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E25

SELF-PROPELLED, PALLET LIFT TRUCK

U.S. Patents Nos. 9,879,765; D801,616; D805,712; D805,713

SERVICE MANUAL

WARNING

Do not operate this truck unless you have been authorized and trained to do so, and have read all warnings and instructions in Operator's Manual and on this truck.

Do not operate this truck until you have checked its condition. Give special attention to wheels, horn, battery, controller, lift system, brakes, steering mechanism, guards and safety devices.

Operate truck only from designated operating position. Do not carry passengers. Keep feet clear of truck and wear foot protection.

Observe applicable traffic regulations. Yield right of way to pedestrians. Slow down and sound horn at cross aisles and wherever vision is obstructed.

Start, stop, travel, steer and brake smoothly. Slow down for turns and on uneven or slippery surfaces that could cause truck to slide or overturn. Use special care when traveling without load as the risk of overturning may be greater.

Always look in direction of travel. Keep a clear view, and when load interferes with visibility, travel with load trailing.

Use special care when operating on ramps travel slowly, and do not angle or turn. Travel with load downhill.

Do not handle loads which are higher than the chassis unless load is secured so that no part of it could fall backward. Before lifting, be sure load is centered, forks are completely under the chassis backrest.

When leaving the truck, neutralize travel control, fully lower lifting mechanism and set brake. When leaving the truck unattended, also shut off power.

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SAFETY WARNING

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

Thorough scheduled 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 malfunctioning and failure, and potential threats to staff and operational safety. Therefore, there must be adequate maintenance, professional trained technician 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. 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 Key switch to “STOP” position and remove the key.
3. Prior to truck maintenance:
   - Raise the drive wheel off the ground, remove the power supply.
   - Use blocks or stands 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.
4. Never use an open flame to check level of oils or fluids leaks.
5. Keep the charging area clean, well-ventilated and dry.
6. Regular operational checks and maintenance should be conducted to braking, steering, control, warning and safety devices to keep them in good operating condition.
7. All data plates and safety signs on the truck should be cleaned regularly to make them clearly visible.
8. Regular checks and maintenance should be conducted on the lifting system to ensure they are safe for use.
9. The hydraulic system should be checked on a regular basis. Hydraulic cylinders, hydraulic valves and other hydraulic components should be inspected for leakage.
10. Regular checks and maintenance should be conducted to batteries, motors, controllers, limit switches, safety devices, wires and connectors. Please pay particular attention to the electrical insulation on the cables and wire harness.
11. Park the truck in a clean environment to minimize the risk of fire.
12. Users are not allowed to change or increase the capacity of the truck.

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SECTION 1 INFORMATION & SPECIFICATIONS

1-1. TRUCK OVERVIEW

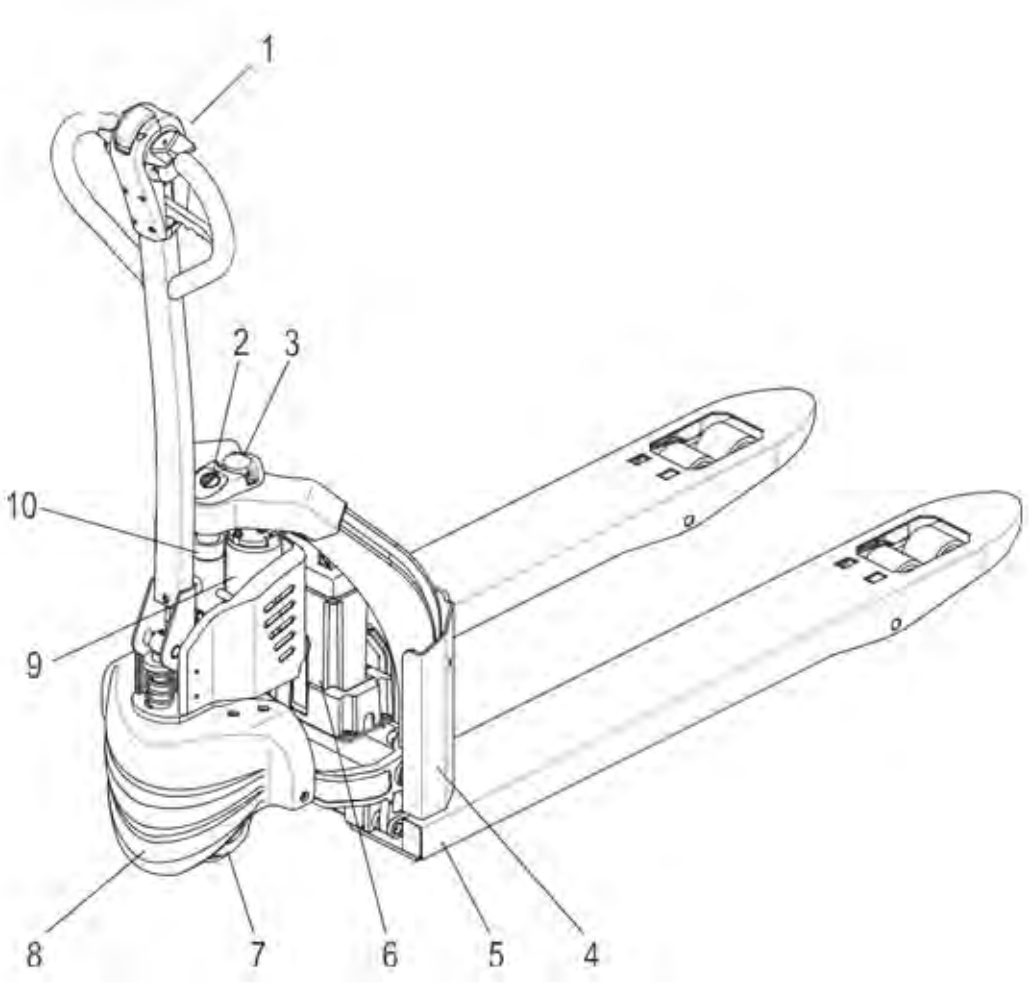

Figure 1-1 E25 Lift Truck

Table 1-1 E25 Lift Truck Components

Pos. #	Description	Pos. #	Description
1	Control Head	6	Battery
2	Key Switch	7	Drive Wheel
3	Emergency Stop Switch	8	Drive Unit Cover
4	Front guard	9	Pump and Motor Assembly
5	Fork	10	Lift Cylinder

Warning: Please refer to the data plate for the load capacity of the truck.

The truck can only be used on the level ground indoors, never use it on mezzanine or balcony area.

The truck should only be operated by authorized personnel.

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1-2. COMMON TOOLS USED FOR SERVICE

Table 1-2 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	Snap Ring Pliers	One for holes and one for shaft
6	Hammer	One Piece
7	Lifting Strap	One Pair
8	WIre Cutters	One Pair
9	Grease Gun	One Piece
10	Box Wrench	22mm/27mm One of Each

1-3. GENERAL TIGHTENING TORQUES

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 1-3 and Table 1-4 to select the suitable screws or bolts for replacement.

Table 1-3 Screws/Bolts Performance Levels

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 boltsare 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.

Table 1-4 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
M8×1	17~20	27~32	37~43	43~52
M10	31~36	49~59	68~81	81~96
M10×1	35~41	55~66	76~90	90~106
M12	55~64	86~103	119~141	141~167
M12×1.5	57~67	90~108	124~147	147~174
M14	87~103	137~164	189~224	224~265
M14×1.5	144~170	149~179	206~243	243~289
M16	136~160	214~256	295~350	350~414
M16×1.5	144~170	228~273	314~372	372~441
M18	186~219	294~353	406~481	481~570
M18×1.5	210~247	331~397	457~541	541~641
M20	264~312	417~500	576~683	683~808
M20×1.5	294~345	463~555	640~758	758~897
M22	360~431	568~680	786~941	918~1099
M22×1.5	395~473	624~747	803~1034	1009~1208
M24	457~547	722~864	998~1195	1167~1397
M24×2	497~595	785~940	1086~1300	1269~1520
M27	669~801	1056~1264	1461~1749	1707~2044
M27×2	723~865	1141~1366	1578~1890	1845~2208
M30	908~1087	1437~1717	1984~2375	2318~2775
M30×2	1005~1203	1587~1900	2196~2629	2566~3072
M36	1587~1900	2506~3000	3466~4150	4051~4850
M36×3	1680~2011	2653~3176	3670~4394	4289~5135
M42	2538~3039	4088~4798	5544~6637	6479~7757
M42×3	2731~3269	4312~5162	5965~7141	6921~8345
M48	3813~4564	6020~7207	8327~9969	9732~11651
M48×3	4152~4970	6556~7848	9069~10857	10598~12688

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SECTION 2 MAINTENANCE AND INSPECTIONS

2-1. OVERVIEW

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

Only trained and qualified personnel should perform maintenance and repairs 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.

Operating conditions:

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

Caution: Modifications to the truck are strictly forbidden without prior written *consent from the manufacturer.*

Note: *Under harsh operating 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.*

Only approved lubricants can be used See Table 2.2 Lubricants.

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2-2. MAINTENANCE

2-2.1. Cleaning

- Do not use flammable liquids to clean the truck.
- Before starting to clean, all power sources should be de-energized or disconnected from the unit.
- When cleaning electrical and electronic components, you should use light vacuum pressure. Meanwhile, clean the dust on the surface of components with non-conductive and anti static brush.
- Do not use water or steam to clean the equipment.

2-2.2. Inspection

Regular inspection and maintenance under normal conditions of use:

Table 2-1 Inspections

Operating Hours	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 has been in operation (after approximately 100 hours of operation), the equipment user must check the fastening of wheel nuts and bolts and re-tighten them if necessary.*

Regular inspection and maintenance under harsh conditions of use:

Under harsh operating conditions, especially:

- Dusty environment
- Corrosive environment
- Extreme environmental conditions
- Cold storage

The maintenance intervals should be shortened by half.

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Table 2-2 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 case for damage or leakage		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 bolts			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.

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Table 2-2 (Continued) Inspection & Maintenance List

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 pivot link for damage or cracks			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 initial100 hours of operation. Then replace every 2000 hours after.				
Check the relief pressure					A
Braking System					
Check the braking operation	A				
Check the air gap of the brake				A	
Check the mounting and electrical connections on the brake					A
Check the stopping distance of brake					A
Lifting Mechanism					
Check the connecting rod & Lift Linkage 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.

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Table 2-2 (Continued) Inspection & Maintenance List

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 decals and warnings are present and legible				A	
Check the chassis for cracks or damages					A
Check the tightness of bolts and nuts			A		
Check covers for damages				A	
Check the all functions to confirm they are operating 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.

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2-2.3. Lubrication

Lubricant

- Improper operations may constitute hazards to the operator, 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.

Please see Table 2.3 for the lubricants used in this truck.

