



Service Manual

Chassis, Mast & Options

FGC15N	AF81F-10121-up
FGC18N	AF81F-10121-up
FGC20CN	AF81F-60121-up
FGC20N	AF82F-10121-up
FGC20N HO	AF90-10121-20120
FGC25N	AF82F-10121-up
FGC25N HO	AF90-10121-20120
FGC28N	AF83F-10121-20120
FGC30N	AF83F-10121-up
FGC33N	AF83F-60121-up

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GENERAL INFORMATION

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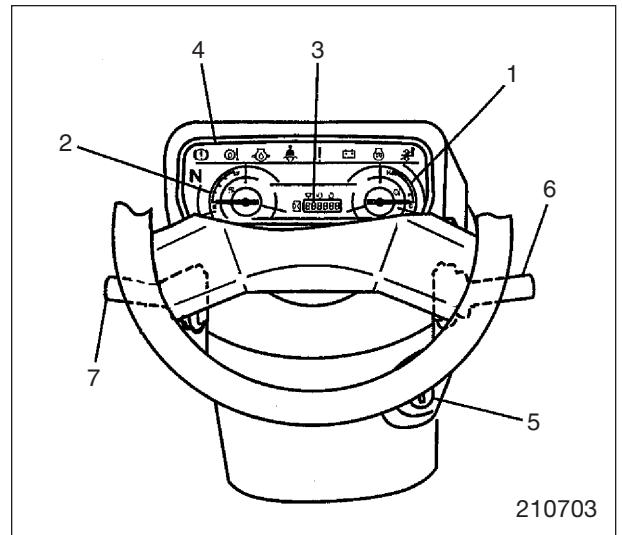
Specification

Items		Truck Models	1 ton class	2 ton class	3 ton class
Cooling System	Type		Water-cooled, forced circulation		
	Radiator		Corrugated fin (pressure) type		
	Water pump		Centrifugal type		
	Thermostat		Wax Pellet Type		

Structure

Console Box

- 1 Engine coolant temperature gauge
- 2 Fuel gauge
- 3 Hour Meter/Warning blinks
- 4 Instrument panel
- 5 Starter switch
- 6 Light switch, turn signal switch
- 7 Direction lever



Coil rating [in case of 20°C (68°F)]

Rated operating voltage: DC 12 V

Coil resistance: 52 ohm

Rated exciting current: 80 mA

Battery

Tends to run down rapidly	— Drive belt slipping	— Readjust.
	* Alternator	
	— Stator coil grounded or open-circuited	— Repair or replace.
	— Rotor coil open	— Replace.
	— Brushes poorly seating on slip rings	— Replace brushes if worn. Clean holder and polish slip rings.
	— Diode ruptured	— Replace.
	* Regulator	
	— Regulated voltage setting too low	— Replace.
	* Battery	
	— Terminal connections loose	— Clean and retighten.
Tends to get overcharged	* Wiring	
	— Open or loose connection between starter switch and regulator IC terminal	— Repair.
	— Fuse blown, or loosely set in holder	— Replace and repair.
	— Open or loose connection between F terminals of regulator and alternator	— Repair.
	* Wiring	
	— Regulator IC and F terminals shorted or miswired	— Repair.
	— Poor grounding of regulator F terminal	— Repair.
* Regulator		
— Pressure coil open-circuited	— Replace.	
— Regulated voltage too high	— Replace.	

VCM-1 Controller, Mast Interlock System Checking Procedure

- (1) Connect service tool to VCM-1.
- (2) Turn the key to ON position and start the engine.
- (3) Display page [4] of Input/Output (I/O) Monitor on the service tool.
- (4) Sit on the operator’s seat. Make sure the status of Seat Switch and Seating Flag is ON in the I/O monitor screen (Fig. 1).

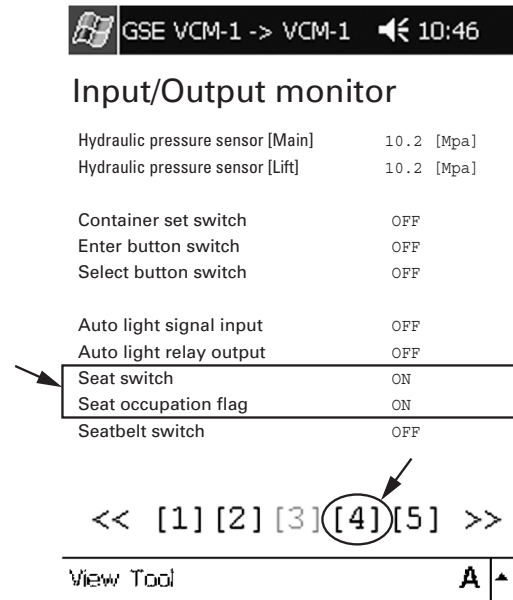


Fig. 1 I/O Monitor [4]

- (5) Display I/O Monitor Page [1] on service tool. When the status of Seating Flag is ON, the controller releases the mast interlock and turns unload output and lift lock output ON. Normal lifting and tilting operation can be conducted in this stage (Fig. 2).

- Check the mast for up and down movement with the lift lever. Check mast for forward/backward tilting with the tilt lever.

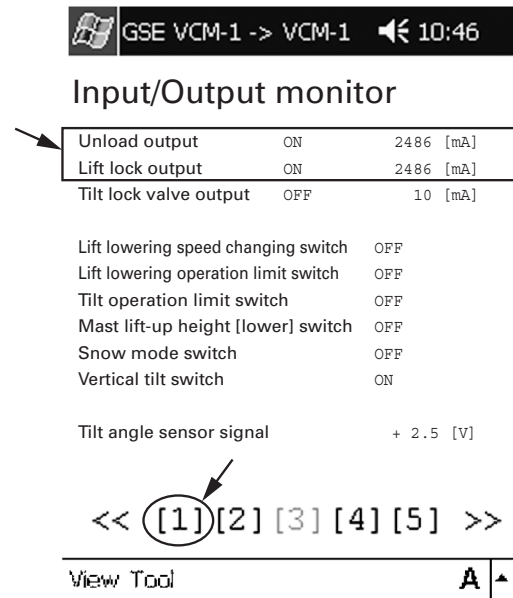


Fig. 2 I/O Monitor [1]

CONTROLLERS

(7) Leave the seat.

Make sure that Seat Switch has turned OFF. And then, by the function of seat delay counter, Seating Flag turns OFF in a few seconds after Seat Switch indicates OFF (Fig. 16).

Also make sure that the vehicle speed sensor input is 4 km/h or less (Fig. 17).

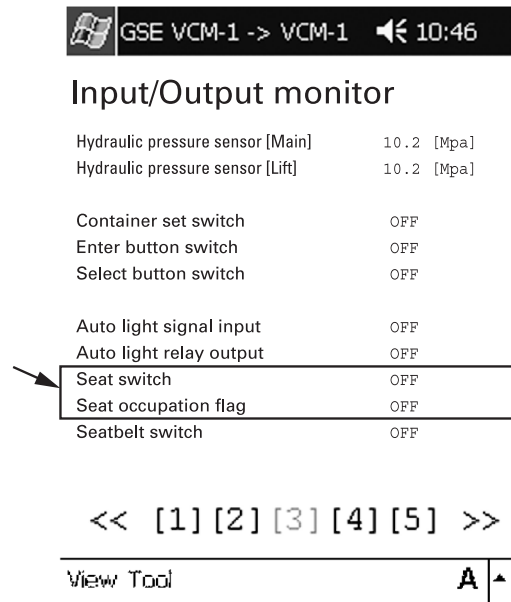


Fig. 16 I/O Monitor [4]

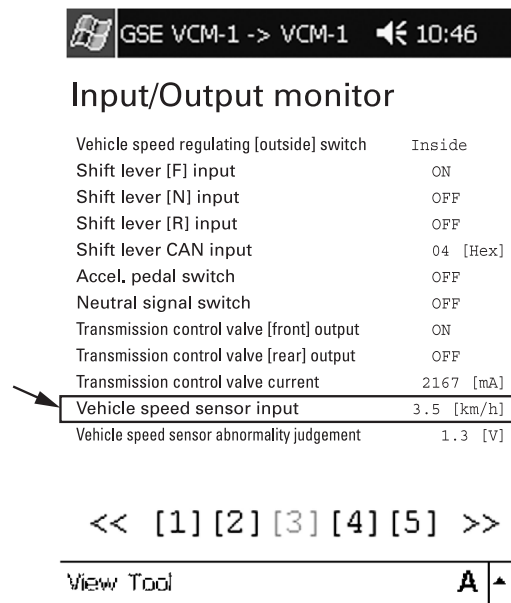
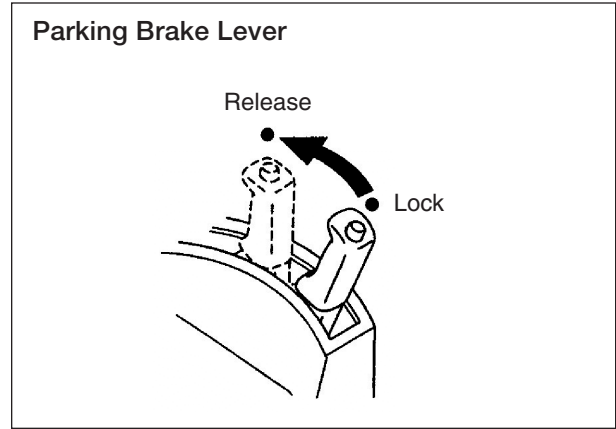


Fig. 17 I/O Monitor [2]

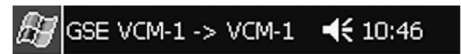
Parking Brake Warning Buzzer/Lamp Checking Procedure with Key in OFF Position

- (1) Place the parking brake lever in Lock position.
 Set the direction lever in the Neutral position.
 Stop the engine and place the key in OFF position.
 Then, power for VCM controller and instrument panel is stopped. (Inoperable)
- (2) Check that the parking brake warning buzzer starts sounding when the parking brake is released.
 (This function is not affected by the status of Seat Switch.)
- (3) Check that the parking brake warning buzzer stops when the parking brake lever is shifted to lock position.



NOTICE: When checking function above, park the truck on a level and solid ground.

- If Seat Switch dose not indicate ON:
 Check Seat Switch for operation and check wiring.
- If Parking Brake Switch does not indicate ON:
 Check Parking Brake Switch for operation and check wiring.
- If Warning Buzzer does not indicate ON:
 Check the warning buzzer output and check wiring.



Active test

- Warning buzzer
- Idle-up solenoid
- Neutral signal
- Reserve ouptup 1
- Reserve output 2
- Reserve output 3

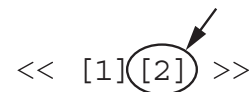
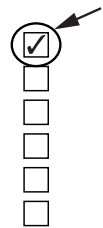


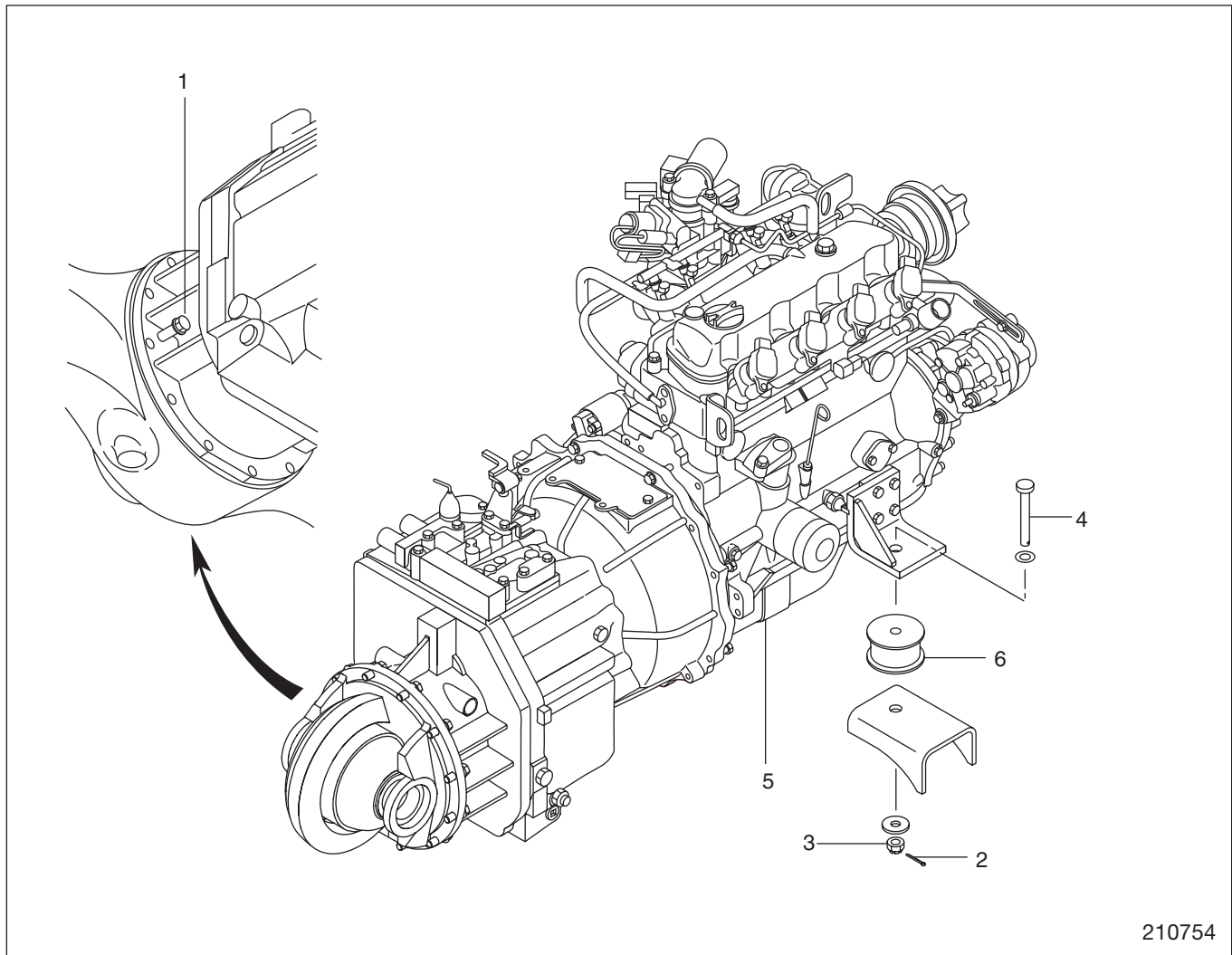
Fig. 33 Active Test [2]

CONTROLLERS

Others (Option)

Sensor	Location
Tilt Angle Sensor and Connector (For tilt automatic leveling option)	Tilt Cylinder Pin
Tilt Lock Solenoid and Connector (For tilt automatic leveling option)	Between Control Valve and Tilt Cylinder
Lift Pressure Sensor and Connector	Between Control Valve and Lift Cylinder

Engine and Transmission Assembly



210754

Sequence

- | | |
|----------------------------|------------------------------------|
| 1 Front axle mounting bolt | 4 Engine mounting bolt |
| 2 Split pin | 5 Engine and transmission assembly |
| 3 Slotted nut | 6 Engine mount |

Start by:

Lifting the engine and transmission assembly with a hoist and slings.

Suggestion for Removal

Slowly lift the engine and transmission assembly 5 out by moving it backwards while maintaining its balance.

Weight of engine and transmission assembly	315 kg (695 lb)
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Removal and Installation

Removal

- (1) Remove the power train assembly.
- (2) Drain the oil from the front axle.
- (3) Remove the bolts holding the flexible plate to the engine flywheel through the hole in the torque converter case.
- (4) Separate the torque converter and transmission combination from the engine.
- (5) Separate the torque converter and transmission combination from the differential carrier.

Installation

- (1) Couple the torque converter and transmission combination to the differential carrier.

NOTE

Wash the flange faces of the transmission case and the differential carrier with solvent and apply a coat of sealant to these faces.

- (2) Couple the torque converter and transmission combination to the engine. Put the torque converter in the transmission case so that the mating face of the flexible plate protrudes approx.13 mm (0.51 in.) from the end face of the transmission housing (See also the "GROUP 5 POWER TRAIN."). The clearance between the flywheel and flexible plate should be 1 to 5 mm (0.04 to 0.20 in.) when the torque converter is coupled to the engine. If this clearance is zero, it is an indication that the torque converter is not coupled to the engine properly. Re-couple it to the engine.
- (3) Tighten the bolts that hold the flexible plate to the flywheel through the hole in the torque converter case.

NOTE

Tighten the bolts in a diagonal sequence.

- (4) Refill the front axle housing with recommended gear oil.

Inspection and Adjustment

Oil Pressure Measurement

1. Transmission oil level check

- (1) Check the transmission fluid level with the level gauge.
- (2) Start and run the engine at an idling speed for about 3 minutes, and then stop the engine.
- (3) Wait for about 30 seconds after stopping the engine, and check the level.
- (4) The checking procedure must be completed within 5 minutes after the engine has stopped.

2. Engine warm-up

Warm up the engine to raise the temperature of the transmission oil.

3. Preparation for oil pressure measurement

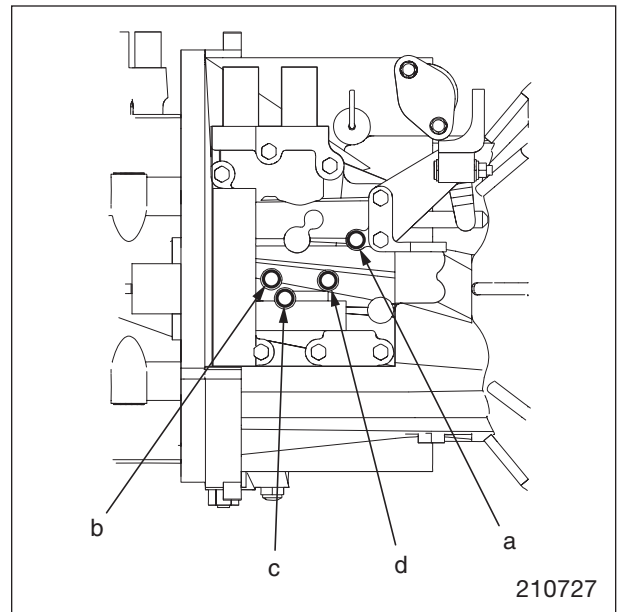
- (1) Raise the front wheels to clear the ground either by jacking up the front axle housing or placing a wood block under the outer mast and tilting the mast forward.
- (2) Block the rear wheels.

! WARNING

The front wheels turn during the clutch pressure measurement. Be careful and stay away from the wheels.

- (3) Connect the oil pressure gauge to each of the oil pressure taps indicated in the illustration.
 - a: Main pressure
 - b: Forward clutch pressure
 - c: Reverse clutch pressure
 - d: Torque converter inlet pressure

NOTICE: When loosening the plugs a through d, tap the plug head once or twice to make the work easier.



Tightening Torque

Unit: N·m (kgf·m) [lbf·ft]

Item	Truck Models	1 ton class	2 ton class	3 ton class
Torque converter housing	Clutch housing cover fixing bolts	15.7 to 20.6 (1.6 to 2.1) [11.6 to 15.2]		
	Torque converter housing, transmission case joining bolts	30.4 to 40.2 (3.1 to 4.1) [22.4 to 29.7]		
Oil pump	Oil pump cover, oil pump housing bolts	3.73 to 5.00 (0.38 to 0.51) [2.75 to 3.69]		
	Oil pump assembly mounting bolt	15.7 to 20.6 (1.6 to 2.1) [11.6 to 15.2]		
Transmission	Transmission case, differential-carrier fixing bolts	44.1 to 51.9 (4.5 to 5.3) [32.5 to 38.3]		
	Suction filter spacer fixing bolts	15.7 to 20.6 (1.6 to 2.1) [11.6 to 15.2]		
	Air breather	4.4 to 5.9 (0.45 to 0.60) [3.25 to 4.35]		
	Draining plug	24.5 to 34.3 (2.5 to 3.5) [18.1 to 25.3]		
	Oil temperature sensor	31.4 to 47.1 (3.2 to 4.8) [23.2 to 34.7]		
	Orifice plug	4.4 to 5.9 (0.45 to 0.60) [3.25 to 4.35]		
	Oil pipe fixing bolts	15.7 to 20.6 (1.6 to 2.1) [11.6 to 15.2]		
	Drive pinion locking nut	245 to 294 (25 to 30) [181 to 217]		
Control valve	Control valve mounting bolt	15.7 to 20.6 (1.6 to 2.1) [11.6 to 15.2]		
	Orifice plug	4.4 to 5.9 (0.45 to 0.60) [3.25 to 4.35]		
	Solenoid valve fixing bolts	2.94 to 3.82 (0.30 to 0.39) [2.17 to 2.82]		
	Side plate fixing bolt	15.7 to 20.6 (1.6 to 2.1) [11.6 to 15.2]		
	Inching valve stopper bolt	15.7 to 17.6 (1.6 to 1.8) [11.6 to 13.0]		
	Regulator, torque converter relief valve plug	19.6 to 29.4 (2.0 to 3.0) [14.5 to 21.7]		
	Hydraulic pressure inspecting port plug	4.4 to 5.9 (0.45 to 0.60) [3.25 to 4.35]		
	Inching control lever fixing nut	15.7 to 20.6 (1.6 to 2.1) [11.6 to 15.2]		

Suggestions for Removal

1. Removing front wheel

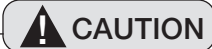
Before removing the front wheels, place stands under the frame and transmission to support it.

2. Removing parking brake cable

To remove the parking brake cable, remove the parking brake lever assembly from the dashboard and disconnect the cable from the lever

3. Removing front axle assembly

- (1) Support the front axle assembly with a supporting forklift truck from under left and right sides of the differential.
- (2) Place the parking brake lever of the supporting forklift truck into the “apply” position, then shut down the engine.

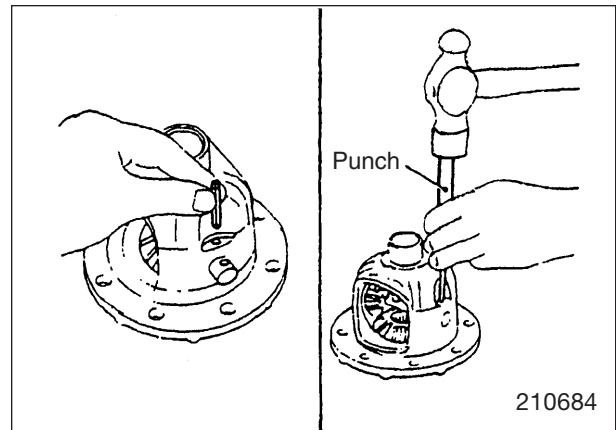


Never fail to place the parking brake lever of the supporting forklift truck into the “apply” position before shutting down the engine.

- (3) Remove the mounting bolts of the front axle assembly.
- (4) Move back the supporting forklift truck to remove the front axle assembly out of the vehicle.

REDUCTION DIFFERENTIAL

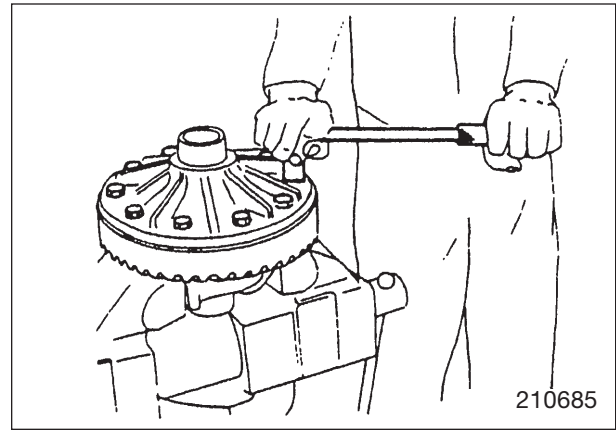
- (5) Strike the pinion mate shaft lock pin into pin hole using a punch (1 ton class).



- (6) Place the ring gear on the differential case.

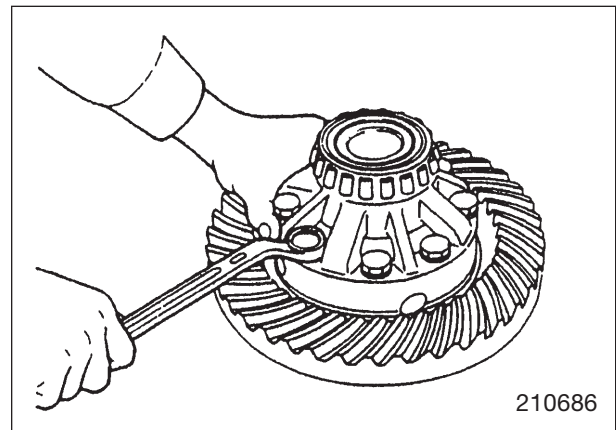
Tighten bolts in a diagonal sequence, lightly tapping bolt head with a hammer.

Tightening torque for ring gear bolt	196 to 226 N·m (20 to 23 kgf·m) [145 to 167 lbf·ft]
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- (7) Assemble differential case, and tighten bolts in diagonal sequence (2, 3 ton classes).

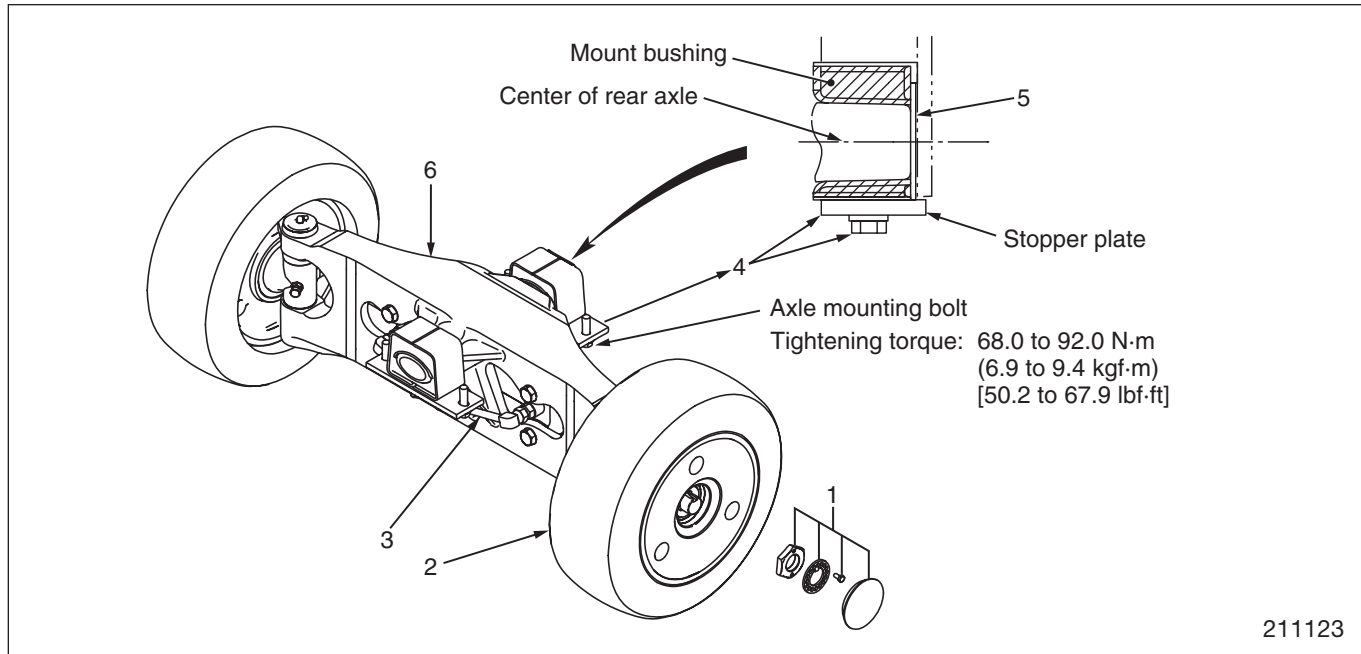
Truck Model	2, 3 ton classes
Item	
Tightening torque for differential case bolt	74 to 81 N·m (7.5 to 8.3 kgf·m) [55 to 60 lbf·ft]



- (8) Press-fit side bearing inner races into differential case.

Removal and Installation

Rear Wheel and Rear Axle Assembly



Removal of Rear Wheels

- (1) Set the parking brake, and block the front wheels.
- (2) Loosen the wheel nut about two turns and raise the rear end of the truck by using a jack or crane at the specified point.

Capacity of jack or crane	5 ton or more
---------------------------	---------------

- Method using a jack
Position the jack at the jacking point and raise the rear tire.
- Method using a crane
Attach lifting sling to the drawbar pin in the counterweight, and lift it.



CAUTION
When the truck is raised, place jack stands under the side frame to support it.

- (3) Remove the wheels.

Installation of Rear Wheels

Follow the sequence of disassembly in reverse.

Removal sequence of axle assembly

- | | |
|-----------------------------------|-----------------------------|
| 1 Cap, Bolt, Lock plate, Lock nut | 4 Bolt, Stopper plate |
| 2 Rear wheel | 5 Rubber shim |
| 3 Hose or pipe | 6 Rear axle (with cylinder) |

Suggestions for Removal

- (1) Refer to “Removal of rear wheels” in previous pages to remove the rear wheels.
- (2) Raise the truck with a jack and support the bottom of both sides of the frame with jack stands. [Approx. 500 mm (19.7 in.) is sufficient for the distance between the bottom of the frame and the ground.]
- (3) Disconnect the hose or pipe 3 from the cylinder elbow (2 places).
- (4) Place a garage jack under the axle to support the axle.
- (5) Remove rear axle mounting bolts, stopper plate 4 and rubber shim 5.
- (6) Lower the garage jack and pull out the rear axle (with cylinder) from the truck.

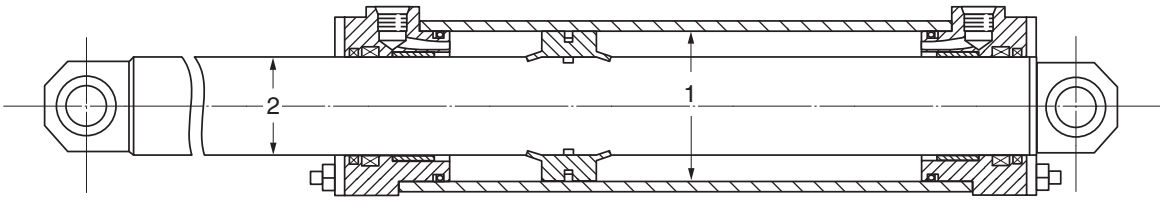
Installation

Follow the sequence of disassembly in reverse, paying attention to the following points.

