

**250<sup>cc</sup> ENGINE**



**OWNER'S MANUAL**

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## FOREWORD

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This engine is a precision machine that has been manufactured by proper machining and assembling of quality materials. Correct use of the engine will give high output irrespective of its very small size.

It is imperative that the engine be protected from improper use. Incorrect usage of the engine will rapidly wear engine components causing subsequent engine failure. The engine should be operated correctly according to this Engine Owner's Manual and additional Service Bulletins to be issued as supplement to this manual whenever required. No matter how properly it may be used, the engine is gradually degraded as time goes by because of parts wear.

To maintain proper functioning of the engine, the user should make it a rule to perform daily and periodic inspections and to carry out necessary maintenance work, readjustments, defective parts replacement and repair.

Since the output power of this engine is 20Hp, improper use of the power may injure or damage the operator, people or things in the vicinity.

Since the manufacturer cannot compel a user to follow every detail of the engine operation instructions, the user is fully responsible for preventing damage and keeping people and things safe.

For the engine to exhibit and maintain its normal functions and to operate safely, the operator must have full knowledge on engine installation (design and procedure). The user should observe the notes for installation given in this manual and study other points to take the best action.

## SUMMARY OF SPECIFICATIONS

MODEL	250cc ENGINE-1	250cc ENGINE-2
Type	Upright Single Cylinder 2 Stroke, Free Air Cooled Engine	
Displacement (cu. in.)	14.78 (242cc)	
Bore x Stroke (in.)	2.835 x 2.343 (72 x 59.5 mm)	
Compression Ratio	Nominal 10.6 : 1 Effective 6.5 : 1	
Max. Permissible Output (with test standard muffler, but Muffler is not supplied.)	20 Hp/6,500 RPM	
Exhaust Gas Temp. Limit (EGT)	1,022°F (550°C)	
Cylinder Head Temp. Limit (CHT)	446°F (230°C)	
Rotating Direction	Counter Clockwise viewed from output shaft side	
Lubrication System	Using fuel mixed with lubricating oil	
Mixture Ratio	Gasoline 25: Lubricant Oil 1 (During Break-in) Gas. 15 : Lub. Oil 1	
Lubricant Oil Spec.	High Quality 2 Stroke Oil	
Gasoline Spec.	Automotive Regular Gasoline	
Carburetor	Diaphragm Type with Pump	
Ignition System	Breaker Point Type Flywheel Magnetq and Ignition Coil	
Ignition Timing		
Retarded	6° B.T.D.C.	
Advanced (Automatic)	21° B.T.D.C.	
Spark Plug	Champion N3	
Starting System	with Recoil Starter	without Recoil Starter
Net Weight (without Muffler)	38.6 lbs (17.5kg)	35.3 lbs (16kg)
Dimensions (L x W x H)		
(inch)	11.81 x 11.57 x 14.84	9.76 x 11.54 x 14.80
(mm)	(300 x 294 x 377)	(248 x 293 x 376)

Remarks: The Above specifications are subject to change without notice.

## BREAK-IN OF NEW ENGINE

The break-in of the engine appreciably affects the life of the engine. Accordingly, it is strongly recommended the following precautions be followed for the first 10 hours of a new engine operation.

1. During break-in operation of a new engine, a mixed fuel of gasoline (15 parts) and oil (1 part) shall be used. However, the use of oil rich fuel will cause increased contamination and accumulation of carbon deposit in spark plug, cylinder, piston and muffler, therefore check these parts removing spark plug after 10 hours break-in operation, and clean them if necessary.
2. Wide open throttle with no load, abrupt acceleration of the engine and abrupt closing of the throttle from high engine revolutions should be strictly avoided.
3. High speed running at full-throttle operation of the engine should be held to a minimum.

