



Service Manual

Chassis, Mast & Options

EP10KRT	ETB10-00011-up
EP12KRT	ETB10-20001-up
EP15KRT	ETB10-50001-up

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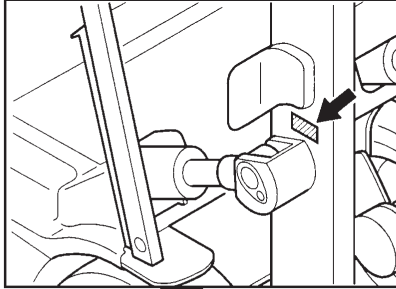


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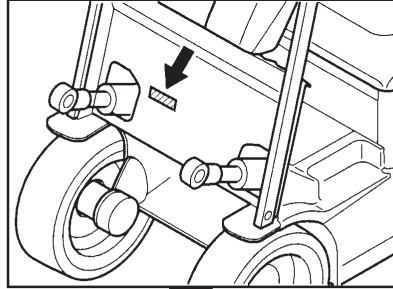
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Serial Number Locations

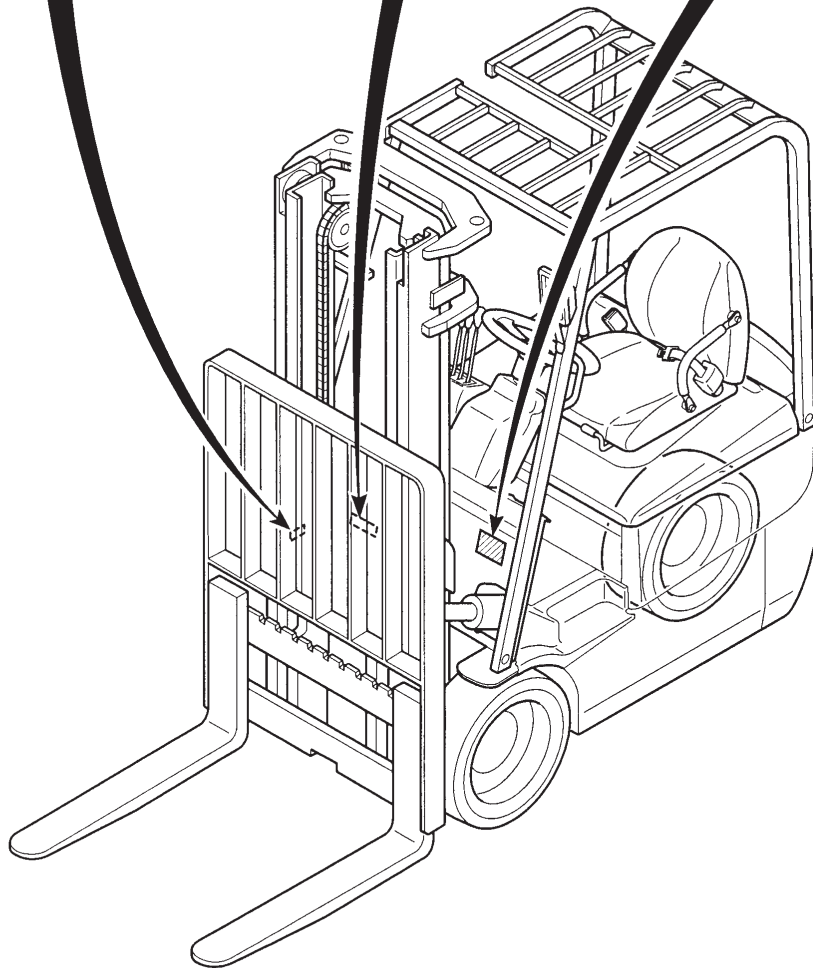
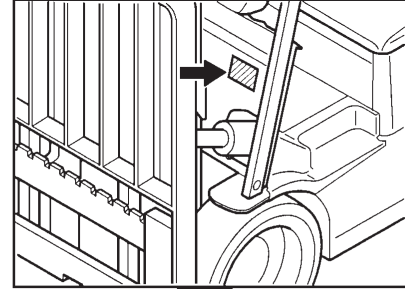
Mast number



Chassis number

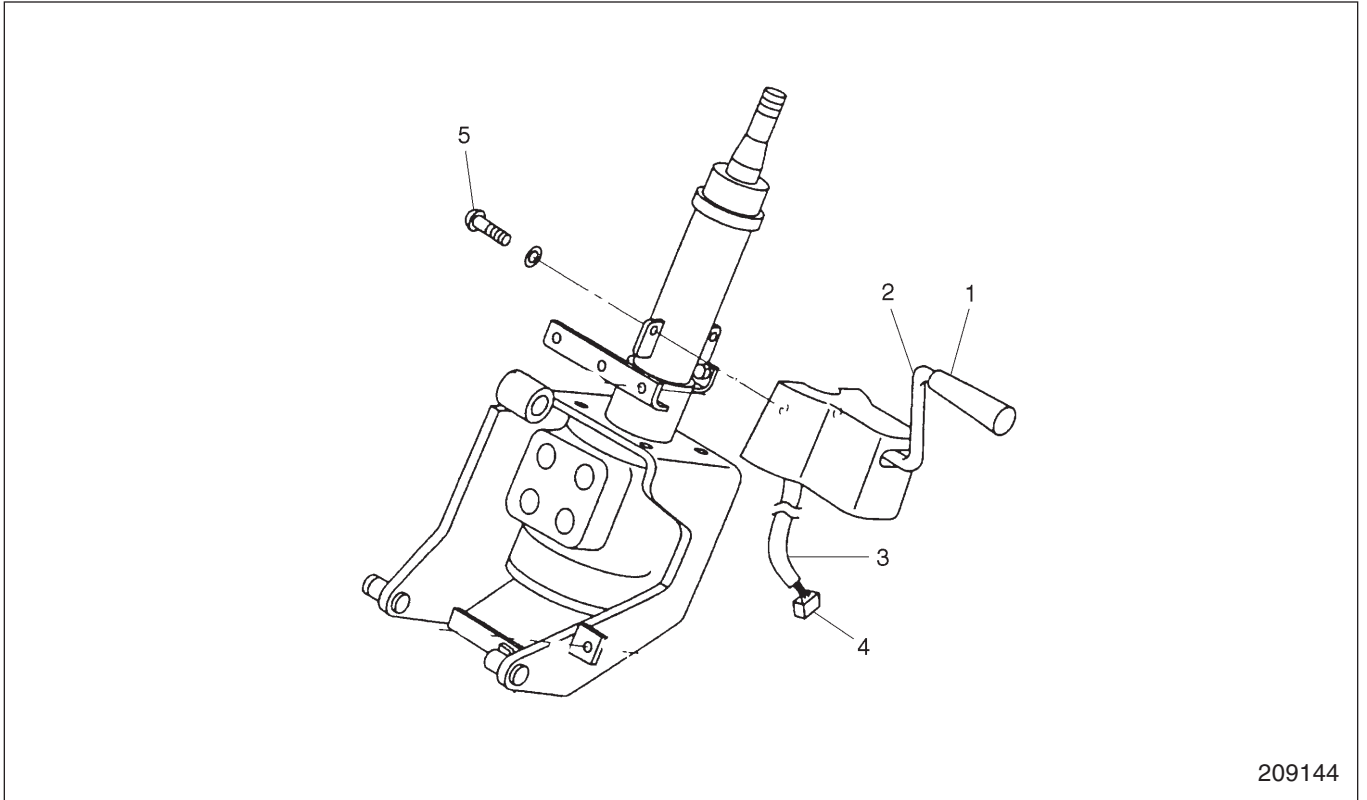


Nameplate



Direction Lever

Structure



- 1 Knob
- 2 Lever
- 3 Harness

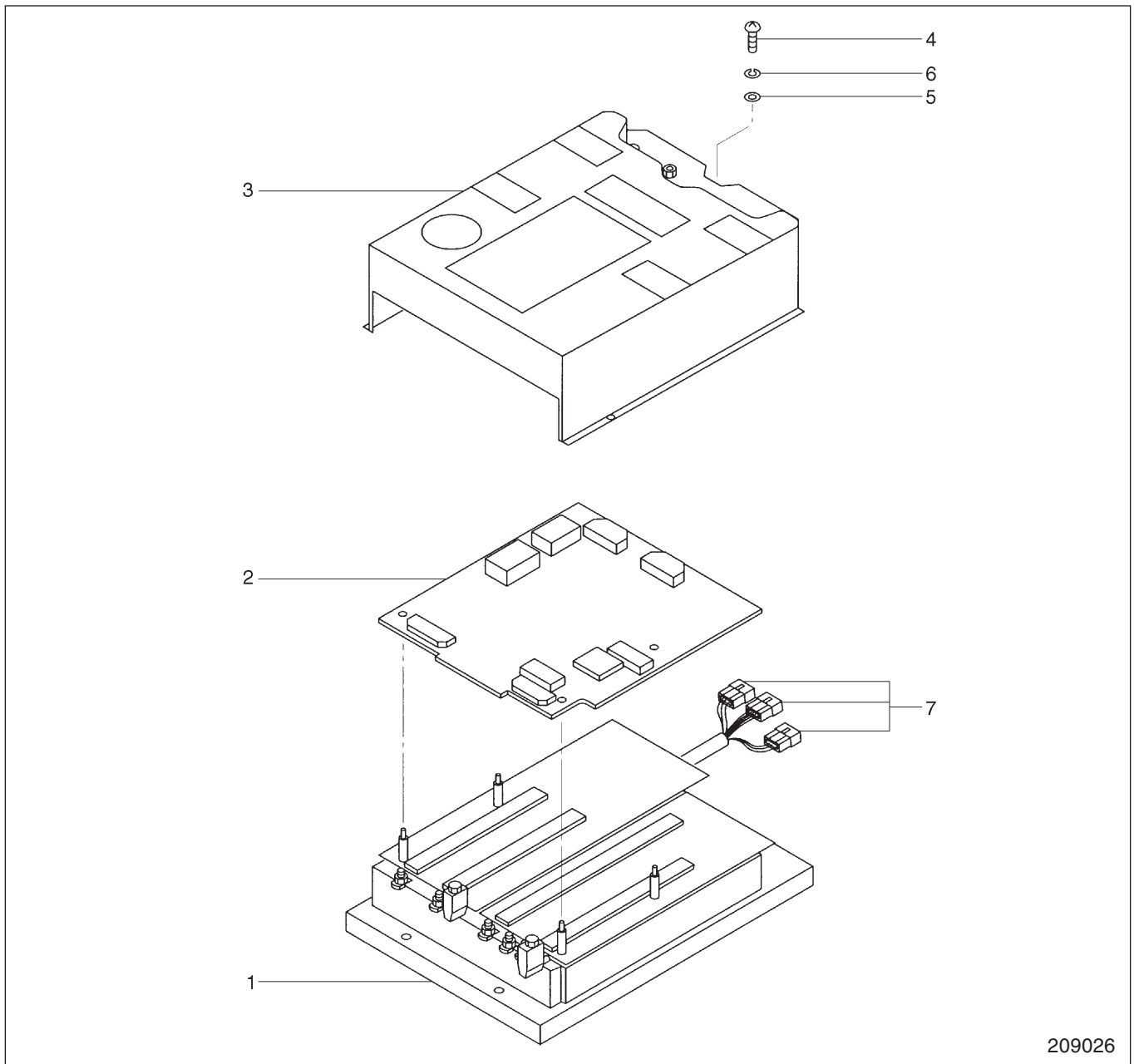
- 4 Connector
- 5 Screw, Spring washer

Outline of Controller

The controller is the heart of the truck operating system.

The logic card contains decision making functions, and is equipped with a battery discharge indicator and a malfunction diagnostic function.

The controller is used to operate the drive motor and hydraulic motor.



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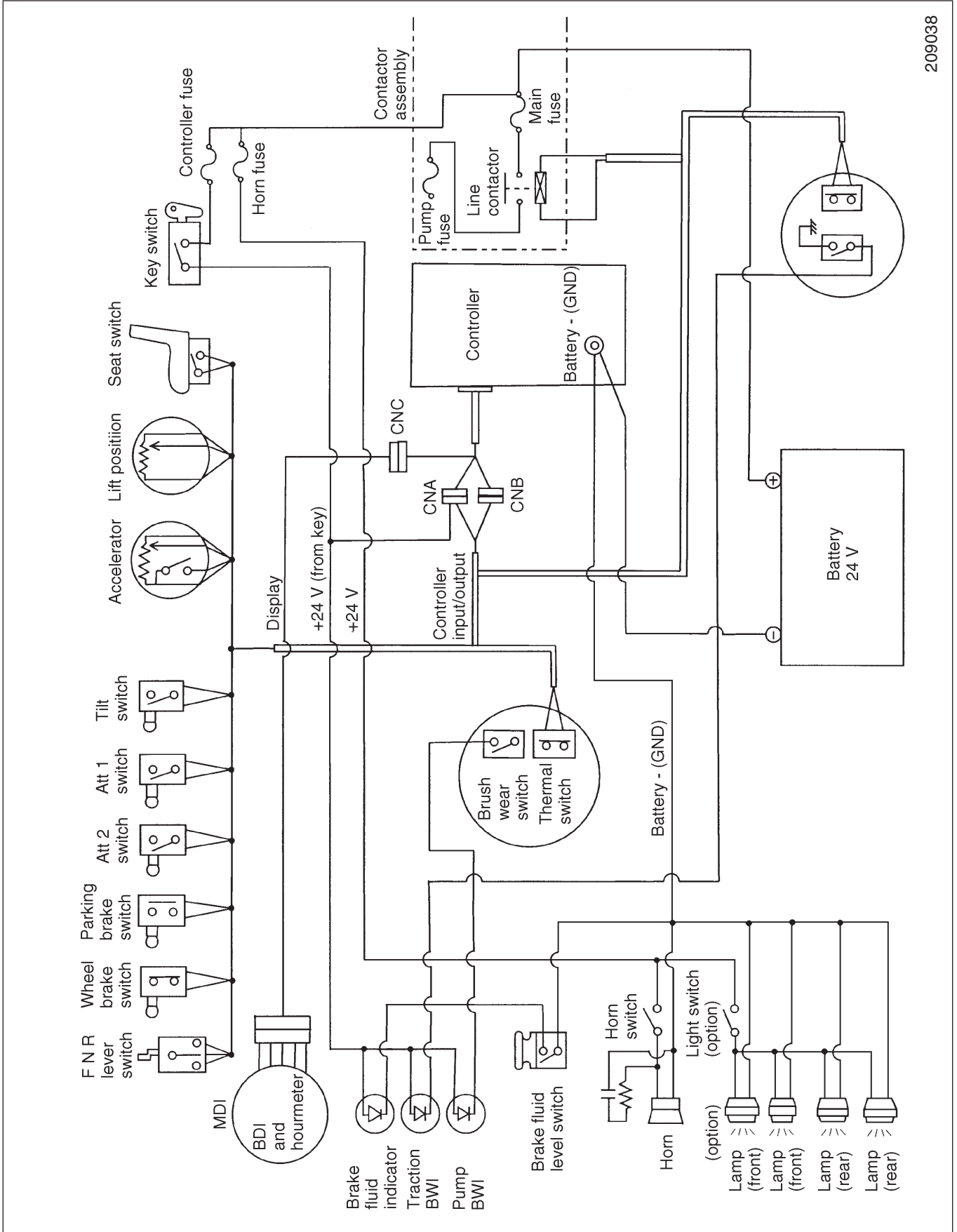
- 1 Controller
- 2 Logics assembly
- 3 Cover
- 4 Screw

