



NEW MODEL FEATURES

ELECTRIC FORKLIFT TRUCKS

7 F B E F 15, 16, 18, 20

< Tillbaka till Servicemanual 7FB EF 15-20

Index

APRIL 2003

Pub. No. CE335-CD

FOREWORD

This manual mainly describes the development objectives of new Toyota forklift 7FBEF15 to 20 models, outlines of main component units, structures and functions of new mechanisms and other technical features.

Please read it carefully for sales and service activities.

This manual has been edited for the vehicles launched into the market in May 2003.

Any later change shall be informed through Toyota Industrial Equipment Parts & Service News.

Please refer to the repair manual and parts catalog for the matters necessary for servicing.

TOYOTA Material Handling Company
A Division of TOYOTA INDUSTRIES CORPORATION

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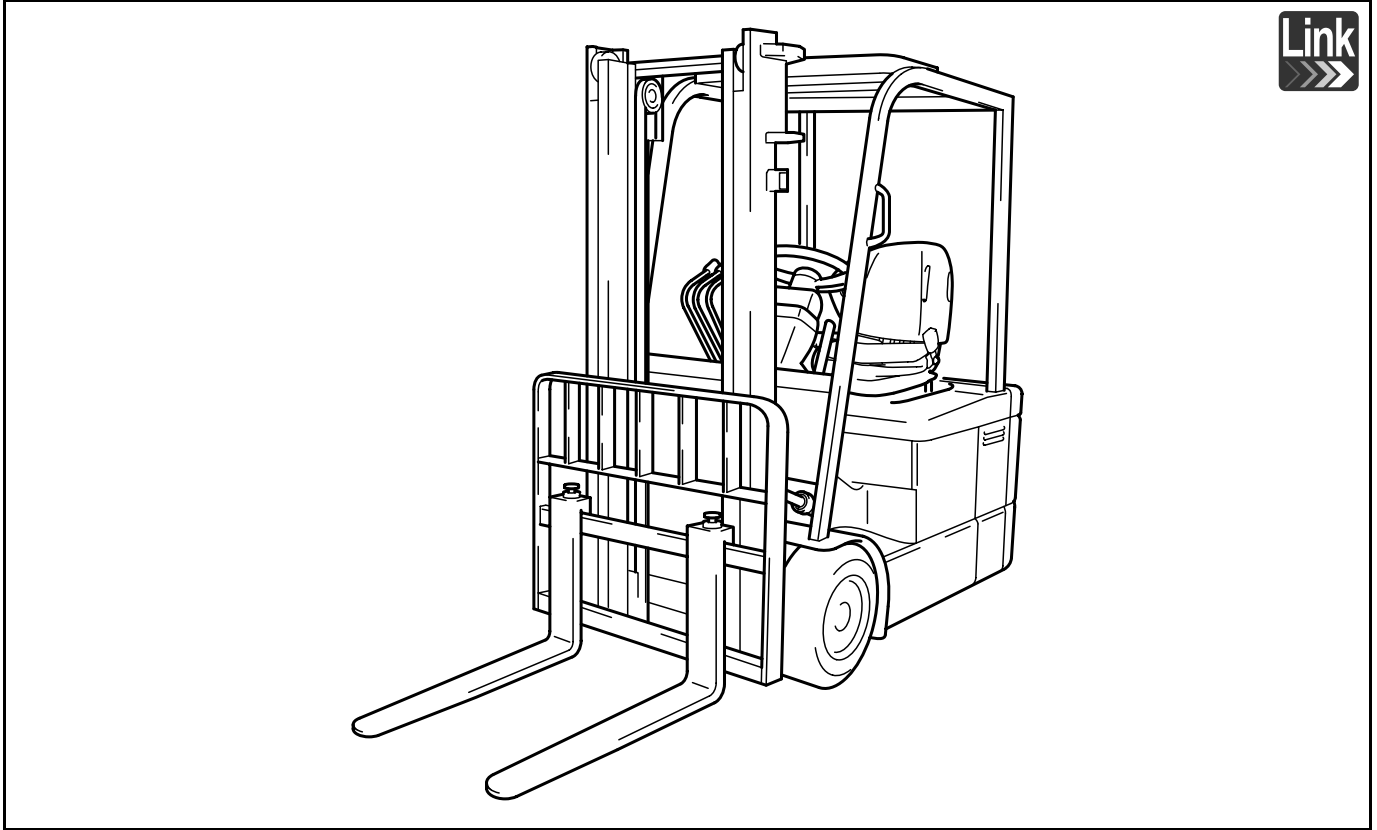
GENERAL