## PRE-STARTING PROCEDURES

1. Check engine nuts and bolts for tightness, if necessary especially of cylinder head bolts and retighten when necessary.
2. See that the fuel tank is filled to the proper level specified by OEM.
3. Use lubricant oil mixed fuel. (25 parts of automotive regular gasoline and 1 (one) part of high quality two cycle engine oil are mixed.)
4. Check spark plug for carbon deposit and clean, if necessary. Set gap properly.
5. Check for proper compression by cranking the engine slowly with the starter rope or hand cranking and also for abnormal sound.

(Tightening Torque Table)

Fastener location	Thread size	Q'ty	Tightening torque	
Spark Plug (& Blind Plug)	14mm	2	217 in-lbs.	250 kg-cm
Cylinder Head Bolts	8	6	234	270
Cylinder Base Nuts	10	4	304	350
Crankcase Through Bolts	8	6	156	180
Flywheel Magneto Nut	16	1	694	800
(Not otherwise specified)	8		156	180
	6		78	90
	5		43	50

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## STARTING

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1. If the engine is cold, fully close choke and hold throttle valve halfway open or quarter open. Ignition switch "ON". (See Page 17. 7. Ignition System.)
2. Pull the recoil starter rope swiftly<sup>(1)</sup>, but do not pull out until the rope length end<sup>(2)</sup>, and allow rope to return slowly not to grip-off the rope handle<sup>(3)</sup>. Follow OEM instruction for starting of recoilless engine.
3. When engine has started, slowly open the choke to the fully opened position, then close throttle to idle engine. For at least two minutes idle engine to warm up, then operate engine to work.
4. If engine is warm, start it with choke fully open or half open.
5. If not start and exhaust gasoline fumes are strong, open choke and throttle, close fuel valve and turn off ignition, then pull rope swiftly to turn crankshaft several times. Thereafter start engine as usual.

### [Cautions]

- (1) Slow pulling of rope might cause a reverse turning start of engine and this kick back of rope would hurt the operator's wrist.
- (2) Hard pulling out at the end of rope gives a heavy shock load to the recoil starter and operator's hand.
- (3) When the rope is released with hand off and allowed to be rewinded into pulley freely, it will be entangled disturbing subsequent operation.

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## CAUTIONS DURING OPERATION

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1. During operation, do not allow the temperature of the spark plug seat and the engine exhaust gas (hereinafter called CHT and EGT) to rise beyond the following limits:

CHT : 446°F (230°C)

EGT : 1,022°F (550°C)

### [Caution]

Operating at temperature beyond the above limits may lead to rapid carbonation of petroleum, causing piston ring sticking, scratching, subsequent burning of the cylinder surface and finally to engine stopping.

Needless to say, the temperature gauges for CHT and EGT measurement shall be accurate.

2. Do not touch the hot engine before or shortly after its stopping, to avoid the risk of burn.
3. To prevent shock hazard, never touch the area surrounding the spark plug or the wiring while the engine is operating.
4. If the engine output shaft or the connected load is exposed without any protective cover, do not allow operators to stand in front of the rotating surface, let alone to touch it. For carburetor adjustment, see [Caution] in CARBURETOR ADJUSTMENT 5 (a).
5. Never operate the engine if it has a fuel leak, less the leak catch fire.
6. The exhaust gas contains CO. Avoid operation in poorly ventilated place.

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## STOPPING

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When stopping engine after use, return the throttle lever and operate the engine at a low speed for a while to allow CHT lowered, then close fuel valve and ignition switch "OFF".

### [Caution]

Do not stop the engine at a high speed revolution abruptly, which gives engine excessive load, unless it has to be stopped for emergency.