- 5 Washer
- 6 Spring washer
- 7 Connector

Malfunction Detection

Malfunction	Detection method/condition	Display					Error code	Fail-safe process	Reset method
		LED							
		Error	Brake	Battery	Thermal	Brush			
Drive motor overheat	Signal input			*		AL065	Output power control	Cooling	
Pump motor overheat	Signal input			*		AL017	Output power control	Cooling	
Controller overheat	Signal input	*				AL062	Output power control	Cooling	
Drive motor brush wear					*				
Pump motor brush wear					*				
Brake fluid low			*						
Drive motor transistor wire breakage	Check the main circuit voltage level	*				AL060	Line contactor OFF	Power reset	
Drive motor transistor shorting	Check the main circuit voltage level	*				AL032	Line contactor OFF	Power reset	
Drive motor stall timer	Time duration elapsed	*				AL072	Line contactor OFF	Power reset	
Drive motor transistor drive error	Error detection signal from drive card	*				AL060	Line contactor OFF	Power reset	
Drive motor current sensor error	Check the current sensor output value	*				AL053	Line contactor OFF	Power reset	
Drive motor armature over current	500 A	*				AL069	Line contactor OFF	Power reset	
Drive motor field over current	50 A	*				AL057	Line contactor OFF	Power reset	
Drive motor field error	Compare the current instruction value and actual current valve	*				AL058	Line contactor OFF	Power reset	
Drive motor field drive error	Error detection signal from H bridge card	*				AL015	Line contactor OFF	Power reset	
Pump motor transistor wire breakage	Check the main circuit voltage level	*				AL028	Line contactor OFF	Power reset	
Pump motor transistor shorting	Check the main circuit voltage level	*				AL028	Line contactor OFF	Power reset	
Pump motor transistor drive error	Error detection signal from drive card	*				AL028	Line contactor OFF	Power reset	
Pump motor current sensor error	Check the current sensor output value	*				AL056	Line contactor OFF	Power reset	
Pump motor over current	500 A	*				AL035	Line contactor OFF	Power reset	
Line contactor error	Check the main circuit voltage level	*				AL037	Line contactor OFF	Power reset	
Regeneration diode error	Check the main circuit voltage level	*				AL032	Line contactor OFF	Power reset	
Drive motor armature diode error	Check the main circuit voltage level	*				AL032	Line contactor OFF	Power reset	
Pump motor armature diode error	Check the main circuit voltage level	*				AL028	Line contactor OFF	Power reset	
Drive motor armature breakage	Check the main circuit voltage level	*				AL032	Line contactor OFF	Power reset	
Pump motor armature breakage	Check the main circuit voltage level	*				AL028	Line contactor OFF	Power reset	
Accelerator error	Input range exceeded	*				AL078	Line contactor OFF	Power reset	

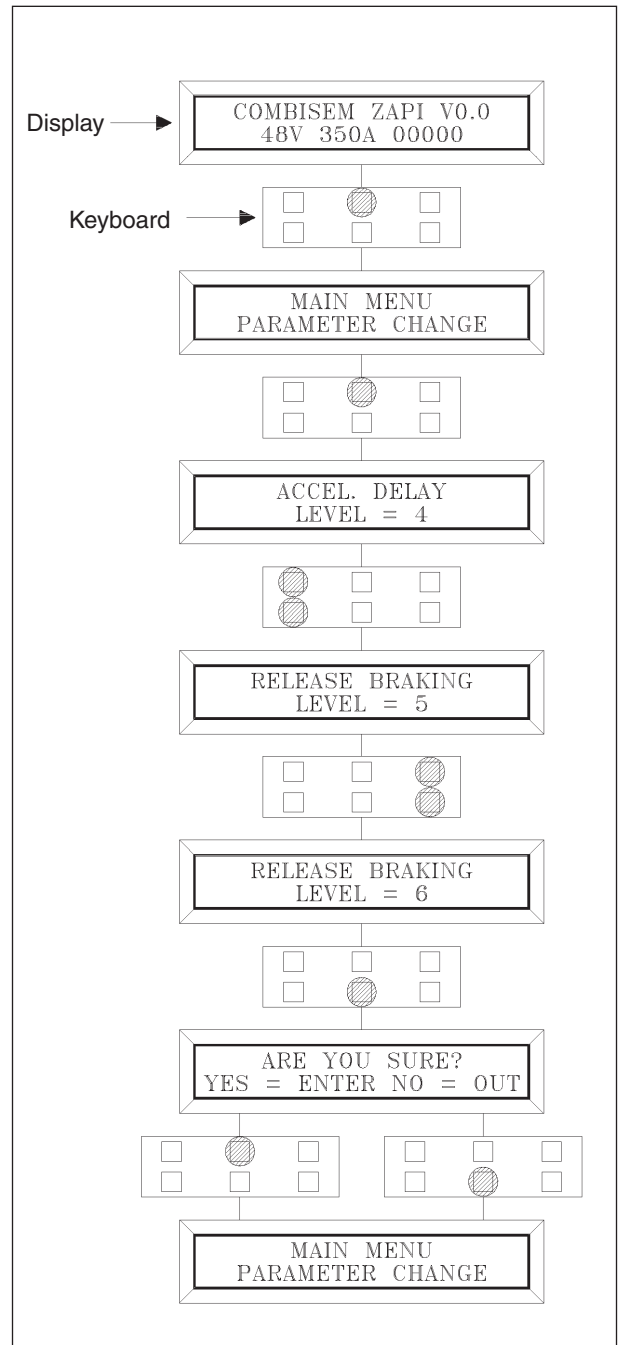
System Construction



209038

Flow Chart showing how to make Program changes using Digital Console fitted with Eprom CK ULTRA.

- 1) Opening Display.
- 2) Press ENTER to go into the General Menu.
- 3) The Display will show: PARAMETER CHANGE.
- 4) Press ENTER to go into the Parameter Change facility.
- 5) The Display will show the first Parameter.
- 6) Press either ROLL UP and ROLL DOWN to display the next parameter.
- 7) The names of the Parameters appear on the Display.
- 8) When the desired Parameter appears, the Display will show a Level Number that will be between 0 and 9. press either PARAM (Top Right) or SET (Bottom Right) buttons to change the Level value.
- 9) The Display will show the New Level.
- 10) When you are satisfied with the results of the changes you have made, Press OUT.
- 11) The Display asks "ARE YOU SURE ?"
- 12) Press ENTER to accept the changes, or Press OUT if you do not wish to accept the changes and wish to make further modifications to the parameters.
- 13) The Display will show: PARAMETER CHANGE
- 14) Press either ROLL UP and ROLL DOWN to display other parameters or press OUT.



(6) Description of alarms menu

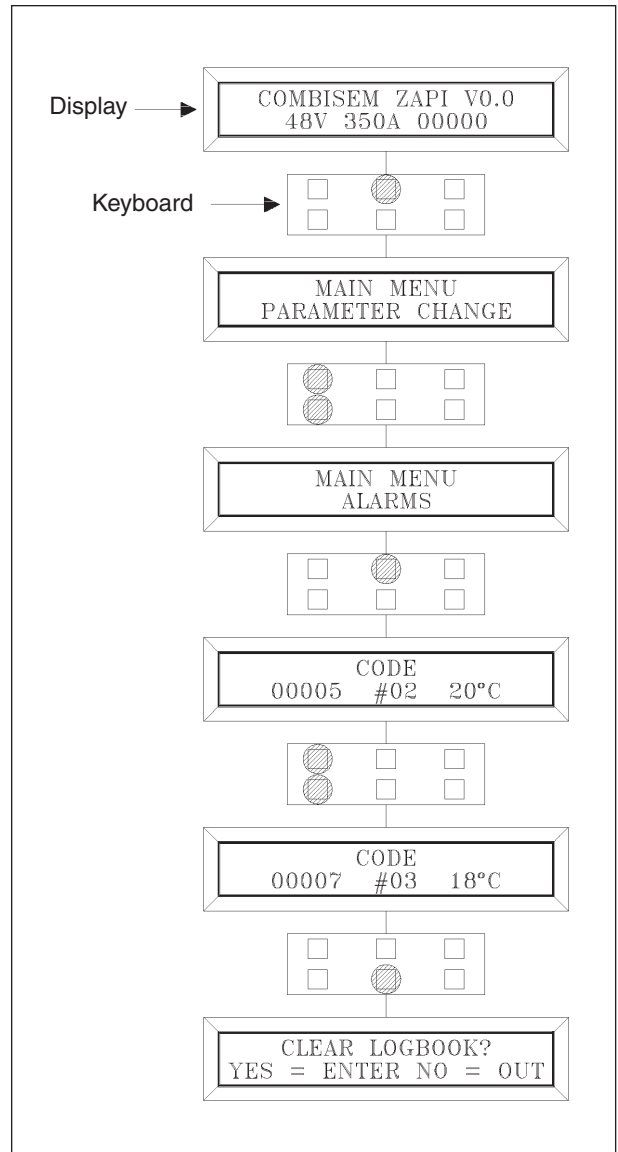
The microprocessor in the chopper remembers the last five alarms that have occurred.

Items remembered relative to each alarm are: the code of the alarm, the number of times the particular alarm occurred, the hour meter count, and the chopper temperature.

This function permits deeper diagnosis of problems as the recent history can now be accessed.

Flow chart showing how to use the ALARMS function via the digital console.

- 1) Opening Display.
- 2) Press ENTER to go into the General menu.
- 3) The Display will show:
- 4) Press ROLL UP or ROLL DOWN button until PARAMETER CHANGE appears on the display.
- 5) The display will show:
- 6) Press ENTER to go into the ALARMS function.
- 7) The display will show the most recent alarm.
- 8) Each press of the ROLL UP button brings up following alarms. Pressing ROLL DOWN returns to the most recent.
- 9) If an alarm has not occurred, the display will show: ALARM NULL.
- 10) When you have finished looking at the alarms, press OUT to exit the ALARMS menu.
- 11) The display will ask CLEAR LOGBOOK?
- 12) Press ENTER for Yes, or OUT for NO.
- 13) Press OUT to return to the opening display.



Problem: Brake Oil, Low Level

Symptom:

- (1) Low brake oil indicator ON.
Normal vehicle operation.

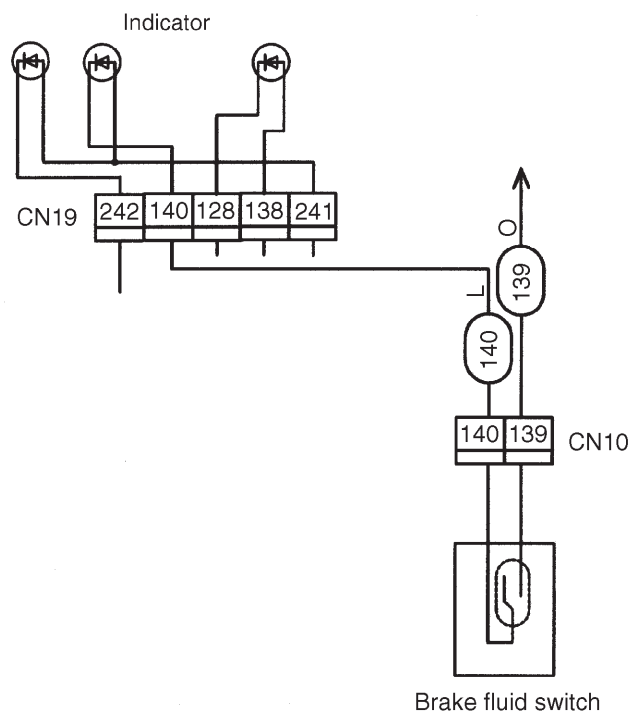
Possible Cause:

- (2) Insufficient brake oil, open wiring, display unit defect.

Checks:

- (3) Check oil level in bare oil reservoir tank
 - Oil level lower than LOW mark
Add brake oil.
 - Oil level higher than LOW mark
- (4) Disconnect battery plug. Disconnect level sensor connector CN10, and check continuity.
 - Continuity
Replace level sensor.
 - No continuity
- (5) With connector CN10 and CN19 disconnected, check continuity between harness connector CN10 socket wire 140-L (blue) and CN19 and between 139-O (orange) and controller.
 - No continuity
Correct or replace wiring.
 - Continuity
Replace traction logic card.

Brake oil level sensor: Normally OFF
(Low oil level: ON)



Brake fluid switch

209050

Problem: Drive Motor, Field Over-current

Symptom:

(1) Display = "AL057".

Inhibit drive and hydraulic operation. Normal power steering operation.

Possible Cause:

(2) Traction current sensor failure, faulty wiring, fault in logic card.

Checks:

(3) Disconnect battery plug.

Inspect field wiring for wire breakage and short.

- Broken or shorting

Correct or replace faulty components.

- No broken and no shorted wire

(4) Replace logic card.

- Unacceptable

Replace controller.

Problem: Forward / Reverse Lever, Tilt Lever, Attachment 1 Lever, Attachment 2 lever, Faulty Setting

Symptom:

(1) Display = "AL079".

Inhibit vehicle operation. Line contactor OFF.

