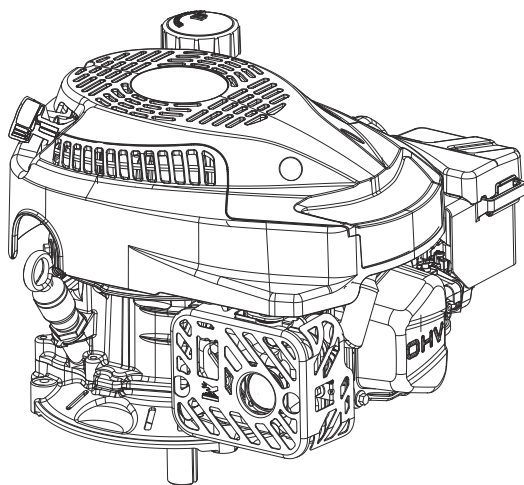




125-S 145-S 170-S Gasoline Engine (Vertical Shaft) Owner's Manual



Chongqing Rato Technology Co.,Ltd.

PREFACE

Thank you for choosing a small general gasoline engine of our company.

The manual gives information with respect to operation and maintenance of the 125-S 145-S 170-S general gasoline engine, and be sure to read it carefully first before operation. Only operate as the manual tells, can insure user's safety and get the best results of the engine operation. If a problem should arise or if you have any questions about your gasoline engine, consult an authorized our company servicing dealer.


The vertical shaft gasoline engine products in this Owner's Manual are mainly used for the lawn mower and mini tiller.

All information and diagrams of this manual are in accordance with the newest products at the publishing time. If revision and other change of the information described in this manual are a little different from the actual status, our company will explain it. Our company reserves the right to make change at any time without notice and without incurring any obligation. No part of this publication may be reproduced without written permission.

This manual should be considered a permanent part of the generator and should remain with the generator if resold.

SAFETY MESSAGES

Your safety and the safety of others are very important. We have provided important safety messages in this manual and on the gasoline engine. Please read these messages carefully.

A safety message alerts you to potential hazards that could hurt you or others. Each safety message is preceded by a safety alert symbol  and one of three words: DANGER, WARNING, or CAUTION. These mean:



You WILL be KILLED or SERIOUSLY HURT if you don't follow instructions.



You CAN be HURT if you don't follow instructions.



Your gasoline engine or other property could be damaged if you don't follow instructions.

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I. SAFETY PRECAUTIONS

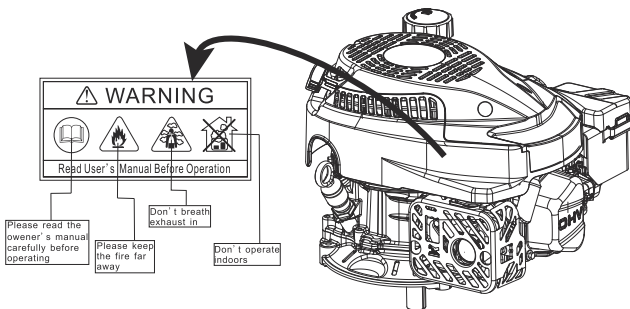
⚠ DANGER Indicate a possibility of invalid warranty and personal or equipment damage if instructions are not followed.

Please pay special attention to the following:

1. Strictly set the engine according to the regulated power on the owner's manual. Do not overload, overrun the engine or run it with low load and at low speed in a long time.
2. Use specified grade of gasoline. The fuel should be fully deposited and filtrated before use. Keep clean the fuel filler, change the oil periodically.
3. Periodically check the installation, connection and the degree of tightness of the fixed bolt. Tighten it if necessary.
4. Periodically clean the element of the air cleaner, change it when necessary.
5. The engine is air-cooled, so clean the radiator, wind cover and fan in time in order to make the engine cool normally.
6. The operator should be familiar with the working principle and structure of the gasoline engine, knowing how to make an emergent stop and the operation of all controlling parts. Any one without training is forbidden to operate the engine. Keep periodical maintenance. Solve problems in time. Do not run the engine in spite of malfunction.
7. Running the engine in a well-ventilated place, keep it at least one meter away from building walls or other equipments, keep away from inflammables such as gasoline, matches and so on to avoid possibility of fire.
8. Refuel in a well-ventilated area with the engine stopped, and in places

