

11. ENGINE

1) CHECK THE OIL LEVEL

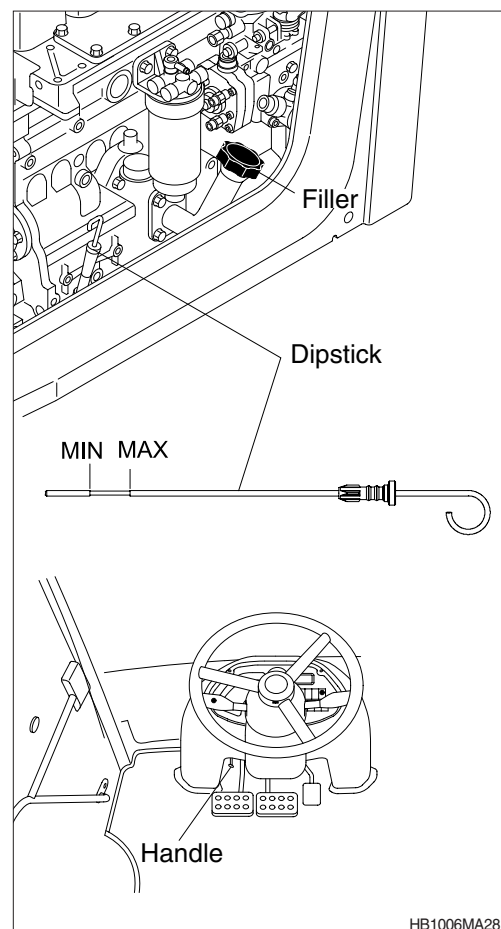
- ※ Check the oil level with the machine on a flat ground before starting.
- ※ If the oil is contaminated or diluted, change the oil regardless of the regular change interval.
Check oil level after engine has been stopped for 15 minutes.

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

- (1) Make sure the park brake is engaged and the FNR lever set to neutral. Lower the loader arms and the backhoe to the ground, switch OFF the engine and remove the starter key.
- (2) Pull the handle and open the engine cover.
- (3) Check that the oil level is between the maximum and minimum marks on the dipstick.
- (4) Add the recommended oil through filler to the maximum level if necessary.

▲ Do not exceed the correct level of engine oil in the sump. If there is too much engine oil, the excess must be drained to the correct level. An excess of engine oil could cause the engine speed to increase rapidly without control.

- (5) Fit filler cap and dipstick, make sure that they are fully inserted and tightened.



2) REPLACEMENT OF ENGINE OIL AND FILTER

- (1) Operate the engine until the coolant temperature reaches about 60°C (140°F).
- (2) Make sure the park brake is engaged and the FNR lever set to neutral. Raise the loader arms and support the safety strut (refer to page 6-15). Lower the backhoe to the ground, switch OFF the engine and remove the starter key.
- (3) Pull the handle and open the engine cover.

▲ Make the machine safe before working underneath it. Park the machine on level ground, lower the attachments to the ground. Block both sides of all four wheels.

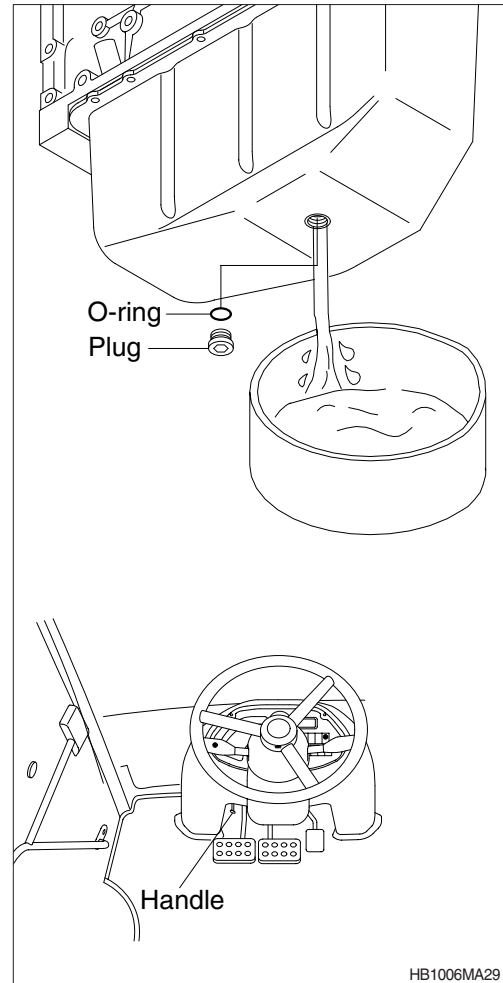
- (4) Place a container of suitable size beneath the sump drain plug.

