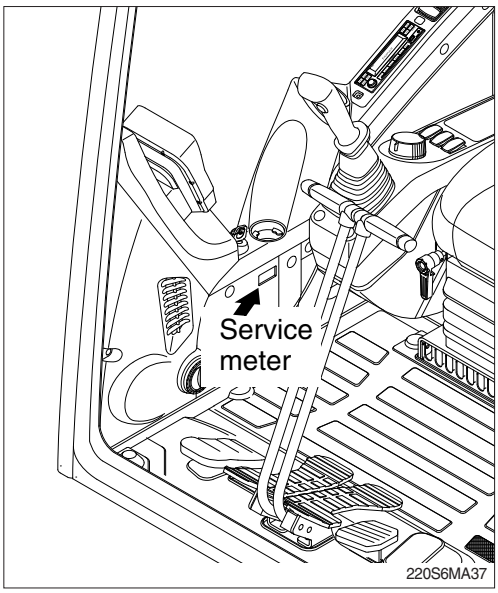
1. INSTRUCTION

1) INTERVAL OF MAINTENANCE



(1) You may inspect and service the machine by the period as described at page 4-10 based on hour meter at control panel.

(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 100hours, carry out all the maintenance「Each 100hours, 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) 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.

⚠ Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

△ Accumulated grease and oil on the machine is a fire hazard. Remove this debris with steam cleaning or high pressure water, at least every 1000 hours.

△ Inspect the engine compartment for any trash build up. Remove any trash build up from the engine compartment.

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

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.

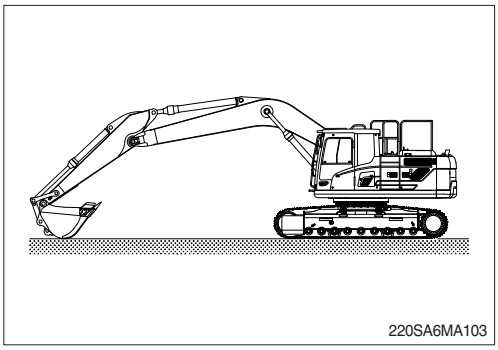
(9) For more detail information of maintenance, please contact local HD Hyundai Construction Equipment dealer.

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

4) RELIEVING THE PRESSURE IN THE HYDRAULIC SYSTEM

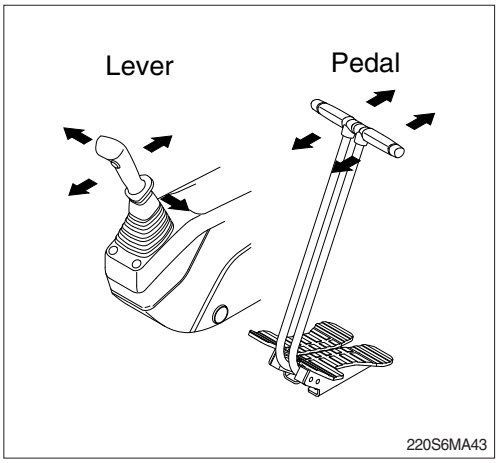
※ **Spouting of oil can cause the accident when loosening the cap or hose right after the operating of machine as the machine or oil is on the high pressure on the condition.**
Be sure to relieve the pressure in the system before repairing hydraulic system.

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

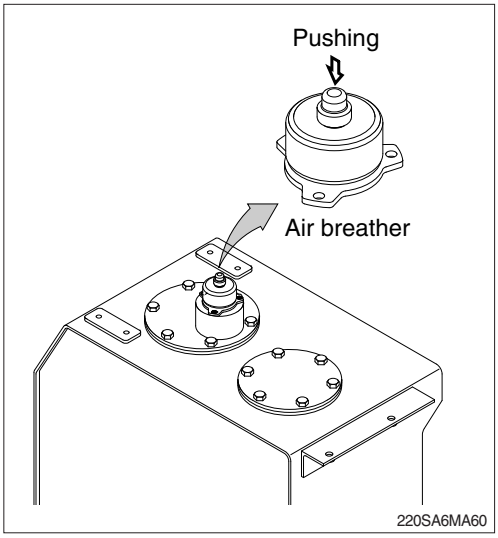


(2) Set the safety knob completely in the UNLOCK position, operate the control levers and pedals fully to the front, rear, left and right, to release the pressure in the hydraulic circuit.

※ **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.**



(3) Relieve the pressure in the tank by pushing the top of the air breather.



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" rowspan="2">Engine</td><td>Fuel hose (tank-engine)</td><td rowspan="2">Every
2 years</td></tr>
<tr><td>Heater hose
(heater-engine)</td></tr>
<tr><td rowspan="6">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="3">Working device</td><td>Boom cylinder line hose</td><td rowspan="3">Every
2 years</td></tr>
<tr><td>Arm cylinder line hose</td></tr>
<tr><td>Bucket 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	8.8T		10.9T		12.9T	
	kgf·m	lbf·ft	kgf·m	lbf·ft	kgf·m	lbf·ft
M 6 × 1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1
M10 × 1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3
M12 × 1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119
M14 × 2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190
M16 × 2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295
M18 × 2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407
M20 × 2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575
M22 × 2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766
M24 × 3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991
M30 × 3.5	120 ~ 161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967

(2) Fine thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8 × 1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0
M10 × 1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2
M12 × 1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128
M14 × 1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202
M16 × 1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308
M18 × 1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446
M20 × 1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622
M22 × 1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839
M24 × 2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056
M30 × 2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126

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)	M12 × 1.75	11.5 ± 4.5	83.2 ± 7.2
2		Engine mounting bolt (bracket-frame, FR)	M20 × 2.5	52.1 ± 5.0	377 ± 36.2
3		Engine mounting bolt (bracket-frame, RR)	M24 × 3.0	90 ± 9.0	651 ± 65.1
4		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
5		Coupling mounting socket bolt	M18 × 2.5	32 ±1.0	231 ±7.2
6		Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
7	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	6.5 ± 0.7	47 ± 5.1
8		Main pump mounting socket bolt	M20 × 2.5	42 ± 4.5	304 ± 32.5
9		Main control valve mounting nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
10		Hydraulic oil tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
11		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
12	Power train system	Swing motor mounting bolt	M20 × 2.5	57.9 ± 5.8	419 ± 42
13		Swing bearing upper part mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
13-1		Swing bearing upper part mounting bolt-HW	M24 × 3.0	100 ± 10	723 ± 72.3
14		Swing bearing lower part mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
14-1		Swing bearing upper part mounting bolt-HW	M24 × 3.0	100 ± 10	723 ± 72.3
15		Travel motor mounting bolt	M16 × 2.0	23 ± 2.5	166 ± 18.1
16		Sprocket mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
17	Under carriage	Upper roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18		Lower roller mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
19		Track tension cylinder mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
20		Track shoe mounting bolt, nut	M20 × 1.5	78 ± 8.0	564 ± 57.9
21		Track guard mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
22	Others	Counterweight mounting bolt	M36 × 3.0	337 ± 33	2440 ± 239
23		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
24		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

※ H/W : High walker

3. FUEL, COOLANT AND LUBRICANTS

1) NEW MACHINE

New machine used and filled with following lubricants.

Description	Specification
Engine oil (API CH-4)	SAE 15W-40, ★SAE 5W-40
Hydraulic oil	HD Hyundai Construction Equipment genuine long life (ISO VG 32, VG 46, VG 68) Conventional hydraulic oil (ISO VG 15★)
Swing and travel reduction gear	SAE 80W-90 (GL-4/GL-5)
Grease	Lithium base grease NLGI No. 2
Fuel	ASTM D975-No. 2
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

★Cold region
Russia, CIS, Mongolia

※ **Refer to the page 7-30 for further information of recommended oils.**

4. MAINTENANCE CHECK LIST

1) DAILY SERVICE BEFORE STARTING

Check items	Service	Page
Visual check		
· Air intake piping	Check	4-27
· Air cleaner dust ejection valve	Drain	4-26
· Crankcase breather tube	Check	-
Engine oil level	Check, Add	4-18
Coolant level	Check, Add	4-20
Fan belt tension and damage	Check, Adjust	4-24
Fuel tank	Check, Refill	6-26
Prefilter (water)	Check, Drain	6-28
Hydraulic oil level	Check, Add	6-38
Attachment pin and bushing ★	Lubricate	6-48
· Boom cylinder tube end		
· Boom foot		
· Boom cylinder rod end		
· Arm cylinder tube end		
· Arm cylinder rod end		
· Boom + Arm connecting		
· Bucket cylinder tube end		
Control panel & pilot lamp	Check, Clean	4-49

★ **Lubricate every 10 hours or daily for initial 100 hours.**

2) EVERY 50 HOURS SERVICE

Check items	Service	Page
Fuel tank (water, sediment)	Drain	4-26
Swing reduction gear oil	Check, Add	4-41
Track tension	Check, Adjust	4-44
Attachment pin and bushing	Lubricate	4-48
· Bucket cylinder rod end		
· Bucket + Arm connecting		
· Bucket control link + Arm		
· Bucket control rod		

3) INITIAL 50 HOURS SERVICE

Check items	Service	Page
Bolts & Nuts	Check, Tight	4-8
· Sprocket mounting bolts		
· Upper roller mounting bolts		
· Lower roller 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		
· Track guard mounting bolts		
· Hydraulic pump mounting bolts		
· Under cover mounting bolts		

4) EVERY 200 HOURS SERVICE

Check items	Service	Page
Hydraulic oil return filter ★	Replace	4-40
Hydraulic oil pilot line filter element ★	Replace	4-41
Hydraulic oil drain filter cartridge ★	Replace	4-40

★ Replace 3 filters for continuous hydraulic breaker operation only.

5) INITIAL 250 HOURS SERVICE

Check items	Service	Page
Engine oil	Change	4-18
Engine oil filter	Replace	4-18
Prefilter (element)	Replace	4-27
Fuel filter element	Replace	4-28
Hydraulic oil pilot line filter element	Replace	4-41
Hydraulic oil return filter	Replace	4-40
Hydraulic oil drain filter cartridge	Replace	4-40
Swing reduction gear oil	Change	4-41
Travel reduction gear oil	Change	4-42

6) EVERY 250 HOURS SERVICE

Check items	Service	Page
Charge air piping	Check	4-27
Charge air cooler	Check	4-23
Cooling fan	Check	4-22
Battery (voltage), battery cable and connections	Check, Clean	4-51
Swing bearing grease	Check, Add	4-41
Bolts & Nuts	Check, Tight	4-8
· 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		
· Track guard mounting bolts		
· Upper roller mounting bolts		
· Lower roller mounting bolts		
· Hydraulic pump mounting bolts		
· Under cover mounting bolts		
Attachment pin and bushing	Lubricate	4-48
· Boom cylinder tube end		
· Boom foot		
· Boom cylinder rod end		
· Arm cylinder tube end		
· Arm cylinder rod end		
· Boom + Arm connecting		
· Bucket cylinder tube end		

7) EVERY 500 HOURS SERVICE

Check items	Service	Page
Engine oil *	Change	4-18
Engine oil filter *	Replace	4-18
Radiator, cooler fin and charge air cooler	Check, Clean	4-23
Air cleaner element (primary) *1	Check, clean	4-26
Prefilter element	Replace	4-27
Fuel filter element	Replace	4-28
Aircon & heater air filter (fresh air recirculation)	Replace	4-52

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

***1 When working in dusty environments, more frequent cleaning is highly recommended.**

8) EVERY 1000 HOURS SERVICE

Check items	Service	Page
Drive belt, cooling fan hub	Check	4-24
Cooling fan belt tensioner	Check	4-25
Hydraulic tank air breather element	Replace	4-40
Hydraulic oil return filter	Replace	4-40
Hydraulic oil drain filter cartridge	Replace	4-40
Hydraulic oil pilot line filter	Replace	4-41
Swing reduction gear oil	Change	4-41
Travel motor reduction gear oil	Change	4-42
Grease in swing gear and pinion	Change	4-42

9) EVERY 2000 HOURS SERVICE

Check items	Service	Page
Engine cleaning	Clean	4-29
Vibration damper (rubber)	Check	4-30
Vibration damper (viscous)	Check	4-30
Coolant, cooling system and antifreeze★2	Change, Flush	4-20, 21, 22, 23
Air cleaner element (primary, safety)★1	Replace	4-26
Hydraulic oil★2	Change	4-39
Hydraulic tank suction strainer	Check, Clean	4-39
RCV lever	Check, Lubricate	4-43
Hoses, fittings, clamps (fuel, coolant, hydraulic)	Check, Retighten, Replace	-

★1 When working in dusty environments, more frequent replacing is highly recommended.

★2 Conventional

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

10) EVERY 5000 HOURS SERVICE

Check items	Service	Page
Overhead set (shop inspection)	Adjust	4-31, 32, 33, 34, 35, 36
Hydraulic oil★3	Change	4-39

★3 HD Hyundai Construction Equipment genuine long life

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

11) EVERY 6000 HOURS SERVICE

Check items	Service	Page
Coolant, cooling system and antifreeze★3	Change, Flush	4-20, 21, 22, 23

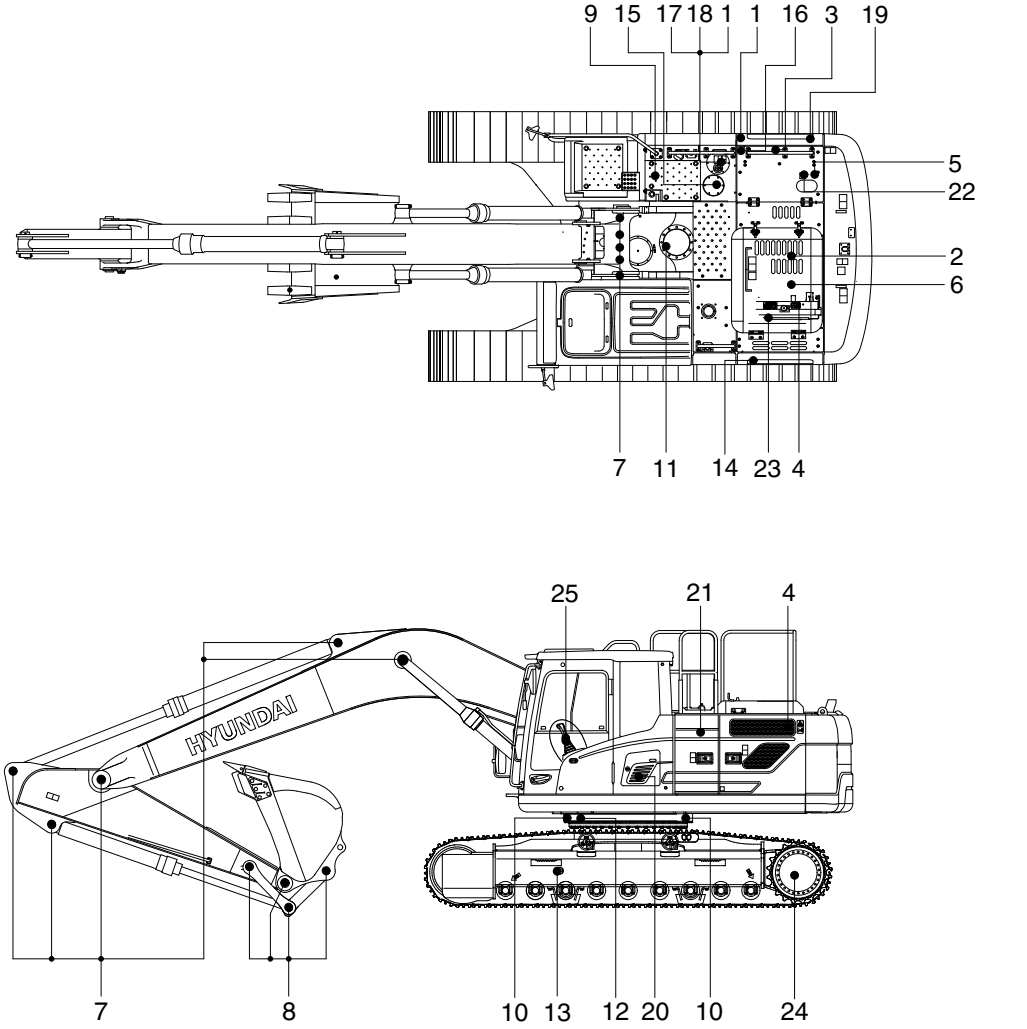
★3 HD Hyundai Construction Equipment genuine long life

12) WHEN REQUIRED

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

Check items	Service	Page
Engine lubrication system		
· Engine oil	Change	4-18
· Engine oil filter	Replace	4-18
Engine cooling system		
· Coolant	Add or Change	4-20, 21, 22, 23
· Radiator	Clean or Flush	4-20, 21, 22, 23
· Charge air cooler	Check	4-23
Fuel system		
· Fuel tank	Drain or Clean	4-26
· Prefilter (water, element)	Drain or Replace	4-27
· Fuel filter element	Replace	4-28
· Fuel filler pump filter	Clean, Replace	4-37
Engine air system		
· Air cleaner element (primary)	Clean or Replace	4-26
· Air cleaner element (safety)	Replace	4-26
Hydraulic system		
· Hydraulic oil	Add or Change	4-38
· Suction strainer	Clean	4-39
· Return filter	Replace	4-40
· Drain line filter	Replace	4-40
· Element of breather	Replace	4-40
· Pilot line filter	Replace	4-41
· RCV lever	Lubricate	4-43
Undercarriage		
· Track tension	Check, Adjust	4-44
Bucket		
· Linkage	Adjust	4-45
· Bucket assy	Replace	4-45
· Tooth	Replace	4-46
· Side cutter	Replace	4-46
Air conditioner and heater		
· Fresh air filter	Replace	4-52
· Recirculation filter	Clean, Replace	4-52

5. MAINTENANCE CHART



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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 use no open flames.

