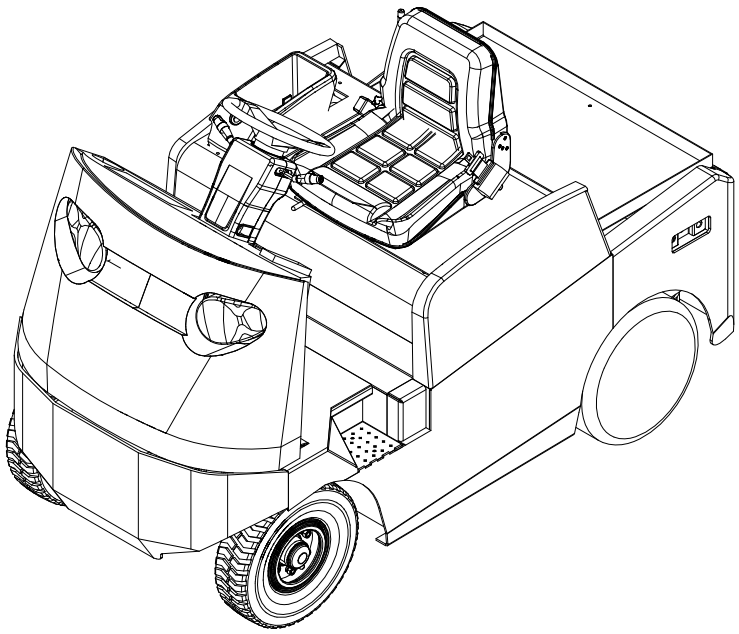
Electrical Towing Tractor

QSD120/150/180-XC1-MI
QSD120/150/180-XC1-M
QSD60/80-XD3-M
QSD60/80-XD3-MI
QSD100-XXD3-M
QSD100-XXD3-MI

Operation and Maintenance Manual



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Foreword

6t~15t electrical tractor are advanced traction vehicles, which have low noise, and no pollution. They can be used for traction on the short ordinary road.

The vehicle has the characteristics of high speed, high efficiency, low energy consumption etc., the cab in the middle equips with large rear tilt dashboard, front and rear view is balanced; high-level design for three electric, strong wading ability and the whole vehicle IPX5 can adapt to outdoor full working conditions operation; front and rear axle with suspension, the whole vehicle has stronger road adaptability and good comfort; synchronous steering with automatic return and good straight line retention, more adaptable to the working conditions of medium and long distance of tractor; the upper closed truck body frame has a low center of gravity, thus makes the battery maintenance and replacement easy and fast. The meter can display the accumulated working time, battery power and fault code, and it is easy to find the cause of the fault according to the fault code.

Content

1 Safety instruction

1. Only trained and authorized operator shall be permitted to operate the truck. The operator should obey the operation rules. No one can operate the truck except driver. Only trained and authorized maintainer shall be permitted to do the maintenance.
2. Comply with traffic rules.
3. Before starting, check the truck and do preparation work. Whenever 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.

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

4. Call the manager to repair when the leak of tyre air, hydraulic oil, brake oil and battery electrolytet happens.
5. After charging or adding electrolyte, clean the truck carefully.
6. Electrical appliances, controllers, motor should prevent of washing by water or showing.
7. Don’t let any metal close the two terminal of the battery to avoid spark or short circuit.
8. Notice the daily maintenance and maintain, check it before and after working, please get rid of fault immediately if found.
9. Don’t start motor with no-load to avoid causing accident when overhauling.
10. Check the battery with no-smoking or any sparks, flame near batteries to avoid exploding.
11. This truck can not work in the circumstance where easy to burnt or explode.

Fire extinguishers must be equipped at working place.

12. 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.

13. The work surface should be solidity and flatness such as cement road surface, bituminous macadam and beton road surface.

- The climatic conditions that the trucks designed for are: temperature is –20℃—50℃; wind speed is lower than 5m/s; air relative humidity is less than 90% (25℃).
- Altitude: up to 2000 m.
- 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 unavoidable, use extreme caution.
- The vibration accelerator of the operator is 0.95m/s^2 under the Max. speed with no load.
- The vibration accelerator of the operator is 0.68m/s^2 under the Max. speed with full load.
- Rugged surface would cause vibration of truck and noise. The high air pressure of tyre will cause vibration and noise, too.
- Wind power may cause the trailer and goods turn over. Except working indoor, do not operate the truck when the weather is execrable, such as windy, thunder storm, snow and etc.
- The noise of the truck is less than 100dB (A), measured by sound power meter.
- The noise near the operator is less than 95dB (A), measured by sound pressure meter, adopt standard EN12053:2000.

14.Before start, press the horn, ensure no others around you.

15.It is forbidden to get on or get off the truck when it is moving.

16.It is forbidden to stand or sit any person at outside of cab when truck is moving.

17.Please haul and join smoothly, it is forbidden to do these with high speed.

18.Don’t make a sudden start, sudden brake or sharp turning, especially for the terrible road condition.

19. When uprising or downgrading, don’t travel on the side way, or it may cause danger of turning over.

20. There are warning signs and operation methods on nameplate, Please follow this operation manual and nameplate of this truck.

Inspect the nameplate, when damaged or lost please replace it.

21. The charged tyre, the compressed or extended spring in the brake is energy stored assembly, which can’t be removed or taken out without air release or energy release; the capacity in the controller is also a energy store assembly, please discharge using horn or resistance connect the

B+ to B- of controller before repairing.

22. Only in the event that the truck manufacturer is no longer in business and there is no successor in the interest to the business, the user may arrange for a modification or alteration to a powered industrial truck provided, however, that the user shall:

- Arrange for the modification or alteration to be designed, tested and implemented by an engineer(s) expert in industrial trucks and their safety;
- Maintain a permanent record of the design, test(s) and implementation of the modification or alteration;
- Approve and make appropriate changes to the capacity plate(s), decals, tags and instruction handbook;
- Affix a permanent and readily visible label to the truck stating the manner in which the truck has been modified or altered together with the date of the modification or alteration, and the name and address of the organization that accomplishes the tasks.

2 Parameters

	Model			QSD120-XC1-MI	QSD120-XC1-M
Performance	Drawbar traction 1×N(60min)			3800	3800
	Max traction N			12000	12000
	Tractive weight on dry concrete ground		kg	12000	12000
	Speed		no-load km/h	23	23
	Turning radius (Outside) mm			2600	2600
	Grade ability %	no-load （%）		25	25
Weigh	Load distribution	Front kg		530	790
		Rear kg		1220	1440
		Whole Weight kg		1750	2230
Motor	Drive motor	Model		HPQ16-80HC	HPQ16-80HC
		Rated power kW		16	16
		Rated voltage V		55	55
		Rated current A		266	266
		Rated rpm r/min		2500	2500
		Field		AC	AC
		Working		60 mins	60 mins
		Insulation grade		H	H
Dimension	Overall length mm			2250	2250
	Overall width mm			1100	1100
	Overall height mm			1430	1430
	Wheelbase mm			1350	1350
	Wheel tread	Front tread		880	880
		Rear tread		910	910
	Ground clearance			100	100
	Drawbar height			350/450	350/450
Battery Voltage/Capacity V/A.h				80/302	80/375
Electric controller				F6-A 80-375-101	F6-A 80-375-101
Tire		Forward		16×6-8-16PR / 2	16×6-8-16PR / 2
		Rear		18×7-8-14PR / 2	18×7-8-14PR / 2

	Model		QSD150-XC1-MI	QSD150-XC1-M
Performance	Drawbar traction 1×N(60min)		4500	4500
	Max traction N		15000	15000
	Tractive weight on dry concrete ground	kg	15000	15000
	Speed	no-load km/h	23	23
	Turning radius (Outside) mm		2600	2600
	Grade ability %	no-load （%）	25	25
Weigh	Load distribution	Front kg	520	850
		Rear kg	1510	1620
		Whole Weight kg	2030	2470
Motor	Drive motor	Model	HPQ16-80HC	HPQ16-80HC
		Rated power kW	16	16
		Rated voltage V	55	55
		Rated current A	266	266
		Rated rpm r/min	2500	2500
		Field	AC	AC
		Working	60 min	60 min
		Insulation grade	H	H
Dimension	Overall length mm		2250	2250
	Overall width mm		1100	1100
	Overall height mm		1430	1430
	Wheelbase mm		1350	1350
	Wheel tread	Front tread	880	880
		Rear tread	910	910
	Ground clearance		100	100
	Drawbar height		350/450	350/450
Battery Voltage/Capacity V/A.h			80/302	80/450
Electric controller			F6-A 80-450-101	F6-A 80-375-101
Tire		Forward	16×6-8-16PR / 2	16×6-8-16PR / 2
		Rear	18×7-8-14PR / 2	18×7-8-14PR / 2

	Model			QSD180-XC1-MI	QSD180-XC1-M
Performance	Drawbar traction 1×N(60min)			4800	4800
	Max traction N			16000	16000
	Tractive weight on dry concrete ground		kg	18000	18000
	Speed		no-load km/h	23	23
	Turning radius (Outside) mm			2600	2600
	Grade ability %	no-load （%）		25	25
Weigh	Load distribution	Front kg		520	850
		Rear kg		1580	1620
		Whole Weight kg		2100	2470
Motor	Drive motor	Model		HPQ16-80HC	HPQ16-80HC
		Rated power kW		16	16
		Rated voltage V		55	55
		Rated current A		266	266
		Rated rpm r/min		2500	2500
		Field		AC	AC
		Working		60 min	60 min
		Insulation grade		H	H
Dimension	Overall length mm			2250	2250
	Overall width mm			1100	1100
	Overall height mm			1430	1430
	Wheelbase mm			1350	1350
	Wheel tread	Front tread		880	880
		Rear tread		910	910
	Ground clearance			100	100
	Drawbar height			350/450	350/450
Battery Voltage/Capacity V/A.h				80/456	80/450
Electric controller				F6-A 80-450-101	F6-A 80-450-101
Tire		Forward		16×6-8-16PR / 2	16×6-8-16PR / 2
		Rear		18×7-8-14PR / 2	18×7-8-14PR / 2

	Model		QSD100-XXD3-MI	QSD100-XXD3-M
Performance	Drawbar traction 1×N(60min)		2500	2500
	Max traction N		7500	7500
	Tractive weight on dry concrete ground	kg	10000	10000
	Speed	no-load km/h	18	18
	Turning radius (Outside) mm		2400	2400
	Grade ability %	no-load （%）	25	25
Weigh	Load distribution	Front kg	570	700
		Rear kg	815	850
		Whole Weight kg	1385	1550
Motor	Drive motor	Model	HPQ4.5-48HC	HPQ4.5-48HC
		Rated power kW	4.5	4.5
		Rated voltage V	33	33
		Rated current A	100	100
		Rated rpm r/min	1780	1780
		Field	AC	AC
		Working	60 min	60 min
		Insulation grade	H	H
Dimension	Overall length mm		2050	2050
	Overall width mm		996	996
	Overall height mm		1340	1340
	Wheelbase mm		1340	1340
	Wheel tread	Front tread	860	860
		Rear tread	879	879
	Ground clearance		135	135
	Drawbar height		274/330/386	274/330/386
Battery Voltage/Capacity V/A.h			48/404	48/420
Electric controller			Inmotion	Inmotion
Tire		Forward	4.00-8 / 2	4.00-8 / 2
		Rear	4.00-8 / 2	4.00-8 / 2

	Model		QSD80-XD3-MI	QSD80-XD3-MI
Performance	Drawbar traction 1×N(60min)		2000	2000
	Max traction N		6000	6000
	Tractive weight on dry concrete ground	kg	8000	8000
	Speed	no-load km/h	18	18
	Turning radius (Outside) mm		2400	2400
	Grade ability %	no-load （%）	25	25
Weigh	Load distribution	Front kg	530	570
		Rear kg	720	730
		Whole Weight kg	1250	1300
Motor	Drive motor	Model	HPQ4.5-48HC	HPQ4.5-48HC
		Rated power kW	4.5	4.5
		Rated voltage V	33	33
		Rated current A	100	100
		Rated rpm r/min	1780	1780
		Field	AC	AC
		Working	60 min	60 min
		Insulation grade	H	H
Dimension	Overall length mm		2050	2050
	Overall width mm		996	996
	Overall height mm		1340	1340
	Wheelbase mm		1340	1340
	Wheel tread	Front tread	860	860
		Rear tread	879	879
	Ground clearance		135	135
	Drawbar height		274/330/386	274/330/386
Battery Voltage/Capacity V/A.h			48/271	48/360
Electric controller			Inmotion	Inmotion
Tire		Forward	4.00-8 / 2	4.00-8 / 2
		Rear	4.00-8 / 2	4.00-8 / 2

	Model			QSD60-XD3-MI	QSD80-XD3-MI
Performance	Drawbar traction 1×N(60min)			1500	1500
	Max traction N			4500	4500
	Tractive weight on dry concrete ground		kg	6000	6000
	Speed		no-load km/h	18	18
	Turning radius (Outside) mm			2400	2400
	Grade ability %	no-load （%）		25	25
Weigh	Load distribution	Front kg		530	570
		Rear kg		620	630
		Whole Weight kg		1150	1200
Motor	Drive motor	Model		HPQ4.5-48HC	HPQ4.5-48HC
		Rated power kW		4.5	4.5
		Rated voltage V		33	33
		Rated current A		100	100
		Rated rpm r/min		1780	1780
		Field		AC	AC
		Working		60 min	60 min
		Insulation grade		H	H
Dimension	Overall length mm			2050	2050
	Overall width mm			996	996
	Overall height mm			1340	1340
	Wheelbase mm			1340	1340
	Wheel tread	Front tread		860	860
		Rear tread		879	879
	Ground clearance			135	135
	Drawbar height			274/330/386	274/330/386
Battery Voltage/Capacity V/A.h				48/271	48/300
Electric controller				Inmotion	Inmotion
Tire		Forward		4.00-8 / 2	4.00-8 / 2
		Rear		4.00-8 / 2	4.00-8 / 2

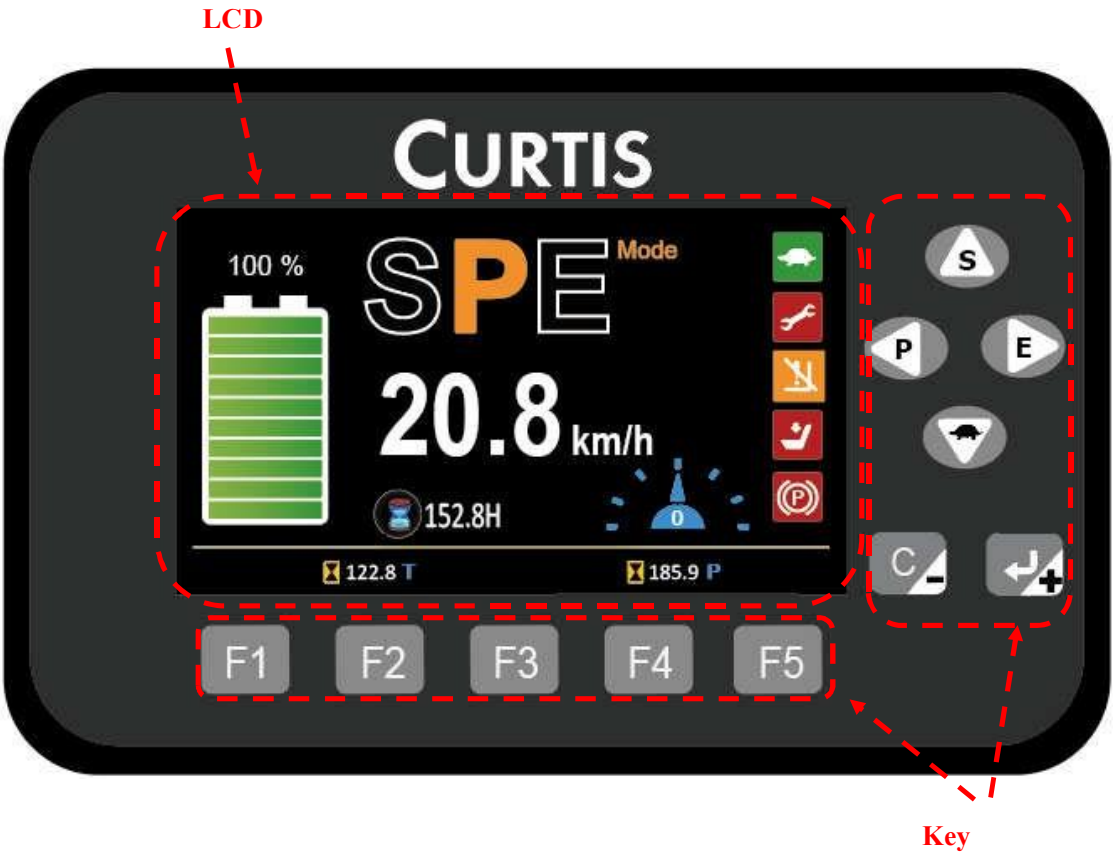
3 Operation system

1.Instrument
2.Horn button
3.Steering lamp switch
4.Emergency stop switch
5.Steering wheel locating device
6.Steering wheel
7.Key switch
8.Brake pedal
9.Accelerator pedal
10.Direction switch
11.Twist plate switch
12.Seat

3.1 Instrument

The multi-function display shows the battery capacity, the service hours, the operating mode, the travel speed and fault code information etc. Graphic illustrations on the multi-function display act as warning indicators. Check fault code and parameter setting through the right button.

QSD120/150/180-XC1-MI、QSD120/150/180-XC1-M



Key function Overview

F1： Enter/exit the operation menu; when the meter is in the password input interface, press F1 to enter the number "1".

F2： Enter/exit the meter menu; when the meter is in the password input interface, press F2 to enter the number "2".

F3： Enter/exit the controller menu; when the meter is in the password input interface, press F3 to enter the number "3".

F4： Enter/exit the controller menu; when the meter is in the password input interface, press F4 to enter the number "4". When the meter is in the menu interface and the menu option is a

modifiable parameter, press F4 to adjust the parameter change.The step size can be set to change the single digit, tens, hundred or thousand digits of the parameter.

F5： when the meter is in the password input interface, press F5 to enter the number "5".

▲：The setting mode is super mode; when the meter is in the password interface, press ▲ to switch the user password or OEM password input setting; when the meter is in the menu interface, press ▲ to move the menu option up.

▼：The setting mode is slow mode; when the meter is in the password interface, press ▼ to switch the user password or OEM password input setting; when the meter is in the menu interface, press ▼ to move the menu option down.

◄： The setting mode is power mode; when the meter is in the password interface, press the key to switch the user password or OEM password input setting; when the meter is in the menu interface, press the key to return to the previous menu.

►：The setting mode is economic mode; when the meter is in the password interface, press the key to switch the user password or OEM password input setting; when the meter is in the menu interface, press the key to enter the next level menu.

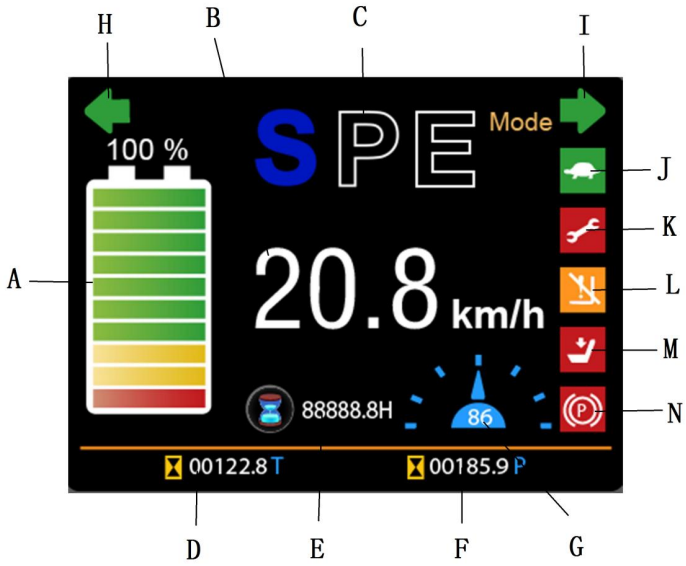
C/-： When the meter is in the password interface, it is used to delete the entered password; when the meter is in the menu interface, it is used to reduce the parameter setting value or return to the previous menu.

↵/+： Enter the fault interface; when the meter is in the password interface, it is used to check the input password; when the meter is in the menu interface, it is used to increase the parameter setting value or enter the next level menu.

Boot interface

Main display interface

The main interface of the instrument is mainly used to display the basic status of the vehicle, displayed as follows:



A	Battery level display	H	Left turn indication
B	Travel speed display	I	Right turn indication
C	Operating mode display	J	Turtle speed mode indication
D	Traction controller running hours display	K	Fault repair indication
E	Vehicle running hours display	L	Battery below 10%, lift lock indication
F	Pump controller operating hours display	M	Seat indication
G	Vehicle steering angle display	N	Park indication

Battery level display [A]

Shows the remaining capacity of the battery.

As shown in the above figure, when the battery power is less than 20%, the entire battery indicator will flash. At this time, please stop working and charge immediately. It is recommended to charge when two grids remain (the remaining battery is about 30%), otherwise the battery life will be greatly shortened.

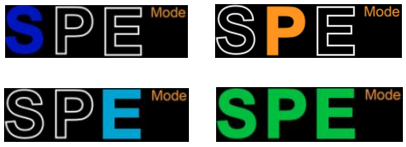
CAUTION

- **Charging in time is very important, otherwise it will affect the lift-span of battery!**

Travel speed display [B]

Normal work, display the truck travel speed.

Operating mode display [C]



As the diagram shows

S mode is super mode, thus the truck's acceleration, deceleration rate, max climbing gradient and so on is much higher. It is applied for transporting mass of good in short time and climbing big gradient slop， but it costs more energy， so the mode will not be used in normal state except emergency.

P mode is power mode. All kinds of index are lower than that of super mode. It is applied for the case of long distance transporting and needing higher power or speed.

E mode is economical mode. All the parameters are optimized. Working in this mode can save power so it is applied for a long time work after charging, and it is suggested to work in this mode in normal work-time.

SPE mode: The truck is in Safety Mode. In this mode, maximum traveling speed is limited to 7km/h. it is very good for working in a crowd warehouse or other compact space. In this mode, the slow indicator[F]  will be on.

CAUTION

- **The default mode is mode E. after power cutting every time, the work mode resets to mode E no matter which mode it is before power cutting, but the switch key is still in the mode before turn off.**

Traction controller running hours display [D]

The hourglass icon indicates the hour meter function.

Display the cumulative working time of the traction controller

Vehicle running hours display [E]

The hourglass icon indicates the hour meter function.

When the vehicle key switch is turned on, the hour meter starts counting, and the minimum resolution is 0.1 hour.

Pump controller operating hours display [F]

The hourglass icon indicates the hour meter function.

Display pump controller cumulative working time.

Vehicle steering angle display [G]

Steering wheel (rear wheel) steering angle and steering direction display.

As the steering wheel turns, the centered arrow symbol rotates around the center of the circle.

1.Steering direction display: the arrow is turned to the left around the center of the circle, then it is turned left; when it is deflected to the right, it is turned right.

2.Steering angle display: The larger the deflection angle, the larger the turning angle.

Left turn indication [H]

When the vehicle turns left, turn on the left turn signal and the indicator lights up.

Right turn indication [I]

When the vehicle turns right, turn on the right turn signal and the indicator lights up.

Crawl speed indicator[J]

When the truck in SPE mode, the crawl speed indicator light up.

Fault indicator[K]

The light up when the controller is wrong or operation mistake, and the fault code shows in the main display screen.

Lifting low speed indicator[L]

When there is 10% power, the indicator is on, and the mast lifting speed drops, to remind user to charge the battery as soon as possible.

Seat switch indicator[M]

When operator leaves the seat, the light will be on, and the truck will be unable to travel or lift. This function needs the seat to equip with seat switch.

Parking brake applied indicator[K]

When parking brake applied, the light up.

Battery low capacity indicator

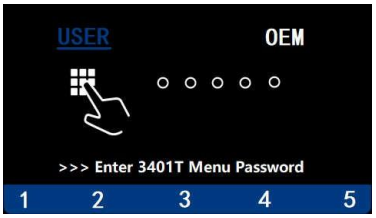
This indicator lights up when the power is less than 20%.

Lithium battery heating interface

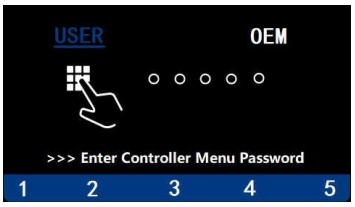
The heating interface of the lithium battery model is shown below：

Menu password interface

When the meter is in the main interface, press F2, the meter will enter the password interface before entering the corresponding meter menu. Only when the user inputs the correct password, the meter will enter the corresponding menu interface. The password interface is displayed as follows:



When the meter is in the main interface, press F3, the meter will enter the password interface before entering the corresponding controller menu. Only when the user inputs the correct password, the meter will enter the corresponding menu interface. The password interface is displayed as follows:



USER password/OEM password

The meter sets menu options at different permission levels for the users. As shown in the figure above, when “User Password/USER” is selected and the corresponding user password is entered, the meter enters the user level menu; after “OEM password/ OEM is selected, enter the corresponding OEM password, the meter enters the OEM level menu. If the password is entered incorrectly, the meter will prompt the password error and you need to re-enter the correct password.

Password interface button function

When the meter is in the password input interface, the function of each button is as follows:

F1：Enter the number "1" for the password.

F2：Enter the number "2" for the password.

F3：Enter the number "3" for the password.

F4：Enter the number "4" for the password.

F5：Enter the number "5" for the password.

▲：Switch user password/OEM password.

▼：Switch user password/OEM password.

◄：Switch user password/OEM password.

►：Switch user password/OEM password.

C/-：Delete the entered password; if the password has been deleted, press the C/- button to return the meter to the main interface.

↵/+：When the 4-digit password is all entered, press  and the meter will automatically verify that the password is entered correctly. If the password is correct, the meter enters the corresponding menu. If the password is entered incorrectly, the meter prompts the password error. Note: When the password input is less than 4 digits,  is invalid pressed.

Fault interface

When the meter is in the main interface, press  to enter the fault interface. The fault code and the corresponding fault name are displayed according to the currently received controller fault code. The fault interface is displayed as follows:

For lithium battery models, when the lithium battery fails, the fault interface is shown as follows:

When the meter is in the fault interface, press  again and the meter will return to the main interface display.

Key function

When the meter is in the main interface, you can enter the following 4 menu interfaces by pressing F1~F4.