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

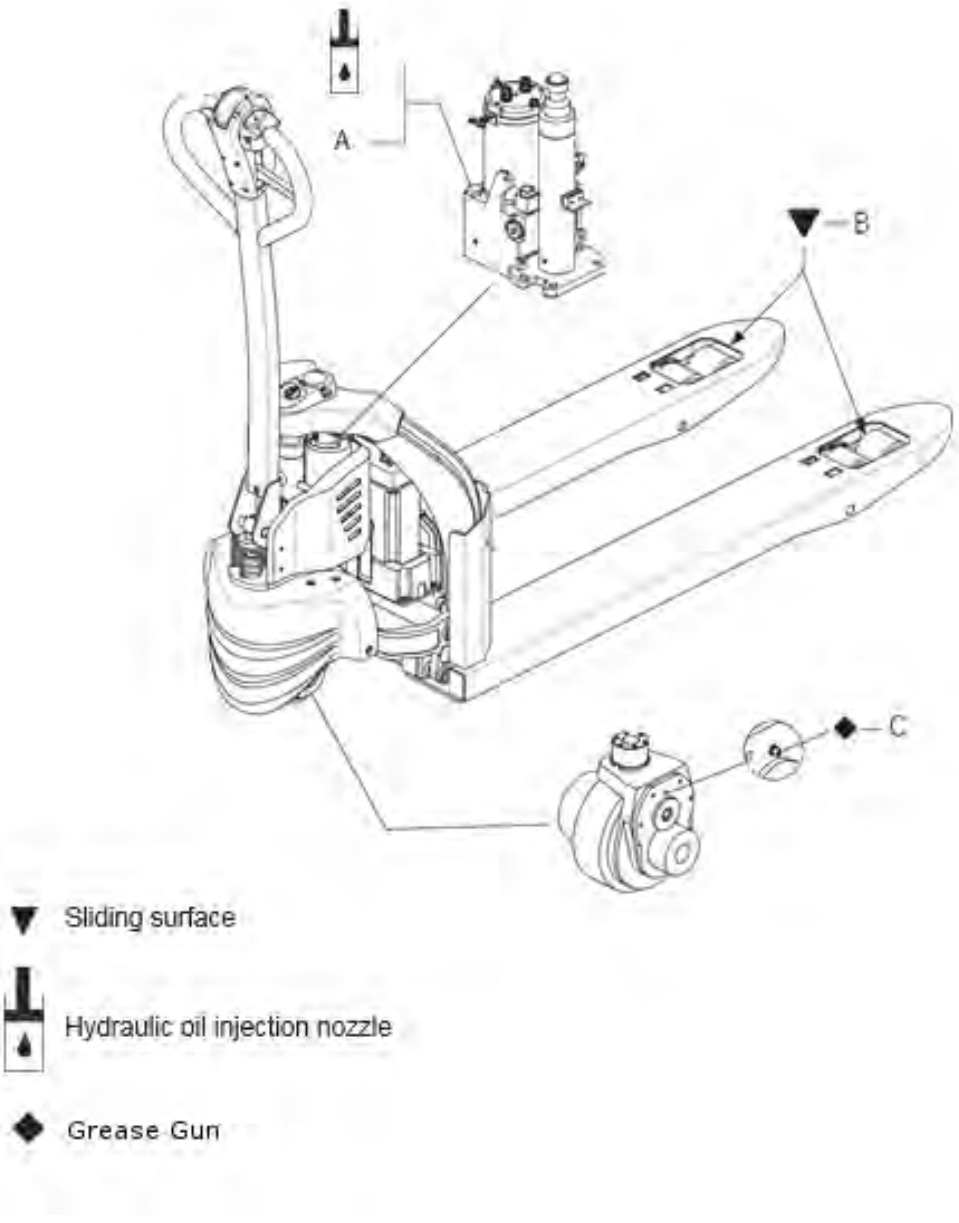

Figure 2-1 Lubrication Points

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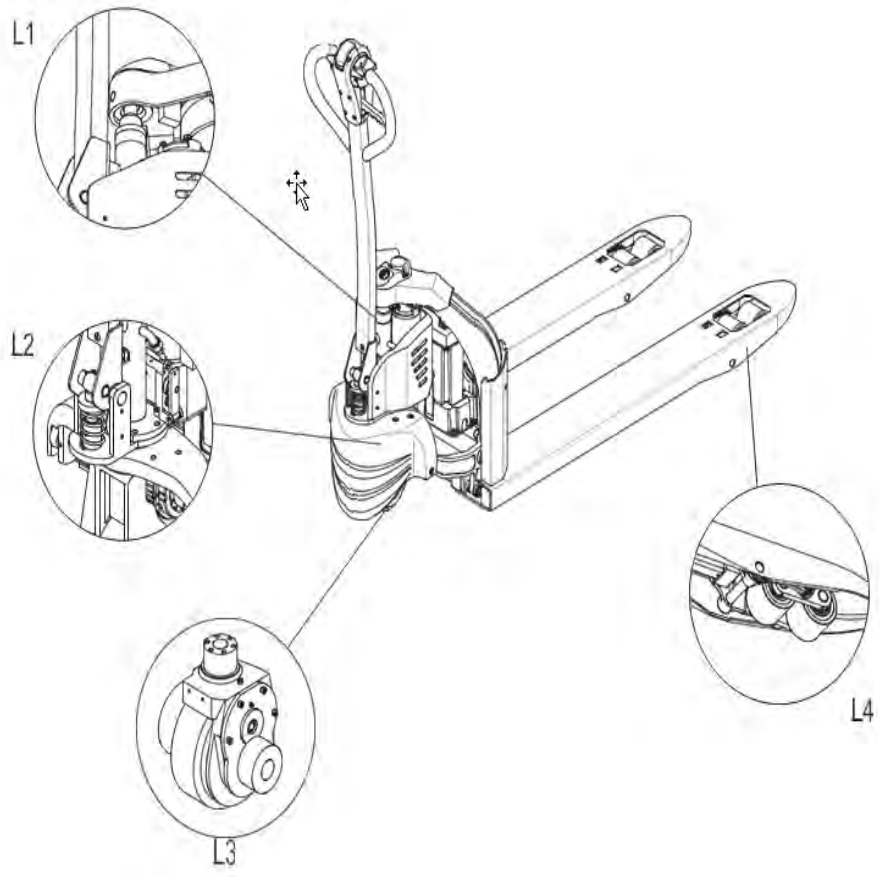
Table 2-3 Lubricants

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 (MoS2)	-	100 grams	Gearbox

Table 2-4 **Sliding Surface Lubrication Table**

Code	Position
L1	Steel Ball
L2	Steering Bearing
L3	Drive Wheel
L4	Load Wheel



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SECTION 3 OPERATIONS AND FUNCTIONS

3-1. OPERATIONS & FUNCTIONS

3-1.1. Travel Switch

Location: Control Head.

Function: To control the travel speed signal to the drive controller.

Description: When the vehicle is powered on, the travel switch is at Neutral position.

Note: Unserviceable.

3-1.2. Lifting/Lowering Switch

Location: Control Head.

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.

3-1.3. Emergency Reverse Switch

Location: Control Head.

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

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

Note: Unserviceable.

3-1.4. Horn Switch

Location: Control Head.

Function: To Operate the horn;

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

Note: Unserviceable.

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3-1.5. Display Panel

Location: Control Head.

Function: To display the battery power, operating hours, fault information

Description: 24V operating voltage;

Note: Unserviceable.

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

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.

3-1.8. Charger

Location: Charger holder;

Function: Charge the battery;

Description: 100V~240V operating voltage,

Note: Unserviceable.

3-1.9. Horn

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.

3-1.10. Controller

Location: On the valve body;

Function: To control the power to the Drive Motor.

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

Note: Unserviceable

3-1.11. Lifting Limit Switch

Location: Chassis

Function: Stop the pump motor at top lifting height.

Description: Lift limit switch is normally opened. When the forks are lifted in max lift height (that is the trigger for the limit switch to open circuit), lifting will be stopped.

Note: Unserviceable

3-1.12. Handle Switch

Location: Cylinder

Function: The truck cannot be driven if the handle switch is not closed;

Description: To prevent misuse of truck;

Note: Unserviceable.

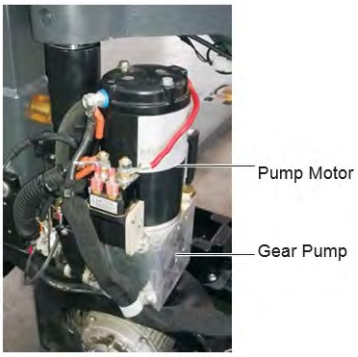
3-1.13. Pump Motor

Location: On the valve body.

Function: To provide power for gear pump to raise the fork assembly.

Description: Upon receiving the signal from the lift switch the pump assembly will activate.

Note: Unserviceable.



3-1.14. Gear Pump

Location: In the valve body;

Function: To provide pressure for hydraulic system.

Description: N/A;

Note: Unserviceable.

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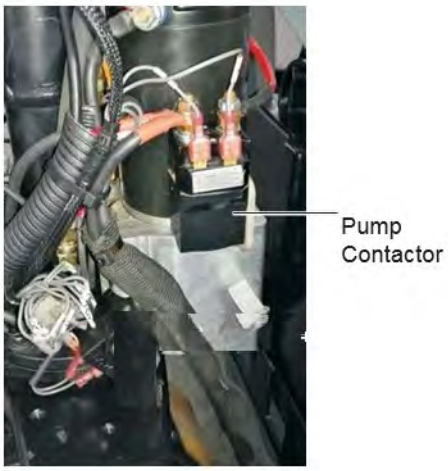
3-1.15. Pump Contactor

Location: On the valve body;

Function: To provide current to the pump motor.

Description: The signal from the lift switch turns the contactor On/OFF.

Note: Unserviceable.



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SECTION 4 CHASSIS

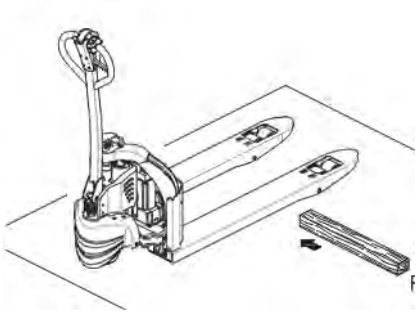
4-1. LOAD WHEEL

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.



- Block the underside of the frame by placing a wooden wedge or stand under the chassis near the load wheel, lifting the load wheel off the ground.

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

Single Wheel (see Figure 4-1)

- Remove roll pin (1) within the wheel bracket with a punch pin.
- Knock out the load wheel axle (2) and remove the load wheel and bearing assembly;
- Remove the bearings (3) from the load wheels (4).

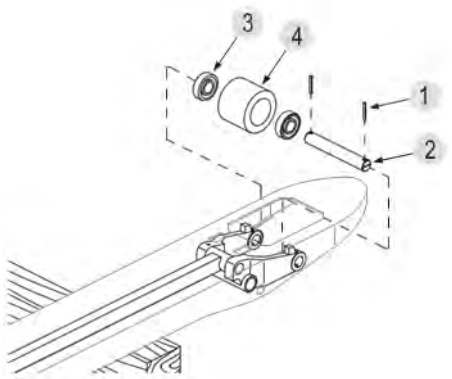


Figure 4-1 Single Wheel

Installation

- Install according to the reverse order of removal;
- Run the truck to see if the load wheel is functioning properly. If there is an unusual noise check the bearings and alignment of the wheels

Caution: *When installing, please apply appropriate amount of grease on the axle first.* (See Section 2.2.3 for specifications) Quality of tires directly affects the stability and driving performance of the device. If you need to replace the factory fitted tires, 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

Table 4-1 Faults and Causes

1	Fault	Bearing noise or jammed
	Cause	Bearing fatigue damage or foreign
2	Fault	Abnormal tire 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).

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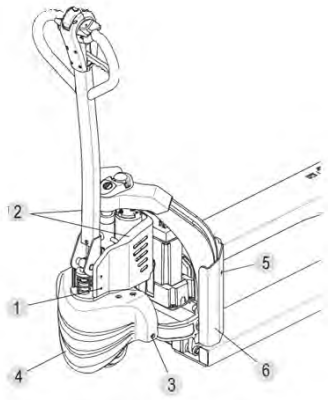

Installation

- 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

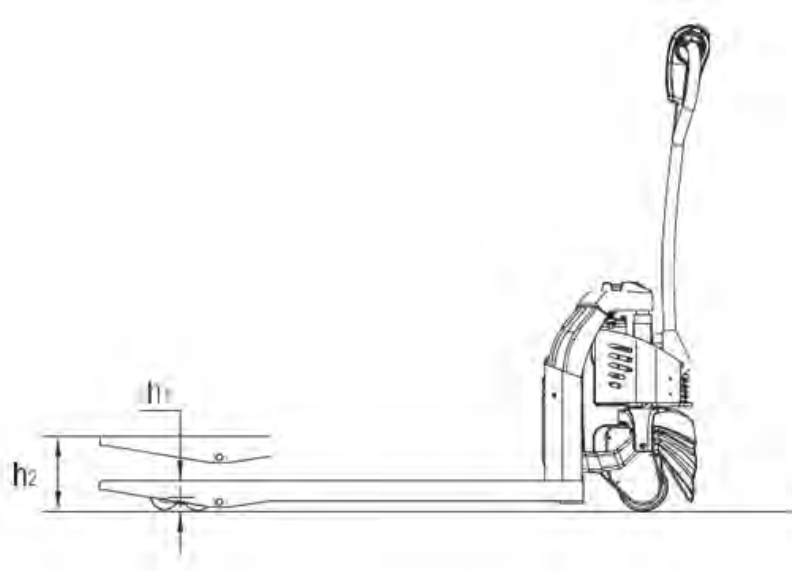

Figure 4-2

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 or other supporting structure.

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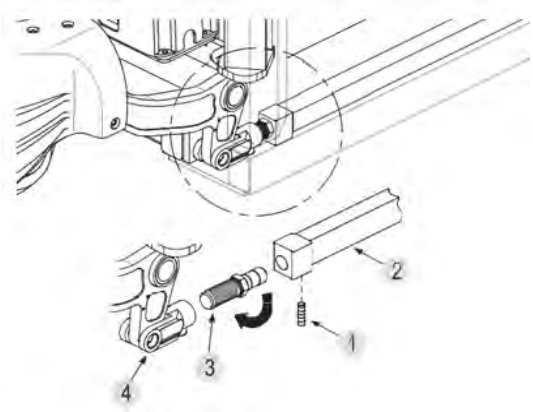

- Loosen the set screw (1) and adjust the relative distance between the screw head (3) and the connector (4);
- Turn the connector for 180° according to the arrow direction in the figure, the forks can then be lifted for 0.75 mm, whereas can be lowered for 0.75 mm;
- Adjust the fork surface distance to standard value, tighten the set screw (1).

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.*

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 structure.

