7. PLANNED MAINTENANCE AND LUBRICATION

1. INTRODUCTION

ONLY TRAINED AND AUTHORIZED PERSONNEL should perform planned maintenance. Local HYUNDAI dealers are prepared to help customers put in place a planned maintenance program for checking and maintaining their lift trucks according to applicable safety regulations.

⚠ Powered industrial trucks may becomes hazardous if maintenance is neglected.

As outlined in section 4, operator maintenance and care, the operator should make a safety inspection of the lift truck before operating it. The purpose of this daily examination is to check for any obvious damage and maintenance problems, and to have minor adjustments and repairs made to correct any unsafe condition.

In addition to the operator's daily inspection, HYUNDAI recommends that the owner set up and follow a periodic planned maintenance (PM) and inspection program. The PM identifies needed adjustments, repairs, or replacements so they can be made before failure occurs. The specific schedule(frequency) for the PM inspections depends on the particular application and lift truck usage.

Planned maintenance is the normal maintenance necessary to provide proper and efficient machines operation. To protect your investment and prolong the service life of your machine, follow the scheduled maintenance check list.

This section recommends typical planned maintenance and lubrication schedules for items essential to the safety, life, and performance of the truck. It also outlines safe maintenance practices and gives brief procedures for inspections, operational checks, cleaning, lubrication, and minor adjustments.

Specifications for selected components, fuel, lubricants, critical bolt torques, refill capacities, and settings for the truck are found in section 8.

If you have needed for more information on the care and repair of your truck, see your HYUNDAI dealer.

2. SAFE MAINTENANCE PRACTICES

The following instructions have been prepared from current industry and government safety standards applicable to industrial truck operation and maintenance. These recommended procedures specify conditions, methods, and accepted practices that aid in the safe maintenance of industrial trucks. They are listed here for the reference and safety of all workers during maintenance operations. Carefully read and understand these instructions and the specific maintenance procedures before attempting to do any repair work. When in doubt of any maintenance procedure, please contact your local HYUNDAI dealer.

1) Powered industrial trucks can become hazardous if maintenance is neglected. Therefore, suitable maintenance facilities and trained personnel and procedures shall be provided.

2) Maintenance and inspection of all powered industrial trucks shall be performed in conformance with the manufacturer's recommendations.

3) Follow a scheduled planned maintenance, lubrication, and inspection system.

4) Only trained and authorized personnel are permitted to maintain, repair, adjust, and inspect industrial trucks and must do so in accordance with the manufacturer's specifications.

5) Always wear safety glasses. Wear a safety (hard) hat in industrial plants and in special work areas where protection is necessary and required.

6) Properly ventilate work area, vent exhaust fumes, and keep shop clean and floors dry.

7) Avoid fire hazards and have fire protection equipment present in the work area. Do not use an open flame to check for level or leakage fuel, electrolyte, or coolant. Do not use open pans of fuel or flammable cleaning fluids for cleaning parts.

8) Before starting work on truck.

(1) Raise drive wheels free of floor and use oak blocks or other positive truck positioning devices.

(2) Remove all jewelry (watches, rings, bracelets, etc.).

(3) Put oak blocks under the load engaging means, inner masts, or chassis before working on them.

(4) Disconnect the battery ground cable (-) before working on the electrical system.

※ **Refer to the jacking and blocking section in the service manual for proper procedures.**

9) Operation of the truck to check performance must be conducted in an authorized, safe, clear area.

10) Before starting to operate the truck.

(1) Be seated in a safe operating position and fasten your seat belt.

(2) Make sure parking brake is applied.

(3) Put the gear selector lever in NEUTRAL.

(4) Start the engine.

(5) Check functioning of lift and tilt systems, direction and speed controls, steering, brakes, warning devices, and load handling attachments.

11) Before leaving the truck.

(1) Stop the truck.

(2) Fully lower the load-engaging means: mast, carriage, forks or attachments.

(3) Put the gear selector lever in NEUTRAL.

(4) Apply the parking brake.

(5) Stop the engine.

(6) Turn the key switch to the OFF position.

(7) Put blocks at the wheels if the truck must be left on an incline.

12) Brakes, steering mechanisms, control mechanisms, warning devices, lights, governors, lift overload devices, lift and tilt mechanisms, articulating axle stops, load backrest, cabin and frame members must be carefully and regularly inspected and maintained in a safe operating condition.

13) Special trucks or devices designed and approved for hazardous area operation must receive special attention to insure that maintenance preserves the original approved safe operating features.

14) Fuel systems must be checked for leaks and condition of parts. Extra special consideration must be given in the case of a leak in the fuel system. Action must be taken to prevent the use of the truck until the leak has been corrected.

15) All hydraulic systems must be regularly inspected and maintained in conformance with good practice. Tilt and lift cylinders, valves, and other parts must be checked to assure that drift or leakage has not developed to the extent that it would create a hazard.

16) When working on the hydraulic system, be sure the engine is turned off, mast is in the fully-lowered position, and hydraulic pressure is relieved in hoses and tubing.

⚠ Always put oak blocks under the carriage and mast rails when it is necessary to work with the mast in an elevated position.

17) The truck manufacturer's capacity, operation, and maintenance instruction plates, tags, or decals must be maintained in legible condition.

18) Batteries, limit switches, protective devices, electrical conductors, and connections must be maintained in conformance with good practice. Special attention must be paid to the condition of electrical insulation.

19) To avoid injury to personnel or damage to the equipment, consult the manufacturer's procedures in replacing contacts on any battery connection.

20) Industrial trucks must be kept in a clean condition to minimize fire hazards and help in detection of loose or defective parts.

21) Modifications and additions that affect capacity and safe truck operation must not be done without the manufacturer's prior written approval. This is an OSHA requirement.
Capacity, operation, and maintenance instruction plates, tags, or decals must be changed accordingly.

22) Care must be taken to assure that all replacement parts, including tires, are interchangeable with the original parts and of a quality at least equal to that provided in the original equipment. Parts, including tires, are to be installed per the manufacturer's procedures. Always use genuine HYUNDAI or HYUNDAI-approved parts.

23) When removing tires follow industry safety practices. Most importantly, deflate pneumatic tires completely prior to removal. Following assembly of tires on multi-piece rims, use a safety cage or restraining device while inflating.

24) Use special care when removing heavy components, such as counterweight, mast, etc.. Be sure that lifting and handling equipment is of the correct capacity and in good condition.

3. INSTRUCTIONS BEFORE MAINTENANCE

1) INTERVAL OF MAINTENANCE

(1) You may inspect and service the machine by the period as described at based on service meter of LCD.

(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 250 hours, carry out all the maintenance each 250 hours, each 100 hours and daily service at the same time.

Service meter

180D97CD131

※ Time intervals between maintenance are largely determined by operating conditions. For example, operation in sandy, dusty locations requires shorter maintenance intervals than operation in clean ware-houses. The indicated intervals are intended for normal operation. The operating condition classifications are ;

① **Normal operation**
Eight hour material handling, mostly in buildings or in clean, open air on clean paved surfaces.

② **Harsh operation**

a. All harsh working environment

b. Long term heavy load operation

c. High and low temperature working environment

d. Sudden change in temperature

e. Dusty or sandy working environment

f. Highly corrosive chemical working environment

g. Damp working environment

If the lift truck is used in severe or extreme operating conditions, you must shorten the maintenance intervals accordingly.

※ **Since the operating environment of lift trucks varies widely, the above descriptions are highly generalized and should be applied as actual conditions dictate.**

2) PRECAUTION

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

(2) The monitor installed on this truck does not entirely guarantee the condition of the truck.
Daily inspection should be performed according to maintenance.

(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 Hyundai for maintenance advise it 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 hose, tube and filter etc., regularly. Replaced damaged or worn parts at proper time to keep the performance of the truck.

(2) Use Hyundai 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.

(7) Stop the engine when you fill the oil.

(8) Relieve hydraulic system of the pressure by opening of breather when repairing the hydraulic system.

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

(10) For more detail information of maintenance, please contact local Hyundai dealer.

※ **Be sure to start the maintenance after fully understanding the section 1, safety hints.**

4) PRECAUTION WHEN INSTALLING HYDRAULIC HOSES OR PIPE.

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

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

(3) Use Hyundai genuine parts.

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

(5) Keep the specified tighten torque.

5) PERIODICAL REPLACEMENT OF SAFETY PARTS

(1) These are the parts which the operator cannot judge the remained lifetime of them by visual inspection.

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

※ Replacement of consumable service parts is not covered under warranty.

No.	Periodical replacement of safety parts	Interval
1	Fuel hose	Every 2 to 4 years
2	Hydraulic pump hose	Every 2 years
3	Power steering hose	Every 2 years
4	Packing, seal, and O-ring steering cylinder	Every 2 to 4 years
5	Lift chain	Every 2 to 4 years
6	Lift cylinder hose	Every 1 to 2 years
7	Tilt cylinder hose	Every 1 to 2 years
8	Side shift cylinder hose	Every 1 to 2 years
9	Brake hose or tube	Every 1 to 2 years
10	Brake reservoir tank tube	Every 2 to 4 years
11	Intake air line	Every 2 years
12	Coolant hose and clamps	Every 2 years

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

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

6) EMISSION-RELATED COMPONENTS WARRANTY (USA AND CANADA ONLY)

Hyundai shall have obligation under the EPA (Environmental Protection Agency) regulation of warranty about Emission-related components. This warranty shall exist for 3,000 hours or five years, whichever occurs first.

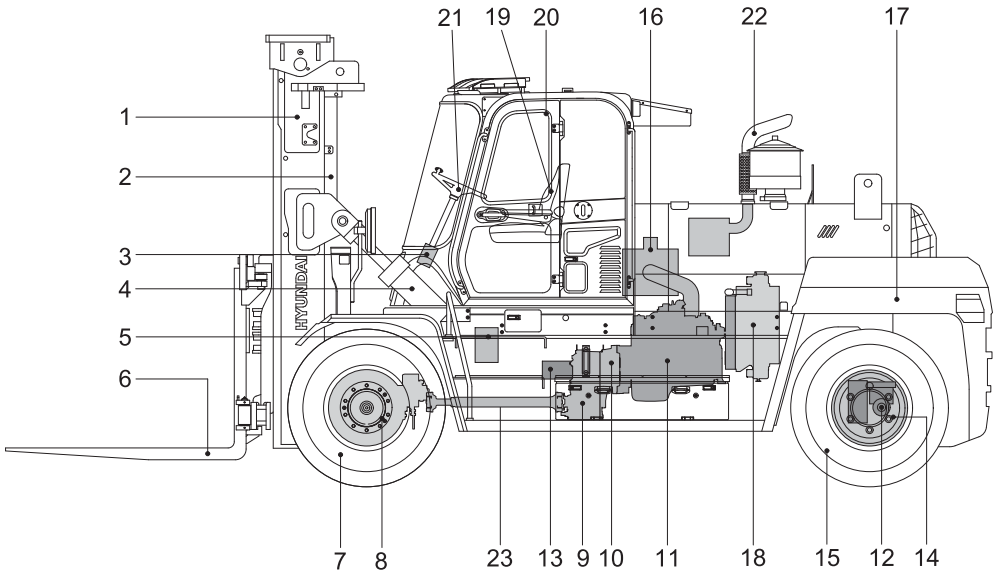
Naturally, this warranty does not cover to damage arising from accident, misuse or negligence, use of non-Hyundai parts, or from alterations not authorized by Hyundai.

※ Emission-related components according to the EPA regulation.

1. Air-induction system.
2. Fuel system.
3. Ignition system.
4. Exhaust gas recirculation systems.
5. After treatment devices.
6. Crankcase ventilation valves.
7. Sensors.
8. Electronic control units.

4. PLANNED MAINTENANCE INTERVALS

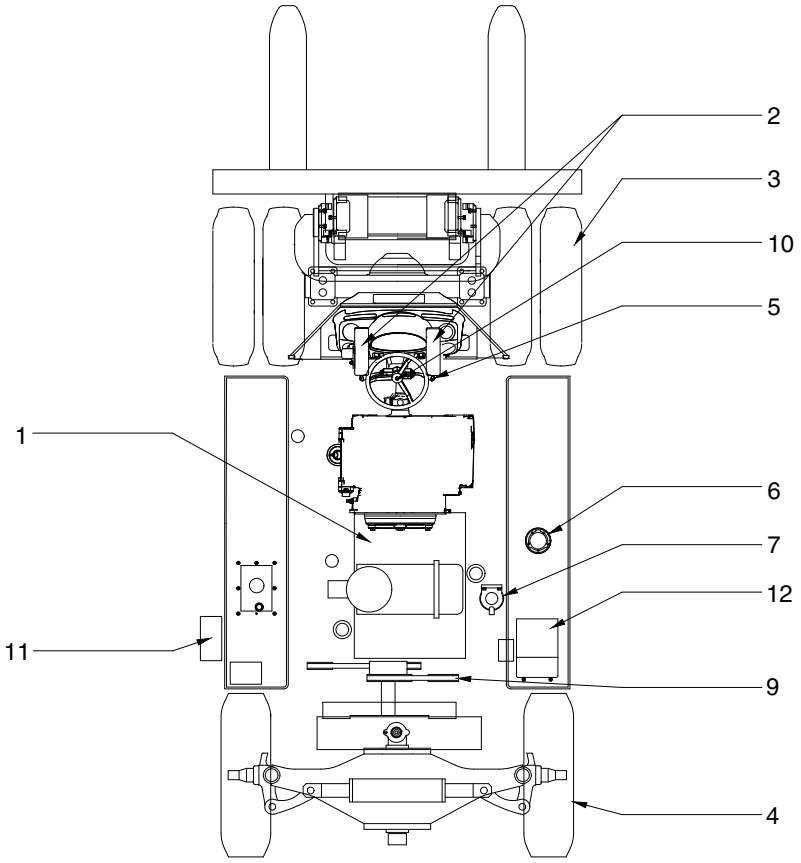
1) MAJOR COMPONENTS LOCATION



180D9OM21

1	Mast	9	Transmission	17	Counterweight
2	Lift cylinder	10	Torque converter	18	Radiator
3	Steering unit	11	Engine	19	Seat
4	Tilt cylinder	12	Steering cylinder	20	Cabin
5	Main control valve	13	Hydraulic pump	21	Steering wheel
6	Fork	14	Steering axle	22	Muffler
7	Front wheel	15	Rear wheel	23	Propeller shaft
8	Drive axle	16	Air cleaner		

2) SERVICE LOCATIONS



180D9MA011A

※ Service intervals are based on the hourmeter reading.
※ Stop the engine when servicing.
※ Do not open the cap or drain plug to avoid injury by unexpected spouting of high temperature fluid or gas.
※ Open the cap slowly to relieve pressure.
※ Always keep the surface of control & instrument panels clean in case of damage or malfunction detected in panel, replace it with a new one.
※ Depending on the ambient and operation contions, the replacement cycle may be shortened.
- All harsh working environment
- Long term heavy load operation
- High and low temperature working environment
- Sudden change in temperature
- Dusty or sandy working environment
- Highly corrosive chemical working environment
- Damp working environment

※ For other details, refer to the service manual.

