EP中力

TV Series CPD13/15/16/18/20

TW Series CPD13/15/16/18/20

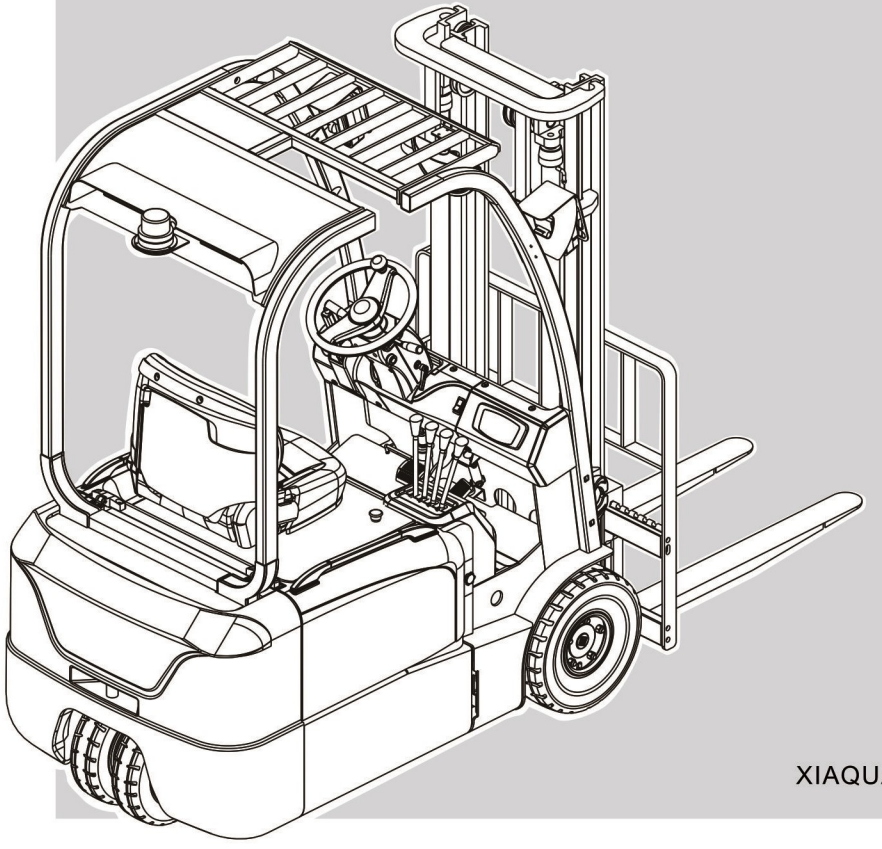
TV-C Series CPD18

# Electric Three-wheel Forklift

# 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



CE

CE CERTIFICATE

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

EP EQUIPMENT CO.,LTD. is one of the world's leading companies manufacture, design material handling equipment and provide related service. With over 100,000m$^2$ plant it produces over 100,000 trucks per year, and provides professional, effective and optimized material handling solutions worldwide, until now it has developed three major kinds of business:

· Material handling equipment: Focus on electric forklift and warehouse equipment
·OEM parts: Global parts supply
·Imow industry,online: One stop industrial products supply

Guided by our customer-oriented concept, EP has developed service centers in more than 30 countries around the world, from which customers are able to receive timely local service. Moreover, 95% of warranty parts can be shipped out within 24 hours after been ordered. Through our online after-sales service system, customers can process their warranty claims, order spare parts and consult the operation manuals, maintenance materials and spare parts

With business all over the world, EP has thousands of employees and hundreds of agents worldwide to provide our global customers with prompt local service.

Based on the concept of sharing economy , EP also offer rental service for various logistics equipment. Adhering to the idea "Making the leasing of logistic equipment more simple", EP is devoted to providing customized one-stop leasing solutions for our customers with our high quality, reasonable price and prompt rental service.

EP's mission&vision is " Let more people apply the electrical material handling equipment to relieve the intensity of labour" and "Let's grow together".

EP EQUIPMENT CO., LTD
Address: XIAQUAN, DIPU, ANJI, ZHEJIANG, CHINA
Tel: + 86-0571-28023920
Fax: + 86-0571-28035616
Website: www.ep-ep.com
Email: service@ep-ep.com

catalogs.

# Foreword

Thanks for your purchasing our forklift truck.

The forklift truck is our company's new product. It has the character of small turning radius, beautiful shape, small dimensions, low gravity. This series forklift truck use front 2-motor drive, rear wheel turning, lifting and turning share one pump etc. new technology.

Please operator and whom in charge of the truck must read the manual carefully before operate the truck.

We have the right to improve the truck, maybe there are some difference between your product and the description in this manual.

If you have any questions please keep in touch with the sales department or let the agents know.

The battery forklift has already passed CE certificate.

CE

Notes:

1. This manual is used for operation and maintenance , the detail parameter s, size and specifications in context is only for reference , the real parameters will depend on sale files.
2. Manual pictures for reference only, the real car shall prevail, and shall not affect the manual use.
3.Manual pictures only sign for one of the models in this series models.

# 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 detective parts.

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

# INDEX

**Appendix**
**Lithium Battery Use and Maintenance Manual**

## 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

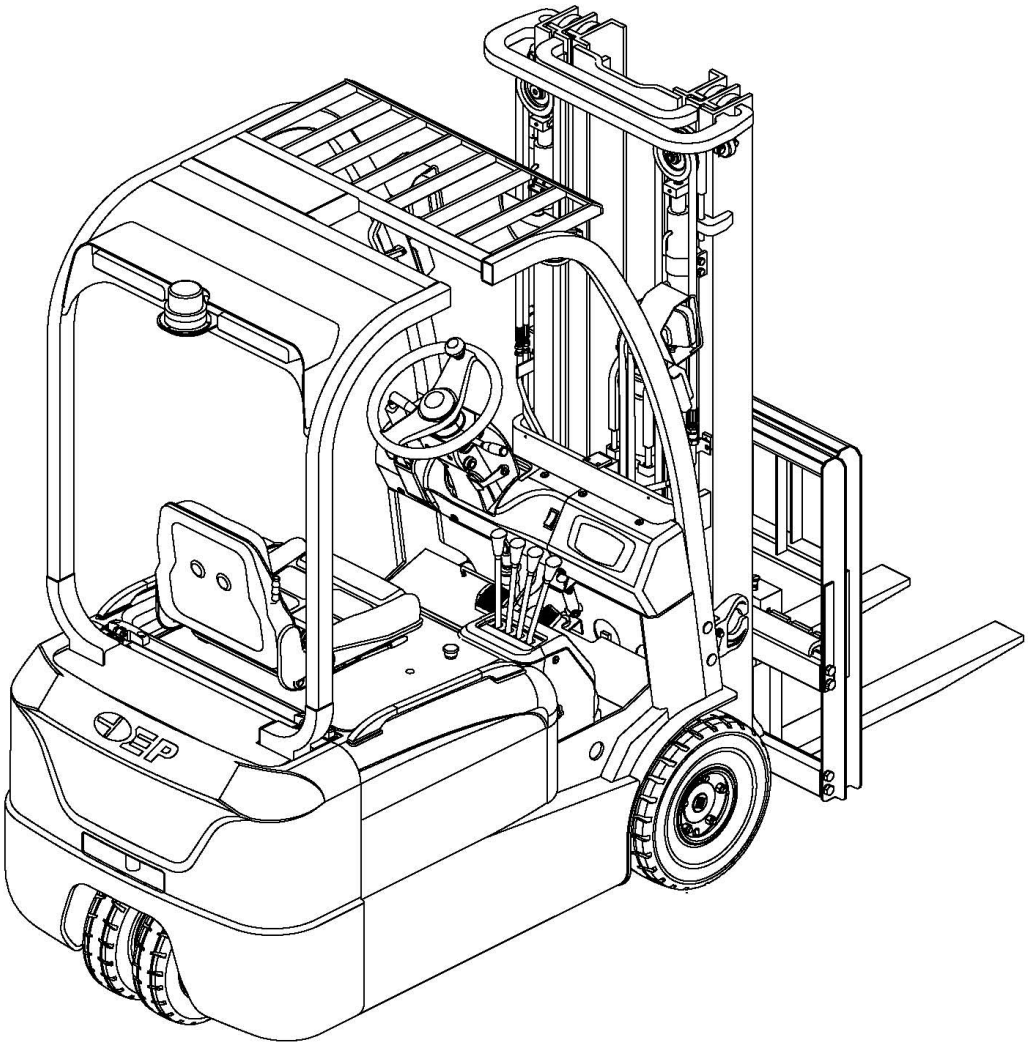
## 1.1Application

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

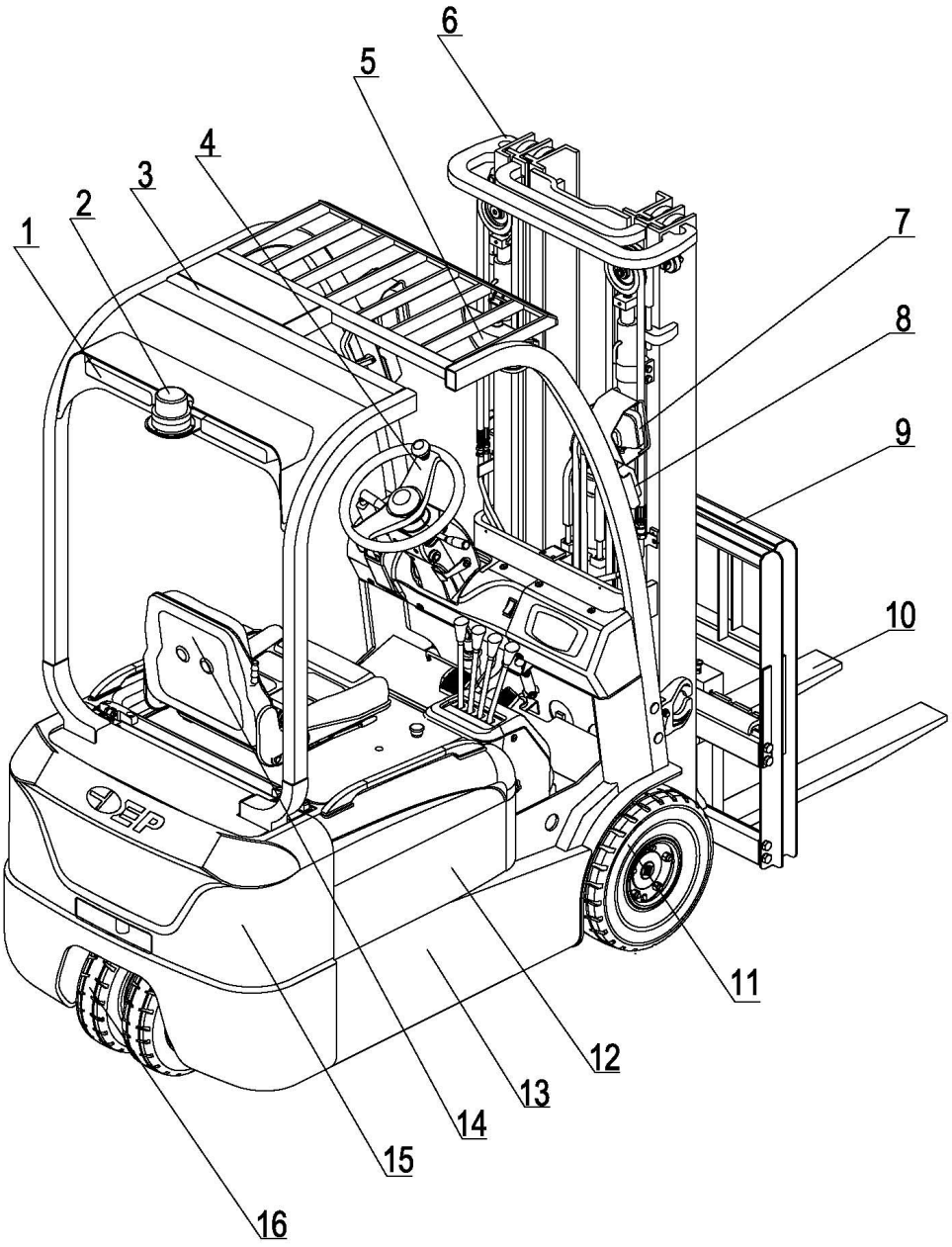
Custom can choice attachments random.

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.

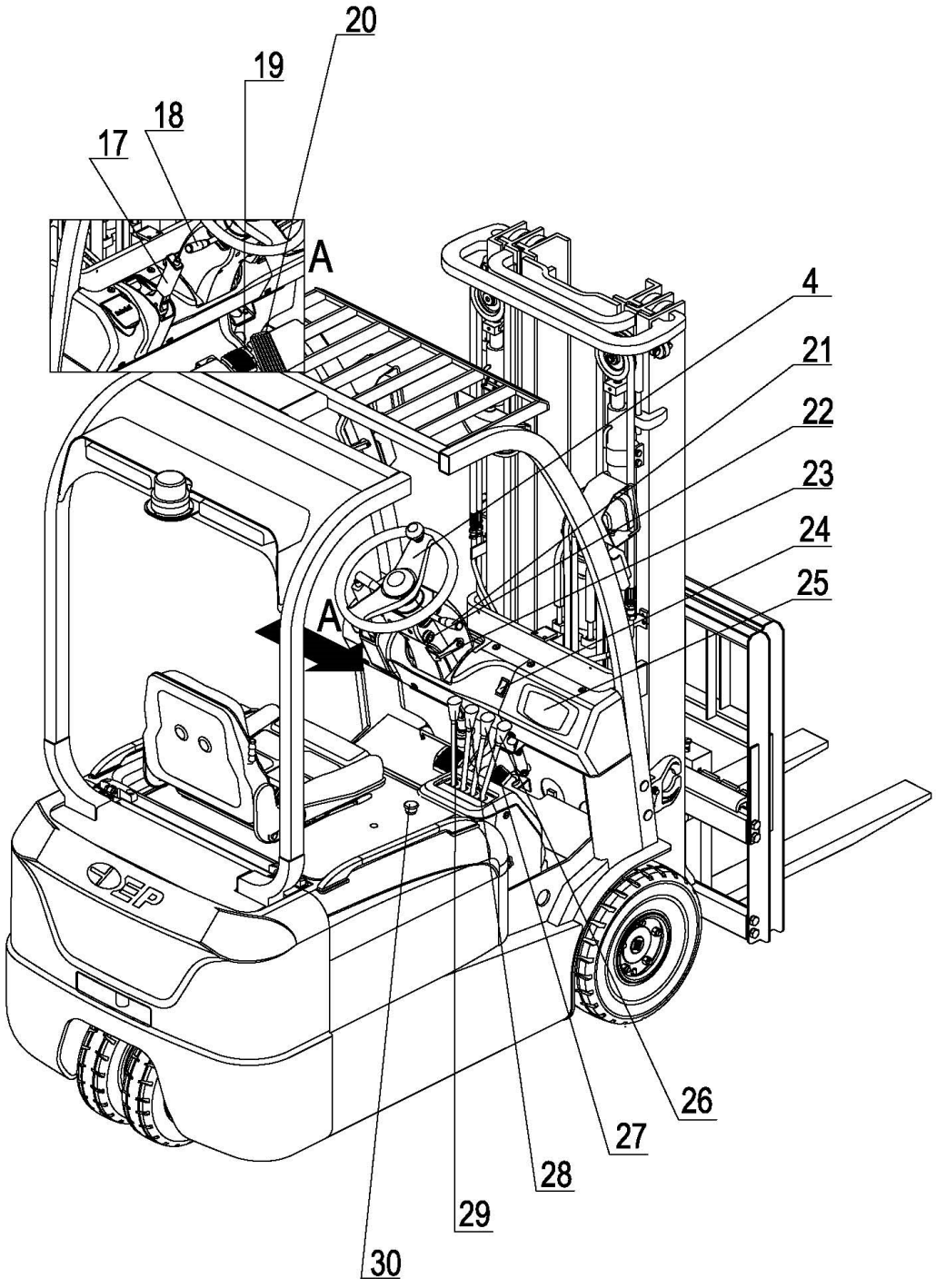


## 1.2 Assemblies




| Item | Component | Item | Component |
|---|---|---|---|
| 1 | Rear Lamp Unit | 9 | Load back rest |
| 2 | Caution light | 10 | Fork |
| 3 | Overhead safe guard | 11 | Front wheel |
| 4 | Steering wheel | 12 | Side battery cover hood |
| 5 | Viewfinder | 13 | Chassis |
| 6 | Mast | 14 | Seat |
| 7 | Head light | 15 | Counter weight |
| 8 | Front Little Lamp | 16 | Rear wheel |

