Precautions when using diesel fuel

- To maintain the performance and service life of the engine, always use clean and high-quality fuel.
- To avoid freezing in cold climates, use a diesel fuel that still functions when the temperature is at least 12°C (21.6°F) below the lowest expected ambient temperature.
- Use a diesel fuel that has a cetane number of 45 or higher. When operating at a very low temperature or at a high altitude, a higher cetane number fuel will be required.
- Use fuel with sulfur content of less than 15 ppm by volume.
  Especially in the U.S.A. and Canada, ultra-low sulfur fuel should be used.
  A higher sulfur content fuel may cause sulfuric acid corrosion in the cylinders of the engines.
- Never mix kerosene, used engine oil, or residual fuel with the diesel fuel. Use of kerosene is prohibited.
- 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.
- Use zinc- and sodium-free fuel.
- Do not use the fuel that has been in storage for a long time.
- Do not use the fuel purchased from a non-authorized dealer.
- In the EU, use fuel that satisfies the following conditions
  - Sulfur content is 10 mg/kg (10 ppm) or less, and 15 mg/kg (15 ppm) or less at the final distribution point.
  - Cetane number is 45% or more.
  - Fatty acid methyl ester (FAME) content is 7% v/v or less.

Precautions when using bio-diesel fuel

The warranty of the engine manufacturer may be voided by using a bio-diesel fuel that does not meet the standard or that is deteriorated.

Hydrotreated Vegetable Oil (HVO) fuel

HVO fuel compliant with EN15940 can be used.

IMPORTANT: Note that HVO fuel has a lower fuel density than light oil, which may reduce engine power and machine performance.

Precautions when using HVO fuel

Do not use HVO fuel that does not comply with the specified standards. Doing so could result in malfunction.

Lubricant

Location	Type	Type by air temperature -4 14 32 50 68 86 104°F -20 -10 0 10 20 30 40°C	When to replace
Hydraulic oil tank	Takeuchi genuine hydraulic oil 46	ISO VG46	Every 4000 hrs.***
	Biodegradable oil recommended by Takeuchi***** Mobil EAL Envirosyn 46H Panolin HLP Synth 46	ISO VG46	Every 4000 hrs.
	Anti-wear hydraulic oil	ISO VG32 ISO VG46 ISO VG68	Every 2000 hrs.***
Engine cooling system	Cooling water (water + coolant)** SAE: J814C or J1034	Mixture of 50% coolant	Every 1000 hrs. or two years
Engine oil pan****	Shell Rimula R6 LM 10W-40		Every 500 hrs. or once a year
Slew reduction gear Travel reduction gear	Gear oil API: GL-4	SAE 90	Every 1000 hrs after the initial 250 hrs*.
Slew bearing	Lithium based grease EP-2 NLGI No.2	—	Every 500 hrs.
Working equipment			Daily or every 10 hrs.

*: If the ratio of traveling time to total operating time is high, replace the gear oil earlier than the specified time.

**: For water, use tap water (soft). Do not use well or river water. When the ambient temperature drops below 0°C (32°F), add coolant (antifreeze). Follow the coolant manufacturer's instructions to determine the mixture ratio.

***: The hydraulic oil replacement interval depends on the type of hydraulic oil being used. New machine are delivered with Takeuchi genuine hydraulic oil 46, and the hydraulic oil replacement intervals indicated in this manual assume that Takeuchi genuine hydraulic oil 46 is being used. When using conventional antiwear hydraulic oil, the hydraulic oil should be replaced every 2000 hours.

****: The engine oil used at the factory. If any engine oil other than Shell Rimula R6 LM 10W-40 is to be used, refer to the engine oil list DQC IV LA. (See the instruction manual for the engine.)

*****: When replacing a mineral oil with a biodegradable oil, the residual mineral oil in the machine should be about 2% or less, as complying with the ISO 15380. For details, refer to "Biodegradable oil" on page 8-13.

API standard: American Petroleum Institute
ACEA standard: Association des Constructeurs Européens d'Automobiles
SAE standard: Society of Automotive Engineers

Volume

Engine oil pan	Engine cooling system	Hydraulic oil tank
Upper limit: 10 L (10.6 US qt.) Lower limit: 9 L (9.5 US qt.)	27 L (28.5 US qt.)	System: 234 L (61.8 US gal.) Tank: 107 L (28.1 US gal.)

Fuel tank	Slew reduction gear	Travel reduction gear
Level capacity: 278 L (73.4 US gal.)	2.0 L (2.1 US qt.) 5.3 L (5.6 US qt.)*	2.1 L X 2 (2.22 US qt.) X 2

*: Applicable machine models 514601202 to 514601203
Applicable machine models 514700950 to 514700964

Note: After flushing or changing hydraulic oil, the cleanliness of hydraulic oil before the operation shall be ISO CODE 20/17/14 or better as specified in ISO.

Hydraulic system specifications

Working pressure range	P1, P2 MAIN : 34.3 MPa (4974.8 psi) P3 Pilot : 3.9 MPa (565.6 psi) See workshop manual for detail. "Service data - Specification table"
Working temperature range	-40 - 100°C
Type of fluid being used	ISO VG32 - 68 or equivalent oil. See workshop manual for detail. "Service data - Table of fuel and lubricant"
Working flow-rate range	P1, P2 MAIN : 112.0 L/min (29.6 US gal/min) P3 Pilot : 20.0 L/min (5.3 US gal/min) See workshop manual for detail. "Service data - Specification table"
Lifting provisions	Refer to "Hoisting the machine" on page 4-4.
Emergency, safety and energy isolation requirements	Refer to "Operating the machine with an accumulator" on page 2-111.
Painting or protective coating	Painted or plated (each hydraulic components)

REGULARLY REPLACE THE HYDRAULIC OIL

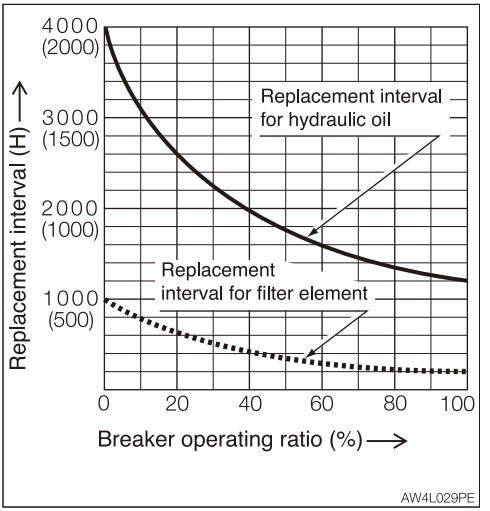
When a hydraulic breaker is used, the oil deteriorates more quickly than that used for a usual excavation operation. Be sure to replace the hydraulic oil and the return filter elements.

- Failure to replace these in time can lead to damage to the machine and the breaker hydraulic system. To prolong the service life of the hydraulic devices, properly replace the hydraulic oil and the return filter elements according to the table below.
- When replacing the hydraulic oil, clean the suction strainer.

Replacement interval (hours)

Item	Hydraulic oil	Filter element
1st time	—	25
2nd time	—	100
Periodically	1200 (600)	200

When the breaker operating ratio is 100%. Refer to “Hydraulic breaker” on page 8-6.



( ): When a conventional antiwear hydraulic oil is used.

HANDLING OF DEF/ADBLUE®

The standard for DEF/AdBlue®
The DEF/AdBlue® used must be compliant with ISO 22241.

Quantity of DEF/AdBlue® to add

DEF/AdBlue® tank
Tank capacity 20 L (5.3 US gal.)

Storing DEF/AdBlue®
- Store the DEF/AdBlue® solution in a sealed container to prevent it from vaporizing.
- Store the solution in an indoor place, away from the direct sunlight, well vented and at the temperature lower than 25°C (77°F). Do not store it in a place where the temperature falls below –5°C (23°F).
- The life of DEF/AdBlue® is dependent on the temperature of the room it is stored.
- The quality of DEF/AdBlue® is maintained even after it is frozen and thawed. It is useable without doing anything.
- When storing or carrying the DEF/AdBlue® solution, use the container in which it was contained when purchased.
  If you must use the other container made out of polyethylene or stainless steel, choose a clean one without any water or dirt adherent to it and clean it with the DEF/AdBlue® solution before use.
- Do not store the DEF/AdBlue® solution in a place where the temperature may become extremely high.
  There is a risk that ammonia gas may be released if the DEF/AdBlue® solution heats up to high temperature.
  Seal the container before storing, and open the seal in an open outdoor area.
  If there is a pungent odor, do not get near it unless necessary.
- Do not use expired DEF/AdBlue® solution (including solution left in the tank) stored for a long period. Doing so could cause ammonia slip, degraded NOx conversion efficiency or device damage. For the life of DEF/AdBlue®, refer to the table below.

Effective storage period in accordance with JIS K2247-3/ISO 22241-3

Storage temperature	Expected DEF/AdBlue® life
$\leqq$ 10°C (40°F)	36 months
10°C (40°F)<T $\leqq$ 25°C (77°F)	18 months
25°C (77°F)<T $\leqq$ 30°C (86°F)	12 months
30°C (86°F)<T $\leqq$ 35°C (95°F)	6 months

LIST OF CONSUMABLES

Periodically replace consumables such as filters and elements according to the table below.

System	Item	Part name	Part No.	When to replace
Hydraulic system	Hydraulic oil return filter	Element	15511-03400	Every 1000 hrs after the initial 50 hrs.
	Pilot line filter		15512-00601	
	Air breather filter		15520-00902	Every 1000 hrs.
Engine lubrication system	Engine oil filter	Cartridge	19039-00216	Every 500 hrs. or once a year
SCR system	Supply module filter	Cartridge	D04602317	Every 1000 hrs. or three years
Fuel system	Pre-fuel filter	Element	19039-00237	Every 1000 hrs. or once a year
	Main fuel filter		19039-00218	
Air cleaner system	Air cleaner	Primary (Outer) element	19111-14001	Every 1000 hrs. or two years
		Secondary (Inner) element	19111-14002	When the primary elements are replaced.
AC system	Receiver dryer		19115-08311	Every 2 years
	Circulation filter	Element	19115-06736	Once a year or if clogging remains after cleaning
	Ventilation filter		19115-13680	

LIST OF TOOLS (IF EQUIPPED)

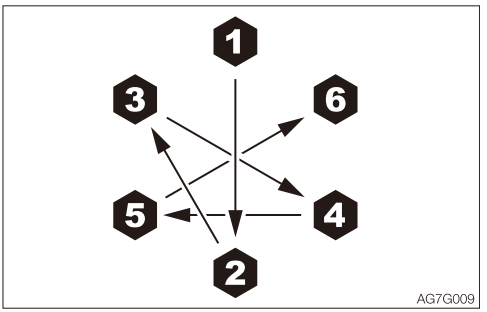
Code	Part name	Part No.	Remarks
1	Spanner	16900-01012	10-12
2	Spanner	16900-01417	14-17
3	Screwdriver	16902-20205	(+) (–) replaceable shank
4	Hammer	16903-00330	3/4
5	Adjustable wrench	16904-00250	250 mm
6	Pliers	16905-00200	200 mm
7	Spanner	16900-01013	10-13
8	Spanner	16900-01922	19-22
9	Spanner	16900-02427	24-27
10	Spanner	16900-02730	27-30
11	Spanner	16900-03236	32-36
12	Spanner	16909-00019	19
13	Spanner	16901-00041	41
14	Hex. wrench	16906-00250	2.5 mm
15	Hex. wrench	16906-00500	5 mm
16	Hex. wrench	16906-00600	6 mm
17	Hex. wrench	16906-00800	8 mm
18	Hex. wrench	16906-01000	10 mm
19	Hex. wrench	16906-01200	12 mm
20	Tool case	16914-00005	
21	Grease gun	16910-60610	500 cc
22	Drain connector	15545-12201	90-degree type
23	Drain connector	15545-12200	Straight type

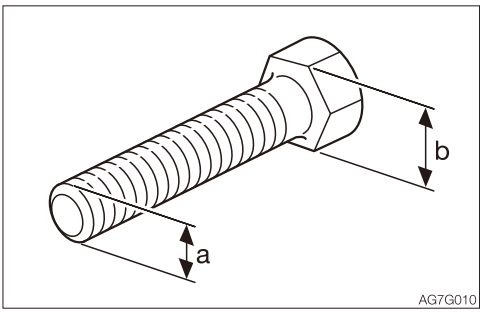
LIST OF TIGHTENING TORQUES

Nuts and Bolts (for ISO strength category 10.9)

Tighten nuts and bolts at the torques shown on the table below, unless otherwise specified.

- The tightening torques used for the mounted plastic covers are not listed in the table below. Consult your sales or service dealer for details. They will be damaged if over tightened.
- When replacing nuts and bolts, replace them with nuts and bolts of the same size and standards.
- Tighten nuts and bolts alternately (top, bottom, left then right) or in 2 or 3 times so that they are evenly tightened.





Classification	Head width (b)	Size (a) x pitch	Tightening torque	
			General connection points	
	mm	mm	N·m	ft-lb
Coarse	10	M6 x 1.0	9.8±0.8	7.2±0.6
	12, 13	M8 x 1.25	23±1.8	17±1.4
	14, 17	M10 x 1.5	47±3.8	35±2.8
	17, 19	M12 x 1.75	83±6.6	62±5
	19, 22	M14 x 2.0	134±10.7	99±7.9
	22, 24	M16 x 2.0	208±16.6	153±12.2
	27, 30	M20 x 2.5	411±32.9	303±24.2
Fine	12, 13	M8 x 1.0	25±2	18±1.4
	14, 17	M10 x 1.25	50±4	37±3
	17, 19	M12 x 1.5	87±7	64±5.1
	19, 22	M14 x 1.5	135±10.8	100±8
	22, 24	M16 x 1.5	221±17.7	163±13
	27, 30	M20 x 1.5	452±36.2	333±26.6

MEMO

SAFETY-CRITICAL PARTS

To use the machine safely, periodically perform inspection and maintenance. The safety-critical parts listed below must be periodically replaced for an increased safety.
Serious injury or a fire could result if they are worn or damaged.

List of safety-critical parts

Unit		Safety-critical parts to be replaced periodically	When to replace
Fuel system		Fuel hoses	Every 2 years
		Packing on fuel filler cap	
Engine		Engine oil filter hoses	
Cooling system		Rubber hoses	
Heater & AC systems		Heater hoses	
		Air conditioner hoses	
Hydraulic system	**Main body**	Hydraulic hoses (pump - delivery)	
		Hydraulic hoses (pump - suction)	
		Hydraulic hoses (slew motor)	
		Hydraulic hoses (travel motor)	
	Working equipment	Hydraulic hoses (boom cylinder piping)	
		Hydraulic hoses (arm cylinder piping)	
		Hydraulic hoses (bucket cylinder piping)	
		Hydraulic hoses (swing cylinder)	
		Hydraulic hoses (blade cylinder)	
		Hydraulic hoses (pilot valve)	
		Hydraulic hoses (auxiliary piping)	
		Seat belt	Every 3 years
		Non-slip sheet	
Engine		V-rib belt	Every 3000 hrs.

The material of the safety-critical part listed above tends to change over time and cause wear or deterioration. It is difficult to determine the degree of deterioration at the periodic inspection, and thus they need to be replaced with new ones after a certain time to maintain their proper performance even if they appear in good condition. Note that regardless of the replacement schedule, replacement must be performed immediately if a symptom of wear is found. If a hose clamp is deformed or cracked, replace it together with the hose immediately. When replacing the safety-critical parts, ask your sales or service dealer.
In addition to the safety-critical parts, inspect the hydraulic hoses and retighten or replace as necessary. When replacing the hydraulic hoses, replace the O-rings and seals at the same time.
Check the fuel and hydraulic hoses according to the periodic schedule described below. Refer to “Maintenance”.

Type of inspection	Inspection item
Daily inspection	Leakage from the connecting parts of hydraulic or fuel hoses Damage to cab - replace*
Monthly inspection	Leakage from the connecting parts of hydraulic or fuel hoses Damaged hydraulic or fuel hoses (cracks, wear and tear)
Annual inspection	Leakage from the connecting parts of hydraulic or fuel hoses Deteriorated, twisted, damaged hydraulic or fuel hoses (cracks, wear and tear) or hoses in contact with other parts of the machine

*: Cab parts No. 05786-00161

MAINTENANCE LIST

Inspection and maintenance item	Page
Walk-around inspection	
Inspecting by opening the engine hood and covers	5-20
Inspecting by walking around the machine	5-21
Inspecting while sitting in the operator's seat	5-21
Daily inspection (every 10 hours)	
Inspecting and replenishing the coolant	5-22
Inspecting and replenishing the engine oil	5-24
Cleaning the dust screen	5-25
Inspecting the pre-fuel filter and draining	5-26
Inspecting the fuel level	5-27
Inspecting the hydraulic oil tank level and replenishing	5-28
Inspecting and cleaning the air cleaner	5-30
Lubricating the working equipment	5-32
Checking the DEF/AdBlue® level and refilling	5-33
After the initial 50 hours (only for new machines)	
Replacing the hydraulic oil return filter	5-36
Replacing the pilot line filter	5-37
Inspecting and adjusting the compressor belt (AC)	5-38
Every 50 hours	
Inspecting and adjusting the crawler tension	5-40
Draining the water from the fuel tank	5-42
Inspecting the battery fluid level and replenishing	5-43
After the initial 250 hours (only for new machines)	
Replacing the slew motor gear oil	5-46
Replacing the travel motor gear oil*	5-47

*: If the percentage of the traveling time within the total operating time is high, replace the gear oil earlier than the specified time.
(AC): Air conditioner

Inspection and maintenance item	Page
Every 250 hours	
Inspecting the slew motor gear oil	5-48
Cleaning the cooler fins	5-49
Inspecting and adjusting the compressor belt (AC)	5-49
Cleaning the air filters (AC)	5-50
Cleaning the condenser (AC)	5-51
Inspecting the refrigerant (gas) level (AC)	5-52
Every 500 hours	
Lubricating the slew bearing	5-54
Replacing the engine oil and the oil filter	5-55
Inspecting the concentration of coolant additive	5-56
Inspecting the slew pinion gear	5-57
Every 1000 hours	
Replacing the hydraulic oil return filter	5-58
Replacing the pilot line filter	5-58
Replacing the slew motor gear oil	5-58
Replacing the travel motor gear oil*	5-58
Replacing the engine cooling system	5-59
Replacing the air cleaner element	5-61
Replacing the air breather filter	5-62
Replacing the fuel filters	5-62
Replacing the DEF/AdBlue® supply module filter	5-64
Inspecting and adjusting the V-rib belt	5-64
Inspecting the engine installation condition	5-64
Inspecting the low-temperature starting device	5-64

*: If the percentage of the traveling time within the total operating time is high, replace the gear oil earlier than the specified time.
(AC): Air conditioner

Inspection and maintenance item	Page
Every 2000 hours	
Inspecting the accumulator	5-65
Every 3000 hours	
Replacing the V-rib belt	5-67
Every 4000 hours	
Replacing the hydraulic oil and cleaning the suction strainer	5-68
When required	
Replacing the bucket teeth and the side cutters	5-71
Replacing the bucket	5-73
Adjusting the gap between the bucket and arm (If equipped)	5-76
Inspecting and replenishing the windshield washer fluid	5-77
Lubricating the levers and pedals	5-78
Inspecting the rubber crawlers	5-79
Replacing the rubber crawlers	5-80
Replacing the diesel particulate filter <Applicable machine models 514700950 or later>	5-81
Every 2 years	
Replacing the receiver dryer	5-82

*: If the percentage of the traveling time within the total operating time is high, replace the gear oil earlier than the specified time.

MEMO

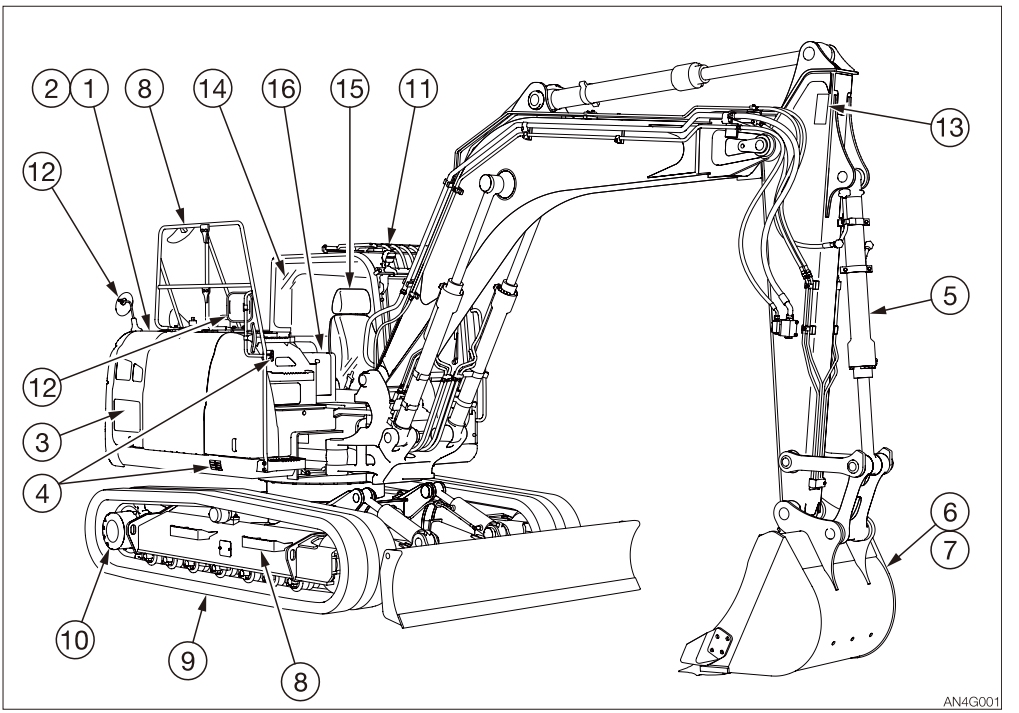
WALK-AROUND INSPECTION

Perform the following inspections every day before starting the engine for the first time.

⚠ WARNING

- **Before operating, perform the walk-around inspections and make repairs immediately where necessary.**
- **Be sure to secure the engine hood or cover before working the inside. Do not keep the hood or cover open on a windy day or if the machine is parked on a slope.**

Before starting the engine, look around the machine and clean any combustibles from the surroundings of the engine. Also, inspect if oil or water is leaking and any nuts, bolts or electric wiring are loosened or damaged.



INSPECTING BY OPENING THE ENGINE HOOD AND COVERS

1. Check for any twigs, leaves, oil or other combustible materials around the engine and battery.
2. Check for leakage of oil, fuel, DEF/AdBlue® or engine cooling water around the engine.
3. Check for oil leakage from the hydraulic oil tank, hydraulic devices, hoses or connections.

INSPECTING BY WALKING AROUND THE MACHINE

4. Check lights for dirt, damage and burnt out bulbs.
5. Check attachments and hoses for damage.
6. Check the bucket, bucket teeth and side cutter for wear, damage and looseness.
7. Check the hook, slip stopper and hook mount of buckets with hooks for damage. (Option)
8. Check the handrail, the steps and the slip-resistant surfaces for damage and loose bolts.
9. Check the crawlers, carrier rollers, track rollers, idlers and sprockets for damage, wear and loose bolts.
10. Check for oil leakage from the travel motor, carrier rollers, track rollers and idlers.
11. Check the cab and guard for damage and loose nuts and bolts.
12. Check the mirrors for dirt or damage, and adjust them.
13. Check the labels for dirt and damage.

INSPECTING WHILE SITTING IN THE OPERATOR'S SEAT

14. Check the windshield for dirt or damage.
15. Check the seat and seat belt for dirt or damage.
    Check the operator's seat for dirt, oil or other combustible materials.
16. Check the monitor, instruments and switches for dirt or damage.

DAILY INSPECTION (EVERY 10 HOURS)

Perform the following inspections every day before starting the engine for the first time.

⚠ WARNING

- **Before operating, perform the daily inspections and make repairs immediately where necessary.**
- **Be sure to secure the engine hood or cover before working the inside. Do not keep the hood or cover open on a windy day or if the machine is parked on a slope.**

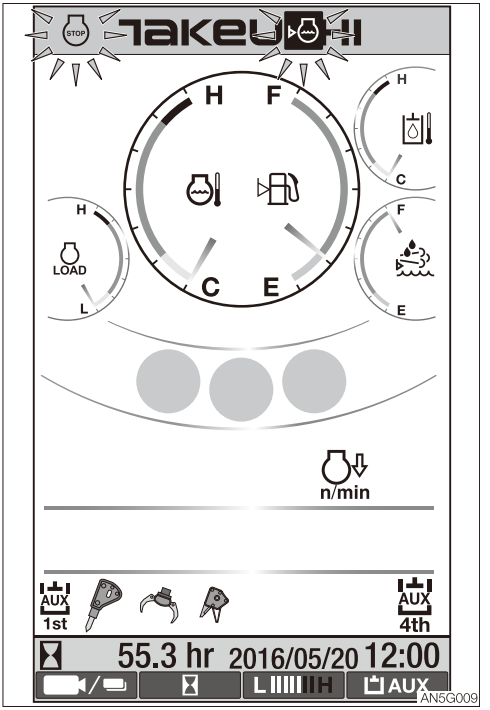
INSPECTING AND REPLENISHING THE COOLANT

Select a firm, level work area. Make sure there is adequate light and, if indoors, ventilation.

⚠ WARNING

- **Do not remove the radiator cap, the drain plug or the expansion tank cap when the cooling water is hot. Stop the engine and wait until the engine and the radiator cool before slowly loosening the radiator cap, the drain plug and the expansion tank cap to remove them.**
- **Always wear the protective goggle and gloves when handling coolant (antifreeze). If any coolant (antifreeze) comes in contact with eyes or skin, wash it off with clean water. Otherwise, it could result in injures.**
- **When performing maintenance on the machine, clean up the foot area and strictly observe the following so as not to fall:**
  - **Do not spill oil or grease.**
  - **Do not leave tools scattered around.**
  - **Watch your step when walking.**
- **Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.**

Inspection

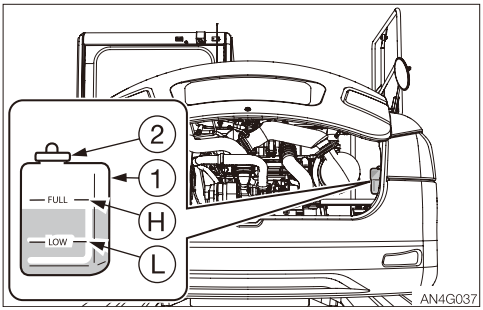


Inspect the coolant level by checking the coolant level warning lamp on the multi information display.
Refer to “4. Coolant level warning lamp” on page 2-21.
If the lamp is flashing, add the coolant.