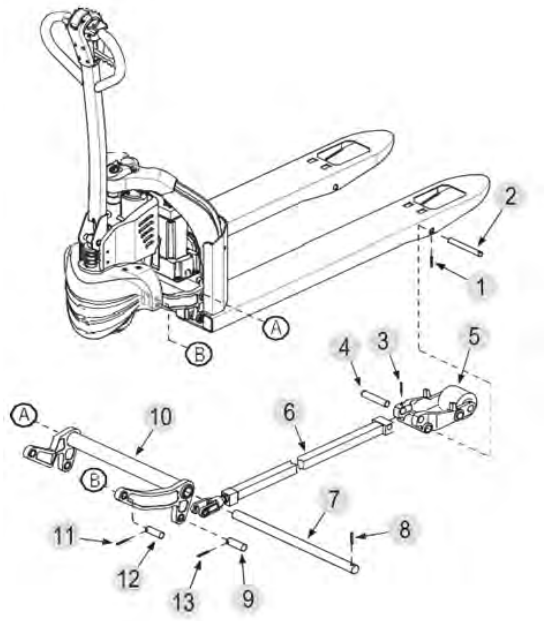

Figure 4-3

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 roll pin (1) out of 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 roll pin (11) out from the pivot link, and tap the short axle (12) out from the side to separate the lower connecting rod (10) with the pivot link.
- Tap the roll pin (13) out from the long connecting rod (6), and tap the short axle (9) out from the side to separate the lower connecting rod (10) with the long connecting rod (6).
- Tap the roll pin (8) out from the chassis, and tap the long axle (7) out from the side to separate the lower connecting rod (10) with the chassis.

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.

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NOTES

SECTION 5 DRIVE SYSTEM

5-1. DRIVE ASSEMBLY

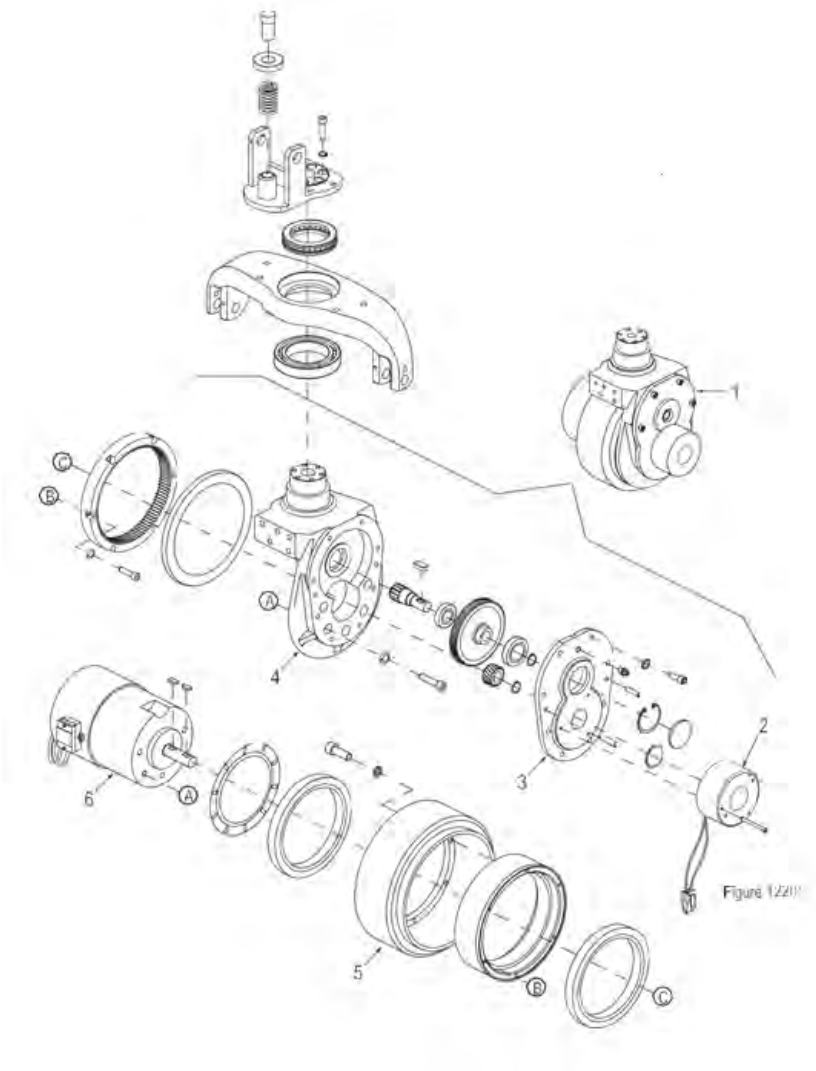

Figure 5-1 Drive Unit

Table 5-1 Drive Assembly

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

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5-1.1. Removal and Installation

Removal

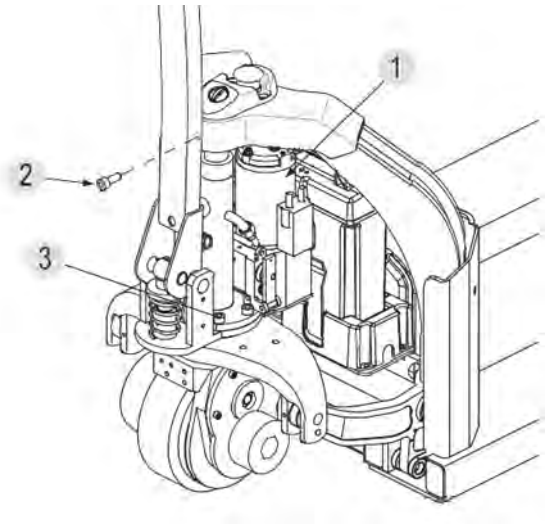

Figure 5-2

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

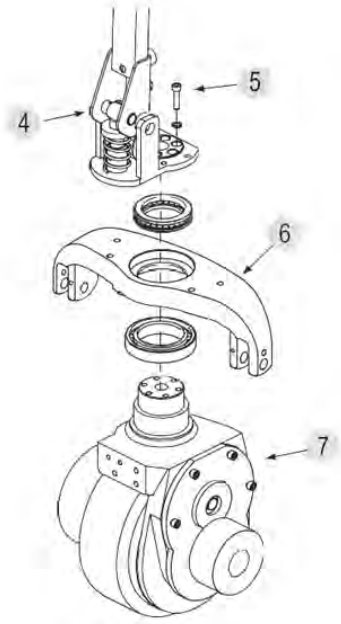

Figure 5-3

- 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);
- Drive the assembly (7) down with a hammer to remove it from the bearing carrier (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.

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5-2. ELECTROMAGNETIC BRAKE

The truck is stopped by the electric brake. When the truck is powered off, the electromagnetic coil (6) releases and the springs (7) force the pressure plate (8) down. The friction force generated between brake pads (2), pressure plate (8) and friction plate (5) will prevent the drive motor from rotating, thus to brake the vehicle.

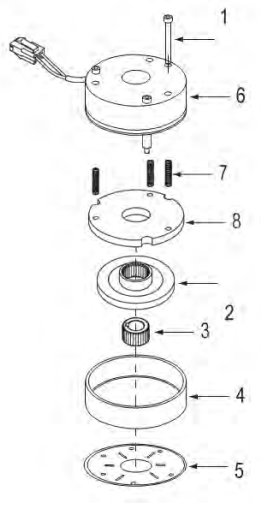

Figure 5-4

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

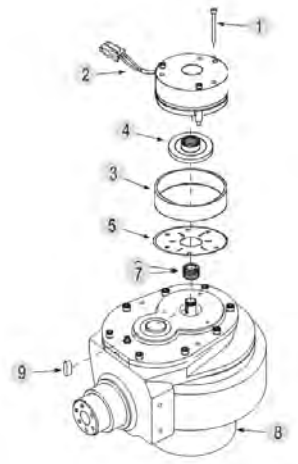

Figure 5-5

- Turn off the power and pull the connectors apart.
- 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 snap ring (6) on the shaft with snap ring pliers and remove the brake gear (7).

Installation

- Install according to the reverse order of rem- oval

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 truck is a maintenance 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 5-6

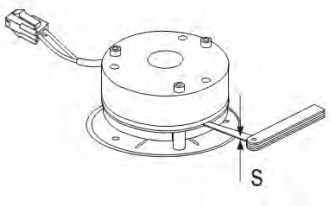

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Figure 5-7

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 brake does not release
	Cause	a. Mechanical part failure b. Foreign body blocking the brake disc movement 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 the brake disc movement
3	Fault	Abnormal noise after the brake is released
	Cause	a. The brake disc may be warped b. Mechanical resistance
4	Fault	Brake temperature is too high
	Cause	Pressure plate does not fully release, over-current of the coil, or energized too frequently

5-2.3. Checking and Testing

Electromagnetic Coil Check

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

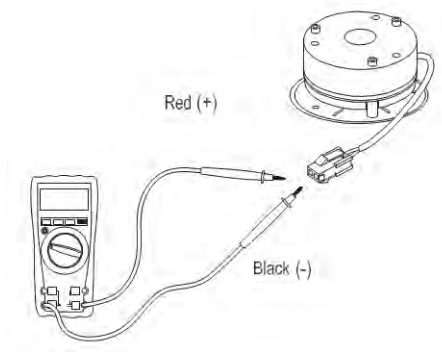

Figure 5-8

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

As shown in the following table.

:

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

Air Gap Checks

- Turn off the truck power connections and pull the brake connectors apart.
- 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	Condition
0.2~0.4mm	Normal
> 0.4mm	The air gap is too large (replace brake pads)

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 releasing the brake to fail.*

Debris Check

Check for debris stuck in the brake assembly that may affect the normal operation of the pressure plates. Check if there is debris in the air gap that may affect the actuation or bouncing off of the pressure plates.

Spring Check

Deformation or debris stuck in the spring may affect the normal pressure on the plates. Check if the distribution of the springs on the electromagnetic coil is correct, and check if there is debris in the spring hole.

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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) has continuity.
- Check if black circuit (circuit between brake and controller) has continuity.

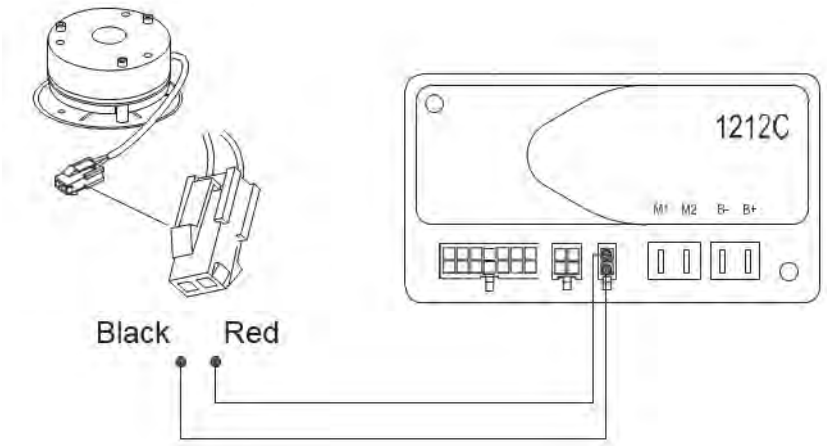

Figure 5-9

5-3. DRIVE WHEEL

5-3.1. Removal and Installation

- Dismantle the motor cable mounting base (1), and remove the motor cables (2);
- Loosen the six allen screws (3) and tap off the drive wheel (4) from the drive assembly (5).
- Install according to the reverse order of rem- oval.

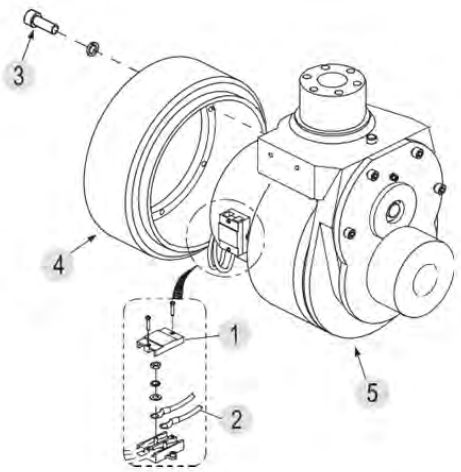

Figure 5-10

Caution: **Tire 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.** ***The wear of tire directly affects the stability and driving performance of the truck. If you need to replace the factory fitted tires, 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 debonding
	Cause	Improper use

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3	Fault	Vehicle sways while running
	Cause	Drive wheel lock nut loosening

5-4. DRIVE MOTOR

This truck obtains power 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 drive out the assembly (7) from the gearbox.

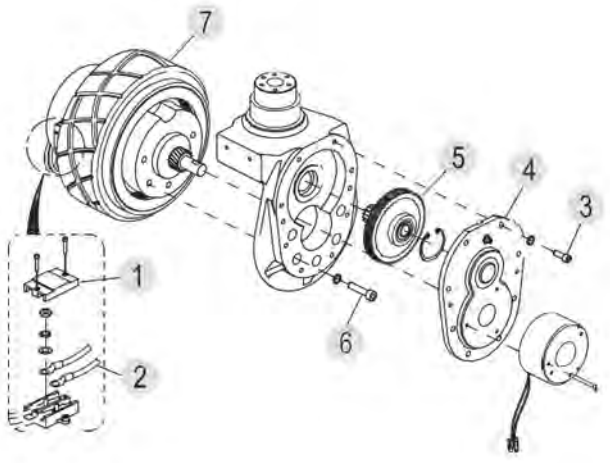

Figure 5-11

- Tap out the drive motor (13), and remove the oil seal (8).

