

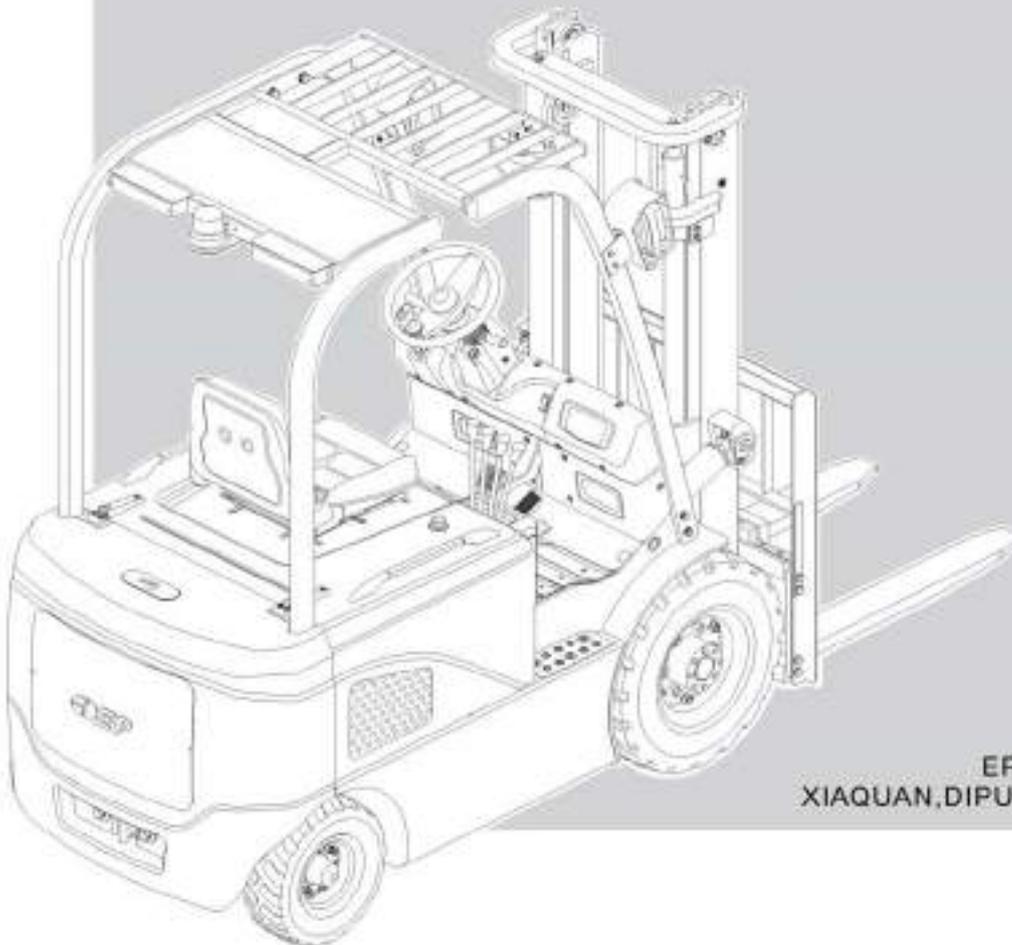


# FT/FTH Series CPD15/18/20/25/30/35 Electric Four-wheel Forklift

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## Operation Manual

- ⚠ WARNING** Read and observe all warnings on this unit before operating it
- ⚠ WARNING** DO NOT operate this equipment unless all factory installed guards and shields are properly secured in place



EP EQUIPMENT CO. LTD.  
XIAQUAN, DIPU, ANJI, ZHEJIANG CHINA

## Foreword

This operation manual is the explanations that how to use FT1.5-3.5 and FTH1.5-3.5 electric forklift truck correctly. It will instruct you how to operate safely and precautionary maintenance. All that in charge of operation, maintenance and management must read and comprehend this manual well. Only in this way it can exert the forklift truck's potential and it will protect your safety.

This manual is also applicable to other type forklift truck with attachment. If you have any questions please keep touches with E-P Equipment Co.,Ltd Sales department or let the agents know.

Because of the renovation on the designing, maybe there are several differences between the explanations and the trucks that you have got. Otherwise, the performance of the truck may have some change because of the request of the customer.

Our four-wheel electrical forklift trucks have already passed CE certificate.

The meanings of Model



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## **WARNING!**

### **TO PREVENT SETIOUS RISK OF INJURY TO YOURSELF AND OTHERS OBSERVE THE FOLLOWING SAFETY INSTRUCTIONS.**

These truck may become hazardous if adequate maintenance is neglected. Therefore, adequate maintenance facilities, trained personnel and procedures should be provided.

Maintenance and inspection shall be performed in conformance with the following practices:

1. A scheduled planned maintenance,lubrication and inspection system should be followed.
2. Only qualified and authorized personnel shall be permitted to maintain, repair, adjust, and inspect truck.
3. Before leaving the truck:
  - Do not park the truck on an incline.
  - Fully lower the load forks.
  - Drawing back parking brake lever ,prevent the truck started unexpected.
  - Drawing back the emergency brake switch .
  - Set the key switch to the "OFF" position and remove the key.
4. Before starting to operate truck:
  - Be in operating position
  - Place directional control in neutral
  - Before operating truck, check functions of lift systems, directional control,speed control,steering, warning devices and brakes.
5. Avoid fire hazards and have fire protection equipment present. Do not use open flame to check lever, or for leakage of electrolyte and fluids or oil. Do not use open pans of fuel or flammable cleaning fluids for cleaning parts.
6. Brakes,steering mechanisms, control mechanisms,guards and safety devices shall be inspected regularly and maintained in legible condition.
7. Capacity, operation and maintenance instruction plates or decals shall be maintained in legible condition.
8. All parts of lift mechanisms shall be inspected to maintain them in safe operating condition.

9. All hydraulic systems shall be regularly inspected and maintained in conformance with good practice. Cylinders, valves and other similar parts shall be checked to assure that "drift" has not developed to the extent that it would create a hazard.

10. Truck shall be kept in a clean condition to minimize fire hazards facilitate detection of loose or defective parts.

11. Modifications and additions which affect capacity and safe truck operation shall not be performed by the customer or user without manufacturer's prior written approval. Capacity, operation and maintenance plates or decals shall be changed accordingly.

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## **Correct use and application**

The “Guidelines for the Correct Use and Application of Industrial Trucks” (VDMA) are supplied with the truck. The guidelines form part of these operating instructions and must be observed. National regulations apply in full.

The truck described in the present operator manual is an industrial truck designed for lifting and transporting load units.

It must be used, operated and serviced in accordance with the present instructions. Any other type of use is beyond the scope of application and can result in damage to personnel, the truck or property. In particular, avoid overloading the truck with loads which are too heavy or placed on one side. The data plate attached to the truck or the load diagram are binding for the maximum load capacity. The industrial truck must not be used in fire or explosion endangered areas, or areas threatened by corrosion or excessive dust.

### **Proprietor responsibilities**

For the purposes of the present operator manual the “proprietor” is defined as any natural or legal person who either uses the industrial truck himself, or on whose behalf it is used. In special cases (e.g. leasing or renting) the proprietor is considered the person who, in accordance with existing contractual agreements between the owner and user of the industrial truck, is charged with operational duties.

The proprietor must ensure that the truck is used only for the purpose it is intended for and that danger to life and limb of the user and third parties are excluded.

Furthermore, accident prevention regulations, safety regulations and operating, servicing and repair guidelines must be followed. The proprietor must ensure that all truck users have read and understood this operator manual.

Failure to comply with the operator manual shall invalidate the warranty. The same applies if improper work is carried out on the truck by the customer or third parties without the permission of the manufacturer’s customer service department.

### **Attaching accessories**

The mounting or installation of additional equipment which affects or supplements the performance of the industrial truck requires the written permission of the manufacturer. In some cases, local authority approval shall be required.

Approval of the local authorities however does not constitute the manufacturer’s Approval.

## 1. Truck Description

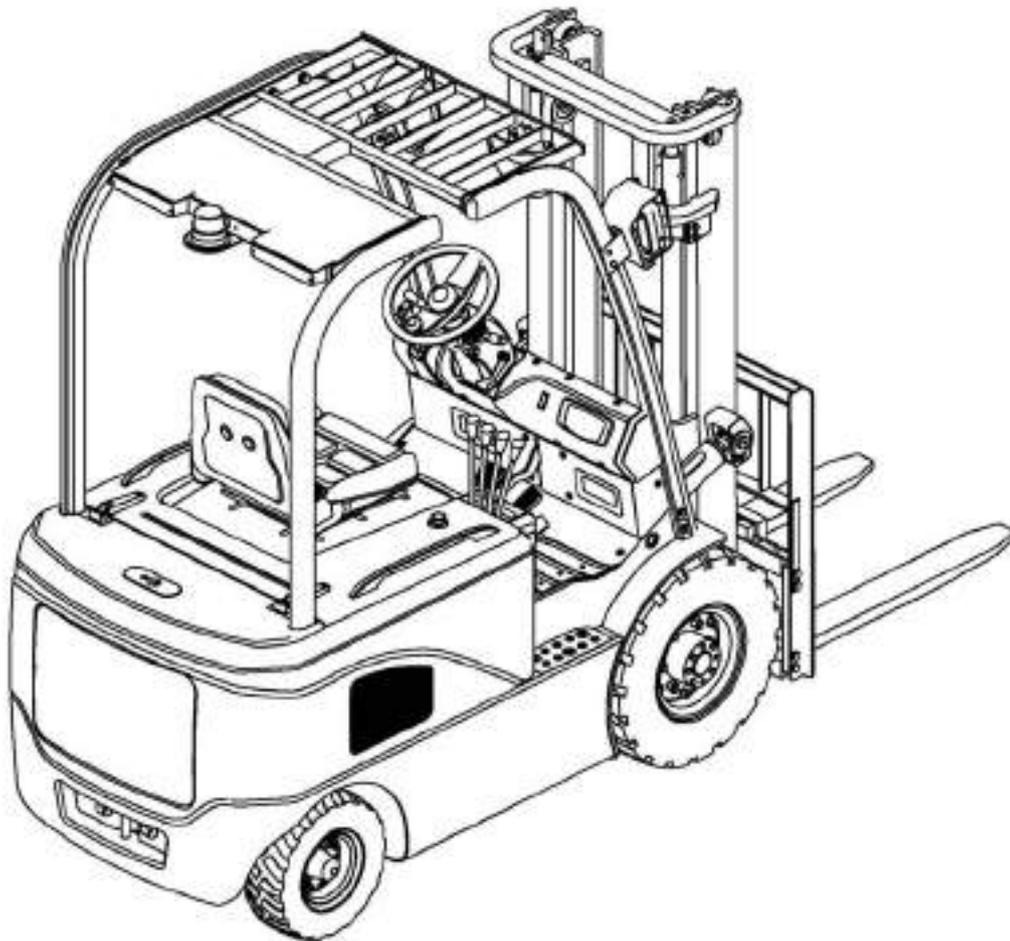
### 1.1 Application

The T series four-wheel truck is a electric sit-down forklift truck. It can lift and carry loads on the flat. The truck have traction function.

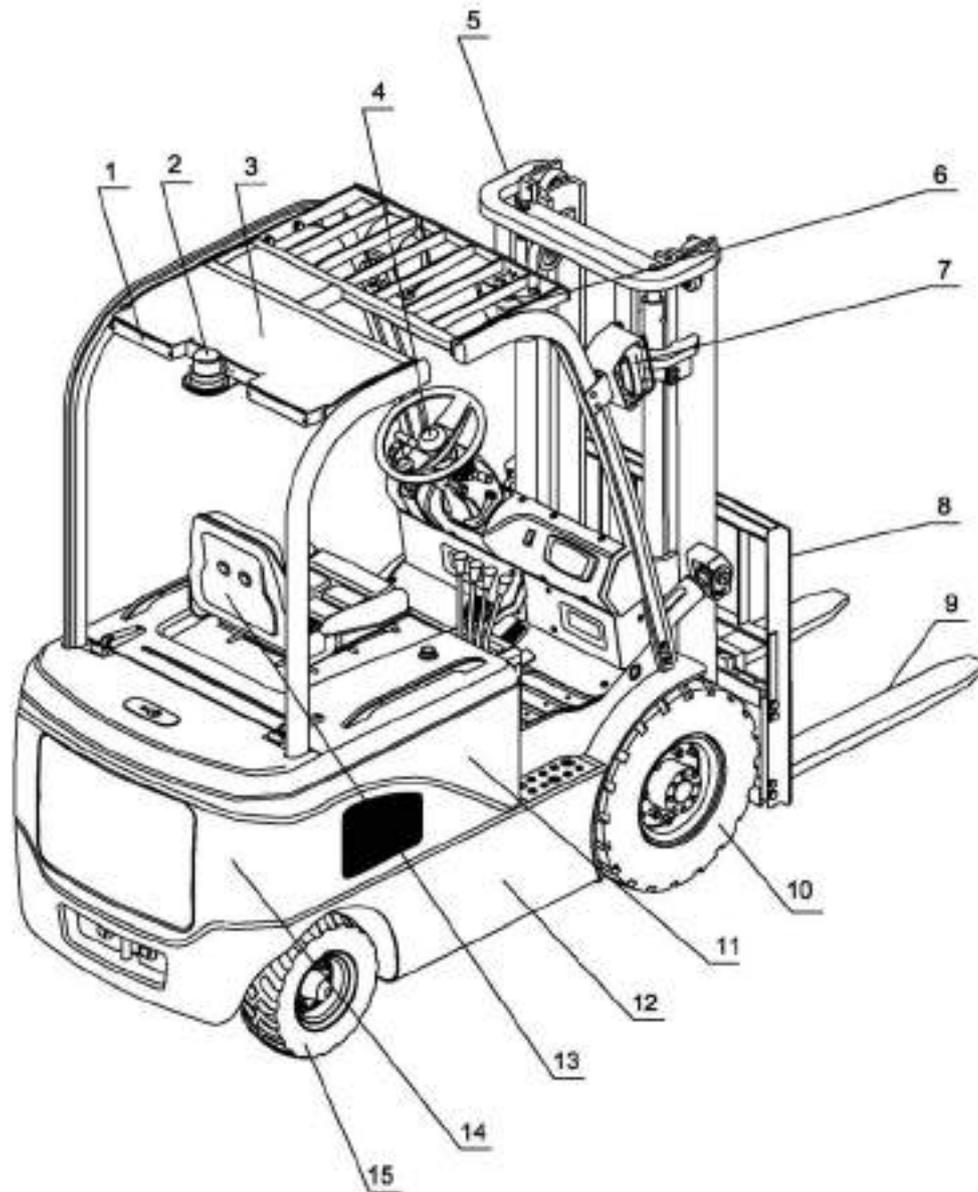
Custom can choice attachments random.

The capacity can be obtained from the data plate.

The capacity with respect to lift height and load center of gravity is indicated on the capacity plate.

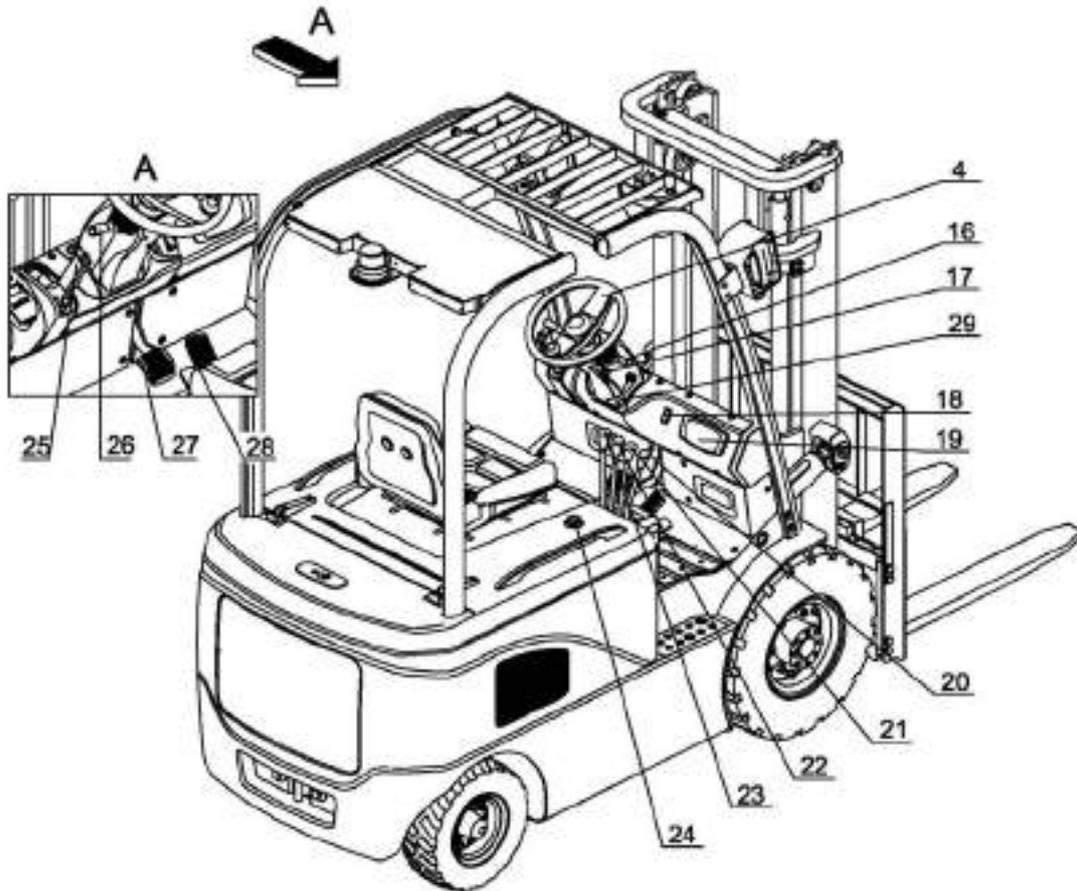


## 1.2 Assemblies



Item	Component	Item	Component
1	Rear Lamp Unit	9	Fork
2	Caution light	10	Front wheel
3	Overhead safe guard	11	Battery side hood
4	Steering wheel	12	Chassis
5	Mast	13	Seat
6	Viewfinder	14	Counter weight
7	Headlight	15	Rear wheel
8	Load back rest		

### 1.3 steer and instrument display



Item	Component	Item	Component
4	Steering wheel	23	Lifting lever
16	Combined lamp switch	24	Emergency disconnect switch
17	Key switch	25	Parking brake lever
18	Caution light switch	26	Travel switch
19	Display	27	Brake pedal
20	Attachments lever	28	Accelerator pedal
21	Side lever	29	Adjusting lever
22	Tilting lever		

### 1.3.1 Steering wheel[4]

The steering wheel is operated in the conventional manner, that is, when the wheel is turn right , the truck will turn to the right; When the wheel is turn left, the truck will turn to the left. The steer wheels are located at the rear of the truck. These cause the rear of the truck to swing out when a turn is made.

### 1.3.2 Combined light switch [16]

This combined light switch is composed of turning light switch and big/small lamp switch. Turning light indicates the traveling direction. When turn on the switch, the lamp flashes.

#### Warning!

The turn signal lever does not automatically return to the neutral position unlike general passenger cars. Reset it by hand.

Forward	Left turning lamp flashes
Neutral	Lamp goes off
Backward	Right turning lamp flashes

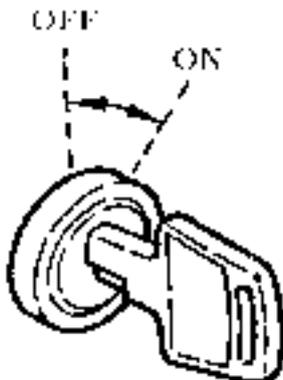
Big/small lamp switch has two shifts. First shift small lamp light on; second shift big and small lamp all light.

### 1.3.3key switch[17]

The key switch has two "ON / OFF" position. Truck power supply is break off when the key turn "OFF". Truck power supply is turn on when the key turn "ON".

If you want to start truck, you should push the travel switch to neutral and loose the accelerator pedal, then turning the key switch to "on" position clockwise.