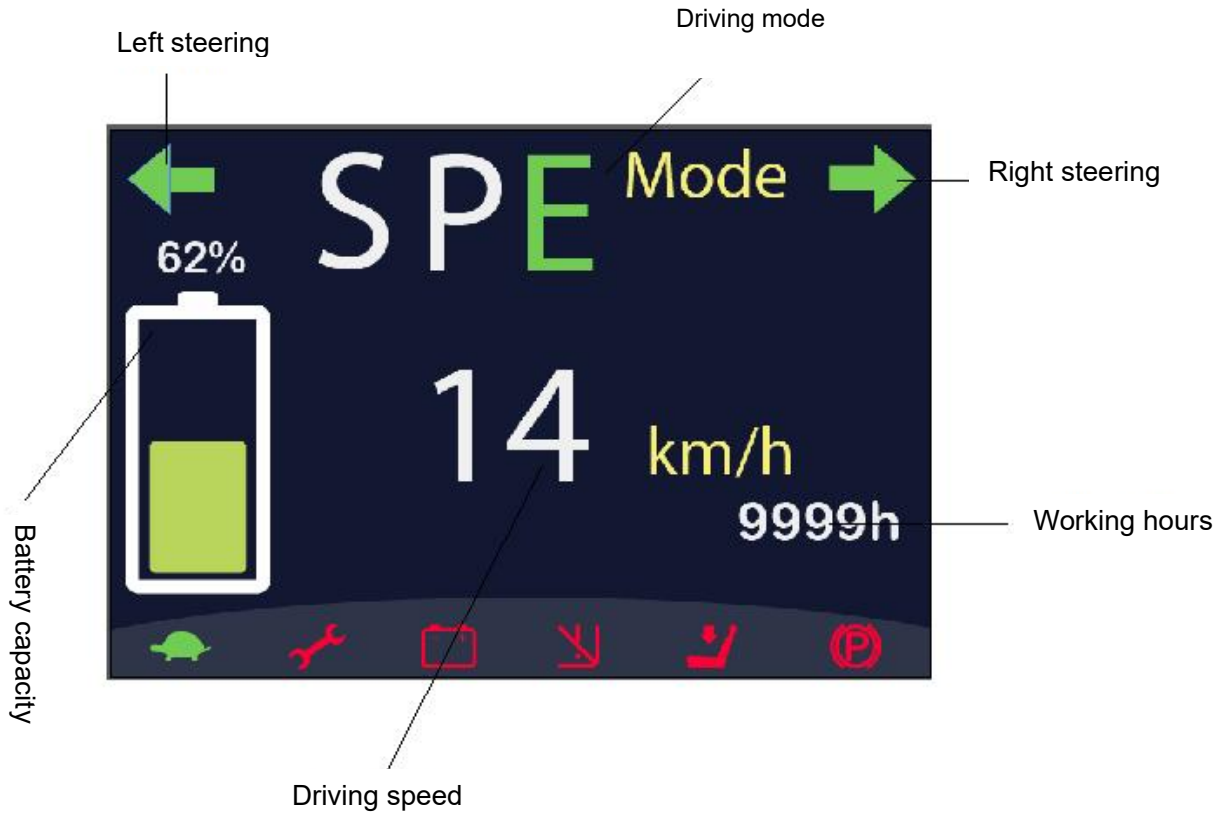
F1	Enter/exit the operation menu.
F2	Enter/exit the meter menu.
F3	Enter/exit the controller menu.
F4	Enter/exit the controller monitoring menu; when the meter is in the meter menu or controller menu interface, if the current menu option is a modifiable parameter, press F4 to adjust the parameter change step size to set the single digit, tens, hundreds, or kilobyte value of the parameter separately.
	Move the menu option up.
	Move the menu option down.
	Return to the previous menu.
	Enter the next level menu.
	When the current menu option is a modifiable parameter, it is used to reduce the parameter setting value, otherwise it will be returned to the previous menu.
	When the current menu option is a modifiable parameter, it is used to increase the parameter setting value, otherwise it will enter the next level menu.

QSD60/80-XD3-M、QSD60/80-XD3-MI、QSD100-XXD3-M、QSD100-XXD3-MI

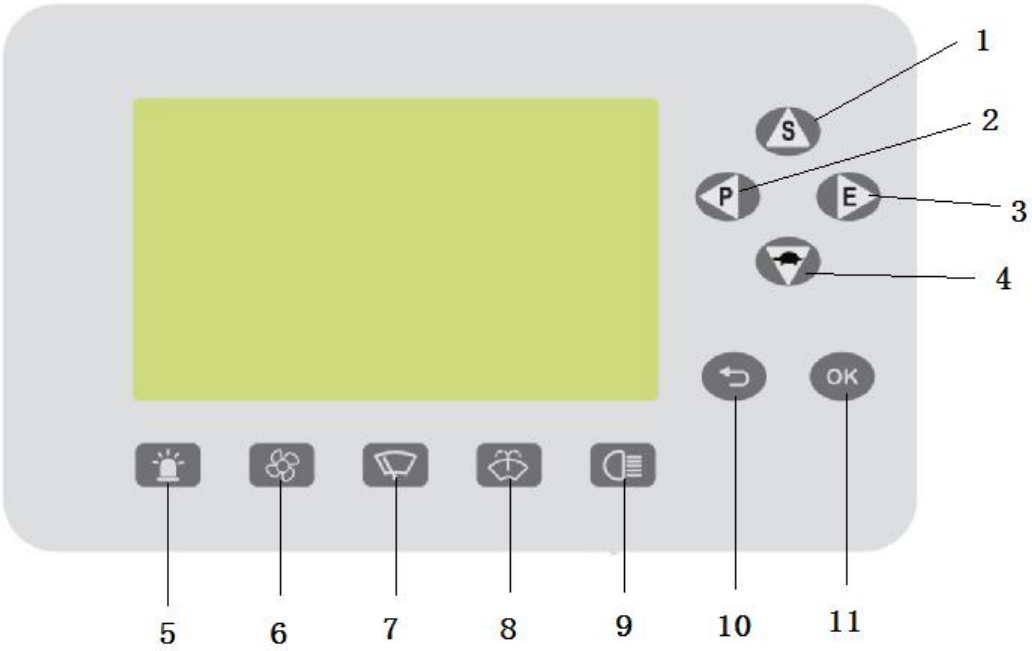
The multi-function display shows the battery capacity, the service hours, the operating mode, the travel speed and fault code information etc. Graphic illustrations on the multi-function display act as warning indicators. Check fault code and parameter setting through the right button.

No.	Parameter name	Description	Remark
1	Turtle speed light	Light up when the vehicle is operating in turtle speed mode	
2	Trouble light	Light up when a controller in the vehicle is faulty	
3	Battery light	Light up when the battery level is below 20%	
4	Lifting lock light	When the power level is lower than or equal to 10%, the lifting lock light is on	
5	Seat light	Light up when the driver leaves the seat	0：light up；1：go out
6	Parking brake light	Light up when the driver operates the hand brake	

Main display interface



Parameter name	Description	Remark
Driving mode	Display the current working mode, with 4 working modes of “S”, “P”, “E” and “SPE”	
Driving speed	Display current vehicle speed in KM/h	
Battery capacity	Show current battery level icon	
Working hours	Tractor accumulating working hours	
Left steering	Show left turn arrow indication	Optional
Right steering	Show right turn arrow indication	Optional



No.	Designation	Function	Remark
1	S mode switch	Change to “S” working mode	
2	P mode switch	Change to “P” working mode	
3	E mode switch	Change to “E” working mode	
4	Turtle speed mode switch	Change to “SPE” working mode	
5	Caution light switch	Turn on/off caution light	
6	Fan switch	Turn on/off fan	Optional
7	Wiper switch	Turn on/off wiper	Optional
8	Washer switch	Turn on/off washer switch	Optional
9	Beam light switch	Turn on/off beam light	Optional
10	Return button		
11	OK button		

Driving mode introduction：

There are four operating modes: “S”, “P”, “E” and “SPE”, and the button to switch the operating mode is “S” button, “P” button, “E” button, “Turtle speed” button respectively. When the operating mode is not changed, the default operating mode is E mode.

S mode: Super mode allows for the fastest acceleration and deceleration and the maximum grade ability. It is used for climbing steep inclines and handling a large number of goods in a short period of time. However, it consumes the most power and should therefore be used sparingly.

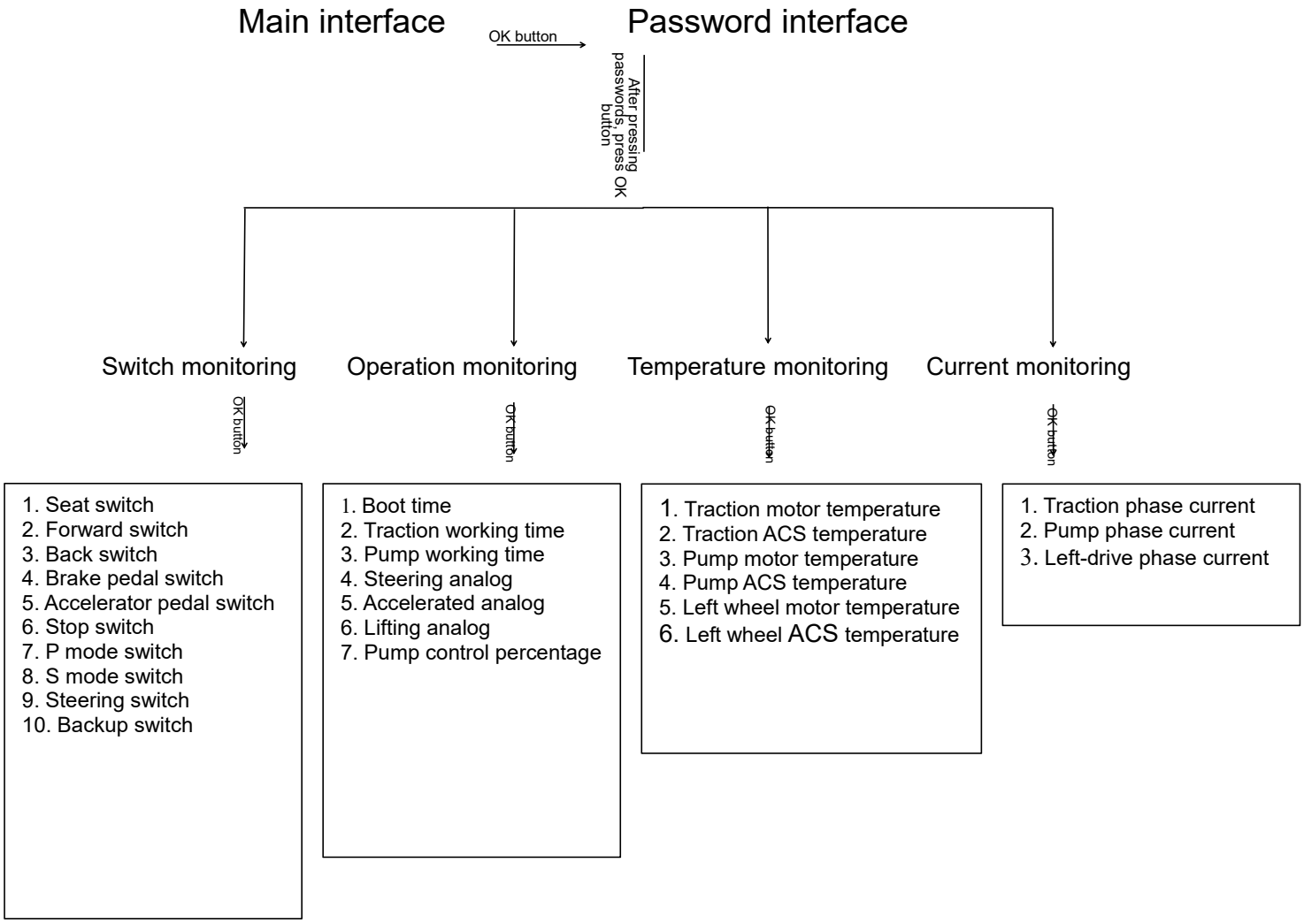
P mode: Power mode offers slightly lower performance than Super mode and is used for long-distance transport situations that require greater power or speed.

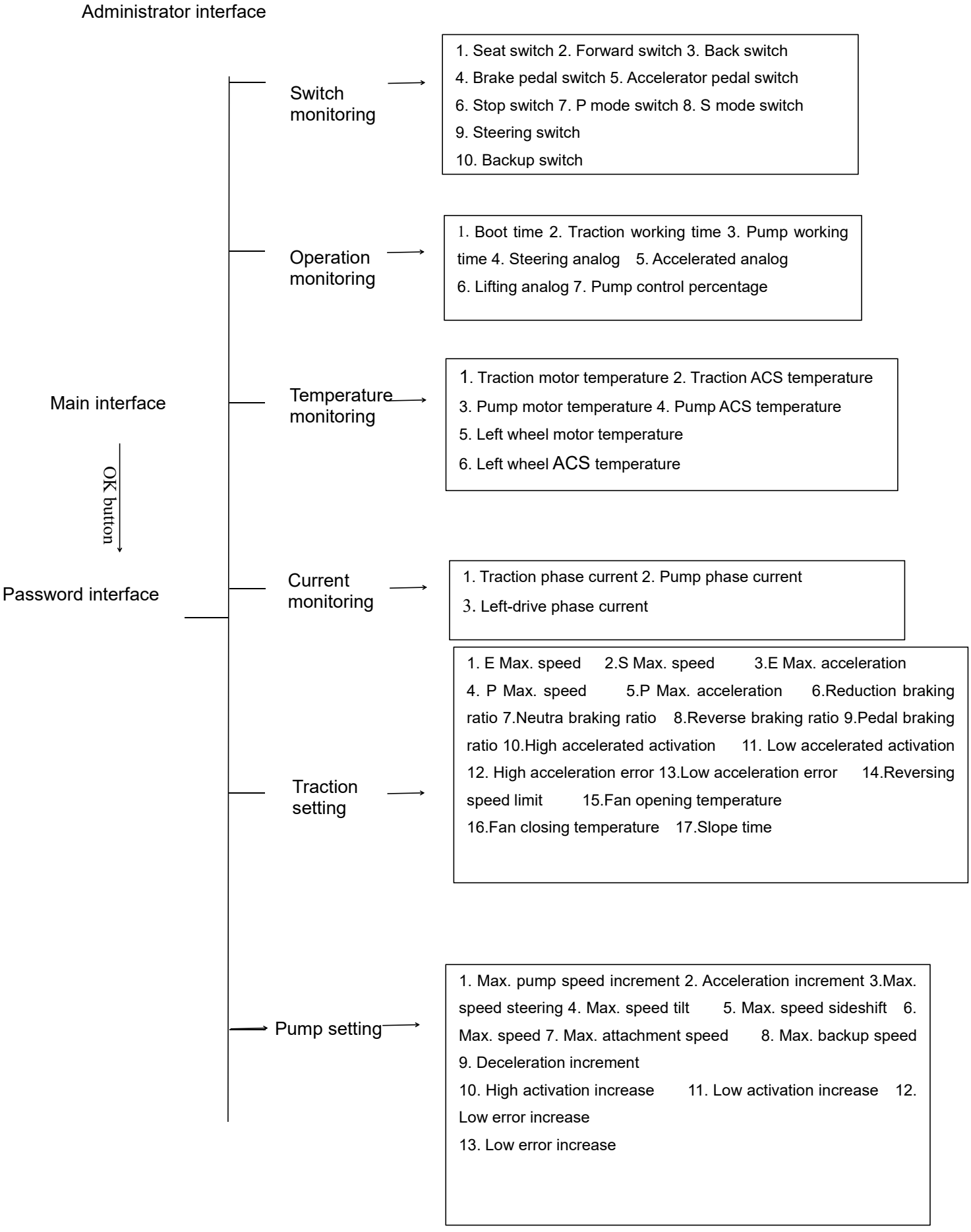
E mode: Economy mode offers optimized all-round performance and energy saving. It is suitable for prolonged operation on a single charge and is recommended for normal work.

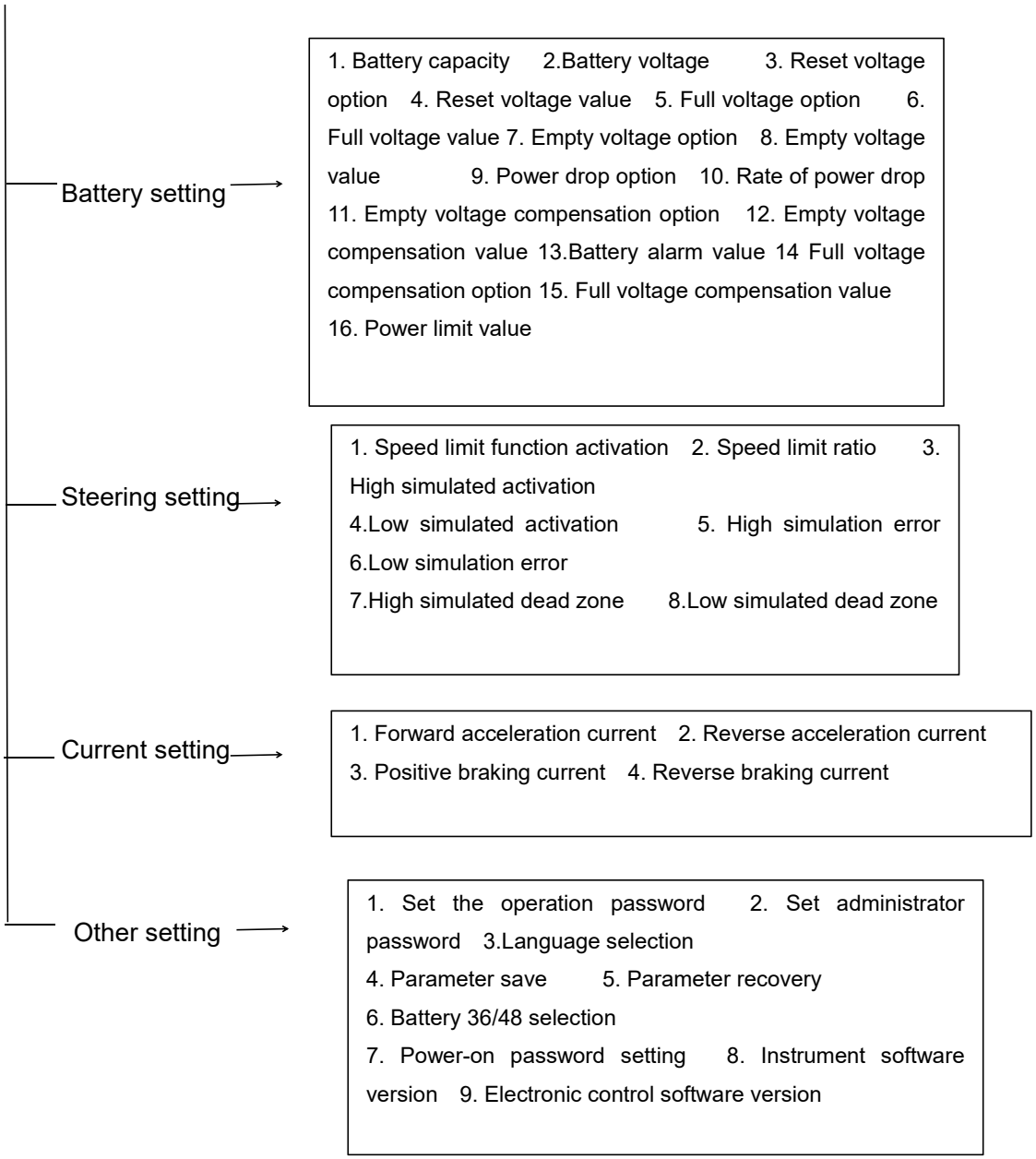
SPE mode: Safe mode limits the maximum travel speed to about 7 km/h. It is used for working in congested warehouses and confined spaces. In this mode, the turtle speed indicator lamp will be illuminated.

Instrument menu structure

Operator interface

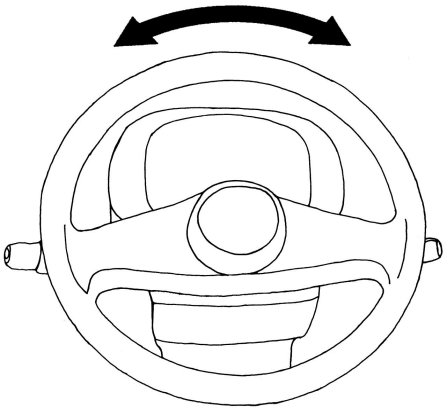



Administrator interface
Switch monitoring
1. Seat switch 2. Forward switch 3. Back switch
4. Brake pedal switch 5. Accelerator pedal switch
6. Stop switch 7. P mode switch 8. S mode switch
9. Steering switch
10. Backup switch
Operation monitoring
1. Boot time 2. Traction working time 3. Pump working time 4. Steering analog 5. Accelerated analog
6. Lifting analog 7. Pump control percentage
Main interface
Temperature monitoring
1. Traction motor temperature 2. Traction ACS temperature
3. Pump motor temperature 4. Pump ACS temperature
5. Left wheel motor temperature
6. Left wheel ACS temperature
OK button
Password interface
Current monitoring
1. Traction phase current 2. Pump phase current
3. Left-drive phase current
Traction setting
1. E Max. speed 2.S Max. speed 3.E Max. acceleration
4. P Max. speed 5.P Max. acceleration 6.Reduction braking ratio 7.Neutra braking ratio 8.Reverse braking ratio 9.Pedal braking ratio 10.High accelerated activation 11. Low accelerated activation
12. High acceleration error 13.Low acceleration error 14.Reversing speed limit 15.Fan opening temperature
16.Fan closing temperature 17.Slope time
Pump setting
1. Max. pump speed increment 2. Acceleration increment 3.Max. speed steering 4. Max. speed tilt 5. Max. speed sideshift 6. Max. speed 7. Max. attachment speed 8. Max. backup speed
9. Deceleration increment
10. High activation increase 11. Low activation increase 12. Low error increase
13. Low error increase


Battery setting
1. Battery capacity 2.Battery voltage 3. Reset voltage option 4. Reset voltage value 5. Full voltage option 6. Full voltage value 7. Empty voltage option 8. Empty voltage value 9. Power drop option 10. Rate of power drop 11. Empty voltage compensation option 12. Empty voltage compensation value 13.Battery alarm value 14 Full voltage compensation option 15. Full voltage compensation value 16. Power limit value
Steering setting
1. Speed limit function activation 2. Speed limit ratio 3. High simulated activation
4.Low simulated activation 5. High simulation error 6.Low simulation error
7.High simulated dead zone 8.Low simulated dead zone
Current setting
1. Forward acceleration current 2. Reverse acceleration current
3. Positive braking current 4. Reverse braking current
Other setting
1. Set the operation password 2. Set administrator password 3.Language selection
4. Parameter save 5. Parameter recovery
6. Battery 36/48 selection
7. Power-on password setting 8. Instrument software version 9. Electronic control software version

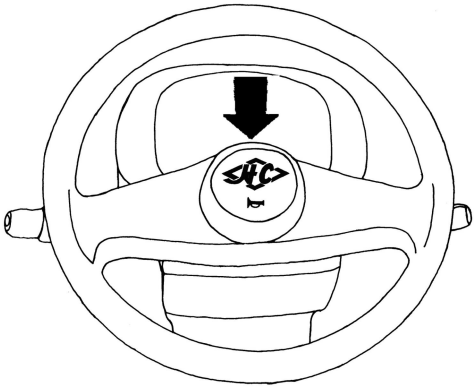
3.2 Control section

Steering wheel



The steering wheel controls the truck's running direction. Rotating anticlockwise, the truck will turn to the left; rotating clockwise, the truck will turn to the right. It is similar with the car's operation.

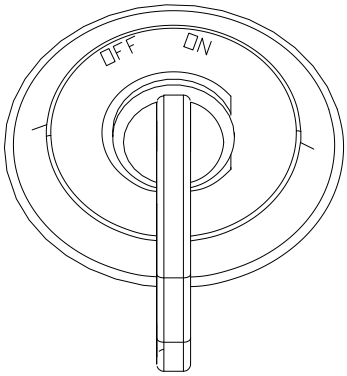
Horn



It is in the middle of the steering wheel, press to sound.

> ⚠ Caution
> The horn button can only work after the vehicle starts.

Key switch



OFF

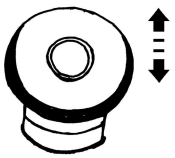
This is where the key is inserted or removed.

ON

Turn the key clockwise from the "OFF" position. When the key is placed in the "ON" position, the vehicle is ready to start.

> ⚠ **Note**
> ①Pull the emergency stop button before starting the vehicle.
> ②Place the reversing handle in neutral before starting the vehicle.
> ③Do not step on the accelerator pedal when starting the vehicle.
> If the reversing handle is not in the neutral position or the accelerator pedal has been depressed at the start, a fault will be displayed on the meter. When the reversing handle is placed in neutral or the accelerator pedal is released, the fault will be relieved immediately.

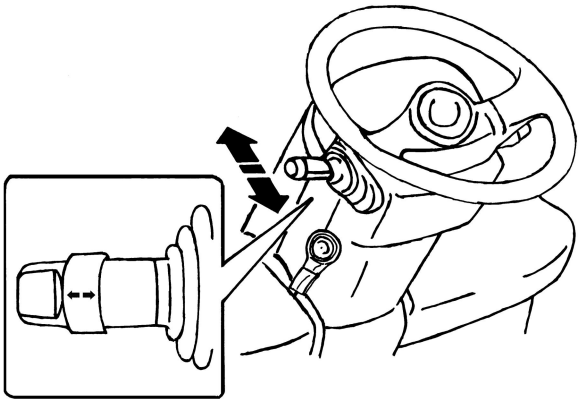
Emergency disconnect switch[5]



When happen emergency, presses down the emergency disconnect switch, and then the main power of the truck will be cut off, the truck stops working.

> **Caution**
> Please don't use the emergency disconnect switch to substitute the function of key switch.

Steering switch



When steering light switch is at turning position, steering lights are flashing, at the same time, corresponding indicator light is also flashing.

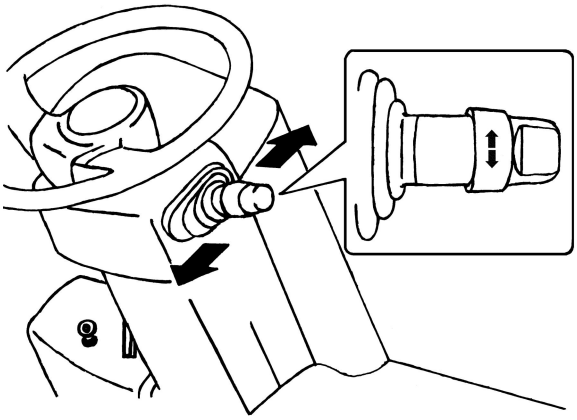
R — right

N — neutral

L — left

> Caution
> Only the steering light switch can be used after the vehicle starts.
> Steering lever does not go back neutral automatically, it needs hands to reset.