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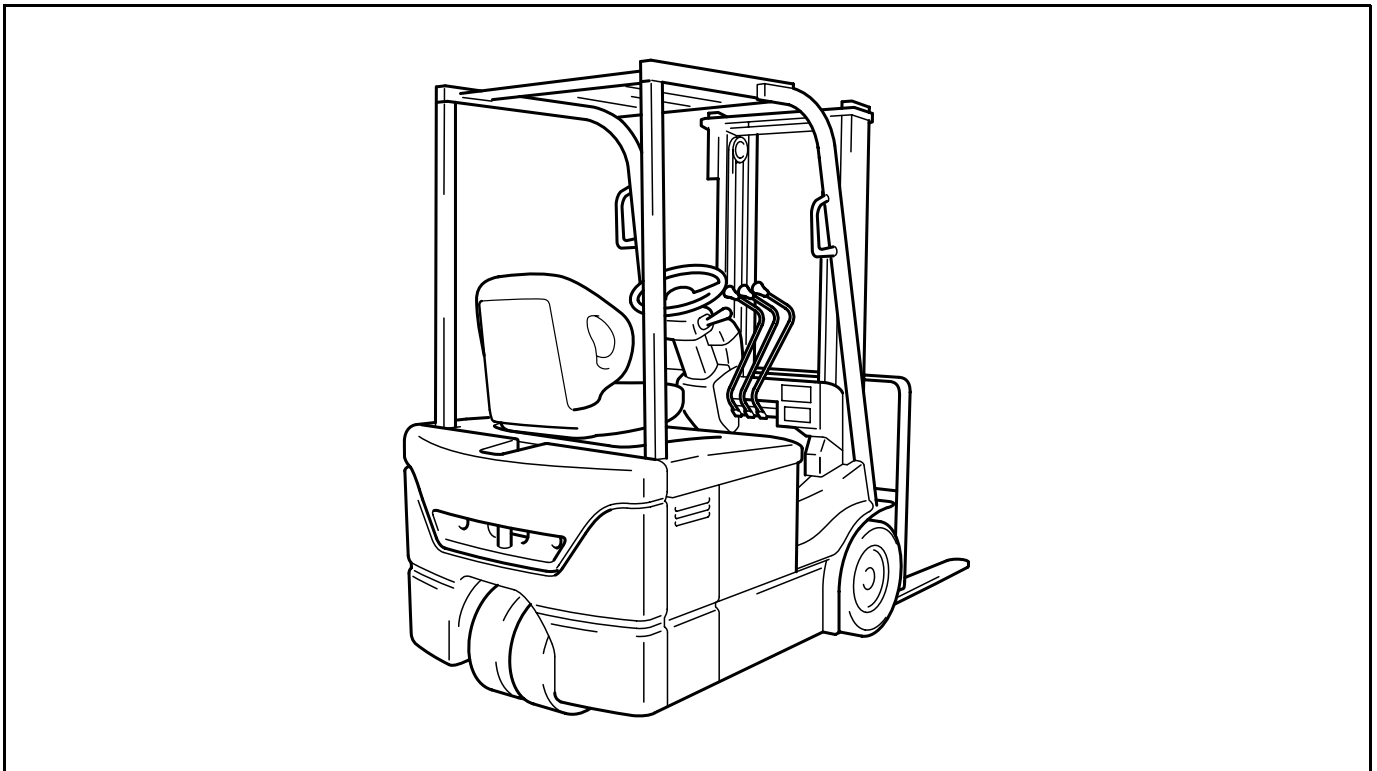
VEHICLE EXTERIOR VIEWS

■ Vehicle exterior views

Front View



Rear View



MODEL LINEUP

■ Vehicle model lineup

Payload (L.C. 500 mm)	New model	Previous model	Voltage
1.5 ton	7FBEF15	5FBE15	48V
1.6 ton	7FBEF16	–	48V
1.8 ton	7FBEF18	5FBE18	48V
2.0 ton	7FBEF20	–	48V

L.C.: Load center

DEVELOPMENT OBJECTIVE

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DEVELOPMENT OBJECTIVE

■ Development objective

Toyota 5FBE series, 1,500-kg to 1,800-kg three-wheel, counter battery type forklift have favorably been accepted by a large number of customers thanks to their ease of use and reliability since the model change in 1993.

After the model changes by competitors in later years, however, disparities in specifications and equipment compared to 7FB series and 7FBR series have been pointed out.

Growing environmental concerns in the market, on the other hand, has been adding to the importance of battery vehicles.

■ Development concepts

1	Optimum material handling operation matching each customer's needs by making the most of the features of AC-motor drive system.
2	Adoption of the SAS (mast control and steering synchronizer) developed in the 7 series and highly evaluated in the market for realization of high stability comparable with that of the 7 series.
3	Easier ingress and egress by adoption of the open step, small-diameter steering wheel and tilt steering with memory.
4	Addition of 1,600- and 2,000-kgf models to the 1,500- and 1,800-kgf models in the previous series.

The AC drive system, especially was implemented in 1999 ahead of other companies by consolidation of our time-tested technologies. Its features have fully been utilized not only in performances but also in operating feel.

We propose these models as three-wheel counter battery forklift trucks without an equal in performance and operating feel.

FEATURES (SELLING POINTS)

■ Major selling points

The greatest feature of the new models is adoption of the AC motor drive system. New features of the 7FB series have also been adopted in many places.

