

**OPERATING
AND
MAINTENANCE
INSTRUCTIONS**

•
MODEL

BF

INDUSTRIAL TRACTOR ENGINES

•
PRELIMINARY COPY

ONAN

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A DIVISION OF ONAN CORPORATION

GENERAL INFORMATION

ENGINE MODEL REFERENCE

Identify your model by referring to the MODEL and SPEC (specification) NO. as shown on the unit nameplate.

How to interpret MODEL and SPEC NO.

BF-MS/1831A			
1	2	3	4

1. Factory code for general identification purposes.
2. Specific Type:
MS-ELECTRIC starting with stub shaft, starter and flywheel alternator.
3. Factory code for optional equipment supplied.
4. Specification (Spec Letter) advances with factory production modification.

If your engine needs service or repair, contact an Onan Service Center. Trained mechanics will assure expert repair service on your Onan engine.

OUT-OF-SERVICE PROTECTION

Protect an engine that is to be out-of-service for more than 30 days as follows:

1. Run engine until thoroughly warm.
2. Turn off fuel supply and run until engine stops.
3. Drain oil from oil base while still warm. Refill and attach a warning tag stating oil viscosity used.
4. Remove spark plugs. Pour 1 oz. (two tablespoons) of rust inhibitor (or SAE #50 oil) into the cylinders. Crank engine over a few times. Install spark plugs.
5. Service air cleaner.
6. Clean governor linkage and protect by wrapping with a clean cloth.
7. Plug exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.
8. Wipe entire unit. Coat rustable parts with a light film of grease or oil.
9. Provide a suitable cover for the entire unit.
10. If battery is used, disconnect and follow standard battery storage procedure.

S P E C I F I C A T I O N S

Type	4 Cycle, Air Cooled
Horsepower @ 3600 rpm	16.0
No. of Cylinders	2
Displacement (cu. in.)	40
Stroke	2.625"
Bore	3.125"
Crankshaft	Horizontal, Ductile Iron
Valves	Mechanical, Poppet
Bearings (Main and Rod)	Sleeve
Oil Capacity	4 pt.
Oil Capacity with Filter	4½ pt.
Lubrication System	Pressure Feed
Weight (Lbs.)	95
Tappets (Cold) INTAKE001 - .002"
EXHAUST008 - .010"
Breaker Point Gap (Full Separation)020"
Spark Plug Gap025"
Ignition Timing Advance	21° BTC
Head Bolt Torque (cold)	15 ft. lb.

BEFORE STARTING

Check the engine to make sure it has been filled with oil and fuel. The chart below lists oil and fuel recommendations.

Crankcase Oil: Fill the crankcase with a good quality oil that meets the API (American Petroleum Institute) service designations SD, CC. Recommended oil numbers for expected ambient temperatures are as follows:

TEMPERATURE	GRADE
Below 30F	SAE 5W30
Above 30F	SAE 30

Fill oil to 1/8" from top of oil base.

CAUTION Do not overfill crankcase. Do not use service DS oil. Do not mix brands nor grades of motor oil.

Refer to Maintenance section for recommended oil change intervals.

Recommended Fuel: Use clean, fresh, regular grade, automotive gasoline. Do not use highly leaded premium types.

WARNING Never fill the fuel tank when the engine is running.

Inspection: Inspect the engine visually before starting. Check for loose or missing parts and any damage which may have occurred in shipment.

STARTING

1. This engine is equipped with a cable-controlled manual choke. Refer to Figure 2 for Open and Closed positions of the choke lever.
2. To start the engine, turn on ignition switch, pull the Choke button way out (for a cold engine) and push the starting switch. When the engine starts,

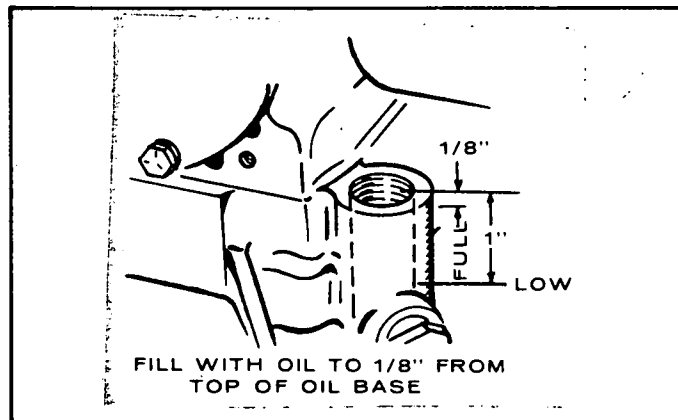


FIGURE 1. CRANKCASE OIL LEVEL

gradually push the choke button in until the engine runs smoothly.

