

# Operation Manual

ICE251





EP EQUIPMENT CO.,LTD. is one of the world's leading companies manufacture, design material handling equipment and provide related service. With over 100,000 square meters 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 catalogs.

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".

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## Foreword

Thanks for your purchasing our forklift truck.

This forklift truck is our company's new product. It has the beautiful shape, small dimensions, low gravity.

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.

Forklift truck ICE301B has already passed CE certificate.

### Notes:

1. This manual is used for operation and maintenance , the detail parameters, 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.

### Internet address and QR code of Parts manual

By entering the address <http://www.ep-care.com> in a web browser or by scanning the QR code, Login after registration, Select "Parts purchase" function and input part number or model name to find the truck.



**Note:** After registration, please send email to [info@ep-care.com](mailto:info@ep-care.com) to activate your account

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## **WARNING!**

### **TO PREVENT SETIOUS RISK OF INJURY TO YOUORSELF 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.
  - Push the travel combination switch to neutral ,prevent the truck started unexpected.
  - Press the emergency stop switch .
  - Set the key switch to the "OFF" position and remove the key.
4. Before starting to operate truck:
  - Be in operating position
  - Place directional control in neutral
  - Before operating truck, check functions of lift systems, directional control,speed control,steering, warning devices and brakes.
5. Avoid fire hazards and have fire protection equipment present. Do not use open flame to check lever, or for leakage of electrolyte and fluids or oil. Do not use open pans of fuel or flammable cleaning fluids for cleaning parts.
6. Brakes,steering mechanisms, control mechanisms,guards and safety devices shall be inspected regularly and maintained in legible condition.
7. Capacity, operation and maintenance instruction plates or decals shall be maintained in legible condition.
8. All parts of lift mechanisms shall be inspected to maintain them in safe operating condition.

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

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

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.

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## **Correct use and application**

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

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

### **Proprietor responsibilities**

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

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

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

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

### **Attaching accessories**

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

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

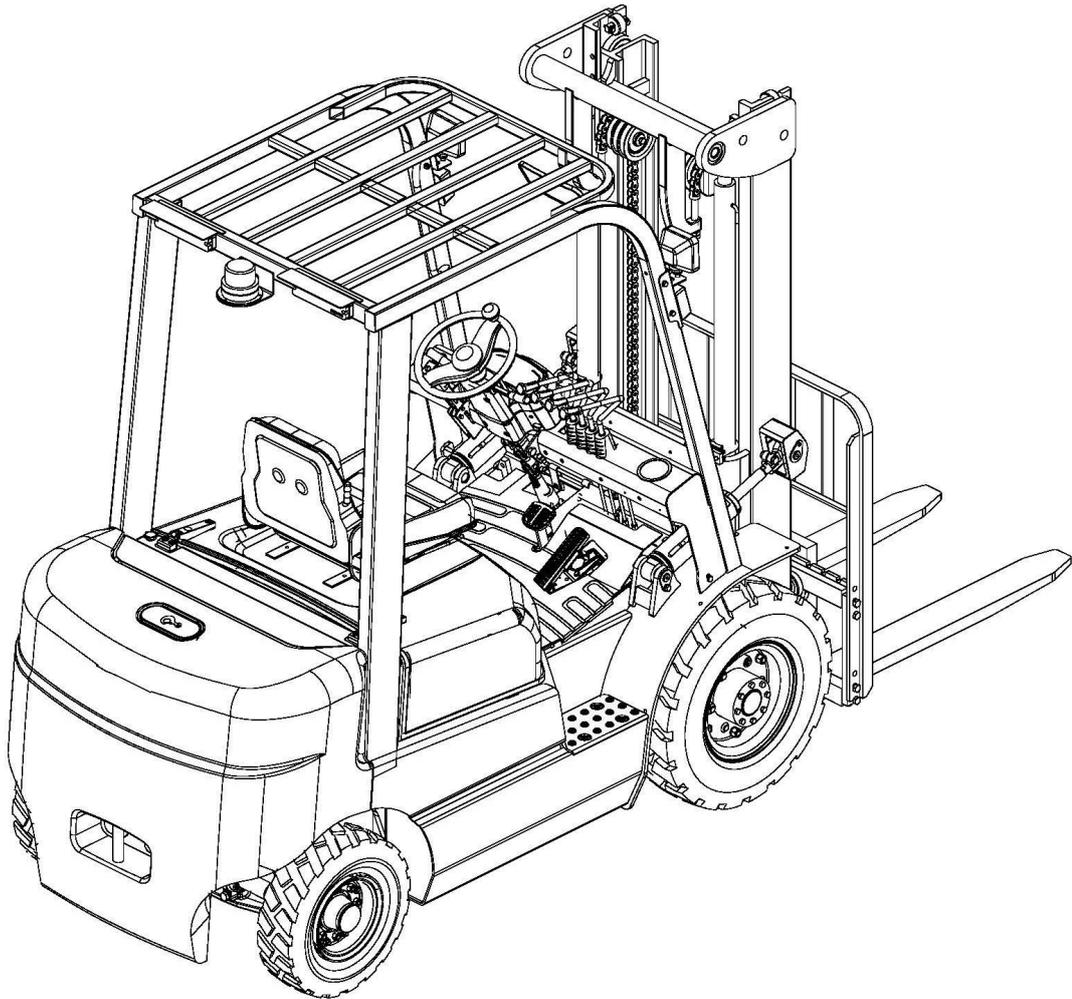
## 1. Truck Description

### 1.1 Application

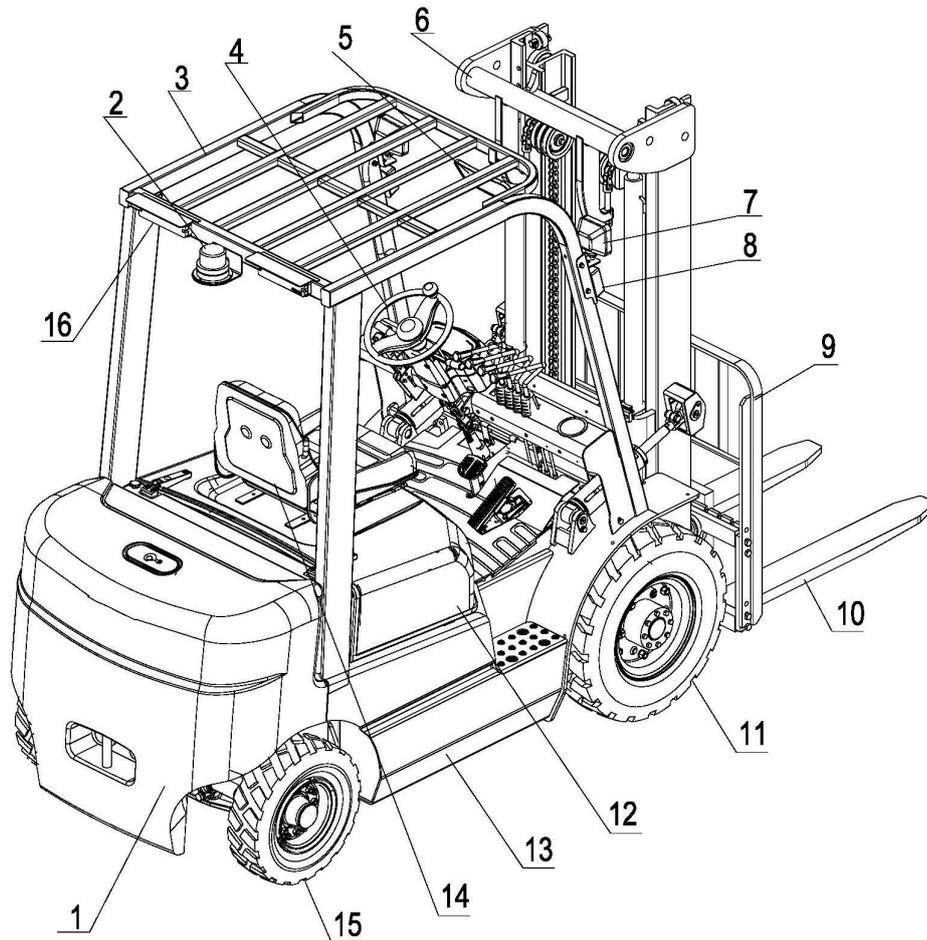
The electric forklift truck is use for industrial floors and industrial elevator.

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 chart.

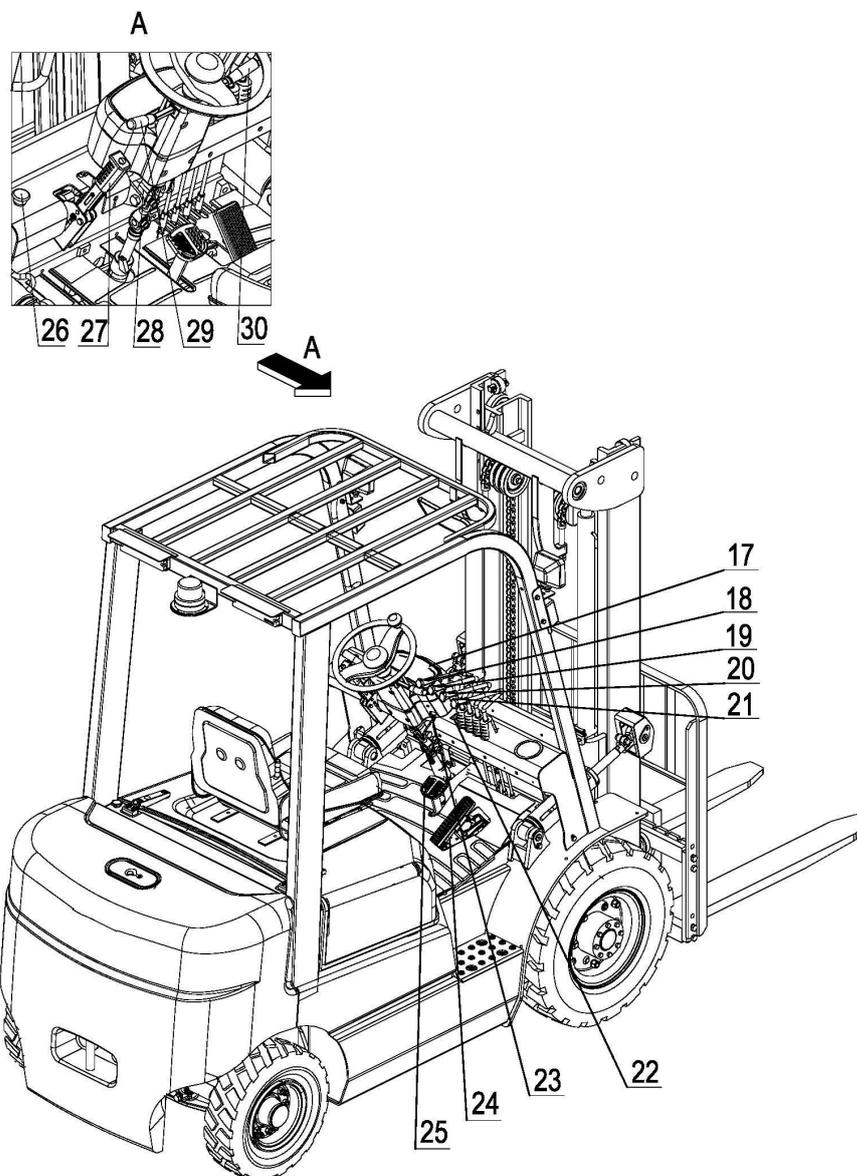


## 1.2 Assemblies



Item	Component	Item	Component
1	Counter weight	9	Load backrest
2	Caution light	10	Forks
3	Overhead Guard	11	Steer wheels
4	Steering wheel	12	Battery hood
5	Rearview mirror	13	Chassis
6	Mast	14	Seat
7	Headlight	15	Drive wheels
8	Small headlight	16	Rear combination lights

### 1.3 steer and instrument display



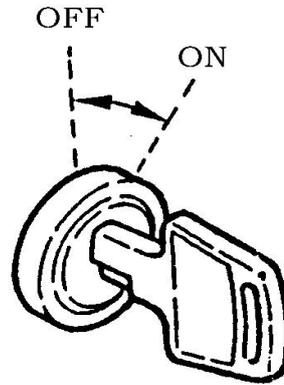
Item	Component	Item	Component
17	Display unit	24	Accelerator pedal
18	Lifting lever	25	Brake pedal
19	Tilting lever	26	Emergency stop switch
20	Side lever	27	Hand brake lever
21	Attachment lever	28	Steering column tilting angle
22	Caution light switch	29	Travel combination switch
23	Key switch	30	Combined lamp switch

### 1.3.1 Steering wheel[4]

The steering wheel is operated in the conventional manner, that is, when the wheel is turn right , the truck will turn to the right; When the wheel is turn left, the truck will turn to the left. When press the horn button,it will sound.

