

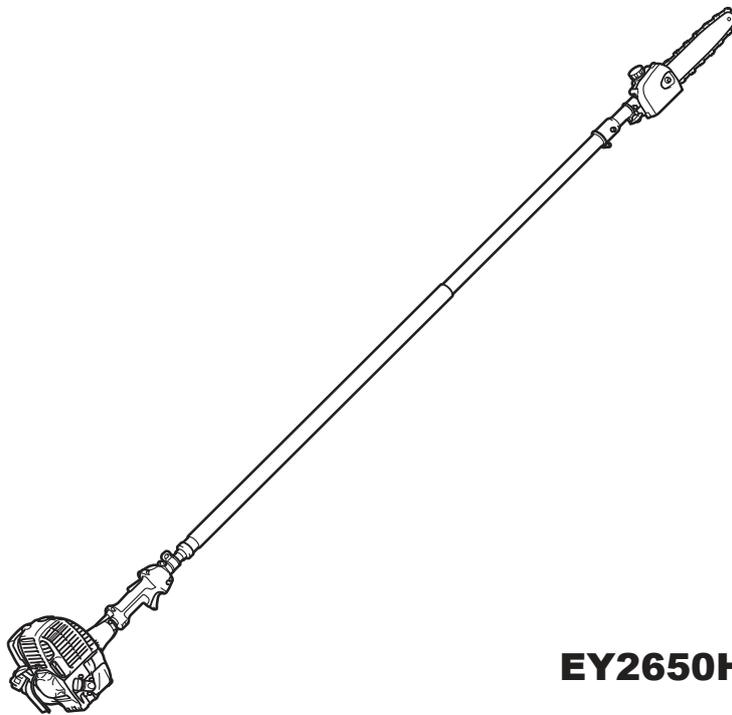


Telescopic Petrol Pole Saw

EY2650H

INSTRUCTION MANUAL

Original Instruction Manual



EY2650H

⚠ WARNING:

Read this instruction manual carefully before putting the Telescopic Petrol Pole Saw into operation and strictly observe the safety regulations!
Save instruction manual for future reference.

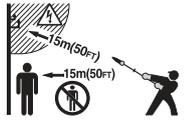
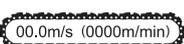
Thank you very much for purchasing the MAKITA Telescopic Petrol Pole Saw. We are pleased to recommend to you the MAKITA Telescopic Petrol Pole Saw which is the result of a long development programme and many years of knowledge and experience. Please read this booklet which refers in detail to the various points that will demonstrate its outstanding performance. This will assist you to obtain the best possible result from your MAKITA Telescopic Petrol Pole Saw.



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SYMBOLS

You will note the following symbols when reading the instructions manual.

	Read instruction manual and follow the warnings and safety precautions!		No open flame!
	Take particular care and attention!		Chain oil.
	Wear protective helmet, eye and ear protection.		Keep the area of operation clear of all persons and pets!
	Protective gloves must be worn!		Fuel (Gasoline)
	Wear sturdy boots with non-slip soles.		Engine-manual start
	Keep a distance of at least 15 m (50 ft) between the equipment and bystanders and/or electrical line (including any branches contacting it). Risk of electrical shock and/or personal injury.		First Aid
	Never hold the pole saw at an angle of more than 60°.		ON/START
	Chain speed.		OFF/STOP
	Forbidden!		Emergency stop
	No smoking!		

SAFETY INSTRUCTIONS

General instructions

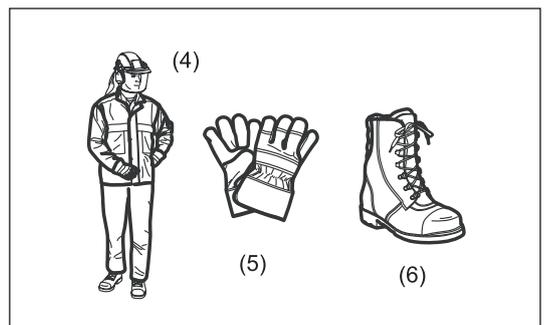
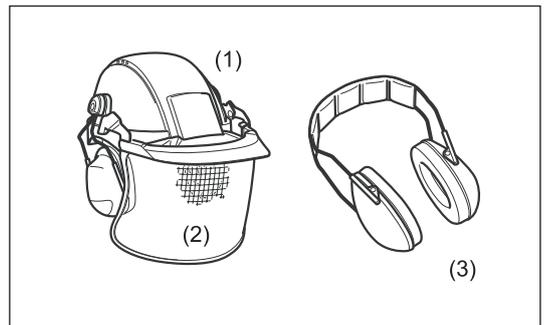
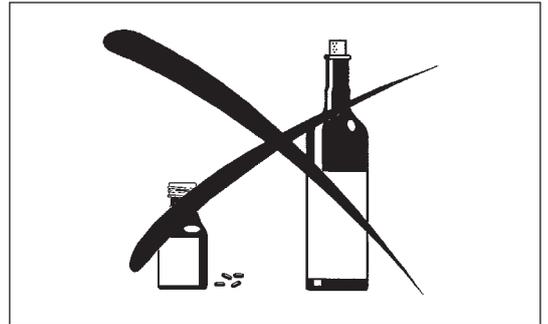
- To ensure correct operation, user has to read this instruction manual to make himself familiar with the handling of the equipment. Users insufficiently informed will risk danger to themselves as well as others due to improper handling.
- It is recommended only to lend the equipment to people who have proven to be experienced with equipment. Always hand over the instruction manual.
- First users should ask the dealer for basic instructions to familiarize oneself with the handling of an engine powered cutter.
- Children and young persons aged under 18 years must not be allowed to operate the equipment. Persons over the age of 16 years may however use the device for the purpose of being trained only whilst under supervision of a qualified trainer.
- Use the equipment with the utmost care and attention.
- Operate the equipment only if you are in good physical condition. Perform all work calmly and carefully. The user has to accept liability for others.
- Never use the equipment after consumption of alcohol or drugs, or if feeling tired or ill.
- Never attempt to modify the equipment.
- National regulations may restrict of the use of the equipment. Follow the regulations about handling of pole saws and chain saws in your country.

Intended use of the machine

This equipment is designed only for the purpose of pruning branches and limbs less than 15 cm in diameter. Never use the equipment for the other purpose. Abusing the equipment may cause serious injury.

Personal protective equipment

- The clothing worn should be functional and appropriate, i.e. it should be tight-fitting but not cause hindrance. Do not wear either jewelry or clothing which could become entangled with bushes or shrubs.
- In order to avoid either head-, eye-, hand- or foot injuries as well as to protect your hearing the following protective equipment and protective clothing must be used during operation.
- Always wear a helmet where there is a risk of falling objects. The protective helmet (1) is to be checked at regular intervals for damage and is to be replaced at the latest after 5 years. Use only approved protective helmets.
- The visor (2) of the helmet (or alternatively goggles) protects the face from flying debris and stones. During operation always wear goggles, or a visor to prevent eye injuries.
- Wear adequate noise protection equipment to avoid hearing impairment (ear muffs (3), ear plugs etc.).
- The work overalls (4) protect against flying stones and debris. We strongly recommend that the user wears work overalls.
- Special gloves (5) made of thick leather are part of the prescribed equipment and must always be worn during operation.
- When using the equipment, always wear sturdy shoes (6) with a non-slip sole. This protects against injuries and ensures a good footing.
- When handling the saw chain or adjusting the chain tension, wear protective gloves. Saw chain can cut bare hands severely.



Work area safety

- **⚠ Danger:** Keep the pole saw at least 15 m away from electric lines and communication cables (including any branches contacting them). Touching or approaching high-voltage lines with the pole saw can result in death or serious injury. Watch power lines and electrical fences around the work area before starting operation.
- Operate the pole saw under good visibility and daylight conditions only. Do not operate the pole saw in darkness or fog.
- Start and operate the engine only outdoors in a well ventilated area. Operation in a confined or poorly ventilated area can result in death due to suffocation or carbon monoxide poisoning.
- During operation, never stand on an unstable or slippery surface or a steep slope. During the cold season, beware of ice and snow and always ensure secure footing.
- During operation, keep bystanders or animals at least 15 m away from the pole saw. Stop the engine as soon as someone approaches.
- Before operation, examine the work area for wire fences, walls, or other solid objects. They can damage the saw chain.
- **⚠ WARNING:** Use of this product can create dust containing chemicals which may cause respiratory or other illnesses. Some examples of these chemicals are compounds found in pesticides, insecticides, fertilizers and herbicides. Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: work in a well ventilated area, and work with approved safety equipment, such as those dust masks that are specially designed to filter out microscopic particles.

Putting into operation

- Before assembling or adjusting the equipment, switch off the engine and remove the spark plug cap.
- Before starting the engine, inspect the equipment for damages, loose screws/nuts or improper assembly. Sharpen blunt saw chain. If the saw chain is bent or damaged, replace it. Check all control levers and switches for easy action. Clean and dry the handles.
- Never attempt to start the engine if the equipment is damaged or not fully assembled. Otherwise serious injury may result.
- Adjust the chain tension properly. Refill the chain oil, if necessary.

Starting up the engine

- Please make sure that there are no children or other people, also pay attention to any animals in the working vicinity.
- Wear the personal protective equipment before starting the engine.
- Make sure that the attachment is attached in place, the control lever for easy action and check for proper functioning of the lock-off lever.
- If the saw chain moves at idle, stop the engine and adjust the idle speed down. Ask authorized service center for adjustment if in doubt. Check for clean and dry handles and test the function of the start/stop switch.

Start the engine only in accordance with the instructions.