3. Black smoke from the exhaust and a rough running engine usually indicates over-choking.
4. To stop the engine, turn off ignition switch.

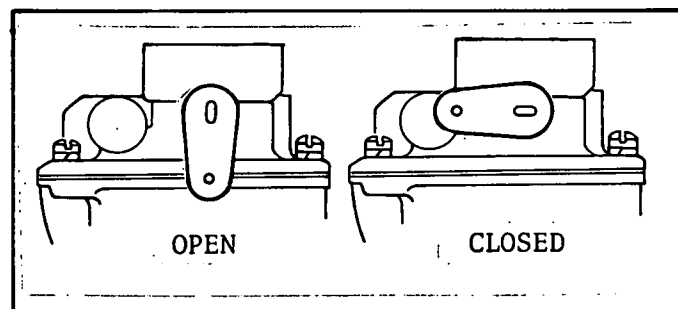


FIGURE 2 CHOKE LEVER POSITIONS

MAINTENANCE

1. **Oil Level:** Check oil level at least every 8 hours of operation. Check more frequently on a new or overhauled engine as oil consumption is higher until piston rings seat properly. See Figure 1.
2. **Oil Change:** Change crankcase oil after the first 50 hours of operation; change every 100 hours after that. If operating in extremely dusty conditions, change oil more frequently.
3. **Oil Filter:** Replace oil filter every 200 hours; replace more often in dusty

conditions. Tighten the filter finger-tight plus 1/4 to 1/2 turn. See Figure 3.

