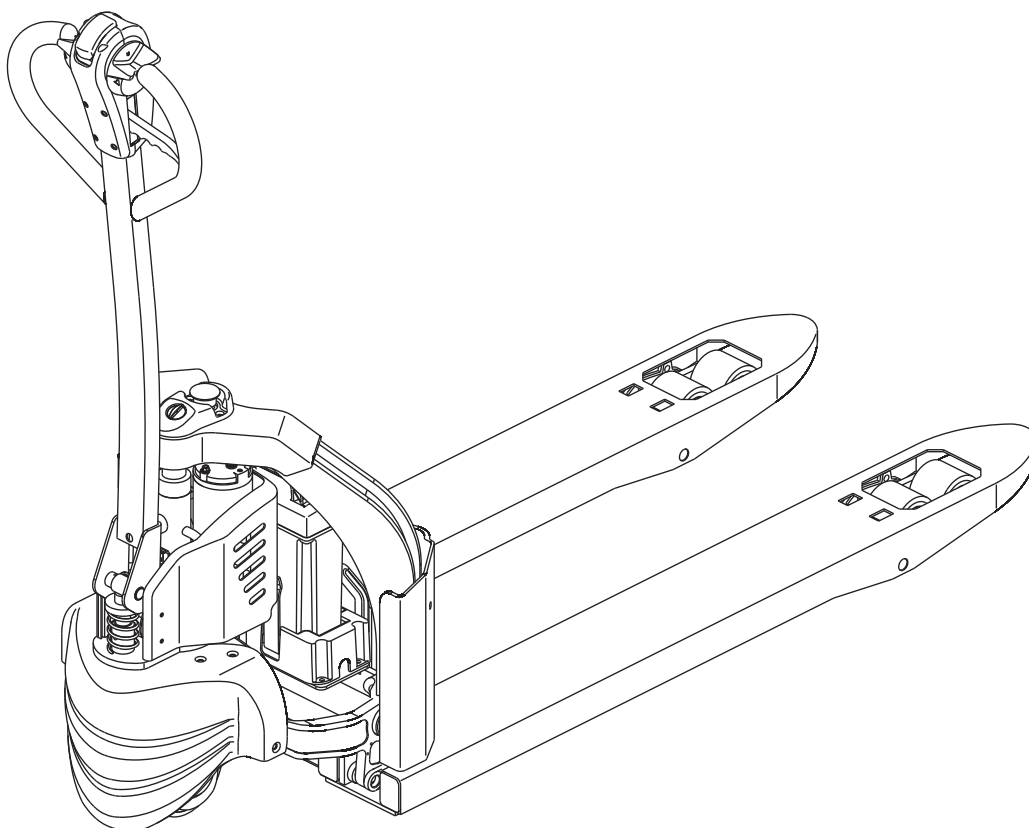




Service Manual

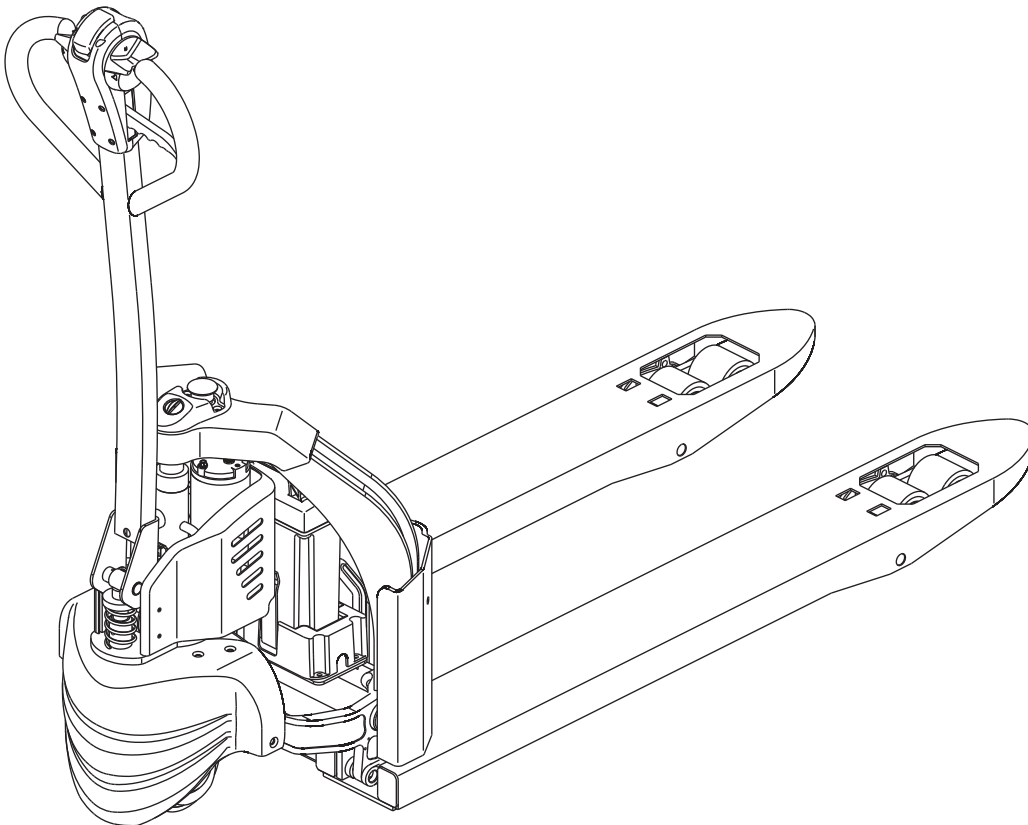
EPT12-EZ
Electric Pallet Truck





Service Manual

EPT12-EZ
Electric Pallet Truck



Release Date	Version No.	Changes (Serial number)
2016-09-27	SM-1113 09.16	New Version

- * If there are any changes, revised version will be published once every 12 months; if there is no change, please follow the most recent version.
- * Please refer to the corresponding version of the service manual against the purchase time of your vehicle.
- * If you need the latest versions of the manual, please contact our service department or dealer to obtain.

This manual applies to:

Model	Specifications
EPT12-EZ	1,200 kg Capacity

Some sections of the manual only involve certain model, please refer to the manual according to the actual configuration of the vehicle.

FOREWORD

This Service Manual can help readers learn more about the truck system components, maintenance and troubleshooting, and other related information. The operation and maintenance personnel must read this Manual carefully before using the product. And when vehicle is in use, be sure to follow the complete operation and maintenance information in this Manual for vehicle maintenance.

Before using, please check if the pages of the Manual are clear and complete, so as not to affect your normal use because of incomplete information. If the contents of the Manual have been illegible or damaged, which may affect reading, please contact our company or dealer for replacement.

With the constant update and improvement of our products, the equipment you are using may be slightly different from what has been described in this Manual, therefore, we must reserve the right to modify the appearance, configuration and technical specifications. If you have any questions, please contact our sales department or dealer.

Safety signs and instructions:



Please strictly adhere to these safety instructions to avoid personal injury.



Please pay attention to the important safety instructions.



Instructions.

Copyright

Copyright of Service Manual belongs to *EP Equipment Co., Ltd.*

EP Equipment Co., Ltd.

EP Industrial Park, Xiaquan Village,
Dipu Town, Anji County, Zhejiang Province

www.ep-zl.com

REV. SM-1113 09.16

TABLE OF CONTENTS

SECTION	PAGE
1. INFORMATION & SPECIFICATIONS	1
1.1 After-sales Service Platform	3
1.2 Introduction.....	4
1.3 Common Tools.....	5
1.4 General Tightening Torques	6
2. MAINTENANCE	9
2.1 Overview.....	11
2.2 Maintenance.....	12
2.2.1 Cleaning	12
2.2.2 Inspection	12
2.2.3 Lubrication	16
3. STRUCTURE & FUNCTIONS	19
3.1 Structure & Functions	21
3.1.1 Travel Switch	21
3.1.2 Lifting/Lowering Switch.....	21
3.1.3 Emergency Reverse Switch	21
3.1.4 Horn Switch	21
3.1.5 Instrument.....	22
3.1.6 Key Switch.....	22
3.1.7 Emergency Stop Switch	22
3.1.8 Charger.....	22
3.1.9 Buzzer	23
3.1.10 Controller	23
3.1.11 Lifting Limit Switch	23
3.1.12 Interlock Switch	23
3.1.13 Pump Motor	24
3.1.14 Gear Pump	24
3.1.15 Pump Contactor.....	24
3.1.16 Solenoid Valve.....	24
4. CHASSIS SYSTEM	25
4.1 Load Wheel	27
4.1.1 Removal and Installation	27
4.1.2 Faults and Causes.....	28
4.2 Cover	28
4.2.1 Removal and Installation	28
4.3 Lifting Mechanism.....	29
4.3.1 Fork Inspection	29

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION	PAGE
4.3.2 Connecting Rod Adjustment	29
4.3.3 Removal and Installation	30
5. DRIVE SYSTEM.....	31
5.1 Drive Assembly - A.....	33
5.1.1 Removal and Installation	34
5.2 Electromagnetic Brakes - A	35
5.2.1 Removal and Installation	35
5.2.2 Faults and Causes.....	36
5.2.3 Checking and Testing	36
5.2.4 Control Circuit Troubleshooting	37
5.3 Drive Wheel - A.....	38
5.3.1 Removal and Installation	38
5.3.2 Faults and Causes.....	38
5.4 Drive Motor - A.....	38
5.4.1 Removal and Installation	38
5.4.2 Faults and Causes.....	39
5.4.3 Checking and Testing	40
5.5 Gearbox - A.....	40
5.5.1 Removal and Installation	40
5.5.2 Faults and Causes.....	40
5.6 Drive Assembly - B	41
5.6.1 Removal and Installation	42
5.7 Electromagnetic Brakes - B.....	43
5.7.1 Removal and Installation	43
5.7.2 Faults and Causes.....	44
5.7.3 Checking and Testing	44
5.7.4 Control Circuit Troubleshooting	45
5.8 Drive Wheel - B	46
5.8.1 Removal and Installation	46
5.8.2 Faults and Causes.....	46
5.9 Drive Motor - B	47
5.9.1 Removal and Installation	47
5.9.2 Faults and Causes.....	47
5.9.3 Checking and Testing	48
5.10 Transmission Chain - B	49
5.10.1 Removal and Installation	49
5.10.2 Faults and Causes.....	49
6. OPERATING SYSTEM.....	51
6.1 Control Lever	53

TABLE OF CONTENTS

SECTION	PAGE
6.2 Button Switch.....	54
6.2.1 Removal and Installation	54
6.2.2 Faults and Causes.....	54
6.2.3 Checking and Testing	54
6.2.4 Control Circuit Troubleshooting	55
6.3 Travel Switch	57
6.3.1 Removal and Installation	57
6.3.2 Faults and Causes.....	57
6.3.3 Checking and Testing	57
6.3.4 Control Circuit Troubleshooting	57
7. HYDRAULIC SYSTEM.....	59
7.1 Overview.....	61
7.1.1 Hydraulic Schematic Diagram	62
7.2 Pump and Motor Assembly.....	63
7.2.1 Removal and Installation	63
7.2.2 Component.....	63
7.3 Pump Motor	64
7.3.1 Removal and Installation	64
7.3.2 Faults and Causes.....	65
7.3.3 Checking and Testing	65
7.4 Pump Contactor.....	66
7.4.1 Removal and Installation	66
7.4.2 Faults and Causes.....	67
7.4.3 Checking and Testing	67
7.4.4 Control Circuit Troubleshooting	68
7.5 Solenoid Valve(Electrical Lowering)	68
7.5.1 Faults and Causes.....	68
7.5.2 Checking and Testing	69
7.5.3 Control Circuit Troubleshooting	69
7.6 Reach Cylinder	70
7.6.1 Cylinder Removal Precautions	70
7.6.2 Cylinder Installation Precautions	71
7.6.3 Removal and Installation	71
7.7 Hydraulic Troubleshooting	73
7.8 Hydraulic Symbol.....	74
8. ELECTRICAL SYSTEM	75
8.1 Controller	77
8.1.1 Removal and Installation	77
8.1.2 Controller Interface Function	77

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION	PAGE
8.2 Key Switch.....	79
8.2.1 Removal and Installation	79
8.2.2 Faults and Causes.....	79
8.2.3 Checking and Testing	79
8.2.4 Control Circuit Troubleshooting	79
8.3 Emergency Stop Switch	80
8.3.1 Removal and Installation	80
8.3.2 Faults and Causes.....	80
8.3.3 Checking and Testing	80
8.3.4 Control Circuit Troubleshooting	80
8.4 Inductive Switch.....	81
8.4.1 Removal and Installation	81
8.4.2 Faults and Causes.....	81
8.4.3 Checking and Testing	82
8.4.4 Control Circuit Troubleshooting	82
8.5 Battery	83
8.5.1 Removal and Installation	83
8.5.2 Faults and Causes.....	84
8.5.3 Checking and Testing	84
8.5.4 Control Circuit Troubleshooting	84
8.6 Mini Instrument.....	85
8.6.1 Removal and Installation	85
8.6.2 Faults and Causes.....	85
8.6.3 Checking and Testing	85
8.6.4 Control Circuit Troubleshooting	85
8.6.5 Display.....	86
8.7 Handheld Unit (Optional).....	89
8.7.1 Handheld Unit Connection.....	89
8.7.2 Handheld Unit Main Menu	89
8.7.3 Monitor Menu.....	90
8.8 Controller Error Message	92
8.8.1 Traction Controller	92
8.9 Electrical Schematic Diagrams.....	96
8.10 Cable Wiring Diagrams.....	98
8.11 Wiring Harness and Connectors.....	99
9. TROUBLESHOOTING	101
9.1 Preparation Before Troubleshooting.....	103
9.1.1 Check the Voltage of Battery	103
9.2 Troubleshooting Solutions of Common Faults.....	104

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION	PAGE
APPENDIX	107
B SERVICE MANUAL - BATTERY	109
B1 Lead-acid Battery	111
B1-1 Safety and Warnings.....	111
B1-2 Use of Battery	111
B1-2.1 Pre-use Checks	111
B1-2.2 Discharging.....	111
B1-2.3 Charging	112
B1-2.4 Temperature.....	112
B1-3 Maintenance & Care	112
B1-3.1 Daily Maintenance	112
B1-3.2 Weekly Maintenance.....	112
B1-3.3 Monthly Maintenance.....	113
B1-3.4 Care	113
B1-4 Storage	114
B1-5 Troubleshooting	114
B2 Maintenance-free Battery	117
B2-1 Safety and Warnings.....	117
B2-2 Use of Battery	117
B2-2.1 Pre-use Checks	117
B2-2.2 Discharging.....	117
B2-2.3 Charging	118
B2-3 Maintenance & Care	118
B2 Lirhium-ion Battery	119
B2-1 Safety and Warnings.....	119
B2-2 Use of Battery	119
B2-2.1 Pre-use Checks	119
B2-2.2 Discharging.....	119
B2-2.3 Charging	120
B2-3 Maintenance & Care	120
C SCHEDULE	121

TABLE OF CONTENTS

SAFETY WARNING



For your own safety and that of others, please observe the following safety instructions:

Thorough and normative maintenance is one of the most important prerequisites to ensure stable and reliable operation of truck. Neglecting regular maintenance could easily lead to the truck malfunction and failure, and potential threats to staff and operational safety. Therefore, there must be adequate maintenance equipment, professional maintenance personnel and a comprehensive maintenance plan in place.

Please perform the maintenance and inspections according to the following provisions:

1. To strictly enforce the truck maintenance, lubrication and inspection plans.
2. Truck maintenance, lubrication and inspection personnel must be approved by accredited certification or evaluation agency.
3. The following operations shall be performed before you leave the truck:
 - No parking on slopes.
 - Fully lower the forks.
 - Cut off the power supply.
 - Turn the switch lock to “STOP” and remove the key.
4. Prior to truck maintenance:
 - Raise the drive wheel off the ground, or cut off the power supply connection.
 - Use wooden wedges or other effective fixtures.
 - When performing maintenance underneath the vehicle, make sure that the lifting device or jack leg is secure.
 - Park your vehicle in a safe and secure area.
5. Never use an open flame to check level of electrolyte, other oils or fluids for leaks.
6. Keep the parking lot clean, well-ventilated and dry.
7. Regular checks and maintenance should be conducted to braking, steering, control, warning and safety devices to keep them in good condition.
8. All nameplates and safety signs on the truck should be cleaned regularly to make them clearly visible.
9. Regular checks and maintenance should be conducted to all the devices of lifting system to ensure them to be safe for use.
10. The hydraulic system should be checked regularly based on usage. Hydraulic cylinders, hydraulic valves and other hydraulic components should be ensured to be without leakage.
11. Regular checks and maintenance should be conducted to batteries, motors, controllers, limit switches, protective devices, wires and connectors, and so on. Please pay particular attention to the electrical insulation.
12. Park the truck in a clean environment to minimize the risk of fire.
13. Without the permission of the manufacturer, users are not allowed to change or increase the capacity of the truck. After having been changed under permission, the nameplates and safety signs on the truck should also be changed accordingly.

1. INFORMATION & SPECIFICATIONS

1

LET'S GROW TOGETHER!



NOTE:

1.1 After-sales Service Platform

Claims/Replacement Parts Service Platform:

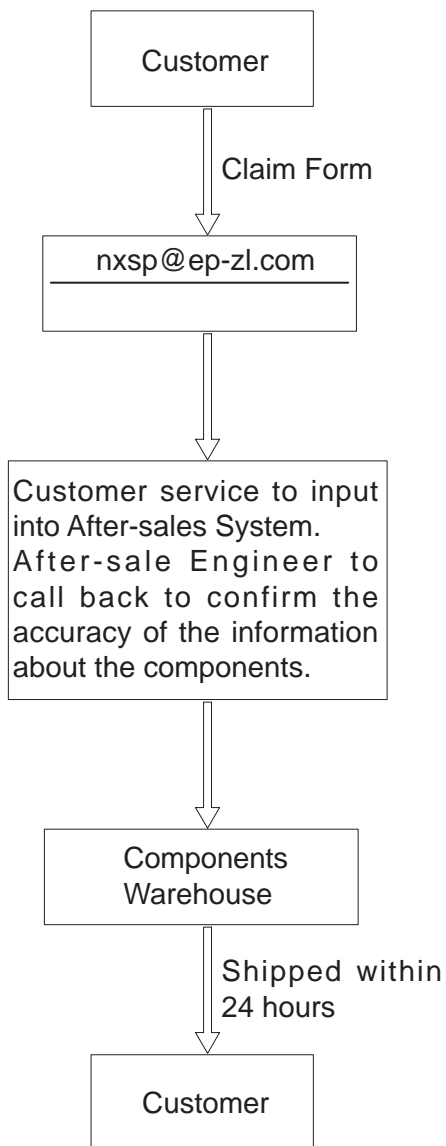


Figure 50004-1

After-sales Maintenance Service Platform:

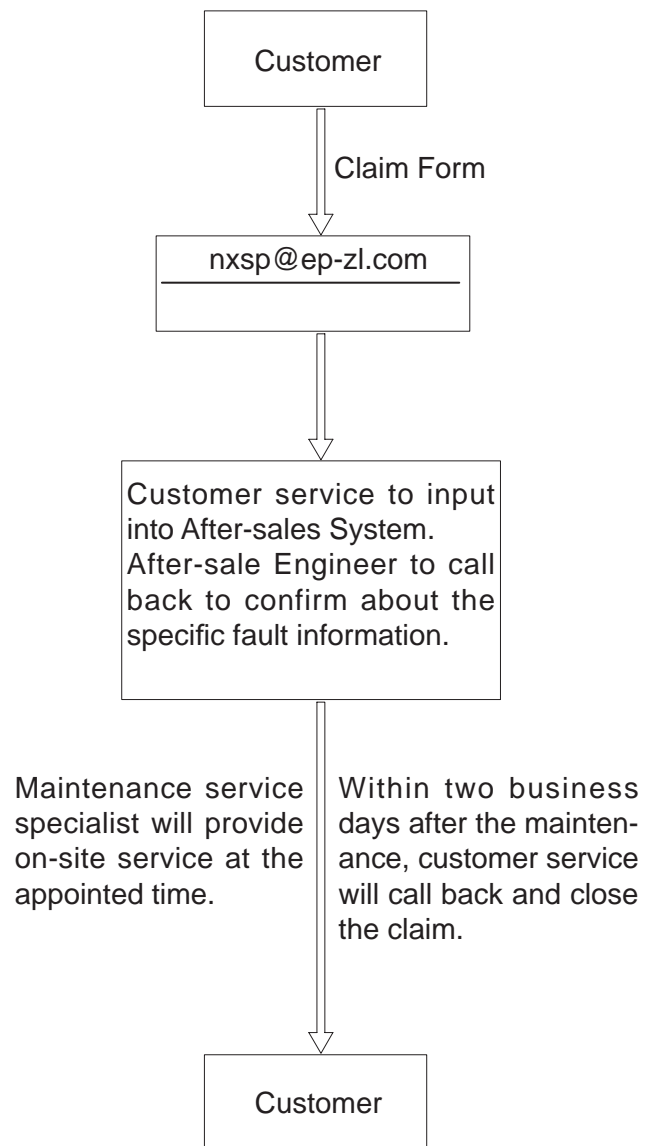


Figure 50005-1

i NOTE

In order to provide you with a fast and efficient after-sales service, when you claim / order spare parts or after-sales service upon maintenance, please provide accurate truck model, vehicle body serial number and part number.

INFORMATION & SPECIFICATIONS

1.2 Introduction

1

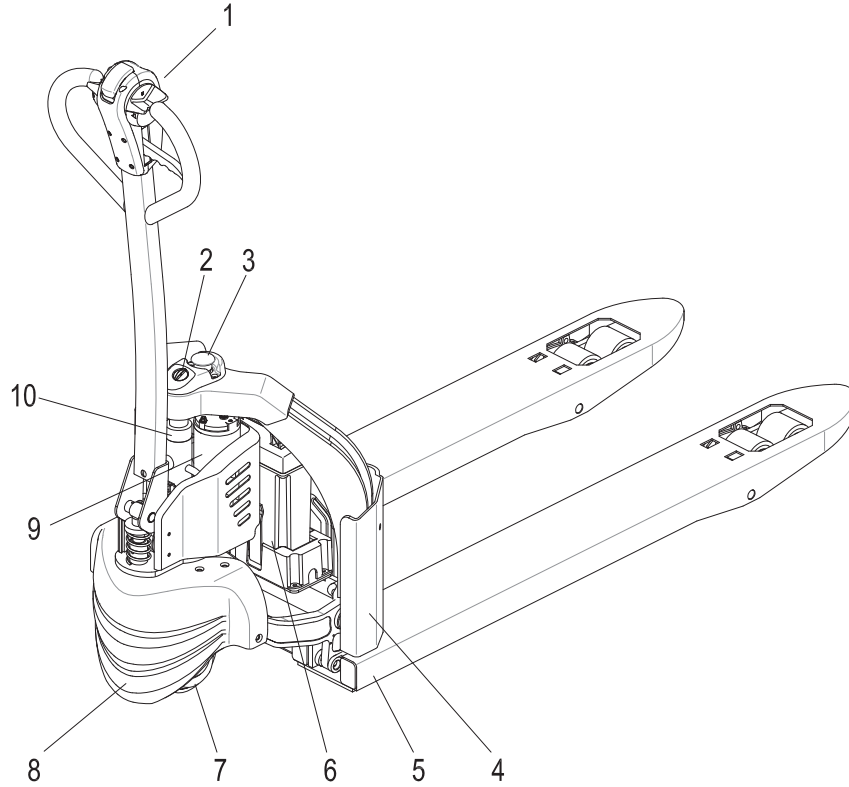


Figure 12001

No.	Name
1	Control Lever
2	Key Switch
3	Emergency Stop Switch
4	Front guard
5	Chassis

No.	Name
6	Battery
7	Drive Wheel
8	Drive Cover
9	Pump and Motor Assembly
10	Lift Cylinder

INFORMATION & SPECIFICATIONS

This series are electric pallet trucks. Its important structure is as shown in Figure 12001.

 **WARNING**

- Please refer to the nameplate for rated load capacity of the vehicle.
- The vehicle can only be used on the level ground indoors, never use it on mezzanine or balcony area.

 **WARNING**

Truck can only be operated by single operator; other personnel is forbidden from riding.

1.3 Common Tools





No.	Name	Remark
1	Hex Wrench	2#~6# One Set
2	Hex Head Socket Wrench	8#~19# One Set
3	Phillips Screwdriver	2# One Piece
4	Slotted Screwdriver	2# One Piece
5	Circlip Pliers	One for holes and one for shaft
6	Hammer	One Piece
7	Spreader, Crane	One Pair
8	Diagonal Pliers	One Piece
9	Grease Gun	One Piece
10	Tiger Tooth Wrench	22#/27# One of Each

INFORMATION & SPECIFICATIONS

1.4 General Tightening Torques

1
Screws or bolts used on the truck are of 8.8 grade or higher performance level.

When you are conducting truck maintenance, you can refer to Table 1.4.1 and Table 1.4.2 to select the suitable screws or bolts for replacement.

Performance Level		Material	Specification (mm)
	5.8 grade	Low carbon steel	M6 ~ M48
	8.8 grade	Quenched and tempered medium carbon steel	M6 ~ M48
	10.9 grade	Quenched and tempered medium carbon alloy steel	M6 ~ M48
	12.9 grade	Quenched and tempered medium carbon alloy steel	M6 ~ M48



CAUTION

- *The performance levels of screws or bolts are marked on the heads of the screws or bolts.*
- *If you find the screws or bolts used on certain position are not marked with performance level, please select spare parts with performance level of at least 8.8 grade or higher level for replacement.*

INFORMATION & SPECIFICATIONS

1

Table 1.4.2 Metric Screws/Bolts Tightening Torque Table (n•m)

Nominal Diameter (mm)	Performance Level			
	5.8	8.8	10.9	12.9
	Proof Stress (MPa)			
	380	600	830	970
M6	7~8	10~12	14~17	17~20
M8	16~18	25~30	34~41	41~48
M8x1	17~20	27~32	37~43	43~52
M10	31~36	49~59	68~81	81~96
M10x1	35~41	55~66	76~90	90~106
M12	55~64	86~103	119~141	141~167
M12x1.5	57~67	90~108	124~147	147~174
M14	87~103	137~164	189~224	224~265
M14x1.5	144~170	149~179	206~243	243~289
M16	136~160	214~256	295~350	350~414
M16x1.5	144~170	228~273	314~372	372~441
M18	186~219	294~353	406~481	481~570
M18x1.5	210~247	331~397	457~541	541~641
M20	264~312	417~500	576~683	683~808
M20x1.5	294~345	463~555	640~758	758~897
M22	360~431	568~680	786~941	918~1099
M22x1.5	395~473	624~747	803~1034	1009~1208
M24	457~547	722~864	998~1195	1167~1397
M24x2	497~595	785~940	1086~1300	1269~1520
M27	669~801	1056~1264	1461~1749	1707~2044
M27x2	723~865	1141~1366	1578~1890	1845~2208
M30	908~1087	1437~1717	1984~2375	2318~2775
M30x2	1005~1203	1587~1900	2196~2629	2566~3072
M36	1587~1900	2506~3000	3466~4150	4051~4850
M36x3	1680~2011	2653~3176	3670~4394	4289~5135
M42	2538~3039	4088~4798	5544~6637	6479~7757
M42x3	2731~3269	4312~5162	5965~7141	6921~8345
M48	3813~4564	6020~7207	8327~9969	9732~11651
M48x3	4152~4970	6556~7848	9069~10857	10598~12688

INFORMATION & SPECIFICATIONS

1

2. MAINTENANCE

2

LET'S GROW TOGETHER!



NOTE:

2.1 Overview

Only by performing regular vehicle maintenance and repair, can ensure the continuous and reliable use of the truck.

Only specially trained and qualified personnel are capable of maintenance and repair operations of the equipment. If you want to perform the maintenance and repair on your own, it is recommended that on-site training should be conducted to your maintenance personnel by the service representative of the vendor.

Working conditions:

- Truck must be parked on the level ground reserved for maintenance (such area needs to be clean and with less dust), block the wheels with wooden wedges, disconnect the key switch and disconnect the battery connections.
- When lifting the truck, the lifting tools can only be installed on the fixed positions as specified.
- When jacking up the truck, appropriate tools, such as wedge blocks, wooden blocks, and so on, must be used to secure the truck to prevent the occurrence of accidental rolling or tipping over.



WARNING

When lifting load components or during the operations under the cabin, sufficiently strong chains or safety device must be used to secure the vehicle.



CAUTION

Without the supplier's consent, it is strictly forbidden to make modifications to truck, especially to the safety devices. It is strictly forbidden to change the various working speeds of the truck.



NOTE

- *Under harsh working conditions: such as, the external temperature is too high or too low, dusty, or implementing multiple shifts per day, the maintenance and care interval should be shortened.*
- *Prior to lubrications, replacement of filters or operating the hydraulic system, please clean the external parts carefully and use a clean container.*
- *Only compliant lubricants can be used See Table 2.2 Lubricants.*

MAINTENANCE

2.2 Maintenance

2.2.1 Cleaning

- Do not use flammable liquids to clean the truck.
- Before starting to clean, all necessary security measures must be taken to prevent sparking (short circuit) during operation. If the truck is powered by battery, battery plug must be pulled out.
- When cleaning electrical and electronic components, you should use low-intensity suction gas or compressed dry air. Meanwhile, clean the dust on the surface of components with non-conductive and antistatic brush.
- Do not use vapor steam to clean the equipment.

Regular inspection and maintenance under harsh conditions of use:

Under harsh working conditions, especially:

- Dusty environment
- Corrosive environment
- Cold storage environment

The maintenance intervals should be shortened by half.

2.2.2 Inspection

Regular inspection and maintenance under normal conditions of use:

Operating Hours (h)	Requirements
50	At least once per 7 days
250	At least once per 60 days
500	At least once per 90 days
1000	At least once every 6 months
2000	At least once per year



CAUTION

When the truck is at running-in phase (after approximately 100 hours of operation), the equipment user must check the fastening of wheel nuts and bolts and re-tighten them if necessary.

