CATERPILLAR®

99759-64100

Service Manual

EP30K, EP35K
Chassis & Mast

EP30K **ETB9B-00011-up**
EP35K **ETB9B-50001-up**

FC/MC

FOREWORD

This service manual is a guide to servicing of Caterpillar® Lift Trucks of 3.0 ton and 3.5 ton models. The instructions are grouped by systems to serve the convenience of your ready reference.

Long productive life of your lift trucks depends to a great extent on correct servicing — the servicing consistent with what you will learn from this service manual. We hope you read the respective sections of this manual carefully and know all the components you will work on before attempting to start a test, repair or rebuild job.

The descriptions, illustrations and specifications contained in this manual were of the trucks of serial numbers in effect at the time it was approved for printing. Caterpillar 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 specific potential hazard resulting in serious bodily injury or death.

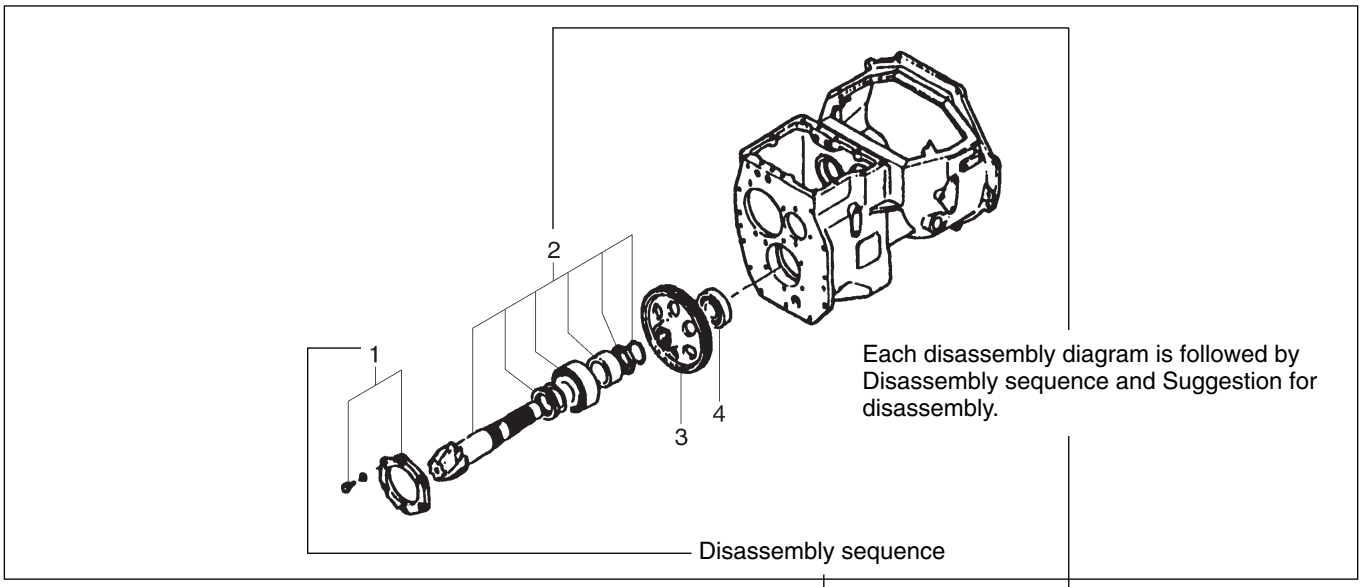
⚠ CAUTION — Indicates a specific potential hazard resulting in bodily injury, or damage to, or destruction of, the machine.

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

Pub. No. 99759-64100

HOW TO READ THIS MANUAL

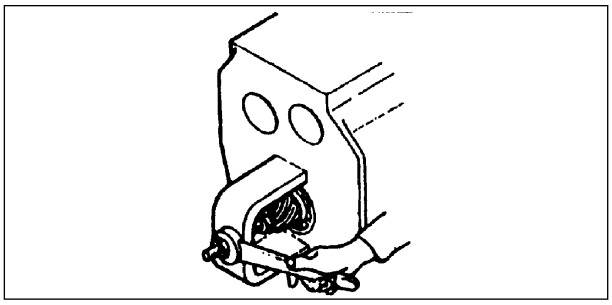
Disassembly diagram (example)



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

Suggestion for disassembly

(1) Output shaft removal



Unit: mm (in.)

Clearance between cylinder and piston	A	0.020 to 0.105 (0.00079 to 0.00413)
	B	0.15 (0.0059)

A: Standard value
B: Repair or service limit

SAFETY

⚠WARNING

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

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.

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 this truck 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.

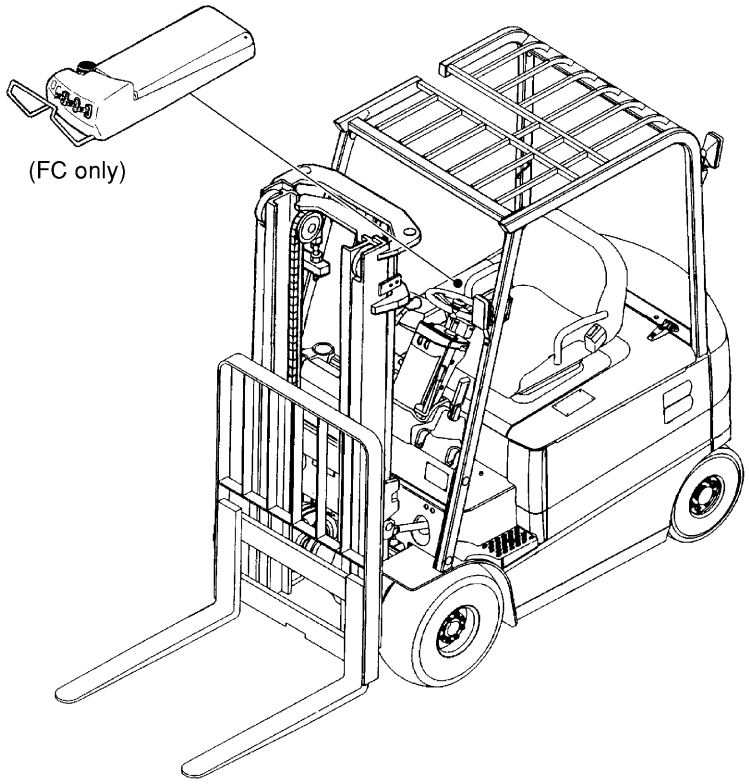
10. Always use tools that are in good condition and be sure you understand how to use them before performing any service work.
11. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary. Do not mix metric fasteners with standard nuts and bolts.
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
VEHICLE ELECTRICAL COMPONENTS	Console Box, Key Switch, Lamp Specification Chart
MAIN CONTROLLER	Outline, Controller Components, Logic Card Components, Controller Models, Operation Outline, Drive System, Hydraulic System, Fail-safe System, Malfunction Detection, Malfunction Data Record, Setting, Self-diagnosis, etc.
TROUBLESHOOTING FOR CONTROL CIRCUITS	Faulty central vehicle monitor system, Faulty diagnosis indication, or Other abnormalities
POWER TRAIN	Procedure and Key Points for Removal and Installation
MOTORS	Motor Installation Positions, Specifications, Structures, Tightening of High-power Cable Terminals, Inspection of Brushes for Wear and Brush Replacement, Procedures and Key points for removal and Installation, etc.
TRANSFER AND DIFFERENTIAL	Structure and Functions, Procedures and Key Points for Disassembly and Reassembly, Service Data
FRONT AXLE	Structure and Functions, Disassembly and Reassembly of Front Axle Assembly, Service Data
REAR AXLE	Rear Axle, Rear Wheels, Removal and Installation, Disassembly and Reassembly, Adjustment, Troubleshooting, Service Data
BRAKE SYSTEM	Specifications, Structure and Functions, Procedures and Key Points for Disassembly and Reassembly, Inspection and Adjustment, Troubleshooting, Service Data
STEERING SYSTEM	Specifications, Structure and functions, Procedures and Key Points for Removal and Installation, Steering Control Valve, Hydraulic Circuit, Troubleshooting, Service Data
HYDRAULIC SYSTEM	Tank, Pump, Control Valve, Lift and Tilt Cylinders, Flow Regulator Valve, Down Safety Valve
MAST AND FORK	Simplex Mast, Duplex Mast, Triplex Mast
SERVICE DATA	Inspection Standards, Periodic Replacement of Parts, Lubrication Standards, Main Component Weights, Tightening Torque for Standard Bolts and Nuts, Special Tools
OPTIONS	Back Mirror Kit, Back Buzzer Kit, Working Lamp Kit, Tire Kit

