TOYOTA

NEW MODEL FEATURES

ELECTRIC FORKLIFT TRUCKS

7FBMF 16,18
7FBMF 20,25
7FBMF 30,35
7FBMF 40,45,50

< Tillbaka till Servicemanual 7FBMF 16-50

Index

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SECTION INDEX

FOREWORD

This manual mainly describes the development objectives of new Toyota forklift 7FBMF16~50 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 September 2002.

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

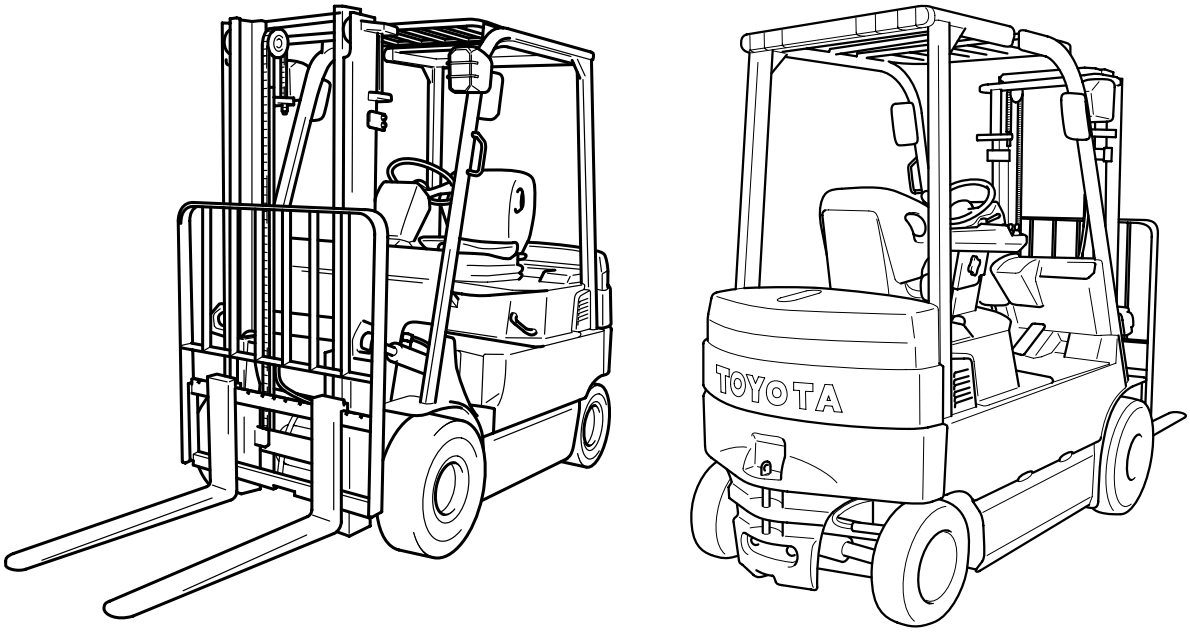
Please refer to the repair manual and parts catalog for the matters necessary for servicing.