※ Oil will gush from the hole when the drain plug is removed. Hot oil and engine components can burn you.

- (5) Drain the engine oil.

① Machine with a sump plug, remove the sump drain plug and its O-ring. Let the oil drain out, then clean and refit the drain plug with a new O-ring.

· Tightening torque : 4.1 kgf · m (30 lbf · ft)



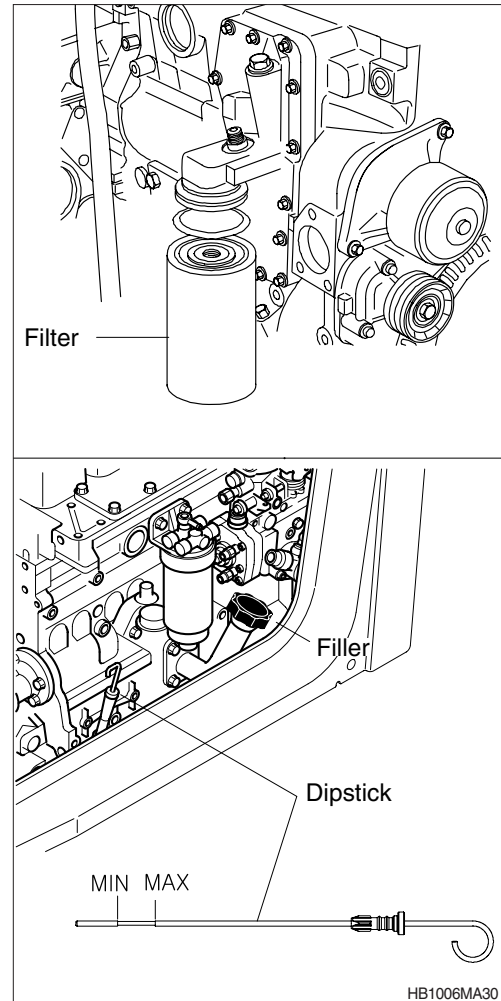
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- (6) Clean the area around the oil filter head.
- (7) Remove the oil filter, use a filter wrench if necessary.
- (8) Clean the seal face of the filter head.
- (9) Fit new filter.
 - ① Smear the seal on the new filter with clean engine oil.
 - ② Screw the filter on until it just contacts the filter head.
 - ③ Turn the filter at least a further 3/4 of a turn.

▲ Do not over fill the engine with oil.

- (10) Through filler point, fill the engine oil to the MAX mark on the dipstick. Wipe off any split oil, refit the filler cap and make sure it is secure.
- (11) 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.



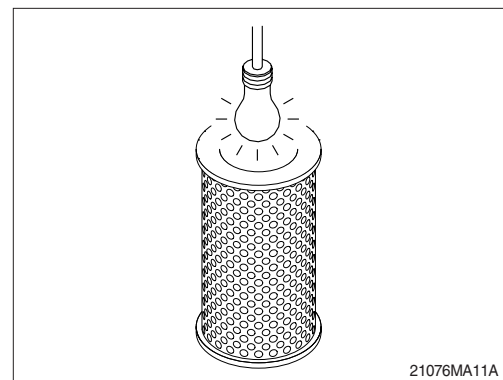
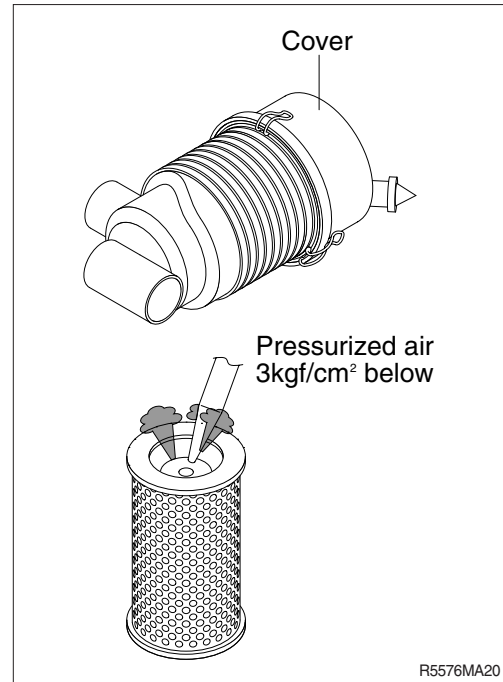
3) CLEANING OF AIR CLEANER