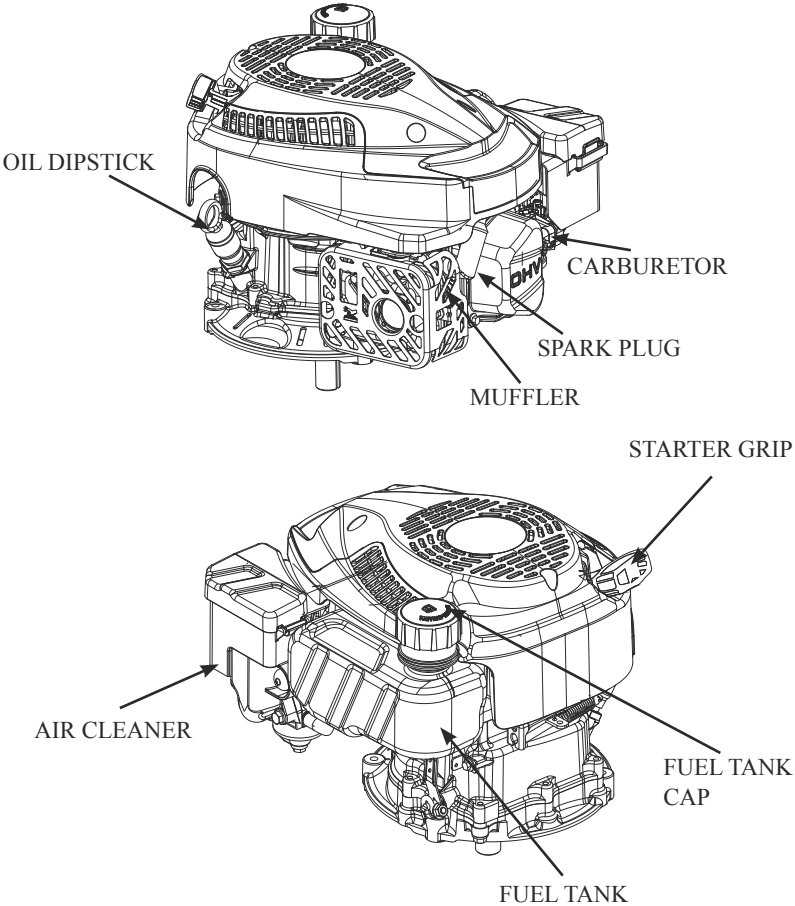
- refueling or storing gasoline, no smoking and any flames or sparks.
9. Refuel the fuel tank not too full so as to avoid fuel's spilling out. If there is spilled fuel around, be sure to clean it thoroughly before starting.
 10. Do not run the engine in airtight or ill-ventilated places.
 11. The exhaust muffler is very hot during running the engine even after the engine stops. Never touch it, or you may get burns. Transport or store the engine with it cooling down entirely.
 12. Inclination of gasoline engine which indicates the included angle between crankcase cover and level is less than 26° during its running. If that is over 26° , oil will flow into combustion chamber and burn with white smoke, which will cause gasoline engine has lower power and higher emission.
 13. Safe warning label:

Please carefully read warning label before operating. Our company will not assume any responsibility for person hurt, or equipment damaged caused by disregarding this warning label.

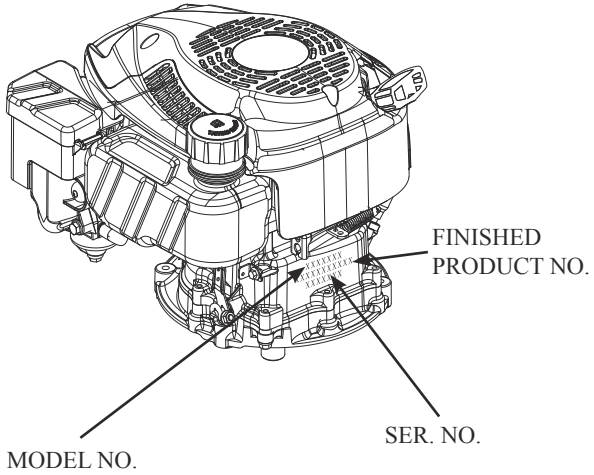


II. PARTS DESCRIPTION

1. Feature



2. Model No.



III. PRE-OPERATE INSPECTION

1. Engine Oil

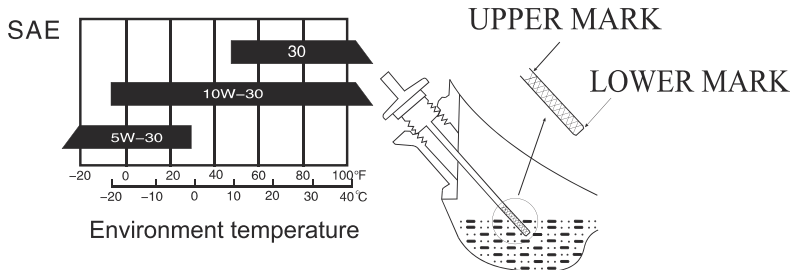
Engine oil is a key factor in deciding the engine's performance. Do not apply engine oil with additives or 2-stroke gasoline engine oil, because they haven't enough lubrication, and may shorten the engines service life.

