2-stroke gasoline engine for UAV

GT120THU

Maintenance manual

Ver.1.03

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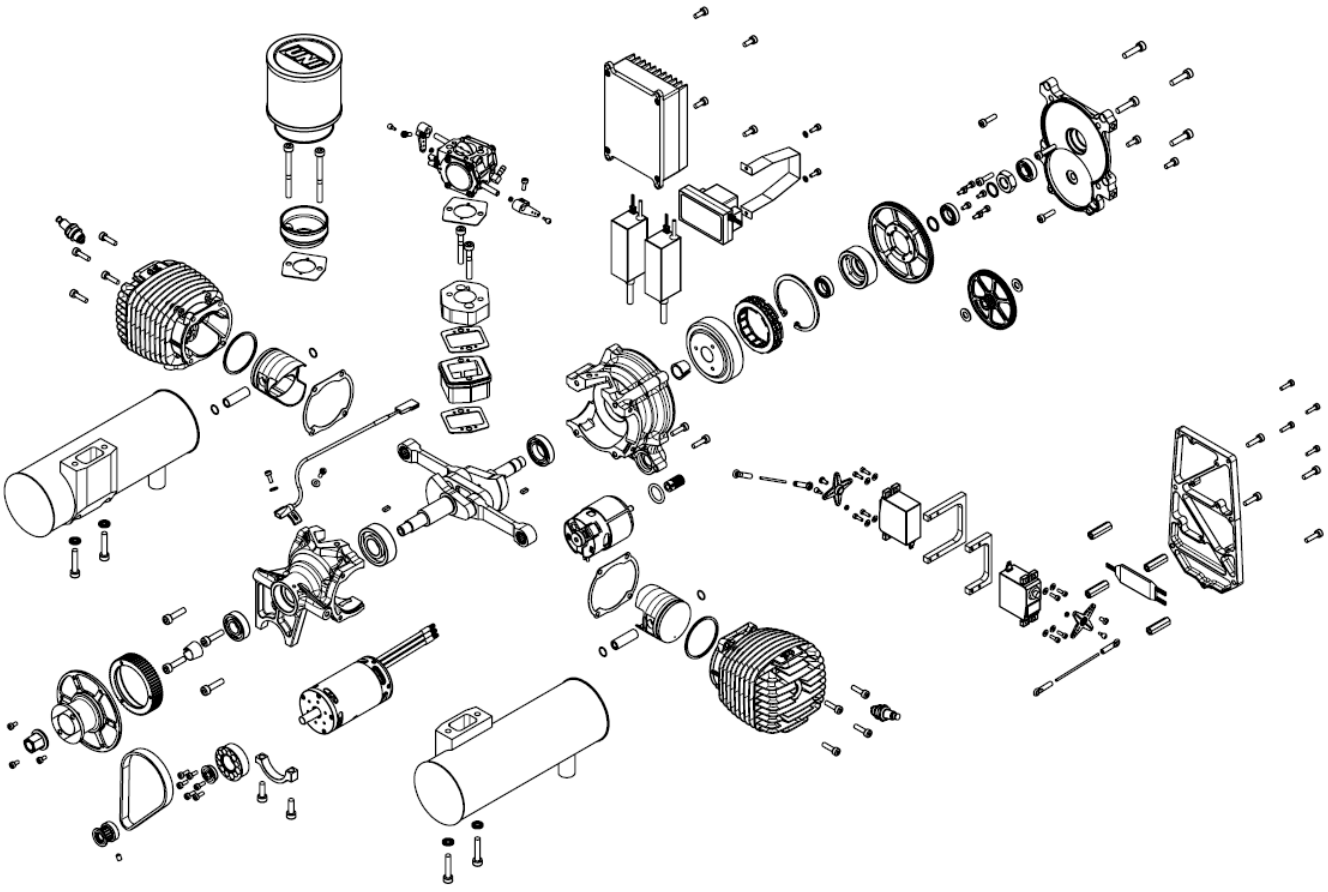


O.S. ENGINES MFG. CO., LTD.

Content

1. ABOUT THIS MANUAL

The 'GT120THU maintenance manual' explains about periodic inspection and maintenance of GT120THU, and about repair when it has an operation failure.

It is of vital importance, before maintenance of the engine, to read this manual and adhere to the advice contained herein. The "SAFETY INSTRUCTIONS AND WARNINGS" (below) must be read first.

2. SAFETY INSTRUCTIONS AND WARNINGS

(1) The power of the engine is capable of harming you, or others, if it is misused or abused. As an owner you are responsible for the safe operation of the engine, so act with discretion and care at all times.

(2) The advice which follows is grouped under two headings according to the degree of damage or danger which might arise through misuse or neglect.

WARNING-These cover events which might involve serious (in extreme circumstances, even fatal) injury.

ATTENTION- These cover the many other possibilities, generally less obvious sources of danger, but which, under certain circumstances, may also cause damage or injury.

(3) WARNING

① Never touch, or allow any object to come into contact with the rotating propeller and do not crouch over the engine when it is running.

② Gasoline is poisonous. Do not allow it comes into contact with the eyes or mouth. Always store it in a clearly marked container in a cool and dark place and out of reach of children.

③ Gasoline is highly flammable. Keep it away from an open flame, excessive heat, sources of sparks, or anything else which might cause it to ignite. Do not smoke or allow anyone else to smoke near to it.

④ Carry out mixing of gasoline and oil outdoors or in a well-ventilated place away from any source of fire.

⑤ Refill the fuel tank only after the engine is well cooled down, or there is a danger of fire.

⑥ The engine generates considerable heat. Do not touch any part of the engine until it has cooled down.

⑦ Never operate your engine in an enclosed space. Internal combustion engines exhaust deadly carbon-monoxide. Run your engine only in an open space.

⑧ Do not move the operation system of the engine or UAV aircraft alone or there is a possibility of injury.

⑨ Make sure (at least more than 2 people) understands the engine instruction clearly when getting ready to operates the engine or there is a possibility of injury.

⑩ When adjusting the output of regulate rectifier, make sure it matches the voltage of power supplies, or it could bring a danger of fire.

⑪ Do not charger the battery while the regulator rectifier is working since it could bring the danger of fire.

Observe the laws and regulations in each country and district concerning the usage, transportation and storage of gasoline. Ask details at fire station in each district.

(4) ATTENTION

① Follow the instruction of each manufacturer and pay attention to using or assembling propeller, drive and rotor. Otherwise there is a possibility to make them damaged.

② Start the engine after mounting it to the aircraft, or there is a possibility of injury.

③ Be sure to use an effective silencer. Frequent exposure to an open exhaust may eventually impair your hearing. Such noise is also likely to cause annoyance to others over a wide range.

④ Mount the engine in the aircraft surely following the manufacturer's instruction.

⑤ Keep unauthorized people away from the engine more than 30 meters before starting it, also do not allow them coming close to a running engine, or there is a possibility of injury.

⑥ When checking a spark plug with the power switch turned on, do not hold the plug, the plug cap, and the high-tension cord, or you will get an electric shock.

⑦ Make sure of using a proper diameter and pitch propeller, power train and rotor, or there is a possibility of injury

⑧ Do not use the propeller, powertrain, and rotor with a crack, damage, or malfunction, also do not modify them, or there is a possibility of piecing apart during operation.

⑨ Be sure to use accessory screws to fit a propeller and a clutch with designated torque mentioned in the instruction manual. Check if the screws are properly fastened every time before flight, or there is a possibility of injury during operation.

