OWNER'S MANUAL

BGS25-LI / BGS30-LI / BGS40-LI HIGH-PERFORMANCE STACKER

ACTUAL PRODUCT MAY NOT APPEAR EXACTLY AS SHOWN

⚠ WARNING

Do not operate or service this product unless you have read and fully understand the entire contents of this manual. Failure to do so may result in property damage, bodily injury or death.

BLUE GIANT®

STARTING FROM DECEMBER 2, 2021

ISSUE DATE: MAY 14, 2026 REV. 1.0 (PART# 038-1259E)

FOREWORD

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

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

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

Safety Notices and Text Mark-Ups

Safety instructions and important explanations are indicated by the following graphics:

DANGER

Means that failure to comply can cause risk to life and/or major damage to property.

WARNING

Strictly adhere to these safety instructions to avoid personal injury or damage to equipment or personal property.

CAUTION

Pay attention to the important safety instructions.

NOTE

Pay attention to information that could be helpful.

PROPOSITION 65

WARNING

In accordance to
California Health & Safety Code Sections 25249.5 et. seq.
this warning is to let you know that this product can expose you to chemicals known to the state of California to cause cancer, birth defects and other reproductive harm.
For more information visit: www.p65warnings.ca.gov

TABLE OF CONTENTS

⚠WARNING

- Do not operate this truck unless authorized and trained to do so and have read all instructions in this Operator's Manual and on this truck. Read, understand, and comply with the information on the truck's nameplate at all times.
- Do not operate this truck until you have performed the Daily Operator Checklist. Report any problems to the designated authority and do not use the truck until they are corrected by a qualified technician.
- If there is a fault code on the BDI/display, recycle the key and see it the code displays again. If the code displays again, do not operate the truck. Investigate the fault code and contact a service technician.
- This truck must not be modified without written manufacturer's consent.
- Operate cautiously on ramps, slopes, and uneven floors. Travel slowly and do not angle or turn. This truck is not for use on mezzanines or balcony areas.
- Operate truck only from designated operator position.
- Before operating, inspect the floor area it will be used on and be certain it will support the truck at full capacity and lift height. Identify and avoid holes, drop-offs, bumps, and obstructions.
- Never place any part of your body into the mast structure or between the mast and the truck.
- Do not carry passengers.
- Before and during all truck operations ensure that adequate clearance is maintained from overhead obstructions and energized electrical conductors and parts.
- Elevate forks only to pick up a load. Watch for obstructions overhead.
- Ensure loads are centered and do not contact any obstructions in the truck's vicinity.
- Maintain a clear view of the ground while traveling and a safe distance from obstacles in the truck's path. Ensure personnel in the vicinity are aware of the truck's movement. Travel at a safe speed for the conditions the truck is operating in.
- Observe applicable traffic regulations. Yield the right of way to pedestrians. Slow down and sound horn at cross aisles and wherever vision is obstructed. Avoid hazardous locations.
- When leaving the truck unattended, remove the key to prevent unauthorized use.
- Start, stop, travel, steer, and brake smoothly. Slow down for turns and on uneven or slippery surfaces that could cause the truck to slide or overturn. Use special care when traveling without a load as the risk of overturn can be greater.
- Travel with lifting mechanism as low as possible. Always look in the direction of travel. Keep a clear view.
- Do not handle loads that are taller than the load backrest unless secured to prevent falling.
- Do not expose the truck and battery directly to water as there is no ingress protection.

Truck Components

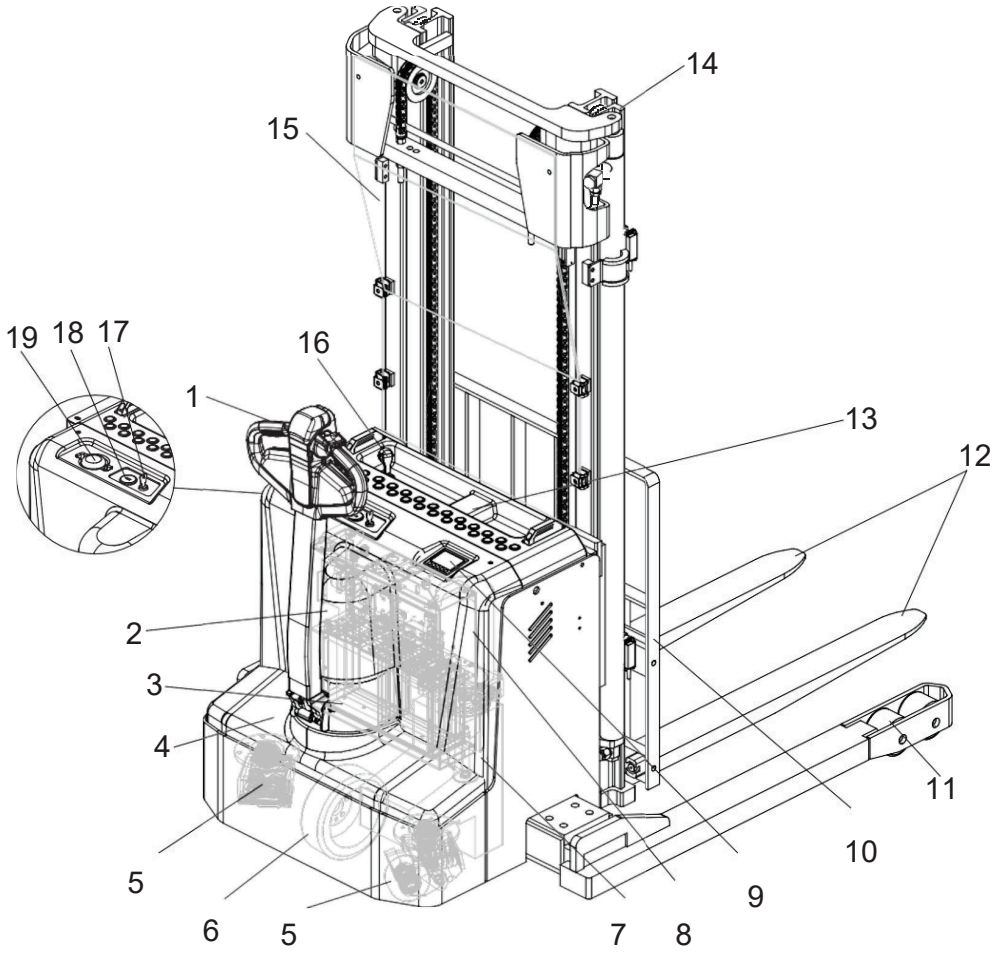


Fig 2140-00001SM

No.	Item	No.	Item
1	Control handle	11	Load wheels
2	Upper cover	12	Fork
3	Rotation cover	13	Battery panel
4	Lower cover	14	Mast
5	Caster	15	Protective plastic
6	Driving wheel	16	Charger plug
7	Hydraulic unit	17	Key switch
8	Battery	18	USB
9	Display instrument	19	Emergency stop switch
10	Fork carriage		

1.1 Common Tools

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

1.2 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 1.4.1 and Table 1.4.2 to select the suitable screws or bolts for replacement.

Table 1.4.1 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

- The performance levels of screws or bolts are marked on the heads of the screws or bolts.
- Select spare parts with a performance level of at least 8.8 grade or higher level for replacement.

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

Nominal Diameter (mm)	Performance Level			
	5.8	8.8	10.9	12.9
	Proof Stress (MPa)			
	380	600	830	970
M6	7~8	10~12	14~17	17~20
M8	16~18	25~30	34~41	41~48
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

Service Preparation

Regular truck maintenance and repair can help to ensure the continuous and reliable use of the truck.

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

Working Conditions:

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

WARNING

When lifting load components sufficiently strong chains or safety device(s) must be used to secure the truck.

CAUTION

Do not make modifications to truck, especially to the safety devices without written permission from the manufacturer.

NOTE

Under harsh working conditions: for example, if the external temperature is too high or too low, is dusty, or are implementing multiple shifts per day, the maintenance and care intervals should be shortened.

Operational application temperatures: lower than 32° F or higher than 104°F.

Only compliant lubricants can be used See Table 2.2 Lubricants.

2.1 Lock Out / Tag Out Procedure

Key Notes

- This does not apply to any service work inside of the battery.
- This is a generalized procedure and is not applicable for all service work activities. The specific LOTO (lock-out tag-out) procedure is dependent on what type of work is being done and on the specific truck model.
- Consult the service manual for more details.

Preparation

1. Notify affected employees that the truck needs to be locked out.
2. Wear appropriate PPE (personal protection equipment) and ensure you are trained on the procedure/equipment before starting
3. Read the truck specific service manual for details
4. Park on level ground
5. Turn key off and remove from vehicle
6. Press the emergency stop button (if equipped)
7. Chock the wheels
8. Gravitational and Hydraulic Potential De-Energize:
    a. Jack up the truck using appropriate lift and jack stand if needed to access underneath
    b. Lower the mast all the way to ground. If mast needs to be raised, then lower the mast on a 2x4/4x4 strut to prevent mast from falling in case hydraulic failure. Add an orange safety cone to end of the forks
9. Electric De-Energize:
    a. If Lead acid Truck: Disconnect the battery power cable connector to the truck
    b. If Li-Ion Truck: Disconnect the 2-communication connector (red arrows below). This way, the battery will not be able to output any power/voltage. When the truck is turned off the truck has no power from the battery
    c. Alternatively, a clamshell style LOTO device can be added to the e-stop of the truck that prevents one from turning and lifting up on the e-stop
10. Lock out the main power source and tag out the truck with identification:
    a. Your name
    b. Date
    c. Serial number
    d. Activity being performed
11. Identify all other energy sources that could potentially be hazardous and discharge any other residual energy from other applicable energy sources
12. Try to start the equipment to ensure it is disabled

2.2 Cleaning

- Do not use flammable liquids to clean the truck.
- Before cleaning, all necessary safety measures must be taken to prevent sparks (short circuit) during operation. If the truck is powered by battery, disconnect it.
- When cleaning electrical and electronic components, use compressed dry air. Clean the dust on the surface of components with non-conductive and antistatic brush.
- Do not use a pressure washer to clean the truck.

Regular inspection and maintenance under harsh conditions of use:

- Dusty environment
- Corrosive environment
- Cold storage environment

2.2.1 Inspection

Regular inspection and maintenance under normal conditions of use:

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

CAUTION

During the run-in period (after approximately 100 service hours) or after repair work, the owner must check the wheel nuts/bolts and retighten if necessary.

Table 2.1 Inspection & Maintenance List					
Interval in days/months/years	**7 d**	**60 d**	**90 d**	**6 m**	**1y**
Interval in hours	**50**	**250**	**500**	**1000**	**2000**
Functions and Control					
Check the functions of the operation switches and display	A				
Check alarm system functions	A				
Check interlock switch functions	A				
Check the emergency switch functions	A				
Check the cables for damage and if the terminals are secure		A			
Check and tighten the controller					A
Check the limit switch functions	A				
Check fault information records				A	
Power Supply & Drive System					
Check the battery cables for damage and replace if necessary				A	
Check the battery charge connector				A	
Check if the cable connections between battery monomers are secure, apply some grease to electrodes if necessary				A	
Check the position of various bearings for noise					A
Check front and rear wheel fastenings and tighten. (after each maintenance or repair, at the latest after 100 hours).		A			
Replace gear oil	Replace once every 800~1000 hours				
Check the gearbox for abnormal noise or leaks				A	
Check and lubricate the bearings between drive motor and gearbox		A / L			
Check the drive wheel and load wheel for worn or damage	A				
Check the wheel bearings and fixation			A		

A = Check / Adjust
Refer to Inspection & Maintenance List
for regular inspection and maintenance of the trucks.

L = Lubrication

Under harsh conditions, the lubrication intervals

should be shortened by half.

Table 2.1 Inspection & Maintenance List (Continued)					
Interval in days/months/years	**7 d**	**60 d**	**90 d**	**6 m**	**1y**
Interval in hours	**50**	**250**	**500**	**1000**	**2000**
Power Supply & Drive System					
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 wear					A
Check the oil tank mount and check for leaks					A
Check the hydraulic oil level				A	
Replace the hydraulic oil	Replace after 100 hours of early operation. Then replace once every 2000 hours.				
Check the function of emergency pressure relief valve				A	
Replace oil tank air filter					A
Replace the oil tank breather and filter					A
Braking System					
Check the braking functions of electromagnetic brake	A				
Check and adjust the air gap of electromagnetic brake				A	
Check the installation and connection of electromagnetic brake					A
Check the stopping distance of electromagnetic brake (between 4 to 6 feet)					A

A = Check / Adjust

Refer to Inspection & Maintenance List for regular inspection and maintenance of the trucks.

L = Lubrication

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

Table 2.1 Inspection & Maintenance List (Continued)					
Interval in days/months/years	**7 d**	**60 d**	**90 d**	**6 m**	**1y**
Interval in hours	**50**	**250**	**500**	**1000**	**2000**
Lifting System					
Check the mast for damage					A
Clean and lubricate the rolling surface of lift mast column with grease		A / L			
Check and lubricate the rollers on mast and fork frame			A / L		
Check the fixation of lift mast				A	
Check the tubing for connections and leaks			A		
Check and lubricate the chains			A / L		
Check the lifting chains and chain guides for wear, adjust and grease				A	
Check the blocking shelf on the fork frame for fixation and wear				A	
Check the fork for wear and damage				A	
Visually inspect rollers, sliders and stoppers				A	
Check the lifting and lowering speed					A
Other					
Check if the decals are clear and complete				A	
Check the chassis for cracks or damage					A
Check the connections of bolts and nuts			A		
Checking covering parts for damage					A
Check the caster for wear and cracks				A	
Check if the optional features are functioning properly	A				

A = Check / Adjust

Refer to Inspection & Maintenance List for regular inspection and maintenance of the trucks.

L = Lubrication

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

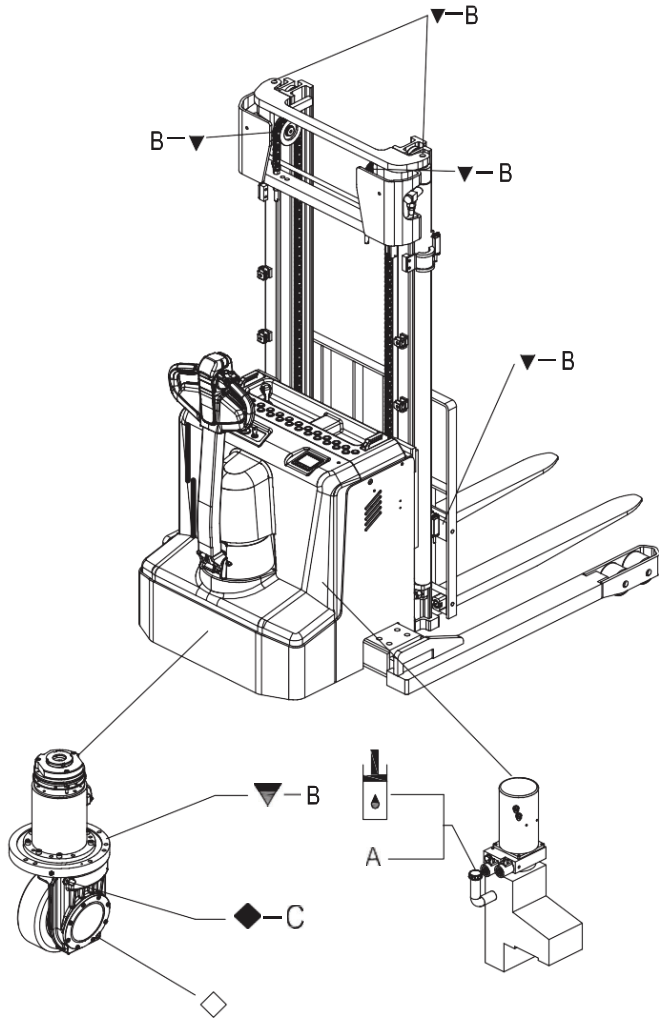
2.3 Lubrication

When storing or adding lubricant, use clean containers. Do not mix different types and specifications of lubricants with each other (except for those that state they can be mixed).

See Table 2.2 for the lubricants used in this truck.

CAUTION

The use and disposal of lubricants must be carried out in strict accordance with local government regulations.



