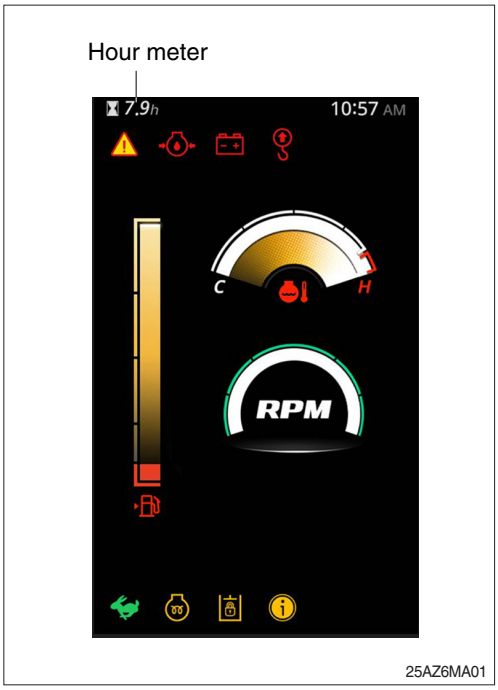
1. INSTRUCTION

1) INTERVAL OF MAINTENANCE

(1) You may inspect and service the machine by the period as described at page 6-9 based on hour meter at cluster.

(2) Shorten the interval of inspect and service depending on site condition. (Such as dusty area, quarry, sea shore and etc.)

(3) Practice the entire related details at the same time when the service interval is doubled.
For example, in case of 100 hours, carry out all the maintenance 「Each 100 hours, each 50 hours and daily service」 at the same time.



2) PRECAUTION

(1) Start to maintenance after you have the full knowledge of machine.

(2) The monitor installed on this machine does not entirely guarantee the condition of the machine. Daily inspection should be performed according to clause 4, maintenance check list.

(3) Engine and hydraulic components have been preset in the factory.
Do not allow unauthorized personnel to reset them.

(4) Ask to your local dealer or HD Hyundai Construction Equipment for the maintenance advice if unknown.

(5) Drain the used oil and coolant in a container and handle according to the method of handling for industrial waste to meet with regulations of each province or country.

3) PROPER MAINTENANCE

(1) Replace and repair of parts
It is required to replace the wearable and consumable parts such as bucket tooth, side cutter, filter and etc., regularly.
Replace damaged or worn parts at proper time to keep the performance of machine.

(2) Use genuine parts.

(3) Use the recommended oil.

(4) Remove the dust or water around the inlet of oil tank before supplying oil.

(5) Drain oil when the temperature of oil is warm.

(6) Do not repair anything while operating the engine.
Stop the engine when you fill the oil.

(7) Relieve hydraulic system of the pressure before repairing the hydraulic system.

(8) Confirm if the cluster is in the normal condition after completion of service.

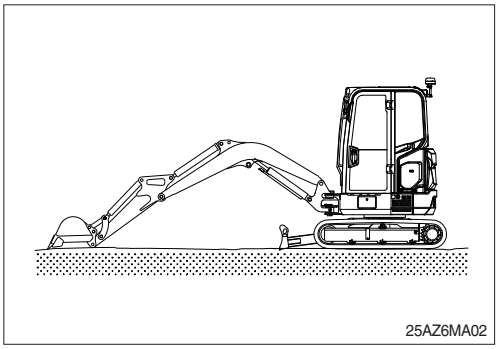
(9) For more detail information of maintenance, please contact local HD Hyundai Construction Equipment dealer.

※ **Be sure to start the maintenance after fully understand the chapter 1, safety hints.**

4) RELIEVING THE PRESSURE IN THE HYDRAULIC SYSTEM

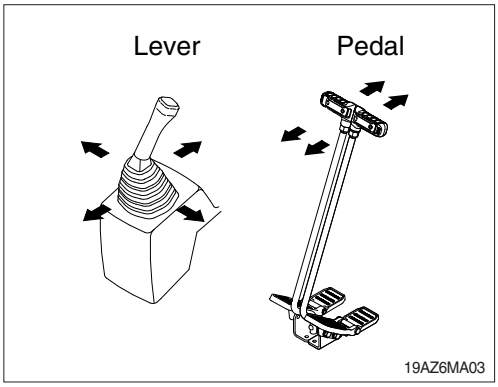
※ **Spouting of oil can cause the accident when loosening the cap or hose right after the operating of machine as the machine or oil is on the high pressure on the condition.**
Be sure to relieve the pressure in the system before repairing hydraulic system.

(1) Place machine in parking position, and stop the engine.



(2) Set the safety lever completely in the release position, operate the control levers and pedals fully to the front, rear, left and right, to release the pressure in the hydraulic circuit.

※ **This does not completely release the pressure, so when serving hydraulic component, loosen the connections slowly and do not stand in the direction where the oil spurt out.**



5) PRECAUTION WHEN INSTALLING HYDRAULIC HOSES OR PIPES

(1) Be particularly careful that the joint of hose, pipe and functioning item are not damaged.
Avoid contamination.

(2) Assemble after cleaning the hose, pipe and joint of functioning item.

(3) Use genuine parts.

(4) Do not assemble the hose in the condition of twisted or sharp radius.

(5) Keep the specified tighten torque.

6) PERIODICAL REPLACEMENT OF SAFETY PARTS

(1) It is desirable to do periodic maintenance the machine for using the machine safely for a long time.
However, recommend to replace regularly the parts related safety not only safety but maintain satisfied performance.

(2) These parts can cause the disaster of life and material as the quality changes by passing time and it is worn, diluted, and gets fatigued by using repeatedly.
These are the parts which the operator can not judge the remained lifetime of them by visual inspection.

(3) Repair or replace if an abnormality of these parts is found even before the recommended replacement interval.

<table>
<tr><th colspan="3">Periodical replacement of safety parts</th><th>Interval</th></tr>
<tr><td colspan="2">Engine</td><td>Fuel hose (tank-engine)</td><td>Every 2 years</td></tr>
<tr><td rowspan="9">Hydraulic system</td><td rowspan="3">Main circuit</td><td>Pump suction hose</td><td rowspan="3">Every 2 years</td></tr>
<tr><td>Pump delivery hose</td></tr>
<tr><td>Swing hose</td></tr>
<tr><td rowspan="6">Working device</td><td>Boom cylinder line hose</td><td rowspan="6">Every 2 years</td></tr>
<tr><td>Arm cylinder line hose</td></tr>
<tr><td>Bucket cylinder line hose</td></tr>
<tr><td>Dozer cylinder line hose</td></tr>
<tr><td>Boom swing cylinder line hose</td></tr>
<tr><td>Extension cylinder line hose</td></tr>
</table>

※1. Replace O-ring and gasket at the same time when replacing the hose.

2. Replace clamp at the same time if the hose clamp is cracked when checking and replacing the hose.

2. TIGHTENING TORQUE

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6 × 1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.7 ~ 4.1	19.5 ~ 29.7
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 81.0	9.8 ~ 15.8	70.9 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 163
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 344
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	349 ~ 458	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.0	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1656
M36 × 4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242

(2) Fine thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8 × 1.0	2.2 ~ 3.4	15.9 ~ 24.6	3.0 ~ 4.4	21.7 ~ 31.8
M10 × 1.2	4.5 ~ 6.7	32.5 ~ 48.5	5.9 ~ 8.9	42.7 ~ 64.4
M12 × 1.25	7.8 ~ 11.6	56.4 ~ 83.9	10.6 ~ 16.0	76.7 ~ 116
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 131	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 195	26.6 ~ 36.0	192 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 391	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 516	70.7 ~ 95.7	511 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 665	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1339	182 ~ 248	1314 ~ 1796
M36 × 3.0	192 ~ 260	1390 ~ 1880	262 ~ 354	1894 ~ 2562

2) PIPE AND HOSE (FLARE type)

Thread size (PF)	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

3) PIPE AND HOSE (ORFS type)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130
1-7/16-12	41	21	152
1-11/16-12	50	35	253

4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

5) TIGHTENING TORQUE OF MAJOR COMPONENT

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (engine-bracket)	M10 × 1.25	6.9±1.4	49.9±10.1
2		Engine mounting bolt (bracket-frame)	M12 × 1.75	13.0±1.0	94±7.2
3		Radiator mounting bolt, nut	M12 × 1.75	12.8±3.0	92.6±21.7
4		Coupling mounting bolt	M12 × 1.75	9.3±0.5	67.3±3.6
5		Flywheel housing mounting bolt, nut	M10 × 1.5	6.9±1.4	49.9±10.1
6		Fuel tank mounting bolt	M10 × 1.5	6.9±1.4	49.9±10.1
7	Hydraulic system	Main pump mounting bolt	M12 × 1.75	13.0±1.0	94±7.2
8		Main control valve mounting bolt	M10 × 1.5	6.9±1.4	49.9±10.1
9		Hydraulic oil tank mounting bolt	M12 × 1.75	12.8±3.0	92.6±21.7
10		Turning joint mounting bolt, nut	M10 × 1.5	6.9±1.4	49.9±10.1
11	Power train system	Swing motor mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
12		Swing bearing upper mounting bolt	M12 × 1.75	12.8±3.0	92.6±21.7
13		Swing bearing lower mounting bolt	M12 × 1.75	12.8±3.0	92.6±21.7
14		Travel motor mounting bolt	M12 × 1.75	12.8±3.0	92.6±21.7
15		Sprocket mounting bolt	M12 × 1.75	12.3±1.2	89±8.7
16	Under carriage	Upper roller mounting bolt, nut	M12 × 1.75	12.3±1.2	89±8.7
17		Lower roller mounting bolt	M16 × 1.5	31.3±3.0	226±21.7
18	Others	Counterweight mounting bolt	M20 × 2.5	59.7±8.7	419±62.9
19		Canopy/Cab mounting bolt, nut	M12 × 1.75	12.8±3.0	92.6±21.7
20		Operator's seat mounting bolt	M 8 × 1.25	2.5±0.5	18.1±3.6
21		Lower frame lower cover mounting bolt	M10 × 1.5	6.9±1.4	49.9±10.1
22		Travel motor cover mounting bolt	M10 × 1.5	6.9±1.4	49.9±10.1

3. FUEL, COOLANT AND LUBRICANTS

1) NEW MACHINE

New machine used and filled with following lubricants.

Description	Specification
Engine oil	SAE 15W-40 (API CI-4)
Hydraulic oil	HD Hyundai Construction Equipment genuine long life hydraulic oil (ISO VG 32, VG 46, VG 68) Conventional hydraulic oil (ISO VG 15, ★: Cold region)
Travel reduction gear	SAE 85W-140 (API GL-5)
Grease	Lithium base grease NLGI No. 2
Fuel	ASTM D975-No. 2, ★1: Ultra low sulfur diesel
Coolant (DCA4)	ASTM D6210 Mixture of 50% ethylene glycol base antifreeze and 50% water. Mixture of 60% ethylene glycol base antifreeze and 40% water.★

SAE : Society of Automotive Engineers
API : American Petroleum Institute
ISO : International Organization for Standardization
NLGI : National Lubricating Grease Institute
ASTM : American Society of Testing and Material
DCA4 : Brand name of Chemical Additive
manufactured by the Cummins Fleetguard Co.

★ : Cold region
Russia, CIS, Mongolia

★1 : Ultra low sulfur diesel
- sulfur content ≤ 10 ppm

※ Refer to page 2-82 for further information of recommended oils.

4. MAINTENANCE CHECK LIST

1) DAILY SERVICE BEFORE STARTING

Check items	Service	Page
Visual check		
Fuel tank	Check, Refill	6-24
Hydraulic oil level	Check, Add	6-27
Engine oil level	Check, Add	6-17
Radiator coolant level	Check, Add	6-19
Fan belt tension & damage	Check, Adjust	6-22
Control panel & pilot lamp	Check, Clean	6-35
Water separator	Check, Drain	6-25
★ Attachment pins	Lubricate	6-34
· Boom cylinder head and rod		
· Boom connecting		
· Arm cylinder head and rod		
· Boom + Arm connecting		
· Bucket cylinder head		

★ Lubricate every 10 hours or daily for initial 50 hours.

