CAT® Lift Trucks

Service Manual

Chassis, Mast & Options

EP10KRT PAC ETB10A-00011-up
EP12KRT PAC ETB10A-20001-up
EP15KRT PAC ETB10A-50001-up

99759-6G100

FOREWORD

This service manual is a guide for servicing Cat® lift trucks. For your convenience the instructions are grouped by systems as a ready reference.

The long productive life of your lift trucks depend on regular and proper servicing. Servicing consistent with what you will learn by reading this service manual. Read the respective sections of this manual carefully and familiarize yourself with all of the components before attempting to start a test, repair or rebuild job.

The descriptions, illustrations and specifications contained in this manual are for trucks with serial numbers in effect at the time of printing. Cat lift trucks reserves the right to change specifications or design without notice and without incurring obligation.

Safety Related Signs

The following safety related signs are used in this service manual to emphasize important and critical instructions:

⚠ WARNING — Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

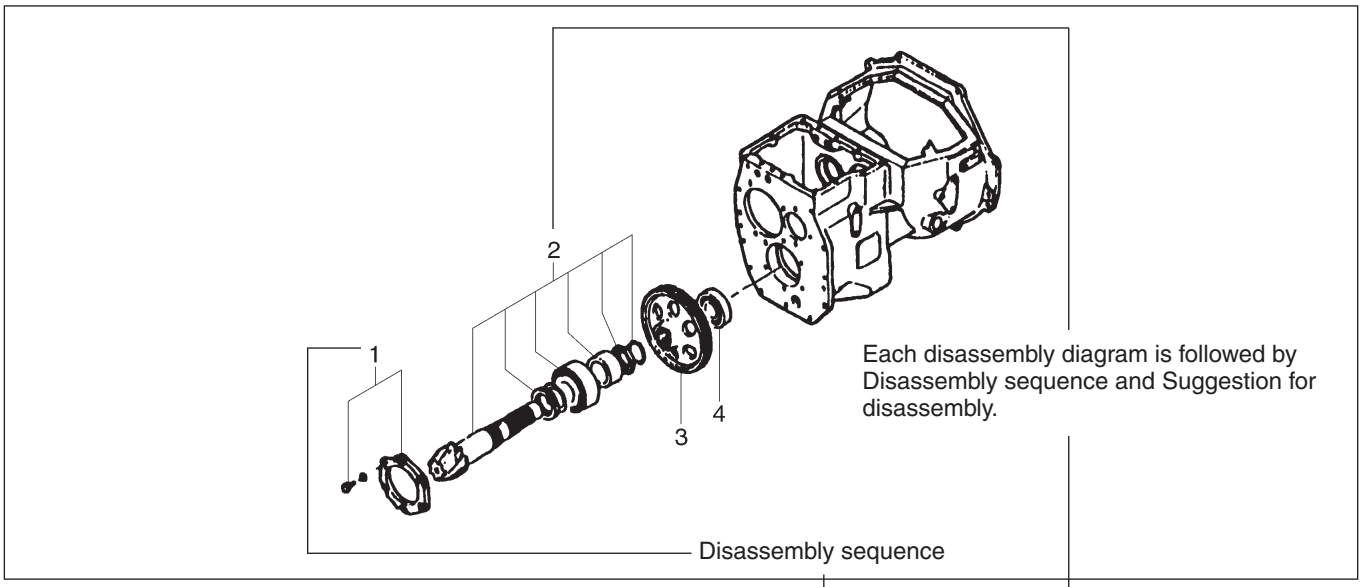
⚠ CAUTION — Indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury or damage to the machine.

NOTE — Indicates a condition that can cause damage to, or shorten service life of, the machine.

Pub. No. 99759-6G100

HOW TO READ THIS MANUAL

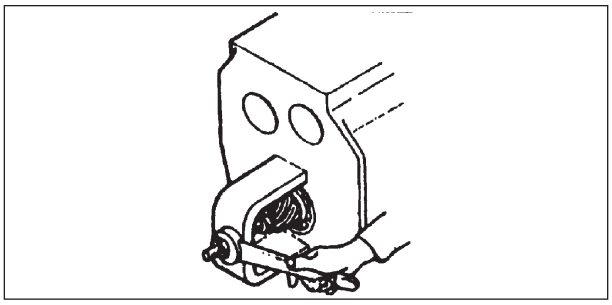
Disassembly diagram (example)



1 Cover, Bolt, Washer (part name)
2 Output shaft (part name)

Suggestion for disassembly

(1) Output shaft removal



Unit: mm

Clearance between cylinder and piston	A	0.020 to 0.105
	B	0.15

A: Standard value
B: Repair or service limit

SAFETY

⚠WARNING

The proper and safe lubrication and maintenance for these lift trucks, recommended by Cat lift truck, are outlined in the OPERATION & MAINTENANCE MANUAL.

Improper performance of lubrication or maintenance procedures is dangerous and could result in injury or death. Read and understand the OPERATION & MAINTENANCE MANUAL before performing any lubrication or maintenance on these trucks.

The serviceman or mechanic may be unfamiliar with many of the systems on this truck. This makes it important to use caution when performing service work. A knowledge of the system and/or components is important before the removal or disassembly of any component.

Because of the size of some of the truck components, the serviceman or mechanic should check the weights noted in this Manual. Use proper lifting procedures when removing any components.

Following is a list of basic precautions that should always be observed.

1. Read and understand all warning plates and decals on the truck before operating, lubricating or repairing the product.
2. Always wear protective glasses and protective shoes when working around trucks. In particular, wear protective glasses when pounding on any part of the truck or its attachments with a hammer or sledge. Use welders gloves, hood/goggles, apron and other protective clothing appropriate to the welding job being performed. Do not wear loose-fitting or torn clothing. Remove all rings from fingers when working on machinery.
3. Do not work on any truck that is supported only by lift jacks or a hoist. Always use blocks or jack stands to support the truck before performing any disassembly.

⚠WARNING

Do not operate these trucks unless you have read and understand the instructions in the OPERATION & MAINTENANCE MANUAL. Improper truck operation is dangerous and could result in injury or death.

4. Lower the forks or other implements to the ground before performing any work on the truck. If this cannot be done, make sure the forks or other implements are blocked correctly to prevent them from dropping unexpectedly.
5. Use steps and grab handles (if applicable) when mounting or dismounting a truck. Clean any mud or debris from steps, walkways or work platforms before using. Always face truck when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.
6. To avoid back injury, use a hoist when lifting components which weigh 23 kg (50 lb.) or more. Make sure all chains, hooks, slings, etc., are in good condition and are of the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.
7. To avoid burns, be alert for hot parts on trucks which have just been stopped and hot fluids in lines, tubes and compartments.
8. Be careful when removing cover plates. Gradually back off the last two bolts or nuts located at opposite ends of the cover or device and pry cover loose to relieve any spring or other pressure, before removing the last two bolts or nuts completely.
9. Be careful when removing filler caps, breathers and plugs on the truck. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the truck has just been stopped because fluids can be hot.

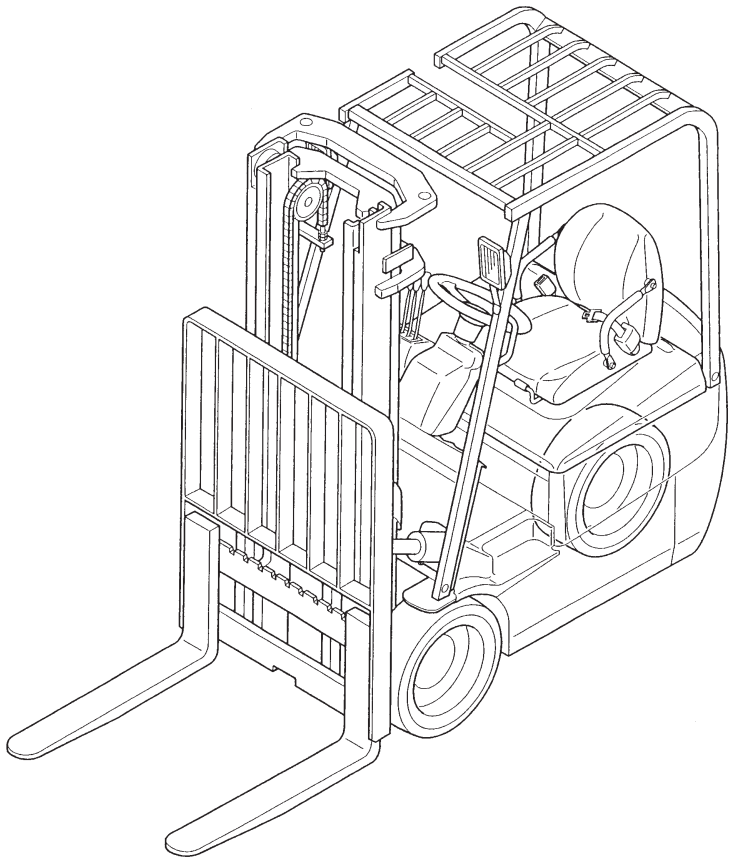
10. Always use tools that are in good condition and be sure you understand how to use them before performing any service work.
11. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary. Do not mix metric fasteners with standard nuts and bolts.
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. Do not connect wiring to a line containing fluid.
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.