⑩ Always check the throttle linkage. If it is disconnected, throttle movement becomes uncontrollable, which may result in a serious accident.

⑪ Do not wear ties, loose sleeve shirt, scarf, a transmitter hook band when you come close to the rotating propeller, drive train, and rotor. Do not carry a pencil, a screwdriver in your shirt pocket from where they could fall through the propeller arc.

⑫ Wear safety glasses, and use the built-in starter when you start the engine.

⑬ Do not start the engine in an area containing loose gravel or sand. The propeller may throw such material in your face and eyes and cause injury.

⑭ If you have to carry the aircraft to runway with the engine running, make the engine on idling. Keep the propeller pointed away from you and others with keeping an eye on it.

⑮ Turn off the ignition module when you stop the engine or fully close the carburetor via the transmitter to shut off the fuel supply. Otherwise there is a possibility of injury.

⑯ Right after the engine is stopped, the engine may start with a crank even the igniter is turned off. Do not crank the engine, or there is a possibility of injury.

⑰ Be sure to install an externally operable switch for the ignition system to stop the engine if it starts unintentionally with the transmitter turned off or there is the possibility of injury.

⑱ Design the throttle linkage, with which the engine can be stopped via transmitter.

3. NOTIFICATION ON INSPECTION, MAINTENSANCE, AND REPAIR OF THE ENGINE

The following instruct the general precaution, which need to be followed upon engine inspection, maintenance and repair.

(1) Must use new genuine parts to replace any old ones.

(2) Clean the engine and its peripheral equipment before the work.

(3) Always use the right size tools in correct way. Do not use wrong size tools or tools for different purpose.

(4) Make sure the fuel tank has been removed out of aircraft before disassembling the engine otherwise specified.

(5) Make sure that all the system is turned off or batteries are removed before disassembling the engine otherwise specified.

(6) To avoid assembling wrong parts to the engine, keep the different parts grouped after disassembling.

(7) Keep your own memo to remind you how to re-assemble the engine as it was in case the “5. Exploded view” does not help you assembling the engine.

(8) Clean the dirt and old oil from the engine parts after disassembling, also remove the liquid gasket which has applied on joint parts.

(9) To avoid corrosion and rust, apply oil to the disassembled parts and store them in a plastic bag.

(10) Replace the O-rings, gaskets, C-clip retainers and stainless steel wire for binding and tie wraps with new ones after disassembling.

(11) Replace the screws and bolts if there are damages on them.

(12) Measure the parts periodically, which have operating limit size with calibrated instruments (calipers, micrometers, dial gauges, etc.).

(13) Since the gasoline or oil could cause damage to the resin parts such as rubber and plastic, make sure there is no any of it adheres to resin parts while working on the engine.

(14) When you remove a part like a cylinder head and a muffler, cover the hole with a plastic sheet not to dust come inside the engine.

(15) Replace the parts according to the criterion of each part to change explained in this manual if there are scratches, deformations, damages and cracks etc.

(16) Use new kerosene or gasoline to wash ball bearing taken out of the engine..

(17) When using an air blower to dry a ball bearing after cleaning them, hold the inner and outer race not to be rotated by the air blow, or there is a possibility for it to rotate beyond the limited and cause damages.

(18) In case you check rotation of a ball bearing by feeling with fingers, hold the inner race and turn the outer race to check, or vice versa.

(19) When you remove a ball bearing pressing the steel balls, check and confirm smooth rotation with feeling of fingers. Replace it with new one if you feel it rough.

(20) Apply oil to joint surface of two parts when assembling (no special oil type designated, we recommend 2-cycle oil for gasoline engines.)

(21) When installing a ball bearing, in case of single side sealed type, install it with the sealed side shown outside, in case of open type, with a model name engraved on the outer lace shown outside after assembling.

(22) When fixing parts with multiple screws, temporarily tighten all of them first, and make firm tightening starting from the center area to outer area, next, hotter area to colder area, finally tighten the diagonal screws.

(23) After completing assembly, make sure if all the screws and bolts are tighten up in each process.

(24) There is no any basic maintenance process stated in this maintenance manual. For more information, refer to the Federal Aviation Regulation Part 43 (13-1A and 13-2A).
（http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_43.13-1B_w-chg1.pdf）

4. OVERVIEW OF PERIODIC INSPECTION

We suggest the following periodic inspection after 25, 50, and 100-hour operation even the engine does not have any problem.

(1) Inspection after 25-hour operation

① Check the engine outside appearance

② Check the fuel tube

③ Check the fuel filter

④ Check the air cleaner

⑤ Check the plug cap and high-tension cord

⑥ Check the spark plug

⑦ Check the throttle linkage and the chock linkage

⑧ Check the throttle servo and the choke servo

⑨ Check all the screws.

⑩ Check all the wirings

(2) Inspection after 50-hour operation

Do the following inspection in addition to the above inspection.

① Generator belt tension adjustment

② Regulate rectifier inspection

③ Generator inspection

④ Ignitor inspection

(3) Inspection after 100-hour operation

100 hours inspection means doing the check and maintenance as follows in addition to all the 25 and 50-hour inspection.

① Disassemble and inspect each part of engine

i) inspection and maintenance of the cylinder block

ii) inspection and maintenance of the pistons

iii) inspection and maintenance of the piston rings

iv) inspection and maintenance of the piston pins

v) inspection and maintenance of the crankshaft and the connecting rods

vi) inspection and maintenance of the ball bearings

vii) inspection and maintenance of the carburetors

viii) inspection and maintenance of the generator

ix) inspection and maintenance of the starter motor

x) inspection and maintenance of the starter gears

xi) inspection and maintenance of the one-way clutch

② Air cleaner maintenance

③ Fuel tube filer replacement

④ Fuel tube replacement

⑤ Generator belt replacement

5. INSPECTION AFTER EVERY 25 HOURS OF OPERATING TIME

(1) Visual inspection of the engine

Check the engine if there are dents, damage, losses on the cooling fins. Check if foreign objects stuck between the cooling fins to be removed. Check if there are oil leakages or oil stains, or fretting wears on the surface of it.

In case you find large dents and losses of the cooling fins, replace the damaged parts. Remove the foreign objects between the fins if there are. Unusual oil on the surface of the engine often tells a crack on the surface. Replace the part if it is damaged.

(2) Inspection of the fuel tubes

①Take out cowlings and bodies to expose the fuel tubes for inspection.

②Check for damages on the tube: kinks, tears, wears, deformation, and hardening etc.
It is difficult to find the tubes are hardened and brittle by visual inspection, so check the tubes by bending and touching them.

③Check for leaking fuel around the connecting parts.

④Pull the tubes to check for the clamping force. Tube clamps do not maintain the clamping force to joint nipples when the tubes are hardened.

⑤Remove the tubes in the fuel tank and check for the damage on the tubes. Check if the fuel tube with a weight fit at the end is still flexible enough to bend itself in response to the position of aircraft.

⑥In case you find some problem in the above 1-5, change the tubes.

⑦Check for leaking fuel around the fuel exit of the fuel tank. If there is a leak, fasten the tube clamp or change it. Follow the instructions of fuel tank if there are.

(3) Inspection of the fuel filter

①Filter Body A of the fuel filter is transparent to check for the dust in the filter. Wash the filter following the processes below 2-7.

②Remove the tube cramps at the both ends of the filter.

