CAT® Lift Trucks

Service Manual

Chassis & Mast

MC/FC

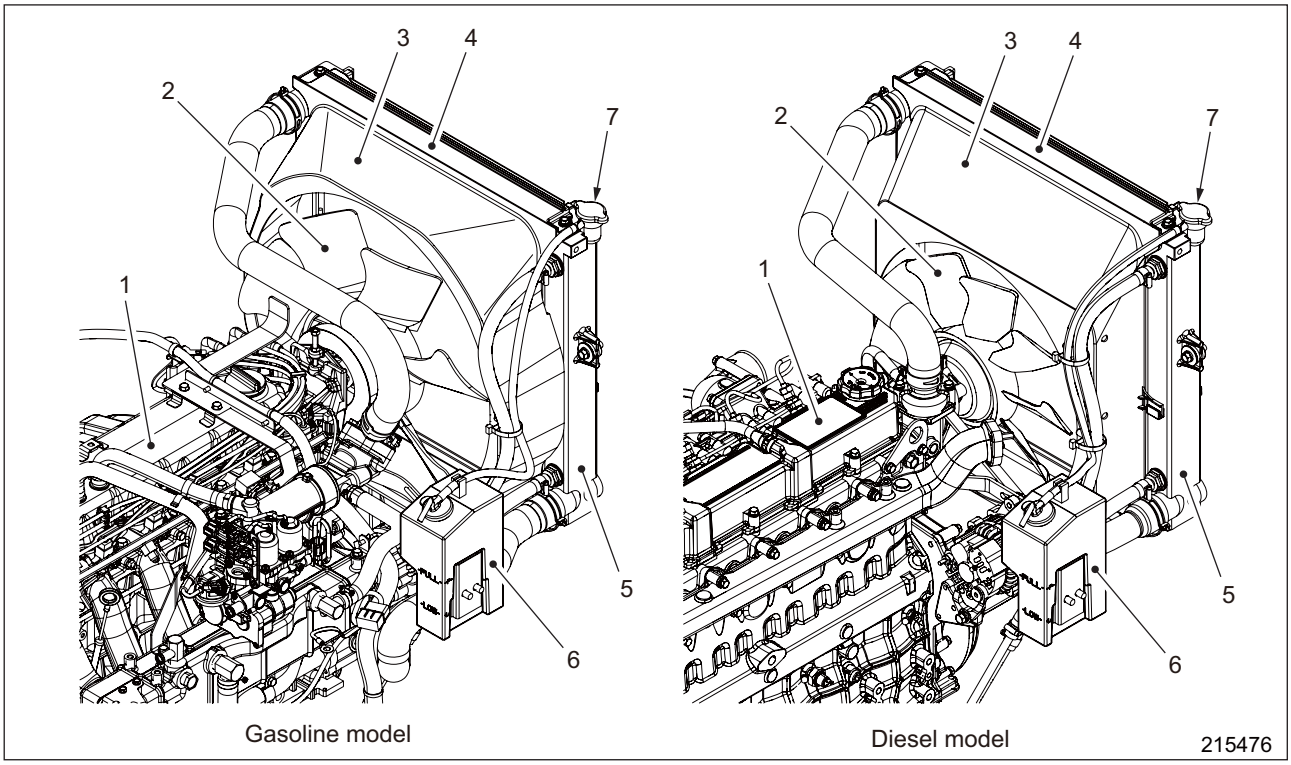
GP40N1	AT40-02011-up
GP45N1	AT29D-52011-up
GP50CN1	AT29D-82011-up
GP50N1	AT33C-52011-up
GP55N1	AT33C-82011-up

DP40NM1	AT12B-02011-up
DP45NM1	AT19D-52011-up
DP50CNM1	AT19D-82011-up
DP50NM1	AT28C-52011-up
DP55NM1	AT28C-82011-up

For use with TB45 Gasoline Engine & S6S Diesel Engine
Service Manual and Fuel System Supplements

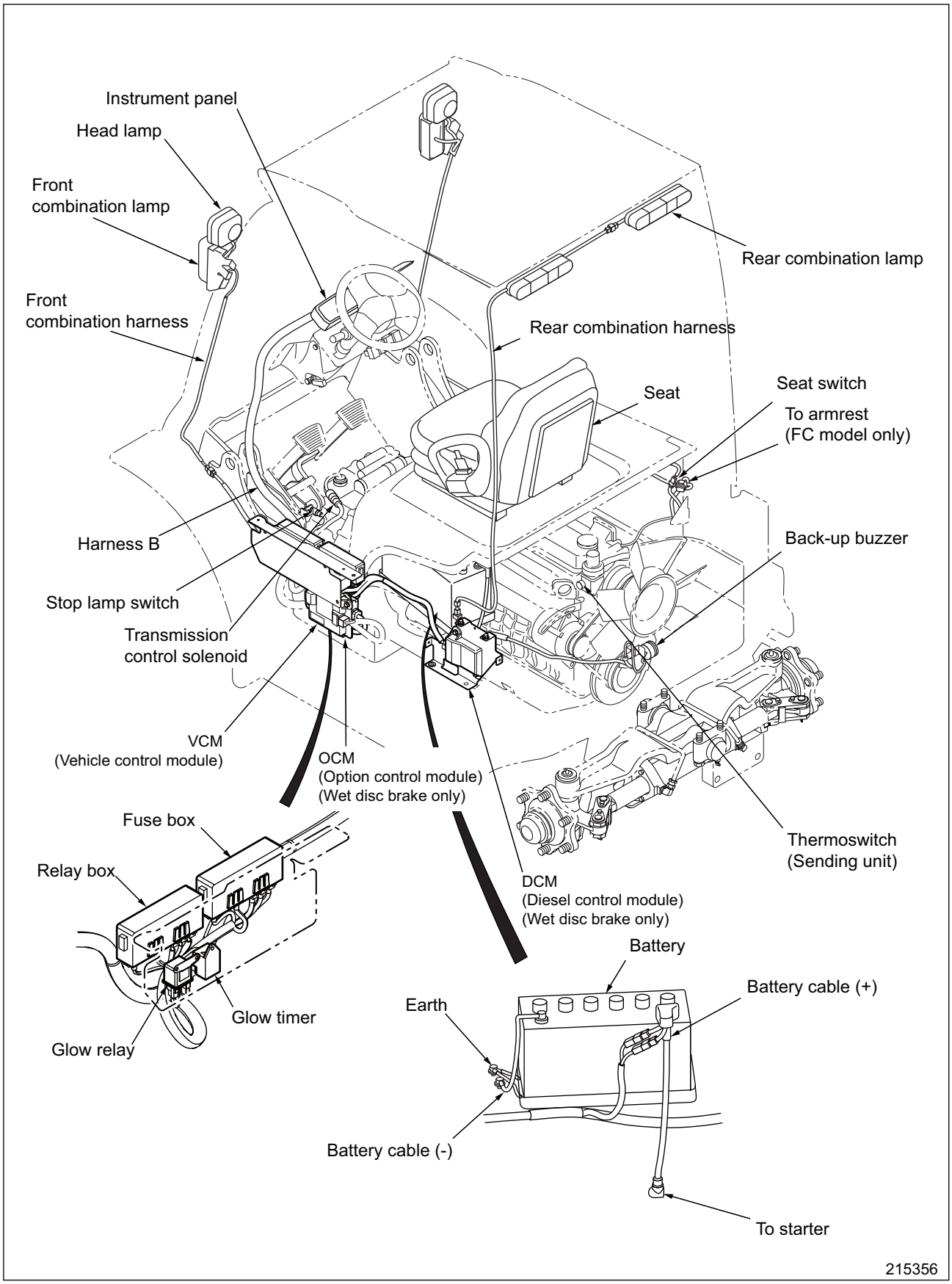
99739-8B120
Vol.1

2. Structure



1 Engine
2 Fan (coupled directly to the engine crankshaft)
3 Shroud
4 Radiator
5 Oil cooler for torque converter
6 Reserve tank
7 Radiator cap

1.2 Diesel Model



2.2.9 Relay box

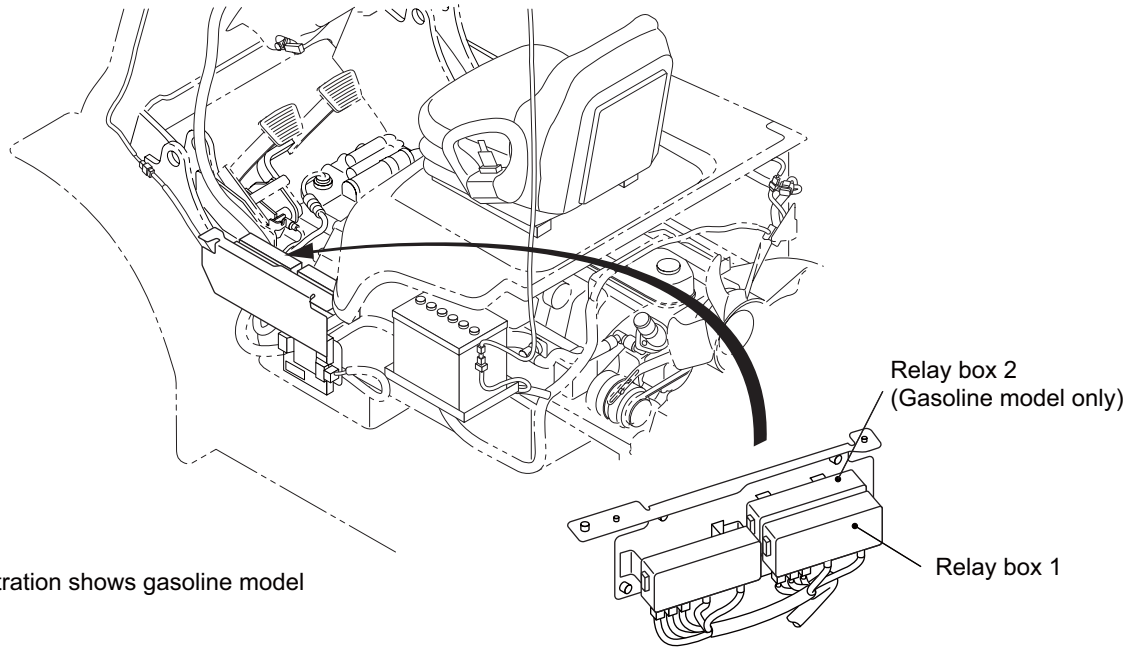
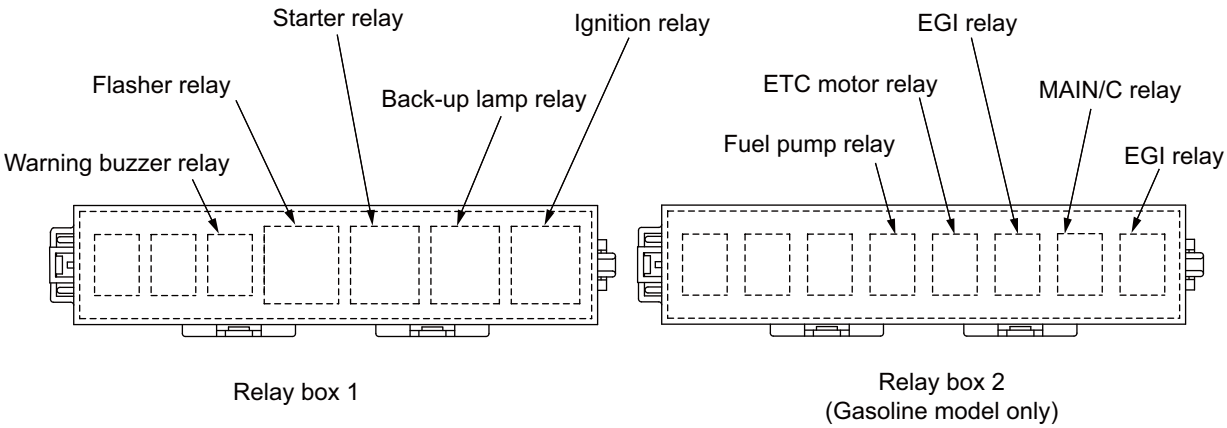


Illustration shows gasoline model



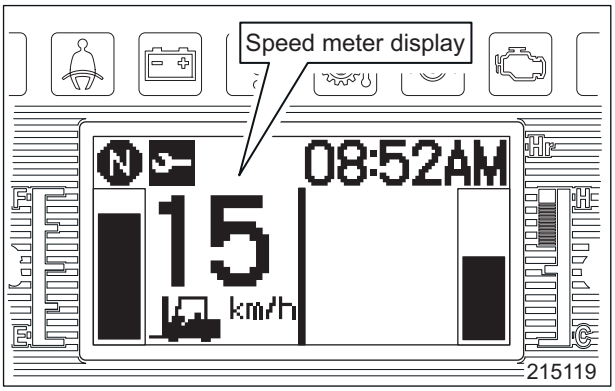
Relay box 1

Relay box 2
(Gasoline model only)

215367

5.2.2 Speed meter display

This display shows current lift truck speed.



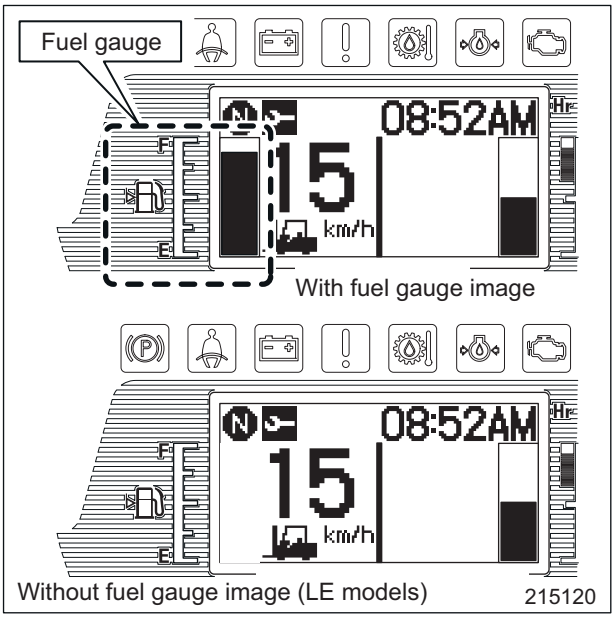
Note:

Actual speed	Display
0.1 to 1.0 km/h (0.06 to 0.62 Mph)	1 km/h (0.62 Mph)
1.1 to 2.0 km/h (0.68 to 1.24 Mph)	2 km/h (1.24 Mph)
• • • • 24.1 to 25.0 km/h (14.97 to 15.53 Mph)	• • • • 25 km/h (15.53 Mph)

Speed display value is rounded to a higher number.

5.2.3 Fuel gauge

This gauge shows the remaining amount of fuel (gasoline or diesel fuel). It shows the remaining amount of fuel just after the key switch is turned to the ON position. After that, the remaining amount is displayed for 2 minutes on average.



Note:

E (Empty) remaining amount

Truck model	Remaining amount
4.0 to 5.5 ton	14.3 liter (872.6 cu.in.) or less

Note: LPG dual fuel truck shows gasoline remaining amount only.

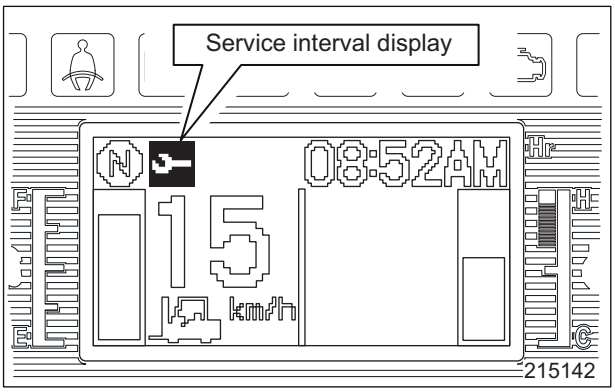
(3) For password registration, change, and cancellation, use the service tool.
(For details, see the service tool manual.)

Note: • Password registration, change or cancellation should be performed by service personnel.
• Password registration of "0000" or "1111" are not available.
Register a different 4-digit password.
•Up to 32 different passwords can be registered to support different truck operations.

5.6.2 Service interval display (Dealer option)

Service interval display will notify an operator of the scheduled inspections and maintenance when the hour counter reaches to pre-set number of hours. Note that service interval symbol will not be displayed if this setup is not installed. For setting up the service interval display, use the service tool. (For details, see the service tool manual.)

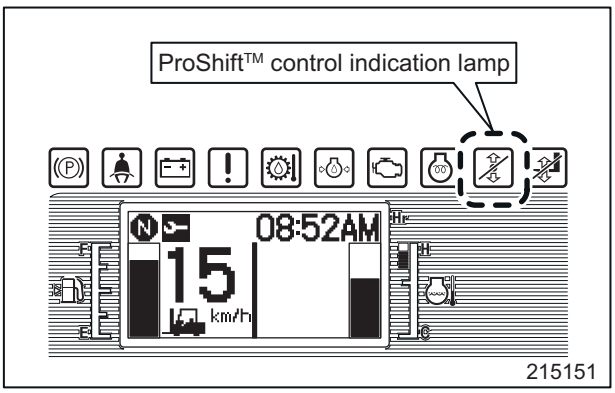
Note: • ONLY service engineers should set up and perform the service interval display setting.



5.6.3 ProShift™ control display (Manufacturer's option)

The ProShift™ control display will notify an operator of the lift truck condition by the ProShift™ control lamp glowing when a protective function activates against a full reverse or sudden acceleration. For setting up the ProShift™ control display, use the service tool. (For details, see the service tool manual.)

Note: ONLY service engineers should set up and perform the ProShift™ control display setting.



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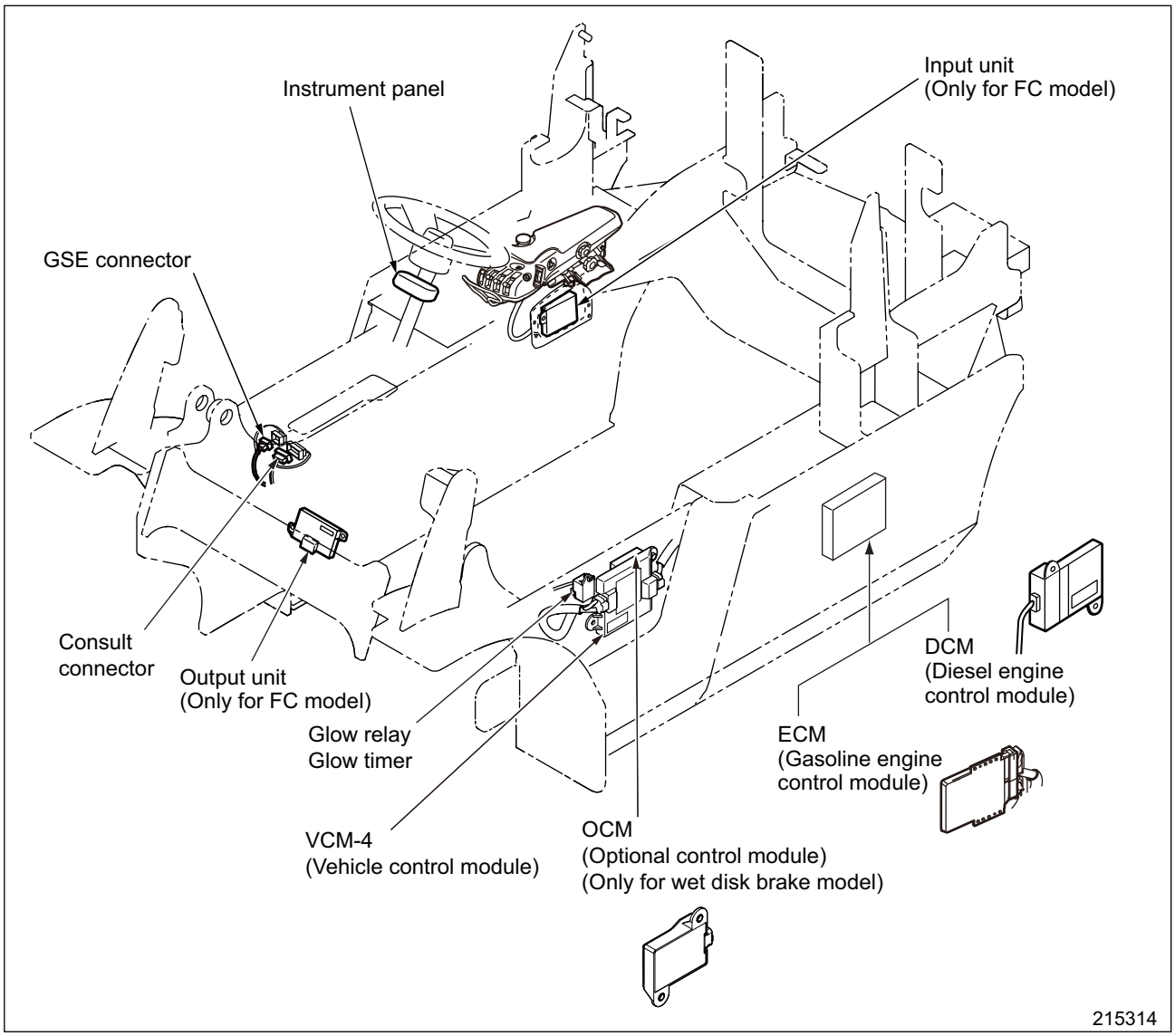
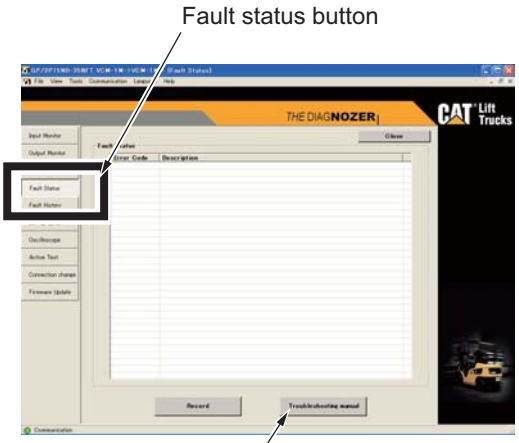
1. Outline

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. The fault status monitor screen allows you to monitor a current fault status. Pressing the trouble-shooting manual button in the lower part of screen brings up a list of error code and the troubleshooting information.



4.2 Mast Interlock System of VCM-4 Controller, Checking Procedure

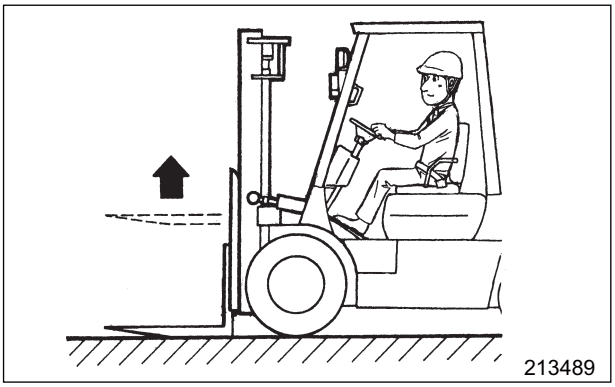
♦Mast Interlock System

(a) Raise the forks high enough to see them from the operator seat.

(b) Apply the parking brake and place the direction lever to the neutral position. Then, with the engine idling (without pressing the accelerator pedal), half rise from the operator seat.

(c) Check that the mast interlock indicator lamp blinks in a few seconds. Operate the lift lever to check that the forks do not move up and down.

(d) Operate the tilt lever to ensure the mast does not tilt forward or backward.



⚠ CAUTION

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.

♦Mast Interlock System of VCM-4 Controller, Checking Procedure

(1) Connect the service tool to the VCM-4 controller.

(2) Turn the key switch to the ON position and start the engine.

(3) Display the input monitor screen of the service tool.

(4) While monitoring the input monitor screen, sit in the operator seat and make sure that the seat switch status and the seat switch timer are ON.

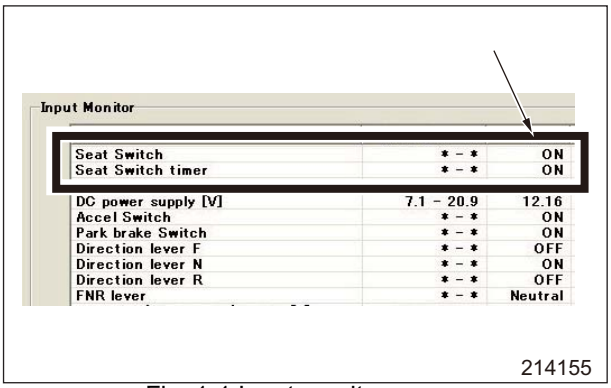


Fig. 1-1 Input monitor screen

(5) Display the service tool output monitor screen. When the status of the seat switch timer is ON, the controller unlocks the mast interlock and turns the unload output and the lift lock output ON. (Fig. 1-2)
You can operate the mast system under this condition.

♦Operate the lift lever to check that the forks move up and down, and operate the tilt lever to check that the mast tilts forward and backward.