GROUP INDEX

GROUP INDEX	Items involved	
GENERAL INFORMATION	Serial Number Locations, Dimensions, Technical Data	1
VEHICLE ELECTRICAL COMPONENTS	Console Box, Key Switch, Lamp Specification Chart	2
MOTORS	Motor Installation Positions, Specifications, Structures, Tightening of High-power Cable Terminals, Procedures and Key Points for Removal and Installation, etc.	3
FRONT AXLE	Structure and Functions, Disassembly and Reassembly of Front Axle Assembly, Service Data	4
REAR AXLE	Rear Axle, Rear Wheels, Removal and Installation, Disassembly and Reassembly, Adjustment, Troubleshooting, Service Data	5
BRAKE SYSTEM	Specifications, Structure and Functions, Procedures and Key Points for Disassembly and Reassembly, Inspection and Adjustment, Troubleshooting, Service Data	6
STEERING SYSTEM	Specifications, Structure and Functions, Procedures and Key Points for Removal and Installation, Steering Control Valve, Hydraulic Circuit, Troubleshooting, Service Data	7
HYDRAULIC SYSTEM	Tank, Pump, Control Valve, Lift and Tilt Cylinders, Flow Regulator Valve, Down Safety Valve	8
MASTS AND FORKS	Simplex Mast, Duplex Mast, Triplex Mast	9
SERVICE DATA	Inspection Standards, Periodic Replacement of Parts, Lubrication Standards, Main Component Weights, Tightening Torque for Standard Bolts and Nuts, Special Tools	10
OPTIONS	Amber Strobe Kit, Working Lamp Kit, Tire Kit	11

GENERAL INFORMATION

Vehicle Exterior



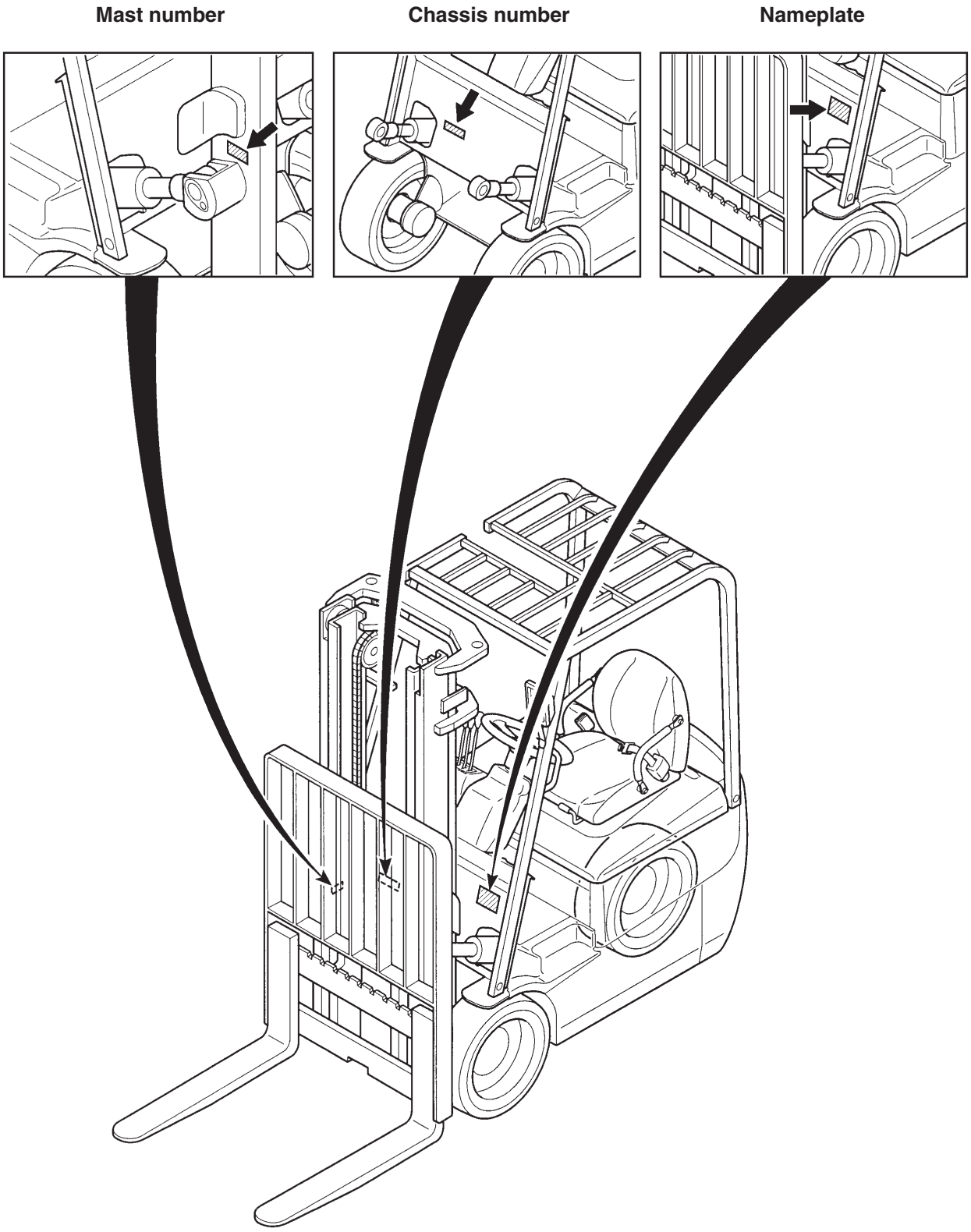
103378

Models

This manual applies to EP10KRT PAC, EP12KRT PAC and EP15KRT PAC.

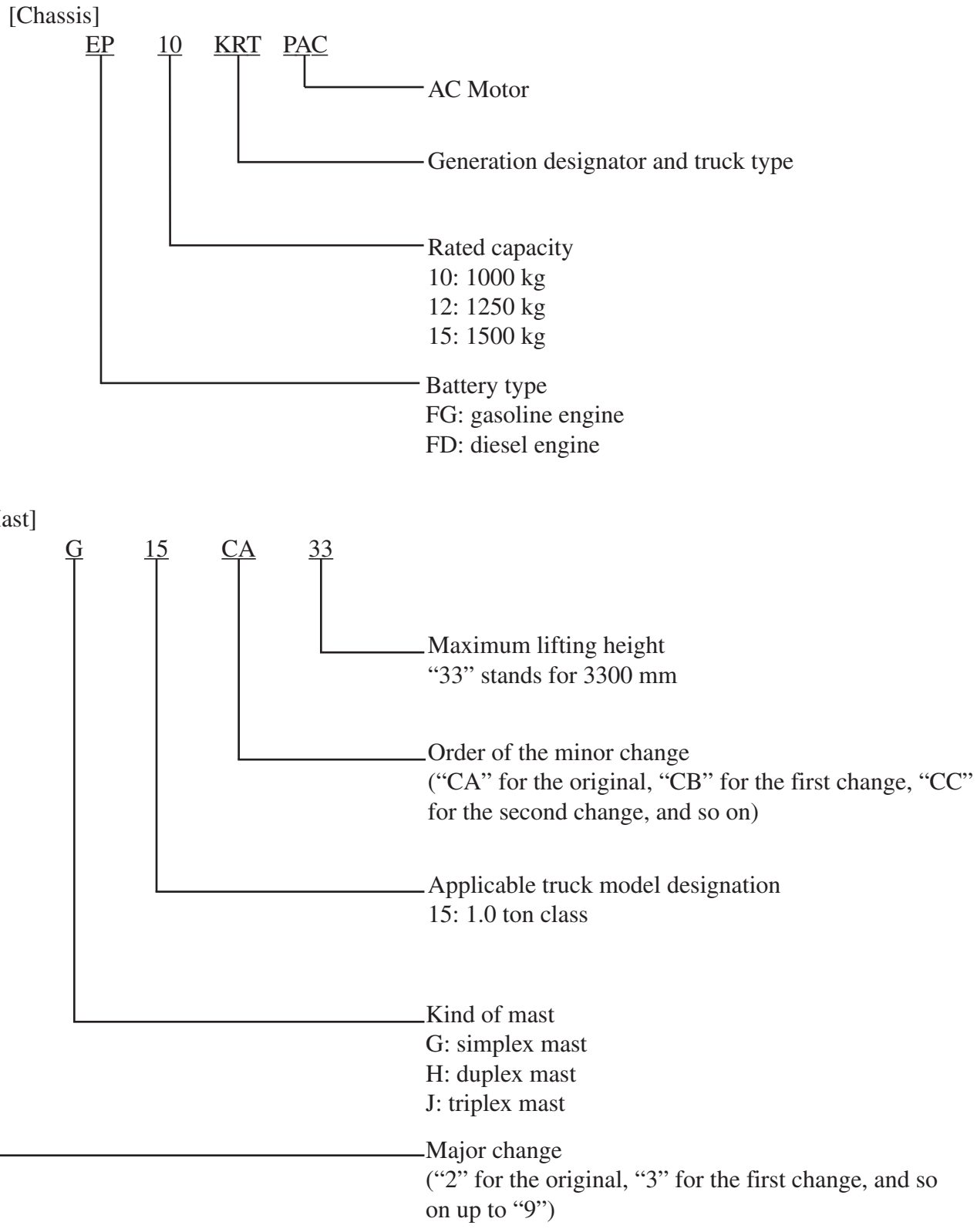
Truck Model	Serial Number
EP10KRT PAC	ETB10A-00011-up
EP12KRT PAC	ETB10A-20001-up
EP15KRT PAC	ETB10A-50001-up

