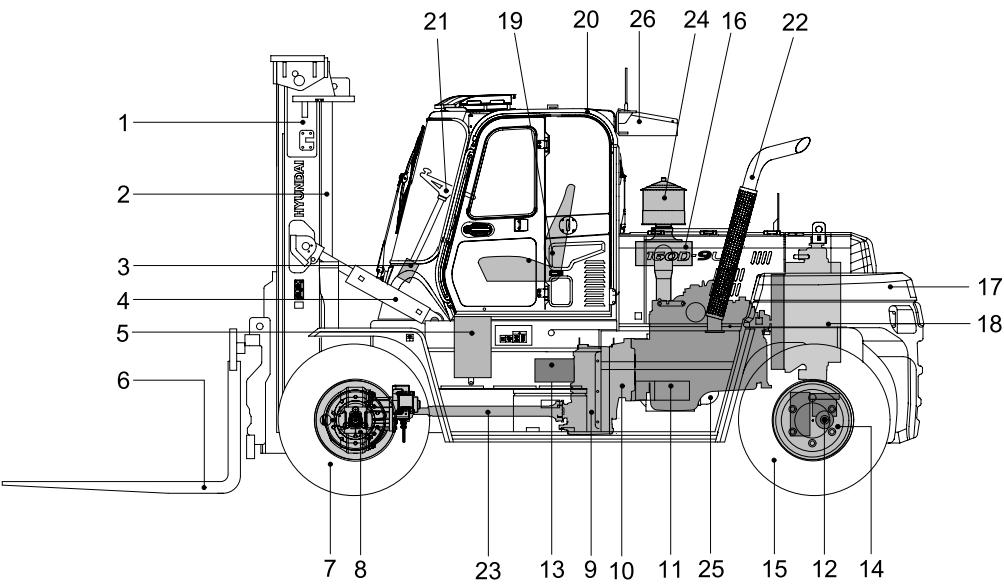


## SECTION 2 REMOVAL & INSTALLATION OF UNIT

Group 1 Major components .....	2-1
Group 2 Removal and installation of unit .....	2-2

# SECTION 2 REMOVAL & INSTALLATION OF UNIT

## GROUP 1 STRUCTURE



160D9LOM21

- |                      |                      |                          |
|----------------------|----------------------|--------------------------|
| 1 Mast               | 10 Torque converter  | 19 Seat                  |
| 2 Lift cylinder      | 11 Engine            | 20 Cabin                 |
| 3 Steering unit      | 12 Steering cylinder | 21 Steering wheel        |
| 4 Tilt cylinder      | 13 Hydraulic pump    | 22 Silencer              |
| 5 Main control valve | 14 Steering axle     | 23 Drive shaft           |
| 6 Fork               | 15 Rear wheel        | 24 Precleaner            |
| 7 Front wheel        | 16 Air cleaner       | 25 Aftertreatment device |
| 8 Drive axle         | 17 Counterweight     | 26 Air conditioner (opt) |
| 9 Transmission       | 18 Radiator          |                          |

## GROUP 2 REMOVAL AND INSTALLATION OF UNIT

Remove and install following units as explained in the flow chart.

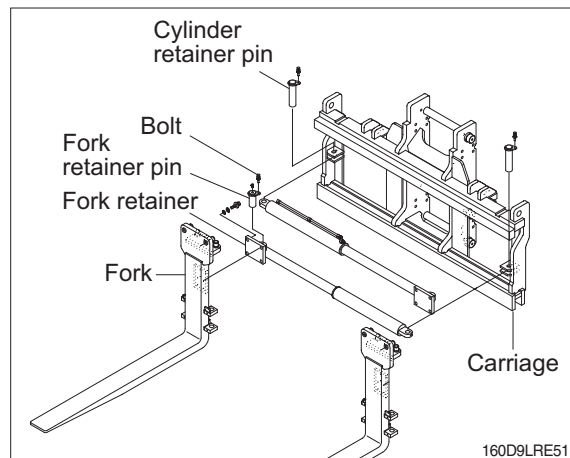
### 1. MAST

#### 1) REMOVAL



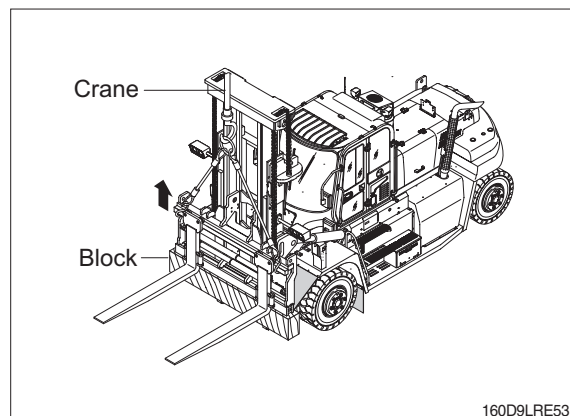
#### (1) Forks

- ① Lower the fork carriage until the forks are approximately 25 mm (1 in) from the floor.
- ② Loosen the bolt and take out the fork retainer pin and release the fork retainer with the carriage.  
Slide one hanger bar at a time out of carriage assembly.
- ③ Remove only one fork at a time.
  - ※ On larger forks it may be necessary to use a block of wood.
  - ※ Remove all wiring harness for the head lamp and work lamp etc.

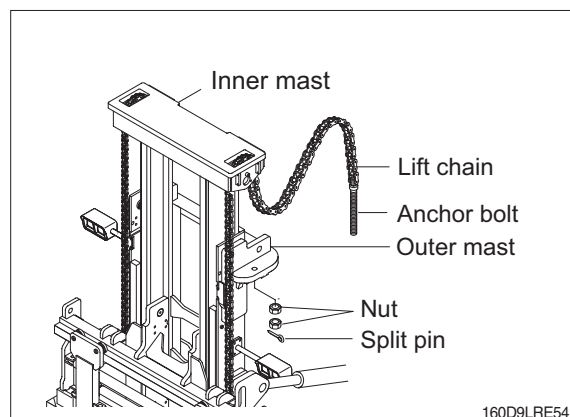


#### (2) Carriage

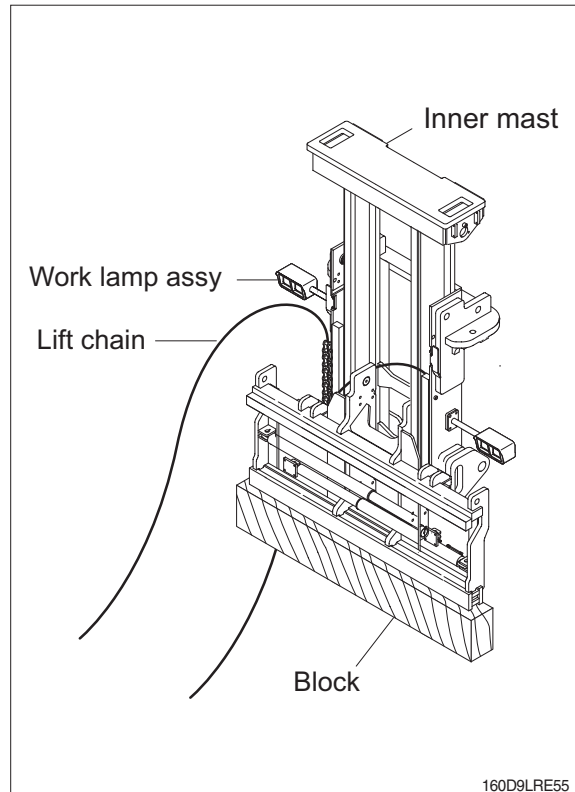
- ① With the mast vertical, raise the carriage high enough to place blocks under the load forks. This is done to create slack in the load chains when the carriage is lowered. Lower the carriage all the way down to the floor. Make sure the carriage is level, this will prevent any binding when the mast is raised.



- ② While supporting lift chains, remove split pin and nuts from the anchor bolt.



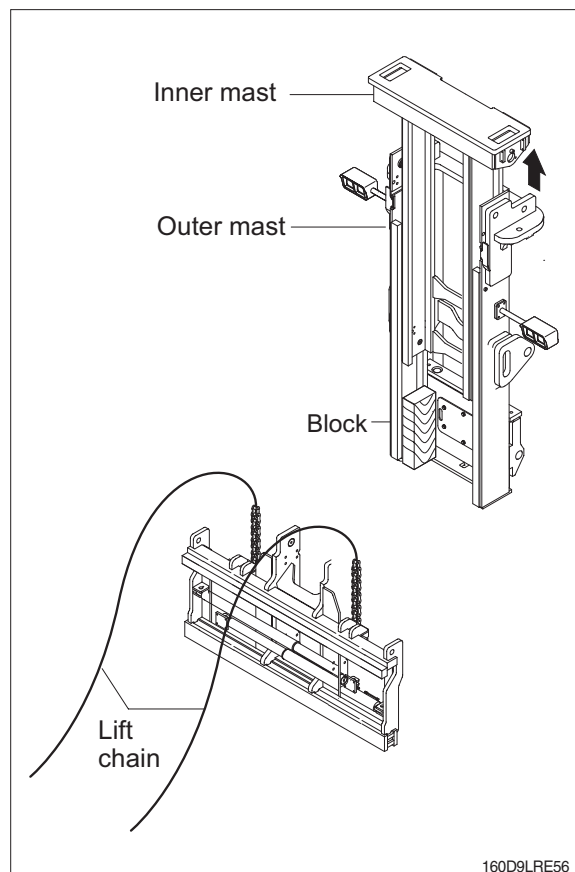
- ③ Pull the chains out of the sheaves and drape them over the front of the carriage.



