



# Service Manual

## Chassis & Mast

### **FBC15N, FBC18N, FBC18LN**

A4BC1-10200-up

A4BC1-20200-up

A4BC1-30200-up

### **FBC20N, FBC25N**

A4BC2-10200-up

A4BC2-20200-up

### **FBC25EN, FBC25LN, FBC30N**

A4BC3-20200-up

A4BC3-30200-up

A4BC3-40200-up

### **FBC30LN**

A4BC4-10200-up

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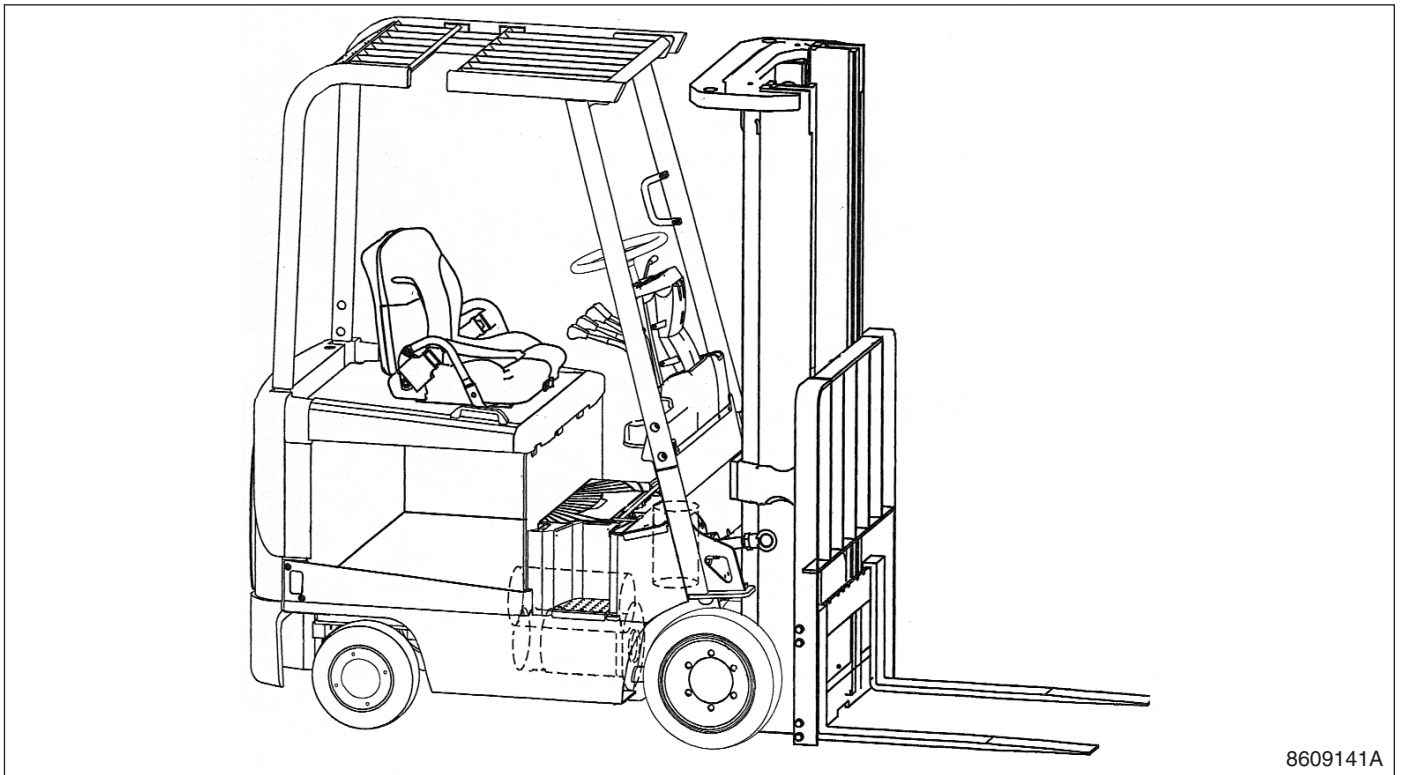


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## Scope

This service manual deals with all components or systems of the Mitsubishi forklift trucks, except for the electrical system, which is covered in a separate manual.



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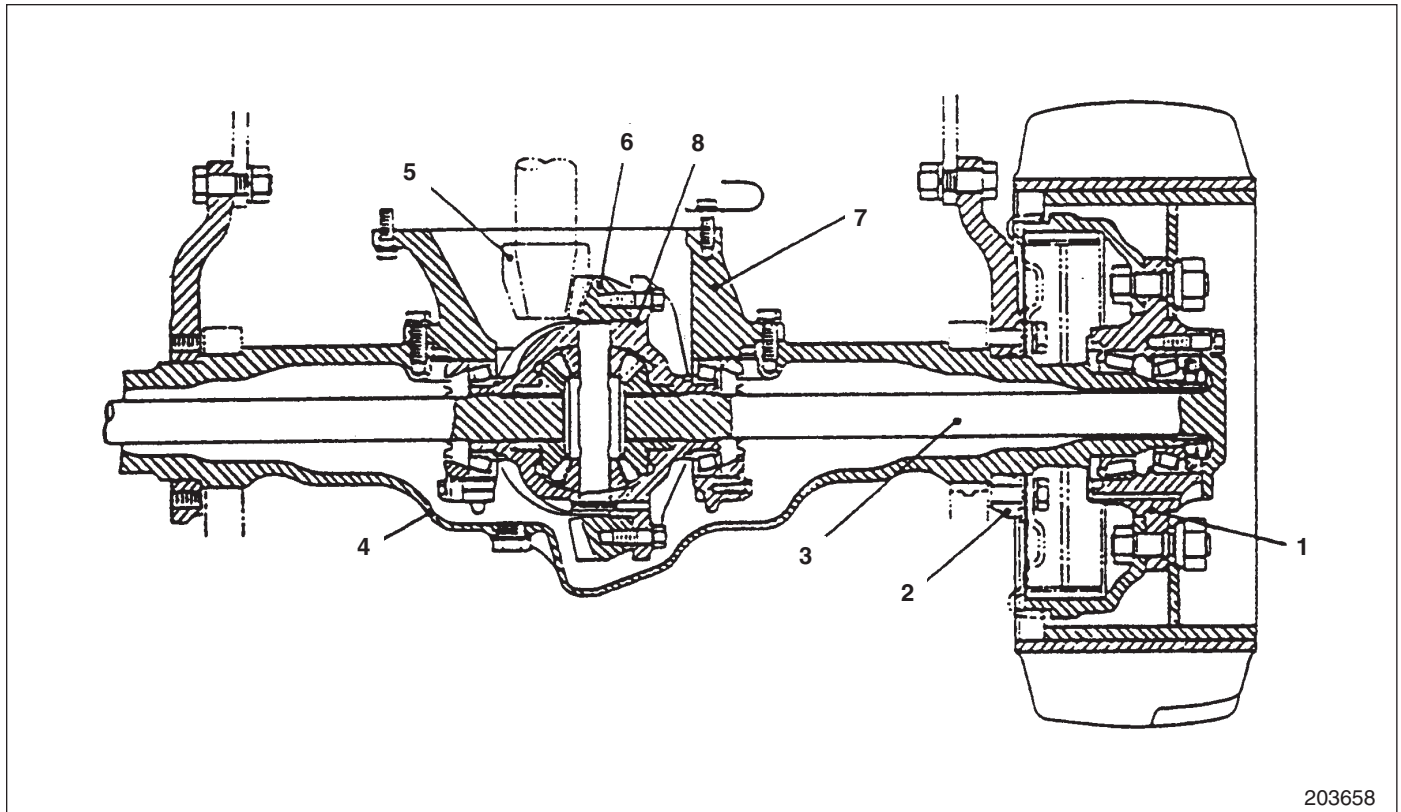
## Truck Models Covered

This service manual furnishes service and maintenance information for the following trucks.

Truck Model	Serial Number
FBC15N, FBC18N, FBC18LN	A4BC1-10200-up
	A4BC1-20200-up
	A4BC1-30200-up
FBC20N, FBC25N	A4BC2-10200-up
	A4BC2-20200-up
FBC25EN, FBC25LN, FBC30N	A4BC3-20200-up
	A4BC3-30200-up
	A4BC3-40200-up
FBC30LN	A4BC4-10200-up

## Front Axle

### Description



203658

- |                    |                         |
|--------------------|-------------------------|
| 1. Front wheel hub | 5. Reduction pinion     |
| 2. Frame support   | 6. Reduction gear       |
| 3. Axle shaft      | 7. Differential case    |
| 4. Axle housing    | 8. Differential carrier |

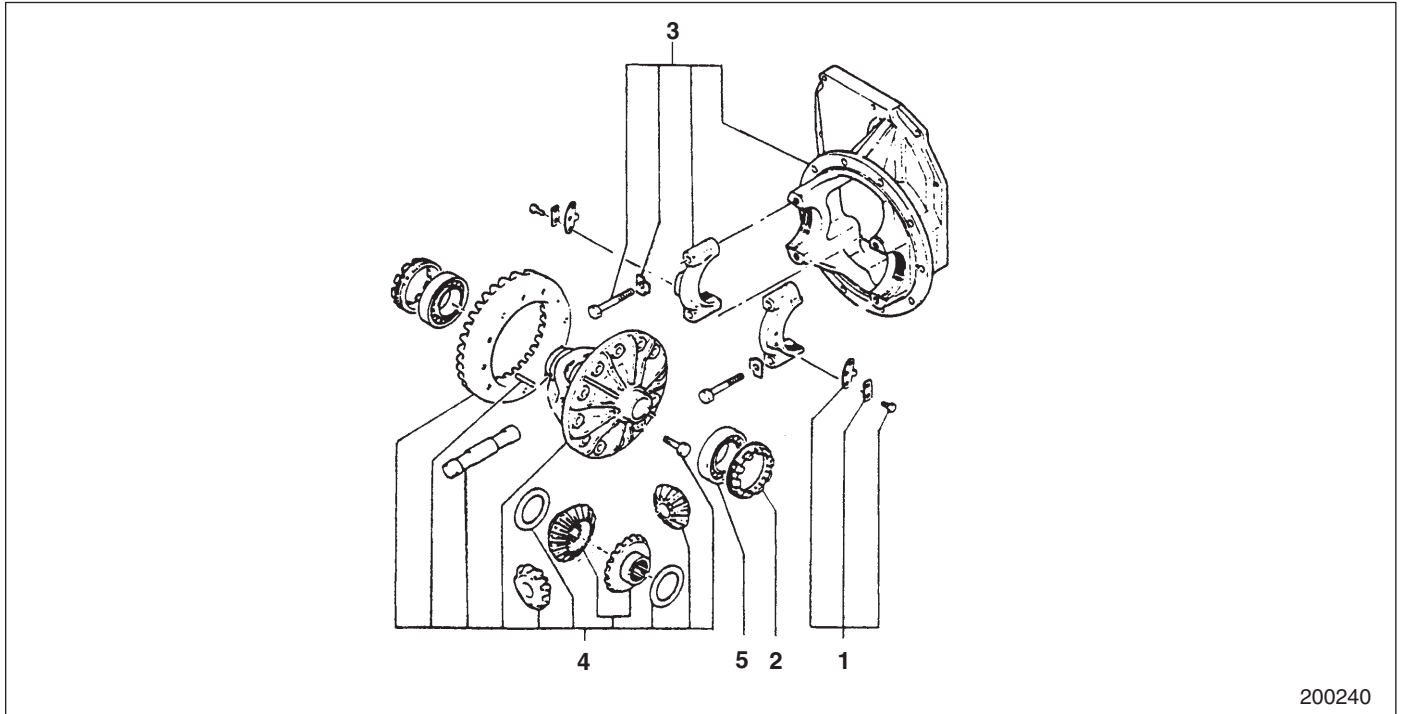
### General Information

The frame supports hold the front axle housing in such a manner as to allow a limited amount of rotary motion of the housing, the rotary sliding surfaces being lubricated with grease.

The cushion tire is press-fitted to the outer ring of the wheel hub.

## Reduction Differential

### Description



200240

### Sequence

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Lock plates</li> <li>2. Side bearing nuts</li> <li>3. Differential carrier assembly (lock washers, side bearing caps, and differential carrier)</li> </ol> | <ol style="list-style-type: none"> <li>4. Reduction gear and differential gear assembly (spring pins, pinion shafts, differential pinions, differential bevel gear, washers, and differential case)</li> <li>5. Tapered roller bearings</li> </ol> |
|--|--|

### Start By:

1. Remove the differential carrier from the transmission case.
2. Check the pattern of gears at time of removal. This step is important when assembly has been completed and checking pattern of gears to match.