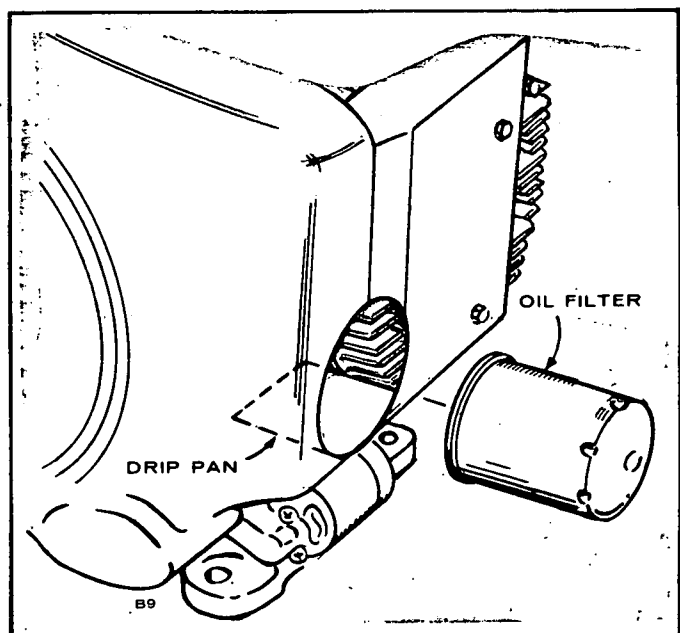


FIGURE 3 OIL FILTER

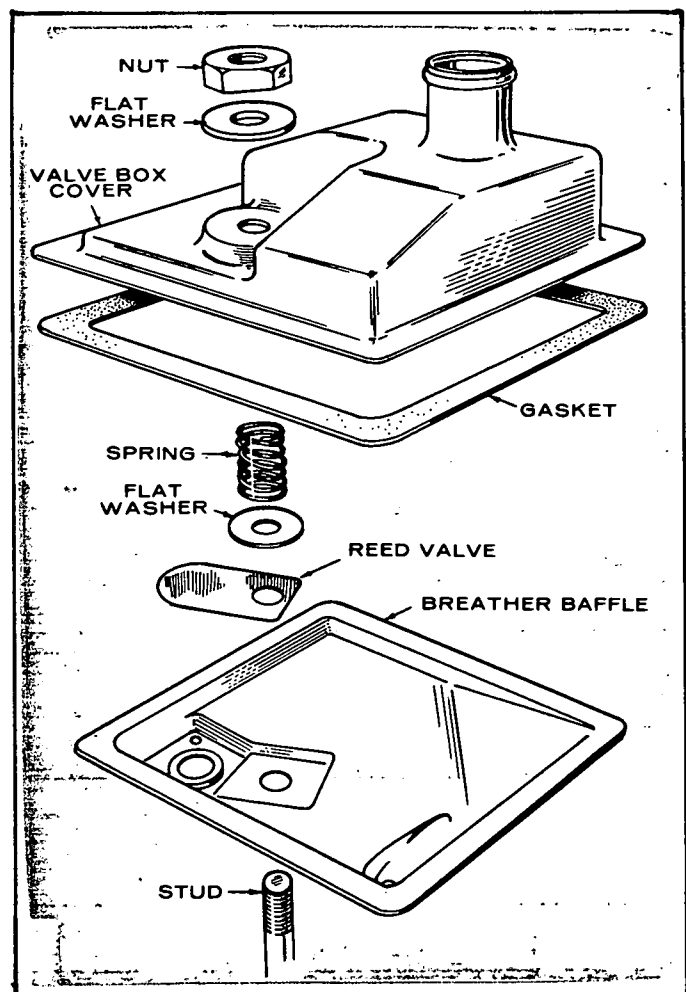


FIGURE 4 BREATHER VALVE ASSEMBLY

4. Crankcase Breather: This engine uses a crankcase breather valve for maintaining crankcase vacuum. No maintenance is generally required. If the crankcase becomes pressurized as evidenced by oil leaks at the seals, clean baffle and valve in a suitable solvent. See Figure 4.