## 1.3 steer and instrument display




| Item | Component | Item | Component |
|---|---|---|---|
| 4 | Steering wheel | 24 | caution light switch |
| 17 | Parking brake lever | 25 | display |
| 18 | Direction switch | 26 | Attachments lever |
| 19 | Brake pedal | 27 | Side lever |
| 20 | Accelerator pedal | 28 | Tilting lever |
| 21 | Combined lamp switch | 29 | Lifting lever |
| 22 | Key switch | 30 | Emergency disconnect switch |
| 23 | Adjusting lever | | |

### 1.3.1Steering 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.

### 1.3.2Combined light switch [21]

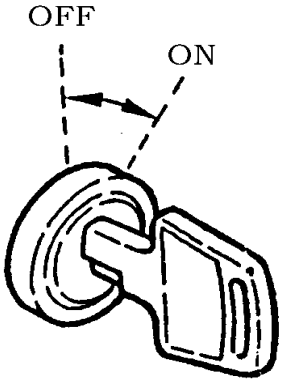
This combined light switch is composed of turning light switch and big/small lamp switch. Turning light indicates the traveling direction. When turn on the switch, the lamp flashes.

**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.

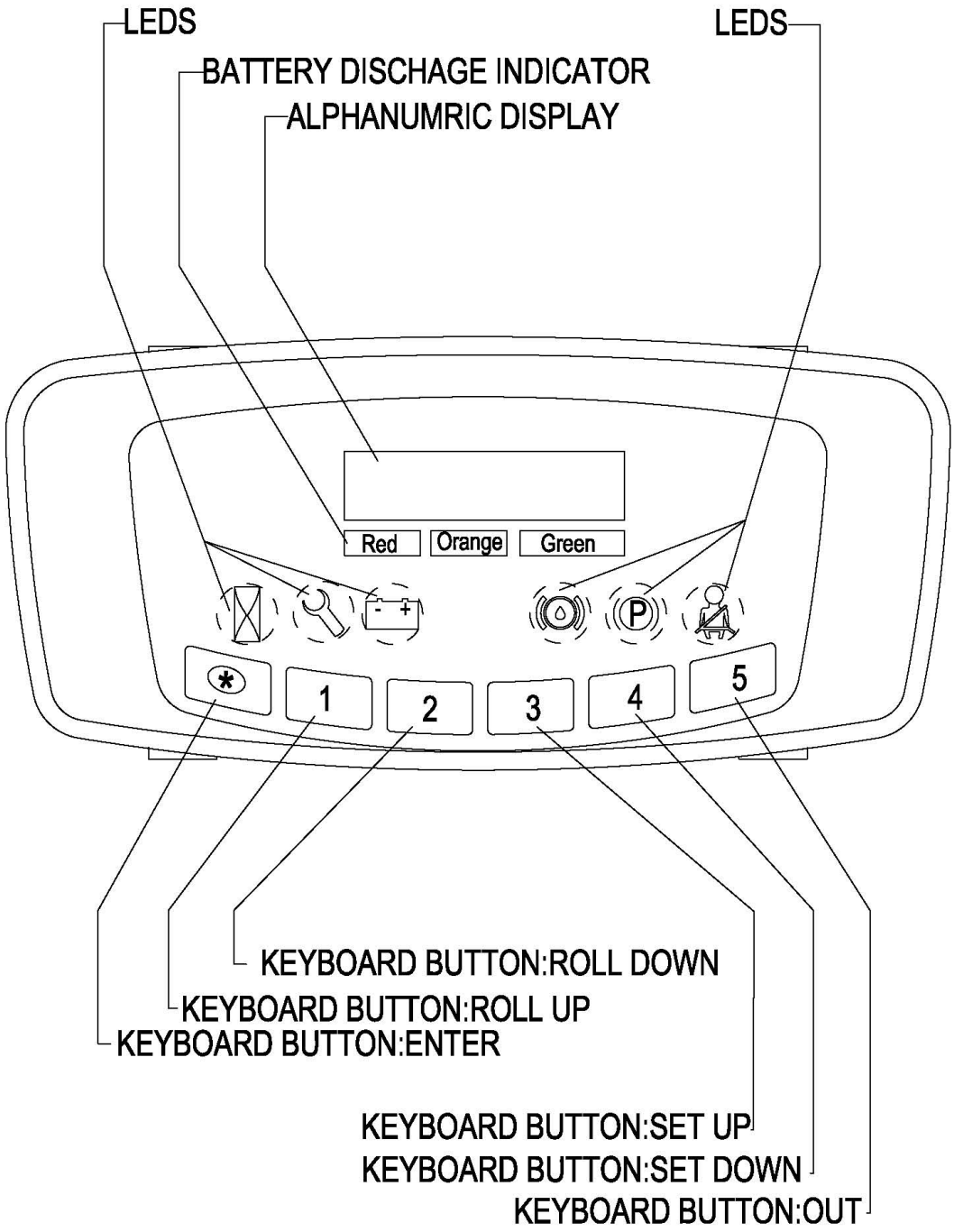
### 1.3.3key switch[22]




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".
You should push the forward-reverse lever to neutral and loose the accelerator pedal, then turning the key switch to “on” position clockwise.
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 Forward-Reverse lever 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.

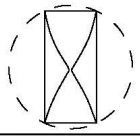
### 1.3.4 Instrument and display[25]



**The meanings of six indicators:**

**Power indicator**

Only lights on when power supply is OK.

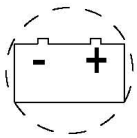


**Error indicator**

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

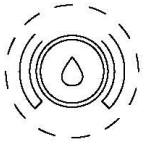
**Low battery warning**

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.



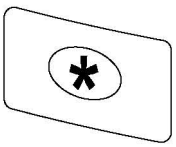
**Parking brake indicator**

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:**

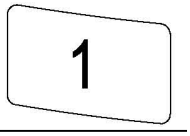



**ENTER Button:**

Save all changing

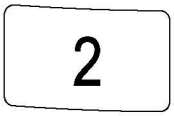
**ROLL UP Button:**

Change the digit marked by cursor



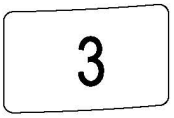

**ROLL DOWN Button :**

Change the digit marked by cursor



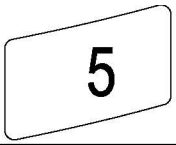

**SET UP Button :**

Shift cursor on previous digit



**SET DOWN Button:**
Shift cursor on following digit

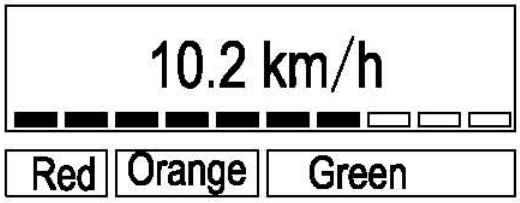

**OUT Button:**
Cancel all changing




**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).

**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.




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. )

### 1.3.5Emergency disconnect switch [30]

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

### 1.3.6Travel switch [18]

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 [17]**

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 [29]**

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 [28]**

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[27]**

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 [26]**

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 [20]**

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 [19]**

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

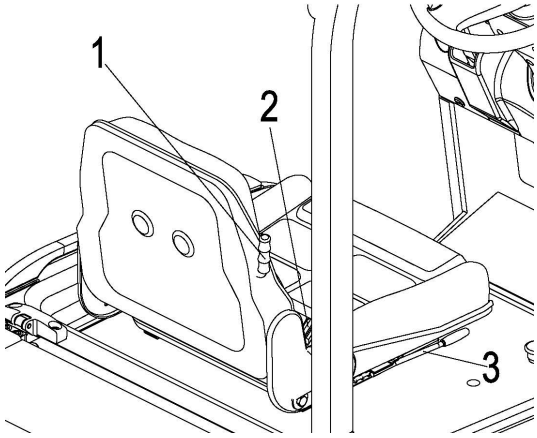
**Chassis[13]**

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[14]**

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.

**Fork stopper**

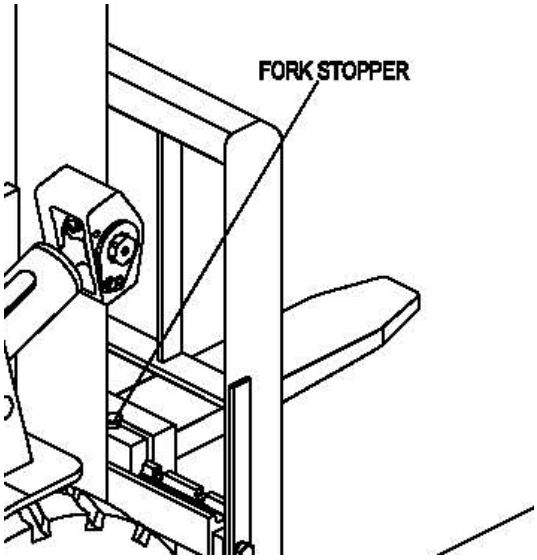
Fork stoppers are locked the forks in position. To adjust fork spacing, pull up fork stoppers, turn and shift the forks to the desired position. The fork spacing should be adjusting according to loads to be handled.

**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 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 drop into reservoir cup.

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

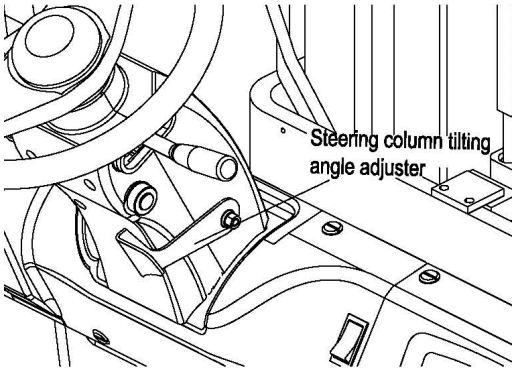
Two headlights and combination lights （turn signal, parking and backup） are installed at the front side of the truck. Take care of the lights, and wipe dirt, if any, and replace any damaged light immediately.

**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[23]**

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)**

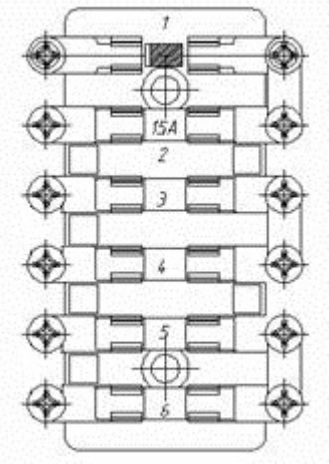
There is a safety belt on the seat, before you operate the forklift truck, please fasten the seat belt to protect yourself.