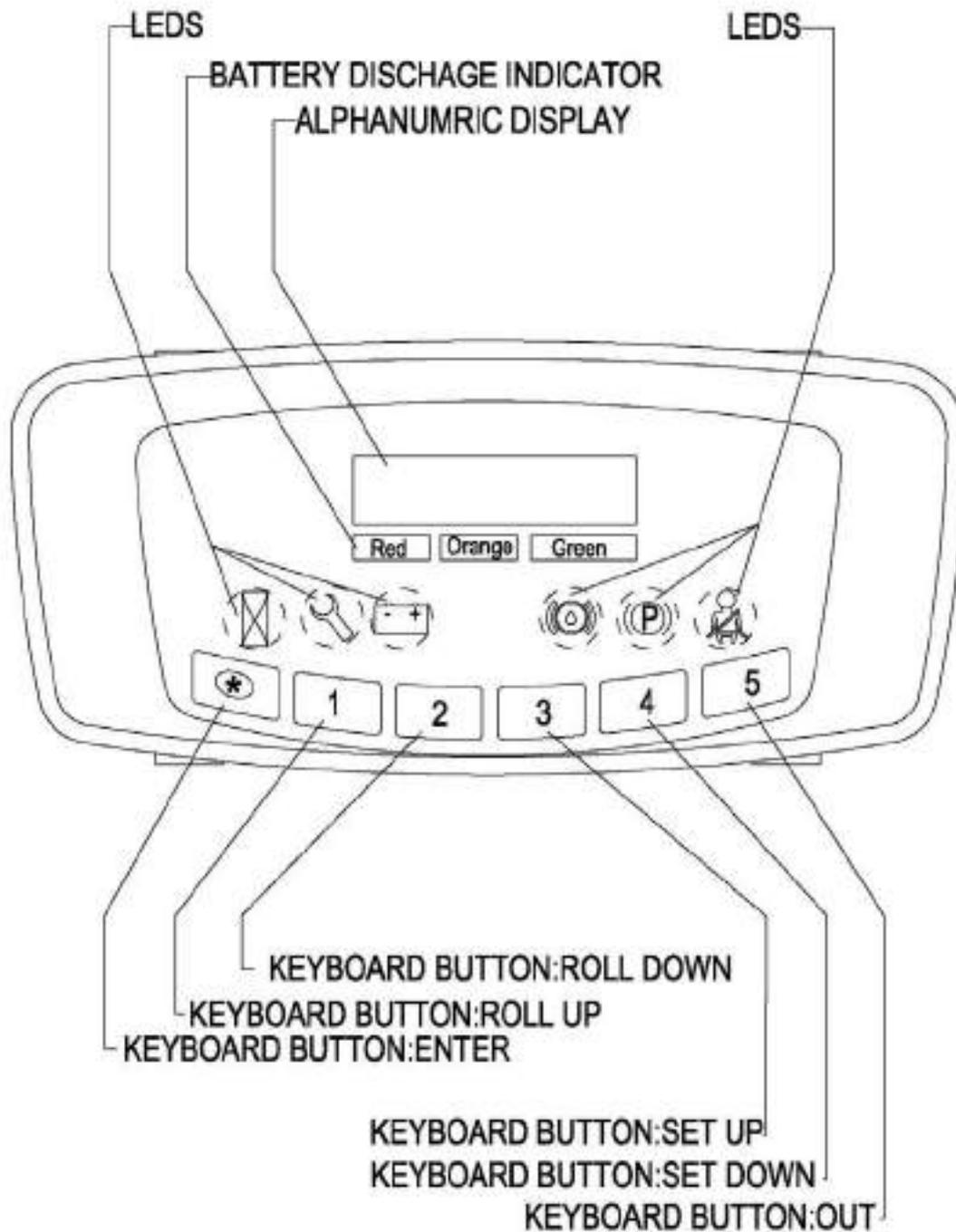
Before you leave truck, removing the key prevents the truck from being switched on by unauthorised personnel.



#### Warning!

Turning the key switch "on" does not make the forklift truck move, if the travel switch is not in the neutral position or the accelerator pedal is being pushed. Error code maybe appear, don't worry about it. When the forklift can be operated then the error code should be disappeared.

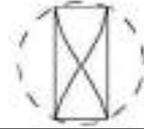
### 1.3.4 FT Series Instrument and display[19]



**The meanings of six indicators:**

**Power indicator**

Only lights on when power supply is OK.



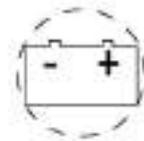
**Error indicator**

When operation is wrong, error code will display on the dashboard.  
The error indicator lights on.



**Low battery warning**

When battery quantity is lower than 20% of maximum capacity, The indicator lights on, at the same time, buzzer beep. When LED shows no power, please charge battery as quick as possible.



**Parking brake warning**

When the controller's temperature is out of range, The indicator lights on.



**Parking brake indicator**

When pulling on the parking brake lever, this lamp lights on.



**Safety belt indicator**

When the safety belt is off ,this lamp lights on.



**The meanings of six Button:**

**ENTER Button:**

Save all changing



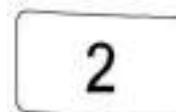
**ROLL UP Button:**

Change the digit marked by cursor



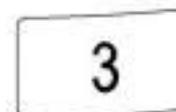
**ROLL DOWN Button :**

Change the digit marked by cursor



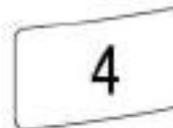
**SET UP Button :**

Shift cursor on previous digit



**SET DOWN Button:**

Shift cursor on following digit



**OUT Button:**

Cancel all changing



**Dash display LED**

When turn on the key switch, the system will self-diagnose, the lamp will lights on one by one. After self-diagnose LED will display battery capacity. The blank means consumed electricity. You should charge the battery when the low battery warning light on. When battery charge level below 10% , please charging the battery immediately. At the same time low battery protection start work, it means truck just able to travel, can't lift. (see "4.3 Charging the battery" on page 36).

The LED dashboard will show the speed when the truck start traveling. You can know your truck's working condition through the LED dashboard.

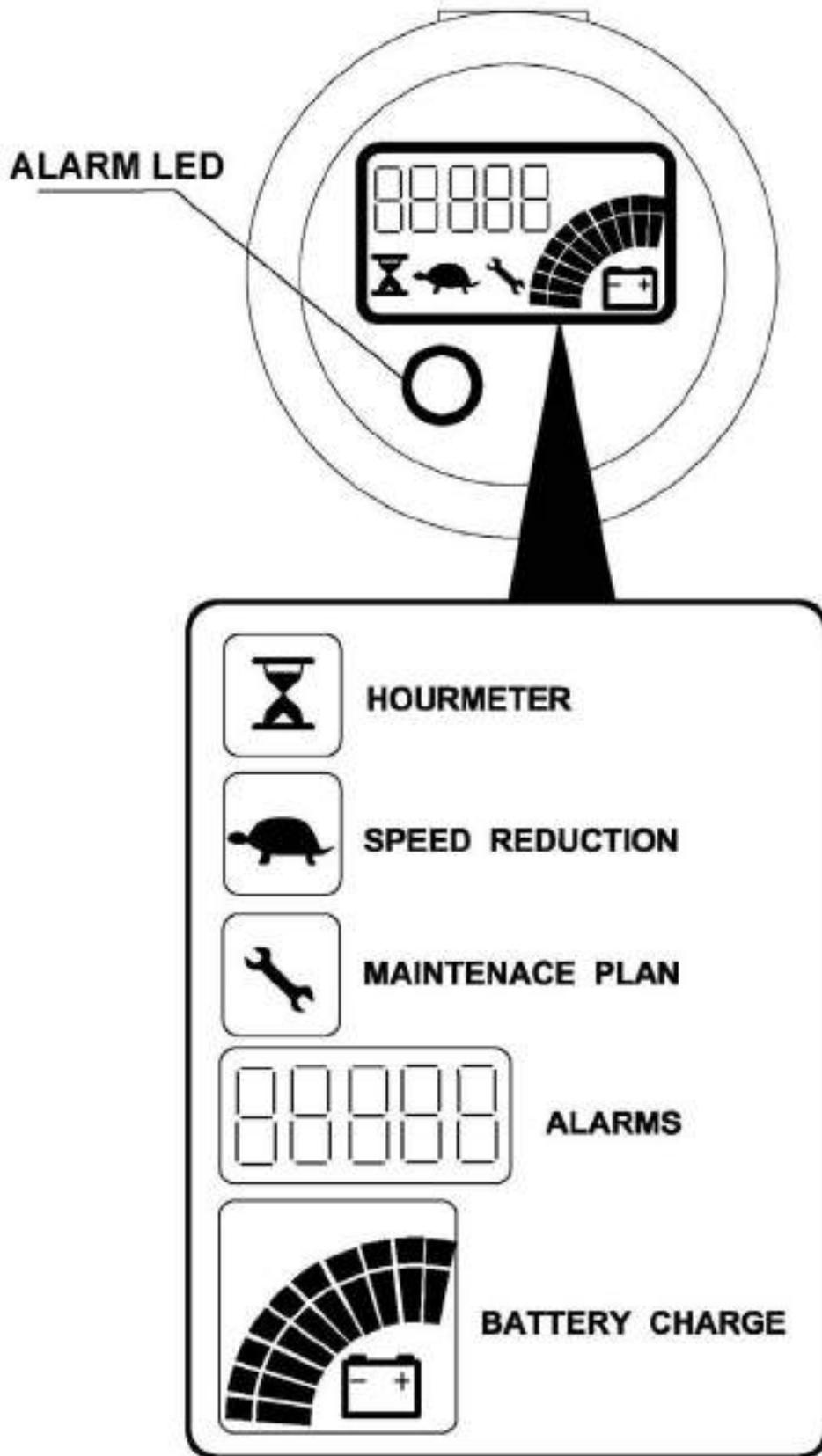
The LED dashboard will show fault codes when the truck in trouble. After remove the trouble, please restart the truck . ( Fault codes see "6.6Electrical system" on page 68. )

**Warning!**

If the truck still work when the battery capacity in a low level, it will induce controller's temperature out of rage, so that the truck life will shorted.



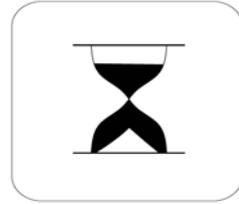
FTH Series Instrument and display[19]



## The meanings of indicators:

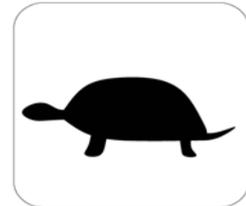
### Hour meter

It is normally off, it blinks when the Hour Meter is working.



### Speed reduction

It is normally off, when it appears (fixed) it shows activation of the "soft" mode of the truck, in which maximum speed and acceleration are reduced.



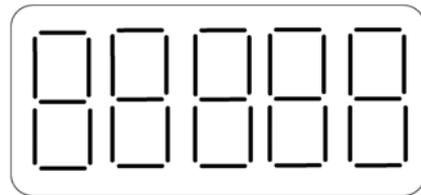
### Maintenance plan

It is normally off; when it appears (fixed) it shows the request of programmed maintenance or the Alarm state. In this case the relative code will be displayed.



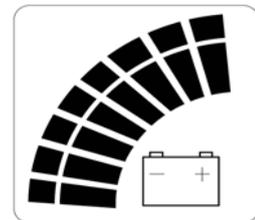
### Alarms

The same display can also indicate the Alarm state, showing a Code corresponding to the type of Alarm. To attract attention, the Red LED will start blinking when an Alarm is generated.



### Battery State of charge

The battery State of Charge indicate is integrated in the LCD display is shown by ten notches. Each notch represent the 10% of the battery charge. As the battery becomes discharged, the notches turn off progressively, one after the other, in proportion to the value of the residual battery charge.



### 1.3.5 Emergency disconnect switch [24]

When happen emergency, presses down the emergency cut off power switch, the main power of the reach truck will be cut off.

#### Warning!

Please don't use the emergency disconnect switch to substitute the

### 1.3.6 Travel switch [26]

The travel switch is for switching between forward and backward moves. When the lever is pushed forward and accelerator pedal pressed, the forklift trucks moved forward. When the lever is pushed backward, the forklift trucks moved backward.

**Warning!**

While traveling, if change the travel switch, electric braking will operate, speed will lower until stop, then travel to the opposite direction.

**Warning!**

Turning the key switch “on” does not make the forklift truck move, if the travel switch is not in the neutral position or the accelerator pedal is being pressed. In this case, the travel switch should be returned to neutral and move you foot from the accelerator pedal. Then the truck can be operated.

**1.3.7 Levers**

**Parking brake lever [25]**

Use this parking brake lever to park the lift truck. And the parking brakes are applied on the front two wheels by pulling up on this lever. To release the parking brakes, move the lever forwards.

**Warning!**

If parking on a grade is unavoidable , be sure to block the wheel.

There is a micro switch at the left side of the parking brake lever, it can make running invalid to tense the lever.

**Lifting lever [23]**

The forks can be raised or lowered by pulling backwards or pushing the lever. Lifting speed can be controlled by tilt backwards angle of lever while the lowering speed can be controlled by tilt forwards angle of the lever. The motor speed or accelerator pedal does not have to do with the lowering speed of the forks.

**Tilting lever [22]**

The mast can be tilted by operation of this tilting lever. Pulling on this lever backwards will tilt the mast backwards, and pushing it forwards will tilt the mast forwards. The tilt speed can be controlled by tilt angle of the lever.

**Warning!**

The tilt lock mechanism built in the hydraulic control valve does not allow the mast to tilt forwards while the engine is being shut down even if the tilt lever is pushed forwards.



### Side lever[21]

The fork can be move to side by operation of this lever. The move speed can be controlled by tilt angle of the lever.

You don't have the lever, when you truck use two unite valve.

### Attachment lever [20]

The function of attachment lever is up to attachment.

You don't have the lever, when you truck use two or three unites valve.

## 1.3.8 Pedal

### Brake pedal [27]

Press this pedal to slow or stop the truck. At the same time, the brake light comes on.

#### Warning!

No permitted to press the brake pedal and the accelerator pedal at one time, otherwise, it should harm the traveling motor.

### Accelerator pedal [28]

As the accelerator pedal is slowly pressed, the drive motor start turning and the forklift truck will start to move. According to the force applied to the pedal, the speed is adjusted with not steps.

#### Warning!

Before open the key switch to press the accelerator pedal, the more function digital indicator shall show alarm information. Then you must release the accelerator pedal.

When loosen the accelerator pedal, truck can make soft brake because of electric control's regenerate brake.

## 1.3.9 Body and others

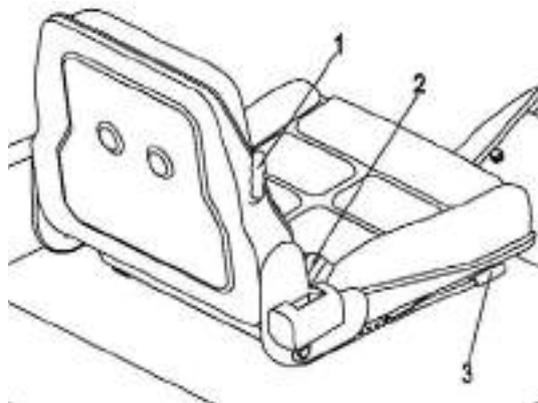
### Chassis[12]

The chassis, in conjunction with the counterweight, forms the supporting base structure of the truck. It is used to support the main components.

### Seat and adjusting lever[13]

Adjust operator's seat to position which is comfortable for you and provides easy access to all hand and foot controls.

The seat is unlocked by turn the adjusting lock[2] anticlockwise. Fasten seat handle[1] and pulling backwards or pushing the handle can change the lean of seat. Before proceeding with work, adjust operator's seat and make sure that it is securely locked.



Turning seat lever[3] to outboard can change the position of seat. Before proceeding with work, adjust operator's seat and make sure seat lever was turned inboard.

### Overhead safe guard[3]

The overhead guard used is strong enough to meet safety standard, and protects the operator from falling materials. The top gap is used to lift the batteries. It is forbidden for use a truck that does not with safeguard.

### Hood

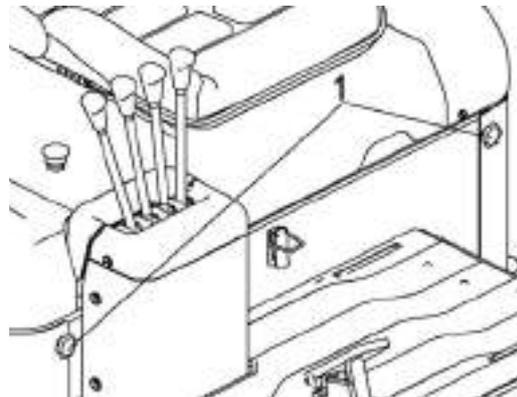
The hood can be swung up fully to provide easy examining and maintenance of the storage batteries. You can lift up the hood with little effort with an aid of hood damper. To lock the hood, push down on the front of hood until it covered.

#### Warning!

- 1、 Be careful do not to catch you fingers in the hood when closing it.
- 2、 When you want to close the hood, don't forgot to lock the hood lock,in order to avoid hood open suddenly.

### Side battery cover hood[11]

It is cover hood of battery one left and one right. When you want to take off the hood, you should take off the knob[1] at first and pull to upside.

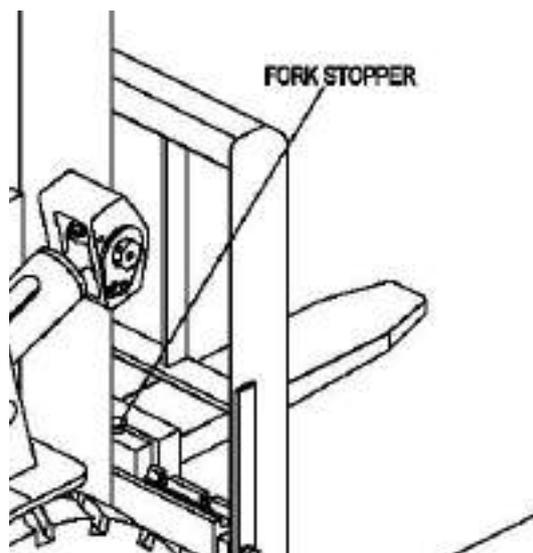


### Fork stopper

Fork stoppers are locked the forks in position. To adjust fork spacing, pull up fork stoppers, turn and shift the forks to the desired position. The fork spacing should be adjusting according to loads to be handled.

#### Warning!

- The forks should be set symmetrically to machine centerline and fork stoppers should always be set.
- There are two gaps on the beam of load bracket. It is used in attach forks.
- It is forbidden to lock the fork on the gap position, to prevent the fork fall off from the gap.



### Step and safely grip

The safely steps are provided on both side of the truck body. The safely grip is provided on the front left pillar of the overhead guard. Use the safely step and safely grip facing the truck when mounting and dismounting the truck.

### Brake fluid reservoir cup

The brake booster is located beside Parking brake lever.

#### Warning!

The brake fluid is poisonous, be careful do not drop down. When add brake fluid, be careful do not let dirt and other thing

### Head lights[7] and Front Little Lamp[8]

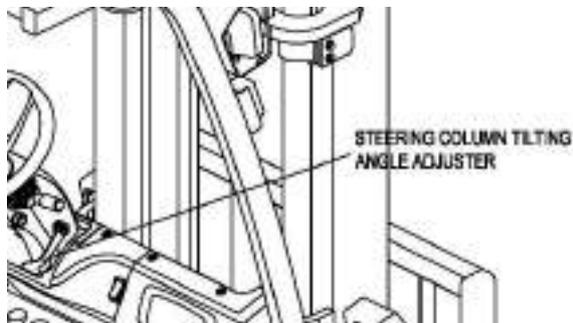
Two headlights and combination lights ( turn signal, parking and backup ) are installed at the front side of the truck. Take care of the lights, and wipe dirt, if any, and replace any damaged light immediately.

### Rear Lamp Unit [1]

The combination lights at the rear side serve as turn signal, show width lamp, brake lamp, parking lamp, back-up lamp and rear reflector. Pay attention to keep them from being damaged or covered with dust, if any, clean or replace immediately.

### Steering column tilting angle adjuster[30]

The tilting angle of the steering column is adjustable with a range of 12.5 degrees to suit individual operators. The steering column is unlocked by turning the right handle counterclockwise and locked by turning the right handle clockwise.



### Hydraulic oil reservoir cap

The hydraulic oil reservoir cap is located at the right side below the battery hood; open the right side battery hood and right battery cover hood when adding oil. The cap is provided with the dipstick. After fill in clean hydraulic fluid, tighten lock the cap.

### Air leakage plug

There is an air leakage plug on the oil tank to let air in the tank goes out. You'd better often check the plug and see whether been jammed.

### Dead man switch (optional)

When the operator leaves seat, this switch cut off, and the power of truck is cut off.

### Safety seat belt (optional)

There is a safety belt on the seat, before you operate the forklift truck, please fasten the seat belt to protect yourself.

### Fuse box

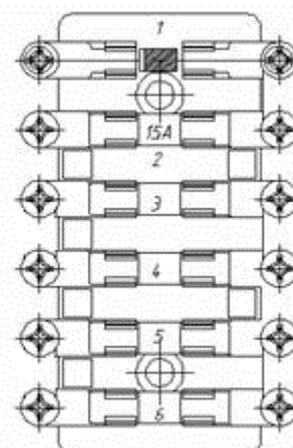
1st is control circuit fuse 15A.

