MITSUBISHI FORKLIFT TRUCKS

Service Manual

MC/FC

Chassis, Mast & Options

FB16N	**EFB15-20011-up**
FB18N	**EFB15-70001-up**
FB20CN	**EFB17-20011-up**

For use with FB16N-FB20CN Controller Service Manual.

99759-57110

FOREWORD

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

The long productive life of your forklift truck(s) depends 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 the trucks with serial numbers in effect at the time of printing. Mitsubishi forklift trucks reserve 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. 99759-57110

SAFETY

⚠ WARNING

The proper and safe lubrication and maintenance for these forklift trucks, recommended by Mitsubishi Forklift Trucks, 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.

⚠ WARNING

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

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.

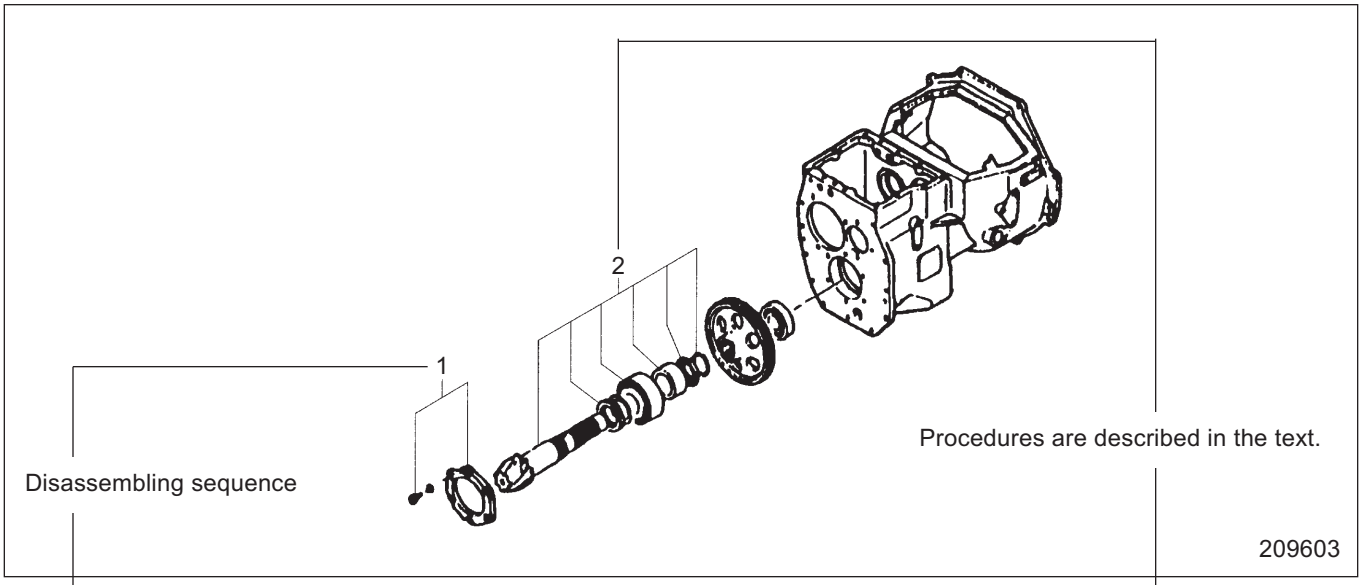
Following is a list of basic precautions that should always be observed.

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.
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.

HOW TO USE THIS MANUAL
(Removal, Installation, Assembly and Disassembly)

Disassembly diagram (example)



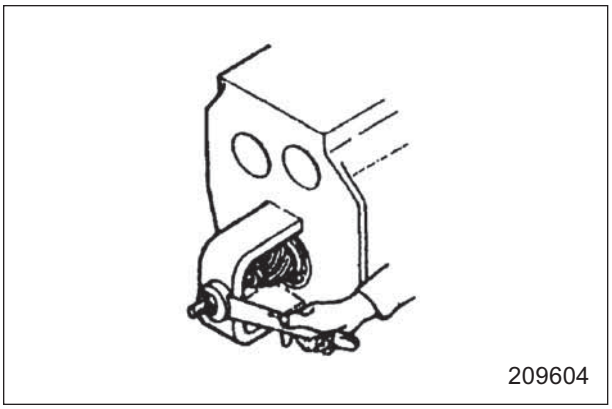
Sequence

1 Cover, Bolt, Washer (part name)
2 Snap ring ..... (part name)

Suggestion for disassembling

1. Output shaft, Removing

   Remove output shaft using a special tool.