Direction switch

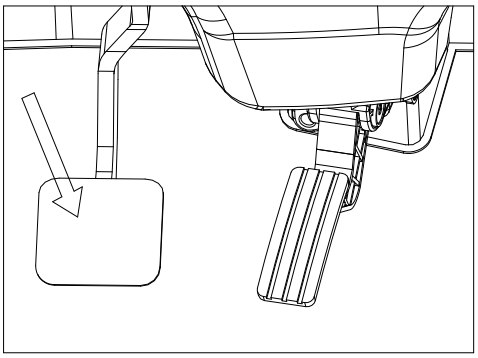


Pull forward ----go forward

Pull backward--- reverse

> **Notice**
> The directional switch is in the middle position before the vehicle can start.
> Stop the vehicle before shifting between the forward gear and the reverse gear.

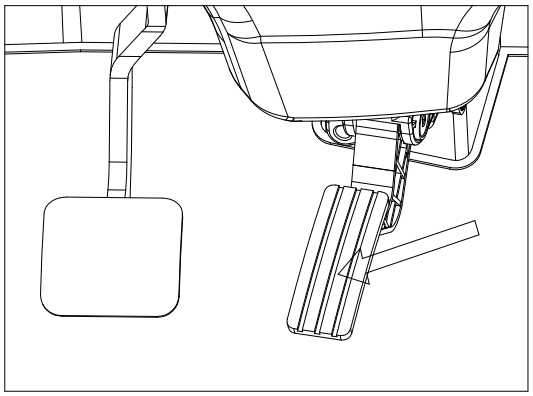
Brake pedal



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

> **Caution!**
> No permitted to press the brake pedal and the accelerator pedal at same time, otherwise, it is harmful to the traveling motor.

Accelerator pedal



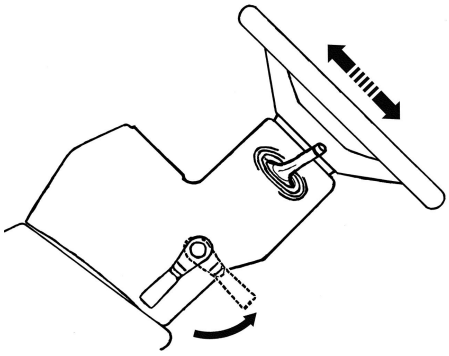
As the accelerator pedal is slowly pressed, the drive motor start turning and the forklift truck will start to move. According to the force applied to the pedal, the speed is adjusted with not steps.

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.

Note

When the vehicle is running, the accelerator pedal is released to achieve soft braking.

Steering wheel locating device



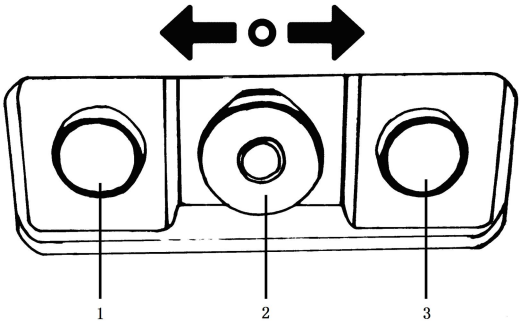
Steering wheel's location is adjustable, the method is that, push off the adjust rod installed at left of steering column, and then move steering wheel to the location hoped, at last, pull on the adjust rod and lock it.

⚠Caution

A. After stopping the truck and pulling hand brake, it is allowed to adjust tilt angle of steering wheel.

B. After adjusting, pull steering wheel and ensure it is locked.

Inching switch



Forward inching switch [1]

Press it once -truck move forward slowly, loosen- truck stop.

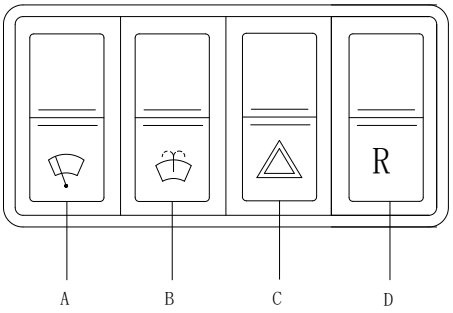
Emergency button [2]

Press down ----- power is cut off, so at the time, no matter how press switch 1,2, the truck remain stopping. If want to make inching switch work again, please rotate it clockwise to make it eject, the power is on again.

Backward inching switch [3]

Press it once -truck move backward slowly, loosen- truck stop.

Twist plate switch



Front window wiper switch(A)

It has 2 speed shifts, press back: 1 - fast and continuous, 2- low and continuous. Press front: stop

Front window wiper water injection switch [B]

Press back ---- inject, loosen --- stop injecting.

Hazard lamps switch(C)

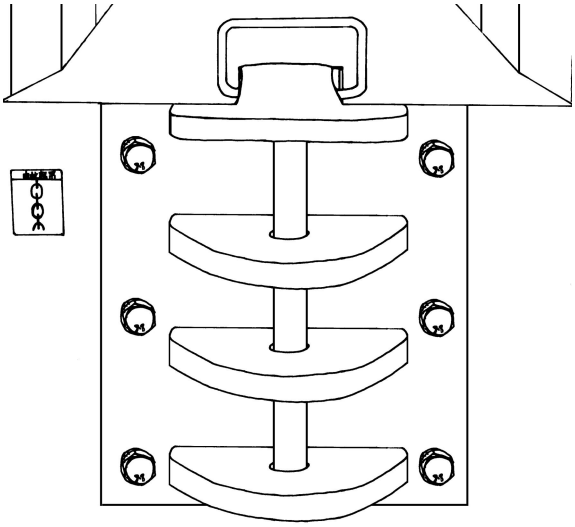
Press back————Hazard lamps flashes, means truck is in fault, or stop suddenly.
Press front————close.

Inching switch energize button **(D)**

Press back—it is connected by power
Press front—inching switch is cut off.

3.3 Truck body part

Towing operation



Towing methods：

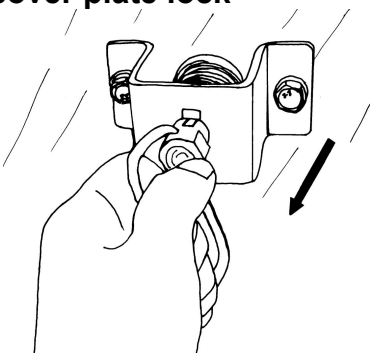
①Hold the traction pin ring, turn clockwise and lift the traction pin up

②According to the height of the trailer off the ground, select the towing position of the trailer drawbar. Lift the traction pin and extend the trailer drawbar into the hanging plate

③Adjust the position of the drawbar, lower the traction pin, and rotate it counterclockwise to the end.

> ⚠ **Caution**
>
> Complete the towing operation on a flat surface. Pay attention to safety and prevent your hands and body from being caught.
>
> ·Make sure the connection is secure before starting the towing operation.
>
> ·The load can only be removed after the trailer has completely stopped.
>
> ·Be careful not to hurt your hand when connecting or disconnecting the drawbar.

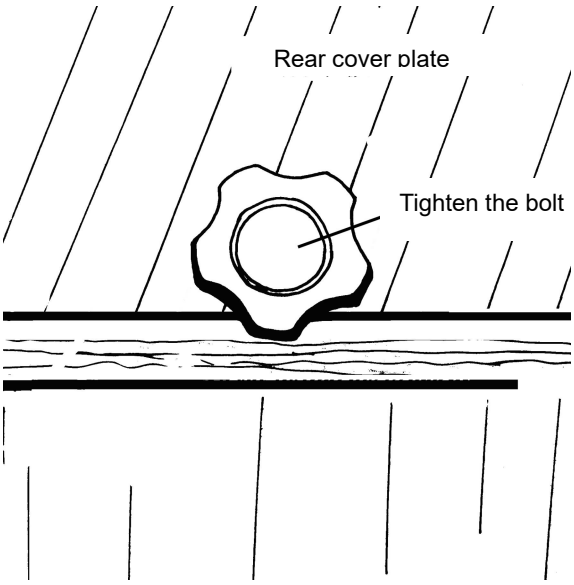
Front cover plate lock



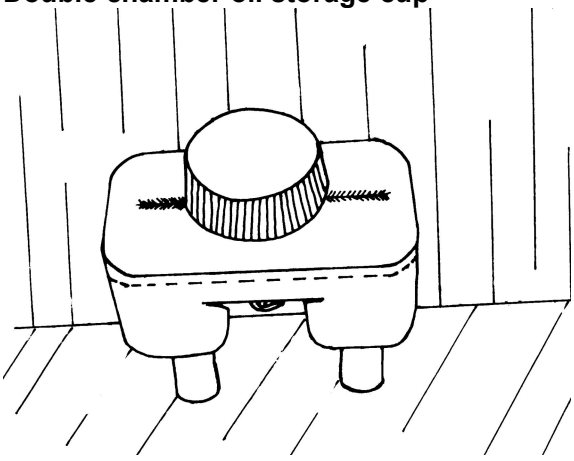
The front cover plate lock assembly is located between the two seats on the back wall of the cab

Hold the lock ring and pull it outwards, and the front cover will automatically open under the action of the gas spring.

Rear cover plate tightening bolt



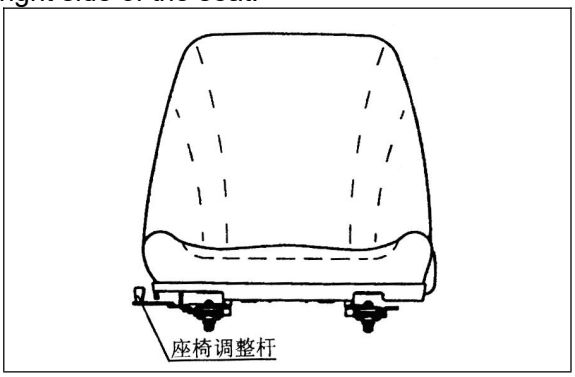
Double chamber oil storage cup



The oil storage tank is located in the upper right corner of the instrument rack, which is filled with the imported DOT 3 brake fluid.

Seat

The seat can be adjusted and equipped with safety belt. The seat adjusting lever is on the right side of the seat.



Adjust operator's seat to position, which is comfortable for you and provides easy access to all hand and foot controls. The seat is unlocked by moving the adjusting lever to the right.

Before proceeding with work, adjust operator's seat and make sure that it is securely locked.

Caution

a. Before adjusting the lever, you'd better turn of the key switch

b. Stop the truck to adjust the seat.

Safety belt

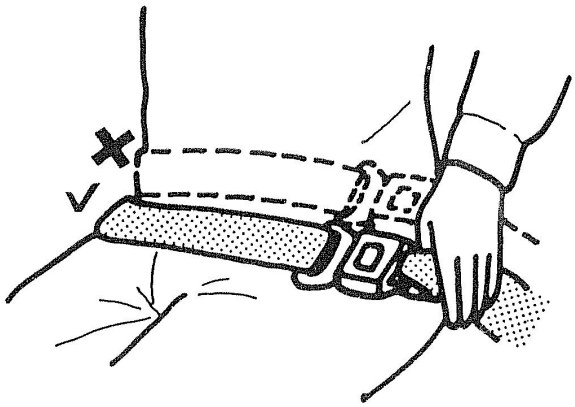
While you are on the vehicle and wearing the safety belt, your back and waist should close to the seat as much as possible. Do not tilt the seat back too much or the seat belt will not stretch properly.

Often check if the bolts of the fixed seat belt are loose, whether the buckle and the shrinking device are normal, and belt pins are loose. Not allowed to tie the knot. Do not let the belt press on the hard or fragile objects. And also do not make friction with the sharp edge to avoid damaging the belt.

The components installed on the safety belt can not be removed arbitrarily. If the safety belt used frequently, you should always do exterior inspection, when found something abnormal, please immediately replace new belt. The belt can be used for 3-5years, if there is something abnormal, it should be scrapped early.

Specialty for safety belt

Tighten safety belt



The safety belt burls in box and it needs an assistant action to get it out. So there may be some trouble if you don't familiar with it.

One kind of seat: it needs your one hand press the white round button (with the word "press to release") and the other hand pull the safety belt out. Then plug it to the socket in another side of the seat.

There may be another kind of seat: the seat with movable safety belt box. Rotate the box forward, the belt can't be pulled out; only rotate backward can it be pulled out. Then plug into the socket in another side of the seat and rotate the box forward. Thus the safety belt will work in normal position.

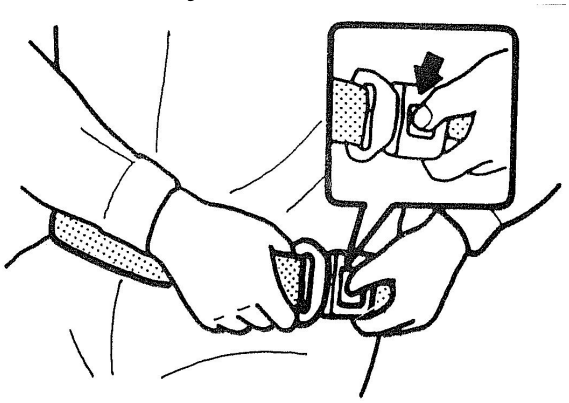
While you are on the vehicle and wearing the Safety belt, at the same time, your back and waist should close to the seat as much as possible. Don't tighten the safety belt at the waist.

Don't make the seat back tilt backward too much, or the belt can't extend correctly.

It is forbidden to tie or twist.

In daily work, tighten safety belt can protect you from being hurt much when the truck turns over.

Unfasten safety belt



Press the red button (with the word PRESS) on the socket with your left thumb, then it will unfasten.

Safety belt inspection

Check whether the bolts which fixed seat belt were loose frequently. It is forbidden to use the Safety belt when the belt was tie a knot. Do not let the belt press on the hard or fragile objects. And also do not make friction with the sharp edge to avoid damaging the belt.

The components which are on the Safety belt can not be removed arbitrarily. If the Safety belt used frequently, you should always do exterior inspection, when found something abnormal, please immediately replace new belt. The belt can be used for 3-5years, when found something abnormal, it should be scrapped early.

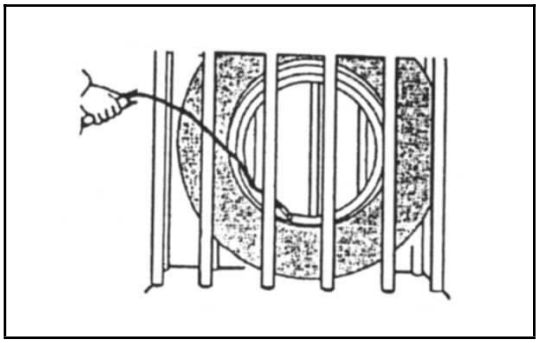
9.Tyre replacement

Warning

•When using the air compressor, the pressure should be adjusted first, because the maximum output pressure of the air compressor is much higher than the specified pressure of the tire, otherwise, it will cause serious accidents.

• Place the tire in a protective frame when inflating for safety。

•To ensure safety, place the tire in a protective frame when inflated.



Front tyres

1) parked the tractor on a horizontal, solid ground;

(2) Tighten the hand brake and place a wooden pad at the rear of the rear wheel to prevent the tractor from moving;

3) Place the jack on the cut surface at the bottom of the counterweight.

Note: make sure the minimum weight of the Jack is 2/3 of the total weight of the forklift.

4) Loosen the nut on the wheel 1-2 laps counterclockwise.

Warning

Do not remove the nut before the front wheel is lifted off the ground.

5）Slowly lift the forklift with a Jack until the front wheel is completely off the ground. As shown in the diagram, wooden mats are placed on both sides of the forklift to support the forklift.

6) Remove the nuts of the wheels and replace the rear tires.

Warning

a. when the tire is removed from the hub, the rim bolts and nuts can only be removed after deflating;

b. make sure that the mats used to support the forklift are integral and solid enough.

c. must not enter the forklift when

supporting the forklift only with wooden mats.

7) install the nut in the order shown and lock the nut temporarily.

Remove the wooden pad under the frame, slowly lower the forklift to the ground, and remove the wooden pad and Jack at the back of the front wheel.

9) Fasten the nut to the specified torque in a crosswise manner. please refer to the "tightening torque" table.

10) Adjust the tire pressure to the specified parameters.

Rear wheel

① Park the tractor on a horizontal and solid ground.

② Pull the parking brake lever and place chocks before front wheels to prevent movement of forklift.

③Put the lifting jack under the counterweight.

Caution： Make sure the jack capacity is greater than 2/3 of service weight of forklift.

④ Loosen wheel nuts 1-2 turns by turning them counter-clockwise.

Warning

Do not remove wheel nuts until rear tires are raised from ground.

⑤ Raise the forklift with jack until rear wheels off the ground. Support forklift truck by putting additional wooden blocks under both sides of the front truck frame as shown below.

⑥ Take out the wheel nut of rear wheel, and then replace the wheel.

Warning

a. When removing tire from wheel rim, do not remove rim set bots and nuts before releasing air;

b. Make sure that wooden blocks used to support lift truck are solid, one-piece units;

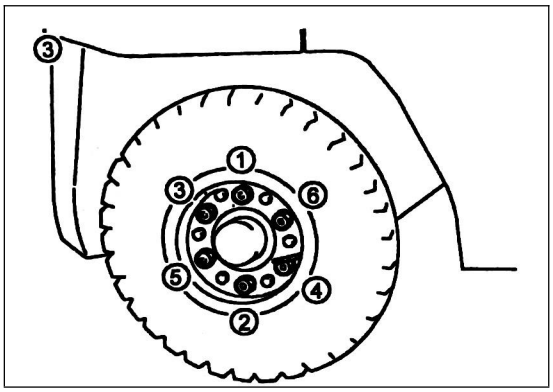
c. Never get under forklift while it is supported only by wooden blocks.

⑦ Retighten nuts as shown in figure below.

⑧ Remove the wooden block under chassis body. Let down the forklift slowly. Then take away the chocks and jack from the rear part of the front wheel.

⑨ Retighten the wheel nut with the correct torque. Please refer to *Tightening Torque Table*.

⑩Adjust tire pressure to specified value.



4 General rules

4.1 New truck inspection

The new truck, all have tested strictly, but during the transport, some parts, components maybe damage or loosen, so after you receive the truck, we recommend you inspect these items.

- Inspect all technical papers-brochure, certification, and packing list are complete
- Check all the fasteners, especially transmission, steering, brake, and wheels.
- Check the motor, controller, electrical equipments, instruments, wirings and connectors is intact and strong, and check the electrical appliance and instruments can work normally.
- Check batteries are intact, especially whether battery shell ruptured.
- Check the rotation, brake of motor and driven system, and the state of steering system.
- Check the attendant tools are complete and intact.

4.2 During brake-in

We recommend operating the machine under light load conditions for the first stage of ration. Especially the requirements given below should be observed while the machine is in a stage of 100 hours of operation

- To avoid new battery be over discharged in the period of first 100 hours for new truck. (New batteries' real capacity only 80% of rated capacity during the first 10 circles).
- The periodic maintenance must be operated.
- Don't make a sudden start, sudden brake or sharp turning
- Replace all the oil or lubrication grease by schedule
- Limit the loading weight not overweight than the 70-80% of load capacity。

4.3 Operation

4.3.1Inspection before start up

a.Check the level and specific gravity whether meet the specified value, and the pouring plug are intact, and the cell cable contacted strongly. Then close the hood.
b.Check the instrument is normal, connected firmly. And turn on the key switch, check the display of instrument is ok.

c.Check the dive mechanics, whether all the joint parts intact, and joint firmly.

d.Check the steering flexible.

e.Check the tire bolts are loose.

f.Check the driving axle, whether there is leakage of gear oil. If serious should check whether normal

Note: Get on and off the left hand hold the steering wheel or handle, the right hand hold the seat, get on and off the car.

4.3.2 Start up

a.Turn on the key switch, and then the meter head light is on, it indicates power, and power should be full, and the timer begins to count.
b.Release the parking brake level, put forward or backward the direction handle, and then press the accelerator pedal.
c.Look around before stepping the acceleration pedal, confirm there are no obstacles, then press the pedal slowly, start the truck stably, and accelerate the truck gradually. It is forbidden to press the acceleration pedal suddenly.

4.3.3 Driving

The road for the truck running should be hard cement surface.
a.When the truck running, you can control the speed by pressing the accelerating pedal. And the stand.
b.It is forbidden to turn off the key switch, when the truck is running.
c.When the truck running on the flat road,If you

need to press the brake pedal, so you should release the accelerating pedal or accelerating knob first, then press the pedal gradually, to slow the truck. Sudden brake will not only speed up the abrasion of lining, drum, and tires, but also easily damage the axle gear, shaft and motor. In addition, sudden brake no advantage to steering. Especially for stand-type, probably, throw out the driver.
d.Observe whether there are special sounds, smells and something abnormal during braking and steering.
e.You should slow the truck, when turning according to the turning radium and channel width. It is forbidden to turning at full speed, avoid of accident. So you'd better running the truck at 1/3 of max speed.
f.Some extent wind power will make the trailer and good turn over.

⚠Note:
1. During traveling, if the view of operator is blocked (such as turning, subway, the channel is too narrow), excepting using the viewfinder, it needs to equipped with a guider. The operator should operate according to the guider's hint. 2. The operator should have enough prediction and judge about the things of the road, wall and its room. Don't keep luck mind, especially the turning, the inside track of the back trailer leans inside, another way, the inside room for the back truck body is bigger than the front. 3. when uprising or downgrading, don't travel on the side way, or it may cause danger of turning over.

4.3.4 Reversing

It is allowed to reverse when don't equipped with trailer. When reversing, you must stop the truck completely, then ensure that there are no obstacles no both sides, and then press the accelerating pedal or accelerating knob to control the revering speed.

4.3.5 Traction

The truck moves back slowly to approach trailer till 0.3-1m, and park truck, do not pull hand brake, use inching switch to approach slowly, manipulate hoop handle to pull traction pin up, when trailer traction rod gets into hoop handle, and then plugs into traction pin.
·make sure the traction pin has plugged.

⚠ Notice:
a.Trailer must park on smooth and solid road in advance, it is forbidden to park on ramp.
b.Before plugging and pulling out traction pin, it must operate hoop handle, do not allow humans to get into the interval between truck body and trailer, because the trailer may slip and move, it may clamp humans and cause dangerous incident.

⚠ Warning:
a. operation of trailer link should be steady. It is forbidden to do it in high speed, and the speed should be less than 2.5km/h.
b. the trailer should be equipped with brake device.
c. the trailer should be parked on hard surface rather than ramp.
d. only manipulate the pothook handle can pull out the tow pin. It is not allowed to get into the truck body and trailer, prevent the trailer from slipping, otherwise the human body will be in danger.

4.3.6 Stopping

Release the accelerating pedal or knot, and truck will stop slowly, when necessary press the brake pedal, and put Direction Switch in the neutral position. Tighten the brake lever.

⚠ Caution:
a. Must park on hard road
b. Don't park on the cross, passageway or traveling route.
c. Don't park on ramp. If you have to this, please use hard wood to underlay the wheel; don't park on dangerous circumstance.

4.3.7 Deposit

a.Wright down the driving record, and turn it to the manager for signature.
b.Pull the parking brake level, and put Direction Switch in the neutral position.
c.Turn off the key switch, and get out the key.
d.Clean the truck inside and outside, and Remove debris embedded in the tires.
e.Tell the truck's condition to the person who charge the battery, after checking the truck, the operator can leave.

5 Maintenance and lubrication

When the truck running, due to the influence of various factors, the mechanic, parts will loose gradually, and friction, mechanical damage may happen accidently. If not carry out the necessary maintenance and lubrication, the whole truck performance will deteriorated, and the reliability of mechanic will also be decreased, even make accidents. So it is very important to carry out regular maintenance and lubrication according to the mileage. Because the trucks have different work conditions, so the interval miles (time), items of maintenance and lubrication is different.

① The fork lift truck needs inspection and maintenance periodically so as to make it in good working condition.

② Inspection and maintenance are usually ignored; you'd better find the problems and solve it in time.

③ Use the orthodoxy spare part of ZHEJIANG HANGCHA ENGINEERING MACHINERY CO., LTD.

④ Don't use different oil when changing or adding oil.

⑤ Don't rave about oil and electrolyte used at will, and carry on handling according to the local environmental protection laws and regulations.

⑥ Maintain on schedule.

⑦ After you make maintenance, you'd better make a record.

⑧ Forbid to repair the fork lift truck if you haven't been trained.

5.1 Maintenance interval mileage (time)

Daily maintenance	everyday after using
Bank one maintenance	every 1000～2000km(300h)
Bank two maintenance	every5000～8000km（1000h）

5.2 Maintenance operation

5.2.1 Daily maintenance: clean is the basic, and check the bolts is important.

a. Check whether all items have been repaired which need to repair.

b. Check the battery if full charge, the electrolyte level and gravity specific correspondent to the stand value, the pouring plug are intact, battery box are rupture or leakage.

c. Check the cell cables are burnt, the stuns are loosen and cleanness.

d. Check all the instruments, lamps, horn are normal, and all stuns are connected firmly.

e. Check all parts are lubricated and leakage.

f. Check all the brake mechanic parts are intact, and are connected reliable. And whether the brake is flexible and the free trip of pedal.

g. And Check the steering wheel working conditions and whether steering are lightly and flexible.

h. Check the shaft and tire blots are loosen.

i. Listen to the motor, drive system, and chassis, check if there are abnormal noise, and the

instruments are works normal.

j. Check front axle assembly seat, rear axle assembly seat, chassis, battery box are intact rupture, and the weld line are split.

k. Clean the truck every day, and wipe the inside and outside of the truck. Remove the battery, and wash the acid on the inside and outside surface of the battery box periodically.

5.2.2 Rank one of maintenance:Lubricate the blots is important, and clean the whole truck

a. Remove the truck, clean and inspect the battery completely, and charge the battery. Clean the cell cable's end, if there are burnt, repair or replace it.

b. Hoist the battery box, clean the acid inside and outside completely.

c. Clean the acid and mud, which on the chassis and other parts.

d. Inspect the bolts which fasten the gear box and rear axle. Inspect and add the lubricant.

e. Check Semi axle sleeve seat and bolts. Check the bolts which fasten the steering mechanism. And Check the steering wheel working conditions

f. Check the front axle, and the nuts which fasten the front axle.

g. Check the nuts which fasten the tires and the bolts which fasten the shaft.

h. Check friction of brake lining.

i. Check the blots which fasten the brake wheel and brake seat.

j. Inspect or replace the straight pin and pin brake mechanism

k. Check the free trip of brake pedal.

l. Check the front and rear tires, wheel hub blots and nuts.

m. Clean the motor, check and tighten the bolts.

n. Check the instruments, lamps, horn, fuses, switch, and insulation to motor shell, and tighten the bolts. Check the junction box's stunts and its insulation to the truck body.

o. Check all the wires are intact, and tighten their stuns.

p. Check the abrasion of contact point; when the point is too hard or friction, it need to be replaced.