TOYOTA Material Handling Company
A Division of TOYOTA INDUSTRIES CORPORATION

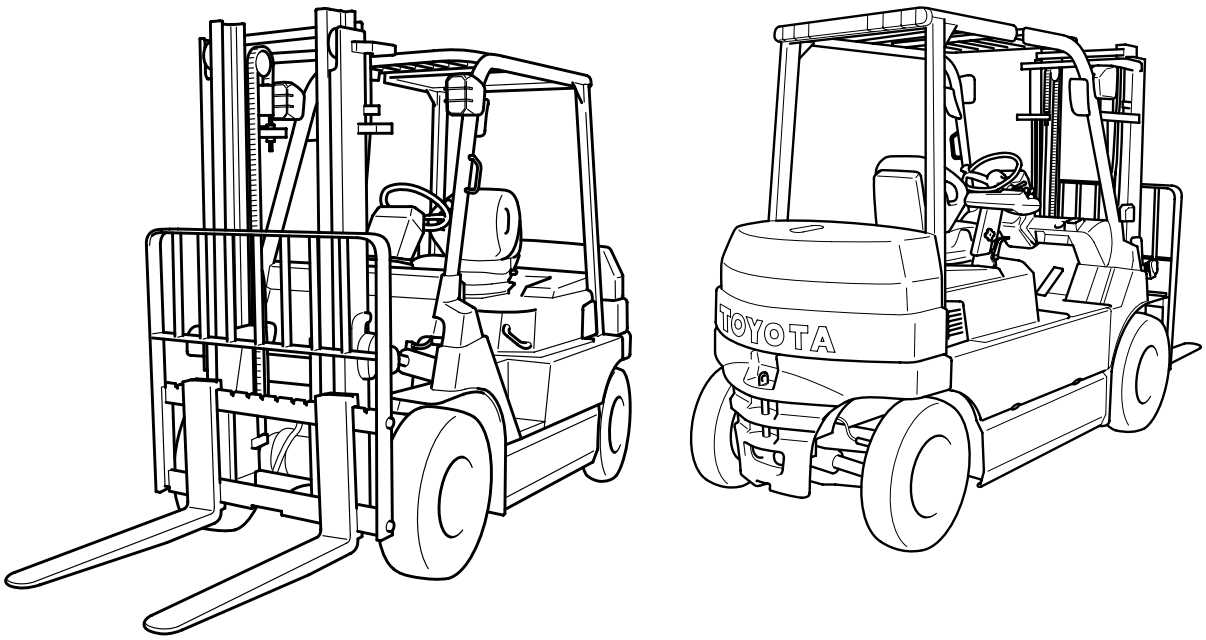
GENERAL

VEHICLE EXTERIOR VIEWS

7FBMF16~35



7FBMF40~50

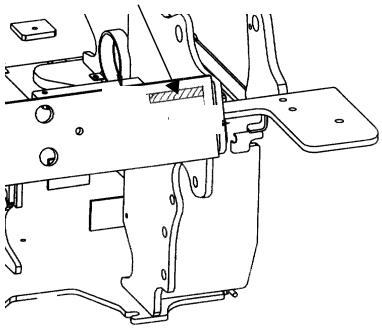


MODEL LINE-UP

Models

	Capacity (Load Center 500 mm)	Model (80V or 72 V)	
		New	Previous
1 ton Series	1.6 ton	7FBMF16	FBMF16
	1.8 ton	7FBMF18	—
2 ton Series	2.0 ton	7FBMF20	FBMF20
	2.5 ton	7FBMF25	FBMF25
3 ton Series	3.0 ton	7FBMF30	FBMF30
	3.5 ton	7FBMF35	—
4 ton Series	4.0 ton	7FBMF40	—
	4.5 ton	7FBMF45	—
	5.0 ton	7FBMF50	—

Frame number stamping

Model	Stamping Style (Starting Number)	Stamping Location
7FBMF16	7FBMF18Ⓔ10011	Stamp on LH & upper surface of front cross plate 
7FBMF18		
7FBMF20	7FBMF25Ⓔ10011	
7FBMF25		
7FBMF30	7FBMF35Ⓔ10011	
7FBMF35		
7FBMF40	7FBMF50Ⓔ10011	
7FBMF45		
7FBMF50		

STANDARD EQUIPMENTS

○ : STD P:OPT —: Not Available

	Standard Equipment	1.6-3.5 ton	4.0-5.0 ton	Note
Electrical System	AC Power system for travelling & load handling	○	○	
	AC Power controller for steering	—	○	1.6-3.5 ton: DC system
	Multiple display (All round model)	P	P	
Chassis	SAS (System of Active Stability)	○	○	
	Wet brake system	○	○	
	Parking brake system of electric switch type	○	○	
	Full hydraulic power steering	○	○	
Body	Overhead guard	○	○	
	Memory tilt steering column	○	○	
	ORS seat	○	○	
	Floor mat	○	○	
	Battery hood damper	○	○	
	Assist grip (LH)	○	○	
	Instrument panel holder	○	○	
	Paper clamp on battery hood	○	○	
	Drawbar pin	○	○	
Load Handling System	Wide visible mast (V)	○	○	H3300 mm
	Load bucharest	○	○	H1220 mm
	Fork	○	○	1.6~1.8 ton: L800 mm 2.0~5.0 ton: L1000 mm
	Mini-lever control system	○	○	
	3-way valve (A400)	○	○	
Others	Electric horn	○	○	
	Headlight	P	P	
	Rear-view mirror	P	P	

DEVELOPMENT OBJECTIVES

DEVELOPMENT OBJECTIVES

TOYOTA 1.6 ~ 3.0 ton FBMF 16 ~ 30 counterbalance type electric 4-wheel forklift trucks have had an established reputation as high performance forklift trucks since first their model launched in 1989.
There have been rising demands for clean electric forklift trucks with relevant to environmental concern; and further the market wants higher capacity forklift than 3.0 ton beside the existing capacity models.
Keeping these points in mind, the design concepts were established, as follows:

1. AC induction motor

Making best use of the advantages of AC induction motor drive system to respond to customer's needs for the most suitable load handling system.

2. SAS - System of Active Stability

In order to gain better stability, SAS has been developed. SAS, adopted by 7 series, has already won high confidence from the industrial truck markets.
This same level of stability will be incorporated into the new 7FBMF 16 ~ 50 models.

3. Introducing larger capacity models of 3.5 ton and over in addition to new 1 ~ 3 ton capacity models to enhance the product range.

Creation of over 3.5 ton capacity models has been undertaken together with the model changes launched for 1 ~ 3 ton capacity models.
Most of all, the AC induction drive motor system has been a pioneering endeavor having rallied our technological powers for a successful introduction in our products. Excellent features inherent to AC induction motor have been used to its full advantages with success.
Furthermore, varied demands for additional features have been implemented. Emphasis has been placed on system design development such as the mini-lever system and the wet brake system, etc.
The 7FBMF 16 ~ 50 models certainly have outstanding features compared to other forklift models. On operation, the differences are so obvious in fundamentals, performance, comfort, etc. New 7FBMF 16 ~ 50 models are commendable as an epoch in new era.