Service Data

Gear Backlash	A	0.11 to 0.28 mm (0.0043 to 0.0110 in.)
	B	0.5 mm (0.020 in.)

A: Standard Value
B: Repair or Service Limit

Symbols or abbreviation

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

Units

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

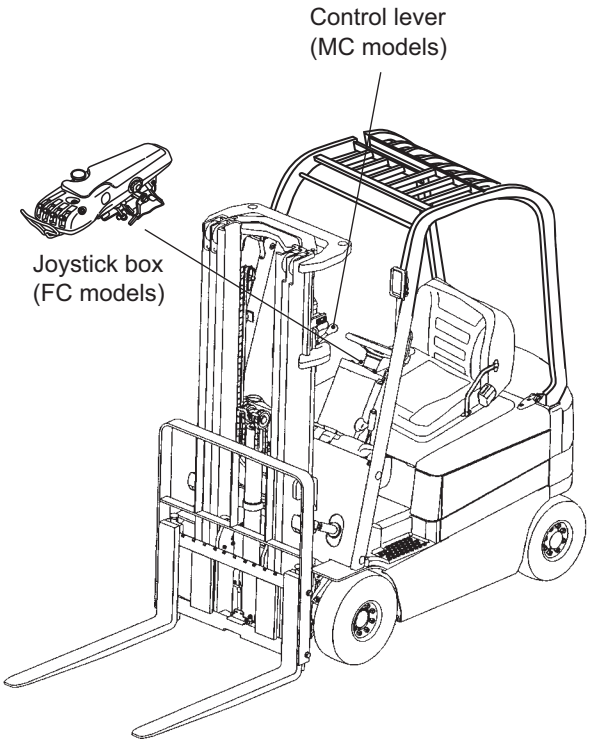
Item	SI unit	Customary unit
Force	1 N	0.1020 kgf
	(1 lbf)	(0.4536 kgf)
Pressure	1 kPa	0.0102 kgf/cm^2
	(1 psi)	(0.0703 kgf/cm^2)
Torque	1 N·m	0.1020 kgf·m
	(1 lbf·ft)	(0.1383 kgf·m)

GROUP INDEX

GROUP INDEX	Items
GENERAL INFORMATION	Vehicle exterior, Models, Serial number locations, Chassis and mast model identification, Dimensions, Technical data
VEHICLE ELECTRICAL COMPONENT	Console box, Direction lever, Accelerator control, Key switch, Fuses, Lamp specification chart, Troubleshooting of lighting and horn systems, Joystick box
POWER TRAIN	Procedures and suggestions for removal and installation, Service data
TRANSFER UNIT	Specifications, Structure and functions, Procedures and suggestions for disassembly and reassembly, Service data
REAR AXLE	Structure, Procedures and suggestions for removal and installation, Procedures and suggestions for disassembly and reassembly, Adjustment, Troubleshooting, Service data
BRAKE SYSTEM	Specifications, Structure and functions, Procedures and suggestions for disassembly and reassembly, Inspection and adjustment, Troubleshooting, Service data
STEERING SYSTEM	Specifications, Structure and functions, Procedures and suggestions for removal and installation, Steering control valve, Hydraulic circuit diagram, Troubleshooting, Service data
HYDRAULIC SYSTEM	Specifications, Finger-tip control type (Description, Removal and installation, Disassembly and reassembly, Inspection and adjustment, Hydraulic circuit diagram), Mechanical control type (Control valve, Removal and installation, Hydraulic circuit diagram), Troubleshooting, Service data
MAST AND FORKS	Mast systems, Description, Removal and installation, Disassembly and reassembly, Inspection and adjustment, Troubleshooting, Service data
SERVICE DATA	Inspection standards, Periodic replacement of parts, Lubrication standards, Main component weights, Tightening torque for standard bolts and nuts, Special tool table