**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.

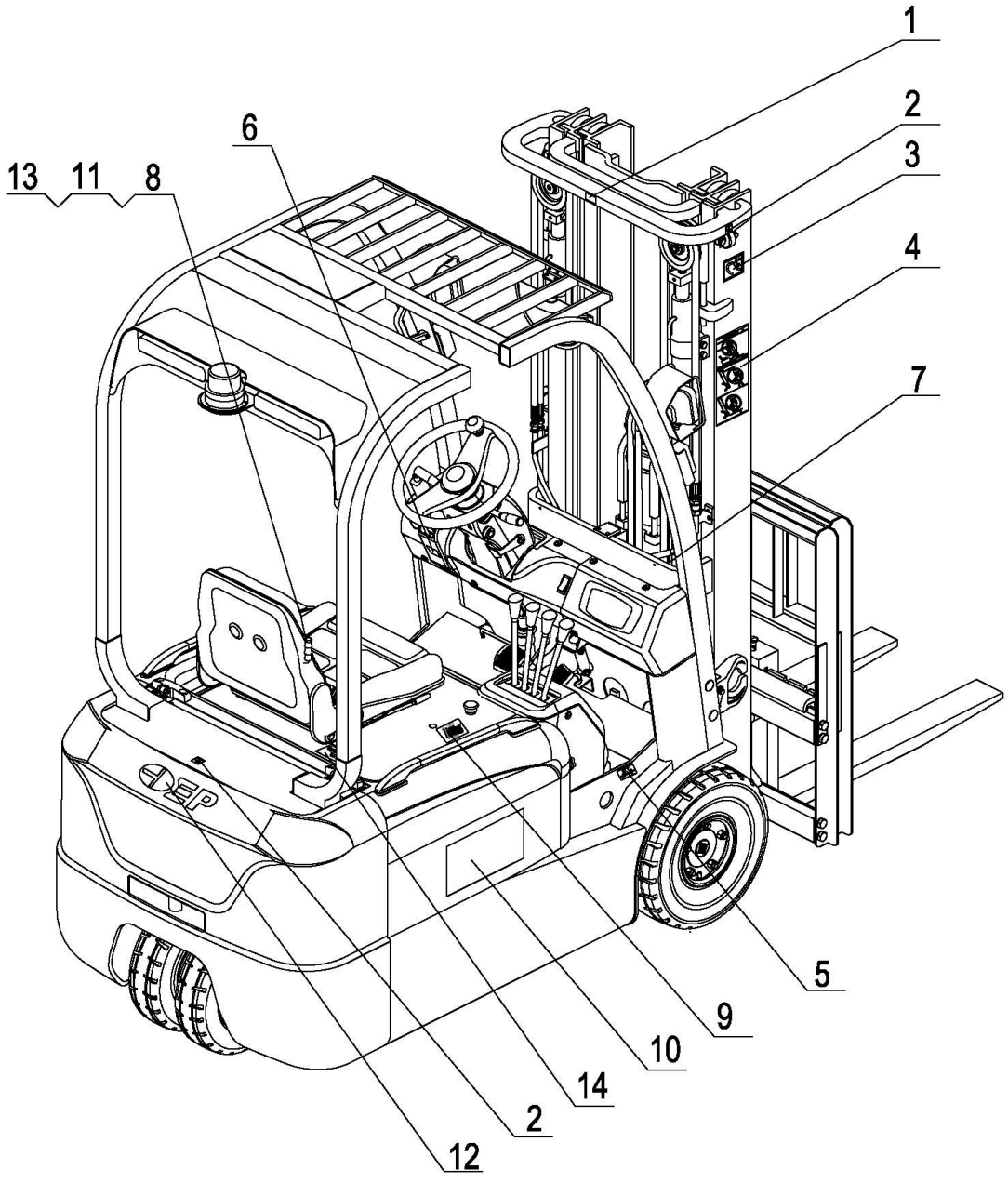



**Warning!**

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
2
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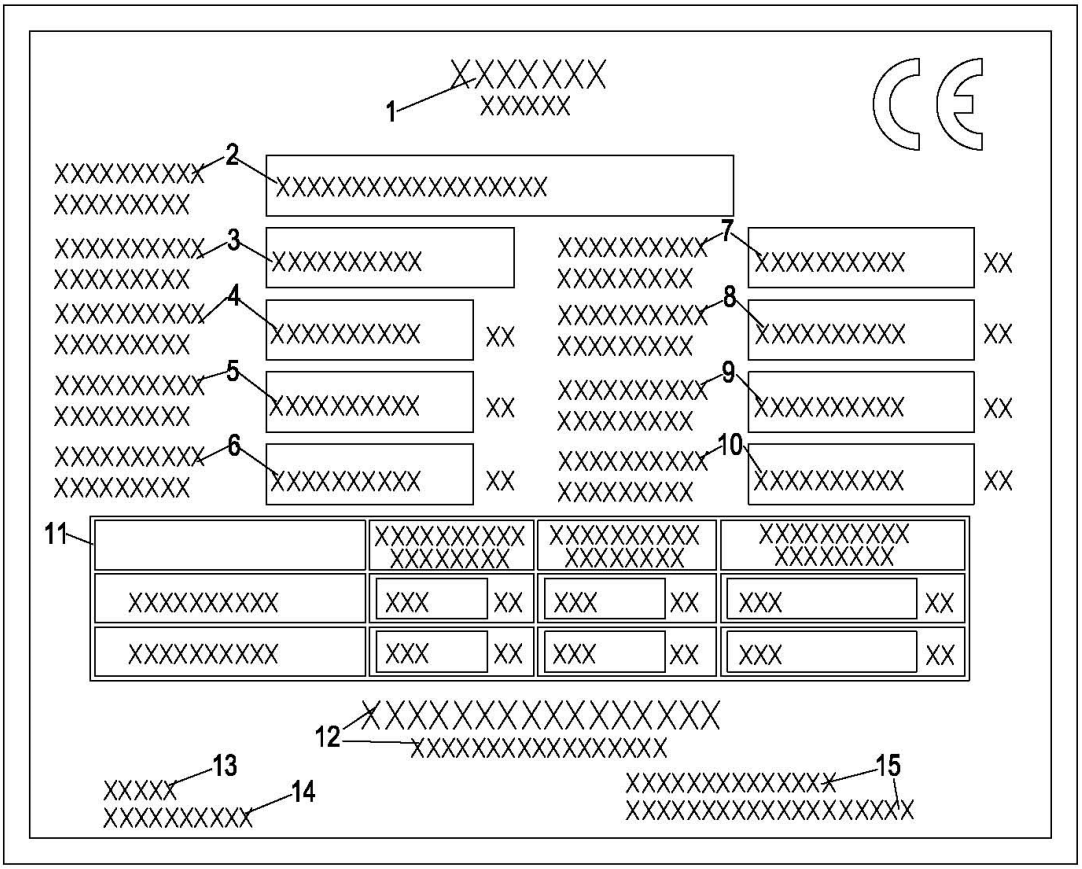
### 1.4.1Truck data plate




| 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.

### 1.5.1Performance data for standard trucks

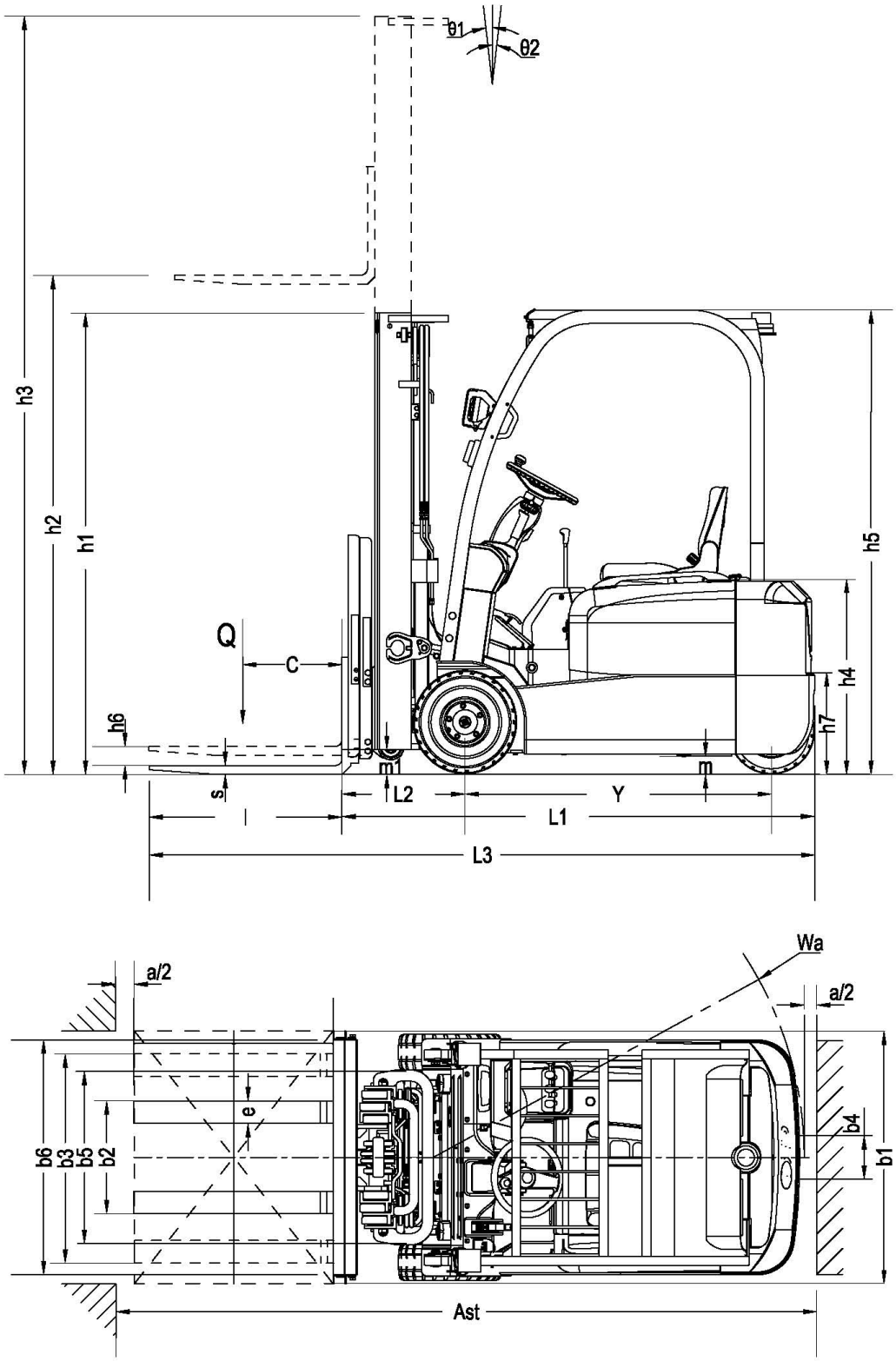
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Brand | | | EP | EP | EP | EP | EP |
| | Type | | | CPD1.3TV | CPD1.5TV | CPD1.6TV | CPD1.8TV | CPD2.0TV |
| | Power cell | | | Battery | Battery | Battery | Battery | Battery |
| | Operation type | | | Rider seated | Rider seated | Rider seated | Rider seated | Rider seated |
| Q | Rated capacity | | kg | 1300 | 1500 | 1600 | 1800 | 2000 |
| C | Load center of gravity distance | | mm | 500 | 500 | 500 | 500 | 500 |
| | Travel speed | Fully load | km/h | 13 | 13 | 13 | 13 | 13 |
| | | Non-load | km/h | 14 | 14 | 14 | 14 | 14 |
| | Raise lift speed ( Max ) | Fully load | m/s | 0.3 | 0.29 | 0.28 | 0.27 | 0.26 |
| | | Non-load | m/s | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 |
| | Lowing speed(Max ) | Fully load | m/s | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 |
| | | Non-load | m/s | 0.435 | 0.435 | 0.435 | 0.435 | 0.435 |
| | Max. grade ability (5 min rating) | Fully load | % | 10.5 | 10.5 | 10.5 | 10.5 | 10.5 |
| | | Non-load | % | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 |
| | Net weight | including battery | kg | 3050 | 3100 | 3150 | 3375 | 3570 |
| | Axes lode (Fully load) | Front/rear | kg | 3810/350 | 4215/335 | 4385/315 | 4640/320 | 5050/380 |
| | Axes lode (Non-load) | Front/rear | kg | 1470/1390 | 1570/1480 | 1585/1515 | 1620/1540 | 1750/1680 |
| | Tyre | Front×2 | | 18X7-8 | 18X7-8 | 18X7-8 | 18X7-8 | 18X7-8 |
| | | Rear×2 | | 15X4.5-8 | 15X4.5-8 | 15X4.5-8 | 15X4.5-8 | 15X4.5-8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Thread(Front/Rear) | | mm | 902/175 | 902/175 | 902/175 | 902/175 | 902/175 |
| | Motor | Driven motor×2 | Kw | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| | | Pump motor | Kw | 11 | 11 | 11 | 11 | 11 |
| | Battery | standard | | DIN | DIN | DIN | DIN | DIN |
| | | Pressure / capacitance | V/Ah | 48/400 | 48/400 | 48/500 | 48/500 | 48/600 |
| | | weight | kg | 635 | 635 | 753 | 753 | 900 |
| | Controller | Type | | AC | AC | AC | AC | AC |
| | | Manufacturer | | ZAPI | ZAPI | ZAPI | ZAPI | ZAPI |
| | Operating pressure for attachment | | bar | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 |
| | Noise level | | dB(A) | 68 | 68 | 70 | 70 | 74 |

### 1.5.2Dimensions

| | Description | | | CPD1.3TV | CPD1.5TV | CPD1.6TV | CPD1.8TV | CPD2.0TV |
|---|---|---|---|---|---|---|---|---|
| h2 | Lifting height | | mm | 3000 | 3000 | 3000 | 3000 | 3000 |
| h6 | Free lifting height | | mm | 120 | 120 | 120 | 120 | 120 |
| s | Fork dimension | thickness | mm | 40 | 40 | 40 | 40 | 40 |
| e | | width | mm | 100 | 100 | 100 | 100 | 120 |
| l | | length | mm | 920 | 920 | 920 | 920 | 1070 |
| θ1 | Tilting angle | forward | Deg | 6 | 6 | 6 | 6 | 6 |
| θ2 | | backward | Deg | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| L1 | Truck dimension | Length to face of fork | mm | 1830 | 1830 | 1930 | 1930 | 2040 |
| L3 | | Whole length | mm | 2750 | 2750 | 2850 | 2850 | 3110 |
| b1 | | Width | mm | 1050 | 1050 | 1050 | 1050 | 1130 |
| h1 | | Height when mast lowered | mm | 1995 | 1995 | 1995 | 1995 | 1995 |
| h3 | | Height when mast lifting | mm | 3945 | 3945 | 3945 | 3945 | 3945 |
| h5 | | Height to safeguard | mm | 2040 | 2040 | 2040 | 2040 | 2040 |
| h4 | | Height seat | mm | 855 | 855 | 855 | 855 | 855 |
| h7 | | Traction Height | mm | 475 | 475 | 475 | 475 | 475 |
| h7 | Traction Height | | mm | 1040 | 1040 | 1040 | 1040 | 1040 |
| Wa | Turning radius | Min | mm | 1445 | 1445 | 1555 | 1555 | 1665 |
| L2 | Overhand | Front | mm | 397.5 | 397.5 | 397.5 | 397.5 | 397.5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| m | Ground clearance | chassis | mm | 95 | 95 | 95 | 95 | 95 |
| | | Mast | mm | 105 | 105 | 105 | 105 | 105 |
| Y | Wheelbase | | mm | 1258 | 1258 | 1358 | 1358 | 1468 |
| b4 | Front-wheelbase (drive- wheel) | | mm | 902 | 902 | 902 | 902 | 902 |
| b6 | Rear wheelbase (drive-wheel) | | mm | 175 | 175 | 175 | 175 | 175 |
| Ast | Working aisle width with pallet | 1000×1200 crossways | mm | 3217 | 3217 | 3314 | 3314 | 3420 |
| | | 800×1200 lengthways | mm | 3036 | 3036 | 3133 | 3133 | 3240 |


θ1
θ2
h3
h2
h1
h5
Q
C
h6
h4
h7
m1
m2
s
l
L2
Y
L1
L3
Wa
a/2
a/2
e
b6
b3
b5
b2
b4
b1
Ast

## 1.6Relationship between load and stability of truck

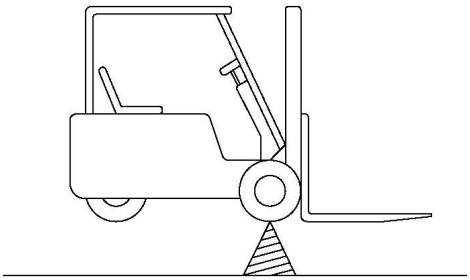
It is very important for operator to know the truck's structure and relationship between load and stability.