Possible Cause:

(2) Key switch turned on while forward / reverse lever was left either in forward or reverse position. Key switch turned on while tilt lever, Attachment 1 lever or Attachment 2 lever was in ON position or accelerator pedal was depressed. Faulty forward / reverse lever switch, tilt lever switch, Attachment 1 lever switch and Attachment 2 lever switch; logic card defect.

Checks:

(3) Move forward / reverse, tilt, Attachment 1 and / or Attachment 2 levers to neutral. Select direction of movement again and depress accelerator pedal.

- Normal vehicle operation

Correct starting procedure requires all of forward / reverse, tilt, Attachment 1 and Attachment 2 levers be in neutral position and accelerator pedal be released when key switch is turned on.

- No change

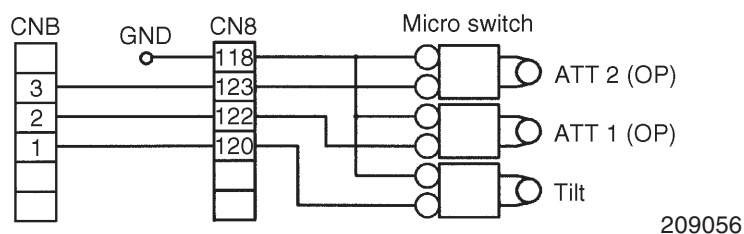
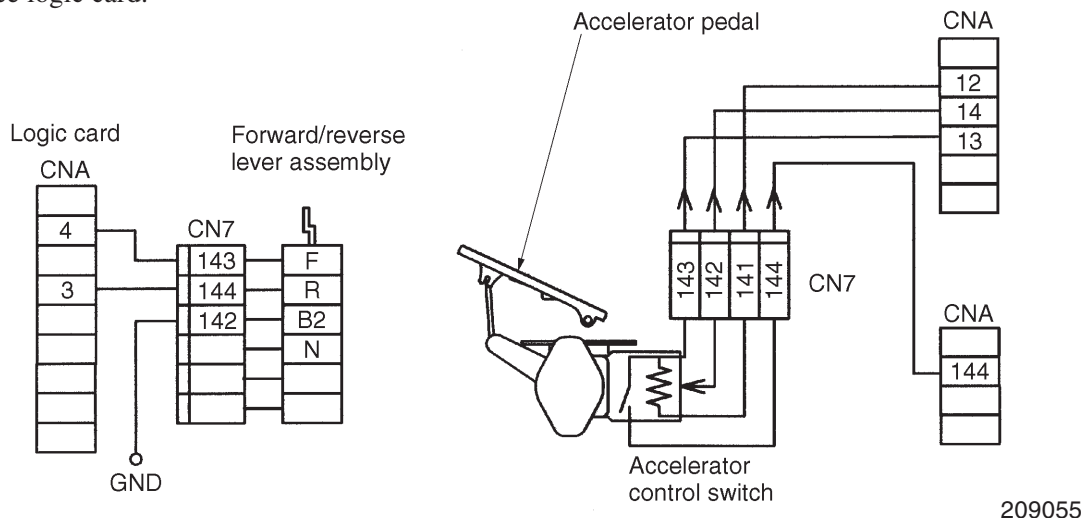
(4) Use self-diagnostic function to locate faulty circuit or component.

- Faulty component located

Correct or replace faulty component.

- Faulty component not located

Replace logic card.



Problem: Battery Consumption

Symptom:

(1) Battery low indicator “AL066”.

Poor traction power and acceleration. Lifting speed slower than normal.

Possible Cause:

(2) Much consumption with small capacity or poor battery.

Checks:

(3) Check battery voltage in case of both operating and non operating.

- Battery voltage lower than 23.6 V

Check the following:

Battery capacity

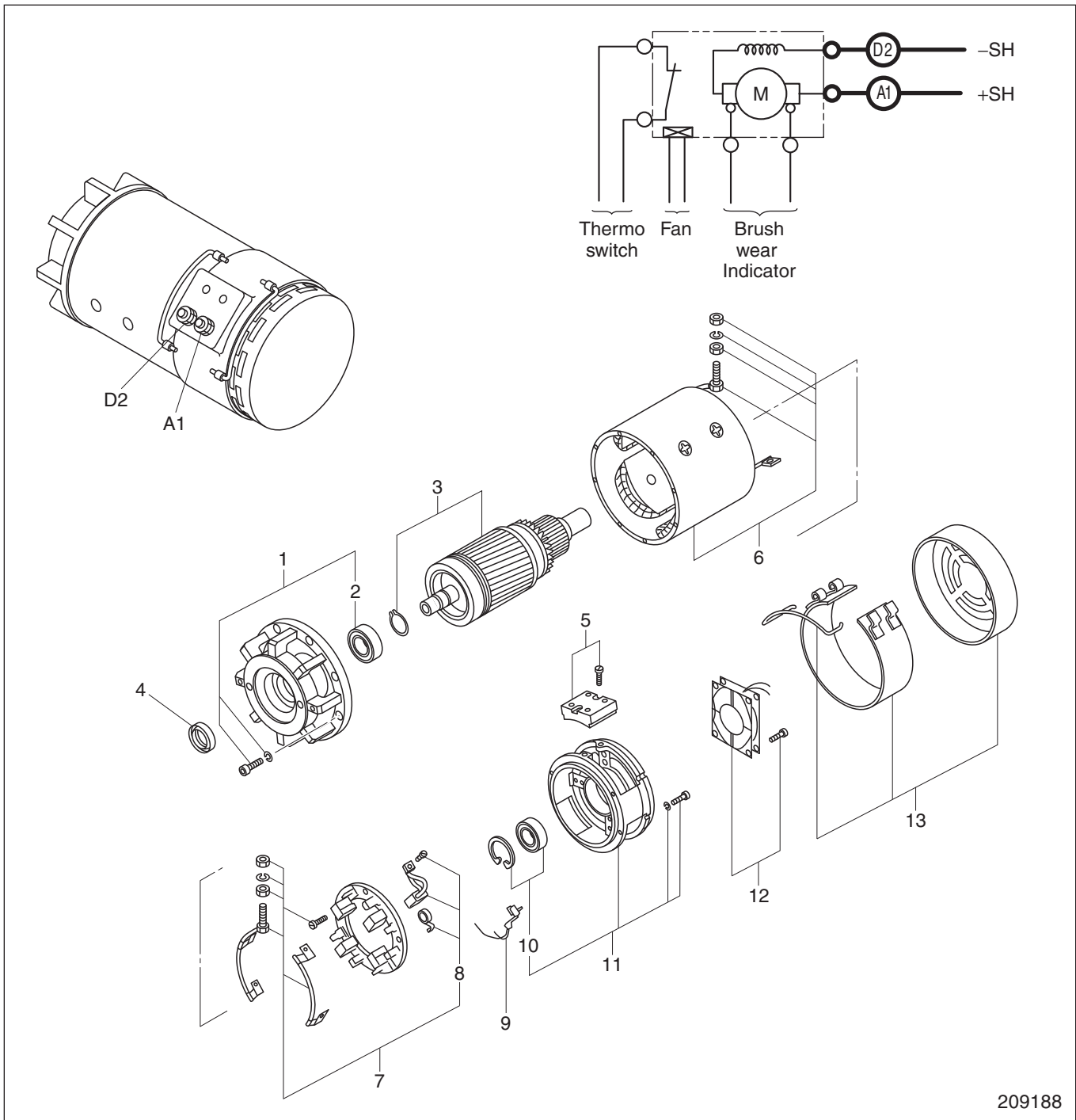
Power supply to pump motor

Large cargo load

- Battery voltage higher than 23.6 V

Replace logic card.

Pump Motor



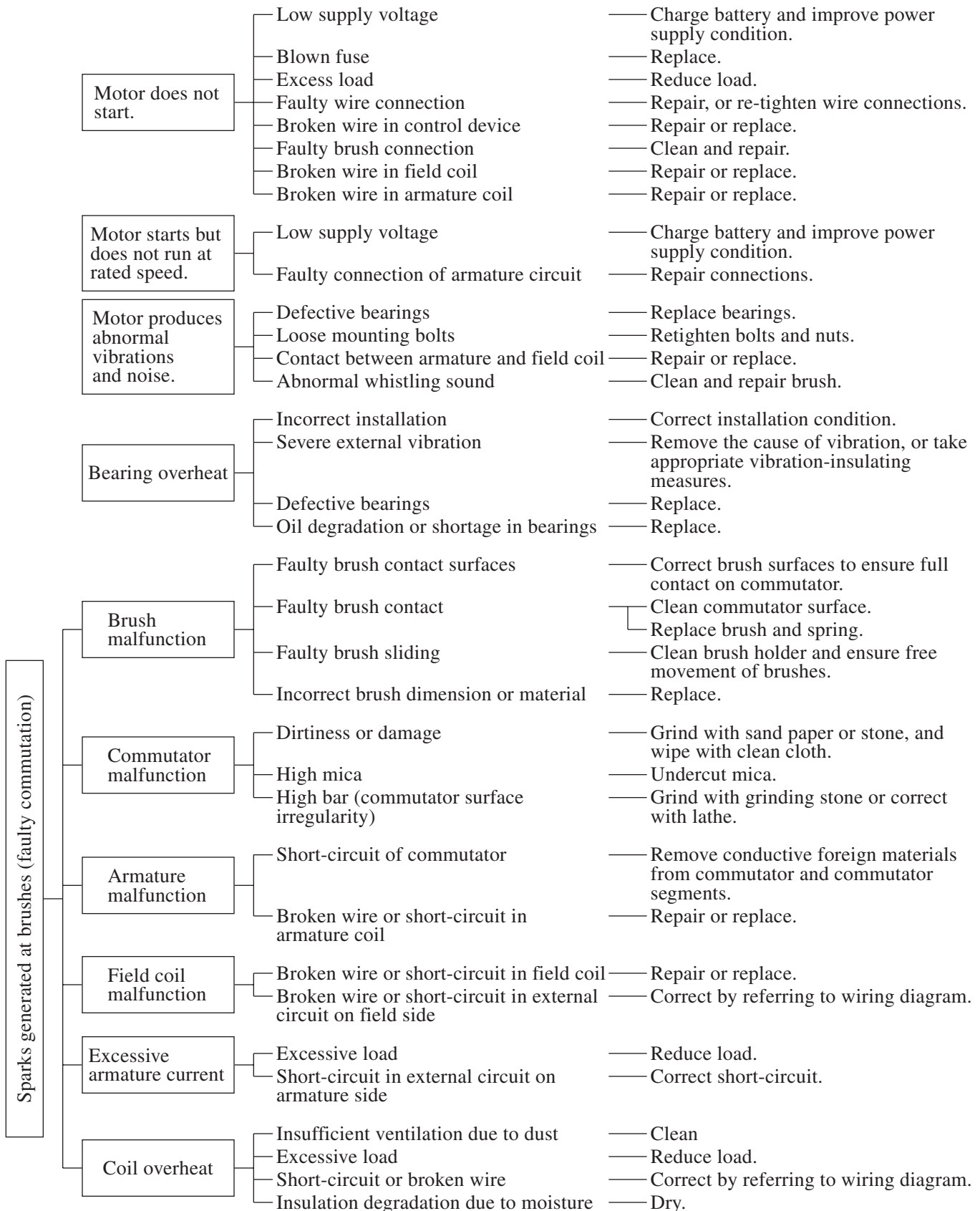
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Main components

- | | |
|---------------------|-------------------------------|
| 1 Drive end bracket | 8 Set of brushes with springs |
| 2 Bearing | 9 Thermal protector |
| 3 Armature | 10 Bearing |
| 4 Gasket | 11 Commutator end bracket |
| 5 Connection plate | 12 Fan |
| 6 Stator | 13 Cover |
| 7 Brush holder | |

Troubleshooting

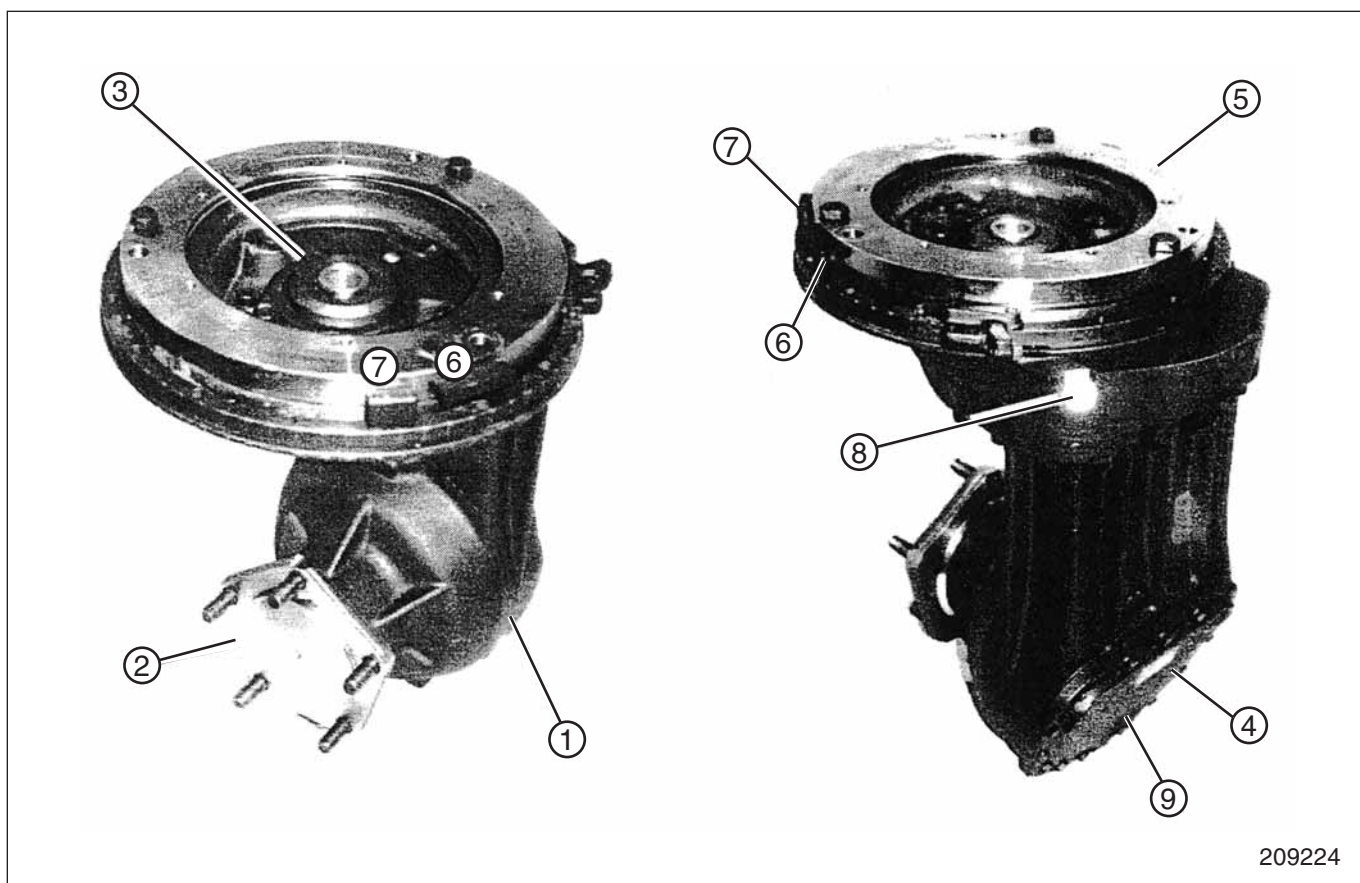
Problems with rotation of the motor are attributable not only to a fault in the motor itself but also to a fault in the controller that supply the motor with electric power. Therefore, you should perform motor troubleshooting also referring to the Troubleshooting section in the “Group 3 Main Controller” in addition to this page.