2nd, 3rd and 4th are light and beeper circuit fuse. All of them are 15A.

5th and 6th is spare fuse 15A.

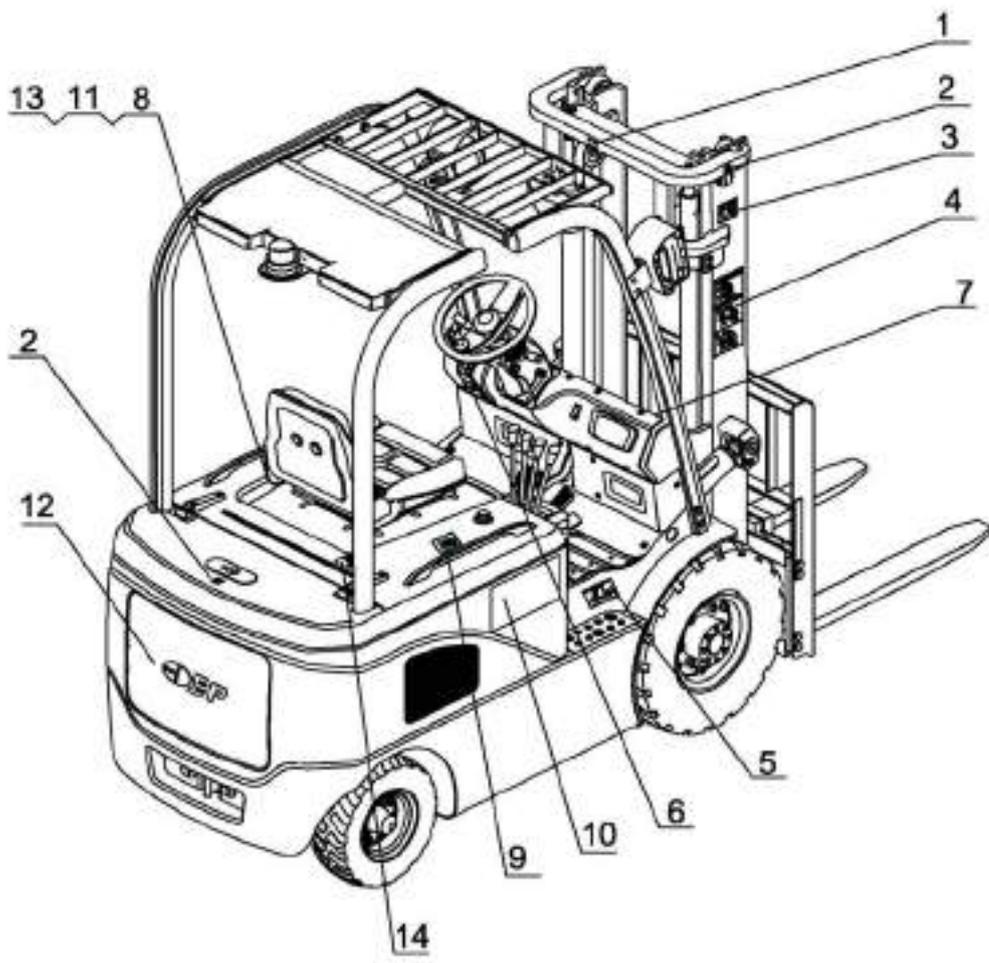
#### Warning!

When replace a new fuse, please choose the same capacity fuse of the old one.

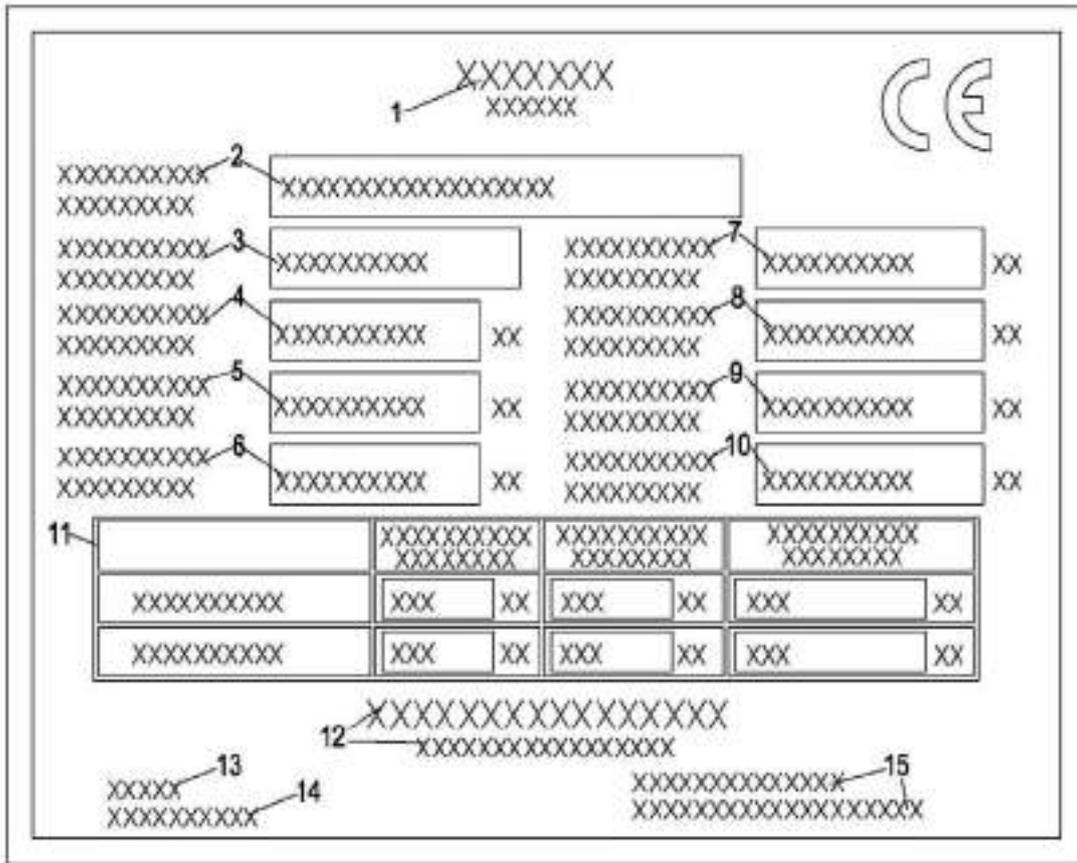


## 1.4 Identification points and data plates

Item	Description
1	"Never put your hands in inner and outer mast." warning
2	Strap points for crane lifting
3	CE Decal
4	"Never stand under the forks" and "Never stand or ride on forks for any reason" warning
5	Tyre pressure
6	Parking brake Decal
7	Truck data plate
8	"truck security warning" warning
9	Load curve
10	Truck label
11	Operation explain Decal"prepare before drive","notice during drive","notice during load, unload and stow"
12	EP decal
13	Security mark (motorcycle safety helmet)
14	Hydraulic pressure decal



### 1.4.1 Truck data plate



Item	Description	Item	Description
1	Model name	9	Max. allowable battery weight ( kg )
2	Type	10	Min. allowable battery weight ( kg )
3	Serial no.	11	load-lift height table
4	Nominal load center ( mm )	12	Manufacturer
5	Weight without battery(kg)	13	License no.
6	Nominal voltage ( V )	14	Service tel
7	Service weight ( kg )	15	address
8	Rated capacity ( kg )		

For queries regarding the truck or ordering spare parts please quote the truck serial number(3).

### 1.5. Standard Version Specifications

Technical specification details in accordance with VDI 2198. Technical modifications and additions reserved.

### 1.5.1 Performance data for standard trucks

Brand															
Type			CPD15FT	CPD15FTH	CPD18FT	CPD18FTH	CPD20FT	CPD20FTH	CPD25FT	CPD25FTH	CPD30FT	CPD30FTH	CPD35FT	CPD35FTH	
Power cell			Battery												
Operation type			Sit-drive												
Q	Rated capacity	kg	1500	1500	1800	1800	2000	2000	2500	2500	3000	3000	3500	3500	
C	Load center of gravity distance	mm	500	500	500	500	500	500	500	500	500	500	500	500	
	Travel speed	Fully load	km/h	11.5	11.5	11.5	11.5	13	13	13	13	11	11	11	11
		Non-load	km/h	12	12	12	12	13.5	13.5	13.5	13.5	12	12	12	12
	Raise lift speed ( Max )	Fully load	m/s	0.3	0.28	0.3	0.28	0.3	0.28	0.3	0.28	0.23	0.22	0.23	0.22
		Non-load	m/s	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.37	0.37	0.37	0.37
	Lowling speed (Max )	Fully load	m/s	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.50/	0.50/	0.50/	0.50/
		Non-load	m/s	0.44	0.44	0.44	0.44	0.435	0.435	0.435	0.435	0.48	0.48	0.48	0.48
	Max.grade ability (5 min rating)	Fully load	%	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
		Non-load	%	14	14	14	14	14	14	14	14	12	12	12	12
	Max.Drawbar pull(S2 5min)	Fully load	N	11000	11000	11000	11000	17000	17000	17000	17000	18000	18000	18000	18000
Net weight (including battery)		kg	3650	3650	3650	3650	4150	4152	4170	4170	4985	4985	5100	5100	
	Axes lode (Fully load)	Front/rear	kg	4490/460	4490/460	4920/530	4920/530	5940/460	5940/460	6600/500	6600/500	7230/750	7230/750	7800/800	7800/800
	Axes lode (Non-load)	Front/rear	kg	1440/2010	1440/2010	1540/2110	1540/2110	2220/2180	2220/2180	2290/2310	2290/2310	2140/2840	2140/2840	2200/2900	2200/2900

Tyre	Frontx2		6.5-10-10 PR	6.5-10-10 PR	6.5-10-10 PR	6.5-10-10 PR	7.00-12-12 PR	7.00-12-12 PR	7.00-12-12 PR	7.00-12-12 PR	28X9-15	28X9-15	28X9-15	28X9-15
	Rearx2		5.00-8-10 PR	5.00-8-10 PR	5.00-8-10 PR	5.00-8-10 PR	18X7-8							
Motor	Driven motorx2	Kw	7.5	7.5	7.5	7.5	11	11	11	11	11.75	11.75	11.75	11.75
	Pump motor	Kw	9.2	8.2	9.2	8.2	8.6	8.6	8.6	10	10	13	10	13
Battery	standard		BS											
	Pressure / capacitance	V/AH	48/400 (Max545)	48/400 (Max545)	48/400 (Max545)	48/400 (Max545)	48/500 (Max700)	48/500 (Max700)	48/630 (Max700)	48/630 (Max700)	80/500 (Max550)	80/500 (Max550)	80/500 (Max550)	80/500 (Max550)
Battery weight (including battery box)		kg	930	930	930	930	990	990	990	990	1492	1492	1492	1492
Controller	Type		AC											
	Manufacturer		ZAPI											
Operating pressure for attachment		bar	145	145	145	145	175	175	175	175	180	180	180	180
Noise level		dB (A)	70	70	70	70	72	72	72	72	75	75	75	75

## 1.5.2Dimensions

	Description		CPD15FT	CPD15FTH	CPD18FT	CPD18FTH	CPD20FT	CPD20FTH	CPD25FT	CPD25FTH	CPD30FT	CPD30FTH	CPD30FT	CPD30FTH	
H3	Lifting height	mm	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	
H2	Free lifting height	mm	135	135	135	135	100	100	100	100	100	100	100	100	
s	Fork dimension	thickness	mm	40	40	40	40	40	40	40	45	45	50	50	
e		width	mm	100	100	100	100	120	120	120	125	125	125	125	
l		length	mm	920	920	920	920	1070	1070	1070	1070	1070	1070	1070	
θ1	Tilting angle	forward	Deg	6	6	6	6	6	6	6	6	6	6	6	
θ2		backward	Deg	12	12	12	12	12	12	12	12	12	12	12	
L2	Truck dimension	Length to face of fork	mm	2075	2075	2075	2075	2280	2280	2280	2280	2550	2550	2600	2600
L1		Whole length	mm	2995	2995	2995	2995	3350	3350	3350	3350	3620	3620	3670	3670
B3		Width	mm	1040	1040	1040	1040	1040	1040	1040	1040	1100	1100	1100	1100
b1		Load back rest width	mm	1080/1070	1080/1070	1080/1070	1080/1070	1150	1150	1150	1150	1220	1220	1220	1220
h1		Height when mast lowered	mm	1995	1995	1995	1995	1995	1995	1995	1995	2025	2025	2025	2025
H4		Height when mast lifting	mm	3955	3955	3955	3955	4220	4220	4220	4220	4250	4250	4250	4250
H6		Height to safeguard	mm	2170	2170	2170	2170	2230	2230	2230	2230	2230	2230	2230	2230
H7		Seat Height	mm	1130	1130	1130	1130	1160	1160	1160	1160	1160	1160	1160	1160

H10		Traction Height	mm	335	335	335	335	310	310	310	310	310	310	310	310
Wa	Turning radius	Min	mm	1920	1920	1920	1920	2100	2100	2100	2100	2300	2300	2300	2300
x	Overhand	Front	mm	413	413	413	413	440	440	440	440	480	480	480	480
M2	Ground	chassis	mm	110	110	110	110	100	100	100	100	120	120	120	120
M1	clearance	Mast	mm	110	110	110	110	110	110	110	110	130	130	130	130
Y	Wheelbase		mm	1280	1280	1280	1280	1500	1500	1500	1500	1625	1625	1625	1625
B10	Front-wheelbase (drive- wheel)		mm	890	890	890	890	970	970	970	970	1000	1000	1000	1000
B11	Rear wheelbase (drive-wheel)		mm	920	920	920	920	950	950	950	950	980	980	980	980
Ast	Working aisle width with pallet	1000×1200 crossways	mm	3630	3630	3630	3630	3890	3890	3990	3990	4125	4125	4225	4225
		800×1200 lengthways	mm	3430	3430	3430	3430	3690	3690	3790	3790	3925	3925	4025	4025



## 1.6 Relationship between load and stability of truck

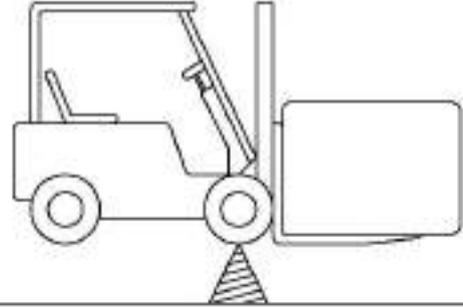
It is very important for operator to know the truck's structure and relationship between load and stability.

### **Warning! The structure of the truck**

The basic structure of the truck is mast (include mast and forks) and body (include tire).

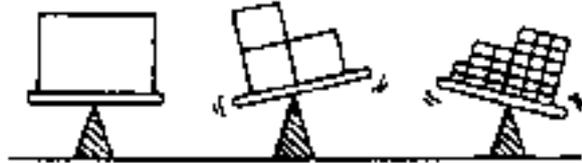
The lift truck keeps the balance of weight between the truck body and the load on the forks with the center of the front wheels as a fulcrum when the rated capacity load is placed in position.

Due care should be paid to the weight and the center of gravity of loads to maintain the stability of the truck.



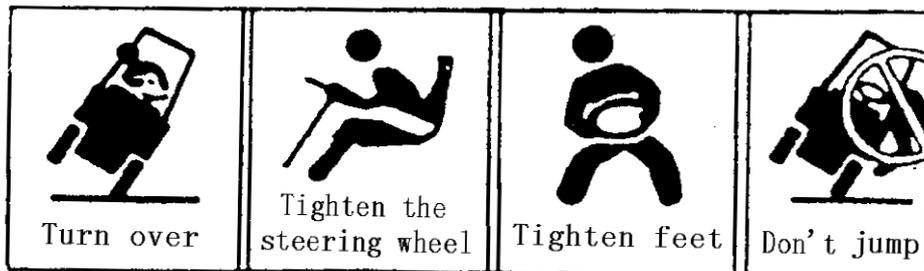
### **Warning! Load center**

There is difference because of the loads' shape, gravity, such as box, board and large roller. It is very important to distinguish the difference and the gravity center of loads.



### **Warning!**

If the truck will turn over, do not attempt to get out of the truck, because the speed of overturn is much faster than you. You should hold the steering wheel handle, and this practice will let you in the seats.



**Warning! Gravity and stability**

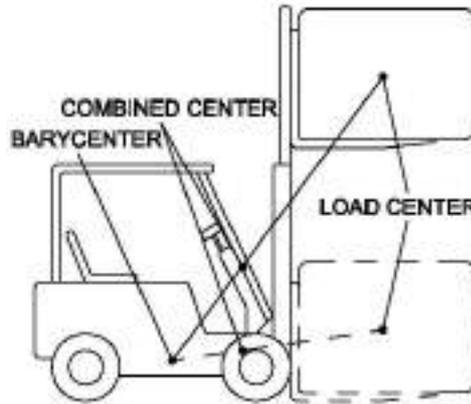
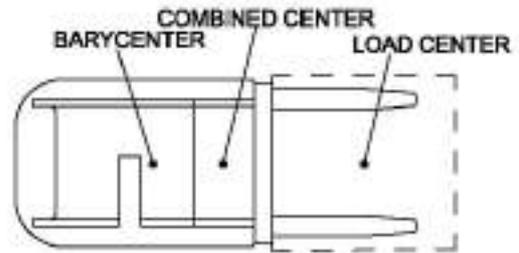
The combined center that is composed of the barycenter and the load center determine the stability of lift trucks.

When unloaded, the barycenter does not change; when loaded, the barycenter is determined by the truck and the load's center.

The barycenter is also determined by the tilting and lifting of the mast.

The combined center is determined by these factors:

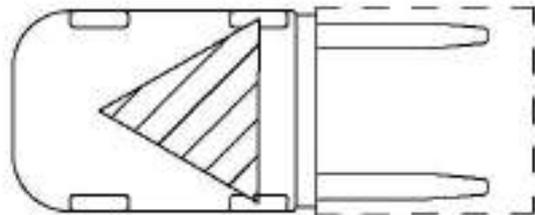
- Load's size, weight and shape.
- The lifting height.
- The tilting angle.
- The pressure of the tire.
- The radius of turning.
- The road and grade's angle.



**Warning! the stability zone of the barycenter**

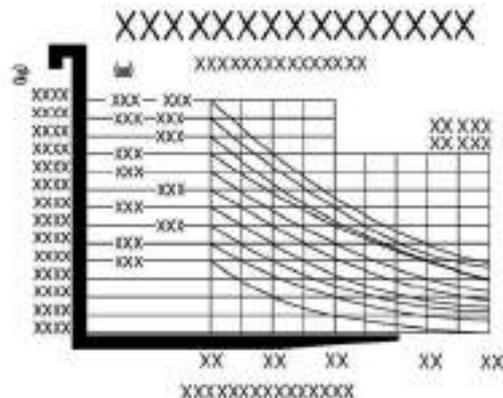
In order to make the truck stable, the combined center must be in the triangle which is made up of two points that the two front wheels attach ground and the midpoint of the back driving axle.

If the combined center is in the front driving axle, the two front wheels become two fulcrums, the truck will overturn. If the combined center departs the triangle, the trucks shall overturn in the corresponding direction.



**Warning! Capacity chart**

The chart given above shows the relation between the load center and the weight of loads.

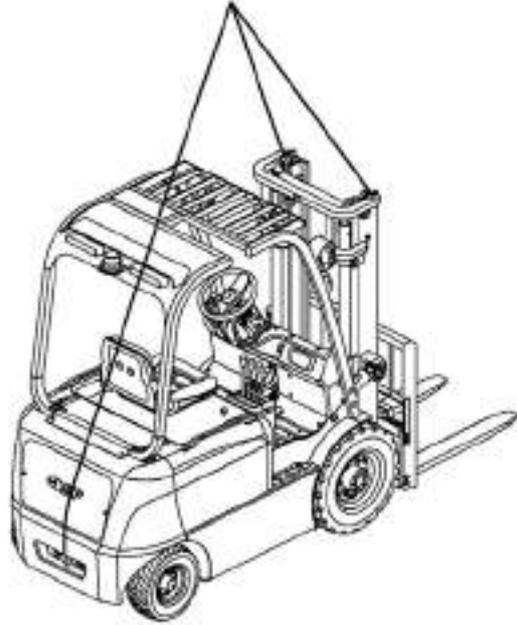


## 2. Transport and Commissioning

### 2.1 Transport

#### 2.1.1 Lifting the truck by crane

- The Fork Lift Truck is designed for material handling only, It is inappropriate for long-distance transportation. The Fork Lift Truck must be transported by ship, train or lorry, of 5T loading.
- Use a lifting pallet to hoist the truck.
- Use the steel wire ropes to tie the holes in the two side of the outside mast's beam and the rear of truck's body, then use the lifting device to hoist the truck. The steel wire ropes the rear of truck's body,
  - The steel wire rope attach to the counterweight should through the safeguard gap, and make the safeguard not be distorted.



