



Service Manual

Chassis, Mast & Options

FB20K PAC	EFB8C-00011-up
FB25K PAC	EFB8C-50001-up
FB30K PAC	EFB9C-00011-up
FB35K PAC	EFB9C-50001-up

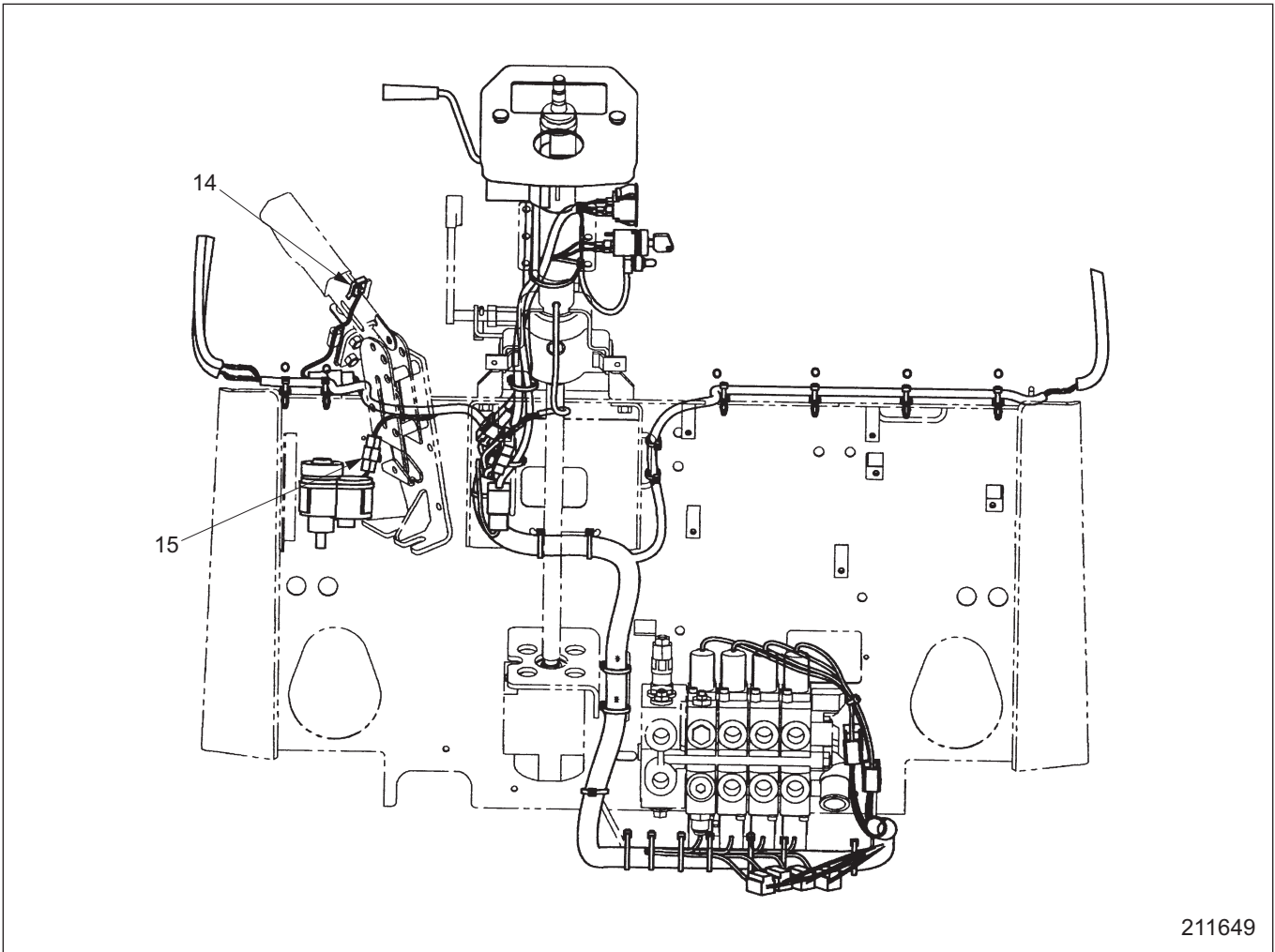
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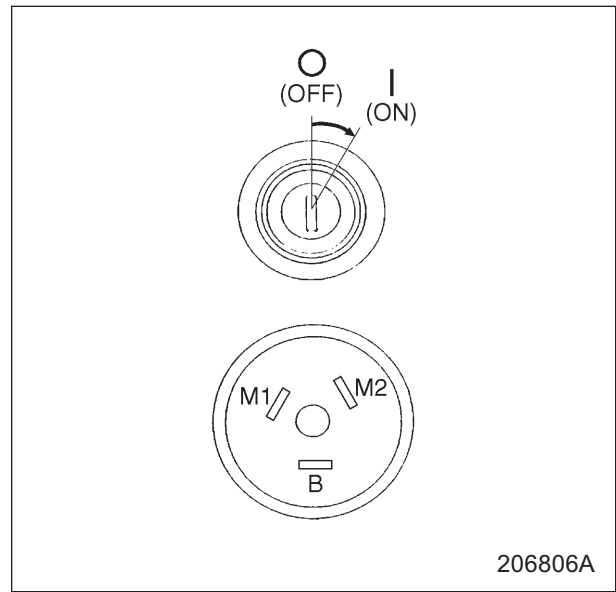
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14 Parking brake switch

15 Brake fluid level sensor

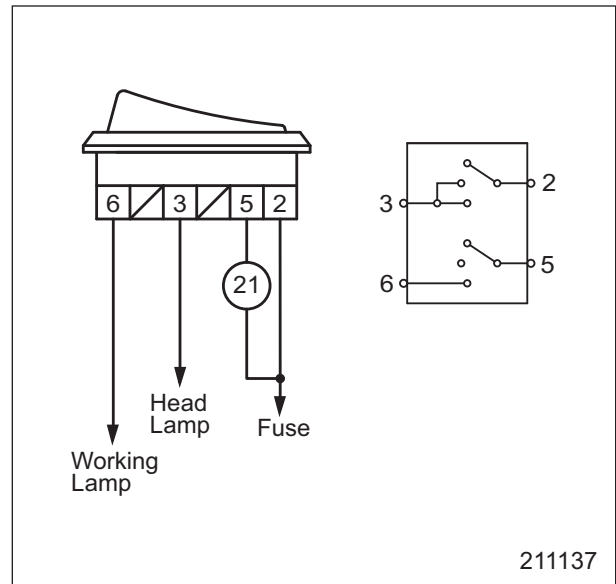
Key Switch

Terminal	B	M1, M2
Connection destination	Main fuse Battery	Logic card
○ (OFF)		
I (ON)	○ ——— ○	○ ——— ○



Lighting Switch

Terminal	2	5	3	6
Connection destination	Battery	Battery	Head lamps	Working lamp
OFF	○ ——— ○			
ON (1)	○ ——— ○	○ ——— ○	○ ——— ○	
ON (2)	○ ——— ○	○ ——— ○	○ ——— ○	○ ——— ○



Inspection of machine side components

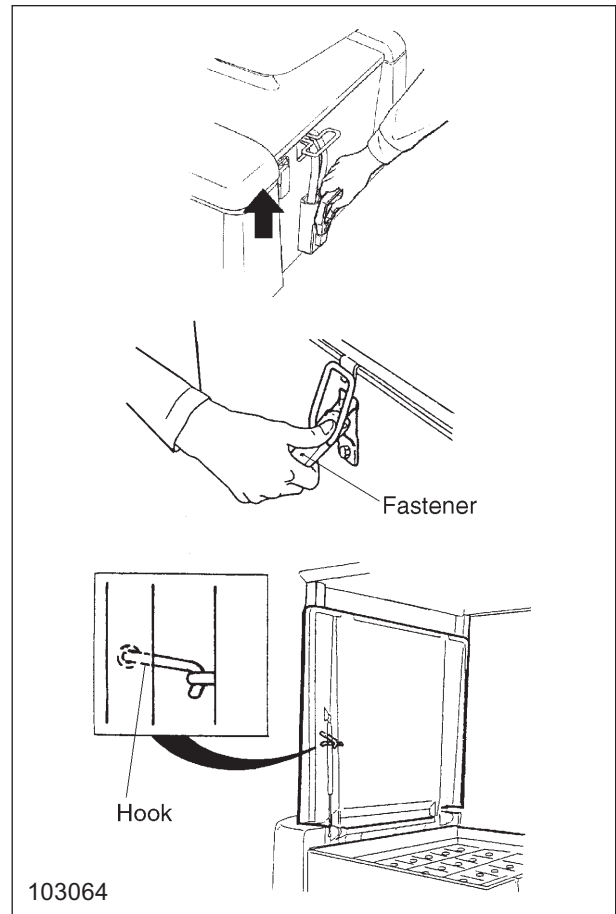
Shown in the following table are the machine side basic components that must be inspected first when a problem occurs in the FC system and the conditions and points for performing their checking.

Conditions in the machine	Check item	What to check	Remedy
Key switch OFF Emergency switch ON	Hydraulic line	Hoses, pipes and connectors for damage and sign of leak.	Repair leaking or damaged parts.
	Hydraulic devices	Check control valve and hydraulic cylinders for damage and oil leaks.	Repair damaged or leaking parts, if any.
	Electrical connectors and wires	Check connectors for tightness, burns and breakage; check wires for insulator stripping and signs of rubbing.	Repair.
Key switch ON Emergency switch OFF	System check lamp	Check to be sure the lamp goes ON and OFF properly; if not, check the bulb.	Replace lamp bulb if blown.
	Hydraulic devices	With your hands off control levers, see if the solenoid valves and hydraulic pump are making any abnormal sounds.	Refer to the sections dealing with control valve and hydraulic pump, respectively.
		Operate the control levers to see if any abnormal sound, indicative of flow throttling, comes from control solenoid valve or from any other solenoid valve.	(Proper function of solenoid valves is essential to troubleshooting.)
	Work attachments	Check each work attachment for the following: (a) Does it work properly? (b) Does it “inch” properly? (c) Does mast go down with proper speed?	See “4. Troubleshooting guide for solenoid control valves” on page 2-26.

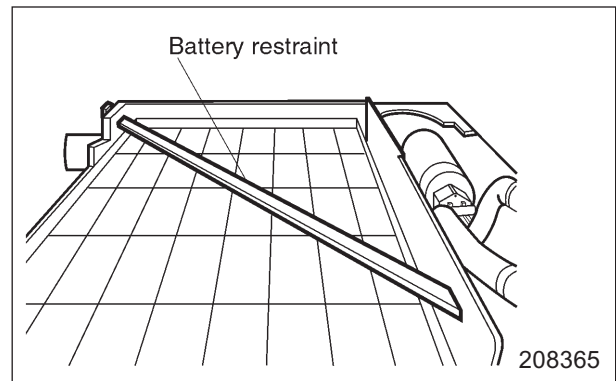
Battery Removal and Installation

Removal

1. Disconnect the battery plug.
2. Release the fastener and fully open the battery cover. Hook the cover to hold it up.
3. Remove both side covers.

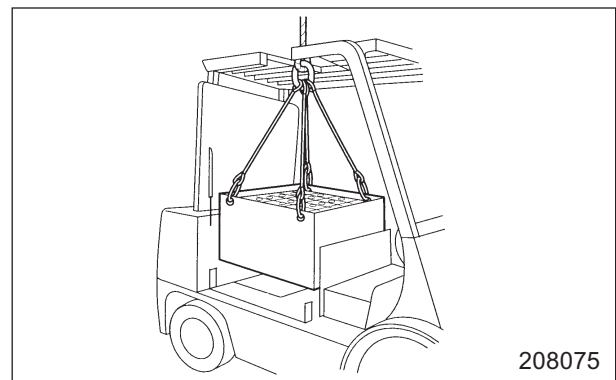


4. Remove the battery restraint.



5. Using a hoist, lift the battery case out of the vehicle.

Truck Models	2 ton class and 2.5 ton class	3 ton class and 3.5 ton class
Battery weight	1385 kg (3053 lb)	1872 kg (4127 lb)

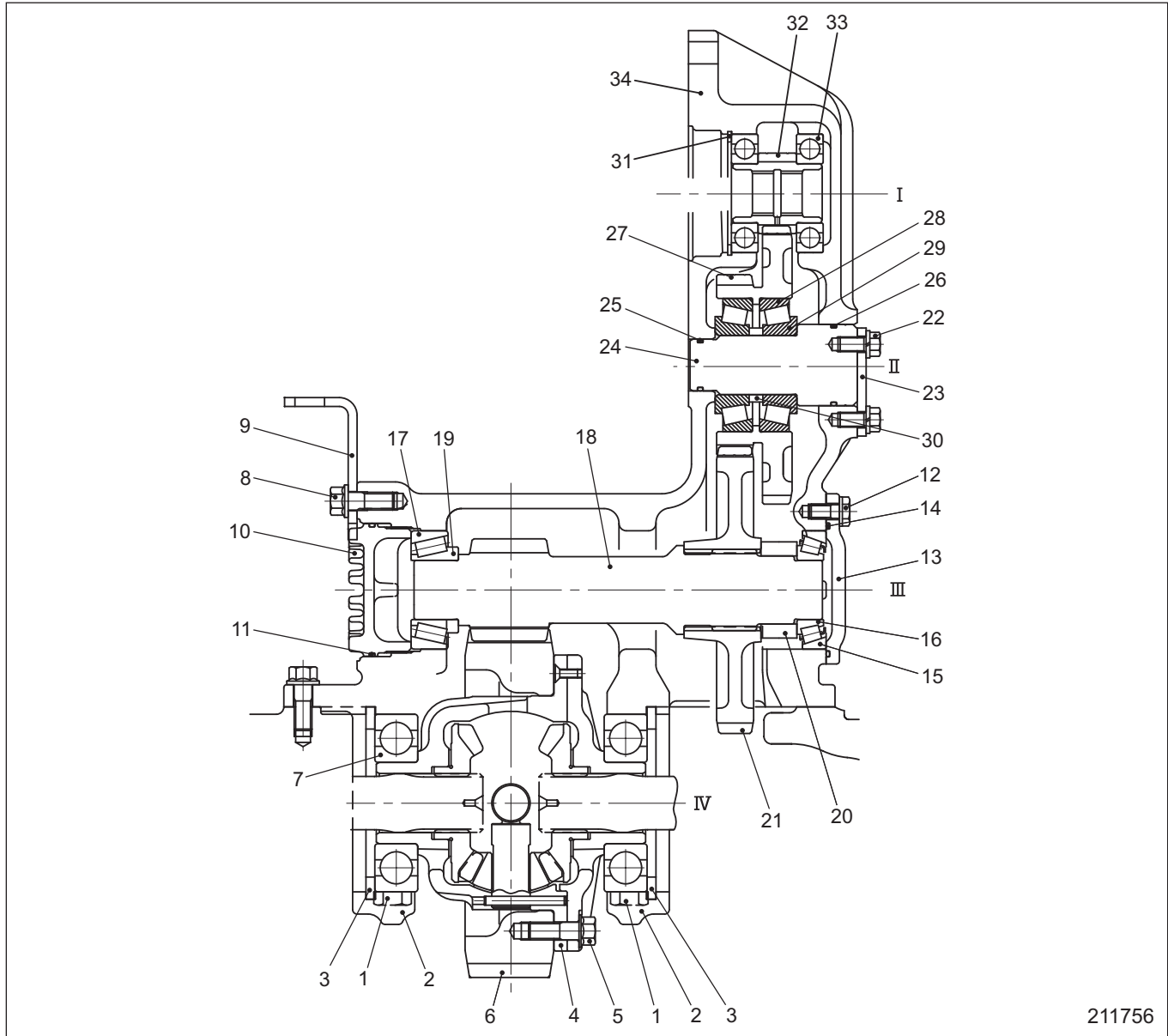


Installation

Follow the removal sequence in reverse.