1. Adoption of AC Motor Drive System

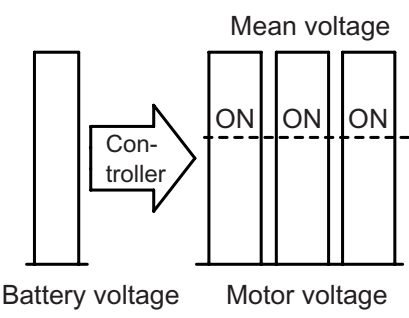
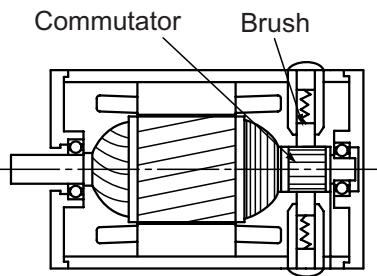
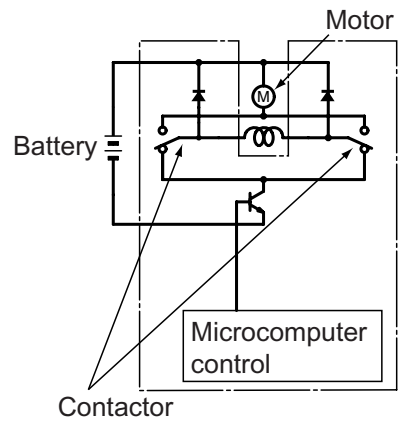
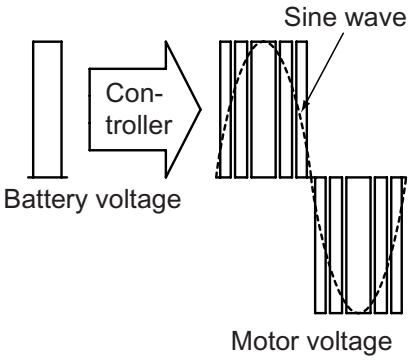
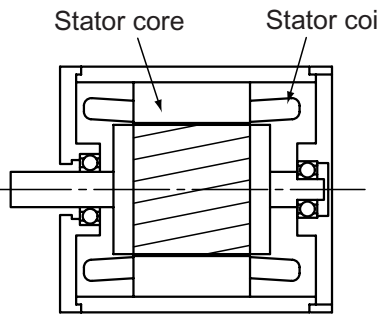
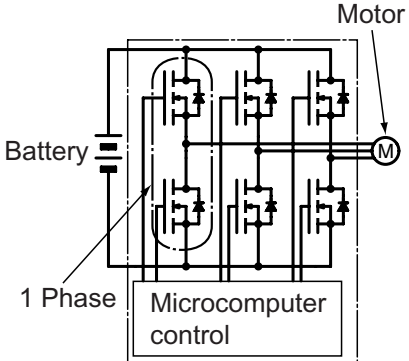
What is AC motor drive system?

The conventional DC motor drive system uses a controller for battery current chopping (ON and OFF) to control the motor power by changing the chopping ratio to realize from inching at the time of starting up to the maximum power.

The controller in the AC motor drive system converts the battery current to a three-phase alternate current, whose sine wave form (frequency and waveform height) varies to control the motor power.

The table below compares the motor voltage, motor structure and the controller between the AC system and DC system.

Comparison between the DC and AC systems

	Motor voltage	Motor structure	Controller
DC system	 <p>Battery voltage Mean voltage ON ON ON Motor voltage</p>	 <p>Commutator Brush</p>	 <p>Battery Motor Microcomputer control Contactor</p>
	<ul style="list-style-type: none"> • Conversion from battery DC voltage into the mean voltage by the chopper 	<ul style="list-style-type: none"> • Need of brush and commutator maintenance • Complicated structure 	<ul style="list-style-type: none"> • Relatively easy by mean DC voltage control • Need of contactor for rotating direction change
AC system	 <p>Battery voltage Sine wave Controller Motor voltage</p>	 <p>Stator core Stator coil</p>	 <p>Battery Motor 1 Phase Microcomputer control</p>
	<ul style="list-style-type: none"> • Conversion from battery DC voltage into the AC voltage by the controller 	<ul style="list-style-type: none"> • No brush and commutator (maintenance-free) • Compact and lightweight 	<ul style="list-style-type: none"> • Conversion from DC into three-phase AC by the module • No need of contactor for rotating direction change

Features of AC motor drive system

The table below shows three major features of the AC motor drive system. The AC motor drive system has already been adopted in the industrial world by making the most of these features.

	System feature	Product feature
1	Simple, compact motor structure	Realization of higher performance in the same product size
2	Realization of new control by three-phase AC control	Realization of new performance and feel thanks to wider motor control range
3	No motor brush and contactor	Reduction of maintenance cost for motor brush and contactor

It has been known to worldwide forklift engineers that the AC motor drive system, as stated above, is a very excellent system for battery forklift trucks.

Selling points of the new models fully utilizing these features are explained below.

2. Power Select Function

The performance best matching the operator can be selected by single switch operation.

