MITSUBISHI
FORKLIFT TRUCKS

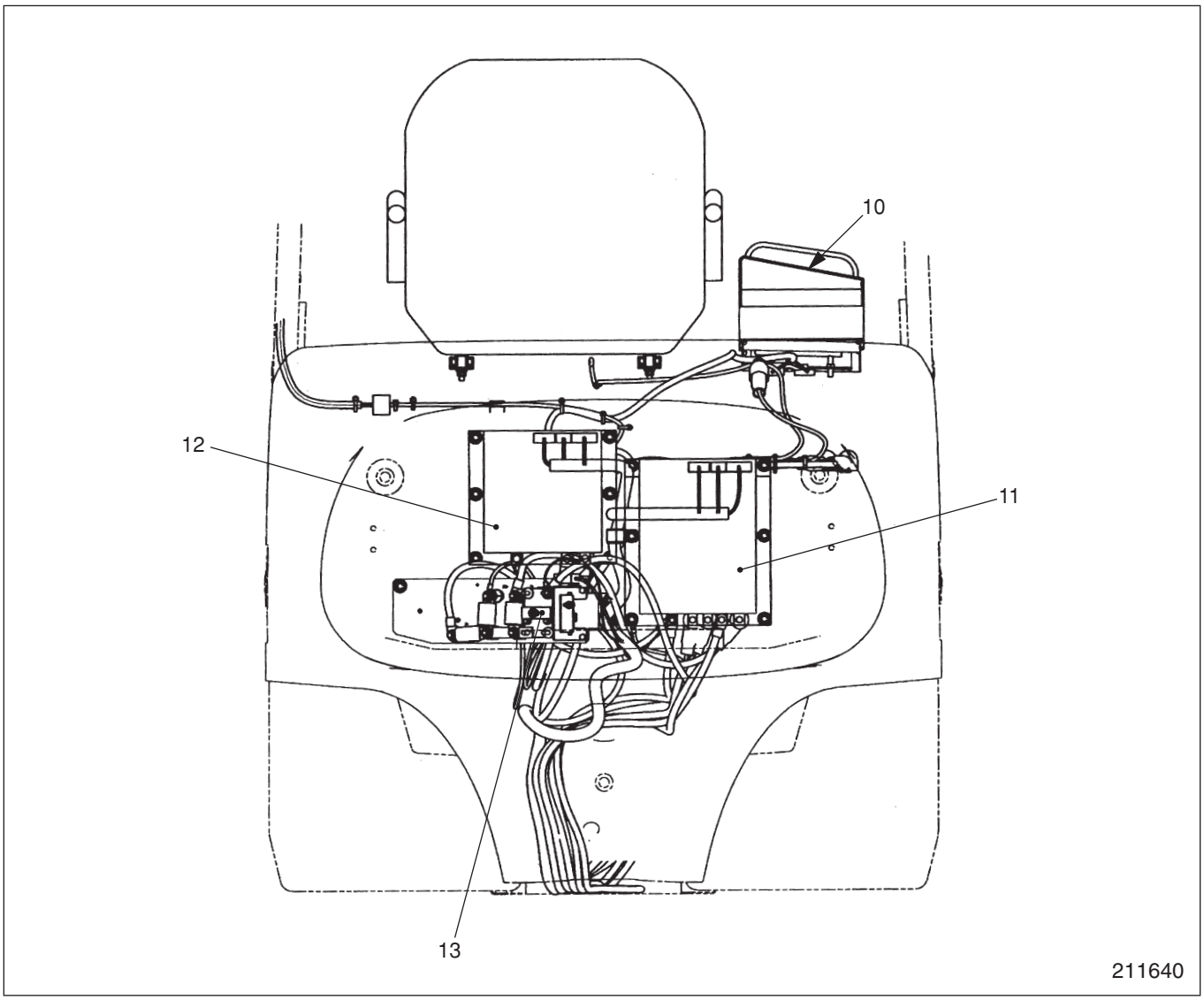
Service Manual

Chassis, Mast & Options

FB20K	**EFB8B-00011-up**
FB25K	**EFB8B-50001-up**
FB30K	**EFB9B-00011-up**
FB35K	**EFB9B-50001-up**

For use with FB20K-FB35K
Controller Service Manual.

99759-5D100



10 Joystick box (FC only)
11 Traction controller
12 Hydraulic controller
13 Contactor

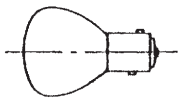
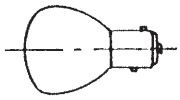
Fuses

Capacity (A)	Location	Main connecting device
325	Contactor assembly	Traction motor
325		Pump motor
50		Steering pump motor
15	Fuse holder	Horn switch, Lighting switch
10		Key switch, Contactor

NOTE

Refer to Parts Manual for proper replacement fuses.

Lamp Specification Chart

Item / Lamp	Quantity	Bulb color	Bulb		Remarks
			80 V	External diagram	
Head lamps	2	Clear	55 W		
Working lamp	1	Clear	55 W		

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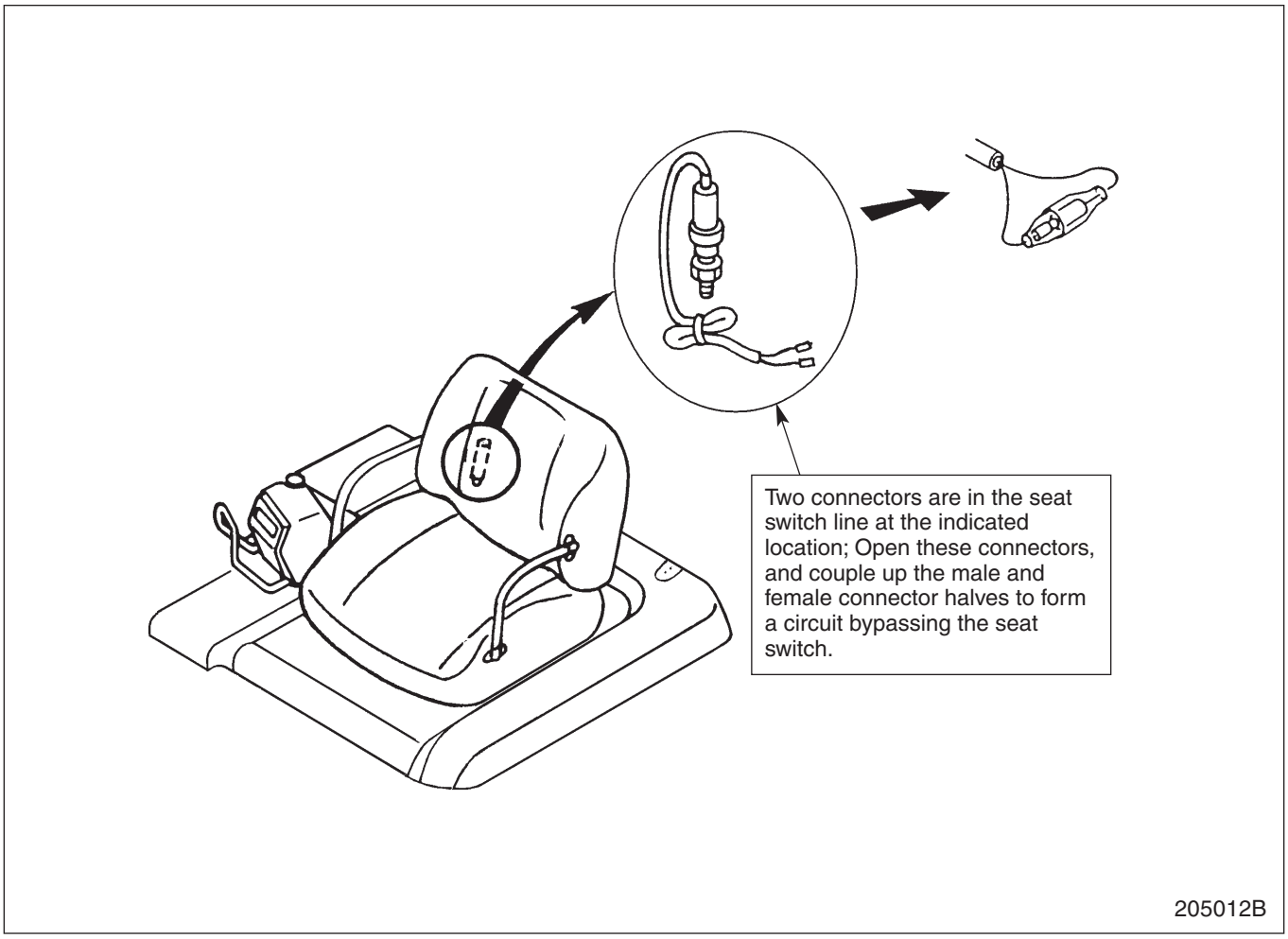
(2) How to cope with a failed (open-circuit) seat switch.

Your troubleshooting investigation might reveal that the seat switch is an open-circuit or otherwise faulted and will not function.

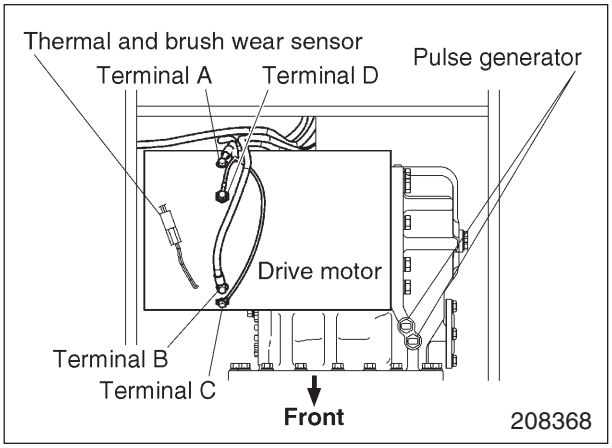
In such a case, you can create a temporary circuit through the seat switch wiring. The method is explained in this illustration. The seat switch is a safety part. Be sure to replace it with a new one as soon as possible.

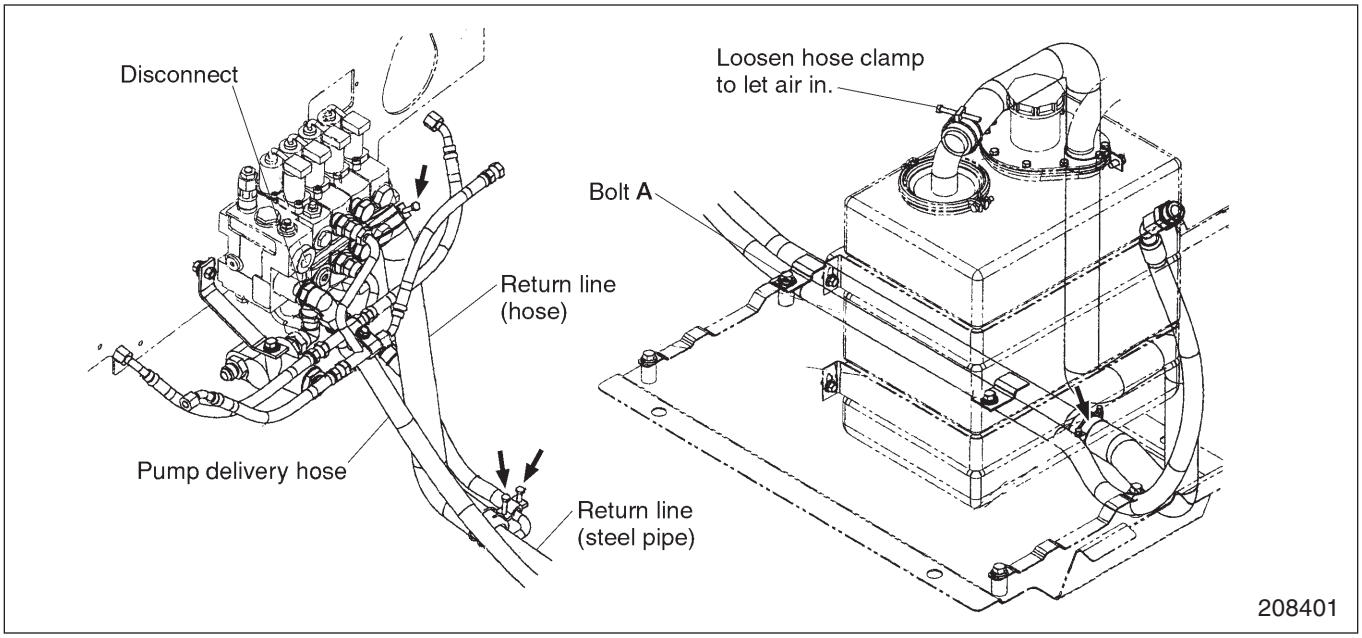


⚠ CAUTION

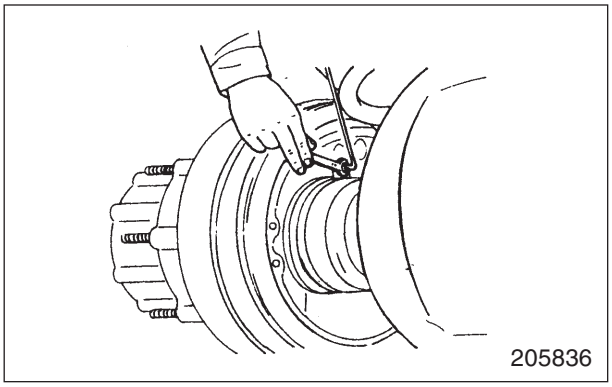
Illustrated above is a band-aid method permissible only in an emergency situation. Be sure to restore the seat switch line to the normal hookup after replacing the failed switch.

6. Put matching marks on the terminals (4 places) of the drive motor and disconnect the drive motor cables from the terminals.
7. Disconnect the thermal sensor and brush wear sensor wire harness from the main harness B at the connector.
8. Disconnect the pulse generator from the harness at their connectors (2 places). Provide matching marks on the connectors before disconnection.
9. Ready an oil pan with a capacity of 10 liters (3 U.S.gal) or so to receive oil that flows out when hoses and pipes are removed from the hydraulic system.



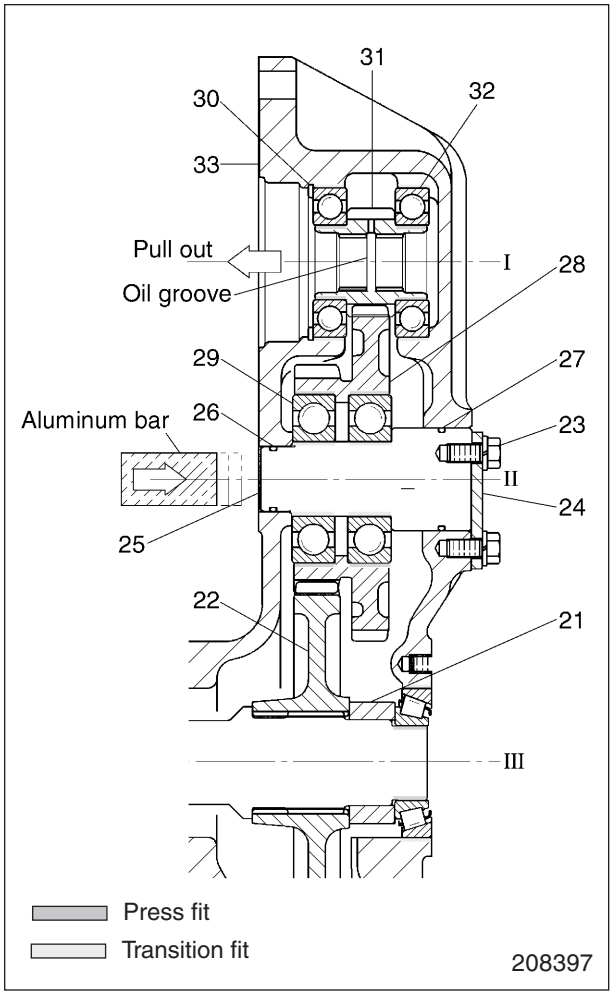


10. Remove the return line from the hydraulic control valve.
    (1) Loosen the hose clamp on the hydraulic tank side end of the return line to let air in the air line. (This is to prevent oil in the tank from being siphoned when the return line is disconnected.)
    (2) Remove the bolt A.
    (3) Loosen the arrow-marked hose clamps and remove the return line hose and pipe.
11. Disconnect the pump delivery hose at the hydraulic control valve.
12. Disconnect the service brake hydraulic pipe at the brake side joint.
13. Unclamp the parking brake cable and disconnect it at the parking brake lever.



14. Remove the axle drain plug and let oil out where necessary. [8.5 liters (2.3 U.S.gal)]

6. Remove the spacer 21, then remove the third gear 22. The third shaft 19 is fitted with the bearing inner race 20. The inner race 20 may be left fitted to the third shaft 19 if it is in a satisfactory condition for reuse. If it needs to be replaced, remove it using an appropriate puller.
7. Remove three bolts 23, then remove the lock plate 24. Apply an aluminum bar to the second shaft 25 from the drive motor fitted side, and hammer the bar lightly to force the second shaft 25 out of place with O-rings 26 and 27 fitted to it.
8. Remove the second gear 28 with the ball bearing 29 attached. The ball bearing 29 may be left fitted to the second gear 28 if it is in a satisfactory condition for reuse. If it needs to be replaced, remove it using an appropriate puller.
9. Remove the snap ring 30. Remove the input gear 31 fitted with the ball bearings 32 from the transfer case 33 using a slide hammer puller. The ball bearing 32 may be left fitted to the input gear 31 if it is in a satisfactory condition for reuse.



2. Installation of oil seal retainer and bearing inner race

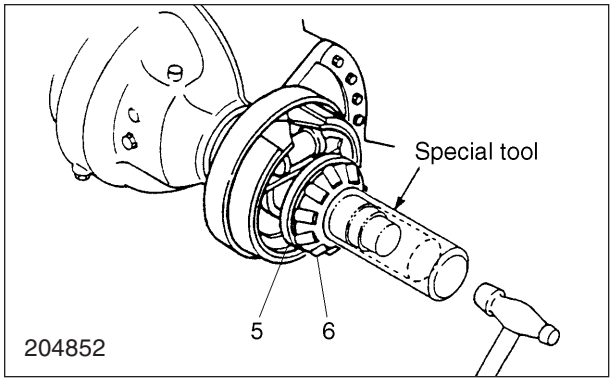
(1) Pack the taper roller bearing inner race 6 with AUTOLEX A or equivalent grease; force grease inside the bearing cage using your palm.

(2) Install the seal retainer 5 in the illustrated direction using the special tool.

(3) Install the bearing inner race 6 using the special tool.

Special tool needed

Installer	64309-12300



3. Reassembly of wheel hub and drum sub-assembly

(1) Once the wheel hub 7 and the brake drum 8 have been separated, always replace the bolts 9 and the nut 10 with new ones. Stake the bolt end crisscross using a flat tip chisel.

Nut tightening torque	59 ± 5.9 N·m (6.0 ± 0.6 kgf·m) [43.4 ± 4.3 lbf·ft]

(2) Press-fit the bearing outer race 11 in the hub 7 using the special tool.

Special tool needed

Installer	91268-05700

(3) Install the oil seal 12 in the illustrated direction into the hub 7 using the bearing and seal driver.

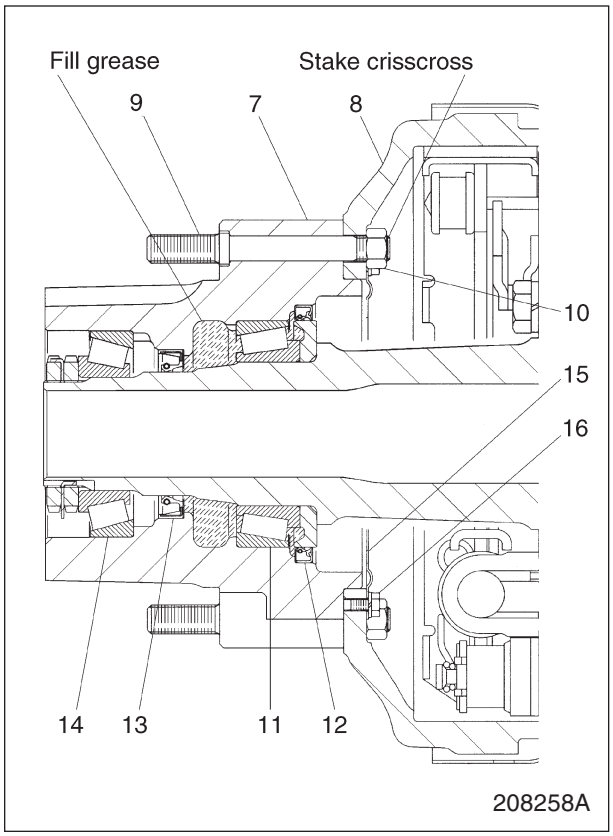
(4) Install the oil seal 13 in the illustrated direction into the hub 7 using the bearing and seal driver.

(5) Press-fit the bearing outer race 14 in the hub 7 using the bearing and seal driver.

(6) Fill AUTOLEX A or equivalent grease into the portion shown with ▨ in the illustration. Apply the grease also to the oil seal lip. Take care that grease does not enter inside the brake drum 8.

(7) Install the deflector 15 and tighten the bolts 16 to the torque given below.

Bolt tightening torque	9.8 ± 1.0 N·m (1.0 ± 0.1 kgf·m) [7.2 ± 0.7 lbf·ft]

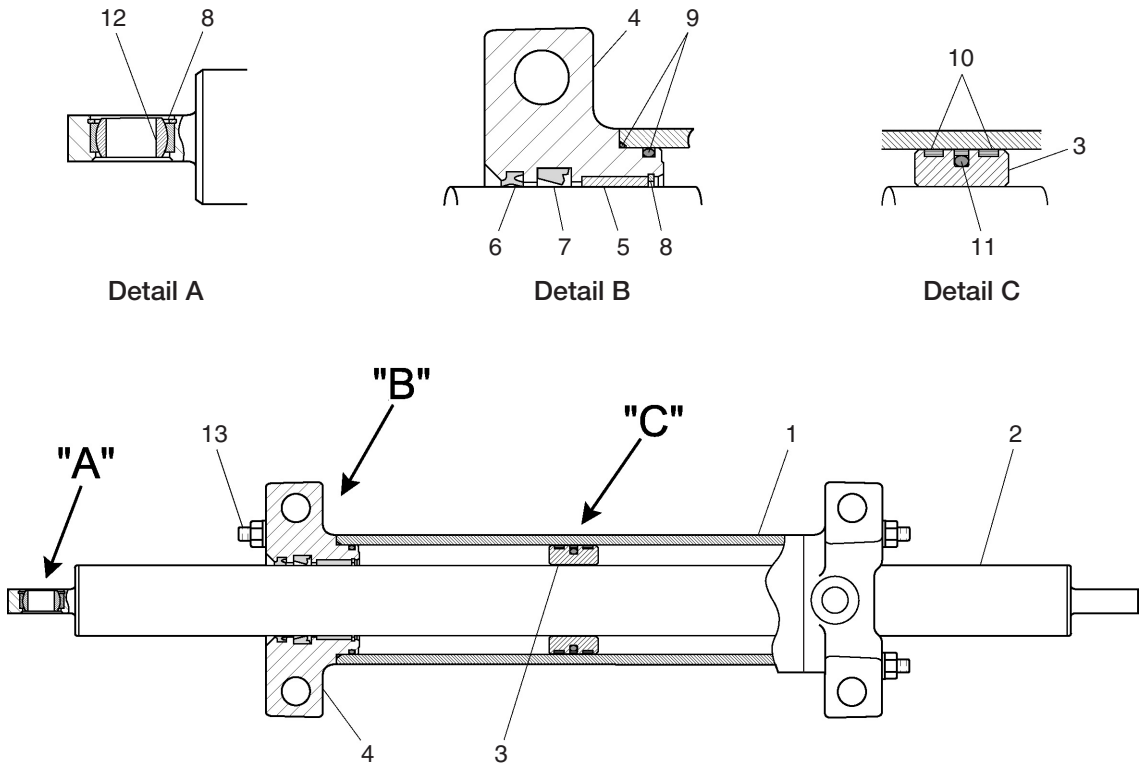


4. Installation of wheel hub and drum sub-assembly

(1) Carefully install the wheel hub and drum sub-assembly in the front housing while keeping it level.