Procedures and Suggestions for Disassembly and Reassembly

Transfer and Differential Gear Disassembly



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Sequence

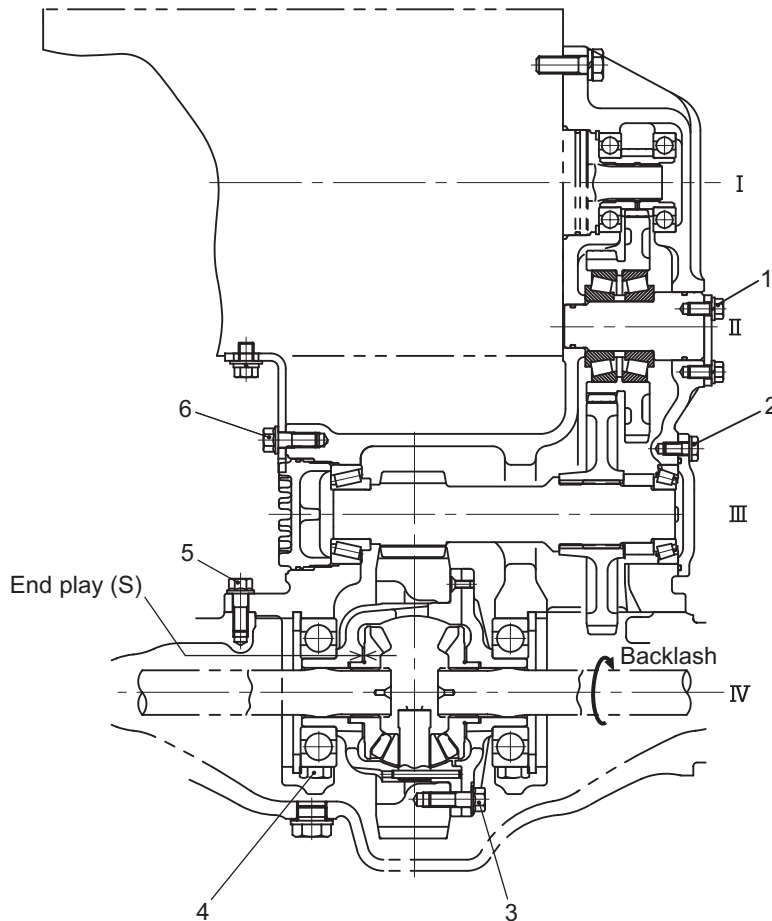
- | | | |
|-------------------------------------|-----------------------------------|-----------------------------------|
| 1 Bolt | 13 Cover | 25 O-ring |
| 2 Bearing cap | 14 O-ring | 26 O-ring |
| 3 Retainer | 15 Bearing outer race | Remove parts 27 and 28 as a unit. |
| Remove parts 4 to 7 as an assembly. | 16 Bearing inner race | 27 Second gear |
| 4 Differential gear assembly | 17 Bearing outer race | 28 Bearing outer race |
| 5 Bolt | Remove parts 18 and 19 as a unit. | 29 Bearing inner race |
| 6 Output gear | 18 Third shaft | 30 Spacer |
| 7 Ball bearing | 19 Bearing inner race | 31 Snap ring |
| 8 Bolt | 20 Spacer | Remove parts 32 and 33 as a unit. |
| 9 Motor bracket | 21 Third gear | 32 Input gear |
| 10 Nut | 22 Bolt | 33 Ball bearing |
| 11 O-ring | 23 Lock plate | 34 Transfer gear case |
| 12 Bolt | 24 Second shaft | |

Service Data

A : Standard value
Unit : mm (in.)

Item		Truck Models	
		2 ton class, 2.5 ton class	3 ton class, 3.5 ton class
Third gear shaft taper roller bearing preload (Tangential force required at output gear mounting bolt to rotate output gear) N (kgf) [lbf]		A	42 to 84 (4.3 to 8.6) [9.5 to 19]
Bolt tightening torque N·m (kgf·m) [lbf·ft]	Bolt 1	A	33 ± 3 (3.4 ± 0.3) [24.6 ± 2.2]
	Bolt 2	A	59 ± 6 (6.0 ± 0.6) [43.4 ± 4.3]
	Bolt 3	A	118 ± 10 (12.0 ± 1.0) [86.8 ± 7.2]
	Bolt 4	A	123 ± 10 (12.5 ± 1.0) [90.4 ± 7.2]
	Bolt 5	A	108 ± 10 (11.0 ± 1.0) [79.6 ± 7.2]
	Bolt 6	A	108 ± 10 (11.0 ± 1.0) [79.6 ± 7.2]
End play of side gear (S)		A	0.19 (0.007)
Differential gear backlash		A	0.9 to 1.3°

Transfer and Differential



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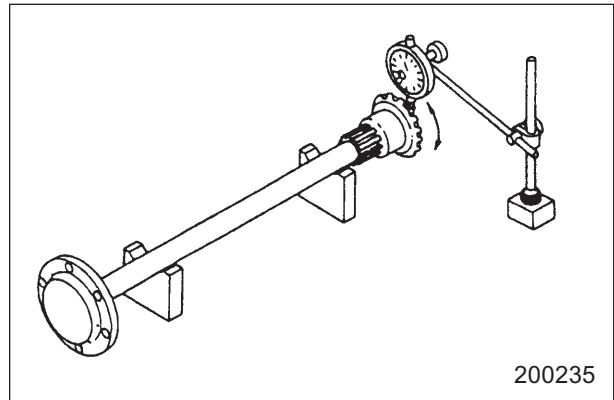
Inspection and Repair

1. Axle shaft 2

(1) Insert the differential side gear to the axle shaft, and measure looseness in the rotating direction with a dial gauge.

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

Looseness of axle shaft spline	A	0.07 to 0.17 (0.0028 to 0.0067)
	B	0.5 (0.020)

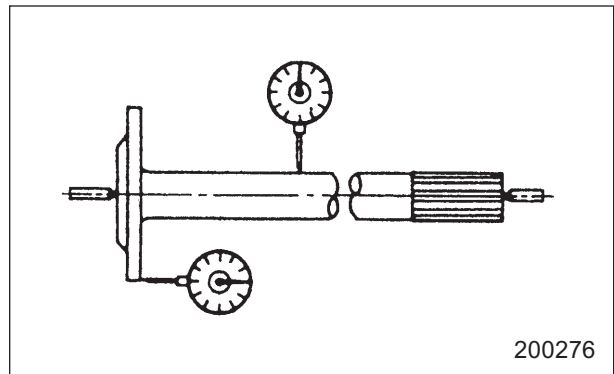


(2) Measuring axle shaft bend

(a) Attach a dial gauge to the center of the axle shaft, and rotate the axle shaft. Measure bend of the axle shaft.

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

Axle shaft bend (1/2 of gauge reading)	A	0.5 (0.020) or less
	B	1.0 (0.039)



(b) Attach a dial gauge to the edge of the flange, and rotate the axle shaft. Measure deflection of the flange.

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

Flange deflection	A	0.08 (0.0031)
	B	0.5 (0.020)

2. Seal retainer 18

Check for wear or damage on the retainer circumference.

3. Brake drum 8

If uneven wear or damage is found on the inner surface of the brake drum, grind and repair.

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

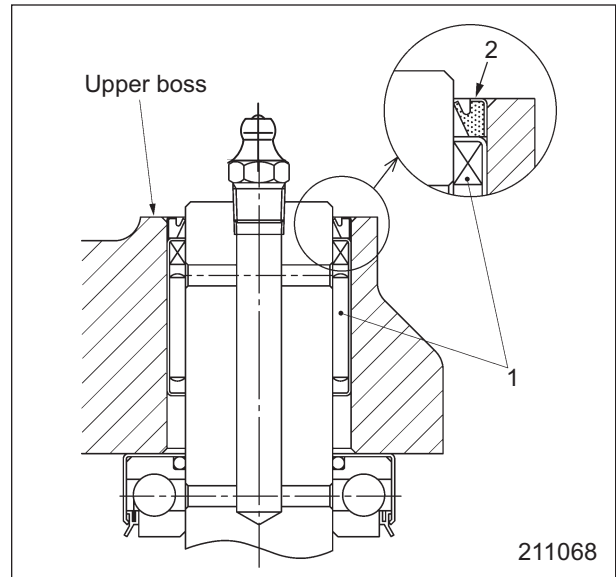
Inner diameter of brake drum	A	310 ^{+0.15} ₀ (12.2 ^{+0.0059} ₀)
	B	312.0 (12.283)

4. Hub bearings

Examine the rollers and bearing races for grooving, abrasive wear, pitting, bruising, or corrosion. Replace both the outer race and inner race of damaged bearings.

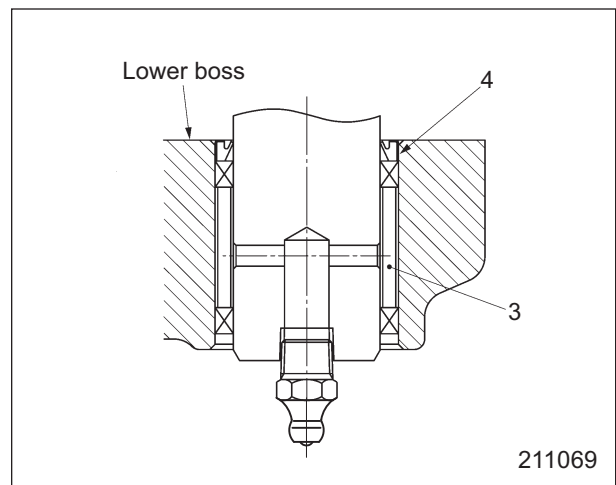
Suggestions for Reassembly

1. Use the special tool to insert and press-fit the needle bearing 1 into the kingpin bore in the rear axle upper boss from outside.
2. Use the special tool to insert and press-fit the oil seal 2 into the kingpin bore with the lip positioned as shown in the illustration.



Upper boss

3. Use the special tool to insert and press-fit the needle bearing 3 into the kingpin bore in the rear axle lower boss from outside.
4. Use the special tool to insert and press-fit the oil seal 4 into the kingpin bore with the lip positioned as shown in the illustration.
5. Temporarily install the bearing 6 and knuckle 5 in the rear axle body and measure the clearance "A". The clearance must be 0.3 mm (0.01 in.) or less for both the right and left sides of the axle. If the clearance exceeds the specification, adjust it with the shim 7. The shim is available in two thicknesses: 0.6 mm (0.02 in.) and 0.2 mm (0.008 in.).
6. Grease the roller surfaces of each needle bearing, oil seal lip surface, and periphery of both kingpin ends, and then insert the kingpin 8 from under the rear axle.
7. Visually check the alignment of the stopper bolt hole in the knuckle 5 and the locking hole in the kingpin 8, then lock the kingpin in the knuckle holding the stopper bolt and nut 9.
8. Install the grease nipples. Fully grease the kingpin and bearings through the grease nipples.



Lower boss

Service Data

A: Standard value B: Repair or service limit

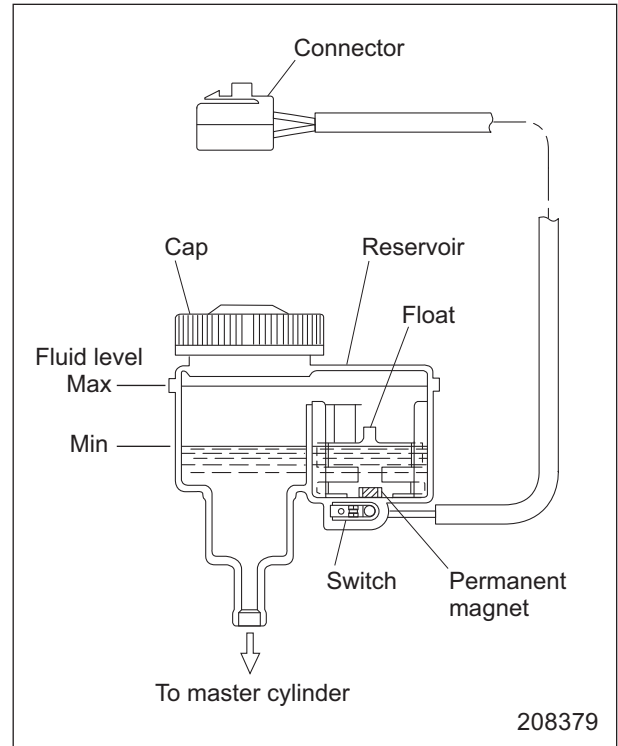
Unit: mm (in.)

Item	Truck Models		2.0 ton class, 2.5 ton class	3.0 ton class, 3.5 ton class
	Rear axle			
Toe-in	(deg)	A	1° 29'	
Caster	(deg)	A	0°	
Camber	(deg)	A	0°	
Steering angle	Inward (deg)	A	83° 6'	
	Outward (deg)	A	56° 33'	
Tangential force at hub bolt 1	N (kgf) [lbf]	A	6.7 to 67 (0.7 to 7) [1.54 to 15.4]	
Front and back clearance for center pin 2	(total)	A	0.8 (0.03) or less	
		B	1.2 (0.047)	
Tightening torque of steering cylinder bolt 3	N·m (kgf·m) [lbf·ft]	A	262 ± 10 (26.7 ± 1) [193.2 ± 7.4]	
Outer nut tightening torque 4	N·m (kgf·m) [lbf·ft]	A	156.9 ± 15.7 (16.0 ± 1.6) [115.7 ± 11.6]	
Tightening torque of stopper bolt nut 5	N·m (kgf·m) [lbf·ft]	A	66.7 ± 6.67 (6.8 ± 0.68) [49.2 ± 4.9]	
Allowable tread groove depth 6 (wear limit)			5 (0.2)	
Tightening torque of elbow nut 7	N·m (kgf·m) [lbf·ft]	A	39.2 (4.0) [28.9]	
Tightening torque of wheel nut 8	N·m (kgf·m) [lbf·ft]	A	156.9 ± 15.7 (16.0 ± 1.6) [115.7 ± 11.6]	
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Reservoir Tank

The brake fluid reservoir tank is located under the dashboard on the left-hand side. It incorporates a brake fluid level sensor, which consists of a reed switch (this is built into the bottom of the reservoir tank) and a float (this follows changes in fluid level). The float contains a permanent magnet.