- ④ Slowly raise inner mast upright until mast clears top of fork carriage. Move carriage to work area and lower the mast.

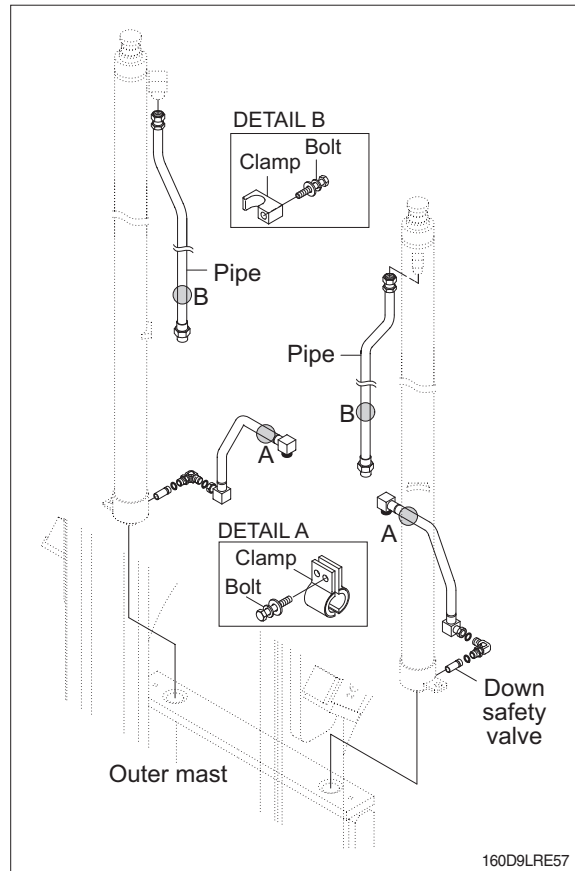
**▲ Make sure that carriage remains on floor and does not bind while mast is being raised.**

- ⑤ Inspect all parts for wear or damage. Replace all worn or damaged parts.

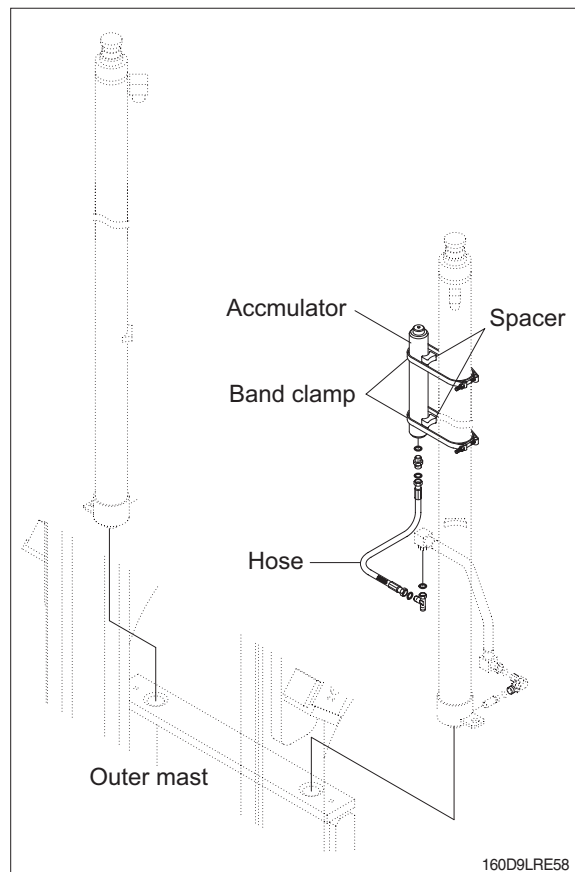


### (3) Piping

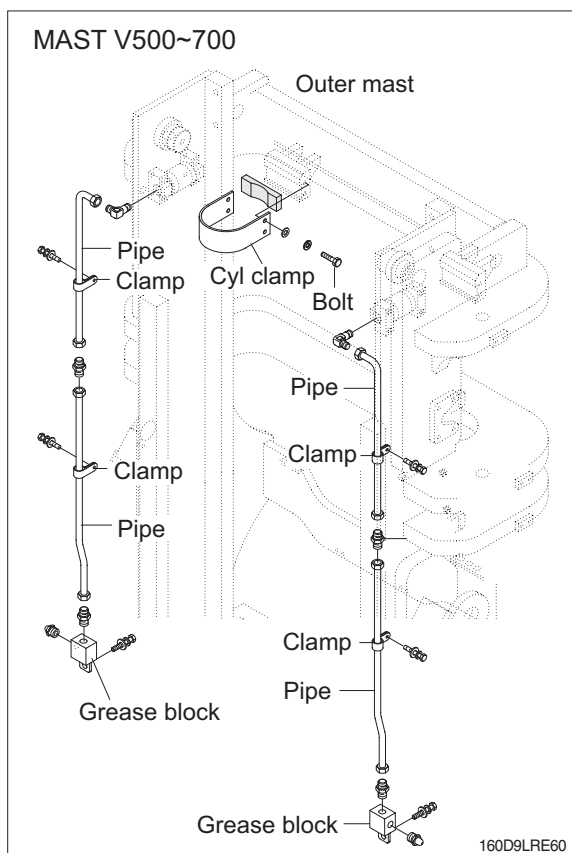
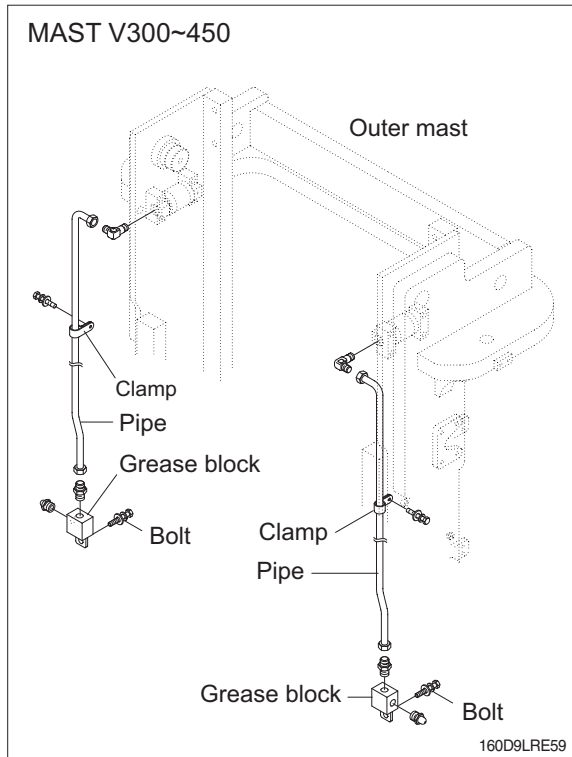
- ① Remove the pipes and clamps attached to the cylinder.
- ※ Put blind plugs in the piping immediately after removing pipes.  
This prevents the hydraulic oil from flowing out and also prevents dust and dirt from getting in.



- ② Remove the band clamp and hose from the accumulator.
- ③ Loosen the bolt band clamps and remove the accumulator and spacers.

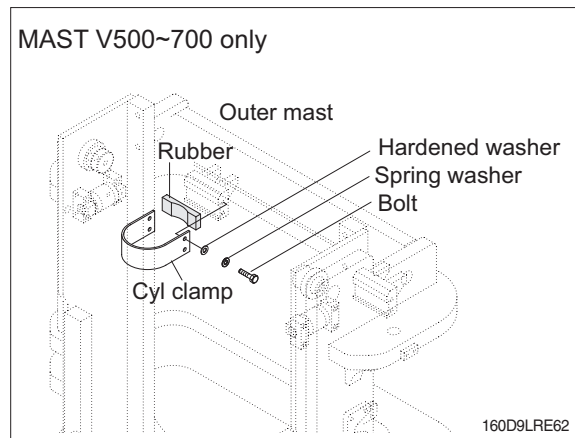


- ④ Remove the clamps and lubrication pipes.
- ⑤ Remove bolts and grease blocks.



#### (4) Lift cylinder

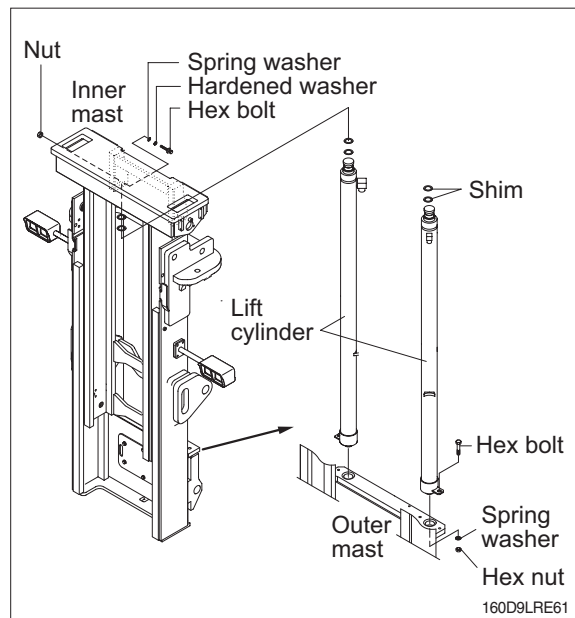
- ① Loosen the hexagon bolts and washers and remove the clamp and rubber securing the lift cylinder to the outer mast (mast V500~V700 only).



- ② Loosen and remove hexagon bolt, nut and washers securing lift cylinder to inner mast.
- ③ Bind the lift cylinder with overhead hoist rope and pull up so that the rope has no slack or binding.