GENERAL INFORMATION

Vehicle Exterior



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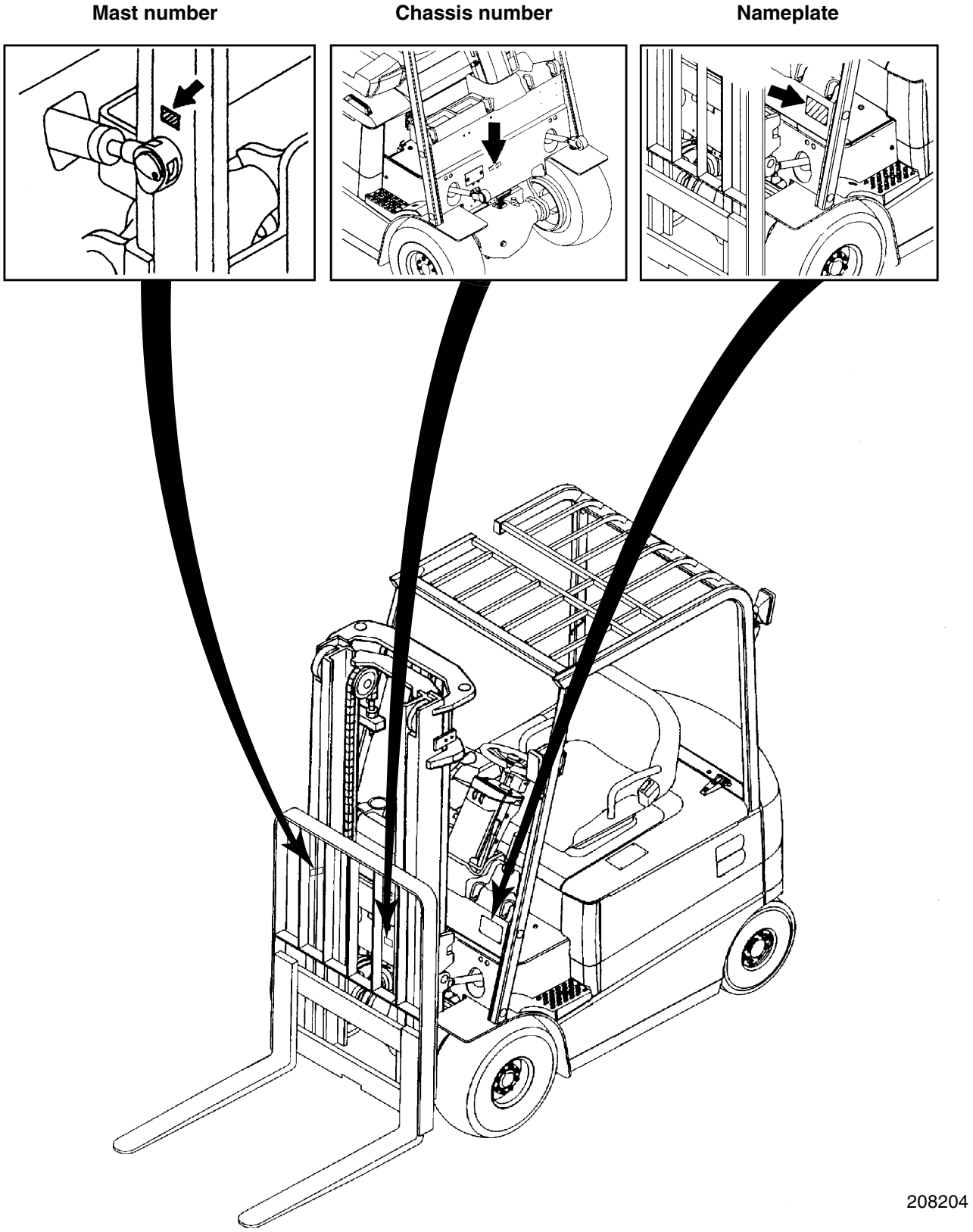
Models

This manual applies to EP30K and EP35K.