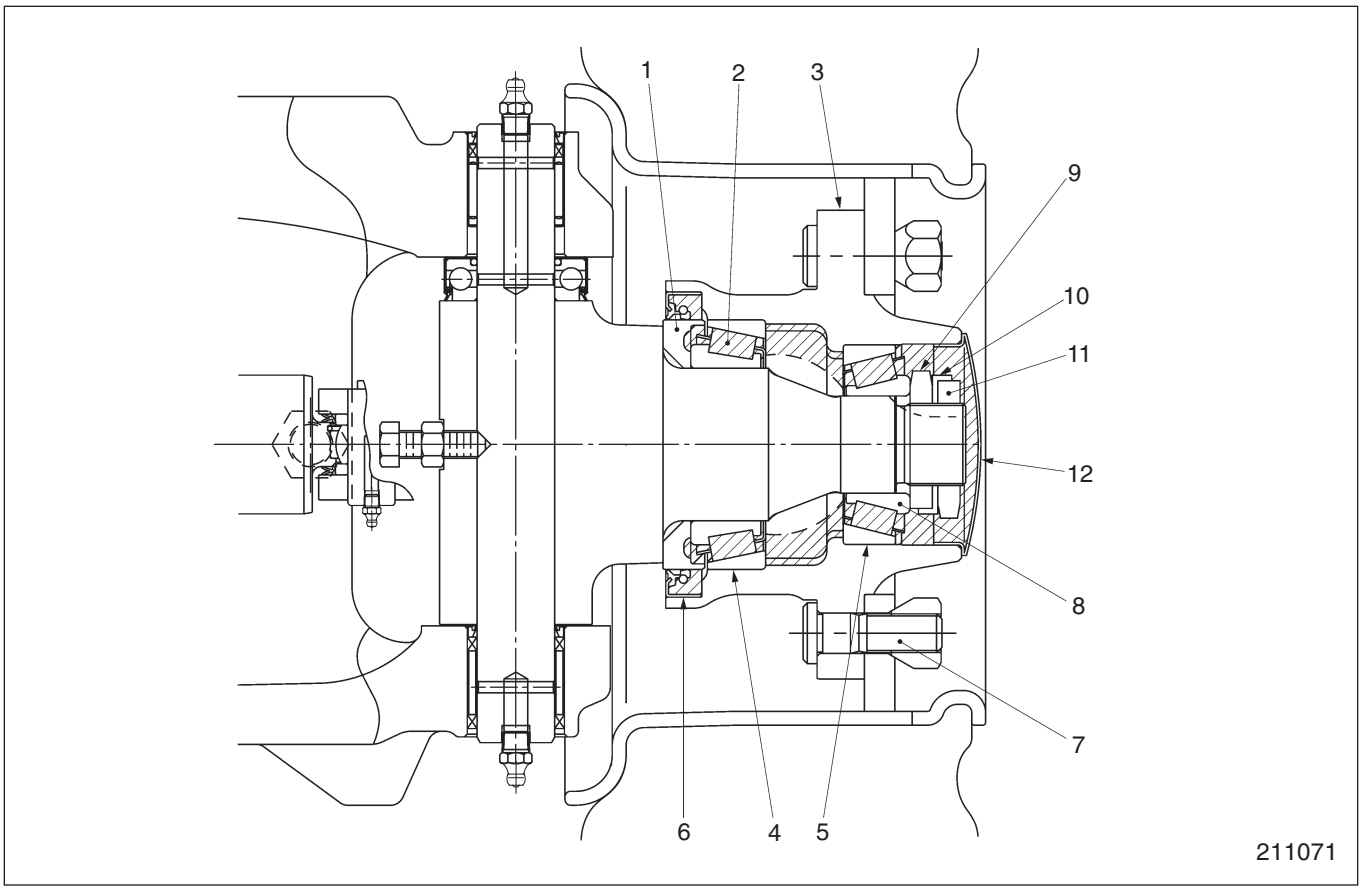
(2) Adjust the hub bearing preload.
Refer to "Adjusting Hub Bearing Preload" on the next page.

Steering Cylinder



1 Cylinder tube
2 Piston rod
3 Piston
4 Cylinder head
5 Bushing
6 Wiper
7 U-seal
8 Snap ring
9 O-ring
10 Guide ring
11 Piston seal
12 Spherical bearing
13 Tie rod

3. Assembling Rear Axle Hub



Sequence

1 Oil seal retainer
2 Bearing cone

Assembly parts 3 to 7 prior to final assembly.

3 Hub
4 Bearing cup
5 Bearing cup
6 Oil seal
7 Wheel bolt
8 Bearing cone
9 Inner nut
10 Lock washer
11 Outer nut
12 Cap

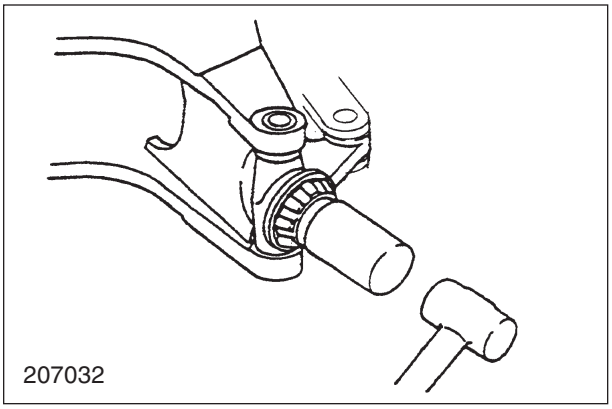
Suggestions for Reassembly

1. Install the seal retainer 1 in the illustrated direction with the special tool (64309 - 40400).
2. Install the bearing cone 2 with the special tool (64309-40400).

   Special tool needed

Bearing installer	64309 - 40400

3. Tapping with hammer, fit the wheel bolt 7 into the hub bolt hole.



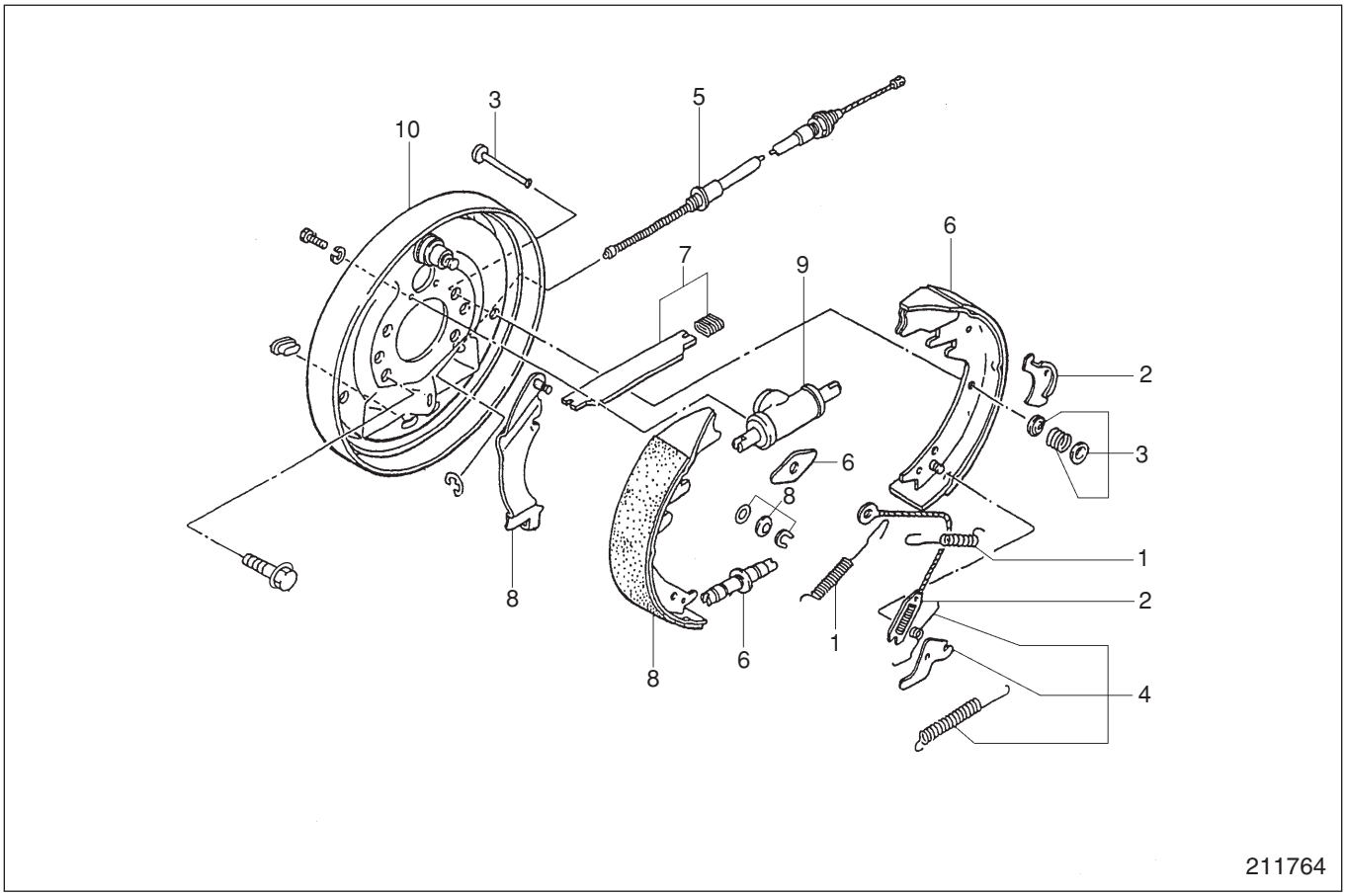
BRAKE SYSTEM

Procedures and Suggestions for Disassembly, Inspection and Reassembly

Wheel Brake

Disassembly

2 ton class and 2.5 ton class

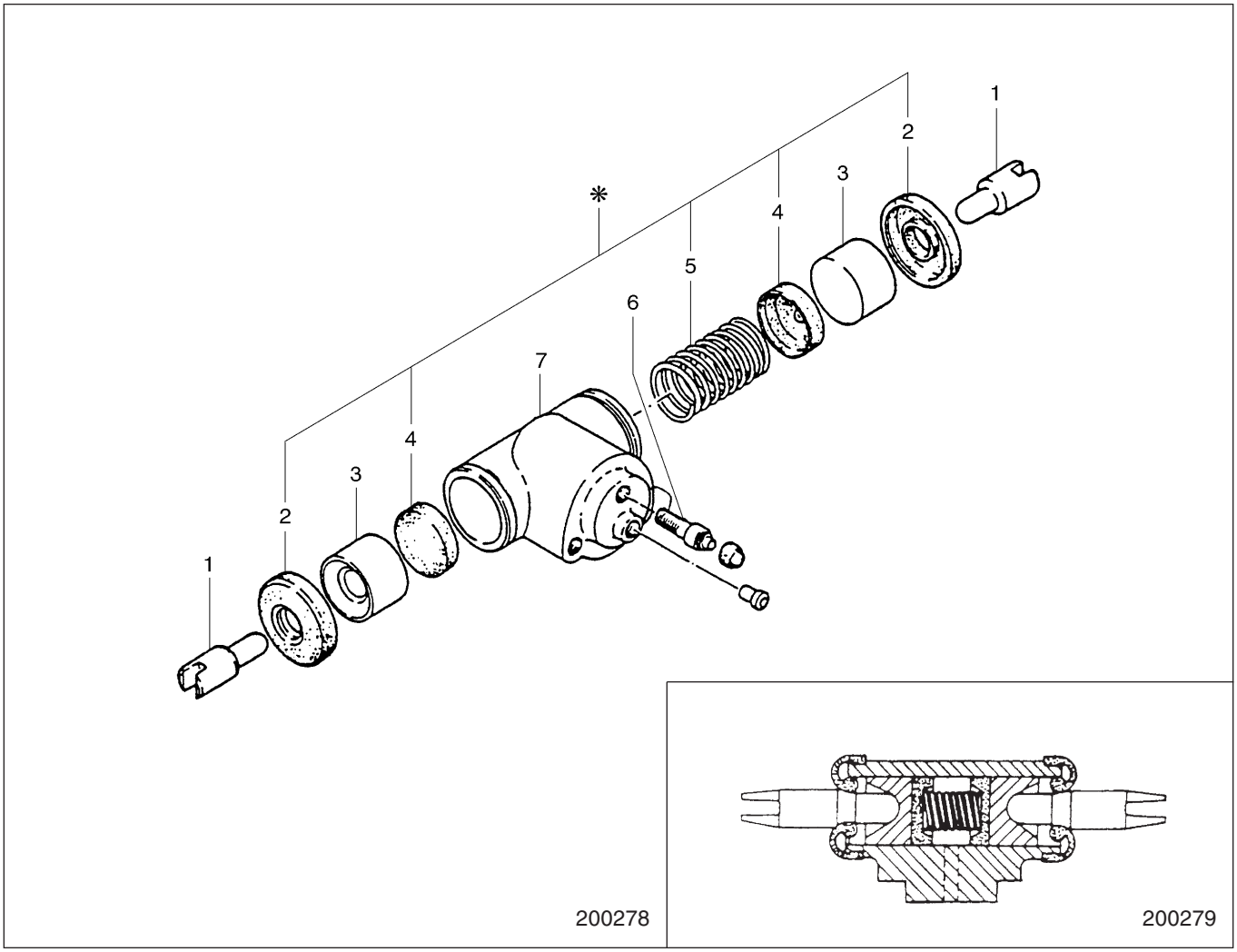


Sequence

1 Return springs
2 Fitting cable, Cable guide
3 Shoe hold pin, Shoe hold spring, Cup, Pin
4 Adjusting lever, Adjusting spring and Return spring
5 Brake cable
6 Shoe guide plate, Shoe and lining (secondary), Adjusting screw
7 Strut, Spring
8 Shoe and lining (primary), Parking brake lever, Retainer, Spring washer
9 Wheel cylinder
10 Backing plate

Wheel Cylinder

Disassembly



Sequence

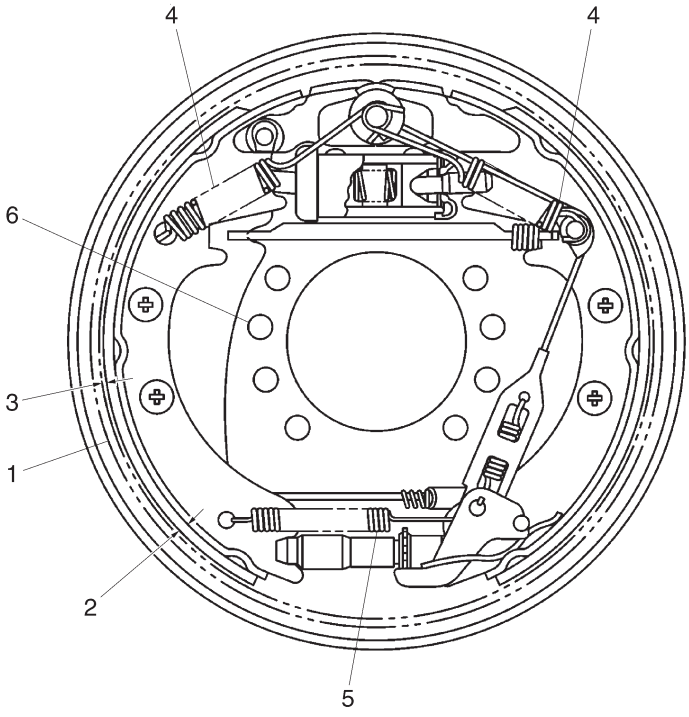
1 Connecting link
2 Boot
3 Piston
4 Piston cup
5 Return spring
6 Bleeder screw, Cap
7 Cylinder body

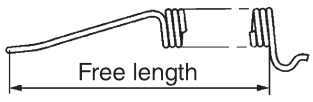
NOTE

Parts marked with (*) are included in the repair kit.

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

Item				Truck Models: 3 ton class	3.5 ton class
Wheel brakes	Inside diameter of brake drum 1		A	$310\ ^{+0.15}_{0}$ ($12.20\ ^{+0.006}_{0}$)	
			B	312.0 (12.28)	
	Thickness of lining 2		A	5.67 (0.22)	
			B	3 (0.12)	
	Clearance between drum and shoe 3 (one side)		A	0.1 to 0.35 (0.004 to 0.014)	
	Return spring 4	Free length	A	Primary: 120 (4.72) Secondary: 139.2 (5.48)	
		Length under test force	A	Primary: 134 (5.28)	Secondary: 145.4 (5.72)
		Test force N (kgf) [lbf]	A	226 ± 23 (23 ± 2.3) [51 ± 5.1]	
	Spring 5	Free length	A	126 (4.96)	
		Length under test force	A	145.4 (5.72)	
		Test force N (kgf) [lbf]	A	78.5 ± 7.8 (8 ± 0.8) [17.6 ± 1.76]	
	Tightening torque for backing plate bolt 6 N·m (kgf·m) [lbf·ft]		A	215 ± 21.5 (21.9 ± 2.2) [158.6 ± 15.9]	





Primary return spring 4

Secondary return spring 4

Spring 5

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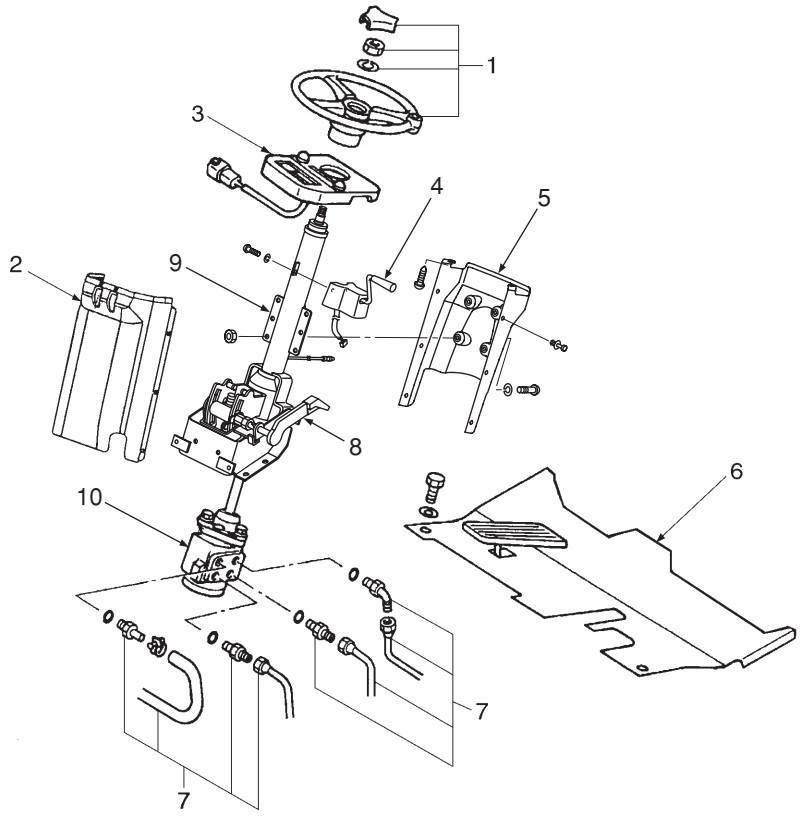
Procedures and Suggestions for Removal and Installation

Steering Column Assembly

Removal



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Sequence

1 Steering wheel, Cap, Nut, Washer
2 Console box (front panel)
3 Central vehicle monitor panel
4 Direction lever
5 Console box (rear panel)
6 Floor plate
7 Hose, Pipe, Hose clamp, Connector, O-ring
8 Tilt steering lock lever, Spacer, Lock bolt, Lock plate, Pin, Lock nut
9 Steering column assembly
10 Steering control valve

⚠ WARNING

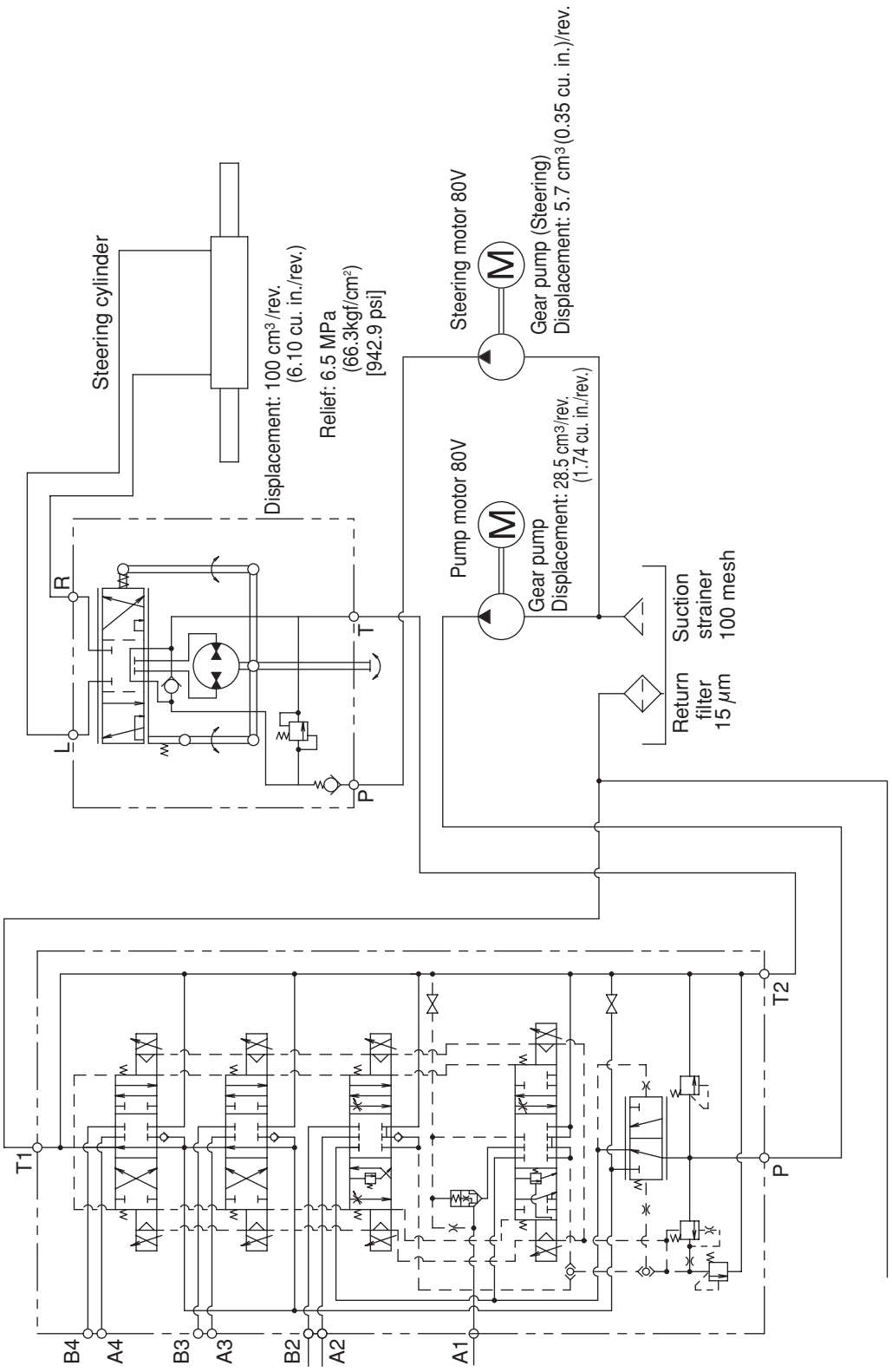
Hydraulic pressure can cause personal injury. Before any steering system hydraulic lines or components are disconnected, make sure all hydraulic pressure is released in the steering system. Move the steering wheels to the left and right, then straight.

NOTE

For servicing the steering cylinder, see “Group 6 REAR AXLE ”.

For servicing the pump and valve, see “Group 9 HYDRAULIC SYSTEM”.

Hydraulic Circuit Diagram (2 Ton Class and 2.5 Ton Class)



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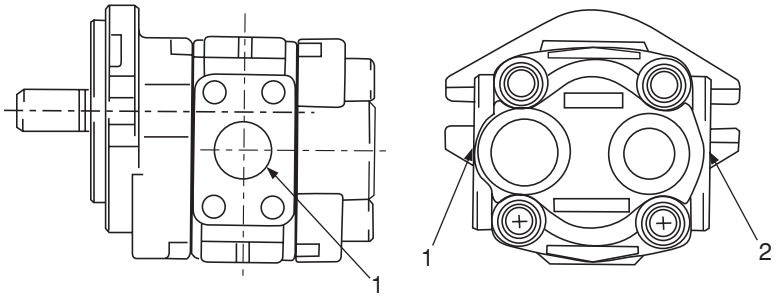
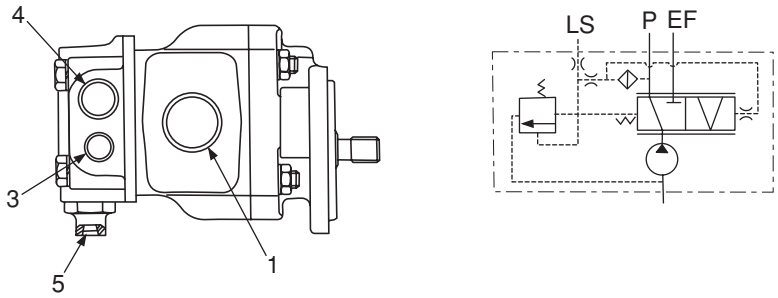
Hydraulic Pump



Hydraulic pump for 2 ton class and 2.5 ton class
Displacement: 28.8 cc/rev.
(1.76 cu. in./rev.)

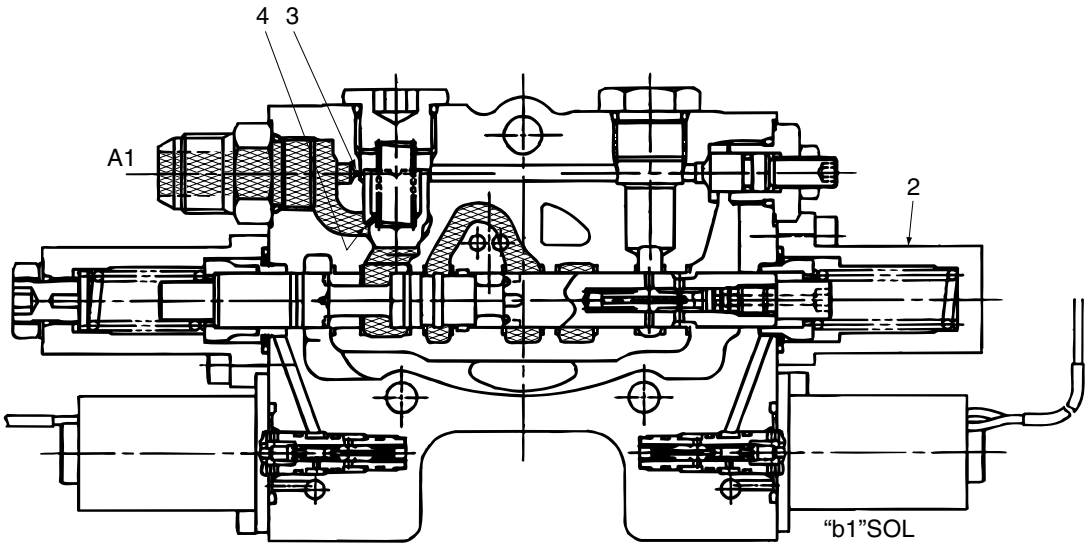


Hydraulic pump for 3 ton class and 3.5 ton class
Displacement: 29.0 cc/rev.
(1.77 cu. in./rev.)

211625

1 Inlet port
2 Outlet port
3 Priority port (P)
4 Secondary port (EF)
5 Load sensing port (LS)

Lift section



Blocking oil

207441

Emergency Lift Lock Mechanism

With the proportional electromagnetic pressure control valve on the "b1" SOL side in activation (lift in lowering operation), if spool sticking should occur, deactivation of the proportional electromagnetic pressure control valve cancels pilot pressure in cap 2. As a result, the lift lock valve moves to the position indicated in the diagram, and the pilot oil passage closes.