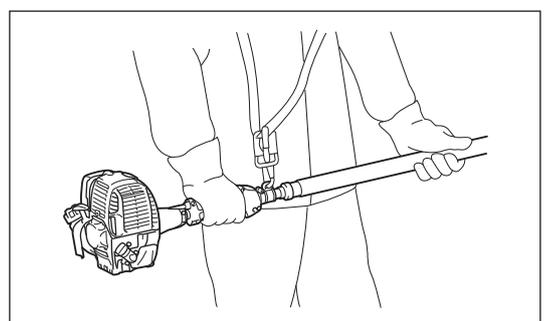
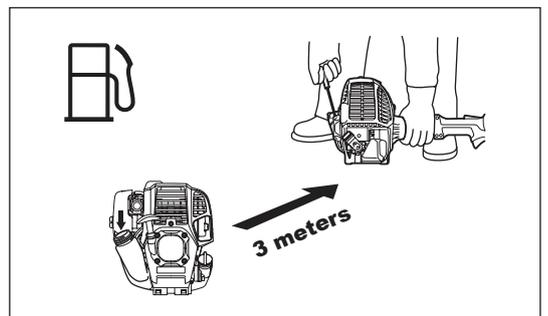
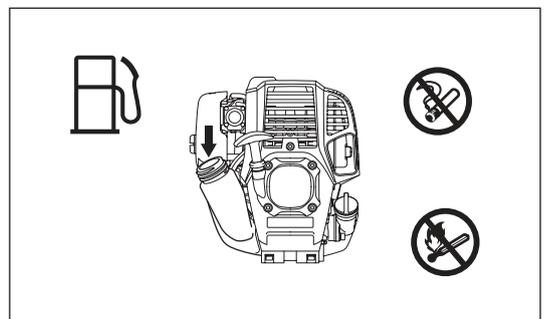
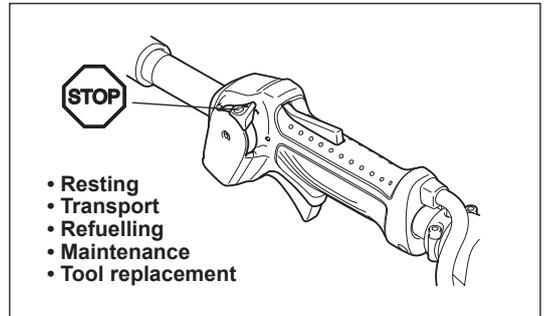
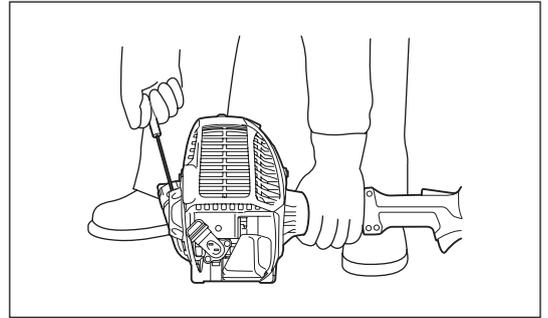
- Do not use any other methods for starting the engine!
- Place the equipment on firm ground. Maintain good balance and secure footing.
- When pulling the starter knob, hold the equipment firmly against the ground by your left hand. Never step on the drive shaft.
- Before starting the engine, make sure that there is no person or animal in the work area.
- When starting the engine, keep the saw chain and guide bar clear of your body and other object, including the ground. The saw chain may move when starting and may cause serious injury or damage to the saw chain and/or property.
- The engine is to be switched off immediately in case of any engine problems.
- Should the saw chain hit stones or other hard objects, immediately switch off the engine and inspect the equipment.
- Operate the equipment only with the shoulder strap attached which is to be suitably adjusted before putting the equipment into operation. It is essential to adjust the shoulder strap according to the user size to prevent fatigue occurring during use. Never hold the cutter with one hand during use.
- With the engine running only at idle, attach the shoulder harness. During operation, keep the equipment on your right side firmly.
- All protective installations and guards supplied with the machine must be used during operation.
- Never operate the engine with faulty exhaust muffler.
- Except in case of emergency, never drop or cast the equipment to the ground or this may severely damage the equipment.

Refuelling

- Shut off the engine during refuelling, keep away from open flames and do not smoke.
- Avoid skin contact with mineral oil products. Do not inhale fuel vapor. Always wear protective gloves during refuelling. Change and clean protective clothing at regular intervals.
- Take care not to spill either fuel or oil in order to prevent soil contamination (environmental protection). Clean the equipment immediately after fuel has been spilt.
- Avoid any fuel contact with your clothing. Change your clothing instantly if fuel has been spilt on it (to prevent clothing catching fire).
- Inspect the fuel cap at regular intervals making sure that it can be securely fastened and does not leak.
- Carefully tighten the fuel tank cap. Change location to start the engine (at least 3 meters away from the place of refuelling).
- Never refuel in closed rooms. Fuel vapors accumulate at ground level (risk of explosions).
- Only transport and store fuel in approved containers. Make sure the fuel stored is not accessible to children.

Method of operation

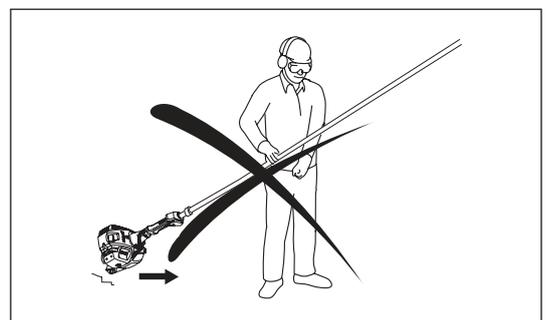
- In the event of an emergency, switch off the engine immediately.
- If you feel any unusual condition (e.g. noise, vibration) during operation, switch off the engine. Do not use the equipment until the cause is recognized and solved.
- The saw chain continues to move for a short period after releasing the throttle trigger. Don't rush to contact the saw chain.
- Hold the front grip with the left hand and the rear grip with the right hand, no matter you are right-hander or left-hander. Wrap your fingers and thumbs around the grips.
- Never attempt to operate the equipment with one hand. Loss of control may result in serious or fatal injury. To reduce the risk of injury, keep your hands and feet away from the blades.
- Do not overreach. Keep proper footing and balance at all times.
- Watch for hidden obstacles such as tree stumps, roots and ditches to avoid stumbling. Clear fallen branches and other objects away.
- If the equipment gets heavy impact or fall, check the condition before continuing work. Check the fuel system for fuel leakage and the controls and safety devices for malfunction. If there is any damage or doubt, ask Makita authorized service center for the inspection and repair.
- Do not touch the gear case. The gear case becomes hot during operation.
- When you leave the equipment, even if it is a short time, always stop the engine. The equipment unattended with the engine running may be used by unauthorized person and cause serious accident.



- Pay attention to the environment. Avoid unnecessary throttle operation for less pollution and noise emissions. Adjust the carburetor correctly.
- During or after operation, do not put the hot equipment onto dry grass or combustible materials.
- Do not hold your right hand above shoulder height.
- During operation, never hit the saw chain against hard obstacles such as stones and nails. Take particular care when cutting branches next to walls, wire fences or the like.
- If branches get caught in the saw chain, always stop the engine and remove the spark plug cap. Otherwise unintentional start may cause serious injury.
- If the saw chain becomes clogged, always stop the engine and remove the spark plug cap before cleaning.
- Accelerating the engine with the saw chain blocked increases the load and will damage the engine and/or clutch.
- Before cutting limbs, keep an escape area away from the falling limb. First, clear obstructs such as limbs and branches from the work area. Move all tools and goods from the escape area to another safe place.
- Before cutting branches and limbs, check the falling direction of them, considering the condition of branches and limbs, adjoining trees, wind direction, etc. Pay full attention to the falling direction, and the rebound of the branch, which hit the ground.
- Never hold the pole saw at an angle of more than 60°. Otherwise falling objects can hit the operator and cause serious injury. Never stand underneath the limb being cut.
- Pay attention to broken or bent branches. They may bounce back in cutting, causing unexpected injury.
- Before cutting limbs that you intend to cut, remove branches and leaves around them. Otherwise the saw may be caught by them.
- To prevent the saw from being caught in the kerf, do not release the throttle lever before pulling the saw out of the kerf.
- If the saw chain is bound in the kerf, immediately stop the engine, carefully move the branch to open the kerf and release the saw.
- Avoid kickback (rotational reactive force towards the operator). To prevent kickback, never use the guide bar nose or perform a penetrating cut. Always beware of the position of the guide bar nose.
- Check the chain tension frequently. When checking or adjusting the chain tension, stop the engine and remove the spark plug cap. If the tension is loose, tighten it.
- Operate the equipment with as little noise and contamination as possible. In particular check the correct setting of the carburetor.
- Never stand on a ladder and run the equipment.
- Never climb up into trees to perform cutting operation.
- Wait until the chain reaches its full working speed before cutting.
- Take a rest to prevent loss of control caused by fatigue. We recommend to take a 10 to 20-minute rest every hour.

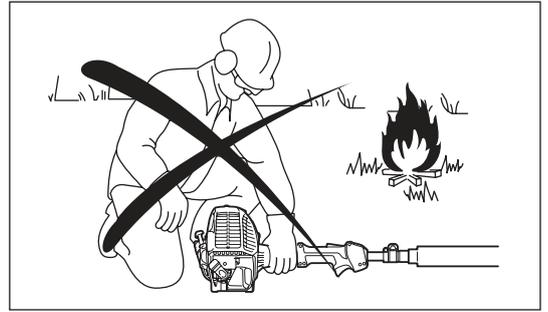
Transport

- Before transporting the equipment, switch off the engine and remove the spark plug cap.
- Always fit the guide bar cover during transportation.
- Always use the tool protection included with the equipment.
- Carry it in a horizontal position by holding the shaft. Keep the hot muffler away from your body.
- When transporting the equipment in a vehicle, properly secure it to avoid turnover. Otherwise fuel spillage and damage to the equipment and other baggage may result.
- Shut off the engine during transport.
- Ensure that the fuel tank is completely empty.
- When unloading the equipment from the truck, never drop the engine to the ground or this may severely damage the fuel tank.
- Remember to lift the entire equipment from the ground when moving the equipment. Dragging the fuel tank is highly dangerous and will cause damage and leakage of fuel, possibly causing fire.



Maintenance instructions

- Have your equipment serviced by our authorized service center, always using only genuine replacement parts. Incorrect repair and poor maintenance can shorten the life of the equipment and increase the risk of accidents.
- Before doing any maintenance or repair work or cleaning the equipment, always stop the engine and remove the spark plug cap. Wait until the engine gets cold.
- To reduce the risk of fire, never service or store the equipment in the vicinity of fire.
- Always wear protective gloves when handling the saw chain.
- Always clean dust and dirt off the equipment. Never use gasoline, benzene, thinner, alcohol or the like for the purpose. Discoloration, deformation or cracks of the plastic components may result.
- After each use, tighten all screws and nuts, except for adjustment screws.
- Keep the saw chain sharp. If the saw chain has become blunt and cutting performance is poor, ask Makita authorized service center to sharpen it or replace it with new one.
- Do not attempt any maintenance or repair not described in this instruction manual. Ask Makita authorized service center for such work.
- Clean the equipment at regular intervals and check that all screws and nuts are well tightened.
- Always store the equipment in locked rooms and with an emptied fuel tank.



Storage

- Before storing the equipment, perform full cleaning and maintenance. Fit the guide bar cover. Remove the spark plug cap. Drain the fuel and chain oil after the engine gets cold.
- Store the equipment in a dry and high or locked location out of reach of children.
- Do not prop the equipment against something, such as a wall. Otherwise it may fall suddenly and cause an injury.

Observe the relevant accident prevention instructions issued by the relevant trade associations and by the insurance companies. Do not perform any modifications on the equipment as this will endanger your safety.

The performance of maintenance or repair work by the user is limited to those activities as described in the instruction manual. All other work is to be done by an Authorized Service Center. Use only genuine spare parts and accessories released and supplied by MAKITA. Use of non-approved accessories and tools means increased risk of accidents. MAKITA will not accept any liability for accidents or damage caused by the use of non-approved attachments and fixing devices of attachments, or accessories.

First aid

In case of accident make sure that a first-aid box is available in the vicinity of the cutting operations. Immediately replace any item taken from the first aid box.

When asking for help, please give the following information:

- Place of accident
- What happened
- Number of injured persons
- Kind of injuries
- Your name



Vibration

- People with poor circulation who are exposed to excessive vibration may experience injury to blood vessels or the nervous system. Vibration may cause the following symptoms to occur in the fingers, hands or wrists: "Falling asleep" (numbness), tingling, pain, stabbing sensation, alteration of skin color or of the skin. If any of these symptoms occur, see a physician!
- To reduce the risk of "white finger disease", keep your hands warm during operation and well maintain the equipment and accessories.