Serial Number Locations

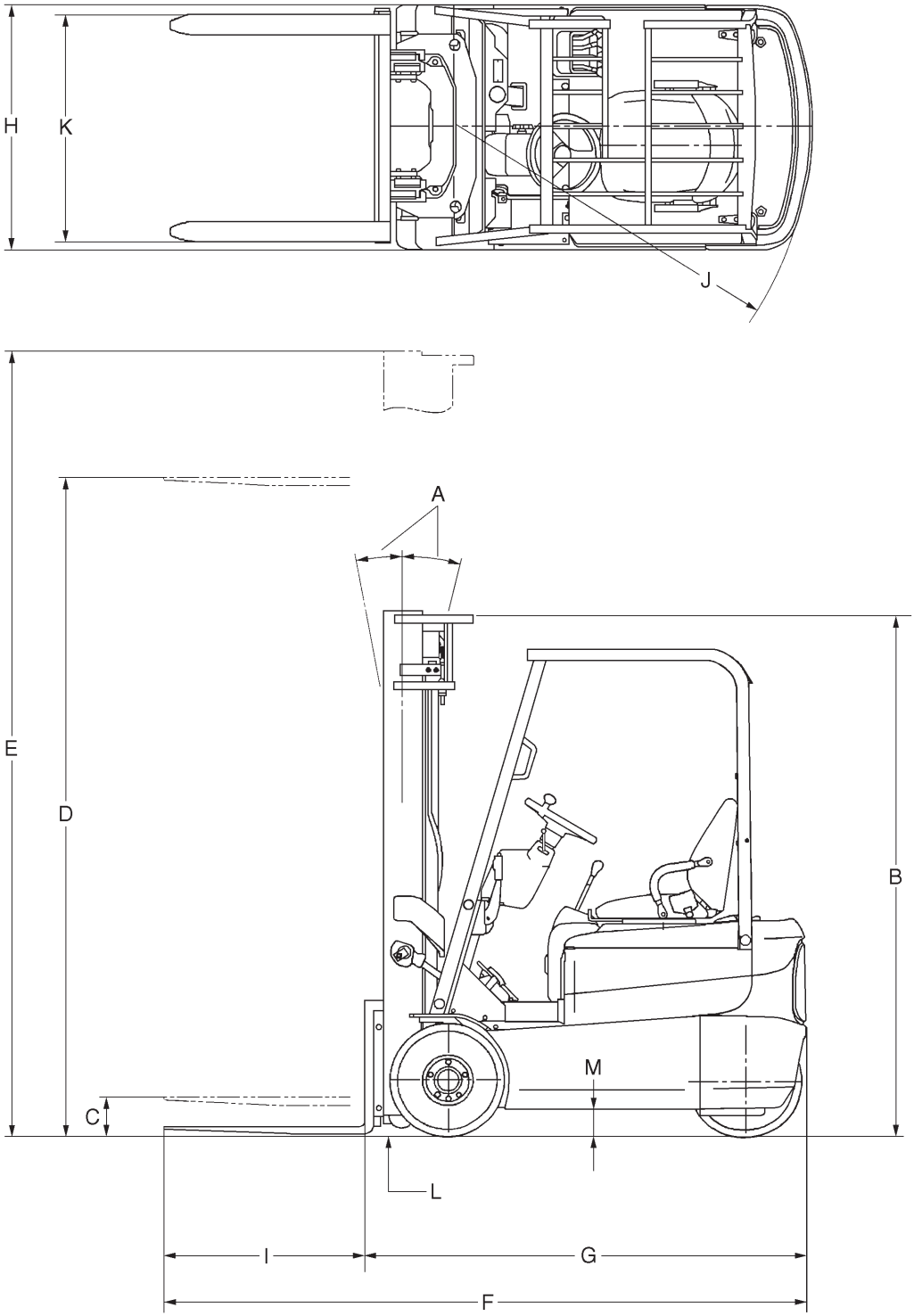


209010

Chassis and Mast Model Identification



Dimensions



209011

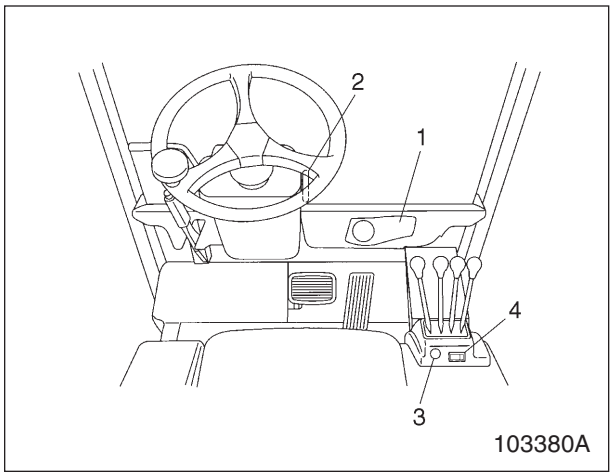
Technical Data

Truck model		EP10KRT PAC	EP12KRT PAC	EP15KRT PAC
Mast tilt, forward/backward	A (deg)	5/7	5/7	5/7
Height with mast lowered	B (mm)	2110	2110	2110
Standard free lift	C (mm)	120	120	120
Standard lift height	D (mm)	3290	3290	3290
Overall height with mast raised (without backrest)	E (mm)	3895	3895	3895
Overall length	F (mm)	2500	2500	2575
Length to fork face (includes fork thickness)	G (mm)	1700	1700	1775
Overall width	H (mm)	997	997	997
Forks dimensions (thickness × width × length)	I (mm)	35 × 80 × 800	35 × 80 × 800	35 × 80 × 800
Turning circle radius	J (mm)	1370	1370	1445
Fork carriage width	K (mm)	900	900	900
Ground clearance under mast, with load	L (mm)	80	80	80
Ground clearance center of wheelbase, with load	M (mm)	100	100	100
Travel speed, with/without load	km/h	11.5/13.5	11.2/13	11/12.5
Lifting speed, with/without load	m/s	0.29/0.48	0.27/0.48	0.26/0.48
Lowering speed, with/without load	m/s	0.52/0.50	0.52/0.50	0.52/0.50
Rated drawbar pull, with/without load (60 min. short duty)	N	1706/1991	1569/1937	1435/1876
Maximum drawbar pull, with/without load (5 min. short duty)	N	5327/5621	5190/5558	5056/5497
Gradeability, with/without load	%	9.6/15.1	8.1/13.6	6.9/12.3
Maximum gradeability, with/without load	%	16.4/25.1	14.0/22.6	12.2/20.6
Battery to DIN 43531/35/36A/B/C/No.		DIN43535A		
Battery voltage/capacity at 5-hour discharge	V/Ah	24/600, 720	24/600, 720	24/720, 840
Battery weight	kg	445, 524	445, 524	524, 600
Truck weight, without load (including Maximum battery)	kg	2380	2595	2800
Drive motor capacity (60 min. short duty)	kW	5	5	5
Pump motor output @15 % duty factor	kW	6.5	6.5	6.5
Drive motor control method		Mosfet		
Pump motor control method		Mosfet		

VEHICLE ELECTRICAL COMPONENTS

Console Box

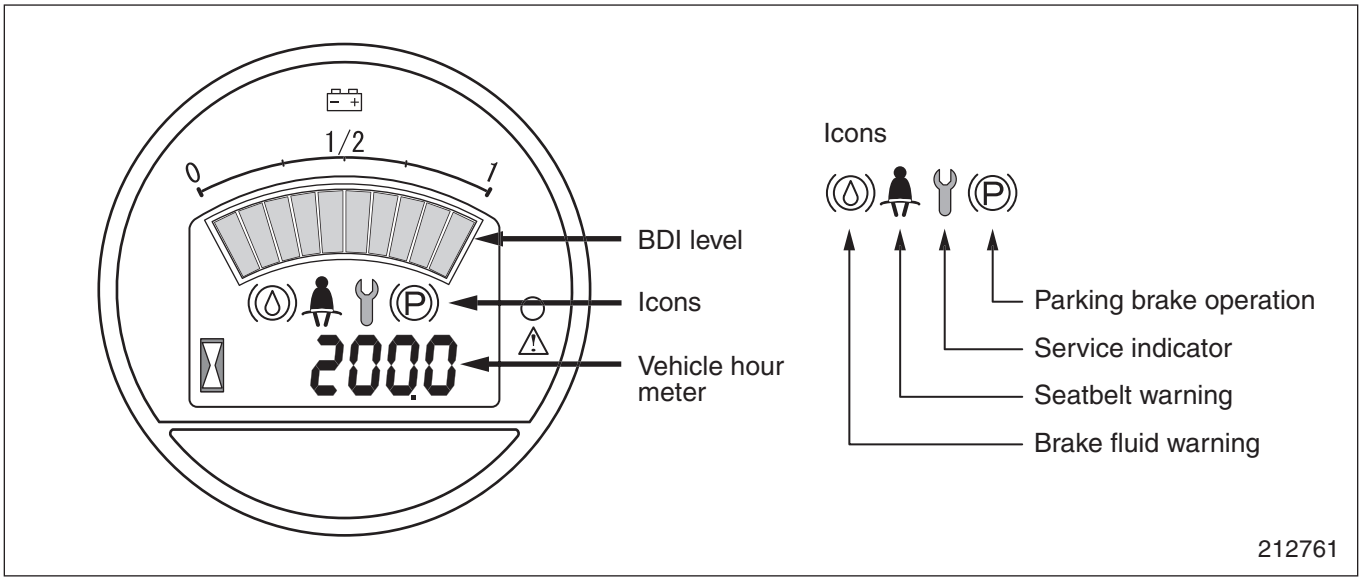
1 Vehicle monitoring system (VMS)
2 Steering tilt knob
3 Key switch
4 Lighting switch



Functions of Vehicle Monitor System (VMS)

Normal operation display

The display will be seen as below when the key switch is turned to the on position.