Table 2.1 Inspection & Maintenance List					
Interval in days/months/years	7 d	60 d	90 d	6 m	1y
Interval in hours	50	250	500	1000	2000
Functions and Control					
Check the functions of the operation switches and display	A				
Check alarm system functions	A				
Check interlock switch functions	A				
Check the emergency switch functions	A				
Check the cables for damage and if the terminals are secure		A			
Check the lifting limit switch functions	A				
Check and tighten the controllers and contactors					A
Check fault information records and operating hours				A	
Power Supply & Drive System					
Check the battery cables for damage and replace if necessary				A	
Check the battery charge connector				A	
Check the battery and the battery holder for damage or liquid penetration		A			
Check the position of various bearings for noise					A
Clean or add the gear grease					A / L
Check the gearbox for abnormal noise or leaks				A	
Check and lubricate the bearings between drive motor and gearbox		A / L			
Check the drive wheel and load wheel for worn or damage	A				
Check the wheel bearings and fixation			A		
Check and lubricate the transmission chains		A / L			

A = Check / Adjust

Please refer to Inspection & Maintenance List for regular inspection and maintenance of the vehicles.

L = Lubrication

Under harsh conditions, the lubrication intervals should be shortened by half.

MAINTENANCE

Table 2.1 Inspection & Maintenance List (Continued)					
Interval in days/months/years	7 d	60 d	90 d	6 m	1y
Interval in hours	50	250	500	1000	2000
Power Supply & Drive System					
Check the bearing bridge for damage or crack			A		
Check the travel speed					A
Hydraulic System					
Check the functions of hydraulic system	A				
Check if the hoses, pipes and interfaces are fastened or sealed securely, and check if there is damage				A	
Check the cylinders for leaks				A	
Check the cylinders for damages and check the fixation					A
Check the valve body for leaks				A	
Check the hydraulic oil level				A	
Clean or replace the hydraulic oil	Replace after 100 hours of early operation. Then replace once every 2000 hours				
Check the relief pressure					A
Braking System					
Check the braking functions of electromagnetic brake	A				
Check the air gap of electromagnetic brake				A	
Check the installation and connection of electromagnetic brake					A
Check the braking distance of electromagnetic brake					A
Lifting Mechanism					
Check the connecting rod mechanism for wear or damage				A	
Check whether the pin shaft is fixed securely				A	

A = Check / Adjust

Please refer to Inspection & Maintenance List for regular inspection and maintenance of the vehicles.

L = Lubrication

Under harsh conditions, the lubrication intervals should be shortened by half.

Table 2.1 Inspection & Maintenance List (Continued)					
Interval in days/months/years	7 d	60 d	90 d	6 m	1y
Interval in hours	50	250	500	1000	2000
Lifting Mechanism					
Check and lubricate the moving parts of connecting rod mechanism		A/L			
Check the lifting and lowering speed					A
Other					
Check if the signs are clear and complete				A	
Check the chassis for cracks or damages					A
Check the connections of bolts and nuts			A		
Checking covering parts for damages				A	
Check if the optional features are functioning properly	A				

A = Check / Adjust

Please refer to Inspection & Maintenance List for regular inspection and maintenance of the vehicles.

L = Lubrication

Under harsh conditions, the lubrication intervals should be shortened by half.

MAINTENANCE

2.2.3 Lubrication

Please see Table 2.2 for the lubricants used in this truck.

Lubricant

- Improper operations may constitute hazards to the operator's health and life, as well as to the surrounding environment.
- When storing or adding lubricant, use clean containers. It is strictly forbidden to mix different types and specifications of lubricants with each other (except for those can be mixed under clear statement).

CAUTION

The use and disposal of lubricants must be carried out in strict accordance with the manufacturer's regulations.

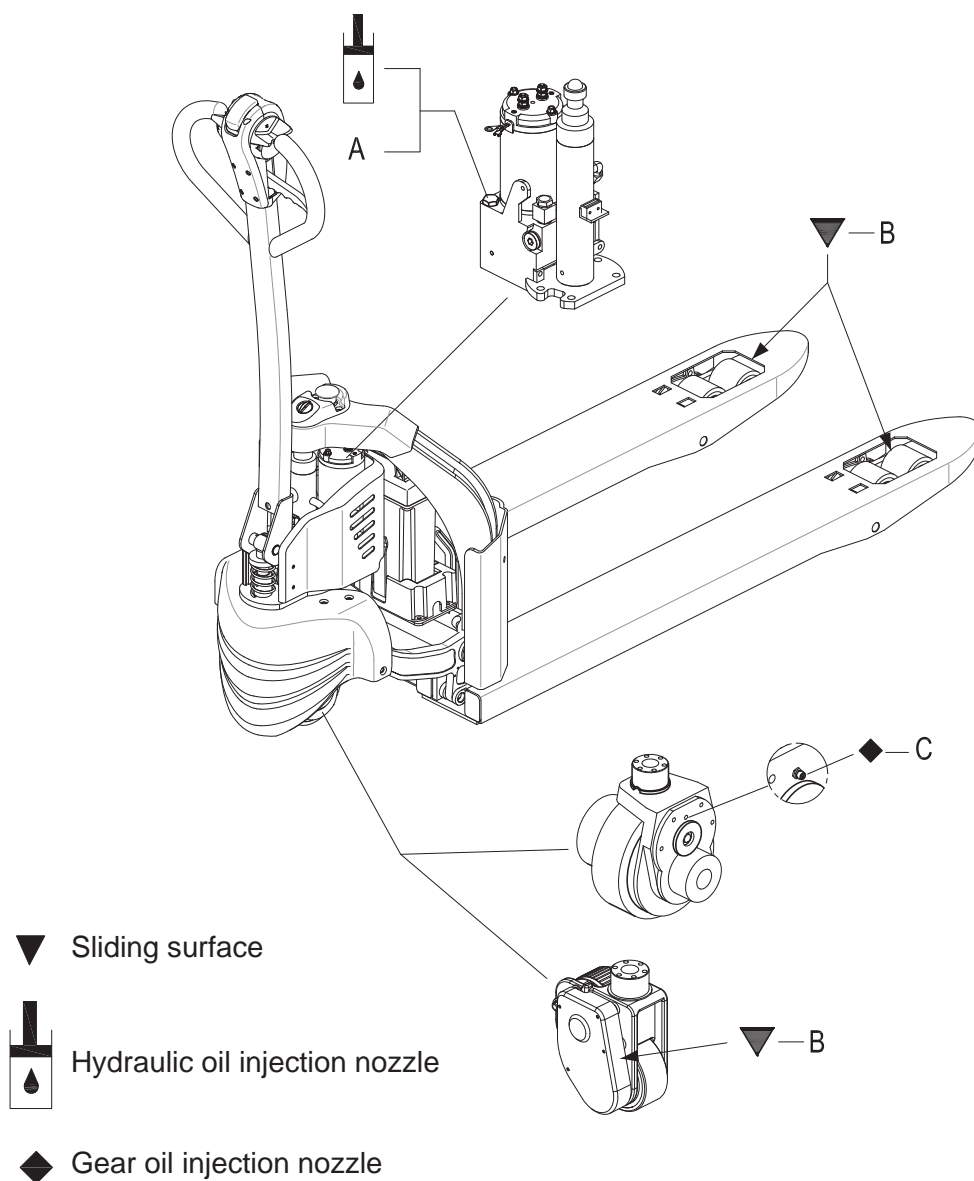


Figure 12002

Table 2.2 Lubricants

Code	Type	Specification	Amount	Position
A	Anti-wear hydraulic oil	L-HM46	0.16 ~ 0.18 L	Hydraulic System
	Low temperature anti-wear hydraulic oil (cold storage)	L-HV32		
B	Multi-purpose grease	Polylub GA352P	Appropriate amount	Sliding surface (See Table 2.3)
C	Grease (MoS ₂)	-	100 grams	Gearbox

Table 2.3 Sliding Surface Lubrication Table

Code	Position
L1	Steel Ball
L2	Steering Bearing
L3	Drive Wheel
*L3	Drive Wheel & Transmission Chains
L4	Load Wheel

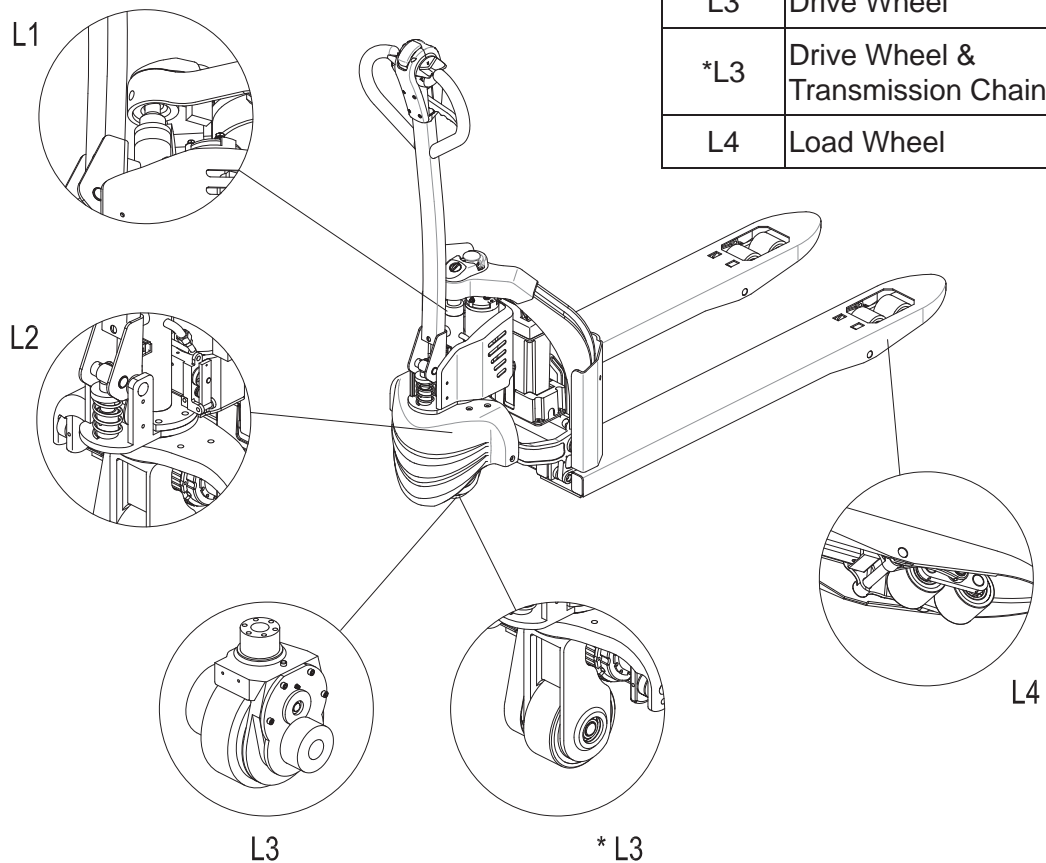


Figure 12003

MAINTENANCE

2

3. STRUCTURE & FUNCTIONS

3

LET'S GROW TOGETHER!



NOTE:

3.1 Structure & Functions

3.1.1 Travel Switch

Location: control lever;

Function: to output travel speed signal to the drive controller;

Description: when the vehicle is powered on, the travel switch is at Middle position;

Note: Unserviceable.



Travel Switch

3.1.2 Lifting/Lowering Switch

Location: control lever;

Function: to lift / lower the fork;

Description: the lifting/lowering switch is normally-open. When pressing, the switch is on; after release, the switch will automatically reset;

Note: Unserviceable.



Lifting/Lowering Switch

3.1.3 Emergency Reverse Switch

Location: control lever;

Function: press the switch, the vehicle will travel in reverse direction;

Description: reverse switch is normally-open. When pressing, the reverse switch is on; after release, the switch will automatically reset;

Note: Unserviceable.



Emergency Reverse Switch

3.1.4 Horn Switch

Location: control lever;

Function: to press the horn;

Description: the horn switch is normally-open. When pressing, the horn switch is on; after release, the switch will automatically reset;

Note: Unserviceable.



Horn Switch

STRUCTURE & FUNCTIONS

3.1.5 Instrument

Location: control lever;

Function: to display the battery power, working hours, fault information, and so on;

Description: 24V operating voltage;

Note: Unserviceable.



Instrument

3.1.6 Key Switch

Location: top of chassis;

Function: for operator to switch on or off the truck;

Description: remove the key to prevent operations to the truck by unauthorized operator;

Note: Unserviceable.



Key Switch

3.1.7 Emergency Stop Switch

Location: top of chassis;

Function: to disconnect the circuit and switch off all electrical functions, achieving emergency braking;

Description: under normal circumstances, switch cover is at high position, and the circuit is connected, when pressing this switch, the circuit is disconnected;

Note: Unserviceable.

Emergency Stop Switch



3.1.8 Charger

Location: charger holder;

Function: charge the battery;

Description: 100V~240V operating voltage,

Note: Unserviceable.



Charger

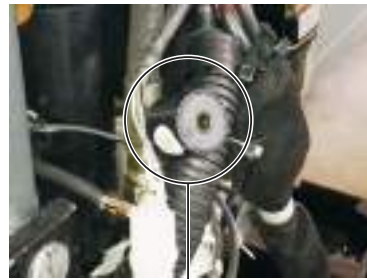
3.1.9 Buzzer

Location: left side of pump and motor assembly;

Function: can provide sound alarm through the operation to horn switch operation;

Description: 24V operating voltage;

Note: Unserviceable.



Buzzer

3.1.10 Controller

Location: on the valve body;

Function: to control the truck through the signal input ;

Description: 24V operating voltage, to control the circuit;

Note: Unserviceable.



Controller

3.1.11 Lifting Limit Switch

Location: chassis;

Function: limit the lifting height of the fork;

Description: lifting limit switch is normally opened. When the fork is lifted in higher position (that is to trigger the limit switch to disconnect), lifting will be limited;

Note: Unserviceable.



Lifting Limit Switch

3.1.12 Interlock Switch

Location: cylinder;

Function: the truck cannot be operated if the interlock switch is not closed;

Description: to prevent misuse of truck;

Note: Unserviceable.



Interlock Switch

STRUCTURE & FUNCTIONS

3.1.13 Pump Motor

Location: on the valve body;

Function: to provide power for gear pump for lifting the loading rack;

Description: upon receiving the signal input by control switch, traction controller to control the power transmission of pump motor;

Note: Unserviceable.



Pump Motor

Gear Pump

3.1.14 Gear Pump

Location: in the valve body;

Function: to provide pressure for hydraulic system of the entire vehicle;

Description: N/A;

Note: Unserviceable.

3.1.15 Pump Contactor

Location: on the valve body;

Function: to connect and disconnect circuit of pump motor, and to control the power transmission of pump motor;

Description: the signal obtained by drive controller from lifting switch controls the ON/OFF of pump contactor;

Note: Unserviceable.



Pump Contactor

Solenoid Valve

3.1.16 Solenoid Valve

Location: on valve body ;

Function: to realize the lowering of fork, controller gets signal from the lowering switch to control the absorption of solenoid valve, forming a hydraulic circuit;

Description: 24V operating voltage;

Note: Unserviceable.

4. CHASSIS SYSTEM

4

LET'S GROW TOGETHER!



NOTE:

4.1 Load Wheel

4.1.1 Removal and Installation

Removal

- Lift the forks of the vehicle carefully with lifting equipment;;



WARNING

Make sure the lifting equipment is solid and secure, and the load capacity should be greater than the total weight of the vehicle.

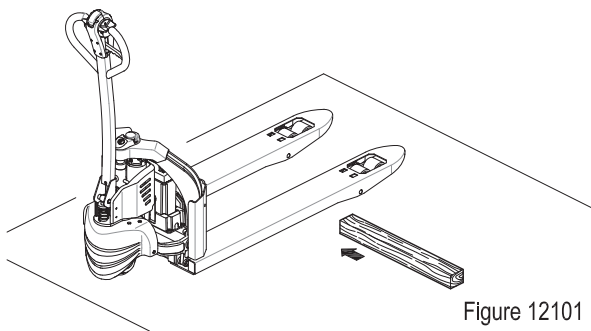


Figure 12101

- Place a wooden wedge under the chassis near load wheel, make the load wheel off the ground;



WARNING

When replacing wheels, be sure that the truck won't tilt.

Double Wheels (see Figure 12102)

- Remove the coiled elastic cylindrical pin (2) within the wheel bridge (1) with an ejector pin;
- Turn the wheel bridge to vertical direction, knock out the wheel pin shaft (3) from side, and remove the load wheel and bearing assembly;
- Remove the bearing (5) of load wheel (4) with hammer and jacking equipment.

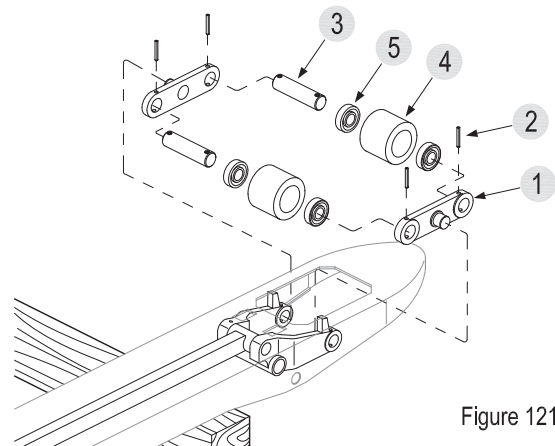


Figure 12102

Single Wheel (see Figure 12103)

- Remove the coiled elastic cylindrical pin (1) within the wheel bracket with an ejector pin;
- Knock out the wheel pin shaft (2) from side and remove load wheel and bearing assembly;
- Remove the bearing (3) of load wheel (4) with hammer and jacking equipment.

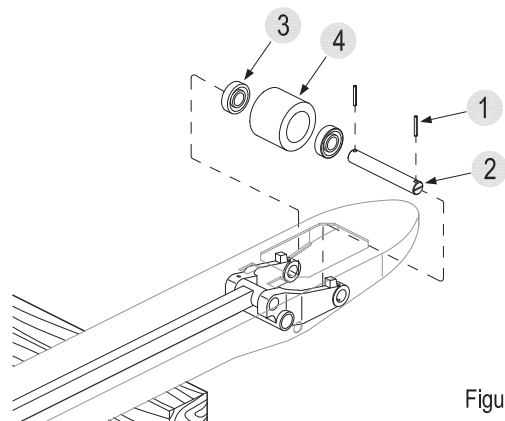


Figure 12103

Installation and Commissioning

- Install according to the reverse order of removal;
- Run the truck to see if the load wheel is functioning properly. If there is blocking or noise, please install again.

CHASSIS SYSTEM

CAUTION

When installing, please apply appropriate amount of grease on the axle first.
(See Section 2.2.3 for specifications)

Quality of tyres directly affects the stability and driving performance of the device.

If you need to replace the factory-fitted tyres, please use original spare parts provided by the equipment manufacturer to reach the original design performance of the truck.

4.1.2 Faults and Causes

1	Fault	Bearing noise or jammed
	Cause	Bearing fatigue damage or foreign
2	Fault	Abnormal tyre wear, cracking or degumming
	Cause	Improper use

4.2 Cover

4.2.1 Removal and Installation

Removal

- Unscrew the eight screws (1), remove the protective cover (2);
 - Unscrew the six screws (3), remove the drive cover (4);
- Unscrew the four screws (5), remove the front guard (6).

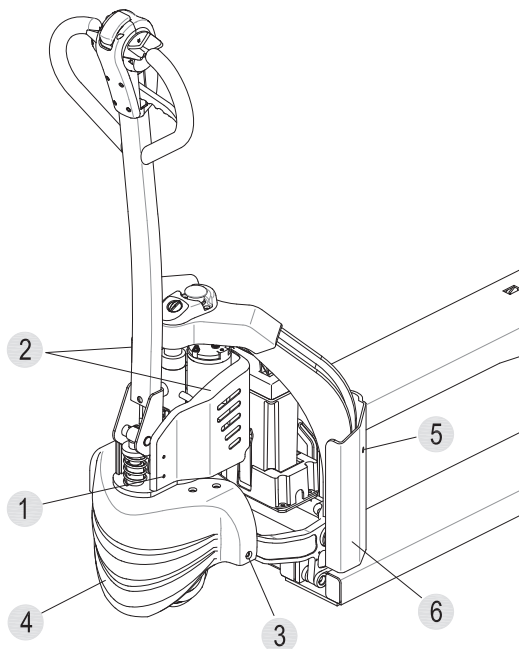


Figure 12104

Installation

- Install according to the reverse order of removal.

4.3 Lifting Mechanism

4.3.1 Fork Inspection

Lower the forks completely down:

The truck is equipped with batteries, the height from fork surface at center of load wheel to the ground (h1):

- Single Wheel : 80 mm
- Double Wheels : 80 mm

Lift the forks completely:

The truck is equipped with batteries, the height from fork surface at center of load wheel to the ground (h2):

- Single Wheel : 195 mm
- Double Wheels : 195 mm

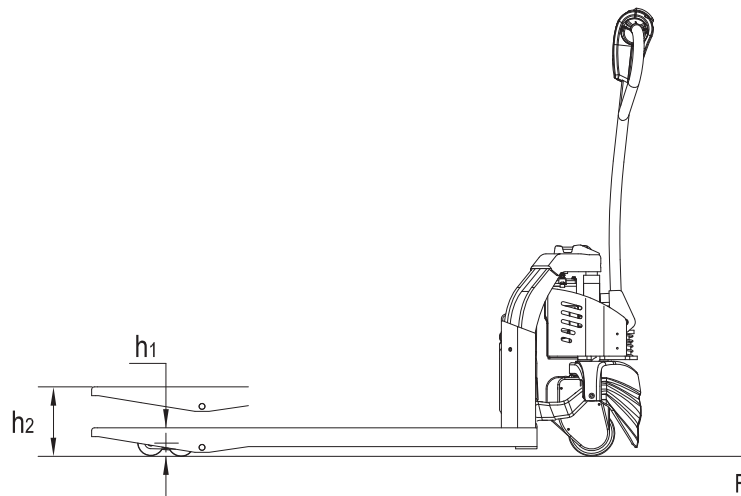


Figure 12105

4.3.2 Connecting Rod Adjustment

- Fully lower the forks and switch off the power supply;
- Tilt the vehicle to the left or right and support it with a block and other supporting stuff;
- Loosen the set screw (1) and adjust the relative distance between the screw head (3) and the connector (4);
- Turn the connector for 180° according to the arrow direction in the figure, the forks can then be lifted for 0.75 mm, whereas can be lowered for 0.75 mm;
- Adjust the fork surface distance to standard value, tighten the set screw (1).

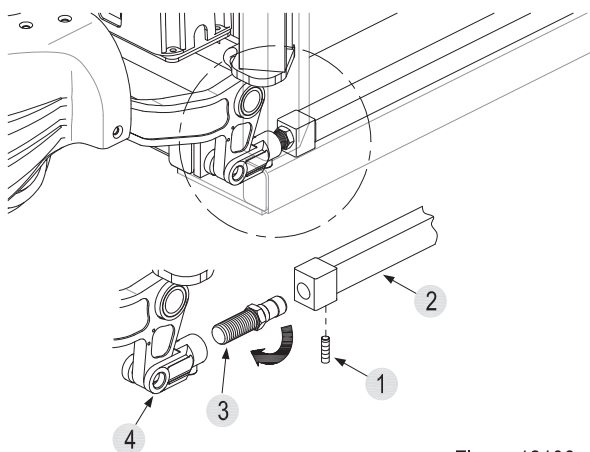


Figure 12106

CAUTION

Before unscrewing the set screw (1), mark the relative position of the long rod (2) and the threaded rod (3). So that after the adjustment is completed, the set screw can be accurately screwed into the long rod and threaded rod.

CHASSIS SYSTEM

4.3.3 Removal and Installation

Removal

- Fully lower the forks and switch off the power supply;
- Tilt the vehicle to the left or right and support it with a block and other supporting stuff;

- Tap the coiled elastic cylinder (8) out from the chassis, and tap the long axis (7) out from the side to separate the lower connecting rod (10) with the chassis.
- Tap the coiled elastic cylinder (3) out, tap the long connecting rod pin shaft (4) out from the side, and remove the wheel frame assembly (5).

CAUTION

When replacing the long connecting rod, the connecting rod must be adjusted so that the fork surface height can reach the specified value.

Installation

- Install according to the reverse order of removal.

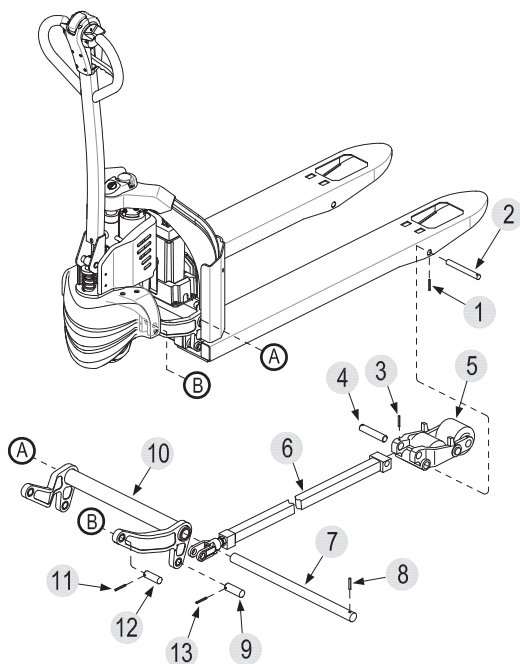


Figure 12107

CAUTION

Before going on with the next step, please fix the wheel bracket first. Be sure to avoid the falling of wheel bracket during removal, resulting in personal injury.

- Tap the coiled elastic cylinder (1) into the axle (2), and tap the axle (2) out from the side to separate the wheel frame from the front chassis;
- Remove the cover; (see Section 4.2)
- Tap the coiled elastic cylinder (11) out from the bearing bridge, and tap the short axis (12) out from the side to separate the lower connecting rod (10) with the bearing bridge;
- Tap the coiled elastic cylinder (13) out from the long connecting rod (6) , and tap the short axis (9) out from the side to separate the lower connecting rod (10) with the long connecting rod (6) ;

5. DRIVE SYSTEM

5

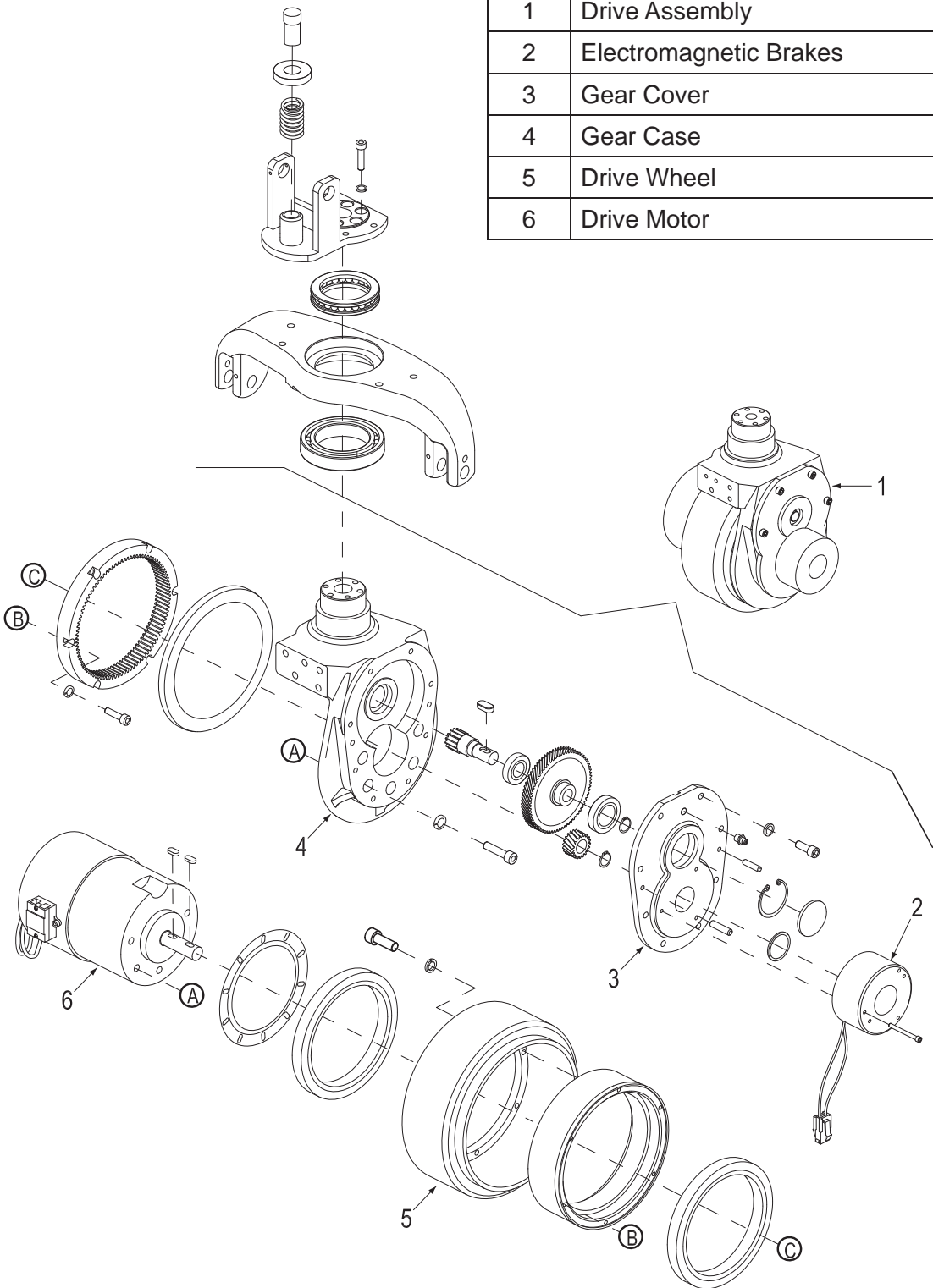
LET'S GROW TOGETHER!



NOTE:

5.1 Drive Assembly - A

No.	Name
1	Drive Assembly
2	Electromagnetic Brakes
3	Gear Cover
4	Gear Case
5	Drive Wheel
6	Drive Motor



5

Figure 12201

DRIVE SYSTEM

5.1.1 Removal and Installation

Removal

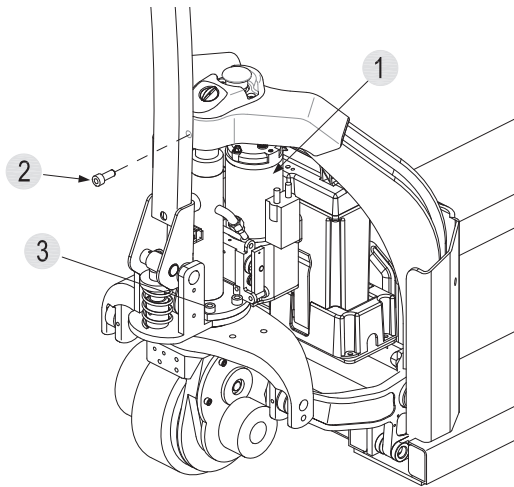


Figure 12202

- Unscrew the fastening screw (2) and four mounting screws (3) with a wrench and remove the integral hydraulic station assembly (1) from the vehicle;
- Unscrew the four screws (5) with a wrench, and remove the handle assembly (4) off from the drive assembly (7);
- Knock the drive assembly (7) down with a hammer to remove it from the bearing bridge (6).