**▲ Make sure the lift cylinder be tightened firmly for safety.**

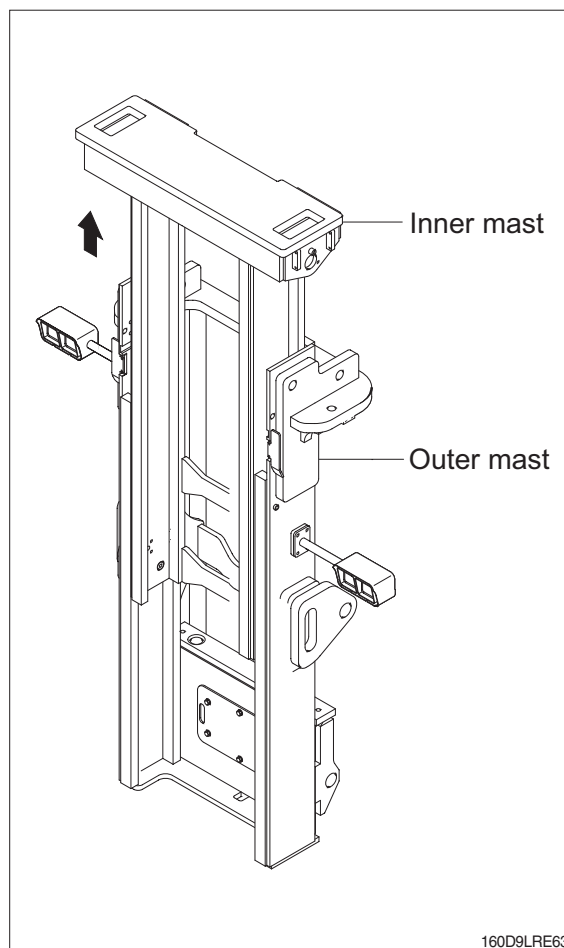
- ④ Loosen and remove hexagon bolt and nut with washer securing lift cylinder to outer mast.
- ⑤ Using an overhead hoist, slowly raise the inner mast high enough to clear lift cylinder.
- ⑥ Using an overhead hoist, draw out lift cylinder carefully and put down on the work floor.



### (5) Inner mast

- ① Using an overhead hoist raise the inner mast straight and carefully draw out of outer mast section.

▲ Be careful the mast not to swing or fall.



### (6) Tilt cylinder pin

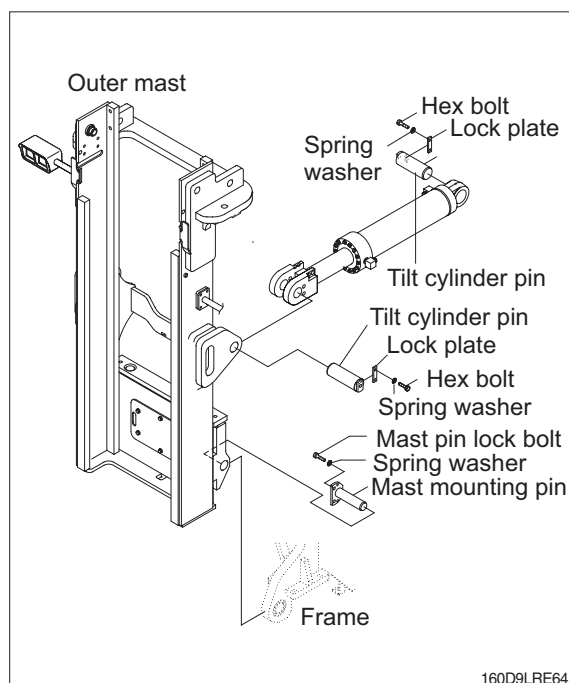
Loosen the bolt and washer and remove the lock plate and tilt cylinder pin at outer mast side.

### (7) Mast support pin

- ① Attach a crane to the stay at the top of the outer mast, and raise it.

Loosen the mast pin lock bolt and remove the mounting pin from mast support of the outer mast and main frame, then slowly raise outer mast.

※ This operation is carried out under the truck, so use a pit, or if there is no pit, jack up the truck and loosen with an impact wrench.





## 2) INSTALLATION

After assembling mast components totally without piping connections, install mast assembly to the equipment.

※ Installation procedure for each of mast component is the reverse of the removal procedure.

### (1) Mast support pin

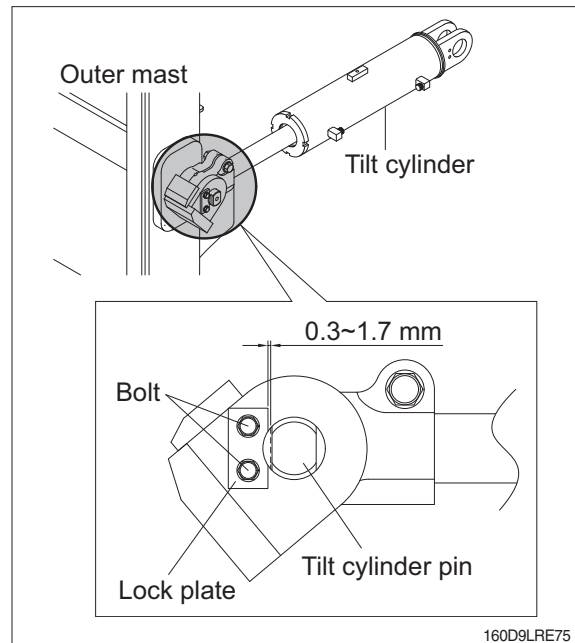
Check the mast mounting pins for wear, then install pins into the mast support bracket and main frame and tighten the mast pin lock bolts.

· Tightening torque : 12.5 kgf·m (90.4 lbf·ft)

### (2) Tilt cylinder pin

Hold the mast with a crane, operate the tilt control lever and align the holes, then knock the pin and install the lock plate by the bolts.

· Tightening torque : 15.8 kgf·m (114 lbf·ft)



### (3) Lift cylinder installation and adjustment

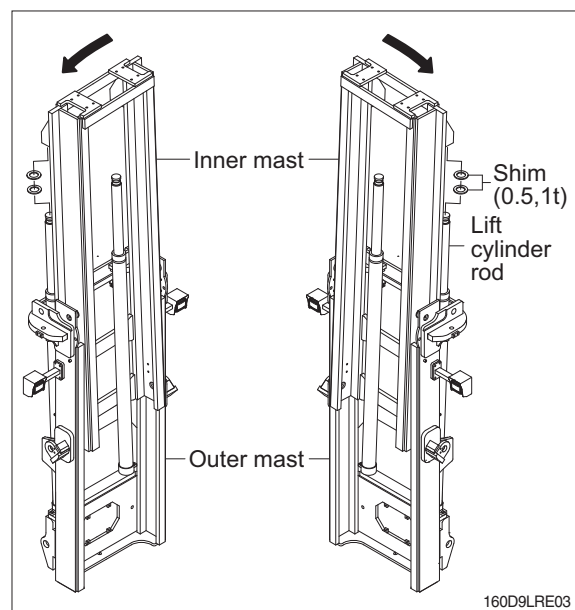
- ① Assemble the lift cylinder at the outer mast, then tighten the stopper bolt and nut. If the lift cylinder assembly has been replaced, adjust as follows so that the left and right cylinders are synchronized at the maximum lifting height.
- ② Assemble the cylinder rod to the inner mast, and check the left-to-right play of the mast at the maximum lifting height.

※ If play is to LEFT, install adjustment shim to LEFT cylinder.

※ If play is to RIGHT, install adjustment shim to RIGHT cylinder.

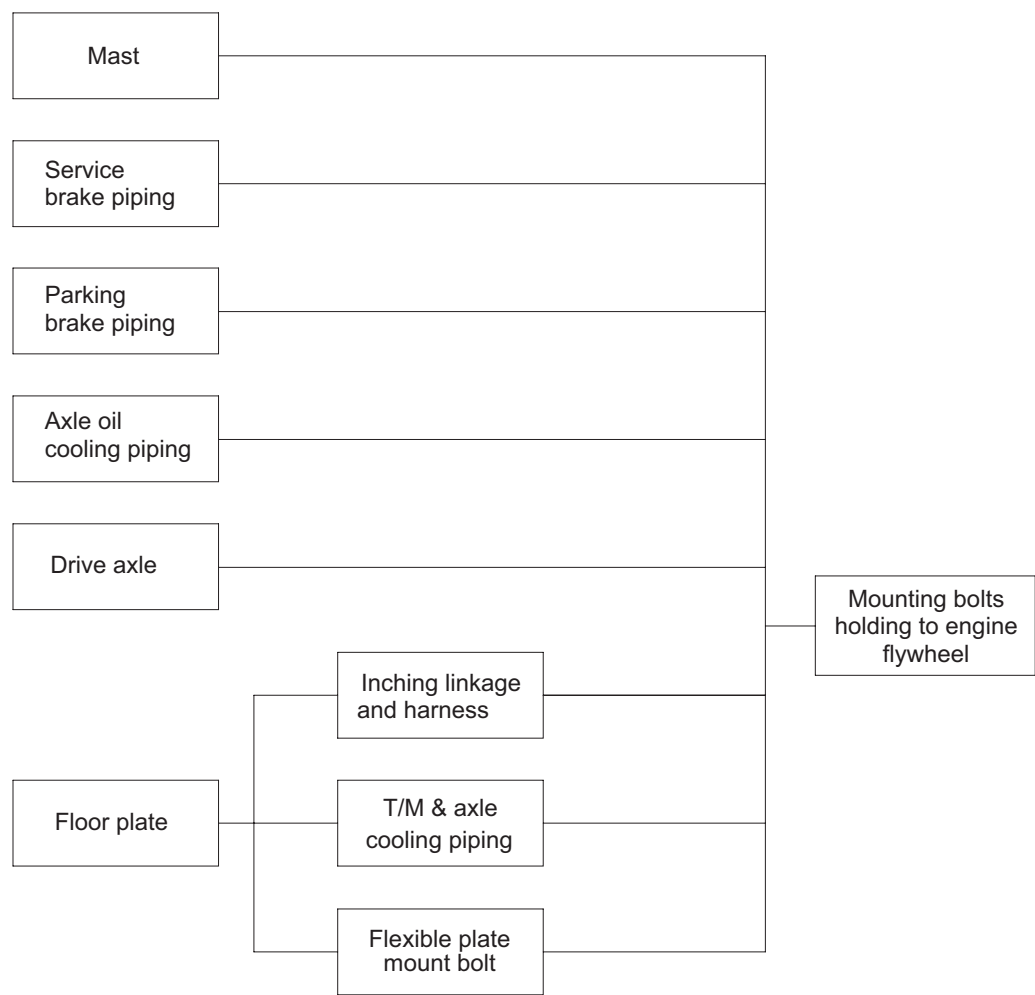
· Shim thickness : 1.0 mm (0.04 in)  
0.5 mm (0.02 in)