- (1) Be sure to insert the rubber shim 5.
- (2) Tighten bolts 4 to the specified torque.
- (3) If stopper plate 4 was damaged, it is necessary to replace.

Service Data

A: Standard value
Unit: mm (in.)

Items	Truck Models		1 ton class	2 ton class	3 ton class
		Internal diameter of cylinder tube 1	A	63.5 (2.50)	
	External diameter of piston rod 2	A	44.45 (1.750)		
Steering cylinder					
	209446A				

BRAKE SYSTEM

3. Brake drums

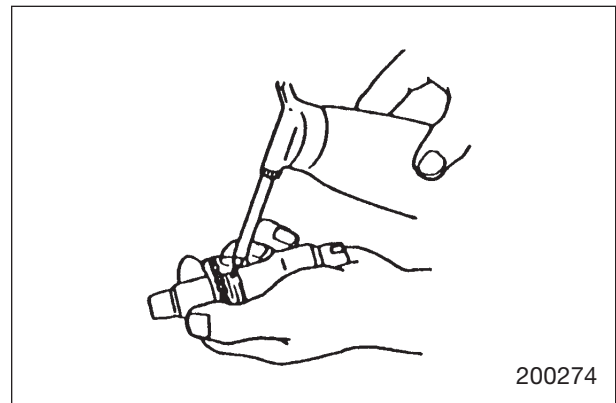
Check the inside (friction) surface of the drum for abnormal wear, grooving and other defects. Minor grooving can be removed by grinding, provided that the inside diameter does not exceed the service limit.

A: Standard value B: Service limit

Truck Model		1 ton class	2, 3 ton classes
Item			
Inside diameter of brake drum	A	254 mm (10.0 in.)	310 mm (12.2 in.)
	B	256 mm (10.1 in.)	312 mm (12.3 in.)

4. Adjusting screws

Check the wheel teeth for wear. Turn the screw by hand to see if its rotating parts turn smoothly.



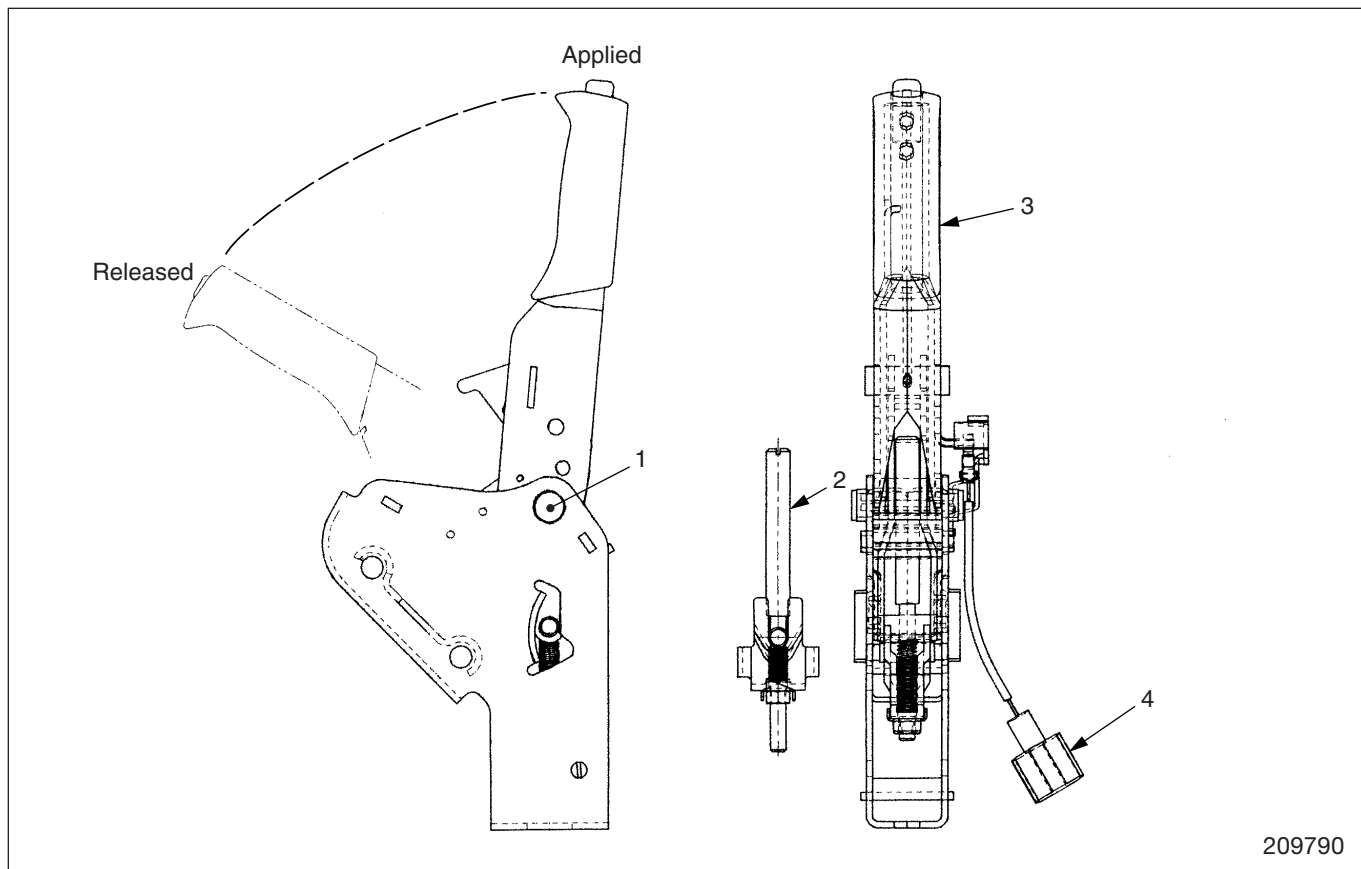
5. Parking brake cable

Replace a cable if it shows stretching, rust or damage.

6 Other parts

- (1) Check the shoe return springs for cracks or fatigue.
- (2) Check the adjusting springs for cracks or fatigue.
- (3) Check the cable with spring for stretching.

Parking Brake Lever



- 1 Lever support pin
- 2 Adjusting screw

- 3 Parking brake lever assembly
- 4 Parking brake switch

Inspection and Repair

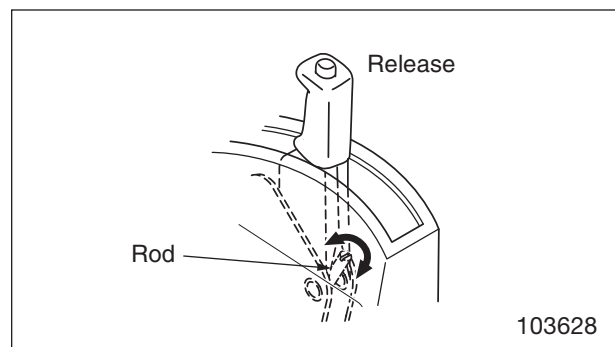
- (1) If the lever support pin and/or the pin hole in the lever are badly worn, replace the worn part(s).
- (2) Replace the parking brake cable if it is stretched, damaged or rusted.

Reassembly

With the parking brake cable and lever connected, the force required to pull the lever should be 245 to 295 N (25 to 30 kgf) [55 to 66 lbf].

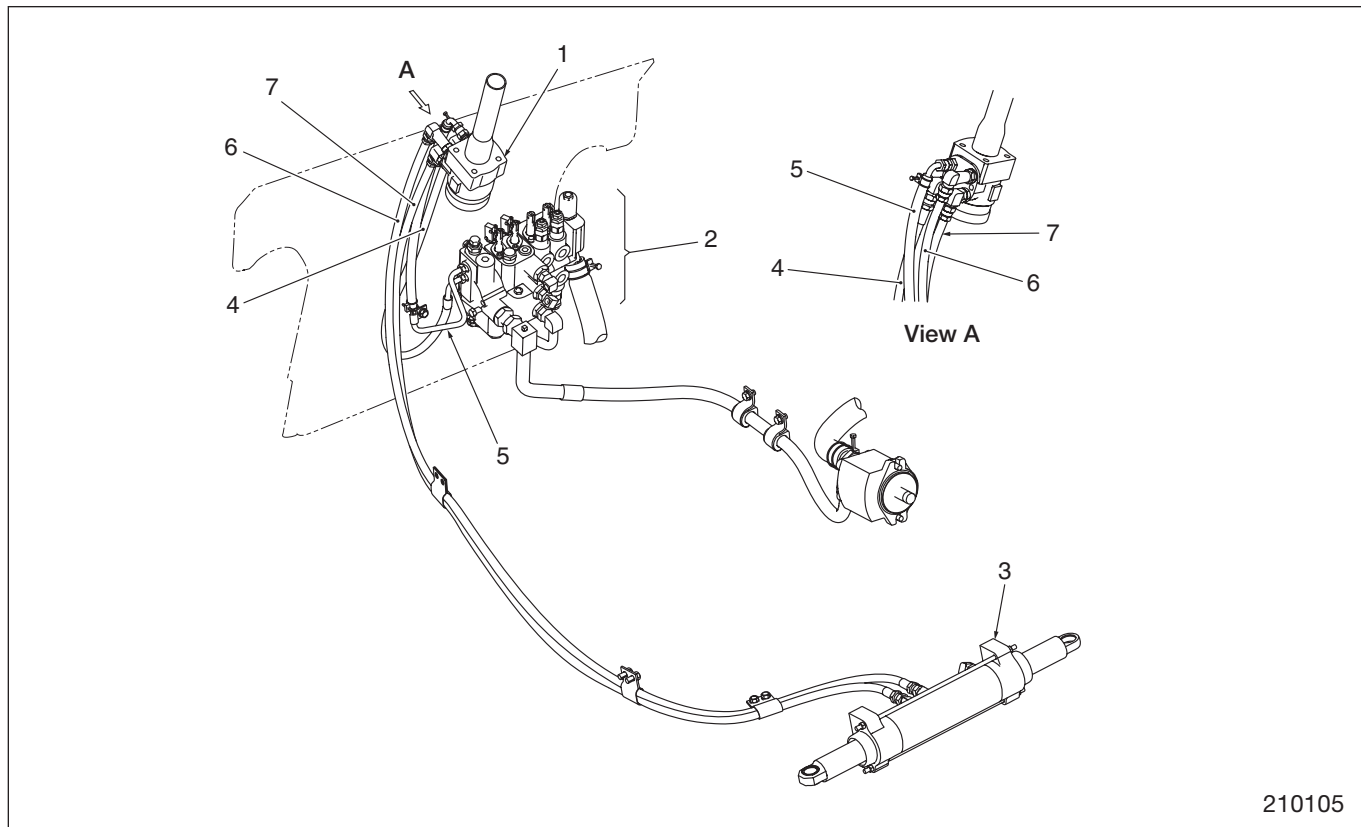
Adjustment

- (1) Put the lever to the release position.
- (2) Turn the rod clockwise to increase the lever's tension; counterclockwise to decrease it.



Disassembly and Reassembly

Disassembly and Reassembly of Piping



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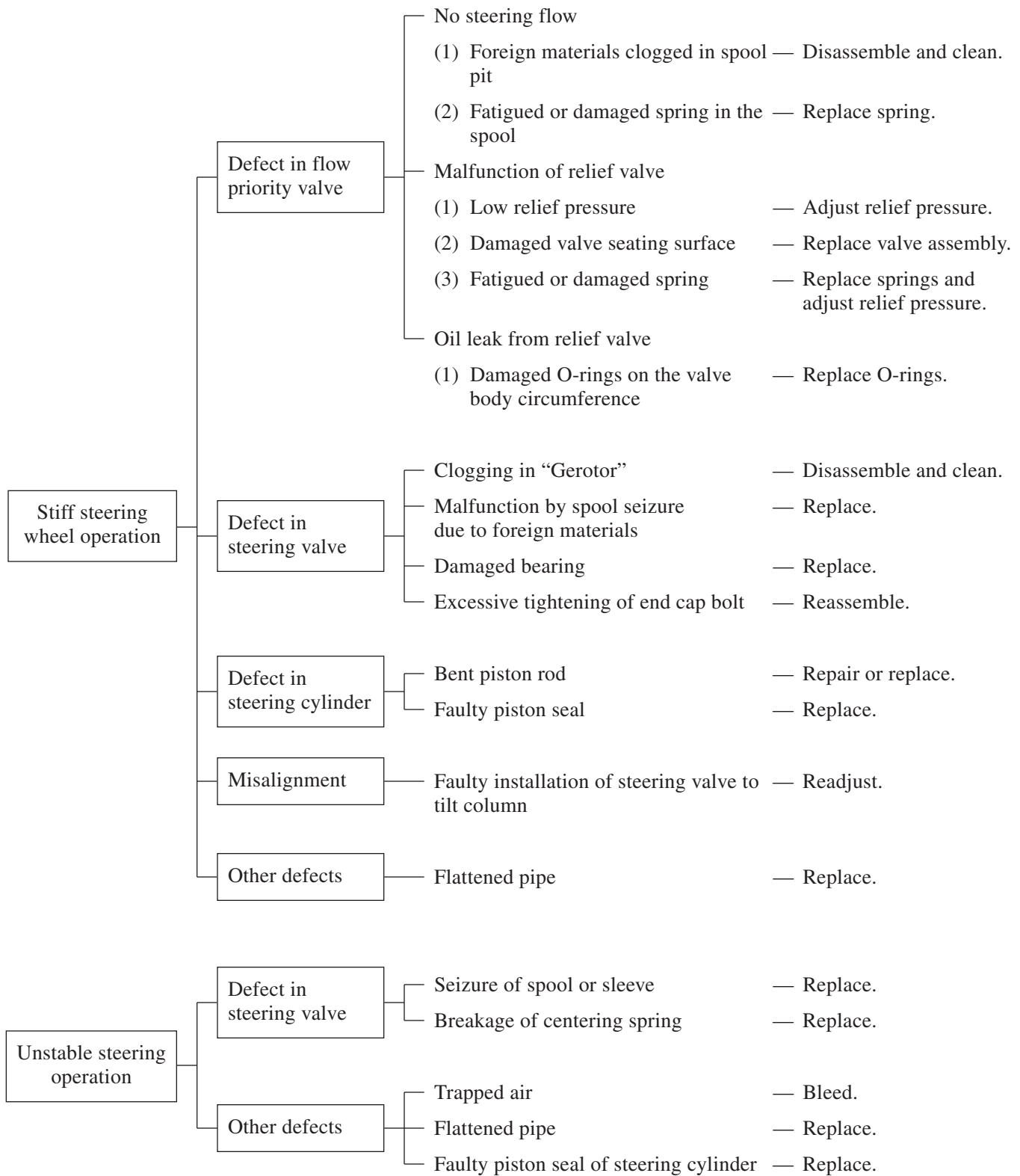
Main parts or devices

- | | |
|--|--|
| 1 Steering valve | 5 Hose and pipe (steering valve T port → T2 port) |
| 2 Hydraulic control valve (The illustration shows MC valve.) | 6 Hose (steering valve L port ↔ steering cylinder) |
| 3 Steering cylinder | 7 Hose (steering valve R port ↔ steering cylinder) |
| 4 Hose (PF port → steering valve P port) | |

Suggestions for Disassembly and Reassembly

- (1) The important point in maintenance of the hydraulic system is to perform work in a clean place and never allow abrasive foreign substance to enter the system.
- (2) O-rings must be replaced, once disturbed.
- (3) Hoses (especially high-pressure section) of the steering system are safety related parts. Replace them with new ones after a lapse of a predetermined time interval regardless of the presence or absence of damage. For a replacement interval, follow the “Operation & Maintenance Manual.”
- (4) When removing or installing hoses, use a double spanner as needed to prevent excessive force from being applied to the matching fittings.
- (5) Bleed air after reassembly. Air bleeding method is as follows.
 - (a) Raise the rear tires by placing jack stands under the truck body.
 - (b) While changing the engine revolution by depressing the accelerator pedal, turn the steering wheel lock-to-lock and relieve pressure to bleed air.

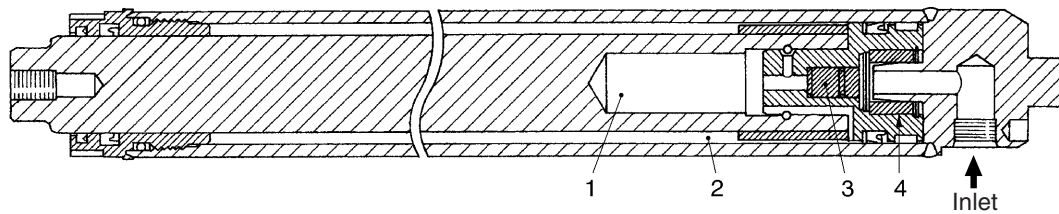
Troubleshooting



Lift Cylinders

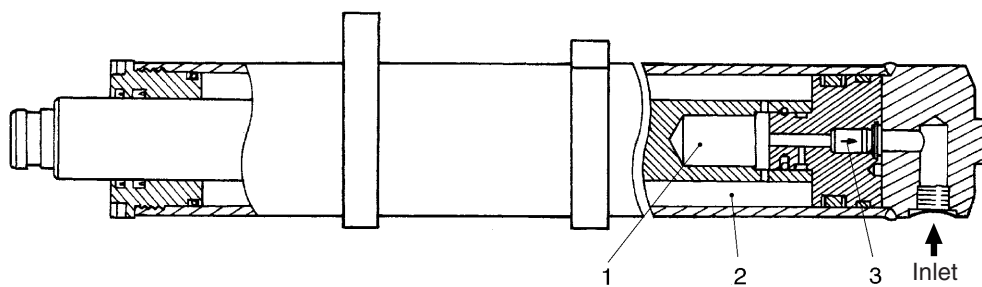
Lift cylinder

Type 1: Simplex mast and triplex mast second cylinder



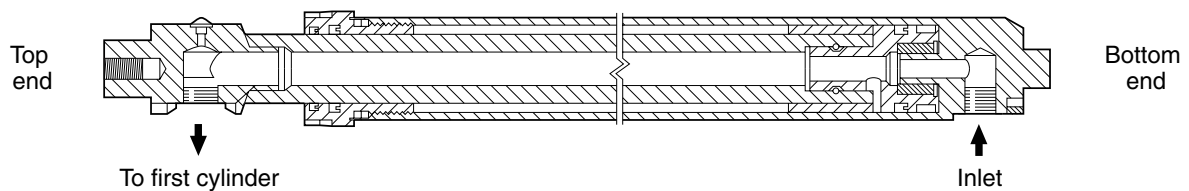
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Type 2: Duplex and triplex mast first cylinder



207604

Type 3: Duplex mast second cylinder



000825C

All the lift cylinders are of a single-acting type.

The type 1 cylinder is used as the Simplex mast cylinder and second cylinder of the Triplex masts. During an upward stroke of the piston, the oil and air in space 2 flow into chamber 1. When the pressure of the oil and air exceeds the set pressure, check valve 3 opens to let excess oil and air to flow out toward the inlet port. Space 2 is always filled with a small amount of oil, which prevents shocks that would otherwise occur when the piston reaches the upward stroke end.

Part 4 is a down-stroke cushioning mechanism. This mechanism prevents the piston from bottoming hard against the head just as the rod completely retracts. This is achieved by narrowing the oil flowing gap between the piston and head further as the piston moves downward.

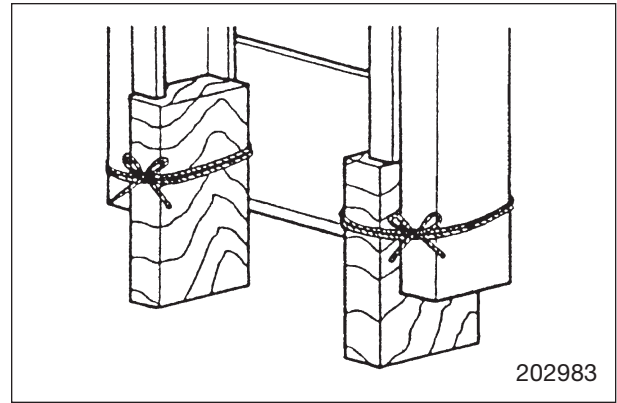
The type 2 cylinder is used as the first cylinder of the Duplex mast and Triplex mast. Like the type 1 cylinder, it has chamber 1 and check valve 3 that form an up-stroke cushioning mechanism. Space 2 is always filled with cushioning oil, which prevents direct contact between the piston and retainer at the end of a rising stroke of the piston.

The type 3 cylinder is used as the duplex mast's second cylinder. Oil flowing in from the bottom end first flows through a passage in the rod toward the first cylinder (see type 2 above). When the first cylinder's rod has been extended fully, the second cylinder's piston moves upward.

The type 3 cylinder is provided with a bleeder valve.

- (3) Place wood blocks under the inner mast (for duplex mast) or middle mast (for triplex mast).

Make sure the right and left wood blocks are the same in height.

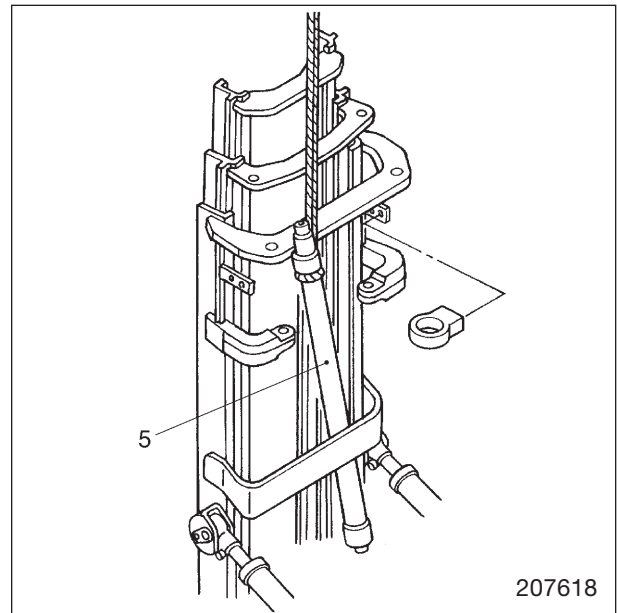


- (4) Hitch a sling to second lift cylinder 5 behind the mast, remove cylinder clamp retaining bolts, and gently remove second lift cylinder 5.

Wind the sling securely to the cylinder. The cylinder cannot be lifted straight up since the mast cross-member is located above the cylinder. Tilt the cylinder and move it away from the cross-member to remove. Be careful not have the hands caught between the cylinder and mast.



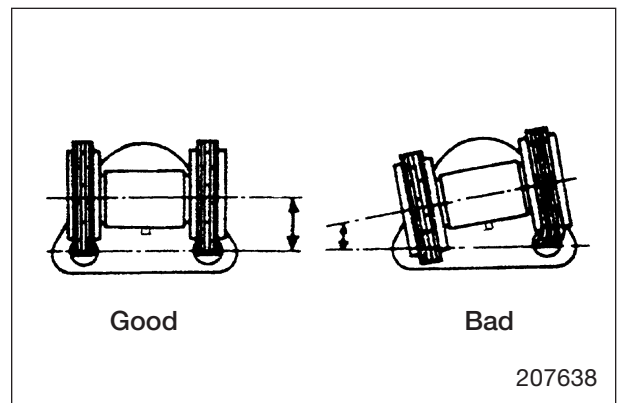
Be careful not to have your hands caught by crossmembers.



Installation

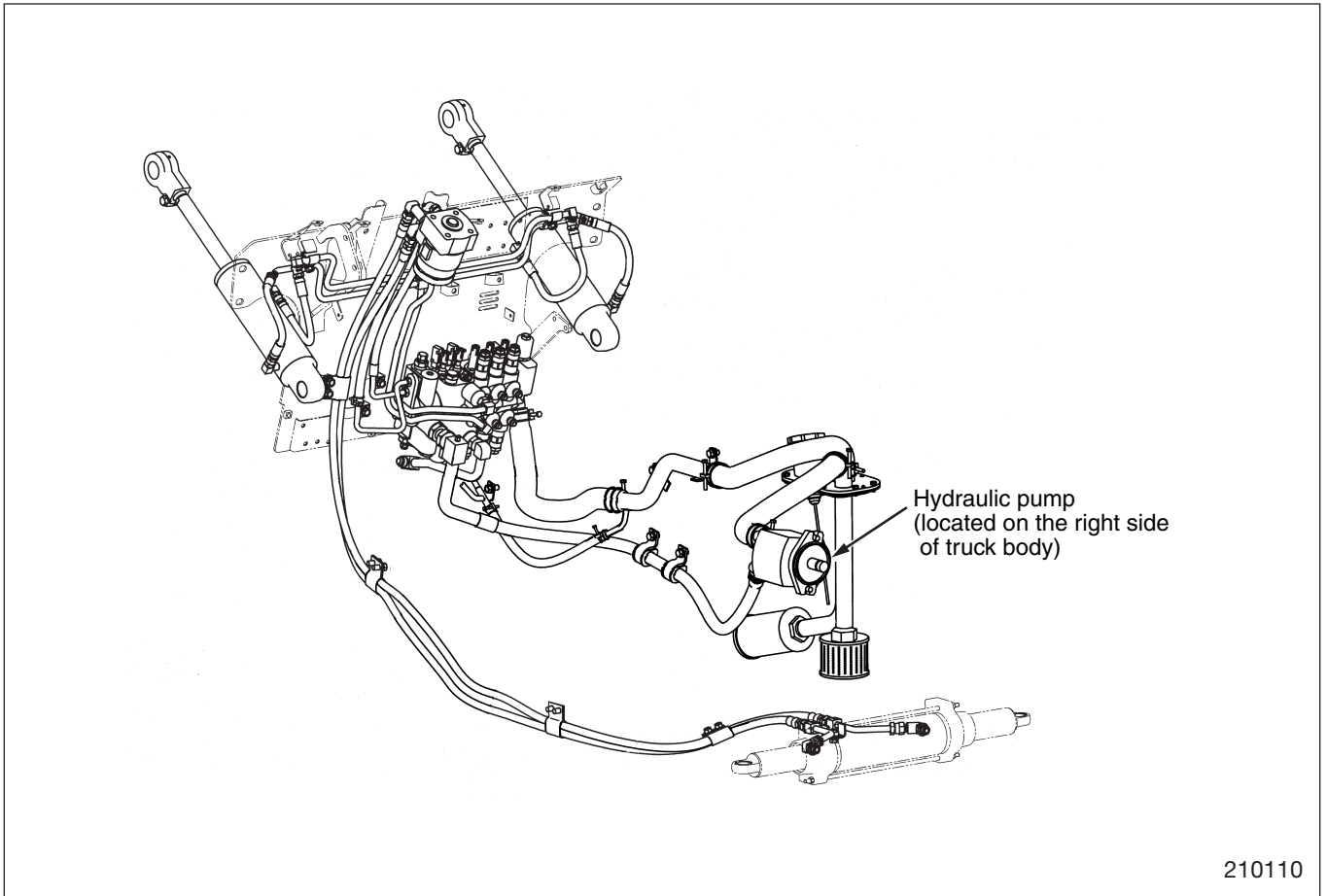
To reinstall, follow the removal sequence in reverse, and do the following steps:

- (1) Install chain wheel support assembly parallel to a line connecting the centers of chain anchor bolt holes on first lift cylinder 3 to prevent chains from twisting.
- (2) Adjust the chain tensions.
(Refer to “Chain Tension Inspection” on page 13-33.)
- (3) Extend and retract the lift cylinders several times under no load condition to bleed air out of the cylinder circuits and to make sure that the cylinders move smoothly.
- (4) After proper operation is confirmed, check the oil level.

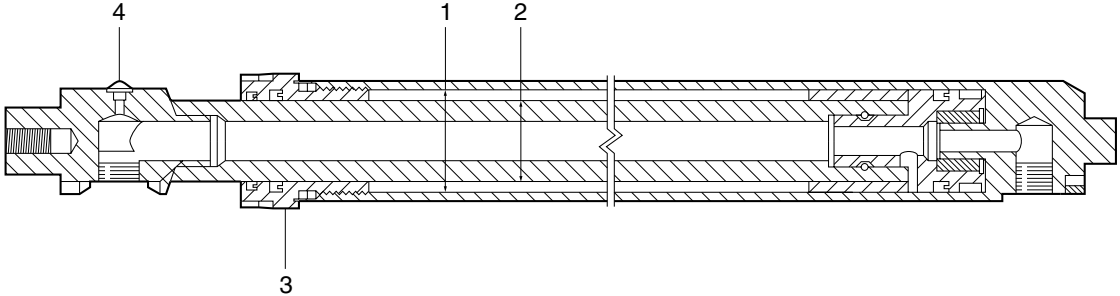


Piping

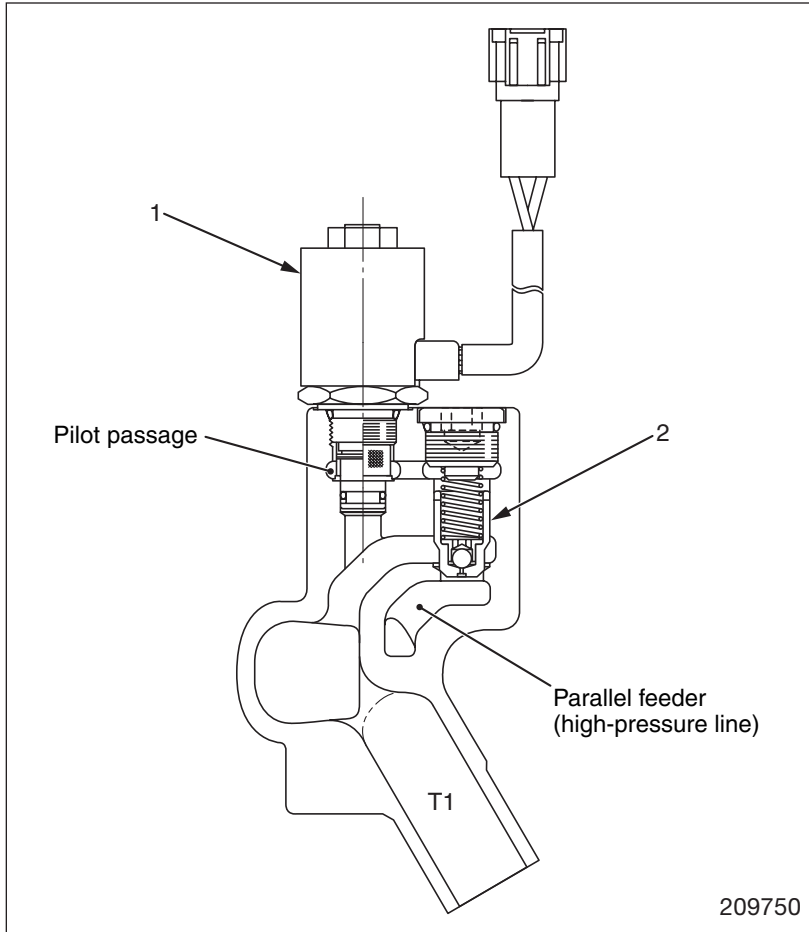
(For piping around the mast, refer to "GROUP 13 MAST AND FORKS.")