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## MAJOR ADJUSTMENT

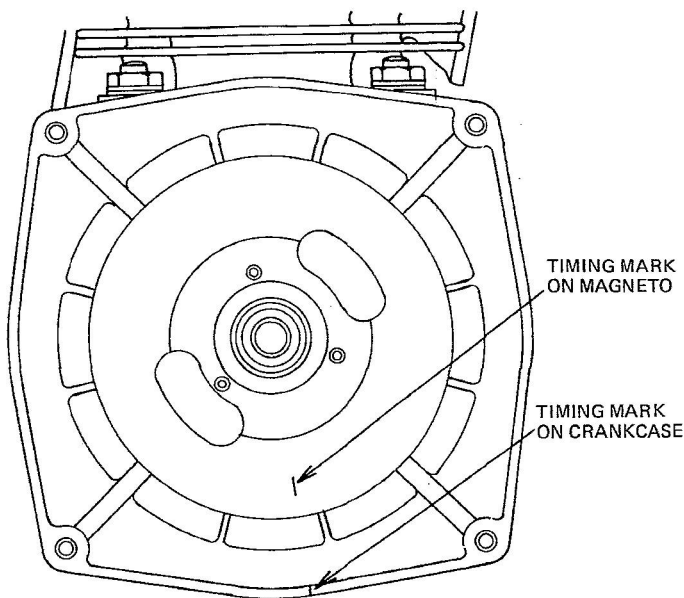
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### I. IGNITION TIMING AND POINT GAP ADJUSTMENT

Proceed as follows:

1. Inspect visually through the access opening in the magneto the contact point for damage. If damaged, clean with fine sandpaper (No. 500/600) and dry cloth. If badly damaged, remove the flywheel from the magneto. Remove point and clean with oil stone. Take care to polish point so that they make flat.
2. After the inspection on the point has been completed, rotate crankshaft until the point is brought to position of widest opening, and check the point gap. There should be a 0.3 to 0.4mm (.012" to .016") gap.  
If the point gap is incorrect, adjust the point gap as follows:  
Loosen the screws that secure the contact breaker. Set gap to 0.3mm-0.4mm (.012"- .016"). Tighten the screws.
3. After the proper point gap has been obtained, as above, check the ignition timing. Rotate the magneto until timing mark on crankcase aligned with the timing mark on the magneto. (Fig. 1)  
Check the contact point. When the timing marks are aligned, the point should be starting to open.
4. After the correct ignition timing is obtained, reverse removal procedures to assemble all parts in place.
5. Consult the dealer and ask for assistance if it is difficult to perform any of the above adjustments.

Fig. 1



## II. CARBURETOR ADJUSTMENT

### 1. Installation and Inspection of the Carburetor

The engine is shipped with the carburetor removed. First, install the carburetor on the cylinder. Use a gasket to prevent air leaks and tighten bolts firmly to the specified torque. Air leaks in this portion may cause mal-function at low speeds. The carburetor is equipped with a pump. Connect a hose to its nipple to transmit pulsating power from the engine crankcase. Make sure there is no leak in the connection; a leak in the hose joint may reduce the pump deliver to an inadequately small rate.

### 2. Carburetor Setting

The function of a carburetor is to supply an engine with fuel mixed with air in a ratio suitable for the required engine operating conditions. However, some points need adjusting and setting according to the nature and condition of the load. See (Fig. 2) for the carburetor adjustment devices. The *pilot screw* is located by the stamped letter "L" on the throttle lever side of the air intake and the metering needle is on the other side by the stamped letter "H".