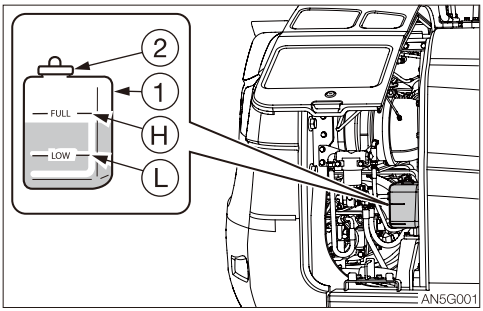
Replenishing

Note: Use only clean water (soft water) to replenish the cooling water loss due to evaporation. Use coolant (antifreeze) and clean water (soft water) of the specified mixing ratio to replenish the cooling water loss due to leaking.

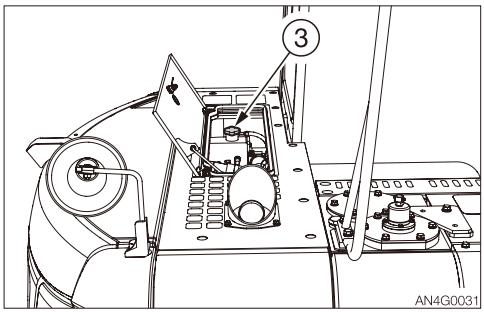
<Applicable machine models 514601202 or later>



<Applicable machine models 514700950 or later>

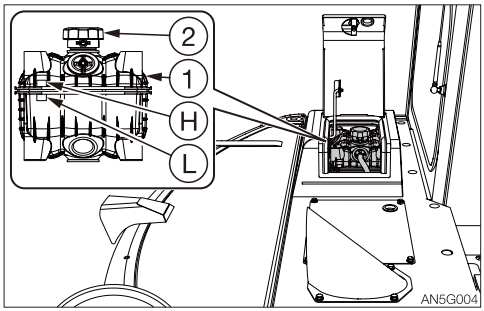


1. Remove the cap (2) of the reserve tank (1).



2. Add cooling water up to the upper limit (H) of the reserve tank (1).
   If the reserve tank (1) is found empty at the inspection, check for water leakage and then the water level in the radiator (3). Add water to the radiator (3) as required, and then to the reserve tank (1).
3. Install the cap (2).

<Low noise package>



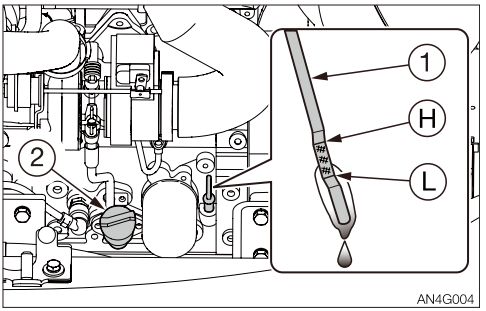
1. Remove the cap (2) of the expansion tank (1).
2. Add cooling water up to the upper limit (H) of the expansion tank (1).
3. Install the cap (2)

INSPECTING AND REPLENISHING THE ENGINE OIL

⚠ WARNING

- **Be sure to stop the engine before performing the inspection and maintenance.**
- **The parts of the machine are hot immediately after the engine is stopped. Be careful not to burn yourself.**
- **Be aware of the high-temperature engine oil. You could burn yourself with it.**

Inspection



1. Open the engine hood.
2. Take out the dipstick (1) and wipe off the oil with a rag.
3. Fully insert the dipstick (1) again, and then pull it out.
4. Check the oil left on the dipstick (1).
   The level should be between the upper limit (H) and the lower limit (L).
   If it is below the lower limit (L), replenish.

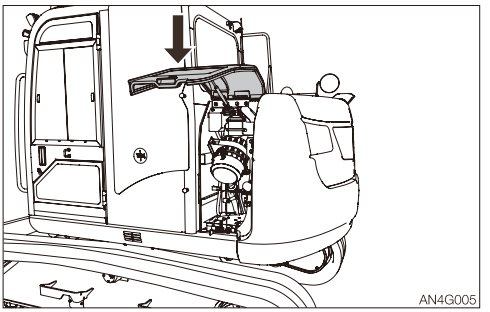
Replenishing

1. Open the engine hood.
2. Remove the oil filler cap (2).
3. Add oil up to between the upper limit (H) and the lower limit (L) of the dipstick (1).
   Problems could arise if the oil level is either too low or too high.
4. Tighten the oil filler cap (2).
5. Perform the engine warm-up procedure. (When the engine oil temperature is lower than 80°C)
6. Park the machine on a level ground and wait for five minutes. Inspect the oil level again while the engine oil is still warm.

CLEANING THE DUST SCREEN

⚠ WARNING

Stop the engine and allow each part of the machine to cool down before performing maintenance.



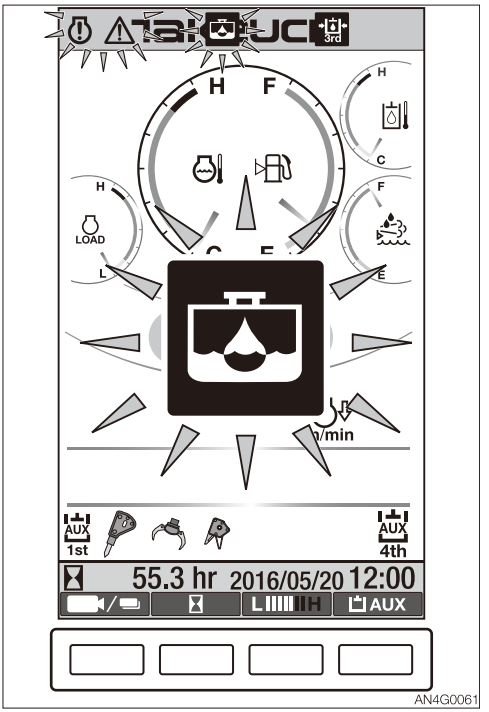
1. Open the left side cover.
2. Inspect if any dirt or bugs are on the dust screen.
3. Clean the dust screen.

INSPECTING THE PRE-FUEL FILTER AND DRAINING

⚠ WARNING

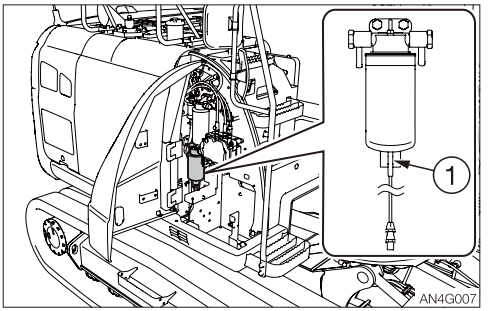
- Do not smoke or permit open flames while handling fuel or working on the fuel system.
- Stop the engine in a well-ventilated place and allow it to cool down before performing maintenance.
- Clean up spilled fuel immediately.

Inspection



1. Turn the starter switch to the ON position.
2. Inspect the water separator warning lamp.
3. If the warning lamp is flashing, drain the water.

Draining

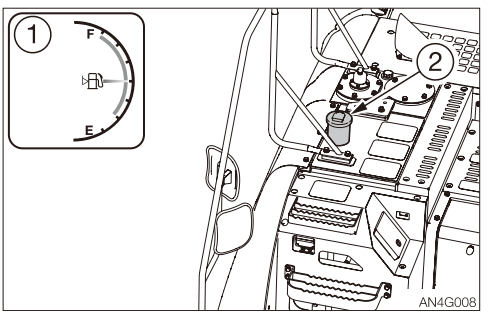


1. Turn the starter key to the OFF position to stop the engine.
2. Open the front cover (for maintenance).
3. Remove the electric wiring.
4. Place a pan for catching fuel under the drain valve (1).
5. Loosen the drain valve (1) to drain water until the pure fuel comes out.
6. Tighten the drain valve (1).
   Tightening torque: 1.6±0.3 N·m (1.2±0.2 ft-lb)
7. Install the electric wiring.

INSPECTING THE FUEL LEVEL

⚠ WARNING

- Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.
- Do not smoke or permit open flames while handling fuel or working on the fuel system.
- Never remove the fuel cap or add fuel when the engine is running or still hot. Do not spill fuel on the hot surface of the machine.
- Fill the fuel tank in a well ventilated place.
- Clean up spilled fuel immediately.
- Do not fill the fuel tank to capacity. Allow room for oil expansion.
- Securely tighten the fuel filler cap.
- Use the correct grade of fuel for the operating season.



1. Check the fuel level using the fuel gauge (1).
   F: Full
   E: Empty
2. If the level is low, add fuel from the fuel port (2) while watching the fuel gauge (1). Refer to “Fuel filler port” on page 2-6.

INSPECTING THE HYDRAULIC OIL TANK LEVEL AND REPLENISHING

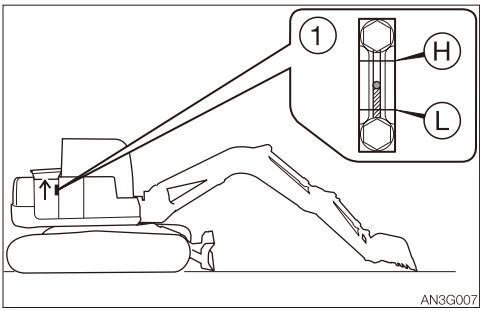
⚠ WARNING

- **Before performing maintenance on the top of the machine, clean the place you will work on and observe the following to prevent falling.**
  - **· Do not spill oil or grease.**
  - **· Do not leave tools scattered around.**
  - **· Watch your step when walking.**
- **Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.**
- **Oil may spurt out if caps or filters are removed or pipes are disconnected before releasing the pressure in the hydraulic system.**
  - **· Press the air breather button to relieve the internal pressure from the tank.**

Inspection

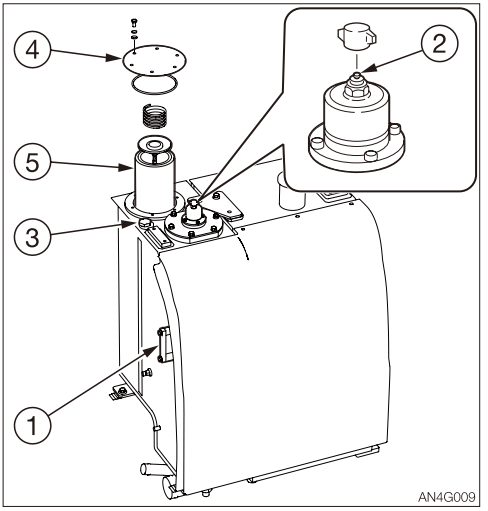
The oil level changes with the oil temperature. Inspect the oil by maintaining the machine posture as shown in the figure.

- Machine posture for inspecting the hydraulic oil level



1. Start the engine and run it at low speed.
2. Fully retract the cylinders (arm and bucket), and lower the bucket to the ground.
3. Lower the dozer blade, and then stop the engine.
4. Open the right side cover.
5. Inspect the oil level using the sight gauge (1).
   - · When the oil temperature is about 20°C (68°F):
     The level should be between the upper limit (H) and the lower limit (L).
     If it is below the lower limit (L), replenish.
   - · When the oil temperature is about 50 to 80°C (122 to 176°F):
     The level should be slightly below the upper limit (H).

Replenishing



IMPORTANT: Do not fill up to the level higher than the upper limit (H). It will damage the hydraulic circuits or result in oil spurting. If accidentally done, stop the engine and wait the hydraulic oil to cool, and then let the excessive oil to drain from the drain plug.

1. Remove the air breather cap and press the button (2) to relieve the internal pressure from the tank
2. Remove the plug (3).
3. Add the hydraulic oil up to the middle of the sight gauge (1).
4. Tighten the plug (3).

INSPECTING AND CLEANING THE AIR CLEANER

⚠ WARNING

- **Stop the engine and allow the machine to cool down before performing maintenance.**
  - **The engine, muffler, radiator and many other parts of the machine are hot immediately after the engine is stopped. Touching it will cause burns.**
- **Wear required appropriate equipment such as protective goggle and filter mask when using compressed air, as metal fragments or other objects can fly and cause serious injury.**

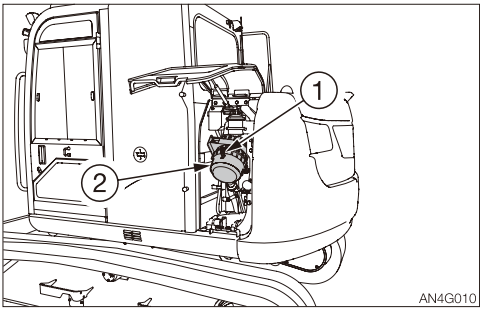
IMPORTANT: Be careful not to scratch the element. Do not use an element if it is damaged.
IMPORTANT: When operating the machine in very dusty places, perform inspection and maintenance operations every day.
IMPORTANT: Be sure to install the element and dust cap securely. If not, dust could be drawn into the cylinder, damaging the engine.

Inspection

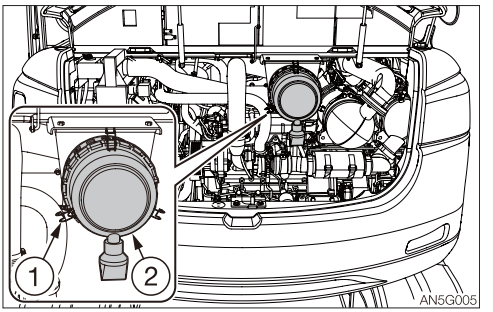
1. Turn the starter switch to the ON position.
2. Check the air cleaner warning lamp.
3. Clean the air cleaner if the warning lamp is flashing.
   If it is extremely dirty, replace the air cleaner element.
   Refer to “Replacing the air cleaner element” on page 5-61.

Cleaning the air cleaner

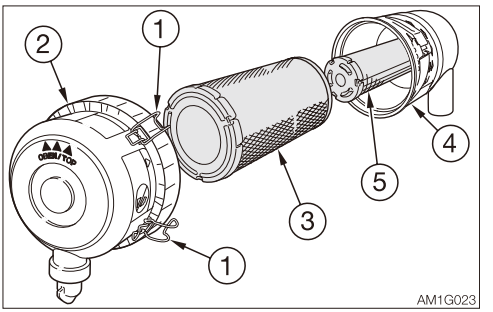
1. Open the left side cover.



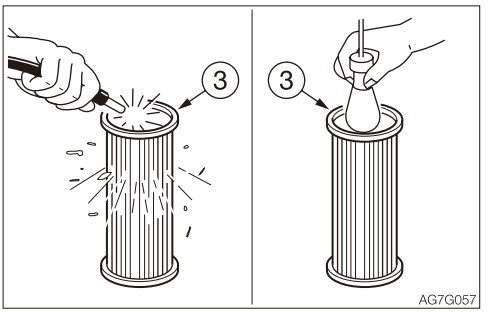
<Low noise package>



2. Loosen the clamps (1) and remove the dust cup (2).

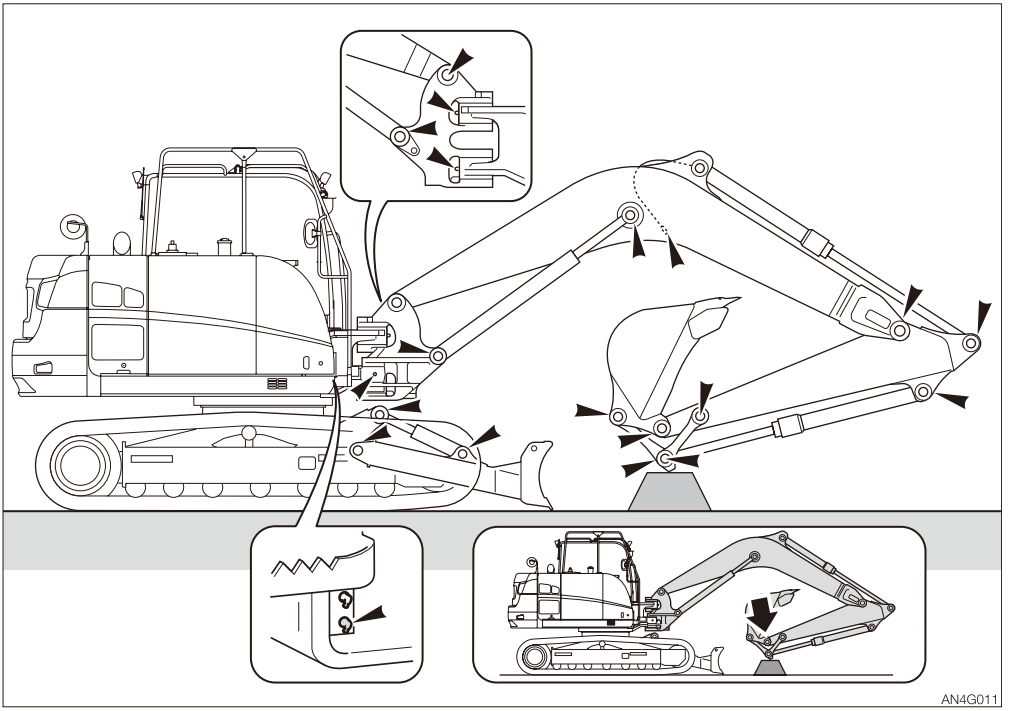


3. Clean the inside of the dust cup (2).
4. Remove the primary element (3).
   To prevent dirt from getting inside the engine, do not remove the secondary element (5).
5. Clean the inside of the body (4).



6. Clean the primary element (3) with dried compressed air (500 kPa/72.5 psi or less). First blow the air from the inside of the element along the pleats. Then blow the air from the outside and finally from the inside again.
7. Light up the inside of the primary element (3) with a light bulb, inspect it, and replace it if there are small holes or thin spots.
8. Install the primary element (3).
9. Install the dust cup (2) with its "▲▲▲ OBEN/TOP" mark facing up, and then fasten it with the clamps (1).

LUBRICATING THE WORKING EQUIPMENT



1. Keep the machine configuration for greasing as shown in the diagram above.
   To insure an easy greasing to the boom bracket vertical axis pin, let the tip of the attachment softly press the base.
2. Stop the engine.
3. Use the grease gun to lubricate the grease fittings.
4. Wipe off the excess grease.

CHECKING THE DEF/ADBLUE® LEVEL AND REFILLING

⚠ WARNING

- When removing the cap from the DEF/AdBlue® tank, take care not to inhale steam.
- Do not put anything else other than DEF/AdBlue® solution in the DEF/AdBlue® tank. Putting liquids, particularly light oil or gasoline, in the tank could cause a fire or damage the SCR system. If this is accidentally done, contact a Takeuchi service dealer.

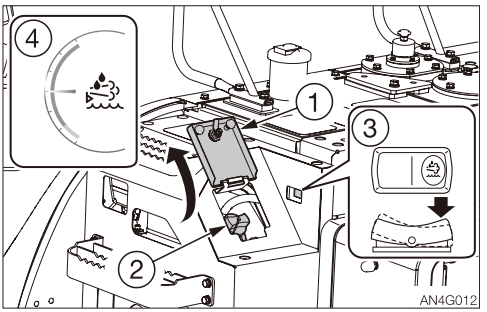
⚠ CAUTION

- DEF/AdBlue® is a colorless, transparent, odorless and non-hazardous aqueous solution (32.5% urea, 67.5% water, freezes at –11°C), and is harmless to the human body. In very rare cases, however, inflammation could occur in some people, and thus proper actions should be taken as follows.
- If skin contact occurs, flush with water. If there are changes in the skin condition or if there is pain, immediately seek medical attention.
- If accidentally swallowed, drink one or two glasses of water or milk and immediately seek medical attention.
- If eye contact occurs, immediately flush with a large amount of clean water and seek medical attention.

IMPORTANT:

- Do not use expired DEF/AdBlue® solution (including solution left in the tank) stored for a long period. Doing so could cause ammonia slip, degraded NOx conversion efficiency or device damage.
- When handling DEF/AdBlue®, do not use anything such as cotton work-gloves whose fibers could get into the solution. Doing so could cause clogging of the DEF/AdBlue® filter or urea deposit at the DM injection port.
- When refilling, be sure to use DEF/AdBlue® conforming to ISO 22241. Do not dilute it or mix it with other chemicals.
- When removing the cap from the DEF/AdBlue® tank, take care not to allow any soil or dirt to enter the tank. Otherwise, the SCR system could fail.
- Do not overfill the tank with DEF/AdBlue® or top off the tank while the engine is running. Doing so could cause the solution to leak from the breather and to freeze. The frozen solution could damage the sensor.
- Do not stand on top of the DEF/AdBlue® tank or piping, and do not put things on them. Doing so could damage them.
- Wipe off any spill of DEF/AdBlue® and rinse it off with water.
- A dry white powder of DEF/AdBlue® may be deposited around the refill port. Wipe it off so that the powder does not enter the tank.
- If DEF/AdBlue® is added while the engine is running or the starter switch is ON, it takes a long time for the level of the DEF/AdBlue® solution to reach the correct level.

Checking the level



Use the DEF/AdBlue® level indicator (4) to check the amount of the DEF/AdBlue® solution remaining.

F: Tank is full.
E: Tank is empty.

Refilling

1. Turn the starter key to the OFF position to stop the engine.
2. Insert the starter key and turn it counterclockwise to unlock the cover (1).
3. Turn the DEF/AdBlue® tank cap (2) counterclockwise and remove it.
4. Press the DEF/AdBlue® symbol side of the refill switch (3) to refill while the buzzer is sounding.
   (The corresponding switch lamp lights up or flashes in conjunction with the buzzer.)
   Buzzer keeps sounding: 100%
   Buzzer sounds at intervals of 0.6 seconds: 80 to 100%
   Buzzer sounds at intervals of 2 seconds: Under 80%
   Buzzer sounds at intervals of 0.3 seconds: Failure
   Upon completion of refilling, press the refill switch (3) again to stop the buzzer sounding. (The buzzer automatically stops sounding after 20 minutes.)
5. Install the DEF/AdBlue® tank cap (2) on the filler port, and then turn the cap clockwise to close.
6. Close the cover (1) and lock it.

Notes:
- If any solution other than DEF/AdBlue® is used, the warning lamp lights up and the buzzer sounds. Refer to “8. DEF/AdBlue® quality indicator lamp” on page 2-23.
- The engine speed is limited if the DEF/AdBlue® solution is insufficient. Running the engine with insufficient DEF/AdBlue® causes the engine to idle.
- If the tank is faulty, please contact a Takeuchi service dealer for advice.

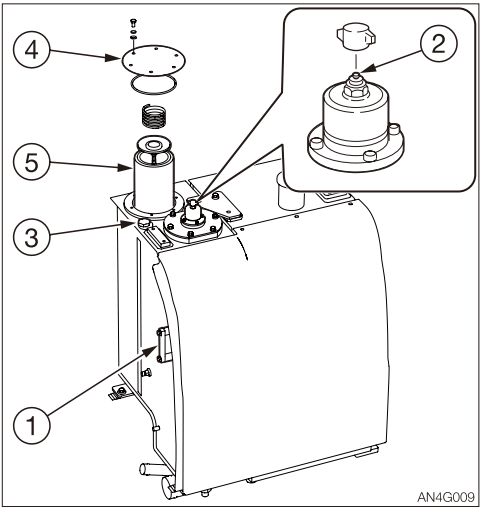
When DEF/AdBlue® is low or the tank is empty:
Corresponding to the DEF/AdBlue® level in the tank, the warning lamp lights up or flashes. Also, the engine output and RPM are limited.
To refill the tank under these conditions, refer to “Restarting when the DEF/AdBlue® level is low or the tank is empty” on page 6-12.

AFTER THE INITIAL 50 HOURS (ONLY FOR NEW MACHINES)

REPLACING THE HYDRAULIC OIL RETURN FILTER

⚠ WARNING

- Stop the engine and allow each part of the machine to cool down before performing maintenance.
  - The engine, the hydraulic system and many other parts of the machine are hot immediately after the engine is stopped. Touching these parts will cause burns.
  - The hydraulic oil is also hot and under high pressure.
    Be careful not to touch the hydraulic oil when loosening the cap or plug. Working on the machine under these conditions could result in burns or injuries due to the hot oil spurting out.
- Before performing maintenance on the top of the machine, clean the place you will work on and observe the following to prevent falling.
  - Do not spill oil or grease.
  - Do not leave tools scattered around.
  - Watch your step when walking.
- Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.
- Oil may spurt out if caps or filters are removed or pipes are disconnected before releasing the pressure in the hydraulic system.
  - Press the air breather button to relieve the internal pressure from the tank.
  - When removing plugs or screws, or when disconnecting hoses, stand to the side and loosen them slowly to gradually release the internal pressure before removing.

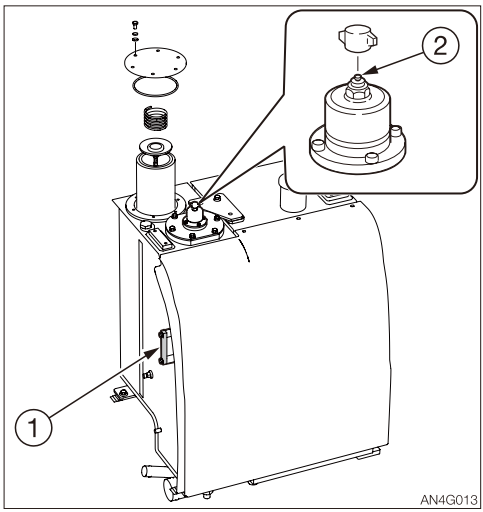


1. Press the air breather button (2) to relieve the internal pressure from the tank.
2. Loosen the bolts and remove the flange (4).
3. Remove the return filter (5).
4. Install a new return filter.
5. Install the flange (4) on its original position.
6. Inspect the level with the sight gauge (1), and replenish if the level is too low.
   Refer to “Inspecting the hydraulic oil tank level and replenishing” on page 5-28.