A: Standard value
Unit: mm (in.)

Items		Truck Models		
		1 ton class	2 ton class	3 ton class
Second cylinder for duplex mast	[Piston] Inside diameter of cylinder tube 1	A	45 (1.77)	
	Diameter of piston rod 2	A	32 (1.26)	35 (1.38)
	Tightening torque for retainer 3 N·m (kgf·m) [lbf·ft]	A	170 to 240 (17.3 to 24.5) [125 to 177]	
	Bleed screw tightening torque 4 N·m (kgf·m) [lbf·ft]	A	4.5 to 5.0 (0.46 to 0.51) [3.32 to 3.69]	
				
000825C				

Unloader Valve



1 Solenoid valve

2 Valve

T1 : Tank port (return passage)

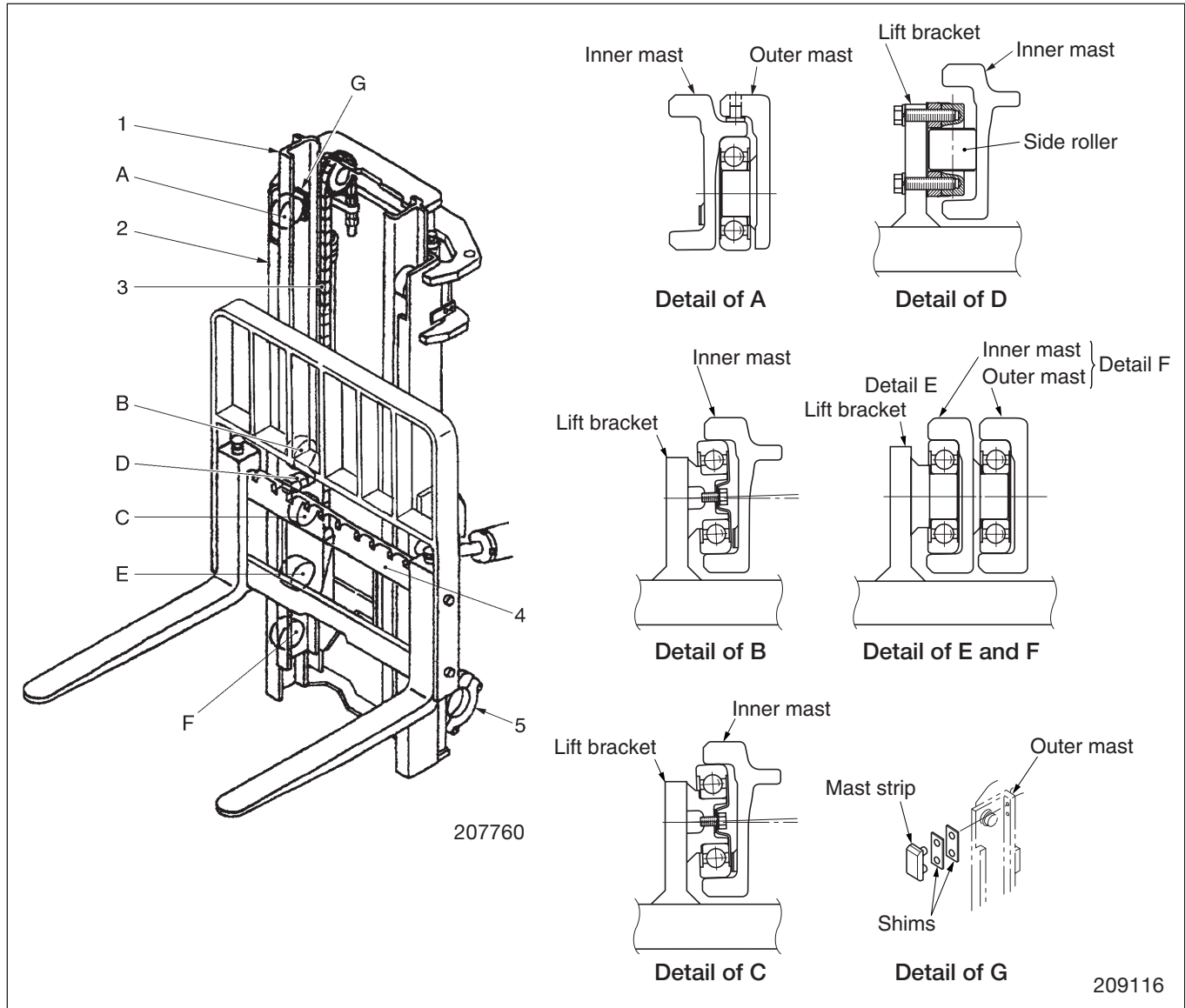
The above illustration shows the unloader valve when the engine stops.

When the seat switch is “open”, solenoid valve 1 is open and pilot oil in the back of valve 2 is connected to the T1 passage. Therefore, oil in the parallel feeder (high-pressure line) lightly pushes up valve 2, flowing to the T1 port. Namely, as hydraulic pressure cannot be held, the cylinder cannot be moved even if the valve operating lever is moved.

When an operator sits on the seat, the seat switch is turned ON, actuating solenoid valve 1 to block the pilot passage. Thus, the parallel feeder can hold oil pressure. This valve is an anti-disaster valve.

Structure

Simplex Mast (5A15C to 5A33C)



- 1 Inner mast
- 2 Outer mast
- 3 Lift chain
- 4 Lift bracket
- 5 Mast-support bearing cap

- A: Main roller
- B: Main roller
- C: Main roller
- D: Side roller

- E: Main roller
- F: Main roller
- G: Mast strip

The simplex mast features two lift cylinders placed behind the mast columns, right and left, to provide excellent visibility.

Mast strips are fitted to the top end of outer mast. These strips are for backing up the inner mast when the mast is tilted backward.

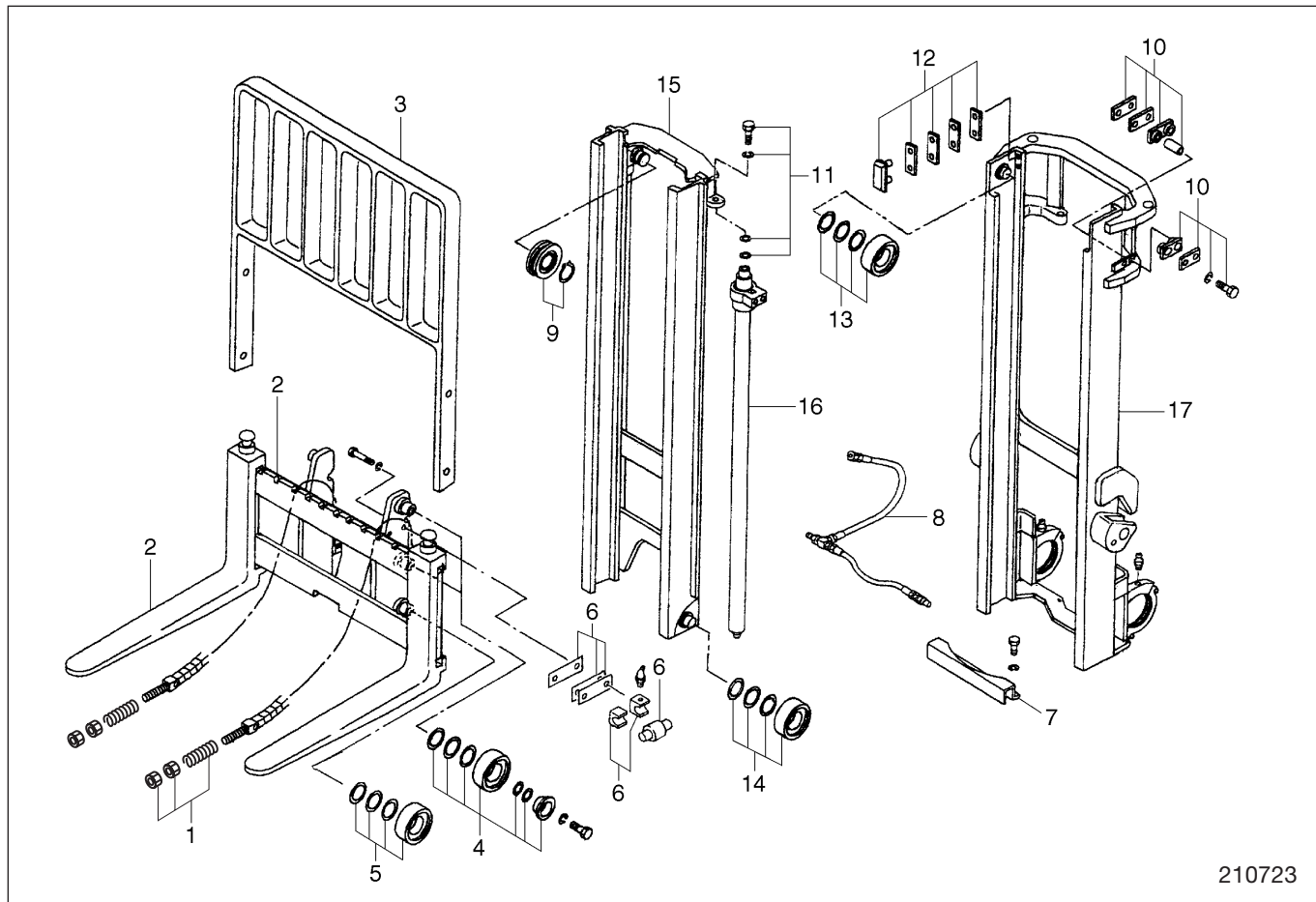
Roller Sizes

Diam. of main roller	1 ton class	2, 3 ton classes
S	99 mm (3.90 in.)	113.8 mm (4.48 in.)
M	100 mm (3.94 in.)	115 mm (4.53 in.)
L	101 mm (3.98 in.)	116 mm (4.57 in.)
LL	102 mm (4.02 in.)	117 mm (4.61 in.)

Disassembly and Reassembly

Simplex Mast

Disassembly



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Sequence

- | | | |
|--------------------------------|--|-----------------------|
| 1 Nuts, Spring | 8 Lift hose (high pressure),
Rubber hose, T-joint, Down
safety valve | 12 Mast strip, Shims |
| 2 Fork, Lift bracket | 9 Snap ring, Chain wheel | 13 Main roller, Shims |
| 3 Backrest | 10 Cylinder clamps, Seats,
Shims, Cushion, Collar, Bolt | 14 Main roller, Shims |
| 4 Main roller, Shims | 11 Bolt, Shims | 15 Inner mast |
| 5 Main roller, Shims | | 16 Lift cylinder |
| 6 Side roller, Brackets, Shims | | 17 Outer mast |
| 7 Hose guard | | |

Suggestions for Disassembly

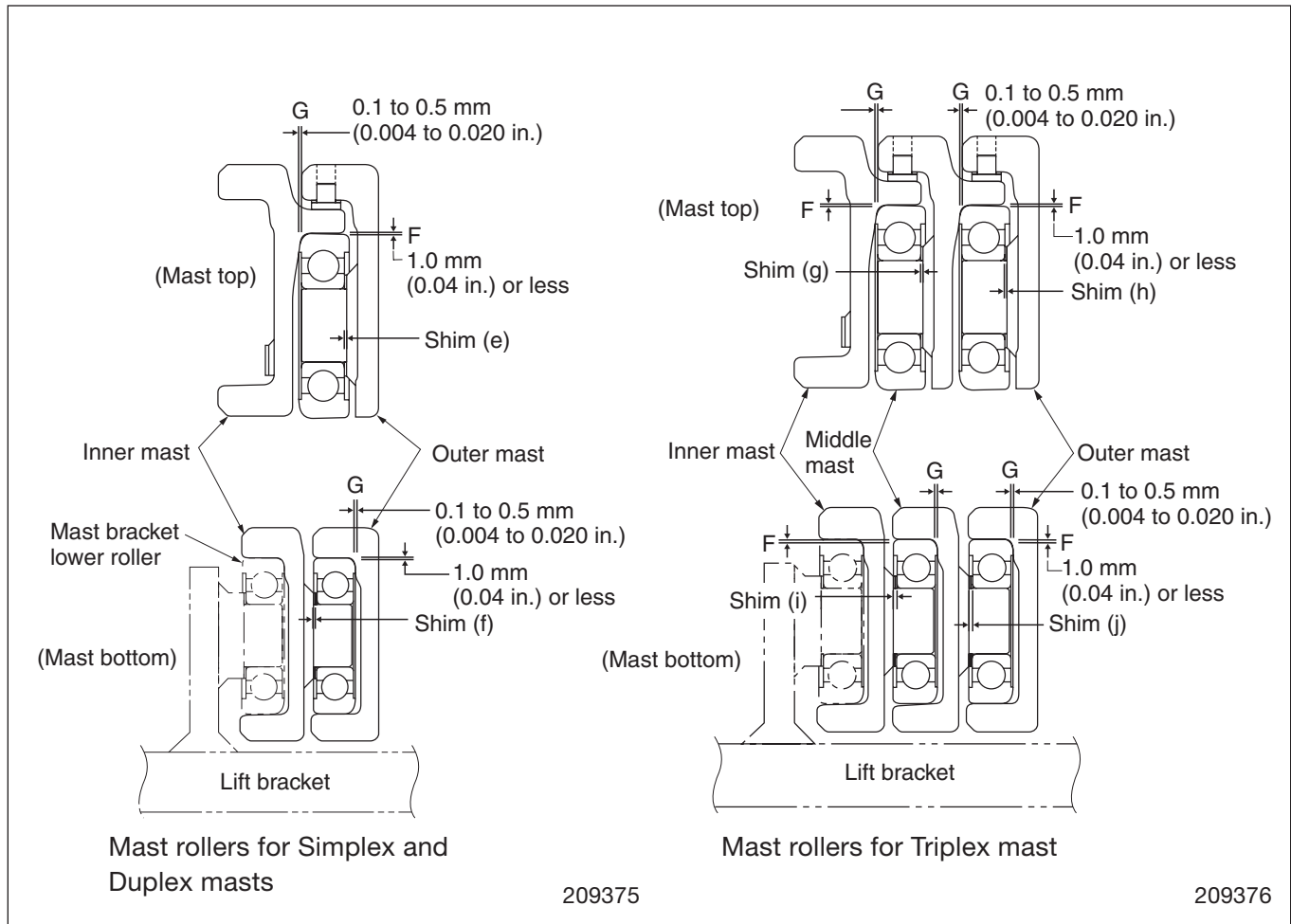
1. Removing mast strips and main rollers

Remove bolts 10, 11 to free lift cylinder 16. Displace the tops of the two lift cylinders from inner mast 15. Slide inner mast 15 toward the bottom of outer mast 17, and remove main rollers 13, 14 and mast strips 12.

NOTE

Before disassembling the mast and fork assembly, measure and record all clearances between each lift bracket and roller and between each mast and roller. Recorded measurements will be helpful when replacing rollers or selecting shims to adjust clearances. Refer to pages 13-35 through 13-38.

2. Installing mast rollers (all mast models)



The mast rollers are completely identical with those of the lift bracket rollers in both the shape and size. The same standard values apply to the roller-to-mast clearances of both rollers.

Clearance F	1 mm (0.04 in.) or less
Clearance G	0.1 to 0.5 mm (0.004 to 0.020 in.)

- Measure the clearance F between the mast and the rolling surface of each roller. If the measurement F is not within the standard value range, replace the roller with the one of an appropriate diameter selected from the table on the right.

NOTICE: Refer to the “Inspection and Adjustment” section in this chapter for the clearance measuring method.

Roller Sizes

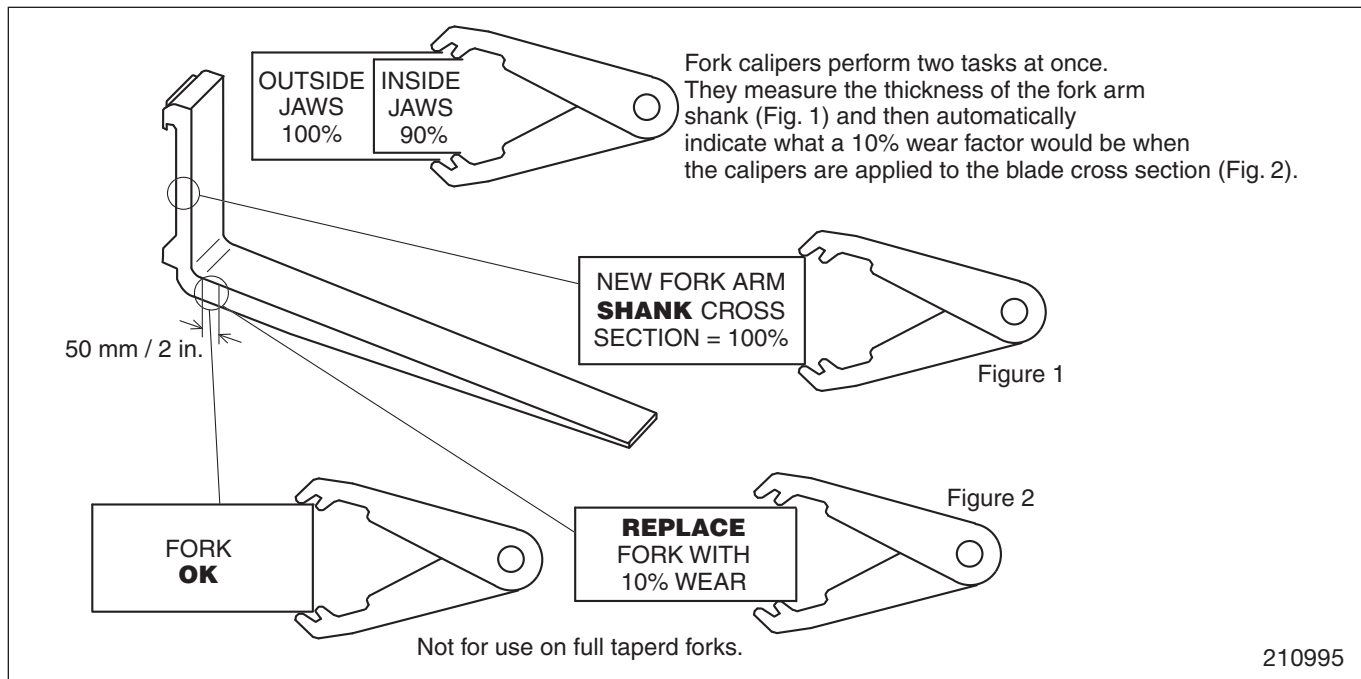
Diam. of main roller	1 ton class	2, 3 ton classes
S	99 mm (3.90 in.)	113.8 mm (4.48 in.)
M	100 mm (3.94 in.)	115 mm (4.53 in.)
L	101 mm (3.98 in.)	116 mm (4.57 in.)
LL	102 mm (4.02 in.)	117 mm (4.61 in.)

- The mast rollers are fitted in the same manner as the lift bracket rollers.

Inspection and Adjustment

The inspection and adjustment in this chapter can be done without dismounting or disassembling. Conduct inspection whenever a defect is suspected.

Forks (all mast models)



Forks are often mistreated and forgotten. As insubstantial as they seem, neglecting forks could make them dangerous.

Forks carry larger loads than almost any lifting device but there are no mandatory requirements for maintenance or inspection.

You can find thousands of extra parts for forklift trucks in some fleet repair shops, but you'll seldom see spare forks. Even when all the trucks on the fleet are the same, fleet maintenance managers rarely order spare forks. Forks last a long time if treated properly, but they can be deceiving by looking as good from most viewing angles when they are worn as when they are new.

It's true that most forks are customized to the truck by model and capacity: they are big and heavy and thought of as indestructible. But forks can be abused or ruined in the course of daily work.

Here are some examples of ways that forks can be damaged:

- Forks can be overloaded either by picking up a load too far out on the forks, or simply by picking up loads heavier than the truck rating.
- Maintenance shops may bend forks back into shape, weld on them, or drill holes through them. Forklift truck users can add attachments to the truck that stress the forks. Drum clamps and portable booms can be supported on the forks—but what is contained in the drum or on the boom hook makes the safety

difference.

- Forks are often used to open rail car doors and break loads out or away from other loads. They are also used to pick up capacity loads not seated against the fork shank and to pick up off-balanced loads far from the side of the truck. The fork tips are sometimes inserted under other fork trucks to lift them during maintenance operations.
- Forklift trucks may collide with building columns and walls, and though the forks show no discernible bend, they may be damaged beyond safety.
- Any time excessive heat is applied to any part of a fork—during repair, for instance—hidden damage may occur.

The fork itself is a concern but so are the hooks that secure them to the lift carriage.

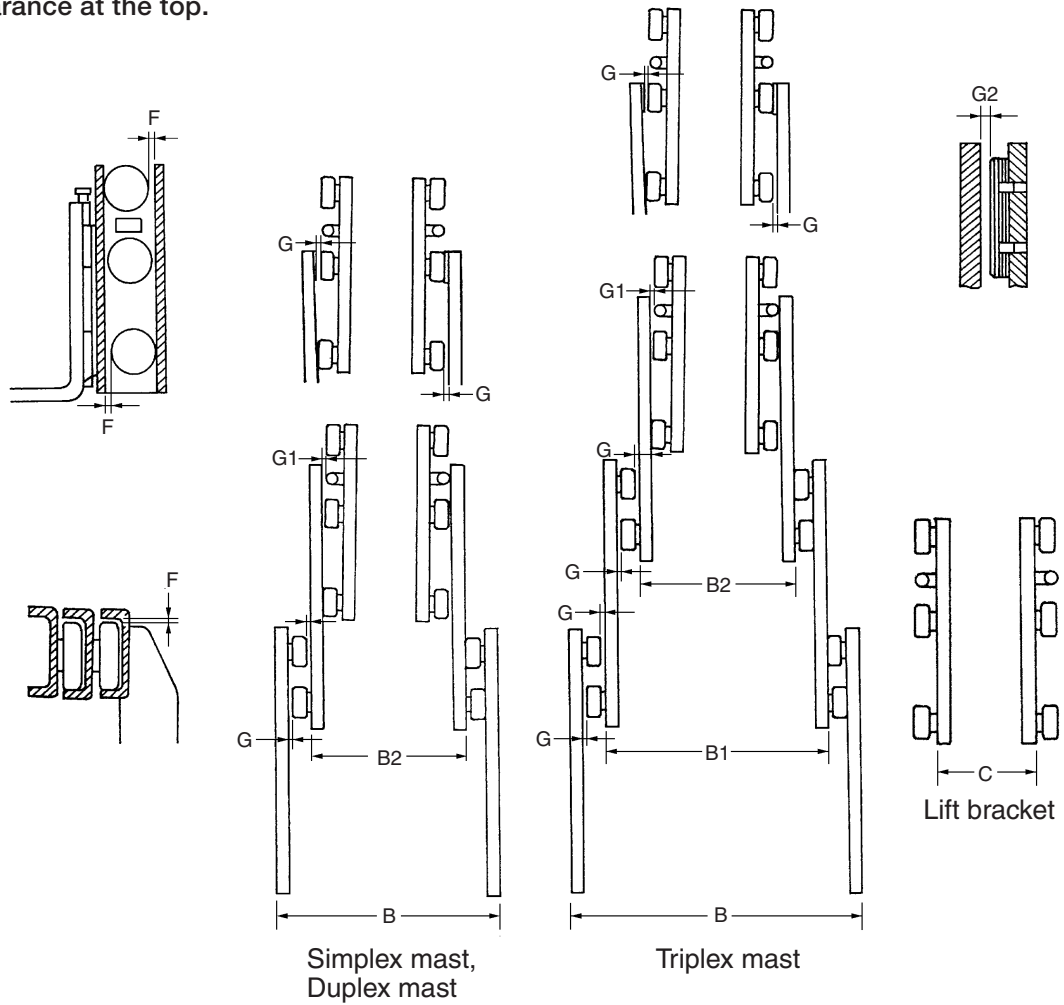
DESIGNED TO TAKE A BEATING

Forks for counterbalanced and straddle forklift trucks are not just bent bars of steel. The manufacturing process is careful and precise with many checks and inspections critical to their safety. Some factors essential to fork manufacture include the steel, the bend and thickness of the heel, the welding of the hooks that hold them on the carriage, and the heat treatment of the finished product.

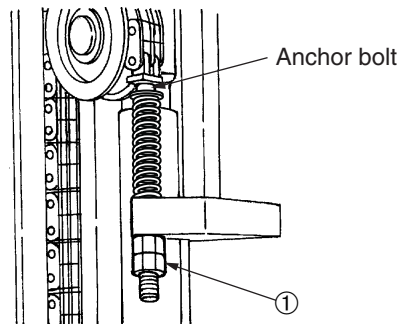
A: Standard value B: Repair or service limit
Unit: mm (in.)

Item	Truck Model		FGC20CN	FGC20N FGC20NHO FGC25N FGC25NHO	FGC28N FGC30N	FGC33N
	FGC15N FGC18N					

The mast width is prone to be narrower at the top than at the bottom. It is recommended to always measure the clearance at the top.