Truck Model	Serial Number
EP30K	ETB9B-00011-up
EP35K	ETB9B-50001-up

Serial Number Locations



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Chassis and Mast Model Identification

[Chassis]

EP 30 K

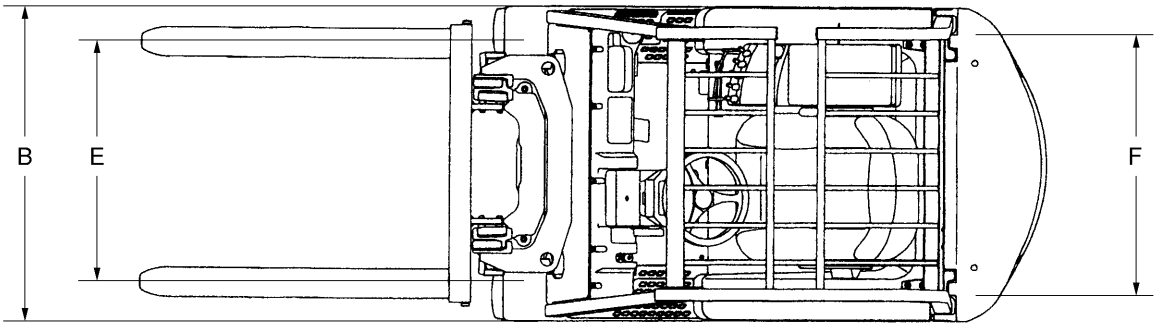
- K: Generation designator
- 30: Maximum capacity
  30: 3000 kg (6600 lb)
  35: 3500 kg (7700 lb)
- EP: Battery type

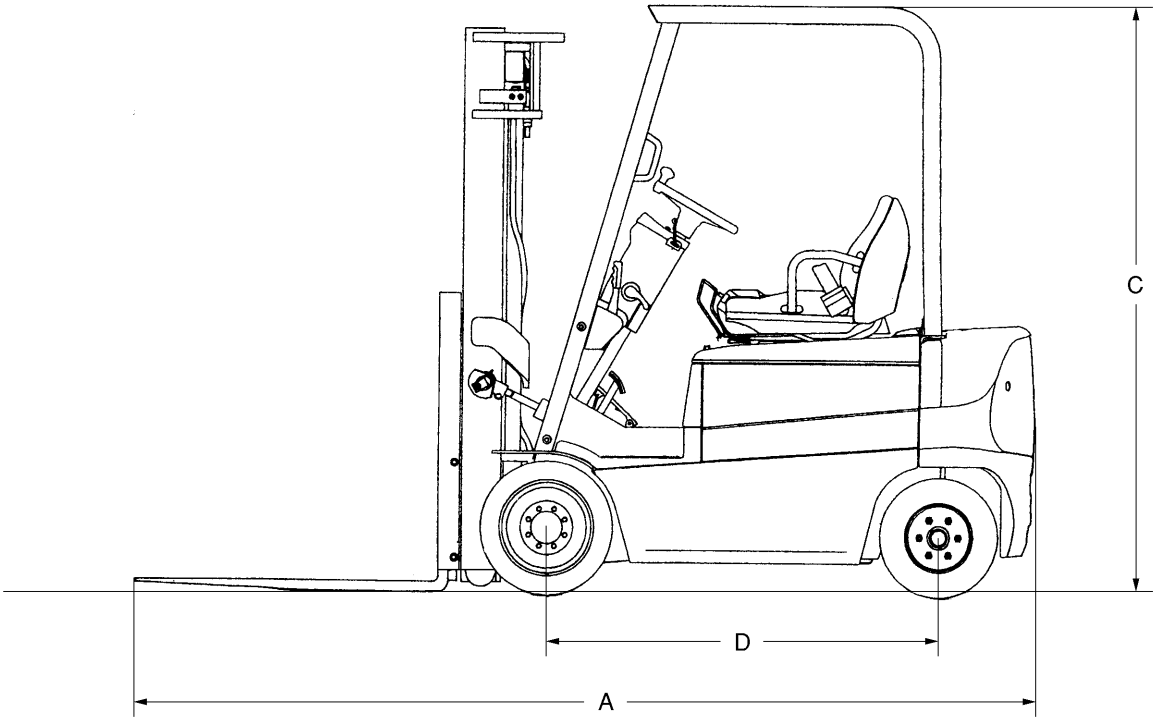
[Mast]

4 R 35 C 30

- 30: Maximum lifting height
  [“30” stands for 3000 mm (118 in.)]
- C: Order of the minor change
  (“A” for the original, “B” for the first change, “C” for the second change, and so on)
- 35: Applicable truck model designation
  35: 3.5 ton class
- R: Kind of mast
  R: simplex mast
  S: duplex mast
  Y: triplex mast
- 4: Major change
  (“2” for the original, “3” for the first change, and so on up to “9”)

Dimensions





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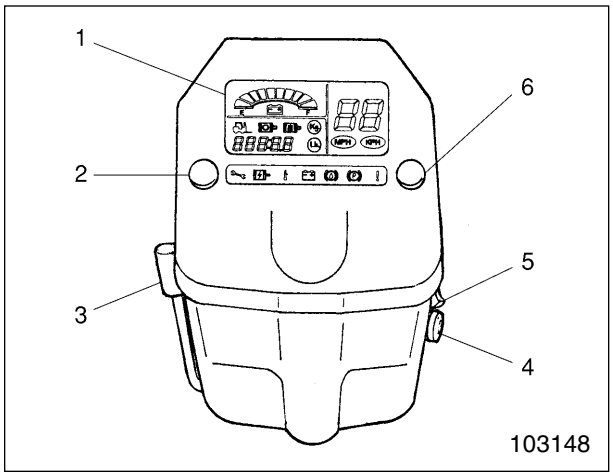
Technical Data

Truck model		EP30K	EP35K
Class		3.0 ton	3.5 ton
Load capacity/load center N (kgf)/mm [lbf/in.]		29400 (3000)/500 [6600/20]	34300 (3500)/500 [7700/20]
Truck size	Length to fork face A mm (in.)	2522 (99.3)	2577 (101.5)
	Width for MCFE (w/SE tire) B mm (in.)	1230 (48.4)	1230 (48.4)
	Height of overhead guard C mm (in.)	2250 (88.6)	2259 (88.9)
Wheelbase D mm (in.)		1690 (66.5)	1690 (66.5)
Service weight (w/o battery) kg (lb)		5060 (11132)	5490 (12078)
Tread front/rear E/F mm (in.)		990/898 (39.0/35.4)	990/898 (39.0/35.4)
Tires size	Front	23 × 9 – 15	250 – 15
	Rear	18 × 7 – 8	18 × 7 – 8
Turning radius mm (in.)		2180 (85.8)	2230 (87.8)
Travel speeds with load km/h (mph)		16 (10)	16 (10)
Lift speeds without load m (in.)/sec		0.54 (21.3)	0.45 (17.7)
Battery voltage V		80	80
Battery rated capacity (5 hrs.) MAX Ah		750	750
Battery weight kg (lb)		1872 (4118)	1872 (4118)
Tilt angle (forwards – backwards)		6° – 8°	6° – 8°
Drive motor, 60 min rating kW		12	12
Pump motor kW		15	15
Drive motor control method		IGBT	IGBT
Pump motor control method		IGBT	IGBT