※ Lubricate the grease into the nipple sufficiently.



2. POWER TRAIN ASSEMBLY

1) REMOVAL



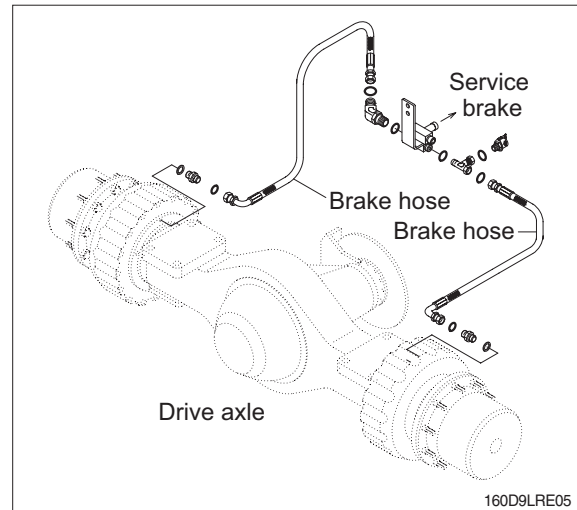
160D9LRE04

(1) Mast

Refer to section on mast (Page 2-2)

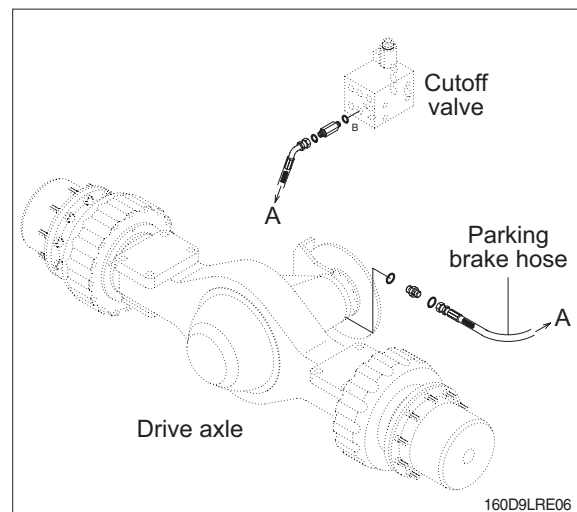
**(2) Service brake piping**

Disconnect the service brake hydraulic hoses from the brake housing of drive axle assy.



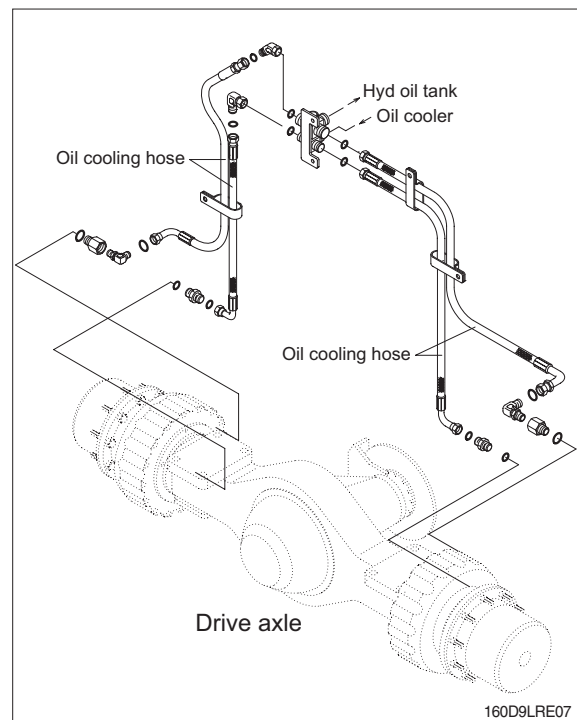
**(3) Parking brake piping**

Disconnect parking brake piping from the drive axle.



**(4) Axle oil cooling piping**

Disconnect the brake cooling piping from the drive axle.



## (5) Drive axle

※ Before removing the drive axle assy, drain all of the oil from the axle.

① Jack up the truck and then put the block under the frame.

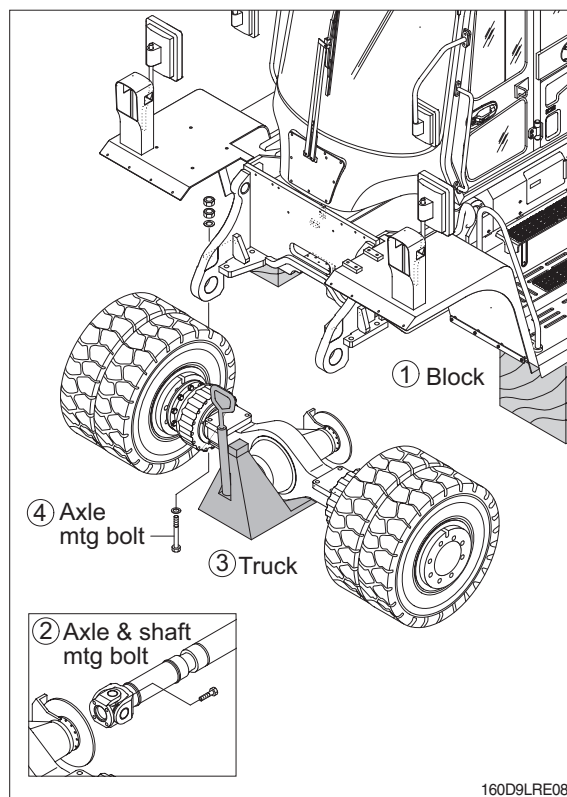
※ If there is a pit, use the pit for safety.

② Loosen hexagonal bolts connecting drive axle to the drive shaft.

③ Prepare the truck under the drive axle unit to support it.

④ Remove mounting bolts fixing the drive axle to the frame and then carefully draw the truck out of the vehicle with the drive axle unit.

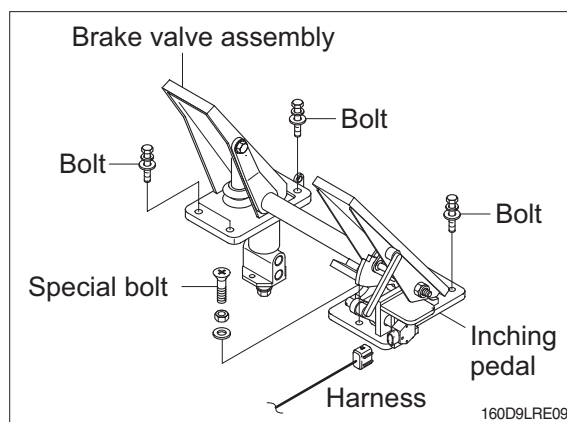
⑤ Loosen the hex bolts connecting the drive shaft to the transmission and remove drive shaft.



## (6) Inching linkage and harness

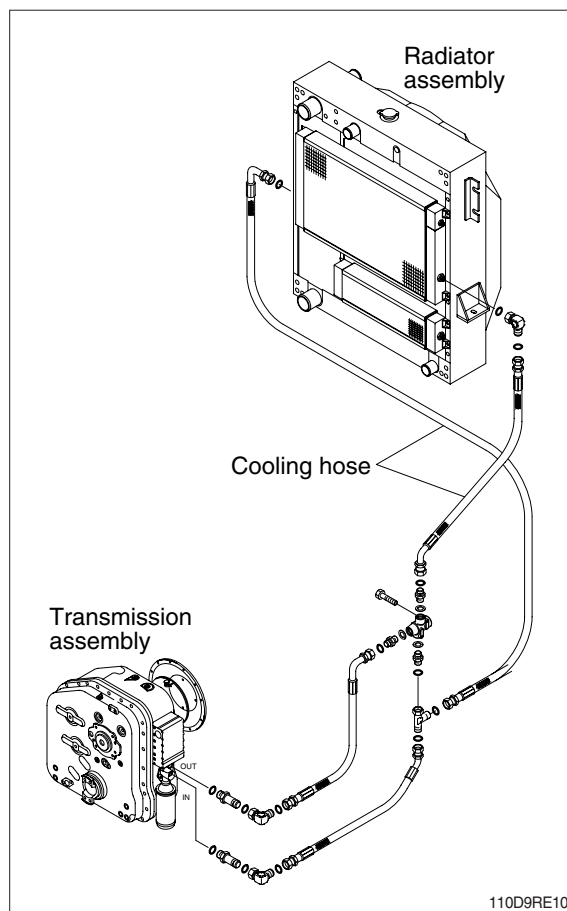
① Remove bolt fixing the inching linkage assembly.