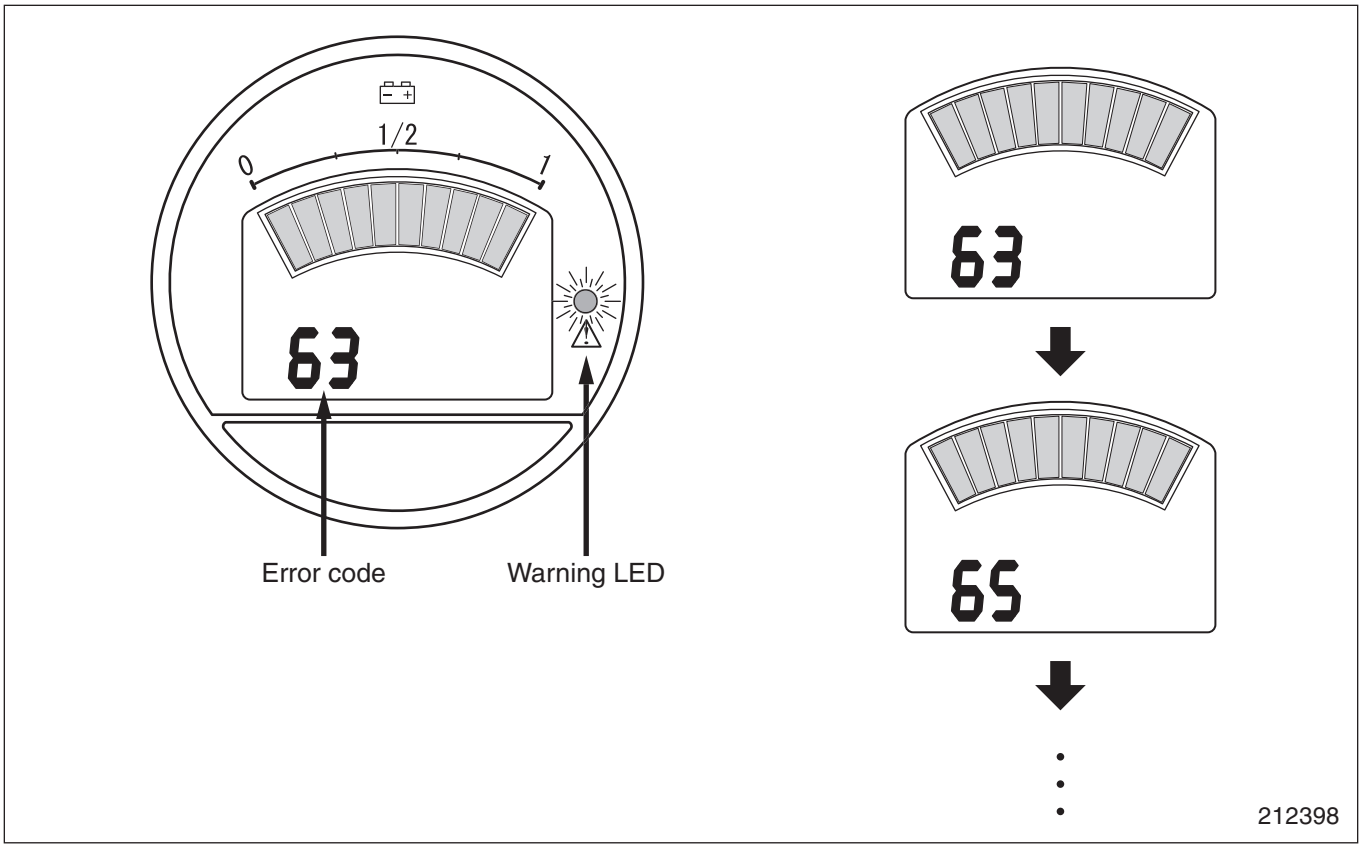


Item	Description
BDI level	Indicates the remaining battery capacity of the current battery voltage with 11 levels BDI Level 0 to BDI Level 10. The BDI level gauge flashes when BDI level becomes BDI Level 1.
Brake fluid warning	Glows when the brake fluid level drops.
Seatbelt warning	Glows when the seat belt is not fastened.
Service indicator	Flashes when the vehicle hour meter reaches 20 hours before the preset time, and lights when it reaches the preset time.
Parking brake operation	Glows when the parking brake is engaged.
Vehicle hour meter	Indicates cumulative hours of the vehicle operations.

Error display

An error code is displayed when a malfunction occurs.

When faults occur simultaneously, the errors are displayed successively as shown in the figure below.



Item	Description
Error code	Indicates the code assigned to the fault.
Warning LED	Lights while the fault is occurring.

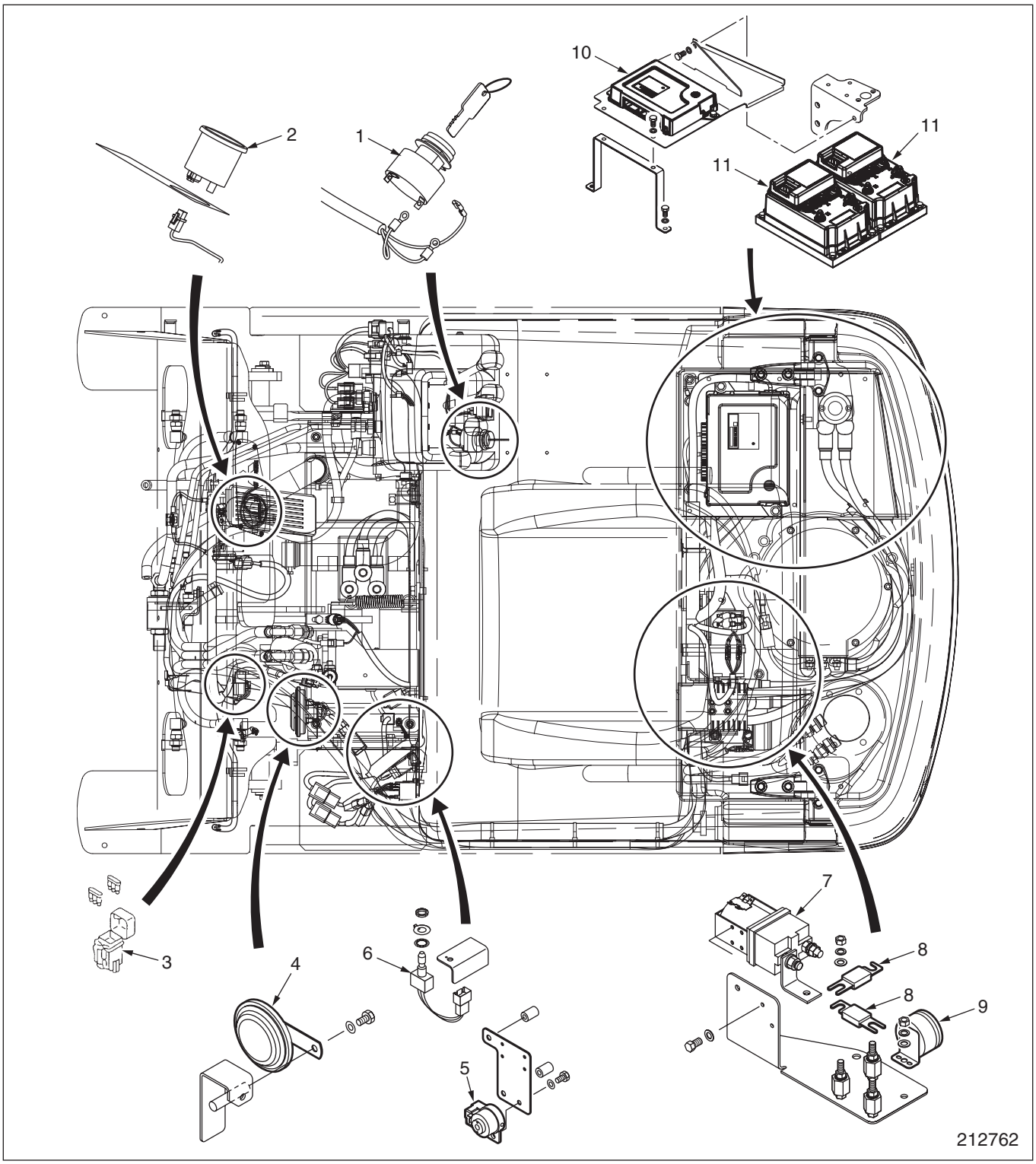
Error Code and Explanations

Error code with ( ) means flashing.

Error code	Explanation	Error code	Explanation
E0	Traction Motor, Overheating	63	Traction Inverter Fault
E2	Pump Motor, Overheating	65	Pump Inverter Fault
E5	Traction Inverter, Overheating	72	Contactor Coil Fault
E7	Pump Inverter, Overheating	74	Hydraulic Lock Solenoid Fault
14	Traction Motor Current Sensor Fault	76	PDS Buzzer Fault
15	Traction Motor, Over-current	78	Battery Voltage Too Low
16	Traction Motor, Stall Timer	79	Battery Voltage Too High
34	Pump Motor Current Sensor Fault	83	Lift Stroke Sensor Fault
35	Pump Motor Over-current	E	Direction Lever or Accelerator, Faulty Setting
40	Line Contactor Fault	(E)	Seat Switch, Faulty Setting For Traction
45	Traction Motor Open	(L)	Seat Switch, Faulty Setting For Hydraulic
47	Pump Motor Open	H1	Lift Lever, Faulty Setting
51	Accelerator Sensor Fault	H2	Tilt Lever, Faulty Setting
52	Traction Motor Pulse Input Fault	H3	Attachment 1 Lever, Faulty Setting
57	Pump Motor Pulse Input Fault	H4	Attachment 2 Lever, Faulty Setting
60	Display Communication Fault	Lo	Battery Consumption Too Much
61	Logic Card Initialize Failure	(Lo)	Battery Consumption Much
62	Logics Fault		

Traction Motor (Drive Motor)