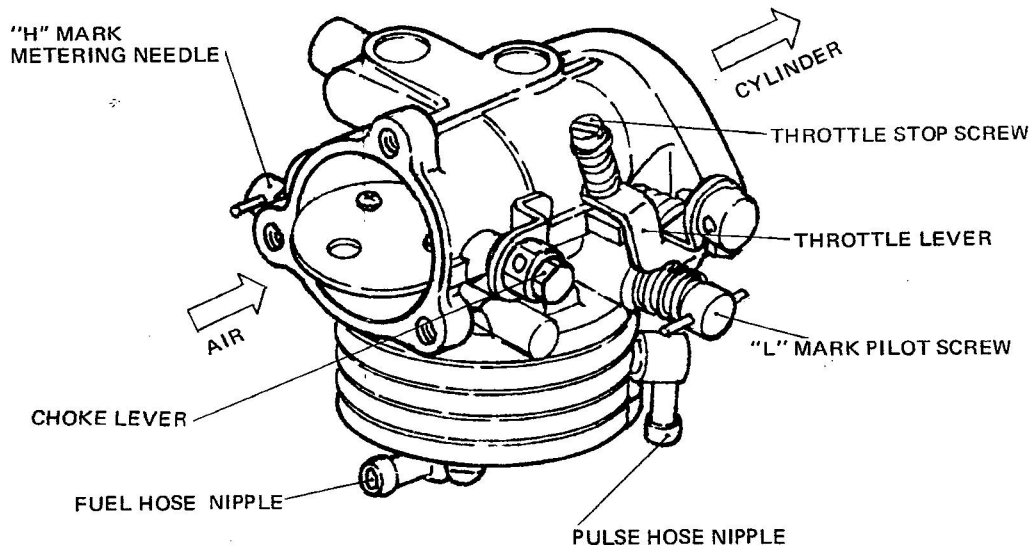
The metering needle and the pilot screw each have a needle valve at their ends. The needle valve is adjusted by a screw and closed up when the screw has been rotated clockwise until its end comes into contact with the valve-seat. This fully closed position provides the reference point for adjustment and setting of the metering needle and the pilot screw.

#### [Caution]

When fully closing the needle valve, do not apply excessive torque to the screw in its final turn. The screw and the seat easily yield to excessive force applied thereto and become maladjusted. So, tighten the screw to the torque just enough to stop the low-pressure flow of fuel.

One more adjustment means is the throttle stop screw on the throttle lever, with which to maintain the throttle valve at a position slightly opened from the fully closed position.

Fig. 2





### 3. Standard Load and Standard Setting

The standard engine load is equivalent to the fan load (a load absorbing Hp which increases in proportion to the cube of the engine rpm's) absorbing the standard engine output (20Hp/6500rpm). The carburetor setting for standard load operation under weather conditions close to the standard conditions of atmospheric pressure = 760 mmHg (29.92 inch Hg), ambient temperature = 15°C (60°F), and humidity = 0% is determined through a severe performance test and *usually does not need to be altered*. See 4 (a) and 5 (a) for Standard Setting.

However, if the load deviates from the expected standard load, if conditions change because of any part replacement, or if a change in weather conditions or in altitude brings about a significant change in air density, readjust the machine carefully in accordance with the following instructions.

Particularly, idling adjustment is required for each small change in the load. And if the standard fan load is affected by the travel of the vehicle, small readjustment may be required so as to fit the fan load to practical conditions after an approximate adjustment is made under the stationary condition of zero traveling speed.

### 4. Idling Adjustment

- (a) Loosen the pilot screw (near stamped with L) by  $1/2$  ( $\pm 1/8$ ) revolution, the standard loosen revolution, from the fully closed position and warm up the engine sufficiently by idling.
- (b) Open the throttle valve slightly from its fully closed position by the throttle stop screw so that the idling speed is a little higher than the standard idling speed of 1,200 ( $\pm 100$ ) RPM.  
With a load such as a centrifugal clutch, the engine becomes unloaded and unstable at low speed rotation. In this case, set the speed at the idling speed specified by OEM.
- (c) Obtain the highest engine speed by tightening or loosening the pilot screw, and then loosen the pilot screw by  $1/8$  revolution from the highest speed position.
- (d) Close the throttle valve by loosening the throttle stop screw until the idling speed decreases to the standard idling speed (or the OEM specified speed).

### 5. Main Fuel Flow Adjustment

- (a) Open the Metering Needle (near stamped with H) by  $3/4$  ( $\pm 1/8$ ) screw revolution, the standard loosening turn, from the fully closed position and warm up the engine sufficiently by idling.

#### [Caution]

The metering needle (near stamped with H) is located on the power take-off shaft side. If the load connected to the power take-off shaft is exposed, the operator would run the risk of touching the rotating load by adjusting the metering needle while the engine is running. In that case, be sure to stop the engine for metering needle adjustments. If adjustment during engine operation is inevitable, the user is responsible for providing appropriate protective devices to secure safety under such conditions.