When the fluid level drops below the minimum level marked on the tank, the switch closes, causing the brake fluid level indicator to illuminate. While the fluid level is sufficiently high, the switch remains open and the indicator remains off.



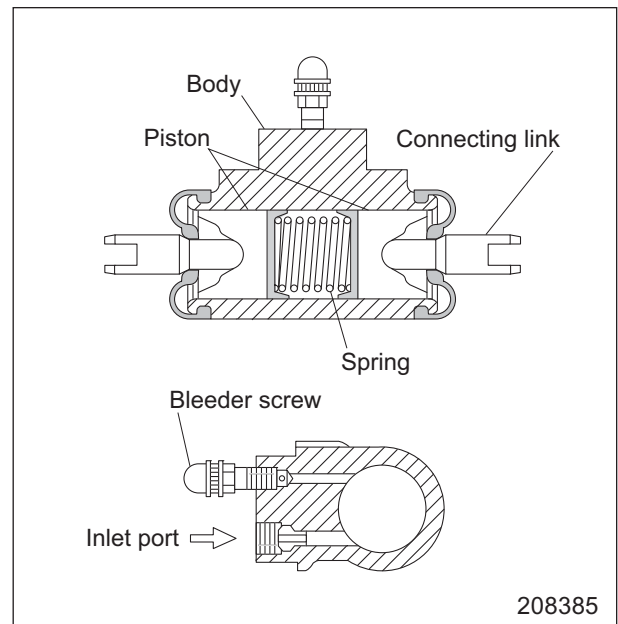
Wheel Cylinder

A wheel cylinder is located in each wheel brake assembly.

When the brake pedal is depressed, pressurized brake fluid from the master cylinder enters the wheel cylinder body through the inlet port. The fluid acts on the left and right-hand pistons, causing them to expand the primary and secondary shoes via the corresponding connecting links.

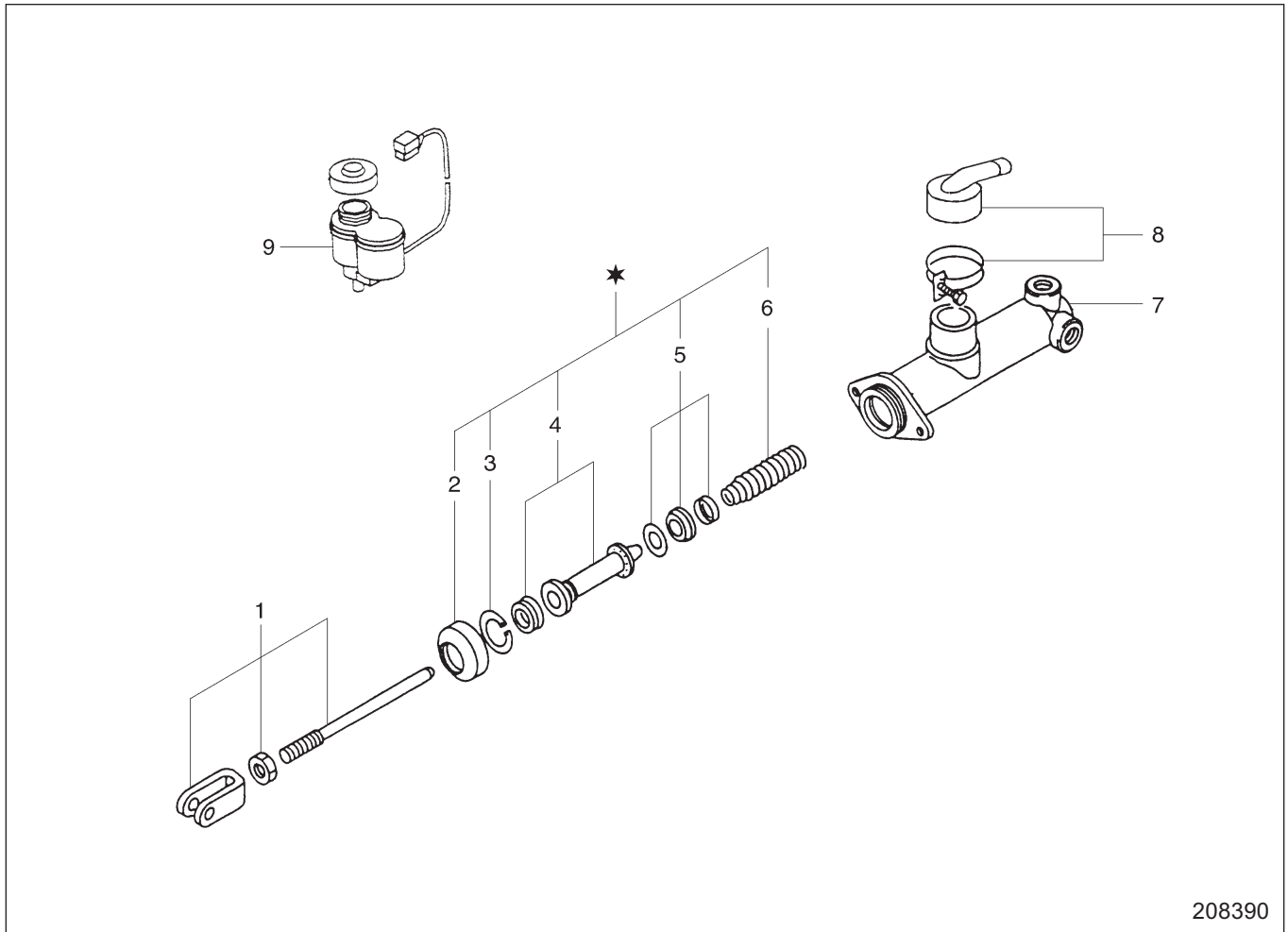
When the brake pedal is released, the pistons are moved back to their original positions by the brake shoe return spring in the wheel brake assembly.

Each wheel cylinder has a bleeder screw, which is used to remove any air that enters the brake system when the system is serviced. The bleeder screw is loosened to remove the air.



Master Cylinder and Fluid Reservoir

Disassembly

**Sequence**

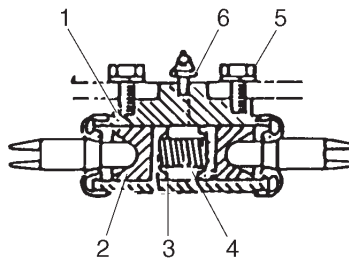
- | | |
|--|-------------------|
| 1 Clevis, Lock nut, Push rod | 6 Return spring |
| 2 Boot | 7 Cylinder body |
| 3 Stopper ring | 8 Filler, Clamp |
| 4 Secondary cup, Piston | 9 Fluid reservoir |
| 5 Spring seat, Primary cup, Cup spacer | |

NOTE

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

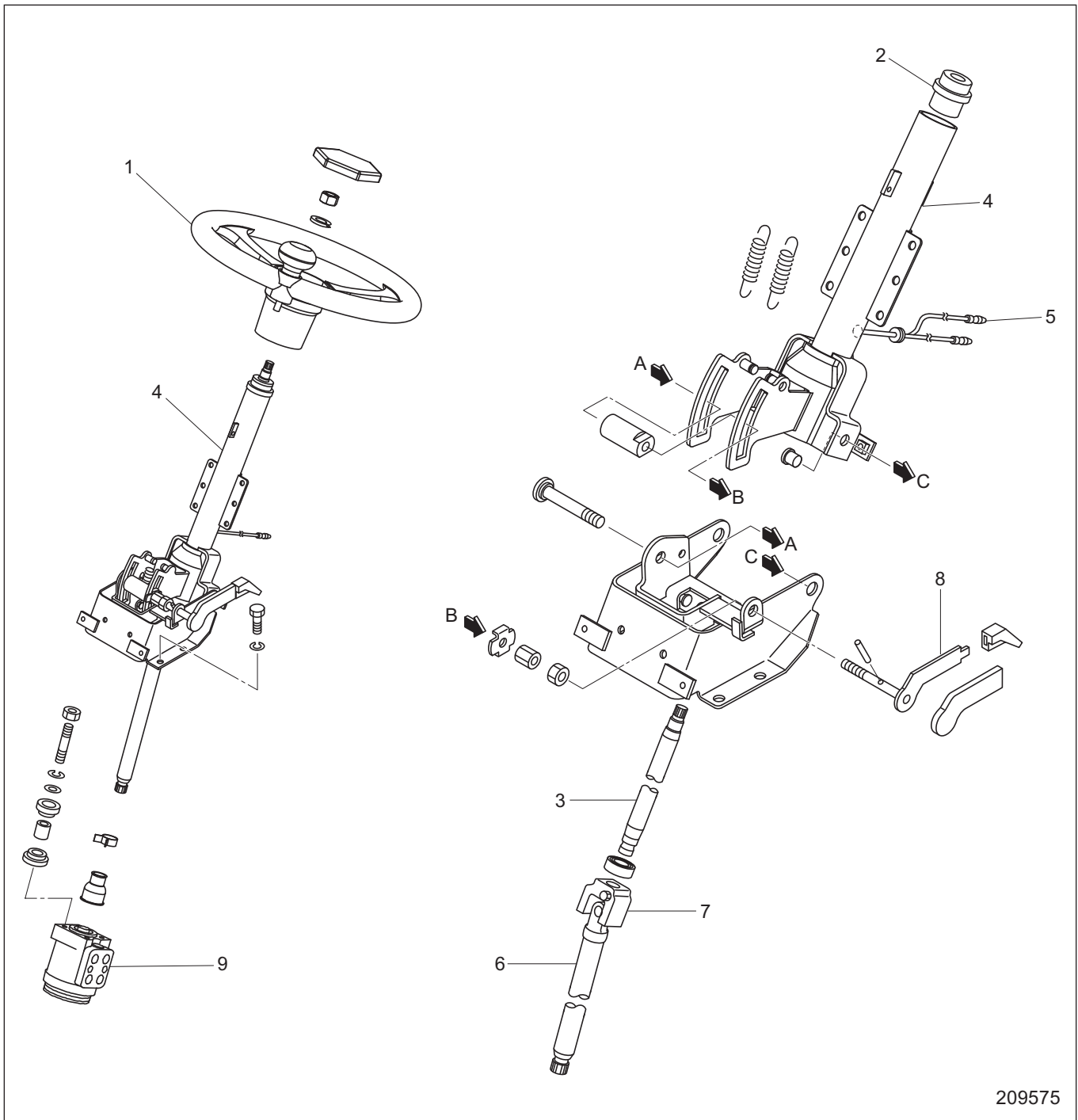
A: Standard value B: Repair or service limit
Unit: mm (in.)

Item		Truck Models		3 ton class	3.5 ton class
Wheel cylinder	Inside diameter of cylinder body 1		A	28.58 ^{+0.052} ₀ (1.1252 ^{+0.00205} ₀)	
	Diameter of piston 2		A	28.58 ^{-0.020} _{-0.053} (1.1252 ^{-0.00079} _{-0.00209})	
	Clearance between cylinder and piston		A	0.020 to 0.105 (0.00079 to 0.00413)	
			B	0.15 (0.0059)	
	Diameter of piston cup (lip side) 3		A	30.5 ± 0.125 (1.201 ± 0.0049)	
			B	(Replace every year)	
	Return spring 4	Free length	A	58 (2.28)	
		Length under test force	A	22 (0.87)	
		Test force	A	13 ± 1 (1.3 ± 0.1) [2.9 ± 0.2]	
		N (kgf) [lbf]	B	(Replace every year)	
Tightening torque N·m (kgf·m) [lbf·ft]	Wheel cylinder bolts 5	A	17.65 to 26.48 (1.8 to 2.7) [13.0 to 19.5]		
	Bleeder screw 6	A	5.88 to 8.83 (0.6 to 0.9) [4.3 to 6.5]		



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Tilt Steering Assembly



209575

- 1 Steering wheel
- 2 Column bushing
- 3 Steering shaft
- 4 Column housing
- 5 Horn cord

- 6 Drive shaft
- 7 Universal joint
- 8 Tilt lock knob
- 9 Steering valve

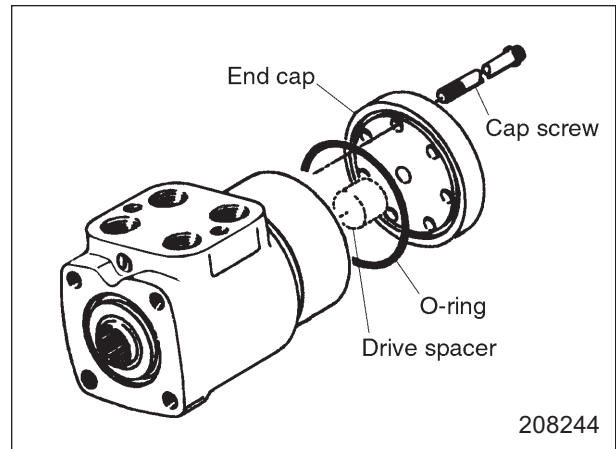
The tilt steering assembly is installed to the bracket under the dashboard.

The tilt steering assembly can tilt $\pm 6^\circ$ around the universal joint.

Push down the knob, and move the steering wheel forward and backward.

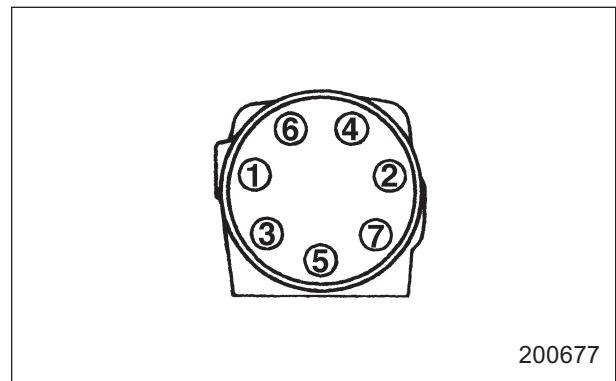
(10) Reassembling the end cap

- Install the drive spacer in the Gerotor set. Install the O-ring in the end cap. Install the end cap in the Gerotor set and align the holes.