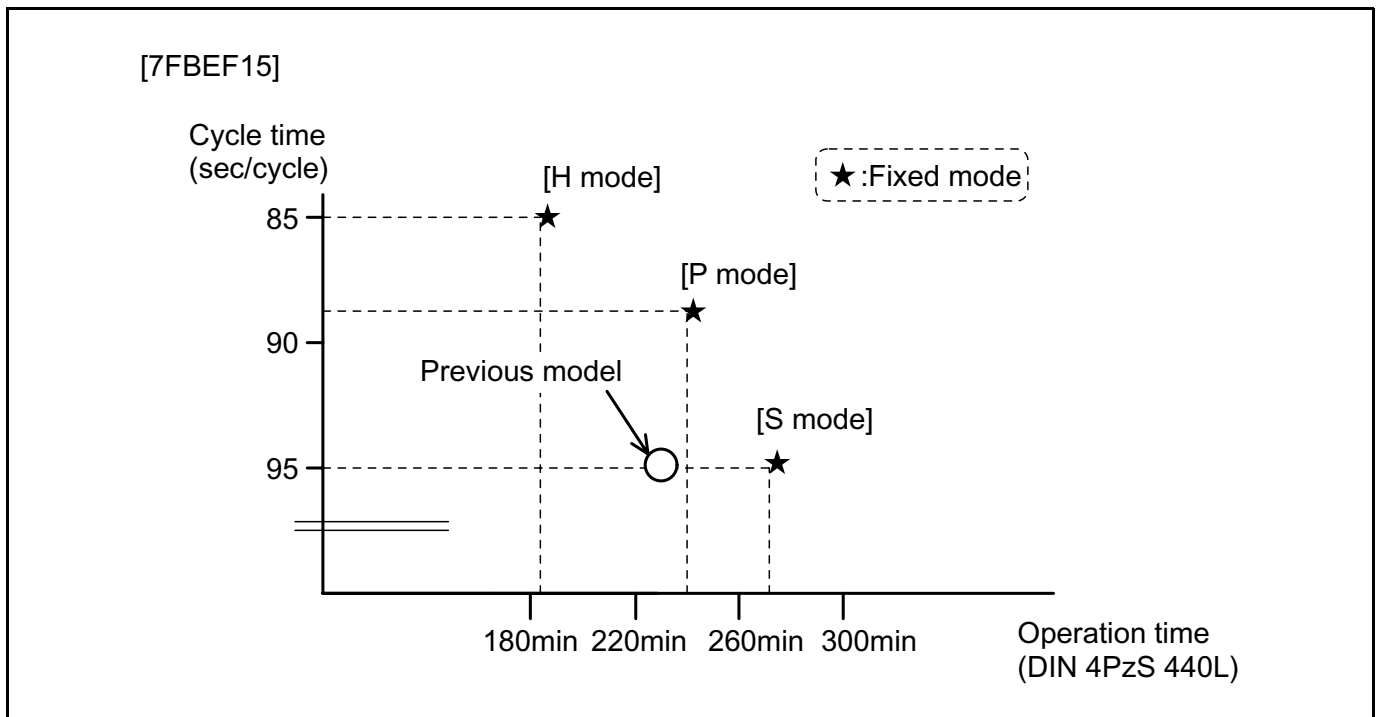
The traveling performance in loaded state is improved in new models by making the most of the simple, compact structure of the AC motor. One switch selects any of the following modes.

- **Mobility-preference mode featuring the shortest cycle time (H mode)**
- **Efficiency-preference mode for short cycle time and long working hours (P mode)**
- **Operation-hour-preference mode featuring the longest operation hours with the performance equivalent to that of previous models (S mode)**

To satisfy individual customer requirements, a power control select function is provided for setting the traveling mode by selection from six modes including H, P and S.

The operation efficiency is greatly improved by selection of the optimum performance for each customer need like H mode selection for a job requiring the power and performance or S mode selection for continuous operation for many hours.

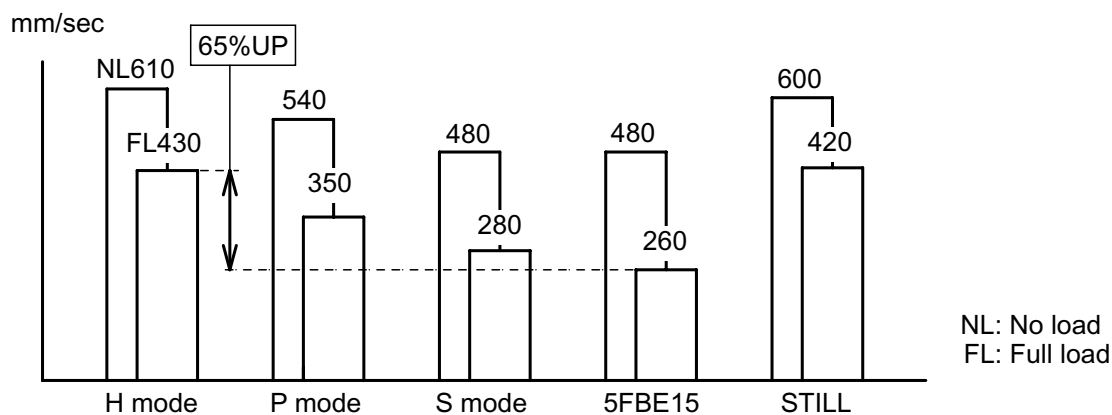
Power select function



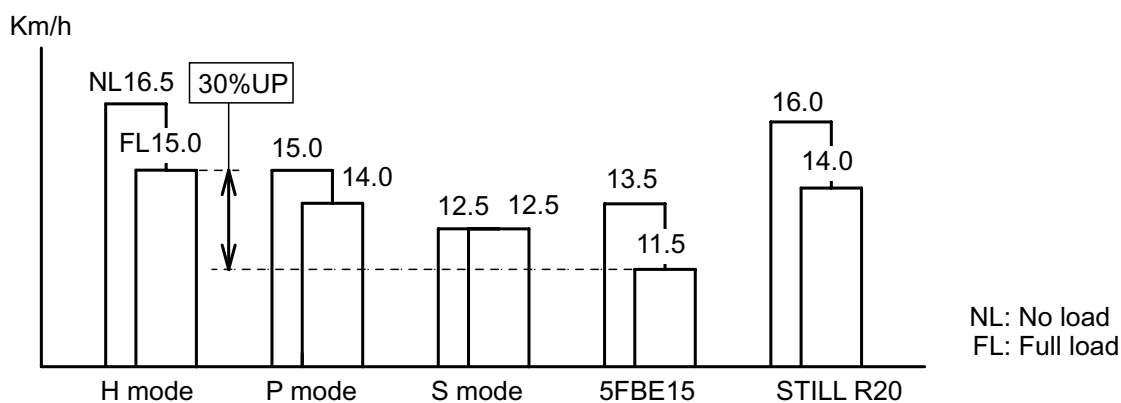
Especially, the loaded traveling and material handling performances in the H mode have been improved over 30%. As a result, our 30-m operation cycle time has been shortened by about 10% or more.