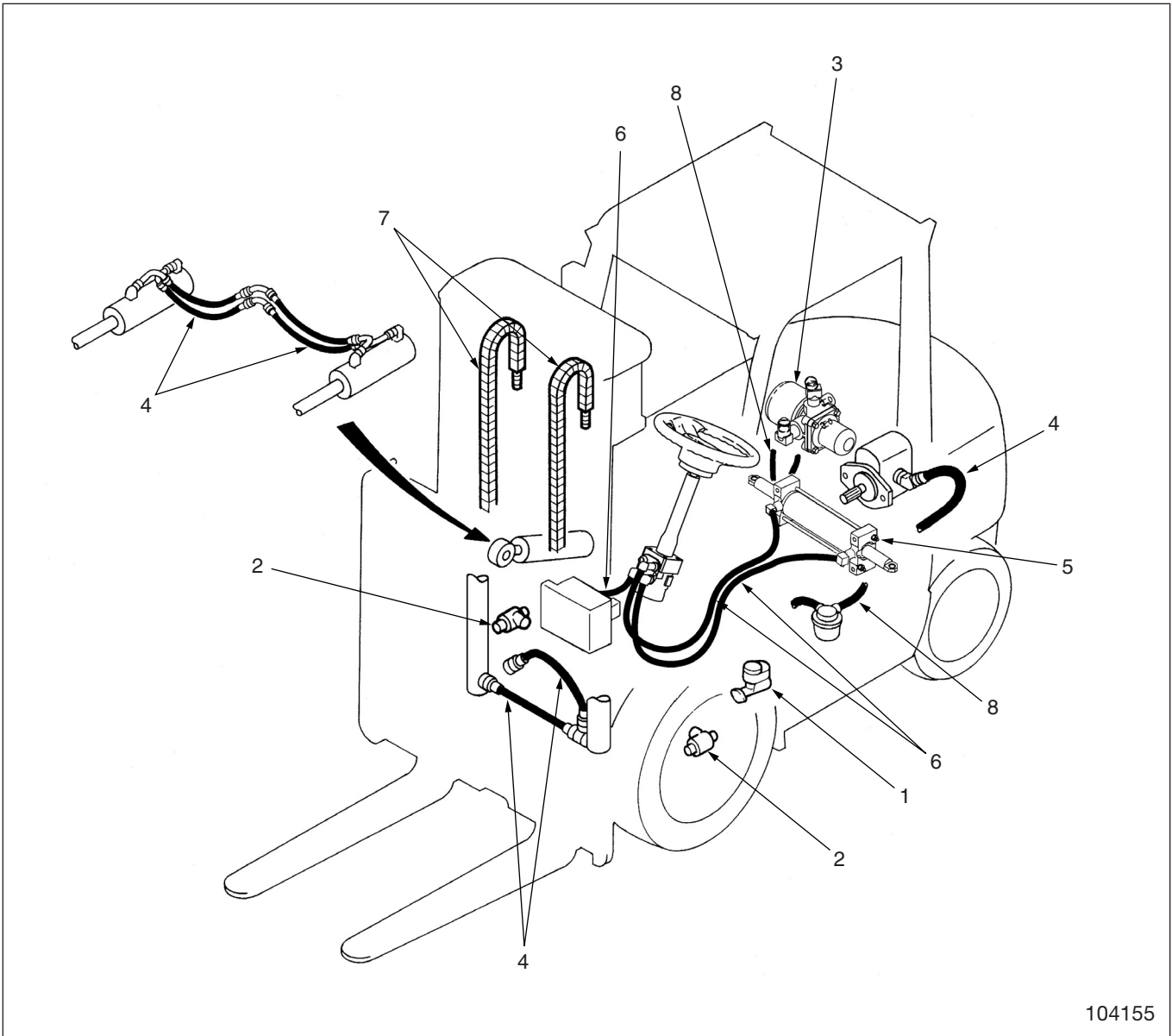


Tightening torque for double nut (lower) ① N·m (kgf·m) [lbf·ft]	A	98 (10) [72.3]	147 (15.0) [108.5]
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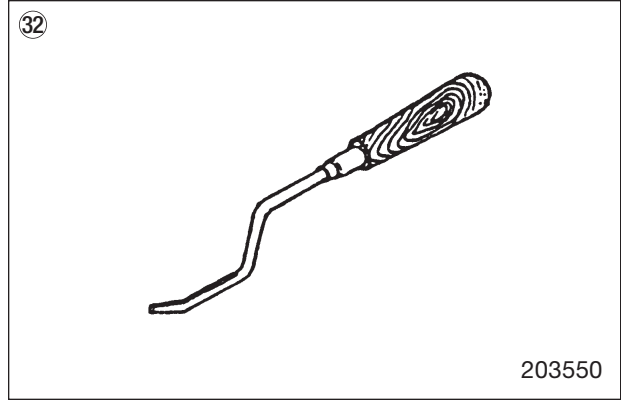
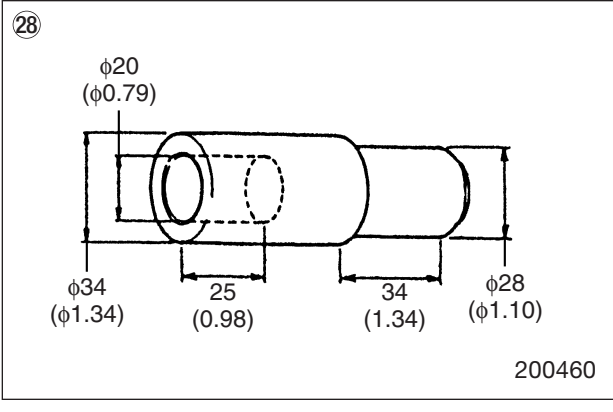
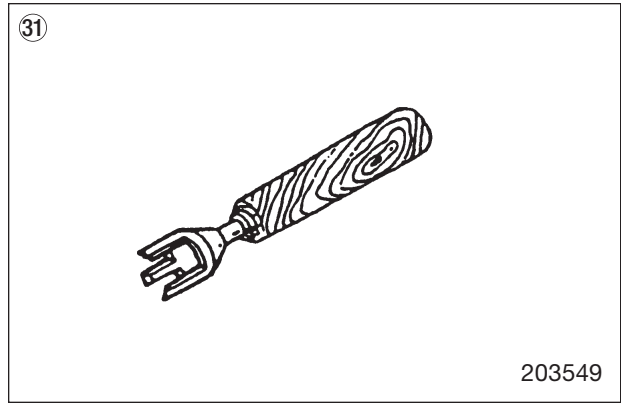
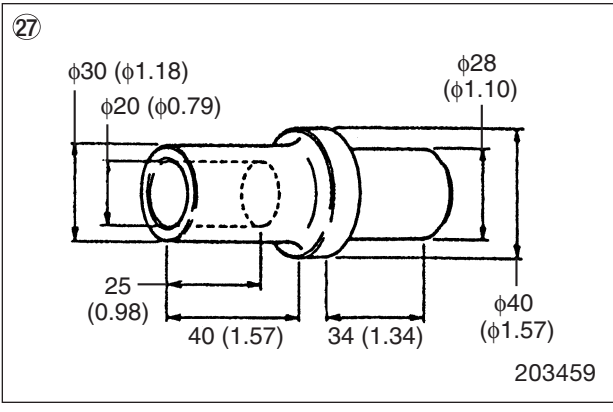
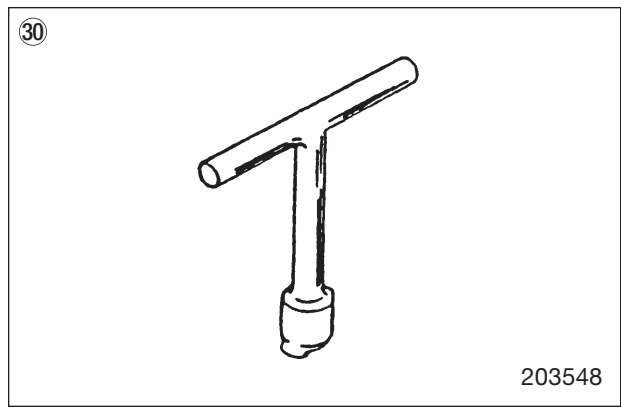
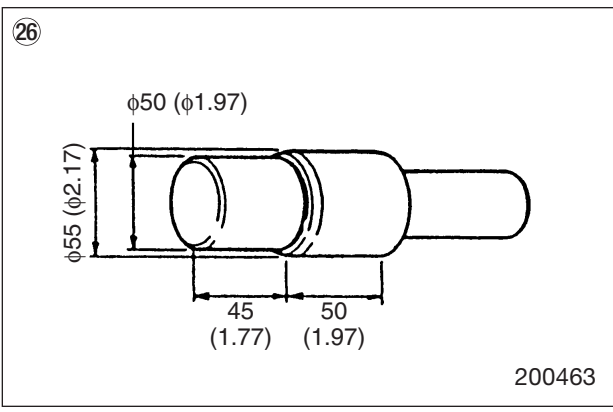
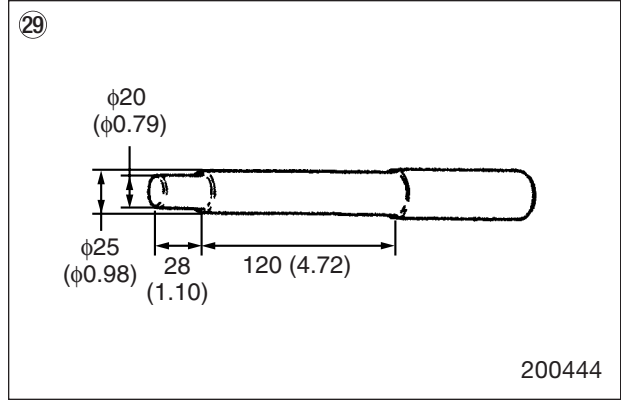
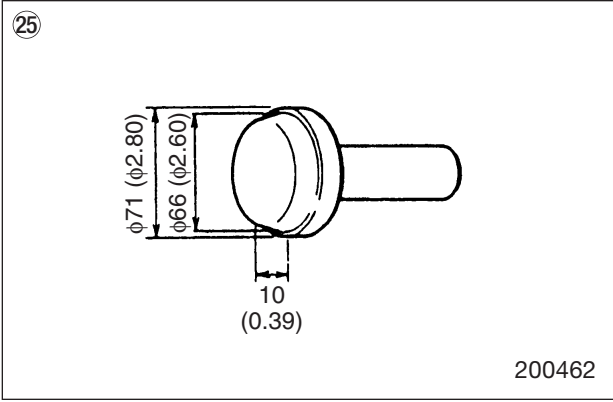


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Location of Periodic Replacement Parts



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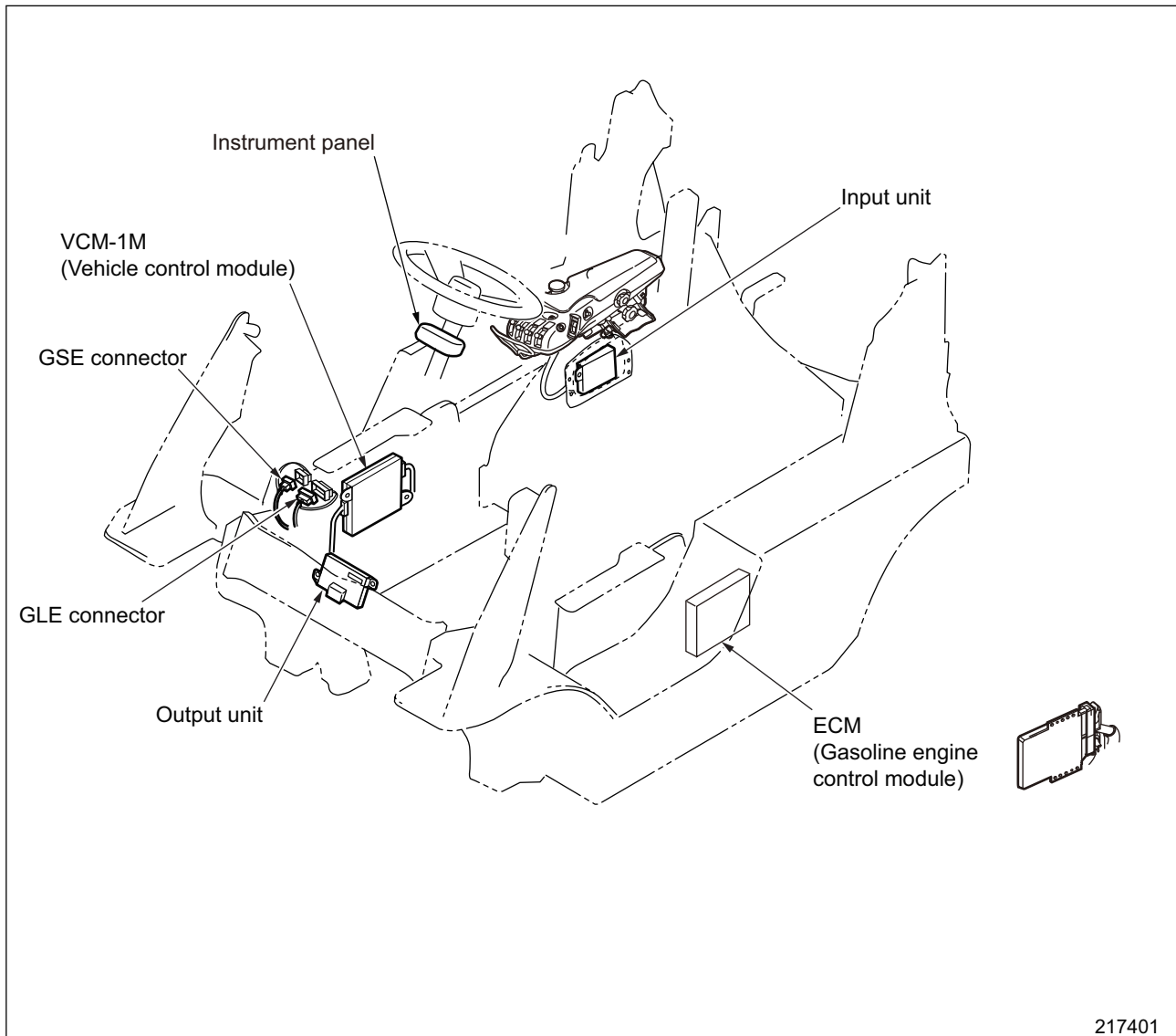
6. Performance

Truck model	Class		1 ton class		
	Gasoline-engine truck		FGC15N	FGC18N	FGC20CN
Capacity	kg (lb)	1500 (3000)	1750 (3500)	2000 (4000)	
Load center	mm (in.)	500 (24)			
Lift speed	Loaded	mm/s (fpm)	620 (120)		
	Unloaded	mm/s (fpm)	630 (125)		
Travel speed (Powershift Truck)	Loaded	km/h (mph)	15.5 (9.5)		
	Unloaded	km/h (mph)	16.5 (10.0)		

Truck model	Class		2 ton class		3 ton class	
	Gasoline-engine truck		FGC20N	FGC25N	FGC30N	FGC33N
Capacity	kg (lb)	2000 (4000)	2500 (5000)	3000 (6000)	3300 (6500)	
Load center	mm (in.)	500 (24)				
Lift speed	Loaded	mm/s (fpm)	580 (115)		530 (105)	
	Unloaded	mm/s (fpm)	590 (115)		540 (105)	
Travel speed (Powershift Truck)	Loaded	km/h (mph)	17.5 (11.0)		16.5 (10.0)	
	Unloaded	km/h (mph)	18.0 (11.5)		17.0 (10.5)	

1. Outline

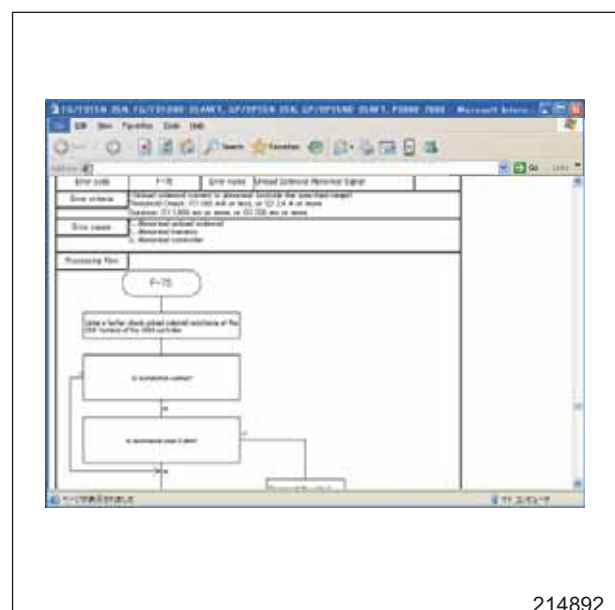
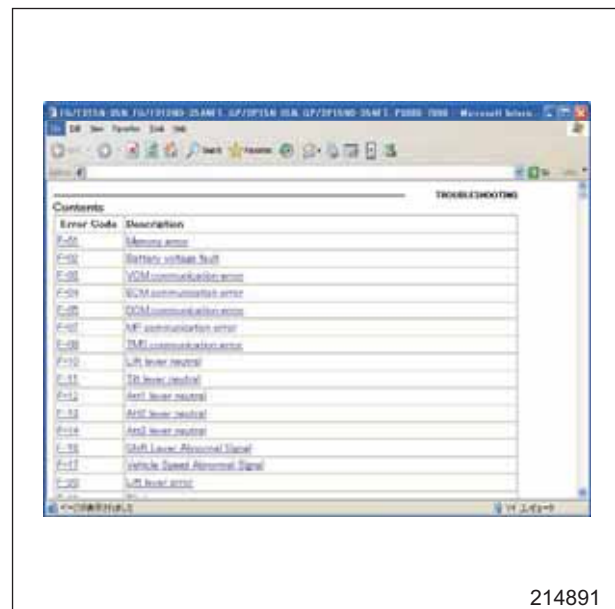
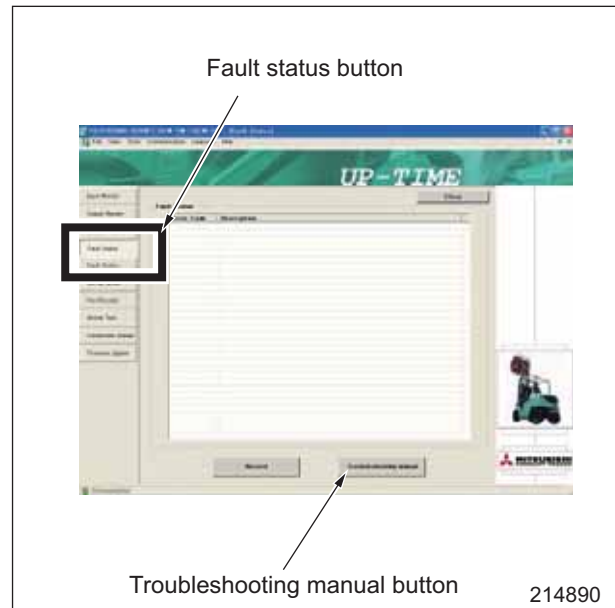
The controllers control both the lift truck body and the engine.
Each controller is located as shown below.



(4) Fault Status

Click the fault status button from the menu or toolbox to display the fault status monitor screen in the main window. On the fault status monitor screen, the user can monitor a current fault condition.

Pressing the troubleshooting manual button in the lower part of screen brings up the troubleshooting information for the error codes.



- (6) Watching the input monitor screen, leave the operator's seat and check that the seat switch turns OFF. (Fig 1-3). A few seconds later the seating flag will turn OFF due to the seat delay counter function. (Fig. 1-4)



Fig. 1-3 Input monitor screen

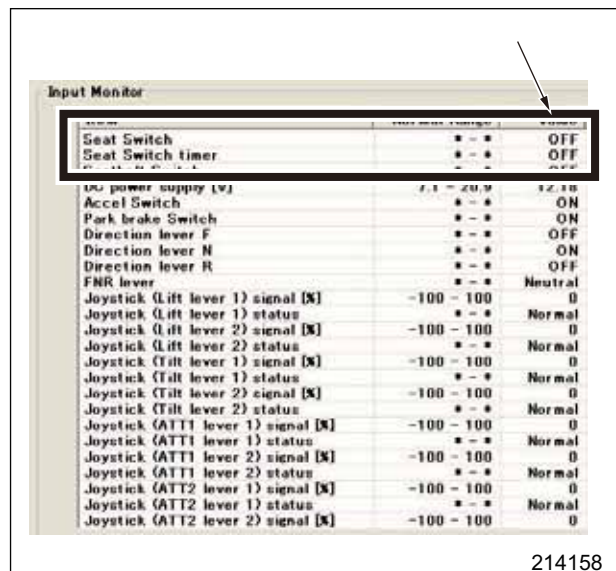


Fig. 1-4 Input monitor screen

- (7) Make sure that the mast interlock indicator lamp on the instrument panel blinks. (Fig. 1-5)

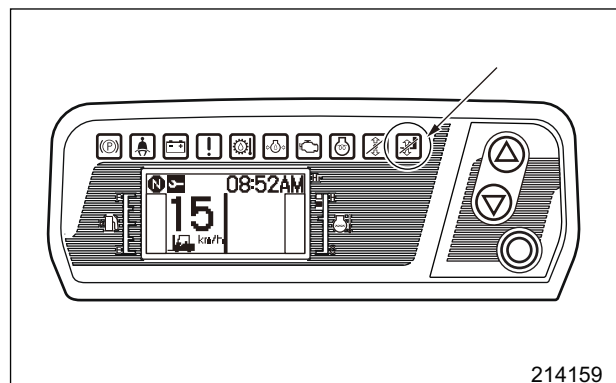


Fig. 1-5 Instrument panel screen

- (5) Check the box of either T/M solenoid F or T/M solenoid R, and press the write button. (Fig. 2-10)
- (6) When the write confirmation dialogue box is displayed, press the YES button the same as (4) above, and when the write completed dialogue box is displayed, press the OK button to complete the set-up.
 - ◆ Do not check both boxes of T/M solenoid F or T/M solenoid R to avoid the controller damage.

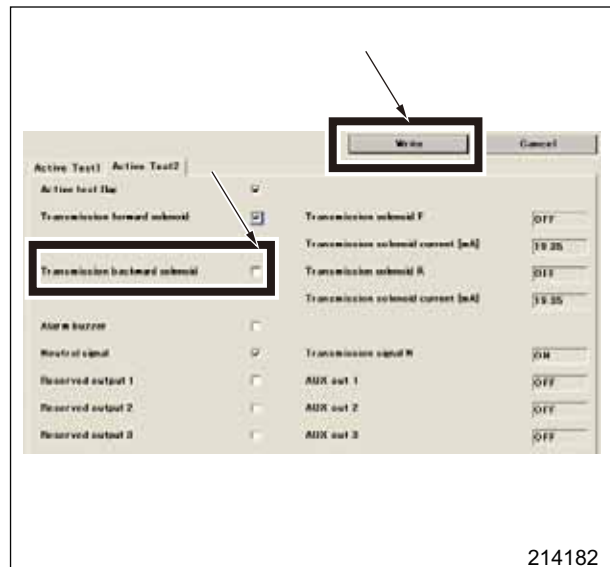


Fig. 2-10 Active test check screen

- (7) Press the output monitor button in the service tool screen to display the output monitor screen (Fig. 2-11), and make sure that the T/M control valve current is 2 (A) or around on the screen.

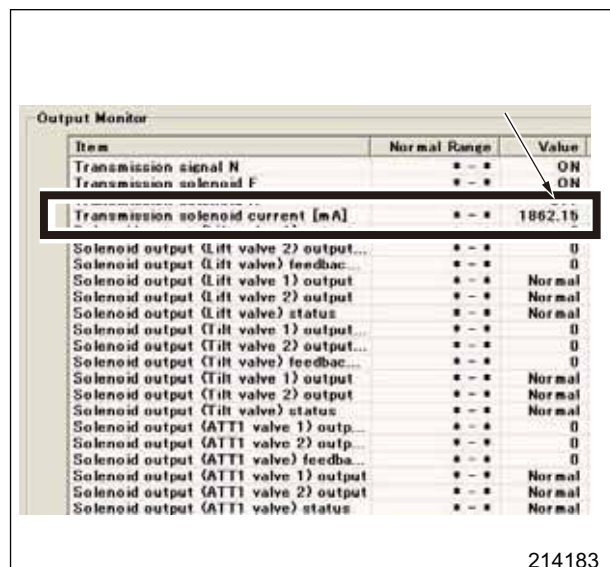


Fig. 2-11 Output monitor screen

- (8) After confirmation, turn the key switch to the OFF position to terminate the active test. Be sure to turn the key switch to the OFF position before proceeding to the next operation.
 - ◆ If a defect is found, refer to "Error Codes and Troubleshooting of Section 10" and check for the possible causes for error codes F-85, F-87, and F-89.

9.6 T/M Solenoid

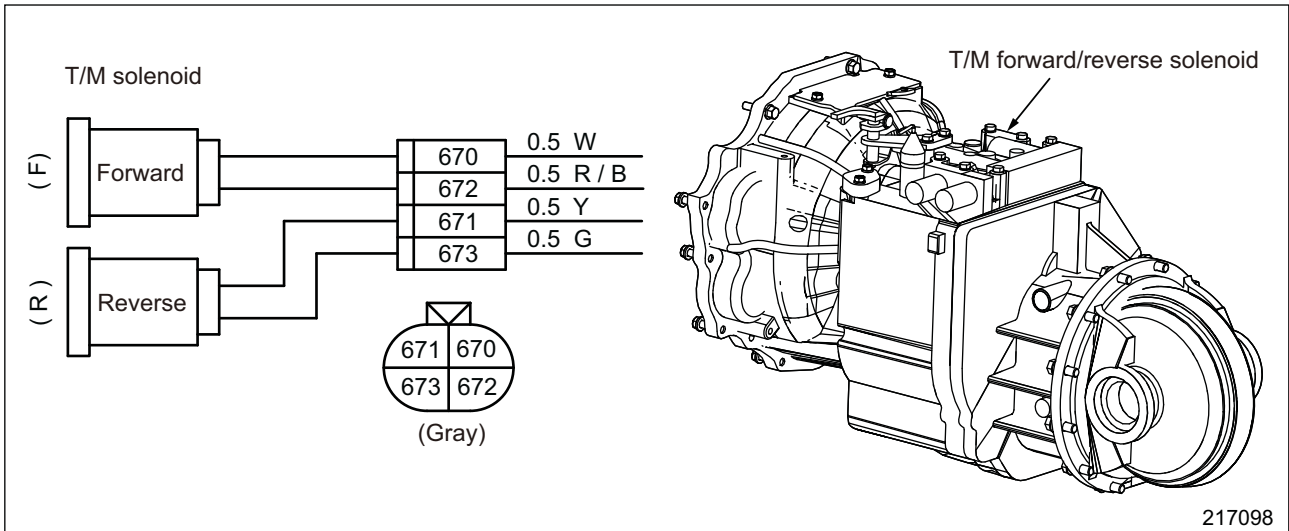


Fig. 7-8 T/M solenoid

9.7 Unload Solenoid

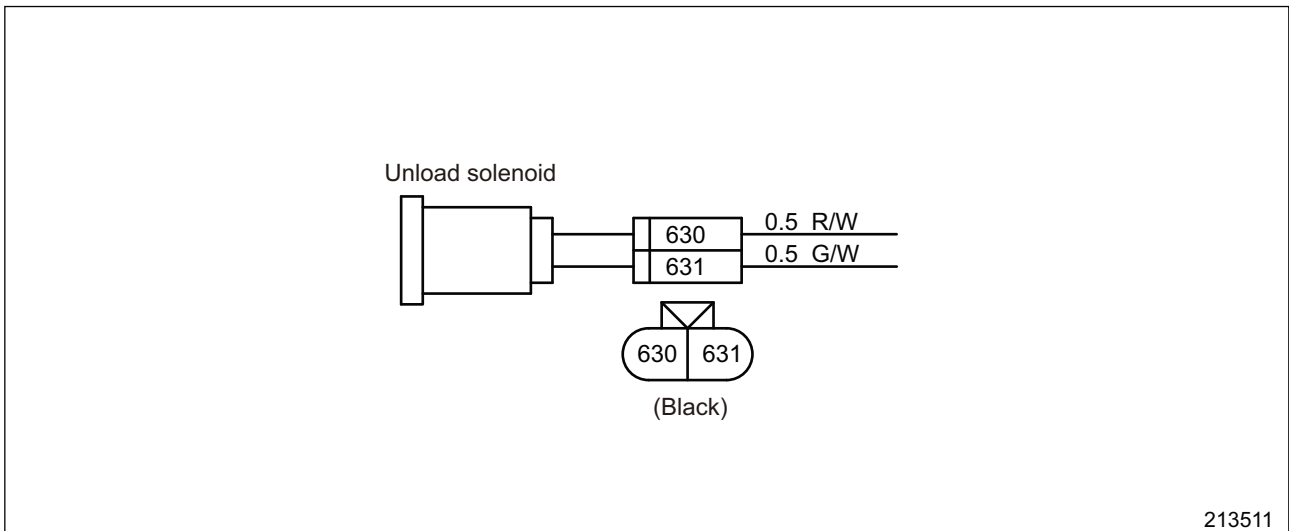


Fig. 7-9 Unload solenoid

9.8 Lift Lock Solenoid

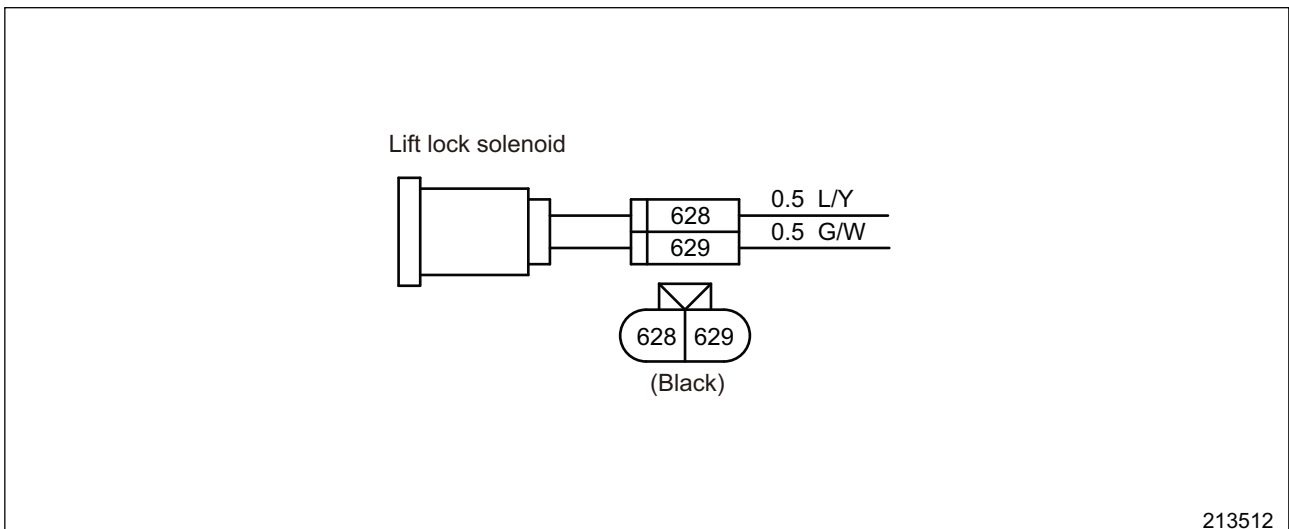


Fig. 7-10 Lift lock solenoid

Diagnosis	Att1 lever error (F24)
Logic conditions	CAN receiving abnormal flag from input unit ————— F24
Recovery	Turn on power again.
Action	Turn OFF the Att1 solenoid output. (Before 400-millisecond continuity, set the current command value to 0mA)
LED blink pattern	D

Diagnosis	Att2 lever error (F26)
Logic conditions	CAN receiving abnormal flag from input unit ————— F26
Recovery	Turn on power again.
Action	Turn OFF the Att2 solenoid output. (Before 400-millisecond continuity, set the current command value to 0mA)
LED blink pattern	D

Diagnosis	Att3 lever error (F28)
Logic conditions	CAN receiving abnormal flag from input unit ————— F28
Recovery	Turn on power again.
Action	Turn OFF the Att3 solenoid output. (Before 400-millisecond continuity, set the current command value to 0mA)
LED blink pattern	D

Diagnosis	Joystick lever error (F29)
Logic conditions	Error of both lever signals (primary and secondary) ————— F29
Recovery	Turn on power again.
Action	Indication only
LED blink pattern	D

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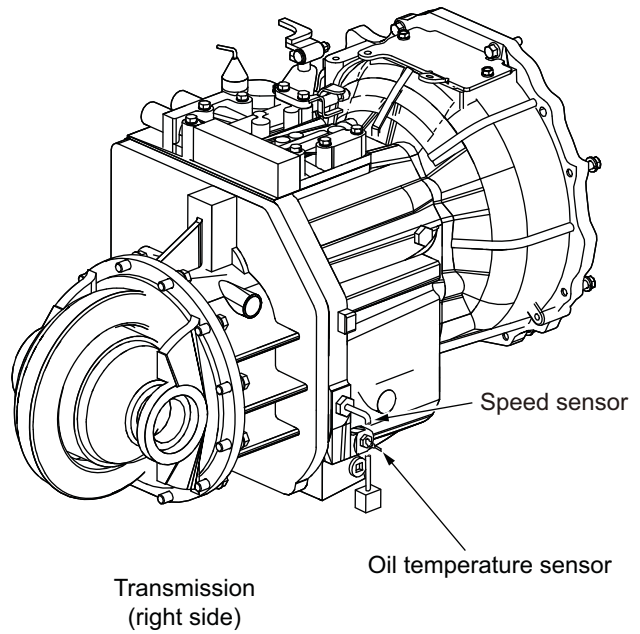
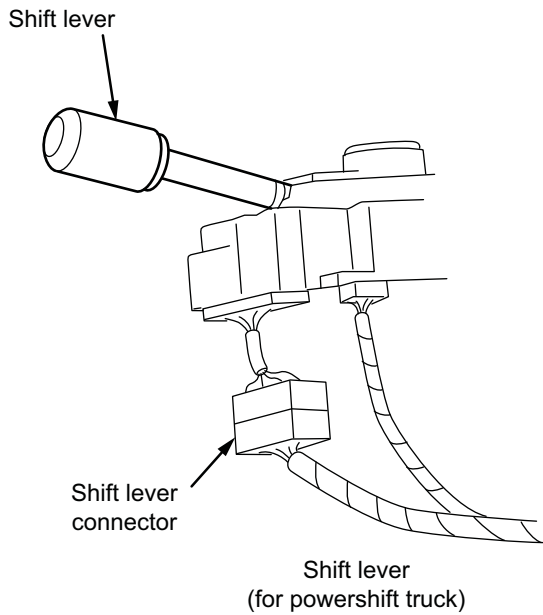
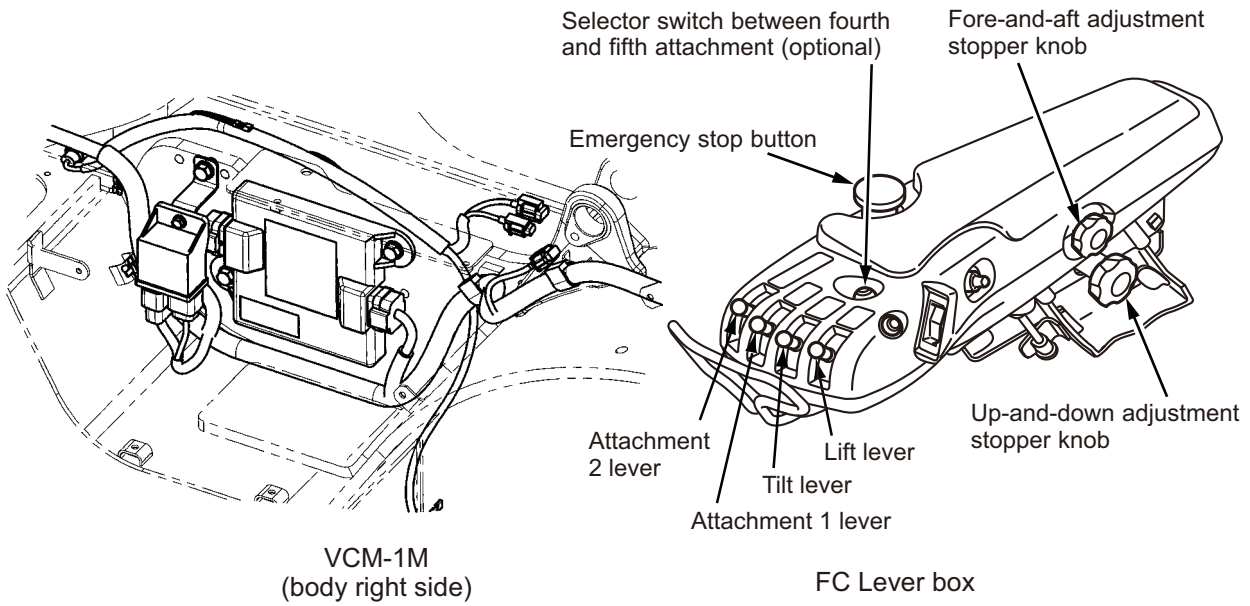
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10.3 Error Codes and Troubleshooting

Error code	Description	Probable cause	Check item
F-01 D-51	Memory check error	1. Controller bad	
F-02 D-52	Battery voltage fault	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. Controller bad	
F-03 D-53 E-03 L-03	VCM communication error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. VCM Controller bad	3. Communication line check
		4. Controller bad	
F-04 D-54 E-04 L-04	ECM communication error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. ECM Controller bad	3. Communication line check
		4. Controller bad	
F-06 S-06	OCM communication error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. OCM Controller bad	3. Communication line check
F-07 D-57 E-07 L-07	MP communication error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. Instrument panel bad	3. Communication line check
		4. Controller bad	
F-08 D-58 E-08 P-08 L-08	TMS communication error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. TMS Controller bad	3. Communication line check
		4. Controller bad	
F-10	Lift lever neutral error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. Lift lever bad	3. Lever connection check
		4. Controller bad	
F-11	Tilt lever neutral error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. Tilt lever bad	3. Lever connection check
		4. Controller bad	
F-12	Att1 lever neutral error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. Att1 lever bad	3. Lever connection check
		4. Controller bad	
F-13	Att2 lever neutral error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. Att2 lever bad	3. Lever connection check
		4. Controller bad	
F-14	Att3 lever neutral error	1. Connector contact bad	1. Connector connection check
		2. Harness bad	2. Harness connection check
		3. Att3 lever bad	3. Lever connection check
		4. Controller bad	

11. Locations of Sensors and Switches



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1.2.6 Installation

Follow the removal sequence reverse.