**Warning! The structure of the truck**

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

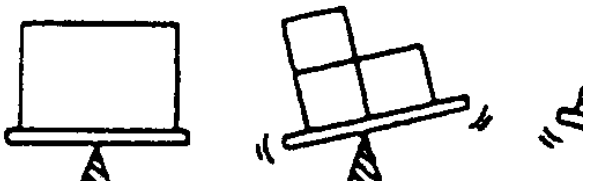
The lift truck keeps the balance of weight between the truck body and the load on the forks with the center of the front wheels as a fulcrum when the rated capacity load is placed in position.

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



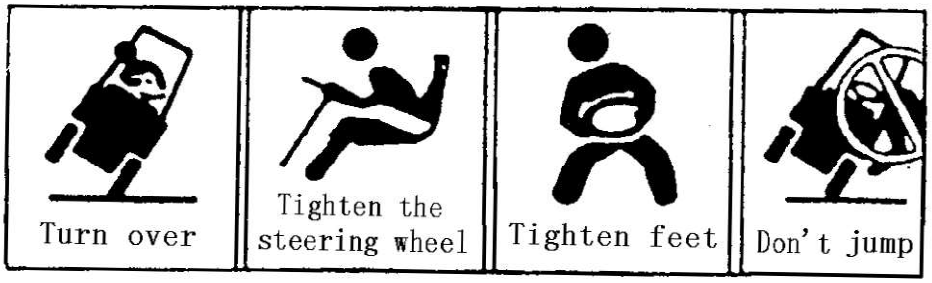
**Warning! Load center**

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.

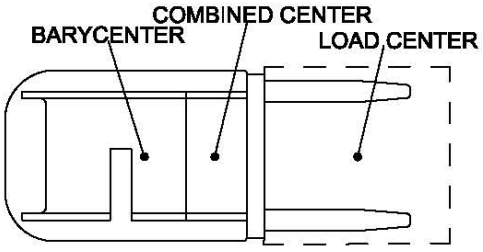
The lifting height.

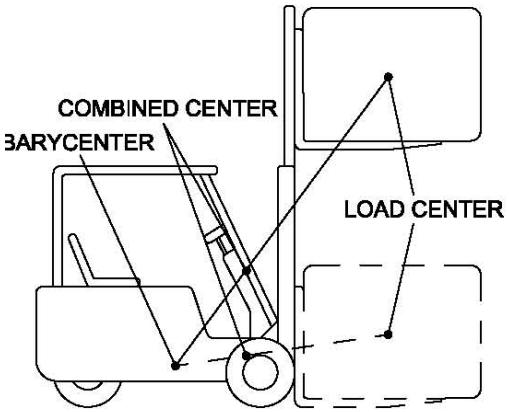
The tilting angle.

The pressure of the tire.

The radius of turning.

The road and grade's angle.

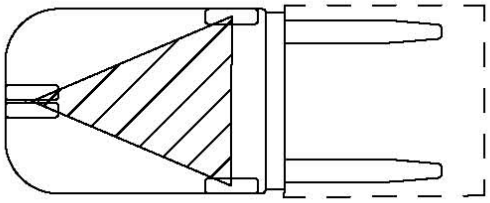



**Warning! the stability zone of the barycenter**

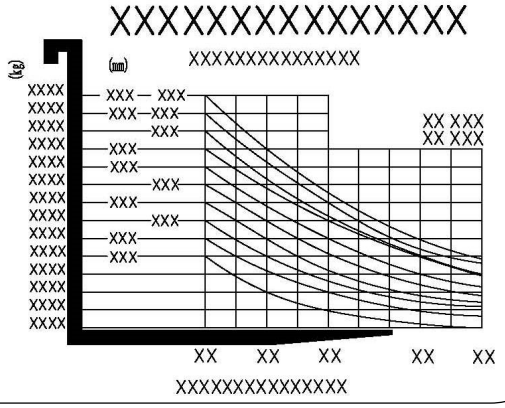
In order to make the truck stable, the combined center must be in the triangle which is made up of two points that the two front wheels attach ground and the midpoint of the back driving axle.

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 departures 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

## 2.1Transport

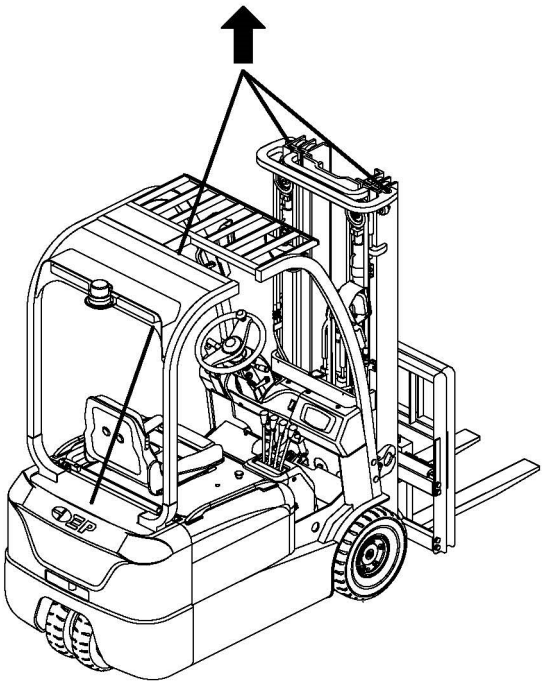
### 2.1.1Lifting the truck by crane

• 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.

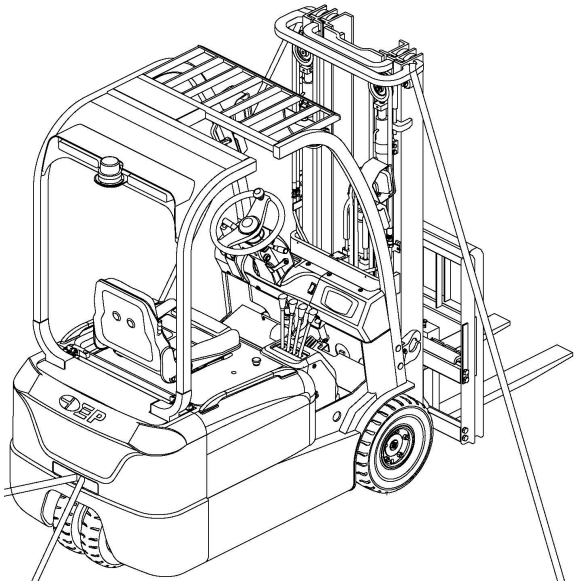
• When lifting the truck, don't take yourself below the truck.

### 2.1.2Securing 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 "3.1Safety Regulations for the Operation of Forklift Trucks" on page 29.

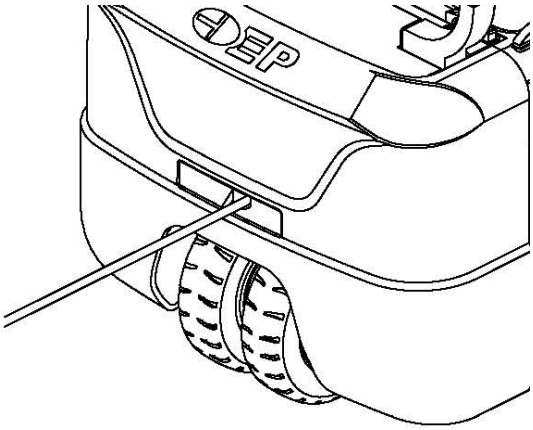
- The rope(2) is used to fix the truck must be firm enough. The rope(2) round the mast above the beam(1) and fixed to truck.



- 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.

### 2.2Using 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).

### 2.3During 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.

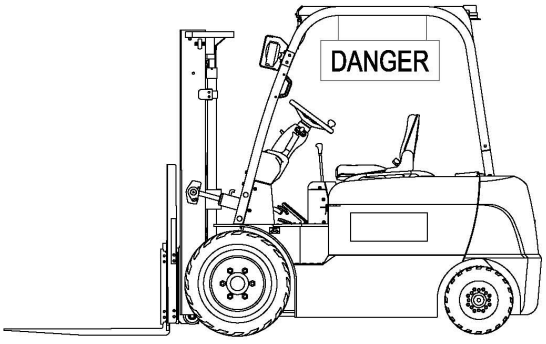
# 3.Operation

## 3.1Safety 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 comers .
- 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℃~50℃

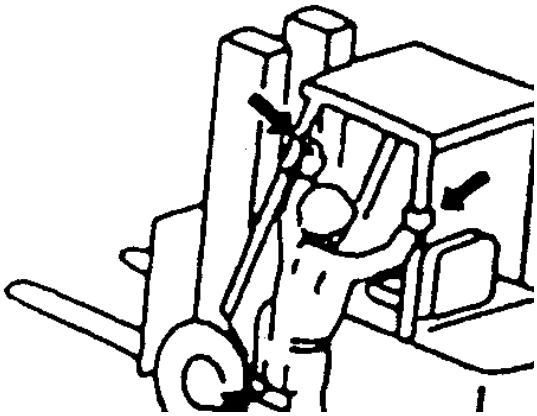
Wind speed: Less than 5m/s.

Air specific humidity: Less than 90%. (Temp at 20℃).

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

9. Start safely

Before staring up, make sure that:

The parking brake lever is applied securely.

The forward-reverse lever is in neutral.

Before staring, 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.

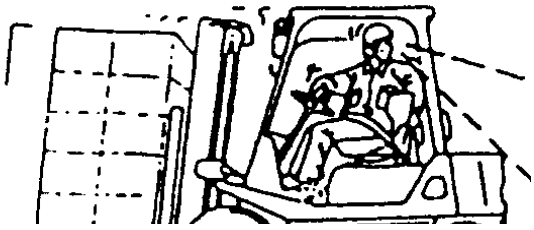
10. Prohibit sudden stop or turning

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.

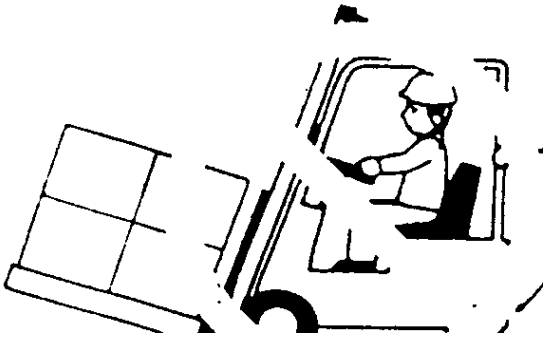
11. Pay attention to the route of the truck

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



12. Don’t offer rides to others

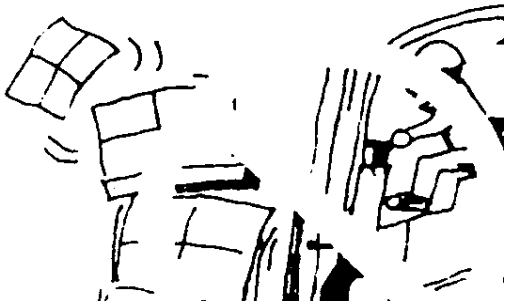
Never allow other person(s) to ride on the forks, pallets or on the truck.



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.

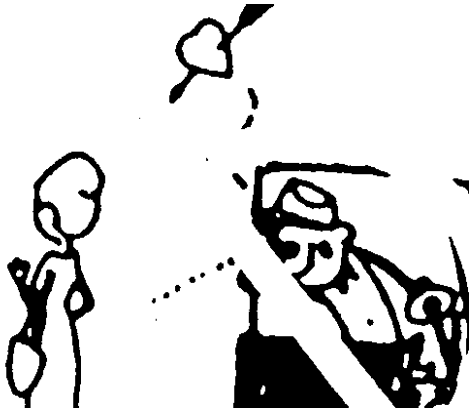
14. Know capacity of truck

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.

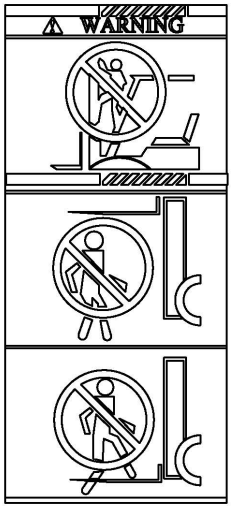
19. Attach safeguard and load bracket

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.



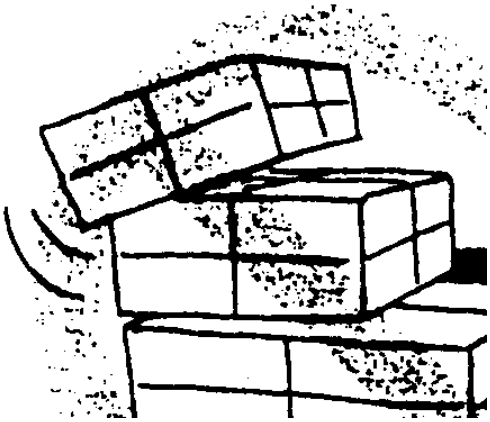

21. Avoid be clamped by the mast

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 departures 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.

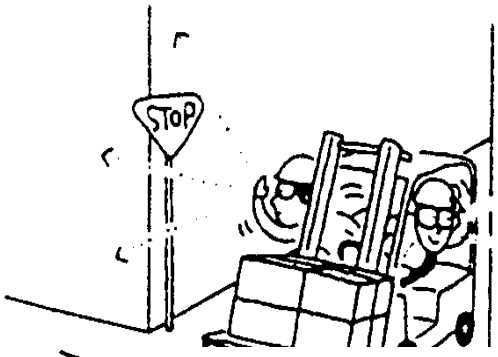
When operating with long loads such as lumber, pipe, etc., or in the case of the Large-sized model or the truck with spreader, be extremely careful of load end swing at corners or in narrow aisles. Be alert for fellow workers.

26. Carry the load low

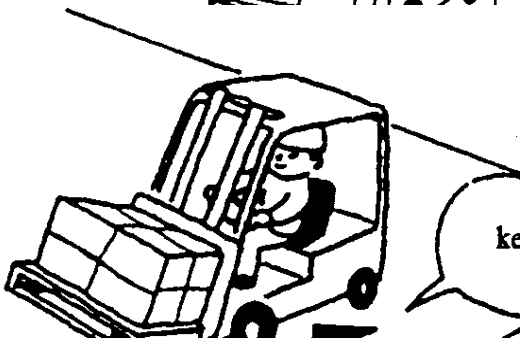
It is dangerous to travel with forks higher than appropriate position regardless of whether loaded or not. Keep the good traveling posture. (When traveling, the forks should be 15 to 30 cm above the ground or floor.)

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.

