

## ROUTER POWERED BY ONAN SPECIFICATIONS

<b>ENGINE:</b>	2 Cylinder opposed, 23 HP
<b>WEIGHT:</b>	425 #
<b>FUEL:</b>	Regular Gasoline
<b>FUEL TANK CAPACITY:</b>	3-3/4 Gallons
<b>MAXIMUM DEPTH OF CUT:</b>	1-5/8"
<b>DEPTH:</b>	Depth gauge for precise depth control.
<b>SAFETY FEATURES:</b>	Braking system and safety guards for increased safety.
<b>DEPTH CONTROL:</b>	Electric actuator for fingertip depth control.
<b>CUTTER DESIGN:</b>	6 radially located sprocket shaped cutters on 12" diameter cutter head.
<b>CUTTERS:</b>	Hardened alloy steel for long cutter life.
<b>CRACK CLEANING RATE:</b>	Up to 1500 L.F. per hour.

# OPERATION GUIDE

## WISCONSIN ENGINE

### Model W2-1230

#### INTRODUCTION

The **Model W2-1230** is a two cylinder, four cycle, Vee type, air cooled gasoline engine of the most advanced design, and is readily and efficiently adaptable to a great variety of customer requirements. This typical **Wisconsin** heavy-duty engine has full pressure lubrication with a full-flow oil filter, and is capable of operating at a 30° angle in any direction.

**COOLING** is accomplished by a flow of air circulated around the cylinders and heads of the engine from a combination fan-flywheel encased in a metal shroud. The air is divided and directed by ducts and baffle plates to insure uniform cooling of all parts.

#### **IMPORTANT:**

Never operate an engine with any part of the shrouding removed - this will retard air cooling.

Keep the air intake screen, and the cylinder and hand fins free from dirt and chaff. Improper circulation of cooling air will cause engine to overheat.

**BATTERY IGNITION** (12 volt) distributor with automatic advance is furnished as standard equipment, and can be supported by an efficient **30 amp Flywheel Alternator** and unified Rectifier-Regulator module, or a lower output 10 amp Flywheel Alternator.

**ROTATION** of the crankshaft is clockwise when viewing the flywheel or starting end of the engine. This gives counterclockwise rotation when viewing the power take-off end of the crankshaft. With a **Take-off Shaft** optionally available at flywheel end, full engine power can be taken from either end of crankshaft.

## SPECIFICATIONS

Bore .....	3.75 inch
Stroke .....	3.40 inch
Piston Displacement - cu. in. ....	75.0
Cu. cm. ....	1230.0

### Horsepower

1600 R.P.M. ....	15.0
1800 R.P.M. ....	17.5
2000 R.P.M. ....	19.5
2200 R.P.M. ....	21.0
2400 R.P.M. ....	22.0
2600 R.P.M. ....	23.0
2800 R.P.M. ....	23.6
3000 R.P.M. ....	24.0
3200 R.P.M. ....	24.5
3400 R.P.M. ....	24.8
3600 R.P.M. ....	25.0

Engine rated performance is documented to Engine Test Code — SAE J-245. Continuous duty operation is recommended at 85% of horsepower shown.

The friction in new engines cannot be reduced to the ultimate minimum during the regular block test, but engines are guaranteed to develop at least 85% of maximum power when shipped from the factory. Power will increase, as friction is reduced, after a few days of operation. The engine will develop at least 95% of power when friction is reduced to a minimum.

BATTERY IGNITION (12 volt) .. Distributor with automatic advance

BEARINGS, crankshaft main ..... Sleeve Type  
1000 lb. thrust capacity - 1000 lb. belt load

COMPRESSION RATIO ..... 6.81

CONNECTING ROD Forged Steel Automotive Shell Bearings

CRANKSHAFT ..... Ductile Iron

CYLINDER DESIGN ..... L-head

GEAR TRAIN ..... Helical Gears

ROTATION .....	Counterclockwise at T.O. end
STARTING MOTOR .....	with Folo-Thru Bendix
TORQUE, maximum .....	51 ft. lbs. at 2000 r.p.m.
VALVE GUIDES .....	Replaceable
VALVES and SEAT INSERTS .....	Hardened exhaust Exhaust Valve Rotators - Replaceable Inserts

## SAFETY PRECAUTIONS

Careless use of the engine causes a high percentage of accidents. Avoid serious injury by being alert, use common sense and be safety minded. Observe the following precautions and carefully enforce them when operating your *Wisconsin Engine*. Read operating instructions thoroughly — Know how to stop the engine in case of emergency.

(•) This symbol indicates important safety messages throughout this operators guide — *Read Them Carefully.*

- Engine should be operated only by qualified persons.
- Do not operate engine in a closed building unless the exhaust is piped outside. This exhaust contains carbon monoxide, a poisonous, odorless and invisible gas, which if breathed can cause serious illness and possible death.
- Keep exhaust connection tight and components in good condition, noise from a faulty exhaust system can also be harmful.
- Exhaust system parts get very hot — avoid touching these parts until engine has stopped and has sufficiently cooled.
- Never refuel a hot or running engine. DO NOT smoke while filling fuel tank or servicing fuel system.
- Always refuel slowly to avoid spillage.
- Make sure all fuel lines and connections are tight and in good condition.

- Handle batteries carefully, battery acid will burn skin and can cause blindness if it contacts the eyes.
- Avoid sparks near battery. Gas given off by battery is explosive.
- Keep engine and surrounding area clean and clear of trash.
- When starting engine, maintain a safe distance from moving parts of equipment. Be sure all rotating parts are secure and in good condition.
- Do not start engine with clutch engaged.
- Never run engine with governor linkage disconnected, or operate at speeds in excess of 3600 R.P.M. load.
- Never make adjustments on machinery while it is connected to the engine, without first disconnecting the ignition cables from the spark plugs. Turning the machinery over by hand during adjusting or cleaning might start the engine and machinery with it, causing serious injury to the operator.
- Never run engine while safety switches are disconnected, or protective screening is removed from unit.
- Do not leave engine running while lubricating, making adjustments or repairs unless specifically recommended.
- Never leave engine unattended while it is running.
- Keep hands, feet and clothing away from all moving parts.
- Mount a fire extinguisher close to the engine. Maintain extinguisher properly and be familiar with its use.
- Precaution is the best insurance against accidents.

# Model W2-1230

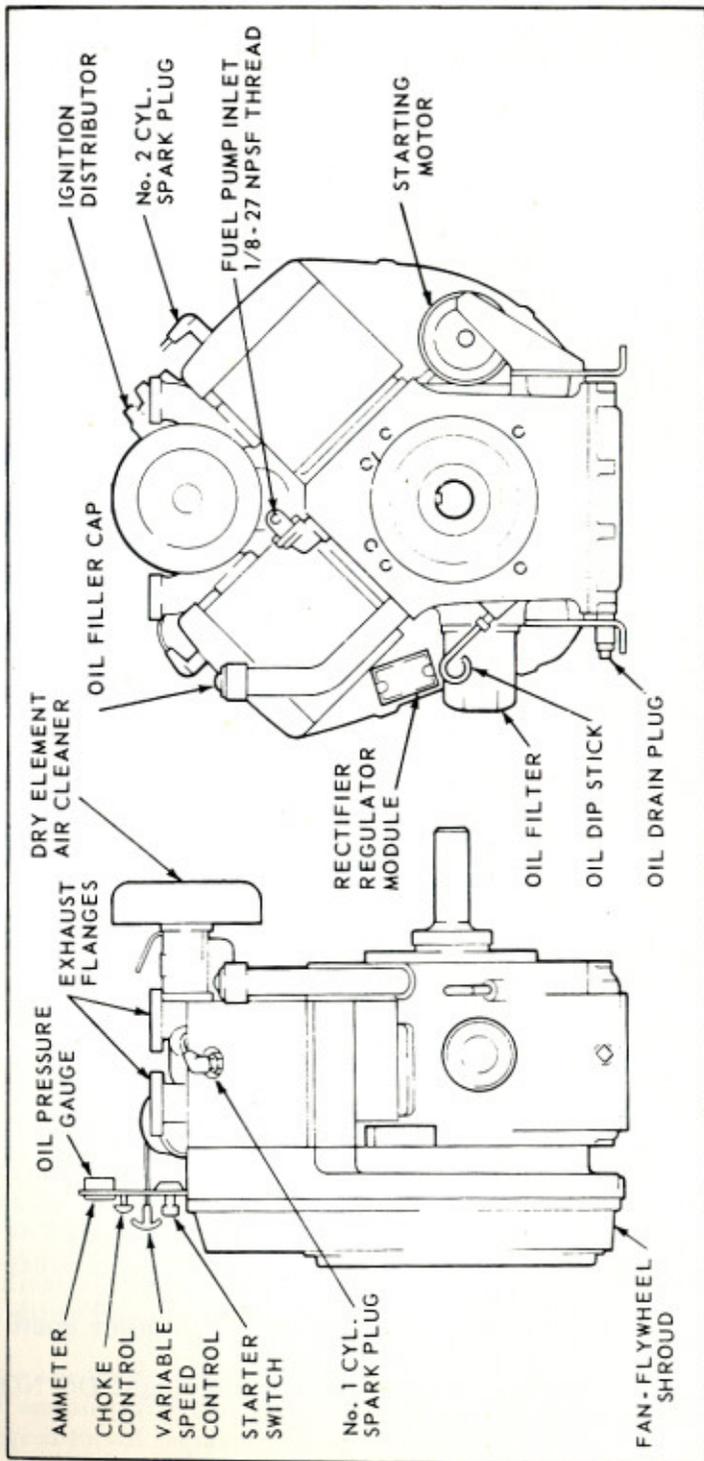


FIGURE 1, REFERENCE VIEWS

# STARTING and OPERATING INSTRUCTIONS

Model W2-1230

## IMPORTANT:

**Engine is shipped without oil.** Fill crankcase to proper level, and add oil to Clutch or Reduction gear units and Oil Bath Air Cleaner if furnished. Refer to Lubrication paragraphs, Oil Chart, and Air Cleaner Maintenance.