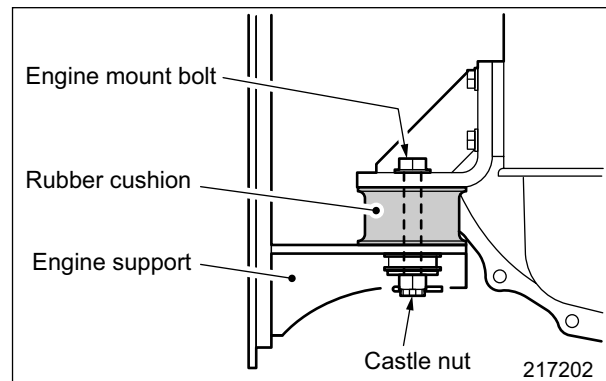
1.2.7 Suggestions for Installation

(1) Engine and transmission assembly

- (a) Apply sealant (oil resistant liquid gasket such as ThreeBond # 1104) to the transmission mounting surface of the front axle/
- (b) Slowly lift the assembly/

Weight of engine and transmission assembly	315kg (695lb)
--	---------------

- (c) While aligning the holes in the rubber cushions and those in the left and right engine supports, lower the lifted assembly.
 - (d) On each side, first insert the engine mounting bolt and align the bolt holes in the transmission and front axle, then fasten the bolts (12 places).
 - (e) Fasten each engine mounting bolt with the castle nut and lock the nut with the split pin.
- (2) Check that the clutch valve plunger is pushed out completely when the cable connected between the inching pedal and the transmission.
- (3) Bleed the air out of the brake fluid circuit after connecting the break pipe.
- (4) When installing the exhaust pipe, use a new gasket.
- (5) Connect the ground (negative) cable to the battery only after making sure that all wiring is connected properly.
- (6) Refill the engine, radiator, front axle, and transmission with oils/coolant, and check for leakage. Unless otherwise specified, use distilled water mixed with LLC at a concentration of 35%.



WARNING

Antifreeze solution is TOXIC. In case of contact with your skin, FLUSH IMMEDIATELY WITH WATER.

Have your Mitsubishi forklift truck dealer discard anti-freeze solution drained from the engine.

- (7) Bleed the air out of fuel circuit of engine/
- (8) After checking the parts, start the engine. Operate the mast lifting / tilting and steering, and check the hydraulic oil level. Also recheck the engine oil, coolant and transmission oil levels.



2. Removal and Installation

2.1 Removal

- (1) Remove the power train assembly.
- (2) Drain the oil from the front axle.
- (3) Remove the bolts holding the flexible plate to the engine flywheel through the hole in the converter case.
- (4) Separate the torque converter and transmission combination from the engine.
- (5) Separate the torque converter and transmission combination from the differential carrier.

2.2 Installation

- (1) Couple the torque converter and transmission combination to the differential carrier.

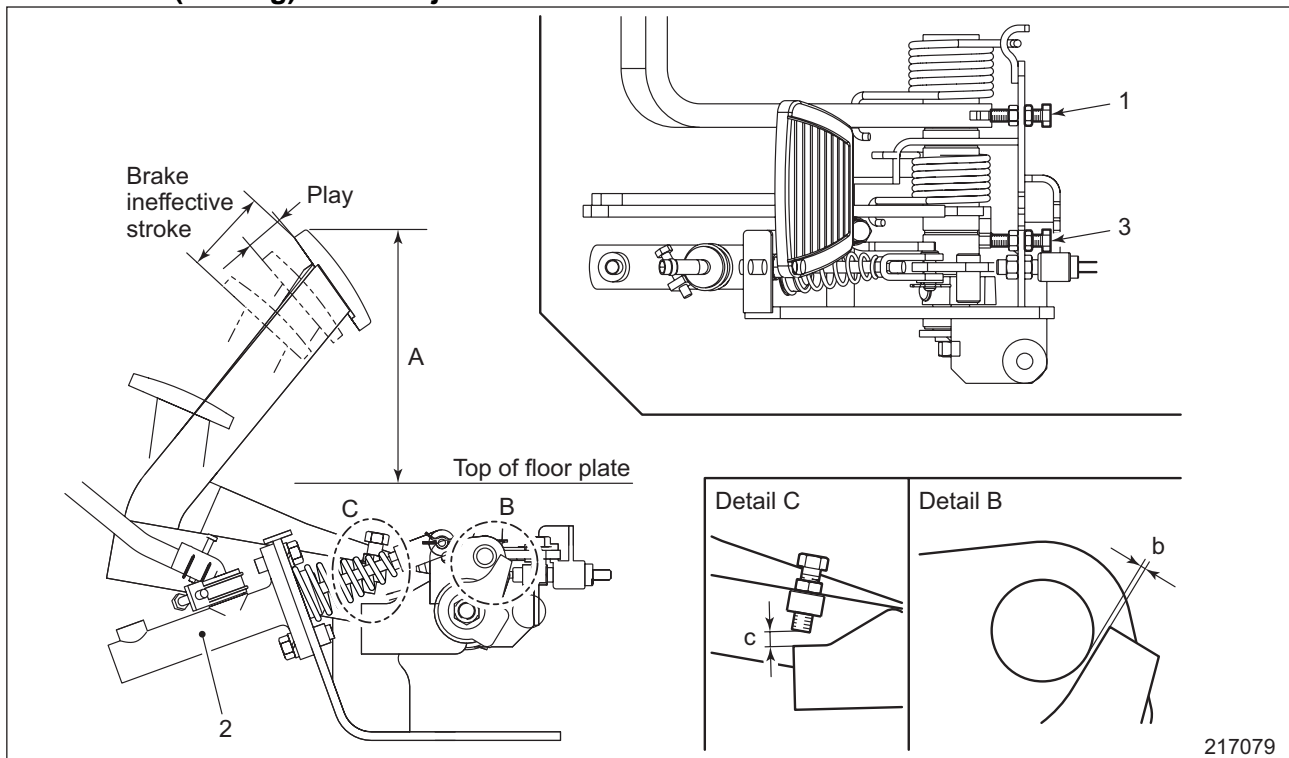
Note: Wash the flange faces of the transmission case and the differential carrier with solvent and apply a coat of sealant to these faces.

- (2) Couple the torque converter and transmission combination to the engine. Put the torque converter in the transmission case so that the mating face of the flexible plate is protruded approx.13 mm (0.51 in.) from the end face of the transmission housing (See also the "GROUP 5 POWER TRAIN."). The clearance between the flywheel and flexible plate should be 1 to 5 mm (0.04 to 0.20 in.) when the torque converter is coupled to the engine. If this clearance is zero, it is an indication that the torque converter is not coupled to the engine properly. Re-couple it to the engine.
- (3) Tighten the bolts that hold the flexible plate to the flywheel through the hole in the converter case.

Note: Tighten the bolts in a diagonal sequence.

- (4) Refill the front axle housing with recommended gear oil.

6.2 Clutch (Inching) Pedal Adjustment



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The clutch (inching) mechanism is linked to the brake pedal. Depressing the brake pedal cuts the pressure acting on the transmission before the brakes take effect, bringing the transmission to a neutral condition.

A faulty inching mechanism may create such problems as failure in clutch disengagement and partial clutch engagement. This in turn may cause an abnormal increase in the transmission temperature, as well as braking malfunctions and clutch plate seizures. Be sure to make all the following adjustments carefully so that these problems may be avoided.

(1) Adjusting brake pedal

- (a) Adjust the brake pedal height A (from the floor plate top surface to the brake pedal top surface) to the following standard value by turning the stopper bolt 1 and then lock it with the lock nut.

Unit: mm (in.)

Brake pedal height A	191 (7.52)
----------------------	------------

- (b) Remove the clearance between the push rod pin of the brake master cylinder 2 and the piston (zero clearance).

Chapter 7 FRONT AXLE AND REDUCTION DIFFERENTIAL

1. Structure	7-1
1.1 Front Axle	7-1
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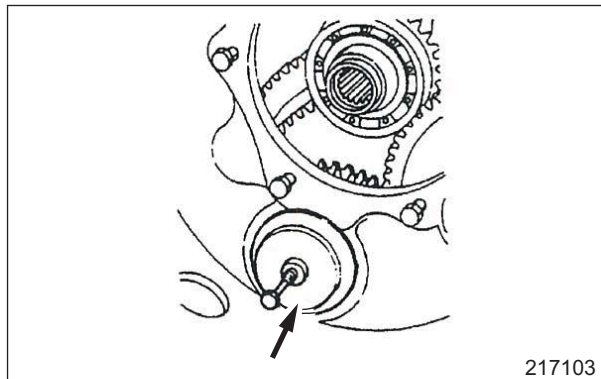
2.3 Reduction Differential

⚠ WARNING

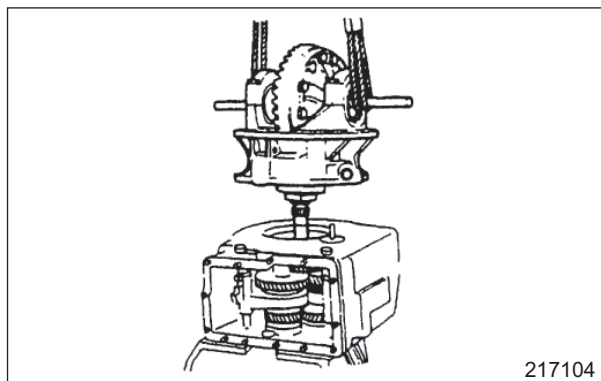
Be careful when removing and installing the differential carrier with engine and transmission as they are heavy.

2.3.1 Removal

- (1) Remove differential carrier with engine and transmission.
- (2) Separate engine from transmission case.
- (3) Remove torque converter.
- (4) Remove oil pump.
- (5) Pull out drive pinion rear end cover.
- (6) Remove drive pinion, fixing nut at drive pinion rear end.
- (7) Remove differential carrier mounting bolts and remove differential carrier from transmission case.



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2.3.2 Installation

To install, follow the removal sequence in reverse.

Unit: N·m (kgf·m) [lbf·ft]

Items	Truck type	
	1 ton class 2 ton class	3 ton class
Tightening torque for carrier to transmission	30 to 40 (3.1 to 4.1) [22 to 30]	
Tightening torque for differential carrier to axle housing	19 to 25 (1.9 to 2.5) [14 to 18]	38 to 52 (3.9 to 5.3) [28 to 38]
Tightening torque for drive pinion lock nut	275 to 343 (28 to 35) [203 to 253]	

3.2.3 Reassembly

To reassemble, follow the disassemble sequence in reverse.

CAUTION

- (1) Arrange shims, washers and the like to install correctly.
- (2) Thoroughly clean the surfaces on which shims, washers, bearings and bearing caps are to be installed.
- (3) Apply gear oil when installing bearings.
- (4) Pack recommended multi-purpose grease cavity between lips when fitting oil seal.

Differential case

- (1) Install pinion mate gears and, side gears together with their thrust washers onto differential case.
- (2) Fit pinion mate shaft (1 ton class).

Note: Pay attention to direction and position of lock pin hole.

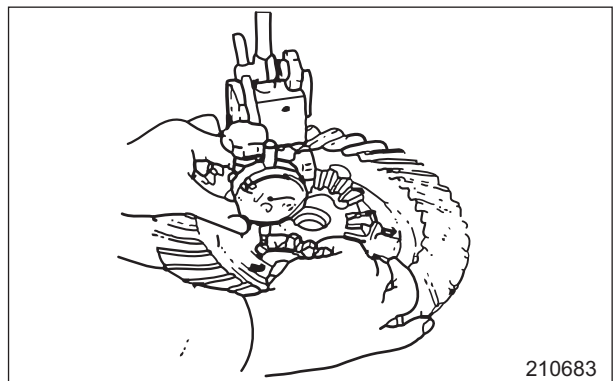
- (3) Measure backlash between side gear and pinion mate gear using dial gauge.

Unit: mm (in.)

Backlash	A	0.15 to 0.20 (0.0059 to 0.0079)
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A: Standard value

- (4) If out of specification, change side gear thrust washers so that specified backlash can be obtained.
- (5) Strike the pinion mate shaft lock pin into pin hole using a punch (1 ton class).

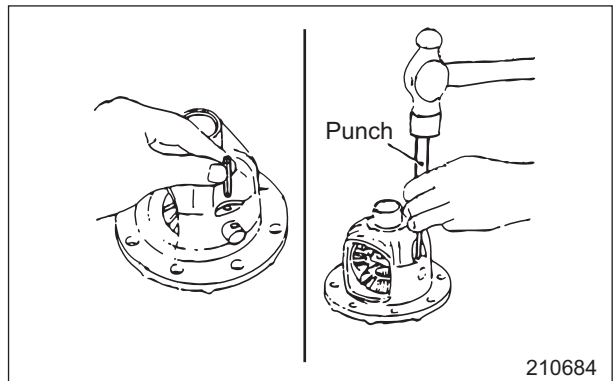


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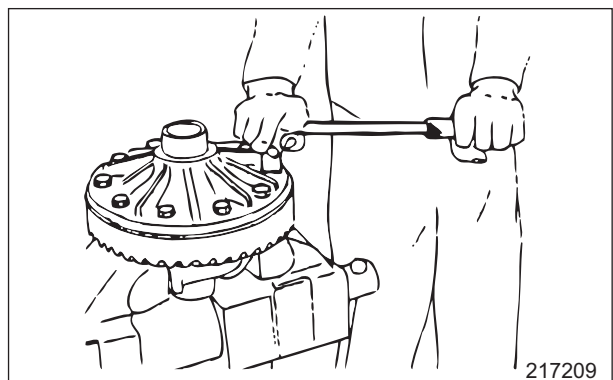
- (6) Place the ring gear on the differential case. Tighten bolts in a diagonal sequence, lightly tapping bolt head with a hammer.

Unit: N·m (kgf·m) [lbf·ft]

Tightening torque for ring gear bolt	196 to 226 (20 to 23) [145 to 167]
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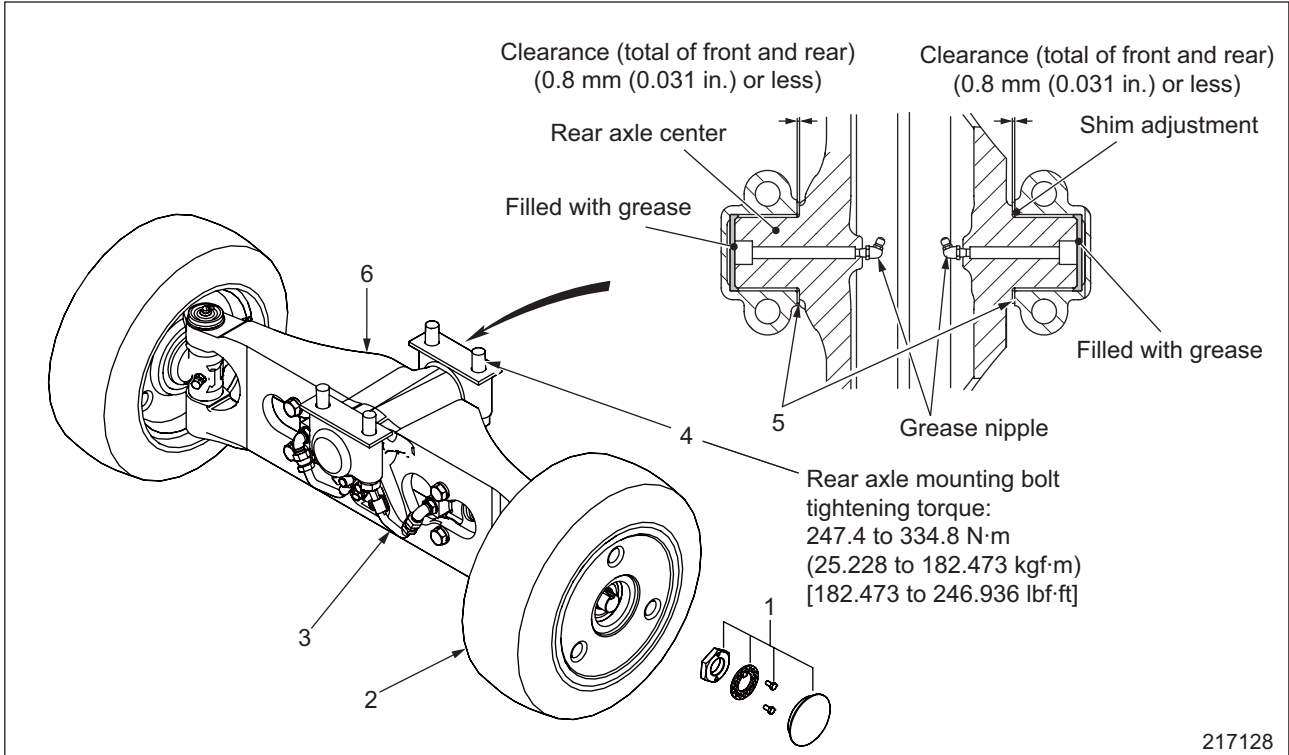
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2. Removal and Installation

2.1 Rear Wheel and Rear Axle Assembly



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2.1.1 Removal of rear wheels

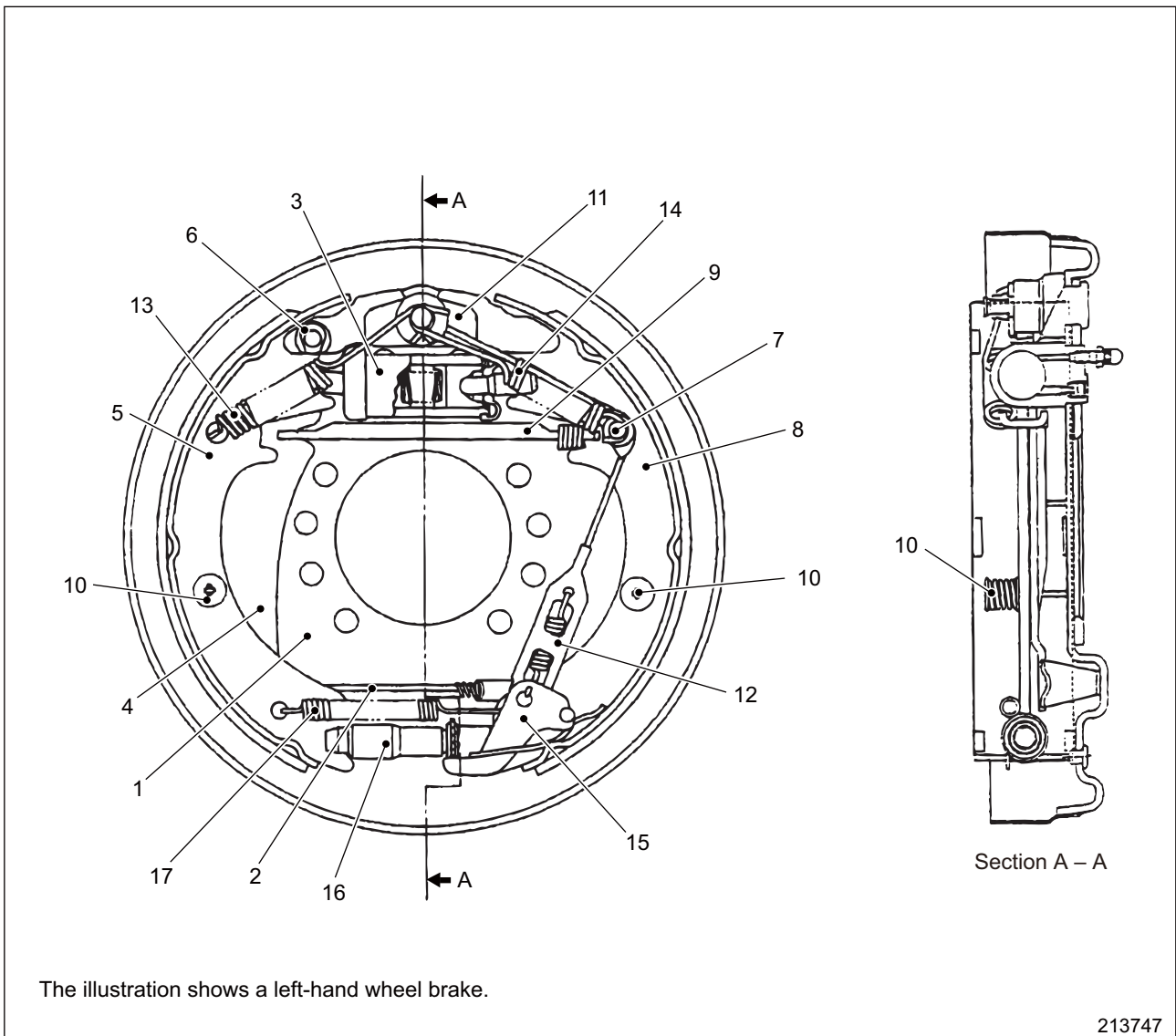
- (1) Set the parking brake and block the front wheels.
- (2) Loosen the wheel nut about two turns and raise the rear end of the truck by using a jack or crane at the specified point.
 - (a) Method using a jack
Position the jack under the counterweight at the jacking point and raise the rear tire.
 - (b) Method using a crane
Attach lifting sling to the drawbar pin in the counterweight and lift it.
- (3) Remove the wheels.



CAUTION

When the lift truck is lifted by either method, place jack stands under the frame to support it securely.

2-3 ton class



Reassembly sequence

- | | |
|--------------------------------------|--------------------------------------|
| 1 Backing plate assembly | 10 Pin, Hold-down spring, Cup |
| 2 Parking brake cable, Snap ring | 11 Shoe guide plate |
| 3 Wheel cylinder | 12 Fitting ring |
| 4 Parking brake lever | 13 Return spring (primary) |
| 5 Primary shoe and lining assembly | 14 Return spring (secondary) |
| 6 Retainer, Washer | 15 Adjusting lever, Adjusting spring |
| 7 Pin, Sheave, Washer | 16 Adjusting screw |
| 8 Secondary shoe and lining assembly | 17 Return spring |
| 9 Strut, Anti-rattle spring | |

Prepare parts 4 through 8 in assembly beforehand.

5. Service Data

Unit: mm (in.)

Item			Truck type	
			1 ton class	2-3 ton class
Master cylinder	Inside diameter of cylinder body 1	A	19.05 (0.75)	
	Diameter of piston 2	A	19.05 (0.75)	
	Clearance between piston and cylinder	A	0.020 to 0.105 (0.00079 to 0.00413)	
		B	0.15 (0.0059)	
	Primary cup tightness 3	A	1.0 (0.039)	
		B	0.4 (0.016) (Replace every year or whenever overhauling)	
	Secondary cup tightness 4	A	1.1 (0.043)	
		B	0.4 (0.016) (Replace every year or whenever overhauling)	
Free length of return spring 5	A	59.2 (2.3)		
	B	53.9 (2.1) (Replace every year or whenever overhauling)		

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A: Standard value B: Repair or service limit

2.4 Steering Valve

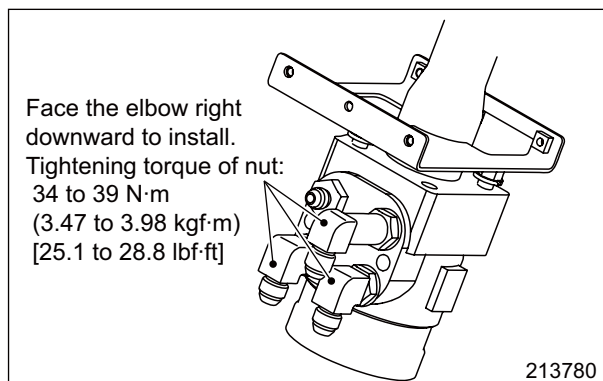
2.4.1 Removal

- (1) Remove the cover 4 around the steering column.
- (2) Disconnect four hoses from the steering valve.
- (3) Remove the bolt 5 and then, remove the steering valve 6.

2.4.2 Installation

For installation of the steering valve, follow the removal sequence in reverse, while following the instructions below.

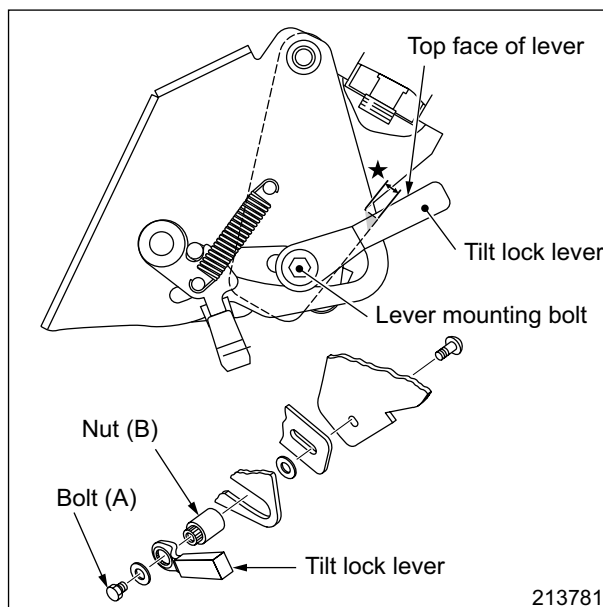
- (1) Apply grease to the serrated area on the lower part of the steering shaft.
- (2) Tighten the mounting bolt to the specified torque.
- (3) Be careful about the orientation when installing the elbow on the steering valve. Tighten it to the specified torque.



2.5 Tilt Lock Lever

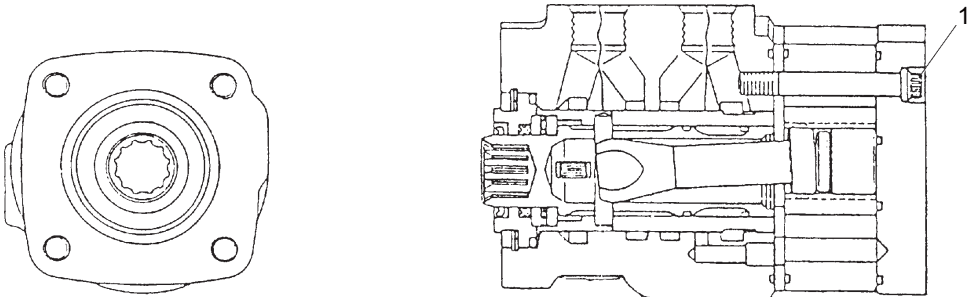
2.5.1 Disassembly

- (1) Put alignment marks on the tilt lock lever and the nut (B) for proper installation at reassembly.
- (2) Remove the bolt (A) and then, remove the tilt lock lever.