2) EVERY 50 HOURS SERVICE

Check items	Service	Page
Fuel tank (water, sediment)	Drain	6-24
Track tension	Check, Adjust	6-31
Swing gear and pinion	Lubricate	6-29
Bucket linkage and blade pin	Lubricate	6-34
· Bucket cylinder rod		
· Arm + Bucket connecting		
· Arm + Link, Bucket control		
· Bucket control rod		
· Boom swing post + Upper frame connecting		
· Boom swing cylinder head and rod		
· Dozer blade + Lower frame connecting		
· Dozer blade cylinder head and rod		

3) INITIAL 50 HOURS SERVICE

Check items	Service	Page
Boom swing cylinder	Check, Tight	6-29
Bolts and nuts	Lubricate	6-5
· Sprocket mounting bolts		
· Travel motor mounting bolts		
· Swing motor mounting bolts		
· Swing bearing mounting bolts		
· Engine mounting bolts		
· Counterweight mounting bolts		
· Turning joint locating bolts		
· Track shoe mounting bolts and nuts		
· Hydraulic pump mounting bolts		

※ Service the above items only for the new machine, and thereafter keep the normal service interval.

4) EVERY 200 HOURS SERVICE

Check items	Service	Page
★ Hydraulic oil return filter	Replace	6-28
★ Pilot line filter element	Replace	6-29

★ Replace the filter for continuous hydraulic breaker operation only.

5) INITIAL 250 HOURS SERVICE

Check items	Service	Page
Fuel filter element	Replace	6-24
Travel reduction gear oil	Change	6-30
Hydraulic oil return filter	Replace	6-28
Pilot line filter element	Replace	6-29

6) EVERY 250 HOURS SERVICE

Check items	Service	Page
★Engine oil	Change	6-17, 18
★Engine oil filter	Replace	6-17, 18
Battery (voltage)	Check	6-35
Swing bearing grease	Lubricate	6-29
Boom swing cylinder	Lubricate	6-29
Bolts and nuts	Check, Tight	6-5
· Sprocket mounting bolts		
· Travel motor mounting bolts		
· Swing motor mounting bolts		
· Swing bearing mounting bolts		
· Engine mounting bolts		
· Counterweight mounting bolts		
· Turning joint locating bolts		
· Track shoe mounting bolts and nuts		
· Hydraulic pump mounting bolts		
Attachment pins	Lubricate	6-34
· Boom cylinder head and rod		
· Boom connecting		
· Arm cylinder head and rod		
· Boom + Arm connecting		
· Bucket cylinder head		

★ If you use high sulfur containing fuel above than 0.5% or use low grade of engine oil reduce change interval.

7) EVERY 400 HOURS SERVICE

Check items	Service	Page
Fuel filter element	Replace	6-24
Water separator	Clean	6-25

8) EVERY 500 HOURS SERVICE

Check items	Service	Page
Fan belt	Replace	6-22
Radiator and cooler fin	Check, Clean	6-22
☆Air cleaner element (primary)	Clean	6-23

☆ **Clean the primary element only after 500 hours operation or when the air cleaner warning lamp blinks.**
Replace primary element and safety element after 4 times cleanings of primary element.

9) EVERY 1000 HOURS SERVICE

Check items	Service	Page
Heater filter	Replace	6-26
Hydraulic oil return filter	Replace	6-28
Pilot line filter element	Replace	6-29
Travel reduction gear oil	Change	6-30

10) EVERY 2000 HOURS SERVICE

Check items	Service	Page
Radiator coolant★1	Change	6-19, 20, 21
Hydraulic oil★1	Change	6-27
Hydraulic oil suction strainer	Check, Clean	6-28
Hoses, fittings, clamps (fuel, coolant, hydraulic)	Check, Retighten, Replace	-

★1 Conventional

※Change hydraulic oil every 600 hours of continuous hydraulic breaker operation.

11) EVERY 5000 HOURS SERVICE

Check items	Service	Page
Hydraulic oil★2	Change	6-27

★2 HD Hyundai Construction Equipment genuine long life

※Change hydraulic oil every 1000 hours of continuous hydraulic breaker operation.

12) EVERY 6000 HOURS SERVICE

Check items	Service	Page
Radiator coolant★2	Change	6-19, 20, 21

★2 HD Hyundai Construction Equipment genuine long life

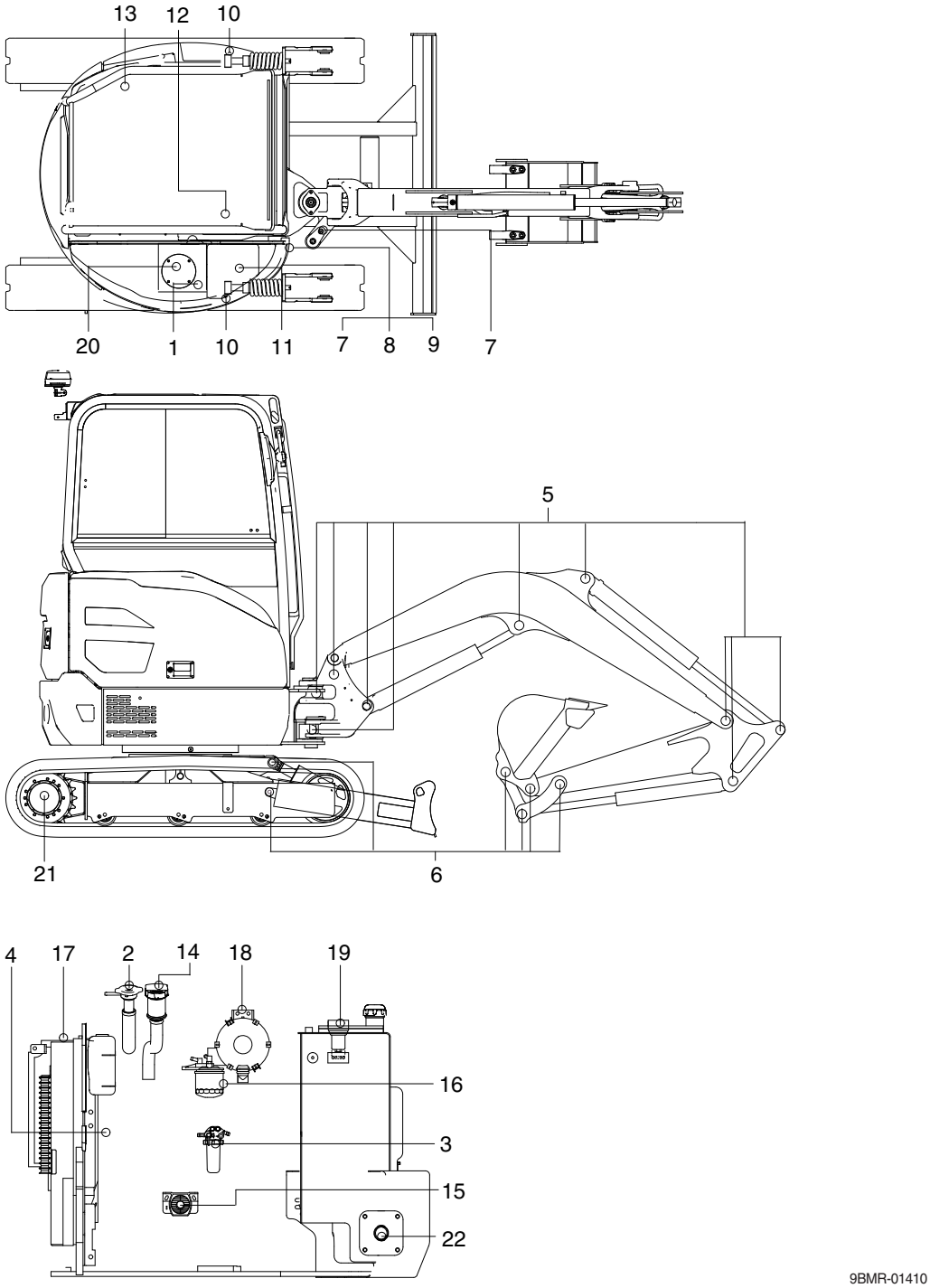
13) WHEN REQUIRED

Whenever you have trouble in the machine, you must perform the service of related items, system by system.

Check items	Service	Page
Fuel system		
· Fuel tank (water, sediment)	Drain or Clean	6-24
· Water separator	Drain or Replace	6-25
· Fuel filter element	Replace	6-24
Engine lubrication system		
· Engine oil	Change	6-17, 18
· Engine oil filter	Replace	6-17, 18
Engine cooling system		
· Radiator coolant	Add or Change	6-19, 20, 21
· Radiator and cooler	Clean or Flush	6-19, 20, 21, 22
Engine air system		
· Air cleaner element (primary)	Clean or Replace	6-23
· Air cleaner element (safety)	Replace	6-23
Hydraulic system		
· Hydraulic oil	Add or Change	6-27
· Hydraulic oil return filter	Replace	6-28
· Pilot line filter element	Replace	6-29
· Hydraulic oil suction strainer	Clean	6-28
Undercarriage		
· Track tension	Check, Adjust	6-31
Bucket		
· Tooth	Replace	6-33
· Side cutter	Replace	6-32
· Linkage	Adjust	6-32
· Bucket assy	Replace	6-32
Others		
· Heater filter	Clean or Replace	6-26