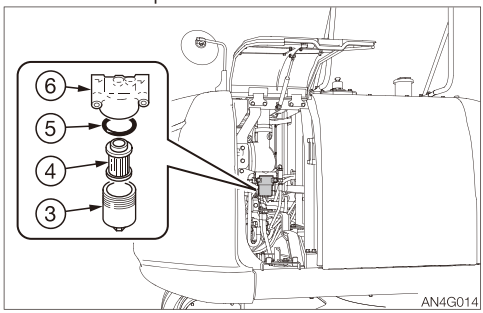
REPLACING THE PILOT LINE FILTER

⚠ WARNING

- Stop the engine and allow each part of the machine to cool down before performing maintenance.
  - The engine, the hydraulic system and many other parts of the machine are hot immediately after the engine is stopped. Touching these parts will cause burns.
  - The hydraulic oil is also hot and under high pressure immediately after the engine is stopped.
    Be careful not to touch the oil when loosening the cap or plug. Working on the machine under these conditions could result in burns or injuries due to the hot oil spurting out.
- Oil may spurt out if caps or filters are removed or pipes are disconnected before releasing the pressure in the hydraulic system.
  - Press the air breather button to relieve the internal pressure from the tank.
  - When removing plugs or screws, or when disconnecting hoses, stand to the side and loosen them slowly to gradually release the internal pressure before removing.



1. Press the air breather button (2) to relieve the internal pressure from the tank.



2. Open the right side cover.
3. Turn the case (3) counterclockwise and remove it.
4. Remove the element (4) and O-ring (5).
5. Clean the inside of the case (3).
6. Apply a thin layer of oil on the O-ring of the new filter.
7. Install the new element on the filter stand (6).
8. Apply a thin layer of oil on the new O-ring (5).
9. Install the new O-ring (5) and the case (3) on the filter stand (6).
   Tightening torque: 78.5±4.9 N·m (57.9±3.6 ft-lb)
10. Inspect the level with the sight gauge (1) and replenish if the level is too low.
    Refer to “Inspecting the hydraulic oil tank level and replenishing” on page 5-28.

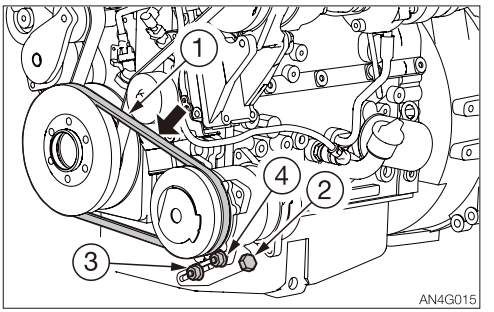
INSPECTING AND ADJUSTING THE COMPRESSOR BELT (AC)

⚠ WARNING

- **Stop the engine and allow the machine to cool down before performing maintenance.**
  - **The engine, muffler, radiator, hydraulic lines, sliding parts and many other parts of the machine are hot immediately after the engine is stopped. Touching these parts will cause burns.**
- **The high-pressure pipes of the air conditioner can be very hot (80 to 120°C or 176 to 248°F). Be careful not to burn yourself.**

IMPORTANT: Do not let any oil or grease get on the belt. It will cause the belt to slip, decrease the cooling capacity or shorten the service life of the air conditioner.

If the belt is too slack, it will slip and vibrate, resulting in decreased cooling capacity. The service life of the air conditioner also will be shortened. Adjust the belt tension to the standard value (approximately 8 mm or 0.31 in).



Inspection

1. Open the engine hood.
2. The belt tension is normal if the belt tension gauge indicates the following value.
   400±50 N (90±11 lbf)

Adjustment

If the belt tension is not normal, adjust it with the adjuster bolt (2).

1. Loosen the locking nuts (3) and (4).
2. Turn the adjuster bolt (2) as follows.
   - Tighten: Clockwise
   - Loosen: Counterclockwise
3. Tighten the locking nuts (3) and (4) after adjustment.

Note: When replacing with a new belt, run the engine at low idle speed for about 15 minutes to break in the new belt, and then adjust the tension again.
The belt tension must be adjusted as follows:
650±50 N (146±11 lbf)

Replacing

Replace the belt in the following cases:

- There are cuts or cracks.
- The belt is worn and touches the bottom of the V groove in the pulley.
- The belt stretched too loose to be adjusted.

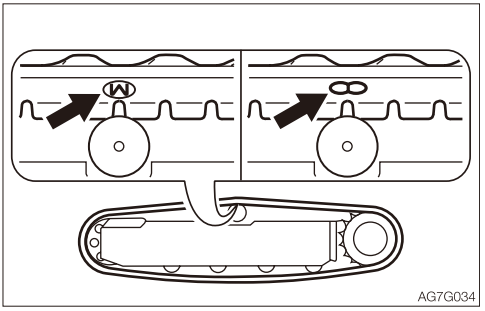
EVERY 50 HOURS

INSPECTING AND ADJUSTING THE CRAWLER TENSION

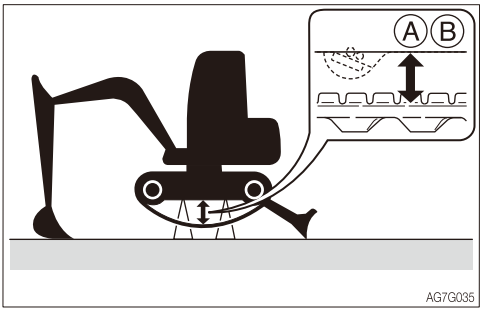
⚠ WARNING

- **If you must work beneath the raised machine or working equipment, always use wood blocks, jack-stands or other rigid and stable supports. Never get under the machine or working equipment if they are not sufficiently supported. This procedure is especially important when working on hydraulic cylinders.**
- **Be careful with the high-pressure grease In the track adjuster, the grease has been injected under high pressure. If the tension is adjusted without following the prescribed procedure, the grease discharge valve may fly off, resulting in injury.**
  - **Never loosen the grease fitting.**
  - **Loosen the grease discharge valve slowly. Do not turn it more than 1 turns.**
  - **Do not put your face, arms, legs or body in front of the grease discharge valve.**
  - **If grease does not come out when the grease discharge valve is loosened, the valve is faulty. Ask a Takeuchi service agent for repair.**

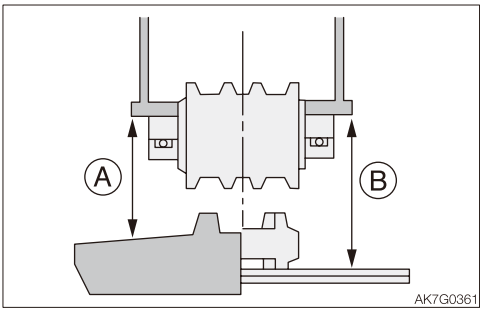
Inspection



1. For rubber crawlers, move the machine so that the “M” or “∞” mark at the joint is at the top center of the crawler frame.



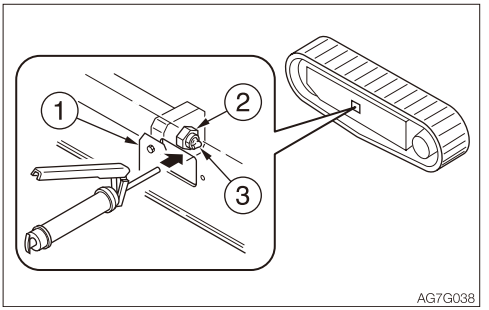
2. Use the working equipment to lift the machine body. Operate the levers slowly.



3. Inspect the gap (A or B) between the bottom surface of the frame at the center of the crawler frame and the top surface of the crawler.
   The gap (A or B) must be within the following range:

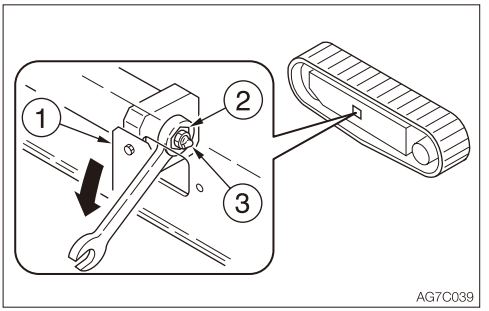
   (A) Rubber crawler
   155 to 165 mm (6.1 to 6.5 in.)
   (B) Steel crawler
   250 to 280 mm (9.8 to 11 in.)
   (B) Segmental rubber crawler
   235 to 265 mm (9.3 to 10.5 in.)

Adjustment
Increasing the tension



1. Remove the cover (1).
2. Using the grease gun, insert grease through the grease fitting (3) in the grease discharge valve (2).
3. Inspect the crawler tension.

Decreasing the tension



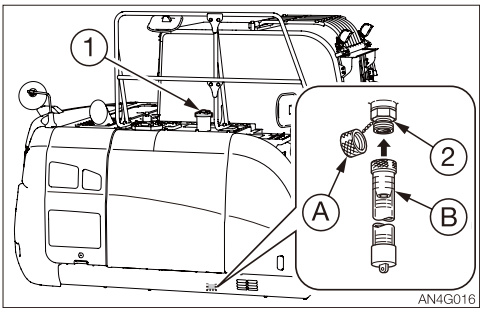
1. Remove the cover (1).
2. Using the spanner, slowly loosen the grease discharge valve (2) (one turn) and drain the grease.
   If the grease does not drain easily, move the machine forward or backward.
3. Tighten the grease discharge valve (2).
   · Tightening torque: 59 to 88 N·m (43.4 to 65.1 ft-lb.)

DRAINING THE WATER FROM THE FUEL TANK

⚠ WARNING

- **Before performing maintenance on the top of the machine, clean the place you will work on and observe the following to prevent falling.**
  - **Do not spill oil or grease.**
  - **Do not leave tools scattered around.**
  - **Watch your step when walking.**
- **Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.**
- **Do not smoke or permit open flames while handling fuel or working on the fuel system.**
- **Never remove the fuel cap or add fuel when the engine is running or still hot. Do not spill fuel on the hot surface of the machine.**
- **Fill the fuel tank in a well ventilated place.**
- **Do not fill the fuel tank to capacity. Allow room for oil expansion.**
- **Clean up spilled fuel immediately.**
- **Securely tighten the fuel filler cap.**
- **Use the correct grade of fuel for the operating season.**

Do the draining operation before starting the machine.



1. Remove the fuel filler cap (1).
2. Place a pan under the drain valve (2).
3. Remove the cap (A), install the connector (B) and then drain water and sludge from the bottom of the tank. (The water comes out once the screw is tightened.)
4. Remove the connector (B) and install the cap (A).
5. Add fuel.
6. Tighten the fuel filler cap (1) and lock it.
7. Bleed air.

Bleeding air from the fuel system
Refer to “Bleeding air from the fuel system” on page 6-11.

Note: Air in the fuel system causes the engine to fail to start or to have problems. Bleed air when the fuel tank is emptied, using the same procedure above.

INSPECTING THE BATTERY FLUID LEVEL AND REPLENISHING

⚠ DANGER

- Do not use the battery when the fluid level is below the lower level limit. Doing so will hasten the deterioration of the internal portions of the battery and shorten the battery life. It also can cause rupturing (explosion).
- Batteries generate flammable hydrogen gas which may explode. Keep away from flame, sparks, fire or lighted cigarettes.
- Use a dampened cloth to clean above the fluid level line and check the fluid level. Do not clean with a dry cloth; otherwise it can cause static electricity to build up, resulting in ignition or explosion.
- Do not use the cable if it's connecting terminal is loose or corroded. If used, ignition or explosion may occur.

⚠ WARNING

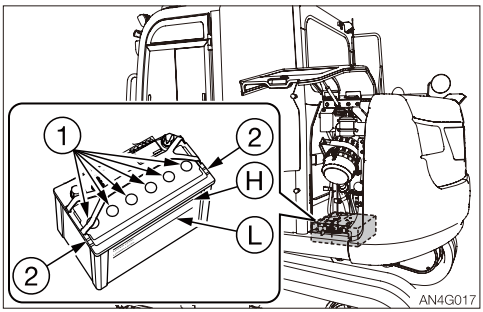
- Wear protective goggle and clothing when working with batteries.
- Do not add the distilled water above the upper level limit. Doing so could cause the fluid to leak. This fluid can cause skin damage if contacted, or can cause the machine components to corrode.
- Batteries contain sulfuric acid which will damage eyes or skin if contacted.
  - If eye contact occurs, flush immediately with clean water and get prompt medical attention.
  - If accidentally swallowed, drink large quantities of water or milk and call a physician immediately.
  - If acid contacts skin or clothing, wash off immediately with a lot of water.

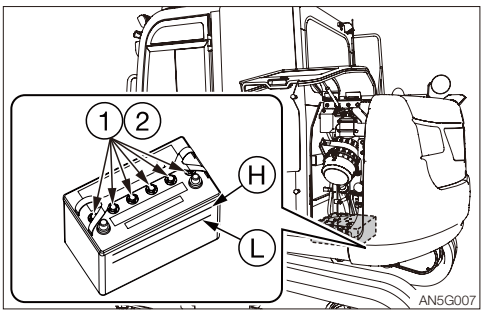
Inspection

Turn the starter switch to ON and check the battery voltage on the display. The battery is normal if the voltage is 24 V or more.
Refer to "(4) Data display" on page 2-35.

IMPORTANT: Check the fluid level of all cells following the steps below, even when the fluid level can be checked using the indicator.
IMPORTANT: The SCR system operates for up to two minutes after the starter switch is turned to the OFF position. When removing the batteries or electrical connectors for inspection or maintenance, wait for at least two minutes after the starter switch is turned to the OFF position. Otherwise, the system could fail.

Note: Under normal operating conditions, the maintenance-free battery does not require addition of water because of the special plate designed to minimize fluid loss. However, for those machines that are heavily used or operated under severe conditions (for example, in high ambient temperature), the fluid level often becomes low. If that is the case, check the fluid level of the maintenance-free battery and add water as needed.





1. Open the left side cover.
2. Inspect the fluid level.
   The fluid level must be between the upper level line (H) and lower level line (L). If not, add distilled water up to the line (H).
3. Check the battery terminal for looseness, dirt and corrosion.
4. Check the exhaust holes (2) for dirt.
5. Check the battery voltage. Confirm it is 24 V or more.
   Refer to “(4) Data display” on page 2-35.

Replenishing

1. Loosen the sealing plugs (1) and add distilled water up to the highest level line (H).
2. Securely tighten the sealing plugs (1).

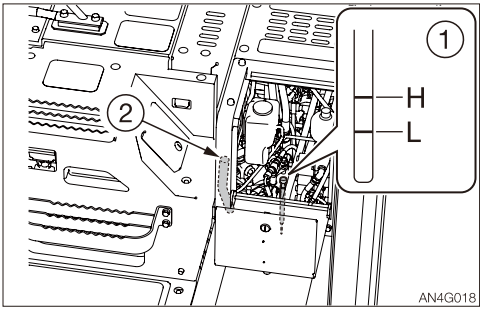
MEMO

AFTER THE INITIAL 250 HOURS (ONLY FOR NEW MACHINES)

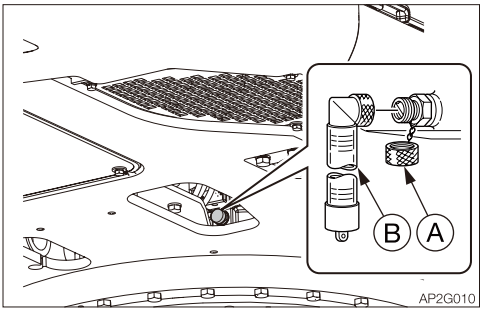
REPLACING THE SLEW MOTOR GEAR OIL

⚠ WARNING

- Stop the engine and allow each part of the machine to cool down before performing maintenance.
  - The slew motor is hot immediately after the engine is stopped. Touching it will cause burns.
  - The gear oil is also hot and under high pressure immediately after the engine is stopped.
    Be careful not to touch the oil when loosening the plug. Working on the machine under these conditions could result in burns or injuries.
- When performing maintenance on the machine, clean up the foot area and strictly observe the following so as not to fall:
  - Do not spill oil or grease.
  - Do not leave tools scattered around.
  - Watch your step when walking.
- Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.
- The pressure in the reduction gear case of slew motor may cause oil or the cap to fly out. Loosen the cap slowly to release the pressure.

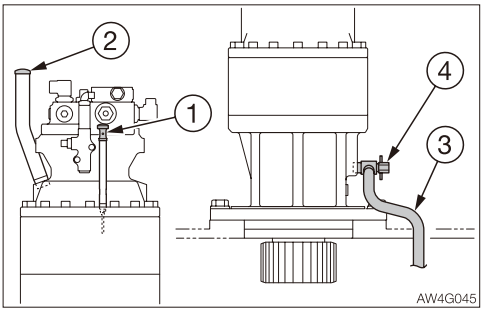


<Applicable machine models 514601204 or later>
<Applicable machine models 514700965 or later>



1. Remove the cap (2).
2. Place a pan under the plug to catch the waste oil.
3. Remove the cap (A), install connector (B) and drain the oil. (The oil comes out when the screw is tightened.)
4. Remove the connector (B) and install the cap (A).
5. Add oil up to the upper limit (H) of the level gauge (1).
   Problems could arise if the oil level is either too low to too high.
6. Tighten the cap (2).

<Applicable machine models 514601202 to 514601203>
<Applicable machine models 514700950 to 514700964>



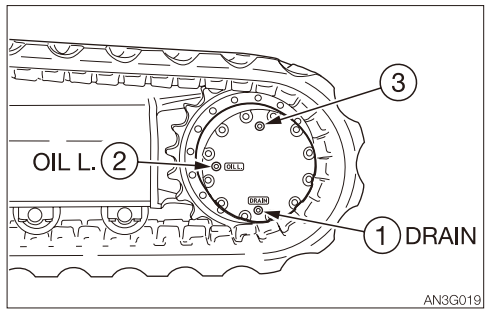
1. Remove the cap (2).
2. Place a pan under the hose (3) to catch the waste oil.
3. Loosen the drain valve (4) and drain the oil.
4. Tighten the drain valve (4).
5. Add oil up to the upper limit (H) of the level gauge (1).
   Problems could arise if the oil level is either too low to too high.
6. Tighten the cap (2).

REPLACING THE TRAVEL MOTOR GEAR OIL

⚠ WARNING

- **Stop the engine and allow the machine to cool down before performing maintenance.**
  - **The travel motor is hot immediately after the engine is stopped. Touching it will cause burns.**
  - **The gear oil is also hot and under high pressure immediately after the engine is stopped.**
    Be careful when loosening the plugs. Working on the machine under these conditions could result in burns or injuries.
- **The pressure in the reduction gear case of travel motor may cause oil or the plug to fly out. Loosen the plug slowly to release the pressure.**

IMPORTANT: If the percentage of the traveling time within the total operating time is high, replace the gear oil earlier than the specified time.



1. Set the travel motor so that plug (1) is at the very bottom.
2. Place a pan under the plug (1).
3. Remove the plugs (1), (2) and (3) and drain the oil.
4. Rewrap the plugs with new sealing tape.
5. Tighten the plug (1).
   · Tightening torque: 98 N·m (72.3 ft-lb.)
6. Add oil through the hole of the plug (3) until oil flows out of the hole of the plug (2).
7. Tighten the plugs (2) and (3).
   · Tightening torque: 98 N·m (72.3 ft-lb.)

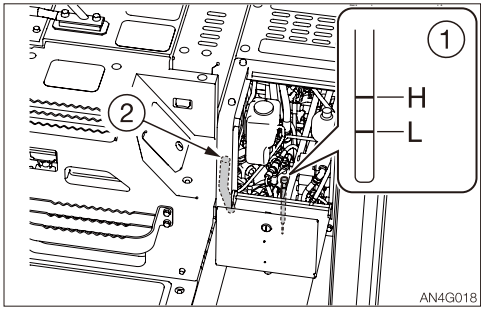
EVERY 250 HOURS

INSPECTING THE SLEW MOTOR GEAR OIL

⚠ WARNING

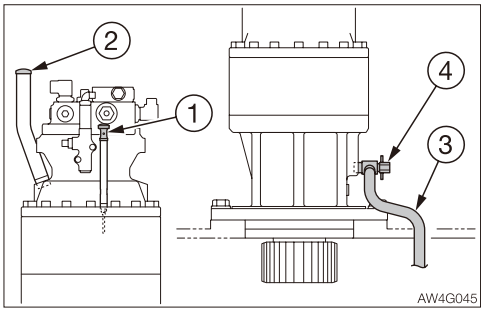
- Stop the engine and allow each part of the machine to cool down before performing maintenance.
  - The slew motor is hot immediately after the engine is stopped. Touching it will cause burns.
  - The gear oil is also hot and under high pressure immediately after the engine is stopped.
    Be careful not to touch the oil when loosening the plugs. Working on the machine under these conditions could result in burns or injuries.
- When performing maintenance on the machine, clean up the foot area and strictly observe the following so as not to fall:
  - Do not spill oil or grease.
  - Do not leave tools scattered around.
  - Watch your step when walking.
- Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.
- The pressure in the reduction gear case of slew motor may cause oil or the plug to fly out. Loosen the plug slowly to release the pressure.

Inspection



1. Take out the level gauge (1) and wipe off the oil with a rag.
2. Fully insert the level gauge (1) again, and then pull it out.
3. Check the oil left on the level gauge (1).
   The level should be between the upper limit (H) and the lower limit (L).
   If it is below the lower limit (L), replenish.

Replenishing



1. Remove the oil filler cap (2).
2. Add oil up to between the upper limit (H) and the lower limit (L) of the level gauge (1).
   Problems could arise if the oil level is either too low or too high.
3. Tighten the oil filler cap (2).

CLEANING THE COOLER FINS

⚠ WARNING

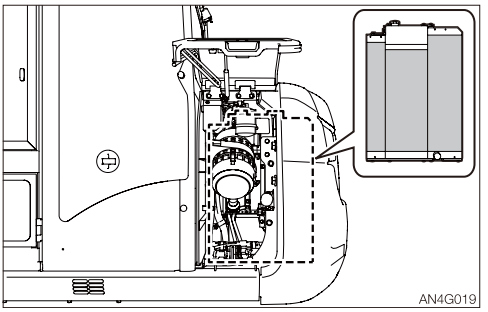
Wear required appropriate equipment such as protective goggle and filter mask when using compressed air, as metal fragments or other objects can fly and cause serious injury.

IMPORTANT: Be careful not to damage the fins when cleaning.

- **When using compressed air or pressurized water, make sure the pressure is no higher than 200 kPa (28 psi) and hold the nozzle sufficiently away from the fins.**

IMPORTANT: When using water, cover the electrical system to prevent water from getting in.

IMPORTANT: When operating the machine in very dusty places, perform inspection and maintenance operations every day.



1. Open the left side cover and the engine hood.
2. Blow compressed air on the fins to remove mud and dirt stuck on them.

INSPECTING AND ADJUSTING THE COMPRESSOR BELT (AC)

Refer to “Inspecting and adjusting the compressor belt (AC)” on page 5-38.

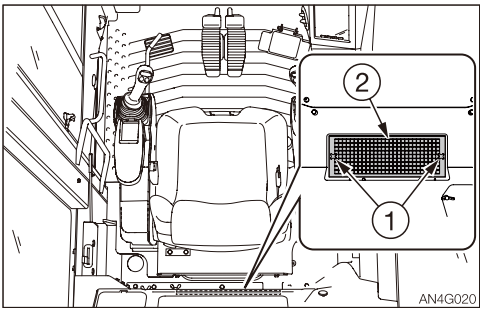
CLEANING THE AIR FILTERS (AC)

⚠ WARNING

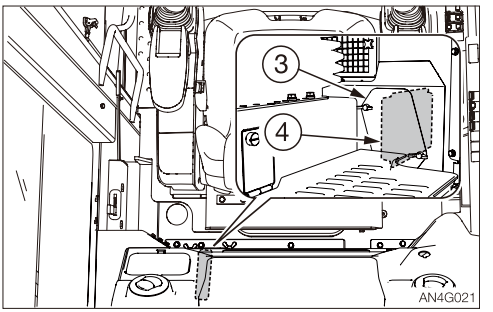
Wear required appropriate equipment such as protective goggle and filter mask when using compressed air, as metal fragments or other objects can fly and cause serious injury.

Clean the filters immediately after operating in dusty places.
If the filters are clogged, the air flow is reduced and a booming sound is heard from the air conditioner unit.

Removing the filters



1. Move the seat all the way forward, and then fold down the backrest toward the front.
2. Loosen the knobs (1) and remove the circulation filter (2).
   Circulation filter (2): Part No. 19115-06736



3. Loosen the knobs and remove the cover (3).
4. Remove the ventilation filter (4).
   Ventilation filter (4): Part No. 19115-13680
5. Use compressed air or water to clean the filters, depending on how dirty they are.

Cleaning

1. Blow dry, compressed air (138 kPa or 20 psi or less) directly on the filters from the inside, moving up and down along the pleats.
   Be sure to keep the nozzle at an adequate distance from the filters.
2. Wash the filter with neutral detergent if it is very dirty. Dry the filter completely after washing it.

Replacing

Replace the filter with a new one once a year or if it is still clogged after blow-drying with compressed air and washing.

CLEANING THE CONDENSER (AC)

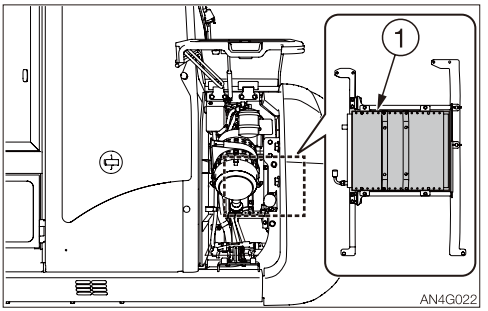
⚠ WARNING

Wear required appropriate equipment such as protective goggle and filter mask when using compressed air, as metal fragments or other objects can fly and cause serious injury.

IMPORTANT: Be careful not to damage the fins when cleaning.

- **When using compressed air or pressurized water, make sure the pressure is no higher than 200kPa (28 psi) and hold the nozzle sufficiently away from the fins.**

If the condenser is dirty, heat will not discharge properly. Wash dirt off the condenser with water.



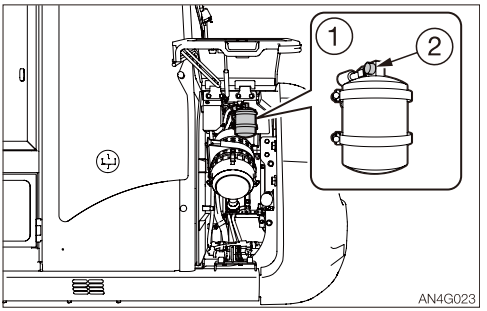
1. Open the left side cover.
2. Clean the condenser (1).

