YANMAR

YANMAR CONSTRUCTION EQUIPMENT CO., LTD.

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OPERATION & MAINTENANCE MANUAL EXCAVATOR ViO35-7B (US)

YANMAR

OPERATION & MAINTENANCE MANUAL

EXCAVATOR

ViO35-7B (US)

(S/N 70501 & Above)

YANMAR

Read this manual carefully to learn how to operate and service your machine correctly. Failure to do so could result in personal injury or machine trouble.

This manual is the permanent part of your machine, when you sell your machine, hand it together with machine.

This machine had been designed by metric. Accordingly, dimensions mentioned in this manual are metric.

Discrimination of right side and left side for the machine are determined based on the machine posture, in where the blade is in front. i.e. Right side of the operator is machine's right side when the operator seats toward the blade.

The machine operated and serviced correctly has the warranty that is the YANMAR product support program. However, in case of the abuse or modification without permission of YANMAR, the warranty does not become the subject and also product improvement program may not become the subject.

All information, illustrations and specifications in this manual are based on the latest product information available at the time of publication. The right is reserved to make changes at any time without notice.

REFERENCE INFORMATION

Write the correct information for your YANMAR Excavator in the spaces below.

Always use these numbers when referring to your YANMAR Excavator.

Model name : _____

Serial Number : _____

Engine Serial Number : _____

Your YANMAR Excavator Dealer : _____

Address : _____

Phone : _____

CALIFORNIA
Proposition 65 WARNING

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

In case of exporting this product and providing the related technical material to non-residents in Japan or residents overseas, it is required to comply with the export and trade control laws and regulations of Japan and other relevant countries.
Please be sure to follow the necessary procedure.

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101 International Parkway, Adairsville, GA 30103
TEL: (770) 877-7810 FAX: (770) 877-7565

For Emissions or Warranty Information:
Website: http://us.yanmar.com/
E- mail: CS_support@yanmar.com
Toll Free Telephone Numbers:
1-855-416-7091
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MAINTENANCE

1. Precautions for Servicing

Do not use any inspection or servicing procedures that are not described and recommended in this manual.
Park the machine on solid, level ground to inspect and service it.

■ Check the hour meter

Read the hour meter every day to check if any service item has reached the time prescribed for implementation.

■ Use YANMAR genuine replacement parts

Use YANMAR genuine parts specified in the Parts Catalog.

■ Use YANMAR genuine lube oil and grease

Use YANMAR genuine lube oil and grease of specified viscosity for the operating temperature range.

■ Use clean lube oil and grease

Use clean lube oil, grease and containers and prevent dust from mixing into them.

■ Clean the machine

Clean the machine for easy isolation of faulty parts.
Particularly clean the grease nipple, breather, and the oil level gauge glass to prevent dust from entering into them.

■ Be careful of high water and oil temperatures

It is dangerous to replace the oil, the cooling water and the filter immediately after stopping the engine. Wait until their temperatures drop. When the engine oil is too cool, heat the oil to adequate temperature [approximately 68 °F to 104 °F (20 °C to 40 °C)] before draining oil to improve draining efficiency.

■ Check the drained oil and the old filter element

When replacing the engine oil, the hydraulic oil, or the filter element, check the drained oil and the old filter element for metallic dust and foreign solid deposits.

■ Observe precautions for replenishing oil

If a strainer is mounted on the oil port, do not remove the strainer to replenish oil.

■ Be careful of dust

When checking or replacing the oil, do this in a clean environment to prevent dust contamination.

■ Attach the warning tag

When the oil or the cooling water is being drained, attach the "SERVICING IN PROGRESS" tag to one of the control levers so that other persons will not start the engine.

■ Observe the warning labels

Observe the warning labels affixed to the machine.

■ Observe the precautions for welding

- Make sure to disconnect the battery cables (positive and negative terminals).
- Do not apply a voltage of 200 V or more continuously.
- Ground the machine within 3.3 ft. (1000 mm) from the welded part.
- Make sure that there is no seal or bearing between the welded part and the grounded part.
- Do not ground around the pins on the implement or the hydraulic cylinder.

■ Be careful of fire

Clean parts with noncombustible detergent.

■ Clean mating surfaces before assembly

When you have removed a part with an O-ring or a gasket seal, clean the mating surfaces before installing the new part.
At this point, do not fail to refit the O-ring or the gasket.

■ Do not drop anything from your breast pocket

When you open the cover and attempt to look down into the inside of the machine, remove loose items from your breast pocket to eliminate the risk that they may drop into the machine.

■ Check the undercarriage

After the machine is used at a rocky place, check the undercarriage for damage. Check for loose bolts and nuts, cracks, wear, and other damage. Loosen the tension of the crawlers more than usual.

■ Observe the precautions for cleaning the machine

- Do not spray steam directly at the connectors.
- Do not splash water on the monitors in the cabin.
- Do not spray high-pressure water directly at the radiator and the oil cooler.

■ Check before and after working

If the machine is to be used in mud, rain, snow, or on a beach, check for loose plugs and cocks before working. After working, clean the machine and check each part for cracks and damage and check for loose or missing bolts and nuts. Apply grease earlier than usual. Particularly apply grease every day to the pins on the implement which are submerged in mud.

■ Observe the precautions for working in a dusty place

If you use the machine in a dusty place, be careful of the following:

- Check the air cleaner for clogging.
- Clean the air cleaner element earlier than scheduled.
- Clean the radiator fin earlier to prevent it from clogging.
- Clean or replace the fuel filter element earlier than scheduled.
- Clean the electric equipment, especially the starter motor and the generator, to avoid dust deposits.

■ Do not mix oils

Never mix oils of different makes or types. If you have to replenish an oil with a different make or type than the one already in the tank, remove the remaining oil completely.

2. Basic Servicing Practices

- Use YANMAR genuine replacement parts.
- Do not mix oils of different makes and types when replacing or replenishing oil.
- The following types of oil, fuel and cooling water are used at the factory for shipping unless otherwise specified:

Item	Type
Engine oil	SAE10W30, CF
Travel reduction gear oil	Gear oil SAE90 (GL-4)
Hydraulic oil	ISO VG46
Fuel	Diesel light oil (Ultra low sulfur)
Engine cooling water	YANMAR genuine long-life coolant (LLC) 51 % + water

Diesel fuel

- Because the fuel injection pump is a precision device, using a fuel containing water or dust will cause problems.
- Be careful that impurities will not be mixed into the fuel especially after storing the machine and refueling.
- Be sure to use a fuel recommended in the Operation & Maintenance Manual.
  In addition, keep in mind that you should use a fuel appropriate for the operating temperature range because it will freeze at temperatures lower than 5 °F (-15 °C).
- Fully refuel every day after finishing the work so that the moisture in the fuel tank will not condense and water will not mix with the fuel.
- Before starting the engine, or ten minutes after refueling, drain any deposits and water through the drain plug on the fuel tank.
- If the fuel level becomes low or the filter element is replaced, the air should be bled from the fuel system.

Diesel Fuel Specifications

Diesel fuel should comply with the following specifications. The table lists several worldwide specifications for diesel fuels.

Diesel fuel specification	Location
ASTM D975 No. 1D S15 No. 2D S15	USA
EN590:96	European Union
ISO 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade No. 2	Japan
KSM-2610	Korea
GB19147-2016	China

■ Additional technical fuel requirements

- The fuel cetane number should be equal to 45 or higher.
- The sulfur content must not exceed 0.5 % by volume. Less than 0.05 % is preferred. A higher sulfur content fuel may cause sulfuric acid corrosion in the cylinders of the engines. Especially in U.S.A. and Canada, Ultra Low Sulfur fuel must be used.
- Never mix kerosene, used engine oil, or residual fuels with the diesel fuel.
- Water and sediment in the fuel should not exceed 200 mg/kg.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Poor quality fuel can reduce engine performance and/or cause engine damage.
- Fuel additives are not recommended. Some fuel additives may cause poor engine performance. Fuel additives containing alcohol content, such as drainage agent etc. have adverse effects on the sealing section, and it will result in fuel leaks. Consult your dealer for more information.
- Ash content not to exceed 0.01 % by mass.
- Carbon residue content not to exceed 0.35 % by mass. Less than 0.1 % is preferred.
- Total aromatics content should not exceed 35 % by volume. Less than 30 % is preferred.
- PAH (Polycyclic Aromatic Hydrocarbons) content should be below 10 % by volume.
- Metal content of Mg, Si, and Al should be equal to or lower than 1 mass ppm. (Test analysis method JPI-5S-44-95)
- Lubricity: Wear mark of WS1.4 should be Max. 0.018 in. (460 µm) at HFRR test.
- Be sure to use fuel that does not contain zinc or sodium.

- Never use kerosene or fuel mixed with kerosene.
- Never use fuel that has been stored in a drum or the like for a long period of time.
- Be sure to use fuel purchased from authorized diesel fuel suppliers.

■ Bio-diesel fuels

In Europe and in the United States, as well as some other countries, non-mineral oil based fuel resources such as RME (Rapeseed Methyl Ester) and SOME (Soybean Methyl Ester), collectively known as FAME (Fatty Acid Methyl Esters), are being used as extenders for mineral oil derived diesel fuels.
YANMAR approves the use of bio-diesel fuels that do not exceed a blend of 7 % (by volume) of FAME with 93 % (by volume) of approved mineral oil derived diesel fuel. Such bio-diesel fuels are known in the marketplace as B7 diesel fuels.

These B7 diesel fuels must meet certain requirements.

1. The bio-fuels must meet the minimum specifications for the country in which they are used.
   - In Europe, bio-diesel fuels must comply with the European Standard for both EN14214 and EN590 (for Oxidation stability).
   - In the United States, bio-diesel fuels must comply with the American Standard for both ASTM D-6751 and ASTM D-7467 (for Oxidation stability).
2. Bio-fuels should be purchased only from recognized and authorized diesel fuel suppliers.

Precautions and concerns regarding the use of bio-fuels:

1. Free methanol in FAME may result in corrosion of aluminum and zinc FIE components.
2. Free water in FAME may result in plugging of fuel filters and increased bacterial growth.
3. High viscosity at low temperatures may result in fuel delivery problems, supply pump seizures, and poor injection nozzle spray atomization.
4. FAME may have adverse effects on some elastomers (seal materials) and may result in fuel leakage and dilution of the engine lubricating oil.
5. Even bio-diesel fuels that comply with a suitable standard as delivered, will require additional care and attention to maintain the quality of the fuel in the equipment or other fuel tanks. It is important to maintain a supply of clean, fresh fuel. Regular flushing of the fuel system, and/or fuel storage containers, may be necessary.
6. Use bio diesel fuel within 2 months after filling it to the fuel tank, or within 3 months after its production at the manufacturer.
   The use of bio-diesel fuels that do not comply with the standards as agreed to by the diesel engine manufacturers and the diesel fuel injection equipment manufacturers, or biodiesel fuels that have degraded as per the precautions and concerns above, may affect the warranty coverage of your engine.

Engine oil

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize and/or shorten engine life.
- Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap/dipstick and the surrounding area before you remove the cap.
- Never mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
- Never overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.

⚠ WARNING

Burn Hazard!

- **Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.**
- **Failure to comply could result in death or serious injury.**

Engine Oil Specifications

Use an engine oil that meets or exceeds the following guidelines and classifications:

■ Service categories

- API service categories CD, CF, CF-4, CL-4
- ACEA service categories E3, E4, E5
- JASO service category DH-1

■ Definitions

- API classification (American Petroleum Institute)
- ACEA classification (Association des Constructeurs Européens d'Automobilies)
- JASO (Japanese Automobile Standards Organization)

Note:

- *Be sure the engine oil, engine oil storage containers, and engine oil filling equipment are free of sediments and water.*
- *YANMAR does not recommend the use of engine oil "additives."*

■ Additional technical engine oil requirements:

The engine oil must be changed when the Total Base Number (TBN) has been reduced to 1.0 mgKOH/g. TBN (mgKOH/g) test method; JIS K-201-5.2-2 (HCI), ASTM D4739 (HCI).

Engine cooling water

- Because unpotable water may contain much calcium and impurities, using it will cause water scale to build up in the engine or the radiator, causing poor heat exchange and overheating.
  Never use unpotable water for cooling purposes.
- When using an anti-freeze, observe the precautions described in the Operation & Maintenance Manual.
- A YANMAR machine is shipped with YANMAR genuine anti-freeze. The anti-freeze is anticorrosive to protect the cooling system. Because the anti-freeze can be used continuously over two years, you need not remove it in hot weather.

⚠ DANGER

Keep sources of ignition away from the antifreeze because it is flammable.

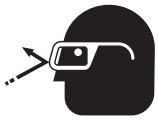
- The mixing ratio of anti-freeze to water differs based on air temperature.
  For the mixing ratio, refer to Section "Replacing the engine cooling water" on page 230.
- If the engine is overheated, replenish the cooling water after the engine has cooled down.
- Shortage of cooling water will cause the cooling system not only to overheat but also to corrode, due to air which comes in the system.

⚠ DANGER

Scald Hazard!