② Disconnect harness cable from the inching pedal assembly.



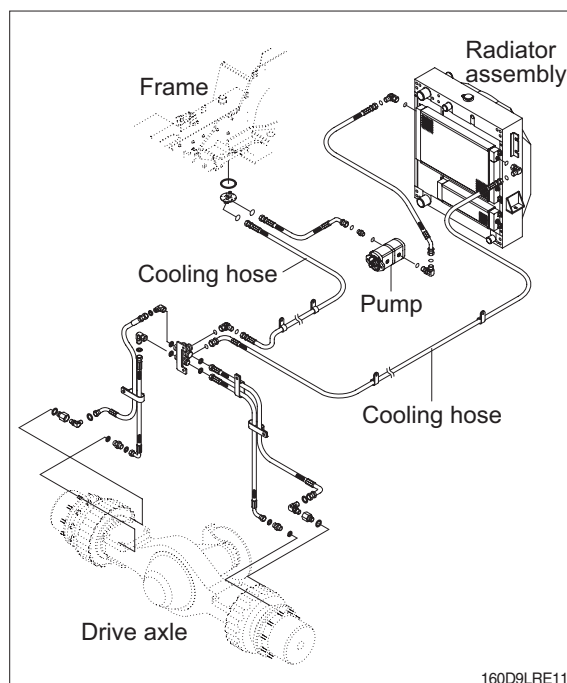
## (7) Transmission and axle cooling piping

- ① Disconnect cooling hoses and connectors from the transmission.
- ※ Make sure that the coolant has been drained from the line.



- ② Disconnect axle cooling hoses and connectors from the axle.
- ※ Make sure that the axle cooling oil has been drained from the line.

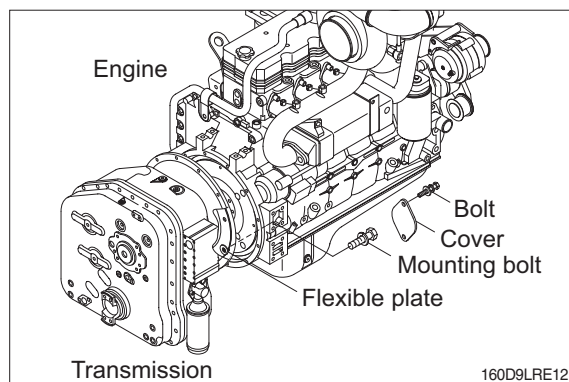
**⚠ When disconnecting the oil cooling hoses, take care that oil should not be spilt on the floor.**  
If someone slips due to oil spillage, it can cause to do him severe injuries.  
In case of spilling out of the oil on the floor, wipe away immediately it in order to prevent someone from unexpected accident.



## (8) Flexible plate

- ① Loosen the bolt and remove the cover on the left side of the flywheel housing then remove the 8 mounting bolts installed to the engine flywheel.

To rotate the flywheel, remove 1 mounting bolt, then insert a turning tool in the mounting hole. One man must turn the engine fan by hand while the other turns the flywheel.

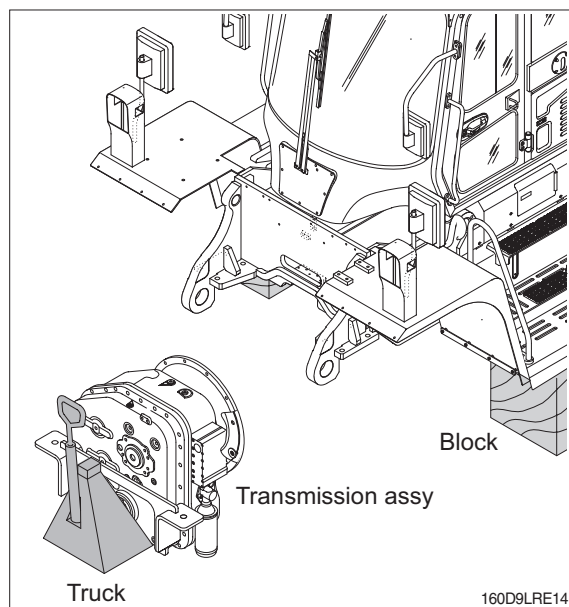
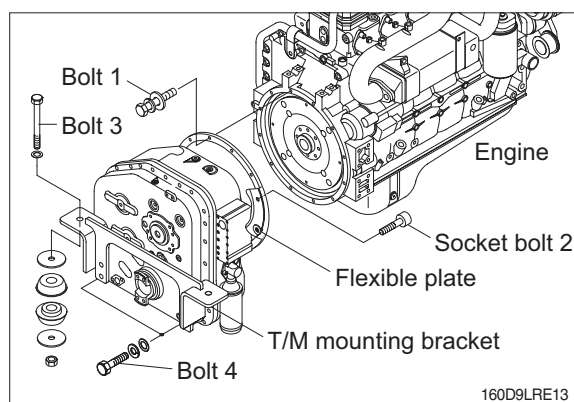


## (9) Mounting bolts holding to flywheel housing

- ① Loosen the mounting bolt 1 to disconnect the transmission assembly from the torque converter housing.
- ② Loosen the socket bolt 2 to disconnect the flexible plate from the engine flywheel.
- ③ Loosen the mounting bolt 3 to disconnect the transmission mounting bracket from the main frame.

※ Remove the transmission assembly with transmission mounting bracket. Therefore the bolt 4 does not loosen.

- ④ Using a moving truck slowly pull out transmission assembly to the front.



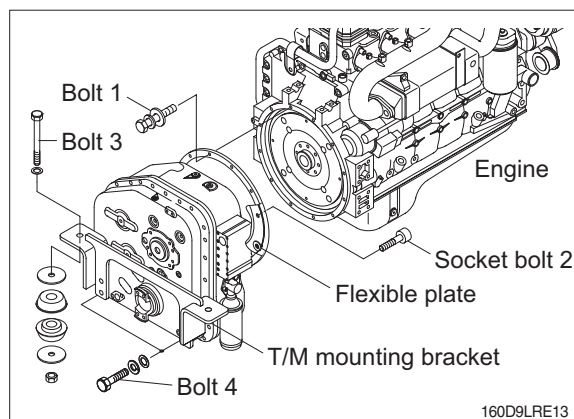
## 2) INSTALLATION

Installation is the reverse order to removal, but be careful of the following points.

(1) Tightening torque of the mounting bolts for the transmission.

- ① Bolt 1 : 5.5~8.3 kgf·m (39.8~60.0 lbf·ft)
- ② Bolt 2 : 3.9~5.1 kgf·m (28.1~36.9 lbf·ft)
- ③ Bolt 3 : 25.2~34.2 kgf·m (182~247 lbf·ft)
- ④ Bolt 4 : 50~66 kgf·m (362~477 lbf·ft)

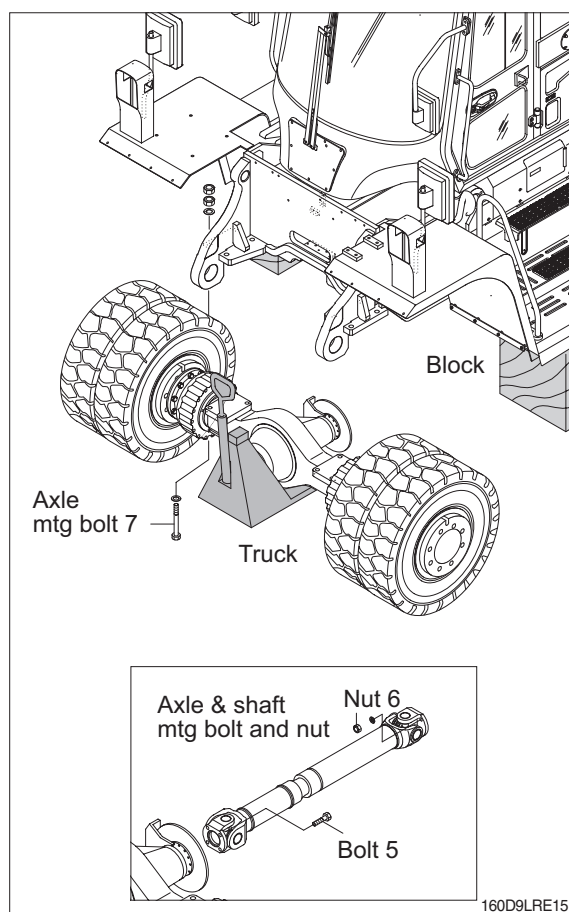
※ Apply loctite #277 on the thread before tightening the bolts 1, 2 and 4.



(2) Tightening torque of the mounting bolts for the drive axle and shaft.