⚠ WARNING Check the engine with it stopped on a level ground.

Engine oil capacity: 125-S/145-S/170-S 0.3L~0.5L

Engine oil recommended: SAE15W-40

As viscosity varies with regions and temperatures, SJ class oil is recommended.

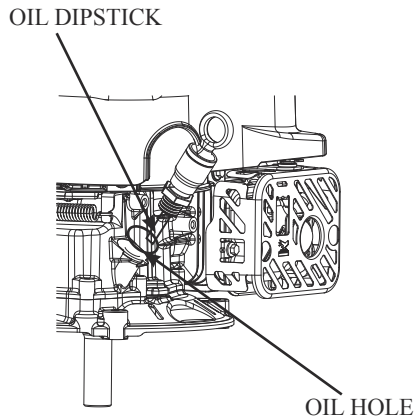


Check method:

- 1) Remove the dipstick and clean it.
- 2) Reinsert the dipstick into the oil Filling hole without screwing it, and check oil level.
- 3) If the oil level is too low, add the recommended engine oil up to the oil upper level.
- 4) Reinstall the dipstick.

Engine oil change:

Used engine oil may cause skin cancer if repeatedly left in contact with the skin for prolonged periods. It is still advisable to thoroughly wash your hands with soap and water as soon as possible after handling used oil. Please dispose of used engine oil in a manner that is compatible with the environment.

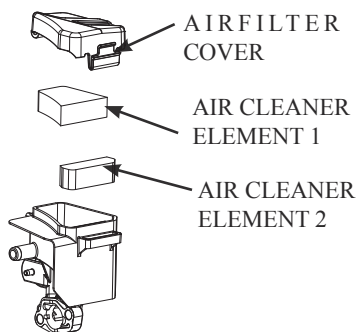


- 1) Screw the oil dipstick out.
- 2) Tilt the gasoline engine and let the oil overflowing out from the hole.

2. Air Cleaner



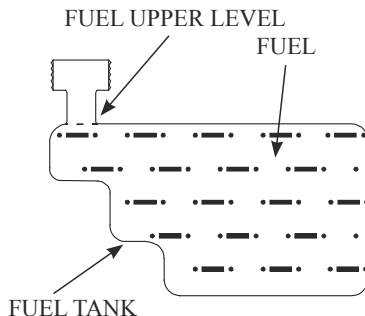
Never run the engine without an air cleaner, or severe wear of the engine may be resulted in.



- 1) Remove the air cleaner housing.
- 2) Remove foam element or paper element, paying attention to prevent dust and foreign matter entering into air cleaner.
- 3) Check, clean or replace damaged air cleaner parts.
- 4) Reinstall the air cleaner parts back.

3. Fuel Check

- 1) Remove the fuel tank cap and check fuel level.
- 2) If the level is too low, refuel the tank. Remember adding fuel not over the fuel upper level.



! WARNING

- 1. Gasoline is extremely flammable and is explosive under certain conditions.**
- 2. Refueling in a well-ventilation area with the engine stopped. Do not smoke and allow flames or sparks in the area where gasoline is stored or where the fuel tank is refueled.**
- 3. Do not overfill the fuel tank (there should be no fuel in the filling neck). After refueling, make sure the fuel tank cap is set back securely.**
- 4. Be careful not to spill fuel when refueling. Spilled fuel or fuel vapor may ignite. If any fuel is spilled, make sure the area is dry before starting the engine.**
- 5. Avoid repeated or prolonged contact with skin or breathing of fuel vapor. Keep out of reach of children.**

Fuel tank capacity: 0.8L

Only use unleaded gasoline and recommend gasoline grade 90#over.

Unleaded gasoline can reduce gasoline engine carbon deposit and prolong the exhaust system service life.

Never use contaminated gasoline or mixed gasoline with oil. Don't allow the dust, foreign matter or water entering into fuel tank.

! CAUTION

Fuel may damage the oil paint and plastic. Be careful not to spill fuel when refueling. Any damage due to oil spilling is not within valid warranty.