5.2.3 Rank two of maintenance:Clean is the basic, and adjustment is important.

Except all the rank one maintenance, add the following items:

a. Vent the gear oil of the driving axle, and add with new gear oil.

b. Check the lubrication of wheel hub and add with lubricant.

c. Check the seal ring of wheel hub, replace it in time according to the friction.

d. Check the friction of tires, repair or replace it in time.

e. Check the steering wheel working conditions, and steering chain device, add or replace lubricant.

f. Check the steering axle has crack or the weld line is rupture.

g. Check the steering chain wheel, the tension of chain, adjust it according to the situation.

h. Check abrasion of brake lining, and replace it according to abrasion situation..

i. Check the abrasion of all pins of mechanism, deformation, repair or replace it.

j. Adjust the free trip of brake pedal.

k. Inspect and repair the electrical system.

l. Check controller's safety system per 2 years, it is that: according to "6.4 controller's fault diagnosed table", first set a fault in advance, and then check whether the display fault code is right or not .

5.3 Lubrication

Lubrication is one of the important factors, which can affect the performance and life-span of truck. When using the truck, combined with the maintenance, add lubricant or grease to the appointed point according to the lubrication schedule.

Caution: Before add lubricant, you must clean the position, where you need to add lubricant. Generally, there is a sign which to add grease, and add grease until the grease spill over, and prevent infiltration of dust and dirt.

1. Axle box and reduction gearbox: replace oil 2000km in new truck, and then replace oil every 2 years.GL-5 85W/90type.
2. Operation joint: lubricate in every 2000km or 300hby dripping.HJ-20mechanical oil （GB443-64）.
3. Steering ,wheel hub:8000km or1000h，lubricate with ZG-2if necessary.

5.4 Periodic replacement of key safe parts

Some parts can't be found damnification or shatter though schedule maintenance. In order to make sure the safety of truck, please replace these parts termly listed in following table.

If there is any off-normal happened on these parts before replacement time, please replace it deservedly.

Name of key safe parts	service life (years)
Brake hose or hard tube	I～2
High pressure rubber hose, tube for hydraulic system	2
Grease cup for brake fluid	2～4
Brake pump, jar cover of sub pump and dustproof cover	1
Sealing member, rubber articles inside of hydraulic system	2

5.5 Truck used oil

Description	Brand, code	**Remark**
Gear oil for heavy load truck	GL-5 85W/90	One in drive axle and one in reduction gear box
Brake fluid	DOT3 brake fluid	
Industrial vaseline	2#	Battery terminal
Lubricating grease	3# General purpose lithium lubricating *grease* for automobile	

5.6 Inspect tire and Replace tire

Inspect tire

Turn the tire valve cap counter clock-wise and move it. Using a tire pressure gauge, measure the inflation pressure, and adjusting it to the specified pressure, if needed. After making sure there is no air leakage from the tire valve, reinstall the cap. Check that each tire does not get damaged at the tread surface or side face or bending at the rim.

WARNING

- **Since the forklift truck needs tires that have a high inflation pressure to carry heavy loads, even a small bending of rims or damage at the tread surface could cause an accident.**
- **When using an air compressor, first adjust the air pressure of the compress-or. Failure to do so will cause a serious accident, since the compressor delivers the maximum pressure.**

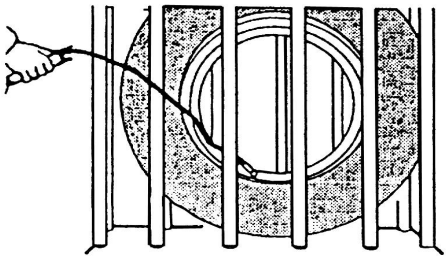
- **Put the tire in the chain-link-cable barrier.**

Tire Pressure

Tire pressure use the new criterion (New Criterion: GB/T2982-2001)

Front tire：7.9 bar

Rear tire：8.3 bar

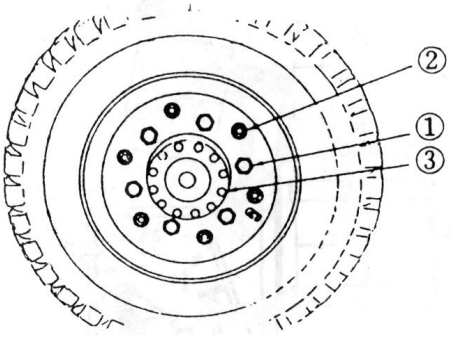


Hub nuts tighten torque check

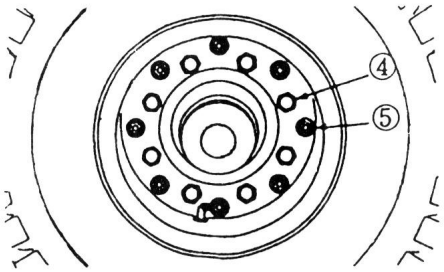
Check hub nuts should be tightened to the specified torque securely.

- Hub nut
- Divided rim bolt
- Drive shaft bolt
- Hub nut
- Divided rim bolt

Driving wheel (Rear wheel)



Steering wheel (Front wheel)



WARNING

· **All nuts and bolts should be properly installed and tighten before inflating tire and rim assy. An inflated tire contains potentially explosive energy. Don't over inflate.**

Replace tire

When the tire is damaged, you should replace it in time. Put a jack under the truck make the tire just beyond ground and put a wood block under the chassis. Loosen nut ①or④, replace new tire. Tighten the nut crossly and symmetrically.

The value of tighten torque shown in <<Table for bolt's tight torque>>.

Note: For the replaced tire, do not remove rim bots before releasing air, or else it may cause something accident.

6 Deposit the truck for a long time

6.1 On the basic of deposit, do inspection and maintenance as follows:

- Disconnect the battery plug prevent of discharging, and stop the truck in shadow.
- On the exposed parts and some shaft coated with rust-proof oil
- Cover the ventilate holes prevent the humidity accessing easily.
- Sheltered entire truck with cover.
- Add oil (grease) to all lubricant points.
- Fill up the truck body with block to reduce the load of the wheels.

6.2 Running after deposit for a long time

- Get down the antirust oil on the exposed parts.
- Vent the gear oil of the crankcase, driving axle, transmission box, hydraulic transmission box，clear it and add with new gear oil.
- Clean out dirty things and water in the hydraulic oil reservoir and fuel reservoir add with new hydraulic oil.
- Recharge the battery, then install on the truck.
- Check others carefully such as start, running, turning etc.

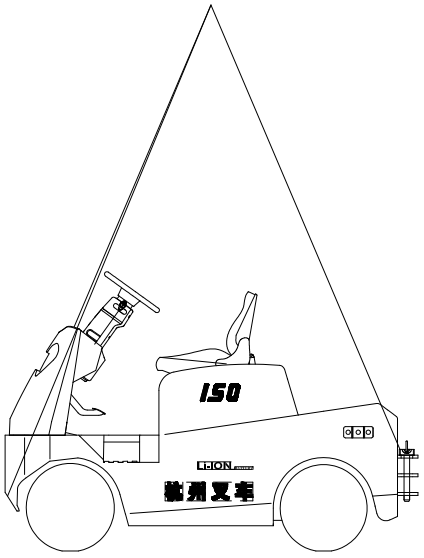
7 Truck’s convey, hoisting

The truck is designed for traction short distance only, It is inappropriate for long-distance transportation. Truck must be transported by ship, train or lorry of 5T loading.

When swinging the tractor:

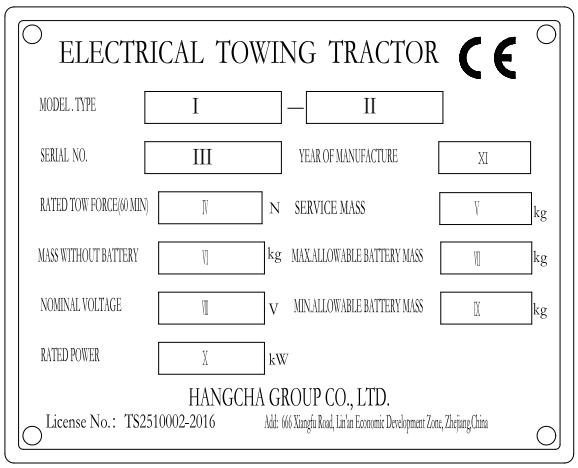
1. Pull out the pin (used for fixing the front cover plate assembly) between the two seats
2. There are two lift holes under the front cover plate assembly, open the front cover plate assembly before lifting
3. Hang the hook at the two lift holes and rear tow hook. Then lift the truck slowly using the lift device. After finishing lift, reassemble the front cover plate and install the pin.

> ⚠ **Note**:
> prevent the hook from falling off. It is not allowed to hang the hook on other place. Otherwise may cause big accident.

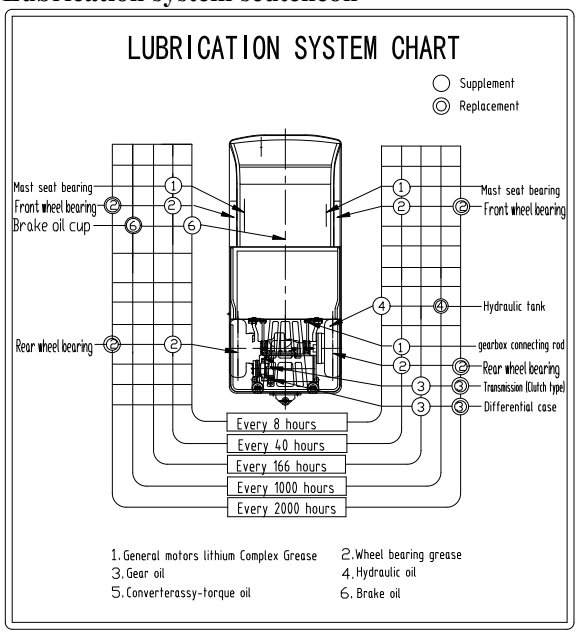


8 Scutcheon

Product nameplate



Lubrication system scutcheon

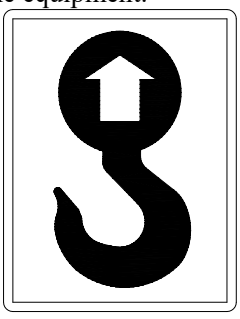


Tonnage sign

100 150

lifting label

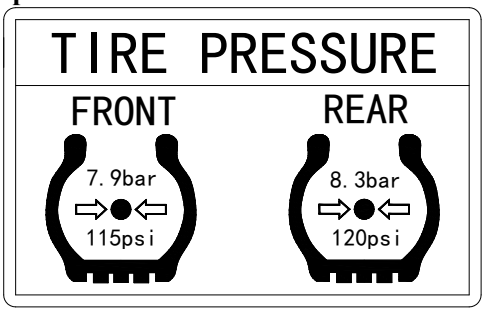
Fixed point for using the crane for the loading and unloading of the equipment.



Arrowhead

HANGCHA LOGO

Tire pressure label



9 Instruction of main parts

Electric towing tractor is front wheel steering and rear wheel drive. It is mainly composed of five parts: truck body system, drive system, steering system, control system and electrical system.

9.1 Tractor body system

The truck body system consists of frame, instrument frame assembly,container,side door and bottom plate.
The frame is welded with steel plate, the instrument frame is welded with steel plate, and is fixed on the frame with bolts. The instrument frame is equipped with display meter, key switch and etc. The controller is installed at the rear of the frame. Water washing is strictly prohibited here.
The instrument rack is equipped with high visibility digital instrument, key switch, light switch, steering rod adjusting device, etc. Traction pin are installed at the rear of the vehicle for towing trailers.

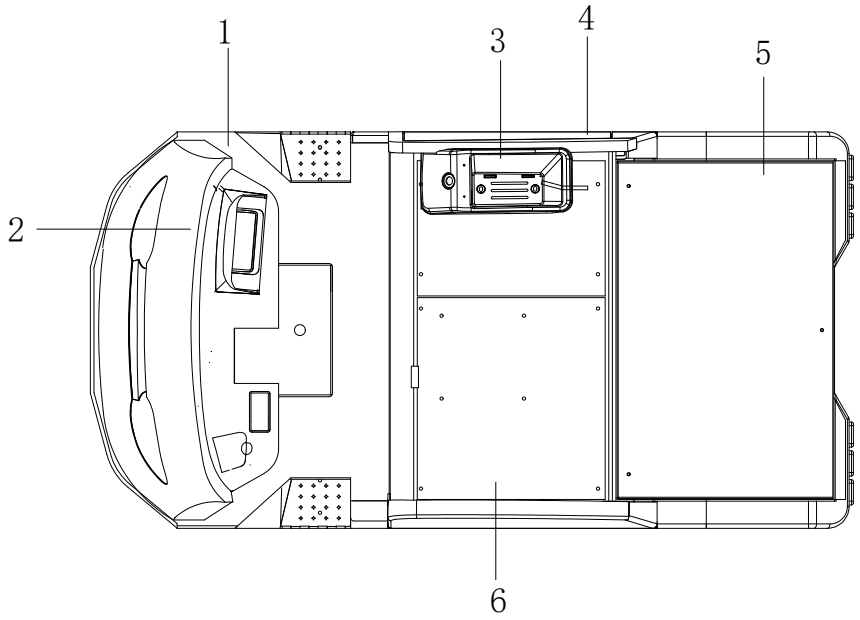


Fig 9-1

1.Frame 2. Instrument hood 3.Container 4.Door assembly 5.Aftertable 6.Seat pan

9.2 Driving system

QSD120/150/180-XC1-MI 、 QSD120/150/180-XC1-M Driving system composed of a AC traction motor, driving axle, wheels, etc. refer figure 8-2.

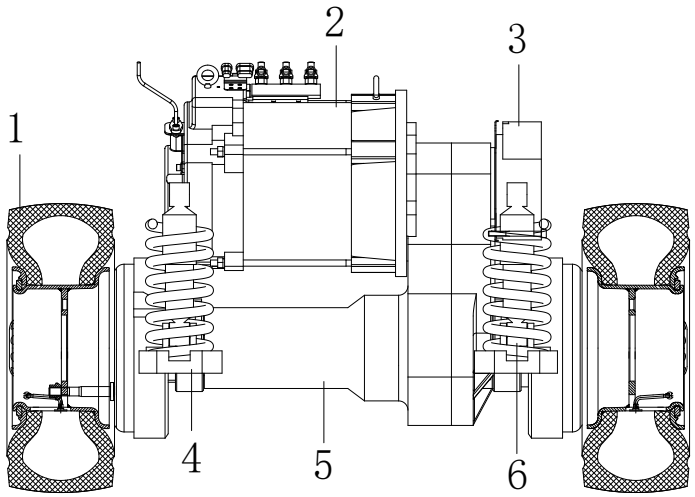


Fig 9-2

1.Tire 2. Motor 3.magnetic brake straining beam 4.rocker arm 5.Drive axle assembly 6.Absorber

QSD60/80-XD3-M、QSD60/80-XD3-MI、QSD100-XXD3-M、QSD100-XXD3-MI Driving system composed of a AC traction motor, driving axle, wheels, etc. refer figure 9-3.

.The gears and bearings in the drive axle are splash-lubricated and the lubricant grade is GL-5 85W/140.

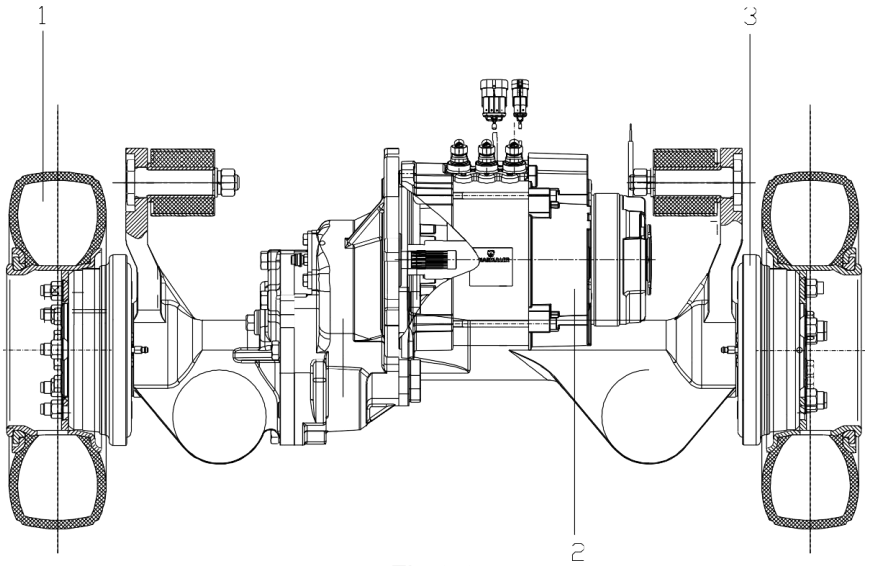
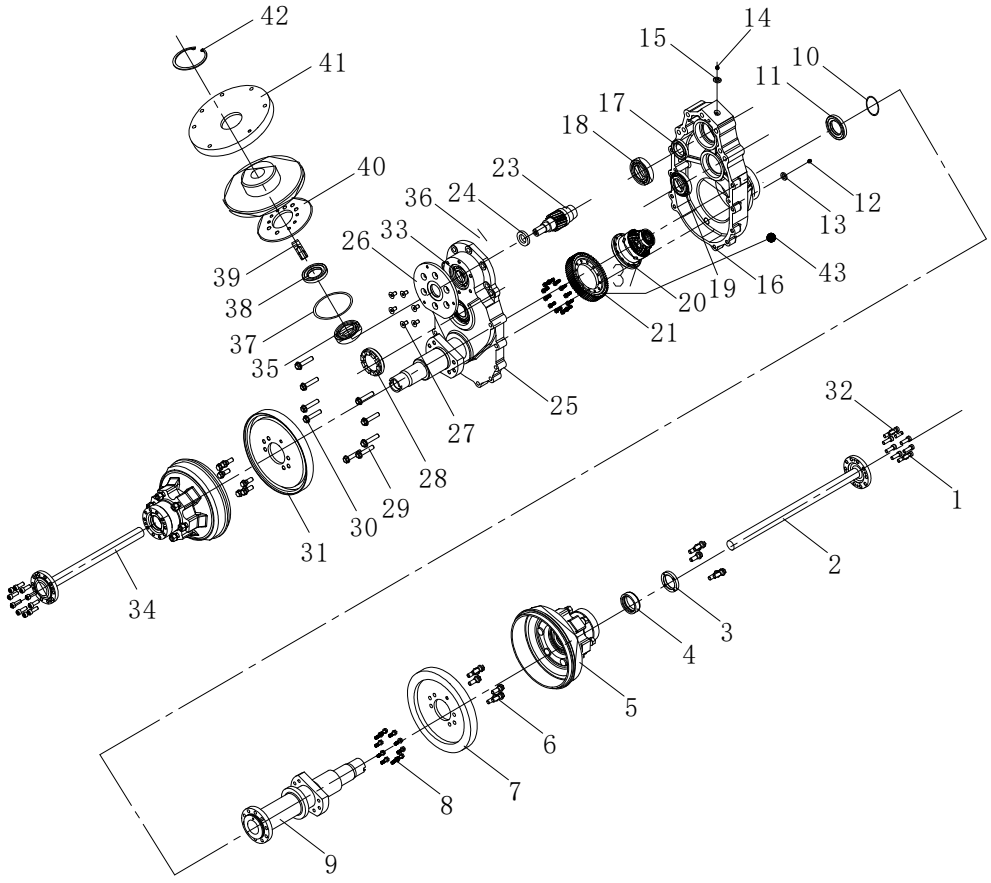


Fig 9-2

1. Wheel 2.AC motor 3. Drive axle

9.2.1 Drive axle

Drive axles of QSD120/150/180-XC1-MI and QSD120/150/180-XC1-M have the advantages of reasonable design, advanced structure, small size and light weight, and are composed of differential assembly, wheel assembly, left and right boxes, half-shafts and other components.



1.Screw	2.Half shaft,LH	3.Locking nut	4.Locking shim	5.Wheel side assy	6.Bolt	7.Brake assy,LH
8.Bolt	9.Left support shaft	10.O-ring	11.Differential lock nut	12.Plug screw	13.Compound gasket	14.Vent cap
15.Compound gasket	16.Left box body	17.Oil seal	18.Bearing	19.Bearing	20.Differential assembly	21.Speed driven wheel
22.Bolt	23.Motor gear shaft	24.Bearing	25.右 Right support box	26.Hand brake installation board	27.Screw	28.Nut
29.Bolt	30.Bolt	31.Brake assy,RH	32.Straight pin	33.Bearing	34.Half shaft,RH	35.Bearing
36.Ordinary flat key	37.O-ring	38.Oil seal	38.Column pin straight groove	40.Adjusting shim	41.Magnetic brake	42.Circlip for shaft
43.Straight pin						

Fig 9-4 Driving axle

Technical parameters

No.	Item	Parameter
1	Maximum allowable static load	1600kg
2	Maximum allowable input torque	4.25
3	Maximum allowable input speed	4.875
4	Total speed ratio	20.72
5	Maximum output torque	4169N.m
6	Foot brake specifications	254X50
7	Tire nuts	SphereSR14
8	Rim bolt distribution circle	Φ146
9	Parking brake	125N.m
10	Service brake	2x2000N.m=4000N.m
11	Service weight	About 165Kg

Use and Maintenance

1.Coupling of rim and axle

The rim nut is M14×1.5, and the tightening torque is 165N.m-195N.m. When a group of rim nuts is tightened, it must be noted that they should be tightened symmetrically and evenly. In normal use, the nuts should be checked frequently for looseness and tightened in time. When the spherical rim nut is used, it should be checked whether the nut spherical surface and the rim ball socket match, and should be indeed compacted to make the connection secure.

2.Lubrication

a.Types of lubricants GL-5 85W/90 gear oil

b.Oil injection position and volume

The oil injection screw plug in the box: the oil injection volume is about 3.5 liters.

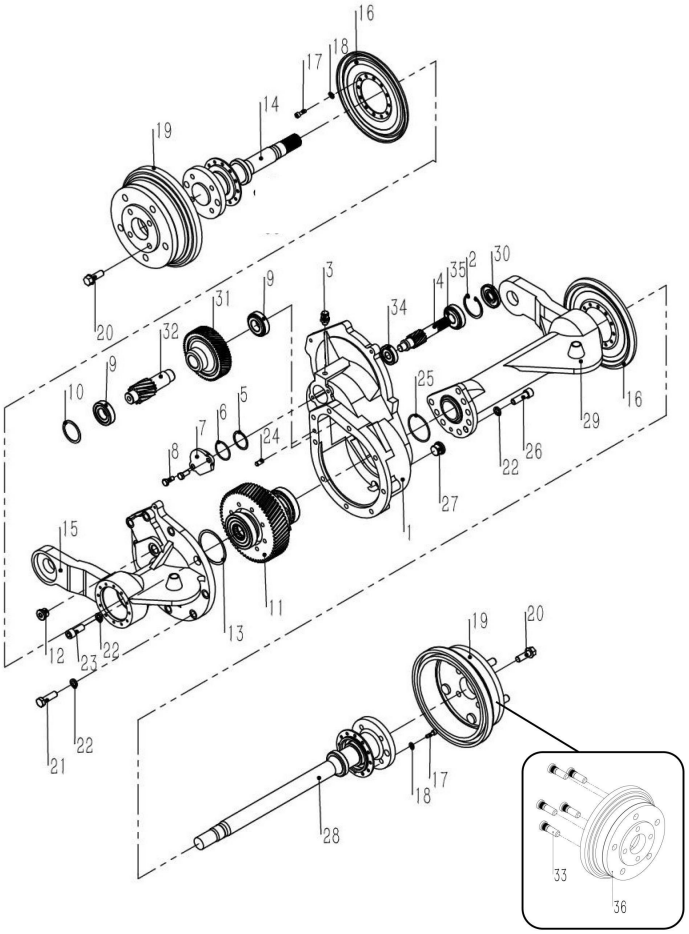
3.Use and Maintenance

a.Clean oil, mud and dust frequently, especially the ventilation plug should be kept clear. Check the fastening of all parts, focusing on the mounting block, main reducer and rim bolts, etc., and tighten them in time if there is any loosening.

b.Frequently check the leakage of each part, and repair and exclude in time.

c.The friction plate surface of the brake shall be free of foreign matters to ensure braking performance.

Drive axles of the QSD60/80-XD3-M, QSD60/80-XD3-MI, QSD100-XXD3-M and QSD100-XXD3-MI are composed of left and right half shafts, differentials, brakes, and other components.



1.Drive axle housing	2.Retaining ring	3.Vent plug	4.Gear shaft	5.Adjust the pad	6.O-ring
7.End cover	8.Bolt	9.Bearing	10.Adjust the pad	11.Differential	12.Differential
13.Adjust the pad	14.Shaft（Right）	15.Bracket（Right）	16.Brake assembly	17.Screw	18.Washer
19.Brake hub	20.Bolt	21.Bolt	22.Washer	23.Screw	24.Pin
25.O-ring	26.Screw	27.Plug	28.Shaft（Left）	29.Bracket（Left）	30.Oil seal
31.Driven gear	32.Gear shaft	33.Bolt	34.Bearing	35.Bearing	36.Wheel hub

Fig 9-5 Driving axle

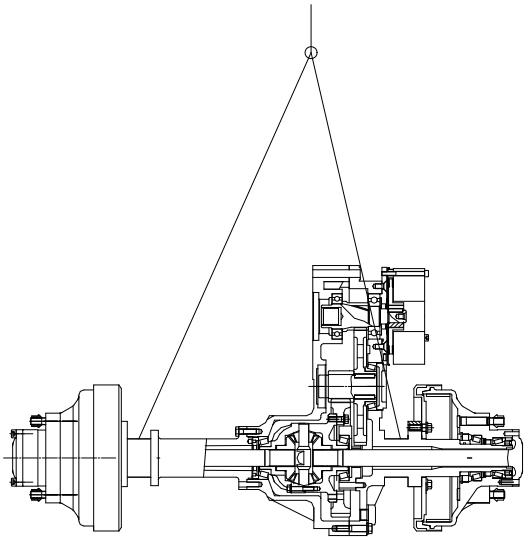
Technical parameters

No.	Item	Parameter
1	Maximum allowable static load	1450kg
2	Maximum allowable input torque	65N.m
3	Maximum allowable input speed	5000rpm
4	Total speed ratio	22.159:1
5	Maximum output torque	1420N.m
6	Service weight	About 76Kg

Fault diagnoses and correction

Condition	Probable cause	Corrective action
Unusual noise	·Loose axle mounting bracket bolts.	Tighten.
	·Loose wheel nuts.	Tighten.
	·Worn or damaged wheel bearing.	Replace.
	·Wheel bearing not properly adjusted	Adjust.
	·Worn sun gear (drive shaft) splines.	Replace.
	·Insufficient lubrication.	Lubricate
Unstable driving.	·Loose wheel nut.	Tighten.
	·Deformed road wheel.	Replace.
	·Worn or damaged wheel bearing.	Replace.
	·Loose axle mounting bracket bolts.	Tighten.
	·Wheel bearing not properly adjusted.	Adjust.
	·Improper tire pressure.	Adjust.
Oil leakage	·Worn or damaged axle tube oil seal.	Replace.
	·Final drive improperly installed.	Replace gasket.
	·Loose filler or drain plug.	Tighten.