③Take out the fuel filter putting a piece of rug under the filter to catch and absorb the fuel that will run out of the tubes when they are disconnected.

④Disassemble the filter.

i) Unscrew Filter body A and B.

ii) Remove the mesh from Filter body B.

iii) Remove the o-ring from Filter body A.

⑤ Wash and inspection of the each part.

i) Wash the mesh to remove the dust and dirt with gasoline or kerosene. Blow off the dust and dirt with compressed air.

WARNING

Gasoline and kerosene are highly flammable. Carry out washing the fuel filter only outdoors or in well ventilated area away from any source of fire.

ii) Wash Filter body A and B both inside and outside with gasoline or kerosene using compressed air or a brush.

iii) Check for the damages on Filter body A, B, the mesh and the o-ring: crack, tear, wear, and deformation with a magnifying glass. Replace the fuel filter set in case of any damage.

⑥Do not twist and damage the o-ring when you assemble the fuel filter after cleaning. Screw Filter body B onto Filter body A with tightening torque of 0.8N・m.

⑦Connect the fuel filter again to the fuel tubes following “11. FUEL TUBE” in page 8 in the instruction manual.

(4) Inspection of the air filter

①Check for the damages on the air filter: cracks, tears, wears, deformation, and deterioration. Replace the air filter set in case of any damage.

②Remove visible foreign objects from the surface of the air filter with fingers. Do not use compressed air otherwise the air filter will get damage. Also, if you blow off the dust with compressed air from the outside filter, the dust in the filer will come into the engine through the carburetor.

③This is a wet type air cleaner. In case it gets dry or gets dust, wash and re-oil it as follows.

i) Loosen the hose clamp to remove the air cleaner unit.

ii) Wash the air filter using air filter cleaner available in the market. Follow the instructions of air filter cleaners.

WARNING

Wash the air filter only outdoors or in well ventilated area away from any source of fire.

iii) After washing the air filter, dry and re-oil it with air filter oil available in the market. Follow the instructions of air filter oil.

iv) Attach the air filter to the carburetor with the hose clamp with fastening torque of 1.0N・m.

(5) Inspection of the spark plug cap and the high-tension cord

①Remove the plug cap. Pull and shake the plug cap holding its body tight. Do not pull the high-tension cord or use a screw driver to remove the plug cap from the spark plug. It may ruin the plug cap.

②Check for tear and worn on the surface of the high-tension cord. In case the outer metal mesh is worn more than 1/2 of its thickness, replace the whole ignition system. The high-tension cord cannot be replaced itself alone. In case it is worn less than 1/2, use a spiral cord protector. In case string of the outer metal mesh is cut considerably, more than 5 strings per 10mm cord length, replace the ignition system. If less, reinforce the cord with a spiral cord protector.

③Check if the caulking parts (Fig.2) come off. Make sure to caulk the parts firmly. Send back the ignition system for repair to us if it is requested.

④Check if the ring is placed at the right position (Fig.2). If the ring is damaged or lost, replace CODE No.74002200 PLUG CAP SET.

⑤Check for damage of the silicon part in the plug cap. In case of damage, replace CODE No.74002200 PLUG CAP SET.

⑥Fit the plug cap on the spark plug after inspection.

Fig. 2

(6) Inspection of the spark plug

①Remove the spark plug using a 14mm spark plug socket removal tool available in the market.

②Check for damages on the spark plug. Replace it if any damage on it.

③Clean the center and ground electrodes with a wire brush.

④Check the spark gap of NGK CM-6 spark plug. It should be 0.4 ~0.5 ㎜

⑤For general information of the spark plug, visit the homepage of the manufacturer.
http://www.ngk-sparkplugs.jp/english/index.html

⑥For further information other than the above, visit the following homepage and refer to Advisory Circular 43. 13-1B, 8-15~17.
https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_43.13-1B_w-chg1.pdf

⑦Re-install the spark plug after the inspection. The fastening torque is 12N・m.

(7) Inspection of the throttle linkage and the choke linkage

①Check for damages on the throttle arm, the choke arm, the servo horns, the link rods, the ball links, and the linkage balls (missing, crack, scratch, and deformation). Replace the parts if there is some damage.

②Turn on the operating system and check for looseness of the throttle linkage and the choke linkage by shaking the both ends of which with fingers. If there is looseness, replace a ball link. There is still looseness even after replacing a ball link, replace a linkage ball as well.

(8) Inspection of the throttle servo and the choke servo

①Check for damage on the throttle servo the choke servo, and their rubber bushes: missing, crack, scratch, and deformation. Replace it if there is damage or deterioration.

②Disconnect the ball link before inspection of the throttle servo and the choke servo.

③Turn on the operation system, and move up and down the throttle stick, and check if the throttle servo moves smoothly without strange noise. Replace it if you recognize strange noise from the servo or unsmooth movement of it.

④Turn on the radio control system, check if the throttle servo horn and the choke servo horn are fixed tight.

⑤Turn on the operation system, and shake the cables from each servo. If there is chattering or noise, replace the servo.

⑥Re-connect the ball link which was disconnected in ii) above.

⑦In case the throttle servo and the choke servo are repaired or replaced, readjust the linkages of the throttle valve and the choke valve to open/close them fully without excessive tension of the linkages. Also make sure normal ⇔ reverse adjustment is done by the operation system.

NOTICE

Do not get stuck your finger in the servo and the servo horn. I may cause injury.

(9) Inspection of the fixing screws

①Fasten the engine mounting screws with a torque of 5.5N・m.

②fasten the silencer fixing screws with a torque of 7.2N・m.

(10) Inspection of the cables

Check the following cables for damage: cut, scratch, deformation, hardening.

The cable between the rotation sensor and the signal dividing unit SDU-01

The cables between the signal dividing unit SDU-01 and the ignitor IG-11 (2 pcs)

The cables between the ignitor (2pcs) and the power source

The cable between the starter motor and the starter switch SSW-100

The cable between the starter switch SSW-100 and the power source

The cable between the generator OGA-200 and the regulate rectifier ORF-200

The cable between the regulate rectifier ORF-200 and the power supply destination

The cable between the throttle servo and the receiver

The cable between the choke servo and the receiver

Check for damage on the connectors of the above: loosening, scratch, deformation, disconnection. Replace the parts if there is any damage.

6. INSPECTION AFTER EVERY 50 HOURS OF OPERATING TIME

(1) Adjustment of the tension of the generator belt

①Press the point shown with the arrow in Fig.3 applying 2.2 pound-force (1kgf) pressure and measure the deflection.

②The belt should give in 0.5 - 1.0mm. If not, follow the procedure below.

③Loosen the M5 screw pointed with the arrow in Fig.4.

④Turn the generator to adjust the deflection within 0.5 – 1.0mm.

⑤Fix the M5 screw after adjustment with fastening torque 5.4N・m.

(2) Inspection of the regulate rectifier

①Start the engine and move the throttle up until the generator can generate the set voltage: 3,000rpm when the set voltage is 12V, 6,000rpm when the set voltage is 24V.

②Measure the voltage of the output when no load and when 5A load.

③Check if the difference of voltage when no load and when 5A load is less than 1.0V. In case the difference is not within the range, replace the regulate rectifier.