FEATURES (SELLING POINTS)

■ Table of selling points

mfr: manufacturer
◎: Newly adopted, ○: Improved
S: STD, P: OPT, –: Not available

Selling point	Function or Item		Objective	1.5 ~ 3.5t	4.0 ~ 5.0t	mfr A	Relative page
Improved performance							
Improvement in operation hours and work cycles without an operator noticing a decline in performance	◎	Power keep function	Better performance at a low battery level	S	S	—	1-8 2-2
Availability of different power modes for different needs: H mode: High power mode P mode: Power mode S mode: Standard mode Other customized modes are available as well.	◎	Power select function	A touch on a switch selects optimum power mode.	S	S	—	1-11 2-2
		Load handling power control		S			
Improvement on operator comfort							
Improvement in ease of getting on and 0ff	○	The entry area has been widened by installing the battery under floor	Ease of getting on and off equivalent to the engine-powered model	S	S	—	1-10
Increased leg space	○		Expansion of foot space	S	S	—	1-10
Improved serviceability							
Improved serviceability	◎	AC motor	Need for servicing motor brushes is eliminated.	S	S	—	1-7
	◎	Overheat protector	Power is reduced automatically when motor is overheated.	S	S	—	2-5 5-2
	◎	AC controller	Need for servicing contactor is eliminated.	S	S	—	2-2
	◎	Thermal protector	Output is reduced automatically when controller is overheated.	S	S	—	2-5 5-2
Reduced need for servicing brake	◎	Wet brake system	Service life of brake system is prolonged	S	S	S	5-10
	◎	Regenerative system (accelerator off)	Service life of brake system is prolonged.	S	S	S	2-5
Higher safety during servicing	○	Jacking points under the counter weight and frame	Jacking points indicated for higher safety	S	S	—	9-2

Selling point	Function or Item		Objective	1.6 ~ 3.5t	4.0 ~ 5.0t	mfrA	Relative Page
Safety							
Improved turning stability	◎	SAS-active control rear stabilizer	Rear wheel ground grip force increased when required	S	S	—	11-6
Improved material handling stability	◎	SAS-active mast function controller (front tilt angle control)	Controls front tilt angle for high lifting, etc.	S	S	—	11-10
Load collapse reduction	◎	SAS-active mast function controller (rear tilt speed control)	Controls rear tilt speed for high lifting, etc.	S	S	—	11-10
Operation error prevention for lift lever	◎	SAS-active mast function controller (key-lift interlock)	Prevents unintended fork lowering	S	S	—	11-10
Large reduction of natural drop and front tilt (1/3 of previous values)	◎	SAS-active mast function control (key-lift interlock)	Cuts off valve oil leaks when the key switch is turned OFF.	S	S	—	11-10
Easy monitoring of SAS operation status	◎	SAS-operation monitor, indicator lamp, and diagnosis	Easy recovery from SAS faults	S	S	—	3-2
Availability of maximum travel speed control		Speedometer	Large display easy to see	S	S	—	3-4
		Speed alarm	Warning is given when travel speed exceeds preset level.	P	P	—	3-5
		Speed limiter	Sets limits to travel speed	S	S	—	3-4
Improved visibility	○	High-mount rear combination lamps	Visibility of forklift truck from surrounding area	P	P	—	9-6
Forward view		Super-wide visible mast	Maintains advantages of internal width of wide mast.	S	S	—	10-2
Operability, etc.							
Easy operation	◎	SAS-active mast function control (automatic fork leveling control)	Automatically sets the mast vertical.	S	S	—	11-12
	◎	Steerage, load handling lever, accelerator pedal	Reduced operation power	S	S	—	—
	◎	Mini-lever		S	S	P	10-12
	◎	Anti roll back		S	S	S	2-5
Improved traveling stability	◎	Regenerative system (accelerator off)	Regenerative braking equivalent to engine brake	S	S	—	2-5
Smooth and quick switchback operation	◎	AC motor and AC controller	Quick switchback operation without time lag	S	S	—	2-5
Improved meter of screen	○	Multiple display	Legible display	S	S	—	3-2
Battery roll out	◎			P	P	—	12-3