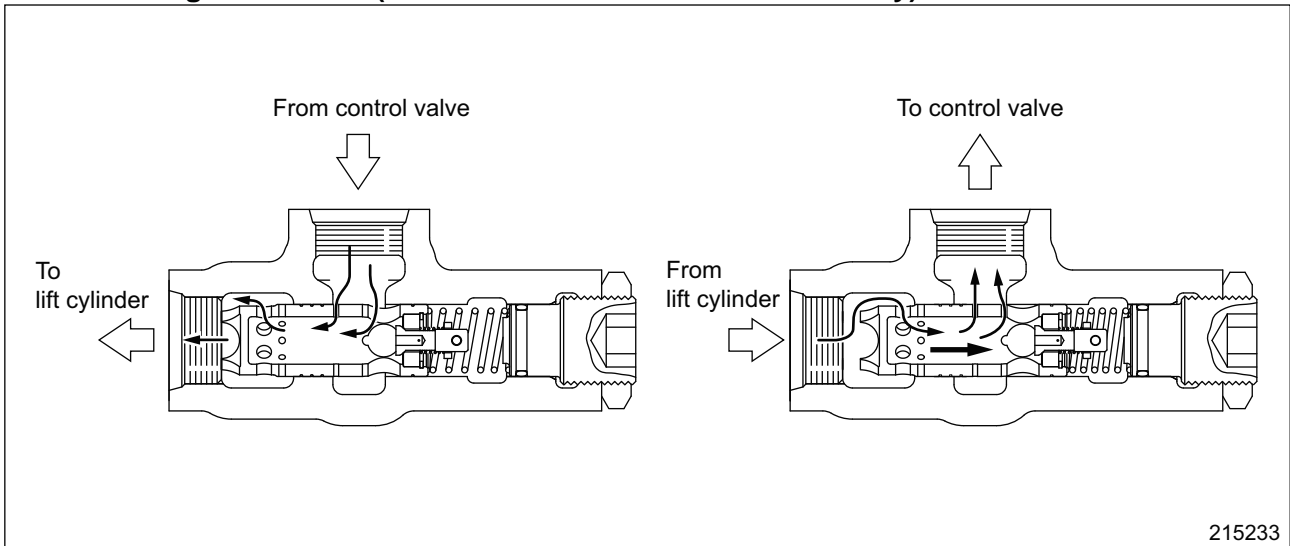
5. Service Data

Unit: N·m (kgf·m) [lbf·ft]

Item		Truck type			
		1 ton class	2 ton class	3 ton class	
Steering effort (at steering wheel rim)	N (kgf) [lbf]	A	13 (1.3) [2.9] or less		
Tightening torque of steering wheel nuts		A	52.6 to 64.4 (5.36 to 6.57) [38.8 to 47.5]		
Tightening torque of steering bracket bolts		A	32.3 (3.3) [23.8]		
Steering valve mounting bolt tightening torque		A	39 ± 5 (4.0 ± 0.5) [28.8 ± 3.7]		
Steering valve	Displacement	cm ³ /rev (U.S.gal/rev) [cu.in./rev]	A	69 (0.018) [4.2]	80 (0.021) [4.9]
	Rotating torque in normal operation		A	1.5 (0.15) [1.1]	
	Tightening torque of cap bolt 1		A	23 (2.3) [17]	23 (2.3) [17]
Steering system relief valve set pressure	MPa (kgf/cm ²) [psi]	A	8.8 ^{+0.5} ₀ (90 ^{+5.1} ₀) [1276 ^{+72.5} ₀]	10.3 ^{+0.5} ₀ (105 ^{+5.1} ₀) [1494 ^{+72.5} ₀]	10.3 ^{+0.5} ₀ (105 ^{+5.1} ₀) [1494 ^{+72.5} ₀]
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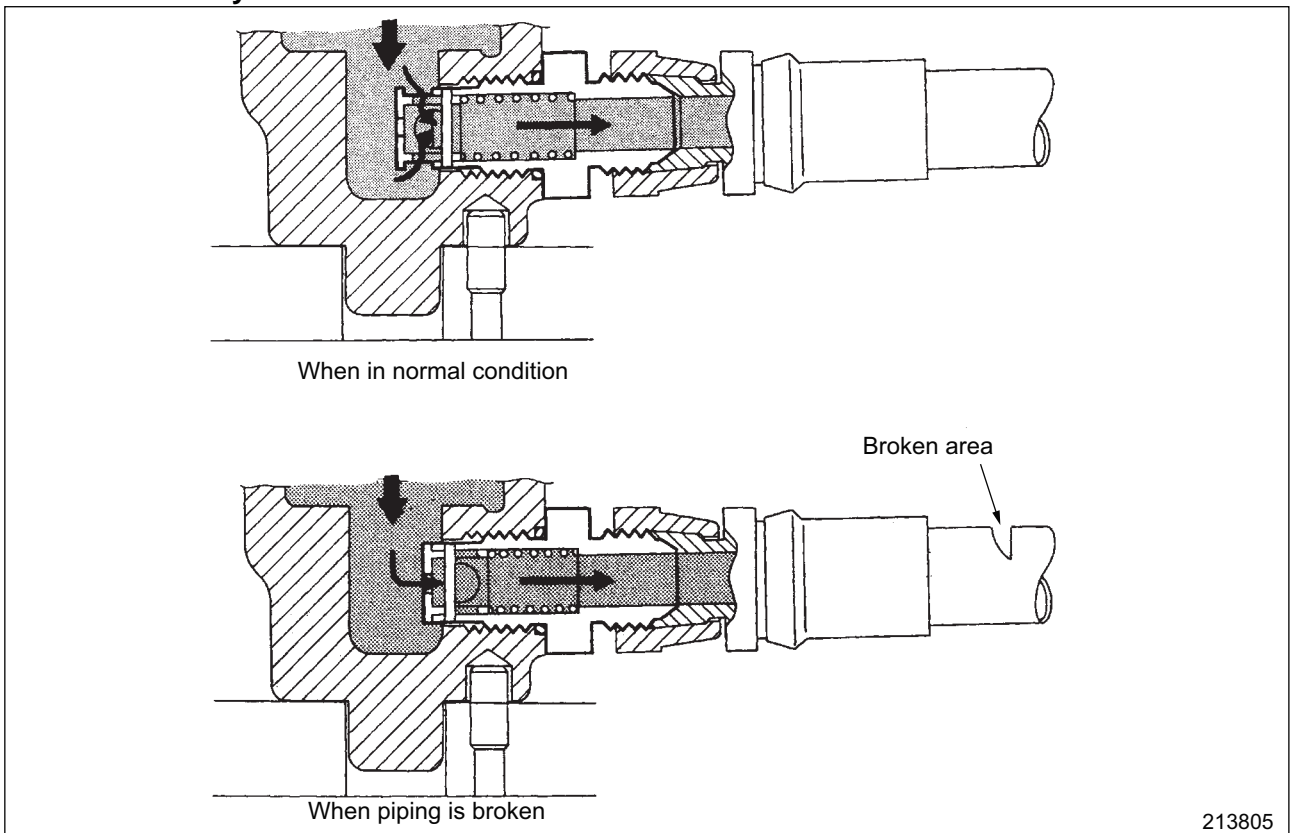
A: Standard value

1.7 Flow Regulator Valve (for Trucks with FC Control Valve Only)



The flow regulator valve is connected between the control valve and the lift cylinder. When the forks are lowered, the valve regulates the oil flow as the load varies on the lift cylinder, thereby keeping the forks lowering speed constant, irrespective of the load weight.

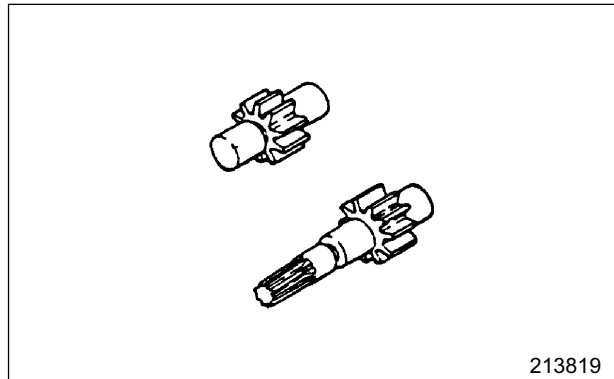
1.8 Down Safety Valve



The down safety valve is located at the bottom of the right lift cylinder. This valve is a safety valve which regulates the flow of oil to prevent the fork from moving down too quickly if the piping between the lift cylinder and flow regulator valve is broken; or if the flow of return oil from the lift cylinder becomes excessive due to a maladjusted regulator valve or a fault of another component.

Inspection and Repair

- (1) Drive and driven gears
 - (a) Check the gear teeth for wear, chipping or other defects.
 - (b) Check the side faces of the gears for wear or damage.
 - (c) Check the shafts for wear or damage.
- (2) Covers, body and bushings



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Reassembly

To reassemble, follow the disassembly sequence in reverse. Also follow the instructions given below.

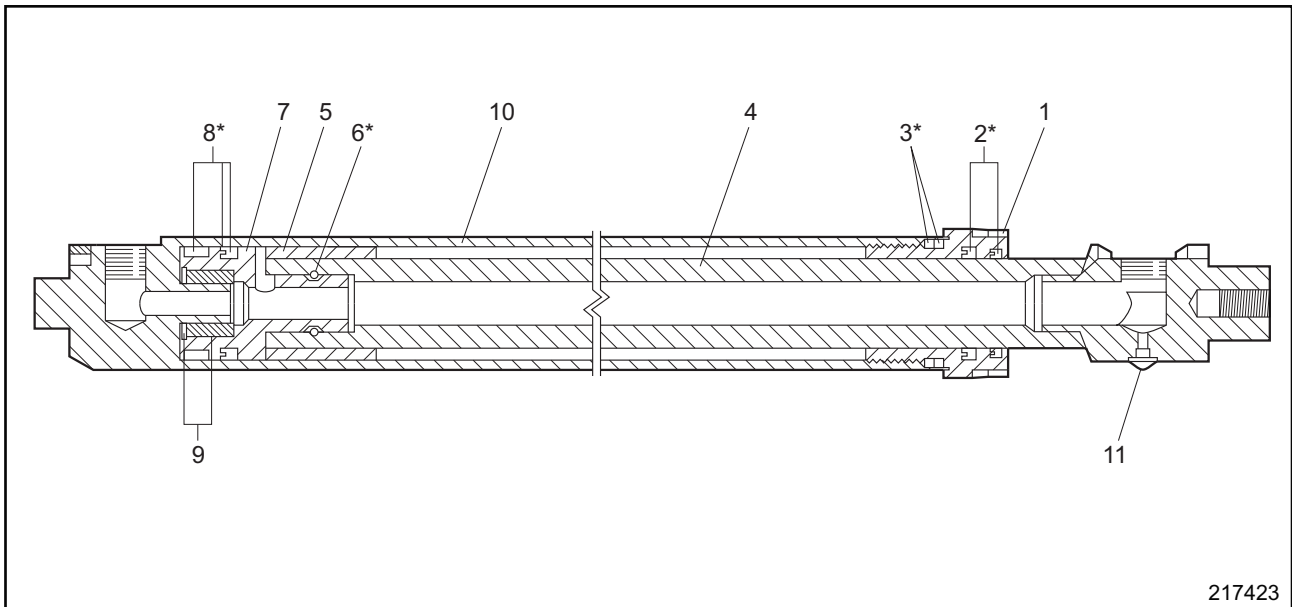
- (1) Replace the seal kit parts with new ones.
- (2) Completely remove oil or grease on the mating surfaces of covers 1, 2 and body 8.
- (3) Visually check all the parts for cleanliness and apply hydraulic oil to the inside surface of the body before reassembly.
- (4) Apply grease to the lip of the shaft seal.
- (5) Be careful not to cause damage to the lip of shaft seal by spline edges of drive gear 5.
- (6) Tighten the bolts evenly and progressively.
- (7) The pump is assembled properly if the pipe wrench fitted on the pump shaft can be turned easily by hand.

Test operation

Perform test operation after installing the pump.

- (1) Check that the oil amount in the hydraulic tank is sufficient.
- (2) Attach a pressure gauge to the pump delivery hose.
Refer to "Main Relief Valve."
- (3) Start the engine, adjust the adjusting screw of the main relief valve in sequence from 0 to 18.1 MPa (0 to 185 kgf/cm²), and check the temperature rise of the pump body by touching it by hand. If the temperature rise of the pump body is substantial compared to the oil temperature rise, disassemble again for checking.
- (4) Set the relief valve to the specified pressure.
- (5) Measure the lifting speed of the fork without a load. If the speed is to the specified value, the pump discharge volume is normal.
- (6) Check that the fork operates normally by raising and lowering it under load.

Reassembly



Sequence

- | | |
|-----------------------|---------------------------------------|
| 1 Retainer | 6 Pull-in wire |
| 2 Wire ring, Rod seal | 7 Piston |
| 3 Backup ring, O-ring | 8 Backup ring, Piston seal, Wear ring |
| 4 Piston rod | 9 Sleeve, Snap ring |
| 5 Spacer | 10 Cylinder tube |
| | 11 Seal washer, Bleed screw |
- Install parts 1, 2, 3, 4, 5, 6, 7 to part 4.

Note: Replacement parts marked with an asterisk (*) are included in the seal kit.

Suggestions for Reassembly

- (1) Use all parts in the seal kit to replace removed parts.
- (2) Apply hydraulic oil to the sliding sections on the cylinder tube inner surface and piston rod outer surface before installation.
- (3) Tighten the retainer 1 to the specified torque.

Unit: N·m (kgf·m) [lbf·ft]

Item	Truck model	1, 2 ton classes	3 ton class
Tightening torque for retainer		170 to 240 (17.3 to 24.5) [125 to 177]	200 to 270 (20.4 to 27.5) [148 to 199]

- (4) Tighten the bleed screws 11 to the specified torque.

Unit: N·m (kgf·m) [lbf·ft]

Tightening torque for bleed screw	4.5 to 5.0 (0.46 to 0.51) [3.32 to 3.69]
-----------------------------------	--

3.2 Control Valve

(1) External leakage

- (a) Check for oil leaks from the joint between adjacent valve housings sealed by O-ring.
- (b) Check for oil leaks from the screw connections.

(2) Internal leakage

It is not practical to check the control valve alone for internal leakage. How to check the control valve in place (under normal operating conditions) will be described.

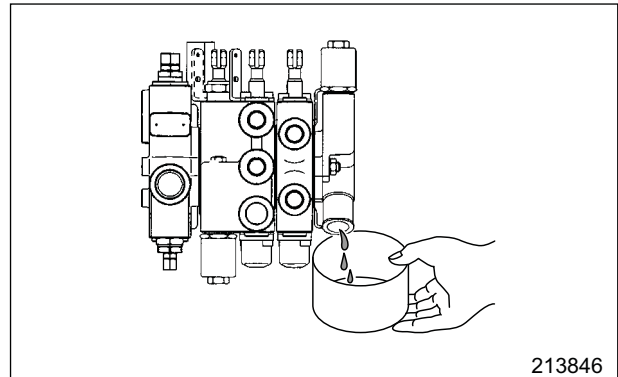
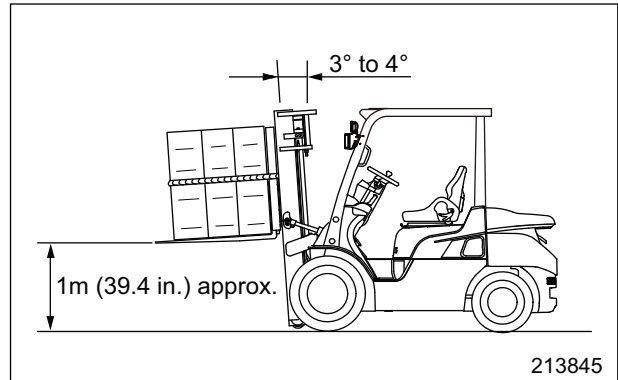
The internal leakage to be checked includes leakages occurring at the lift spool, tilt spool, tilt lock valve and check valves at the oil temperature of approximately 50°C (122°F).

- (a) Pick up a load equal to the rated capacity, and lift it approximately 1 m (39.4 in.) high. Tilt the mast about 3° to 4° forward, and stop the engine.
- (b) Quickly disconnect the oil return hose, and start collecting the oil coming out of the hose as shown.

Unit: cc (cu in.)

Amount of oil collected for 15 minutes	20 (1.2) or less
--	------------------

- (c) If the lift cylinders or tilt cylinders drift (the mast tilts forward or the fork lowers) excessively in spite of the fact that the amount of oil collected for 15 minutes is less than 20 cc (1.2 cu in.), measure the internal leakage of each cylinder. (The measurement is the assembly standard and not the service limit.)



6.1.2 Hydraulic Circuit Diagram of MC Hydraulic Control Valve

•For the entire diagram of the hydraulic system, refer to 1.2 Hydraulic Circuit Diagram.

- 1 Priority valve
- 2 Main relief valve
- 3 Steering system relief valve
- 4 Lift valve
- 5 Second valve (operates in conjunction with lift lowering switch)
- 6 Tilt valve
- 7 Attachment valve
- 8 Unload Valve
- 9 Solenoid for unload valve
- 10 Center bypass port
- 11 Parallel feeder

P : Supplied oil from pump

PF : To steering valve

T2 : Return from steering valve

T1 :To hydraulic tank

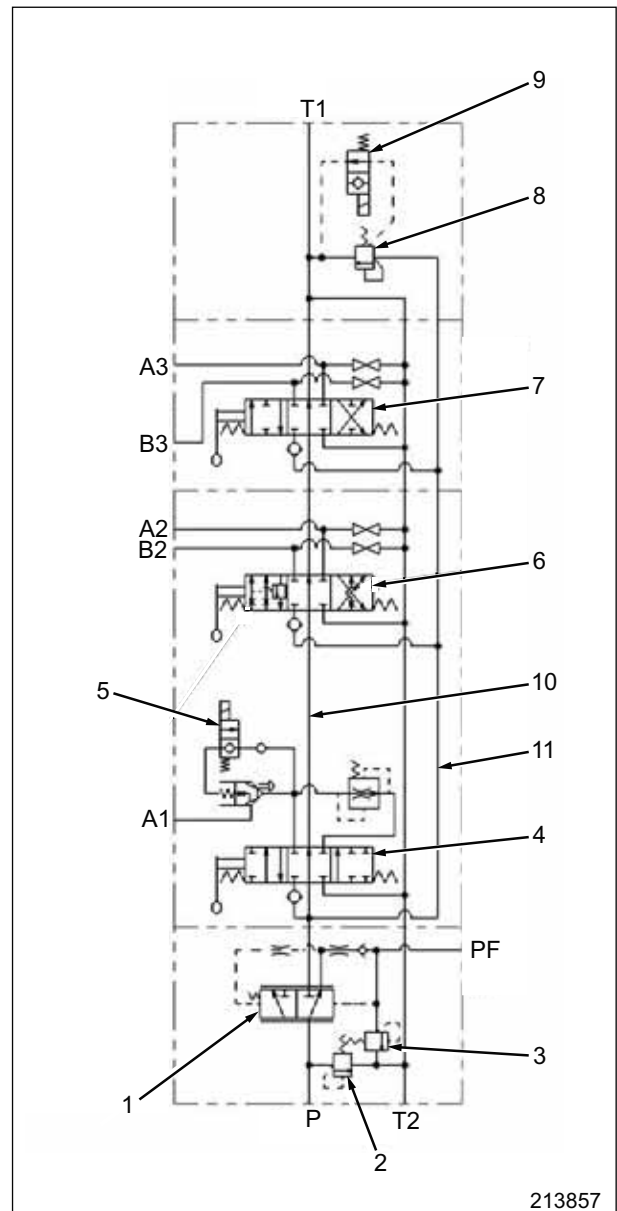
A1 :To lift cylinder

A2 : To tilt cylinder rod end

B2 : To tilt cylinder head end

A3 : To actuator for attachment valve

B3 : To actuator for attachment valve

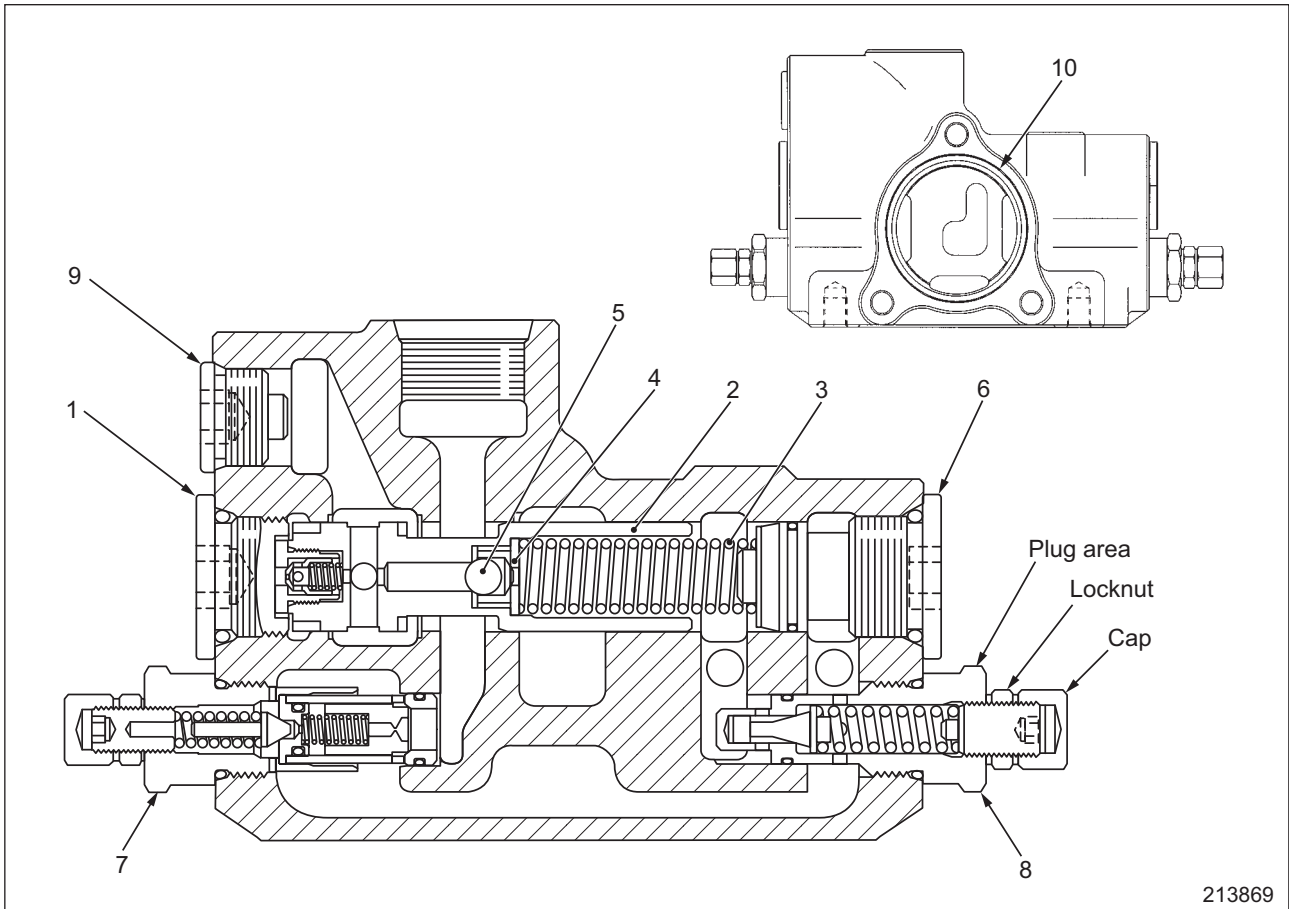


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6.3 Disassembly and Reassembly

6.3.1 Valve of Inlet Cover Section

Disassembly



Sequence

I. Priority valve (1 thru 6)

- | | | |
|------------------|------------|----------------|
| 1 Plug, O-ring | 3 Spring | 5 Ball |
| 2 Spool assembly | 4 Retainer | 6 Plug, O-ring |

II. Main relief valve (7)

- 7 Main relief valve

III. Steering system relief valve (8)

- 8 Steering system relief valve

IV. Other parts (9 and 10)

- | | |
|----------------|-----------|
| 9 Plug, O-ring | 10 O-ring |
|----------------|-----------|

Suggestions for Disassembly

- (1) Do not disassemble the main relief valve and the relief valve of the steering system unless there is any abnormality.

Note: When loosening the relief valve, apply a spanner to the plug area of the relief valve to remove. If the lock nut is loosened by mistake, the set pressure of the relief valve changes. If it is loosened by mistake, use a pressure gauge to reset.

Action

The illustrations on the previous page show the valve in operation. When the pump is not operating (the engine is stopped), the valve spool 1 is pressed by the spring 2 to the rightmost position.

The extra flow restricted area G is closed.

When the valve is in operation, oil introduced from the port P enters the hollow portion of the valve spool from the inlet hole in the spool and passes through the control orifice E and PF restricted area F before it flows in the passage B. This is the PF flow of oil.

The pressure of PF flow acts on the left end of the valve spool 1 to join the force of spring 2 in pressing the valve spool 1 to the right.

In the meantime, oil entering the hollow portion of the valve spool 1 and flowing in the direction of the damper chamber C presses the valve 3 to the right. The oil is released into the chamber C from the small hole (s) in the forward end of the valve 3 and presses the valve spool 1 to the left.

When the volume of flow from the port P increases, PF flow in the hollow portion of the valve spool 1 increases as well. As a result, the pressure difference between before and after the control orifice E becomes greater, causing the valve spool 1 to move to the left and narrow the PF restricted area F. When the restricted area F is closed, PF flow decreases and the pressure difference decreases as well.

When the volume of flow from the port P decreases, PF flow in the hollow portion of the valve spool 1 decreases. As a result, the pressure difference between before and after the control orifice E decreases. The valve moves to the right to close the extra flow restricted area G. The extra flow decreases and PF flow increases, and as a result, the pressure difference becomes greater.

In actual load handling operations, not only the flow oil supplied from the pump varies but differential pressure occurs between PR flow and MF flow. In such cases, the valve spool 1 moves to make the pressure difference between before and after the control orifice E constant, stabilizing PF flow.

Action of Valve 3

The valve 3 and the orifice (s) in the forward end of the valve serve to control the moving speed of the valve spool 1 (especially when the restricted area G is opened) to prevent hunting due to sharp increase in the volume of flow when the valve spool moves, thereby stabilizing the flow of oil. In other words, when the extra flow restricted area G opens, oil flows into the damper chamber C, where the small orifice (s) in the forward end of the valve 3 is the only passage of oil so that the movement of the valve spool 1 is slow.

When the PF flow restricted area F opens, oil in the chamber C is released. The release takes place quickly because four holes (r) on the circumference of the valve 3 and the small orifice (s) in the forward end of the valve are used. As a result, the valve spool moves to the right quickly to open the restricted area F. This prevents a kickback phenomenon on the steering wheel.

Action of Port PF Check Valve

This valve holds pressure in the steering system to prevent a kickback phenomenon.

Notice: Kickback phenomenon

This is a phenomenon in which steering pressure is affected by fluctuations in operating pressure during cargo handling operation and the steering wheel being handled is caused to kickback. It occurs when PF port pressure cannot be maintained. The valve 3 described above and port PF check valve are a means of preventing this kickback phenomenon.

PF relief valve

This is a relief valve for priority flow (PF flow), that is for the steering system.

The pressure of oil in the oil passage B shown in the illustration on the previous page, or the oil pressure of PF flow, is always applied to the valve poppet 4.

When the pressure of PF flow exceeds the specified value, the valve poppet 4 moves to the right against the force of the spring 5, releasing oil into the drain passage. In this way, oil pressure in the steering system is maintained below set value.

The screw 6 is for set pressure adjustment. Turning it clockwise increases set pressure.

For set pressure and setting procedure, refer to "Inspection and Adjustment."

7.1.6 Actuation of Electromagnetic Proportional Pressure Control Valve

This is a solenoid-aided reducing valve that regulates (reduces) pilot oil pressure from the reducing valve in the inlet section to necessary level proportional to the travels of load-handling lever before it is delivered to the chamber 2.

Pressure in the chamber 2 is proportional to travel of load-handling lever; the larger the travel, the higher the pressure, hence the stroke of the main spool 3 increases. Inversely, if the travel is small, the pressure is low and the stroke of the main spool 3 is short.

The valve consists of a solenoid part A and a pressure regulator part B.

The solenoid part A is activated by electric current fed from the controller to protrude the solenoid rod 4 and push the spool 5. The force of the solenoid rod 4 to push the spool 5, that is thrust F , is proportional to the travel of the lever, this is variance of electric current.

Flow of Oil with Cargo-Handling Lever in "Neutral" Position

When the load-handling lever is in the "neutral" position, the solenoid is inactive with its rod retracted. Solenoid rod 4 remains in the retracted position. There is no pressure of pilot oil from the reducing valve in the inlet section because the unload valve is open and extra flow is released from the main relief valve into the drain passage. Also, the pilot oil passage 7 is closed by the spool 5.

Oil in the chamber 2 flows to the drain passage through the passages 8, (d), (c), (e), 9 and 10 in that order.

Flow of Oil When Solenoid is Activated

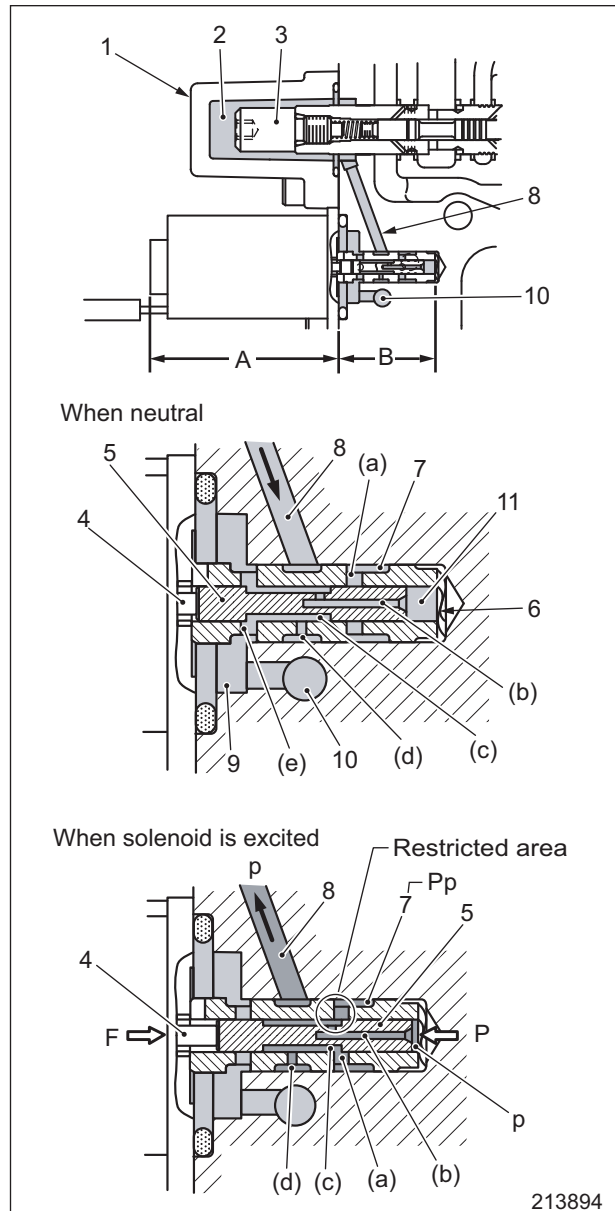
When the solenoid is activated, the solenoid rod 4 protrudes and the spool 5 moves to the right.