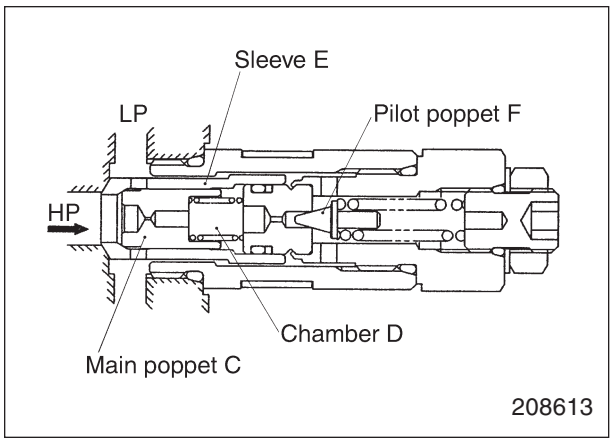
Consequently, pressure equalizes before and after orifices 3, 4, and the load check valve returns to its seat by spring force to lock the cylinder.

Main Relief Valve

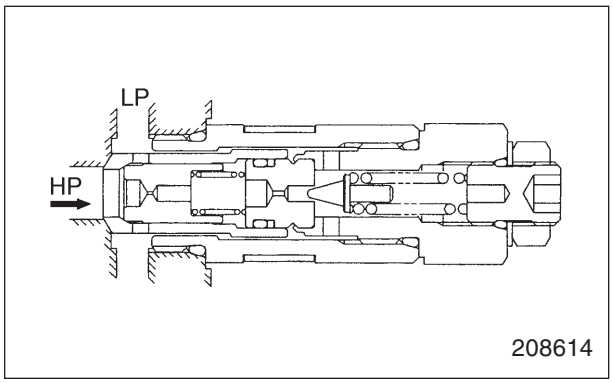
Main Relief Valve Operations

The main relief valves are installed between high-pressure oil passage HP and low-pressure oil passage LP, and perform the following operations.

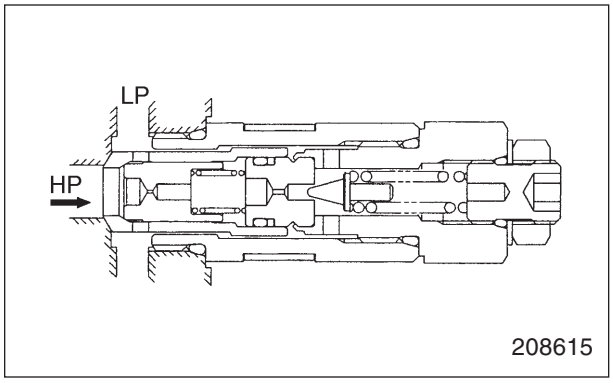
(1) Chamber D is filled with oil entering through orifices in main poppet C, thus main poppet C and sleeve E are firmly seated because of the difference in area sizes.



(2) When pressure in HP reaches the preset pilot spring force, pilot poppet F opens. Oil flows around the pilot poppet and passes through the holes and enters low-pressure passage LP.

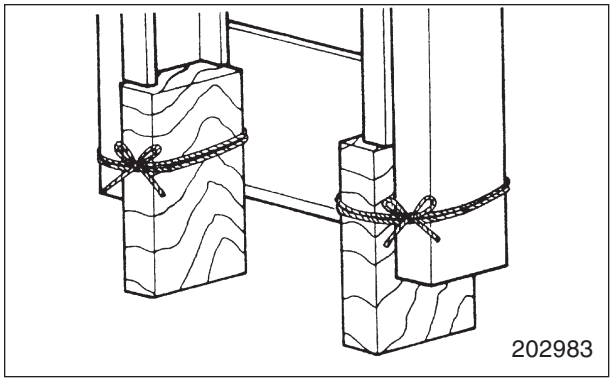


(3) Because pilot poppet F opens, oil flows from HP to chamber D through orifices in main poppet C. This oil flow results in pressure differences between HP and chamber D, thus causing main poppet C to open and allow oil to flow directly from HP to LP.



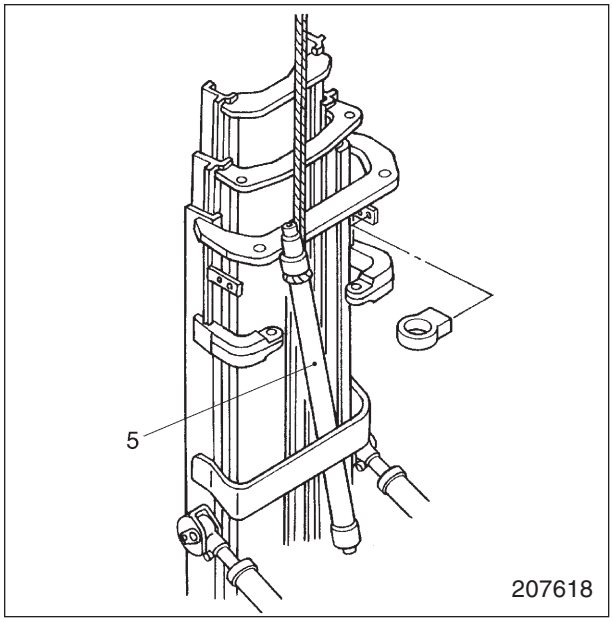
(3) Place wood blocks under the inner mast (dual-stage full free panoramic mast) or middle mast (triple-stage full free panoramic mast).

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



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

Hitch 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 place the hands between the cylinder and mast.



Installation

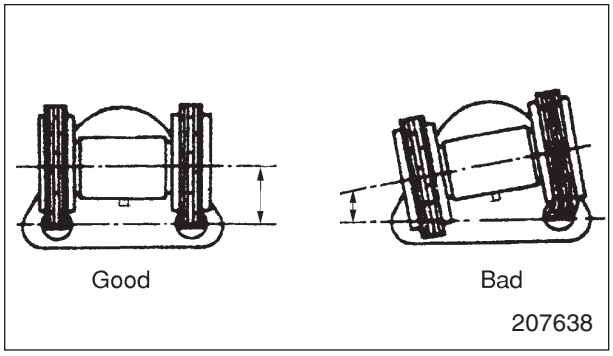
To reinstall, follow the removal sequence in reverse, and follow the instructions below:

(1) Install chain wheel support assembly 4 parallel to a line connecting the centers of chain anchor bolt holes on the first lift cylinder 3 to prevent chains from twisting.

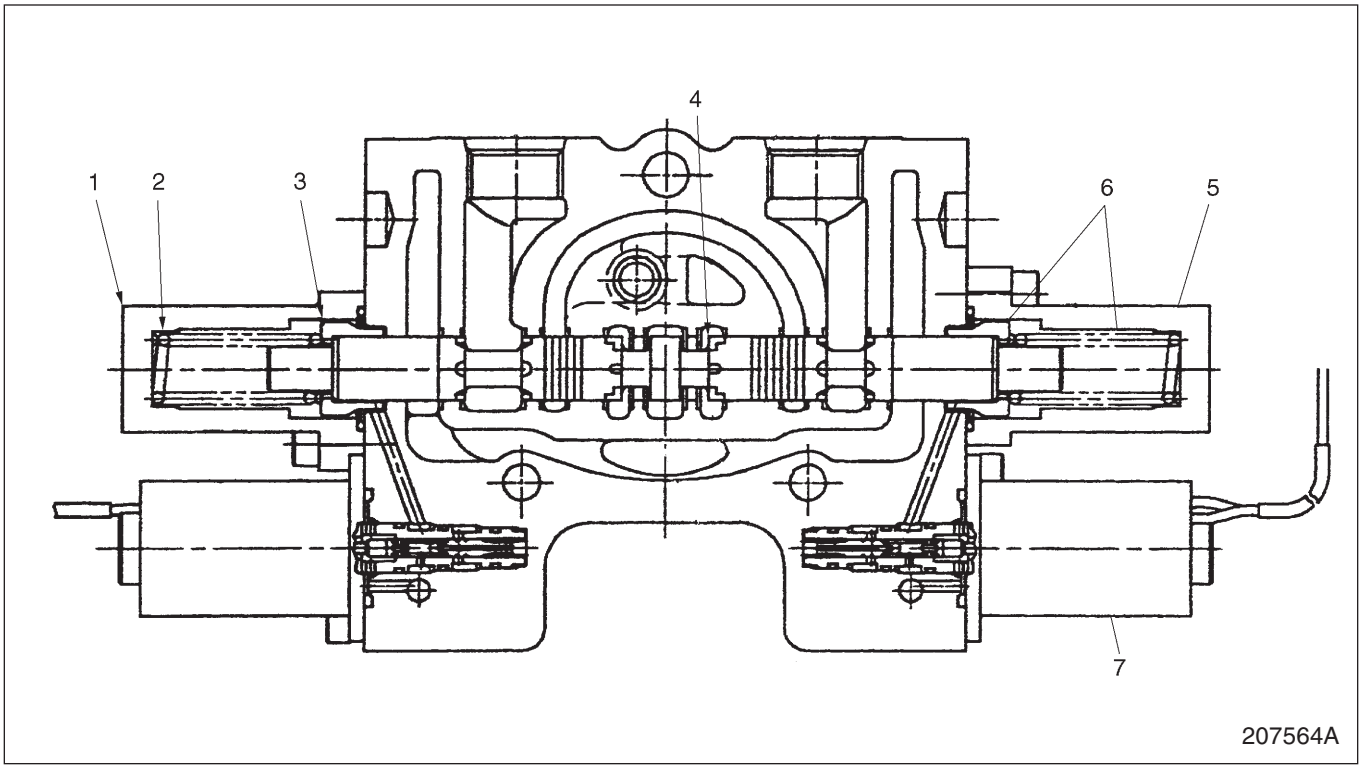
(2) Adjust the chain tensions.
(Refer to “Inspection and Adjustment” in “GROUP 10 MAST AND FORK”.)

(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.



Disassembly of Attachment Section Assembly



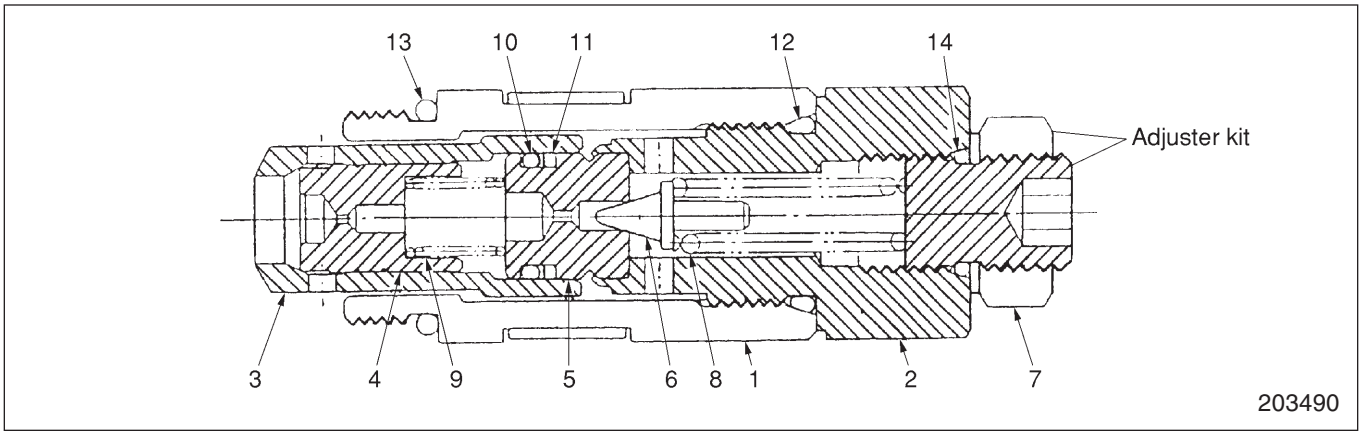
Sequence

1 Cap, Socket-head bolt
2 Spring
3 Spring seat
4 Spool
5 Cap, Socket-head bolt
6 Spring, Spring seat
7 Proportional electromagnetic pressure control valve

Suggestions for Disassembly

For disassembly procedures, refer to the tilt section.

Main Relief Valve



1 Cap
2 Plug
3 Sleeve
4 Main poppet
5 Pilot seat
6 Poppet
7 Lock nut
8 Pilot spring
9 Spring
10 O-ring
11 Back up ring
12 O-ring

The seal kit consists of parts 13 and 14.

13 O-ring
14 O-ring

Disassembly

Do not disassemble the main relief valve unless it fails to limit the pressure properly. If the main relief valve is disassembled, the relief pressure setting must be readjusted. The disassembly procedure is as follows:

(1) Loosen lock nut 7 of the adjuster kit, then turn the adjuster screw twice counterclockwise to reduce force of spring 8.

(2) Hold cap 1 in a vise, then unscrew and remove plug 2 to allow easy removal of the internal parts.

Inspection after disassembly

If an abnormality is evident and does not take the form of damage that can be rectified by lapping, replace the main relief valve assembly with a new one.

(1) Check whether main poppet 4 slides smoothly inside the sleeve. It must slide smoothly.

(2) Visually inspect the spring. It must not be bent or otherwise damaged.

(3) Visually inspect the contact surfaces of pilot poppet 6 and pilot seat 5. They must be free of damage and uneven wear.

(4) Visually inspect the orifice. Remove any blockage.

Reassembly

Only O-rings 13 and 14 are available as service parts.

(1) Hold cap 1 vertically in a vise with the plug end at the top.

(2) Insert the parts into cap 1 in appropriate sequence through opening in the top of the cap.

(3) Screw plug 2 (with the adjuster kit attached) into the cap by hand. It must be possible to screw the plug into the cap smoothly.

(4) Tighten plug 2 into cap 1 using a wrench.

Unit: N·m (kgf·m) [lbf·ft]

Tightening torque	69 to 78 (7 to 8) [51 to 58]

Pressure adjustment

(1) Turning adjuster screw clockwise increases the relief pressure setting. Turning it counterclockwise decreases the relief pressure setting.

(2) Adjust relief pressure setting to 18.1 $^{+0.5}_{-0}$ MPa (185 $^{+5}_{-0}$ kgf/cm^2) [2631 $^{+71}_{-0}$ psi].

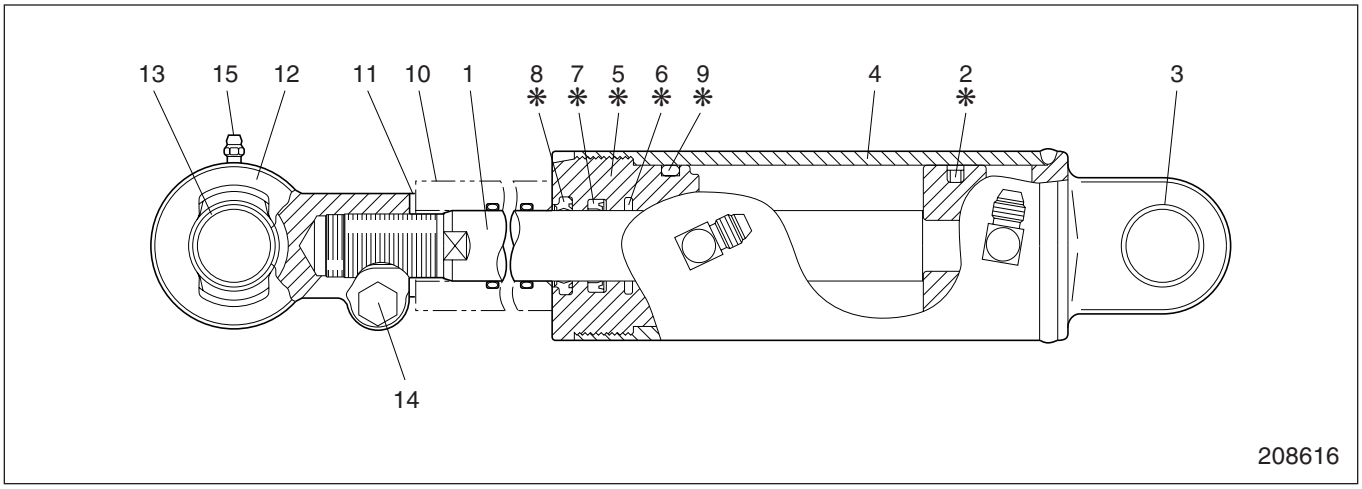
(3) Tighten lock nut to the torque shown below while holding the adjuster screw to prevent it from turning.

Unit: N·m (kgf·m) [lbf·ft]

Tightening torque	27 to 31 (2.8 to 3.2) [20.2 to 23.1]

For instructions on pressure inspection and adjustment on the vehicle, see page 9-71.

Reassembly



Sequence

1 Piston rod assembly
2 Piston seal
3 Bushing
4 Cylinder tube
5 Guide bushing
6 Buffer ring
7 Rod packing
8 Dust seal
9 O-ring
10 Sleeve
11 Shim

NOTE: Parts 10 and 11 are used only in the 3° and 6° backward tilt cylinders.

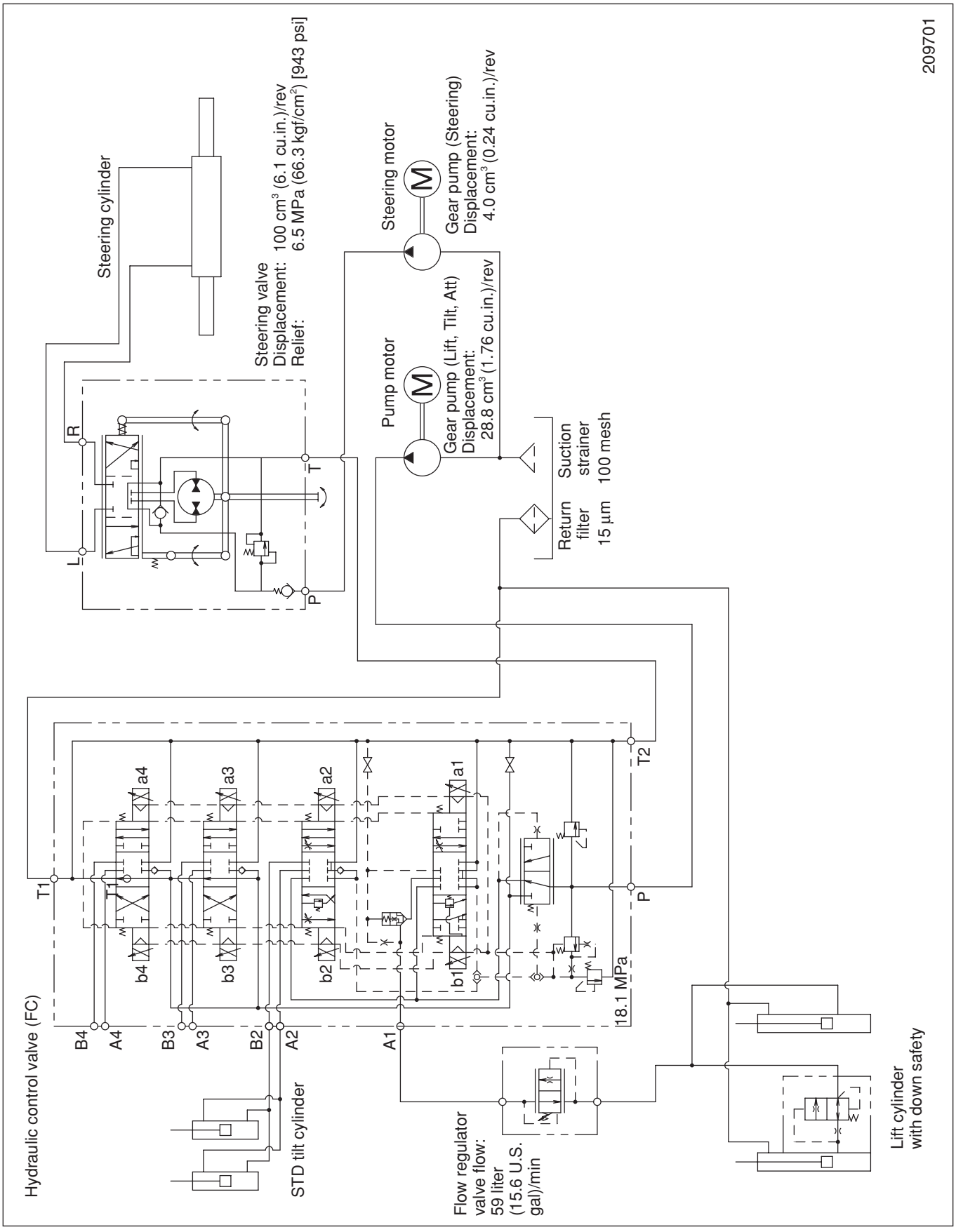
12 Tilt socket
13 Spherical bearing
14 Bolt, Nut
15 Grease nipple

NOTE

Parts marked with ✻ are included in the seal kit.

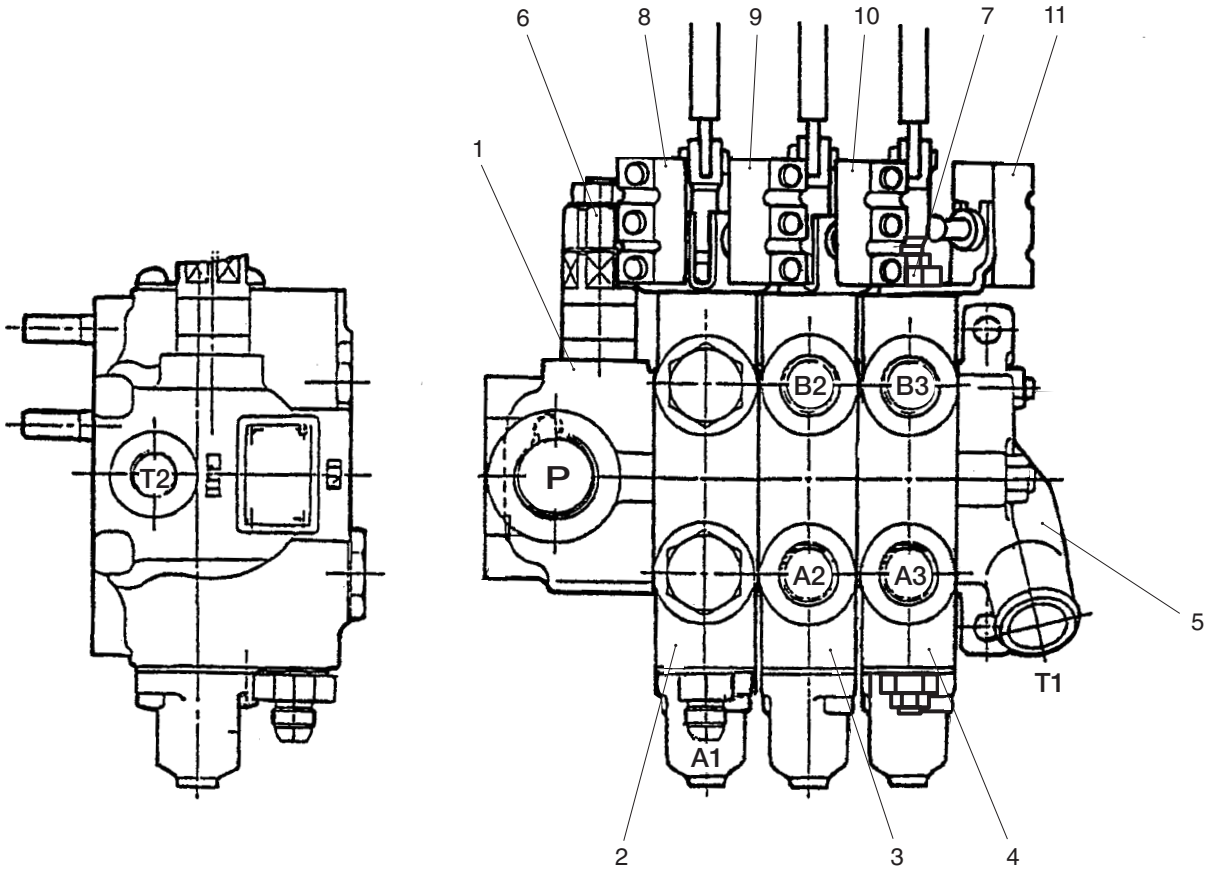
Hydraulic Circuit Diagram (FC)

2 Ton Class and 2.5 Ton Class



Control Valve

General



1 Inlet cover
2 Lift valve assembly
3 Tilt valve assembly
4 Attachment valve assembly
5 End cover
6 Main relief valve
7 Shut-off valve assembly (for attachment section)
8 Lift switch 1 (microswitch)
9 Lift switch 2 (microswitch)
10 Tilt switch (microswitch)
11 Attachment switch (microswitch)

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

The control valve structure is shown above. The parts are joined together by three tie-bolts.