1.5 ton

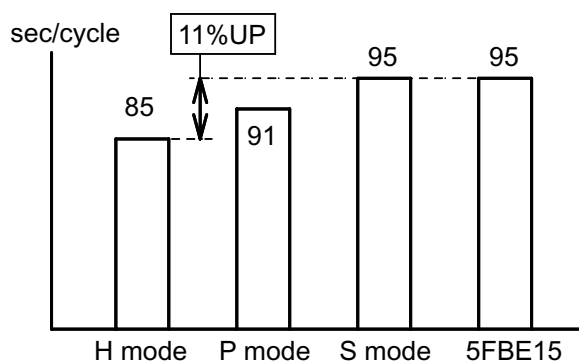
Lifting speed



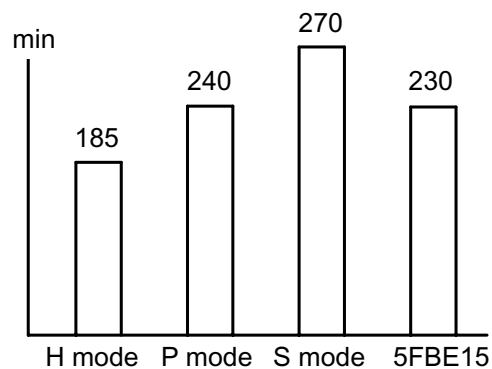
Traveling speed



Cycle time
(TOYOTA 30m operation cycles)



Operation time
(DIN 4PzS 440L, TOYOTA 30m operation cycles)



3. Improved Efficient Operation Hour

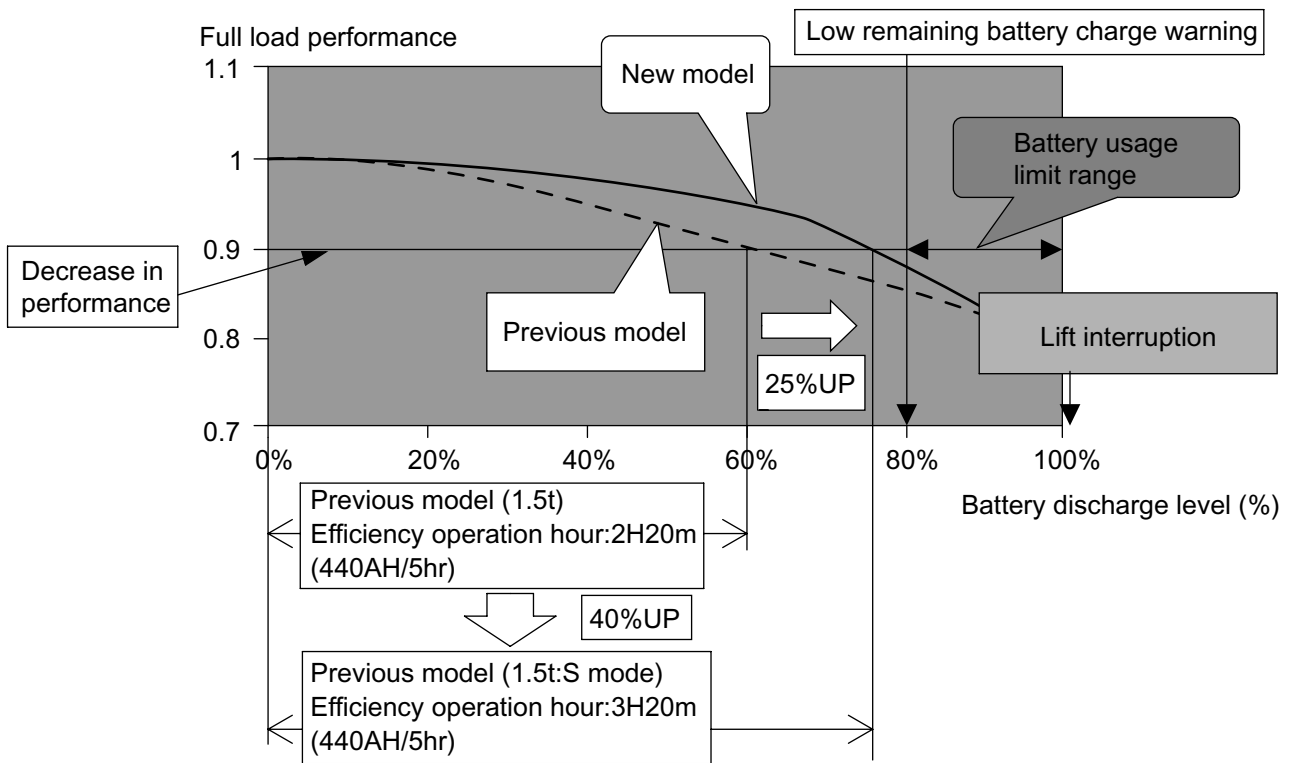
The accelerator-off regeneration system is added to the AC drive system for longer operation compared to the previous models. The power up function is also adopted for longer efficiency operation hours.