"Light knocking" or "spark exploding" sound can be hear when the engine overloading. It is normal. Do not worry about that.

If " knocking" or "spark exploding" sound occur at a steady speed under normal load, change brand of gasoline; if such phenomena still happen, consult your dealer for help, otherwise the engine may be damaged.

When the engine is running, continuously "Knocking" or "spark exploding" sound occurring will damage engine.

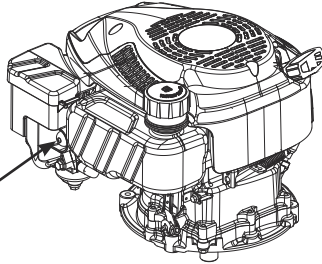
"Knocking" or "spark exploding" sound from misusing will not be within the valid warranty.

IV. STARTING THE ENGINE

1. Starting method:

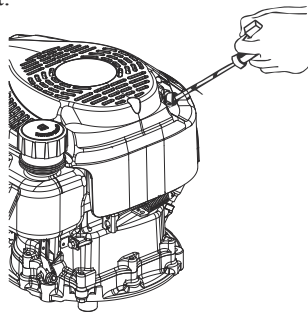
Starting primer bulb operation is important operation of the starting engine. For cold starting, slightly press the primer bulb one to three times in succession and quickly pull the recoil cable grip. For hot starting, directly pull the starter cable grip.

PRESS PRIMER
BULB ONE TO
THREE TIMES.
THEN, PULL
CABLE GRIP.
START ENGINE



2. STARTING THE ENGINE

Pull the starter grip lightly until resistance is felt, then, briskly pull to syncline upper 30 degree out.

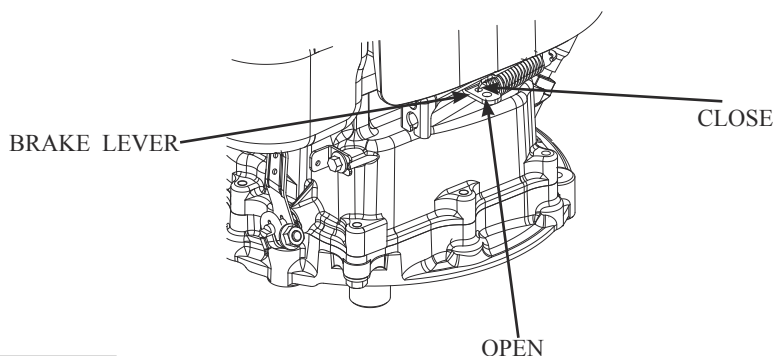


NOTICE

Don't allow the starter grip to snap back against the engine. Return it gently to prevent damage to the starter

V. STOPPING THE ENGINE

If the engine is controlled by brake lever, only turn the brake lever to “CLOSE” position for stopping engine



Sudden stopping at high speed under heavy load is forbidden, otherwise damage will result.

VI. EXHAUST CONTROL SYSTEM SERVICE

With the engine running, carbon monoxide, oxide of nitrogen and hydrocarbon will produce, and in certain conditions, oxide of nitrogen and hydrocarbon will react chemically each other to make smoke while carbon monoxide is toxic, so exhaust control of them is very important. The company decreases the exhaust emissions by introducing poor-fuel carburetors and other devices into the engine to solve the problem.

To keep the exhaust of your engine with in the standard exhaust emission, pay attention to the following:

1. Maintenance

Maintain the engine periodically in accordance with the maintenance schedule in the manual. The maintenance schedule is made out on the base of normal use in normal conditions, if using under heavy load, dusty or wet circumstances or in high temperature, service of the engine should be done more often.

2. Replacing Parts

To ensure the best quality and reliability, use only new genuine our company parts or their equivalents for repair and replacement.

3. Tampering and Altering

Tampering with or altering the emission control system may increase emissions beyond the legal limit. Among those acts that constitute tampering are:

- 1) Removal or alteration of any part of the intake, fuel, or exhaust systems.

- 2) Altering or defeating the governor linkage or speed-adjusting mechanism to cause the engine to operate outside its design parameters.

4. Problems Affecting Exhaust Emissions

- 1) Difficult starting or difficult stopping.
- 2) Unstable idle speed.
- 3) Give off black smoke or consume too much fuel.
- 4) Poor ignition sparks or sparks returned.
- 5) Too early ignition.

VII. MAINTENANCE

1. Maintenance Schedule

In order to keep the engine well, must periodically service and adjust the engine. Service shall be as following schedule.