**Chapter 3: Transfer Assembly**

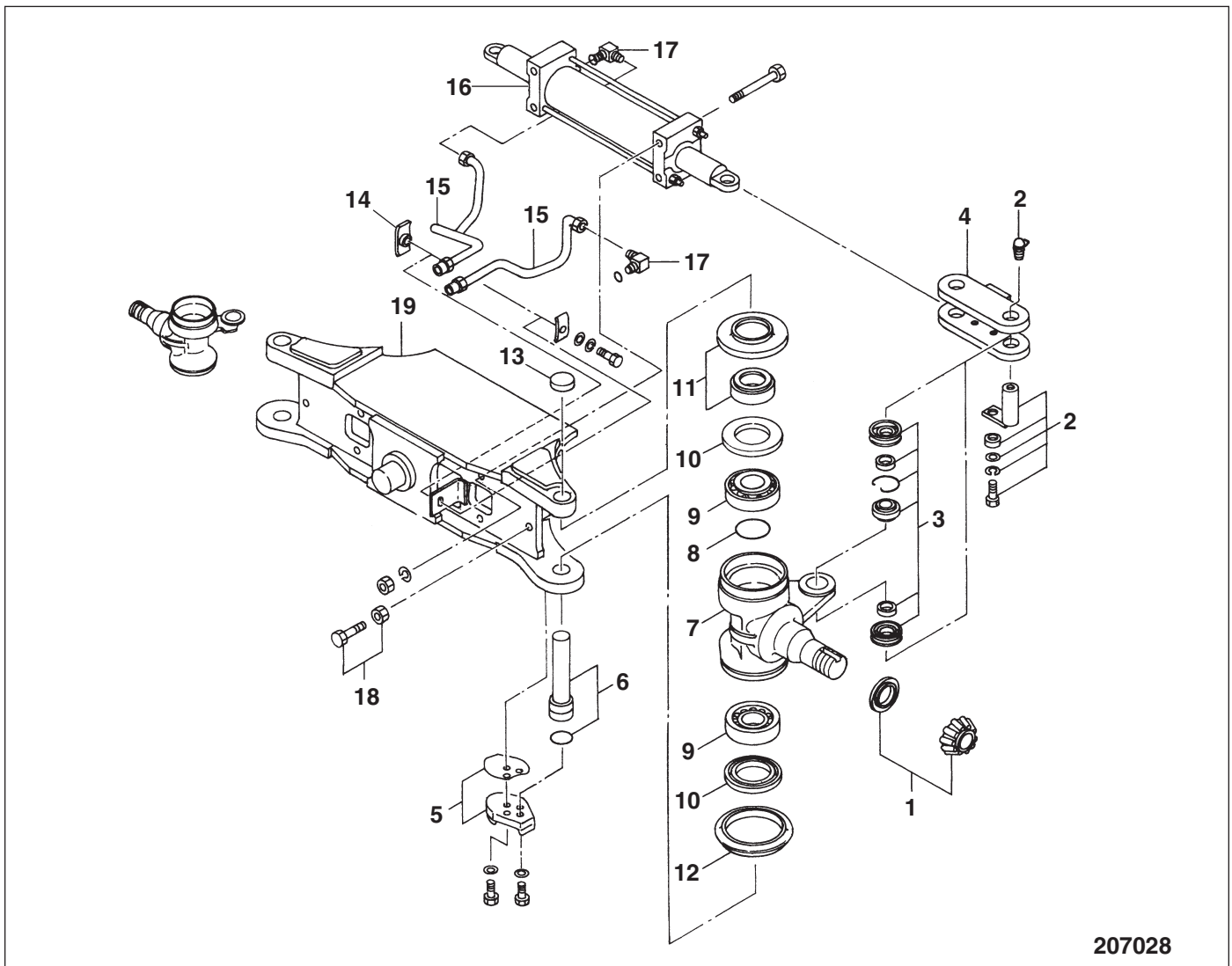
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# Disassembly

## REAR AXLE ASSEMBLY



207028

### Disassembly

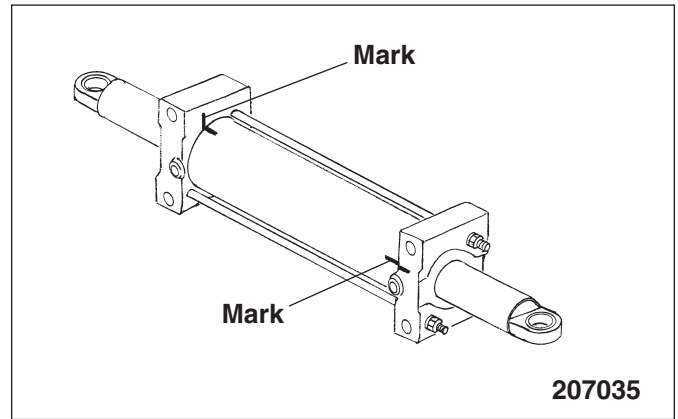
#### Disassembly sequence

- |   |   |
|---|---|
| 1 Taper roller bearing (inner), Retainer                                | 9 Taper roller bearing                          |
| 2 Tie rod pin, Bolt, Spring washer, Plain washer, Collar, Grease nipple | 10 Oil seal                                     |
| 3 Spherical bushing, Ring, Retainer, Dust seal                          | 11 Cover, Retainer                              |
| 4 Tie rod   | 12 Boot   |
| 5 Kingpin plate, Shim   | 13 Cover  |
| 6 Kingpin, O-ring   | 14 Clamp, Bolt, Spring washer                   |
| Remove parts 7 through 12 as an assembly.                               | 15 Pipe (L.H., R.H.)                            |
| 7 Knuckle   | 16 Steering cylinder [Bolt, Spring washer, Nut] |
| 8 O-ring  | 17 Elbow, O-ring                                |
|   | 18 Stopper bolt, Lock nut                       |
|   | 19 Rear axle housing                            |

**Suggestions**

**Mark Cylinder End Caps**

Mark the cylinder end caps for proper alignment before they are disassembled from the cylinder.



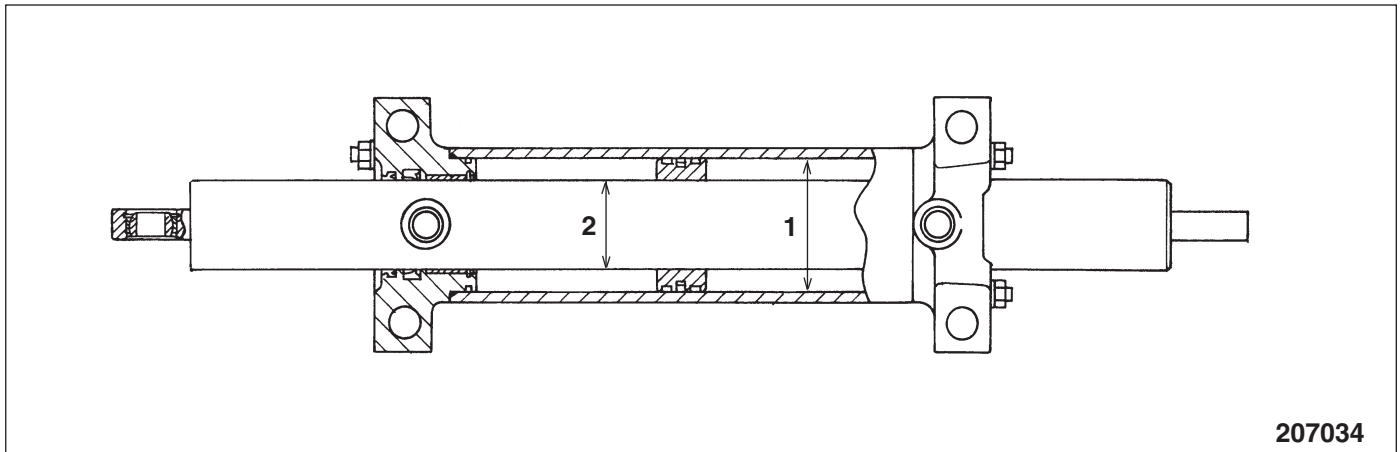
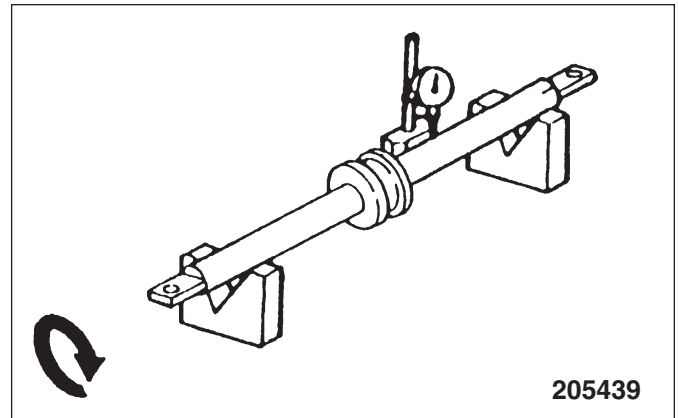
**Inspection and Repair**

- 1 Cylinder tube 8:  
Check for wear, damage or rust inside the cylinder.
- 2 Piston rod 9:  
Check for rust, damage, scratches or impact marks on the rod surface.
- 3 Rings and gaskets:  
Replace the entire seal kit.

A: Standard value

Unit: mm (in.)

		FBC15N-FBC18LN	FBC20N-FBC30LN
Internal diameter of cylinder tube 1	A	63(2.480)	75(2.953)
External diameter of piston rod 2	A	40(1.575)	50(1.968)



## Inspection after Disassembly

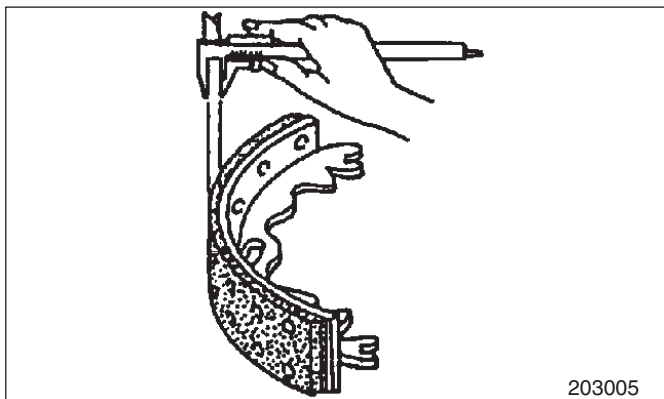
### Backing Plate

1. Check the backing plate for cracks.
2. Tighten the backing plate mounting bolts to the specified torque.

Tightening torque for backing plate mounting bolts	16 kgf•m (116 lbf•ft) [157 N•m]
--	---------------------------------------

### Shoes and Linings

1. Check each shoe and lining for cracks.
2. Replace the lining if it is dirty, greasy, burnt, or glazed.
3. Check the thickness of the lining. Replace the lining if it exceeds the service limit.



		FBC15N - FBC18LN	FBC20N-FBC30LN
Lining thickness	A	4.87 (0.19)	6 (0.24)
	B	2.5 (0.10) maximum	3 (0.12) maximum

Unit: mm (in.)

A = Assembly standard B = Repair or service limit

### Brake Drums

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

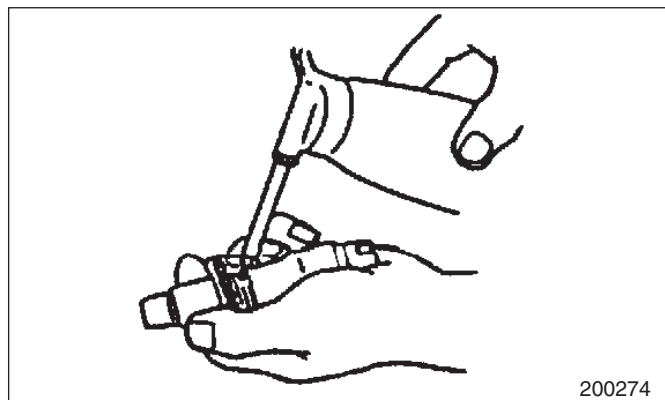
		FBC15N - FBC18LN	FBC20N-FBC30LN
Inside diameter of brake drum	A	254 + <sup>0.13</sup> <sub>0</sub> (10.0 + <sup>0.0051</sup> <sub>0</sub> )	310 + <sup>0.15</sup> <sub>0</sub> (12.2 + <sup>0.0059</sup> <sub>0</sub> )
	B	256 (10.08)	312 (12.28)

Unit: mm (in.)

A = Assembly standard B = Repair or service limit

### Adjusting Screws

Check the wheel teeth for wear. Turn the screw by hand to ensure its rotating parts turn freely.



### Parking Brake Cable

Replace a cable if it is permanently stretched, rusted, or damaged.

### Other:

1. Check the return springs for cracks or fatigue.
2. Check the adjusting springs for cracks or fatigue.
3. Check the fitting cables for stretching.

## **Chapter 6: Steering System**

### **Steering System**

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## Suggestions

### Removing the Motor and Pump Assembly

After disconnecting the steer pump hoses, motor cables, and harness leads, remove the pump and motor assembly by removing the motor bracket mounting hardware where the bracket is bolted to the frame.

### Removing the Pump

Remove the pump from the motor.

## Installation

1. To install, reverse removal sequence.

**Chapter 7: Hydraulic System**

**Hydraulic System**

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**Control Valve**

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**Lift and Tilt Cylinders**

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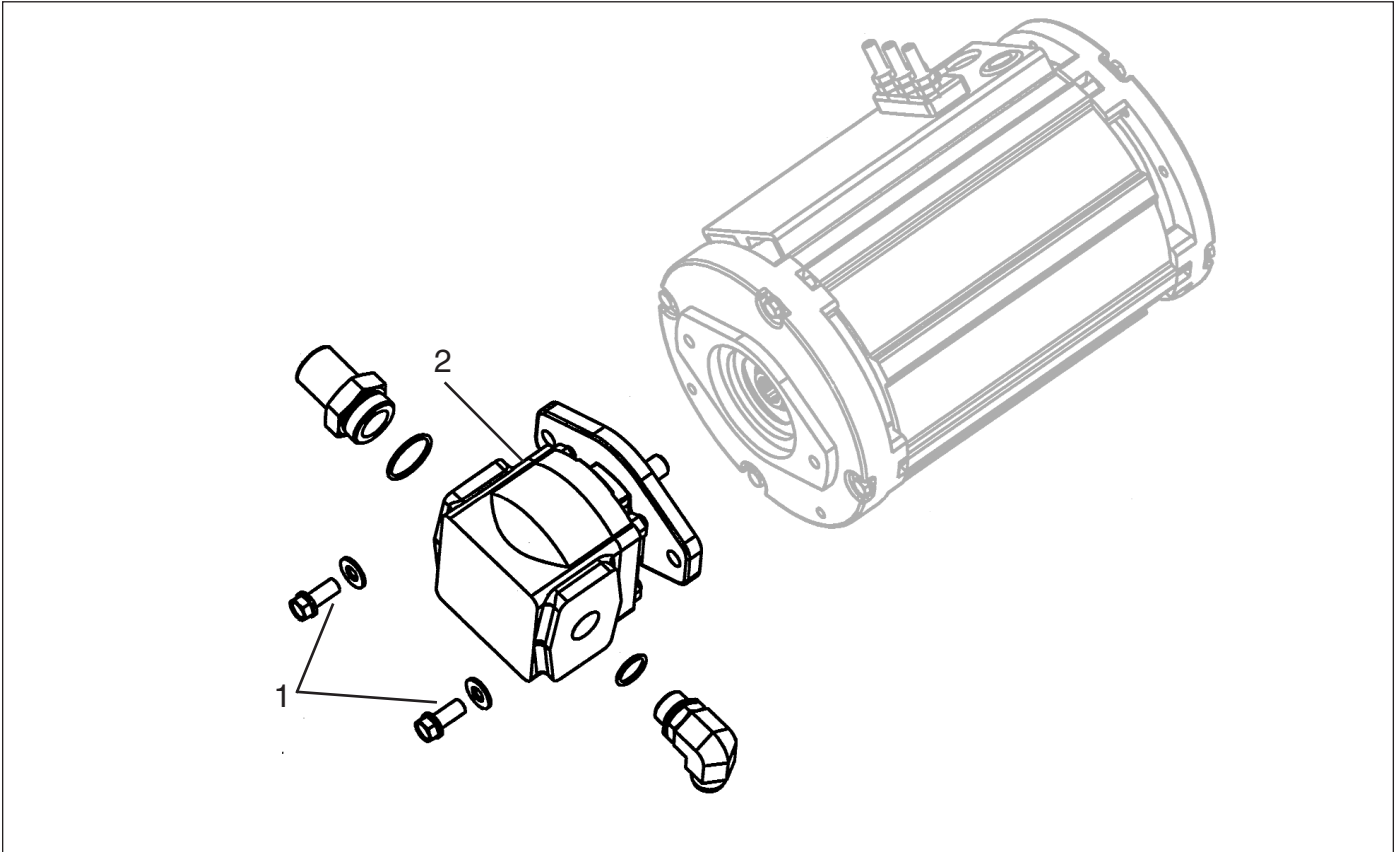
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## Hydraulic Pump