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	160 (42.3)	1
	2	Engine oil level	Check, Add	EO	23.1 (6.1)	1
	4	Radiator coolant	Check, Add	C	31 (8.2)	1
	5	Prefilter (water)	Check, Drain	-	-	1
	6	Fan belt tension and damage	Check, Adjust	-	-	1
	7	★Attachment pin & bushing	Check, Lubricate	PGL	-	11
	9	Fuel tank	Check, Refill	DF	400 (106)	1
50 Hours or weekly	8	Bucket linkage pins	Check, Lubricate	PGL	-	6
	9	Fuel tank (water, sediment)	Check, Drain	-	-	1
	11	Swing reduction gear oil	Check, Add	GO	6.2 (1.6)	1
	13	Track tension	Check, Adjust	PGL	-	2

★ For initial 100 hours.

Service interval	No.	Description	Service action	Oil symbol	Capacity ℓ (U.S.gal)	Service points No.
250 Hours	7	Attachment pins & bushings	Check, Lubricate	PGL	-	11
	10	Swing bearing grease	Check, Add	PGL	-	2
	14	Battery (voltage), battery cable and connections	Check	-	-	1
Initial 250 Hours	2	Engine oil	Change	EO	23.1 (6.1)	1
	3	Engine oil filter	Replace	-	-	1
	5	Prefilter (element)	Replace	-	-	1
	11	Swing reduction gear oil	Change	GO	6.2 (1.6)	1
	15	Hydraulic oil return filter	Replace	-	-	1
	16	Hydraulic oil drain filter cartridge	Replace	-	-	1
	19	Hydraulic oil pilot line filter element	Replace	-	-	1
	22	Fuel filter element	Replace	-	-	1
	24	Travel reduction gear case oil	Change	GO	4.5 (1.2)	2
500 Hours	2	Engine oil	Change	EO	23.1 (6.1)	1
	3	Engine oil filter	Replace	-	-	1
	5	Prefilter (element)	Replace	-	-	1
	20	Aircon & heater filter (fresh air & recirculation)	Replace	-	-	2
	21	Air cleaner element (primary)	Check, Clean	-	-	1
	22	Fuel filter element	Replace	-	-	1
	23	Radiator, oil cooler, charge air cooler	Check, Clean	-	-	3
1000 Hours	6	Drive belt, cooling fan hub	Check	-	-	2
	6	Cooling fan belt tensioner	Check	-	-	1
	11	Swing reduction gear oil	Change	GO	6.2 (1.6)	1
	12	Swing gear and pinion grease	Change	PGL	7.9 kg (17.5 lb)	1
	15	Hydraulic oil return filter	Replace	-	-	1
	16	Hydraulic oil drain filter cartridge	Replace	-	-	1
	17	Hydraulic oil air breather element	Replace	-	-	1
	19	Hydraulic oil pilot line filter	Replace	-	-	1
	24	Travel reduction gear oil	Change	GO	4.5 (1.2)	2
2000 Hours	1	Hydraulic oil★1	Change	HO	160 (42.3)	1
	2	Engine cleaning	Clean	-	-	1
	2	Vibration damper (rubber)	Check	-	-	4
	2	Vibration damper (viscous)	Check	-	-	4
	4	Coolant, cooling system and antifreeze★1	Change	C	31 (8.2)	1
	18	Hydraulic oil suction strainer	Check, Clean	-	-	1
	21	Air cleaner element (primary, safety)	Replace	-	-	2
	25	RCV lever	Check, Lubricate	PGL	-	2
	-	Hoses, fittings, clamps (fuel, coolant, hydraulic)	Check, Retighten, Replace	-	-	-
5000 Hours	1	Hydraulic oil★2	Change	HO	160 (42.3)	1
	2	Overhead set (shop inspection)	Adjust	-	-	1
6000 Hours	4	Coolant, cooling system and antifreeze★2	Change	C	31 (8.2)	1
As required	20	Aircon & heater fresh filter	Replace	-	-	1
	20	Aircon & heater recirculation filter	Clean, Replace	-	-	1
	21	Air cleaner element (primary)	Clean, Replace	-	-	1
	21	Air cleaner element (safety)	Replace	-	-	1

★1 Conventional ★2 HD Hyundai Construction Equipment 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

6. SERVICE INSTRUCTION

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.

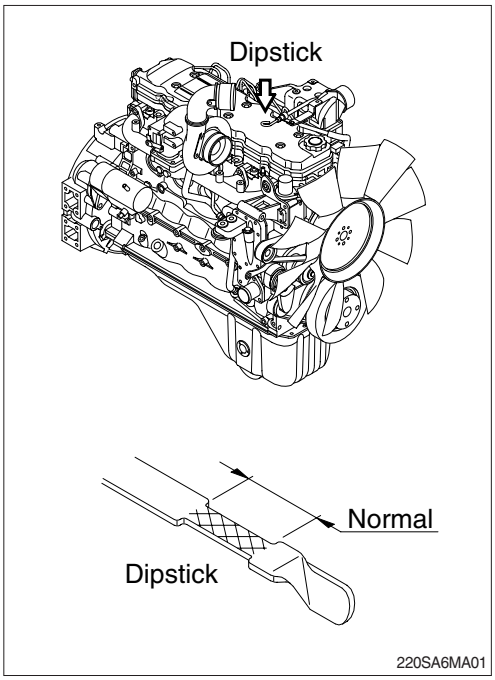
(3) If oil level is LOW, add oil and then check again.

※ **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.**

※ **Keep all parts clean from contaminants. Contaminants may cause rapid wear and shortened component life.**



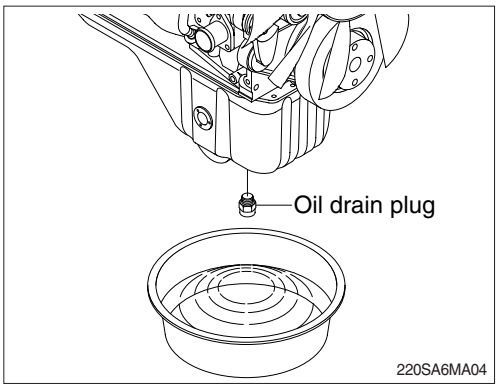
2) REPLACEMENT OF ENGINE OIL AND OIL FILTER

(1) Operate the engine until the coolant temperature reaches 60˚C (140˚F). Shut off the engine.

(2) Remove the oil drain plug. Drain the oil immediately to be sure all the oil and suspended contaminants are removed from the engine.

※ **A drain pan with a capacity of 24 liters (6.3 U.S. gallons) will be adequate.**

※ **Disposal of the waste oil in accordance with local regulations.be adequate.**

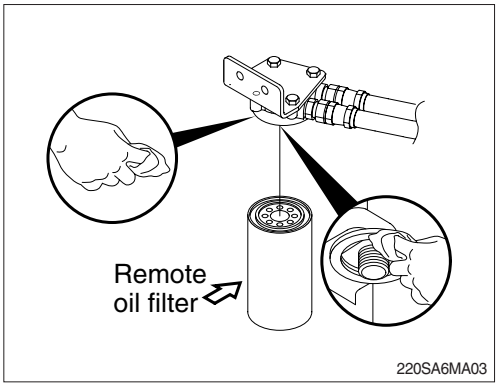


(3) Clean the area around the lubricating oil filter head.

(4) Use oil filter wrench to remove the oil filter.

(5) Clean the gasket surface of oil filter head.

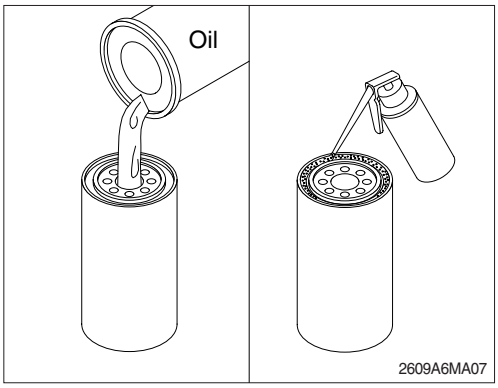
※ **The O-ring can stick on the filter head. Be sure it is removed before installing the new filter.**



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

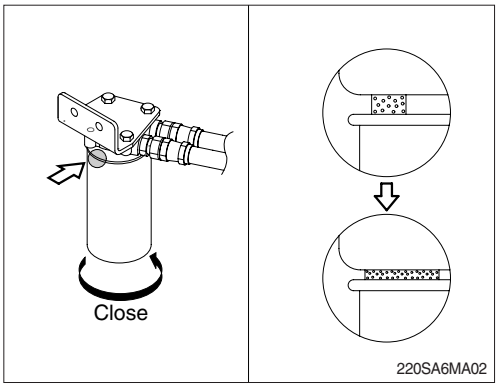
※ **Fill the filters with clean lubricating oil.**

※ **Be careful the no debris is poured into the filter. If using an oil supply with a metallic or plastic seal under the cap, be careful to peel the seal back. Punching the seal with a knife or sharp object can create debris in the oil container.**



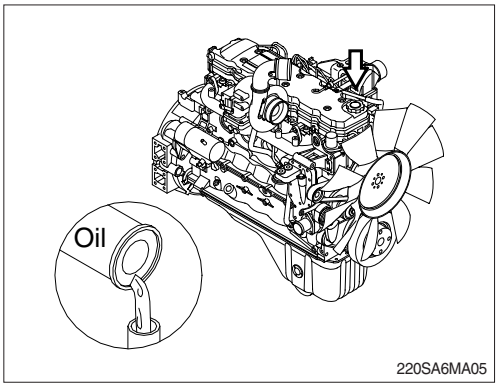
(7) Install the filter to the filter head.
Tighten the filter until the gasket contacts the filter head surface.
Tighten 3/4 to 1 turn after the gasket makes contact with the filter head.

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

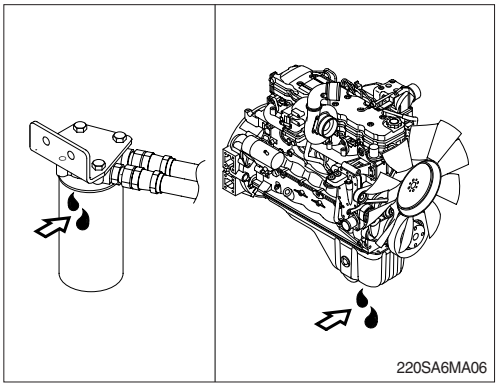


(8) Clean and check the lubricating oil drain plug threads and sealing surface.
Install the lubricating oil pan drain plug.

(9) Fill the engine with clean oil to the proper level.
· Quantity : 23.1 ℓ (6.1 U.S.gallons)



(10) 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 15 minutes for oil to drain down before checking.



3) CHECK COOLANT

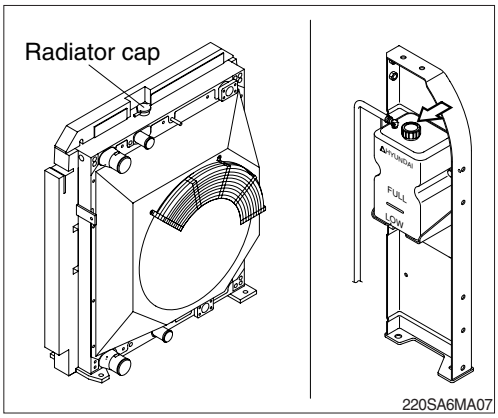
(1) Check if the level of coolant in reservoir tank is between FULL and LOW.

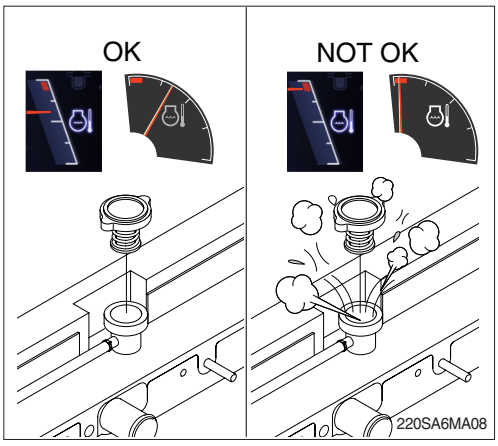
(2) Add the mixture of antifreeze and water after removing the cap of the reservoir tank if coolant is not sufficient.

(3) Be sure to use the reservoir empty, add the coolant by opening the cap of radiator.

(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.**



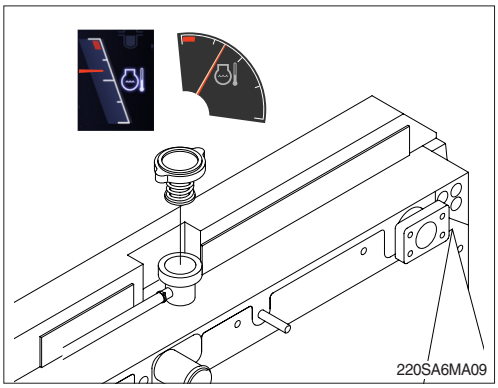


4) FLUSHING AND REFILLING OF RADIATOR

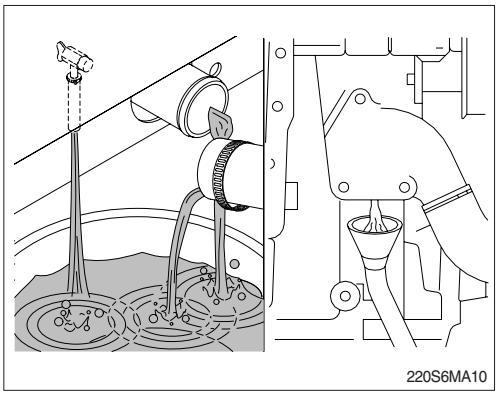
(1) Change coolant

⚠ **Avoid prolonged and repeated skin contact with used antifreeze. Such prolonged repeated contact can cause skin disorders or other bodily injury.**
Avoid excessive contact-wash thoroughly after contact.
Keep out of reach 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 valve on the bottom of the engine oil cooler housing.
A drain pan with a capacity of 40 liters (10.6 U.S. gallons) will be adequate.