INSPECTING THE REFRIGERANT (GAS) LEVEL (AC)

⚠ WARNING

- **Exposure of the eyes or hands to the cooler's refrigerant could result in blindness or frostbite. Never touch the refrigerant or loosen the parts of the cooling circuit.**
- **Keep flames away if the refrigerant gas is leaking.**
- **The high-pressure pipes of the air conditioner can be very hot (80 to 120°C or 176 to 248°F). Be careful not to burn yourself.**

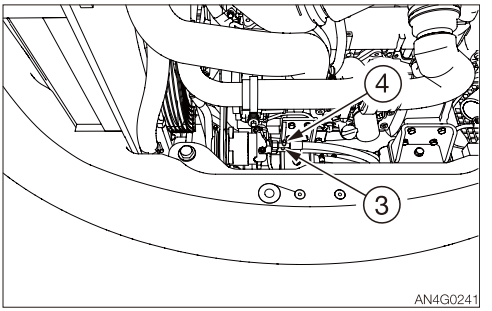
The cooling capacity decreases if the amount of refrigerant is insufficient. Inspect the refrigerant level using the sight glass (2) on the top of the receiver dryer (1).



1. Open the left side cover.
2. Inspect the places for the conditions below.

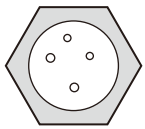
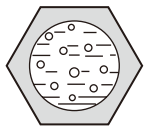
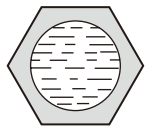
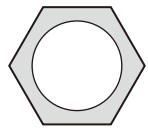
Places for inspection	Conditions
Cab door	Fully open
Temperature control	Minimum temperature
Fan speed	High
Ventilation / Circulation select switch	Circulation
Engine speed	Maximum speed
Air conditioner switch	ON

3. Inspect the refrigerant by watching the flow of air bubbles through the sight glass (2).
   Refer to "Check list for refrigerant volume" on page 5-53.
4. Open the engine hood.



5. Check the temperature of the compressor's high pressure pipe (3) and low pressure pipe (4).
   Refer to "Check list for refrigerant volume" on page 5-53.

Check list for refrigerant volume

Air conditioner	Normal	Abnormal		
High/low pressure pipe temperature	High pressure pipe is hot (80 to 120°C or 176 to 248°F), low pressure pipe is cold (8 to 15°C or 46 to 59°F). Clear difference in temperature between the pipes.	High pressure pipe is warm, low pressure pipe is slightly cool. No significant difference in temperature between the pipes.	Little difference in temperature between the high-pressure pipe and the low-pressure pipe.	High pressure pipe is hot, low pressure pipe is slightly cool. A significant difference in temperature between the pipes.
Pipe connection	Normal	Some places are dirty with oil.	Some places are extremely dirty with oil.	Normal
Sight glass	 AG7G064 Almost transparent with some bubbles. Fully transparent when the engine speed is increased or decreased.	 AG7G065 Flow of bubbles can be seen constantly. Sometimes transparent or white with bubbles.	 AG7G066 Mist-like flow is faintly visible.	 AG7G067 No bubbles is visible, even when the fan is set to High and the engine is idling.
Refrigerant level	Proper level	Refrigerant may be leaking.	Refrigerant has leaked; little is left.	Refrigerant level too high

If the air conditioner is not working
If the air conditioner does not work well, set the fan switch to OFF and contact your sales or service dealer for inspection and/or repairs.

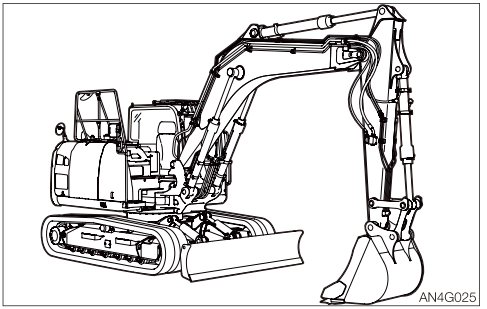
IMPORTANT: Continued use of the air conditioner when it is not working properly will damage its various parts.
IMPORTANT: Using the air conditioner when there is no refrigerant will damage the compressor.
IMPORTANT: Always consult your sales or service dealer for replacing the refrigerant. Be sure to use R134a refrigerant (1800 g or 4 lb.).

EVERY 500 HOURS

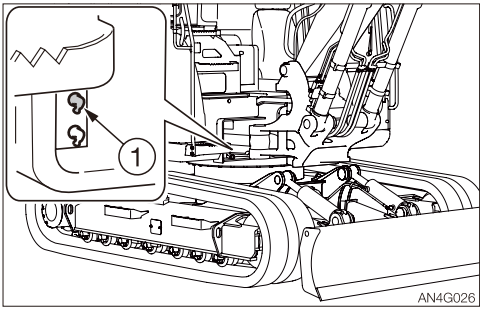
LUBRICATING THE SLEW BEARING

⚠ WARNING

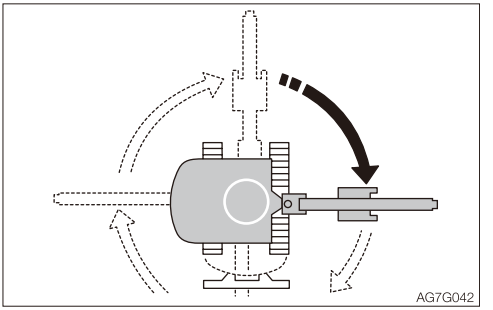
Do not slew while lubricating. Doing so is dangerous, as you may get caught in the machine.



1. Stop the engine with the machine in the posture shown on the figure above.



2. Use the grease gun to grease the grease fitting (1).

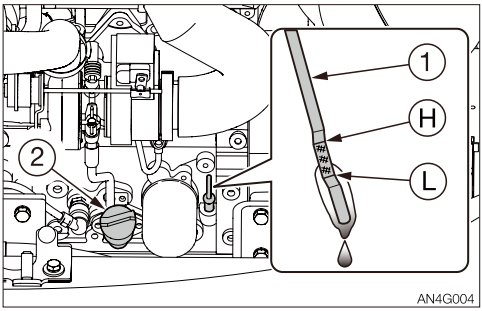


3. Start the engine, lift the bucket and slew clockwise 90°.
4. Lower the bucket to the ground, and then stop the engine.
5. Repeat the steps 2 to 4 above three times.
6. Wipe off the grease expelled from the slew bearing and grease fitting.

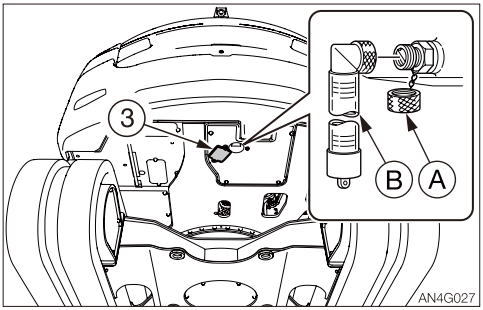
REPLACING THE ENGINE OIL AND THE OIL FILTER

⚠ WARNING

- **Be sure to stop the engine before performing the inspection and maintenance.**
- **The parts of the machine are hot immediately after the engine is stopped. Be careful not to burn yourself.**
- **Be aware of the high-temperature engine oil. You could burn yourself with it.**



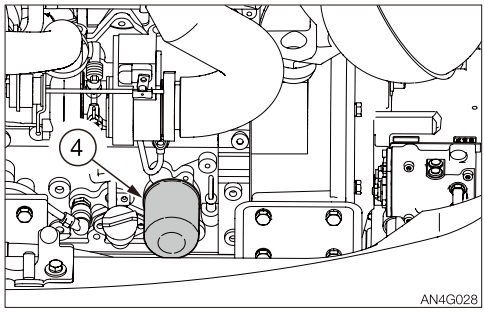
1. Open the engine hood and remove the oil filler cap (2).



2. Loosen the bolts and remove the under cover (3).
3. Place a pan under the plug to catch the waste oil.
4. Remove the cap (A), install connector (B) and drain the oil. (The oil comes out when the screw is tightened.)
5. Remove the connector (B) and install the cap (A).

IMPORTANT: Check the waste oil for metal powder. If it contains large amount of metal powder, consult your sales or service dealer.

6. Install the under cover (3).



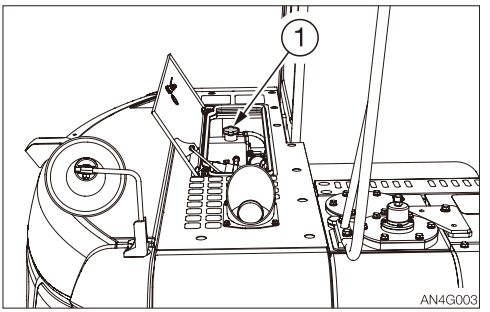
7. Turn the filter (4) counterclockwise with the filter wrench and remove it.
8. Clean the surface on which the filter stand is installed.
9. Apply a thin layer of oil on the packing of the new filter.
10. Install the new filter by hand.
11. Securely tighten the filter with the specified torque after its packing comes in contact with the surface of installation. Tightening torque: 10 to 12 N·m (7.4 to 8.9 ft-lb)
12. Add oil up to between the upper limit (H) and the lower limit (L) of the dipstick (1). Problems could arise if the oil level is either too low or too high.
13. Tighten the oil filler cap (2).
14. Perform the engine warm-up procedure. (When the engine oil temperature is lower than 80°C)
15. Park the machine on a level ground and wait for five minutes. Inspect the oil level again while the engine oil is still warm.

INSPECTING THE CONCENTRATION OF COOLANT ADDITIVE

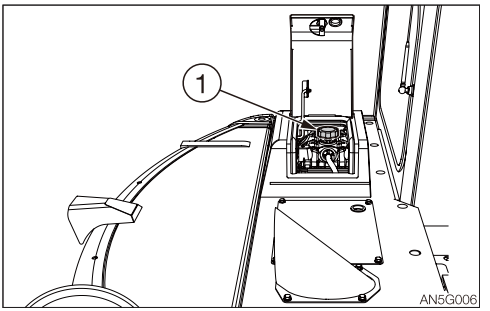
⚠ WARNING

- **Do not remove the radiator cap or the drain plug when the cooling water is hot. Stop the engine and wait until the engine and the radiator cool before slowly loosening the radiator cap and the drain plug to remove them.**
- **Always wear the protective goggle and gloves when handling coolant (antifreeze). If any coolant (antifreeze) comes in contact with eyes or skin, wash it off with clean water. Otherwise, it could result in injures.**
- **When performing maintenance on the machine, clean up the foot area and strictly observe the following so as not to fall:**
  - **Do not spill oil or grease.**
  - **Do not leave tools scattered around.**
  - **Watch your step when walking.**
- **Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.**

1. Open the maintenance cover.

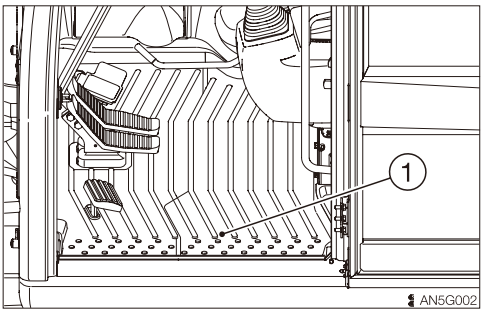


<Low noise package>

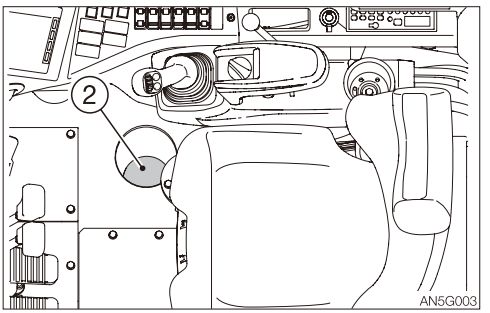


2. Remove the radiator cap or the expansion tank cap (1), and check the concentration of the coolant additive.
3. Adjust the concentration of the coolant additive, as necessary.
4. Install the radiator cap or the expansion tank cap (1).

INSPECTING THE SLEW PINION GEAR



1. Remove the floor mat (1).



2. Remove the cap (2).
3. Make sure that the gear tooth surface of the slew bearing is well greased.
   If the surface is not adequately greased, add grease.
   If the grease has turned white due to water or mud entered it, replace the whole grease. Consult your sales or service dealer for help.
   Grease full capacity: 12 L (3.2 US gal) or 10.8 kg (24 lbs.)
4. Install the cap (2).
5. Install the floor mat (1).

EVERY 1000 HOURS

REPLACING THE HYDRAULIC OIL RETURN FILTER

Refer to “Replacing the hydraulic oil return filter” on page 5-36.

REPLACING THE PILOT LINE FILTER

Refer to “Replacing the pilot line filter” on page 5-37.

REPLACING THE SLEW MOTOR GEAR OIL

Refer to “Replacing the slew motor gear oil” on page 5-46.

REPLACING THE TRAVEL MOTOR GEAR OIL

Refer to “Replacing the travel motor gear oil” on page 5-47.

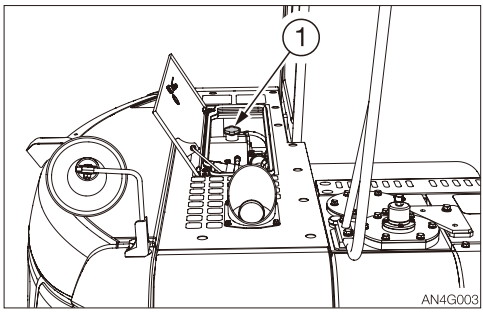
REPLACING THE ENGINE COOLING SYSTEM

Replace the coolant after the two-year operation even if the running time is less than 1000 hours.

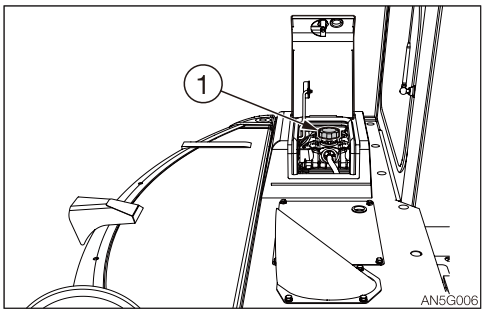
⚠ WARNING

- **Stop the engine and allow the machine to cool down before performing maintenance.**
  - **The engine, muffler, radiator and many other parts of the machine are hot immediately after the engine is stopped. Touching these parts will cause burns.**
  - **The engine coolant is also hot and under high pressure immediately after the engine is stopped. Be careful when loosening the caps or plugs. Working on the machine under these conditions could result in burns or injuries due to the hot coolant spurting out.**
- **If maintenance must be performed with the engine running, always work as a two person team communicating each other.**
  - **One person must sit in the operator's seat so that he/she can immediately stop the engine when necessary. He/she must take care not to touch the lever or pedal unless necessary.**
  - **The one who performs maintenance must make sure to keep his/her body or clothing away from the moving part of the machine.**
- **Standing at the back of the machine while the engine is running is extremely dangerous, as the machine could move suddenly. Never stand at the back of the machine while the engine is running.**
- **Do not remove the radiator cap or the drain plug when the cooling water is hot. Stop the engine and wait until the engine and the cooling water cool. Then, slowly loosen the radiator cap and the drain plug to remove them.**
- **When performing maintenance on the machine, clean up the foot area and strictly observe the following so as not to fall:**
  - **Do not spill oil or grease.**
  - **Do not leave tools scattered around.**
  - **Watch your step when walking.**
  - **Lower the boom so that the attachment rests on the ground.**
- **Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.**

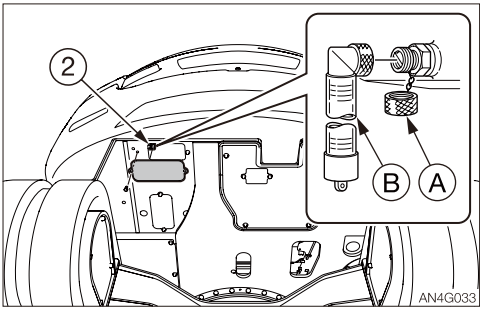
1. Open the maintenance cover.



<Low noise package>



2. Gradually loosen the radiator cap or the expansion tank cap (1) to release the internal pressure, and then remove the cap.



3. Loosen the bolts and open the cover (2).
4. Place a pan for catching the waste coolant under the drain plug (3).
5. Remove the cap (A), install the connector (B), and then drain the coolant. (The coolant comes out when the screw is tightened.)
6. Clean the cooling system, as necessary.
7. Remove the connector (B) and install the cap (A).
8. Take time and slowly add the new coolant (mixture of antifreeze and tap water) to the radiator through the fill port until it is full.
9. Close the radiator cap (1).
10. Warm up the engine. Use the meters to check that there are no irregularities in the cooling system at this time.
11. Increase the water temperature to at least 90°C (194°F). Then, run the engine for about 10 minutes with the thermostat kept open.
12. Stop the engine, wait until the cooling water temperature becomes lower, and then check the level of coolant in the radiator.
    If necessary, add cooling water until the radiator is full.
13. Close the radiator cap (1) and the cover (2).
14. Clean the interior of the reserve tank, and then add coolant to the upper limit (H).
15. When the coolant has been replaced, inspect the coolant level once again after operating the machine.
    When the machine is operated, the coolant is distributed throughout the entire system, resulting in the lower coolant level.
    Add coolant up to the full level.

REPLACING THE AIR CLEANER ELEMENT

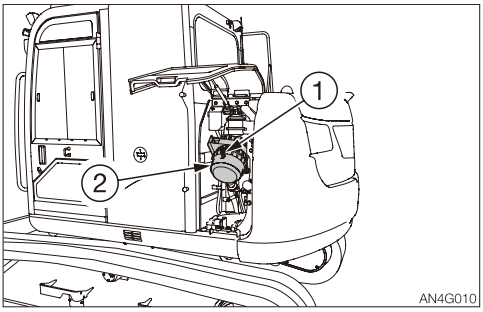
⚠ WARNING

Stop the engine and allow the machine to cool down before performing maintenance.

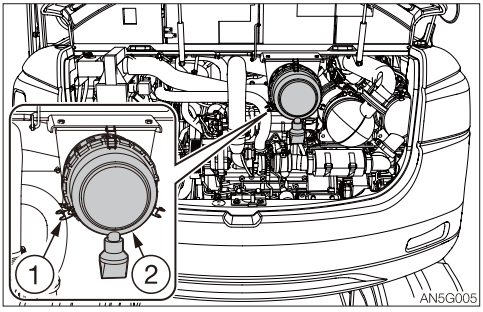
- **The engine, muffler, radiator and many other parts of the machine are hot immediately after the engine is stopped. Touching these parts will cause burns.**

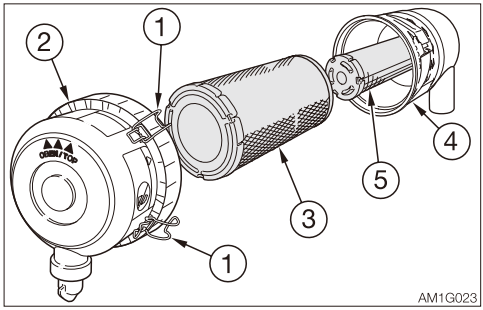
IMPORTANT: Do not use an element if its pleats, gaskets or seals are damaged.
IMPORTANT: Be sure to install the element and dust cap securely. If not, dust could be drain into the cylinder, damaging the engine.

1. Open the left side cover.



<Low noise package>



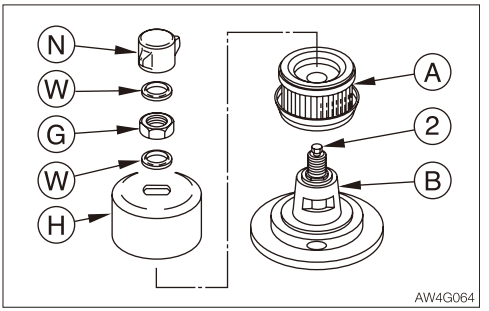


2. Loosen the clamps (1) and remove the dust cup (2).
3. Clean the inside of the dust cup (2).
4. Remove the primary element (3).
5. Clean the inside of the body (4).
6. Remove the secondary element (5).
7. Install the new elements.
8. Install the dust cup (2) with its "▲▲▲ OBEN/TOP" mark facing up, and then fasten it with the clamps (1).

REPLACING THE AIR BREATHER FILTER

⚠ WARNING

- Stop the engine and allow each part of the machine to cool down before performing maintenance.
- Before performing maintenance on the top of the machine, clean the place you will work on and observe the following to prevent falling.
  - Do not spill oil or grease.
  - Do not leave tools scattered around.
  - Watch your step when walking.
- Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.
- Oil may spurt out if caps or filters are removed or pipes are disconnected before releasing the pressure in the hydraulic system.
  - Press the air breather button to relieve the internal pressure from the tank.

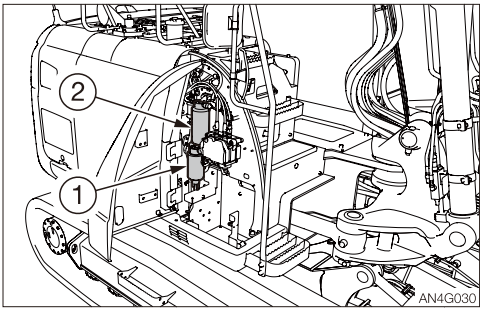


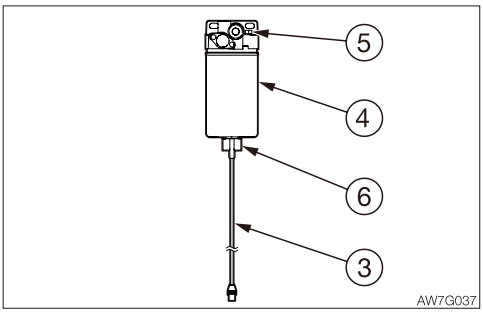
1. Remove the cap nut (N).
2. Press the button (2) to relieve the internal pressure from the tank.
3. Remove the seal washer (W) and the nut (G).
4. Remove the cover (H).
5. Install the filter (A) paying attention to the sides (top and bottom).
6. Install the body (B) and the cover (H) by aligning their notches.
7. Install the seal washer (W) and the nut (G).
8. Securely tighten the cap nut (N) by hand.

REPLACING THE FUEL FILTERS

⚠ WARNING

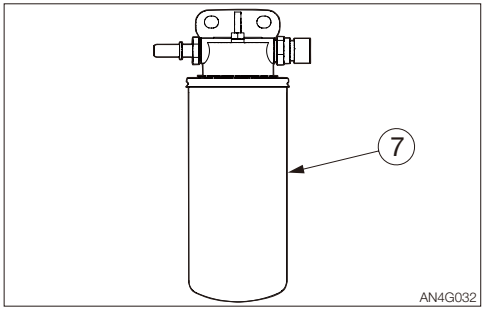
- Do not smoke or permit open flames while handling fuel or working on the fuel system.
- Stop the engine in a well-ventilated place and allow it to cool down before performing maintenance.
- Clean up spilled fuel immediately.





1. Open the front cover (for maintenance).
2. Remove the electric wiring (3).
3. Place a pan under the pre-fuel filter (1) to catch fuel.
4. Loosen the vent plug (5) and the drain plug (6) to drain the fuel inside.
5. Remove the filter (4) with a filter wrench.
6. Remove dirt from the seal surface of the new filter and its mating surface.
7. Apply a thin layer of fuel on the seal surface of the filter (4), and then turn the filter clockwise to install it.
   Tightening torque: 17 to 18 N·m (12.5 to 13.3 ft-lb)
8. Install the drain plug (6).
   Tightening torque: 1.6±0.3 N·m (1.2±0.2 ft-lb)
9. Tighten the vent plug (5).
   Tightening torque: 6.5±1.3 N·m (4.8±1 ft-lb)
10. Install the electric wiring.
11. Bleed air.
    Refer to “Bleeding air from the fuel system” on page 6-11.

Main fuel filter



1. Open the front cover (for maintenance).
2. Place a pan under the main fuel filter (2) to catch fuel.
3. Remove the filter (7) with a filter wrench.
4. Remove dirt from the seal surface of the new filter and its mating surface.
5. Apply a thin layer of fuel on the gasket.
6. Install the filter (7) by turning it clockwise.
   Tightening torque: 10 to 12 N·m (7.4 to 8.9 ft-lb)
7. Bleed air.
   Refer to “Bleeding air from the fuel system” on page 6-11.

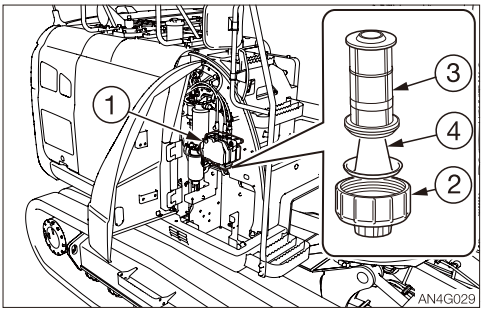
REPLACING THE DEF/ADBLUE® SUPPLY MODULE FILTER

Replace the DEF/AdBlue® supply module filter after three-year operation even if the running time is less than 1000 hours.

⚠ WARNING

Follow appropriate laws and regulations when disposing of the removed DEF/AdBlue® solution.

1. Turn the starter switch to the OFF position and wait for two minutes until the SCR system stops.
2. Open the front cover (for maintenance).



3. Remove the electric wiring from the supply module (1).
   Cover the electric wiring just removed with a plastic bag so that it will not be splashed with the DEF/AdBlue® solution.
4. Place a pan under the cover (2).
5. Remove the cover (2).
   Socket wrench: 27 mm
6. Pull out the filter (3) and the compensation body (4).
7. Set a new filter (3) and a new compensation body (4).
8. Install the cover (2).
   Tightening torque: 22.5±2.5 N·m (16.6±1.8 ft-lb)
9. Install the electric wiring.

INSPECTING AND ADJUSTING THE V-RIB BELT

Check for wear and abnormality. Repair or replace as necessary.
Refer to “Replacing the V-rib belt” on page 5-65.

INSPECTING THE ENGINE INSTALLATION CONDITION

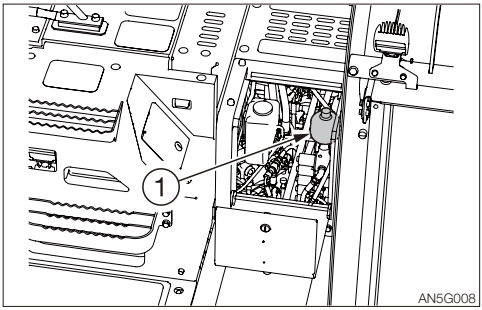
Check for damage or loose bolt. Repair or replace as necessary.
This operation requires experience. Ask a Takeuchi service agent for it.