Hydraulic oil port

Gear oil fill point

Gear oil drain point

Contact surface

Fig 2140-00002SM

Table 2.2 Lubricants

Code	Type	Specification	Amount	Position
A	Anti-wear hydraulic oil	L-HM32	5~7L (See Table 2.3)	Hydraulic unit
B	Multi-purpose grease or Grease—Lithium base, general purpose.	Polylub GA352P	Appropriate amount	Contact surface (See Table 2.4)
	Chain spray	/	Appropriate amount	Chains
C	Heavy Duty Gear Oil	GL-80W-90 (GL-5)	1.38 L	Gearbox

Table 2.3 Application Amount of Hydraulic Oil

Mast	Lifting Height (mm)	Quantity (L)
Duplex	2500	5
	2700	5.2
	3000	5.5
	3300	5.8
	3600	6.1
	3900	6.3
Triplex Full Freelift	4000	6.4
	4500	6.5
	4800	6.6
	5000	6.7
	5500	7

Table 2.4 Sliding Surface Lubrication Table

Code	Position
L1	Mast steel channel and rollers
L2	Chains
L3	Fork carriage
L4	Steering Bearing
L5	Drive wheel gear
L6	Caster

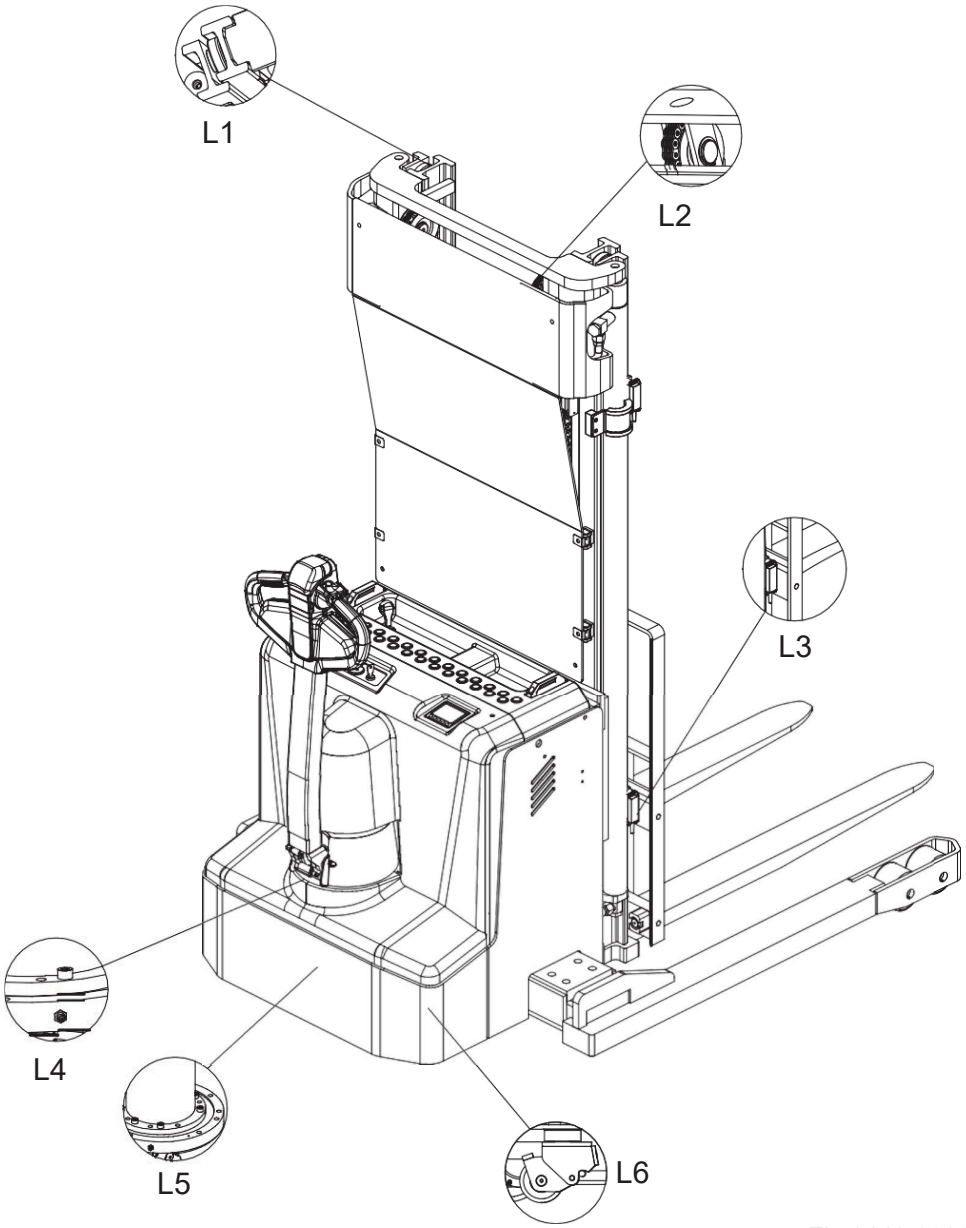


Fig 2140-00003SM

Structure & Functions

3.1.1 Travel Switch

Location: Control pod

Function: To output travel speed signal to the drive controller

Description: When the truck is powered on, the travel switch is in the neutral position

Note: Unserviceable.

Travel Switch

3.1.2 Horn Switch

Location: Control pod

Function: Operates the horn

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

Note: Unserviceable.

Horn Switch

3.1.3 Lifting Switch

Location: Control pod

Function: Lifts the forks

Description: The lifting switch is normally open. When pressing, the switch is on, after release, the switch will automatically reset.

Note: Unserviceable.

Lifting Switch

3.1.4 Emergency Reverse Switch

Location: Control pod

Function: When the switched is pressed, the switch, the truck will travel in reverse direction

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

Note: Unserviceable.

Emergency Reverse Switch

3.1.5 Crawl Speed Switch

Location: Control pod

Function: Press the button and rotate the travel switch, the truck will travel at a very slow speed

Description: The crawl speed switch is normally open. When pressing, the switch is on, after release, the switch will automatically reset.

Note: Unserviceable.

Crawl Speed Switch

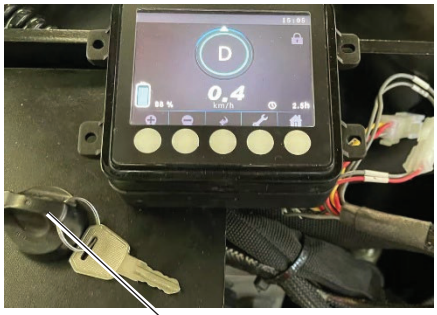
3.1.6 Key Switch

Location: Upper cover of the chassis

Function: To switch truck power on or off

Description: Insert the key and turn clockwise to start the truck, turn counter-clockwise to shut off the truck. Remove the key

Note: Unserviceable.



Key Switch

3.1.7 Fuse

Location: Fuse1 and fuse2 on main wiring harness, fuse 3 on electrical mounting plate

Function: Overcurrent protection

Description: Fusing current is 10A (Fuse 1,Fuse 2) & 200A (Fuse 3).

Note: Unserviceable.

Fuse1 Fuse2

Fuse3

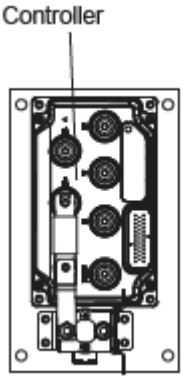
3.1.8 Controller

Location: Drive motor

Function: To control the truck through the signal input

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

Note: Unserviceable.



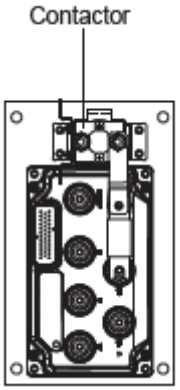
3.1.9 Contactor

Location: Electrical mounting plate

Function: To connect and disconnect circuit and to control the power transmission of drive motor

Description: To provide power loads through controller under the circumstances that the controller is failure-free.

Note: Unserviceable.



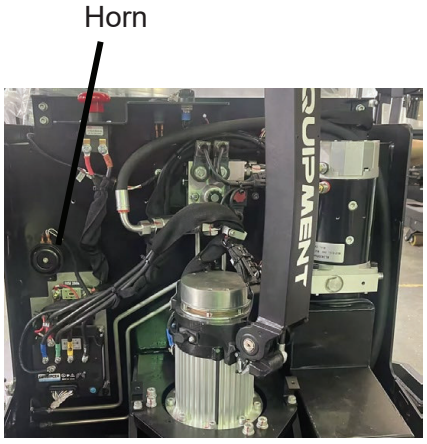
3.1.10 Horn

Location: Above electrical mounting plate

Function: Provides sound when the horn switch is pressed.

Description: 24V operating voltage

Note: Unserviceable.



3.1.11 Pump Motor

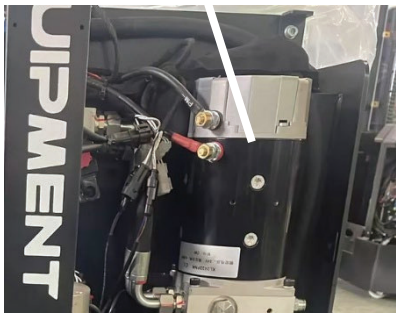
Location: Valve body

Function: To provide power for gear pump for lifting the loading rack

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

Note: Unserviceable.

Pump Motor



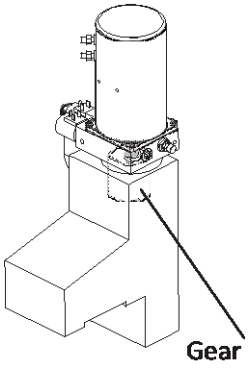
3.1.12 Gear Pump

Location: Valve body

Function: To provide pressure for hydraulic system of the entire truck

Description: Supplies pressure for hydraulic system

Note: Unserviceable.



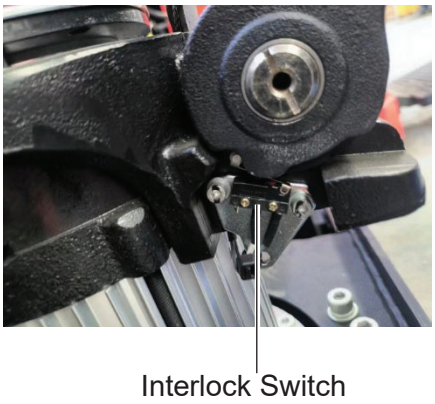
3.1.13 Interlock Switch

Location: Handle joint

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

Description: Prevents misuse of truck

Note: Unserviceable.



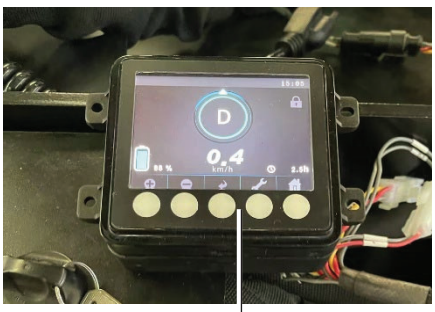
3.1.14 Display

Location: Upper cover of the chassis

Function: Displays the battery power, working hours, fault information,and so on

Description: 24V operating voltage

Note: Unserviceable.



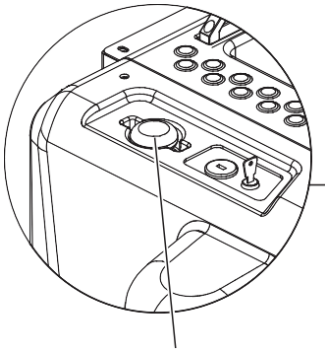
3.1.15 Emergency Stop Switch

Location: Upper cover of the chassis

Function: Disconnects the circuit and switch off all electrical functions, achieving emergency braking

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

Note: Unserviceable.



Emergency Stop Switch

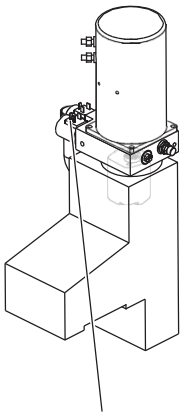
3.1.16 Solenoid Valve

Location: Valve body

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

Description: 24V operating voltage

Note: Unserviceable.



Solenoid Valve

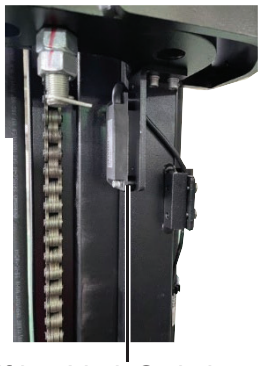
3.1.17 Lifting Limit Switch

Location: Inner mast

Function: When the fork carriage is lifted and the limit switch is triggered, the truck will stop lifting

Description: Lifting limit switch is normally open

Note: Unserviceable.



Lifting Limit Switch

3.1.18 Speed Reduction Switch

Location: Vertical mounting plate of the mast

Function: When the fork carriage is lifted and the speed reduction switch is triggered, the travel speed of truck will be reduced

Description: Lifting limit switch is normally open. When the fork carriage is lifted in higher position (that is to trigger the speed reduction switch to closed), the travel speed of truck will be reduced

Note: Unserviceable.

Chassis System

4.1 Load Wheel

Removal

- Lift the forks of the truck carefully with lifting equipment

WARNING

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

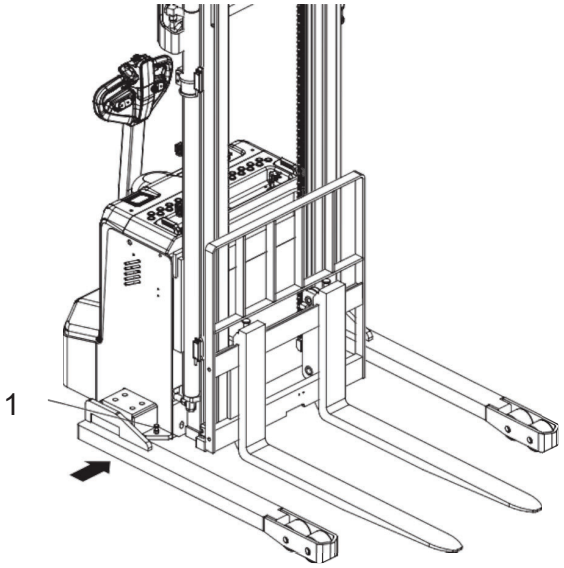


Fig 2140-10001SM

- Screw the screw (1) to the ground so that one side of the wheel is suspended.

WARNING

When replacing wheels, make sure that the truck does not tilt.

For the BGS25-LI (Fig 2140-10002SM)

- Remove the snap ring (16) in the fork leg with a wrench.
- Remove the wheel pin shaft (11) from side, and remove washers (12), load wheel and bearing assembly.
- Remove the bearing (14) of load wheel (13) with hammer and jacking equipment.

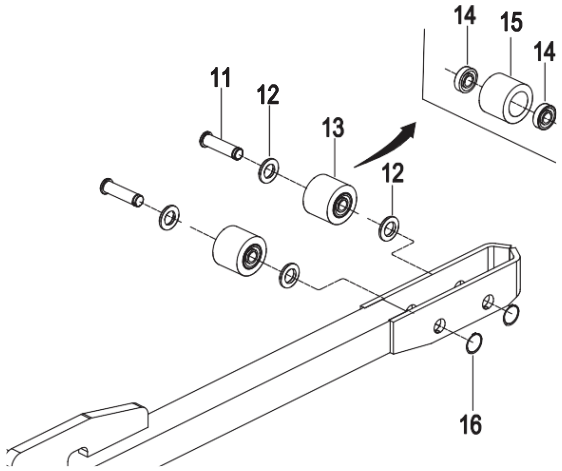


Fig 2140-10002SM

For the BGS30-LI & BGS40-LI (Fig 2140-1003SM)

- Remove the snap ring (16) in the fork leg with a wrench.
- Remove the wheel pin shaft (11) from side, remove washers (12), load wheel and bearing assembly.
- Remove the bearing (14) of load wheel (15) with hammer and jacking equipment.

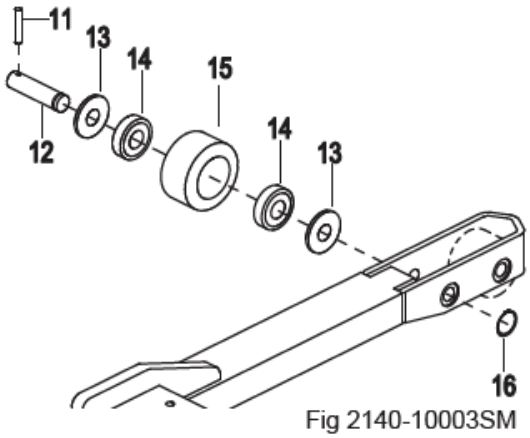


Fig 2140-10003SM

Installation

Install in the reverse order of removal.

Run the truck to see if the load wheel is functioning properly. If there is blocking or noise, install again.

⚠ CAUTION

Quality of tires directly affects the stability and driving performance of the truck.

If you need to replace the factory-fitted tires, use original spare parts provided by the equipment manufacturer.

4.1.2 Faults and Causes

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

4.2 Cover

Removal

- Unscrew the two screws (2) with a wrench, remove the upper cover (1).
- Unscrew the two screws (3) and remove the lower cover (4).

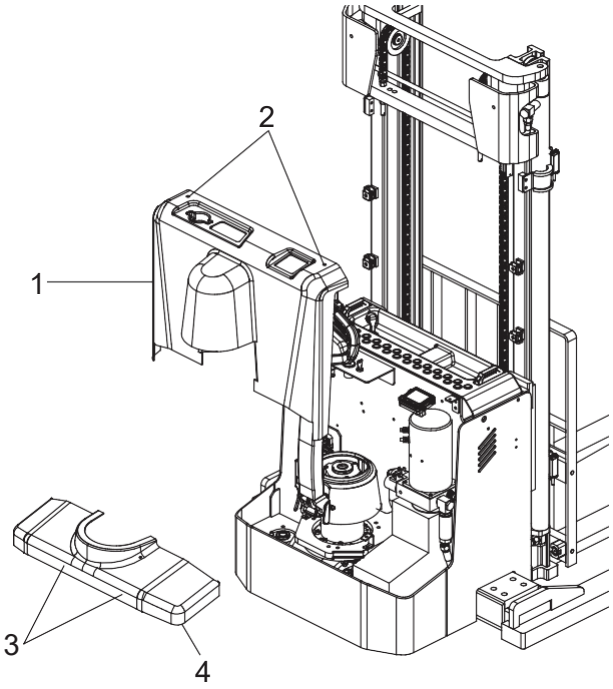


Fig 2140-10003SM

- Unscrew the screws (6) on the right.
- Unscrew the screws (6) on the left.
- Remove the rotation cover (7) from the drive assembly.

Fig 216-10006SM

⚠ CAUTION

The covers are made of plastic materials. Even force must be applied when removing. Be sure not to concentrate the force on one spot to prevent damage.

Installation

Install in the reverse order of removal.

4.3 Caster

Removal

- Lift the truck carefully with lifting equipment.
- Unscrew the four screws (1), then remove the caster (2) from the chassis.

WARNING

Make sure the lifting equipment is solid and secure, and the load capacity is greater than the total weight of the truck. Do not lift over 12 inches to prevent the hazards to the maintenance personnel working on the truck during caster removal and installation.

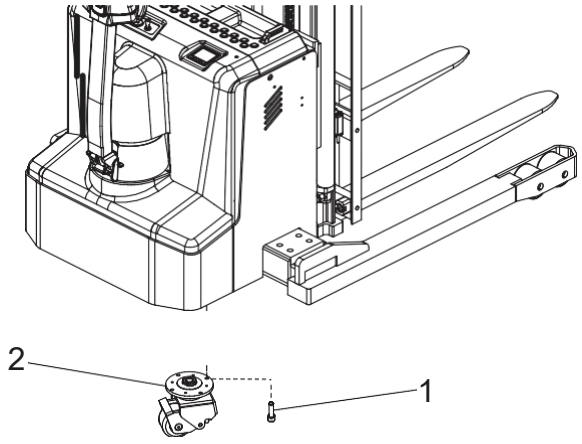


Fig 2140-10004SM

Installation

Install in the reverse order of removal.

Adjustment

- When the replacement is completed, park on level ground to see if the casters and drive wheel are both be in contact with the ground.
- When the truck is running, check if the three wheels are functioning properly.

WARNING

After an extended period of use, the drive wheel will become worn. When this occurs, change the height of drive wheel by adjusting the adjusting nut so the two casters and drive wheel will be in close contact with the ground.

CAUTION

Tire wear can affect the stability of the truck. Adjust the caster(s) with minor wear regularly and replace caster(s) with heavy wear.

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

Upon maintenance or replacement for parts of the caster, refer to Fig 2108-00052OM for removal and installation.