(1) Primary element

- ① Loosen the wing nut and remove the element.
 - ② Clean the inside of the body.
 - ③ Clean the element with pressurized air.
 - Remove the dust inside of the element by the pressurized air (below 3 kgf/cm², 40 psi) forward and backward equally.
 - ④ Inspect for cracks or damage of element by putting a light bulb inside of the element.
 - ⑤ Insert element and close cover.
- ※ Replace the primary element after 4 times cleanings.

(2) Safety element

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



4) CHECK COOLANT LEVEL

Visually check the coolant level daily, do not depend on the coolant level indicator to illuminate before adding coolant.

▲ Do not remove the radiator cap from a hot engine. Wait until the coolant temperature is below 50°(120°) before removing the radiator cap. Heated coolant spray or steam can cause personal injury.

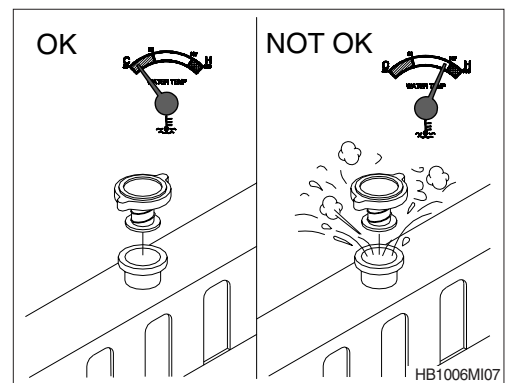
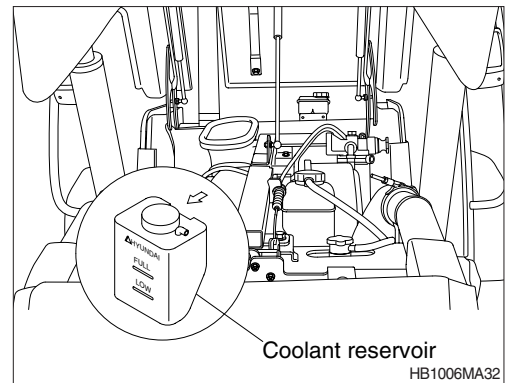
※ Do not add cold coolant to a hot engine ; engine castings can be damaged. Allow the engine to cool to below 50° (120°) before adding coolant.

(1) Make sure the park brake is engaged and the FNR lever set to neutral. Lower the loader arms and the backhoe to the ground, switch OFF the engine and remove the starter key.

(2) Open the engine cover.

(3) The coolant level should be between the LOW and the FULL marks on coolant reservoir.

(4) Carefully loosen cap on the coolant reservoir. Let any pressure escape before removing the cap. Add the mixture of water and antifreeze until it reaches the correct level.



5) FLUSHING AND REFILLING OF RADIATOR

(1) Change coolant

⚠ Avoid prolonged and repeated skin contact with used antifreeze. Such prolonged repeated contact can cause skin disorders or other bodily injury.

Avoid excessive contact-wash thoroughly after contact.

Keep out of reach of children.

⚠ Protect the environment : Handling and disposal of used antifreeze can be subject to federal, state, and local law regulation.