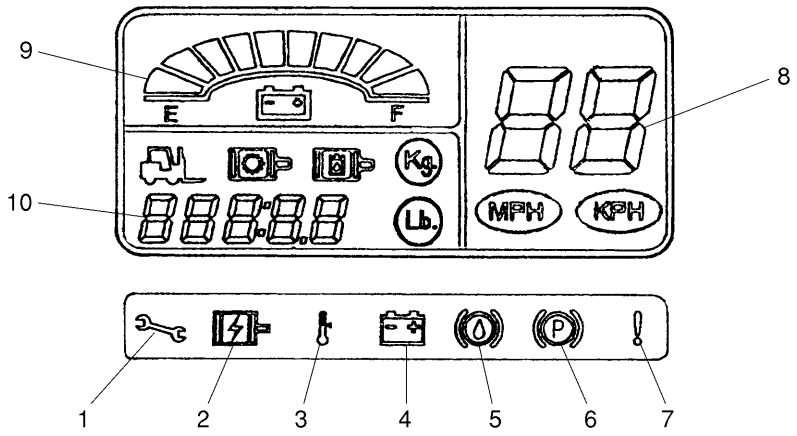
VEHICLE ELECTRICAL COMPONENTS

Console Box

1 Central vehicle monitoring system (CVMS)
2 Mode selector button
3 Steering tilt lever
4 Key switch
5 Lighting switch
6 Mode check button

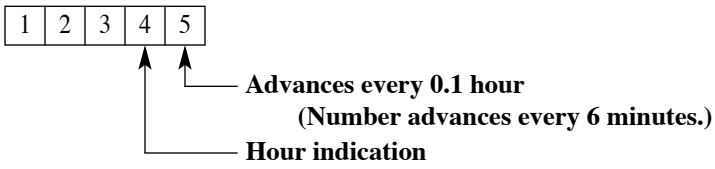


Functions of Central Vehicle Monitor System (CVMS)



Operations

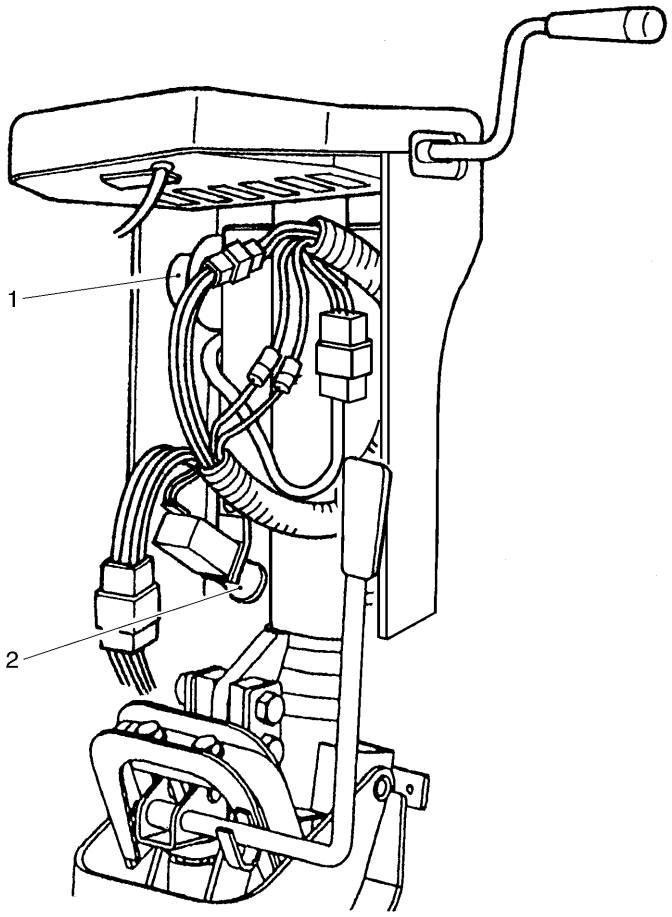
No.	Monitor name	When OFF	When ON or flashing	Remarks
1	Service indicator	Starts flashing 20 hours before set time. Remains ON when set time is reached.		
2	Worn motor brush lamp	Drive motor and pump motor brushes in operable condition	Worn brushes	After brushes are replaced, lamp turns OFF.
3	Controller/motor overheat lamp	Controller, drive motors and pump motor in normal temperature	Overheat	Overheat causes significant output loss. When component temperature lowers to normal level, output power returns.
4	Remaining battery charge warning lamp	Normal battery condition	Flashing indicates battery need to be recharged soon. ON indicates battery needs to be recharged and lifting function inoperable.	
5	Brake fluid level lamp	Normal fluid level	Low fluid level	

No.	Monitor name	When OFF	When ON or flashing	Remarks
6	Parking lamp	Parking brake disengaged	Parking brake engaged	
7	Malfunction lamp	Normal	Vehicle malfunction	
8	Speedometer	KPH, MPH		
	Error indicator			
9	Battery discharge indicator (BDI)			Indicates remaining battery power.
10	Hourmeter Time display			

Error indicator

Indication	Condition
E	When key switch is set to [ON] with forward/reverse lever in [F] or [R] position. Turns OFF when the lever is set to [N].
E 0 ON	Drive motor overheated.
E 2 ON	Pump motor overheated.
E 3 ON	Traction controller overheated.
E 4 ON	Worn drive motor brush.
E 6 ON	Worn pump motor brush.
E 7 ON	Hydraulic controller overheated.
H 1 ON	Faulty setting of lift lever.
H 2 ON	Faulty setting of tilt lever.
H 3 ON	Faulty setting of attachment lever 1.
H 4 ON	Faulty setting of attachment lever 2.