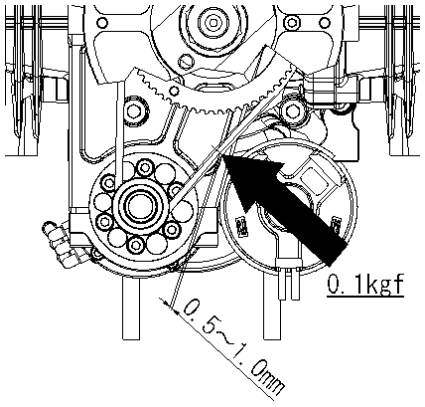


Fig.3

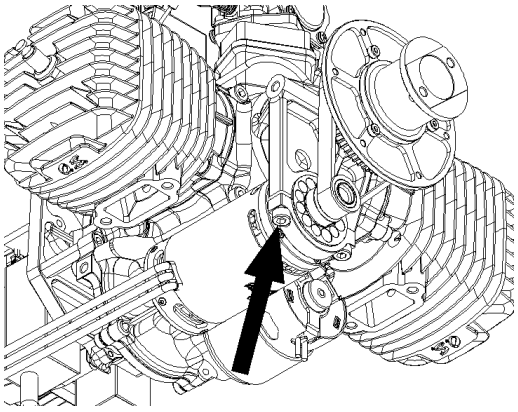


Fig.4

(3) Inspection of the generator

① Inspection of insulation resistance

i) Disconnect all the three connectors from the regulate rectifier.

ii) Measure the resistance between any one of the three connectors and the tip of the generator shaft. Use an ohmmeter (AC125V).

iii) In case the resistance is 10MΩ or less, replace the generator.

② Inspection of phase-to-phase insulation resistance

i) Measure the resistance between each three of the connectors, which were disconnected in the above process.

ii) In case the average of the phase-to phase resistance measured is 65mΩ±5mΩ, and the deviation is 10mΩ or more, replace the generator.

iii) Connect the cables of the generator after inspection or replacement.

(4) Inspection of the ignitor

Generally, spark ignition is more difficult in a combustion chamber of an engine, where fuel mixture is compressed, than under atmospheric pressure. The discharge distance (the spark plug gap) is 0.4 – 0.5mm in the engine, which is equivalent to the discharge distance of 5-6mm under atmospheric pressure. So make a spark plug for spark check under atmospheric pressure as shown below, whose discharge distance is more than 5mm.

①How to make a special spark plug for spark check

i) Get CM-6 ready. It doesn't have to be a new one but a used one.

ii) Cut off a part of the spark plug body as shown in the picture.

②Detach the both plug caps and remove the spark plugs.

③Attach the special spark plug mentioned in ① to the plug cap.

④Turn on the starter and check if there is a spark between the center electrode and the spark plug body, which is cut short as shown in Fig. 6. Replace the ignitor if there is no spark.。

Note: The spark check inspection should be done to both ignitors, right and left.

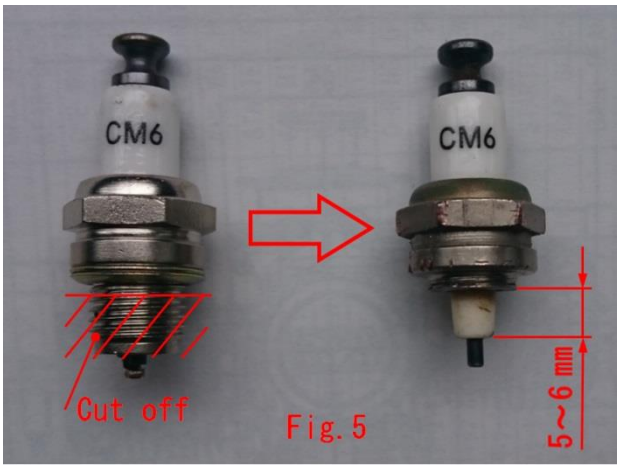


Fig. 5

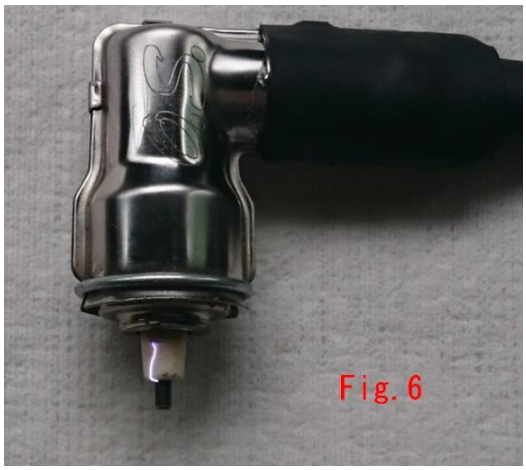


Fig. 6

WARNING

Inspect the ignitors in well ventilated room away from any source of fire to avoid fire accidents.

7. INSPECTION AFTER EVERY 100 HOURS OF OPERATING TIME

The engine needs to be dismounted and disassembled for maintenance. Contact us if you need us to inspect it.

(1) Disassembling the engine for inspection and replacement

①Inspection and maintenance of the cylinder blocks

i) Remove the spark plug and the four cap screws M4 x 15 from the cylinder block and detach it from the engine. Replace the gasket whenever you detach the cylinder block.

ii) Wash the cylinder block with gasoline.

WARNING

When you wash the part with gasoline or kerosene, carry out the work only outdoors or in well ventilated area away from any source of fire to prevent a fire.

iii) Remove the carbon sticking to the combustion chamber and the exhaust port.

iv) Check the cylinder inner wall for vertical scoring. Replace the cylinder block if necessary.

v) Replace the cylinder block if you can feel scratches with a finger nail on inner wall even if there is no overheat mark.

vi) Measure the inner diameter of the cylinder block at around 10mm from the top dead center. The maximum limit of the inner diameter of the cylinder is ϕ44.070mm. Inner diameter should be measured at four points, 0, 45, 90, 135 degrees to check roundness. The differences between the longest and the shortest diameter should be less than 0.050mm. If the difference is more than 0.030mm, replace the cylinder block.

vii) In case there is no defect after the above procedures i)～vii), the existing cylinder block can be used again, but replace the cylinder gasket.

②Inspection and maintenance of the pistons

i) Remove the piston pin retainers (circlips), the piston pin (wrist pin), and the piston ring from the piston. Do not use the used piston pin retainers when you assemble the piston again.

ii) Wash the piston with gasoline or kerosene.

WARNING

When you wash the part with gasoline or kerosene, carry out the work only outdoors or in well ventilated area away from any source of fire to prevent a fire.

iii) Remove the carbon sticking to the piston.

iv) Check the bottom surface of the piston ring groove (see Fig.7) for sticking carbon. (Fig.8) and remove the carbon not to give damage to the piston groove.

v) Check the piston for any scratches. Replace the piston if there are scratches.

vi) Check the base surface of the piston groove for any damages with a magnifying glass. Replace the piston if there are damages on it. (Fig.9)

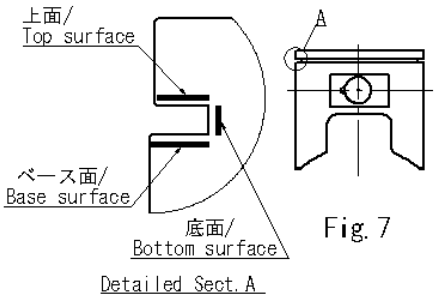
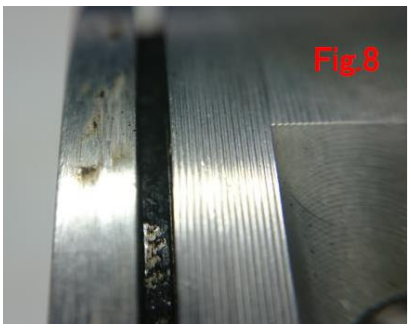
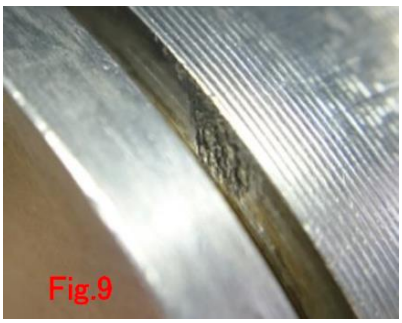


Fig. 7





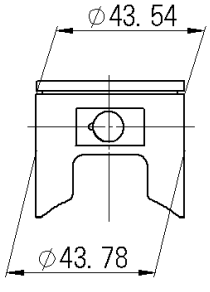


Fig. 10

vii) Measure the diameters of two points shown in fig. 10 with a blade micrometer. The minimum limit diameter is ϕ43.540mm at just below the piston groove, and ϕ43.980mm at below piston pin hole (wrist pin hole).