### Removal



### Sequence

1. Hardware
2. Pump

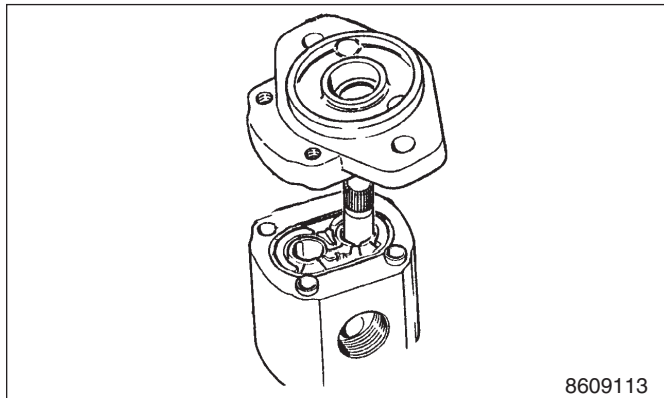
### Start By:

1. Disconnect the battery from the truck.
2. Disconnect the hoses attached to the pump fittings.
3. Disconnect the power cables and wire leads from the pump motor.
4. Raise the truck enough to allow the pump and motor assembly to be removed from below the truck. Make sure that the truck is stable and secure in the raised position.
5. Secure the motor from above with a crane, hoist, or other adequate device, or support it at its center with a garage jack.
6. Remove the motor and pump assembly from the truck.
7. Remove the hydraulic fittings from the pump.

# HYDRAULIC SYSTEM

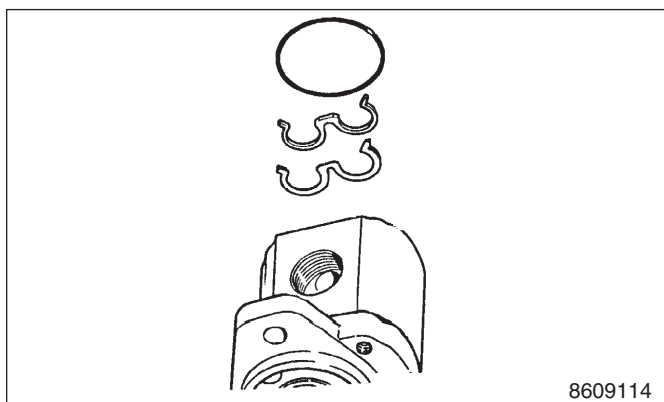
## Reassembling the Flange

Slip the shaft seal and flange assembly over the driveshaft and carefully refit the mounting flange, ensuring that it is positioned squarely onto the dowels in the body.



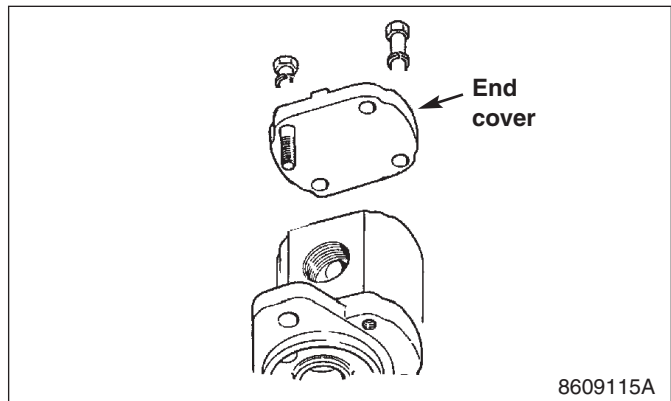
## Reassembling the Rear O-ring and Seals

1. Hold the whole unit together and carefully turn it over. Ensure that it is supported on the mounting flange, not the driveshaft.
2. Remove the end cover and install a new O-ring, bush seal, and backup seal.



## Reassembling the End Cover:

Replace end cover and refit the bolts and washers. Tighten the bolts.



	FBC15N - FBC18LN	FBC20N - FBC30LN
Tightening torque for bolts	4.7 to 5.2 kgf•m (34 to 38 lbf•ft) [46 to 51 N•m]	9.0 to 10.4 kgf•m (65 to 75 lbf•ft) [88 to 102 N•m]

### NOTE

**Lube splines before installing in pump motor. Use molybdenum disulfide grease.**

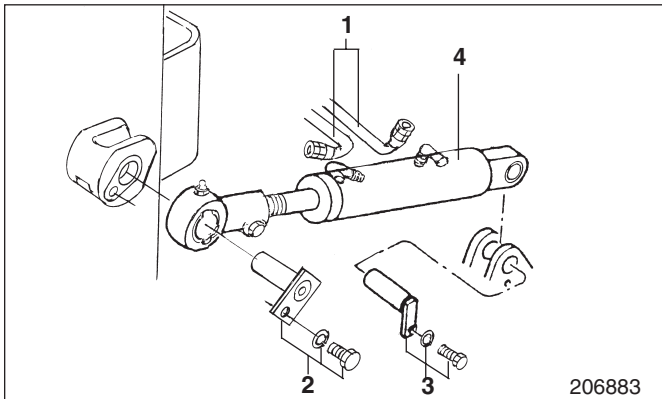
## Suggestions

### Removing Tilt Socket

#### Later Version

**⚠ WARNING**

If both tilt cylinders are to be removed at the same time, make sure that the mast is held either by a hoist or is securely supported and held in place by blocks.



1. Rubber hose
2. Tilt socket pin, bolt, washer
3. Tilt cylinder pin, bolt, washer
4. Tilt cylinder

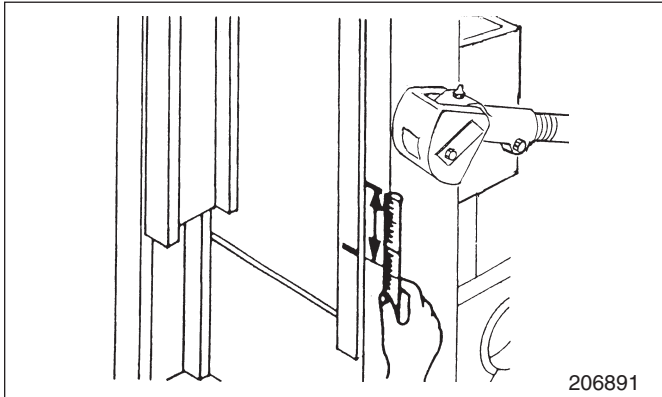
**NOTE**

When the tilt cylinders are to be replaced, it is necessary to adjust the cylinder stroke and tilt.

## Testing

### Lift Cylinder Drift Test

1. Pick up a load equal to the rated value, tilt the mast to the vertical position, raise the forks 1 to 1.5 m (3.3 to 4.9 ft) and stop the truck.
2. Scribe a line on the mast column and measure the drift of the lift cylinder (drop for 15 minutes)

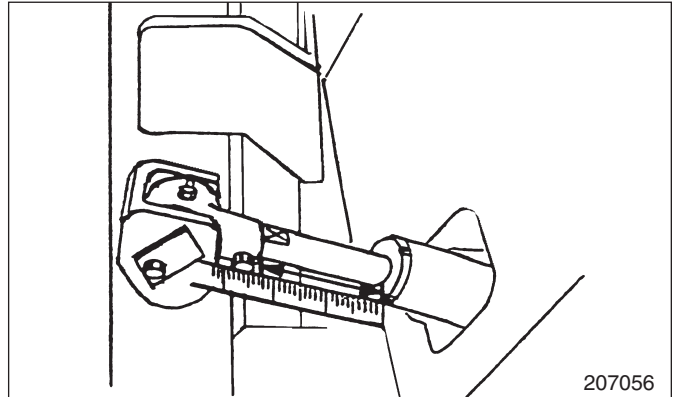


	FBC15N - FBC25EN	FBC25LN - FBC30LN
Lift cylinder drift (rated load)	50 (2.0) maximum	40 (1.6)

Unit: mm (in.)/15 min

### Tilt Cylinder Drift Test

1. Pick up a load equal to the rated value, tilt the mast to the vertical position, raise the forks about 50 cm (20 in.) and stop the truck.
2. Measure the drift extension of the tilt cylinder for (extension) 15 minutes.



	FBC15N - FBC18LN	FBC20N - FBC25EN	FBC25LN - FBC30LN
Tilt cylinder drift (rated load)	22 (0.9) maximum	20 (0.8)	15 (0.6)

Unit: mm (in.)/15 min

### Piping

1. Check each hydraulic circuit for leaks.
2. Check to make sure that each hose is free from twisting or excessive loops.

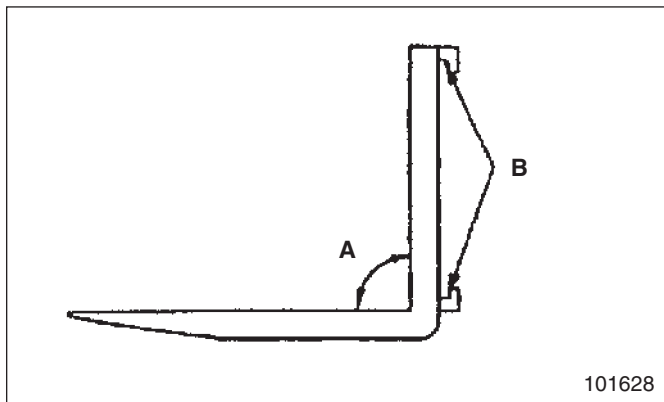
## Inspection and Adjustment

### Forks

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

Forks with cracks should be removed from service.

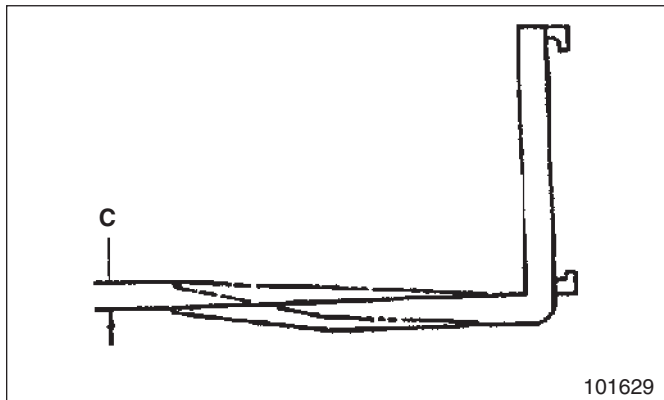
“Wet Test” magnetic particle inspection is generally preferred due to its sensitivity and the ease of interpreting the results.



- 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 entering loads.

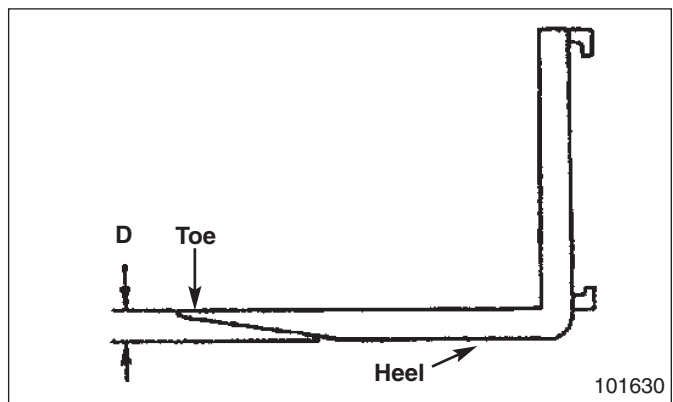
The maximum allowable difference in fork tip elevation C is 5 mm (0.20 in.) for pallet forks.

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



- Check the fork blade D. The fork should be withdrawn from service if the thickness is reduced to less than the tolerant thickness.

Check the heel of fork. Fork blade length may also be reduced by wear, especially on tapered forks and platens. Remove the forks from service when the blade length is no longer adequate for the intended loads.