### 1.3.2key switch[23]

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 travel combination switch to neutral and release the accelerator pedal, then turning the key switch to “on” position clockwise.

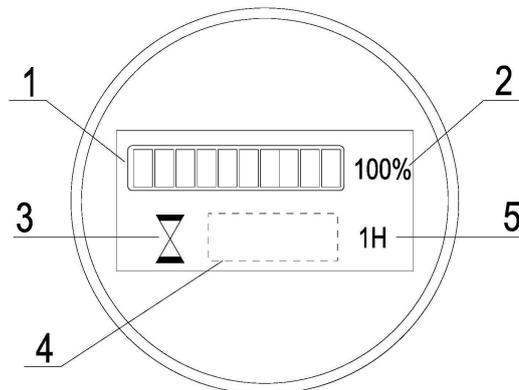


Removing the key prevents the truck from being switched on by unauthorised personnel.

#### **Warning!**

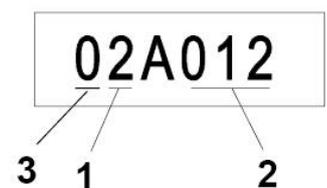
Turning the key switch “on” does not make the forklift truck move, if the travel combination switch is not in the neutral position or the accelerator pedal is being pressed. Error code maybe appear, don't worry about it. When the forklift can be operated then the error code should be disappeared.

### 1.3.3 Display unit [17]



Item	Description
1	LED (1) displays the remaining charge.when 1st block and 2nd block blinks alternatively,it indicates low power needs to be charged
2	LED (2) displays remaining charge percentage;
3	LED (3) always on, it indicates interlock switch opened, LED(3) flashing, it indicates interlock switch closed, the display start timing.
4	LED (4) displays the the fault code.
5	LED (5) displays the total running time

Error Code		
1	Controller number	2 = traction controller 5 = Pump controller
2	Error code	note
3	Controller number	0 = master controller 2 = slave controller



## Scan and download App through QR code labelled on the truck

1. Register a new account;
2. Activate Bluetooth and connect the truck;
3. Monitor battery status and truck location in real time.



### 1.3.4 Emergency stop switch [26]

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

#### **Warning!**

Please don't use the emergency disconnect switch to substitute the function of key switch

### 1.3.5 Travel combination switch[29]

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 combination switch should be returned to neutral and move you foot from the accelerator pedal. Then the truck can be operated.

### 1.3.6 Levers/buttons

#### Lifting lever/button [18]

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 forks can be raised or lowered by pressing the lifting button or the down button.)

The motor speed or accelerator pedal does not have to do with the lowering speed of the forks.



#### Tilting lever/button [19]

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. (The mast can be tilted by pressing the button.)



#### 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/button[20]

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.

### 1.3.7 Pedal

#### Brake pedal [25]

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 [24]

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.

## 1.3.8 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]

Pull the driver seat forward-backward with adjusting lever(2), and move the seat forward or backward to proper position. Release the adjusting lever, the driver seat will be locked.



#### **Warning!**

*Lock the driver seat forward-backward adjusting lever on the set position.*

### Adjust seat back

Driver sits on.

Pull forward the seat back adjusting switch (1), and adjust the back inclination. Release the switch, the seat back will be locked.

### Safety belt

Fasten safety belt before driving. It protects driver when accidents happen. Regularly clean and check safety belt, avoid dirt.

### Regular check items related to the safety belt:

- 1)cut or frayed straps;
- 2)worn or damaged hardware, including anchor points;
- 3)buckle or retractor malfunction;
- 4)loose stitching.

### Correctly use safety belt

Sit on the seat correctly.

Check if the safety belt twisted.  
Fasten the safety belt and check safety belt lock.

### **Periodically check the safety belt**

Check if safety belt is damaged or cracked.  
Check if the metal pieces of safety belt(including anchor point) are worn or damaged.  
Check if lock catch for safety belt or traction machine functions normally.

### **Overhead safe guard**

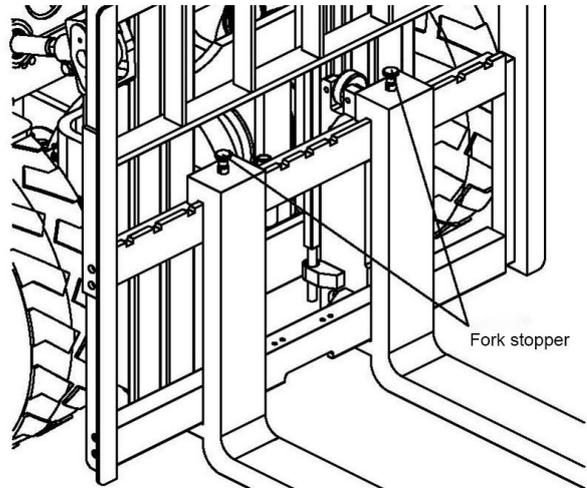
The overhead guard used is strong enough to meet safety standard, and protects the operator from falling materials.It is forbidden for use a truck that does not with safeguard.

### **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 one gaps on the beam of load bracket. It is used in attach forks.
- It is forbidden to lock the fork on the



### **Step and safely grip**

The steps are provided on 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.

#### **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.

### **Brake fluid reservoir cup**

The brake booster is located on the panel in the front of the truck.

### 1.4 Identification points and data plates



Sling label



Bolt fastening label



Air pressure of pneumatic tire label



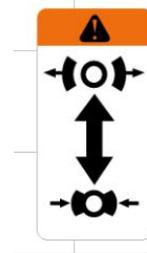
Gas spring indicator label



Wear the helmet when driving



Notice "No standing under the load carriage" label



Hand brake label



"Instruction" label



No driving in the rain



"Anti-pinch" label



"Fill port" label

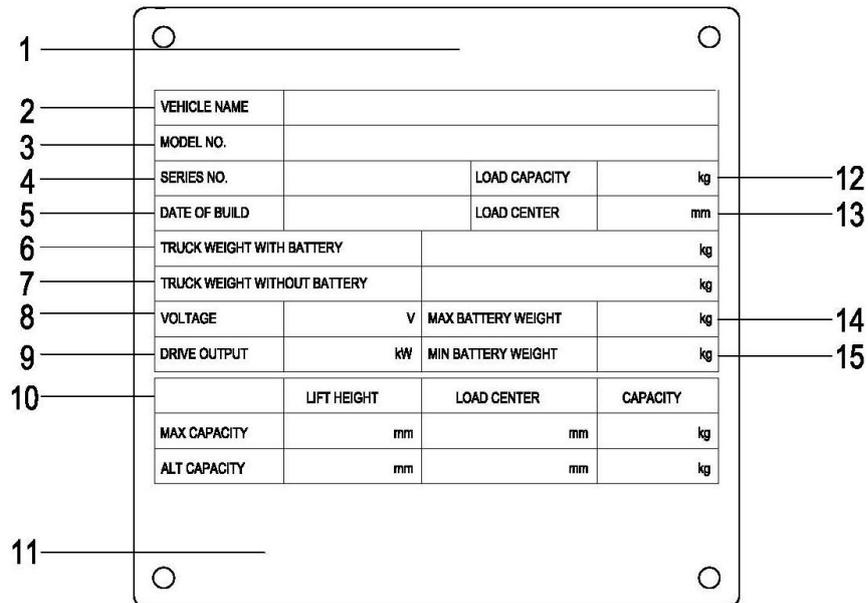


If the truck will turn over, do not attempt to get out of the truck, because the speed of overturn is much faster than you. You should hold the steering wheel handle, and this practice will let you in the seats.



It is forbidden to flush the forklift with water pipe.

### 1.4.1 Truck data plate



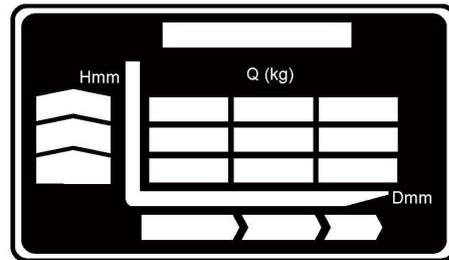
Item	Description	Item	Description
1	Manufacturer	9	Drive output(kw)
2	Vehicle name	10	load-lift height table
3	Model no.	11	License no.
4	Serial no.	12	Load capacity(kg)
5	Date of build	13	Load center(mm)
6	Truck weight with battery(kg)	14	Max. allowable battery weight(kg)
7	Truck weight without battery(kg)	15	Min. allowable battery weight(kg)
8	Voltage(V)		

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

### 1.4.2 The load capability chart

The capacity plate gives the capacity (Q) of the truck in kg for a vertical mast. The maximum capacity is shown as a table with a given load centre of gravity D (inmm) and the required lift height H (in mm).

The capacity plate of the truck indicates the truck's capacity with the forks as originally supplied.



### 1.5. Standard Version Specifications

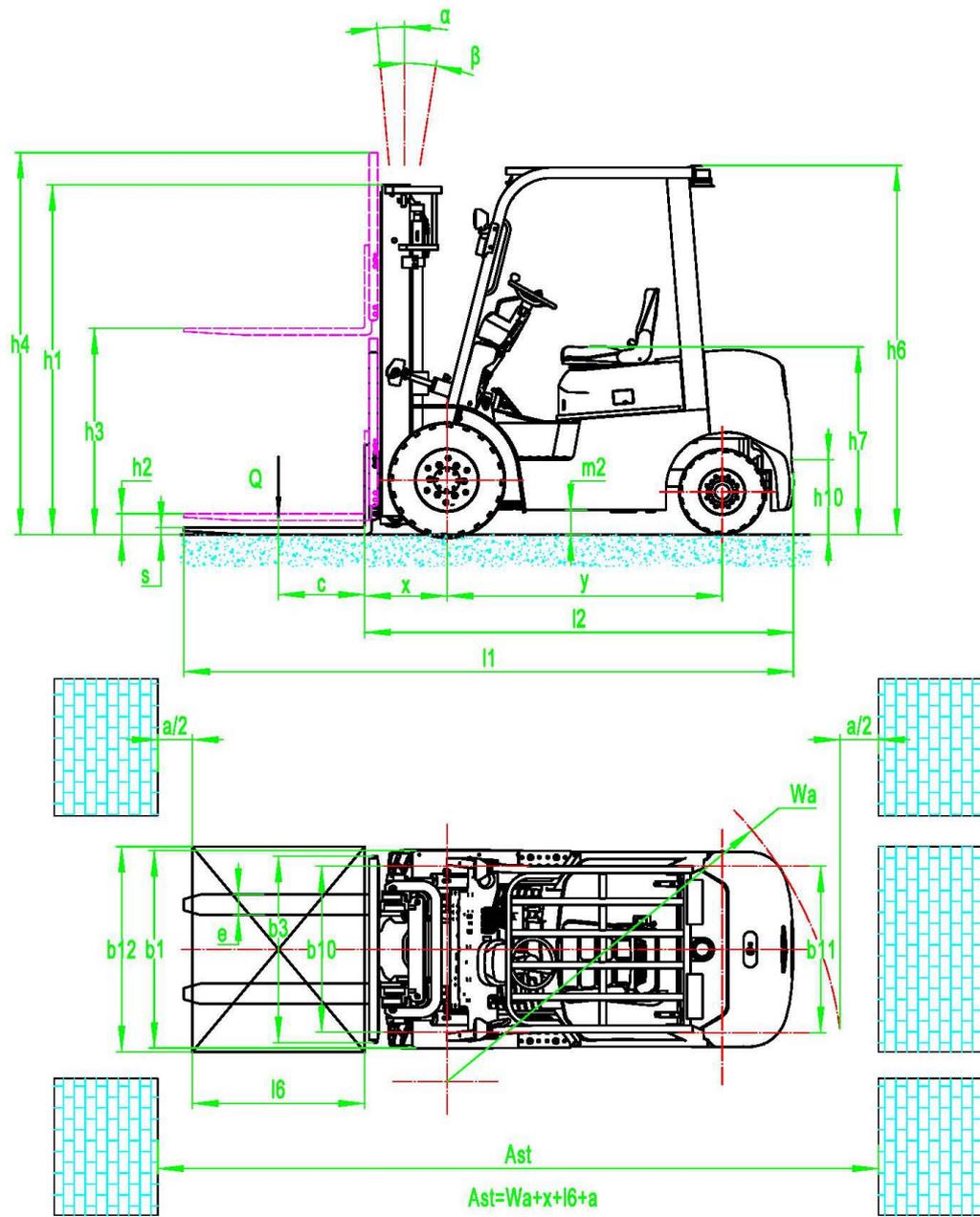
Technical specification details in accordance with VDI2198. Technical modifications and additions reserved.