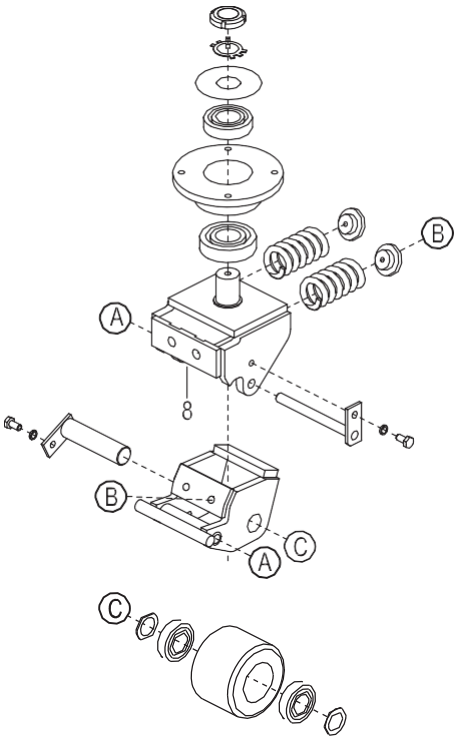


Fig 2108-00052OM

Drive System

Drive Assembly

No.	Name
1	Drive Wheel
2	Gear Case
3	Steering Bearing
4	Drive Motor
5	Electromagnetic Brakes

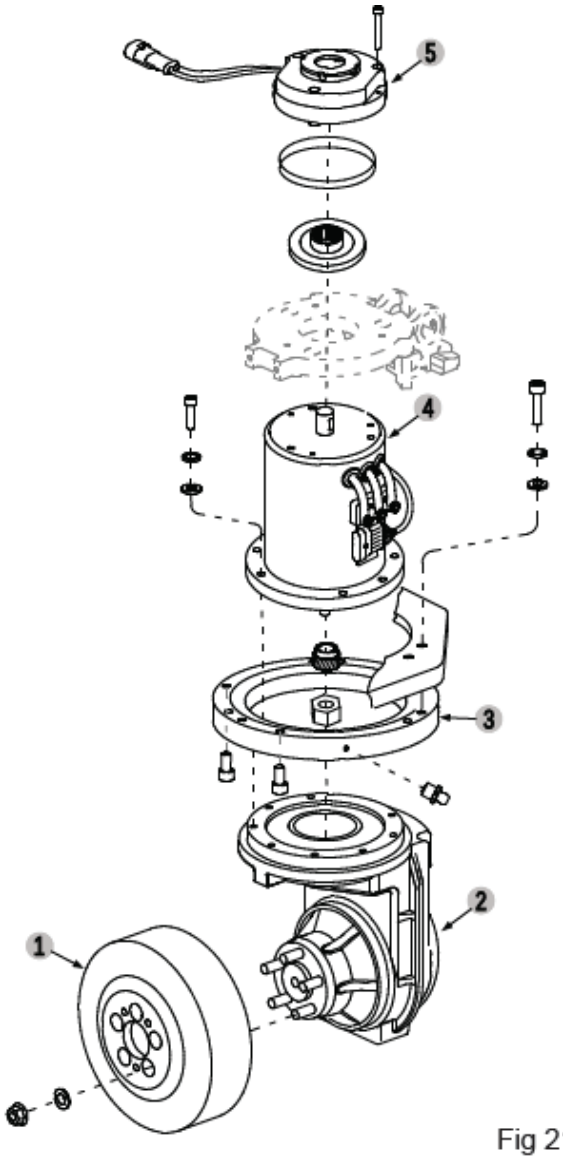


Fig 2116-20001SM

5.1 Electromagnetic Brake

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

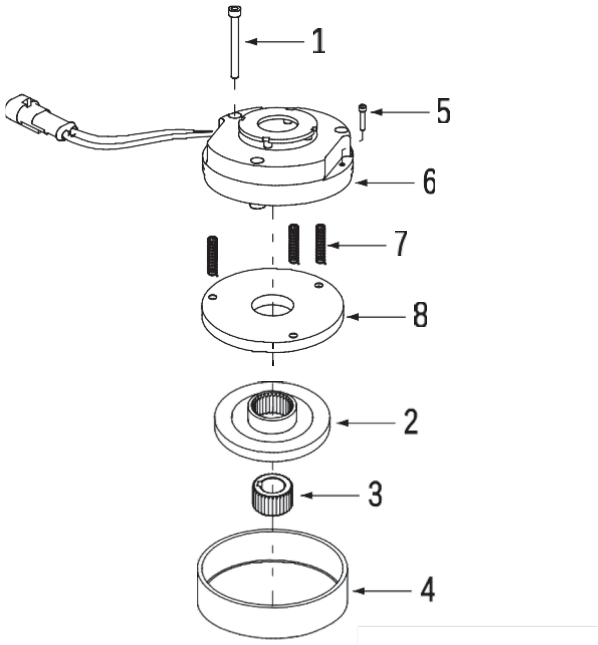


Fig 2116-20002SM

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

Removal

The brake is installed on the drive motor.

- Switch off the truck power connections and pull out the brake connectors.
- Remove the three mounting screws (1) with wrench. Remove the electromagnetic coil (6) and the dust cover (4).
- Remove the brake pads (2).
- Remove the circlip on the shaft with circlip pliers and remove the brake gear (3).

Installation

Install in the reverse order of removal.

Adjustment

- Switch off the truck power.
- Remove the rotation cover.
- Loosen the three mounting screws (1) (See Fig 2116-20002SM).
- Adjust the three adjusting screws (5) with wrench to make the air gap between electromagnetic coils and pressure plate be 0.2mm ~ 0.3 mm.
- Turn on the power and press the handle. Slowly turn the accelerator button.
  If the brake is absorbed (with the sound of absorption), it is working properly.
  If the brake does not absorb, it needs to be re-adjusted.

Air gap	Standard value	Maximum value
s	0.2 mm	0.4 mm

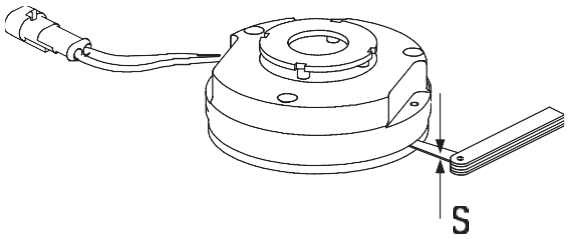


Fig 2116-20003SM

⚠ CAUTION

When the air gap(s) exceeds 0.4mm, replace the brake pads (2, Fig 2116-20002SM*)*

Faults and Causes

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

Checking and Testing

Electromagnetic Coil Checks

- Switch off the truck power connections and pull out the brake connectors.
- Check the resistance of the coil with a multi-meter. Measurement method is as shown in Fig 2116-20004SM.

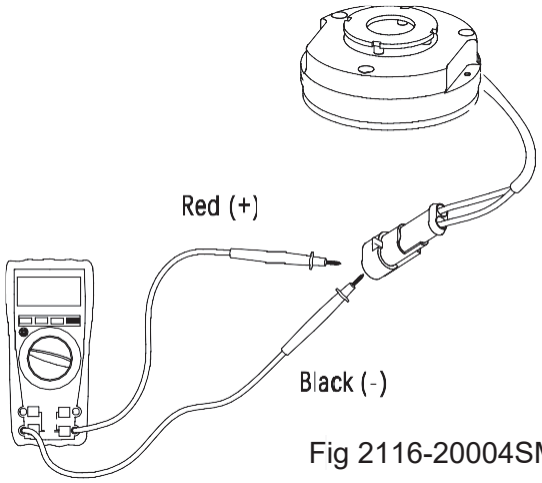


Fig 2116-20004SM

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

  As shown in the following table:

Resistance Measurement	Judgment
Approx. 20~40 Ω	Normal
0 Ω	Coil shorting (replace the brake)
∞ Ω	Coil breaking (replace the brake)

Air Gap Checks

- Switch off the truck power and pull out the brake connectors.
- Check the air gap between electromagnetic coil and pressure plate with feeler gauge. Measurement method is as shown in Fig 2116-20003SM.
- Determine if the air gap is normal according to the gauge measurements.

As shown in the following table:

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

NOTE

After an extended period of use, the electromagnetic brake pads will show wear. When the air gap between electromagnetic coil and pressure plate may exceed the predetermined maximum value, an electromagnetic absorption failure may occur.

Foreign Body Checks

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

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

Mounting Screws Checks

Three mounting screws in the brake may affect the normal absorption of pressure plates.

Check if the mounting screws are bending due to a collision.

Spring Checks

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

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

NOTE

After a period of use, springs may become deformed, this may result in abnormal air gap of the brake, and the spring must be replaced.

Control Circuit Troubleshooting

Brake Control Circuit (Fig 2116-20005SM)

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

- Set the multimeter to ON-OFF.
- Check if #45 circuit (circuit between brake and controller) is conducted.
- Check if #41 circuit (circuit between brake and controller) is conducted.

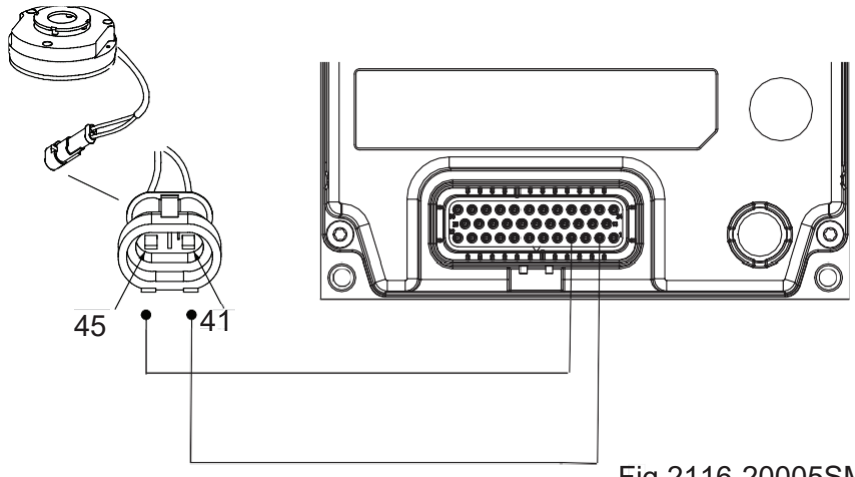


Fig 2116-20005SM

5.2 Drive Wheel

Removal

- Raise the truck carefully with lifting equipment through the lifting holes on left and right.

WARNING

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

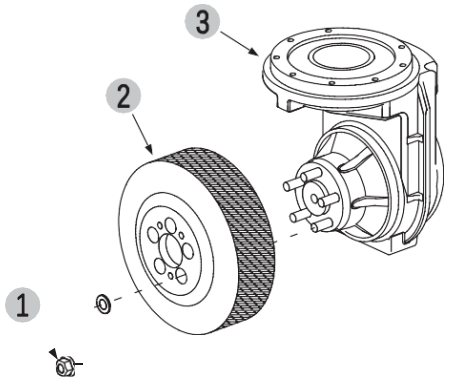


Fig 2116-20006SM

- Rotate the drive assembly to the right.
- Loosen the five flange nuts (1) with wrench or socket wrench, and then unscrew the flange nuts and spherical washer by order.
- Remove the drive wheel (2) from the gearbox (3).

Installation

Install according to the reverse order of removal.

CAUTION

Screw the five nuts as shown in Fig 2116-20006SM.

Tighten the nuts by order and mark with the torque: 140 N • m.

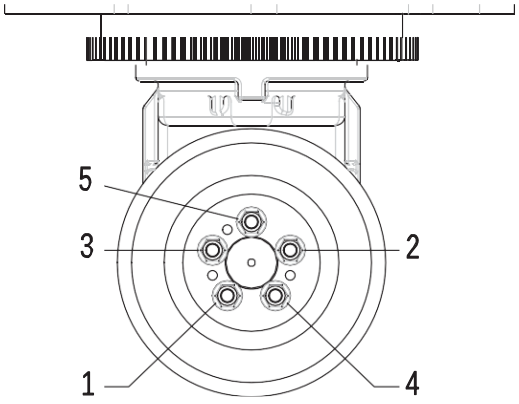


Fig 2116-20007SM

CAUTION

Tire wear can affect the stability of the truck. Adjust the caster(s) regularly with minor wear or replace the caster(s) with heavy wear.

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

Faults and Causes

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

5.3 Drive Motor

Removal

Drive motor (4, Fig 2116-20001SM) is mounted on the large steering bearing (3).

- Switch off the truck power and remove the brake (See Section 5.1).
- Unplug the AMP connector on the drive motor, and remove the U, V and W cables connected between drive motor and controller.
- Unscrew the eight screws (1, Fig 2116-20008SM) and dismantle the drive motor (2).
- Unscrew the nut on the motor shaft, then remove the helical gear.

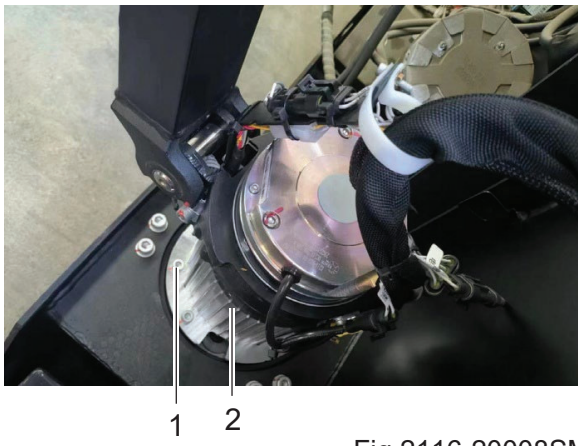


Fig 2116-20008SM

Installation

Install according to the reverse order of removal.

CAUTION

When installing the motor gear of gearbox onto the shaft of the motor, make sure that the woodruff key on the motor shaft is fully seated on the motor gear.

Motor gear should fully engage with the gear within the gearbox, rotate the gearbox without blocking, and then fix it with six screws.

Requirements on tightening torque of fixing screws: 140 N • m.

Faults and Causes

1	Fault	Motor does not rotate
	Cause	a. Cable U, V, or W is broken b. Loosening connections to cable U, V or W c. Stator coil open circuit d. Motor bearing damage e. Speed encoder or its circuit failure.
2	Fault	Motor is rotating in slow speed and reverse
	Cause	Cable connection error
3	Fault	Motor with abnormal noise or vibration
	Cause	a. Uneven clearance between stator and rotor • Bearing failures b. Loosening fixing screws on motor housing.
4	Fault	Motor temperature too high, controller failure
	Cause	a. Stator winding short circuit b. Motor U, V and W terminals with surface c. Bearing failure, resulting in severe heating d. Motor cooling duct blockage with foreign body e. Overload
5	Fault	On load, motor speed is turning slow
	Cause	a. Insufficient voltage of battery b. Overload c. U, V, W terminals with abnormal voltage input d. Speed encoder or its circuit failure

Checking and Testing U, V, W Terminals

- Identify if the motor windings are normal through measuring the resistance of U-V, V-W, and U-W respectively, if there is short circuit or breakage.

  As shown in the following table:

⚠ CAUTION

Due to the small size of windings, when measuring with a multimeter, put it on a low resistance range.

Resistance Measurement	Judgment
200m Ω – 300m Ω	Normal *
0 Ω	Winding internal short circuit (replace the motor)
∞ Ω	Winding internal open circuit (replace the motor)
* The difference between the resistance values measured at U-V, V-W and U-W shall not be greater than 2%.	

- Identify if there is leakage current through measuring the resistance between U, V, W and motor housing respectively.

  As shown in the following table:

Resistance Measurement	Judgment
0 Ω	Leakage current (replace the motor)
∞ Ω	Normal *
* For normal motor, U, V and W terminals are insulated from motor housing.	

Temperature Sensor

Temperature sensor is used to monitor motor temperature.

Measure the resistance between pin connector (20#) and (39#) with a multimeter to identify if the temperature sensor is normal.

As shown in the following table:

Resistance Measurement	Judgment
With readings	Normal
0 Ω	Sensor short circuit (replace the motor)
∞ Ω	Sensor open circuit (replace the motor)

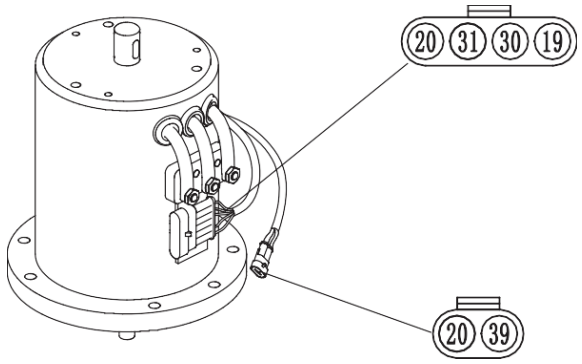


Fig 2116-20009SM

Speed Encoder

Speed encoder is used to detect the speed of the motor and covert the speed into fixed signals.

Checking

- Check if the motor encoder and the appearance of cables are in good condition, and if the plug connection is secure.
- Remove the speed encoder and check its sensing surface for wear.

Testing

The truck is powered on, measure the voltage between pin connector (19#) and (20#) with a multimeter, normally should be 12V，+5 V is possible on request (HW customization).

Check the “ENCODER” readings on TESTER Menu. Operate the truck, if the display is always “0”:

speed encoder failure
motor encoder disc failure

Control Circuit Troubleshooting

Motor Control Circuit (Fig 2116-20010SM)

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

- Set the multimeter to ON-OFF
- Check if #19/#20/#30/#31/#39 circuit (circuit between motor and controller) is conducted.

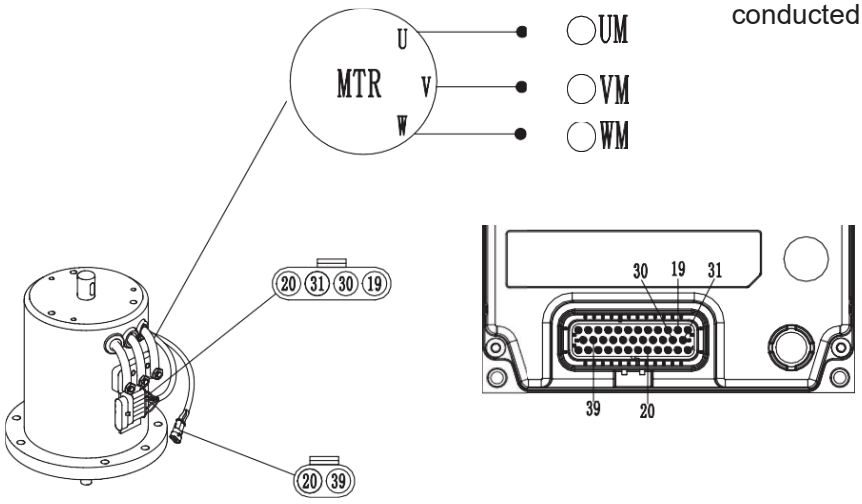


Fig 2116-20010SM

5.4 Gearbox

Removal

The gearbox is installed under the drive mounting base.