When removal and installation, be sure to protect the wire harness cable from being damaged.

Installation

- Install according to the reverse order of removal.

- 5**
- Remove the cover (see Section 4.2);
 - Disconnecting the connection between the elbow wire harness and main harness; remove the wire rope on the manual valve of hydraulic station (1) (for manual lowering models);
 - Remove the cable between the drive motor and the controller;

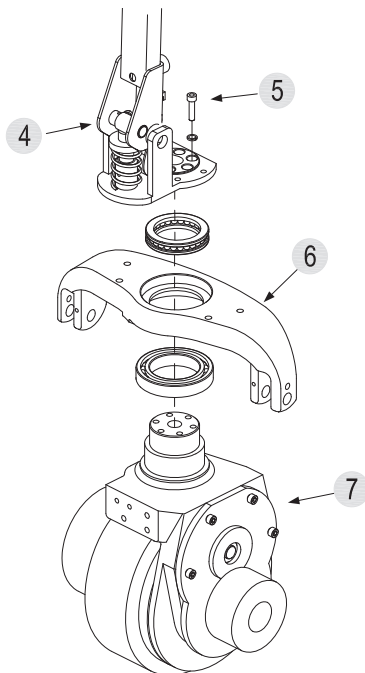


Figure 12203

5.2 Electromagnetic Brakes - A

The truck is braked through electromagnetic brake. When the truck is powered off, the electromagnetic coil (6) doesn't absorb the pressure plate (8), the friction force generated between brake pads (2), pressure plate and friction plates (5) will prevent the drive motor from rotating, thus to brake the vehicle.

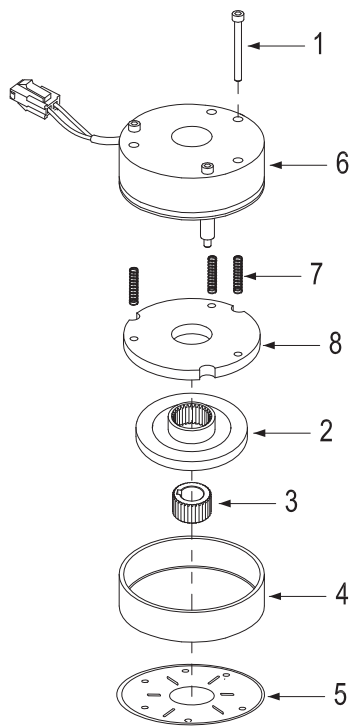


Figure 30203

No.	Name
1	Mounting screws
2	Brake pads
3	Brake gear
4	Dust cover
5	Friction plate
6	Electromagnetic coil
7	Spring
8	Pressure plate

5.2.1 Removal and Installation

Removal

The brake is installed on the drive motor. See Figure 30204

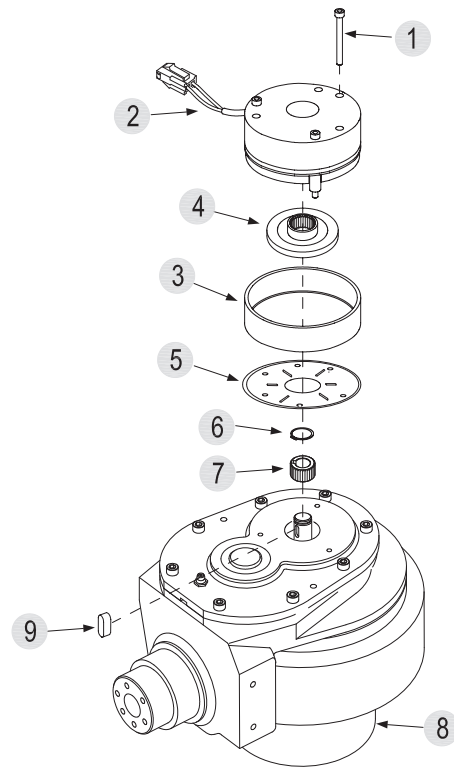


Figure 30204

- Switch off the truck power connections and pull out the brake connectors;
- Remove the drive cover;(see Section 4.2)
- Remove the three mounting screws (1) with wrench. Remove the electromagnetic coil (2) and dust cover (3);
- Remove the brake pads (4) and friction plates (5) by order;
- Remove the circlip (6) on the shaft with circlip pliers and remove the brake gear (7).

Installation

- Install according to the reverse order of removal.

DRIVE SYSTEM

CAUTION

When installing the brake gear (7), make sure the flat key is installed on the shaft of drive motor (8).

Adjustment

The electromagnetic brake used in this series of truck is an air gap adjustment-free brake. After the normal installation is completed, the air gap between electromagnetic coils and pressure plate should be standard gap distance.

As shown in the following table:

Air gap	Standard value	Maximum value
s	0.2 mm	0.4 mm

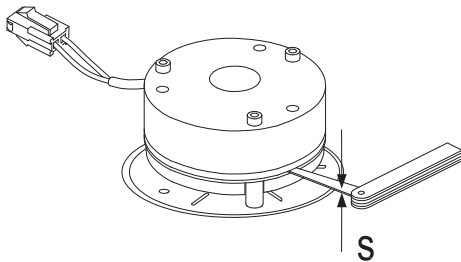


Figure 30205

CAUTION

When the air gap s exceeds 0.4mm, replace the brake pads (2, Figure 30203)

5.2.2 Faults and Causes

1	Fault	After the coil is energized, the pressure plate does not absorb
	Cause	a. Mechanical part failure; b. Foreign body blocking; c. Coil failure; d. Coil supply voltage less than 24V

2	Fault	After the coil is powered off, the pressure plate won't release
	Cause	Foreign body blocking
3	Fault	Abnormal noise after absorption
	Cause	a. Fully absorbed, but plate not flat. b. Mechanical resistance
4	Fault	Brake temperature is too high
	Cause	Pressure plate does not fully absorb, overcurrent of the coil, or energized too frequently

5.2.3 Checking and Testing

Electromagnetic Coil Checks

- Switch off the truck power connections and pull out the brake connectors;
- Check the resistance of the coil with a multimeter: measurement method is as shown in Figure 30206;

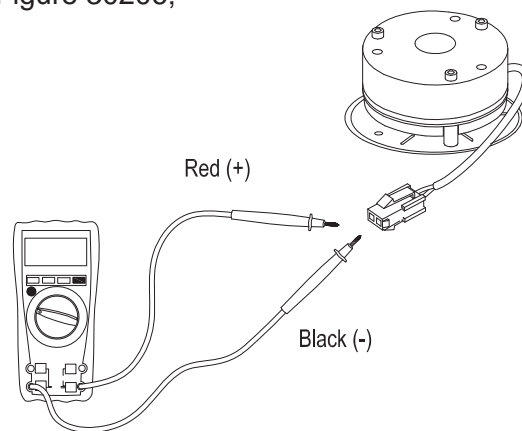


Figure 30206

- Identify if the electromagnetic coil is normal according to the readings of resistance on the multimeter. As shown in the following table:

Resistance Measurement	Judgment
Approx. 30 Ω	Normal
0 Ω	Coil shorting (replace the brake)
∞ Ω	Coil breaking (replace the brake)

Air Gap Checks

- Switch off the truck power connections and pull out the brake connectors;
- Check the air gap between electromagnetic coil and pressure plate with feeler gauge: measurement method is as shown in Figure 50208;
- Determine if the air gap is normal according to the gauge measurements.
As shown in the following table:

Air gap distance	Judgment
0.2~0.4mm	Normal
> 0.4mm	The air gap is too large (replace brake pads)

i NOTE

After a period of use, brake pads of the electromagnetic brake will wear. After being worn too much, the air gap between electromagnetic coil and pressure plate may exceed the predetermined maximum value, which may cause electromagnetic absorption failure.

Foreign Body Checks

Foreign bodies stuck in the brake may affect the normal absorption of pressure plates.

Check if there is foreign body in the air gap that may affect the absorption or bouncing off of the pressure plates.

Spring Checks

Deformation or foreign bodies stuck in the spring may affect the normal absorption of pressure plates.

Check if the distribution of the springs on the electromagnetic coil is correct, and check if there is foreign body in the spring hole.

i NOTE

After a period of time of use, the springs may be deformed due to the effect of radial force, such case may result in abnormal air gap of the brake, and the spring must be replaced.

5.2.4 Control Circuit Troubleshooting

Brake Control Circuit (Figure 12213)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF;
- Check if red circuit (circuit between brake and controller) is conducted;
- Check if black circuit (circuit between brake and controller) is conducted;

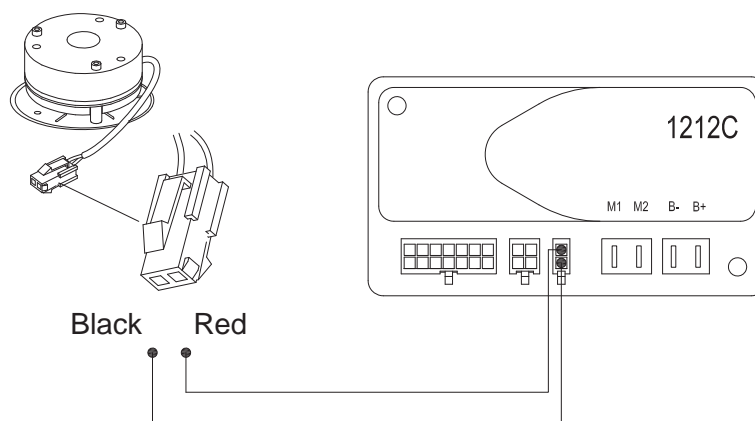


Figure 12213

DRIVE SYSTEM

5.3 Drive Wheel - A

5.3.1 Removal and Installation

- Dismantle the motor cable mounting base (1), and remove the motor cables (2);
- Loosen the six screws (3) with a wrench, and knock out the drive wheel (4) from the drive assembly (5);
- Install according to the reverse order of removal.

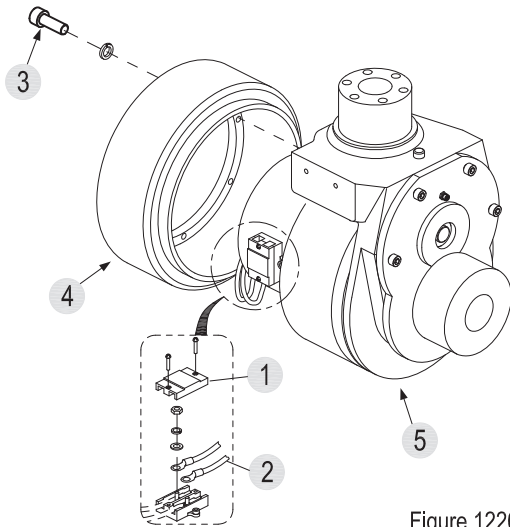


Figure 12204

CAUTION

Tyre wear can affect the stability of the truck, adjust the caster with minor wear on a regular basis, or replace the caster with heavy wear.

Quality of tyres directly affects the stability and driving performance of the device. If you need to replace the factory-fitted tyres, please use original spare parts provided by the equipment manufacturer to reach the original design performance of the truck.

5.3.2 Faults and Causes

1	Fault	Drive wheel slipping or jumping
	Cause	Wear
2	Fault	Drive wheel cracking or degumming
	Cause	Improper use
3	Fault	Vehicle sways while running
	Cause	Drive wheel lock nut loosening

5.4 Drive Motor - A

This truck obtains drive force through DC motor.

5.4.1 Removal and Installation

Drive Motor

Removal

- Remove the drive wheel; (see Section 5.3.1)
- Remove the brake; (see Section 5.2.1)
- Loosen the eight screws (3) with a wrench, and remove the gearbox cover (4) and gear set (5);
- Unscrew the five screws (6) and knock out the assembly (7) from the gearbox ;

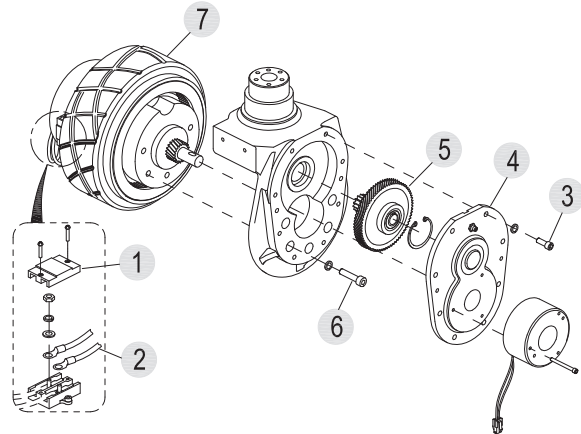


Figure 30208

(See Figure12205)

- Knock out the drive motor (13), and remove the oil seal (8);

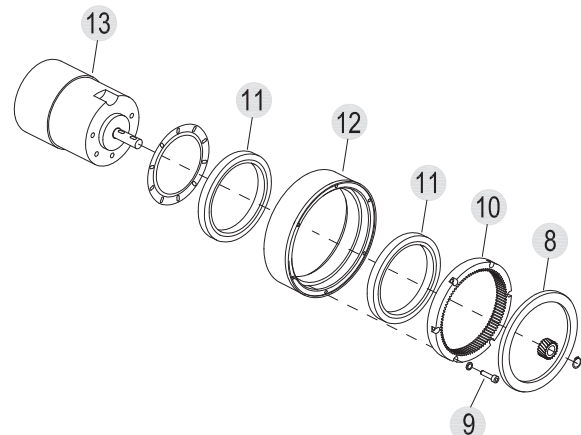


Figure 12205

- Loosen the six screws (9) with a wrench, and dismantle the large ring gear (10), bearing (11) and inner wheel (12) by order.

Carbon Brush

- Unscrew the three screws (1) and remove motor end cover (2) ;
- Unscrew the two screws (5) and remove the carbon brush (7) on the holder (6).
- Install according to the reverse order of removal.

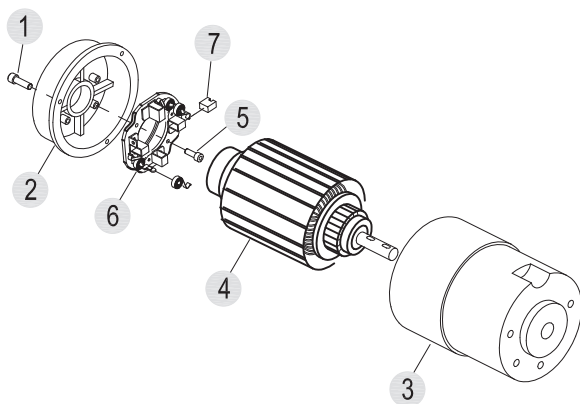


Figure 30210

CAUTION

When replacing the carbon brush, replace the complete set of carbon brushes.

WARNING

Due to magnetic force, the rotor and the stator may pull each other, therefore, when dismantling motor rotor, do not hold your hand between the rotor and the stator to avoid pinch hazard!

Adjustment

- After replacing the motor or carbon brush, conduction test must be carried out to the motor (see Section 5.4.3).
- After replacing carbon brush, running operation must be carried out to the carbon brush: By running the motor with repeated lifting, letting the carbon brush to be fully running, making its surface smooth to fit the rotor.

5.4.2 Faults and Causes

1	Fault	Motor does not rotate
	Cause	a. Negative electrode cable broken; b. Motor positive and negative electrode with loose terminals; c. Armature winding with broken circuits; d. Motor bearing damaged and blocked; e. Serious wearing of carbon brush.
2	Fault	Motor speed is turning slow
	Cause	a. Insufficient voltage of battery; b. Carbon brush worn or carbon brush spring pressure decreases; c. Bearing wear or lack of lubricating oil; d. Armature winding has short circuit elements; e. Carbon brush winding grounded.
3	Fault	Motor sometimes can start, sometimes cannot
	Cause	a. Motor positive and negative electrode with loose terminals and poor connection; b. Carbon brush wear and tear; c. Armature winding has circuit broken unit.
4	Fault	Motor with abnormal noise or vibration
	Cause	a. Uneven clearance between stator and rotor; b. Bearing failures; c. Loosening fixing screws on motor housing.
5	Fault	Motor smoking or burning smell
	Cause	Stator winding short circuit, motor burnt

DRIVE SYSTEM

6	Fault	Excessive temperature rise
	Cause	a. Stator winding short circuit; b. Motor positive and negative electrodes with surface oxidation, resistance increases and results in heating; c. Bearing failure, resulting in severe heating.

5.4.3 Checking and Testing

Checking

- Check if the drive motor and appearance of cables are in good condition, and if the plug connection is secure;
- Check if the circuit is connected.

Testing

- Remove the cables on the drive motor;
- Carry out ON/OFF test to motor positive and negative electrodes with a multimeter:
 - If connected, the motor is normal;
 - If not connected:
 - 1) Broken circuits in rotor coils (replace the motor);
 - 2) Carbon brush wearing, move on to the next step.
- Replace the carbon brush .
(See Section 5.4.1)

CAUTION

When replacing the carbon brush, replace the complete set of carbon brushes.

Circuit of drive motor

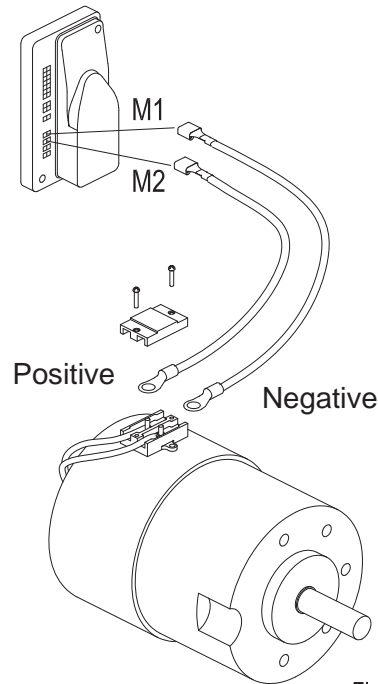


Figure 30211

5.5 Gearbox - A

5.5.1 Removal and Installation

See Section 5.4.1 .

CAUTION

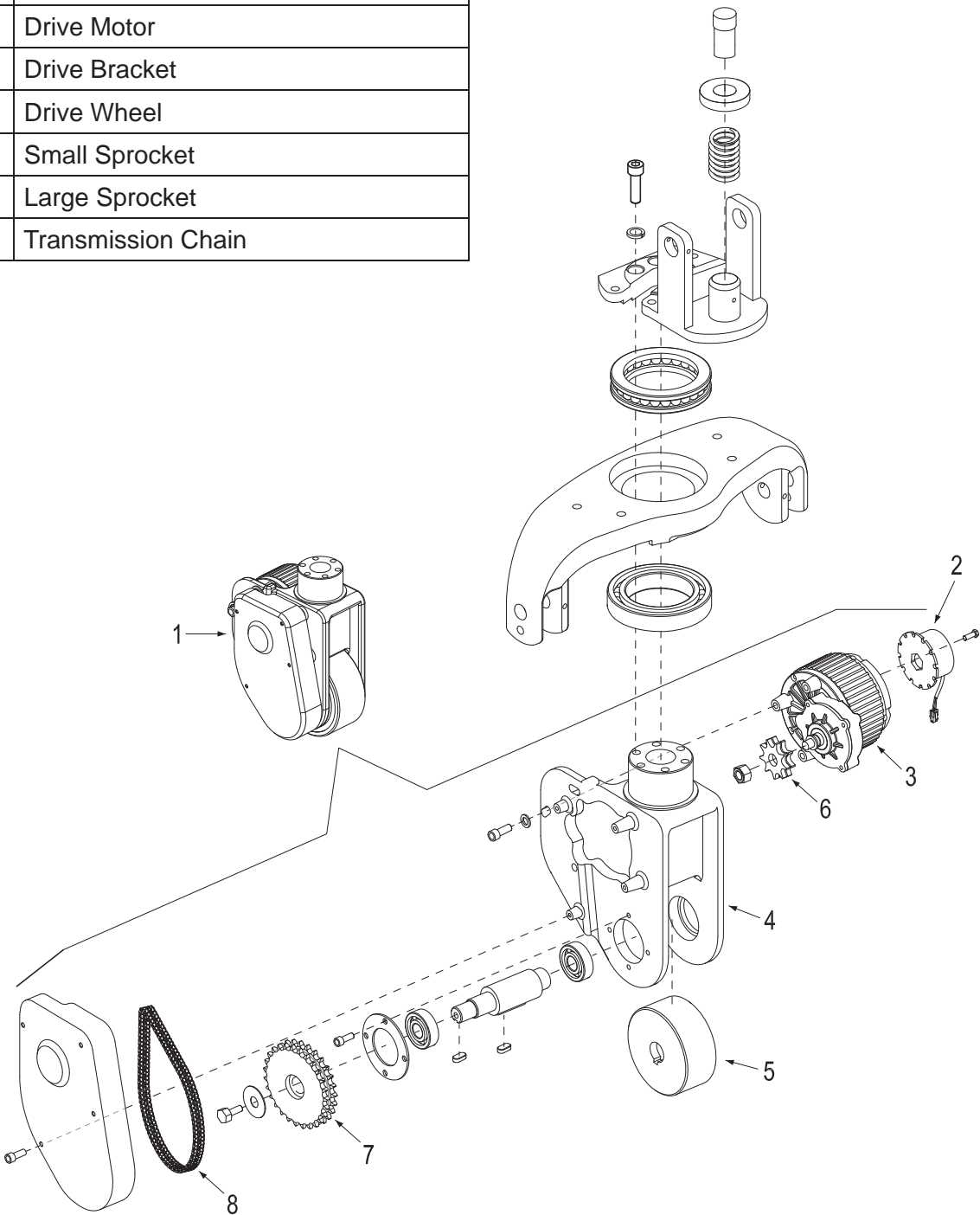
Please add gear oil to the grease nipple on the gearbox cover (see Section 2.2.3 for specification and filling amount)

5.5.2 Faults and Causes

1	Fault	Gearbox Abnormal Noise
	Cause	a. Supporting bearing wear; b. Gear wear, the gap is too big; c. Foreign objects in gear oil.
2	Fault	Gearbox Oil Leaks
	Cause	Oil seal wear or aged
3	Fault	Gearbox Stuck
	Cause	a. Gear fastening screws or nuts loosening; b. Support bearing damage c. Foreign objects in gear oil.

5.6 Drive Assembly - B

No.	Name
1	Drive Assembly
2	Electromagnetic Brakes
3	Drive Motor
4	Drive Bracket
5	Drive Wheel
6	Small Sprocket
7	Large Sprocket
8	Transmission Chain



5

Figure 12206

DRIVE SYSTEM

5.6.1 Removal and Installation

Removal

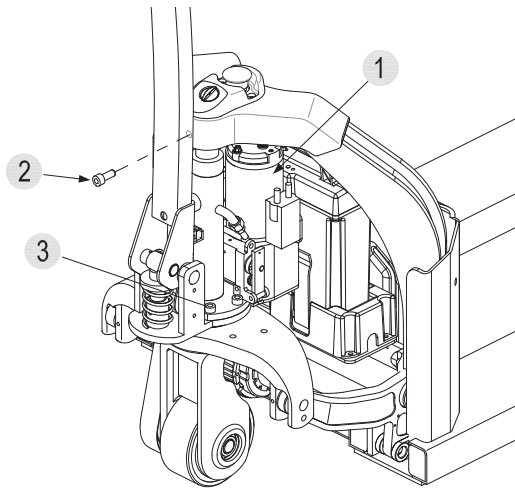


Figure 12207

- Remove the cover (see Section 4.2);
- Disconnecting the connection between the elbow wire harness and main harness; remove the wire rope on the manual valve of hydraulic station (1) (for manual lowering models);
- Remove the cable between the drive motor and the controller;

- Unscrew the fastening screw (2) and four mounting screws (3) with a wrench and remove the integral hydraulic station assembly (1) from the vehicle;
- Unscrew the four screws (5) with a wrench, and remove the handle assembly (4) off from the drive assembly (7);
- Knock the drive assembly (7) down with a hammer to remove it from the bearing bridge (6).



WARNING

When removal and installation, be sure to protect the wire harness cable from being damaged.

Installation

- Install according to the reverse order of removal.

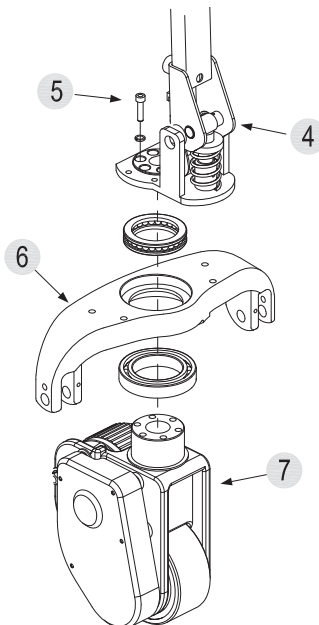


Figure 12208

5.7 Electromagnetic Brakes - B

The truck is braked through electromagnetic brake. When the truck is powered off, the electromagnetic coil (6) doesn't absorb the pressure plate (8), the friction force generated between brake pads (2), pressure plate and friction plates (5) will prevent the drive motor from rotating, thus to brake the vehicle.

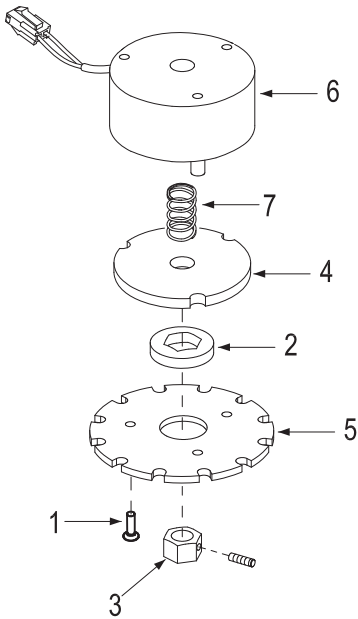


Figure 12209

No.	Name
1	Mounting screws
2	Brake pads
3	Brake nut
4	Pressure plate
5	Friction plate
6	Electromagnetic coil
7	Spring

5.7.1 Removal and Installation

Removal

The brake is installed on the drive motor. See Figure 12210

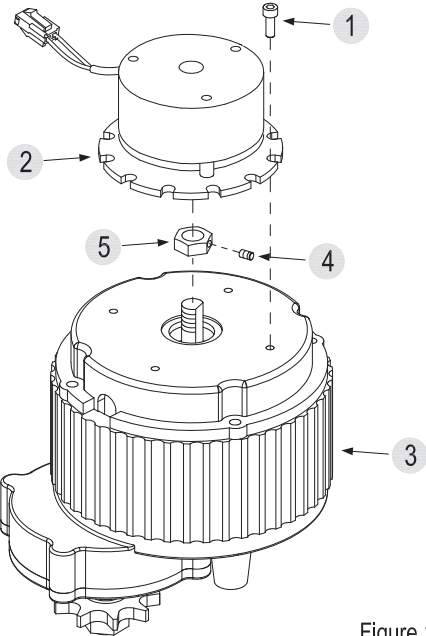


Figure 12210

- Switch off the truck power connections and pull out the brake connectors;
- Remove the drive cover;(see Section 4.2)
- Remove the four mounting screws (1) with wrench. Remove the electromagnetic brake (2) from the motor (3);
- Remove the screw (4) and brake nut (5) by order.

Installation

- Install according to the reverse order of removal.



When installing the electromagnetic brake (2), make sure the brake nut (5) is installed on the brake pads of brake.

DRIVE SYSTEM

Adjustment

The electromagnetic brake used in this series of truck is an air gap adjustment-free brake. After the normal installation is completed, the air gap between electromagnetic coils and pressure plate should be standard gap distance.

As shown in the following table:

Air gap	Standard value	Maximum value
s	0.2 mm	0.4 mm

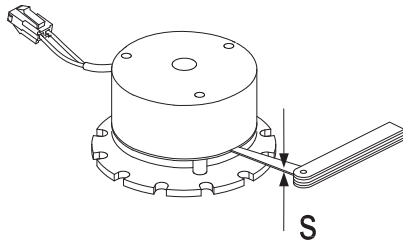


Figure 12211

CAUTION

When the air gap *s* exceeds 0.4mm, replace the brake pads (2, Figure 12209)

5.7.2 Faults and Causes

1	Fault	After the coil is energized, the pressure plate does not absorb
	Cause	a. Mechanical part failure; b. Foreign body blocking; c. Coil failure; d. Coil supply voltage less than 24V
2	Fault	After the coil is powered off, the pressure plate won't release
	Cause	Foreign body blocking
3	Fault	Abnormal noise after absorption
	Cause	a. Fully absorbed, but plate not flat. b. Mechanical resistance
4	Fault	Brake temperature is too high
	Cause	Pressure plate does not fully absorb, overcurrent of the coil, or energized too frequently

5.7.3 Checking and Testing

Electromagnetic Coil Checks

- Switch off the truck power connections and pull out the brake connectors;
- Check the resistance of the coil with a multi-meter: measurement method is as shown in Figure 12212;

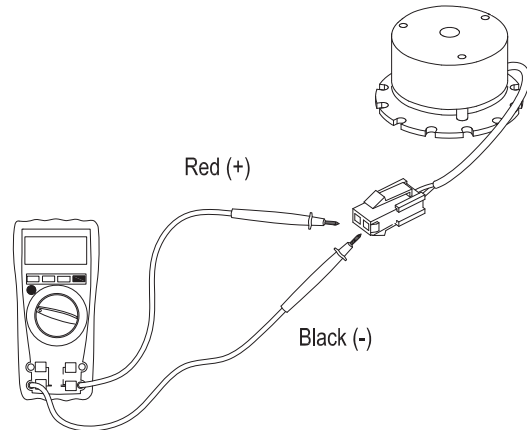


Figure 12212

- Identify if the electromagnetic coil is normal according to the readings of resistance on the multimeter.

As shown in the following table:

Resistance Measurement	Judgment
Approx. 50 Ω	Normal
0 Ω	Coil shorting (replace the brake)
∞ Ω	Coil breaking (replace the brake)

Air Gap Checks

- Switch off the truck power connections and pull out the brake connectors;
 - Check the air gap between electromagnetic coil and pressure plate with feeler gauge: measurement method is as shown in Figure 12211;
 - Determine if the air gap is normal according to the gauge measurements.
- As shown in the following table:

Air gap distance	Judgment
0.2~0.4mm	Normal
> 0.4mm	The air gap is too large (replace brake pads)

i NOTE

After a period of use, brake pads of the electromagnetic brake will wear. After being worn too much, the air gap between electromagnetic coil and pressure plate may exceed the predetermined maximum value, which may cause electromagnetic absorption failure.