Power keep function

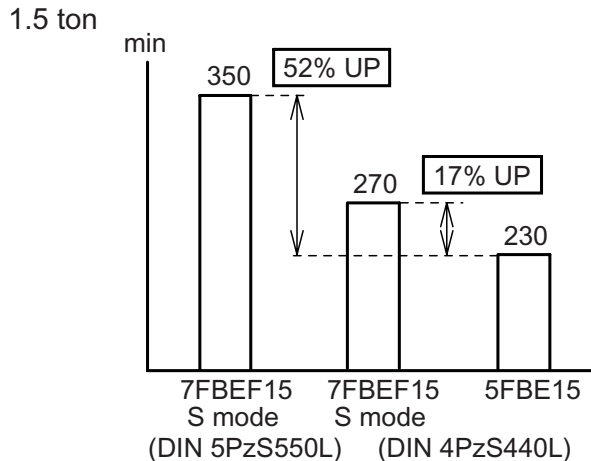
(Setting to the P mode at the Efficiency-preference and the S mode for Operation-hour-preference)
 The power keep function has been developed as the new control in new models for maintaining the discharged battery performance by making use of the wider motor control range of the AC motor drive system.

- The efficiency operation hours allowing operation without feeling performance degradation is improved by 40% by adoption of the power keep function and extension of the operation hours.
- The number of operation cycles without feeling performance degradation is also improved by 40%.

This new function actually improves the operation efficiency at each customer greatly.



However, note that efficient operation becomes hard when the battery level indicated by the battery charge indicator becomes one bar (battery discharge to about 90%).



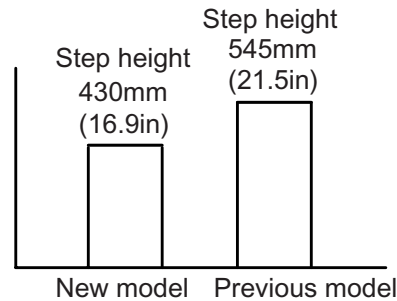
4. Easy Ingress/Egress and Dwelling Ability

Easy Ingress/Egress

An open step is provided for easy ingress/egress.

The tilt steering is also provided with a memory as on the 7FB series to allow full forward tilting of the steering column to ensure smoother ingress/egress.

Step height



Dwelling Ability

Compared to previous models, the head clearance is increased by 25 mm (0.98 in) to 1,025 mm (40.4 in).

5. Maintenance Cost Reduction

Maintenance items specific to battery vehicles are as follows:

- 1) Addition of distilled water for battery
- 2) Pump motor brush replacement
- 3) Pump contactor replacement in controller
- 4) Drive motor brush replacement
- 5) Drive contactor replacement in controller

Since the AC motor has no brush and contactor as explained earlier, brush replacements are unnecessary. Depending on the operating conditions at each customer, the annual maintenance cost can be reduced as much as 80%.

The newly adopted acceleration-off regeneration system regenerates the electrical braking energy upon accelerator pedal release during traveling in the battery by making the most of the wider motor control range of the AC motor drive system. This accelerator-off regeneration system not only extends the operation hours and improves the running stability by electrical braking but also reduces the brake load and lining wear for less brake maintenance cost.

6. Safety Functions

The new models are installed with the SAS safety functions adopted on the 7FB series to ensure equivalent safety. Though the safety functions are summarized below, refer to the SAS Control Equipment section for further details.

Safety Function List

Safety control		Functional outline
Mast control	Active mast front tilt angle control	Decreases the front tilt angle at a high fork height or under a heavy load, and increases it at a low fork height or under a low load.
	Active mast backward tilt speed control	Retards the backward tilting speed at a high fork height, and increases it at a low fork height.
	Key-lift interlock	If the key switch is in the OFF position, the lift operation is disabled even when the material handling lever is operated.
	Automatic fork leveling control	Forward tilting by pressing the button causes the mast to be stopped automatically when the fork is leveled.
Steering synchronizer (EHPS)		The steering knob is not shifted during full hydraulic power steering.

EHPS: ELECTRONICALLY CONTROLLED FULLY-HYDRAULIC POWER STEERING

On three-wheel battery counter vehicles, the automatic control rear stabilizer is not provided because of no rear wheel swing mechanism.

7. Anti-rollback

A function for easy starting on a slope (reduction of rollback on a slope) is provided.

8. Model Series

The 1.6- and 2.0-ton models have been developed anew to enrich the model line-up. The 1.0- and 1.25-ton models have been discontinued.

	Capacity (kgf)					
	1000	1250	1500	1600	1800	2000
7FBE			●	◎	●	◎
5FBE	○	○	●	●	●	

● : Continuation ◎ : New

9. Maximum battery capacity

The battery compartment length in the longitudinal direction has been widened by 87 mm on the 1.5-ton model and 193 mm on the 1.8-ton model to accept the same DIN-size batteries for the STILL R20 on all series models.