Outline of Design

■ Major differences from previous models

Item		New models	Applicable model	Previous models	Applicable model	Relative page
General	Overhead guard height	2195mm	1.6 ~ 1.8 ton	2160mm	1.6 ton	—
		2195mm	2.0 ton	2180mm	2.0 ton	
		2215mm	2.5 ton	2180mm	2.5 ton	
		2215mm	3.0 ~ 3.5 ton	2275mm	3.0 ton	
		2310mm	4.0 ~ 5.0 ton	—	—	
	Wheelbase	1420mm	1.6 ~ 1.8 ton	1360mm	1.6 ton	
		1580mm	2.0 ~ 2.5 ton	1505mm	2.0 ~ 2.5 ton	
		1725mm	3.0 ~ 3.5 ton	1650mm	3.0 ton	
		2080mm	4.0 ~ 5.0 ton	—	—	
Motor	Drive motor (72V/80V)	AC: 12.0 / 13.3 kw	1.6 ~ 1.8 ton	DC: 7.6 / 8.6 kw	1.6 ton	5-2
		AC: 15.4 / 17.1 kw	2.0 ~ 3.5 ton	DC: 10.1 / 10.6 kw	2.0 ~ 3.0 ton	
		AC: 14.9 / 16.6 kw	4.0 ~ 5.0 ton	—	—	
	Pump motor (72V/80V)	AC: 12.0 / 13.5 kw	1.6 ~ 1.8 ton	DC: 11.5 / 13.0 kw	1.6 ton	10-27
		AC: 16.9 / 18.6 kw	2.0 ~ 2.5 ton	DC: 14.8 / 17.0 kw	2.0 ~ 2.5 ton	
		AC: 16.9 / 18.6 kw	3.0 ~ 3.5 ton	DC: 16.5 / 18.5 kw	3.0 ton	
		AC: 22.8 / 25.4 kw	4.0 ~ 5.0 ton	—	—	
	PS motor (72V/80V)	DC: 1.0 / 1.1 kw	1.5 ~ 3.5 ton	DC: 1.0 / 1.1 kw	1.5 ~ 3.0 ton	10-27
		Same motor for PS as well as hydraulic oil pump	4.0 ~ 5.0 ton	—	—	
Controller	Traveling	Main controller & traveling motor driver	1.6 ~ 5.0 ton	Traveling & load handling controller	1.6 ~ 3.0 ton	Section 2, 11
	Load handling	Main controller & load handling motor driver	1.6 ~ 3.5 ton			
	SAS	Controller of SAS includes the steerage control	1.6 ~ 5.0 ton	—		
	Steerage		1.6 ~ 3.5 ton	Steerage controller	1.6 ~ 3.0 ton	
		Controller of main includes the steerage control	4.0 ~ 5.0 ton	—	—	
Brake mechanism	Main brake	Wet brake	1.6 ~ 5.0 ton	Dry brake	1.6 ~ 3.0 ton	5-10
	Parking brake	Parking brake system of electric switch type	1.6 ~ 5.0 ton	Parking brake lever of ratchet type	1.6 ~ 3.0 ton	5-13
SAS equipment	SAS specifications	SAS-active control stability	1.6 ~ 5.0 ton	—	—	11-6
		Mast function control • Front tilt angle control • Rear tilt speed control • Automatic fork leveling control • Key-lift interlock		—	—	11-10
Frame	Overhead guard Clearance	1055mm	1.6 ~ 3.5 ton	1030mm	1.6 ~ 3.0 ton	Section 9
		1075mm	4.0 ~ 5.0 ton	—	—	
	Step height	525mm	1.6 ~ 1.8 ton	515mm	1.6 ton	
			2.0 ton	540mm	2.0 ~ 2.5 ton	
		545mm	2.5 ton			
			3.0 ~ 3.5 ton	675 (2nd) /160 (1st)	3.0 ton	
		535mm	4.0 ~ 5.0 ton	—	—	
	Underclearance Center of Wheelbase (Without load)	90mm	1.6 ~ 1.8 ton	110mm	1.6 ton	
			2.0 ton	130mm	2.0 ~ 2.5 ton	
		110mm	2.5 ton			
			3.0 ~ 3.5 ton	225mm	3.0 ton	
		150mm	4.0 ~ 5.0 ton	—	—	
Others	Floor mat	Equipped	1.6 ~ 5.0 ton	Nothing	1.6 ~ 3.0 ton	—
	Material handling lever	Mini-lever with armrest	1.6 ~ 5.0 ton	Manual lever on the front cowl	1.6 ~ 3.0 ton	10-12
	Seat	ORS seat with seat belt	1.6 ~ 5.0 ton	Seat with seat belt	1.6 ~ 3.0 ton	8-4

AC POWER SYSTEM

■ AC system in industrial trend

Industries have already employed AC power system by making use of its features. Three major features are:

	System design advantages	Product level advantages
1	Simpler and smaller construction of motor	More powerful motor can be used without increasing size.
2	Three-phase AC control realizes wider control range.	Wide control range offers a higher performance and operability.
3	Motor brushes and contactors are dispensed with.	Reduced maintenance cost as the needs for servicing motor brushes and contactors are eliminated.