REAR AXLE

(2) Rear axle assembly schematic

- 1 Rear axle housing
- 2 Wheel shaft
- not illustrated gear set, consisting of input pinion, helical gear, bevel pinion shaft and crown gear
- 3 Housing top section (with integrated input pinion)
- 4 Housing cover
- 5 Centering ring
- 6 Lock plate
- 7 Final stop (2x)
- 8 Oil filler-and oil inspection plug
- 9 Oil drain plug



209224

REAR AXLE

Tap with a plastic hammer or a copper mandrel from the bottom against the top section 1, so that it loosens from the axle housing.

Cautiously lift off and remove the housing top section.

NOTE

Housing top section can only be replaced completely. Centering ring can be reused.

NOTE

Remove cylinder pins, breather valve and grease nipples only in case of damage. Check housing top section according to chapter "Reassembly", step 15.1 and keep it properly.

2.1 Remove input from the housing top section and disassemble it

With two assembly levers press cover assembly 2 cautiously against the bearing outer ring (with radial shaft seal, grooved ball bearing, O-ring and input pinion) out of the bearing bore.

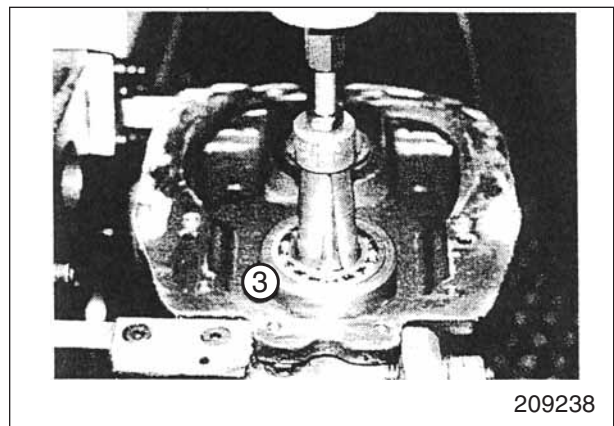
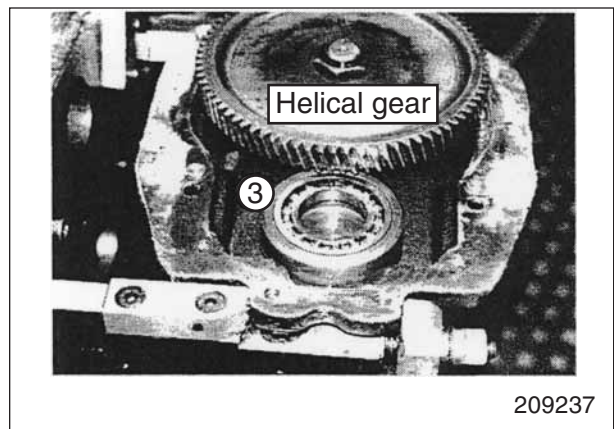
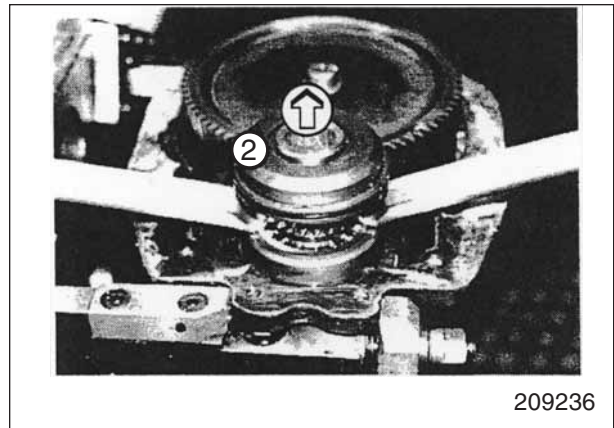
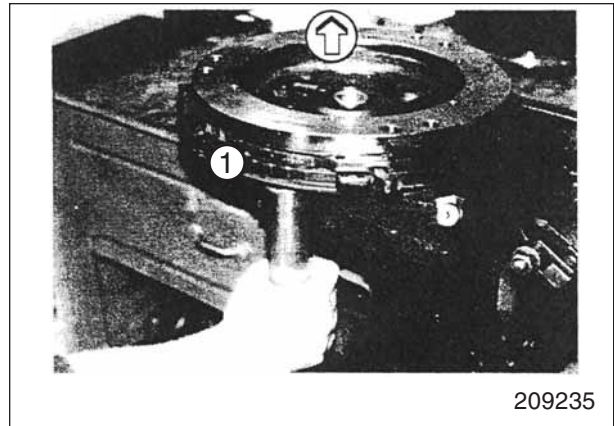
CAUTION

Do not damage the input pinion tooting!
Damages might cause louder running noises!

NOTE

Prior to removing the grooved ball bearing 3, the helical gear has to be taken off first, as indicated in page 7-31 step 7.1.

Pull grooved ball bearing 3 with a bearing extractor out of the bore hole in the housing top section and remove it.



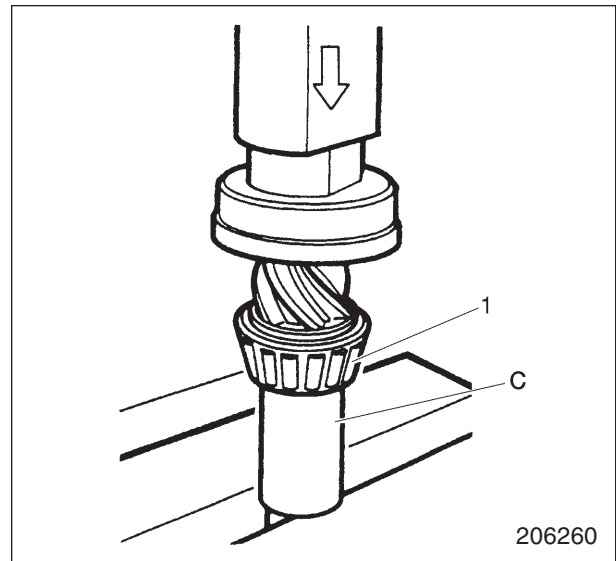
5. Preassemble bevel pinion shaft

With bush "C" cautiously install bearing inner ring 1 until contact.

If no press is available, the bearing can be installed in accordance with the following NOTE.

NOTE

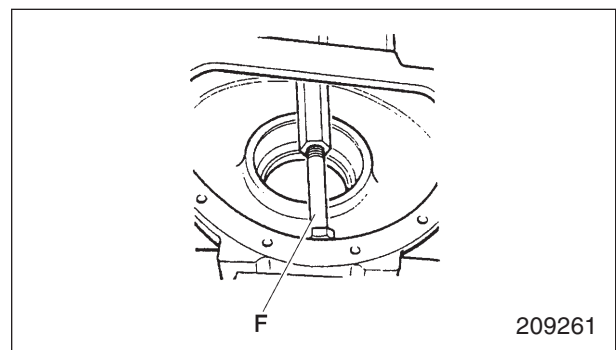
Heat bearing ring up to 90°C maximum and install it until it makes contact.
Install subsequently until contact after cooling down!



6. Install bevel pinion shaft into the housing

Wet the cage space between rollers of the bearing inner ring with gear oil.

Insert preassembled bevel pinion shaft from the bottom into the housing. With clamping fixture "F", apply a slight preload to the bearing outer ring.



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REAR AXLE

16.1 Install housing top section

Provide sealing surface of the housing with a thin layer of **LOCTITE 574**.

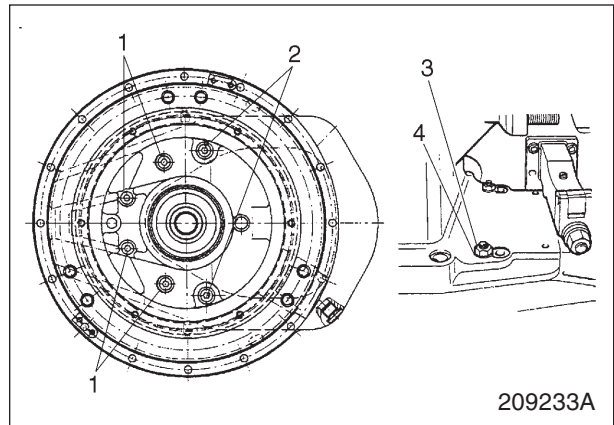
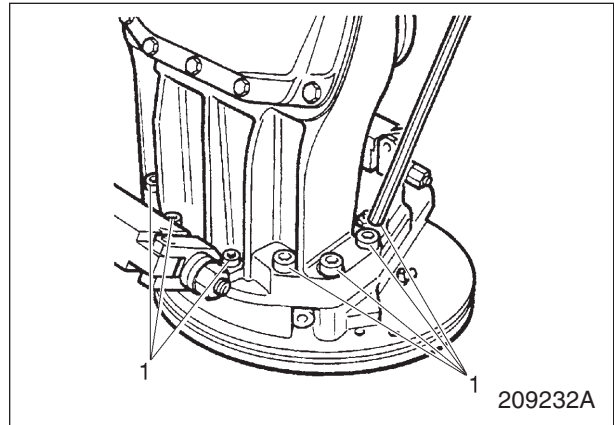
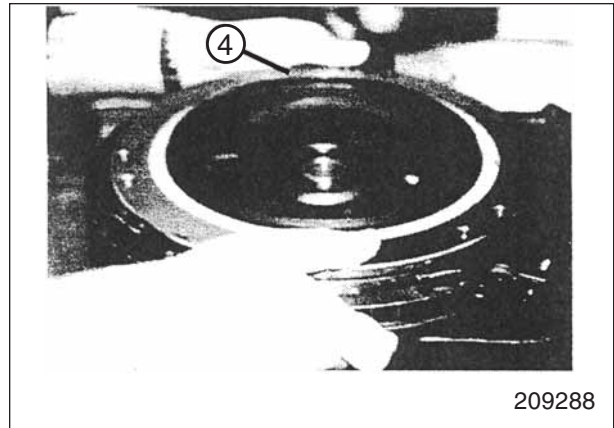
NOTE

The plane face of the housing and the housing top section have to be cleaned with LOCTITE Fast Cleaner and must be free of grease before assembling.

Place housing top section onto the rear axle housing, so that the cylindrical pins in the rear axle housing are positioned in the fitting bores of the top section.

Screw in the socket head bolts 1 at the bottom side of the rear axle housing as well as inside the housing top section and tighten them uniformly.

In addition, install the two socket head bolts 2, hexagon nuts 3 and washers 4



16.2 Check axial play of the input in housing top section

Have wheel shaft rotated several times.

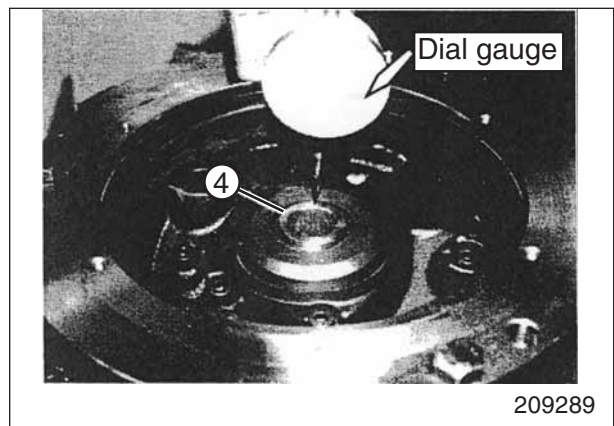
For measurement of the axial play of the input, a dial gauge with a magnetic stand is to be positioned right-angled onto the plane face of the input pinion and the dial indicator must be set to "Zero".

Mark the position of the dial gauge on the pivoting bearing with a color pencil.