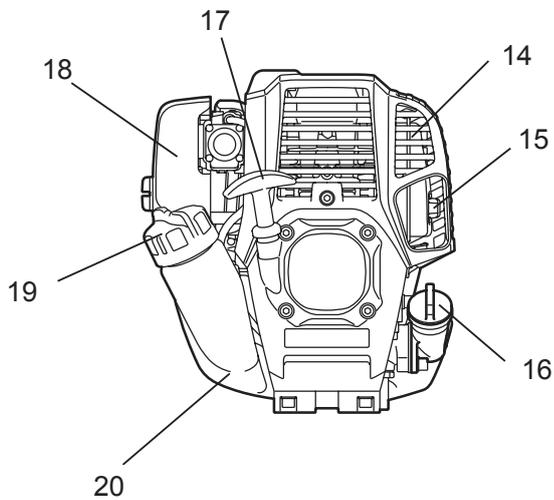
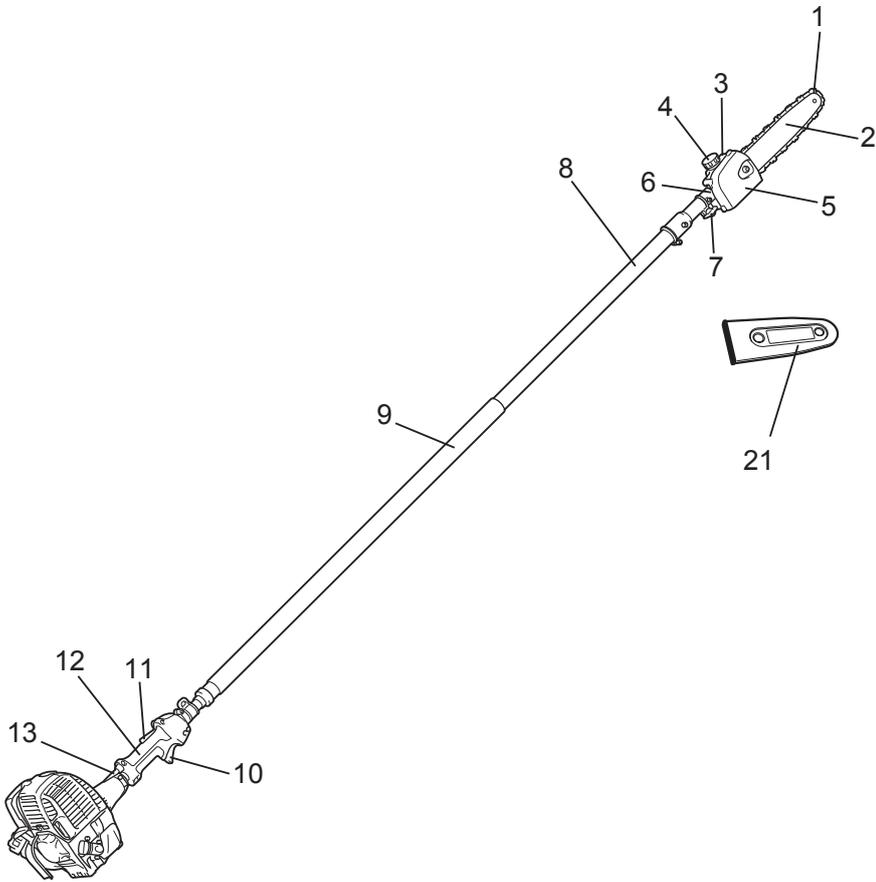
TECHNICAL DATA

Model		EY2650H
Dimension: L x W x H	mm	2,720-3,920 x 223 x 240
Weight	kg	7.2
Fuel tank volume	cm ³	600
Chain oil tank volume	cm ³	120
Engine displacement	cm ³	25.4
Max. chain speed	m/s	21.0
Maximum engine performance		0.77 kW at 7,000 min ⁻¹
Engine speed at recommended max, spindle speed	min ⁻¹	10,000
Idling speed	min ⁻¹	3,000
Clutch engagement speed	min ⁻¹	4,400
Carburetor		Diaphragm type
Spark plug	Type	NGK CMR4A
Electrode gap	mm	0.7 - 0.8
Fuel		Automobile gasoline (petrol)
Engine oil		API grade SF class or higher, SAE 10W-30 oil (automobile 4-stroke engine oil)
Cutting length	mm	255
Guide bar length	mm (inch)	255 (10")
Saw chain		91VXL-39E
Chain pitch	inch	3/8"
Chain gauge	mm (inch)	1.3 (0.05")
Number of sprocket teeth		7
Chain oil		Makita genuine chain oil
Chain oil pump		Plunger pump (Self lubricating type)

- Due to our continuing program of research and development, the specifications herein are subject to change without notice.
- Specifications may differ from country to country.

DESIGNATION OF PARTS

EY2650H



GB	DESIGNATION OF PARTS
1	Saw chain
2	Guide bar
3	Oil tank
4	Oil tank cap
5	Bar holder
6	Gear case
7	Knob
8	Telescopic shaft
9	Front grip
10	Throttle lever
11	Lock-off lever
12	Rear grip
13	Control cable
14	Exhaust muffer
15	Exhaust pipe
16	Oil cap
17	Starter knob
18	Air cleaner
19	Fuel tank cap
20	Fuel tank
21	Guide bar cover

ASSEMBLY AND ADJUSTMENT

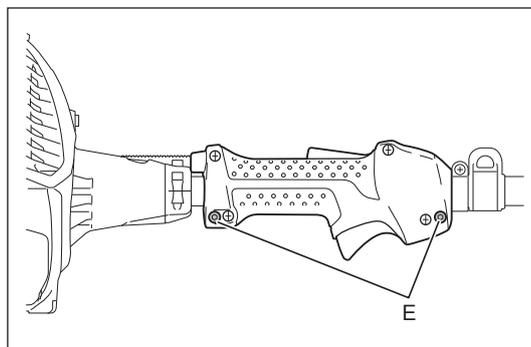
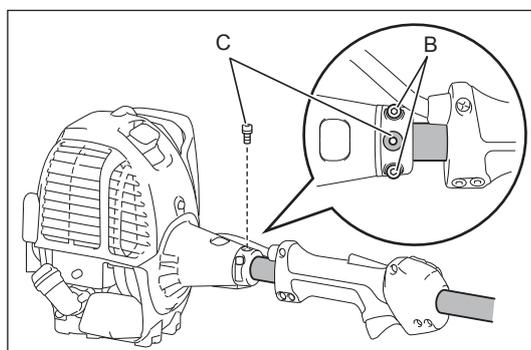
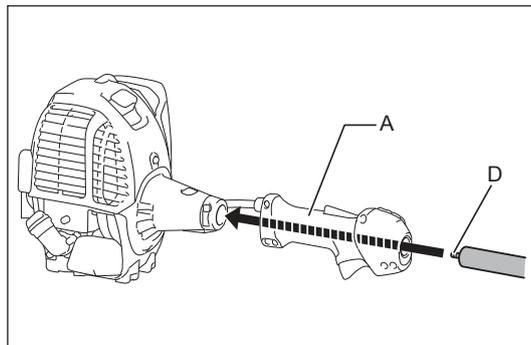
WARNING:

- Before assembling, adjusting or checking, switch off the engine and remove the spark plug cap.
- Always wear protective gloves when handling saw chain.
- Wait until the saw chain cools down before assembling, adjusting or checking. The saw chain become very hot during the operation, and may cause burn.

Assembling shaft and clutch case

Assemble the shaft with the rear grip and the engine unit as follows:

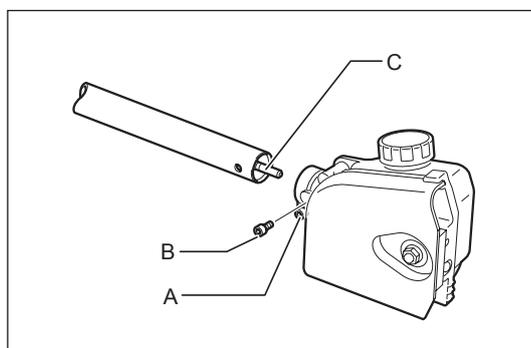
1. Insert the shaft through the rear grip (A).
2. Loosen two fastening bolts (B) and remove the center bolt (C) on the clutch case.
3. Insert the shaft into the clutch case. If it is difficult to fully insert, turn the spline (D) a little.
4. Align the hole on the shaft with the hole of the center bolt.
5. Tighten the center bolt.
6. Tighten two fastening bolts evenly.
7. Adjust the position of the rear grip, then tighten it by two bolts (E).



Assembling shaft and gear case

Assemble the shaft with the gear case as follows:

1. Loosen the bolt (A). And remove the bolt (B).
2. Insert the shaft into the gear case. If it is difficult to fully insert it, turn the spline (C) a little.
3. Align the hole on the shaft with the bolt (B) hole.
4. Tighten the bolt (B) first and then tighten the bolt (A).



Assembling saw chain and guide bar

CAUTION: Make sure that the saw chain, guide bar and sprocket match each other in gauge and pitch.

Assemble the saw chain and guide bar as the following steps.

1. Loosen the nut **(A)** and remove the bar holder **(B)**.
2. Turn the tension screw **(C)** counterclockwise until the tensioning nut **(D)** touches the left end.

NOTICE:

- Do not turn the tension screw counterclockwise too much, otherwise the tension screw and the tensioning nut comes off from the housing.

3. Fit the saw chain **(E)** into the groove of guide bar **(F)**. Start the procedure from the bar nose.

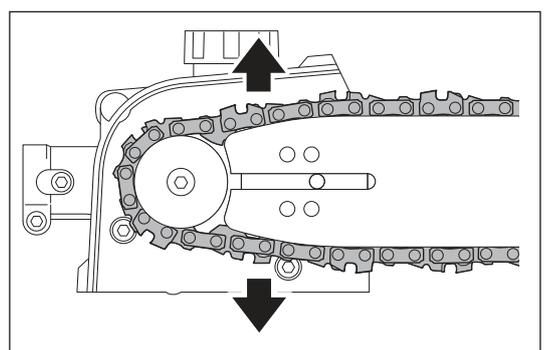
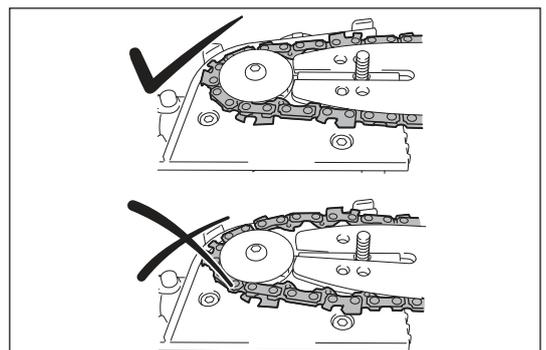
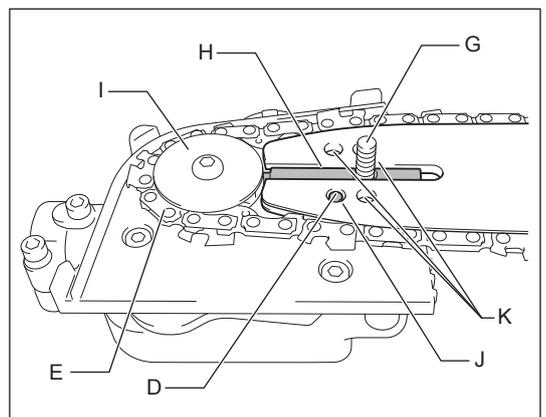
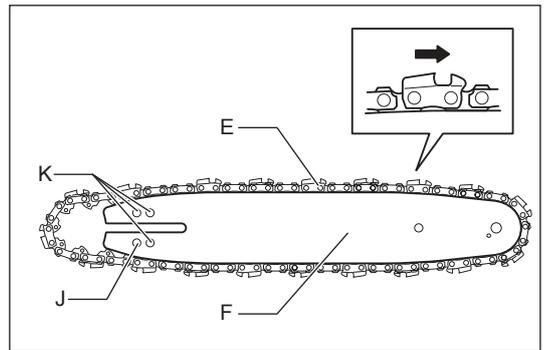
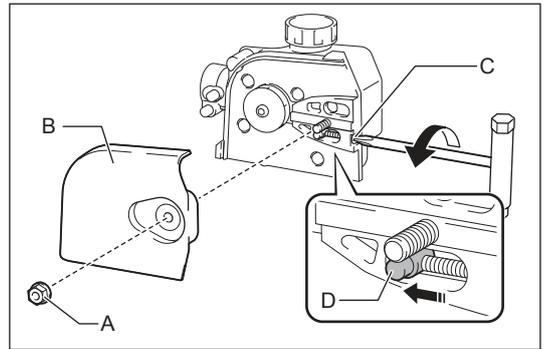
4. Align the position bolt **(G)** with the notch of the guide bar **(H)**, and then fit the saw chain **(E)** onto the sprocket **(I)**. Make sure that the saw chain is kept fitting along the guide bar during the procedure.
5. Install the guide bar **(F)** so that the tensioning nut **(D)** fits into the hole **(J)** on the guide bar. Holes **(K)** are not used.