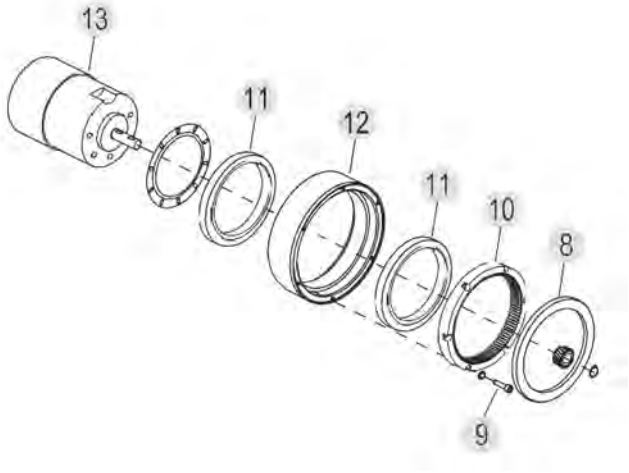

Figure 5-12

- 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.

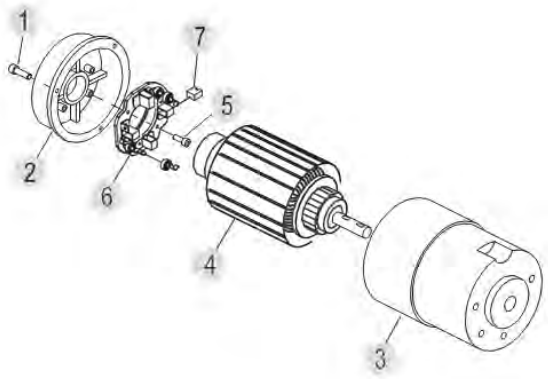

Figure 5-13

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!*

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Adjustment

- After replacing the carbon brushes, operate the truck by running the motor forward and reverse, letting the carbon brush be fully seated, making its surface smooth to fit the rotor (see section 5-4.3.)

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 wear of motor.
2	Fault	Motor speed is turning slow
	Cause	a. Insufficient voltage of battery; b. Carbon motor brush worn or carbon brush spring is weak c. Bearing wear or lack of lubricating oil; d. Armature winding has a short circuit elements; e. Carbon brush winding grounded.
3	Fault	Intermittent Motor operation
	Cause	a. Motor positive and negative cables loose or poor connections b. Carbon brush wear or cracked; c. Armature winding has an open circuit broken.
4	Fault	Motor with abnormal noise or vibration
	Cause	a. Uneven clearance between stator and rotor; b. Bearing failures; c. Loose mounting 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. d. Stator winding short circuit e. Motor positive and negative electrodes with surface oxidation, resistance increases and results in heating f. Bearing failure, resulting in severe heating.

5-4.3. Checking and Testing

Checking

- Check the drive motor and cables condition, and if the connections are secure.
- Check if the circuit is complete.

Testing

- Remove the cables on the drive motor;
- Check the continuity of the motor positive and negative cables with a multimeter: If connected, the motor is normal; If open reconnect or replace:

  1) Broken circuits in rotor coils (replace the motor);
  2) Motor brush worn, move on to the next step.

- Replace the motor brush. (See Section 5-4.1.

Caution: *When replacing the motor brush, replace the complete set of motor brushes.*

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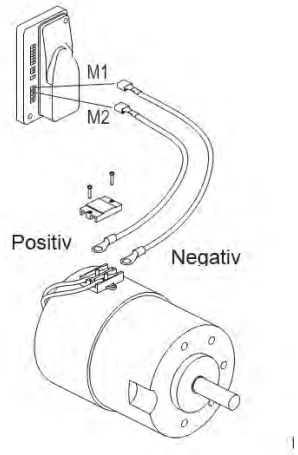
Circuit of drive motor

Figure 5-14



5-5. GEARBOX

5-5.1. Removal and Installation

See Section 5.4.1.

Caution: *Please add gear oil through 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.

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SECTION 6 OPERATING SYSTEM

6-1. CONTROL HEAD

The control head 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 display (14).
- Unscrew the four screws (15) and remove the display (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.

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

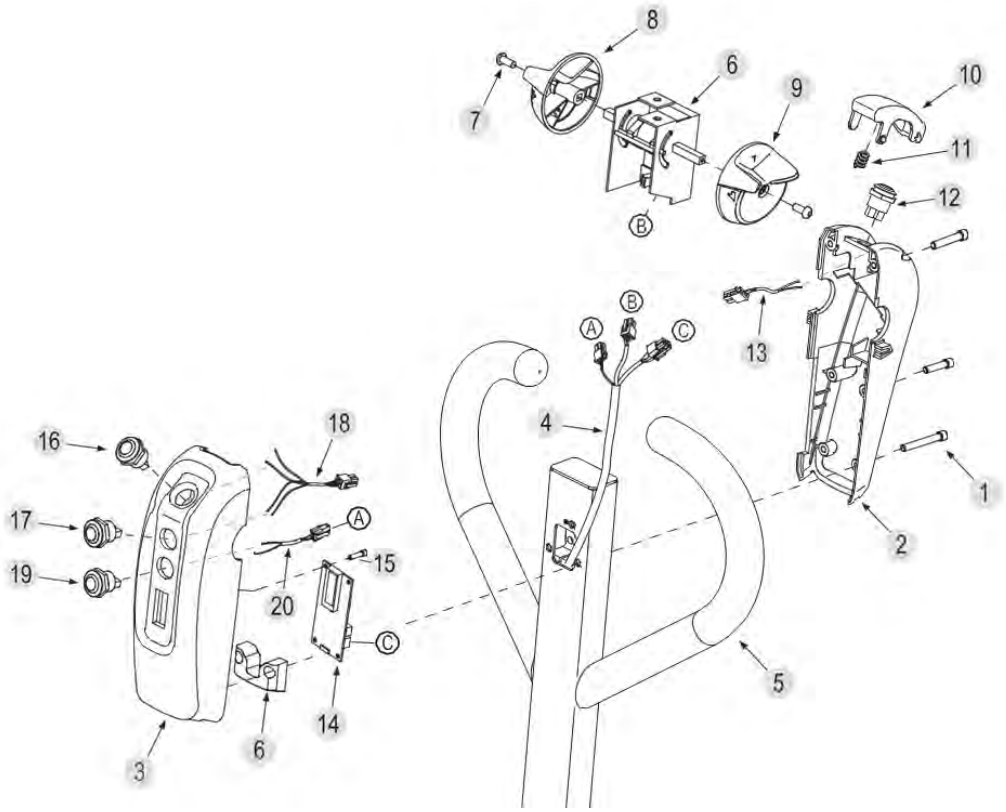

Figure 6-1

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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 switches via the display.(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:

Lifting Switch

(See Figure 12302)

- Carry out an Ohms (Ω) 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 an Ohms (Ω) 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.

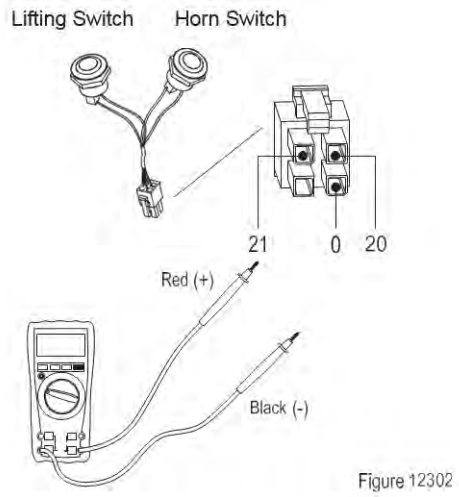

Figure 6-2

Emergency Reverse Switch

- Carry out an Ohms (Ω) 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.

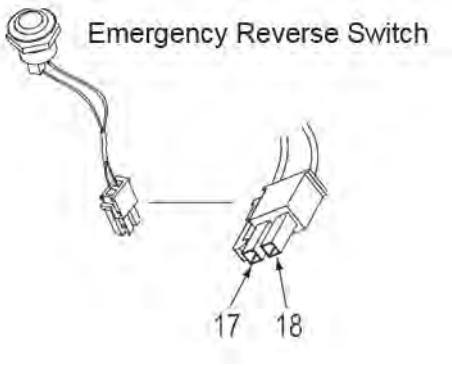

Figure 6-3

6-2.4. Control Circuit Troubleshooting

Lifting-Horn Switch Control Circuit

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

• Set the multimeter to Ohms (Ω)

• Check if #0/#20/#21 circuit (circuit between the switch and display) is conducted.

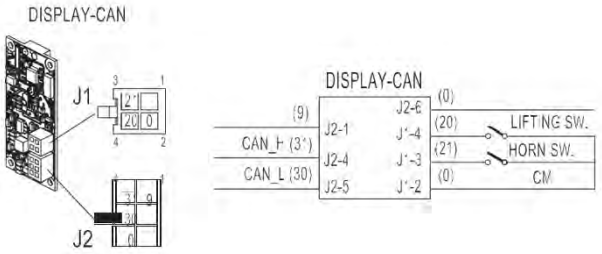

Figure 6-4

Buzzer Control Circuit (Figure 12308)

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

• Set the multimeter to Ohms (Ω)

• 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 operating properly;

Buzzer does not sound, failed, it needs to be replaced.

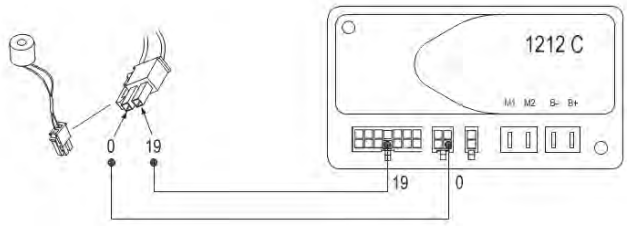

Figure 6-5

Emergency Reverse Switch Control Circuit (Figure 12306)

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

• Set the multimeter to Ohms (Ω)

• 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 Ohms (Ω)

• Check if #0/#9/#10 circuit (circuit between the switch and controller) is conducted.

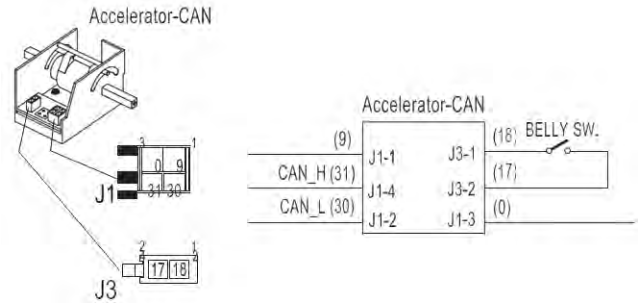

Figure 6-6

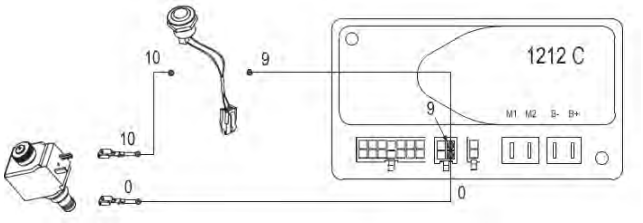

Figure 6-7

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6-3. TRAVEL SWITCH

Travel switch provides forward or backward in- put 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;

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.

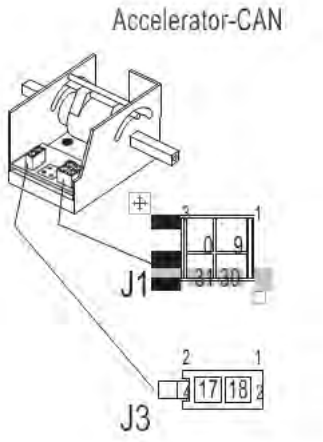

Figure 6-8

Testing

- Diagnose the switch via the display. (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 operating properly; If not this way the accelerator has failed and needs to be replaced.

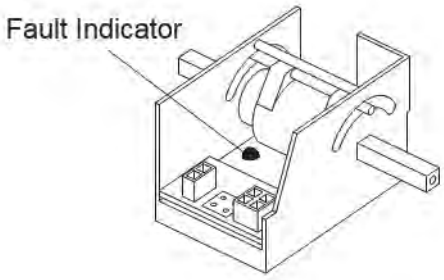

Figure 6-9

6-3.4. Control Circuit Troubleshooting

Travel Switch Control Circuit (Figure 12310)

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

- Set the multimeter to Ohms (Ω)
- Check if #0/#9/#30/#31 circuit (circuit between travel switch and controller) is conducted

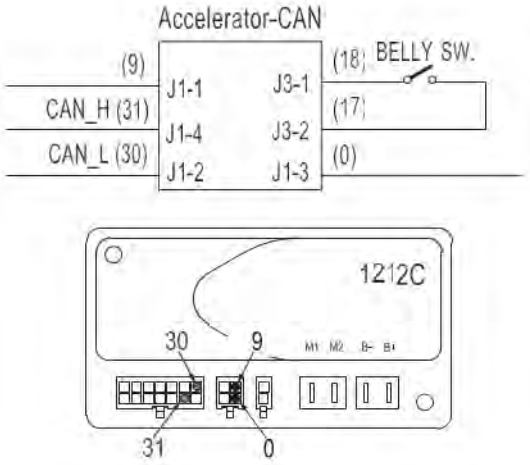

Figure 6-10

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SECTION 7 HYDRAULIC SYSTEM

The hydraulic system pressure is provided by hydraulic power unit system, which is used for lifting. 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.