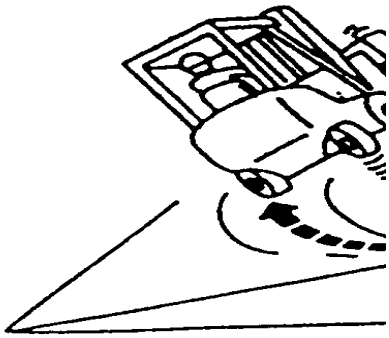
27. Tilt backward when loaded
Travel with load as low as possible and tilted back. If operating with steel pallet or the like, be sure to tilt back the mast to prevent it from slipping off the forks.




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.

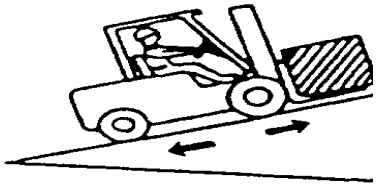


29. Keep some distance from roadside and flat roof
Affirm keeping some distance from roadside and flat roof.



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 unlading, operator's vibration of acceleration is about 0.74m/s2; when laden, is about 0.18m/s2; 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 fork) 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 of fault is found, don't operate truck until corrected.

### 3.2.2 Switching on the truck

⑴ Put direction switch to center position.

⑵ Plug into the plug

⑶ Turn on key switch

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

⑷Tilt 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.

⑸Control shift lever

Forward：Push forward the shift lever.

Backward：Pull backward the shift leve

⑹Loosen 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.

### 3.2.3Travelling, 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 load
- close the deposit area
- enter a narrow passage;
- the condition of road surface is bad.

**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.

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

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.

**Stopping or parking the truck**

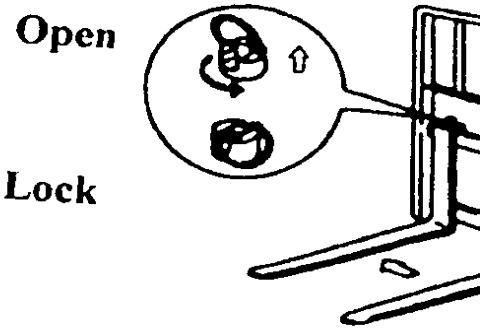
①Slow down and press the brake pedal to stop the truck.
②Place the shift lever in neutral.
③Apply the parking brake by pulling up on the parking brake lever.
④Down the forks on the ground.
⑤Place the key switch in “OFF” to shut off the battery. Remove the key and keep it.

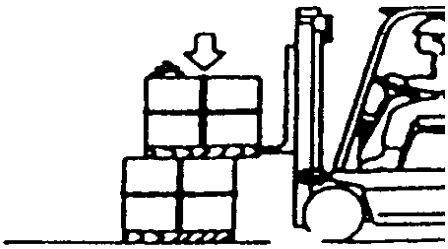
**Warning!**
·Don’t dismount from the moving truck. Never jump off the truck.
·Don’t parking the truck on the working

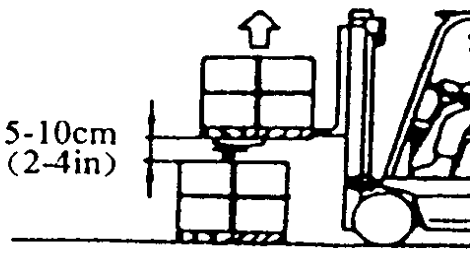
**3.4.2 Collecting and depositing loads**

**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.

**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.

• 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 .

**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.

**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.

• Lower forks to a height of 15 to 20 cm above the ground. Tilt the mast backward fully and move to the desired area.

**Check after operation**

Clean and check the truck after operation:

• Damage or leakage.

• Add grease if necessarily.

**Warning!**

· If you find any trouble, must repair it in the day.

·prohibit operate the forklift before repairing it completely.

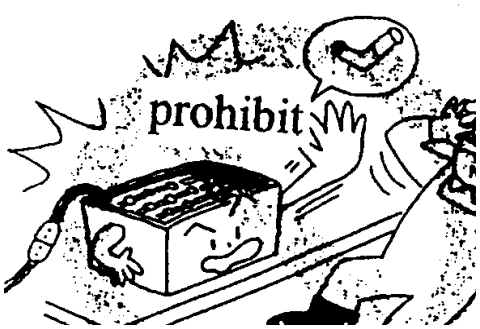
• Check the tyre if it is damaged or inset with foreign body.
• Check the wheel hub nut if it is loose.
• Check the height of electrolyte surface.
• If you haven't lift the fork to the max. height in the day, you should lift it to the max. height 2～3 times.

# 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) |
|---|---|---|---|---|
| 13/15TV | 4PZS400 | 627 | 830 | 522 |
| 16/18TV | 5PZS500 | 627 | 830 | 620 |
| 20TV | 6PZS600 | 627 | 830 | 730 |

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

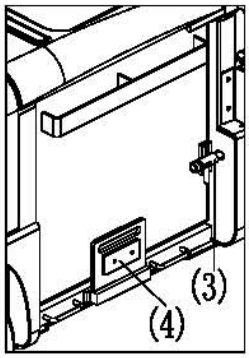
## 4.3Charging the battery

### 4.3.1Exposing the battery

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

– Drawing back the emergency brake switch .

– Open the battery lock [3] and the battery baffle of frame [4] .



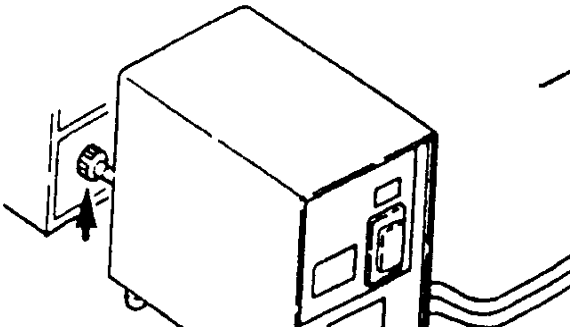
### 4.3.2Charging the battery

**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.

### 4.3.3Charging battery

**1． 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$^3$ |
| First time charge gravity | | 1.270±0.005 g/cm$^3$ |
| Water and vitriol | Volume ratio | 3.1:1 |
| | Quality Ratio | 1.75:1 |
| Vitriol standard | | Specific gravity is 1.835 g/cm$^3$ and Suitable for GB4554-84 or special for battery. |

Specification for distilled water

| Ingredient | | Index |
|---|---|---|
| Appearance | | No color crystal |
| Dry residue | % | ≤0.005 |
| Resistively($25^0$C) | Ω·cm | ≥$7\times10^4$ |
| 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.

**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.

③ The electrode is cooled to $30^0$C, then pour it into battery. It is proper to pour the electrode 15-20mmabove the electrode plate (without dobber).

④ Only when the temperature of the electrode is below $35^0$C (after 3-5 hours), can be first charged.

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

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

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.

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

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

b. 2nd 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.

**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.

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/cm3.
·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

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

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.

### 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.

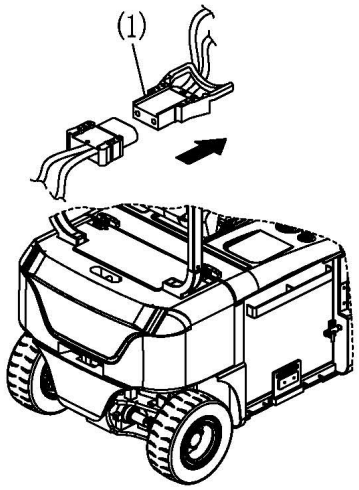
**Warning！**
• If a day's worth of work cannot be completed with one charging, carry out opportunity charging during breaks.
• When the temperature of circumstance is lower, carry out opportunity charging.

• During any charge, the temperature of electrode should not be exceeded $45^0$C，otherwise it should be taken measures such as reducing artificially charging current or lowing the temperature. If the temperature do not drop, you should stop charging, till the temperature dropping down.

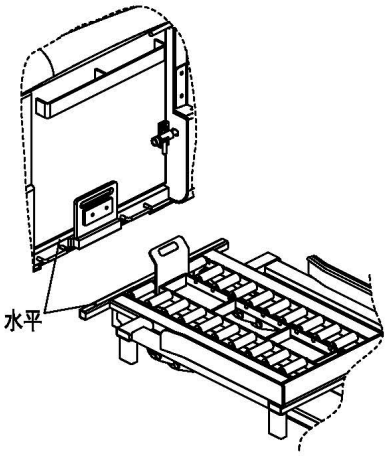
## 4.4Battery removal and installation

### 4.4.1 Removal the battery

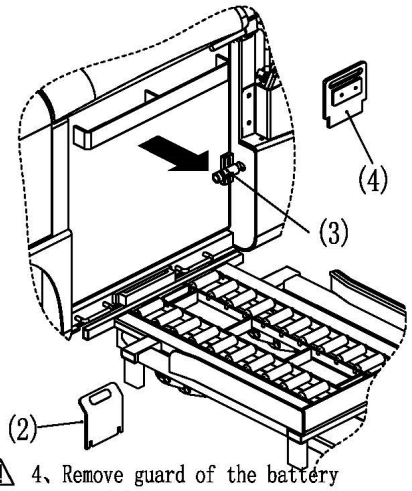
a.Take out the battery



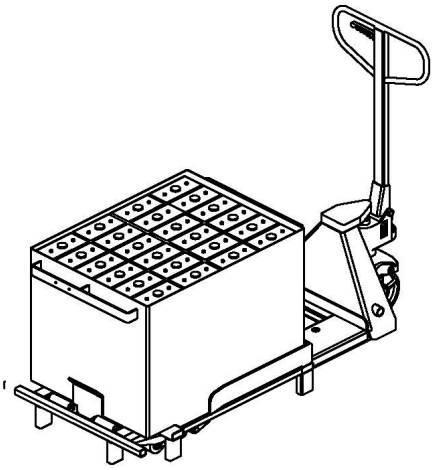

⚠ 1、Forklift safety on level groude.
2、Pull out the power plug(1).




3、The battery bracket aim side door,adjust battery to the frame by means of the interlocking mechanism
interlock.and make it with the bottom of the battery box at the same level height.




⚠ 4、Remove guard of the battery bracket(2).
⚠ 5、Open the battery lock(3)and baffle of frame(4), the battery pulled into the battery bracked.
⚠ 6、Plug guard of the battery bracket(2).

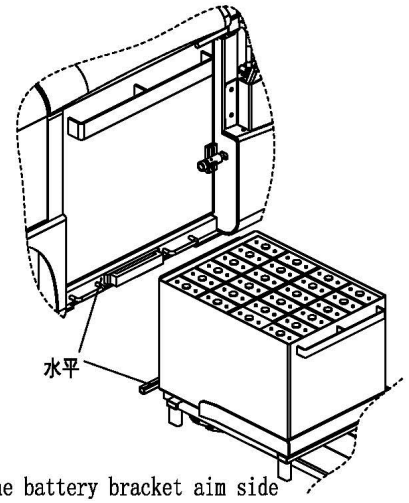


7、Adjust the height of the battery bracket,release interlocking between the frame and the bracket and move away the battery.

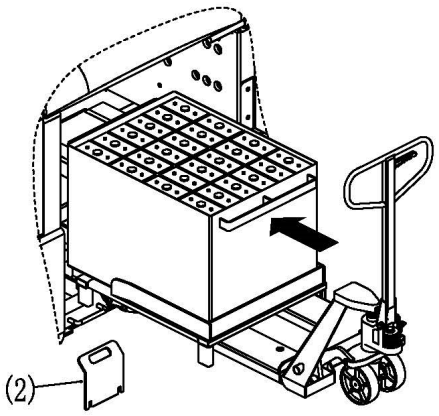
注意⚠

1、Three is ⚠ marked an important step,must operate correctly in order to avoid hazard!

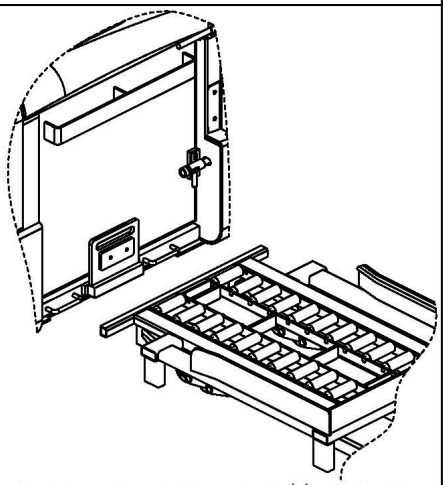
b.Replace the battery



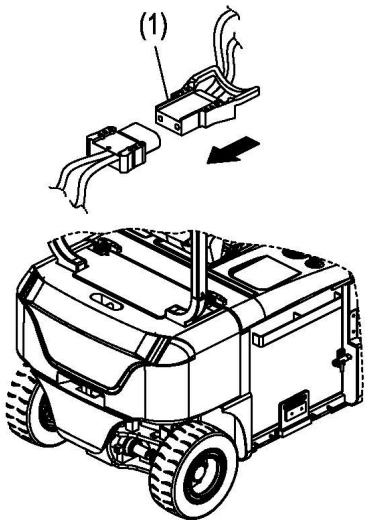

1、The battery bracket aim side door, adjust the height of bracket to the frame by means of the interlocking mechanism interlocking, and make it with bottom of the battery box at the same level height.




⚠ 2、Remove guard of the battery bracket (2) , the battery pulled into the battery box.



⚠ 3、Close the battery lock(3)and baffle of frame(4)。
4、Adjust the height of battery bracket,release interlocking between the frame and the bracket and move away the bracket.




5、Plug in the power plug(1).

注意 ⚠

1、Three is ⚠ marked an important step,must operate corectly in order to avoid hazard!

**Notice!**

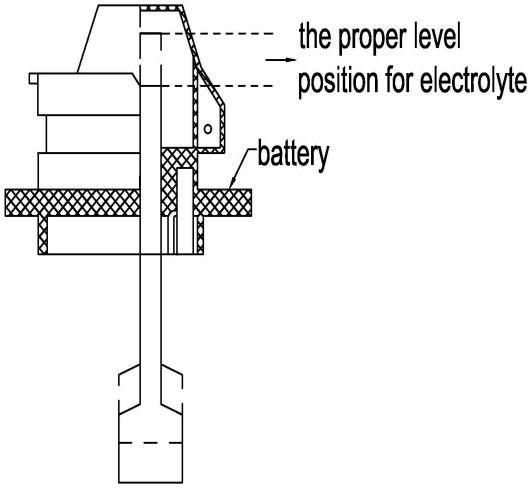
Notarize that the voltage, capability, size of the battery box and weight of the new battery are sameness with the forklift truck before replacing the

## 4.5The 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.



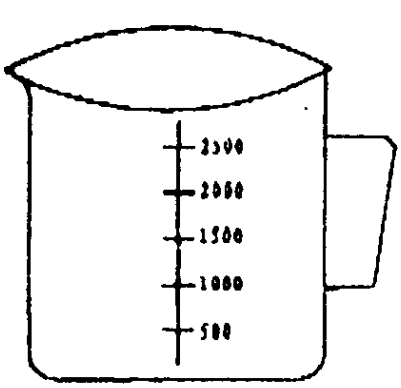

**The battery with the dobber**

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.