- **Never remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.**
- **Tighten the radiator cap securely after you check the radiator. Steam can spurt out during engine operation if the cap is loose.**
- **Always check the level of the engine coolant by observing the reserve tank.**
- **Failure to comply will result in death or serious injury.**

⚠ CAUTION



Engine Coolant Hazard!

- **Wear eye protection and rubber gloves when you handle long life or extended life engine coolant.**
  If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.
- **Failure to comply may result in minor or moderate injury.**

- Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal buildup of rust and scale and/or shorten engine life.
- Prevent dirt and debris from contaminating the engine coolant. Carefully clean the radia-

tor cap and the surrounding area before you remove the cap.
- Never mix different types of engine coolants. This may adversely affect the properties of the engine coolant.

Engine Coolant Specifications

Use a Long Life Coolant (LLC) or an Extended Life Coolant (ELC) that meets or exceeds the following guidelines and specifications.

■ Alternative engine coolant

If an Extended or Long Life Coolant is not available, alternatively, you may use an ethylene glycol or propylene glycol based conventional coolant (green).

Note:
- *Always use a mix of coolant and water. Never use water only.*
- *Mix coolant and water per the mixing instructions on the coolant container.*
- *The mix ratio of Long Life Coolant or antifreeze to water should be from 30 to 60 %.*
- *Water quality is important to coolant performance. YANMAR recommends that soft, distilled or demineralized water be used to mix with coolants.*
- *Never mix extended or long life coolants and conventional (green) coolants.*
- *Never mix different types and/or colors of extended life coolants.*
- *Replace the coolant every 2000 engine hours or every 2 years.*

■ Additional technical coolant specifications:

- ASTM D6210, D4985 (US)
- JIS K-2234 (Japan)
- SAE J814C, J1941, J1034 or J2036 (International)

Hydraulic oil and Reduction gear oil

- Because the oil is used in the machine under extreme conditions (high temperature and pressure), it deteriorates as time elapses. Be sure to use oils of the grades which are specified in the Operation & Maintenance Manual and suitable for the operating temperature range.
  Even if the oil is not contaminated, be sure to replace the oil within the specified service hours.
- Oil is equivalent to blood in a human body. Be careful in handling it so that impurities (water, metallic dust, and foreign solids) will not be mixed into it.
  Most machine failures are caused by impurities in the oils.
  Be careful not to mix impurities into the oils especially after storing the machine and replenishing oils.
- Do not mix oils of different makes and types.
- Use the specified amount of oil.
  Use of larger or smaller amounts of oil than specified may cause machine problems.
- If the oil becomes cloudy, it may suggest that water or air could have been mixed into the hydraulic system. If this event happens, ask your dealer for assistance.
- Be sure to replace the oil filter element with a new one when changing the oil.
- To know what condition the machine is in, it is recommended that you analyze the properties of the oil periodically.
  Ask your dealer for more information on this issue.

Handling grease, oil, fuel and filters

Grease

- Grease ensures smooth operation of moving parts such as connectors and prevents operating noises.
- The nipples not listed on the pages for periodic service are those used for overhaul purposes. Normally it is not necessary to refill them.
  Grease them if any abnormal condition arises after long term use.
- Wipe away all excess grease after greasing.
  Carefully wipe the excess grease from all moving parts which might be easily worn by adhered sand or grit.

Storing the oil and fuel

- Store the oil and fuel indoors so that they are not be contaminated by impurities such as water or dust.
- When you store oil or fuel in drums for a long period, position them so that their outlets align in a straight line (to prevent moisture absorption).
  When storing the oil or the fuel outdoors, cover the drums with a waterproof sheet.
- To avoid deterioration caused by long-term storage, use the oil on a first-in first-out basis.

Filter

- The filters are very important parts which prevent impurities from getting into critical devices through the lube oil, fuel and air systems.
  Replace the filter elements periodically according to the instructions of the Operation & Maintenance Manual.
  Under difficult conditions, you need to replace the filter elements earlier than suggested in the Operation & Maintenance Manual depending on the type of oil and fuel (sulfur content).
- Never reuse the filter elements (cartridge type) by cleaning them.
- When replacing a filter element, confirm that no metallic dust or foreign solids are present on the old filter.
  If they are found to be present, contact the nearest dealer.
- Do not unpack the filter element before use.
- Use YANMAR genuine filter elements.

Electrical equipment

- If electrical equipment gets wet or wiring insulation is broken, electric leaks may occur and the machine may malfunction.
- Check the fan belt for tension and damage, and also check the battery.
- Never disconnect or disassemble the electrical equipment mounted on the machine.
- Do not mount any electrical equipment other than those items provided by YANMAR.
- Be careful not to spray water on the electrical equipment when washing the machine or operating in the rain.
- After working near the sea, take necessary precautions to protect the electrical equipment from corrosion.

Hydraulic system

- The hydraulic system is hot during and immediately after operation. It is also under high pressure during operation. Therefore, check and service the hydraulic system carefully as follows:

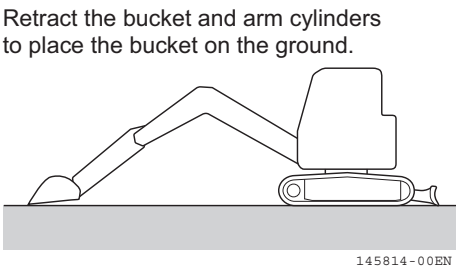


Fig. 2-1

  - Put the bucket on level ground so that no pressure is applied to the hydraulic cylinder circuits.
  - Be sure to stop the engine.
  - Wait until the temperature drops sufficiently before starting maintenance.
  - Release the pressure from the hydraulic circuit.
    Handling accumulator: Refer to page 160.
  - Do not suddenly remove any plugs, screws or connecting parts of the hoses. Otherwise oil may spout out due to residual internal pressure even when the oil temperature has lowered. Be careful not to stand in front of any plugs, screws or connecting parts when loosening them, to prevent injury. Loosen them gradually, to relieve the internal pressure.
  - Always relieve the internal pressure before checking and servicing the hydraulic system.
- Check the hydraulic oil level, replace the filter element, and replace the hydraulic oil when necessary.
- After removing hydraulic hoses and piping, check the O-rings and the packing for damage before reinstalling them.
  Replace them if they are damaged.
- Bleed air after replacing or cleaning the hydraulic oil filter element or strainer, repairing or replacing the hydraulic equipment, or reinstalling the hydraulic cylinder or piping.

Bleed air according to the following procedure:

1. After operating the engine at low idle speed with no load for a couple of minutes, increase the engine speed to a middle speed.
2. Slowly operate each cylinder 4 to 5 times to approximately 4 in. (100 mm) before both stroke ends.
3. Operate the cylinder 4 to 5 times at full stroke.

- Failure to bleed air from the hydraulic cylinder and operating it suddenly to the stroke ends could cause piston seal damage.
- If air is left in the hydraulic circuit, it will compress and expand and the hydraulic equipment will not operate smoothly.
  Air in the hydraulic circuit may shorten the service life of the hydraulic pump.

4. Check the hydraulic oil level and replenish hydraulic oil to the specified level if necessary.
   Refer to Section "Checking and replenishing the hydraulic oil tank" on page 113.

3. Consumables

Replace consumable parts such as filter element and bucket teeth periodically or earlier than wear limit.
Replace consumable parts securely to use our product more economically.
When you replace a part, be sure to use a YANMAR genuine part.
When ordering consumables, let us know the part numbers given in the parts catalog.

■ List of consumables

Item	Parts No.	Q'ty	Replacing time interval
Engine oil filter	119005-35170	1	Every 500 service hours
Fuel filter	119802-55801	1	Every 500 service hours
Air cleaner element	1A8240-05110	1	Every 500 service hours
Hydraulic oil return filter element	172B82-73700	1	Every 500 service hours (At first 250 service hours)

4. Fueling, Oiling and Greasing Based on Temperature Range

Fuel and oil

Select fuel and oil based on to the air temperature range.
The prescribed amount of oil means the total amount of oil included in the piping and equipment.
The amount of oil to be changed means the amount of oil replaced in checking and servicing.
If you start the engine at air temperatures lower than 32 °F (0 °C), use SAE10W, SAE10W-30, or SAE15W-40 even if the temperature in the daytime rises to 50 °F (10 °C) or so.

Part to be refilled	Oil type	Recommendations with regard to temperature ranges (°F) -4 -14 32 50 68 86 (°C) (-20) (-10) (0) (10) (20) (30)	Prescribed amount of oil	Amount of oil to be changed
Engine oil pan	Engine oil	SAE 10W CF SAE 10W-30 CF SAE 15W-40 CF	7.7 Qts. (7.3 L)	7.7 Qts. (7.3 L)
Travel reduction gear	Gear oil	SAE 90 (GL- 4)	0.5 Qts. (0.5 L) (For right and left each)	0.5 Qts. (0.5 L) (For right and left each)
Hydraulic oil system	Hydraulic oil	ISO VG46	In the tank 8.5 Gals. (32 L) Other parts 5.8 Gals. (22 L)	8.5 Gals. (32 L)
Fuel tank	Light oil	No. 1-D or No. 2-D diesel fuel	11.6 Gals. (44 L)	-
Cooling system	Water	YANMAR genuine long-life coolant (LLC) added	Radiator 4.3 Qts. (4.1 L) Subtank 0.4 Qts. (0.4 L)	-

Cooling water

For the mixing ratio of the cooling water, refer to Section "Replacing the engine cooling water" on page 230.

5. Standard Tightening Torque for Bolts and Nuts

Torque table

Bolts or nuts in the metric system should be tightened at the torque described below unless otherwise specified.

Item		Thread size×pitch	Tightening torque ft•lbf (N•m)	Remarks
Hexagon bolt (8.8) Nut	Coarse threads	M6×1	7.23 to 8.68 (9.8 to 11.8)	• Apply 80 % tightening torque when tightened to aluminum. • Apply 60 % tightening torque for 4.8 bolt and lock nut. • Use fine threads for engine only.
		M8×1.25	16.6 to 21.0 (22.6 to 28.4)	
		M10×1.5	32.6 to 43.4 (44.1 to 58.8)	
		M12×1.75	57.9 to 72.3 (78.5 to 98.1)	
		M14×2	86.8 to 108.5 (117.7 to 147.1)	
		M16×2	123.0 to 151.9 (166.7 to 206.0)	
		M18×2.5	173.6 to 209.8 (235.4 to 284.4)	
		M20×2.5	238.7 to 296.6 (323.6 to 402.1)	
	Fine threads	M14×1.5	94.0 to 108.5 (127.5 to 147.1)	
		M16×1.5	155.5 to 177.2 (210.8 to 240.3)	
Hexagon bolt (10.9)		M16×2	169.9 to 220.6 (230.4 to 299.1)	
PT plug		1/8	7.2 (9.8)	-
		1/4	14.5 (19.6)	
		3/8	21.7 (29.4)	
		1/2	43.4 (58.8)	
Pipe joint bolt		M8	9.4 to 12.3 (12.7 to 16.7)	-
		M12	18.1 to 25.3 (24.5 to 34.3)	
		M14	28.9 to 36.2 (39.2 to 49.0)	
		M16	36.2 to 43.4 (49.0 to 58.8)	

IMPORTANT

If a part to be tightened is made of resin like a panel board, excessive tightening torque may damage the tightened part. Be careful when tightening.

6. Replacing Essential Parts Periodically

For safe operation, the machine must be serviced periodically. To increase safety, be sure to periodically replace the parts listed in the table of safety parts on the next page. A fire could result if they deteriorate or are damaged.

These parts are vulnerable to age and wear or deterioration and it is difficult to determine the degree to which they have deteriorated on the occasion of periodic service. To maintain their proper function at all times, therefore, replace them with new ones after using them for a specific period of time even if no abnormality is found with the parts.
If you find abnormalities in these parts before their scheduled replacement time is reached, repair or replace them immediately.
If a hose clamp is deformed or cracked, replace it immediately.
Check the hydraulic hoses (which are not periodic replacement parts). If any abnormality is found in them, retighten them or replace them immediately.

When replacing the hydraulic hoses, replace the O-rings and seals at the same time.

For further information about replacing the safety parts, ask your dealer.

Check the fuel and hydraulic hoses according to the periodic schedule described below.

Check categories	Check points
Start-up check	Oil leak from the connections or bodies of the fuel and hydraulic hoses
Voluntary monthly check	Oil leak from the connections or bodies of the fuel and hydraulic hoses Damage (crack, wear, or peeling) of the fuel and hydraulic hoses
Prescribed annual check	Oil leak from the connections or bodies of the fuel and hydraulic hoses Interference, crushing, aging, torsion, or damage (crack, wear, or peeling) of the fuel and hydraulic hoses

■ List of essential parts

No.	Essential parts to be replaced periodically	Q'ty	Replacement time intervals
1	Fuel hose (fuel tank to water separator)	1	Earlier of either every 2 years or every 2000 service hours
2	Fuel hose (water separator to feed pump)	1	
3	Fuel hose (feed pump to fuel filter)	1	
4	Fuel hose (fuel filter to fuel injection pump)	2	
5	Fuel hose (fuel filter to fuel tank)	1	
6	Fuel hose (fuel injection pump to fuel injection valve)	1	
7	Fuel hose (fuel injection valve to fuel injection valve)	2	
8	Fuel tube cap	1	
9	Main pump outlet hose (P1, P2, P3 to C/V)	3	

7. Maintenance Table

Daily and periodic inspection are important to keep the machine in its best condition. The following is a summary of inspection and servicing requirements by inspection interval. Periodic inspection intervals vary depending on the use, loads, fuels and lube oils used and handling conditions, and are hard to establish definitively. The following should be treated only as a general standard. When the time for an inspection approaches, study the relevant pages in the Operation & Maintenance Manual. Keep a record of daily operation and the results of maintenance work.