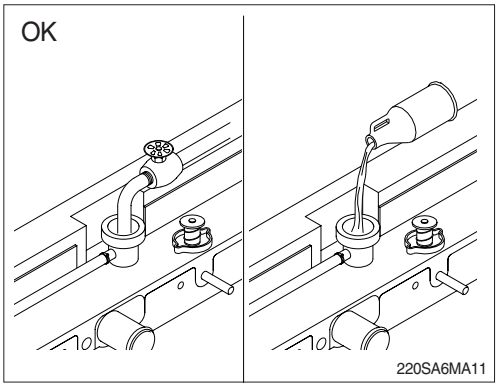

220S6MA10

(2) Flushing of cooling system

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

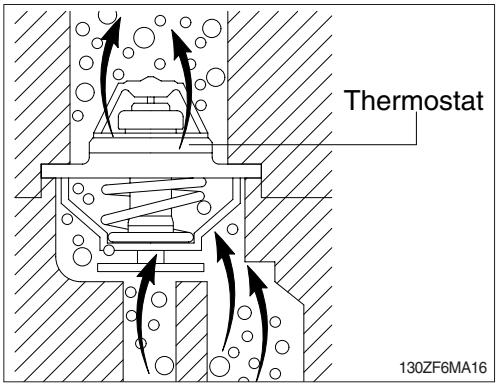
※ Use 0.5kg (1.0 pound) of sodium carbonate for every 23 liters (6.0 U.S. gallons) of water.

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



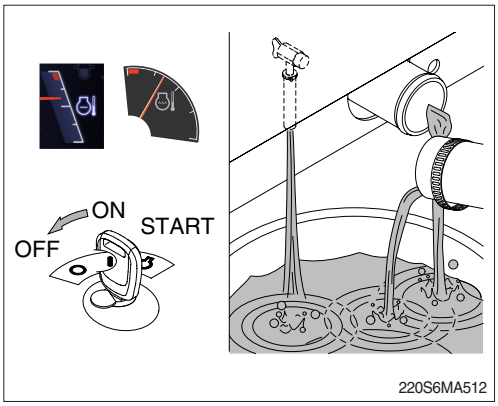
220SA6MA11

※ During filling, air must be vented from the engine coolant passages.
The system must be filled slowly to prevent air locks or serious engine damage can result. Wait 2 to 3 minutes to allow air to be vented, then add mixture to bring the level to the top.



130ZF6MA16

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.

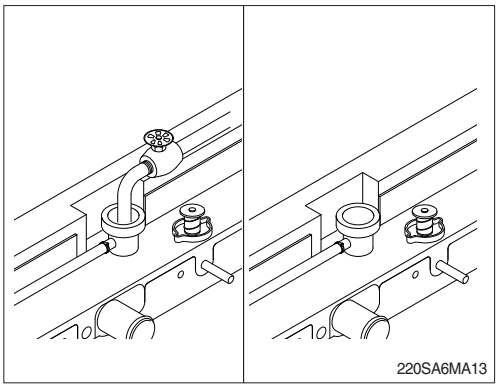


220S6MA512

③ Fill the cooling system with clean water.

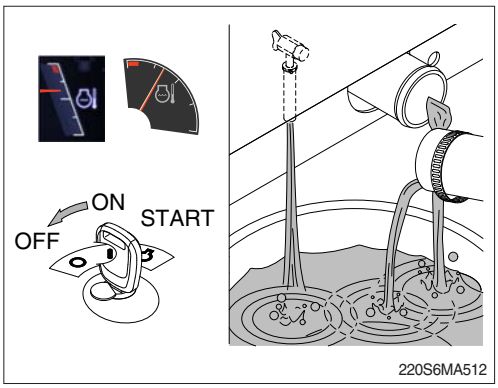
※ **Be sure to vent the engine and aftercooler for complete filling.**

※ **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.

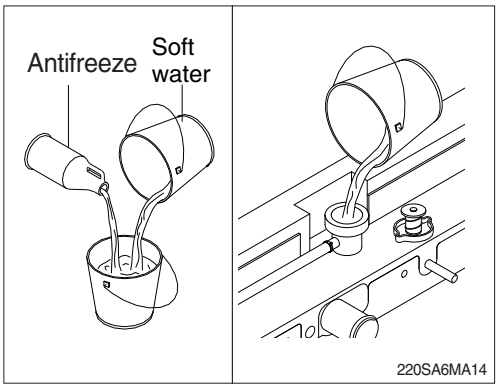
※ **If the water being drained is still dirty, the system must be flushed again until the water is clean.**



(3) Cooling system filling

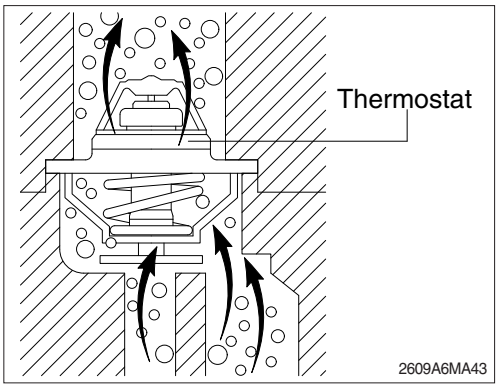
① Use a mixture of 50 percent soft water and 50 percent ethylene glycol antifreeze to fill the cooling system. Refer to the page 7-30.
Coolant capacity (engine only) : 8.5 ℓ (2.2 U.S. gallons)

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

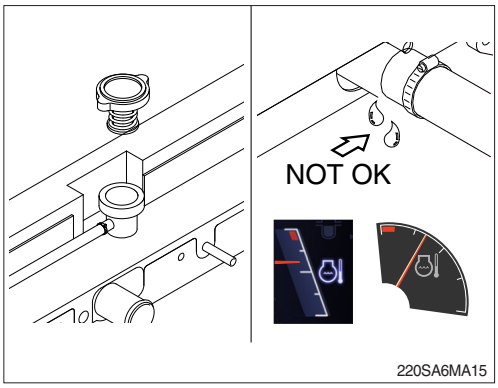


② The system has a maximum fill rate of 19 liters (5.0 U.S. gallons) per minute.
Do not exceed this fill rate.

※ **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.



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.

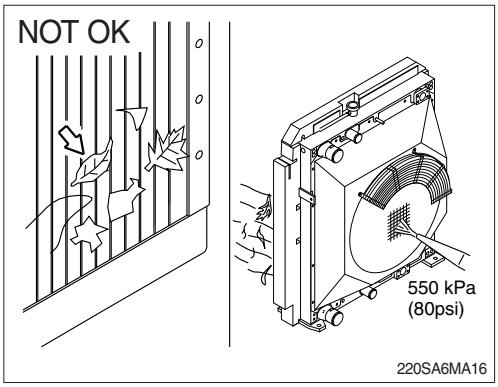
(1) Visually inspect the radiator for clogged radiator fins.

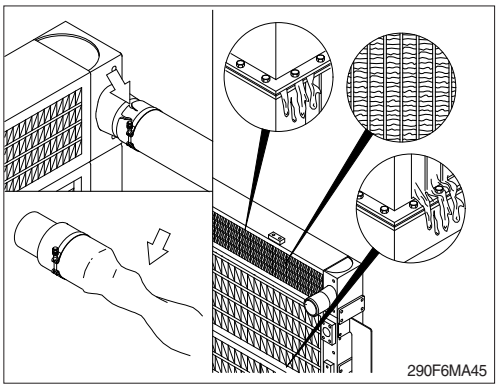
(2) Use 550 kPa (80 psi) air pressure to blow the dirt and debris from the fins.

(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.**

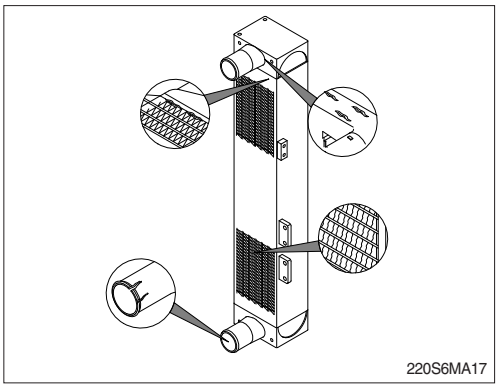
(4) Visually inspect the radiator for core leaks.





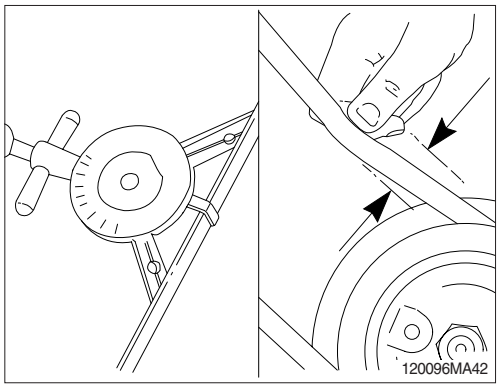
6) CHECK CHARGE AIR COOLER

Inspect the charge air cooler for dirt and debris blocking the fins. Check for cracks, holes, or other damage. If damage is found, please contact HD Hyundai Construction Equipment distributor.

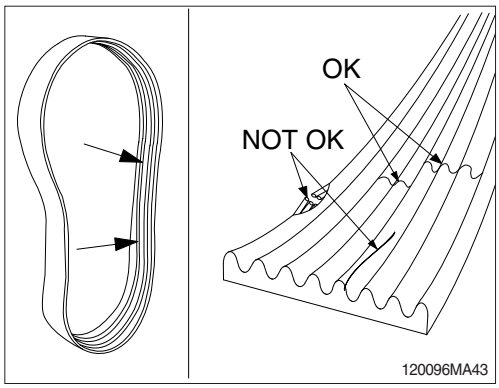


7) FAN BELT

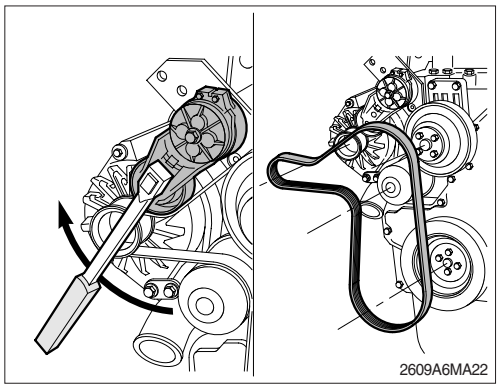
(1) An deflection method can be used to check belt tension by applying 11.3 kgf (25 lbf) force between the pulleys on V-belts. If the deflection is more than one belt thickness per foot of pulley center distance, the belt tension must be adjusted.



(2) Inspect the fan belt for damage.
① Transverse (across the belt) cracks are acceptable.
② Longitudinal (direction of belt ribs) cracks that intersect with transverse cracks are not accept able.
Replace the belt if it is frayed or has pieces of material missing.



(3) Inspect the idle and drive pulleys for wear or cracks.

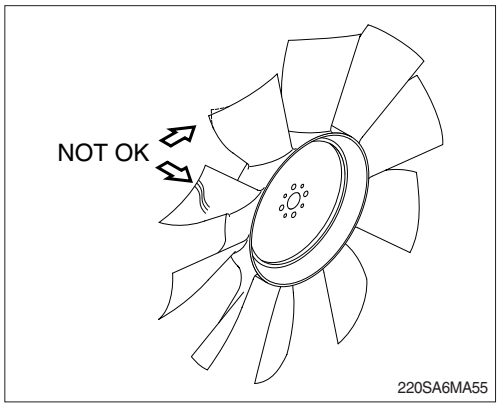


8) INSPECTION OF COOLING FAN

⚠ Personal 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.

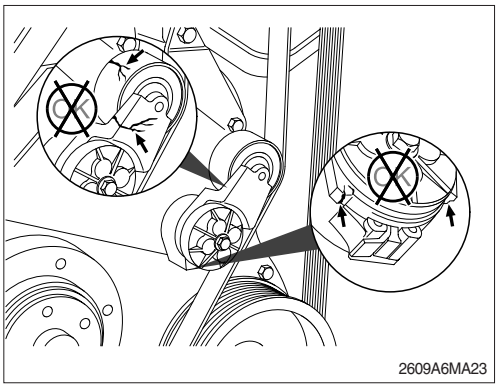
※ Rotate the crankshaft by using the engine bearing gear.

※ 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.

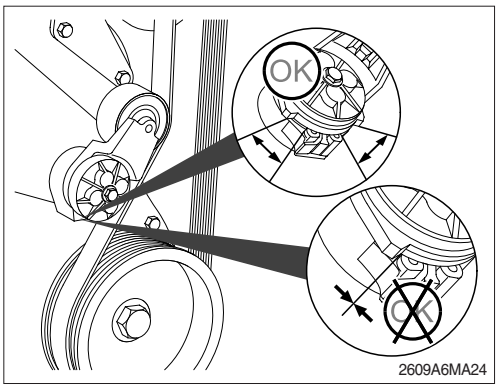


9) FAN BELT TENSIONER

(1) With the engine stopped, check the tensioner arm, pulley, and stops for cracks. If any cracks are found, the tensioner must be replaced.

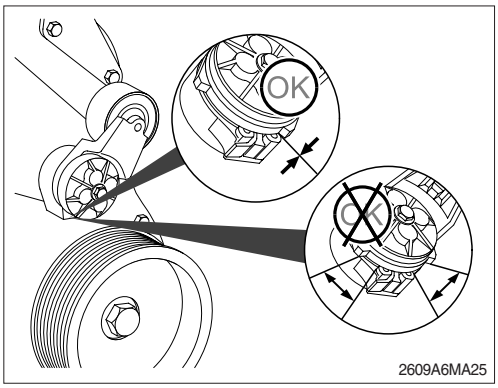


(2) With the belt installed, verify that neither tensioner arm stop is in contact with the spring case stop.
After replacing the belt, if the tensioner arm stops are still in contact with the spring case stop, replace the tensioner.

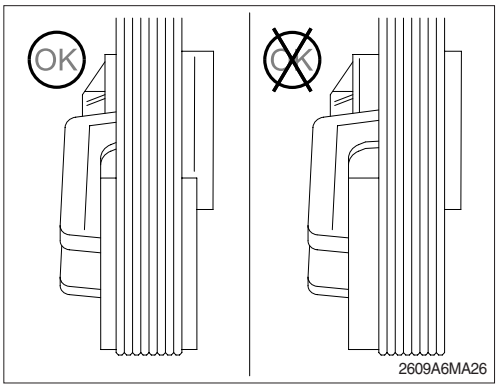


(3) With the belt removed, verify that the tensioner arm stop is in contact with the spring case stop.
If these two are not touching, the tensioner must be replaced.

※ **After replacing the belt, if the tensioner arm stop is still in contact with the spring case stop, the tensioner must be replace.**



(4) Check the location of the drive belt on the belt tensioner pulley. The belt should be centered on, or close to the middle of, the pulley. Misaligned belts, either too far forward or backward, can cause belt wear, belt roll-offs, or increase uneven tensioner bushing wear.