### 4.5.2Replenish 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.

**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.

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

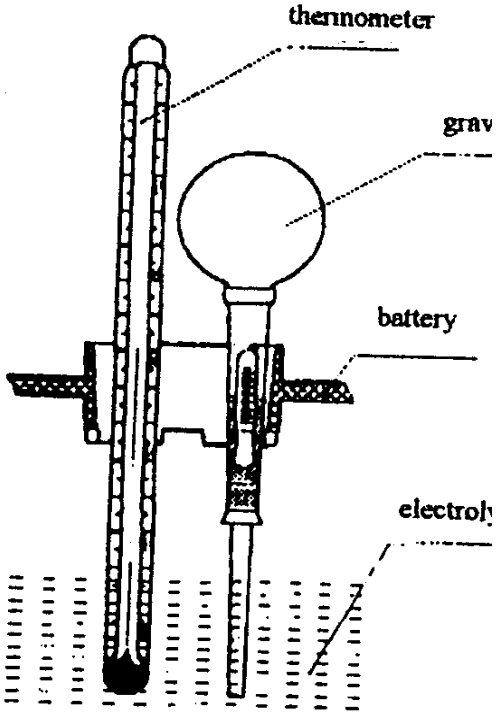
### 4.5.3 Reading the specific gravity

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

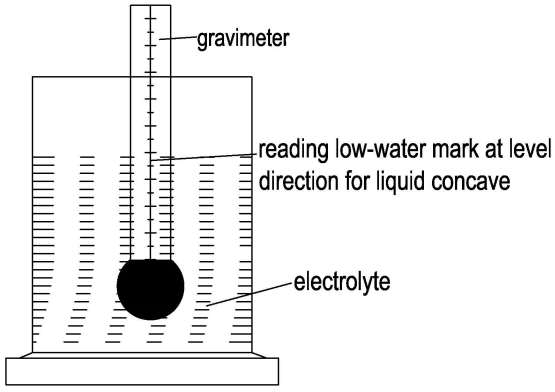
The specific gravity at the standard temperature of $30^0$C should be converted as follow：

D30= Dt + 0.0007( t - 30 )

Thereinto ： D30 ——the specific gravity at the standard temperature of $30^0$C

Dt ——the specific gravity at the temperature of $t^0$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℃.

## 4.6 battery maintenance

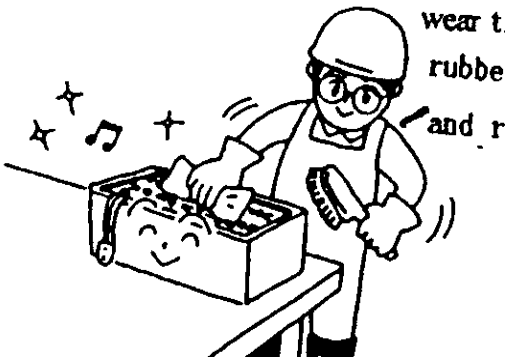
### 1. Inspection for electrolyte

·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

## 5.1Operational 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 orthodoxy 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.

**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.

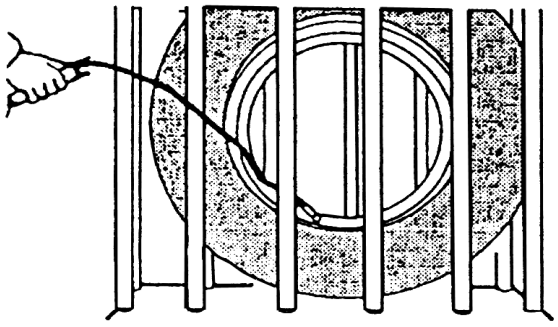
·little trouble brings great accident.

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!**

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 compress-or. 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.

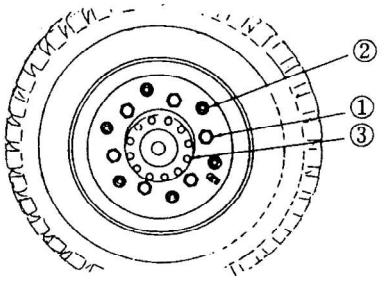
3. Replace tyre

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.

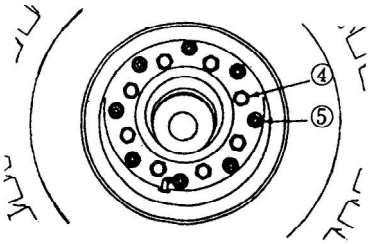
①Hub nut
②Divided rim bolt
③Drive shaft bolt
④Hub nut
⑤Divided rim bolt

Tighten torque refers to "5.3.12Table for bolt's tight torque",page 58.

Driving wheel




Steering




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. 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 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 should be taken to prevent dirt or water from entering the reservoir.

9. Check hydraulic oil

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

10. Replace hydraulic oil

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

11. Drivers seat adjustment

Make sure the driver's seat is properly located. If not properly, shift the adjustinglever 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.

12. Check battery

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

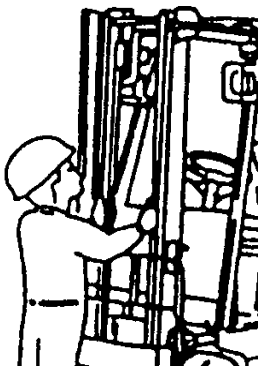
Check the terminal for loose or damage. Otherwise it will be adjust or replace.

Tighten the lock and close the hood

Pull in the plug,turn on the key switch

13. Instrument check (include battery capacity and error diagnose)

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



14. Lighting lever, tilting lever, attachment lever

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

15. 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

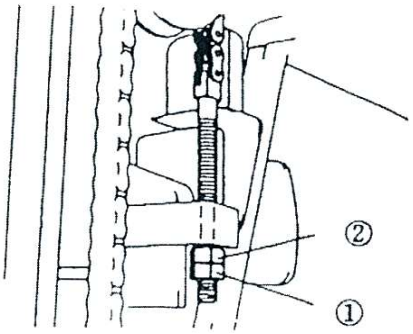
sound.

16. Mast lubrication
You should grease lubrication to mast on schedule.

17. Lift chain tension check
Check the tension and abnormality of the lift chains.

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

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




③If 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.

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

19. 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.

20. Battery maintenance
Refer to "4.Battery Maintenance & Charging"，page35.

21. Other
For instance, pay attention to sound

## 5.3Termly inspection and maintenance

### 5.3.1Storage 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 | | ○ | ○ | ○ | ○ | ○ |

### 5.3.2Controller

| 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 |

### 5.3.3Motor

| 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. | | | | ○ | ○ | ○ |

### 5.3.4Driving 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 | | Replace once every 1000 hours | | | | |
| 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 | ○ | ○ | ○ | ○ | ○ |

### 5.3.5Wheels (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 | ○ | ○ | ○ | ○ | ○ |

### 5.3.6Steering System

| Checking Item | Service required | Tools | Daily (8 hrs) | Weekly (50 hrs) | Monthly (200hrs) | Trimonthly (600 hrs) | Semiannually (1200 hrs) |
|---|---|---|---|---|---|---|---|
| Steering wheel | Check for peripheral play | | ○ | ○ | ○ | ○ | ○ |
| | Check for vertical looseness | | ○ | ○ | ○ | ○ | ○ |
| | Check for sideways looseness | | ○ | ○ | ○ | ○ | ○ |
| | Check for proper operation | | ○ | ○ | ○ | ○ | ○ |
| Steering Gear box and valve | Check mounting bolts for looseness | | | | ○ | ○ | ○ |
| Steering axle | Check king pins for looseness or damage | | | | ○ | ○ | ○ |
| | Check for deflection, deformation ,cracks or damage | | | | ○ | ○ | ○ |
| | Check for mounting condition | Test hammer | | | ○ | ○ | ○ |
| Steering cylinder | Check for operation | | ○ | ○ | ○ | ○ | ○ |
| | Check for oil leaks | | ○ | ○ | ○ | ○ | ○ |
| | Check for mounting parts and joints for looseness | | | | ○ | ○ | ○ |
| | Check sensor wire connection | | | | | ○ | ○ |

### 5.3.7Brake 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 | | | | | | × |

### 5.3.8Hydraulic system

| Checking item | Service required | Tools | Daily (8 hrs) | weekly (50 hrs) | Monthly (200hrs) | Trimonthly (600 hrs) | Semiannually (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 | | | × | ○ | ○ | ○ |

**5.3.9Lifting 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 | **Perform general inspection** | | | | ○ | ○ | ○ |
| 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 | | | | ○ | ○ | ○ |

**5.3.10Additional**

| 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 | ○ | ○ | ○ | ○ | ○ |
| | Check for deformation, cracks or damage | | ○ | ○ | ○ | ○ | ○ |
| Turn signal | Check for proper operation and tight installation | | ○ | ○ | ○ | ○ | ○ |
| Horn | Check for proper operation and tight installation | | ○ | ○ | ○ | ○ | ○ |
| Light & Lamps | Check for proper operation and tight installation | | ○ | ○ | ○ | ○ | ○ |
| Buck-up Buzzer | Check for proper operation and tight installation | | ○ | ○ | ○ | ○ | ○ |
| Meters | Check meters for proper operation | | ○ | ○ | ○ | ○ | ○ |
| wire | Wire damage or looseness | | | ○ | ○ | ○ | ○ |
| | **Looseness of Electric circuit Joint** | | | | ○ | ○ | ○ |

### 5.3.11Replace 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 |

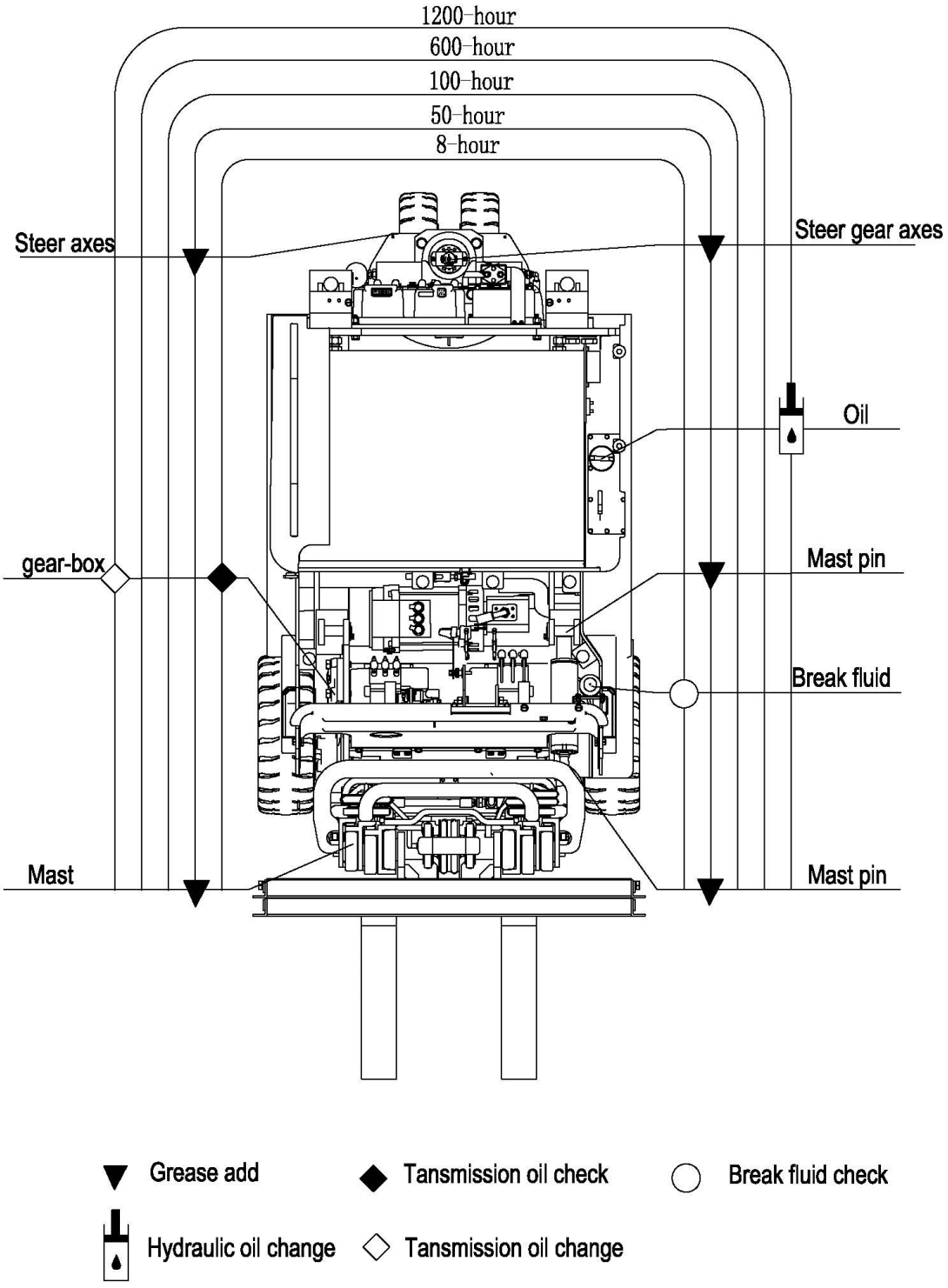
**5.3.12Table for bolt’s tight torque**

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



### 5.4.1Fuels, 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 | capability（L） | remark |
|---|---|---|---|
| Hydraulic oil | HM46# | 23.4 | 1.3-1.5t |
| | | 26.6 | 1.6-1.8t |
| | | 30.2 | 2t |
| Gear oil | Mobil ATF220 | 0.35 | |
| Brake Fluid | ZSM207DOT3 | 1.5 | |
| Lubrication grease | Polylub GA 352P | | |

## 5.5Deposit

### 5.5.1Deposit 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.

### 5.5.2Deposit 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.

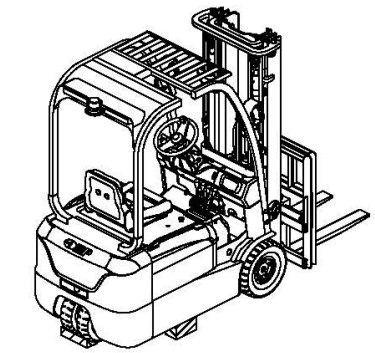
② Brush antirust oil on those parts which is exposed such as piston rod and axle.

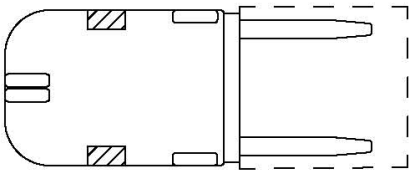
③ Put a cloth on vent-plug.