Driving axle lifting diagram

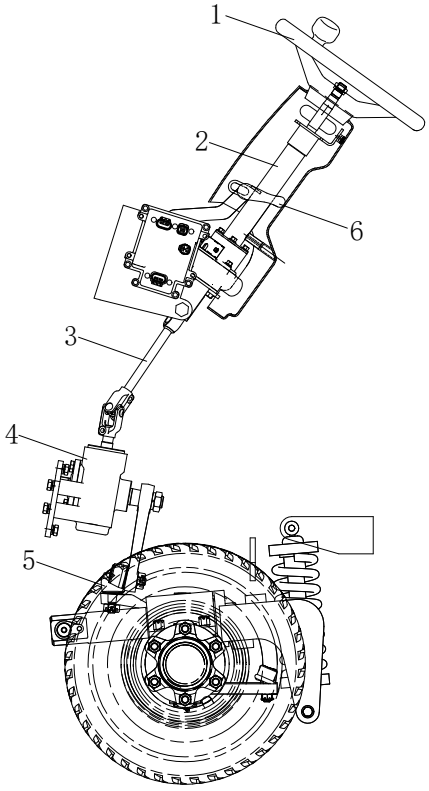


9.3 Steering system

Steering system includes steering device, steering pump, steering axle, and front tires .etc.

9.3.1 Steering device

It consists of steering wheel, upper steering column assembly, universal joint, lower end shaft assembly, bearing, shaft retaining ring, lower end steering tube, steering gear, clamping adjustment device, etc.; the steering wheel tilt angle can be adjusted front and back as needed. See figure 9-6.



1.Steering wheel 2.Steering shaft 3.Joint
4.Steering device 5.Tie rod 6.Clamping regulating device

Fig 9-6 Steering device

9.3.2 Steering axle

General specifications

Axle body type	Center support, swing type	
Turning angle	Inner wheel	37.5°
	Outer wheel	50°
Tyre pressure	1.0MPa	

Trouble diagnoses corrections

condition	Probable cause	Corrective action
Unstable driving	loose wheel nut	tighten
	wheel bearing out of adjustment.	adjust
	faulty steering system.	refer to turning system section
Noises	insufficient lubrication.	Apply calcium grease
	loose bolts and nut.	tighten
	damaged joint bearing at two ends of rod.	replace

9.3.3 Steering axle

Steering axle is welded with high-strength material. Left and right steering knuckle is connected by king pin of steering knuckle and steering axle. There is bearing used between steering knuckle and axle. The steering axle is fixed by bolts and steel plate, when the tractor runs on the rough road, the elastic deformation of the left and right leaf springs ensure that the two steering wheels can contact the ground at the same time, so that the force is uniform. The steering wheel steering angle is achieved through the diverter.

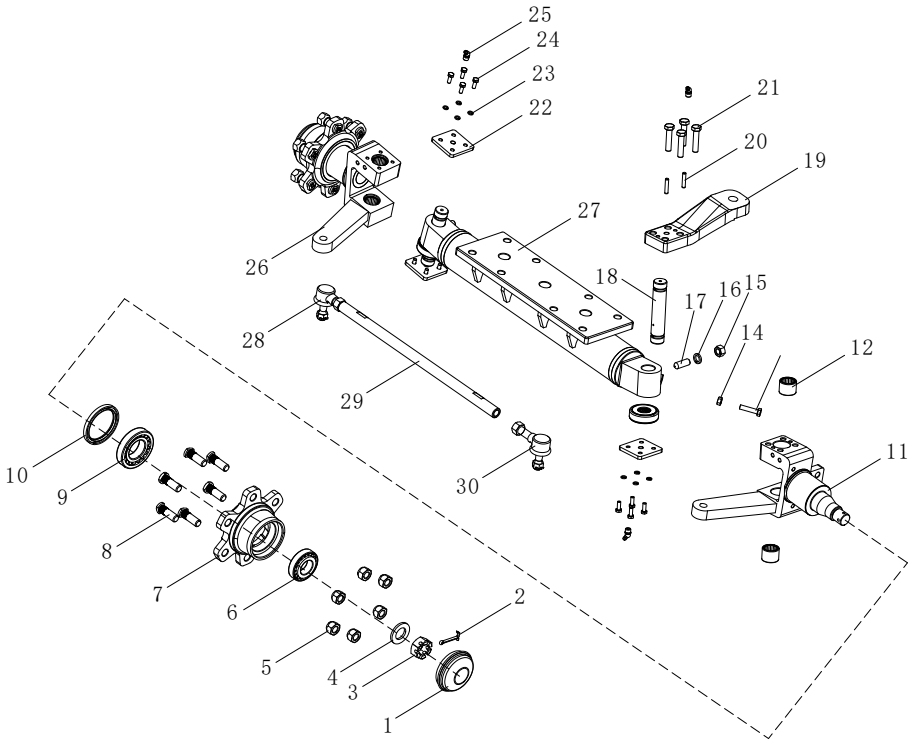


Fig 9-7

1.Wheel hub cover	2.Pin	3.Nut	4.Washer	5.Wheel nut	6.Bearing
7.Steering wheel hub	8.Wheel hub bolt	9.Bearing	10.Seal ring	11.Steering section (left)	12.Bearing
13.Bolt	14.Nut	15.Nut	16.pring washer	17.Screw	18.Main pin
19.Steering arm	20.Straight pin	21.Bolt	22.Main pin seat cover	23.Spring washer	24.Bolt
25.Oil cup	26.Steering section (Right))	27.Steering axle body	28.Cross ball head assembly	29.Tie rod	30.Cross ball head assembly

Remove

Wheel hub

1) Jack up and support forklift truck body with wooden blocks.
2) Remove tire.
3) Remove hubcap.
4) Remove steering spindle nut.
5) Pull off hub assembles.
6) Remove bearing inner race.

Caution：a. Not to drop bearing inner race.

b. Be careful not to damage oil seal.

Kingpin and steering spindle

（1）Remove rod.

（2）Loose lock bolts.（See fig.8-8）；

（3）Remove grease nipples on kingpin.

（4）Remove kingpin.

Caution：Hold kingpin to prevent it from dropping. (See fig.8-9).

（5）Take off spindle, thrust bearing and shim.

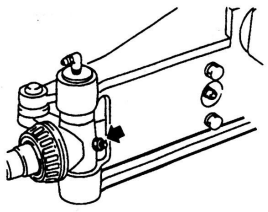


Fig 9-8

INSPECTION：

（1）Replace spindle if cracked.

（2）Replace bearing if its rollers or roller surfaces are rusted or nicked.

（3）Replace steel sleeve if it distortion, out of round, cracked.

（4）Replace thrust bearing and dust cap if them damaged.

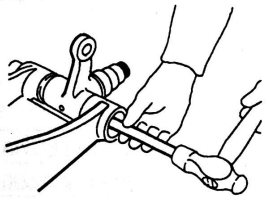


Fig 9-9

Installation

The installation sequence is the reverse of removal, but it should be noted:

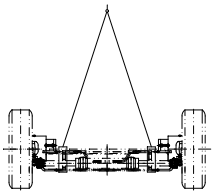
（1）Insert knuckle king pin from the bottom to up;

（2）Install thrust ball bearing with straining ring below, retainer and loose ring above. Apply lubricating grease to the inner wall, loose ring and straining ring of dustproof shell;

（3）Sealing ring with characters faces outward. Apply lubrication grease to roller bearing roller and retainer, and apply grease to the sealing rubber ring lip surface and the concave bag;

（4）Fill enough lubricating grease to all nozzles.

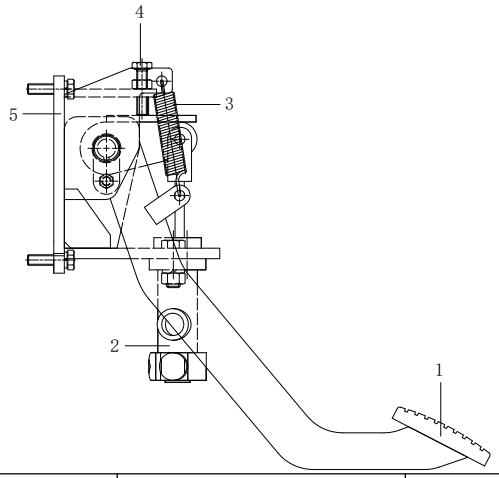
Steering axle lifting:



9.4 Brake system

Brake system includes service brake and parking brake, the two brake devices share one automatic power shoe brake that works on the rear wheel.

9.4..1 Service braking system



1. Brake pedal	2. Brake pump	3. Spring
4. Bolt	5. Support assembly	

Fig. 9-10 Brake pedal assembly

Brake pedal free travel adjustment：

- Adjust limit bolt, get the pedal and front baseboard distance 140±5 mm, and tighten lock nut;
- Adjust push rod length, get the pedal idle running 1mm～3mm, and lock push rod adjusting nut;

When step the brake pedal 10mm～20 mm, brake light switch is on, and release the foot to this situation, the brake light switch is off.

9.4.2 Brake master cylinder

The brake system is rear two-wheel braking type consisting of foot brake, foot brake is composed of a master cylinder, brakes and brake pedal.

Master cylinder contains a valve seat, check valve, return spring, cup piston and secondary cup, which are kept in place with stop washer and stop wire. The exterior of the cylinder is protected from dust by means of a rubber dust cover. The piston is actuated through the push rod by operation of the brake pedal. First, as the brake pedal, the push rod pushes the piston forwards. The brake fluid in the cylinder flows back to the reserve tank through the return port until the primary cup blocks up the return port. After the primary cup passes the return port, the brake fluid in the cylinder is pressurized and opens the check valve, flowing through the brake lines to the wheel cylinder. Thus, each wheel cylinder piston is forced outwards. This brings the brake shoes into contact with the wheel drum and slows or stops the tractor. Meanwhile, the cavity caused behind the piston is filled with brake fluid led through the return port and inlet port to lubricate the piston. When the brake pedal is released, the piston is forced back by the return spring. At the same time, the brake fluid in each wheel cylinder is pressurized by the force of the brake shoe return spring, thus returning into the master through the check valve. With the piston in its original position, the fluid in the cylinder flows into the reserve tank through the return port. The brake fluid in the brake lines and wheel cylinders has a residual pressure proportioned to the set pressure of the check valve, which makes each wheel cylinder piston cup securely seated to prevent oil leakage and eliminates of vapor lock developing when the lift truck is sharply braked.

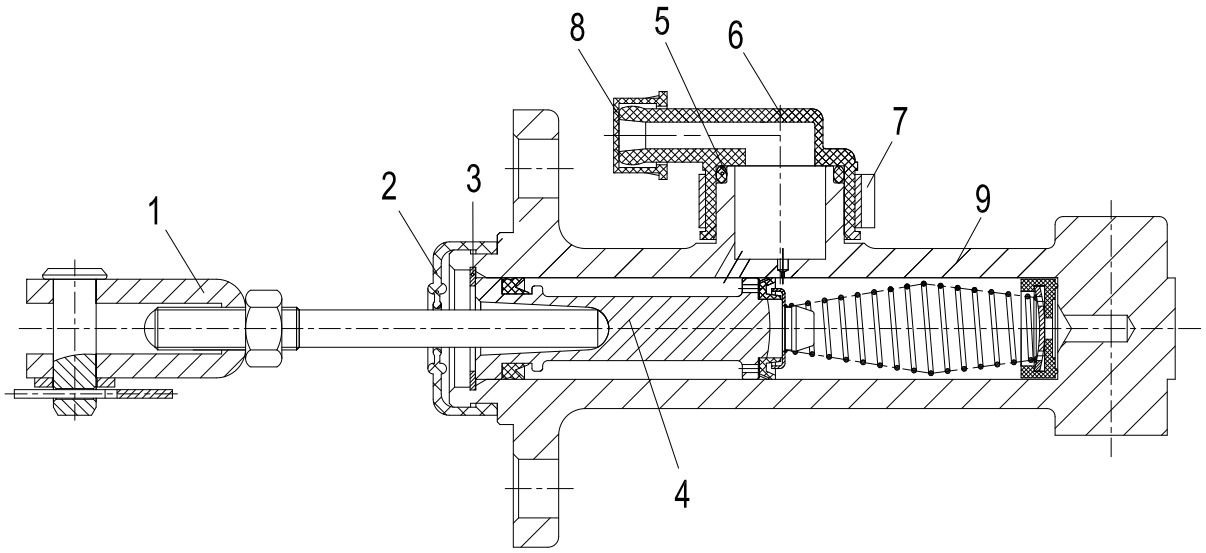


Fig. 9-11 Brake master cylinder schematic diagram

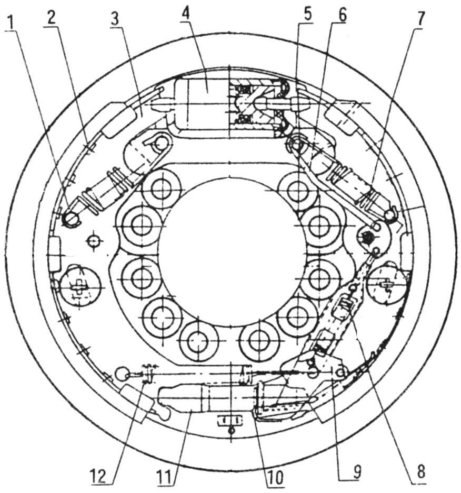
1.Push rod	2.Shield	3.Snap ring	4.Plunger	5.O-ring	6.Inlet oil connector pipe
7.Spring	8.Dust plugs	9.Pump body			

9.4.3 Foot brake

The shoe brake is the internal expansion hydraulic type consisting of brake shoes, spring, wheel cylinder, and adjuster and backing plates. According to sign on brake (left, right) to connect brake and drive axle body, air release bolt is on top, and must clean the oil pipe before connecting it.

When brake shoes do not work and are on initial position, the friction plate and brake drum should have proper clearance, the clearance of this tractor is 0.25-0.4mm. Please adjust clearance after friction plate wear and tear. The adjuster of driving wheel brake consists of upper pull rod, rocker arm, lower pull rod and pawl. When the clearance between brake shoes plate and brake drum increases, the brake function is weak, could drive back the tractor, and then press down brake pedal, press 2-3 times intermittently, the tractor brake is automatically adjusted.

If the friction plate wears seriously (distance between bolt head and friction plate surface is less than 0.5mm). Please replace, and must replace in pairs.



1.brake return spring 2.Brake shoes assemble

3.Brake plate 4.Brake cylinder 5.Pin

6.Upper pull rod 7.brake return spring

8.spring 9.pawl 10.blockage

11.Adjuster assembly 12.spring

9.4.5 Brake system common fault diagnosis and corrections

Fault	Probable cause	Corrective action
When braking, it cannot slow down immediately or brake	①Air in the hydraulic system ② Master cylinder oil supply hole or air hole blockage ③Oil pipe joint loosen or oil pipe rupture to leak oil. ④Cylinder cup aging or damage. ⑤Total run-out of brake drum cylinder to bearing hole centerline is too large. ⑥Bad friction plate and brake drum contact. ⑦Friction plate surface hardening and have oil dirt on it. ⑧ Brake shoe friction plate wear, and brake clearance is large.	①Exhaust air ②Check and repair ③ Tighten pipe joint and replace oil pipe ④Replace cup ⑤Hone or replace brake drum ⑥Close friction plate and brake drum contact surface, reach over 50%, and two end line contact. ⑦ Get rid of oil dirt and replace friction plate. ⑧ Replace friction plate and adjust brake clearance
Brake deviation	① Inconsistent clearance between left/right brake drum and friction plate. ②Inconsistent left and right friction plate material or oil dirt on the friction plate. ③Air in the cylinder, oil pipe joint leaks or blocks. ④ Some wheel friction plates bad contact with brake drum. ⑤ Some wheel brake drums wear and not round.	①Adjust brake clearance ② Replace friction plate or clean oil dirt ③Exhaust air and repair pipeline ④Close friction plate and brake drum contact surface, reach over 50%, and two end line contact. ⑤Hone or replace brake drum
Brake dragging	①No free travel of brake pedal ②Weak or broken brake shoe return springs. ③ Small clearance between brake shoe and brake drum. ④ Cylinder cup aging or damage. ⑤Blockage of brake master cylinder return hole or oil line. ⑥Wheel bearing improper adjustment or damage	①Adjust pedal free travel ②Replace return spring ③Adjust the clearance between brake shoe and brake drum ④ Replace cup ⑤Clean and dredge return hole or oil line. ⑥Adjust or replace bearing,
Brake noise	①Lining surface harden or foreign matters on it ②Warped back plates or loosed blots ③Brake shoes warped or improper install ④Worn friction plate. ⑤Loose or worn wheel bearing loose or wear	①Replace or clean the friction plate. ② Replace baseboard and tighten the bolt ③Reinstall or replace brake shoe ④Replace friction plate ⑤Adjust or replace bearing

9.4.6 Hydraulic brake malfunction diagnosis

In the parking status, step the brake pedal, generate pressure in brake system, continue stress force, if pedal gradually drops, it indicates leakage in hydraulic system, check leakage and oil spots, then you can find out detailed fault position, tighten, repair or replace.

Step the brake pedal, if it can be stepped to the end, it means insufficient brake fluid, overlarge brake clearance, overlarge pedal free travel or air in the system. Check the reason further and eliminate it.

If continually step the pedal, its working stroke decreases, that is the pedal height gradually increases. Otherwise the master pump oil hole blocks and makes the oil in the pump cannot be increased.

9.4.7 Exhaust of air in the hydraulic system

Park the truck on flat and solid road surface, shut down the truck and block the wheels. One person continually step the brake pedal and generate enough pressure; another person under the truck, releases bleed screw, exhausts air, and then screws the bleed screw. After repeat this action several times until fully exhausts the air. After that, add enough brake fluid in time.

9.5 Electrical system

The electrical system of the truck is a double-wire system, and all circuits are not grounded. The working voltage of control circuit and main circuit is 80V for 12t-18t vehicles. The working voltage of control circuit and main circuit is 48V for 6t-small 10t vehicles. The working voltage of the signal and lighting circuits is 24V.

The electrical system includes batteries, motors, controllers, accelerator, instrument, headlights, turn signals, width lights, brake lights, horn, backup buzzer and other equipment

9.5.1 Lithium Battery

1 Safety warning

1.1 Electrodes short circuit is prohibited, do not heat the battery, or throw the battery into water;
1.2 Fully charge the new battery before use;
1.3 Do not mix different brands, different types, different capacities, and old and new batteries;
1.4 The battery combination should not be used in the case of inconsistent capacity saturation of each single cell to avoid overcharge and over discharge of the cell;
1.5 Battery charging method should use professionally configured charging equipment, do not use charging equipment at will;
1.6If the battery occurs odour, heating, discoloration, deformation or any abnormal phenomenon during use, storage or recharging, immediately remove it from the equipment or charger and stop using it. Please immediately contact our technician department or after-sales department;

2 The following operations are strictly prohibited

2.1 Do not put the battery near heat source, dangerous goods and hazardous material, such as fire, heater, corrosive chemical or hazardous machinery; store the batteries in cool, dry and well ventilated places if not used;
2.2 Do not immerse the battery in water or any other liquids, which may cause personnel injury or property loss;
2.3 Electrodes short circuit is prohibited. Avoid any metal or other conductive objects touching the positive and negative terminals of the battery. This operation may result in personal injury or property damage;
2.4 It is forbidden to transport or store batteries together with metals such as tools, cables, etc.
2.5Do not hammer, throw or step on the battery;
2.6 Do not connect the battery with the battery of other type in series or in parallel; this operation may result in personal injury or property damage;
2.7 Do not operate the whole power system with lithium ion battery protection circuit board or battery management system in series or in parallel; This operation may result in personal injury or property damage. If needed, contact our technical department for correct technical support;
2.8 Do not let children or other person lacking of safety knowledge have access to the equipment. This operation may result in personal injury or property damage;
2.9Do not disassemble, squeeze, puncture, storage at elevated temperature or bake the batteries. Violent vibration, impact and falls from heights should also be avoided. This operation may lead to

security risks;
2.10 Do not operate the equipment in a location where static electricity and magnetic field is strong. Or it may damage safety protection device, and lead to potential safety hazard;
2.11 Do not recharge without proper protection device(lithium ion battery circuit board protection, BMS etc.) or with improper charging device (charger or DC power). This operation may result in personal injury or property damage.

3 Basic terms and environmental conditions for lithium ion battery

3.1 Basic terms and definitions

3.1.1 Nominal voltage
A suitable approximate value used to indicate the battery voltage;
3.1.2 Rated capacity
The capacity value specified by the manufacturer when the battery is fully charged under specified conditions;
3.1.3 Actual capacity
The capacity actually discharged when a fully charged single cell is discharged at a specified current under specified conditions:
3.1.4 Overdischarge
The state when the battery voltage is lower than the discharge cutoff voltage is generally regarded as the state in which the battery enters the overdischarge state, which generally refers to the state when the battery voltage reaches 0 V or even the voltage is negative;
3.1.5 Maximum charging voltage
The charging voltage recommended by the manufacturer that should not be exceeded during charging;
3. 1.6 Overcharge
The state when the battery voltage is higher than the maximum charging voltage is usually regarded as the battery entering the overcharge state;
3.1.7 Overcurrent
The battery's operation and charging current are higher than the maximum allowable operation of the manufacturer, and the state of charging current is usually considered as the battery entering the overcurrent state;
3.1.8 Normal temperature charge retention and capacity recovery capability
The battery is discharged at 0.3C after 28 days storage at 20℃±5℃. The ratio of discharge capacity to rated capacity is called normal temperature charge retention capability;
Then charged at 0.3C at 20℃±5℃,and then discharged to the termination voltage. The ratio of discharge capacity to rated capacity is called capacity recovery capability.
3.1.9Charge termination current
The current at which the battery terminates charging during a specified constant voltage charge;
3. 1. 10 State of charge
The amount of electricity stored in the battery is generally expressed as a percentage. For example, 30% SOC means that the battery currently stores 30% of the nominal capacity. SOC is the abbreviation of State Of Charge, and the battery (group) is charged state;
3.1.11Explosion
The battery casing is broken, and solid matter inside is flushed out of the battery and makes a sound;

3.1.12 Fire

Open fire appears in the battery case;

3.1.13 Leakage

The internal components of the battery (electrolyte or other substances) leak out of the reservoir;

3.1.14 Battery Management System (BMS)

An Electronic and electrical system monitors battery voltage, current, and temperature and communicates with other systems such as chargers, loads, thermal management systems, etc. through a series of control actions to optimize battery performance.BMS is the abbreviation of Battery Manager System.

3. 1.15 CAN communication：Control Area Network；

3.1.16 Charging mode CC/CV: CC mode is constant current charging mode, and CV mode is constant voltage charging mode.

3.2 Basic environment in use

3. 2.1 Charging temperature: 0℃~45℃; Discharge temperature: -20℃~50℃; the best use temperature is 15℃～35℃;

3.2.2 When the ambient humidity HR is less than 85%, the battery should be kept as dry as possible;

3.2.3 When charging the battery, try not to fully charge or discharge, thus increase the battery life.

4 Cautions for use and maintenance of lithium ion battery

4. 1 Basic requirements for battery use

4.1.2 Under any circumstances, when testing or using the battery, the terminal voltage of the single battery must be tested in real time. It is strictly forbidden to test the battery pack in series without a management system or a protection board to avoid overcharging or overdischarging of the battery;

4.1.3 The new battery is generally only 50% charged. Please do not use it for a long time before the BMS and charger are commissioned, so as to avoid the truck being stopped due to insufficient battery power during use;

4.1.4 Battery management system: In order to ensure the safe and effective use of the battery and maximize the service life of the battery, the lithium battery product should be equipped with a dedicated power lithium battery management system (BMS) and a dedicated lithium battery charger, when a small number of small capacity batteries are used in series and in groups, you can also use a reliable lithium battery protection board. The Battery Management System (BMS) is as follows:

BMS parameter configuration	Overcharge protection voltage	3.75V
	Maximum charging current	200A
	Overcharge release voltage	3.67 V
	Undervoltage release voltage	2.8 V
	Undervoltage protection voltage	2.7 V
	Over-discharge protection voltage	2.2 V
	Over temperature protection temperature	60℃
	Over discharge release voltage	2.6 V

4. 1.5 In the process of using the battery, it is strongly recommended to adhere to the principle of shallow charge and discharge. The best performance is between 30% and 100% of the power.When the open-circuit voltage of single batteries drops to 3.0V, the actual charge is less than 10%. At this time, the battery pack should be charged in time;

4.1.6 When testing or using the vehicle, always pay attention to the remaining battery capacity of the battery pack, and avoid using the trailer to transport the vehicle for charging when the power is exhausted. In the process of trailer, auxiliary systems such as DC/DC (power supply for lighting, wipers, etc.), steering power, brake power, etc. are still consuming power. Trailer for a long distance will also lead to battery overdischarge;

4.1.7 The high-voltage safety protection work of the battery pack must be well done.The drive main circuit and the low-voltage electrical circuit (including the vehicle body) must be properly isolated, and the reliable DC air circuit breaker and fast DC fuse should be selected;

4.1.8 It is strictly forbidden to separately draw power from the individual batteries in the battery pack to supply power to the low-voltage electrical equipment of the vehicle, so as to avoid the destruction of the consistency of the entire battery.

4.2 Basic requirements for lithium ion battery installation

4.2.1 The battery pack should be installed in the correct orientation. Do not reverse or reverse the installation.

4.2.2 Do not violently disassemble, and avoid personal and property losses.

4.3 Basic requirements for lithium ion battery connection

4.3.1During the battery connection operation, be sure to pay attention to the correct port insertion;

4.3.2 Be careful during battery connection, avoid that the whole battery is reversed and shorted.

4.4 Basic requirements for storage and maintenance of lithium ion battery

The battery pack is stored in an incompletely charged state, typically around 40%. Product storage environment requirements are as follows:

4.4.1 Storage temperature: storage time <3 months, then stored at -40 ° C ~ 60 ° C, 40% SOC; storage time > 3 months, then stored at 0 ° C ~ 25 ° C, 40% SOC;

4.4.2 Storage humidity: 2% RH ~ 90% RH. Storage within 85% RH is recommended.

4.4.3 Storage environment: The product should be stored in a clean, ventilated and cool environment, and avoid direct sunlight, high temperature, corrosive gas, severe vibration, mechanical shock and heavy pressure; away from heat source; altitude is less than 1500 meters, atmospheric pressure is 86kPa~ 106kPa.