#### **Warning!**

- When hoist the truck, don't coil the overhead guard with the steel wire.
- The steel wire ropes and the lifting device must be very firm to support the truck because the truck is very heavy.
- Don't lift the truck by hoist the overhead guard.
- When lifting the truck, don't take yourself below the truck.

#### 2.1.2 Securing the truck during transport

The truck must be securely fastened when transported on a lorry or a trailer.

- Parking the truck securely on a lorry or a trailer. See "3.1 Safety Regulations for the Operation of Forklift Trucks" on page 29.

- The rope is used to fix the truck must be firm enough. The rope round the mast above the beam and fixed to truck.

- Check .

Both sides need to fix.



Loading must be carried out by staff specially trained. In each case correct measurements shall be determined and appropriate safety measures adopted.

### 2.1.3 Towing

·The towing rod on the bottom of the counter balance is used to pull and drag the truck, for installing the rod, first remove the towing rod and then install the ropes. After that, replace the rod.

·Loosen the brake lever. Otherwise, it will damage the controller!

#### **Warning!**

- a. Don't tie the steel wire ropes on the unfixed position.
- b. Don't carry a load to steel wire ropes suddenly.



### 2.2 Using the Truck for the First Time

Only operate the truck with battery current. Rectified AC current will damage the electronic components. Cable connections to the battery (tow leads) must be less than 6 m .

Preparing the truck for operation after delivery or transport

Procedure

- Check the equipment is complete.
- Check the hydraulic oil level.
- Install the battery if necessary, (see "4.4 Battery removal and installation" on page 40).
- Charge the battery, (see "4.3 Charging the battery" on page 36).

### 2.3 During brake-in

We recommended operating the machine under light load conditions for the first stage of operation to get the most from it. Especially the requirements given below should be observed while the machine is in a stage of 100 hours of operation.

1. Must prevent the new battery from over discharging when early used.
2. Perform specified preventive maintenance services carefully and completely.
3. Avoid sudden stop, starts or turns.
4. Oil changes and lubrication are recommended to do earlier than specified.

Limited load is 70~80% of the rated load.

## 3. Operation

### 3.1 Safety Regulations for the Operation of Forklift Trucks

Safety is your business and your responsibility. The "Safety Instructions" covers basic safety procedures and warnings of general application to the typical forklift truck. However, safety precautions given on the following pages are also applicable to lift trucks that have special specifications or attachments.

Read this manual thoroughly and become completely familiar with your truck to get the most out of it.

#### 1. Know your truck

For the purpose of doing material handling job, the forklift truck is different from general passenger cars in structure as follows:

- Poor front view due to the hoist system.
- Rear wheel steering lets the rear of the truck swing outwards when going round corners .
- Compactly designed, the forklift truck is heavy. Most of the weight of the truck and loads is on the front wheels when loaded so the truck lacks stability.
- Read the operator's manual and name plates on the truck, and become familiar with your truck and operating procedures. If there is something in the manual you do not understand, ask your supervisor to explain it to you.

#### 2. Get permission from supervisor

Only trained and authorized operator shall be permitted to operate the truck.

#### 3. Make periodic checks

Inspect the truck at periodic intervals for oil or water leak, deformation, lousiness, etc. If neglected, short life of components will be caused and in the worst case a fatal accident would occur.

make sure having replaced good parts during periodic check.

Wipe off oil, grease or water from the floor board and foot and hand controls, if any.

Strictly prohibit smoking and spark nearby the storage battery when checking it.

If maintenance on high position, such as mast, front and rear lamp, please be careful to prevent fall down or be clamped.

Be careful do not be scalded when inspect the motor, controller and etc.

#### 4. Stop using the forklift when it is in trouble

whatsoever in trouble, you must stop the forklift, hang a mark of "danger" or "trouble" and take off the key, at the same time inform the manager.

only after the trouble is removed, you may use the forklift.



### 5. Protect yourself

Operator must wear helmet, safety shoes and work clothes.

### 6. Prevent exploding

Because there will bring exploding gas in the bosom of the battery, prohibit any flame nearby it absolutely.

Don't let any tools close the two terminal of the battery to avoid spark or short circuit.

Make sure to operate the truck on concrete firmly enough or bituminous macadam.

The weather of working condition is:

Air temperature  $-20^{\circ}\text{C} \sim 50^{\circ}\text{C}$

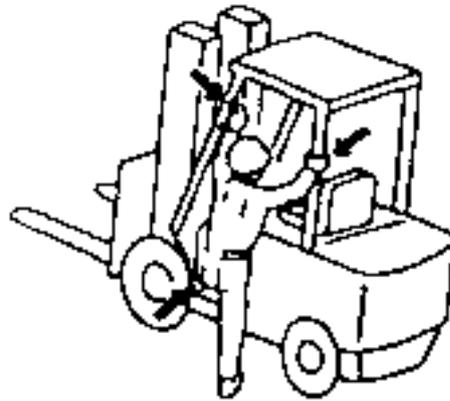
Wind speed: Less than 5m/s.

Air specific humidity: Less than 90%. (Temp at  $20^{\circ}\text{C}$ ).

Truck cannot be operated in explosive gas environments.

### 7. Mount properly

Never mount or dismount the moving truck. Use the safety step(s) and safety grip facing the truck when mounting or dismounting the truck.



### 8. Never move controls unless properly seated

Never attempt to work the controls unless properly seated.

Before starting, adjusting the seat so you can get easy access to all hand and foot controls.

### 9. Start safely

Before starting up, make sure that:

The parking brake lever is applied securely.

The travel switch is in neutral.

Before starting, make sure no one is under, on and close to the truck.

Don't step the accelerate pedal or control the lifting lever or tilting lever before turning on power.

### 10. Prohibit sudden stop or turning

Operate the controls smoothly. Avoid sudden stops or turns.

It is dangerous to make a sharp brake  
Otherwise the truck has the possibility of overturn.



11. Pay attention to the route of the truck

-Pay attention to the route of the truck, be sure to make a wide sight.



12. Don't offer rides to others

Never allow other person(s) to ride on the forks, pallets or on the truck.



13. Know the load to be handled

Taking account of the shape and material of loads to be handled, use a proper attachment and tools.

Avoid hoisting the load, with wire rope hung the forks or attachment, since the wire rope may slide off. If needed, a qualified personnel for slinging operation should perform, making use of a hook or crane arm attachment.

Take care not to protrude the forks out of the load. The protruded fork tips may damage or turn over the adjacent load.



14. Know capacity of truck

Know the rated capacity of your lift truck and its attachment, if any, and never exceed it.

Do not use a man as an additional counterweight. It's quite dangerous.



15. Don't daydream

Keep your mind on your work. Learn to anticipate danger before it arises.

16. Remain seated

Keep your head, hands, arms, feet and legs within the confines of the operator's compartment. Never reach into upright for any reason.



17. Use proper pallet

The pallet and skid used should be strong enough to endure the load. Never use damaged or deformed ones.

18. Use proper attachment

We afford all type of attachment, such as rotating roll clamp, bale clamp, side shifter, and crane jib. You should refit the truck under ours license if you want. It is forbidden to refit it by yourself.

19. Attach safeguard and load bracket

Safeguard protect you do not be hurt by the goods fallen. Load bracket protect you load goods smoothly. It is forbidden to use truck without safeguard or load bracket.

20. Forbidden walk down or up the fork

It is forbidden to walk down the fork or the attachment.

It is forbidden to walk up the fork or stand on the fork.



21. Avoid be clamped by the mast

It is forbidden to put your hands, arms or head stretch between the mast and safeguard.

It is forbidden to put your hands in inner and outer mast.



22. Prohibit load off center

The goods is liable to drop turning or passing rough road when it departs the center. And the forklift may turn over more probably.



23. Don't stack load too high on forks  
Don't stack loads on forks in such a way that the top of loads exceeds the load backrest height. If unavoidable, make the load stable securely. When handling bulky loads that restrict your vision operate the truck in reverse or have a guide.



24. Don't tilt the mast with load high  
Use minimum forward and reverse tilt when stacking and unstacking loads.

Never tilt forward unless load is over stack or at low lift height.

When stacking loads on a high place, once make the mast vertical at a height of 15 to 20 cm above the ground and then lift the load farther. Never attempt to tilt the mast beyond vertical when the load is raised high.

To unstack loads from a high place, insert forks into the pallet and drive backwards, then lower the load. Tilt the mast backwards after lowering. Never attempt to tilt the mast with the load raised high.

25. To handle bulky loads

When handling bulky loads, which restrict your vision, operate the machine In reverse or have a guide. When you have a guide, make sure you understand hand, flag, whistle or other signals.

When operating with long loads such as lumber, pipe, etc., or in the case of the Large-sized model or the truck with spreader, be extremely careful of load end swing at corners or in narrow aisles. Be alert for fellow workers.

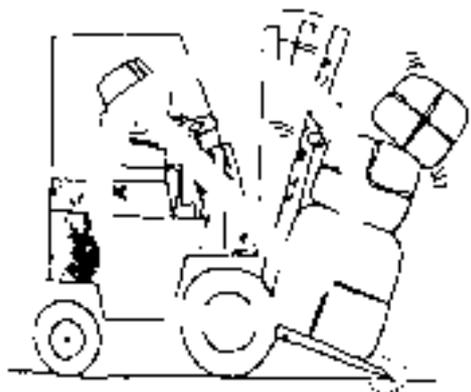
26. Carry the load low

It is dangerous to travel with forks higher than appropriate position regardless of whether loaded or not. Keep the good traveling posture. (When traveling, the forks should be 15 to 30 cm above the ground or floor.)

Do not operate the side shift mechanism, if equipped, when the forks are raised and loaded, since this will cause the truck to be unbalanced.

27. Tilt backward when loaded

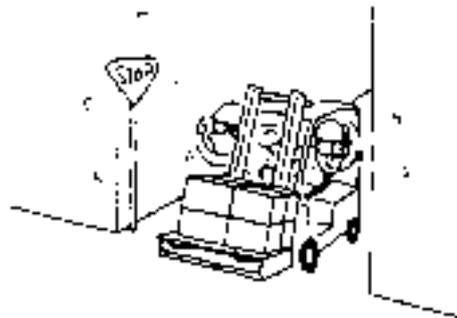
Travel with load as low as possible and tilted back. If operating with steel pallet or the like, be sure to tilt back the mast to prevent it from slipping off the forks.



28. Watch for doorways and Slow down at corners

Watch for branches, cables, doorways, or overhangs. Use caution when working in congested areas.

Slow down and sound horn at cross aisles and other locations where vision is restricted. When make a turn, be sure the speed of the truck is lower than the 1/3 max. of allowable speed.



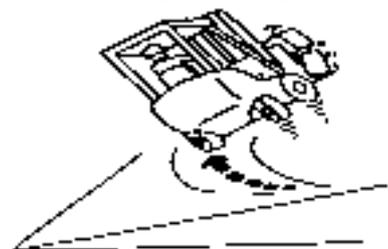
29. Keep some distance from roadside and flat roof

Affirm keeping some distance from roadside and flat roof.



30. Driving over a dock-board or bridge-plate

Before driving over a dock-board or bridge-plate, be sure that it is properly secured and strong enough to sustain the weigh. Check the ground or floor condition of working area in advance.



31. Back down and drive up

When operating loaded truck, have the rear end of your machine pointed downhill.

When operating unloaded truck, have the rear end of your machine pointed upgrade.



32. Avoid work on a grade

Never lift loads with the truck inclined. Avoid loading work on a grade.

33. Never lift a load over anyone

Never permit anyone to stand or walk under upraised forks or other attachments if machine is so equipped. If unavoidable, use a safety stand or block to prevents a possibility of fork attachments falling down or moving unexpectedly.

#### 34. Check work ground area

Inspect the surface over which you will run. Look for holes, drop-offs, obstacles, and look for rough spots. Look for anything that might cause you to lose control, bog down or upset.

Clear away trash and debris. Pick up anything that might puncture a tire or let the load lose balance.

Slow down for wet and slippery roads. Stay away from the edge of the road.

If the ground is bumpy, it will cause the truck bump and bring much noise.

Do not operate the truck when the weather is execrable, such as windy, thunder storm, snow and etc. Especially when wind speed is higher than 10m/s, don't operate the truck outside.

#### 35. Parking correctly

Pulling the hand brake when parking on flat. If necessarily parking on ramp, you should place the wedges under wheels.

Descending and a little forward tilting the fork, shut off key switch and take off key.

Pull out the battery plug.

The parking place must be far away from fireworks.

#### 36. Towing

You can tow the forklift to the safe place with towing pin when the forklift can't run.

Don't tow the truck which steering system or brake system has been damaged.

#### 37. Nameplate

There is operate method and warning label on the truck. Please operate the truck obey the rules on the label and this manual.

Often inspect the nameplate, when damaged or lost please replace it.

#### 38. Noise

The noise of truck is less than 75dBA, test method is use a decibel tester to record the voice 7 meters far away from truck. The decibel near operator's ear is less than 95dBA.

#### 39. Vibration and acceleration

When unloading, operator's vibration of acceleration is about 0.74m/s<sup>2</sup>; when laden, is about 0.18m/s<sup>2</sup>; so when operate on a uneven ground, it may cause more vibration for truck and operator

## 3.2 Operate and run the truck

### 3.2.1 Preparing

Before the truck can be commissioned, operated or a load unit lifted, the driver must ensure that there is nobody within the hazardous area.

#### Checks and operations to be performed before starting daily work

- Visually inspect the entire truck (in particular wheels and load handler) for obvious damage.
- Visually inspect the battery attachment and cable connections.

#### Warning!

Before operating the truck, check all controls and warning devices for proper operation. If any damage or fault is found, don't operate truck until corrected.

### 3.2.2 Switching on the truck

- (1) Put direction switch to center position.
- (2) Plug into the plug
- (3) Turn on key switch

Close the wheel lever with left hand and turn on the key switch with right hand.

- (4) Tilt back the mast

Control the lifting lever to set the bottom of the fork 150-200mm above the ground.

Control the tilting lever to fully tilt back the upright.

- (5) Control shift lever

Forward: Push forward the shift lever.

Backward: Pull backward the shift lever

- (6) Loosen the hand brake lever

Step the brake pedal and push the hand brake lever to the front position. Hold the steering wheel with your left hand and lightly put it on the wheel.

### 3.2.3 Travelling, Steering, Braking

#### Traveling

Step the accelerate pedal slowly, the truck will travel forward or backward.

#### Decrease speed

Loosen the accelerate pedal slowly, the truck will decelerate.

#### Warning!

Don't step the accelerate pedal and brake pedal at the same time.

### Notice!

Decelerate the truck in the situations following:

- turning;
- close the deposit area
- the condition of road surface is bad.
- close the load
- enter a narrow passage;

### Steering

Unlike general passenger-cars, the steer wheels are located at the rear of the truck. These cause the rear of the truck to swing out when turning.

Slow down the truck and move toward the side to which you are turning. The steer hand wheel should be turned a bit earlier than as with the front wheel steering car.

### Notice!

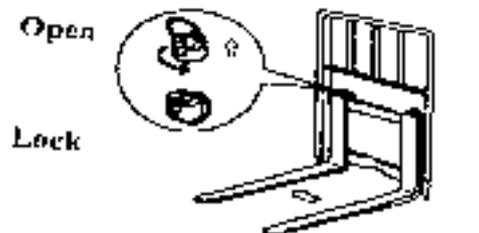
Drive the truck slowly and control the steering wheel carefully, assure there is enough space to steer.

### Stopping or parking the truck

- ① Slow down and press the brake pedal to stop the truck.
- ② Place the shift lever in neutral.
- ③ Apply the parking brake by pulling up on the parking brake lever.
- ④ Down the forks on the ground.
- ⑤ Place the key switch in "OFF" to shut off the battery. Remove the key and keep it.

### Warning!

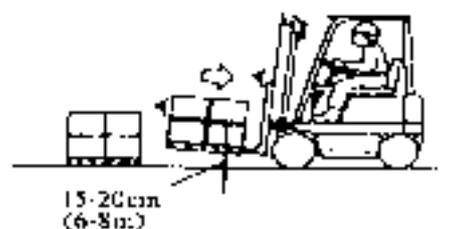
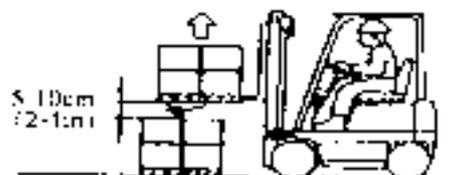
- Don't dismount from the moving truck. Never jump off the truck.
- Don't parking the truck on the working road.



### 3.2.4 Collecting and depositing loads

#### Pick up

- The forks should be adjusted space to maintain proper balance of load.
- Place the truck right in front of the load to be handled.
- The pallet should be evenly positioned across both forks.
- Insert forks into the pallet as far as possible.
- To raise loads from the ground:
  - ① Once lift the forks 5 to 10 cm off the ground or floor and make sure loads rest stable.
  - ② Then, tilt the mast backwards fully and lift forks up to 15 to 20 cm off ground then



start running.

When handling bulky loads which restrict your vision, operate the truck in reverse except when climbing grades.

### Stacking load

- When approaching the deposit area slow down your truck.
- Once stop the truck right in front of the area where your load is to be deposited.
- Check the condition of the deposit position.
- Tilt the mast forward until forks become horizontal. Raise forks until they are a little higher than the deposit position.
- Move forward to place the load directly over the desired area and stop the truck.
- Make sure your load is just over the desired area. Slowly lower the load into position. Make sure the load is securely stacked.
- Disengaged forks from the load by using necessary lift-tilt operation and then back away.
- After making sure the fork tips leave the load, lower the forks to the basic position (15 to 20 cm off the ground).
- Tilt the mast backwards .

#### Warning!

- Never tilt the mast with loads upraised 2m or more.
- Don't leave or dismount from the truck when the load is raise high.

### Un-stacking load

- When approaching the area where the load is to be retrieved, slow down your truck.
- Stop the truck in front of the load so that the distance between the load and fork tips is about 30 cm.
- Check the condition of the load.
- Tilt the mast forward until forks become horizontal. Elevate forks up to the position of the pallet or skid.
- Make sure forks are positioned properly for the pallet. Move forward slowly to insert forks into the pallet as far as possible and then stop the truck.
- Raise the forks 5 to 10 cm off the stack
- Check all around the truck to insure that the path of travel is unobstructed and back away slowly.
- Lower forks to a height of 15 to 20 cm above the ground. Tilt the mast backward fully and move to the desired area.

#### Warning!

If the forks are hard to be fully inserted, use the following procedure: Move forward and insert 3/4 of the forks. Raise the forks 5 to 10 cm and move backward 10 to 20 cm with the pallet or skid on the forks, and then lower the pallet or skid on the stack. Move forward again to insert the forks fully.

### 3.2.5 Check after operation

Clean and check the truck after operation:

- Damage or leakage.
- Add grease if necessarily.
- Check the tyre if it is damaged or inset with foreign body.
- Check the wheel hub nut if it is loose.
- Check the height of electrolyte surface.

- If you haven't lift the fork to the max. height in the day, you should lift it to the max. height 2~3 times.

#### **Warning!**

- If you find any trouble, must repair it in the day.
- prohibit operate the forklift before repairing it completely.

## 4. Battery Maintenance & Charging

### 4.1 Safety regulations for handling acid batteries

1. No firing

Explosive gas, smoking, flame and sparkle easily give off in the battery, each can cause battery explosion.



2. Protection against electric shock

- Battery has high voltage and energy.
- Do not bring short circuit.
- Do not approach tools to the two poles of the battery, which can cause the sparkle.

3. Correct wire connection

- Not allowing changing from anode to cathode, otherwise, resulting in sparkle burning and explosion.

4. Do not overuse battery

- If you use up the energy of battery till the forklift immovability, you will shorten its working hours.
- Shower for battery appears need for charge, please charge it quickly.

### 4.2 Battery type & dimension

Battery type & dimension as follow :

Tuck type	Battery type	Battery height (mm)	Battery length (mm)	Battery width (mm)
15/18/20FT	24D500	487	1002	711
25FT	7VBS630	720	1000	520
30/35FT	5DB500	793	1072	650

When replacing or installing batteries, ensure that the battery is correctly secured in the battery compartment of the truck.