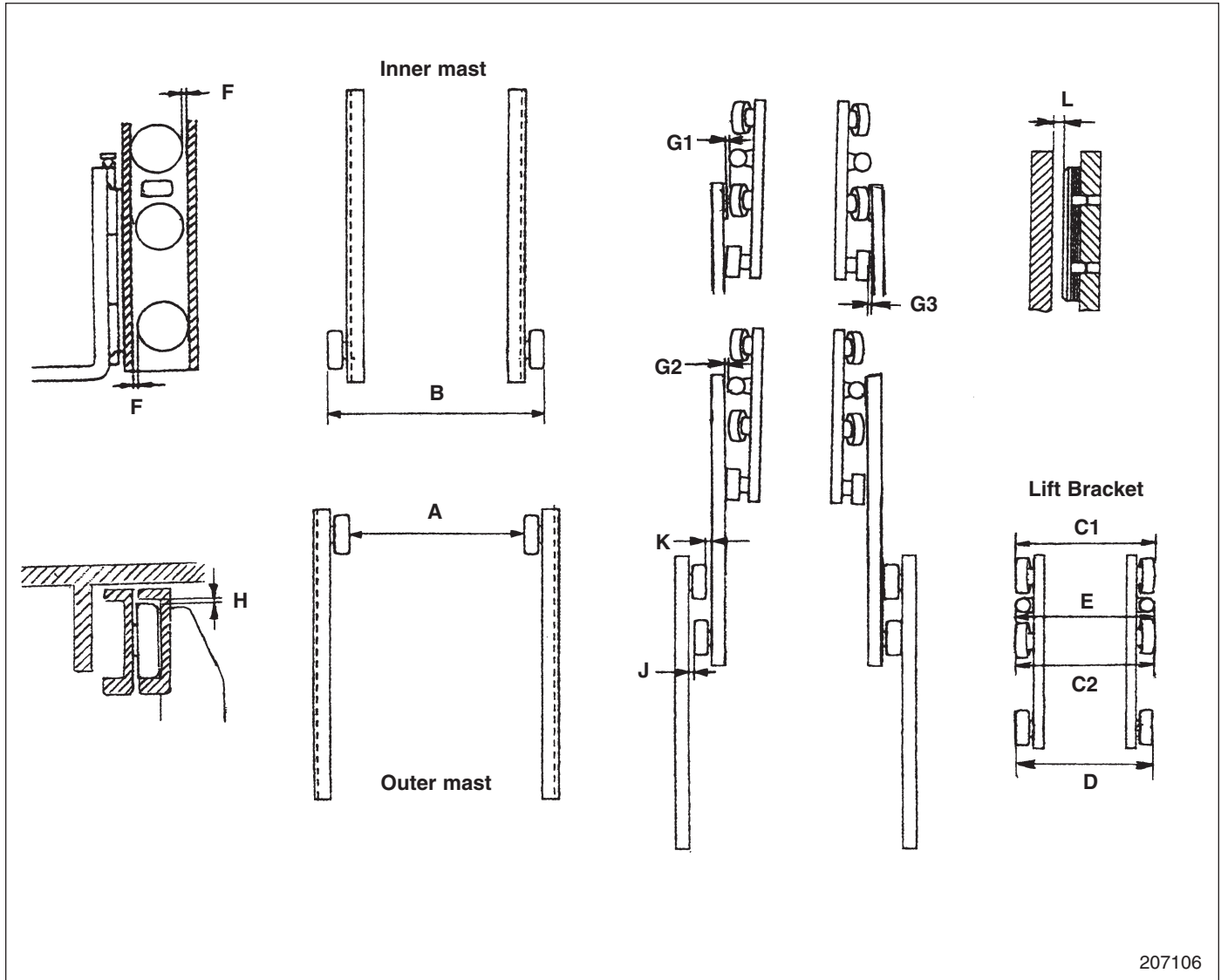


Tolerant Thickness	Standard	Limit
FBC15N	40 (1.6)	31 (1.2)
FBC18N - FBC18LN	40 (1.6)	33 (1.3)
FBC20N	45 (1.8)	36 (1.4)
FBC25N, FBC25EN, FBC25LN	45 (1.8)	39 (1.5)
FBC30N, FBC30LN	45 (1.8)	40 (1.57)

Unit: mm (in.)

# MAST AND FORKS

## Service Data



207106

## Hydraulic System

	Complaint	Possible Cause	Remedy
Lift and Tilt Cylinders	Will not lift or tilt	Not enough oil in hydraulic tank Relief valve out of order because of: 1) Seized main valve 2) Broken valve spring Oil pump defective Control valve switch misaligned or defective	Refill  Replace Replace relief valve  Replace  Readjust or replace
	Will not lift rated load	Relief valve out of order because of: 1) Too low a relief valve setting 2) Defective plunger and poppet seat 3) Weakened spring 4) Damaged O-ring in valve case Oil pump defective Piston seals worn or damaged	Readjust Replace relief valve Replace relief valve Replace O-ring  Replace  Replace
	Lift speed is too low	Rpm too low Control lever installed loose, resulting in not enough spool stroke Tank strainer clogged Pump not delivering enough oil	Adjust  Repair or replace  Clean or replace  Repair or replace
	Lowering speed is too low	Sleeve seized in flow regulator valve Dirt in flow regulator valve  Abnormal resistance to flow due to flattened hose or local clogging	Repair  Clean, repair system and replace defective hose  Replace hose
	Cylinder vibrates when actuated	Piston rod distorted Control lever installed loose, resulting in not enough spool stroke Air in oil circuit  Not enough oil in hydraulic tank	Repair or replace Repair or replace  Bleed air by operation cylinder through full stroke  Refill
	Load will not hold	Control valve spool leaking internally Lift connector on bottom of control valve not tight Sliding (inside) surface of cylinder tube slightly grooved Sliding (inside) surface of tube badly grooved Piston seals broken or distorted Oil leakage from piping	Replace  Torque to 33 ± 3.5 ft•lbs  Repair or replace cylinder assembly  Replace  Replace seal kit  Repair or replace

# MAINTENANCE SERVICE DATA

## Rear Axle

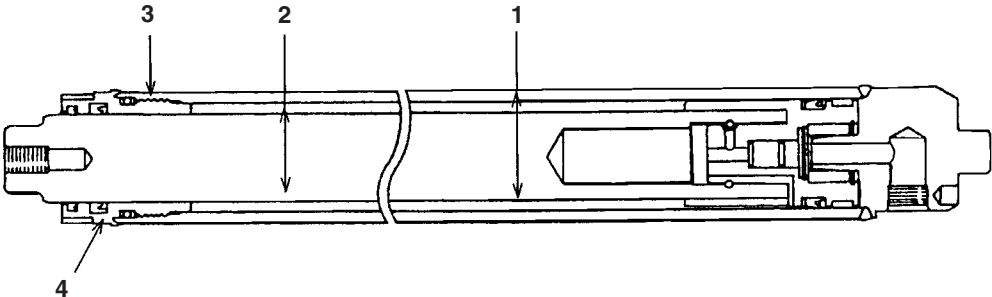
Item		Truck Model	FBC15N - FBC18LN	FBC20N - FBC30LN
Oscillating angle		A	3°	
Toe-in		A	0°	
Caster		A	0°	
Camber		A	1°	
Total fore-aft play of axle at center pin (1)		A	0.8 (0.031)	
		B	1.2 (0.047)	
Turning Angle	Inside (2)	A	83°	83°
	Outside (3)	A	54°	56°
Tightening torque, kgf•m (lb•ft) [N•m]	Support bolts (4)	A	14.8 (107) [145]	
	Stopper bolt nuts (5)	A	6.8 (49) [67]	
Cylinder minimum test pressure, kgf•cm <sup>2</sup> (psi) [kPa]		A	107 (1522) [10,500]	163 (2320) [16,000]

8609145

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

# MAINTENANCE SERVICE DATA

## Hydraulic System, continued

Item		Truck Model	FBC15N - FBC18LN	FBC20N - FBC25EN	FBC25LN - FBC30LN
Lift Cylinder	[Piston] Inside diameter of cylinder tube (1)	A	45 $\begin{smallmatrix} +0.2 \\ 0 \end{smallmatrix}$ (1.77 $\begin{smallmatrix} +0.008 \\ 0 \end{smallmatrix}$ )	50 $\begin{smallmatrix} +0.2 \\ 0 \end{smallmatrix}$ (1.97 $\begin{smallmatrix} +0.008 \\ 0 \end{smallmatrix}$ )	55 $\begin{smallmatrix} +0.2 \\ 0 \end{smallmatrix}$ (2.17 $\begin{smallmatrix} +0.008 \\ 0 \end{smallmatrix}$ )
	Diameter of piston ring (2)	A	35 (1.38)	40 (1.57)	45 (1.77)
	Thread diameter (3)	A	M49 x 1.5	M54 x 1.5	M59 x 1.5
	Tightening torque (4)  N•m (kgf•m) [lbf•ft]	A	170 to 240 (17.3 to 24.5) [125 to 175]	200 to 270 (20.4 to 27.5) [150 to 200]	270 to 304 (27.5 to 31.0) [200 to 225]
					
207073					
Return Filter	Tightening torque  N•m (kgf•m) [lbf•ft]	A	49 ± 10 (5 ± 1) [36 ± 7.2]		

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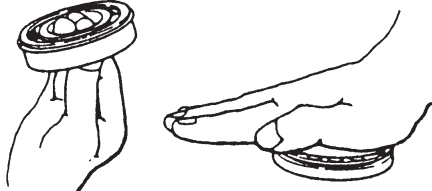
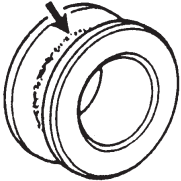
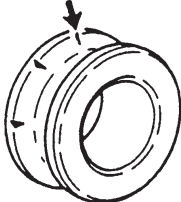
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# MAINTENANCE SERVICE DATA

Inspection Point		How to Check	Maintenance Intervals					Service Data
			Daily (pre-start)	Every 50 hours or weekly	Every 200 hours or monthly	Every 1200 hours or 6 months	Every 2400 hours or 1 year	
Tilt cylinders	Cracks, distortion, or other defects	Visual	●	●	●	●	●	
	Oil leaks	Visual	●	●	●	●	●	
	Forward rod drift (rated load)	Watch/scale			●	●	●	<b>FBC15N - FBC18LN</b> 22 mm (0.9 in.)/15 min <b>FBC20N - FBC25LN</b> 20 mm (0.8 in.)/15 min <b>FBC30N - FBC30LN</b> 15 mm (0.6 in.)/15 min
	Mounts—rattle or damage	Visual/free	●	●	●	●	●	
	Rod socket nut—tightness	Torque wrench	●	●	●	●	●	<b>FBC15N - FBC18LN</b> 15 kgf·m (108 lbf·ft) [147 N·m] <b>FBC20N - FBC30LN</b> 40 kgf·m (289 lbf·ft) [392 N·m]
Piping	Oil leaks	Visual	●	●	●	●	●	
	Rubber hoses: damage	Visual			●	●	●	
	Hose reels and swivel joint—distortion or other defects	Visual			●	●	●	
Mast and lift bracket	Cracks, distortion, or other defects	Visual/dye check	●	●	●	●	●	
	Mast supports—rattle or damage				●	●	●	
	Main rollers—clearance, damage	Feeler gauge/dial gauge			●	●	●	Each roller to mast clearance (at max. height): 0.1 to 0.5 mm (0.004 to 0.020 in.)

**Inspection Guide**

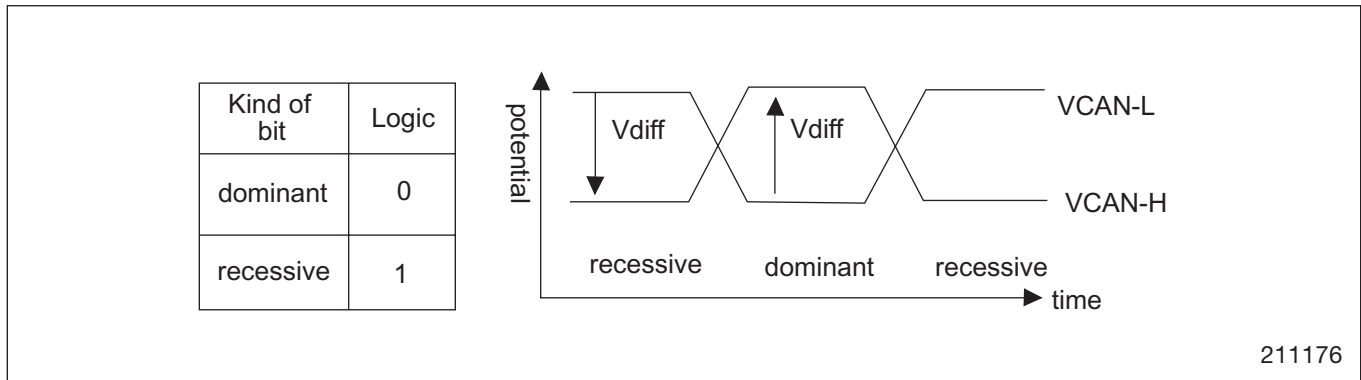
Check	For (item or defect)	How
<p>Antifriction bearings</p>	<p><b>ITEMS</b></p> <ul style="list-style-type: none"> <li>a) Fit on shaft</li> <li>b) Fit in housing</li> <li>c) Preload (small initial load applied to absorb initial bearing deformation)</li> </ul>	<p>Measure inside diameter with an indicator hole gauge and shaft outside diameter with an indicating micrometer</p> <p>Measure outside diameter with an indicating micrometer and housing inside diameter with an indicator hole gauge</p> <p>As stated in service manual</p>
	<p><b>DEFECTS</b></p> <ul style="list-style-type: none"> <li>a) High running temperature (caused by over lubrication)</li> <li>b) Noise (humming), vibration, or rough running</li> <li>c) Creep (marks of circumferential slip on inner ring's surface in contact with shaft or on outer ring's surface in contact with housing due to loose fit of bearing)</li> <li>d) Corrosion</li> <li>e) True brineling (caused by careless installation or removal)</li> </ul>	<p>As shown</p> <div style="text-align: center;">  <p><b>Radial bearing</b>      <b>Thrust bearing</b></p> </div> <p style="text-align: right;">8609153</p> <p>Visually</p> <p>Visually</p> <div style="text-align: center;">  <p>8609151</p> </div> <div style="text-align: center;">  <p>8609152</p> </div>

10. Always use tools that are in good condition and be sure you understand how to use them before performing any service work.
11. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary.
12. If possible, make all repairs with the truck parked on a level, hard surface. Block truck so it does not roll while working on or under truck.
13. Disconnect battery and discharge any capacitors (electric trucks) before starting to work on truck. Hang "Do not Operate" tag in the Operator's Compartment.
14. Repairs, which require welding, should be performed only with the benefit of the appropriate reference information and by personnel adequately trained and knowledgeable in welding procedures. Determine type of metal being welded and select correct welding procedure and electrodes, rods or wire to provide a weld metal strength equivalent at least to that of parent metal.
15. Do not damage wiring during removal operations. Reinstall the wiring so it is not damaged nor will it be damaged in operation by contacting sharp corners, or by rubbing against some object or hot surface. Place wiring away from oil pipe.
16. Be sure all protective devices including guards and shields are properly installed and functioning correctly before starting a repair. If a guard or shield must be removed to perform the repair work, use extra caution.
17. Always support the mast and carriage to keep carriage or attachments raised when maintenance or repair work is performed, which requires the mast in the raised position.
18. Loose or damaged fuel, lubricant and hydraulic lines, tubes and hoses can cause fires. Do not bend or strike high pressure lines or install ones which have been bent or damaged. Inspect lines, tubes and hoses carefully. Do not check for leaks with your hands. Pin hole (very small) leaks can result in a high velocity oil stream that will be invisible close to the hose. This oil can penetrate the skin and cause personal injury. Use cardboard or paper to locate pin hole leaks.
19. Tighten connections to the correct torque. Make sure that all heat shields, clamps and guards are installed correctly to avoid excessive heat, vibration or rubbing against other parts during operation. Shields that protect against oil spray onto hot exhaust components in event of a line, tube or seal failure, must be installed correctly.
20. Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Always make sure all raised components are blocked correctly and be alert for possible pressure when disconnecting any device from a system that utilizes pressure.
21. Do not operate a truck if any rotating part is damaged or contacts any other part during operation. Any high speed rotating component that has been damaged or altered should be checked for balance before reusing.
22. When handling the parts containing asbestos, be careful not to inhale the asbestos. Doing so is hazardous to your health.  
  