Foreign Body Checks

Foreign bodies stuck in the brake may affect the normal absorption of pressure plates.

Check if there is foreign body in the air gap that may affect the absorption or bouncing off of the pressure plates.

Spring Checks

Deformation or foreign bodies stuck in the spring may affect the normal absorption of pressure plates.

Check if the distribution of the springs on the electromagnetic coil is correct, and check if there is foreign body in the spring hole.

i NOTE

After a period of time of use, the springs may be deformed due to the effect of radial force, such case may result in abnormal air gap of the brake, and the spring must be replaced.

5.7.4 Control Circuit Troubleshooting

Brake Control Circuit (Figure 12214)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF;
- Check if red circuit (circuit between brake and controller) is conducted;
- Check if black circuit (circuit between brake and controller) is conducted;

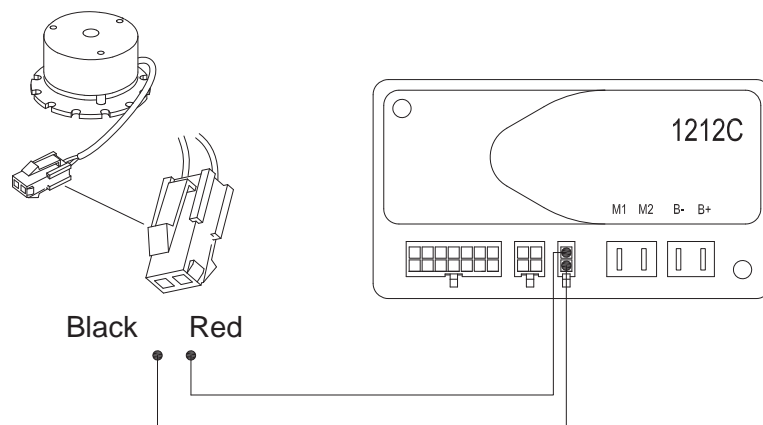


Figure 12214

DRIVE SYSTEM

5.8 Drive Wheel - B

5.8.1 Removal and Installation

Removal

- Remove the drive cover;(see Section 4.2)
- Rotate the drive assembly to the right for 90 degrees;
- Unscrew the four screws (2) with a wrench and remove the sprocket cover (3) from the drive bracket (5);
- Loosen the three screws (4) with a wrench and remove the chain (6);
- Unscrew the screw (7) with a wrench and remove the large sprocket (8);
- Unscrew the four screws (9) with a wrench and remove the guard (10);
- Remove the bearing (12), axle (11) and drive wheel (13) in sequence from the bracket (5).

Installation

- Install according to the reverse order of removal.

CAUTION

Tyre wear can affect the stability of the truck, adjust the caster with minor wear on a regular basis, or replace the caster with heavy wear.

Quality of tyres directly affects the stability and driving performance of the device. If you need to replace the factory-fitted tyres, please use original spare parts provided by the equipment manufacturer to reach the original design performance of the truck.

5.8.2 Faults and Causes

1	Fault	Drive wheel slipping or jumping
	Cause	Wear
2	Fault	Drive wheel cracking or degumming
	Cause	Improper use
3	Fault	Vehicle sways while running
	Cause	Drive wheel lock nut loosening

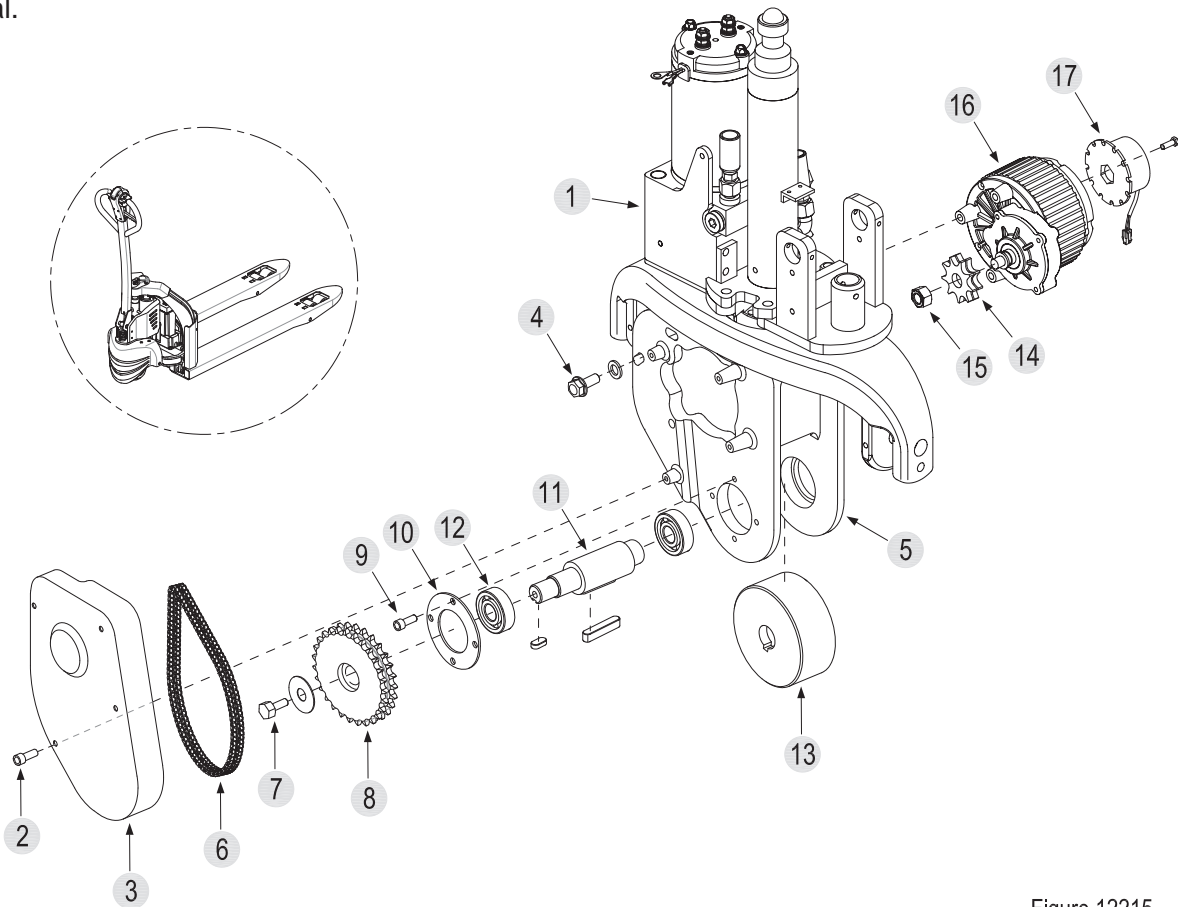


Figure 12215

5.9 Drive Motor - B

This truck obtains drive force through DC motor.

5.9.1 Removal and Installation

Drive Motor

Removal

- Remove the protective cover; (see Section 4.2)
- Remove the motor cable from the controller;
- Remove the brake; (see Section 5.7.1)
(see Figure12215)
- Unscrew the four screws (2) with a wrench and remove the sprocket cover (3) from the bracket (5);
- Unscrew the three screws (4) with a wrench and remove the drive motor (16) from the bracket (5);
- Unscrew the lock nut (15) with a wrench and remove the small sprocket (14) from the drive motor (16).

Carbon Brush

- Unscrew the four screws (1) and remove motor end cover (2) ;
- Unscrew the four screws (5) and remove the carbon brush (7) on the holder (6).
- Install according to the reverse order of removal.

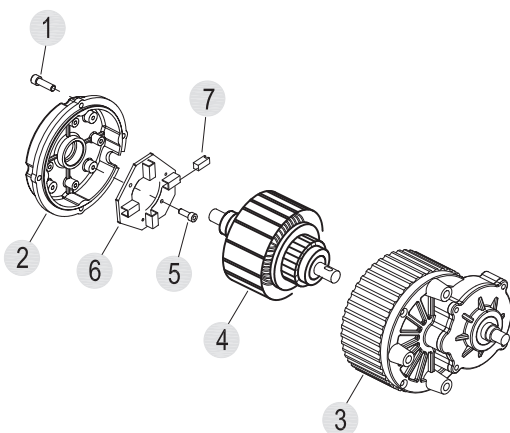


Figure 12216

CAUTION

When replacing the carbon brush, replace the complete set of carbon brushes.

WARNING

Due to magnetic force, the rotor and the stator may pull each other, therefore, when dismantling motor rotor, do not hold your hand between the rotor and the stator to avoid pinch hazard!

Adjustment

- After replacing the motor or carbon brush, conduction test must be carried out to the motor (see Section 5.9.3).
- After replacing carbon brush, running operation must be carried out to the carbon brush: By running the motor with repeated lifting, letting the carbon brush to be fully running, making its surface smooth to fit the rotor.

5.9.2 Faults and Causes

1	Fault	Motor does not rotate
	Cause	a. Negative electrode cable broken; b. Motor positive and negative electrode with loose terminals; c. Armature winding with broken circuits; d. Motor bearing damaged and blocked; e. Serious wearing of carbon brush.
2	Fault	Motor speed is turning slow
	Cause	a. Insufficient voltage of battery; b. Carbon brush worn or carbon brush spring pressure decreases; c. Bearing wear or lack of lubricating oil; d. Armature winding has short circuit elements; e. Carbon brush winding grounded.

DRIVE SYSTEM

3	Fault	Motor sometimes can start, sometimes cannot
	Cause	a. Motor positive and negative electrode with loose terminals and poor connection; b. Carbon brush wear and tear; c. Armature winding has circuit broken unit.
4	Fault	Motor with abnormal noise or vibration
	Cause	a. Uneven clearance between stator and rotor; b. Bearing failures; c. Loosening fixing screws on motor housing.
5	Fault	Motor smoking or burning smell
	Cause	Stator winding short circuit, motor burnt

Circuit of drive motor

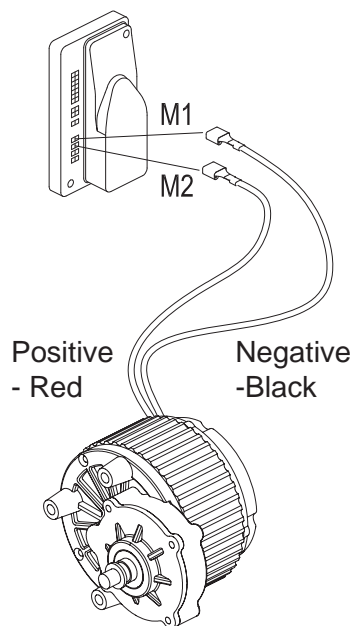


Figure 12217

5.9.3 Checking and Testing

Checking

- Check if the drive motor and appearance of cables are in good condition, and if the plug connection is secure;
- Check if the circuit is connected.

Testing

- Remove the cables on the drive motor;
- Carry out ON/OFF test to motor positive and negative electrodes with a multimeter:
 - If connected, the motor is normal;
 - If not connected:
 - 1) Broken circuits in rotor coils (replace the motor);
 - 2) Carbon brush wearing, move on to the next step.
- Replace the carbon brush .
(See Section 5.9.1)

CAUTION

When replacing the carbon brush, replace the complete set of carbon brushes.

5.10 Transmission Chain - B

5.10.1 Removal and Installation

See Section 5.8.1 .

 CAUTION

After disassembling the drive chain, apply an appropriate amount of grease to the chain and sprocket (see Section 2.2.3 for specifications).

Adjustment

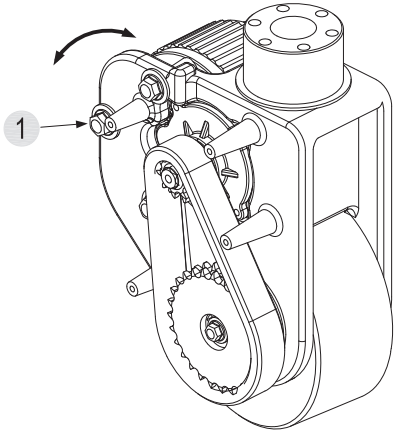


Figure 12218

- Loosen the three screws (1) securing the drive motor;
- Adjust the tension of the transmission chain as shown in the figure;
- After the adjustment is completed, tighten the screw at bottom. Then tighten the two screws at top.

5.10.2 Faults and Causes

1	Fault	Transmission chain with abnormal noise
	Cause	a. Chain loosening; b. Lack of grease.
2	Fault	The vehicle cannot travel
	Cause	a. Chain stuck; b. Chain fell off or broke.

DRIVE SYSTEM

5

6. OPERATING SYSTEM

6

LET'S GROW TOGETHER!



NOTE:

6.1 Control Lever

Control lever is used to control the travel, lifting, lowering, horn and emergency reverse of the vehicle.

Removal

Control lever is mounted on long handle (5)..

- Unscrew the six screws (1) on the lower cover (2) of the handle to separate the handle from the long handle;
- Disconnect the connection between the handle and elbow harness (4);
- Unscrew the screw (7) and remove the right knob (8) and left knob (9) from the accelerator (6);
- Remove the emergency reverse wire harness (13) from the accelerator (6) and remove the accelerator from the lower cover (2);
- Remove the emergency reverse button (10) and remove the spring (11);
- Disconnect the emergency reverse wire harness (13) from the emergency reverse switch (12) and remove the emergency reverse switch (12) from the lower cover (2);

- Remove the lift-horn harness (18) from the instrument (14);
- Unscrew the four screws (15) and remove the instrument (14) from the top cover (3);
- Disconnect the lift-horn harness (18) from the horn switch (16)/lift switch (17) and remove the horn switch (16)/lift switch (17) from the top cover (3);
- Disconnect the lowering harness (20) from the lowering switch (19) and remove the lowering switch (19) from the top cover (3); (For electrical lowering models)

Installation

- Install according to the reverse order of removal.



When removing or installing, please pay attention to protect the cables from being damaged.

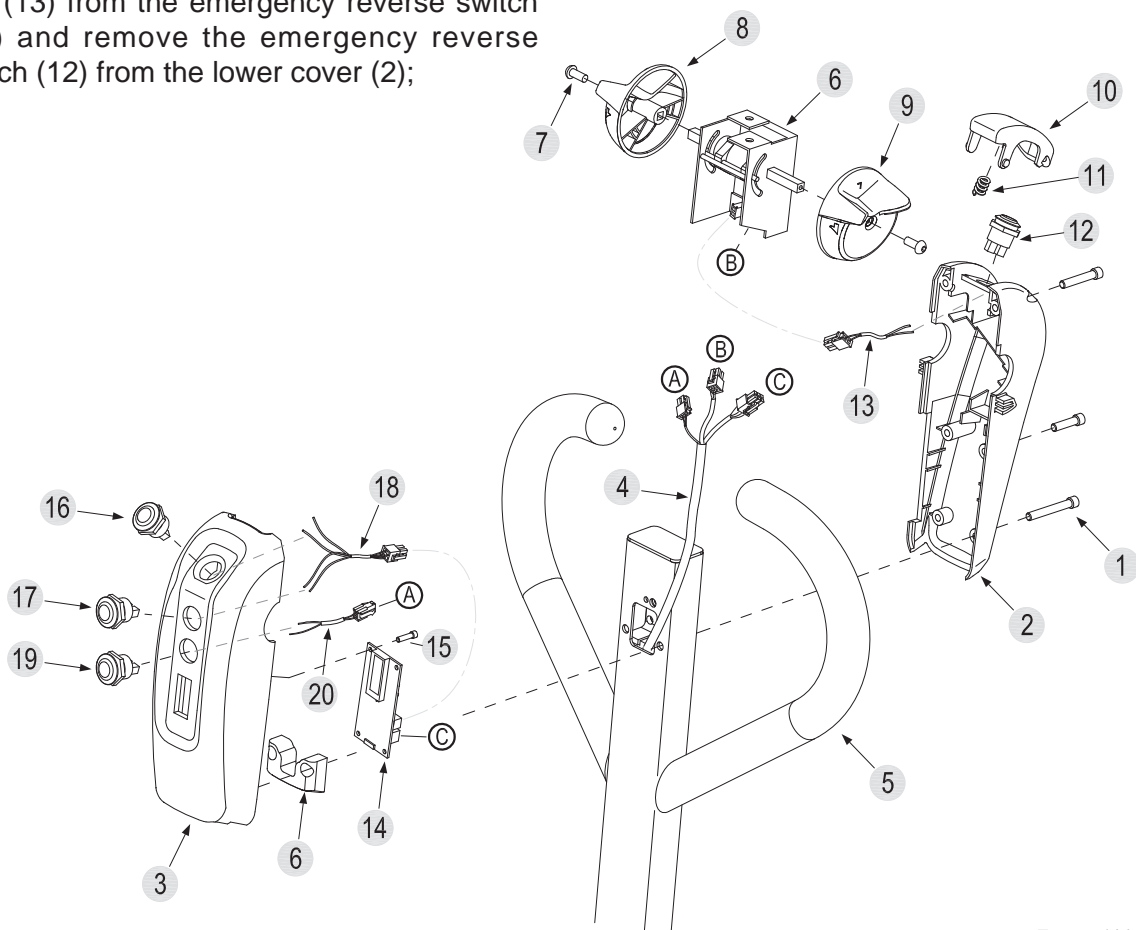


Figure 12301

OPERATING SYSTEM

6.2 Button Switch

Push button switch is the switch that makes the dynamic and static contacts ON or OFF to achieve the switching of circuits through push-button drive mechanism. In the electrical control circuits of this truck, the push button switch is used for manual emitting of control signals to control the vehicle lifting, lowering, horn and emergency reverse.

By function:

- Lifting Button Switch
- Lowering Button Switch
(For electrical lowering models)
- Horn Button Switch
- Emergency Reverse Switch

6.2.1 Removal and Installation

See Section 6.1 .

6.2.2 Faults and Causes

1	Fault	Operate the push button switch, but the vehicle responds with no action
	Cause	a. Push button switch failure; b. Push button switch circuit not conducted.
2	Fault	Push button switch not operated, but the vehicle responds with action
	Cause	Pushbutton switch failure

6.2.3 Checking and Testing

Checking

- Check if the pushbutton switch and the appearance of cables are in good condition, and if the plug connection is secure.

Testing

- Diagnostics the the switches via the instrument.(see Section 8.6)

- Check if the push button switch circuit is connected;
- Carry out ON/OFF test to the push button switch with a multimeter:

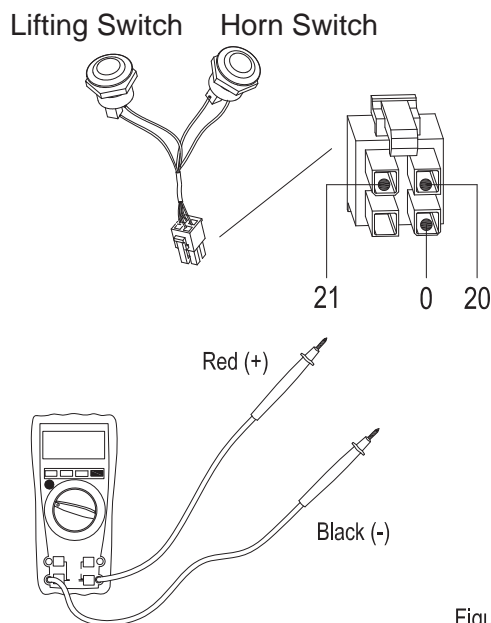


Figure 12302

Lifting Switch

(See Figure 12302)

- Carry out ON/OFF test to the circuit between #0 and #20 with a multimeter: push button switch at original position, broken circuit; press the button , the circuit is conducted.

Horn Switch

(See Figure 12302)

- Carry out ON/OFF test to the circuit between #0 and #21 with a multimeter: push button switch at original position, broken circuit; press the button , the circuit is conducted.

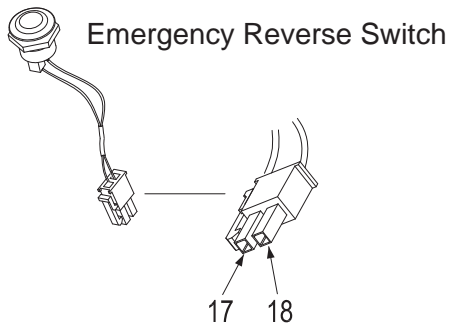


Figure 12303

Emergency Reverse Switch

(See Figure 12303)

- Carry out ON/OFF test to the circuit between #17 and #18 with a multimeter: push button switch at original position, broken circuit; press the button, the circuit is conducted.

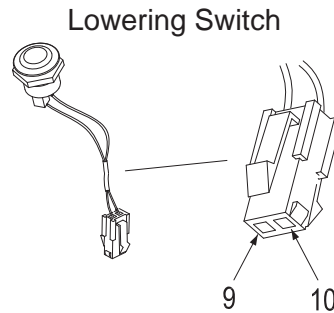


Figure 12304

Lowering Switch (For electrical lowering models)

(See Figure 12304)

- Carry out ON/OFF test to the circuit between #9 and #10 with a multimeter: push button switch at original position, broken circuit; press the button, the circuit is conducted.

6.2.4 Control Circuit Troubleshooting

Lifting-Horn Switch Control Circuit (Figure 12305)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF;
- Check if #0/#20/#21 circuit (circuit between the switch and instrument) is conducted.

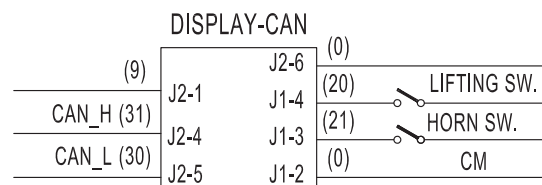
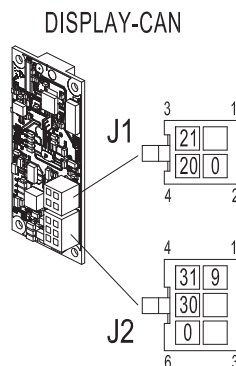


Figure 12305

OPERATING SYSTEM

Buzzer Control Circuit (Figure 12308)

Check if the circuit is broken by using a multi-meter:

- Set the multimeter to ON-OFF;
- Check if #0/#19 circuit (circuit between the buzzer and controller) is conducted.

Buzzer Checks

Energize the buzzer with a voltage of 24V: Buzzer sounds, it is working properly; Buzzer does not sound, it failure, needs to be replaced.

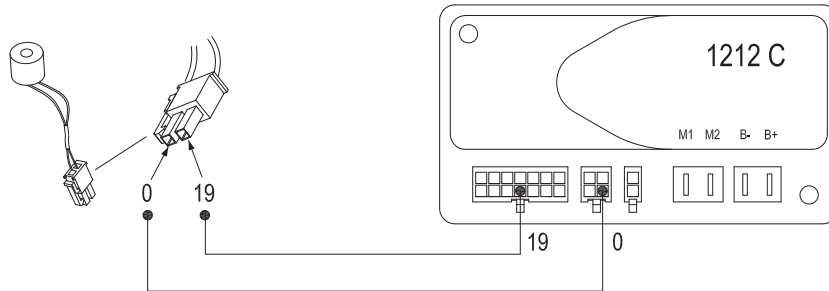


Figure 12308

Emergency Reverse Switch Control Circuit (Figure 12306)

Check if the circuit is broken by using a multi-meter:

- Set the multimeter to ON-OFF;
- Check if #17/#18 circuit (circuit between the switch and accelerator) is conducted.

Lowering Switch Control Circuit (Figure 12307)

Check if the circuit is broken by using a multi-meter:

- Set the multimeter to ON-OFF;
- Check if #0/#9/#10 circuit (circuit between the switch and controller) is conducted.

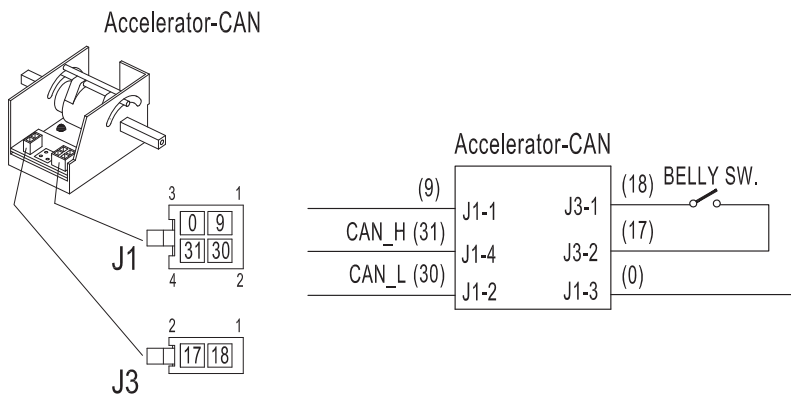


Figure 12306

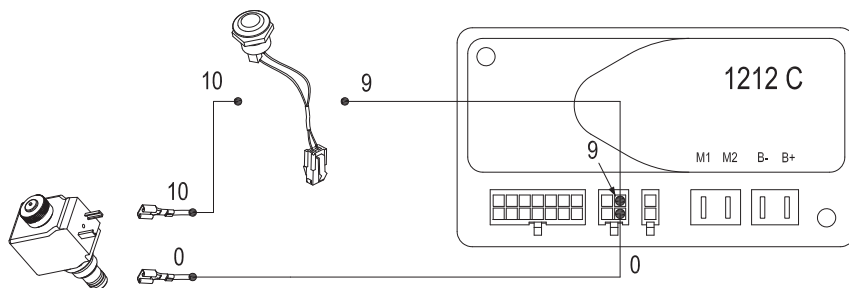


Figure 12307

6.3 Travel Switch

Travel switch provides forward or backward input signals for the vehicle.

6.3.1 Removal and Installation

See Section 6.1 .

6.3.2 Faults and Causes

1	Fault	Operate travel switch, the vehicle cannot go forward or backward
	Cause	a. Travel switch failure; b. Travel switch circuit not conducted.
2	Fault	Travel switch not operated, the vehicle goes forward or backward automatically
	Cause	Travel switch failure;

Testing

- Diagnostics the the switch via the instrument. (see Section 8.6)
- Diagnostics via the fault indicator on the accelerator:
When the indicator is lit or repeatedly flashing once/twice, it indicates that the accelerator is working properly;
On the contrary, the accelerator is with failure and needs to be replaced.

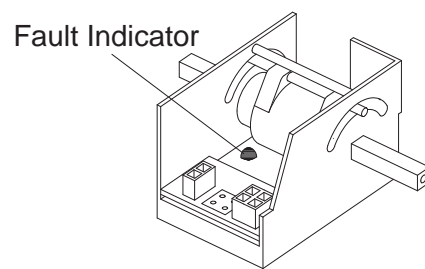
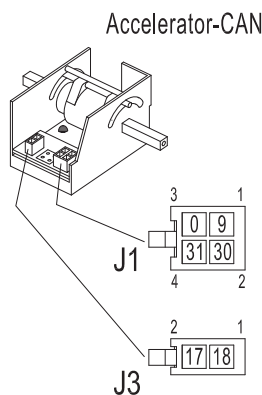


Figure 12309

6.3.3 Checking and Testing

Checking

- Check if the appearance of travel switch and its wiring harness are in good condition, and if the connectors are connected securely.



6.3.4 Control Circuit Troubleshooting

Travel Switch Control Circuit (Figure 12310)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF;
- Check if #0/#9/#30/#31 circuit (circuit between travel switch and controller) is conducted.

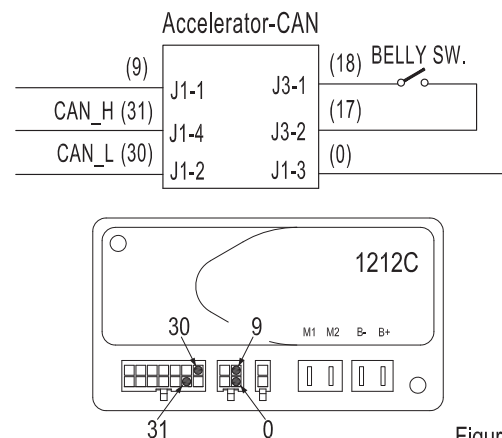


Figure 12310

7. HYDRAULIC SYSTEM

7

LET'S GROW TOGETHER!



NOTE:

The system pressure of the entire hydraulic system pressure is provided by hydraulic power unit system, which is used for lifting. While the hydraulic power unit is equipped with a relief valve to ensure that the entire system pressure is always within the safety limits that can lift the maximum load capacity.

Solenoid valve on the valve body is used for the control of lowering. Throttle valve is used for the control of lowering speed. Inlet is equipped with a filter to prevent the impurities in the hydraulic oil from entering into the pump.

Hydraulic Schematic Diagram - manual lowering is as shown in Figure 12401;

Hydraulic Schematic Diagram - electrical lowering is as shown in Figure 12402;

See Section 7.8 for hydraulic symbol descriptions.

7.1 Overview

- Lower the fork to the bottom, remove the air filter on cylinder, observe the oil level with the oil dipstick. When adding hydraulic oil, please use hydraulic oil of the same specifications.
- When the fork occasionally jitters, that may be leaks in the cylinder, or there could be leaks on the valve body. Dismantle and clean (to clean with hydraulic oil of the same specifications) the valve on the valve body, discharge the foreign bodies within the valve body through repeatedly lifting and lowering of the mast.
- If hydraulic oil is becoming less, please thoroughly check the hydraulic system for leaks.
- Disassembly of cylinder needs to be performed in a clean environment. Before removing the cylinder, the stains on the cylinder must be removed first. Carefully remove the piston rod to prevent the cylinder wall from being scratched by its end surface or damaged part. Every time when replacing the cylinder, also replace the cylinder seals.

Hydraulic Oil

Hydraulic oil for truck:

Specifications: Anti-wear Hydraulic Oil L-HM46.

* For cold storage: Low Temperature Anti-wear Hydraulic Oil L-HV32.

Hydraulic Seals

The seals installed within the cylinder are made of rigid polyurethane. The deformation during assembly due to compression will not cause a permanent deformation.

When assembling, pay attention to prevent the seals from being broken, rolled and undercut.

Assembly Instructions

The tools used to install the seals must be made of soft metal or suitable plastic, without burrs and sharp edges on surfaces. It is prohibited to use the tools that can easily damage the surface of seals, such as, screwdriver or other similar tools with hard front edges.

Where the hydraulic seals to be installed should be free of burrs, sharp edges and cracks. If the installation of seals needs to cross sharp edges, grooves or cuts, protective devices must be used for protection. Before installing, lubrication should be performed to the seals and the mounting positions first.



The lubricant used during assembly must be of the same specifications with the hydraulic oil used in the vehicle.