INSPECTING THE LOW-TEMPERATURE STARTING DEVICE

This operation requires experience. Ask a Takeuchi service agent for it.

EVERY 2000 HOURS

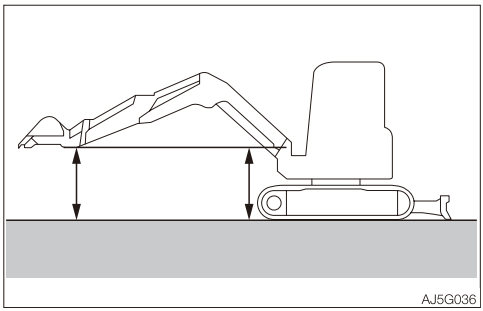
INSPECTING THE ACCUMULATOR



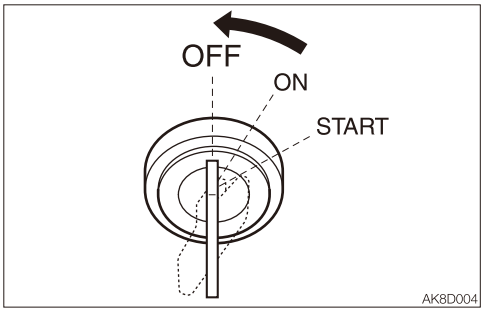
⚠ WARNING

- High-pressure nitrogen gas is enclosed in the accumulator (1). If handled incorrectly, it could explode and cause serious injury. Strictly observe the following precautions:
  - Do not disassemble.
  - Do not allow flame nearby or throw it into a fire.
  - Do not drill, weld or fuse.
  - Do not subject it to physical shock such as hitting, rolling or dropping.
  - Before disposing of the unit, the sealed gas must be drained. Contact a Takeuchi sales or service dealer for help.
- Clear all personnel from the work area.
- Sound the horn to warn people around the machine.

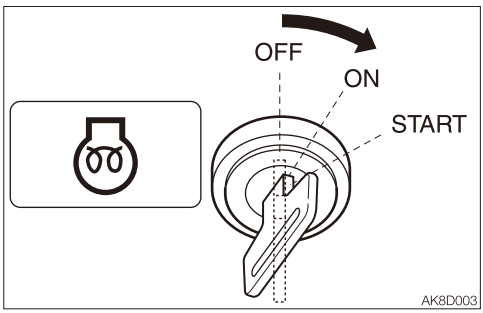
IMPORTANT: If the accumulator (1) fails, the boom cannot be lowered or the residual pressure in the hydraulic circuit cannot be released while the engine is stopped.



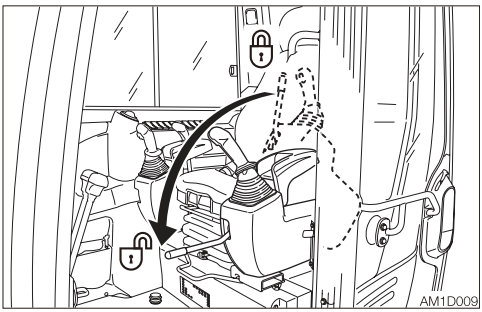
1. Start the engine, then fully retract the arm and bucket cylinders.
2. Operate the boom so that the tip of the arm is positioned at the bottom of the boom.



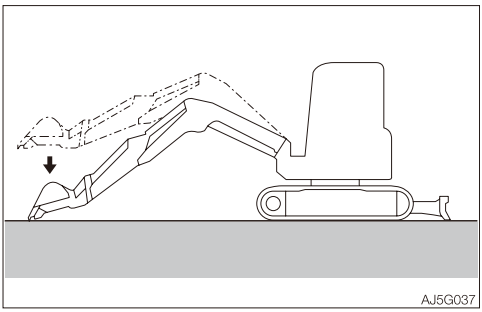
3. Turn the starter key to the OFF position to stop the engine.



4. Turn the key to the ON position. (Do not start the engine.)



5. Fully lower the safety lock lever to disengage the lock.



6. Lower the boom until the bucket contacts the ground.
   The machine is normal if the bucket is lowered to the ground. The accumulator (1) is probably faulty if the boom cannot be lowered or stops halfway. Consult a Takeuchi sales or service dealer for help.

Note: When the boom is lowered to lower the bucket to the ground, do it within 10 minutes of stopping the engine.

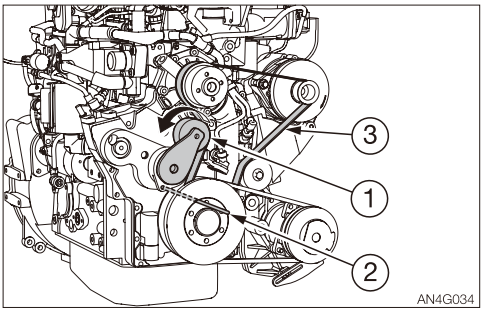
EVERY 3000 HOURS

REPLACING THE V-RIB BELT

⚠ WARNING

Stop the engine and allow the machine to cool down before performing maintenance.

- **The engine, muffler, radiator, hydraulic lines, sliding parts and many other parts of the machine are hot immediately after the engine is stopped. Touching these parts will cause burns.**
- **When performing maintenance on the machine, clean up the foot area and strictly observe the following so as not to fall:**
  - **Do not spill oil or grease.**
  - **Do not leave tools scattered around.**
  - **Watch your step when walking.**
- **Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.**



1. Use a wrench to push the tensioning pulley (1) in the direction of the arrow.
2. Secure the tensioning pulley (1) with the pin (2) and replace the V-rib belt with a new one.
3. Remove the pin (2) with the wrench and apply tension onto the V-rib belt (3).
4. Make sure that the V-rib belt (3) is properly seated on the guide of the tensioning pulley (1).

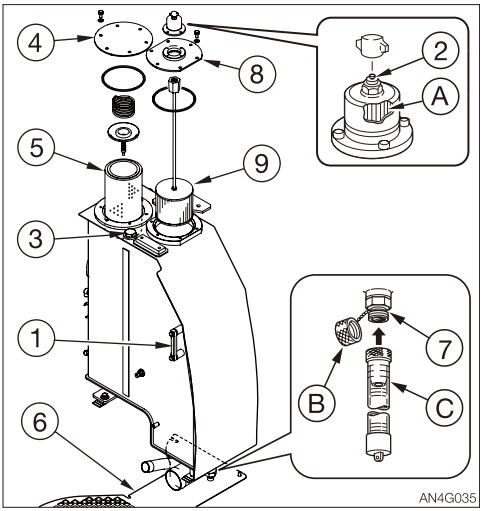
EVERY 4000 HOURS

REPLACING THE HYDRAULIC OIL AND CLEANING THE SUCTION STRAINER

⚠ WARNING

- Stop the engine and allow each part of the machine to cool down before performing maintenance.
  - The engine, the hydraulic system and many other parts of the machine are hot immediately after the engine is stopped. Touching these parts will cause burns.
  - The hydraulic oil is also hot and under high pressure.
    Be careful not to touch the hydraulic oil when loosening the cap or plug. Working on the machine under these conditions could result in burns or injuries due to the hot oil spurting out.
- Before performing maintenance on the top of the machine, clean the place you will work on and observe the following to prevent falling.
  - Do not spill oil or grease.
  - Do not leave tools scattered around.
  - Watch your step when walking.
- Never jump down from the machine. Use the steps and handrails when climbing up and down the machine, and always support your body at three points with your hands and feet.
- Oil may spurt out if caps or filters are removed or pipes are disconnected before releasing the pressure in the hydraulic system.
  - Press the air breather button to relieve the internal pressure from the tank.
  - When removing plugs or screws, or when disconnecting hoses, stand to the side and loosen them slowly to gradually release the internal pressure before removing.

1. Slew 45° clockwise and set the machine to the hydraulic oil level inspection posture.
   Refer to “Inspecting the hydraulic oil tank level and replenishing” on page 5-28.



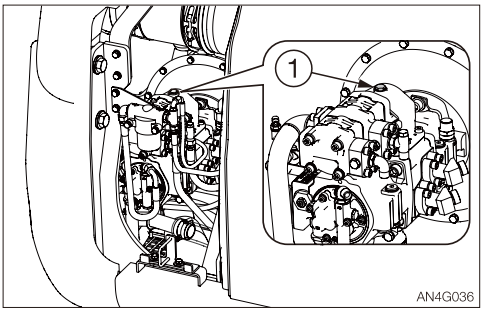
2. Press the button (2) to relieve the internal pressure from the tank.
3. Replace the air breather filter (A).
   Refer to “Replacing the air breather filter” on page 5-62.
4. Remove the plug (3).
5. Loosen the bolts and remove the under cover (6).
6. Place a pan under the plug (7) to catch the waste oil.
7. Remove the cap (B), install the connector (C), and then drain the hydraulic oil. (The oil comes out once the screw is tightened.)
8. Loosen the bolts and remove the flange (4).
9. Remove the return filter (5).
10. Loosen the bolts and remove the flange (8).
11. Remove the suction strainer (9) and clean it.
12. Clean the inside of the hydraulic oil tank.
13. Install the suction strainer (9) on the tank and then install the flange (8).
14. Install the new return filter (5) and the flange (4) on the tank.

15. Remove the connector (C) and install the cap (B).
16. Add hydraulic oil from the hole of plug (3) up to the level between the upper limit (H) and the lower limit (L) in the sight gauge (1).
17. Tighten the plug (3).
18. Bleed air from the hydraulic oil circuit following “Bleeding air” below.
19. Set the machine to the hydraulic oil level inspection posture and inspect the oil level after the oil cools.
    Refer to “Inspecting the hydraulic oil tank level and replenishing” on page 5-28.
20. Tighten the under cover (6).

Bleeding air

IMPORTANT: After replacing the hydraulic oil or hydraulic devices, or after performing maintenance of the hydraulic devices, bleed air from the hydraulic circuits and hydraulic devices. Failure to do so may damage the hydraulic devices.

• Hydraulic pump



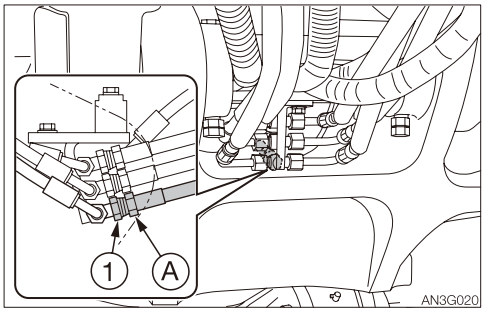
1. Open the right side cover.
2. Loosen the vent plug (1) on the hydraulic pump.
3. Once hydraulic oil overflows from the vent plug hole (1), tighten the vent plug (1).

If the boom or arm does not move normally, air may be present in the following locations. This operation is dangerous and requires experience. Ask your sales or service dealer for help.

• Emergency shut-off valve

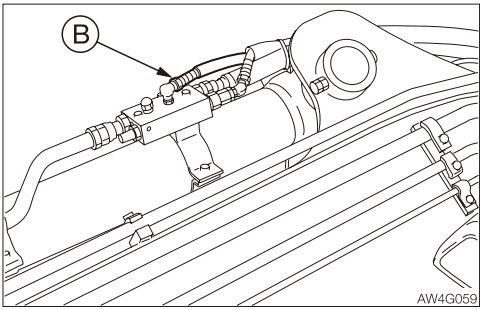
1. Place a pan under the hose (A) or (B) to catch the waste oil.
2. Start the engine and run it at low idle.
3. Fully lower the safety lock lever to the unlock position.

Boom



4. Hold the hose fitting (A) in place with a wrench and slowly loosen the hose nut (1).
5. Slowly move the boom in the “Boom lower” direction a little until there are no more air bubbles coming from the hose nut (1) joint.
6. Hold the hose fitting (A) in place with a wrench and tighten the hose nut (1).
   Tightening torque: 50 N·m (36.9 ft-lb.)

Arm



4. Loosen the hose (B) slowly.
5. Slowly move the arm in the “Arm in” direction a little until there are no more air bubbles coming from the hose (B) joint.
6. Tighten the hose (B).
   Tightening torque: 50 N·m (36.9 ft-lb.)

• Slew motor and cylinders

1. Start the engine, let it run at a low-idling speed for 10 minutes.
2. Maintain the engine at low idle, then extend and retract each cylinder 4 or 5 times, without letting them reach the stroke end.
3. Slew slowly left and right several times.
4. Run the engine at high speed, then extend and retract each cylinder 4 or 5 times, without letting them reach the stroke end.
5. Slew left and right several times.
6. Return the engine speed to low idle, then extend and retract each cylinder 4 or 5 times to the stroke end.

WHEN REQUIRED

REPLACING THE BUCKET TEETH AND THE SIDE CUTTERS

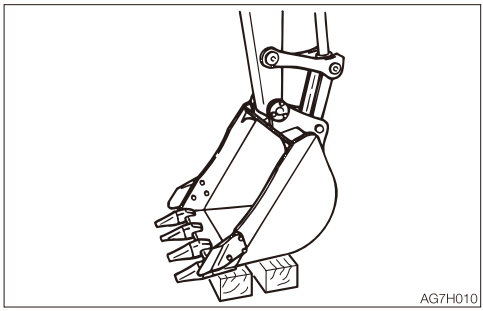
Replace the bucket teeth if the tooth points are worn. Do not wait until the bucket is damaged.

⚠ WARNING

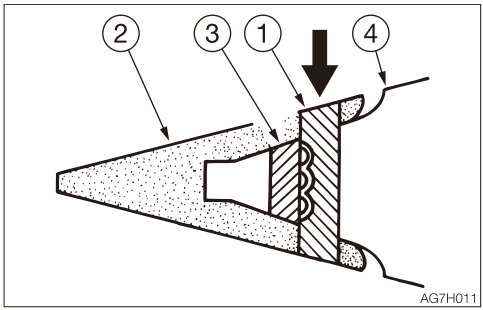
- **Before performing maintenance or repairs under the machine, lower all moveable working equipment to the ground or in the lowermost position.**
- **To prevent unexpected movement, firmly secure the working equipment when repairing or replacing the bucket teeth or side cutter.**
- **When using a hammer, pins may fly out or metal particles may be scattered. This may lead to serious injury.**
  - **If hard metal parts such as pins, bucket teeth, side cutter or bearings are hit with a hammer, wear protective gear such as safety goggles and gloves.**
  - **When hitting pins or bucket teeth, always check that there is no one in the surrounding area.**
- **Do not allow unauthorized personnel in the work area while working.**

Removing

1. Clean the bucket and park the machine on a flat and rigid ground.



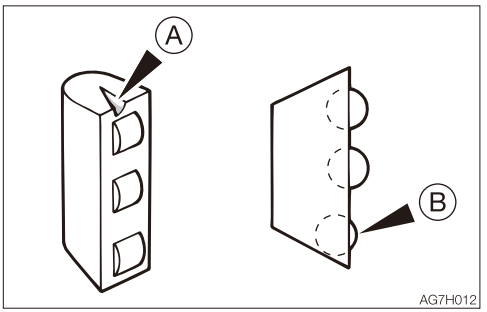
2. Place the bucket with its bottom flat on the blocks so that the locking pin can be knocked out.
3. Remove the key, and then check that the bucket is stable.



4. Knock out the locking pin (1) and remove the point (2).

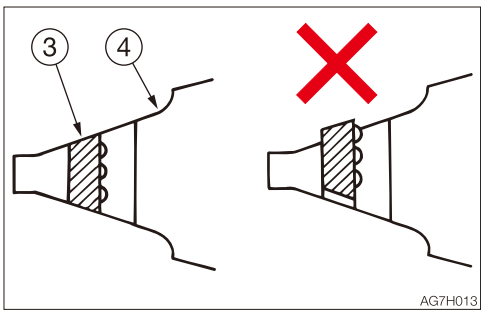
Note: If the drift is set against rubber pin lock (3) when it is hit, the rubber pin lock may break. Set it against the back of the locking pin.

5. Remove the rubber pin lock (3). Check if the rubber pin lock is still usable. Replace it if it is as follows.

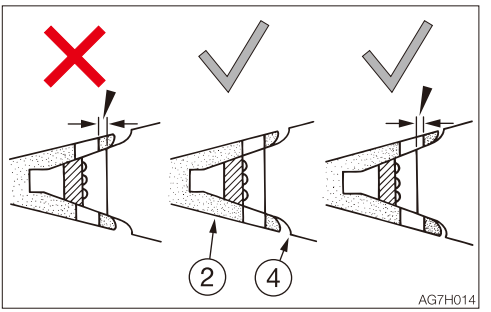


A .....There are cracks in the rubber and the roller is coming off.
B .....The roller is dented when pressed with a finger.

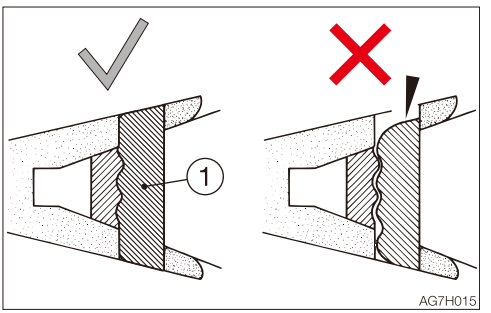
Installation



1. Remove the dirt on the surface of adaptor and the inner part of tooth, make the better contact on the mating part.
2. Push rubber pin lock (3) into the welding adaptor (4).
   Do not let the rubber pin lock stick out from the welding adaptor surface.

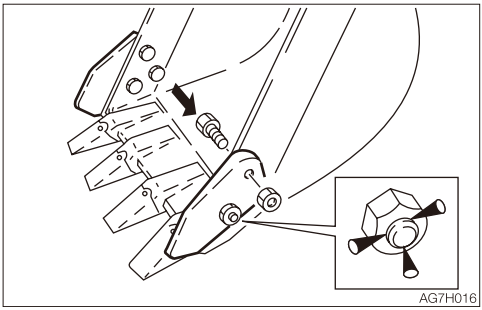


3. Install the point (2) onto the welding adaptor (4).
   Insert the point so that the surface behind the point's pin hole is aligned with the surface behind the welding adapter's pin hole.



4. Knock out the locking pin (1).
   Check that the end surfaces of the locking pin just knocked out are aligned with the upper and lower surface of the point. Do not use the worn locking pin.
   The life of the teeth can be lengthened and the frequency of its replacement can be reduced by turning it upside down so that it will wear evenly.
   Replace the rubber pin lock and locking pin at the same time as replacing the teeth. This makes it possible to prevent the teeth from falling out.

• Side cutter
Installation



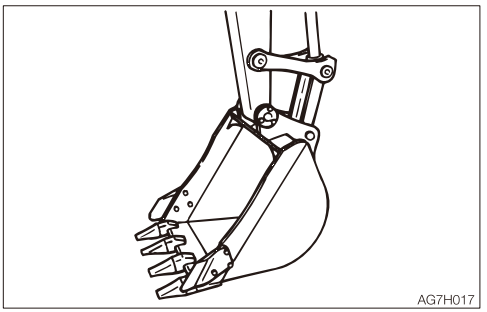
1. Insert the bolts from the inner of the bucket and tighten the side cutter with nuts.
   Tightening torque: 475 N·m (350 ft-lb.)
2. Caulk the bolts with a punch at three spots along the periphery of the screw to prevent the nuts from coming loose.

REPLACING THE BUCKET

⚠ WARNING

- Before performing maintenance or repairs under the machine, lower all working equipment to the ground or in the lowermost position.
- If maintenance must be performed with the engine running, always work as a two person team communicating each other.
  - One person must sit in the operator's seat so that he/she can immediately stop the engine when necessary. He/she must take care not to touch the lever or pedal unless necessary.
  - The one who performs maintenance must make sure to keep his/her body or clothing away from the moving part of the machine.
- When using a hammer, pins may fly out or metal particles may be scattered. This may lead to serious injury.
  - If hard metal parts such as pins, bucket teeth, side cutter or bearings are hit with a hammer, wear protective gear such as safety goggles and gloves.
  - When hitting pins or bucket teeth, always check that there is no one in the surrounding area.
- When aligning the pin holes, always do so by checking them visually. Do not insert your finger in the pin hole, or you could lose your finger.

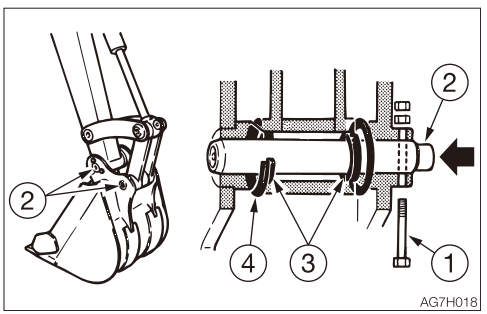
Removing



1. Lower the bucket to the ground as shown on the figure above in a stable position.

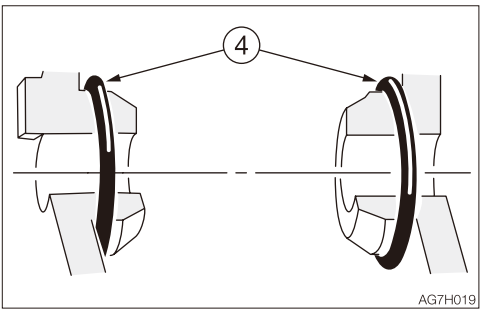
Note: When removing pins, set the bucket so that it is barely touching the ground. If the bucket is firmly touching the ground, the resistance will be great and it will be difficult to remove the pin.

2. Set the safety lock lever to the locked position and stop the engine.

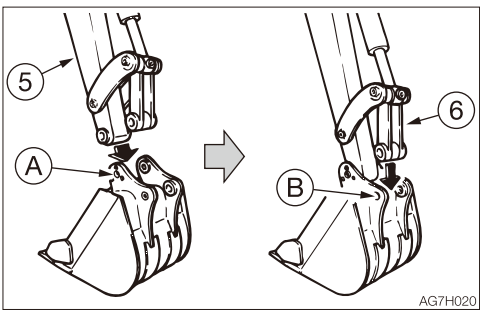


3. Remove the bolt (1).
4. Hammer the pin (2) out of the bucket.
5. Remove the bucket.
   Inspect the pin seal (3) and replace it if it is deformed or damaged. (See next page.)

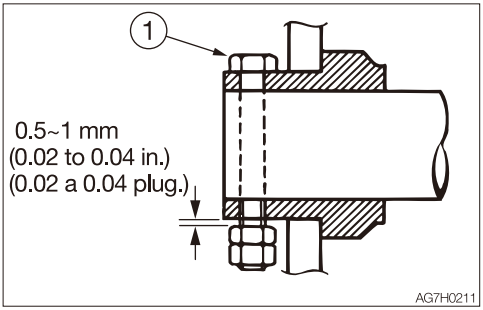
Installation



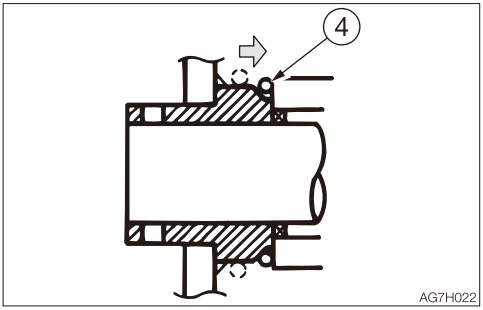
1. Set the O-ring (4) on the bucket as shown on the figure above.



2. Align the pin hole (A) on the bucket with the pin hole on the arm (5), and install the pin (2).
3. Operate the cylinder, align the pin hole (B) on the bucket with the pin hole on the link arm (6), and install the pin (2).

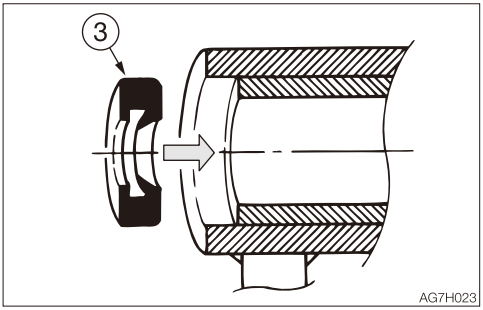


4. Align the turn prevention holes, and then install the bolt (1) and the nut. Be sure to leave a gap of about 0.5 to 1 mm (0.02 to 0.04 in.) between the nut and bucket bush, or the nut will come loose.



5. Adjust the gap between the bucket and the arm.
   Refer to “Adjusting the gap between the bucket and arm (If equipped)” on page 5-74.
6. Slide the O-ring (4).

Replacing the pin seal

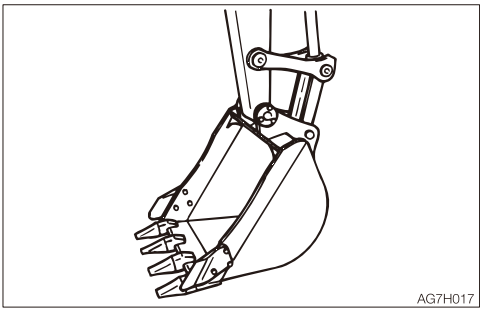


1. Set the pin seal (3) in the direction shown on the figure above.
2. Use a mallet to slowly press the pin seal in. Be careful not to damage the seal.

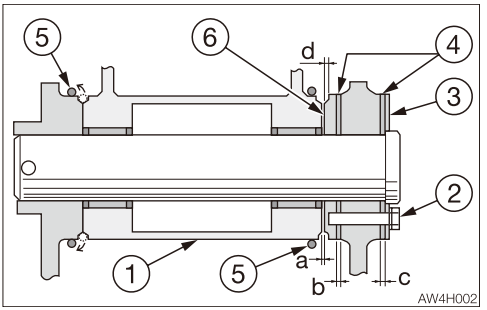
ADJUSTING THE GAP BETWEEN THE BUCKET AND ARM (IF EQUIPPED)

⚠ WARNING

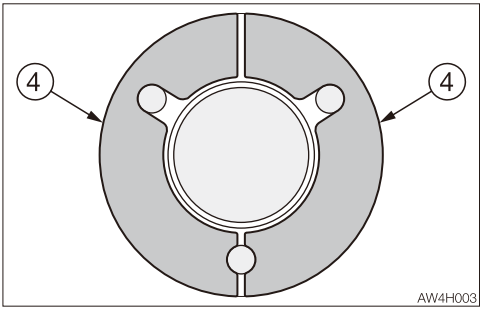
- **Before performing maintenance or repairs under the machine, lower all working equipment to the ground or in the lowermost position.**
- **To prevent unexpected movement, securely block the working equipment when adjusting the gap.**



1. Lower the bucket to the ground in a stable position as shown in the figure above.
2. Slew the upperstructure slightly to the left and lightly press the arm to the left side of the bucket (the side without an adjuster).
3. Set the safety lock lever to the lock position and stop the engine.