Table of service time intervals

■ List of periodic inspection and servicing

◇ : Check ○ : Supply ● : Replace □ : Adjust (clean) ■ : Oil & grease

Check & service items		Every 50 hrs	Every 100 hrs	Every 250 hrs	Every 500 hrs	Every 1000 hrs	Every 1500 hrs	Every 2000 hrs	Every 3000 hrs	Page
Fuel oil	Fuel tank	□								217
	Water separator				□					221
	Fuel filter element				●					222
	Fuel hose							● (within two years)		
Lube oil	Engine oil				● (within one year)					223
	Engine oil filter				● (within one year)					
	Engine oil hose							◇ (within two years)		223
	Travel reduction oil		● (1st time)	◇		●				
Cooling water	Cooling water							● (within two years)		230
	Radiator				□					
	Cooling water hose							◇ (within two years)		
Hydraulic system	Hydraulic oil					●				228
	Suction filter					□				
	Return filter			● (1st time)	●					
	Oil cooler				□					
	Hydraulic hose							● (within two years)		
	Accumulator							◇		
Upper-structure	Swing gears and swing bearings	■								
Engine	Air cleaner			□	●					
	Compressor belt (Cabin spec.)	◇ (1st time)		□						
	Fan belt	◇ (1st time)		□						
	Valve clearance					□				
	Valve sheet							◇ (As required)		
	Crankcase breather system						◇			
	Breather hose							◇ (within two years)		
	Fuel injection valve						◇			
	Check, clean and test EGR valve									□

Note:

When machine is used at dusty worksites clean and replace filter element twice or more frequently than specified in the table.

Service intervals when using the hydraulic breaker

When a hydraulic breaker is used, the hydraulic oil deteriorates earlier than in usual bucket excavating work. Set up the service time intervals as follows:

- **Replacing the hydraulic oil return filter element**

  Replace the hydraulic oil return filter element after 100 to 150 hours only at initial time for a new machine. After that, replace it in accordance with the chart at the **Fig. 7-1**.

- **Replacing the hydraulic oil in the hydraulic oil tank**

  Replace the hydraulic oil in accordance with the chart at the **Fig. 7-1**.

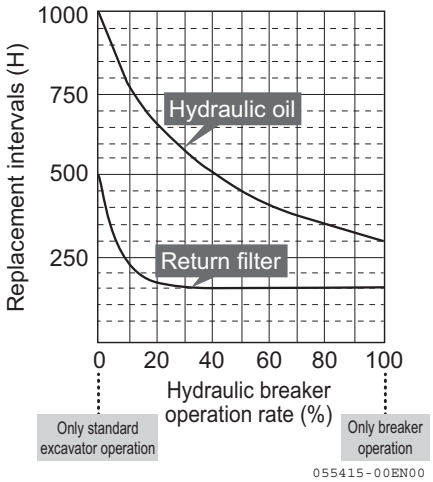


Fig. 7-1

8. Procedures for Maintenance

First services

Service it as follows only at the initial time for a new machine.

■ At first 100 hours

Replacing the lube oil for the travel reduction gearbox.
For this procedures, refer to Section "Maintenance every 1000 service hours".

■ At first 250 hours

Replacing hydraulic return filter element.
For this procedure, refer to Section "Maintenance every 500 service hours".

Nonperiodic services

Checking the rubber crawlers (for rubber crawler types)

Rubber crawlers in the following condition require repair or replacement. Ask your dealer to repair or replace them.

■ Height of lugs

- As the lug height "a" is reduced by wear, the tractive force decreases.
  If "a" becomes 0.2 in. (5 mm) or less, replace the crawler with a new one.

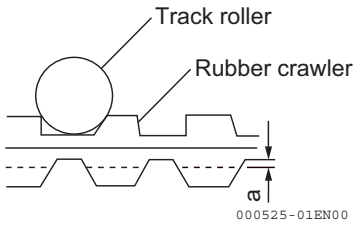


Fig. 8-1

- If two or more links of the steel cord inside the crawler are exposed due to wear of the lugs, replace the crawler with a new one.

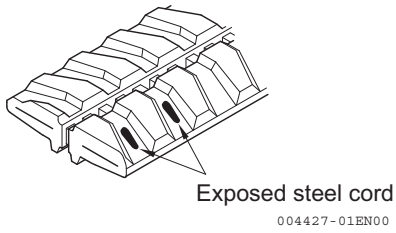


Fig. 8-2

■ Rubber crawler steel cord breakage

If half or more of either of the steel cords is broken, replace the rubber crawler with a new one.

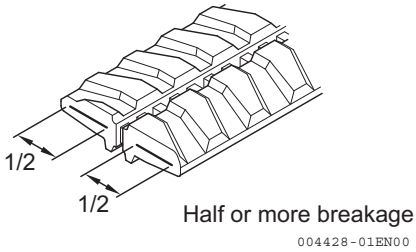


Fig. 8-3

■ Separation of the core metal of the rubber crawler

If the core metal of the rubber crawler separates even at one place, replace the rubber crawler with a new one.

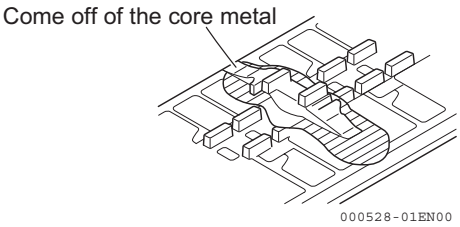


Fig. 8-4

■ Rubber crawler tension

If the rubber crawler tension is habitually loose even after grease is injected, the grease adjuster may be defective internally. Ask your dealer to repair the grease adjuster.

■ Crack in the rubber crawler

If a crack occurs between any lugs of the rubber crawler, repair it if the crack length reaches approximately 2.4 in. (60 mm). If the inside steel cord is exposed even though the crack is small, repair the rubber crawler immediately. If the crack length is less than 1.2 in. (30 mm) or the crack depth is less than 0.4 in. (10 mm), you do not need to repair the rubber crawler. For a decision on whether the rubber crawler should be replaced, repaired or should continue to be used, ask your dealer.

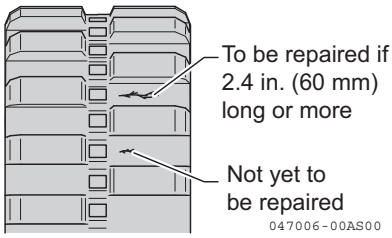


Fig. 8-5

Checking and adjusting the rubber crawler tension

⚠ WARNING

- **When adjusting the rubber crawler tension while raising the machine, do not support the machine with the implement only.**
  The control levers could move or the hydraulic oil could flow out accidentally so that the machine would fall.
- **When raising the machine, support it with safety blocks of sufficient strength.**
  When the machine is being checked or adjusted by two persons, one must operate the machine in response to signs from the other.

How a rubber crawler wears out depends on the working conditions and the nature of the ground. Be sure to check the rubber crawlers for wear and tension from time to time.
When a new rubber crawler is mounted, perform the first check after 30 hours operation.

■ Checking the rubber crawler tension

1. Move the machine so that the joint (△ mark) on the inside surface of the rubber crawler is positioned at the upper center of the track frame.

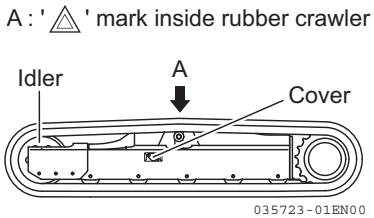


Fig. 8-6

2. Lift the machine with the implement and the safety blocks.
   To do this, operate the control lever slowly.

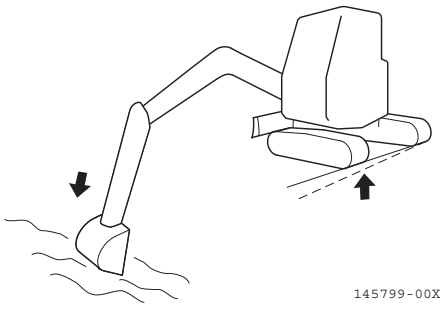


Fig. 8-7

3. The tension is proper if the clearance between the middle track roller rim and the rubber crawler is 0.3 to 0.5 in. (8 to 13 mm).

Working with the rubber crawler too loose will cause the rubber crawler to come off or the core metal to wear out earlier.

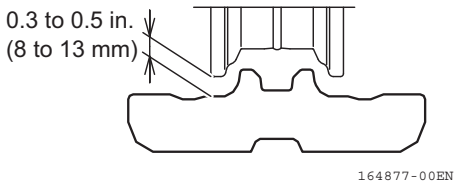


Fig. 8-8

■ Adjusting the rubber crawler tension

• To increase the tension

Prepare a grease gun.

1. Remove the cover **(Fig. 8-9, 1)**.

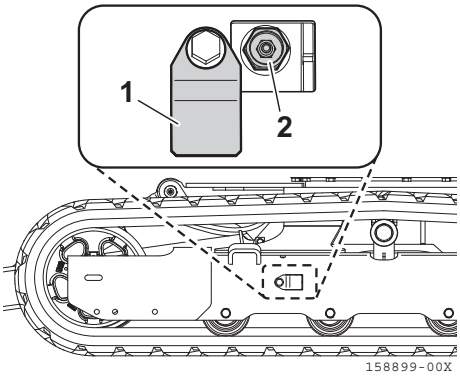


Fig. 8-9

2. Raise the machine using the implement and the safety blocks. Inject grease through the nipple valve **(Fig. 8-9, 2)** using a grease gun until the rubber crawler tension has achieved the proper clearance [0.3 to 0.5 in. (8 to 13 mm)].

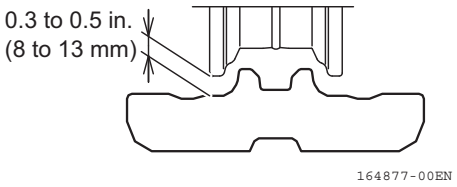


Fig. 8-10

3. To check that the tension is proper, lower the machine and move the machine back and forth slightly.

4. Check the rubber crawler tension again. If the tension is improper, adjust it again.

5. Install the cover **(Fig. 8-9, 1)**.

6. The tension is adjustable until the clearance "a" is reduced to 0 in. (0 mm). If the tension is still loose, the rubber crawler may need repairing due to excessive wear. Contact your dealer and ask for repair.

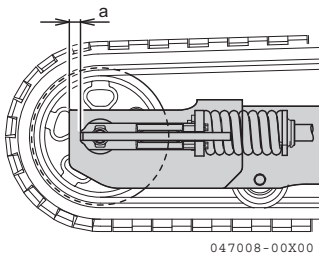


Fig. 8-11

7. If the tension is loose even after grease injection, it is necessary to replace either the rubber crawler or the grease adjuster. Contact your dealer for assistance.

• Loosening the tension

⚠ WARNING

- **Grease is under high pressure. If the nipple valve is opened suddenly, grease could be ejected or the valve could blow, which could cause bodily injury.**
- **Do not rely on valve appearance alone to determine whether or not grease has been discharged, but check that by measuring the tension of the rubber crawler.**
- **Do not open the nipple valve more than one turn.**
- **It is very dangerous to discharge the grease by any procedure other than that described below.**
  If the tension of the rubber crawler cannot be loosened, contact your dealer and ask for repair.

1. Remove the cover **(Fig. 8-12, 1)**.

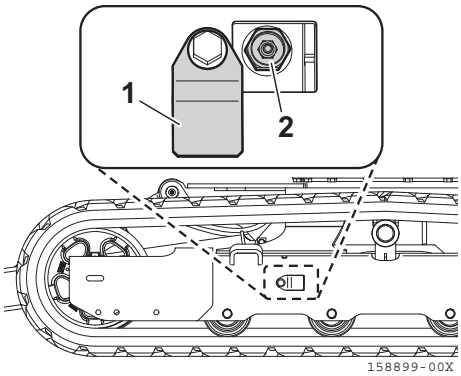


Fig. 8-12

2. Raise the machine with the implement and the safety blocks. Slowly loosen the nipple valve **(Fig. 8-12, 2)** and discharge the grease to adjust the rubber crawler tension and to achieve the proper clearance [0.3 to 0.5 in. (8 to 13 mm)].
Never loosen the nipple valve more than one turn.
(If the grease is not discharging properly, lower the machine and move the machine back and forth slightly.)