5. MAINTENANCE CHART

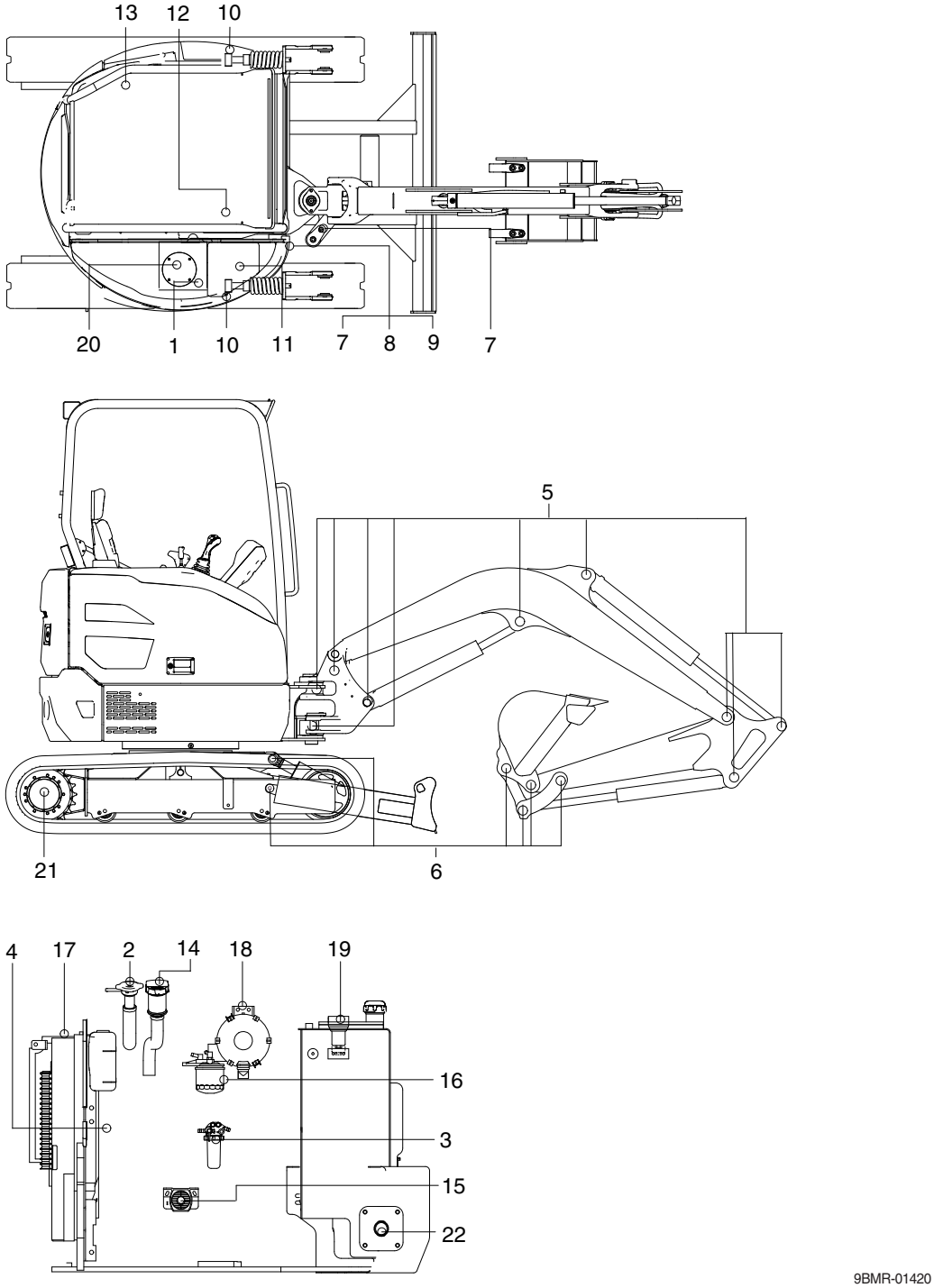
CAB TYPE



Caution

1. Service intervals are based on the hour meter reading.
2. The number of each item shows the lubrication point on the machine.
3. Stop engine while filling oil and do not allow any open flames near the machine.
4. The service intervals in this sign cannot be fit for rough work condition.
5. Do not open the cap or drain plug while hot temperature of fluid to prevent unexpected spouting.

CANOPY TYPE



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Caution

1. Service intervals are based on the hour meter reading.
2. The number of each item shows the lubrication point on the machine.
3. Stop engine while filling oil and do not allow any open flames near the machine.
4. The service intervals in this sign cannot be fit for rough work condition.
5. Do not open the cap or drain plug while hot temperature of fluid to prevent unexpected spouting.

Service interval	No.	Description	Service action	Oil symbol	Capacity ℓ (U.S.gal)	Service points No.
10 Hours or daily	1	Hydraulic oil level	Check, Add	HO	27 (7.1)	1
	2	Radiator coolant	Check, Add	C	6.9 (1.8)	1
	3	Water separator	Drain	-	-	1
	4	Fan belt tension and damage	Check, Adjust	-	-	1
	14	Engin oil level	Check, Add	EO	5.7 (1.5)	1
Initially 50 Hours	5	Attachment pins	Add, Lubricate	PGL	-	9
	7	Boom swing cylinder	Lubricate	PGL	-	2
50 Hours	6	Bucket linkage & blade pins	Lubricate	PGL	-	9
	9	Swing gear and pinion	Lubricate	PGL	-	1
	10	Track tension	Check, Adjust	-	-	2
	11	Fuel tank (water, sediment)	Drain	-	30 (7.9)	1
Initially 250 Hours	16	Fuel filter element	Replace	-	-	1
	19	Pilot line filter element	Replace	-	-	1
	20	Hydraulic oil return filter	Replace	-	-	1
	21	Travel reduction gear oil	Change	GO	0.6 (0.16)	2
250 Hours	5	Attachment pins	Lubricate	PGL	-	9
	7	Boom swing cylinder	Lubricate	PGL	-	2
	8	Swing bearing	Lubricate	PGL	-	1
	13	Battery (voltage)	Check, Clean	-	-	1
	14	Engine oil	Change	EO	5.7 (1.5)	1
	15	Engine oil filter	Replace	-	-	1
400 Hours	3	Water separator	Clean	-	-	1
	16	Fuel filter element	Replace	-	-	1
500 Hours	4	Fan belt	Replace	-	-	1
	17	Radiator and cooler fin	Check, Clean	-	-	2
	18	Air cleaner element (primary)	Check, Clean	-	-	1
1000 Hours	12	Heater filter	Replace	-	-	1
	19	Pilot line filter element	Replace	-	-	1
	20	Hydraulic oil return filter	Replace	-	-	1
	21	Travel reduction gear oil	Change	GO	0.6 (0.16)	2
2000 Hours	1	Hydraulic oil★1	Change	HO	27 (7.1)	1
	2	Radiator coolant★1	Change	C	6.9 (1.8)	1
	22	Hydraulic oil suction strainer	Clean	-	-	1
5000 Hours	1	Hydraulic oil★2	Change	-	-	1
6000 Hours	2	Radiator coolant★2	Change	C	6.9 (1.8)	1
As required	12	Heater filter	Clean, Replace	-	-	1
	18	Air cleaner element (safety, primary)	Replace	-	-	2
	19	Pilot line filter element	Replace	-	-	1

★1 Conventional

★2 HD Hyundai Construction Equipmentyundai genuine long life

※ Oil symbol

Please refer to the recommended lubricants for specification.

DF : Diesel fuel **GO : Gear oil** **HO : Hydraulic oil**

C : Coolant **PGL : Grease** **EO : Engine oil**

1) CHECK ENGINE OIL LEVEL

Check the oil level with the machine on a flat ground before starting engine.

(1) Pull out the dipstick and wipe with a clean cloth.

(2) Check the oil level by inserting the dipstick completely into the hole and pulling out again.
Check to see that the oil level lies between the upper line and lower line.

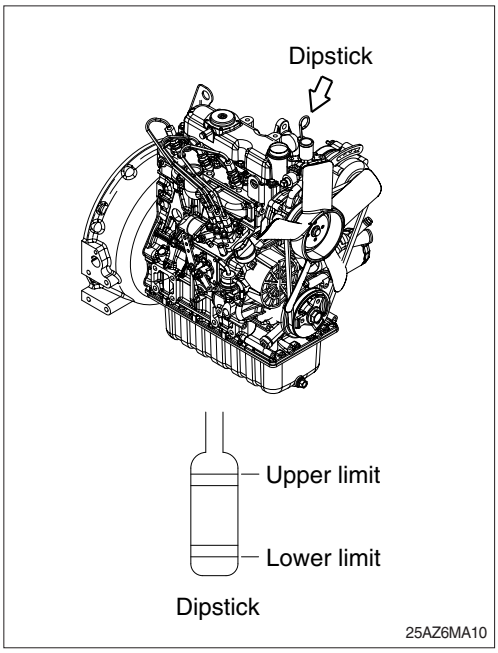
(3) If oil level is LOW, add oil and then check again.

※ **If the oil is contaminated or diluted, change the oil regardless of the regular change interval.**

※ **Check oil level after engine has been stopped for 15 minutes.**

⚠ **Do not operate unless the oil level is in the normal range.**

△ **When you use an oil of different brand or viscosity from the previous, drain the remaining oil. Do not mix 2 different types of oil.**



2) REPLACEMENT OF ENGINE OIL AND OIL FILTER

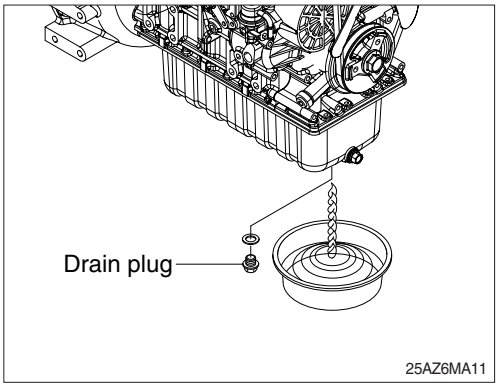
⚠ **To avoid personal injury or death :**

- Be sure to stop the engine before changing the engine oil filter.
- Allow engine to cool down sufficiently, oil can be hot and cause burns.

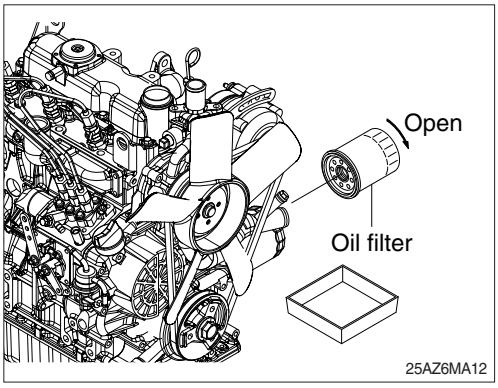
(1) Remove the drain plug and drain all the old oil.

※ **A drain pan with a capacity of 5.0 liters (1.3 U.S. gallons) will be adequate.**

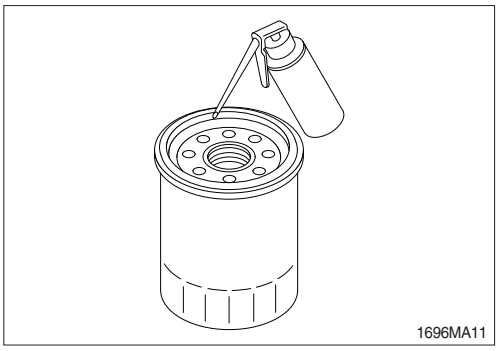
※ **Dispose of the waste oil in accordance with local regulations.**



(2) Clean around the filter head, remove the filter with a filter wrench and clean the gasket surface.



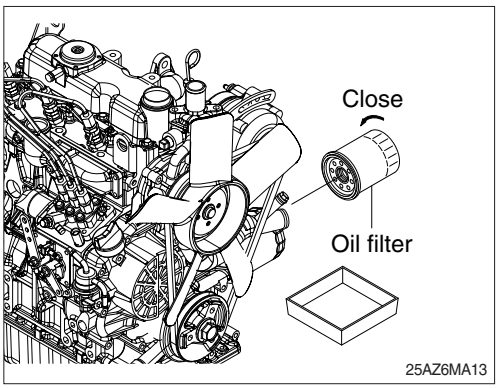
(3) Apply a light film of lubricating oil to the gasket sealing surface before installing the filters.



(4) To install the filter, screw it in by hand.

※ **Mechanical over-tightening may distort the threads or damage the filter element seal.**

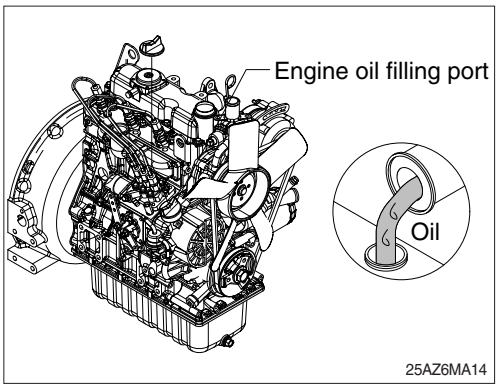
· Install the filter as specified by the filter manufacturer.



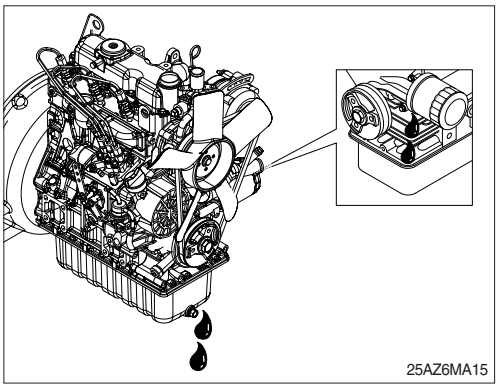
(5) Clean and check the lubricating oil drain plug threads and sealing surface.
Install the lubricating oil pan drain plug.

(6) Fill the engine with clean oil up to the upper line of the dipstick.