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 lever 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

## 6.1Drive system

3 wheel counter balanced battery forklift truck adapt structure of front two motor driven, each separated excited driven motor rated capacity see "1.5.1Performance data for standard trucks" on page 16. Each motor's rotating speed is controlled by the rear wheel rotating angle. Each side motor connects to ZF made GP21 model reduction gear box, wet disk brake system, solid tyre and rim such etc.

GP21 reduction gear box is two grades reduce speed gear, one grade straight gear and one grade planet gear. So the gear box is very small.

Wet disk brake do not need for maintenance on schedule.

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

### 6.1.1GP21 reduction gear box

Specification

| Item | | Parameter |
|---|---|---|
| Service weight (without oil) kg | | 31 |
| Oil volume | | 0.35 |
| Oil type | | ATF DEXRON II |
| Foot brake | Brake fluid | TCL® |
| | Oil pressure | 60-80 bar |
| | Normal pressure (continuous working) | 80bar |
| | Max. pressure | 100bar |
| | Normal fluid volume in brake booster | 1.71cm3 |
| | Max worn fluid volume in brake booster | 3.71 cm3 |
| Hand brake | Hand brake pull force | 100N |
| | Clearance | 6mm |
| | Max worn limit clearance | 13mm |

There are 3 holes on the brake booster of reduction gear box.

Air bleed plug. After add brake fluid, please loose the air bleed plug to let the air out of brake oil tube, and then tighten the plug.

The parking brake line connects to the head of booster. The maximum worn limit is 13mm, if exceed this limit, please replace a new one.

**More details please refer to the <<GP21 repair manual>> by ZF.**

## 6.2Steering system

Steering system include rear steering axle and steering device.

### 6.2.1Steering device

It consists of steering wheel, upside steering column, clamp bolt , gimbal, downside steering axle, bearings and steering gear etc. You can adjust the steering angle forward and backward by yourself.

### 6.2.2Steering axle

The steering axle is import from Italy.
More details please refer to spare part manual.

**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．Two 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 |

## 6.3Brake 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. | Correct and replenish. |
| | Air in brake lines. | Bleed air. |
| | Water or oil on linings. | Clean or replace. |
| | Uneven wear or contact of brake linings. | Grind or replace. |
| | Improper functioning of master cylinder or wheel cylinder. | Correct or replace. |
| | Clogged oil lines. | Clean. |
| Brake dragging | No free play of brake pedal. | Adjust. |
| | Improper shoe sliding. | Adjust. |
| | Improper operation of wheel cylinder. | Adjust or replace. |
| | Faulty piston cup. | Replace. |
| | Weak or broken return springs. | Replace. |
| | Clogged master cylinder return port. | Clean. |
| | Clogged oil lines. | Clean. |
| | Wheel bearing out of adjusting. | Adjust or replace. |

## 6.4Hydraulic 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.

### 6.4.1Main pump

| Trouble | Probable cause | Corrective action |
|---|---|---|
| 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.<br>Add oil in oil tank.<br>Checks pump oil seal.<br>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.<br>·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. |

### 6.4.2Control valve

| Trouble | Probable cause | Corrective action |
|---|---|---|
| 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. |

| Trouble | Probable cause | Corrective action |
|---|---|---|
| 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 blots. |
| | 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 1.6t 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.

## 6.5Lifting 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. |

| Condition | Probable cause | Corrective action |
|---|---|---|
| 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. |

## 6.6Electrical 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” | × | × | × | × | × | ALARM the watchdog has been triggered | -If the alarm is present in Init status, remove the alarm condition<br>-If the alarm has occurred in ready or running mode, it is necessary to remove alarm condition and to activate a traction request. |
| 17 | “LOGIC FAILURE #3” | × | × | | × | | ALARM failure in over-load protection hw circuit | To remove alarm condition＋ activation of traction request |
| 18 | “LOGIC FAILURE #2” | × | × | × | | | ALARM failure in U,V,W voltage feedback circuit | To remove alarm condition＋ activation of traction request |
| 19 | “LOGIC FAILURE #1” | × | | × | × | × | ALARM an overvoltage or undervolt. Condition has been detected | To recycle the key switch |
| 30 | “VMN LOW” | × | × | × | × | × | ALARM 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<br>-If the alarm has occurred in ready or running 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” | × | × | × | × | | ALARM 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<br>-If the alarm has occurred in ready or running mode , it is necessary to remove alarm condition and to activate a traction request. |
| 53 | “STBY I HIGHT” | × | × | × | × | | ALARM Wrong voltage in the current sensor feedback circuit | If the alarm is present in Init status, remove the alarm condition<br>-If the alarm has occurred in ready or running mode, it is necessary to remove alarm condition and to activate a traction request. |
| 60 | “CAP CHARGE” | × | × | × | | | ALARM 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” | × | | × | × | × | ALARM line contactor coil driver is shorted | If the alarm is present in Init status, remove the alarm cause<br>-If the alarm has occurred in ready or running mode, it is necessary to remove alarm cause and to activate a traction request. |
| 75 | “CONTACTOR DRIVER” | × | | | × | × | ALARM 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” | × | | × | × | × | ALARM<br>-Init the LC and EB coil driver protection circuit is damaged<br>-ready or running short on LC coil or EB coil | If the alarm is present in Init status, remove the alarm cause<br>-If the alarm has occurred in ready or running mode, it is necessary to remove alarm cause and to activate a traction request. |
| 37 | “CONTACTOR CLOSED” | × | | × | | | ALARM 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” | × | | × | | | ALARM 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” | × | × | | | × | ALARM motor speed sensor (encoder) does not work properly | To recycle the key |
| 84 | “STEER SENSOR KO | × | | × | × | × | ALARM steering poti signal out of rage | To remove the alarm cause |
| 86 | “PEDAL WIRE KO” | | × | × | × | × | ALARM fault in accelerator negative (NPOT) input circuit | To remove alarm cause and activate a traction request |
| 245 | “WRONG SET BATTERY” | × | | × | | | ALARM 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” | × | | × | × | × | ALARM Master µC detects a slave µC malfunction | To recycle the key |
| 247 | “MASTER KO” | | × | × | × | × | ALARM slave µC detects a Master µC malfunction or a mismatch between input status and Master commands(via CAN bus) | To recycle the key |
| 250 | “INPUTMISMATCH” | | × | × | × | × | ALARM slave µC has detects a mismatch between input status and input status transmitted via CAN bus by Master µC | To recycle the key |
| 253 | “AUX OUTPUT KO” | × | | × | × | × | ALARM EB coil driver shorted or open | If the alarm is present in Init status, remove the alarm cause<br>-If the alarm has occurred in ready or running mode, it is necessary to remove alarm cause and to activate a traction request. |
| 13 | “EEPROM KO” | × | | × | × | × | Warning Eeprom fault , controller will use default parameters | 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 | | |
| 61 | “HIGHT TEMPERATURE” | × | × | × | × | × | Warning Master or Slave or both temperature higher than 75℃ | To remove Warning cause |
| 65 | “MOTOR TEMPERATURE” | × | | × | × | × | Warning Right or lift or both temperature high | To remove Warning cause |
| 66 | “BATTERY LOW” | × | | × | × | × | Warning battery charge level below 20 % | To remove Warning cause |
| 78 | “VACC NOT OK” | × | | × | × | | Warning accelerator signal(CPOT) voltage higher than VACC MIN +1V while the traction enable switch is open | To remove Warning cause |
| 79 | “INCORRECT START” | × | | × | × | × | Warning Wrong traction request sequence | To remove Warning cause |
| 80 | “FORWARD+BACKWARD” | × | | × | × | × | Warning Forward and reverse input are both active | To remove Warning cause |
| 249 | “THERMIAC SENSOR KO” | × | × | × | × | × | Warning Master or slave temperature sensor is out of range | To remove Warning cause |
| 251 | “WATTING FOR NODE # 4” | × | | × | × | × | Warning Master μC signal that slave μC is in alarm status | To remove Warning cause |
| 251 | “WATTING FOR NODE # 3” | | × | × | × | × | Warning Slave μC signal that master μC is in alarm status | To remove Warning cause |
| 241 | “NO CAN MESSAGE # 4” | × | | × | × | × | ALARM Master has lost can communication with the slave | To remove Alarm cause |
| 247 | “NO CAN MESSAGE # 4” | | × | × | × | × | ALARM Slave has lost can communication with the master | To remove Alarm cause |

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

**1. WATCH DOG**

It is a self-diagnosing test within the logic between Master and Slave µcontrollers. This alarm could also be caused by a CAN bus malfunctioning, which blinds Master-Slave 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**

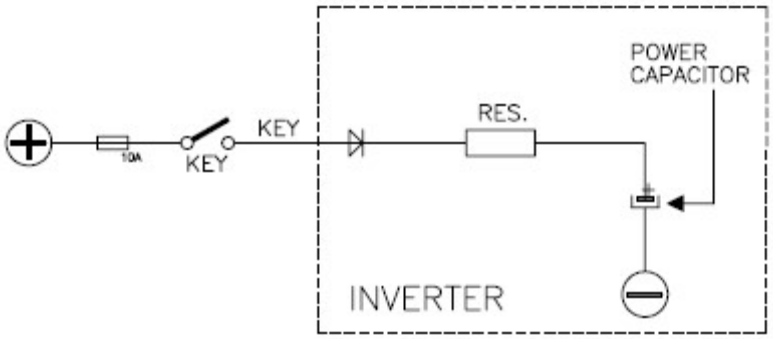
The µCs verify if the feedback of current sensors device output is within the zero current window. Possible causes of the alarm:

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 µController checks the LC coil driver shortcircuit protection hardware. If it does not react in a correct way to the µC 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 µC 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. STEER SENSOR KO**

This is an alarm which signals an out of range of the steering potentiometer signal. The fault condition is entered in these two following conditions:
- the "Set steer 0 pos" (straight wheels program parameter is wrong (lower than "Set steer min" or higher than "Set steer max").
- the feedback signal of the steering potentiometer is outside the window defined by "Set steer min" and "Set steer max" parameters.

In the first case, repeat the steering potentiometer acquisition. In the second case, check the steering poti and its wiring. Eventually, repeat again the steering potentiometer acquisition.

**11. PEDAL WIRE KO**

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

**12. 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.

**13. SLAVE KO**

Slave and Master µCs perform a cross-check in order to verify their functionality. If the MASTER detects SLAVE µC malfunctioning, it brings the controller in a safe status opening the power bridge and the Line Contactor.

**14. MASTER KO**

Slave and Master µCs perform a cross-check in order to verify their functionality. There are two conditions under which slave enters this fault condition:
- the SLAVE µC receives incoherent can message from the MASTER µC
- the SLAVE µC compares the inputs status and the related MASTER operations, and find they are not coherent.

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

**15. INPUT MISMATCH**

Safety related inputs (Fw direction, Rev direction, accelerator enable, seat switch) are input to both microcontrollers by independent hw circuit. The two µCs read these inputs and compare by exchanging related status on the CAN bus. If the SLAVE µC 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.

**16. AUX OUTPUT KO**

The µP checks the driver of the electromechanical brake coil. If the status of the driver output does not correspond to the signal coming from the µP, 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.

**17. EEPROM KO**

Fault in the area of memory in which the adjustment parameters are stored; this alarm does not inhibits 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.

**18. HIGH TEMPERATURE**

Master or Slave 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.

**19. MOTOR TEMPERATURE**

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

**20. 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.

**21. 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.

**22. 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.

**23. FORW + BACK**

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

a. defective wiring;

b. running microswitch failure;

c. incorrect operation;

d. if the defect persists, replace the logic.

**24. 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.

**25. WAITING FOR NODE #4**

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

**26. WAITING FOR NODE #3**

The Master µC has detected a fault condition, the Slave is aware of this thanks to CAN bus communication; it cannot drive the motor until the Master has resolved its problem. The fault has to be looked for in the Master.

**27. NO CAN MESSAGE #4**

Master (node #3) signals that it has lost can communication with the Slave (node #4). 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. NO CAN MESSAGE #3**

Slave (node #4) signals that it has lost can communication with the Master (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.

### 6.6.3Pump 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 | | |
| 28 | “PUMP VMN LOW” | | × | × | × | × | ALARM Wrong voltage output of pump chopper, the motor voltage feedback is not coherent with applied PWM | If the alarm is present in Init status, remove the alarm cause<br>-If the alarm has occurred in ready or running mode, it is necessary to remove fault cause and to activate a function request. |
| 56 | “PUMP STBY I HIGH” | × | × | × | × | | ALARM in ready condition (no PWM applied to pump chopper) the pump current sensor feedback is out of the zero current window. | If the alarm is present in Init status, remove the alarm cause<br>-If the alarm has occurred in ready or running mode, it is necessary to remove fault cause and to activate a function request. |
| 242 Slave | “PUMPTEMPERAT” | | × | × | × | × | Warning the pump chopper temperature is higher than 75 ℃ | To remove Warning cause |
| 242 Master | “PUMP” | × | | × | × | × | Warning Master controller signals that salve μC has detected a fault in the pump chopper | To remove Warning cause |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 243 | “PUMP INC. START” | | × | × | × | | Warning pump incorrect start sequence | To remove Warning cause |
| 244 | “PUMP VACC MOTOR” | | × | × | × | | Warning pump accelerator voltage is 1V greater than the minimum value programmed | To remove Warning cause |

### 6.3.4 Analysis of pump related alarms displayed in console

**1. PUMP VMN LOW**

The pump chopper power output is feedback to the µC. If this feedback voltage is not coherent with the applied PWM, this fault condition is signalled. There could be many causes:

- failure in the pump chopper power section
- failure in the pump chopper driving section
- failure in the pump chopper voltage feedback circuit
- dispersion in the pump motor to truck frame.

**2. PUMP STBY I HIGH**

The pump chopper current sensor feedback is out of the zero-current window while no PWM is applied to the pump chopper. The most likely cause is a failure in the current sensor.

**3. PUMP TEMPERATURE**

Pump chopper temperature is higher than 75°C, maximum current is proportionally reduced. If the alarm is present when the controller is cold, there is a failure in the temperature sensor or in the feedback circuit.