The 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 7-1;

See Section 7-7. for hydraulic symbol descriptions.

7-1. Overview

- Lower the fork assembly completely, 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, there 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,remove any debris or foreign bodies within the valve body through repeatedly lifting and lowering of the mast.
- If hydraulic oil level decreases, please thoroughly check the hydraulic system for leaks.
- If disassembly of cylinder needs to be performed do it in a clean environment. Before removing the cylinder, the residual oil in the cylinder must be removed first. While removing the piston rod be careful to prevent the cylinder wall from being scratched by its end surface or damaged part. Every time you service the cylinder, please 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 torn, rolled or cut.

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.

The surfaces where the hydraulic seals are 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.

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

7-1.1. Hydraulic Schematic Diagram

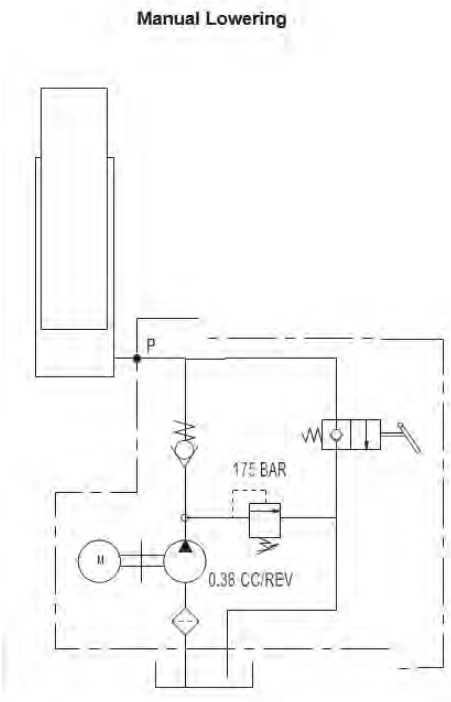

Figure 7-1

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7-2. PUMP AND MOTOR ASSEMBLY

7-2.1. Removal and Installation

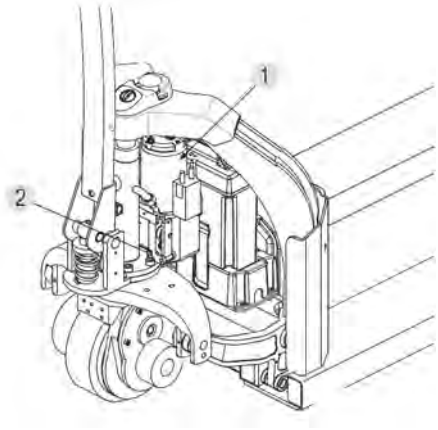

Figure 7-2

Removal

- Remove the protective cover; (see Section 4.2)
- Remove wiring harness and cables from the pump motor, pump contactor and controller;
- Remove the hydraulic line (3) from the hydraulic unit.

Caution: *When removing the hydraulic line the system will lose some hydraulic oil, please refer to Section 2-2.3. for supplementary adding of hydraulic oil.*

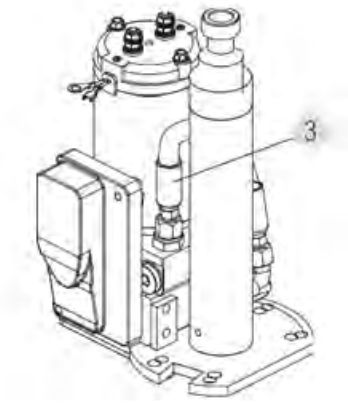

Figure 7-3

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

Installation

- Install in the reverse order of removal.

7-2.2. Components

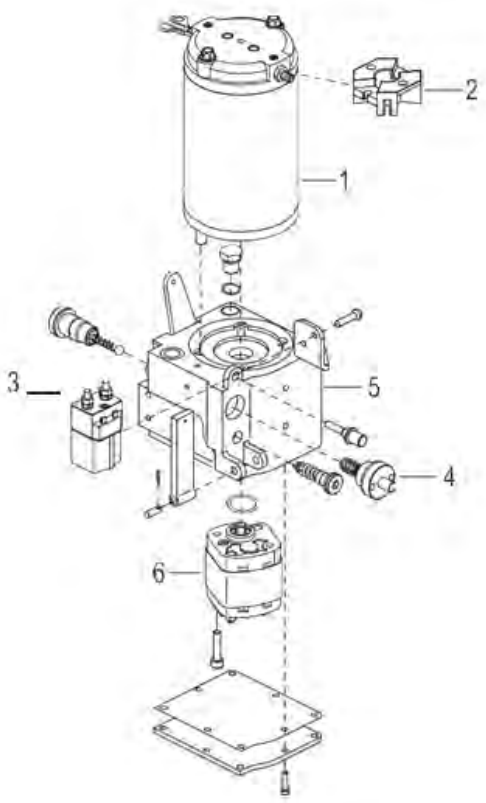

Figure 7-4

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

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7-3. PUMP MOTOR

7-3.1. Removal and Installation

Removal

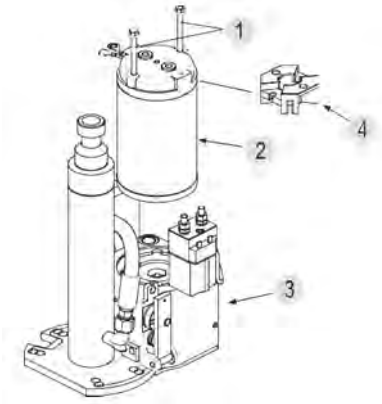

Figure 7-5

- 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). Re- move 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 pump motor or carbon brush, con- duction test must be carried out to the motor (see Sec- tion 7-3.3.).
- After replacing the carbon brushes, operate the truck by running the motor with repeated lifting, letting the carbon brush be fully seated, making its surface smooth to fit the rotor (see section 7-3.3.).

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.

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7-3.3. Checking and Testing

Checking

- Check if the appearance of the pump motor and of cables are in good condition, and connected securely.

Testing

- Remove the cables on the pump motor;
- Carry out a continuity test on the motor cables with a multimeter: If there is continuity the motor is normal; If there is no continuity check:

  1) Check for an open circuit or a break in the rotor coils (replace the motor);
  2) Check the motor brushes for excess wearing, move on to the next step.

- Replace the carbon brush (See Section 7-3.1.).

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

Circuit between pump motor and pump contactor

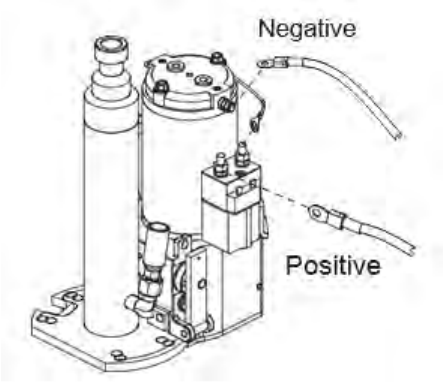

Figure 7-6

7-4. PUMP CONTACTOR

This truck uses a contactor with normally- open contacts. The ON/OFF operation of the contactors is controlled through the switches in the control head.

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 close the core and close the contactor: when the contactor is opened (C and D) connected, 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 opens: the circuit is disconnected.

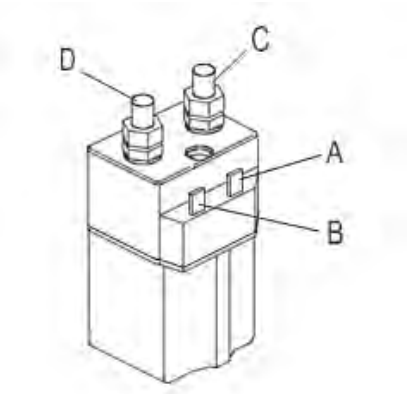

Figure 7-7

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)

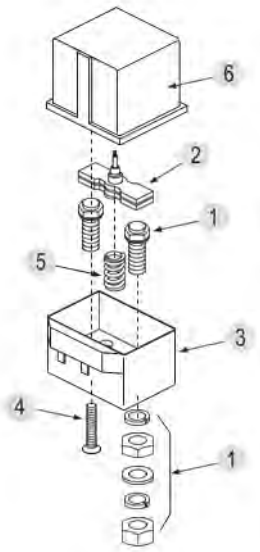

Figure 7-8

- 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.

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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 bent; d. Anti-force spring damaged.
2	Fault	Contactor not closed or not fully closing
	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 cracks, damages and discoloration.
- If any of the above case is found, please replace with new contactor.

Coil Check

- 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	Condition
Approx. 30 Ω	Normal
0 Ω	Coil shorted (replace the contactor)
∞ Ω	Coil failure (replace the contactor)

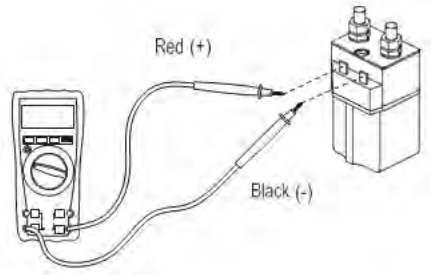

Figure 7-9

Contact Check

- 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 close.
- If the tip surface is uneven or the contact does not close, replace the main contactor.

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 Ohms (Ω);
- Check if #0/#2 circuit (circuit between pump contactor and controller) has continuity.

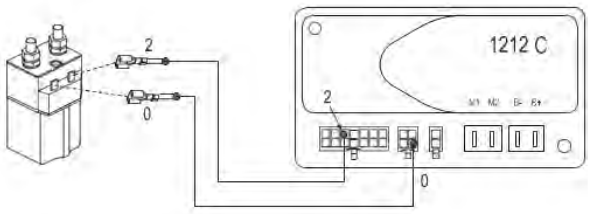

Figure 7-10

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7-5. LIFT CYLINDER

7-5.1. Cylinder Removal Precautions

- Before removing the cylinder, be sure to relieve the hydraulic pressure first, by lowering the forks to the ground. When removing the hydraulic line the pressurized hydraulic oil within the line may be sprayed out at high pressure, 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 hydraulic line can be loosened; in order to avoid the residual pressure within the circuit, the fitting should be loosened slowly, loosen the fitting by a half turn and shake the hose to see if there is stored pressurized oil, and then complete the removal;
- The cylinder is an integral mechanical part of the linkage frame, the connection points must be supported appropriately to avoid personal injury or damage to the equipment;

Repair

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

Before removing, prepare work area to prevent the cylinder parts from being contaminated by the surrounding dust and impurities. 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;

- Secure the lift cylinder in a vise, clamping lightly at the base of the cylinder.
- Unscrew the cap
- Remove the cylinder rod from the cylinder.

NOTE: If the cylinder tube or piston rod are damaged, the entire lift cylinder must be replaced.

- Replace seals and wiper ring.
- Coat all parts with hydraulic oil.
- Insert piston rod, with attached parts, into cylinder tube.

7-5.2. 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 take care not to cause permanent deformation while installing it; 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.*

- Aftermarket cylinder parts must not be arbitrarily used, **ONLY** 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, bleed the air from 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.

7-5.3. Removal and Installation

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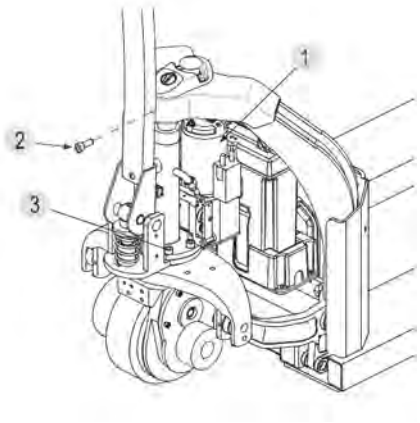

Figure 7-11

- 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 cable on the manual valve of hydraulic power unit (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) and remove the integral hydraulic station assembly (1) from the vehicle.
- Remove the tubing (4) from the cylinder (8)

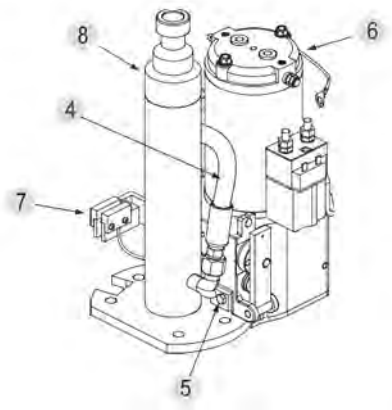

Figure 7-12

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) 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 tubing 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.
- Replace the problem parts and assembly in reverse steps.