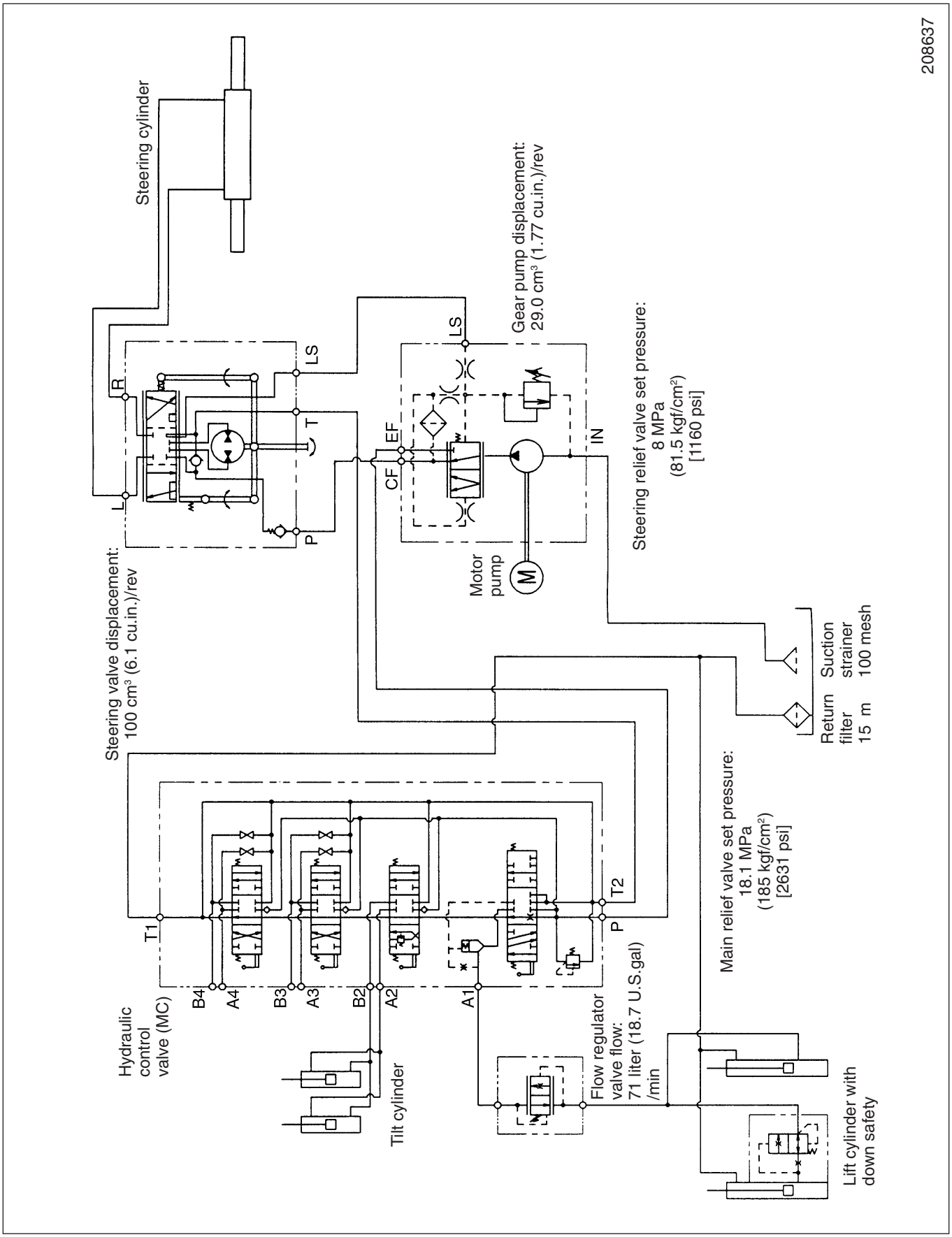
Since a lapping process is used for the coupling of the body and spool, the body and spool combination cannot be changed.

The inlet cover contains the main relief valve. The lift valve assembly contains the load check valve. The tilt valve spool contains the tilt lock valve.

The microswitches located on top of the control valve turn ON and OFF according to the spool movement, and send lift and tilt signals to the logic card.

The lift valve is equipped with two microswitches for two-step lift speed selection.

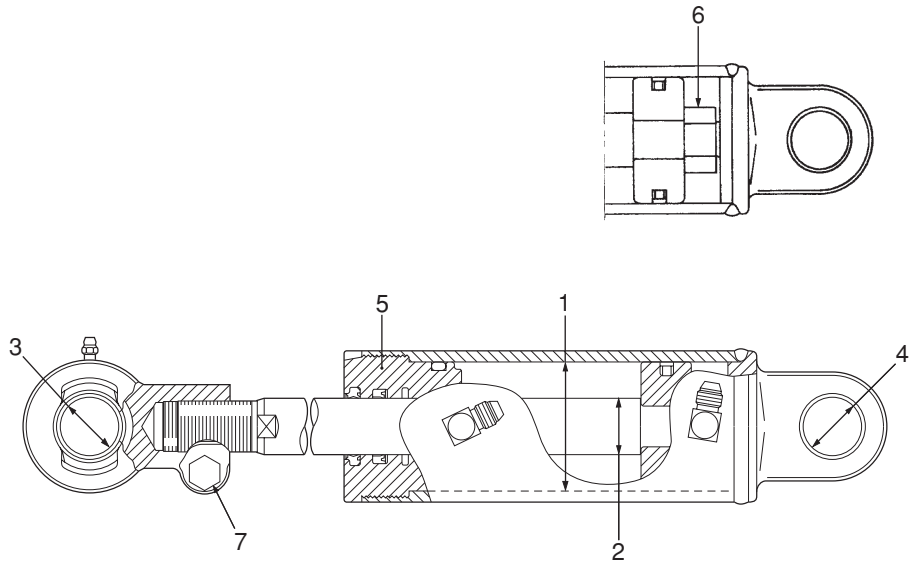
3 Ton Class and 3.5 Ton Class



A: Standard value

Unit: mm (in.)

Item				Truck Models: 2 ton class, 2.5 ton class	3 ton class, 3.5 ton class
Tilt cylinders	Inside diameter of cylinder tube 1		A	70 (2.76)	80 (3.15)
	Diameter of piston rod 2		A	30 (1.18)	35 (1.37)
	Inside diameter of tilt socket bushing (fitted) 3		A	$35\ ^{0}_{-0.012}$ ($1.38\ ^{0}_{-0.0005}$)	
	Inside diameter of cylinder tube head bushing (fitted) 4		A	$32\ ^{+0.085}_{0}$ ($1.26\ ^{+0.003}_{0}$)	
	Tightening torque N·m (kgf·m) [lbf·ft]	Guide bushing 5	A	314 ± 31 (32 ± 3.2) [232 ± 23]	373 ± 37 (38 ± 3.8) [275 ± 27]
		Nut 6	A	235 ± 19.6 (24 ± 2.0) [173 ± 14.5]	392 ± 25 (40 ± 2.5) [289 ± 18]
		Tilt socket bolt 7	A	157 to 182 (16.0 to 18.6) [116 to 134]	80 ± 10 (8.0 ± 1.0) [59 ± 7.4]

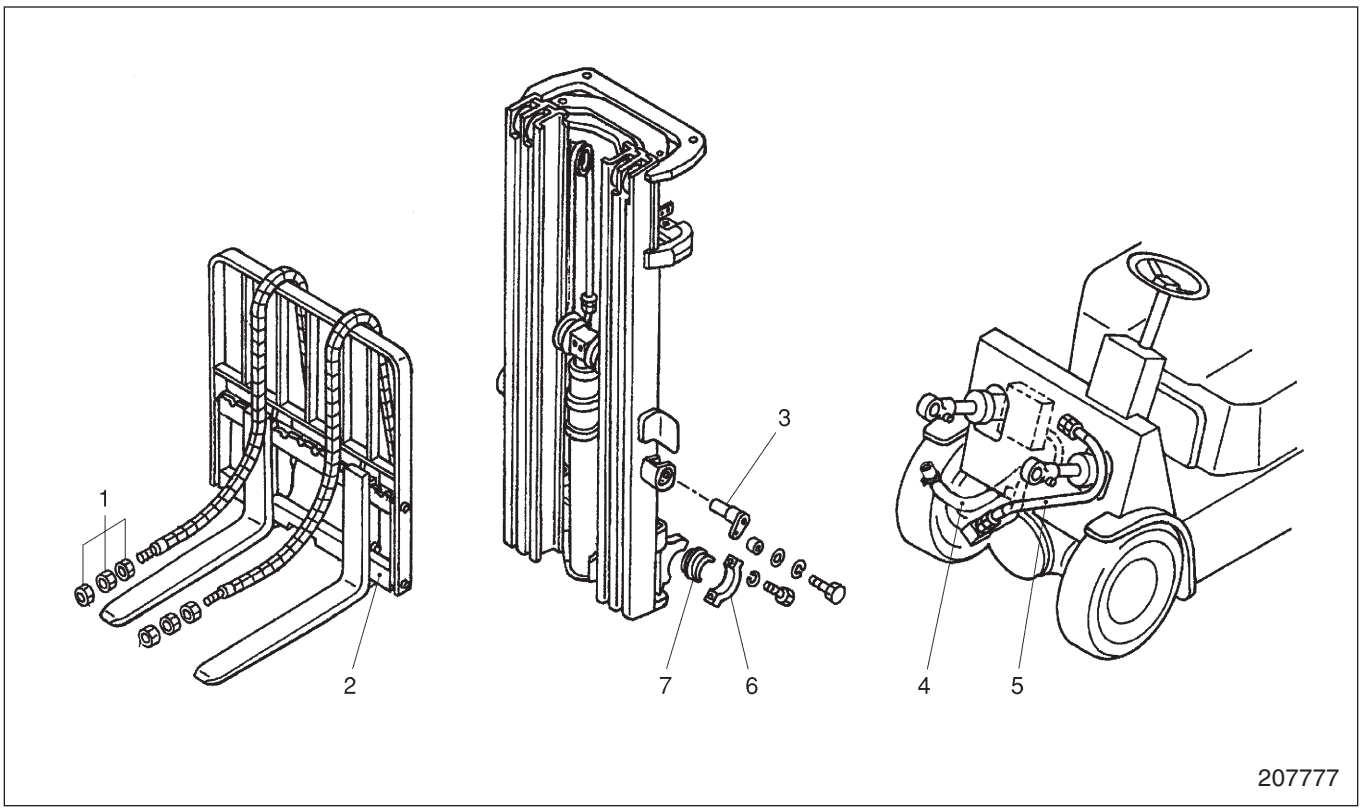


211630

Mast and Lift Bracket Assembly

The following describes the procedures for removing and reinstalling the mast assemblies of dual-stage full free panoramic mast (Duplex Mast) and triple-stage full free panoramic mast (Triplex Mast). Note that the triple-stage full free panoramic mast (Triplex Mast) is used as an example.

Triple-stage Full Free Panoramic Mast (Triplex Mast)



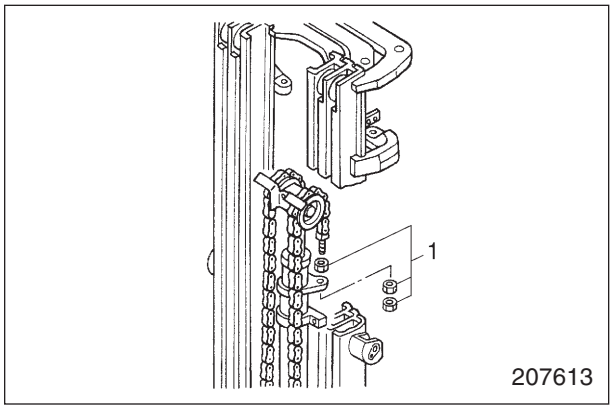
Sequence

1 Nuts
2 Fork, Lift bracket assembly
3 Tilt socket pin
4 Low-pressure hose
5 High-pressure hose for lift cylinders
6 Mast support cap
7 Mast support bushing

Suggestions for Removal

1. Removing lift bracket assembly 2

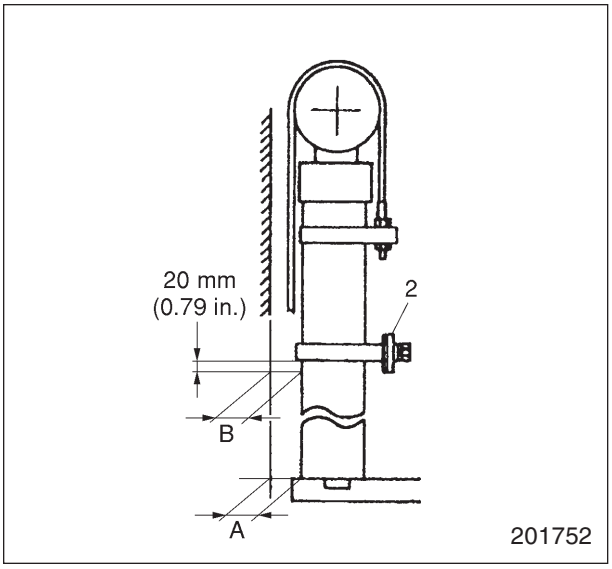
(1) Lower lift bracket assembly 2, and place wood blocks under the assembly. Tilt the mast forward, lower the inner mast to the bottom, then remove nuts 1 from the anchor bolts of the first lift chains.



3. Installing first lift cylinder

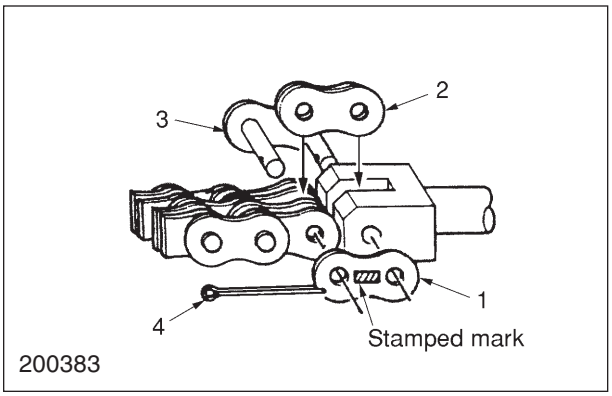
   The first lift cylinder must be installed parallel to the mast when the lift cylinder rod is contracted.

   Make sure the cylinder does not tilt forward. Using shims 2, adjust the backward inclination so that clearance at section B is 0 to + 0.5 mm (0 to + 0.02 in.) larger than clearance at section A.



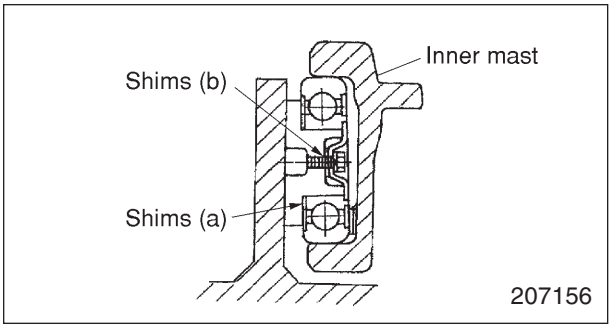
4. Precaution for installation of chain anchor kit

   Be careful not to confuse the center plate with the link plate.



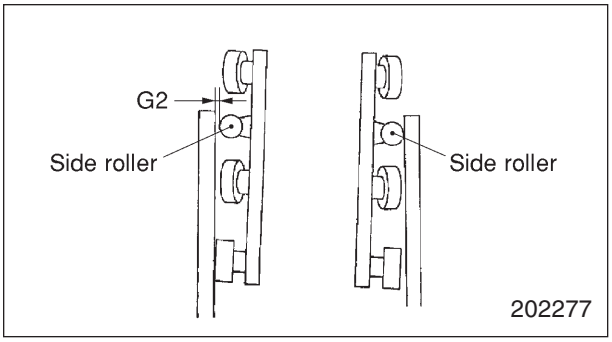
1 Link plate (stamped mark on surface)
2 Center plate (no stamped mark)
3 Link
4 Split pin

If clearance G1 is greater than 0.5 mm (0.020 in) by way of example, add a 0.5 mm (0.020 in) thick shim a on the inner side of the roller and remove shim b of the same thickness from the underside of the stopper, then tighten the bolt.

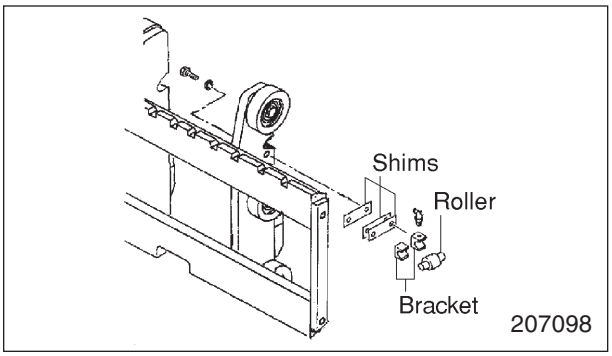


(7) Lower the lift bracket slightly from the top, then adjust clearance G2 between the side roller and mast by increasing or decreasing the thickness of the shims.

Clearance G2	0.1 to 0.5 mm (0.004 to 0.020 in.)

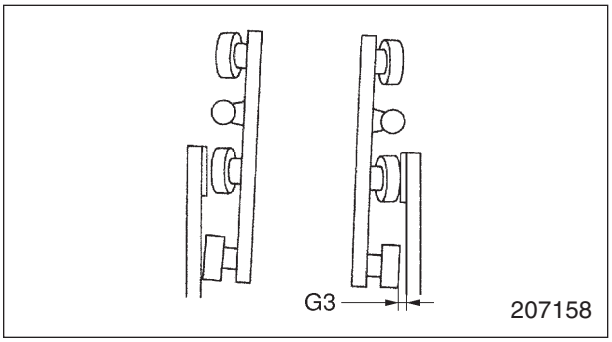


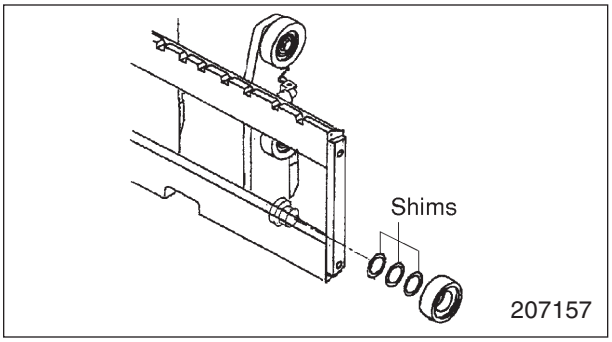
Adjust the side roller clearance by adding shims between the roller bracket and lift bracket.



(8) With the lift bracket at the top, adjust clearance G3 with shims.

Clearance G3	0.1 to 0.5 mm (0.004 to 0.020 in.)





Service Data

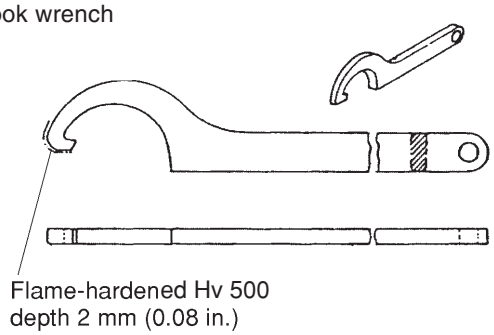
Simplex Mast, Duplex Mast

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

Item \ Truck Models				2 ton class, 2.5 ton class	3 ton class, 3.5 ton class
Forks and chains	Difference in height between fork tips		A	5 (0.20)	
	Thickness of forks (width × thickness)		A	100 × 40 (3.9 × 1.57)	125 × 45 (4.9 × 1.77)
			B	100 × 38 (3.9 × 1.50)	125 × 43 (4.9 × 1.69)
	Length of lift chains (per 20 links)		A	381 (15.00)	508 (20.00)
			B	392 (15.43)	523 (20.59)
Rollers	Diameter of main roller	S	A	113.8 (4.48)	
		M	A	115 (4.53)	
		L	A	116 (4.57)	
		LL	A	117 (4.61)	
	Diameter of side roller		A	42 (1.65)	
Mast and lift bracket	Longitudinal clearance of lift bracket middle rollers (with forks slightly lifted) F		A	0.1 to 1.0 (0.004 to 0.039)	
	Lateral clearance of lift bracket middle main rollers (fully raised) G1		A	0.1 to 0.5 (0.004 to 0.020)	
	Lateral clearance of lift bracket side rollers (fully raised) G2		A	0.1 to 0.5 (0.004 to 0.020)	
	Lateral clearance of lift bracket lower main rollers (fully raised) G3		A	0.1 to 0.5 (0.004 to 0.020)	
	Longitudinal clearance of mast main rollers (in the whole lift range) H		A	0.1 to 1.0 (0.004 to 0.039)	
	Lateral clearance of inner mast main rollers (fully raised) J		A	0.1 to 0.5 (0.004 to 0.020)	
	Lateral clearance of outer mast main rollers (fully raised) K		A	0.1 to 0.5 (0.004 to 0.020)	
	Mast strip clearance (fully raised) L		A	0.1 to 0.5 (0.004 to 0.020)	
Distortion of finger bar			B	5 (0.2), maximum	

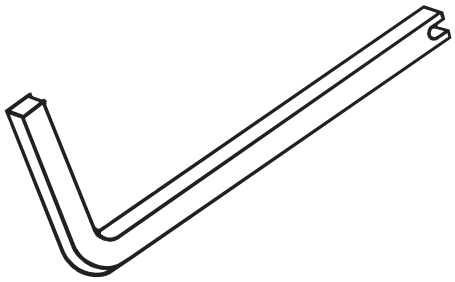
Inspection/Maintenance Location and Item		Pre-operation Inspection	Periodic Inspection Interval					Remarks Service Standard
			Every Week or 50 Hours	Every Month or 200 Hours	Every 3 Months or 600 Hours	Every 6 Months or 1200 Hours	Every 12 Months or 2400 Hours	
Chains and chain wheels	Length of lift chains (20 links)	○						Allowed lift chain stretch: 2 ton class, 2.5 ton class: 392 mm (15.43 in.) 3 ton class, 3.5 ton class: 523 mm (20.59 in.)
	Chain deformation, damage, lubrication and rusting			○				
	Chain bushing coupling, bolt deformation and damage			○				
	Chain wheel deformation and damage						○	
	Chain wheel bearing rattle			○				
Attachments	Attachment abnormality and mounting conditions	○						
Hydraulic system								
Cylinders	Looseness, deformation and damage of rods, rod bolts and rod ends						○	
	Cylinder operating condition	○						
	Drift lowering and forward tilting distances					○		Drift lowering distance: 2 ton class, 2.5 ton class: 50 mm (1.97 in.)/15 min 3 ton class: 40 mm (1.57 in.)/15 min 3.5 ton class: 35 mm (1.38 in.)/15 min Drift forward tilting distance: 2 ton class, 2.5 ton class: 20 mm (0.79 in.)/15 min 3 ton class, 3.5 ton class: 15 mm (0.59 in.)/15 min
	Cylinder oil leaks and damage	○						
	Wear and damage of piston and cylinder shaft bearings						○	
Oil pump	Oil leaks, abnormal noise, wear in drive unit, and mounting looseness	○						
Hydraulic tank	Oil level and contamination	○					⊗	N level: 28.2 liter (7.45 U.S.gal) H level: 30.0 liter (7.93 U.S.gal)
	Filter clogging					⊗		
Operation levers	Linkage looseness			○				
	Lever functions			○				
Control valves	Oil leaks	○						
	Safety valves	○						
	Release pressure measurement						○	18.1 MPa (185 kgf/cm^2) [2631 psi]

Hook wrench



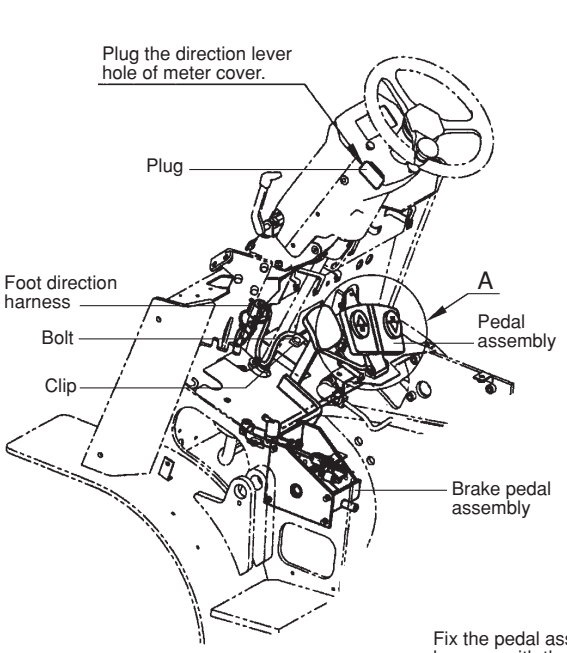
⑨ 203556

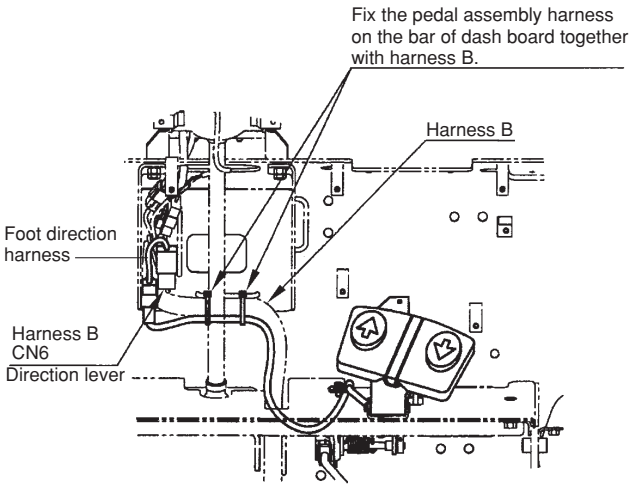
Spring installer



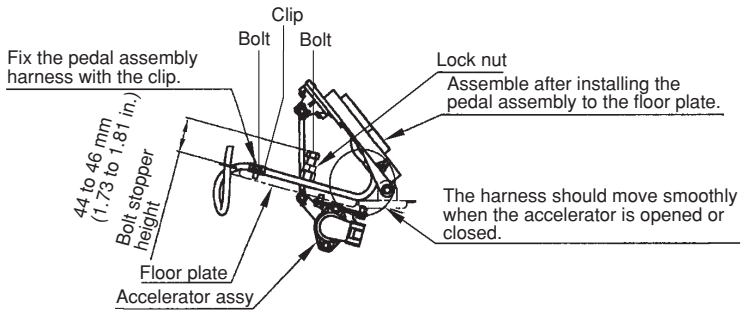
⑩ 206997

Foot Direction Control Kit





Detail of wiring

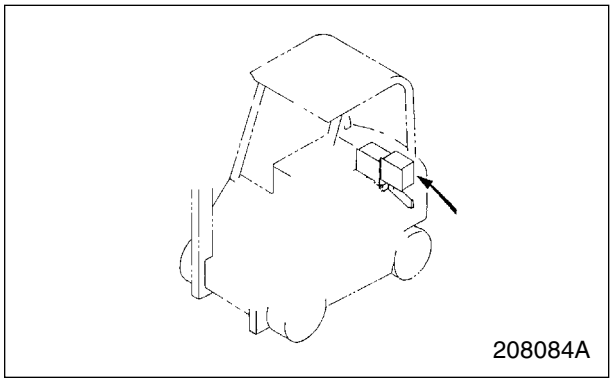


A: Detail of pedal assembly installation

211686

Maintenance Precautions

The FC model contains a microcomputer. Following are the precautions to be observed in performing any maintenance on the FC model.