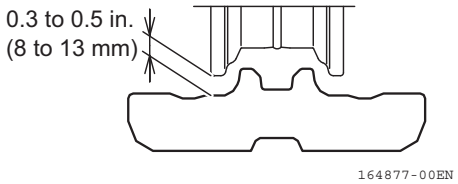


Fig. 8-13

3. Tighten the nipple valve **(Fig. 8-12, 2)**.
Tightening torque:
36.1 to 38.4 ft•lbf (49 to 52 N•m)

4. To check that the tension is proper, lower the machine and move the machine back and forth slightly.

5. Recheck the rubber crawler tension and readjust it if necessary.

6. Completely wipe away all of the discharged grease.

IMPORTANT

The rubber crawler is not grease-resistant.
Completely wipe away all of the grease because grease will shorten its service life.

7. Install the cover **(Fig. 8-12, 1)**.

Replacing the rubber crawler

⚠ WARNING

- **To replace the rubber crawler with a new one, work with a partner. You must operate the machine in response to signs from your partner.**
- **When raising the machine, support it with safety blocks of sufficient strength.**
- **Because the rubber crawler is replaced with the machine in a raised position, there is a danger that the machine may accidentally fall. Do not move any parts other than the rubber crawler to be replaced in doing the job.**
- **The high internal pressure of the grease can cause the nipple valve to eject. When you loosen the nipple valve, do not loosen it more than one turn. At this point, do not loosen any parts other than the nipple valve. Also, do not turn your face toward the nipple valve.**
- **When removing the rubber crawler, make sure that all of the grease has been completely discharged before turning the sprocket.**
- **If the tension of the rubber crawler cannot be loosened by the procedure described here, ask your dealer to repair the rubber crawler.**

■ Removing the rubber crawler

Prepare a grease gun and steel pipes.

1. Raise the machine with the implement and the safety blocks.
   To do this, slowly operate the control lever.
2. Remove the cover **(Fig. 8-14, 1)** and loosen the nipple valve **(Fig. 8-14, 2)** little by little to gradually discharge the grease. Never loosen the nipple valve **(Fig. 8-14, 2)** more than one turn.

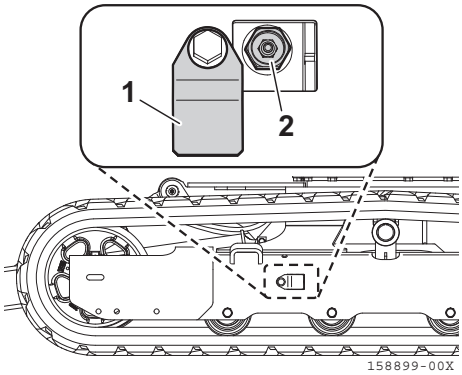


Fig. 8-14

3. Insert the steel pipes into the rubber crawler and turn the sprocket in the reverse direction. When the rubber crawler is separated from the idler by the steel pipes, slide the rubber crawler off.

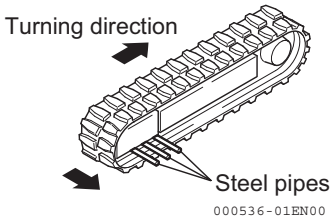


Fig. 8-15

■ Installing the rubber crawler

1. Raise the machine with the implement and the safety blocks.
   To do this, slowly operate the control lever.

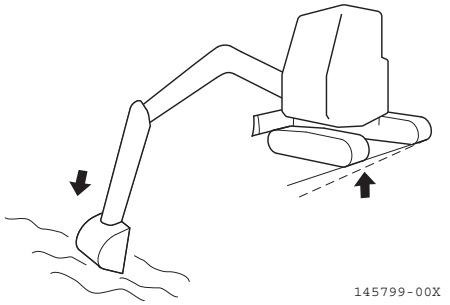


Fig. 8-16

2. Engage the rubber crawler with the sprocket, and place the rubber crawler on the idler.
3. Rotate the sprocket in the reverse direction to push the rubber crawler in, and then stop rotating it.
4. Insert a steel pipe into the rubber crawler, and rotate the sprocket again to place the rubber crawler on the idler.
5. Stop rotating the sprocket, and confirm that the rubber crawler is securely positioned on both the sprocket and the idler.
6. Adjust the rubber crawler tension, referring to Section "Checking and adjusting the rubber crawler tension" on page 203.
7. Confirm that the rubber crawler is fully engaged with both the sprocket and the idler, and that the rubber crawler tension is sufficient. Then lower the machine to the ground.

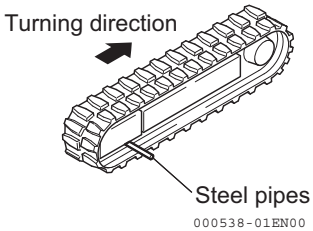


Fig. 8-17

Checking and adjusting the steel crawler

⚠ WARNING

- **When adjusting the steel crawler tension while raising the machine, do not support the machine with the implement only. The control levers could move or the hydraulic oil could flow out accidentally so that the machine would fall.**
- **When raising the machine, support it with safety blocks of sufficient strength.**
- **When the machine is being checked or adjusted by two persons, one must operate the machine in response to the signs from the other.**

How the pins and bushings on the steel crawler will wear down depends on the working conditions and the ground conditions. Check the steel crawler tension from time to time to keep proper tension.
Check and adjust the steel crawler tension under the same conditions as in operation (for example, mud clogged condition if working in muddy ground.)

■ Checking the steel crawler tension

1. Raise the machine with the implement and the safety blocks. To do this, operate the control lever slowly.

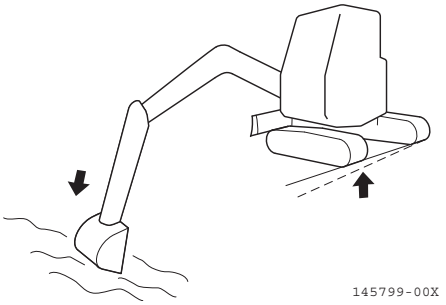


Fig. 8-18

2. At a position that will be safe even if the machine should fall, measure the clearance between the bottom of the track frame center and the upper surface of the shoe plate.
   The tension is proper if the clearance is 5.1 in. (130 mm) [4.7 to 5.1 in. (120 to 130 mm) when replacing with a new one].

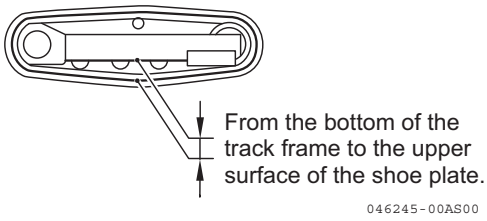


Fig. 8-19

■ Adjusting the steel crawler tension

• To increase the tension

Prepare a grease gun.

1. Remove the cover **(Fig. 8-20, 1)**.

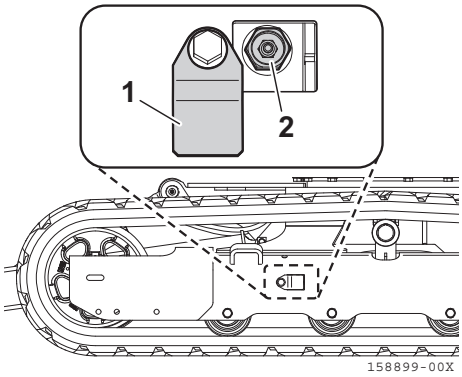


Fig. 8-20

2. Raise the machine with the implement and the safety blocks.
3. Inject grease through the nipple valve **(Fig. 8-20, 2)** using a grease gun until the steel crawler tension is 5.1 in. (130 mm) [4.7 to 5.1 in. (120 to 130 mm) when replacing with a new one].
4. To check that the tension is proper, lower the machine and move the machine back and forth slightly.
5. Check the steel crawler tension again. If the tension is improper, adjust it again.
6. Install the cover **(Fig. 8-20, 1)**.
7. The tension can be adjusted until the clearance “a” is reduced to 0 in. (0 mm). If the tension is still loose after adjustment, the pin and the bushing should be replaced because they are probably worn excessively.
   Ask your dealer to repair the crawler.

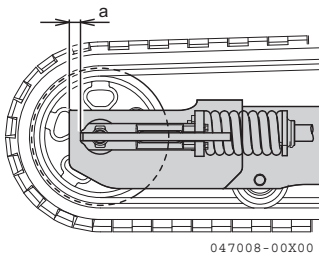


Fig. 8-21

• Loosening the tension

⚠ WARNING

- **Grease is under high pressure. If the nipple valve is opened suddenly, grease could be ejected or the valve could blow, which could cause bodily injury.**
- **Do not rely on valve appearance alone to determine whether or not grease has been discharged, but check that by measuring the tension of the steel crawler.**
  Do not open the nipple valve more than one turn.
- **It is very dangerous to discharge the grease by any procedure other than that described below. If the tension of the steel crawler cannot be loosened, ask your dealer to repair the steel crawler.**

1. Remove the cover **(Fig. 8-22, 1)**.

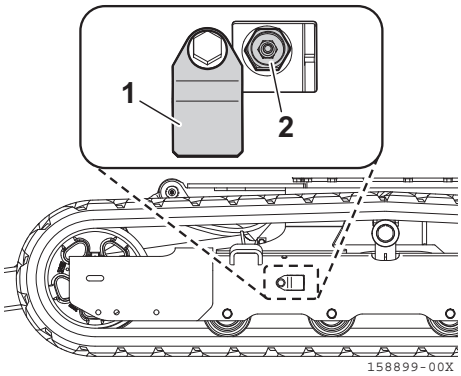


Fig. 8-22

2. Raise the machine with the implement and the safety blocks.

3. Loosen the nipple valve **(Fig. 8-22, 2)** and discharge the grease until the steel crawler tension is 5.1 in. (130 mm) [4.7 to 5.1 in. (120 to 130 mm) when replacing with a new one].

- Never loosen the nipple valve **(Fig. 8-22, 2)** more than one turn.
- If the grease is not discharging properly, lower the machine and move the machine back and forth slightly.

4. Tighten the nipple valve **(Fig. 8-22, 2)**.
Tightening torque:
36.1 to 39.8 ft•lbf (49 to 54 N•m)

5. Completely wipe away all of the discharged grease.

6. To check that the tension is proper, put down the machine and move the machine back and forth slightly.

7. Recheck the steel crawler tension and readjust it if necessary.

8. Install the cover **(Fig. 8-22, 1)**.

Replacing the bucket teeth and side cutter

■ Replacing the bucket teeth

When the bucket teeth are worn, replace them in accordance with the following procedure:

⚠ WARNING

- **When replacing the bucket teeth, be careful not to move the implement by mistake for safety. Place the implement in a stable position, stop the engine, and ensure to move the lock levers to the lock position.**
- **During replacement operations, always wear safety gear such as safety goggles.**

IMPORTANT

Replace the teeth before the point (Fig. 8-23, 1) is worn to the adapter (Fig. 8-23, 4).

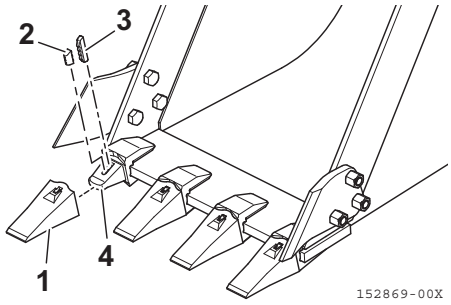


Fig. 8-23

1. Place wood blocks on a level ground and lower the bucket to the ground with its bottom kept level as shown in **Fig. 8-24**.

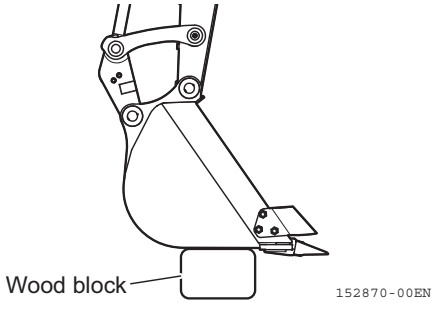


Fig. 8-24

2. Strike out the locking pin **(Fig. 8-23, 3)** installed on the bucket with a hammer and punch to remove the point **(Fig. 8-23, 1)**.

IMPORTANT

Do not strike the punch toward the rubber pin lock (Fig. 8-23, 2). Otherwise the rubber pin lock (Fig. 8-23, 2) may be damaged. Strike the tool toward the back of the pin.

3. Remove the rubber pin lock **(Fig. 8-23, 2)**.
4. Check the removed rubber pin lock **(Fig. 8-23, 2)** and locking pin **(Fig. 8-23, 3)**.
   Using the rubber pin lock **(Fig. 8-23, 2)** and locking pin **(Fig. 8-23, 3)** in the conditions below may cause the point **(Fig. 8-23, 1)** to come off during operation. Replace the applicable part with a new one.
   - There is a crack in the rubber of the rubber pin lock **(Fig. 8-23, 2)** and the roller may come off.
   - When pushed with a finger, the roller sinks in the rubber.
   - With the lower side of the locking pin **(Fig. 8-23, 3)** aligned with the point bottom line, the dimension **(Fig. 8-26, B)** is equal to or more than 1/3 of the dimension **(Fig. 8-26, A)**.