10) CLEANING OF AIR CLEANER

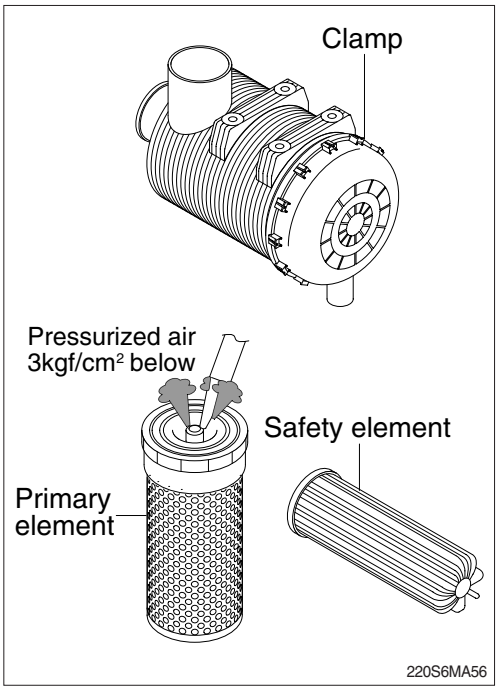
(1) Primary element

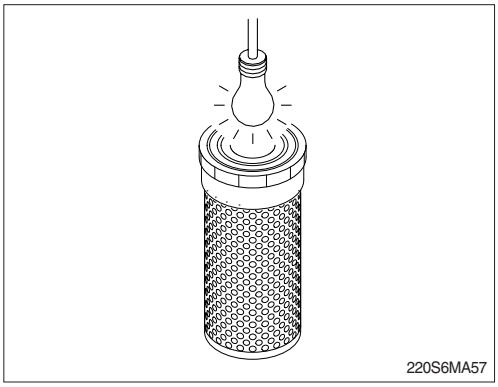
① Loosen the clamps and remove the element.
② Clean the inside of the body.
③ Clean the element with pressurized air.
· Remove the dust inside of the element by the pressurized air (below 3 kgf/cm², 40 psi) forward and backward equally.
④ Inspect for cracks or damage of element by putting a light bulb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

※ **Replace the primary element after 4 times cleanings.**

(2) Safety element

※ **Replace the safety element only when the primary element is cleaned for the 4 times.**
※ **Always replace the safety element. Never attempt to reuse the safety element by cleaning the element.**





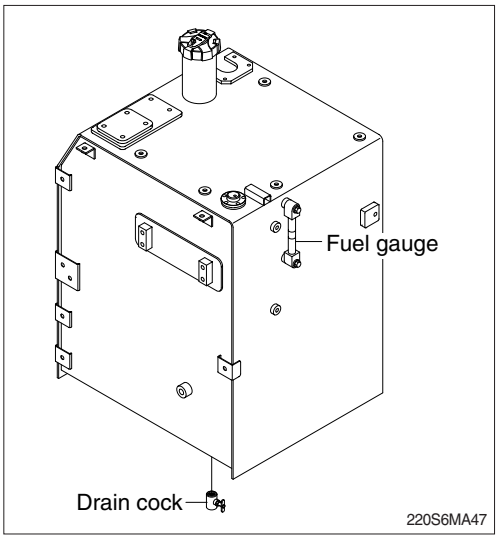
11) FUEL TANK

(1) Fill fuel fully when system the operation to minimize water condensation, and check it with fuel gauge before starting the machine.

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

※ 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.



12) PREFILTER

※ **Inspect or drain the collection bowl of water daily and replace the element every 500hours.**

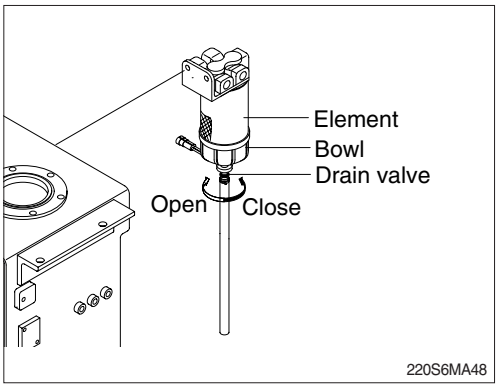
(1) Drain water

① Open bowl drain valve to evacuate water.

② Close drain valve.

※ **Don't tighten up a drain valve so strong.**

※ **Please inspect and drain water frequently for remain water volume to be less than 1/3 volume of a collection bowl.**



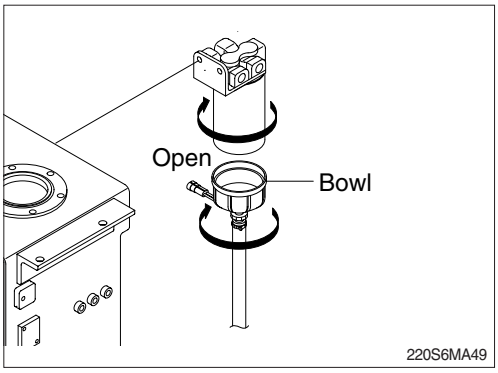
(2) Replace element

① Drain the unit of fuel. Follow "Drain water" instructions above.

② Remove element and bowl from filter head.

※ **The bowl is reusable, do not damage or discard.**

③ Separate element from bowl. Clean bowl and seal gland.

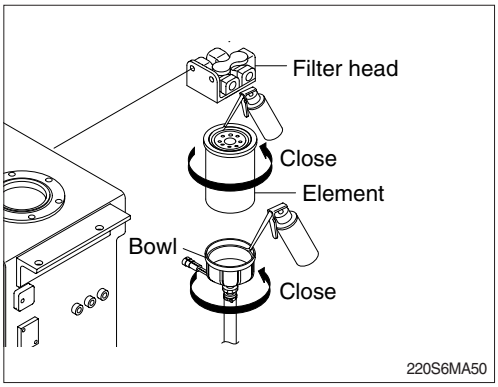


④ Lubricate new bowl seal with clean fuel or motor oil and place in bowl gland.

⑤ Attach bowl to new element firmly by hand.

⑥ Lubricate new element seal and place in element top gland.

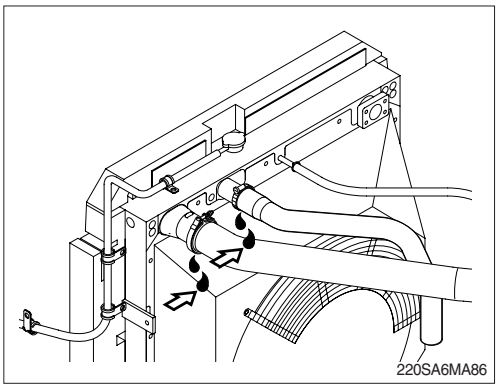
⑦ Attach the element and bowl to the head.



13) CHARGE AIR PIPING

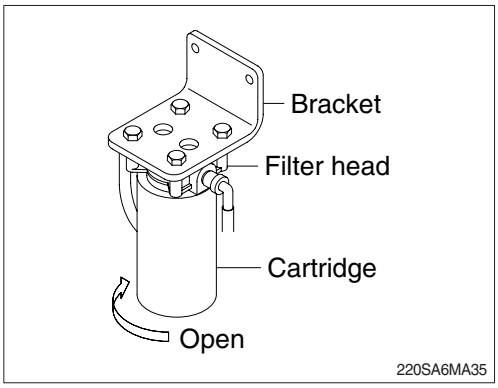
(1) Inspect the charge air piping and hoses for leaks, holes, cracks, or loose connections.

(2) Tighten the hose clamps if necessary.



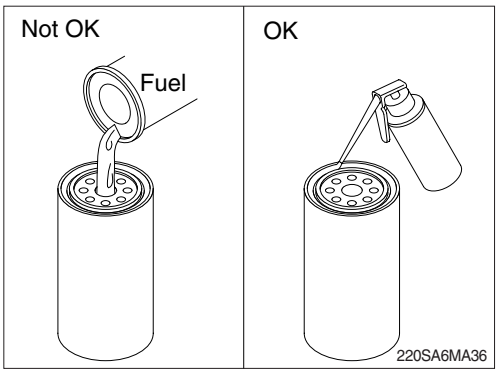
14) REPLACEMENT OF FUEL FILTER

(1) Clean the area around the filter head, remove the filter with a fuel filter wrench and clean the O-ring surface.



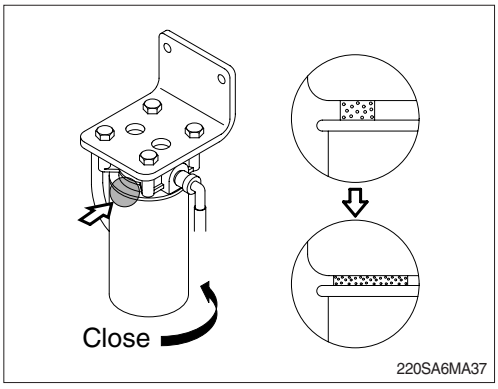
(2) Lubricate the O-ring of fuel filter with clean engine oil.

※ **Do not pre-fill fuel in the new fuel filter.**
The system must be primed after the fuel filter is installed. Pre-filling the fuel filter can result in debris entering the fuel system and anmaging fuel system components.



(3) Install the filter on the filter head.

※ **Tighten the filter until the gasket contacts the filter head surface and tighten the filter an additional 3/4 turn more after contacts the filter head.**



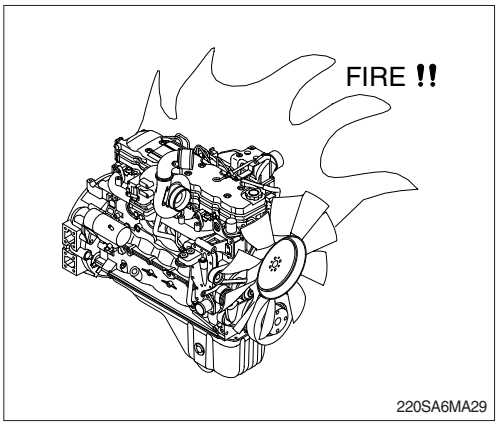
(4) Prime the low pressure system of the fuel system after fuel filter installation

※ **It is not necessary to vent air from the high pressure system before starting the engine.**

⚠ **The fuel pump high-pressure fuel lines and fuel rail contain very high-pressure fuel. Never loosen any fittings while the engine is running. Personal injury and property damage can result.**

15) LEAKAGE OF FUEL

⚠ Be careful and clean the fuel hose, injection pump, fuel filter and other connections as the leakage from these part can cause fire.



16) ENGINE CLEANING

⚠ When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing.
Hot steam can cause serious personal injury.

※ Turn OFF the master switch mounted electric box.

※ Steam ingress into electrical components can cause damage.

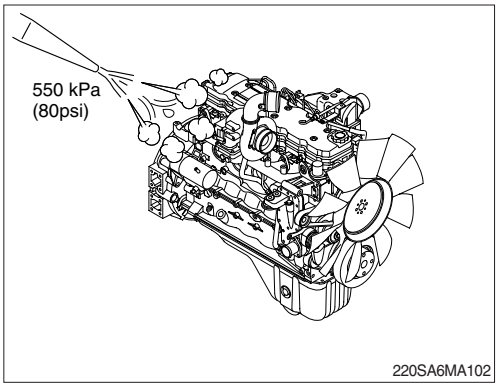
(1) Steam is the recommended method of cleaning a dirty engine or a piece of equipment.

(2) Protect all electrical components, openings, and wiring from the full force of the cleaner spray nozzle.

(3) Components to protect include, but are not limited to the following:
- Electrical components and connectors
- Wiring harnesses
- Belts and hoses
- Bearings (ball or taper roller)

△ Soap, solvent, or water ingress into air intake system can cause engine damage.

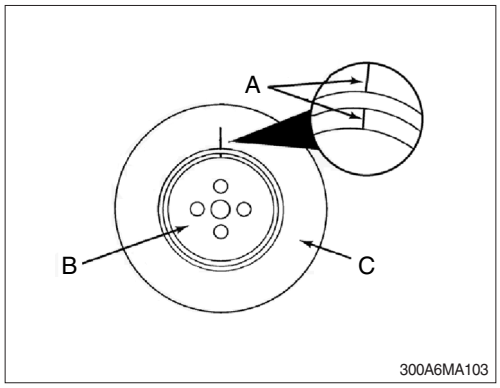
△ Do not directly spray or allow soap, solvent, or water to enter any passages, ports, or cowlings that lead to the engine air intake system.



17) VIBRATION DAMPER

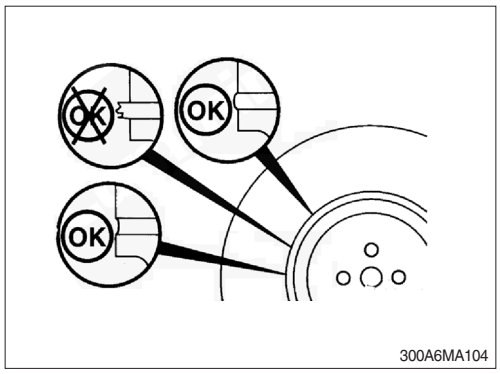
(1) Rubber

① Check the index lines (A) in the vibration damper hub (B) and the inertia member (C). If the lines are more than 1.59 mm (1/16 in) out of alignment, replace the vibration damper.



② Inspect the rubber member for deterioration. If pieces of rubber are missing or if the elastic member is more than 3.18 mm (1/8 in) below the metal surface, replace the damper.

③ Look for forward movement of the damper ring on the hub. Replace the vibration damper if any movement is detected.

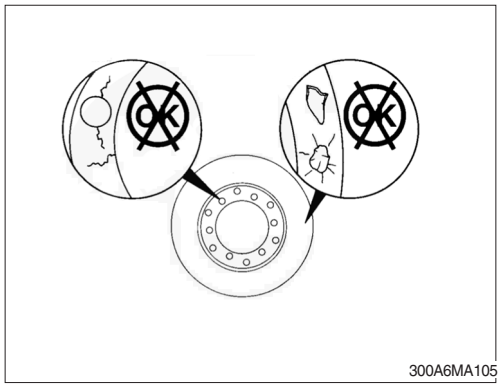


(2) Viscous

※ The silicone fluid in the vibration damper will become solid after extended service and will make the damper inoperative. An inoperative vibration damper can cause major engine or drivetrain failures.

① Check the vibration damper for evidence of fluid loss, dents, and wobble. Inspect the vibration damper thickness for any deformation or raising of the damper cover plate.

② If any of these conditions are identified, contact your local Cummins authorized repair location to replace the vibration damper.movement is detected.



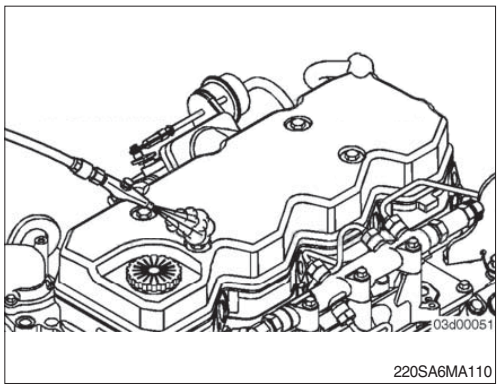
18) OVERHEAD SET ADJUSTMENT

This procedures are perform the repair shop.

※ Service tools

- Cummins barring tool, p/no. 3824591
- Feeler gauge

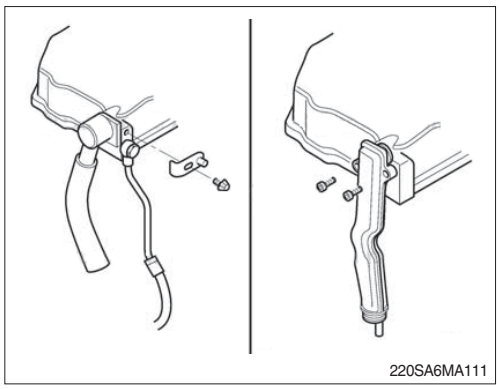
(1) Prior to removing any components, use compressed air to remove any loose debris from around the mounting fasteners and sealing joints.



220SA6MA110

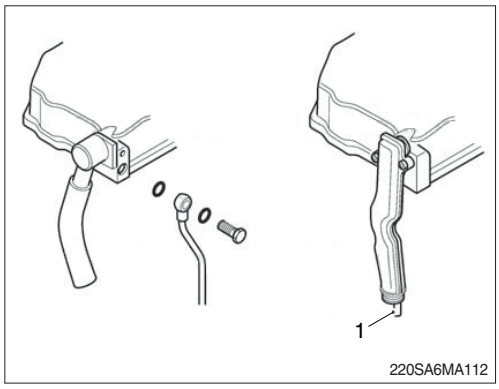
(2) Disconnect the breather tube connection at the back of the rocker lever cover.
In general, two types of breather tube connections are used at the rocker lever cover.

- A clamping plate and capscrew hole the breather tube connection to the rocker lever cover. Remove the capscrew and clamping plate to disconnect the breather tube connection from the rocker lever cover.
- One or two capscrew(s) directly mount the breather tube connection to the rocker lever cover. Remove the capscrew(s) to disconnect the breather tube connection from the rocker lever cover.


220SA6MA111

(3) If equipped, at the rear of the rocker lever, remove the banjo bolt and sealing washers connecting the breather oil drain line to the rocker lever cover.

※ Some engine the breather oil drain line is internal to the breathe connection tube (1).