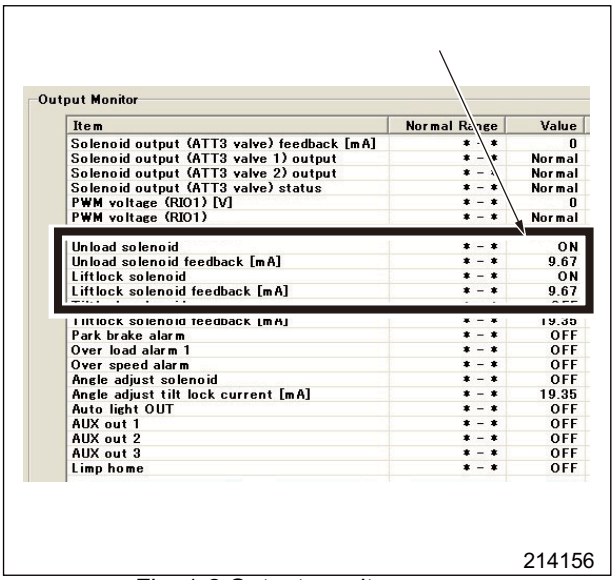


Fig. 1-2 Output monitor screen

(11)To unlock the interlock function, sit on the operator seat and return the direction lever to the neutral position. At this time, make sure that the driving interlock indicator lamp (N) changes from blink to glow.

♦If the seat switch will not turn ON

Check the seat switch operation and wiring connections by referring to the "Harness codes of section 8", the "VCM-4 controller of section 9.1", and the "Seat switch/Seat belt switch of section 9.2."

♦When T/M (F)/(R) Solenoid error occurs

Check the solenoid output according to "Active test inspection procedure" of section 5.3. If the solenoid output does not turn ON even after the active test inspection, refer to the "Error Codes and Troubleshooting of Section 10" and check for the possible causes of the error code F-85, F-87 and F-89.

♦When a speed or speed sensor error occurs

Refer to "Error Codes and Troubleshooting of Section 10" and check for the possible causes of the error code F-17 and F-34.

9. Controller Output Details

9.1 VCM-4 Controller

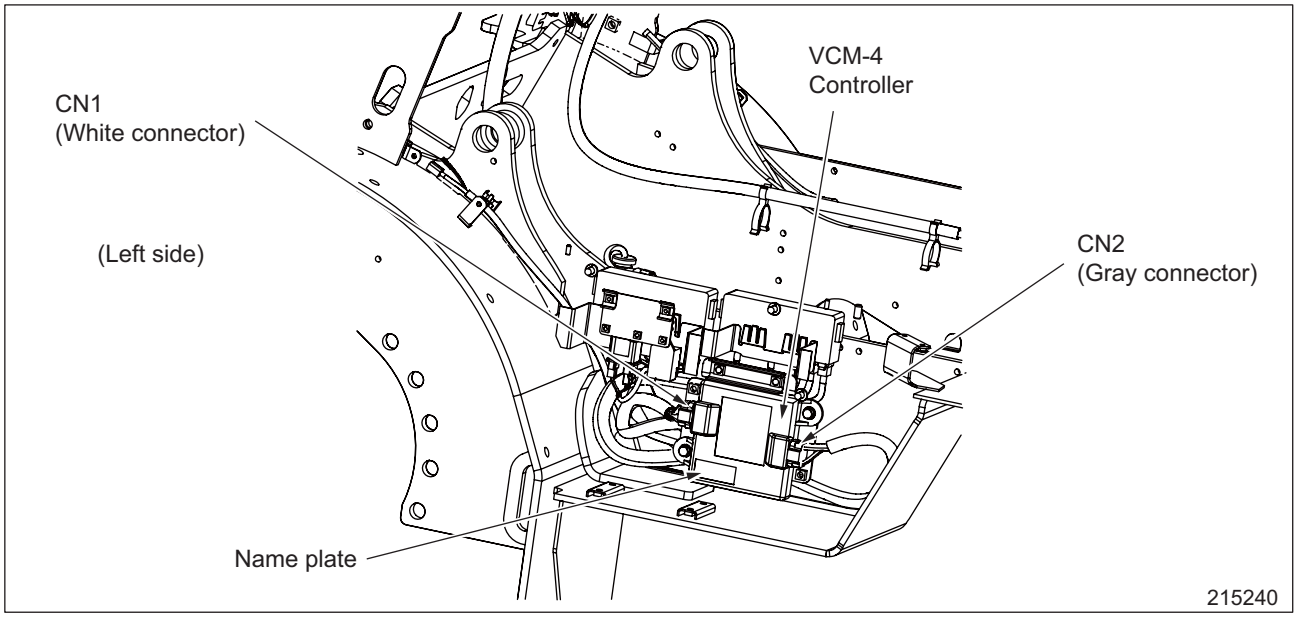


Fig. 7-1 Controller location

(1) VCM-4 Controller pin location

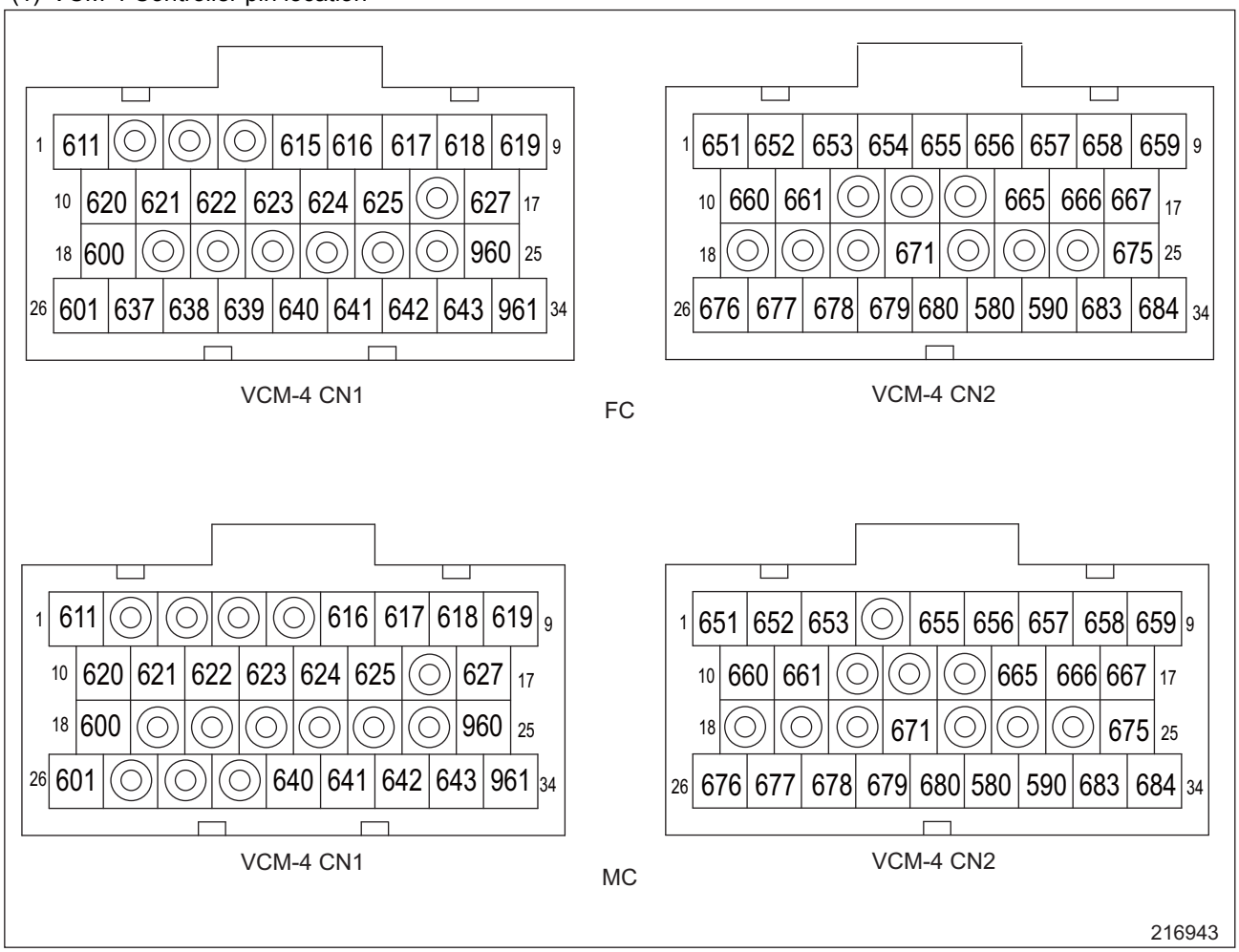


Fig. 7-2 Controller pin allocation (VCM-4)

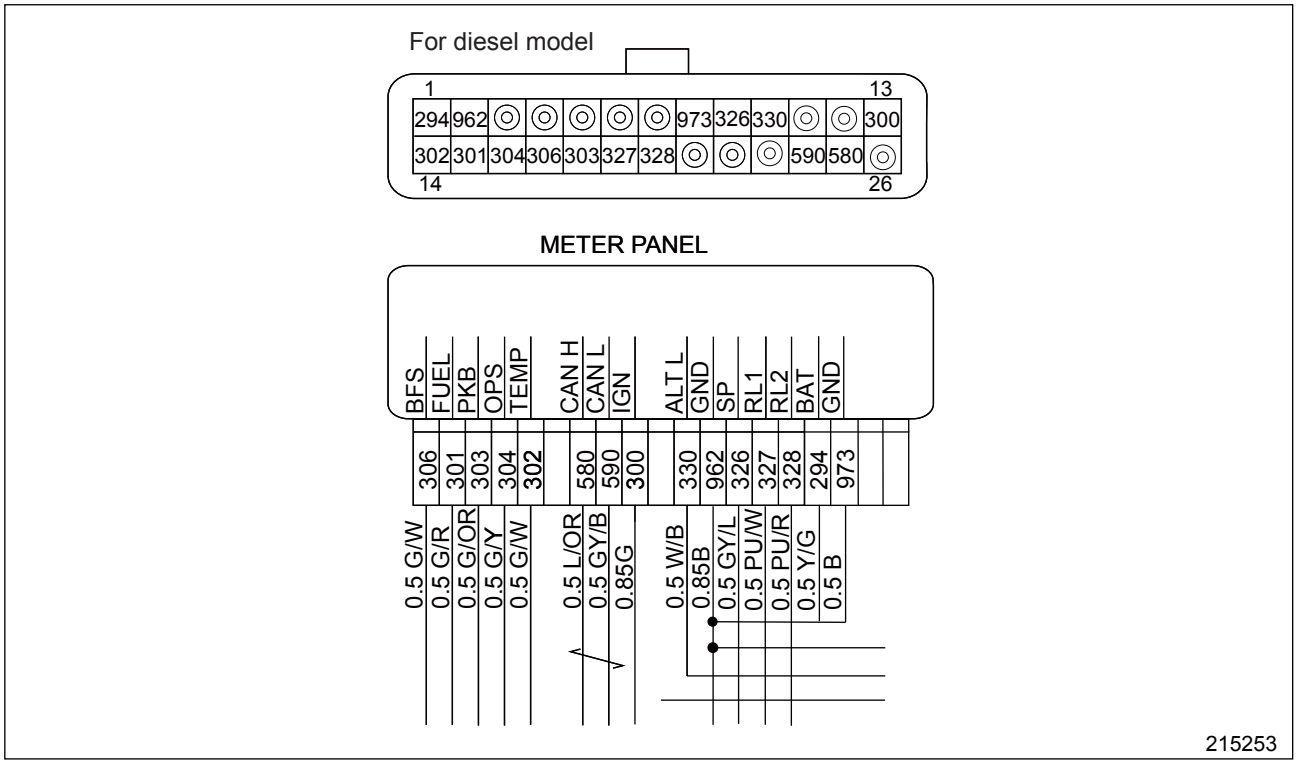


Fig. 7-18 Instrument panel circuit (diesel-engine model only)

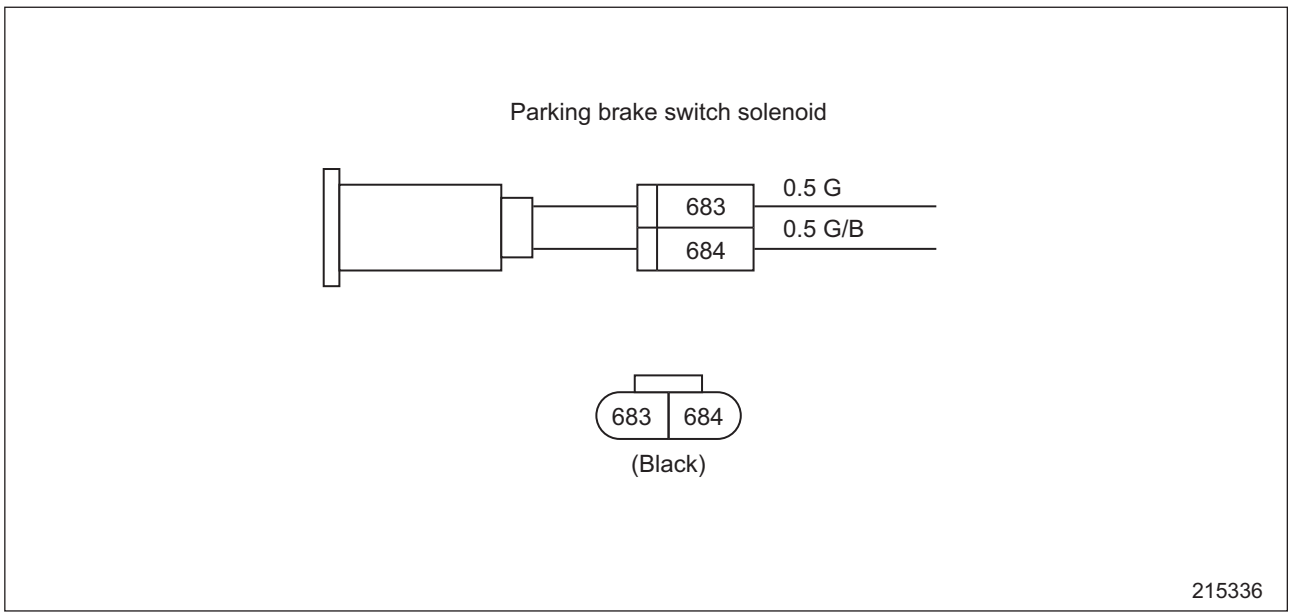
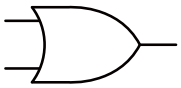
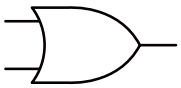


Fig 7-19 Parking brake switch solenoid

Diagnosis	Tilt angle sensor error (F38)
Logic conditions	· Input signal is 0.1 V or less · Input signal is 4.9 V or more (400-millisecond continuity)  F38
Recovery	Turn on power again.
Control action	· No tilt action with the tilt auto-stop ON.
LED blink pattern	D

Diagnosis	Steering error (F40)
Logic conditions	· Only wheel angle sensor has 2-second continuous change. · Steering wheel angle sensor input error  F40
Recovery	Turn on power again.
Control action	· No knob deviation correction control.
LED blink pattern	D

Diagnosis	RI01 error (F41)
Logic conditions	· CAN receiving abnormal flag from output unit. —— F41
Recovery	Recovers automatically
Control action	· Indication only
LED blink pattern	B

Diagnosis	RI01 PWM power error (F44)
Logic conditions	· CAN receiving abnormal flag from output unit. —— F44
Recovery	Recovers automatically
Control action	· Indication only
LED blink pattern	B

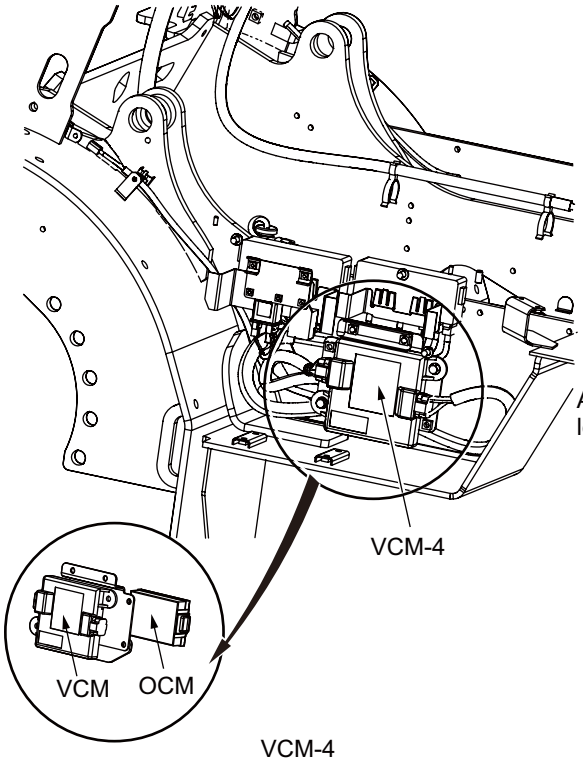
Diagnosis	RI01 communication error (F45)
Logic conditions	· CAN receiving from output unit is impractical. (100-millisecond continuity) —— F45
Recovery	Recovers automatically
Control action	· Activates with default values of output unit incoming data.
LED blink pattern	B

Diagnosis	RI02 error (F46)
Logic conditions	· CAN receiving abnormal flag from input unit. —— F46
Recovery	Recovers automatically
Control action	· Indication only
LED blink pattern	B

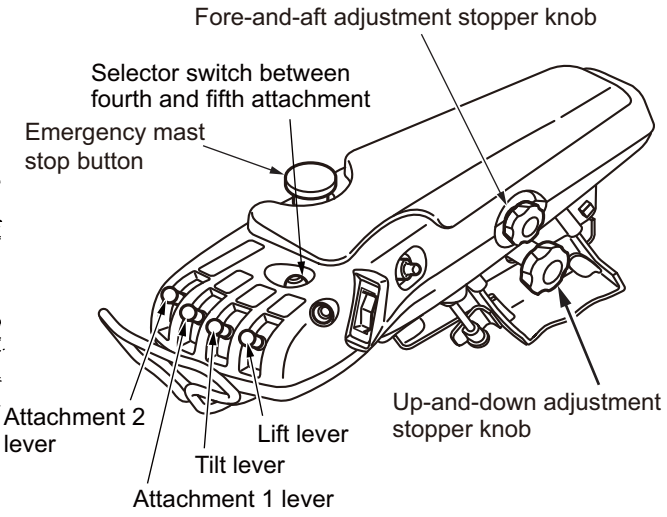
10.3 Error Codes and Troubleshooting

Error code	Diagnosis	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-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-09	Load type set error	1. Controller bad	1. Setting check using service tool
		2. 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	

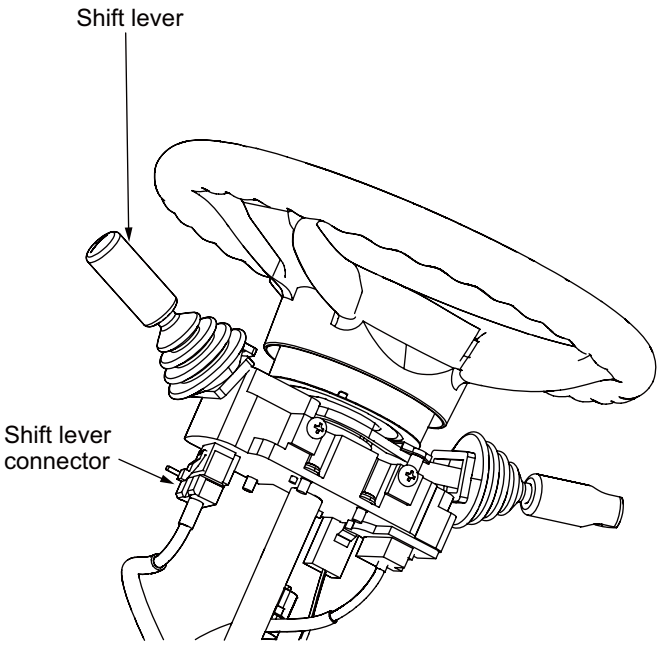
11. Locations of Sensors and Switches



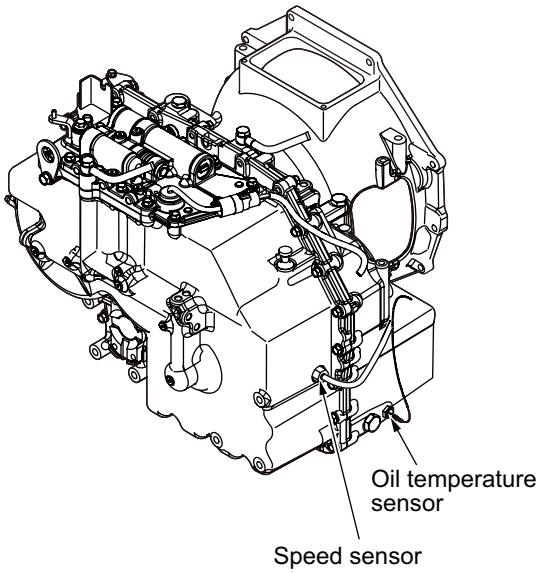
VCM-4
(frame left side)



FC Lever box (for FC model)



Shift lever



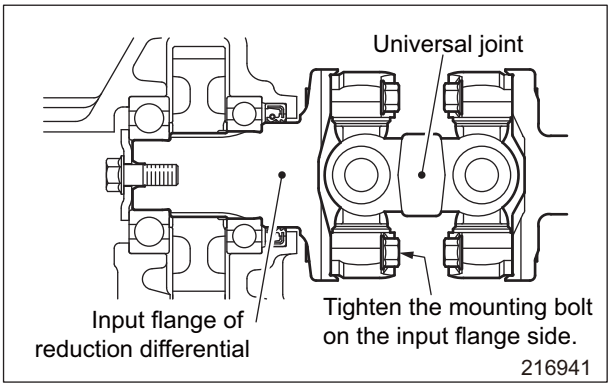
Transmission (left side)

215254

(5) Align the universal joint mounting bolts on the transmission with the input flange threaded holes on reduction differential, and tighten the bolts.

Unit: N·m (kgf·m) [lbf·ft]

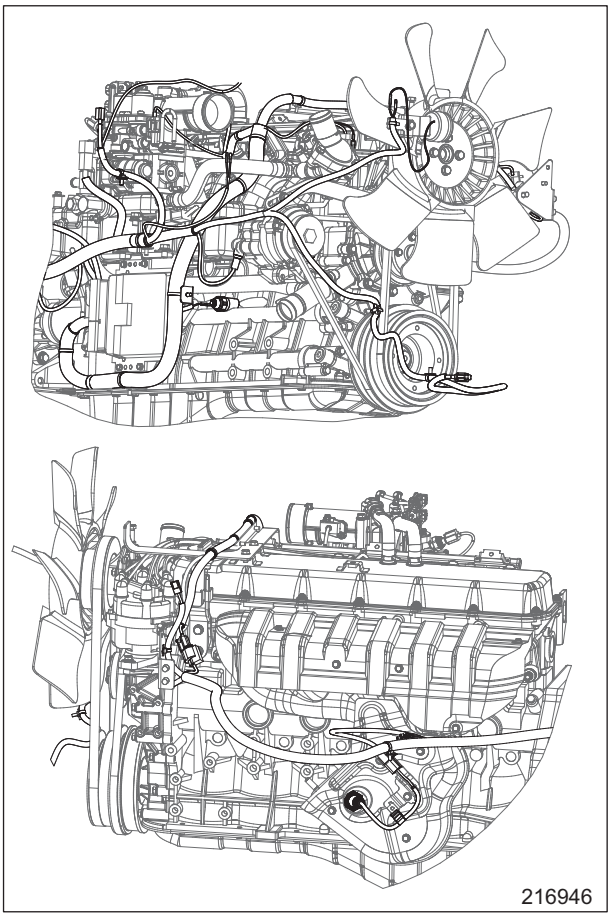
Tightening torque	54.0 to 63.8 (5.51 to 6.51) [39.85 to 47.08]



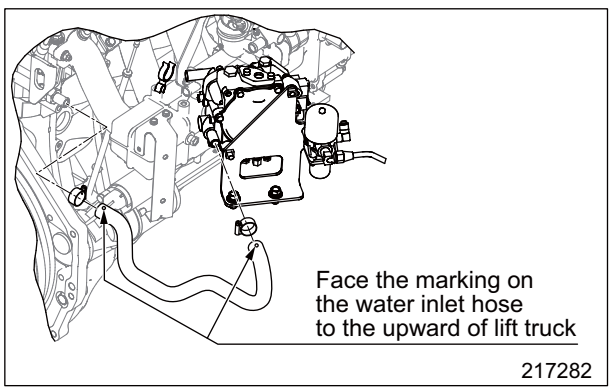
(6) When installing the exhaust pipe, replace the gasket with a new one.

(7) Check that all the harnesses on the engine and the transmission are correctly connected.

(8) Check the battery cable for any missing connections or wrong connections, and then connect the ground (negative) cable to battery.



(9) Face the marking on the water inlet hose to the upward of lift truck when installing the water inlet hose to the vaporizer.