## NEW ENGINE BREAK-IN

Proper Break-in will lead to trouble-free operation and increased engine life. The factory test given to a new engine is not sufficient to establish the polished bearing surfaces which are so necessary for good performance and long engine life. There is no quickway to force the establishment of good bearing surfaces, and these can only be obtained by running a new engine carefully and under reduced speeds and loads for a short period of time as follows:

½ hour	1000-1200 rpm	No load
1 hour	50% rated rpm	25% load
1 hour	75% rated rpm	50% load
1 hour	100% rated rpm	75% load
5 minutes	Low idle	No load

For **break-in** of new engines, use same oil as recommended in oil chart.

## BEFORE STARTING ENGINE

### 1. FUEL

Fill fuel tank with a reputable well known brand of **Regular Grade** gasoline. **Leaded** gasoline is preferred with an \*Anti-knock Index of **87 minimum**. Unleaded regular gasoline may be used, although shorter valve life may be experienced.

**Note:** \*minimum Motor octane number must be 82.

**CAUTION:** Refuel slowly to avoid spillage. **DO NOT** smoke when filling tank.

Be sure that vent hole in fuel tank cap is clean and free of any obstruction.

## 2. LUBRICATION

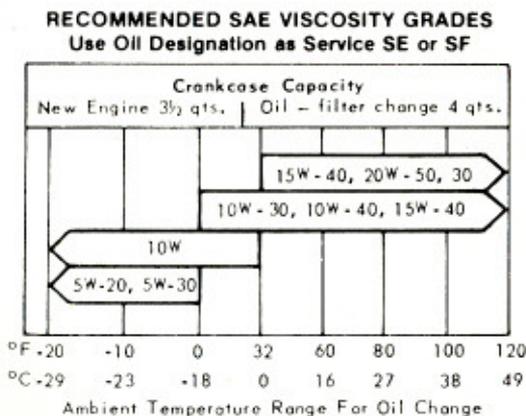
Fill crankcase base with the proper grade of engine oil as specified in "Grade Of Oil" chart. Fill through the oil filter tube opening to the level indicated by the **Full Mark on Dipstick**. Approximately  $3\frac{1}{2}$  quarts are required in a new engine — 4 quarts with oil and filter change.

### IMPORTANT

DO NOT overfill crankcase. DO NOT allow oil level to go below **Add** mark on dip stick.

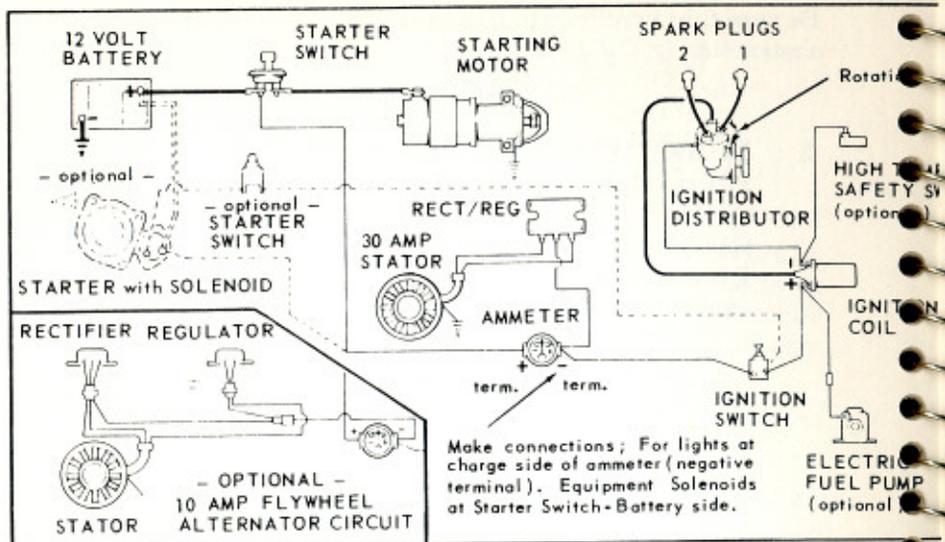
Check oil level every 8 hours. One quart of oil is required to raise the oil level from **Add** to **Full** mark on dip stick.

Change oil every **100 hours** under normal operating conditions. In extreme dusty and extensive idling conditions, change oil at 50 hour intervals.



If engine is used at near maximum performance, it is recommended that a single-viscosity oil of SE Quality be used either grade SAE 30 or SAE 10W.

Proven synthetic oils give superior service in air cooled gasoline engines and can be used, but the recommended oil change interval remains at 100 hours.



## ELECTRICAL SYSTEM

12 Volt Battery Ignition Distributor, Coil and heavy duty Starting Motor are standard equipment. Options include: 10 amp or 30 amp Flywheel Alternator, Instrument Panel, Solenoid Starting, High-Temperature Safety Switch and electric Fuel Pump.

**Battery is not furnished by Teledyne Wisconsin Motor.**

### ALTERNATOR

The 12 volt - 30 amp Flywheel Alternator system consists of a Magnetic Rotor, Starter and Rectifier-Regulator module. No adjustments are required. The alternator is wired into the electrical circuit as illustrated in Fig. 4.

### IMPORTANT

This is a **Negative Ground** system. Charging components will be damaged if grounded wrong in connecting or jumping batteries.

**CAUTION:** Handle battery carefully to prevent acid burns. Avoid sparks near battery — gas given off by battery is explosive.

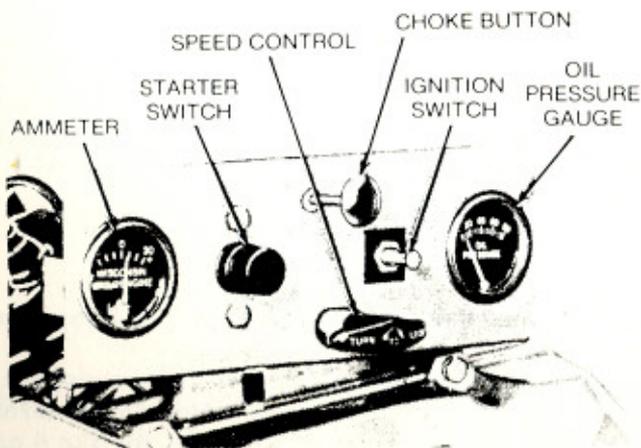
**PRECAUTIONS** to be exercised in the use of Alternators:

1. DO NOT reverse battery connections. Negative battery terminal must be grounded. Reverse polarity will damage rectifier-regulator.
2. Connect booster batteries — positive to positive and negative to negative.
3. DO NOT ground any wires from stator or module which terminate at connectors.
4. DO NOT operate engine with battery disconnected from system.
5. Disconnect at least one battery lead if a battery charger is used.

**STARTING**

**CAUTION:** Maintain a safe distance from moving parts of equipment. Know how to stop the engine quickly in case of emergency.

**CAUTION:** DO NOT operate engine in a closed building unless it is properly ventilated.



**STARTING PROCEDURE, Fig. 5**

1. Check crankcase oil level and gasoline supply. Open fuel shut-off valve in fuel strainer or tank.
2. Disengage clutch, if furnished.
3. Pull variable speed control "T" handle out about half-way and lock in place. With a two speed (idle control) start in full load position — idle after engine starts.
4. Close choke by pulling choke button to extreme out position.
5. Pull out ignition switch.
6. Depress starter switch to start engine.

#### **IMPORTANT:**

DO NOT crank engine for more than 30 seconds at a time. If engine fails to start, wait about 2 minutes between cranking periods to prevent starter from over-heating.

7. After engine starts, push choke button in as required for smooth running.

Less choking is necessary in warm weather or when engine is warm, than when cold. Should flooding occur, open choke fully and continue cranking.

#### **WARM-UP**

After engine starts, allow it to warm up a few minutes before applying load **DO NOT race or gun engine** to hurry WARM-UP. The proper oil film on various surfaces of the pistons, cylinders, bearings, etc., cannot be established until the oil has warmed up and becomes sufficiently fluid.

#### **TO STOP ENGINE**

Depress ignition switch button, tag reads "**To Stop Push In.**"

If engine has been running hard and is hot, do not stop it abruptly from full load. Cool the engine by removing the load and allowing the engine to run idle (1000 to 1200 R.P.M.), for 3 to 5 minutes.

## OIL PRESSURE

Oil pressure is controlled by a non-adjustable relief valve mounted in the crankcase below the oil pump. With engine oil hot, gauge pressure will be from 30 to 50 P.S.I. at engine speeds of 1600 to 3600 r.p.m. If pressure fails below 15 P.S.I., refer to "**Trouble Shooting**" for possible causes.