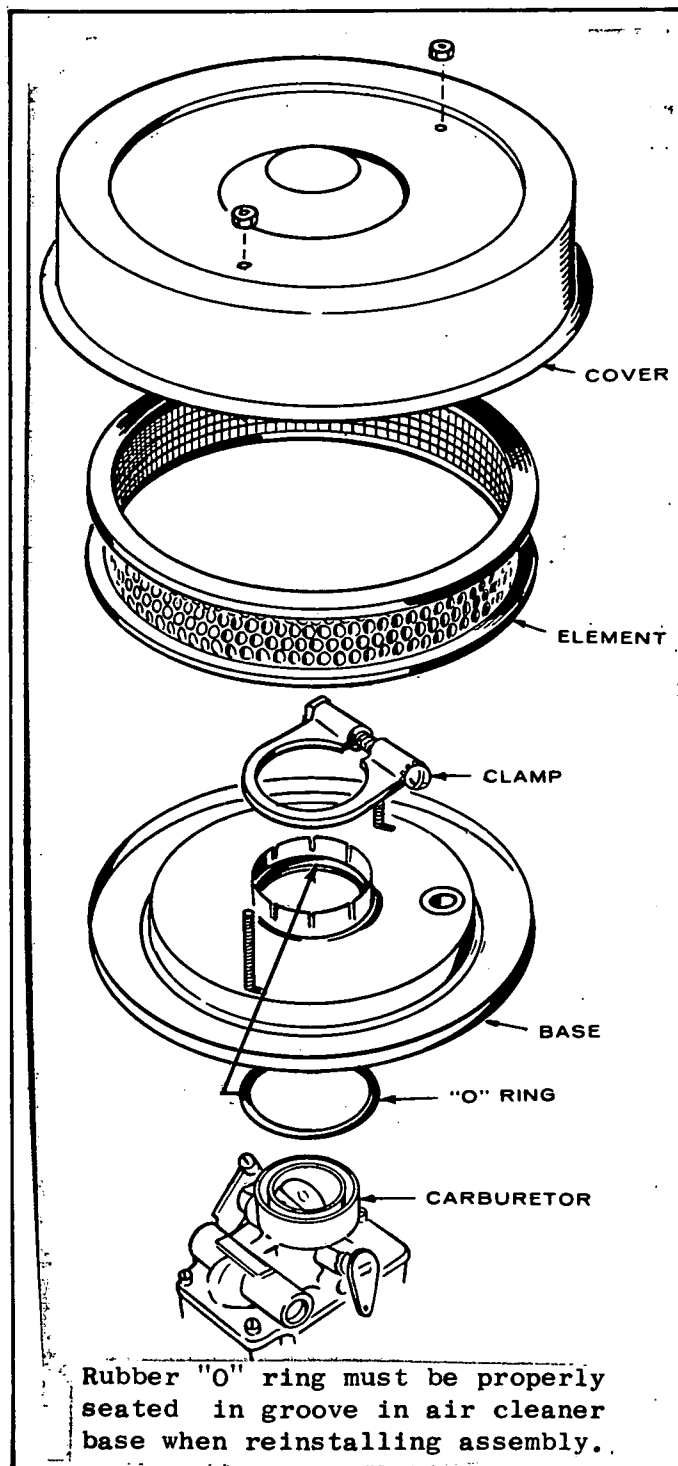


FIGURE 5 AIR CLEANER ASSEMBLY

5. Cartridge Air Cleaner: Check and clean air cleaner element every 50 hours. Clean by gently tapping element on a flat surface. Replace element every 200 hours. Clean or replace more frequently in dusty operating conditions. See Figure 5:

6. Combustion Chamber: Remove combustion chamber deposits (carbon) every 200-400 hours. As this involves removing the cylinder heads, a competent mechanic should perform this operation.

CAUTION Head bolts must be retorqued after cleaning.

7. Cooling System: Check and clean cooling fins at least every 50 hours. Remove any dust, dirt or oil which may have accumulated.

CAUTION A clogged cooling system can cause overheating and engine damage.

8. Spark Plugs: Check, clean and reset spark plugs every 100 operating hours. Replace spark plugs that show signs of fouling or electrode erosion. See Figure 6.

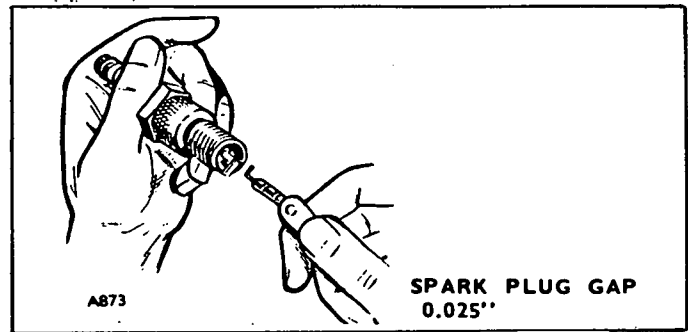


FIGURE 6 SPARK PLUG SETTING
PERIODIC MAINTENANCE SCHEDULE

Regularly scheduled maintenance is the key to lower operating costs and longer service life for the unit. The following schedule can be used as a guide. However, actual operating conditions under which a unit is run should be the determining factor in establishing a maintenance schedule. When operating in very dusty or dirty conditions, some of the service periods may have to be reduced. Check the condition of the crankcase oil, the filters, etc. frequently until the proper service time periods can be established.

For any abnormalities in operation, unusual noises from engine or accessories, loss of power, overheating, etc., contact your ONAN dealer.

PERIODIC SERVICE GUIDE

SERVICE THESE ITEMS	AFTER EACH CYCLE OF INDICATED HOURS					
	8	50	100	200	400	1000
Inspect Engine Generally	x					
Clean Breather Valve				x		
Check Oil Level	x					
Service Air Cleaner		x1				
Change Crankcase Oil			x1			
Check Breaker Points				x		
Check Battery Electrolyte Level				x		
Clean Fuel System				x		
Check Spark Plugs			x			
Remove Carbon & Lead Deposits					x ²	
Replace Oil Filter				x		
Check Valve Clearance					x ²	
Replace Air Cleaner Element				x1		
Inspect Valves, Grind If Necessary						x ²
Complete Reconditioning (If Required)						x ²

x1 Perform more often in extremely dusty conditions.

x² For detailed maintenance, contact an Onan Service Center.

ADJUSTMENTS

CARBURETOR

The carburetor (Figure 7) has a main fuel (high speed) adjustment and a fuel idle adjustment. The main adjustment affects operation under heavy load conditions. Idle adjustment affects operation at light or no load. Under normal circumstances, factory carburetor adjustments should not be disturbed. If the adjustments have been disturbed, turn needles off their seats, 1 to 1½ turns to permit starting, then, readjust them for smooth operation.

CAUTION Forcing the needle against its seat will damage it. The needle does not completely shut off fuel when turned fully in.