3) DAILY (OR EVERY 10 HOURS) CHECK LIST

Item No.	Description	Service Action	Oil symbol	Capacity ℓ (U.S. gal)	Service point	Remark
1	Engine oil level	Check, Add	EO	26 (6.9)	1	7-17
2	Pedal linkage operation	Check, Adjust	-	-	1	7-48
3	Drive rim and tire air pressure	Check, Add	-	-	2	5-3, 7-14
4	Steer rim and tire air pressure	Check, Add or Replace	-	-	2	5-3, 7-14
5	Lamp operation	Check, Replace	-	-	10	7-48
6	Fuel level	Check, Add	DF	312 (82.4)	1	5-13
7	Prefilter	Check, Drain	-	-	1	7-27
8	Radiator coolant	Check, Add	C	42.7 (11.3)	1	7-19
9	Fan belt tension and damage	Check, Adjust, Replace	-	-	1	7-24
10	Horn operation	Check, Replace	-	-	1	5-5, 7-52
11	Battery	Check, Clean	-	-	2	7-45, 46
12	DEF level	Check, Add	DEF	40 (10.6)	1	7-27, 28

※ Oil symbol
Refer to the recommended lubricants for specification.
DF : Diesel fuel HO : Hydraulic oil EO : Engine oil GO : Gear oil G : Grease
MO : Transmission oil BO : Brake cooling oil C : Coolant DEF : Diesel Exhaust Fluid

4) PERIODICAL CHECK LIST

Service item		Oil Symbol	Service interval Hours								Initial Hours		
			50	250	500	1000	1500	2000	3000	4000	50i	100i	250i
Tightening (Mounting bolt)	Pump, MCV, steering unit, priority valve				T								T
	Tilt cylinder rod cover				T								T
	Lift, attachment, steering cylinder							T					
	Mast				T								
	Drive and steering axle				T								
	Drive and steering axle wheel		T										
	Counterweight, cabin		T										
	Engine, radiator, transmission		T										
	Hose, fitting, clamp (fuel, coolant, hydraulic)							T					
Lubrication	Tilt pin and mast roller	G			L								L
	Lift chain	EO			L								L
	Steering axle (linkage, kingpin, trunnion	G		L									
	Attachment cylinder rod and tube end			L									
	Pedal pivot				L								
	Drive shaft			L*1	L*2								
	Tilt cylinder rod	G		L*1	L*2								
	Tilt cylinder tube end	G			L								
	Steering unit spline (column shaft)	G						L					
Oli Leakage	Hydraulic tank				I								I
	Valve (MCV, priority, brake)				I								I
	Pump, steering unit				I								I
	Lift, tilt, steering cylinder			I*1	I*2								I
Function test	Steering wheel operation				I								I
	Natural drop and forward tilt							I					
	Fork load indicator (option)							I					
	Mast tilt angle measurement							M					
Periodic replacement parts	Engine oil	EO			R						R		
	Engine oil filter				R						R		
	Fuel filter					R							
	Prefilter element				R								
	Air cleaner element				R								
	Transmission oil	MO			A	R						R	
	Transmission oil filter					R						R	
	Axle gear oil	GO			A	R						R	
	Brake cooling oil and straniner	BO		A		R						R	
	Radiator coolant	C						R					
	Pilot line filter element					R					R		
	DEF/adBlue® filter					C				R (5000)			
	Brake line filter (strainer)				Clean								
	Air conditioner filter (outer)				Clean	R							
	Fan belt tensioner					C							
	Fan belt					R							
	Hydraulic oil tank air breather filter			R*1	R*2								
	Hydraulic oil return filter					R							
	Hydraulic oil suction strainer							Clean					
	Hydraulic oil	HO		A				R*3		R*4 (5000)			

*1 Harsh condition *2 Normal condition *3 Conventional hydraulic oil *4 Hyundai genuine long life hydraulic oil

A : Aid C : Checking L : Lubrication R : Replacement T : Retightening

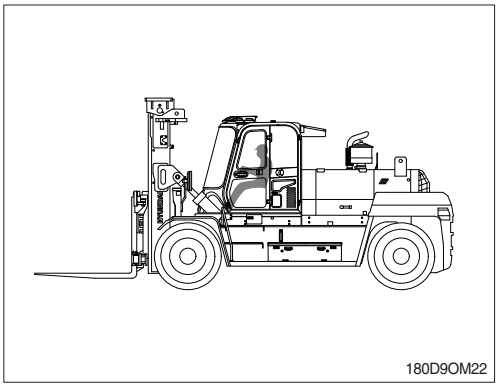
I : Visual inspection (repair or replace if required) M : Measurement (adjust if required)

5. HOW TO PERFORM PLANNED MAINTENANCE

1) VISUAL INSPECTION

First, perform a visual inspection of the lift truck and its components. Walk around the truck and take note of any obvious damage or maintenance problems.

Check to be sure all capacity, safety, and warning plates are attached and legible.



※ **NAMEPLATES AND DECALS: Do not operate a lift truck with damage or lost decals and nameplates. Replace them immediately. They contain important information.**

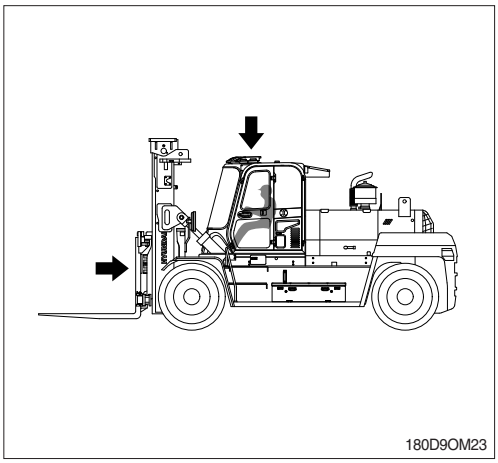
Inspect the truck, before and after starting the engine, for any sign of external leakage of fuel, engine coolant, transmission fluid, etc..

Check for hydraulic oil leaks and loose fittings.

⚠ **HYDRAULIC FLUID PRESSURE: Do not use your hands to check for hydraulic leakage. Fluid under pressure can penetrate your skin and cause serious injury.**

2) CABIN

Be sure that the driver's cabin and any safety devices are in place, undamaged, and attached securely. Check the cabin for damage. Be sure that it is properly positioned and all mounting fasteners are in place and tight.



3) LOAD HANDLING COMPONENTS

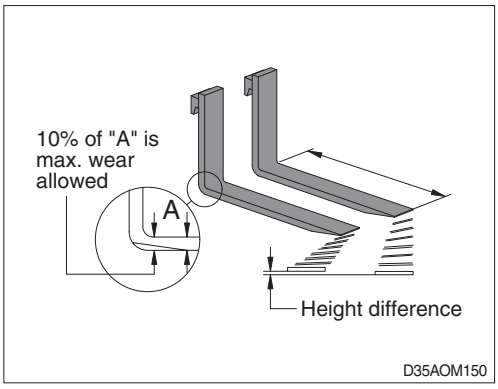
Inspect the mast assembly, load backrest (LBR), rails, carriage rollers, lift chains, and lift and tilt cylinders. Look for obvious wear and maintenance problems and damaged or missing parts. Check for any loose parts or fittings. Check for leaks, damaged or loose rollers, and rail wear (metal flaking). Carefully check the lift chains for wear, rust, corrosion, cracked or broken links, stretching etc.. Check that the lift and carriage chains are correctly adjusted to have equal tension. Check that the lift chain anchor fasteners and locking means are in place and tight. Inspect all lift line hydraulic connections for leaks.

△ **Mast and lift chains require special attention and maintenance to remain in safe operating condition. Refer to lift chain maintenance in this section for additional information.**

4) FORKS

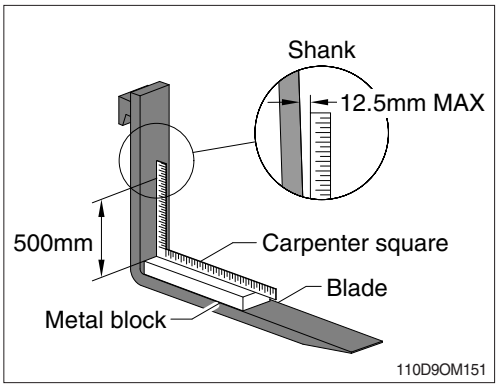
Inspect the load forks for cracks, breaks, bending, and wear. The fork top surfaces should be level and even with each other. The height difference between both fork tips refer to below table.

Fork length	Height difference (mm)
equal or below 1500	3
above 1500	6



⚠ If the fork blade at the heel is worn down by more than 10%, the load capacity is reduced and the fork must be replaced.

Inspect the forks for twists and bends. Put a 50 mm (2 in) thick metal block, at least 100 mm (4 in) wide by 600 mm (24 in) long with parallel sides, on the blade of the fork with the 100 mm (4 in) surface against the blade. Put a 600 mm (24 in) carpenter's square on the top of the block and against the shank. Check the fork 500 mm (20 in) above the blade to make sure it is not bent more than 12.5 mm (0.5 in) maximum.



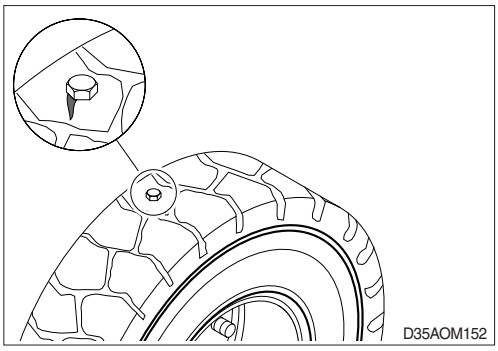
※ If the fork blades are obviously bent or damaged, have them inspected by a trained maintenance person before operating the truck.

Inspect the fork locking pins for cracks or damage. Reinsert them and note whether they fit properly.

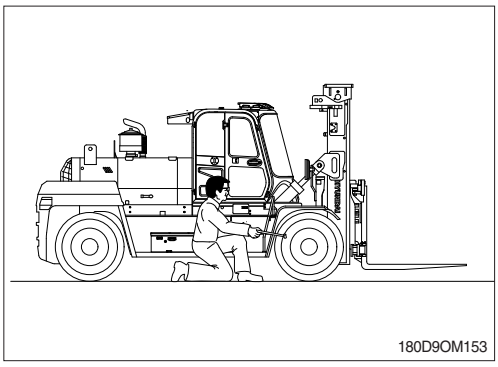
5) WHEEL AND TIRES

Check the condition of the drive and steering wheels and tires. Remove objects that are embedded in the tread. Inspect the tires for excessive wear and breaks or **chunking out.**

Check all wheel lug nuts or bolts to be sure none are loose or missing. Replace missing bolts or lug nuts. Torque loose or replaced items to specifications.



⚠ Check tire pressure from a position facing the tread of the tire, not form the side. Use a long handled gauge to keep your body away from the side. If tires are low, do not operate and do not add air. Check with a mechanic. The tire may require removal and repair.
Incorrect (low) tire pressure can reduce the stability of your lift truck. Do not operate truck with low tire pressure.



· Proper cold inflation : Refer to attached decal.

6) TILTING CABIN

⚠ Keep clearance of people except the operator before tilting the cabin.

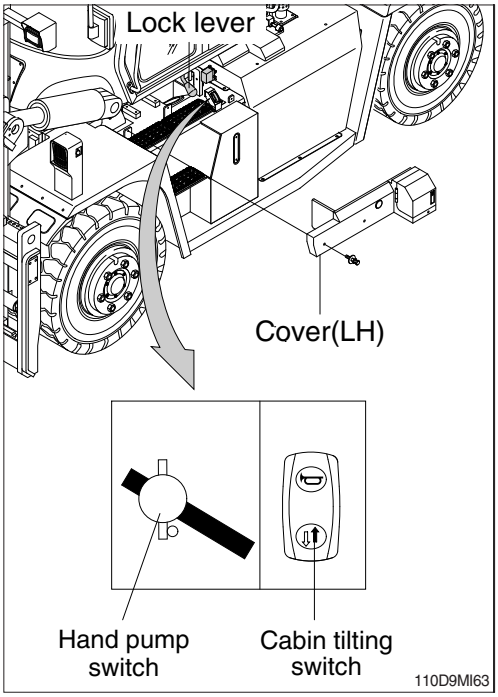
⚠ Before tilting the cabin, make sure that the mast is vertical or tilted forward. Otherwise, the operation could be blocked by mast tilt cylinders.

(1) Locate the truck on the plain and stable floor.

※ **Apply parking brake before servicing.**

(2) Turn the start switch to OFF position.
Remove the frame cover (LH) by removing the mounting bolts or opening the door. The control switch is located between cabin and side frame.

(3) By tilting the cabin, service of hydraulic and electric system such as hydraulic components, hydraulic pipings, electric components, and electric wirings can be easily performed. It is recommended that the service requiring tilting cabin must be carefully performed with a skilled service man.

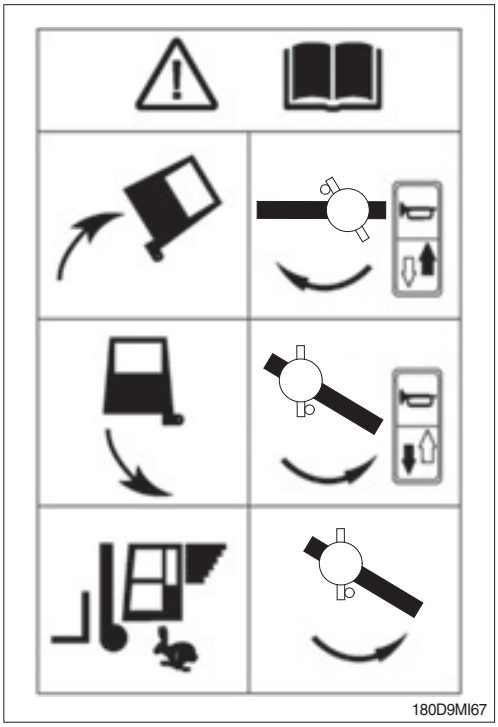


(4) Tilting and returning cabin

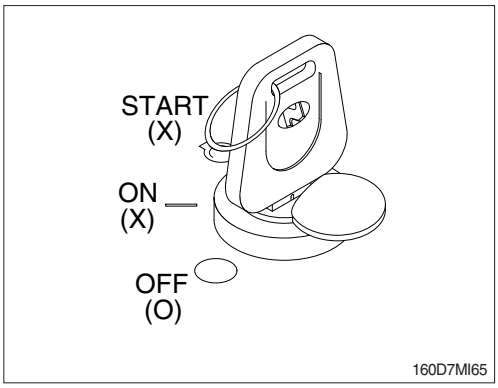
① **Tilting cabin**
After keeping clearance of the people except the operator along with sounding horn, turn the hand pump lever clockwise and then, continuously press the cabin tilt switch to tilt the cabin to right side.

② **Returning cabin**
After keeping clearance of the people except the operator along with sounding horn, turn the hand pump lever counterclockwise and then, continuously press the cabin tilt switch to return the cabin to original location.

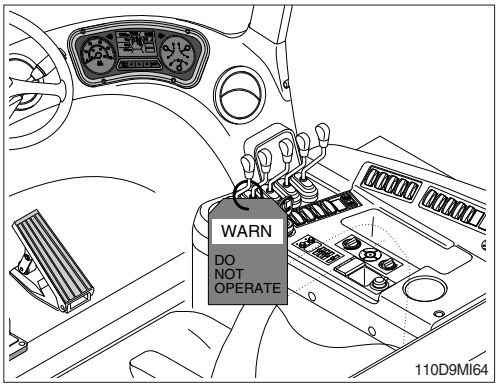
※ **Take care that it must perform by a trained people in order to prevent from abnormal operation.**
Refer to page 3-32 for the cabin tilt switch and hand pump lever.



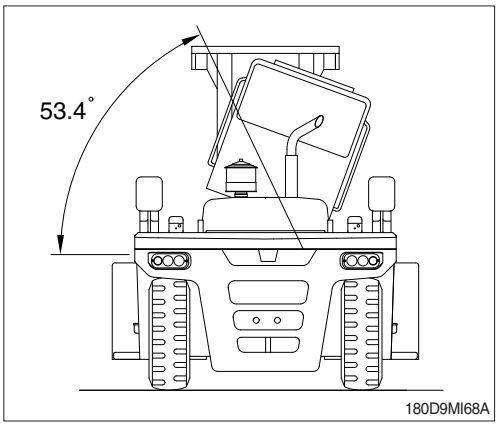
⚠ Do not operate cabin tilting function while the power is ON or engine is running



⚠ Do not operate the tilt control switch or any control parts while servicing under the tilted cabin. It can cause severe injury or death.



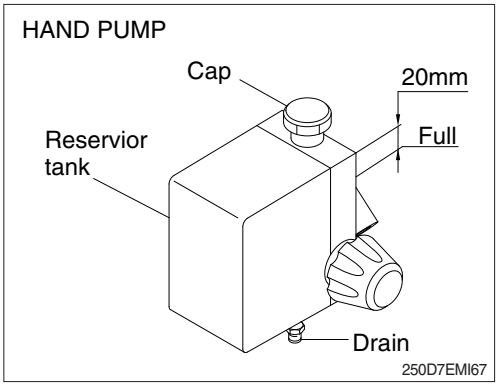
※ The angle of fully tilted cabin is 53.4°.



(5) Replacement of hydraulic oil for hand pump.

Open upper cap and fill 0.5 ℓ by using funnel. After filling, operate tilt cylinder 2~3 times and close the cabin completely to check the oil level in tank. If necessary, fill more oil to keep the level.

· Tank capacity : 0.7 ℓ
· System total capacity : 1.2 ℓ



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.

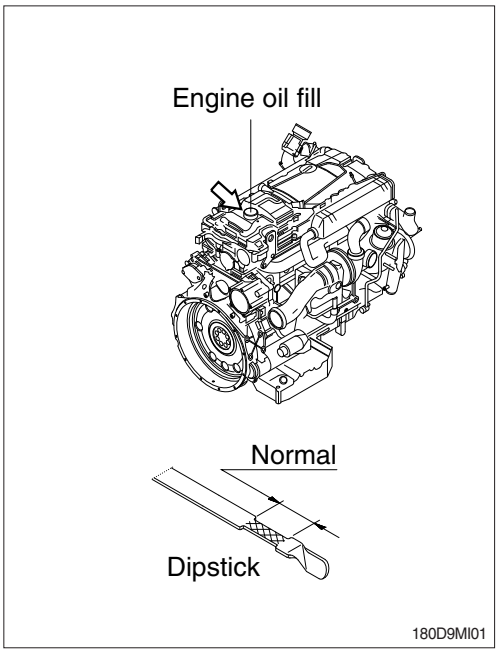
(2) Check the oil level by inserting the dipstick completely into the hole and pulling out again.