- (b) Open the throttle valve fully for a short time, and in the meantime, observe engine speed, EGT and CHT. Before CHT exceeds the limit of 230°C, return the throttle lever to the idling position. Unless, at this moment, the speed ranges from 5,000 up to 6,500 and EGT is lower than the limit of 550°C, the engine may be overloaded or insufficiently loaded, and/or have some trouble. Clean up the cause and correct it.
- (c) If the speed is lower than 6,000 RPM and the EGT lower than 550°C, close the metering needle by 1/8 screw revolution and repeat the procedure stated in (b).

**[Note]**

If the metering needle is screwed home, the fuel flow decreases, fuel mixture becomes lean, EGT and CHT rise, and the engine load increases shortening the engine service life, while the power output and speed of the engine increase. If, on the contrary, the metering needle is opened by turning the screw, EGT and CHT drop, and the engine load is decreased, while the rotation speed is decreased. To obtain the best balance between engine performance and durability, position the metering needle within a reasonable range not so far from the standard position. Then, as soon as the cause for those temporary adjustments has been removed and normal conditions have been restored, return the metering needle to the standard position.

- (d) If, as a result, the EGT and CHT are within their respective limits and the rotation speed increases, screw home the metering needle by 1/8 revolution or less at a time and check the effect according to the instructions in (b). Repeat these procedures until the speed is increased to 6,000 RPM.
- (e) If the rotation speed exceeds 6,000 RPM, open the metering needle by 1/8 screw revolution at a time and check the effect according to the instruction in (b). Repeat these procedures until the speed is decreased to 6,000 RPM.

- (f) After the idling adjustment, accelerate the engine from idling to full open throttle and see whether the engine exhibits signs of trouble such as a hesitation in speed increase in relation to the shift of the throttle lever. If so, open the metering needle slightly and check the effect according to the test procedure described in (b) and (f).
- (g) If the engine fan load is used to drive a vehicle (for example, on a propeller boat), the engine fan itself is moved, and thus load is decreased and rotation speed is increased from the speed adjusted under the stationary conditions of traveling speed zero. In this case, so long as EGT and CHT are maintained within their respective limits, engine speed rise is permitted up to 6,500 RPM.

**[Caution]**

Be sure to observe changes in the values of EGT and CHT, when opening the metering needle by loosening the screw more or less than the standard 3/4 ( $\pm 1/8$ ) turn range from the fully closed position. The tachometer and the thermometers for EGT and CHT measurement to be used in the above adjustment procedures should be accurate.

## PERIODIC CHECK AND MAINTENANCE

Careful attention to following information on periodic check and maintenance will add much to performance economy and long life at your engine.

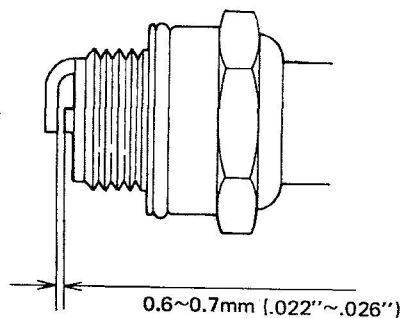
**1. Daily check after engine operation:**

- (a) Remove all foreign matter from exterior of engine.
- (b) Check for fuel leak.
- (c) Check bolts and nuts for tightened.

**2. Every 25 hour check:**

Remove spark plug, clean and check for proper gap. There should be a 0.6 to 0.7mm (.022" to .026") gap. (Fig. 3).