4.5 Basic requirements for lithium ion battery transportation

4.5.1 During the transportation of the battery, it is necessary to avoid exposure to sunlight for a long time and rain;

4.5.2During the loading and unloading process, the battery should be handled gently to prevent falling, rolling, and heavy pressure;

4.5.3 During the process of transportation and use, the battery should be protected from strong impact and excessive extrusion, so as to avoid battery case or internal structural damage;

4.5.4 During the process of transportation and use, the battery should take necessary protection against the positive and negative electrodes of the battery to avoid short circuit and fire.

4.6 Preparation for lithium ion battery installation operation

4.6.1 Please read the instructions such as the battery instruction manual, battery installation operation and maintenance manual provided by our company;
4.6.2 Strict insulation treatment must be performed on tools such as socket wrenches, fixed wrenches, and screwdrivers used for installation operations;
4.6.3 Wear anti-smashing shoes and insulated gloves when installing. Do not wear watches, metal bracelets, necklaces, etc.

4.7 Daily maintenance

1） There should be professionals when charging, make sure the plug and socket is well contacted, charging facility work normally, and each battery connections are well contacted. If abnormal, only charge after being repaired;
2） Check the vehicle dashboard before charging and discharging to ensure that all values are within the normal range;
3） When charging and discharging, avoid water or other conductive objects splash to the battery connector, for example, use when exposed to heavy rain. Before using the product, please read the product specification, instruction manual and use attentions to understand the use method and application range of the product. In the event of incorrect product use, incorrect connection of the circuit or the input power, load function and other parameters that do not conform to the performance parameters marked in the product specification are improper use. The company does not assume any responsibility for damage to products, loads and peripheral connections caused by improper use.

Cautions:

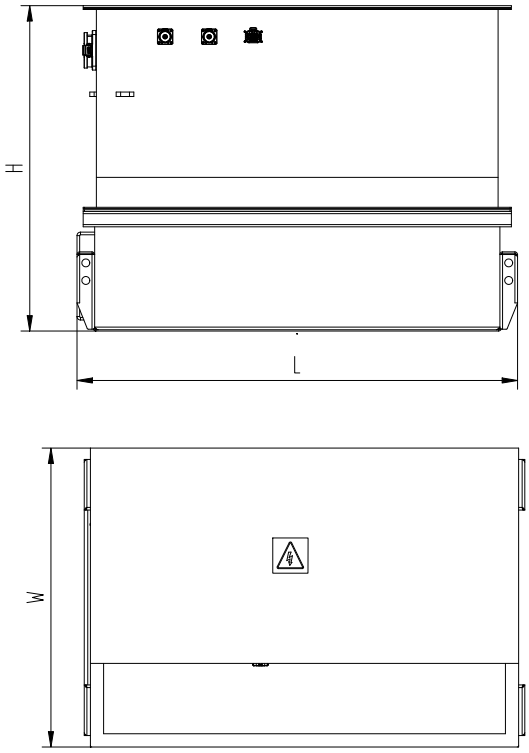
1. Charge the lithium battery immediately after per discharge to avoid battery loss;
2. Never place the battery near high temperature heat source, such as fire and heater etc.
3. Do not use the battery in a location where static electricity and magnetic field is great, otherwise the safety devices may be damaged, causing hidden trouble of safety;
4. Avoid using the battery under high temperature (direct sunlight) for a long time, otherwise, it may cause overheat of the battery or function invalid or service life being shortened;
5. Do not operate an electric vehicle equipped with a lithium battery in an environment where the temperature exceeds 55 °C; if the power battery system is below -25 °C, the power battery system needs to be self-heated to -10 °C to operate the vehicle.
6. Do not dismantle the battery box under any circumstance;
7. Never drop or knock the battery box etc.;
8. Short circuit of the battery is prohibited, never put any other object or tool to avoid battery short circuit;
9. Never wash battery box directly, prevent water getting into the battery and ensure the safety; it's forbidden to mix batteries of different brands, volumes and types;
10. Battery should be kept in a cool and dry place and avoid direct sunlight;

Maintenance instruction:

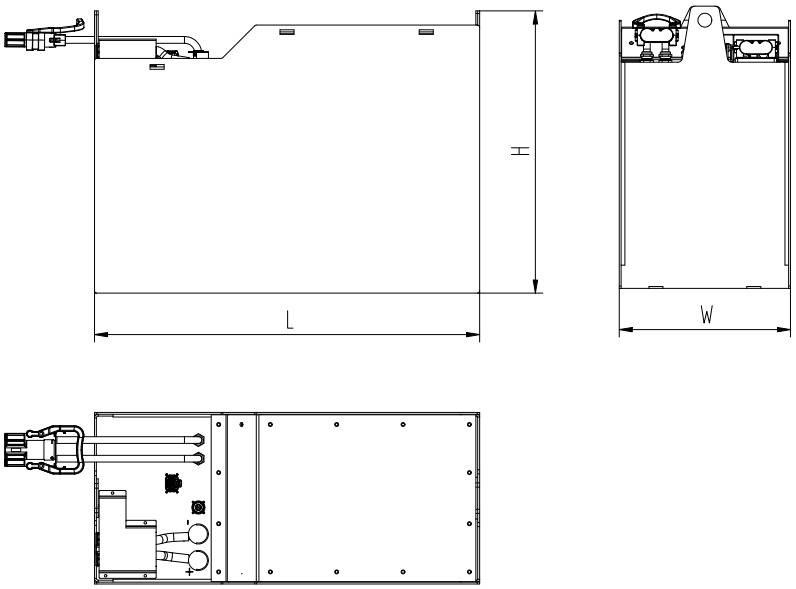
1. Do not change the battery setting parameter at will without the permission of the manufacturer;
2. If the lithium battery needs to interrupt or suspend charging, do not hot plug, avoid current arc to damage charging base;
3. Charging time below 0 °C will be longer than normal temperature charging time;
4. If the lithium battery is not used for a long time, it is necessary to charge and discharge the battery once a month.

5 Size and weight

Item	Long（L） (mm)	Width（W） (mm)	High（H） (mm)	Allow the lightest (kg)
QSD120-XC1-MI	1020	680	740	450
QSD150-XC1-MI	1020	680	740	450
QSD180-XC1-MI	1020	680	740	450



Item	Long（L） (mm)	Width（W） (mm)	High（H） (mm)	Allow the lightest (kg)
QSD60-XD3-MI **QSD80-XD3-MI**	830	369	599	195
QSD100-XXD3-MI	830	369	599	236



Warning

Weight and dimension of the battery has a great influence on the stability and bearing capacity of the truck travelling.

When installing or replacing battery, pay attention to the fixing position of the battery on the truck.

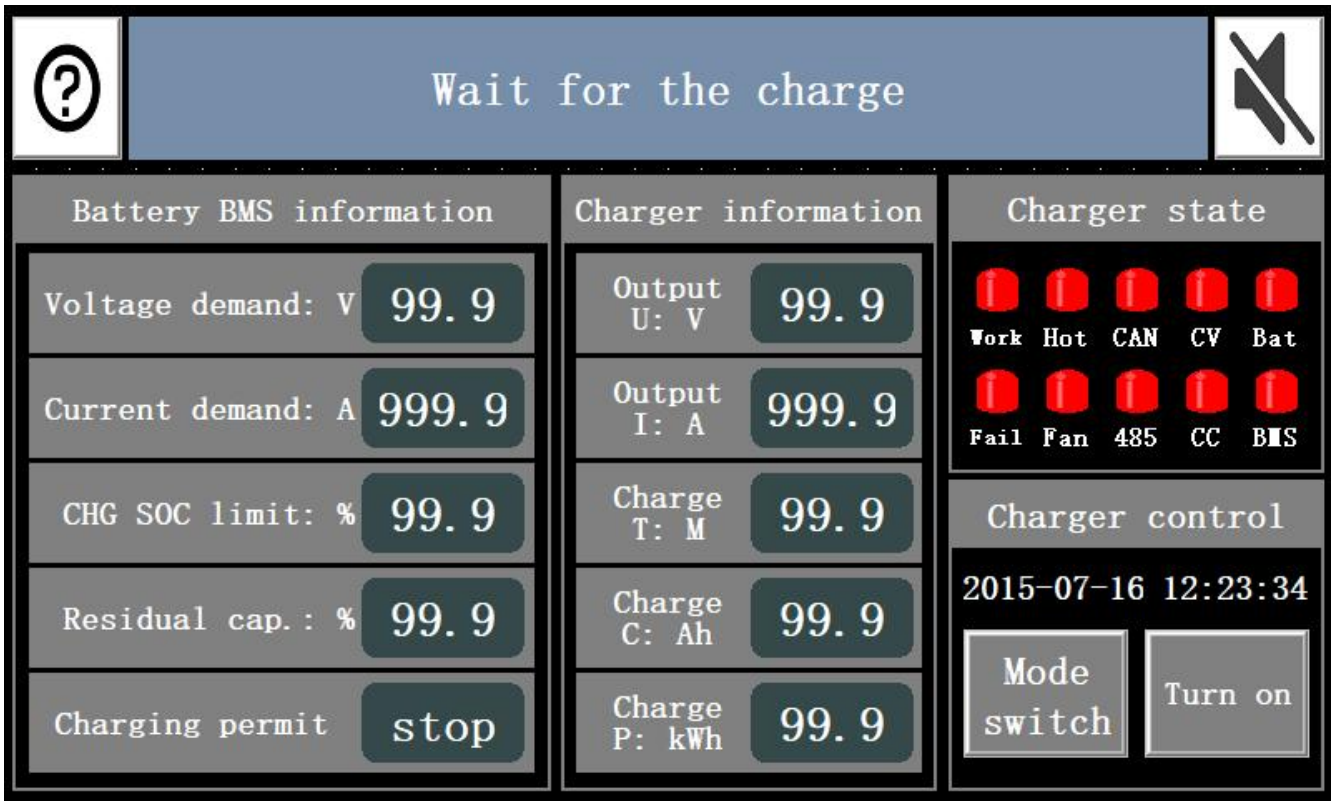
6 Lithium battery charging

The standard charger model of 6~8t model is SLC-48100 Titan intelligent charger; The standard charger model of X10t model is SLC-48200 Titan intelligent charger;The standard charger model of 15~18t model is SLC-80200 Titan intelligent charger;

Touch screen display interface

Start-up interface

Main interface

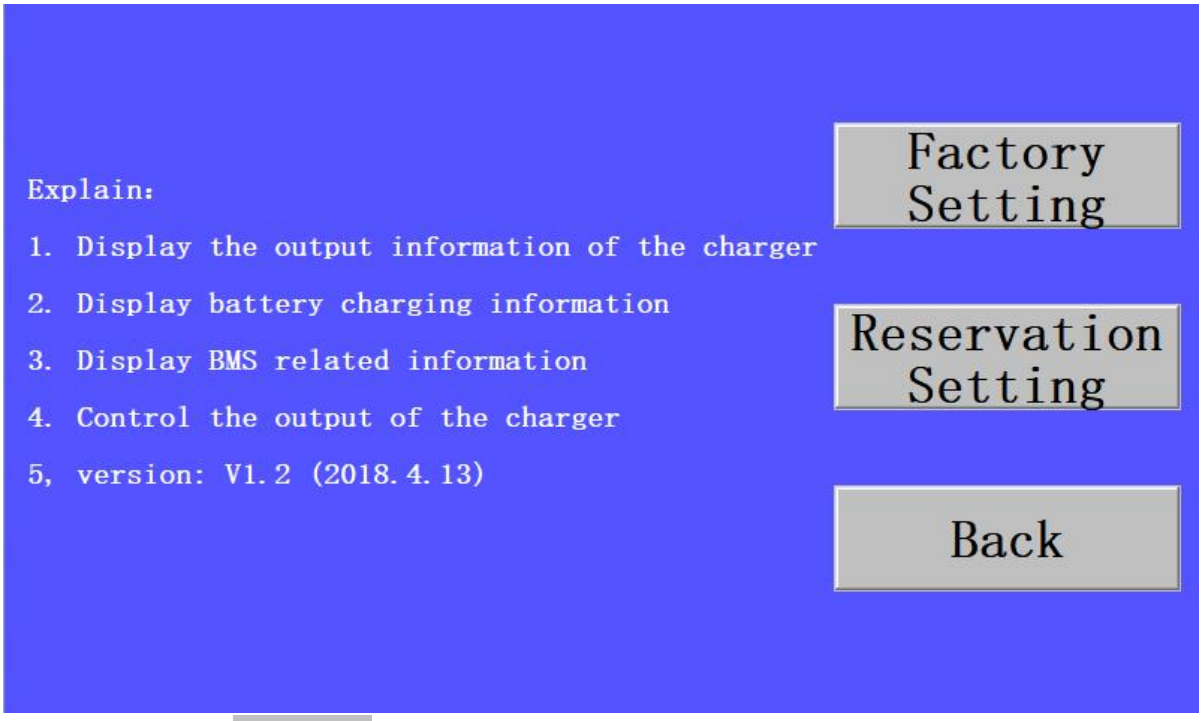


Click on the icon：, Enter the help description interface.

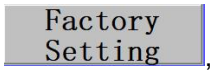
Click on the icon：or, on-off alarm sound, to turn on the alarm sound state, to turn off the alarm sound state.

The control operation requires password permission. **The default password is: 123456**.
Click on the boot icon: toggle charging control to turn on or off.
Click on the purple part of the charging status information bar, enter into the single charging module information display bar.
Click on the battery BMS battery bar to enter the detailed BMS information display bar.
Click on the mode switch, you can perform the normal mode booking mode switch.

Help interface.

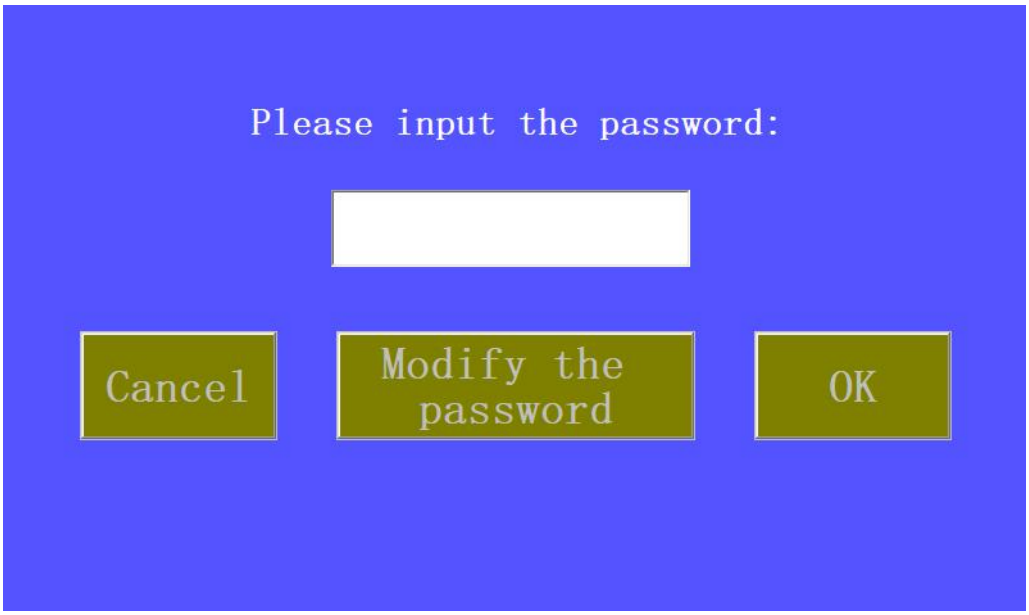


Click on the icon： 

, return to main interface.
Click on the reservation icon to set the time for booking mode. **The default password is 123456.**
Click on the icon： 

, enter the password input interface, enter the correct password into the factory parameter setting interface .

Password entry interface (similar to operation password input interface)



Enter the correct password in the password entry box. **The default password is 888888.**

Click on the icon： 

, return to help description interface.

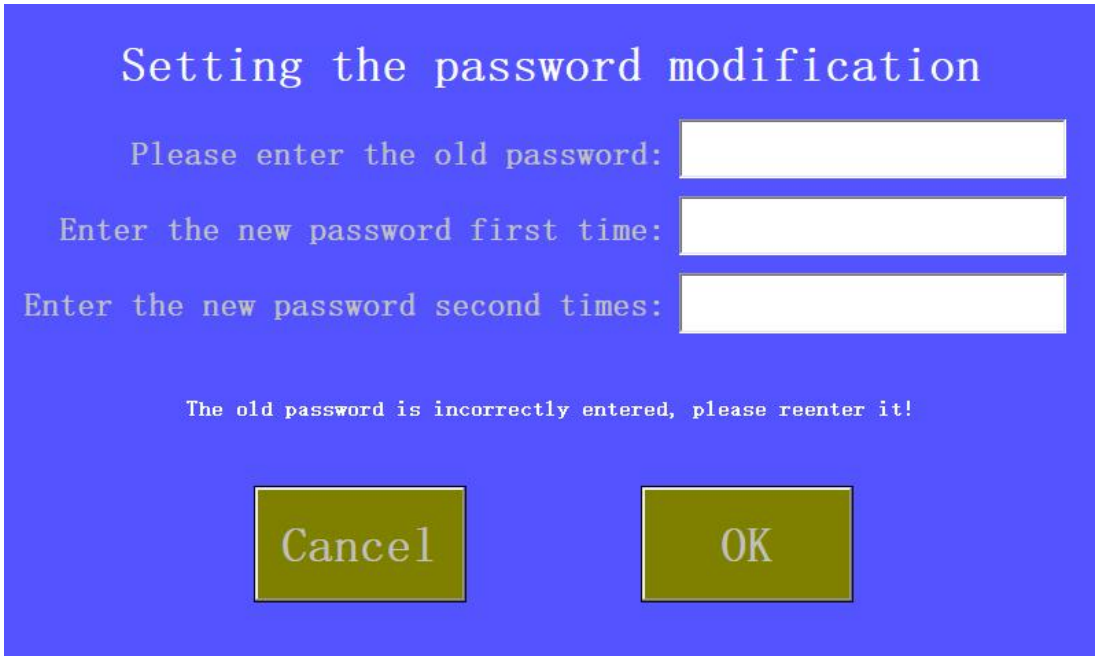
Click on the icon：, 

enter the password modify interface.

Click on the icon： 

, if the password is entered correctly, enter the parameter setting interface, otherwise the password input error is prompted. Please enter it again.

Password modification interface (similar to operation password modify interface)



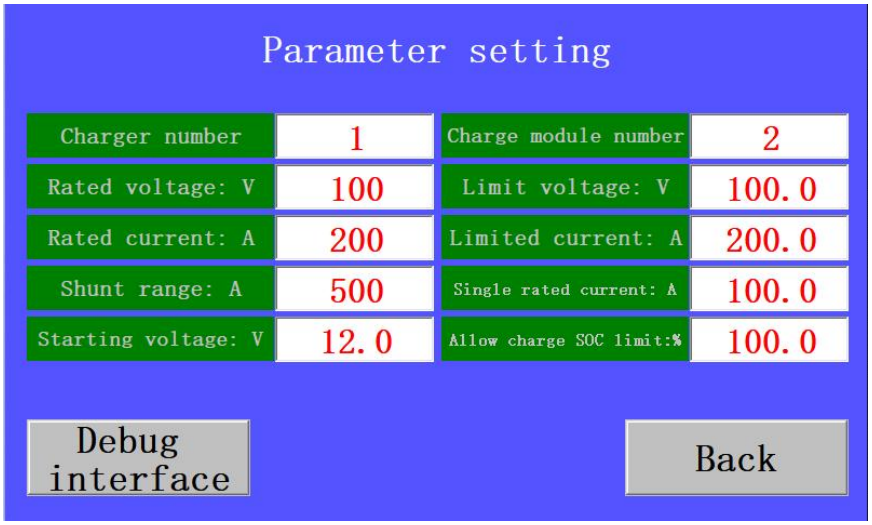
Enter in sequence according to the prompt: Enter the user's old password, enter the new

password for the first time and enter the new password for the second time.

Click on the icon： OK, if the user's old password is entered correctly, the first time the new password is entered and the second time the new password is entered, the modification is successful. Otherwise, the prompt modification fails. Please re-enter.

Click on the icon： Cancel, Return to the password entry interface.

Parameter setting interface



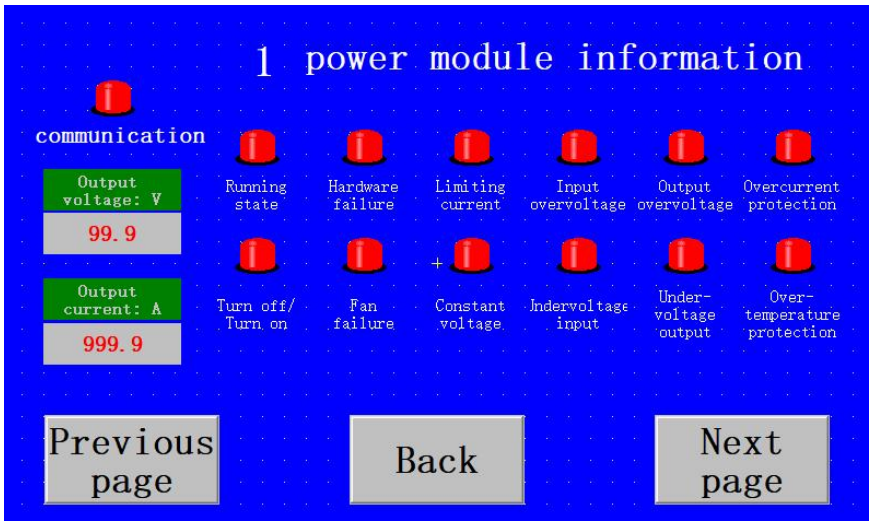
Click on the icon： Back, return to the help description interface.

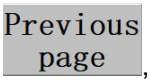
Parameter setting information: rated voltage, rated current and shunt range are related to machine hardware, and must not be arbitrarily modified after the factory.

Consult the manufacturer if the above parameters need to be modified. The charging machine number is easy for the user to distinguish, and the user can set it at will.

Debug interface for the factory to adjust the test, users can not operate at will.

Power module information display interface

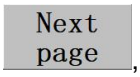


Click on the icon： 

, switch module information backward.

Click on the icon：, 

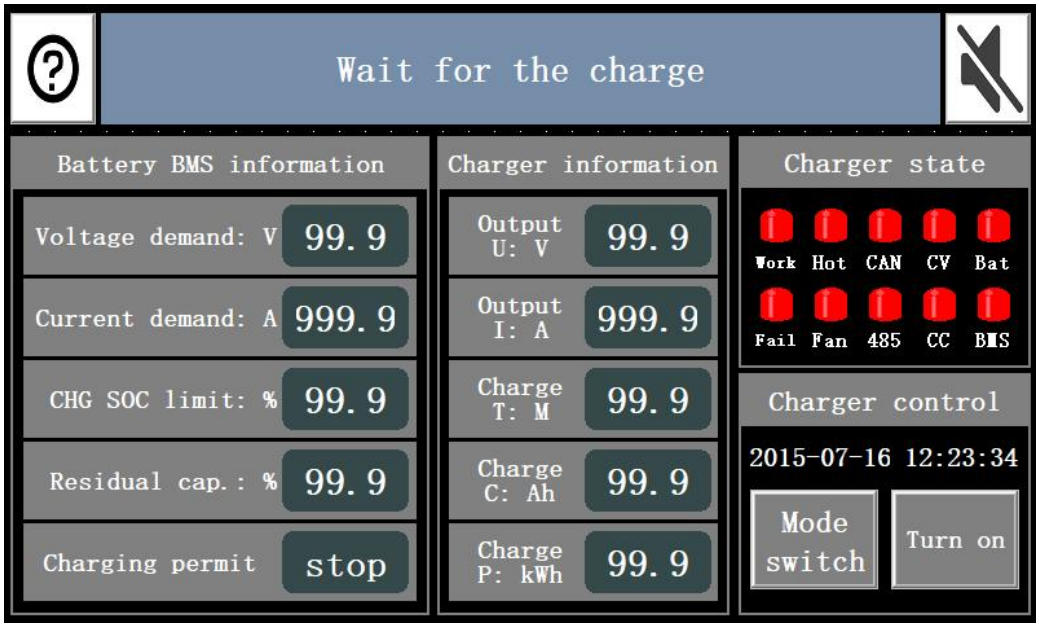
return to the main interface.

Click on the icon： 

, switch module information forward.

Display single power module output voltage, output current, various operating conditions.

Charging process explanation



The charging step：

1. Choose "turn on" charging control mode. The "CAN" and "485" indicator lights are bright green.
2. DC charging gun and battery connection is normal.
3. "Residual capacity" is less than "allowed to charge the SOC limit" to start charging.
4. "Battery" indicator light is bright green (charging machine detected the battery voltage, this

light), "BMS" indicator light green.

5. The "working" light is bright green. When the "output voltage" is similar to the "battery voltage", the charging motor outputs the relay to absorb and the charging machine officially begins to charge the battery. At this point, "output current" and "output voltage" will be output according to "current demand" and "voltage demand".

6. BMS charging complete, send charging termination command, charging motor end charging.

7. During the charging process, charging motor failure ("overheated "and" abnormal "lights of charging motor information are all charging motor failures), BMS charging or" charging allowed "in a prohibited state, and artificial charging control in a" stop "state, all will terminate the charging.

* In appointment mode, the charging machine will only work when the appointment time is set.

User wiring instruction

AC input air switch power supply. The input is an Yida plug and the output is a charging gun.

Warning: PE protection of the earth must be connected, otherwise it may threaten life safety.

Operating instructions

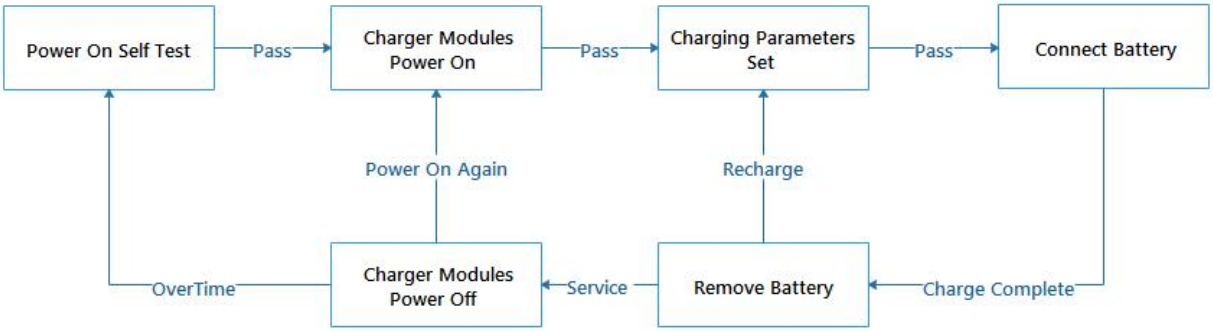
1.Cautions

1) Before the charger is turned on, it should be checked whether the battery box wiring is correct, whether there will be a short circuit or a positive and negative electrode connection. To avoid overloading the charging machine and burning components or lines.