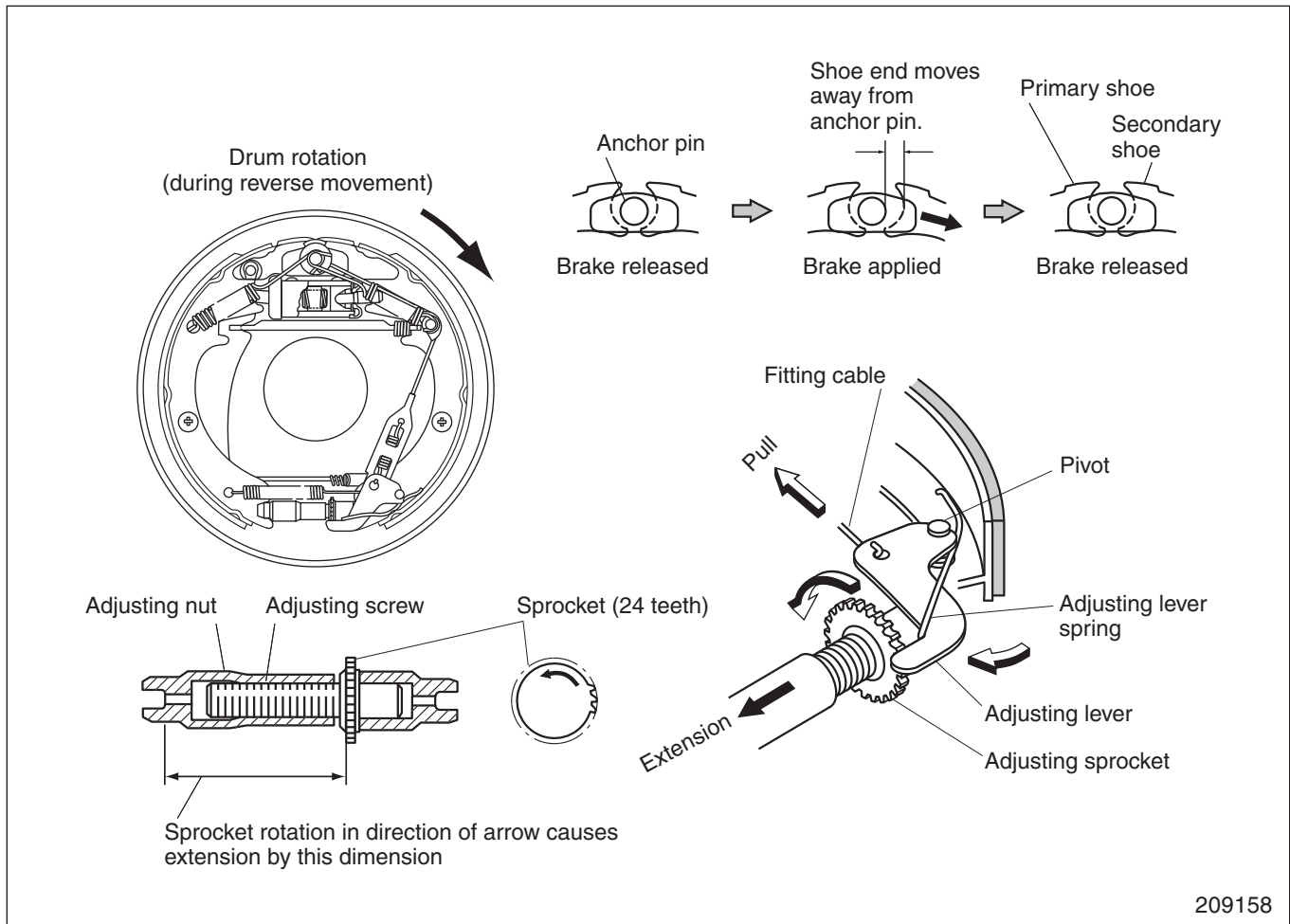
With both hands, press the input pinion upwards and downwards.

Read the axial bearing play on the dial gauge.

Axial play of grooved ball bearing: 0.1 to 0.4 mm.
When checking a bearing play has to be measurable.



3. Automatic Adjusting Mechanism



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The automatic adjusting mechanism maintains the correct lining-to-drum clearance of approximately 0.1 to 0.25 mm. It can operate only when the brakes are applied during reverse movement of the truck. When the lining has worn approximately 0.03 mm, the adjusting sprocket turns by one tooth to recover a proper lining-to-drum clearance.

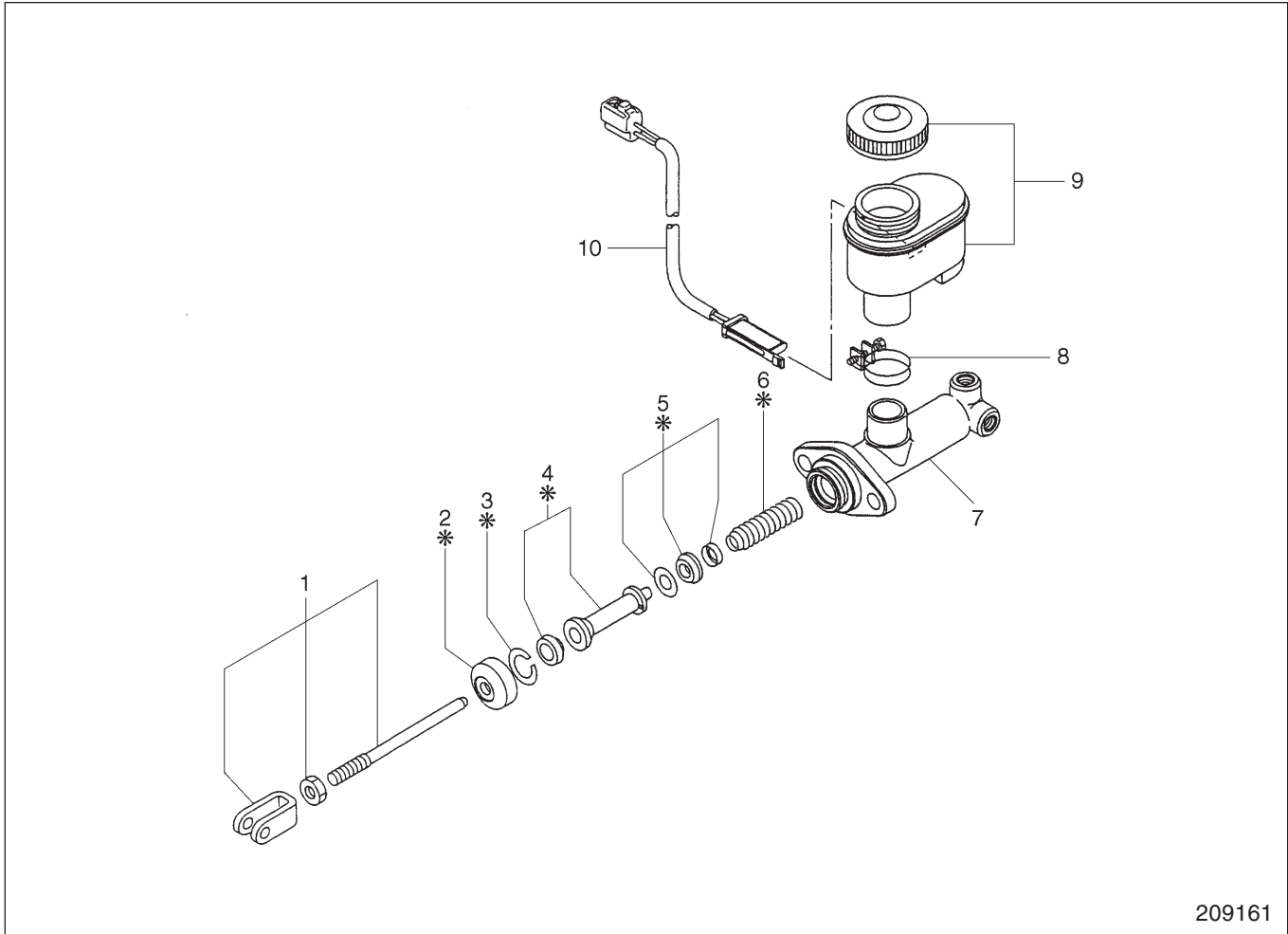
When the operator depresses the brake pedal with the lining-to-drum clearance excessively large, the top end of the secondary shoe moves away from the anchor pin. At this time, the fitting cable that runs from the anchor pin to the adjusting lever via the sheave on the secondary shoe is pulled upward, causing the adjusting lever to swing about its pivot. The edge of the adjusting lever thus turns the sprocket. The resulting increase in the adjuster's dimension causes the lining-to-drum clearance to decrease.

The adjusting mechanism does not operate while the lining-to-drum clearance is within the proper range.

The adjusting screw in the brake on an RH wheel has a right-handed thread, and the adjusting screw in the brake on an LH wheel has a left-handed thread.

Master Cylinder and Fluid Reservoir

Disassembly



209161

Sequence

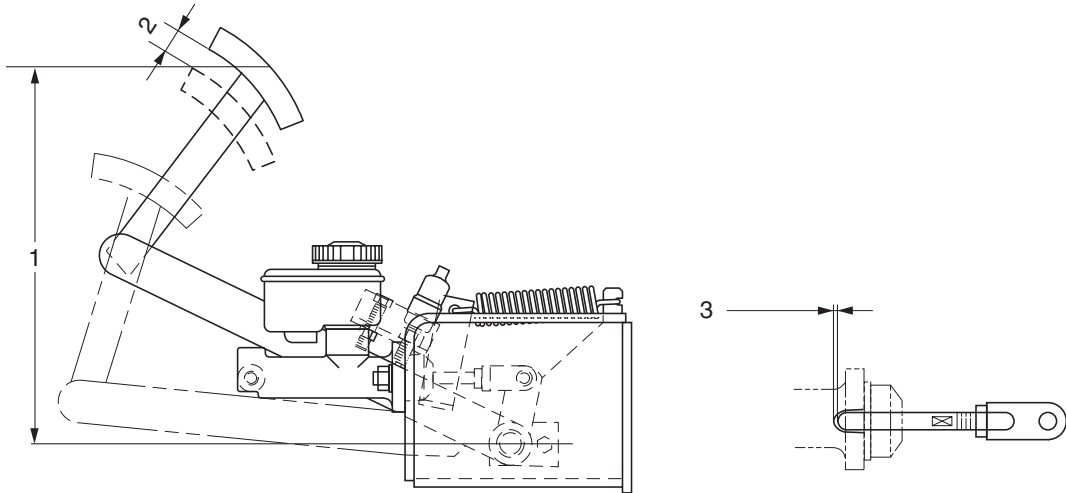
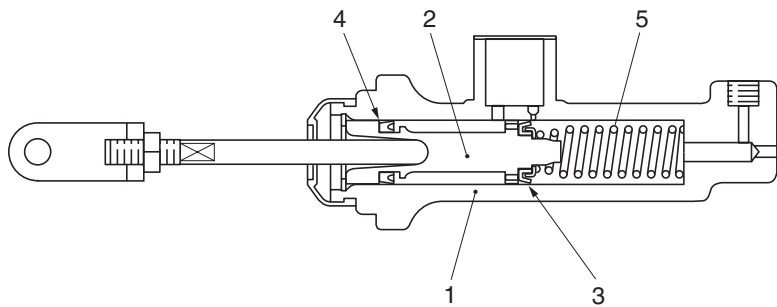
- | | |
|--|-------------------|
| 1 Clevis, Lock nut, Push rod | 6 Return spring |
| 2 Boot | 7 Cylinder body |
| 3 Stopper ring | 8 Clamp |
| 4 Secondary cup, Piston | 9 Fluid reservoir |
| 5 Spring seat, Primary cup, Cup spacer | 10 Harness |

NOTE

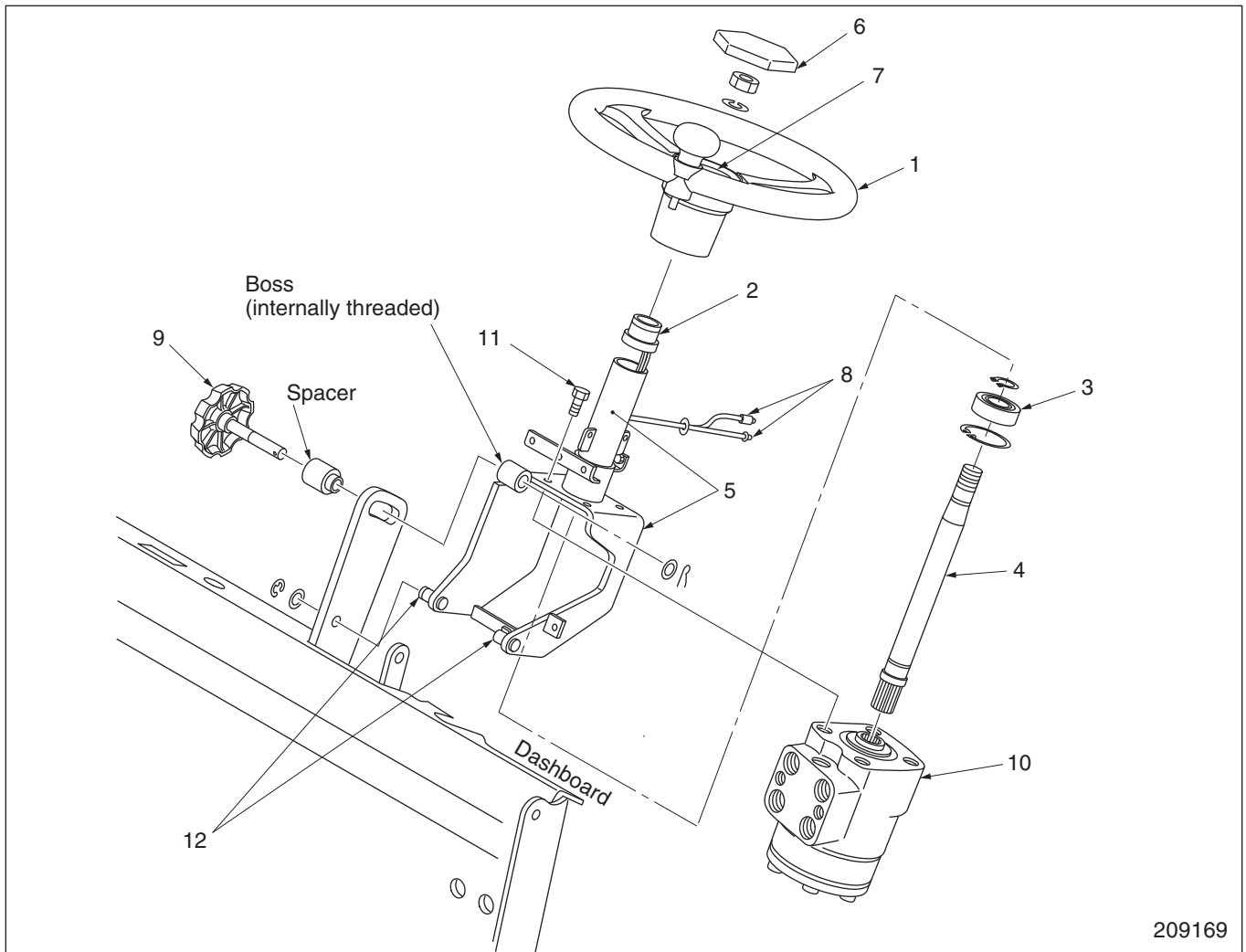
Replacement parts marked with an asterisk (*) are included in the repair kit.