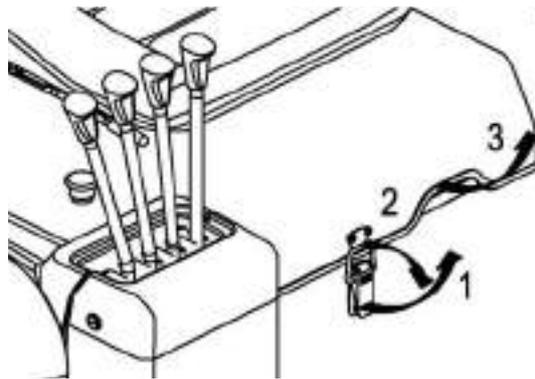
### 4.3 Charging the battery

#### 4.3.1 Exposing the battery

Park the truck securely (See "3.1 Safety Regulations for the Operation of Forklift Trucks" on page 29.)

- Drawing back the emergency brake switch .

- Turn the lock[1] and loose the agraffe[2], then you can lift up the hood by groove[3].



You can lift up the hood with little effort with an aid of hood damper. To lock the hood, push the bottom of the air spring, and push down on the front of hood until it covered.

### 4.3.2 Attentions for charging

1. Please charge in the well-ventilated and appointed site.

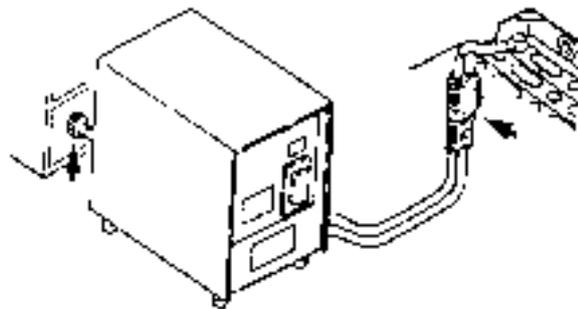
2. Mark 'no smoking' on charging.

3. Inspect wire and pin.

-ahead of charging , please examine wire and pin whether good or not.

- When wire and pin are damaged , please do not charge.

4. Open forklift cover and battery lid for charging , in order to release the explosive gas .



5. In charging , electrical source switch or battery pin are not close, or,

which destroys pin and electrical units as a rule, first press the stopping button on the charger, then unfix the pin.

### 4.3.3 First charging

-All the batteries are not added electrode for the new truck.

Compound electrode

Specific gravity of acid		1.280±0.005 g/cm <sup>3</sup>
First time charge gravity		1.270±0.005 g/cm <sup>3</sup>
Water and vitriol	Volume ratio	3.1:1
	Quality Ratio	1.75:1
Vitriol standard		Specific gravity is 1.835 g/cm <sup>3</sup> and Suitable for GB4554-84 or special for battery.

## Specification for distilled water

Ingredient		Index
Appearance		No color crystal
Dry residue	%	≤0.005
Resistively(25°C)	Ω·cm	≥7×10 <sup>4</sup>
Fe	%	≤0.0004
chlorine	%	≤0.0005
Manganese	%	≤0.00002
Organic compound (calculating oxygen)	%	≤0.0002
Magnesium oxide + calcium oxide	%	≤0.005
Ammonium	%	≤0.0008
Nitrate or nitrite	%	≤0.0005

### Compound course

① Wear the blinkers, rubber overshoes and rubber glove.

② Please pay attention to add the acid to water slowly, and churning with the same time, make it mix equality.

③ The electrode is cooled to 30°C, then pour it into battery. It is proper to pour the electrode 15-20mm above the electrode plate (without dobber).

④ Only when the temperature of the electrode is below 35°C (after 3-5 hours), can be first charged.

⑤ The specific charging cable should be connected to charging machine.

⑥ Inspect

The voltage value that the power needed is the number of the serial battery three times.

Battery voltage (V): 48V

·Inspect the charging machine.

·Inspect every battery's polarity.

### Warning!

Don't pour the water to the acid, in order to avoid the temperature of liquid surface turns high suddenly then boiling and splashing out to hurt someone.

### Notice!

The time that is from pouring the electrode into the battery to starting first charging can't be exceeded 12 hours.

⑦ Charging ways : ( time, current as the form )

a. 1<sup>st</sup> phase: most of the single battery's terminal voltage steps up to 2.4 V;

b. 2<sup>nd</sup> phase : the electrode give off a large number of bubbles, the voltage and the specific gravity steadies 4 hours and the charging value gets to 4.5-5 times than rated capacity.

c. Adjusting the specific gravity and height for the electrolyte

-If the specific gravity is smaller, it will be adjusted as follow: then take out some electrode from the battery, pour the compounded sulfuric acid that its specific gravity is 1.400g/cm<sup>3</sup>.

-If the specific gravity is larger, it will be adjusted as follow: then take out some electrode from the battery, pour some distilled water, but you must keep the electrode height accord with demand

d. After adjusting, you should keep charging on 1 hour; make the density of electrode even upper and under. At this time we have finished the first charging.

e. Close the pouring plug and clean the battery surface acid, then you can use it.

#### **Warning!**

Be sure to notice that the polarity sign on the plug must keep comfortably to the out specific charging end node.

When the charging cable connected to the storage batteries, pay attention to keep comfortably on the polarity sign.

Otherwise maybe you will damage your battery.

#### **Warning!**

During the charging, the temperature of electrode should not be exceeded 45°C 。 Otherwise you should low the temperature. If the temperature do not lowing, you should stop recharging, till the temperature drop down.

#### **4.3.4Daily charging**

• The battery that has been made the first charging and used regular, then charged again, is named daily charging.

• Its way is almost same as the first charging.

• The recharging value is 1.2 times than the last electric discharging. But the electric-change for new battery's fore five times should be 1.5 times than the last electric discharging.

• During any charge, the temperature of electrode should not be exceeded 45°C , otherwise it should be taken

measures such as reducing artificially charging current or lowing the temperature. If

#### **Warning!**

• If a day's worth of work cannot be completed with one charging, carry out opportunity charging during breaks.

• When the temperature of circumstance is lower, carry out opportunity charging.

the temperature do not drop, you should stop charging, till the temperature dropping down.

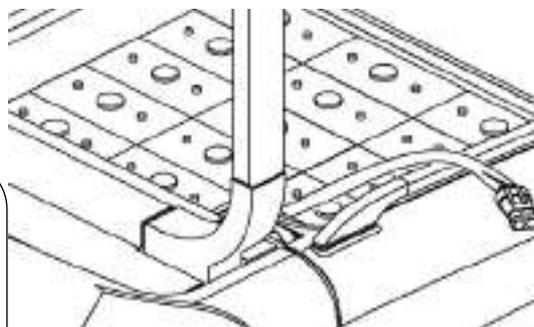
## 4.4 Battery removal and installation

### 4.4.1 Removal the battery

1. Stop the forklift truck on the plainly ground, set the hand brake lever.
2. Disconnect the battery plug.

#### Notice!

Notarize that the voltage, capability, size of the battery box and weight of the new battery are sameness with the forklift truck before replacing the battery.

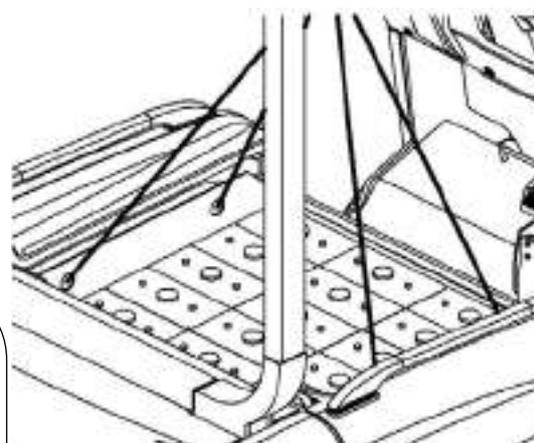


3. Open the hood and remove side battery cover hood.
4. Remove the lock pin.
5. Using the proper tools to pull up the battery.

#### Warning!

·The box must be pulled up with using 4 holes of the pothook at one time, it is permitted to pull up with two holes, otherwise the uniform power cause the battery damaged.

·The steering wheel and other equipment should not be bumped, avoid being damaged when pulling up the battery box.



6. After exchange the full electricity of battery, plug into the lock pin, shut to the hood cover, and plug into the pin of the battery hard.

## 4.5 The proportion and level of electrolyte

### 4.5.1 Inspect electrolyte

#### The battery without the dobber

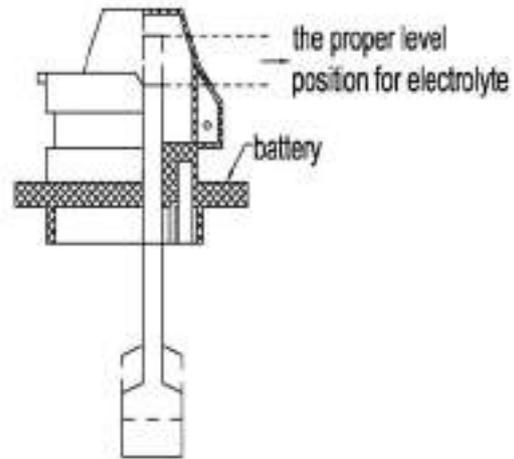
It is proper to pour the electrolyte 15-20mm above the electrode plate.

#### The battery with the dobber

Depending on the dobber of the winded cover to Read the level position of the distilled water.

#### Warning!

If the quantity of the electrolyte is lower, using the battery to cause the battery over-heat and shorten the battery's life.



### 4.5.2 Replenish the distilled water

· Wear the blinkers, rubber overshoes and rubber glove.

① Using the measuring cylinder to take out the distilled water with a certain quantity.

② Open the battery cover for every battery cell.

③ Imbibe distilled water with injector and then supply it into the battery.

The battery with the dobber

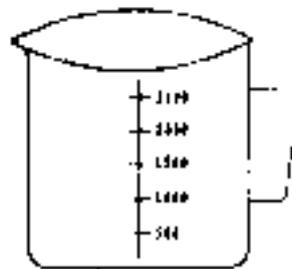
When the red dobber rises, the white line is appeared, please stop to replenish the distilled water.

The battery without the dobber

When the electrolyte is above 15-20mm for the electrode plate, stop to replenish the distilled water.

④ After replenishing the distilled water, close the pouring plug and battery cover.

⑤ Using the damp cloth to clean the surface for every battery cell.



measuring cylinder



injector

#### Warning!

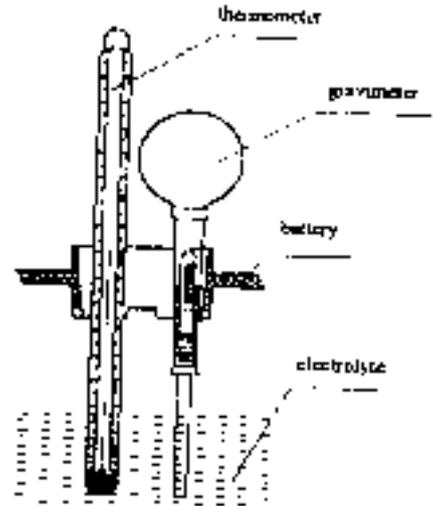
·It is not permitted to overrun the appointed tiptop level when replenishing the distilled water. Adding it too much will result in leakage of electrolyte, it will damage the truck when charging and discharging.

·draw it out with injector if adding it too much.

### 4.5.3 Reading the specific gravity

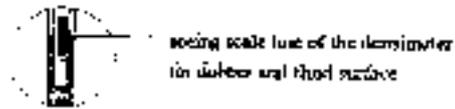
1) The specific gravity of the distilled water should change follow the temperature.

- ① Using thermometer to measure the temperature for electrode.
- ② Put the straw of densimeter into electrolyte vertically, extrude rubber tube with hand and the electrolyte will be sucked into the glasses tube and then the floater of the densimeter will float.
- ③ Numerate the reading of the densimeter.



#### Notice!

The dobber densimeter must rise uprightly without depending on the glass pipe.



2) Using the densimeter to Measuring the proportion

3) Conversion the specific gravity

The specific gravity at the standard temperature of 30°C should be converted as follow:

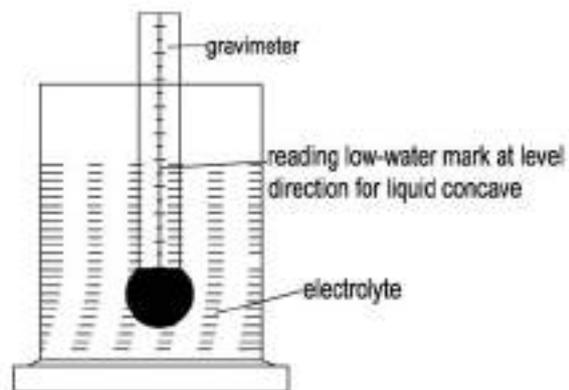
$$D_{30} = D_t + 0.0007(t - 30)$$

Thereinto :  $D_{30}$  —the specific gravity at the standard temperature of 30°C

$D_t$  —the specific gravity at the temperature of  $t^{\circ}\text{C}$  during convert

$t$  — the temperature of the distilled water during convert.

·The specific gravity that was in this book is measured all at the temperature of 30°C.



## 4.6 battery maintenance

### 1. Inspection for electrolyte

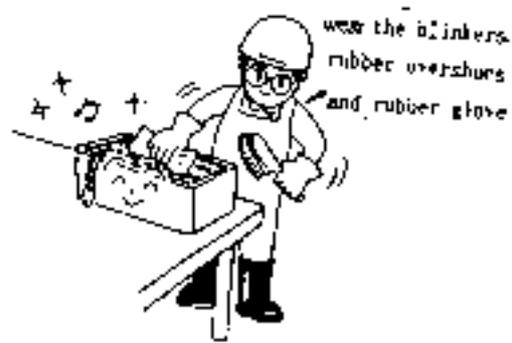
- Do not using forklift which is absent electrolyte.
- Inspection for electrolyte level every week.
- When electrolyte level is low, you must add distilled water to the level appointed.

### **Warning!**

- When the electrolyte is not fit , which heat batter and cause battery and electric system component to burn.
- Person touches vitriol in the electrolyte, which burn ones' body at once sees a doctor for emergency treatment.
- Splashing on the skin or eyes: wash 15~20 minutes in water.
- Splashing on the clothes: take it off immediately.
- Careless drinking: Instead of plenty of water and milk.
- Wearing glasses for protecting eyes、 rubber overshoes and rubber glove.

### **3. Remaining clean battery**

Keep dryness and cleanness on the surface of battery .the point for connecting with wire is also dry and clean. Operator must screw down the vent-cover of battery.



### **Warning!**

1. Do not use dry cloth or fibre cloth to clean the battery , avoiding static to bring the explosion.
2. Unfixing battery plug.
3. Cleaning with wet cloth.
4. Wearing glasses for protecting eyes 、 rubber overshoes and rubber glove.

### **4. Measure in summer**

In summer , water in the electrolyte is easy to evaporate , therefore , electrolyte must often be inspected if in the low electrolyte , you must add distilled water to the level appointed.

### **Warning!**

Filling with distilled water beyond the regulated range , spilt electrolyte will corrode and leak electricity.

### **5. Measure in winter**

- Keep effective and good surrounding for charging.
- For prevention discharge, when it is cold , unfixing the battery pin.
- Measures, such as, covering battery for warmth.

### **6. Equalize charging**

- During using of the battery, it often generates the equipoise phenomena about the voltage density and the capacity.
- Individual battery's voltage and electrode compares with most of other battery during the course of recharging, it rises lowly. During the course of recharging, its battery's

voltage and electrode specific gravity decline ahead than most of other batteries.

- Use equalize charging in the following case:
  - a. discharge voltage often drop down ending voltage;
  - b. discharging current value is often larger;
  - c. Not charging in time after discharging
  - d. The electrolyte is mixed with impurity of a little harm.
  - e. It often undercharge or do not using for a long time;
  - f. Take out the battery group, then check it or clean deposit.

#### **Equalize charging way:**

- ① First recharge the battery normal, as finishing it, and then rest 1 hour.
- ② Recharge it again by the value that belongs to the second normal recharging, until the electrode gives off a large number of bubbles, stop recharging for 1 hour.
- ③ Such as that and do it several times, until the voltage and the density keep fixedness and after for a while, if you recharge again, it will give off a large number of bubble.

#### **7. Opportunity charging**

• If a day's worth of work cannot be completed with one charging, carry out opportunity charging during breaks.

- When the temperature of circumstance is lower, carry out opportunity charging.

#### **8. Charging for long-term storage**

- Carry out equalize charging before storing.
- Carry out equalize charging once every 15 to 30 days during the following storage period.

## 5.Forklift Truck Maintenance

### 5.1 Operational safety and environmental protection

- The fork lift truck needs termly inspection and maintenance, make it in good working condition.
- Inspection and maintenance are usually ignored, you must find the problems and solve it in time.
- Use the orthodox spare part of E-P Equipment
- Don't use different oil when changing or adding oil.
- Forbid to repair the fork lift truck if you haven't been trained.
- Don't rave about oil out of date.
- Maintenance on schedule.
- After you make a maintenance, you'd better make a record.

#### Notice!

- No smoking.
- You should shut off key switch and pull off the plug before service. (except some trouble shooting) .
- Clean the electric part with compress air, do not with water.
- Do not place your hands, feet or any part of body into the gap between the mast and instrument.

### 5.2 Daily maintenance

You should check the truck and keep it in good condition always before starting it for safety. To assure the truck's safety is daily work and your duty.

1. Inspect oil leakage: include hydraulic oil, electrolyte and brake fluid.

Inspect connector of the oil pipe and storage battery to see whether there is any leakage. Use your hand to inspect, do not light a flame.

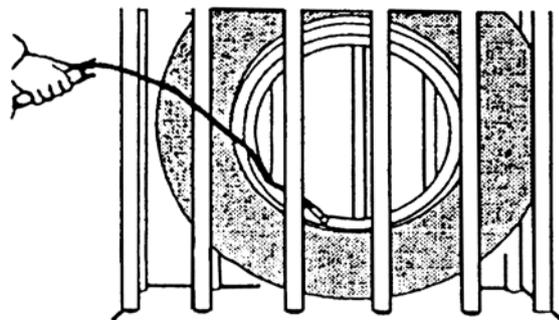
2. Inspect tyre

Turn the tire valve cap counter clock-wise and move it. Using a tire pressure gauge, measure the inflation pressure, and adjusting it to the specified pressure, if needed. After making sure there is no air leakage from the tire valve, reinstall the cap.

Check that each tire does not get damaged at the tread surface or side face or bending at the rim.

#### Warning!

- except checking lights and operating capability, you should shut off the key switch and pull out the plug before checking electric system.
- prohibit operate forklift with trouble.
- little trouble brings great accident.



### Warning!

Since the forklift truck needs tires that have a high inflation pressure to carry heavy loads, even a small bending of rims or damage at the tread surface could cause an accident.

When using an air compressor, first adjust the air pressure of the compressor. Failure to do so will cause a serious accident, since the compressor delivers the maximum pressure.

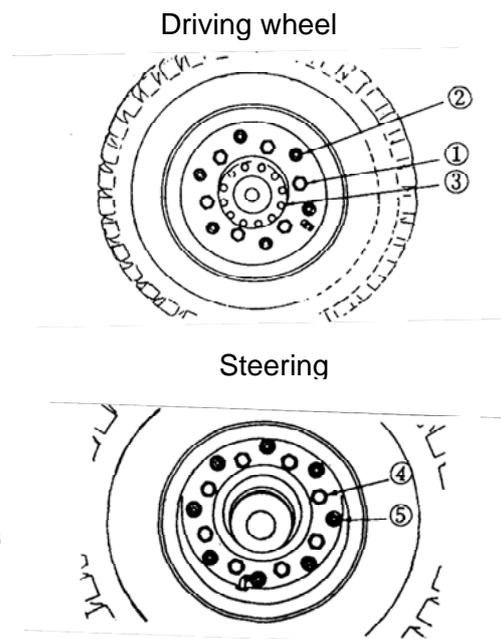
Put the tyre in the chain-link-cable barrier.

### 3. Replace tyre

When the tyre is damaged, you should replace it in time. Put a jack under the truck make the tyre just beyond ground and put a wood block under the chassis. Loosen nut, replace new tyre. Tighten the nut crossly and symmetrically.

- ① Hub nut
- ② Divided rim bolt
- ③ Drive shaft bolt
- ④ Hub nut
- ⑤ Divided rim bolt

Tighten torque refers to "5.3.12Table for bolt's tight torque",page 56.



### 4. Inspect torque of tyre

The tighten torque of front tyre is 140Nm, and rear tyre tighten torque is 121-162Nm. Please inspect and tighten nut on schedule.

### 5. Check brake pedal

Step the brake pedal, check it for slowness or block. The proper brake distance is 2.5m when free load. Adjust the height of pedal to 120~130mm. Adjust brake booster push rod clearance to 1-3mm.