- Remove the drive motor.
- Unscrew the six bolts (1) on the drive mounting base and remove the gearbox.
- Unscrew the eight bolts on the steering bearing, remove the large steering bearing, large ring gear and gearbox by order.

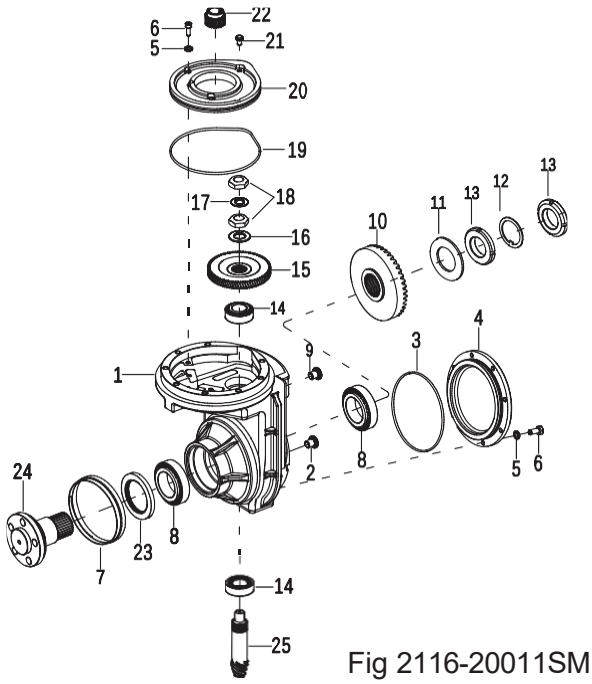


Fig 2116-20011SM

CAUTION

Carry out maintenance work in a clean environment to prevent impurities from entering into gearbox, potentially causing damage.

During the installation, hydraulic oil of the same specifications must be used for cleaning or lubrication.

See Fig 1221-20017SM

- Loosen the oil drain plug (2), drain the gear oil within the gearbox.
- Unscrew the four screws (6) and remove the upper cover (20) and the O-ring (19) from box (1).
- Unscrew the eight screws (6) and remove the side cover (4) and the O-ring (3) from box (1).
- Unscrew the two nuts (13) and remove the locking tab (12) and washer (11) from gear shaft (24).
- Knock out the gear shaft (24) from box (1) and remove the large gear (10), then knock out the bearing (8).
- Remove the cover (7) and the oil seal (23).
- Unscrew the two nuts (18), remove the locking tab (17) and washer (16).
- Remove the hyper gear (25) from below and remove the large helical gear (15), then remove the bearing (14).

Installation

Install in the reverse order of removal.

CAUTION

When installing nut (18) and nut (13), high strength threadlocker must be smeared on the thread of the nut.

CAUTION

Before installing the new gearbox, add gear oil (see Add/Replace Gear Oil Section for specification and filling amount).

Before installing gearbox, remove the proximity switch. When installation is complete, adjust the proximity switch.

Check the Gear Oil Level

- Loosen the oiling port plug and observe the oil level.
- If oil level is aligning with lower level of oiling port, it indicates that the oil level is normal
- If the oil level is below the lower level of oiling port, it is necessary to add gear oil.

Add / Replace Gear Oil

- Loosen the oil drain plug, drain the gear oil within the tank.
- Remount the oil drain plug and add the gear oil of same specification with tubing through oiling port:
- Gear oil specification: 80W-90 GL-5
- Gear oil filling amount: 1.5 QT (1.38 L)

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.

Operating System

6.1 Control Handle

The control handle is used to control travel, lifting, lowering, horn, crawl speed mode and emergency reverse of the truck.

By function:

- Horn Button Switch
- Crawl Speed Switch
- Emergency Reverse Switch
- Lifting and Lower Switch

Removal

- Remove the two screws (2) on the handle (1), lift the cap assembly (3).
- Remove the accelerator assembly (4) and remove the elbow wiring harness from the control handle.
- Remove the four screws (6), remove the handle (1) from the control arm (5).

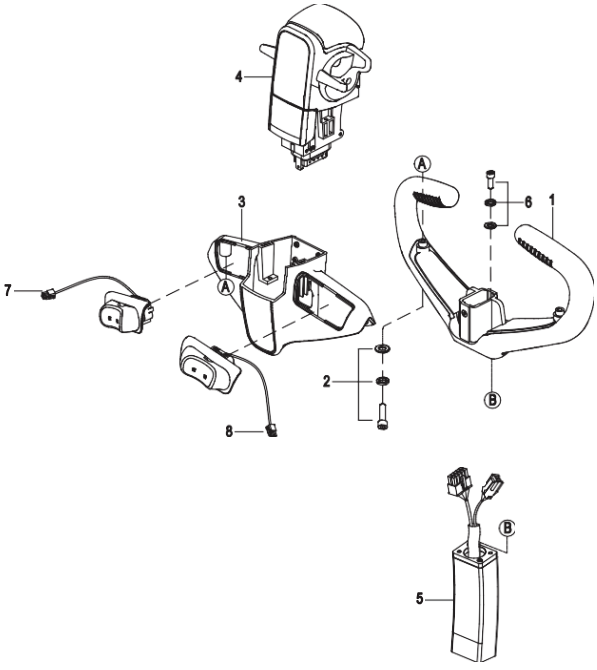


Fig 2116-30001SM

Installation

Install according to the reverse order of removal.

CAUTION

When removing or installing protect the cables from being damaged.

6.2 Accelerator Assembly

The accelerator assembly is used to control the truck start-stop, horn, emergency reverse and travel.

Faults and Causes

1	Fault	Operate the push button switch, but the truck does not respond
	Cause	a. Accelerator assembly failure b. Accelerator assembly circuit not conducted
2	Fault	Accelerator assembly not operated, but the truck responds with action
	Cause	Accelerator assembly failure

Checking

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

Testing

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

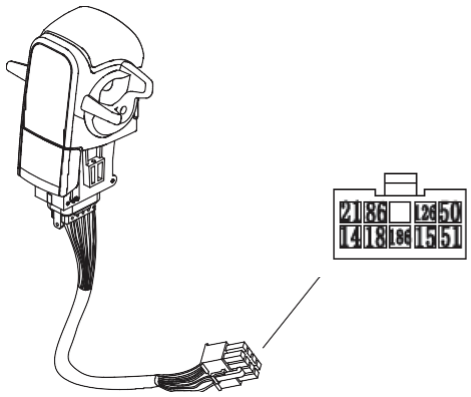


Fig 2140-30002SM

6.3 Handle Head Assembly

(See Fig2140-30002SM)

Carry out ON/OFF test to the handle head assembly with a multimeter. Push Service button switch at original position, broken circuit.

Press the button, the circuit is conducted. The handle head assembly includes lifting, emergency reverse and horn fuctions.

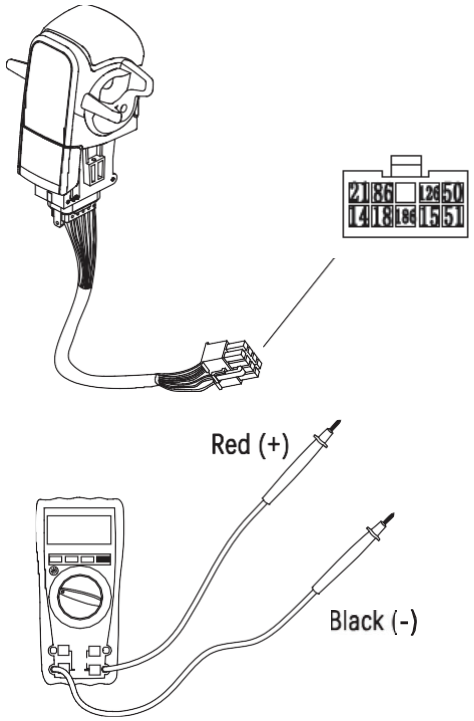


Fig 2140-30002SM

6.4 Travel Switch

(See Fig 2140-30002SM)

Carry out ON/OFF test to the circuit between #18, #21, #50 and #51 with a multimeter. Push button switch at original position, broken circuit, press the button, the circuit is conducted.

6.5 Horn Switch

(See Fig2140-30002SM)

Carry out ON/OFF test to the circuit between #14 and #18 with a multimeter. Push button switch at original position, broken circuit. Press the button, the circuit is conducted.

6.6 Emergency Reverse Switch

(See Fig 2140-30002SM)

Carry out ON/OFF test to the circuit between #86 and #126 with a multimeter. Push button switch at original position, broken circuit. Press the button, the circuit is conducted.

6.7 Crawl Speed Switch

(See Fig 2140-30002SM)

Carry out ON/OFF test to the circuit between #18 and #126 with a multimeter. Push button switch at original position, broken circuit. Press the button, the circuit is conducted.

6.8 Control Circuit Troubleshooting

Travel Switch Control Circuit

(See Fig 2140-30003SM)

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

- Set the multimeter to ON-OFF.
- Check if #21 circuit (circuit between travel switch and controller) is conductive.
- Check if #50 circuit (circuit between travel switch and controller) is conductive.
- Check if #51 circuit (circuit between travel switch and controller) is conductive.
- Check if #18 circuit (circuit between travel switch and GND) is conductive.

Horn Switch Control Circuit

(See Fig 2140-30004SM)

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

- Set the multimeter to ON-OFF.
- Check if #14 circuit (circuit between horn switch and horn) is conductive.
- Check if #21 circuit (circuit between horn switch and controller) is conductive.

Emergency Reverse Switch Control Circuit

(See Fig2140-30005SM)

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

- Set the multimeter to ON-OFF.
- Check if #21 circuit (circuit between emergency reverseswitch and controller) is conductive.
- Check if #86 circuit (circuit between emergency reverse switch and controller) is conductive.

Crawl Speed Switch Control Circuit

(See Fig 2140-30006SM)

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

- Set the multimeter to ON-OFF.
- Check if #18 circuit (circuit between crawl speed switch and GND) is conductive.
- Check if #126 circuit (circuit between crawl speed switch and controller) is conductive.

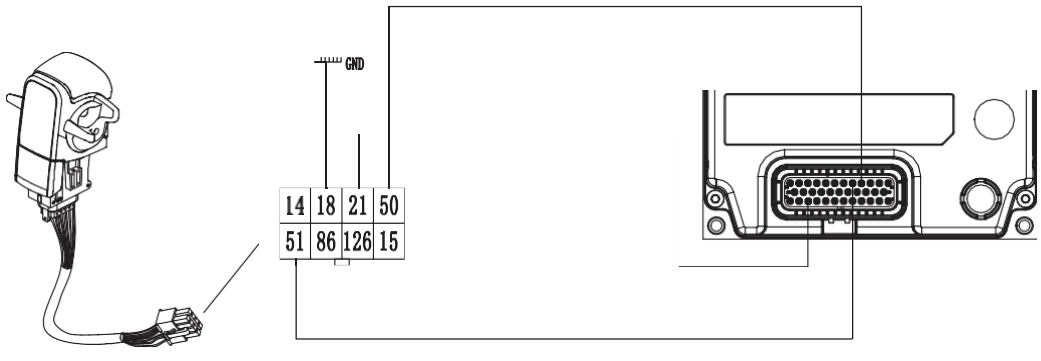


Fig 2140-30003SM

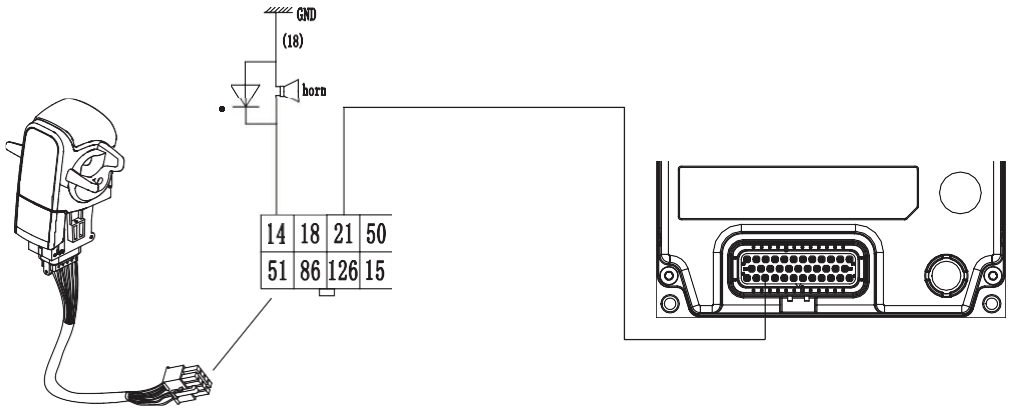


Fig 2140-30004SM

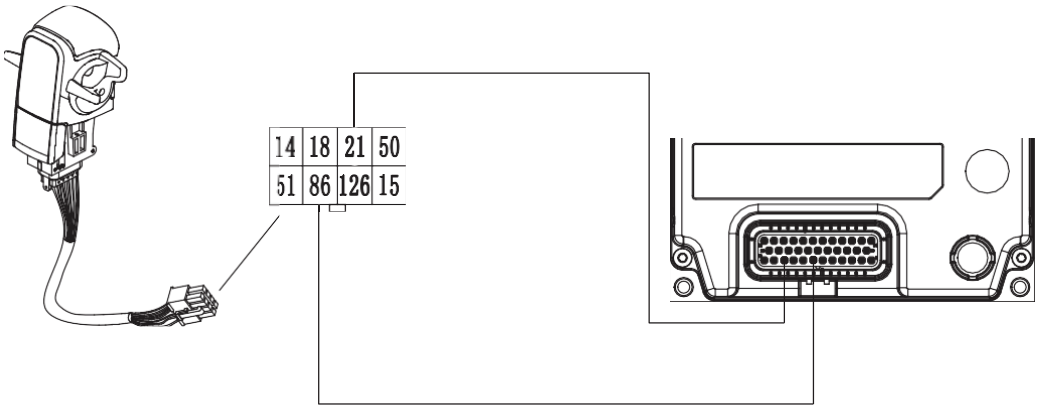


Fig 2140-30005SM

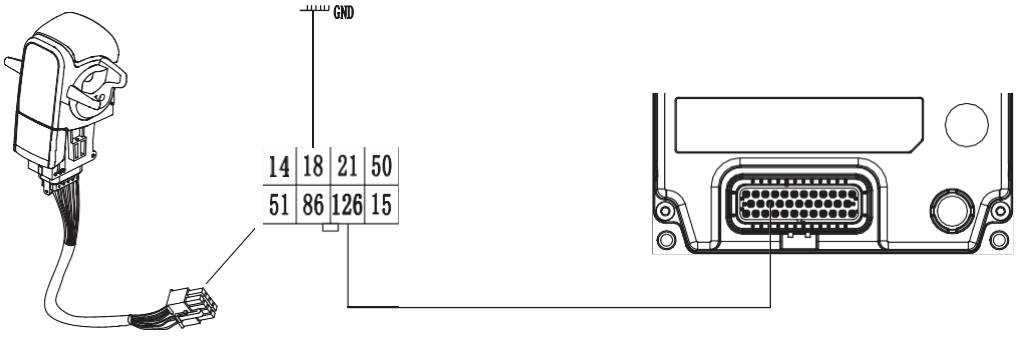


Fig 2140-30006SM

Hydraulic System

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

The solenoid valve controls lowering. The throttle valve controls lowering speed. The inlet is equipped with a filter to prevent the impurities in the hydraulic oil from entering the pump.

Hydraulic Schematic Diagram is as shown in Fig 2116-40001SM.

7.1 Overview

- Lower the forks to the ground, remove the air filter on cylinder, check the oil level with the oil dipstick. When adding hydraulic oil, use hydraulic oil of the same specifications.
- If forks occasionally jitter, there may be a leak in the cylinder or on the valve body. Dismantle and clean (with hydraulic oil of the same specifications) the valve on the valve body. Discharge the foreign bodies within the valve body through repeated lifting and lowering of the mast.
- If hydraulic oil is decreasing, thoroughly check the hydraulic system for leaks.
- Disassembly of cylinder needs to be performed in a clean environment. Before removing the cylinder, debris on the cylinder must be removed. Carefully remove the piston rod to prevent the cylinder wall from being scratched. Every time the cylinder is replaced also replace the cylinder seals.

Hydraulic Oil

Hydraulic oil for truck:

Specifications: Anti-wear Hydraulic Oil L-HM32.

Checking the Hydraulic Oil Level

- Prepare the truck for maintenance and repairs.
- Remove the cover.
- Check whether oil level is between the marks on the tank. If required, add hydraulic oil.

Hydraulic Seals

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

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

Assembly Instructions

The tools used to install the seals must be made of soft metal or suitable plastic, without burrs and sharp edges on surfaces. Do not use tools that can easily damage the surface of seals, such as, screwdriver or other similar tools with hard front edges.

The area where the hydraulic seals are 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. 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 truck.