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Caution: *If the piston rode or cylinder tube is damaged, please replace the entire cylinder.*

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

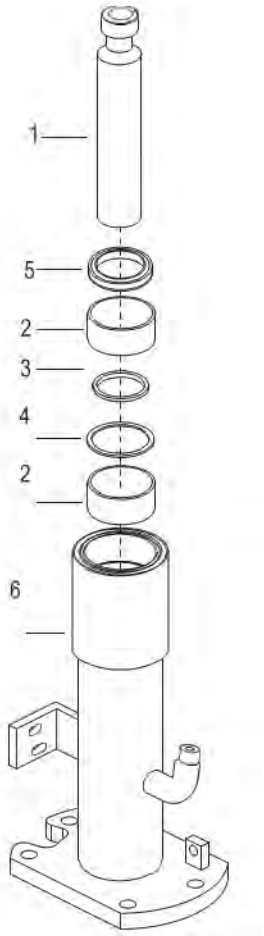

Figure 7-13

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7-6. 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 Fault #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. Flush and clean system and replace with new hydraulic oil.
3	Pump or oil temperature is too high	a. Oil level is to 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 gear pump.
4	Low System Pressure	a. Insufficient oil; b. Relief valve failure. c. Pump wear, internal leakage.	1. Check the hydraulic oil level; 2. See Fault 6; 3. Replace the gear 4. pump.
5	Load will not hold	a. Check valve failure; b. Solenoid valve failure.	1. Check the check valve. Replace as required; 2. Check and clean the solenoid valve spool;
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.

7-7. Hydraulic Symbol

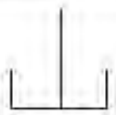
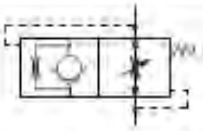
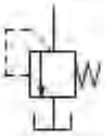
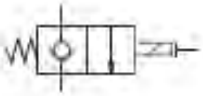
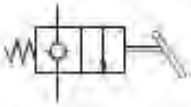
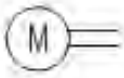
Symbol	Description	Symbol	Description
	Tank Pipe end below liquid level		Explosion-proof valve
	Tank Pipe end above liquid level		Check valve
	Filter		Cylinder Single-acting direction
	Service line (Supply line or return line)		Relief valve
	Control line (Drain line)		Throttle valve With pressure compensation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

Figure 7-14

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SECTION 8 ELECTRICAL SYSTEM

8-1. CONTROLLER

Figure 8-1

8-1.1. Removal and Installation Removal

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

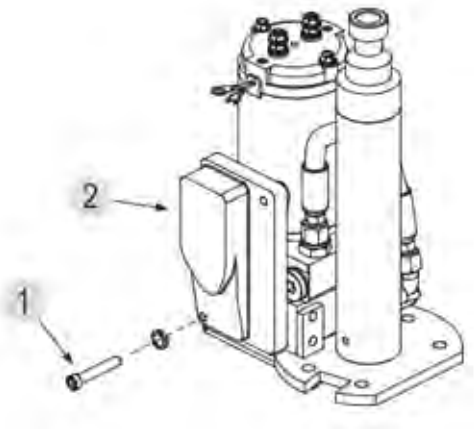

Figure 8-2

Installation

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

8-1.2. Controller Interface Function Traction Controller (1212C)

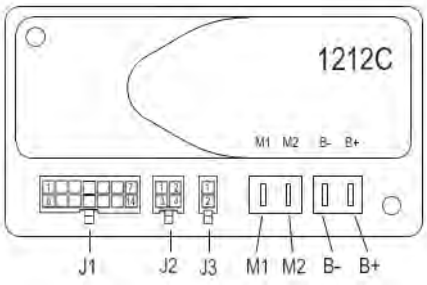

Figure 8-3

J1 Interface

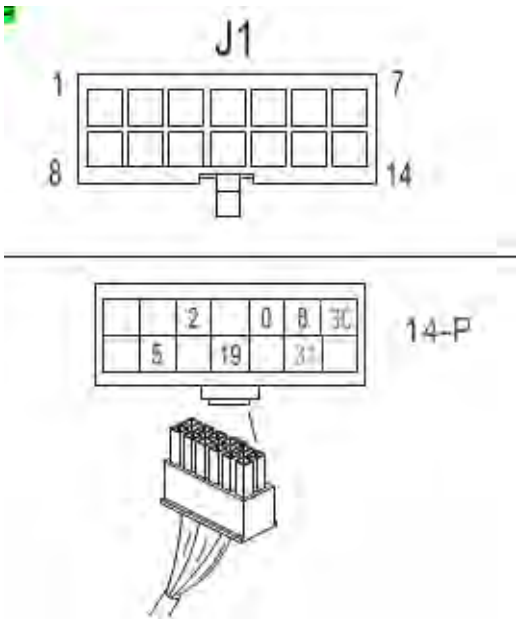

Figure 8-4

J1 Interface	
Pin No.	**Description**
J1#1	-
J1#2	-
J1#3	PUMP CONTACTOR COIL

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J1#4	-
J1#5	KEYSWITCH INPUT (KSI)
J1#6	INTERLOCK
J1#7	CAN L
J1#8	-
J1#9	LIFTING LIMIT SW.
J1#10	-
J1#11	HORN
J1#12	-
J1#13	CAN H
J1#14	-

J2 Interface

(Handheld unit communication interface)

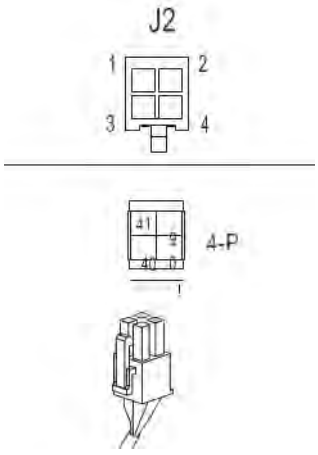

Figure 8-5

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

J3 Interface

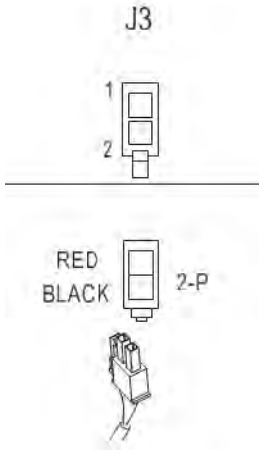

Figure 8-6

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

Terminal stud

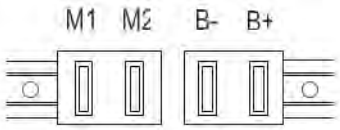

Figure 8-7

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

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8-2. KEY SWITCH

Key switch is used to START / STOP the truck.

8-2.1. Removal and Installation

Removal

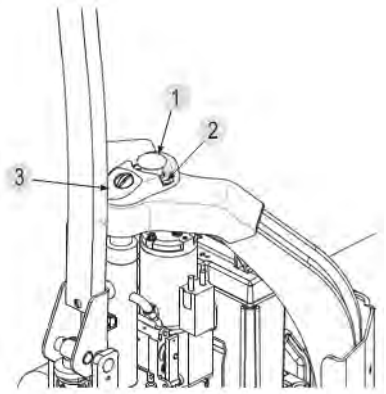

Figure 8-8

- 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 an Ohms (Ω) 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 multi- meter:

- Set the multimeter to Ohms (Ω);
- Check if #0/#1/#3 circuit is conducted.

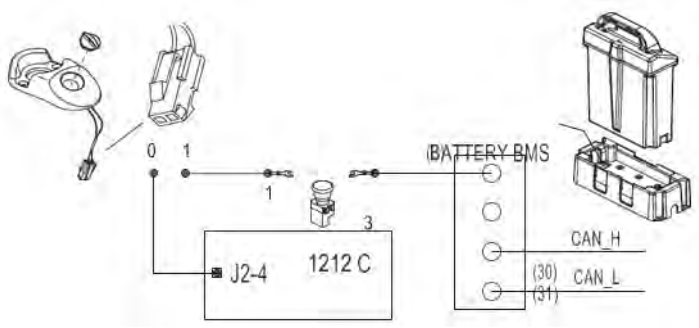

Figure 8-9

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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)

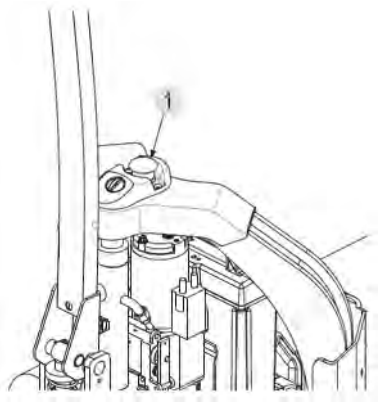

Figure 8-10

- 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

- Ensure the emergency switch and wiring harness are in good condition, and that the connectors are mated securely.

Testing

- Check if the emergency switch circuit is con- ducted;
- Carry out an Ohms (Ω) 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 multi- meter:

- Set the multimeter to Ohms (Ω).
- Check if #0/#1/#3 circuit is conducted.

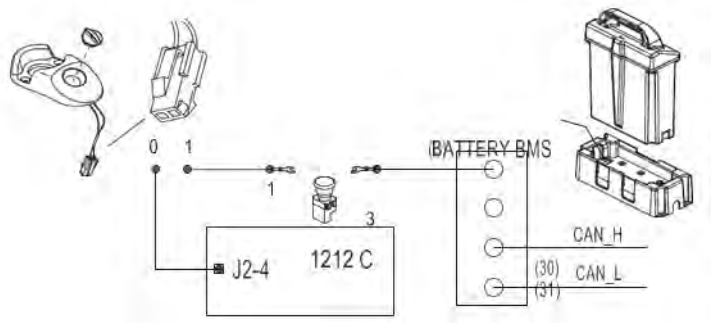

Figure 8-11

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8-4. INDUCTIVE SWITCH

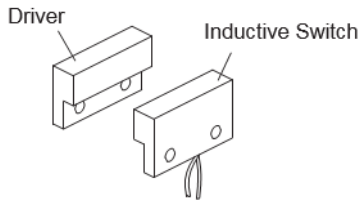

Figure 8-12

By function:

- Interlock Switch
- Lifting Limit Switch

8-4.1. Removal and Installation

Interlock Switch

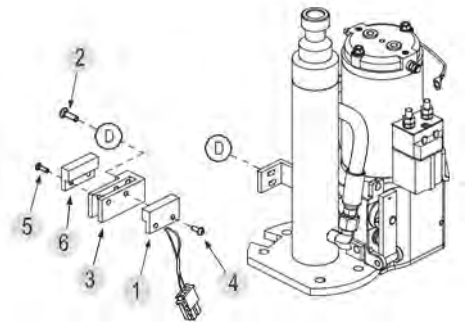

Figure 8-13

- 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

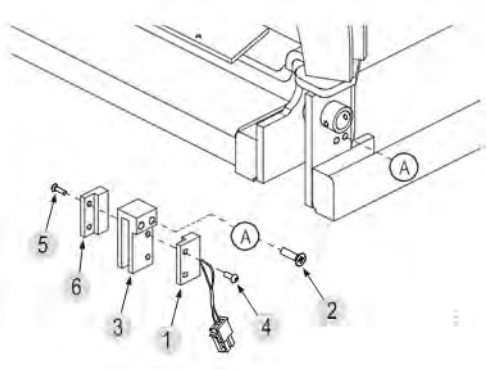

Figure 8-14

- 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.

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.

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8-4.3. Checking and Testing

Interlock Switch

- 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 display; (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 has failed (see Section 8.7).

Lifting Limit Switch

Checking

- Check if the appearance of limit switch and it’s wiring harness are in good condition, and if the connectors are connected securely.

Testing

- Check if the limit switch circuit is conducted;
- Carry out an Ohms (Ω) 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 multimeter:

- Set the multimeter to Ohms (Ω);
- Check if #0/#8 circuit (circuit between inter- lock 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.