**4. PUMP**

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

## Lithium Battery Use and Maintenance Manual

## Table of Content

## Chapter 1 Safety Precautions

| ⚠ CAUTION | |
|---|---|
|  <br>**PROHIBITION** | • DO NOT short-circuit the positive and negative terminals of the battery.<br>• Do not collide, handle gently, and avoid the battery being subjected to excessive vibration, external impact, high drop, etc.<br>• DO NOT place the battery or battery pack in a corrosive chemical environment.<br>• DO NOT charge the battery without a charging device or with a charging device that we do not recognize.<br>• DO NOT expose the battery or leave it in an environment above 45 °C for a long time.<br>• DO NOT disassemble, squeeze, puncture or heat the battery.<br>• Lithium batteries are forbidden for those who lack the knowledge of safe use of lithium batteries.<br>• DO NOT immerse the battery in water or other conductive liquids.<br>• DO NOT use the battery in series or in parallel with other models or types of batteries.<br>• Serial and parallel operation of a complete power supply system containing a lithium-ion battery protection circuit board or battery management system is prohibited. |
|  | • It is strictly forbidden to hot swap battery<br>• It is easy to cause fire and electric shock |
|  | • Be aware of corrosion<br>• It may cause battery damage and shorten battery life |
|  | • No burning<br>• It may cause battery explosion |

# Chapter 2 Battery Introduction and Instructions

## 2.1 Battery Introduction

| | | | |
|---|---|---|---|
| Battery model | CPD18TV8 | Battery weight | 856KG |
| Rated voltage | 48V | Cell material | LFP |
| Rated capacity | 360AH | Battery size | 830*620*574mm |
| Charger voltage | 48V | Charger current | 150A |

## 2.2 Instructions

1. Due to the product in transit or inventory, the lithium battery must be fully charged with the vehicle-specific charger before the first use (do not mix with other models of chargers or use other modified equipment), and then it can be used;

2. The lithium battery should be used at an ambient temperature of -20°C ~ 45°C, do not use or store the battery near a fire source/heat source where the temperature is outside the temperature range;

**Caution!**
Ambient temperature for use:
-20°C ~ 45°C

3. Lithium battery has the performance of charging and using whenever it is necessary, when the battery is low, please charge it in time to avoid over-discharge; the replaced battery should also be charged in time to avoid damage caused by over-discharge of the battery after self-discharge.

4. Do not place metal objects (such as wrenches, knives) on the lithium battery, or other objects that may cause short-circuiting of the battery to avoid short circuit between the positive and negative terminals;

5. Do not bump or strike the lithium battery during use, if the battery leaks or smells, please stop using it immediately and keep away from the fire source.

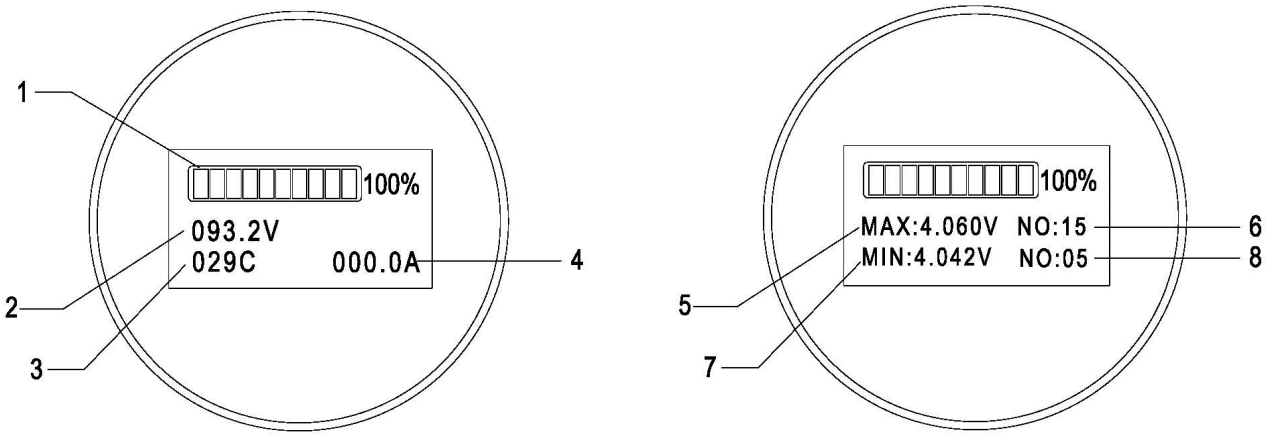
6. If the battery life is significantly shortened, please contact the after-sales for check;

7. If the lithium battery fails and cannot be used, please remove the battery from the handling equipment, the trained personnel can use our BMS special reading instrument to read the information for preliminary judgment; for problems that cannot be solved, please contact the after-sales service department for solutions;

8. Before installing and removing the battery, be sure to read the user manual; the weight of the battery body is evenly distributed, please pay attention to the installation

and removal when there is an external weight; please use two hooks to hang on the lifting rings during the lifting process, and gently lift it to keep it stable and not inclined;
9. The operator must read the instructions carefully before use and receive relevant safety training to be able to handle emergencies;

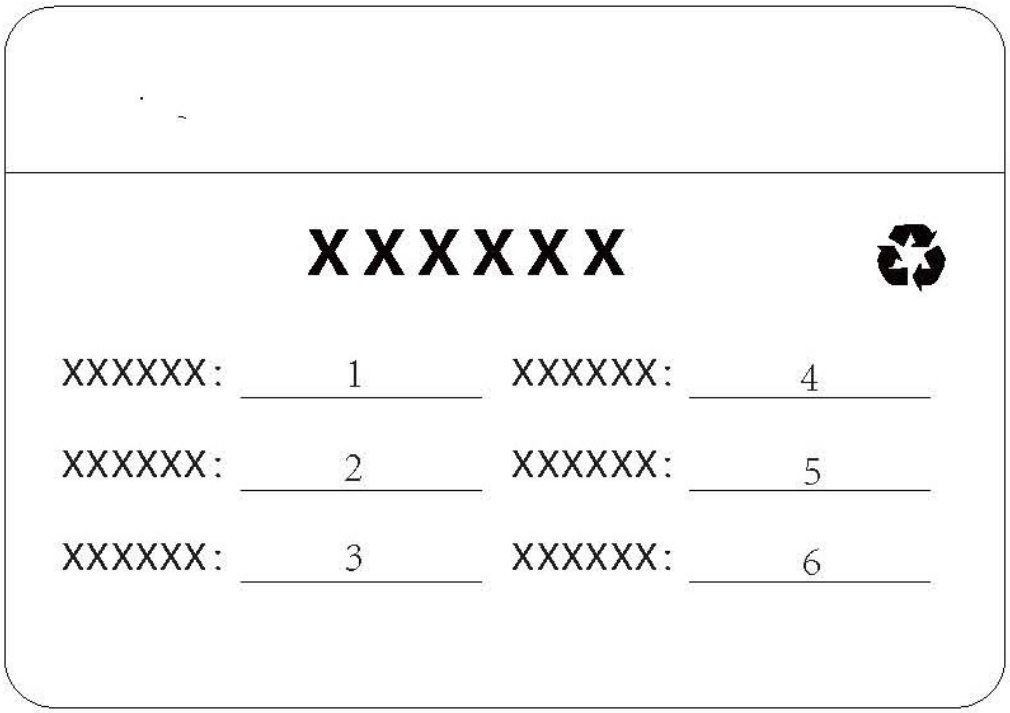
## 2.3 Display Instrument




Display status 1

| No. | Name | Description |
|---|---|---|
| 1 | Energy display | When all 10 cells are on, it indicates that the battery is full; When the first cell and the second flash alternately, it indicates that the battery is low and must be charged. The battery remaining capacity is displayed; “100%” indicates that the battery is fully charged. |
| 2 | Total voltage | The sum of the total voltages of the lithium battery series |
| 3 | Temperature | Battery temperature |
| 4 | Charging current | Current value when charging the lithium battery |
| 5 | Maximum cell voltage | Maximum value of cell voltage |
| 6 | Cell No. of maximum cell voltage | The specific cell which is of the maximum voltage |
| 7 | Minimum cell voltage | Minimum value of cell voltage |
| 8 | Cell No. of minimum cell voltage | The specific cell which is of the minimum voltage |

## 2.4 Battery Nameplate




| No. | Name | No. | Name |
|---|---|---|---|
| 1 | Battery model | 4 | Cell type |
| 2 | Version No. | 5 | Battery weight |
| 3 | S/N | 6 | Date of production |

## Chapter 3 Charging

1. This battery can only be charged with the vehicle-specific charger, other chargers may cause battery damage.
2. The normal charging temperature range of the battery is: 0°C ~ 45°C, please do not charge in the environment beyond the normal temperature range;
3. If the charging is still not completed within the specified time, stop charging the battery;
4. During the charging operation, it is necessary to have professional personnel to operate and care, in order to ensure that the charging plug and socket work normally without heat, to ensure that the charging device works normally, to ensure that the battery pack and its protection circuit work normally, and the whole power supply system has no sign of short circuit, over current, over temperature or overcharge.

**Warning!**
Lithium batteries are strictly prohibited from overcharging and overdischarging.

5. When charging, connect the battery plug connector to the charger plug connector, and there will be contactor sound; after starting charging, the circular display meter will display the total voltage, the maximum and minimum cell voltages, power, temperature, charging current and other information; pay particular attention to the charging current and the maximum and minimum cell voltages, as well as the voltage difference between them; if there is abnormality, stop charging in time and contact the after-sales service department for solutions.

**Caution!**
1. The normal charging temperature range of the battery is: 0°C~45°C.
2. The voltage difference between the maximum and minimum cell voltages during charging is less than 0.1V.
3. The lithium battery voltage matches the charger voltage.
4. The charger should be periodically checked for charging overvoltage protection device.

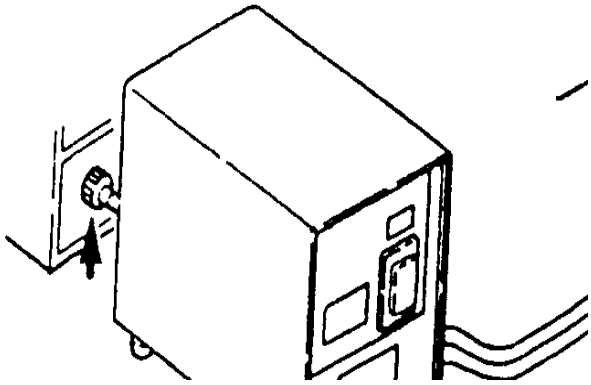
Charging procedure:

• Move the forklift truck to the vicinity of the charger.

• Check the charger before starting charging.

• Check if the battery voltage to be charged matches the charger. (Please refer to the nameplate for rated output of the charger)

• Connect the output plug of the charger to the plug of the lithium battery box on the forklift truck.



## Chapter 4 Storage

1. Try to ensure that the battery or battery pack's power is ≥60% before long-term storage as the battery has the function of self-discharge, be sure to charge the battery once every 3 months to ensure the battery power is ≥60%;
2. The battery should be stored in a temperature environment of -20°C~45°C;
3. Store in a dry, ventilated and cool environment, avoid direct sunlight, high temperature, high humidity, corrosive gas, severe vibration, etc.
4. DO NOT stack, stacking of this series of products is not allowed.

**Caution!**
Ambient temperature for storage:
-20°C~45°C

5. DO NOT store under the condition that the load or the hidden load is connected, that is, it is prohibited to have any form of discharge behavior when storing;
6. If the battery is found to be bulged, cracked, or has a low voltage value after long-term storage, the battery may be damaged; please contact the relevant technical department of the company for technical support.
7. After not using the battery for a long time, do not charge or discharge the battery if the smell of leakage is found near the battery.

## Chapter 5 Transportation

1. During the loading, unloading and transportation process, severe vibration and large external impact should be avoided, and throwing, rolling, inverting, squeezing and excessive stacking are prohibited;
2. Prevent rain during transportation;
3. Ensure that the battery or battery pack has been disconnected from the load or charging device before transportation, without any form of charging and discharging.

**Warning!**
Don't bump, handle gently.

# Chapter 6 Common Problems and Solutions

During the use and maintenance of the lithium-ion battery, the battery or battery system may have one or more of the following abnormal conditions, please organize the professional engineers and technicians to perform the necessary processing according to the instructions in this manual; if you have any questions about the status or solutions, please contact the relevant technical department or after-sales service department of the company to obtain professional technical support.

1. If the battery is found to have abnormal mechanical characteristics such as swelling, cracked casing, melted casing deformation, and distortion of the casing before and during installation, stop using the battery immediately and store it separately;
2. If abnormalities such as looseness, cracks, cracks in the insulation layer, burn marks, etc. of the battery's pole pressing bolts, conductive strips, main circuit wires and connectors are found before and during the installation, stop using the battery immediately, check the reason for analysis and give it a fix;
3. If the polarity of the positive and negative terminals of the battery is found not match the polarity identification before installation, please stop using the battery immediately and contact the after-sales service department to replace the battery or obtain other solutions;
4. If the temperature of the battery exceeds 65°C before and during installation, stop using the battery immediately and leave it separately, if the temperature continues to rise, it needs to be buried with sand;
5. If the battery is found to emit smoke before and during installation, immediately stop using the battery and bury it with sand, and notify the after-sales service department of the company for record and obtain technical support;

# Chapter 7 Maintenance

## 7.1 Daily Maintenance

1. It is necessary to arrange professionals for care during the charging operation, especially when the battery is almost fully charged; make sure that the plug and the socket are in good contact during the charging process to ensure that the charging device works normally and ensure that the connection points of the battery pack are in good contact. If an abnormality occurs, the battery needs to be repaired before charging;
2. Check the battery voltage, temperature, voltage difference, etc. displayed on the circular display meter before charging and discharging to ensure that all values are within the normal range;
3. If there is a large amount of dust, metal shavings or other debris on the upper cover and poles of the battery pack, use compressed air or dry cloth to clean it in time, avoid cleaning with water or water-soaked objects;
4. When charging and discharging, try to avoid water or other conductive liquids splashing on the top cover and poles of the battery, for example, being exposed to heavy rain during use;
5. Estimate the charging time and discharging time of the battery according to the actual status of use of the battery or battery pack, observe whether there is any abnormality in the battery or battery pack at the end of charging and the end of discharging, such as the voltage difference of the battery.

## 7.2 Regular Maintenance

1. Check the nodes such as the conductive strips and voltage collection terminals for looseness, shedding, rusting or deformation, etc., to ensure that the series-parallel harness used in the battery pack is firm and reliable (once a month);
2. Check the battery casing for cracks, deformation, loose poles, bulging and other abnormal conditions (once a month);
3. Check the reliability of the charging device to ensure that the charging device performs the charging action in accordance with the voltage regulation and current regulation signals sent by the BMS and to ensure that the battery will not be overcharged (once a month);
4. Check discharge protection equipment, such as fast-acting fuses, DC contactors, relays, etc., to ensure that the battery pack can be quickly disconnected from the main circuit in the event of a dangerous situation such as short circuit or overcurrent (once a month);

5. Check the insulation resistance between the battery pack and the vehicle body to ensure that the resistance value meets the Chinese national standard (≥500Ω/V) and to ensure that there is no electric leakage with the battery (once a month);

## 7.3 Disposal of Used Battery Packs

To prevent environmental pollution, the battery should be sent to a local recycling center or a dedicated lithium bat