Industry	1970 80 90
Machine tool	DC \ AC
Train	DC \ AC
Electric Automobiles (EV)	DC \ AC
Electric Forklifts	DC

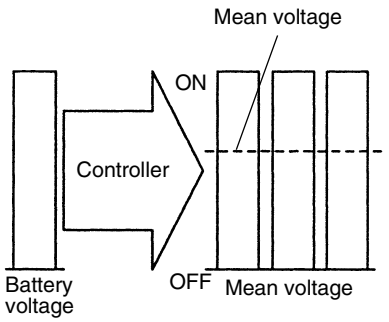
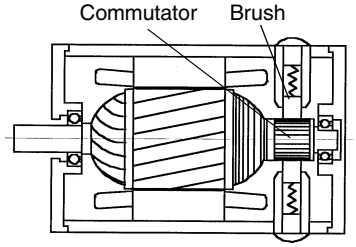
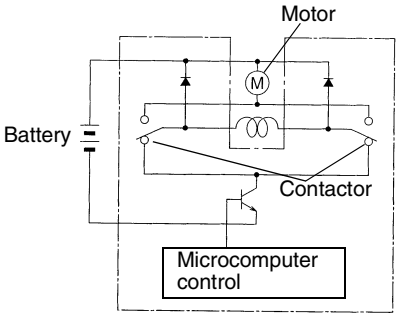
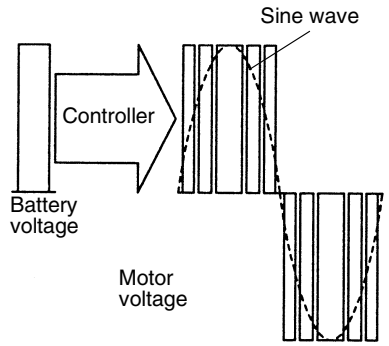
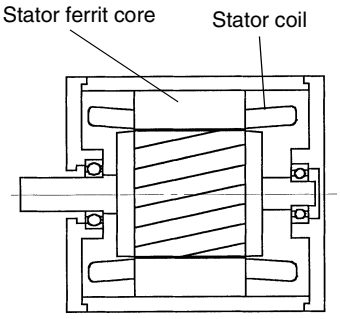
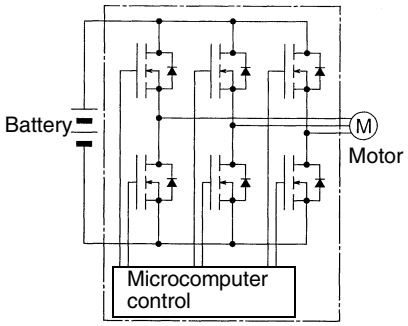
Thereby industrial truck engineers worldwide have already been aware of the splendid features of AC power system to be implemented in electric forklift trucks.
New AC drive motor systems have been adopted not only in the smaller capacity models, but also in the larger capacity models. This new system resolves the opposing factors between larger output necessity and compactness.

■ AC power system as compared with DC power system

In the DC power system the controller will chop the battery current in repetition and control the frequency cycles of ON and OFF. The motor performance will change in proportion with the frequency cycles between ON and OFF, thereby the inching at start to the max. performance is controlled.

The AC power system in the new models includes a controller that transforms the battery current into a three-phase alternating current. The motor power is controlled by changing the sinusoidal waveform (frequency, amplitude, etc.) of the three-phase alternating current.
Motor drive voltage, motor construction, and controller details differ between DC and AC power systems, as follows:

Comparison between DC and AC power systems

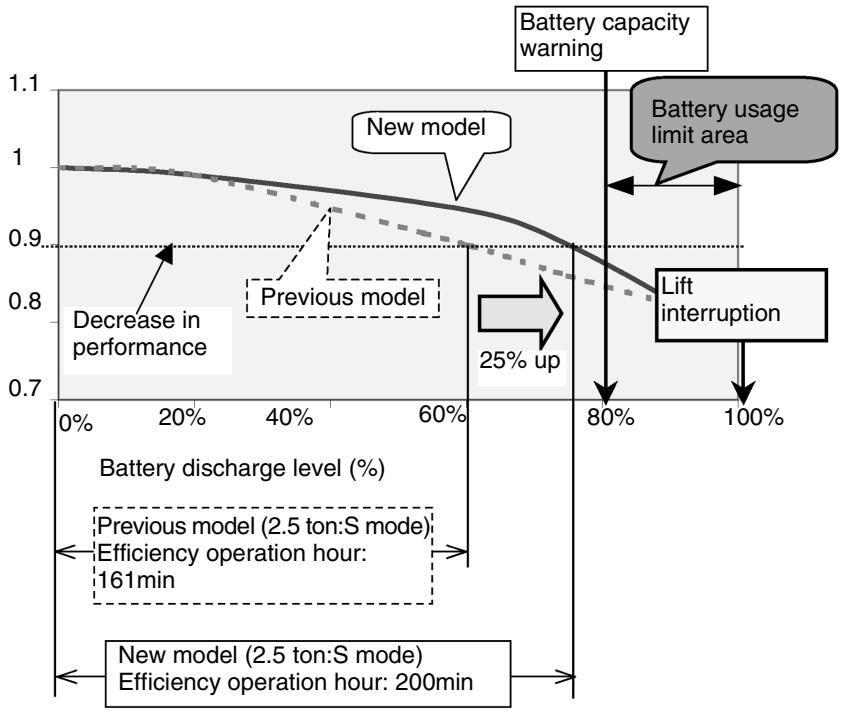
	Motor voltage	Motor construction	Controller
DC power system			
	• A chopper circuit converts the battery current (DC) into a rectangular waveform and controls the mean voltage at a desired level.	• Brushes and commutator require servicing. • Complex mechanism	• Motor power can be controlled simply via the mean DC voltage. • Contactors for reversing the motor rotation are required.
AC power system			
	• Controller converts battery current (DC) into AC.	• Brushes and commutator, which require servicing, arer not used. • Compact and lightweight	• A control module converts DC into three-phase AC. • Contactor for reversing the motor rotation are not required.