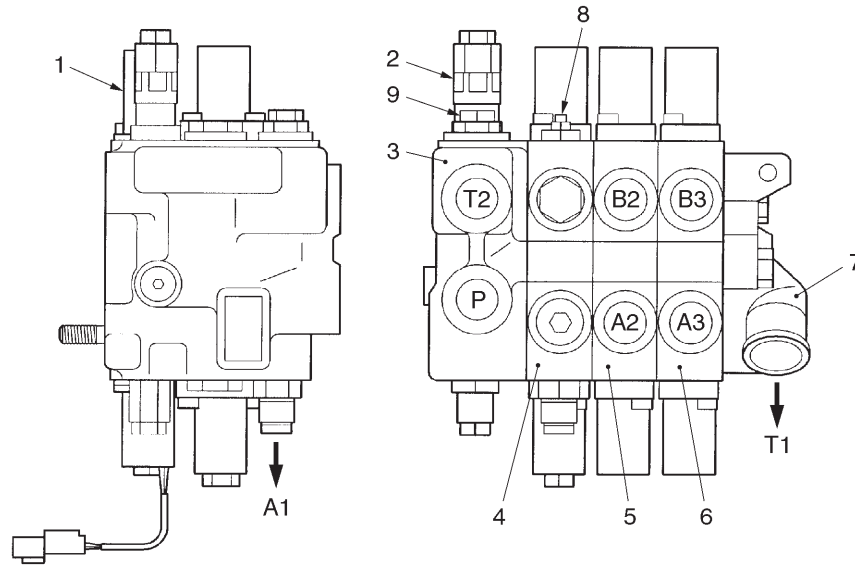
- Apply oil to bolt threads and tighten bolts evenly in the sequence as shown in the illustration on the right. The tightening torque is shown in the table below.

Initial torque for screws	14.7 N·m (1.5 kgf·m) [10.8 lbf·ft]
Finishing torque for screws	23.5 N·m (2.4 kgf·m) [17.3 lbf·ft]



After installing the end cap, install the steering shaft to the spool and make sure the spool rotates smoothly.

Solenoid Control Valve



This drawing shows the three-valve type.

208125A

- 1 Proportioning solenoids
- 2 Main relief valve
- 3 Inlet section (with built-in flow divider valve)
- 4 Lift section (No. 1 valve)
- 5 Tilt section (No. 2 valve)
- 6 Attachment section (No. 3 and No. 4 valves)

- 7 End cover
- 8 Emergency shut-off valve (for releasing lift lock)
- 9 Shut-off valve assembly (for attachment section)

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

The control valve consists of the inlet section 3, lift section 4, tilt section 5, attachment section 6, end section 7, and main relief valve 2.

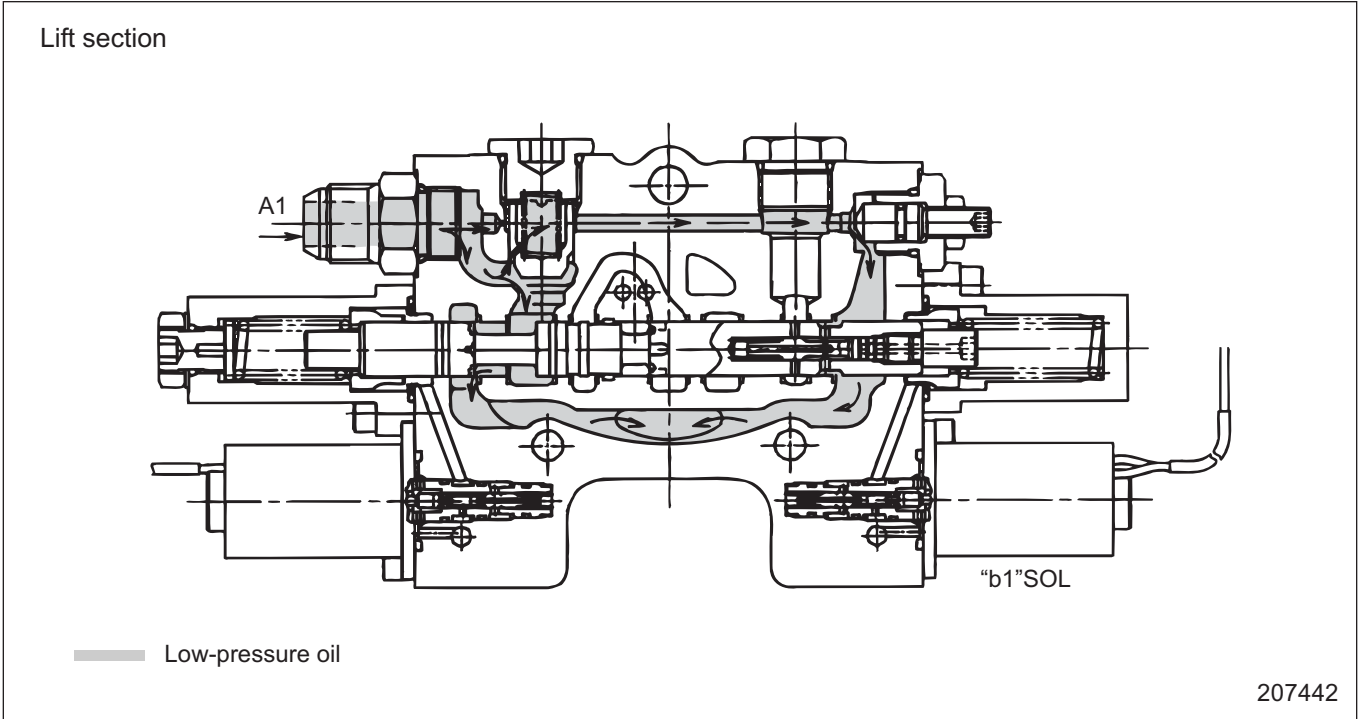
The inlet section has two ports. The P port is the inlet for oil supplied by the hydraulic pump; it is a high-pressure port. The T2 port is the inlet for oil returning from the steering gear; it is a low-pressure port. This section incorporates a flow divider valve, which controls the rate at which oil flows to the lift and tilt sections and the rate at which oil flows to the attachment section. Attached to the outside of the inlet section is the main relief valve 2, which limits the maximum pressure in the high-pressure circuit. Also attached to the outside of the inlet section is the shut-off valve 9, which serves to forcibly relieve the oil pressure in the attachment section. Also attached is a pilot relief valve, which limits the maximum level of the pilot pressure that moves the No. 1, No. 2, No. 3, and No. 4 valves' control spools.

The lift section 4 contains a directional control valve that supplies oil to the lift cylinder. Oil used to raise and lower the lift cylinder flows in and out through the A1 port. The control spool is moved by pilot pressure, which is controlled by a proportioning solenoid. A lift lock valve and an emergency shutoff valve are fitted for use in the event of an emergency.

The tilt section 5 contains a directional control valve that controls the supply of oil to the tilt cylinder. The A2 port is connected to the rod end, and the B2 port is connected to the head end. In terms of construction, the tilt section is almost the same as the lift section.

The attachment section 6 has the A3 port and the B3 port. In terms of construction, it is almost the same as the tilt section.

The end section 7 has the T1 port, which forms part of the line through which oil returns to the hydraulic tank.



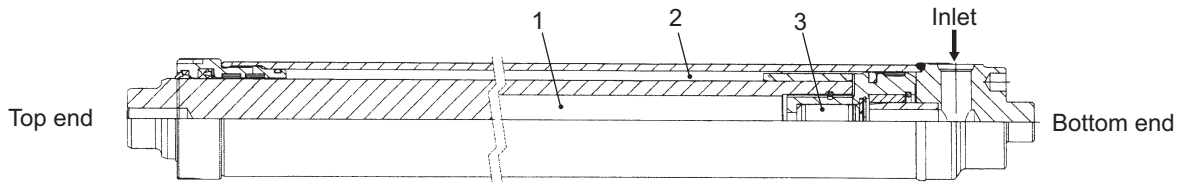
Manual Lift Lowering Operation

In case the proportional electromagnetic pressure control valve on the "b1" SOL side malfunctions and disallows lift lowering operation, opening the shut-off valve creates a pilot oil passage to allow the operation of the load check valve.

Lift and Tilt Cylinders

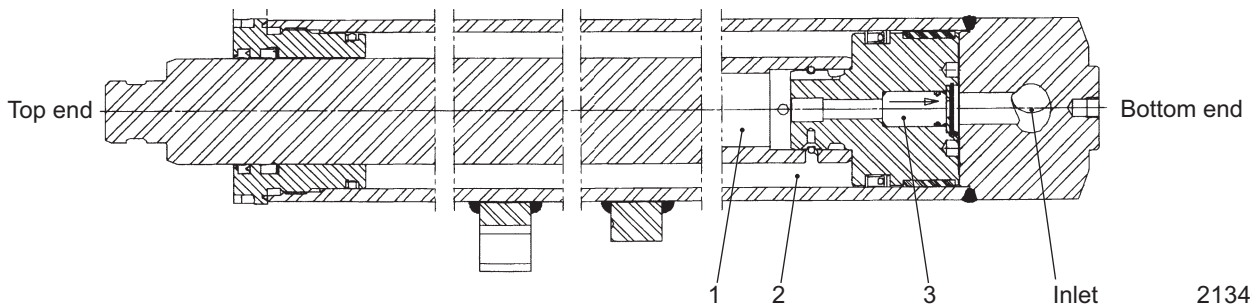
Lift cylinder (Simplex mast)

(Triplex mast second cylinder)



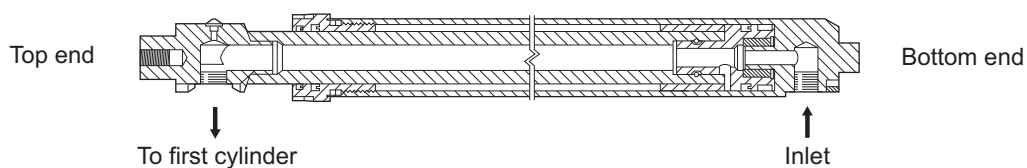
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(Duplex and triplex mast first cylinder)



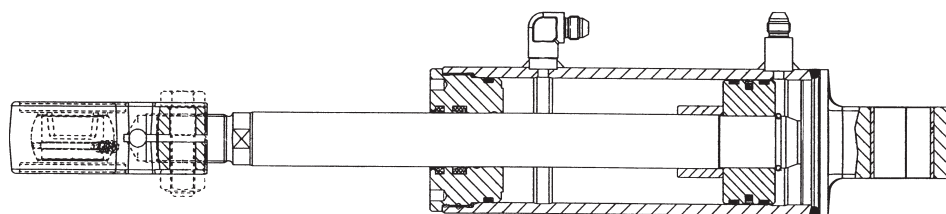
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(Duplex mast second cylinder)



000825C

Tilt cylinder



213461

The left and right lift cylinders are a single-acting type. Air and oil remaining inside air chamber 1 of the rod and inside rod chamber 2 between the tubes open check valve 3 when compressed, thus the air and oil flow out of the cylinder.

Only the second cylinders of the Duplex Mast are provided with bleeding valves.

The left and right tilt cylinders are a double-acting type. The piston rod carries a screw-on socket. This socket is to be repositioned by turning, as necessary, when the cylinder is connected to the outer mast. The right and left cylinders are hydraulically connected to each other. The tilt angle can be increased or decreased by means of spacer and shim of each cylinder.

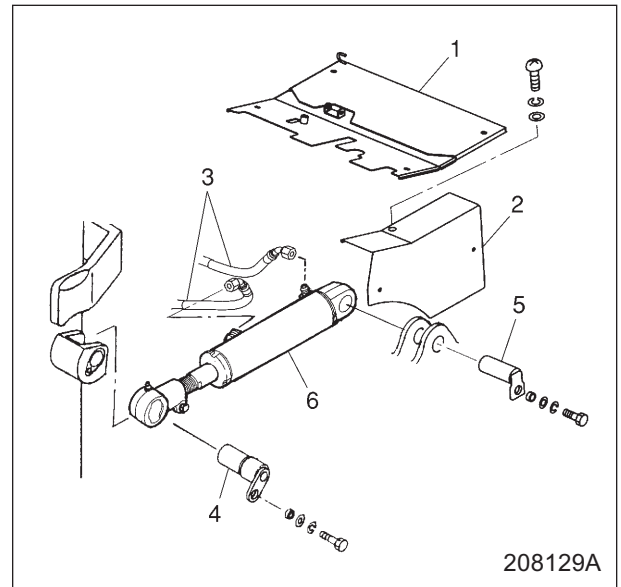
Tilt Cylinders

Procedures and Suggestions for Removal and Installation

Removal

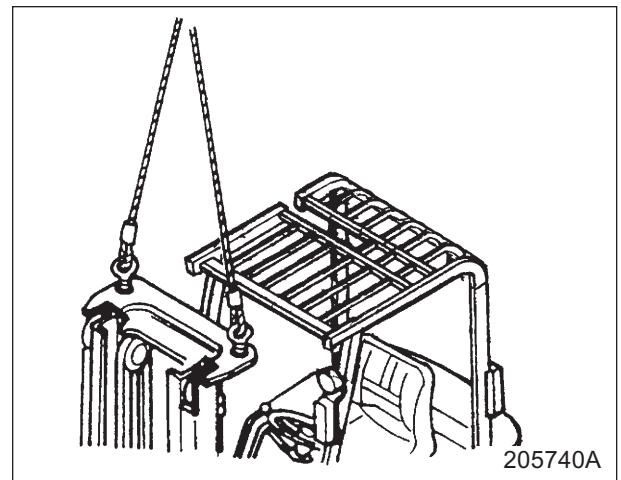
Sequence

- 1 Floor plate
- 2 Cover
- 3 Tilt hose
- 4 Tilt socket pin, Bolt, Washer
- 5 Tilt cylinder pin, Bolt, Washer
- 6 Tilt cylinder



Start by:

- (1) Lower the forks all the way to the floor and tilt the mast fully forward.
- (2) Hitch lifting slings to the top crossmember of the outer mast by using eyebolts. Support the weight of the mast with the hoist.



Cleaning

Wash all disassembled parts with clean solvent.

Use compressed air to dry parts. Place parts on clean paper or cloth for inspection.

Inspection

Inspect each part for burrs, scratches, dents and other surface flaws.

- (1) Remove burrs with an oil stone or with lapping compound. If a part has excessive scratches that may cause oil leaks or malfunctions, replace the part or the section assembly.

NOTE

The valve housings and spools must be used in their original combinations. Since these parts are not interchangeable, if scratches and dents are minor, correct flaws with an oil stone or lapping compound.