- ① Bolt 5 : 13~17 kgf·m (94.0~123 lbf·ft)
- ② Nut 6 : 13~17 kgf·m (94.0~123 lbf·ft)
- ③ Bolt 7 : 85~115 kgf·m (615~832 lbf·ft)

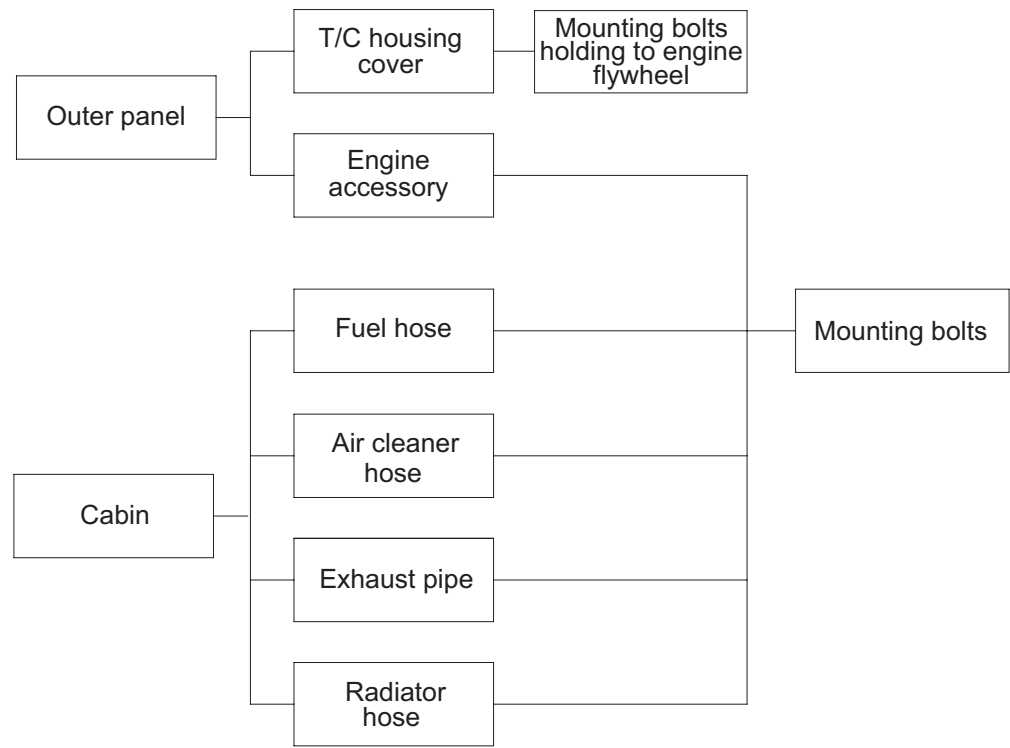
※ Apply loctite #277 on the thread before tightening the bolts.



3. ENGINE

Lever the torque converter, transmission and front axle inside the frame, then remove the engine assembly

1) REMOVAL

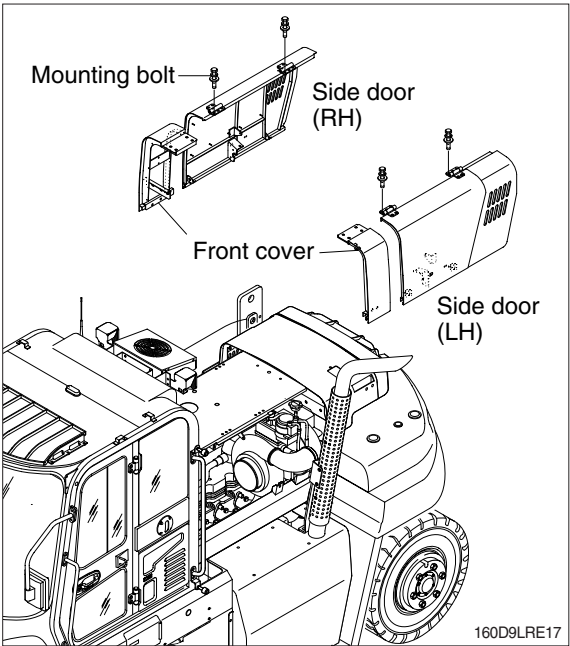


160D9LRE16

(1) Outer panel

① Side door (LH, RH)

Remove the side door (LH, RH) and the front cover (LH, RH) by loosening the mounting bolts.

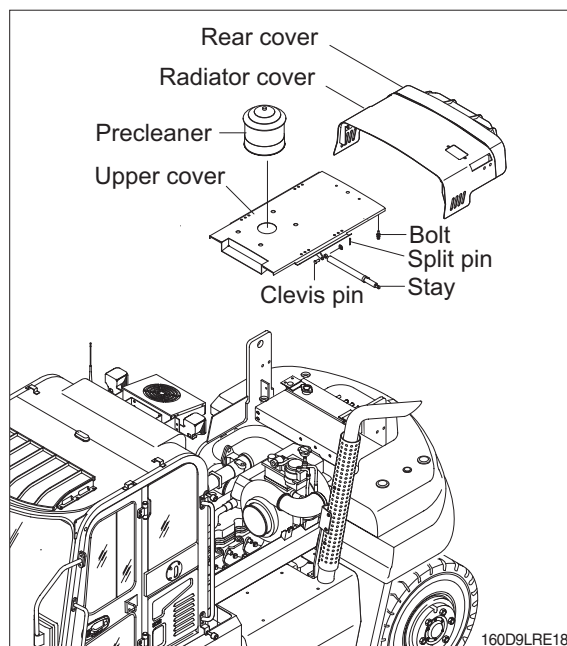


160D9LRE17

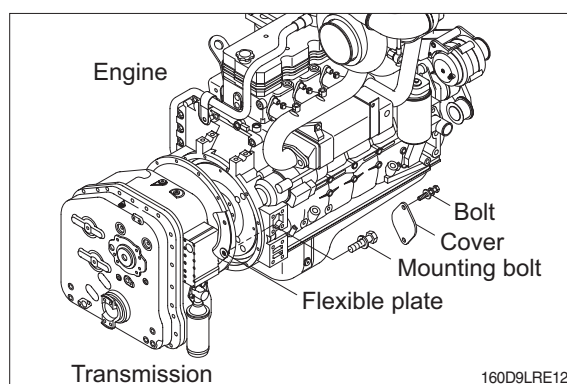


## ② Center cover

- a. Pull upside the precleaner by loosening the clamp and seal in the air intake hole of air cleaner.
- b. Remove rear cover and radiator cover upward by loosening the fixing bolts.
- c. Remove the split pin and clevis pin and disconnect the stay from the upper cover.
- d. Remove the upper cover upward by loosening the fixing bolts.



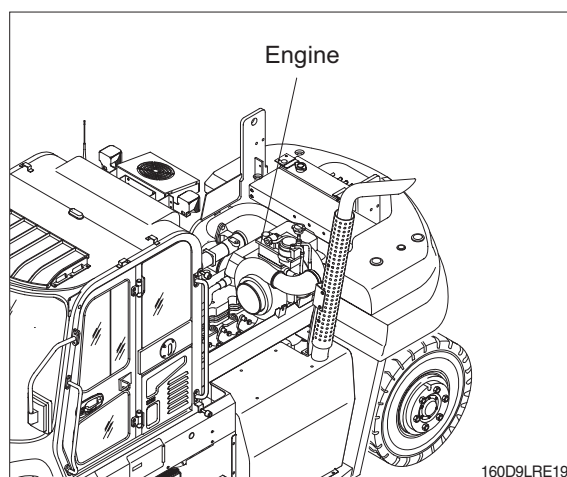
- (2) Flywheel housing cover and mounting bolts. See page 2-13.



## (3) Engine accessory

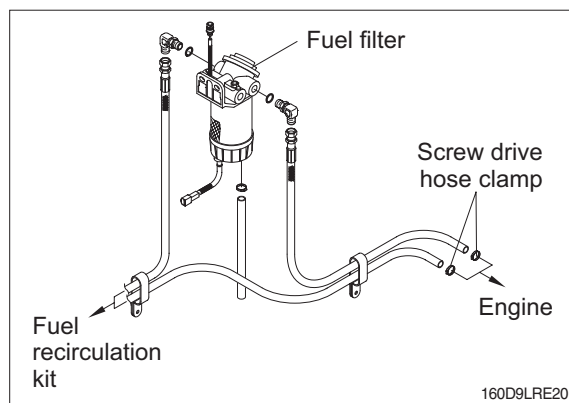
Remove all wiring harnesses, cables and hoses around the engine, dashboard and frame.

- ① Wiring harness to alternator and starter.
- ② Wiring harness for oil pressure and engine water temperature gauges.
- ③ Cables for meters, buttons and accelerator pedal.



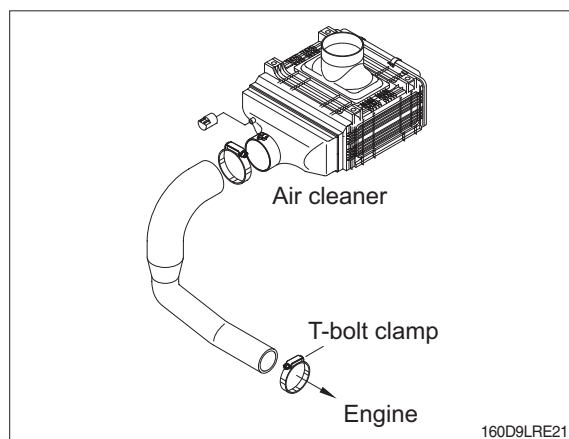
#### ④ Fuel hose

Loosen the screw drive hose clamps and disconnect the fuel hoses.