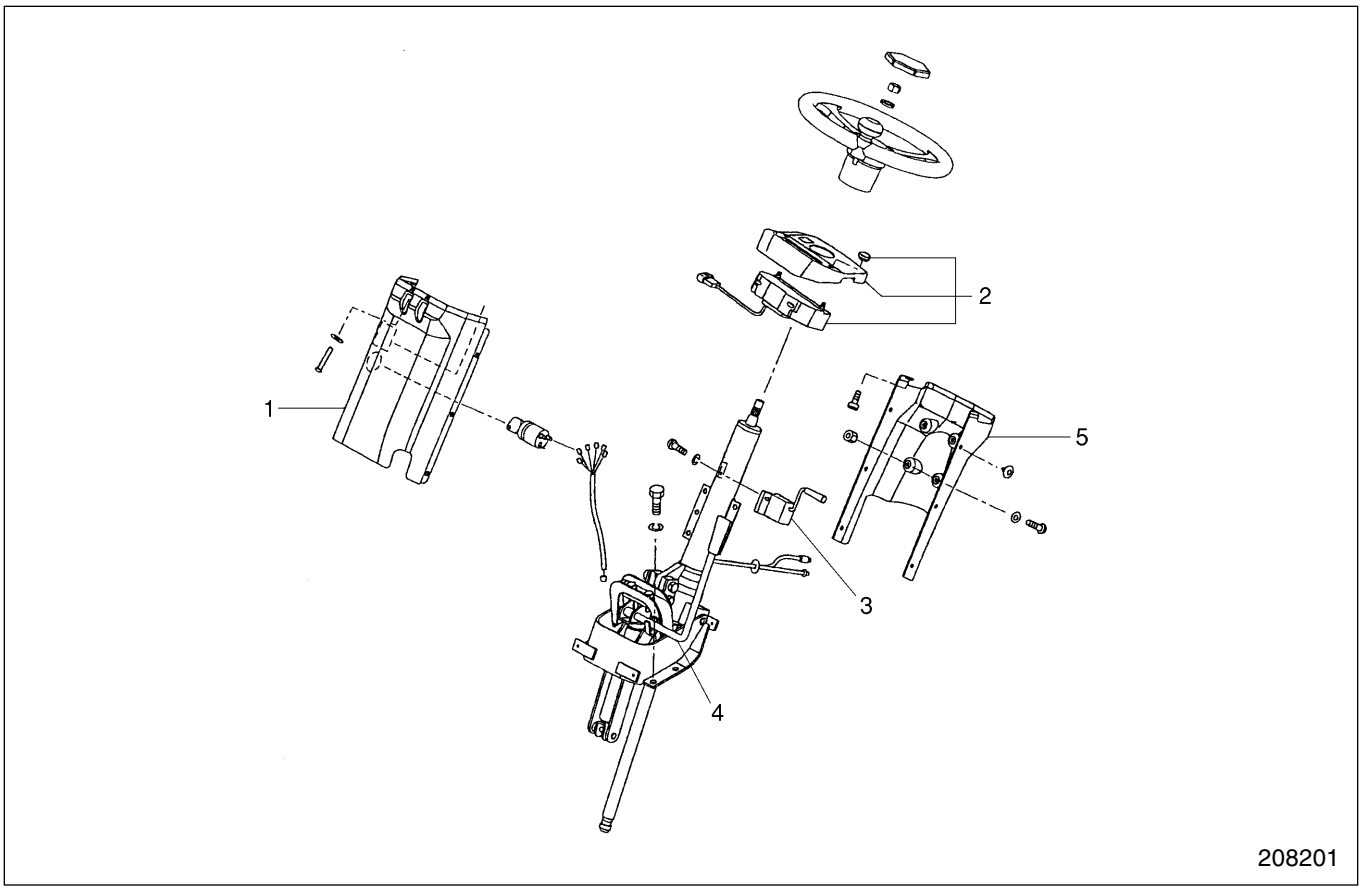
Electrical Components in Console Box



1 Key switch
2 Lighting switch

Disassembly and Reassembly

Disassembly



Sequence

1 Console box (front panel)
2 Central vehicle monitor panel
3 Forward/Reverse lever
4 Steering tilt lever
5 Console box (rear panel)

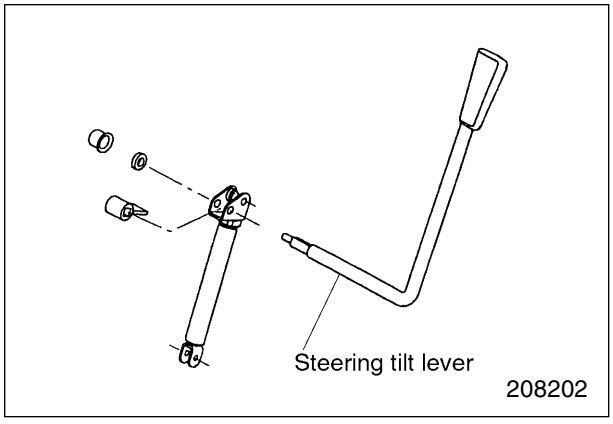
Disassembly procedure

(1) Remove the front panel and monitor panel from the console box.

(2) Disconnect the harness connectors of the horn, turn signal switch and forward/reverse lever.

(3) Remove the screw from the steering tilt lever, and remove the lever from the rear panel of the console box.

(4) Remove the rear panel.