HYDRAULIC SYSTEM

7.1.1 Hydraulic Schematic Diagram

Manual Lowering

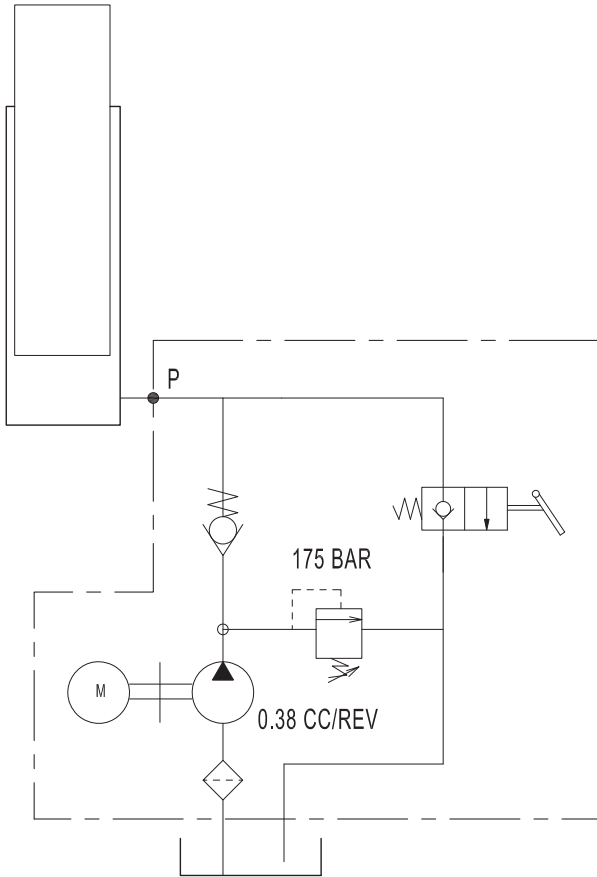


Figure 12401

Electrical Lowering

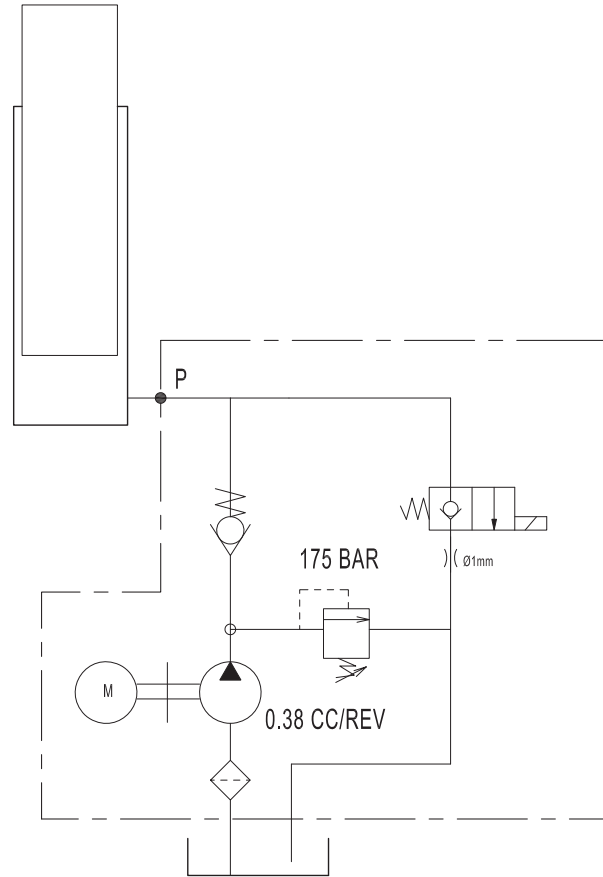


Figure 12402

7

7.2 Pump and Motor Assembly

7.2.1 Removal and Installation

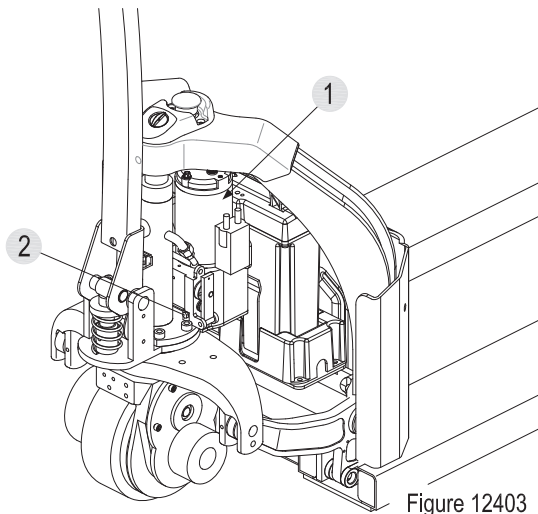


Figure 12403

Removal

- Remove the protective cover; (see Section 4.2)
- Remove wiring harness and cables from the pump motor, pump contactor and controller;
- Remove the tubing (3) from the hydraulic station (1) with a wrench;

CAUTION

When removing the tubing, the system will lose some hydraulic oil, please refer to Section 2.2.3 for supplementary adding of hydraulic oil.

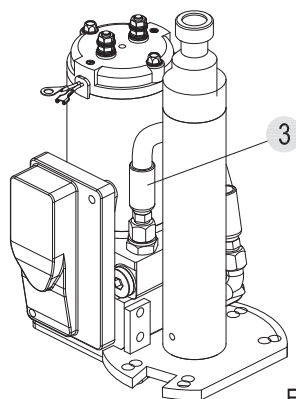


Figure 12404

- Remove the wire rope from the manual valve (for manual lowering models);

- Unscrew the three bolts (2) with a wrench and remove the hydraulic station (1) from the cylinder block;
- Remove the controller and pump contactor from the hydraulic station with a wrench.

Installation

- Install according to the reverse order of removal.

7.2.2 Component

Manual Lowering

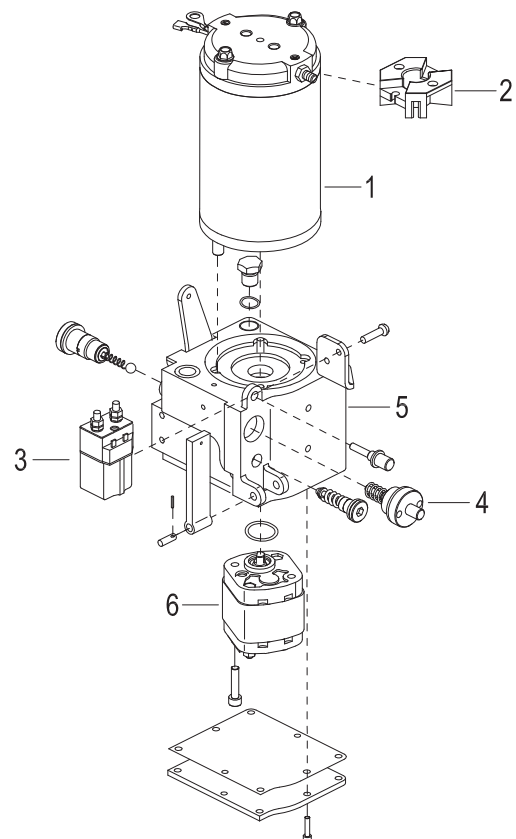


Figure 12405

No.	Name
1	Pump Motor
2	Carbon Brush
3	Pump Contactor
4	Manual Valve
5	Valve Body
6	Gear Pump

HYDRAULIC SYSTEM

Electrical Lowering

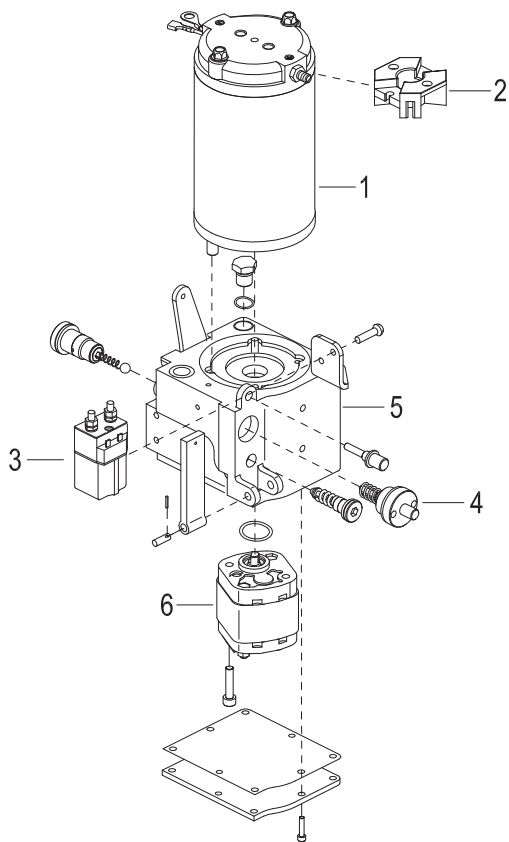


Figure 12405

No.	Name
1	Pump Motor
2	Carbon Brush
3	Pump Contactor
4	Solenoid Valve
5	Valve Body
6	Gear Pump

7.3 Pump Motor

7.3.1 Removal and Installation

Removal

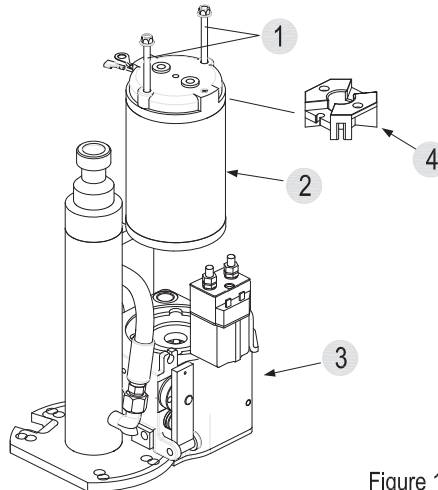


Figure 12407

- Remove the protective cover;(see Section 4.2)
- Remove the cables from the pump motor;
- Remove the 2 long screws (1) on the motor end cover, and remove the pump motor (2) from the valve body (3);
- If you need to replace carbon brush (4). Remove motor end cover, replace the carbon brush on the holder.

CAUTION

When replacing the carbon brush, replace the complete set of carbon brushes.

Installation

- Install according to the reverse order of removal.

CAUTION

When installing the pump motor, make sure the shaft and the coupling on motor rotor are mated in place. (Rotate the motor around to make the end surface of motor be in full contact with valve block).

WARNING

Due to magnetic force, the rotor and the stator may pull each other, therefore, when dismantling motor rotor, do not hold your hand between the rotor and the stator to avoid pinch hazard!

Adjustment

- After replacing the steering motor or carbon brush, conduction test must be carried out to the motor (see Section 7.3.3).
- After replacing carbon brush, running operation must be carried out to the carbon brush: By running the motor with repeated lifting, letting the carbon brush to be fully running, making its surface smooth to fit the rotor.

7.3.2 Faults and Causes

1	Fault	Motor does not rotate
	Cause	a. Negative electrode cable broken; b. Motor positive and negative electrode with loose terminals; c. Armature winding with broken circuits; d. Motor bearing damaged and blocked; e. Serious wearing of carbon brush.
2	Fault	Motor speed is turning slow
	Cause	a. Insufficient voltage of battery; b. Carbon brush worn or carbon brush spring pressure decreases; c. Bearing wear or lack of lubricating oil; d. Armature winding has short circuit elements; e. Carbon brush winding grounded.
3	Fault	Motor sometimes can start, sometimes cannot
	Cause	a. Motor positive and negative electrode with loose terminals and poor connection; b. Carbon brush wear and tear; c. Armature winding has circuit broken unit.

4	Fault	Motor with abnormal noise or vibration
	Cause	a. Uneven clearance between stator and rotor; b. Bearing failures; c. Loosening fixing screws on motor housing.
5	Fault	Motor smoking or burning smell
	Cause	Stator winding short circuit, motor burnt
6	Fault	Excessive temperature rise
	Cause	a. Stator winding short circuit; b. Motor positive and negative electrodes with surface oxidation, resistance increases and results in heating; c. Bearing failure, resulting in severe heating.

7.3.3 Checking and Testing

Checking

- Check if the pump motor and appearance of cables are in good condition, and if the plug connection is secure;
- Check if the circuit is connected.

Testing

- Remove the cables on the pump motor;
- Carry out ON/OFF test to motor positive and negative electrodes with a multimeter:
If connected, the motor is normal;
If not connected:
1) Broken circuits in rotor coils (replace the motor);
2) Carbon brush wearing, move on to the next step.
- Replace the carbon brush (See Section 7.3.1).



When replacing the carbon brush, replace the complete set of carbon brushes.

HYDRAULIC SYSTEM

Circuit between pump motor and pump contactor

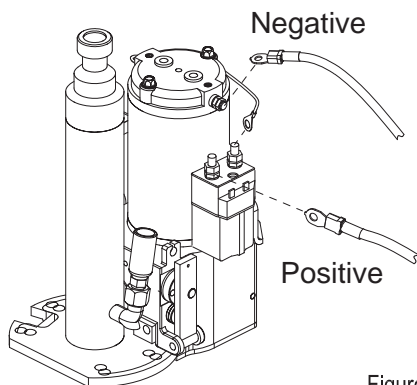


Figure 12408

7.4 Pump Contactor

This truck is using DC contactor with normally-open contacts. And the ON/OFF of the contactors is controlled through controller, thus to achieve the control of ON/OFF of the vehicle.

When the contactor coil (Between A and B) is energized, the coil current will create a magnetic field, making the static stator core produce a steady magnetic force to absorb the core and drive the contactor actions: normally-opened contact (C and D) connected, so the circuit is disconnected.

When the contactor coil is powered off, the magnetic force disappears, the pressure plate is released along with the release of spring, and the contact recovers: normally-opened contact (C and D) disconnected, so the circuit is disconnected.

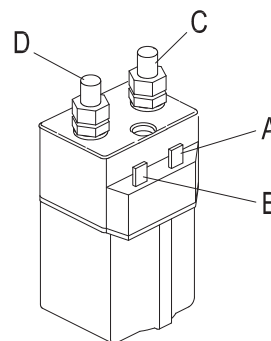


Figure 12409

7.4.1 Removal and Installation

- Remove the cables and wiring harness on the pump contactor, and remove the pump contactor from the valve body;
- Unscrew the two fastening screws (4) with a Phillips screwdriver and remove the top cover of contactor (3);
- Remove the auxiliary contact assembly (2), replace the assembly or coil (6); (when replacing the contacts, replace in pairs)

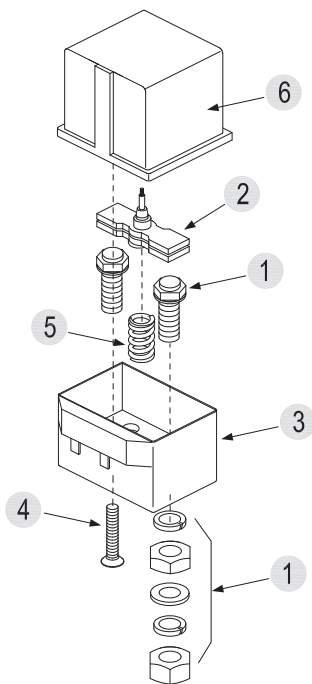


Figure 12410

- After the replacement, re-install in reverse order and tighten the two fastening screws (4);
- Following the reverse order of step 1, fasten the main contactor onto the electrical mounting plate, and re-connect it according to the original connection methods.

7.4.2 Faults and Causes

1	Fault	Contact adhesion or slow release
	Cause	a. Contact fusion welding; b. Contact spring pressure is too low; c. Mechanical moving parts blocked, shaft rusted or crooked; d. Anti-force spring damaged.
2	Fault	Contact not absorbed or not fully absorbed
	Cause	a. Insufficient voltage of battery; b. Main contactor coil open circuit; c. Mechanical moving parts blocked, shaft rusted or crooked; d. Control contact poor contact.

7.4.3 Checking and Testing

Visual Inspection

- Check the surface and appearance of contactor;
- Visually check the surface of contactor for scratches, damages and stains;
- If any of the above case is found, please replace with new contactor.

Coil Checks

- Disconnect the cables on the contactor;
- Check the resistance of the coil with a multi-meter: measurement method is as shown in Figure 12411;
- Identify if the contactor is normal according to the readings of resistance on the multimeter. As shown in the following table:

Resistance Measurement	Judgment
Approx. 30 Ω	Normal
0 Ω	Coil shorting (replace the contactor)
∞ Ω	Coil breaking (replace the contactor)

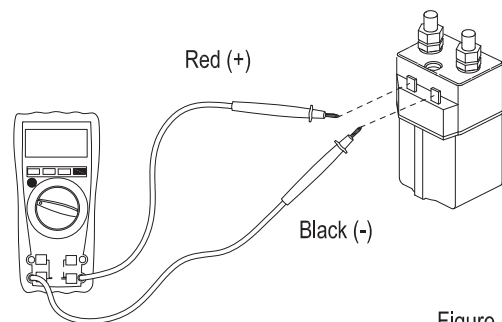


Figure 12411

Contact Checks

- Check if the surface of contact surface is smooth and symmetrical;
- Separately provide the contact with a voltage of 24V to observe if the contact can absorb;
- If the surface is uneven or the contact does not absorb, replace the main contactor.

HYDRAULIC SYSTEM

7.4.4 Control Circuit Troubleshooting

Pump Contactor Control Circuit (Figure 12412)

Check if the circuit is broken by using a multi-meter:

- Set the multimeter to ON-OFF;
- Check if #0/#2 circuit (circuit between pump contactor and controller) is conducted.

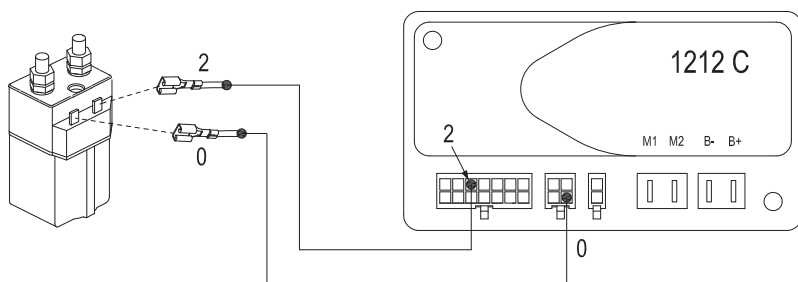


Figure 12412

7.5 Solenoid Valve(Electrical Lowering) 7.5.1 Faults and Causes

When solenoid valve coil is energized (there is voltage between coil end A and B), the electromagnetic coil generates electromagnetic force, and the spool will move, the valve will open, and the vehicle will be lowered.

When the contactor coil is de-energized, the closing part will be released under the effect of the released spring, the hydraulic oil cannot form a loop, thus the lifting mechanism cannot be lowered.

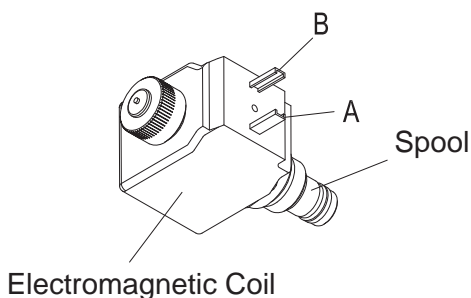


Figure 50410

1	Fault	Solenoid valve does not work after energized
	Cause	a. Different power supply circuits; b. Insufficient power supply voltage; c. Short circuit; d. Unsoldering coil (coil short circuit); e. Main spool and moving core of the solenoid valve blocked by impurities; f. High viscosity of hydraulic oil; g. High frequency of use, service life has expired already.
2	Fault	Solenoid valve cannot be closed
	Cause	a. Main spool or core seals broken or aged; b. Main spool and moving core of the solenoid valve blocked by impurities; c. Spring deformation; d. Balancing hole blocked by impurities; e. High frequency of use, service life has expired already.

3	Fault	Internal leakage
	Cause	Damaged seals or spring deformations
4	Fault	External leakage
	Cause	Loose connections or damaged seals
5	Fault	Noisy when energized
	Cause	a. Unstable supply voltage; b. Impurities on absorption surface or uneven surface of core, needs cleaning.

7.5.2 Checking and Testing

Checking

- Check the solenoid valve connector for loosening or poor connection of leads.

Testing

- Switch off the power supply of the vehicle;
- Measure the resistance between solenoid valve coil end point A and B to identify if the coil is normal; as shown in the following table:

Resistance Measurement	Judgment
Approx. 30 Ω	Normal
0 Ω	Coil shorting (replace the solenoid valve)
$\infty \Omega$	Coil breaking (replace the solenoid valve)

If the coil is normal, move on to the next step.

- Check the solenoid valve for blocking: the fitting clearance between slide valve sleeve and spool is very small, when there is impurity entering or too less lubricant, it is easily blocked.

Handling method:

- Insert a steel wire from the small hole at valve end to make the spool rebound;
- Remove the solenoid valve, take out the spool and spool sleeve, clean with CCl₄ to enhance the flexibility of the moving of spool within the spool sleeve. During disassembly, pay attention to the sequence of assembly and position of external wiring for correct re-assembly and wiring, also check the oil mist spray orifice for blockage and if the lubricant is sufficient.

CAUTION

If the solenoid valve is found with the above mechanical failures, it is recommended to replace the solenoid valve directly.

7.5.3 Control Circuit Troubleshooting

Solenoid Valve Control Circuit (Figure 12413)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF;
- Check if #0/#9/#10 circuit (circuit between solenoid valve and controller) is conducted.

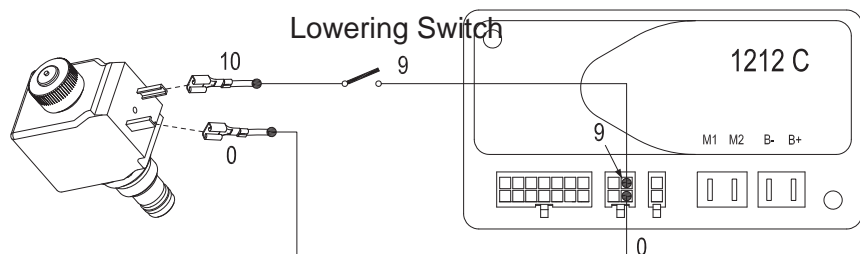


Figure 12413

HYDRAULIC SYSTEM

7.6 Reach Cylinder

7.6.1 Cylinder Removal Precautions

- Before removing the cylinder, be sure to relieve the hydraulic circuit first, which is to lower the lifting mast to the bottom. Otherwise, when removing the tubing connected with the cylinder, the pressured hydraulic oil within the circuit may be sprayed out at high speed along with the tubing, and there is risk of causing personal injury.

Turn off the power source, so that the entire hydraulic system will stop functioning, then the connecting tubing can be loosened; in order to avoid the residual pressure within the circuit, the tubing joint should be loosened slowly, loosen the joint by half and shake the tubing to see if there is overflow of pressured oil, and then go on with the removal;

- Cylinder is the powered actuator in hydraulic system. Therefore, before removing the cylinder from the equipment, the connection part must be supported with appropriate supporting to avoid personal injury or damage to the equipment;
- Cylinder is the powered actuator in hydraulic system. Therefore, before removing the cylinder from the equipment, the connection part must be supported with appropriate supporting to avoid personal injury or damage to the equipment;
- Upon disassembly of the cylinder, you should know the main structure of the cylinder to avoid sightless removal. Due to the different size, structure, purpose of use of the cylinders, the sequences and methods used for removal are also different;
- When removing each part, do not hammer forcefully, it such case cannot be avoided, please lay a copper rod to avoid damage to the parts; special tools must be used for the parts having such requirements, do not hammer forcefully or pry. Fine pitch threaded cylinder cap, after being shaken loose, loosen it with cylinder wrench with even force, copper rod can be used to hammer the part that cannot easily deform, do avoid violent shocks.

- Upon removal, the damage to cylinder threads, oil port threads, cylinder cap threads, piston rod surface and inner cylinder wall should be prevented.

In order to prevent piston rod from bending or deformation, support it wooden block when placing.

When removing seals, the use of sharp tools should be avoided, so as not to stab the seals. For the seals that are difficult to remove, soak them with boiled water, remove them when getting softened.

- Before removing, try to create conditions to prevent the cylinder parts from being contaminated by the surrounding dust and impurities. For example, try to disassemble the equipment in a clean environment; after the disassembly, all parts should be covered with plastic, do not cover with cotton cloth or other cloth used during operation;
- For the cylinder which is found with internal or external leakage during use, if the piston rod or cylinder tube is not scratched, such case may be due to wear or aged seals.

CAUTION

When the seals need to be replaced, replace with the complete set of seals in the cylinder repair kit.

- For the cylinder which is found with internal or external leakage during use, if the piston rod or cylinder tube is not scratched, such case may be due to wear or aged seals (when replacing seals, replace with the complete set of seals in the cylinder repair kit).

Pay special attention to the cylinder tube, piston rod and other moving parts for bumps and scratches. If only minor damage, sand the edge point around the damaged part with fine stone and then polish the part smooth with metallographic sandpaper.

7.6.2 Cylinder Installation Precautions

- All parts should be cleaned up before assembly, then to be assembled after being dried;(during assembly, apply appropriate amount of hydraulic oil for lubrication)
- The tools used to install the seals must be made of soft metal or suitable plastic, without burrs and sharp edges on surfaces. It is prohibited to use the tools that can easily damage the surface of seals, such as, screwdriver or other similar tools with hard front edges.

Where the hydraulic seals to be installed should be free of burrs, sharp edges and cracks. If the installation of seals needs to cross sharp edges, grooves or cuts, protective devices must be used for protection. Before installing, lubrication should be performed to the seals and the mounting positions first with hydraulic oil.

CAUTION

- *O-ring is quite flexible and easy to install, but it must not be pulled up to the extent of permanent deformation, nor scroll it while installing;*
- *Y-ring or X-ring needs to be identified if it is for shaft or hole to avoid misplacement;*
- *The removed O-rings and dust rings should be replaced with new ones.*
- Cylinder parts must not be arbitrarily replaced, the original products provided by the manufacturer should be used;
- After maintenance and assembly of the cylinder is completed, pressure leak testing must be carried out before it can be put operation once again.

Before the testing, discharge the air within the cylinder, run the cylinder in a small range of movement for several times, and pay attention if it is moving without blocking and if there is uneven resistance during the moving. Upon the pressure testing, raise the pressure slowly and observe carefully for leaks.

7.6.3 Removal and Installation

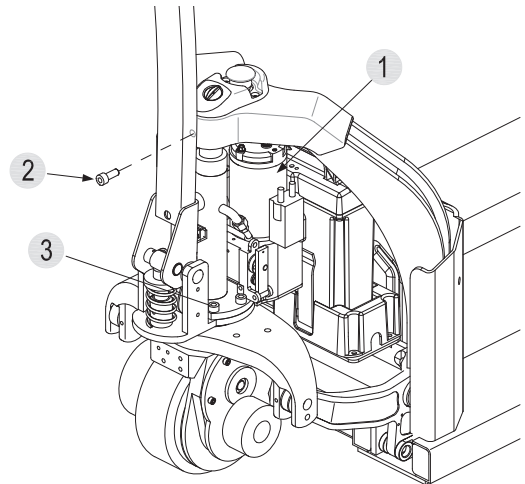


Figure 12202

- Lower the forks completely down, press the emergency stop switch and turn off the key switch;
- Remove the cover (see Section 4.2);
- Disconnecting the connection between the elbow wire harness and main harness; remove the wire rope on the manual valve of hydraulic station (1) (for manual lowering models);
- Remove the cable between the drive motor and the controller;
- Unscrew the fastening screw (2) and four mounting screws (3) with a wrench and remove the integral hydraulic station assembly (1) from the vehicle;

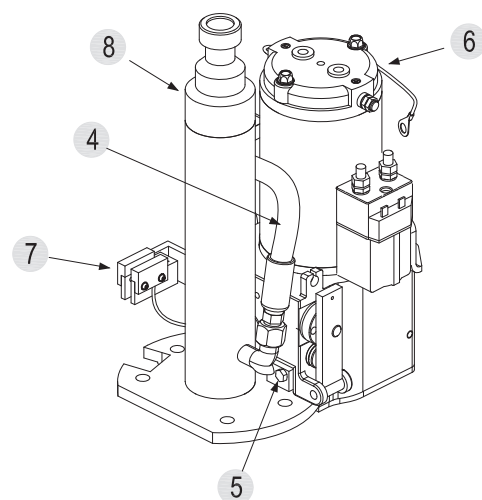


Figure 12414

HYDRAULIC SYSTEM

- Remove the tubing (4) from the cylinder (8) ;

CAUTION

Hydraulic oil may damage truck parts and contaminate the environment. When removing joints or tubings, place a clean container under it for discharge of hydraulic oil.

- Remove the interlock switch (7);
- Unscrew the three bolts (5) with a wrench, and remove the pump and motor assembly (6) from the cylinder (8);
- Install the cylinder according to the reverse order of removal;
- Add hydraulic oil of the same specifications into the tank, see Section 2.2.3;
- Pull out emergency stop switch and turn on the key switch;
- Repeat Lift - Lower cylinder to discharge the air within the tubings and cylinder;
- Check the hydraulic oil level and make sure that the liquid is at standard level.

Cylinder Maintenance

CAUTION

- Use suitable hose clamps to avoid cylinder deformation caused by severely tight hose clamp.
- Carry out the maintenance work in a clean environment to prevent impurities from entering into cylinder, causing cylinder damage.
- During the installation, hydraulic oil of the same specifications must be used for cleaning or lubrication.
- Secure the cylinder to hose clamp and gently clamp the cylinder bottom;
- Pull out the piston rod (1) from the cylinder tube (6) ;
- Remove the dust ring (5), support ring (2) , ring (3) and seal (4) from the cylinder tube (6);
- Clean with hydraulic oil of the same specifications;

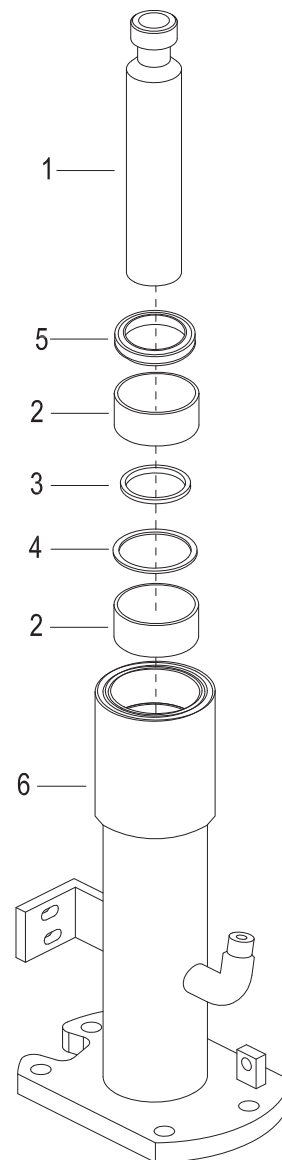


Figure 12415

- Replace the problem parts and assembly in reverse steps.