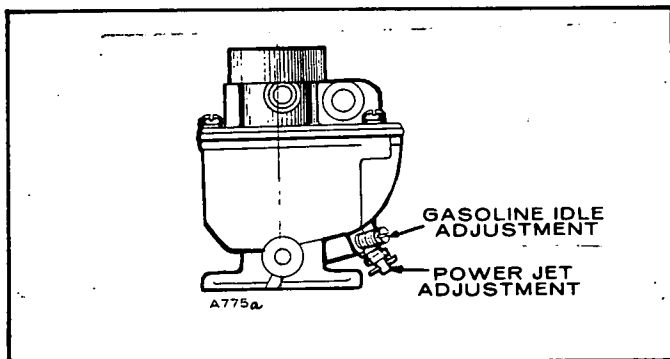


FIGURE 7. CARBURETOR ADJUSTMENT

Before final adjustment, allow the engine to warm up. Make the idle adjustment under no load. Open the main jet until the engine runs smooth under acceleration with no load. Slightly more fuel may be needed (open about 1/4 turn further) when sudden load is applied.

Set the throttle stop screw (located in carburetor throttle lever) with no load connected and while running at a low speed setting. Turn the screw to give 1/32" clearance between the screw and pin (Figure 8).

If the engine develops a "hunting" condition (alternate increase and decrease of engine speed) try correcting by opening the main adjusting needle a little more. Do not open more than 1/2 turn beyond the maximum point of power. If this does not

correct the condition, follow the instructions for regulating the sensitivity of the governor under GOVERNOR ADJUSTMENT.

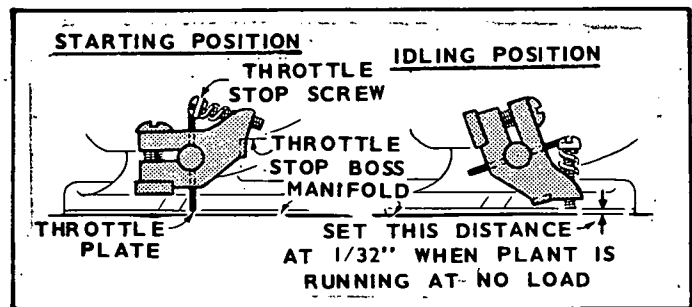


FIGURE 8 THROTTLE ADJUSTMENT

BREAKER POINTS

Replace burned or faulty points. If only slightly burned, dress smooth with file or fine stone and regap.

Ignition breaker points (Fig. 9) must be correctly gapped .020". Crank engine to fully open breaker points (1/4 turn after top center). Loosen and move stationary contact to correct the gap at full point separation. Secure points and check gap with thickness gauge.

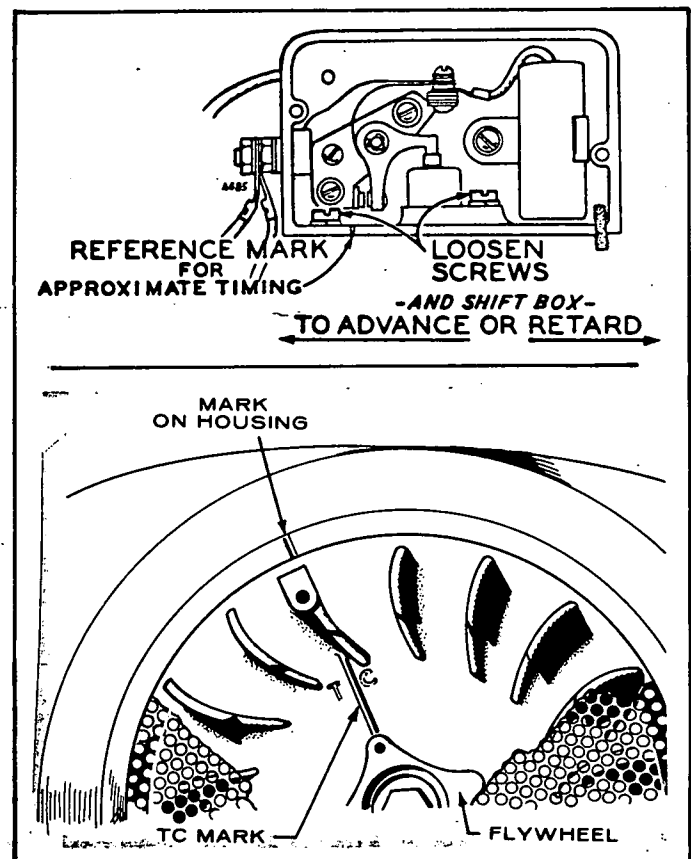


FIGURE 9 IGNITION ADJUSTMENT

Ignition points should break contact just when the timing mark aligns with the flywheel timing mark. Final timing is corrected by properly shifting the breaker point box on its mounting and using a timing light. If specified timing cannot be obtained by shifting the box position, check to be sure timing marks on gears are aligned.