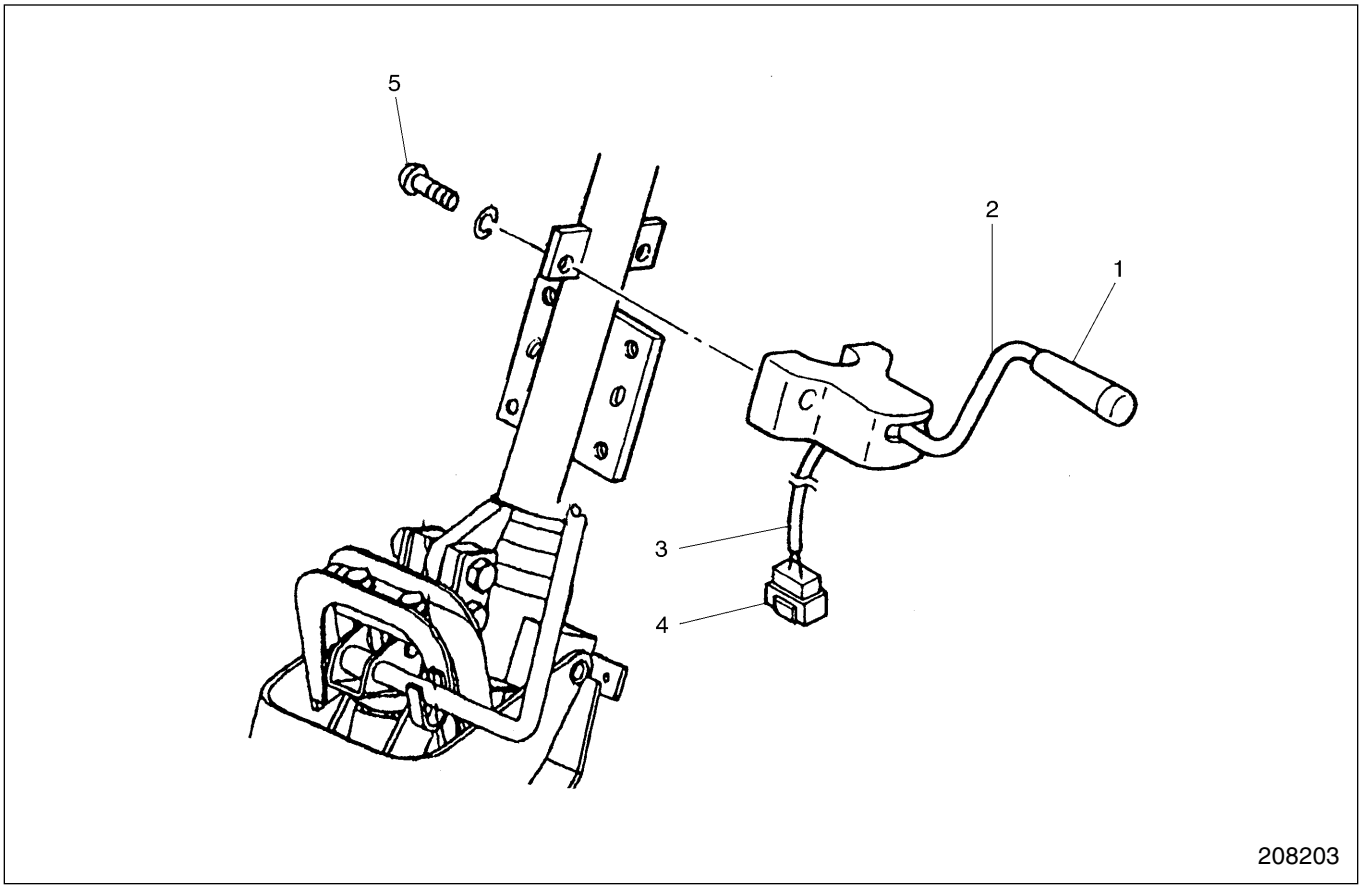


Reassembly

Follow the disassembly procedure in reverse.

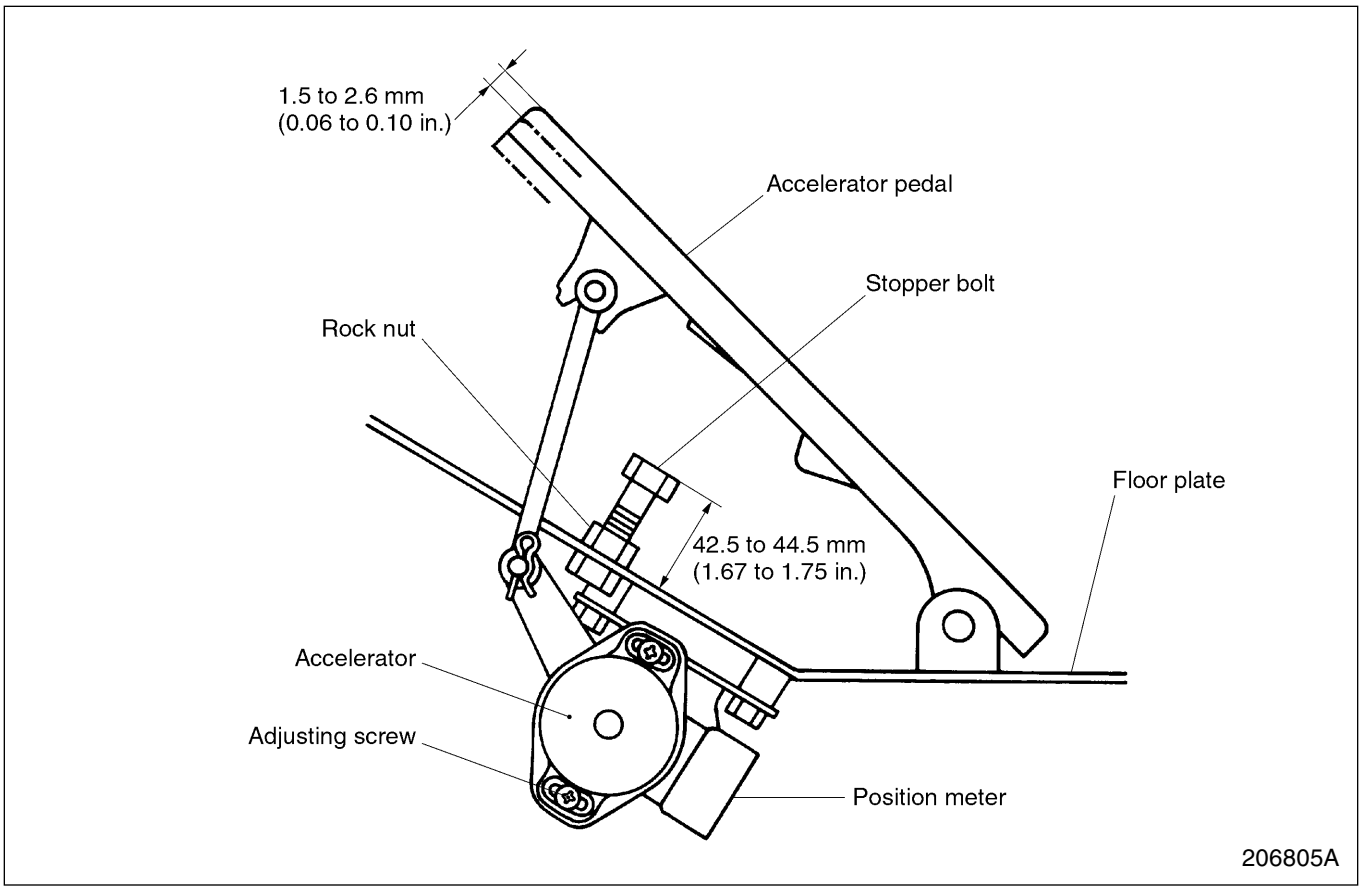
Forward/Reverse Lever

Structure



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

Accelerator Control



Adjustment procedure

(1) Disconnect the battery plug.

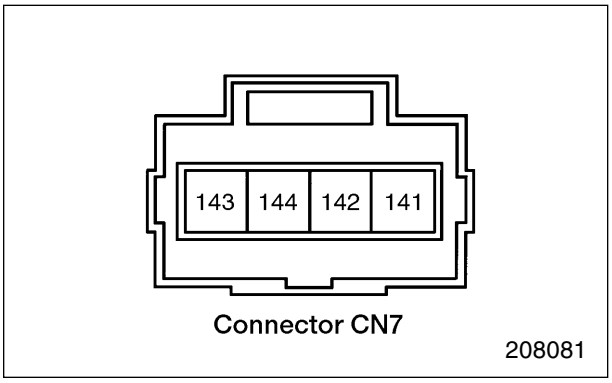
(2) Fix the stopper bolt to 42.5 to 44.5 mm (1.67 to 1.75 in.) from the floor to the upper face of bolt.

(3) Adjust the mounting angle of the position meter using the adjusting screw so the switch inside the position meter turns on when the accelerator pedal is depressed 1.5 to 2.6 mm (0.06 to 0.10 in.).