2) It can be put into use only after the charger has no abnormal, overheating and other warning information.

3) For the safety of charging machines and equipment, it is forbidden to directly disconnect the battery switch under the condition of output current, except in case of emergency.

2. Operation flow chart



Concrete operation

1）Power check

Make sure that AC input zero wire and DC output positive and negative electrode wiring are correct, and that there is no short circuit in input and output; The input voltage and frequency are normal; At any time in the state of electricity.

Offline online charging lines can not be connected at the same time.

2）Power on

Check whether the AC fan wind direction is correct after the power is on.

The touch screen can be turned on normally, communication with the charging machine is normal.

3）Access to the battery

The battery voltage level and current level meet the requirements of the charging machine. Battery polarity is not reversed. Battery's fine. No abnormalities.

4）Power off

After the charging current and voltage drop to 0, exit the battery.

Turn off the AC input air switch.

9.5.2 lead-acid battery

The battery is made up of positive plate, negative plate, separator, battery jar, and battery lid. The positive plate is tube-shape, negative plate is pasted type. The separator is of the microporous type. The battery and lid are heat-sealed. All battery cells connected by welding, there are 24 cells.

Battery weight and dimension

Model / Weight（kg）	QSD120-XC1-M	QSD150-XC1-M	QSD180-XC1-M
Allowable lightest	960	1150	1150
Dimension（mm）	1008×540×735	1008×540×735	1008×540×735

Model / Weight（kg）	QSD60-XD3-M	QSD80-XD3-M	QSD100-XXD3-M
Allowable lightest	500	560	680
Dimension（mm）	830×414×627	830×414×627	830×630×627

Precautions for Battery Use:

1.Battery maintenance

It is important that the battery be properly charged in time, which will affect vehicle performance and battery life.

Over-discharge and over-charge will reduce battery life.

If there is abnormal situation such as odor, too fast electrolyte drop, high electrolyte temperature, please contact the agent or Hangcha after-sales service.

1.1 Maintenance precautions

（1）Maintenance personnel must undergo rigorous training.

（2）Never connect the battery's positive and negative terminals to each other, as this may cause a spark, fire or explosion. Fireworks, mobile phones and electronic products are strictly prohibited.

（3）Maintain and replace batteries and charge in designated well-ventilated areas, and place fire and power warning signs in conspicuous places.

（4）Check the electrolyte level daily. Do not use the truck when the electrolyte volume is low. Fill the distilled water (after charging) and always keep the electrolyte level at the specified height.

（5）The specific gravity of electrolyte was measured weekly.

（6）Make sure the battery surface is clean and dry. The connection terminals should be kept clean and dry. Surface area water and dirt can cause automatic discharge.

（7）Tighten the vent cap and clear the small holes to prevent dust from entering the electrolyte.

（8）Measures in winter: Maintain a good charging environment. Do not park the truck out in the cold or in the freezer for long time especially after the battery is used, it is forbidden to put it in a low temperature environment below 0 °C.

Warning

1. It is forbidden to place metal components and any other objects on it, and it is forbidden to connect the two poles of the battery to avoid short circuit, spark, or even explosion.
2. The electrolyte contains sulfuric acid, which is highly corrosive. If it comes into contact with the body, it may cause burns. Wear goggles, rubber shoes and rubber gloves when handling. Contact with clothing: take off immediately. Contact with skin or eyes: flush with running water for 15 to 20 minutes. Accidental ingestion: drink plenty of water and see a doctor immediately.
3. Explosive gases are generated inside the battery, smoking, flames and sparks are prohibited. Mobile phones and other electronic products are prohibited. Otherwise, the battery will explode.
4. Use a damp cloth when cleaning (no dry cloth or fabric) to prevent static electricity.

1.2 Daily, weekly, monthly, long-term

storage maintenance

Time	Content
Daily	1. After the battery is discharged, it needs to be charged in time. 2. Check the electrolyte level. When the electrolyte level is low, add distilled water to the specified liquid level (after charging). If it is too high, it should be sucked out 3. Check if the vent cap is damaged. 4. Keep the battery surface clean and tidy. 5. Check whether the appearance is deformed, whether the surface is oxidized, stripped, whether the installation position is offset, whether the box is damaged or not.
Weekly	1. The specific gravity of the electrolyte is tested and recorded. 2. Check if the small hole of the vent cover is blocked and dredged to prevent dust from falling into the battery. 3. Check if the battery stud bolt connection is loose (use torque wrench, torque is 25Nm). 4. Check if there is any fluid in the box and handle it.
Monthly	1. Check whether the battery stud bolt is oxidized, whether the battery socket is damaged or deformed, or there is foreign matter. 2. Equalizing charge is performed once a month.
Long-term storage	The battery should be stored in a dry, ventilated place. Before storing the battery, fully charge it, and then charge it once every 30 days.

2.Specific gravity detection and conversion

The specific gravity of the electrolyte is tested at least once a week.

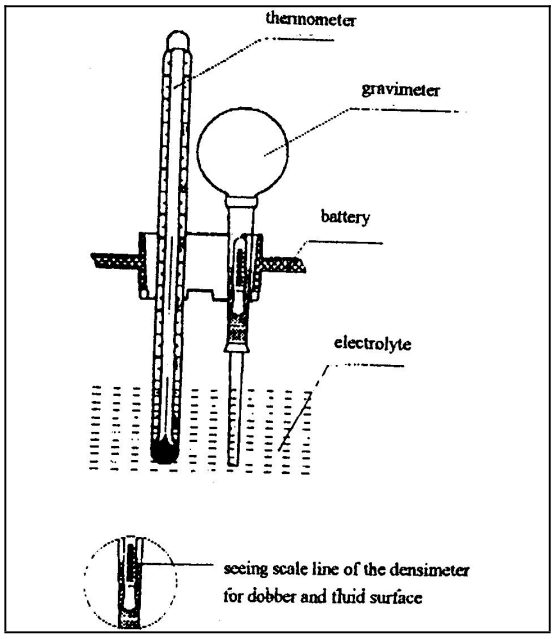
2.1 Specific gravity detection

（1）Use a thermometer to measure the temperature of the electrolyte.

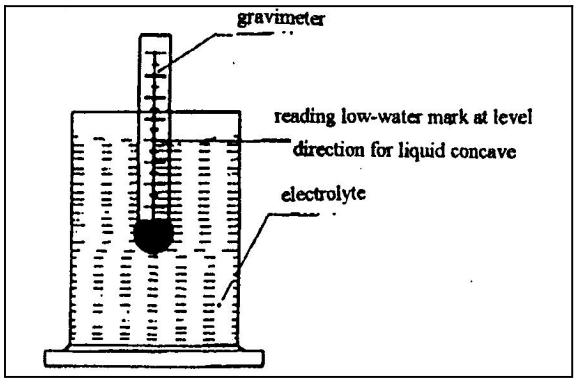
（2）Vertically insert the flexible tube of a pipette-type density meter into the electrolyte and squeeze the bulb. Electrolyte will enter the glass tube and the float will rise up.

（3）Take the density reading

> ⚠ **Caution**
>
> **Hold the density meter vertically so that the float does not touch the sides of the glass tube.**



Use a hydrometer to measure the specific gravity of electrolyte.



2.2 Specific gravity conversion

Convert electrolyte density at the standard temperature of 30°C based on the following formula:

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

Wherein：D_{30}——electrolyte density at 30℃

D_t——measured electrolyte density at t℃.

t——electrolyte temperature during density measurement.

The specific gravity of the electrolyte mentioned in the manual refers to the specific gravity at 30 °C.

Specific gravity of the electrolyte varies with temperature.

Electrolyte after full charge: specific gravity 1.28 g/cm3

Electrolyte after 80% discharge: specific gravity 1.14g/cm3

3. Check the electrolyte level and add distilled water

Do not use the truck when the electrolyte is low.

Check the electrolyte level once a day. When the electrolyte level is low, add distilled water to the specified surface height (should be replenished after charging).

Warning

1. Using a battery when the electrolyte level is low may lead to overheating and shorten the life span of the battery.
2. When the amount of electrolyte is not correct, it will cause the battery to overheat and even burn the battery and electrical system components.

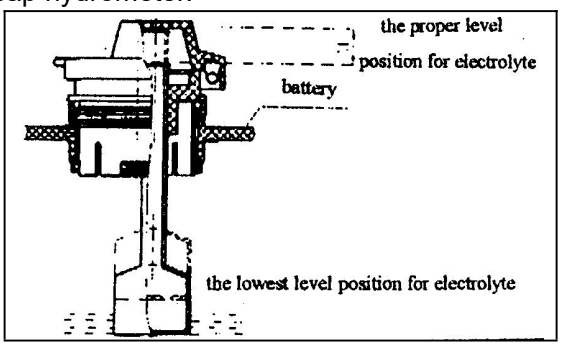
3.1 Check electrolyte level

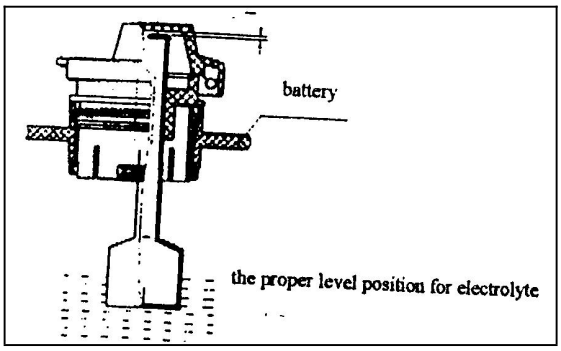
Battery without hydrometer

Electrolyte is 15 ～ 20mm higher than splashguard level.

Battery with hydrometer

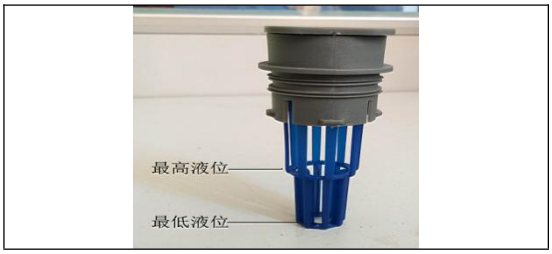
Measure electrolyte level by reading the vent cap hydrometer.





3.2 Topping up distilled water

After the charging is completed, distilled water should be added, and the liquid level is 15-20mm higher than protective screening (that is, in the middle position of the screen). But don't overdo it.



Procedures：

（1）Wear protective eyewear, rubber boots and rubber gloves.

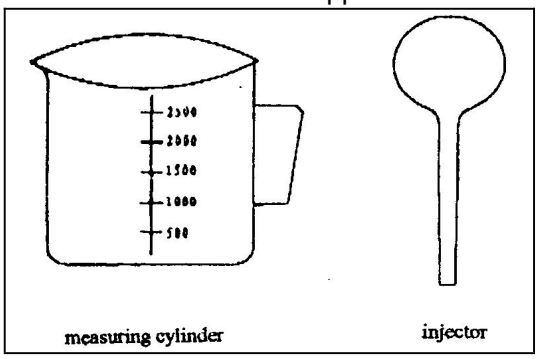
（2）Fill a squeeze bulb pipette with a certain amount of distilled water.

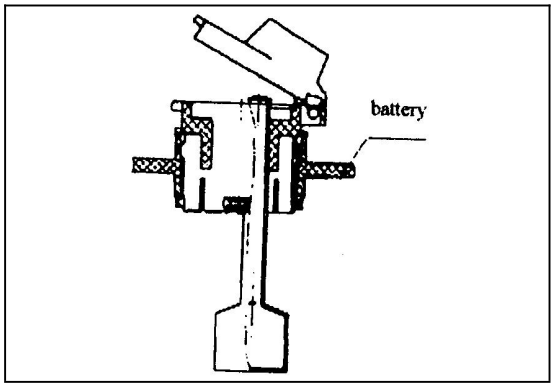
（3）Open all the vent or filler caps on the battery unit.

（4）Inject distilled water into battery cells using squeeze bulb pipette.

Battery with hydrometer

Stop adding water when the red hydrometer float rises and a white line appears.





Battery without hydrometer

Stop adding water when electrolyte is 15-20mm higher than splashguard level.

（5）After topping up, tightly fasten the vent or battery caps.

（6）Use a damp cloth to wipe clean the surface of each battery cell.

（7）Use a squeeze ball pipette to draw off any excess water.

Warning

1. When adding distilled water, do not exceed the specified maximum level. Adding too much water may cause electrolyte leakage and damage the forklift when charging or discharging the battery.
2. Do not use a dry cloth or fabric to wipe the surface of the battery to prevent static electricity from causing an explosion.

4.Battery charging

Warning

1. The forklift should be charged as soon as possible after use. It must be charged in time before the battery is 20% left. Excessive discharge will shorten battery life.

2. Charge in a designated well-ventilated place, away from inflammable and explosive materials, and place a fire and electric warning sign in conspicuous places.

3. Open the forklift hood and battery vent cover while charging to completely release hydrogen. When charging the battery, it is forbidden to use an open flame, mobile phone or other electronic products to prevent explosion. Do not charge when thunder.

4. During the charging process, it is forbidden to suddenly turn off the power switch or unplug the battery, otherwise it will cause sparks and damage the plug and electrical components. Usually it is continuously and automatically filled.

5. After the charging is completed, distilled water should be added, and the liquid level is 15-20mm higher than protective screening (that is, in the middle position of the screen). But don't overdo it.

4.1 Charger requirement and selection

4.1.1 Charger

（1）When the charger is in use, its casing needs to be reliably grounded.

（2）Disconnect power when replacing fuse.

（3）Only qualified professionals are permitted to disassemble the charger casing for testing or maintenance.

（4）Do not rebuild or disassemble charger.

（5）Take measures to prevent damage

caused by charger overheating in high temperature season. If necessary, suspend work temporarily.

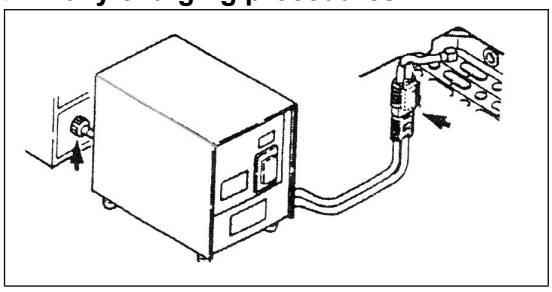
（6）Never continuously charge multiple batteries, which will overheat the charger and may even damage it. After charging, let the charger rest for an hour before re-using it.

4.1.2 Charger selection

Choose charger according to battery voltage and capacity (see parameter list). Generally, the charger current is selected according to the middle value of the battery capacity (1/10 to 1/7), that is, the current = (1/10 to 1/7) battery capacity. For example, the battery capacity is 630Ah, the charger current = (1/10 ~ 1 / 7) 630 = 63A ~ 90A, the choice of 70A-80A charger is most suitable.

Please use the Hangcha pure charger.

4.2 Daily charging procedures



（1）When the forklift meter shows 20% of the remaining power, it should be charged in time.

（2）Turn off the forklift key switch and press the red emergency stop button.

（3）Open the forklift cover and unplug the forklift cable from the battery socket.

（4）Open the battery venting cover to release the explosive gas, and measure the temperature of the electrolyte. If it exceeds 45 °C, it needs to be naturally cooled to below 45 °C, and then charged. The electrolyte temperature during charging should not exceed 55 °C.

（5）Check if the charger plug and the battery socket are damaged. After checking the error, plug the battery into the charger plug. It is strictly forbidden to misconnect positive and negative poles.

（6）Plug in the charger and press the charger's charging switch to charge.

（7）After the charging is completed, the charging device is automatically powered off. Now disconnect the power of the charger and then unplug the charger.

（8）Check the electrolyte level as required in the manual. If it is not enough, add distilled water (filled with Hangcha pure distilled water).

（9）For those equipped with automatic water filling system, distilled water should be added according to the relevant parts of Operation and Maintenance Manual (Automatic Water Filling System of Battery (optional)).

（10）Close the vent cover, clean the battery surface, and close the battery cover. Plug the forklift cable plug into the battery socket and the charging is completed.

4.3 Equalizing charge

4.3.1 Reason of equalizing charge

With time, the voltage, density and capacity of a battery tend to become unbalanced. The voltage and specific gravity of some cells increase more slowly compared with other cells when charging, and decrease at a faster rate when discharging.

Equalizing charge should be applied when any of the following situations occur：

(1)The discharge voltage frequently falls below the cut-off voltage;

（2）The discharge current is frequently too high;

（3）The battery is not charged in a timely manner after discharge is complete;

（4）The battery frequently gets insufficient charge, or hasn't been used for a long time;

4.3.2 Equalizing charge method

Please follow the instructions of the charger. Set to equalizing charge mode and charge. Equalizing charge is performed once a month.

9.5.3 AC motor

Technical parameter ：

Motor type	Rated voltage	Rated power	Rated current	Rated rpm	Insulation grade
HPQ12-80HC	55V	16kW	266A	2500r/min	H
HPQ4.5-48HC	33V	4.5kW	100A	1780r/min	H

Usage and maintenance

（1）The temperature of ambient air should not be high than 40℃, and relative humidity should not exceed 75％(20℃) when the motor is working continuously with full load.

（2）Keep surface and ambient environment clean, make sure there is no nonego in motor when motor is working. Notice whether there is abnormal sound, shake or over loading over a long period of time.

（3）The normal working temperature of bearing should not exceed 95℃, when the temperature is too high or there is some asymmetry noise, it means that maybe there is nonoge entering or bearing is damaging, at the time, remove and clean the bearing to check, after cleaning it, and it has no damage evidence, but there is "za,za" noise when working, so the new bearing must be instead of old bearing

Fill about 2/3 space grease in oil chamber of bearing cap after installing bearing. And exchange new 3# lithium base grease after working for 2000～2500h, and prevent dust and humidity entering.

（4）This motor has no commutator and brush and is maintenance-free. However, it is necessary to carry out external dust removal and check whether the wiring is good.

Battery replacement：

When the battery needs to be replaced, do as follow:
1. Park the truck on the strong and flat ground, pull up the hand brake;
2. Open the hood and unfix the battery plug;
3. Remove the fixed pin which located the battery on the truck body;
4. Lift the four holes of the battery;
5. Replace battery. Install the pin again, connect the battery plug and close the hood.

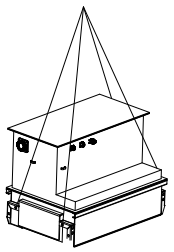
Caution

1.Make sure that the voltage, capacity, size and weight of the new battery are according with the forklift truck before replacing the battery.

2.The replaced wasted liquid of the battery should not be poured at will and should be dealt according to the local environmental protection law.

Caution

The box must be pulled up with using 4 holes of the pothook at the same time. It is not allowed to pull up with only two holes. Otherwise, the asymmetric power will cause the battery damaged.



Battery disposal

Batteries may only be disposed of in accordance with national environmental protection regulations or disposal laws. The manufacturer's disposal instructions must be followed.

WARNING

- **Batteries contain an acid solution which is poisonous and corrosive. Above all avoid any contact with battery acid.**
- **Dispose of used battery acid in accordance with regulations.**
- **Always wear protective clothing and goggles when working with batteries.**
- **Do not let battery acid come into contact with skin, clothing or eyes. If necessary, rinse with plenty of clean water.**
- **Call for a doctor immediately in the event of physical damage(e.g. skin or eye contact with battery acid).**
- **Neutralise any spilled battery acid immediately with plenty of water.**
- **Only batteries with a sealed battery container may be used.**
- **Follow national guidelines and legislation.**

9.6 Controller

CURTIS Controller

Summarize

CURTIS company procreates controller ， adopt international advanced closed loop system and advanced control technique。Designing large screen instrument， can clear display “electric quantity”、“speed”、“total time of run ” and so on information。Designation adopt code plus character manner，increase maintain efficiency。Four work models can be set through meter so as to suitable for different condition.

（1）SAFETY & PROTECTION FEATURES

- Reverse Polarity of the battery
- Connection errors
- All inputs are protected against connections errors.
- Current overload protection
- it have detecting element，control peak current.
- Thermal protection: If the controller temperature exceeds 85°C, the maximum current reduces in proportion to the thermal increase. The temperature can never exceed 115°C; If the electric machinery temperature exceeds 145°C, the maximum current reduces in proportion to the thermal increase. The temperature can never exceed 165°C.
- Low Battery charge: When the battery charge is low, the maximum current is reduced proportionally to the battery discharge.
- External Agents: Electric control is hermetical .The chopper is protected against dust and spray of liquid to economy.
- Protection against accidental Start Up: A precise sequence of operations is necessary before the machine will start. Operation can not commence if these operations are not carried out correctly. Requests for drive must be made after closing the Key Switch.

（2）OPERATIONAL FEATURES

- Feedback control system make the vehicle speed follow accelerator ，whether low speed or not high speed easy control .
- Two archives speed and acceleration design ， can apply to most situation.

- Regeneration technology make change direction of fork even smooth。
- Three regenerative braking mode ：
  a. Acceleration pedal part release appear regenerative braking;
  b. Direction reverse regenerative braking;
  c. Ramp downslide appear regenerative braking，except increase security drive，reclaim part of electric energy，prolong work time of every time .
- Control speed during downgrade： speed lie on accelerator 。if speed exceed set point，controller may automatic braking，this give optimal ramp.

Notice:

- Maintain electric control ， must first cut off electrical source， then hold 10-100ohmic resistance join controller anode and cathode，release residual voltage in the capacitor, or else you may meet tip-and-run danger.
- Magnetic and radiation have some effect to inverter，long time effect may mangle controller, So need apart form magnetic and radiation.

Failure code

There are two LEDs including a yellow LED and a red LED. The two LEDs have four different display modes, indicating the type of information they are providing.

DISPLAY	STATUS
Neither LED illuminated	Controller is not powered on, has a dead battery, or is severely damaged.
Yellow LED flashing	Controller is operating normally.
Yellow and red LEDs both on solid	Controller is in Flash program mode.
Red LED and yellow LED flashing alternately	Controller has detected a fault.

CODE	PROGRAMMER LCD DISPLAY	POSSIBLE CAUSE
1 , 2	Controller Overcurrent	1. External short of phase U, V, or W motor connections. 2. Motor parameters are mis-tuned. 3. Controller defective.
1 , 3	Current Sensor Fault	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective.
1 , 4	Precharge Failed	1. External load on capacitor bank (B+ connection stud) that prevents the capacitor bank from charging. 2. See 1311 menu Monitor » Battery: Capacitor Voltage.
1 , 5	Controller Severe Undertemp	1. Controller is operating in an extreme environment. 2. See 1311 menu Monitor » Controller: Temperature.
1 , 6	Controller Severe Overtemp	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller. 4. See 1311 menu Monitor » Controller: Temperature.
1 , 7	Severe Undervoltage	1. Battery Menu parameters are misadjusted. 2. Non-controller system drain on battery. 3. Battery resistance too high. 4. Battery disconnected while driving. 5. See 1311 menu Monitor » Battery: Capacitor Voltage. 6. Blown B+ fuse or main contactor did not close.
1 , 8	Severe Overvoltage	1. Battery Menu parameters are misadjusted. 2. Battery resistance too high for given regen current. 3. Battery disconnected while regen braking. 4. See 1311 menu Monitor » Battery: Capacitor Voltage.
2 , 1	Controller Undertemp Cutback	1. Controller is performance-limited at this temperature. 2. Controller is operating in an extreme environment. 3. See 1311 menu Monitor » Controller: Temperature.
2 , 2	Controller Overtemp	1. Controller is performance-limited at this temperature.

CODE	PROGRAMMER LCD DISPLAY	POSSIBLE CAUSE
	Cutback	2. Controller is operating in an extreme environment. 3. Excessive load on vehicle. 4. Improper mounting of controller. 5. See 1311 menu Monitor » Controller: Temperature.
2 , 3	Undervoltage Cutback	1. Normal operation. Fault shows that the batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system drain on battery 4. Battery resistance too high. 5. Battery disconnected while driving. 6. See 1311 menu Monitor » Battery: Capacitor Voltage. 7. Blown B+ fuse or main contactor did not close.
2 , 4	Overvoltage Cutback	1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking 5. See 1311 menu Monitor » Battery: Capacitor Voltage.
2 , 5	+5V Supply Failure	1. External load impedance on the +5V supply (pin 26) is too low. 2. See 1311 menu Monitor » outputs: 5 Volts and Ext Supply Current.
2 , 6	Digital Out 6 Overcurrent	1. External load impedance on Digital Output 6 driver (pin 19) is too low.
2 , 7	Digital Out 7 Overcurrent	1. External load impedance on Digital Output 7 driver (pin 20) is too low.
2 , 8	Motor Temp Hot Cutback	1. Motor temperature is at or above the programmed Temperature Hot setting, and the requested current is being cut back. 2. Motor Temperature Control Menu parameters are mis-tuned. 3. See 1311 menus Monitor » Motor: Temperature and Monitor » Inputs: Analog2. 4. If the application doesn't use a motor thermistor, Temp Compensation and Temp Cutback should be programmed Off.
2 , 9	Motor Temp Sensor Fault	1. Motor thermistor is not connected properly. 2. If the application doesn't use a motor thermistor, Temp Compensation and Temp Cutback should be programmed Off. 3. See 1311 menus Monitor » Motor: Temperature and Monitor » Inputs: Analog2.
3 , 1	Coil 1 Driver Open/Short	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.
3 , 1	Main Open/Short	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.
3 , 2	Coil2 Driver Open/Short	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.
3 , 2	EM Brake Open/Short	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.
3 , 3	Coil3 Driver Open/Short	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.
3 , 4	Coil4 Driver Open/Short	1. Open or short on driver load. 2. Dirty connector pins.