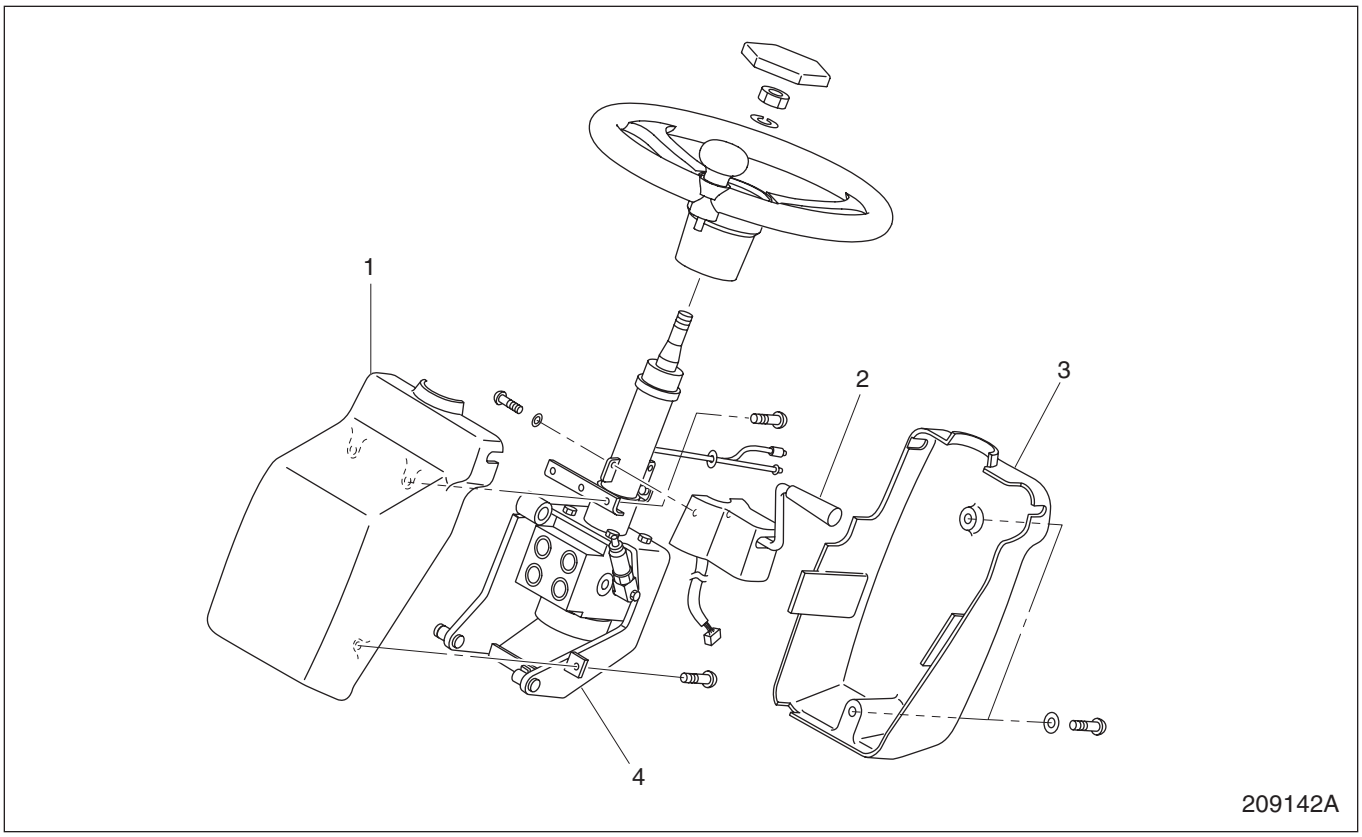
Electrical Components



1	Key switch	4	Horn	7	Contactor	10	Logic unit
2	Display	5	PDS buzzer	8	Fuse	11	Inverter
3	Fuse holder	6	DRS switch	9	Backup buzzer		

Disassembly and Reassembly

Disassembly

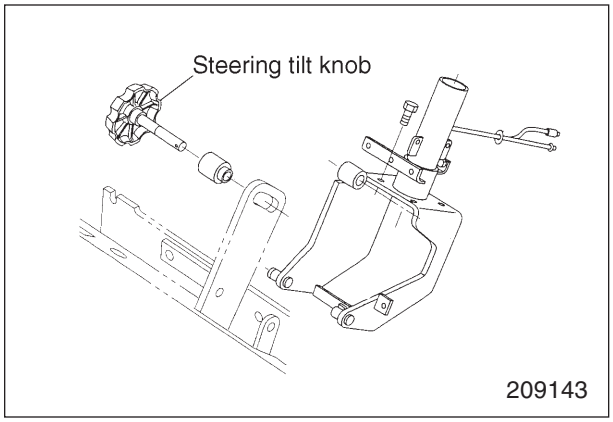


Sequence

1 Console box (front panel)
2 Forward/reverse lever
3 Console box (rear panel)
4 Steering column assembly

Disassembly procedure

(1) Remove the rear and front panels from the steering column assembly.
(2) Disconnect the direction lever harness connectors.
(3) Disconnect the horn harness connectors.
(4) Remove the steering tilt knob from rear panel of console box.
(5) Remove the steering column assembly.

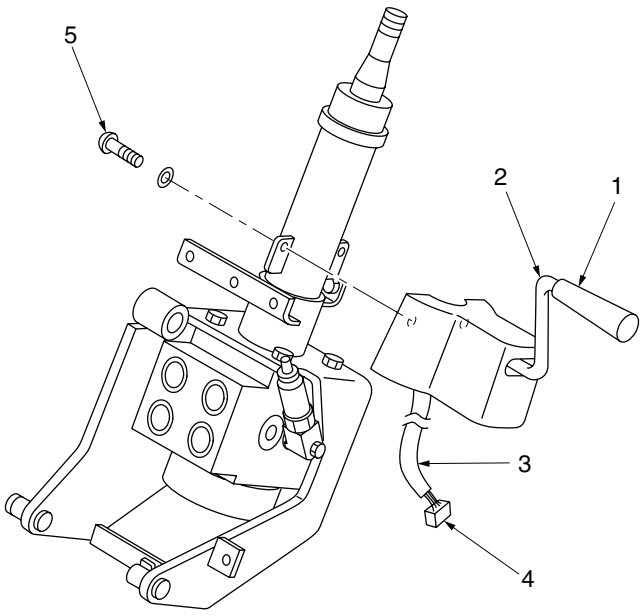


Reassembly

Follow the disassembly procedure in reverse.

Direction Lever

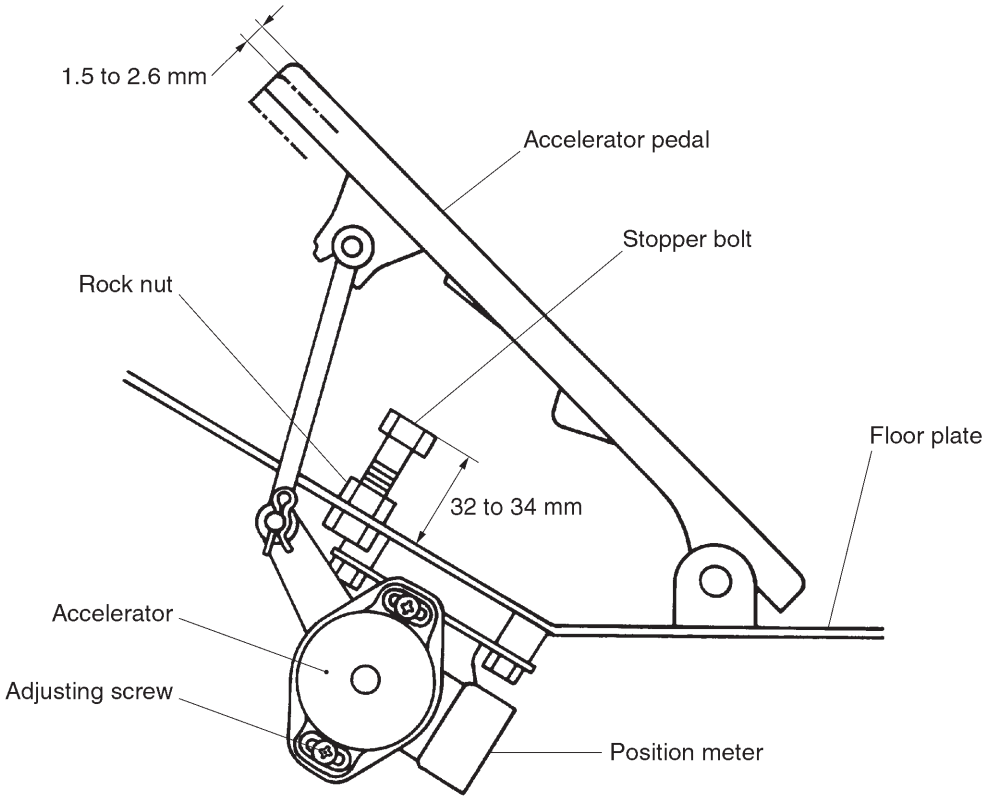
Structure



209144A

1 Knob
2 Lever
3 Harness
4 Connector
5 Screw, Spring washer

Accelerator Control



Adjustment procedure

(1) Disconnect the battery plug.

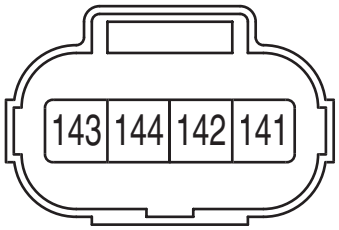
(2) Fix the stopper bolt to 32 to 34 mm from the floor to the upper face of bolt.

(3) Adjust the mounting angle of the position meter using the adjusting screws so the switch inside the position meter turns on when the accelerator pedal is depressed 1.5 to 2.6 mm.

Make sure the inside switch turns ON by testing for continuity between terminals 143 and 144 with an ohmmeter.

(4) Perform the accelerator self diagnosis, refer to the controller service manual.

(5) Make sure when the accelerator is fully depressed the display reads 100%. If not, readjust the stopper bolt.