6. Place the saw chain onto the groove of the guide bar properly. If the saw chain is not placed into the groove of the guide bar properly at this point, adjust and fit it appropriately.
7. Fit the bar holder **(B)** and tighten the nut **(A)** securely. Then loose the nut a half turn as a provision of the chain tension adjustment.
8. Adjust the chain tension. Refer to the section "Adjusting the chain tension."

CAUTION:

- Keep the applicable chain tension. Loose tension can cause the saw chain derail.

To remove the saw chain and guide bar, turn the tension screw **(C)** counterclockwise first. Pull the saw chain outward to let the saw chain comes out from the groove of the guide bar, then remove them from the housing.



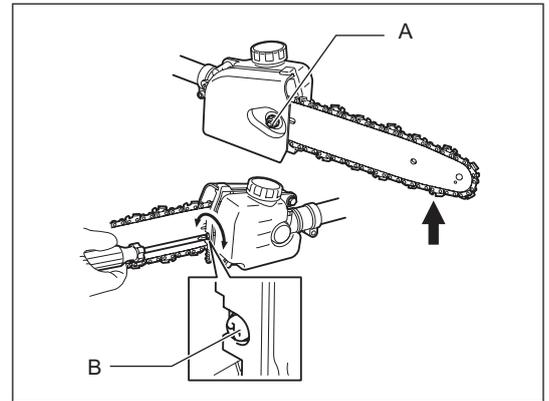
Adjusting the chain tension

CAUTION:

- Keep the applicable chain tension. Loose tension can cause the saw chain to come off during operation. Too tight tension can damage the saw chain or guide bar.
- During operation, check the chain tension frequently. The saw chain stretches and becomes loose during operation. When use a new saw chain, adjust the tension more frequently.

Adjust the chain tension as the following steps.

1. Loosen the nut **(A)** a half turn.
2. Hold the bar nose up. Turn the tensioning screw **(B)** clockwise until the saw chain fits the underside of the guide bar snugly.
3. Grasp the saw chain in the middle of the guide bar and lift up. The gap between the guide bar and the tie strap of the saw chain should be approximately 3 - 4 mm (0.118"-0.157"). If it is not, turn the tensioning screw counterclockwise slightly and do the step 2 again.
4. Tighten the nut **(A)** securely.
5. If necessary, tighten the tensioning screw a little to prevent it from falling.



Filling the chain oil tank

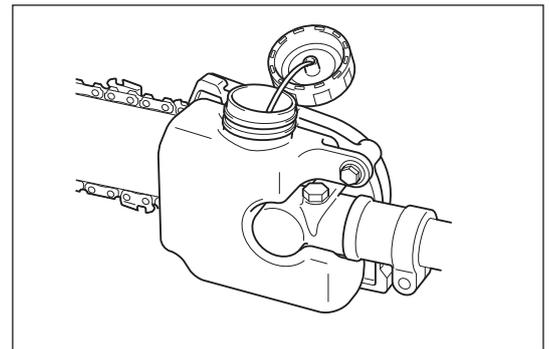
The saw chain must be lubricated with chain oil during operation. Before operation, fill the chain oil tank. After supplying the oil, tighten the oil cap securely.

Use Makita genuine chain oil only.

NOTICE:

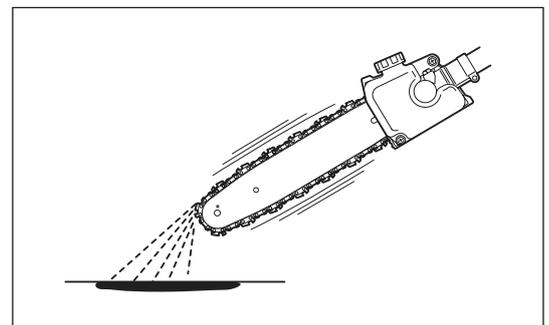
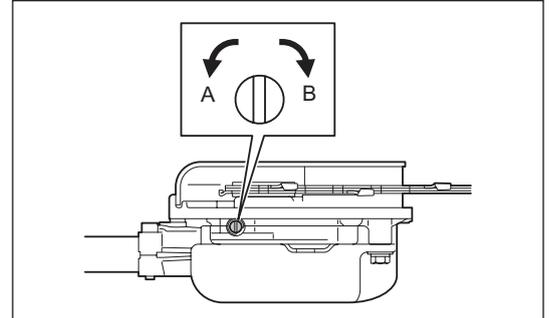
- Never use waste oil. It may damage the oil pump.
- Avoid dusty environment when filling the chain oil. Dust and other foreign materials may damage the oil feed system.

During operation, always pay attention to the oil level. Refill the tank if the oil level becomes low. The tank becomes empty in approximately 40 minutes of operation (depending on the setting of the chain lubrication).



Adjusting the chain-oil feeding rate

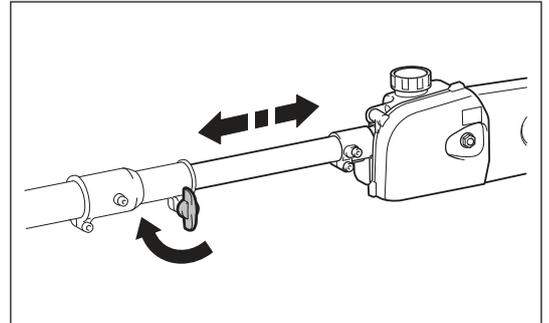
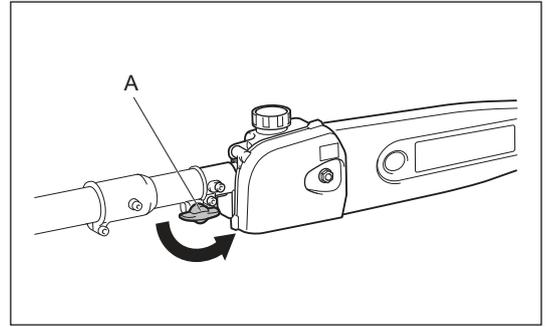
The chain-oil feeding rate is adjustable in three steps. According to the operation, for example cutting hard limbs, adjust the feeding rate. To adjust the chain-oil feeding rate, use a flat-bladed screwdriver. Push in the adjusting screw and turn it. To increase feeding rate, turn the adjusting screw counterclockwise **(A)**. To reduce feeding rate, turn it clockwise **(B)**. After adjusting the chain-oil feeding rate, check the feeding rate by driving the equipment at medium speed.



Adjusting the length of pole saw

Adjust the length of the pole saw as follows:

1. Turn the knob **(A)** counterclockwise.
2. Adjust the length of the pole.
3. Turn the knob clockwise to fasten the gear head.



Shoulder strap

Adjusting the shoulder strap

Adjust the strap to the suitable length for your operation.

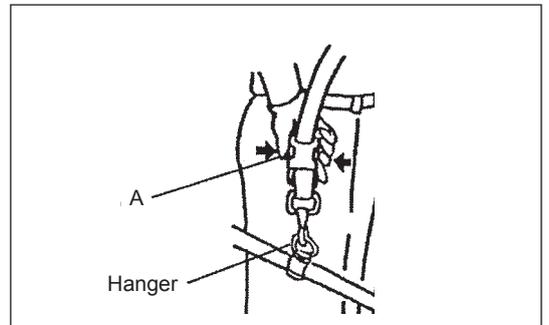
Detachment

In case of emergency, push the notches **(A)** at both sides, and detach the equipment.

Be extremely careful to maintain control of the equipment at this time. Do not allow the equipment to be deflected toward you or anyone in your vicinity.

WARNING: Failure to maintain complete control of the machine at all could result in serious injury or DEATH.

Note: In some countries, shoulder strap does not have this detachment function.



BEFORE START OF OPERATION

Inspection and refill of engine oil

- Perform the following procedure, with the engine cooled down.
- Set the engine level, remove oil cap (Fig. 1), and check to see whether or not there is oil in the range between the upper limit and lower limit marks of the oil pipe (Fig. 2).
- Top up with oil to upper limit mark if oil is insufficient (oil level is close to lower limit mark) (Fig. 3).
- The area surrounding the external marks is transparent, so the amount of oil inside can be checked without having to remove the oil cap. However, if oil pipe becomes extremely dirty, visibility may be lost, and oil level will have to be checked against stepped section on inside of oil pipe.
- For reference, the oil refill time is about 10h (every 10 refuellings).
If the oil changes in color or mixes with dirt, replace it with new one. (For the interval and method of replacement, refer to P 19)

Recommended oil: SAE 10W-30 oil of API Classification, Class SF or higher (4-stroke engine for automobile)

Oil volume: Approx. 0.08L

Note: If the engine is not kept upright, oil may go into around the engine, and may be refilled excessively.
If the oil is filled above the limit, the oil may be contaminated or may catch fire with white smoke.

Point 1 in Replacement of oil: "Oil cap"

- Remove dust or dirt near the oil refill port, and detach the oil cap.
- Keep the detached oil cap free of sand or dust. Otherwise, any sand or dust adhering to the oil cap may cause irregular oil circulation or wear on the engine parts, which will result in troubles.