Note 1: Measure the diameter in two directions, the direction of the piston pin and the direction 90 degrees to the piston pin. Adopt the smaller diameter as the data.

Note 2: The piston is barrel shaped. Do not use a standard micrometer to measure the diameter precisely. Use a blade micrometer.

viii) Measure the inner diameter of the piston pin hole (Fig. 11) with an internal caliper gauge.

Replace the piston in case the measured inner diameter is more than ϕ9.140mm.

Note: Measure the piston pin hole at both ends vertically and horizontally. Adopt the largest as the data.

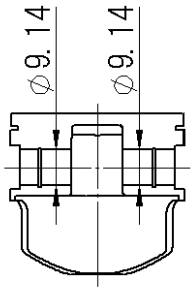


Fig. 11

Viiii) Install the maintained piston ring (see 3. Inspection and maintenance of the piston ring below) or a new piston ring in the piston ring groove and make sure it moves smoothly in the groove.

③Inspection and maintenance of the piston ring

Note: There is no top side and base side of the piston ring when it is new, but once it is used, surfaces of the piston ring become matching to the top/base surface of the piston ring groove. So once top/base side is decided, the top side should always be on top side and the base side always on base side. Do not install the piston ring upside down when you use the same piston ring after maintenance.

i) Remove carbon buildup on the inner side of the piston ring with a tool made of softer material than the piston ring itself not to give damage on it.

ii) Check the upper side of the piston ring for carbon buildup and remove the carbon buildup. Do not file off the ring itself but only remove the carbon buildup.

iii) Check the outer surface of the ring for heat mark or any scratches. Replace the ring if there are damages on it. Check the inner wall of the cylinder block for damage as well. It is likely to have damages on it when the outer surface of the ring is damaged.

iv) Check the bottom side of the piston ring for heat mark or any scratches. Replace the ring if there are damages on it. Check the base surface of the piston ring groove for damages as well. It is likely to have damages on it when the bottom side of the piston ring is damaged.

④Inspection and maintenance of the piston pin

i) Pull out the piston pin to remove carbon buildup.

ii) Measure the outer diameter of the piston pin, both ends, center vertically and horizontally (total 6 points). Replace the piston pin in case the measured diameter is less thanϕ9.010mm. (Fig.12)

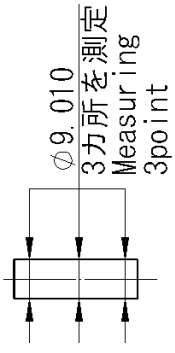


Fig. 12

⑤Inspection and maintenance of the crankshaft assembly

Note: The crankshaft assembly and connecting rods cannot be disassembled.

i) Wash the assembly unit with kerosene or gasoline.

WARNING

When you wash the part with gasoline or kerosene, carry out the work only outdoors or in well ventilated area away from any source of fire to prevent a fire.

ii) Measure each diameter of the crankshaft shown in Fig.13 with a micrometer. Replace the crankshaft assembly in case the measured diameter is less than the size shown in Fig.13.

iii) Check the balancing of the crankshaft using a dial indicator (see Fig.13). If the value is more than 0.100, replace the crankshaft assembly.

iv) Measure the big end of the connecting rod our of round with a dial indicator. In case the value is more than 0.120, replace the crankshaft assembly.

v) To check the play of the small end of connecting rod, put a piston pin in the small end and measure the play of the piston pin with a dial indicator. In case the value is more than 0.050, replace the connecting rod.

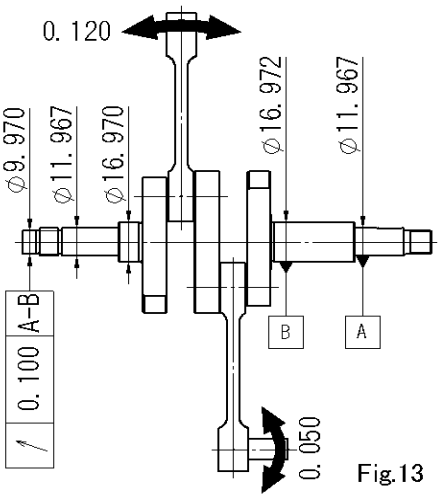


Fig.13

⑥Inspection and maintenance of the ball bearings

Dismount the ball bearings out of the crankcase or the housing when you check them.

i) Wash the ball bearings with kerosene or gasoline. Before starting the work, follow the instructions (16)～(19) in "3. Notification on inspection, maintenance, and repair of the engine" in this manual (page 4)

WARNING

When you wash the parts with gasoline or kerosene, carry out the work only outdoors or in well ventilated area away from any source of fire to prevent a fire.

ii) Check the ball bearings for damages with a magnifying glass, outer rings, inner rings, balls, and cages. You can inspect balls and cages only for open type ball bearings. Replace the bearings in case there are damages.

iii) Hold the bearing horizontally in one hand, and then rotate the outer ring to confirm that it turns smoothly. Replace the ball bearing if it does not turn smoothly. Ball bearings are important parts in the engine, so replace immediately when you find something abnormal.

⑦Inspection and maintenance of the carburetor

Some parts cannot be assembled upside down, left side right, or inside out even they look the same. Follow the instructions (16)～(19) in "3. Notification on inspection, maintenance, and repair of the engine" in this manual (page 4).

i) Dismount the carburetor from the engine to wash with kerosene or gasoline. Do not blow compressed air so close not to give damage on the internal parts.

WARNING

When you wash the part with gasoline or kerosene, carry out the work only outdoors or in well ventilated area away from any source of fire to prevent a fire.

ii) Check the carburetor for damages and missing parts. Replace the part if there are damages.

iii) Move the throttle arm and the choke arm from the fully close position to the fully open position to check it moves smoothly without looseness. Replace the part if it does not move smoothly without looseness.

iv) In case the engine does not work well after adjustment of the carburetor, remove the 4 screws, Plate 1, Sheet 1, and 2 (See Fig.14). Take out the mesh in Part A in Fig.14 and wash off the dust with kerosene or gasoline, or blow off the dust with compressed air. Check Sheet 1 and 2 (Fig.14) for any deformation and hardening. Replace it in case of deformation and hardening. Reassemble the carburetor placing the parts

in order at which they were minding the front side and the back side. Fastening torque of the four screws is 0.8N・m.