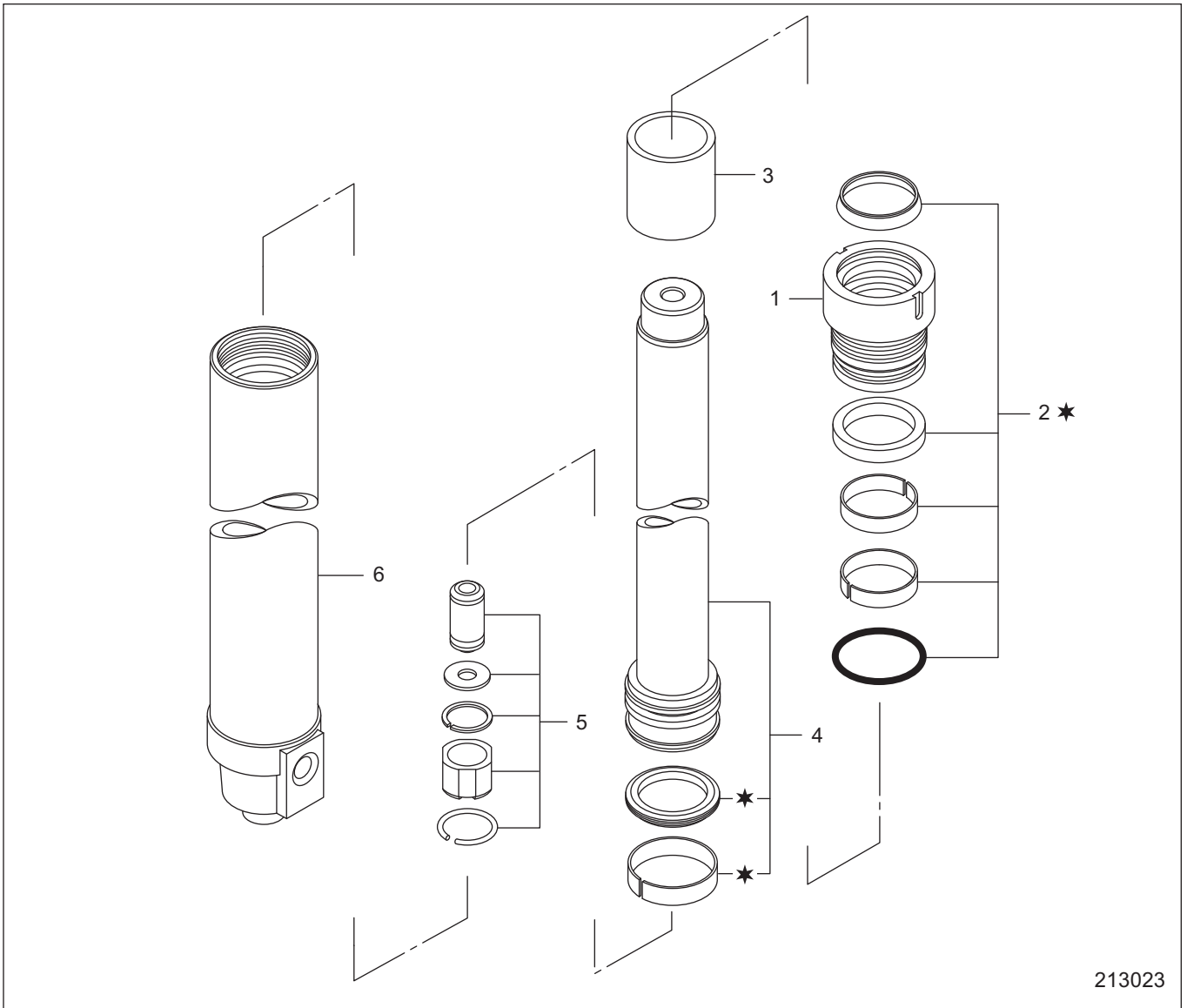
- (2) Make sure all moving and sliding parts operate smoothly. Make sure there are no foreign particles in grooves and oil passages.
- (3) Check orifices for clogs.
- (4) Replace broken or bent springs.
- (5) If the main relief valve does not operate smoothly, inspect the valve (refer to the “Main Relief Valve” on page 9-54).
- (6) Replace all seals, wipers and O-rings with new parts.

Lift Cylinders

Procedures and Suggestions for Disassembly and Reassembly

Simplex Mast, Triplex Mast Second Cylinders

Disassembly



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Sequence

- | | |
|--|--|
| 1 Bearing | 5 Check valve, Washer, Circlip, Bushing, Snap ring |
| 2 Wiper ring, O-ring, Rod guide rings, Seal | 6 Cylinder tube |
| 3 Spacer | |
| 4 Piston rod, Piston seal, Piston guide ring | |

NOTE

Parts marked with ★ are included in the seal kit.

Down Safety Valve

Procedures and Suggestions for Disassembly and Reassembly

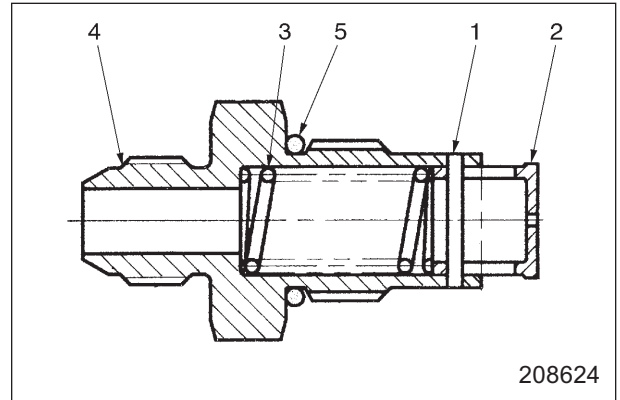
Disassembly

Sequence

- 1 Spring pin
- 2 Valve
- 3 Spring
- 4 Connector
- 5 O-ring

Suggestions

Push out spring pin 1. All parts except O-ring 5 can then be removed.



Inspection after disassembly

Inspect all parts. If any part is abnormal, replace the assembly with a new one.

Reassembly

Follow the disassembly procedure in reverse.

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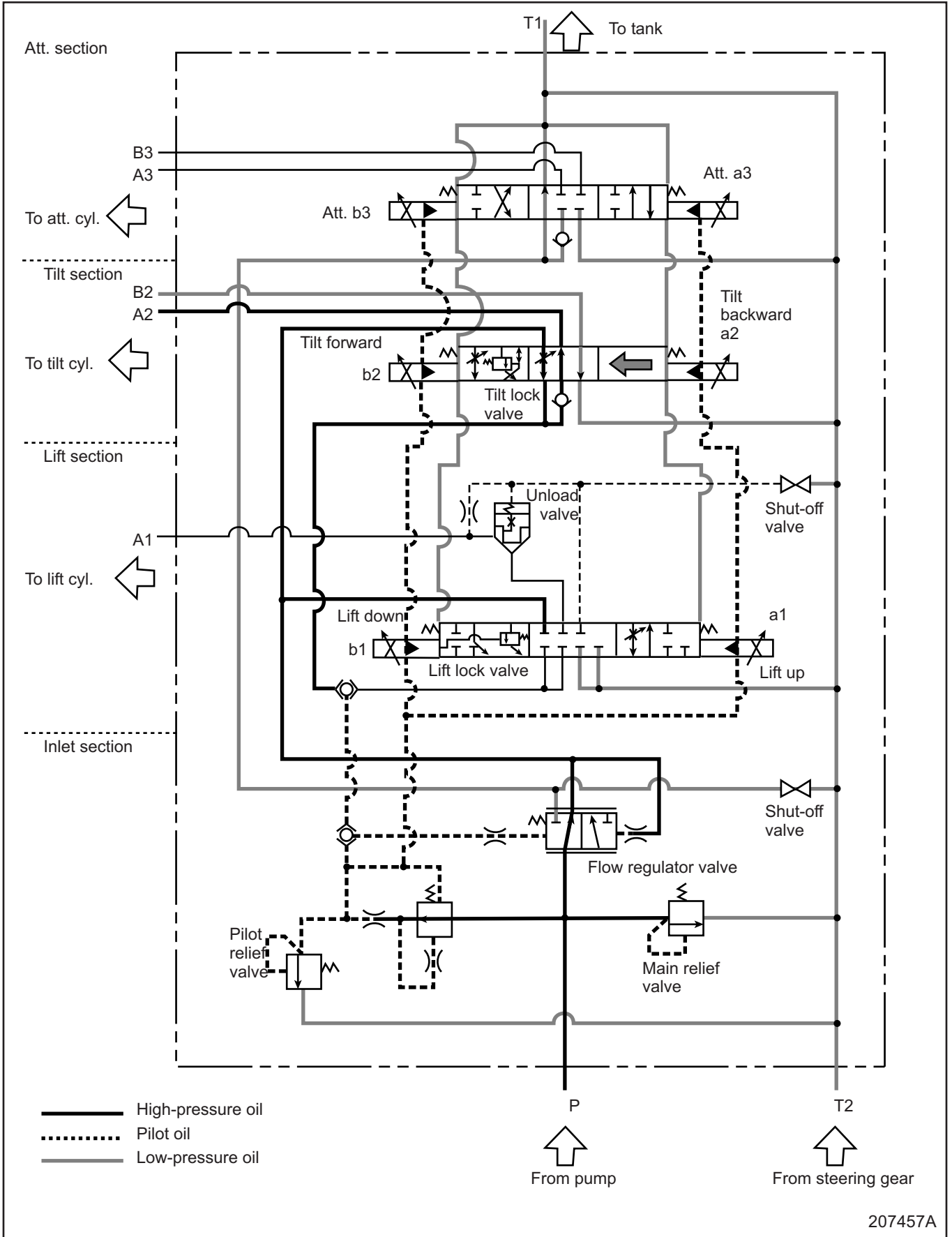
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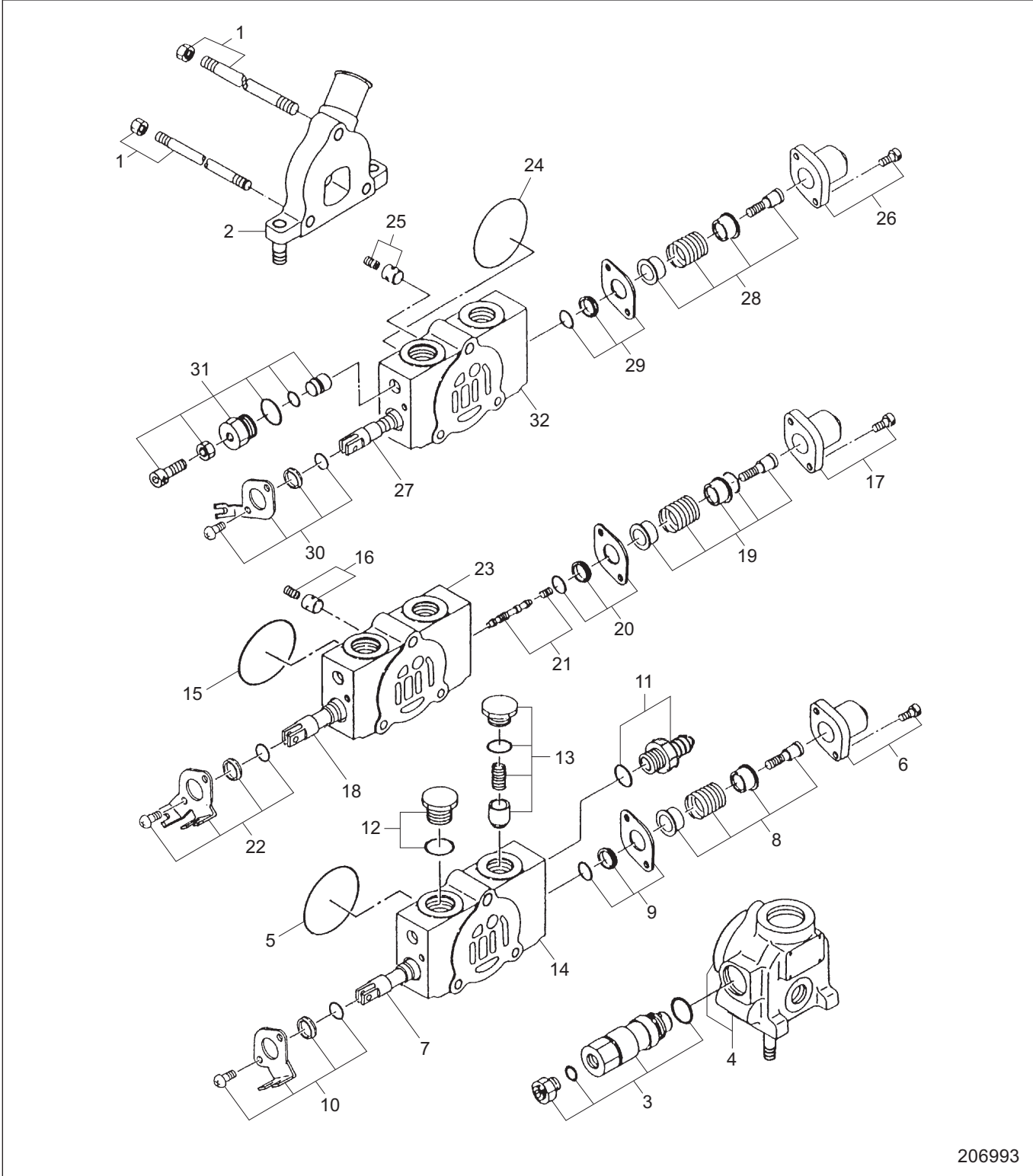
Tilt Backward