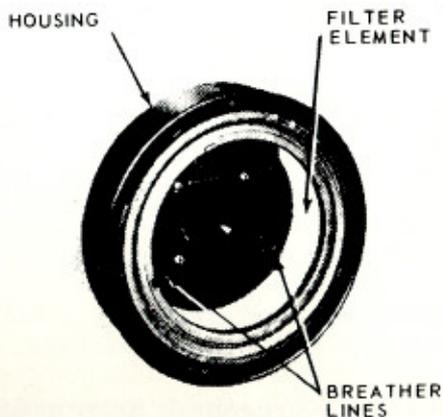
## MAINTENANCE

### AIR CLEANERS

The air cleaner is an essential accessory, filtering the air entering the carburetor and preventing abrasive dirt from entering the engine and wearing out valves and piston rings in a very short time.

The air cleaner must be serviced frequently, depending on the dust conditions in which the engine is operated. Check connections for leaks or breaks and replace all broken or damaged hose clamps on remote or side mounted air cleaners.

**Excessive smoke or loss of power are good indications that the air cleaner requires attention.**



**FIGURE 6 - DRY ELEMENT AIR CLEANER**

The dry element air cleaner mounted directly to the carburetor is standard equipment on this model engine. **DO NOT** oil element, and **DO NOT** use gasoline or kerosene for cleaning.

**Service Daily;** or twice a day if engine is operating in very dusty conditions. Remove element and shake out the accumulated dust and dirt. Wipe out dirt from inside cover and from housing.

**Once Each Week;** The filtering cartridge should be taken out and rinsed under a faucet with cold water, then wash by repeated dippings for several minutes in a solution of lukewarm water and a mild, **Non-sudsing** detergent. Rinse in cold water from the inside out, and allow to dry overnight before installing in air cleaner. In cold weather, protect element from freezing until dry.

After five washings or one year of service, which ever comes first, replace the cartridge element. New filter elements are available from all Teledyne Wisconsin Motor Distributors and Service Centers.

### **HEAVY DUTY AIR CLEANERS, Fig. 7**

Dry Element or Oil Bath heavy duty type air cleaners are optionally used, and are mounted either to the side of the engine or to the equipment structure.

#### **DRY TYPE HEAVY DUTY AIR CLEANER**

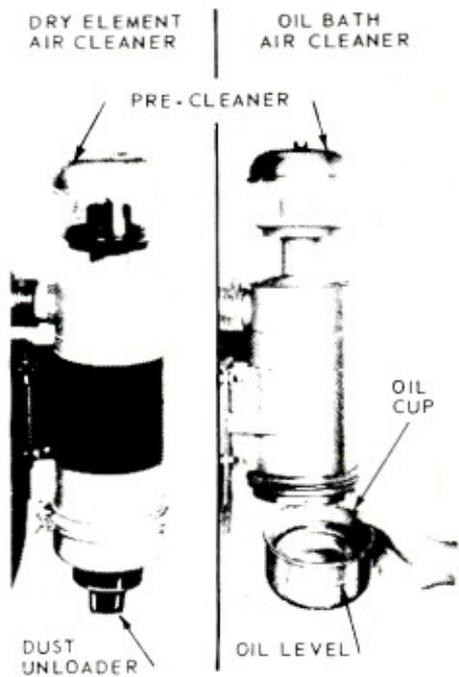
**Service Daily;** squeeze rubber dust unloader once or twice a day to check for possible obstruction. If engine is operating in very dusty conditions, remove cartridge and shake out the accumulated dust and dirt.

Wipe out dirt from inside housing and bowl, after removing baffle and dumping out dust.

**Once Each Week;** The filtering cartridge should be taken out and rinsed under a faucet with cold water, then wash by repeated dippings for several minutes in a solution of lukewarm water and a mild, **Non-sudsing** detergent. Rinse in cold water from the inside out, and allow to dry overnight before re-installing. In cold weather, protect element from freezing until dry.

**DO NOT use Gasoline, Kerosene or Solvent for cleaning — DO NOT oil Element.**

After ten washings or one year of service, which ever comes first, replace cartridge element — available from your nearest Teledyne Wisconsin Motor Distributor or Service Center.



**FIGURE 7 - HEAVY DUTY AIR CLEANERS**

**OIL BATH HEAVY DUTY AIR CLEANER**

**Service Daily;** or twice a day if engine is operating in very dusty conditions. **Once each week;** in comparatively clean conditions.

Remove oil cup from bottom of air cleaner and clean thoroughly. Add the same grade of oil, as used in the engine crankcase, to the **Level Line** indicated on the oil cup.

**IMPORTANT:**

Operating the engine under dusty conditions without oil in the air cleaner or with dirty oil, may wear out cylinders, pistons, rings and bearings in just a few days time.

**Once a Year;** or oftener if conditions are severe, the air cleaner should be removed from the engine and the element, which is not removable, should be washed in a solvent to clean out accumulated dust and dirt.

## PRE-CLEANER

The optionally furnished collector type precleaner, mounted to the top of the air cleaner as illustrated in Fig. 7, removes the larger dirt and dust particles before the air reaches the main air cleaner.

Clean bowl regularly of accumulated dust and dirt. **DO NOT** put oil or water in pre-cleaner, this must be kept dry.

## CRANKCASE BREATHER, Fig. 8

The crankcase is ventilated by means of a closed breather system, controlled by **Reed type breather valves**. The breather valve is an integral part of each of the two valve chamber inspection covers.

Oil and fuel vapors (**blow-by**) in the crankcase are released through the breather valves to the air cleaner, carburetor and intake manifold, where it is mixed with fresh fuel vapor and burned in the combustion chamber.

### IMPORTANT:

It is necessary that the breather valves be kept clean and operable, and the breather lines free of obstruction.

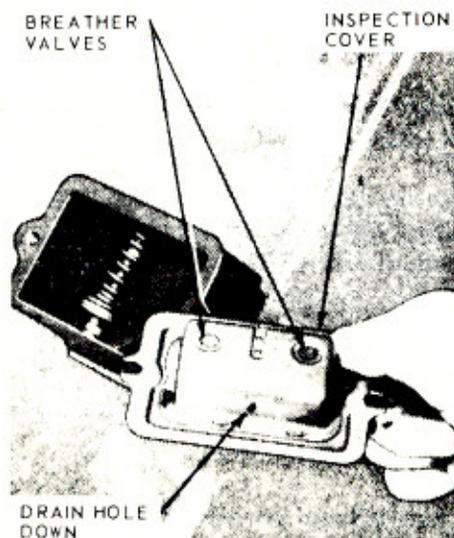


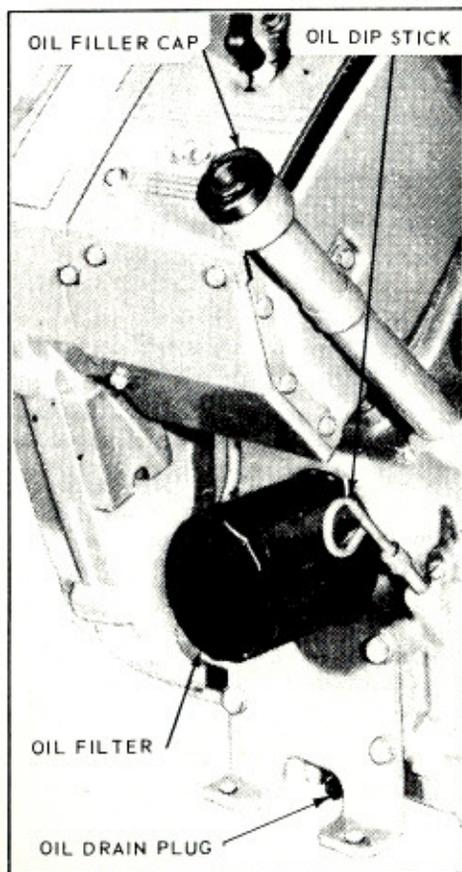
FIGURE 8 - CRANKCASE BREATHER

The operation of the breather valves is also important in maintaining a partial vacuum in the crankcase to prevent oil leaks at seal and gasket surfaces.

**Every 100 Hours;** Inspect breather lines.

**Every 250 Hours;** Remove inspection covers and clean breather valves with a solvent.

**CAUTION:** Do not use gasoline, naphtha, or benzine. They are highly flammable.



**FIGURE 9 - LUBRICATION**

### **CRANKCASE OIL, Fig. 9**

**Check Oil Level Every 8 Hours.** One quart of oil is required to raise the oil level from **Add** to **Full** mark on dipstick.

**Change Oil Every 100 Hours** under normal operating conditions. In extreme dusty and extensive idling conditions, change oil at 50 hour intervals. Remove drain plug and allow oil to drain into a suitable container. Drain oil while engine is hot — it will flow more freely.

**CAUTION:** Wear gloves when removing drain plug from a hot engine.

Crankcase capacity	3-1/2	Quarts
With Oil Filter Change	4	Quarts

**IMPORTANT:**

**DO NOT** overfill crankcase. **DO NOT** allow oil level to go below **Add** mark on dipstick.

Refer to **Recommended Grades of Oil** chart, page 1, for classification and grade of oil to be used.

**OIL FILTER Fig. 9**

Under ordinary conditions all of the engine oil is circulated through a **full-flow Micro-Fine** oil filter. But, when the filter element becomes extremely dirty, the oil by-passes the filter material through a relief valve within the oil filter. As a result, there is no variation in oil pressure to indicate that the oil filter is clogged and requires replacement. Because clean oil is so essential for the friction free operation of all bearing surfaces, it is very important that the oil filter be changed at the recommended interval.