If the shop dust may contain asbestos, follow the precautions described below.
  - a. Do not use compressed air for cleaning.
  - b. Do not brush or apply grinder on asbestos containing materials.
  - c. To clean asbestos containing materials, wipe with moistened cloth or use a vacuum cleaner with particle filter.
  - d. If you have to handle the parts containing asbestos for a long time, be sure to do it in a well-ventilated area.
  - e. If the asbestos in the air cannot be removed, wear a mask.
  - f. Be sure to observe the working rules and regulations.
  - g. When disposing of materials with asbestos, be sure to observe the environmental protection regulations of your area.
  - h. Avoid working in the atmosphere where asbestos particles may be suspended.

CONTROLLER

The data are expressed with electric potential difference in high- and low-level signals as follows.

They are transferred to each controller through the serial communication protocol.



Main specifications

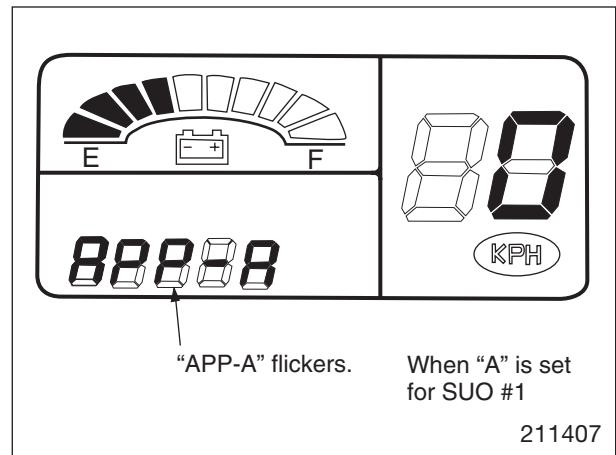
Communication protocol	CANbus 2.0B passive	Non-Return to Zero method Broadcast communication protocol
Communication line	Dual 2-wire type serial communication	
Communication speed	500 kbps	
Data length	0 to 8 bytes	

(3) When terminating the data checking mode for SUO #1, perform the following procedure.

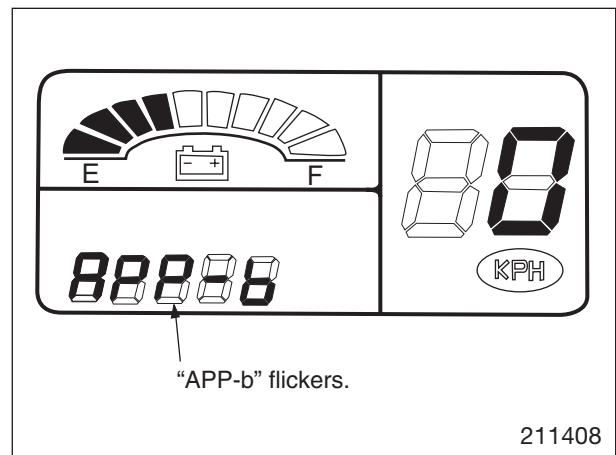
- Press the left button on the display unit.  
The mode changes to RUN mode.
- Press the right button on the display unit.  
The mode changes to RUN mode.
- **Press the right button 4 seconds or more.**  
The mode changes to the data changing mode for SUO #1.

To change data, perform the following procedures.

- (1) Perform steps (1) and (2) of the data checking procedures to change the mode to the data checking mode.
- (2) Press the right button on the display unit 4 seconds or more. The mode changes to the data changing mode for SUO #1.
  - Current data of SUO #1 flickers. This enables to change the SUO #1 data.



(3) Press the left button on the display unit to change the SUO #1 data.



(4) When terminating the data changing mode for SUO #1, perform the following procedure.

- Press the right button on the display unit.  
The mode changes to RUN mode.

### #5 Auxiliary 1 Speed

This setting affects pump speed when you operate the attachment 1 lever.

MC spec: speed when attachment 1 switch is turned on

Attachment 1 speed will become faster if the value setting is increased. The range setting is 1 to 10 for all models.

### #6 Auxiliary 2 Speed

This setting is not used for all models.

Attachment 2 speed is the same as attachment 1 (#5).

### #7 Top Travel Speed Limit

This setting affects maximum truck speed without load. Truck speed with load will be less than this setting. This setting affects top speed, and does not affect gradability or acceleration. For this option to lock in speed, software version 0043 and higher must be installed.

The range setting is 5 to 18 [km/h].

[When #40 is set for “2.0 tons or more (except for EE type)”, #41 is set for “36 volts” and #43 is set for “MC Transistor Control Type”: 5 to 17.]

[When #40 is set for “less than 2.0 tons (EE type)”, #41 is set for “36 volts” and #43 is set for “MC Contactor Control Type”: 5 to 11.]

[When #40 is set for “2.0 tons or more (EE type)”, #41 is set for “36 volts” and #43 is set for “MC Contactor Control Type”: 5 to 12.]

[When #41 is set for “48 volts (EE type)” and #43 is set for “MC Contactor Control Type”: 5 to 14.]

### #8 Acceleration Rate

This setting affects response time to calculate speed order from accelerator pedal position.

Acceleration of trucks becomes faster if the value setting is increased.

The range setting is 1 to 5.

(When #40 is set for “EE type” and #43 is set for “MC Contactor Control Type”: 1 to 2.)

## Setup Options (Group 1)

Option #	Title of Option	Description	Range	Default Value
#1	Application Pre-Sets (Truck Operation Mode)	The value setting of the following 7 items are registered beforehand. <u>Top travel speed</u> , <u>Acceleration rate</u> , <u>Traveling power</u> , <u>Regen adjustment</u> , <u>Start lift speed</u> , <u>Top lift speed</u> , <u>Tilt speed</u> . Refer to the explanation for details.	A, b, C, d, E (1), (4)	A (4)
#2	Start Lift Speed	Beginning lift speed Start lift speed cannot exceed top lift speed. (1: SLOW → 10: FAST)	1 to 10	1
#3	Top Lift Speed	Lift speed when operating the lever at maximum	1 to 10	9 (4)
#4	Tilt Speed	Speed setting for tilt	1 to 10	7
#5	Auxiliary 1 Speed	Speed setting for attachment 1	1 to 10	3
#6	Auxiliary 2 Speed	Not used	–	–
#7	Top Travel Speed Limit	Maximum travel speed	5 to 18 [km/h] or 5 to 17 [km/h] (3), (4)	15 (4)
#8	Acceleration Rate	Choice of acceleration rate (1: SLOW → 5: FAST)	1 to 5 (4)	3 (4)
#9	Traveling Power	Choice of powering characteristic (1: ECONOMY, 2: STANDARD, 3: HIGH POWER)	1, 2, 3 (4)	2 (4)
#10	Service Indicator	This function notifies service personnel that maintenance time is approaching or has passed. It means the lapsed time when setting up. Approached: !LED flicker (20 hour) Passed : !LED turn on and power reduction (selected) (2) Refer to the explanation for details.	0, 0.1, 100, 150, ...950, 1000, =0.1 (6 min.), =100, =150, ..=950, =1000 (In increments of 50 [hour])  = ”: power reduction 0: no action	0

- NOTICE:
- (1) Before changing, when parameter data are different from the values of the selected mode, the truck mode indicator (A to E) flickers.  
When the truck mode is changed, all parameter data is replaced by the set values of the selected mode.
  - (2) The data from the truck hour meter at set time is saved apart from the selected value. If the key switch is turned off without setting the DRS switch to R, the data at set time is maintained.  
When the DRS switch is set to R, the data at set time is replaced by the current truck hour meter data.
  - (3) When #40 is set for “2.0 tons or more” and #41 is set for “36 volts”, the setting range is 5 to 17 [km/h].  
For setting other than above, the setting range is 5 to 18 [km/h].

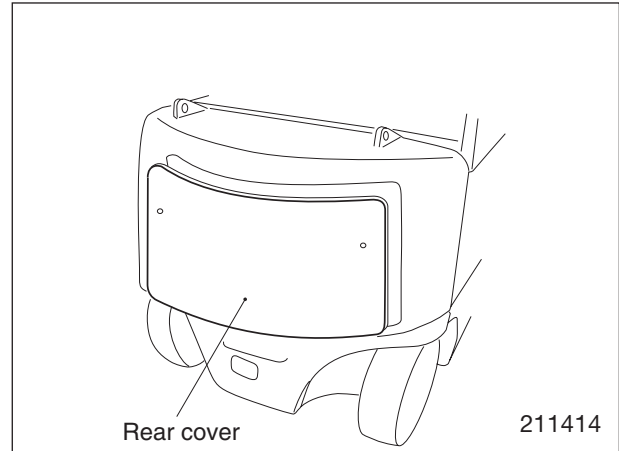
Fault	How to detect	Display							Code	Steering operation	Result	To return to normal	Memory
		LED											
		Error	Brake Oil	Parking Brake	Battery Low	Over Temp.	Seat Belt	Service Indicator					
Seat switch, Faulty Setting For Hydraulic	Seat SW is off at power-on.								(L)	×	Line contactor Off Steering contactor Off	Seat switch ON Lever is in neutral	
	Seat SW is off.									○	Disables lever operation		
Display Communication Fault	When serial communication is not going on	*							60	○	ERROR LED (!) flickers	Turn off key	*
	Display hour meter error									○	ERROR LED (!) lights		
Logic Card Initialize Failure	SUO Gr.#3 and default setting are not set. Inverter setting error	*							61	×	Line contactor Off Steering contactor Off	Turn off key	*
Logics Fault	Sum check of ROM Memory check of RAM Sum check of SUO data (EEPROM)	*							62	×	Line contactor Off Steering contactor Off	Turn off key	*
Traction Inverter Fault	Sum check of ROM Memory check of RAM Initial mode SW setting fault When CAN communication is not going on	*							63	×	Line contactor Off Steering contactor Off	Turn off key	*
Pump Inverter Fault	Sum check of ROM Memory check of RAM Initial mode SW setting fault When CAN communication is not going on	*							65	×	Line contactor Off Steering contactor Off	Turn off key	*
Contactor Coil Fault	Contactor coil current sensor Line contactor Pump contactor Steering contactor	*							72	×	Line contactor Off Steering contactor Off	Turn off key	*
Hydraulic Lock Solenoid Fault	Checks current of lift lock valve power circuit.	*							74	○	Disables lever operation	Turn off key	*
Electromagnetic Brake Solenoid Fault	Checks current of electromagnetic brake valve power circuit.	*							75	○	Line contactor Off Steering contactor Hold	Turn off key	*
Battery Voltage Too Low	Voltage class is not correct.	*							78	×	Line contactor Off Steering contactor Off	Turn off key	*
Battery Voltage Too High	Voltage class is not correct.	*							79	×	Line contactor Off Steering contactor Off	Turn off key	*
Battery Consumption Much	Much consumption with small capacity battery				*					○	Power reduction (economy table)	Charge battery	
Battery Consumption Too Much	Too much consumption with small capacity battery				*				(Lo)	×	Line contactor Off(*) Steering contactor Off(*)	Turn off key	
Brake Oil, Low Level	Level sensor (Contact)	*								○		Turn off key	

- NOTICE:
- (1) E0, E2, E5 and E7 don't appear on the display, but are stored in the memory.
  - (2) E, (E), (L), H1-H3, and Lo appear on the display, but are not stored in the memory. (E) means flickering.
  - (3) "Line contactor off(\*)" means that the contactor will open immediately when a fault is detected. "Line contactor off" means that the contactor will open when current goes to 0.
  - (4) Contactor "hold" means "no change." When the error occurs while the contactor is turned on, it stays on.

## Replacing Logic Unit

### Removal

1. Turn off the key switch.
2. Disconnect the battery plug.
3. Remove the rear cover.



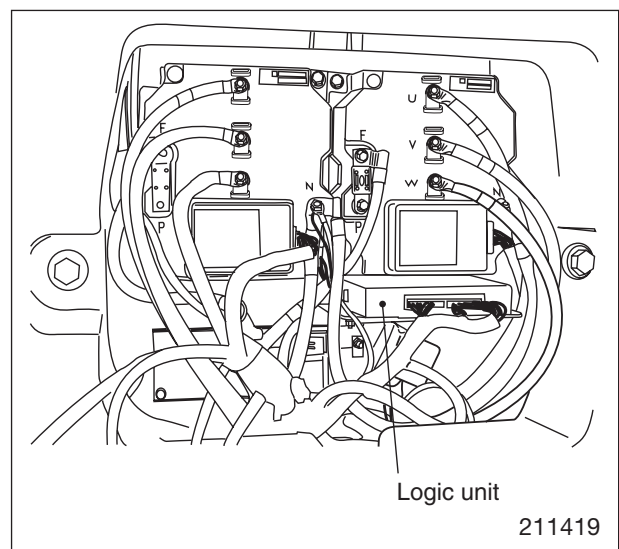
4. Disconnect the connector (P3, 4, 5 complex) from the logic card and the connector (P8) from the power supply card.

**CAUTION**

When disconnecting the connector, hold the connector housing and plug, and unlock the connector.

Holding the case may cause damage to the inside card, while holding the cable may cause wire breakage.

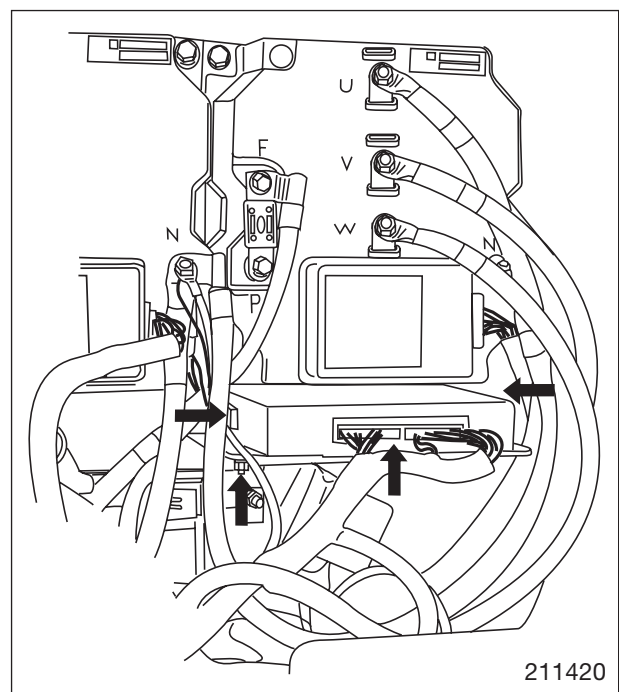
Take care when working on logic card removal. The DRS switch is located on the left side and can become damaged by rough handling.