4. Slightly loosen the 3 bolts (2) (using a 22 mm (0.87 in) wrench) and remove the shims (4) from “gap c” between the blade (3) and bucket. The shims (4) are in two parts and can be removed easily when the bolts are slightly loosened by sticking a screwdriver in the seam between the left and right shims.
5. Move the O-ring (5) to bring the gap (a) into view and measure the width of the gap (a).



6. Press the head of the bolts (2) with a finger to eliminate gap (a). This increases gap (b). Insert the shims removed above into gap (b), using as many shims as can be inserted easily.
7. Set the remaining shims back in gap (c), then tighten the bolts.
   Tightening torque : 83 N·m (61.5 ft-lb).
   This completes the adjustment.

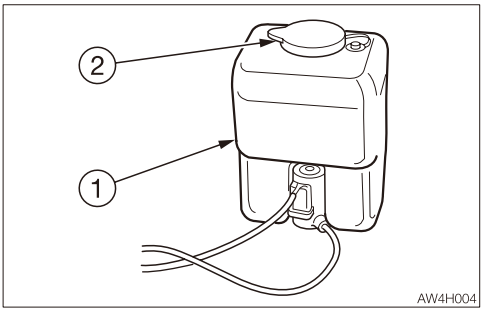
Note: The proper total number of shims for gaps (b) and (c) is 6 x 2 = 12. If you forget to set the shims remaining in step 7 above back in gap (c), the tip of bolts (2) will extend past the boss (6). This may damage the boss at the arm’s tip or cause the bolt to break. If the end face of boss (6) wears and the width of the groove (d) for the O-ring reaches 5 mm (0.2 in), replace boss (6) with a new one.

INSPECTING AND REPLENISHING THE WINDSHIELD WASHER FLUID

⚠ WARNING

Choose ethyl alcohol as washer solution. Do not use methyl alcohol as washer solution. It could damage the eyes.

Use a windshield washer fluid designed specifically for motor vehicles. Follow the instructions included with the washer fluid.



Inspection

1. Open the center cover.
2. Inspect the washer tank (1) and add washer fluid if the level is low.

Replenishing

1. Mix the washer fluid to the prescribed concentration.
2. Remove the cap (2) and add washer fluid. Keep the dust away while replenishing the washer fluid.
3. Install the cap (2).

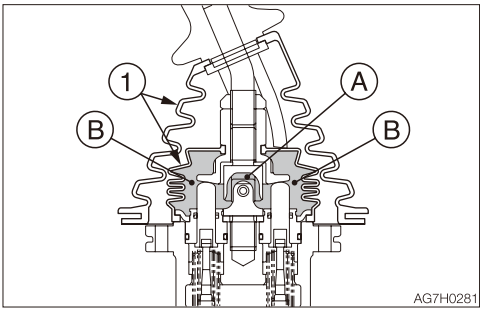
LUBRICATING THE LEVERS AND PEDALS

⚠ WARNING

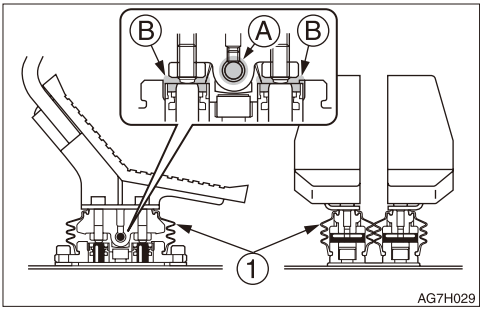
Set the machine to the parking posture, stop the engine, remove the starter key and store it. Failure to do so may result in the machine moving abruptly, leading to serious injury or death.

If the levers or pedals no longer move smoothly, grease them.

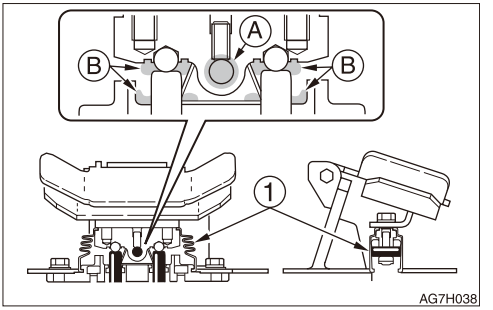
Operating levers



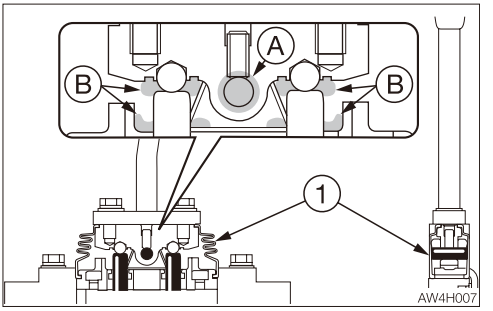
Travel levers/pedals



Boom swing pedal



Dozer blade lever



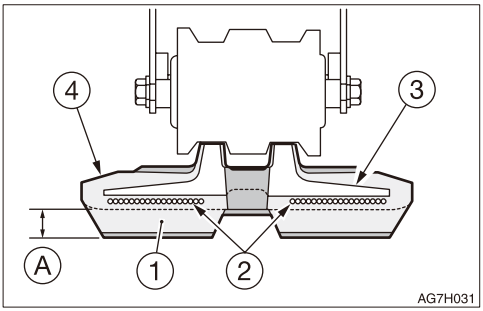
1. Remove the lower mount section of the boot (1) and turn it upward.
2. Wipe off the old grease.
3. Apply grease to points (A) and (B).
4. Set the boot (1) back as it was.

INSPECTING THE RUBBER CRAWLERS

Repair or replace the rubber crawlers if their condition becomes as described below. Consult your sales or service dealer for repair or replacement.

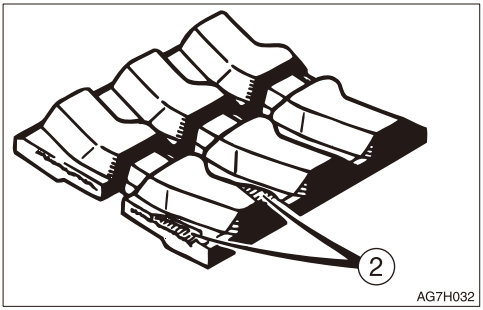
Rubber crawler
Replace the crawler if the entire crawler is stretched and cannot be adjusted.

(1) Lug



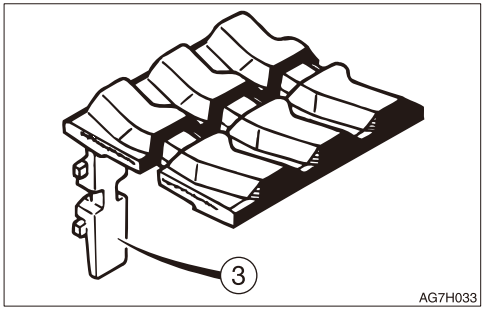
Replace if the height of (A) is 5 mm (0.2 in.) or below.

(2) Steel cord



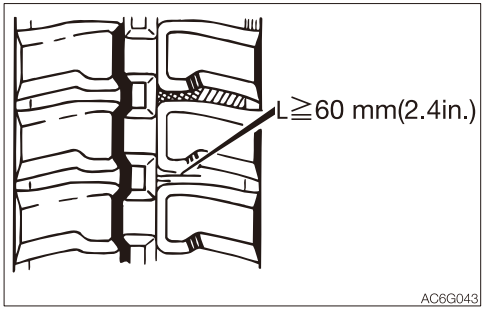
Replace if the steel cord is exposed for two links or more.
Replace if the half or more of the steel cords on one side are cut.

(3) Metal core



Replace if even one metal core is off.

(4) Rubber



Repair if there are cracks of 60 mm (2.4 in.) or greater in length.
If the steel cord is visible, repair as soon as possible, regardless of the length of the crack.

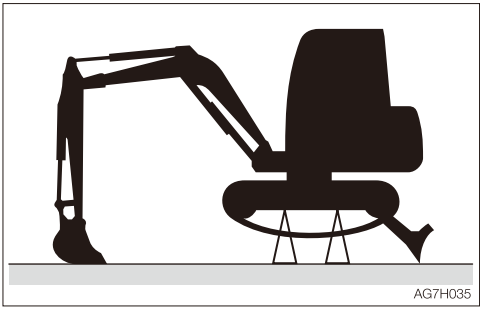
REPLACING THE RUBBER CRAWLERS

⚠ WARNING

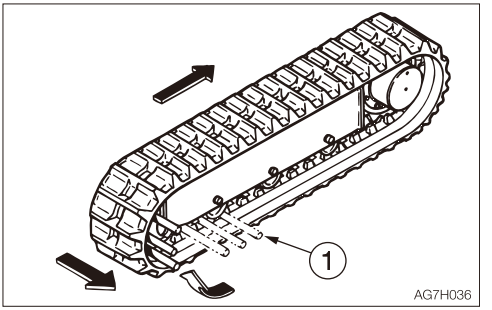
- **If you must work beneath the raised machine or working equipment, always use wood blocks, jack-stands or other rigid and stable supports. Never get under the machine or working equipment if they are not sufficiently supported.**
- **If maintenance must be performed with the engine running, always work as a two person team communicating each other.**
  - **One person must sit in the operator's seat so that he/she can immediately stop the engine when necessary. He/she must take care not to touch the lever or pedal unless necessary.**
  - **The one who performs maintenance must make sure to keep his/her body or clothing away from the moving part of the machine.**

Removal

1. Fully release the tension of the rubber crawler.
   Refer to "Inspecting and adjusting the crawler tension" on page 5-40.



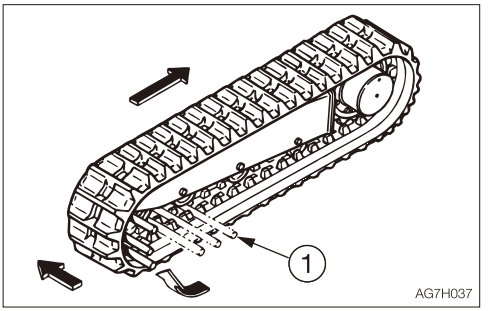
2. Use the working equipment to lift the body.



3. Set an iron pipe (1) in the rubber crawler and turn the sprocket slowly in the reverse direction.
4. Turn until the iron pipe (1) is directly next to the idler and the rubber crawler lifts away from the idler, then stop turning the sprocket.
5. Slide the rubber crawler sideways and remove it from the crawler frame.
   Remove the other rubber crawler using the same procedure.

Installation

1. Use the working equipment to lift the body.



2. Set the rubber crawler on the sprocket.
3. Set an iron pipe (1) in the rubber crawler and turn the sprocket slowly in the reverse direction.
4. Turn until the iron pipe (1) is directly next to the idler and the rubber crawler lifts away from the idler, then stop turning the sprocket.
5. Slide the rubber crawler inward, engage it on the idler, then pull out the iron pipe.
6. Check that the rubber crawler is securely engaged on the sprocket and idler.
7. Tighten the rubber crawler to the standard tension.
   Refer to “Inspecting and adjusting the crawler tension” on page 5-40.
8. Install the other rubber crawler using the same procedure.

REPLACING THE DIESEL PARTICULATE FILTER <APPLICABLE MACHINE MODELS 514700950 OR LATER>

The DPF must be replaced if the ash lamp lights up or flashes. Refer to “16. Standstill regeneration in process/Demand indicator lamp/Ash lamp <Applicable machine models 514700950 or later>” on page 2-24.
This operation requires experience. Ask a Takeuchi service agent for it.

EVERY 2 YEARS

REPLACING THE RECEIVER DRYER

This operation requires experience. Ask your sales or service dealer for it.

MAINTENANCE DURING EXTENDED STORAGE PERIOD

STORAGE PROCEDURES

If the machine is to be stored for 30 days or more, store it indoors. If it must be stored outdoors, park the machine on a surface laid with lumber on a flat ground, and place a waterproof cover over it so that it stays dry.

1. Clean the machine.
2. Inspect for oil leakage, water leakage, cracks and loose nuts and bolts.
3. Add fuel and replace the hydraulic oil and oil.
4. To prevent the DEF/AdBlue® solution from evaporating, fill up the DEF/AdBlue® tank.
5. To prevent rusting and freezing, replace the engine coolant with long-life coolant (LLC).
   Refer to “Replacing the engine cooling system” on page 5-59.
6. Use the grease gun to lubricate the grease fittings.
7. Fully retract the bucket and arm cylinders and lower the bucket and dozer blade to the ground.
8. Apply rust-inhibiting oil to the hydraulic cylinder rods.
9. Disconnect the negative cable from the battery and cover the battery to prevent freezing.

IMPORTANT: The SCR system operates for up to 2 minutes after the starter switch is turned to the OFF position.
When removing the batteries or electrical connectors for inspection or maintenance, wait for at least 2 minutes after the starter switch is turned to the OFF position. Otherwise, the system could fail.

During storage

⚠ WARNING

- **Do not operate the machine in an enclosed area without adequate ventilation.**
- **If natural ventilation is not possible, install ventilators, fans, exhaust extension pipes or other venting devices.**

1. To prevent rusting, operate the machine once a month so that the oil can be circulated throughout the system.
2. Inspect the battery and recharge it as necessary.
   Ask your sales or service dealer for recharging.

Starting the machine after storage

IMPORTANT: If the above “Storage procedures” have not been followed during the extended storage periods, consult your sales or service dealer before starting the machine again.

1. Wipe off the rust-inhibiting oil that was applied on the piston rods of the hydraulic oil cylinders.
2. Add oil or grease as necessary.
3. If the storage period has been four months or more, replace DEF/AdBlue®. There is a risk that the SCR system may malfunction; contact a Takeuchi service dealer for assistance.

Returning the engine to service

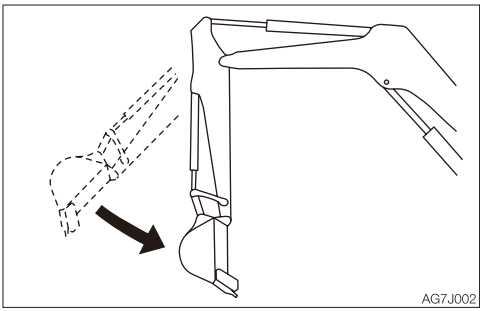
1. Perform the daily checks.
2. The engine should be pre-oiled before startup.
   a. Crank the engine, leaving the fuel system shut off so the engine will not start, for 15 seconds.
   b. Then pause for 30 seconds.
   c. Repeat the procedure until you have cranked the engine for a total of one minute. This will circulate the oil in the engine's lubrication system.
3. Prime the fuel system.
4. Start the engine. Allow the engine to idle for approximately 15 minutes while you check for:
   · Proper oil pressure
   · Fuel, engine oil or coolant leaks
   · Proper operation of the indicators and/or gauges
5. Avoid prolonged operation at minimum or maximum engine speeds and loads for the remainder of the first hour of operation.

TROUBLESHOOTING

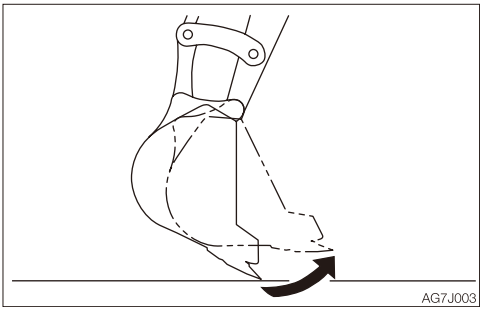


SYMPTOMS THAT ARE NOT MALFUNCTIONS

The symptoms listed below are not malfunctions.



- The arm retracting speed momentarily slows down when it reaches an almost vertical position while the engine is running at low speed.



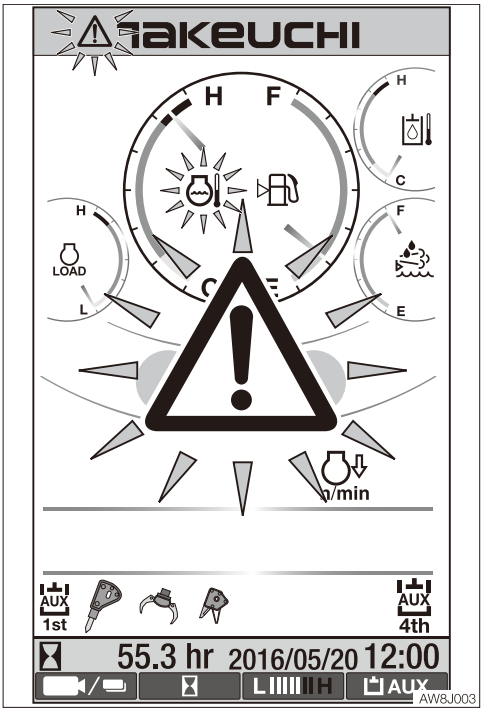
- The bucket teeth moving speed momentarily slows down when it reaches an almost horizontal position while the engine is running at low speed.
- The slew motor produces noise at the beginning and end of the slewing.
- The travel motor produces noise when stopped suddenly from its high speed traveling.
- The control valve produces noise if excessive force is applied to the working equipment or when it moved to the stroke end.
- It becomes less easy to operate the machine when an attachment weighing more than a standard arm or bucket is installed.

IF THE ENGINE OVERHEATS

⚠ WARNING

- **Do not open the engine hood when steam is coming from it. The steam or hot water may spurt out and cause burns.**
- **Do not try to remove the radiator cap or the drain plug when the cooling water is hot. Stop the engine, wait until the engine and the radiator cool, and then slowly loosen the radiator cap to release the internal pressure.**
- **Before performing maintenance, stop the engine and allow the machine to cool down.**

The symptoms listed below indicate overheating.



- An alarm is sounded and the vehicle and engine emergency lamp and the coolant temperature warning lamp start flashing.
- The water temperature gauge level is in the red zone.
- Steam comes from the engine room.

Remedy procedure

1. Park the machine in a safe place.
2. Check if steam is coming out of the closed engine hood.
3. If there is steam, stop the engine immediately and contact your sales or service dealer for repair. If steam, is not coming out run the engine at low idle and let the water temperature cool down.
4. When the water temperature gauge LED drops in the green zone, stop the engine.
5. Perform the inspections and the remedies listed below once the engine cools down.
   - V-rib belt slack ..... Adjust
     Refer to page 5-65.
   - Coolant level ..... Add
     Refer to page 5-22.
   - Water leakage ..... Repair
   - Radiator fins..... Clean
     Refer to page 5-49.
   - Sediment in cooling system
     ..... Clean
     Refer to pages 5-59 to 5-60.

If the problem persists after the above remedies, contact your sales or service dealer for repair.

IF THE BATTERY GOES DEAD

The symptoms below indicate that the battery is dead.
- The starter motor does not turn or fails to start the engine.
- The horn is too weak.

Remedy procedure

Start the engine using the booster battery on the other vehicle (booster vehicle) and the jumper cables.

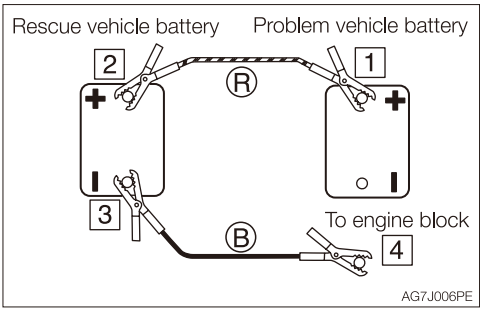
⚠ WARNING

- **When starting the engine using the jumper cables, be sure to connect the cables by following the proper steps. Improper use of jumper cables can result in battery explosion or unexpected machine motion.**
  - **Do not allow the booster vehicle and the machine with a dead battery (dead machine) to touch each other.**
  - **Do not allow the positive (+) and the negative (–) clips of the jumper cables to touch each other.**
  - **When connecting, attach the jumper cable to the positive (+) terminals first. When disconnecting, remove the cable from the negative (–) terminal (ground) first.**
  - **Connect the last clip of the jumper cable to a point as far away from the battery as possible.**
- **Always wear the protective goggle when jump starting the engine by using the jumper cables.**

IMPORTANT: Use the jumper cables and clips of a size suited to the capacity of battery. Do not use damaged or corroded jumper cables and clips.
IMPORTANT: Be sure that the battery of the booster vehicle has the same capacity as the battery of the dead machine.
IMPORTANT: Be sure to connect the clips securely.

Connecting the jumper cables

IMPORTANT: Set the starter keys of the booster vehicle and the dead machine to the OFF position.



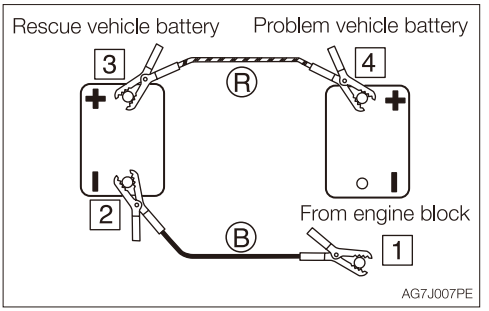
1. Connect the clip of jumper cable (R) to the positive (+) battery terminal of the dead machine.
2. Connect the other clip of jumper cable (R) to the positive (+) battery terminal of the booster vehicle.
3. Connect the clip of jumper cable (B) to the negative (–) battery terminal of the booster vehicle.
4. Connect the other clip of jumper cable (B) to the engine block of the dead machine. Connect the clip to a place as far from the battery as possible.

Starting the engine

1. Check that the clips are securely connected to the terminals.
2. Start the engine of the booster vehicle and run it at high speed.
3. Start the engine of the dead machine.

Disconnecting the jumper cables

Once the dead machine is successfully running, remove the jumper cables by following the same steps as for connection in the reverse order.



1. Disconnect the clip of jumper cable (B) from the engine block of the dead machine.
2. Disconnect the other clip of jumper cable (B) from the negative (–) battery terminal of the booster vehicle.
3. Disconnect the clip of jumper cable (R) from the positive (+) battery terminal of the booster vehicle.
4. Disconnect the clip of jumper cable (R) from the positive (+) battery terminal of the dead machine.

Recharging

Ask your sales or service dealer for recharging the dead battery.

MEMO

IF A FUSE BLOWS

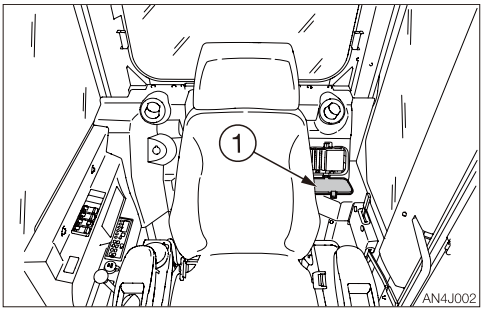
If a light does not come on or the electrical system does not work, a fuse may be blown. Inspect the fuses.

INSPECTING AND REPLACING THE FUSE

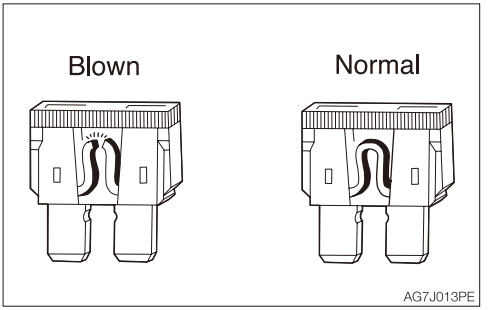
⚠ WARNING

If the fuse blows again soon after replacement, then the electric system is likely faulty. It may pose a fire hazard if not properly repaired. Contact your sales or service dealer for advice.

1. Turn the starter key to the OFF position to stop the engine.

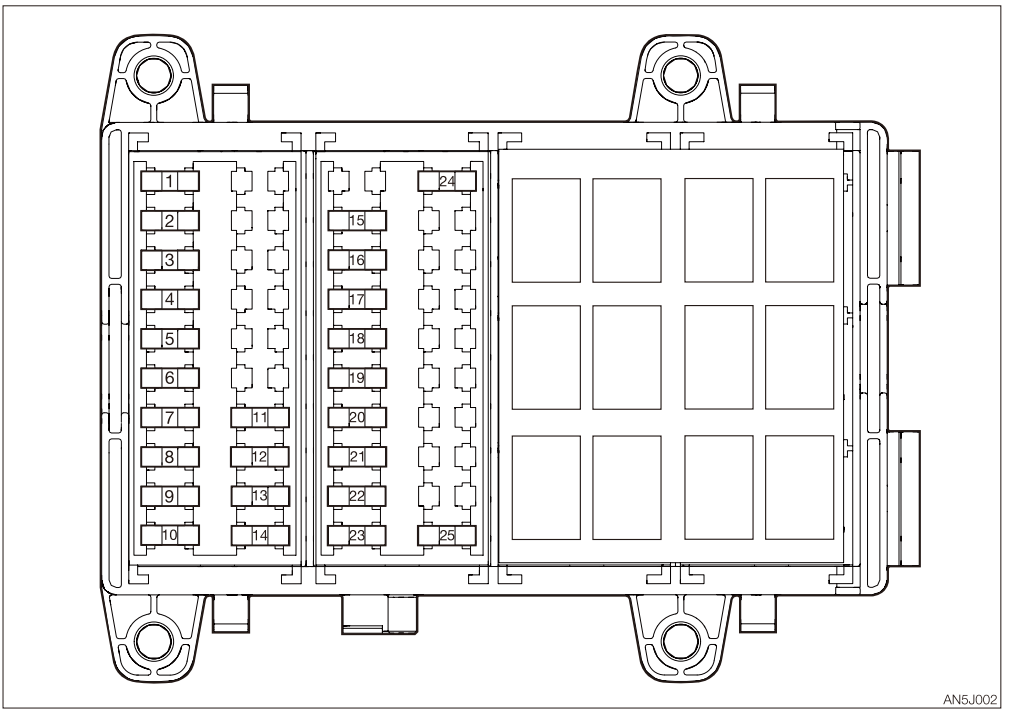


2. Open the fuse box cover (1).
3. Inspect for blown fuses.



4. If a fuse is blown, replace it with a spare fuse of the same capacity.

Fuse layout and circuits protected

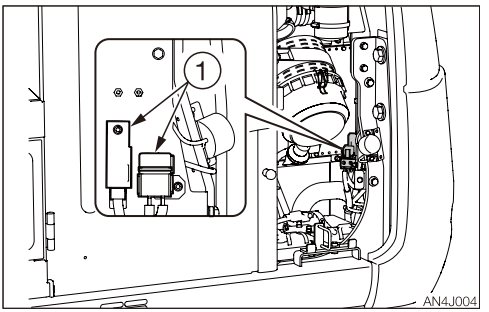


No.	Capacity	Symbol	Protected circuit	Fuse No.
1	25A		Fan switch	F10
2	10A		Air conditioner switch	F9
3	15A	OPT (2)	Option (2)	F8
4	10A	OPT (1)	Option (1)	F7
5	25A	CAB	Cab	F6
6	10A		Display	F5
7	10A		Controller, travel alarm	F4
8	20A		Safety lock lever	F3
9	10A		Wiper	F2
10	20A		Lights	F1
11	5A	OPT (12V)	Option (12V)	F14
12	15A		NOx sensor	F13

No.	Capacity	Symbol	Protected circuit	Fuse No.
13	5A		DEF sensor	F12
14	3A		Immobilizer	F11
15	10A		Controller	F29
16	10A		Display	F28
17	3A		Immobilizer	F27
18	25A		Fuel supply pump	F26
19	30A		ECU	F25
20	20A 10A**		Feed pump	F24
21	30A		SCR system	F23
22	10A		Starter switch	F22
23	10A		Horn	F21
24	10A	OPT (12V)	Option (12V)	F40
25*	5A		Pre heater	F31

*: Applicable machine models 514601202 or later
**: Applicable machine models 514601295 or later
Applicable machine models 514701167, 514701169 or later

INSPECTING THE SLOW BLOW FUSE



If the machine is not turned on after turning the starter switch to the ON position, the cartridge type slow blow fuse (1) is likely blown. Open the left side cover for inspection. If the slow blow fuse is blown, contact your sales or service dealer.