Make sure the inside switch ON by continuity between two arrow terminals using a tester.

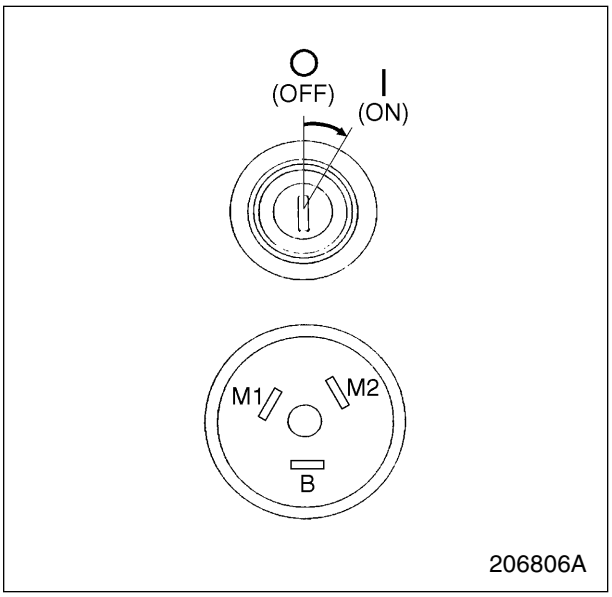
(4) Perform the accelerator self-diagnostics according to the table on page 3-23. The display should read OFF and Speed 0 without the accelerator depressed. The display should change to ON before the speed changes from 0 to 1. If not, then readjust accelerator switch.

(5) Make sure when the accelerator is fully depressed the display reads Speed 16. If not, readjust the stop bolt.



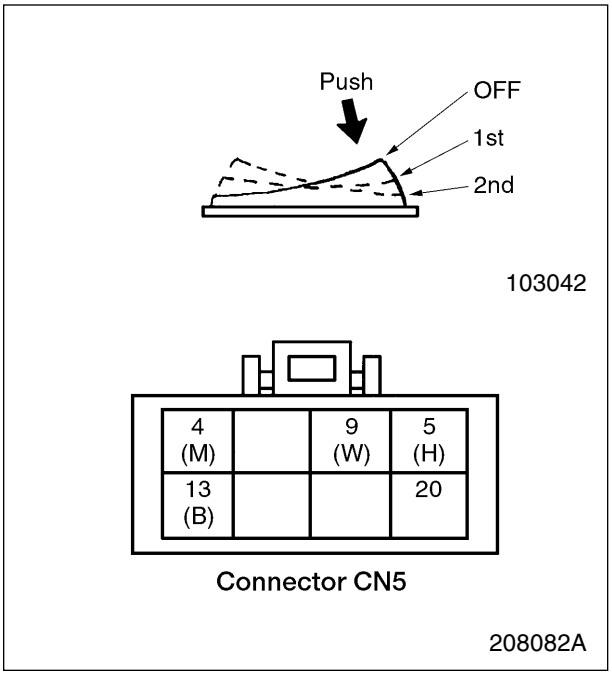
Key Switch

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

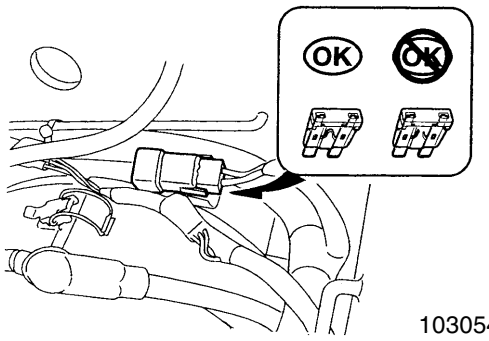


Lighting Switch

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



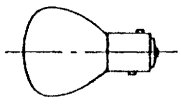
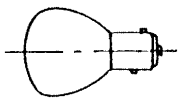
Fuses

<table>
<tr><th>Capacity (A)</th><th>Location</th><th>Main connecting device</th><th></th></tr>
<tr><td>50</td><td rowspan="3">Main controller</td><td rowspan="2">Battery</td><td rowspan="3">Refer to “GROUP 3 MAIN CONTROLLER”</td></tr>
<tr><td>500</td></tr>
<tr><td>325</td><td>Loading hydraulic motor</td></tr>
<tr><td>15</td><td rowspan="2">Fuse holder</td><td>Electric parts</td><td rowspan="2"> 
</td></tr>
<tr><td>10</td><td>Controller</td></tr>
</table>

NOTE

Refer to Parts Manual for proper replacement fuses.

Lamp Specification Chart

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

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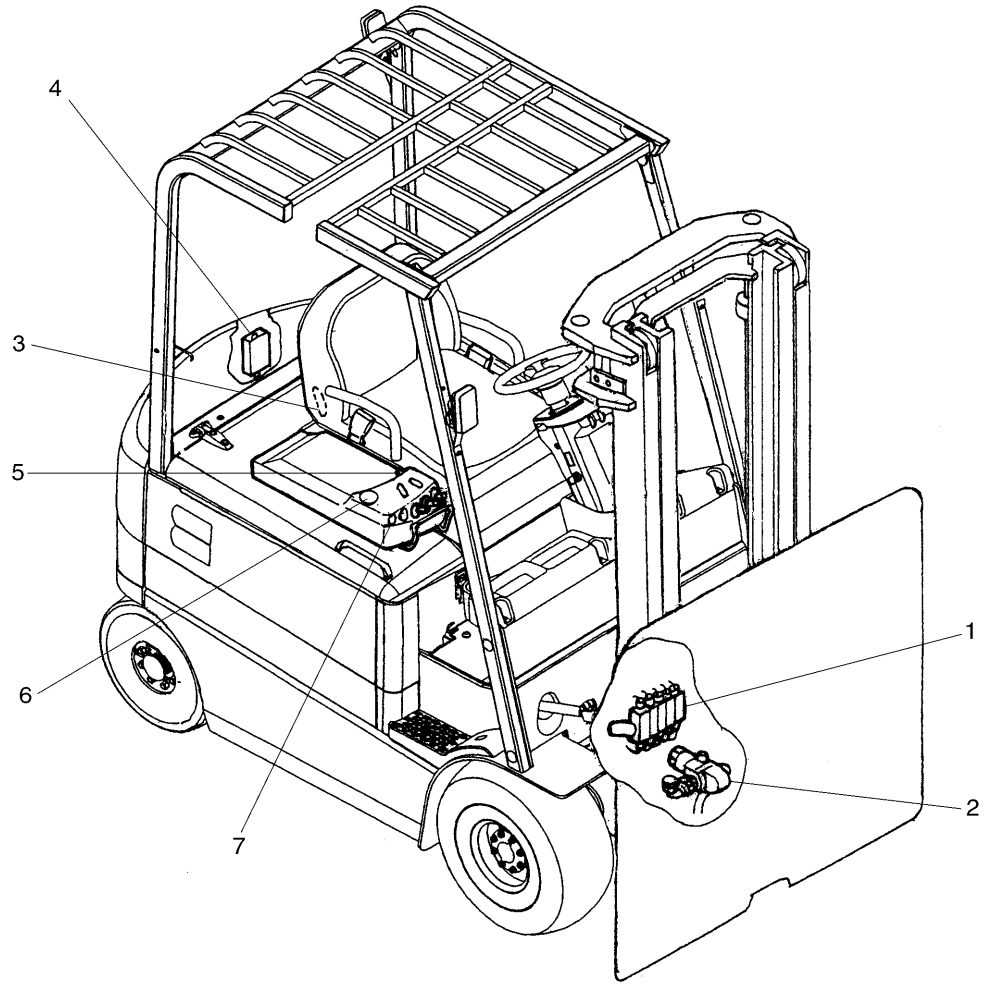
FC (Finger-tip Control System)