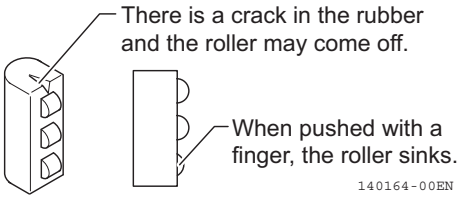


Fig. 8-25

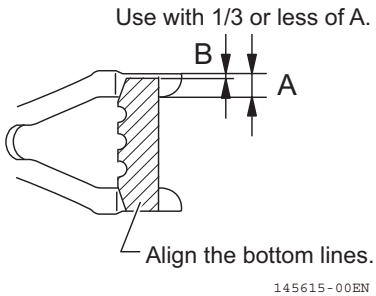


Fig. 8-26

5. Clean the surface of adapter **(Fig. 8-23, 4)** with a tool such as a putty knife to remove the hard mud fixed on it.
6. Push the rubber pin lock **(Fig. 8-23, 2)** into the hole on the adapter **(Fig. 8-23, 4)** by hand or by a hammer.

IMPORTANT

Do not let the rubber pin lock (Fig. 8-23, 2) come out of the adapter (Fig. 8-23, 4) surface.

7. Install the point **(Fig. 8-23, 1)** to the adapter **(Fig. 8-23, 4)** and check that the rear surface of the pin hole on the point **(Fig. 8-23, 1)** is almost aligned with the rear surface of the pin hole on the adapter **(Fig. 8-23, 4)** when the point **(Fig. 8-23, 1)** is pushed strongly onto the adapter **(Fig. 8-23, 4)**.
8. Insert the locking pin **(Fig. 8-23, 3)** into the pin hole on the point **(Fig. 8-23, 1)** and strike it so that the upper end of the locking pin **(Fig. 8-23, 3)** will be flush with the surface of the point.
   - Replace the rubber pin lock **(Fig. 8-23, 2)** and locking pin **(Fig. 8-23, 3)** with new ones at the same time when replacing the point **(Fig. 8-23, 1)**. This prevents the point **(Fig. 8-23, 1)** from coming off.

■ Replacing the side cutter

Delay in replacing the side cutter could damage the bucket.
Replace the side cutter before the bucket is damaged.

Tightening torque:
108.50 to 130.18 ft•lbf (147.1 to 176.5 N•m)
Screw lock agent: Loctite 262

- Replace the bolts, nuts and spring washers when replacing the side cutter.

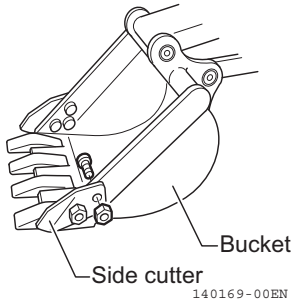


Fig. 8-27

Replacing the blade cutting edge (Angle blade spec.)

⚠ WARNING

When replacing the cutting edge, be careful not to move the blade by mistake for safety.
Place the blade in a stable position, stop the engine, and securely lock the lock levers.

When the cutting edge is worn, loosen the nuts as shown in the figure and replace the cutting edge.
When installing the cutting edge, apply adhesive to the bolts and tighten the nuts with the following tightening torque.
Tightening torque:
151.8 to 173.5 ft•lbf (205.8 to 235.2 N•m)
Adhesive: Loctite 262

- Replace the bolts, nuts and spring washers when replacing the cutting edge.

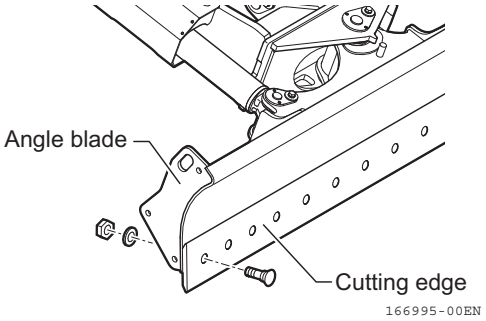


Fig. 8-28

Maintenance, inspection and servicing of air conditioner (Cabin spec.)

Daily maintenance and periodic inspection and servicing are required for the air conditioner to use it comfortably in the best condition.
Proper maintenance allows reduction in trouble and longer life of the air conditioner.
Exact inspection and servicing prevent trouble and reduce the cost for repair.
The air conditioner should also be checked and serviced at the time of a voluntary monthly inspection and a prescribed annual inspection of the machine.
It is recommended that the rubber hoses and electrical wires should be replaced every two years to use the air conditioner in the best condition.

Check points

- Abnormal sound and vibration of compressor
- Damage to compressor and condenser, and oil oozing in surrounding areas
- Abnormal sound and vibration of air conditioner unit
- Oil oozing on air conditioner hose and in unit connecting areas

The air conditioner should also be checked and serviced at the time of a voluntary monthly inspection and a prescribed annual inspection of the machine.
It is recommended that the rubber hoses and electrical wires should be replaced every two years to use the air conditioner in the best condition.

■ Cleaning the inner and outer air filters

1. Grab the knobs of the outer air filter **(Fig. 8-29, 1)** and the inner air filter **(Fig. 8-29, 2)**, then pull them out.
2. Blow off the clogged dirt or the like with compressed air.
3. Reinstall the cleaned filters.

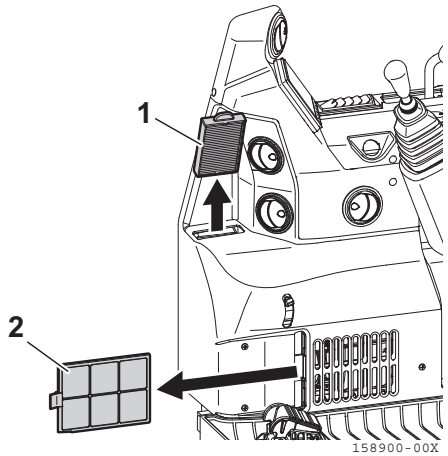


Fig. 8-29

Note:

- *Inner air filter **(Fig. 8-29, 2)** can be washed off with water after removing dirt. Outer air filter **(Fig. 8-29, 1)** can NOT be washed off with water.*
- *If the function has not been recovered even after cleaning, replace the filter.*
- *When washing the cabin floor or other parts with water, be sure to cover the filters to protect them from muddy water splashes.*

Checking and cleaning condenser

⚠ WARNING

- **Be sure to stop the engine and remove the starter switch key before checking and servicing the condenser.**
- **Be sure to reinstall the cover and other parts, which have been removed for checking and servicing, to their original positions after completion of the work.**

1. Open the cabin rear cover.

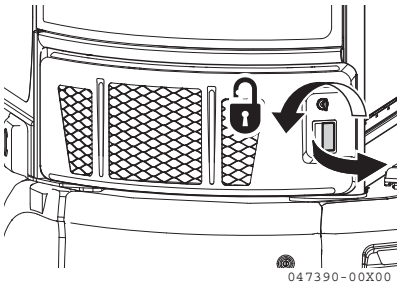


Fig. 8-30

2. If there is any mud or dirt on the condenser **(Fig. 8-31, 1)**, wash it off with water.

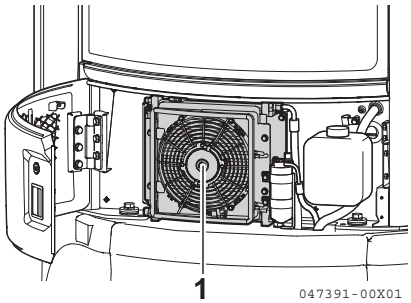


Fig. 8-31

- If there is some mud or dirt on the condenser fin, it will cause degradation of the air conditioner performance. Wash it off from the fin with water, using a soft brush.
- If the condenser fin is crushed or deformed, it will also cause degradation of the air conditioner performance. Repair it with a screwdriver or the like, taking care not to damage the condenser fin.

Checking the refrigerant quantity

Open the cabin rear cover and observe the flow of the refrigerant air bubble from the sight glass (inspection window) of the liquid tank according to the following procedure to check the refrigerant quantity.

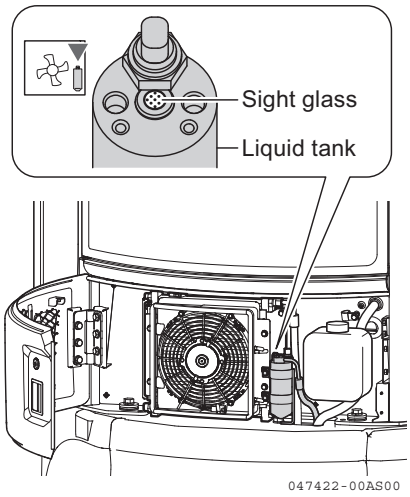


Fig. 8-32

1. Start the engine and run it at the maximum speed.
2. Set the fan switch **(Fig. 8-33, 1)** at the H level.
3. Set the temperature control dial **(Fig. 8-33, 2)** to the C position. (Full counterclockwise position.)
4. Turn the air conditioner switch **(Fig. 8-33, 3)** ON. (The lamp goes on.)

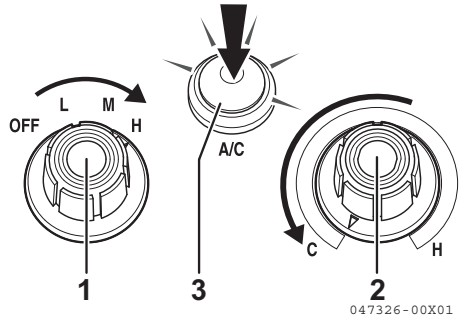


Fig. 8-33

5. Check the refrigerant condition from the sight glass and compare it with the check list for the refrigerant quantity.

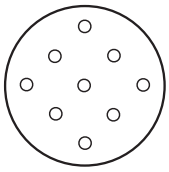
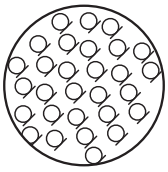
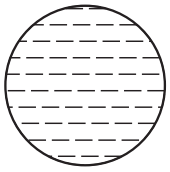
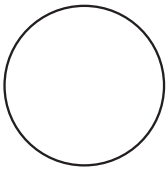
IMPORTANT

If the refrigerant quantity is not normal, ask your dealer for check and repair.

Refrigerant type: R134a

Quantity: 1.54 lbs. (700 g)

Check list for the refrigerant quantity

Air conditioner condition	Normal	Abnormal		
Temperatures of high and low pressure pipes	Temperature difference is big. High pressure pipe : hot Low pressure pipe : cold Compressor discharge side temperature : 158 °F (70 °C) Compressor intake side temperature : 41 °F (5 °C)	High pressure pipe is warm and low pressure pipe is rather cool. Temperature difference is not so big.	There is almost no difference in temperature between high and low pressure pipes.	High pressure pipe is hot and low pressure pipe is rather warm. There is some difference in temperature between them.
Sight glass	Almost transparent. Even if air bubble flow is seen, it becomes transparent as the engine speed changes.  046691-00X00 *1	Air bubble flow is always seen. It is sometimes transparent or white.  046692-00X00	Flow of mist or the like is seen slightly.  046730-00X00	No air bubble flow is seen even cabin windows, idling engine, and rotating fan to the maximum.  046731-00X00 *2
Pipe connection	Normal	Some parts are contaminated by oil.	Some parts are badly contaminated by oil.	Normal
Refrigerant quantity	Refrigerant quantity is adequate and normal.	Refrigerant might leak in a small amount from some part.	Almost all refrigerant leaks and does not remain.	Refrigerant quantity is too large.

**1 : When the outside air temperature is low, air bubble might be seen even if the refrigerant quantity is adequate.*

**2 : When there is no refrigerant, no air bubble is seen, either. Therefore, be sure to check the difference in temperature between the high and low pressure pipes.*

Cleaning the cabin floor (Cabin spec.)

Clean the cabin floor periodically with a broom to remove dust and dirt, or wipe it off with a hard-wrung waste cloth.
Wash the floor with water around feet only. Do not throw water or use steam cleaning. Be careful not to get water especially onto the air conditioner duct, inner air filter, and engine stop switch, and place a cover over them if necessary.

Checking before start-up

Check the items described below before starting the engine first in a day.
For details of the following items, refer to Section "Checking before start-up" on page 109 of "OPERATION" PART.

- Checking and replenishing the cooling water
- Checking and draining the water separator
- Checking and replenishing the engine oil
- Checking and replenishing the fuel in the fuel tank
- Checking and replenishing the hydraulic oil tank
- Checking and adjusting the fan belt tension
- Checking and replenishing the battery
- Greasing
- Checking the electrical equipment

Maintenance every 50 service hours

Greasing the swing gear and the swing bearing

⚠ WARNING

Do not swing the upperstructure while greasing.
Swing the upperstructure after each stage of greasing is completed to avoid serious bodily injury.

1. Using a grease gun, apply grease through the grease nipples shown in **Fig. 8-34**.
2. Swing the upperstructure in small increments and grease after each stop, until the upperstructure has made a full revolution.