### 6. Check the parking brake lever

The force of hand brake lever should be less than 300N. The force is adjusted by the screw on the top of lever. The force increases clock-wise screwing, it decreases counter lock-wise screw.

### Notice!

To step the brake pedal is helpful to tighten or loose the hand brake lever.

### 7. Check accelerate pedal

The acceleration changes as the stroke changes.

### 8. Drivers seat adjustment

Make sure the driver's seat is properly located. If not properly, shift the adjusting lever to the right and move the driver's seat to a position which provides easy access to all foot and hand controls. After adjustment, shake the driver's seat a little to be sure that it is securely locked.

### 9. Check battery

Check proportion of electrolyte. Refer to "battery" section.

Check the terminal for loose or damage. Otherwise it will be adjust or replace.

Tighten the lock and close the hood

Pull in the plug,turn on the key switch

### 10. Instrument check (include battery capacity and error diagnose)

Refer to "1.3.4 Instrument and display",page 6.

### 11. Lighting lever, tilting lever, attachment lever

Check the lifting lever and tilting lever for looseness. Return position well.

### 12. Mast

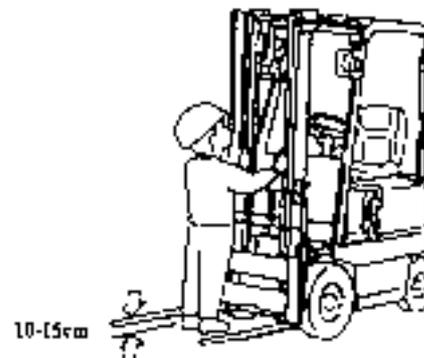
Actuate the lift and tilt levers to be certain that the carriage moves up and down properly and the mast can be tilted smoothly. Pay attention to system operating sound.

### 13. Mast lubrication

You should grease lubrication to mast on schedule.

### 14. Lift chain tension check

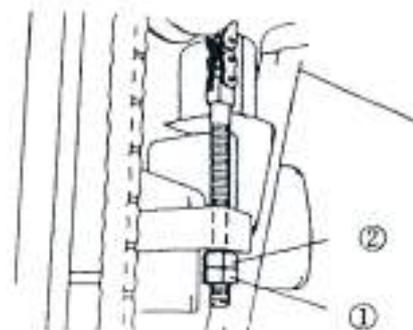
Check the tension and abnormality of the lift chains.



① To check the tension, raised the fork about 10-15 cm above the ground.

② And push the middle of the chain with the thumb. Make certain the tension for the right and left chains are even.

③ If uneven tension is found, loosen the lock nut (1) of anchor pin and adjust the chain, turning the adjusting nut (2) of the chain anchor pin.



15. Check steering system

Turn the wheel right and left separately to check steering system.

16. Turn signal, horn and other lamp check

Make sure that the turn signal operates properly by moving the turn signal lever.

Make sure that the sound of horn is properly by press the horn button

Check the other lamp and back-up buzzer.

17. Battery maintenance

Refer to "4.Battery Maintenance & Charging", page34.

18. Other

For instance, pay attention to sound

### 5.3 Termly inspection and maintenance

#### 5.3.1 Storage battery

○ — Check, revise, adjust  
 × — Replace

Checking item	Service required	Tools	Daily (8 hrs)	weekly (50 hrs)	Monthly (200hrs)	Trimonthly (600 hrs)	Semiannually (1200 hrs)
Storage battery	Electrolyte level	Eyeballing		○	○	○	○
	Electrolyte proportion	Densimeter		○	○	○	○
	Battery quantity		○	○	○	○	○
	Terminal looseness		○	○	○	○	○
	Looseness of connecting wire		○	○	○	○	○
	cleanness of the battery surface		○	○	○	○	○
	If there is tool on the battery.		○	○	○	○	○
	The tightness of air cap			○			
	Far away from firing		○	○	○	○	○

### 5.3.2 Controller

Checking Item	Service Required	Tools	Daily (8 hrs)	Weekly (50 hrs)	Monthly (200 hrs)	Trimonthly (600 hrs)	Semiannually (1200 hrs)
Controller	Check connector for worn					○	○
	Check contactor for running					○	○
	Check inching switch for running					○	○
	Check the connection among motor, battery and power unit.					○	○
	Check the controller error diagnose system						First time 2 years

### 5.3.3 Motor

Checking Item	Service Required	Tools	Daily (8 hrs)	Weekly (50 hrs)	Monthly (200 hrs)	Trimonthly (600 hrs)	Semiannually (1200 hrs)
Motor	Clean the foreign body on the motor				○	○	○
	Clean or replace the bearing						○
	If the connection is correct and firm.				○	○	○

### 5.3.4 Driving system

Checking Item	Service required	Tools	Daily (8 hrs)	Weekly (50 hrs)	Monthly (200hrs)	Trimonthly (600 hrs)	Semiannually (1200 hrs)
Transmission	Check for noise		○	○	○	○	○
	Check for oil leaks		○	○	○	○	○
	Change oil						✓
Driving axle (front axle)	Check wheel hub bearing for looseness, noise			○	○	○	○
	Clean and replace grease					×	×
	Check the axle body for deformation, crack or damage				○	○	○
	Check bolts which is connected to the truck body for looseness				○	○	○
	Check wheel hub bolts for tighten torque	Torque wrench	○	○	○	○	○

### 5.3.5 Wheels (Front, Rear Wheels)

Checking Item	Service required	Tools	Daily (8 hrs)	Weekly (50 hrs)	Monthly (200hrs)	Trimonthly (600 hrs)	Semiannually (1200 hrs)
Tyre	Check for abrasion, cracks or damage		○	○	○	○	○
	Check for spikes, stones or foreign matter				○	○	○
	Check the wheel hub for damage		○	○	○	○	○
	Check the split body wheel hub-bolts for looseness	Test hammer	○	○	○	○	○

### 5.3.6 Steering System

Checking Item	Service required	Tools	Daily (8 hrs)	Weekly (50 hrs)	Monthly (200hrs)	Trimonthly (600 hrs)	Semiannual y (1200 hrs)
Steering wheel	Check for peripheral play		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Check for vertical looseness		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Check for sideways looseness		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Check for proper operation		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Steering Gear box and valve	Check mounting bolts for looseness				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Steering axle	Check king pins for looseness or damage				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Check for deflection, deformation ,cracks or damage				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Check for mounting condition	Test hammer			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Steering cylinder	Check for operation		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Check for oil leaks		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Check for mounting parts and joints for looseness				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Check sensor wire connection					<input type="radio"/>	<input type="radio"/>

### 5.3.7 Brake system

Checking item	Service required	Tools	Daily (8 hrs)	weekly (50 hrs)	Monthly (200hrs)	Trimonthly (600 hrs)	Semiannually (1200 hrs)
Brake pedal	Check for free travel	Scale	○	○	○	○	○
	Check for pedal travel		○	○	○	○	○
	Check for proper operation		○	○	○	○	○
	Check for air mixed in brake piping		○	○	○	○	○
Parking brake	Check for lever is securely locked and has sufficient lever stroke		○	○	○	○	○
	Check for proper operation		○	○	○	○	○
Rod, Cable, etc	Check connections for looseness				○	○	○
Hoses and Pipes	Check for damage, leakage or collapse				○	○	○
	Check for loose connection or clamping parts				○	○	○
Brake Master Cylinder, Wheel Cylinder	Check for fluid leaks				○	○	○
	Check for fluid level, Change brake fluid		○	○	○		×
	Check master cylinder and wheel cylinder for proper operation						○
	Check master cylinder and wheel cylinders for fluid leaks or damage						○
	Check master cylinder piston cup, and check valve for wear or damage change						×

### 5.3.8 Hydraulic system

Checking item	Service required	Tools	Daily (8 hrs)	weekly (50 hrs)	Monthly (200hrs)	Trimonthly (600 hrs)	Semiannual y (1200 hrs)
Hydraulic reservoir	Check for oil level, Change oil		○	○	○	○	×
	Clean suction strainer						○
	Drain for foreign matter						○
Control lever	Check levers for looseness at link		○	○	○	○	○
	Check for proper operation		○	○	○	○	○
Control valve	Check for oil leaks		○	○	○	○	○
	Check relief valve and tilt lock valve for proper operation				○	○	○
	Measure relief pressure	Oil press gauge					○
Hose, Piping Hose Reel & Swivel Joint	Check for oil leaks, looseness, collapse, deformation and damage				○	○	○
	Replace hoses.						× 1-2 years
Hydraulic Pump	Check hydraulic pump for oil leaks or noise		○	○	○	○	○
	Check pump drive gear for wear			×	○	○	○

### 5.3.9 Lifting system

Checking item	Service required	Tools	Daily (8 hrs)	weekly (50 hrs)	Monthly (200hrs)	Trimonthly (600 hrs)	Semiannually (1200 hrs)
Chains & Sheave	Check chain for tension, damage or rust		○	○	○	○	○
	Lubrication of chains				○	○	○
	Check connection of chain anchor pin and chain for looseness				○	○	○
	Check sheaves for deformation or damage				○	○	○
	Check sheave bearings for looseness				○	○	○
Optional Attachment	<b>Perform general inspection</b>				○	○	○
Lifting cylinder	Check piston rod, rod screw and connection for looseness deformation or damage	Test hammer	○	○	○	○	○
	Check cylinders for proper operation		○	○	○	○	○
	Check for oil leaks		○	○	○	○	○
	Check pins and cylinder bushings for wear or damage				○	○	○
Fork	Check forks for damage, deformation or wear				○	○	○
	Check for stopper pins for damage or wear					○	○
	Check fork base and hook welding for defective cracks or wear				○	○	○
	Check tilt cylinder bracket and mast for defective weld ,cracks or damage				○	○	○

Checking item	Service required	Tools	Daily (8 hrs)	weekly (50 hrs)	Monthly (200hrs)	Trimonthly (600 hrs)	Semiannually (1200 hrs)
Bracket	Check tilt cylinder bracket and mast for defective weld ,cracks or damage				○	○	○
	Check outer and inner masts for defective weld, cracks or damage				○	○	○
	Check for defective weld, cracks or damage of lift bracket				○	○	○
	Check roller bearings for looseness				○	○	○
	Check mast support bushings for wear or damage						○
	Check mast support cap bolts for looseness				○ (for 1st time only)		○
	Check lift cylinder tall bolts, piston rod head bolts, U-bolts, and piston head guide bolts for looseness	Test hammer			○ (for 1st time only)		○
	Check rollers, roller pins and welded parts for cracks or damage				○	○	○

### 5.3.10 Additional

Checking item	Service required	Tools	Daily (8 hrs)	weekly (50 hrs)	Monthly (200hrs)	Trimonthly (600 hrs)	Semiannually (1200 hrs)
Overhead Guard & Load Backrest	Check for tight installation	Test hammer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Check for deformation, cracks or damage		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Turn signal	Check for proper operation and tight installation		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Horn	Check for proper operation and tight installation		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Light & Lamps	Check for proper operation and tight installation		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buck-up Buzzer	Check for proper operation and tight installation		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meters	Check meters for proper operation		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
wire	Wire damage or looseness			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<b>Looseness of Electric circuit Joint</b>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 5.3.11 Replace the key safe parts termly

- Some parts should be checked termly to detect the damage , for improving the safety more, users should replace the parts termly which is listed in the table as follows .
- If the parts is abnormal before the replacing time is coming ,it should be replaced immediately .

Key safe part's description	Term of using (year)
Brake hose or tube	1~2
Hydraulic hose for lifting system	1~2
Lifting chain	2~4
High-pressure hose , hose for hydraulic system	2
Brake oil cup	2~4
Brake master cylinder, brake slave cylinder cover and dust sleeve	1
Inner hermetic, rubber matter	2

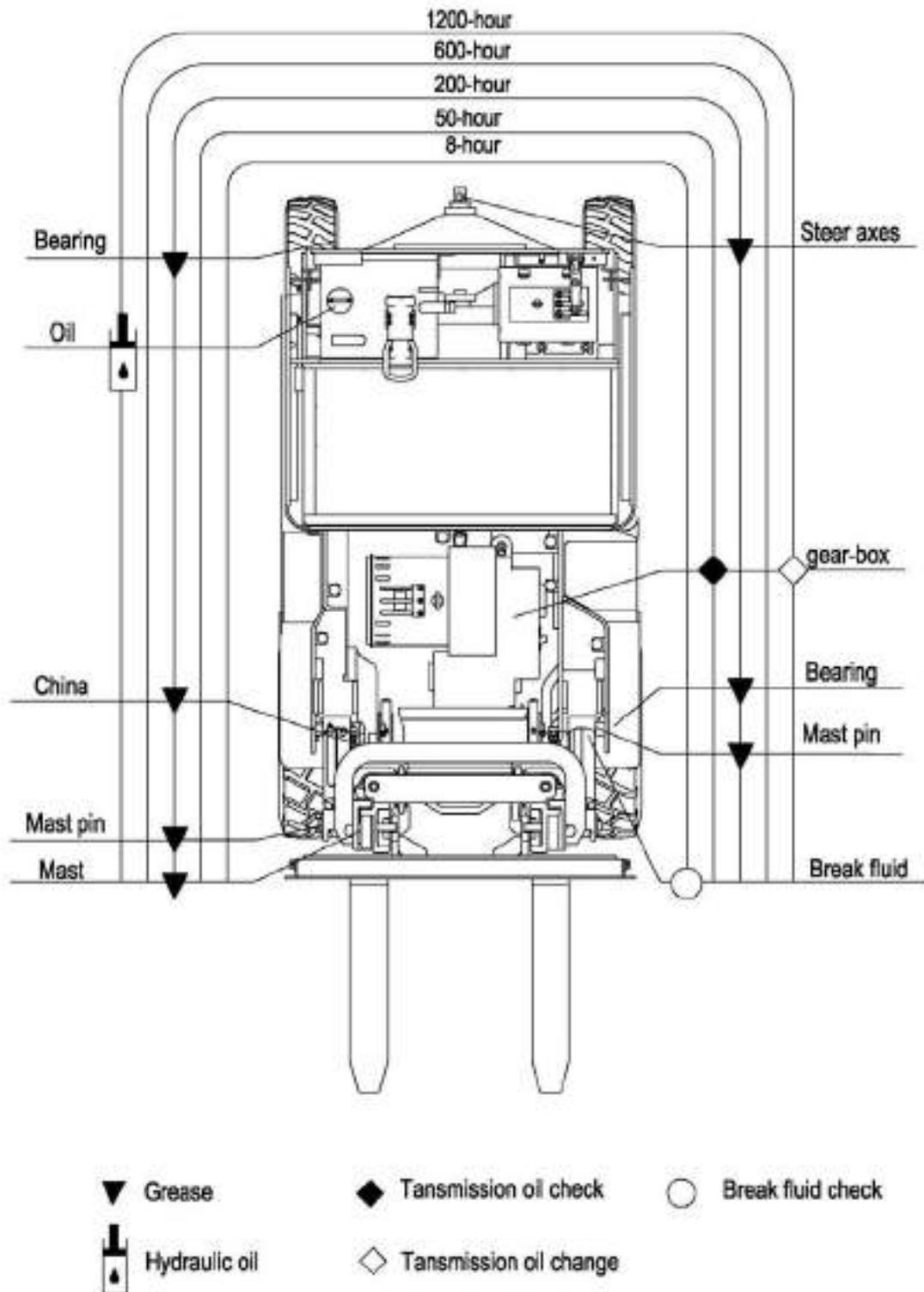
**5.3.12 Table for bolt's tight torque**

Unit N·m

Bolt's diameter	Grade					
	4.6	5.6	6.8	8.8	10.9	12.9
6	4~5	5~7	7~9	9~12	13~16	16~21
8	10~12	12~15	17~23	22~30	30~36	38~51
10	20~25	25~32	33~45	45~59	65~78	75~100
12	36~45	45~55	58~78	78~104	110~130	131~175
14	55~70	70~90	93~124	124~165	180~201	209~278
16	90~110	110~140	145~193	193~275	280~330	326~434
18	120~150	150~190	199~264	264~354	380~450	448~597
20	170~210	210~270	282~376	376~502	540~650	635~847
22	230~290	290~350	384~512	512~683	740~880	864~1152
24	300~377	370~450	488~650	651~868	940~1120	1098~1464
27	450~530	550~700	714~952	952~1269	1400~1650	1606~2142
30	540~680	680~850	969~1293	1293~1723	1700~2000	2181~2908
33	670~880	825~1100	1319~1759	1759~2345	2473~3298	2968~3958
36	900~1100	1120~1400	1694~2259	2259~3012	2800~3350	3812~5012
39	928~1237	1160~1546	1559~2079	2923~3898	4111~5481	4953~6577

Note: The bolt is commonly.

## 5.4 Lubrication Schedule



### 5.4.1 Fuels, coolants and lubricants

**Handling consumables:** Consumables must always be handled correctly. Follow the manufacturer's instructions.

Improper handling is hazardous to health, life and the environment. Consumables must only be stored in appropriate containers. They may be flammable and must therefore not come into contact with hot components or naked flames.

Only use clean containers when filling up with consumables. Do not mix consumables of different grades. The only exception to this is when mixing is expressly stipulated in the Operating Instructions.

Avoid spillage. Spilled liquids must be removed immediately with suitable bonding agents and the bonding agent/consumable mixture must be disposed of in accordance with regulations.

Name	Trademark, code name	capacity (L)	Notice
Hydraulic oil	HM46#	40.4	1.5-2.0t
		43.3	2.5-3.5t
Gear oil	85W-90GL-5	4.5	
Brake Fluid	ZSM207DOT3	1.5	
Lubrication grease	Polylub GA 352P		

### 5.4.2 Fuels, coolants and lubricants check

#### 1. Brake fluid level check

Open the front soleplate. Check the fluid level in the brake fluid reservoir. The level should be between the two seams of the reservoir. When adding fluid, due care should be taken to prevent air entering the brake tube.

#### **Warning!**

Don't spatter the brake oil onto the surface of paint otherwise the paint will be damaged.

When adding fluid, due care should be taken to prevent dirt or water from entering the reservoir.

#### 2. Check hydraulic oil

Loosen the cap of hydraulic oil inside of right frame, pull out dipstick and check if the oil level is between the scales. Add oil when low.

#### 3. Replace hydraulic oil

Replace hydraulic oil once half year on schedule. When replaced, first loosen the oil plug at the bottom of the hydraulic oil tank. Push out the oil dipstick and put an oil pan below the plug to drain the waste oil. Dump and age the waste oil, you should obey the rule of local environment protection.

#### 4. Check and replace gear oil

According to the Lubrication Schedule you need to check gear oil every 200 hour. It do not need add new gear oil except gear oil use up.

Change gear oil every 1200 hour. Please add gear oil after drain the waste oil.

### 5.5 Deposit

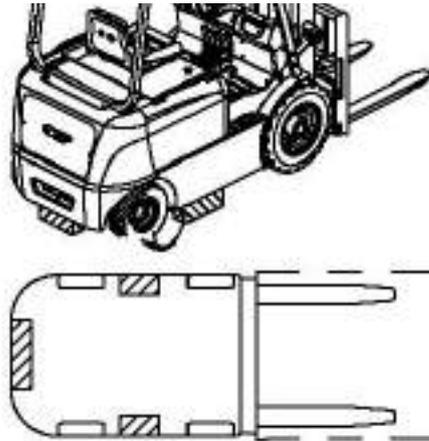
#### 5.5.1 Deposit the truck for a short time

- ① Park your truck on a level ground-preferably in a wide area. If parking on a slope is unavoidable, position the truck so that it crosses the slope and block the wheels to prevent accidental roll.
- ② Make sure the shift lever on neutral position.
- ③ Pull up the lever of the hand brake.
- ④ Shut off switch and control the lift and tilt lever several times so that the inner pressure in the hydraulic tube will decrease.
- ⑤ Unplug the power outlet
- ⑥ Take down the key and deposit it in a safe position.

#### 5.5.2 Deposit the truck for a long time

On the basic of the “deposit” you should do these checks and maintain additional:

- ① Take out plug to prevent discharge and stay to dark place.
- ② Brush antirust oil on those parts which is exposed such as piston rod and axle.
- ③ Put a cloth on vent-plug.
- ④ Mantle the truck with mantle.
- ⑤ Add grease at all lubricate point.
- ⑥ Fill up the truck body and counter weight with block to reduce bearing of the two rear wheels.



#### **Warning!**

- a. The block must be single and hard enough to support the truck.
- e. Don't use a block with high than 300mm (11.81 inch) .
- c. Lift the truck to height of placing on the bearing block.
- d. Place two same size blocks under the left and right sides of the truck.
- e. After supporting the truck with block, swing the truck forward, backward, left and right, check its safety.