Disassembly and Reassembly

Procedures and Suggestions for Disassembly and Reassembly

Disassembly



206993

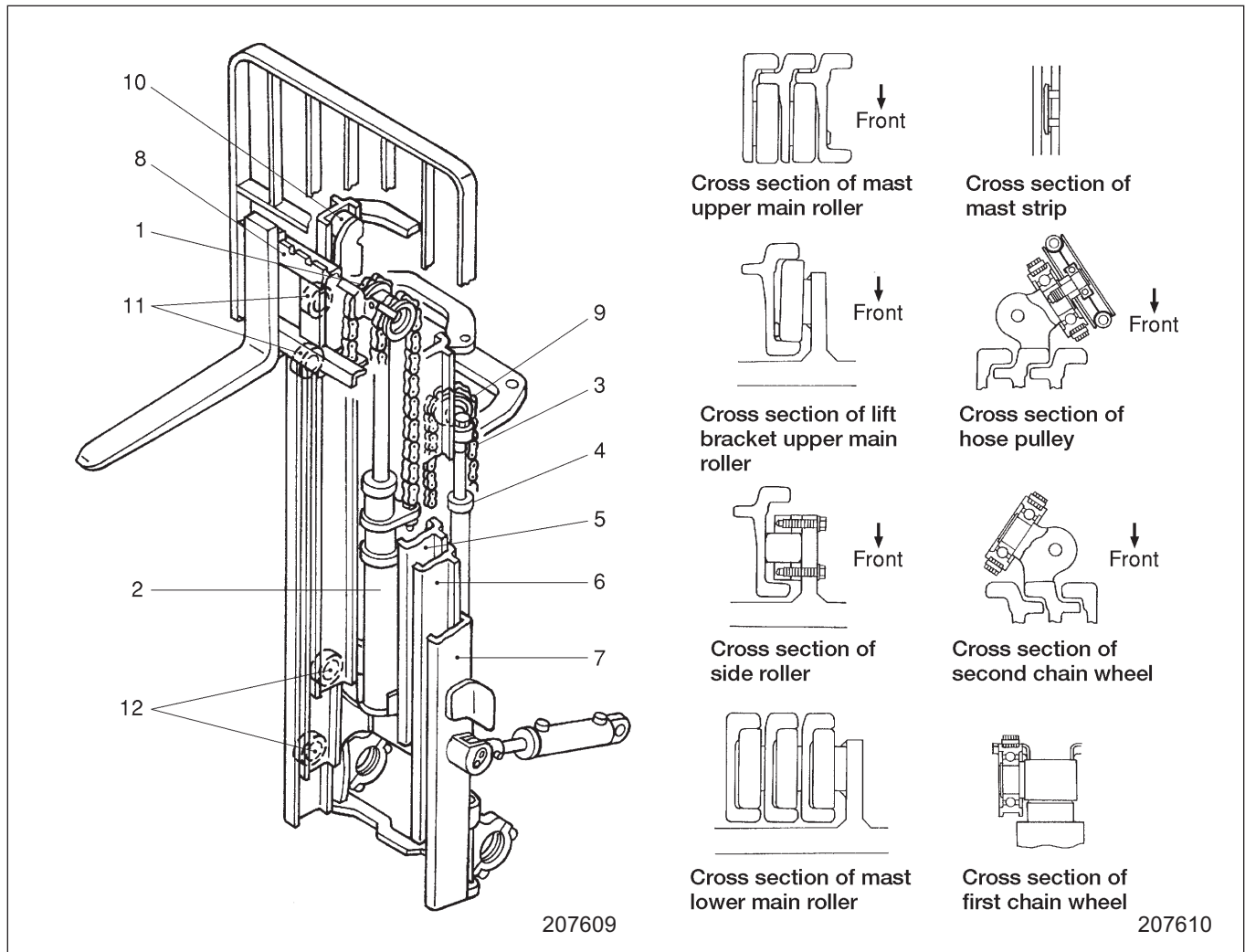
Service Data

A: Standard value

Unit: mm (in.)

Item		Truck Models		2 ton class, 2.5 ton class	3 ton class, 3.5 ton class
Simplex mast	Simplex mast Lift speed (rated load)	mm/sec (fpm)	A	FB20K PAC: 550 (108.3) FB25K PAC: 500 (98.4)	FB30K PAC : 450 (88.6) FB35K PAC : 400 (78.7)
	Simplex mast Lowering speed (rated load)	mm/sec (fpm)	A	500 (98.4)	
	Forward tilt angle		A	6°	
	Backward tilt angle		A	8°	
	Lift cylinder rod drift (rated load) Oil temperature 45 °C (113 °F)	mm (in.)/15 min.	A	50 (1.97), max	FB30K PAC: 40 (1.57), max FB35K PAC: 35 (1.38), max
	Tilt cylinder rod drift (forward) (rated load) Oil temperature 45 °C (113 °F)	mm (in.)/15 min.	A	20 (0.79), max	15 (0.59), max
Main relief valve setting		MPa (kgf/cm ²) [psi]	A	18.1 ^{+0.49} ₀ (185 ⁺⁵ ₀) [2625 ⁺⁷¹ ₀]	
Hydraulic pump	Capacity	cc (cu. in.)/rev	A	32.2 (1.96)	
Control valve	Tightening torque N·m (kgf·m) [lbf·ft]	Tie bolts (1/2 in.)	A	46 (4.7) [34]	
		Tie bolts (3/8 in.)	A	19 (1.9) [14]	

Triple-stage Full Free Panoramic Mast (Triplex Mast)



- | | | |
|------------------------|----------------|-----------------------------|
| 1 First lift chain | 5 Inner mast | 9 Second chain wheel |
| 2 First lift cylinder | 6 Middle mast | 10 Lift bracket main roller |
| 3 Second lift chain | 7 Outer mast | 11 Mast upper main roller |
| 4 Second lift cylinder | 8 Lift bracket | 12 Mast lower main roller |

The triplex mast provides a free lift amount until the top of lift bracket reaches the mast height.

The mast assembly consists of the inner mast, middle mast, outer mast, lift bracket, first lift cylinder and second lift cylinders.

The first lift cylinder raises the lift bracket, while the second cylinder operates the three-stage telescopic mechanism and lift bracket. Two pairs of lift chains are installed. The cylinders and lift chains are designed for smooth and effective operation.

For lifting operation, oil is first sent to the first lift cylinder which raises the forks until the cylinder rod reaches its stroke end.

When the first lift cylinder rod extends fully, the second lift cylinders raise the assembly consisting of the lift bracket, first lift cylinder, inner mast and middle mast.

The shoulder sections of the mast main rollers contact the mast rails. The rollers are installed perpendicular to the sliding surfaces.

The main rollers are the same as those in dual-stage panoramic mast (simplex mast).

3. Lift chains, chain wheels and chain wheel supports

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

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

Truck Model		2 ton class, 2.5 ton class	3 ton class, 3.5 ton class
		Item	
Length of lift chain (per 20 links)	A	381 (15.00)	508 (20.00)
	B	392 (15.43)	523 (20.59)

4. Mast strips

Check the mast strips for damage, wear or distortion.

Reassembly

To reassemble, follow the reverse of disassembly procedure, and follow the steps below:

1. Main rollers

- (1) Longitudinal clearance adjustment between mast and lift bracket

Rollers for mast and lift bracket are available in four sizes (diameters) for selective use. Select the size that will provide a longitudinal clearance of 1 mm (0.04 in.) or less.

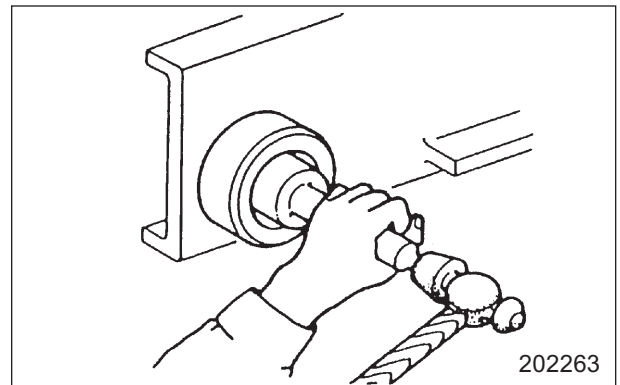
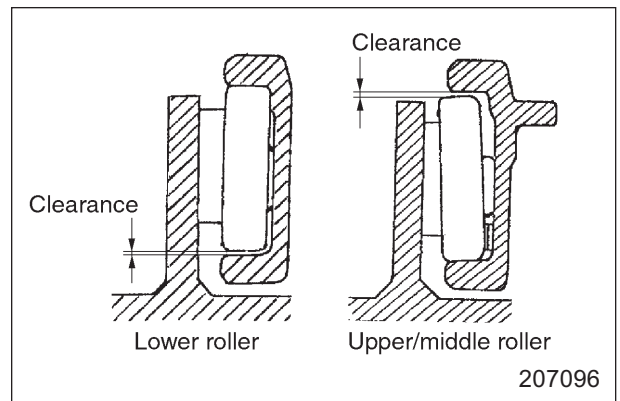
Roller sizes

Unit: mm (in.)

Truck Model		2 ton class, 2.5 ton class	3 ton class, 3.5 ton class
		Item	
Diam. of main roller	S	113.8 (4.48)	
	M	115 (4.53)	
	L	116 (4.57)	
	LL	117 (4.61)	

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

Place the roller with its larger chamfered side facing outside.



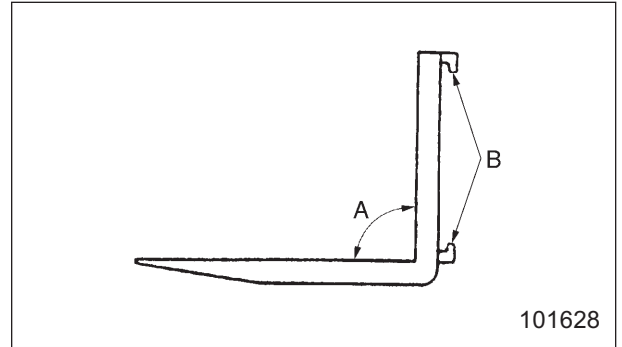
Inspection and Adjustment

Forks

1. Carefully inspect the forks for cracks. Special attention should be given to the heel section **A**, all weld areas and mounting brackets **B**.

Forks with cracks should be removed from service.

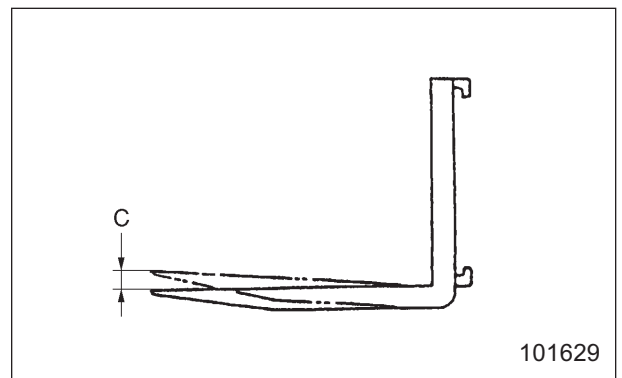
Magnetic particle inspection is generally preferred due to its sensitivity and the ease of interpreting the results.



2. Check the difference in height of one fork tip to the other when mounted on the fork carrier. A difference in fork tip height can result in uneven support of the load and cause problems when loaded.

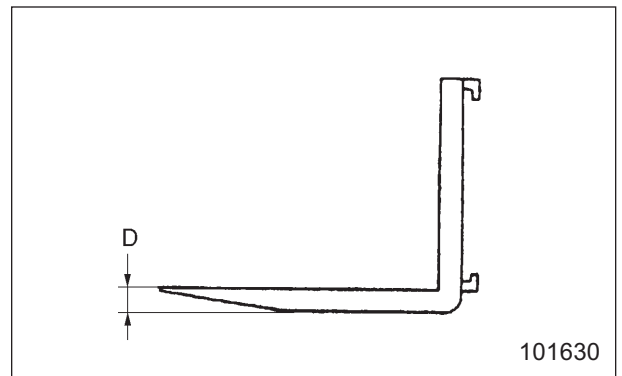
The maximum allowable difference in fork tip elevation **C** is 5 mm (0.20 in.) for pallet forks.

Replace one or both forks when the difference in fork tip height exceeds the maximum allowable difference.



3. Check the fork blade **D**. The fork should be withdrawn from service if the thickness is reduced to less than the allowable thickness.

Fork blade length may also be reduced by wear, especially on tapered forks and platens. Withdraw the forks from service when the blade length exceeds the repair/service limit.



Unit: mm (in.)

Truck Model \ Tolerant Thickness	Standard value	Repair or service limit
2 ton class, 2.5 ton class	40 (1.57)	38 (1.50)
3 ton class, 3.5 ton class	45 (1.77)	43 (1.69)

Procedure for replacing main roller shims
[Triple-stage full free panoramic mast (Triplex Mast)]

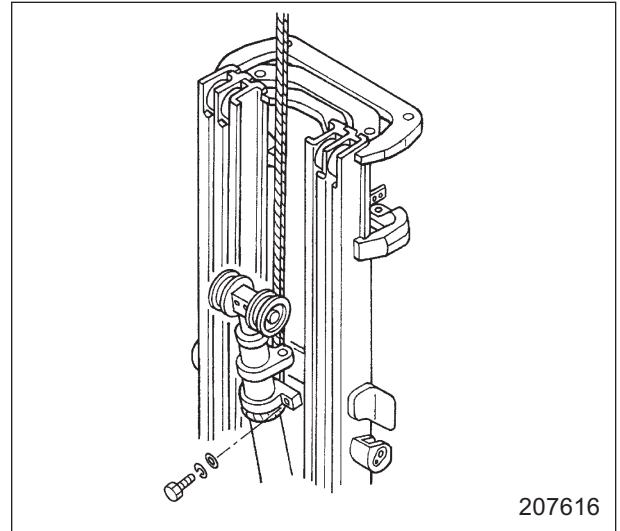
1. Remove the lift bracket from the mast.

NOTE

Refer to the “Removal and Installation” section (page 10-8) for the removal procedure of the lift bracket assembly.

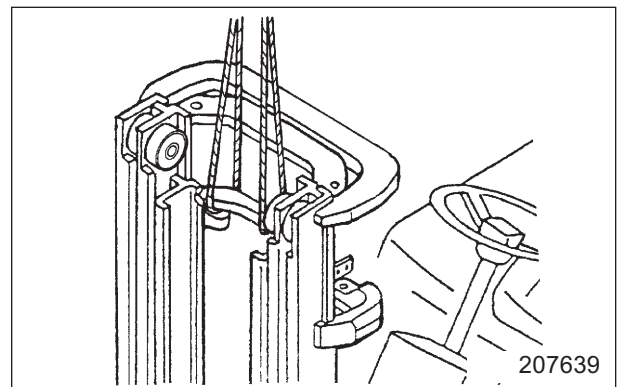
2. Removing first lift cylinder

- (1) Hitch a sling on the first lift cylinder, and suspend it with a hoist. Wind the sling securely to prevent slipping.
- (2) Remove lift cylinder connecting bolts and mounting bolts, and gently remove the first lift cylinder.



3. Position the inner mast lower than the middle mast by following the steps below:

- (1) Raise the front end of the forklift truck, and support it with blocks.
- (2) Hitch slings to the upper cross-member of the inner mast, and suspend with a hoist.
- (3) Remove the chain guards for the second lift chain wheels.
- (4) Dismount the second lift chains on the outer mast side, and place them in front of the inner mast.
- (5) Lower the inner mast until main rollers can be removed.
- (6) Place wood blocks under the inner mast for support.
- (7) Now the main rollers can be removed from the inner mast and middle mast. Remove the mast strips and shims in advance as they drop easily under this condition.



NOTE

In this condition, second lift cylinders cannot be dismounted.