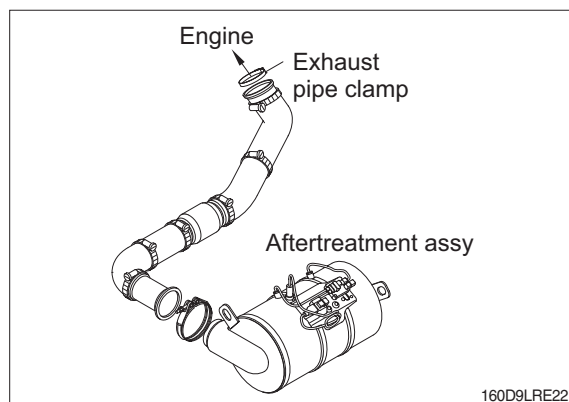
#### ⑤ Air cleaner hose

Loosen the T-bolt clamp and disconnect the intake hose.



#### ⑥ Exhaust pipe

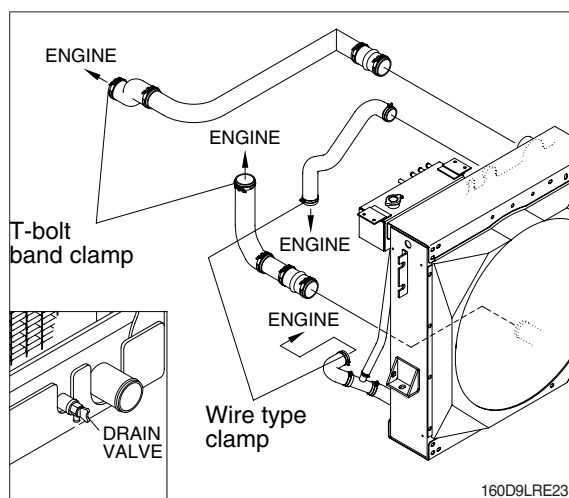
Loosen the exhaust pipe clamp and disconnect the exhaust pipe.



#### (4) Radiator hose

① Open the drain valve of the radiator and drain the cooling water.

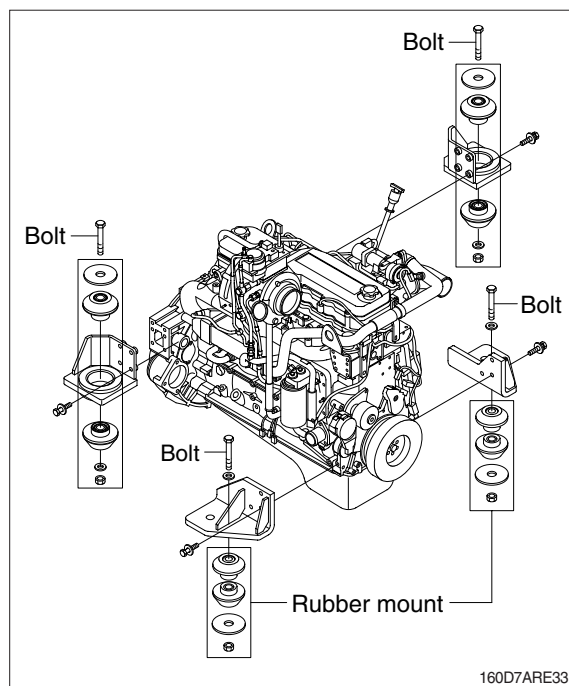
② Loosen the T-bolt band clamps and wire type clamps and disconnect the hoses.



### (5) Engine mounting bracket

Attach a crane to the engine hook and raise, then remove mounting bolts. Raise the engine slightly, slide towards the radiator, then lift up.

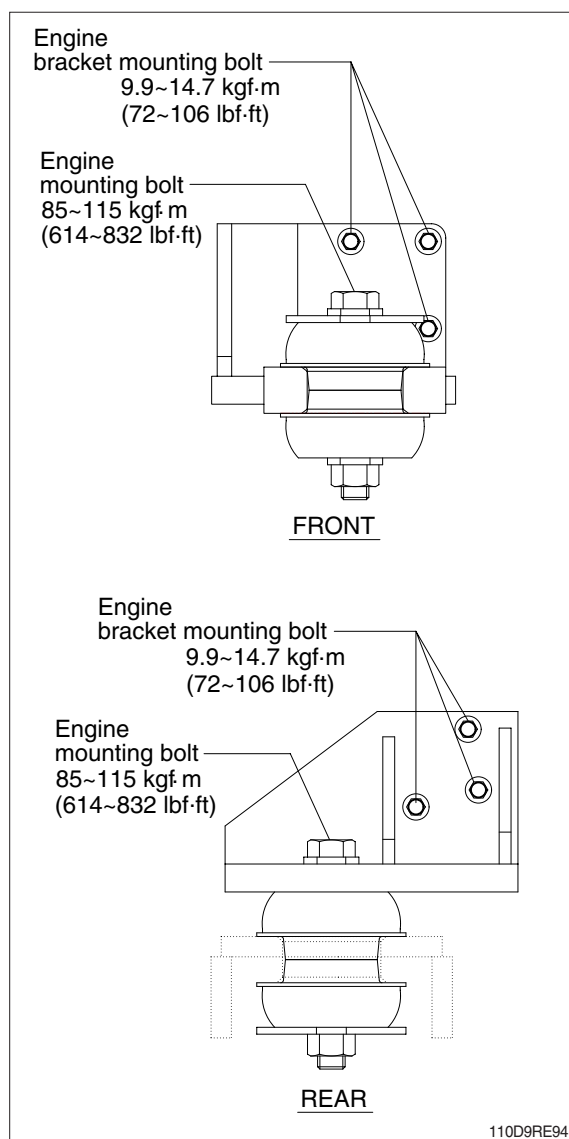
- ※ When sliding the engine, be careful of the collision of engine and radiator.



## 2) INSTALLATION

Installation is the reverse order to removal, but be careful of the following points.

- (1) Tighten the engine bracket mounting bolts.
  - ※ Apply loctite #277 on the thread before tightening the mounting bolts.
  - ※ Do not remove the bolts unless necessary. Loctite is coated over the threads of bolt. So, once the bolts were removed, coat them with loctite when installing.
  - ※ Before installing the bolts, loctite in the holes should be removed by a tap.
- (2) Tighten the engine mounting bolts and nuts.

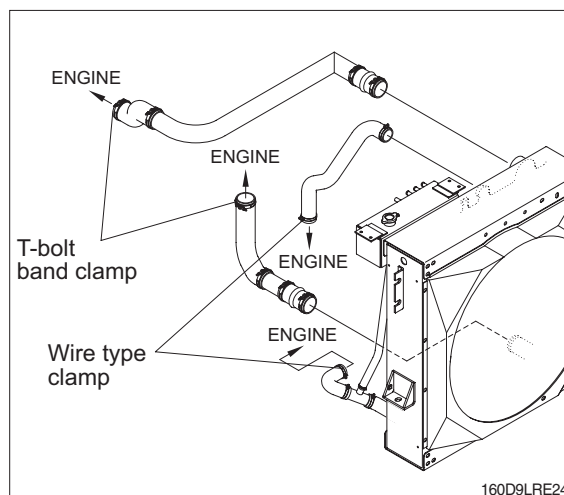


- (3) Tightening torque of mounting bolt installed to torque converter housing.
- See page 2-14, **2) INSTALLATION.**

#### (4) Radiator hoses

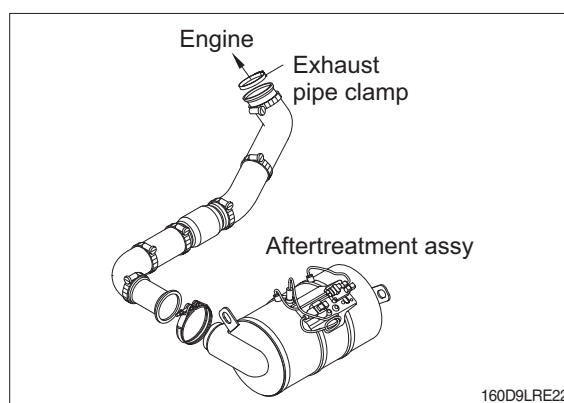
Insert the radiator hoses securely and fit the T-bolt band clamps and wire type clamps.

- Tightening torque
- T-bolt band clamp : 0.85 kgf · m (6.1 lbf · ft)
- Wire type clamp : 0.8 kgf · m (5.8 lbf · ft)



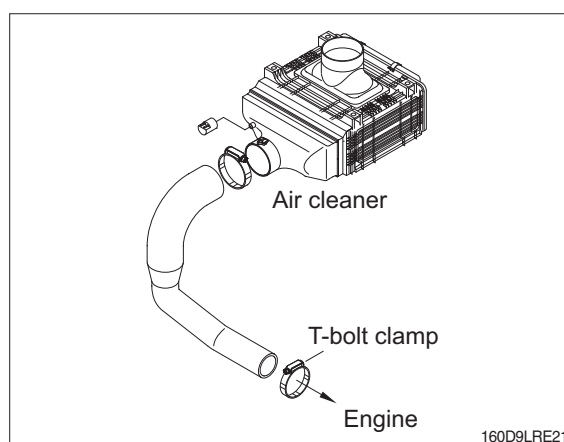
#### (5) Exhaust pipe

Insert the exhaust pipe to the engine securely and fit the exhaust pipe clamp.



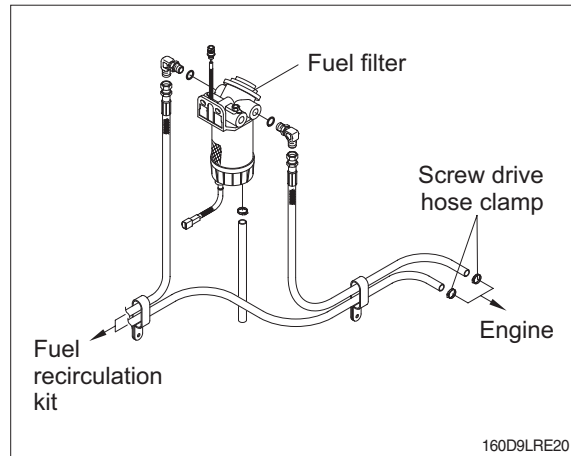
#### (6) Air cleaner hose

- ① Insert the air cleaner hose securely and fit the T-bolt clamp.