Hydraulic Schematic Diagram

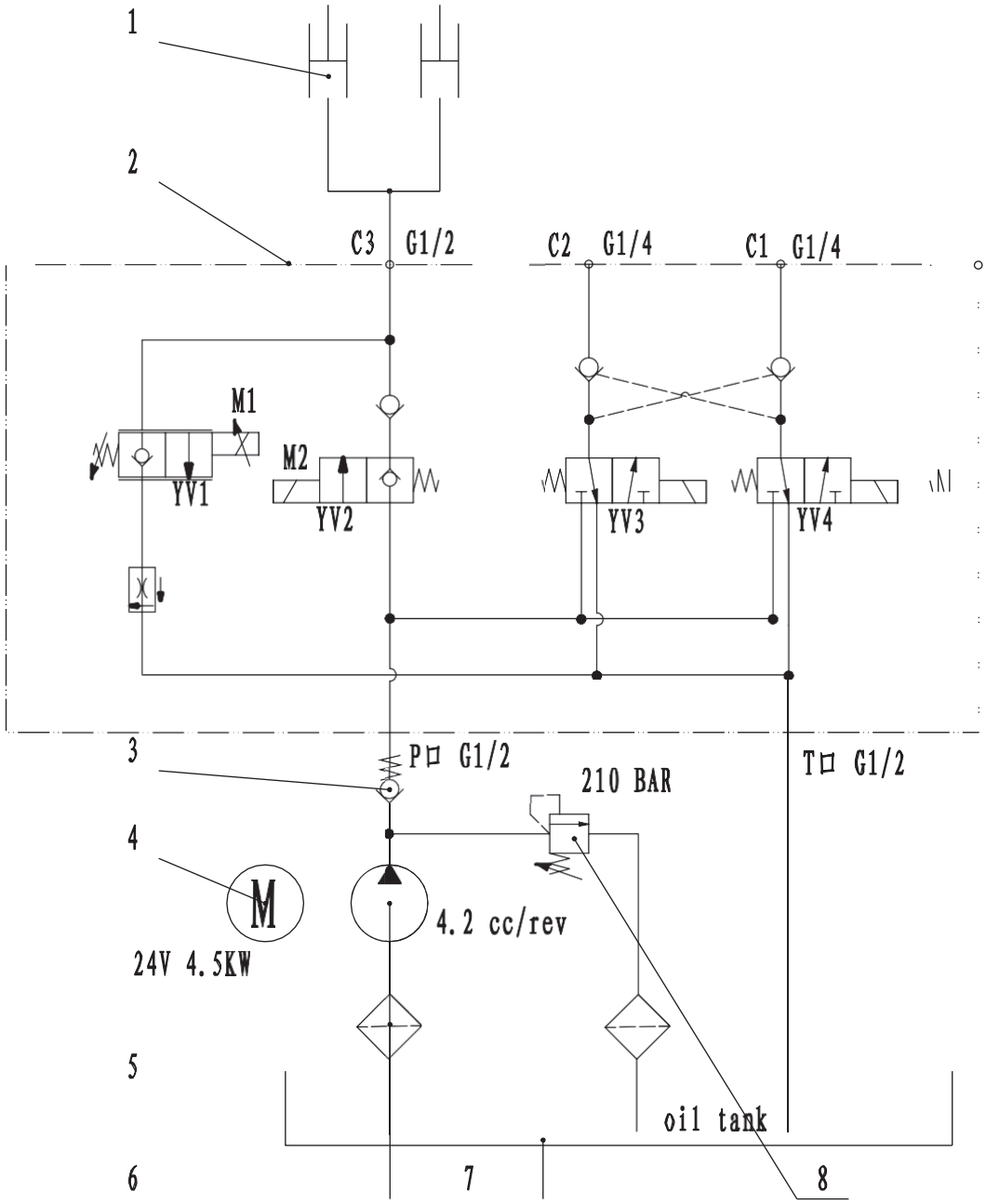


Fig 2140-40001SM

7.2 Pump and Motor Assembly

Removal

- Remove the upper cover.
- Remove the positive and negative electrode cables from the pump motor and the wires from the solenoid valve.
- Loosen the connector (2, Fig 2140-40002SM) with a wrench and remove the tubing from the valve body.
- Remove the two screws (1, Fig 2140-40002SM) on mounting plate with a wrench and remove the hydraulic station.
- Remove the four bolts (3, Fig 2140-40003SM), remove the pump and motor assembly from the oil tank.

⚠ CAUTION

When removing the tubing, the system will lose some hydraulic oil, refer hydraulic oil section for specifications.

Installation

Install according to the reverse order of removal.

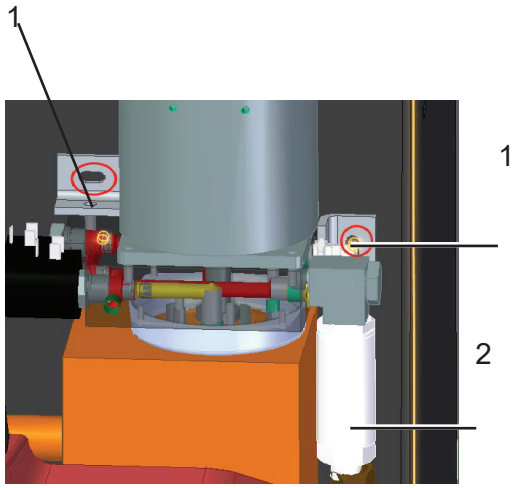


Fig 2140-40002SM

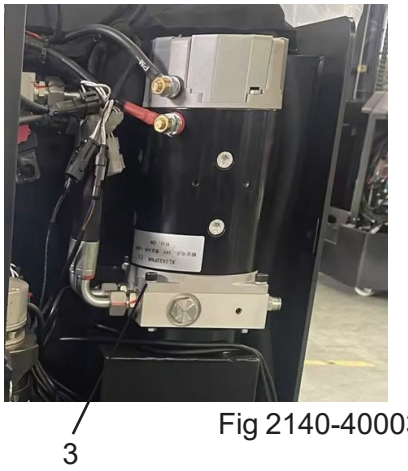


Fig 2140-40003SM

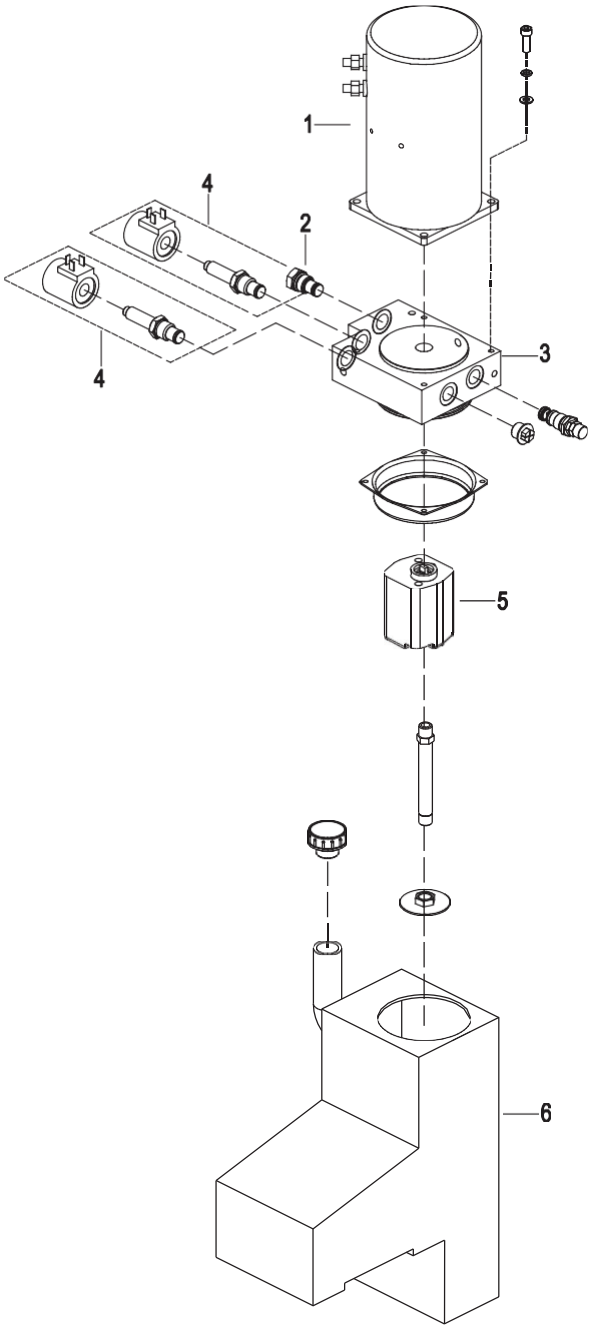


Fig 2140-40004SM

No.	Name
1	Pump Motor
2	Check Valve
3	Valve Plate
4	Solenoid Valve
5	Gear Pump
6	Hydraulic Oil Tank

3 Pump Motor

Removal

Fig 2140-40005SM

- Remove the pump and motor assembly.
- Remove the four long screws (1) on the motor end cover, and remove the pump motor (2) from the valve block (3).

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 towards each other, therefore, when dismantling, do not put your hand between the rotor and the stator to avoid a pinch hazard.

Adjustment

After replacing the steering motor, a conduction test must be carried out to the motor.

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.
2	Fault	Motor speed is turning slow
	Cause	a. Insufficient voltage of battery. b. Bearing wear or lack of lubricating oil. c. Armature winding has short circuit elements.
3	Fault	Motor sometimes can start, sometimes cannot
	Cause	a. Motor positive and negative electrode with loose terminals and poor connection; b. 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

Checking

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

Testing

- Remove the cables on the pump motor.
- Carry out ON/OFF test to motor positive and negative electrodes with a multimeter:

  If connected, the motor is normal.

  If not connected, broken circuits in rotor coils (replace the motor).

- Replace the carbon brush.

7.4 Solenoid Valve

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

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

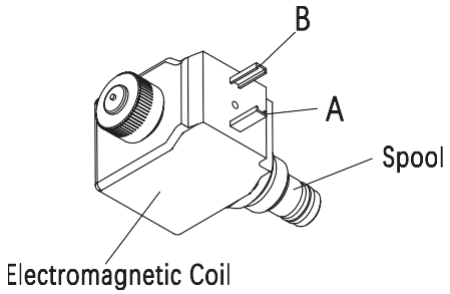


Fig 2116-40006SM

Faults and Causes

1	Fault	Solenoid valve does not work after energized
	Cause	a. Different power supply circuits. b. Insufficient power supply voltage. c. Short circuit. d. Unsoldering coil (coil short circuit). e. Main spool and moving core of the solenoid valve blocked by impurities. f. High viscosity of hydraulic oil. g. High frequency of use, service life has expired already.
2	Fault	Solenoid valve cannot be closed
	Cause	a. Main spool or core seals broken or aged. b. Main spool and moving core of the solenoid valve blocked by impurities. c. Spring deformation. d. Balancing hole blocked by impurities. e. High frequency of use, service life has expired already.
3	Fault	Internal leakage
	Cause	Damaged seals or spring deformations
4	Fault	External leakage
	Cause	Loose connections or damaged seals
5	Fault	Noisy when energized
	Cause	a. Unstable supply voltage. b. Impurities on absorption surface or uneven surface of core, needs cleaning.

Checking

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

Testing

- Switch off the power supply of the truck.
- Measure the resistance between solenoid valve coil end point A and B to identify if the coil is normal.

  As shown in the following table:

Resistance Measurement	Judgment
Approx. 20~30 Ω	Normal
0 Ω	Coil shorting (replace the solenoid valve)
∞ Ω	Coil breaking (replace the solenoid valve)

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

- Check the solenoid valve for blocking. The fitting clearance between slide valve sleeve and spool is very small, when there is impurity entering or not enough lubricant, it is easily blocked.

Handling method:

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

⚠ CAUTION

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

7.5 Cylinder

Cylinder Removal Precautions

- Before removing the cylinder, be sure to relieve the hydraulic circuit first, which is to lower the lifting mast to the ground. Otherwise, when removing the tubing connected with the cylinder, the pressured hydraulic oil within the circuit may be sprayed out at high speed along with the tubing, and there is risk of causing personal injury.
- Turn off the power source so that the entire hydraulic system will stop functioning, then the connecting tubing can be loosened. To avoid the residual pressure within the circuit, the tubing joint should be loosened slowly. Loosen the joint by half and shake the tubing to see if there is overflow of pressured oil and then continue with removal.
- The cylinder is the powered actuator in hydraulic system. Therefore, before removing the cylinder from the equipment, the connection part must be supported with appropriate supporting to avoid personal injury or damage to the equipment.
- Prior to disassembly of the cylinder, you should be familiar with its main structure. Due to the different size, structure, purpose of use of the cylinders, the sequences and methods used for removal also differ.
- When removing each part, do not hammer forcefully. If it cannot be avoided, use a copper rod to avoid damage to the parts. To loosen fine threaded cylinder caps, use cylinder wrench with even force, as to not damage the threads.

- Upon removal, the damage to cylinder threads, oil port threads, cylinder capthreads, piston rod surface and inner cylinder wall should be prevented.
- To prevent piston rod from bending or deformation, support it wooden block when placing it.
- When removing seals, the use of sharp tools should be avoided, so as not to puncture or cut the seals. For the seals that are difficult to remove, soak them with boiled water, remove them when softened.
- Before removing, try to create conditions to prevent the cylinder parts from being contaminated by the surrounding dust and impurities.
- If a cylinder is found with leaks or drift during operation and there is no indication of damage on the cylinder or piston, damage could be caused by worn or deteriorating seals.

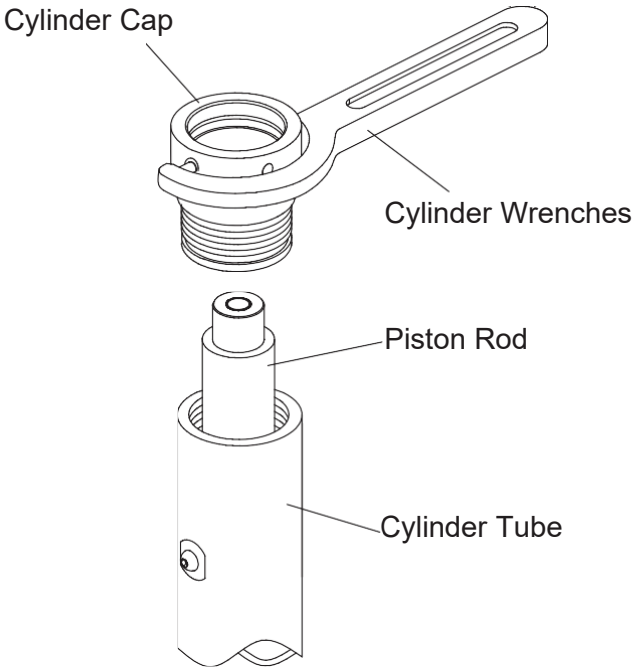


Fig 2116-40007SM

⚠ CAUTION

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

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

Cylinder Installation Precautions

- All parts should be cleaned and dried before assembly.
- During assembly apply an 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. Do not use tools that can easily damage the surface of seals, such as a screwdriver or other similar tools with hard front edges.
- Before installing, lubrication should be performed to the seals and the mounting positions with hydraulic oil.

⚠ CAUTION

An O-ring is quite flexible and easy to install, but it must not be rolled or stretched to the extent of permanent deformation while installing.

Y-ring or X-ring needs to be identified if it is for shaft or hole to avoid misplacement.

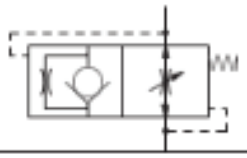
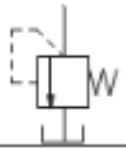
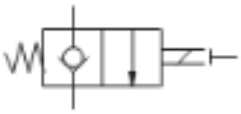
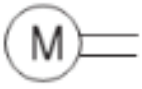
The removed O-rings and dust rings should be replaced with new ones.

- Cylinder parts must be replaced with products provided by the manufacturer.
- After maintenance and assembly of the cylinder is complete, a pressure leak test must be carried out before it can return to operation.
- Before the testing, discharge the air within the cylinder, run the cylinder in a small range of movement several times, and pay attention if it is moving without blocking and if there is uneven resistance during the moving. During the pressure test, raise the pressure slowly and watch for leaks.

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. Discharge and clean, and replace with new hydraulic oil.
3	Pump or oil temperature is too high	a. Oil is too thin. b. Pump cavitation. c. Valve body internal relief.	1. Discharge and clean, and add new hydraulic oil. 2. Check the oil inlet piping for air leaks. 3. Replace the valve body.
4	Low System Pressure	a. Insufficient oil. b. Relief valve failure. c. Pump wear, internal leakage.	1. Check the hydraulic oil level. 2. See Fault 6. 3. Replace the gear pump.
5	On load, declined	a. Solenoid valve failure.	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 Symbols

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)		Cylinder
	Motor		
	Hydraulic Pump		

Electrical System

8.1 Controller

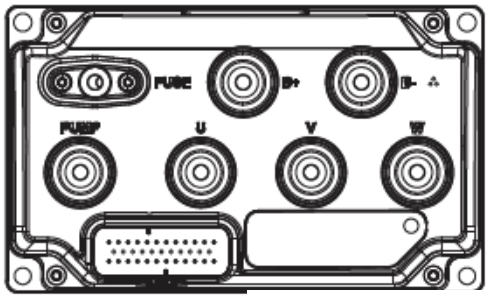


Fig 2116-50001SM

Controller Functions

Electrical control of this truck is mainly driven by traction controller.

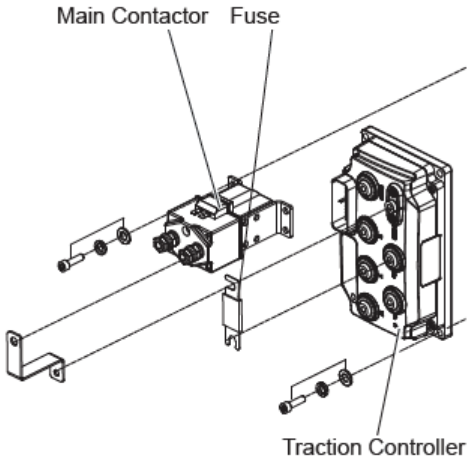


Fig 2116-50002SM

Removal (See Fig 2116-50001SM)

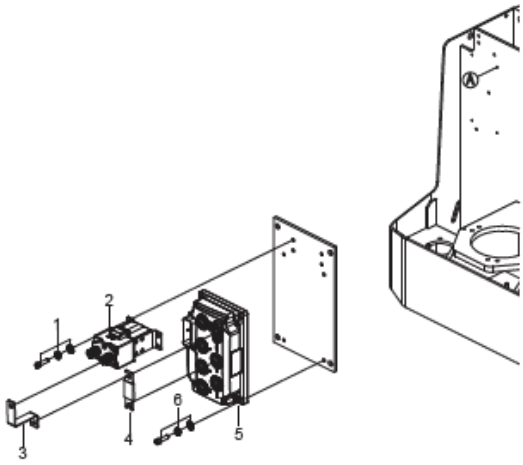


Fig 2116-50003SM

- Remove the upper cover.
- Disconnect the wiring harness and cables.
- Unscrew the nuts with a wrench and remove the copper guide plate (3) and fuse (4).
- Unscrew the four screws (1), remove the main contactor (2).
- Unscrew the four screws (6), remove the controller (5).

Installation

Apply appropriate amount of thermal grease on the back of controller.

Install in the reverse order of removal.

