Model 68 regulator, all of the line connections should be checked with pressure testing (or other suitable) solution (with the fuel turned on) to be certain there are no leaks.**

(2) Cleaning the Type B Fuel Filter

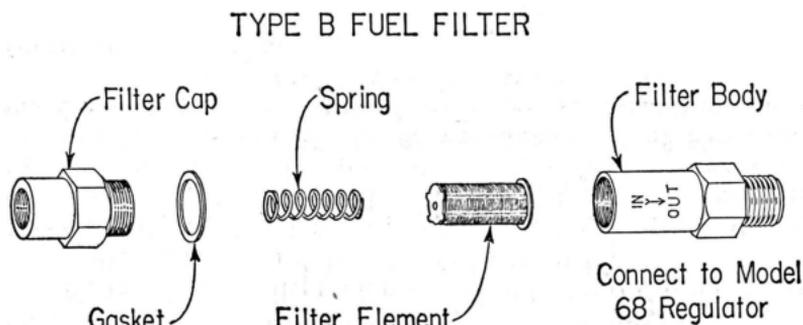


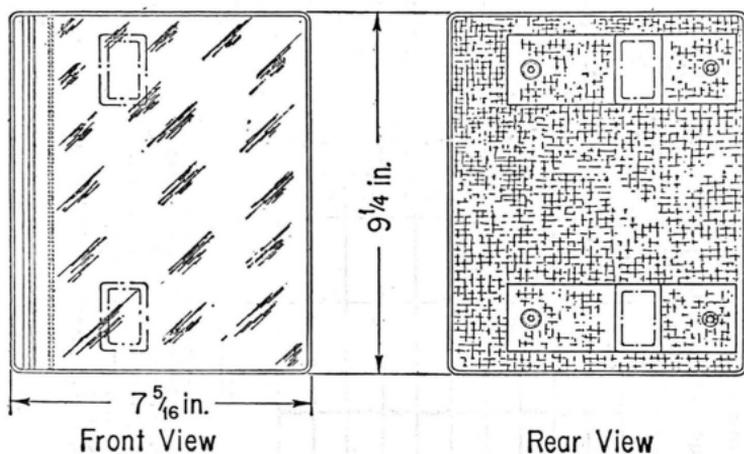
Fig. 11

Remove the fuel filter from the Model 68 regulator. Unscrew the filter cap from the filter body. Remove the spring and filter element from the filter body. After washing the spring, element, and body in a suitable commercial solvent, rinse in clean solvent and then dry them. If compressed air is used, always direct the flow of air from the inside-out of the element. Reassemble the fuel filter by inserting the element into the filter body with the round end entering first. The gasket is then placed on the filter cap. The spring is located in the filter body so that when the filter cap and body are joined, the spring will hold the element compressed inside the filter body. Tighten the cap and body with approximately 75 foot-pounds of torque. **After the fuel filter has been reassembled to the Model 68 regulator, the joint at the gasket and other line connections should be checked with pressure testing (or other suitable) solution (with the fuel turned on) to be certain there are no leaks.**

8.04 The air-cooling system should be checked and cleaned frequently as clogged air passages will result in overheating with possibilities of serious engine damage.

9. ENGINE LOG

9.01 An engine log (Form E-4637 or equivalent) should be maintained with each portable tool. A B log holder (a special plastic case) is available to hold the engine log and can be secured to the portable tool by the plastic flaps on the back of the plastic envelope.



B LOG HOLDER

Fig. 12

LOG FOR AIR COOLED ENGINES

FORM E-4637 (1-61)

TOOL No. 35

CARD No. 1

SERIAL No. 118483

LOCATION Milwaukee TOOL Generator

ENGINE Briggs & Stratton TYPE 943114 MODEL 80432 FUEL Propane

Check crankcase oil level before starting engine and at least every 5 hours.

Change oil once a month or every 100 hours, whichever comes first.

Clean and reoil air cleaner once a month or every 100 hours, whichever comes first.

| DATE | OPER- ATOR | HOURS USED | CUMU- LATIVE HOURS | OIL | | REMARKS |
|--------|---------------|---------------|--------------------------|--------------------------|-------------------------|-------------|
| | | | | Crankcase Add Changed | Air Cleaner Serviced | |
| 1-16-1 | DD | 8 | 60 | ✓ | | |
| 1-17-1 | DD | 7 | 67 | ✓ | | |
| 1-24-1 | DD | 5 | 72 | ✓ | | |
| 1-27-1 | KL | 8 | 80 | ✓ | | |
| 1-31-1 | KL | 7 | 87 | ✓ | | |
| 2-1-1 | DD | 6 | 93 | ✓ | ✓ | |
| 2-2-1 | KL | 8 | 101 | ✓ | ✓ | Won't start |
| 2-6-1 | KL | 5 | 106 | ✓ | | |

Notes:

① Indicates oil changed and air filter serviced after one months use.

② Indicates oil level checked and oil added as required.

③ The remarks column is for special information.

Fig. 13

9.02 The log provides valuable information to the mechanic assigned to repair the engine as well as serving to remind the operator of the more essential service functions.

9.03 Instructions for keeping the engine log. (See Fig. 13.)
Fill in the first two columns and check the oil **PRIOR** to starting the engine.