5. Remove M10 bolts (two places) and remove the logic unit.

### Installation

Follow the removal sequence in reverse.



## AC Motor System Basics

### 1. Feature of AC motor

The AC motor model trucks covered by this manual use AC motors (three-phase induction motors) as the traction motor and pump motor. AC motors have the following advantages over DC motors:

- (1) AC motors are simple in construction. As they have no such friction parts as brushes and commutators, daily maintenance load is significantly reduced.
- (2) AC motors are compatible with high-speed operation.
- (3) An AC motor of a certain size produces higher power than a DC motor of the same size.

### 2. Speed control of induction motors

Speed control of DC motors depends on regulation of the field and armature current amounts, while that of AC motors basically depends on adjustment of the frequency of the alternating current power supply. The speed of an AC motor is determined by the frequency of the power supply AC current and the load on the motor. In addition, the voltage and current to the motor must be controlled properly so that the motor operates in its optimum characteristic range. (Fig. 1)

The frequency and voltage can be controlled by a variety of methods including the “vector control method” employed in the AC motor model trucks. This method provides highly responsive control according to ever changing truck-operating conditions through high-speed calculation on huge amount of data. The vector control calculation is performed by the inverter. (Fig. 2)

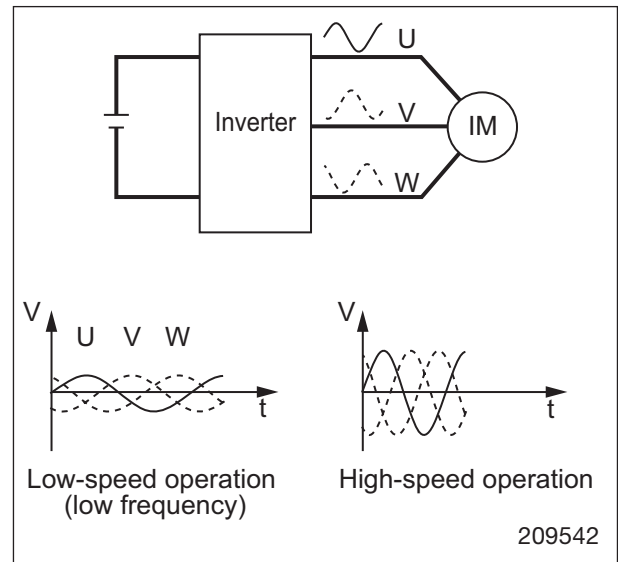


Fig. 1

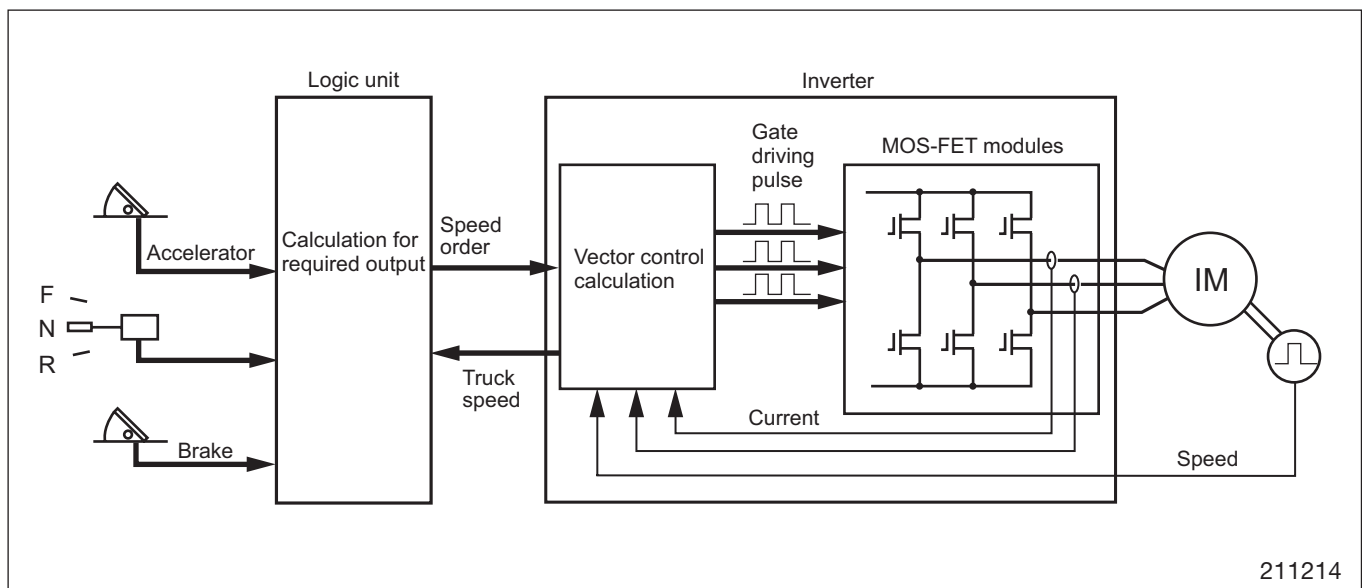
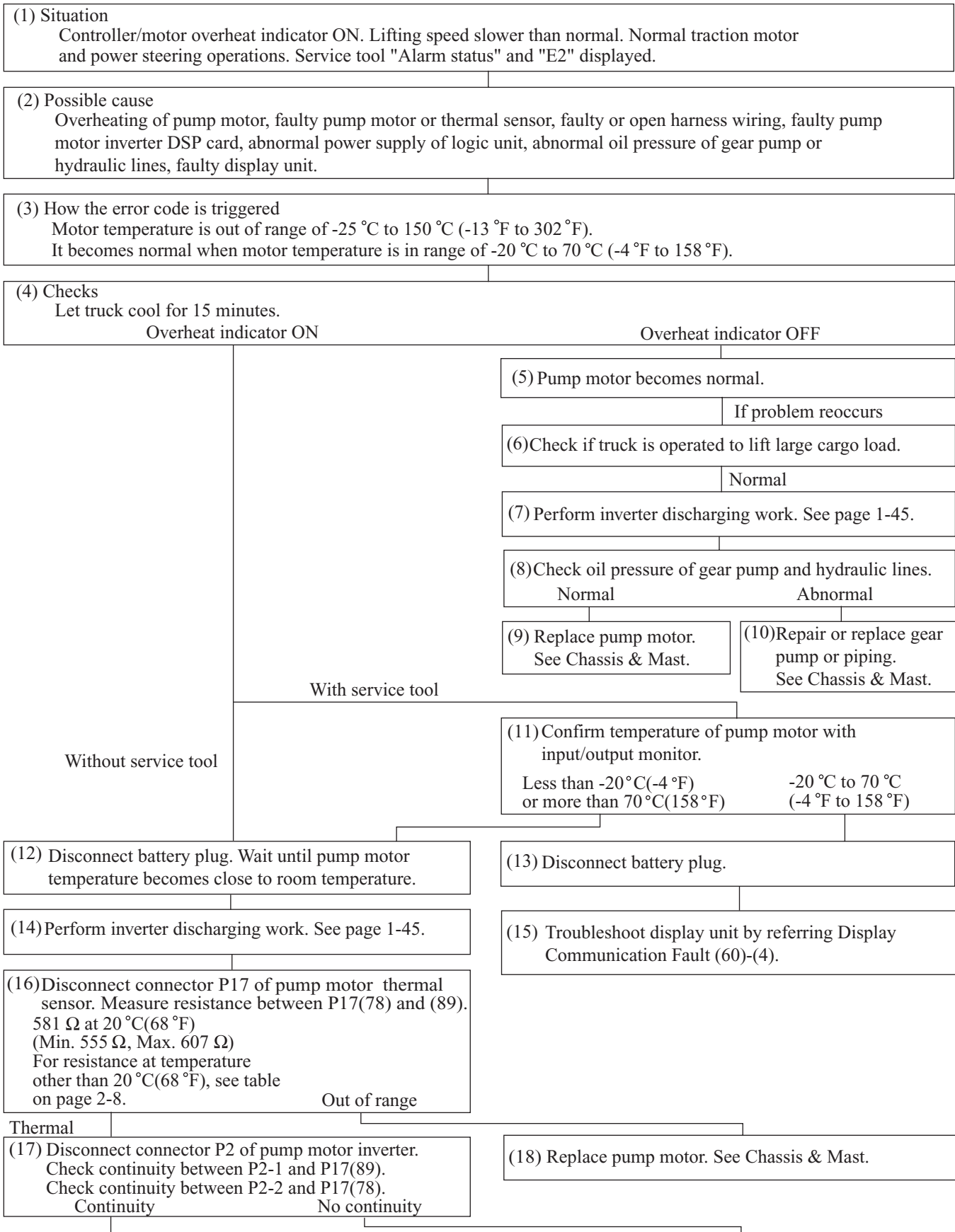
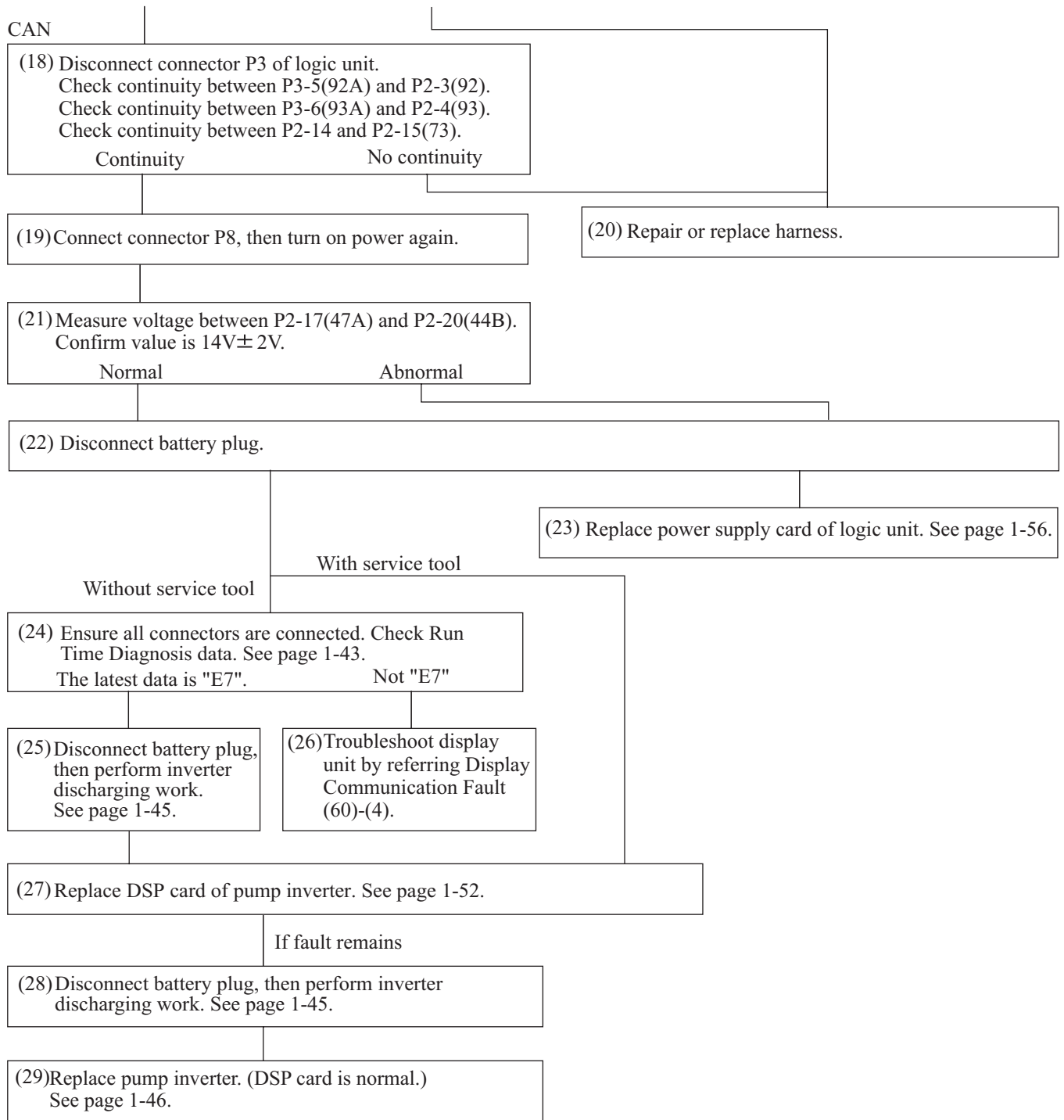
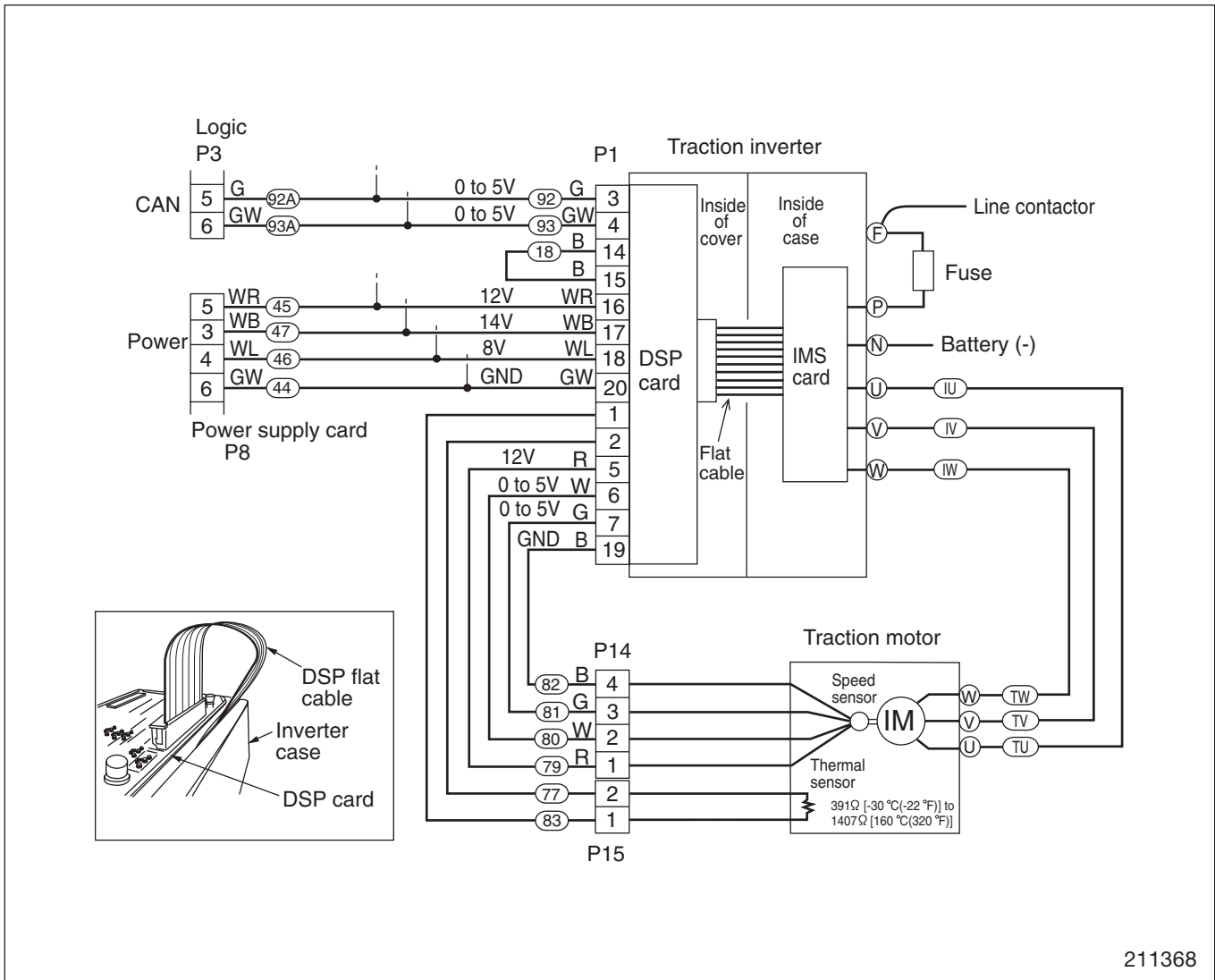