208084A

(1) When removing the controller cover, make proper provisions to keep out rain, washing water splashes and the like.

(2) After using the controller setting function, check to make sure the control system is in keeping with the truck specifications.

NOTE

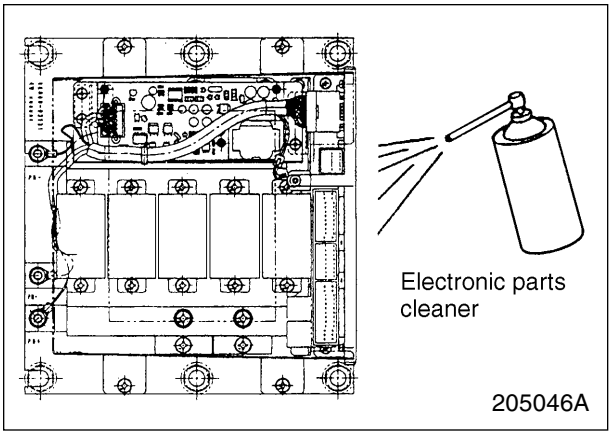
Improper setting of the system will result in inability to lower the forks in an inching manner. (See "How to Set Controller" on page 2-14.)

(3) Before performing repairs which require welding, be sure to disconnect the battery plug and the controller from the system at its connectors.

(4) When handling the controller by hand, never touch its electrical terminals, or your body charge will rupture some of the electronic elements in the internal controller circuits.

3. How to clean harness connectors and system components

(1) Open-circuit trouble is often due to the harness connectors and components in dirty condition: dust, together with greasy matter, forms grime which, in time, penetrates electrical connections, resulting in loose metal-to-metal contact or, for worse, electrical separation of surfaces in contact. For this reason, it is essential that the connectors and components be cleaned at each periodic inspection and at the time of servicing the machine. Instead of a commonly used solvent, use Electronic parts cleaner (in the manner illustrated on the right).

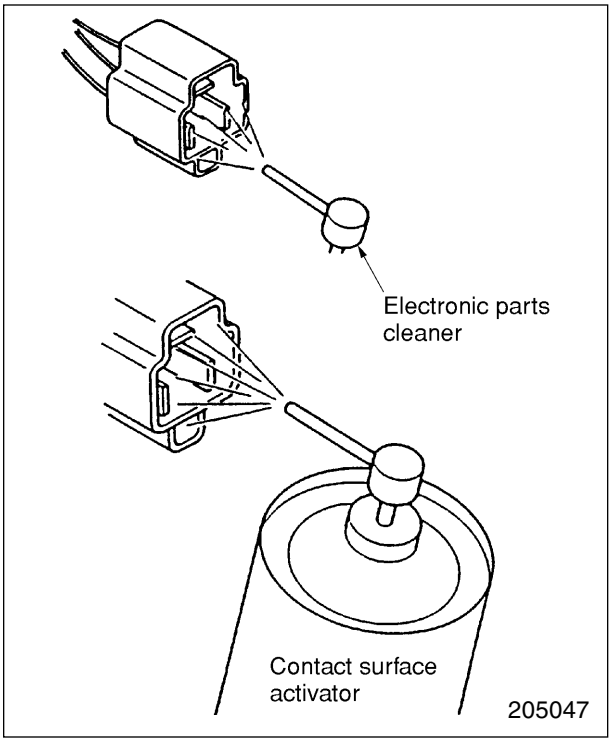


Electronic parts cleaner	Three Bond 29B

NOTE

The cleaner liquid is volatile. All you have to do is just give a strong spray to wash off grime. No need to wipe off the sprayed liquid.

(2) After checking the connector for continuity, wash it as above. Then, uncouple the connector and spray contact surface activator onto contact surfaces. Now, install and remove the connector several times to wet the surfaces thoroughly with the activator liquid. After coupling up the connector so sprayed on, check to be sure that it is correctly locked.



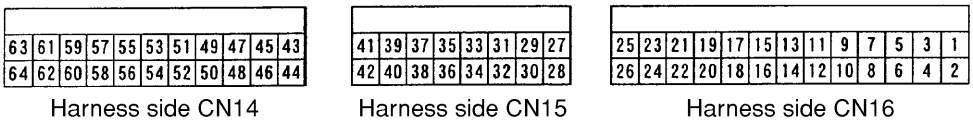
Contact surfaces activator	Three Bond 2501S (aerosol)

NOTE

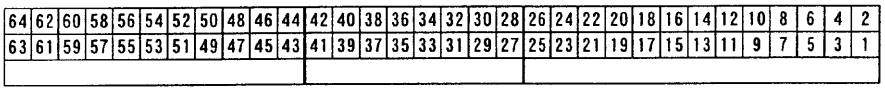
Do not spray too much: bear in mind that this spray liquid reacts with some resins (plastic materials).

MAIN CONTROLLER

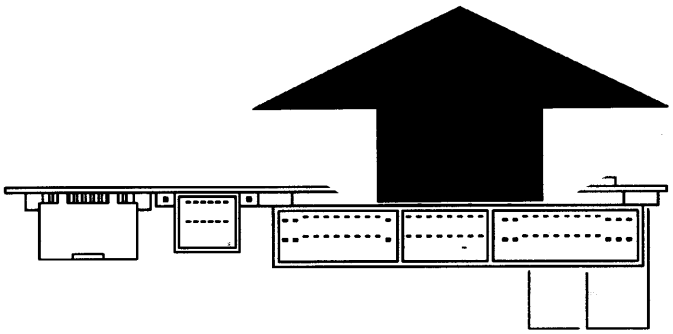
Hydraulic Control Logic Card

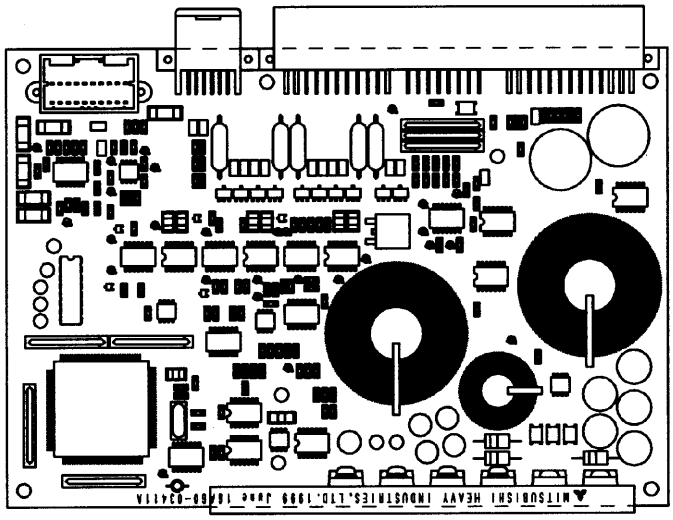


Harness side CN14 Harness side CN15 Harness side CN16



Logic card side CN1





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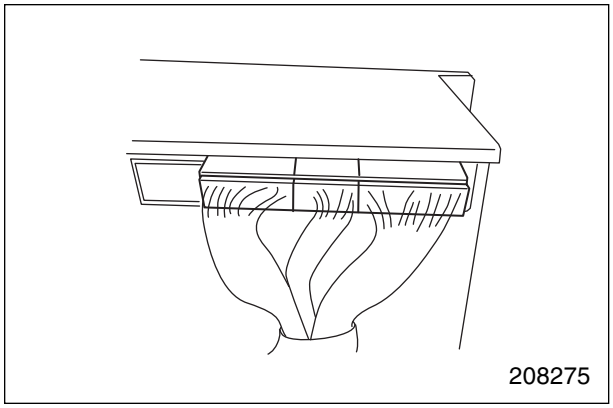
Setup Options (Group 1)

Option #	Title of Option	Description	Range	Default value
#1	Application pre-sets (truck operation mode)	There are 5 truck modes. This option sets combination of 7 option values, which are top travel speed, Acceleration rate, Traveling power, Regen adjustment, Start lift speed, Top lift speed, Tilt speed.	A, B, C, D, E If any of these 7 option values are changed, A to E will flash.	A
#2	Start lift speed	This option sets starting lift speed . (when first lift switch is on) Start lift speed cannot exceed top lift speed.	1 to 10	7
#3	Top lift speed	This option sets maximum lift speed. (when second lift switch is on)	1 to 10	9
#4	Tilt speed	This option sets tilt speed. Tilt speed is prior to lift speed in case the two levers are simultaneously operated.	1 to 10	7
#5	Auxiliary 1 speed	This option sets speed setting for attachment 1.	1 to 10	3
#6	Auxiliary 2 speed	This option sets speed setting for attachment 2.	1 to 10	1
#7	Top travel speed limit	This option sets maximum travel speed.	5 to 16 km/h (3 to 10 mph)	14
#8	Acceleration rate	This option determines of acceleration rate. (slow, moderate, fast)	1, 2, 3	2
#9	Traveling power mode	This option determines of powering characteristic. (econo, standard, high power)	1, 2, 3	2
#10	Service indicator	This option sets the time which reminds the maintenance time. The time set here is added to the truck's hourmeter at that time and that value is stored in memory as the maintenance time. When the truck's hourmeter reaches to the maintenance time, service reminder LED turns on. And it will flicker 20 hours before the time. You can reduce the truck power when the LED is solid by setting selection. You can also set the demo-mode, which shows the Service Indicator function in a short period of time.	100 to 500 hours in 50-hr. increments. Selecting '=' attached number makes the power reduction function effective. Setting 0.1 makes the truck demo-mode. 0: Disable	0

Note:

(1) In #1 Application Presents, we add Traveling Power to the Gemini's function.

Disconnect connectors CN1, CN2 and CN3. (for Hydraulic: CN14, CN15 and CN16)

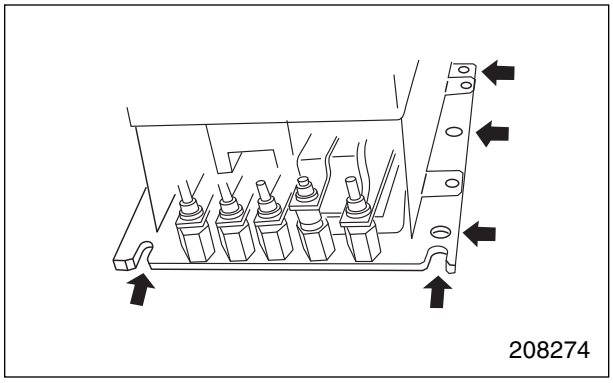

208275

NOTE

- Hold the connectors to unplug. Do not pull the harnesses to disconnect the connectors.

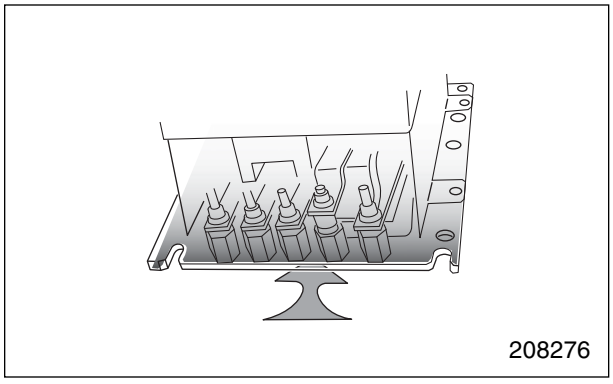
  Remove the controller mounting screws (M10: 6 places), and remove the controller.
- There is thermal cement between counterweight and controller. It is important to cooling the controller. Keep the thermal cement for reinstallation.

Remove the controller mounting screws (M10: 6 locations for traction controller and hydraulic controller. 3 locations for contactor plate), and remove the controller.


208274

(3) Installation of controller

Follow the removal procedure in reverse.


208276

NOTE

There is thermal cement between counterweight and controller. It is important to cooling the controller.

Spread the thermal cement flatly then mount controller on it.

Check Current Sensor of Hydraulic Controller

Turn the key switch off. Disconnect battery plug. Disconnect current sensor connector J4.

Set the circuit tester to 20 VDC range. Connect the positive (+) terminal of the circuit tester to J4-4GR. Connect the negative (-) terminal of the circuit tester to the NEG terminal.

Connect the battery plug and turn the key switch ON.

Pin No.	Standard condition
J4-4GR	14 to 16 V

- If values measured in above deviate from the specified ranges, replace the hydraulic logic card.

Then, connect the positive (+) terminal of the circuit tester to J4-2YR.

Pin No.	Standard condition
J4-2YR	4 to 6 V

- If values measured in this step deviate from the specified ranges, replace the logic card.

⚠ WARNING

To prevent the vehicle from moving suddenly, lift the front wheels off the ground by placing wood blocks under the vehicle. Do not approach the front wheels during testing.

Turn the key switch off and disconnect the battery plug. Connect current sensor connector.

Place wood blocks under the vehicle to lift the front wheels off the ground. Engage the parking brake. Set the circuit tester to 20 VDC range. Connect the positive (+) terminal of the circuit tester to No. 2 pin of current sensor.

Pin No.	Standard condition
J4-2YR	0 to 0.3 V

Connect the battery plug and turn the key switch ON.

- If values measured in the above step deviate from the specified ranges, replace the current sensor.

Shift the forward/reverse lever to Forward. Gradually depress the accelerator pedal (with front wheels stationary) and read the voltage change.

Pin No.	Standard condition
J4-2YR	Increase

- If values measured in this step deviate from the specified condition, replace the current sensor.

Problem: Drive Motor, Worn Brushes

Symptom:

(1) Worn brush indicator ON.

Poor drive power and acceleration. Normal pump motor and power steering operation.

Possible Cause:

(2) Worn drive motor brush, short circuit, logic card defect, display unit defect.

Checks:

(3) Check stored fault code. Verify "E4" is present.

- No "E4"

  Replace display unit.

- "E4"

(4) Disconnect battery plug. Disconnect drive motor brush wear detector connector.

Reconnect battery plug, and close key switch. Check to see if indicator turns OFF.

- Indicator OFF

  Inspect brushes and replace, if necessary.

- Indicator ON

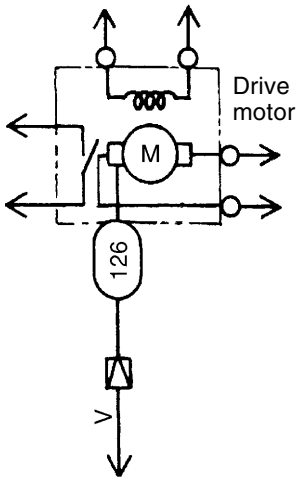
(5) Disconnect battery plug. Check continuity between wire 126-V (purple) of drive motor sensor connector and traction controller connector CN3-13. (For protect diode, current can through only from CN3-13 to sensor's connector.) Check shorting of these terminals with NEG.

- No continuity or shorted

  Correct or replace wiring.

- Continuity and no shorted

  Replace logic card.



208209

Problem: Drive Motor, Armature Over-current

Symptom:

(1) Display = “15”.

Inhibit drive and hydraulic operation. Normal power steering operation.

Possible cause:

(2) Short circuit in T1 IGBT, short circuit in T2 IGBT, faulty wire connection, drive card defect, traction CS1 current sensor failure, traction logic card defect.

Checks:

(3) Disconnect battery plug.

Inspect armature wiring for breakage and shorting.

- Broken or shorting

  Correct or replace faulty components.
- No broken and No shorting

(4) Check T2 IGBT, T2 IGBT and drive card for abnormality.

- Unacceptable

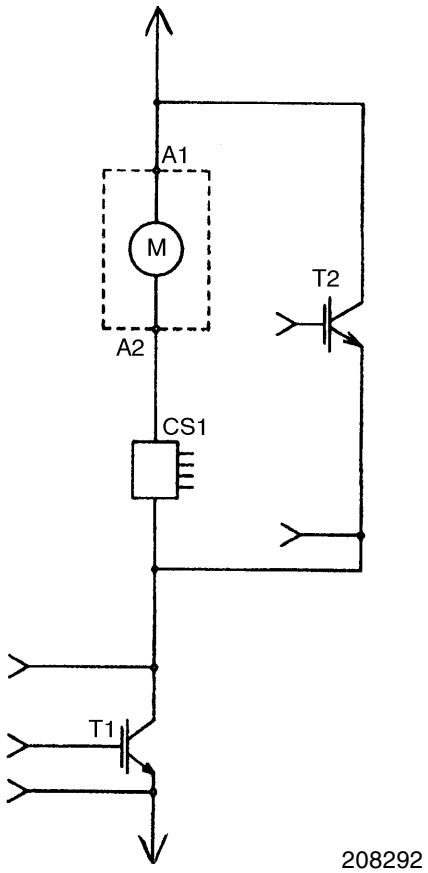
  Replace faulty components.
- Acceptable

(5) Check CS1 for abnormality.

- Unacceptable

  Replace faulty component.
- Acceptable

  Replace traction logic card.



208292

Problem: Pump Motor, Over-current

Symptom:

(1) Display = “35”.

2 ton: Inhibit drive and hydraulic operation. Normal power steering operation.

3 ton: Inhibit vehicle operation.

Possible Cause:

(2) Short circuit in pump IGBT, faulty wire connection, drive card defect, pump CS current sensor failure, logic card defect.

Checks:

(3) Disconnect battery plug.

Inspect pump wiring for breakage and shorting.

- Broken or shorting

  Correct or replace faulty components.

- No broken and no shorting

(4) Check T1P IGBT and drive card for abnormality.

- Unacceptable

  Replace faulty component.

- Acceptable

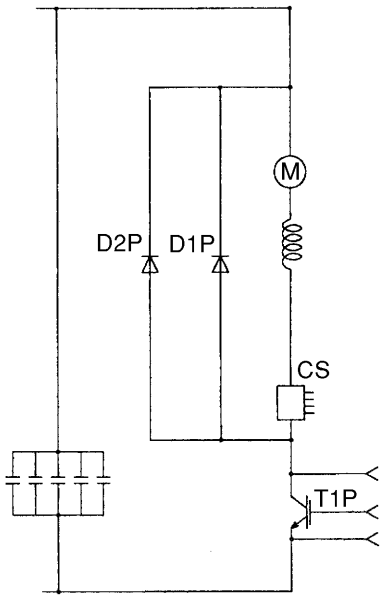
(5) Check CS for abnormality.

- Unacceptable

  Replace faulty component.

- Acceptable

  Replace logic card.



208296

Problem: FC Solenoid, Fault

Symptom:

(1) Display = “55”.
Related function is disabled.

Possible Cause:

(2) Faulty solenoid, faulty wiring , hydraulic logic card defect.

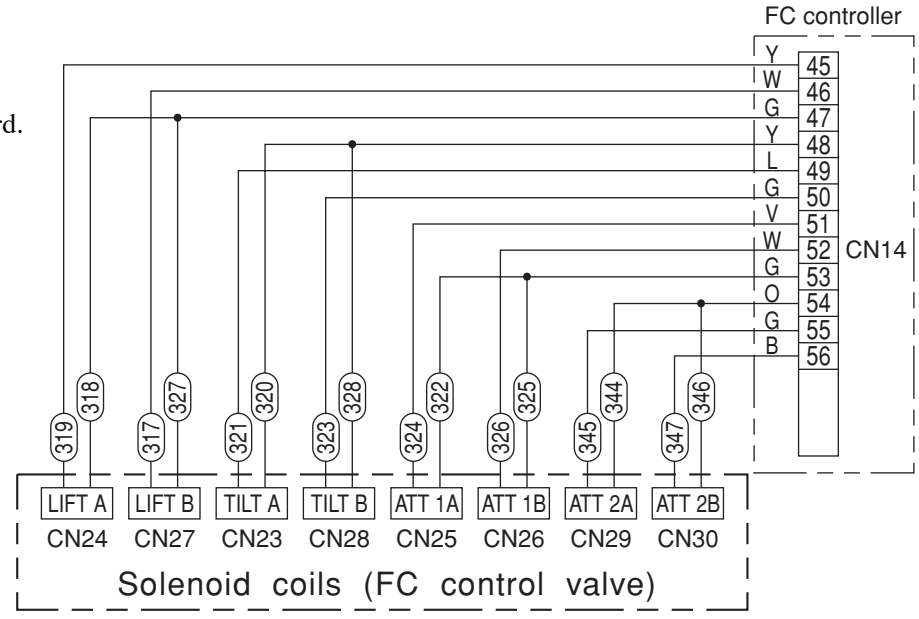
Checks:

(3) Check the emergency button.
- Pushed
  Release and turn the key on again.
- Released

(4) Disconnect battery plug.
Disconnect CN14 hydraulic controller.
Check continuity between CN14-43 and CN14-44.
- No continuity
  Correct or replace wiring.
- Continuity

(5) Check conductivity and shorting NEG between solenoid connector and hydraulic controller connector CN14.
Lift; 319Y and CN14-45, 317W and CN14-46, 318G and CN14-47, 327G and CN14-47
Tilt; 321 and CN14-49, 323G and CN14-50, 320Y and CN14-48, 328V and CN14-48
Attach 1; 324V and CN14-51, 326O and CN14-52, 322B and CN14-53, 325L and CN14-53
Attach 2; 345G and CN14-55, 347B and CN14-56, 344O and CN14-54, 346W and CN14-54
- No conductivity or shorting
  Correct or replace the wiring.
- Conductivity and no shorting

(6) Measure resistance of solenoids. (around 7.5 ohm)
- Unacceptable
  Replace solenoid.
- Acceptable
  Replace hydraulic logic card.



208221

Problem: Controller Communication, Fault

Symptom:

(1) Display = “62”.

Inhibit vehicle operation. Line contactor OFF.

Possible Cause:

(2) Faulty hydraulic logic card, faulty wiring, faulty traction logic card.

Checks:

(3) Check hydraulic controller LED.

- Cyclic ON/OFF (0.5 Hz)

(4) Disconnect battery plug. Check continuity between drive controller CN1-59Br (brown) and hydraulic controller CN14-62, and between CN1-60W (white) and CN14-61 and between CN1-61B (black) and CN14-63.

- No continuity

  Correct or replace wiring.

- Continuity

(5) Disconnect battery plug. Check continuity between traction controller CN3-1R (red) and hydraulic controller CN16-1, and between CN14-63B (black) and NEG.

- No continuity

  Correct or replace wiring.

- Continuity

  Replace hydraulic logic card.

- Other

  Replace hydraulic logic card.

(6) Replace hydraulic logic card.

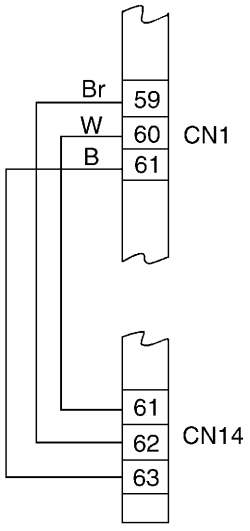
- Normal vehicle operation

  Vehicle operation normally.

- No change

  Replace traction logic card.

- OFF



208309

POWER TRAIN

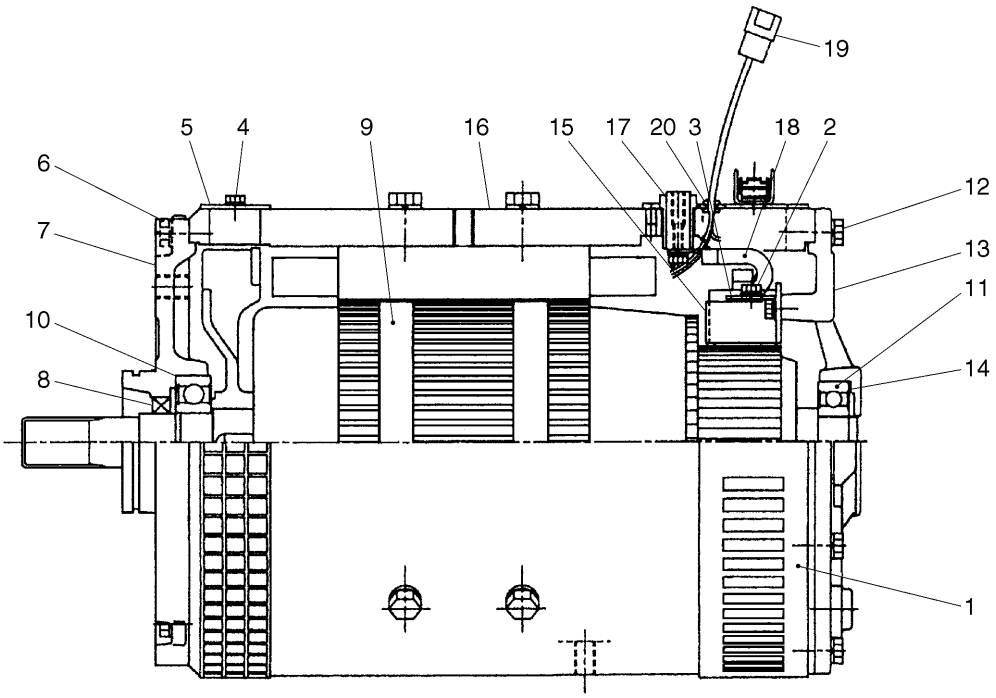
MOTORS

Procedures and key Points for Disassembly and Reassembly

Drive Motor and Pump Motor

Disassembly

Drive motor



208350

Sequence

1 Brush cover
2 Bolt, Spring washer, Washer
*3 Brush
4 Bolt, Spring washer, Washer
5 Cover
6 Bolt, Spring washer

Remove parts 7 and 8 as a unit.

7 Front bracket
*8 Oil seal

Note: Replace the * marked parts with new ones once the motor was disassembled.

Remove parts 9 to 11 as a unit.