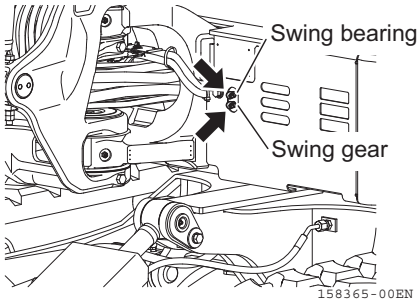


Fig. 8-34

Draining the water and deposits in the fuel tank

⚠ WARNING

Keep sparks, flames and lit cigarettes away.

■ **Things to prepare**

- Container for fuel waste

1. Swing the boom to left.
2. Swing the upperstructure so that the drain cock **(Fig. 8-35, 1)** at the side of the swing cylinder will be positioned in the middle of the right and left crawlers.
3. Put the container for fuel waste under the hose for the drain cock.
4. Open the drain cock **(Fig. 8-35, 1)** to discharge the water and dirt deposits in the fuel tank from the drain hose. Take care that the fuel does not contact your body.
5. After clean fuel flows out, set the drain cock **(Fig. 8-35, 1)** to the close position.

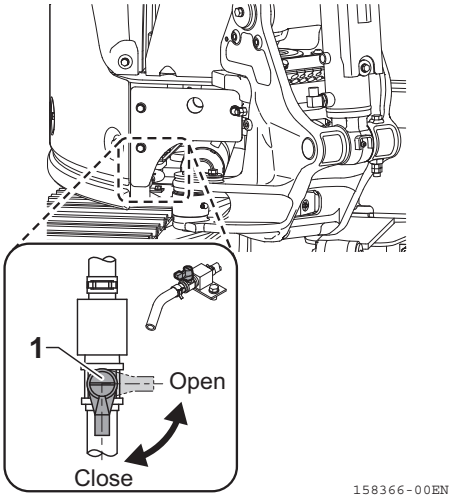


Fig. 8-35

Maintenance every 100 service hours

Perform the same maintenance as indicated for every 50 service hours.

Maintenance every 250 service hours

Also perform the maintenance every 50 service hours.

Checking and cleaning the air cleaner

⚠ WARNING

- **Never attempt to clean and replace the air cleaner while the engine is running. Always stop the engine and allow it to cool first.**
- **Compressed air is used to clean the element. Always wear safety goggles to prevent injury to your eyes.**
- **The maximum compressed air pressure should be less than 0.7 MPa for cleaning purposes.**

■ Cleaning procedure for element

1. Open the rear hood.
2. Remove the clip **(Fig. 8-36, 1)** and then the dust cup **(Fig. 8-36, 2)**.
3. Remove the air cleaner element **(Fig. 8-36, 3)**.
   Cover the connector side in the back of the air cleaner body with a waste cloth and tape to prevent dirt from entering.

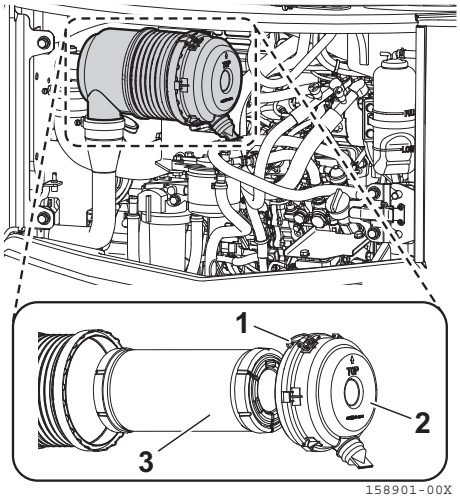


Fig. 8-36

4. Clean the dust cup **(Fig. 8-36, 2)** and the inside of the body.
5. Blow the dry, compressed air (0.7 MPa or less) from inside the element along the pleats to initially remove the dirt. Then blow compressed air from outside the element along the pleats to remove dirt. Blow compressed air again from inside the element, to complete the dirt removal.

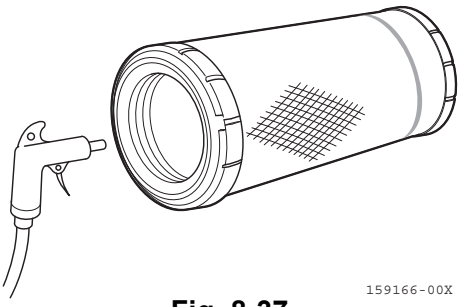


Fig. 8-37

6. After cleaning, illuminate the element from inside with a light bulb and check it. If there are any small holes or thin areas, replace the element with a new one.

Fig. 8-38

IMPORTANT

- **When cleaning the element, do not tap it or strike it against other objects. Otherwise the element may be damaged.**
- **Do not reuse the element if the pleat, gasket or seal is damaged.**
- **If clogging occurs (air cleaner clogging error is issued) soon after cleaning of the elements, replace the inner element.**

7. Remove the protective cloth and tape used to cover the inner element.
8. Install the cleaned elements **(Fig. 8-36, 3)** to the air cleaner case.
9. Install the dust cup **(Fig. 8-36, 2)** so that the arrow mark will come on the upper side and secure it with the clip **(Fig. 8-36, 1)**.
10. Close the rear hood.

Checking and replenishing the lube oil for the travel reduction gearbox

⚠ WARNING

- **The gear oil and casing of the reduction gearbox are hot immediately after ceasing machine operation and can cause bodily injury.**
  Do not allow hot oil or the gearbox to contact your skin.
  Replace oil after the oil and the gearbox have cooled sufficiently, if necessary.
- **At operating temperature, the reduction gearbox is hot and its contents are under pressure.**
  In such condition, the oil or a plug may be ejected violently, causing bodily injury. Remove a plug slowly to gradually relieve the residual pressure.

■ Things to prepare

- Container for oil
- Oil jug

1. Set the level port **(Fig. 8-39, 1)** and the drain port **(Fig. 8-39, 2)** in position **Fig. 8-39**.
2. Place a container receiving waste oil under the level port **(Fig. 8-39, 1)**.
3. Remove the level port plug using a hexagon wrench (8 mm). Make sure that the oil level reaches the lower end of the level port.
4. When the oil quantity is insufficient, replenish gear oil through the level port **(Fig. 8-39, 1)** until gear oil overflows from the level port **(Fig. 8-39, 1)**.
   Refer to Section "Fueling, Oiling and Greasing Based on Temperature Range" on page 194 for the oil to be used.

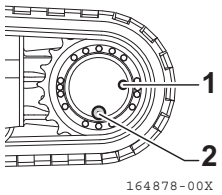


Fig. 8-39

5. Reinstall the plug.
   Tightening torque:
   36.1 to 50.6 ft•lbf (49.0 to 68.6 N•m)

Checking and adjusting the fan belt and air conditioner belt

⚠ WARNING

- **Stop the engine, take the key out of the starter switch, and then place "DO NOT USE" tag on the switch section.**
- **Immediately after the engine has stopped, the engine and surrounding area are very hot. After the engine has cooled down, perform the check and adjustment.**

■ Checking

1. Open the rear hood.
2. Measure the belt tension by pushing the measurement point on each of the fan belt and air conditioner belt with a finger, etc.

	Fan belt	Air conditioner belt
Measurement point	**Fig. 8-40 1**	**Fig. 8-40 2**
Pushing load	22.1 lbf (98.1 N)	22.1 lbf (98.1 N)
Adequate tension	0.59 to 0.79 in. (15 to 20 mm)	0.79 to 0.98 in. (20 to 25 mm)

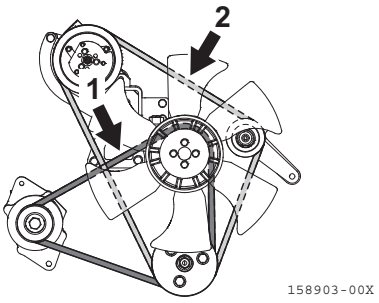


Fig. 8-40

3. Adjust the tension if necessary.
4. With the adequate tension, check that the belts do not contact the V-groove bottom of any pulley.
5. If any belt is elongated and cannot be adjusted, if damage such as a scratch and crack occurs, or if any belt contacts the V-groove bottom of any pulley, replace the belt with a new one.
   Fan belt (Part number: 25152-004150)
   Air conditioner belt (Part number: 172B82-18490)
6. When no abnormality is found on the belts and pulleys, close the rear hood.

■ Adjusting the fan belt

1. Remove the generator cover **(Fig. 8-41, 1)**.

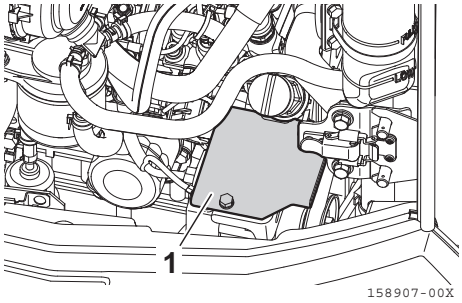


Fig. 8-41

2. Loosen the securing bolt **(Fig. 8-42, 2)** and nut **(Fig. 8-42, 3)** of the generator.
3. Place the bar between the generator and the gear case, and move the generator to the rear of the machine so that the tension of the fan belt is at the specified value.

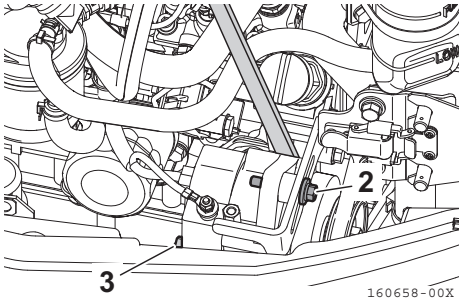


Fig. 8-42

4. With the belt tension at the specified value, tighten the securing bolt **(Fig. 8-42, 2)**.
5. Check the belt tension again. If the tension is proper, tighten the securing nut **(Fig. 8-42, 3)** and install the generator cover **(Fig. 8-41, 1)**.

■ Adjusting the air conditioner belt

1. Remove the floor mat.
2. Open the cover of the seat mount **(Fig. 8-43, 1)**, remove the bolt and then the cover of the seat mount **(Fig. 8-43, 1)**.
3. Tighten the tension pulley bolt **(Fig. 8-43, 2)**.
4. Loosen the adjuster lock nut **(Fig. 8-43, 3)**.
5. Turn the adjuster bolt **(Fig. 8-43, 4)** to adjust the belt tension to the specified value.

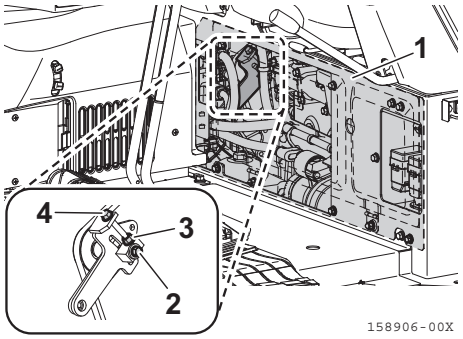


Fig. 8-43

6. When the adjustment is complete, tighten the tension pulley bolt **(Fig. 8-43, 2)**, and then tighten the adjuster lock nut **(Fig. 8-43, 3)**.
7. Check the belt tension again. If the tension is proper, install the cover of the seat mount **(Fig. 8-43, 1)**.

Maintenance every 500 service hours

Also perform the maintenance every 50, 100, and 250 service hours.

Cleaning the water separator and replacing the filter element

⚠ WARNING

- **Be sure to keep flames such as lit cigarettes away.**
- **Only after the engine has cooled down sufficiently, check and maintain the water separator.**
- **The fuel leaked or spilled onto hot surfaces or electrical components may cause a fire.**
- **Drain the fuel before removing the water separator cup.**

■ Cleaning the water separator

Things to prepare

- Container for fuel wastes
- Filter wrench (Part number: 17130-92760)

1. Open the rear hood. Drain the fuel from the water separator **(Fig. 8-44, 1)**.
   Checking and draining the water separator: Refer to page 110.

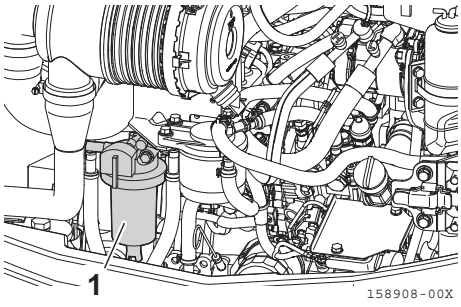


Fig. 8-44

2. After setting the fuel cock **(Fig. 8-45, 2)** to OFF (closed position), loosen the retainer ring **(Fig. 8-45, 3)** and remove the cup.
   Be careful not to loose the float **(Fig. 8-45, 5)** when removing the cup **(Fig. 8-45, 4)**.
3. Remove the filter element **(Fig. 8-45, 6)** and clean the cup **(Fig. 8-45, 4)** and the filter element **(Fig. 8-45, 6)** using light oil or a washing oil.
4. Check the O-rings **(Fig. 8-45, 7 and 8**) and if either is damaged or deformed, replace it with a new one.
   O-ring **7** (Parts No.: 24321-000650)
   O-ring **8** (Parts No.: 24311-000160)
5. Attach the O-ring **(Fig. 8-45, 8)** and the filter element **(Fig. 8-45, 6)** to the water separator body.
6. Attach the O-ring **(Fig. 8-45, 7)** and the cup **(Fig. 8-45, 4)** containing the float **(Fig. 8-45, 5)** to the body of the water separator, and then attach the retainer ring **(Fig. 8-45, 3)**.
   Always tighten the retainer ring by hand, without using tools.
7. Bleed the air from the fuel.
   How to bleed the air: Refer to page 223.
8. After air releasing, start the engine to check for leaking and other problems.
   Then, stop the engine and close the rear hood.