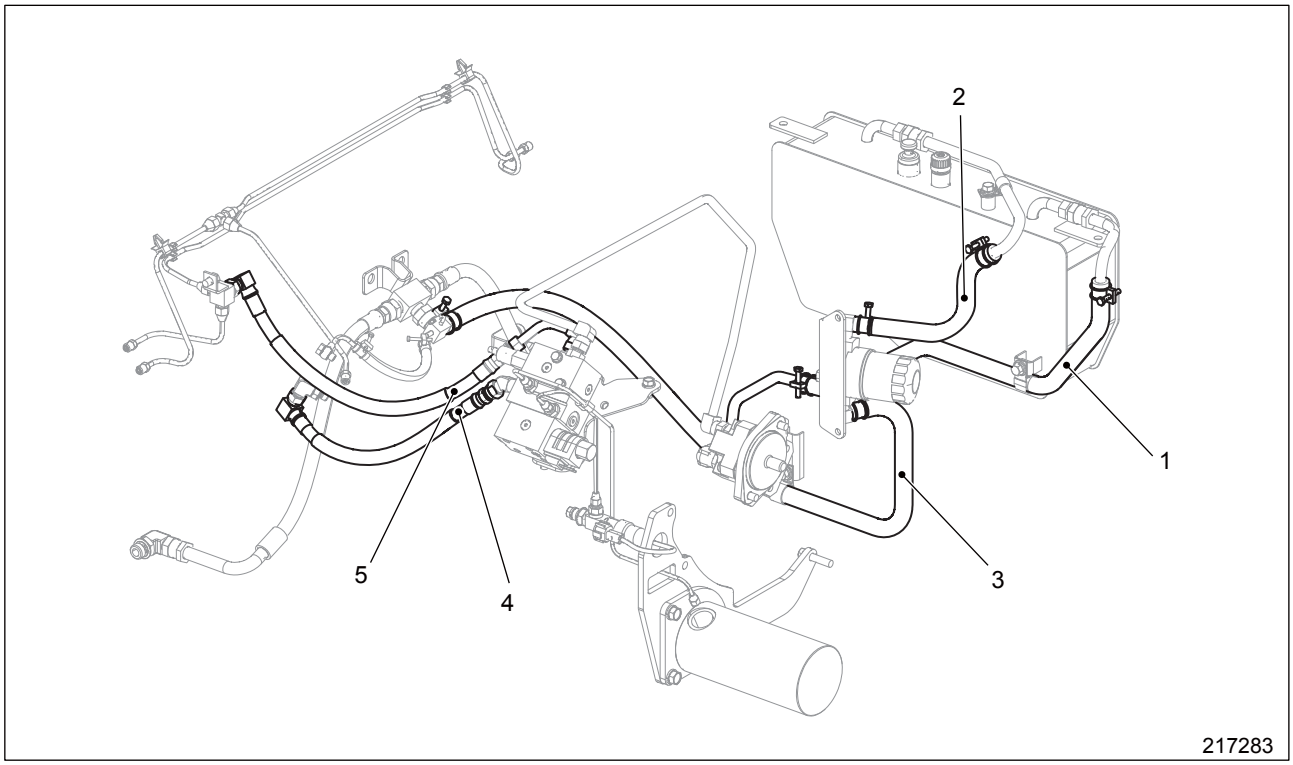
3. Removal and Installation (Wet disc brake)

3.1 Removal of Engine and Transmission Assembly

This section only provides the information on the removal and installation of the power line specific to the wet disc brake. For the information common to both wet disc brake and standard truck, refer to the removal and installation for the standard truck.

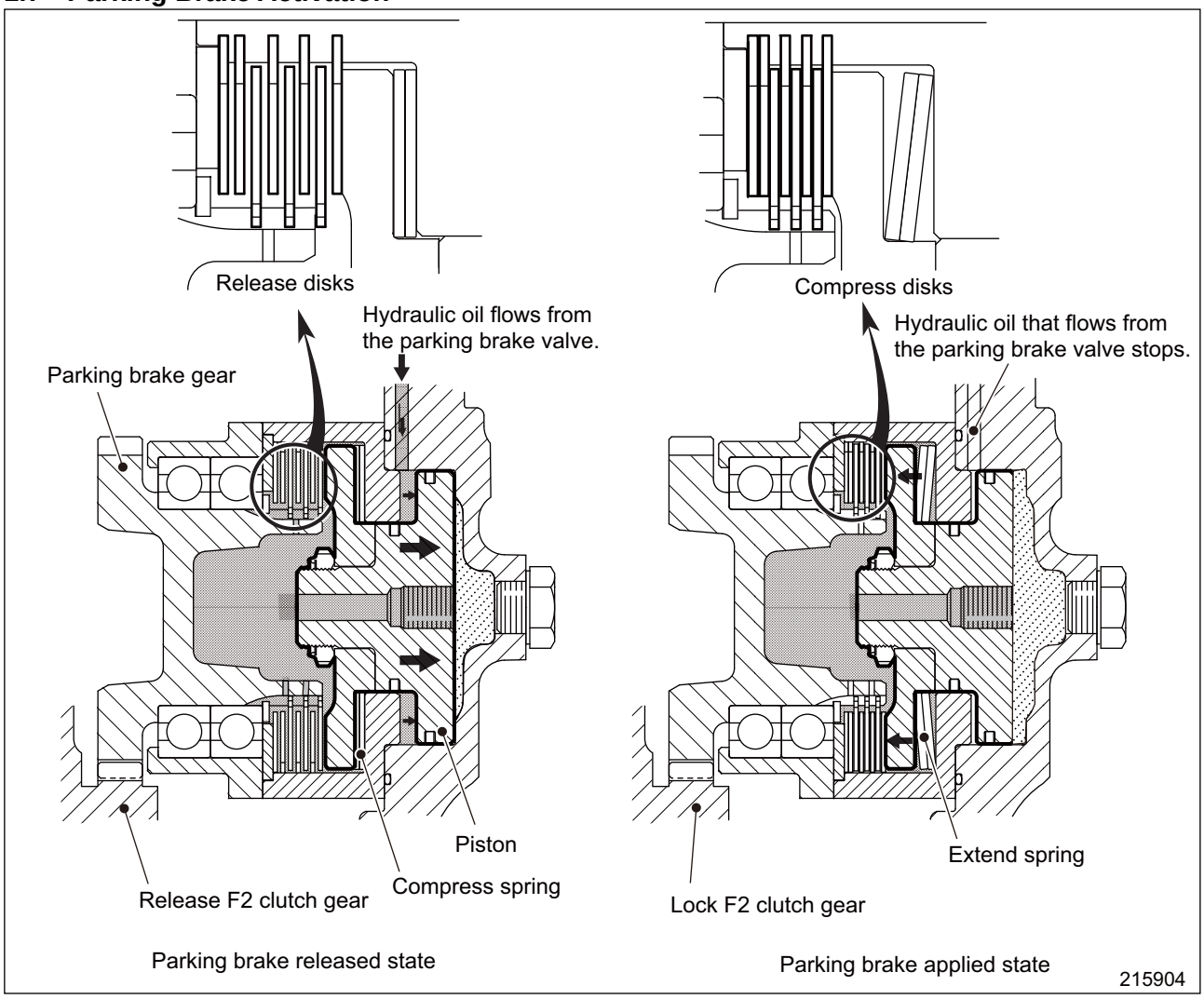
Suggestions for Removal

Removal of Wet Disc Brake Hoses



1 Suction hose
2 Return outlet hose
3 Return inlet hose
4 Rubber hose
5 Rubber hose

1.7 Parking Brake Activation



♦Parking brake released state

When the parking brake switch is released (shown on the left in the illustration)

Hydraulic oil flows into the parking brake through the PKB port of the parking brake valve. Then the piston is forced to move to the right as shown in the illustration.
This piston movement compresses the springs, thereby releasing the discs (mating plate and friction plate).
This brings the parking brake gear into the disengaged position.

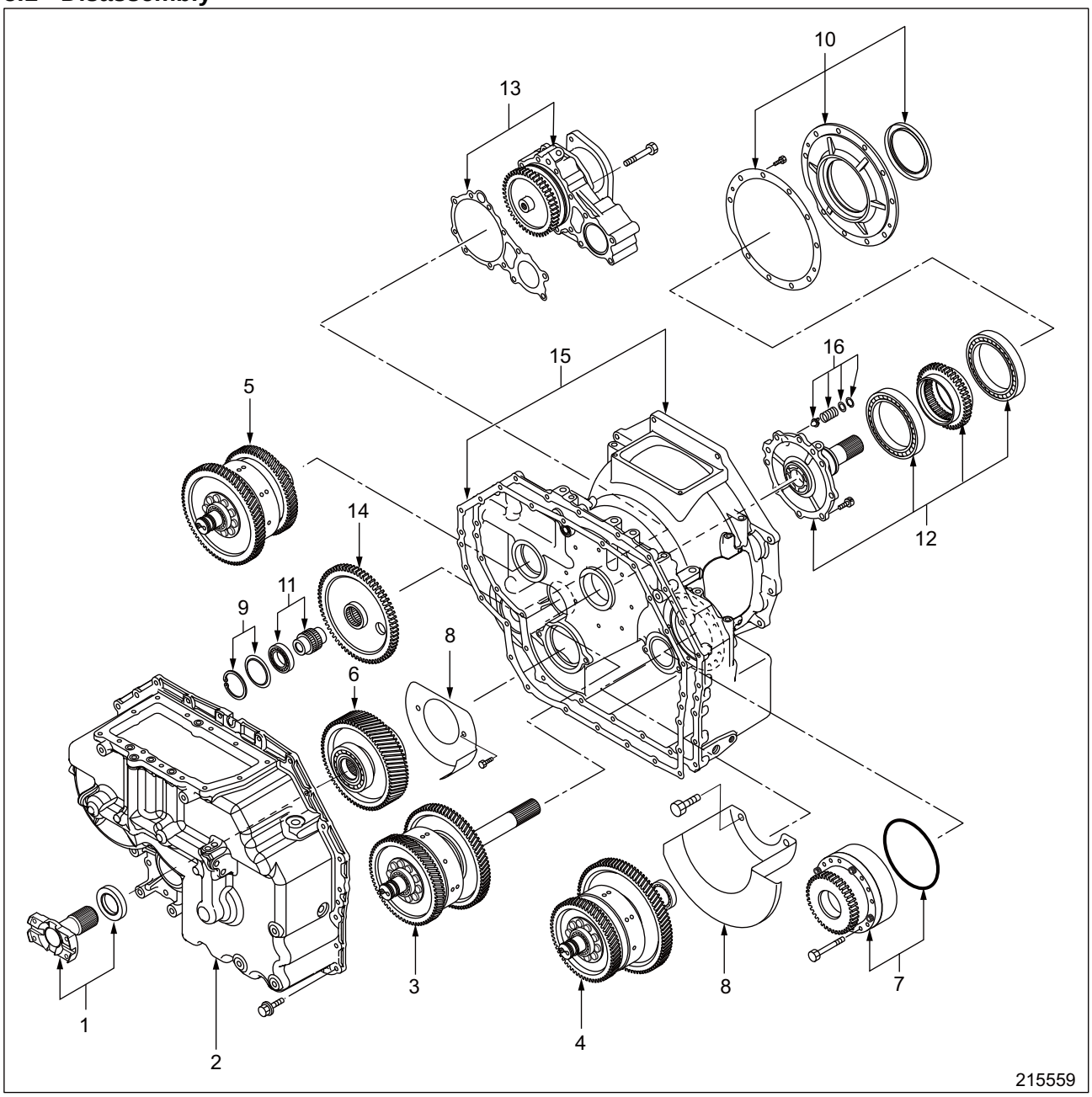
♦Parking brake applied state

When the parking brake switch is actuated (pushed) or when the engine is stopped (shown on the right in the illustration)

Hydraulic oil that flows from the parking brake valve stops.
The piston is clamped against the discs by the expansion force of the springs.
The parking brake gear that has been disengaged is now fixed and the F2 clutch is thereby fixed to generate a brake force.

5. Transmission

5.1 Disassembly

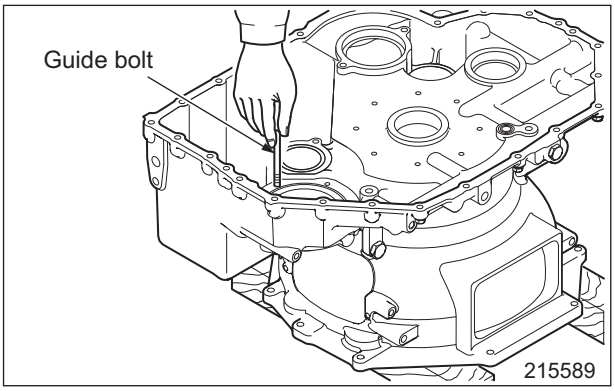


Disassembly sequence

1 Output flange, Oil seal
2 Transmission housing
3 R1 clutch pack assembly
4 F2 clutch pack assembly
5 F1 clutch pack assembly
6 Output gear
7 Parking brake assembly, O-ring
8 Baffle plate
9 Snap ring, PTO bearing plate
10 Torque converter housing, Oil seal
11 PTO idler shaft, Bearing
12 Stator shaft assembly
13 Gear pump assembly, Gasket
14 PTO idler gear
15 Torque converter housing, Gasket
16 Relief valve, Spring washer, Snap ring

(15)Turn over the torque converter housing.

(16)Install the guide bolt to the torque converter housing for proper alignment to the parking brake assembly.

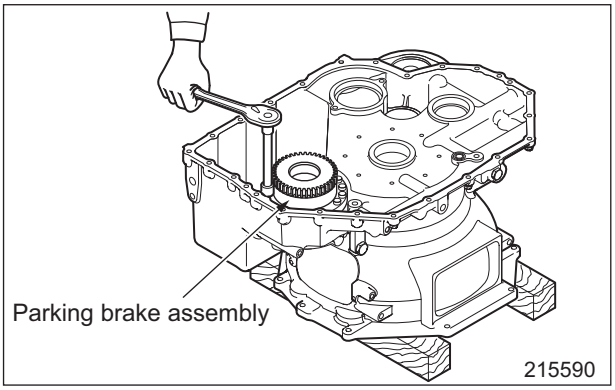


(17)Install the parking brake assembly, and evenly tighten its bolts to the specified torque.

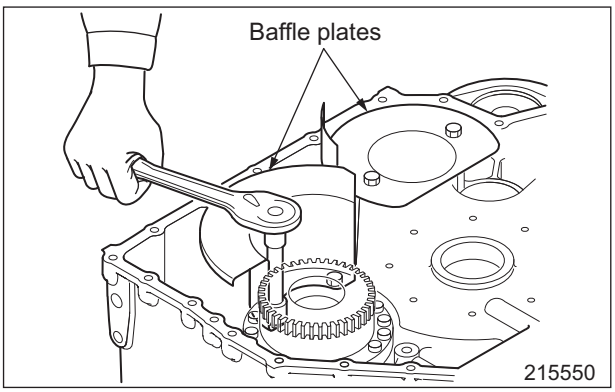
Unit: N·m (kgf·m) [lbf·ft]

Parking brake assembly mounting bolt tightening torque	21.6 ± 2.2 (2.20 ± 0.22) [15.93 ± 1.62]

Note: When installing the parking brake assembly, be sure to prevent the O-ring from protruding from the mating surface and the piston seals from being damaged.

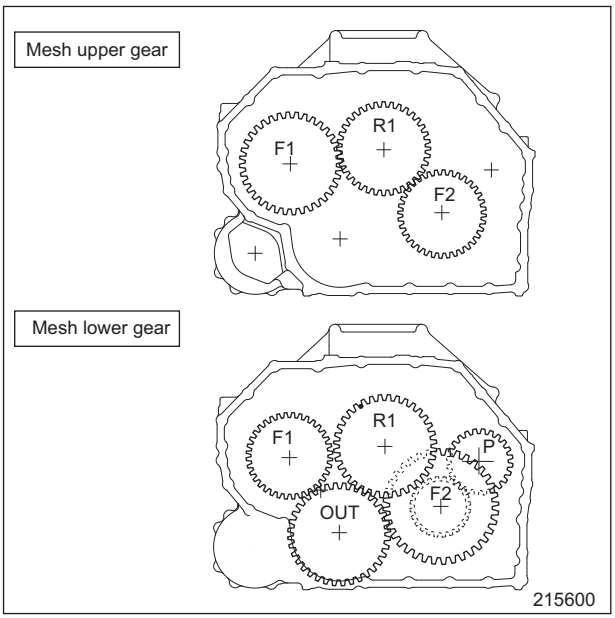


(18)Install the baffle plate.



(19)Install the output gear and each clutch pack by referring to the following steps.
Each gear is meshed each other as shown in the illustration on the right.

(a) Apply ATF Dexron-II to each bearing.



6.3 Reassembly

(1) Install the piston seal to the clutch piston.

(2) Apply ATF Dexron-II to both the piston seal and sliding surface of the clutch piston.

(3) Using a wood bar, evenly push the clutch piston into the clutch drum.

Note: Be sure to push the clutch boss when pushing the clutch piston.

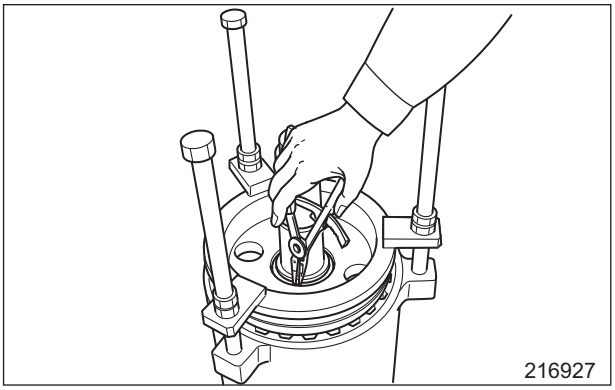
(4) Install both the clutch return spring and spring retainer.

Note: Be sure to install a new snap ring. Do not reuse snap rings once removed.

(5) Using a clutch pack stand kit (special tool) or a press, compress the spring retainer and clutch return spring together, and install the snap ring.

Special tool	Part number
Stand	91K67-00700
Ring	91K67-00800
Plate	91K67-00900
Bolt	91K67-01100

Note: Be sure to evenly tighten the clutch pack stand kit with bolts.

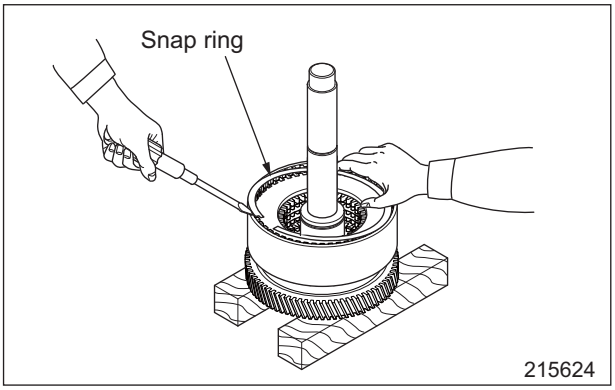


(6) Assemble friction plates and mating plates in the same order before they were removed.

(7) Install the pressure plate with the marked side facing upward.

(8) Install the snap ring into the clutch drum groove using a flathead screwdriver.

Note: Use a new snap ring. Do not reuse snap rings once removed.

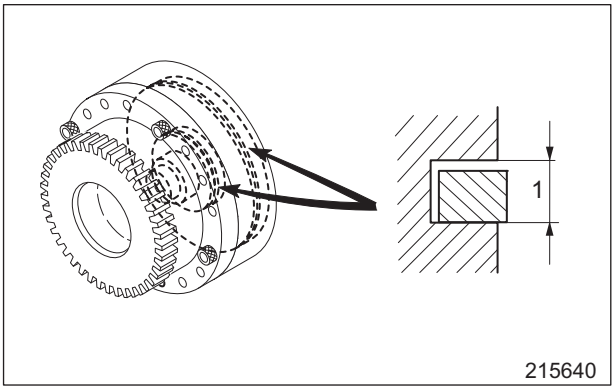


9.2 Inspection and Repair

(1) Piston

(a) Inspect sliding area for wear and damage.
If any scratches are found, polish the scratched surface using a fine grit sandpaper. If a significant scratches are found, replace the clutch piston with a new one.

(b) Measure the width of the piston seal groove, and if the measured width exceeds the service limit, replace the piston with a new one.



Unit: mm (in.)

Width of piston seal groove 1	A	$40\ ^{+0.1}_{0}$ ($1.57\ ^{+0.004}_{0}$)
	B	0.165 (0.0065)

A : Standard value B: Service limit

Note: Be sure to replace piston seals with new ones whenever they are removed.

(2) Gear
Check gears for wear or damage.

(3) Housing
Check both the piston sliding portion and parking brake spring contact area for wear or damage.

(4) Friction plates and mating plates

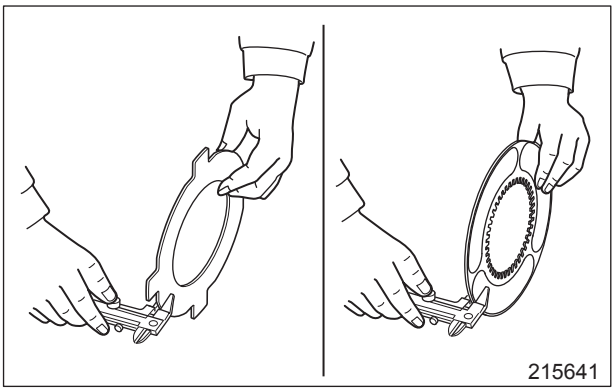
(a) Check both plates for seizure, uneven contact, distortion, or damage.

(b) Check mating plates for hot spots (scattered black carbon deposits).

(c) Check both the inner and outer teeth of each plate for wear or damage.

(d) Measure thickness of each plate.

Note: If any of the above defects is found, replace the entire plates with new ones.



Unit: mm (in.)

Friction plate	A	2.55 ± 0.15 (0.1004 ± 0.0059)
	B	2.37 (0.0933)
Mating plate	A	1.6 ± 0.1 (0.063 ± 0.004)
	B	1.47 (0.0579)

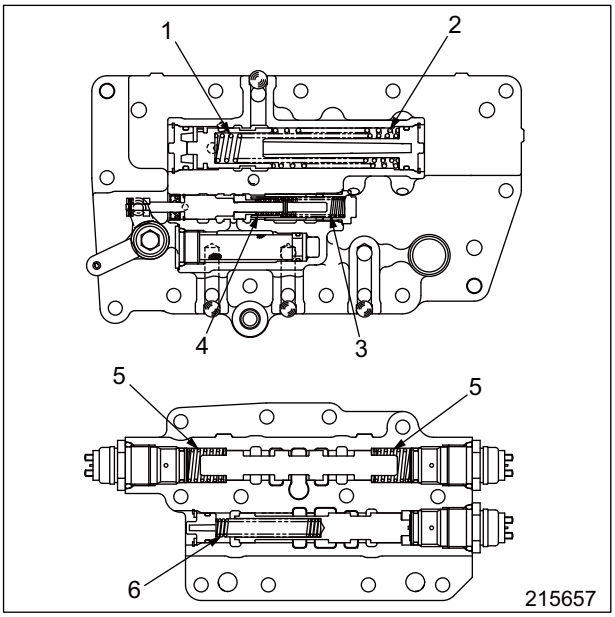
A : Standard value B: Service limit

(9) Measure the free length and the height under load of each spring.

Unit: mm (in.)