	Capacity (kgf)			
	1500	1600	1800	2000
7FBE	5PzS550L	6PzS660L	6PzS660L	6PzS660L
5FBE	4PzS440L	—	4PzS440L	—

MAJOR DIFFERENCES BETWEEN NEW AND PREVIOUS MODELS

–:Not applicable

Item		New models		Previous models	
			Applicable models		Applicable models
General	Wheel base	1385 mm	1.5 ton	1295 mm	All models
		1490 mm	1.6 to 2.0 ton	–	–
	Overall width	1070 mm	1.5 to 1.8 ton	1075 mm	All models
		1125 mm	2.0 ton	–	–
Overall height	1980mm	All models	1950mm	All models	
Motor	Drive motor	AC: 4.9 kW × 2	All models	DC: 3.3 kW × 2	All models
	Pump motor	AC: 9.2 kW	All models	DC: 8 kW	All models
	PS motor	–	–	DC: 0.75 kW	All models
Controller	Main controller	Traveling, material handling and steering control	All models	Traveling/material handling control	All models
	Steering controller	–	All models	Contact type	All models
Traveling system	Steering system	Steering synchronizer, EHPS system	All models	FHPS system	All models
	Parking brake lever	Parking brake lever ratchet type	All models	Parking brake lever ratchet type	All models
Tires	Front tire	18 × 7-8	1.5 to 1.8 ton	18 × 7-8-14PR	1.5 ton
		200/50-10	2.0 ton	18 × 7-8-16PR	1.8 ton
	Rear tire	15 × 4.1/2-8(dual)	1.5 to 1.8 ton	16 × 6-8-10PR(dual)	All models
		16 × 6-8(dual)	2.0 ton		
SAS equipment	SAS specifications	Mast control <ul style="list-style-type: none"> • Active mast front tilt angle control • Mast backward tilt angle control • Automatic fork leveling control • Key-lift interlock 	All models	–	–
		Steering synchronizer EHPS	All models	–	–
Frame	Head clearance	1025mm	All models	1000mm	All models
	Step height	430mm	All models	–	–
Auxiliary equipment	Rear combination lamp	High-mount embedded type	All models	Add-on type	All models

ELECTRICAL SYSTEM

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BATTERY

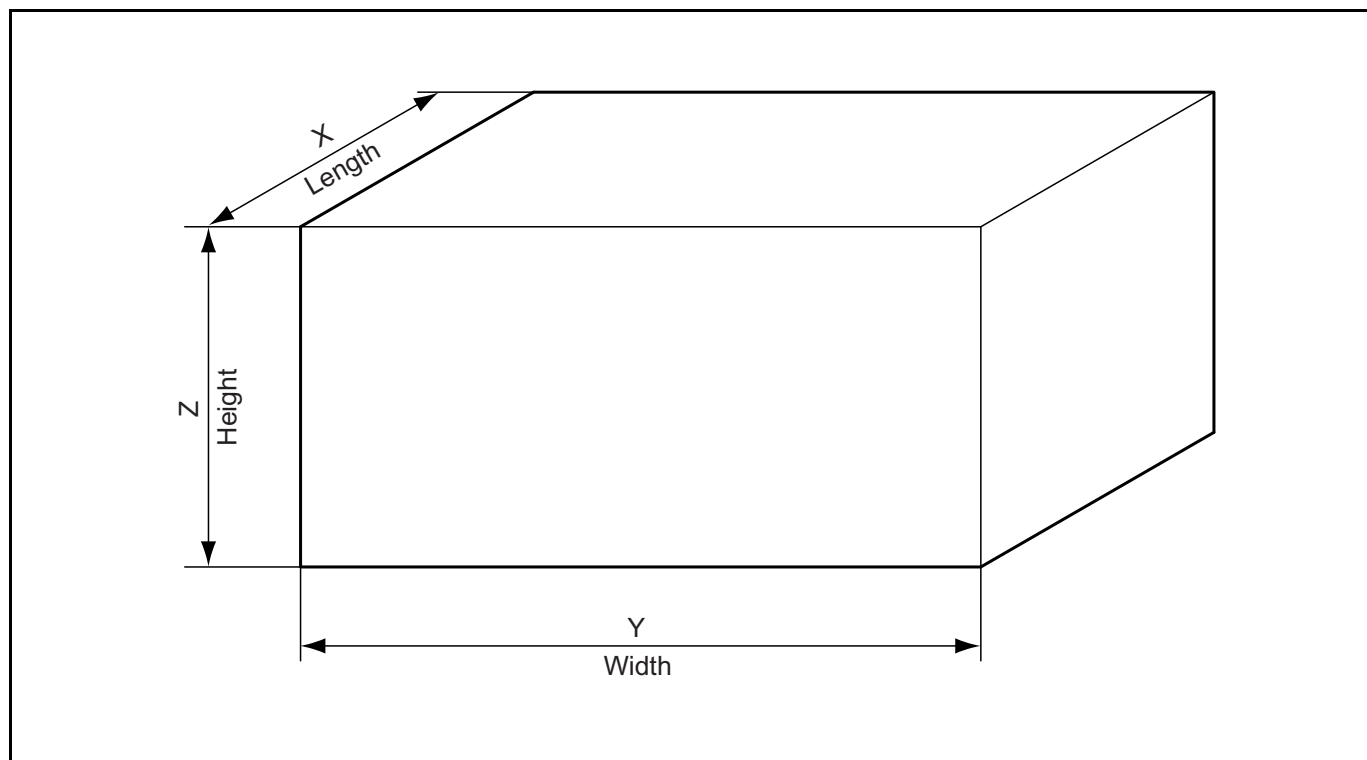
■ General

1. Battery Compartment and Necessary Weight

When purchasing the battery locally, always adjust the weight to satisfy the minimum weight shown in the table below.