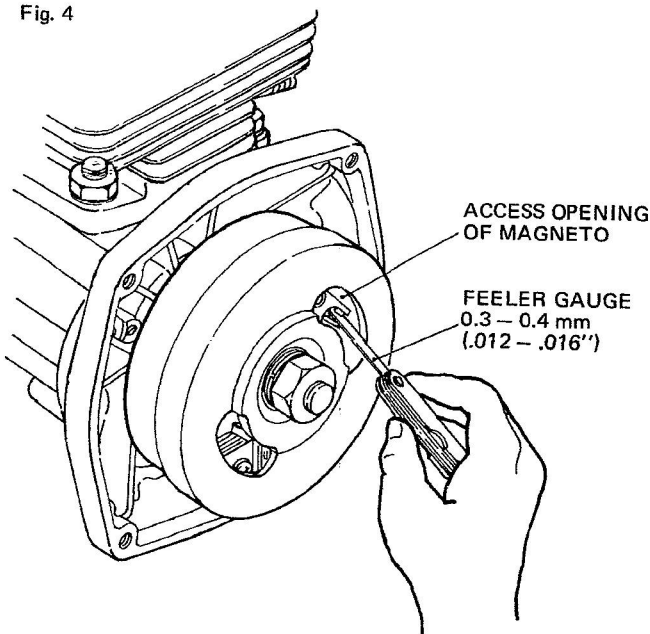
Fig. 3



**3. Every 50 hour check:**

Clean magneto point and adjust point gap. There should be a 0.3 to 0.4mm (.012" to .016") gap. (Fig. 4).

Fig. 4



**4. Every 100 hour check:**

- (a) Remove cylinder head and cylinder, and clean carbon residue from combustion chamber and piston ring grooves. Check exhaust port and muffler and remove carbon, if accumulated.
- (b) Check the needle bearing at small end of con-rod and replace it if it is excessively overheated or flaked.

### CHECK ITEMS EACH CHECK HOUR

The following item with  mark should be checked every check hour.

	Daily check	Every 25 hour check	Every 50 hour check	Every 75 hour check	Every 100 hour check
1. Remove all foreign matters from exterior of engine.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Check for fuel leakage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Check bolts and nuts for tightened.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Check for proper spark plug gap.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Check for proper point gap.			<input type="checkbox"/>		<input type="checkbox"/>
6. Check cylinder head and cylinder and clean carbon from combustion chamber.					<input type="checkbox"/>
7. Check for needle bearing at small end of con-rod.					<input type="checkbox"/>

## TROUBLE SHOOTING

### 1. TROUBLE (A): Difficult of starting

Symptom		Cause	Remedy
Spark plug does not issue sparks	Spark plug is faulty.	<ol style="list-style-type: none"> <li>1. Wet electrode of spark plug</li> <li>2. Carbon sticking to electrode of spark plug.</li> <li>3. Poor insulation caused by breakdown of insulating materials of spark plug.</li> <li>4. Too narrow or too wide gap between electrodes of spark gap.</li> <li>5. Burning of electrode of spark plug.</li> </ol>	<ol style="list-style-type: none"> <li>1. Wipe and dry</li> <li>2. Clean</li> <li>3. Replace</li> <li>4. Adjust to 0.022" thru 0.026"</li> <li>5. Replace</li> </ol>
	Magneto is faulty.	<ol style="list-style-type: none"> <li>1. Inferior gap between contact points.</li> <li>2. Damaged or dirty contact points.</li> <li>3. Breakage of covering of spark plug wire.</li> <li>4. Short circuit of contact body.</li> <li>5. Looseness of contact body.</li> <li>6. Puncture of condenser.</li> <li>7. Over rich mixture.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust to 0.012" thru 0.016"</li> <li>2. Clean the point</li> <li>3. Exchange with new wire or repair.</li> <li>4. Repair the shorted part.</li> <li>5. Tighten</li> <li>6. Replace</li> <li>7. Adjust carburetor</li> </ol>