Accumulator inner spring 1	Free length	A	154 ± 5 (6.1 ± 0.2)
		B	147 (5.8)
	Height / under load	A	145 (5.7) / 61 ± 5 N (6.5 ± 0.5 kgf) [13.7 ± 1.1 lbf]
		B	145 (5.7) / 54 N (5.5 kgf) [12.1 lbf]
Accumulator outer spring 2	Free length	A	109.5 ± 3.5 (4.3 ± 0.14)
		B	104 (4.1)
	Height / under load	A	100 (3.9) / 61 ± 5 N (6.5 ± 0.5 kgf) [13.7 ± 1.1 lbf]
		B	100 (3.9) / 54 N (5.5 kgf) [12.1 lbf]
Inching return spring 3	Free length	A	87 ± 3 (3.4 ± 0.12)
		B	83.5 (3.3)
	Height / under load	A	50.2 (2.0) / 51 ± 5 N (5.2 ± 0.5 kgf) [11.5 ± 1.1 lbf]
		B	50.2 (2.0) / 43 N (4.4 kgf) [9.7 lbf]
Inching spring 4	Free length	A	18.4 (0.7)
		B	18.3 (0.7)
	Height / under load	A	16.4 (0.6) / 49 ± 5 N (5.0 ± 0.5 kgf) [11.0 ± 1.1 lbf]
		B	16.4 (0.6) / 41 N (4.2 kgf) [9.2 lbf]
Directional spring 5	Free length	A	32.5 ± 1 (1.3 ± 0.04)
		B	30.5 (1.2)
	Height / under load	A	23.4 (0.9) / 39 ± 3 N (4.0 ± 0.3 kgf) [8.8 ± 0.7 lbf]
		B	23.4 (0.9) / 34 N (3.5 kgf) [7.6 lbf]
Solenoid spring 6	Free length	A	87.5 ± 3 (3.4 ± 0.1)
		B	83.5 (3.3)
	Height / under load	A	67 (2.6) / 80 ± 7 N (8.2 ± 0.7 kgf) [18.0 ± 1.6 lbf]
		B	67 (2.6) / 69 N (7.0 kgf) [15.5 lbf]

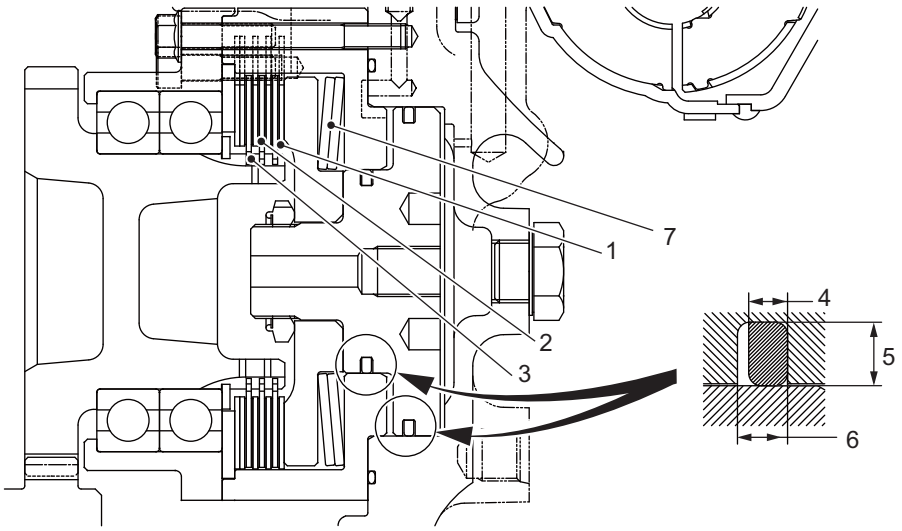
A: Standard value B: Repair or service limit



14.Troubleshooting

Condition		Possible cause	Action
Power output is low.	Engine	Engine lacks power.	Tune up engine
		Poor engine performance.	Tune up engine
	Torque converter	Seizure of stator freewheel.	Replace torque converter assembly.
		Impeller is damaged or rubbing.	Replace torque converter assembly.
	Transmission	Spool action in main regulator valve is faulty.	Repair or replace
		Fatigued spring in main regulator valve	Replace the spring
		Worn gears in oil pump, resulting in reduced capacity	Disassemble for inspection. If defective, replace.
		Magnet strainer is clogged.	Replace
		Water is mixed with oil.	Change oil
		Oil level is too low.	Refill
		Clutch slips or brake drags due to improper adjustment of pedal links.	Adjust
		Main pressure too low, resulting in slipping clutches.	Adjust
		Seal rings or O-rings are worn.	Inspect. If defective, replace.
		Clutch piston is damaged.	Replace
		Friction plate is seized or dragging.	Replace
	Road wheels	High mechanical resistance in road wheels.	Check and/or adjust brake system.
No power flow	Torque converter	Flexible plate is broken.	Replace
	Transmission	Oil pump drive is defective.	Replace
		Turbine shaft is broken.	Replace
		Main oil pressure is too low.	Check pump gears for wear. If worn, replace.
		Oil level is too low.	Refill
		Improper adjustment of inching pedal link.	Adjust
		Clutch shaft seal ring is worn.	Replace
		Clutch shaft plug slips out, resulting in oil leak.	Repair
		Clutch is seized.	Replace
		Shafts are broken.	Replace
		Clutch drum is defective, particularly snap ring groove.	Replace
		Snap ring for clutch drum is broken.	Replace
		Clutch piston oil passages are clogged.	Clean or replace
		Shaft splines are worn.	Replace shafts
	Power train	Faulty action of spools	Repair or replace
		Universal joint is broken.	Replace
		Either reduction differential parts or front axle parts are broken.	Repair or replace

Unit: mm (in.)

Item				Specified value
Parking brake	Thickness of mating plate 1		A	1.6 ± 0.1 (0.0630 ± 0.0039)
			B	1.47 (0.0579)
	Thickness of friction plate 2		A	2.55 ± 0.15 (0.1005 ± 0.0059)
			B	2.37 (0.0934)
	Backlash of friction plate and gear 3		A	0.1 to 0.3 (0.0039 to 0.0118)
			B	0.4 (0.0158)
	Width of piston seal 4		A	3.1 ± 0.1 (0.1221 ± 0.0039)
			B	2.9 (0.1143)
	Piston seal height 5		A	5.7 ± 0.1 (0.2246 ± 0.0039)
			B	5.5 (0.2167)
	Piston groove width 6		A	$4.0\ ^{+0.1}_{0}$ ($0.1576\ ^{+0.0039}_{0}$)
			B	4.2 (0.1655)
	Parking brake spring 7	Free length	A	7.5 (0.295) [reference]
		Height / under load	A	5.6 (0.2206) / 10360 ± 1040 N (1056.4 ± 106.1kgf) [2329.0 ± 233.8 lbf]
			B	5.6 (0.2206) / 9320 N (950.4 kgf) [2095.2 lbf]
	 215905			

A: Standard value B: Repair or service limit

3. Removal and Installation

3.1 Front Wheels (Common to Standard and Option Truck)

3.1.1 Preparation

(1) Block the rear wheels.

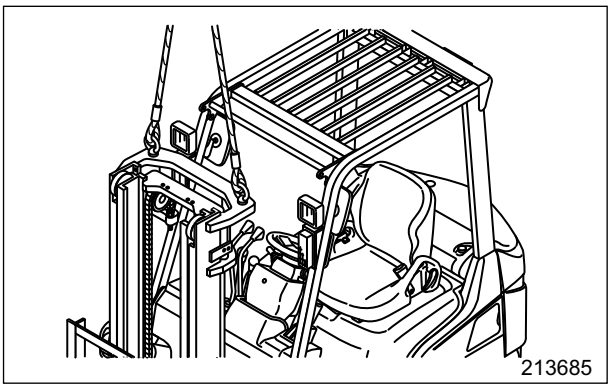
(2) Loosen the wheel nuts by two full turns.

(3) Raise the front wheels off the ground by either method below.

(4) Stop the engine.

Raising the front wheels

(a) Method using a crane
Hitch slings to the eye-bolts at both ends of the top cross member on the outer mast, and then lift the front end of the lift truck with a hoist.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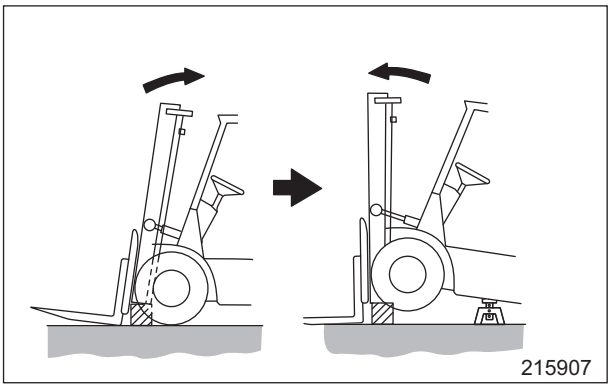
(b) Using hydraulic system
Firstly, tilt the mast all the way back and place wood blocks under the mast. Then, tilt the mast forward to raise the front wheels.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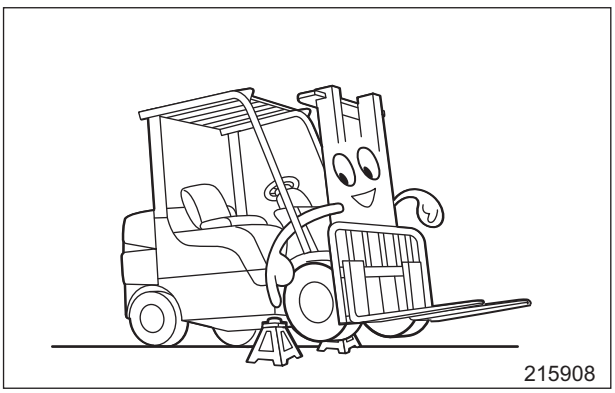
⚠ WARNING

After the front wheels are raised by either method, be sure to place jack stands under the frame to support it.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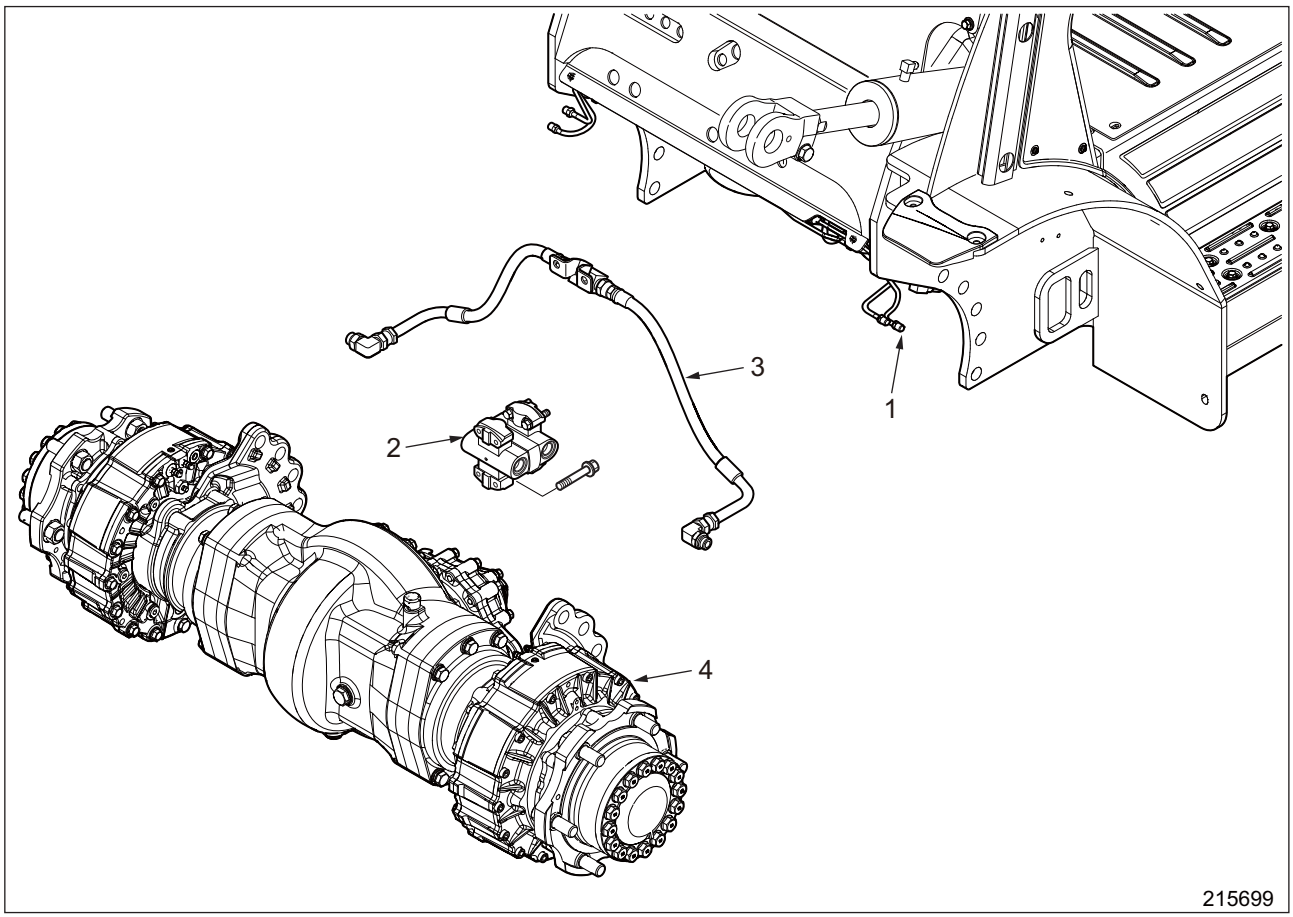
3.5.2 Removal

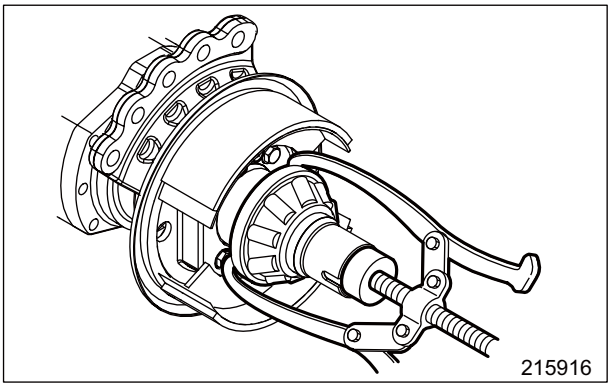


Removal sequence

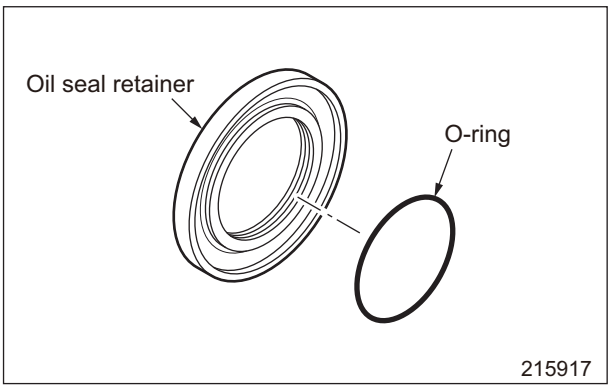
1 Brake pipe
2 Universal joint
3 Cooling return horse
4 Front axle assembly

(3) Tapered roller bearing

(a) Remove the tapered roller bearing and the oil seal retainer together using a bearing retainer.

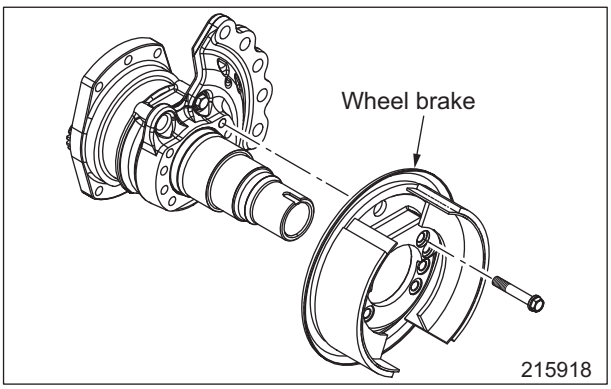


(b) Remove the O-ring from the oil seal retainer.

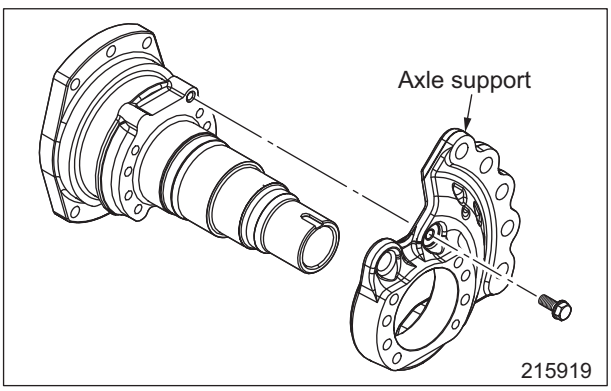


(4) Wheel Brake assembly

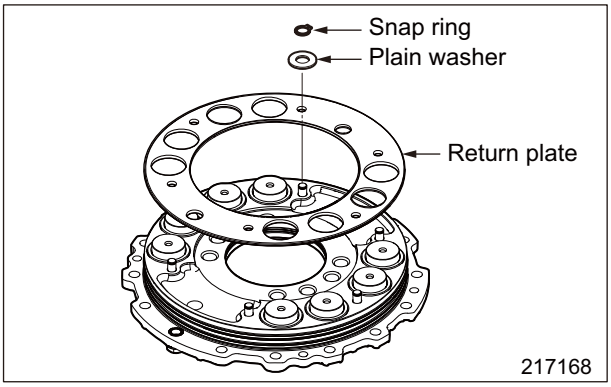
(a) Remove the mounting bolts and remove the wheel brake assembly.



(b) Remove the mounting bolts and remove the axle support.



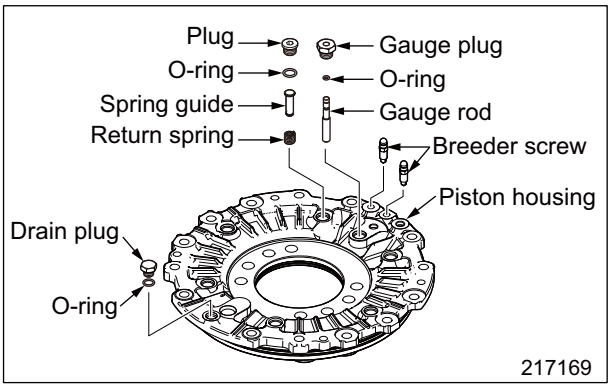
(13)Remove the snap ring and plain washer that fixed the return plate, and then remove the return plate.



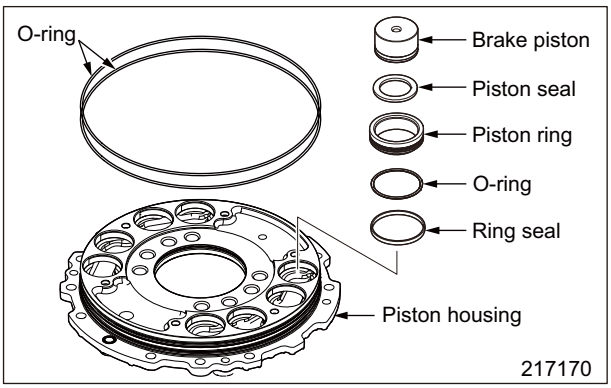
(14)Remove the gauge plug, gauge rod and O-ring from the piston housing.

(15)Remove the plug, O-ring, spring guide and return spring from the piston housing.

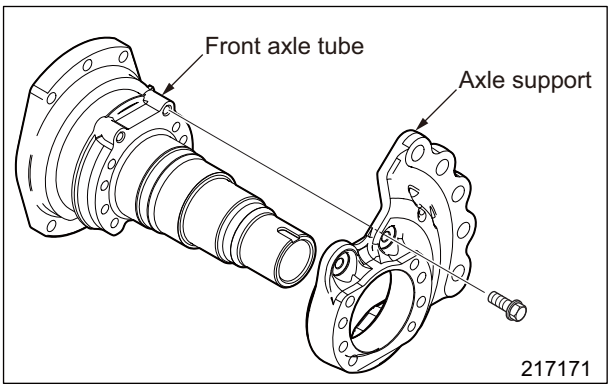
(16)Remove the drain plug, O-ring and breeder screw from the piston housing.



(17)Remove the brake piston, piston seal, piston ring, ring seal and O-ring from the piston housing.



(18)Remove the axle support from the front axle tube.



(17)Axle shaft

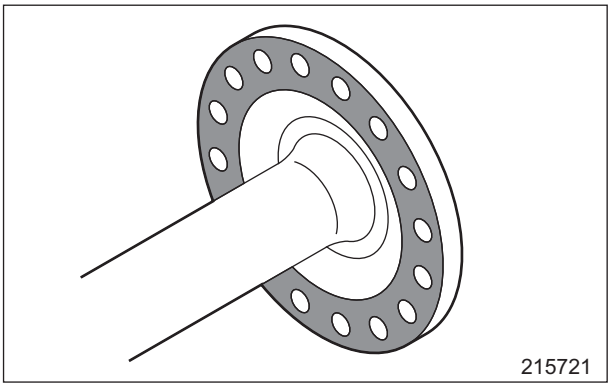
(a) Apply liquid gasket to the mating surfaces between the wheel hub and the axle shaft.

Liquid gasket	ThreeBond #1194 or equivalent

(b) Tighten the mounting bolt to the specified torque.

Unit: N·m (kgf·m) [lbf·ft]

Tightening torque	219 (22.3) [161.6]



(6) Adjusting bearing preload

(a) Tap the reduction gear on the back with a copper hammer while rotating it for a snug fitting.

(b) Hook a spring balance to the reduction gear mounting bolt head.

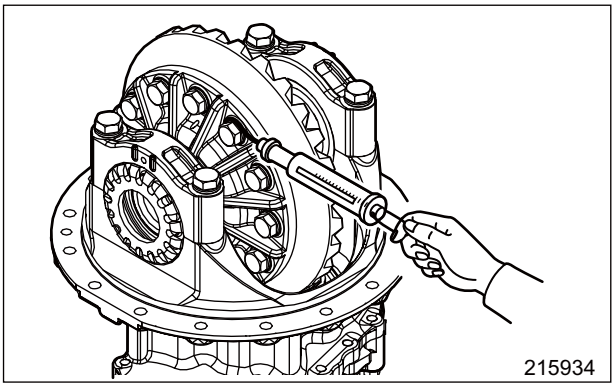
(c) Pull the spring balance, and measure tangential force just as the reduction gear starts to move.

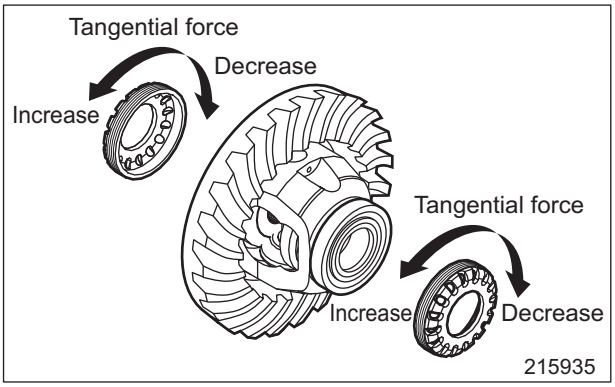
Unit: N (kgf) [lbf]

Tangential force	14.7 to 29.4 (1.5 to 3.0) [3.3 to 6.6]

(d) If the tangential force falls out of the specified range, adjust the force by changing the tightening force of the adjusting screws.

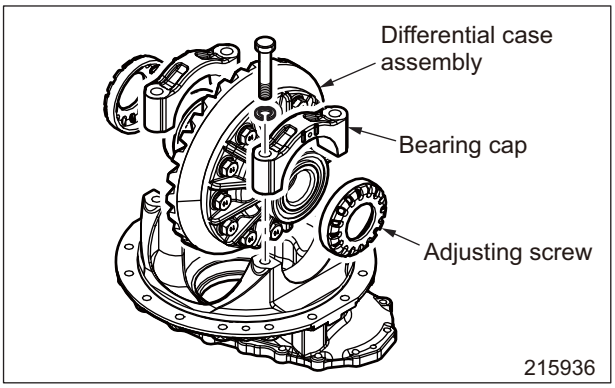
Note: When turning the adjusting screws, turn the adjusting screws, right and left, by the same amount in the same direction in order not to affect the bearing preload.





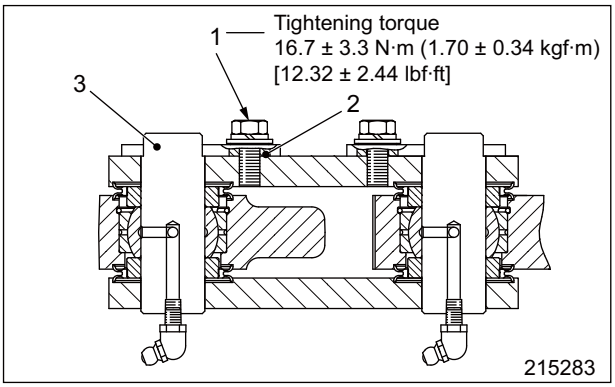
(7) Removing differential case assembly
After confirming the differential case preload, remove the differential case from the differential carrier.

Note: Put alignment marks across the adjusting screw and the bearing cap.



3.2 Disassembly and Reassembly of Knuckle (King Pin)

Suggestions for Disassembly



Start by

(1) Remove rear wheels.

(2) Remove wheel hubs.

Separation of tie rod

(1) In order to separate the knuckle from the tie rod, remove the bolt washer assembly 1 and spacer 2 on the knuckle and pull out the tie rod pin 3.

(2) In order to overhaul completely, disassembly is necessary. For details, refer to "Disassembly and Reassembly of tie rod."

Removal of king pin

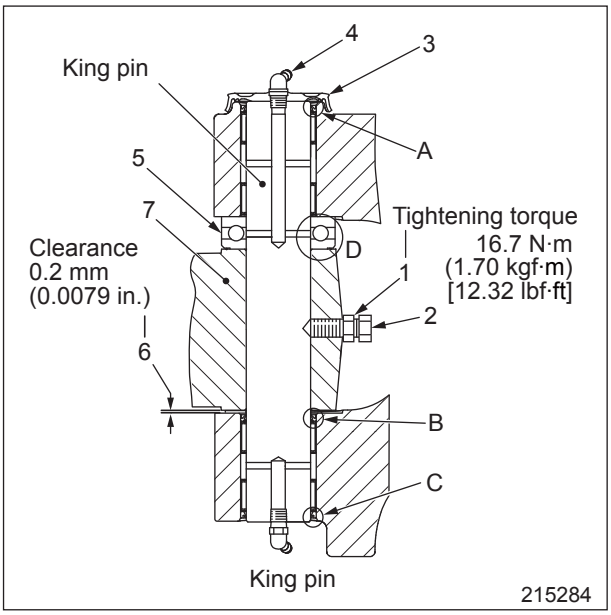
(1) Loosen the lock nut 1 and remove the stopper bolt 2.