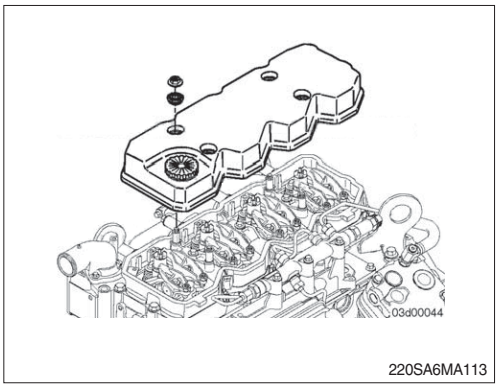
220SA6MA112

※ **Do not remove the rocker lever gasket on engines in which the rocker lever cover gasket is fit into a groove at the base of the rocker lever cover. The gasket is reusable. Once the gasket is removed from the rocker lever cover, it must be replaced.**

(4) Remove the mounting nuts and isolators from the rocker lever cover.

※ **If equipped, it may be necessary to gently pry the breather tube connection from the back of the rocker lever cover while removing.**

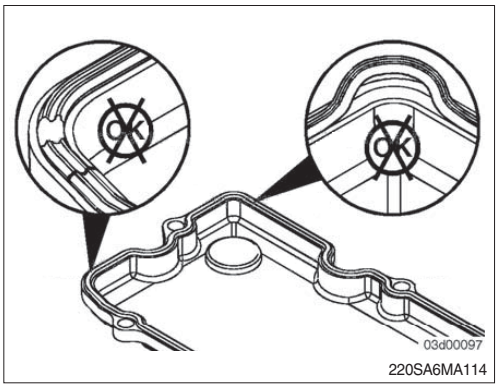
(5) Remove the rocker lever cover.



220SA6MA113

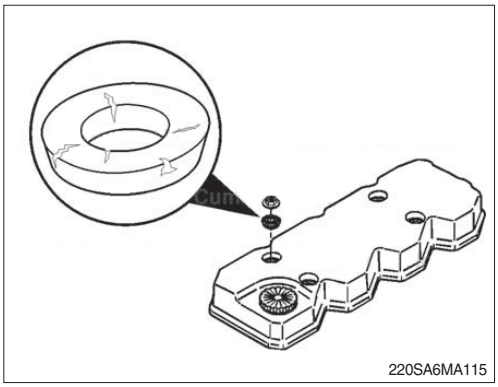
※ **Check the gasket while it is installed in the valve cover. Once the gasket is removed from the cover it must be replaced.**

(6) Check the gasket for cracks on the sealing surface.
Replace the gasket if damage is present.
Replace the gasket if it is removed from the groove in the rocker lever cover.



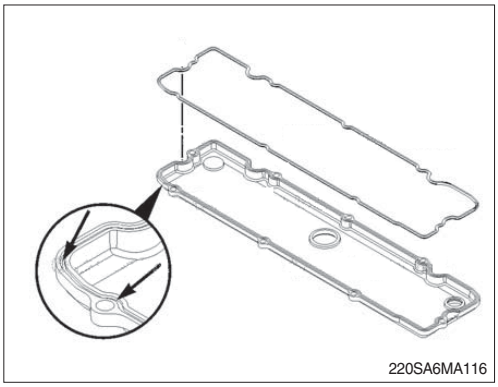
220SA6MA114

(7) Inspect the rubber isolators for cracks.
Replace if cracked or broken.


220SA6MA115

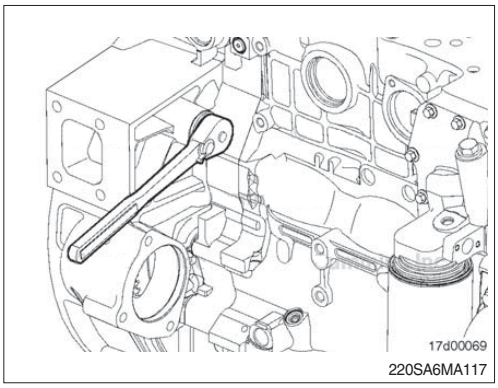
※ **If the gasket has been removed from the rocker lever cover, a new gasket must be used.**

(8) If replacing the press-in rocker lever gasket, the following installation procedure must be used.
- Press the molded gasket into the corners of the rocker lever cover.
- Press the rest of the gasket into the rocker lever cover.


220SA6MA116

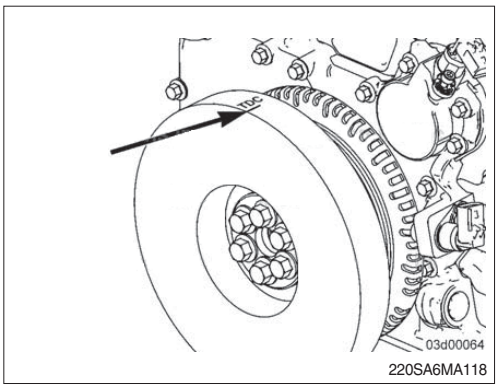
※ **Engine coolant temperature must be less than 60 ℃ (140 °F).**

(9) Use the barring tool, to rotate the crankshaft until the number is at TDC.
TDC can be determined by the following method.



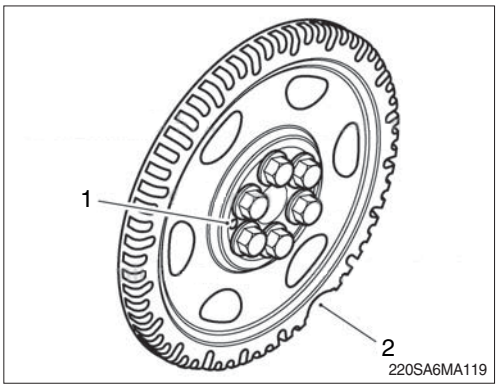
220SA6MA117

(10) Align the vibration damper/crankshaft speed indicator ring so the TDC indicator is at the 12 o'clock position. If both number 1 cylinder rocket levers are loose, move to the following steps. If both number 1 cylinder rocker levers are not loose, rotate the crankshaft 360 degrees.



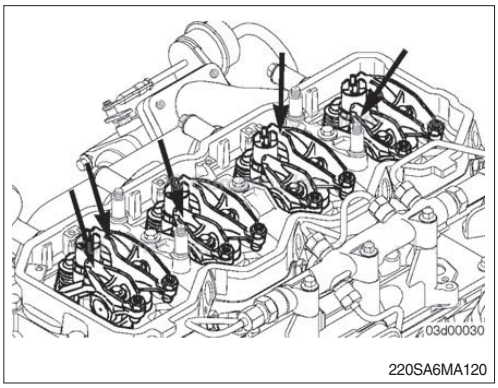
220SA6MA118

※ **If no TDC mark is present on either the vibration damper or the crankshaft speed indicator ring, align the large gap in the crankshaft speed indicator ring to the 5 o'clock position (2). The dowel pin will be visible in the 9 o'clock position (1). Check that both number 1 cylinder rocker levers are loose. If they are not loose, rotate the crankshaft 360 degrees and check again.**



220SA6MA119

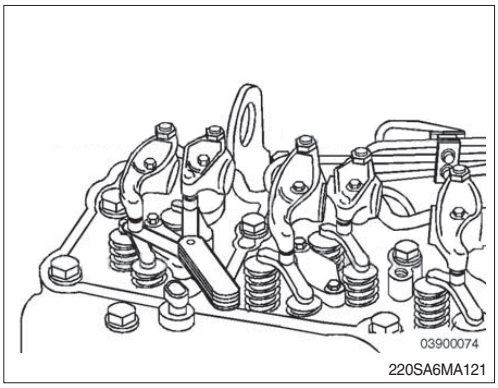
(11) With the engine in this position, lash can be checked on the following rocker arms.
(E=exhaust, I=Intake)
Four-cylinder 1I, 1E, 2I and 3E)
Six-cylinder 1I, 1E, 2I, 3E, 4I and 5E)



220SA6MA120

※ **Lash check limits**

Item		mm	inch
Intake	Min	0.152	0.006
	Max	0.381	0.015
Exhaust	Min	0.381	0.015
	Max	0.762	0.030



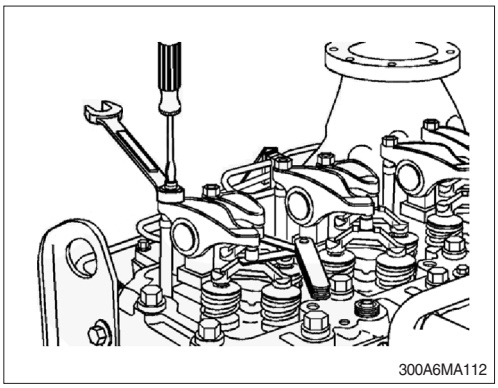
※ **Checking the overhead setting is usually performed as part of a troubleshooting procedure, and resetting is not required during checks, as long as the lash measurements are within the above ranges.**

※ **The clearance is correct when some resistance is "felt" when the feeler gauge is slipped between the crosshead and the rocker lever socket.**

(12) Measure lash by inserting a feeler gauge between the corsshead and the rocker lever socket. If the lash measurement is out of specification, loosen the locknut, and adjust the lash to nominal specifications.

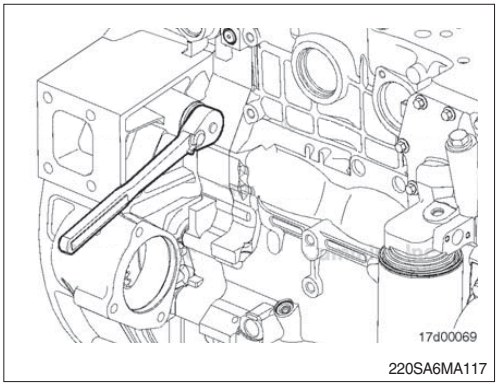
Lash specifications

Item	mm	inch
Intake	0.254	0.010
Exhaust	0.508	0.020



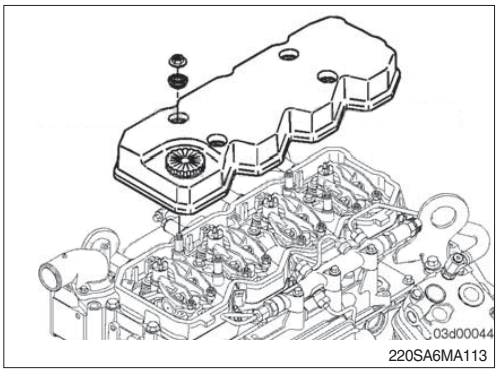
(13) Tighten the locknut.
Tightening torque : 2.4 kgf·m (17.4 lbf·ft)

(14) Use the barring tool, to rotate the crankshaft 360 degrees.
Following the same steps and specifications as previously stated, measure lash for the following rockers.
(E=exhaust, I=Intake)
Four-cylinder 2E, 3I, 4E and 4I)
Six-cylinder 2E, 3I, 4E, 5I, 6I and 6E)
Reset if out of specification.



(15) Stud mounted rocker lever cover

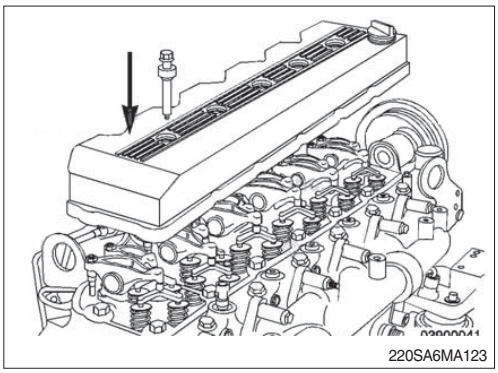
① Install the rocker lever cover over the mounting capscrews.
② Install the isolators and mounting nuts.
③ Tighten the mounting nuts.
Tightening torque : 2.4 kgf·m (17.4 lbf·ft)



220SA6MA113

(16) Capscrew mounted rocker lever cover

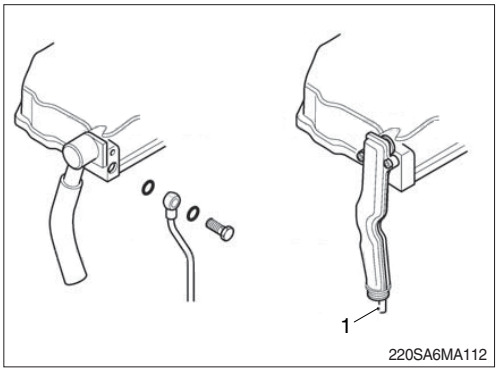
① Install the rocker lever cover.
② Install the mounting capscrews and isolators.
③ Tighten the mounting capscrews.
Tightening torque : 2.4 kgf·m (17.4 lbf·ft)


220SA6MA123

(17) If equipped, at the rear of the rocker lever cover, install the banjo bolt and sealing washers connecting the breather oil drain line to the rocker lever cover.

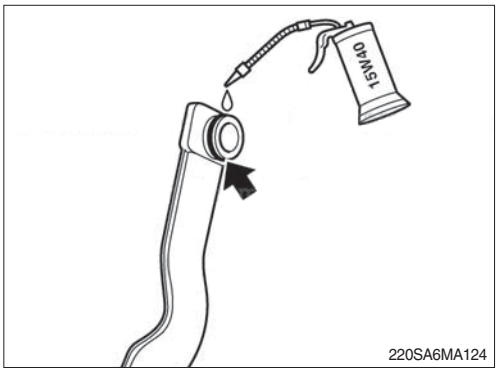
Tightening torque : 1.2 kgf·m (8.7 lbf·ft)

※ Some engine the breather oil drain line is internal to the breathe connection tube (1).



220SA6MA112

(18) Prior to connecting the breather connection tube to the rocker lever cover, apply clean engine oil to the O-ring located on the breather tube connection.

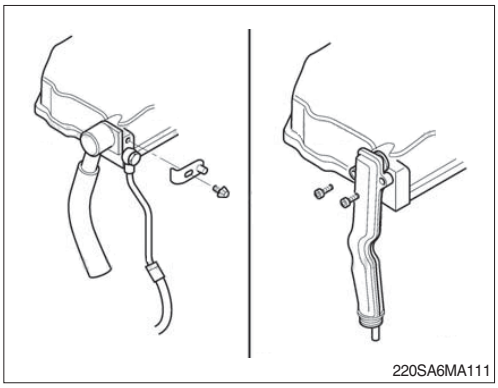


220SA6MA124

(19) Connect the breather tube connection to the rocker lever cover.

In general, two types of breather tube connections are used at the rocker lever cover.

- A clamping plate and capscrew hole the breather tube connection to the rocker lever cover. Remove the capscrew and clamping plate to disconnect the breather tube connection from the rocker lever cover.
- One or two capscrew(s) directly mount the breather tube connection to the rocker lever cover. Remove the capscrew(s) to disconnect the breather tube connection from the rocker lever cover.


220SA6MA111

(20) Tighten the capscrew(s).

Tightening torque : 1.0 kgf·m (7.2 lbf·ft)

19) FUEL FILLER PUMP FILTER

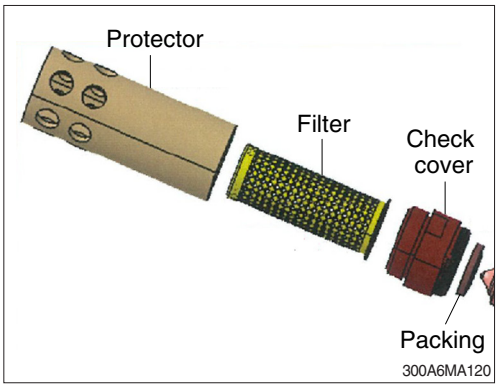
Cleaning the filter periodically as followings.

(1) Clean the filter when it is required by visual inspection.

(2) Replace the filter when it is permanently damaged.

※ Clean with fuel or air blow, water should not be mixed.

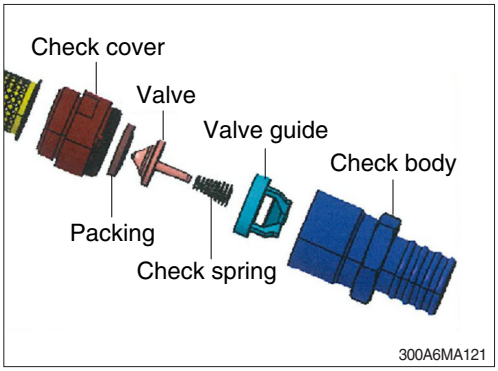
※ The structure can be loosen by hand.