(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.**

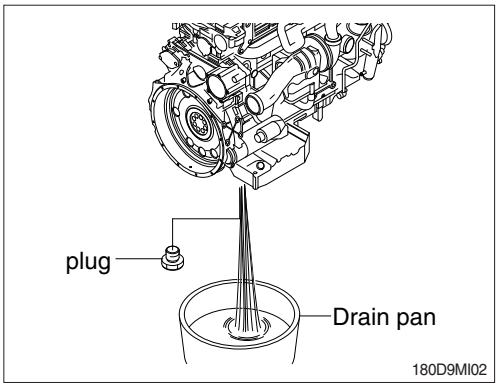


2) REPLACEMENT OF ENGINE OIL AND OIL FILTER

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

(2) Remove the plug and allow the oil to drain.
- Wrench size : 24 mm

※ **A drain pan with a capacity of 30 liters (6.6 U.S.gallons) will be adequate.**

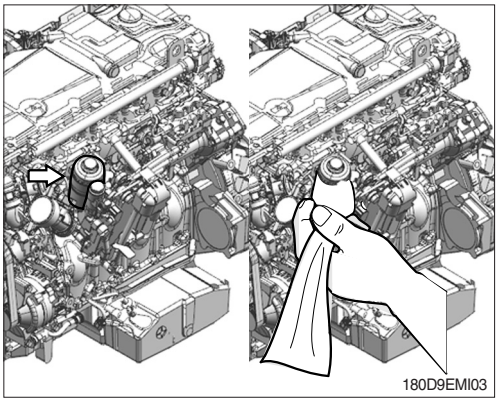


(3) Clean the area around the oil filter head.

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

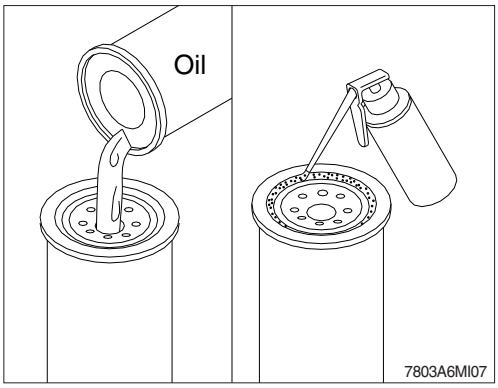
(5) Clean the gasket surface of oil filter head.

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



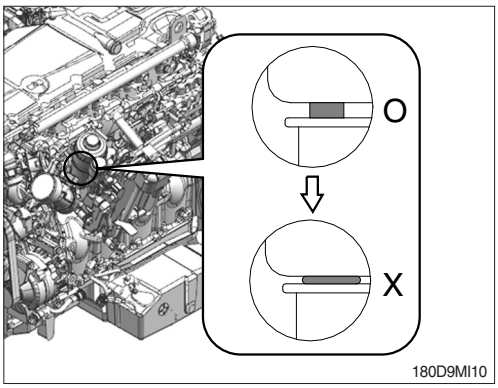
(6) Apply a light film of lubricating oil to the gasket sealing surface before installing the filter.

※ **Fill the filter with clean lubricating oil before installation.**

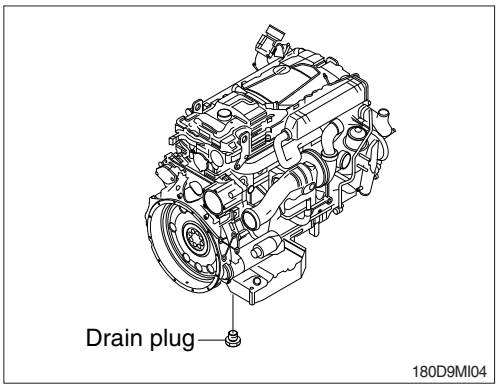


(7) Install the filler to the filter head.

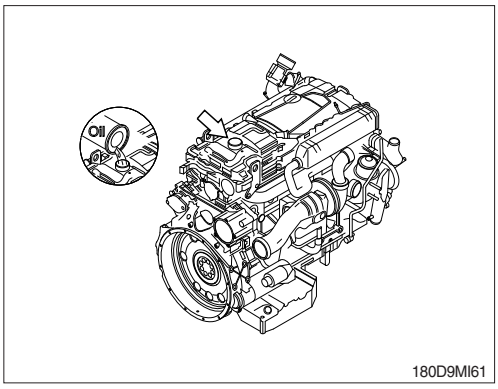
※ **Mechanical over-tightening may distort the threads or damage the filter element seal.**



(8) Clean and inspect the oil drain plug threads and the seal surface. If any damage is found, the oil drain plug must be replaced. Install and tighten the oil drain plug.

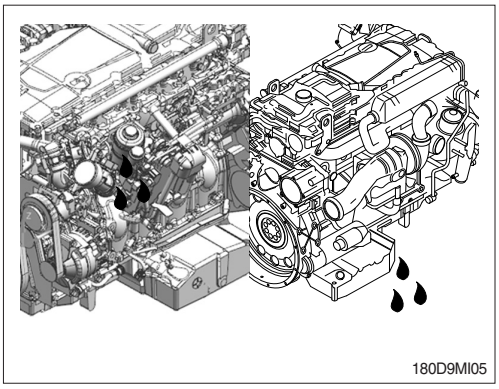


(9) Fill the engine with clean oil to the proper level.
· Quantity : 27 ℓ (7.1 U.S.gallons)



(10) Operate the engine at low idle and inspect for leaks at the filter and the drain plug.
Shut the engine off and check oil level with dipstick. Allow 15 minutes for oil to drain down before checking.

※ **Do not overfill the engine with oil.**



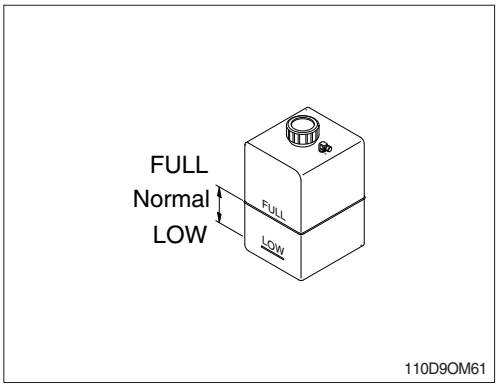
3) CHECK COOLANT LEVEL

(1) Check the coolant level at reservoir tank when the engine is cooled.

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

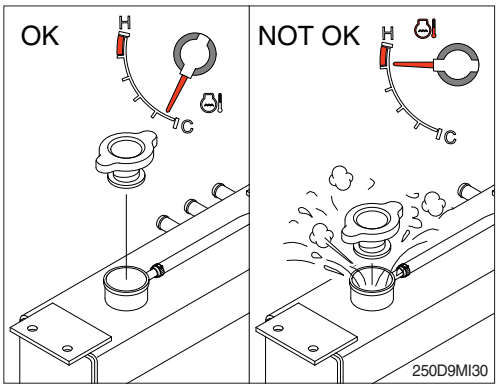
(3) The coolant level should indicate the middle position.

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

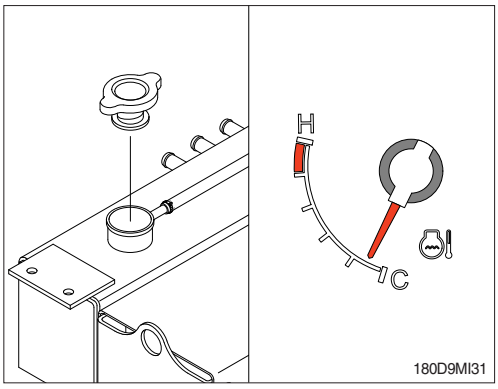


⚠ **Do not remove the surge tank cap from a hot engine. Wait until the coolant temperature is below 50°C (120°F) before removing the surge tank cap. Heated coolant spray or steam can cause personal injury.**

※ **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.**



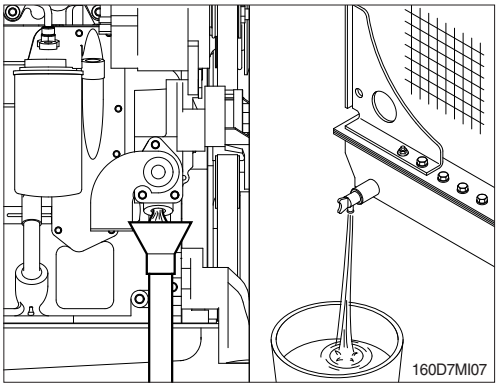
4) FLUSHING AND REFILLING OF RADIATOR



(1) Change coolant

⚠ Avoid prolonged and repeated skin contact with used antifreeze. Such prolonged 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 handing of used antifreeze.

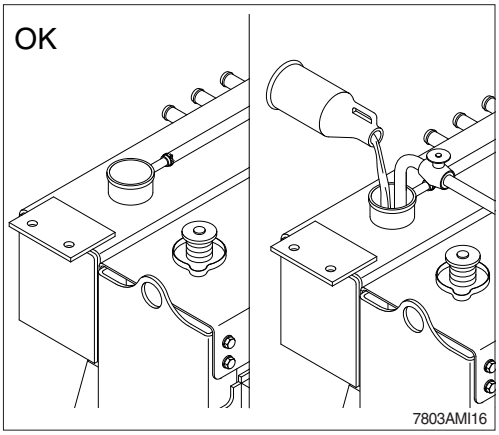


⚠ Wait until the temperature is below 50°C (120°F) before removing the coolant system radiator cap. Failure to do so can cause personal injury from heated coolant spray.
Drain the cooling system by removing the plug on the fuel tank and removing the plug in the bottom of the water inlet.
A drain pan with a capacity of 45 liters (11.9 U. S.gallons) will be adequate in most applications.

(2) Flushing of cooling system

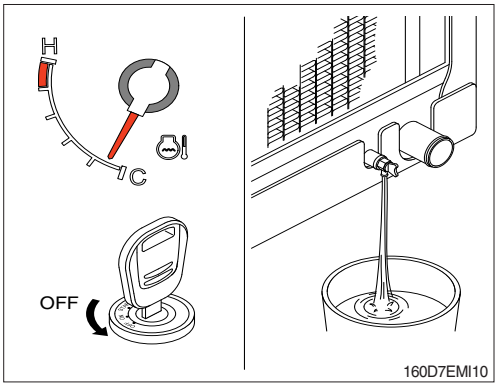
① Fill the system with a mixture of sodium carbonate and water (or a commercially available equivalent).

※ 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.



※ **The system must be filled properly to prevent air locks.**
During filling, air must be vented from the engine coolant passages. Wait 2 to 3 minutes to allow air to be vented; then add mixture to bring the level to the top.
Adequate venting is provided for a fill rate of 19 liters/minute (5 U.S.gal/minute)

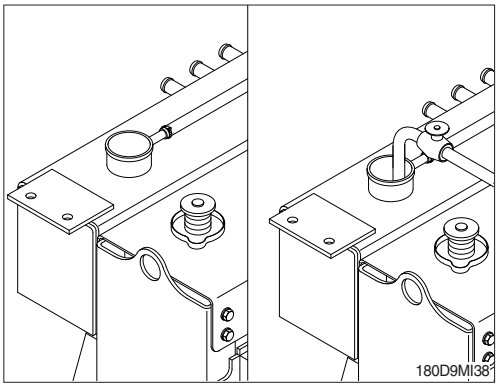
② Operate the engine for 5 minutes with the coolant temperature above 80°C (176°F).
Shut the engine off, and drain the cooling system.



③ Fill the cooling system with clean water.

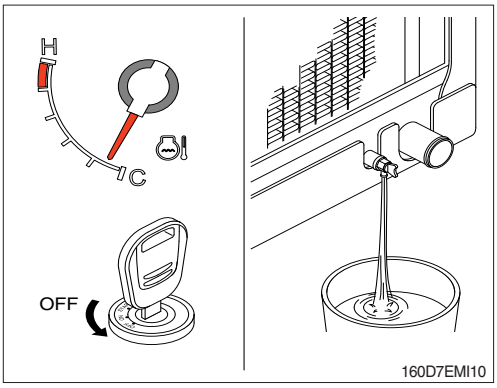
※ **Be sure to vent the engine and aftercooler for complete filling.**

※ **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.**

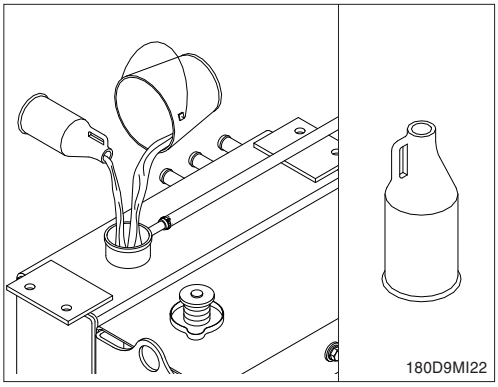


(3) Cooling system filling

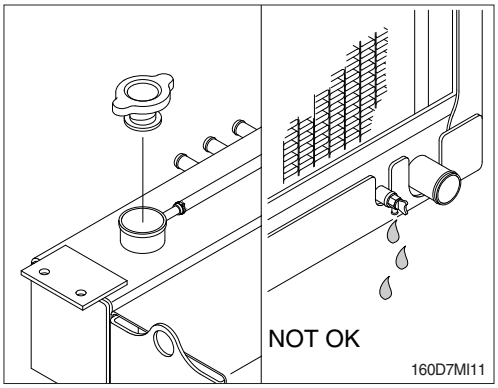
※ The system must be filled properly to prevent air locks.
During filling, air must be vented from the engine coolant passages. Wait 2 to 3 minutes to allow air to be vented; then add mixture to bring the level to the top.
Adequate venting is provided for a fill rate of 19 liters/minute (5 U.S.gal/minute)

① Use a mixture of 50 percent water and 50 percent ethylene glycol antifreeze to fill the cooling system.

※ Coolant capacity (Engine only); 23.5 ℓ (6.2 U.S.gallons)
※ Use the correct amount of DCA4 corrosion inhibitor to protect the cooling system.



② Install the radiator 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.

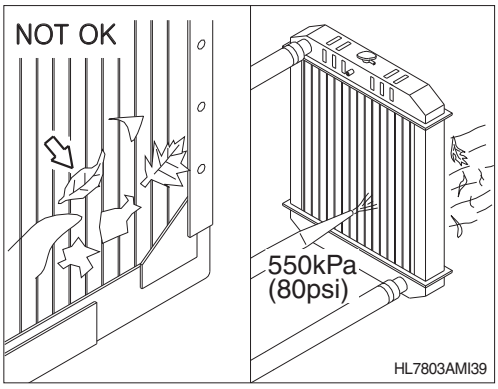


5) CLEAN RADIATOR AND OIL COOLER

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.

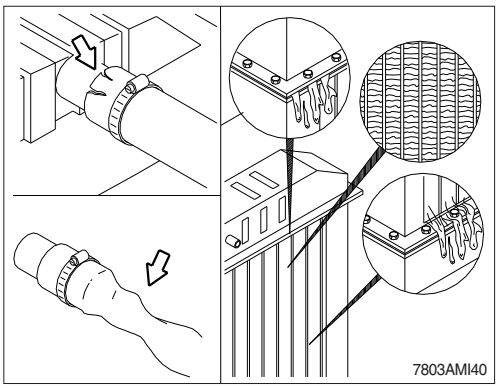
(2) Use 550 kPa (80 psi) air pressure to blow the dirt and debris from the fins.
Blow the air in the opposite direction of the fan air flow.



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

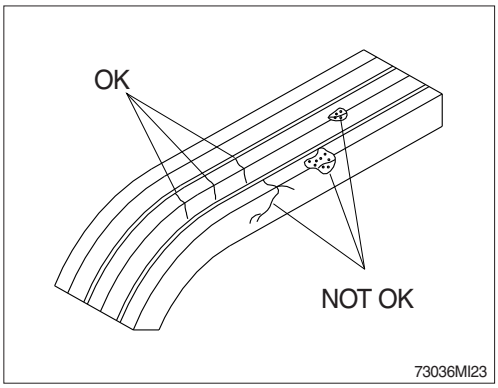
※ **If the radiator must be replaced due to bent or broken fins which can cause the engine to overheat, refer to the manufacturer's replacement procedures.**

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



6) DRIVE BELT

(1) Inspect the belts daily. Check the belts for intersecting cracks. Transverse (across the belt width) cracks are acceptable.
Longitudinal (direction of belt length) cracks that intersect the transverse cracks are not acceptable. Replace a belt if it is frayed or has pieces of material missing.

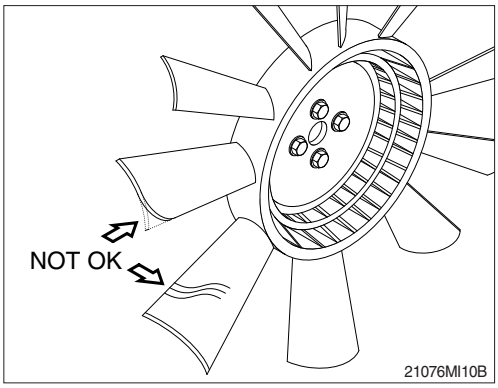


7) INSPECTION OF COOLING FAN

⚠ **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.**

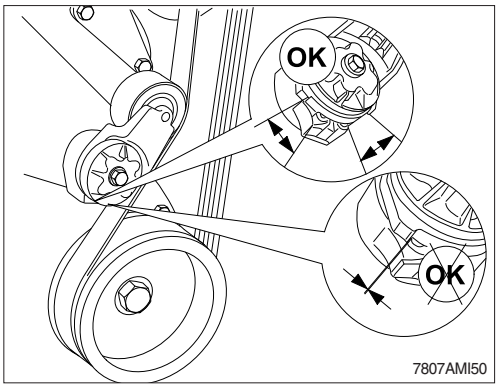
※ **Rotate the crankshaft by using the engine barring gear.**

※ **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.