IGNITION TIMING

The engine is equipped with an automotive type battery ignition system. Both spark plugs fire simultaneously, thus the need for a distributor is eliminated. Spark advance is fixed at 21°BTC (before top center) which should be maintained for best performance. Ignition timing should be checked periodically, especially after breaker point replacement.

Should retiming be required, follow the procedure outlined below:

1. Remove the breaker box cover. If the timing is very far off, attain an approximate setting by loosening the mounting screws and shift the breaker box (and spacer if used) to align the reference marks on the crankcase and breaker box (or spacer).
2. Crank the engine over slowly in the direction of crankshaft rotation (clockwise) until the "TC" mark on the flywheel and the "TC" mark on the blower housing are exactly in line. The flywheel timing mark is on the flywheel behind the chaff screen. If there is difficulty in locating the TC mark, the use of a flashlight beam through the screen should aid in locating the marks.
3. Adjust the ignition breaker point gap width to .020" at full separation.
4. Turn the flywheel to the left (counterclockwise) against crankshaft rotation, until the flywheel timing mark is about two inches past the 21° mark on the blower housing.
5. Turn the flywheel slowly to the right (clockwise) and note whether the ignition points just separate when the mark on the flywheel aligns with the mark on the housing. If the marks align as the points break, timing is

correct. If they do not, loosen the breaker box mounting screws and shift the whole breaker box assembly slightly toward the #1 cylinder (nearest the gear cover) to retard the timing (points not breaking soon enough). Shift toward the #2 cylinder to advance the timing (points breaking too soon). Tighten the breaker box screws securely after making an adjustment.

To accurately check the time at which the spark occurs, use an automotive timing light when the engine is running. Connect the timing light according to its manufacturers instructions. Either spark plug can be used as they fire simultaneously.

To accurately check the time at which the spark occurs when not running the engine, connect a continuity test lamp set across the ignition breaker points. Touch one test prod to the breaker box terminal to which the coil lead is connected and touch the other test prod to a good ground on the engine. Turn the crankshaft against rotation (counterclockwise) until the points close. Then slowly turn the crankshaft with rotation (clockwise). The lamp should go out just as the points break which is the time at which ignition occurs.

6. Install the breaker box cover.

BATTERY CHARGE CIRCUIT

The battery charge voltage is regulated by solid state rectifiers within the regulator. Since there is no adjustment in the regulator, maintenance is minimal with the exception of keeping the heat sink fins clean at all times.

CAUTION This engine uses a 12 volt, negative ground system. Do not reverse battery connections as damage may occur to the charging system.

GOVERNOR ADJUSTMENT

Engine speed is governor-controlled and preset at the factory. Proper governor adjustment is one of the most important factors in maintaining the power and speed desired from the engine.