Remove the 4 screws, Plate 2, Sheet 3, and 4 (See Fig.15). Check Sheet 3 and 4 (Fig.15) for any deformation and hardening. Replace it in case of deformation and hardening. Reassemble the carburetor placing the parts in order at which they were minding the front side and the back side. Fastening torque of the four screws is 0.8N・m.

In case the performance does not improve after the maintenance, replace the carburetor.

Visit the following for further inspection and maintenance.

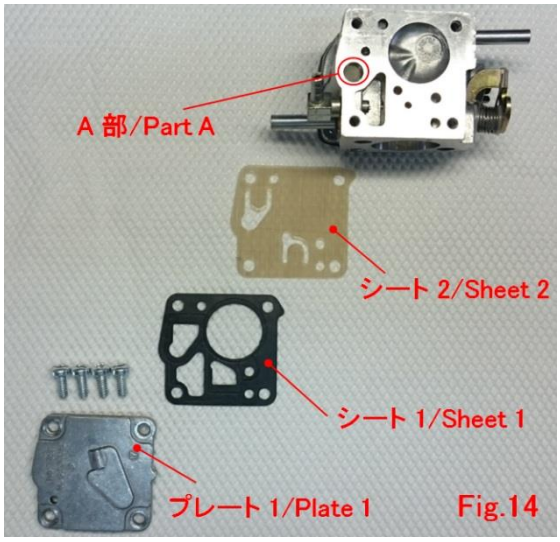


Fig.14

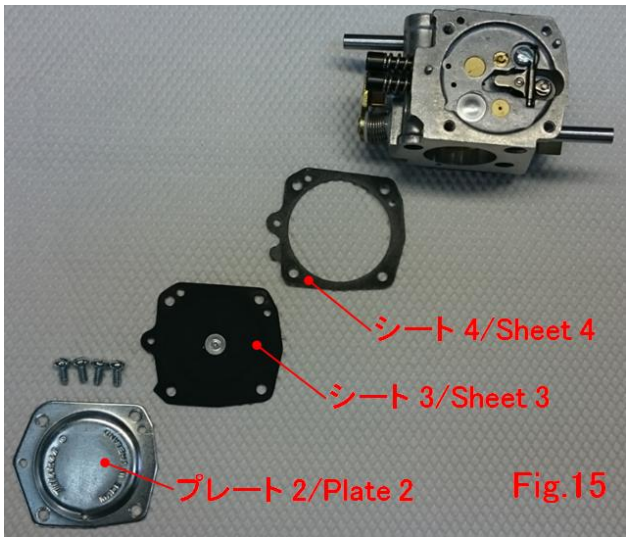


Fig.15

WARNING

When you wash the parts with gasoline or kerosene, carry out the work only outdoors or in well ventilated area away from any source of fire to prevent a fire.

⑧Inspection and maintenance of the generator

i) Dismount the generator from the engine. Check the generator including connectors, lead wires for any damages. If there are any damages, replace the part.

ii) Remove the driven pulley 3G16 and the generator adapter from the generator. Measure the diameter shown in Fig.16 at 12mm from the shaft end with a blade micrometer. In case the diameter is ϕ7.960 or less, replace the shaft.

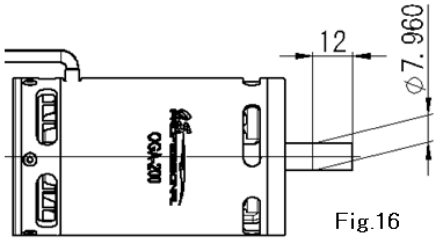


Fig.16

iii) The generator shaft and the ball bearings of the generator adapter need to be glued with adhesive such as LOCTITE®601. Lubricate the ball bearings with machine oil (viscosity ISO VG68～100) after wash.

⑨Inspection of the starter motor

i) Dismount the starter motor from the engine. Check the motor including connectors, lead wires for any damages. If there are any damages, replace the part.

ii) Measure looseness of the shaft with a dial indicator. In case the value is more than 1.0mm (thrust) and 0.05mm (radial), replace the shaft.

iii) Measure the gap between the Brush end face and the Brush guide end face (Fig. 17) with a pair of Vernier caliper. In case the gap is 5.0mm or more, replace the starter motor.

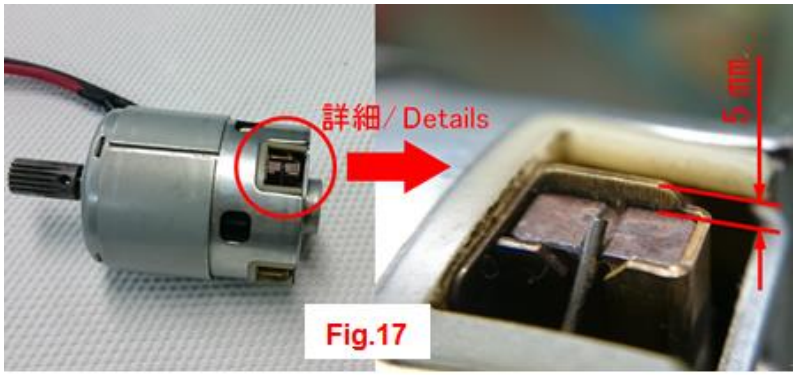


Fig.17

⑩Inspection and maintenance of the starter gears

Remove the gears from the engine. Wash the gears with kerosene or gasoline. Check the gears for damages or uneven wear of the teeth. Replace the gears if there are damages and uneven wears.

WARNING

When you wash the parts with gasoline or kerosene, carry out the work only outdoors or in well ventilated area away from any source of fire to prevent a fire.

⑪Inspection and maintenance of the one-way clutch

Remove the one-way clutch from the engine, clean it with kerosene or gasoline. Check by vision to make sure there is no any damage on it. Replace it if there are damages and uneven wears.

WARNING

When you wash the parts with gasoline or kerosene, carry out the work only outdoors or in well ventilated area away from any source of fire to prevent a fire.

⑫Inspection and maintenance of the generator belt and pulley

Remove the generator belt and check the following.

i) worn notches

ii) missing notches

iii) cracking on the outer surface

iv) cracking between the notches

v) fabric exposed on the side of the belt

vi) oil adhering to the surface of the belt

In case you find the above, replace the belt.

Check the driver pulley and the driven pulley for worn or missing teeth. In case of these damages, replace the pulleys.

(2)Inspection and maintenance of the air cleaner

Dismount the air cleaner and follow the instructions in “5. INSPECTION AFTER EVERY 25 HOURS OF OPERATING TIME” ③ o f (4).