Service Data

A: Standard value B: Repair or service limit
Unit: mm

Item		Truck Model	EP10KRT	EP12KRT	EP15KRT
Brake pedal	Height of pedal 1	A	288 ± 3		
	Free play of pedal 2	A	3 to 10		
	Play of push rod 3	A	1 ± 0.5		
	 <p style="text-align: right;">209162A</p>				
Master cylinder	Inside diameter of cylinder body 1	A	19.05 ^{+0.052} ₀ (3/4 inch)		
	Diameter of piston 2	A	19.05 ^{-0.020} _{-0.053}		
	Clearance between cylinder and piston	A	0.020 to 0.105		
		B	0.2		
	Diameter of primary cup (lip side) 3	A	20 ⁰ _{-0.3}		
	Diameter of secondary cup (lip side) 4	A	20.2 ± 0.2		
	Free length of return spring 5	A	46.8		
 <p style="text-align: right;">207077</p>					

Steering Column Assembly



209169

- | | | |
|------------------|-------------------|----------------------------------|
| 1 Steering wheel | 6 Horn button | 11 Steering valve mounting bolts |
| 2 Column bushing | 7 Horn switch | 12 Tilt pivot pin |
| 3 Ball bearing | 8 Horn cord | |
| 4 Steering shaft | 9 Knob bolts | |
| 5 Column bracket | 10 Steering valve | |

The steering shaft 4 is mounted in the column bracket 5 via the ball bearing 3 and column bushing 2 such that it is rotatable.

The steering wheel 1 is installed on the top end of the steering shaft 4 using a nut.

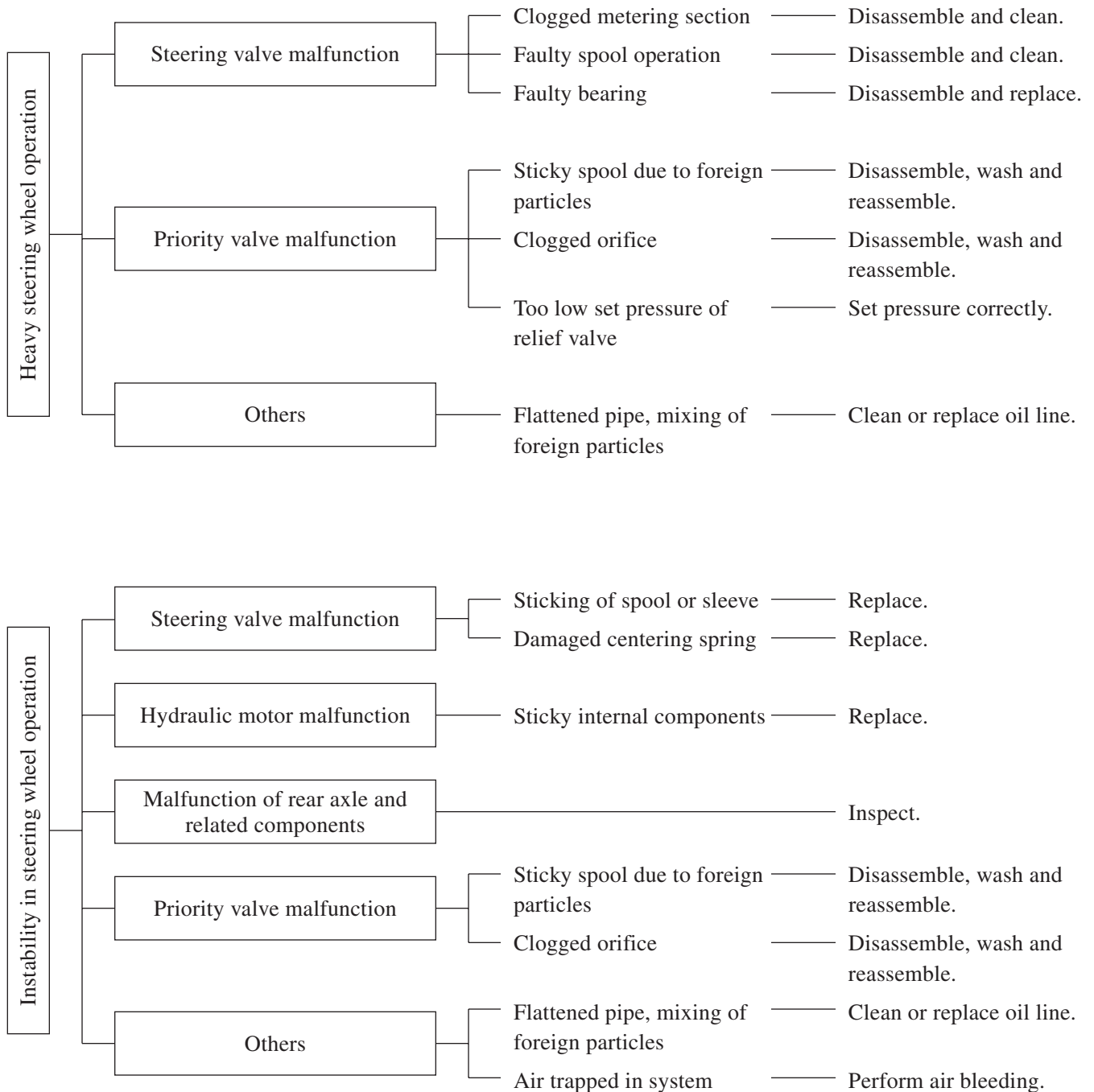
The steering valve 10 is attached to the column bracket 5 using the bolts 11.

As the steering shaft 4 is splined to the steering wheel at the top end and to the steering valve at the bottom end, the steering valve shaft can rotate completely together with the steering wheel 1.

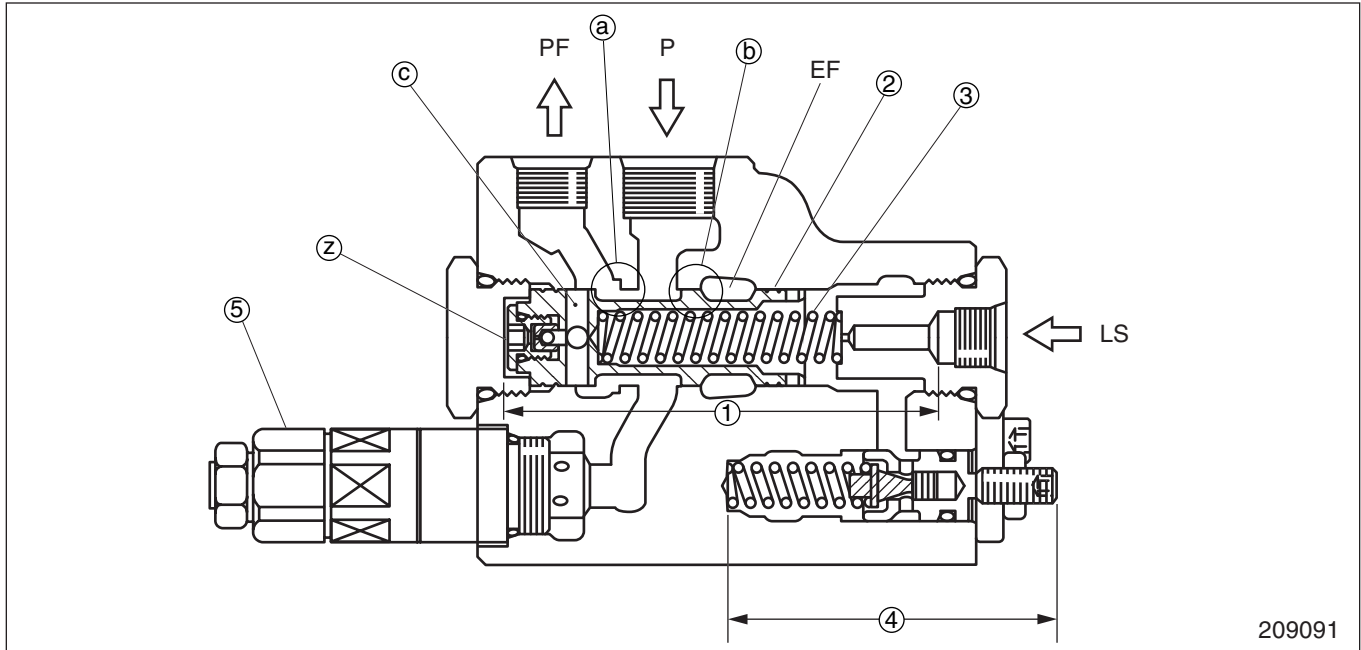
The column bracket 5 is attached to the dashboard by means of its pins 12 and also its internally threaded boss complete with the spacer in such a way that it can turn about the pins 12. By loosening the knob bolt 9, the operator, therefore, can tilt the whole steering column assembly.

When the horn button 6 is pressed, the horn switch 7 closes the horn circuit, causing the horn to sound.

Troubleshooting



Inlet Valve Section



- 1 Priority valve assembly
- 2 Valve spool
- 3 Spring
- 4 Steering system relief valve
- 5 Main relief valve
- a: Passage (P to PF)
- b: Passage (P to EF)
- c: Passage
- z: Chamber

- P: From pump
- PF: To steering system
- EF: Center bypass port of passage to tilt and lift sections
- LS: Load sensing pressure

Hydraulic pump output oil flows through the P port into the inlet valve section.

Passage (a) is always open, allowing pressure oil from the P port to flow through the PF port toward the steering valve.

After passing through the PF port, pressure oil flows through passage (c) into chamber (z), pushing the valve spool 2 to the right against the combined force of LS pressure and the spring 3 (see the drawing above).

As a result, passage (b) is open, opening the P port to passage EF. This allows oil to flow from the EF port to the tilt and lift sections for the use in control of the mast.

The priority valve 1 ensures that the steering system is always supplied with pressure oil through the PF port in an amount enough for its operation irrespective of variation in the oil flow rate and pressure at the P port and also in the steering resistance. The excess oil not

used by the steering system flows out of the valve through the EF passage.

The rate at which oil flows through the PF port to the steering system is controlled by the movement of the valve spool 2. Passages (a) and (b) are correlated such that when one opens the other closes.

As the steering system demands higher rates of oil flow, the valve spool 2 moves toward the left. This opens passage (a) wider, achieving a higher rate of oil flow to the PF port and onwards. As the steering system demands lower rates of oil flow, the spool 2 moves toward the right. This opens passage (b) wider, achieving a higher rate of oil flow to the EF passage and onward.

The movement of the valve spool (2) is controlled by the relationship between the PF port pressure and LS port pressure. This is described in detail in the "Group 9 Steering Valve" of this manual.

Start by:

- (1) Before disconnecting the pipes from the control valve, bring the mast to the vertical position and place the fork to the lowest position in order to release the residual pressure in the pipes.
- (2) Support the weight of the mast with a crane.
- (3) If an attachment is connected, take necessary measures to prevent it from moving.
- (4) Remove the floor plate.
- (5) Remove the battery box.

Suggestions for Removal

1. Disconnect all the hydraulic pipes and hoses from the control valve.
2. Remove the snap pin and washer 8, then pull out the pin 9. Separate the control rods from the valve spools.
3. While holding the control valve assembly by hand, remove the two bolts 10 and bolt 11. Remove the control valve assembly 12.

Installation

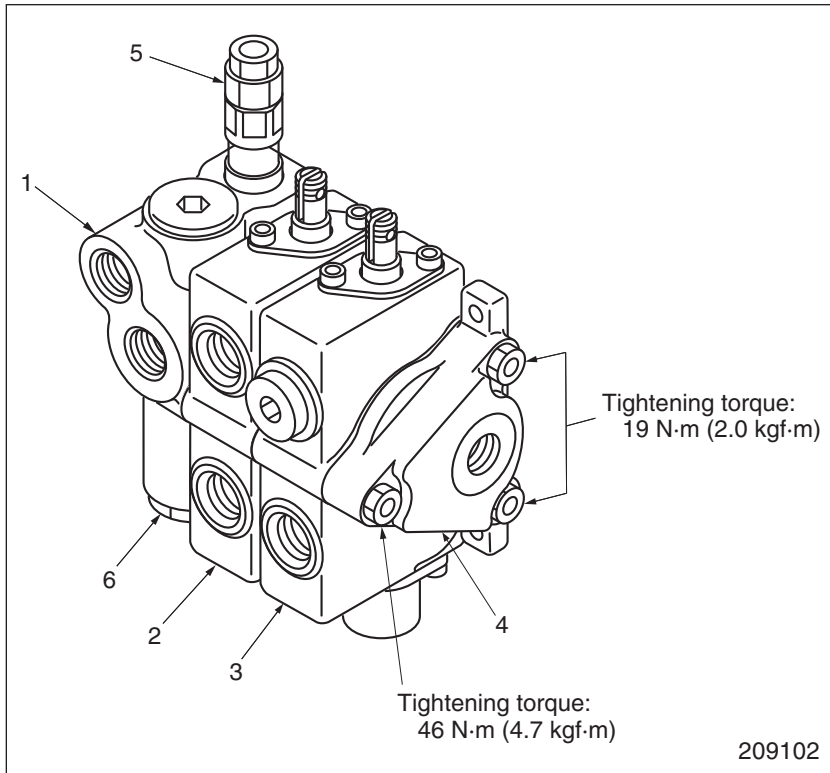
Follow the removal procedure in reverse.

NOTE

Avoid applying undue force to electrical devices such as the stroke sensor and microswitch when they are removed and installed. Using excessively large forces can damage these devices.