**Every 100 hours of operation, or at every oil change, replace oil filter.**

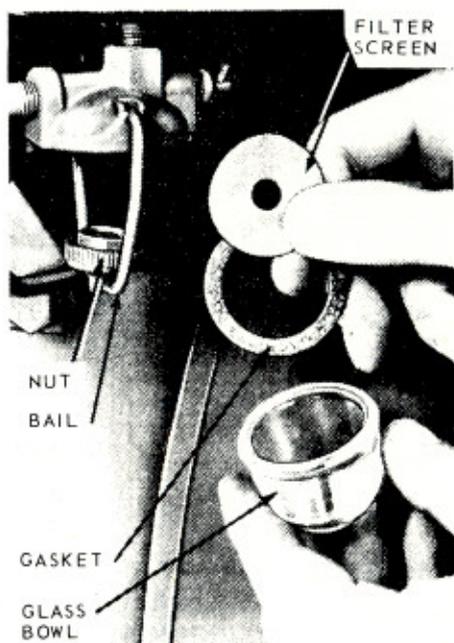
For replacement, use only a Wisconsin **Micro-Fine** oil filter, specifically designed for this model engine.

When reassembling new filter, add a film of oil to the face of the base gasket. Turn filter to a snug fit, then 1/2 turn more — **DO NOT over-tighten.**

**FUEL FILTER, Fig. 10**

It is very important that the fuel be filtered to prevent sediment, dirt and water from entering the carburetor and causing trouble

or even complete stoppage of the engine. A glass bowl fuel filter should be connected into the fuel system between the tank and fuel pump, see Fig. 10.



**FIGURE 10 - FUEL FILTER**

Inspect glass filter bowl daily, and clean if dirt or water are visible. To remove sediment bowl, loosen nut below glass bowl and swing bail to one side. Twist bowl as it is being removed to prevent gasket from sticking to bowl and breaking. Clean screen and bowl thoroughly — replace gasket if it is damaged or hardened.

### **IGNITION DISTRIBUTOR, Fig. 13**

Check for faulty and loose fitting wires, and for cracks in distributor cover.

**Every 250 Hours;** apply 1 or 2 drops of light engine oil (10W), to the felt in the top of the cam sleeve, and 1 drop to breaker arm pivot.

**Every 250 Hours;** add a small amount of high melting point grease to the breaker arm rubbing block.

**Avoid Excessive Lubrication.** Oil on the contact points will cause them to burn.

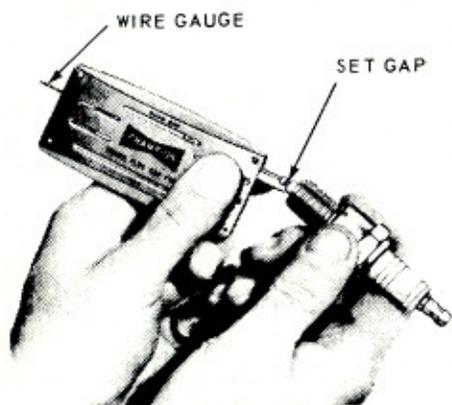
### **SPARK PLUGS, Fig. 11**

Incorrect gap, fouled or worn spark plug electrodes, will have an adverse affect on engine operation.

**Every 250 Hours;** remove spark plugs — clean, regap or replace if necessary.

**Spark plug gap - 0.030 inch**

Replacement plugs must be of the correct heat range, like Champion No. D-16J, AC No. C86 Commercial (Wisconsin YD-6). Thread size is 18 mm. In reassembly tighten spark plugs, **28 to 34 foot pounds torque (dry).**

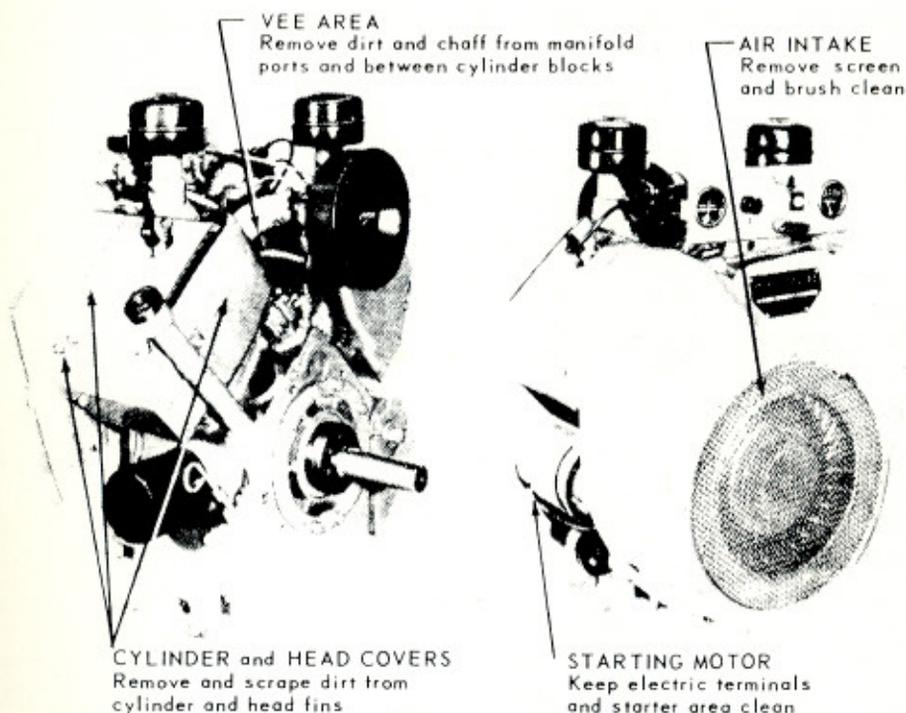


**FIGURE 11 - SPARK PLUG**

### **STARTING MOTOR, Fig. 12**

No maintenance is required other than keeping the outside of the starting motor clean, and periodic inspection for insecure mounting and loose or corroded cable connections.

In extreme dust and dirt conditions it may be necessary to occasionally remove the starter from the engine and clean the Bendix by brushing with Kerosene. **DO NOT oil Bendix drive** — if necessary lubricate with powdered graphite.



### KEEP ENGINE CLEAN, Fig. 12

This engine is cooled by blasts of air which must be allowed to circulate all around the cylinders and cylinder heads to properly cool the engine and thereby keep it in good running condition. If dust, dirt or chaff is allowed to collect in the cylinder shrouding or in the V between the cylinders, it will retard the flow of air and cause the engine to overheat. Keep flywheel screen clean, so as not to restrict the intake of cooling air.

#### IMPORTANT:

DO NOT operate engine with damaged or badly dented shrouding.

DO NOT operate engine with any part of the shrouding removed.

DO NOT allow warm air to recirculate back through the cooling system.

## ADJUSTMENTS

### CARBURETOR, Fig. 16

The carburetor **Main Metering Jet** is of the fixed type and therefore no adjustment is necessary.

The correct amount of throttle plate opening for the proper low idle speed is obtained by means of the **Throttle Stop Screw**. However, this is set at the factory so that no immediate adjustment is necessary. The **Idle Adjustment** is for smooth low speed operation and this adjustment, if necessary, must be made with the engine running at idle speed (throttle valve closed). Initial setting is approximate **1 turn open**.

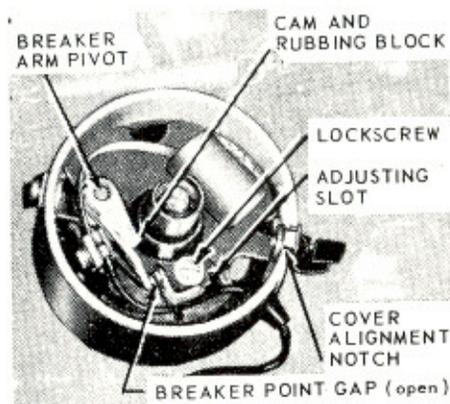


FIGURE 13 - DISTRIBUTOR BREAKER POINTS

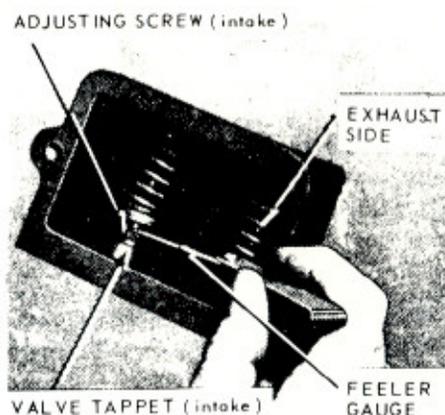
### DISTRIBUTOR BREAKER POINTS, Fig. 13

The breaker point gap should be:

.020 inch at full separation

To readjust point gap, turn engine over slowly until the distributor breaker arm **Rubbing Block** is on a high point of the **Cam**. Loosen the stationary contact **Lockscrew** slightly and place a feeler gauge between the points. Insert the end of a screwdriver into the **Adjusting Slot** on the breaker plate. Open or close the points by moving the point bracket until a slight drag is felt when sliding the feeler gauge from between the points. Tighten lockscrew and recheck point gap.

Points that are badly pitted or worn should be replaced and properly adjusted.



**FIGURE 14 - VALVE TAPPET ADJUSTMENT**

### VALVE TAPPET ADJUSTMENT, Fig. 14

With the tappets in their **lowest position** (valves completely closed) and **engine cold**, the clearance between valve stem and tappet adjusting screw should be.