· Quantity : 5.7 ℓ (1.5 U.S.gallons)



(7) Operate the engine at low idle and inspect for leaks at the filters and the drain plug.
Shut the engine off and check the oil level with the dipstick.
Allow 5 minutes for oil to drain down before checking.



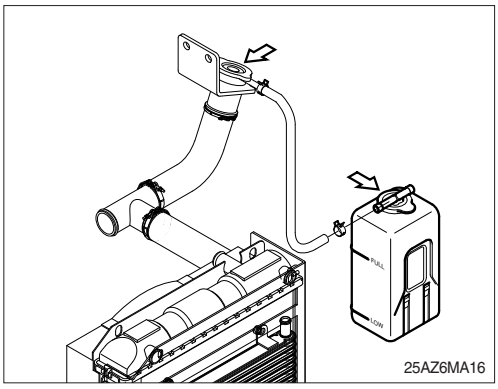
3) CHECK COOLANT

(1) Check if the level of coolant in reservoir tank is between FULL and LOW.

(2) Add the mixture of antifreeze and water after removing the cap of the reservoir tank if coolant is not sufficient.

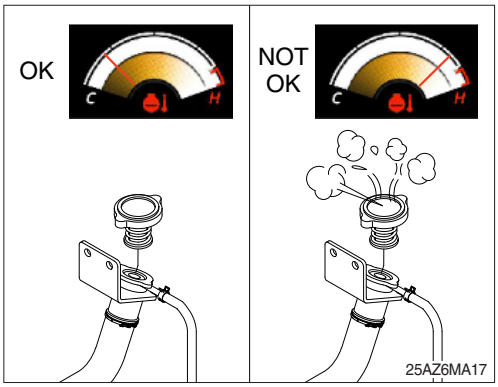
(3) Be sure to add the coolant by opening the cap of radiator when coolant level is below LOW.

(4) Replace gasket of radiator cap when it is damaged.



⚠ **Hot coolant can spray out if radiator cap is removed while engine is hot. Remove the cap after the engine has cooled down.**

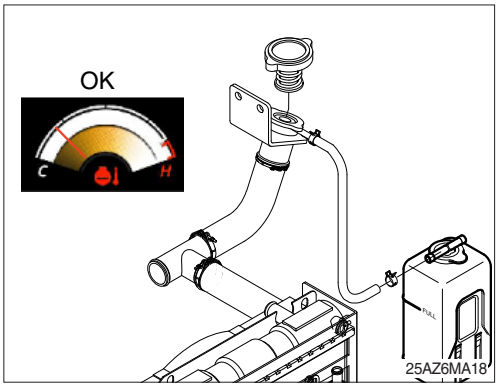
※ **Do not add cold coolant to a hot engine ; engine castings can be damaged. Allow the engine to cool to below 50°C (120°F) before adding coolant.**



4) FLUSHING AND REFILLING OF RADIATOR

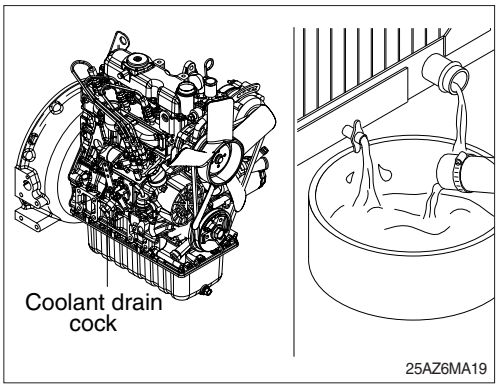
(1) Change coolant

⚠ **Avoid prolonged and repeated skin contact with used antifreeze.**
Such prolonged and repeated contact can cause skin disorders or other bodily injury.
Avoid excessive contact-wash thoroughly after contact.
Keep out of reach is made of children.



※ **Protect the environment : Handling and disposal of used antifreeze can be subject to federal, state, and local law regulation.**
Use authorized waste disposal facilities, including civic amenity sites and garages providing authorized facilities for the receipt of used antifreeze.
If in doubt, contact your local authorities for guidance as to proper handling of used antifreeze.

⚠ **Wait until the temperature is below 50°C (122°F) before removing the coolant system pressure cap.**
Failure to do so can cause personal injury from heated coolant spray.
Drain the cooling system by opening the drain valve on the radiator and opening the drain cock on the engine. A drain pan with a capacity of 10 liters (2.6 U.S.gallons) will be adequate in most applications.

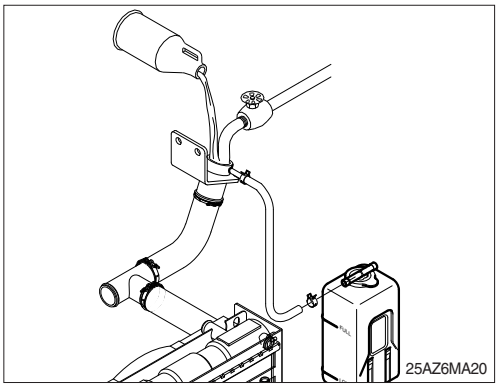


(2) Flushing of cooling system

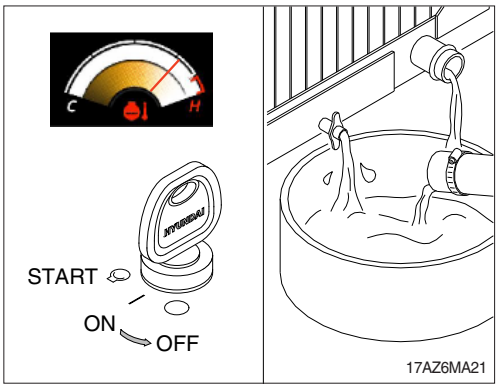
① Fill the system with a mixture of sodium carbonate and water (or a commercially available equivalent).

※ **Use 0.5 kg (1.0 pound) of sodium carbonate for every 23 liters (6.0 U.S. gallons) of water.**

※ **Do not install the radiator cap.**
The engine is to be operated without the cap for this process.



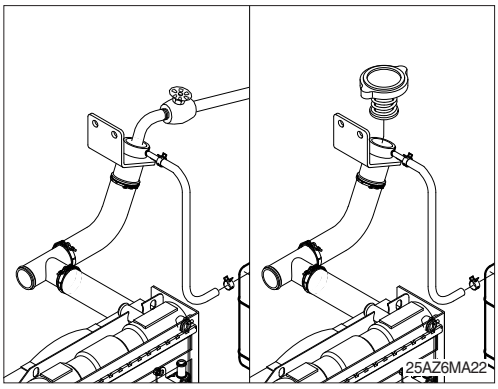
② Operate the engine for 5 minutes with the coolant temperature above 80°C (176°F).
Shut the engine off, and drain the cooling system.



③ Fill the cooling system with clean water.

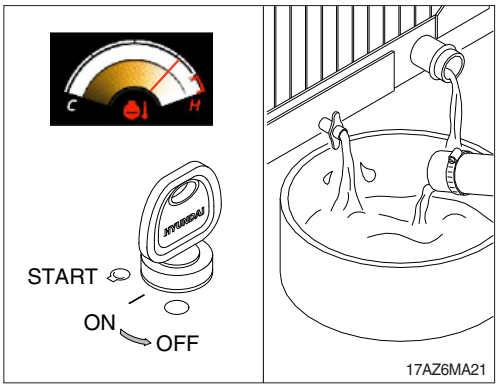
※ **Be sure to vent the engine and aftercooler for complete filling.**

※ **Do not install the radiator cap or the new coolant filter.**



④ Operate the engine for 5 minutes with the coolant temperature above 80°C(176°F) .
Shut the engine off, and drain the cooling system.

※ **If the water being drained is still dirty, the system must be flushed again until the water is clean.**

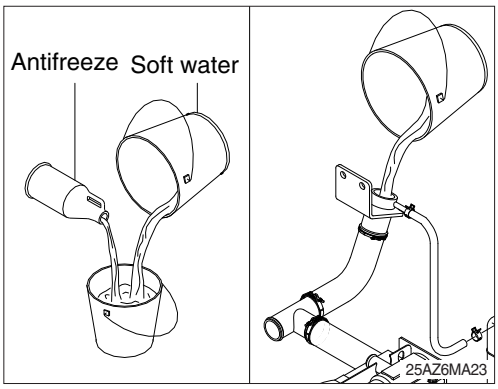


(3) Cooling system filling

① Use a mixture of 50 percent soft water and 50 percent ethylene glycol antifreeze to fill the cooling system. Refer to page 2-82.

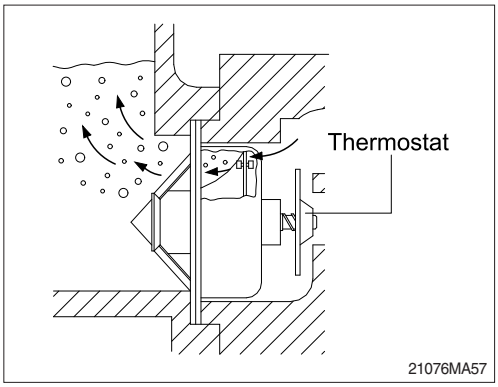
※ **Use the correct amount of DCA4 corrosion inhibitor to protect the cooling system.**

※ **Do not use hard water such as river water or well water.**

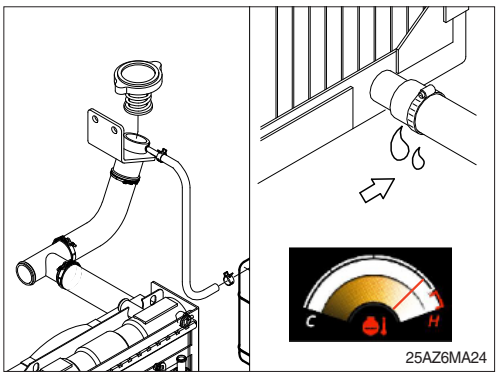


② The system has a maximum fill rate of 14 liters (3.5 U.S. gallons) per minute.
Do not exceed this fill rate.

※ **The system must be filled slowly to prevent air locks.**
During filling, air must be vented from the engine coolant passage.



③ Install the pressure cap. Operate the engine until it reaches a temperature 80°C (176°F), and check for coolant leaks.
Check the coolant level again to make sure the system is full of coolant after allow engine to cool.

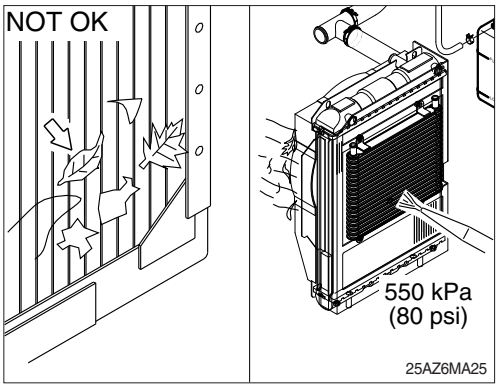


5) CLEAN RADIATOR AND OIL COOLER

Check, and if necessary, clean and dry outside of radiator and oil cooler. After working in a dusty place, clean radiator more frequently.

(1) Visually inspect the radiator for clogged radiator fins.

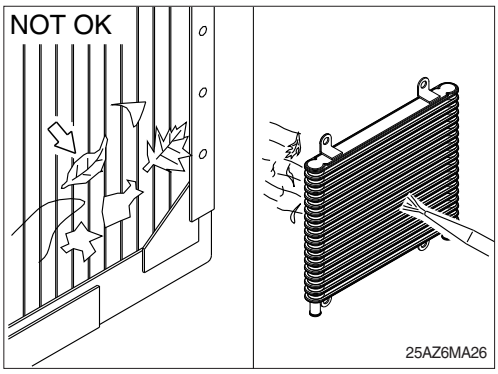
(2) Use 550 kPa (80 psi) air pressure to blow the dirt and debris from the fins.
Blow the air in the opposite direction of the fan air flow.