Pilot oil (P_p) entering the oil passage 7 flows through the oil passages (a), (c) and (d) into the chamber 2 via the passage 8.

At the same time, oil flows into the chamber 11 from the oil passage (b) and pushes the spool 5 to the left against the thrust of the solenoid rod 4.

•When the pressure of oil supplied into the chamber 2 overcomes the thrust of the solenoid rod 4, the spool 5 is allowed to push the rod to the left, closing the restricted area to the oil passages (a) and (c). The pressure of supplied oil lowers as a result. Inversely, when the pressure of oil supplied into the chamber 2 is overcome by the thrust of the solenoid rod 4, the spool 5 moves to the right, opening the restricted area to the oil passages (a) and (c). The pressure of supplied oil rises as a result.

In this way, the pressure in the chamber 2 is maintained proportional to the thrust of the solenoid rod 4.



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- 1 Cap
- 2 Chamber
- 3 Main spool
- 4 Solenoid rod
- 5 Spool
- 6 Wave washer
- 7 Oil passage receiving pilot oil from reducing valve
- 8 Passage of pilot oil for actuating valve spool
- 9 Return oil passage
- 10 Drain passage
- 11 Chamber

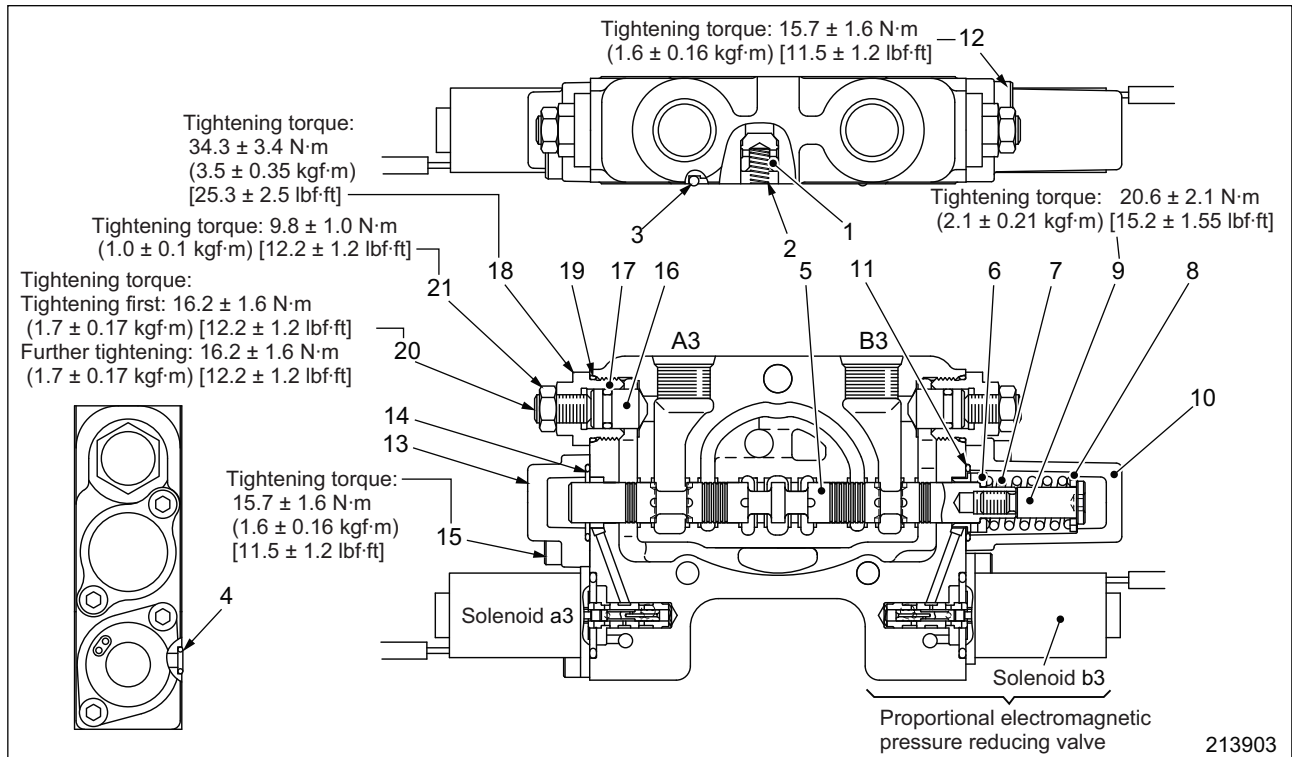
(a), (b), (c), (d), (e): Small oil passages

p: Reduced oil pressure

P: Force to push spool to left with p

F: Thrust of solenoid rod

Attachment valve



Reassembly of attachment control valve

- | | | |
|----------------------------------|---------------|--------------|
| 1 Poppet | 8 Spring seat | 16 Valve |
| 2 Spring | 9 Cap screw | 17 O-ring |
| 3 O-ring | 10 Cap | 18 Plug |
| 4 O-ring | 11 O-ring | 19 O-ring |
| 5 Spool | 12 Bolt | 20 Set screw |
| 6 Spring seat | 13 Cap | 21 Lock nut |
| 7 Spring | 14 O-ring | |
| (free length: 31.2 mm (1.2 in.)) | 15 Bolt | |

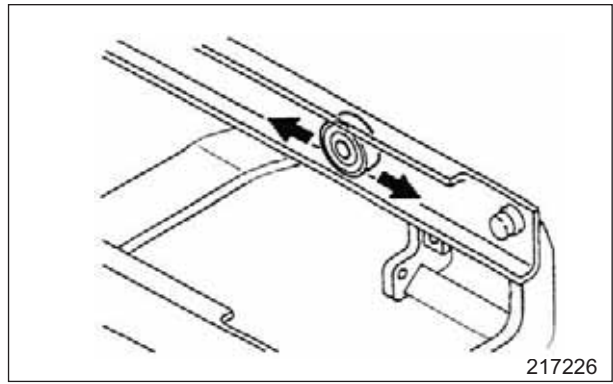
Attachment Control Valve

- (1) Install the parts 1 through 4 before combining the housing sections.
- (2) With hydraulic oil applied, insert the lift spool 5 into place in the housing with care. Check that the spool slides smoothly.
- (3) Install the spring seat 6, spring 7 and spring seat 8 in position, and tighten the cap screw 9 to the specified torque.
- (4) Fit the O-ring 11 on the cap 10. Install the cap to the housing using the bolt 12. Tighten the bolt to the specified torque.
- (5) Fit the O-ring 14 on the cap 13, and install the cap to the housing using the bolt 15. Tighten the bolt to the specified torque.
- (6) Fit the O-ring 17 on the valve 16, and insert the valve into place in the plug 18. Fit the O-ring 19 on the plug, and screw the plug in the housing to the specified torque
- (7) Tighten the set screw 20 to a torque of 16.2 ± 1.6 N·m (1.7 ± 0.17 kgf·m) [12.2 ± 1.2 lbf·ft].
- (8) Tighten the lock nut to the specified torque.
- (9) Further tighten the set screw 20 to a torque of 16.2 ± 1.6 N·m (1.7 ± 0.17 kgf·m) [12.2 ± 1.2 lbf·ft].
- (10) Install the other shut-off valve.

Inspections after Disassembly

(1) Mast

- (a) Check each roller for wear, binding or other defects.
- (b) Check each roller on rolling surface for pitting or other defects.
- (c) Check the mast member and the welded joints of cross-members, shafts and supports for cracks.
- (d) Check the mast support bushings for wear or other defects.



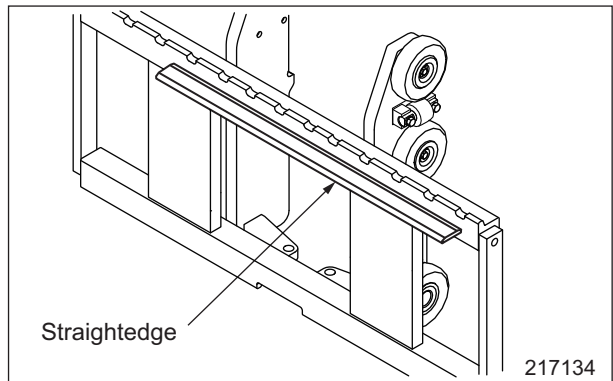
(2) Lift bracket

- (a) Check the main rollers and side rollers for smooth rotation. Inspect each roller for wear and cracks.
- (b) Check the welded portions of the bracket for cracks.
- (c) Check the finger bar for bend or distortion.

Unit: mm (in.)

Distortion of finger bar	A	5 (0.2) maximum
--------------------------	---	--------------------

A: Standard value



(3) Lift chains, chain wheels and chain wheel supports

- (a) Measure the length of each chain to make sure that the two chains are equal in length. Also check the chains for wear, indication of breakage and link binding and twisting.
- (b) Check each chain anchor bolt for cracks or defects on thread.
- (c) Check each chain wheel support and chain wheel for crack or wear. Check that the wheels rotate smoothly.

Chain elongation

Unit: mm (in.)/20 links

Item		Truck type		
		1 ton class	2 ton class	3 ton class
Simplex Mast	A	317.5 (12.5)	381 (15)	508 (20)
	B	327 (12.9)	392 (15.4)	523 (20.6)

A: Standard value B: Repair or service limit

(4) Mast strip

Check the mast strips for damage, wear or distortion.

6.2 Chain Tension Inspection and Adjustment

CAUTION

Turn the engine/main key to the (OFF) position before inspecting or adjusting lift chains, anchor bolts and nuts. Place blocks under the forks when they are raised. Failure to do so can result in serious injury or death due to a sudden movement of heavy components.

Inspection of chain tension

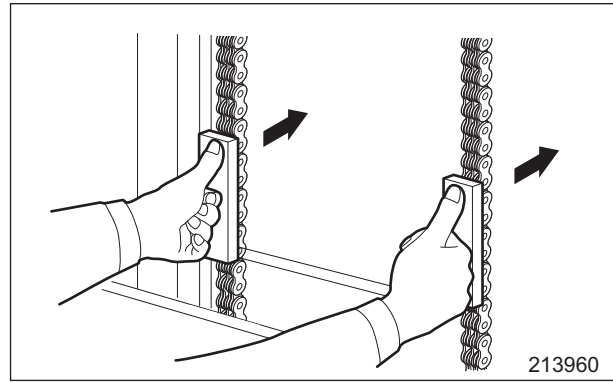
- (1) Place the mast vertical and on level ground, then lower the forks to the ground. Make sure that the lift cylinders are fully retracted.
- (2) Raise the forks approx. 100 mm (4.0 in.) from the ground.
- (3) Turn the key to the (OFF) position.
- (4) Place blocks approx. 90 mm (3.5 in.) high under the forks.
- (5) Push the chains at the middle point between the chain wheel and chain fixed end on the lift bracket.
Check the right and left chains for even tightness. If tension on the right and left chain is uneven, adjust the tension.

Adjustment of right and left chain balance

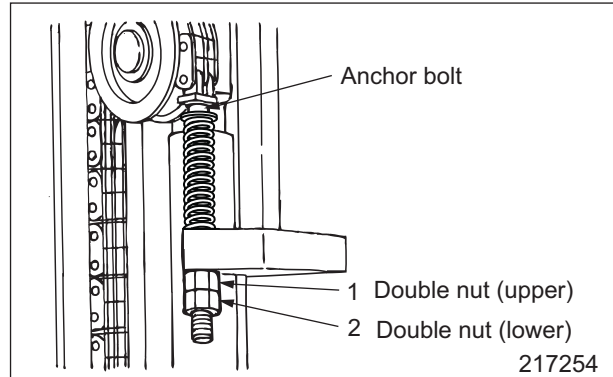
- (1) Remove the blocks placed under the forks. Start the engine.
- (2) Lower the forks to the ground and tilt forward until the tips come in contact with the ground. The chains are now slack to facilitate the adjustment.
- (3) Stop the engine.
- (4) Loosen the double nut (lower) 1.
- (5) Turn double nut (upper) 2 to adjust the chain tension.
- (6) Start the engine, and place the mast vertical again.
- (7) Repeat steps (2) through (5) of the procedure in "Inspection of chain tension," to check the chain tension, and adjust it as needed.

Tightening of nuts after adjustment

- (1) Hold the anchor bolt with a wrench so as not to twist the chain, then tighten the clamp 2.
- (2) Hold the double nut (upper) 3 with a wrench and tighten double nut (lower) 1 to the specified torque.



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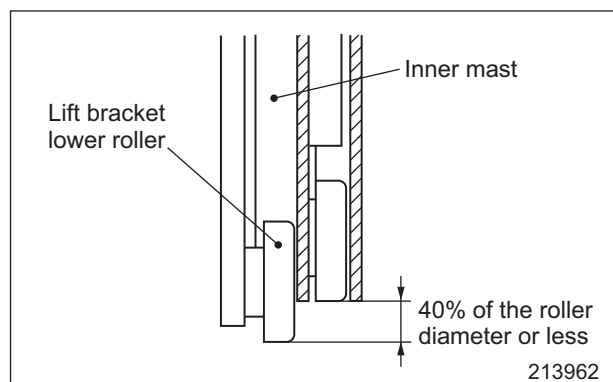
Tightening torque

Unit: N·m (kgf·m) [lbf·ft]

Item	Truck type	
	1 ton class 2 ton class	3 ton class
Nuts 1, 3	98 ⁺⁴⁹ / ₀ (10 ⁺⁵ / ₀) [72 ⁺³⁶ / ₀]	147 ⁺⁴⁹ / ₀ (15 ⁺⁵ / ₀) [108 ⁺³⁶ / ₀]

CAUTION

After the adjustment, raise and lower the lift bracket several times. Then check the position of lift bracket when the lift cylinder is fully retracted. Make sure the protrusion of each lift bracket main roller does not exceed 40% of the roller diameter. If it exceeds, elongation of chains is suspected.



213962

9. Duplex Mast

9.1 Mast System

Following table shows a combination of truck and mast models:

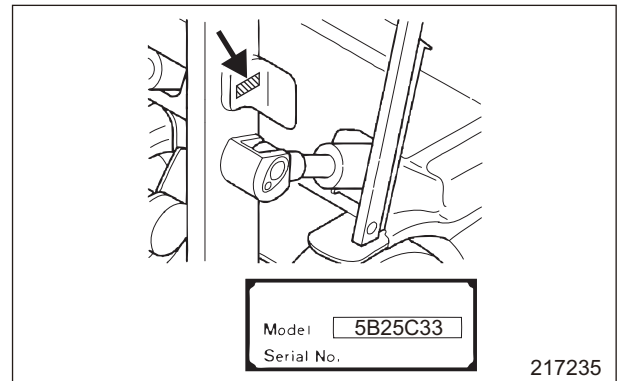
Truck type	Mast
1 ton class	5B15C□□
	5B20C□□
2 ton class	5B25C□□
3 ton class	5B30C□□
	5B33C□□

Note: "□□" presents maximum lift height.

Example: 33 = Lift height of 3300 mm (129.9 in.)

Mast type and code

Code	Mast type
B	Duplex mast



Mast serial number location

Example: 5 B 25 C 33

- Maximum lifting height
["33" stands for 3300 mm 130 in.]
- Order of the minor charge
("A" for the original,
"B" for the first change,
"C" for the second change,
and so on)
- Applicable truck model designation
(Example: FG25AN)
15, 20: 1 ton class, 25: 2 ton class,
30, 33: 3 ton class
- Mast type
- Generation of truck compatible with
the mast
("2" for the original,
"3" for the first change,
and so on up to "9")

214832

How to read mast model code

♦Clearance G1

Clearance between side roller circumference and inner mast side roller thrust surface: Move the side roller to the upper end of the inner mast and slide the lift bracket to either the left-most or rightmost position. Take measurement of clearance G1 between the roller circumference and inner mast. Adjust the clearance with shims (d) to the specification.

Unit: mm (in.)

Clearance G1	0.1 to 0.5 (0.004 to 0.020)
--------------	--------------------------------

(1) Choosing correct roller diameters

♦Measure clearance F for upper rollers 2, middle rollers 3 and lower rollers 4. If the measured clearances do not conform to the standard values, replace with rollers of correct diameters listed in the table on the right.

Note: For measuring procedures, refer to "Inspection and Adjustment."

♦The rollers should rotate smoothly when installed.

Unit: mm (in.)

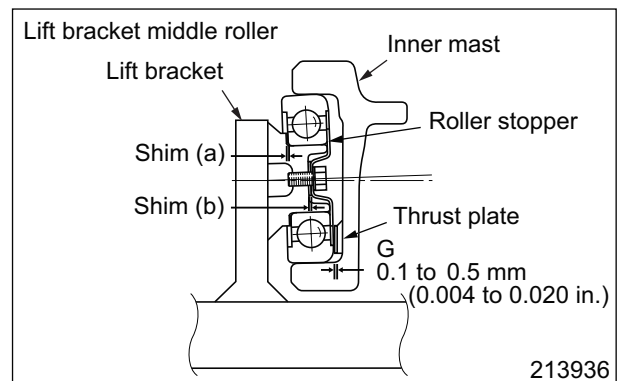
Size (diameter)	Truck type	
	1 ton class	2 ton class 3 ton class
S	99 (3.90)	113.8 (4.48)
M	100 (3.94)	115 (4.53)
L	101 (3.98)	116 (4.57)
LL	102 (4.02)	117 (4.61)

(2) Adjusting clearance G between the middle roller and thrust plate

Note: The following adjustment is not required for the upper roller.

♦Measure clearance G between the middle roller and thrust plate. If the measured clearance does not conform to the standard value, adjust clearance G in the manner described below.

Note: For measuring procedures, refer to "Inspection and Adjustment."



♦Adjusting method

If clearance G is excessive, increase the thickness of shims (a) as required. Increase the thickness of shims (b) by the same amount that are added to shims (a). Shim (a) is available in two sizes: 1 mm (0.04 in.) and 0.5 mm (0.020 in.). Shim (b) is available in only one size, 1 mm (0.04 in.). If shims (a) are increased by 0.5 mm (0.020 in.), shims (b) do not need to be increased by the equal amount.

At the factory, shims (a) are usually adjusted to 1 mm (0.04 in.) and shims (b) to 2 mm (0.08 in.) for the shipment.

14.4 Adjusting Clearance Between Lift Bracket Roller and Inner Mast

(1) Back-to-front clearance check on lift bracket main rollers

- (a) Raise the forks slightly from the ground.
- (b) Insert a bar between the upper part of lift bracket and the inner mast, and slide the inner mast to one side. Using feeler gauges, measure clearance F between the main roller and inner mast on the opposite side.

Unit: mm (in.)

F	1 (0.04) maximum
---	------------------

(c) If clearance is out of specification, use oversize rollers.

For roller replacement procedure, refer to "Choosing correct roller diameters" on (1) Choosing correct roller diameters.

(2) Right-to-left clearance check on lift bracket main rollers and side rollers

- (a) Raise the mast to the top.
- (b) Set a dial indicator on the inner mast with its contact point rested on the side of the lift bracket.
- (c) Go over to the opposite side of the mast, and slide the lift bracket to one side with a bar. Set the indicator to zero.
- (d) Insert a bar between the inner mast and lift bracket on the indicator side, and slide the lift bracket to the opposite side.
- (e) Insert a bar between the inner mast and lift bracket on the indicator side, and slide the lift bracket to the opposite side. Read the indicator. This reading is clearance G between the middle roller and thrust plate. If clearance is out of specification, it is necessary to add shims to the seat of the roller to adjust to correct clearance.

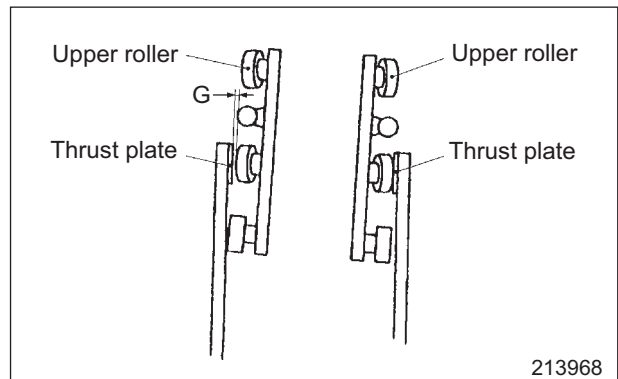
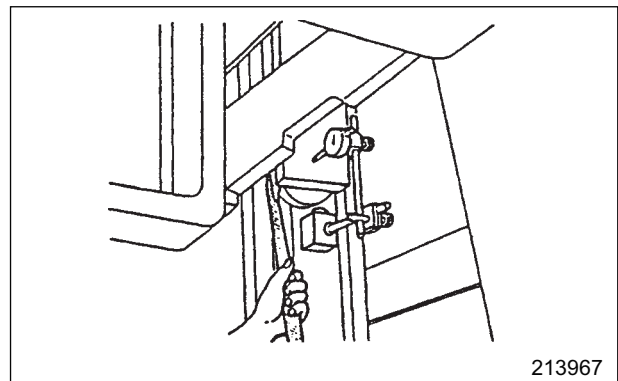
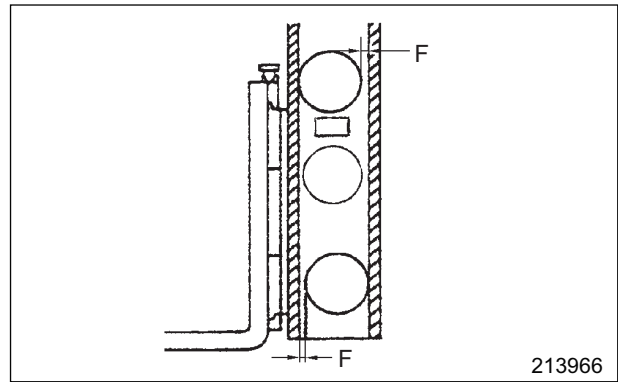
Note: Upper rollers are free from checking and adjusting.

Unit: mm (in.)

G	0.1 to 0.5 (0.004 to 0.020)
---	--------------------------------

For adjustment, refer to "Adjusting clearance G1 between the middle roller and thrust plate" on 12.2.1

(2) Adjusting clearance G between the middle roller and thrust plate.



18.2 Mast Operation

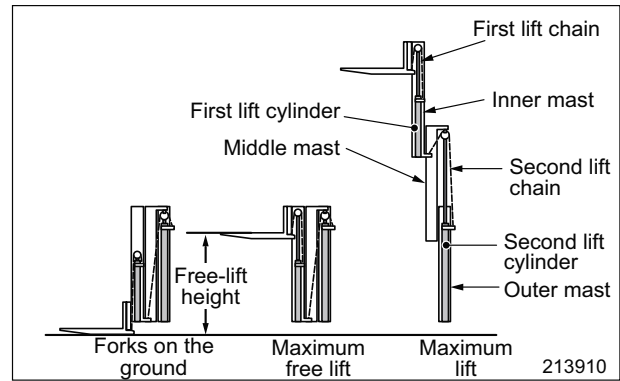
18.2.1 Operation of Triplex Mast

Mast Operation

The first lift cylinder extends, bringing the forks to the maximum free-lift height.

When the first lift cylinder rod has reached the end of the stroke, the second lift cylinders take over to lift the middle mast while at the same time the second lift chain lifts an assembly of the forks, inner mast and first lift cylinders.

Reverse the lifting sequence to activate the lowering mechanism.



20.2.2 Installing Mast Rollers

Mast rollers are identical in shape and size with lift bracket lower rollers.

Unit: mm (in.)

Clearance F	1 (0.04) maximum
Clearance G	0.1 to 0.5 (0.004 to 0.020)

- Measure clearance F between the rollers' rolling contact surfaces and masts. If the measured clearances do not conform to the standard values, replace with rollers of correct diameters listed in the table below.

Note: For measuring procedures, refer to "Inspection and Adjustment."

Unit: mm (in.)

Size (diameter)	Truck type	
	1 ton class	2 ton class 3 ton class
S	99 (3.90)	113.8 (4.48)
M	100 (3.94)	115 (4.53)
L	101 (3.98)	116 (4.57)
LL	102 (4.02)	117 (4.61)

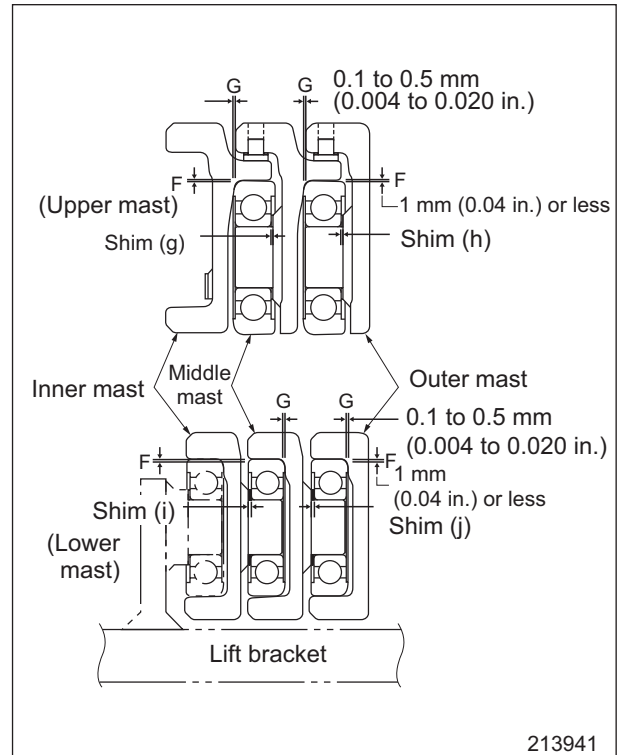
♦For installation of mast rollers, follow the procedures for the lift-bracket rollers.

- Measure clearance G between the rollers and masts. If the measured clearances exceed the standard value, increase the thicknesses of shims (g) - (j) under the roller seats as required.

At the factory, shims (g) - (j) are usually adjusted to the values shown in the table below for the shipment.

Unit: mm (in.)

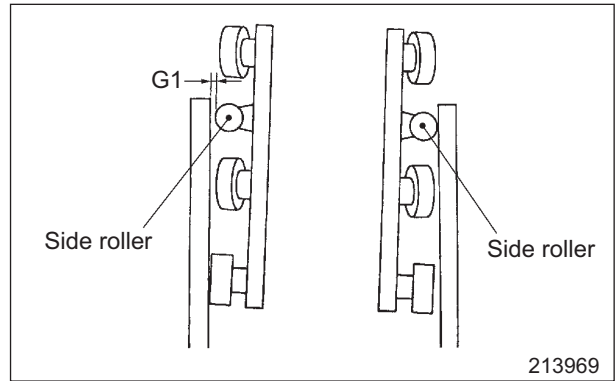
Item	Truck type	
	1 ton class	2 ton class 3 ton class
Shim (g)	1 (0.04)	1 (0.04)
Shim (h)	2 (0.08)	1 (0.04)
Shim (i)	2 (0.08)	1 (0.04)
Shim (j)	2 (0.08)	1 (0.04)



- (f) Lower the lift bracket slightly from the top so that the side roller comes in contact with the inner mast.

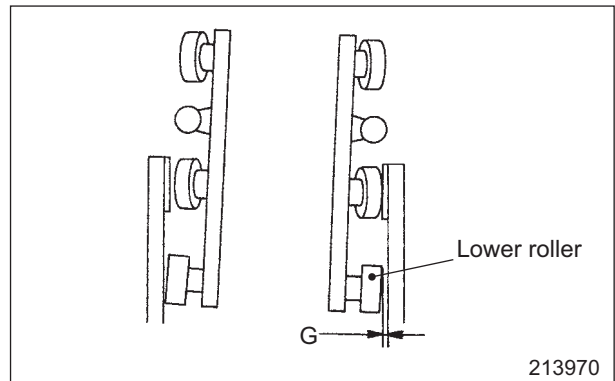
Measure the clearance $G1$ between the side roller and inner mast. If clearance is out of specification, it is necessary to add shims to the seat of the roller bracket to adjust to correct clearance.

For adjustment and installation procedures, refer to "Adjusting clearance $G1$ between the side roller and the inner mast" on (5) Adjusting clearance $G1$ between the side roller and inner mast.



- (g) With the lift bracket at the top, check clearance G between the lower roller and inner mast. If clearance is out of specification, it is necessary to add shims to the seat of the roller to adjust to correct clearance.

For adjustment and installation procedures, refer to "Adjusting clearance G between the lower roller and inner mast" on (3) Adjusting clearance G between the lower rollers and inner mast.



22.5 Mast Roller Clearance Adjustment

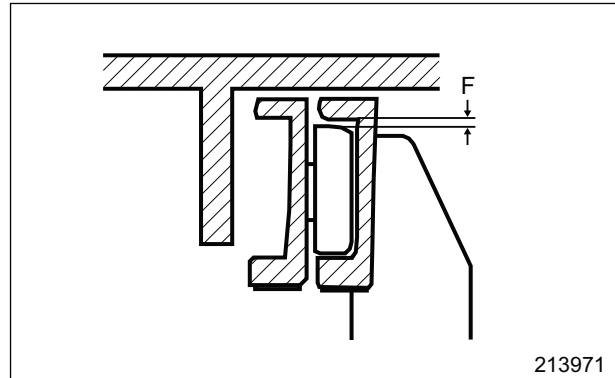
- (1) Back-to-front clearance check on mast main rollers

- (a) Tilt the mast fully backward.
- (b) Using feeler gauges, measure clearance F between the inner mast lower roller and outer mast.

Unit: mm (in.)