**Intake - .007 inch    Exhaust - .020 inch**

The **intake valve** is to the left in the cylinder block, facing the valve chamber opening. The **exhaust valve** is to the **right**. Place a feeler gauge of proper clearance thickness between valve stem and tappet screw. Adjust clearance by means of two 1/2 - 7/16 inch tappet wrenches.

## TIMING

### FIRING ORDER

The firing interval (crankshaft degrees), between No. 1 cylinder and No. 2 is 270° — from No. 2 cylinder to No. 1, 450°.

The **No. 2 cylinder** is on the **Right Hand Side**, when viewed from flywheel end of engine No. 2 cylinder is on the left hand side, nearest to the flywheel.

### DISTRIBUTOR

The distributor is of the mechanical advance type and it is driven off an engine speed governor shaft through a pair of 2:1 ratio gears. Thus, the distributor operates at **one-half** engine speed in a **clockwise direction**, when viewed from above.

## SPARK ADVANCE

The running spark advance is  $6^\circ$  before Top Dead Center (T.D.C.) at 1800 r.p.m., with the distributor **fully advanced** to  $22^\circ$  before T.D.C. at **3400 r.p.m.** Engines are properly adjusted at the factory for accurate timing and peak dependable performance for the complete operating range of speeds from 1600 through 3600 r.p.m. Future timing can be checked and adjusted in the following manner:

### TIMING MARKS

**Two timing slots** are provided on the right hand side of the front face of flywheel shroud:

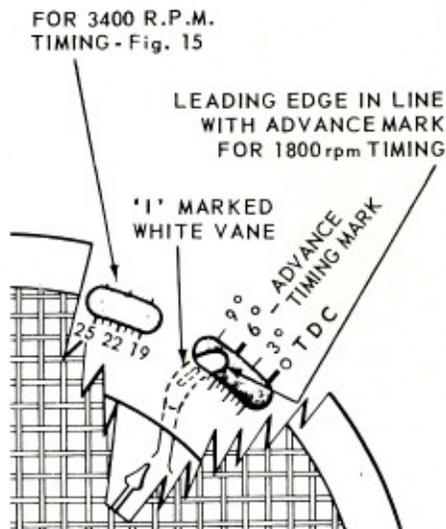
1. For timing variable high speed engines to  $22^\circ$  at 3400 r.p.m., refer to Fig. 15 which illustrates  $25^\circ$ ,  $22^\circ$ ,  $19^\circ$  and T.D.C. timing marks. A **cast arrow** identifies the "I" marked flywheel vane that is visible through the opening at the  $22^\circ$  mark.
2. For fixed speed engines, particularly those operating at 1800 r.p.m., refer to Fig. 16 which illustrates  $9^\circ$ ,  $6^\circ$ ,  $3^\circ$  and T.D.C. timing marks. The **cast arrow** identifies the "I" marked flywheel vane that is visible through the opening at the  $6^\circ$  mark.

### NOTE:

Read **Important Note** with reference to Fig. 18 on page 6, for adjusting engine speed to 1800 r.p.m. for  $6^\circ$  advance timing.



**FIGURE 15 - SPARK ADVANCE  
VARIABLE HIGH SPEED**



**FIGURE 16 - SPARK ADVANCE  
FIXED LOW SPEED**

## TIMING CHECK AND ADJUSTMENT

### IMPORTANT:

It is necessary that the distributor breaker point gap be **.020 inch**, because any change in gap opening will affect the ignition advance. Check and adjust if necessary, per Distributor Breaker Point Adjustment paragraphs, before timing.

A **slotted opening** is provided on the rim of the flywheel screen so that timing can be checked without removing the screen.

### CAUTION:

**DO NOT** operate engine with screen removed from front face of shroud.

### NOTE:

Paint the **"I" marked** flywheel vane **white**, so that it will be clearly visible for checking with a **Timing Light**.

1. With reference to Fig. 17, insert a small screwdriver into the No. 1 terminal tower on the distributor cap, making contact with the spark plug wire terminal. Connect the red terminal clip, from a conventional automotive type **Timing Light**, to the metal portion of the screwdriver. One of the other two

timing light wires is connected to the battery, and the other to the ground.

2. With reference to Fig. 15 and the engine operating at **3400 r.p.m.**, allow the flash from the timing light to illuminate the **"I" whitened flywheel vane**. At the time of the flash the **leading edge** of the vane should line up with the **22° Timing Mark** on the flywheel shroud.
- 2a. For fixed **low speed** applications, operate the engine at **1800 r.p.m.** and allow the flash from the timing light to illuminate the **"I" whitened flywheel vane**. At the time of the flash the leading edge of the vane should line up with the **6° Timing Mark** on flywheel shroud, as illustrated in Fig. 16.



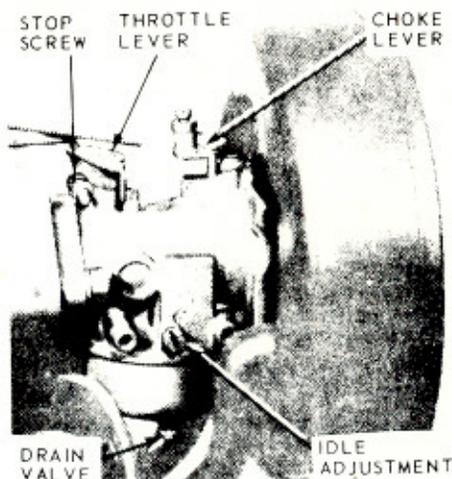
FIGURE 17

3. If timing is incorrect, loosen the advance arm **clamp screw** at the base of the distributor. A screwdriver clearance hole is provided in the flywheel shroud as shown in Fig. 17.

With the engine again running at timing speed turn the distributor body **very slightly** clockwise or counterclockwise as required, until **white vane** and **Timing Mark** do match up. Securely tighten clamp screw when satisfactory timing is accomplished.

#### IMPORTANT:

On fixed low speed applications timing should be adjusted to 6° before T.D.C. at 1800r.p.m.



**FIGURE 18, CARBURETOR ADJUSTMENT**

For engines where the governor is set to operate at speeds other than 1800 R.P.M., a tachometer will have to be used, and the speed adjusted to 1800 r.p.m. in the following manner, and with reference to **Fig. 18**.

1. Run engine at idle speed, **1000 r.p.m.**
2. Turn **Stop Screw** on carburetor throttle lever clockwise until engine speed reaches **1800 r.p.m.**
3. Proceed to check and adjust timing.
4. After timing is accomplished, turn stop screw on carburetor throttle lever counterclockwise until original idle speed of **1000 r.p.m.** is obtained.

### **CLUTCH ADJUSTMENT**

The clutch is an optional accessory furnished either as a power take-off unit, or a clutch reduction assembly.

If the clutch begins to slip, it should be readjusted to prevent it from becoming overheated and damaged. First, remove inspection plate to expose the **adjusting ring**. Release clutch by pushing **shifter lever forward** (toward engine).

# OPERATION GUIDE BRIGGS & STRATTON ENGINE

## MODEL SERIES 402400 — 422400

### IN THE INTEREST OF SAFETY

**DANGER:** DO NOT RUN THE ENGINE IN AN ENCLOSED AREA. Exhaust gases contain carbon monoxide, an odorless and deadly poison. A FIRE OR EXPLOSION CAN OCCUR RESULTING IN PERSONAL INJURY IF THE FOLLOWING INSTRUCTIONS ARE NOT FOLLOWED:

1. DO NOT FILL GASOLINE TANK WHILE engine is running. Allow engine to cool two minutes before refueling.
2. Do not operate the engine when an odor of gasoline is present or other explosive conditions exist.
3. If gasoline is spilled, move machine away from the area of the spill and avoid creating *any* source of ignition until the gasoline has evaporated.
4. DO NOT STORE, SPILL OR USE GASOLINE NEAR AN OPEN FLAME, or devices such as a stove, furnace or water heater which utilize a pilot light, or devices which can create a spark.
5. Refuel outdoors preferably, or only in well ventilated areas.
6. DO NOT OPERATE ENGINE WITHOUT A MUFFLER. Inspect muffler periodically and replace, if necessary.
7. Periodically clean the muffler area to prevent grass, dirt and combustible material from accumulating.
8. DO NOT use this engine on any forest covered, brush covered or grass covered unimproved land unless a spark arrester is attached to the muffler.

9. DO NOT operate the engine if air cleaner or covered directly over the carburetor air intake is removed.
10. When transporting equipment which is powered by an engine using a float feed carburetor and gravity fuel source, the fuel shut off valve must be closed to prevent fuel leaking from carburetor.
11. DO NOT choke carburetor to stop engine.

**WARNING: DO NOT RUN ENGINE AT EXCESSIVE SPEEDS.** Operating an engine at excessive speeds increases the danger of personal injury.

**DO NOT TAMPER WITH GOVERNOR SPRINGS, GOVERNOR LINKS OR OTHER PARTS WHICH MAY INCREASE THE GOVERNED ENGINE SPEED.**

Do not tamper with the engine speed selected by the original equipment manufacturer.

**DO NOT TOUCH** hot mufflers, cylinders or fins as contact may cause burns.

Dirt and grass clippings or other debris, in cooling fins or governor parts can affect engine speed. See cleaning instructions in MAINTENANCE section.