(3) Visually inspect the radiator for bent or broken fins.

※ **If the radiator must be replaced due to bent or broken fins which can cause the engine to overheat, refer to the manufacturer's replacement procedures.**

(4) Visually inspect the radiator for core and gasket leaks.

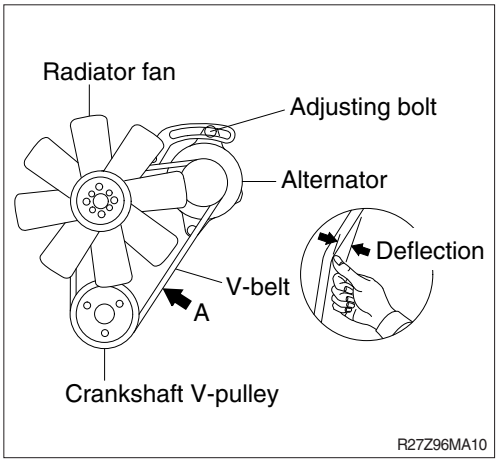


6) FAN BELT TENSION

(1) Press the V-belt at the midpoint of the alternator pulley and the crankshaft pulley, and measure the deflection of the belt.

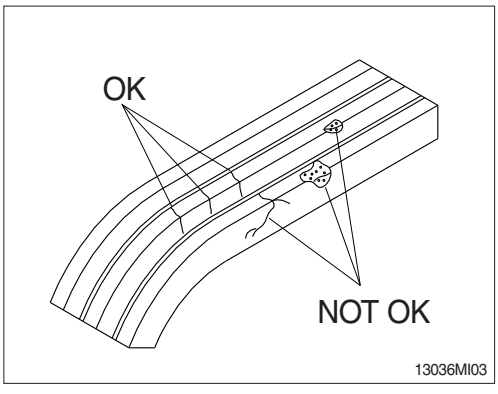
Item	Standard value
V-belt tension Belt deflection when pressed with a force of approx. 10 kgf·m (22.0 lbf·ft)	7.0 ~ 9.0 mm 0.28 ~ 0.31 in

(2) If the measured deflection does not conform to the standard value, loosen the adjusting bolt and move the alternator for adjustment.



(3) Inspect the drive for damage.

※ **Replace fan belt if it is damaged.**

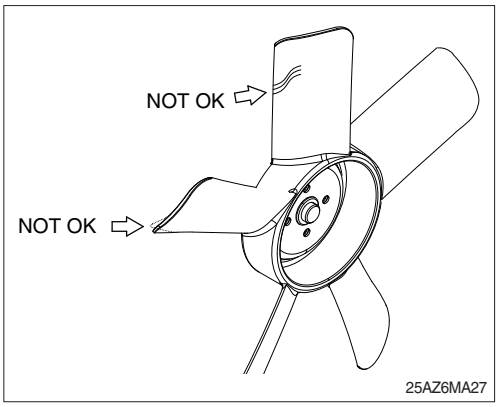


7) INSPECTION OF COOLING FAN

⚠ Serious injury can result from a fan blade failure. Never pull or pry on the fan.
This can damage the fan blade and cause fan failure.

※ Rotate the crankshaft by using the engine barring gear.

※ A visual inspection of the cooling fan is required daily.
Check for cracks, loose rivets, and bent or loose blades.
Check the fan to make sure it is securely mounted. Tighten the capscrews if necessary.
Replace any fan that is damaged.



8) CLEANING OF AIR CLEANER ELEMENT

(1) Primary element

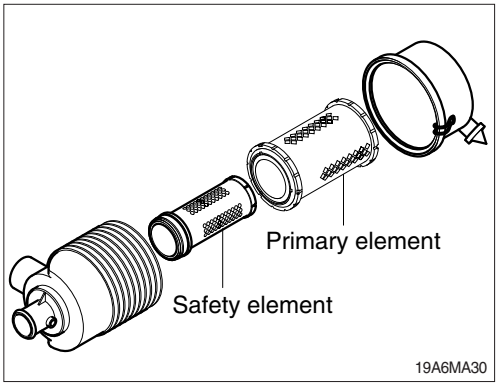
① Open cover and remove the element.
② Clean the inside of the body.
③ Clean the element with pressurized air.
· Remove the dust inside of the element by the pressurized air (below 3 kgf/cm², 40 psi) forward and backward equally.
④ Inspect for cracks or damage of element by putting a light bulb inside of the element.
⑤ Insert element and close cover.

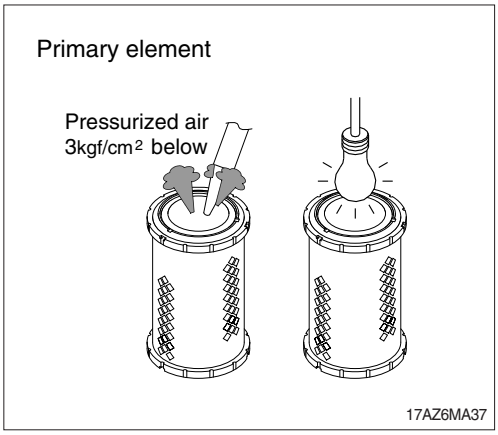
※ Replace the primary element after 4 cleanings.

(2) Safety element

※ Replace the safety element only when the primary element is cleaned 4 times.

※ Always replace the safety element. Never attempt to reuse the safety element by cleaning the element.





9) FUEL TANK

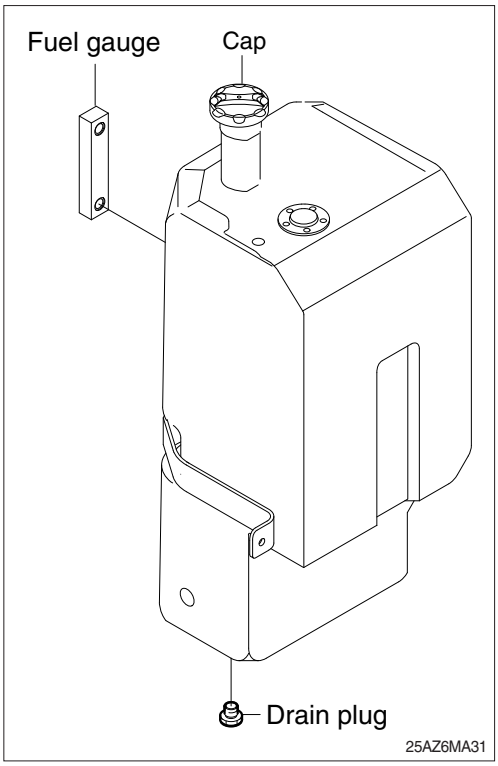
(1) Fill fuel tank fully to minimize water condensation and check the fuel gauge level before starting the machine.

(2) Drain the water and sediment in the fuel tank by opening the drain plug.

※ **Be sure to LOCK the cap of fuel tank.**

※ **Remove the strainer of the fuel tank and clean it if contaminated.**

⚠ **Stop the engine when refueling.**
All lights and flames shall be kept at a safe distance while refueling.



10) REPLACING THE FUEL FILTER ELEMENT

Water and dust in fuel are collected in the filter. So, replace the filter every 400 hours service.

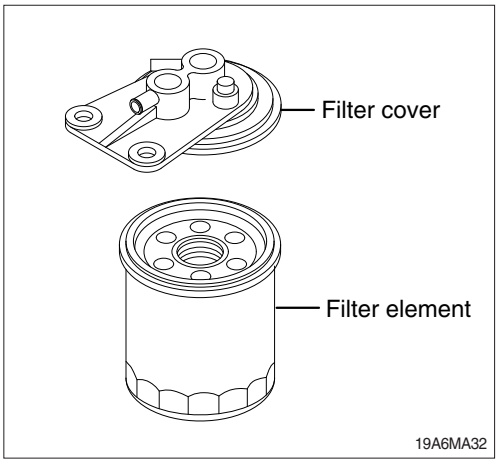
(1) Remove the used filter with filter wrench.

(2) Apply a thin film of fuel to the surface of new filter gasket before screwing on.

(3) Then tighten enough by hand.

(4) Loosen the air vent plug to let the air out.

(5) Start engine and check for fuel leakage.



11) REPLACING THE WATER SEPARATOR

(1) Close the fuel valve (1).

(2) Unscrew the screw ring (4) and remove the filter cup (3), and rinse the inside with kerosene.

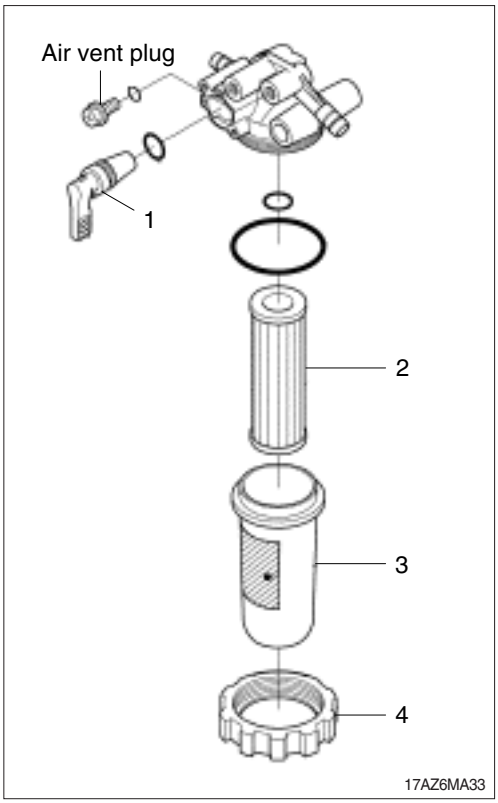
(3) Replace the element (2) with a new one.

(4) Reassemble the water separator, keeping out dust and dirt.

※ **Clean element (2) every 100 hours.**

※ **Be sure to clean the filter cup (3) periodically.**

⚠ **Make sure that any fire hazard is not around the work area when handling fuel.**
Wipe off spilled fuel thoroughly. It can cause a fire.



12) BLEEDING THE FUEL SYSTEM

(1) Fill the tank with fuel and open the water separator lever (1).

(2) Loosen the air vent plug (2) a few turns.

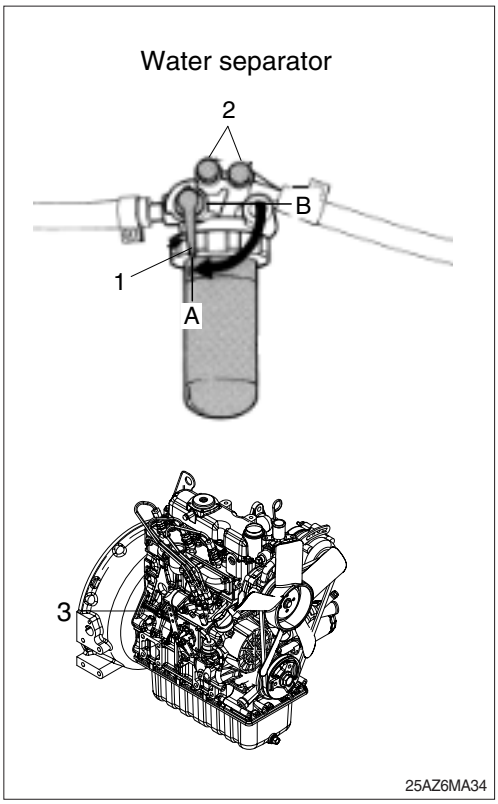
(3) Screw back the plug when bubbles do not come up any more.

(4) Open the air vent plug (3) on top of the fuel injection pump.

(5) Retighten the plug when bubbles do not come up any more.