### 2. TROUBLE (B): Shortage of Power

Symptom	Cause	Remedy
Compression is Good and Fuel flows	<ol style="list-style-type: none"> <li>1. Too rich mixture</li> <li>2. Use of inferior fuel.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust carburetor</li> <li>2. Exchange with quality fuel.</li> </ol>
Fuel flows but Compression is Not Good.	<ol style="list-style-type: none"> <li>1. Worn-out cylinder, piston and piston ring.</li> <li>2. Gas leak of cylinder head.</li> </ol>	<ol style="list-style-type: none"> <li>1. Exchange with new parts.</li> <li>2. Repair</li> </ol>
Fuel does not flow into Carburetor	<ol style="list-style-type: none"> <li>1. No fuel</li> <li>2. Clogging of filter</li> <li>3. Looseness of Induction pipe, Carburetor, etc.</li> </ol>	<ol style="list-style-type: none"> <li>1. Supply</li> <li>2. Clean</li> <li>3. Tighten</li> </ol>
Compression is Good	<ol style="list-style-type: none"> <li>1. Air comes in from joints of fuel pipe.</li> <li>2. Air comes in from fixing part of induction pipe and carburetor.</li> <li>3. Mixture of water into fuel.</li> <li>4. Clogging of muffler with carbon.</li> <li>5. Wrong ignition timing.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten perfectly.</li> <li>2. Exchange with new packings, or tighten well.</li> <li>3. Exchange with quality fuel. Drain water.</li> <li>4. Disassemble and clean</li> <li>5. Adjust</li> </ol>

### 3. TROUBLE (C): Overheat and Knocking

Symptom	Cause	Remedy
(Over Heating)  EGT and CHT exceed Limit.	<ol style="list-style-type: none"> <li>1. Too lean fuel mixture.</li> <li>2. Advanced ignition timing by point wear.</li> <li>3. Clogging of cylinder fin, etc. with dust and particles.</li> <li>4. Lack of cooling.</li> <li>5. Gas leak caused by loosen spark plug.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust carburetor</li> <li>2. Adjust point gap -0.016".</li> <li>3. Clean</li> <li>4. Provide more cooling.</li> <li>5. Tighten or replace.</li> </ol>
(Knocking)  Tendency of Unusual Noise.	<ol style="list-style-type: none"> <li>1. Advanced ignition timing</li> <li>2. Inferiority of fuel (Octane # &amp; etc.)</li> <li>3. Carbon built up in cylinder head.</li> <li>4. Lean mixture</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the point gap 0.012"—0.016".</li> <li>2. Exchange with quality fuel</li> <li>3. Clean</li> <li>4. Adjust carburetor</li> </ol>

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## STORAGE FOR A LONG PERIOD

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1. When the engine is to be stored for a length of time, clean each part well and coat oil on each metal portion.
2. Remove fuel hose and pull recoil starter rope swiftly several times to scavenge fuel from engine, or tilt to drain fuel, if necessary.
3. Pour a spoonful of lubricating oil (SAE #30) into cylinder through spark plug opening and rotate crankshaft to move piston up and down several times, then close spark plug hole and pull recoil rope until a compression is felt where an angle before top dead center (where the breaker point is closed).
4. Cover carburetor air inlet, fuel inlet, cylinder exhaust port and spark plug hole. Cover all engine to protect against dirt and dust and store in a place with a lower humidity.
5. When pack the whole within an airtight envelope, use activated decalcant bags enclosed.

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## NOTE FOR INSTALLATION

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The installation method (design and construction) has a considerable effect not only on engine performance and durability but also on inspection and maintenance. Read the following instructions carefully and consider the design thoroughly for secure engine installation.

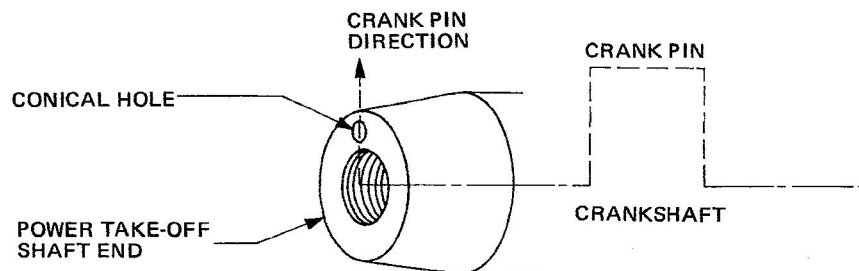
### 1. Engine and Ignition Coil Installation