**ALWAYS KEEP HANDS AND FEET CLEAR OF MOVING OR ROTATING PARTS.**

**TO PREVENT ACCIDENTAL STARTING** when servicing the engine or equipment, always remove the spark plugs or wire from the spark plugs, shown on page . Disconnect negative wire from battery terminal if equipped with a 12 volt starting system.

## **WHEN WORKING ON EQUIPMENT**

**DO NOT STRIKE FLYWHEEL** with a hard object or metal tool as this may cause flywheel to shatter in operation, causing personal injury or property damage. To remove flywheel, use Briggs & Stratton approved tools only.

## IN THE INTEREST OF ENVIRONMENT

A muffler which leaks because of rust or damage can permit an increased exhaust noise level. Therefore, examine the muffler periodically to be sure it is functioning effectively. To purchase a new muffler, see SERVICE AND REPAIR INFORMATION.

**WARNING:** If this engine is not equipped with a spark arrester and is to be used on any forest covered, brush covered, or grass covered unimproved land, before using on such land a spark arrester must be added to the muffler. The arrester must be maintained in effective working order by the operator. In the State of California the above is required by law (Section 4442 of the California Public Resources Code). Other states may have similar laws. Federal laws apply on federal lands. See your Authorized Briggs & Stratton Service Center for spark arrester muffler options.

## **SERVICE & REPAIR INFORMATION**

If service or repair is needed, contact an Authorized Briggs & Stratton Service Center. To serve you promptly and efficiently, the Service Center will need the model, type and code number on your engine.

Each Authorized Service Center carries a stock or original Briggs & Stratton repair parts and is equipped with special service tools. Trained mechanics assure expert repair service on all Briggs & Stratton engines.

Major engine repairs should not be attempted unless you have the proper tools and a thorough knowledge of internal combustion engine repair procedure.

Your nearest service center is listed in the "Yellow Pages" under "Engines, Gasoline" or "Gasoline Engines".

This illustrated book includes common specifications, and detailed information covering the adjustment, tune-up and repair procedures for Twin Cylinder, 4 cycle models. It is available from any Authorized Briggs & Stratton Service Center. Order as Part Number 271172.

### **BEFORE STARTING**

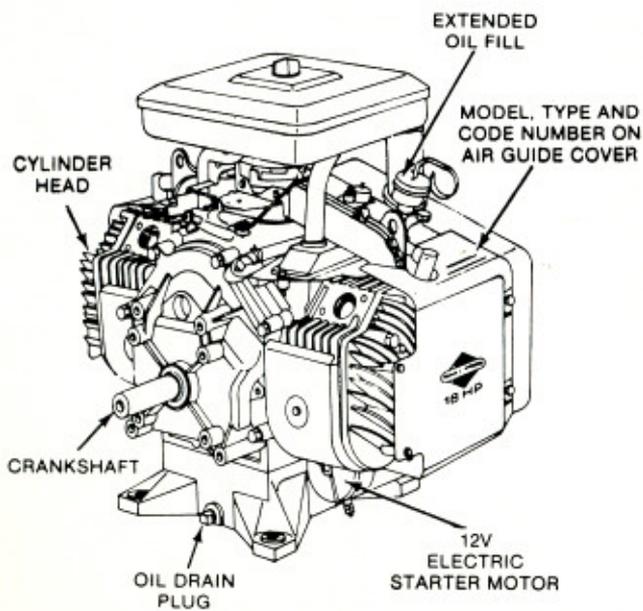
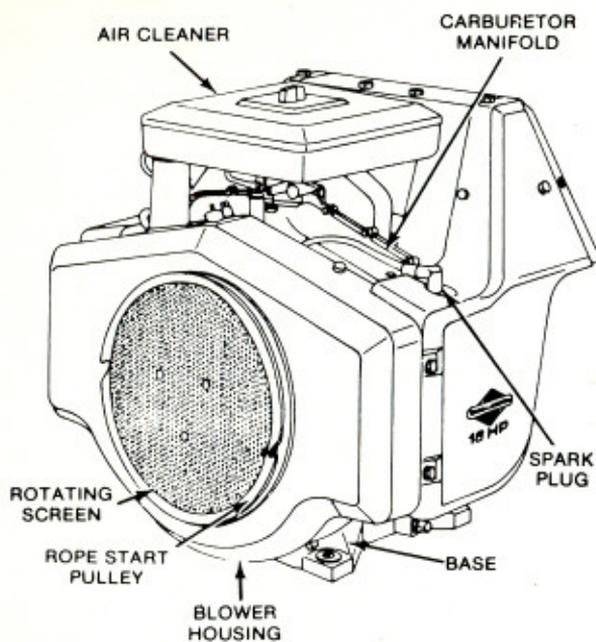
#### **READ THE OPERATING INSTRUCTIONS OF THE EQUIPMENT THIS ENGINE POWERS**

Use a high quality detergent oil classified "For Service SF, SE, SD or SC." Detergent oils keep the engine cleaner and retard the information of gum and varnish deposits. Nothing should be added to the recommended oil.

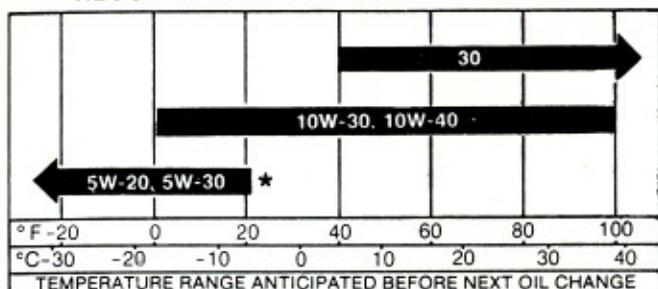
\*If not available, a synthetic oil may be used having 5W-20, 5W-30 or 5W-40 viscosity.

#### **FILL CRANKCASE WITH OIL**

Place engine level. Clean area around oil fill before removing dipstick.

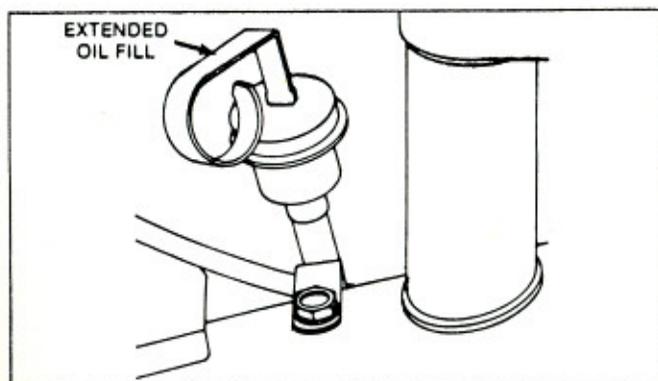


## RECOMMENDED SAE VISCOSITY GRADES



\*If not available, a synthetic oil may be used having 5W-20, 5W-30 or 5W-40 viscosity.

**EXTENDED OIL FILL.** Remove cap and dipstick. **FILL TO FULL MARK** on dipstick, **POUR SLOWLY**. Capacity approximately 3 pints (1.4 liters). When checking oil level, screw dipstick assembly firmly but slowly until cap bottoms on tube. **DO NOT OVERFILL.** Dipstick assembly must be securely assembled into tube at all times when engine is operating.



## CHARGE BATTERY

Charge battery before use on engines equipped with 12 volt electric starter motor. See manufacturers' recommendations.

## FUEL RECOMMENDATIONS

Our engines will operate satisfactorily on any gasoline intended for automotive use. **DO NOT MIX OIL WITH GASOLINE.**

We recommend the use of clean, fresh, *lead-free* gasoline. Leaded gasoline may be used if lead-free is not available. A minimum of

77 octane is recommended. The use of lead-free gasoline results in fewer combustion deposits and longer valve life.

## STARTING

**OPEN FUEL VALVE** on engines so equipped.

**CHOKE ENGINE:** Move equipment control lever to "CHOKE" position.

**NOTE:** This should fully close choke on carburetor. If it does not, remote control must be re-adjusted. See ADJUSTMENT section.

**NOTE:** A warm engine requires less choking than a cold engine.

### TO START ENGINE

**DANGER: ALWAYS KEEP HANDS AND FEET CLEAR OF ROTATING MACHINERY.**

Turn key to "START" position and/or press starter button on powered equipment. The best starter life is provided by using short starting cycles of several seconds. Prolonged cranking can damage the starter motor if cranked more than 15 seconds per minute. When engine starts, open choke gradually.

When equipment is not in operation, provide protection from direct exposure to weather.

### COLD WEATHER STARTING HINTS

1. Be sure to use the proper oil for the temperature expected.
2. Declutch all possible external loads.
3. Set speed control at part-throttle position.
4. A warm battery has much more starting capacity than a cold battery.
5. Use fresh winter grade fuel.

**NOTE:** Winter grade gasoline has higher volatility to improve starting. Do not use gasoline left over from summer.

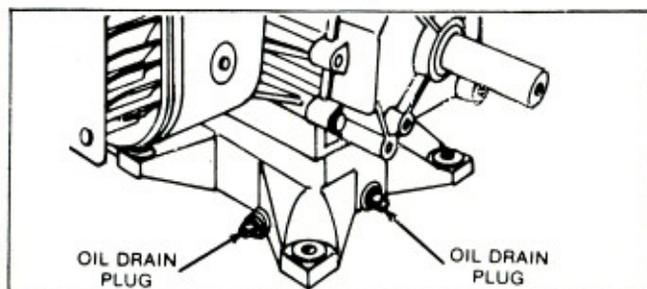
## TO STOP ENGINE

Turn key to "OFF" position. Do not choke carburetor to stop the engine.