- (1) **DATE** — Fill in the month, day and year — for example, January 16, 1961 would be marked 1/16/1.
- (2) **OPERATOR** — Enter the operator's initials.
- (3) **HOURS USED** — Fill in the number of hours (to the nearest half hour) that the engine is run.
- (4) **CUMULATIVE HOURS** — Add the number of hours that the engine is used on a particular day to the previous total. For example, on 1/17/1 the engine was run 7 hours, added to 60 (previous total) equals 67.
- (5) **CRANKCASE — ADD** — Place a check (✓) mark in this column indicating the crankcase oil level was checked and oil added as required. The amount added is not important, unless a relatively large amount is required (see Remarks column).
- (6) **CRANKCASE — CHANGED** — Enter the cumulative hour total in this column whenever the oil is changed.
- (7) **AIR CLEANER — SERVICED** — Enter a check (✓) mark after servicing the air cleaner at the proper interval.
- (8) **REMARKS** — For special information that will be of interest to the mechanic or to the next operator.

10. STORAGE INSTRUCTIONS

10.01 If it is expected that the engine will not be used for 30 days or more, the following procedure should be adhered to:

- (1) While the engine is still warm, drain the oil from the crankcase. Refill with fresh oil.
- (2) Service air cleaner (see Part 8 or 11).
- (3) Clean dirt and chaff from the cylinder and cylinder head fins, blower housing, etc.
- (4) Remove the spark plug and pour about one ounce of clean motor oil into the cylinder. Crank the engine slowly to spread the oil, and replace the spark plug. A small amount of oil on the threads of the spark plug will facilitate future removal of the plug.

10.02 Store the engine and associated equipment in a dry location.

11. SUPERSEDED AIR CLEANER

11.01 The oil bath air cleaner, illustrated in Fig. 14, is a superseded type and has been replaced by the oil-foam air cleaner.

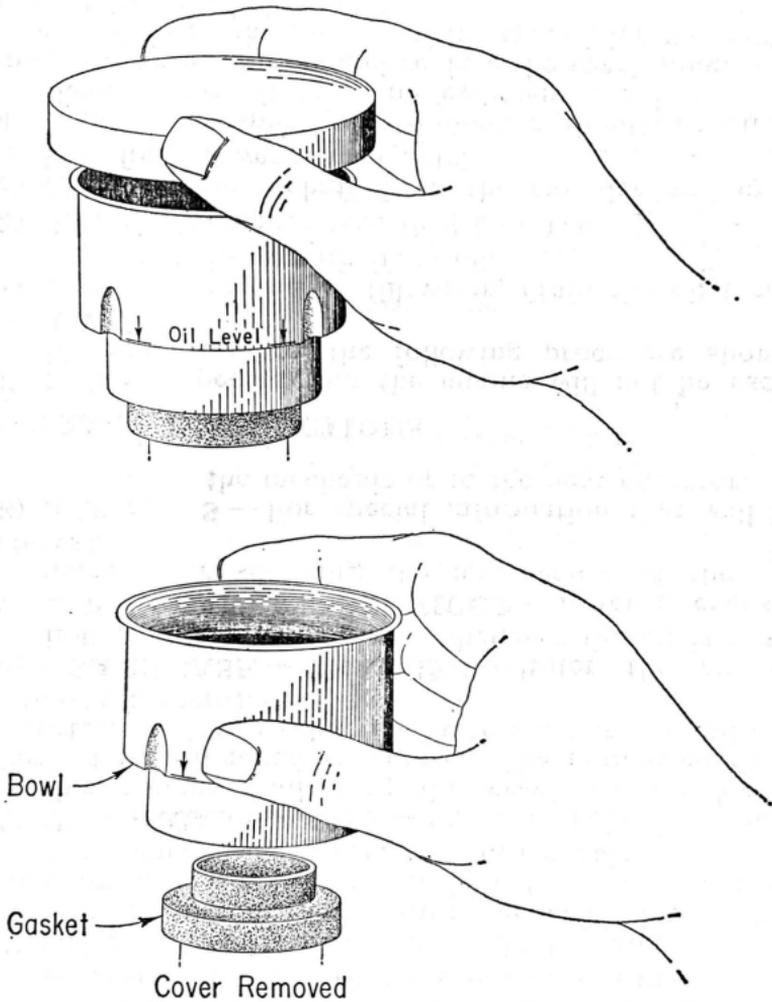


Fig. 14

11.02 Check the oil level in the oil bath air cleaner before starting the engine and after every five hours of operation. Use the same grade of oil in the air cleaner as is used in the engine crankcase (see Par. 4.01).

11.03 Service is required on the oil bath air cleaner once a month or every 25 hours, whichever comes first. ↗

11.04 Service the oil bath air cleaner as follows :

- (1) Remove the top of the air cleaner by turning the filter cover counterclockwise to unscrew. Lift off cover (filter element is attached) and bowl.
- (2) Pour out the old oil. Wash the oil bowl and filter element in kerosene or an equivalent solvent and wipe dry. Pour oil in the small bottom part of the bowl to the "Oil Level" mark. Replace the bowl on the carburetor. Replace the filter element and turn clockwise until snug. Be certain the gaskets are in place and in good condition.

Note: Due to the possibility of spilling oil out of the oil bath air cleaner and causing damage to the engine (i.e., from running the engine without enough oil in air cleaner), it may be desirable to convert to the oil-foam air cleaner which is simple to install. Procure the oil-foam air cleaner locally. The Briggs & Stratton part numbers for the parts required are :

| | |
|--------|---|
| 296766 | Air Cleaner (includes metal housing and foam element) |
| 27994 | Gasket |
| 93323 | Screw |

Additional elements may be obtained as required. The Briggs & Stratton part number is 27987. ↙