MAINTENANCE SCHEDULE

| Items | | Frequency | | Thereafter, every 3 months or 30hrs of operation | Every 6 months or 50 hrs of operation | Every year or 100 hrs of operation |
|--------------------------|------------------------------|-------------------------------------|---|---|--|---|
| | | Every time | First month or 10 hrs of operation | | | |
| Engine oil | Check- Refill | ✓ | | | | |
| | Change | | ✓ | ✓ | | |
| Air filter element | Check | ✓ | | | | |
| | Clean | | | ✓ | | |
| | Change | | | | ✓ | |
| Spark plug | Clean- adjust | | | | ✓* | |
| Spark arrester | Clean | | | | ✓ | |
| Valve clearance** | Check- adjust | | | | | ✓ |
| Fuel hose | Check | Every 2 years (change if necessary) | | | | |
| Cylinder head, Piston | Remove carbon deposits | Every 125 hours | | | | |

* These items should be serviced by company authorized dealer, unless you have the proper tools and mechanically proficient.



Service more frequently when used in dusty areas.

2. Maintenance Method

1) Replacement of engine oil

Drain the engine oil rapidly and completely out when the engine is hot.

- (1) Remove the oil dipstick, drain plug and washer and drain engine oil thoroughly. Reinstall the drain plug and screw in it securely.
- (2) Fill the recommended engine oil and check oil level with oil dipstick.
- (3) Reinstall the oil dipstick and tighten it securely.

CAUTION

Please dispose of used engine oil and the oil containers in a manner that is compatible with the environment. We suggest you take used oil in a sealed container to your local recycling center or service station for reclamation. Do not throw it in the trash or pour it on the ground or down a drain.

2) Maintenance of air cleaner

A dirty or damaged air cleaner will allow dust entering into the engine, causing rapid engine wear. So, service the air cleaner in time.

- . Remove the bolt and air cleaner cover. Be careful to prevent dirt and debris from falling into the air cleaner base opening.
- . Remove the foam element or paper element.
- . Check, clean or replace the damaged air cleaner parts.
- . Reinstall the air cleaner parts, then bolt and screw down it.

⚠ WARNING

Never clean the air cleaner element with gasoline or low flash-point detergents, or explosion may happen.

⚠ CAUTION

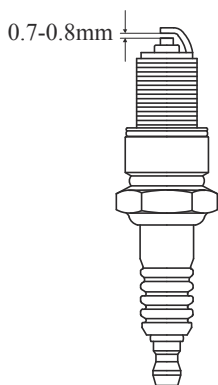
Clean the foam filter with soapy water, blow the paper element with compressed air or lightly tap off dust and never dry to brush .

⚠ WARNING

- (1) Gasoline is extremely flammable and explosive in certain condition. Keep cigarette, sparks and fire away.
- (2) After reinstalling the deposit cup, don't start the engine until the area around is dry.

3) Maintenance of spark plug

In order to ensure the engine normal running, gap of the spark plug must be correct and no deposit around the spark plug.



Spark recommended using plug model
TORCH: F5TC/F5RTC

⚠ WARNING

Don't touch the muffler to avoid burn in the engine running or just stopping a moment.

- (1) Remove the spark plug cap.
- (2) Clear away dirt around the spark plug base.
- (3) Dismantle the spark plug with a spark plug wrench.
- (4) Visually check the spark plug. Clean with a steel brush. If the insulator is damaged, replace the spark plug instead.
- (5) Measure the spark plug clearance with a feeler. The clearance should be 0.7~0.8mm. If adjustment is necessary, bend the side electrode carefully.
- (6) To avoid cross-threading, first, screw in spark plug by hand, then tighten with a spark plug wrench to compress the gasket.
- (7) If a new spark plug is used, please replace it with same spark plug model as can as possible, and more twist 1/2 turns after compressing the gasket.
- (8) If reinstalling the used spark plug, just more twist 1/8-1/4 turns.

 **CAUTION**

- (1) The spark plug must be tightened securely, or it may become very hot to damage the engine.**
- (2) Only use recommended spark plug or the equivalent. Incorrect heat range of the spark plug may damage the engine.**

VIII. TRANSPORT AND STORAGE

CAUTION

Do not incline the engine so as to avoid fuel's spill in transporting. Spilled fuel or fuel vapor may ignite to cause fire. If suspension for a long time, storage should be as following:

1. The storage area is dry and free of dust.
2. Completely drain fuel out of the fuel tank and carburetor.

WARNING

Fuel is extremely flammable and explosive under certain conditions. Keep smoke, fire and spark away from operating site.