Main Component Weights

Unit: kg (lb)

Item	Truck Models	
	2 ton class, 2.5 ton class	3 ton class, 3.5 ton class
Counterweight	FB20K PAC: 565 (1246) FB25K PAC: 758 (1671)	FB30K PAC: 776 (1711) FB35K PAC: 1160 (2557)
Power line		
Transfer, differential and front axle (without traction motor)	260 (573)	285 (628)
Traction motor	113 (249)	113 (249)
Head guard	70 (154)	73 (161)
Rear axle (with steering cylinder)	126 (278)	126 (278)
Mast [3.3 m (130 in.), Simplex]		
Outer mast	225 (496)	FB30K PAC: 251 (553) FB35K PAC: 258 (569)
Inner mast	154 (340)	FB30K PAC: 180 (397) FB35K PAC: 190 (419)
Lift bracket (including backrest)	132 (291)	FB30K PAC: 167 (368) FB35K PAC: 175 (386)
Forks (set of two)	109 (240)	147 (324)
Lift cylinder and related parts	80 (176)	FB30K PAC: 85 (187) FB35K PAC: 100 (220)
Mast [3.3 m (130 in.), Duplex]	459 (1012)	FB30K PAC: 870 (1918) FB35K PAC: 905 (1995)
Mast [4.8 m (189 in.), 4.7 m (185 in.), Triplex]	710 (1565)	FB30K PAC: 800 (1764) FB35K PAC: 838 (1847)

Symbols or abbreviation

OP	Option
R1/4	Taper pipe thread (external) 1/4 inch (formerly PT1/4)
Rc1/8	Taper pipe thread (internal) 1/8 inch (formerly PT1/8)
G1/4A	Straight pipe thread (external) 1/4 inch (formerly PF1/4-A)
Rp1/8	Straight pipe thread (internal) 1/8 inch (formerly PS1/8)

Units

1. SI Units are used in this manual.
2. The following table shows the conversion of SI unit and customary unit.

Item	SI unit	Customary unit
Force	1 N	0.1020 kgf
	(1 lbf)	(0.4536 kgf)
Pressure	1 kPa	0.0102 kgf/cm ²
	(1 psi)	(0.0703 kgf/cm ²)
Torque	1 N·m	0.1020 kgf·m
	(1 lbf·ft)	(0.1383 kgf·m)

CONTROLLER

Mode		A	b	C	d	E	
Feature/ Application		Standard	High Power	Economy	Long Distance	Short Shuttle	
Characteristic	Vehicle speed	Medium	Fast	Slow	Fast	Medium	
	Acceleration	Medium	Fast	Slow	Slow	Fast	
	Power	Medium	High	Low	Low	High	
	Lift	Medium	Medium	Slow	Medium	Medium	
	Tilt	Medium	Medium	Medium	Medium	Medium	
	Regeneration	Low	Low	Low	Low	High	SUO #
Default value	Max vehicle speed	18	20 (18) ⁾	16	20 (18) ⁾	12	7
	Acceleration rate	3	4	2	3	4	8
	Traveling power	2	3	1	3	2	9
	Start lift speed	1	1	1	1	1	2
	Top lift speed	9	9	8	9	9	3
	Tilt speed	3	3	3	3	3	4
	Automatic regeneration	7	7	7	7	7	23

⁾ Max vehicle speed of 3.5 ton truck is 18 km/h.

When the truck operation mode (SUO #1) is set, the values above are entered in the applicable set option items.

When default settings are changed, the indication (A to E) flashes to indicate that the settings are modified.

Other Functions

1. Service indicator (SUO #10)

When the vehicle hourmeter indication reaches the set value, the service indicator turns ON to notify the need for maintenance. Output power control can be also activated at the same time. The setting can be made in a range of 100 to 500 at 50 hour increments. The service indicator turns ON when the hourmeter indication exceeds the value of the current hourmeter reading plus the set value.

The indicator starts flashing 20 hours before the set time, and remains lit when the hourmeter indication reaches the set time. Setting "0.1" activates the demo mode. In this mode, the output power control is conducted six minutes after the setting is made.

2. Auxiliary input for function control (SUO #11, #14, #17)

Auxiliary inputs to the logic card can be used to prohibit lift.

3. Stall timer (SUO #20)

This option adjusts the time to shut down the truck when the traction motor torque is too high.

4. Tire size adjustment (SUO #27)

This function provides a correction value to compensate for a diameter change resulting from tire wear. It is used to adjust the vehicle speed data.

5. Auxiliary input for travel speed (SUO #30)

Auxiliary input to limit the maximum vehicle speed or reduce output power.

6. Auxiliary maximum travel speed setting (SUO #31)

This option determines the maximum travel speed limit of #30.

7. Auxiliary output power limit (SUO #32)

This option determines the output power limit in % of #30.

Removal and Installation of Logic Card

1. Removal of controller cover

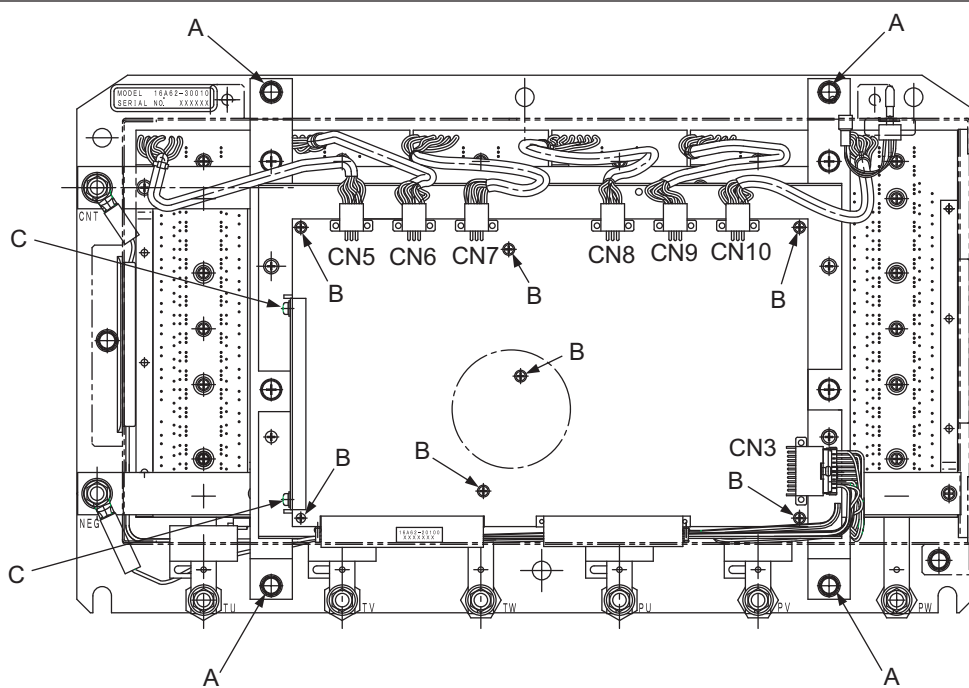
Remove the cover mounting screws (M6: 6 places), and remove the controller cover.

2. Removal of logic card

(1) Disconnect connectors CN3, CN5, CN6, CN7, CN8, CN9 and CN10.

(2) Remove the logic card bracket mounting screws (M6: 4 places marked A in the illustration below), and remove the logic card with bracket.

(3) Remove the logic card mounting screws (M3: 7 places marked B in the illustration below), and the heat-sink mounting screws (M4: 2 places marked C in the illustration below), and remove the logic card.



The screws marked A are for mounting the logic card bracket. The screws marked B and C are for mounting the logic card.

213481

3. Installation of logic card

Follow the removal procedure in reverse.

CONTROLLER

- Short-circuit P terminal and N terminal. Set the multimeter to the 20 k ohm range. Measure resistance between each terminal.

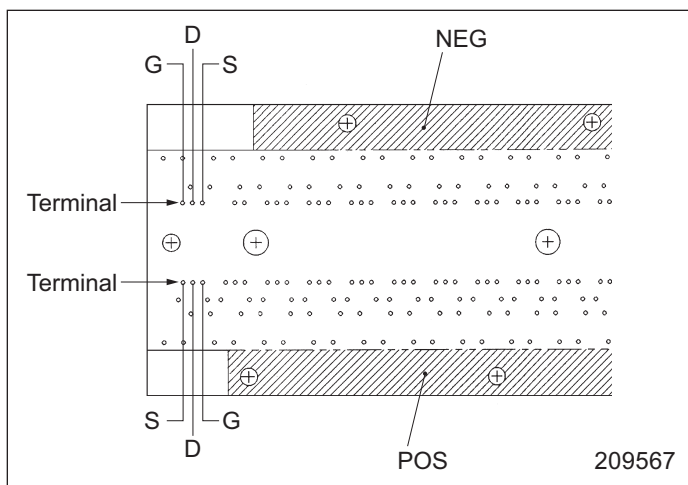
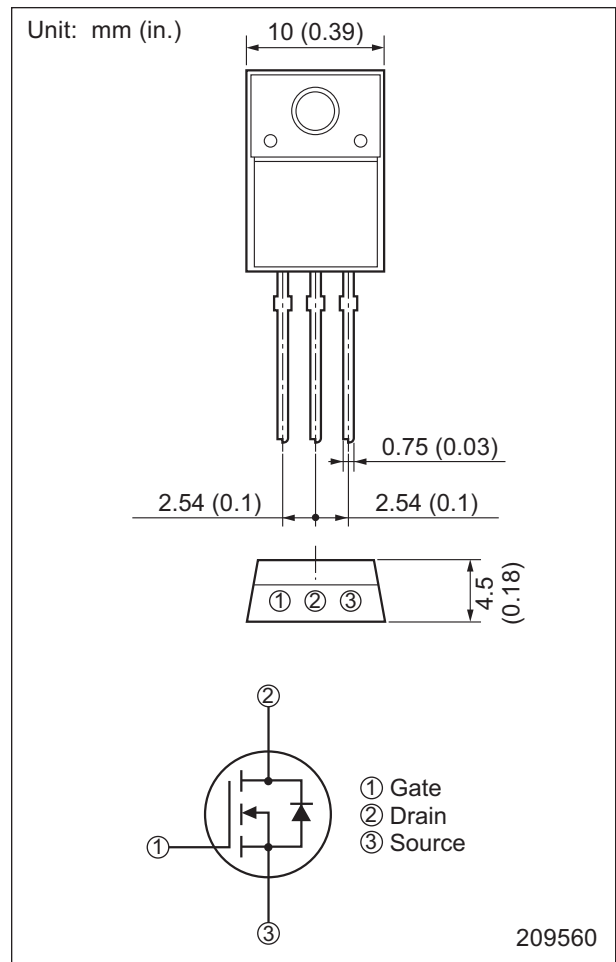
+ of multimeter	- of multimeter	Standard multimeter indication
N terminal	F terminal	1 M ohm or higher
P terminal	F terminal	1 M ohm or higher

- Set the multimeter to the 20 k ohm range. Measure resistance for each FET.

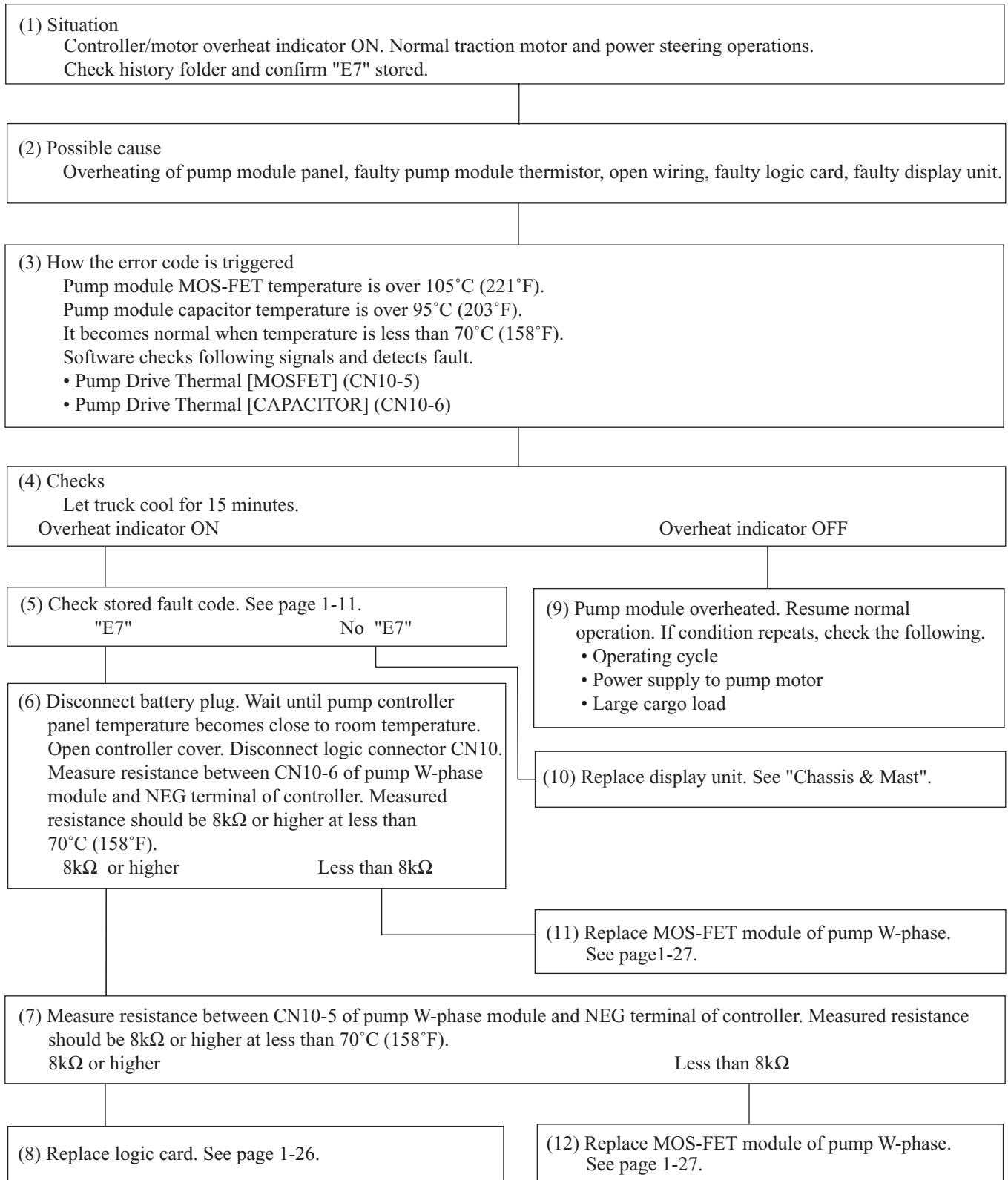
NOTE

The terminals of each MOS-FET module are covered with insulation coating. Remove the coating from the terminals shown in the illustration below before performing measurement. Apply insulation coating to the terminals after measurement.