9 Armature assembly
*10 Ball bearing
*11 Ball bearing
12 Bolt, Spring washer

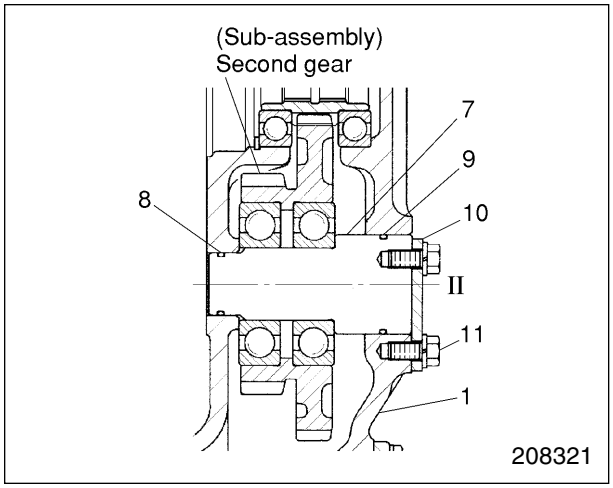
Remove parts 13 to 15 as a unit.

13 Rear bracket
14 Wave washer
15 Holder assembly

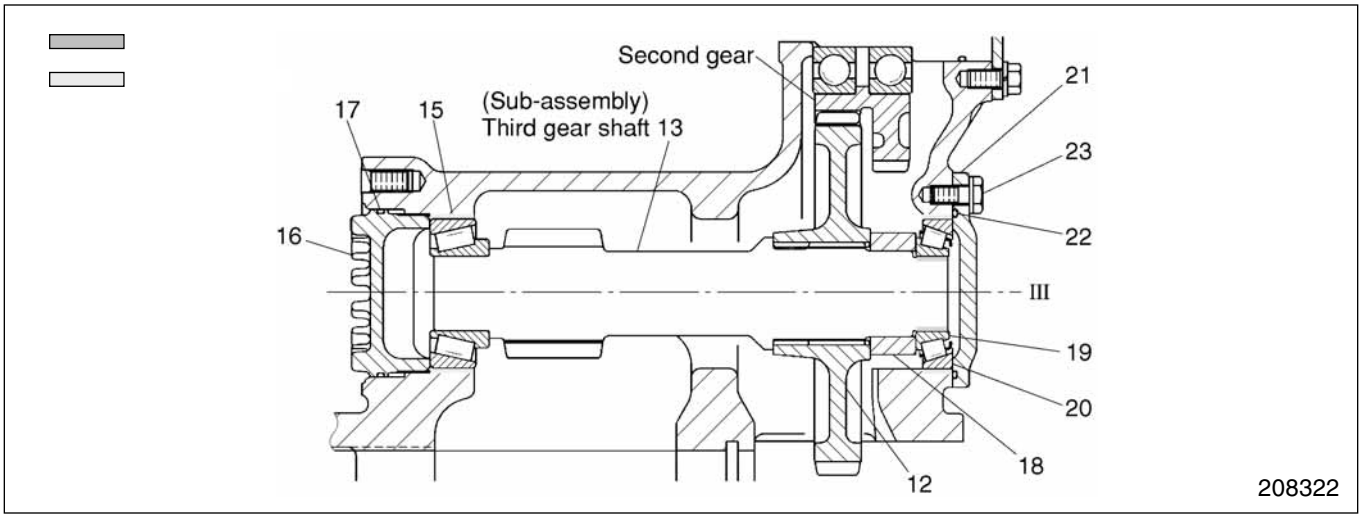
TRANSFER AND DIFFERENTIAL

7. Grease the O-rings 8, 9 and fit them onto the second shaft 7.
   Place the subassembled second gear into the gear case 1 from the differential gear side opening to engage its teeth with those of the input gear. Move the second gear to align its center with the center of the second shaft hole (axis II) in the case. With the two centers in alignment, push the second shaft 7 into place by hand. Prior to this, position the second shaft 7 so that its bolt hole aligns with the bolt hole in the lock plate 10.
8. Fit the lock plate 10. Coat the threads of the bolts 11 with thread lock cement, then tighten them to the torque specified below.

Bolt tightening torque	33 ± 3 N·m (3.4 ± 0.3 kgf·m) [24.6 ± 2 lbf·ft]



1	Transfer gear case	8	O-ring
7	Second shaft	9	O-ring
		10	Lock plate



12	Third gear	17	O-ring	21	Cover
13	Third gear shaft	18	Spacer	22	O-ring
15	Bearing outer race	19	Bearing inner race	23	Bolt
16	Nut	20	Bearing outer race		

9. Engage the teeth of the third gear 12 with those of the second gear. Then, slide the subassembled third gear shaft into the third gear 12 through the spline. Tapping with a soft head hammer, fit the bearing outer race 15 into the appropriate bore in the transfer gear case 1.
   Fit O-ring 17 onto the nut 16, and screw the nut until it lightly touches the bearing outer race 15.
10. Install the spacer 18. Using the special tool specified below, press-fit the bearing inner race 19 onto the third gear shaft 13.
    Special tool needed

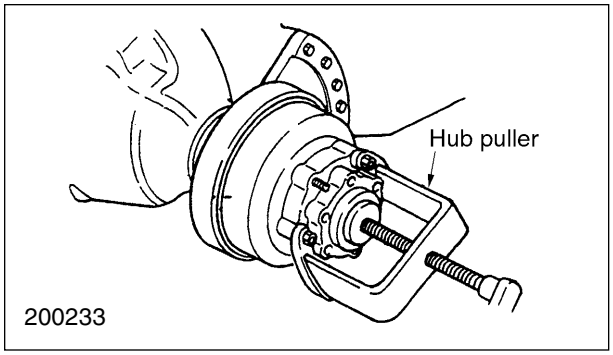
Bearing installer	91268-01500

11. Tapping with a soft head hammer, fit the bearing outer race 20 into the appropriate bore in the transfer gear case 1 to such an extent that the bearing protrudes a little from the case end face.
12. Fit O-ring 22 to the cover 21. Coat the threads of the bolt 23 with thread lock cement, then tighten the bolt to the torque specified below to secure the cover.

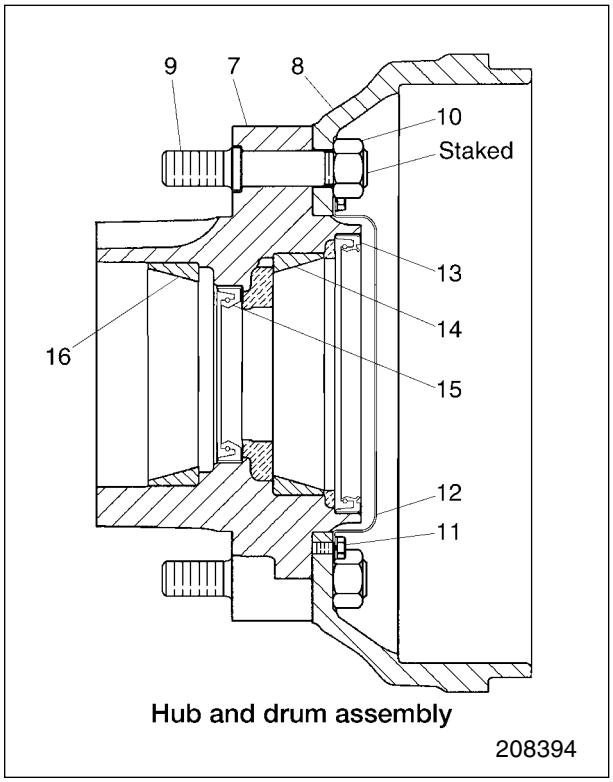
Bolt tightening torque	59 ± 6 N·m (6.0 ± 0.6 kgf·m) [43.4 ± 4.3 lbf·ft]

(4) Remove the hub and drum assembly.

The hub and drum assembly will be removed by pulling horizontally. If it cannot be pulled out, use the hub puller as shown in the illustration at right.



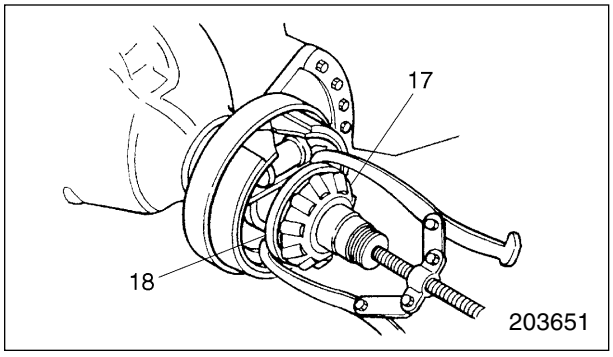
- Remove the oil deflector 12 if necessary.
- Do not remove the following parts from the inside of the wheel hub 7 unless they are faulty. When removing them, use a puller.
  - Taper roller bearing outer race 14 and 16
  - Oil seal 13 and 15
- Normally, it is not necessary to separate the wheel hub 7 and the brake drum 8. To separate them, the nut 10 must be removed. (The nut 10 has been staked to the bolt 9 after assembly to prevent dropping off.)



3. Removal of seal retainer and bearing inner race

Do not remove the retainer 18 and the bearing inner race 17 left on the axle housing unless they are faulty.

If they are to be replaced, remove them together using a puller.



4. Removal of front axle support and/or front axle housing

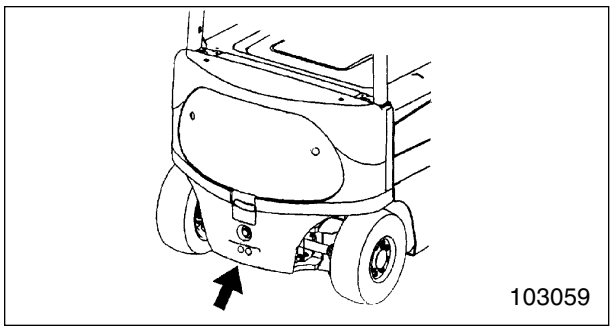
These parts cannot be removed without dismounting the power train assembly from the vehicle body. Refer to “GROUP 5 POWER TRAIN” for the procedure.

Procedures and Key Points for Removal and Installation

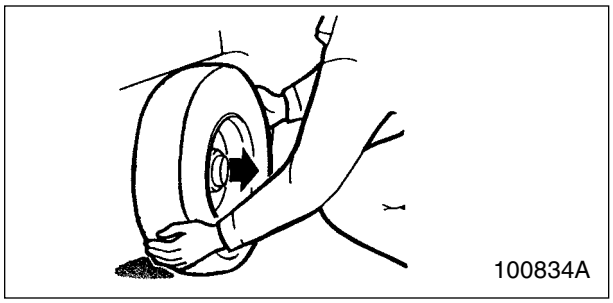
Rear Wheels

Removal

1. Stop the forklift truck on a flat surface and apply the parking brake. Put wheel blocks under the front wheels.
2. Loosen the wheel nuts two turns or so.
3. Place a jack just under the middle of the counterweight and lift the rear of the truck off the ground.
4. To prevent the truck body from falling down even if the jack slips off, put wooden blocks under the truck. Make sure that the truck is steadily, propped up when the jack is removed.
5. Remove the rear wheels.



Position the jack under the counterweight and raise the rear wheel.

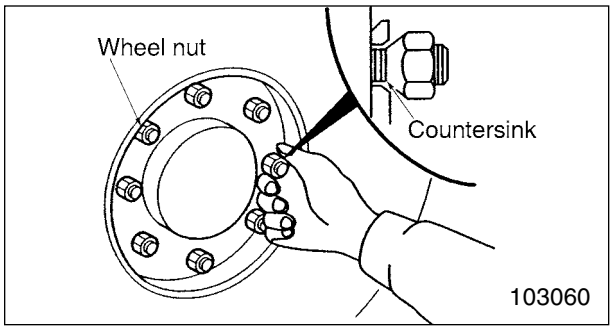


Installation

1. Install the wheel and tighten the wheel nuts finger tight until their clamping surfaces come into full-face contact with the counterbores in the rim.

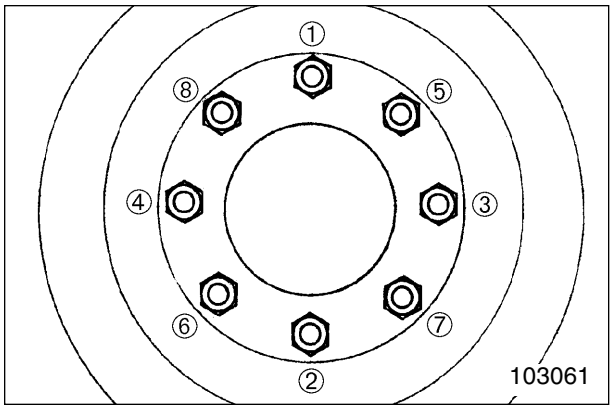
NOTE

Make sure the clamping surfaces of the wheel nuts and countersinks are free of dirt.



2. Lower the truck by operating the jack until the tire just touches the ground. Then tighten the wheel nuts in the sequence shown, in two or three steps, to the specified torque.

Tightening torque for wheel nuts (rear)	157 ± 15.7 N·m (16 ± 1.6 kgf·m) [115.7 ± 11.6 lbf·ft]



3. Lower the truck fully and remove the jack and the wood blocks under the truck.
4. After tire replacement, drive the truck for a while and check the wheel nuts for tightness.

4. Using the special tool, press-fit the bearing outer race 4 and 5 to the new hub 3.
5. Using the special tool, press-fit the oil seal 6 to the hub 3.
6. Filling insides of rear axle hubs with grease

   Pack grease into the rear axle hubs. See the illustration for proper grease filling condition. Apply grease to the bearing cage. Fill grease to approximately 80 % of the cavity. Do not supply grease to full level. Filling grease to maximum level causes excessive generation of heat and quickly deteriorates the grease. When coating oil seal lips with grease, be careful not to use too much grease, since an excess amount of grease can cause leaks.
7. Preload adjustment and lock nut tightening

   Proceed as follows:

   (1) Tighten the inner nut 9 until the hub 3 can no longer be turned by hand. Then loosen it 60 to 80°.

   (2) Rotate the hub several times to settle the bearing.

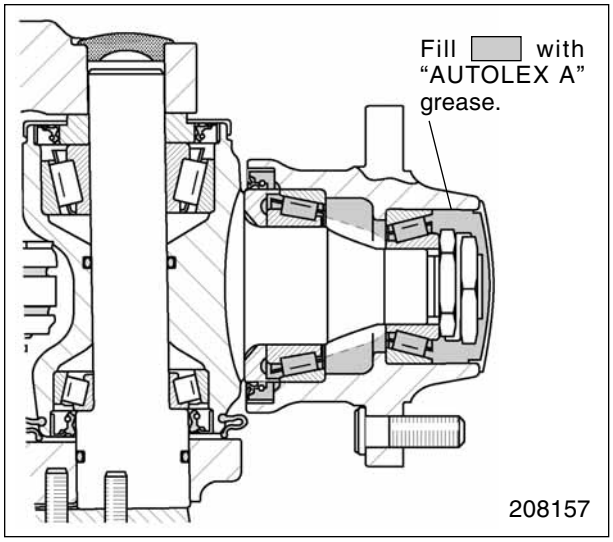
   (3) Tighten the inner nut securely, and measure the torque required to start the rotation of the hub. If the measured value is not within the specified limit, perform the preload adjustment again.

   To measure preload, attach a spring balance to a wheel bolt, then read the tangential force generated when the hub starts rotating.

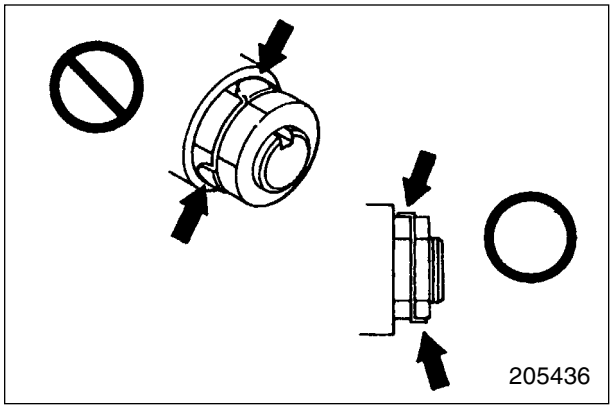
   (4) After adjusting the preload, tighten a new lock washer and an outer nut to the specified torque.

   (5) Bend the lock washer to both sides (inward and outward).

   (6) Fill the cap with grease, and install the cap.



Preload of hub bearing (Torque)	290 to 490 N·cm (30 to 50 kgf·cm) [2.17 to 3.6 lbf·ft]
Tangential force on hub bolt	43 to 71 N (4.4 to 7.3 kgf) [9.7 to 16 lbf]
Lock nut tightening torque	157 N·m (16 kgf·m) [116 lbf·ft]

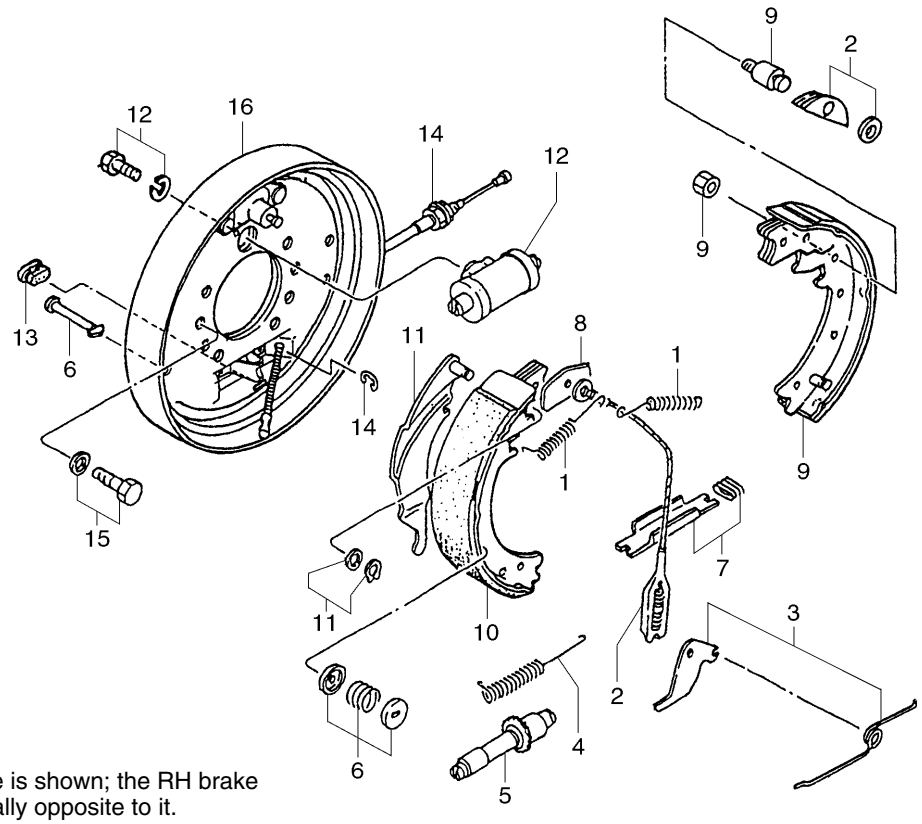


BRAKE SYSTEM

Procedures and Key Points for Disassembly, Inspection and Reassembly

Wheel Brake

Disassembly



The LH brake is shown; the RH brake is symmetrically opposite to it.

208386

Sequence

1 Return springs
2 Fitting cable, Washer, Sheave
3 Adjusting lever, Adjusting lever spring
4 Spring
5 Adjusting screw
6 Hold-down spring, Cup, Pin
7 Strut, Anti-rattle spring
8 Shoe guide plate
9 Secondary shoe and lining assembly, Pin, Nut

Remove parts 10 and 11 as a unit.

10 Primary shoe and lining assembly
11 Retainer, Washer, Parking lever
12 Bolt, Wheel cylinder
13 Cover
14 Snap ring, Parking brake cable
15 Brake mounting bolt, Spring washer
16 Backing plate assembly

Start by:

(1) Remove the front wheel.

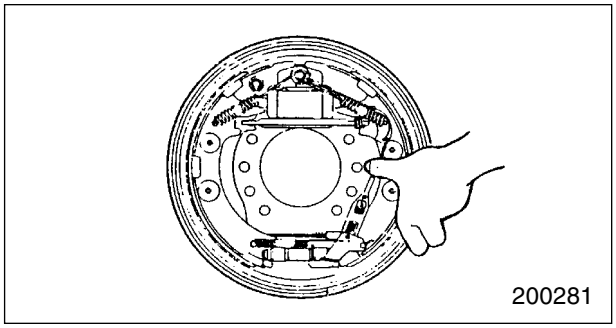
(2) Remove the wheel hub and brake drum.
(Refer to the "2. Removal of front wheel hub and drum assembly" of the "Disassembly Procedure" section on page 8-2.)

(3) Disconnect the brake pipe from the wheel brake assembly.

(4) If necessary, free the end of the parking brake cable closer to the parking brake lever.

Inspection and Adjustment

Automatic Adjustment



1. With all wheel brake components installed correctly, the drum-to-shoe clearance should be within the correct range of 0.10 to 0.38 mm (0.004 to 0.015 in.) as seen at right angles to the side of the brake. Push the cable by thumb to pull the adjusting lever. Observe the lever turns the adjusting screw by one tooth, and remove the push to observe the adjusting screw returns to the original position.
2. If the lever fails or is sluggish to turn the adjusting screw in the above test, the likely cause is that the lever is not properly positioned relative to the sprocket wheel. Be sure that the lever is so positioned that its actuating tip touches the sprocket wheel at a level about 9 mm (0.35 in.) under the center line of the screw, as shown.
3. Where the automatic adjusting device is suspected of malfunctioning during normal use of the machine, the following possible causes must be considered:

(1) Check that springs A and B are correctly installed.

(2) Any of these parts is in bad condition and requires replacement:

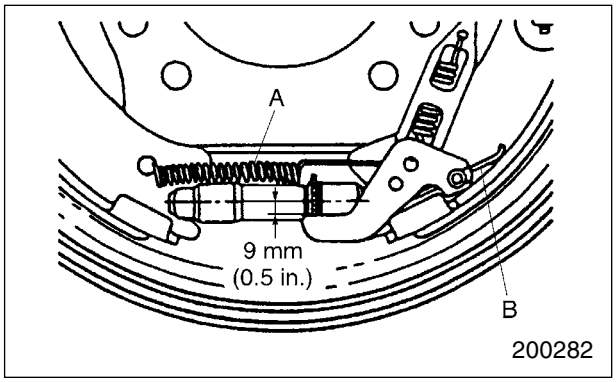
a) fitting cable, b) adjusting lever, and c) adjusting screw.

4. Use the following methods to determine whether the drum-to-shoe clearance is correct.

(1) Fit the wheel hub in position, then turn it by hand. If the drum-to-shoe clearance is correct, you will feel only slight resistance. If you feel significant resistance, the clearance is too small.

(2) Air-bleed the brake fluid lines, then depress the brake pedal. If the pedal stroke is unusually long, the drum-to-shoe clearance is too large.

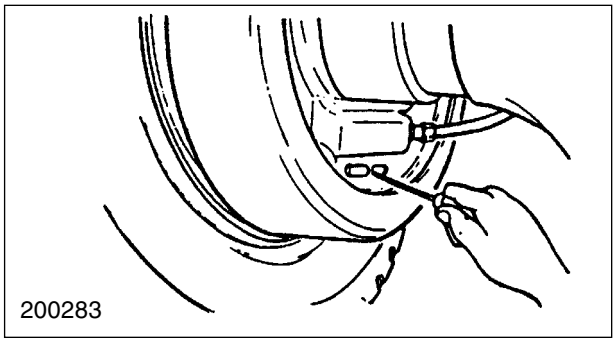
If the drum-to-shoe clearance is incorrect, make the necessary adjustment in accordance with the “Manual Adjustment” subsection.



Adjusting sprocket wheel and lever positions

Manual Adjustment

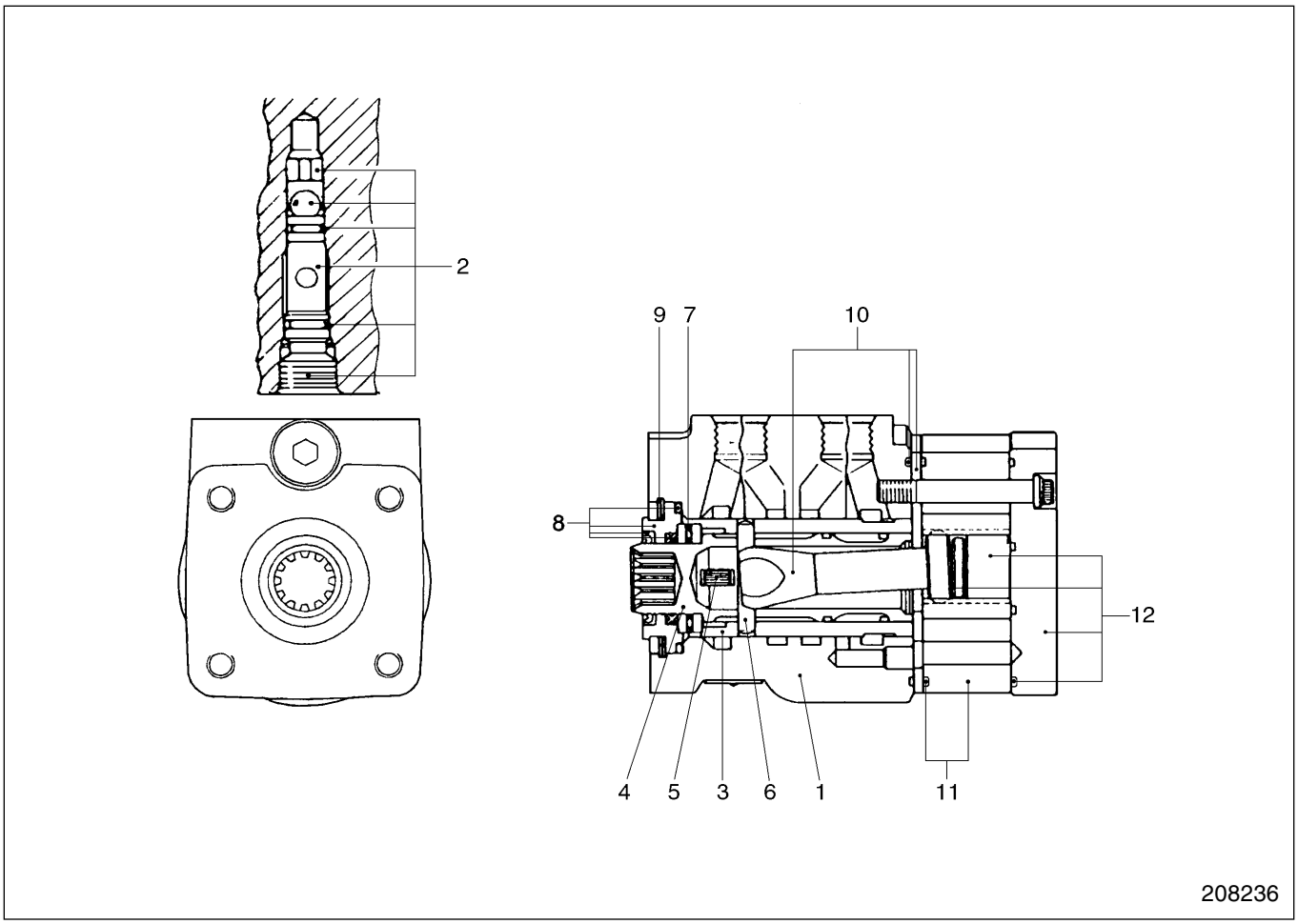
The drum-to-shoe clearance can be adjusted by rotating the adjusting screw with a screwdriver put to the sprocket wheel. The hole thorough which the screwdriver tip can be inserted is provided in the backing plate.