Hydraulic Control Valve Assembly

Disassembly and Reassembly



Control valve assembly (2-valve type)

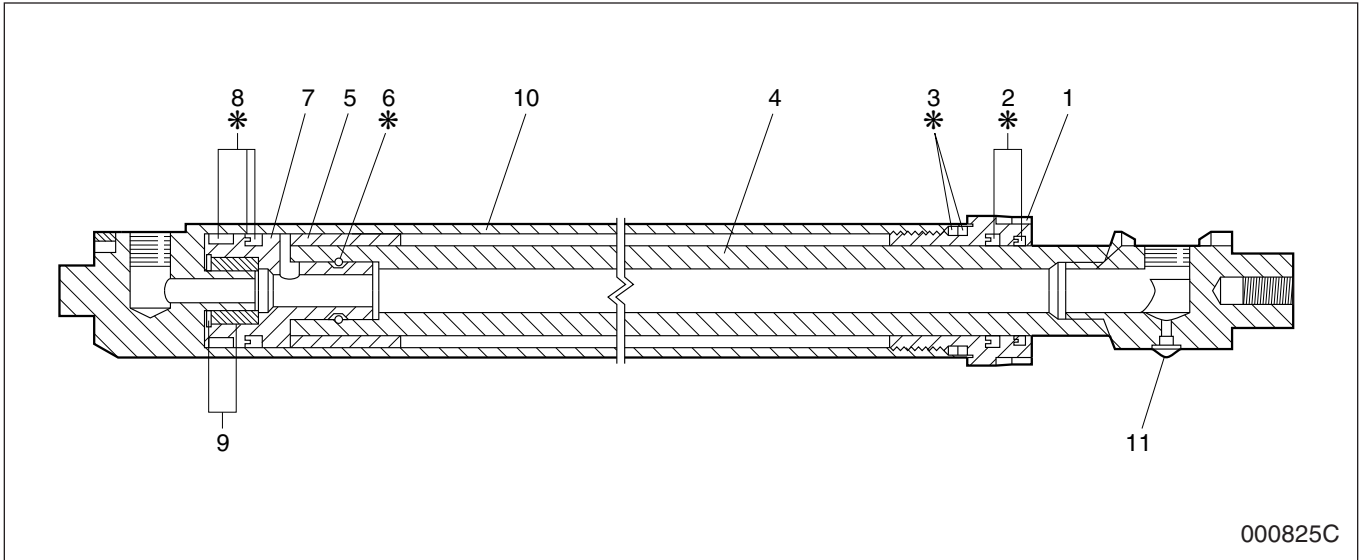
Main Component

- 1 Inlet valve section
- 2 Tilt valve section
- 3 Lift valve section
- 4 End cover
- 5 Main relief valve
- 6 Steering relief valve

Suggestions for Disassembly and Reassembly

- (1) Do not disassemble main relief valve 1 or steering system relief valve 2 unless it is impossible to adjust the setting of the valve.
- (2) Tighten the tie bolts (securing the valve housings) as evenly as possible to prevent distortion of the housings. Remember, a failure to follow this precaution will result in sluggish movement of the spools.

Reassembly



Sequence

- 1 Retainer
- 2 Wiper ring, Rod seal
- 3 Backup ring, O-ring
- 4 Piston rod
- 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

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

NOTE

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

Suggestions for Reassembly

1. Use all parts in the seal kit to replace removed parts.
2. Apply hydraulic oil to the bore surface of tube and also to the wiper ring, rod seal, and wear ring.
3. When holding the tube in a vise, take care not to distort the tube.
4. Fill the cavity between the shell and rod with 25 to 30 cm³ of Hydraulic oil before installing the retainer.
5. Tighten the retainer 1 to the specified torque.
6. Tighten the bleed screws 11 to the specified torque.

Unit: N·m (kgf·m)

Bleed screw tightening torque	4.5 to 5.0 (0.46 to 0.51)
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Retainer tightening torque	170 to 240 (17.3 to 24.5)
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Lift Cylinders and Tilt Cylinders

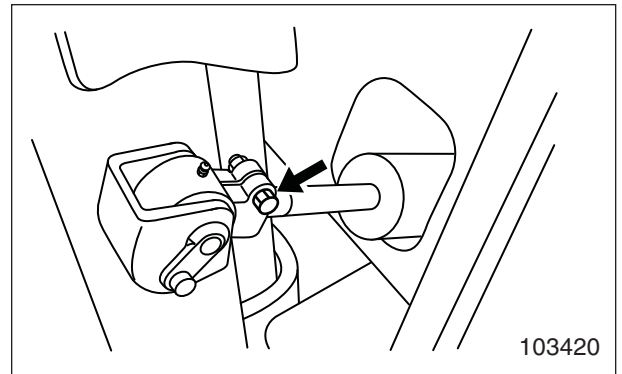
(1) Adjustment of mast tilt angle

- (a) Park the truck on a level ground.
- (b) Tilt the mast backward to the maximum position.
- (c) Measure the backward tilt angles of both right and left tilt cylinders.
- (d) To adjust, loosen the socket tightening bolt, turn the tilt cylinder rod and adjust the cylinder stroke until the right and left tilt cylinders are tilted at the same angle.

NOTE

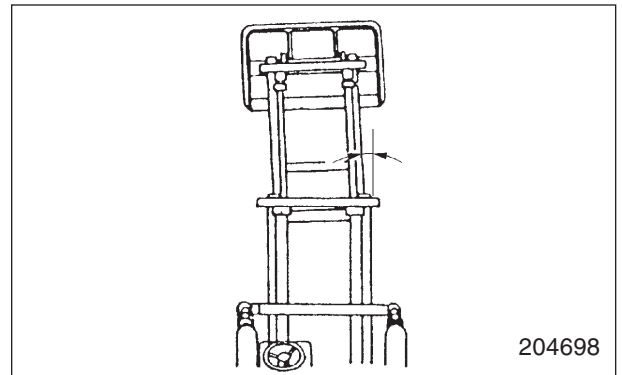
The forward tilt angle of the masts is automatically set when the backward tilt angle is adjusted.

Forward tilt – Backward tilt (STD)	5° – 7°
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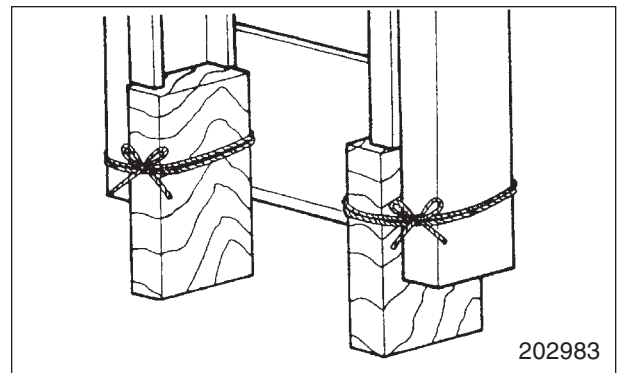
(2) Adjustment of right and left lift cylinder strokes

- (a) Slowly raise the inner mast, and observe how the piston rods, left and right, stop at the moment the inner mast reaches its maximum height.
- (b) If the top of the inner mast jolts at that moment, make a shim adjustment. Abnormal condition can be detected by a little time lag in stopping between the piston rods, left and right, and shaking of the rod with a longer cylinder stroke.



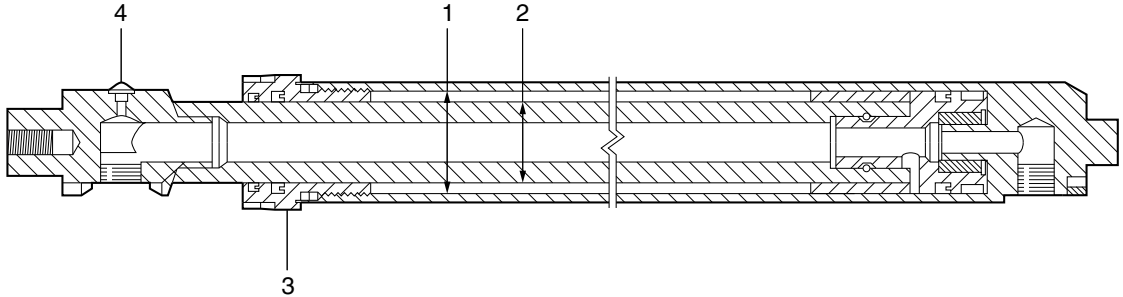
Adjustment method

- (1) Raise the inner mast, and place wood blocks under the inner mast. Lower the mast until the inner mast contact the wood blocks. Use blocks strong enough to support the mast.



A: Standard value

Unit: mm

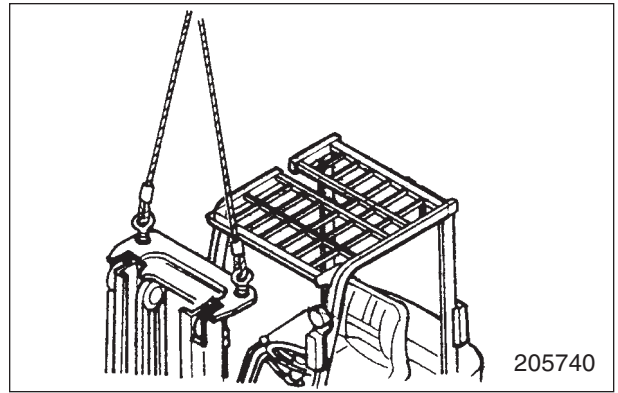
Item		Truck Model		
		EP10KRT	EP12KRT	EP15KRT
Lift cylinders (Duplex mast second cylinders)	[Piston] Inside diameter of cylinder tube 1	A	45	
	Diameter of piston rod 2	A	32	
	Outside diameter of retainer 3	A	60	
	Tightening torque for retainer 3 N·m (kgf·m)	A	170 to 240 (17.3 to 24.5)	
	Bleed screw tightening torque 4 N·m (kgf·m)	A	4.5 to 5.0 (0.46 to 0.51)	
				
000825C				

2. Separating mast and tilt cylinders 4

- (1) Hitch a sling to the mast. Using two eye-bolts and a sling as shown and support the mast with a hoist.

CAUTION

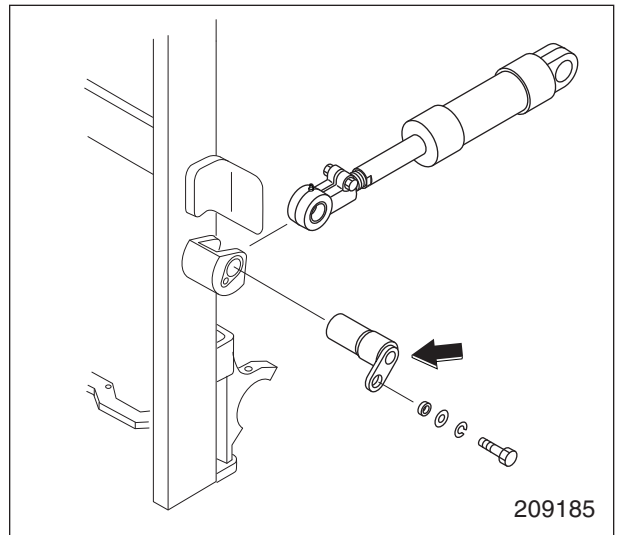
Be sure to use a hoist having a capacity enough to support the mast assembly.



- (2) Place wood blocks under the tilt cylinder mounting section and remove the tilt socket pins, and separate the mast from the tilt cylinders.
- (3) Turn the key to ON and pull back the tilt lever to retract the tilt cylinder rods.

3. Disconnecting low-pressure hose for lift cylinder
Disconnect the hoses at the hydraulic tank.

4. Disconnecting high-pressure hoses for lift cylinder
Place the mast in the bottom position, disconnect the hoses at the flow regulator valve.

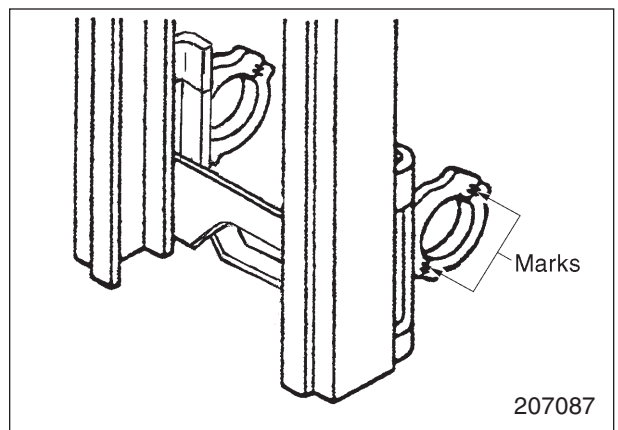


5. Removing mast support bearing caps 7

- (1) Mark the bearing caps to ensure the correct reassembling before removing them.
- (2) Remove the cap bolts and lift off the mast assembly. Lay it down flat on a level floor.

NOTE

Lay the mast assembly on a floor large enough to disassemble the parts.



NOTE

The lift bracket disassembly procedure is the same as for the duplex mast.

Start by:

With the lift bracket side facing up, place the mast horizontally on wood blocks. Place a wood block as a wedge to prevent the inner and middle masts from sliding.

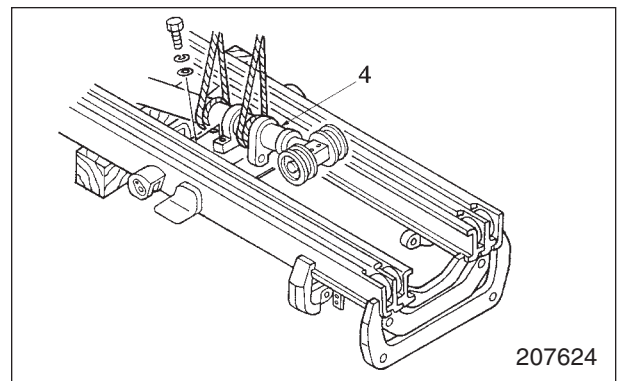
Before disassembling the mast and fork assembly, measure and record all clearances between each lift bracket and roller and between each mast and roller. Recorded measurements will be helpful when replacing rollers or selecting shims to adjust clearances. Refer to pages 11-30 through 11-33.

Suggestions

1. Removing first lift cylinder 4

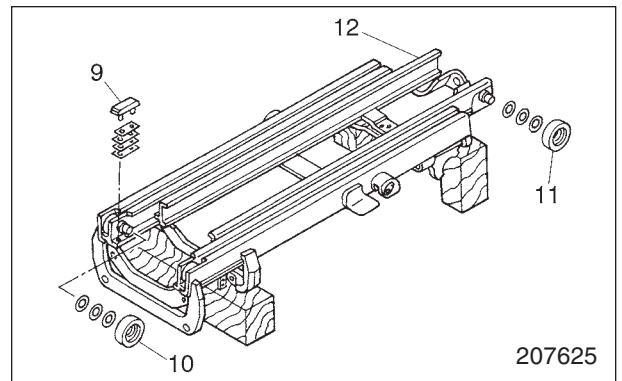
- (1) Remove retaining bolts from the first lift cylinder.
- (2) Hitch slings on lift cylinder 4, and gently remove the cylinder.

Use two slings. Wind or tie slings securely to prevent slipping.