#### 1.5.1 Performance data for standard trucks

1.1	Manufacturer	Code	Unit /	
1.2	Model designation			ICE251
1.3	Drive unit			Electrics
1.4	Operator type			seated
1.5	rated capacity	Q	t	2.5
1.6	Load center distance	c	mm	500
1.8	Load distance, centre of drive axle to fork	x	mm	495
1.9	Wheelbase	y	mm	1595
2.1	Service weight (include battery)		kg	3770
2.2	Axle loading, laden driving wheels /steering wheels		kg	5490/780
2.3	Axle loading, unladen driving wheels /steering wheels		kg	1450/2320
3.1	Tyre type, driving wheels /steering wheels			pneumatic tyre
3.2	Tyre size, driving wheels (diameter×width)		mm	7.00-12-12PR
3.3	Tyre size, steering wheels (diameter×width)		mm	6.00-9-10PR
3.5	Wheels, number driving/steering (x=drive wheels)		mm	2x/ 2
3.6	Tread, Driving wheels	b <sub>10</sub>	mm	970
3.7	Tread, Steering wheels	b <sub>11</sub>	mm	975

4.1	Tilt of mast/fork carriage forward/backward	$\alpha/ \beta$ (°)		6/ 10
4.2	Height, mast lowered	$h_1$	mm	2060
4.3	Free lift (load backrest)	$h_2$	mm	140
4.4	Lift height	$h_3$	mm	3000
4.5	Height, mast extended	$h_4$	mm	4050
4.7	Height of overhead guard (cabin)	$h_6$	mm	2160
4.8	Seat height	$h_7$	mm	1095
4.12	Tow center of pin height	$h_{10}$	mm	435
4.19	Overall length	$l_1$	mm	3573
4.20	Length to face of forks	$l_2$	mm	2503
4.21	Overall width	$b_1/ b_2$	mm	1154
4.22	Fork dimensions	$s/ e/ l$	mm	40×125×1070
4.23	Fork carriage class/type A, B			2A
4.24	Fork carriage width	$b_3$	mm	1090
4.31	Ground clearance, laden, below mast	$m_1$	mm	100
4.32	The minimum ground clearance of frame	$m_2$	mm	150
4.34.1	Aisle width for pallets 1000 × 1200 crossways	$A_{st}$	mm	3985
4.34.2	Aisle width for pallets 800 × 1200 lengthways	$A_{st}$	mm	4195
4.35	Turning radius	$W_a$	mm	2290
5.1	Travel speed, laden/ unladen		km/ h	11/12
5.2	Lifting speed, laden/ unladen		m/ s	0.28/0.37

5.3	Lowering speed, laden/ unladen		m/ s	0.45/0.5
5.5	Drawbar pull, laden/unladen		N	15/15
5.6	Max. drawbar pull, laden/unladen (time)		N	—
5.7	Gradeability, laden/unladen		%	—
5.8	Max. gradeability, laden/unladen		%	15/15
5.10	Service brake type			Hydraulic / Mechanical
	park brake type			Mechanical
6.1	Drive motor rating S2 60 min		kW	10
6.2	Lift motor rating at S3 15%		kW	12
6.3	The maximum allowed size battery		mm	731X 608X326
6.4	Battery voltage/nominal capacity K5			80V205AH
6.5	Battery weight		kg	/
8.1	Type of drive unit			AC
10.5	Steering type			Hydraulic
10.7	Sound pressure level at the driver's ear		dB (A)	< 74



## 1.6 Relationship between load and stability of truck

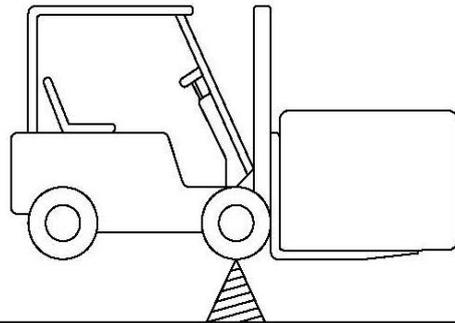
It is very important for operator to know the truck's structure and relationship between load and stability.

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

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

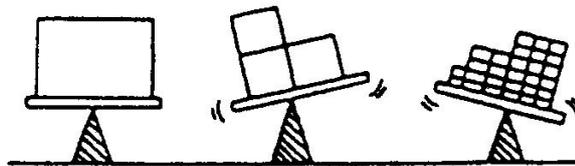
The lift truck keeps the balance of weight between the truck body and the load on the forks with the center of the front wheels as a fulcrum when the rated capacity load is placed in position.

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



### **Warning! Load center**

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



**Warning! Gravity and stability**

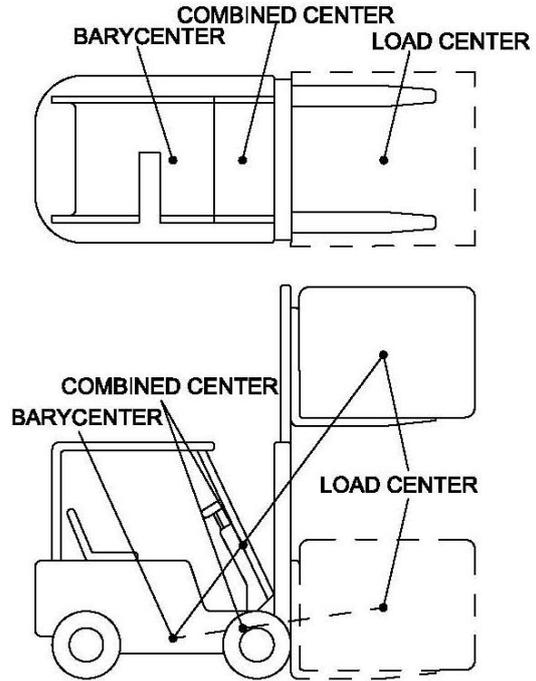
The combined center that is composed of the barycenter and the load center determine the stability of lift trucks.

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

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

The combined center is determined by these factors:

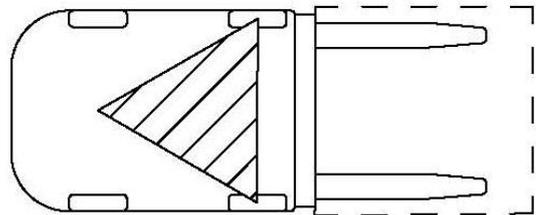
- Load's size, weight and shape.
- The lifting height.
- The tilting angle.
- The pressure of the tire.
- The radius of turning.
- The road and grade's angle.



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

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

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

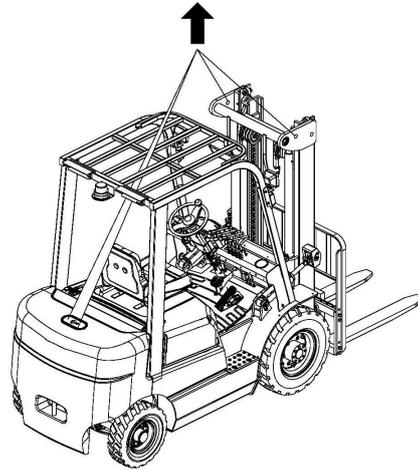


## Transport and Commissioning

### 2.1 Transport

#### 2.1.1 Lifting the truck by crane

- The Fork Lift Truck is designed for material handling only, It is inappropriate for long-distance transportation. The Fork Lift Truck must be transported by ship, train or lorry, or 5T loading.
- Use a lifting sling 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 rope attach to the counterweight should through the safeguard gap, and make the safeguard not be distorted.



#### **Warning!**

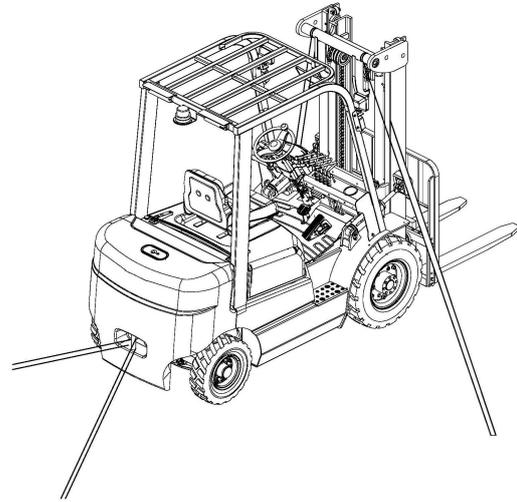
- When hoist the truck, don't coil the overhead guard with the steel wire.
- The steel wire ropes and the lifting device must be very firm to support the truck because the truck is very heavy.
- Don't lift the truck by hoist the overhead guard.
- When lifting the truck, don't take anybody below the truck.

### 2.1.2 Securing the truck during transport

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

- Parking the truck securely on a lorry or a trailer. See "Safety Regulations for the Operation of Forklift Trucks" .
- The rope is used to fix the truck must be firm enough. The rope round the mast above the beam and fixed to truck.
- Check both sides need to fix.

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

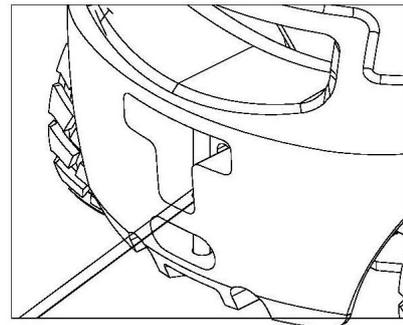


### 2.1.3 Towing

The towing rod on the bottom of the counter balance is used to pull and drag the truck.

#### **Warning!**

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



#### **Towing procedure**

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

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

- Press the emergency stop button.
- Lower the goods, but do not allow the fork arms to touch the ground.
- Remove the load.
- Pull on the hand brake lever.
- The driver should operate the steering wheel during towing, and the brake when necessary.
- Do not exceed the truck's maximum working speed when towing.

## 2.2 Using the Truck for the First Time

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

Preparing the truck for operation after delivery or transport

Procedure

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

### **2.3 During brake-in**

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

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

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

## **3.Operation**

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

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

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

#### **1. Know your truck**

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

- Poor front view due to the hoist system.
- Rear wheel steering lets the rear of the truck swing outwards when going round corners .
- Compactly designed, the forklift truck is heavy. Most of the weight of the truck and loads is on the front wheels when loaded so the truck lacks stability.
- Read the operator’s manual and name plates on the truck, and become familiar with your truck and operating procedures. If there is something in the manual you do not understand, ask After-sales service personnel 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, please be careful to prevent fall down or be clamped.

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

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

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

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

#### **5. Protect yourself**

Operator must wear helmet, safety shoes and work clothes.

## 6. Prevent exploding

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

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

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

The weather of working condition is:

Air temperature  $-20^{\circ}\text{C}\sim 40^{\circ}\text{C}$

Wind speed: Less than 5m/s.

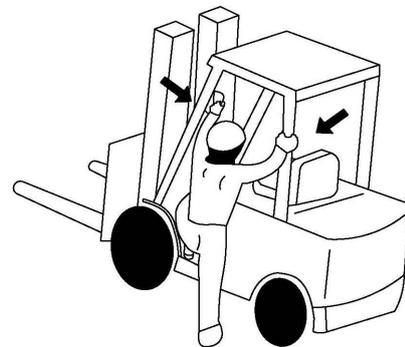
Air specific humidity: Less than 90%. (Temp at  $20^{\circ}\text{C}$ ).

Truck cannot be operated in explosive gas environments.



## 7. Mount properly

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



## 8. Never move controls unless properly seated

Never attempt to work the controls unless properly seated.

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

## 9. Start safely

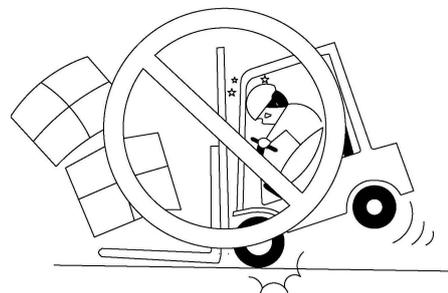
Before starting up, make sure that:

The parking brake lever is applied securely.