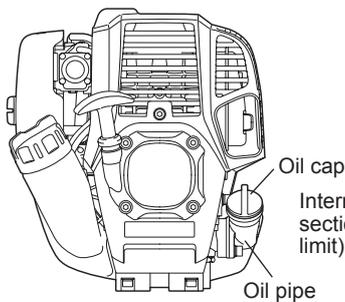


Fig. 1

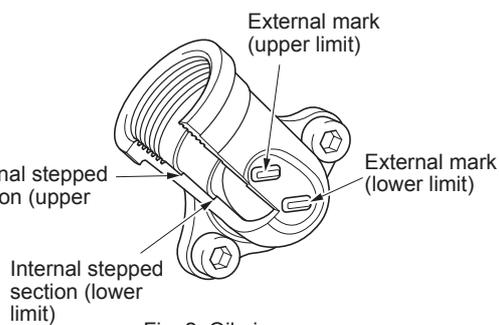


Fig. 2 Oil pipe

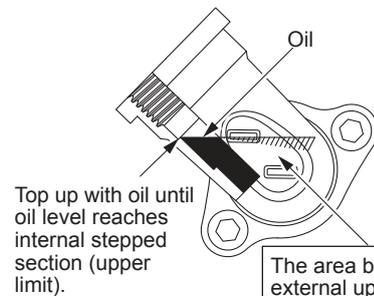
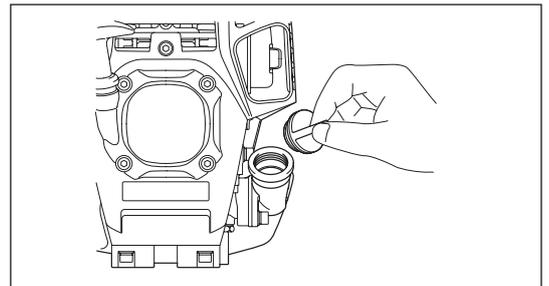


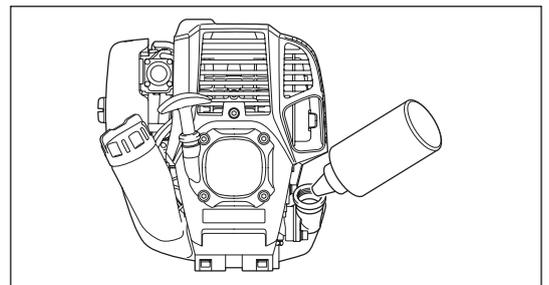
Fig. 3

The area between the external upper and lower limits is transparent, so oil level can be checked externally against these marks.

- (1) Keep the engine level, and detach the oil cap.



- (2) Fill with oil to upper limit mark. (see Fig. 3)
Use oil bottle when filling.



- (3) Securely tighten the oil cap. Insufficient tightening may cause oil leakage.

Note

- Do not replace oil with the engine in a tilted position.
- Filling with oil while engine is tilted leads to overfilling which causes oil contamination and/or white smoke.

Point 2 in Replacement of oil: "If oil spills out"

- If oil spills out between the fuel tank and engine main unit, the oil is sucked into through the cooling air intake port, which will contaminate the engine. Be sure to wipe out spilt oil before start of operation.

REFUELLING

Handling of fuel

It is necessary to handle fuel with utmost care. Fuel may contain substances similar to solvents. Refuelling must be performed in a sufficiently ventilated room or in the open air. Never inhale fuel vapor, and keep fuel away from you. If you touch fuel repeatedly or for a long time, the skin becomes dry, which may cause skin disease or allergy. If fuel enters into the eye, clean the eye with fresh water. If your eye remains still irritated, consult your doctor.

Do not perform refuelling in the dusk or on unstable surface.

Storage period of fuel

Fuel should be used up within a period of 4 weeks, even if it is kept in a special container in a well-ventilated shade.

If a special container is not used or if the container is not covered, fuel may deteriorate in one day.

STORAGE OF MACHINE AND REFILL TANK

- Keep the machine and tank at a cool place free from direct sunshine.
- Never keep the fuel in the cabin or trunk.

Fuel

The engine is a four-stroke engine. Be sure to use an automobile gasoline (regular gasoline or premium gasoline).

Points for fuel

- Never use a gasoline mixture which contains engine oil. Otherwise, it will cause excessive carbon accumulation or mechanical troubles.
- Use of deteriorated oil will cause irregular startup.

Refuelling

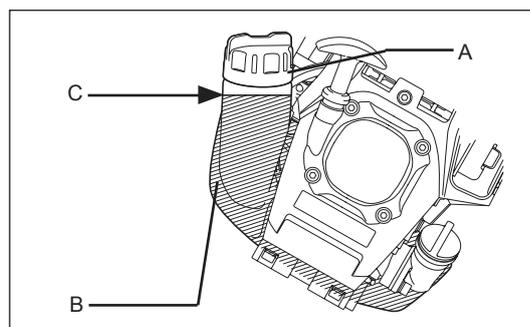
WARNING: INFLAMMABLES STRICTLY PROHIBITED

CAUTION: Do not forget to close the fuel tank cap after refuelling. Never start the engine with the fuel tank cap opened.

Gasoline used: Automobile gasoline (unleaded gasoline)

1. Loosen the fuel tank cap (**A**) a little to avoid the fuel spilling.
2. Detach the fuel tank cap. And tilt the engine so that the refuel port faces upwards.
3. Refuel carefully with discharging air from the fuel tank (**B**). (Do not refuel over the fuel upper limit (**C**).)
4. Wipe well the periphery of the fuel tank cap to prevent foreign matter from entering into the fuel tank.
5. After refuelling, securely tighten the fuel tank cap.

- If there is any flaw or damage on the tank cap, replace it.
- The tank cap wears out in course of time. Replace it every two to three years.



POINTS IN OPERATION AND HOW TO STOP

CAUTION:

Observe the applicable accident prevention regulations!

NOTICE:

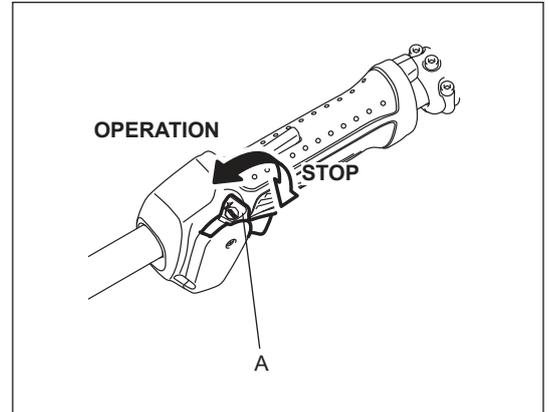
Remove the guide bar cover before starting the engine.

STARTING

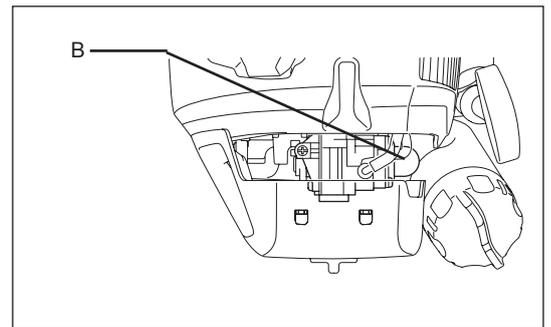
Move at least 3 m away from the place of refuelling. Place the equipment on a clean piece of ground taking care that the attachment does not come into contact with the ground or any other objects.

A: Cold start

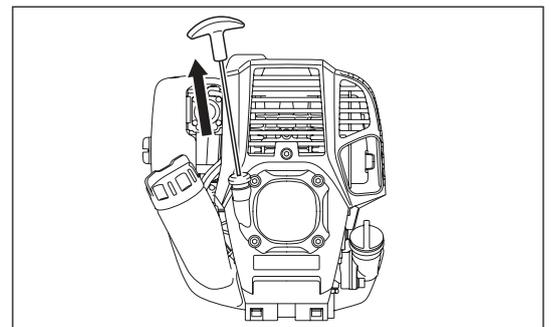
- 1) Set this machine on a flat space.
- 2) Set the I-O switch **(A)** to OPERATION.



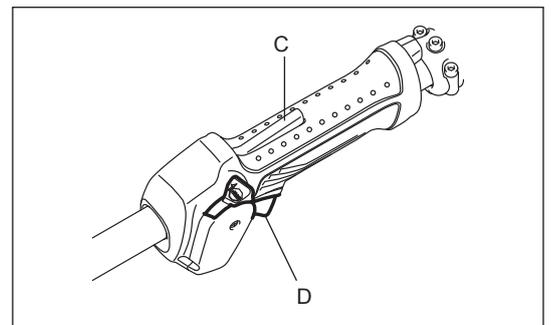
- 3) Primer pump
Continue to push the primer pump **(B)** until fuel enters into the primer pump.
(In general, fuel enters into the primer pump by 7 to 10 pushes.)
If the primer pump is pushed excessively, an excess of gasoline returns to the fuel tank.



- 4) Recoil starter
Pull the start knob gently until it is hard to pull (compression point). Then, return the start knob, and pull it strongly.
Never pull the rope to the full. Once the start knob is pulled, never release your hand immediately. Hold the start knob until it returns to its original point.



- 5) The handle equips with lock-off lever **(C)** to prevent accidental start. To pull the throttle lever **(D)**, grasp the handle to release the lock (the lock-off button is pressed by hand pressure).



- 6) Warm-up operation
Continue warm-up operation for 2 to 3 minutes.

Note: In case of excessive fuel intake, remove the spark plug and pull the starter handle slowly to remove excess fuel. Also, dry the electrode section of the spark plug.

Caution during operation:

If the throttle lever is opened fully in a no-load operation, the engine rotation is increased to 10,000 min⁻¹ or more. Never operate the engine at a higher speed than required and at an approximate speed of 6,000 - 8,500 min⁻¹.

B: Startup after warm-up operation

- 1) Push the primer pump repeatedly.
- 2) Keep the throttle lever at the idling position.
- 3) Pull the recoil starter strongly.
- 4) If it is difficult to start the engine, open the throttle by about 1/3.
Pay attention to the attachment which may rotate.

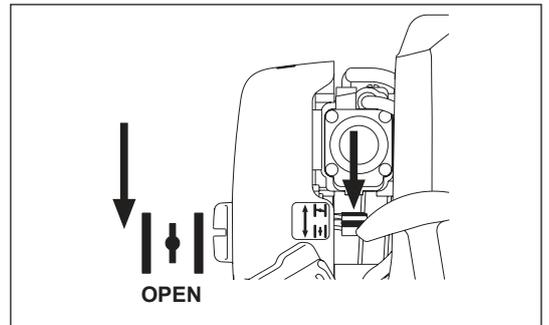
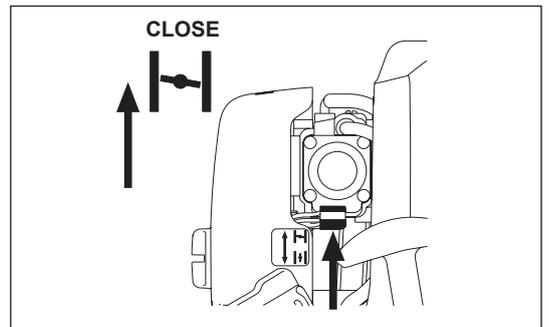
At times, such as winter, when starting the engine is difficult

Operate choke lever with the following procedure when starting engine.

- After implementing startup steps 1) to 3), set choke lever to the CLOSE position.
- Implement startup step 4) and start engine.
- Once engine starts, set choke lever to the OPEN position.
- Implement startup step 5) and complete warm up.