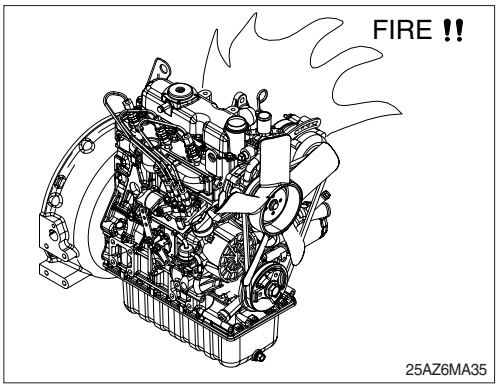
※ **Always keep the air vent plug on the fuel injection pump closed except when air is vented, or it may cause the engine to stop.**

※ **Air bleeding of the fuel system is required if ;**
- **A after the fuel filter and pipes have been detached and refitted**
- **A after the fuel tank has become empty**
- **A before the engine is to be used after a long storage**



13) LEAKAGE OF FUEL

⚠ Use care when cleaning the fuel hose, injection pump, fuel filter and other connections as the leakage from these parts can cause fire.



14) CLEANING OF HEATER FILTER

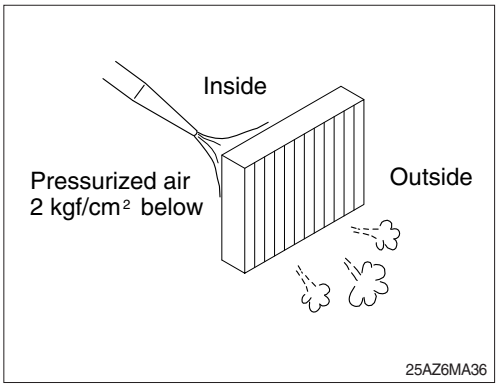
※ Always stop the engine before servicing.

(1) Remove the heater filter.

(2) Clean the filter using a pressurized air (below 2 kgf/cm^2, 28 psi).

⚠ When using pressurized air, be sure to wear safety glasses.

(3) Inspect the filter after cleaning. If it is damaged or badly contaminated, use a new filter.

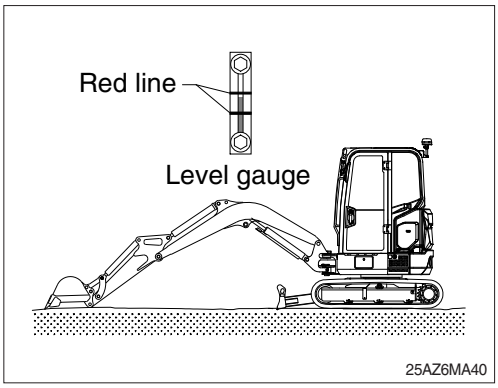


15) HYDRAULIC OIL CHECK

(1) Position the machine as shown in the illustration on the right. Please stop the engine and wait for about 5 minutes.

(2) Check the oil level at the level gauge of hydraulic oil tank.

(3) The oil level is normal if between the red lines.



16) FILLING HYDRAULIC OIL

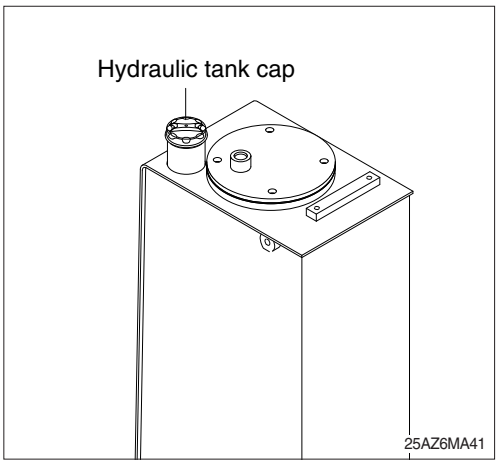
(1) Position the machine like the hydraulic oil check. Then stop engine.

(2) Loosen the Hydraulic tank cap.

(3) Fill the oil to the specified level.

(4) Start engine after filling and operate the work equipment several times.

(5) Check the oil level at the level check position after engine stops.



17) CHANGE HYDRAULIC OIL

(1) Position the machine like the hydraulic oil check. Then stop engine.

(2) Remove the bolt (1) and return filter cover (2).
· Tightening torque : 6.9±1.4 kgf·m
(50±10 lbf·ft)

(3) Prepare a suitable container with a capacity of 40 ℓ (10.6 U.S. gal).

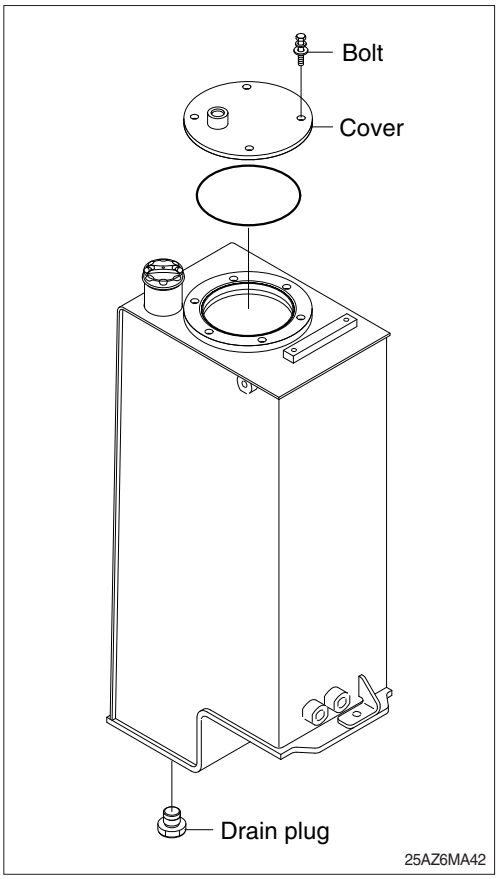
(4) To drain the oil loosen the drain plug at the bottom of the oil tank.

(5) Close the drain plug and fill proper amount of recommended oil.

(6) Assemble with reverse order of disassembly.

(7) To bleed air from hydraulic pump loosen the air breather at top of hydraulic pump assembly.

(8) Start engine and run continually. Release the air by full stroke of each control lever.



18) CLEAN SUCTION STRAINER

Clean suction stainer as follows.

(1) Remove the bolt (1) and suction cover (2)
· Tightening torque : 6.9±1.4 kgf · m
(50±10 lbf · ft)

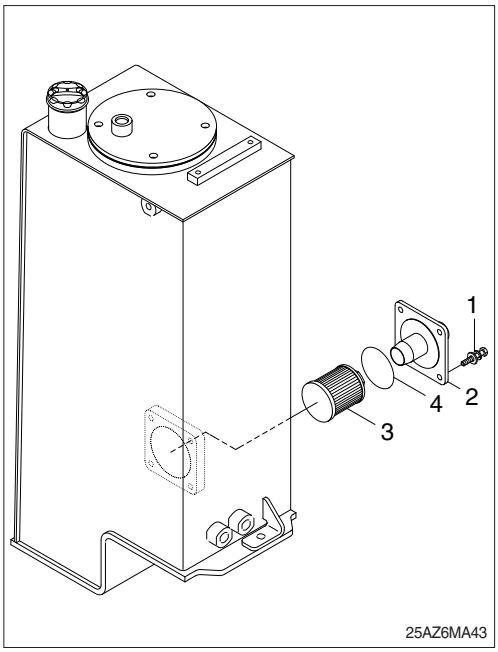
(2) Remove the suction strainer (3) from suction cover (2)

(3) Wash the suction strainer with gasoline or cleaning oil (mineral spirits).

(4) Replace the suction strainer if it is damaged.

(5) Assemble with reverse order of disassembly.

※ **Be sure to install a new O-ring (4).**



19) REPLACEMENT OF RETURN FILTER

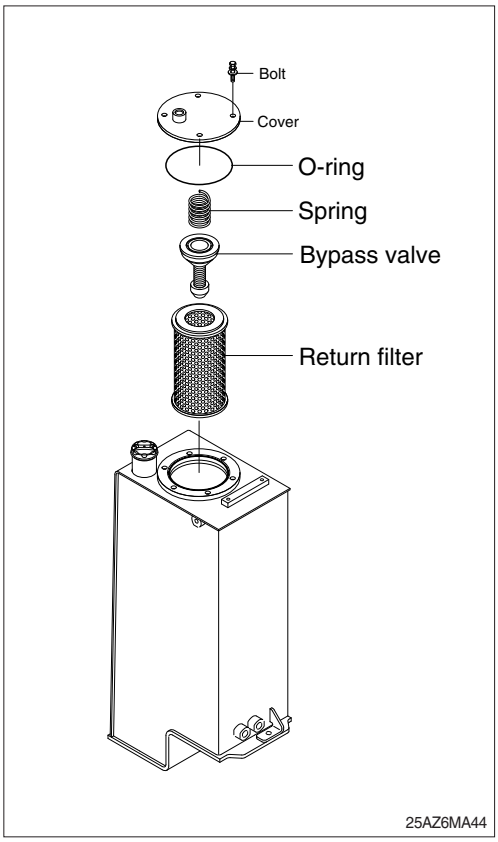
Replace return filter as follows.

(1) Remove the cover.

(2) Remove the return filter in the tank.

(3) Replace the element with new one.

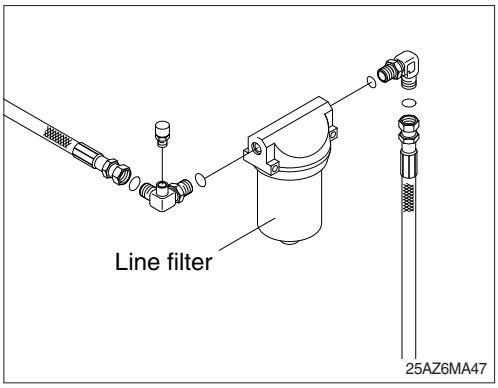
(4) Reassemble by reverse order of disassembly.
· Tightening torque : 6.9±1.4 kgf · m
(50±10 lbf · ft)



20) REPLACEMENT OF PILOT LINE FILTER

(1) Loosen the nut positioned on the filter body.
(2) Pull out the filter element and clean filter housing.
(3) Install the new element and tighten using specified torque.

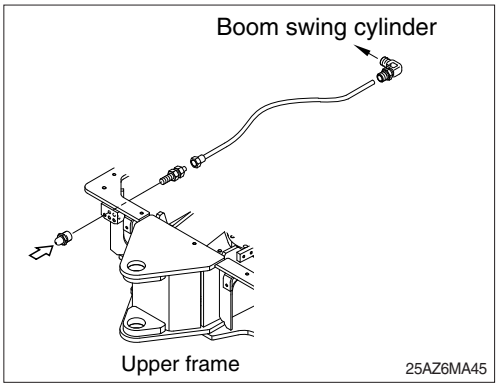
※ **Change cartridge after initial 250 hours of operation. Thereafter, change cartridge every 1000 hours.**



21) LUBRICATE BOOM SWING CYLINDER

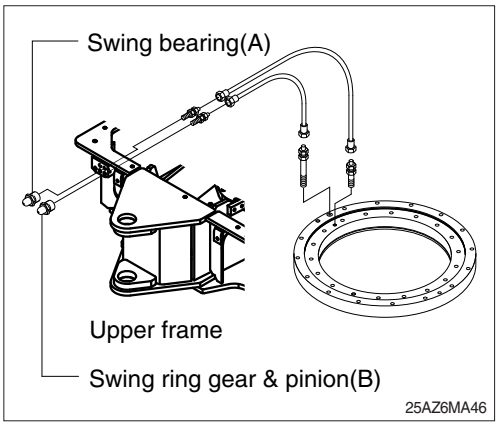
(1) Grease at fitting.