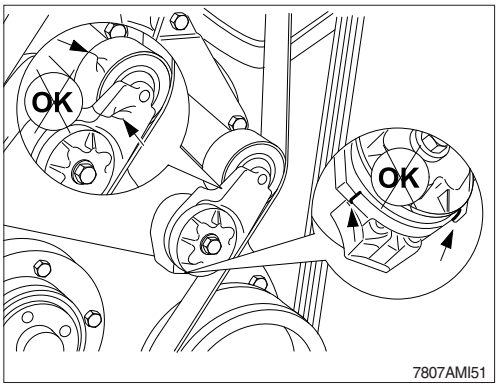


8) BELT TENSIONER, AUTOMATIC ADJUSTMENT

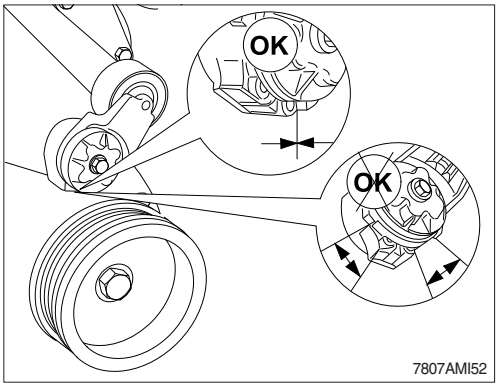
(1) Every 1000hours, or 1 year, whichever occurs first, inspect the automatic belt tensioner.
With the engine turned off, check that neither the top nor bottom tensioner arm stop is touching the cast boss on the tensioner body. If either of the stops is touching a boss, the alternator belt must be replaced. Check to make sure the correct belt part number is being used it either condition exists.



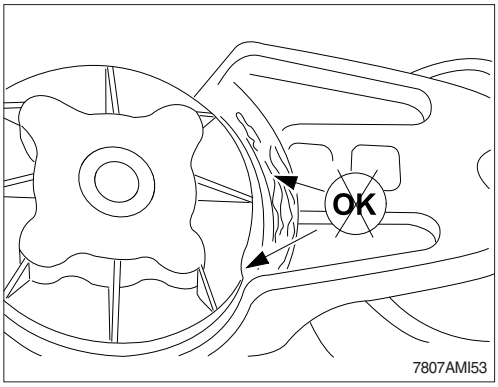
(2) Check the tensioner pulley and body for cracks. If any cracks are noticed, the tensioner must be replaced. Refer to a Cummins Authorized Repair facility. Check the tensioner for dirt buildup. If this condition exists, the tensioner must be removed and steam-cleaned.



(3) Check that the bottom tensioner arm stop is in contact with the bottom tensioner arm stop boss on the tensioner body. If these two are not touching, the tensioner must be replaced.



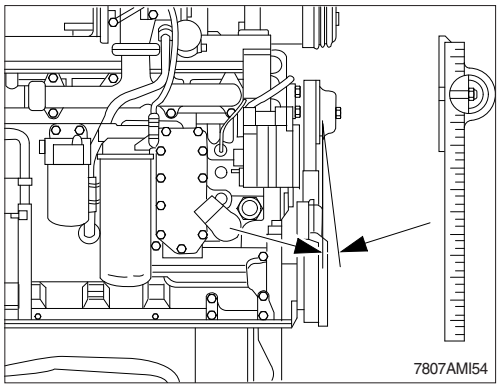
(4) Inspect the tensioner for evidence of the pivoting tensioner arm contacting the stationary circular base. If there is evidence of these two areas touching, the pivot tube bushing has failed and the tensioner must be replaced.



(5) A worn tensioner that has play in it or a belt that "walks" off its pulley possibly indicates pulley misalignment.

※ **Maximum pulley misalignment is three degrees. This measurement can be taken with a straightedge and an inclinometer.**

(6) Install the belt.



9) CLEANING OF AIR CLEANER

(1) Primary element

① Remove the cover by pulling off the clamps and loosen the wing nut to pull out the outer 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, 40psi) forward and backward equally.

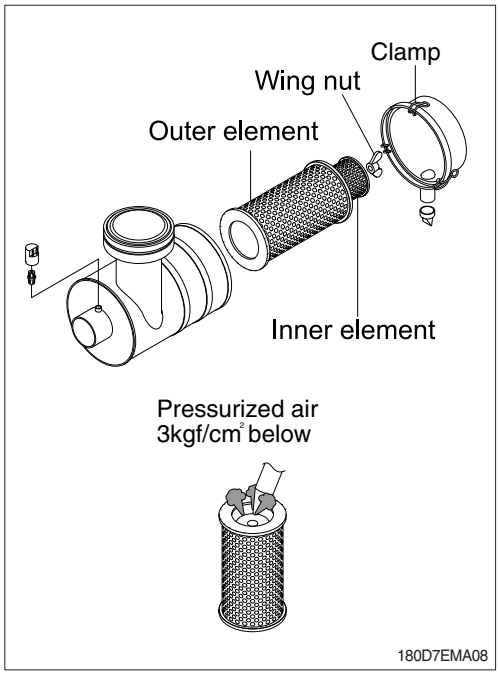
④ Inspect for cracks or damage of element by putting a light bulb inside of the element.

⑤ Insert element and fasten the clamps.

※ **When the air cleaner warning lamp is ON, clean the primary element.**

※ **The primary element should be replaced if the warning lamp is ON after installation of a clean primary element, or if the exhaust smoke is still black.**

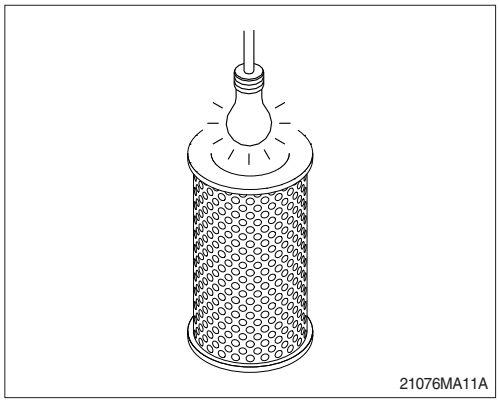
※ **Replace the primary element after 10 times cleanings.**



(2) Safety element

※ **The safety element should be replaced at the time the primary element is replaced.**

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



10) FUEL TANK

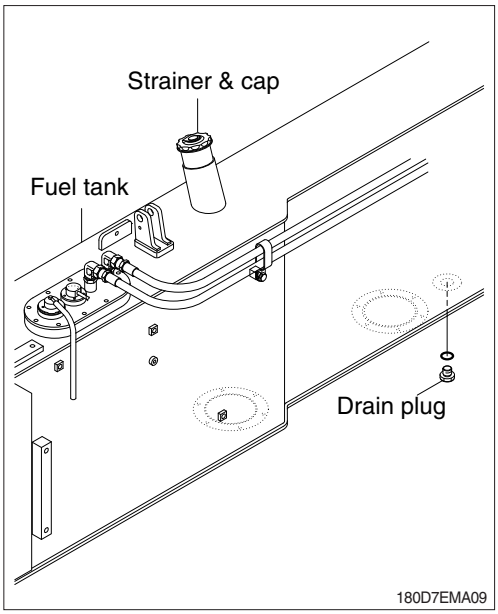
(1) Fill fuel fully when system the operation to minimize water condensation, and check it with fuel gauge before starting the machine.

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



11) REPLACEMENT OF FUEL FILTER

(1) Clean around the filter head, remove the filter and clean the gasket surface.
· Wrench size : 90~95 mm (3.5~3.8 in)

(2) Replace the O-ring.

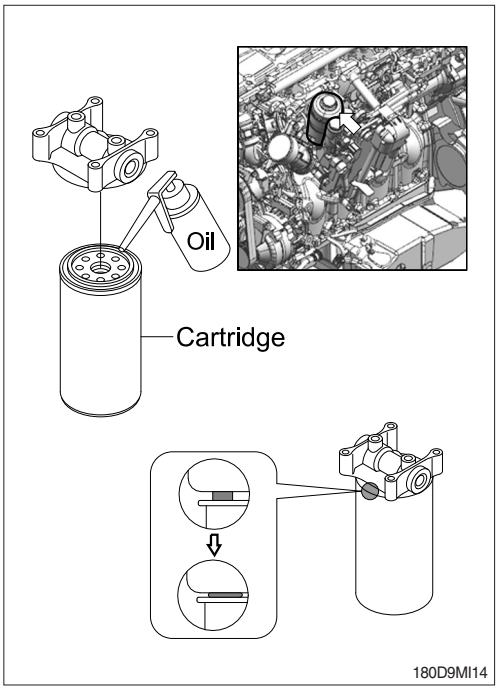
(3) Apply engine oil on the gasket of filter when mounting, and tighten 3/4 to 1 turn more after the gasket touches the filter head.

(4) Relieve the air after mounting.

※ **Do not pre-fill an on-engine fuel filter with fuel. 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 damaging fuel system components.**

※ **Check for fuel leakage after the engine starts.**

※ **If air is in the fuel system, the engine will not start. Start engine after bleeding the air according to the method of bleeding air.**



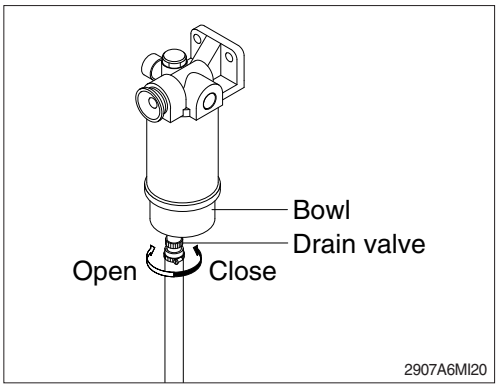
12) PREFILTER

※ **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.



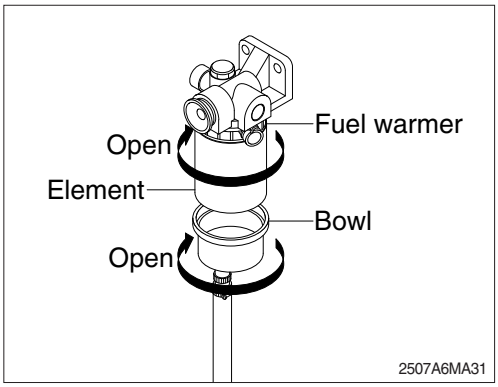
(2) Replace element

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

② Remove element, fuel warmer and bowl from filter head.

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

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

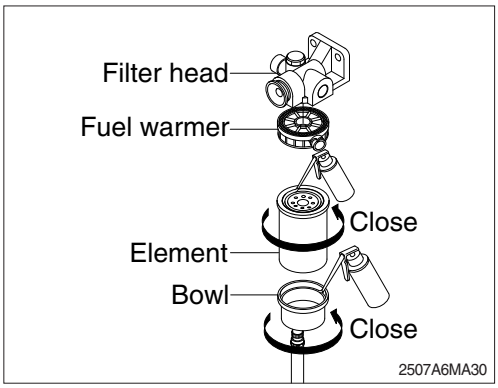


④ Lubricate new bowl seal with clean fuel or motor oil and place in bowl gland.

⑤ Attach bowl to new element firmly by hand.

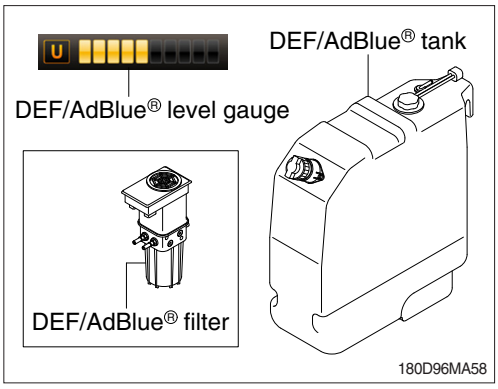
⑥ Lubricate new element seal and place in element top gland.

⑦ Attach the element, fuel warmer and bowl to the head.

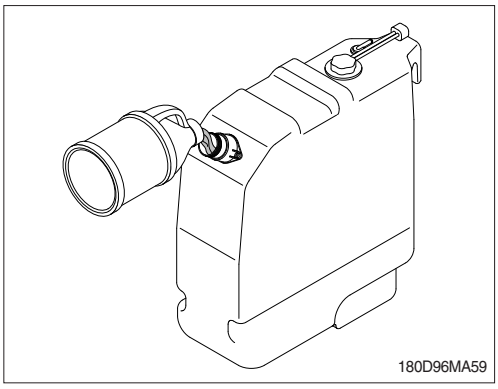


13) DEF / AdBlue® TANK

(1) The DEF / AdBlue® tank level must be checked daily with DEF / AdBlue® level gauge.



(2) If the DEF / AdBlue® level is found to below, DEF / AdBlue® must be added.



Before filling the tank

① Switch off the engine.

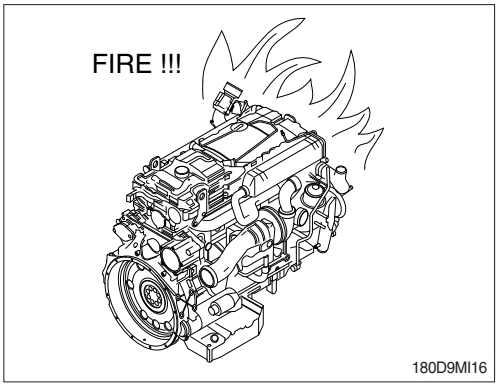
② Secure the vehicle against rolling away. Always fill the tank with at least 5 liters, as smaller amounts could cause malfuctions.

⚠ Do not allow diesel fuel to run into the DEF / AdBlue® tank. You could otherwise damage the exhaust gas aftertreatment system.

⚠ Do not mix additives to DEF / AdBlue®.

14) 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.



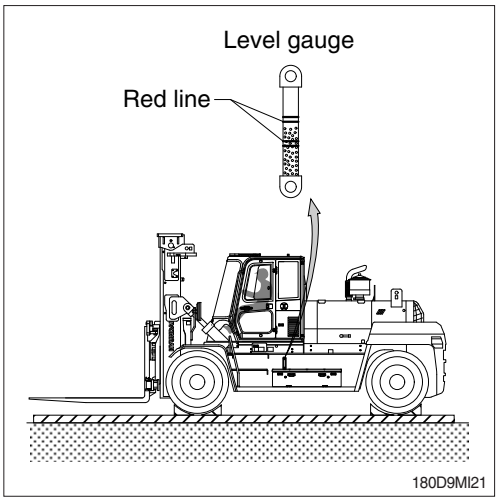
15) HYDRAULIC OIL CHECK

(1) Lower the forks on the ground at a flat location as in the illustration.
Stop the engine and then leave for about 5 minutes.

(2) Check the oil level at the level gauge. The level gauge is located on the left side of the hydraulic oil tank.

(3) The sight gauge should indicate the middle position (between red lines).

※ **Add hydraulic oil, if necessary.**



16) FILLING HYDRAULIC OIL

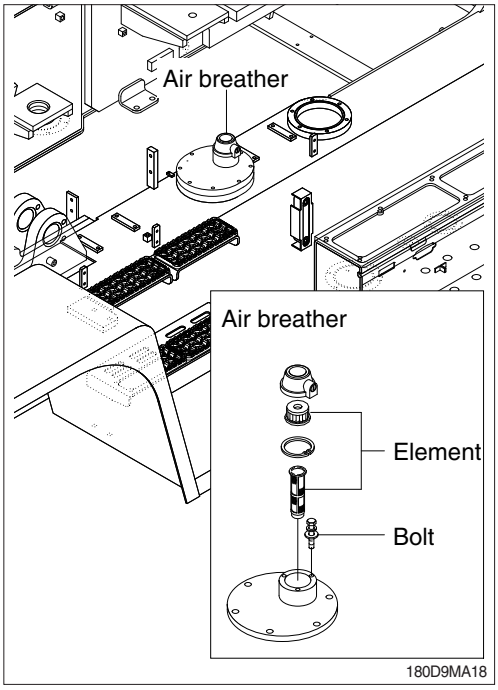
(1) Stop the engine to the position of level check.

(2) Check air breather filter and replace it if necessary.

(3) Loosen cap 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.



17) CHANGE THE HYDRAULIC OIL

(1) Lower the forks on the ground and extend the tilt cylinder to the maximum.

(2) Loosen the cap and relieve the pressure in the tank.

(3) Prepare a suitable drain pan.

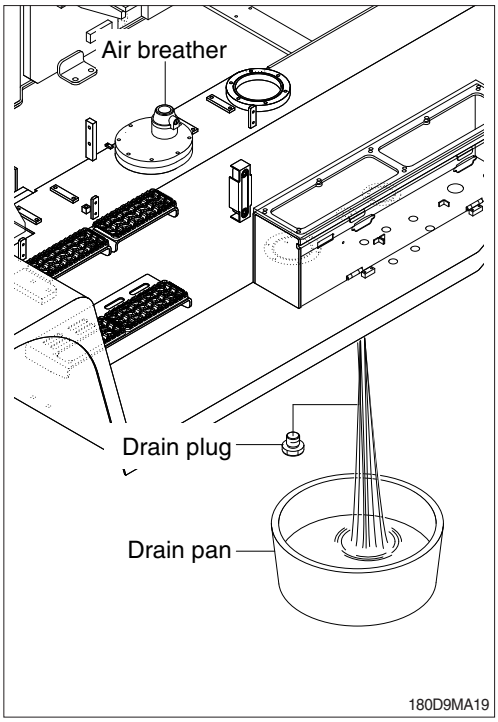
(4) To drain the oil loosen the drain plug.