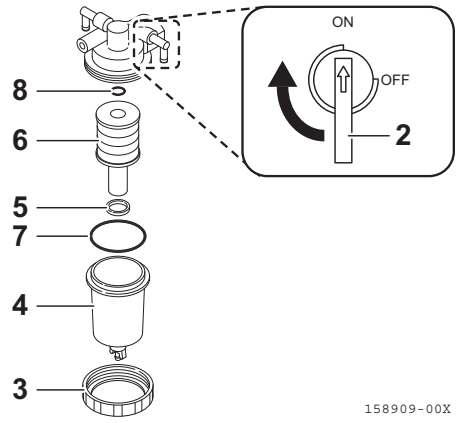


Fig. 8-45

Replacing the fuel filter and bleeding the air from the fuel passage

⚠ WARNING

- **Be sure to keep flames such as lit cigarettes away.**
- **Immediately after the engine has stopped, the engine components are very hot. Only after the engine has cooled down, perform the operations.**
- **The fuel leaked or spilled onto hot surfaces or electrical components may cause a fire.**

■ Replacing the fuel filter

Things to prepare
- Container for fuel wastes
- Filter wrench (Part number: 171301-92750)
- New fuel filter
  List of consumables: Refer to page 193.

1. Open the rear hood.
2. Place the container for fuel under the fuel filter **(Fig. 8-46, 1)**.
3. Turn the fuel filter **(Fig. 8-46, 1)** counterclockwise to remove with a filter wrench.
4. Clean the fuel filter **(Fig. 8-46, 1)** mount.
   Fill up a new filter with fuel and install it with the engine oil applied to its seal surface.
5. After the fuel filter **(Fig. 8-46, 1)** has been replaced, bleed the air.
   How to bleed the air: Refer to page 223.
6. After bleeding the air completely, start the engine to check for fuel leak and other problems.
   If no problem is found, stop the engine and close the rear hood.

IMPORTANT

To prevent the fuel filter from being overtightened, turn it slightly until the mount contacts the seal surface, and then additionally tighten it 2/3 turns.

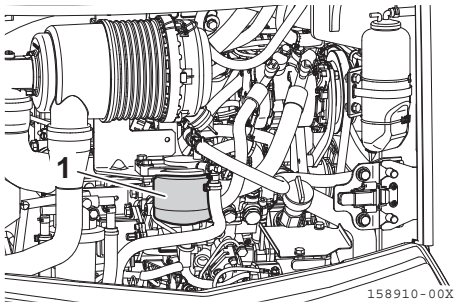


Fig. 8-46

■ How to bleed the air

The machine is equipped with the automatic air bleeding device (solenoid pump). Bleed the air in the procedure below.

1. Fill up the fuel tank.
2. Move the lock lever to the lock position, and fully turn the engine control dial clockwise.
3. Turn the key to the “ON” position to energize for approximately 25 to 30 seconds. (Normally, the air has been bled in 25 to 30 seconds.)
4. Turn the key to the “START” position to start the engine.

IMPORTANT

If starting fails, turn the key to the “OFF” position, and wait for 1 minute or longer. Then, turn the key again to the “START” position.

- Bleed the air in the same way also in case of run-out of fuel.
  After the engine starts, if it runs irregularly, turn the key to the "OFF" position, wait for one minute or more and turn the key to the "START" position again.

Replacing the engine oil and engine oil filter

⚠ WARNING

Immediately after the engine has stopped, the engine components are very hot. Only after the engine has cooled down, replace the oil.

■ Things to prepare

- Engine oil: 7.7 Qts. (7.3 L)
- Container for waste oil
- Filter wrench (Part number: 119640-92750)
- New engine oil filter
  List of consumables: Refer to page 193.

1. Swing the upperstructure so that the drain plug **(Fig. 8-47, P)** at the bottom of the engine will be positioned in the middle of the right and left crawlers.
2. Remove the cover **(Fig. 8-47, 1)** at the bottom of the machine body, and place the container for waste oil under the drain plug **(Fig. 8-47, P)** and hose **(Fig. 8-47, 2)**.
3. Slowly remove the drain plug **(Fig. 8-47, P)** using a tool with a width across flats of 19 mm so that the oil will not splash your body, and drain the waste oil.
   Check the waste oil, and contact your dealer if a lot of metallic particles or foreign objects are mixed in it.

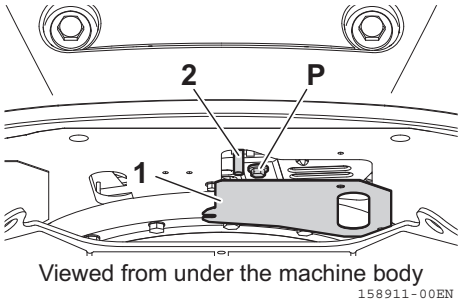


Fig. 8-47

4. Reinstall the drain plug **(Fig. 8-47, P)**.
   Tightening torque:
   39.8 to 46.5 ft•lbf (54 to 63 N•m)

5. Turn the oil filter (cartridge) **(Fig. 8-48, 3)** counterclockwise with a filter wrench to remove.
   After removing the oil filter **(Fig. 8-48, 3)**, wait for 10 to 15 minutes.

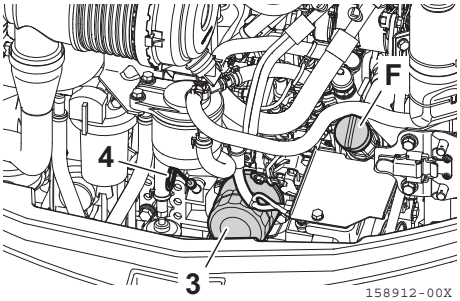


Fig. 8-48

6. Clean the filter mount and apply the engine oil (or apply grease lightly) to the seal surface of a new oil filter **(Fig. 8-48, 3)** and install the filter.
7. When installing the filter, additionally turn it 2/3 turns after the seal surface has contacted the filter mount.
8. After replacing the oil filter **(Fig. 8-48, 3)**, add engine oil to the upper limit mark on the oil dipstick **(Fig. 8-48, 4)** through the oil supply port **(Fig. 8-48, F)**.
9. Tighten the oil supply port cap securely, and allow the engine to run at low idle speed for a while and then stop the engine. After that, check that the oil level exceeds the midpoint between the upper and lower limit marks on the oil dipstick **(Fig. 8-48, 4)**. Refer to "Checking before start-up" on page 109.
10. Check for oil leakage, then install the cover **(Fig. 8-47, 1)** at the bottom of the machine body and close the rear hood.

Replace the engine oil and oil filter 1 year after the previous replacement even if the service hours have not reached 500 hours.
Also replace them when the service hours have reached 500 hours, even if 1 year has not passed.

Checking and cleaning the radiator and oil cooler

⚠ WARNING

- **Checking and cleaning these components while the engine is running are dangerous. Always stop the engine before checking and cleaning.**
- **Compressed air may scatter objects around these components and it is dangerous. Check that there are no other persons nearby, and always wear protective gear such as safety goggles.**
- **The maximum compressed air pressure should be less than 0.7 MPa.**

1. Open the rear hood and then the light hood.
2. Clean off any mud, dirt or leaves clogged in the radiator fins **(Fig. 8-49, 1)** and the oil cooler fins **(Fig. 8-49, 2)** by blowing compressed air or by flushing with steam.

IMPORTANT

When compressed air is used for cleaning, blow it at a distance from the fins. A damaged fin will cause water and oil leaks and overheating.

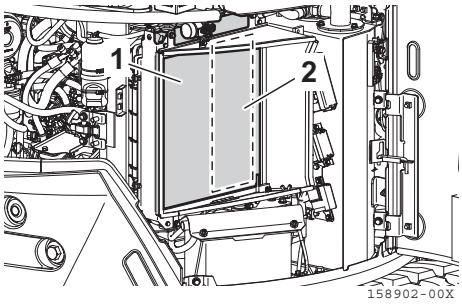


Fig. 8-49

3. Check whether the fins **(Fig. 8-49, 1, 2)** of the radiator and oil cooler have fallen over and whether dust has been removed cleanly.
4. Close the right hood and then the rear hood.

Replacing the air cleaner element

⚠ WARNING

Replacing components while the engine is running is dangerous. Be sure to stop the engine before replacing any component.

■ Things to prepare

- New air cleaner element
  List of consumables: Refer to page 193.

1. Open the rear hood.
2. Remove the clip **(Fig. 8-50, 1)** and then the dust cup **(Fig. 8-50, 2)**.
3. Remove the air cleaner element **(Fig. 8-50, 3)**.
   Cover the connector side in the back of the air cleaner body with a waste cloth and tape to prevent dirt from entering.
4. Clean the inside of the dust cup **(Fig. 8-50, 2)** and the air cleaner body. Remove the waste cloth or tape used to cover the connector in the back side of the body.
5. Install a new element **(Fig. 8-50, 3)**.
6. Reinstall the dust cup **(Fig. 8-50, 2)** with the arrow mark facing upward.
7. Close the rear hood.

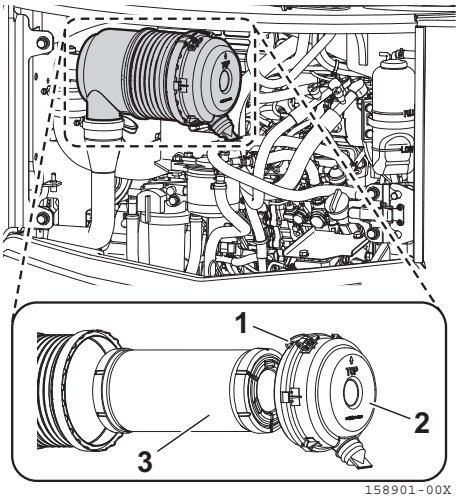


Fig. 8-50

Replacing the hydraulic oil return filter

⚠ WARNING

- **The hydraulic oil and the tank surface are very hot immediately after operations. Replacing the filter in such condition is dangerous, and may cause bodily injury such as a burn.**
  Wait until the tank has cooled enough to permit you to touch its surface with your bare hand, and then start the operation.
- **Removing the tank cap carelessly may cause the hydraulic oil to spout out because of the pressure inside the tank. Slowly and evenly loosen the 3 mounting bolts, and then remove the cap.**

■ Things to prepare

- New hydraulic oil return filter element
  List of consumables: Refer to page 193.

1. Open the front cover (right), and clean the hydraulic oil tank cover **(Fig. 8-51, 1)** and its surrounding area with a waste cloth or other.
2. Loosen the hose bands **(Fig. 8-51, 3)** fixing the return hoses **(Fig. 8-51, 2)**, and disconnect the return hoses **(Fig. 8-51, 2)**.
3. Slowly and evenly loosen the 3 bolts **(Fig. 8-51, 4)** on the hydraulic oil tank cap, release the internal pressure, and then remove the cover **(Fig. 8-51, 1)** and hydraulic oil return filter together.

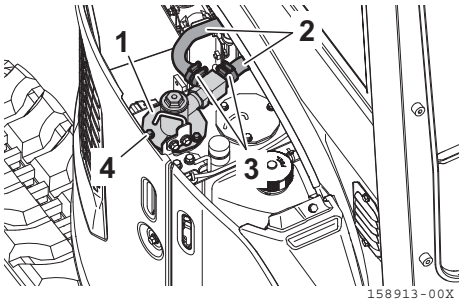


Fig. 8-51

4. Separate the return pipe **(Fig. 8-52, 5)** and return filter **(Fig. 8-52, 6)** using a spanner with a width across flats of 32 mm and 41 mm.

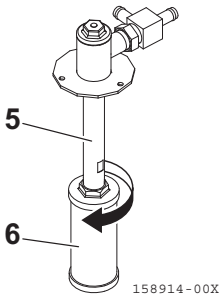


Fig. 8-52

5. Install a new filter to the return pipe **(Fig. 8-52, 5**).
6. Wipe the cap mount on the hydraulic oil tank with a waste cloth and check the O-ring. If the O-ring is damaged, replace it with a new one and then reinstall the cover **(Fig. 8-51, 1)**.
   O-ring (Part number: 24321-000900)
7. Reinstall the return hoses **(Fig. 8-51, 2)**, and tighten the hose bands **(Fig. 8-51, 3)**.
8. Bleed the air from the hydraulic circuit, and check the oil level in the hydraulic oil tank. Refer to "Hydraulic system" on page 191.
9. Close the front cover (right).

IMPORTANT

- **Do not allow any dust or dirt to enter the hydraulic tank when installing the cap.**
- **Reinstall the hose bands to the return hose so that the fastened portions will face in the opposite directions.**

Maintenance every 1000 service hours

Also perform the maintenance every 50, 100, 250 and 500 service hours.