Controller Interface Function

Traction Controller

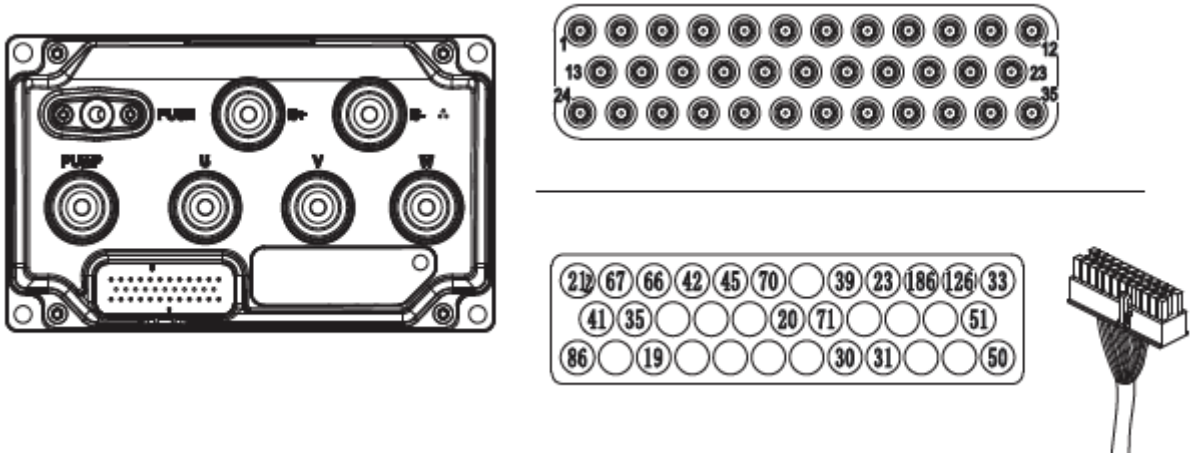


Fig 2140-50001SM

A Interface					
Pin No.	**Description**	**Pin No.**	**Description**	**Pin No.**	**Description**
J1-1	KSI	J1-13	Coil returm	J1-31	Encoder A
J1-2	Drive 1	J1-14	Input 13 ENC 2B	J1-32	Encoder B
J1-3	Drive 4	J1-15	Input 6/Pot 6	J1-33	Input 8
J1-4	Drive 3	J1-18	I/O GND	J1-34	CAN Termination
J1-5	Drive 2	J1-19	Drive 6	J1-35	CAN L
J1-6	Drive 5	J1-20	Drive 7		
J1-7	Motor temp sensor	J1-21	CAN Termination		
J1-8	Motor temp sensor	J1-22	Input 7		
J1-9	Interlock	J1-23	CAN H		
J1-10	Input 10(PWM)	J1-24	Input 9		
J1-11	Input 11 ENC 1C	J1-26	5V+		
J1-12	Input 12 ENC 2A	J1-27	Input 19/Pot 19		

8.2 Fuse

The entire truck is equipped with three fuses. When a fuse fails, the truck may not be able to run properly.

Function		Status		
		Fuse 1	Fuse 2	Fuse 3
Fuse 1 10A		×	O	O
Fuse 2 10A		O	×	O
Fuse 3 200A		O	O	×
1	Drive	×	×	×
2	Lifting / Lowering	×	×	×
3	Steering	O	O	O
4	Traction Controller	×	×	×
5	Interlock tiller	×	×	×

× : Failure
O : Normal

Location of Fuses

Fuse 1: installed on the main wiring harness

Fuse 2: installed on the main wiring harness

Fuse 3: installed on the electrical mounting bracket

★ Fuse position in electrical schematic diagram

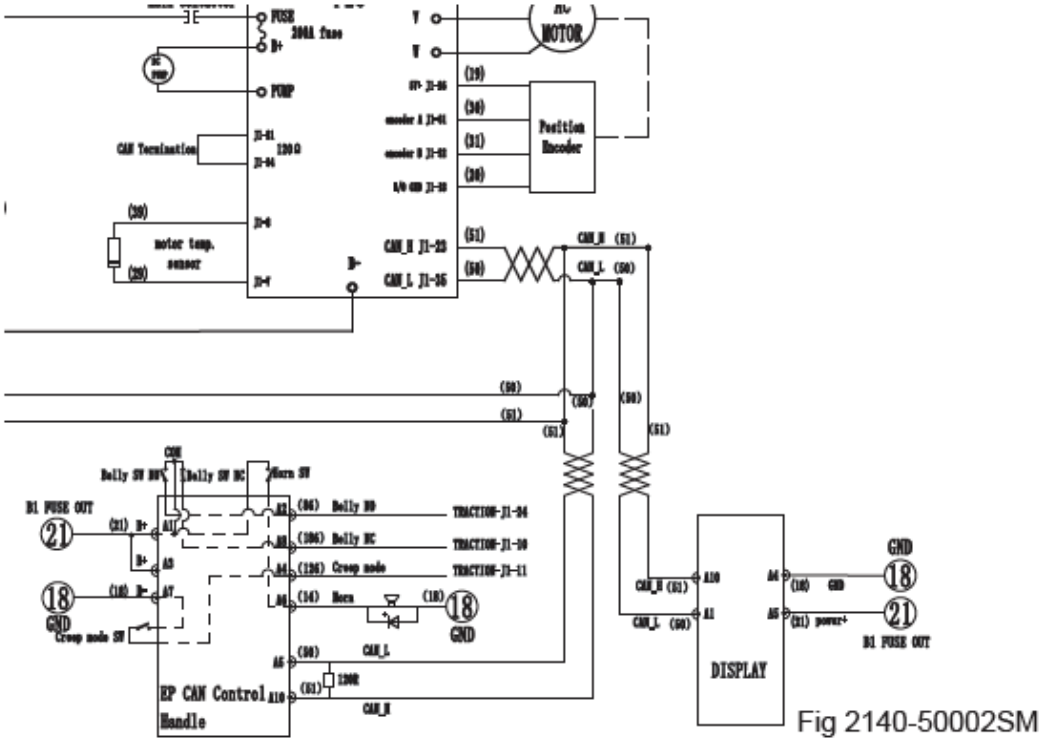


Fig 2140-50002SM

Checking

- Check the fuses for damage, check the connectors at terminal lugs for loosening or poor connection of leads.

Testing

- Turn the key switch to "OFF", remove key, pull out the battery plug and disconnect the power supply.
- Set the multimeter to resistance measurement: with black probe (-) connected to one end of the fuse; red probe (+) connected to another end of the fuse.
- Identify if the fuse is normal according to the readings of resistance on the multimeter.

As shown in the following table:

Resistance Measurement	Judgment
0 Ω	Normal
∞ Ω	Failure (replace the fuse)

8.3 Main Contactor

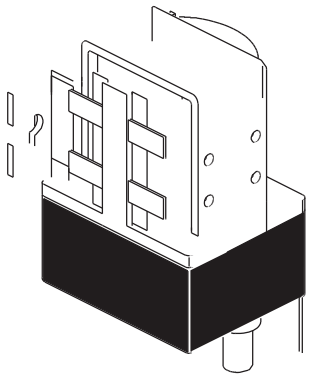


Fig 2116-50006SM

This truck is using main contactor with normally-opened contacts. The controller operates the ON/OFF function of the contactors.

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

When the contactor coil is powered off, the magnetic force disappears, the pressure plate is released along with the release of spring, and the contact recovers: normally-opened contact disconnected, so the circuit is disconnected. For installation and removal see Section 8.1.

Faults and Causes

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

Visual Inspection

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

Coil Checks

- Disconnect the cables on the contactor.
- Check the resistance of the coil with a Multi-meter: measurement method is as shown in Fig 2116-50007SM.
- Identify that the contactor has normal resistance using a multimeter.

As shown in the following table:

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

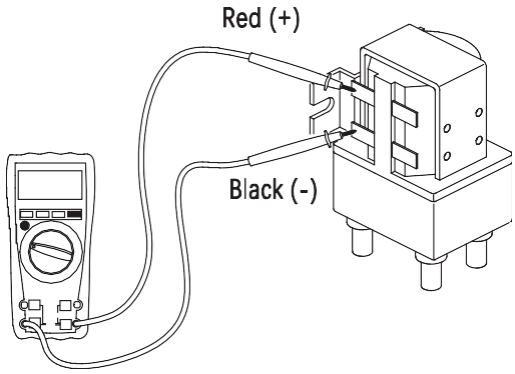


Fig 2116-50007SM

Contact Checks

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

Control Circuit Troubleshooting

Main Contactor Control Circuit (Fig 2116-50008SM)

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

- Set the multimeter to ON-OFF.
- Check if #21#42 circuit (circuit between main contactor and controller) is conducted.

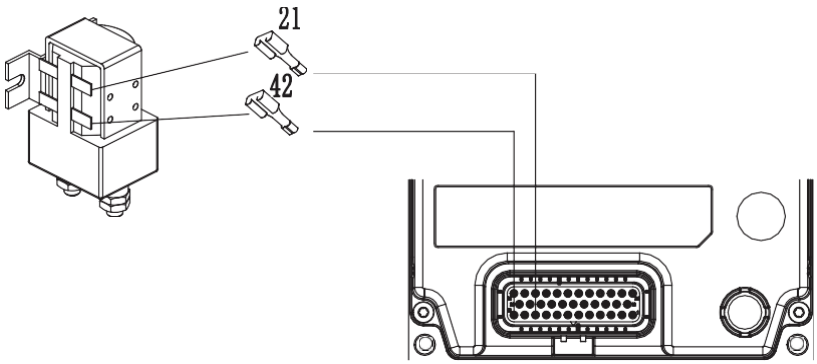


Fig 2116-50008SM

8.4 Limit Switch

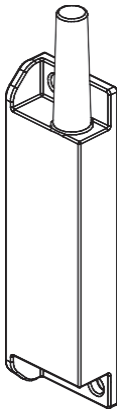


Fig 2140-50003SM

Limit switch is magnetic induction type.

By function:

- Lifting Limit Switch (Optional)
- Speed Reduction Switch

Removal and Installation

See the Structures & Functions section for mounting positions of two limit switches.

- Remove two fixing screws (1), then remove the switch harness.
- Install following the above steps in reverse order.

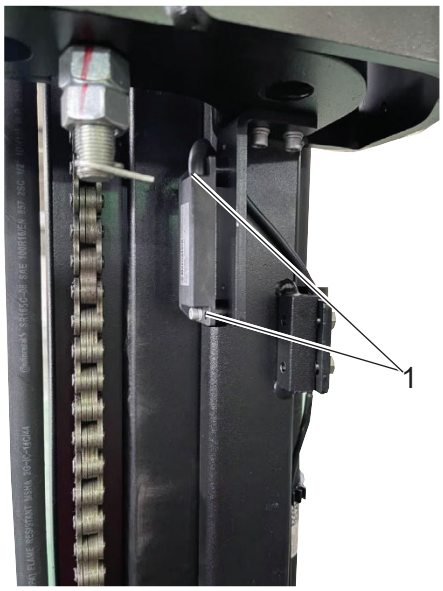


Fig 2140-50004SM

Faults and Causes

Lifting Limit Switch

1	Fault	Lifting mechanism cannot lift
	Cause	a. Lifting limit switch is disconnected. b. Lifting limit switch with broken circuit.
2	Fault	Lifting mechanism does not stop after the being lifted to the top, and continues impacting the mechanical limiter
	Cause	Lifting limit switch is always in a OFF state.

Speed Reduction Switch

1	Fault	When speed reduction switch is activated, the speed is not reduced
	Cause	Speed reduction switch is always in OFF state.

Checking

- Check the limit switch for damage and check the roller for deformation.
- Check if the handwheel is working smoothly and if there is a blockage.

Testing

- Enter TESTER Menu to check if each limit switch is working properly.
- Turn the key switch to "OFF", remove key, pull out the battery plug and switch off the power supply.
- Check the ON/OFF normally-open (NO) terminal with a multimeter.
- Check the ON/OFF normally closed (NC) terminal with a multimeter.

Control Circuit Troubleshooting

Lifting Limit Switch Control Circuit (Fig 2140-50005SM)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF.
- Check if #21/#33 circuit (circuit between limit switch and controller) is conducted.

Speed Reduction Switch Control Circuit (Fig 2140-50006SM)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF.
- Check if #21/#35 circuit (circuit between limit switch and controller) is conducted.

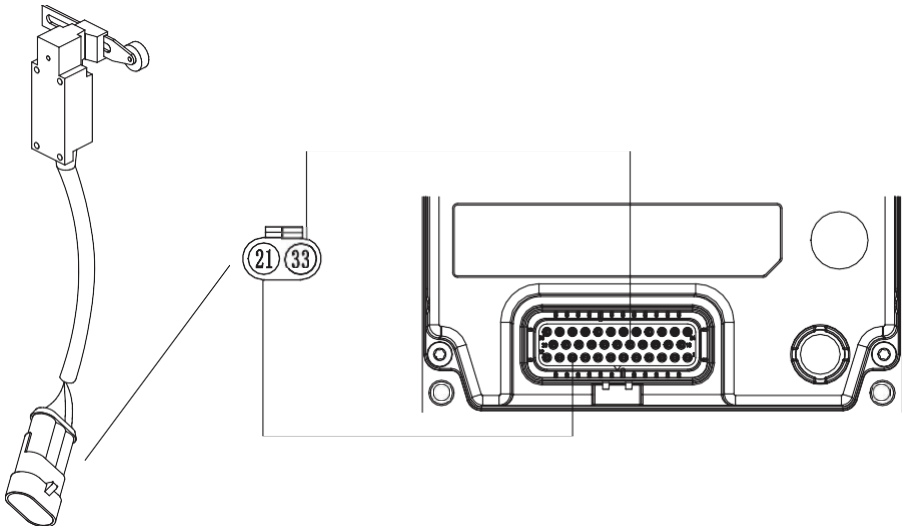


Fig 2140-50005SM

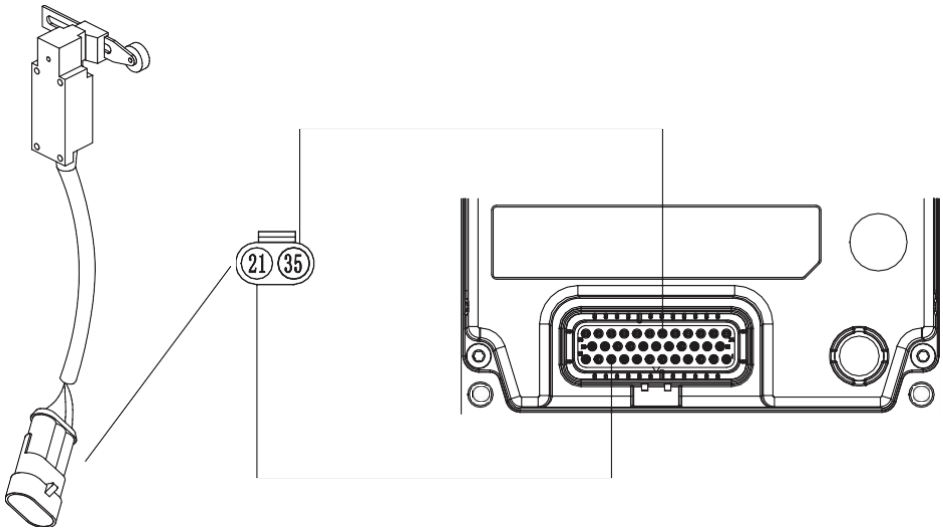


Fig 2140-50006SM

8.5 Key Switch

Key switch is used to START / STOP the truck.

Removal

- Turn off power to the truck.
- Remove the upper covers.
- Disconnect the key switch (1) connector from main wiring harness.
- Remove the two screws (2) and remove the key switch from the mounting plate (3).

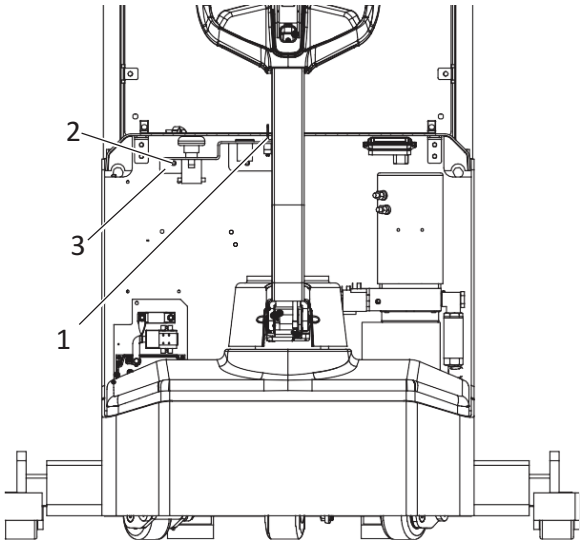


Fig 2140-50007SM

Installation

Install according to the reverse order of removal.

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)

Checking

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

Testing

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

Control Circuit Troubleshooting

Key Switch Control Circuit (Fig 2116-50015SM)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF.
- Check if #80/#81 circuit is conducted.

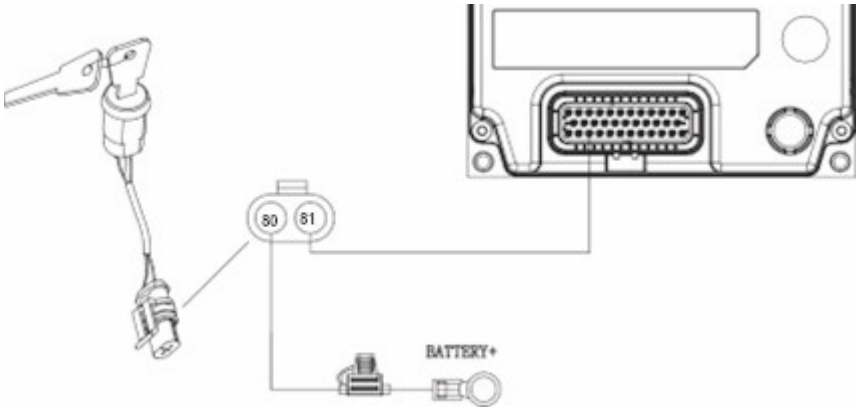


Fig 2116-50015SM

8.6 Display

The display shows remaining battery power and working hours (this function is available on the component with timer function).

Removal and Installation

Removal

- Remove the upper cover.

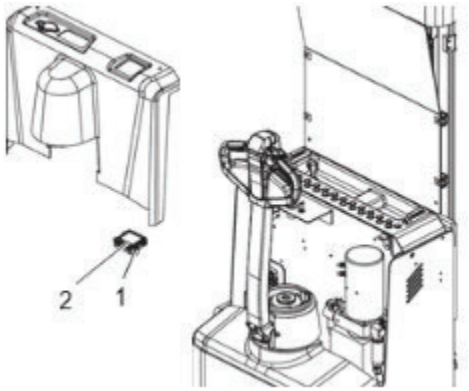


Fig 2140-50008SM

- Disconnect the display (2) connector from the wiring harness.
- Unscrew the four nuts (1) and remove the display from the upper cover.

Installation

Install in the reverse order of removal.

Faults and Causes

1	Fault	No display on the charge gauge
	Cause	a. Charge gauge failure. b. Charge gauge circuit not conducted.
2	Fault	Power capacity display not accurate
	Cause	a. Charge gauge wrong gear. b. Charge gauge failure.

Checking

Check if the appearance of display its wiring harness are in good condition, and they are connected securely.

Control Circuit Troubleshooting

Charge Gauge Control Circuit (See Electrical Schematic Diagrams)

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

- Set the multimeter to ON-OFF.
- Check if #18/#21/#50/#51 circuit is conducted.