CAUTION

If the piston rod or cylinder tube is damaged, please replace the entire cylinder.

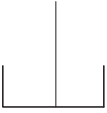
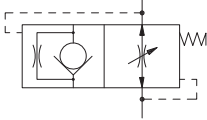
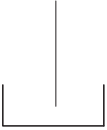

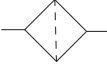


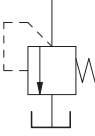

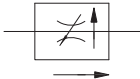

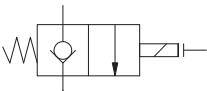

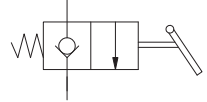

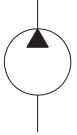
If the seals are aged or damaged, please replace the complete set of seals.

7.7 Hydraulic Troubleshooting

Fault Symptom		Failure Causes	Troubleshooting Measures
1	Noisy pump	a. Insufficient oil; b. High viscosity of oil; c. Hydraulic oil with foam;	1. Check the hydraulic oil level. 2. Replace the hydraulic oil. 3. See ITEM # 2.
2	Hydraulic oil with foam	a. Pump cavitation; b. There is water in the oil.	1. Check the amount of oil; 2. Check if the viscosity of hydraulic oil is normal; 3. Check the oil inlet piping for air leaks; 4. Replace oil.
3	Pump or oil temperature is too high	a. Oil level too low; b. Pump cavitation; c. Valve body internal relief.	1. Identify oil leak and add oil to reservoir; 2. Check the oil inlet piping for air leaks; 3. Replace the valve body.
4	Low System Pressure	a. Insufficient oil; b. Relief valve failure. c. Pump wear, internal leakage.	1. Check the hydraulic oil level; 2. See ITEM # 6; 3. Replace pump.
5	Load will not hold	a. Check valve failure. b. Solenoid valve failure.(only for Electric lowering)	1. Check the check valve. Replace as required. 2. Check and clean the solenoid valve spool.(only for Electric lowering)
6	Relief valve pressure unstable or too low	a. Pressure adjustment screw too loose; b. Relief valve spring breakage or deformation; c. Relief valve spool wear or blocked.	1. Adjust to proper pressure through hydraulic pressure gauge. 2. Replace the relief valve. 3. Clean or replace the relief valve.

HYDRAULIC SYSTEM

7.8 Hydraulic Symbol

Symbol	Description	Symbol	Description
	Tank Pipe end below liquid level		Explosion-proof valve
	Tank Pipe end above liquid level		Check valve
	Filter		Cylinder Single-acting direction
	Service line (Supply line or return line)		Relief valve
	Control line (Drain line)		Throttle valve With pressure compensation device
	Connecting pipe		Solenoid Valve Two-way two-pass
	Port (Test port)		Manual Valve Two-way two-pass
	Motor		
	Hydraulic pump		

8. ELECTRICAL SYSTEM

8

LET'S GROW TOGETHER!



NOTE:

8.1 Controller

8.1.2 Controller Interface Function Traction Controller (1212C)

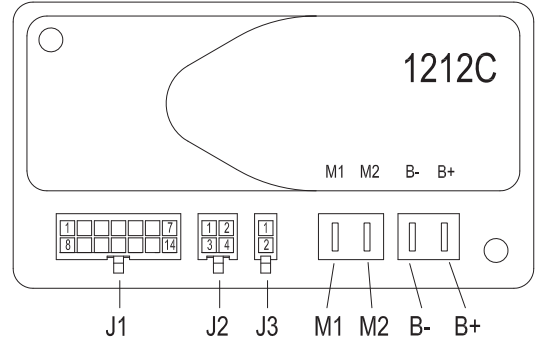


Figure 12519

8.1.1 Removal and Installation

Removal

- Remove the protective cover;(see Section 4.2)
- Remove the wiring harness and cables on the controller;
- Unscrew the two screws (1) with a wrench and remove the controller (2) ;

J1 Interface

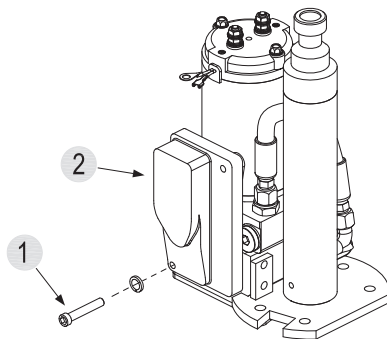
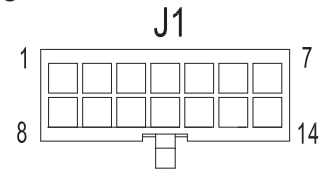


Figure 12501

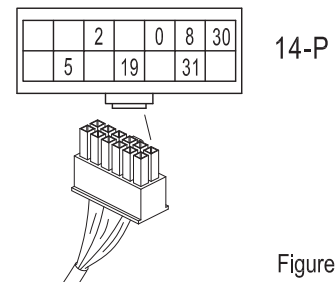


Figure 12502

Installation

- Apply appropriate amount of thermal grease on the back of controller;
- Place the controller onto the valve body, tighten the two screws with a wrench;
- Plug the wiring harness and cables into corresponding ports.

J1 Interface	
Pin No.	Description
J1#1	-
J1#2	-
J1#3	PUMP CONTACTOR COIL
J1#4	-
J1#5	KEYSWITCH INPUT (KSI)
J1#6	INTERLOCK
J1#7	CAN L
J1#8	-
J1#9	LIFTING LIMIT SW.
J1#10	-

ELECTRICAL SYSTEM

J1 Interface - Continued	
Pin No.	Description
J1#11	HORN
J1#12	-
J1#13	CAN H
J1#14	-

J2 Interface (Handheld unit communication interface)

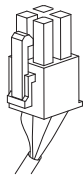
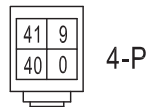
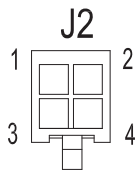


Figure 12503

J2 Interface	
Pin No.	Description
J2#1	Rx
J2#2	I/O GND
J2#3	Tx / Charge inhibit
J2#4	B+

J3 Interface

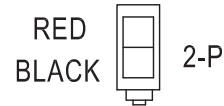


Figure 12504

J3 Interface	
Pin No.	Description
J3#1	Positive of electromechanical brake coil.
J3#2	Negative of electromechanical brake coil.

Terminal stud

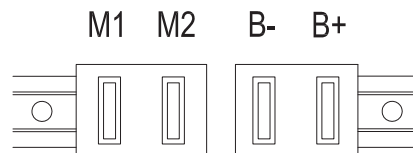


Figure 30506

Terminal stud	
Pin No.	Description
M1	Negative of the motor.
M2	Positive of the motor.
B-	- Batt.
B+	+Batt.

8.2 Key Switch

Key switch is used to START / STOP the truck.

8.2.1 Removal and Installation

Removal

- Remove the protective cover;(see Section 4.2)

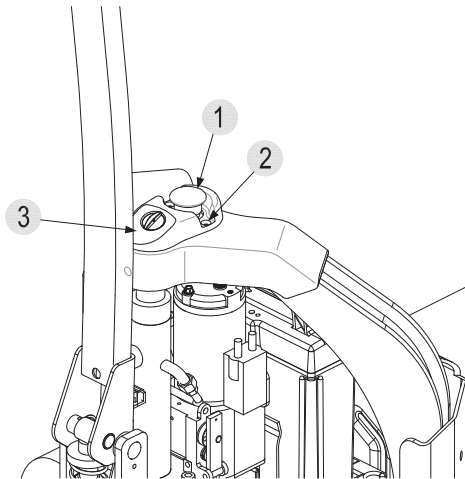


Figure 12505

- Disconnect the key switch connector from wiring harness;
- Unscrew the screws on the emergency stop switch (1) and remove switch;
- Unscrew the two screws (2) on the switch housing, and remove the key switch assembly (3).

Installation

- Install according to the reverse order of removal.

8.2.2 Faults and Causes

1	Fault	Turn the key switch to "ON", the vehicle won't start
	Cause	a. Key switch failure; b. Key switch circuit not conducted.
2	Fault	Turn the key switch to "OFF", the vehicle won't stop
	Cause	a. Key switch failure; b. Key switch shorted (short circuit)

8.2.3 Checking and Testing

Checking

- Check if the appearance of key switch its wiring harness are in good condition, and if the connectors are connected securely.

Testing

- Check if the key switch circuit is conducted;
- Carry out ON/OFF test to the key switch with a multimeter:
key switch at "OFF" position, open circuit;
place the key switch at "ON" position, the circuit is conducted.

8.2.4 Control Circuit Troubleshooting

Key Switch Control Circuit (Figure 12506)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF;
- Check if #0/#1/#3 circuit is conducted.

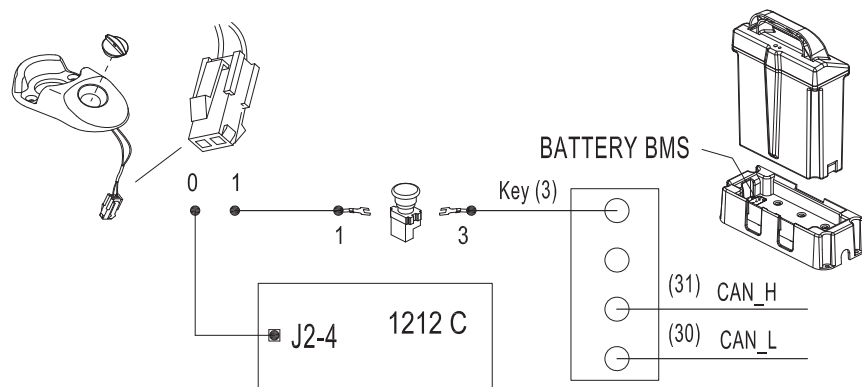


Figure 12506

ELECTRICAL SYSTEM

8.3 Emergency Stop Switch

Emergency switch is used for emergency cut-off of the power supply to all the control circuits.

8.3.1 Removal and Installation

Removal

- Remove the protective cover;(see Section 4.2)

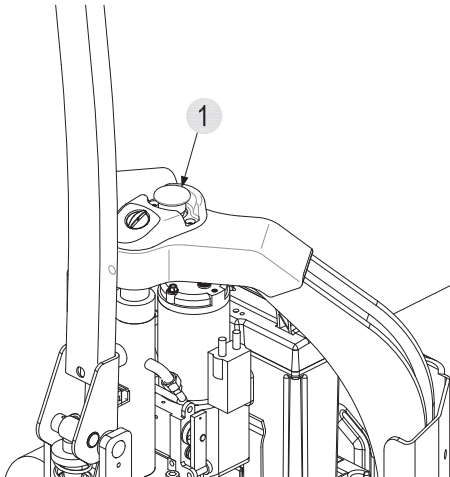


Figure 12507

- Disconnect the emergency stop switch connector from wiring harness;
- Unscrew the screws on the emergency stop switch (1) and remove switch.

Installation

- Install according to the reverse order of removal.

8.3.2 Faults and Causes

1	Fault	Emergency switch at pulled-out status, the vehicle not energized
	Cause	a. Emergency switch failure; b. Emergency switch circuit not conducted.
2	Fault	Emergency switch pressed, the vehicle still energized
	Cause	a. Emergency switch failure; b. Emergency switch shorted (short circuit)

8.3.3 Checking and Testing

Checking

- Check if the appearance of emergency switch its wiring harness are in good condition, and if the connectors are connected securely.

Testing

- Check if the emergency switch circuit is conducted;
- Carry out ON/OFF test to emergency switch with a multimeter:
Emergency switch in pulled-out status, circuit conducted;
press the emergency switch, the circuit is opened.

8.3.4 Control Circuit Troubleshooting

Emergency Switch Control Circuit (Figure 12506)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF;
- Check if #0/#1/#3 circuit is conducted.

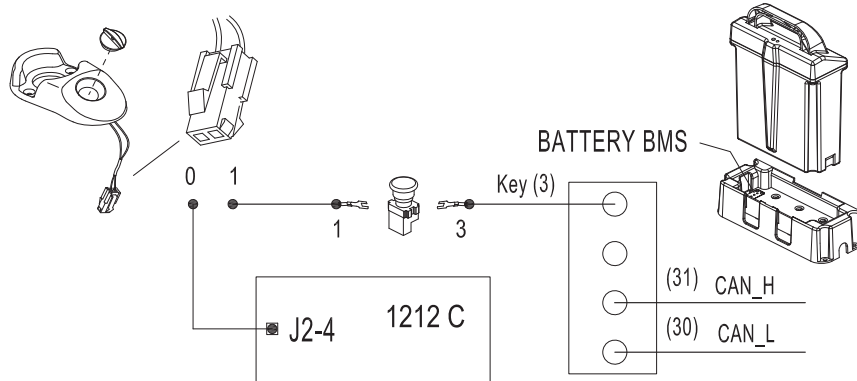


Figure 12506

8.4 Inductive Switch

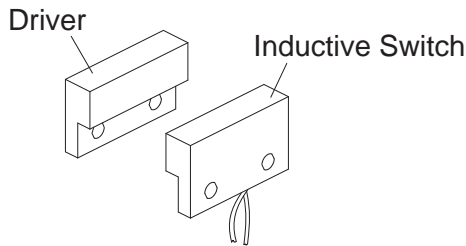


Figure 12508

By function:

- Interlock Switch
- Lifting Limit Switch

8.4.1 Removal and Installation

Interlock Switch

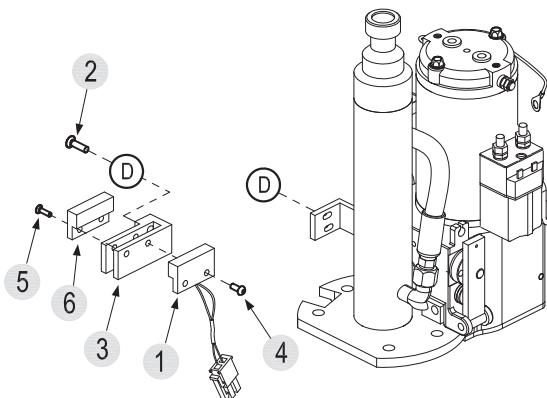


Figure 12509

- Remove the protective cover;(see Section 4.2)
- Disconnect the connection between interlock switch (1) and main wiring harness;
- Unscrew the two screws (2) with a wrench, and remove the mounting plate (3) from the cylinder ;
- Unscrew the two screws (4) with a wrench, and remove the interlock switch (1) from the mounting plate (3).
- Unscrew the two screws (5) with a wrench, and remove the drive (6) from the mounting plate (3).
- Install according to the reverse order of removal.

Lifting Limit Switch

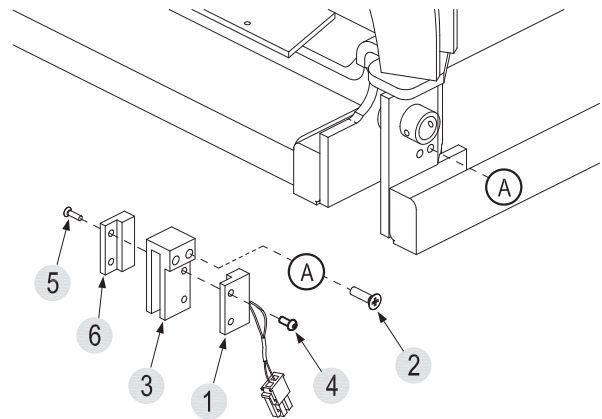


Figure 12510

- Remove the front guard;(see Section 4.2)
- Disconnect the connection between lifting limit switch (1) and main wiring harness;
- Unscrew the two screws (2) with a wrench, and remove the mounting plate (3) from the chassis;
- Unscrew the two screws (4) with a wrench, and remove the lifting limit switch (1) from the mounting plate (3).
- Unscrew the two screws (5) with a wrench, and remove the drive (6) from the mounting plate (3).
- Install according to the reverse order of removal.

8.4.2 Faults and Causes

Interlock Switch

1	Fault	Interlock switch not pressed, the vehicle can still travel
	Cause	a. Interlock switch failure; b. Interlock switch shorted (short circuit).
2	Fault	Interlock switch pressed, the vehicle cannot travel
	Cause	a. Interlock switch failure; b. Interlock switch with broken circuit.

ELECTRICAL SYSTEM

Lifting Limit Switch

1	Fault	Lifting mechanism cannot lift
	Cause	a. Lifting limit switch failure; b. Lifting limit switch shorted (short circuit).
2	Fault	Lifting limit switch pressed, lifting mechanism does not stop
	Cause	a. Lifting limit switch failure; b. Lifting limit switch with broken circuit.

8.4.3 Checking and Testing

Interlock Switch

Checking

- Check if the appearance of interlock switch and its wiring harness are in good condition, and if the connectors are connected securely;

Testing

- Check the status of the switch via the instrument; (see Section 8.6)
- Enter Monitor Menu to check the status of the switch: "Inhibit", press the interlock switch, if the display does not change, then it indicates the interlock switch or its circuit failure; (see Section 8.7)

Lifting Limit Switch

Checking

- Check if the appearance of limit switch and its wiring harness are in good condition, and if the connectors are connected securely;

Testing

- Check if the limit switch circuit is conducted;
- Carry out ON/OFF test to the limit switch with a multimeter:
The driver is far away from the limit switch (original position), open circuit;
The driver is close to the limit switch, and the circuit is conducted.

8.4.4 Control Circuit Troubleshooting

Interlock Switch Control Circuit (Figure 12511)

Check if the circuit is broken by using a multi-meter:

- Set the multimeter to ON-OFF;
- Check if #0/#8 circuit (circuit between interlock switch and controller) is conducted.

Lifting Limit Switch Control Circuit (Figure 10512)

- Check if #0/#5 circuit (circuit between interlock switch and controller) is conducted.

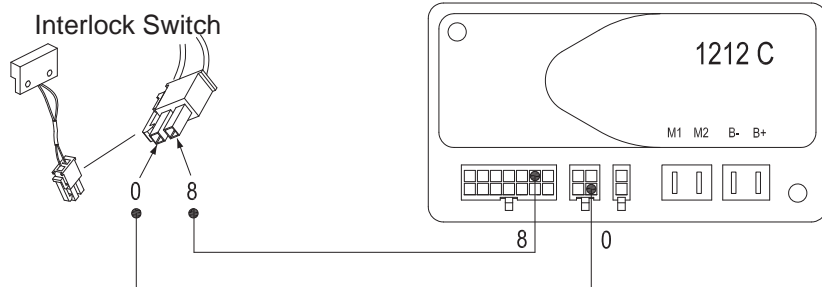


Figure 12511

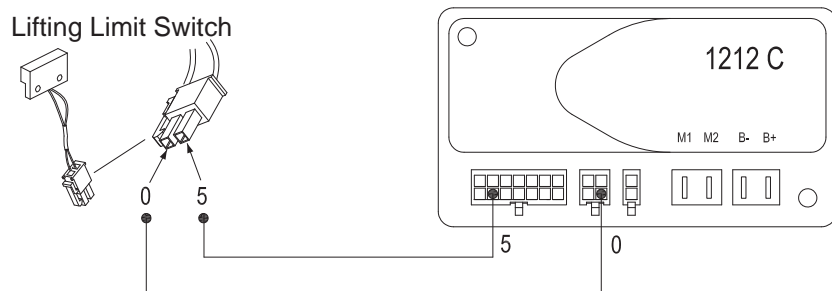


Figure 12512

8.5 Battery

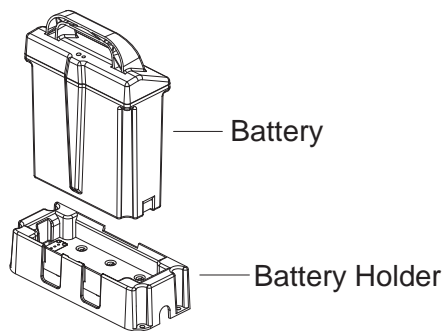


Figure 12513

8.5.1 Removal and Installation

Removal

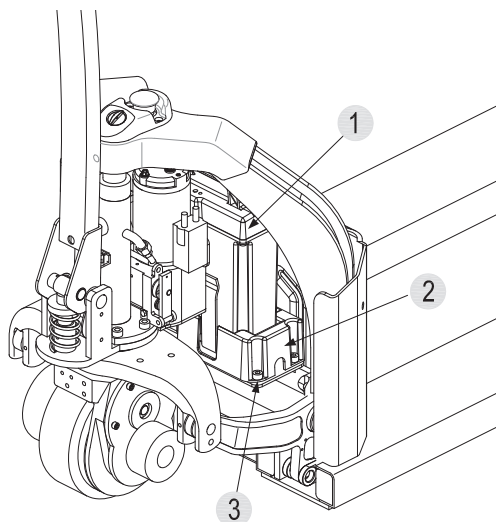


Figure 12514

- Turn off the power supply and lift the battery (1) from the holder (2);
- Remove the protective cover; (see Section 4.2)
- Remove the positive electrode power supply cable from the pump contactor and remove the negative electrode power supply cable from the pump motor;
- Disconnect the power supply cable from the power supply communication cable (see wiring harness and connector diagram);
- Unscrew the four screws (3) with a wrench, and remove the battery holder assembly (2) from the chassis;

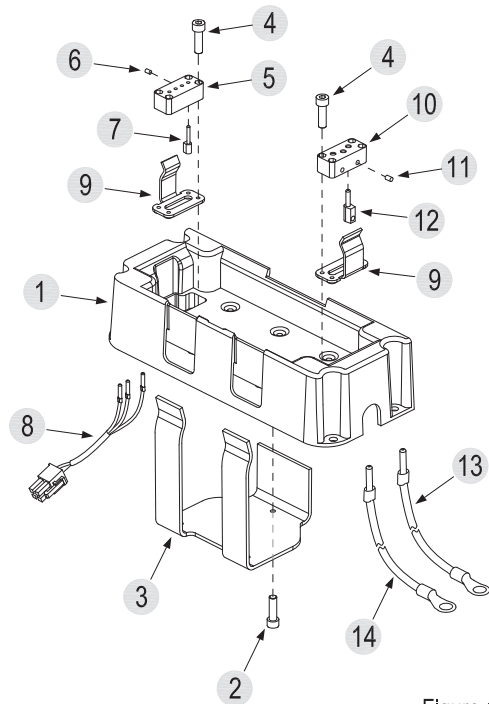


Figure 12515

(See Figure 12515)

- Remove the front guard; (see Section 4.2)
- Unscrew the four screws (4) with a wrench, and remove the socket (5) from the battery holder (1);
- Unscrew the set screw (6) in the socket (5) and remove the power supply battery cable (8) from the pin (7);
- Unscrew the four screws (4) with a wrench, and remove the socket (10) from the battery holder (1);
- Unscrew the set screw (11) in the socket (10) and remove the positive electrode power supply cable (14) and the negative electrode power supply cable (13) from the pin (12).

Installation

- Install according to the reverse order of removal.

ELECTRICAL SYSTEM

8.5.2 Faults and Causes

1	Fault	Whole vehicle power outage
	Cause	a. Battery failure; b. Battery with broken circuit.

8.5.3 Checking and Testing

Checking

- Check if the appearance of battery and battery holder are in good condition, and if the connectors are connected securely;

Testing

- Check if the circuit of battery and battery holder is conducted;
- Short the port #3 and #(B+), measure the voltage between port #B- and #B+ with a multimeter: (see Figure 12516)
22.4V~29.2V, the battery is normal;
otherwise, the battery needs to be replaced.

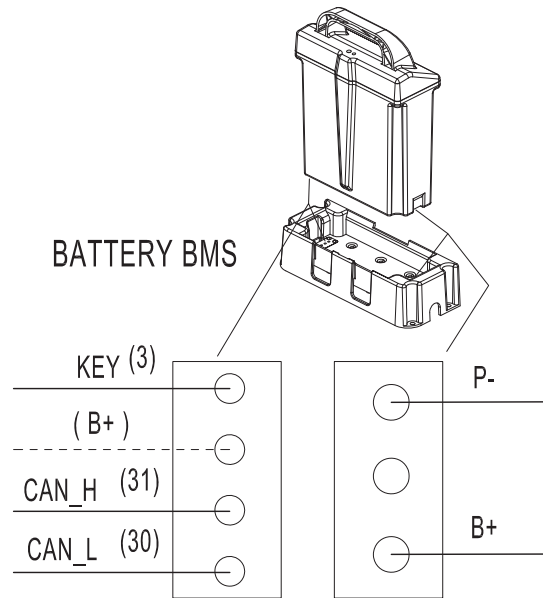


Figure 12516

8.5.4 Control Circuit Troubleshooting

Battery Control Circuit (Figure 12517)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF;
- Check if #0/#1/#3/#30/#31 circuit is conducted.

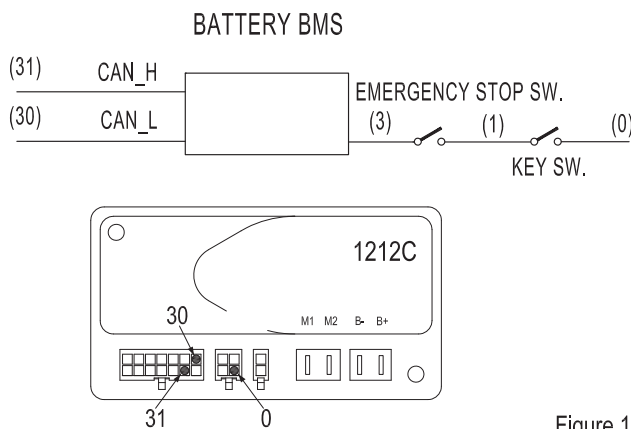


Figure 12517

8.6 Mini Instrument

It can display the remaining capacity, running time, fault information and other vehicle operation information.

8.6.1 Removal and Installation

See Section 6.1 .

8.6.2 Faults and Causes

1	Fault	No display on the instrument
	Cause	a. Instrument faults; b. Instrument circuit not connected.
2	Fault	[Display Interface 2]: NOEMS 0% [Display Interface 3]: NO CAN CTR
	Cause	Instrument CAN communication faults

8.6.3 Checking and Testing

Checking

- Check if the instrument and interface are in good condition, and if the connectors are connected securely.

Testing

- Check if the instrument circuit is conducted;
- Apply a voltage of 12V~24V to instrument interfaces J2-1 and J2-6:
If the instrument is lit, then it is normal;
If the instrument not lit, there must be fault.

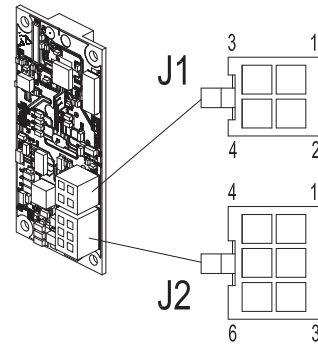
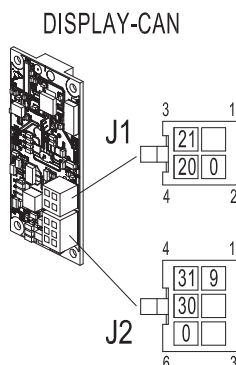


Figure 12518

J1 Interface	
Pin No.	Description
1	-
2	CM (+24V).
3	Horn Input.
4	Lift Input.

J2 Interface	
Pin No.	Description
1	Negative power supply.
2	-
3	-
4	High level CAN-BUS voltage I/O.
5	Low level CAN-BUS voltage I/O.
6	Positive power supply.

8.6.4 Control Circuit Troubleshooting

Mini Instrument Control Circuit (Figure 12305)

Check if the circuit is broken by using a multi-meter:

- Set the multimeter to ON-OFF;
- Check if #0/#9/#30/#31 circuit (circuit between instrument and controller) is conducted;

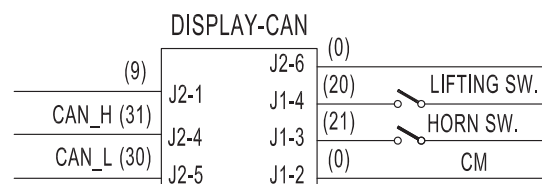
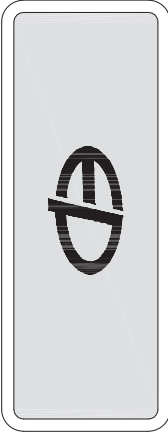
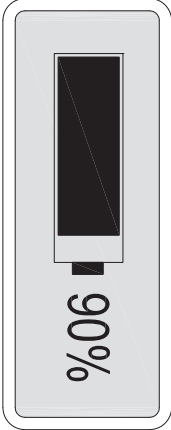
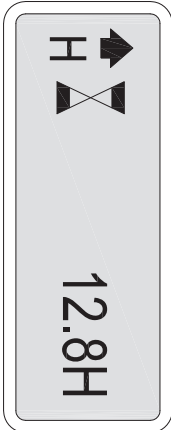













Figure 12305

ELECTRICAL SYSTEM


8.6.5 Display

1. The vehicle is started properly		
Interface Location	Display	Description
Display Interface 1		* After flashing, jump directly to [Display Interface 2]
Display Interface 2		* Every 3 seconds, jump to [Display Interface 3] [Display Interface 2] Display the remaining capacity of battery.
Display Interface 3		* Every 3 seconds, jump to [Display Interface 2] [Display Interface 3] <ul style="list-style-type: none">  Horn works properly, flashing  Reverse switch works properly, flashing  Travel forward properly, flashing  Travel backward properly, flashing  Lifting properly, flashing  Control level connection fault, flashing  Always on, interlock switch opened Flashing, interlock switch closed, start timing 12.8H Total running time

2. Battery Faults		
Interface Location	Display	Description
Display Interface 2		* Every 3 seconds, jump to [Display Interface 3] [Display Interface 2] "BMSTEM" will flash continuously "90%" is the remaining capacity of battery Fault: Battery temperature is high Troubleshooting: 1) Improve working environment 2) Replace the battery
Display Interface 2		* Every 3 seconds, jump to [Display Interface 3] [Display Interface 2] "BMSEER" will flash continuously "90%" is the remaining capacity of battery Fault: Other faults of battery Troubleshooting: 1) Replace the battery
Display Interface 2		* Every 3 seconds, jump to [Display Interface 3] [Display Interface 2] "NOBMS" will flash continuously "5%" and "0%" flashes alternatively Fault: Battery CAN communication not connected Troubleshooting: 1) Check the wire connection of battery CAN communication; 2) Replace the battery

3. Controller CAN Communication Fault		
Interface Location	Display	Description
Display Interface 3		* Every 3 seconds, jump to [Display Interface 2] [Display Interface 3] "NO CAN CTR" will flash continuously Fault: Controller CAN communication not connected Troubleshooting: 1) Check the wire connection of controller CAN communication; 2) Replace the controller

ELECTRICAL SYSTEM

4.Trouble		
Interface Location	Display	Description
Display Interface 4		<p>*Display always [Display Interface 4] [Display Interface 4] "F X.X": fault code (X refers to a number) For example: F 2.3: Fault 2, 3 "90%" is the remaining capacity of battery.</p>

8.7 Handheld Unit (Optional)

Handheld unit must be used together with controller, if necessary, it can be purchased from our company or dealer.