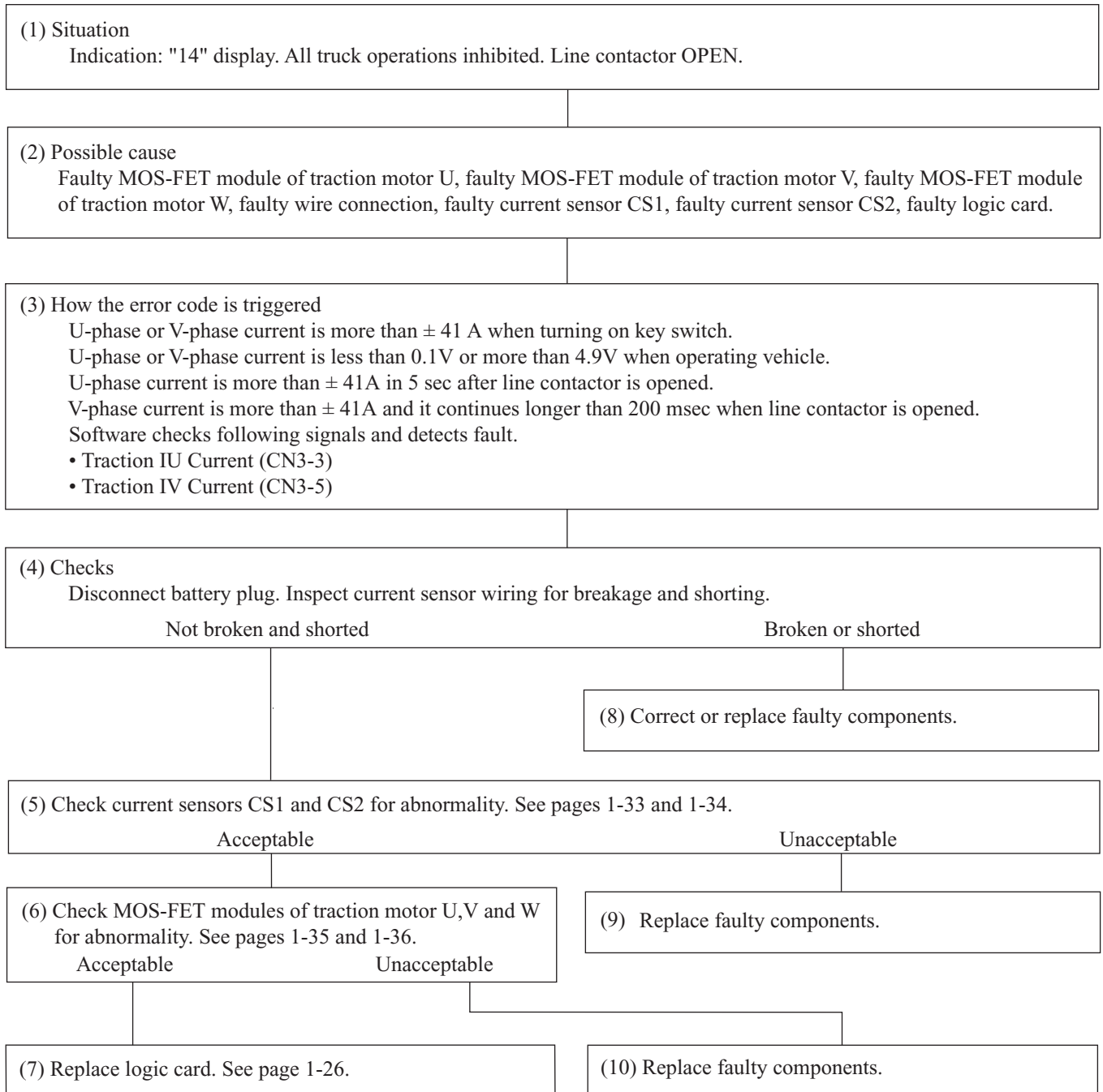
Location	+ of multimeter	- of multimeter	Standard multimeter indication
QL01 to QL20	Gate terminal	Source terminal	10.0 to 10.4 k ohm Exactly same for all
QH01 to QH20	Gate terminal	Source terminal	10.0 to 10.4 k ohm Exactly same for all



Problem: Pump Module, Overheating (E7)



Problem: Traction Motor Current Sensor Fault (14)



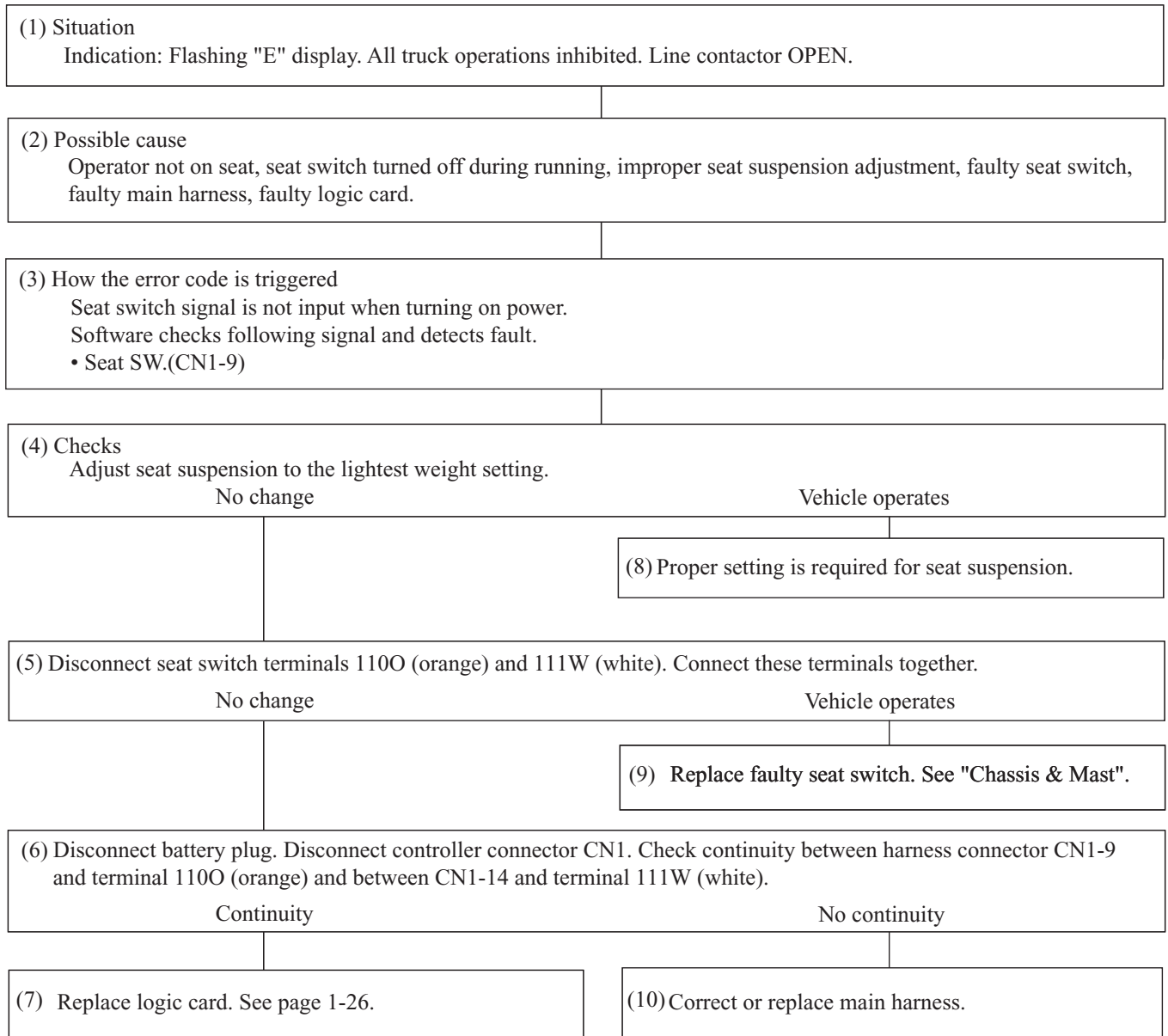
Problem: Pump Motor Driver V Fault (32)

<p>(1) Situation Indication: "32" display. All truck operations inhibited. Line contactor OPEN.</p>	
<p>(2) Possible cause Faulty MOS-FET module of pump motor V, faulty current sensor CS3, faulty current sensor CS4, faulty logic card.</p>	
<p>(3) How the error code is triggered Abnormal signal is input from pump V module. Software checks following signal and detects fault when signal is longer than 1 msec. • V ERR (CN9-2)</p>	
<p>(4) Check MOS-FET module of pump motor V for abnormality. See pages 1-35 and 1-36.</p>	
Acceptable	Unacceptable
	<p>(7) Replace faulty MOS-FET module of pump motor V. See page 1-27.</p>
<p>(5) Check current sensors CS3 and CS4 for abnormality. See pages 1-33 and 1-34.</p>	
Acceptable	Unacceptable
<p>(6) Replace logic card. See page 1-26.</p>	<p>(8) Replace faulty components.</p>

Problem: Accelerator Sensor Fault (51)

<p>(1) Situation Indication: "51" display. Traction and hydraulic operations inhibited. Line contactor HOLD and normal power steering operation.</p>			
<p>(2) Possible cause Improper accelerator pedal linkage, faulty accelerator sensor, faulty wire connection, faulty logic card.</p>			
<p>(3) How the error code is triggered Accelerator sensor voltage is out of range of 0.2V to 4.8V. Sensor voltage is 1.41V or more when accelerator switch is opened. Sensor voltage is 0.3V or less when accelerator switch is closed. Software checks following signals and detects fault when signal is longer than 200 msec.</p> <ul style="list-style-type: none"> • Accel Angle (CN1-19) • Accel Idle SW (CN1-7) 			
<p>(4) Checks Disconnect battery plug. Check link length of accelerator pedal. See "Chassis & Mast".</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">Acceptable</td> <td style="width: 50%; text-align: center;">Unacceptable</td> </tr> </table>		Acceptable	Unacceptable
Acceptable	Unacceptable		
	<p>(8) Adjust accelerator pedal linkage. See "Chassis & Mast".</p>		
<p>(5) Disconnect accelerator connector CN7 and controller connector CN1. Check continuity between CN7-141R (red) and CN1-18, CN7-142G (green) and CN1-19, CN7-143B (black) and CN1-20, CN7-144L (blue) and CN1-7.</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">Continuity</td> <td style="width: 50%; text-align: center;">No continuity</td> </tr> </table>		Continuity	No continuity
Continuity	No continuity		
	<p>(9) Correct or replace wiring.</p>		
<p>(6) Reconnect battery plug and connectors CN1 and CN7. Check voltage of CN1-19 without pressing accelerator pedal and while pressing accelerator pedal fully. Check continuity between accelerator wirings 143 and 144 without pressing accelerator pedal and while pressing accelerator pedal fully.</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">Acceptable</td> <td style="width: 50%; text-align: center;">Unacceptable</td> </tr> </table>		Acceptable	Unacceptable
Acceptable	Unacceptable		
<p>(7) Replace logic card. See page 1-26.</p>	<p>(10) Replace accelerator. See "Chassis & Mast".</p>		

Problem: Seat Switch Faulty Setting (Flashing E)



Problem: Attachment 3 Lever Faulty Setting (H5)

<p>(1) Situation Indication: "H5" display. All truck operations inhibited. Line contactor OPEN.</p>	
<p>(2) Possible cause Faulty SUO (Setup Option) setting, faulty wiring, faulty logic card.</p>	
<p>(3) How the error code is triggered Attachment 3 lever is not neutral when turning on power. Software checks following signals and detects fault. <ul style="list-style-type: none"> • Attach 3 Joystick (CN2-26) (FC) • Attach 3 SW. (CN2-18) (MC) </p>	
<p>(4) Checks Check SUO (#43 and #45 in group 3) setting.</p>	
Acceptable	Unacceptable
	<p>(7) Set proper setting. See pages 1-12 to 1-14.</p>
<p>(5) Check controller connector CN14-18 and CN14-26. These should be open (not connected).</p>	
No continuity	Continuity
<p>(6) Replace logic card. See page 1-26.</p>	<p>(8) Correct or replace wiring.</p>

Problem: Controller Fault (66)

(1) Situation

Indication: "66" display. All truck operations inhibited. Line contactor OPEN.

(2) Possible cause

Faulty logic card.

(3) How the error code is triggered

ROM SUM value of logic card is different from check data. Writing or deletion check faults of RAM and Dual Port RAM. Data communication fault between traction CPU and pump CPU.

(4) Replace logic card. See page 1-26.

Problem: Battery Consumption Too High (Flashing Lo)

<p>(1) Situation Indication: Flashing "Lo" display. All truck operations inhibited. Line contactor OPEN.</p>			
<p>(2) Possible cause Too much consumption with small capacity, poor battery, improper battery voltage adjustment setting (Setup Option #46), faulty line contactor, faulty wiring, faulty logic card.</p>			
<p>(3) How the error code is triggered When battery voltage is less than 22 V. Software checks following signal and detects fault. • POS Voltage (CN1-30)</p>			
<p>(4) Check battery voltage in case of both operating and non operating.</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center; border: none;">22 V or more</td> <td style="width: 50%; text-align: center; border: none;">Less than 22 V</td> </tr> </table>		22 V or more	Less than 22 V
22 V or more	Less than 22 V		
<p>(5) Set #46 of Setup Option Group 3. See pages 1-12 to 1-14.</p>	<p>(10) Charge battery or replace with new battery.</p>		
<p>If fault remains</p>			
<p>(6) Disconnect battery plug. Check the line contactor tip for breakage, burned and movement.</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center; border: none;">Acceptable</td> <td style="width: 50%; text-align: center; border: none;">Unacceptable</td> </tr> </table>		Acceptable	Unacceptable
Acceptable	Unacceptable		
<p>(11) Replace contactor.</p>			
<p>(7) Check resistance of contactor coil.</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center; border: none;">118 to 145Ω</td> <td style="width: 50%; text-align: center; border: none;">Lower than 118Ω or more than 145Ω</td> </tr> </table>		118 to 145Ω	Lower than 118Ω or more than 145Ω
118 to 145Ω	Lower than 118Ω or more than 145Ω		
<p>(12) Replace contactor coil.</p>			
<p>(8) Disconnect controller connector CN2. Check continuity between CN2-31 and line contactor coil A1 (red), and CN2-33 and line contactor coil A2 (green).</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center; border: none;">Continuity</td> <td style="width: 50%; text-align: center; border: none;">No continuity</td> </tr> </table>		Continuity	No continuity
Continuity	No continuity		
<p>(9) Replace logic card. See page 1-26.</p>	<p>(13) Replace or correct contactor wiring.</p>		

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