GENERAL INFORMATION

Vehicle Exterior



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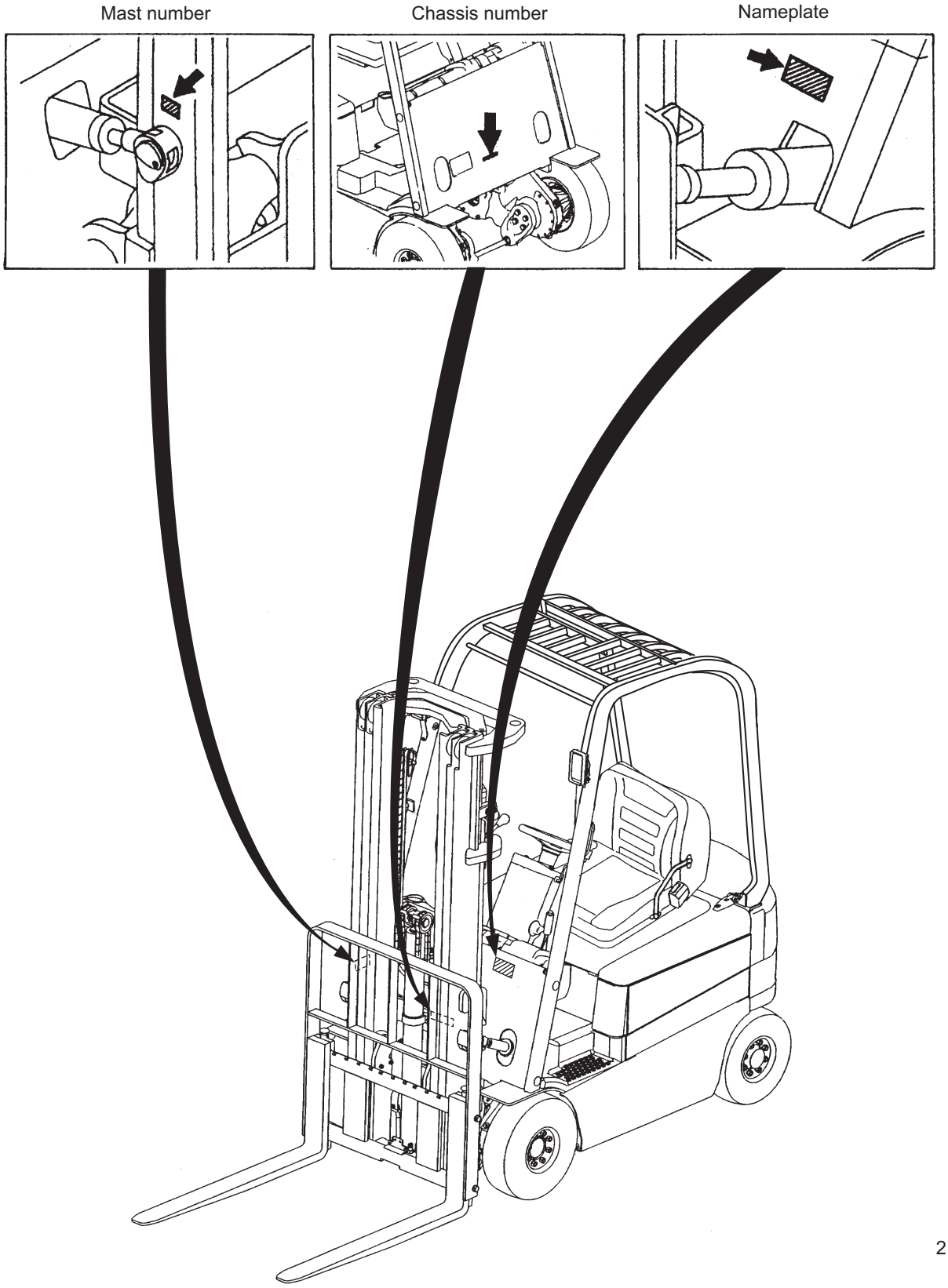
Models

This manual applies to FB16N, FB18N and FB20CN.