8.7 Interlock Switch

Removal and Installation

- Remove the cover.
- Remove the connection between interlock switch (1) and main wiring harness.
- Unscrew the two screws (2) with a wrench, and remove the interlock switch (3) from the joint seat.
- Install according to the reverse order of removal.

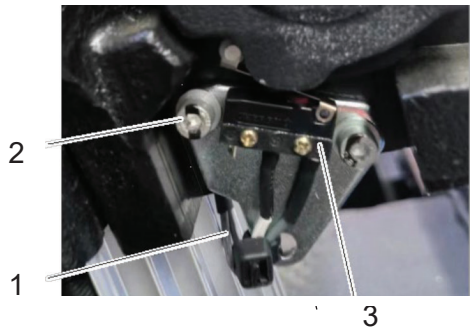


Fig 2116-50018SM

Faults and Causes

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.

Checking

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

- Repeatedly press the interlock switch to check if it resets properly.
- Normally-opened (NO).

Testing

- Enter TESTER Menu to check the status of the switch.
- Check if the interlock switch circuit is conducted.
- Carry out ON/OFF test to interlock switch with a multimeter.
  Reset the interlock switch (original position), the circuit is disconnected.
  Press the interlock switch, the circuit is conducted.

Control Circuit Troubleshooting

Interlock Switch Control Circuit (Fig 2140-50009SM)

Check if the circuit is broken by using a multimeter:

- Set the multimeter to ON-OFF.
- Check if #21/#23 circuit (circuit between interlock switch and controller) is conducted.

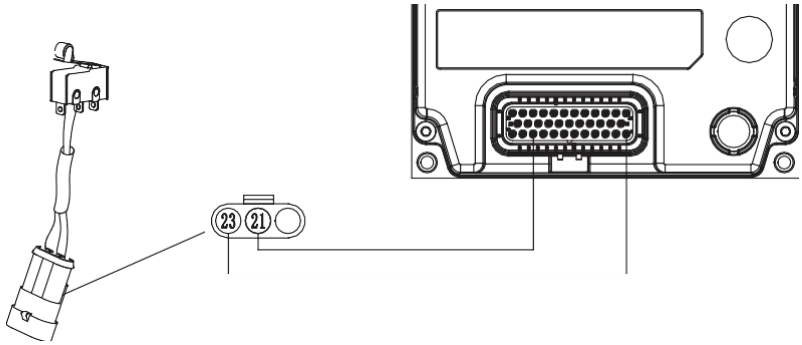


Fig 2140-50009SM

8.8 Controller Error Message

Electrical faults are mainly caused by electrical components failure or electrical circuit failure. When some components failures which may not affect the ON/OFF of control circuit occur, the instrument won't display fault code; when the components failures which may affect the ON/OFF of control circuit occur to the electrical circuit, the controller will alarm for error, and fault information will be displayed on the instrument.

Traction Controller Troubleshooting

Fault Code (Flash Code)	Description	Possible Cause
17	Severe B+ Undervoltage	1. Non-controller system drain on battery. 2. Battery resistance too high. 3. Battery disconnected while driving. 4. Blown B+ fuse or main contactor did not close. 5. Battery parameters are misadjusted. 6. See Programmer » Monitor menu » Controller » Capacitor Voltage.
37	Motor Open	1. Motor phase is open. 2. Bad crimps or faulty wiring.
38	Main Contactor Welded	1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external circuit to B+) is providing a current to the capacitor bank (B+ connection terminal).
39	Main Contactor Did Not Close	Type 1: 1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. An external load on the capacitor bank (B+ connection terminal) is preventing the capacitor bank from charging. 4. Blown B+ fuse. 5. Main Contactor parameters mistuned Main Pull-in Voltage,Main Holding Voltage. Type 2: 1. Main contactor opened during operation (while commanded closed). 2. Driver wiring to contactor’s coil (e.g., pin 3 wiring) removed during operation. 3. Contactor/coil defective
14	Precharge Fault	1. An external load on the capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. 2. See Programmer » System Monitor menu » Controller » Capacitor Voltage.

Fault Code (Flash Code)	Description	Possible Cause
15	Controller Severe Undertemp	1. Controller is operating in an extreme environment. 2. See Programmer » System Monitor menu » Controller » Controller Temperature.
16	Controller Severse Overtemp	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller. 4. See Programmer » System Monitor menu » Controller » Controller Temperature.
22	Controller Overtemp Cutback	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller which is preventing controller cooling. 4. Controller is performance-limited at this temperature. 5. See Programmer » System Monitor menu » Controller: Temperature.
28	Motor Temp Hot Cutback	1. Motor temperature is at or above the programmed Temperature Hot setting—resulting in a reduction of controller drive current. 2. The motor temperature and sensor control parameters are misadjusted. 3. See Programmer » AC Motor Setup » Temperature Sensor.
29	Motor Temp Sensor Fault	1. Motor thermistor is not connected properly. 2. Sensor polarity (between Pin 8 and Pin 18) is incorrect. 3. The motor temperature and sensor parameters are misadjusted. 4. See Programmer » System Monitor menu » AC Motor » Temperature.
31	Main Open/Short	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.
A3	Dirver3 Fault (MC)	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 3 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 3 » Driver 3 Overcurrent.

Fault Code (Flash Code)	Description	Possible Cause
47	EMER Rev HPD	Emergency reverse operation has concluded, but the throttle, forward and reverse inputs, and interlock have not been returned to neutral.
47	HPD/Sequencing Fault	1. Incorrect sequence in application of Keyswitch, Interlock, Direction, or Throttle. 2. Faulty wiring, crimps, or switches at KSI, Interlock, Direction, or Throttle. 3. Moisture in above-noted digital input switches causing invalid (real) On/Off state. 4. Verify input switch status. See Programmer » System Monitor menu » Inputs » Switch Status. 5. Verify Throttle. See Programmer » System Monitor menu » Inputs » Throttle Command.
94	Emer Rev Timeout	1. Emergency reverse was activated and concluded because the EMR Timeout timer has expired. 2. The emergency reverse input is stuck On.
54	Interlock SRO Fault	Incorrect starting sequence. Possible reasons for this alarm are: 1- A travel demand active at key-on. 2- Man-presence sensor active at key on.
63	VCL HPD Fault	
5F	VCL SRO Fault	
53	EMR Switch Fault	
36	Encoder Fault	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Programmer » System Monitor menu » AC Motor: Motor RPM. 4. See Programmer » AC Motor Setup » Quadrature Encoder » Encoder fault Setup
93	ENCODER LOS (LIMIT SPEED)	1. Limited Operating Strategy (LOS) control mode has been activated as a result of either an Encoder Fault (flash code 3-6) or a Stall Detected fault (flash code 7-3). 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Vehicle has stalled.
52	CAN Tiller PDO Fault	The controller lost the communication with tiller at least once, when the truck is using
62	Tiller CANbus Fault	Wait for the tiller CAN-BUS communication when truck is keyed-on
67	Tiller Handshake Fault	

Fault Code (Flash Code)	Description	Possible Cause
5E	Brake pedal PDO Fault	If the Brake Pedal is CAN Brake Pedal, but the controller can't get the can message from brake,the alarm occurs
7B	Unactivated Controller Fault	If downlaod a SW with activation function, but haven't do any activation before,the alarm occrus
5A	Key Lock Warning	If the PASSWORD function is active but haven't enter the correct password,the alarm occurs
66	Gauge Handshake Fault	The controller can't get message from DISPLAY when the truck start,this alarm occurs
5B	BMS PDO Fault	If the communication between BMS and controller is out of time,this alarm occurs
65	BMS Protect Fault	If the battery charge level is too low, the BMS require the main contactor open,this alarm occurs
		If the battery charge level is too low, the BMS require the controller to reduce the traction speed,this alarm occurs
		If the battery charge level is too low, the BMS require the controller to stop the lift function,this alarm occurs
19	Speed Limit Supervision	1. Motor speed detected that exceeds the limit set by the Max Speed Supervision parameter. 2. Misadjusted Max Speed Supervision parameters. 3. See: Programmer » Application Setup » Max Speed Supervision menu.
1A	Travel Control Supervision	1. With the vehicle in the stopped state, the detected motor frequency and/or phase current exceeds the limit set by the Travel Control Supervision parameter. 2. Misadjusted Travel Control Supervision parameters. 3. See: Programmer » Application Setup » Travel Control Supervision menu.
5C	Charge Inhibt Waring	Active if battery charger input is high
A2	Driver2 Fault (EB)	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 2 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 2 » Driver 2 Overcurrent.
32	EM Brake Driver	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.

Fault Code (Flash Code)	Description	Possible Cause
92	EM Brake Failed to Set	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.
12	Controller Overcurrent	1. External short of phase U, V, or W motor connections. 2. Speed encoder noise problems. 3. Motor parameters are mistuned. 4. Controller defective.
95	Pump Overcurrent	1. External short of pump motor. 2. Controller defective.
88	Encoder Pluse Error	1. Encoder Steps parameter does not match the actual motor encoder. 2. Verify parameter settings: AC Motor Setup » Quadrature Encoder » Encoder Steps.
64	HYD SRO Fault	Man-presence switch is not enabled at pump Request
25	+5V Supply Failure	1. External load impedance on the +5V supply is too low. 2. See the System Monitor » Outputs menu: External_5V_Supply,Ext_5V_Current.
26	Ext 12V Supply Failure	1. External load impedance on the +12V supply is too low. 2. See Programmer » System Monitor menu » Outputs:External_12V_Supply,Ext_12V_Current.
91	Bad Firmware	The firmware in the controller is incorrect. 1. The CRC of the application or OS do not match. 2. The application was built with an incompatible OS version.
68	VCL Run Time Error	1. Runtime errors are defined using the VCL Error Module and VCL Error. See the System Information file:• Curtis Integrated Toolkit™ » VCL Studio » Help 2. Using driver control commands in VCL can lead to VCL runtime errors if the VCL command and the driver assignment do not match.
18	Severe B+/KSI Overvoltage	1. Battery-voltage applied to KSI (pin 1) exceeds the Severe Overvoltage limit. 2. See Programmer » Monitor menu » Battery » Keyswitch Voltage.

Fault Code (Flash Code)	Description	Possible Cause
24	B+ Overvoltage Cutback	1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking. 5. See Programmer » System Monitor menu » Controller » Currents » OverVoltageCutback. 6. See Programmer » System Monitor menu » Controller » Capacitor Voltage.
57	EPS Shutdown Fault	The controller receives from EPS information about the safety contacts being open.
58	EPS Limit Fault	
59	EPS Software Fault	
46	EEPROM Failure	1. Failure to read or write to nonvolatile (NV) memory. 2. Internal controller fault.
49	Parameter Change Fault	While the Interlock was On, a safety_x005fbased parameter was changed. Parameters with this property are marked with a [PCF] (Parameter Change Fault) in the Parameter menu listings
5D	Parameter Change fail	A parameter was was changed but fail to save.
73	Stall Detected	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Programmer »System Monitor menu » AC Motor » Motor RPM.
87	Motor Characterization Fault	Motor characterization failed during characterization process. The fault type indicates the cause.
23	B+ Undervoltage Cutback	1. Batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system-drain on battery. 4. Battery resistance too high. 5. Battery disconnected while driving. 6. Blown B+ fuse or main contactor did not close. 7. See Programmer » System Monitor menu » Controller » Currents »UnderVoltageCutback. 8. See Programmer » System Monitor menu » Controller » Capacitor Voltage.

Fault Code (Flash Code)	Description	Possible Cause
13	Current Sensor Fault	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective.
42	Throttle Input	1. Throttle voltage exceeded the Analog Low or Analog High parameters for the analog input defined for the throttle input. 2. See Programmer » Controller Setup » Inputs » Analog 1 Type. 3. See Programmer » Controller Setup » Inputs » Configure.
83	Internal Hardware	Internal controller fault detected
C1	Branding Error	1. Software and hardware branding mismatch. 2. For technical support on this fault, contact the Curtis distributor where you obtained your controller or the Curtis sales-support office in your region.
D3	Hardware Compatibility	The OS (device profile, .cdev file) is incompatible with the controller.The loaded software (.cdev) is not compatible with the controller hardware.
97	Pump Hardware	
89	Parameter Out of Range	1. Parameter value detected outside of the limits. 2. Use CIT or the 1313HHP to view the parameter's range and adjust the parameter's value.
99	Parameter Mismatch	1. A parameter with the [PCF] label was changed. 2. Incorrect position feedback type chosen for motor technology in use. 3. Dual drive is enabled in torque mode. 4. Dual drive enabled on only one controller.
A8	Driver Assignment	1. A Driver Output is used for two or more functions. 2. See Programmer » Controller Setup » IO Assignments » Coil Drivers:Main Contactor Driver, EM Brake Driver,Hydraulic Contactor Driver.
BC	Analog Assignment	1. An Analog Input is used for two or more functions. 2. An Analog Input is outside the range of analog inputs. 3. See Programmer » Controller Setup » IO Assignments » Controls.

Fault Code (Flash Code)	Description	Possible Cause
C5	Lift Input Fault	The associated fault diagnostic with the assigned lift-input source triggers this fault. For example: If the Lift_Input_Source is an analog input, then any faults detected by the respective Input fault diagnostics are cascaded and reported within this fault code.Note: An analog input fault diagnostics may be out of range when set as a voltage input or may include potentiometer faults if configured as a 2/3-wire pot.
C6	Lower Input fault	The associated fault diagnostic with the assigned lower-input source triggers this fault. For example: If the Lower_Input_Source is an analog input, then any faults detected by the respective Input fault diagnostics are cascaded and reported within this fault code.Note: An analog input fault diagnostics may be out of range when set as a voltage input or may include potentiometer faults if configured as a 2/3-wire pot.
35	Lower Driver	See Driver 1* Fault* Driver 1 is the PD Driver, therefore the Lower Driver fault cascades to the Driver 1 fault (see flash code 10-1)
4A	EMR Switch Redundancy	1. Either or both Emergency Reverse input switches are inoperative, resulting in an invalid state. NO NC State On Off valid Off On valid On On invalid Off Off invalid 2. Ingress of dirt or moisture in switch(s).
A1	Dirver1 Fault	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 1 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 1 » Driver 1 Overcurrent.
A4	Driver4 Fault	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps orfaulty wiring. 4. Driver overcurrent, as set by the Driver 4 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 4 » Driver 4 Overcurrent.

Fault Code (Flash code)	Description	Possible Cause
A5	Driver5 Fault	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 5 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 5 » Driver 5 Overcurrent.
A6	Driver6 Fault	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 6 Overcurrent parameter.Note: Driver 6 is a digital (On/Off) 1 Amp output.
A7	Driver7 Fault	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 7 Overcurrent parameter. Note: Driver 7 is a digital (On/Off) 1 Amp output.
B1	Analog 1 Out of Range	1. Analog 1 input voltage is above the parameter setting of Analog 1 High. 2. Analog 1 input voltage is below the parameter setting of Analog 1 Low. 3. See Programmer » Controller Setup » Inputs » Analog 1. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 1 Low / Analog 1 High.
B2	Analog 2 Out of Range	1. Analog 2 input voltage is above the parameter setting of Analog 2 High. 2. Analog 2 input voltage is below the parameter setting of Analog 2 Low. 3. See Programmer » Controller Setup » Inputs » Analog 2. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 2 Low / Analog 2 High.
B3	Analog 3 Out of Range	1. Analog 3 input voltage is above the parameter setting of Analog 3 High. 2. Analog 3 input voltage is below the parameter setting of Analog 3 Low. 3. See Programmer » Controller Setup » Inputs » Analog 3. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 3 Low / Analog 3 High.

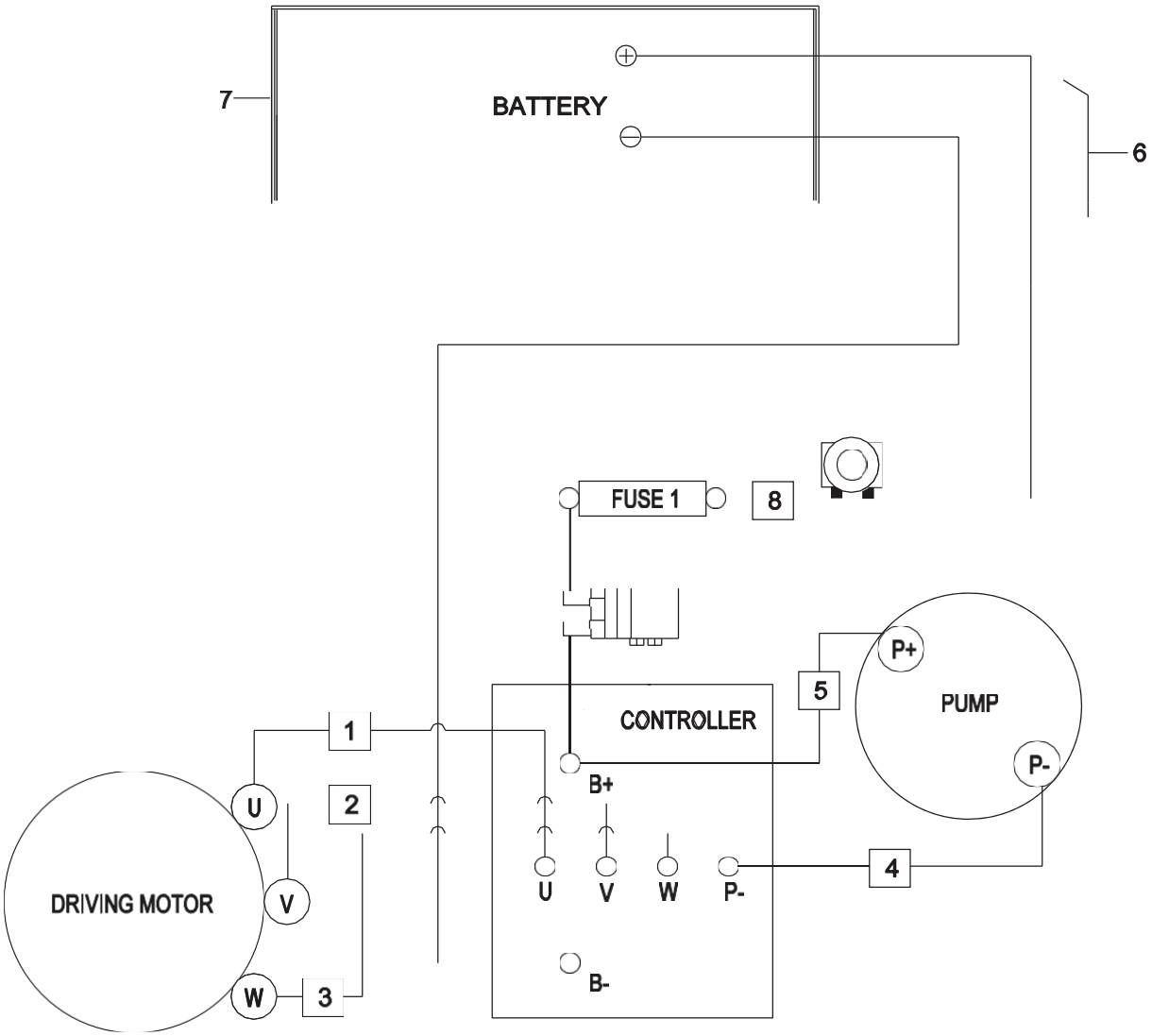
Fault Code (Flash Code)	Description	Possible Cause
B4	Analog 4 Out of Range	1. Analog 4 input voltage is above the parameter setting of Analog 4 High. 2. Analog 4 input voltage is below the parameter setting of Analog 4 Low. 3. See Programmer » Controller Setup » Inputs » Analog 4. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 4 Low / Analog 4 High.
B5	Analog 5 Out of Range	1. Analog 5 input voltage is above the parameter setting of Analog 5 High. 2. Analog 5 input voltage is below the parameter setting of Analog 5 Low. 3. See Programmer » Controller Setup » Inputs » Analog 5. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 5 Low / Analog 5 High.
B6	Analog 6 Out of Range	1. Analog 6 input voltage is above the parameter setting of Analog 6 High. 2. Analog 6 input voltage is below the parameter setting of Analog 6 Low. 3. See Programmer » Controller Setup » Inputs » Analog 6. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 6 Low / Analog 6 High.
B7	Analog 7 out of range	1. Analog 7 input voltage is above the parameter setting of Analog 7 High. 2. Analog 7 input voltage is below the parameter setting of Analog 7 Low. 3. See Programmer » Controller Setup » Inputs » Analog 7. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 7 Low / Analog 7 High.
B8	Analog 8 Out of Range	1. Analog 8 input voltage is above the parameter setting of Analog 8 High. 2. Analog 8 input voltage is below the parameter setting of Analog 8 Low. 3. See Programmer » Controller Setup » Inputs » Analog 8. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 8 Low / Analog 8 High.