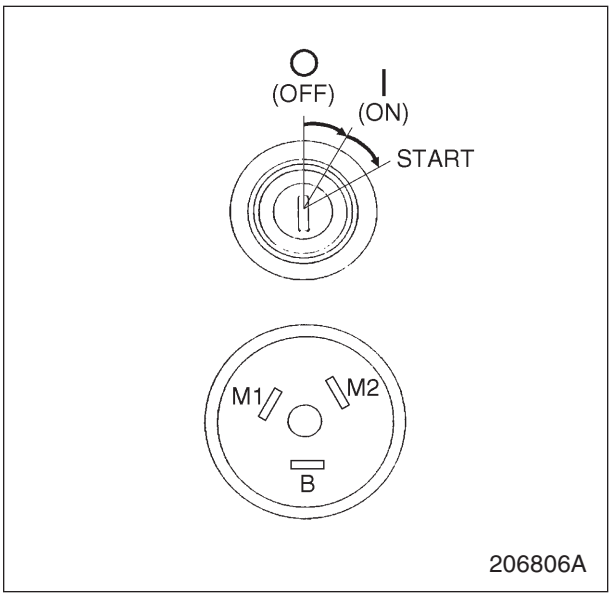


Connector CN16

213007

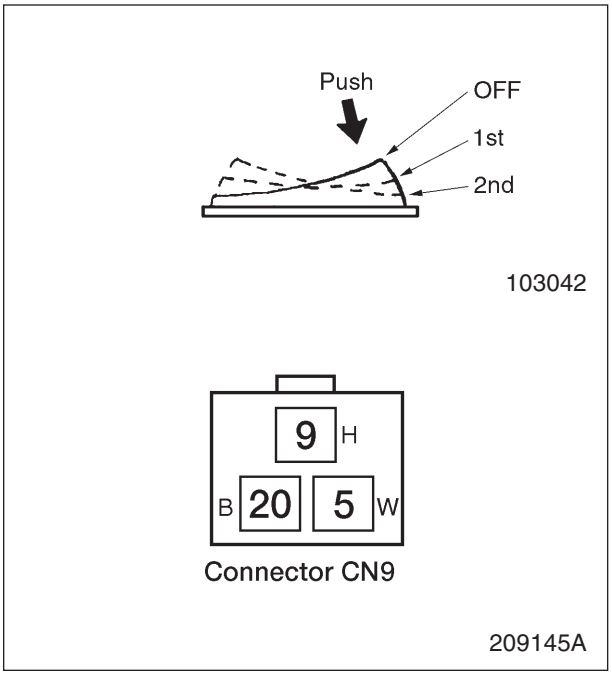
Key Switch

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

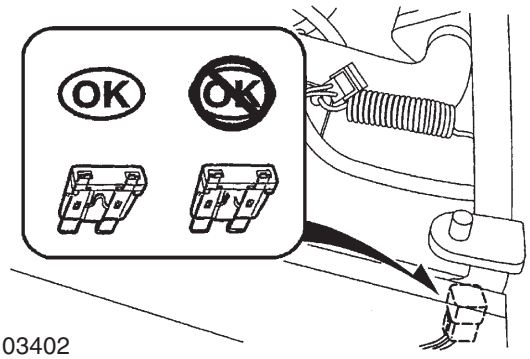


Lighting Switch

Terminal	B	W	H
Connection destination	Battery	Working lamp	Head lamps
1st position	○		○
2nd position	○	○	○



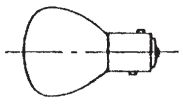
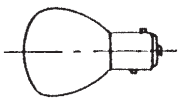
Fuses

Capacity (A)	Location	Main connecting device	
500	Contactor assembly	Traction motor	Refer to the Service Manual for Controllers. (Pub. No. 99759-5H100).
500		Pump motor	
15	Fuse holder	Key switch, Lighting switch	 103402
10		Power relay	

NOTE

Refer to Parts Manual for proper replacement fuses.

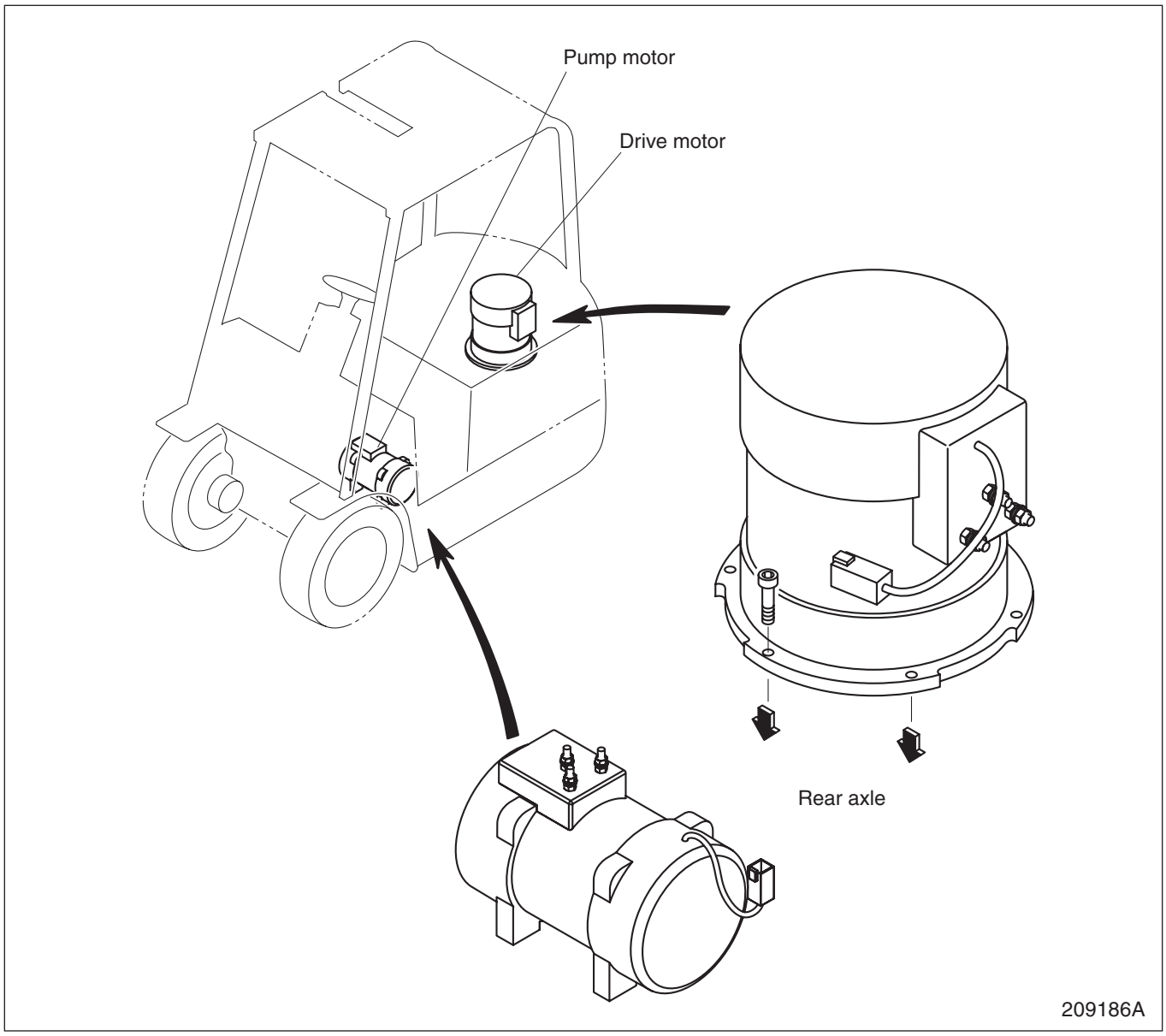
Lamp Specification Chart

Item / Lamp	Quantity	Bulb color	Bulb	
			24 V	External diagram
Head lamps	2	Clear	50 W	
Working lamp	1	Clear	50 W	