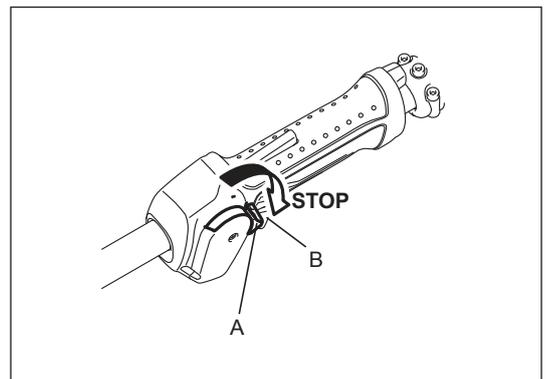
CAUTION: If a bang (explosive sound) is heard and the engine stops, or the just-started engine stalls before the choke lever is operated, return the choke lever to the OPEN position, and pull the starter knob a few times again to start the engine.

CAUTION: If the choke lever is left in the CLOSE position, and the starter knob merely pulled repeatedly, too much fuel will be sucked in, and the engine will become difficult to start.



STOPPING

- 1) Release the throttle lever (B) fully, and when the engine rpm has lowered, set the I-O switch (A) to STOP the engine will now stop.
- 2) Be aware that the attachment may not stop immediately and allow it to slow down fully.

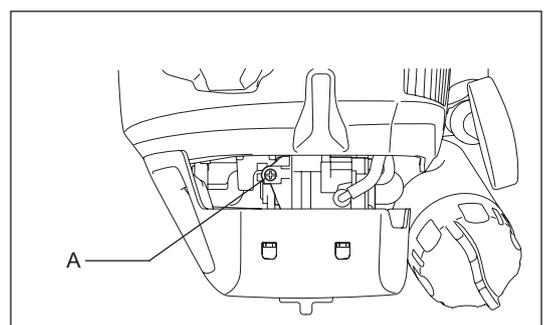


ADJUSTMENT OF LOW-SPEED ROTATION (IDLING)

When it is necessary to adjust the low-speed rotation (idling), perform it by the carburetor adjusting screw (A).

CHECKUP OF LOW-SPEED ROTATION

- Set the low-speed rotation to 3,000 min⁻¹.
If it is necessary to change the rotation speed, regulate the adjusting screw, with Phillips screwdriver.
- Turn the adjusting screw to the right, and the engine rotation will increase.
Turn the adjusting screw to the left, and the engine rotation will drop.
- The carburetor is generally adjusted before shipment. If it is necessary to readjust it, please contact Authorized Service Center.



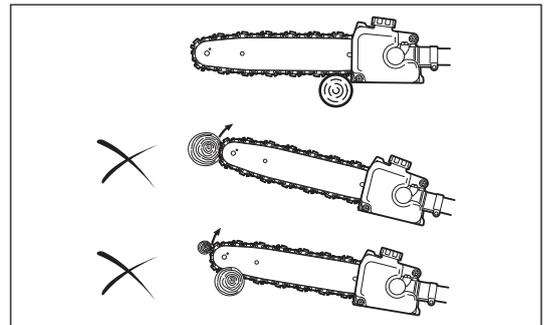
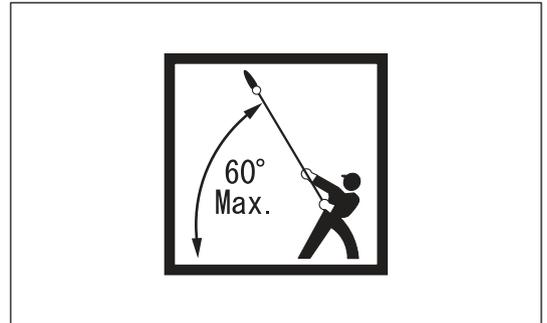
OPERATION

Standing position

- Stand on stable surface. Make the angle of the pole saw become 60° against the horizontal ground.
- Cut lower branches first so that the branches fall easier.
- Always keep escape route in case a cut branch falls towards the operator.

Method

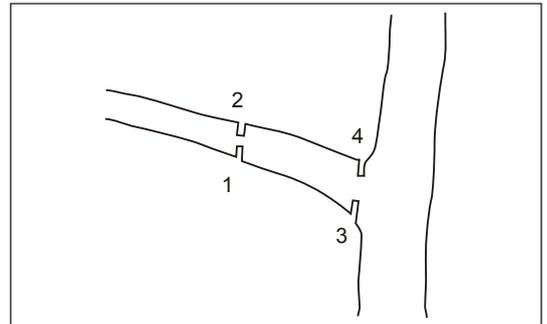
- Start the engine, and pull the throttle until the saw chain reaches its full speed.
- Press the saw chain onto the branch lightly. Do not force the equipment, otherwise it may damage the equipment.
- Never use the tip of the bar for cutting. Otherwise dangerous kickback may occur, and it may result in personal injury.



Tips for cutting thick branch

When you cut a thick branch, use the following method.

1. Make a small notch on the under side of the branch where is a bit distance from you intend to cut.
2. Cut the branch from the upper side of where you notched.
3. Make another small notch on the under side of the branch where you intend to cut.
4. Cut where you intend to cut from the upper side.



SERVICING INSTRUCTIONS

CAUTION: Before doing any work on the equipment, always stop the engine and pull the plug cap off the spark plug (see “checking the spark plug”).

Always wear protective gloves!

When inspecting or maintaining the equipment, always put it down. Assembling or adjusting the equipment in an upright position may result in serious injury.

Always put the guide bar cover when servicing.

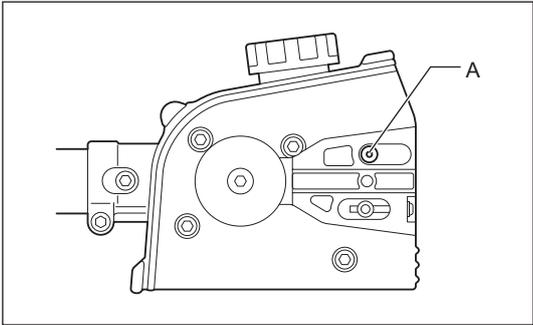
To ensure a long service life and to avoid any damage to the equipment, the following servicing operations should be performed at regular intervals.

Daily checkup and maintenance

- Before operation, check the machine for loose screws or missing parts. Pay particular attention to a specified attachment for mounting in place securely.
- Before operation, always check for clogging of the cooling air passage and the cylinder fins. Clean them if necessary.
- Perform the following work daily after use:
 - Clean the equipment externally and inspect for damage.
 - Clean the air filter. When working under extremely dusty conditions, clean the filter several times a day.
 - Check that there is sufficient difference between idling and engagement speed to ensure that the attachment is at a standstill while the engine is idling (if necessary reduce idling speed). If under idling conditions the tool should still continue to run, consult your nearest Authorized Service Agent.
- Check the functioning of the I-O switch, the lock-off lever and the control lever.

Cleaning the chain-oil feed port

Clean the chain-oil feed port (A) daily. To access it, remove the bar holder and guide bar.

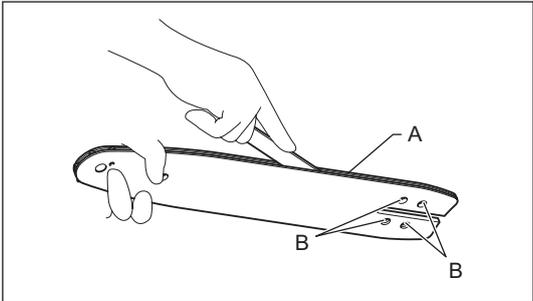


Cleaning and inspecting the guide bar

Clean the guide bar daily. Remove saw dust from the groove (A) and chain-oil feed port (B).

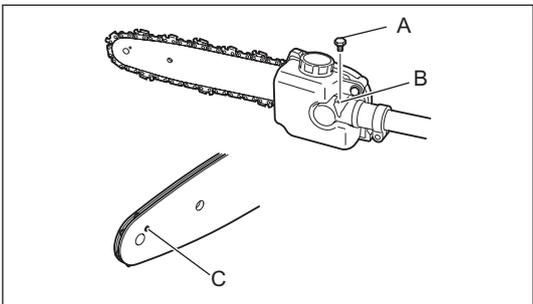
To avoid one side wear of the guide bar, turn it over every time you replace or sharpen the saw chain.

If the groove is worn, bent, cracked or deformed, replace the guide bar.



Inspecting the saw chain

When you feel the saw chain is worn, deformed, cracked or you need more effort for the cutting, replace it or ask Makita authorized service center to sharpen it.



Lubricating moving parts

NOTICE: Follow the instruction of the frequency and amount of grease supplied. Otherwise insufficient lubrication may damage moving parts.

Gear case:

Remove the grease plug (A) and fill lithium-base grease through the grease hole (B) every 25 hours of operation.

Guide bar nose:

Apply grease (Shell Alvania No. 2 or equivalent) from the grease hole (C) every 10 hours of operation.

REPLACEMENT OF ENGINE OIL

Deteriorated engine oil will shorten the life of the sliding and rotating parts to a great extent. Be sure to check the period and quantity of replacement.



ATTENTION: In general, the engine main unit and engine oil still remain hot just after the engine is stopped. In replacement of oil, confirm that the engine main unit and engine oil are sufficiently cooled down. Otherwise, there may remain a risk of scald.

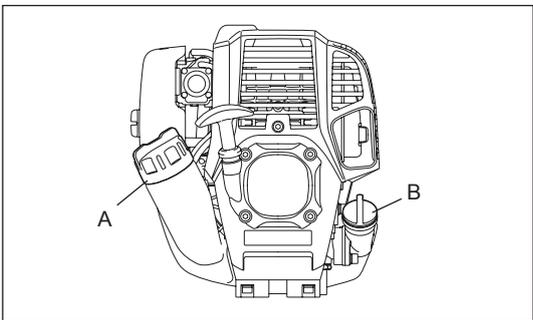
Note: If the oil filled above the limit, it may be contaminated or may catch fire with white smoke.

Interval of replacement: Initially, after 20 operating hours, and subsequently every 50 operating hours

Recommended oil: SAE10W-30 oil of API Classification SF Class or higher (4-stroke engine oil for automobile)

In replacement, perform the following procedure.

- 1) Confirm that the fuel tank cap (A) is tightened securely.
- 2) Place large container (pan, etc.) under drain hole (C).

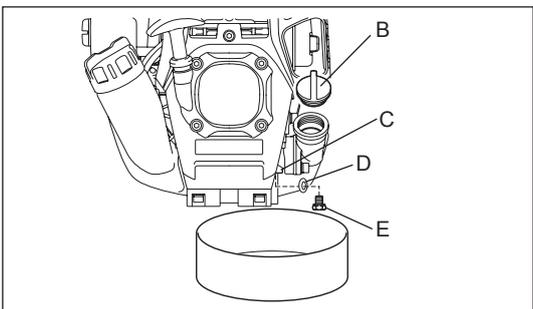


- 3) Remove drain bolt (E) and then remove oil cap (B) to drain out oil from drain hole.

At this time, be sure not to mislay drain bolt's gasket (D), or to make dirty any of the removed components.