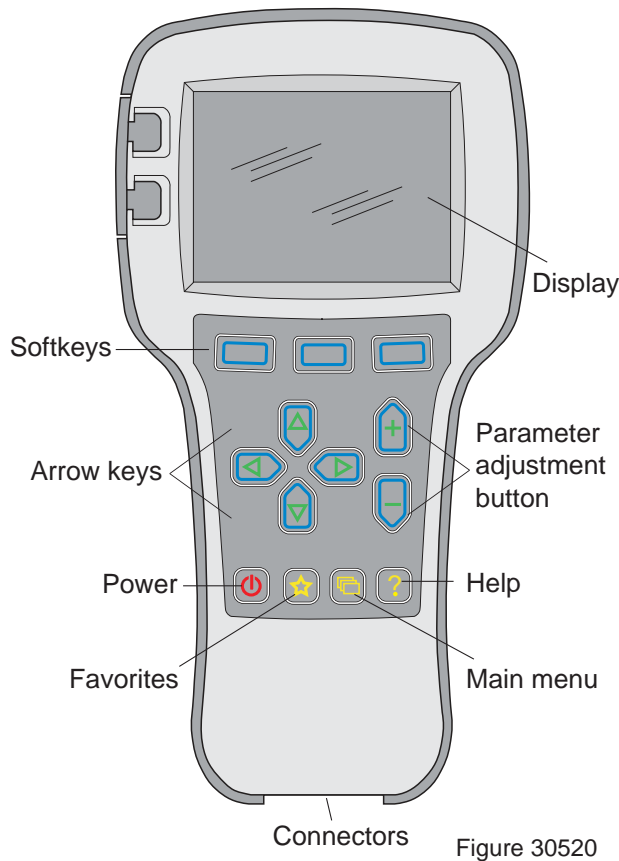


Figure 30520

8.7.1 Handheld Unit Connection

- Remove upper cover;(See Section 4.2)
- Plug the handheld unit communication cable into the handheld unit communication interface of the controller;



J2 Interface - Handheld unit communication interface

- Turn on the key switch, pull out emergency stop switch, the display of handheld unit will be flashing:

if the connection is successful: The programmer automatically powers up, and displays this screen while it loads information from the controller. Once the programmer has uploaded the information from the controller, it displays the Main Menu.

If the controller is not turned on when the programmer is connected, you can power up the programmer by pressing the Power key; the message "No System detected" will be displayed.

8.7.2 Handheld Unit Main Menu



- With Arrow keys (Figure 30520), you can carry out menu switching;
- "Select", select ENTER the menu.

Parameters : parameter change
 Monitor : vehicle running test
 Diagnostics : error alarms

* See "Handheld Unit Operation Manual" for detailed operations

ELECTRICAL SYSTEM

8.7.3 Monitor Menu

The parameters in Monitor Menu are real-time presentation of the running status of the equipment.

Traction Controller (1212C)

Name	Display Range	Description
KSI Voltage	0.0 ~ 38.2 V	KSI Voltage.
Battery Voltage	0.0 ~ 38.2 V	Battery Voltage.
Cap Voltage	0.0 ~ 38.2 V	Capacitor Voltage.
Motor Voltage	-27.4 ~ +27.4 V	Voltage drop between the motor terminals.
Pot Low Voltage	0.0 ~ 5.0 V	Pot low voltage.
Temp	-55 ~ +120 °C	Controller's internal temperature.
Motor Thermal Cutback	0 ~ 100 %	Current cutback during motor over temperature, as a percentage of max current. 100% = no cutback.
Armature Current	-90 ~ +90 A	Measured motor armature current.
Current Limit	-90 ~ +90 A	Ultimate current limit of the controller, taking into account boost mode, thermal protection, etc.
Resistance	0 ~ 854 mohm	Measured system resistance, when the motor is stalled.
Throttle	-100 ~ 100 %	A vailable throttle input.
BDI	0 ~ 100 %	Status of battery capacity in percentage.
Hourmeter	0 ~ 99999.9 hours	Hours of operation since the hourmeter was last reset.
Mode Switch	On / Off	Status of the mode switch (at J1-4).
Forward Switch	On / Off	Status of the forward switch .
Reverse Switch	On / Off	Status of the reverse switch.
Interlock Switch	On / Off	Status of the interlock input switch (at J1-6).
EMR Switch	On / Off	Status of the emergency reverse switch .
AUX Switch	On / Off	Status of the AUX input switch (at J1-9).

ELECTRICAL SYSYTEM

Name	Display Range	Description
Mode Input	On / Off	Status of the mode input.
Forword Input	On / Off	Status of the forward input.
Reverse Input	On / Off	Status of the reverse input.
Interlock Input	On / Off	Status of the interlock input.
EMR Input	On / Off	Status of the emergency reverse input.
Lift Lockout Input	On / Off	Status of the lift lockout.
Main Relay	On / Off	Status of the main relay driver.
EM Brake	On / Off	Status of the EM brake driver.
Driver 1	On / Off	Status of the driver 1.
Driver 2	On / Off	Status of the driver 2.
CAN NMT State	0 ~ 127	Controller NMT state 0 = initialization 4 = stopped 5 = operational 127 = pre-operational

ELECTRICAL SYSTEM

8.8 Controller Error Message

The error message can be obtained in two ways:

- 1) By reading the appropriate display on the handheld unit ;
- 2) By reading the fault codes display by the mini indicator.

Handheld Unit Diagnostics

The fault information is shown in the Diagnostics menu of the handheld unit.

Indicator Diagnostics

The fault code is shown in the [Display Interface 4] of the mini indicator.

8.8.1 Traction Controller

Flash Code	Error Message	Effect of Fault	Possible cause
	Error text		
1,1	Motor Temp Hot Cutback	Current limit cutback	1. Excessive load on vehicle. 2. Controller is operating in extreme high temperature.
1,2	Throttle Fault	Kill the throttle input	1.Throttle input wire open or shorted. 2.Throttle pot defective.
1,3	Undervoltage Cutback	Current limit cutback	1. Battery voltage <16.8 volts. 2. Bad connection at battery or controller.
1,4	Overvoltage Cutback	Current limit cutback	1. Battery voltage >overvoltage cutback point. 2. Vehicle operating with charger attached. 3.Intermittent battery connection.
1,5	Severe Overvoltage	a.Kill the throttle input; b.Shut down EM brake driver	1. Battery voltage >34.0 volts. 2. Vehicle operating with charger attached. 3.Intermittent battery connection.
1,6	Severe Undervoltage	a.Kill the throttle input; b.Shut down EM brake driverc	1. Battery voltage <13.8 volts.

ELECTRICAL SYSTEM

Flash Code	Error Message	Effect of Fault	Possible cause
	Error text		
2,1	SRO Fault	Kill the throttle input	1.Improper sequence of direction and KSI and interlock inputs.
2,2	EMR Sequencing Fault	a.Kill the throttle input; b.Shut down EM brake driver	1.Emerg. Rev. switch (belly button) is pressed before KSI on.
2,3	Main Driver Fault	a.Kill the throttle input; b.Shut down the main relay	1. Internal relay coil is broken. 2. Internal relay driver is open or shorted.
2,4	Main Relay Welded	a.Kill the throttle input; b.Shut down the main relay	1. Internal relay welded. 2. Controller defective.
2,5	Main Relay DNC	a.Kill the throttle input; b.Shut down the main relay	1. Internal relay was command to be close and it did not. 2. Internal relay tips are oxidized.
2,6	Pump SRO Fault	Shut down the driver 1 and/or driver 2 (depending on parameter)	1. Lift or lower switch pressed before Keyswitch is on.
3,1	Wiring Fault	Kill the throttle input	1.Misadjusted throttle. 2.Broken throttle pot or throttle mechanism.
3,2	Brake On Fault	a.Kill the throttle input; b.Short the motor armature	1.Electromagnetic brake driver shorted. 2.Electromagnetic brake coil open.
3,3	Precharge Fault	Kill the throttle input	1.Controller defective.
3,4	Brake Off Fault	a.Kill the throttle input; b.Short the motor armature	1.Electromagnetic brake driver open. 2.Electromagnetic brake coil shorted.
3,5	HPD Fault	Kill the throttle input	1. Improper sequence of throttle and interlock input. 2. Emergency Reverse operation has concluded, but the throttle has not been returned to neutral.

ELECTRICAL SYSYTEM

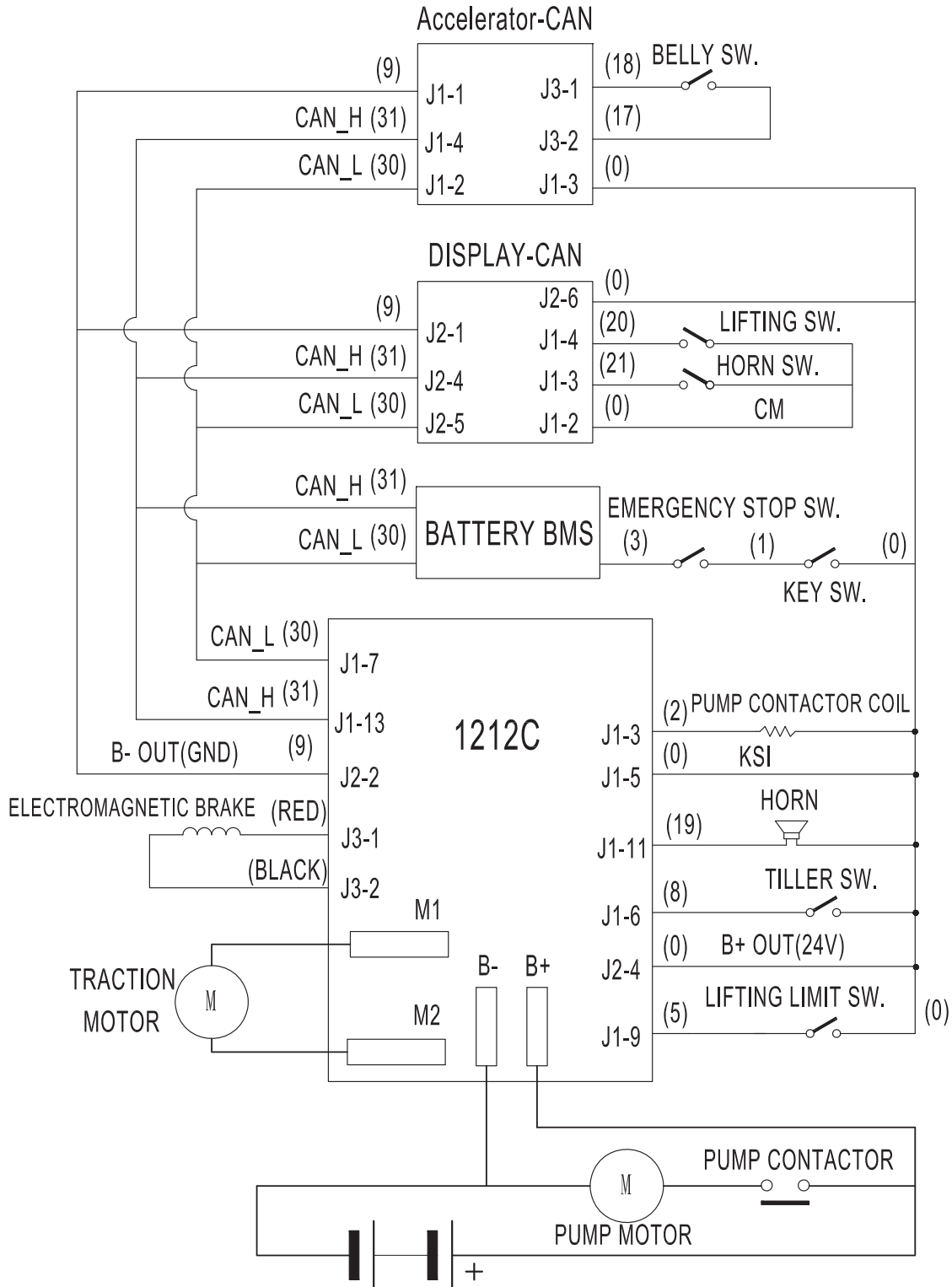
Flash Code	Error Message	Effect of Fault	Possible cause
	Error text		
3,6	Gage Handshake Failed	Motor speed reduced to 20%	1.The handshake with gage failed at start up.
4,1	Current Sense Fault	a.Kill the throttle input; b.Shut down main relay and EM brake driver; c.Shut down the full-bridge driver.	1.Controller defective.
4,2	EMR Sequencing Fault	a.Kill the throttle input; b.Shut down main relay and EM brake driver; c.Shut down the full-bridge driver.	1.Controller defective.
4,3	Hardware Fault	a.Kill the throttle input; b.Shut down main relay and EM brake driver; c.Shut down the full-bridge driver.	1. Motor voltage does not correspond to throttle request. 2. Controller defective.
4,4	Software Fault	a.Kill the throttle input; b.Shut down main relay and EM brake driver; c.Shut down the full-bridge driver.	1. Software defective. 2. Controller defective.
4,5	Battery Disconnect Fault	a.Kill the throttle input; b.Shut down EM brake driver; c.Shut down the motor armature.	1. Battery not connected. 2. Poor connection to battery terminals.
4,6	Motor Overtemperature	Motor speed reduced	1. The motor is in high temperature.
4.7	Tiller Handshake Failed	Kill the throttle input	1. The handshake with tiller failed at start up. 2. The Stuffing Bit check failed while the stuffing bit check is enabled.
5,1	Low BDI	Motor speed reduced	1.The battery discharge falls below the programmed threshold.
5,2	Controller Overtemp Cutback	Current limit cutback starts at 80 °C	1.Excessive load on vehicle. 2.Controller is operating in high temperature.

ELECTRICAL SYSYTEM

Flash Code	Error Message	Effect of Fault	Possible cause
	Error text		
5,3	Controller Severe Overtemp	Current limit cut off	1.Excessive load on vehicle. 2.Controller is operating in high temperature.
5,4	Controller Undertemp Cutback	Current limit cutback starts at -10 °C and is reduced to 50% at -25°C	1. Controller is operating in extreme low temperature. 2. The temperature sensor is broken.
5,5	Parameter Change Fault	a.Kill the throttle input; b.Shut down main relay and EM brake driver; c.Shut down the full-bridge driver. d.Shut down the driver 1 and driver 2.	1. A parameter value is changed that requires a power cycle (such as Throttle Type, Interlock Type, Driver Type, EMR Trpe, Pump SRO Type, AUX Switch Input Type). 2. Parameters are restored to the default settings.
5,6	Parameter Fault	a.Kill the throttle input; b.Shut down main relay and EM brake driver; c.Shut down the full-bridge driver.	1. The CRC of the parameters does not calculate correctly. 2. Controller defective.
5.7	Password Check Failed	Kill the throttle input	1. The input password from CAN message is wrong at start up.
6,1	Motor Short	a.Kill the throttle input; b.Shut down main relay and EM brake driver; c.Shut down the full-bridge driver.	1.The motor wires shorted.
6,2	Motor Open	a.Kill the throttle input; b.Shut down main relay and EM brake driver.	1.Motor wires open. 2.Faulty motor cable wiring. 3.Controller defective.
6,3	Gage PDO Timeout	No action	1.Communication between the 1212C and the gage has halted.
6,4	PDO Timeout	a.Kill the throttle input; b.Shut down the driver 1 and driver 2.	1.Communication between the 1212C and the CAN tiller has halted.
6,5	BMS PDO Timeout	No action	1.Communication between the 1212C and the BMS has halted.
6,6	Driver 1 Fault	Shut down the driver 1	1.The driver 1 is open or shorted.
6,7	Driver 2 Fault	Shut down the driver 2	1.The driver 2 is open or shorted.

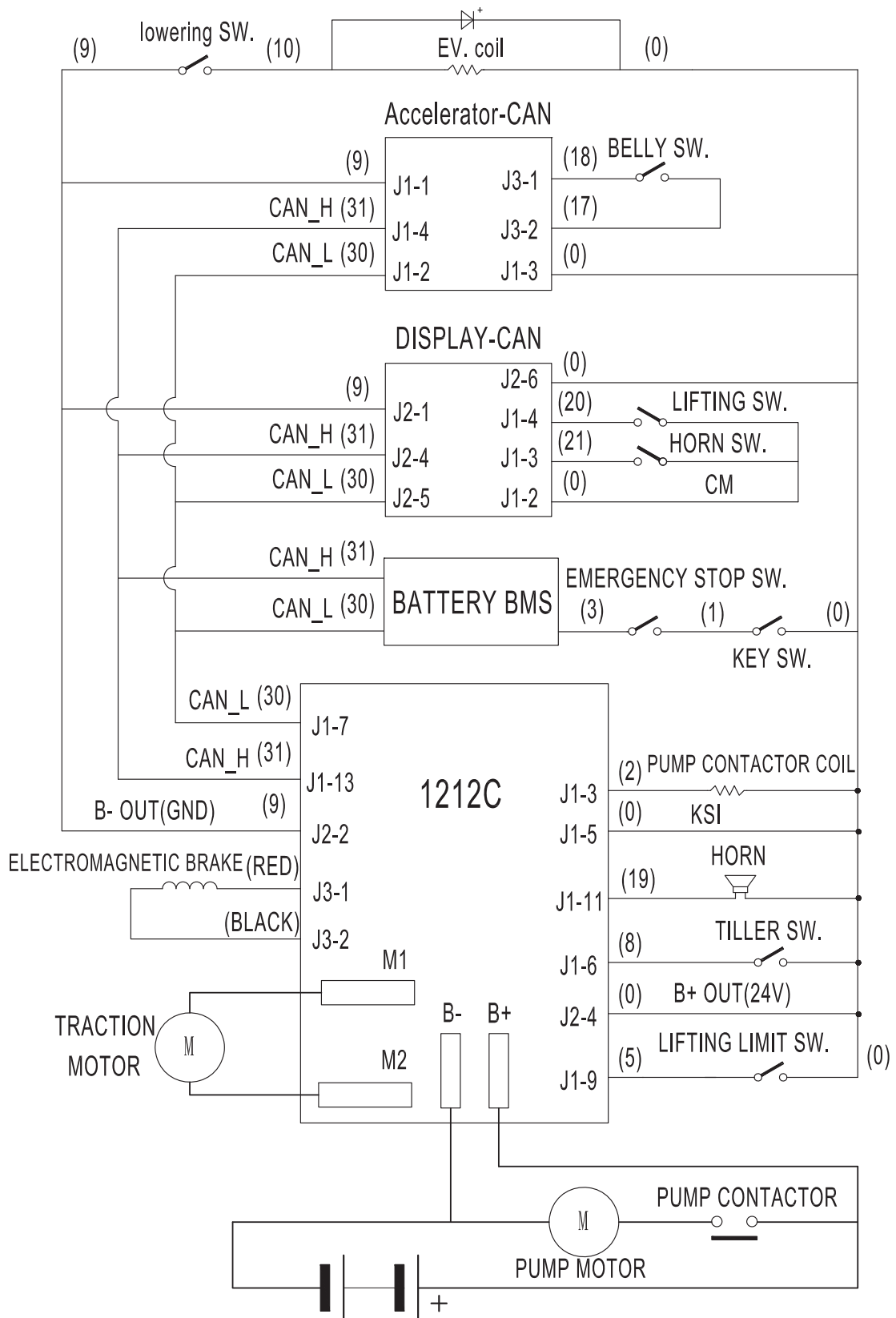
ELECTRICAL SYSTEM

8.9 Electrical Schematic Diagrams Manual Lowering



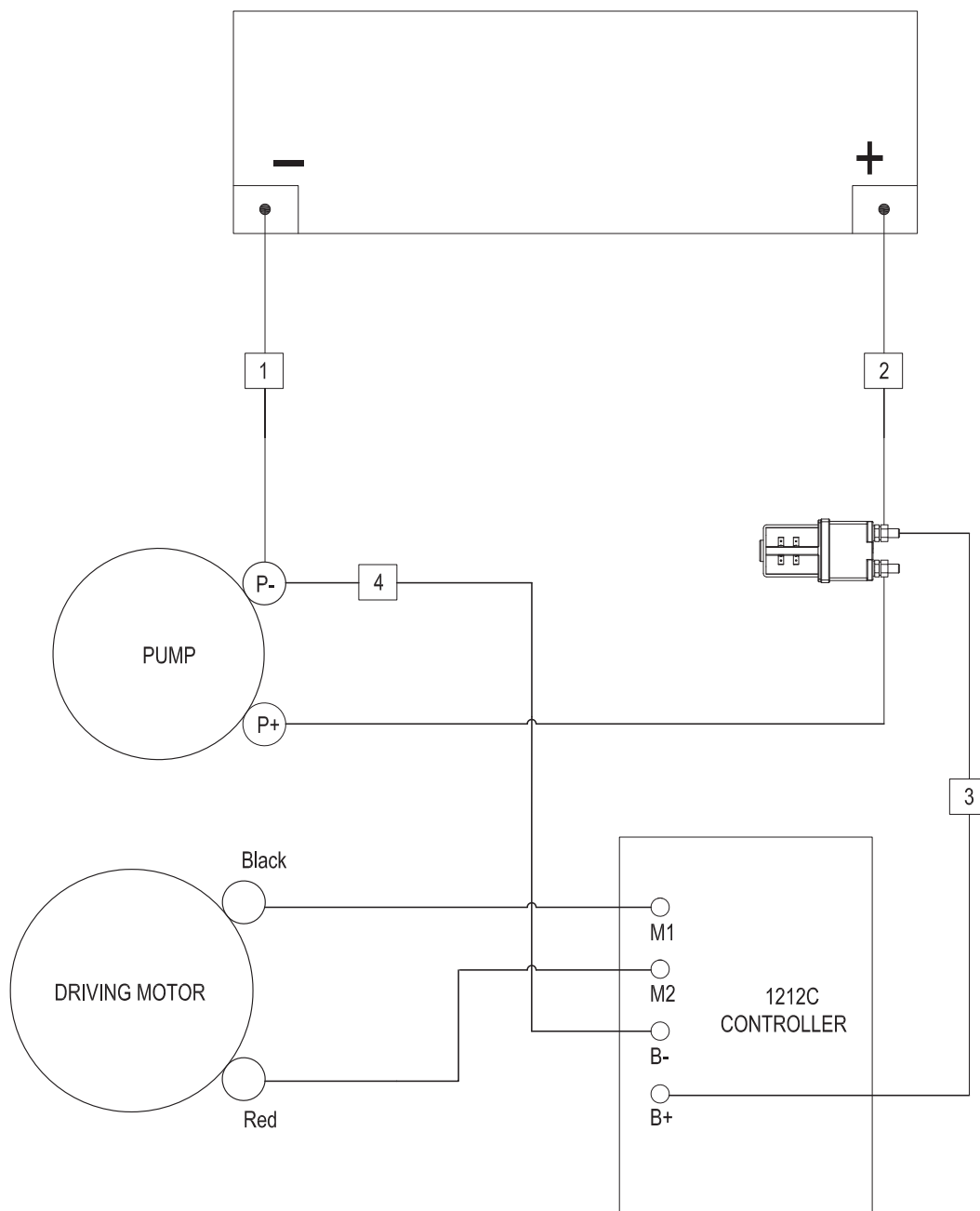
8

Electrical Lowering



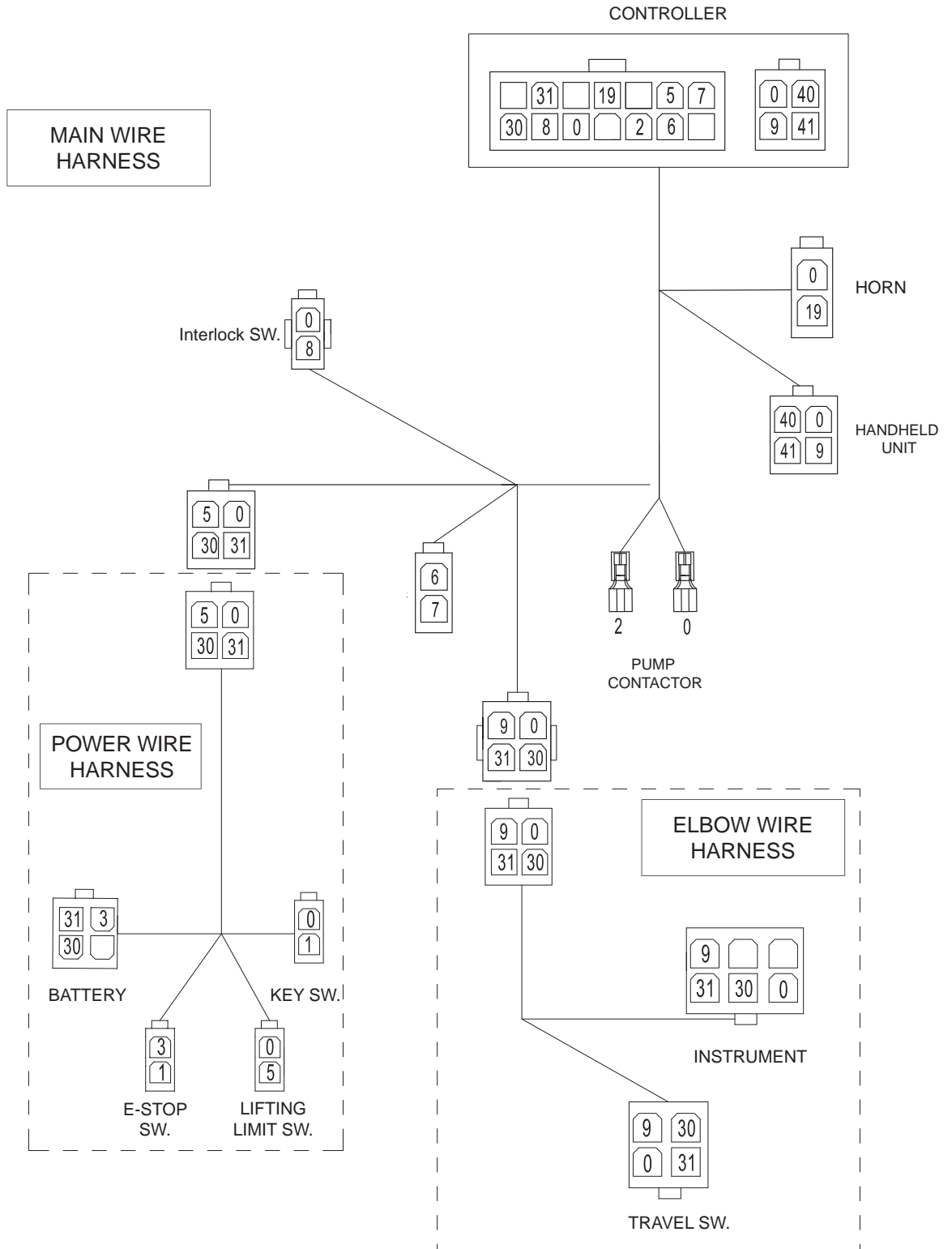
ELECTRICAL SYSTEM

8.10 Cable Wiring Diagrams



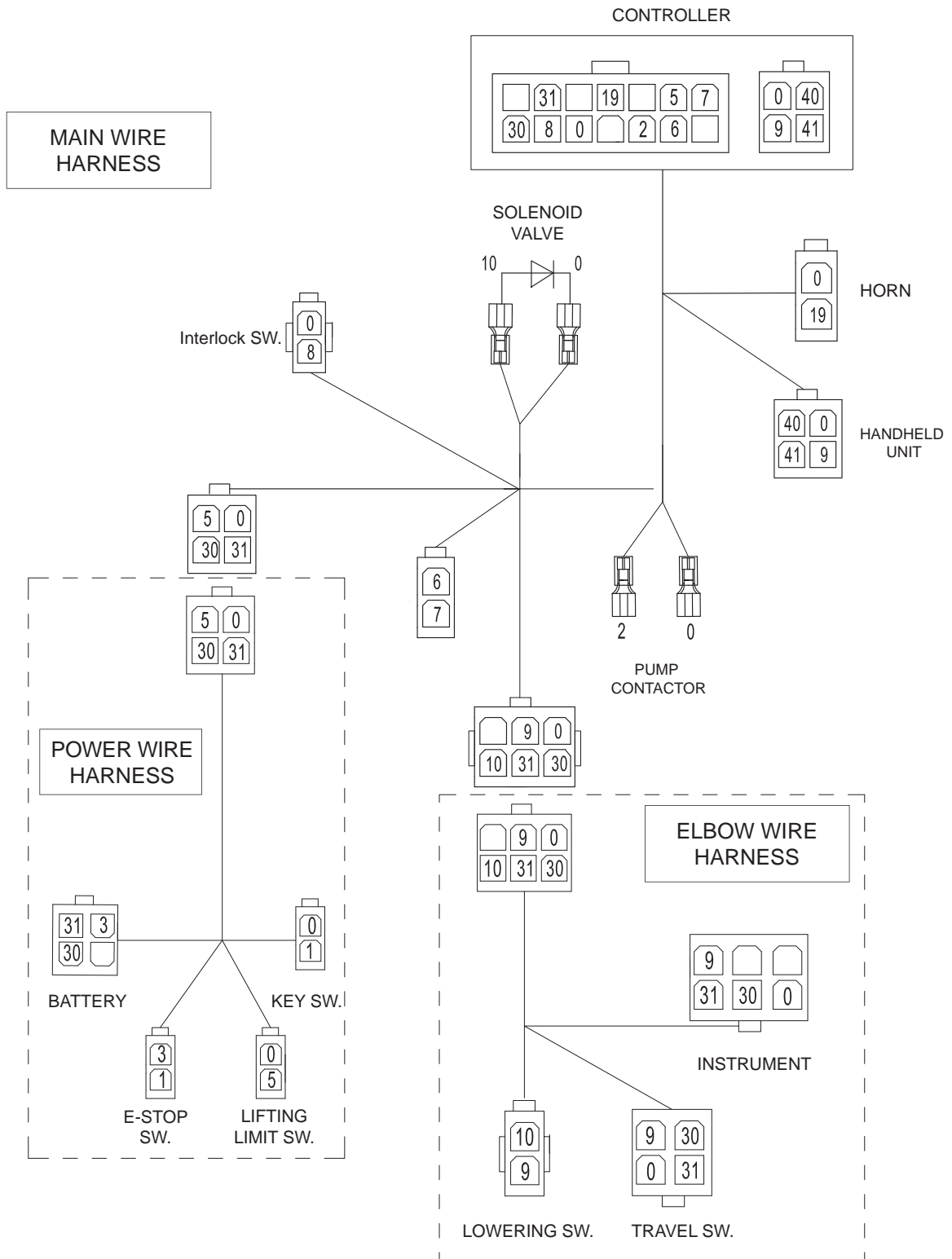
No.	Name
1	Power Cable B-
2	Power Cable B+
3	Controller Cable B+
4	Controller Cable B-

8.11 Wiring Harness and Connectors Manual Lowering



ELECTRICAL SYSTEM

Electrical Lowering



8

9. TROUBLESHOOTING

9

LET'S GROW TOGETHER!