(2) Remove the following parts attached to the upper part of the king pin. On the king pin, remove the king pin cover 3 and grease nipple 4.

(3) Apply a soft metal piece to the king pin from above and drive the king pin downward. Support the king pin by hand so that it will not fall down.

(4) Remove the thrust bearing 5, shim 6 and knuckle 7.

(5) Pull out the dust seal and needle bearing from the rear axle body as necessary.



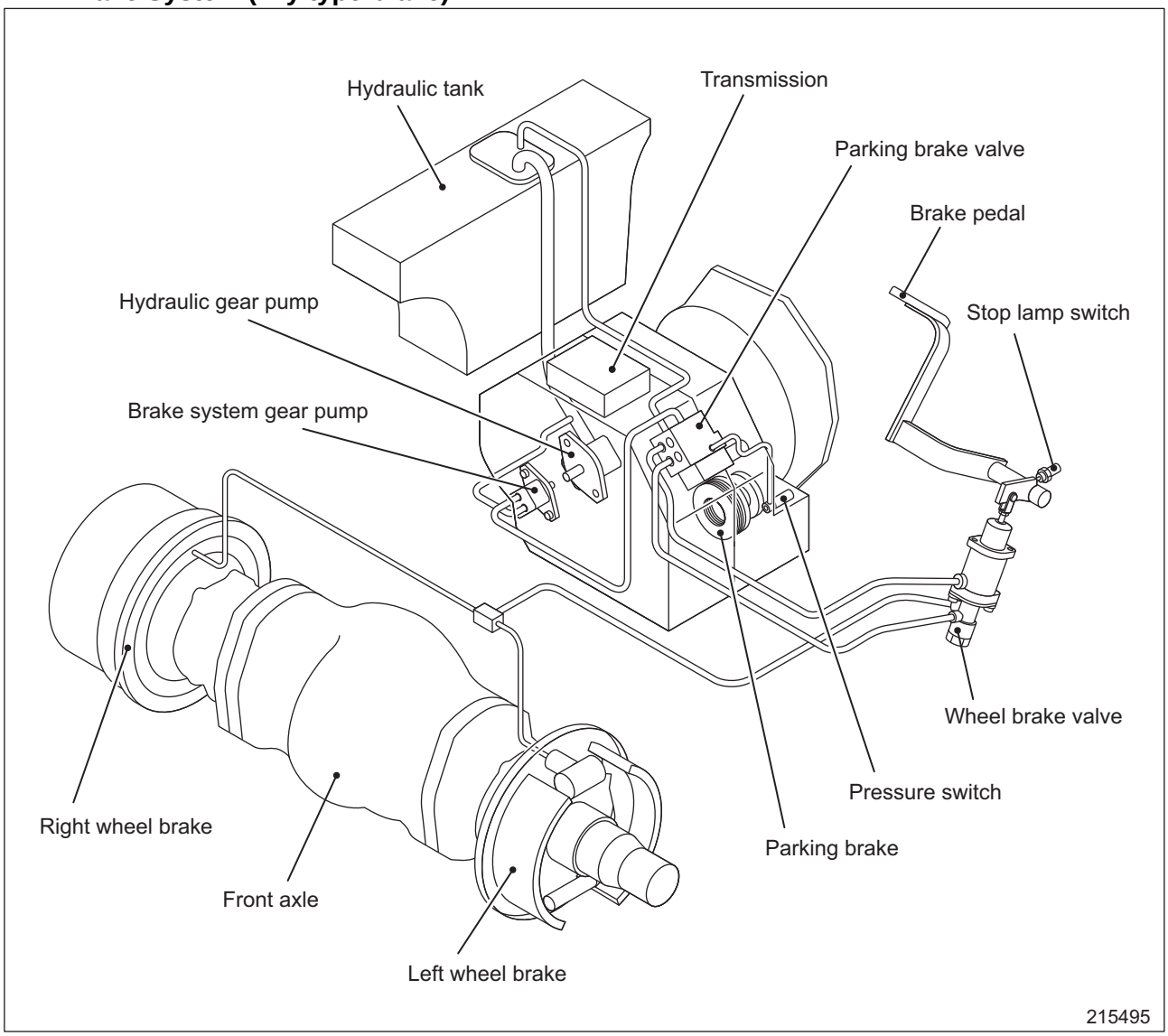
Inspections after Disassembly

Clean and inspect disassembled parts.

- Needle bearing and thrust bearing
  Replace the bearing if damage, seizure, peel, rotation failure, or unusual noise is found.
- Dust seal
  Replace the damaged or worn oil seal with a new one.

1. Structure

1.1 Brake System (Dry type brake)

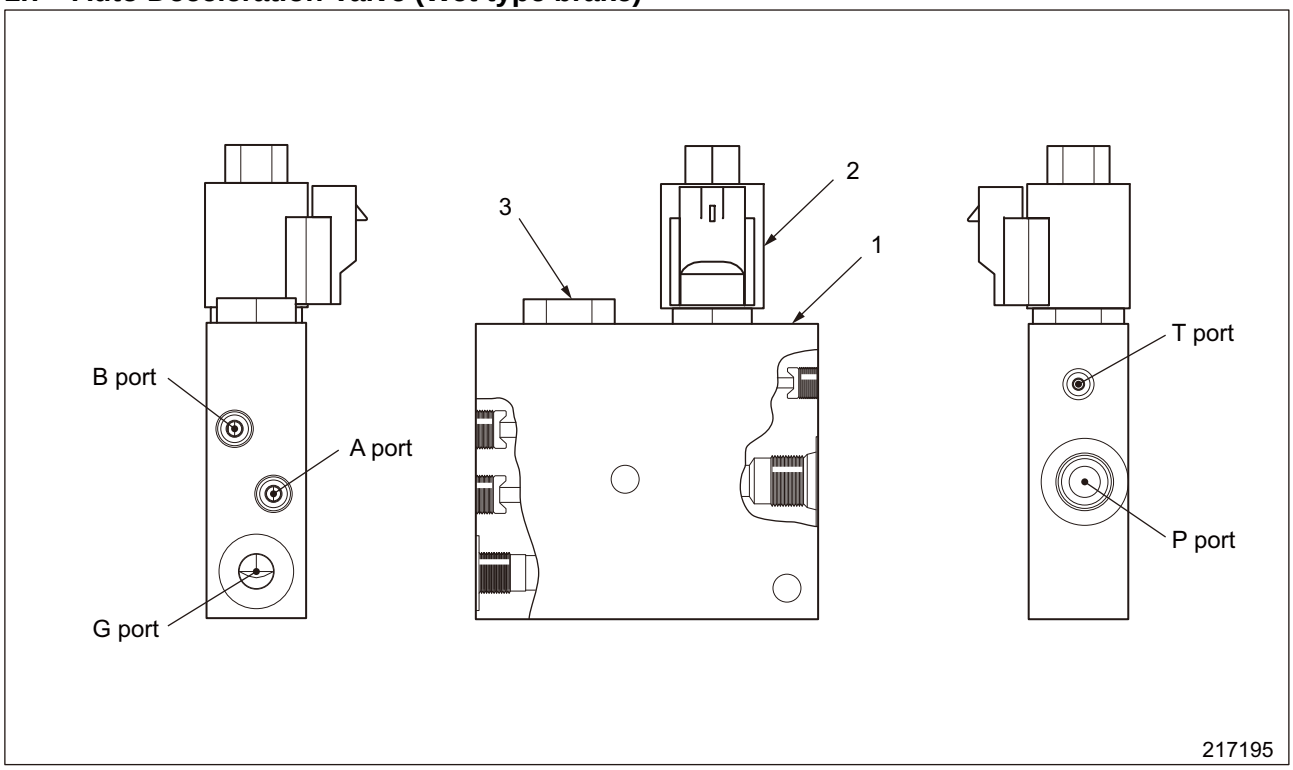


The wheel brake has a brake drum set into each side of the front axle.
The parking brake with a wet multi-disc brakes (negative brakes) is set in the transmission. A gear pump in the braking system uses hydraulic oil from the braking system to generate pressure to activate the wheel brakes and the parking brake.

⚠ CAUTION

DO NOT use brake fluid, use hydraulic oil.

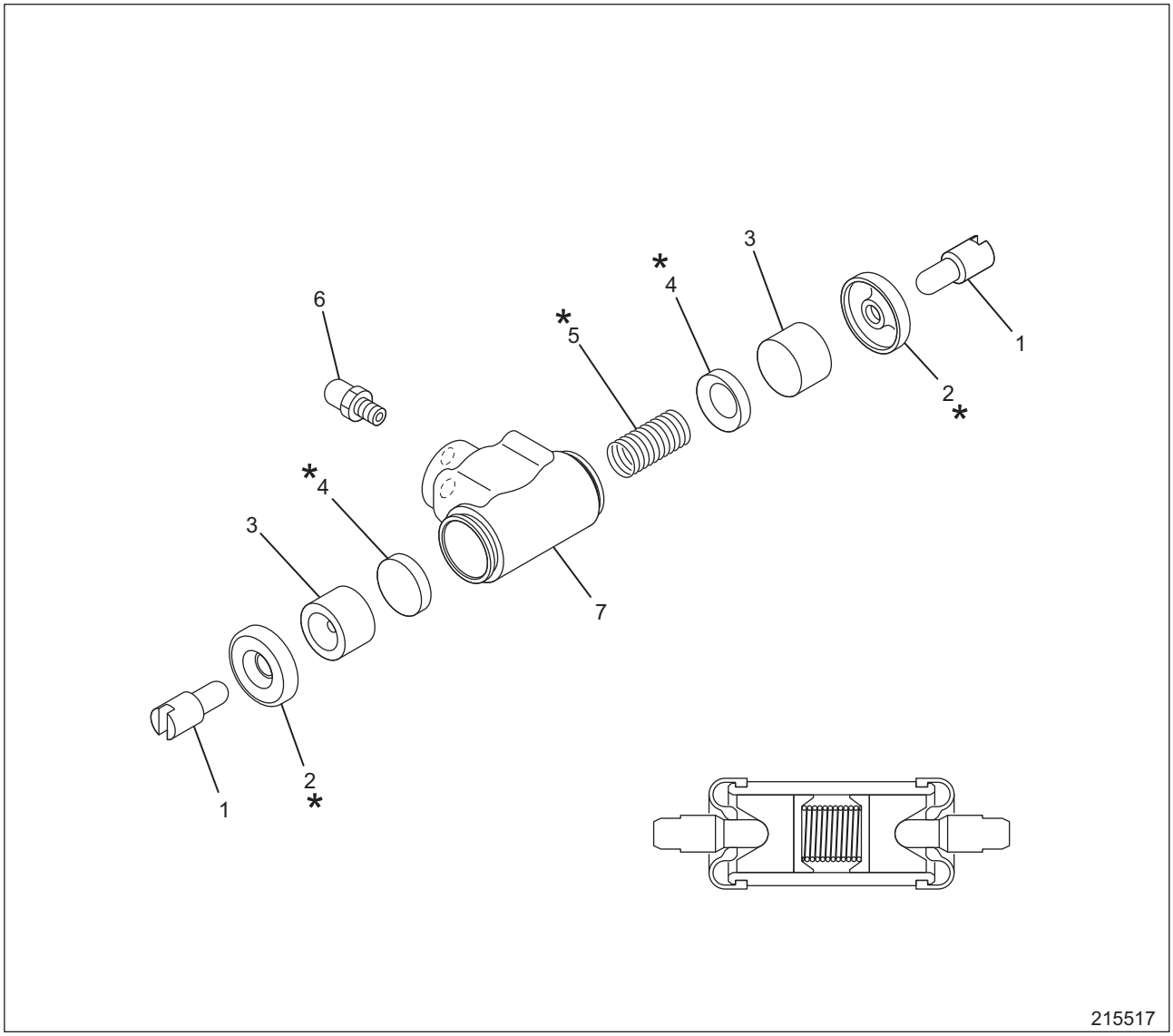
1.7 Auto Deceleration Valve (Wet type brake)



1 Block
2 Solenoid valve
3 Shuttle valve

2.2 Wheel Cylinder (Dry type brake)

2.2.1 Disassembly (4.0, 4.5 ton class)



Disassembly sequence

1 Connector link
2 Boot
3 Piston
4 Piston cup
5 Return spring
6 Bleeder screw, Cap
7 Cylinder body

Note: The parts marked * are included in the repair kit, and they should be changed periodically.

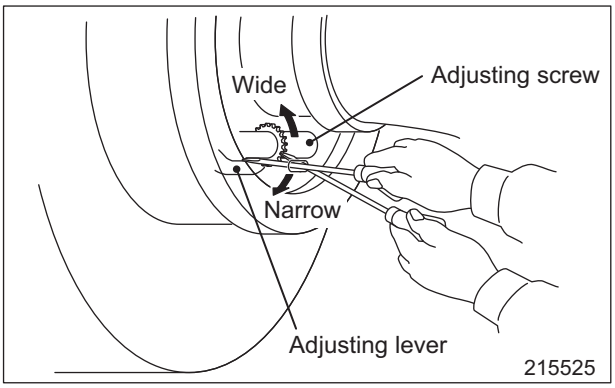
3.2 Manual Adjustment (Dry type brake)

(1) Remove the cover attached to the adjusting hole which is located on the back of the backing plate.

(2) Adjust the drum-to-lining clearance to specification by turning the adjusting screw wheel with two screwdrivers through a hole on the back of the backing plate.

(3) Hold the adjusting lever with one screwdriver and turn the wheel of the adjusting screw with the other screwdriver.

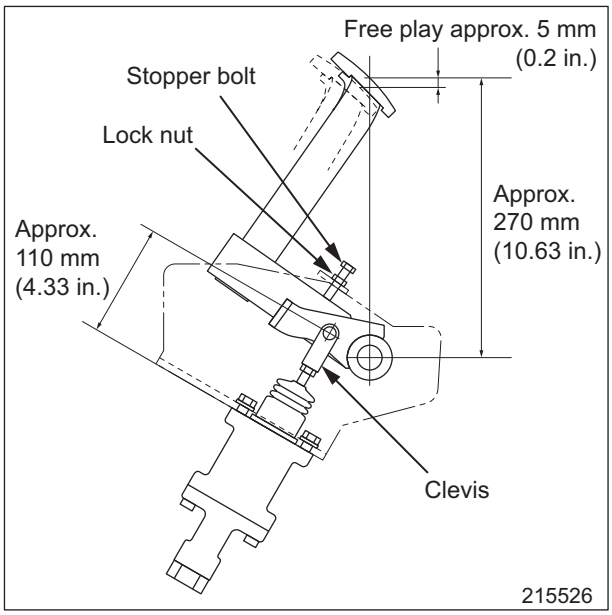
Note: The adjusting screw wheel can be adjusted by the notch of the wheel. One notch equals 0.03 mm (0.001 in.) in diameter.



3.3 Brake Pedal Adjustment (Common to dry and wet type)

(1) Adjust the stopper bolt to set the brake pedal pad height at approx. 270 mm (10.63 in.) from the center of the shaft, and lock it into place with a lock nut.

(2) In order to keep the clearance value to 1 mm (0.04 in.) between the push rod and the piston inside the wheel brake valve, set the distance from the center of the clevis slot to the edge of the body to approx. 110 mm (4.33 in.), adjust the push rod by rotating, and lock the clevis with locking nut. Make sure the free play of the brake pedal is approx. 5 mm (0.2 in.) after the adjustment is completed.



(Wet type brake)

Item	Condition	Possible cause	Action
Service brake	Brake will not activate	Leak from the hydraulic system, or main tank oil level is too low.	Repair leak and add brake oil.
		Air mixed in the hydraulic system	Bleeding air from brake oil line.
		Brake piston seal worn or damaged	Replace
		Friction plate worn or facing damaged	Replace
		Mating plate worn	Replace
	Uneven braking effect	Wheel tires are inflated unequally.	Re-inflate to specifications.
		Friction plate worn or facing damaged	Replace
		Mating plate worn	Replace
	Brake return failure	Piston return spring deteriorated	Replace
		Spring guide bent	Replace
	Brake squeaks	Inappropriate brake oil	Replace with the specified brake oil.
		Poor contact between friction plate and mating plate	Repair
Parking brake	Brake will not activate	Brake spring deteriorated	Replace
		Oil line is sealed up.	After draining oil from the port to forcibly release the parking brake valve, disassemble and check the parking brake valve.
	Brake can not be released.	Insufficient oil line pressure	Measure the hydraulic pressure of the relief valve in the parking brake valve, and adjust it.
		Parking brake valve failure	Replace
		Electric wiring damaged	Check the wiring continuity.

2.3.2 Installation

Follow the steps below for the installation.

(1) Turn the projection (a) on the cancel cam of the combination switch by hand to orient the same direction as shown in the illustration.

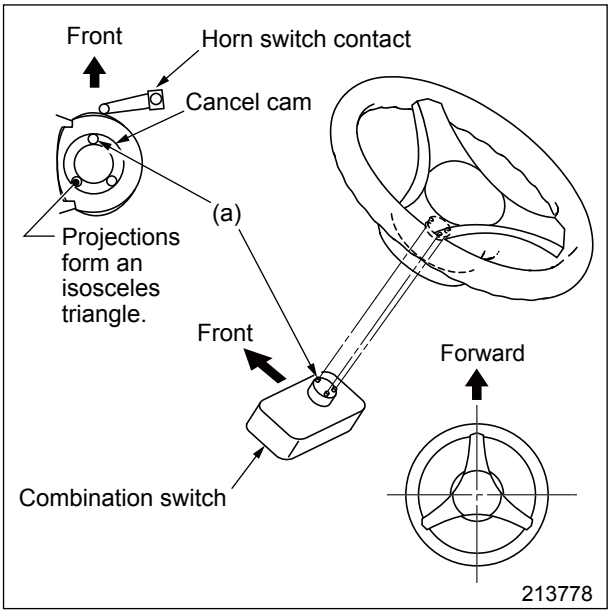
(2) Apply a thin coat of grease to the sliding area of the horn contact underneath the steering wheel boss.

(3) Orient the steering wheel to the forward driving position. Install the steering wheel so that its concave point fits the projection of the combination switch. Rotate the steering wheel to both directions several times to make sure the complete fit.

(4) Before tightening the steering wheel nut, make sure that the automatic return of the combination switch functions properly.

(5) If automatic return does not function, repeat the step (3) and (4).

(6) Tighten the steering wheel nut to the specified torque.



Unit: N·m (kgf·m) [lbf·ft]

Tightening torque for wheel nuts	58.5 ± 5.9 (5.97 ± 0.60) [43.15 ± 4.35]

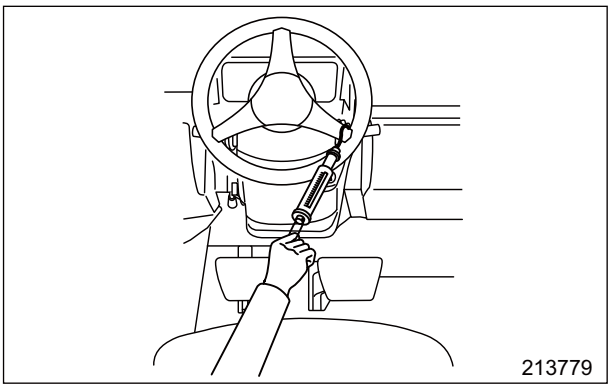
Inspection after Installation

Steering effort

(1) Apply the parking brake.

(2) Run the engine to warm the hydraulic oil temperature up to between 40 and 60 °C (104 and 140 °F).

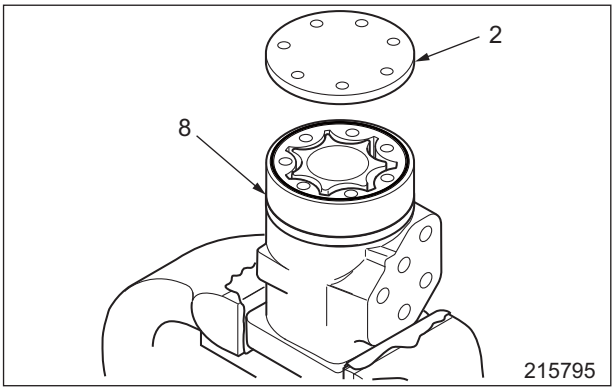
(3) Attach a spring scale to the rim or knob of the steering wheel, and measure the steering effort required to turn the steering wheel clockwise or counterclockwise from the straight-ahead position. Steering effort should be the value specified below or lower. If measured value exceeds the specified value below, then remove and reinstall the steering control valve, as misalignment of steering control valve is suspected.



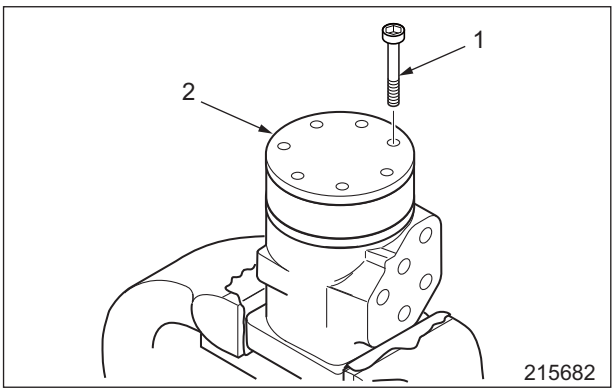
Unit: N (kgf) [lbf]

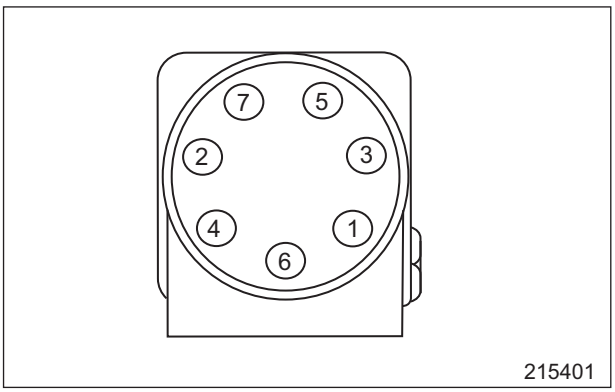
Steering effort (at steering wheel rim)	13 (1.3) [2.92]

(14)Place the end cap 2 on the gerotor (outer ring) 28, and align the bolt holes.

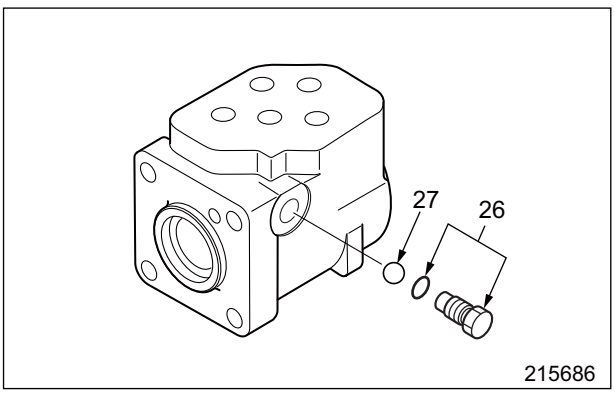


(15)Insert the seven cap screws 1 into the mounting holes of the end cap 2. Tighten the seven cap screws to the torque value of 9.8 N·m (1.00 kgf·m) [7.23 lbf·ft], and then tighten the screws in the order shown in the illustration to the torque value of 17±1 N·m (1.73±0.10 kgf·m) [12.54±0.74 lbf·ft]. Install the steering shaft into the spool and make sure that the spool turns smoothly.