(5) After draining oil, tighten the drain plug.

(6) Fill proper amount of recommended oil.

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

※ **The oil must be free of bubbles. If bubbles are present in the oil, air is entering the hydraulic system. Inspect the suction hoses and hose clamps for leakage or damage.**



18) CLEANING AND REPLACING RETURN FILTER

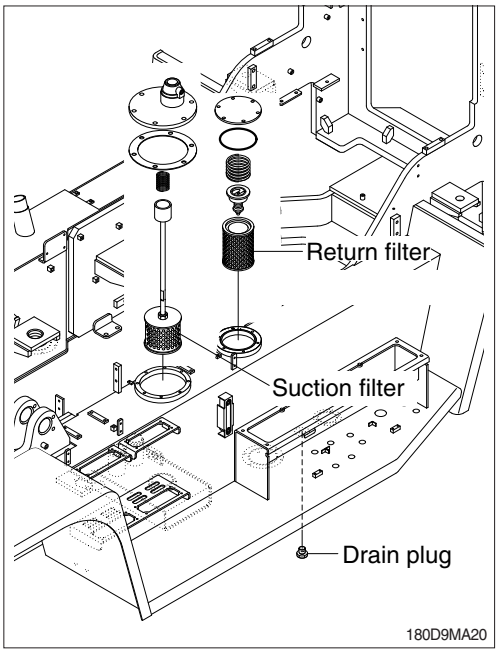
Clean and replace the return filter in the following manner.

(1) Remove the flange by loosening the mounting bolt.

(2) Remove return filter from the tank.

(3) Replace the return filter element with new one.

(4) Install the cover on the tank.
· Tightening torque : 6.9±1.4 kgf · m
(50±10 lbf · ft)



19) REPLACEMENT OF ELEMENT IN HYDRAULIC TANK BREATHER

(1) Loosen the cap and relieve the pressure in the tank.

(2) Loosen the screw and remove the cover.

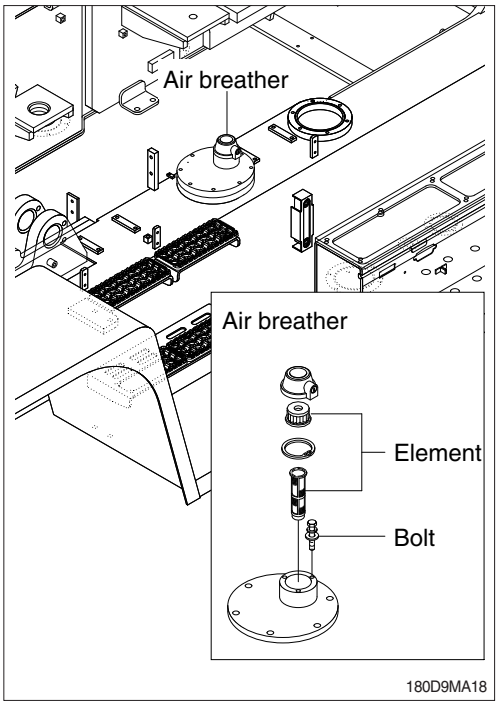
(3) Pull out the filter.

(4) Replace the filter with new one.

(5) Reassemble by reverse order of disassembly.

· Tightening torque of the bolts :

2.7~4.1 kgf · m (19.5~29.7 lbf · ft)



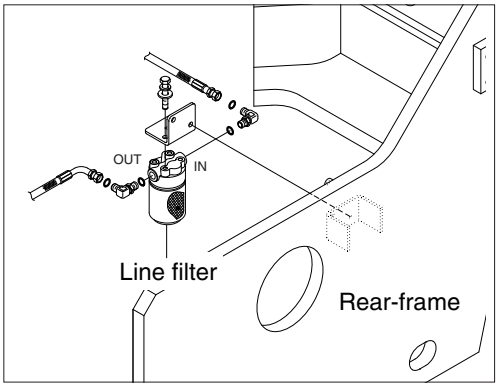
20) REPLACE THE ELEMENT OF THE BRAKE LINE FILTER

(1) Remove the filter case from the filter assy.

(2) Pull out the filter element and clean filter case.

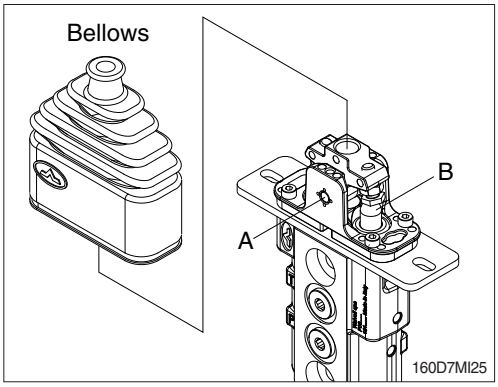
(3) Replace filter element and O-ring with new parts.

(4) Reassemble line filter.



21) LUBRICATE RCV LEVER

Remove bellows and grease the joint (A) and the sliding parts (B).



22) TIRE PRESSURE

(1) Inappropriate tire pressure is a primary cause for tire damage. Insufficient tire pressure will damage internal carcass of tire. Repeated excessive bending will damage or break the carcass. Excessive pressure will also cause premature damage of tire.

(2) Recommended tire pressure (When tire is cooled)

Size	Pressure
12.00-20, 20PR	10 kgf/cm^2 (142 psi)

(3) Continuous operation will produce heat and increase pressure on tire. But such phenomenon was already taken into account when designing a tire. Do not try to remove normally increased air because tires may be crushed or overinflated.

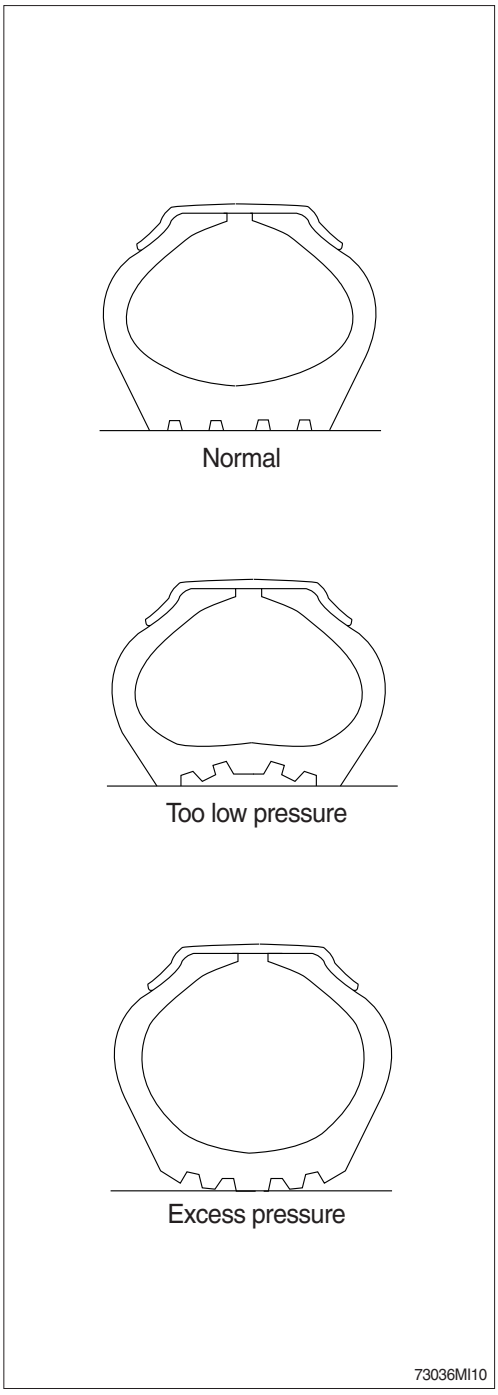
(4) The three major causes for excessive heat and pressure of tire are insufficient pressure, excessive load and overspeed. Avoid excessive load and overspeed in order to keep tires in good shape.

⚠ Do not inflate tires using flammable gases or alcohol injector.
This cause explosion or personal injury.

⚠ Inflate tires at the pressure level recommended by the manufacturer, and check periodically pressure and wear of tires.

⚠ When replacing the inflated tire, do not stand near the tire.

※ Check the tire when the tire is at normal temperature and the truck is not loaded.



⚠ Do not use recycled wheel parts.

⚠ When removing lockering or inflating tire, use safety cable or chain to ensure safety.
Be sure to bleed air before removing lockering. Never inflate tires unless the lockering is assembled in its place.

※ Avoid the followings when traveling.

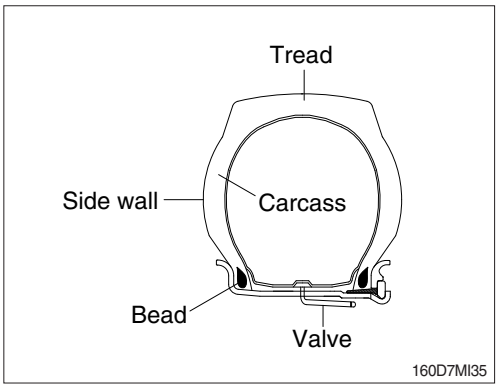
① Rubbing tires against road bank or rack at cargo-unloading spot.
② Tires slippage during working.
③ Abrupt starting of the truck.
④ When oil, grease or gasoline smeared on tire, clean those. Otherwise it may cause of permanent deformation.

23) REPLACEMENT OF TIRE

⚠ Disassembly, reassembly, replacement and repair of tire requires special skills and equipment. Contact a tire repair shop.

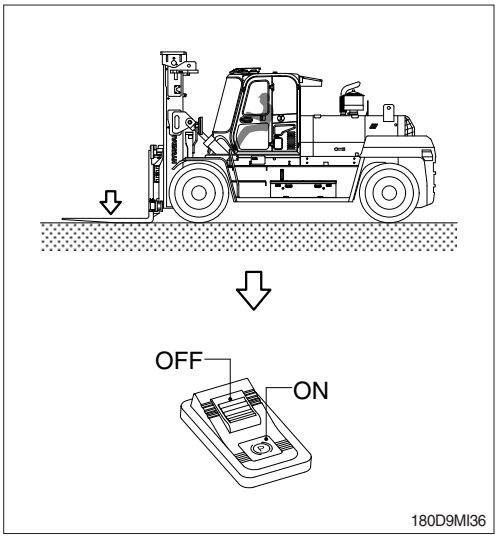
(1) Tires to be replaced

① Tires with broken or bent bead wires
② Tires exposed more than 1/4 of carcass fly.
③ Tires whose carcass is damaged more than 1/3 of the tire width.
④ Tires which show fly separation.
⑤ Tires which has a radial crack near the carcass.
⑥ Tires which are judged to be unsuitable for use because of deformation or damage.

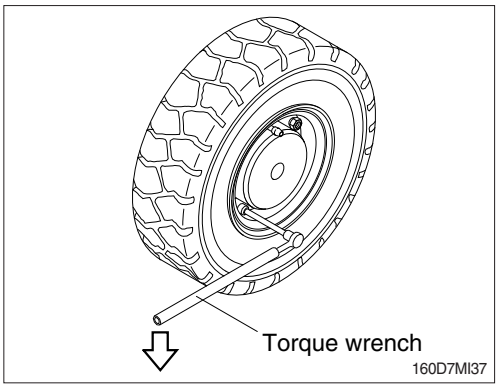


(2) Separation of tire

① After moving the truck to flat ground, lower the fork to the ground and turn the parking brake switch ON.

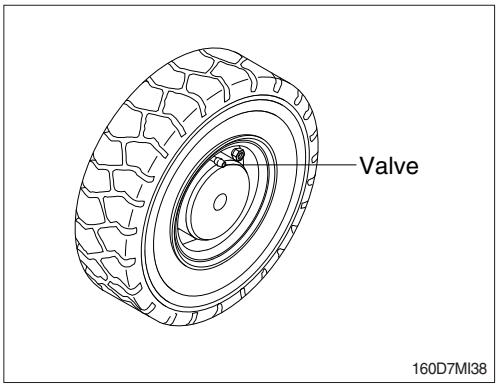


② Loosen slightly all wheel mounting.
· Tools : Socket 22 ㎜
Torque wrench
Extension bar
③ Lift the machine with a jack.
④ Loosen all wheel mounting nuts and replace the tire.



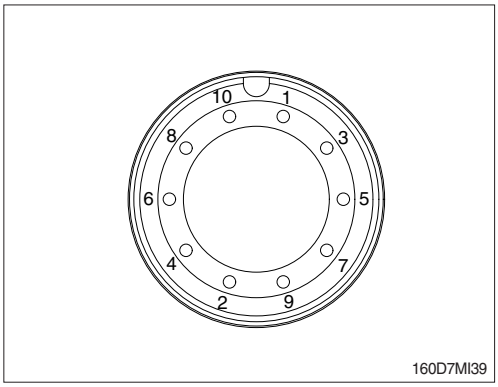
(3) Direction of tire to be installed

① Be careful that the valve should be facing the outside.



(4) Mounting of tire

① Lightly tighten nuts as shown in the illustration.
② Lower the jack after tire is replaced.
③ Tighten nuts according to the specified tighten torque.
· 71~96 kgf · m (513~694 lbf · ft)

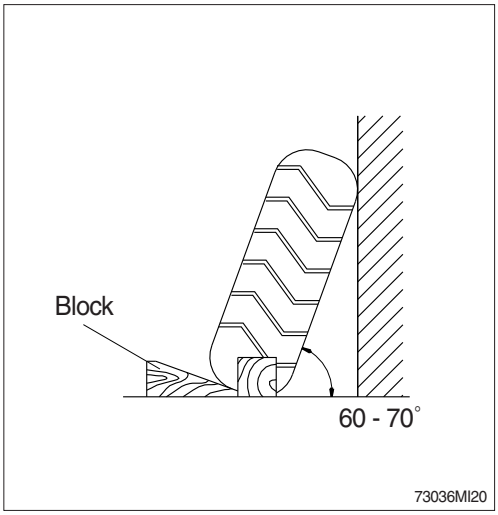


24) STORING TIRES AFTER REMOVAL

As a basic rule, store the tires in a warehouse which unauthorized persons cannot enter. If the tire are stored outside, always erect a fence around the tires and put up "No Entry" and other warning signs that even young children can understand.

Stand the tire on level ground, and block it securely so that it cannot roll or fall over.

If the tire should fall over, get out of the way quickly. The tires for the industrial truck are extremely heavy, so trying to hold the tire may lead to serious injury.

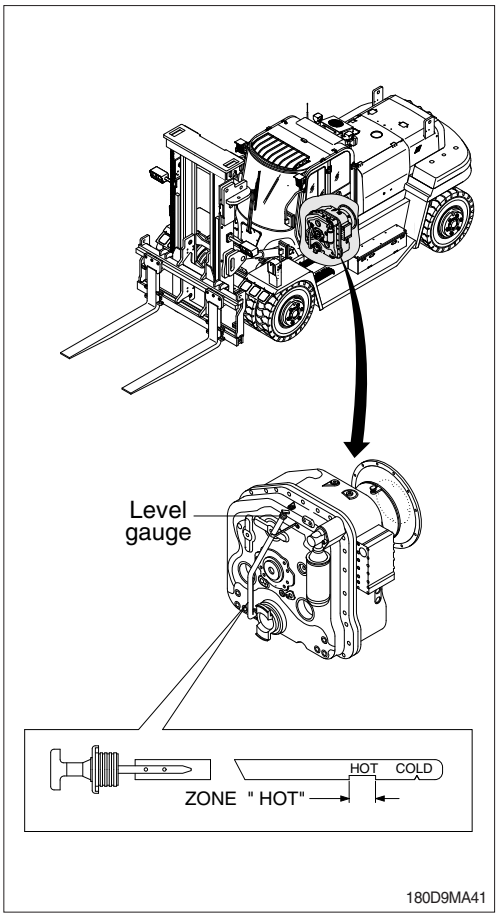


25) CHECK TRANSMISSION OIL LEVEL

(1) The oil level check must be carried out as follows; oil level check (weekly).
(2) At horizontally standing machine.
(3) Transmission in neutral position.
(4) In cold start phase, the engine must be running about 2~3 minutes at idling speed, and the marking on the oil level gauge must then be lying above the cold start mark COLD.
(5) At operating temperature of the transmission (about 80~90˚C) and the engine idling speed.

① Loosen oil level gauge by counterclockwise rotation, remove and clean it.
② Insert oil level gauge slowly into the oil level tube until contact is obtained, and pull it out again.
③ On the oil level gauge, the oil level must be lying in the zone HOT.
④ Insert the oil level gauge again, and tighten it by clockwise rotation.

⚠ When checking, press the parking brake switch and fix the tires with blocks.