The travel combination switch is in neutral.

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

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



## 10. Prohibit sudden stop or turning

Operate the controls smoothly. Avoid sudden stops or turns.

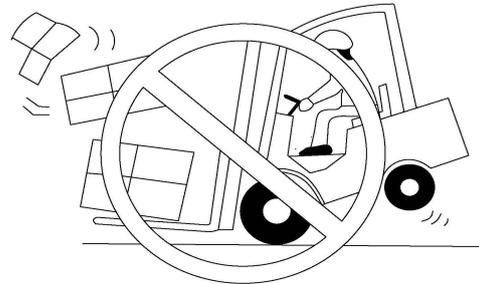
It is dangerous to make a sharp brake. Otherwise the truck has the possibility of overturn.

11. Pay attention to the route of the truck

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

12. Don't offer rides to others

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



13. Know the load to be handled

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

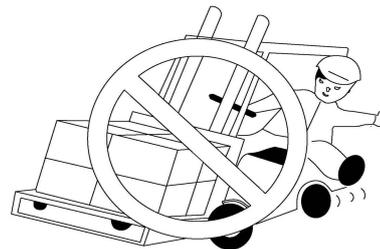
Avoid hoisting the load, with wire rope hung the forks or attachment, since the wire rope may slide off. If needed, a qualified personnel for slinging operation should perform, making use of a hook or crane arm attachment.

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

14. Know capacity of truck

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

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



15. Don't daydream

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



16. Remain seated

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



17. Use proper pallet

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

18. Use proper attachment

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



19. Attach safeguard and load bracket

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



20. Forbidden walk down or up the fork

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

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



21. Avoid be clamped by the mast

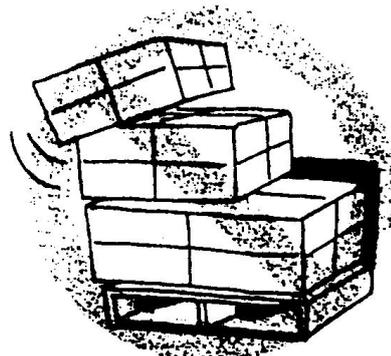
It is forbidden to put your hands, arms or head stretch between the mast and safeguard.

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



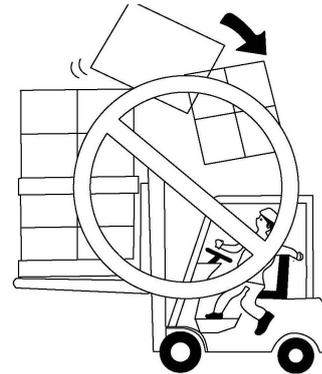
22. Prohibit load off center

The goods is liable to drop turning or passing rough road when it 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.

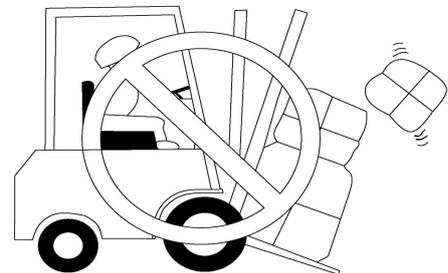


24. Don't tilt the mast with load high

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

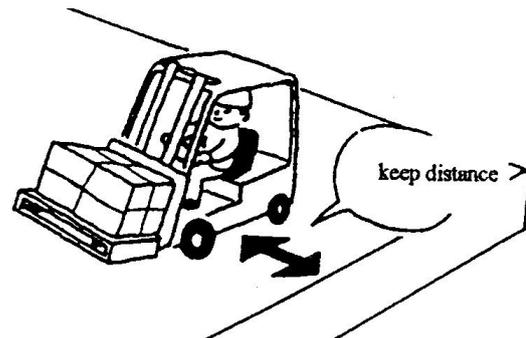
Watch for branches, cables, doorways, or overhangs. Use caution when working in congested areas.

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.



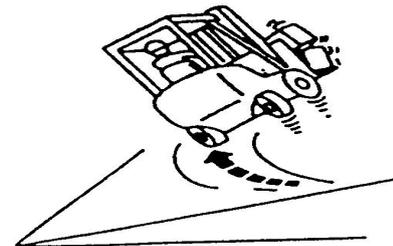
29. Keep some distance from roadside and flat roof

Affirm keeping some distance from roadside and flat roof.



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

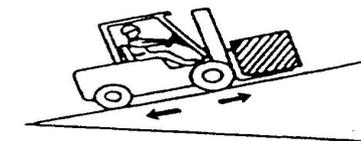
Before driving over a dock-board or bridge-plate, be sure that it is properly secured and strong enough to sustain the weight. Check the ground or floor condition of working area in advance.



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 prevent a possibility of fork attachments falling down or moving unexpectedly.



34. Check work ground area

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

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

lose balance.

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

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

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

### 35. Parking correctly

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

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

Pull out the battery plug.

The parking place must be far away from fireworks.

### 36. Towing

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

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

### 37. Nameplate

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

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

### 38. Noise

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

### 39. Vibration and acceleration

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

## 3.2 Operate and run the truck

### 3.2.1 Preparing

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

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

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

#### **Warning!**

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

### 3.2.2 Switching on the truck

- (1) Put the travel combination switch to center position.
- (2) Plug into the connector if necessary;
- (3) Turn on key switch

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

- (4) Tilt back the mast

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

Control the tilting lever to fully tilt back the upright.

- (5) Control shift lever

Forward: Push forward the direction switch.  
Backward: Pull backward the direction switch.

### 3.2.3 Travelling, Steering, Braking

#### Traveling

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

#### Decrease speed

Loosen the accelerate pedal slowly, the truck will decelerate.

#### Warning!

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

#### Notice!

Decelerate the truck in the situations following:

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

#### Steering

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

Slow down the truck and move toward

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

#### Notice!

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

#### Stopping or parking the truck

① Slow down and press the brake pedal to stop the truck.

② Place the travel combination switch in neutral.

③ Down the forks on the ground.

④ Place the key switch in "OFF" to shut off the battery. Remove the key and keep it.

#### Warning!

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

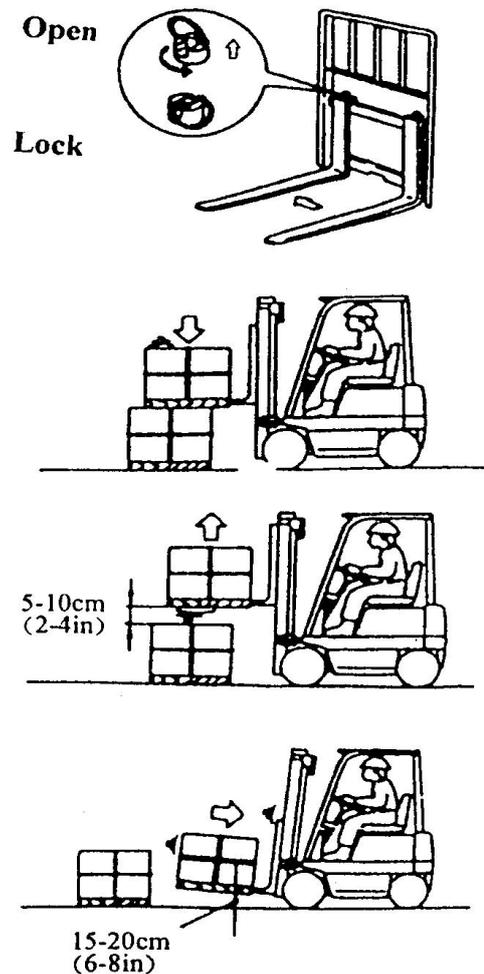
### 3.2.4 Collecting and depositing loads

#### Pick up

- The forks should be adjusted space to maintain proper balance of load.
- Place the truck right in front of the load to be handled.
- The pallet should be evenly positioned across both forks.
- Insert forks into the pallet as far as possible.
- To raise loads from the ground:

- ① Once lift the forks 5 to 10 cm off the ground or floor and make sure loads rest stable.
- ② Then, tilt the mast backwards fully and lift forks up to 15 to 20 cm off ground then start running.

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



#### Stacking load

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

#### Warning!

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

### Un-stacking load

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

#### **Warning!**

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

### 3.2.5 Check after operation

Clean and check the truck after operation:

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

#### **Warning!**

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

## 4. Battery Maintenance & Charging

### 4.1 Safety regulations for handling acid batteries

#### 1. No firing

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



#### 2. Protection against electric shock

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

#### 3. Correct wire connection

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

#### 4. Do not overuse battery

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

### 4.2 Battery type & dimension

Battery type & dimension as follow :

Tuck type	Battery type	Voltage/ rated capacity	Charger	Charging time(h)
ICE251	Lithium-ion battery	80V/155Ah	30A	5h

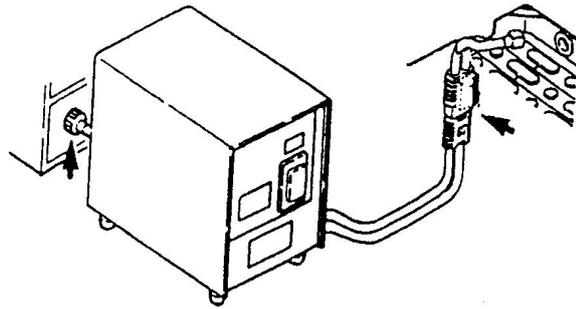
When replacing or installing batteries, ensure that the battery is correctly secured in the battery hood of the truck.

## 4.3 Charging the battery

### 4.3.1 Charging 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 connector whether good condition.
  - When wire and connector are damaged, please do not charge.
4. In charging , electrical source switch or battery connector are not close , or , which destroys connector and electrical units as a rule.



### 4.3.1 Charging Procedure

Insert the electric switch key and turn clockwise;  
Tilt the lift mast forwards slightly. The truck must be stationary on the ground;

Pull the hand brake;

Press the emergency stop switch;

Connect charger connector to the battery connector (1) ;

Switch on the charger and charge the battery in accordance with the battery and charging station manufacturers' instructions;

5. After the battery is fully charged. first close the charger, then remove the connector.



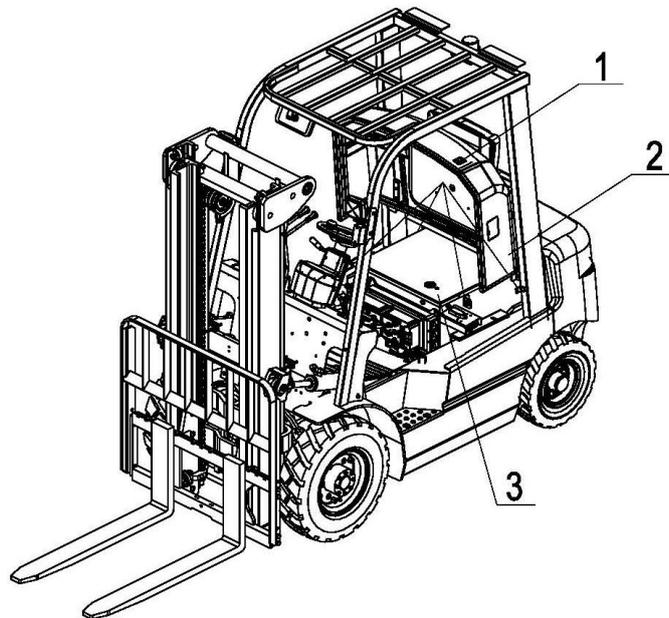
## 4.4 Battery removal and installation

### 4.4.1 Removal the battery

a. Take out the battery

1. Press the switch(1), open the battery hood(2), expose the battery;
2. Disconnect the battery wires harness from the truck;
3. Attach the lifting hook to the battery.
4. Sling the battery to a certain height with a hoist, then move it rightwards;

Install according to the reverse order of removal.



## 4.5 Battery maintenance

### 1. Remaining clean battery

Keep dryness and cleanness on the surface of battery .the point for connecting with wire is also dry and clean.(See the APPENDIX)



## 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 provided spare parts.
- 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 Maintenance Safety Regulations

#### **Maintenance personnel**

Forklift Truck must only be serviced and maintained by the manufacturer's trained personnel.

The manufacturer's service department has field technicians specially trained for these tasks. We therefore recommend a maintenance contract with the manufacturer's local service centre.

#### **Lifting and jacking up**

When the Forklift Truck is to be lifted, the lifting gear must only be secured to the points specially provided for this purpose.

When jacking up the Forklift Truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks). You may only work underneath a raised load handler if it is supported by a sufficiently strong chain.