Vehicle model		Compartment dimensions mm (in)			Minimum required battery weight (with case) Kg (lb)	Remarks
		Length X	Width Y	Height Z		
STD	7FBEBF15	630 (24.8)	830 (32.7)	627 (24.7)	830 (1830)	
	7FBEBF16 to 20	738 (29.1)	↑	↑	985 (2172)	
R/O	7FBEBF15	630 (24.8)	↑	↑	830 (1830)	
	7FBEBF16 to 20	738 (29.1)	↑	↑	985 (2172)	

R/O: Battery roll-out specifications

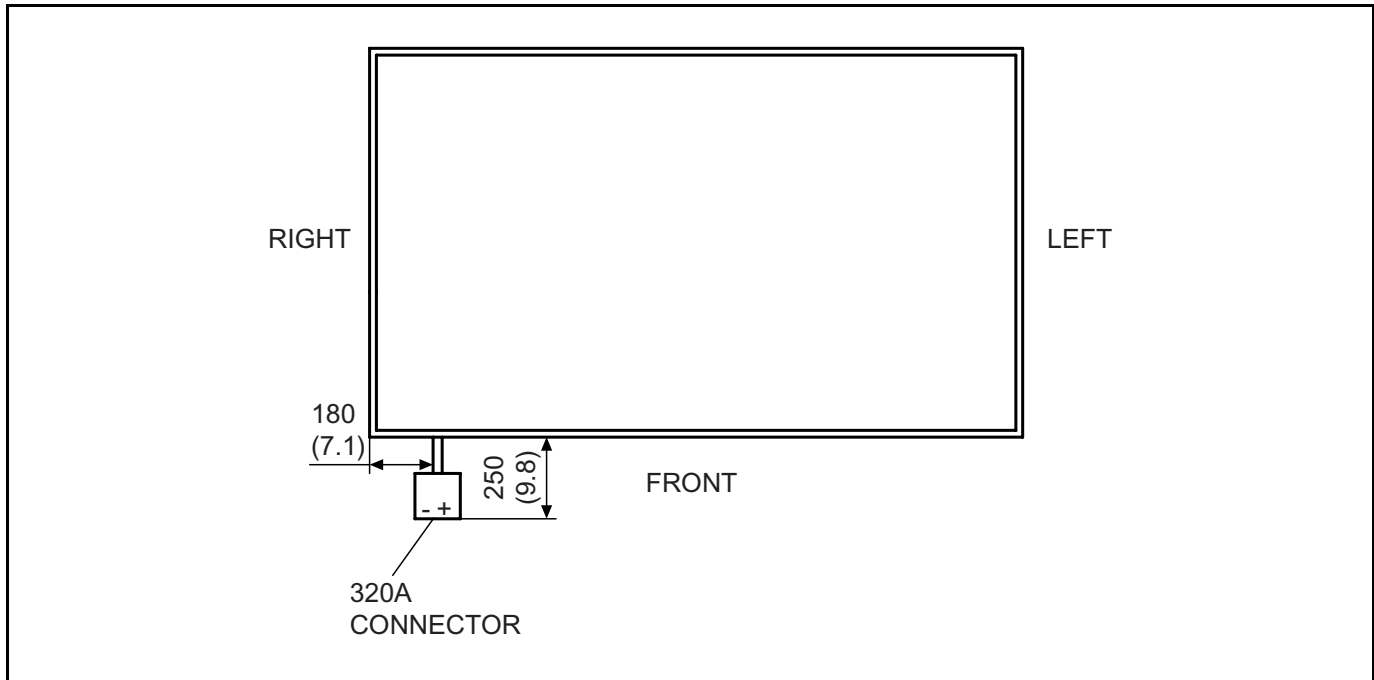


2. Battery Specifications

No batteries are provided.

Please use the batteries conforming to DIN 43 531A.

Use 320A connectors.



2

3. Battery List

The table below shows recommended batteries.

Refer to the general description for batteries with regard to the minimum required weight.

DIN 43 531A

Vehicle models	Voltage	Installed battery			Battery case		
		Supplier	Model	Capacity [AH/5HR]	Dimensions mm (in)		
					length	width	height
7FB EF15	48	VARTA	5PzS550L	550	630 (24.8)	830 (32.7)	627 (24.7)
			5PzS600Hx	600	↑	↑	↑
		OLDHAM	24CYQ5	500	↑	↑	↑
			24CYH5	550	↑	↑	↑
		CHLORIDE	5PzS500	500	627 (24.7)	↑	↑
			5PzS550H	550	↑	↑	↑
7FB EF16 to 20	48	VARTA	6PzS660L	660	738 (29.1)	830 (32.7)	627 (24.7)
			6PzS720Hx	720	↑	↑	↑
		OLDHAM	24CYQ6	600	↑	↑	↑
			24CYH6	660	↑	↑	↑
		CHLORIDE	6PzS600	600	735 (28.9)	↑	↑
			6PzS660H	660	↑	↑	↑

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