26) REPLACEMENT OF TRANSMISSION OIL AND FILTER ELEMENT

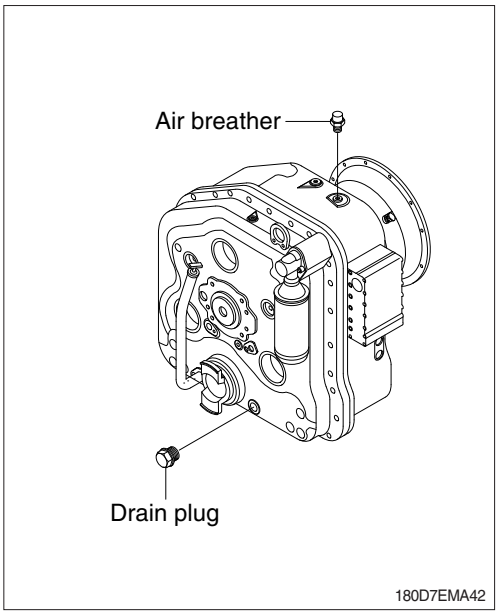
(1) Operate the machine for a few minutes in order to warm the transmission oil.

(2) Move the machine to flat ground. Lower the forks to the ground and slightly apply downward force.

(3) Press the parking brake switch and stop the engine.

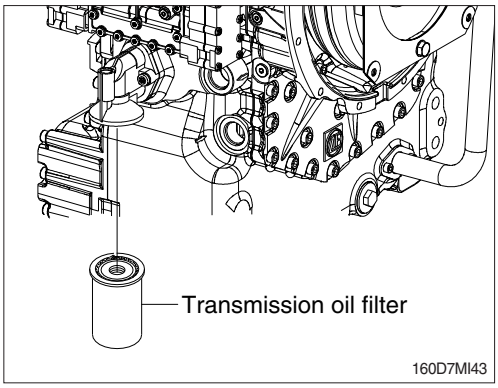
(4) Open transmission air breather to relieve internal air pressure.

(5) Remove the transmission drain plug. Allow the transmission oil to drain into a suitable container.



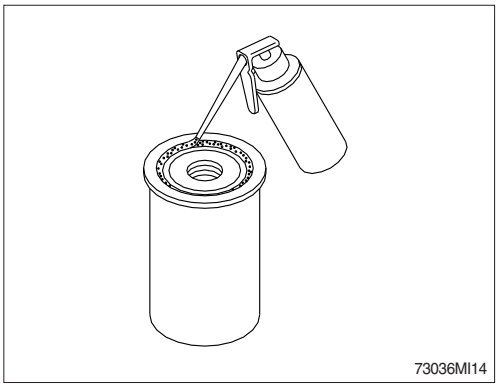
(6) Remove the transmission oil filter cartridge. Dispose of the used transmission oil filter cartridge properly.

(7) Clean the filter cartridge mounting base. Remove any part of the filter cartridge gasket that remains on the filter cartridge mounting base.



(8) Apply a light coat of oil to the gasket of a new transmission oil filter cartridge.

(9) Install the new transmission oil filter cartridge. Screw the filter in until contacts with the sealing surface is obtained and tighten it now by hand about 1/3 to 1/2 turn.



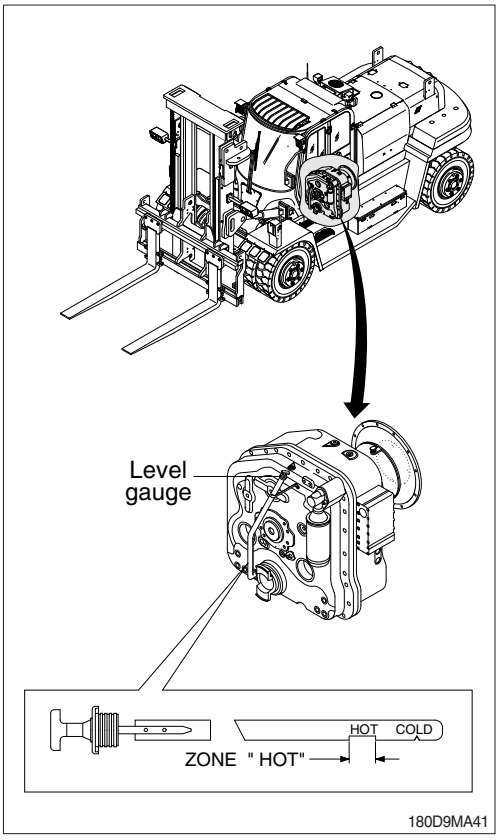
(10) Mount the drain plug of transmission after cleaning it.

(11) Fill the oil through level gauge inlet and check if the oil is at the appropriate level.

(12) The proper oil amount is 27 liters (7.1 U.S. gallons)

⚠ As the truck is hot after operation wait until the temperature has dropped.

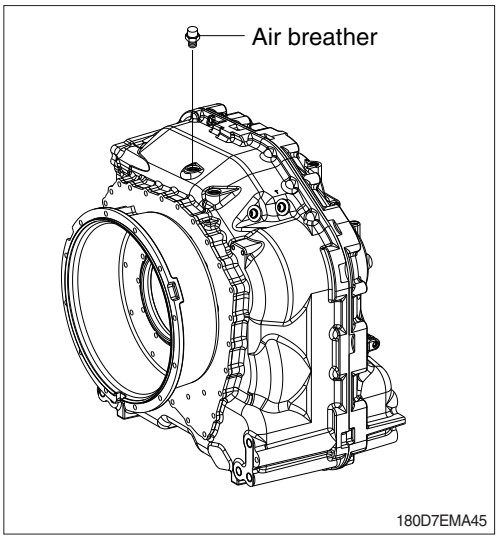
⚠ It is imperative to pay attention to absolute cleanliness of oil and filter.
Binding is in any case the marking on the oil level gauge.



27) CLEANING TRANSMISSION AIR BREATHER

(1) Remove dust or debris around the air breather.

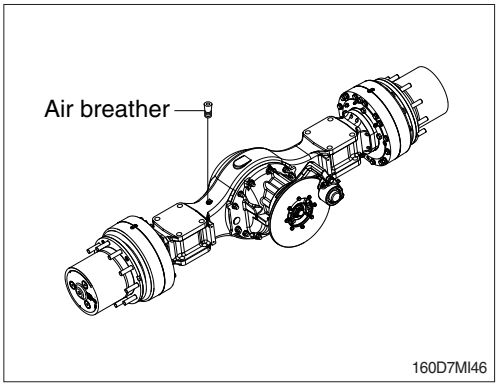
(2) Remove the air breather and wash it with cleaning oil.



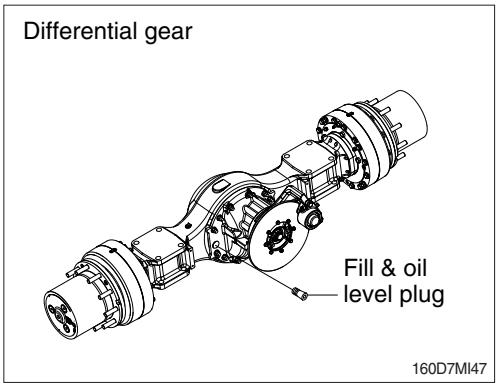
28) CHECK AND SUPPLYING AXLE OIL

(1) Move the truck to flat ground.

(2) Open the axle air breather to relieve internal air pressure.



(3) Remove the plug and check the oil amount.
If the oil level is at the hole of the plug, it is normal.

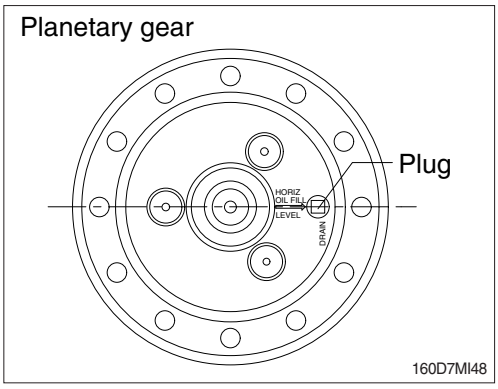


(4) If the oil level is below the plug hole, supply oil through a plug hole.

⚠ When checking the oil level, turn the parking brake switch ON and fix the tires with blocks.

⚠ As the truck is hot after operation, wait until the temperature has dropped.

※ Set the plug of planetary gear in parallel to the ground.



29) CHANGE THE AXLE OIL

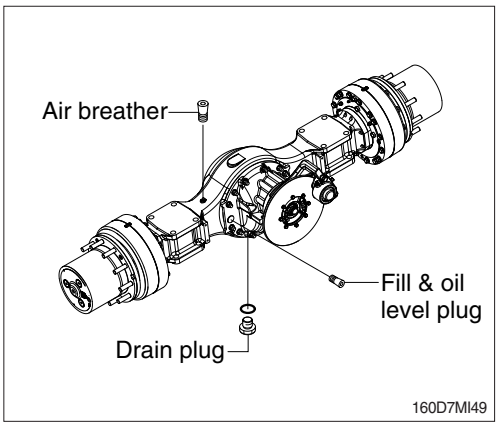
(1) Place a case under drain plug to catch oil.

(2) Remove the air breather to relieve internal pressure.

(3) Drain oil in the differential gear.

① Remove the refilling plug and remove the drain plug to drain oil off.

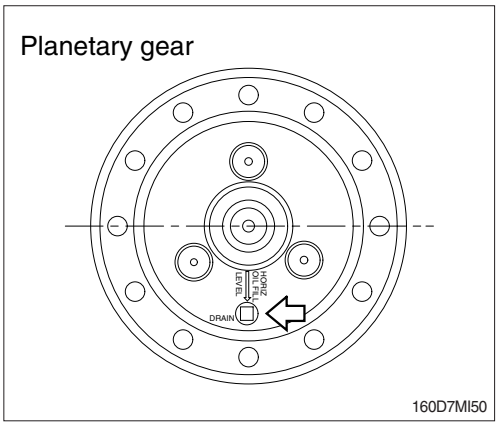
② Wash drain plug and install it.



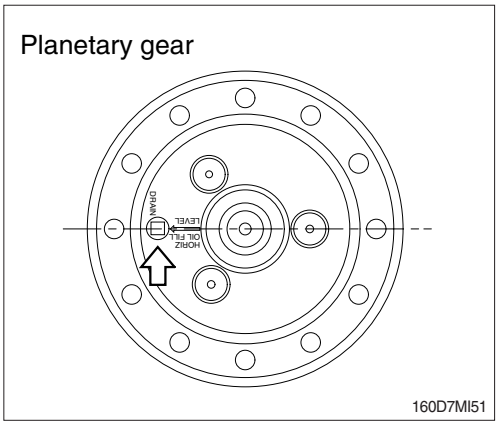
(4) Drain oil in the planetary gear.

① Drain oil by removing drain plug.

※ The drain plug should be facing the ground.



(5) After draining, put the drain plug of planetary gear in parallel to the ground.

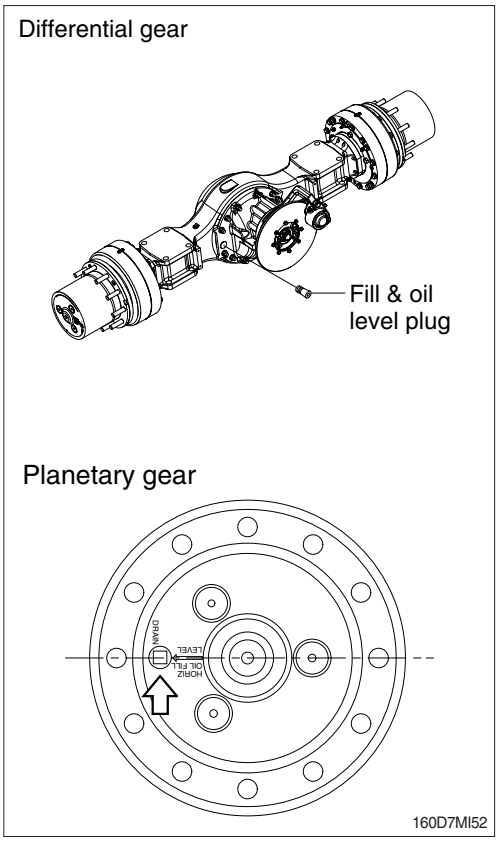


(6) Supply oil into the differential gear and the planetary gear.
· Oil amount : 27.5 ℓ (7.3 U.S. gal) (Differential gear)+2×3.2 ℓ (0.8 U.S. gal) (Planetary gear)

(7) Supply oil until it overflows from the oil filler, then install the plug.

⚠ **As the machine is hot after operation, wait until the temperature has dropped.**

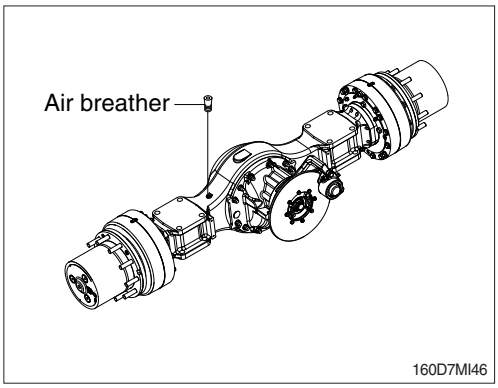
※ **If a work requires frequent use of brake, replace it earlier than normal change interval.**



30) CLEANING AXLE BREATHER

(1) Remove dust or debris around the breather.

(2) Remove the breather and wash it with cleaning oil.



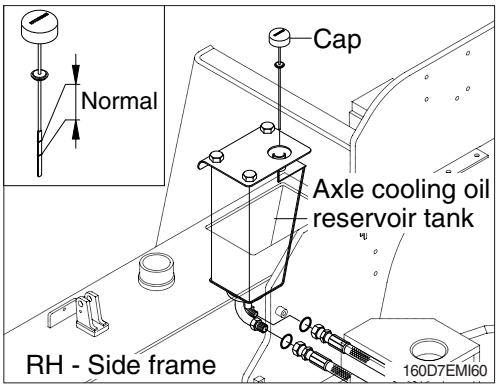
31) STRAINER FOR THE TRANSMISSION AND AXLE COOLING LINE

(1) Remove suction filter element from the flange assy using spanner.

(2) Check and clean throughly inside of the suction filter element by using compressed air.

(3) Reassemble the element on the flange assy.

※ **Replace new element if necessary.**



32) LUBRICATION

(1) Supply grease through the grease nipple, using grease gun.

(2) After lubricating, clean off spilled grease.

⚠ Press the parking brake switch and fix front and rear tires with blocks.

⚠ Set the mast and forks in a stable position and turn the hydraulic safety lock valve into the lock position.

(3) Lubrication points

① Adjust cylinder : 2EA

② Forks : 2EA

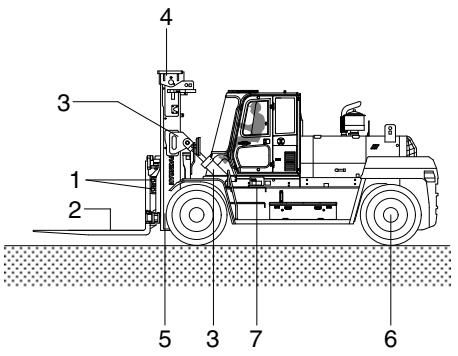
③ Tilt cylinder : Left/Right, 2EA

④ Lift chain : 2EA

⑤ Mast support : Left/Right, 2EA

⑥ Steering axle : 5EA

⑦ Hydraulic pump drive spline : 1EA



1 Adjust cylinder (2EA)
2 Fork (2EA)
3 Tilt cylinder (Left/Right, 2EA)
4 Lift chain (2EA)
5 Mast support (Left/Right, 2EA)
6 Steering axle (5EA)
7 Hydraulic pump drive spline (1EA)

180D9OP17A

33) FORKS REPLACEMENT

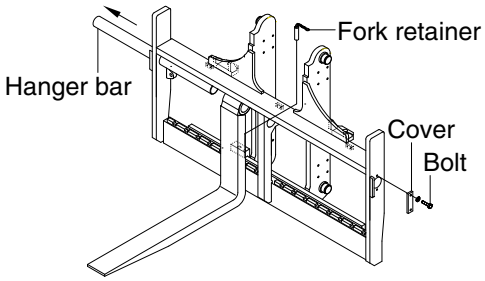
① Lower the fork carriage until the forks are approximately 25 mm (1 in) from the floor.

② Take out the spring pin and remove the pin weld assy.

③ Remove only one fork at a time.

※ On larger forks it may be necessary to use a block of wood.

④ Reverse the above procedure to install load forks.

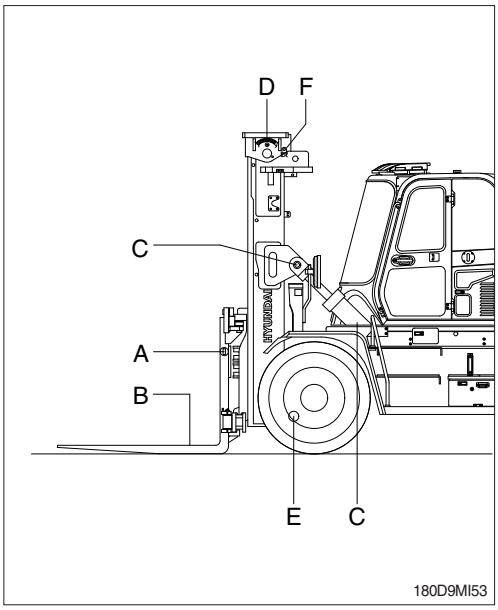


100D7MS07

34) MAINTENANCE OF WORK EQUIPMENT

(1) Lubricate to each point of working device.
Lubricate the grease to grease nipple in accordance with lubrication intervals.