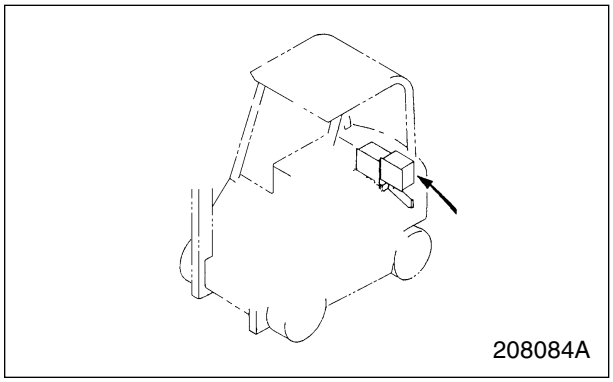
Nomenclature



1 Solenoid control valve
2 Flow regulator valve
3 Seat switch
4 Controller
5 Lowering speed selector switch
6 Safety switch
7 Joystick levers (finger-control system)

Maintenance Precautions

The FC model contains a microcomputer. Following are the precautions to be observed in performing any maintenance on the FC model.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(1) When removing the controller cover, make proper provisions to keep out rain, washing water splashes and the like.

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

NOTE

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

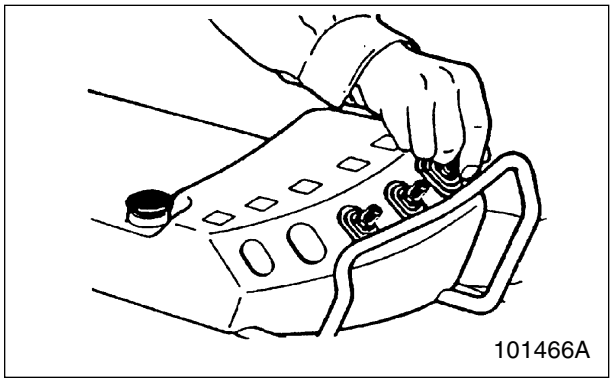
(3) Before performing repairs which require welding, be sure to disconnect the battery plug and the controller from the system at its connectors.

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

Description

1. Finger-control system

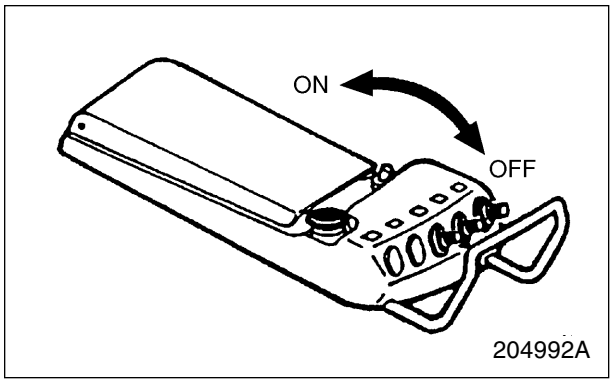
This system, unlike the conventional mechanical control, is electronically actuated to reduce the effort required of the operator in moving the control levers for lift, tilt and attachment functions.



(1) In the full free masts, more oil returns from the 1st lift cylinder than from the 2nd lift cylinders to allow the 1st lift cylinder to retract faster in order to add to productivity.

(2) The lowering speed selector switch insures smooth fork and mast movement no matter how abruptly the operator may move the control levers. This switch is ideal for handling of fragile loads.

ON: 350 mm/s (69 fpm)
OFF: 500 mm/s (98 fpm)



(3) This system provides the following safety functions.

(a) The lift, tilt and attachment functions are not performed even if the control levers are moved when the safety switch is in ON (pushed) position.

(b) The lift, tilt and attachment functions are not performed even if the control levers are moved when the seat switch is not ON (the operator is not seated).

(c) The system indicator light ⚠ in the LED section alerts the operator to problems occurring in the electrical system and, at the same time, stops function. (If any problem occurs in the lift system, for example, the system becomes inoperative.)

Operating Principles

1. Finger-control system

(1) The system is activated by turning ON the safety switch (when the key switch and the seat switch are ON (when the operator is seated).

(2) As the control levers (joysticks) are moved to operate the equipment (mast and forks), the amount of lever movement will be translated into an electrical signal: this signal goes into the controller, in which it is converted to output signal. At this point the controller issues ON signal to increase the pump motor speed, thereby hydraulic pressure being introduced into the control valve. The system is now ready to actuate the equipment. The output signal applies to the proportioning solenoid selected by the direction of the joystick movement. Inside the control valve of that solenoid, its spool is forced to slide, altering the internal oil passage to direct the oil to the corresponding cylinders. The spool keeps on sliding until it comes to the position at which the pressure of its pilot chamber becomes equal to the force of its centering spring. In the meantime, the cylinder extends or retracts against its load. As the joystick is moved back to its neutral position, the signal to the proportioning solenoid dies to lower the pilot chamber pressure and allow the centering spring to push the spool to its neutral position, whereby the line to the cylinder becomes shut off: the pressure in the line is now trapped, holding the cylinder there. At the same time, the motor speeds lowers and the part of the system actuating the equipment goes into no-load state.

(3) If the lowering speed selector switch is turned ON, the effect of a change in lever stroke signal upon the output signal is retarded. Thus, with this switch turned ON, the equipment will not move quickly even if the lever is moved quickly.

(4) Power supply to the controller is initiated from the Power Relay through a 10-Amp fuse. Pressing the safety switch into OFF position shuts down the output to solenoids without shutting down the Main Controller.