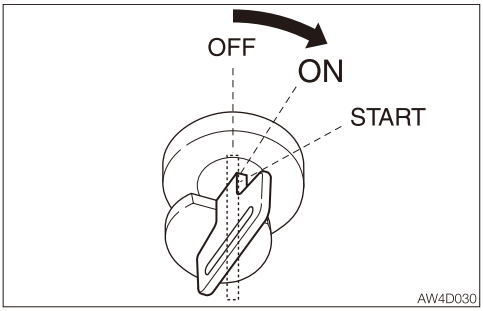
Note: Slow blow fuses are large type fuses used in high current applications. Like a regular fuse, they act as fuses by protecting the electric components and wirings from damage caused by excessive current draw.

RESTARTING AFTER ADDING FUEL

BLEEDING AIR FROM THE FUEL SYSTEM

IMPORTANT: NEVER use the starter motor to crank the engine in order to prime the fuel system. This may cause the starter motor to overheat and damage the coils, pinion gear and/or ring gear.
IMPORTANT: If the engine stalls due to fuel shortage, add fuel, turn the key to the ON position for 60 seconds, and then turn it to the START position. Running the starter for a long time before there is enough fuel is going through can cause the starter to fail.

1. Add fuel.



2. Turn the starter switch to the ON position and hold it there for 20 seconds.
   Air is released from the pump during this period.
3. Turn the starter switch to the OFF position, and then to the ON position. Hold it there for 20 seconds again.
   Repeat this step at least twice until air is completely released.

Note: Air in the fuel system causes the engine to fail to start or to have other problems. Always bleed air when the fuel tank is emptied or when there is air in the fuel system.

RESTARTING WHEN THE DEF/ ADBLUE® LEVEL IS LOW OR THE TANK IS EMPTY

1. Turn the starter switch to the OFF position.
2. Refill the DEF/AdBlue® tank
3. Perform the warm-up operation until the warning lamp goes out.
4. If the warning lamp does not go out, turn the starter switch to the OFF position, and then restart the machine.

IF A WARNING LAMP FLASHES

If an alarm is sounded or a warning lamp starts flashing during operation, park the machine in a safe place and perform the remedy procedures described below.

Warning lamp	Lamp name	Causes and remedies
 AW4J0041	**ECM error warning lamp**	There is a problem in the engine. If an error code is displayed on the multi-information display, inform your sales or service dealer of the code and ask for help. Refer to “Multi-information display” on page 2-20 to 2-47. Refer to “Engine error code list” on pages 6-18 to 6-33.
 AN4J005	**Engine stop request warning lamp**	
 AW4J007	**Vehicle and engine emergency lamp**	There is a problem in the machine. Refer to the respective warning lamp below. Get the vehicle or engine error code number from the multi- information display and consult your sales or service dealer referring to the number on the “Vehicle error code list” or “Engine error code list”. Refer to “Multi-information display” on page 2-20 to 2-47. Refer to “Vehicle error code list” on pages 6-16 and 6-17. Refer to “Engine error code list” on pages 6-18 to 6-33.
 AG7J018	**Coolant temperature warning lamp**	The coolant temperature is too high and the engine is overheating. Refer to “If the engine overheats” on page 6-3.
 AN4J006	**Coolant level warning lamp**	The coolant level is too low. Make sure that there is no leakage, and then add the coolant.

Warning lamp	Lamp name	Causes and remedies
 AG7J017	**Engine oil pressure warning lamp**	There is a problem in the engine lubrication system. Check the engine oil level. If the lamp is flashing when the level is normal or even after replenishment of oil or coolant, consult your sales or service dealer. Refer to “Inspecting and replenishing the engine oil” on page 5-24.
 AN4J008	**DEF/AdBlue® level warning lamp**	The DEF/AdBlue® level is low. Make sure that there is no leakage, and then add the DEF/AdBlue® solution. Refer to “Checking the DEF/AdBlue® level and refilling” on page 5-33.
 AR0J004	**SCR system warning lamp**	There is a problem in the SCR system. Contact a Takeuchi service dealer for advice.
 AR0J005	**DEF/AdBlue® quality indicator lamp**	The DEF/AdBlue® quality is deteriorated. Replace with the DEF/AdBlue® solution that complies the correct Standard.
 AG7J019	**Battery charge warning lamp**	There is a problem with the V-rib belt or charger. Check the V-rib belt for slack or breakage and adjust as necessary. If the lamp continues flashing after maintenance, there is likely a problem with the charger. Contact a Takeuchi service dealer for assistance. Refer to “Replacing the V-rib belt” on page 5-65.

Warning lamp	Lamp name	Causes and remedies
 AW4J009	**Water separator warning lamp**	Water is in the water separator. Drain water. Refer to “Inspecting the pre-fuel filter and draining” on page 5-26.
 AG7J020	**Air cleaner warning lamp**	The air cleaner is clogged. Clean it. Refer to “Inspecting and cleaning the air cleaner” on page 5-30.
 AU7J002	**Hydraulic oil temp. warning lamp**	The hydraulic oil temperature became too high due to machine overworking. Stop operation, run the engine at low idle and let the hydraulic oil cool down.
 AQ0J004	**Third auxiliary hydraulic warning lamp**	Pressure in the third auxiliary hydraulic line is too low Consult your sales or service dealer for help.
 AW4J010	**Fuel level warning lamp**	The fuel level is too low. Add fuel. Refer to “Inspecting the fuel level” on page 5-27.
 AM1J005	**Lift overload warning lamp**	This lamp starts flashing if the overload warning device is activated. If it occurs, reduce the load to be lifted. Refer to “Lift overload warning switch” on page 2-57.
 AW8J001	**Auto greasing warning indicator lamp**	The grease tank is empty or the fuse is blown; greasing is disabled. • Add grease to the grease tank • Identify the blown fuse and replace it with a new one.

VEHICLE ERROR CODE LIST

If an error code appears on the display, consult your sales or service dealer.

Error code	Error details
9	Impossible to sense ACC key
402	CAN 0 communication error
502	CAN communication error (ECM)
602	CAN communication error (cluster gauge)
612	CAN communication error (OX)
652	CAN communication error (IOX)
702	CAN communication error (HVAC)
822	CAN communication error (TAKEUCHI Security System)
1703	Main power supply voltage error (too high)
1704	Main power supply voltage error (too low)
1713	OX power supply voltage error (too high)
1714	OX power supply voltage error (too low)
1733	IOX power supply voltage error (too high)
1734	IOX power supply voltage error (too low)
2503	MC sensor voltage error (too high)
2504	MC Sensor voltage error (too low)
2513	IOX sensor voltage error (too high)
2514	IOX sensor voltage error (too low)
3300	Alternator charge faulty
3401	Engine oil pressure error
3500	Overheat
3600	Air cleaner clogged
3700	Water separator
3820	Hydraulic oil temp. too high
3823	Hydraulic oil temp. sensor voltage error (too high)
3824	Hydraulic oil temp. sensor voltage error (too low)

Error code	Error details
5303	Accelerator sensor error (short circuit)
5304	Accelerator sensor error (cable break)
5503	Fuel sender voltage error (too high)
5504	Fuel sender voltage error (too low)
5603	Lift alarm sensor error (short circuit)
5604	Lift alarm sensor error (cable break)
5833	Pressure sensor P3 error (short-circuit)
5834	Pressure sensor P3 error (cable break)
6503	AUX1 slide switch voltage value error (too high)
6504	AUX1 slide switch voltage value error (too low)
6509	AUX1 slide switch neutral error
6519	AUX1 (L) switch error
6529	AUX1 (R) switch error
6609	AUX2 slide switch neutral error
6603	AUX2 slide switch voltage value error (too high)
6604	AUX2 slide switch voltage value error (too low)
6709	AUX3 switch error
6859	Grease level low
8005	Pump PWM output electric current error (too low)
8015	AUX1 (L) PWM output electric current error (too low)
8025	AUX1 (R) PWM output electric current error (too low)
8035	AUX2 (L) PWM output electric current error (too low)
8045	AUX2 (R) PWM output electric current error (too low)
8055	Fan drive PWM output voltage error (too low)
8715	AUX1 pressure SOL output electric current error (too low)
8725	AUX2 pressure SOL output electric current error (too low)
9900	Options settings change (TFM)
9990	Model changed
9991	Unknown model

PWM = Pulse width modulation

<Applicable machine models 514700950 or later>

ENGINE ERROR CODE LIST

If an error code appears on the display, consult your sales or service dealer.

SPN	FMI	Error description
29	2	Machine - Position accelerator pedal 2 - Data erratic intermittent or incorrect
29	3	Machine - Position accelerator pedal 2 - Voltage above normal or shorted to high source
29	4	Machine - Position accelerator pedal 2 - Voltage below normal or shorted to low source
51	0	Engine - Throttle valve position - Data above normal operational range (Most severe level)
51	1	Engine - Throttle valve position - Data below normal operational range (Most severe level)
51	3	Engine - Throttle valve position - Voltage above normal or shorted to high source
51	4	Engine - Throttle valve position - Voltage below normal or shorted to low source
51	5	Engine - Throttle valve position - Current below normal or open circuit
51	6	Engine - Throttle valve position - Current above normal or grounded circuit
51	7	Engine - Throttle valve position - Mechanical system not responding or out of adjustment
51	11	Engine - Throttle valve position - Root cause not known
51	12	Engine - Throttle valve position - Bad intelligent device or component
91	3	Machine - Position accelerator pedal - Voltage above normal or shorted to high source
91	4	Machine - Position accelerator pedal - Voltage below normal or shorted to low source
91	11	Machine - Position accelerator pedal - Root cause not known
94	1	Engine - Fuel low pressure sensor - Data below normal operational range (Most severe level)
94	3	Engine - Fuel low pressure sensor - Voltage above normal or shorted to high source
94	4	Engine - Fuel low pressure sensor - Voltage below normal or shorted to low source
97	3	Engine - Water in fuel sensor - Voltage above normal or shorted to high source
97	4	Engine - Water in fuel sensor - Voltage below normal or shorted to low source
97	12	Engine - Water in fuel sensor - Bad intelligent device or component

SPN	FMI	Error description
100	0	Engine - Oil pressure sensor - Data above normal operational range (Most severe level)
100	1	Engine - Oil pressure sensor - Data below normal operational range (Most severe level)
100	3	Engine - Oil pressure sensor - Voltage above normal or shorted to high source
100	4	Engine - Oil pressure sensor - Voltage below normal or shorted to low source
102	1	Engine - Charge air pressure sensor - Data below normal operational range (Most severe level)
102	2	Engine - Charge air pressure sensor - Data erratic intermittent or incorrect
102	3	Engine - Charge air pressure sensor - Voltage above normal or shorted to high source
102	4	Engine - Charge air pressure sensor - Voltage below normal or shorted to low source
105	0	Engine - Charge air temperature sensor - Data above normal operational range (Most severe level)
105	1	Engine - Charge air temperature sensor - Data below normal operational range (Most severe level)
105	3	Engine - Charge air temperature sensor - Voltage above normal or shorted to high source
105	4	Engine - Charge air temperature sensor - Voltage below normal or shorted to low source
105	11	Engine - Charge air temperature sensor - Root cause not known
107	0	Engine - Air filter differential pressure sensor - Data above normal operational range (Most severe level)
107	3	Engine - Air filter differential pressure sensor - Voltage above normal or shorted to high source
108	0	Engine - Ambient pressure sensor - Data above normal operational range (Most severe level)
108	1	Engine - Ambient pressure sensor - Data below normal operational range (Most severe level)
108	3	Engine - Ambient pressure sensor - Voltage above normal or shorted to high source
108	4	Engine - Ambient pressure sensor - Voltage below normal or shorted to low source
108	11	Engine - Ambient pressure sensor - Root cause not known

SPN	FMI	Error description
110	0	Engine - Coolant temperature sensor - Data above normal operational range (Most severe level)
110	1	Engine - Coolant temperature sensor - Data below normal operational range (Most severe level)
110	3	Engine - Coolant temperature sensor - Voltage above normal or shorted to high source
110	4	Engine - Coolant temperature sensor - Voltage below normal or shorted to low source
111	1	Engine - Coolant level sensor - Data below normal operational range (Most severe level)
132	11	Engine - Air mass - Root cause not known
157	3	Engine - Rail pressure sensor - Voltage above normal or shorted to high source
157	4	Engine - Rail pressure sensor - Voltage below normal or shorted to low source
164	2	Engine - Rail pressure - Data erratic intermittent or incorrect
168	0	Machine - Battery voltage - Data above normal operational range (Most severe level)
168	1	Machine - Battery voltage - Data below normal operational range (Most severe level)
168	2	Machine - Battery voltage - Data erratic intermittent or incorrect
168	3	Machine - Battery voltage - Voltage above normal or shorted to high source
168	4	Machine - Battery voltage - Voltage below normal or shorted to low source
171	0	Engine - Ambient air temperature sensor - Data above normal operational range (Most severe level)
171	1	Engine - Ambient air temperature sensor - Data below normal operational range (Most severe level)
171	3	Engine - Ambient air temperature sensor - Voltage above normal or shorted to high source
171	4	Engine - Ambient air temperature sensor - Voltage below normal or shorted to low source
172	0	Engine - Ambient air temperature sensor - Data above normal operational range (Most severe level)
172	1	Engine - Ambient air temperature sensor - Data below normal operational range (Most severe level)
172	2	Engine - Ambient air temperature sensor - Data erratic intermittent or incorrect
172	3	Engine - Ambient air temperature sensor - Voltage above normal or shorted to high source
172	4	Engine - Ambient air temperature sensor - Voltage below normal or shorted to low source
175	0	Engine - Oil temperature - Data above normal operational range (Most severe level)

SPN	FMI	Error description
175	3	Engine - Oil temperature - Voltage above normal or shorted to high source
175	4	Engine - Oil temperature - Voltage below normal or shorted to low source
190	0	Engine - Rotation speed - Data above normal operational range (Most severe level)
190	2	Engine - Rotation speed - Data erratic intermittent or incorrect
190	8	Engine - Rotation speed - Abnormal frequency or pulse width or period
190	11	Engine - Rotation speed - Root cause not known
190	12	Engine - Rotation speed - Bad intelligent device or component
190	14	Engine - Rotation speed - Special instructions
411	0	Engine - EGR differential pressure - Data above normal operational range (Most severe level)
411	2	Engine - EGR differential pressure - Data erratic intermittent or incorrect
411	3	Engine - EGR differential pressure - Voltage above normal or shorted to high source
411	4	Engine - EGR differential pressure - Voltage below normal or shorted to low source
411	11	Engine - EGR differential pressure - Root cause not known
412	3	Engine - EGR temperature sensor - Voltage above normal or shorted to high source
412	4	Engine - EGR temperature sensor - Voltage below normal or shorted to low source
520	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout
624	3	Machine - Amber warning lamp - Voltage above normal or shorted to high source
624	4	Machine - Amber warning lamp - Voltage below normal or shorted to low source
624	5	Machine - Amber warning lamp - Current below normal or open circuit
624	12	Machine - Amber warning lamp - Bad intelligent device or component
630	12	Engine - ECU calibration memory - Bad intelligent device or component
639	14	Machine - CAN - Special instructions
651	3	Engine - Injector 1 - Voltage above normal or shorted to high source
651	5	Engine - Injector 1 - Current below normal or open circuit
652	3	Engine - Injector 2 - Voltage above normal or shorted to high source
652	5	Engine - Injector 2 - Current below normal or open circuit
653	3	Engine - Injector 3 - Voltage above normal or shorted to high source
653	5	Engine - Injector 3 - Current below normal or open circuit
654	3	Engine - Injector 4 - Voltage above normal or shorted to high source
654	5	Engine - Injector 4 - Current below normal or open circuit

SPN	FMI	Error description
655	3	Engine - Injector 5 - Voltage above normal or shorted to high source
655	5	Engine - Injector 5 - Current below normal or open circuit
656	3	Engine - Injector 6 - Voltage above normal or shorted to high source
656	5	Engine - Injector 6 - Current below normal or open circuit
676	11	Engine - Glow plug relay - Root cause not known
677	3	Engine - Starter relay - Voltage above normal or shorted to high source
677	4	Engine - Starter relay - Voltage below normal or shorted to low source
677	5	Engine - Starter relay - Current below normal or open circuit
677	12	Engine - Starter relay - Bad intelligent device or component
729	3	Engine - Preheating relay - Voltage above normal or shorted to high source
729	4	Engine - Preheating relay - Voltage below normal or shorted to low source
729	5	Engine - Preheating relay - Current below normal or open circuit
729	12	Engine - Preheating relay - Bad intelligent device or component
898	9	Machine - Externally requested engine rotation speed - Abnormal update rate timeout
975	3	Engine - Fan - Voltage above normal or shorted to high source
975	4	Engine - Fan - Voltage below normal or shorted to low source
975	5	Engine - Fan - Current below normal or open circuit
1079	13	Engine - Sensor supply voltage - Out of calibration
1080	13	Engine - Sensor supply voltage 2 - Out of calibration
1109	2	Engine - Protection system requested shutdown - Data erratic intermittent or incorrect
1136	0	Engine - ECU temperature - Data above normal operational range (Most severe level)
1176	0	Engine - TC charge pressure - Data above normal operational range (Most severe level)
1176	1	Engine - TC charge pressure - Data below normal operational range (Most severe level)
1176	2	Engine - TC charge pressure - Data erratic intermittent or incorrect
1176	3	Engine - TC charge pressure - Voltage above normal or shorted to high source
1176	4	Engine - TC charge pressure - Voltage below normal or shorted to low source
1180	0	Engine - TC charge temperature before turbine - Data above normal operational range (Most severe level)
1180	1	Engine - TC charge temperature before turbine - Data below normal operational range (Most severe level)
1180	3	Engine - TC charge temperature before turbine - Voltage above normal or shorted to high source

SPN	FMI	Error description
1188	0	Engine - TC wastegate - Data above normal operational range (Most severe level)
1188	2	Engine - TC wastegate - Data erratic intermittent or incorrect
1188	3	Engine - TC wastegate - Voltage above normal or shorted to high source
1188	4	Engine - TC wastegate - Voltage below normal or shorted to low source
1188	6	Engine - TC wastegate - Current above normal or grounded circuit
1188	7	Engine - TC wastegate - Mechanical system not responding or out of adjustment
1188	11	Engine - TC wastegate - Root cause not known
1188	12	Engine - TC wastegate - Bad intelligent device or component
1188	13	Engine - TC wastegate - Out of calibration
1231	14	Machine - CAN - Special instructions
1235	14	Machine - CAN - Special instructions
1237	2	Engine - Shutdown override switch - Data erratic intermittent or incorrect
1322	12	Engine - Misfire for multiple cylinders - Bad intelligent device or component
1323	12	Engine - Misfire cylinder 1 - Bad intelligent device or component
1324	12	Engine - Misfire cylinder 2 - Bad intelligent device or component
1325	12	Engine - Misfire cylinder 3 - Bad intelligent device or component
1326	12	Engine - Misfire cylinder 4 - Bad intelligent device or component
1327	12	Engine - Misfire cylinder 5 - Bad intelligent device or component
1328	12	Engine - Misfire cylinder 6 - Bad intelligent device or component
1639	0	Engine - Fan rotation speed - Data above normal operational range (Most severe level)
1639	1	Engine - Fan rotation speed - Data below normal operational range (Most severe level)
1639	12	Engine - Fan rotation speed - Bad intelligent device or component
1761	0	Exhaust aftertreatment - DEF tank level sensor - Data above normal operational range (Most severe level)
1761	1	Exhaust aftertreatment - DEF tank level sensor - Data below normal operational range (Most severe level)
1761	2	Exhaust aftertreatment - DEF tank level sensor - Data erratic intermittent or incorrect
1761	14	Exhaust aftertreatment - DEF tank level sensor - Special instructions
2659	0	Engine - EGR mass flow - Data above normal operational range (Most severe level)
2659	1	Engine - EGR mass flow - Data below normal operational range (Most severe level)
2659	2	Engine - EGR mass flow - Data erratic intermittent or incorrect

SPN	FMI	Error description
2659	12	Engine - EGR mass flow - Bad intelligent device or component
2791	0	Engine - EGR actuator - Data above normal operational range (Most severe level)
2791	2	Engine - EGR actuator - Data erratic intermittent or incorrect
2791	3	Engine - EGR actuator - Voltage above normal or shorted to high source
2791	4	Engine - EGR actuator - Voltage below normal or shorted to low source
2791	6	Engine - EGR actuator - Current above normal or grounded circuit
2791	7	Engine - EGR actuator - Mechanical system not responding or out of adjustment
2791	12	Engine - EGR actuator - Bad intelligent device or component
2791	13	Engine - EGR actuator - Out of calibration
2791	16	Engine - EGR actuator - Data above normal operational range (Moderately severe level)
2797	4	Engine - Injector group - Voltage below normal or shorted to low source
2798	4	Engine - Injector group 2 - Voltage below normal or shorted to low source
3031	0	Exhaust aftertreatment - DEF tank temperature - Data above normal operational range (Most severe level)
3031	1	Exhaust aftertreatment - DEF tank temperature - Data below normal operational range (Most severe level)
3224	1	Exhaust aftertreatment - NOx sensor mixing section - Data below normal operational range (Most severe level)
3224	2	Exhaust aftertreatment - NOx sensor mixing section - Data erratic intermittent or incorrect
3224	9	Exhaust aftertreatment - NOx sensor mixing section - Abnormal update rate timeout
3234	2	Exhaust aftertreatment - NOx sensor after SCR - Data erratic intermittent or incorrect
3234	9	Exhaust aftertreatment - NOx sensor after SCR - Abnormal update rate timeout
3234	11	Exhaust aftertreatment - NOx sensor after SCR - Root cause not known
3241	0	Exhaust aftertreatment - Temperature before SCR Cat - Data above normal operational range (Most severe level)
3248	4	Exhaust aftertreatment - Temperature after DPF - Voltage below normal or shorted to low source
3251	0	Exhaust aftertreatment - DPF differential pressure - Data above normal operational range (Most severe level)
3251	1	Exhaust aftertreatment - DPF differential pressure - Data below normal operational range (Most severe level)
3253	2	Exhaust aftertreatment - DPF differential pressure - Data erratic intermittent or incorrect
3253	3	Exhaust aftertreatment - DPF differential pressure - Voltage above normal or shorted to high source

SPN	FMI	Error description
3253	4	Exhaust aftertreatment - DPF differential pressure - Voltage below normal or shorted to low source
3361	3	Exhaust aftertreatment - DEF metering unit - Voltage above normal or shorted to high source
3361	4	Exhaust aftertreatment - DEF metering unit - Voltage below normal or shorted to low source
3361	6	Exhaust aftertreatment - DEF metering unit - Current above normal or grounded circuit
3361	7	Exhaust aftertreatment - DEF metering unit - Mechanical system not responding or out of adjustment
3519	3	Exhaust aftertreatment - DEF tank temperature - Voltage above normal or shorted to high source
3519	4	Exhaust aftertreatment - DEF tank temperature - Voltage below normal or shorted to low source
3519	12	Exhaust aftertreatment - DEF tank temperature - Bad intelligent device or component
3519	13	Exhaust aftertreatment - DEF tank temperature - Out of calibration
3520	1	Exhaust aftertreatment - DEF quality sensor - Data below normal operational range (Most severe level)
3520	2	Exhaust aftertreatment - DEF quality sensor - Data erratic intermittent or incorrect
3520	3	Exhaust aftertreatment - DEF quality sensor - Voltage above normal or shorted to high source
3520	4	Exhaust aftertreatment - DEF quality sensor - Voltage below normal or shorted to low source
3520	8	Exhaust aftertreatment - DEF quality sensor - Abnormal frequency or pulse width or period
3520	13	Exhaust aftertreatment - DEF quality sensor - Out of calibration
3532	3	Exhaust aftertreatment - DEF tank level sensor - Voltage above normal or shorted to high source
3532	4	Exhaust aftertreatment - DEF tank level sensor - Voltage below normal or shorted to low source
3532	13	Exhaust aftertreatment - DEF tank level sensor - Out of calibration
3699	0	Exhaust aftertreatment - Passive regeneration - Data above normal operational range (Most severe level)
3699	2	Exhaust aftertreatment - Passive regeneration - Data erratic intermittent or incorrect
3711	12	Exhaust aftertreatment - Temperature during Stand Still - Bad intelligent device or component
3936	14	Exhaust aftertreatment - Time Stand Still - Special instructions
4171	2	Dynamic temperature check of temp before SCR
4243	11	Exhaust aftertreatment - SCR heater - Root cause not known
4334	0	Exhaust aftertreatment - DEF pump pressure - Data above normal operational range (Most severe level)