- ⑦ Run the truck once a week. Lift the fork to the highest height some times.
- ⑧ Check proportion and level of electrolyte.
- ⑨ Charge the battery equally once a month.

**Warning!**

- Carry out equalize charging before storing.
- Carry out equalize charging once every 15 to 30 days during the following storage period.

## 6. Troubleshooting

### 6.1 Drive system

4 wheel counter balanced battery forklift truck adapt structure of front two motor driven, each separated excited driven motor rated capacity see "1.5.1 Performance data for standard trucks" on page 18.

Trouble	Probably cause	Method of troubleshooting
Too much noise When traveling or change direction	Gear clearance is too big.	Adjust.
	Too much worn of gear.	Replace.
Too much noise when traveling	Oil level is low.	Add oil.
	Gear clearance is too big.	Adjust.
	Too much worn of gear.	Replace.

## 6.2 Steering system

Steering system include rear steering axle and steering device.

### Trouble Diagnostic:

Condition	Probable cause	Corrective action
Leaking in steering device	1. Oil leaking occurs between sections	Tighten nuts or replace seals
	2. Damage of seal in shift necking	Replace
	3. Damage of seal in safety valve	Replace
	4. Not flat of shim in limiting position bolt	Grinding shim or replace it
High effort for steering of failure to rotate steering wheel	1. Not enough oil supported by pump	Adjust control valve
	2. Air enters in the line of steering gear	Bleed the air
	3. Not enough oil in tank	Fill oil
	4. Too low pressure setting of the relief valve in the dividing valve or blocking in valve	Adjust pressure or clear dirt
	5. Too high viscosity oil	Replace wrong oil
	6. The steering fails to return to its natural position due to breakage of locking spring or insufficient spring pressure	Replace wrong spring
	7. Break or deform of swivel pin	Replace it
	8. Break or deform of coupling	Replace coupling
	9. Wrong in spring or safety valve	Replace spring
	10. Too much internal leakage in the steering cylinder	Replace seal or cylinder
	11. Deform of steering axle	Repair it
Free play in hand wheel and wobble in wheels	1. Damage of bearing fitted in swivel pin	Replace bearing
	2. Too much clearance in rim bearing	Adjust
	3. Too much clearance between steering rotator and stator and descend of volume efficiency	Replace rotator or stator
Front Left and right wheel does not match to rear wheel	Controller parameter is not correct.	Adjust

### 6.3 Brake system

The hand brake device adopts a hand-pulling soft brake wire device. It makes use of auto-assist pressure linings type brake together with foot brake. Only when parking truck, use the hand brake. If it occurs for foot brake malfunction, use hand brake to stop the truck.

The force of hand brake lever can adjust by screw. When driving screw clockwise, pull fore increase, otherwise, when driving screw anti-clockwise, pull fore decrease. The pull force is limited in the range of 100~300N.

#### Trouble diagnostic

Condition	Probable cause	Corrective action
Insufficient brake force	Oil leakage in brake lines. Air in brake lines. Water or oil on linings. Uneven wear or contact of brake linings. Improper functioning of master cylinder or wheel cylinder. Clogged oil lines.	Correct and replenish. Bleed air. Clean or replace. Grind or replace. Correct or replace. Clean.
Brake dragging	No free play of brake pedal. Improper shoe sliding. Improper operation of wheel cylinder. Faulty piston cup. Weak or broken return springs. Clogged master cylinder return port. Clogged oil lines. Wheel bearing out of adjusting.	Adjust. Adjust. Adjust or replace. Replace. Replace. Clean. Clean. Adjust or replace.

### 6.4 Hydraulic system

The high pressure oil from main pump goes to control valve, then goes to lifting cylinder or tilting cylinder. When lifting and tilting spool is in neutral, the lifting pump is out off work. When pulling lifting spool, high pressure oil goes to the bottom of lifting cylinder piston and then push piston rod under. When pushing lifting spool, it is that bottom of lifting cylinder piston connects with low pressure line and then piston rod drops by deadweight and weight of cargo. In this time, oil from lifting cylinder goes by unidirectional speed limiting valve so as to control the falling speed, then the lifting pump out off work also. When operating tilting spool, high pressure oil goes to one house of tilting cylinder and another connects with low pressure line so as to make mast tilt forward or backward.

### 6.4.1 Main pump

<b>Trouble</b>	<b>Probable cause</b>	<b>Corrective action</b>
No oil from oil pump	Low oil level in tank.	Add oil to specified level.
	Clogged suction pipe or strainer.	Clean oil line and tank. If oil is dirty, change.
Low discharge pressure on oil pump.	Worn bearing damaged backup ring and O-ring.	Replace faulty parts.
	Maladjusted relief valve.	Readjust to specified pressure using pressure gauge.
	Air in oil pump.	Retighten suction side pipe. Add oil in oil tank. Checks pump oil seal. Do not operate pump until bubbles in tank disappear.
Noisy oil pump	Cavitation due to crushed suction hose or clogged strainer.	Adjust or replace crushed hose and clean strainer.
	Air being sucked from loose suction side joint.	Retighten each joint.
	Cavitation due to too high oil viscosity.	·replace with new oil having proper viscosity for temperature at which pump is to be operate. ·to operate when oil temperature is normal.
	Bubbles in hydraulic oil.	Determine cause of bubbles and remedy.
Oil leaking from oil pump	Faulty oil seal on pump, faulty O-ring or worn sliding surfaces on pump.	Replace faulty parts.

### 6.4.2 Control valve

<b>Trouble</b>	<b>Probable cause</b>	<b>Corrective action</b>
Pressure of relief valve is not steady or too low.	Loose of pressure-adjust screw.	Readjusted and retighten.
	Distorted or damaged pressure-adjust spring.	Replace.
	Worn or blocked relief valve core.	Replace or clean.
	Pump abated.	Examine and repair pump.

<b>Trouble</b>	<b>Probable cause</b>	<b>Corrective action</b>
Fork tilt forward when control lever is used while engine is off.	Worn or damaged tilt lock valve.	Replace valve core and tilt lock valve as an assemble.
	Broken tilting lock spring.	Replace spring.
	Damaged tilt valve plunger O-ring.	Replace O-ring.
Mast is unstable when tilting forward.	Malfunctioning tilt relief valve.	Replace tilt relief valve assembly.
Lowering distance of mast is big when spool valve is in the center.	Valve body and spool valve is worn and clearance between them is too great.	Replace spool valve with specified clearance.
	Spool valve is not in center.	Keep being in the center.
	Cylinder seal abated.	Examine and repair cylinder.
	Taper valve is worn or blocked by dirt.	Replace or clean taper valve.
Spool valve is not return neutral position.	Damaged or distorted reposition-spring.	Replace spring.
	Dirt exists between valve body and spool valve.	Clean.
	Blocked control device.	Adjusted.
	Not coaxial parts at reposition	Reinstall, be coaxial
Leakage	Damaged O-ring.	Replace.
	Faulty seal of joint.	Check and retighten.
	Loose seal plate.	Clean seal plate and retighten bolts.
	Loosed lock-nut of relief valve and connect-nut between plate and plate.	Tighten.

### Adjusting the pressure of the main relieve valve

The pressure of the main relieve valve is all ready adjusted in the factory, and it can't be adjusted generally. The following is an example of 1.8t truck to specify how to adjust the pressure.

- (1). Put 125 percent of the rated load (2000kg) on the forklift stable.
- (2). Step the accelerated pedal to the end, control the lift pole, if the forklift can get the height of 300mm, the main relieve valve is all right. Otherwise, adjust it as step (3).
- (3). If the forklift can't work, enhance the pressure main relieve valve, remove the front soleplate, loosen the tightening nut of the main relieve valve, screw the adjusting nut clockwise to enhance the pressure of the main relieve valve. If the height of lift is higher than 300mm, screw the adjust nut anti-clockwise to reduce the pressure.
- (4). Step the accelerated pedal to the end to make the forklift in the height range of 0-300mm. Otherwise, adjust it as step (3).
- (5). Retighten the tightening nut, fix it on the front soleplate.

#### Warning !

- The load should be put stably.
- Don't adjust if the pressure is already adjusted correctly.

### 6.5 Lifting system

Condition	Probable cause	Corrective action
Fork arm carrier or mast tilt by itself.	1. Tilt cylinder and ring abraded excessively	Replace piston ring tilt cylinder.
	2. The hydraulic control valve spring is inoperative.	Replace it.
The fork arms carrier moves up and down sluggishly.	1. Caused by piston jamming or bent piston rod.	Replace the faulty parts.
	2. Too much dirt is accumulated in the cylinder.	Strip it down and clean.
Forks are lifted or lowered unsmooth.	1. Carriage bracket assembly out of adjustment.	Adjust clearance with thrust metal and carriage side roller.
	2. Insufficient clearance between inner and outer masts or rollers and mast.	Adjust clearance with rollers.
	3. Biting foreign materials between moving parts.	Remove foreign materials.
	4. Insufficient lubrication.	Apply grease on contact surfaces of sliding parts. (butter)
	5. Bent carriage bracket assembly.	Repair or replace.
Forks are lifted unevenly	1. Lift chains out of adjustable.	Adjust lift chains.

<b>Condition</b>	<b>Probable cause</b>	<b>Corrective action</b>
Lift roller does not rotate	1. Grease stiffened or dirt accumulated on lift roller and mast sliding surfaces.	Clean and lubricate lift rollers.
	2. Improperly adjusted lift roller.	Adjust.
Excessive mast noise	1. Insufficient lubrication.	Lubricate.
	2. Improperly adjusted lift roller, side roller and back-up metal.	Adjust.
	3. Rubber pad on lower of outer mast is useless for container fork lift truck.	By adjusting shims and rubber pad, piston rod is in touch with bottom of cylinder body after inner mast is in touch with rubber pad.
Insufficient lift power or no lift movement.	1 . Excessive wear occurs between the oil pump body and gears, causing too much clearance.	Replace the worn parts or the oil pump.
	2. The lifting jack piston Yx-ring has worn, resulting in excessive inner leaks.	Replace Yx-ring.
	3. Springs of the multiple control valve and its relief valve are inoperative oil leaks.	Replace.
	4.Excessive wear occurs of the hydraulic control valve, resulting in excessive oil leaks.	Replace.
	5. Oil leaks occur between the hydraulic control valve sections.	Dismantle for regrinding the joint surfaces and reassemble the valve.
	6. Leakage occur in the hydraulic pipe.	Tighten the joint nuts and inspect the seal for damage.
	7. The hydraulic oil temperature is too high. Oil viscosity is too low and the rate is insufficient.	Change the wrong hydraulic oil or stop operation for reducing the oil temperature. Find out the reasons for high oil temperature and eliminate the trouble.
	8. The load carried is beyond the designed capacity.	Observe the lifting capacity limit.

## 6.6 FV Series Electrical system

### 6.6.1 "Dualac2" and "Dualac2&hp" Inverter diagnostic traction related fault codes

Code	Alarm string	master	slave	Controller status			description	Condition that has to occur to come out from alarm status
				Init	Ready	Motor running		
8	"WATCH DOG"	x	x	x	x	x	<u>ALARM</u> the watchdog has been triggered	-If the alarm is present in Init status, remove the alarm condition -If the alarm has occurred in <u>ready</u> or <u>running</u> mode, it is necessary to remove alarm condition and to activate a traction request.
17	"LOGIC FAILURE # 3"	x	x		x		<u>ALARM</u> failure in over-load protection hw circuit	To remove alarm condition + activation of traction request
18	"LOGIC FAILURE # 2"	x	x	x			<u>ALARM</u> failure in U,V,W voltage feedback circuit	To remove alarm condition + activation of traction request
19	"LOGIC FAILURE # 1"	x	x	x	x	x	<u>ALARM</u> an overvoltage or undervolt. Condition has been detected	To recycle the key switch
30	"VMN LOW"	x	x	x	x	x	<u>ALARM</u> Wrong voltage on motor power outputs; failure in the power section or in the MOSFET driver circuit or in the motor	-If the alarm is present in Init status, remove the alarm condition -If the alarm has occurred in <u>ready</u> or <u>running</u> mode, it is necessary to remove alarm condition and to activate a traction request.

Code	Alarm string	master	slave	Controller status			description	Condition that has to occur to come out from alarm status
				Init	Ready	Motor running		
31	"VMN HIGHT"	x	x	x	x		<u>ALARM</u> wrong voltage on motor power outputs; failure in the power section or in the MOSFET driver circuit or in the motor	-If the alarm is present in Init status, remove the alarm condition -If the alarm has occurred in <u>ready</u> or <u>running</u> mode , it is necessary to remove alarm condition and to activate a traction request.
53	"STBY I HIGHT"	x	x	x	x		<u>ALARM</u> Wrong voltage in the current sensor feedback circuit	If the alarm is present in Init status, remove the alarm condition -If the alarm has occurred in <u>ready</u> or running mode, it is necessary to remove alarm condition and to activate a traction request.
60	"CAP CHARGE"	x	x	x			<u>ALARM</u> power capacitor voltage does not increase when the key is turned ON; failure in the power section , or in the logic PCB ,or in the driver PBC ,or in the motor	To remove alarm condition
74	"DRIVER SHORTED"	x		x	x	x	<u>ALARM</u> line contactor coil driver is shorted	If the alarm is present in Init status, remove the alarm cause -If the alarm has occurred in <u>ready</u> or running mode, it is necessary to remove alarm cause and to activate a traction request.
75	"CONTACTOR DRIVER"	x			x	x	<u>ALARM</u> line contactor coil driver is open (not able to drive the coil to the correct voltage)	To remove alarm cause and to activate traction request

Code	Alarm string	master	slave	Controller status			description	Condition that has to occur to come out from alarm status
				Init	Ready	Motor running		
76	"COIL SHORTED"	x		x	x	x	<u>ALARM</u> -Init the LC and EB coil driver protection circuit is damaged - <u>ready</u> or running short on LC coil or EB coil	If the alarm is present in Init status, remove the alarm cause -If the alarm has occurred in <u>ready</u> or <u>running</u> mode, it is necessary to remove alarm cause and to activate a traction request.
37	"CONTACTOR CLOSED"	x		x			<u>ALARM</u> line contactor power contact is stuck	To remove alarm cause within a timeout ;if the timeout is elapsed, it is necessary to remove alarm cause and to activate traction request
38	"CONTACTOR OPEN"	x		x			<u>ALARM</u> line contactor power contact dose not pull-in	To remove alarm cause within a timeout ;if the timeout is elapsed, it is necessary to recycle the key
82	"ENCODER ERROR"	x	x			x	<u>ALARM</u> motor speed sensor (encoder) does not work properly	To recycle the key
86	"PEDAL WIRE KO"		x	x	x	x	<u>ALARM</u> fault in accelerator negative (NPOT) input circuit	To remove alarm cause and activate a traction request
245	"WRONG SET BATTERY"	x		x			<u>ALARM</u> the battery voltage dose not correspond to "SET BATTERY" parameters	To remove the alarm cause

Code	Alarm string	master	slave	Controller status			description	Condition that has to occur to come out from alarm status
				Init	Ready	Motor running		
246	"SLAVE KO"	x		x	x	x	<u>ALARM</u> Traction $\mu$ C detects a pump $\mu$ C malfunction	To recycle the key
246	"MASTER KO"		x	x	x	x	<u>ALARM</u> Pump $\mu$ C detects a traction $\mu$ C malfunction or a mismatch between input status and Master commands(via CAN bus)	To recycle the key
250	"INPUTMISMATCH"		x	x	x	x	<u>ALARM</u> Pump $\mu$ C has detects a mismatch between input status and input status transmitted via CAN bus by Traction $\mu$ C	To recycle the key
253	"AUX OUTPUT KO"	x		x	x	x	<u>ALARM</u> EB coil driver shorted or open	If the alarm is present in Init status, remove the alarm cause -If the alarm has occurred in stby or running mode, it is necessary to remove alarm cause and to activate a traction request.
13	"EEPROM KO"	x		x	x	x	<u>Warning</u> Eeprom fault , controller will use default parameters	To remove Warning cause
61	"HIGHT TEMPERATURE"	x	x	x	x	x	<u>Warning</u> Traction or Pump or both temperature higher than 75°C	To remove Warning cause

Code	Alarm string	master	slave	Controller status			description	Condition that has to occur to come out from alarm status
				Init	Ready	Motor running		
65	"MOTOR TEMPERATURE"	×		×	×	×	<u>Warning</u> Right or lift or both temperature high	To remove Warning cause
66	"BATTERY LOW"	×		×	×	×	<u>Warning</u> battery charge level below 20 %	To remove Warning cause
78	"VACC NOT OK"	×		×	×		<u>Warning</u> accelerator signal(CPOT) voltage higher than VACC MIN +1V while the traction enable switch is open	To remove Warning cause
79	"INCORRECT START"	×		×	×	×	<u>Warning</u> Wrong traction request sequence	To remove Warning cause
80	"FORWARD+BACKWARD"	×		×	×	×	<u>Warning</u> Forward and reverse input are both active	To remove Warning cause
249	"THERMIAC SENSOR KO"	×	×	×	×	×	<u>Warning</u> Traction or Pump temperature sensor is out of range	To remove Warning cause
251	"WATTING FOR NODE # 5"	×		×	×	×	<u>Warning</u> Traction μC signal that Pump μC is in alarm status	To remove Warning cause
251	"WATTING FOR NODE # 3"		×	×	×	×	<u>Warning</u> Pump μC signal that Traction μC is in alarm status	To remove Warning cause
247	"NO CAN MESSAGE # 5"	×		×	×	×	<u>ALARM</u> Traction has lost can communication with the Pump	To remove Warning cause
247	"NO CAN MESSAGE # 4"		×	×	×	×	<u>ALARM</u> Pump has lost can communication with the Traction	To remove Warning cause

242	PUMP WARNING	×		×	×	×	<u>Warning:</u> Traction controller signals that Pump $\mu$ C has detected a fault in pump chopper.	To remove Warning cause
243	PUMP INC. START		×	×	×		<u>Warning:</u> pump incorrect start sequence	To remove Warning cause
244	PUMP VACC NOT OK		×	×	×		<u>Warning:</u> pump accelerator voltage is 1V greater than the minimum value programmed	To remove Warning cause

## **6.6.2 Analysis of traction related alarms displayed on console**

### **1. WATCH DOG**

It is a self-diagnosing test within the logic between Master and Slave  $\mu$ controllers. This alarm could also be caused by a CAN bus malfunctioning, which blinds Traction-Pump communication. So, before replacing the controller, check the CAN bus.

### **2. LOGIC FAILURE #3**

Fault in the hardware section of the logic board which manages the hardware current protection. Replace the logic board.

### **3. LOGIC FAILURE #2**

Fault in the hardware section of the logic board which manages the phase' s voltage feedback. Replace the logic board.

### **4. LOGIC FAILURE #1**

This alarm signals that the undervoltage / overvoltage protection interrupt has been triggered. Two possible reasons:

- a. A real undervoltage / overvoltage situation happened.
- b. Fault in the hardware section of the logic board which manages the overvoltage protection. Replace the logic card.

### **5. VMN LOW, VMN HIGH**

The test is carried out during initial diagnosis and in standby. Possible causes:

- a. problem with the motor connections or the motor power circuit; check if the 3 phases are correctly connected; check if there's a dispersion of the motor to truck frame.
- b. fault in the inverter power section, replace the controller.

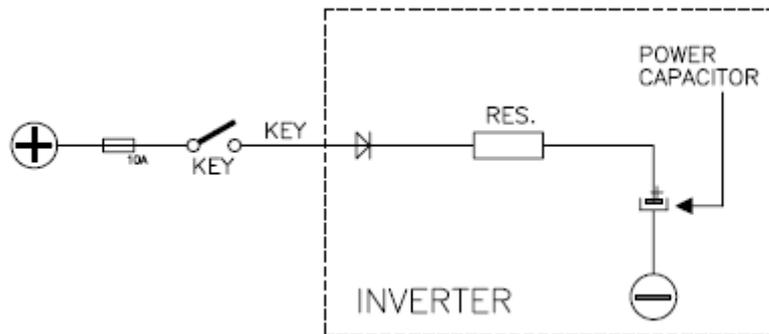
### **6. STBY I HIGH**

The  $\mu$ Cs verify if the feedback of current sensors device output is within the zero current window. Possible causes of the alarm:

- a. current sensor failure;
- b. failure in the logic card: first replace the logic card; if the defect persists, replace the power unit.

### **7. CAPACITOR CHARGE**

Follows the charging capacitor system: When the key is switched ON, the inverter tries to charge the capacitor through a power resistance, and check if the capacitor are charged within a timeout. If they do not charge, an alarm is signalled; the main contactor is not closed.



Possible reasons:

- a) the charging resistance is opened.
- b) The charging circuit has a failure.
- c) There is a problem in the power section.