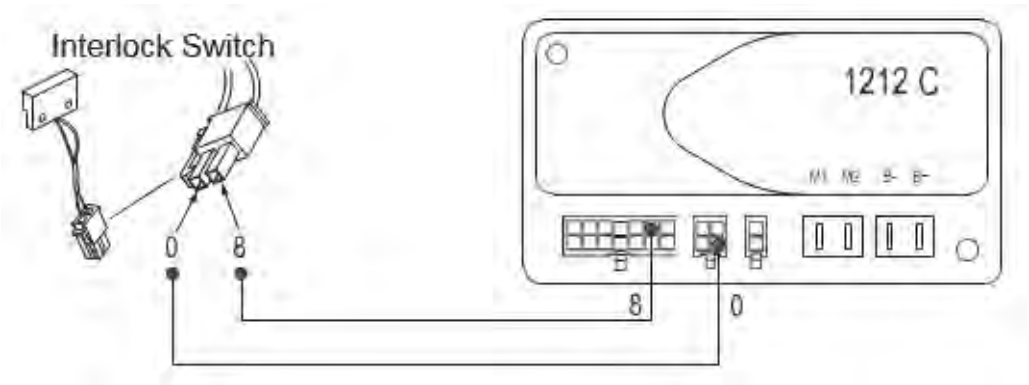

Figure 8-15

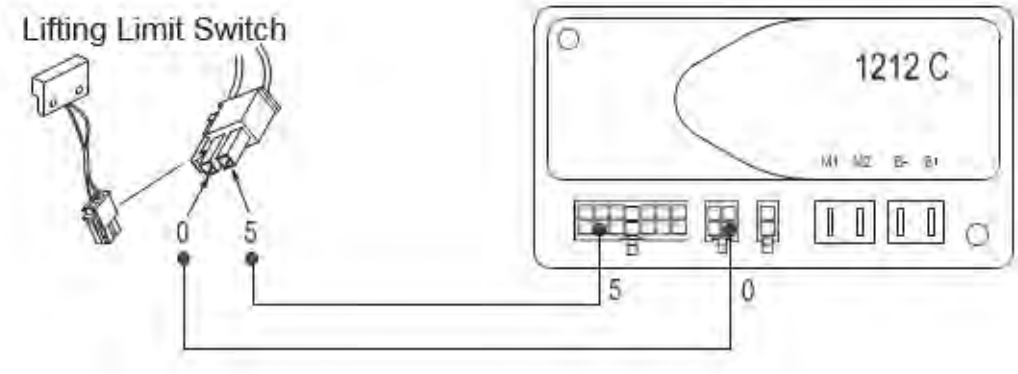

Figure 8-16

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8-5. BATTERY

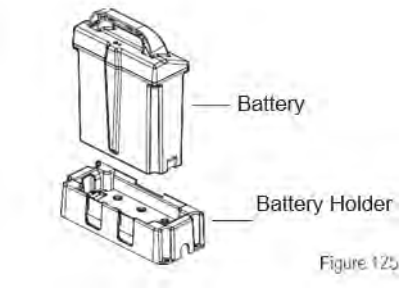

Figure 8-17

8-5.1. Removal and Installation

Removal

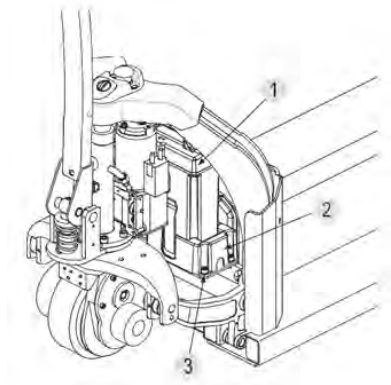

Figure 8-18

- 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), and remove the battery holder assembly (2) from the chassis.

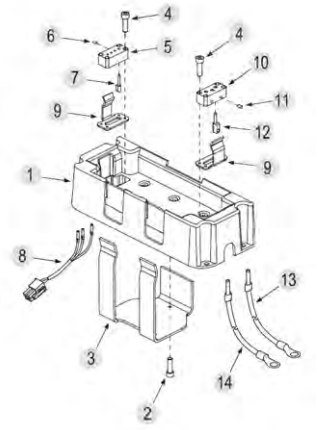

Figure 8-19

(See Figure12515)

- Remove the front guard; (see Section 4.2)
- Unscrew the four screws (4), 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.

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8-5.2. Faults and Causes

1	Fault	Vehicle has no power
	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
- Install jumper wire between port #3 and #(B+), measure the voltage between port #B- and #B+ with a multimeter:
- 22.4V~29.2V, the battery is normal; otherwise, the battery needs to be replaced.

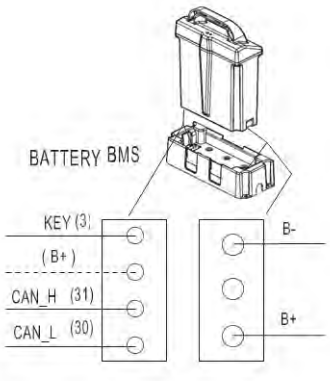

Figure 8-20

8-5.4. Control Circuit Troubleshooting Battery

Control Circuit (Figure 12517)

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

- Set the multimeter to Ohms (Ω)
- Check if #0/#1/#3/#30/#31 circuit is conducted.

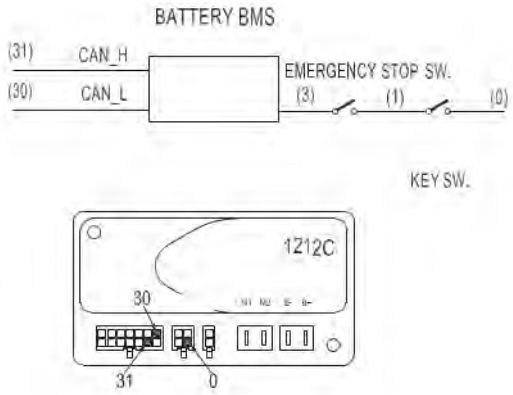

Figure 8-21

8-6. DISPLAY

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

Removal and Installation

See Section 6.1.

8-6.1. Faults and Causes

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

8-6.2. Checking and Testing

Checking

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

Testing

- Check if the display circuit is complete;
- Apply a voltage of 12V~24V to display interfaces J2-1 and J2-6:

If the display is lit, then it is normal;

If the display not lit, there must be fault.

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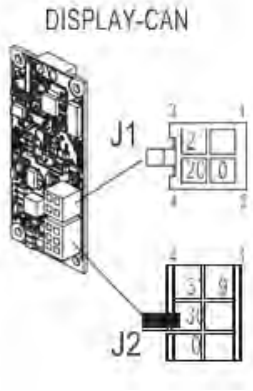

Figure 8-22

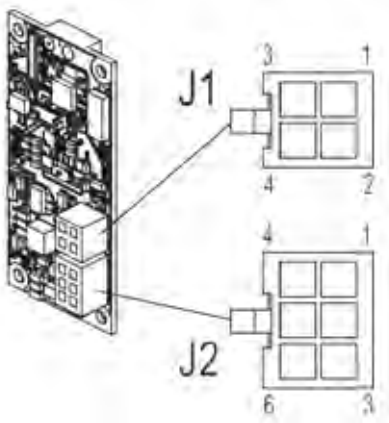

Figure 8-23

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

J2 Connector	
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.

Display Control Circuit

Check if the circuit is open by using a multimeter:

- Set the multimeter to Ohms (Ω).
- Check if #0/#9/#30/#31 circuit (circuit between display display and controller) is conducted;

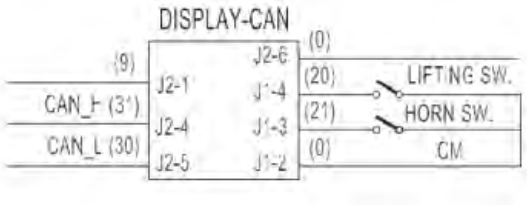

Figure 8-24

8-6.3. 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] 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

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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

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Interface Location	Display	Description
Display Interface 4		*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.

8-7. HANDHELD UNIT (OPTIONAL)

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

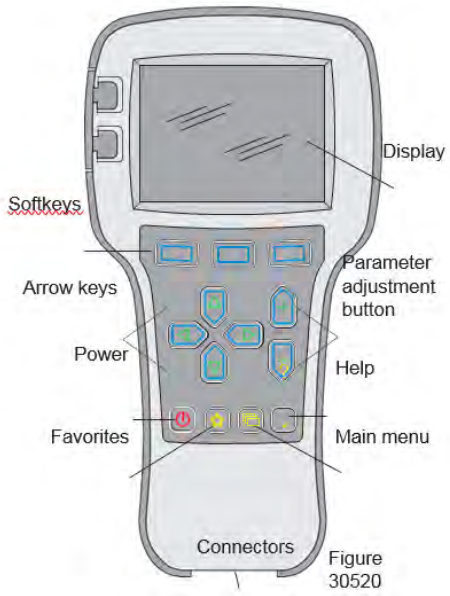

Figure 8-25

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.

Figure 8-26

- 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

Figure 8-27

- With Arrow keys (Figure 30520), you can carry out menu switching.
- Parameters: parameter change Monitor: vehicle running test Diagnostics error alarms
- See “Handheld Unit Operation Manual” for detailed operations

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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 ℃	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	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%	Available throttle input.
BDI	0 ~ 100%	Status of battery capacity in percentage.
Hour meter	0 ~ 99999.9 hours	Hours of operation since the hour-meter 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).

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Name	Display Range	Description
Mode Input	On / Off	Status of the mode input.
Forward 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

8-8. Controller Error Message

The error message can be obtained in two ways:

1. By reading the appropriate display on the hand-held unit.
2. By reading the fault codes display by the display

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 display

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8-8.1. Traction Controller

Flash Code	Error Message Error text	Effect of Fault	Possible cause
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	Throttle no operation	1.Throttle input wire open or shorted. 2.Throttle pot defective.
1,3	Under voltage Cutback	Current limit cutback	1. Battery voltage <16.8 volts. 2. Bad connection at battery or controller.
1,4	Over-voltage Cutback	Current limit cutback	1. Battery voltage >over-voltage cutback point. 2. Vehicle operating with charger attached. 3.Intermittent battery connection.
1,5	Severe Over-voltage	a. Throttle no operation 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 Under voltage	a. Throttle no operation b. Shut down EM brake driver	1. Battery voltage <13.8 volts.

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Flash Code	Error Message Error text	Effect of Fault	Possible cause
2,1	SRO Fault	Throttle no operation	1.Improper sequence of direction and KSI and interlock inputs.
2,2	EMR Sequencing Fault	a. Throttle no operation b. Shut down EM brake driver	1.Emerg. Rev. switch (belly button) is pressed before KSI on.
2,3	Main Driver Fault	a. Throttle no operation 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. Throttle no operation b. Shut down the main relay	1. Internal relay welded. 2. Controller defective.
2,5	Main Relay DNC	a. Throttle no operation 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	Throttle no operation	1. Mis-adjusted throttle. 2. Broken throttle pot or throttle mechanism.
3,2	Brake On Fault	a.Throttle no operation b.Short the motor armature	1.Electromagnetic brake driver shorted. 2.Electromagnetic brake coil open.
3,3	Precharge Fault	Throttle no operation	1.Controller defective.
3,4	Brake Off Fault	a.Throttle no operation b.Short the motor armature	1.Electromagnetic brake driver open. 2.Electromagnetic brake coil shorted.
3,5	HPD Fault	Throttle no operation	1. Improper sequence of throttle and interlock input. 2. Emergency Reverse operation has concluded, but the throttle has not been returned to neutral.

Flash Code	Error Message Error text	Effect of Fault	Possible cause
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.Throttle no operation 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.Throttle no operation b.Shut down main relay and EM brake driver; c.Shut down the full-bridge driver.	1.Controller defective.
4,3	Hardware Fault	a.Throttle no operation 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.Throttle no operation 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.Throttle no operation 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 Over-temperature	Motor speed reduced	1. The motor is in high temperature.
4.7	Tiller Handshake Failed	Throttle no operation	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 Over temp Cutback	Current limit cutback starts at 80 ℃	1.Excessive load on vehicle. 2.Controller is operating in high temperature.

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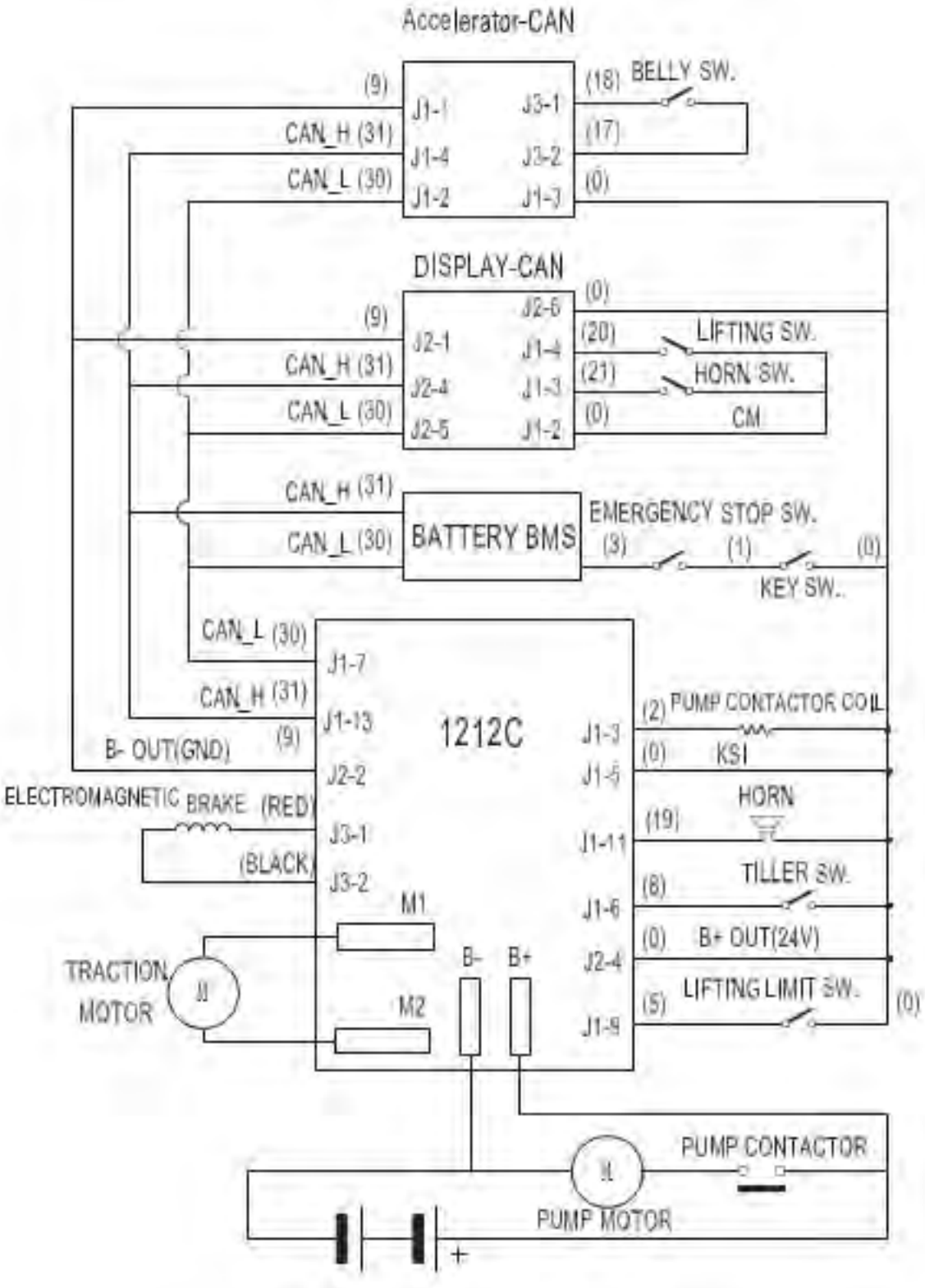
Flash Code	Error Message Error text	Effect of Fault	Possible cause
5,3	Controller Severe Overtemp	Current limit cut off	1. Excessive load on vehicle. 2. Controller is operating in high temperature.
5,4	Controller Undertemp Cutback	Current limit cutback starts at 14°F (-10°C) and is reduced to 50% at -13°F (-25°C)	1. Controller is operating in extreme low temperature. 2. The temperature sensor is broken.
5,5	Parameter Change Fault	a.Throttle no operation 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 Type, Pump SRO Type, AUX Switch Input Type). 2. Parameters are restored to the default settings.
5,6	Parameter Fault	a.Throttle no operation 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	Throttle no operation	1. The input password from CAN mess- age is wrong at start up.
6,1	Motor Short	a.Throttle no operation 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.Throttle no operation 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.Throttle no operation 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.