#### **Cleaning**

Do not use flammable liquids to clean the Forklift Truck.

Prior to cleaning, all safety measures required to prevent sparking (e.g. through short circuits) must be taken. For battery-operated Forklift Truck , the battery connector must be removed. Only weak suction or compressed air and non-conductive antistatic brushes may be used for cleaning electric or electronic assemblies.

If the Forklift Truck is to be cleaned with a water jet or a high-pressure cleaner, all electrical and electronic components must be carefully covered beforehand as moisture can cause malfunctions.

Do not clean with pressurised water.

After cleaning the Forklift Truck , carry out the activities detailed in the “commissioning(on page 17)” section.

### **Electrical System**

Only suitably trained personnel may operate on the Forklift Truck ’s electrical system. Before working on the electrical system, take all precautionary measures to avoid – electric shocks.

For battery-operated Forklift Truck , also de-energise the Forklift Truck by removing the battery connector.

### **Welding**

To avoid damaging electric or electronic components, remove these from the Forklift Truck before performing welding operations.

### **Settings**

When repairing or replacing electric or electronic components or assemblies, always note the truck-specific settings.

### **Tyres**

The quality of tyres affects the stability and performance of the Forklift Truck . When replacing factory fitted tyres only used original manufacturer’s spare parts, as otherwise the data plate specifications will not be kept.

When changing wheels and tyres, ensure that the Forklift Truck does not slew (e.g. when replacing wheels always left and right simultaneously).

### **Hydraulic hoses**

The hoses must be replaced every six years. When replacing hydraulic components, also replace the hoses in the hydraulic system.

## **5.3 Servicing and inspection**

Thorough and expert servicing is one of the most important requirements for the safe operation of the Forklift Truck . Failure to perform regular servicing can lead to truck failure and poses a potential hazard to personnel and equipment.

The service intervals stated are based on single shift operation under normal operating conditions. They must be reduced accordingly if the Forklift Truck is to be used in conditions of extreme dust, temperature fluctuations or multiple shifts.

The following maintenance checklist states the tasks and intervals after which they should be carried out. Maintenance intervals are defined as:

W = Every 50 service hours, at least weekly

A = Every 500 operating hours

B = Every 1000 operating hours, or at least annually

C = Every 2000 operating hours, or at least annually

W service intervals are to be performed by the customer.

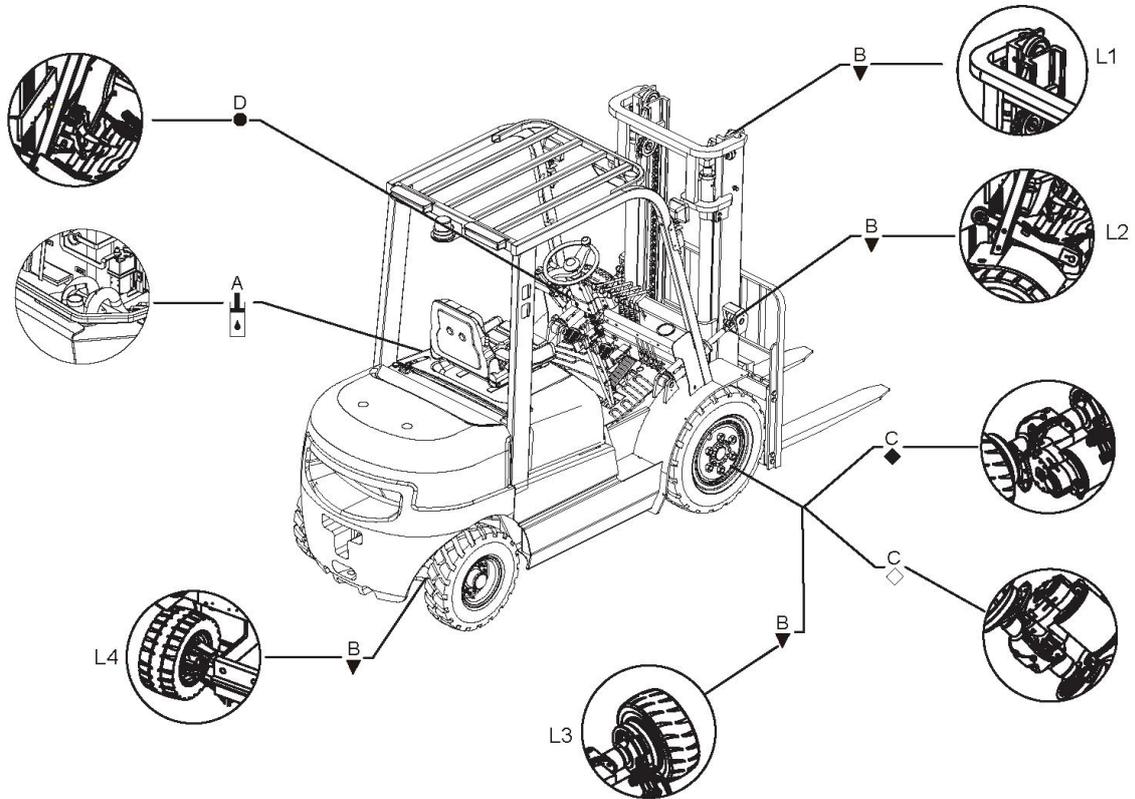
In the run-in period - after approx. 100 service hours - or after repair work, the owner must check the wheel nuts/bolts and re-tighten if necessary.

### 5.3.1 Maintenance Checklist

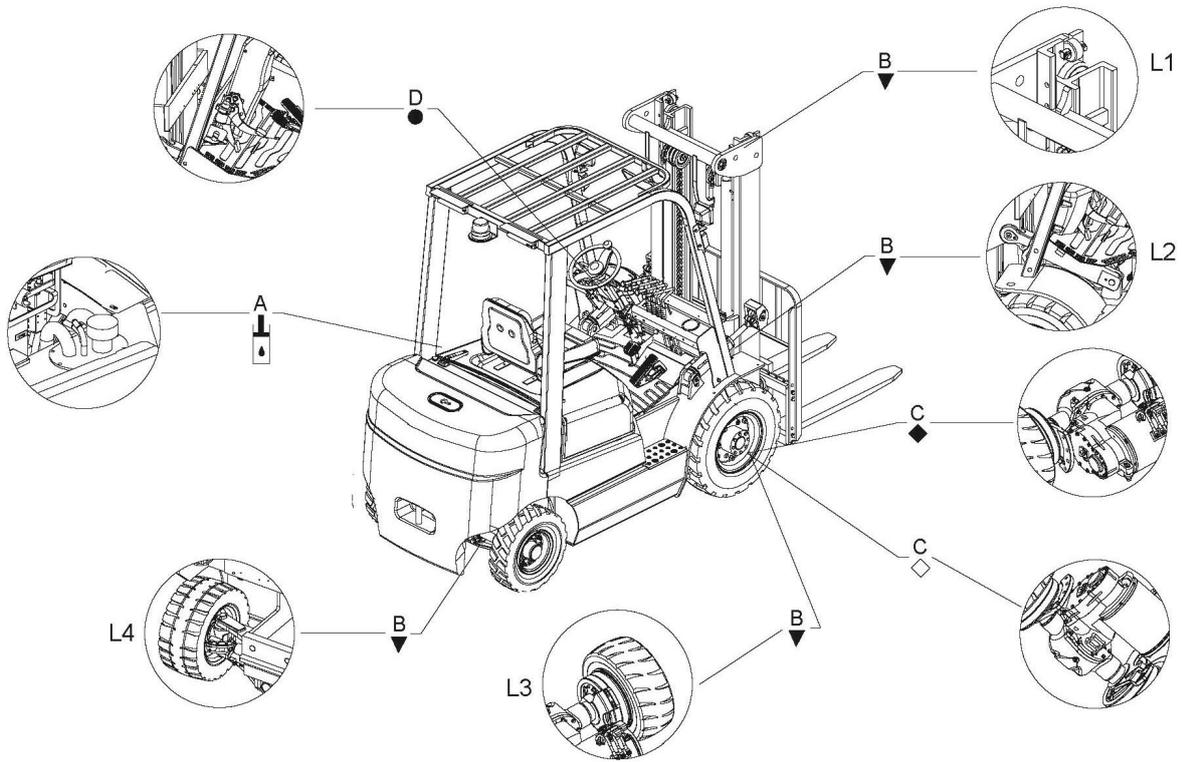
		Maintenance interval ●			
		W	A	B	C
Braking	Check magnetic brake air gap.			●	
Electrical system	Test instruments, displays and control switches.			●	
	Test warning and safety device.			●	
	Make sure wire connections are secure and check for damage.			●	
	Test micro switch setting.			●	
	Check contactors and relays.			●	
	Fix the motor and cable.			●	
Power supply	Visually inspect battery.			●	
	Visually inspect battery plug.			●	
	Check battery cable connections are secure, grease terminals if necessary.			●	
Travel	Check transmission for noise and leakage.			●	
	Check travel mechanism, adjust and lubricate if necessary.			●	
	Check wheels for wear and damage.			●	
	Check wheel suspension and attachments.			●	
	Check drive support plate.			●	
Truck frame	Check chassis for damage.			●	
	Check labels.			●	
	Check mast attachment.			●	
	Check screw connections.			●	
	Check gates and panels are secure and free of damage.			●	
Hydraulic operations	Test hydraulic system.			●	
	Check that hose and pipe lines and their connections are secure, check for leaks and damage.			●	
	Check cylinders and piston rods for damage and leaks, and make sure they are secure.			●	
	Check hydraulic oil level.			●	
	Replace hydraulic oil.				●

		Maintenance interval ●			
		W	A	B	C
Lifting	Check lifting chains and chain guides for wear, adjust and grease			●	
	Check Load handler and Pallet for wear and damage.			●	
	Perform sight check of rollers, sliding elements, and stops			●	
Steering system	Test electric steering.			●	
	Check steering tothing for wear and lubricate.			●	
Lubrication	Grease the vehicle in accordance with the lubrication schedule.			●	
Gearbox	Replace gear oil once every 1000 hours				

## 5.4 Lubrication Schedule



- ▼ sliding surface
-  hydraulic oil injection nozzle
- ◆ Gear oil injection nozzle
- ◇ Gear oil discharge nozzle
- Brake fluid



- ▼ sliding surface
- ⊥ hydraulic oil injection nozzle
- ◆ Gear oil injection nozzle
- ◇ Gear oil discharge nozzle
- Brake fluid

#### 5.4.1 Fuels, coolants and lubricants

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

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

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

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

Name	Trademark, code name	Amount	Position
Hydraulic oil	L-HM46#	See Table1	Hydraulic system
Gear oil	85W-90GL-5	4.5L (Align with oiling port)	Drive axle
Brake Fluid	ZSM207DOT3	After the gas within the system is completely discharged, add to 2/3 of the oil cup	Brakes
Lubrication grease	Polylub GA 352P	Appropriate amount	Sliding Surface (See Table2)

Table					
Mast	Lifting height (mm)	Quantity (L)	Mast	Lifting height (mm)	Quantity (L)
2-stage Mast (ICE301B)	2000	30	2-stage Full Mast (ICE301B)	2500	38
	2500	34		2700	38
	2700	34		3000	42
	3000	36		3300	42
	3300	36		3600	40
	3500	38		4000	42
	3600	38	3-stage Mast (ICE301B)	4300	38
	4000	42		4500	40
	4300	42		4800	42
	4500	44		5000	44
				5500	46
				6000	48

Mast	Lifting height (mm)	Quantity (L)
2-stage Mast (ICE251B)	3000	36
	3300	36
	3500	38
	3600	38
	3700	39
	4000	42
	4300	42
	4500	44
	5000	46

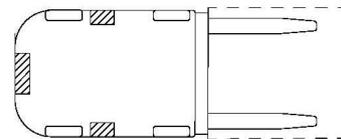
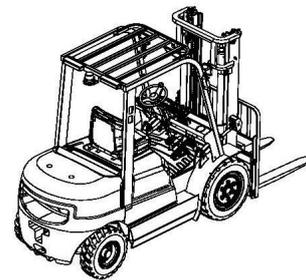
## 5.5 Deposit

### 5.5.1 Deposit the truck for a short time

① Park your truck on a level ground-preferably in a wide area. If parking on a slope is unavoidable, position the truck so that it crosses the slope and block the wheels to prevent accidental roll.

Make sure the travel combination switch on neutral position.