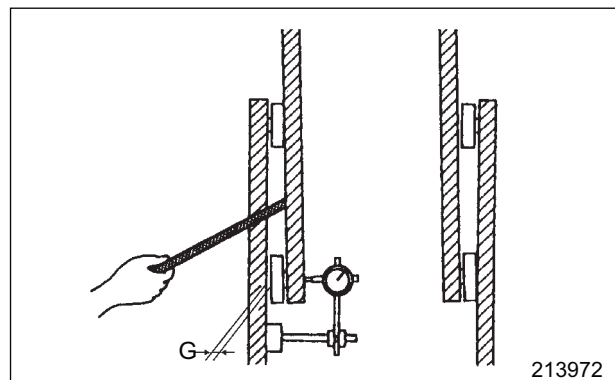
F	1 (0.04) maximum
-----	------------------

- (c) If clearance is out of specification, use oversize rollers. For mast roller replacement and installation procedures, refer to "Installing mast rollers" on 12.2.2 Installing Mast Rollers.



- (2) Right-to-left clearance inspection on inner mast main rollers

- (a) Raise the mast to the top.
- (b) Set a dial indicator on the inside of the outer mast with its contact point rested on the inner mast.
- (c) Go over to the opposite side of the mast, and push the inner mast against the outer mast. Set the indicator to zero (0).



SAFETY

WARNING

The proper and safe lubrication and maintenance for these lift trucks, recommended by Mitsubishi Forklift Trucks, are outlined in the **OPERATION & MAINTENANCE MANUAL**.

Read and understand the OPERATION & MAINTENANCE MANUAL before performing any lubrication or maintenance on these trucks.

Improper performance of lubrication or maintenance procedures is dangerous and could result in injury or death.

The serviceman or mechanic may be unfamiliar with many of the systems on this truck. This makes it important to use caution when performing service work. A knowledge of the system and/or components is important before the removal or disassembly of any component.

Because of the size of some of the truck components, the serviceman or mechanic should check the weights noted in this Manual. Use proper lifting procedures when removing any components.

Following is a list of basic precautions that should always be observed.

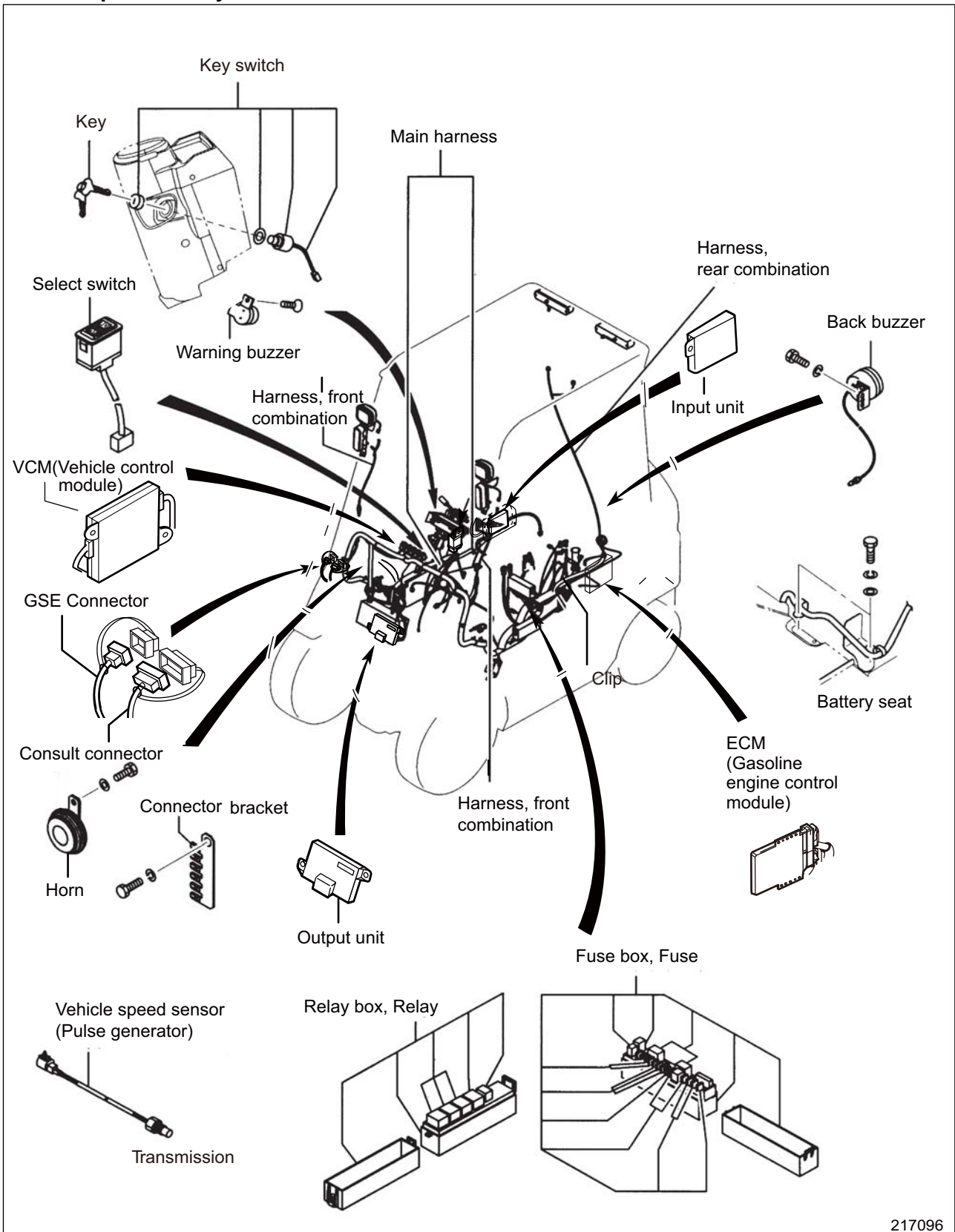
- (1) Read and understand all warning plates and decals on the truck before operating, lubricating or repairing the product.
- (2) Always wear protective glasses and protective shoes when working around trucks. In particular, wear protective glasses when using a hammer or sledge on any part of the truck or its attachments with a hammer or sledge. Use welders gloves, hood/goggles, apron and other protective clothing appropriate to the welding job being performed. Do not wear loose fitting or torn clothing. Remove all rings from fingers when working on machinery.
- (3) Do not work on any truck that is supported only by lift jacks or a hoist. Always use blocks or jack stands to support the truck before performing any disassembly.
- (4) Lower the forks or other implements to the ground before performing any work on the truck. If this cannot be done, make sure the forks or other implements are blocked correctly to prevent them from dropping unexpectedly.

WARNING

Do not operate these trucks unless you have read and understood the instructions in the OPERATION & MAINTENANCE MANUAL. Improper truck operation is dangerous and could result in injury or death.

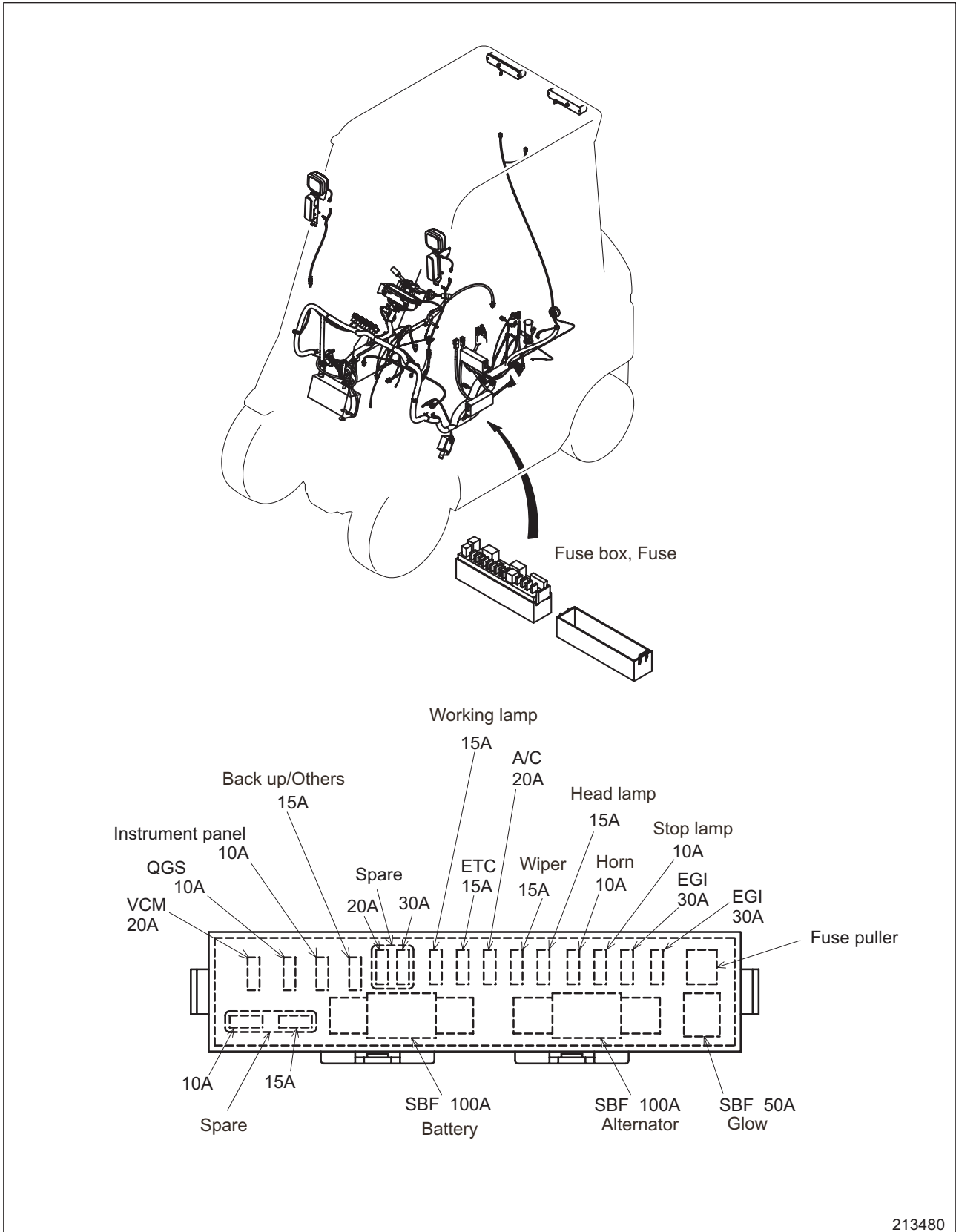
- (5) Use steps and grab handles (if applicable) when mounting or dismounting a truck. Clean any mud or debris from steps, walkways or work platforms before using. Always face truck when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.
- (6) To avoid back injury, use a hoist when lifting components which weigh 23 kg or more. Make sure all chains, hooks, slings, etc., are in good condition and are of the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.
- (7) To avoid burns, be alert of the hot sections and hot fluids in lines, tubes and compartments, even when idle or off.
- (8) Be careful when removing cover plates. Gradually remove the last two bolts or nuts located at opposite ends of the cover or device and pry cover loose to relieve any springs or other pressures, before removing the last two bolts or nuts completely.
- (9) Be careful when removing filler caps, breathers and plugs on the truck. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. Be aware that the danger of being sprayed or splashed is even greater if the truck has just been stopped because fluids can be hot.
- (10) Always use tools that are in good condition and be sure you understand how to use them before performing any service work.
- (11) Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary.
- (12) If possible, make all repairs with the truck parked on a level, hard surface. Block truck so it does not roll while working on or under truck.

1.2 Components Layout



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2.2.11 Fuse box



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5.3.4 How to set up the clock time

- (1) Turn the key switch to the ON position.
- (2) Select clock time display (when the hour meter is being displayed).

Button	Press	Display
○	Short	Clock time (":" will blink)

- (3) Select time adjust mode and unit adjust mode.

Button	Press	Display
○	Long	Time unit adjust mode

- (4) Time unit adjustment

Button	Press	Display
△	Short	01→12 (1 hour at each press)
	Long	01→12 (continuous)
▽	Short	12→01 (1 hour at each press)
	Long	12→01 (continuous)
○	Short	After adjusting, change to minute adjust mode.

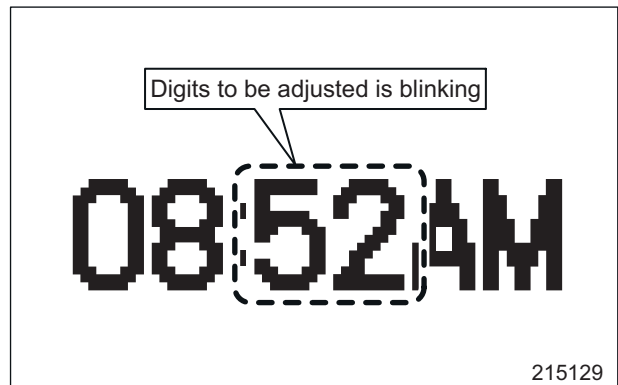
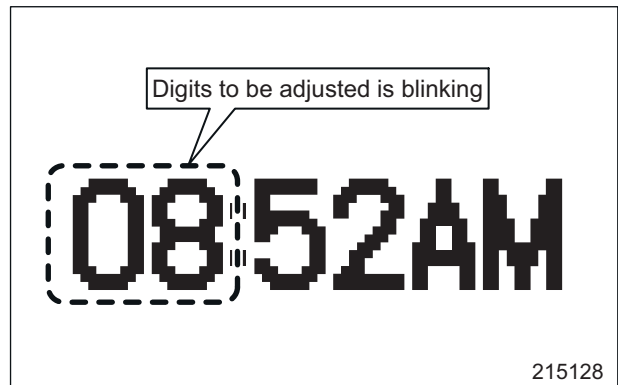
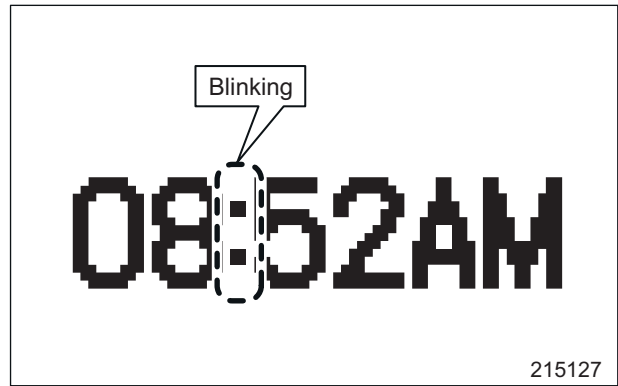
Note: Hour display shows 00:00 PM after 11:00 AM, and AM and PM are displayed in sequence.

- (5) Minute adjustment

Button	Press	Display
△	Short	01→59 (1 minute at each press)
	Long	00→59 (continuous)
▽	Short	59→00 (1 minute at each press)
	Long	59→00(continuous)
○	Short	After adjusting, change to the standard screen.

Note: 1. A second time scale is not available.

2. If elapsed time is 3 minutes or more after the last operation of button, the screen returns to the standard screen automatically.
3. Precision errors are one minute or less per month.
4. When the battery is changed, the time resets. Be sure to set the time after the battery change.
5. If the engine is started during setup procedure, the setting being conducted becomes invalid and the display returns to the standard screen.



(2) Trigger load value setup
(on screen B for example)

(a) With a short press on the Δ or the ∇ button, select the load value symbol to bring up the load value setup screen on screen B.

Button	Press	Display
Δ or ∇	Short	
\bigcirc	Short	Enter (execution)

(b) Set up a trigger load

Button	Press	Display
Δ	Short	0 to 50.0, 0.1 at a time
	Long	0 to 50.0, incrementally
∇	Short	50.0 to 0, 0.1 at a time
	Long	50.0 to 0, incrementally
\bigcirc	Short	Enter (execution)

After the setup of screen B is completed, the setup value is displayed for one second, and then the display returns to the standard screen.

Note: Trigger load setup for exterior alarm function has no connection with the setting of overload warning display.

(3) When speed or load value is not set up, select exterior alarm setup screen

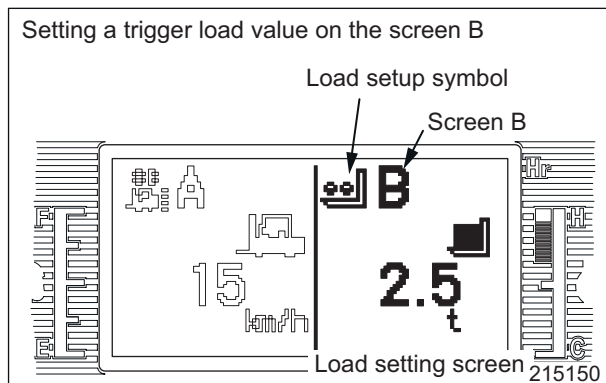
(a) Select exterior alarms screen.

Button	Press	Display
Δ ∇	Long	Exterior alarm setting screen

(b) With a short press on the Δ or the ∇ button, select the symbol for no setup.

Button	Press	Display
Δ or ∇	Short	
\bigcirc	Short	Enter (execution)

Note: 1. When the exterior alarms are not used, select no set up on screen A and B.



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2.2 Cooling System

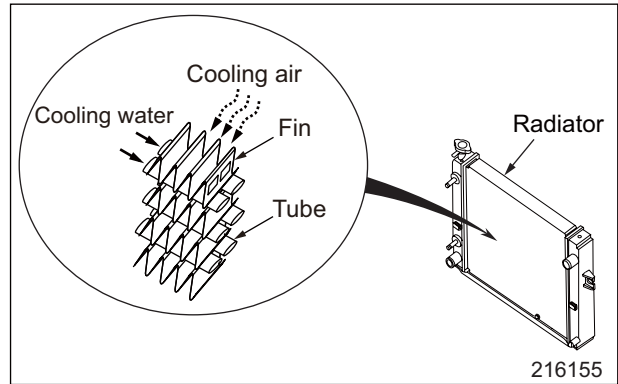
CAUTION

- ♦Be sure to conduct maintenance work on level and hard ground.
- ♦Stop the engine, and remove the starter key.
- ♦Make sure that sufficient space is available for the lift truck to move around and that no one or no obstacle is around the lift truck.

(1) Check and clean radiator fin.

Service Hours	1st Month (200 hrs) only
	Every 3 months (500 hrs)

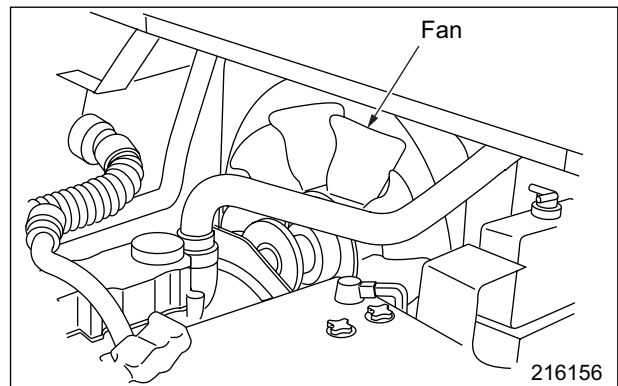
- ♦Visually check the radiator fins for contamination.
- ♦If the fins are too dirty, clean the fins using compressed air.



(2) Check cooling fan.

Service Hours	Prestart (Daily/10 hrs)
---------------	-------------------------

- ♦Check the fan for oil or dirt contamination.
- ♦Do not use gasoline, kerosene, etc. for cleaning. Wipe contamination off the surface with a rag or paper.

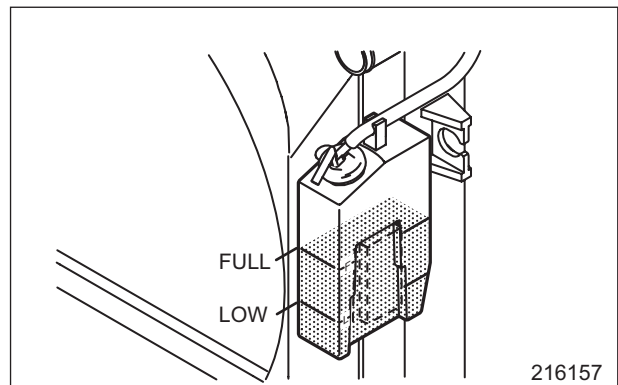


(3) Check engine coolant level.

Service Hours	Prestart (Daily/10 hrs)
---------------	-------------------------

- ♦Make sure that the coolant level is between FULL and LOW marks on the reserve tank.

Note: Refer to the appropriate engine service manual.



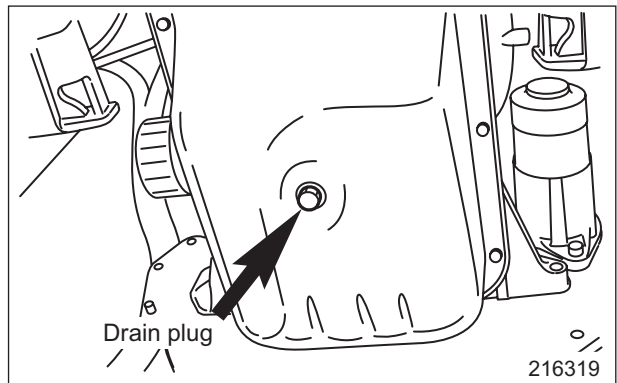
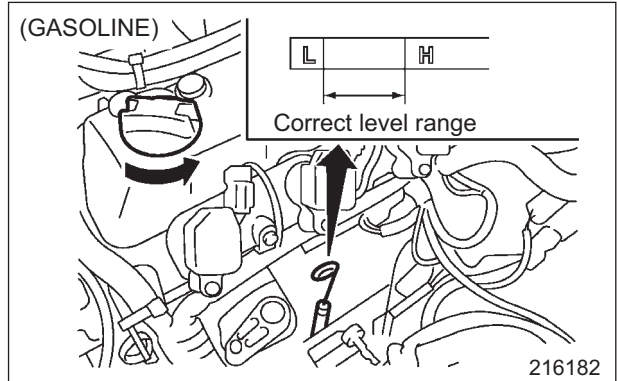
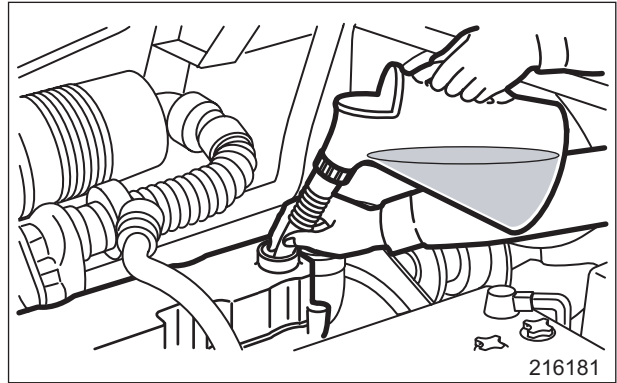
(9) Change engine oil.

Service Hours	1st Month (200 hrs) only
	Every 3 months (500 hrs)

- (a) Loosen the drain plug located in the engine oil pan, and drain the engine oil.
- (b) Remove the oil filler cap, and pour oil to the specified level.
- (c) Run the engine to circulate the oil through the engine.
- (d) Stop the engine. Wait for a while to let the engine oil to pour down to the oil pan, and then check the oil level.

Note: Refer to the appropriate engine service manual.

Engine oils	Gasoline-engine model	API service classification SJ or above
-------------	-----------------------	--



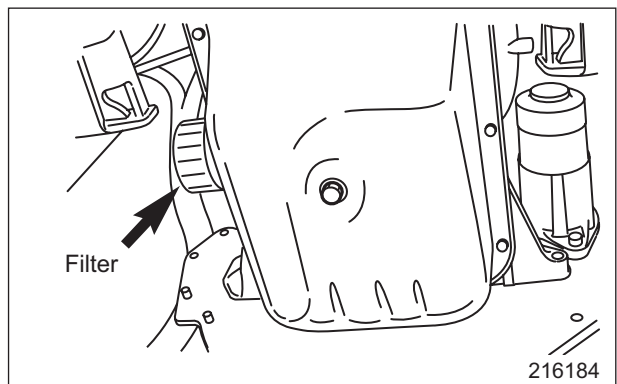
(10) Change engine oil filter.

Service Hours	1st Month (200 hrs) only
	Every 3 months (500 hrs)

- Change the oil filter at every oil change.
- Add the amount of oil that the filter holds.

Note: Refer to the appropriate engine service manual.

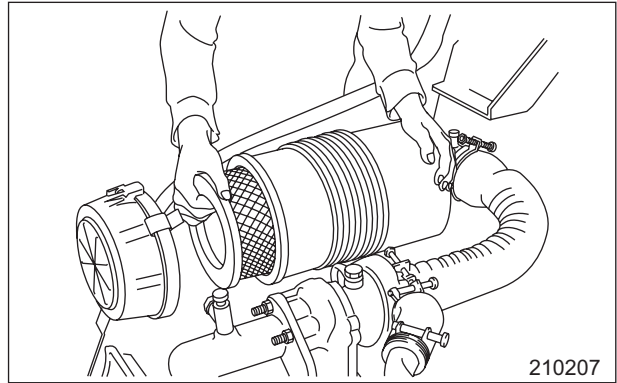
Engine oils	Gasoline-engine model	API service classification SJ or above
-------------	-----------------------	--



(2) Change air cleaner element.

Service hours	Every 6 months (1000 hrs)
---------------	---------------------------

- ♦Replace the air cleaner element with a new one.



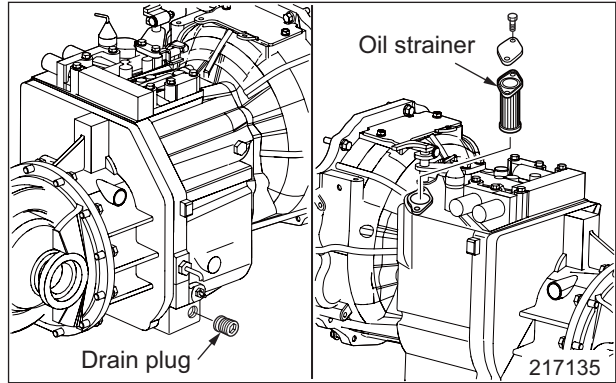
(7) Clean T/M strainer.

Service hours	Every 6 months (1000 hrs)
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- ♦ Remove the drain plug, and drain the oil. Pull out the oil strainer assembly, and clean the strainer.
- ♦ If clogging is found, replace the strainer with a new one.

Note: Refer to Chapter 6, POWERSHIFT TRANSMISSION, 4.1 Disassembly, 5 Oil Pump Assembly and 6.1 Oil Pressure Measurement.

Powershift transmission oil	Dexron II
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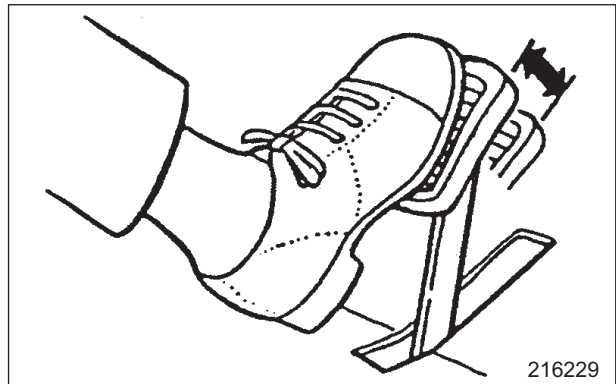


(8) Adjust inching pedal (for powershift T/M).

Service hours	Yearly (2000 hrs)
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- ♦ Properly adjust the brake pedal height and free play.
- ♦ Properly adjust the height of inching pedal.
- ♦ Properly adjust the clearance between inching and brake link mechanism.
- ♦ Inching cable should be adjusted on the T/M side.

Note: Refer to Chapter 6, POWERSHIFT TRANSMISSION, 6.2 Clutch (Inching) Pedal Adjustment and 6.3 Inching Cable, Adjustment.

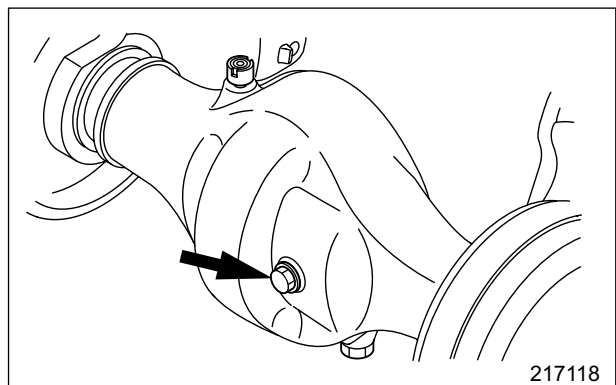


(9) Change differential oil.

Service hours	Every 6 months (1000 hrs)
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- ♦ Remove the drain plug, and drain the oil.
- ♦ Fill oil from the filler hole to the filler hole level.

Differential oil	GL-4 or GL-5
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5.3 Adjustment Value and Oil Quantities

Note: The values in the following table are based on the standard model.

Items		Truck model			
		FGC15N	FGC18N	FGC20CN	
Alternator drive belt deflection-when pushed onward with 98 N (10kgf) [22 lbf] pressure		mm (in.)	11 to 13 (0.43 to 0.51)		
Spark plug	Type	FR2A-D			
	Gap	mm (in.)	0.9 (0.04)		
Engine idling speed		rpm	700		
Steering wheel free play-when measured at rim with engine idling		mm (in.)	15 to 30 (0.6 to 1.2)		
Inching pedal free play		mm (in.)	1.5 to 6.5 (0.06 to 0.26)		
Brake pedal free play	Manual truck	mm (in.)	7 (0.28)		
	Powershift truck	mm (in.)	7 (0.28)		
Parking brake lever operating effort		N (kgf) [lbf]	150 to 200 (15 to 20) [34 to 45]		
Tire size	Front	Single	18 × 6 × 12-1/8		
		Dual	-	-	-
	Rear	14 × 5 × 10			
Tightening torque for wheel nuts, N·m (kgf·m) (lbf·ft)	Front	156.9±15.7 (141.2±172.6) [115.8±11.6]			
	Rear	-	-	-	
Lift chain elongation limit		mm (in.)/ 20 links	327 (12.9)		
Refill capacities (approximate), liter (cu.in.)	Engine cooling system-0.65 liter (39.7 cu.in.) reserve tank included		lter (cu.in.)	6.8 (415.0)	
	Engine oil	Engine	3.5 (0.9)		
		Oil filter	0.3 (0.1)		
		Total	Low : 4.5 (1.2) / High : 5.5 (1.5)		
	Transmission oil	Powershift Truck	5.0 (1.3)		
	Transfer and differential gear oil		5.0 (1.3)		
	Hydraulic oil		lter (cu.in.)	28 (1708.7)	
Brake fluid reservoir		lter (cu.in.)	0.135 (8.2)		
Battery electrolyte specific gravity, corrected to 20°C (68°F)		1.26 to 1.28			

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