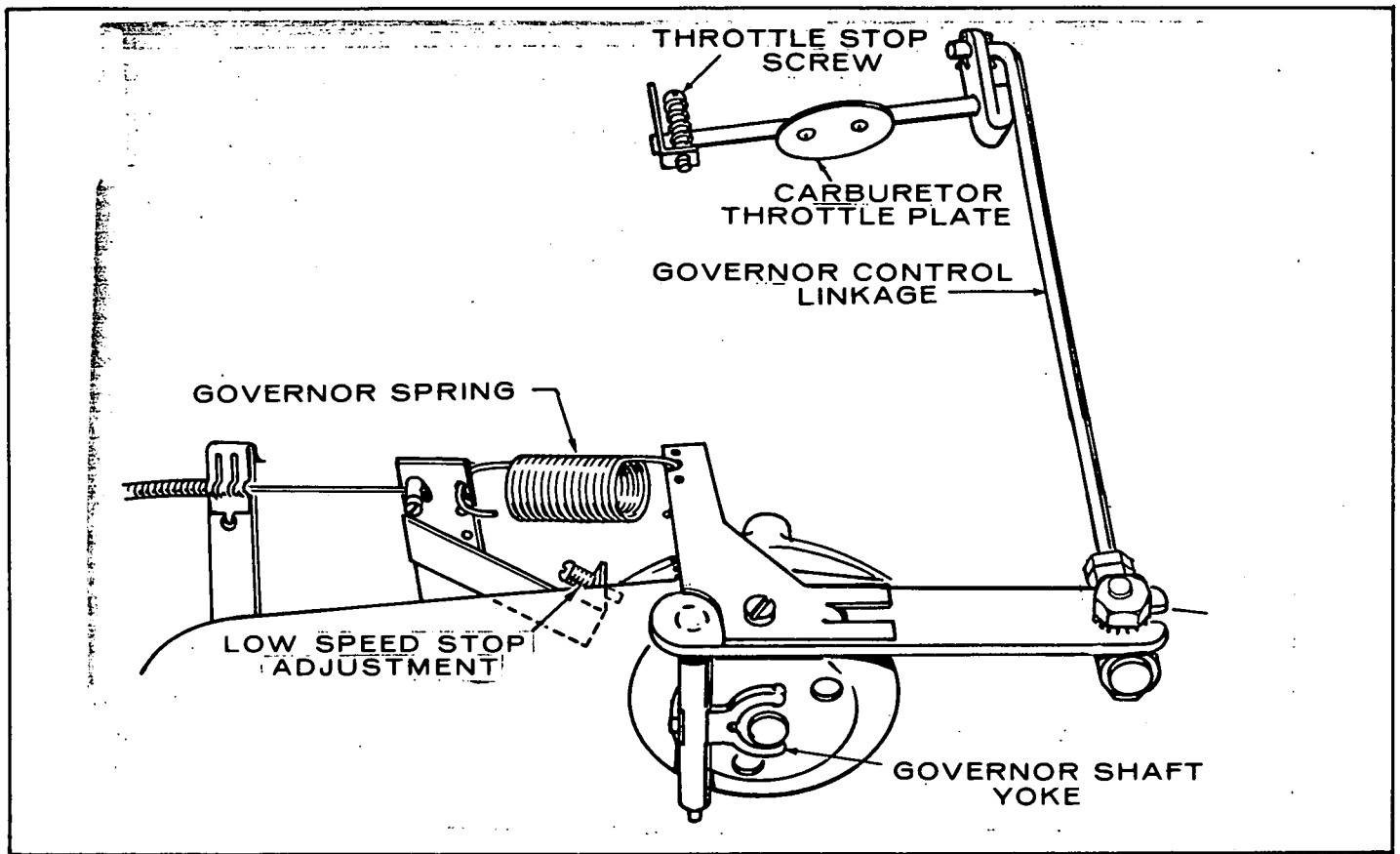


FIGURE 10 GOVERNOR ADJUSTMENT

These engines are adapted for use where a wide range of speed settings is desired. Engine speed is controlled at any given point between minimum and maximum by simply shifting the throttle lever on the dash panel until the desired speed is reached.

The design of the variable speed governor gives an automatic decrease in sensitivity when the speed is increased and the result is good stability at all speeds.

Before making governor adjustment, run the engine about 15 minutes to reach normal operating temperature. If the engine is being run with the throttle wide open, either the governor is not properly adjusted or the engine is overloaded. It is difficult to determine if after long usage the governor spring has become fatigued. If, after properly making all other adjustments, the regulation is still erratic, install a new spring (Figure 10).

The governor control spring is factory set in the center hole of the governor control shaft bracket. To increase the sensitivi-

ty, move the spring loop into the hole nearest the control shaft. To decrease the sensitivity, move the spring outward. After the sensitivity has been set, adjust the low speed with the adjustment screw on the control wire bracket.

A reliable instrument for checking engine speed is required for accurate governor adjustment. Engine speed can be checked with a tachometer.

Check the governor arm, linkage, throttle shaft, and lever for binding condition or excessive slack and wear at connecting points. A binding condition at any point will cause the governor to act slowly and regulation will be poor. Excessive looseness will cause a hunting condition and regulation will be erratic. Work the arm back and forth several times by hand while the engine is idle. If either of these conditions exist, find out where the trouble lies and adjust or replace parts as needed.