- ② Pull up the hand brake lever.
- ③ Shut off switch and control the lift and tilt lever several times so that the inner pressure in the hydraulic tube will decrease.
- ④ Cut off the power to the truck.
- ⑤ Take away the key and deposit it in a safe position.



### 5.5.2 Deposit the truck for a long time

On the basis 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

### 6.1 Drive System

4 wheel counter balanced battery forklift truck adapt structure of driving transverse , driven motor rated capacity see "1.5.1Performance data for standard trucks" .

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

## 6.2 Steering System

Steering system include rear steering axle and steering device.

### Trouble Diagnostic:

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

## 6.3 Brake System

### Trouble diagnostic

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

## 6.4 Hydraulic System

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

### 6.4.1 Main Pump

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.
Low discharge pressure on oil pump.	Worn bearing damaged backup ring and O-ring.	Replace faulty parts.
	Maladjusted relief valve.	Readjust to specified pressure using pressure gauge.
	Air in oil pump.	Retighten suction side pipe. Add oil in oil tank. Checks pump oil seal. Do not operate pump until bubbles in tank disappear.
Noisy oil pump	Cavitation due to crushed suction hose or clogged strainer.	Adjust or replace crushed hose and clean strainer.
	Air being sucked from loose suction side joint.	Retighten each joint.
	Cavitation due to too high oil viscosity.	·replace with new oil having proper viscosity for temperature at which pump is to be operate. ·to operate when oil temperature is normal.
	Bubbles in hydraulic oil.	Determine cause of bubbles and remedy.
Oil leaking from oil pump	Faulty oil seal on pump, faulty O-ring or worn sliding surfaces on pump.	Replace faulty parts.

#### 6.4.2 Control Valve

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.
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.
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### Adjusting the pressure of the main relieve valve

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

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

**Warning !**

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

## 6.5 Lifting System

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

## 6.6 Electrical System

### 6.6.1 Fault Codes

Error Message		Possible cause	Fault elimination
Error	Error text		
162	BUMPER STOP	The two digital inputs dedicated to the bumper functionality are high at the same time.	<ul style="list-style-type: none"> <li>- Turn off one or both inputs dedicated to the bumper functionality;</li> <li>- If the alarm occurs even if the inputs are in the rest position, check if the micro-switches are stuck.</li> <li>- In case the problem is not solved, replace the logic board</li> </ul>
176	HOME SENS.ERR XX	<p>The controller detected a difference between the estimated absolute orientation of the rotor and the position of the index signal (ABI encoder).</p> <p>It is caused by a wrong acquisition of the angle offset between the orientation of the rotor and the index signal</p>	Repeat the auto-teaching procedure.
164	PWM ACQ. ERROR		
8	WATCHDOG	This is a safety related test. It is a self-diagnosis test that involves the logic between master and supervisor micro-controllers.	This alarm could be caused by a CAN bus malfunctioning, which blinds master-supervisor communication.

Error Message		Possible cause	Fault elimination
Error	Error text		
215	EVP DRIV. SHORT.	<ul style="list-style-type: none"> <li>- The EVP driver is shorted (output A19).</li> <li>- The microcontroller detects a mismatch between the valve set-point and the feedback of the EVP output.</li> </ul>	<ul style="list-style-type: none"> <li>- Check if there is a short circuit or a low-impedance conduction path between the negative of the coil and -BATT.</li> <li>- Collect information about:               <ul style="list-style-type: none"> <li>o the voltage applied across the EVP coil,</li> <li>o the current in the coil,</li> <li>o features of the coil.</li> </ul> </li> <li>Ask for assistance to Your dealer in order to verify that the software diagnoses are in accordance with the type of coil employed.</li> <li>- If the problem is not solved, it</li> </ul>
239	CONTROLLER MISM.	<p>The software is not compatible with the hardware. Each controller produced is “signed” at the end of line test with a specific code mark saved in EEPROM according to the customized Part Number. According with this “sign”, only the customized firmware can be uploaded.</p>	<ul style="list-style-type: none"> <li>- Upload the correct firmware.</li> <li>- Ask for assistance to your dealer technician in order to verify that the firmware is correct.</li> </ul>
222	SEAT MISMATCH	<p>This alarm can appear only in a Traction + Pump configuration. There is an input mismatch between the traction controller and the pump controller relatively to the seat input (A6): the two values recorded by the two controllers are different.</p>	<ul style="list-style-type: none"> <li>- Check if there are wrong connections in the external wiring.</li> <li>- Using the TESTER function, verify that the seat inputs are in accordance with the actual state of the external switch.</li> <li>- In case no failures/problems have been found, the problem is in the controller which has to be</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
19	LOGIC FAILURE #1	This fault is displayed when the controller detects an undervoltage condition at the key input (A1). Undervoltage threshold depends on the nominal voltage of the controller.	Fault at startup or in standby: - Fault can be caused by a key input signal characterized by pulses below the undervoltage threshold, possibly due to external loads like DC/DC converters
18	LOGIC FAILURE #2	Fault in the hardware section of the logic board which deals with voltage feedbacks of motor phases.	The failure lies in the controller hardware. Replace the controller.
17	LOGIC FAILURE #3	A hardware problem in the logic board due to high currents (overload). An overcurrent condition is triggered even if the power bridge is not driven.	The failure lies in the controller hardware. Replace the controller.
220	VKEY OFF SHORTED	The logic board measures a key voltage that is constantly out of range, below the minimum allowed value.	- Check that the battery has the same nominal voltage of the inverter. - Check the battery voltage, if it is out of range replace the battery. - In case the problem is not solved, replace the logic board.
230	LC COIL OPEN	This fault appears when no load is connected between the NLC output (A16) and the positive voltage (for example +KEY).	- Check the wiring, in order to verify if LC coil is connected to the right connector pin and if it is not interrupted. - If the alarm is still present, than the problem is inside the logic board; replace it.

Error Message		Possible cause	Fault elimination
Error	Error text		
245	IQ MISMATCHED	The error between the Iq (q-axis current) setpoint and the estimated Iq is out of range.	Ask for assistance to your dealer technician in order to do the correct adjustment of the motor parameters.
207	INIT VMN LOW 01/02/03	Before switching the LC on, the software checks the power-bridge voltage without driving it. The software expects the voltage to be in a "steady state" value. If it is too low, this alarm occurs.	<ul style="list-style-type: none"> <li>- Check the motor power cables.</li> <li>- Check the impedance between U, V and W terminals and -Batt terminal of the controller.</li> <li>- Check the motor leakage to truck frame.</li> <li>- If the motor connections are OK and there are no external low impedance paths, the problem is inside the controller. Replace it.</li> </ul>
206	INIT VMN HIGH 81/82/83	Before switching the LC on, the software checks the power-bridge voltage without driving it. The software expects the voltage to be in a "steady state" value. If it is too high, this alarm occurs.	<ul style="list-style-type: none"> <li>- Check the motor power cables;</li> <li>- Check the impedance between U, V and W terminals and -Batt terminal of the controller.</li> <li>- Check the motor leakage to truck frame.</li> <li>- If the motor connections are OK and there are no external low impedance paths, the problem is inside the controller. Replace it.</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
31	VMN HIGH	<p>Cause1: Before switching the LC on, the software checks the power bridge: it turns on alternatively the low-side power MOSFETs and expects the phase voltages decrease down to -BATT. If the phase voltages are higher than 10% of the nominal</p>	<p>- If the problem occurs at start-up (the LC does not close), check:</p> <ul style="list-style-type: none"> <li>o motor internal connections (ohmic continuity);</li> <li>o motor power cables connections;</li> <li>o if the motor connections are OK, the problem is inside the controller. Replace it.</li> </ul>
30	VMN LOW	<p>Cause1: Start-up test. Before switching the LC on, the software checks the power bridge: it turns on alternatively the high-side power MOSFETs and expects the phase voltages increase toward the positive rail value. If one phase voltage is below 66% of the rail voltage, this alarm occurs.</p> <p>Cause2:</p>	<p>- If the problem occurs at start up (the LC does not close at all), check:</p> <ul style="list-style-type: none"> <li>o motor internal connections (ohmic continuity);</li> <li>o motor power-cables connections;</li> <li>o if the motor connections are OK, the problem is inside the controller; replace it.</li> </ul>
227	HW FAULT 11/12/13	<p>At each start-up the supervisor micro-controller checks that the hardware circuit intended to enable and disable the LC driver (A16) works properly.</p>	<p>This type of fault is not related to external components. Replace the logic board.</p>
227	HW FAULT 01/02/03	<p>At each start-up the supervisor micro-controller checks that the hardware circuit for enabling and disabling of the power bridge works properly.</p>	<p>This type of fault is not related to external components. Replace the logic board.</p>

Error Message		Possible cause	Fault elimination
Error	Error text		
213	POSITIVE LC OPEN	The voltage feedback of LC driver (A16) is different from expected, i.e. it is not in accordance with the driver operation.	<ul style="list-style-type: none"> <li>- Verify LC coil is properly connected.</li> <li>- Verify CONF. POSITIVE LC parameter is set in accordance with the actual coil positive supply (see paragraph 8.2.5). Software, depending on the parameter value, makes a proper diagnosis:</li> </ul>
253	FIELD ORIENT. KO	The error between the Id (d-axis current) setpoint and the estimated Id is out of range.	Ask for assistance to your dealer technician in order to do the correct adjustment of the motor parameters.
37	CONTACTOR CLOSED	Before driving the LC coil, the controller checks if the contactor is stuck. The controller drives the power bridge for several dozens of milliseconds, trying to discharge the capacitors bank. If the capacitor voltage does not decrease by more than 20% of the key voltage, the alarm is raised.	It is suggested to verify the power contacts of LC; if they are stuck, is necessary to replace the LC.
38	CONTACTOR OPEN	The LC coil is driven by the controller, but it seems that the power contacts do not close. In order to detect this condition the controller injects a DC current into the motor and checks the voltage	<ul style="list-style-type: none"> <li>- LC contacts are not working. Replace the LC.</li> <li>- If LC contacts are working correctly, contact your dealer technician.</li> </ul>
212	POWER MISMATCH	The error between the power setpoint and the estimated power is out of range.	Ask for assistance to your dealer technician about the correct adjustment of the motor parameters.

Error Message		Possible cause	Fault elimination
Error	Error text		
170	WRONG KEY VOLT.	The measured key voltage is not the right one for the inverter.	<ul style="list-style-type: none"> <li>- Check if the SET KEY VOLTAGE parameter in the ADJUSTMENT list is set in accordance with the key voltage.</li> <li>- Check if the key voltage is ok using a voltmeter, if not check the wiring.</li> <li>- In case the problem is not solved.</li> </ul>
251	WRONG SET BAT	At start-up, the controller checks the battery voltage (measured at key input) and it verifies that it is out of a $\pm 20\%$ range around the nominal value.	<ul style="list-style-type: none"> <li>- Check that the SET BATTERY parameter in the ADJUSTMENT list matches the battery nominal voltage.</li> <li>- Through the TESTER function, check that the KEY VOLTAGE</li> </ul>
196	MOT.PHASE SH.36 MOT.PHASE SH.37 MOT.PHASE SH.38	<p>Short circuit between two motor phases. The number that follows the alarm identifies where the short circuit is located:</p> <ul style="list-style-type: none"> <li>- 36 U – V short circuit</li> <li>- 37 U – W short circuit</li> <li>- 38 V – W short circuit</li> </ul>	<ul style="list-style-type: none"> <li>- Verify the motor phases connection on the motor side</li> <li>- Verify the motor phases connection on the inverter side</li> <li>- Check the motor power cables.</li> <li>- Replace the controller.</li> <li>- If the alarm does not disappear, the problem is in the motor. Replace it.</li> </ul>
53	STBY I HIGH	In standby, the sensor detects a current value different from zero.	The current sensor or the current feedback circuit is damaged. Replace the controller.
180	OVERLOAD	The motor current has overcome the limit fixed by hardware.	<p>Reset the alarm by switching key off and on again.</p> <p>If the alarm condition occurs again, ask for assistance to your dealer technician. The fault condition could be affected by</p>