### (7) Fuel hoses

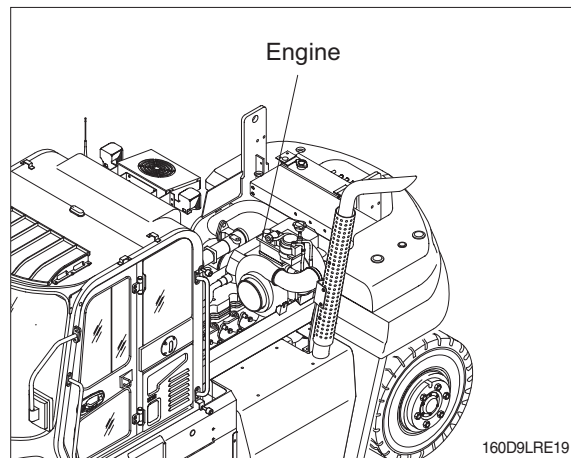
Insert the fuel hoses securely and fit the screw drive clamps.



### (8) Engine accessory

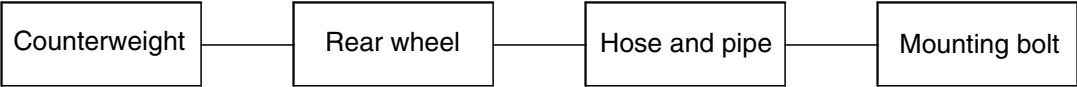
Install all wiring harnesses, cables and hoses around the engine, dashboard and frame.

- ① Wiring harness to alternator and starter.
- ② Wiring harness for oil pressure and engine water temperature gauges.
- ③ Cables for meters, buttons and accelerator pedal.



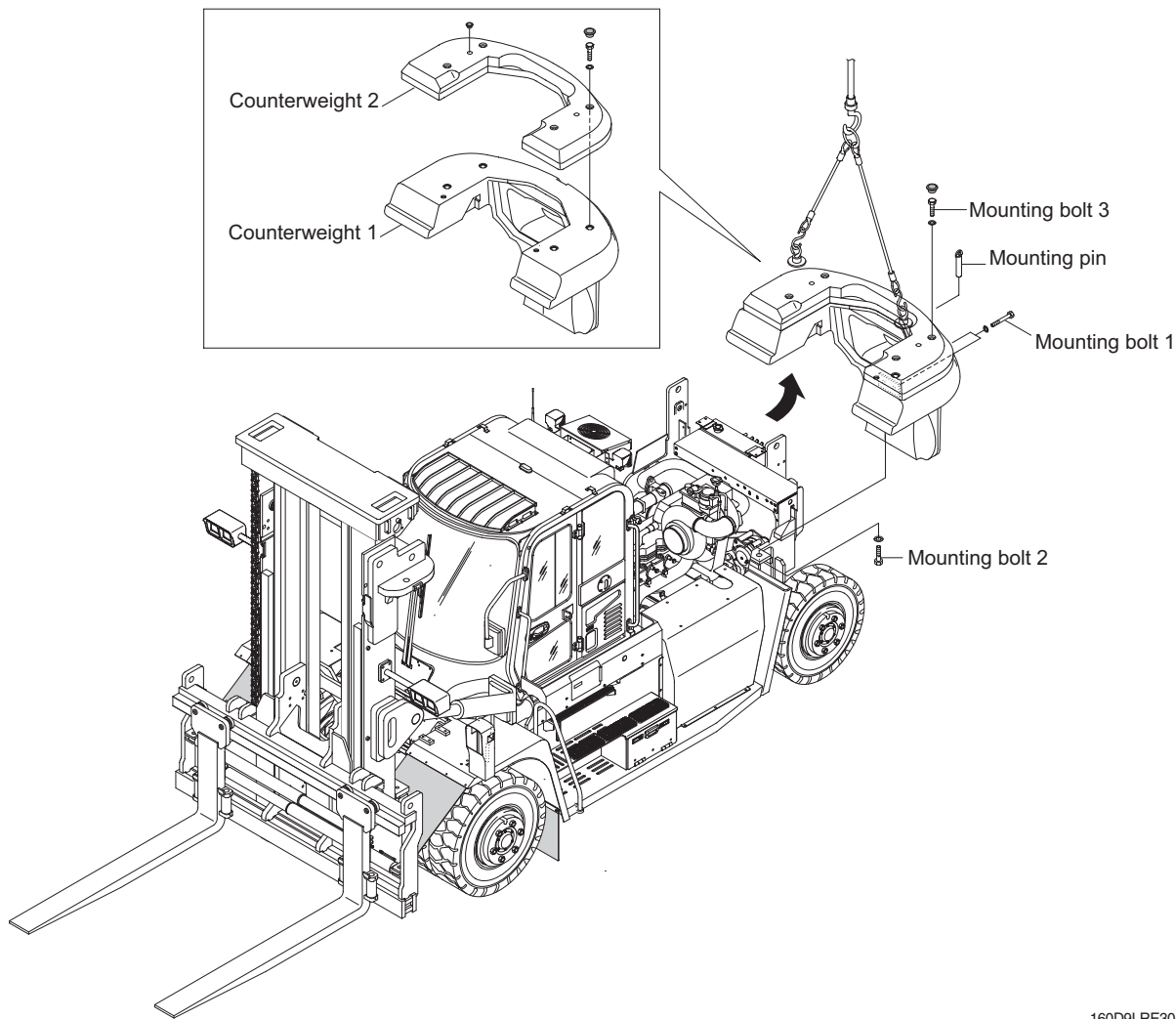
4. REAR AXLE

1) REMOVAL



110D9RE35

(1) Counterweight



160D9LRE30

- ① Hold the counterweight with hoist bars, and raise it with a crane.
- ② Remove the mounting bolts, raise slightly and move it slowly to rear side.
  - Weight of counterweight (standard)

Model	Counter weight 1	Counter weight 2
160D-9L / 180D-9B	4440 kg (9790 lb)	3070 kg (6770 lb)

· Tightening torque : 199±29.9 kgf · m (1440±216 lbf · ft)

## (2) Rear wheel

Remove mounting bolt and hub nut with socket wrench and then carefully take out the tire assembly.

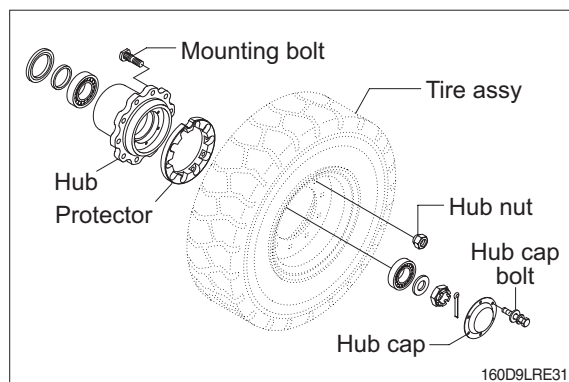
· Tightening torque

- Hub nut

$83.2 \pm 10 \text{ kgf}\cdot\text{m}$  ( $602 \pm 72.3 \text{ lbf}\cdot\text{ft}$ )

- Hub cap bolt

$2.5 \pm 0.5 \text{ kgf}\cdot\text{m}$  ( $11.8 \pm 3.6 \text{ lbf}\cdot\text{ft}$ )



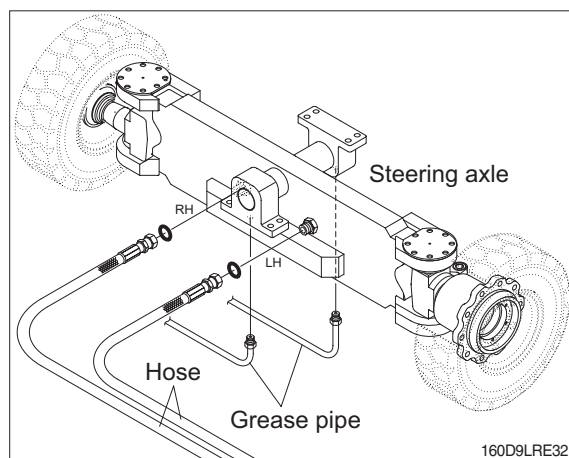
## (3) Hose and piping

- ① Disconnect the hoses from the steering axle and then drain out oil.
- ② Disconnect the pipes from the axle support.

**⚠ When disconnecting the oil hoses and pipe, take care that oil should not be spilt on the floor.**

If someone slips due to oil spillage, it can cause to do him severe injuries.

In case of spilling out of the oil on the floor, wipe away immediately it in order to prevent someone from unexpected accident.



## (4) Mounting bolt

- ① Put a block under the steering axle, support on a truck, and raise the frame with a crane.
- ② Remove the mounting bolts installing to the frame, and pull out to the rear.
- ③ There are shims between the support and steering axle to prevent play. Adjust the axial direction gap is below 0.5 mm by using the shim.
  - Shim thickness : 0.2 mm, 0.5 mm
  - Mounting bolt tightening torque  $100 \pm 15 \text{ kgf}\cdot\text{m}$  ( $723 \pm 72.3 \text{ lbf}\cdot\text{ft}$ )

※ Apply loctite #277 on the thread before tightening.