Specifications

Items \ Truck Models			FB30K	FB35K
Type			All hydraulic power steering	
Diameter of steering wheel		mm (in.)	328 (12.9)	
Steering gear	Manufacture		Ognibene	
	Displacement	cc (cu. in.) /rev.	100 (6.1)	

Reassembly



Sequence

1 Long housing
2 Check valve, Check ball retainer, Ball, O-ring, Check seat and Set screw
3 Control sleeve
4 Control spool
5 Centering springs
6 Pin
7 Thrust needle, Race bearings
8 Seal gland bushing, Oil seal, Dust seal and O-ring
9 Retaining ring
10 Drive shaft, Spacer plate and O-ring
11 Metering “Gerotor” set, O-ring
12 End cap, O-ring, Spacer and Bolts

Start by :

(1) Replace worn or defective parts.

(2) Wash all metal parts and blow dry.

(3) Replace O-rings and seals.

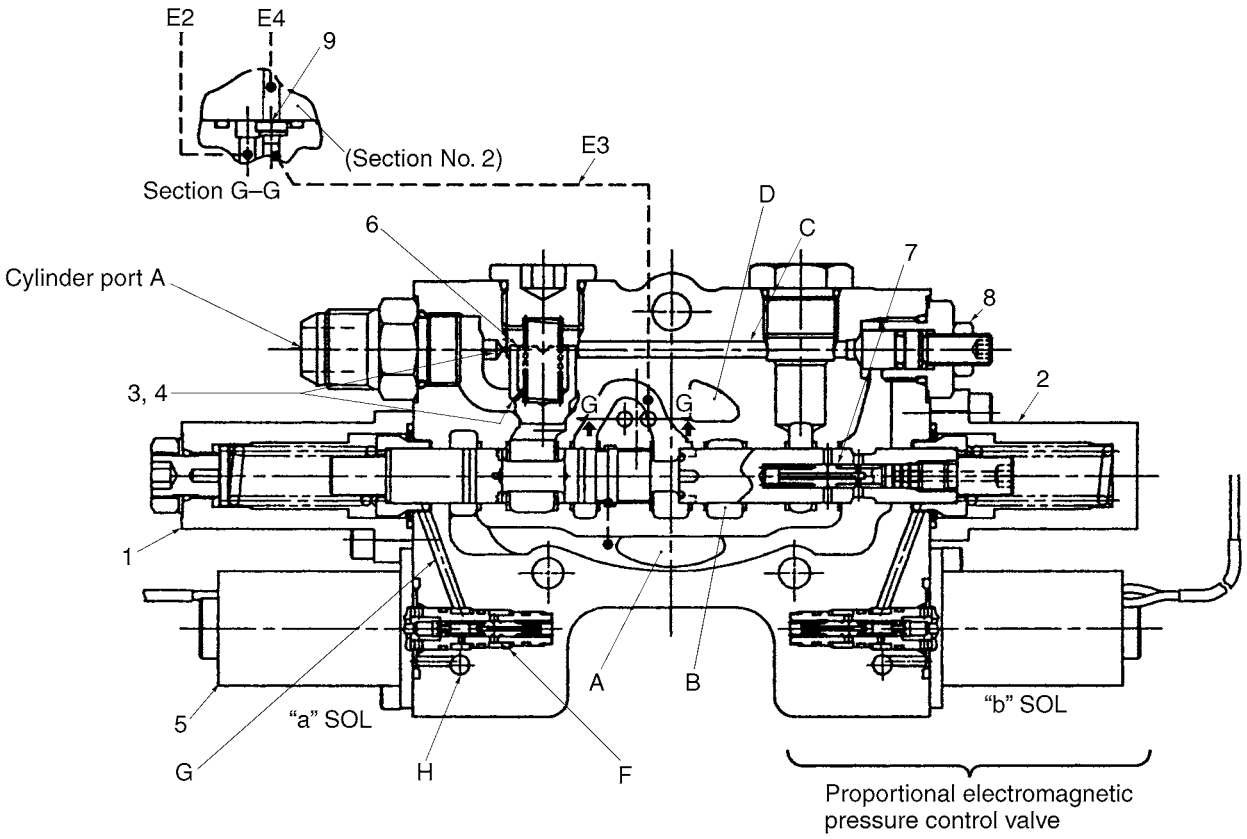
(4) Apply grease to O-rings and other sealing parts.

Specifications

Items \ Truck Models				FB30K, FB35K
Hydraulic system	Hydraulic pump	Type		Gear pump
		Rated discharge volume cc/rev. (cu. in./rev.)		29.7 (1.81)
		Drive system		Direct connection with pump motor
	Control valve	Type		FC: KVSB-65PSL-3 MC: KVSF-65-3 (equipped with microswitches)
		Main relief pressure Mpa (kgf/cm^2) [psi]		18.1 (185) [2631]
	Flow regulator valve	Type		Variable type
		Control flowrate liter/min (U.S.gal./min)		71 (18.7)
	Simplex mast [at mast lift of 3.0 m (9.84 ft)]	Lift cylinder mm (in.)	Inside diameter	55 (2.165)
			Stroke	1515 (59.6)
	Duplex mast [at mast lift of 3.0 m (9.84 ft)]	First lift cylinder mm (in.)	Inside diameter	85 (3.37)
			Stroke	770 (30.3)
		Second lift cylinder mm (in.)	Inside diameter	50 (1.97)
			Stroke	1460 (57.4)
	Triplex mast [at mast lift of 4.0 m (13.1 ft)]	First lift cylinder mm (in.)	Inside diameter	85 (3.37)
			Stroke	715 (28.1)
		Second lift cylinder mm (in.)	Inside diameter	55 (2.165)
			Stroke	1280 (50.3)
	Tilt cylinder (forward tilt of 6°; rearward tilt of 8°) mm (in.)		Inside diameter	80 (3.15)
			Stroke	124 (4.88)
	Operating oil volume liter (U.S.gal)			N level: 28.2 (7.45) H level: 30.0 (7.93)

Lift Section

Structure and Names of Parts

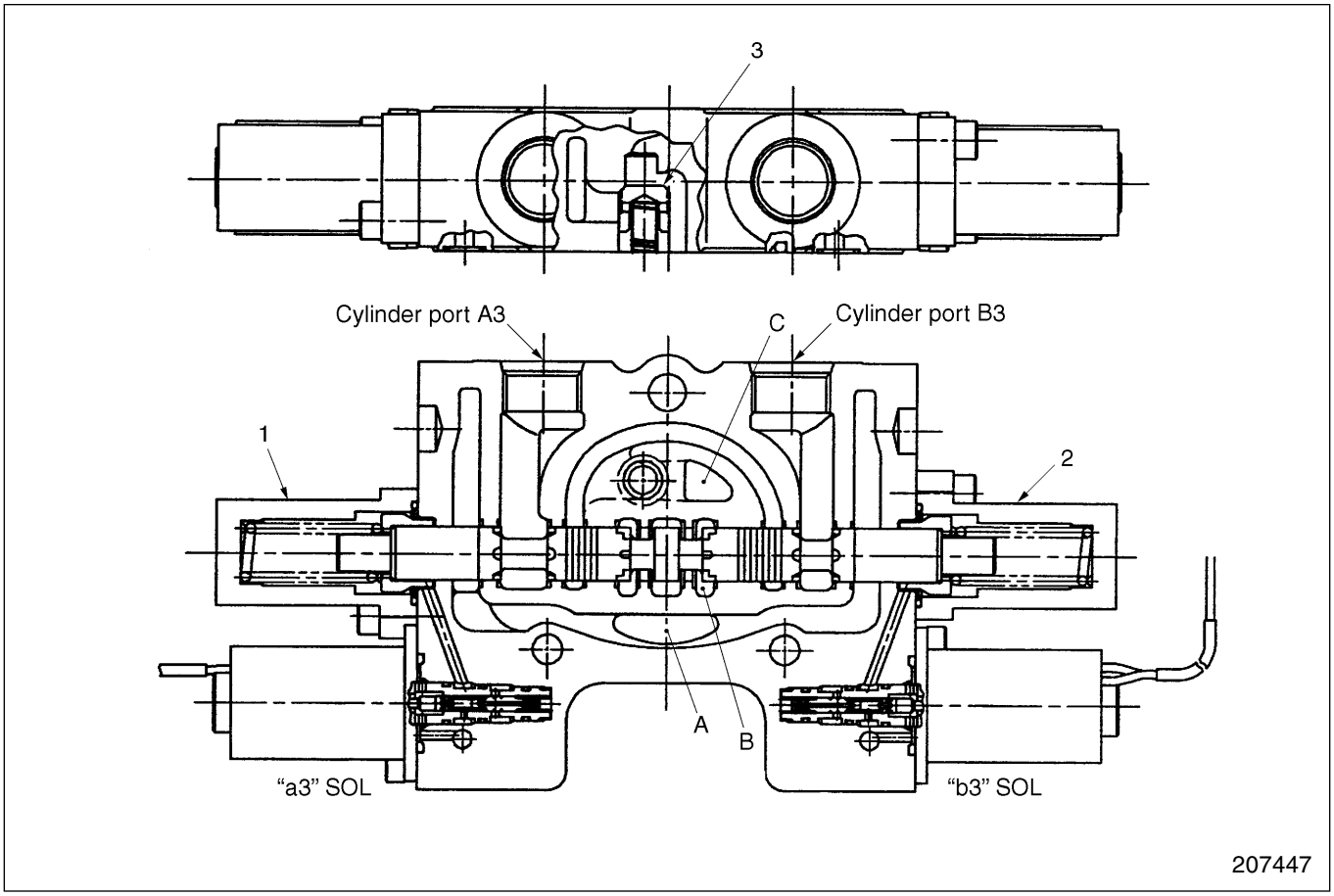


1 Cap
2 Cap
3 Orifice
4 Orifice
5 Proportional solenoid
6 Load check valve
7 Lift lock valve
8 Shut-off valve
9 High-pressure selector valve

A: Low-pressure oil passage
B: Control channel
C: Pilot oil passage
D: Surplus oil channel
E2-E4:
Control pressure oil passages
F: Primary pressure oil passage
G: Secondary pressure oil passage
H: Drain oil passage

Attachment Section

Structure and Names of Parts



1 Cap
2 Cap
3 Load check valve

A: Low-pressure channel
B: Neutral channel
C: Parallel feeder (High-pressure channel)

2. Removing return hose

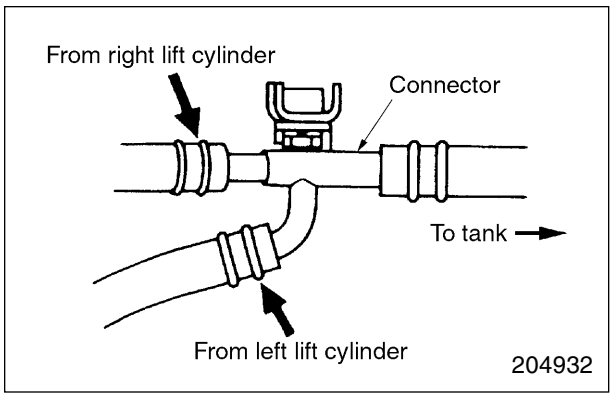
Lift the mast to the maximum lift position, and turn the key switch off. Disconnect the return hose from the right and left lift cylinders at the connectors.

Removing hose guard

With the masts at the maximum lift position, remove the hose guard from the front side.

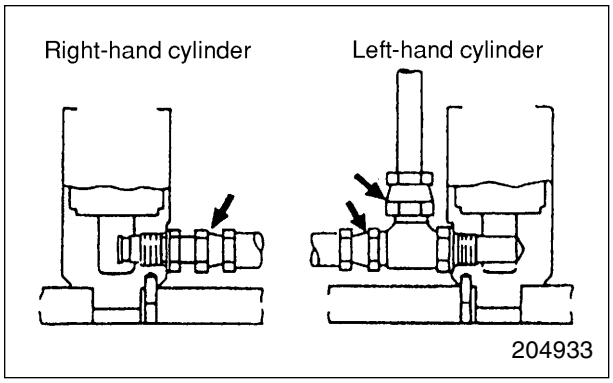
Lowering masts

Operate the lift lever gradually to lower the masts.



3. Disconnecting high-pressure hoses

Disconnect the high-pressure hoses at the joints indicated by arrows. Use a drip pan to catch oil flowing out of the hoses.

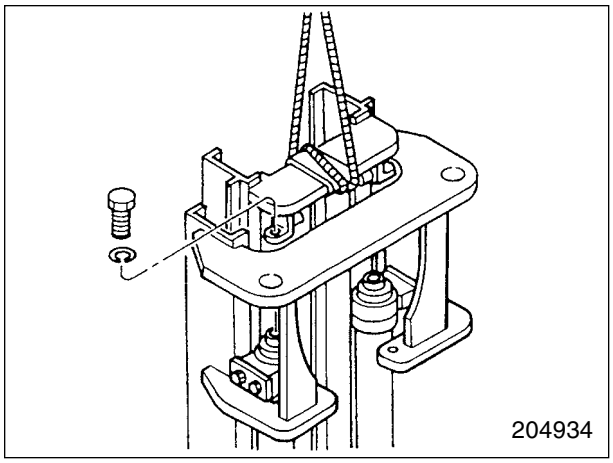


4. Removing set bolts

(1) Remove the set bolt at the top of each lift cylinder. Lift the inner mast to separate the cylinder rod ends. To lift the inner mast, hitch a sling around the mast with protective rag.

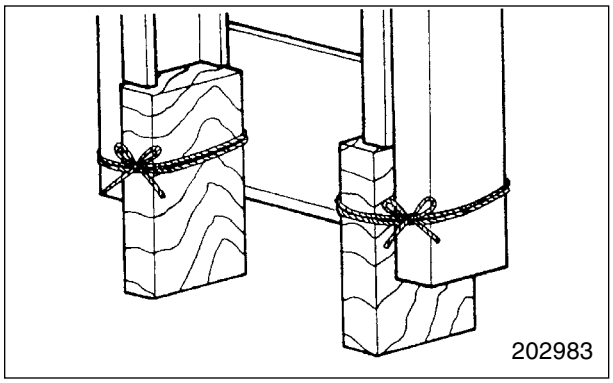
NOTE

The rod end of either lift cylinder is shim adjusted to eliminate the difference in stroke between the cylinders. Before removing the set bolts, make a record of the amount of shims and cylinders to which the shims are fitted.



(2) Tie wood blocks under the inner mast and detach the sling. Use blocks strong enough to support the mast.

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



Key Points for Disassembly

Spool

(1) Loosen plug 1 (27 Hex) by rotating two to three turns. Dismount orifice plug 2 (27 Hex) from inlet housing. Spring 3 can be removed together with the plug.

(2) Remove plug 1 from the housing.

(3) Slowly pull out spool 4 assembly by holding it at the spring guide section.

(4) Remove cap screw 5 (5 Hex), and remove spring 6 and valve 7 from spool 4.

Main Relief Valve

Refer to the "Main Relief Valve" on page 12-55.

Shut-off Valve

Refer to the instructions for the lift section's shut-off valve on page 12-43. It has the same structure as the inlet section's shut-off valve.

Pilot Relief Valve

Loosen plug 8 (19 Hex), then remove it together with spring 9 and pilot poppet 10 from inlet housing.

NOTE

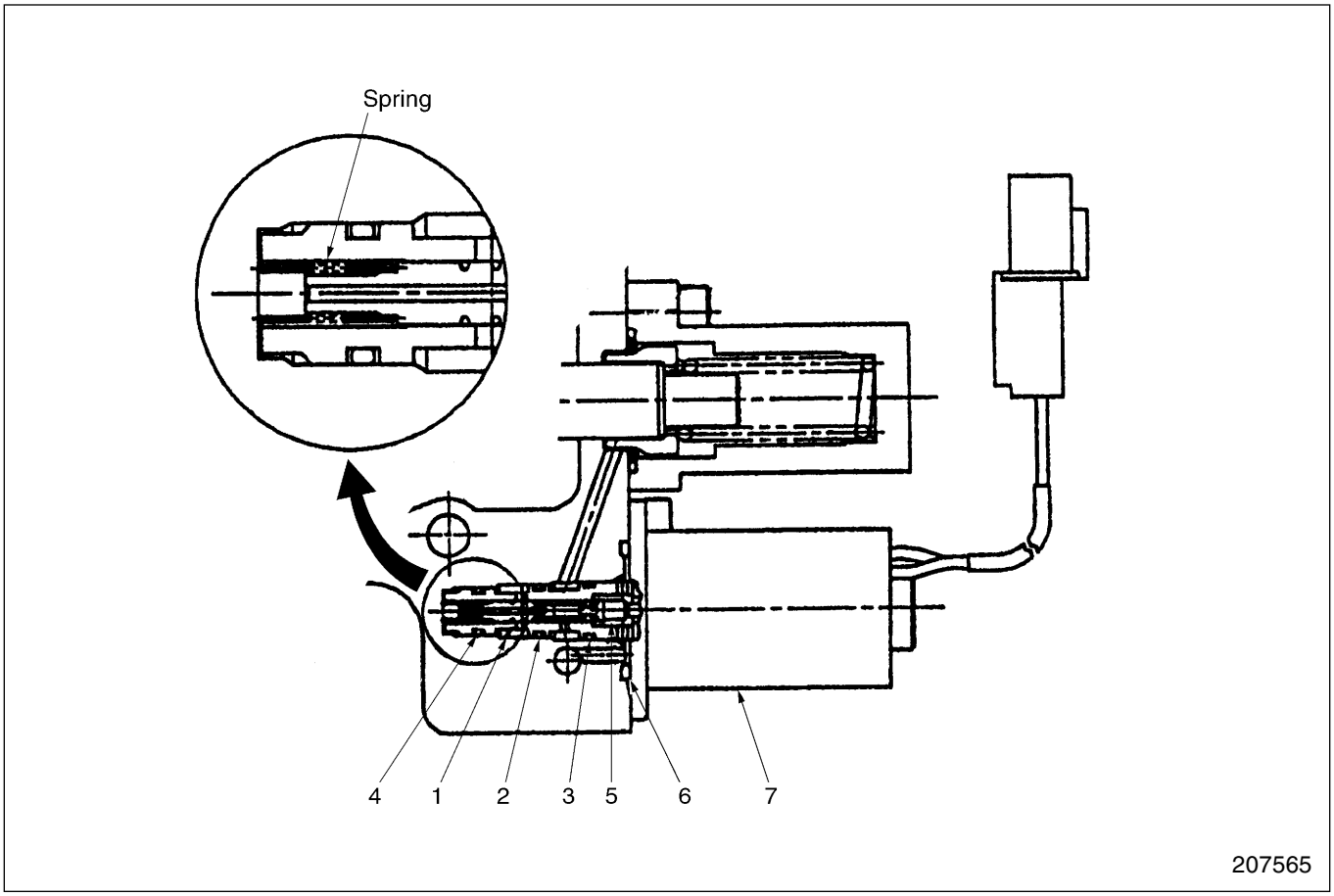
Do not loosen adjuster kit 11 (17 Hex) unless necessary, since loosening the adjuster kit changes relief pressure.

Inspection After Disassembly

(1) Check the springs for fatigue.

(2) Check the sliding surfaces of the piston and valve for damage.

Reassembly of proportional electromagnetic pressure control valve



1 Sleeve
2 O-ring
3 O-ring
4 O-ring
5 Shuttle
6 O-ring
7 Solenoid, Bolt

Key Points for Reassembly

(1) Install O-rings 2, 3, 4 on sleeve 1.

(2) Insert shuttle 5 into sleeve 1. Make sure it slides smoothly.

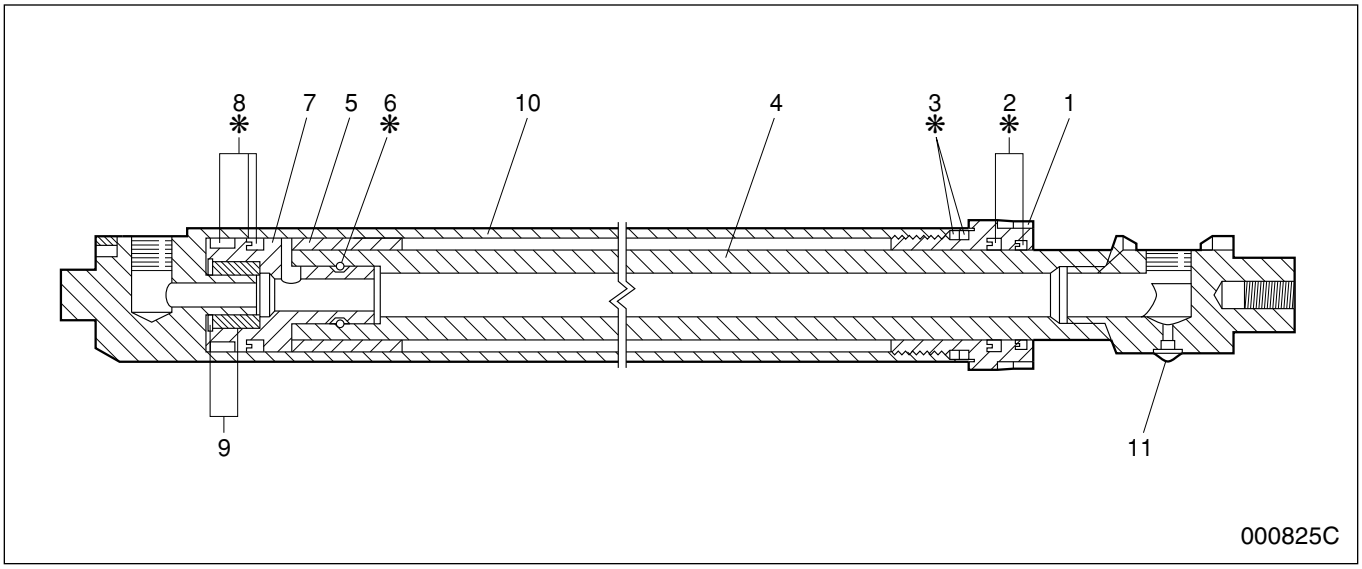
(3) Insert sleeve 1 into valve housing, and install O-ring 6.

(4) Position proportional solenoid 7 on valve housing so the solenoid lead wire faces upward. Install the solenoid on the valve housing with Allen wrench (4 Hex).

Unit: N·m (kgf·m) [lbf·ft]

Tightening torque	7 to 9 (0.7 to 0.9) [5.11 to 6.57]

Reassembly



Sequence

1 Retainer
2 Wire ring, Rod seal
3 Backup ring, O–ring
4 Piston rod

Install parts 1, 2, 3, 5, 6, 7 to Part 4.

5 Spacer
6 Pull-in wire
7 Piston
8 Backup ring, Piston seal, Wear ring
9 Sleeve, Snap ring
10 Cylinder tube
11 Seal washer, Bleed screw

NOTE

Replacement parts marked with an asterisk (✻) are included in the seal kit.

Suggestions

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]

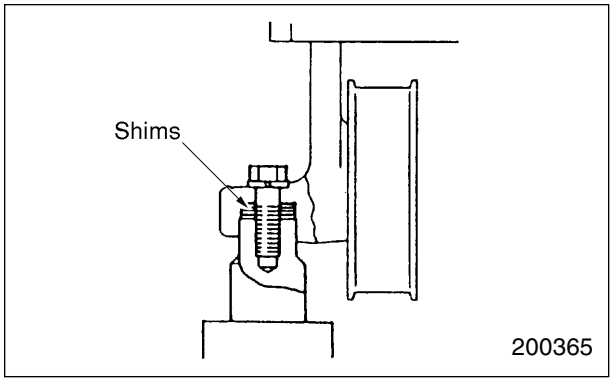
Retainer tightening torque	200 to 270 (20.4 to27.5) [146 to 200]

4. Tighten the bleed screws 11 to the specified torque.

Unit: N·m (kgf·m) [lbf·ft]

Bleed screw tightening torque	4.5 to 5.0 (0.46 to 0.51) [3.33 to 3.69]

(2) Loosen the stopper bolt located at the upper part of the lift cylinder that stopped first. Lower the piston rod, and insert a shim at the upper piston rod end.



NOTE

When lowering the piston rod, operate the lift lever to lower the masts and release oil from the cylinder.

(3) Raise the piston rod, then tighten the lift cylinder stopper bolt. Remove the wood blocks from under the inner masts.

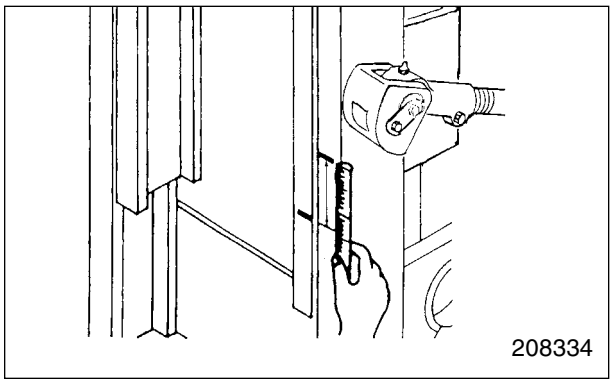
(4) Lower the inner masts gently, and check to see if the piston rods move smoothly until the inner masts reach the lowest position.