Error Message		Possible cause	Fault elimination
Error	Error text		
60	CAPACITOR CHARGE	When the key is switched on, the inverter tries to charge the power capacitors through the series of a PTC and a power resistance, checking if the capacitors are charged within a certain timeout. If the capacitor voltage results less than 20% of the nominal battery	<ul style="list-style-type: none"> <li>- Check if an external load in parallel to the capacitor bank, which sinks current from the capacitors-charging circuit, thus preventing the caps from charging well. Check if a lamp or a dc/dc converter or an auxiliary load is placed in parallel to the capacitor</li> </ul>
185	TILLER ERROR	Input mismatch between Hard&Soft input (A11) and tiller/seat input (A6): the two inputs are activated at the same time.	<ul style="list-style-type: none"> <li>- Check if there are wrong connections in the external wiring.</li> <li>- Using the TESTER function, verify that inputs are in accordance with the actual state of the external switches.</li> <li>- Check if there is a short circuit between A11 and A6.</li> <li>- In case no failures/problems have been found, the problem is in</li> </ul>
248	NO CAN MSG.	This fault is signaled when there is no communication with the supervisor uC.	This type of fault is not related to external components; replace the logic board.
210	WRONG RAM MEM.	The algorithm implemented to check the main RAM registers finds wrong contents: the register is "dirty". This alarm inhibits the machine operations.	Try to switch the key off and then on again, if the alarm is still present replace the logic board.
74	DRIVER SHORTED	The driver of the LC coil is shorted.	<ul style="list-style-type: none"> <li>- Check if there is a short or a low impedance pull-down between NLC (A16 (A36) and –BATT.</li> <li>- The driver circuit is damaged; replace the logic board.</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
75	CONTACTOR DRIVER	The LC coil driver is not able to drive the load. The device itself or its driver circuit is damaged.	This type of fault is not related to external components; replace the logic board.
223	MC-EF COIL SHOR.	This alarm occurs when there is an overload of the MC driver (A16) and EB driver (A17). As soon as the overload condition disappears, the alarm will be removed automatically by releasing and then enabling a travel demand.	<ul style="list-style-type: none"> <li>- Check the connections between the controller outputs and the loads.</li> <li>- Collect information about characteristics of the coils connected to the two drivers and ask for assistance to your dealer technician in order to verify that the maximum current that can be supplied by the hardware is not exceeded.</li> <li>- In case no failures/problems have been found, the problem is</li> </ul>
202	VDC LINK OVERV.	<p>This fault is displayed when the controller detects an overvoltage condition.</p> <p>Overvoltage threshold depends on the nominal voltage of the controller.</p> <p>Nominal Voltage:24V 36/48V 72/80V 96V;</p> <p>Undervoltage threshold :35V 65V 115V 130V</p> <p>As soon as the fault occurs, power bridge and MC are opened. The condition is triggered using the same HW interrupt used for undervoltage detection, uC discerns between the two evaluating the voltage present across DC-link capacitors:</p> <ul style="list-style-type: none"> <li>- High voltage Overvoltage condition</li> <li>- Low/normal voltage Undervoltage condition</li> </ul>	If the alarm happens during the brake release, check the line contactor contact and the battery power-cable connection.

Error Message		Possible cause	Fault elimination
Error	Error text		
175	SPEED FB. ERROR	This alarm occurs if the absolute position sensor is used also for speed estimation. If signaled, it means that the controller measured that the engine was moving too quick.	<ul style="list-style-type: none"> <li>- Check that the sensor used is compatible with the software release.</li> <li>- Check the sensor mechanical installation and if it works properly.</li> <li>- Also the electromagnetic noise on the sensor can be a cause for the alarm.</li> <li>- If no problem is found on the motor or on the speed sensor, the problem is inside the controller, it is necessary to replace the logic board.</li> </ul>
82	ENCODER ERROR	This fault occurs in the following conditions: the frequency supplied to the motor is higher than 40 Hz and the signal feedback from the encoder has a jump higher than 40 Hz in few tens of milliseconds. This condition is related to an encoder failure.	<ul style="list-style-type: none"> <li>- Check the electrical and the mechanical functionality of the encoder and the wires crimping.</li> <li>- Check the mechanical installation of the encoder, if the encoder slips inside its housing it will raise this alarm.</li> <li>- Also the electromagnetic noise on the sensor can be the cause for the alarm. In these cases try to replace the encoder.</li> <li>- If the problem is still present</li> </ul>
181	WRONG ENC SET	Mismatch between "ENCODER PULSES 1" parameter and "ENCODER PULSES 2" parameter	Set the two parameters with the same value, according to the adopted encoder.
195	POS. EB. SHORTED	The DC-link voltage drops to zero when a high-side MOSFET is turned on.	<ul style="list-style-type: none"> <li>- Check that motor phases are correctly connected.</li> <li>- Check that there is no dispersion to ground for every motor phases.</li> <li>- In case the problem is not solved, replace the controller.</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
200	VDC OFF SHORTED	The logic board measures a key voltage value that is constantly out of range, above the maximum allowed value.	<ul style="list-style-type: none"> <li>- Check that the battery has the same nominal voltage of the inverter.</li> <li>- Check the battery voltage, if it is out of range replace the battery.</li> <li>- In case the problem is not solved, replace the logic board.</li> </ul>
233	POWERMOS SHORTED	<p>This alarm occurs only when the controller is configured to drive a PMSM and the feedback sensor selected in the HARDWARE SETTINGS list is ENCODER ABI + PWM.</p> <p>The controller does not detect correct information on PWM input at start-up.</p>	<ul style="list-style-type: none"> <li>- Re-cycle the key.</li> <li>- Check the sensor in order to verify that it works properly.</li> <li>- Check the wiring.</li> <li>- If the problem occurs permanently it is necessary to substitute logic board.</li> </ul>
237	ANALOG INPUT	This alarm occurs when the A/D conversion of the analog inputs returns frozen values, on all the converted signals, for more than	If the problem occurs permanently it is necessary to replace the logic board.
235	CTRAP THRESHOLD	This alarm occurs when a mismatch is detected between the setpoint for the overcurrent detection circuit (dependent on parameter DUTY PWM CTRAP) and the feedback of the actual threshold value.	The failure lies in the controller hardware. Replace the logic board.

Error Message		Possible cause	Fault elimination
Error	Error text		
224	WAITING FOR NODE	The controller receives from the CAN bus the message that another controller in the net is in fault condition; as a consequence the controller itself cannot enter into an operative status, but it has to wait until the other node comes out from the fault status.	Check if any other device on the CAN bus is in fault condition.
66	BATTERY LOW	The battery charge is evaluated to be lower than 10% of the full charge and the BATTERY CHECK setting is other than 0 (refer to SET OPTION menu).	<ul style="list-style-type: none"> <li>- Check the battery charge and charge it if necessary.</li> <li>- If the battery is actually charged, measure the battery voltage through a voltmeter and compare it with the value in the BATTERY VOLTAGE reading in the TESTER function. If they are different, adjust the ADJUST BATTERY parameter with the value measured through the voltmeter.</li> </ul>
247	DATA ACQUISITION	Controller in calibration state.	The alarm ends when the acquisition is done.
249	CHECK UP NEEDED	This is a warning to point out that it is time for the programmed maintenance.	Turn on the CHECK UP DONE option after that the maintenance service.

Error Message		Possible cause	Fault elimination
Error	Error text		
244	WARNING SLAVE	Warning on supervisor uC.	Connect the Console to the supervisor uC and check which alarm is present.
171	ACQUIRING A.S.	Controller is acquiring data from the absolute feedback sensor.	The alarm ends when the acquisition is done
173	ACQUIRE END	Absolute feedback sensor acquired.	
172	ACQUIRE ABORT	The acquiring procedure relative to the absolute feedback sensor aborted.	
168	SIN/COS D.ERR	This alarm occurs only when the controller is configured as PMSM and the feedback sensor selected is sin/cos. The signal coming from sin/cos sensor has a wrong direction.	<ul style="list-style-type: none"> <li>- Check the wirings.</li> <li>- If the motor direction is correct, swap the sin and cos signals.</li> <li>- If the motor direction is not correct, swap two of the motor cables.</li> <li>- If the problem is not solved,</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
169	ENCODER D.ERR	This alarm occurs only when the controller is configured as PMSM and the feedback sensor selected is the encoder. The A and B pulse sequence is not correct.	<ul style="list-style-type: none"> <li>- Check the wirings.</li> <li>- If the motor direction is correct, swap A and B signals.</li> <li>- If the motor direction is not correct, swap two of the motor cables.</li> <li>- If the problem is not solved,</li> </ul>
240	EVP DRIVER OPEN	The EVP driver (A19) is not able to drive the EVP coil. The device itself or its driving circuit is damaged.	This fault is not related to external components. Replace the logic board.
214	EVP COIL OPEN	No load is connected between the NEVP output (A19) and the electrovalve positive terminal.	<ul style="list-style-type: none"> <li>- Check the EVP condition.</li> <li>- Check the EVP wiring.</li> <li>- If the problem is not solved,</li> </ul>
238	HW FAULT EV XX	At start-up, the hardware circuit dedicate to enable and disable the EV drivers is found to be faulty.	This type of fault is not related to external components. Replace the logic board.
211	STALL ROTOR	The traction rotor is stuck or the encoder signal is not correctly received by the controller.	<ul style="list-style-type: none"> <li>- Check the encoder condition.</li> <li>- Check the wiring.</li> <li>- Through the TESTER function, check if the sign of FREQUENCY and ENCODER are the same and if they are different from zero during a traction request.</li> <li>- If the problem is not solved, replace the logic board.</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
208	EEPROM KO	A HW or SW defect of the non-volatile embedded memory storing the controller parameters. This alarm does not inhibit the machine operations, but it makes the truck to work with the default values.	Execute a CLEAR EEPROM procedure (refer to the Console manual). Switch the key off and on to check the result. If the alarm occurs permanently, it is necessary to replace the controller. If the alarm
209	PARAM RESTORE	The controller has restored the default settings. If a CLEAR EEPROM has been made before the last key re-cycle, this warning informs you that EEPROM was correctly cleared.	<ul style="list-style-type: none"> <li>- A travel demand or a pump request cancel the alarm.</li> <li>- If the alarm appears at key-on without any CLEAR EEPROM performed, replace the controller.</li> </ul>
241	COIL SHOR. EVAUX	This alarm occurs when there is an overload of one or more EV driver. As soon as the overload condition	<ul style="list-style-type: none"> <li>- Check the EVs conditions.</li> <li>- Check the wiring.</li> <li>- Collect information about</li> </ul>
232	CONT DRIV EV XX	<p>One or more on/off valve drivers are not able to drive the load.</p> <ul style="list-style-type: none"> <li>- 02 EV1</li> <li>- 04 EV2</li> <li>- 08 EV3</li> <li>- 20 EV4</li> </ul> <p>If more than one output is affected</p>	The device or its driving circuit is damaged. Replace the controller.
234	DRV SHOR EV XX	<p>One or more on/off valve drivers are shorted.</p> <ul style="list-style-type: none"> <li>- 02 EV1</li> <li>- 04 EV2</li> <li>- 08 EV3</li> <li>- 20 EV4</li> </ul> <p>If more than one output is affected by this fault condition, the code shown will correspond to the sum of the faulty-EVs codes.</p>	<ul style="list-style-type: none"> <li>- Check if there is a short circuit or a low impedance path between the negative terminal of the coils and -BATT.</li> <li>- If the problem is not solved, replace the logic board.</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
229	HW FAULT EB 01/02/03	At start-up, the hardware circuit dedicated to enable and disable the EB driver (A18) is found to be faulty.	This type of fault is not related to external components. Replace the logic board.
254	EB. DRIV.SHRT.	<ul style="list-style-type: none"> <li>- The EB driver is shorted.</li> <li>- The microcontroller detects a mismatch between the valve setpoint and the feedback at the EB output.</li> </ul>	<ul style="list-style-type: none"> <li>- Check if there is a short or a low impedance path between the negative coil terminal and -BATT.</li> <li>- Check if the voltage applied is in accordance with the parameters set.</li> <li>- If the problem is not solved, replace the controller.</li> </ul>
246	EB.DRIV.OPEN	The EB coil driver is not able to drive the load. The device itself or its driving circuit is damaged.	This type of fault is not related to external components. Replace the logic board.
216	EB. COIL OPEN	This fault appears when no load is connected between the NEB output (A18) and the EB positive terminal PCOM (A17).	<ul style="list-style-type: none"> <li>- Check the EB coil.</li> <li>- Check the wiring.</li> <li>- If the problem is not solved, replace the logic board.</li> </ul>
221	HANDBRAKE	Handbrake input is active.	<ul style="list-style-type: none"> <li>- Check that handbrake is not active by mistake.</li> <li>- Check the SR/HB input state through the TESTER function.</li> <li>- Check the wirings.</li> <li>- Check if there are failures in the microswitches.</li> <li>- If the problem is not solved, replace the logic board.</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
243	THROTTLE PROG.	A wrong profile has been set in the throttle profile.	Set properly the throttle-related parameters.
187	LIFT + LOWER	Both the pump requests (LIFT and LOWER) are active at the same time.	<ul style="list-style-type: none"> <li>- Check that LIFT and LOWER requests are not active at the same time.</li> <li>- Check the LIFT and LOWER input states through the TESTER function.</li> <li>- Check the wirings.</li> <li>- Check if there are failures in the micro-switches.</li> </ul>
228	TILLER OPEN	Tiller/seat input has been inactive for more than 30 seconds.	<ul style="list-style-type: none"> <li>- Activate the tiller/seat input.</li> <li>- Check the tiller/seat input state through the TESTER function.</li> </ul>
252	WRONG ZERO	At start-up the amplifiers used to measure the motor voltage sense voltages above 3 V or below 2 V.	This type of fault is not related to external components. Replace the logic board.
250	THERMIC SENS. KO	The output of the controller thermal sensor is out of range.	This kind of fault is not related to external components. Replace the controller.