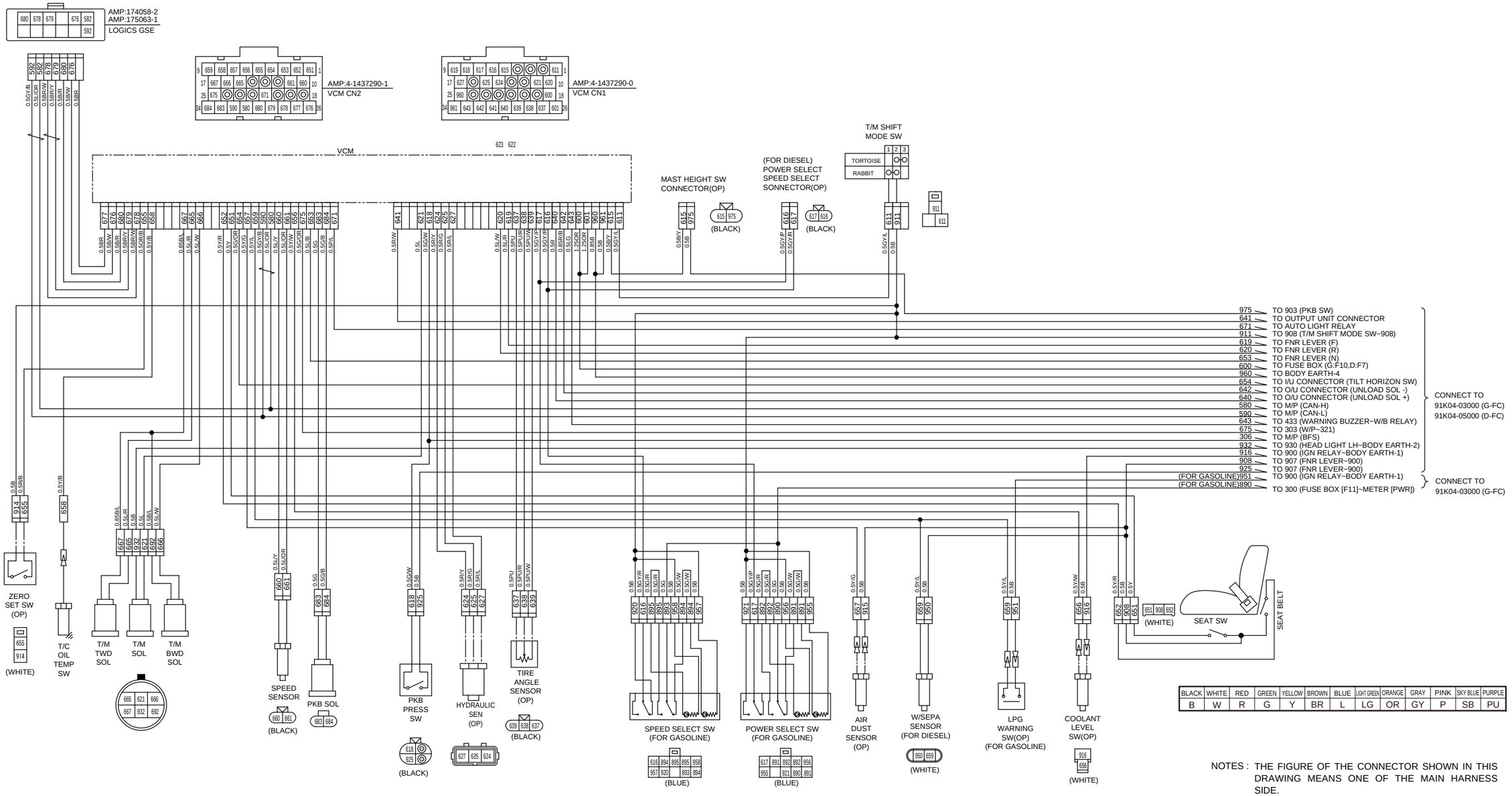




(16)Install the ball 27 and the plug assembly 26 to the housing. Tighten the plug assembly to the torque value of 49±5 N·m (5.00±0.51 kgf·m) [36.14±3.69 lbf·ft].



Electrical Schematic (5/8)



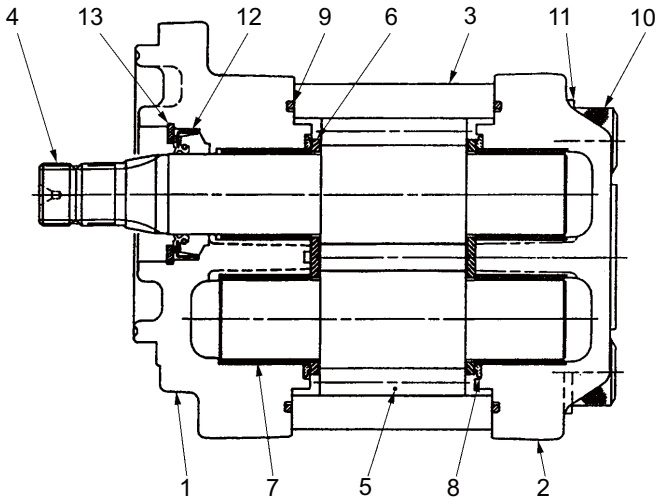
BLACK	WHITE	RED	GREEN	YELLOW	BROWN	BLUE	LIGHT GREEN	ORANGE	GRAY	PINK	SKY BLUE	PURPLE
B	W	R	G	Y	BR	L	LG	OR	GY	P	SB	PU

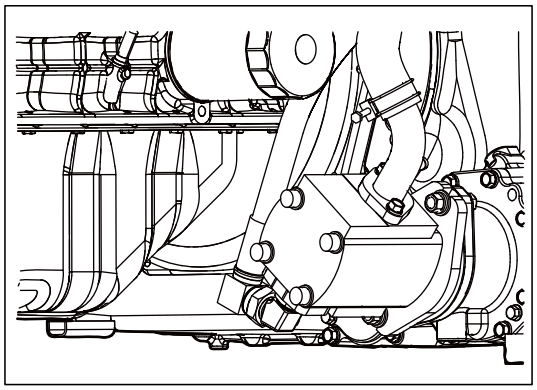
NOTES : THE FIGURE OF THE CONNECTOR SHOWN IN THIS DRAWING MEANS ONE OF THE MAIN HARNESS SIDE.

MC/FC

Schematic No.	Used for	Truck Model	Serial No.
ES019-8B110 5/8	99739-8B110	GP40N1	AT40-00011-up
		GP45N1	AT29D-50001-up
		GP50CN1	AT29D-80001-up
		GP50N1	AT33C-50001-up
		GP55N1	AT33C-80001-up
		DP40NM1	AT12B-00011-up
		DP45NM1	AT19D-50001-up
		DP50CNM1	AT19D-80001-up
		DP50NM1	AT28C-50001-up
		DP55NM1	AT28C-80001-up

1.5 Hydraulic Pump (Gear Pump)





Pump installed on transmission

215309

Main components

1 Front cover
2 Rear cover
3 Body
4 Drive gear
5 Driven gear
6 Side plate
7 Bushing
8 Gasket (shaped like 3)
9 Gasket
10 Hexagon socket head bolt
11 Washer
12 Shaft seal
13 Snap ring

Pump types

The standard lift truck model is equipped with a single-gear pump like the one shown in the illustration above.

Installation of pump

The pump is directly coupled to PTO in the transmission.

Inspection and Repair

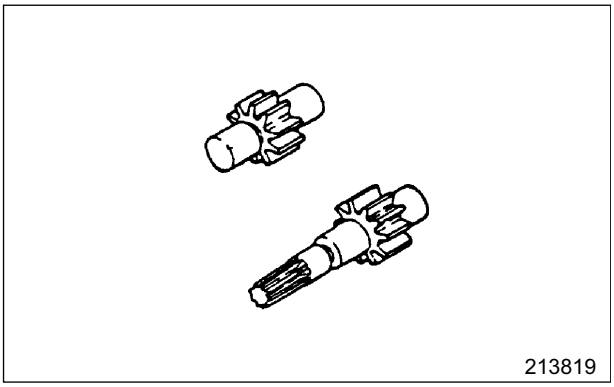
(1) Drive and driven gears

(a) Check the gear teeth surface and tip for wear or damage.

(b) Check the side faces of the gears for wear or damage.

(c) Check the shafts for wear or damage.

(2) Check the covers, body and bushings for wear or damage.



Reassembly

For reassembly, follow the disassembly sequence in reverse by following the instructions below.

(1) Replace all the seal kit parts marked (*) with new ones.

(2) Completely remove oil or grease from the mating surfaces of the covers 1, 2 and the 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 shaft seal lip.

(5) Be careful not to cause damage to the lip of shaft seal or the spline edges of drive gear 5.

(6) Tighten the bolts evenly and progressively.

(7) The pump shaft should be lightly turned with a pipe wrench when assembled.

Operation test

Conduct operation test after the pump has been installed.

(1) Ensure that there is sufficient oil in the hydraulic tank.

(2) Attach a pressure gauge to the pump delivery hose. Refer to "Main Relief Valve of 3.2 Control Valve."

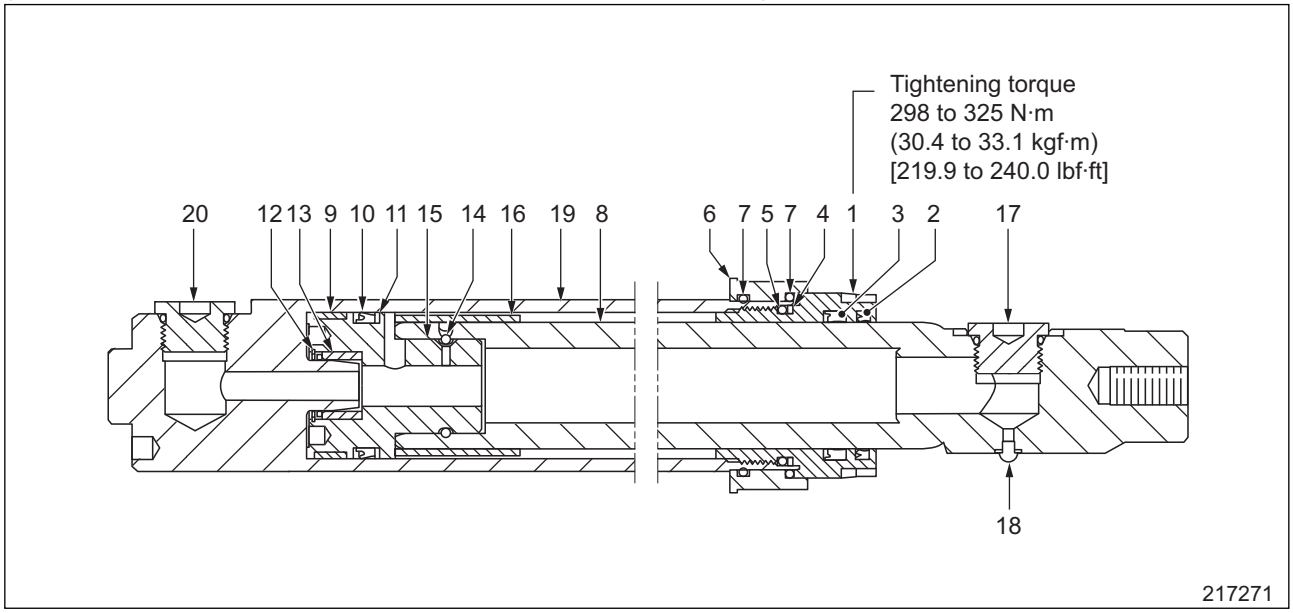
(3) Start the engine, and gradually turn the adjusting screw of the main relief valve from 0 to 19.1 Mpa (0 to 185 kgf/cm^2) [0 to 2625 psi], and check the temperature rise of the pump body by touching it by hand. Compare the temperature rise of the pump body against the oil temperature rise. If the temperature of the pump body is abnormally higher, disassemble and reassemble the pump for a second inspection.

(4) Set the relief valve to the specified pressure.

(5) Measure lifting speed of the forks under no load weight. If the measured speed meets the specified value, the pump oil discharge amount is normal.

(6) Check that the forks move up and down smoothly under load.

(GP50CN1, GP50N1, GP55N1, DP50CNM1, DP50NM1, DP55NM1)



Disassembly sequence: First, disassemble the second cylinder into the following three main parts (I through III), and then disassemble the main parts into components.

I. Holder sub-assembly (including parts 1 through 5)

1 Retainer
2 Wiper ring
3 Rod seal
4 Back-up ring
5 O-ring
6 Sleeve
7 O-ring

II. Piston rod sub-assembly (including parts 6 through 16)

8 Rod
9 Wear ring
10 Piston seal
11 Nylon ring
12 Circlip
13 Sleeve
14 Pull-in wire
15 Piston
16 Spacer
17 Plug, O-ring
18 Air bleed screw, Washer seal

III. Cylinder tube assembly (including parts 17 and 18)

19 Cylinder tube assembly
20 Plug, O-ring

3. Inspection and Adjustment

3.1 Hydraulic Tank

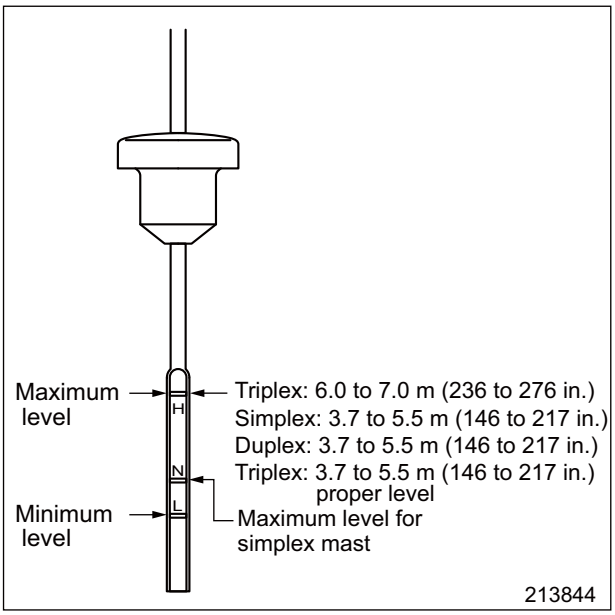
(1) Daily check of oil
Check hydraulic oil level when truck is on level ground, check for cleanliness and white turbidity (mixing of air or water).

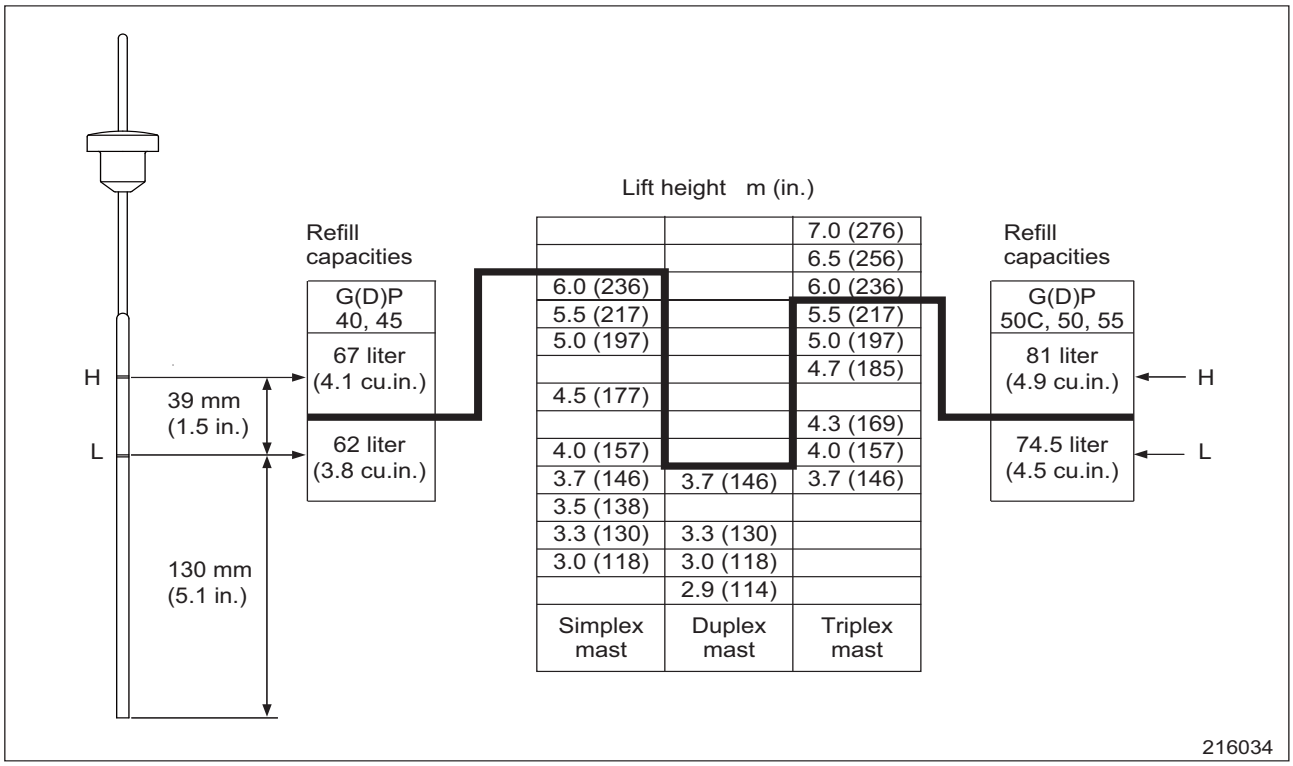
(2) Proper oil level for daily check
Check the level of the hydraulic oil with the mast fully lowered.

Unit: m (in.)

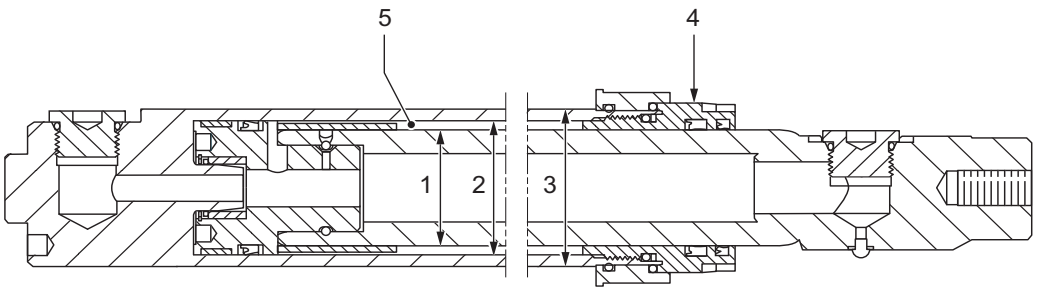
Simplex mast	3.7 to 5.5 (146 to 217)	L level
Duplex mast		L level
Triplex mast		L level
Triplex mast	6.0 to 7.0 (236 to 276)	H level

- The oil level must be higher than the L level and lower than the H level when the mast is fully lowered, regardless of mast type or any combination of the mast and attachment.





Unit: mm (in.)

Item			Truck model
			5.0C, 5.0, 5.5 ton class
Second lift cylinder for duplex mast	Rod outside diameter 1	A	51 (2.01)
	Cylinder inside diameter 2	A	60 (2.36)
	Cylinder outside diameter 3	A	70 (2.76)
	Tightening torque for cylinder head 4 N·m (kgf·m) [lbf·ft]	A	298 to 325 (30.4 to 33.1) [219.9 to 240.0]
	Sealed-in amount of cushion oil 5 cc (cu.in.)	A	25 to 30 (1.52 to 1.83)
	 217280		

A:Standard Value

6.3.4 Tilt Section

(1) Neutral

The discharged oil from the pump returns to the tank through the unload passage. Since the A2 and B2 ports are blocked, the hydraulic oil will not flow into the tilt cylinder (Fig. 14).

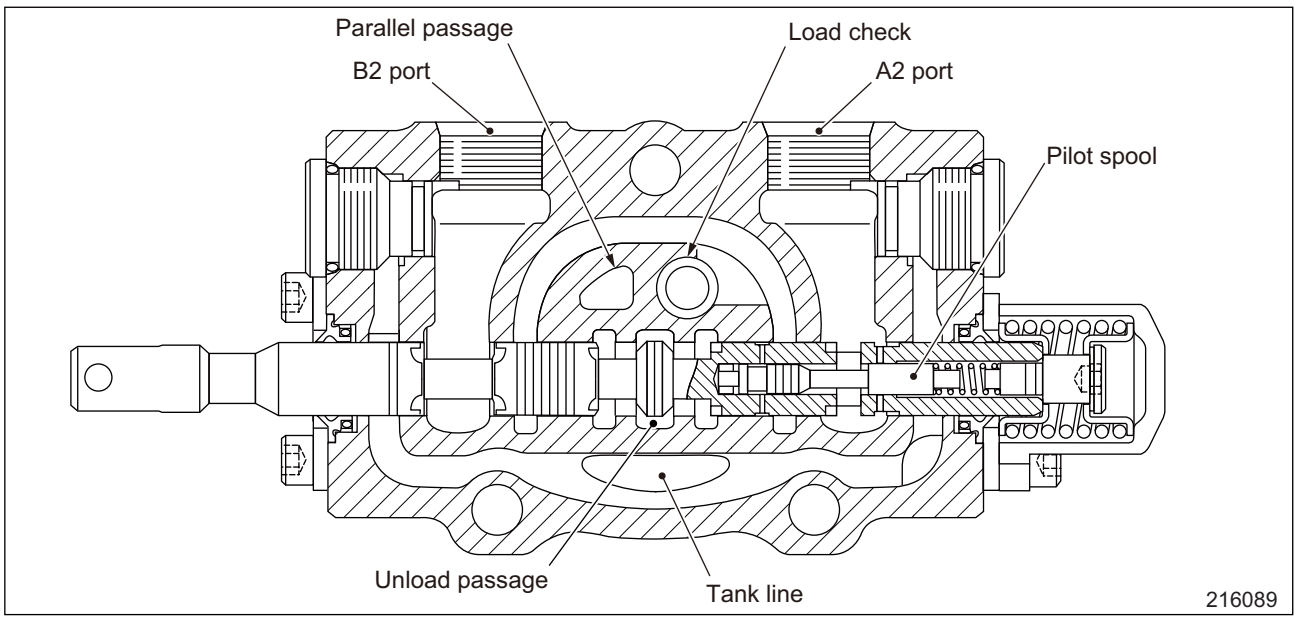


Fig. 14 Tilt section

(2) Spool in pulled-out position (backward tilt)

The unload passage is closed so that the discharged oil from the pump flows into parallel passage, and flows out of A2 port by opening the load check valve. The return oil from B2 port flows back to the tank through the tank passage. When the cylinder load pressure exceeds a relief valve set pressure, the relief valve is actuated so that the hydraulic oil returns to the tank passage. The return spring returns the spool to the neutral position (Fig. 15).

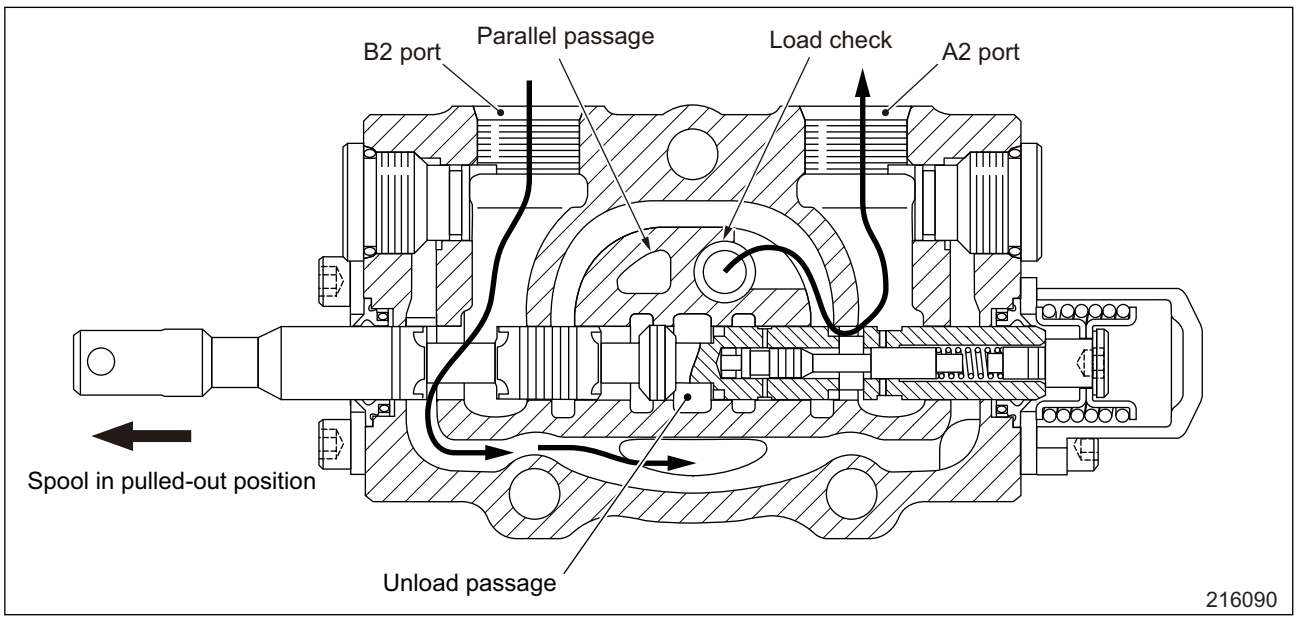
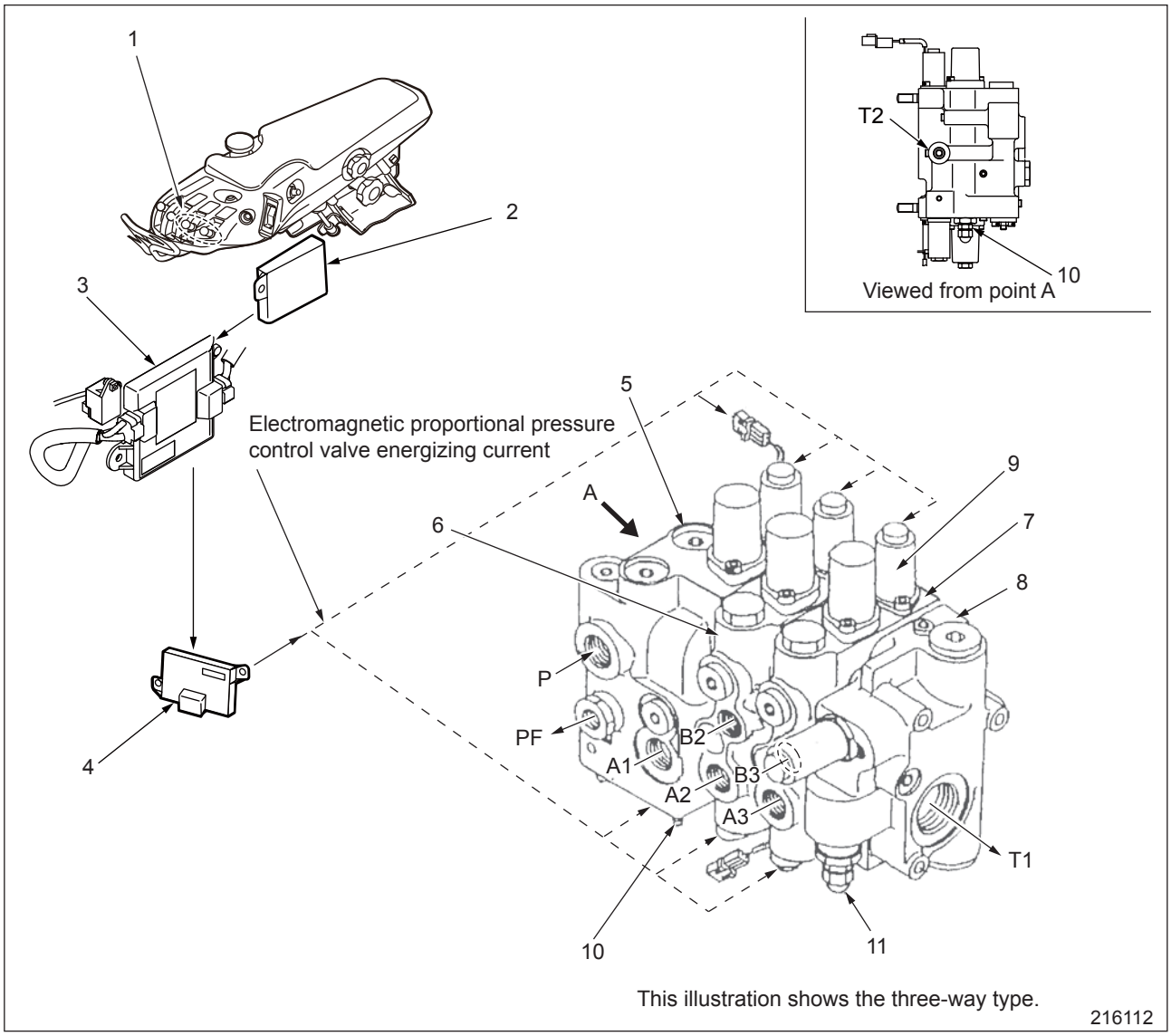