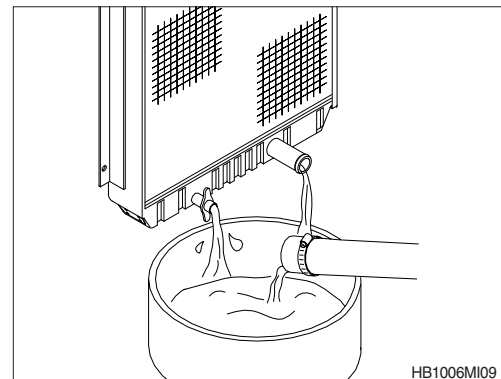
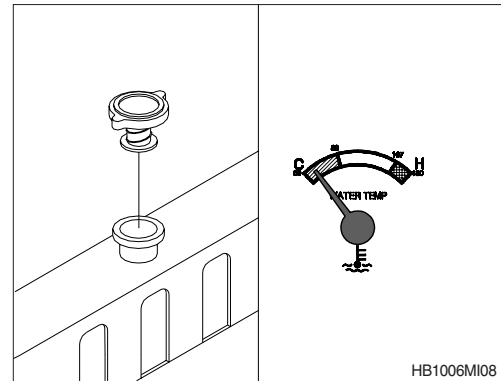
Use authorized waste disposal facilities, including civic amenity sites and garages providing authorized facilities for the receipt of used antifreeze.

If in doubt, contact your local authorities for guidance as to proper handling of used antifreeze.

⚠ Wait until the temperature is below 50°C (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 turning the stopper to the open position.

A drain pan with a capacity of 45 liters (11.9 U.S.gallons) will be adequate in most applications.

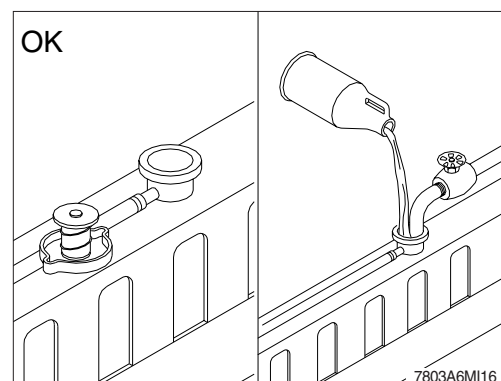


(2) Flushing of cooling system

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.

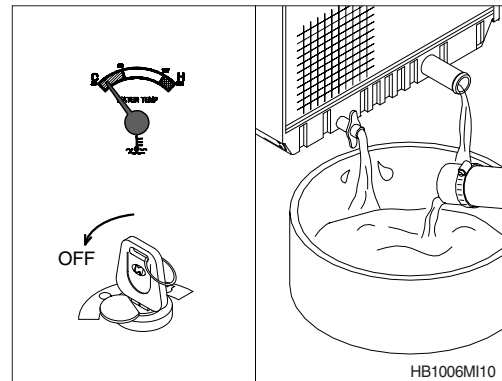


※ The system must be filled properly to prevent air locks.

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).

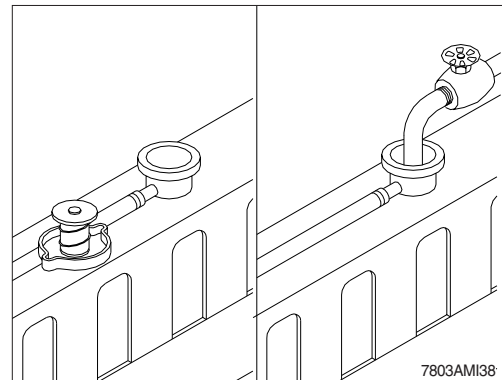
② Operate the engine for 5 minutes with the coolant temperature above 80°C (176°F). Shut the engine off, and drain the cooling system.



③ Fill the cooling system with clean water.

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

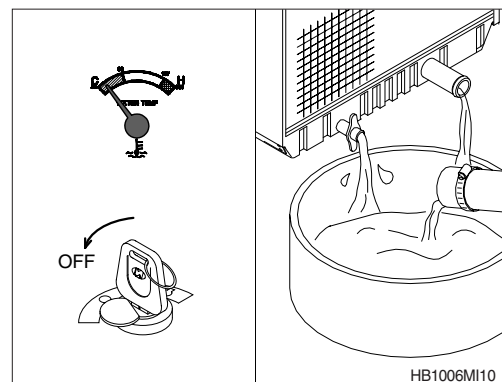
※ **Do not install the radiator cap or the new coolant filter.**



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.