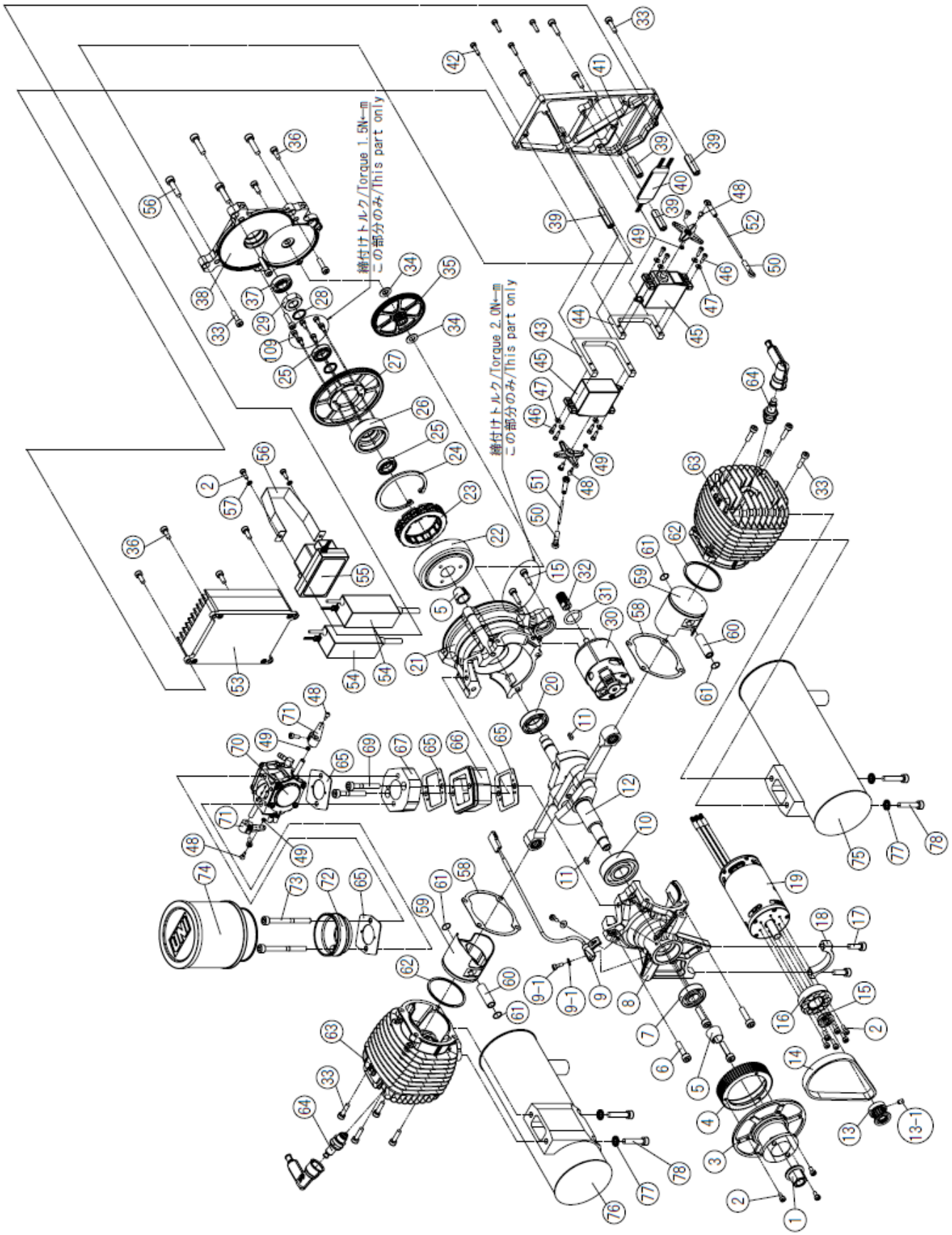
(3)Replacing the fuel filter

Replace the fuel filter.

(4)Replacing the fuel tubes

All the fuel tubes, which have been used for more than one year should be replaced.

7. EXPLODED VIEW



8. PARTS LIST

№	Code	名称	Name	備考/Note
1	79850100	ﾅｯﾄ M10X1.0	M10X1.0	締付 トルク/ Tightening Torque 44N･m
2	79871109	ｷｬｯﾌﾟｽｸﾘｭｰ M3X6(10 ｲﾘ)	CAP SCREW M3X6(10/SET)	締付 トルク/ Fastening Torque 1.1N･m
3	4AA08000	ﾌｧﾝｼｬﾌﾄ	FAN SHAF	
4	4AA70010	ﾄﾞﾗｲﾌﾞﾌﾟｰﾘ 3G63	DRIVE PULLEY 3G63	
5	29708100	ﾃｰﾊﾟｰｺﾚｯﾄ	TAPER COLLET	
6	79871520	ｷｬｯﾌﾟｽｸﾘｭｰ M5X20(10 ｲﾘ)	CAP SCREW M5X20(10/SET)	締付 トルク/ Fastening Torque 7.2N･m
7	29332000	ﾎﾞｰﾙ ﾍﾞｱﾘﾝｸﾞ(F)	BALL BEARING (F)	
8	4AA01000	ﾌﾛﾝﾄｹｰｽ	FRONT CASE	
9	74002320	回転ｾﾝｻｰ	ROTATION SENSOR	
9-1	74002321	ｾﾝｻｰ ﾄﾘｯｹﾈｼﾞｾｯﾄ(2 ｲﾘ)	SENSOR SCREW SET(2/SET)	締付 トルク/ Fastening Torque 0.4N･m
10	28631000	ﾎﾞｰﾙ ﾍﾞｱﾘﾝｸﾞ(M)	BALL BEARING (M)	
11	29708200	ﾍｲｺｳ ｷｰ	PARAREL KEY	
12	4AA02000	ｸﾗﾝｸｼｬﾌﾄ一式	CRANKSHAFT ASSY	
13	4AA07020	ﾄﾞﾘﾌﾞﾝﾌﾟｰﾘ 3G16	DRIVEN PULLEY 3G16	
13-1	79820406	ｾｯﾄｽｸﾘｭｰ M4X6(10 ｲﾘ)	SET SCREW M4X6(10/SET)	締付 トルク/ Fastening Torque 1.5N･m
14	4AA07050	ﾍﾞﾙﾄ 3GT-255-10	BELT 3GT-255-10	
15	4AA32000	ﾎﾞｰﾙ ﾍﾞｱﾘﾝｸﾞ(ｼﾞｪﾈﾚｰﾀ)	BALL BEARING(GENERATOR)	
16	54059001	ｼﾞｪﾈﾚｰﾀｱﾀﾞﾌﾟﾀ-	GENERATOR ADAPTER	
17	79871515	ｷｬｯﾌﾟｽｸﾘｭｰ M5X15(10 ｲﾘ)	CAP SCREW M5X15(10/SET)	締付 トルク/ Fastening Torque 5.4N･m
18	4AA07040	ｼﾞｪﾈﾚｰﾀﾎﾙﾀﾞ-	GENERATOR HOLDER	
19	54053000	ｼﾞｪﾈﾚｰﾀｰ OGA-200	GENERATOR OGA-200	
20	27130020	ﾎﾞｰﾙ ﾍﾞｱﾘﾝｸﾞ(R)	BALL BEARING(R)	
21	4AA01800	ﾘｱｹｰｽ	REAR CASE	
22	4AA07070	ﾜﾝｳｪｲﾎﾙﾀﾞ-ｱｳﾀ-	ONE WAY HOLDER OUTER	
23	4AA07080	ﾜﾝｳｪｲｸﾗｯﾁ	ONE WAY CLUTCH	
24	4AA07090	ﾜﾝｳｪｲﾘﾃｰﾅｰ(RTW-55)	ONE WAY RETAINER(RTW-55)	
25	4AA07110	ﾎﾞｰﾙ ﾍﾞｱﾘﾝｸﾞ(ﾜﾝｳｪｲ)	BALL BEARING(ONE WAY)	
26	4AA07100	ﾜﾝｳｪｲﾎﾙﾀﾞ- ｲﾝﾅｰ	ONE WAY HOLDER INNER	
27	4AA07130	ｽﾀｰﾀｰｽﾊﾟｰｷﾞｱ	STARTER SPUR GEAR	
28	4AA07120	ｼﾑﾘﾝｸﾞ 12X16X1	SIM RING 12X16X1	