Fig. 15 Spool in pulled-out position

7. FC Control Valve

7.1 Structure and Functions

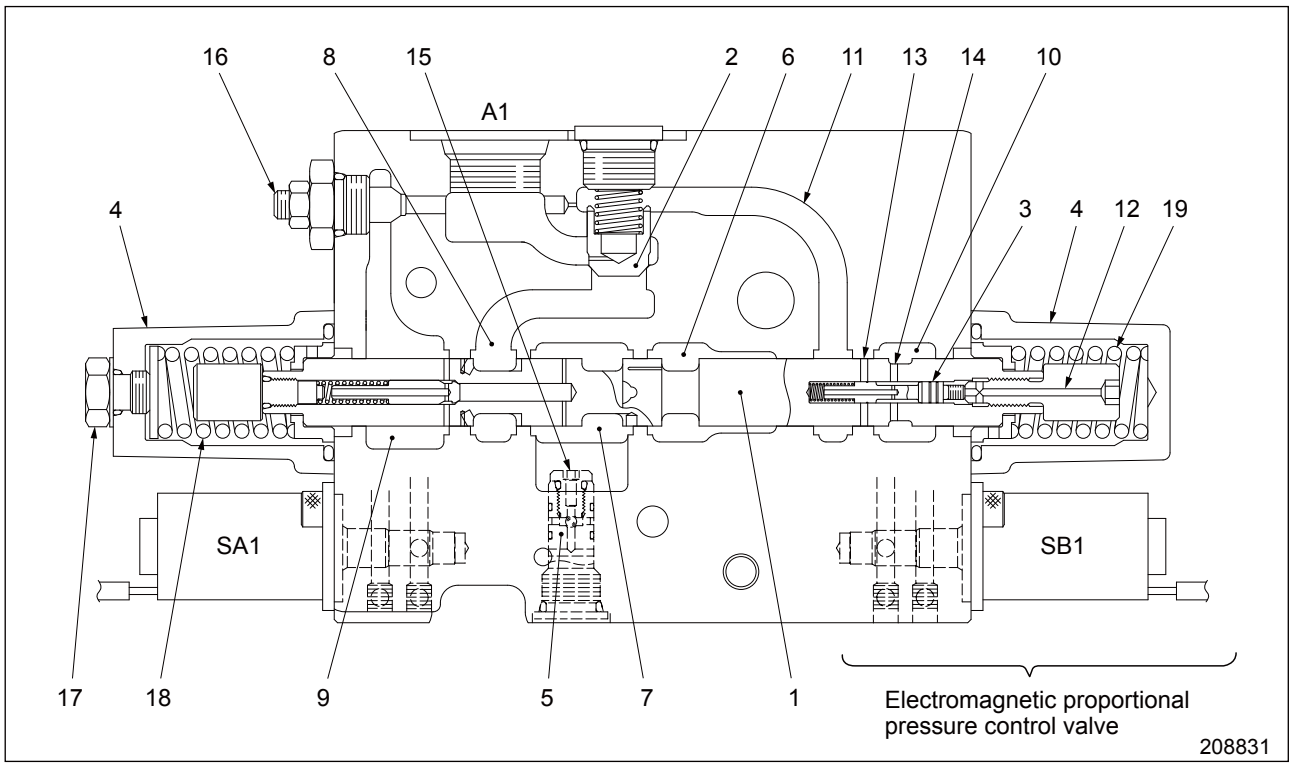
7.1.1 Control valve



1 FC control box (for lift, tilt and attachment levers)
2 Input unit
3 VCM controller
4 Output unit
5 Inlet section
6 Tilt section
7 Attachment section
8 End cover section
9 Electromagnetic proportional pressure control valve
10 Main relief valve (for lift/tilt levers)
11 Main relief valve (for attachment lever)

P: From hydraulic pump
T1: To hydraulic tank (return oil)
T2: From steering valve (return oil)
PF: To steering valve
A1: To lift cylinder
A2: To tilt cylinder (rod end)
B2: To tilt cylinder (head end)
A3: To attachment actuator
B3: To attachment actuator

7.1.4 lift Valve



Main components

1 Lift spool
2 Load check valve
3 Lift lock valve
4 Cap
5 Shuttle valve
6 Oil passage of lift/tilt circuit
7 Passage (load pressure take-out chamber)
8 Passage to A1 port
9 Passage to hydraulic tank
10 Passage to hydraulic tank
11 Load check valve operating pilot oil passage
12 Passage in cap screw
13 Passage
14 Passage
15 Load pressure take-out port
16 Shut-off valve
17 Spring force adjusting screw
18 Spring
19 Spring

Condition with FC control lever in Neutral Position

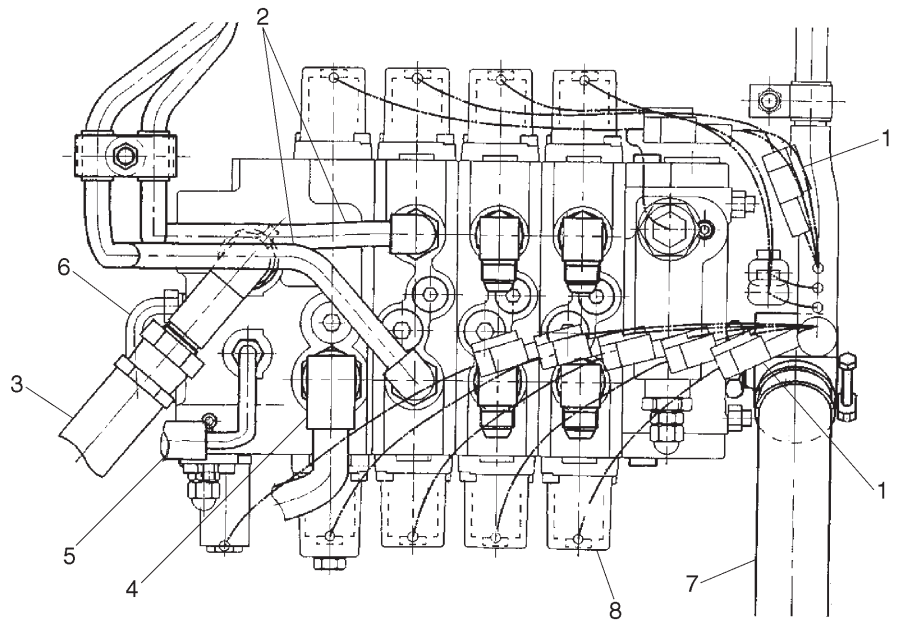
Since both the electromagnetic proportional pressure control valves (SA1 and SB1) are deenergized, lift spool 1 does not move in either direction and is held in its neutral position by centering springs 18 and 19 that are housed in right and left caps 4.

The hydraulic oil from the passage of lift/tilt circuit in the bleed-off valve enters passage 6 but cannot flow further as the outlet of passage 6 is blocked by lift spool 1.

Since the return oil passage from the A1 port is also blocked by load check valve 2, the hydraulic oil in the lift cylinder cannot be drained.

7.2 Procedures and Suggestions for Removal and Installation

7.2.1 Removal



This illustration shows the four-way type.

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Sequence

1 Electric wires of proportioning solenoids (to be disconnected at connectors)
2 Tilt pipe, Connector, O-ring
3 Pump delivery hose
4 Lift line (with flow regulator valve)
5 Pipe to steering valve
6 Return hose from steering valve
7 Return hose to hydraulic tank
8 Nuts for valve mounting studs, bolt, control valve assembly

Start by:

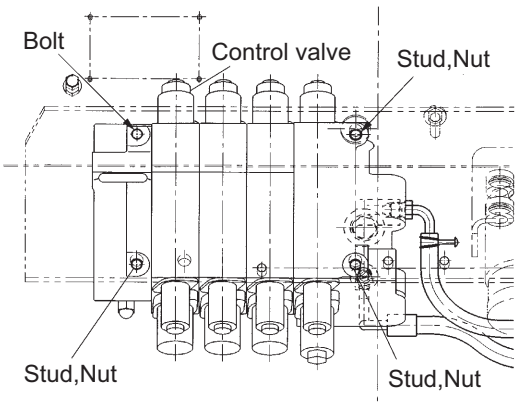
(1) Lower the forks to the floor with the mast in vertical position, and release the residual pressure in the pipes, before disconnecting them.

(2) Remove the floor plate.

Suggestion for Removal

(1) Disconnect the control valve end of each pipe and hose. If necessary, loosen the clamps so the pipes and hoses do not obstruct removal of the control valve.

(2) Remove the bolts and nuts that mount the control valve to the dashboard, and remove the control valve.



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Front view

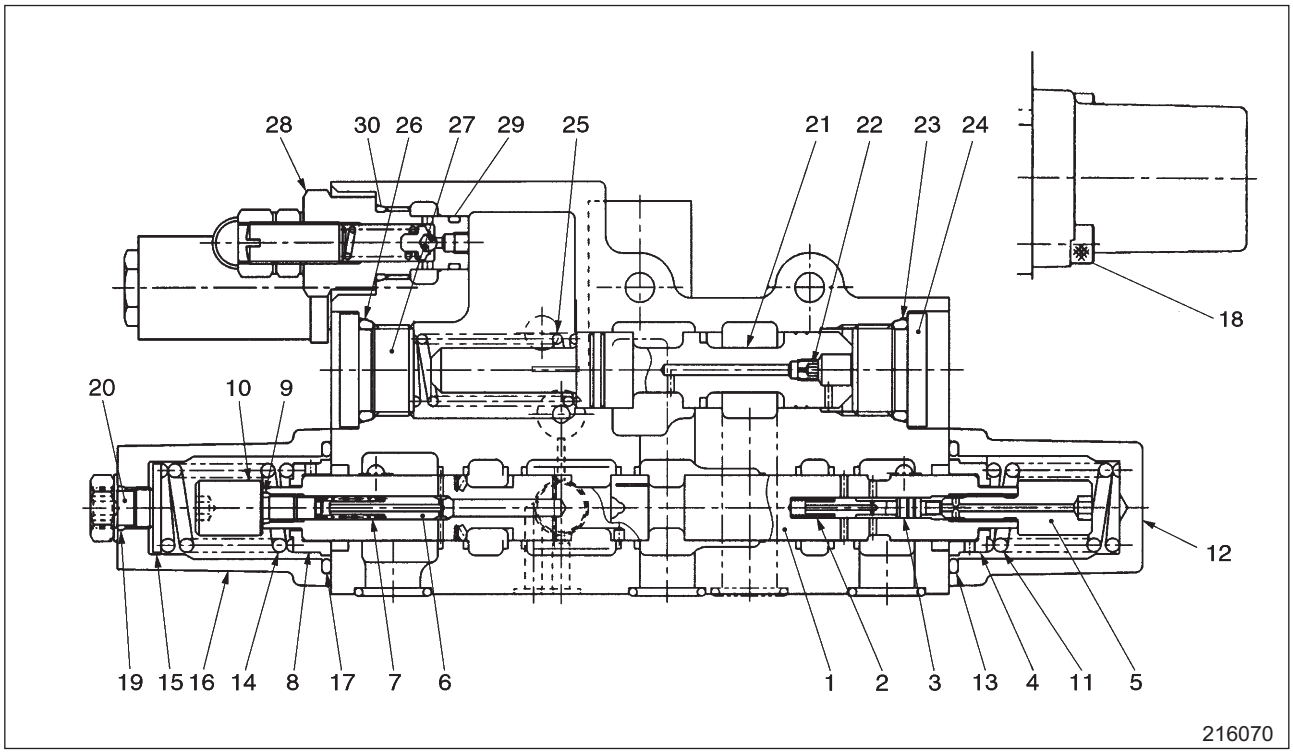
Installation

Follow the removal sequence in reverse. During installation, conduct the following inspection.

Check the hydraulic oil level. If the oil level is low, add hydraulic oil to the specified level.

7.3.2 Reassembly of Valve Sections

Valves Incorporated in Inlet Section (Part 1)



Lift valve components (1 thru 20)

Sequence

1 Lift spool
2 Spring
3 Valve
4 Spring seat
5 Cap screw
6 Valve
7 Spring
8 Spring seat
9 O-ring
10 Cap screw
11 Spring
[free length: 47 mm (1.850 in.)]
12 Cap
13 O-ring
14 Spring
[free length: 42.4 mm (1.669 in.)]
15 Spacer
16 Cap
17 O-ring
18 Bolt
19 O-ring
20 Adjuster kit

Bleed-off valve components (21 thru 27)

Sequence

21 Spool
22 Orifice
23 O-ring
24 Plug
25 Spring
26 O-ring
27 Plug

Pressure relief valve components (28 thru 30)

Sequence

28 Relief valve assembly
29 O-ring
30 O-ring

Suggestions for Reassembly

Attachment valve

(1) Insert spool 1 carefully into the valve housing.

(2) On the right end of the spool, install spring guide 2, spring 3 and spring guide 4, then screw cap screw 5 into the spool and finger-tighten it.

(3) Do the same operation as step (2) for the other end of spool 1.

(4) Using a hexagon wrench engaged in the socket of each cap screw, tighten both the cap screws to the torque shown below. Check the spool for smooth movement.

Unit: N·m (kgf·m) [lbf·ft]

Tightening torque	40.2 ± 4.0 (4.1 ± 0.4) [30 ± 3]

(5) Fit O-ring 7 on cap 6, place the cap in position and secure it with socket head bolts 8 by tightening them to the torque shown below.

Unit: N·m (kgf·m) [lbf·ft]

Tightening torque	15.7 ± 1.6 (1.6 ± 0.16) [11.5 ± 1.0]

Load check valve

(1) Install valve 9 in the valve housing.

(2) Install spring 10 in position.

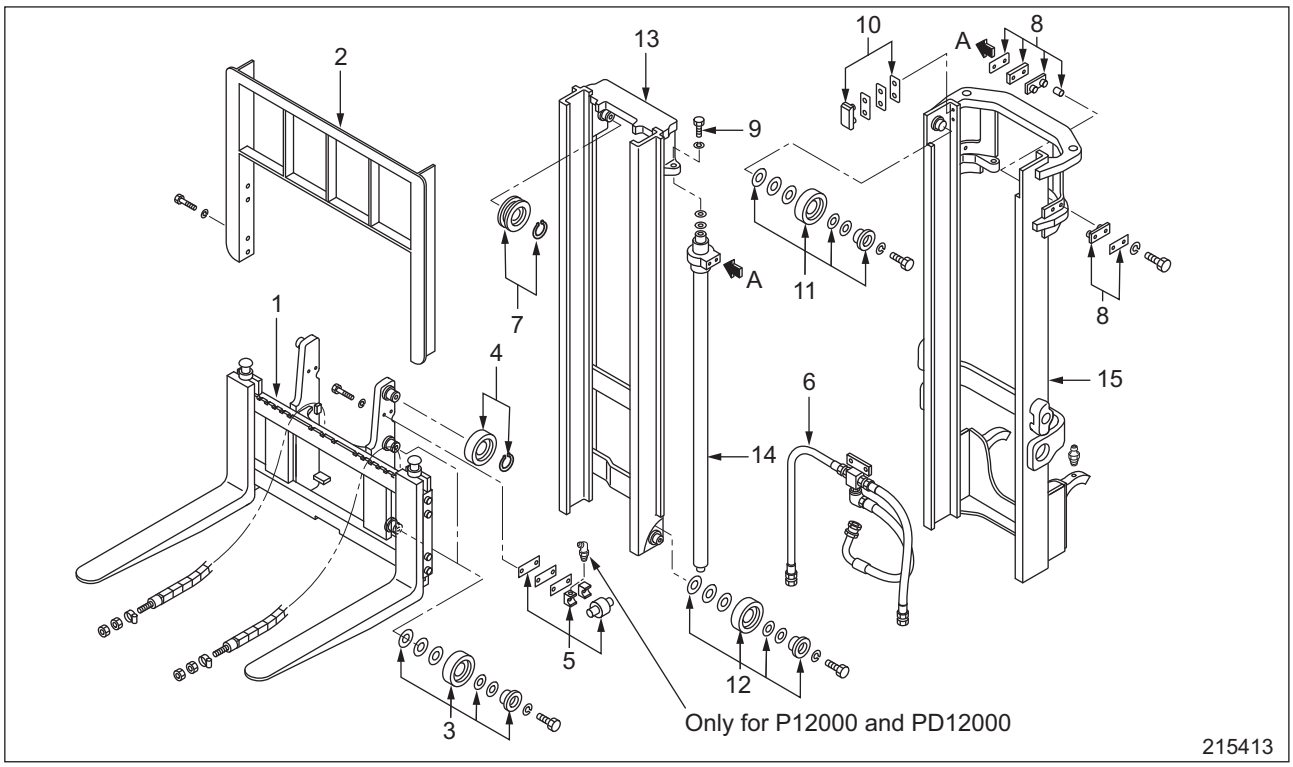
(3) Fit O-ring 12 on plug 11, then screw the plug into the housing and tighten it to the torque shown below.

Unit: N·m (kgf·m) [lbf·ft]

Tightening torque	63.7 ± 6.4 (6.5 ± 0.65) [47 ± 4.7]

4. Disassembly and Reassembly

4.1 Simplex Mast Disassembly



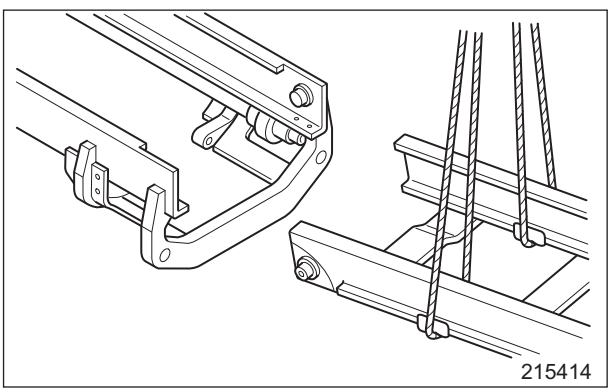
Disassembly sequence

1 Forks, Lift bracket
2 Load backrest extension
3 Lift bracket middle and lower rollers, Shims
4 Lift bracket upper rollers, Snap rings
5 Lift bracket side rollers, Brackets, Shims
6 Lift hose (for high pressure), Rubber hose, T-joint, Down safety valve
7 Snap ring, Chain wheel
8 Cylinder clamps, Seats, Shims, Cushion, Collar, Bolts
9 Bolt, Shims
10 Mast strips, Shims
11 Outer mast main rollers, Shims
12 Inner mast main rollers, Shims
13 Inner mast
14 Lift cylinder
15 Outer mast

Suggestions for Disassembly

(1) Removing mast strips and main rollers
Remove bolts 9 and 10 to free the lift cylinders 15, then cross the two lift cylinders at the top. Slide the inner mast 14 downward from the outer mast 16, and remove the main rollers 12 and 13 and the mast strips 11.

(2) Removing inner mast
After removing the main rollers from the mast, hitch a sling to the cross-member of the inner mast and slide the inner mast upward from the outer mast. Hitch a sling to the inner mast again and gently pull out the inner mast from the outer mast by clearing the outer mast roller shafts.



5. Removal and Installation of Mast Rollers and Strips without Removing Mast from Lift Truck

5.1 Simplex Mast

- To remove or install the mast rollers and the mast strips, lower the inner mast below the outer mast. Follow the removal and installation procedure below.

(1) Disconnect the lift bracket assembly from the mast.

(2) Lift the front side of the lift truck by 15 to 20 cm (5.9 to 7.9 in.) to place wood blocks underneath. Keep the front side of the lift truck off the ground in preparation to lower the inner mast with a hoist.

(3) Remove the set bolts located on the top of the lift cylinders. Hitch a sling to the inner mast and lift the inner mast with a hoist in order to separate the lift cylinder piston rods from the inner mast.

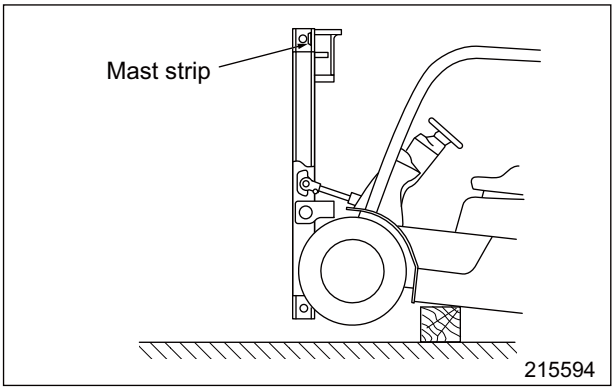
(4) Remove the lift cylinder clamp bolts, and separate the lift cylinders from the outer mast. Pull out the lift cylinders from the mounting seats at the bottom of the outer mast. Tilt the cylinder tops inward until they rest on the outer mast cross member. Using a rope, fix the cylinders onto the cross member.

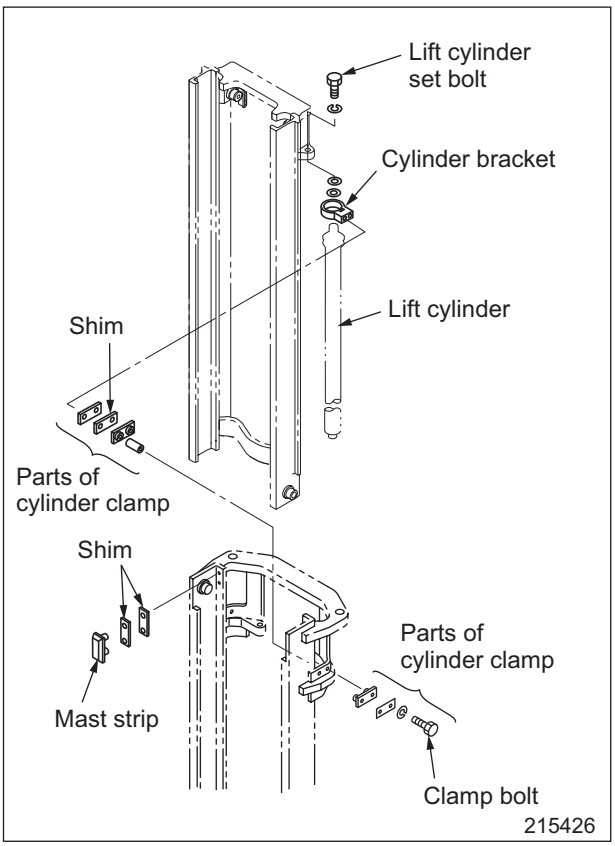
(5) Using the hoist, slowly lower the inner mast until the inner mast contacts the lift cylinders.