Fig. 2

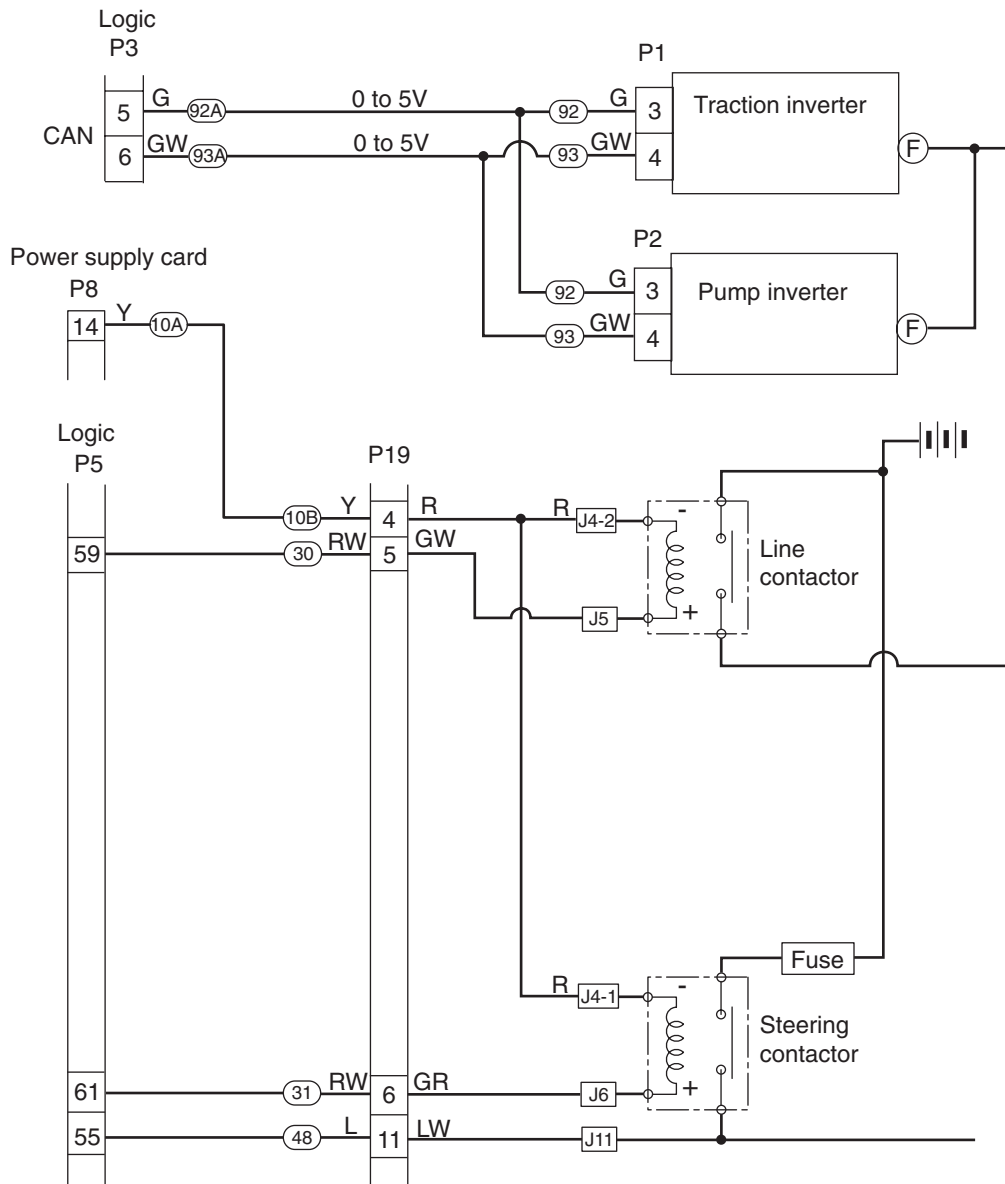
## Problem: Pump Motor, Overheating (Transistor Control Type) (E2)