**CAUTION: TO PREVENT ACCIDENTAL STARTING** when servicing the engine or equipment, always remove the spark plugs or wire from the spark plugs shown on page Disconnect negative wire from battery terminal if equipped with a 12 volt starter system.

**CHECK OIL LEVEL** regularly — after each five hours of operation. **BE SURE OIL LEVEL IS MAINTAINED.**

**CHANGE OIL** after first five hours of operation. Thereafter change oil every 25 hours of operation. Remove oil drain plug and drain oil while engine is warm. Replace drain plug. Remove dipstick and refill with new oil of proper grade. Replace dipstick.

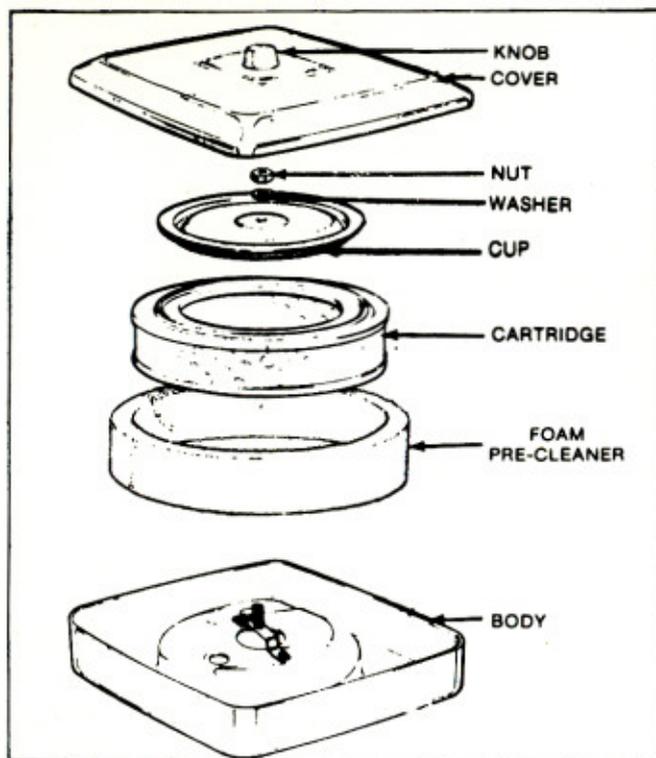


## TO SERVICE DUAL ELEMENT AIR CLEANER

Clean and re-oil foam pre-cleaner at three month intervals or every 25 hours, whichever occurs first.

**NOTE:** Service air cleaner more often under dusty conditions.

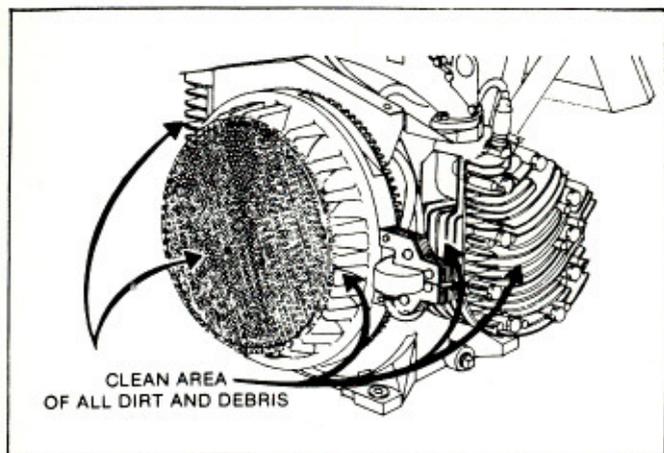
1. Remove knob and cover.
2. Remove foam pre-cleaner by sliding it off the paper cartridge.
3. a. Wash foam pre-cleaner in kerosene or liquid detergent and water.  
b. Wrap foam pre-cleaner in cloth and squeeze dry.  
c. Saturate foam pre-cleaner in engine oil. Squeeze to remove excess oil.
4. Install foam pre-cleaner over paper cartridge. Reassemble cover and screw down tight.



Yearly or every 100 hours, whichever occurs first, remove paper cartridge. Clean by tapping gently on flat surface. If very dirty, replace cartridge, or wash in a low or non-sudsing detergent and warm water solution. Rinse thoroughly with flowing water from inside out, until water is clear. Cartridge must be allowed to stand and air dry *thoroughly* before using. Service more often if necessary.

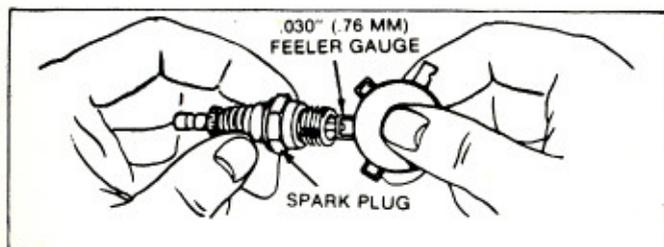
**CAUTION:** Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. **DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.**

**CLEAN COOLING SYSTEM** — Grass, chaff or dirt may clog the rotating screen and the air cooling system, especially after prolonged service in cutting tall dry grasses. Yearly or every 100 hours, whichever occurs first, remove the blower housing and clean the areas shown to avoid overspeeding, overheating and engine damage. Clean more often if necessary.



**DANGER:** Periodically clean muffler area to remove all grass, dirt and combustible debris.

**SPARK PLUGS** — Clean and reset gap at .030" every 100 hours of operation.



**CAUTION:** Do not blast clean spark plugs. Spark plugs should be cleaned by scraping or wire brushing and washing with a commercial solvent.

Sparking can occur if wire terminals do not fit firmly on spark plugs. Reform terminals if necessary.

**REMOVE COMBUSTION DEPOSITS** every 100-300 hours of operation. Remove cylinder heads and cylinder head shields. Scrape and wire brush the combustion deposits from cylinder, cylinder heads, top of pistons and around valves. Use a soft brush to remove deposits. Re-assemble gaskets, cylinder heads and cylinder head shields. Turn screws down finger tight, with the three longer screws around the exhaust valve, if so equipped. Torque cylinder head screws in a staggered sequence to 165 inch pounds (18.65 Nm).

**SPARK ARRESTER EQUIPPED MUFFLER** — If engine muffler is equipped with spark arrester screen assembly, remove every 50 hours for cleaning and inspection. Replace if damaged.

**CLEAN ENGINE** — Remove dirt and debris with a cloth or brush. Cleaning with a forceful spray of water is not recommended as water could contaminate the fuel system.

**FUEL FILTER** — Replace IN-LINE filter every season.

## ADJUSTMENTS

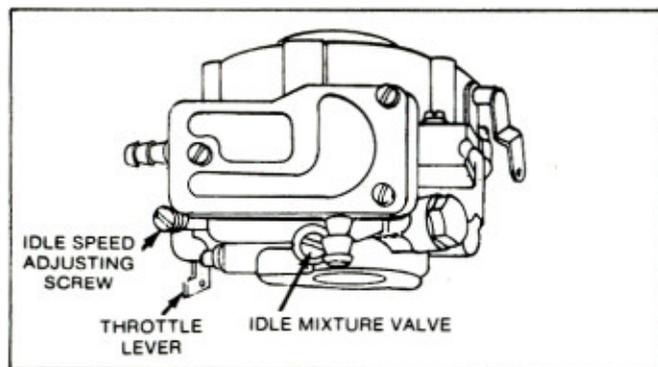
### CARBURETOR ADJUSTMENTS

Minor carburetor adjustment may be required to compensate for differences in fuel, temperature, altitude or load.

**NOTE:** The air cleaner must be assembled to carburetor when running engine.

Gently turn the idle mixture valve clockwise until it just closes. Valve may be damaged by turning it in too far. Open idle valve  $1\frac{1}{2}$  turns counterclockwise.

This initial adjustment will permit the engine to be started and warmed up prior to final adjustment.



Start engine and place equipment speed control lever in idle position. Hold carburetor throttle lever against idle stop, and adjust idle speed screw to obtain: 1200 to 1400 RPM. Turn idle mixture valve *slowly* clockwise (lean mixture) until speed *just* starts to slow. Then turn idle mixture valve  $\frac{1}{2}$  turn

counterclockwise. Now adjust idle speed screw to obtain: 900 to 1200 RPM. Release throttle lever.

**NOTE:** Engines operated at altitudes of approximately 5000 feet, may require the installation of a high altitude carburetor main jet to achieve best engine performance. If erratic performance or lack of power is observed, select the fixed main jet part number 231333. It may be ordered through your nearest Briggs & Stratton Service Center.

## CONTROL ADJUSTMENTS

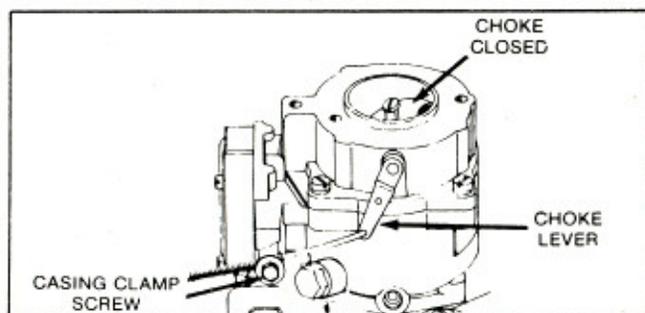
Proper choke and speed control operation is dependent upon correct adjustment of controls on the powered equipment.