8-9. Electrical Schematic Diagrams

Manual Lowering



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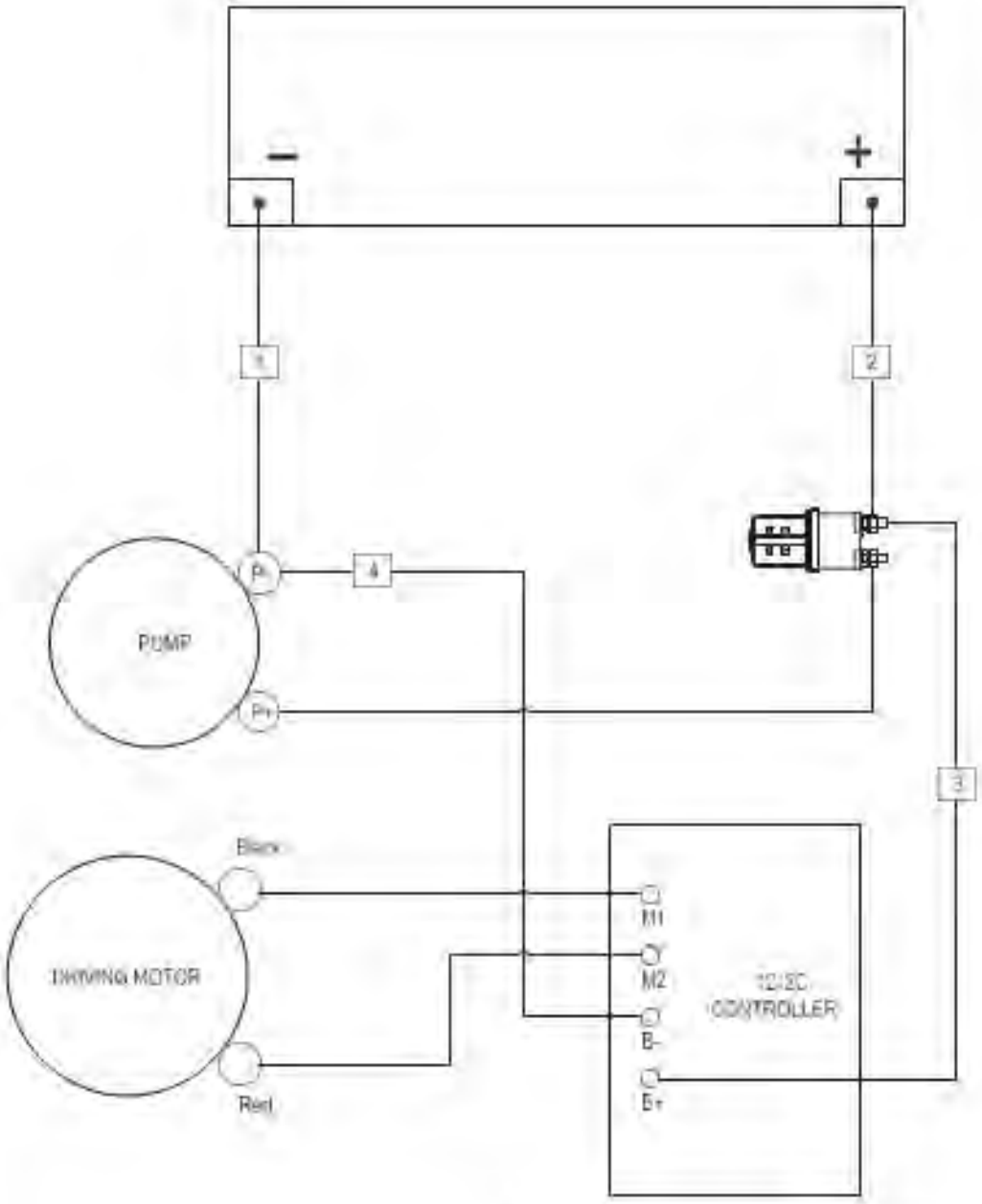
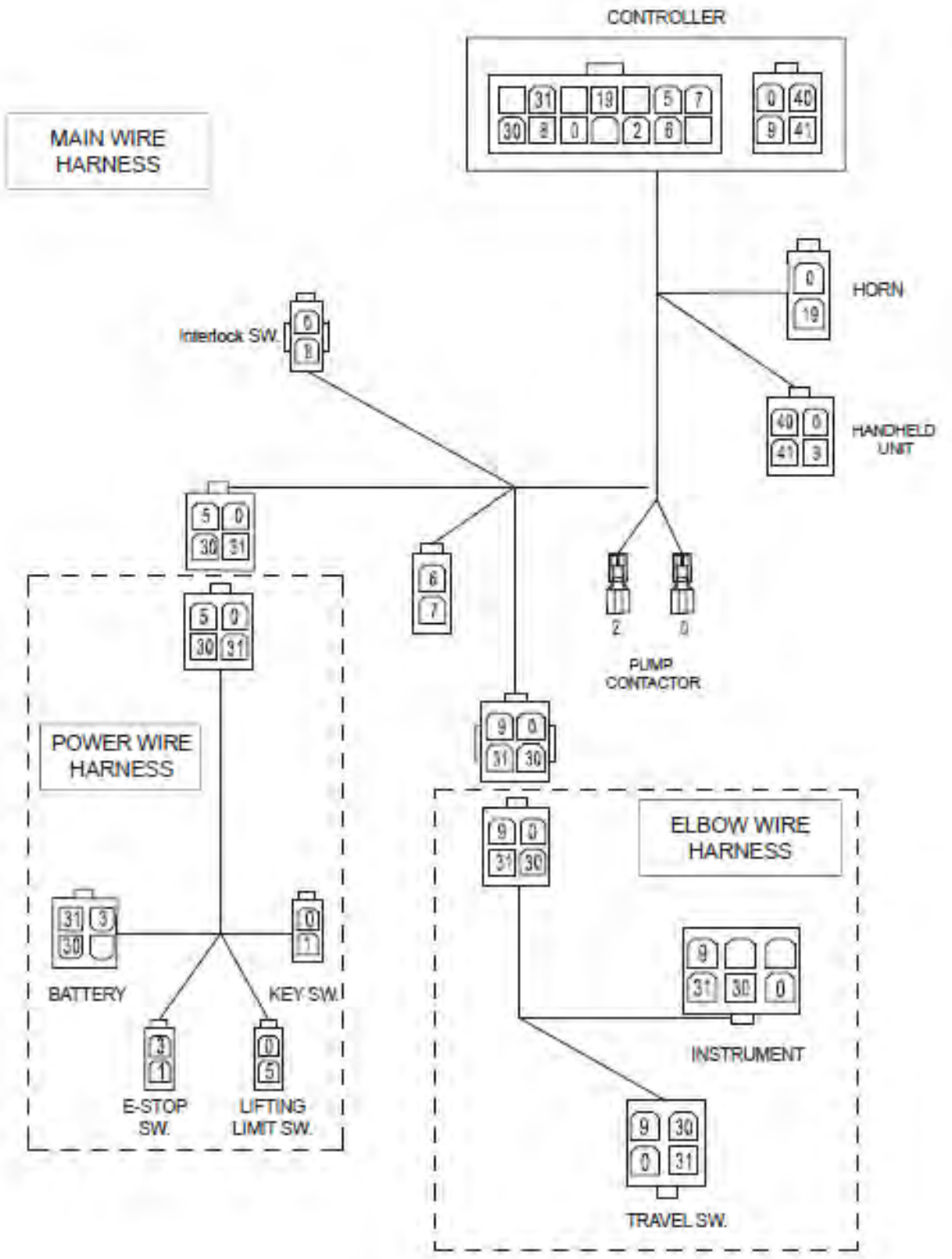
8-10.Cable Wiring Diagrams



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

8-11.WIRING HARNESS AND CONNECTORS



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NOTES

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SECTION 9 TROUBLESHOOTING

9-1. 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

- Confirm 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 Fault

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

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9-2. TROUBLESHOOTING 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. Vehicle no function	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 Section8-3.) 4) Replace the controller.
Travel Fault	1. No Forward and reverse travel, other functions are normal	a. IDeadman switch or its circuit connection failure b. Electromagnetic brake locked (Non-mechanical failure, the display will display fault code) c. Travel switch or its circuit connection failure d. Drive motor or its circuit connection failure e. Drive motor carbon brush failure f. Controller failure	Controller failure error, carry out troubleshooting according to the fault code information on the displaydisplay (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. 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.)
	2. The vehicle can travel at low speed, but cannot travel at high speed	Failures due to external factors: a. Electric brake locked or binding (Non-mechanical failure, the display 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 display (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.) 3) Check the drive motor and its connection circuit;

***** 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 will not raise	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 f. (blocked) g. Solenoid valve blocked and cannot reset h. Valve body failure: excessive wear of gear pump,	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 data plate; 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;
	2. The vehicle will not lower	a. Solenoid valve or its circuit connection failure b. Lowering switch or its circuit connection failure c. Valve failure; d. Cylinder deformation or blocked e. Pin came out of the frame or mechanical binding	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.

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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 hose leakage c. Valve failure: Gear pump wear, internal leakage occurs Insufficient relief valve pressure	1) Refer to the rated capacity marked on the data plate; 2) Check the hose and hydraulic components for oil leaks; 3) Wash or replace the valve body
	4. Slow Lowering of Vehicle	a. Solenoid valve blocked 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 worn; 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.

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SECTION 10 LITHIUM-ION BATTERY

10-1.SAFETY AND WARNINGS

- The battery should be away from heat source, combustibles, open flames 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 getting wet or submerged.
- Battery should not be shaken and kept from excess vibrations or shock. Avoid damaging the battery case.
- 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.

WARNING: Failure to comply with instructions for use and maintenance, or failure to use OEM parts, will void the battery warranty.

10-2.USE OF BATTERY

10-2.1. Pre-use Checks

- Ensure the battery is completely secure in its base, or it may be damaged by vibration.
- Check if the poles and wiring connections are properly secured routinely to prevent oxidation.
- You can apply a high quality, protective coating to terminals for additional protection.
- Check if the appearance of battery is in good condition, and Check the battery for damage.
- Before use of battery, make sure the operating temperature is within the range of -4 ° F ~ 140 ° C.

10-2.2. 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.

WARNING: Due to the characteristics of lithium-ion batteries, the battery capacity will have reduced runtime when used in a low-temperature environment.

10-2.3.Charging

- When charging, only DC current can be used. Connect the battery to specified charger only, to avoid overload of circuit and interface.
- Any 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.
- Operating temperature of charging:
- -4˚F ~ 140 ˚F (-20 °C ~ 60 °C)
- Operating voltage of charger: 100V ~ 240V, 1-phase
- Charging time:
- 2h ~ 2.5h

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10-3.MAINTENANCE & CARE

Daily Maintenance

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

Battery storage

- Battery should be stored in a dry, frost-free room where the temperature is within the range of 39°F ~ 95°F (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.

SECTION 11 OPERATORS CHECKLIST

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.		

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