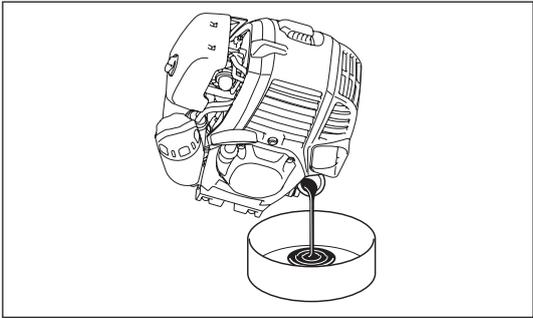
- 4) Once all the oil has been drained, combine gasket and drain bolt, and tightly secure drain bolt, so that it will not loosen and cause leaks.

* Use cloth to fully wipe off any oil attached to bolt and equipment.

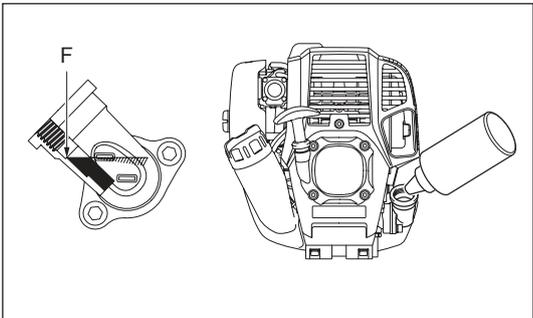
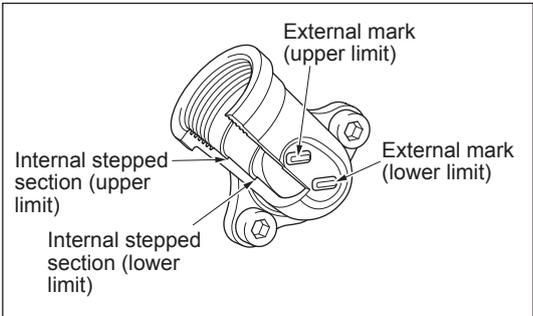


Alternative draining method

Remove oil cap, tilt the equipment toward oil filler hole, and drain out oil. Collect oil in container.



- 5) Set the engine level, and gradually fill up to upper limit mark **(F)** with new oil.
- 6) After filling, tightly secure oil cap, so that it will not loosen and cause leaks. If oil cap is not tightly secured, it may leak.



POINTS ON OIL

- Never discard replaced engine oil in garbage, earth or sewage ditch. Disposal of oil is regulated by law. In disposal, always follow the relevant laws and regulations. For any points remaining unknown, contact Authorized Service Agent.
- Oil will deteriorate even when it is kept unused. Perform inspection and replacement at regular intervals (replace with new oil every 6 months).

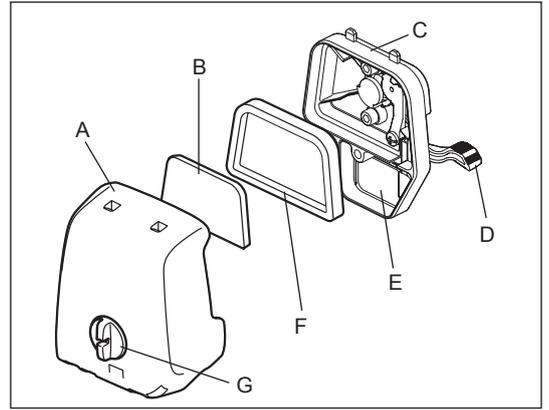
CLEANING OF AIR CLEANER



DANGER: INFLAMMABLES STRICTLY PROHIBITED

Interval of cleaning and inspection: Daily (every 10 operating hours)

- Turn the choke lever **(D)** to the full close side, and keep the carburetor off from dust or dirt.
- Loosen the fixing bolt **(G)**.
- Remove the air cleaner cover **(A)** by pulling its bottom side.
- Remove the elements **(B) (F)** and tap them to remove dirt.
- If the elements are heavily contaminated:
Remove the elements, immerse them in warm water or in water-diluted neutral detergent, and dry them completely. Do not squeeze or rub them when washing.
- Before attaching the elements, be sure to dry them completely. Insufficient drying of the elements may lead to difficult startup.
- Wipe out oil adhering around the air cleaner cover and the breather part **(E)** with waste cloth.
- Fit the element (sponge) **(B)** into the element (felt) **(F)**.
Fit the elements into the plate **(C)** so that the sponge faces the air cleaner cover.
- Immediately attach the cleaner cover and tighten it with fixing bolts. (In remounting, first place the upper claw, and then the lower claw.)



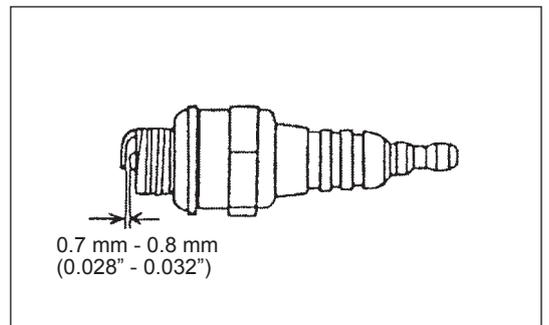
NOTICE:

- Clean the elements several times a day, if excessive dust adheres to it. Dirty elements reduce engine power and make starting engine difficult.
- Remove oil on the elements. If operation continues with the elements remaining not cleared of oil, oil in the air cleaner may fall outside, resulting in contamination of the environment.
- Do not put the elements on the ground or dirty place. Otherwise they pick up dirt or debris and it may damage the engine.
- Never use fuel for cleaning the elements. Fuel may damage them.

CHECKING THE SPARK PLUG

- Only use the supplied universal wrench to remove or to install the spark plug.
- The gap between the two electrodes of the spark plug should be 0.7 - 0.8 mm (0.028" - 0.032"). If the gap is too wide or too narrow, adjust it. If the spark plug is clogged or contaminated, clean it thoroughly or replace it.

CAUTION: Never touch the spark plug connector while the engine is running (danger of high voltage electric shock).



CLEANING OF FUEL FILTER

WARNING: INFLAMMABLES STRICTLY PROHIBITED

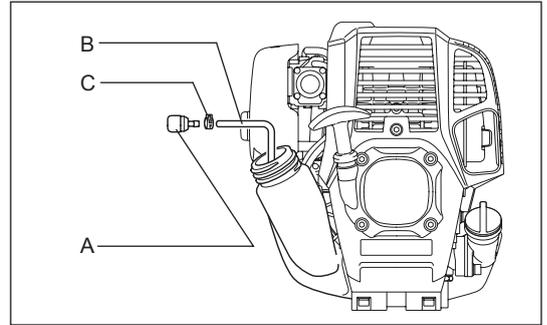
Interval of cleaning and inspection: Monthly (every 50 operating hours)

Suction head in the fuel tank

Check the fuel filter (A) periodically. To check the fuel filter, follow the steps below:

- (1) Remove the fuel tank cap, drain the fuel to empty the tank. Check the tank inside for any foreign materials. If any, remove them.
- (2) Pull out the suction head by using a wire hook through the tank opening.
- (3) If the fuel filter clogged slightly, clean it. To clean it, gently shake and tap it in fuel. To avoid damage, do not squeeze or rub it. The fuel used for the cleaning must be disposed in accordance with the method specified by regulations in your country.
If the fuel filter became hard or heavily clogged up, replace it.
- (4) After checking, cleaning or replacing, insert the fuel filter into the fuel pipe (B) and fix it by the hose clamp (C). Push the fuel filter in all the way to the bottom of the fuel tank.

Clogged or damaged fuel filter can cause insufficient fuel supply and reduce engine power. Replace the fuel filter at least quarterly to ensure satisfactory fuel supply to the carburetor.



REPLACEMENT OF FUEL PIPE

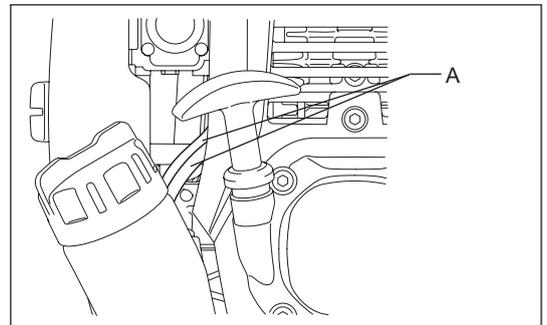
CAUTION: INFLAMMABLES STRICTLY PROHIBITED

Interval of cleaning and inspection: Daily (every 10 operating hours)

Replacement: Annually (every 200 operating hours)

Replace the fuel pipe (A) every year, regardless of operating frequency. Fuel leakage may lead to fire.

If any leakage is detected during inspection, replace the fuel pipe immediately.



INSPECTION OF BOLTS, NUTS AND SCREWS

- Retighten loose bolts, nuts, etc.
- Check for fuel and oil leakage.
- Replace damaged parts with new ones for safety operation.

CLEANING OF PARTS

- Keep the engine always clean.
- Keep the cylinder fins free of dust or dirt. Dust or dirt adhering to the fins will cause piston seizure.

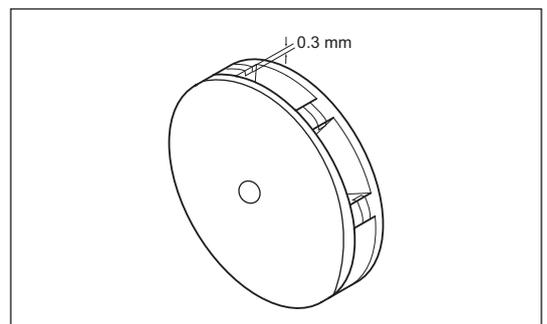
REPLACEMENT OF GASKETS AND PACKINGS

In reassembling after the engine is dismantled, be sure to replace the gaskets and packings with new ones.

Any maintenance of adjustment work that is not included and described in this manual is only to be performed by Authorized Service Agents.

INSPECTING SPROCKET

Check the sprocket for wear every 50 hours of use. Replace it if the wear marks becomes 0.3 mm or deeper.



Sharpening the saw chain

Sharpen the saw chain when:

- Mealy sawdust is produced when damp wood is cut;
- The chain penetrates the wood with difficulty, even when heavy pressure is applied;
- The cutting edge is obviously damaged;
- The saw pulls to the left or right in the wood. The reason for this behavior is uneven sharpening of the saw chain, or damage to one side only.

Sharpen the saw chain frequently, but remove only a little material each time.

Two or three strokes with a file are usually sufficient for routine reshaping. When the saw chain has been resharpened several times, have it sharpened in MAKITA authorized service center.