3. Replace engine oil.
4. Remove the spark plug. Fill about a spoon of fresh engine oil onto the cylinder. Crank the engine up to distribute engine oil evenly. Reinstall the spark plug.
5. Lightly pull the recoil starter rope until the resistance is felt. Close the choke to protect the dust from entering in.
6. Cover the engine to protect dust entering.

IX. TROUBLESHOOTING

1. Start Engine Difficultly (By using recoil starter)

| TROUBLE | | CAUSE | | REMEDY | |
|--------------------------------|---|--|--|--|--|
| Normal cylinder compression | Normal spark plug spark | Something wrong with the fuel system. | Fuel supply is not smooth or no fuel supply. | There is no enough fuel in fuel tank and fuel cock is closed. | Fill fuel, open fuel cock. |
| | | | | Air vent in the fuel filler cap is clogged | Dredge air vent. |
| | | | | Fuel cock is clogged | Clean first and then dredge |
| | | | | Improper or clogged main oil flow hole. | Readjust or clean, blow to get through. |
| | | | | Needle valve is not closed properly or start hole is clogged. | Dismantle needle valve and repair, clean, blow to get through. |
| | | | Float is damaged or sticking. | Repair float | |
| | Normal spark plug is normal. | | Fuel is too filthy or deteriorated | Replace | |
| | | | There is water in fuel. | Replace | |
| | | | Too much fuel in engine | Drain extra fuel, dry up spark plug electrodes. | |
| | | | Wrong fuel brand | Select proper fuel brand corresponding with the requirements. | |
| | | | | | |
| Normal fuel supply system. | Normal high-tension line spark. | Spark plug is in bad conditions | Too much carbon deposit and dirt around electrodes. | Clear away. | |
| | | | Electrodes are burn damaged seriously or insulators damaged. | Replace spark plug. | |
| | | | Improper electrodes gap. | Adjust to proper value. | |
| | High-tension line no spark | | Normal spark plug | High -tension line is damaged. | Replace |
| | | | | Ignition coil is damaged. | Replace |
| | Magneto loses magnetism. | Replace | | | |
| | Wrong gap between ignition coil and flywheel | Adjust gap between ignition and flywheel | | | |
| | | | | | |
| Abnormal cylinder compression. | Normal fuel supply system. High-tension coil run out Normal ignition system. | | Piston ring is worn to or even over its wear limit | Replace | |
| | | | Piston ring is broken. | Replace | |
| | | | Piston ring is sticking. | Clear up carbon fouling. | |
| | | | Spark plug is not installed tighten or without a gasket. | Tighten with a gasket in. | |
| | | | Air leakage between cylinder block and cylinder head. | Check cylinder gasket, and the flatness of the surface by which cylinder block contacting with cylinder head | |
| | | | | Tighten cylinder head bolts in stipulated order to stipulated torque. | |
| | | | Air leakage in the valves | Check valve. Clearance and tightness, repair if necessary. | |

If still can't starting, have the engine to our authorized dealer for repairing.

! WARNING

- **When testing the spark plug, never hold the high- voltage wire of the spark plug with wet hand.**
- **Make sure there is no spilled fuel outside the engine and that the spark plug isn't dipped with fuel.**
- **To prevent fire, keep sparks far away from the spark plug mounting hole.**

2. Gasoling Engine Power Output Insufficiency

| TROUBLE | CAUSE | | REMEDY |
|---|--------------------|---|----------------------------------|
| When increasing throttle, speed increase slow or even decrease and stop running | Fuel supply system | Air in fuel line or fuel line clogged | Exhaust air or dredge fuel line |
| | | Main oil flow hole is not adjusted properly | Readjust |
| | | In carburetor, needle valve hole and main oil flow hole clogged. | Clean and blow to get through |
| | | Fuel cock is clogged up. | Clean, replace damaged part |
| | | Too much carbon deposit in combusting chamber. | Clear away |
| | | Too much carbon fouling in muffler and exhaust pipe. | Clear away |
| | | Air cleaner is clogged up. | Clean air cleaner filter element |
| | | Intake pipe is leaking | Repair or replace |
| | Poor compression | Piston or cylinder or piston ring is worn | Replace the worn |
| | | Air leakage from the surface by which cylinder block contacting with cylinder head. | Replace cylinder gasket |
| | | Too big or too small valve clearance. | Readjust |
| | | Valve tightness is poor. | Repair |