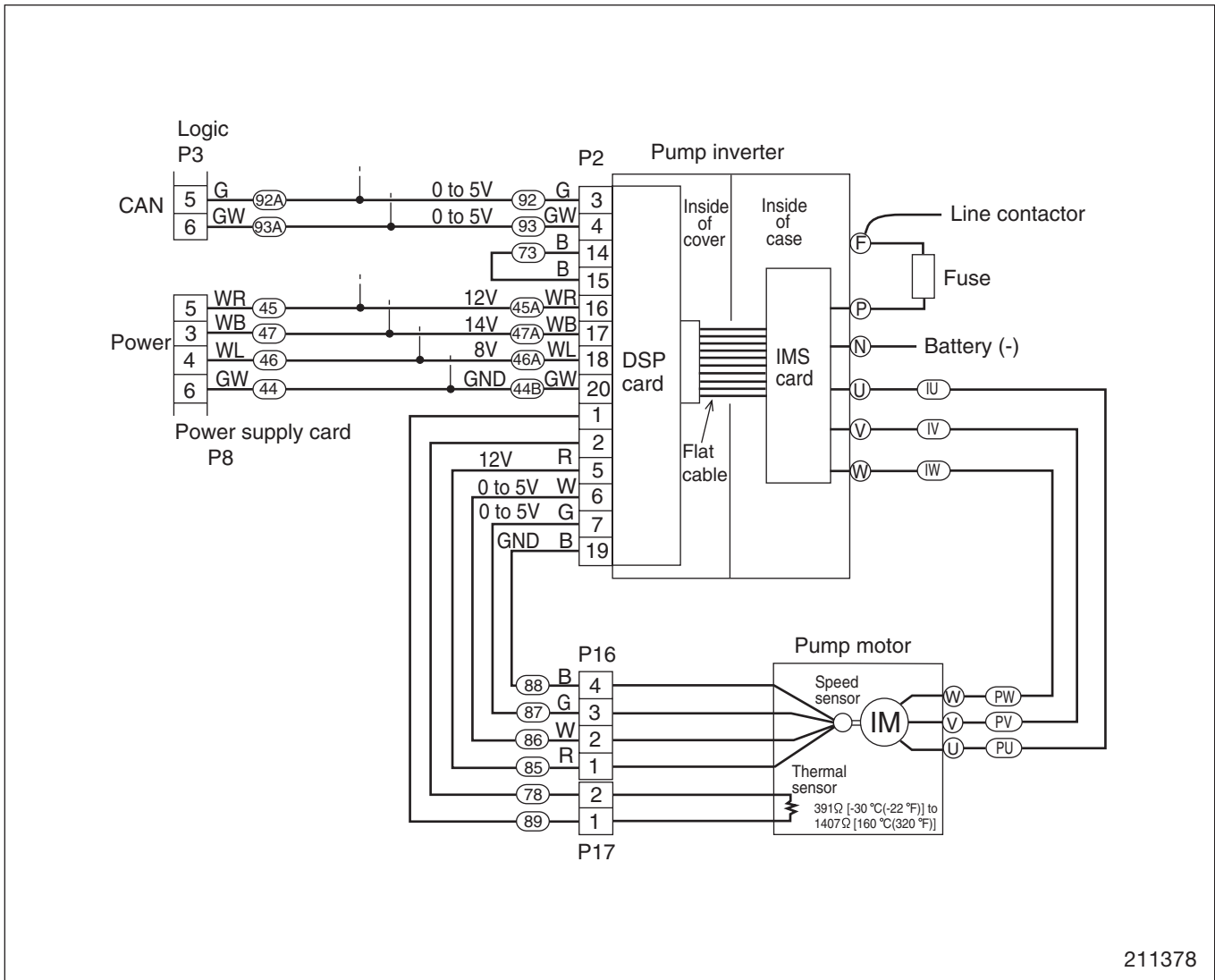
211368



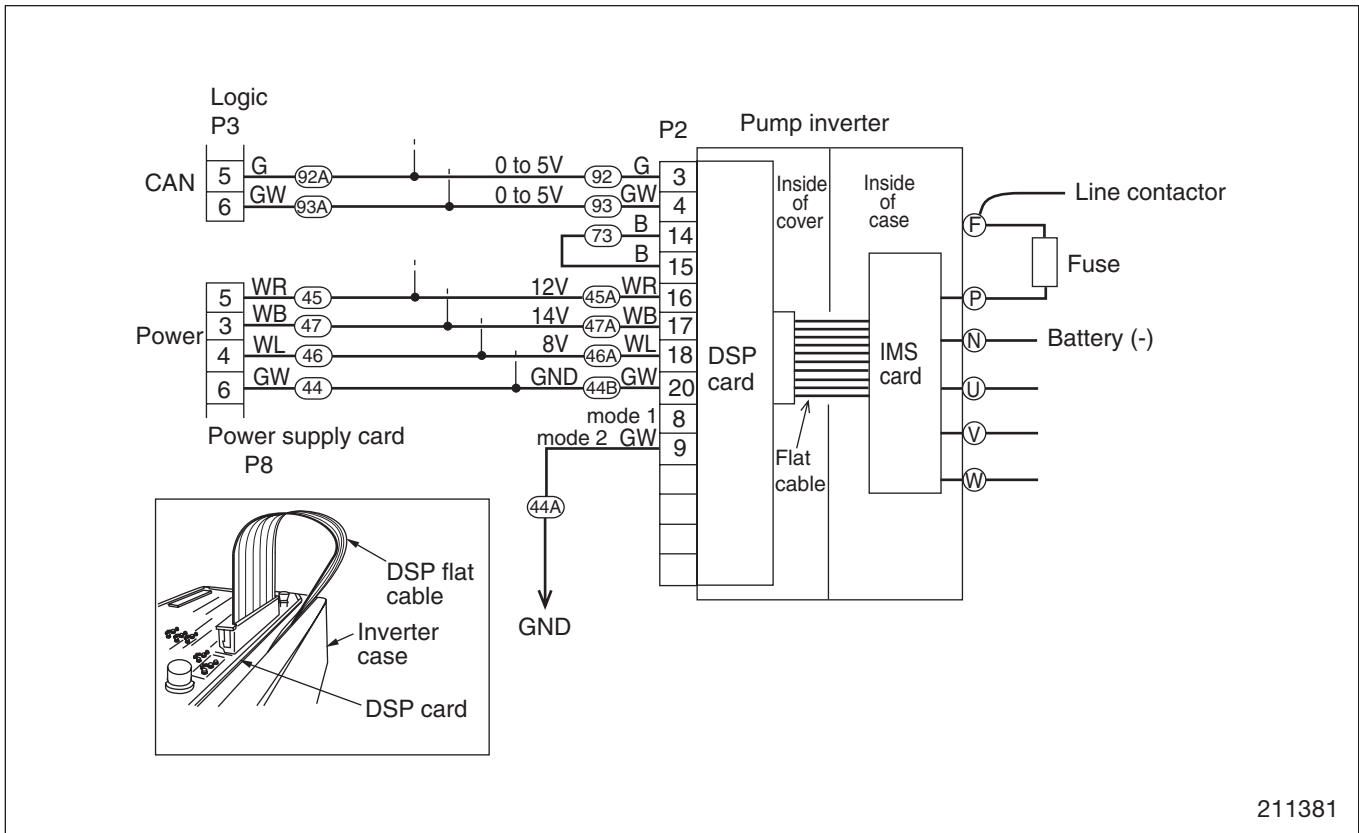
Transistor Control Type

211373



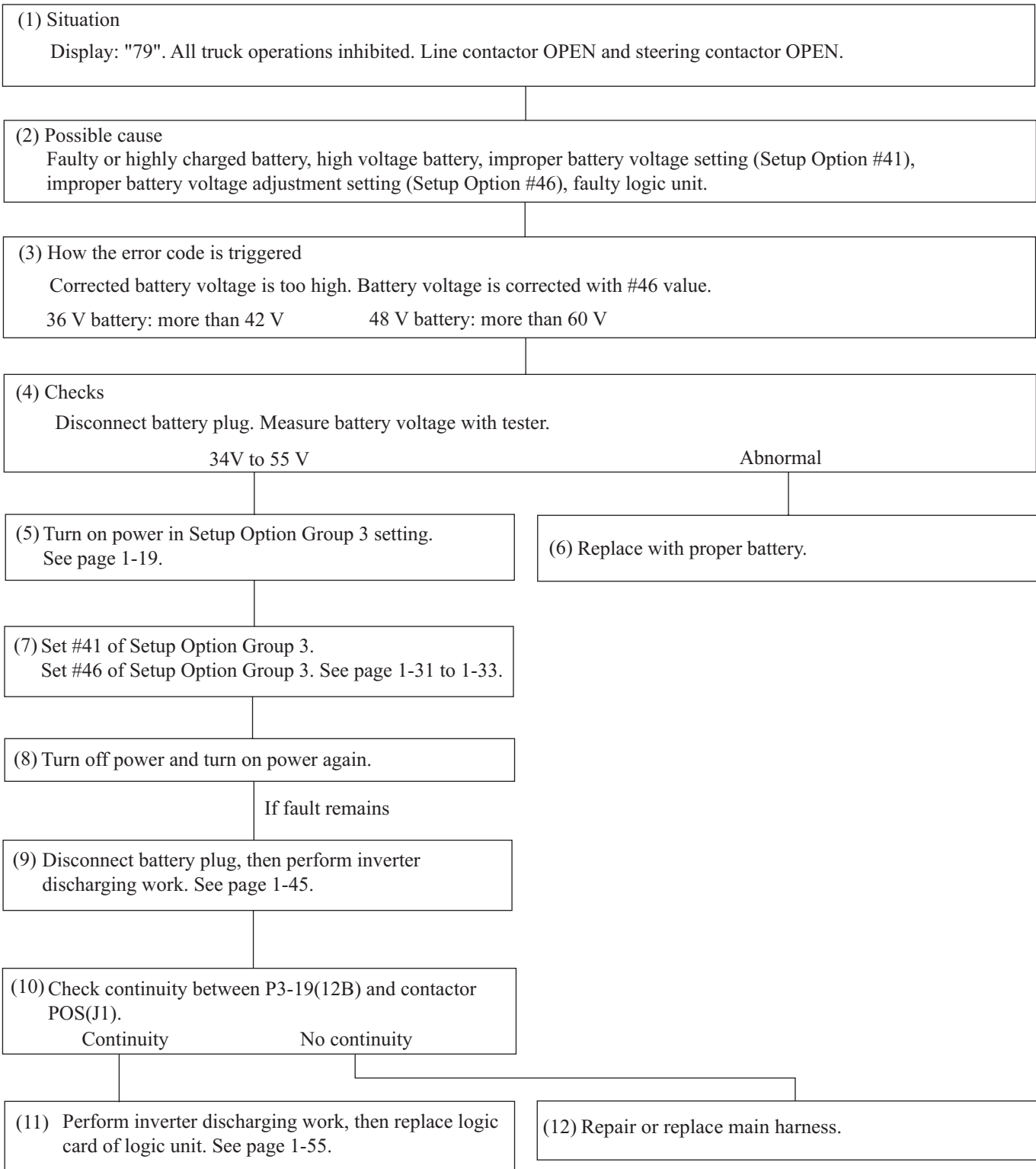


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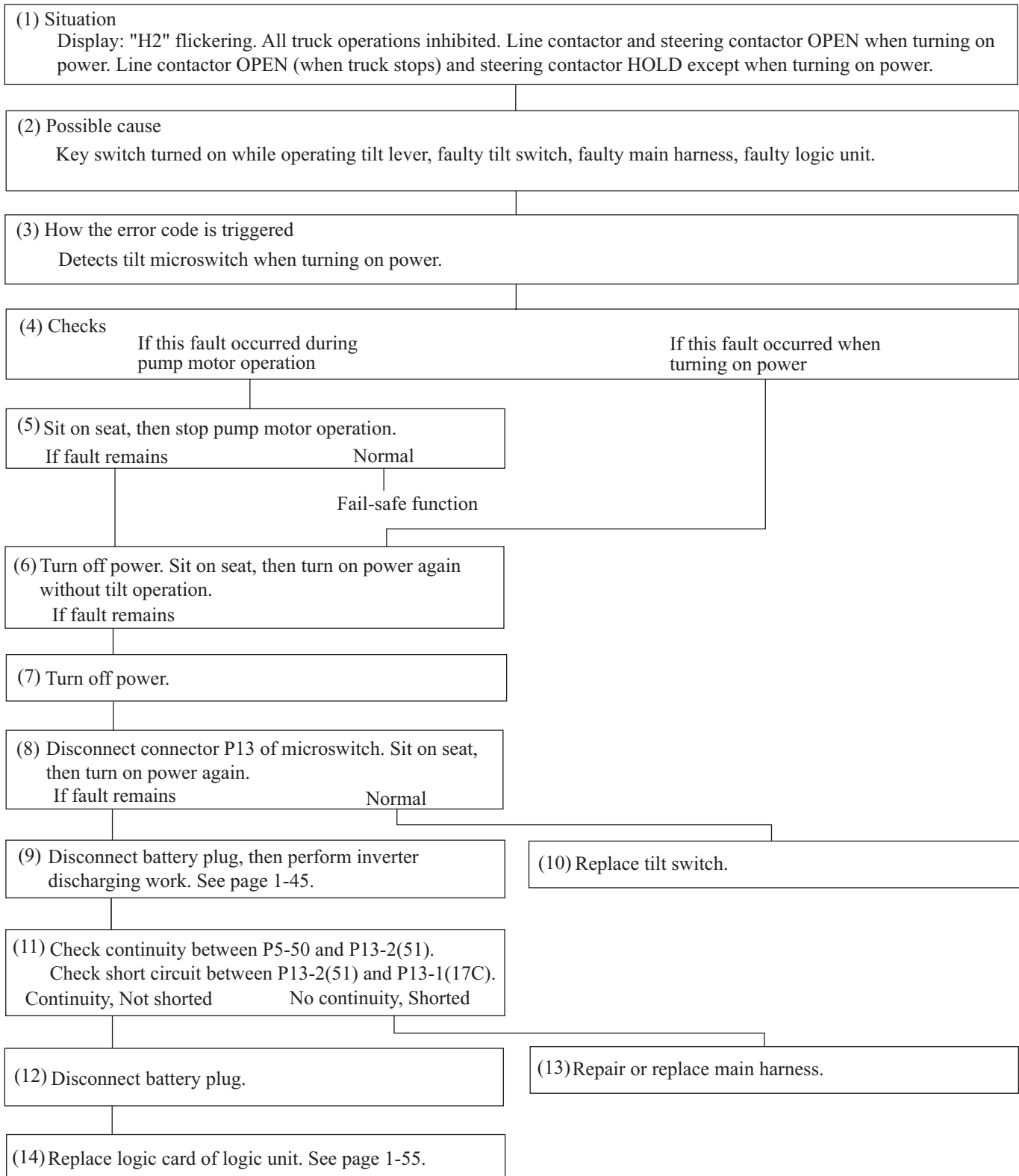


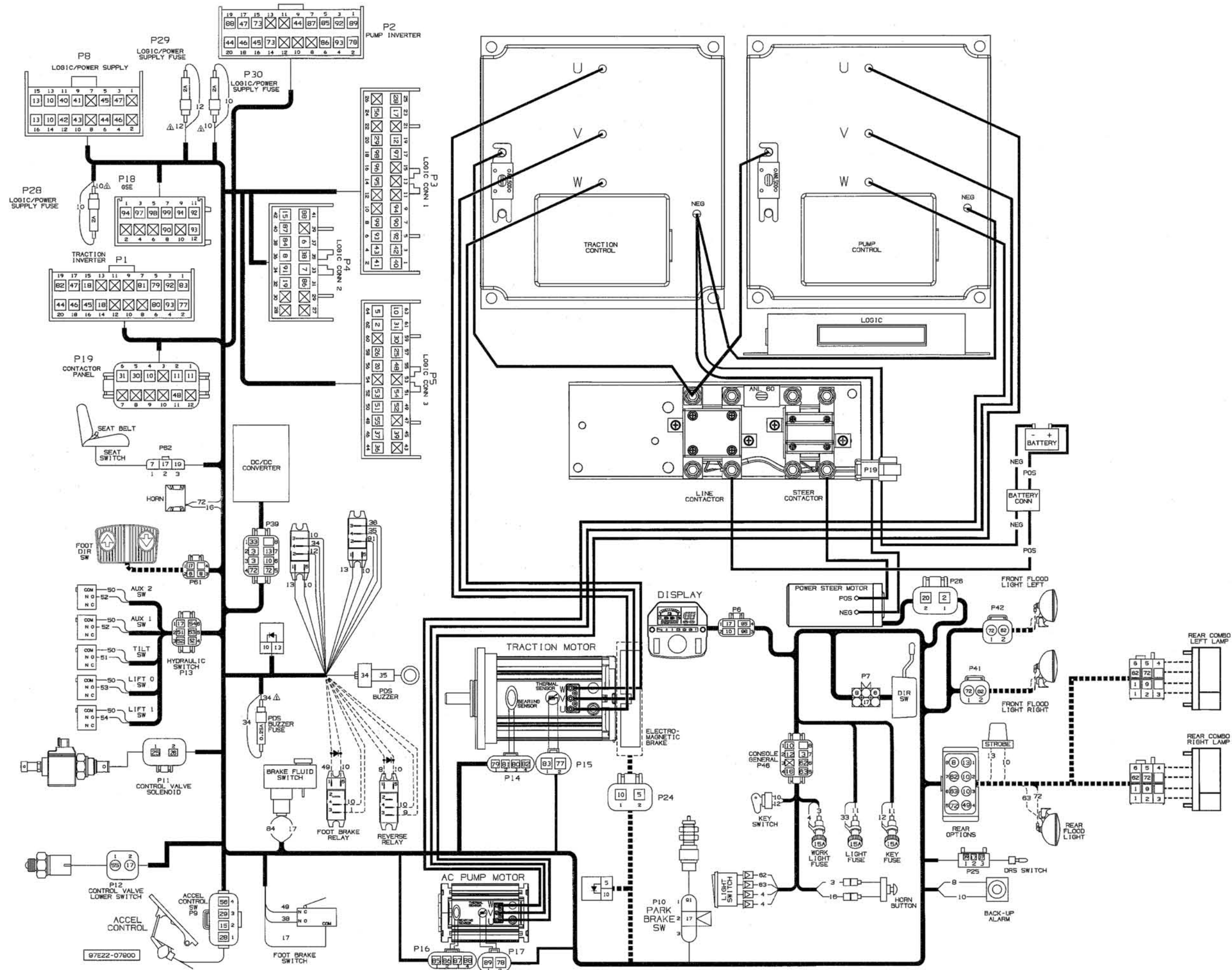
211381

## Problem: Battery Voltage Too High (79)



## Problem: Tilt Lever, Faulty Setting (H2)





97E22-07900 Transistor Hydraulics	Truck Model	Serial Number
	FBC15N	A4BC1-10200
	FBC18N	A4BC1-20200
	FBC18LN	A4BC1-30200
	FBC20N	A4BC2-10200
	FBC25N	A4BC2-20200
	FBC25EN	A4BC3-20200
	FBC25LN	A4BC3-30200
	FBC30N	A4BC3-40200
	FBC30LN	A4BC4-10200

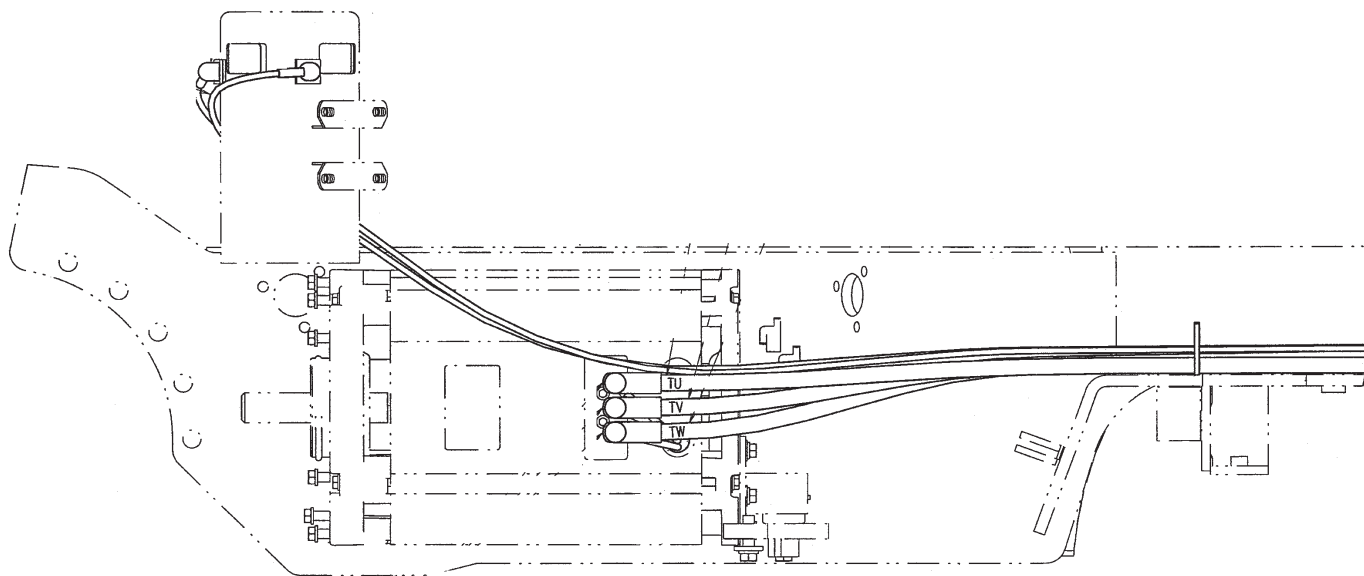
## Tightening of High-Power Motor Cable Terminals

### CAUTION

If the high-power cable terminals of the battery operated vehicle are not tightened properly, the increased contact resistance causes excessive heat generation, and could cause a fire in the worst case. To prevent accidents and equipment problems, be sure to regularly check the tightening torque of the high power cable terminals. Do not pull the cables to check connections or during adjustment. If the cable terminal sections are moved, re-tighten the connections.

Truck Size	Number of Terminals	Tightening Torque
1 Ton Drive & Pump	3	11.3 ± 1.1 N•m (1.2 ± 0.1 kgf•m) [8.33 lbf•ft]
2 / 3 Ton Drive & Pump	3	14.7 ± 1.1 N•m (1.5 ± 0.1 kgf•m) [11 lbf•ft]

## Traction Motor & Power Steer Motor Cable Routing



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