(3) Check valve

① The check valve keeps equipped conditions on the hose ordinarily except maintenance.

② Remove the contamination or replace the check valve when the foreign material is caught.

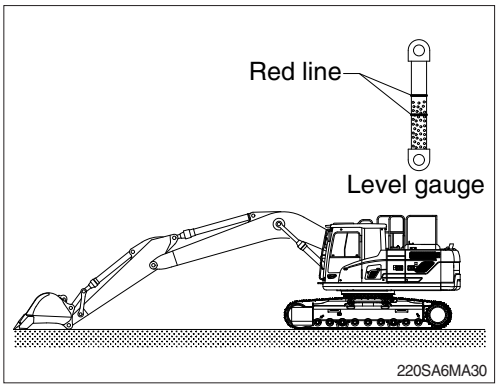


20) HYDRAULIC OIL CHECK

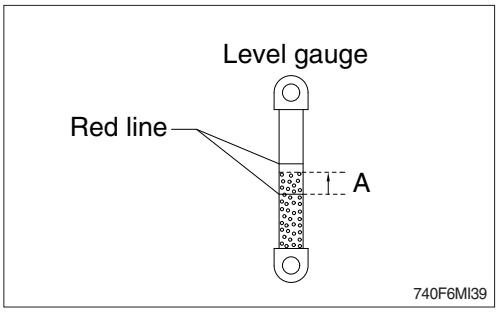
(1) Position the machine as shown in the illustration on the right. Please stop the engine and wait for about 5 minutes.

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

(3) The oil level is normal if the oil is between the red lines. The oil level depends on the temperature of the hydraulic oil. Refer to the height (A) in the below table to check the level gauge.



Temperature		Height A	
℃	°F	mm	inch
0	32	15	0.6
10	50	25	1.0
20	68	30	1.2
30	86	35	1.4
40	104	40	1.6



※ Refer to page 3-22 for checking the temperature of the hydraulic oil.

※ Add the hydraulic oil, if necessary.

21) FILLING HYDRAULIC OIL

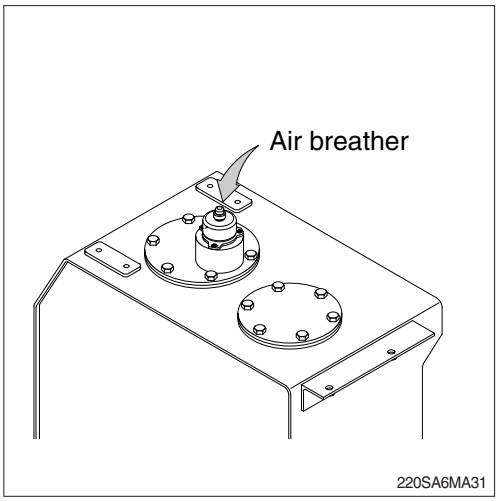
(1) Stop the engine to the position of level check.

(2) Relieve the pressure in the tank by pushing the top of the air breather.

(3) Remove the breather on the top of oil tank and 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.



22) CHANGE HYDRAULIC OIL

(1) Lower the bucket on the ground pulling the arm and bucket cylinder to the maximum.

(2) Relieve the pressure in the tank by pushing the top of the air breather.

(3) Remove the cover.
- Tightening torque : 6.9±1.4 kgf · m (50±10 lbf · ft)

(4) Prepare a suitable container.

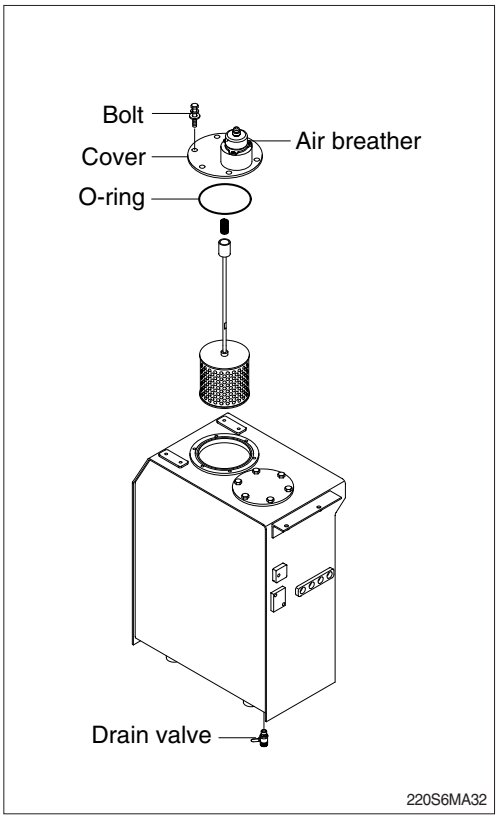
(5) To drain the oil open the drain valve at the bottom of the oil tank.

(6) Fill proper amount of recommended oil.

(7) Put the breather in the right position.

(8) Bleed air hydraulic pump loosen the air breather at top of hydraulic pump assembly.

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



23) CLEAN SUCTION STRAINER

Clean suction strainer as follows paying attention to the cause to be kept during oil filling.

(1) Remove the cover.
- Tightening torque : 6.9±1.4 kgf · m (50±10 lbf · ft)

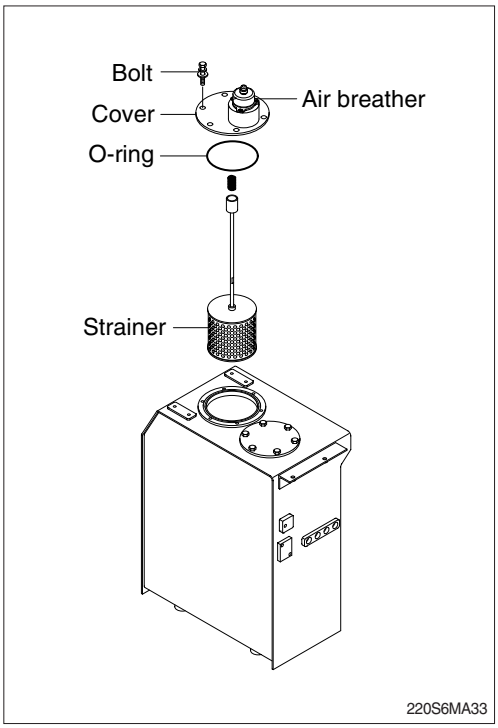
(2) Pull out the strainer in the tank.

(3) Wash the foreign material on the suction strainer with gasoline or cleaning oil.

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

(5) Assemble with reverse order of disassembly. Be sure to install a new O-ring and reinsert in the oil tank.

※ Loosen the bolt slowly at the cover can be spring out by the spring when removing it.



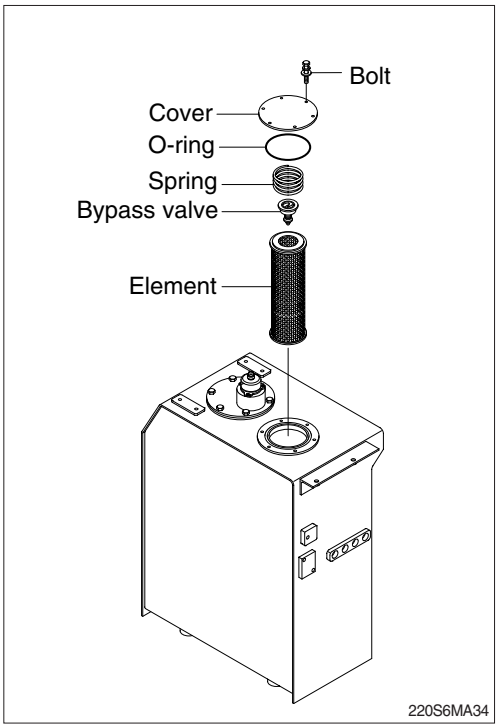
24) REPLACEMENT OF RETURN FILTER

Replace as follows paying attention to the cause to be kept during the replacement.

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

(2) Remove the spring, by-pass valve and return filter in the tank.

(3) Replace the element with new one.



25) REPLACEMENT OF ELEMENT IN HYDRAULIC TANK BREATHER

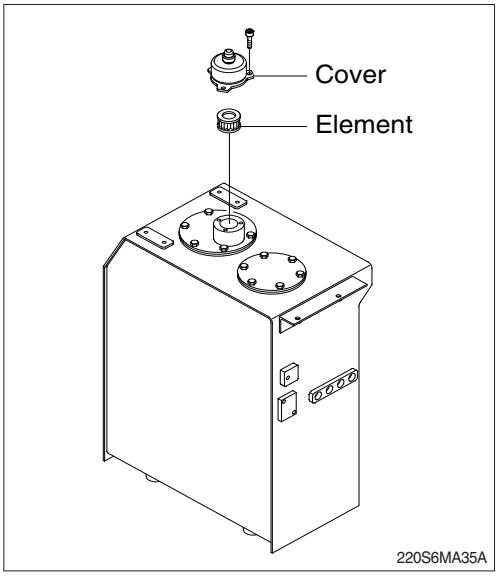
(1) Relieve the pressure in the tank by pushing the top of the air breather.

(2) Loosen the bolt and remove the cover.

(3) Pull out the filter element.

(4) Replace the filter element new one.

(5) Reassemble by reverse order of disassembly.
· Tightening torque : 0.8~1.0 kgf · m
(5.9~7.4 lbf · ft)

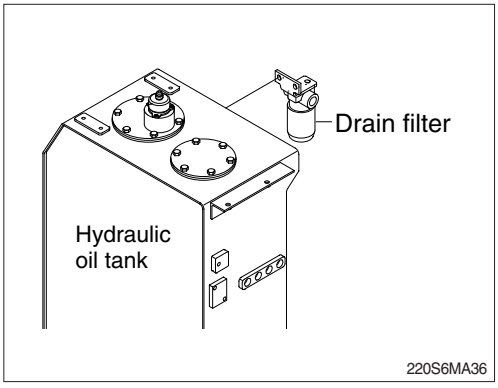


26) REPLACE OF DRAIN FILTER CARTRIDGE

Clean the dust around filter and replace with new one after removing the cartridge.

※ Tighten about 2/3 turn more after the gasket of cartridge contacts seal side of filter body for mounting.

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



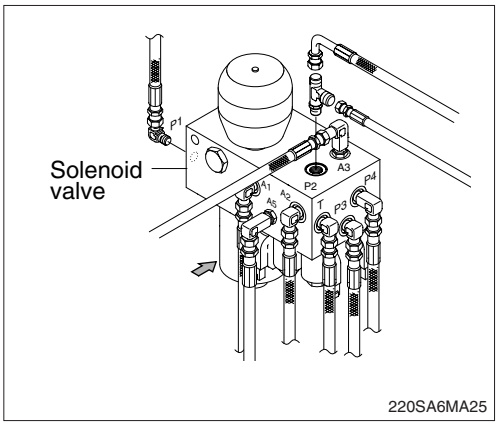
27) REPLACE OF PILOT LINE FILTER

(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.



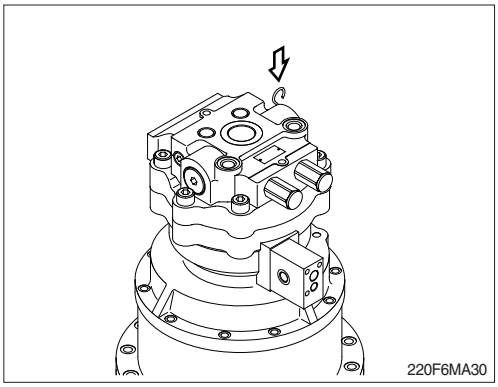
220SA6MA25

28) CHECK THE SWING REDUCTION GEAR OIL

(1) Pull out the dipstick and clean it.

(2) Insert it again.

(3) Pull out one more time to check the oil level and fill the oil if the level is not sufficient.


220F6MA30

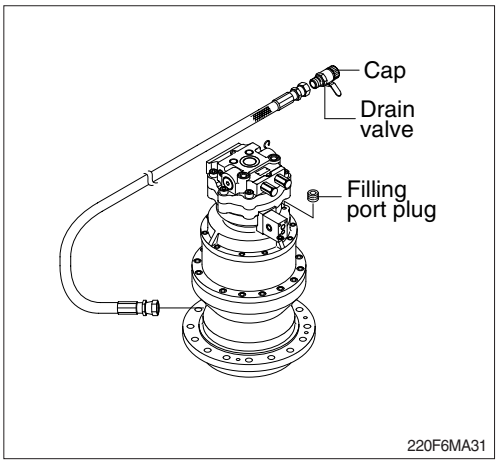
29) CHANGE SWING REDUCTION GEAR OIL

(1) Raise the temperature of oil by swinging the machine before replace the oil and park the machine on the flat ground.

(2) Prepare a proper container.

(3) Open the cap and loosen the drain valve.

(4) Clean around the valve and close the drain valve and cap.
Fill proper amount of recommended oil.
· Amount of oil : 6.2 ℓ (1.6 U.S.gal)

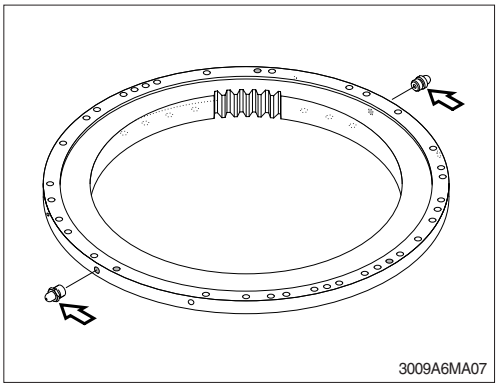


220F6MA31

30) LUBRICATE SWING BEARING

(1) Grease at 2 fitting.

※ Lubricate every 250 hours..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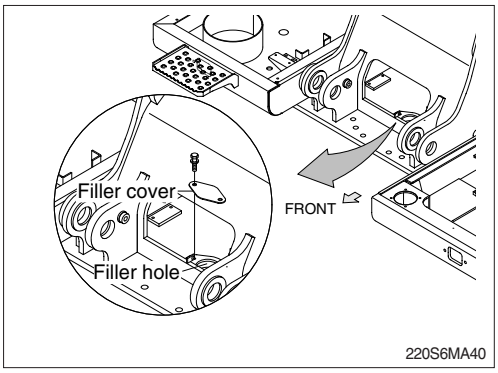
31) SWING GEAR AND PINION

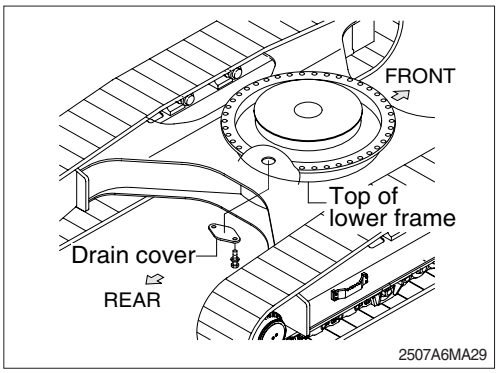
(1) Drain old grease

① Remove under cover of lower frame.
② Remove drain cover of lower frame.
③ Remove filler cover of upper frame.
④ Operate full turn (360˚) of swing several times.



(2) Refill new grease

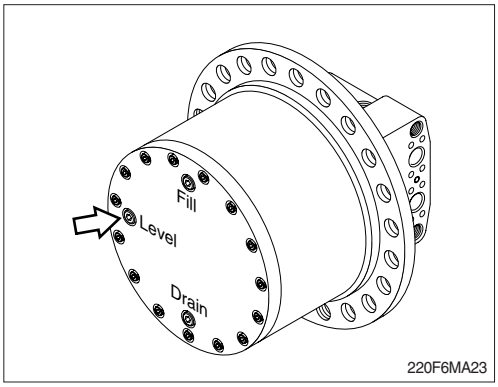
① Install drain cover.
② Fill with new grease.
③ Install filler cover.
· Capacity : 7.9 kg (17.5 lb)



32) CHECK THE TRAVEL REDUCTION GEAR OIL

(1) Operate the machine to the position of drain plug down to the 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.
· Amount of oil : 4.5 ℓ (1.2 U.S.gal)



33) CHANGE OF THE TRAVEL REDUCTION GEAR OIL

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

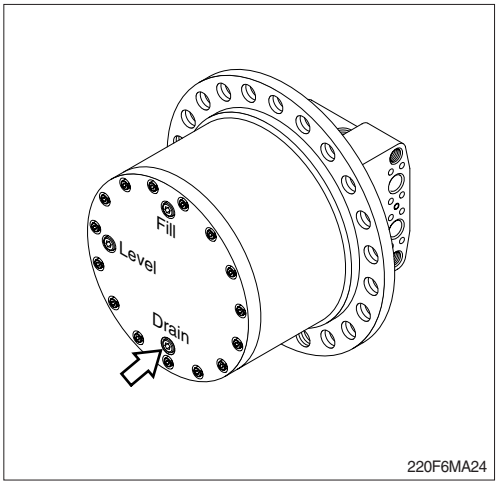
(2) Stop when the position of the drain plug is down.