205833

MOTORS

Motor Installation Positions

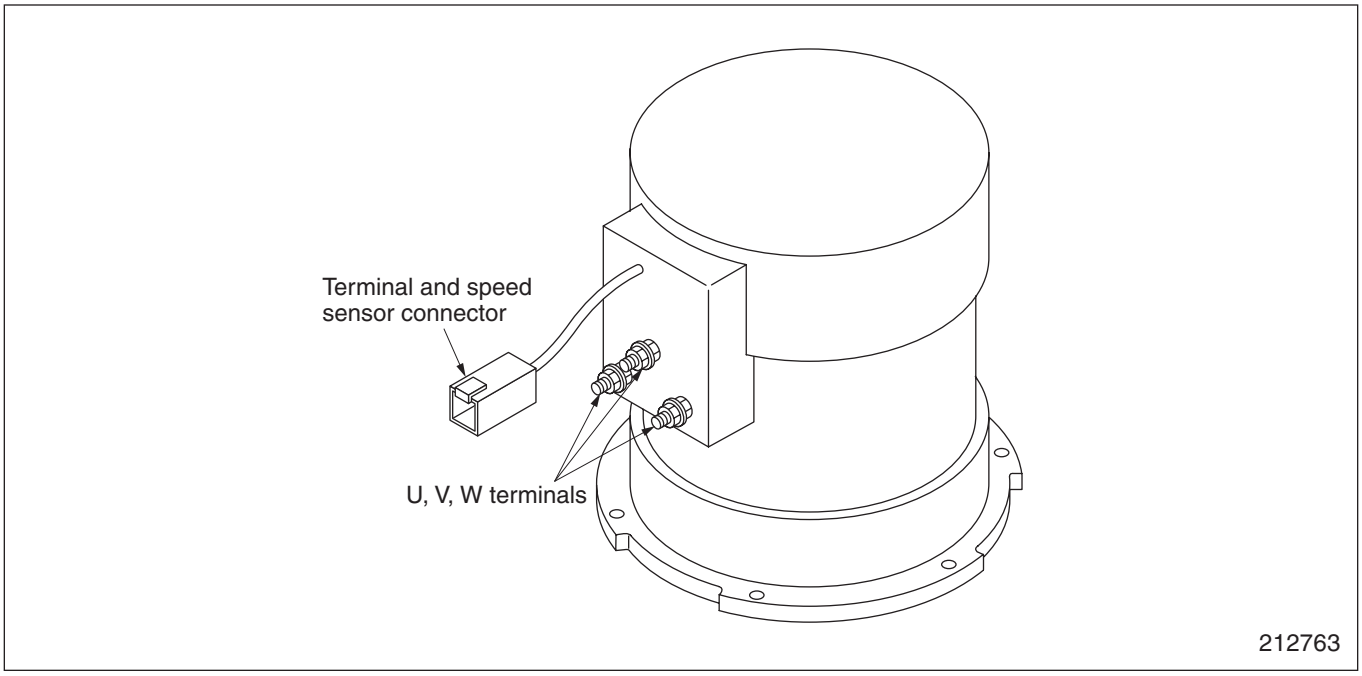


Specifications

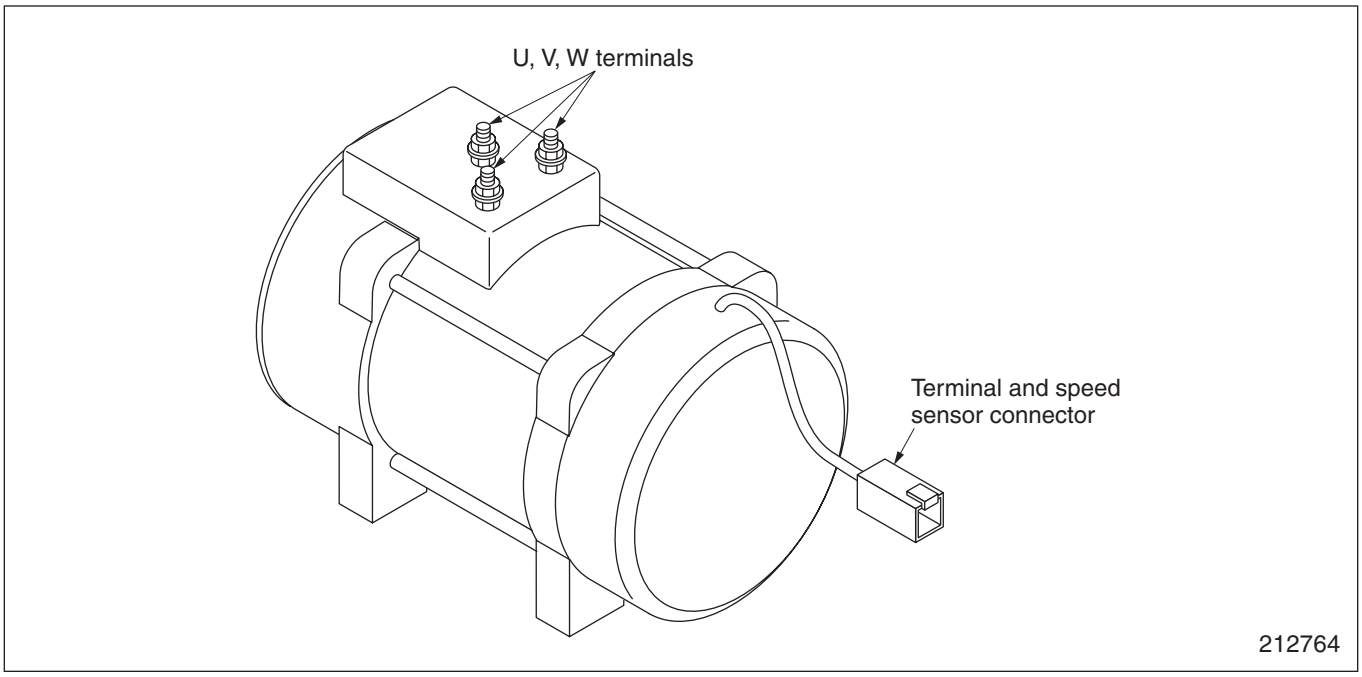
Item	Drive Motor	Pump Motor
Type	Induction, three-phase AC	Induction, three-phase AC
Voltage	24 V	24 V
Output	5 kW (S2 60 min.)	6.5 kW (S3 15 %)
Weight kg (lb)	43 kg	33 kg

Structure

Drive Motor



Pump Motor



The AC motor model lift trucks covered by this manual use three-phase induction AC motors as the drive motor and pump motor.

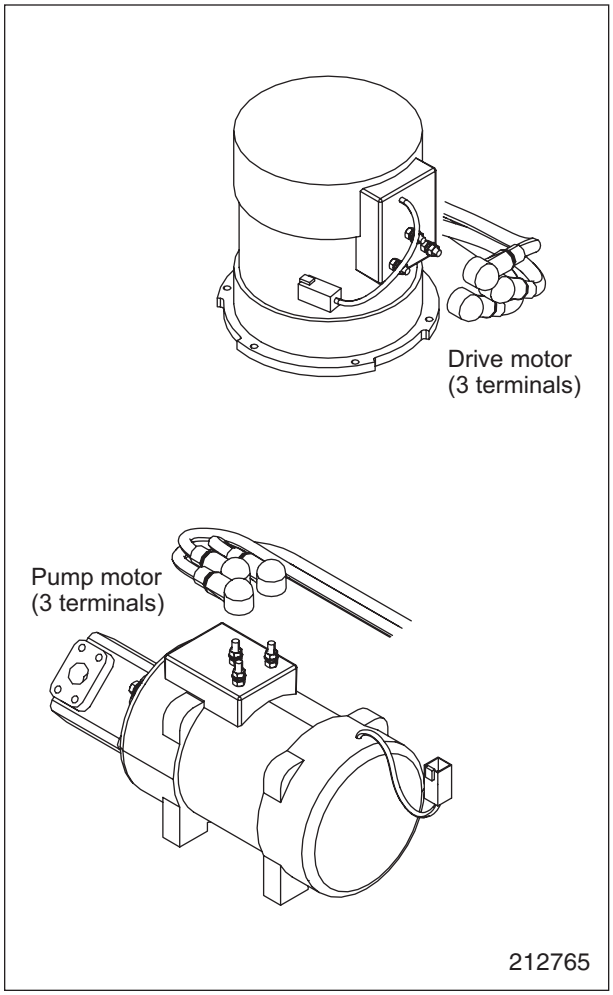
For the feature and speed control of AC motors, Refer to the applicable controller service manual.

Tightening of High-power 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.

Name of Motor	Number of Terminals	Tightening Torque
Drive motor	3	8 N·m (0.8 kgf·m)
Pump motor	3	8 N·m (0.8 kgf·m)



Removal and Installation

Drive Motor

Removal

(1) Park the truck on a flat surface in the service area.

(2) Turn off (press) the battery switch, then disconnect the battery cable by detaching the plug from the jack on the side of the battery box.

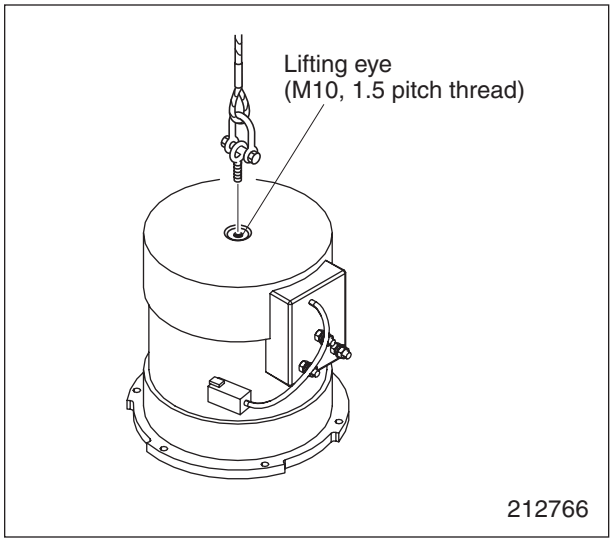
(3) Remove the battery cover.

(4) Remove the rear cover.

(5) Disconnect all the cables and harnesses. Put marks as necessary to facilitate reconnection.

(6) Screw an eyebolt (M10, 1.5 pitch) into the motor shaft and attach it to a hoist using a sling.

(7) Remove the six motor mounting bolts (hex socket bolts), then hoist away the motor from the truck.



Installation

Follow the removal sequence in reverse while respecting the following instructions.

(1) Apply molybdenum grease to the splines on the shaft.

(2) When installing the motor on the truck, use guide bolts while making sure each section of the motor faces in the correct direction.

(3) Tighten the motor mounting bolts to the following torque.

Tightening torque	38.1 N·m (3.9 kgf·m)

(4) Install the terminal of each cable such that it does not interfere with another.

(5) Each cable terminal should be properly covered with a boot.

Pump Motor

Removal

(1) Remove the pump motor from the truck following the instructions on page 10-14.

(2) Separate the hydraulic pump from the pump motor.

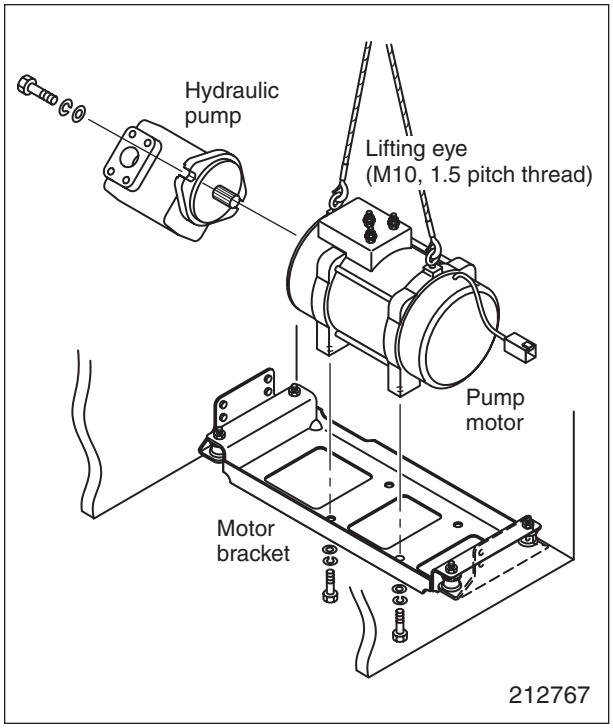
Installation

(1) Apply molybdenum grease to the internal splines in the shaft before assembling the hydraulic pump.

(2) Install the pump to motor bracket.

(3) Install the terminal of each cable such that it does not interfere with another.