■ Power keep function

(Functions in power mode: P, standard mode: S)

Power keep function using the benefit of AC power system further lengthen the operation hours epochally.
With conventional electric powered forklift trucks, the vehicle performance decreases gradually as the battery level goes low.
The power keep function adopted to new models takes advantage of the increased controllability provided by the AC system to keep the vehicle performance even when the battery level has become low. With this power keep function, the maximum operating hours have increased by 25%, and the number of work cycles that can be completed without the operator noticing a decline in performance has also increased by 25%.
New power keep function offers a significant and essential improvement in the material handling efficiency.
(See page 2-2 for further detail.)

Battery discharge level and vehicle performance



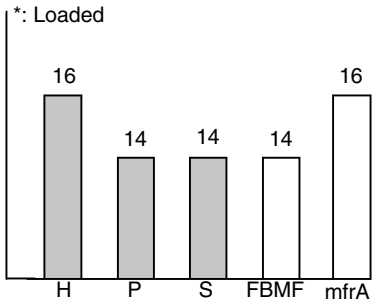
Even the battery indicator is flashing to indicate the charge warning, the performance level of 7FBMF series is batter than that of the former FBMF models.
In view of the battery protection, it is advisable to charge the battery before discharging to the limit.

■ Performance features in comparison

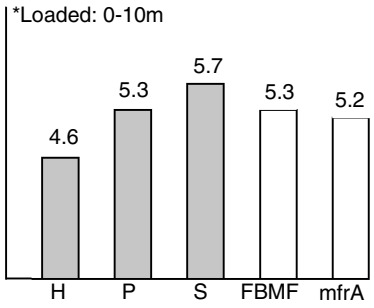
mfr: manufacturer

2.5 ton

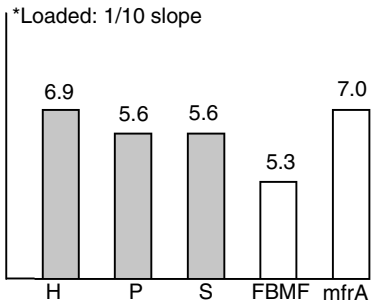
Traveling speed (km/h) [a]



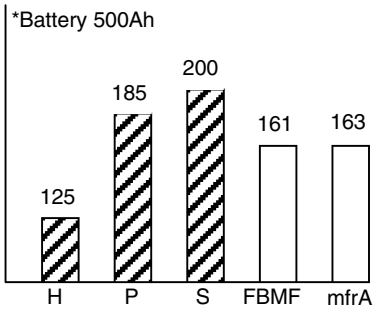
Acceleration (sec) [b]



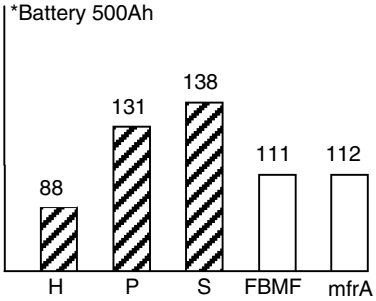
Slope climbing speed (km/h) [c]



Efficiency operation hours (min) [d] (Toyota 30m cycle)

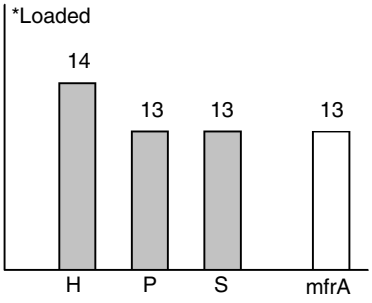


No of cycle (cycle) [e] (Toyota 30m cycle)

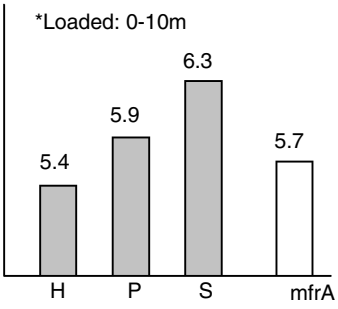


4.5 ton

Traveling speed (km/h) [f]

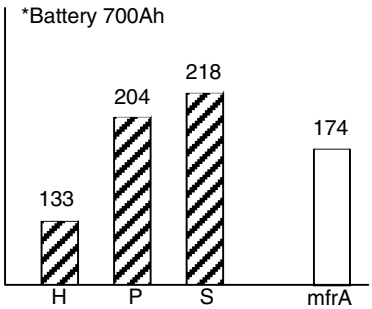


Acceleration (sec) [g]