3. Gasoline Engine Gannot Running Unsmoothly

| TROUBLE | CAUSE | REMEDY |
|---------------------|--|---------------------------------|
| Knocking sound | Piston, cylinder or piston ring is worn excessively. | Replace the worn |
| | Piston pin and piston pin hole are worn excessively. | Replace piston or piston pin |
| | Tie rod small head is worn excessively. | Replace tie rod |
| | Roller bearing for crankshaft main shaft is worn. | Replace roller bearing |
| Abnormal combustion | Engine is too hot | Shoot trouble |
| | Too much carbon deposit in combustion chamber | Clear away |
| | Improper gasoline brand or low gasoline quality | Replace with qualified gasoline |
| Spark lacking | There is water in float chamber | Clean |
| | improper spark plug electrodes clearance | Adjust |
| | Something wrong with induced coil, and so on | Check and replace damaged parts |

4. Stop Suddenly When Running

| TROUBLE | CAUSE | REMEDY | |
|-----------------------------|--------------------|---|--|
| Stop suddenly when running. | Fuel supply system | Fuel is finished | Refill fuel |
| | | Carburetor is clogged | Check fuel line and dredge |
| | | Float chamber is leaking | Repair |
| | | Needle valve is stucked. | Dismantle float chamber and eliminate it |
| | Ignition system | Spark plug is punctured, or short-circuited by carbon deposit | Replace spark plug |
| | | Side electrode of spark plug is dropped out | Replace spark plug |
| | | High-tension wire is dropped out | Weld on |
| | | Ignition coil is punctured or short-circuited | Replace ignition coil |
| | | Parking wire is located on engine body | Find out meeting and insulate |
| | The other | Cylinder is seriously scored and valve dropped out | Repair or replace damaged parts |

5. Gasoline Engine Is Overheat

| TROUBLE | CAUSE | REMEDY |
|-----------------------------|--|--------------------------|
| Gasoline engine is overheat | Oil insufficient or wrong oil ratio in the gasoline | Refill engine oil |
| | Exhaust pipe blocked up | Clean exhaust pipe |
| | Shroud leaking | Repair damaged part |
| | Cooling fins blocked by foreign matter | Clear cooling fins |
| | Connection rod deformation to make piston and cylinder bushing side wear | Replace connection rod |
| | Cylinder or piston or piston ring is worn to make hunting between cylinder and crankcase | Replace the worn parts |
| | Improper adjustment of engine governor to produce speed high. | Readjust engine governor |
| | Crankshaft main bearing burnt out | Replace main bearing |



The gasoline engine should be kept about 80 ~ 110℃ temperature around the outlet of the shroud. If the temperature is too high, it will indicate the gasoline engine overheating.

6. Abnormal Noise Exist When Engine Running

| TROUBLE | CAUSE | REMEDY |
|---|---|-----------------------------------|
| Beating sound | Piston, piston ring or cylinder is worn | Replace the worn part |
| | Connection rod or piston pin and piston pin hole are worn | Replace the worn part |
| | Crankshaft main neck is worn | Replace bearing |
| | Piston ring is broken | Replace piston ring |
| Metal beating sound when abnormal combustion occurs | Too much carbon deposit in combustion chamber | Clear away carbon deposit |
| | Improper fuel brand | Replace fuel |
| | Engine is overheat | Find a cause and eliminate it |
| The other | Improper valve clearance | Readjust valve clearance properly |
| | Fly wheel is not connected with crankshaft tightly | Connect tightly |

X. SPECIFICATIONS

1. Main Specifcaton

| Model | 125-S | 145-S | 170-S |
|---|--|------------------|------------------|
| items | | | |
| L×W×H(not including crankshaft output terminal)(mm) | 325×305×250 | 325×305×250 | 325×305×250 |
| Dry Weight(kg) | 7.5 | 7.5 | 7.5 |
| Engine Type | single cylinder horizontal,4-stroke, (OHV) | | |
| Displacement(ml) | 127.1 | 144.3 | 170.1 |
| Bore × Stroke(mm) | 61×43.5 | 65×43.5 | 70×44.2 |
| Theoretical Maximum Power | 2.0kw/3600r/min | 2.5kw/3600r/min | 2.8kw/3600r/min |
| Maximum Torque | 6.8N•m/2500r/min | 7.8N•m/2500r/min | 8.8N•m/2500r/min |
| Min Fuel Consumption | 450g/kw•h | 450g/kw•h | 420g/kw•h |
| Cooling System | | Forced air | |
| Ignition System | capacitance discharge type | | |
| PTO Shaft Rotation | vertical shaft output | | |