29	79850121	ﾅｯﾄ M12X1.75LH	NUT M12X1.75LH	締付トルク/ Fastening Torque 44N･m
30	4AA07140	ｽﾀｰﾀｰﾓｰﾀｰ	STARTER MOTOR	
31	4AA07410	O-ﾘﾝｸﾞ (P15-FKM)	O-RING (P15-FKM)	
32	4AA07190	ｽﾀｰﾀｰﾋﾟﾆｵﾝｷﾞｱ	STARTER PINION GEAR	
33	79871415	ｷｬｯﾌﾟｽｸﾘｭｰ M4X15(10 ｲﾘ)	CAP SCREW M4X15(10/SET)	締付トルク/ Fastening Torque 3.6N･m
34	79872060	平ﾜｯｼｬ 6.0(10 ｲﾘ)	WASHER 6.0(10/SET)	
35	4AA07210	ｽﾀｰﾀｰﾐﾄﾞﾙｷﾞｱ	STARTER MIDDLE GEAR	
36	79871410	ｷｬｯﾌﾟｽｸﾘｭｰ M4X10(10 ｲﾘ)	CAP SCREW M4X10(10/SET)	締付トルク/ Fastening Torque 2.7N･m
37	4AA07240	ﾎﾞｰﾙ ﾍﾞｱﾘﾝｸﾞ(ｶﾊﾞｰ)	BALL BEARING(COVER)	
38	4AA07250	ﾘｱｶﾊﾞｰ	REAR CAVER	
39	4AA07270	ﾃﾞﾊﾞｲｽﾌﾟﾚｰﾄｽﾃｰ	DEVICE PLATE STAY	
40	4AA07400	ｼﾝｺﾞｳﾌﾞﾝｷｭﾆｯﾄ SDU-01	SIGNAL DISTRIBUTOR SDU-01	
41	4AA07260	ﾃﾞﾊﾞｲｽﾌﾟﾚｰﾄ	DEVICE PLATE	
42	79871140	ｷｬｯﾌﾟｽｸﾘｭｰ M3X12(10 ｲﾘ)	CAP SCREW M3X12(10/SET)	締付トルク/Fastening Torque 1.1N･m
43	4AA07290	ｻｰﾎﾞﾏｳﾝﾄ L	SERVO MOUNT L	
44	4AA07280	ｻｰﾎﾞﾏｳﾝﾄ S	SERVO MOUNT S	
45	4AA07300	ｻｰﾎﾞ BLA1HF	SERVO BLA1HF	
46	79871030	ｷｬｯﾌﾟｽｸﾘｭｰ M2.6X10(10 ｲﾘ)	CAP SCREW M2.6X12(10/SET)	締付トルク/ Fastening Torque 0.18N･m、LOCTITE 222 使用
47	79872026	平ﾜｯｼｬ 2.6(10 ｲﾘ)	WASHER 2.6(10/SET)	
48	4AA07060	ﾘﾝｹｰｼﾞﾎﾞｰﾙ	LINKAGE BALL	
49	79850020	ﾅｯﾄ M2X0.4(10 ｲﾘ)	NUT M2X0.4(10/SET)	
50	4AA07310	ﾎﾞ-ﾙﾘﾝｸ	BOLL LINK	
51	4AA07330	ﾘﾝｸﾛｯﾄﾞ L39.5	LINK ROD L39.5	
52	4AA07320	ﾘﾝｸﾛｯﾄﾞ L48	LINK ROD L48	
53	54055000	ﾚｷﾞｭﾚｰﾄﾚｸﾃｨﾌｧｲｱ ORF-200	REGULATE RECTIFIER ORF-200	
54	74002D00	ｲｸﾞﾅｲﾀｰ IG-11	IGNITION MODULE IG-11	
55	4AA07340	ｽﾀｰﾀｰｽｲｯﾁ SSW-100	STARTER SWITCH SSW-100	
56	4AA07350	ﾃﾞﾊﾞｲｽﾊﾞﾝﾄﾞ	DEVICE BAND	
57	79872030	平ﾜｯｼｬ 3.0(10 ｲﾘ)	WASHER 3.0(10/SET)	
58	28614000	ｼﾘﾝﾀﾞｰ ｶﾞｽｹｯﾄ	CYLINDER GASKET	
59	4AA03200	ﾋﾟｽﾄﾝ	PISTON	
60	29706000	ﾋﾟｽﾄﾝ ﾋﾟﾝ	PISTON PIN	

61	29317000	ﾋﾟｽﾄﾝﾋﾟﾝ ﾘﾃｲﾅｰ(2 ｲﾘ)	PISTON PIN RETAINER(2/SET)	
62	4AA03400	ﾋﾟｽﾄﾝ ﾘﾝｸﾞ	PISTON RING	
63	4AA03100	ｼﾘﾝﾀﾞｰﾌﾞﾛｯｸ	CYLINDER BLOCK	
64	71669000	ｽﾊﾟｰｸ ﾌﾟﾗｸﾞ CM-6	SPARK PLUG CM-6	
65	4AA15000	ｷｬﾌﾞ及びﾘｰﾄﾞｶﾞｽｹｯﾄ ｾｯﾄ	CAB.& REED GASKET SET	
66	4AB18000	ﾘｰﾄﾞﾊﾞﾙﾌﾞ	REED VALVE	
67	4AA82000	ｷｬﾌﾞﾚﾀｰｲﾝｼｭﾚｰﾀｰ-GT120THU	CARBURETOR INSULATOR	
68	4AB82000	ﾘﾍﾟｱｷｯﾄ HS-324A	REPAIR KIT HS-324A	
69	79871540	ｷｬｯﾌﾟｽｸﾘｭｰ M5X40(10 ｲﾘ)	CAP SCREW M5X40(10/SET)	締付トルク/Torque 4.0N･m
70	4AB81000	ｷｬﾌﾞﾚﾀｰ HS-324A	CARBURETOR HS-324A	
71	4AB81410	ｽﾛｯﾄﾙｱｰﾑ	THROTTLE LEVER	
72	4AA83000	ｴｱｸﾘｰﾅｰｱﾀﾞﾌﾟﾀｰ	AIR CLEANER ADAPTER	
73	79871555	ｷｬｯﾌﾟｽｸﾘｭｰ M5X55(10 ｲﾘ)	CAP SCREW M5X55(10/SET)	締付トルク/Torque 5.4N･m
74	4AA84000	ｴｱｸﾘｰﾅｰ PK-7E	AIR CLEANER PK-7E	
付属品/ACCESSORIES				
—	78300000	ｶﾞｿﾘﾝ用燃料フィルター S	GASOLINE FUEL FILTER S	
—	70000001	ﾎｰｽｸﾘｯﾌﾟ φ6 (5 ｲﾘ)	HOSE CLIP 6 (5PCS/SET)	
オプション/OPTION				
75	4AA07390	ｻｲﾚﾝｻｰ E-6030R	SILENCER E-6030R	
76	4AA07380	ｻｲﾚﾝｻｰ E-6030L	SILENCER E-6030L	
77	55500006	ﾉﾙﾄﾛｯｸﾜｯｼｬ M5SP(10 ｲﾘ)	NORDLOCK WASHERS M5SP(10/SET)	
78	79871525	ｷｬｯﾌﾟｽｸﾘｭｰ M5X25(10 ｲﾘ)	CAP SCREW M5X25(10/SET)	締付トルク/ Fastening Torque 7.2N･m