Truck Model	Serial Number
FB16N	EFB15-20011-up
FB18N	EFB15-70001-up
FB20CN	EFB17-20011-up

Serial Number Locations



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Chassis and Mast Model Identification

[Chassis]

FB 16 N

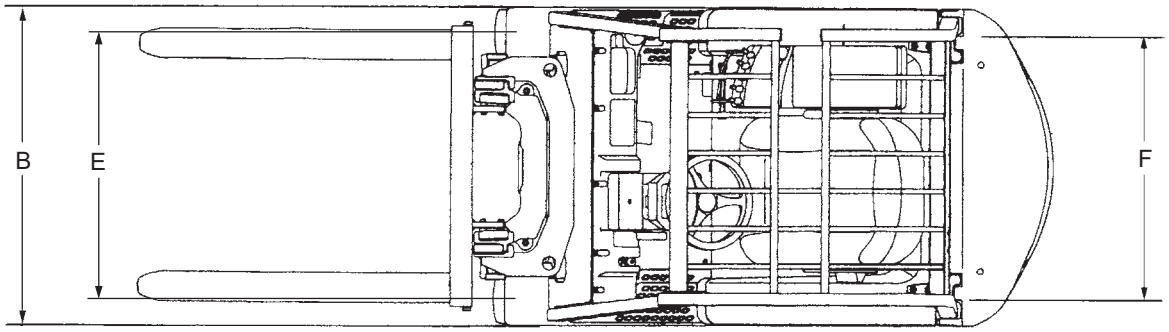
- N: Generation designator
- 16: Maximum capacity
  - 16: 1600 kg (3500 lb)
  - 18: 1800 kg (4000 lb)
  - 20: 2000 kg (4400 lb)
- FB: Battery type

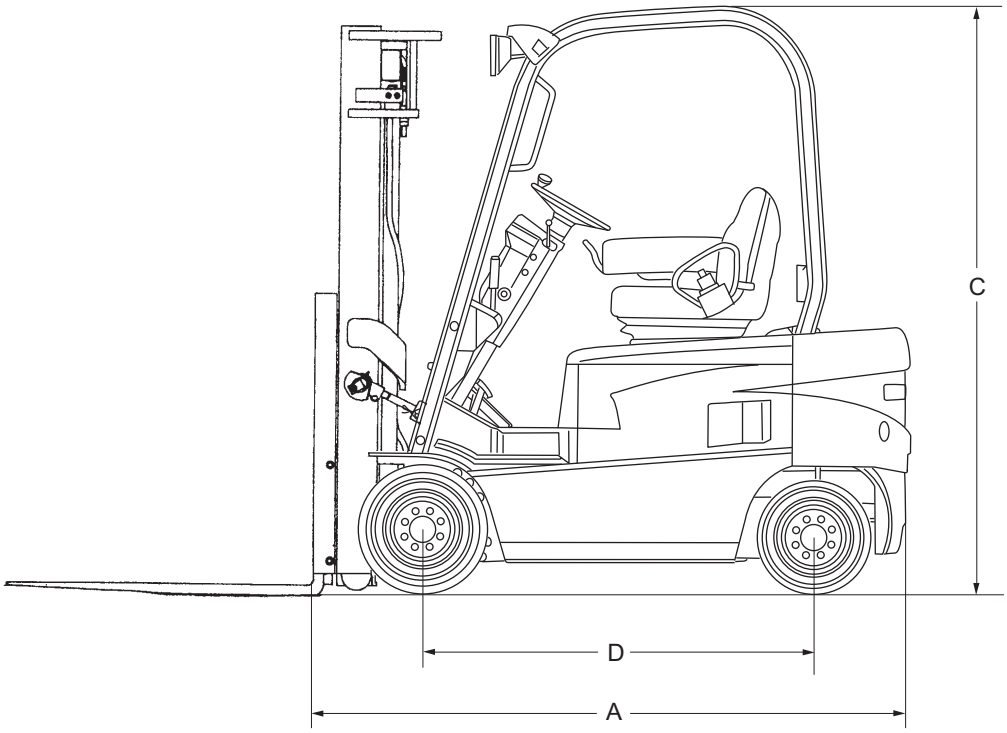
[Mast]