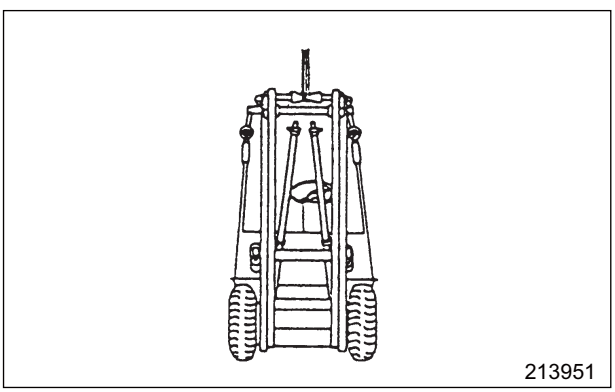
(6) The main rollers of the inner and outer masts can now be removed. Before attempting to remove the main rollers, remove the mast strips and shims first as they tend to drop easily.

(7) Adjust the number of shims for the main rollers and the mast strips as required.

- To install the mast rollers and the mast strips, follow the removal sequence in reverse.





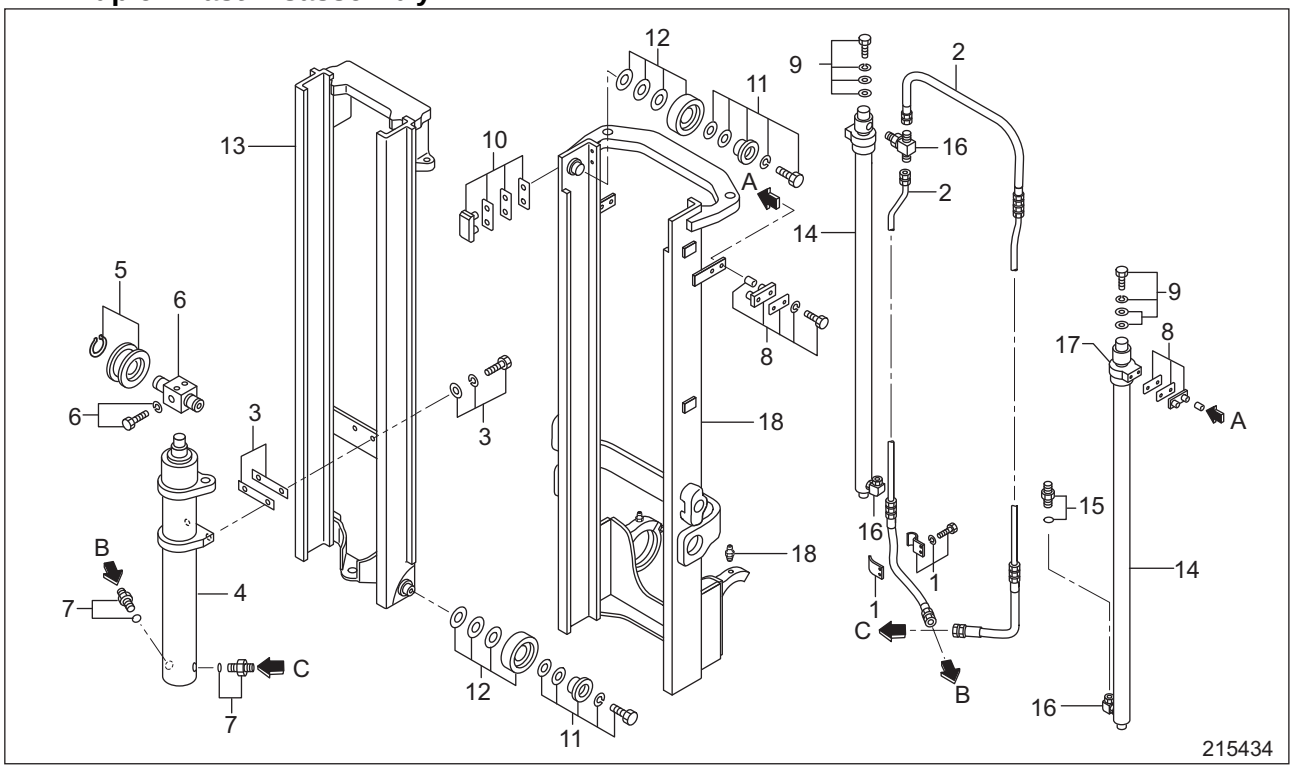


7. Troubleshooting (Simplex Mast)

Item	Condition	Possible cause	Action
Mast	Lift bracket and inner mast do not move smoothly.	Clearance between lift rollers and side rollers is incorrect.	Readjust right-to-left / front-to-back clearances.
		Rollers do not rotate smoothly on their shafts.	Relubricate side rollers and replace other rollers.
		Clearance on mast strip is incorrect.	Adjust the number of shims
	Lift bracket or inner mast are tilted	Clearance on side rollers is too much.	Increase the number of shims
		Lift chains are unequally tensioned.	Readjust chain tension
		Shim adjustments are unequal between left and right lift cylinders (at maximum height)	Adjust the number of shims
	Mast makes noise.	Rollers do not rotate smoothly on their shafts.	Adjust or replace rollers after inspection
	Natural descent of lift cylinder piston (under rated load)	Lift cylinder packing is damaged.	Replace
		Sliding (inside) surface of lift cylinder tube is damaged.	Replace
	Whole mast shakes.	Mast support bushing is worn out.	Retighten or replace bushing
	Mast is distorted.	Off-center load or overload	Replace mast assembly
	Fork tips are different in height.	Distortion of finger bar	Repair or replace
		Distortion of forks	
		Uneven loading	

12.Disassembly and Reassembly

12.1 Duplex Mast Disassembly



Disassembly sequence

1 Hose clamps, Bolts, Washers
2 High-pressure hose (First lift cylinder)
3 Bolt, Washer, Shim
4 First lift cylinder
5 Chain wheels, Snap rings
6 Chain wheel supports, Bolts, Washers
7 Down safety valve, O-ring
8 Cushions, Collars, Shims, Bolts, Washers, Clamps
9 Bolt, Washer, Shim
10 Mast strip, Shim
11 Stoppers, Shims, Bolts, Washers
12 Main roller, Shim
13 Inner mast
14 Second lift cylinder
15 Down safety valve, O-ring
16 Elbow, O-ring
17 Cylinder bracket
18 Outer mast, Grease nipple

Note: The lift bracket disassembly procedure for the duplex mast is the same as that of the simplex mast.

12.2.7 Installing Hydraulic Lines

General instructions

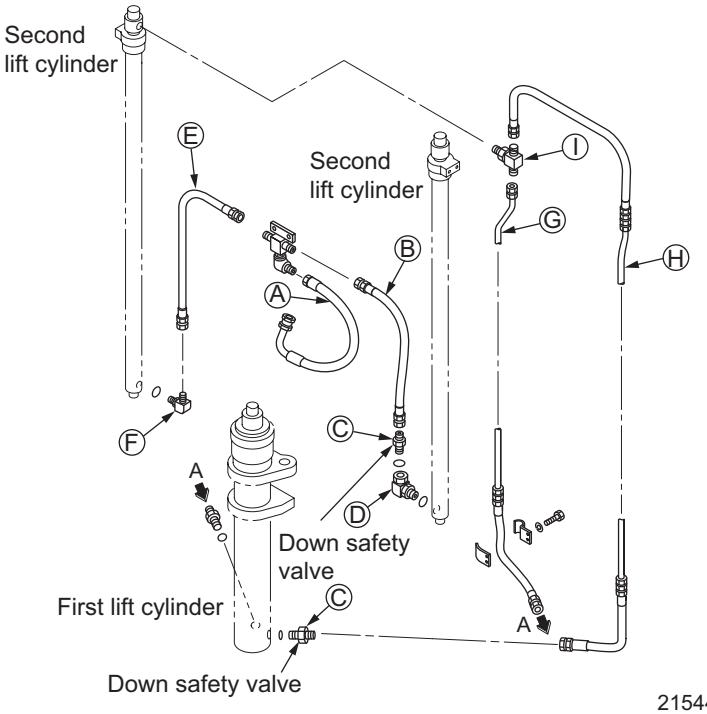
- Prevent abrasive dust or dirt from entering into the hydraulic system during installation.
- Apply hydraulic oil to the O-rings before installation.
- When assembling an elbow connector (connection with straight thread and O-ring) as indicated by F in the illustration, follow the steps in the "Installation procedure for a fitting with straight thread and O-ring" below.

Duplex Mast

Tightening torque

Unit: N·m (kgf·m) [lbf·ft]

Item	All truck model
Nut Ⓐ	118 ± 11.8 (12.0 ± 1.2) [87.1 ± 8.7]
Nut Ⓑ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓒ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓓ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓔ	118 ± 11.8 (12.0 ± 1.2) [87.1 ± 8.7]
Nut Ⓕ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓖ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓗ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓘ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]



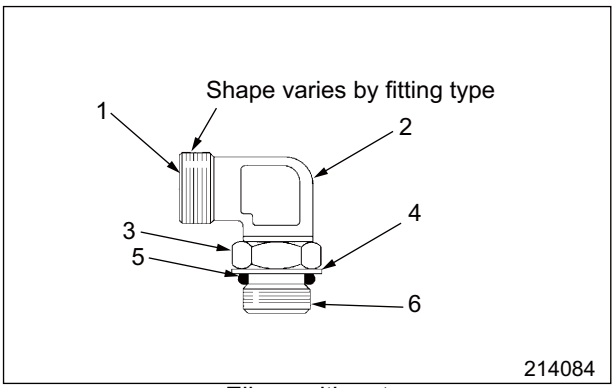
Installation procedure for a fitting with straight thread and O-ring

(1) Apply grease or hydraulic oil to both sides of the O-ring seal.

(2) Turn lock nut 3 so that it moves up against the body of the fitting 2. Then slide the washer 4 and the O-ring 5 up against the lock nut 3.

(3) Turn the body of the fitting 2 by hand until washer 4 comes into contact with the housing surface and the O-ring 5 is settled into place, then turn it backwards to orient the body fitting end to an appropriate direction. Never loosen the body fitting more than one turn.

(4) Tighten the lock nut 3 to the specified torque.



Elbow with nut

1 End of fitting body (for hose connection)
2 Fitting body
3 Lock nut
4 Back-up washer
5 O-ring
6 Threaded portion to the housing

15.Troubleshooting (Duplex Mast)

Item	Condition	Possible cause	Action
Mast	Lift bracket and inner mast do not move smoothly.	Clearance between lift rollers and side rollers is incorrect.	Readjust right-to-left / front-to-back clearances.
		Rollers do not rotate smoothly on their shafts.	Relubricate side rollers and replace other rollers.
		Clearance on mast strip is incorrect.	Adjust the number of shims
	Lift bracket or inner mast are tilted	Clearance on side rollers is too much.	Increase the number of shims
		Lift chains are unequally tensioned.	Readjust chain tension
		Shim adjustments are unequal between left and right lift cylinders (at maximum height)	Adjust the number of shims
	Mast makes noise.	Rollers do not rotate smoothly on their shafts.	Adjust or replace rollers after inspection
	Natural descent of lift cylinder piston (under rated load)	Lift cylinder packing is damaged.	Replace
		Sliding (inside) surface of lift cylinder tube is damaged.	Replace
	Whole mast shakes.	Mast support bushing is worn out.	Retighten or replace bushing
	Mast is distorted.	Off-center load or overload	Replace mast assembly
	Fork tips are different in height.	Distortion of finger bar	Repair or replace
		Distortion of forks	
		Uneven loading	

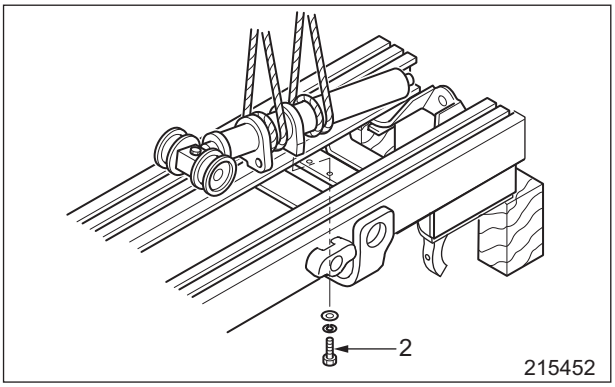
16.Service Data (Duplex Mast)

Suggestions for Disassembly

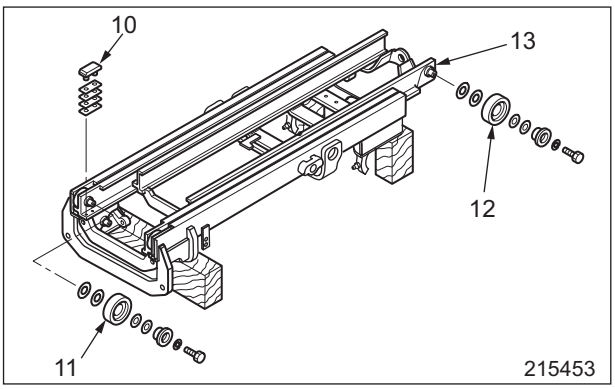
(1) Removing first lift cylinder 4

(a) Remove retaining bolts 2 from the first lift cylinder.

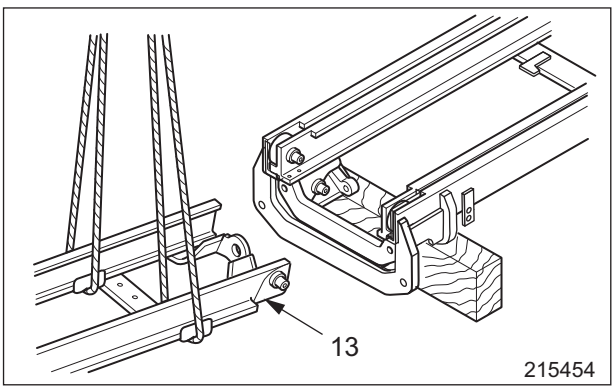
(b) Tie two slings securely to the first lift cylinder, and gently lift the cylinder.



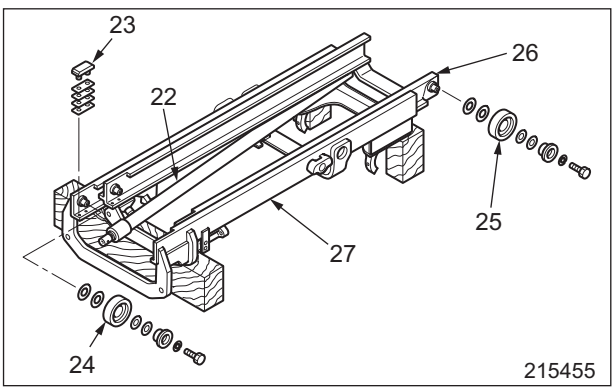
(2) Removing inner mast and main rollers
Lower inner mast 13 until main rollers 12 can be removed. Remove main rollers 11 and mast strips 10 from middle mast.



(3) Removing inner mast
Using a sling, slightly lift the inner mast 13 to clear the middle mast roller shafts, and separate the inner mast from the middle mast.



(4) Remove the set bolts from the top of the second lift cylinder rod 22. Then place the cylinders on the outer mast. Lower the middle mast 26 until the main roller 25 can be removed. Then remove the main roller 24 and the mast strips 23 from the outer mast.



20.2.7 Installing Hydraulic Lines

General instructions

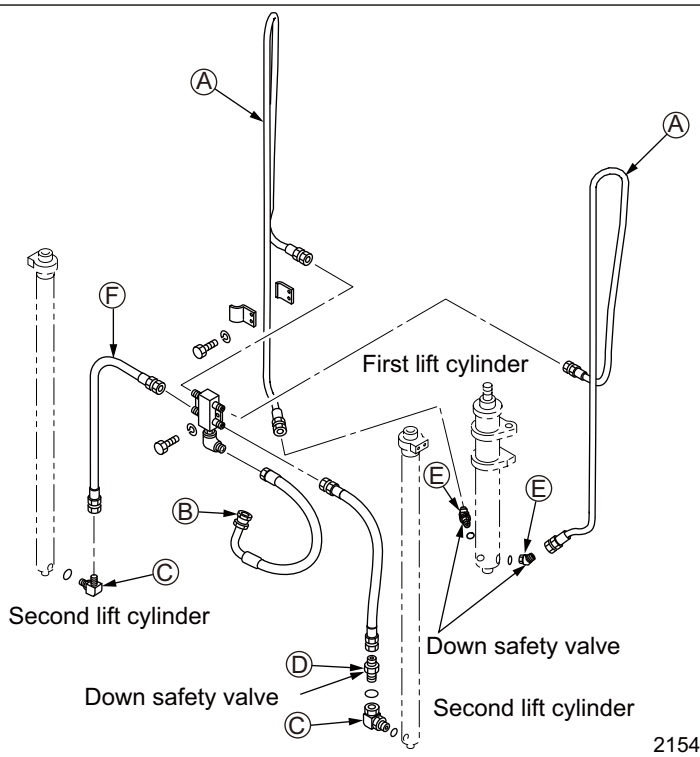
- Prevent abrasive dust or dirt from entering into the hydraulic system during installation.
- Apply hydraulic oil to the O-rings before installation.
- When assembling an elbow connector (connection with straight thread and O-ring) as indicated by F in the illustration, follow the steps in the "Installation procedure for a fitting with straight thread and O-ring" below.

Triplex Mast

Tightening torque

Unit: N·m (kgf·m) [lbf·ft]

Item	All truck model
Nut Ⓐ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓑ	118 ± 11.8 (12.0 ± 1.2) [87.1 ± 8.7]
Nut Ⓒ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓓ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓔ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]
Nut Ⓕ	58.8 ± 5.9 (6.0 ± 0.6) [43.4 ± 4.4]



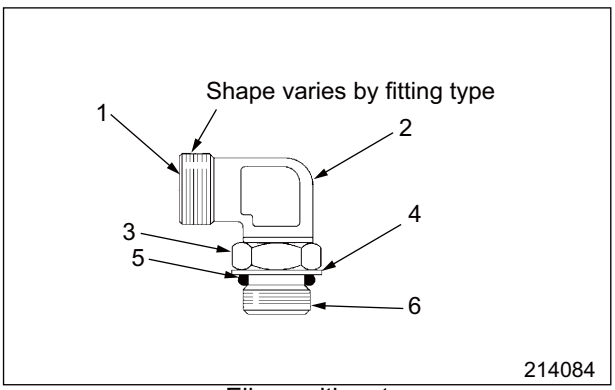
Installation procedure for a fitting with straight thread and O-ring

(1) Apply grease or hydraulic oil to both sides of the O-ring seal.

(2) Turn lock nut 3 so that it moves up against the body of the fitting 2. Then slide the washer 4 and the O-ring 5 up against the lock nut 3.

(3) Turn the body of the fitting 2 by hand until washer 4 comes into contact with the housing surface and the O-ring 5 is settled into place, then turn it backwards to orient the body fitting end to an appropriate direction. Never loosen the body fitting more than one turn.

(4) Tighten the lock nut 3 to the specified torque.



Elbow with nut

1 End of fitting body (for hose connection)
2 Fitting body
3 Lock nut
4 Back-up washer
5 O-ring
6 Threaded portion to the housing

(5) Measuring right-to-left clearance on outer mast main rollers

(a) Lift the mast to the maximum lift position.

(b) Set a dial indicator on the outer mast with its contact point rested on the middle mast.

(c) Using a claw bar, push the inner mast roller against the outer mast's rolling surface. Then go over to the opposite side of the mast and set the dial indicator to zero.

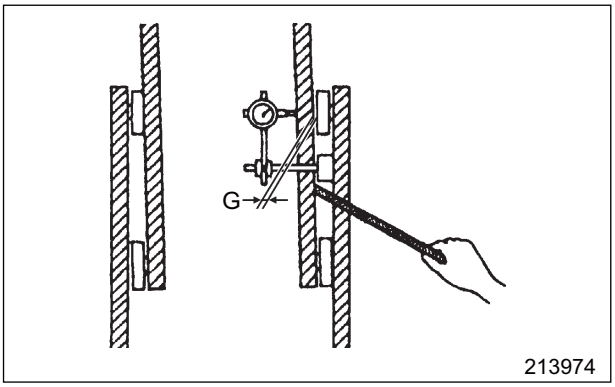
(d) Insert a claw bar between the middle mast and the outer mast on the dial indicator side, and push the middle mast to the opposite side.

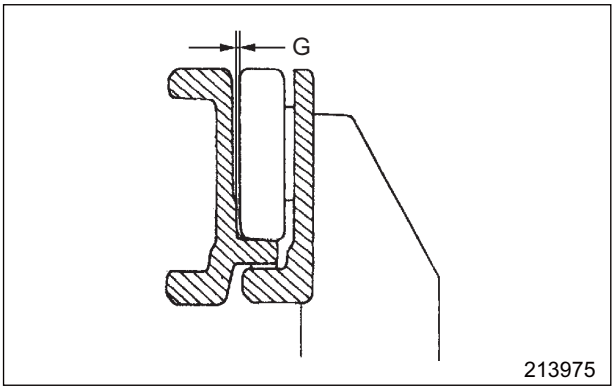
(e) Measure clearance G between the outer mast roller and the inner mast.

Unit: mm (in.)

G	0.1 to 0.5 (0.004 to 0.02)

(f) If clearance deviates from the specified value, adjust the number of shims. For shim adjustment, refer to "12.2.2 Installing Mast Rollers."





System	Check items	Pre-start (daily/10 hours)	Weekly (50 hours)	1st month (200 hrs) only	3 months (500 hours)	6 months (1000 hours)	12 months (2000 hours)	Others (See Note 1)
Electrical	Alternator			×		×		
	Battery electrolyte level	×						
	Battery electrolyte specific gravity (Not required if battery type is maintenance free)				×			
	Battery terminal loosen & damage	×						
	Driving interlock system	×						
	Electrical wire	×						
	Horn	×						
	Instrument panel lamps (Incl. parking brake switch & seat belt)	×						
	Mast interlock system	×						
	Parking brake buzzer & lamp	×						
	Starter			×		×		
	Voltage, current, other electrical system						×	
	Back-up lamp	×						
	Stop lamps, turn-signal lamps	×						
	Working & head lamps	×						
	Warning devices, lamps, and instruments						×	
Engine	Cylinder head bolt & manifold nut			×		×		
	Engine (Exhaust, noise, and vibration)	×						
	Engine idle speed (Diesel engine)				×			
	Engine idle speed (Gasoline / LP-Gas engine)						×	
	Engine oil (Dirt & level)	×						
	Intake & exhaust valve clearance			×	×			
	Positive crankcase ventilation valves & hoses				×			
	Engine oil (Diesel model)			R	R			
	Engine oil (Gasoline model)			R	R			
	Engine oil filter			R	R			
	Compressing & injection pressure						×	
	Exhaust pipe & muffler				×			
	Water separator (Diesel engine)					×		
	Water separator element (Diesel engine)					R		
Frame & Chassis	Assist grips	×						
	Loosen bolts & nuts			×	×			
	Overhead guard	×						
	Seat adjustment	×						
	Seat belt	×						
	Rear view mirror	×						

X: Check, C: Clean, L: Lubricate, R: Replace

4.3 Adjustment Value and Oil Quantities

Note: The values in the table below are for the standard model.

Unit:mm (in.)

Item				Truck model				
				GP40N1	GP45N1	GP50CN1	GP50N1	GP55N1
Alternator drive belt deflection-when pushed inward with 98 N (10 kgf) [22 lbf] pressure				11 to 13 (0.43 to 0.51)				
Spark plug type				BPR4E				
Spark plug gap				0.8 to 0.9 (0.0315 to 0.0354)				
Engine idling speed			(min^{-1})	650 to 700				
Steering wheel free play-when measured at rim with engine idling				15 to 30 (0.59 to 1.18)				
Inching pedal free play				3 to 6 (0.12 to 0.24)				
Brake pedal free play				5 (0.20)				
Tire size	Front tire	Single		8.25-15-14PR (1)	300-15-18PR (1)			
		Double		7.50-16-12PR (1)				
	Rear tire			7.00-12-12PR (1)				7.00-12-14PR (1)
Tire pressure	Front tire	Single	kPa(kgf/cm^2)[psi]	800(8.2)[116.0]				
		Double	kPa(kgf/cm^2)[psi]	700(7.1)[101.5]				
	Rear tire		kPa(kgf/cm^2)[psi]	700 (7.1) [101.5]		850 (8.7) [123.3]		1000 (10.2) [145.1]
Wheel nuts tightening torque	Front tire		N·m(kgf·m)[lbf·ft]	600±60 (61.18±6.12) [442.54±44.25]				
	Rear tire		N·m(kgf·m)[lbf·ft]	377.3 (38.47) [278.45]				
Lift chain elongation limit			mm/20 links	518 (20.39)	648 (25.51)			
Fuel tank capacity			liter (cu.in.)	87 (5309)	105 (6407)			
Engine cooling system -0.65 liter (0.17 cu.in.) reservoir tank included			liter (cu.in.)	16 (976.4)				
Engine oil	Engine		liter (cu.in.)	8.3 (506.5)				
	Oil filter		liter (cu.in.)	0.3 (18.3)				
	Total		liter (cu.in.)	8.6 (524.8)				
Transmission oil			liter (cu.in.)	17 (1037.4)				
Transfer and differential gear oil level			liter (cu.in.)	7.9 (482.1)				
Hydraulic oil			liter (cu.in.)	72 (4394)		81 (4943)		
Battery electrolyte specific gravity, corrected to 20°C (68°F)				1.26 to 1.28				