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

(4) Drain the oil to adequate container.

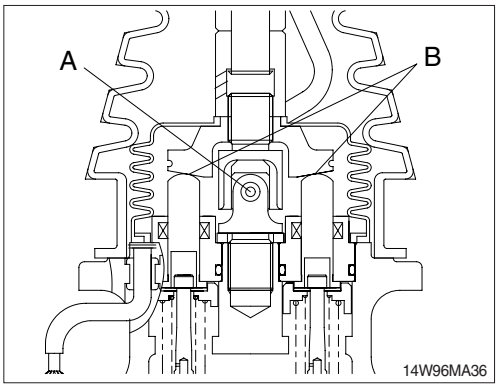
(5) Tighten the drain plug and fill specified amount of oil at filling port.

(6) Tighten the level plug and travel slowly to check if there is any leakage of oil.



34) LUBRICATE RCV LEVER

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



35) ADJUSTMENT OF TRACK TENSION

(Machine Serial No. : -#0234)

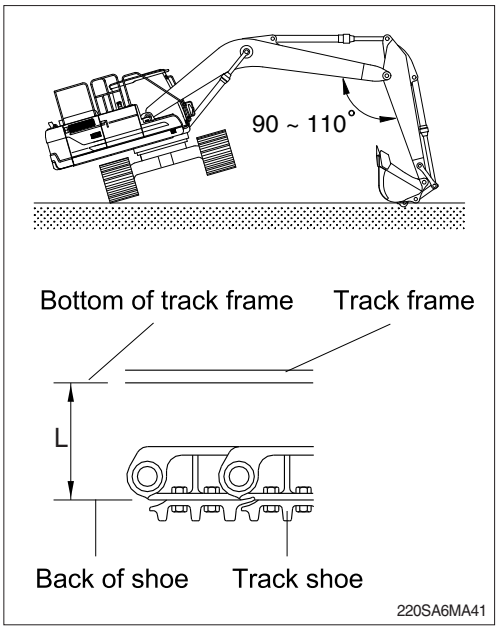
※ It is important to adjust the tension of track properly to extend the lifetime of track and traveling device.

※ The wear of pins and bushings on the under-carriage 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.

(2) Measure the distance between bottom of track frame on track center and back of shoe.

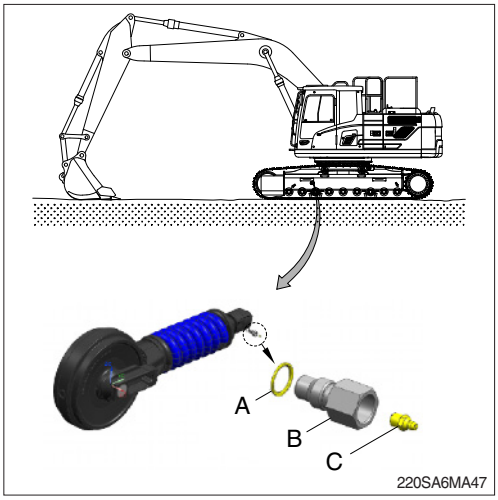
※ Remove mud with rotating the track before measuring.



(3) If the tension is tight, loosen the valve (B) gradually to drain the grease, but not more than one turn.
If the tension is loose, fill the grease through grease nipple (C) using a grease gun.

(4) When the proper track sag is obtained, close grease valve (B) but do not tighten excessively as the fitting may be damaged.
· Valve tightening torque : 13 kgf·m (94 lb·ft)

Length (L)	
360~390 mm	14.2~15.4"



※ Remove the mud and sand cleanly on the assembly face in order to prevent damage to seal (A) before assembling grease valve (B).
If seal (A) is damaged, replace with a new one and assemble it.

⚠ Personal injury or death can result from grease under pressure.
Keep face, hands and body away from the nipple and valve.

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

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

35) ADJUSTMENT OF TRACK TENSION

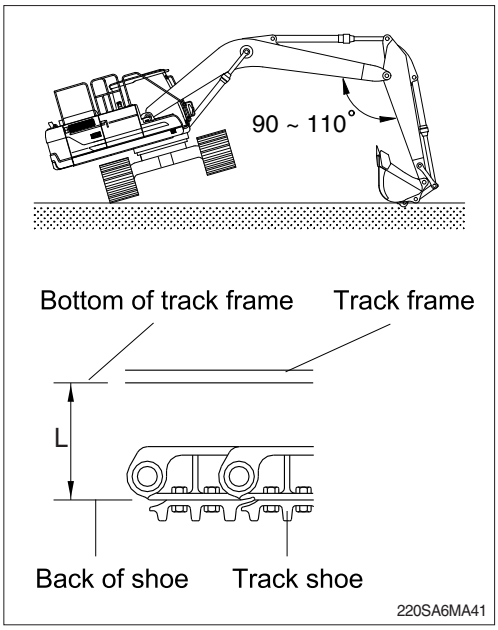
(Machine Serial No. : #0235-)

⚠ **Serious injury or death can result from grease under pressure. Keep face, hands and body away from the fitting valve.**

※ **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.

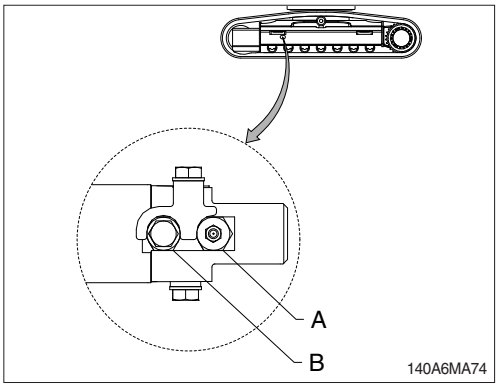


(2) Measure the distance between bottom of track frame on track center and back of shoe.

※ **Remove mud by rotating the track before measuring.**

Length (L)	
360~390 mm	14.2~15.4"

(3) The track tension can be adjusted using the grease fitting valve (A) and handle screws (B) located in the center of each side frame. When you fill the grease fittings with grease, it increases the length of the adjustable cylinders. As the adjustable cylinders become longer, pressure builds up in the tension springs, causing them to expand beyond the track idlers.



(4) If the tracks and adjustment devices expand to the point where there is insufficient deflection or space between parts, turn the handle screw clockwise once or twice to release some of the grease. Once the track tension is suitable, tighten the handle screw in the counterclockwise direction.

· Valve tightening torque : 7±1 kgf·m (5.2±0.7 lb·ft)

※ **Check the tension again after rotating the track 3~4 times.**

⚠ **After draining, if the handle screw can not be turned counterclockwise, the grease will continue to drain. Moreover, excessive counterclockwise turning may damage the screw's stopper. Rotate the handle screw by no more than one or two turns.**

36) 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 signals to each other and work carefully for safety's sake.

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

(2) Lock the safety knob 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.

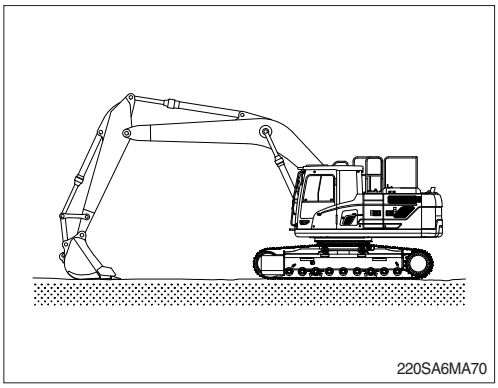
※ If the bucket is lowered strongly to the ground, the resistance will be increased and it will be difficult to remove the pins.

※ After remove the pins, make sure that they do not become contaminated with sand or mud and that the seals of bushing 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 knocking 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.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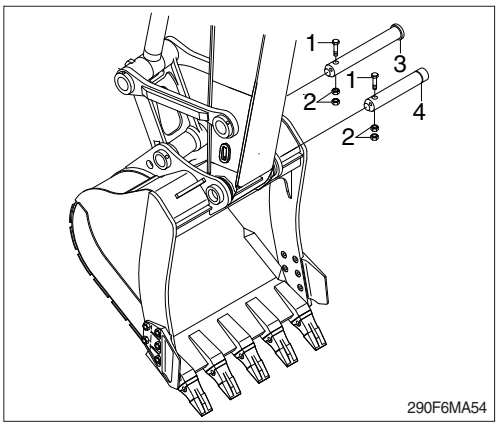

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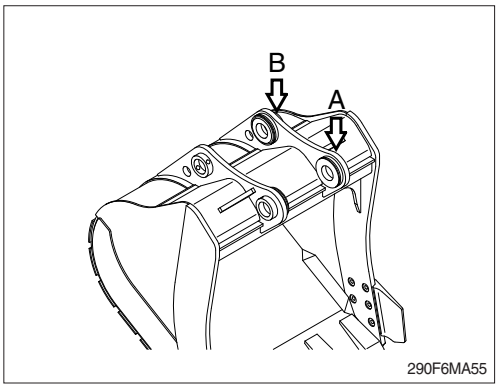

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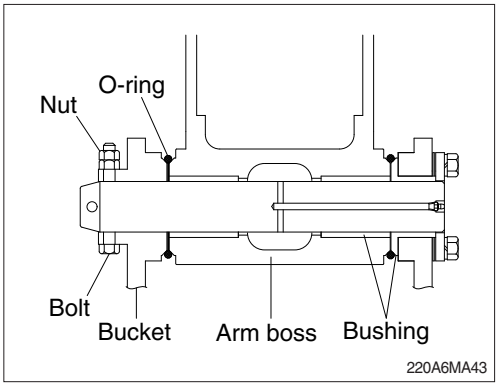


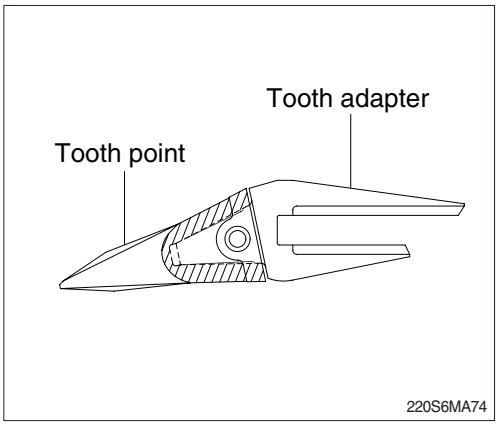
220A6MA43

37) REPLACEMENT OF BUCKET TOOTH

(1) Timing of replacement

① Check wearing condition as shown in the illustration and replace tooth point before adapter starts to wear.

② If excessive use, tooth adapter has worn out, replacement may become impossible.



(2) Instructions for replacement

① Pull out pin by striking pin with punch or hammer, avoiding damage to lock washer.

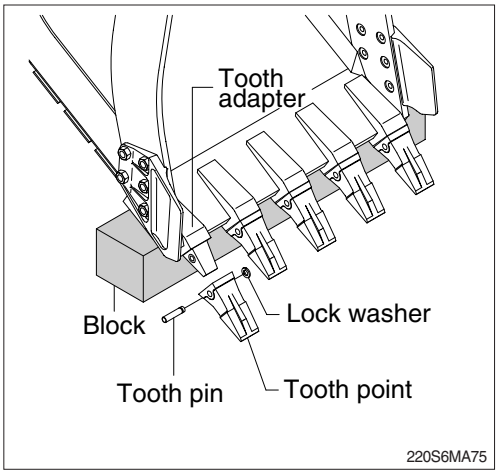
② Remove dust and mud from surface of tooth adapter by using knife.

③ Place lock washer in its proper place, and fit tooth tip to adapter.

④ Insert pin until lock washer is positioned at tooth point groove.

⚠ Personal injury can result from bucket falling.

⚠ Block the bucket before changing tooth points or side cutters.



38) ADJUSTMENT OF BUCKET CLEARANCE

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

(2) Swing to the right and keep the arm boss to be contact to the bucket left.

(3) Lock the safety knob to the LOCK position and stop the engine.

(4) Measure the clearance (A) between bucket and arm boss. This is the total clearance.

(5) Adjusting

① Loosen bolt (2), and remove washer (3), plate (1) and shim (4).

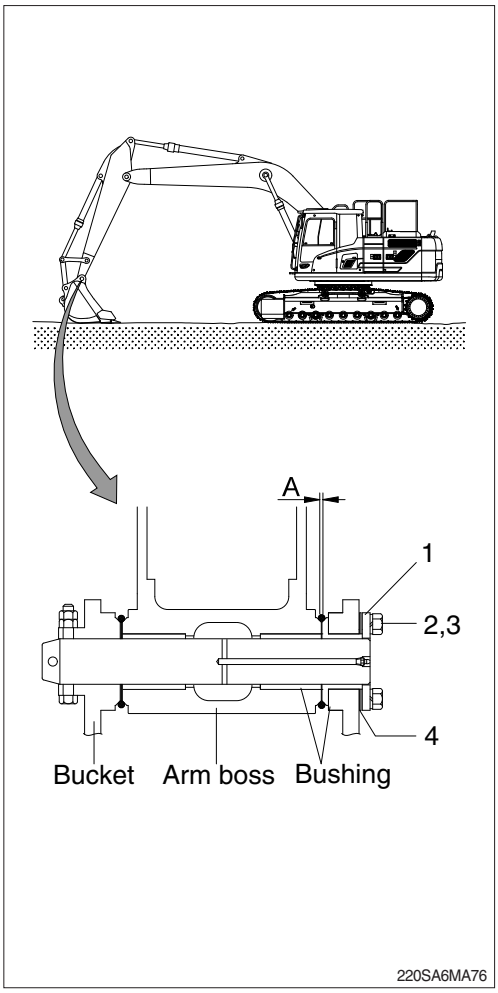
② Remove the shim equivalent value with measuring value.

③ Assemble the parts in the reverse order of removal.

· Tightening torque : 29.6±3.2 kgf · m
(214.0±23.1 lbf · ft)

· Normal clearance : 0.5 ~ 1.0 mm
(0.02 ~ 0.04 in)

※ If the bucket is not adjusted correctly, noise and vibration created during operation, and damaged O-ring, pin and bushing quickly.



39) LUBRICATE PIN AND BUSHING

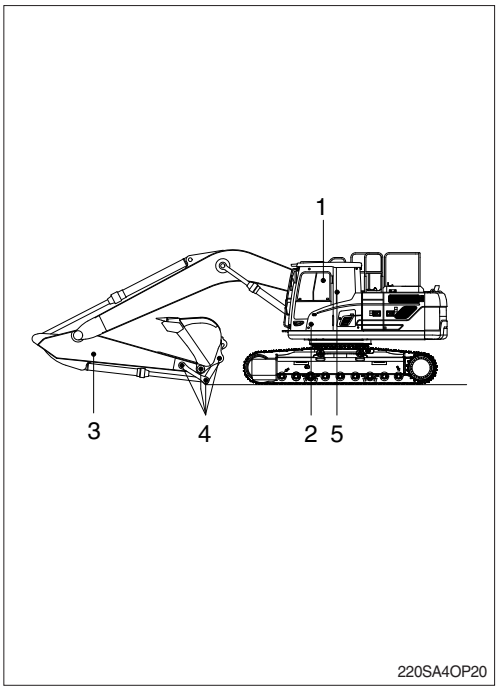
(1) Lubricate to each pin of working device

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

No.	Description	Qty
1	Lubrication manifold at boom	5
2	Boom cylinder pin (head)	2
3	Lubrication manifold at arm	3
4	Bucket cylinder pin (rod)	1
	Bucket link (control rod)	2
	Arm and bucket connection pin	1
	Bucket and control rod connection pin	1
	Arm and control link connection pin	1
5	Boom rear bearing center ★	1

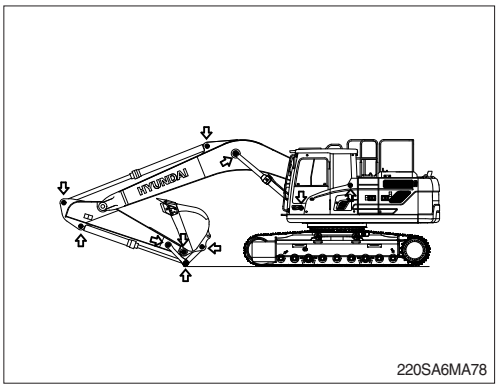
※ Shorten lubricating interval when working in water or dusty places.