2 G 15 A 30

- 30: Maximum lifting height
  ["30" stands for 3000 mm (118 in.)]
- A: Order of the minor change
  ("A" for the original, "B" for the first change, "C" for the second change, and so on)
- 15: Applicable truck model designation
  - 15: 1 ton class
  - 20: 2 ton class
- G: Kind of mast
  - G: simplex mast
  - H: duplex mast
  - J: triplex mast
- 2: Major change
  ("1" for the original, "2" for the first change, and so on up to "9")

Dimensions





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Technical Data

Truck Models				FB16N	FB18N	FB20CN
Class				1.6 ton	1.8 ton	2.0 ton
Load Capacity/Load Center			N (kgf)/mm [lbf/in.]	15690 (1600)/500 [3530/20]	17650 (1800)/500 [3970/20]	19610 (2000)/500 [4410/20]
Truck size	Length to Fork Face	A	mm (in.)	2074 (81.7)	2074 (81.7)	2188 (86.1)
	Width	B	mm (in.)	1070 (42.1)	1070 (42.1)	1130 (44.5)
	Height of Overhead Guard	C	mm (in.)	2048 (80.6)	2048 (80.6)	2048 (80.6)
Wheelbase		D	mm (in.)	1360 (53.5)	1360 (53.5)	1463 (57.6)
Truck weight, without load/ including battery			kg (lb)	3190 (7033)	3280 (7231)	3470 (7650)
Tread Front/Rear		E/F	mm (in.)	913/898 (35.9/35.4)	913/898 (35.9/35.4)	935/898 (36.8/35.4)
Tires Size	Front			18 x 7-8	18 x 7-8	200/50-10
	Rear			16 x 6-8	16 x 6-8	16 x 6-8
Turning Radius			mm (in.)	1810 (71.3)	1810 (71.3)	1910 (75.2)
Travel Speeds Unloaded/Loaded			km/h (mph)	17/17 (10.6/10.6)	17/17 (10.6/10.6)	17/17 (10.6/10.6)
Maximum Gradeability Unloaded/Loaded			%	35/27	35/25	35/24
Lift Speeds Unloaded/Loaded			m (in.)/sec	0.60/0.50 (23.6/19.7)	0.60/0.44 (23.6/17.3)	0.60/0.40 (23.6/15.7)
Lowering Speed Unloaded/Loaded			m (in.)/sec	0.5/0.52 (19.7/20.5)	0.5/0.52 (19.7/20.5)	0.5/0.52 (19.7/20.5)
Battery Voltage			V	48	48	48
Battery Rated Capacity (5 hrs.) MAX			Ah	600	600	720
Battery Compartment Size			mm (in.)	1006 x 521 x 650 (39.6 x 20.5 x 25.6)	1006 x 521 x 650 (39.6 x 20.5 x 25.6)	1006 x 624 x 650 (39.6 x 24.6 x 25.6)
Battery Weight			kg (lb)	865 (1907)	865 (1907)	1000 (2205)
Tilt Angle (forwards-backwards)				6°-7°	6°-7°	6°-7°
Traction Motor, 60 min rating			kW	2 x 5.0	2 x 5.0	2 x 5.0
Hydraulic Motor (15% duty)			kW	14	14	14
Traction Motor Control Method				MOSFET	MOSFET	MOSFET
Hydraulic Motor Control Method				MOSFET	MOSFET	MOSFET