CODE	PROGRAMMER LCD DISPLAY	POSSIBLE CAUSE
		3. Bad crimps or faulty wiring.
3 , 5	PD Open/Short	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.
3 , 6	Encoder Fault	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See 1311 menu Monitor » Motor: Motor RPM.
3 , 7	Motor Open	1. Motor phase is open. 2. Bad crimps or faulty wiring.
3 , 8	Main Contactor Welded	1. Main contactor tips are welded closed. 2. Motor phase U is disconnected or open. 3. An alternate voltage path (such as an external precharge resistor) is providing a current to the capacitor bank (B+ connection stud).
3 , 9	Main Contactor Did Not Close	1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. External load on capacitor bank (B+ connection stud) that prevents capacitor bank from charging. 4. Blown B+ fuse.
4 , 1	Throttle Wiper High	1. Throttle pot wiper voltage too high. 2. See 1311 menu Monitor » Inputs: Throttle Pot.
4 , 2	Throttle Wiper Low	1. Throttle pot wiper voltage too low. 2. See 1311 menu Monitor » Inputs: Throttle Pot.
4 , 3	Brake Wiper High	1. Brake pot wiper voltage too high. 2. See 1311 menu Monitor » Inputs: Brake Pot.
4 , 4	Brake Wiper Low	1. Brake pot wiper voltage too low. 2. See 1311 menu Monitor » Inputs: Brake Pot.
4 , 5	Pot Low Overcurrent	1. Combined pot resistance connected to pot low is too low. 2. See 1311 menu Monitor » Outputs: Pot Low.
4 , 6	EEPROM Failure	1. Failure to write to EEPROM memory. This can be caused by EEPROM memory writes initiated by VCL, by the CAN bus, by adjusting parameters with the 1311, or by loading new software into the controller.
4 , 7	HPD/Sequencing Fault	1. KSI, interlock, direction, and throttle inputs applied in incorrect sequence. 2. Faulty wiring, crimps, or switches at KSI, interlock, direction, or throttle inputs. 3. See 1311 menu Monitor » Inputs.
4 , 7	Emer Rev HPD	1.Emergency Reverse operation has concluded, but the throttle, forward and reverse inputs, and interlock have not been returned to neutral.
4 , 9	Parameter Change Fault	1.This is a safety fault caused by a change in certain 1311 parameter settings so that the vehicle will not operate until KSI is cycled. For example, if a user changes the Throttle Type this fault will appear and require cycling KSI before the vehicle can operate.
6 , 8	VCL Runtime Error	1. VCL code encountered a runtime VCL error. 2. See 1311 menu Monitor » Controller: VCL Error Module and VCL Error. This error can then be compared to the runtime VCL module ID and error code definitions found in the specific OS system information file.
6 , 9	External Supply Out of Range	1. External load on the 5V and 12V supplies draws either too much or too little current. 2. Fault Checking Menu parameters Ext Supply Max and Ext Supply Min are mis-tuned. 3. See 1311 menu Monitor » Outputs: Ext Supply Current.
7 , 1	OS General	1. Internal controller fault.
7 , 2	PDO Timeout	1. Time between CAN PDO messages received exceeded the PDO Timeout Period.
7 , 3	Stall Detect	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See 1311 menu Monitor » Motor: Motor RPM.
8 , 7	Motor Characterization Fault	1. Motor characterization failed during the motor characterization process.
8 , 8	Encoder Characterization Fault	1. Encoder characterization failed during the motor characterization process. 2. Motor encoder pulse rate is not a standard value (32, 48, 64, 80 ppr).

CODE	PROGRAMMER LCD DISPLAY	POSSIBLE CAUSE
8 , 9	Motor Type Fault	1. The Motor type parameter value is out of range.
9 , 2	EM Brake Failed to Set	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.
9 , 3	Limited Operating Strategy（LOS）	1. Limited Operating Strategy (LOS) control mode has been activated, as a result of either an Encoder Fault (Code 36) or a Stall Detect Fault (Code 73). 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Vehicle is stalled.
9 , 4	Emer Rev Timeout	1. Emergency Reverse was activated and concluded because the EMR Timeout timer has expired. 2. The emergency reverse input is stuck On.

INMOTION Controller

Summary：

International advanced closed-loop system and the advanced control technology are integrated in the controller. Faults displayed by codes improve the efficiency of maintenance. The peripheral components can also be detected by the meter, and the functions of the handheld unit can be realized by the meter.

（1）Drive motor

The drive motor adopts a three-phase AC variable frequency motor with high power conversion rate, no commutator and brush, and realizes maintenance-free.

（2）Safety and protection features

①Polarity protection of the battery

②Circuit connection protection

③All inputs are protected against connections errors

④Current overload protection

⑤It have detecting element, limit peak current

⑥Thermal protection

If the controller temperature exceeds 85°C, thermal protection will work; the maximum current reduces in proportion to the thermal increase. Once the temperature exceeds 115°C, it will shut down automatically and give a warning.

If the motor temperature exceeds 145°C, thermal protection will work; the maximum current reduces in proportion to the thermal increase. Once the temperature exceeds 165°C, it will shut down automatically and give a warning.

⑦Battery overdischarge protection

When the capacity of battery is low, there will be a buzzer alarm, the maximum speed and current reduce greatly.

⑧External guard protection

Electric control is hermetical which can protect against dust and liquid into the body.

⑨Starting order protection

The drive request must be issued after the electric lock switch is closed and the vehicle is started.

⑩ When electrical elements are damaged, the control can protect itself to avoid more damage.

（3）Operation features

①Close-loop control system make the vehicle speed follow accelerator, which make control easily whether low speed or high speed.

②Regeneration technology makes direction change more smoothly.

③Three regenerative braking mode:

A. Regenerative brake from accelerator pedal release partly.

B. Regenerative brake from direction reverse

C. Regenerative brake from traveling downhill

Besides increasing driving security, it can recycle parts of electric energy, and prolong work hours of every shift.

⑤Speed control during traveling downhill: motor speed lies on accelerator. If motor speed exceeds the setting value of accelerator, the controller will brake automatically, which gives an optimal protection of ramp.

Caution：

— Before maintaining the controller, cut off the power. Connect a 10-100 ohm resistance to the positive and negative poles of controller to release residual voltage in the capacitor, or else there might be an electric shock.

— Magnetic field and radiation of surroundings will effect on the inverter, controller may be

damaged due to the long time effect. So keep away from magnetic field and radiation.

Controller fault code

Most faults in the electrical control system can be displayed through the multi-function meter, and fault information can be found based on the fault code displayed by the digital multi-function meter. If equipped with a handheld unit, it is easier to find the cause of the malfunction.

Controller fault diagnosis

Code	Type	Fault	Reason
101	Application error	Accelerator pedal switch is activated when the key is turned on	Accelerator pedal is activated when the truck starts.
102	Application error	Direction switch is activated when the key is turned on	Direction switch(Forward/Backward) is activated when the truck starts.
103	Application error	Forward/Backward direction switches are activated simultaneously	Forward/Backward direction switches are activated simultaneously
104	Application error	Traction analog voltage error	Over-limit accelerator pedal analog (less than 30 or larger than 2800)
105	Application error	Traction switch error	When the accelerator pedal switch is not activated, analog voltage is larger than 30%
111	Application error	CAN communication error	CAN communications electrical failure, the error may be a wiring error, not connect the terminal resistance, the connection terminal breaks or communication unit is damaged
114	Application error	Low battery voltage	Alarm when the power is less than 25%, travel slowly when the power is less than 15%
115	Application error	Startup procedure error	Internal error occurred while starting
116	Application error	Lift switch is activated when the key is turned on	Lift switch is activated when the truck starts.
117	Application error	Pump switch 1 is activated when the key is turned on	Pump switch 1 is activated when the truck starts
118	Application	Pump switch 2 is activated when	Pump switch 2 is activated when the

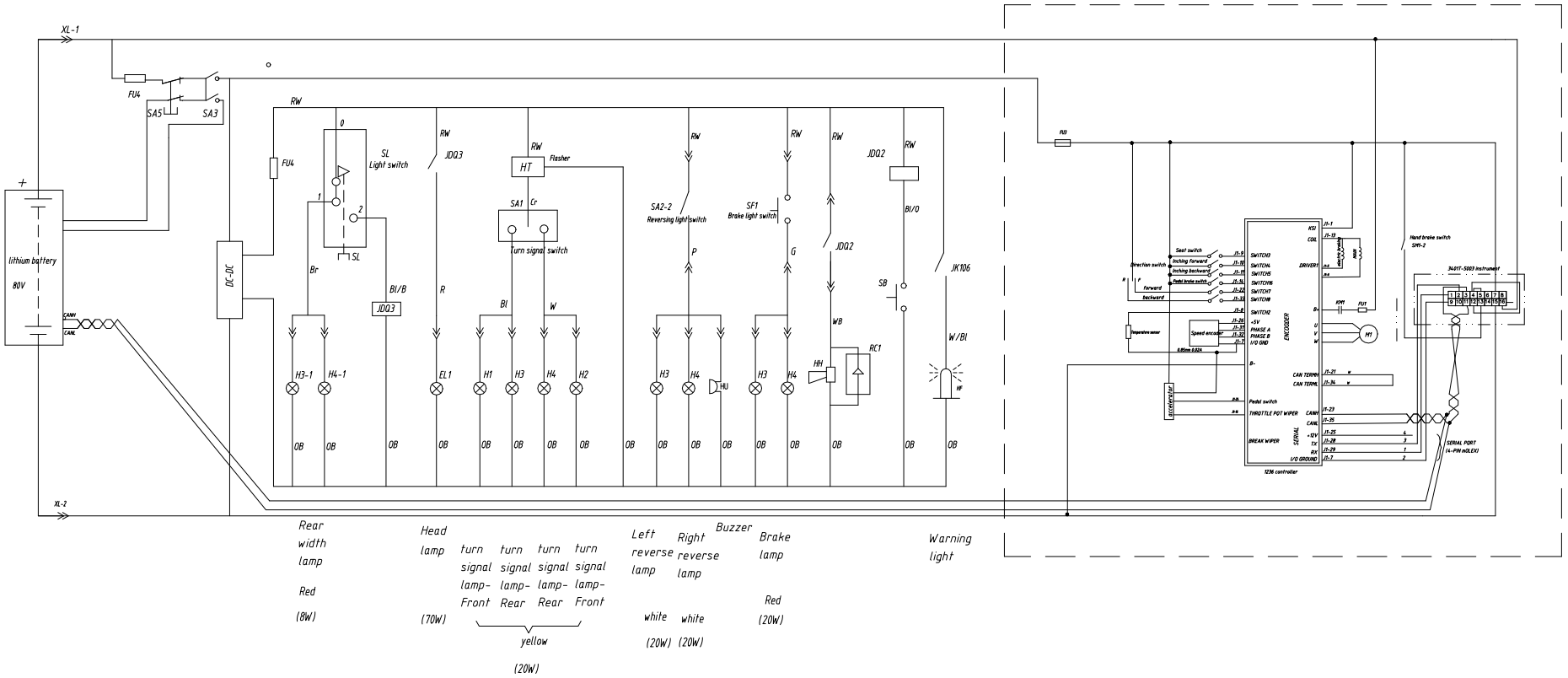
Code	Type	Fault	Reason
	error	the key is turned on	truck starts
119	Application error	Pump switch 3 is activated when the key is turned on	Pump switch 3 is activated when the truck starts
120	Application error	Pump switch 4 is activated when the key is turned on	Pump switch 4 is activated when the truck starts
121	Application error	Pump analog voltage error	Over-limit pump analog (less than 10 or larger than 2800)
122	Application error	Lift switch and speed lifter error	When the lift switch is not activated, analog voltage is larger than 30%
124	Application alarm	Direction switch is activated when driver leaves	Driver leaves the forklift, but the direction switch is still activated, turn off the direction switch and this error disappears
125	Application error	Main contactor does not close	Main contactor does not close
301	Traction alarm	Low traction ACS temperature	ACS temperature is lower than -20℃
302	Traction alarm	High traction ACS temperature	ACS temperature is higher than 80℃
303	Traction alarm	Traction ACS temperature sensor error	ACS temperature sensor is disconnected or short
304	Traction alarm	Low traction motor temperature	Motor temperature is lower than-35℃
305	Traction alarm	High traction motor temperature	Motor temperature is higher than 145℃
306	Traction alarm	Traction motor temperature sensor error	Motor temperature sensor is disconnected or short
307	Traction alarm	Traction encoder error	Motor speed encoder is disconnected or short
308	Traction alarm	High traction ACS voltage	To 24V truck, voltage is higher than 36V; to 48V truck, voltage is higher than 68V; to 80V truck, voltage is higher than 98V
309	Traction alarm	Low traction ACS voltage	To 24V truck, voltage is lower than 18V; to 48V truck, voltage is lower than 24V; to 80V truck, voltage is lower than 60V
310	Traction alarm	Traction ACS use default parameter	Traction ACS use default parameter, the error will disappear after restart
311	Traction alarm	Traction power is reduced	ACS output power is reduced
312	Traction alarm	Traction calibration parameter error	Calibration parameter error

Code	Type	Fault	Reason
316	Traction alarm	Traction current sensor error	Current sensor use default parameter
317	Traction alarm	Traction outlet error	Outlet is disconnected or short
318	Traction alarm	Traction other error	Other error
351	Traction error	Traction ACS short or motor short	ACS short or motor U,V,W short
352	Traction error	Too high traction ACS temperature	ACS temperature is higher than 125℃
353	Traction error	Too high traction motor temperature	Motor temperature is higher than 180℃
354	Traction error	Traction ACS current sensor error	ACS current sensor error
355	Traction error	No charging after power on the traction ACS capacitor	Within 10-second power on the ACS, the voltage is lower than 85% of the nominal voltage
356	Traction error	Traction ACS no response	ACS no response, check the wiring, if the wiring is correct, it means ACS is damaged
357	Traction error	Slave node ACS communication timeout	Slave node ACS communication timeout
358	Traction error	Traction ACS communication SDO error	Traction ACS communication SDO error
359	Traction error	Master node ACS communication timeout	Master node ACS communication timeout
360	Traction error	Too low traction ACS voltage	To 24V truck, ACS voltage is less than 18V; to 48V truck, ACS voltage is less than 18V; to 80V truck, ACS voltage is less than 40V
361	Traction error	Too high traction ACS voltage(software)	To 24V truck, ACS voltage is higher than 36V; to 48V truck, ACS voltage is higher than 68V; to 80V truck, ACS voltage is higher than 106V software testing)
362	Traction error	Too high traction ACS voltage(hardware)	To 24V truck, ACS voltage is higher than 36V; to 48V truck, ACS voltage is higher than 68V; to 80V truck, ACS voltage is higher than 106V (hardware testing)
363	Traction error	Too high traction ACS PCB	ACS PCB temperature is higher than 125℃
364	Traction	Other error	Other error

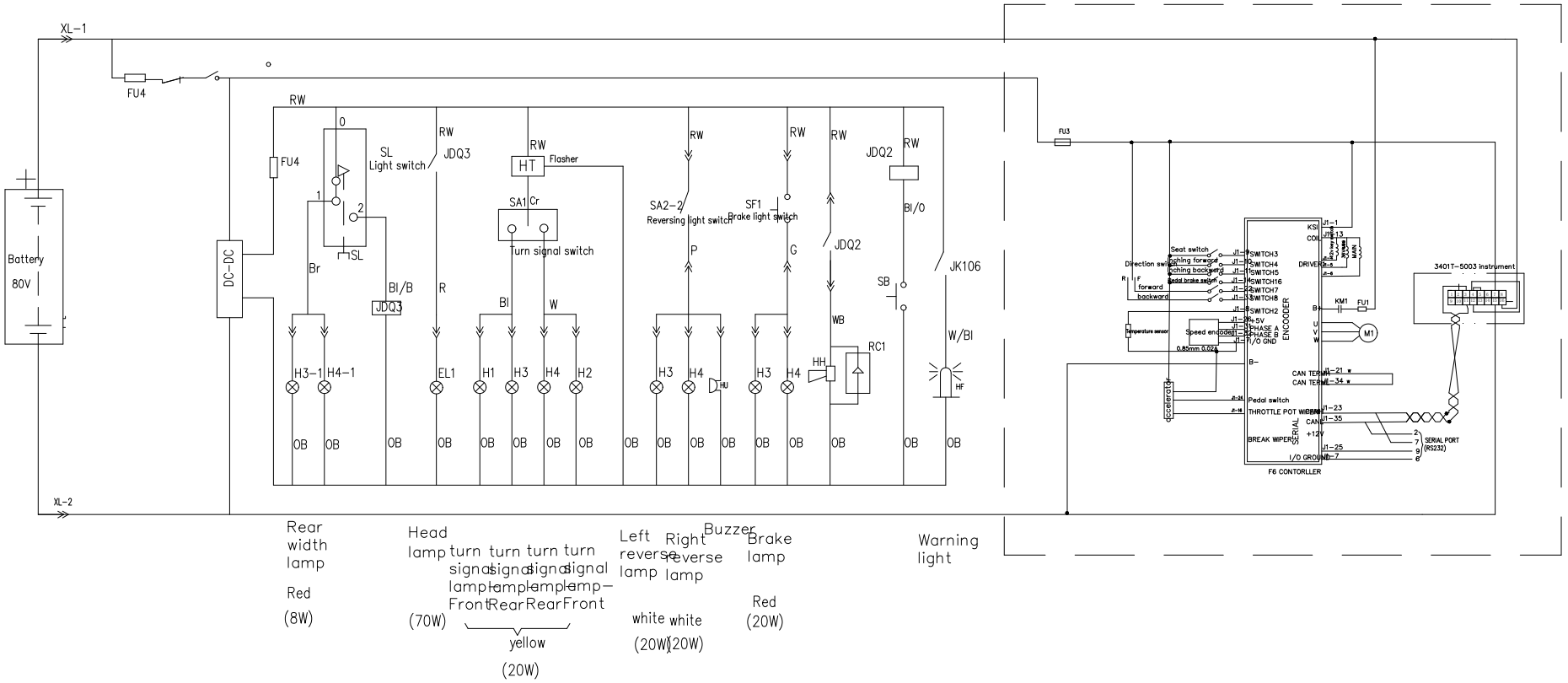
Code	Type	Fault	Reason
	error		
401	Pump alarm	Low pump ACS temperature	ACS temperature is lower than -20℃
402	Pump alarm	High pump ACS temperature	ACS temperature is higher than 80℃
403	Pump alarm	Pump ACS temperature sensor error	ACS temperature sensor is disconnected or short
404	Pump alarm	Low pump motor temperature	Motor temperature is lower than-35℃
405	Pump alarm	High pump motor temperature	Motor temperature is higher than 145℃
406	Pump alarm	Pump motor temperature sensor error	Motor temperature sensor is disconnected or short
407	Pump alarm	Pump encoder error	Motor speed encoder is disconnected or short
408	Pump alarm	High pump ACS voltage	To 24V truck, voltage is higher than 36V; to 48V truck, voltage is higher than 68V; to 80V truck, voltage is higher than 98V
409	Pump alarm	Low pump ACS voltage	To 24V truck, voltage is lower than 18V; to 48V truck, voltage is lower than 24V; to 80V truck, voltage is lower than 60V
410	Pump alarm	Pump ACS use default parameter	Pump ACS use default parameter, the error will disappear after restart
411	Pump alarm	Pump power is reduced	ACS output power is reduced
412	Pump alarm	Pump calibration parameter error	Calibration parameter error
416	Pump alarm	Pump current sensor error	Current sensor use default parameter
417	Pump alarm	Pump outlet error	Outlet is disconnected or short
418	Pump alarm	Pump other error	Other error
451	Pump error	Pump ACS short or motor short	ACS short or motor U,V,W short
452	Pump error	Too high pump ACS temperature	ACS temperature is higher than 125℃
453	Pump error	Too high pump motor temperature	Motor temperature is higher than 180℃
454	Pump error	Pump current sensor error	ACS current sensor error
455	Pump error	No charging after power on the pump ACS capacitor	Within 10-second power on the ACS, the voltage is lower than 85% of the nominal voltage

Code	Type	Fault	Reason
456	Pump error	Pump ACS no response	ACS no response, check the wiring, if the wiring is correct, it means ACS is damaged
457	Pump error	Slave node ACS communication timeout	Slave node ACS communication timeout
458	Pump error	ACS communication SDO error	ACS communication SDO error
459	Pump error	Master node ACS communication timeout	Master node ACS communication timeout
460	Pump error	Too low pump ACS voltage	To 24V truck, ACS voltage is less than 18V; to 48V truck, ACS voltage is less than 18V; to 80V truck, ACS voltage is less than 40V
461	Pump error	Too high pump ACS voltage(software)	To 24V truck, ACS voltage is higher than 36V; to 48V truck, ACS voltage is higher than 68V; to 80V truck, ACS voltage is higher than 106V (software testing)
462	Pump error	Too high pump ACS voltage(hardware)	To 24V truck, ACS voltage is higher than 36V; to 48V truck, ACS voltage is higher than 68V; to 80V truck, ACS voltage is higher than 106V (hardware testing)
463	Pump error	Too high pump temperature	
464	Pump error	Other error	Other error

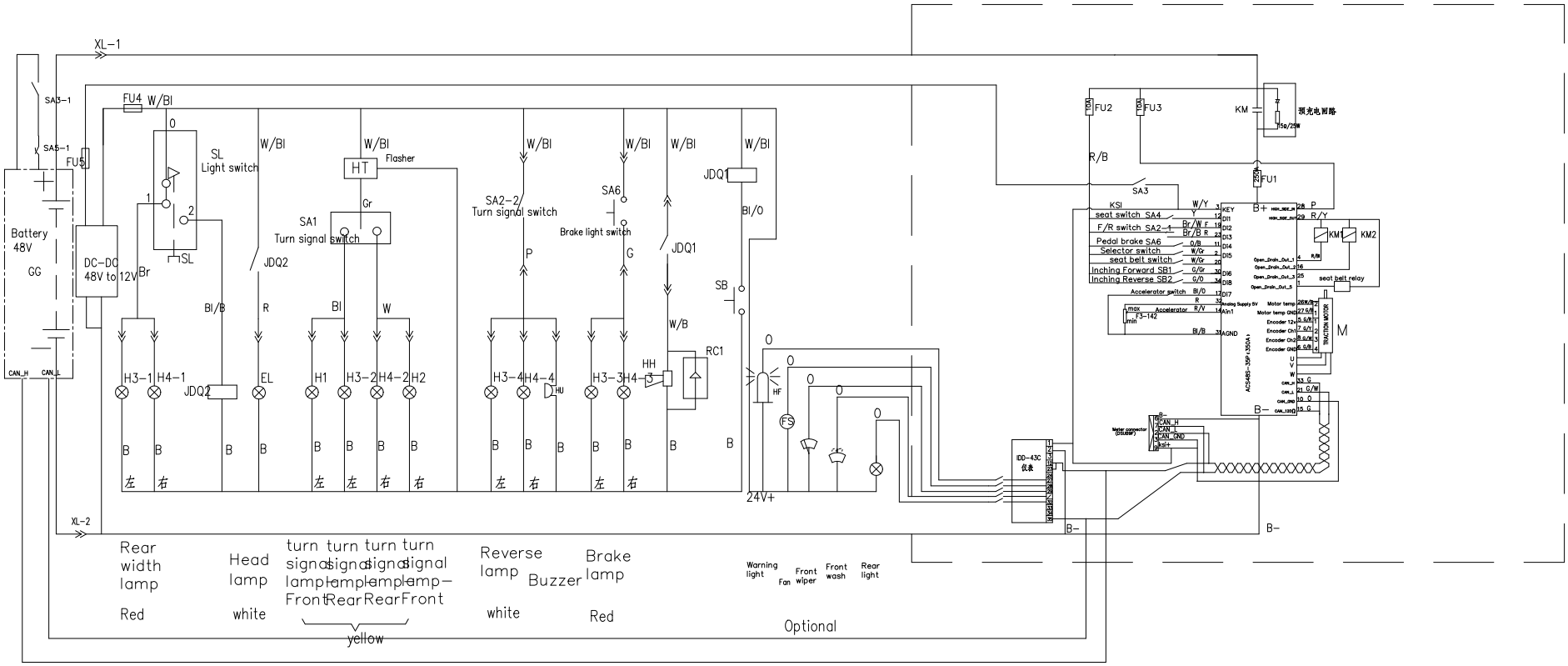
Electrical system schematic diagram



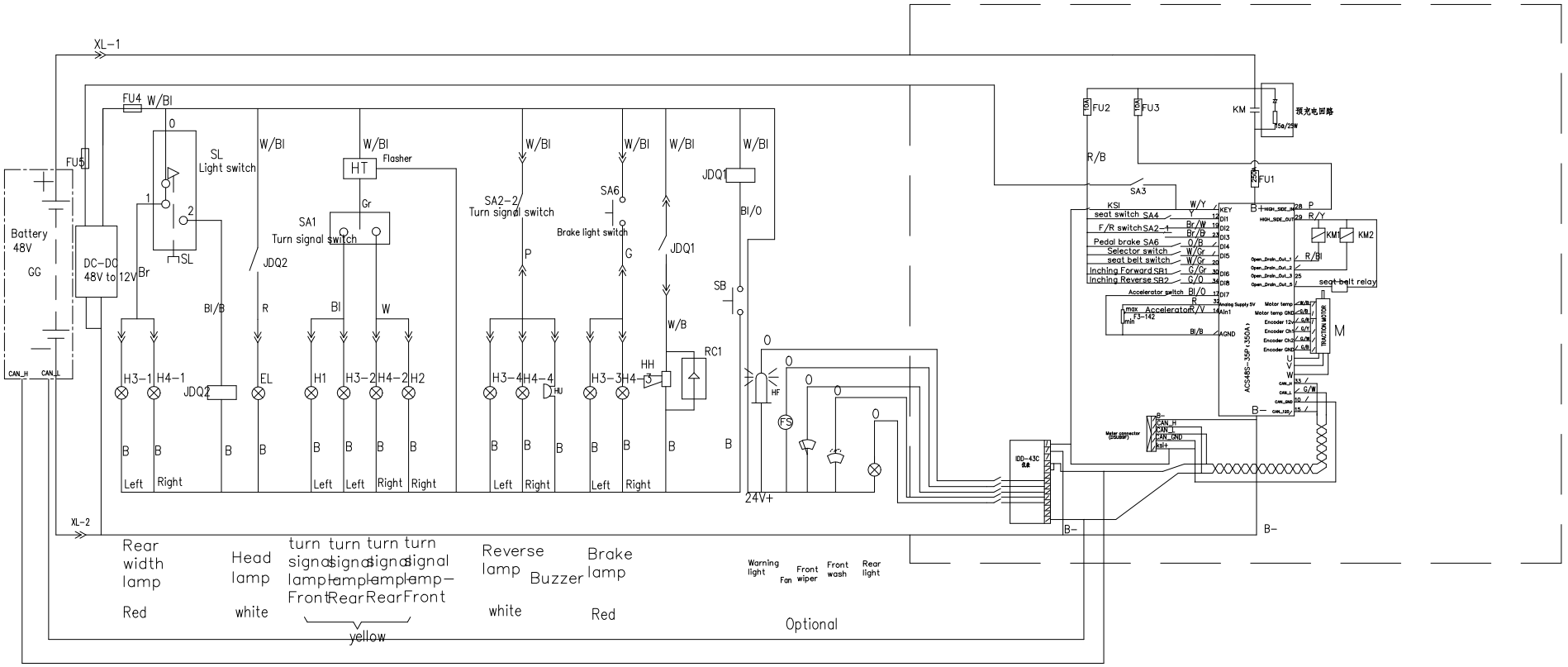
QSD120/150/180-XC1-MI Electrical system schematic diagram



QSD120/150/180-XC1-M Electrical system schematic diagram



QSD60/80-XD3-M、QSD100-XXD3-MI Electrical system schematic diagram



QSD60/80-XD3-M、QSD100-XXD3-M Electrical system schematic diagram

Maintenance record

Date	Maintenance content	Maintainer

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