※ **Lubricate every 250 hours.**



22) LUBRICATE SWING BEARING AND SWING RING GEAR & PINION

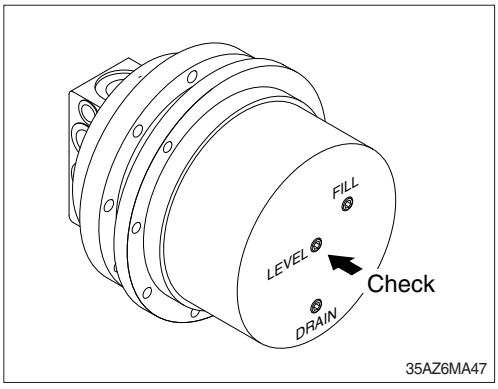
(1) Grease at 2 fitting.
A : Lubricate every 250 hours.
B : Lubricate every 50 hours.



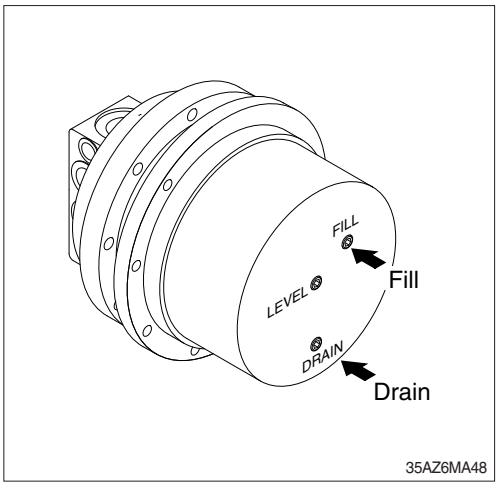
23) CHECK THE TRAVEL REDUCTION GEAR OIL

(1) Position the travel motor as shown in the illustration and make sure the machine is on flat ground.

(2) Loosen the level plug and check the oil level.
If the level is at the hole of the plug, it is normal.
Fill the oil if it is not sufficient.
· Tightening torque : 4.0±0.5 kgf·m
(28.9±3.6 lbf·ft)



24) CHANGE OF THE TRAVEL REDUCTION GEAR OIL



(1) Raise the temperature of the oil by traveling machine first.

(2) Position the travel motor as shown in the illustration and make sure the machine is on flat ground.

(3) Loosen the level plug and then the drain plug.

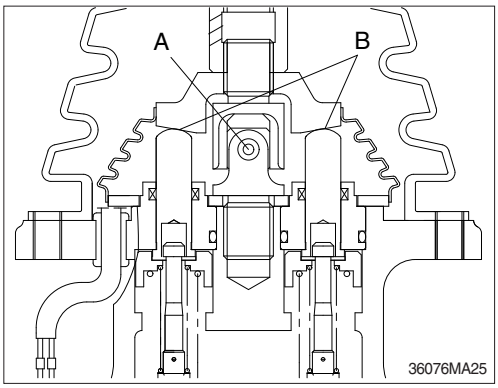
(4) Drain the oil to adequate container.

(5) Tighten the drain plug and fill specified amount of oil at filling port.
- Amount of oil : 0.6 ℓ (0.16 U.S.gal)
- Tightening torque : 4.0±0.5 kgf·m (28.9±3.6 lbf·ft)

(6) Tighten the level plug and travel slowly to check if there is any leakage of oil.
- Tightening torque : 4.0±0.5 kgf·m (28.9±3.6 lbf·ft)

25) LUBRICATE RCV LEVER

Remove the bellows and with a grease gun grease the joint part (A) and sliding parts (B).



26) ADJUSTMENT OF TRACK TENSION

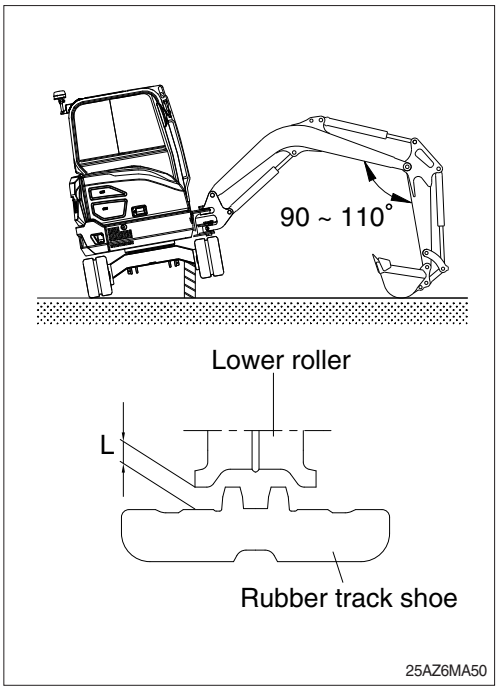
※ It is important to adjust the tension of track properly to extend the life of track and traveling components.

※ The wear of pins and bushings on the undercarriage will vary with the working conditions and soil properties.
It is thus necessary to continually inspect the track tension so as to maintain the standard tension on it.

(1) Raise the chassis with the boom and arm as shown in the illustration.

(2) Measure the distance between bottom of lower roller and track of shoe.

※ Remove mud by rotating the track before measuring.



(3) If the tension is tight, drain the grease in the grease nipple and if the tension is loose, charge the grease.

⚠ Personal injury or death can result from grease under pressure.

⚠ When loosening the grease nipple, do not loosen more than one turn as there is a danger of a spring coming out of the nipple because of the high pressure inside.

※ When the grease does not drained smoothly, move the machine to forward and backward a short distance.
If the track tension is loose even after the grease is charged to the maximum, change the pins and bushings as they are worn excessively.

Rubber track

Length (L)	
5~10 ㎜	0.2~0.4"

27) REPLACEMENT OF BUCKET

⚠ **When knocking the pin in with a hammer, metal particles may fly and cause serious injury, particularly if they get into your eyes.**
When carrying out this operation, always wear goggles, helmet, gloves, and other protective equipment.

※ **When the bucket is removed, place it in a stable condition.**

※ **When performing joint work, make sure to signal clearly to each other and work carefully to avoid serious injury.**

(1) Lower the bucket on the ground as shown in the illustration on the top right.

(2) Lock the safety lever to the LOCK position and stop the engine.

(3) Remove the stopper bolts (1) and nuts (2), then remove pins (3, 4) and remove the bucket.

※ **When removing the pins, place the bucket so that it is in light contact with the ground.**

※ **If the bucket is lowered strongly to the ground, the resistance will be increased and it will be difficult to remove the pins.**

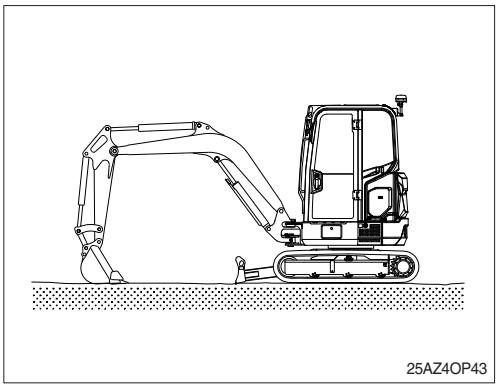
※ **After removing the pins, make sure that they do not become contaminated with sand or mud and that the seals of bushings on both sides do not become damaged.**

(4) Align the arm with holes (A) and the link with holes (B), then coat with grease and install pins (3, 4)

※ **When installing the bucket, the O-rings are easily damaged, so fit the O-rings on the boss of the bucket as shown in the picture.**
After hitting the pin, move the O-ring down to the regular groove.

(5) Install the stopper bolt (1) and nuts (2) for each pin, then grease the pin.

· Tightening torque : 6.9±1.4 kgf·m
(50±10 lbf·ft)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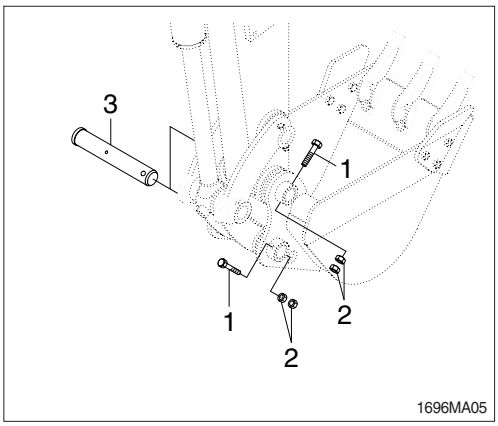

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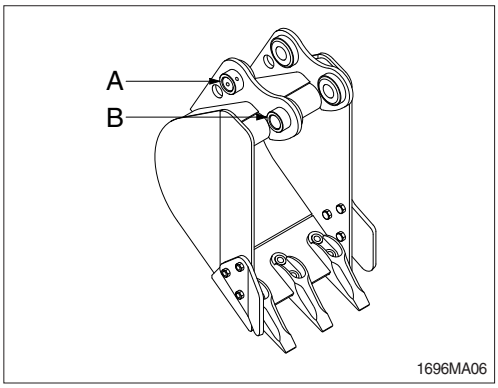

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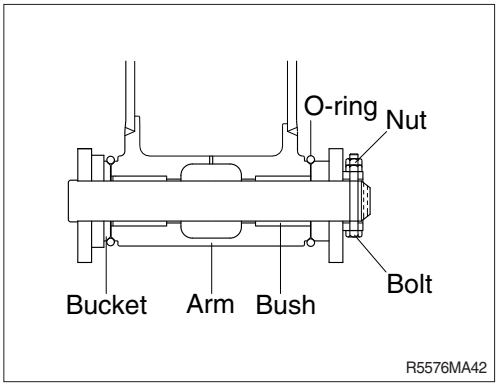

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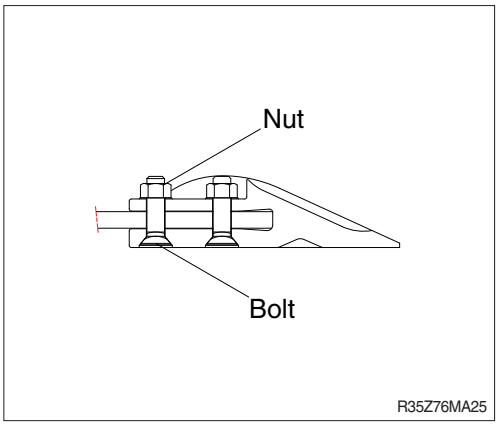
28) REPLACEMENT OF BUCKET TOOTH

(1) Loosen the bolts and nuts.
(2) Remove dust and mud from surface of bucket by using knife.
(3) Fit news tooth to bucket.
(4) Fasten bolts and nuts.

⚠ Personal injury can result from bucket falling.
⚠ Block the bucket before changing tooth tips or side cutters.



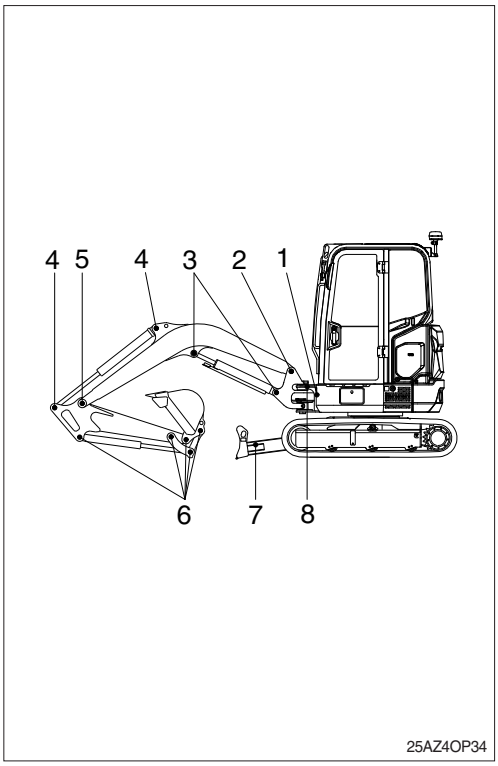
29) LUBRICATE PIN AND BUSHING

(1) Lubricate to each pin of working device

Lubricate the grease to the grease nipple according to the lubricating interval.