### TO CHECK OPERATION OF CHOKE CONTROLS

Move control lever to "CHOKE" position. The carburetor choke should be closed.

### TO ADJUST CHOKE:

Place control lever on equipment in "CHOKE" position. Loosen casing clamp screw. Move casing and wire until choke is completely closed. Tighten casing clamp screw.



## SPEED CONTROL ADJUSTMENT

The acceptable operating speed range is 1800 to 3600 RPM. Idle speed is 1400 RPM. The manufacturer of the equipment on which the engine is used, specifies the top governed no load speed at which the engine may be operated. **DO NOT EXCEED** this speed.

Engine speed is controlled by movement of the control lever. Move control lever on equipment, "A," to slowest engine speed

possible. Throttle lever on carburetor should touch idle speed adjusting screw. To adjust, loosen control casing clamp screw "B." Move control casing and wire in direction shown by arrow until throttle lever touches idle speed adjusting screw on carburetor. Retighten casing clamp screw "B."

**CAUTION:** Throttle lever on carburetor **MUST** touch idle speed adjusting screw when equipment control lever is in slowest position.

## GENERAL INFORMATION

These engines are two-cylinder L-head, air-cooled type.

### MODEL SERIES 402400

Bore .....	3-7/16" (87.31 mm)
Stroke .....	2-5/32" (54.77 mm)
Displacement .....	40.00 cu. in. (656.0 cc)
Horsepower Max. ....	16 @ 3600 RPM
Torque (Ft. Lbs.) Max. ....	25.8 @ 2700 RPM

### MODEL SERIES 422400

Bore .....	3-7/16" (87.31 mm)
Stroke .....	2-9/32" (57.94 mm)
Displacement .....	42.33 cu. in. (694.0 cc)
Horsepower Max. ....	18 @ 3600 RPM
Torque (Ft. Lbs.) Max. ....	28.6 @ 2600 RPM

The horsepower ratings listed are established in accordance with the Society of Automotive Engineers Test Code - J607. For practical operation, the horsepower loading should not exceed 85% of this rating. Engine power will decrease 3½% for each 1,000 feet (304.8 m) above sea level and 1% for each 10° above 60° F (16° C).

### TUNE-UP SPECIFICATIONS

Spark Plug Type	Champion	Autolite
Resistor Long Plug	RJ-12	308
Spark Plug Gap .....	.030" (.76 mm)	
Intake Valve Clearance**	.004" - .006" (.10 - .15 mm)	
Exhaust Valve Clearance**	.007" - .009" (.18 - .23 mm)	

\*\*with valve spring installed.

**WARNING:** For electrical safety, always remove cable from negative (-) side of the battery before attempting any repairs or maintenance.

## **STORAGE INSTRUCTIONS**

Engines to be stored over 30 days should be completely drained of fuel to prevent gum deposits from forming on essential carburetor parts, fuel filter and tank.

**NOTE:** The use of a fuel additive, such as STA-BIL, or an equivalent, will minimize the formation of fuel gum deposits during storage. Such an additive may be added to the gasoline in the fuel tank of the engine, or to the gasoline in a storage container.

- a. All fuel should be removed from the tank. Run the engine until it stops from lack of fuel. The small amount of fuel that remains in the sump of the tank should be removed by absorbing it with a clean, dry cloth.
- b. While engine is still warm, drain oil from crankcase. Refill with fresh oil.
- c. Remove spark plugs, pour approximately one ounce (30 cc) of engine oil into cylinder and crank slowly to distribute oil. Replace spark plugs.
- d. Clean dirt and chaff from cylinders, cylinder head fins, blower housing, rotating screen and muffler areas.
- e. Store in a clean and dry area.
- f. Charge battery and store as recommended by the manufacturer.

## **TROUBLE SHOOTING**

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The three prime requisites essential to starting and maintaining satisfactory operation of internal combustion engines are:

1. **A Proper Fuel Mixture** in the cylinder.
2. **Good compression** in the cylinder.
3. **Good Spark, Properly Timed**, to ignite the mixture.

If all three of these conditions do not exist the engine cannot be started.

As a guide to locating some of the difficulties in starting, **causes** are listed under the three main headings of:

### **Fuel Mixture, Compression and Ignition.**

#### **FUEL MIXTURE**

No fuel in tank or fuel valve closed.

Plugged vent hole in fuel tank cap.

Fuel line clogged.

Fuel pump diaphragm worn or punctured.

Carburetor not choked sufficiently, especially if engine is cold.

Water, dirt, or gum in gasoline interfering with free flow of fuel to carburetor.

Poor grade, stale or out-of-season gasoline.

Carburetor flooded, caused by too much choking especially if engine is hot.

Dirt or gum holding float needle valve in carburetor open. This condition would be indicated if fuel continues to drip from carburetor with engine standing idle.

Carburetor out of adjustment. Restricted (dirty) air cleaner.

## COMPRESSION

Cylinders dry due to engine having been out of use. Pour one fluid ounce of crankcase oil through spark plug holes.

Loosen or broken spark plug. A hissing noise will be heard in cranking due to escaping gas mixture on compression stroke.

Damaged cylinder head gasket or loose cylinder head. This will likewise cause hissing noise on compressions stroke.

Valve stuck open. Piston rings stuck or worn.

Valves adjusted with insufficient clearance.

## IGNITION

Test for spark by removing spark plugs and observe spark at plug gap while turning engine over. No spark or weak spark may be attributed to the following:

Ignition wires loose or disconnected at spark plug, distributor or coil.

Broken or frayed ignition wires.

Spark plug insulator broken.

Spark plugs wet or dirty.

Spark plug gap incorrect.

Condensation on spark plug electrodes.

Breaker point gap incorrect.

Breaker points pitted or fused.

Breaker arm sticking.

Condenser leaking or grounded.

Spark timing wrong.

Weak battery, Faulty ignition coil.

## **ENGINE MISSES**

Spark plug gap incorrect.

Worn, leaking or loose ignition cables.

Weak spark. See "Ignition" test for spark.

Loose connections at ignition cables.

Breaker points pitted or worn.

Water in gasoline. Sticky valves.

Poor compression. See "Compression."

## **ENGINE STOPS**

Fuel tank empty.

Water, dirt or gum in gasoline.

Gasoline vaporized in fuel lines, due to excessive heat around engine (Vapor Lock).

Vapor lock in fuel lines due to using winter gas (too volatile) in hot weather.

Air vent hole in fuel tank cap plugged.

Ignition troubles. See "Ignition."

## **OVERHEATING**

Crankcase oil supply low.

Ignition timing wrong.

Low grade of gasoline.

Engine overloaded.

Restricted cooling air circulation.

Part of air shroud removed from engine.

Dirt between cooling fins.

Intake screen clogged with dirt.

Restricted exhaust.

### **ENGINE SURGES OR GALLOPS**

Carburetor flooded.

Governor spring hooked into wrong hole.

Governor rod incorrectly adjusted.

### **ENGINE KNOCKS**

Poor grade gasoline or of low octane rating.

Operating under heavy load at low speed.

Loose or burnt out rod bearings.

Spark advanced too far.

Worn or loose piston pin.

Carbon or lead deposits in cylinder head.

Backfires thru carburetor.

High oil pressure.

Low or no oil pressure.

ENGINE MAINTENANCE SCHEDULE	Daily	Weekly	100	250
		or 50 Hrs.	Hrs.	Hrs.
CHECK OIL LEVEL. Add to level of filler hole opening.	•			
CHECK AIR CLEANER. Shake out accumulated dirt from dry element.	•			
CLEAN AIR INTAKE SCREEN. Clean cooling fins if necessary.	•			
CLEAN AIR FILTER ELEMENT. Replacement Element LO 194 A		•		
CHANGE CRANKCASE OIL. Use grade and classification of oil recommended. In adverse conditions change oil every 50 hours of operation.			•	
REPLACE OIL FILTER every oil change. Replacement Filter RV 51.			•	
INSPECT CRANKCASE BREATHER SYSTEM. Clean if necessary.			•	
DISTRIBUTOR CAM. Apply 1 or 2 drops of light oil (10W) to felt in cam sleeve and 1 drop to breaker arm pivot.				•
INSPECT SPARK PLUGS and BREAKER POINTS. Replace if necessary and regap. (Spark Plugs .030 inch) (Breaker gap .020 inch). Replacement Spark Plugs YD6.				•
INSPECT FUEL FILTER. Clean filter screen or strainer in fuel tank.				•
INSPECT COOLING SYSTEM. Remove shrouding and scrape off dirt from between fins, around cylinder head and from shrouding.				•
INSPECT STARTING MOTOR. Check for loose mounting and cable connections.				•

OE 24  
 12V MANNING  
 AND RV  
 10 H DEEP CYCLE  
 11 1/4 L 6 13/16 W

ROUTER - WAN NHC.

NO FUEL FILTER

AIR CLEANER ELEMENT - 32103

ENG. OIL FILTER - 32122

MS - 3898 D

ROUTER - WISC #1220

NO FUEL FILTER

AIR CLEANER ELEMENT - 32103

ENG. OIL FILTER - 31311

"TURBO" OPTIONAL PRE-CLEANER  
32104

BRIGGS - ROUTER - 18 HP.

AIR CLEANER ELEMENT - 32107

Foam. Pre-cleaner - 32108