No.	Description	Qty
A	Fork adjustment cylinder pin	2
B	Fork shaft	1
C	Tilt cylinder pin	2
D	Load chain	2
E	Mast support pin	2
F	Chain sheave pin	2

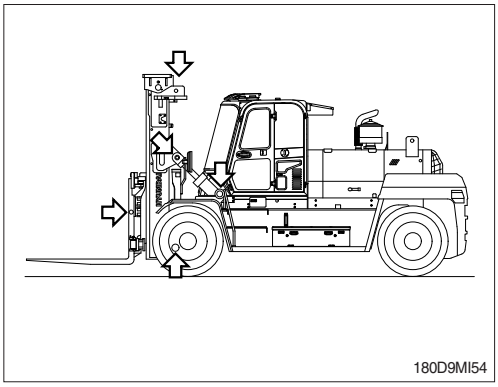


※ Shorten lubricating interval when working in the water or dusty place.

(2) Check for wear and tear of work equipment pins and bushings.

(3) Check for damage of forks and mast linkage part.

※ Check daily and lubricate the fork positioner hanger bar and bottom plate where the fork is contacted, or the forks may vibrate temporarily while positioning.

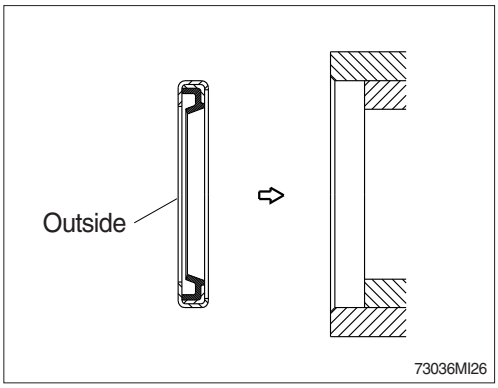


(4) Dust seals are mounted on the rotating part of working device to extend the lubricating interval.

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

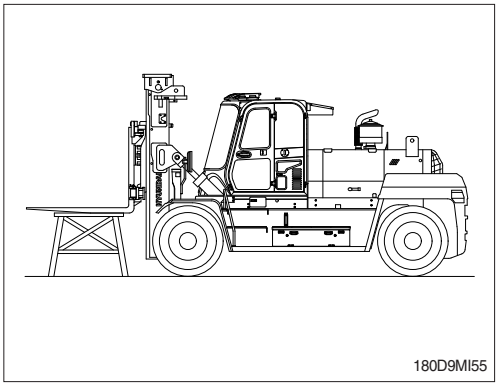
※ If it is assembled in wrong direction, it will cause fast wear of pin and bushing, and create noise and vibration during operation.

※ Make sure the seals are not damaged or deformed.



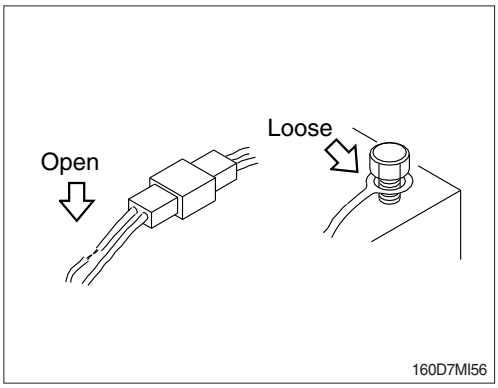
34) WORK EQUIPMENT SUPPORT

When carrying out inspection and maintenance with the forks raised, fit a stand under the forks securely to prevent the work equipment from coming down. In addition, set the work equipment control levers to the Hold position and Lock with the safety lock.



1) WIRING, GAUGES

Check regularly and repair loose or malfunctioning gauges when found.



2) WELDING REPAIR

Before start to welding, follow the below procedure.

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

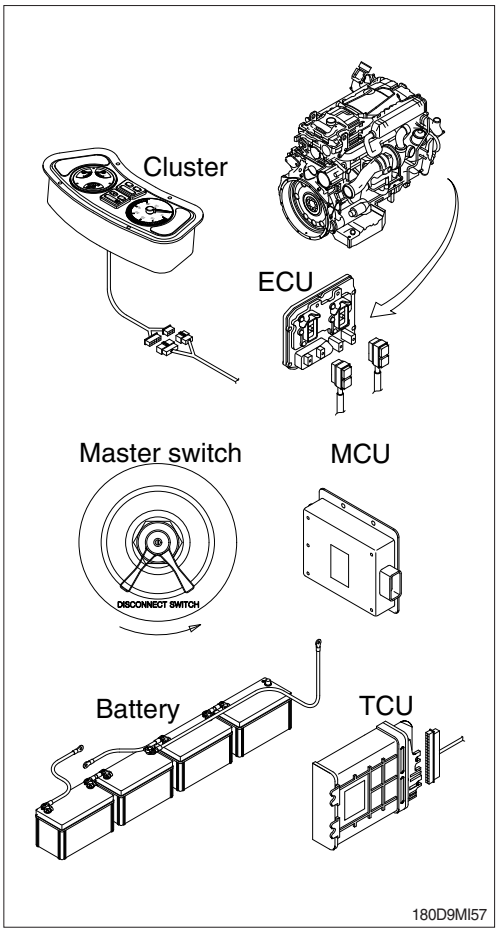
(2) Disconnect ground cable from battery by master switch.

(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 (ECU, MCU, TCU, cluster etc).

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

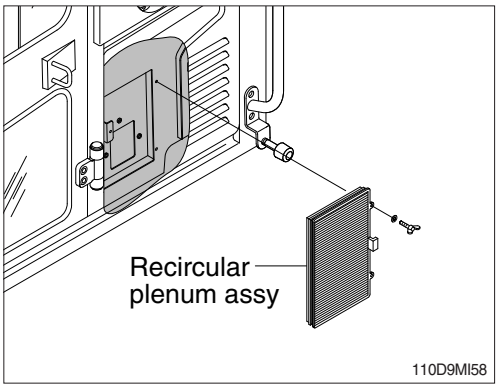


8. AIR CONDITIONER AND HEATER

1) CLEANING AND REPLACING FILTER

※ Always stop the engine before servicing.

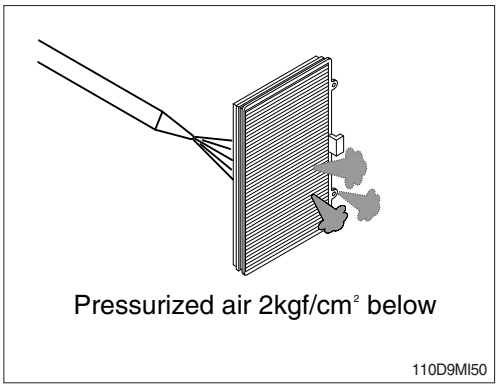
(1) Open the door, loosen the wing bolt and remove the recircular plenum assembly.



(2) Clean the recircular plenum using a pressurized air (Below 2 kgf/cm², 28 psi).

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

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



2) 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.

3) CHECK DURING SEASON

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

4) 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.

5) REFRIGERANT

(1) Equipment contains fluorinated greenhouse gas.

Model	Type	Quantity	GWP
180D-9	HFC-134a	0.55 kg (1.21 lb)	787 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) Envior

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

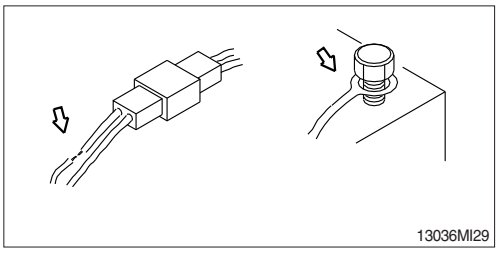
① Eye contact / Limited skin contact
Rinse with warm water and apply a light bandage. Seek medical attention immediately.

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.

1) WIRING, GAUGES

Check regularly and repair loose or malfunctioning gauges when found.



2) BATTERY

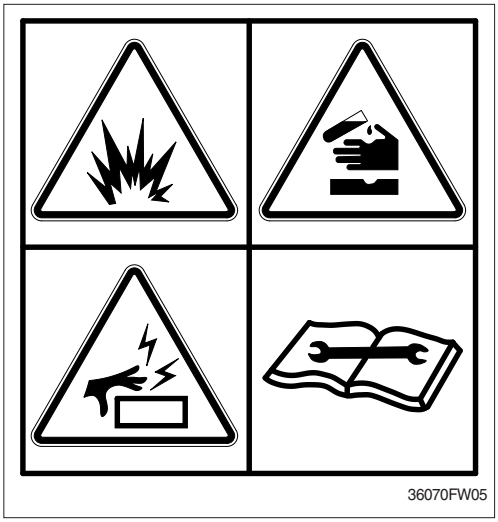
(1) Clean

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.

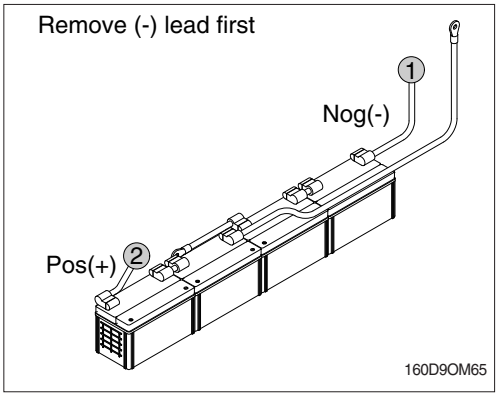
- A battery supplier
- An authorized battery collection facility
- Recycling facility

(3) Removing and installing

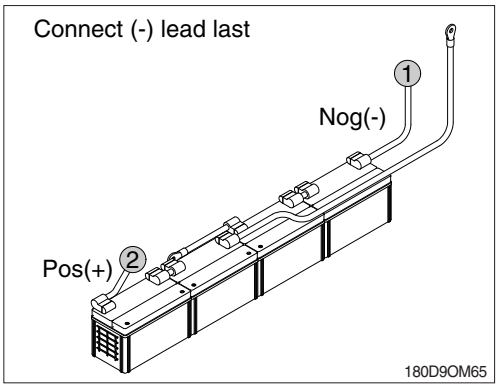
① Remove the lead from the ground side (Normally the (-) terminal side) of the battery. It is dangerous to let a tool, etc., touch the (+) terminal and the body at the same time, since this causes a spark.

② When remounting, connect the ground connection last

⚠ Do not allow tools to touch the (+) terminal and the body of the truck at the same time. This can cause sparking and explosion.
When reinstalling the cables after replaced the battery, pay close attention to maintaining the same alignment state of the cables as it was when supplied. Otherwise, the machine can be exposed to the fire hazards.



⚠ Prior to reinstall the cable, inspect in detail and confirm the condition of the cables and replace it when the cables possess any kind of abnormal damages such as cracking and wear out of the cable sheath that make you feel somedangerous to use it. Do consult an expert about this matter when you are not able to judge its condition. It is strongly recommended to keep the surroundings of the battery cables clean so that the machine can be freed from the risk of firing by eliminating the flammable contaminations such as oil, dust and etc. acting as a fire developer. Dispose of the old battery in locally approved manner.



3) FUSES REPLACEMENT

(1) Fuse box (B+)

No.	Capacity	Related electrical component
①	-	-
②	30 A	MCM/ACM (B+)
③	30 A	Battery power
④	30 A	CPC4 (B+)
⑤	10 A	OBD (B+)
⑥	10 A	Start key (B+)
⑦	10 A	TCU (B+)
⑧	10 A	Turn lamp (B+)
⑨	10 A	OPSS system
⑩	5 A	MP3 player
⑪	5 A	Room lamp
⑫	5 A	Cluster
⑬	-	-
⑭	15 A	Cabin tilt
⑮	5 A	Monitor RMCU
⑯	5 A	Horn
⑰	10 A	DEF sensor
⑱	-	-
⑲	-	-
⑳	-	-
㉑	-	-
㉒	-	-
㉓	-	-
㉔	-	-
㉕	-	-
㉖	-	-
㉗	-	-
㉘	-	-
㉙	-	-
㉚	-	-
㉛	10 A	Neutral relay
㉜	15 A	Time delay relay
㉝	15 A	Time delay relay

					-	-	①
③	30 A	BATT POWER			30 A	MCM/ACM	②
㉔	-	-	15 A ⑭	CABIN TILT	15 A	CPC4	④
㉕	-	-	5 A ⑮	MONITOR RMCU	10 A	OBD	⑤
㉖	-	-	5 A ⑯	HORN	10 A	START KEY(B+)	⑥
㉗	-	-	-	-	10 A	TCU (B+)	⑦
㉘	-	-	-	-	10 A	TURN LAMP(B+)	⑧
㉙	-	-	-	-	5 A	CPSS SYSTEM	⑨
㉚	-	-	-	-	5 A	MP3 PLAYER	⑩
㉛	10 A	NEUTRAL POWER	-	-	5 A	ROOM LAMP	⑪
㉜	15 A	TIME DELAY RELAY	-	-	5 A	CLUSTER	⑫
㉝	15 A	TIME DELAY RELAY	-	-	-	-	⑬

180D9FB01

(2) Fuse box (IG)

No.	Capacity	Related electrical component
①	-	-
②	-	-
③	60 A	IG power
④	5 A	Back-up
⑤	10 A	CPS system
⑥	15 A	Cigar jack/ tilt alarm
⑦	15 A	DC/DC converter
⑧	10 A	MCU
⑨	15 A	MP3 handsfree
⑩	10 A	Monitor / Cluster
⑪	20 A	Aircon heater
⑫	15 A	Seat heater
⑬	10 A	Park solenoid
⑭	10 A	Illumination lamp
⑮	15 A	Head lamp
⑯	15 A	Front work lamp
⑰	15 A	Rear work lamp
⑱	15 A	Wiper horn
⑲	15 A	Fuel warmer main
⑳	5 A	Beacon lamp
㉑	5 A	RMCU
㉒	10 A	Brake lamp selector valve
㉓	15 A	TCU IG
㉔	10 A	ACM, MCM
㉕	10 A	CPC4 / OBD
㉖	5 A	ALT IG
㉗	10 A	TCP wiper
㉘	20 A	Air compressor
㉙	-	-
㉚	-	-
㉛	-	-
㉜	-	-
㉝	-	-

					-	-	①
③	60 A	IG POWER			-	-	②
㉔	10 A	ACM,MCM	10 A ⑭	ILLUM LAMP	5 A	BACK-UP	④
㉕	10 A	CPC4 OBD	15 A ⑮	HEAD LAMP	10 A	OPSS SYSTEM	⑤
㉖	5 A	ALT IG	15 A ⑯	WORK LAMP FRONT	15 A	CIGAR JACK TILT ALARM	⑥
㉗	10 A	TOP WIPER	15 A ⑰	WORK LAMP REAR	15 A	DC/DC CONVERTER	⑦
㉘	10 A	AIR COM-PRESSOR	15 A ⑱	F/R WIPER HORN	10 A	MCU	⑧
㉙	-	-	15 A ⑲	F/WARMER MAIN	15 A	MP3 HAND FREE	⑨
㉚	-	-	5 A ⑳	BEACON LAMP	10 A	MONITOR CLUSTER	⑩
㉛	-	-	5 A ㉑	RMCU	20 A	AIRCON HEATER	⑪
㉜	-	-	10 A ㉒	BRAKE LAMP SELECTOR VALVE	15 A	SEAT HEATER	⑫
㉝	-	-	15 A ㉓	TCU IG	10 A	PARK SOLENOID	⑬

180D9FB02

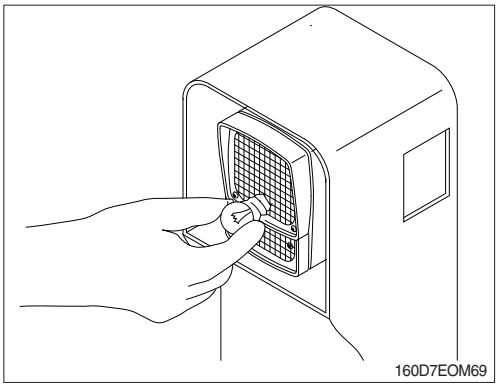
① Turn the starting switch OFF.

② Open the cover of the fuse box, and replace fuses inside (To open the cover of the fuse box, push the side of the cover lightly with a finger, and pull the cover forward to remove it.)

⚠ When replacing the fuse, check the relationship between the fuse and the electrical components it protects. Always replace fuses with a fuse of the same capacity. Always turn the starting switch OFF before replacing any fuse.