Error Message		Possible cause	Fault elimination
Error	Error text		
62	TH. PROTECTION	The temperature of the controller base plate is above 85 °C. The maximum current is proportionally decreased with the temperature excess from 85 °C up	It is necessary to improve the controller cooling. To realize an adequate cooling in case of finned heat sink important factors are the air flux and the cooling-air
204	BRAKE RUN OUT	The CPOT BRAKE input read by the microcontroller is at its maximum value without the hand-brake request.	Check the mechanical calibration and the functionality of the brake potentiometer. If the alarm is still present, replace the logic board.
0	Reload HM from MDI	The hour-meter of the controller is transferred and recorded on the hour-meter of the standard MDI.	
65	MOTOR TEMPERAT.	This warning occurs when the temperature sensor is open (if digital) or if it has overtaken the MAX MOTOR TEMP threshold (if analog).	<ul style="list-style-type: none"> <li>- Check the temperature read by the thermal sensor inside the motor through the MOTOR TEMPERATURE reading in the TESTER function.</li> <li>- Check the sensor ohmic value and the sensor wiring.</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
178	MOTOR TEMP. STOP	The temperature sensor has overtaken the STOP MOTOR TEMP. threshold	- Check the temperature read by the thermal sensor inside the motor through the MOTOR TEMPERATURE reading in the TESTER function.
218	SENS MOT TEMP KO	The output of the motor thermal sensor is out of range.	<ul style="list-style-type: none"> <li>- Check if the resistance of the sensor is what expected measuring its resistance.</li> <li>- Check the wiring.</li> <li>- If the problem is not solved, replace the logic board.</li> </ul>
205	EPS RELAY OPEN	The controller receives from EPS information about the safety contacts being open.	Verify the EPS functionality.
78	VACC NOT OK	<p>At key-on and immediately after that, the travel demands have been turned off.</p> <p>This alarm occurs if the ACCELERATOR reading (in TESTER function) is more than 1 V above the minimum value acquired</p>	<ul style="list-style-type: none"> <li>- Check the wirings.</li> <li>- Check the mechanical calibration and the functionality of the accelerator potentiometer.</li> <li>- Acquire the maximum and minimum potentiometer value through the PROGRAM VACC</li> </ul>
79	INCORRECT START	<p>Incorrect starting sequence.</p> <p>Possible reasons for this alarm are:</p> <ul style="list-style-type: none"> <li>- A travel demand active at key-on.</li> <li>- Man-presence sensor active at key on.</li> </ul>	<ul style="list-style-type: none"> <li>- Check wirings.</li> <li>- Check microswitches for failures.</li> <li>- Through the TESTER function, check the state of the inputs is coherent with microswitches states.</li> <li>- If the problem is not solved, replace the logic board.</li> </ul>

Error Message		Possible cause	Fault elimination
Error	Error text		
80	FORW + BACK	This alarm occurs when both the travel requests (FW and BW) are active at the same time.	<ul style="list-style-type: none"> <li>- Check that travel requests are not active at the same time.</li> <li>- Check the FW and BW input states through the TESTER function.</li> <li>- Check the wirings relative to the FW and BW inputs.</li> <li>- Check if there are failures in the microswitches.</li> <li>- If the problem is not solved, replace the logic board.</li> </ul>
226	VACC OUT OF RANGE	The CPOT input read by the microcontroller is not within the MIN VACC ÷ MAX VACC range, programmed through the PROGRAMM VACC function	<ul style="list-style-type: none"> <li>- Acquire the maximum and minimum potentiometer values through the PROGRAM VACC function. If the alarm is still present, check the mechanical calibration and the functionality of the accelerator potentiometer.</li> <li>- If the problem is not solved, replace the logic board.</li> </ul>
86	PEDAL WIRE KO	This is not implemented in ACE3.	<ul style="list-style-type: none"> <li>- Ask for help to your dealer technician.</li> </ul>
197	WRONG SLAVE VER	Wrong software version on supervisor uC.	Upload the correct software version or ask for assistance to your dealer technician.
236	CURRENT GAIN	The maximum current gain parameters are at the default values, meaning that the maximum current adjustment procedure has not been carried out yet.	Ask for assistance to your dealer technician in order to do the adjustment procedure of the current gain parameters.

Error Message		Possible cause	Fault elimination
Error	Error text		
199	PARAM TRANSFER	Master uC is transferring parameters to the supervisor.	Wait until the end of the procedure. If the alarm remains longer, re-cycle the key.
0	Reload HM	The hour-meter of the controller is transferred and recorded on the hour-meter of the standard MDI.	/
179	STEER SENSOR KO	The voltage read by the microcontroller at the steering-sensor input is not within	- Acquire the maximum and minimum values coming from the steering potentiometer through
198	M/S PAR CHK MISM	At start-up there is a mismatch in the parameter checksum between the master and the supervisor microcontrollers.	Restore and save again the parameters list.
201	TORQUE PROFILE	There is an error in the choice of the torque profile parameters.	Check in the HARDWARE SETTINGS menu the value of those parameters.

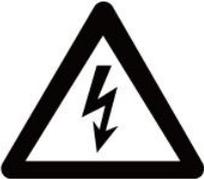
## **APPENDIX**

# Lithium Battery Use and Maintenance Manual

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## Chapter 1 Safety Precautions

 <b>CAUTION</b>	
 <b>PROHIBITION</b>	<ul style="list-style-type: none"> <li>• DO NOT short-circuit the positive and negative terminals of the battery.</li> <li>• Do not collide, handle gently, and avoid the battery being subjected to excessive vibration, external impact, high drop, etc.</li> <li>• DO NOT place the battery or battery pack in a corrosive chemical environment.</li> <li>• DO NOT charge the battery without a charging device or with a charging device that we do not recognize.</li> <li>• DO NOT expose the battery or leave it in an environment above 45 °C for a long time.</li> <li>• DO NOT disassemble, squeeze, puncture or heat the battery.</li> <li>• Lithium batteries are forbidden for those who lack the knowledge of safe use of lithium batteries.</li> <li>• DO NOT immerse the battery in water or other conductive liquids.</li> <li>• DO NOT use the battery in series or in parallel with other models or types of batteries.</li> <li>• Serial and parallel operation of a complete power supply system containing a lithium-ion battery protection circuit board or battery management system is prohibited.</li> </ul>
	<ul style="list-style-type: none"> <li>• It is strictly forbidden to hot swap battery</li> <li>• It is easy to cause fire and electric shock</li> </ul>
	<ul style="list-style-type: none"> <li>• Be aware of corrosion</li> <li>• It may cause battery damage and shorten battery life</li> </ul>
	<ul style="list-style-type: none"> <li>• No burning</li> <li>• It may cause battery explosion</li> </ul>

## Chapter 2 Battery Introduction and Instructions

### 2.1 Battery Introduction

Battery model	ICE301B	Battery weight	/
Rated voltage	80V	Cell material	LFP
Rated capacity	220AH	Battery size	705X565X266mm
Charger voltage	80V	Charger current	65A

### 2.2 Instructions

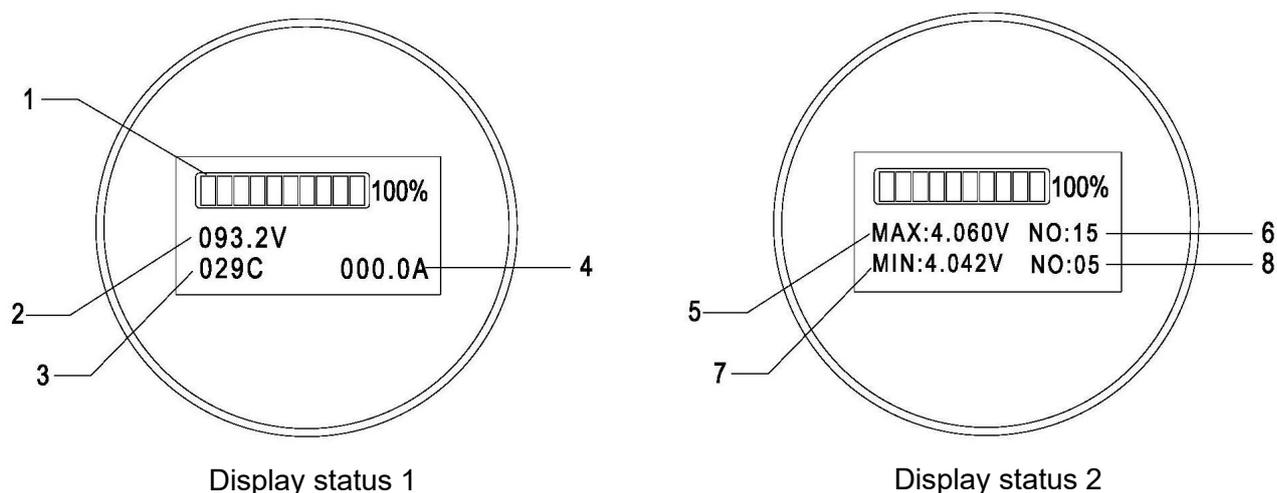
1. Due to the product in transit or inventory, the lithium battery must be fully charged with the vehicle-specific charger before the first use (do not mix with other models of chargers or use other modified equipment), and then it can be used;
2. The lithium battery should be used at an ambient temperature of 0°C ~ 40°C, do not use or store the battery near a fire source/heat source where the temperature is outside the temperature range;
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

**Caution!**

Ambient temperature for use:  
0°C ~ 40°C

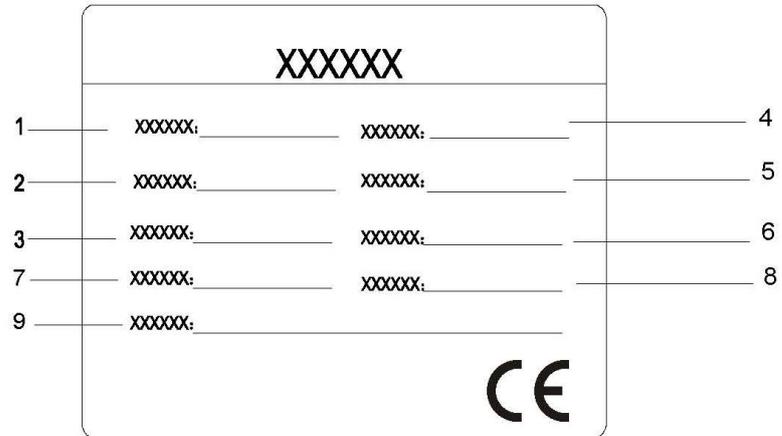
and removal when there is an external weight; please use two hooks to hang on the lifting rings during the lifting process, and gently lift it to keep it stable and not inclined;  
 9. The operator must read the instructions carefully before use and receive relevant safety training to be able to handle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

### 2.3 Display Instrument



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	Nominal Voltage	5	Nominal Capacity
3	Nominal Energy	6	Version NO.
7	Battery Weight	8	Date
9	Serial No.		

## 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: 5°C ~ 40°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.
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.

### **Warning!**

Lithium batteries are strictly prohibited from overcharging and overdischarging.

### **Caution!**

1. The normal charging temperature range of the battery is: 5°C~40°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  $\geq 60\%$  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  $\geq 60\%$ ;
2. The battery should be stored in a temperature environment of  $0^{\circ}\text{C}\sim 40^{\circ}\text{C}$ ;
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.
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.

**Caution!**

Ambient temperature for storage:  
 $0^{\circ}\text{C}\sim 40^{\circ}\text{C}$

## 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 ( $\geq 500\Omega/V$ ) 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.