Test

(1) Gravitational-pull lowering test

(a) Set the masts upright with rated cargo load, raise the masts approximately 1 to 1.5 m (3.3 to 4.9 ft), then turn the key switch off.

(b) Draw a reference line on a mast, and measure the distance of fork lowering after 15 minutes.



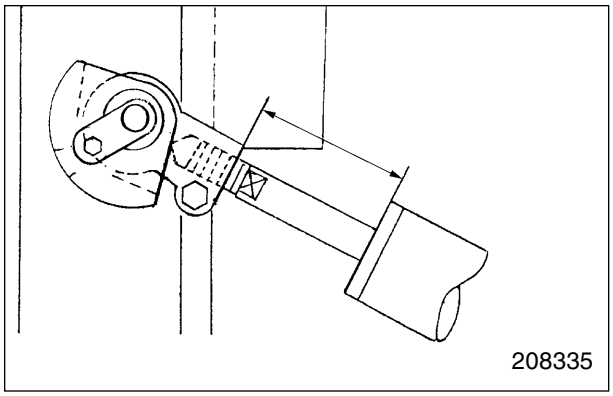
Unit: mm/15 min (in./15 min)

Gravitational-pull lowering distance (with load)	50 (1.97) max.

(2) Gravitational-pull forward tilt test

(a) Set the masts upright with rated cargo load, raise the forks approximately 500 mm (19.7 in.), then turn the key switch off.

(b) Measure the amount of the tilt cylinder extension after 15 minutes.



Unit: mm/15 min (in./15 min)

Item \ Truck Models	FB30K, FB35K
Gravitational-pull forward tilt distance (with load)	22 (0.87)

Inspection of Piping

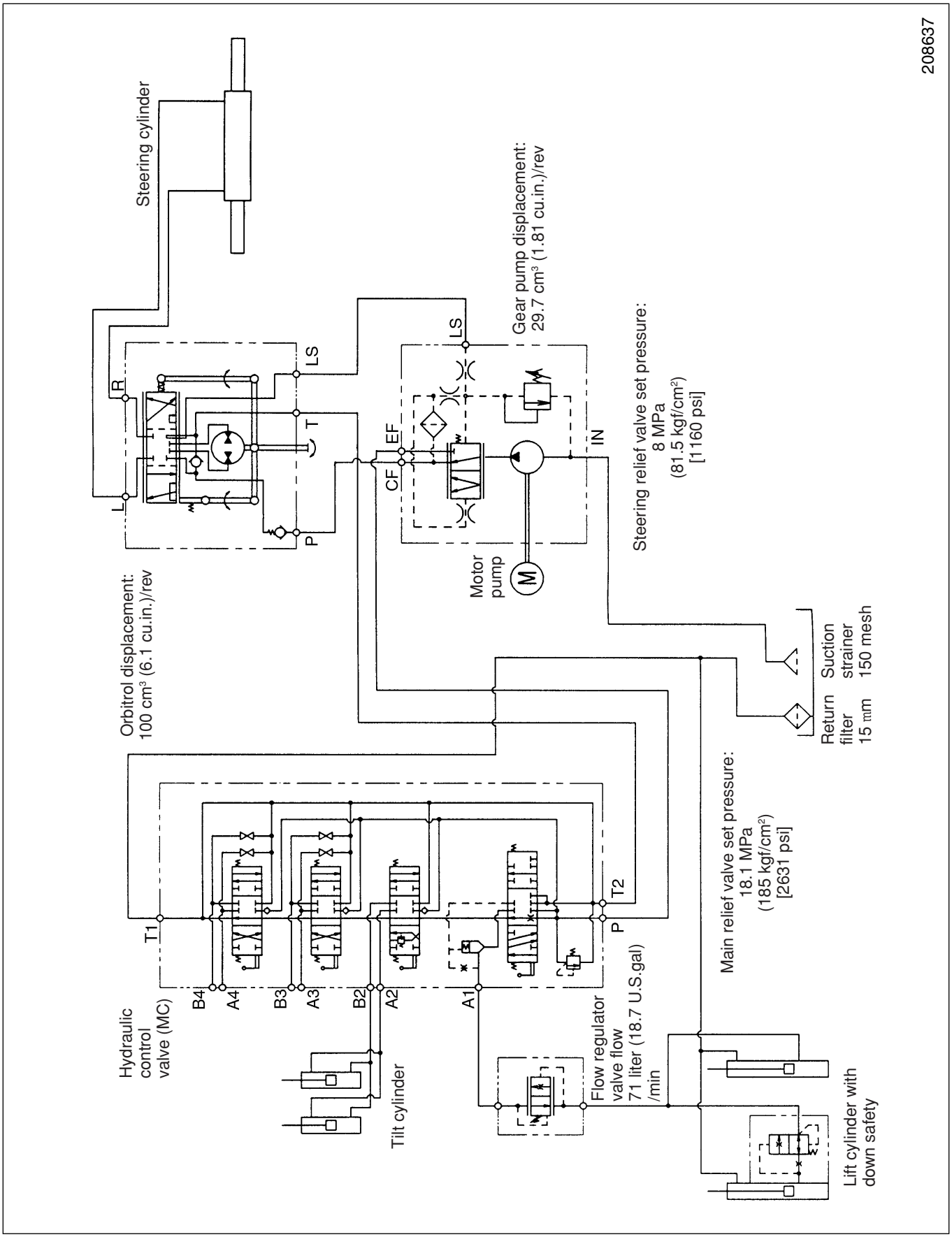
(1) Check the piping for oil leaks.

(2) Check the rubber hoses for damage, twisting and sagging.

Mechanical Control Type (MC Model)

For the component descriptions other than control valve, refer to those for the Finger-tip Control Type (FC model).

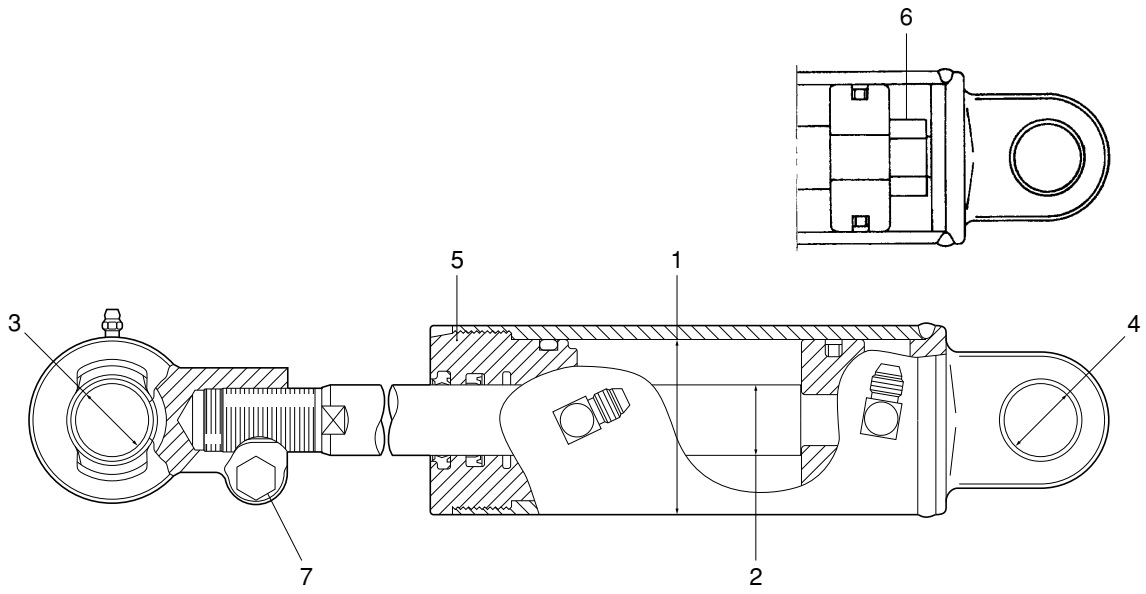
Hydraulic Circuit Diagram (MC)



A: Standard value

Unit: mm (in.)

	Item			Truck Models: FB30K	FB35K
Tilt cylinders	Inside diameter of cylinder tube 1		A	80 (3.15)	
	Diameter of piston rod 2		A	35 (1.37)	
	Inside diameter of tilt socket bushing (fitted) 3		A	$35\ ^{0}_{-0.012}$ ($1.38\ ^{0}_{-0.0005}$)	
	Inside diameter of cylinder tube head bushing (fitted) 4		A	$32\ ^{+0.085}_{0}$ ($1.26\ ^{+0.003}_{0}$)	
	Outside diameter of guide bushing 5		A	93 (3.66)	
	Tightening torque N·m (kgf·m) [lbf·ft]	Guide bushing 5	A	373 ± 37 (38 ± 3.8) [274.8 ± 27]	
		Nut 6	A	392 ± 25 (40 ± 2.5) [289 ± 18]	
		Tilt socket bolt 7	A	127 to 152 (13 to 15.5) [94 to 109]	



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Installation

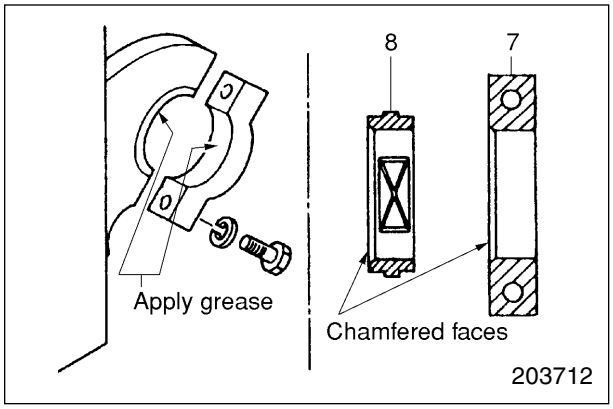
To install, follow the removal sequence in reverse, and service as follows.

1. Procedure for mounting mast support bushings 8 and caps 7.

(1) Apply grease to the inner surfaces of caps and mast support bushings.

(2) Install mast support bushings 8 and caps 7, making sure that the sides with larger chamfered area face toward the center of the vehicle.

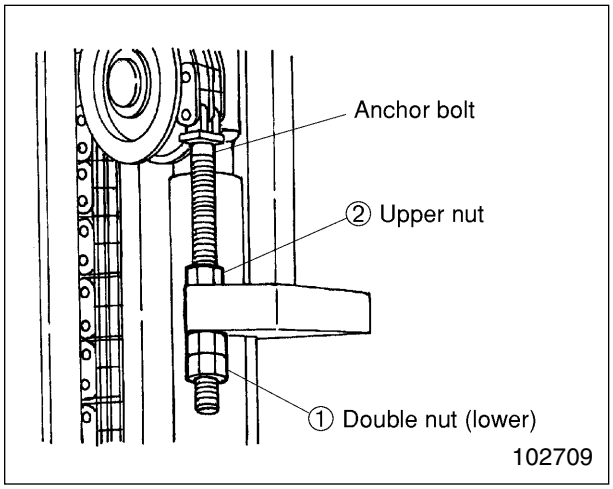
(3) Be sure to tighten the support tightening bolts securely.



	FB30K, FB35K
Bolt tightening torque	287.3 N·m (29.3 kgf·m) [211.9 lbf·ft]

2. Adjust the chain tensions.
(Refer to the “Chain Tension Adjustment” section on page 13-24.)

Tighten the nuts to the specified torque.



	Tightening Torque
Upper nut ②	84.3 N·m (8.6 kgf·m) [62.2 lbf·ft]
Double nut (lower) ①	147 N·m (15 kgf·m) [108.5 lbf·ft]

3. Air bleeding of lift cylinders

Air-bleed the hydraulic lines and cylinders by removing the mast up and down and tilting it forward and backward repeatedly (three or four cycles for each operation).

4. After proper operation is confirmed, check the oil level.

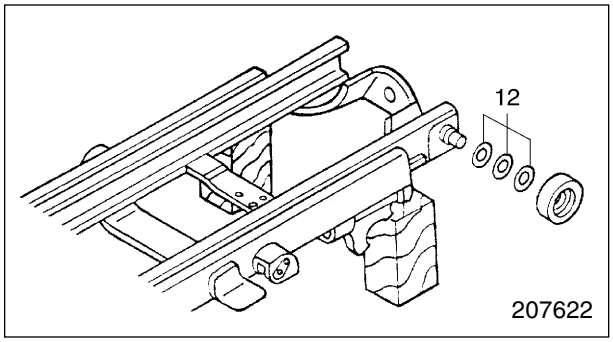
Reassembly

To reinstall, follow the removal sequence in reverse, and service as follows.

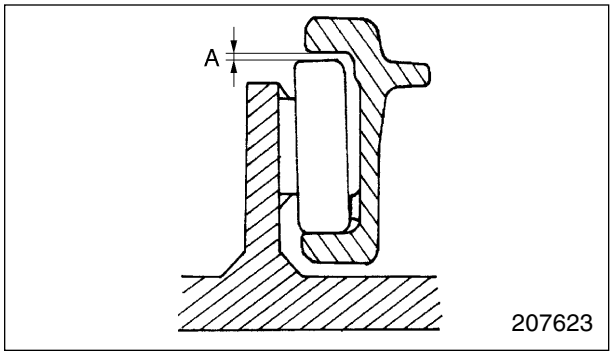
1. Main rollers

(1) Adjust the right and left clearances by increasing or decreasing the thickness of shims 12.

See the "Mast Clearance Adjustment" section on page 13-29 for the adjustment procedure.

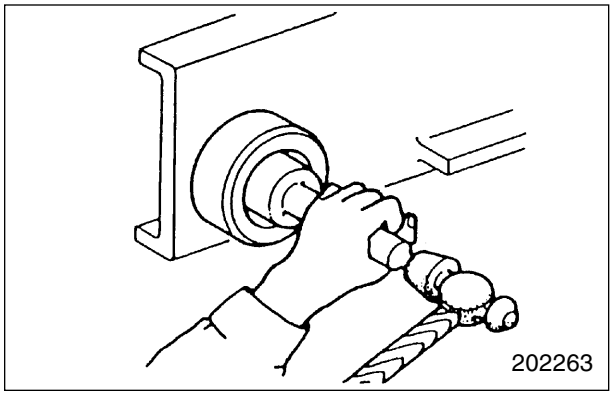


(2) When replacing lift bracket main rollers, make sure clearance A between each roller and mast surface is 1 mm (0.04 in.) or less.



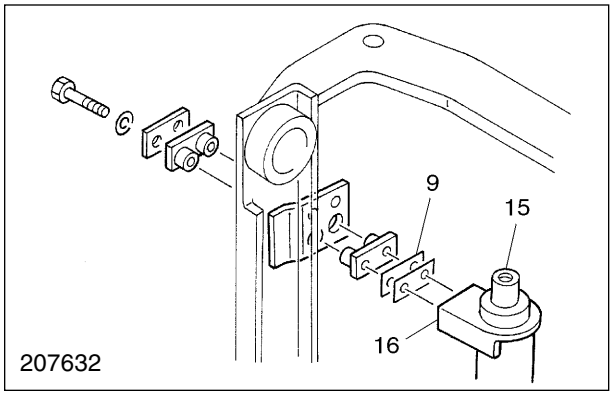
(3) To install main rollers on shafts, use a driving tool. Be careful not to accidentally strike the outer roller surface with the driving tool.

The side of the roller with larger chamfered area must face toward the outside.



2. Installing second lift cylinders

When installing second lift cylinders 15, make sure the cylinders are parallel to the mast to prevent bending stress on the lift cylinders when the mast is positioned at the bottom. Adjust the installation positions of lift cylinder brackets 16 with shims 9.



Clearance Adjustment on Lift Bracket

NOTE

The adjustment procedure for the lift bracket is the same for the Simplex Mast, Duplex Mast and Triplex Mast.

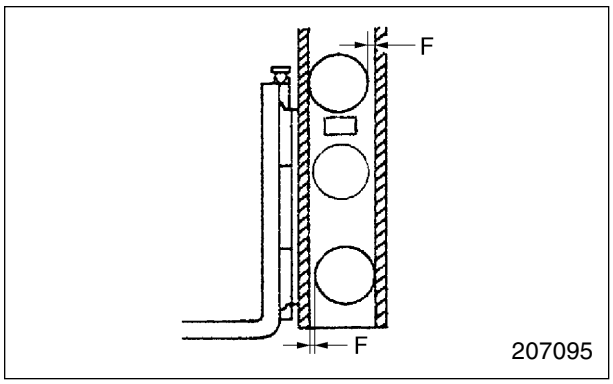
1. Longitudinal clearance adjustment on lift bracket main rollers

(1) Raise the forks a little from the floor.

(2) Insert a bar between the upper part of lift bracket and the inner mast, and push the inner mast to one side. Using feeler gauges, measure the clearance F between the main roller and inner mast on the opposite side.

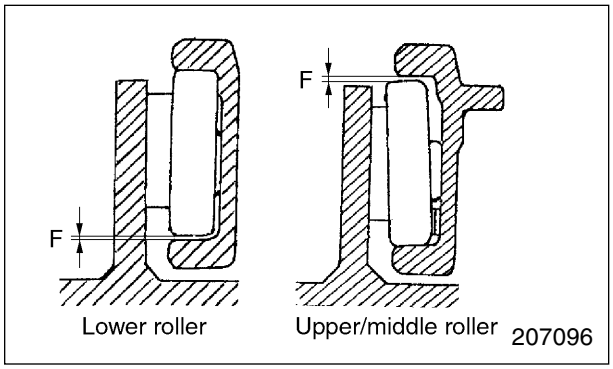
Clearance F	0.1 to 1.0 mm (0.004 to 0.039 in.)

(3) If the clearance F is out of specification, use oversize rollers.



Roller sizes Unit: mm (in.)

		FB30K, FB35K
Diam. of main roller	S	113.8 (4.48)
	M	115 (4.53)
	L	116 (4.57)
	LL	117 (4.60)



(4) Lift bracket main rollers (upper and center rollers)

The upper rollers should be the same in size or 1-rank larger than the center rollers.

2. Lateral clearance adjustment on lift bracket main rollers and side rollers

(1) Raise the mast to the top.

(2) Set a dial indicator on the inner mast with its contact point rested on the side of the lift bracket.

(3) Go over to the opposite side of the mast, and push the lift bracket to one side with a bar. Set the indicator to zero.

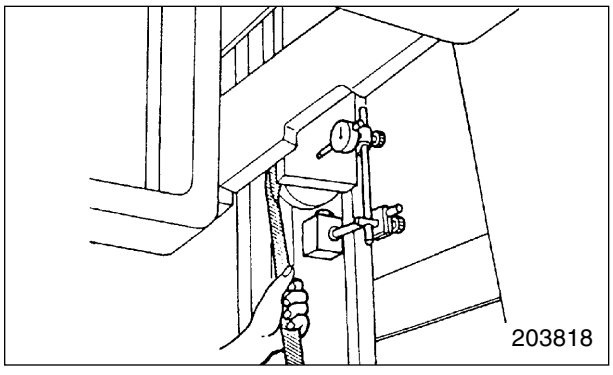
(4) Insert a bar between the inner mast and lift bracket on the indicator side, and push the lift bracket to the opposite side.

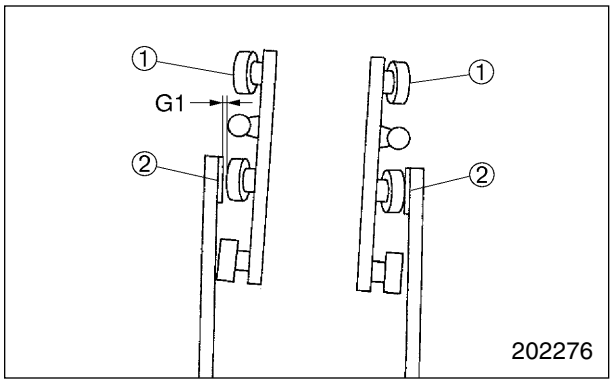
(5) Read the indicator.

Clearance G1	0.1 to 0.5 mm (0.004 to 0.020 in.)

(6) Adjust clearance G1 between the center main roller and weld plate ② at the maximum lift position by increasing or decreasing the thickness of the shim.

Do not install a shim at upper main roller ①.



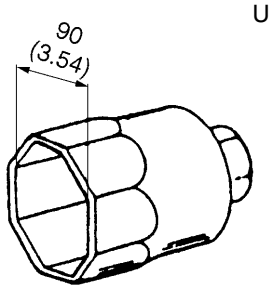


Troubleshooting

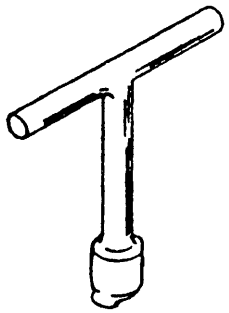
Lift bracket, inner masts and middle masts do not rise or lower smoothly.	Faulty rotation of rollers	Supply grease or replace rollers.
	Improper mast strip clearance	Adjust with shims.
	Improper main roller or side roller clearance	Adjust front-to-back and right-to-left clearances.
Lift bracket or inner masts are lopsided.	Uneven chain tension between right and left chains	Adjust chain tension.
	Excessive side roller clearance	Adjust by adding shims.
	Uneven adjustment of shims between right and left lift cylinders (at maximum lift position)	Adjust by removing shims.
	Lift bracket retaining stopper in contact	Adjust chain tension.
Abnormal noise is generated by masts.	Faulty rotation of rollers	Supply grease or replace rollers.
	Defective hose pulley bearing (for triple-stage full free panoramic mast system only)	Replace.
Lift cylinders descent by leaks.	Damaged gaskets in lift cylinders	Replace.
	Internal leak of control valve	Replace.
Entire masts shake	Worn mast support bushings and caps	Retighten, or replace bushings and caps.
Masts are deformed in shape.	Uneven cargo load or overload	Replace assembly.
Uneven fork end heights	Bent finger bars	Repair or replace.
	Bent forks	Replace.
	Mast deformation due to uneven cargo load	Repair or replace.
Second lift cylinders move when first lift cylinder operates. (triple-stage full free panoramic mast system)	Low oil temperature	Increase oil temperature by raising and lowering lift bracket.
	No clearance for lift bracket roller surfaces	Readjust rollers.
	Clogged pipes	Inspect and clean hydraulic line.
	Improper air bleeding	Bleed hydraulic system.
Mushy operation of fall-prevention function when lifting operation is stopped.	Improper air bleeding	Bleed hydraulic system.

Inspection/Maintenance Location and Item		Pre-operation Inspection	Periodic Inspection Interval					Remarks Service Standard
			Every Week or 50 Hours	Every Month or 200 Hours	Every 3 Months or 600 Hours	Every 6 Months or 1200 Hours	Every 12 Months or 2400 Hours	
Power transmitting system								
Transfer and differential, Front axle	Axle housing oil level and contamination				○	⊗		8.5 liter (2.25 U.S.gal)
	Oil leaks			○				
	Bolt looseness						○	
Drive system								
Tires	Tire cracking and damage	○						
	Tire tread depth			○				
	Abnormal tire wear			○				
	Metal pieces, rocks, other foreign materials on tires			○				
Hub bolts	Damage and looseness	○						
Rims	Damage	○						
Wheel bearings	Wheel bearing rattle					○		
	Abnormal noise in wheel bearings					○		
	Grease replacement						⊗	
Steering system								
Steering wheel	Play, looseness, rattling and operating condition	○						Play: 15 to 30 mm (0.6 to 1.2 in.)
Rear axle	Deformation, cracking and damage					○		
	Oil leaks (cylinder and piping)	○						
	Bolt looseness						○	
Braking system								
Brakes	Free play	○						3 to 9 mm (0.12 to 0.35 in.)
	Distance between depressed brake pedal and floor board	○						
	Air trapped in fluid			○				
	Braking performance	○						
	Uneven braking performance between right and left	○						
	Reservoir tank level and oil leaks	○					⊗	99 cc (6.04 cu. in.)

Unit: mm (in.)

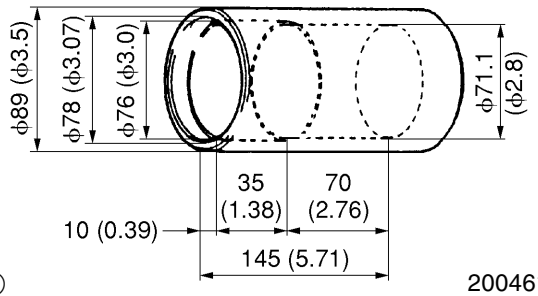


① 203546



⑤ 203548

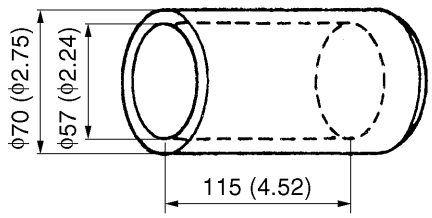
Unit: mm (in.)



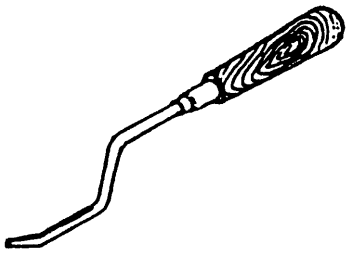
② 200461

⑥ 203549

Unit: mm (in.)

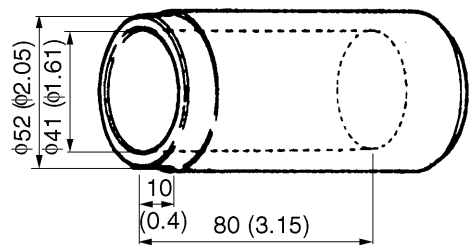


③ 203547



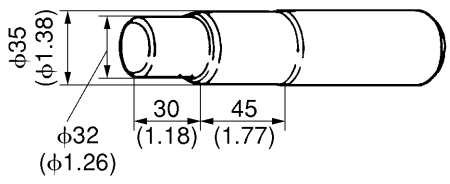
⑦ 203550

Unit: mm (in.)



④ 200447

Installer Unit: mm (in.)



⑧ 200448