4) LAMP BULBS REPLACEMENT

Lamp	Spec (24V)
Head lamp(up)	75W
Head lamp(down)	70W
Turn signal lamp	LED
Clearance lamp	LED
Stop lamp	LED
Backup lamp	LED
License lamp (option)	10W
Beacon lamp (option)	Strobe type
Rear work lamp	65W



⚠ **After checking that the fuse is not blown and that there is no disconnection in the wiring harness, replace the lamp bulb.**

5) FUNCTIONAL TESTS

You will start the engine to complete the functional tests, so be sure that:

- The parking brake is applied.
- The gear selector lever is in NEUTRAL.
- Forks are fully lowered to the floor or ground.
- All controls are in neutral or other correct position.
- You are familiar with the safety procedures given in section 5. **Starting and operating procedures,** in this manual.

As you test the following components, be sure they are properly mounted and working correctly.

(1) Horn

Press the horn button to check horn function. If the horn or any other part does not operate, report the failure and have it repaired before the truck is put into operation.

(2) Hour meter

Start the engine and let it warm up until it runs evenly and accelerates smoothly when you push on the accelerator pedal. Check the hour meter for operation with the engine running. Write the hour meter reading on the PM report form. Report any malfunction or damage.

(3) Indicator lights

Check that all lights are functioning and indicate normal truck operation as described in section 3, **Know your truck,** in this manual.

(4) Service brakes and inching pedal

With the gear selector lever in NEUTRAL and the engine running, push the service brake pedal fully down and hold. The brakes should apply before the pedal reaches the floorplate. If the pedal continues to creep downward, report the failure immediately. Do not operate the truck until the brakes are repaired. Perform the same check with the inching pedal. (Additional braking/ inching checks will follow).

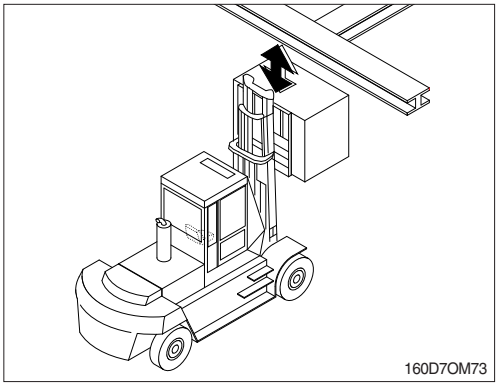
(5) Parking brake

Check the function of the parking brake. Release, then reapply. To check parking brake holding capability, park the lift truck on a grade and apply the parking brake. The parking brake should hold a lift truck with rated load on a 15% grade.

⚠ Do not operate a lift truck if the service or parking brakes are not operating properly.

(6) Lift mechanisms and controls

Pull back on the tilt control lever and hold until the mast reaches the full back tilt position. Push forward on the lever to return the mast to the vertical position. Release the lever.



⚠ Be sure that there is adequate overhead clearance before raising the mast.

Pull back on the lift control lever and raise the fork carriage to full height. Watch the mast assembly as it rises. Release the lever.

If the maximum fork height is not reached, this indicates there is an inadequate (low) oil level in the hydraulic sump tank or severe binding within the mast.

Push forward on the lift control lever. Watch the mast as it lowers. When the forks reach the floor, release the lever.

All movements of the mast, fork carriage, and lift chains must be even and smooth, without binding or jerking. Watch for chain wobble or looseness; the chains should have equal tension and move smoothly without noticeable wobble.

(7) Auxiliary controls (Option)

If your lift truck is equipped with an attachment, test the control lever for correct function and briefly operate the attachment.

(8) Steering system

※ The steering system, steering axle, and steering linkage on your truck should be inspected periodically for abnormal looseness and damage, leaking seals, etc.. Also, be alert for any changes in steering action. Hard steering, excessive freeplay (Looseness), or unusual sound when turning or maneuvering indicates a need for inspection or servicing.

Check the steering system by moving the steering handwheel in a full right turn and then in a full left turn. Return the handwheel to the straight ahead position. The steering system components should operate smoothly when the handwheel is turned. Never operate a truck that has a steering system fault.

⚠ Fasten your seat belt before driving the truck.

(9) Direction control, braking and inching

※ Be sure that the travel area is clear in front of the truck.

① Push firmly on the brake pedal. Release the parking brake. Move the directional control lever from NEUTRAL to FORWARD.

② Remove your right foot from the service brake pedal and put it on the accelerator pedal. Push down until the truck moves slowly forward. Remove your foot from the accelerator pedal and push down on the service brake pedal to stop the truck. The brakes should apply smoothly and equally.

※ Be sure the travel area is clear behind the truck.

③ Put the directional control lever in the REVERSE travel position. Release the service brake and push down on the accelerator pedal until the truck moves slowly in the reverse direction. Remove your foot from the accelerator pedal and push down on the service brake pedal to stop the truck. The brakes should apply smoothly and equally.

④ Put the directional control in FORWARD. Press the inching pedal fully down and hold. Depress the accelerator. The truck should not move. Now, with the accelerator still depressed, slowly release the inching pedal until the truck **Inches** forward smoothly and slowly.

※ Report any problems.

※ When you have completed the operational tests, park and leave the truck according to standard shut down procedure as described in section 5 of this manual. Be sure to make a record of all maintenance and operating problems you find.

6) LUBRICATION

(1) Truck chassis inspection and lubrication

Lubrication and inspection of truck chassis components, including steering wheels, steering axle linkage, steering cylinder, and wheel bearings are easier if the truck is raised and blocked up under the frame. Refer to your service manual for additional information on truck blocking and jacking. Also refer to your service manual for the location of grease fittings.

Inspect the steering cylinder piston rods, seals, and fasteners for damage, leaks, and looseness. Lubricate the steering axle linkage rod ends and linkage pivot points. Be sure to clean the grease fittings before lubricating, and remove the excess grease from all points after lubricating. Lubricate miscellaneous linkage as needed.

(2) Mast and tilt cylinder lubrication

Clean the fittings and lubricate the tilt cylinder rod end bushings (forward end) and both the base rod-end bushings (rear end). Clean and lubricate the mast trunnion bushings.

(3) Lift chains

Lubricate the entire length of the mast rail lift and carriage chains with HYUNDAI chain and cable lube.

7) AIR CLEANING

Always maintain a lift truck in a clean condition. Do not allow dirt, dust, lint, or other contaminants to accumulate on the truck. Keep the truck free from leaking oil and grease. Wipe up all oil spills. Keep the controls and floorboards clean, dry, and safe. A clean truck makes it easier to see leakage and loose, missing, or damaged parts, and helps prevent fires. A clean truck runs cooler. The environment in which a lift truck operates determines how often and to what extent cleaning is necessary.

For example, trucks operating in manufacturing plants that have a high level of dirt, dust, or lint(for example, cotton fibers or paper dust) in the air or on the floor or ground, require more frequent cleaning. The radiator especially may require daily air cleaning to ensure correct cooling.

If air pressure does not remove heavy deposits of grease, oil, etc., it may be necessary to use steam or liquid spray cleaner.

※ **Lift trucks should be air cleaned at every PM interval, or more often if necessary.**

Use an air hose with special adapter or extension, a control valve, and a nozzle to direct the air properly. Use clean, dry, low pressure, compressed air. Restrict air pressure to 207 kPa (30 psi), maximum (OSHA requirement).

⚠ **Wear suitable eye protection and protective clothing when air cleaning. Never point the air nozzle at anyone.**

Air clean the mast assembly, drive axle, radiator- from both counterweight and engine side, engine and accessories, drive line and related components, and steering axle and cylinder.

8) CRITICAL FASTENER TORQUE CHECKS

Fasteners in highly loaded(critical) components can quickly fail if they become loosened. Also, loose fasteners can cause damage or failure of the component. For safety, it is important that the correct torque be maintained on all critical fasteners of components that directly support, handle, or control the load and protect the operator. (SEE SECTION 8. SPECIFICATIONS)

Critical items include:

- Drive axle mounting
- Cabin
- Drive and steering wheel mounting
- Tilt cylinder mounting and yokes
- Counterweight mounting
- Mast mounting and components

Torque specifications are in your service manual.

9) LIFT CHAIN MAINTENANCE

The chain system on the mast was designed for safe, efficient, and reliable transmission of lifting force from hydraulic cylinder to the forks. Safe use of your truck with minimum down time depends on the correct care and maintenance of the lift chains. Most complaints of unacceptable chain performance are a result of poor maintenance. Chains need periodic maintenance to give maximum service life.

⚠ **Do not attempt to repair a worn chain. Replace worn or damaged chains with a set (LH & RH). Do not piece chains together.**

(1) Lift chain inspection and measurement

Inspect and lubricate the lift chains every 10 hours or daily and check tension every 250 hours or monthly. When operating in corrosive environments, inspect the chains every 50 hours. During the inspection, check for the following conditions:

· Rust and corrosion, cracked plates, raised or turned pins, tight joints, wear, and worn pins or holes.

· When the pins or holes become worn, the chain becomes longer. When a section of chain is 3% longer than a section of new chain, the chain is worn and must be discarded.

· Chain wear can be measured by using a chain scale or a steel tape measure. When checking chain wear, be sure to measure a segment of chain that moves over a sheave. Do not repair chains by cutting out the worn section and joining in a new piece. If part of a chain is worn, replace all the chains of both sides on a truck.

(2) Lift chain lubrication

Lift chain lubrication is an important part of your maintenance program. The lift chains operate under heavy loadings and function more safely and have longer life if they are regularly and correctly lubricated. HYUNDAI chain lubricant is recommended; it is easily sprayed on and provides superior lubrication. Heavy motor oil may also be used as a lubricant and corrosion inhibitor.

(3) Lift chain wear and replacement criteria

① New chain length

The distance from the first pin counted to the last pin counted in a span while the chains are lifting a small load.

② Worn chain length

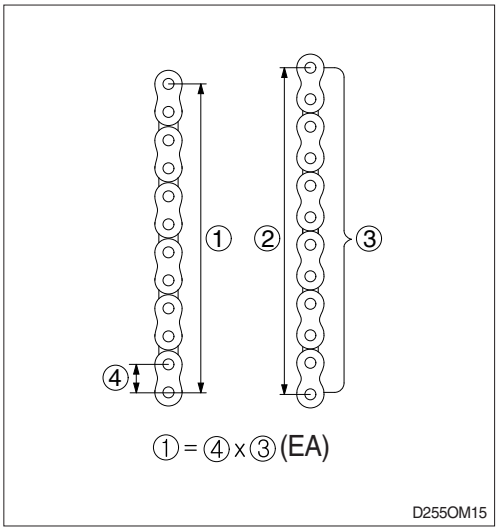
The distance from the first pin counted to the last pin counted in a span while the chains are lifting a small load.

③ Span

The number of pins in the length (Segment) of chain to be measured.

④ Pitch

The distance from the center of one pin to the center of the next pin.

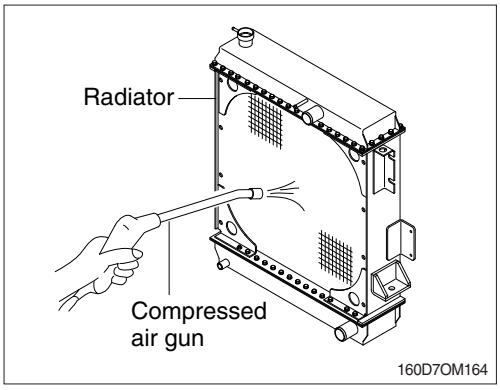


All chains must be replaced if any link has wear of 3% or more, or if any of the damaged conditions notes above are found during inspection. Order replacement chains from your HYUNDAI dealer. Replace all chains as a set. Do not remove factory lubrication or paint new chains. Replace anchor pins and worn or broken anchors when installing new chains. Adjust tension on new chains. Lubricate chains when they are installed on the mast.

※ Please refer to your service manual for additional information on lift chain measurement and maintenance.

10. HANDLING TRUCK IN EXTREMELY HOT PLACES

Pay careful attention particularly to the following points when handling the truck in extremely hot places.



1) Scale and rust form more easily in the cooling system, so wash with anticorrosion liquid. Always try to have clean and soft water circulating in the system.

2) Clogging of the radiator fins is one cause of overheating, so use air or water jets to clean the fins. When doing this, the air nozzle must be at right angles to the radiator.
   · Air pressure max : 2 kgf/cm^2 (30 psi)

3) Check the fan belt tension. If it is too slack, adjust the tension. (refer to the page 7-24.)

4) In case of overheating, do not stop the engine immediately.
   (1) Run the engine at low idling.
   (2) Open the hood to ventilate the engine compartment.
   (3) When the water temperature drops, stop the engine.
   (4) Check the cooling water level. If it is low, add more water.

⚠ Wear safety glasses and a face shield when using compressed air. Never touch the surge tank cap while the engine is hot. Steam may spurt out. Wait until the water temperature drops. It is extremely dangerous to try to check the fan belt tension while the engine is running. When inspecting the fan belt or other moving parts, or near such parts, always stop the engine first.

11. COLD WEATHER OPERATION

1) PREPARATION FOR LOW TEMPERATURE

(1) Replace lubrication oil with oil of the prescribed viscosity.

(2) Fuel of low pour point must be used. ASTM D975 No.1 diesel fuel should be used at ambient temperature lower than -5°C.

(3) When ambient temperatures are below use an anti-freeze mixture per the above table to prevent freezing of the cooling system.

Min ambient temperature (°C)	-5	-10	-15	-20	-25	-30	-50
Amount of antifreeze(%)	25	30	35	40	45	50	60
Amount of water(%)	75	70	65	60	55	50	40

⚠ Use permanent type antifreeze.
⚠ Use soft water (city water, etc.) as mixing water.
⚠ Cooling system must be thoroughly flushed before filling with antifreeze mixture.
⚠ When the climate becomes warmer and antifreeze is not needed, replace with soft water (city water, etc.) after thoroughly cleaning the cooling system.
⚠ Do not expose antifreeze to flame. It is inflammable.

※ Dispose of old antifreeze mixture in locally approved manner.

2) BATTERY

As ambient temperature drops, battery capacity will drop and electrolyte may sometimes freeze if battery charge is low. Maintain battery at a charge level of over 75% and insulate it against cold temperature so that truck can be readily started the next morning.

※ When the electrolyte level is low, add distilled water in the morning before work instead of after the day's work. This is to prevent fluid from freezing at night.

3) CARE AFTER DAILY OPERATION

(1) Drain water from fuel system to prevent freezing.
(2) Fill the tank at the end of each day of operation to drive out moisture laden air to prevent condensation.
Do not fill the tank to top.

⚠ Explosive fumes may be present during refueling.

12. RECOMMENDATION TABLE FOR LUBRICANTS

1) NEW MACHINE

New machine uses following fuel, coolant and lubricant.

Description	Specification
Engine oil	SAE 10W-30/15W-40 (API CJ-4 class or better)
DEF / AdBlue®	ISO 22241 (32.5% high-purity urea and 67.5% deionized water)
T/M oil	Engine oil SAE10W-30 (API CF4 class or better)
Gear oil	SAE 80W-90/Donax TD
Hydraulic oil	ISO VG46/VG68, Hyundai genuine long life hydraulic oil ISO VG15, Conventional hydraulic oil★1
Grease	Lithium base grease NLGI No.2
Fuel	ASTM D975-No.2
Coolant	Mixture of 50% ethylene glycol base antifreeze and 50% water

- SAE : Society of Automotive Engineers
- API : American petroleum Institute
- ISO : International Organization for Standardization
- NLGI : National Lubricating Grease Institute
- ASTM : American Sociery of Testing and Material
- DEF compatible with AdBlue®

★1 : Cold region
Russia, CIS, Mongolia

13. FUEL AND LUBRICANTS

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature ˚C(˚F) -50 (-58) -30 (-22) -20 (-4) -10 (14) 0 (32) 10 (50) 20 (68) 30 (86) 40 (104)
Engine oil pan	Engine oil	26 (6.9)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
DEF/AdBlue®	Mixture of urea and deionized water	40 (10.6)	ISO 22241 (High-purity urea and + deionized water (32.5:67.)
Torque converter transmission	Transmission oil	32 (8.5)	SAE 10W-30 SAE 15W-40
Axle brake	Gear oil	19+2×1.7 (5.0+2×0.4)	SAE 80W-90/API GL-5
	Cooling	19 (5.02)	DONAX TD
Hydraulic tank	Hydraulic oil	Simplex mast : 256 (67.6) Triplex mast : 278.8 (73.7)	★ISO VG 15 ISO VG 46
Cabin tilt hand pump	Hydraulic oil	0.7 (0.2)	ISO VG 68
Fuel tank	Diesel fuel★1	312 (82.4)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (Grease nipple)	Grease	-	★NLGI NO.1 NLGI NO.2
Radiator	Antifreeze : soft water★2	42.7 (11.3)	★Ethylene glycol base permanent type (60 : 40) Ethylene glycol base permanent type (50:50)

NOTES :

① SAE numbers given to engine oil should be selected according to ambient temperature.

② For engine oil used in engine oil pan, use SAE 10W oil when the temperature at the time of engine start up is below 0˚C, even if the ambient temperature in daytime is expected to rise to 10˚C or more.

③ DEF compatible with AdBlue®

④ Use engine oil of API service class CJ-4.

★ : Cold region
Russia, CIS, Mongolia

★1 : Ultra low sulfur diesel
- sulfur content ≤ 15 ppm

★2 : Soft water
City water or distilled water