## 8. MAIN CONTACTOR ALARMS

### COIL SHORTED:

When the key is switched ON the  $\mu$ Controller checks the LC coil driver shortcircuit protection hardware. If it does not react in a correct way to the  $\mu$ C stimulus, the alarm is signalled. Replace the logic board. When the fault occurs while the LC is closed, the alarm signals a shortcircuit across LC coil. Check if there are external shortcircuit and if the ohmic value of the MC coil is correct; otherwise replace the logic.

### DRIVER SHORTED:

When the key is switched ON, the  $\mu$ C checks that the LC coil driver is not shorted; if it is, this alarm is signalled. Preliminary, check if there is an external short or low impedance pull-down between NLC (C26) and -BATT. If no external causes can be found out, replace the controller.

### CONTACTOR DRIVER:

When the initial diagnosis is finished, the traction logic closes the LC and checks the voltage on the Drain of the driver. If this is not low, the driver is not able to close an alarm is signalled. Replace the logic.

### CONTACTOR OPEN:

The main contactor coil has been driven by the logic board, but the contactor does not close. Two possible reasons:

- a) the wires to the coil are interrupted or not well connected.
- b) the contact of the contactor is not properly working (does not pull-in).

### CONTACTOR CLOSED:

Before driving the LC coil, the controller checks if the LC contact is stuck. The controller drives the bridge for a while, trying to discharge the capacitor bank. If they don't discharge, the fault condition is entered. It is suggested to check the contactor contact, if it is mechanically stuck.

## 9. ENCODER ERROR

This alarm is signalled in following condition: the frequency supplied to the motor is higher than 20 Hz, and the signal feedback from the encoder has a

jump higher than 20 Hz in few tens millisecond. This condition clearly shows a malfunctioning of the encoder signal. It is suggested to preliminary check the encoder wiring; if no fault is found in the wiring it is necessary to replace the encoder.

#### **10. PEDAL WIRE KO**

This alarm is signalled if a fault is detected in the accelerator unit wiring (NPOT or PPOT cable is interrupted).

#### **11. WRONG SET BATTERY**

When the key is turned ON, the controller check the battery voltage and compares it with the "SET BATTERY" parameter setting. If the actual value is 20% higher or lower than nominal value, the fault condition is entered. Replace the battery with a correct battery.

#### **12. PUMP KO**

Pump and traction  $\mu$ Cs perform a cross-check in order to verify their functionality. If the Traction detects Pump  $\mu$ C malfunctioning, it brings the controller in a safe status opening the power bridge and the Line Contactor.

#### **13. MASTER KO**

Pump and Traction  $\mu$ Cs perform a cross-check in order to verify their functionality. There are two conditions under which pump enters this fault condition:

- A) the Pump  $\mu$ C receives incoherent can message from the Traction  $\mu$ C.
- B) the Pump  $\mu$ C compares the inputs status and the related Traction operations, and find they are not coherent.

In both cases, the Pump brings the controller to a safe status opening the power bridge and the Line contactor.

#### **14. INPUT MISMATCH**

Safety related inputs (Fw direction, Rev direction, accelerator enable, seat switch) are input to both microcontrollers by independent hw circuit. The two  $\mu$ Cs read these inputs and compare by exchanging related status on the CAN bus. If the SLAVE  $\mu$ C finds a mismatch between its inputs and MASTER inputs, it brings the controller to a safe status opening the power bridge and the Line contactor.

#### **15. AUX OUTPUT KO**

The  $\mu$ P checks the driver of the electromechanical brake coil. If the status of the driver output does not correspond to the signal coming from the  $\mu$ P, the alarm is signalled. It is suggested to preliminary check if there is an external short or low impedance pull down between NAUX (C31) and -BATT. If no external cause can be found, replace the logic card.

## **16. EEPROM KO**

Fault in the area of memory in which the adjustment parameters are stored; this alarm does not inhibit truck operation, but the controller will use default parameters. If the defect persists when the key is switched OFF and ON again, replace the logic. If the alarm disappears, remember that the parameters stored previously have been cancelled and replaced by the default values.

## **17. HIGH TEMPERATURE**

Traction or Pump or both temperatures are greater than 75°C. The maximum current is reduced proportionally to the temperature increase. At 100°C the max current of both inverter is reduced to zero.

If the alarm is signalled when the controller is cold:

- A) thermal sensor failure.
- B) failure in the logic card.

## **18. MOTOR TEMPERATURE**

This warning is signalled if traction or pump or both motors temperature switches open (digital sensor) or if the analog signals overtake the cut off level. If it happens when the motor is cold, check the wiring. If all is ok, replace the logic board.

## **19. BATTERY LOW**

If the "battery check" option is ON, a battery discharge algorithm is carried out. When the charge level is 20% , this alarm is signalled and the current is reduced to the half of the programmed level.

## **20. VACC NOT OK**

The test is made in standby. This alarm indicates that the accelerator voltage is 1V greater than the minimum value programmed by the PROGRAM VACC function.

Possible causes:

- a. the potentiometer is not correctly calibrated;
- b. the potentiometer is defective.

## **21. INCORRECT START**

This alarm signals an incorrect starting sequence. Possible causes:

- a. Fw or Rev or Enable microswitch failure;
- b. error in sequence made by the operator;
- c. incorrect wiring;
- d. if the default persists after checking the harness, replace the logic.

## **22. FORW + BACK**

The test is carried out continuously. An alarm is signalled when a double running request is made simultaneously. Possible causes:

- a. defective wiring;
- b. running microswitch failure;

- c. incorrect operation;
- d. if the defect persists, replace the logic.

### **23. THERMIC SENSOR KO**

The range of inverter temperature sensor is always checked and a warning is signaled if it is out of range.

When this alarm is signalled, the maximum current of the controller is reduced to halt.

### **24. WAITING FOR NODE #5**

The Pump has detected a failure, the Traction cannot close the main contactor because of the alarm status of the Pump (which the Traction knows by the CAN-BUS line). The failure must be looked for in the Pump controller, use the remote console to get connection to the Pump  $\mu$ C.

### **25. WAITING FOR NODE #3**

The Traction  $\mu$ C has detected a fault condition, the Pump is aware of this thanks to CAN bus communication; it cannot drive the motor until the Traction has resolved its problem. The fault has to be looked for in the Traction.

### **26. NO CAN MESSAGE #5**

Traction (node #3) signals that it has lost can communication with the Pump (node #5). This fault could be determined by a problem in the truck CAN bus line or by an internal problem in the controller logic card.

It is suggested to preliminary check CAN bus connection.

### **27) NO CAN MESSAGE #3**

Pump (node #5) signals that it has lost can communication with the Traction (node #3). This fault could be determined by a problem in the truck CAN bus line or by an internal problem in the controller logic card.

It is suggested to preliminary check CAN bus connection.

### **28) PUMP WARNING**

This is a warning in the Traction controller, which inform that the Pump is in a pump chopper related fault condition.

### **29) PUMP INC. START**

This is a warning in the Pump controller, which inform that an incorrect start sequence happened on the pump.

### **30) PUMP VACC NOT OK**

This is a warning in the Pump controller, which inform that lift potentiometer voltage is 1V greater than the minimum value programmed.

## 6.7 FVH Series Electrical System

### 6.7.1 AC-2 INVERTER DIAGNOSTIC -TRACTION CONFIGURATION

The alarms are signalled by a diagnostic LED.

1 blink	logic failure ("WATCHDOG", "EEPROM KO", "LOGIC FAILURE #1", "LOGIC FAILURE #2", "LOGIC FAILURE #3", "CHECK UP NEEDED").
2 blinks:	running request on start-up or error in seat sequence, double direction request or encoder problem ("INCORRECT START", "HANDBRAKE", "FORW + BACK", "ENCODER ERROR").
3 blinks:	phase voltage or capacitor charge failure ("CAPACITOR CHARGE", "VMN LOW", "VMN HIGH").
4 blinks:	failure in accelerator ("VACC NOT OK", "PEDAL WIRE KO", "PEDAL FAILURE").
5 blinks:	failure of current sensor ("STBY I HIGH", "DATA ACQUISITION").
6 blinks:	failure of contactor driver ("COIL SHORTED", "DRIVER SHORTED", "CONTACTOR DRIVER", "AUX OUTPUT KO", "CONTACTOR OPEN", "CONTACTOR CLOSED").
7 blinks:	excessive temperature ("HIGH TEMPERATURE", "MOTOR TEMPERATURE", "THERMIC SENSOR KO", "MOT. TH. SENSOR KO").
8 blinks:	failure of can-bus or problem in the SAFETY circuit ("CAN-BUS KO", "SAFETY", "SAFETY KO").
long blink:	discharge battery or wrong battery voltage ("LOW BATTERY", "WRONG SET BATT.").
no blink:	problem in a remote module ("WAITING FOR NODE").

### 6.7.2 Analysis of alarms displayed on console

#### 1) WATCH DOG

The test is made in both running and standby. It is a self-diagnosing test within the logic. If an alarm should occur, replace the logic.

#### 2) EEPROM KO

Fault in the area of memory in which the adjustment parameters are stored; this alarm inhibits machine operation. If the defect persists when the key is switched OFF and ON again, replace the logic. If the alarm disappears, remember that the parameters stored previously have been cancelled and replaced by the default values.

### **3) LOGIC FAILURE #1**

This alarm signals that an undervoltage / overvoltage protection operation has occurred. Two possible reasons:

- A) A real undervoltage / overvoltage situation happened.
- B) Fault in the hardware section of the logic board which manages the overvoltage protection. Replace the logic card.

### **4) LOGIC FAILURE #2**

Fault in the hardware section of the logic board which manages the phase' s voltage feedback. Replace the logic board.

### **5) LOGIC FAILURE #3**

Fault in the hardware section of the logic board which manages the hardware current protection. Replace the logic board.

### **6) CHECK UP NEEDED**

This is a warning. It is an information for the user that the programmed time for maintenance is elapsed.

### **7) INCORRECT START**

This alarm signals an incorrect starting sequence. Possible causes:

- A) running microswitch failure;
- B) error in sequence made by the operator;
- C) incorrect wiring;
- D) if the default persists, replace the logic.

### **8) FORW + BACK**

The test is carried out continuously. An alarm is signalled when a double running request is made simultaneously. Possible causes:

- A) defective wiring;
- B) running microswitch failure;
- C) incorrect operation;
- D) if the defect persists, replace the logic.

### **9) HANDBRAKE**

The truck does not start because the handbrake switch is opened. Possible causes:

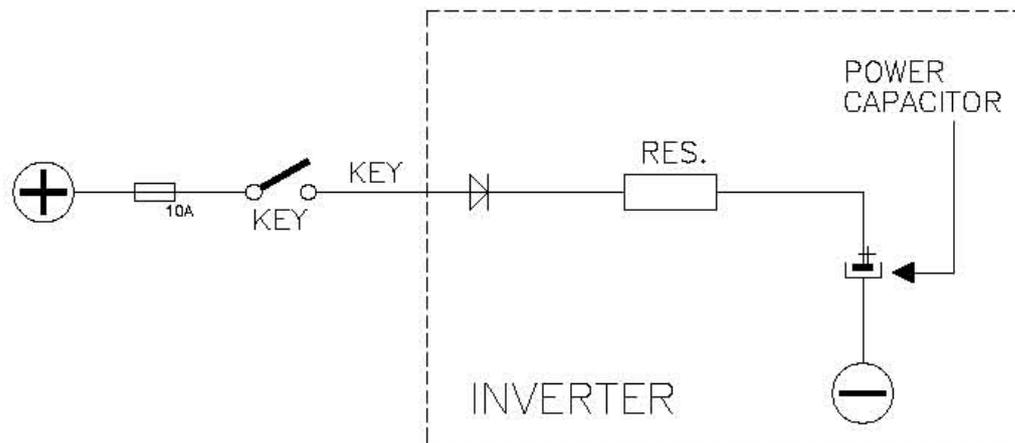
- A) defective wiring;
- B) failure of the microswitch;
- C) incorrect operation of the operator;
- D) if the defect persist, replace the logic.

## 10) ENCODER ERROR

Two consecutive readings of the encoder speed are too much different in between: because of the inertia of the system it is not possible the encoder changes its speed a lot in a short period. Probably an encoder failure has occurred (e.g. one or two channels of the encoder are corrupted or disconnected). Check both the electric and the mechanical encoder functionality. Also the electromagnetic noise on the sensor bearing can be a cause for the alarm.

## 11) CAPACITOR CHARGE

Follows the charging capacitor system:



When the key is switched ON, the inverter tries to charge the capacitor through a power resistance, and check if the capacitor are charged within a timeout. If this is not true: an alarm is signalled; the main contactor is not closed.

Possible reasons:

- A) the charging resistance is opened; if it is opened.
- B) The charging circuit has a failure.
- C) There is a problem on the power modules.

## 12) VMN LOW, VMN HIGH

The test is carried out during initial diagnosis and in standby. Possible causes:

- A) problem with the motor connections or the motor power circuit; check if the 3 phases are correctly connected; check if there's a dispersion of the motor towards ground;
- B) inverter failure, replace it.

## 13) VACC NOT OK

The test is made in standby. This alarm indicates that the accelerator voltage is 1V greater than the minimum value programmed by the PROGRAM VACC function.

Possible causes:

- A) the potentiometer is not correctly calibrated;
- B) the potentiometer is defective.

#### **14) PEDAL WIRE KO**

This alarm is signalled if a fault is detected in the accelerator unit wiring (NPOT or PPOT cable is interrupted).

#### **15) PEDAL FAILURE**

This alarm can be activated on request and it is signalled if the accelerator signal is out of the range. Possible cause: an hardware problem on the logic board or a potentiometer problem (disconnected wire, damaged cursor).

#### **16) STBY I HIGH**

Test carried out in standby. Check if the current is 0. If not verified, an alarm is signalled which inhibits machine operations. Possible causes:

A) current sensor failure;

B) logic failure: first replace the logic; if the defect persists, replace the power unit.

#### **17) DATA ACQUISITION**

This alarm is signalled in the current gain acquisition phase. Wait the end of the acquisition activity.

#### **18) MAIN CONTACTOR ALARMS**

##### **- COIL SHORTED**

When the key is switched ON the  $\mu$ P checks the MC driver FF SR. If it does not react in a correct way to the  $\mu$ P stimulus, the alarm is signalled. Replace the logic board. The FF SR makes an hardware control of the current in the MC coil. If this is too high, it opens the MC and the alarm is signalled.

Check if there are external shortcircuit and if the ohmic value of the MC is correct; otherwise replace the logic.

##### **- DRIVER SHORTED**

When the key is switched ON, the  $\mu$ P checks that the MC coil driver is not shorted; if it is, this alarm is signalled; replace the logic board.

##### **- CONTACTOR DRIVER**

When the initial diagnosis is finished, the traction logic closes the MC and checks the voltage on the Drain of the driver. If this is not low, an alarm is signalled.

Replace the logic.

##### **- CONTACTOR OPEN**

The main contactor coil has been driven by the logic board, but the contactor does not close. Two possible reasons:

A) the wires to the coil are interrupted or not well connected.

B) the contact of the contactor is not properly working.

##### **- CONTACTOR CLOSED**

The controller checks if the LC contact is closed when the coil isn't driven, trying to discharge the capacitor bank. If they don't discharge, the fault condition is entered. It is suggested to check the contactor contact, if it is mechanically stuck or pasted.

### **19) AUX OUTPUT KO**

The  $\mu$ P checks the driver of the electromechanical brake. If the status of the driver output does not correspond to the signal coming from the  $\mu$ P, the alarm is signalled. Replace the logic.

### **20) HIGH TEMPERATURE**

Controller temperature is greater than 75 °C. The maximum current is reduced proportionally to the temperature increase. The controller stops at 100 °C.

If the alarm is signalled when the controller is cold:

- A) check the wiring of the thermal sensor;
- B) thermal sensor failure;
- C) logic failure.

### **21) MOTOR TEMPERATURE**

This warning is signalled if the motor temperature switch opens (digital sensor) or if the analog signal overtakes the cut off level. If it happens when the motor is cold, check the wiring. If all is ok, replace the logic board.

### **22) THERMIC SENSOR KO**

The range of inverter temperature sensor is always checked and a warning is signalled if it is out of range.

When this alarm is signalled, check the connection of the sensors.

### **23) MOT. TH. SENSOR KO**

The range of motor temperature sensor is always checked and a warning is signalled if it is out of range.

When this alarm is signalled, check the connection of the sensors.

### **24) CAN BUS KO**

The diagnosis of the CAN-BUS line is present only if the inverter uses this link (depends on the software version). It is signalled if the inverter does not receive any message from the CAN-BUS line. First of all, check the wiring. If it is ok, the problem is on the logic board, which must be replaced.

### **25) SAFETY**

This alarm is signalled when the "SAFETY" input is open. The "SAFETY" circuit gets active and opens the drivers of LC and EB and stops the machine. Verify the "SAFETY" input connection.

### **26) SAFETY KO**

This alarm is present in combi systems (traction + pump). If a stopping alarm is detected on the pump, the traction also stops. The failure must be looked for in the pump inverter.

**27) BATTERY LOW**

If the "battery check" option is ON, a battery discharge algorithm is carried out. When the charge level is 10%, this alarm is signalled and the current is reduced to the half of the programmed level.

**28) WRONG SET BATT.**

When the key is turned ON, the controller check the battery voltage and verifies it is within a window around the nominal value. Replace the battery with a correct battery.

**29) WAITING FOR NODE**

The controller receives from a remote module via CAN Bus the information that it isn't possible to close the LC (the module isn't ready locked in an alarm state). Verify the other modules to determinate in which of them there is the problem.

### 6.7.3 PUMP TROUBLESHOOTING CHART

LED CODE	PROGRAMMER DISPLAY	LCD	EXPLANATION	POSSIBLE CAUSE
1,1	EEPROM FAULT		EEPROM fault. Note: Usually can be cleared by modifying any parameter value in the Program Menu.	1. EEPROM data lost or damaged. 2. EEPROM checksum error.
1,2	HW FAILSAFE		Self-test or watchdog fault.	1. MOSFET shorted. 2. Controller defective.
1,3	MOTOR SHORTED		Motor shorted.	1. Motor is shorted.
2,1	UNDERVOLTAGE CUTOFF		Undervoltage cutoff.	1. Battery voltage < LOVOLT CUTOFF setting.
2,2	LIFT LOCKOUT		Lift operation locked out due to under voltage.	Controller received appropriate lift lock out signal. Inappropriate lift lockout signal: SS LOCKOUT parameter not set correctly.
2,3	SEQUENCE ERROR		Startup lockout.	1. Improper sequence of throttle or SS and KSI or KSI plus interlock. 2. STARTUP LOCKOUT parameter not set correctly. 3. Misadjusted throttle.
2,4	THROTTLE FAULT		Wiper signal out of range (pot low fault).	1. Throttle input wire open or shorted. 2. Throttle defective. 3. THROTTLE TYPE parameter not set correctly.
3,1	CONT DRVR OC		Main contactor coil overcurrent.	1. Main contactor coil shorted. 2. Controller defective.

LED CODE	PROGRAMMER DISPLAY	LCD	EXPLANATION	POSSIBLE CAUSE
3,2	MAIN CONT WELDED		Main contactor welded.	<ol style="list-style-type: none"> <li>1. Main contactor stuck closed.</li> <li>2. CONT CNTRL parameter not set correctly.</li> <li>3. Main contactor driver shorted.</li> </ol>
3,3	PRECHARGE FAULT		Precharge fault.	<ol style="list-style-type: none"> <li>1. Precharge circuit failure.</li> <li>2. External short or leakage between B+ and B-.</li> </ol>
3,4	MAIN CONT DNC		Main contactor did not close.	<ol style="list-style-type: none"> <li>1. Main contactor coil connection loose.</li> <li>2. Main contactor did not close.</li> <li>3. CONT CNTRL parameter not set correctly.</li> </ol>
4,1	LOW BATTERY VOLTAGE		Low battery voltage.	<ol style="list-style-type: none"> <li>1. Battery voltage &lt; undervoltage cutback threshold.</li> <li>2. Corroded battery terminal.</li> <li>3. Loose battery or controller terminal.</li> </ol>
4,2	OVERVOLTAGE		Overvoltage.	<ol style="list-style-type: none"> <li>1. Battery voltage &gt; overvoltage shutdown threshold.</li> <li>2. Vehicle operating with charger attached.</li> </ol>
4,3	THERMAL CUTBACK		Over-/undertemperature cutback.	<ol style="list-style-type: none"> <li>1. Temperature &gt; 85°C or &lt; -25°C.</li> <li>2. Excessive load on pump motor.</li> <li>3. Improper mounting of controller</li> <li>4. Operation in extreme environment.</li> <li>5. Thermistor failure.</li> </ol>