Sharpening criteria:

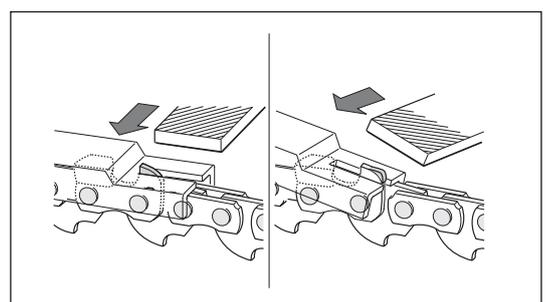
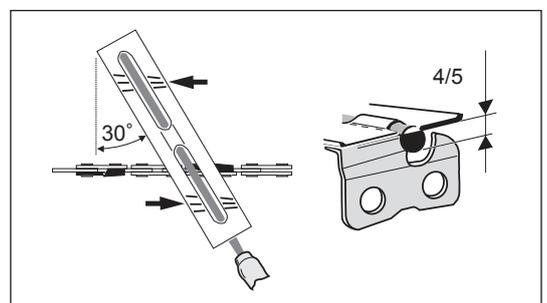
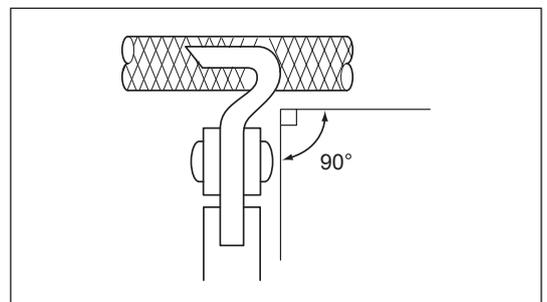
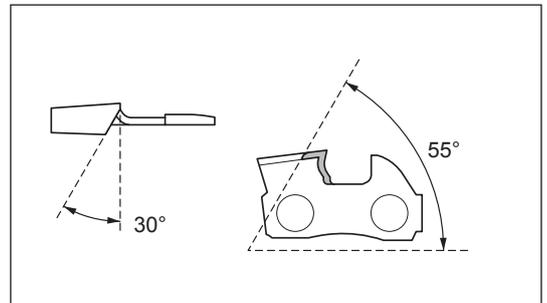
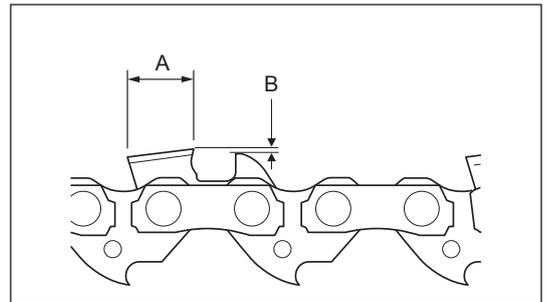
- All cutter length (**A**) must be equal. Cutters of different length prevent the chain from running smoothly, and may cause the chain to break.
- The chip thickness is determined by the distance between the depth gauge (round nose) and the cutting edge (**B**).
- The best cutting results are obtained with following distance between cutting edge and depth gauge.
Chain blade 91VXL: 0.64 mm (0.025")

⚠ WARNING: An excessive distance increases the risk of kick-back.

- The sharpening angle of 30° must be the same on all cutters. Differences in angle cause the chain to run roughly and unevenly, accelerate wear, and lead to chain breaks.
- The side plate angle of the cutter is determined by the depth of penetration of the round file. If the specified file is used properly, the correct side plate angle is produced automatically.
- Proper angle for each saw chain are as follows:
Chain blade 91VXL: 55°

File and file guiding

- Use a special round file (optional accessory) for saw chains to sharpen the chain. Normal round files are not suitable.
- Diameter of the round file for each saw chain is as follows:
Chain blade 91VXL: 4.0 mm (5/32")
- The file should only engage the cutter on the forward stroke. Lift the file off the cutter on the return stroke.
- Sharpen the shortest cutter first. Then the length of this shortest cutter becomes the standard for all other cutters on the saw chain.
- Guide the file as shown.
- The file can be guided more easily if a file holder (optional accessory) is employed. The file holder has markings for the correct sharpening angle of 30° (align the markings parallel to the saw chain) and limits the depth of penetration (to 4/5 of the file diameter).
- After sharpening the chain, check the height of the depth gauge using the chain gauge tool (optional accessory).
- Remove any projecting material, however small, with a special flat file (optional accessory).
- Round off the front of the depth gauge again.



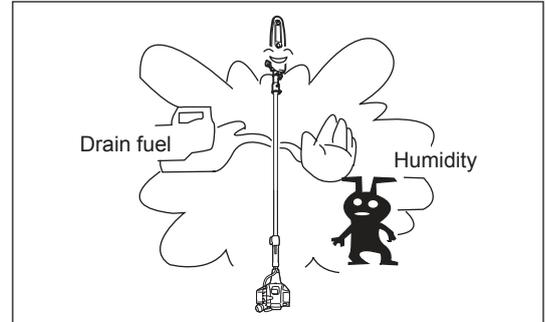
STORAGE



WARNING: When draining the fuel, be sure to stop the engine and confirm that the engine cools down.
The engine is still hot just after stopping the engine. Wait until it cools down, otherwise it may cause burns or fire.

When the machine is kept out of operation for a long time, perform the followings:

- Drain up fuel from the fuel tank and carburetor according to the following procedure:
 - 1) Remove the fuel tank cap, and drain fuel completely. If there is any foreign matter remaining in the fuel tank, remove it completely.
 - 2) Pull out the fuel filter from the refill port using a wire.
 - 3) Push the primer pump until fuel is drained from there, and drain fuel coming into the fuel tank.
 - 4) Reset the filter to the fuel tank, and securely tighten the fuel tank cap.
 - 5) Then, continue to operate the engine until it stops.
- Drain up the chain oil.
- Remove the saw chain and the guide bar.
- Clean the guide groove of the guide bar.
- Lubricate slightly on the saw chain and the guide bar.
- Remove the spark plug, and drip several drops of engine oil through the spark plug hole.
- Gently pull the starter handle so that engine oil will spread over the engine, and attach the spark plug.
- In general, store the machine in horizontal position. If it is not possible, place the machine as the motor unit comes below the cutting tool. Otherwise engine oil may leak from inside.
- Always pay attention to storing the machine in a safe place to prevent machine damage and personal injury.
- Keep the drained fuel in a special container in a well-ventilated shade.



Attention after long-time storage

- Before startup after long-time storage, be sure to replace engine oil (refer to "REPLACEMENT OF ENGINE OIL"). Oil will deteriorate while the machine is kept out of operation.

Fault location

Fault	System	Observation	Cause
Engine not starting or with difficulty	Ignition system	Ignition spark O.K.	Fault in fuel supply or compression system, mechanical defect
		No ignition spark	STOP-switch operated, wiring fault or short circuit, spark plug or connector defective, ignition module faulty
	Fuel supply	Fuel tank filled	Incorrect choke position, carburetor defective, fuel supply line bent or blocked, fuel dirty
	Compression	No compression when pulled over	Cylinder bottom gasket defective, crankshaft seals damaged, cylinder or piston rings defective or improper sealing of spark plug
Warm start problems	Mechanical fault	Starter not engaging	Broken starter spring, broken parts inside of the engine
		Tank filled ignition spark existing	Carburetor contaminated, have it cleaned
Engine starts but dies	Fuel supply	Tank filled	Incorrect idling adjustment, carburetor contaminated Fuel tank vent defective, fuel supply line interrupted, cable or STOP-switch faulty
Insufficient performance	Several systems may simultaneously be affected	Engine idling poor	Air filter contaminated, carburetor contaminated, muffler clogged, exhaust duct in the cylinder clogged

Item	Operating time	Before operation	After lubrication	Daily (10h)	25h	50h	200h	Shutdown/rest
Whole unit	Visually inspect	○						
Engine oil	Inspect	○						
	Replace					○*1		
Tightening parts (bolt, nut)	Inspect	○						
Fuel tank	Inspect	○						
	Drain fuel							○*3
Throttle control	Check function	○	○					
Stop switch	Check function	○	○					
Idle speed	Inspect/adjust			○				
Air cleaner	Clean			○				
Ignition plug	Inspect			○				
Cooling air duct	Clean/inspect			○				
Fuel pipe	Inspect			○				
	Replace						◎*2	
Fuel filter	Clean/replace					○		
Valve clearance (intake valve and exhaust valve)	Inspect/adjust						◎*2	
Engine overhaul							◎*2	
Carburetor	Drain fuel							○*3
Chain oil feed port	Clean			○				
Guide bar	Clean the groove and the chain oil feed port			○				
	Inspect			○				
	Supply grease			○				
Gear case	Supply grease				○			
Sprocket	Inspect					○		
Saw chain	Replace or ask for sharpening							○*4

*1 Perform initial replacement after 20h operation.

*2 For the 200 operating hour inspection, request authorized service center.

*3 After emptying the fuel tank, continue to run the engine and drain fuel in the carburetor.

*4 If required.

TROUBLESHOOTING

Before making a request for repairs, check a trouble for yourself. If any abnormality is found, control your machine according to the description of this manual. Never tamper or dismount any part contrary to the description. For repairs, contact Authorized Service Agent or local dealership.

State of abnormality	Probable cause (malfunction)	Remedy
Engine does not start	Failure to operate primer pump.	Push 7 to 10 times.
	Low pulling speed of starter rope.	Pull strongly.
	Lack of fuel.	Feed fuel.
	Clogged fuel filter.	Clean it.
	Disconnected fuel tube.	Connect fuel tube properly.
	Bent fuel tube.	Straighten fuel tube.
	Deteriorated fuel.	Deteriorated fuel makes starting more difficult. Replace with new fuel. (Recommended replacement: 1 month).
	Excessive suction of fuel.	Set throttle control to medium or high speed, and pull starter handle until engine starts. Once engine starts, saw chain starts rotating. Pay full attention to saw chain. If engine still does not start, remove spark plug, dry the electrode, and reassemble them as they originally were. Then, start as specified.
	Detached plug cap.	Attach securely.
	Contaminated spark plug.	Clean it.
	Abnormal clearance of spark plug.	Adjust clearance.
	Other abnormality of spark plug.	Replace it.
	Abnormal carburetor.	Make request for inspection and maintenance.
	Starter rope cannot be pulled.	Make request for inspection and maintenance.
Abnormal drive system.	Make request for inspection and maintenance.	
Engine stops soon Engine speed does not increase	Insufficient warm-up.	Perform warm-up operation.
	Choke lever is set to "CLOSE" although engine is warmed up.	Set to "OPEN".
	Clogged fuel filter.	Clean it.
	Contaminated or clogged air cleaner.	Clean it.
	Abnormal carburetor.	Make request for inspection and maintenance.
	Abnormal drive system.	Make request for inspection and maintenance.
Chain oil is not supplied.	The oil tank is empty.	Fill the oil tank with chain oil.
	The chain oil feed port is dirty.	Clean the chain oil feed port on the unit and guide bar.
	The adjusting screw of the chain oil feed rate is improperly set.	Set the adjusting screw properly.
Saw chain does not rotate ↓ Stop engine immediately	The guide bar is bent or damaged.	Replace the guide bar.
	Foreign matter caught by saw chain.	Remove foreign matter while the engine stopped.
	Abnormal drive system.	Make request for inspection and maintenance.
The equipment vibrates abnormally ↓ Stop engine immediately	Broken, bent or worn guide bar.	Replace guide bar.
	Loosened saw chain.	Adjust the saw chain tension.
	Abnormal drive system.	Make request for inspection and maintenance.
Saw chain does not stop ↓ Stop engine immediately	High idling rotation.	Adjust idle speed.
	Throttle control wire problem.	Ask service center to replace it.
	Abnormal drive system.	Make request for inspection and maintenance.
Engine does not stop ↓ Run engine at idling, and set choke lever to CLOSE	Detached connector to the I-O switch.	Attach securely.
	Abnormal electric system.	Make request for inspection and maintenance.

When the engine does not start after warm-up operation:

If there is no abnormality found for the checked items, open the throttle by about 1/3 and start the engine.

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