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.

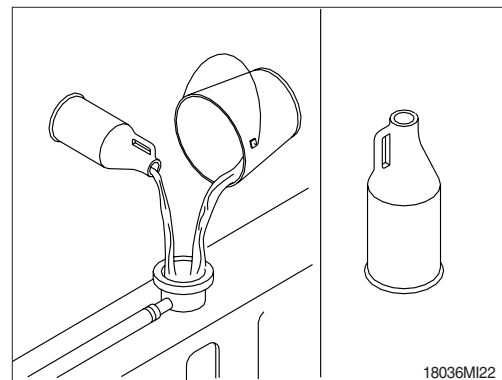
During filling, air must be vented from the engine coolant passages. Wait 2 to 3 minutes to allow air to be vented; then add mixture to bring the level to the top.

· The system has a design fill rate of 19 liters per minute (5 U.S.gallons per minute).

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

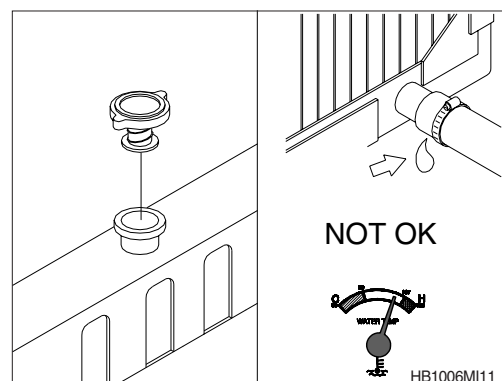
※ Coolant capacity (engine only); 9 l (2.4 U.S.gallons)

※ 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.

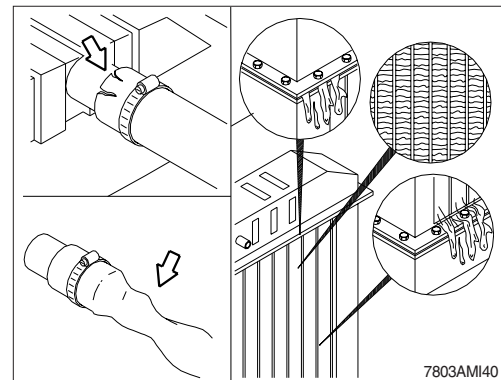
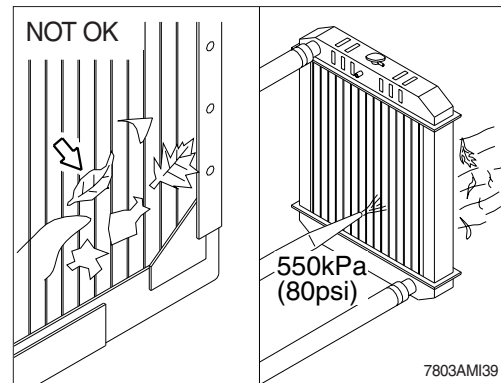
Check the coolant level again to make sure the system is full of coolant.



6) CLEAN RADIATOR AND OIL COOLER

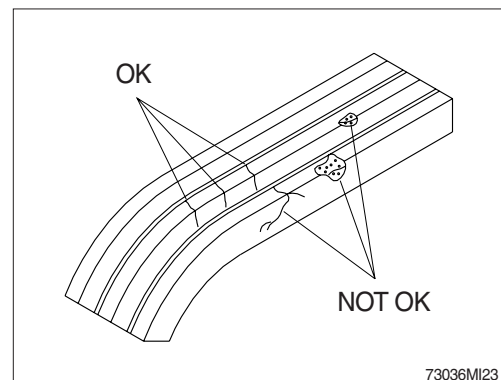
Check, and if necessary, clean and dry outside of radiator and oil cooler. After working in a dusty place, clean radiator more frequently.

- (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 over-heat, refer to the manufacturer's replacement procedures.
- (4) Visually inspect the radiator for core and gasket leaks.



7) 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 is frayed or has pieces of material missing.



8) INSPECTION OF COOLING FAN

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

- ※ Rotate the crankshaft by using the engine 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.