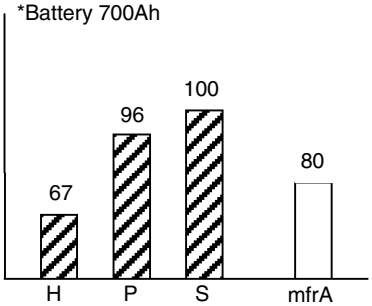


Slope climbing speed (km/h) [h]

Efficiency operation hours (min) [i] (Toyota 50m cycle)

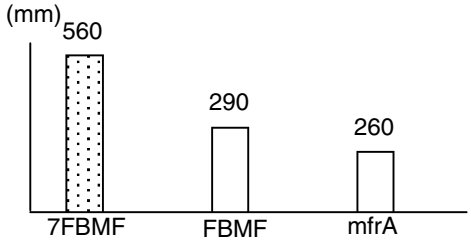


No of cycle (cycle) [j] (Toyota 50m cycle)



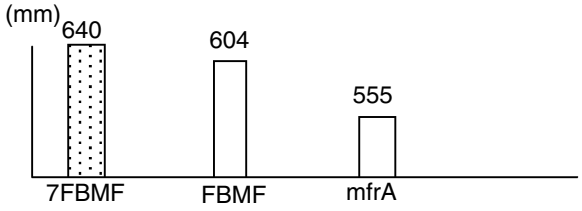
Operator comfort

(1) Improvement of the ease of getting on and off
By new battery layout, improved the ease of getting on and off



Entry clearance (2.5 ton) [a]

(2) Improvement of comfort
By new battery layout, improved the leg space



Leg space (2.5 ton) [b]

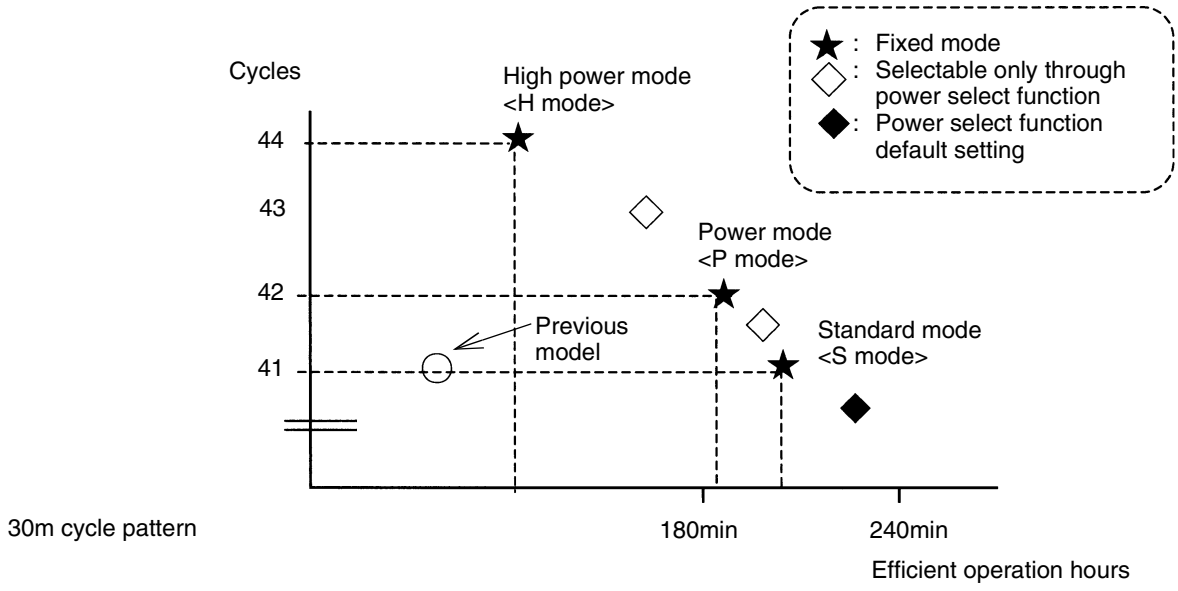
■ Power select function

Using the power select function, the operator can select a desirable power mode.
Even though the conventional models also had a power selection switch, it only produced a small difference in the acceleration.
New models use an AC motor instead of a DC motor.
Since and AC motor is simpler and smaller, it becomes possible to install a motor that produces an output higher than that of a conventional DC motor.
In addition, the operator can select appropriate mode from the following power modes simply by operating a switch.