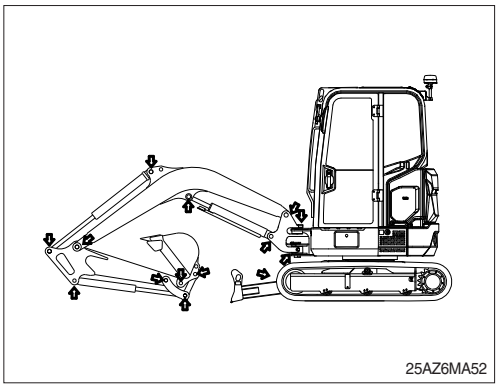
No.	Description	Qty
1	Lubrication manifold at upper frame	3
2	Boom connection pin	2
3	Boom cylinder (head and rod side)	2
4	Arm cylinder pin (head and rod side)	2
5	Boom and arm connection pin	1
6	Bucket cylinder pin (head and rod)	2
	Bucket link (control rod)	1
	Arm and bucket connection pin	1
	Arm and control link connection pin	1
7	Dozer connection pin	2
	Dozer cylinder pin	2
8	Boom swing post	2
	Boom swing cylinder	2

※ **Shorten lubricating interval when working in the water or dusty places.**



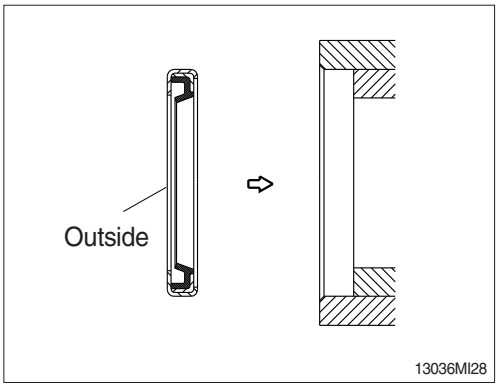
(2) Dust seals are mounted on the rotating part of working device to extend the lubricating interval.

※ **Mount the lip so it is facing outside when replacing dust seals.**



※ **If it is assembled in wrong direction, it will cause fast wear of pin and bushing, and create noise and vibration during operation.**

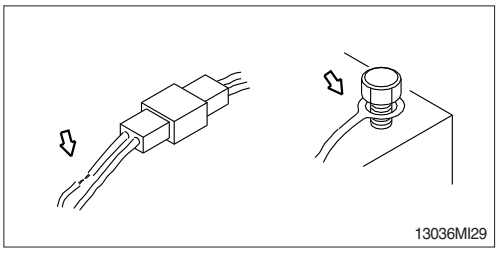
※ **Install seal in the same manner as shown in the illustration. Use a plastic hammer to lightly and evenly tap the seal into place.**



7. ELECTRICAL SYSTEM

1) WIRING, GAUGES

Check regularly and repair loose or malfunctioning gauges when found.



2) BATTERY

(1) Clean

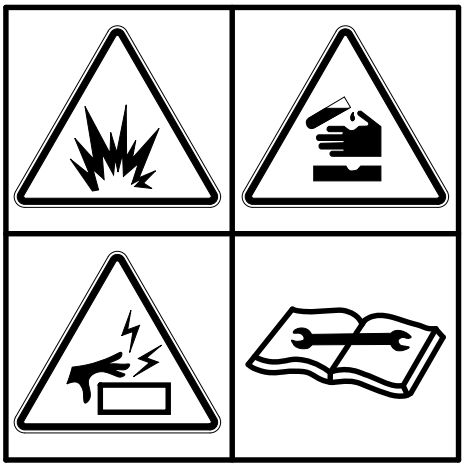
① Wash the terminal with hot water if it is contaminated, and apply grease to the terminals after washing.

⚠ Battery gas can explode. Keep sparks and flames away from batteries.

⚠ Always wear protective glasses when working with batteries.

⚠ Do not stain clothes or skin with electrolyte as it is acid.

Be careful not to get the electrolyte in eyes. If eyes are affected, flush with clean water or eye solution and seek immediate medical attention.



(2) Recycle

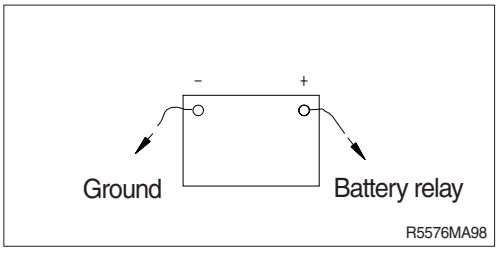
Never discard a battery.

Always return used batteries to one of the following locations.

- A battery supplier
- An authorized battery collection facility
- Recycling facility

(3) Method of removing the battery cable

Remove the cable from the ground connection (⊖ terminal side) and reconnect it last when reassembling.



3) STARTING THE ENGINE WITH A BOOSTER CABLE

Follow these procedures when starting.

(1) Connection of booster cable

※ Use the same capacity of battery for starting.

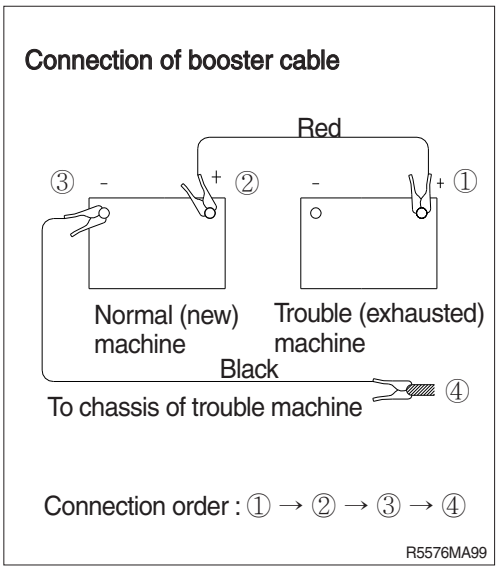
① Make sure that the starting switches of the normal machine and trouble machine are both in the OFF position.

② Connect the red terminal of booster cable to the battery (+) terminal between exhausted and new battery.

③ Connect the black terminal of the booster cable between new battery (-) terminal and chassis of trouble machine.

※ Make and maintain a firm connection.

※ Sparks will occur slightly when making the final connection.

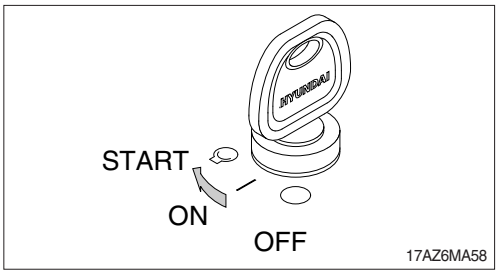


(2) Starting the engine

① Start the engine of the normal machine and keep it running at high idle.

② Start engine of the troubled machine with starting switch.

③ If you can not start it with the first attempt, try again after 2 minutes.



(3) Taking off the booster cable

① Take off the booster cable (black).

② Take off the booster cable (red) connected to the (+) terminal.

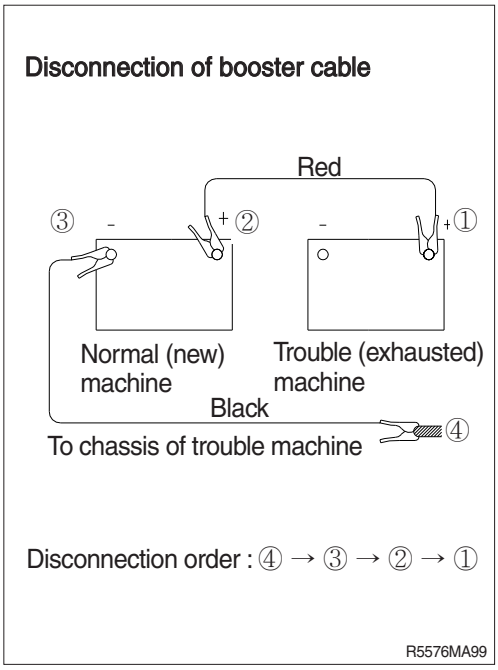
③ Run engine at high idle until charging of the exhausted battery is complete.

⚠ Explosive gas is generated while using the battery or charging it. Keep any flames away and be careful not to cause a spark.

※ Charge the battery in a well ventilated area.

※ Place the machine on the earth or concrete. Avoid charging the machine on any steel or steel plates.

※ Do not connect (+) terminal and (-) terminal when connecting booster cable because it will be shorted.



4) WELDING REPAIR

Before welding, follow the below procedure.

(1) Shut off the engine and remove the starting switch.

(2) Disconnect ground cable from battery by master switch.

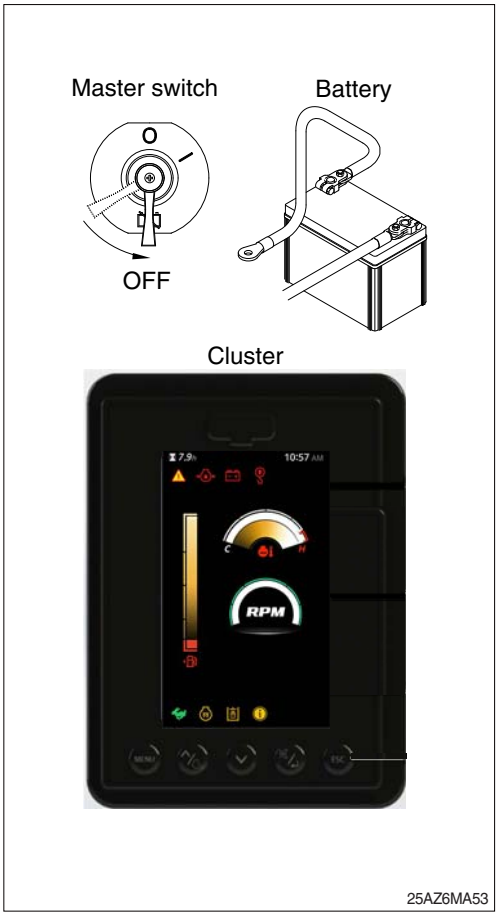
(3) Before carrying out any electric welding on the machine, the battery cables should be disconnected and the connectors pulled out of the cluster etc.

(4) Connect the earth (ground) lead of the welding equipment as close to the welding point as possible.

※ **Remove all paint to ensure a solid ground is achieved.**

※ **Do not weld or use cutting torch on pipes or tubes that contain flammable fluids. Clean them thoroughly with nonflammable solvent before welding or flame cutting on them.**

⚠ **Do not attempt to weld before carrying out the above.**
If not, it will cause serious damage to electric system.



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5) BATTERY CABLE AND CONNECTIONS

⚠ **Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries.**

(1) Remove and inspect the battery cables and connections for cracks or corrosion.

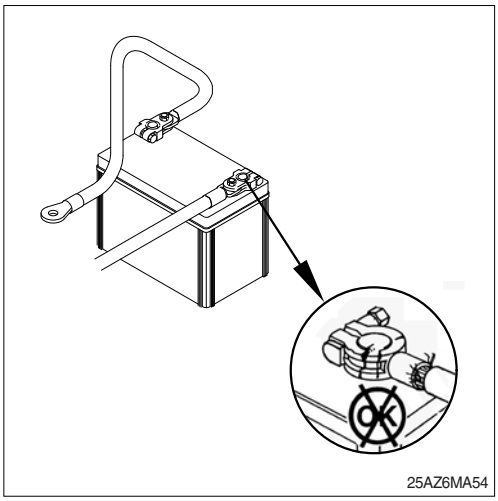
(2) Replace broken terminals, connectors, or cables.

(3) If the connections are corroded, use a battery brush or wire brush to clean the connections.

(4) Make sure all debris are removed from the connecting surfaces.

(5) Install the cables and tighten the battery connections.

(6) Coat the terminals with grease to prevent corrosion.



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