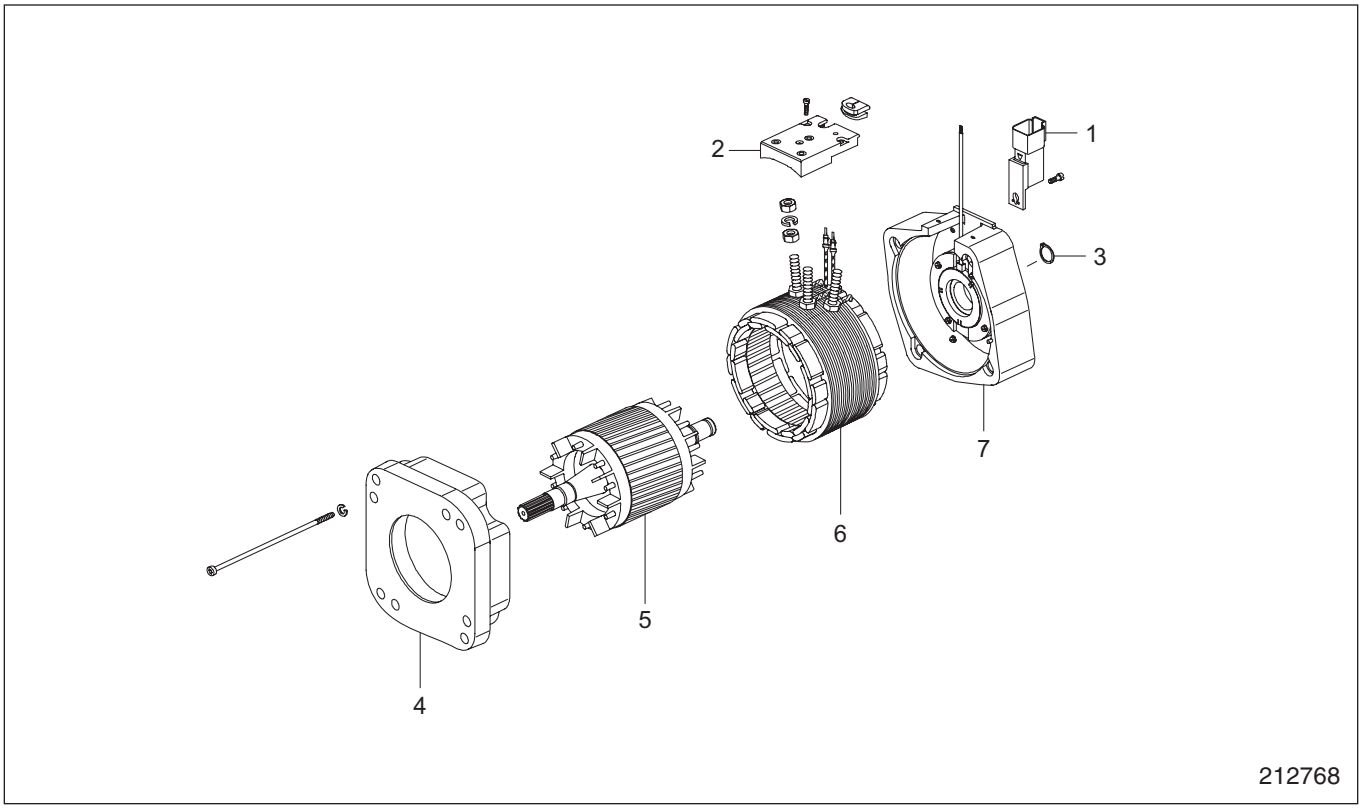
(4) Each cable terminal should be properly covered with a boot.



Disassembly and Reassembly

Disassembly

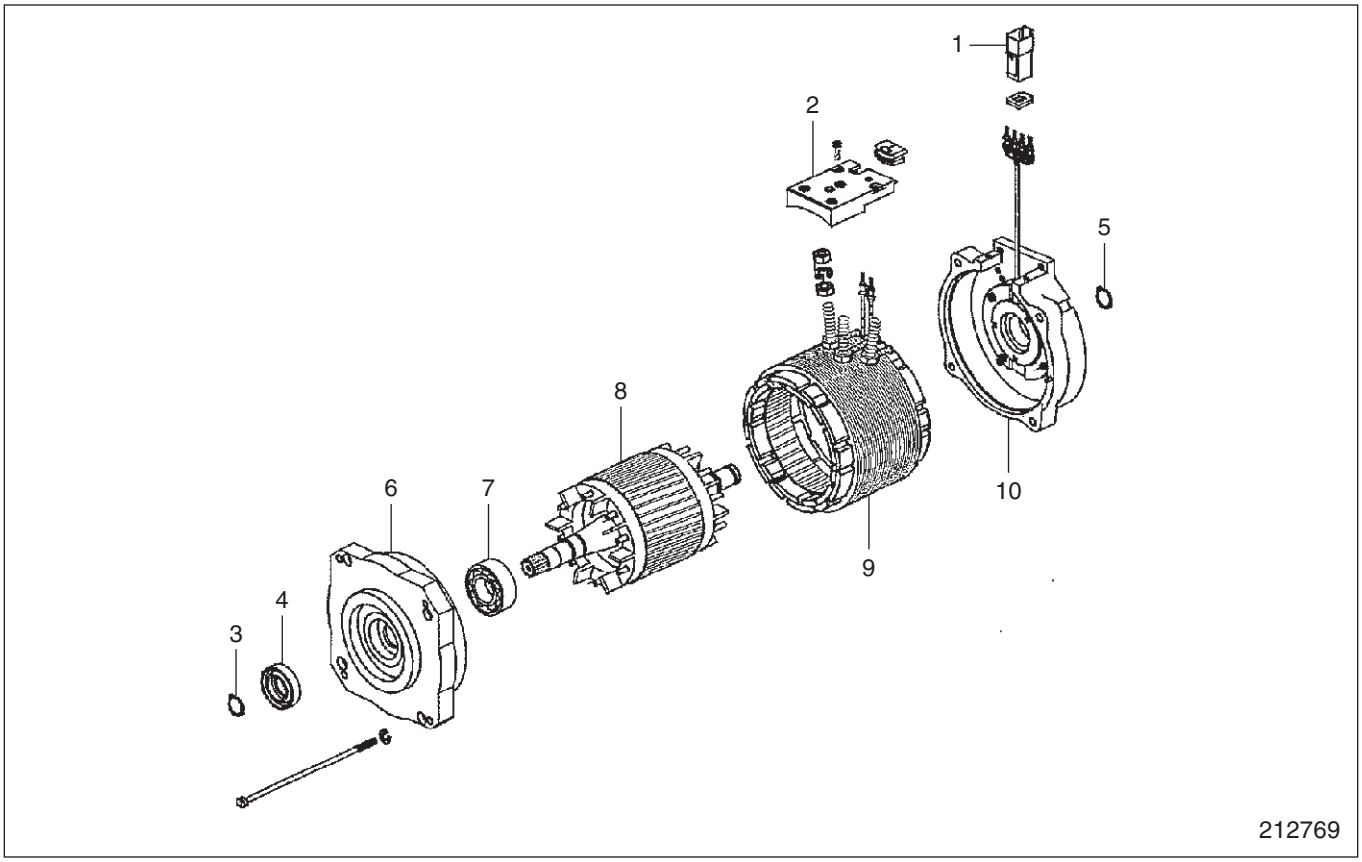
Drive Motor



Sequence

1 Connector
2 Connection plate
3 Snap ring
4 Drive end bracket
5 Armature
6 Stator
7 Brake end bracket

Pump Motor



Sequence

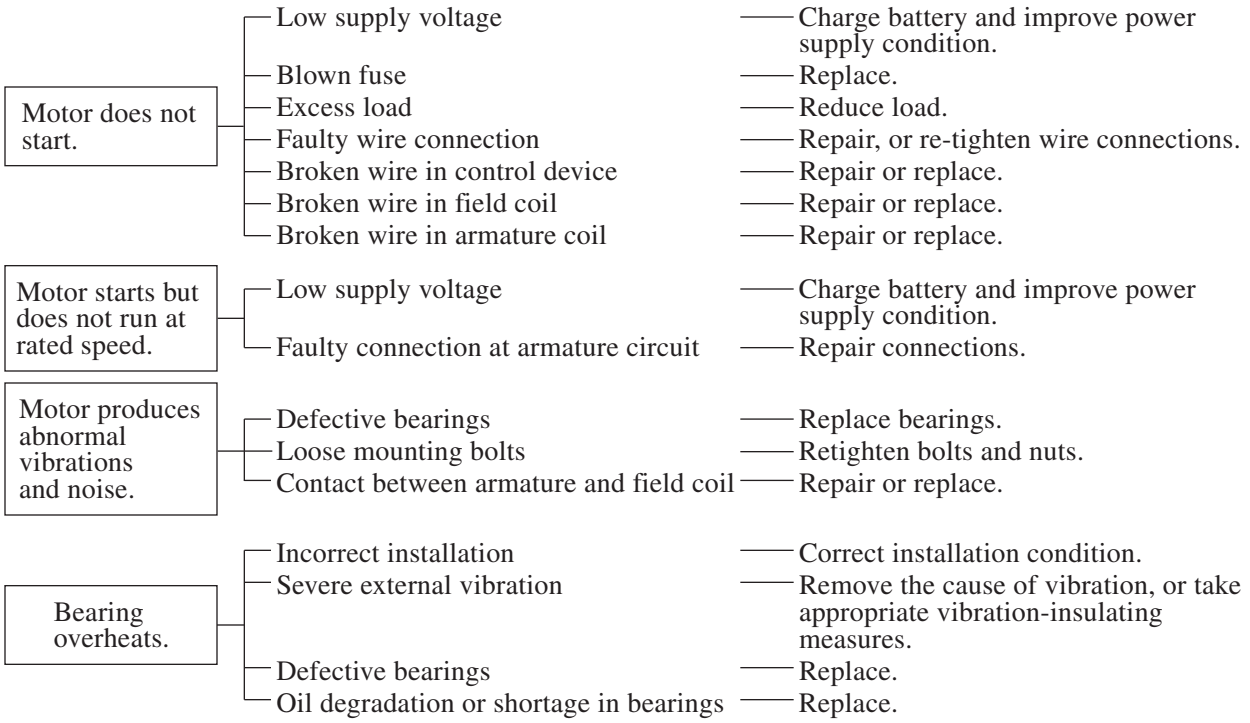
1	Connector	4	Gasket	7	Bearing	10	Brake end bracket
2	Connection plate	5	Snap ring	8	Armature/Rotor		
3	Snap ring	6	Drive end bracket	9	Stator		

Suggestion for Disassembly and Reassembly

Ball bearing at both ends are of maintenance free. If it is necessary to remove the bearings when repairing the motor, the bearings and seals must be replaced.

Replace the bearings and seals after approximately 6,000 operating hours.

Troubleshooting



Service Data

A: Standard value

Unit: mm (in.)

Item \ Truck Models					EP10KRT PAC, EP12KRT PAC, EP15KRT PAC
Drive motor and pump motor	Stator coil insulation resistance			A	1 MΩ min.
	Terminal conductivity (Ω)	Drive motor	U – V	A	0
			V – W	A	0
		Pump motor	W – U	A	0
	Cable terminal tightening torque				8.0 N·m (0.8 kgf·m)

FRONT AXLE

Thank you very much for your reading.

Please Click Here Then Get More Information.