Data Adjustment

| Items | Technical data | Service |
|-------------------------------|---|---|
| Spark plug clearance | 0.7-0.8mm | To see P19 |
| Valve clearance (cold engine) | intake: 0.05~0.1mm exhaust: 0.05~0.1mm | Serviced by our company authorized dealer |

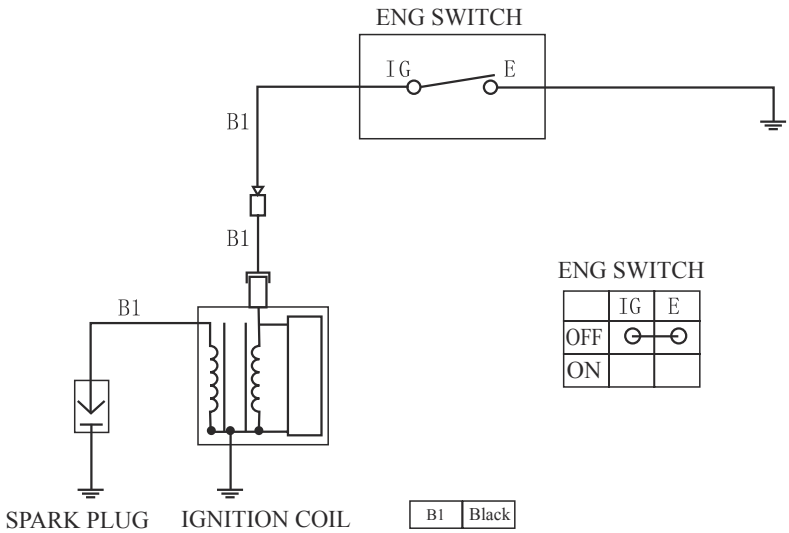
CAUTION

Specification is subject to change without notice. For further information, please contact our company dealer.

2. Torque Of Important Bolts

| Items | Specifications | Torque valve | |
|-------------------------------|----------------|--------------|--------|
| | | N · m | kg · m |
| Connection-rod bolt | M5×26 | 8 | 0.8 |
| Flywheel nut | M14×1.5 | 60 | 6.0 |
| Crankcase cover bolt | M6×30 | 10 | 1.0 |
| Valve clearance adjusting nut | M5 | 8 | 0.8 |

XI. ELECTRIC DIAGRAM



XII. EASY WORN PARTS AND ACCESSORIES LIST

Easy worn parts list:

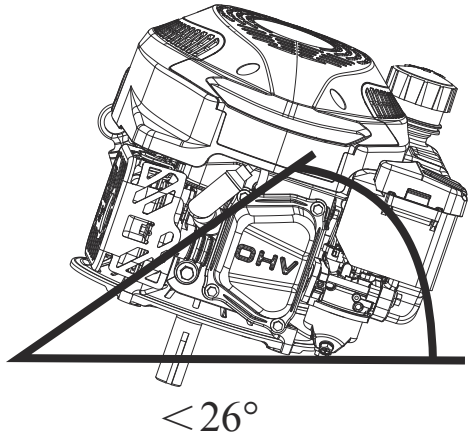
| |
|------------------------------|
| Cylinder head cover gasket |
| Cylinder head gasket |
| Spark plug |
| Oil sealing |
| Breath groove gasket |
| Recoil starter |
| Carburetor gasket |
| Carburetor insulation gasket |
| Insulation plate gasket |
| Exhaust vent gasket |

Accessories list :

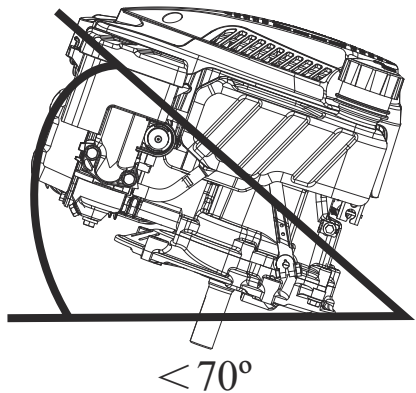
| |
|-----------|
| Socket |
| Force bar |

SAFETY PRECAUTIONS:

1. Engine alone or assembled on the ultimate machine, when it tilts towards the air filter, the angle should not be beyond 26° , or oil would enter the air filter, which affects operation (engine tilts towards the muffler, the angle should be within 90° ; towards the cylinder head, the angle should be within 26°).



2. Engine alone or assembled on ultimate machine, the angle it tilting backwards should not be beyond 70° , or it would accelerate gasoline leakage and affect operation.



3. As power for tillers, this engine can only be used for tillers using in garden tilling.

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