NOTE:

9.1 Preparation Before Troubleshooting

- Park the truck on level ground and block the wheels with wooden wedges;
- Fully lower the fork and press the emergency stop switch.
- Turn off the key switch;
- Open the cover and check the controller.



CAUTION

- *Even if key switch is turned off, the controllers are still energized.*
- *Before checking or repairing the controllers, make sure the battery plug has been unplugged and the electrical circuit is disconnected.*

9.1.1 Check the Voltage of Battery

See Section 8.5 .

- Identify if the battery voltage is normal according to the measured voltage.
As shown in the following table:

Battery	Voltage	Judgment
24V/20Ah	22.4V ~ 29.2V	Normal
	other	Battery Fualt



NOTE

Enter Monitor Menu to check the battery voltage.(see Section 8.7)

TROUBLESHOOTING

9.2 Troubleshooting Solutions of Common Faults

Table 9.1 lists the common faults that may occur and handling methods. Mainly consists of the following items:

Table 9.1 Troubleshooting of Common Faults			
Fault	Fault Symptom	Troubleshooting Order *	Troubleshooting Measures
Power supply failure	1. Whole vehicle power outage	a. Power supply failure b. Emergency stop switch or circuit failure c. Key switch or circuit failure d. Controller failure	1) Check the voltage of storage battery (see Section 8.5.3) 2) Check key switch and its circuit (see Section 8.2) 3) Check emergency stop switch and its circuit (see Section 8.3) 4) Replace the controller.
Travel Fault	1. Forward and reverse moving failures of the vehicle, but other functions are normal	a. Interlock switch or its circuit connection failure b. Electromagnetic brake locked (Non-mechanical failure, the instrument will display fault code) c. Travel switch or its circuit connection failure d. Transmission chain fell off or broke e. Drive motor or its circuit connection failure f. Drive motor carbon brush failure g. Controller failure	Controller failure error, carry out troubleshooting according to the fault code information on the instrument (see Section 8.8). 1) Check if the interlock switch or the connection of its circuit is normal; (See Section 8.4) 2) Electromagnetic brake and its connecting circuit; (see Section 5.2 or 5.7) 3) Check the travel switch and its connection circuit; (see Section 6.3) 4) Check the drive motor and its connection circuit; (see Section 5.4 or 5.9) 5) Check transmission chain; (see Section 5.10) 6) Replace the controller.
	2. The vehicle can travel at low speed, but cannot travel at high speed	Failures due to external factors: a. Electromagnetic brake locked (Non-mechanical failure, the instrument will display fault code) b. Drive motor carbon brush failure Failures due to internal factors: a. Battery voltage deficiency	Controller failure error, carry out troubleshooting according to the fault code information on the instrument (see Section 8.8). 1) Check the voltage of storage battery (see Section 8.5.3) 1) Check if the motor rotation is normal; 2) Check the electromagnetic brake or its connection circuit (see Section 5.2 or 5.7) 3) Check the drive motor and its connection circuit; (see Section 5.4 or 5.9)

* Carry out trouble shooting in accordance with the order listed in the table, it can help you quickly identify problems and resolve accordingly.

Table 9.1 Troubleshooting of Common Faults (continued)

Fault	Fault Symptom	Troubleshooting Order *	Troubleshooting Measures
Hydraulic Failure	1. The vehicle cannot lift	1. Pump motor does not work: a. Pump motor or its circuit connection failure b. Pump contactor or its circuit connection failure c. Lifting switch or its circuit connection failure d. Lifting limit switch or its circuit connection failure 2. Pump motor works: a. Overload b. Insufficient hydraulic oil c. Hydraulic pipeline leakage d. Pump motor reverse rotation e. Cylinder failure (blocked) f. Solenoid valve blocked and cannot reset g. Valve body failure: excessive wear of gear pump, serious internal leaks, insufficient pressure of relief valve or blocked, check valve blocked	1. Pump motor does not work: 1) Check the pump motor and its connection circuit; (see Section 7.3) 2) Check the pump contactor and its connection circuit; (see Section 7.4) 3) Check the lifting switch and its connection circuit; (see Section 6.2) 4) Check the lifting limit switch and its connection circuit; (see Section 8.4) 2. Pump motor works: 1) Refer to the rated capacity marked on the nameplate; 2) Lower the mast to the bottom, check if the amount of oil in the oil tank can meet the requirements (see Section 2.2.3); 3) Check the pipe and hydraulic components for oil leaks; 4) Check the pump motor wiring; 5) Check the cylinder for damage or deformation, remove the cylinder to check for wear or aged seals inside; (see Section 7.6) 6) Wash or replace the solenoid spool (see Section 7.5) 7) Wash or replace the valve body
	2. The vehicle cannot be lowered	a. Solenoid valve or its circuit connection failure b. Lowering switch or its circuit connection failure c. Valve failure; d. Cylinder deformation or blocked	1) Check the lowering button and its connection circuit; (see Section 6.2) 2) Check the solenoid valve and its connection circuit; (see Section 7.5) 3) Check the cylinder for deformation, remove the cylinder to check if the internal assembly is normal ; (see Section 7.6) 4) Clean or replace the valve;

* Carry out trouble shooting in accordance with the order listed in the table, it can help you quickly identify problems and resolve accordingly.

TROUBLESHOOTING

Table 9.1 Troubleshooting of Common Faults (continued)			
Fault	Fault Symptom	Troubleshooting Order *	Troubleshooting Measures
Lift Failure	3. Slow Lifting of Vehicle	a. Overload b. Hydraulic pipeline leakage c. Valve failure: Gear pump wear, internal leakage occurs Insufficient relief valve pressure or blocked	1) Refer to the rated capacity marked on the nameplate; 2) Check the pipe and hydraulic components for oil leaks; 3) Wash or replace the valve body
	4. Slow Lowering of Vehicle	a. Solenoid valve blocking b. Valve body failure: throttle valve failure or blocked	1) Wash or replace the solenoid spool (see Section 7.5) 2) Wash or replace the valve body
	5. Unstable Lifting / Lowering of Vehicle	a. Lifting mechanism loosening or wear; b. Poor lubrication of lifting mechanism;	1) Check if the lifting mechanism is normal; (see Section 4.3)
Other Failures	1. Horn does not sound	a. Horn switch or its circuit connection failure b. Horn failure	1) Check the horn button and its connection circuit; (see Section 6.2) 2) Check the horn and its connection circuit. (see Section 6.2)

* Carry out trouble shooting in accordance with the order listed in the table, it can help you quickly identify problems and resolve accordingly.

APPENDIX

LET'S GROW TOGETHER!



NOTE:

B SERVICE MANUAL - BATTERY

B

LET'S GROW TOGETHER!



NOTE:

B1 Lead-acid Battery

B1-1 Safety and Warnings

- When operating on battery, you must wear protective glasses and protective clothing!
- Electrolyte contains sulfuric acid and is highly corrosive. If it accidentally comes into contact with the skin, wash immediately with plenty of water, if the situation is serious, immediately seek medical advice.
- The battery will produce hydrogen during charging, which may produce an explosive mixture. Smoking or ignition is prohibited near the battery that is being charged or just completes charging, there should not be flame or a hot wire, otherwise there may be fire or explosion hazards!



CAUTION

To avoid accumulation of hydrogen gas, keep the battery cover open during charging, charge the battery at a cool, well-ventilated place.

- To avoid short circuit. Metal parts of the battery cell are live; it is prohibited to place metal objects on the battery to avoid the occurrence of short circuit.
- Dumping of battery is prohibited. Only use proper lifting equipment to lift or transport the battery.



WARNING

- *It is necessary to add water regularly, otherwise may cause damage to the battery due to water loss.*
- *The water must be added after the battery is fully charged, adding water before charging can cause electrolyte overflow.*
- *The amount of water to be added must be strictly controlled, excessive adding of water may lead to electrolyte overflow.*
- *Only distilled water can be added, the adding of tap water or mineral water is prohibited.*

As for the decrease of battery capacity, or even damage to the battery due to failure to comply with the above provisions, the quality assurance will automatically void.

As for failure to comply with instructions for use, maintenance without using original parts, user corruption, or violation of provisions when adding electrolyte and other circumstances, the quality assurance will automatically void.

B1-2 Use of Battery

B1-2.1 Pre-use Checks

- Check if the battery status is normal and also check for mechanical failures;
- Connect the battery connectors, make sure the contact is solid, the electrodes are connected properly, otherwise may cause damage to the battery, truck or charger;
- Check if the electrode bolt of each battery interface is tightened;
- Check electrolyte fluid level. It must be ensured that the electrolyte level is higher than the upper edge of overflow outlet or separator;
- Charge the battery according to the instructions on the operation manual;
- Refill the electrolyte with distilled water to make the electrolyte level reach standard level.

B1-2.2 Discharging

- Do not close or cover the ventilation openings with objects;
- When connecting or disconnecting the battery connector (such as, plug), the power supply must be disconnected first;
- In order to meet or exceed the rated battery service life, the battery should avoid excessive discharge during runtime (capacity less than 20% of the rated capacity);
- Re-charge the battery immediately after discharging without delay.

SERVICE MANUAL - BATTERY

B1-2.3 Charging

- When charging, only DC can be used. Connect the battery with proper charger for specification and size to avoid overload of circuit and interface, and to avoid electrolyte foaming or overflow from the cell;
- The charger purchased separately must be checked by the after-sales service department of our company before it can be used;
- When connecting the battery with the charger, the circuit switch should be at "OFF" position, make sure the connection is correct. It is prohibited to connect the battery with live charger.
- Before battery charging, make sure the electrolyte temperature is within the range of 10 ° C~ 45 ° C;
- When charging, the cover or cover plate of the battery compartment must be opened or removed to ensure that the gas generated during charging can be smoothly discharged.
- When the concentration of the electrolyte and battery voltage remain constant (for more than 2 hours), it indicates that the charging is completed.

B1-2.4 Temperature

- Rated temperature of electrolyte is 30 °C.
- If the temperature is too high, it will reduce the service life of the battery; too low may reduce the battery capacity.
- When the temperature reaches the limit temperature of 55 ° C, it is prohibited to run the battery.

B1-3 Maintenance & Care

B1-3.1 Daily Maintenance

- Charge the discharged battery;
- Visual inspection for excessive dirtiness and mechanical damage after the charging.

B1-3.2 Weekly Maintenance

- Control the electrolyte fluid level. Check the electrolyte fluid level when the charging is about to complete. If necessary, add distilled water into the electrolyte when the charging is about to complete to make the fluid level reach the rated standard.

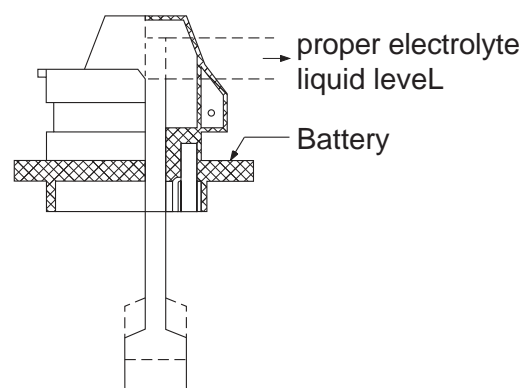


CAUTION

- Lower fluid level may reduce the battery capacity, and thus reduce the service life of battery.
- Higher liquid level may lead to electrolyte overflow when charging, which may cause corrosion to the battery compartment or even the vehicle.

There are two types of battery filler cap used on battery cell:

- 1) Filler cap with buoy



Add distilled water, red buoy will float until white rod appears under the red scale.



WARNING

- Add only distilled water.
- Before adding distilled water, check if the buoy can move up and down properly to prevent the buoy from failing to float up and resulting in excessive filling.

2) Filler cap without buoy

When adding water, stop filling when the electrolyte level is higher than the protective plate for 15~20 mm.



CAUTION

Please operate the electric watering device in accordance with its operating manual.

B1-3.3 Monthly Maintenance

- Before the charging is completed (while the charger is still energized), measure and record the voltage of battery cell the entire battery;
- After the charging is completed, measure and record the electrolyte concentration and temperature of the battery cell.

How to tell if the battery is normal?

- As for a normal set of fully charged batteries, the voltage of each of the battery cell should be around 2.08V, specific gravity of electrolyte should be around 1.28;



CAUTION

After being fully charged, if the voltage of battery cell is lower than 1.85V or the specific gravity of electrolyte is less than 1.05, then that battery cell has been damaged and needs to be replaced.

- As for a group of normal batteries, when the battery is discharged for 80% (the instrument alarms and prompts low battery, you should recharge in a timely manner), the open circuit voltage should be around 1.93V, specific gravity of electrolyte (under 30°C) should be around 1.14.



CAUTION

And you can identify if the battery is fully discharged according to the specific gravity of battery electrolyte when the instrument alarms, and identify if the capacity indicated on the instrument is accurate.

If there is fault, please notify service personnel for repairs.

B1-3.4 Care

1. Keep it clean
 - Battery surface should be clean and dry to prevent the occurrence of leakage currents;
 - Battery cables, terminals and connectors must be tightened and clean, a small amount of special grease should also be applied.



WARNING

- Do not use a dry cloth or fabric to clean the surface of the battery, so that to prevent the occurrence of static electricity, resulting in explosion;
 - Unplug the power plug;
 - Wipe clean with a damp cloth;
 - Please wear goggles, rubber boots and rubber gloves.
2. Make sure that the cable insulation is not damaged and the connection layer has no signs of heating.

SERVICE MANUAL - BATTERY

3. Make sure that the "+" and "-" output terminals are not sulfated (with white salt).
- Slight sulfation: clean top of the element with a damp cloth.
 - Severe sulfation: the battery must be removed for powerful cleaning; the battery base should also be cleaned.
 - Very severe sulfation (or a large amount of electrolyte overflow): please contact the after-sales service department as soon as possible.

DO NOT arbitrarily discharge acidic wastewater after cleaning, dispose such water in accordance with national laws and regulations!

B1-4 Storage

- When the battery is not used for a long time, the battery should be filled up and stored in a dry, frost-free space.
- Regular equalizing charge may help extend the service life of battery and ensure that the capacity won't be reduced.

B1-5 Troubleshooting

- Upon battery or charger failure, please promptly notify the after-sales service department.
- Refer to battery failure analysis to facilitate troubleshooting and elimination.

Battery Fault Analysis			
Fault	Negative Phenomena	Cause	Handling Methods
Insufficient Battery Charge	<ol style="list-style-type: none"> 1. Low static voltage 2. Low density, cannot meet the requirements after being charged 3. Short working time 4. When running, the instrument displays quick drop of capacity 	<ol style="list-style-type: none"> 1. Charger voltage and current are set too low 2. Insufficient initial charge 3. Charger failure 	<ol style="list-style-type: none"> 1. Adjust and repair the charger 2. Battery supplemental charge 3. Battery needs to be replaced in severe situations
Electrolyte has been improperly added to the battery	<p>- In case of high intensity:</p> <ol style="list-style-type: none"> 1. Electrolyte density is not less than 1.300g/cm³ after charging 2. Battery static voltage is higher 3. Initial capacity is good, but reduced after a period of use 4. Electrolyte is turbid <p>- Low density:</p> <ol style="list-style-type: none"> 1. Electrolyte density is still lower than the specified value after charging 2. Battery capacity is low <p>- Adding impure liquid:</p> <ol style="list-style-type: none"> 1. Battery capacity is low 2. Electrolyte is turbid and of abnormal color 3. Battery with severe self-discharge 	<ol style="list-style-type: none"> 1. Initial adding of electrolyte with excessive high or low density 2. Liquid level reduces, adding errors, failed to add pure water in accordance with provisions, but mistakenly adding dilute acid 3. Initial adding of liquid is impure (containing impurities and with odor) 	<ol style="list-style-type: none"> 1. Replace the battery electrolyte 2. Battery needs to be replaced in severe situations

SERVICE MANUAL - BATTERY

Battery Fault Analysis			
Fault	Negative Phenomena	Cause	Handling Methods
Electrode plate sulfation	<ol style="list-style-type: none"> 1. Battery capacity drops during normal discharge 2. Density drops to be lower than normal value 3. Voltage drops quickly when discharging 4. Start charging under high voltage 5. Bubbles generated during charging 6. Coarse crystallization of PbSO₄ 	<ol style="list-style-type: none"> 1. Insufficient initial charge 2. Long time of storage under the state of discharge 3. Long-term insufficient charged 4. Electrolyte density is too high 5. Electrolyte level is too low, the upper part of electrode plate is exposed outside of the electrolyte 6. Impure electrolyte 7. Internal short circuit 	<ol style="list-style-type: none"> 1. Over-discharge method 2. Repeated charging method 3. Water treatment method
Excessive shedding of active substances	<ol style="list-style-type: none"> 1. There is gray-brown substance rising from the bottom when charging 2. Battery capacity reduced 	<ol style="list-style-type: none"> 1. Brown precipitation is due to excessive large charging current 2. White sediment is due to over-discharge 3. Battery electrolyte is impure 	<ol style="list-style-type: none"> 1. Clean up the precipitation 2. Adjust the density 3. Battery needs to be replaced if necessary
Battery overcharged	<ol style="list-style-type: none"> 1. Color of battery filling cap becomes yellow, and then red 2. Battery casing deformation 3. Battery spacers carbonization, deformation 4. Positive electrode corrosion, broken 5. Electrode pole rubber bushing raised, aged and cracked 6. Frequent water-adding, electrolytic turbidity during charging 7. Evenly shedding of active substances from electrode plate 8. Positive electrode plate detonation 	<ol style="list-style-type: none"> 1. Charger voltage and current are set too high 2. Charging time is too long 3. Frequent charging 4. Less discharging, but much charging 5. Charger failure 	<ol style="list-style-type: none"> 1. Adjust and repair the charger 2. Adjust the charging system 3. Battery needs to be replaced in severe situations
Battery Over-discharge	<ol style="list-style-type: none"> 1. Low static voltage 2. Electrolyte density is still low after charging 3. Positive and negative electrode plates curved or fractured 	<ol style="list-style-type: none"> 1. Go on using the battery despite of insufficient charge 2. Battery pack short circuit 3. Small current long time discharge 	<ol style="list-style-type: none"> 1. Supplementary charging 2. Repair the vehicle 3. Battery needs to be replaced in severe situations

SERVICE MANUAL - BATTERY

Battery Fault Analysis			
Fault	Negative Phenomena	Cause	Handling Methods
Battery Short Circuit	<ol style="list-style-type: none"> 1. Low static voltage below 2V 2. Electrolyte density is too low 3. High temperature during charging 4. Truck is with short working time 	<ol style="list-style-type: none"> 1. Electrode plate deformed and short circuit 2. Spacer missing or broken during assembly 3. Positive electrode active substances shedding, short circuit at bottom 	Battery needs to be replaced
Broken circuits	<ol style="list-style-type: none"> 1. Abnormal and unstable voltage upon external connection with load 2. Current fails to input when charging 	<ol style="list-style-type: none"> 1. Poor welding during assembly of electrode pole or electrode plate 2. External short circuit 3. Large current discharge 4. Poor wiring connection or disconnected 5. Electrode plate corrosion 	<ol style="list-style-type: none"> 1. Battery needs to be repaired 2. Battery needs to be replaced if necessary
Battery Reverse Electrodes	<ol style="list-style-type: none"> 1. Negative voltage values 2. Electrolyte density is lower than 1.20g/cm³ after charging 3. Positive and negative electrode lugs, colors of electrode plates are reversed 	Wrong connections of positive and negative electrodes during charging	<ol style="list-style-type: none"> 1. Reverse charging is allowable 2. Battery needs to be replaced in severe situations
Battery Leaks	<ol style="list-style-type: none"> 1. Filling hole leaks 2. Leaks at sealing seams of tank and filling cap 3. Drainage 4. Marks of bumps on external surface of tank 	<ol style="list-style-type: none"> 1. Tank, filling cap with poor heat sealing 2. Electrode lug rubber ring problems 3. Sealing compound cracked 4 External impact due to negligence during use 	<ol style="list-style-type: none"> 1. Repair 2. Battery needs to be replaced if necessary

B2 Maintenance-free Battery

B2-1 Safety and Warnings

- The battery should be away from heat source and the place that is easy to produce sparks, the safety distance should be greater than 0.5m.
- The battery should avoid direct sunlight, and cannot be placed in the environment with large amount of radioactivity, infrared radiation, ultraviolet radiation, organic solvent gas and corrosive gases.
- Due to the high voltage of battery components, there is risk of electrical shock; therefore, insulated tools should be used when installing or removing the conductive straps, wear insulated gloves, aprons and protective goggles when installing or handling batteries. During installation or handling of the batteries, only non-metallic sling can be used, wire ropes cannot be used.
- Dirty strap or loose connection may cause battery ignition, or even damage the battery group, so double-check and remove the dirt on the strap when installing, and tighten the strap.
- DO NOT clean the battery case with organic solvent, DO NOT use carbon dioxide fire extinguisher to extinguish electrical fires, carbon tetrachloride fire extinguisher is available.
- When the battery is connected to the charger or the load, circuit switch should be at "OFF" position, and make sure the connection is correct: positive electrode of the battery is connected to the positive electrode of the charger, and negative electrodes are connected with each other.
- During the use of battery, be sure to tighten the bolts of the terminals, so as to avoid sparks and poor contact.

As for failure to comply with instructions for use, maintenance without using original parts, user corruption, or violation of provisions when adding electrolyte and other circumstances, the quality assurance will automatically void.

B2-2 Use of Battery

B2-2.1 Pre-use Checks

- Check if the fixing bolts on the bracket for the battery are tightened, insecure installation may cause damage to the case due to the shock during the travel of the vehicle. Metal objects should not be placed on the battery to prevent short circuits;
- Check if the poles and wiring connections are reliable from time to time. In order to prevent oxidation of terminals, you can apply Vaseline or other protective agents;
- DO NOT check the capacity of battery through direct ignition (short circuit test), such method may damage the battery;
- There will often be yellow white paste around the battery poles and cover, which is caused by the corrosion of sulfuric acid to the poles, wire clips and holders, etc. These substances are of very large resistance and must be removed in a timely manner;
- When you need to use two batteries in series, the capacities of the two batteries are preferably to be equal. Otherwise it will affect the service life of the battery.

B2-2.2 Discharging

- When connecting or disconnecting the battery connector (such as, plug), the power supply must be disconnected first;
- In order to meet or exceed the rated battery service life, the battery should avoid excessive discharge during runtime (the remaining capacity is less than 20% of the rated capacity);
- Re-charge the battery immediately after discharging without delay;
- The normal load voltage of battery is 20.8V ~24.4V, if the voltage is lower than this range, it indicates that the battery already has capacity loss, the circumstance of long time under load voltage may reduce the service life of the battery.

SERVICE MANUAL - BATTERY

B2-2.3 Charging

- When charging, only DC can be used. Connect the battery with proper charger for specification and size to avoid overload of circuit and interface, and to avoid electrolyte foaming, leading to swollen battery;
- The charger purchased separately must be checked by the after-sales service department of our company before it can be used;
- When connecting the battery with the charger, the circuit switch should be at "OFF" position, make sure the connection is correct. It is prohibited to connect the battery with live charger.
- Before charging the battery, the charging space should be ensured with good ventilation without open flames and combustibles; when the temperature of electrolyte exceeds 40 degrees during charging, reduce the current or take physical cooling measures, the charging must be stopped when the temperature reaches 45 degrees;
- When the battery voltage remains constant (for more than 2 hours), and the load voltage of the battery is within the specified range between 20.8V~24.4V, it indicates that the charging is completed.

B2-3 Maintenance & Care

- Compared to lead-acid batteries, maintenance-free battery eliminates the maintenance to electrolyte.

Daily Maintenance

- Charge the discharged battery;
- Visual inspection for excessive dirtiness and mechanical damage after the charging.

Supplementary Charging

- If the vehicle is not used for more than two months, supplementary charging must be carried out to the battery to prevent permanent battery damage;
- Charging method is in accordance with the requirements of normal charging.

How to tell if the battery is normal?

General diagnostic method for the quality of battery is to fully charge the battery with good charger, and then measure the load voltage with a multimeter to check if the voltage is between 20.8V~24.4V.

How to tell if the charging is normal?

LED charging indicator on the charger is used to display charge status, which can display in three colors: red, yellow and green.

Display	Description	Troubleshooting
LED red on	Battery is charging	Running normally.
LED green on	The charging is completed	Running normally.
LED yellow on	Battery failure	The battery voltage is less than 22.4V or greater than 29.2V.
Flashing Yellow	Charger failure	a. Output current or output voltage is too large. b. The temperature of charger is too high.
Flashing Red	Charger failure	No output current from the charger
NO Lighting	Charger failure	The input of charger is not connected or charger failure.

B3 Lithium-ion Battery

B3-1 Safety and Warnings

- The battery should be away from heat source, combustibles and the place that is easy to produce sparks, the safety distance should be greater than 2.0m.
- The battery should avoid direct sunlight, and cannot be placed in the environment with large amount of radioactivity, infrared radiation, ultraviolet radiation, organic solvent gas and corrosive gases.
- Dirty strap or loose connection may cause battery ignition, or even damage the battery group, so double-check and remove the dirt on the strap when installing, and tighten the strap.
- When the battery is connected to the charger or the load, circuit switch should be at "OFF" position, and make sure the connection is correct: positive electrode of the battery is connected to the positive electrode of the charger, and negative electrodes are connected with each other. Avoid short circuits!
- Please prevent the battery from water or infiltration of any corrosive liquid.
- Battery should be prevented from violent vibrations or shock. Avoid piercing the battery.
- When charging, connect the battery with proper charger for specification and size. The charging time must be no more than 24 hours.
- When the battery residual capacity is less than 10%, battery needs to be charged within 48 hours.
- If batteries are taken out of service for a lengthy period, to ensure the battery is always ready for use, supplementary charging must be carried out at least every 2 months.

As for failure to comply with instructions for use, maintenance without using original parts, user corruption, or violation of provisions when adding electrolyte and other circumstances, the quality assurance will automatically void.

B3-2 Use of Battery

B3-2.1 Pre-use Checks

- Check if the battery is completely locked in the basement, or it may be damaged by the vibration.
- Check if the poles and wiring connections are reliable from time to time. In order to prevent oxidation of terminals, you can apply Vaseline or other protective agents.
- Check if the appearance of battery is in good condition, and Check the battery for leaks.
- Before use of battery, make sure the working temperature is within the range of $-20^{\circ}\text{C} \sim 60^{\circ}\text{C}$.

B3-2.2 Discharging

- When connecting or disconnecting the battery connector (such as, plug), the power supply must be disconnected first.
- In order to meet or exceed the rated battery service life, the battery should avoid excessive discharge during runtime.
- Re-charge the battery after discharging. When the battery residual capacity is less than 10%, battery needs to be charged within 48 hours.
- The normal load voltage of battery is 22.4V ~29.2V, if the voltage is lower than this range, it indicates that the battery already has capacity loss, the circumstance of long time under load voltage may reduce the service life of the battery.

Due to the particularity of lithium-ion batteries, the battery capacity will have a certain attenuation when used in a low-temperature environment.

SERVICE MANUAL - BATTERY

B3-2.3 Charging

- When charging, only DC can be used. Connect the battery with proper charger for specification and size to avoid overload of circuit and interface.
- The charger purchased separately must be checked by the after-sales service department of our company before it can be used.
- When connecting the battery with the charger, the circuit switch should be at "OFF" position, make sure the connection is correct. It is prohibited to connect the battery with live charger.
- Before charging the battery, the charging space should be ensured with good ventilation without open flames and combustibles.
- The charging time must be no more than 24 hours.
- Working temperature of charging:
-20 ° C ~ 60 ° C
Operating voltage of charger:
100V ~ 240V, 1-phase
Charging time:
2h ~ 2.5h

B3-3 Maintenance & Care

Daily Maintenance

- Charge the discharged battery.
- Check the appearance of batter for damage or leaks after the charging.

Battery storage

- Battery should be stored in a dry, frost-free room where the temperature is within the range of 4 ° C ~ 35 ° C. The battery should be away from heat source and avoid direct sunlight.
- If battery is taken out of service for a lengthy period, supplementary charging must be carried out at least every 2 months.
- When reusing, the battery must be fully charged. A full charge takes about 2.5 hours.

Supplementary Charging

- If the battery is not used for more than two months, supplementary charging must be carried out to the battery to prevent permanent battery damage. The charging capacity should be controlled at about 80%.
- Charging method is in accordance with the requirements of normal charging.

How to tell if the battery is normal?

General diagnostic method for the quality of battery is to fully charge the battery with good charger, and then measure the load voltage with a multimeter to check if the voltage is between 22.4V~29.2V.

How to tell if the charging is normal?

LED charging indicator on the charger is used to display charge status, which can display in three colors: red, yellow and green.

Display	Description	Troubleshooting
LED red on	Battery is charging	Running normally.
LED green on	The charging is completed	Running normally.
LED yellow on	Battery failure	The battery voltage is less than 22.4V or greater than 29.2V.
Flashing Yellow	Charger failure	a. Output current or output voltage is too large. b. The temperature of charger is too high.
Flashing Red	Charger failure	No output current from the charger
NO Lighting	Charger failure	The input of charger is not connected or charger failure.

C SCHEDULE

C

LET'S GROW TOGETHER!



NOTE:

Operator's Daily Checklist

Date _____ Operator _____
 Truck No. _____ No. _____
 Department _____
 Runtime
 Meter Reading _____

Daily Check Items	O.K.(√)	Remark
Drive Wheel		
Load Wheel		
Horn		
Lifting / Lowering Control Functions		
Optional Features		
Forward / Reverse Control Functions		
Steering control functions		
Braking Functions		
Check hydraulic system for leaks: cylinders, fittings, tubings, oil tank, etc.		