Replacing the lube oil for the travel reduction gearbox

⚠ WARNING

- **The oil and reduction gearbox case are very hot immediately after the operations. Replacing the oil immediately is dangerous, and may cause bodily injury such as a burn.**
  Wait until the reduction gearbox case has cooled enough to permit you to touch it with your bare hand, and then start the operation.
- **Otherwise, the oil may spout out or plug may be ejected suddenly. Loosen the plug slowly to release the pressure inside the tank.**

■ Things to prepare

- Container for waste oil
- Gear oil: 0.5 Qts. (0.5 L) for right and left each

1. The drain port **(Fig. 8-53, 1)** should come to the lower side.

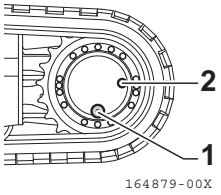


Fig. 8-53

2. Put the container for waste oil under the drain port **(Fig. 8-53, 1)**.

3. Remove the plugs from the drain port **(Fig. 8-53, 1)** and level port **(Fig. 8-53, 2)** with a hexagon socket screw key (8 mm) to drain the waste oil.

4. After draining the waste oil, reinstall the plug to the drain port **(Fig. 8-53, 1)**.
   Tightening torque:
   36.1 to 50.6 ft•lbf (49.0 to 68.6 N•m)
5. Add the gear oil through the level port **(Fig. 8-53, 2)** to the specified level.
   For the oil to be used, refer to "Fueling, Oiling and Greasing Based on Temperature Range" (page 194).
6. After the gear oil overflows from the level port **(Fig. 8-53, 2)**, reinstall the plug to the level port **(Fig. 8-53, 2)**.
   Tightening torque:
   36.1 to 50.6 ft•lbf (49.0 to 68.6 N•m)

Replacing the oil in the hydraulic oil tank and cleaning the suction filter

⚠ WARNING

- **The oil and tank surface are very hot immediately after the operations. Replacing the oil immediately is dangerous, and may cause bodily injury such as a burn. Wait until the tank has cooled enough to permit you to touch its surface with your bare hand, and then start the operation.**
- **First slowly turn the oil supply port cap to release the internal pressure, and then remove the cap carefully.**
- **Removing the tank cap carelessly may eject the cap suddenly because of the spring force holding the filter.**
  Also, the hydraulic oil may spout out because of the pressure inside the tank.
  Slowly and diagonally loosen the 3 mounting bolts and then remove the cap.

■ Things to prepare

- Container for waste oil
- Hydraulic oil 8.5 Gals. (32 L) (When the oil is drained completely from all of the hydraulic equipment, pipes and hoses, 14.3 Gals. (54 L)).
- O-ring for drain plug
  (Part number: 24341-000300)

1. Swing the upperstructure so that the drain plug **(Fig. 8-55, P)** at the bottom of the hydraulic tank will be positioned in the middle of the right and left crawlers.
2. Retract the bucket and arm cylinders to their stroke ends, lower the boom and put the bucket teeth on the ground.

3. Put the blade on the ground and stop the engine.

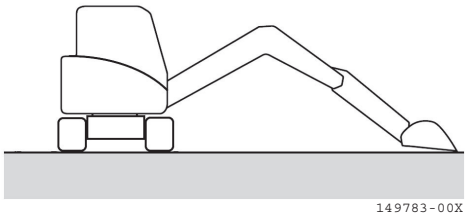


Fig. 8-54

4. Remove the cover **(Fig. 8-55, 1)** on the lower right side of the upperstructure.

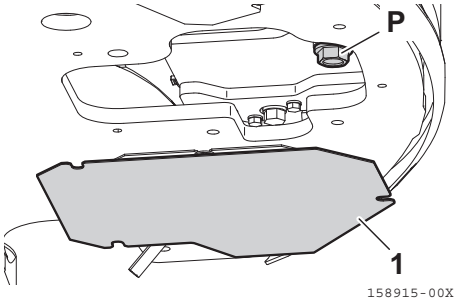


Fig. 8-55

5. Put the container for waste oil under the drain plug **(Fig. 8-55, P)**.
6. Remove the drain plug **(Fig. 8-55, P)** and drain the waste oil.
   When removing the drain plug **(Fig. 8-55, P)**, take care that the oil does not splash your body.
7. Degrease and wash the threads of the drain plug, and replace the O-ring with a new one.
8. After draining, tighten the drain plug **(Fig. 8-55, P)**.
   Tightening torque:
   79.7 to 87.8 ft•lbf (108 to 119 N•m)
9. Open the front cover (right), and clean the cover **(Fig. 8-56, 1)** mount on the upper side of the hydraulic tank with a waste cloth or other.
10. Slowly loosen the bolt **(Fig. 8-56, 2)** to remove the cover **(Fig. 8-56, 1)**.

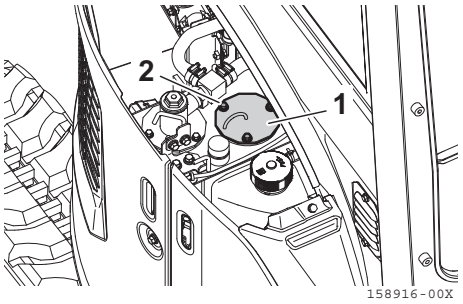


Fig. 8-56

11. Take out the filter **(Fig. 8-57, 3)**.

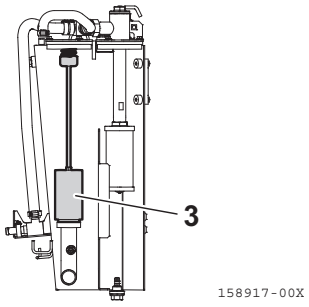


Fig. 8-57

12. Remove dust and dirt adhering to the filter, and wash it with cleaning oil or diesel oil.
13. Check the filter and the seal at the bottom of the filter, replace the filter with a new one if necessary, and install it to the hydraulic tank.

IMPORTANT
Do not allow any dust or dirt to enter the tank when installing the filter.

14. Add the oil to the specified level.
    At the oil temperature of 50 to 86 °F (10 to 30 °C), fill the oil around 0.39 in. (10 mm) above the midpoint of the level gauge. Do not fill more than the upper limit of the oil level gauge.
    Refer to "Fueling, Oiling and Greasing Based on Temperature Range" on page 194.

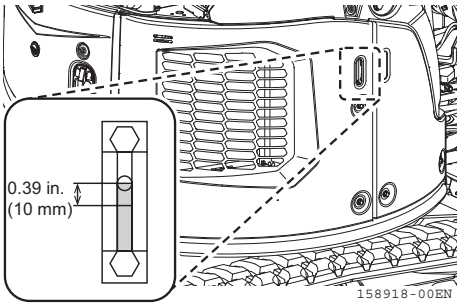


Fig. 8-58

15. Wipe the cap mount with a waste cloth or other and check the O-ring.
    If any flaw is found, replace it with a new one.
    O-ring (Part number: 24321-000900)
16. Reinstall the cap.
17. After replacing the oil, bleed the air from the hydraulic circuit, and check the oil level in the hydraulic oil tank.
    Refer to "Hydraulic system" on page 191.
18. Close the front cover (right).

Checking and adjusting the intake/ exhaust valve clearances

Ask your dealer for checking and adjusting.

Maintenance every 1500 service hours

Also perform the maintenance every 50, 100, 250 and 500 service hours.

Checking the crankcase breather system

Ask your dealer for checking.

Maintenance every 2000 service hours

Also perform the maintenance every 50, 100, 250, 500 and 1000 service hours.

Replacing the engine cooling water

⚠ WARNING

- **The cooling water is very hot immediately after the engine has stopped. Draining the cooling water immediately after stop may cause burns. Only after the engine has cooled down, start the operation.**
- **Cleaning takes place while the engine is running. Therefore, it is very dangerous for persons staying behind the machine, if the machine starts moving. Also, with the rear hood being opened, these persons may contact the radiator fan.**
  Never step into the area behind the machine while the engine is running.
- **Do not remove the radiator cap while the water temperature in the radiator is high. Hot water may spout out.**
  After the cooling water has cooled down, first slowly turn the radiator cap to release the internal pressure, and then remove the cap.

■ Table of mixing ratio of anti-freeze to water

At the delivery from the factory, the concentration of anti-freeze is 51 %.

Lowest temperature [°F (°C)]	5 (-15)	-4 (-20)	-13 (-25)	-22 (-30)	-31 (-35)	-40 (-40)
Concentration of anti-freeze (%)	30	35	40	45	50	55

⚠ WARNING

- **Anti-freeze is flammable. Keep flames away from anti-freeze.**
- **Wear the protective gear not to allow anti-freeze to get into your eyes or contact your skin. If the cooling water gets into your eyes or contacts your skin, flush with water to remove it completely.**

IMPORTANT

- **Use tap water to mix. To use water from a river, a well or a private water-supply system, consult your dealer.**
- **Though the mixing ratio of anti-freeze differs with the ambient temperature, at least 30 % of anti-freeze by volume is required to obtain anti-corrosive effect.**
- **Determine the mixing ratio of anti-freeze on the basis of the lowest temperature in the past, referring to the ratio table. Actually, set a temperature approximately 50 °F (10 °C) lower than the lowest temperature.**
- **Use a densitometer to control the mixing ratio.**
- **Park the machine on level ground to replace the cooling water.**

■ Things to prepare

- Cooling water 1.2 Gals. (4.5 L) or more
- Container for waste fluid

1. Swing the upperstructure so that the drain plug **(Fig. 8-59, P)** will be positioned in the middle of the right and left crawlers.
2. Remove the cover **(Fig. 8-59, 1)** on the lower right side of the upperstructure.

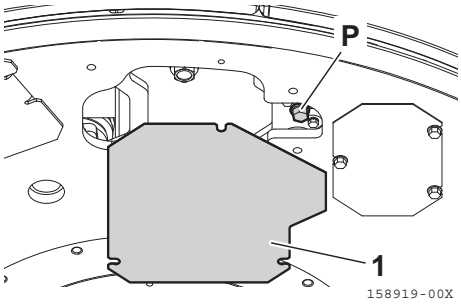


Fig. 8-59

3. Put the container for waste fluid under the drain plug **(Fig. 8-59, P)**.
4. Slowly remove the drain plug **(Fig. 8-59, P)** using a tool with a width across flats of 0.47 in. (12 mm) to drain the cooling water.
5. Remove the storage space for tools. Then, open the front cover (right). Slowly turn the radiator cap **(Fig. 8-60, 2)** and remove the radiator cap.

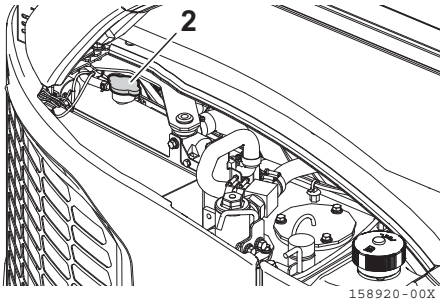


Fig. 8-60

6. After the cooling water has been drained, reinstall the drain plug **(Fig. 8-59, P)**.
7. Open the rear hood, remove the cooling water sub-tank **(Fig. 8-61, 3)**, and drain the cooling water from the sub-tank.

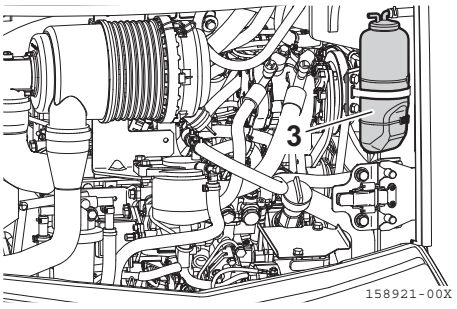


Fig. 8-61

8. Reinstall the cooling water sub-tank **(Fig. 8-61, 3)**, and add the cooling water up to the FULL line.
9. Pour the cooling water into the radiator to fill it up.
10. To bleed the air from the cooling water system, allow the engine to run at low idle speed for 5 to 6 minutes and then at high speed without load for additional 5 to 6 minutes. [While the engine is running, keep the radiator cap **(Fig. 8-60, 2)** removed.]
11. Approximately 5 minutes after stopping the engine, pour the cooling water into the radiator through the water supply port up to almost the port opening, and securely tighten the radiator cap **(Fig. 8-60, 2)**.
12. Check the level in the sub-tank **(Fig. 8-61, 3)**, and if it is below the FULL line, pour the cooling water.
13. Reinstall the cover **(Fig. 8-59, 1)** and the storage space for tools. Then close the hoods.

Checking the accumulator

Refer to "Handling accumulator" on page 160.

Checking and replacing the fuel, cooling water, and lubricating oil hoses

Ask your dealer for checking and replacing.

Lapping the intake and exhaust valve seats

Ask your dealer for lapping.

Maintenance every 3000 service hours

Also perform the maintenance every 50, 100, 250, 500, 1000 and 1500 service hours.

Checking, cleaning and testing EGR valves

Ask your dealer for checking, cleaning and testing.