• High power mode <H mode>	: The most active mode with the quickest cycle-time
• Power mode <P mode>	: The highest efficiency mode with quick cycle time and long operation hour
• Standard mode <S mode>	: The longest operation hour mode with the performance equivalent to MFRA

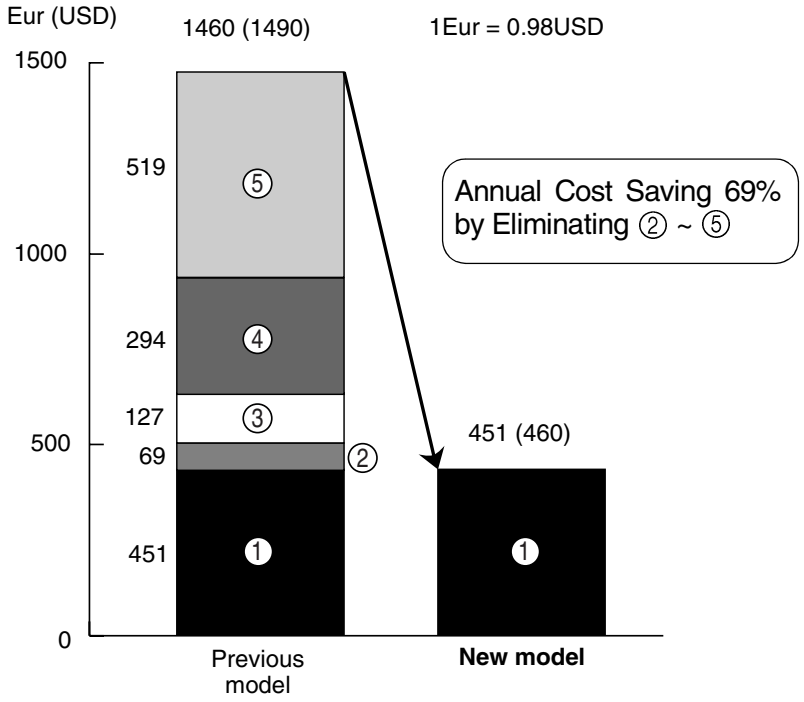
In order to further satisfy the individual customer, a power select function has been provided.
The power select function enables the operator to select one from six power modes, including H, P and S modes, for traveling. The operator can select H mode for operations requiring power and high performance. Select S mode for long time operations, providing the operator with optimum performance to suit the operator's needs and greatly enhance efficiency.

<7FBMF25>



■ Reduced maintenance cost

The following particular items are inherent to the conventional electric powered models.
① Supplying distilled water to the battery
② Material handling motor brush replacement
③ Material handling motor contactor replacement
④ Traveling motor brush replacement
⑤ Traveling motor contactor replacement
The new 7FBMF model eliminates the need for brush and contactor replacement because the new AC motor does not have brushes and the new AC controller does not have contactors.
The average customer can benefit from this by an annual cost savings of 69% for maintenance expenditures.



Taking advantage of the wider control range of the AC power system, a regenerative system is adopted.
The AC induction motor generates a braking force when the vehicle is traveling with the accelerator pedal at rest. Also the electromotive force generated in the AC motor, while the accelerator pedal is released, converts the braking effect energy into electrical energy that is sent to the battery.
This regenerative system increases the operation hours. At the same time, the regenerative system improves the traveling feel because it allows the operator to use less brake pedal force to slow the truck down. Furthermore, the regenerative system reduces load on the brake system, slowing down brake lining wear and decreasing the brake maintenance costs.

■ Stabilizing features

The world-first System of Active Stability (SAS), adopted by the 7FB series models, is available for the new models, too.
Using the SAS the new models achieve the stability level equivalent to that achieved by the 7FB series models.
The following outlines the SAS. For more details of the SAS option, refer to Section 11 “SAS”.

Stability feature		Outline
Rear stabilizer (swing lock)		The rear wheel swing mechanism is locked at high lift-heights and heavy loads, and during a quick turn to obtain a better ground grip force from all four wheels.
Mast function control		
	Front tilt angle control	The front tilt angle is smaller at high heights and heavy loads; greater at low heights and light loads.
	Rear tilt speed control	The rear tilt speed is slower at high heights and faster at low heights.
	Key-lift interlock	The lift lever cannot function by inadvertent contact.
	Automatic fork leveling control	A push on a control button followed by a front tilt operation tilts the mast until the forks are horizontal.

■ Improvement on operability

1. Mini lever
   The hydraulic control levers are displaced to the arm rest fore-front and optimal length, and spacing are given on basis of human engineering. An operator can manipulate the control lever with a hand on the arm rest. Fine operation adjustment can be achieved with the display. The control lever position is adjustable vertically as well as to lengthwise.
   Pleasant material handling operation with less fatigue can be ensured.

■ Anti-rollback

The anti-rollback function is provided to prevent the truck from rolling down on a slope. This is realized by making use of the combined features of the drive motor electric brake and the parking brake.
Restarting can be done smoothly without rolling down.

■ Model line-up

The model line-up has been widened by the development to 3.5 ~ 5 ton class new model ranges; besides, the 1.8 ton model is added onto the 1 ~ 3 ton classes to meet with varied needs from the markets.

◎: New ●: Continuation

		Capacity (kg)								
		1600	1800	2000	2500	3000	3500	4000	4500	5000
TOYOTA	7FBMF	●	◎	●	●	●	◎	◎	◎	◎
	FBMF	●		●	●	●				

CONTROLLER