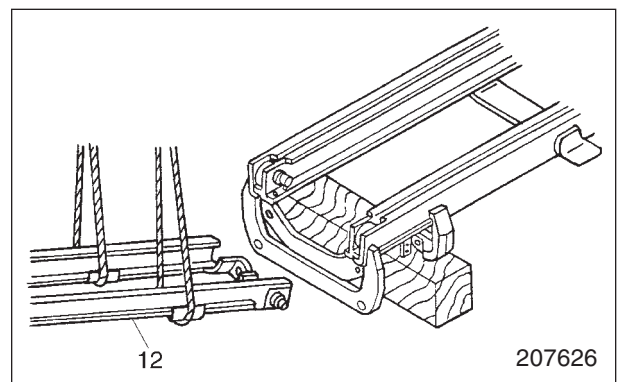
2. Removing inner mast and main rollers

Lower inner mast 12 until the main rollers can be removed. Remove main rollers 10, 11 and mast strips 9.



3. Removing inner mast

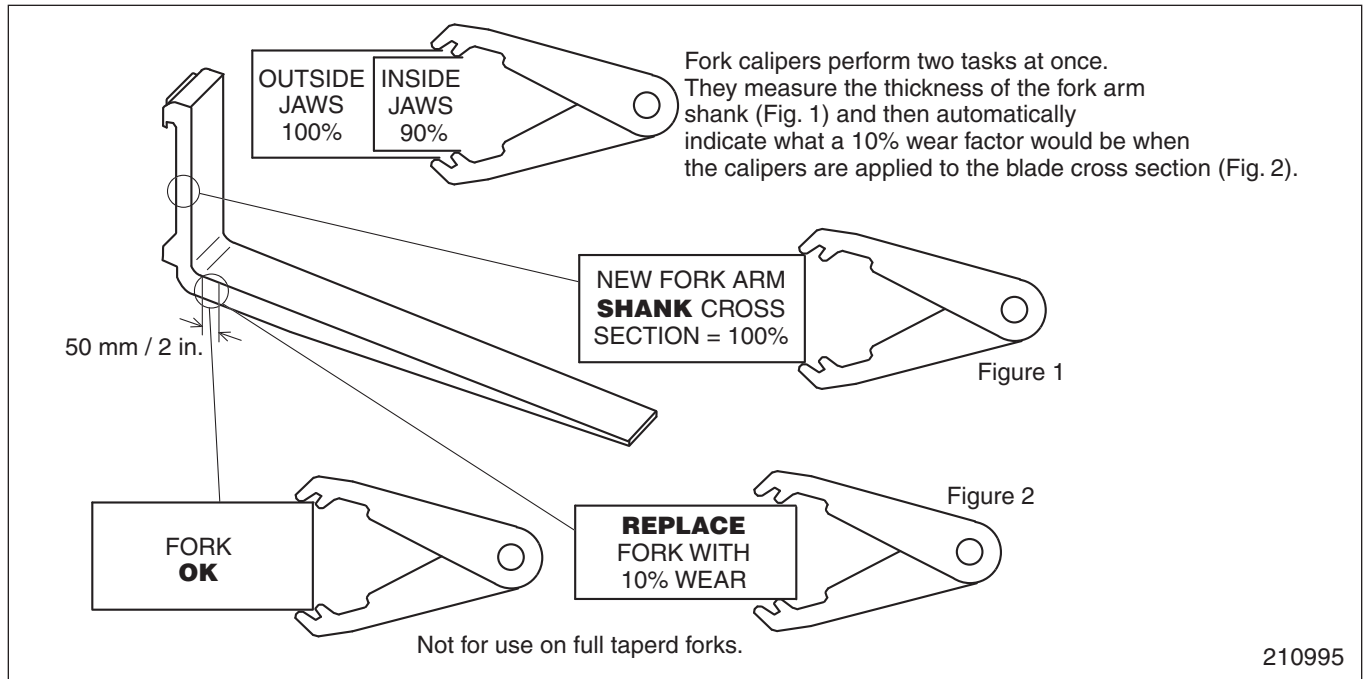
Using slings, lift and remove the inner mast 12, steering it clear of the roller shaft sections of the middle mast.



Inspection and Adjustment

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

Forks (all mast models)



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

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

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

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

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

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

drum or on the boom hook makes the safety difference.

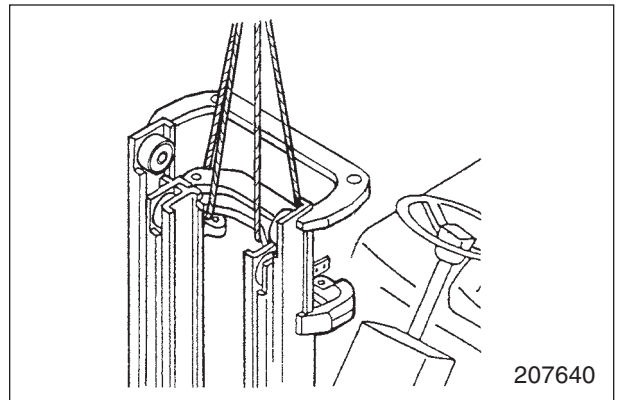
- Forks are often used to open rail car doors and break loads out or away from other loads. They are also used to pick up capacity loads not seated against the fork shank and to pick up off-balanced loads far from the side of the truck. The fork tips are sometimes inserted under other fork trucks to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

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

DESIGNED TO TAKE A BEATING

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

4. Position the middle mast lower than the outer mast by following operations.
 - (1) Lift the inner mast to the height of the middle mast, then place wood blocks for support.
 - (2) Hitch slings to both middle mast and inner mast, and suspend with a hoist.
 - (3) Remove set bolts from the upper sections of the middle mast lift cylinders, then lift the middle mast and inner mast.
 - (4) Remove two lift cylinder clamps, dismount the cylinders from the mounting sections at the lower outer mast section. Tilt the cylinders by moving the top sections towards the center of the vehicle, then secure the cylinders to the cross-member of the outer mast with a rope.
 - (5) Lower the middle mast and inner mast until main rollers can be removed.
 - (6) Place wood blocks under the middle mast and inner mast for support.
 - (7) Now the main rollers can be removed from the middle and outer masts. Remove the mast strips and shims in advance because they are apt to come off under this condition.



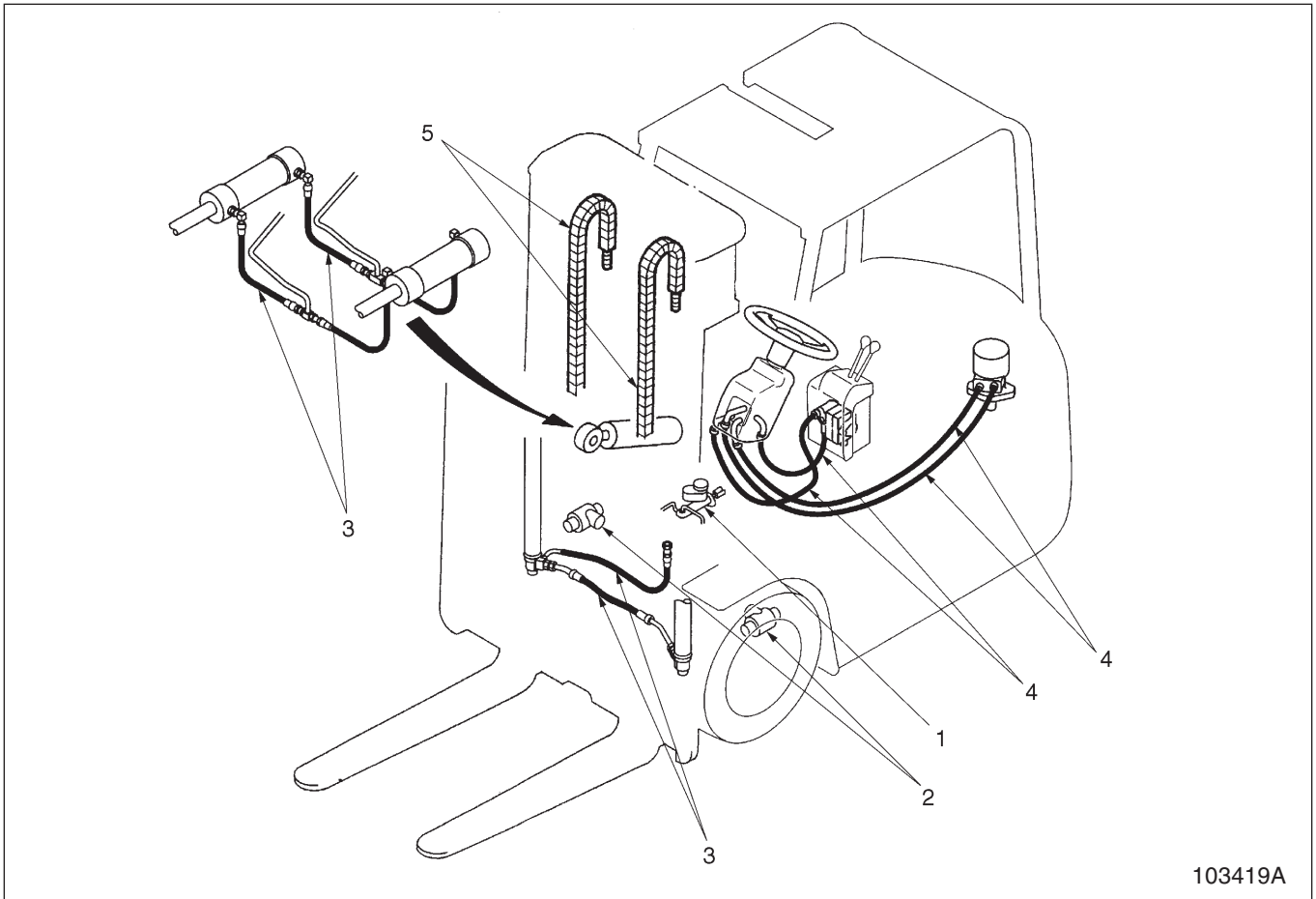
Planned Replacement of Parts

The following parts should be periodically changed as noted below.

These parts are made of materials which will deteriorate with time. Further, it is difficult to determine visually whether or not they are still in good condition. Changing at proper intervals will reduce the chance of injury to the operator and damage to the truck.

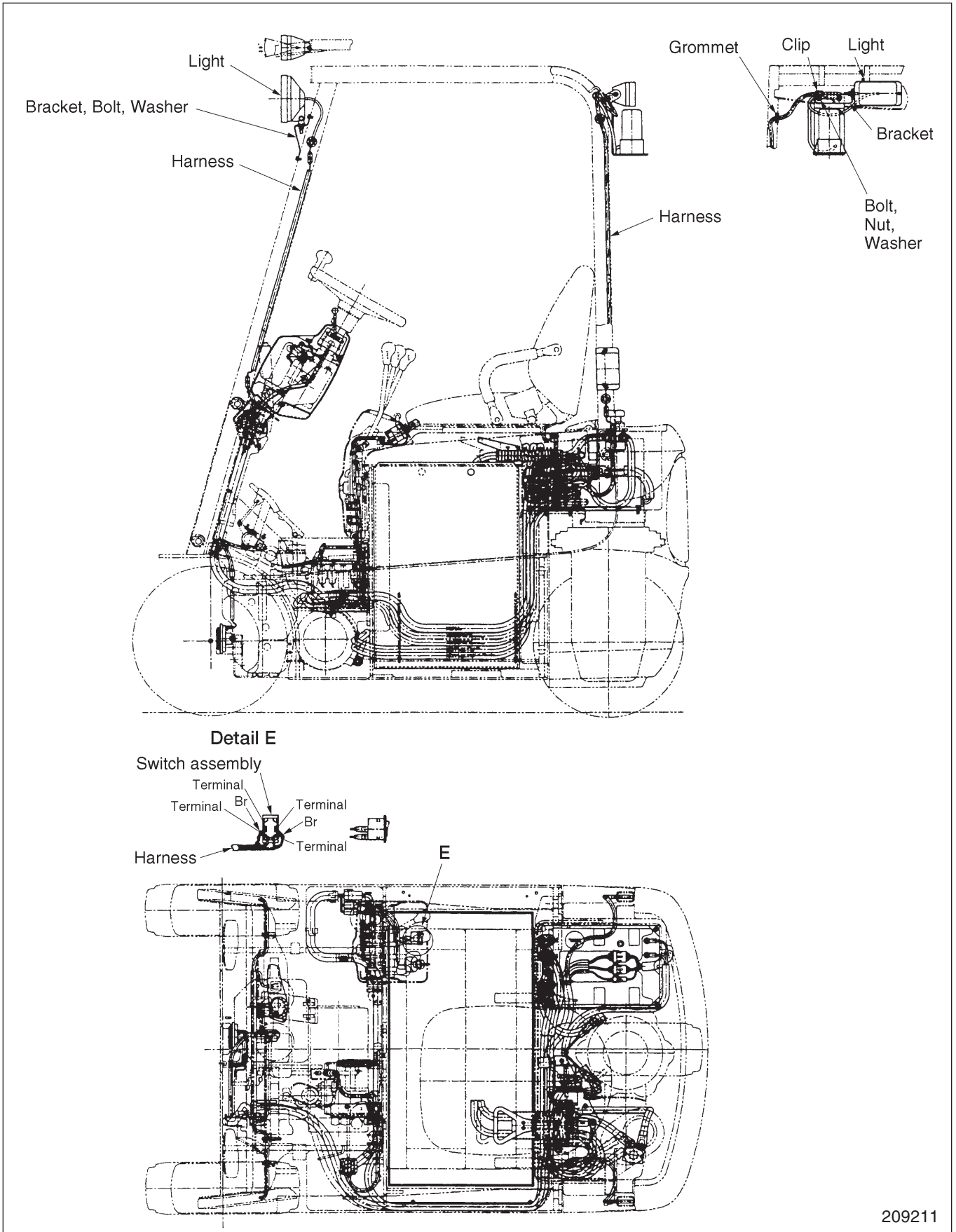
NOTICE: Periodic change of these parts is not covered by *Warranty*.

Ref. No.	Parts to be changed	Interval
1	Rubber parts of brake master cylinder	2400 service hours or 2 years, whichever comes first
2	Rubber parts of wheel cylinders	2400 service hours or 2 years, whichever comes first
3	High-pressure hoses of hydraulic system	2400 to 4800 service hours or 2 to 4 years, whichever comes first
4	Power steering hoses	4800 service hours or 4 years, whichever comes first
5	Lift chains	4800 service hours or 4 years, whichever comes first



103419A

Working Lamp Kit



209211

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