★ Not required : If necessary, lubricate the grease.



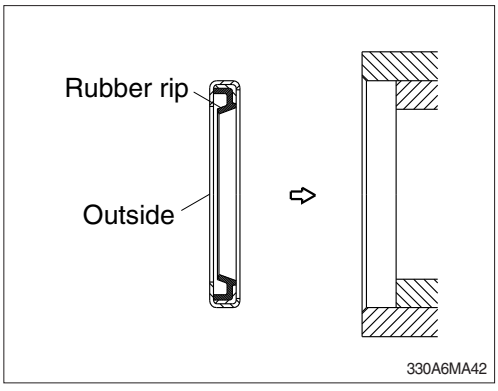
(2) Dust seals are mounted on the rotating part of working device to extend the lubricating interval.

※ Mount the lip to be faced outside when replace the dust seal.



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

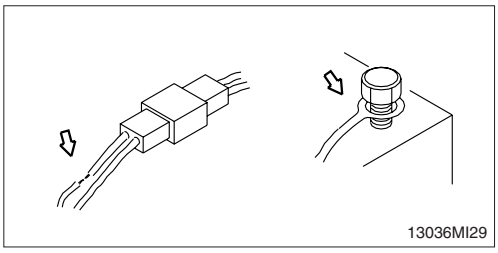
※ Assemble the seal same direction with picture and use with plastic hammer when replace.



7. ELECTRICAL SYSTEM

1) WIRING, GAUGES

Check regularly and repair loose or malfunctioning gauges when found.



2) BATTERY

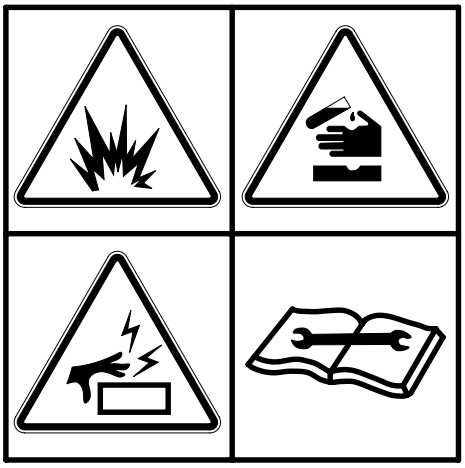
(1) Clean

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. Wash with clean water and go to the doctor if it enters the eyes.



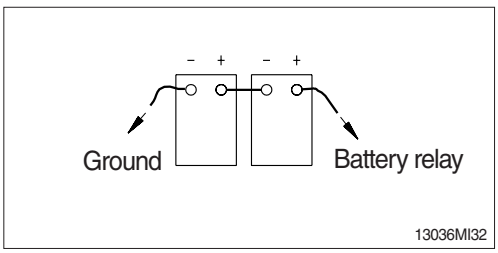
(2) Recycle

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 first (⊖ terminal side) and reconnect it last when reassembling.



3) STARTING THE ENGINE WITH A BOOSTER CABLE

Keep following order when you are going to start engine using booster cable.

(1) Connection of booster cable

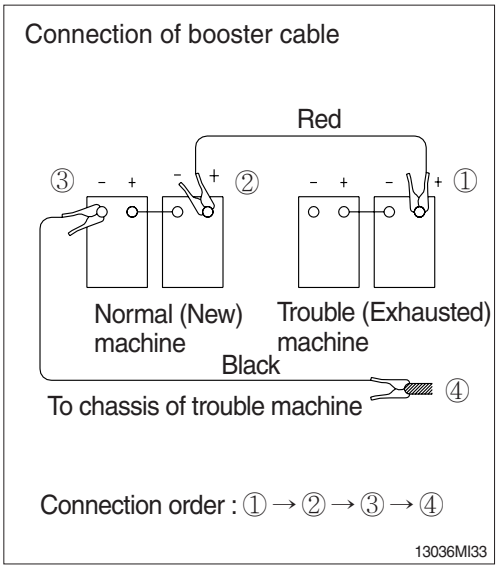
※ Use the same capacity of battery for starting.

① Make sure that the starting switches of the normal machine and trouble machine are both at 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.

※ Keep firmly all connection, the spark will be caused when connecting finally.

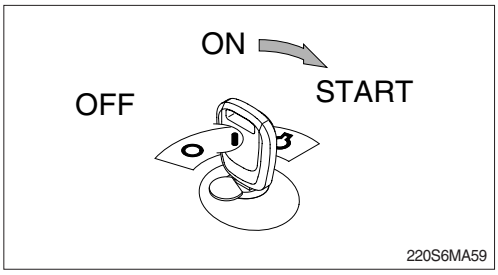


(2) Starting the engine

① Starting the engine of the normal machine and keep it to run at high idle.

② Start engine of the trouble machine with starting switch.

③ If you can not start it by one time, restart the engine 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.

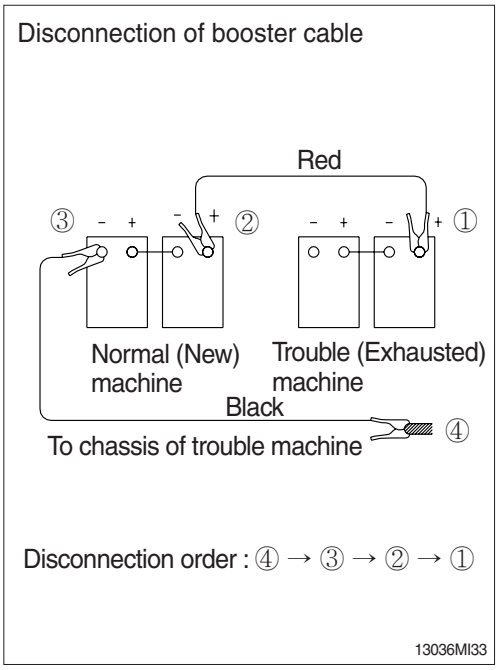
③ Run engine with high idle until charging the exhausted battery by alternator, fully.

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

※ Charge the battery in the well ventilated place.

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

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



4) WELDING REPAIR

Before start to welding, follow the below procedure.

① Shut off the engine and remove the starting switch.

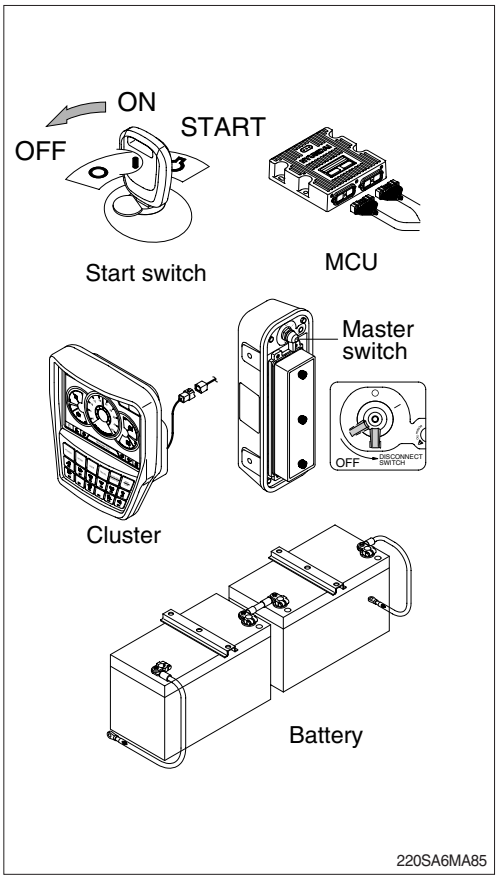
② Disconnect ground cable from battery by master switch.

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

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

※ **Do not weld or flame cut 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 welding work before carry out the above.**
If not, it will caused serious damage at electric system.



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.

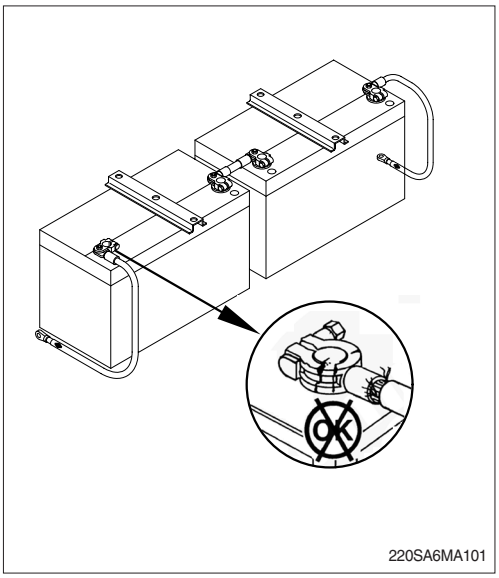
(2) Replace broken terminals, connectors, or cables.

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

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

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

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

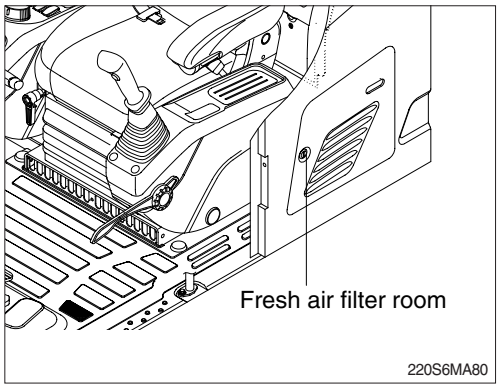


8. AIR CONDITIONER AND HEATER

1) CLEAN AND REPLACE OF FRESH AIR FILTER

※ **Always stop the engine before servicing.**

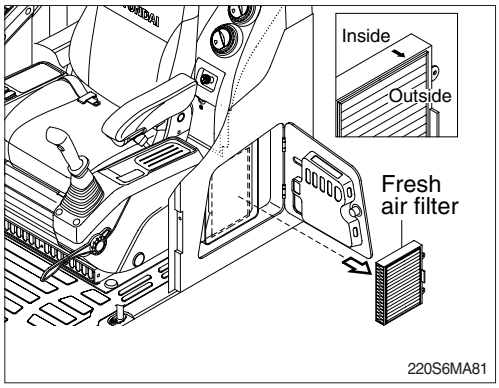
(1) Open the fresh air filter room.



(2) Remove the fresh air filter.

※ **When installing a filter, be careful not to change the filter direction.**

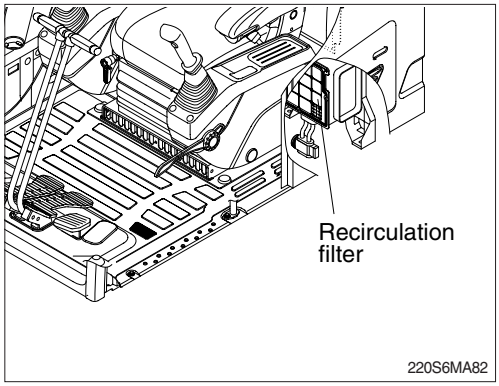
(3) If filter is damaged or badly contaminated, use a new filter.



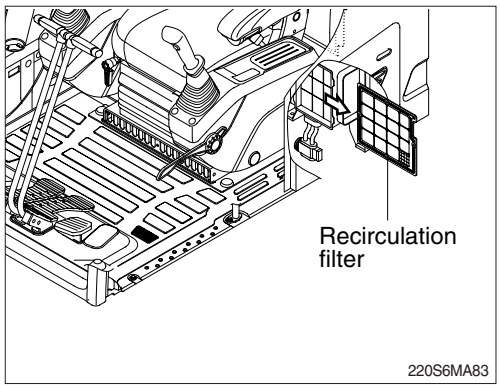
2) CLEAN AND REPLACE OF RECIRCULATION FILTER

※ **Always stop the engine before servicing.**

(1) Move seat and console box to arrow direction using the adjust knob.

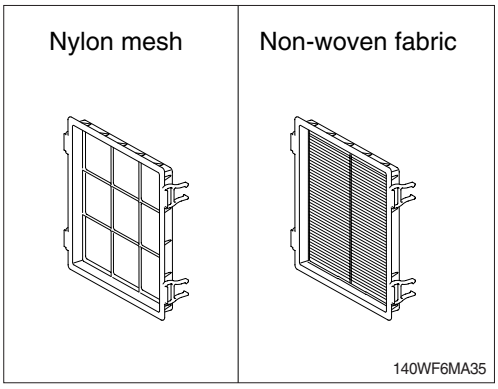


(2) Remove recirculation filter.



(3) Check the recirculation filter type.

(4) Non-woven fabric type (if equipped)
- If filter is damaged or badly contaminated, use a new filter.

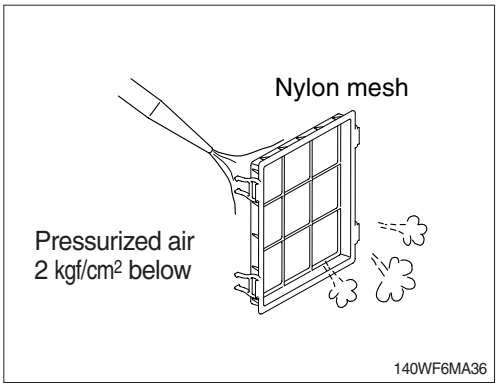


(5) Clean the recirculation filter using a pressurized air (below 2 kgf/cm², 28 psi) or washing with water.

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

※ **Dry off after washing with water.**

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



3) PRECAUTIONS FOR USING AIR CONDITIONER

(1) When using the air conditioner for a long time, open the window once every one hour.

(2) Be careful not to overcool the cab.

(3) The cab is properly cooled if the operator feels cool when entering there from outside (about 5˚C lower than the outside temperature).

(4) When cooling, change air occasionally.

4) CHECK DURING SEASON

Ask the service center for replenishment of refrigerant or other maintenance service so that the cooling performance is not damaged.

5) CHECK DURING OFF-SEASON

Operate the air conditioner 2 or 3 times a month (each for a few minutes) to avoid loss of oil film in the compressor.

6) REFRIGERANT

(1) Equipment contains fluorinated greenhouse gas.

Model	Type	Quantity	GWP
HX220LT3	HFC-134a	0.75 kg (1.65 lb)	930 CO_2 eq.

※ GWP

Global warming potential (GWP) is a measure of how much heat a gas traps in the atmosphere relative to that of carbon dioxide (CO2). GWP is calculated in terms of the 100-year warming potential of 1 kg of a greenhouse gas relative to 1 kg of CO2.

(2) Environmental precautions

The air conditioning system of the machine is filled with HFC-134a refrigerant at the factory.
HFC-134a refrigerant is a flourinated greenhouse gas and contributes to global warming.
Do not release refrigerant into the environment.

(3) Safety precautions

Work on the air conditioning system must only be performed by a qualified service technician.
Do not attempt to preform work on the air conditioning system.
Wear safety goggles, chemical resistant gloves and appropriate personal protective equipment to protect bare skin when there is a risk of contact with refrigerant.

(4) Action in case of exposure

① Eye contact / Limited skin contact
Rinse with warm water and apply a light bandage. Seek medical attention immediately.

② Extensive skin contact
Rinse with warm water and carefully heat the area with warm water or warm clothing.
Seek medical attention immediately.

③ Inhalation
Leave the area and find fresh air. Seek medical attention immediately.