- (1) Install the engine on a vehicle with the crankshaft horizontal and the cylinder in the upright position, and apply a 1/2 in. - 13 UNC thread screw to each of the four threaded holes in the base of the crankcase. Safety for only the above specified installation method has been proved by the manufacturer and the user would be responsible for safety with other installation methods.
- (2) Install the ignition coil on the vehicle side near the engine within reach of the manufacturer supplied lead wire.
- (3) The reciprocating piston movement and the pulsating torque of the power take-off shaft cause engine vibration, applying vibrating forces

to the engine installing portions. To protect the vehicle and the engine from such vibrating forces, those portions should be provided with some suitable vibration damping devices.

- (4) The engine installing portions should have a sufficient safety factor to withstand any possible forces or shocks that the engine may receive from the vehicle movement, such as accelerations or sudden stops.
- ### 2. Power Take-off Coupling
- (1) The power take-off shaft has a taper of 1 in 10 and has no key groove. When connecting it to the tapered hole of the load, see that the two surfaces come into contact with each other over more than 75% of the whole tapered area. Apply a heat-treated steel bolt (for example, an AN8 bolt) to the 1/2in-20 UNF threaded hole at the end of the shaft and tighten it firmly. Retighten the bolt after running in and check it during the 25-hour inspection.
  - (2) The conical hole at the shaft end indicates the crank pin direction (Fig. 5).

Fig. 5



- (2) Install lead wire and an ignition switch on the vehicle as illustrated in chain lines in the wiring diagram. The pin and receptacle type electrical connector terminals are SAE J928a type I Nominal Dia. 0.156inch Standard parts. (ref. JIS D5403, CA104)
- (3) Provide a good electrical connection (conduction) between the switch terminal and the lead wire, which is to be connected to the brown magneto wire (the grounding side), and insulate them completely to avoid a short-circuit.
- (4) Provide a good electrical connection (conduction) between the switch terminal and the lead wire, which is to be connected to the black magneto wire (the exciting coil side), and insulate them completely to avoid a ground short-circuit.
- (5) Use a switch which can open and close the circuit surely for the ignition system.

**[Note]**

Unless all above stated requirements are met, there may be unexpected ignition stops or weakening, or unexpected engine starts, or an intended emergency stop may no happen.

- (6) Clamp the wiring properly to prevent vibrating.
- (7) The ignition system has no radio interference prevention.

## 8. Exhaust System

- (1) Maximum performance of a two-stroke engine is closely related to the size and configuration of the connected exhaust duct. In actual practice, the exhaust system can be designed as desired according to the environment where the engine is used. Therefore, no standard exhaust duct is offered by the manufacturer.
- (2) Exhaust ducts are available from the OEM for attachment to individual engines with optional design to attain maximum engine performance in the operating environment. Be sure to use the exhaust duct supplied from the OEM.

**[Caution]**

Generally speaking, maximum engine output increases as the length of the connecting tubular portion, cylindrical or enlarged end of the exhaust duct increases and the gas flow resistance of the muffler decreases. In other words, the use of an exhaust duct of larger size with less gas flow resistance will increase the engine power output above the standard performance (20Hp/6,500 RPM), but greater load is applied to engine elements. More specifically, EGT and CHT will exceed 550°C (1,022°F) and 230° (446°F), respectively, possibly causing an engine failure.

**Do not overload engine!!**

Always use an exhaust duct of the proper size from OEM.

### **WARNING**

THE MANUFACTURER OF THIS ENGINE DOES NOT WARRANT THAT THE ENGINE IS FIT FOR USE IN [AIRCRAFT] [AIRCRAFT ASSEMBLED FROM A KIT OR OTHERWISE]. NO WARRANTY, REPRESENTATION, GUARANTEE, EITHER EXPRESS OR IMPLIED ARE MADE FOR THIS ENGINE BY THE MANUFACTURER, INCLUDING MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR USE.