SPN	FMI	Error description
4334	1	Exhaust aftertreatment - DEF pump pressure - Data below normal operational range (Most severe level)
4334	2	Exhaust aftertreatment - DEF pump pressure - Data erratic intermittent or incorrect
4341	3	Exhaust aftertreatment - Heater DEF supply line - Voltage above normal or shorted to high source
4341	4	Exhaust aftertreatment - Heater DEF supply line - Voltage below normal or shorted to low source
4341	5	Exhaust aftertreatment - Heater DEF supply line - Current below normal or open circuit
4343	3	Exhaust aftertreatment - Heater DEF pressure line - Voltage above normal or shorted to high source
4343	4	Exhaust aftertreatment - Heater DEF pressure line - Voltage below normal or shorted to low source
4343	5	Exhaust aftertreatment - Heater DEF pressure line - Current below normal or open circuit
4343	11	Exhaust aftertreatment - Heater DEF pressure line - Root cause not known
4345	3	Exhaust aftertreatment - Heater DEF return line - Voltage above normal or shorted to high source
4345	4	Exhaust aftertreatment - Heater DEF return line - Voltage below normal or shorted to low source
4345	5	Exhaust aftertreatment - Heater DEF return line - Current below normal or open circuit
4345	11	Exhaust aftertreatment - Heater DEF return line - Root cause not known
4360	0	Exhaust aftertreatment - Temperature before SCR Cat - Data above normal operational range (Most severe level)
4360	1	Exhaust aftertreatment - Temperature before SCR Cat - Data below normal operational range (Most severe level)
4360	2	Exhaust aftertreatment - Temperature before SCR Cat - Data erratic intermittent or incorrect
4361	2	Exhaust aftertreatment - Dynamic temperature check before SCR - Data erratic intermittent or incorrect
4361	3	Exhaust aftertreatment - Temperature SCR Cat - Voltage above normal or shorted to high source
4361	4	Exhaust aftertreatment - Temperature SCR Cat - Voltage below normal or shorted to low source
4365	0	Exhaust aftertreatment - DEF tank temperature - Data above normal operational range (Most severe level)
4365	2	Exhaust aftertreatment - DEF tank temperature - Data erratic intermittent or incorrect
4365	3	Exhaust aftertreatment - DEF tank temperature - Voltage above normal or shorted to high source
4365	4	Exhaust aftertreatment - DEF tank temperature - Voltage below normal or shorted to low source

SPN	FMI	Error description
4365	12	Exhaust aftertreatment - DEF tank temperature - Bad intelligent device or component
4365	13	Exhaust aftertreatment - DEF tank temperature - Out of calibration
4366	3	Exhaust aftertreatment - DEF tank heating valve - Voltage above normal or shorted to high source
4366	4	Exhaust aftertreatment - DEF tank heating valve - Voltage below normal or shorted to low source
4366	5	Exhaust aftertreatment - DEF tank heating valve - Current below normal or open circuit
4374	13	Exhaust aftertreatment - DEF metering valve - Out of calibration
4375	3	Exhaust aftertreatment - DEF pump - Voltage above normal or shorted to high source
4375	4	Exhaust aftertreatment - DEF pump - Voltage below normal or shorted to low source
4375	5	Exhaust aftertreatment - DEF pump - Current below normal or open circuit
4376	3	Exhaust aftertreatment - DEF reverse valve - Voltage above normal or shorted to high source
4376	4	Exhaust aftertreatment - DEF reverse valve - Voltage below normal or shorted to low source
4376	5	Exhaust aftertreatment - DEF reverse valve - Current below normal or open circuit
4376	12	Exhaust aftertreatment - DEF reverse valve - Bad intelligent device or component
4765	0	Exhaust aftertreatment - Temperature bevor DOC - Data above normal operational range (Most severe level)
4766	0	Exhaust aftertreatment - Temperature after DOC - Data above normal operational range (Most severe level)
4768	2	Exhaust aftertreatment - Temperature sensor before DOC - Data erratic intermittent or incorrect
4768	3	Exhaust aftertreatment - Temperature sensor before DOC - Voltage above normal or shorted to high source
4768	4	Exhaust aftertreatment - Temperature sensor before DOC - Voltage below normal or shorted to low source
4769	2	Exhaust aftertreatment - Temperature sensor after DOC - Data erratic intermittent or incorrect
4769	3	Exhaust aftertreatment - Temperature sensor after DOC - Voltage above normal or shorted to high source
4769	4	Exhaust aftertreatment - Temperature sensor after DOC - Voltage below normal or shorted to low source
5763	0	Engine - EGR valve - Data above normal operational range (Most severe level)
5763	1	Engine - EGR valve - Data below normal operational range (Most severe level)
5763	3	Engine - EGR valve - Voltage above normal or shorted to high source

SPN	FMI	Error description
5763	4	Engine - EGR valve - Voltage below normal or shorted to low source
5763	5	Engine - EGR valve - Current below normal or open circuit
5763	6	Engine - EGR valve - Current above normal or grounded circuit
5763	7	Engine - EGR valve - Mechanical system not responding or out of adjustment
5763	11	Engine - EGR valve - Root cause not known
520521	5	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low.
523008	1	Engine - Manipulation monitoring - Data below normal operational range (Most severe level)
523008	2	Engine - Manipulation monitoring - Data erratic intermittent or incorrect
523009	9	Engine - Fuel pressure relief valve - Abnormal update rate timeout
523009	10	Engine - Fuel pressure relief valve - Abnormal rate of change
523090	2	Machine - Pre selection switch engine brake - Data erratic intermittent or incorrect
523211	9	Engine - CAN engine brake - Abnormal update rate timeout
523212	9	Engine - CAN engine protection - Abnormal update rate timeout
523216	9	Engine - CAN pre heating - Abnormal update rate timeout
523240	9	Engine - CAN Functional mode control - Abnormal update rate timeout
523330	14	Engine - Immobilizer - Special instructions
523350	4	Engine - Injectors bank 1 - Voltage below normal or shorted to low source
523352	4	Engine - Injectors bank 2 - Voltage below normal or shorted to low source
523354	12	Engine - Output power stage Injector - Bad intelligent device or component
523470	2	Engine - Fuel pressure relief valve - Data erratic intermittent or incorrect
523470	7	Engine - Fuel pressure relief valve - Mechanical system not responding or out of adjustment
523470	11	Engine - Fuel pressure relief valve - Root cause not known
523470	12	Engine - Fuel pressure relief valve - Bad intelligent device or component
523470	13	Engine - Fuel pressure relief valve - Out of calibration
523470	14	Engine - Fuel pressure relief valve - Special instructions
523550	12	Engine - Starter switch to long active - Bad intelligent device or component
523601	13	Engine - ECU Sensor supply voltage 3 - Out of calibration
523602	0	Engine - Fan rotation speed - Data above normal operational range (Most severe level)
523603	9	Engine - CAN ambient temperature - Abnormal update rate timeout
523605	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout
523606	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout

SPN	FMI	Error description
523612	3	Engine - ECU - Voltage above normal or shorted to high source
523612	4	Engine - ECU - Voltage below normal or shorted to low source
523612	12	Engine - ECU - Bad intelligent device or component
523612	14	Engine - ECU - Special instructions
523613	0	Engine - Fuel pressure - Data above normal operational range (Most severe level)
523613	1	Engine - Fuel pressure - Data below normal operational range (Most severe level)
523613	2	Engine - Fuel pressure - Data erratic intermittent or incorrect
523615	3	Engine - Fuel metering unit - Voltage above normal or shorted to high source
523615	4	Engine - Fuel metering unit - Voltage below normal or shorted to low source
523615	5	Engine - Fuel metering unit - Current below normal or open circuit
523615	12	Engine - Fuel metering unit - Bad intelligent device or component
523618	3	Machine - Transmission oil sensor - Voltage above normal or shorted to high source
523618	4	Machine - Transmission oil sensor - Voltage below normal or shorted to low source
523619	2	Exhaust aftertreatment - Temperature before SCR Cat - Data erratic intermittent or incorrect
523632	0	Exhaust aftertreatment - DEF pressure - Data above normal operational range (Most severe level)
523632	1	Exhaust aftertreatment - DEF pressure - Data below normal operational range (Most severe level)
523632	3	Exhaust aftertreatment - DEF pressure - Voltage above normal or shorted to high source
523632	4	Exhaust aftertreatment - DEF pressure - Voltage below normal or shorted to low source
523632	11	Exhaust aftertreatment - DEF pressure - Root cause not known
523632	16	Exhaust aftertreatment - DEF pressure - Data above normal operational range (Moderately severe level)
523632	18	Exhaust aftertreatment - DEF pressure - Data below normal operational range (Moderately severe level)
523633	11	Exhaust aftertreatment - Efficiency SCR system - Root cause not known
523668	11	Exhaust aftertreatment - Hardware failure temperature sensor DEF suction unit - Root cause not known
523669	11	Exhaust aftertreatment - Hardware failure quality sensor DEF suction unit - Root cause not known
523670	11	Exhaust aftertreatment - Hardware failure level sensor DEF suction unit - Root cause not known
523698	11	Engine - Shut down request from internal ECU monitoring - Root cause not known

SPN	FMI	Error description
523704	12	Engine - Engine controller 3 - Bad intelligent device or component
523717	12	Engine - CAN ambient conditions - Bad intelligent device or component
523718	3	Exhaust aftertreatment - SCR system - Voltage above normal or shorted to high source
523718	4	Exhaust aftertreatment - SCR system - Voltage below normal or shorted to low source
523718	5	Exhaust aftertreatment - SCR system - Current below normal or open circuit
523718	12	Exhaust aftertreatment - SCR system - Bad intelligent device or component
523719	3	Exhaust aftertreatment - SCR heater - Voltage above normal or shorted to high source
523719	4	Exhaust aftertreatment - SCR heater - Voltage below normal or shorted to low source
523719	5	Exhaust aftertreatment - SCR heater - Current below normal or open circuit
523720	2	Exhaust aftertreatment - Heater DEF metering unit - Data erratic intermittent or incorrect
523720	8	Exhaust aftertreatment - Heater DEF metering unit - Abnormal frequency or pulse width or period
523721	2	Exhaust aftertreatment - DEF temperature - Data erratic intermittent or incorrect
523721	8	Exhaust aftertreatment - DEF temperature - Abnormal frequency or pulse width or period
523721	11	Exhaust aftertreatment - DEF temperature - Root cause not known
523722	8	Exhaust aftertreatment - DEF temperature - Abnormal frequency or pulse width or period
523741	14	Machine - CAN shut down request from engine shut down - Special instructions
523766	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout
523767	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout
523768	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout
523769	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout
523776	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout
523777	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout
523778	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout
523779	9	Machine - CAN torque rotation speed control - Abnormal update rate timeout

SPN	FMI	Error description
523788	0	Engine - CAN TC - Data above normal operational range (Most severe level)
523788	12	Engine - CAN TC - Bad intelligent device or component
523793	9	Engine - CAN AGS - Abnormal update rate timeout
523794	9	Engine - CAN AGS - Abnormal update rate timeout
523803	9	Exhaust aftertreatment - CAN Burner air pump - Abnormal update rate timeout
523858	12	Engine - CAN AGS purification - Bad intelligent device or component
523867	12	Engine - CAN AGS burner air pump - Bad intelligent device or component
523895	13	Engine - Injector 1 IMA Code - Out of calibration
523896	13	Engine - Injector 2 IMA Code - Out of calibration
523897	13	Engine - Injector 3 IMA Code - Out of calibration
523898	13	Engine - Injector 4 IMA Code - Out of calibration
523899	13	Engine - Injector 5 IMA Code - Out of calibration
523900	13	Engine - Injector 6 IMA Code - Out of calibration
523906	3	Engine - Fuel pre feed pump - Voltage above normal or shorted to high source
523906	4	Engine - Fuel pre feed pump - Voltage below normal or shorted to low source
523906	5	Engine - Fuel pre feed pump - Current below normal or open circuit
523906	12	Engine - Fuel pre feed pump - Bad intelligent device or component
523910	0	Exhaust aftertreatment - Burner air pump - Data above normal operational range (Most severe level)
523910	6	Exhaust aftertreatment - Burner air pump - Current above normal or grounded circuit
523910	7	Exhaust aftertreatment - Burner air pump - Mechanical system not responding or out of adjustment
523910	9	Exhaust aftertreatment - Burner air pump - Abnormal update rate timeout
523910	12	Exhaust aftertreatment - Burner air pump - Bad intelligent device or component
523910	14	Exhaust aftertreatment - Burner air pump - Special instructions
523911	0	Exhaust aftertreatment - Burner dosing valve - Data above normal operational range (Most severe level)
523911	4	Exhaust aftertreatment - Burner dosing valve - Voltage below normal or shorted to low source
523911	11	Exhaust aftertreatment - Burner dosing valve - Root cause not known
523912	0	Exhaust aftertreatment - Pressure sensor after burner dosing valve - Data above normal operational range (Most severe level)
523912	1	Exhaust aftertreatment - Pressure sensor after burner dosing valve - Data below normal operational range (Most severe level)

SPN	FMI	Error description
523912	2	Exhaust aftertreatment - Pressure sensor after burner dosing valve - Data erratic intermittent or incorrect
523912	3	Exhaust aftertreatment - Pressure sensor after burner dosing valve - Voltage above normal or shorted to high source
523912	4	Exhaust aftertreatment - Pressure sensor after burner dosing valve - Voltage below normal or shorted to low source
523913	3	Engine - Diagnostic cable glow plug control - Voltage above normal or shorted to high source
523913	4	Engine - Diagnostic cable glow plug control - Voltage below normal or shorted to low source
523914	3	Engine - Glow plug control - Voltage above normal or shorted to high source
523914	4	Engine - Glow plug control - Voltage below normal or shorted to low source
523914	5	Engine - Glow plug control - Current below normal or open circuit
523914	12	Engine - Glow plug control - Bad intelligent device or component
523915	0	Exhaust aftertreatment - Burner post injection metering valve - Data above normal operational range (Most severe level)
523915	3	Exhaust aftertreatment - Burner post injection metering valve - Voltage above normal or shorted to high source
523915	4	Exhaust aftertreatment - Burner post injection metering valve - Voltage below normal or shorted to low source
523915	7	Exhaust aftertreatment - Burner post injection metering valve - Mechanical system not responding or out of adjustment
523915	11	Exhaust aftertreatment - Burner post injection metering valve - Root cause not known
523915	12	Exhaust aftertreatment - Burner post injection metering valve - Bad intelligent device or component
523916	0	Exhaust aftertreatment - Fuel pressure sensor after burner post injection metering valve - Data above normal operational range (Most severe level)
523916	1	Exhaust aftertreatment - Fuel pressure sensor after burner post injection metering valve - Data below normal operational range (Most severe level)
523916	2	Exhaust aftertreatment - Fuel pressure sensor after burner post injection metering valve - Data erratic intermittent or incorrect
523916	3	Exhaust aftertreatment - Fuel pressure sensor after burner post injection metering valve - Voltage above normal or shorted to high source
523916	4	Exhaust aftertreatment - Fuel pressure sensor after burner post injection metering valve - Voltage below normal or shorted to low source
523917	3	Exhaust aftertreatment - Pressure before burner fuel valve - Voltage above normal or shorted to high source
523917	4	Exhaust aftertreatment - Pressure before burner fuel valve - Voltage below normal or shorted to low source
523918	3	Exhaust aftertreatment - Burner metering unit - Voltage above normal or shorted to high source

SPN	FMI	Error description
523918	4	Exhaust aftertreatment - Burner metering unit - Voltage below normal or shorted to low source
523919	0	Exhaust aftertreatment - Burner air pump pressure sensor - Data above normal operational range (Most severe level)
523919	1	Exhaust aftertreatment - Burner air pump pressure sensor - Data below normal operational range (Most severe level)
523919	2	Exhaust aftertreatment - Burner air pump pressure sensor - Data erratic intermittent or incorrect
523919	3	Exhaust aftertreatment - Burner air pump pressure sensor - Voltage above normal or shorted to high source
523919	4	Exhaust aftertreatment - Burner air pump pressure sensor - Voltage below normal or shorted to low source
523920	0	Exhaust aftertreatment - Burner exhaust back pressure sensor - Data above normal operational range (Most severe level)
523920	2	Exhaust aftertreatment - Burner exhaust back pressure sensor - Data erratic intermittent or incorrect
523920	3	Exhaust aftertreatment - Burner exhaust back pressure sensor - Voltage above normal or shorted to high source
523920	4	Exhaust aftertreatment - Burner exhaust back pressure sensor - Voltage below normal or shorted to low source
523921	0	Exhaust aftertreatment - Burner firing chamber temperature - Data above normal operational range (Most severe level)
523921	1	Exhaust aftertreatment - Burner firing chamber temperature - Data below normal operational range (Most severe level)
523921	2	Exhaust aftertreatment - Burner firing chamber temperature - Data erratic intermittent or incorrect
523921	3	Exhaust aftertreatment - Burner firing chamber temperature - Voltage above normal or shorted to high source
523921	4	Exhaust aftertreatment - Burner firing chamber temperature - Voltage below normal or shorted to low source
523922	3	Exhaust aftertreatment - Burner metering unit shut-off valve - Voltage above normal or shorted to high source
523922	4	Exhaust aftertreatment - Burner metering unit shut-off valve - Voltage below normal or shorted to low source
523922	5	Exhaust aftertreatment - Burner metering unit shut-off valve - Current below normal or open circuit
523922	7	Exhaust aftertreatment - Burner metering unit shut-off valve - Mechanical system not responding or out of adjustment
523922	12	Exhaust aftertreatment - Burner metering unit shut-off valve - Bad intelligent device or component
523924	3	Engine - Actuator relay 2 - Voltage above normal or shorted to high source
523924	4	Engine - Actuator relay 2 - Voltage below normal or shorted to low source
523925	3	Engine - Actuator relay 3 - Voltage above normal or shorted to high source
523925	4	Engine - Actuator relay 3 - Voltage below normal or shorted to low source

SPN	FMI	Error description
523926	4	Engine - Actuator relay 4 - Voltage below normal or shorted to low source
523927	3	Engine - Actuator relay 6 - Voltage above normal or shorted to high source
523935	12	Engine - Engine controller 3 - Bad intelligent device or component
523936	12	Engine - Engine controller 3 - Bad intelligent device or component
523938	9	Exhaust aftertreatment - CAN exhaust inlet - Abnormal update rate timeout
523939	9	Exhaust aftertreatment - CAN exhaust inlet - Abnormal update rate timeout
523940	9	Exhaust aftertreatment - CAN exhaust inlet - Abnormal update rate timeout
523941	9	Exhaust aftertreatment - CAN exhaust inlet - Abnormal update rate timeout
523942	9	Exhaust aftertreatment - CAN exhaust inlet - Abnormal update rate timeout
523943	9	Exhaust aftertreatment - CAN exhaust inlet - Abnormal update rate timeout
523946	0	Engine - Injection Zero quantity calibration Injector 1 - Data above normal operational range (Most severe level)
523946	1	Engine - Injection Zero quantity calibration Injector 1 - Data below normal operational range (Most severe level)
523947	0	Engine - Injection Zero quantity calibration Injector 2 - Data above normal operational range (Most severe level)
523947	1	Engine - Injection Zero quantity calibration Injector 2 - Data below normal operational range (Most severe level)
523948	0	Engine - Injection Zero quantity calibration Injector 3 - Data above normal operational range (Most severe level)
523948	1	Engine - Injection Zero quantity calibration Injector 3 - Data below normal operational range (Most severe level)
523949	1	Engine - Injection Zero quantity calibration Injector 4 - Data below normal operational range (Most severe level)
523950	1	Engine - Injection Zero quantity calibration Injector 5 - Data below normal operational range (Most severe level)
523951	0	Engine - Injection Zero quantity calibration Injector 6 - Data above normal operational range (Most severe level)
523960	0	Engine - EGR temperature after EGR cooler - Data above normal operational range (Most severe level)
523960	1	Engine - EGR temperature after EGR cooler - Data below normal operational range (Most severe level)
523980	14	Exhaust aftertreatment - DEF metering quantity - Special instructions
523981	11	Exhaust aftertreatment - DEF tank heater - Root cause not known
523982	0	Engine - Power stage diagnostic - Data above normal operational range (Most severe level)
523982	1	Engine - Power stage diagnostic - Data below normal operational range (Most severe level)

SPN	FMI	Error description
523984	3	Engine - Actuator relay 7 - Voltage above normal or shorted to high source
523986	4	Engine - Actuator relay 6 - Voltage below normal or shorted to low source
523987	4	Engine - Actuator relay 7 - Voltage below normal or shorted to low source
523992	9	Engine - Fan - Abnormal update rate timeout
523995	13	Engine - Injector 7 IMA Code - Out of calibration
523996	13	Engine - Injector 8 IMA Code - Out of calibration
523997	4	Engine - Injectors bank 1 Secondary - Voltage below normal or shorted to low source
523998	4	Engine - Injectors bank 2 Secondary - Voltage below normal or shorted to low source
523999	12	Engine - Injector control Secondary - Bad intelligent device or component
524000	3	Engine - Injector 7 - Voltage above normal or shorted to high source
524000	5	Engine - Injector 7 - Current below normal or open circuit
524001	3	Engine - Injector 8 - Voltage above normal or shorted to high source
524001	5	Engine - Injector 8 - Current below normal or open circuit
524013	7	Exhaust aftertreatment - Burner operation - Mechanical system not responding or out of adjustment
524014	1	Engine - Air pressure glow plug flushing line - Data below normal operational range (Most severe level)
524016	2	Exhaust aftertreatment - Burner air pump - Data erratic intermittent or incorrect
524016	11	Exhaust aftertreatment - Burner air pump - Root cause not known
524018	14	Exhaust aftertreatment - DPF regeneration request - Special instructions
524019	11	Exhaust aftertreatment - Burner air line blocked - Root cause not known
524020	14	Exhaust aftertreatment - Burner regeneration lack of oxygen - Special instructions
524021	11	Exhaust aftertreatment - Burner fuel line - Root cause not known
524022	14	Exhaust aftertreatment - Soot load - Special instructions
524024	11	Exhaust aftertreatment - DOC temperature difference - Root cause not known
524025	5	Exhaust aftertreatment - Stand Still - Current below normal or open circuit
524025	8	Exhaust aftertreatment - Stand Still - Abnormal frequency or pulse width or period
524025	14	Exhaust aftertreatment - Stand Still - Special instructions
524029	2	Exhaust aftertreatment - CAN return actuator - Data erratic intermittent or incorrect
524030	7	Engine - EGR actuator - Mechanical system not responding or out of adjustment
524031	13	Engine - EGR actuator - Out of calibration

SPN	FMI	Error description
524032	2	Engine - EGR actuator - Data erratic intermittent or incorrect
524033	7	Engine - EGR actuator - Mechanical system not responding or out of adjustment
524034	3	Engine - Disc separator - Voltage above normal or shorted to high source
524034	4	Engine - Disc separator - Voltage below normal or shorted to low source
524034	5	Engine - Disc separator - Current below normal or open circuit
524034	12	Engine - Disc separator - Bad intelligent device or component
524036	12	Engine - Diagnostic injector Secondary - Bad intelligent device or component
524038	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524039	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524040	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524041	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524042	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524043	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524044	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524045	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524046	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524047	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524048	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524052	11	Exhaust aftertreatment - Power reduction on Main ECU triggered by fault on Secondary - Root cause not known
524057	2	Engine - Fuel low pressure pump - Data erratic intermittent or incorrect
524063	3	Exhaust aftertreatment - DEF heater - Voltage above normal or shorted to high source
524063	4	Exhaust aftertreatment - DEF heater - Voltage below normal or shorted to low source
524063	5	Exhaust aftertreatment - DEF heater - Current below normal or open circuit
524063	12	Exhaust aftertreatment - DEF heater - Bad intelligent device or component
524065	0	Exhaust aftertreatment - Pressure sensor before SCR Cat - Data above normal operational range (Most severe level)
524065	1	Exhaust aftertreatment - Pressure sensor before SCR Cat - Data below normal operational range (Most severe level)
524065	2	Exhaust aftertreatment - Pressure sensor before SCR Cat - Data erratic intermittent or incorrect
524065	3	Exhaust aftertreatment - Pressure sensor before SCR Cat - Voltage above normal or shorted to high source
524065	4	Exhaust aftertreatment - Pressure sensor before SCR Cat - Voltage below normal or shorted to low source

SPN	FMI	Error description
524067	0	Exhaust aftertreatment - DEF pump temperature - Data above normal operational range (Most severe level)
524067	1	Exhaust aftertreatment - DEF pump temperature - Data below normal operational range (Most severe level)
524067	2	Exhaust aftertreatment - DEF pump temperature - Data erratic intermittent or incorrect
524068	2	Engine - ECU Main Secondary identical - Data erratic intermittent or incorrect
524069	9	Engine - CAN Main Secondary - Abnormal update rate timeout
524070	2	Exhaust aftertreatment - NOx sensor before SCR Cat - Data erratic intermittent or incorrect
524071	2	Exhaust aftertreatment - NOx sensor after SCR Cat - Data erratic intermittent or incorrect
524072	2	Exhaust aftertreatment - NOx sensor before SCR Cat - Data erratic intermittent or incorrect
524073	2	Exhaust aftertreatment - NOx sensor after SCR Cat - Data erratic intermittent or incorrect
524074	2	Exhaust aftertreatment - NOx sensor after SCR Cat - Data erratic intermittent or incorrect
524074	9	Exhaust aftertreatment - NOx sensor after SCR Cat - Abnormal update rate timeout
524075	11	Exhaust aftertreatment - NOx sensor after SCR Cat - Root cause not known
524076	2	Exhaust aftertreatment - NOx sensor before SCR Cat - Data erratic intermittent or incorrect
524076	9	Exhaust aftertreatment - NOx sensor before SCR Cat - Abnormal update rate timeout
524077	11	Exhaust aftertreatment - NOx sensor before SCR Cat - Root cause not known
524078	9	Exhaust aftertreatment - NOx sensor after SCR Cat lambda - Abnormal update rate timeout
524079	9	Exhaust aftertreatment - NOx sensor after SCR Cat lambda - Abnormal update rate timeout
524080	9	Exhaust aftertreatment - NOx sensor before SCR Cat lambda - Abnormal update rate timeout
524081	9	Exhaust aftertreatment - NOx sensor before SCR Cat lambda - Abnormal update rate timeout
524082	9	Exhaust aftertreatment - NOx sensor after SCR Cat NOx - Abnormal update rate timeout
524083	9	Exhaust aftertreatment - NOx sensor after SCR Cat NOx - Abnormal update rate timeout
524084	9	Exhaust aftertreatment - NOx sensor before SCR Cat NOx - Abnormal update rate timeout
524085	9	Exhaust aftertreatment - NOx sensor before SCR Cat NOx - Abnormal update rate timeout