Fault Code (Flash Code)	Description	Possible Cause
BB	Analog 14 Out of Range	1. Analog 14 input voltage is above the parameter setting of Analog 14 High. 2. Analog 14 input voltage is below the parameter setting of Analog 14 Low. 3. See Programmer » Controller Setup » Inputs » Analog 14. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 14 Low / Analog 14 High.
BD	Analog 18 Out of Range	1. Analog 18 input voltage is above the parameter setting of Analog 18 High. 2. Analog 18 input voltage is below the parameter setting of Analog 18 Low. 3. See Programmer » Controller Setup » Inputs » Analog 18. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 18 Low / Analog 18 High.
77	Supervisor Fault	Internal controller fault.
79	Supervision Input Check	Internal controller fault.
9A	Interlock Braking Supervision	1. During an interlock braking event, the motor speed exceeded the limit set by the Interlock Braking Supervision parameters. 2. See Programmer » Application Setup » Interlock Braking » Supervision Enable. 3. See Programmer » Application Setup » Interlock Braking » Interlock Braking Supervision.
9B	EMR Supervision	1. During an EMR event, the motor speed exceeded the limit set by the Emergency Reverse Supervision parameters. 2. See Programmer » Application Setup » Emergency Reverse » Emergency Reverse Supervision.
72	PDO Timeout	1. The time between CAN PDO messages received exceeded the PDO Timeout Period as defined by the Event Timer parameter. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups.
56	EPS PDO Fault	CANbus communication does not work properly. The hexadecimal value “XX” identifies the faulty node.
61	EPS CANbus Fault	
51	CAN bus fault	
96	Pump BDI	The BDI is below the Lift_BDI_Lockout setting. BDI parameters are mistuned.

Fault Code (Flash Code)	Description	Possible Cause
A9	Coil Supply Fault	1. Short on driver loads. 2. Dirty connector pins at controller or device. 3. Bad connector crimps or faulty wiring. 4. Controller defective.
BF	Pump Current Sensor	1. External short of pump motor. 2. Controller defective.
6A	Pump Operation Timeout	1. Lift operation time is too long 2. Bad lift switch or faulty wiring
6B	Operator Protection Fault	If direction input or hydraulic inputs is received when operation sensor (side arm platform and deadman) is hazardous state, an operator protection fault is set.
6C	Creep Mode Fault	Incorrect sequence in application of creep mode.
6E	EP gauge PDO Fault	The time between CAN PDO messages received exceeded the PDO Timeout Period
6F	OEM parameter Out of Range	OEM parameter setting is out of range
55	EMR Input Supervision	EMR switches Supervision

8.8 Cable Wiring Diagrams

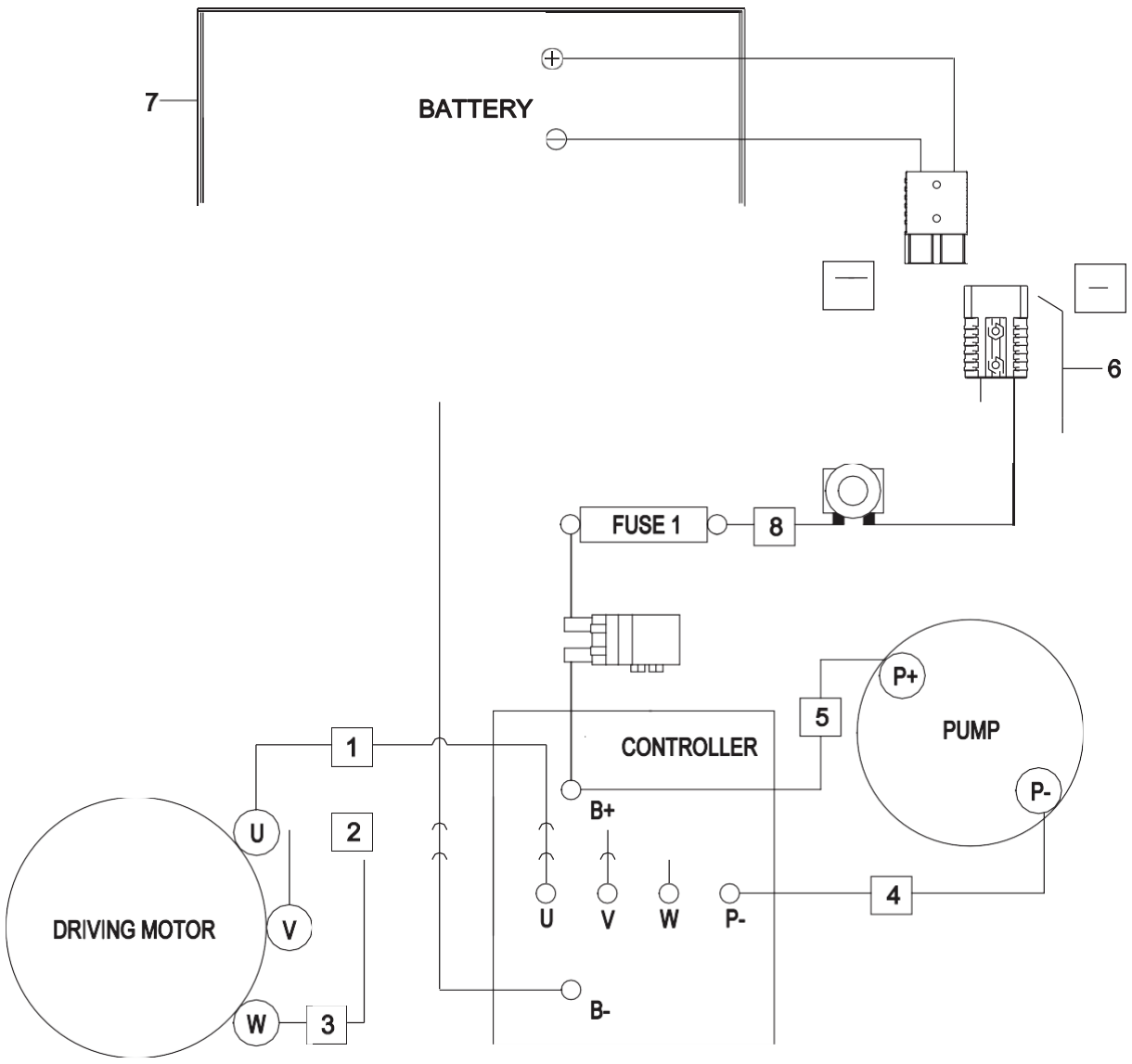
For Lithium Battery



No.	Name
1	Motor Line U
2	Motor Line V
3	Motor Line W
4	P- Cable

No.	Name
5	P+ Cable
6	Power Cable Assembly
7	Lion Battery
8	Emergency Stop Cable

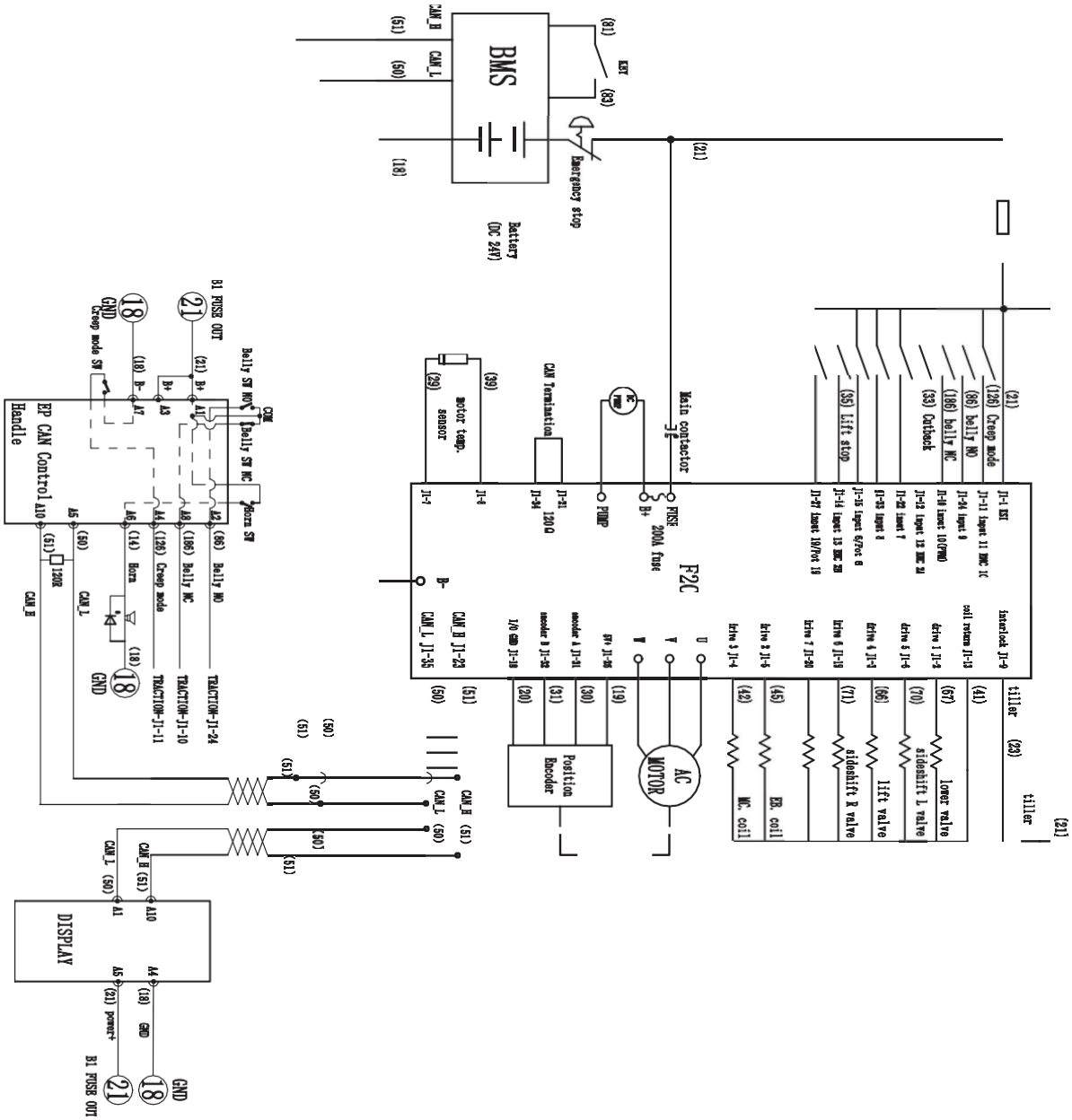
For Lead Acid Battery



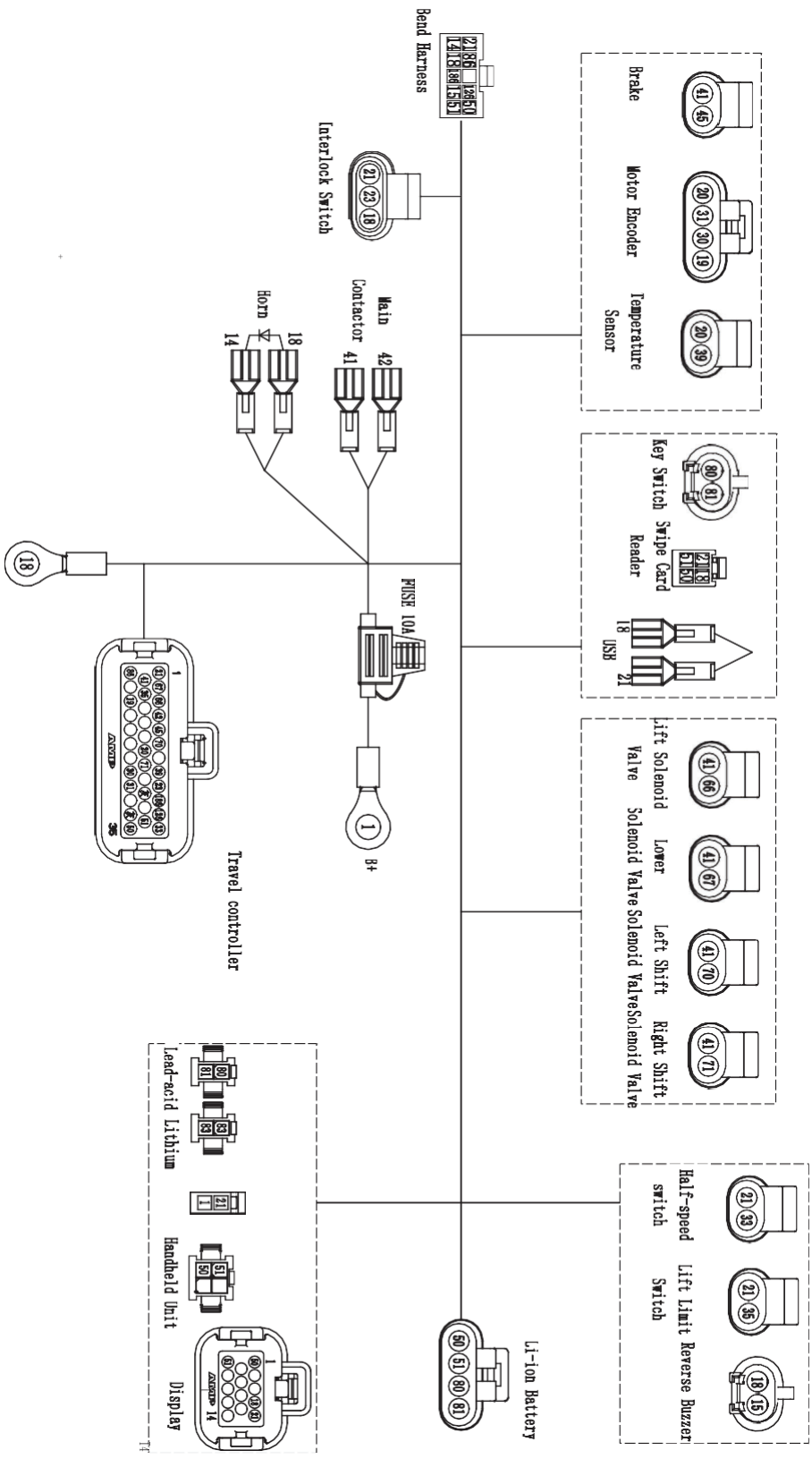
No.	Name
1	Motor Line U
2	Motor Line V
3	Motor Line W
4	P- Cable

No.	Name
5	P+ Cable
6	Power Cable Assembly
7	Li-on Battery
8	Emergency Stop Cable

8.9 Electrical Schematic Diagrams



8.10 Wiring Harness and Connectors



Troubleshooting

9.1 Preparation Before Troubleshooting

- Park the truck on level ground and block the wheels with wooden wedges.
- Fully lower the forks and press the emergency stop switch.
- Turn off the key switch.
- Open the upper 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 has been unplugged and the electrical circuit is disconnected.

Check the Voltage of Battery

- Identify if the battery voltage is normal according to the measured voltage.

As shown in the following table:

Battery	Voltage	Judgment
24V	22.4~29.2V	Normal
	other	Battery Fault

NOTE

Enter Test Menu to check the battery voltage.

CAUTION

If the battery voltage is still abnormal after being charged: open the battery compartment, check the voltage of each battery and its connection circuit respectively.

1) Check if the voltage of single battery is normal.
2) Check if the cables for connections between each battery are normal, check for open circuit and if the connection between connectors is secure.

- Battery leakage check: disconnect the battery connection, black probe (-) connected to (-) terminal of battery plug; red probe (+) connected to the chassis.
- Read the voltage reading on the meter.

  No voltage (0V): normal

  With voltage: battery leakage (remove battery compartment, check each battery and cables)

9.2 Troubleshooting Solutions of Common Faults

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

Table 9.1 Troubleshooting of Common Faults

Fault	Fault Symptom	Troubleshooting Order *	Troubleshooting Measures
Power supply failure	Whole truck power outrage	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 2) Check key switch and its circuit. 3) Check emergency stop switch and its circuit. 4) Replace the controller.
Travel Fault	1. Forward and reverse moving failures of the truck, but other functions are normal	a. Interlock switch or its circuit connection failure b.Electromagnetic brake locked (Non-mechanical failure, the instrument will display fault code) c. Travel switch or its circuit connection failure d. Drive motor or its circuit connection failure e. Controller failure	Controller failure error, carry out troubleshooting according to the fault code information on the instrument. 1) Check if the interlock switch or the connection of its circuit is normal. 2) Electromagnetic brake and its connecting circuit. 3) Check the travel switch and its connection circuit. 4) Check the drive motor and its connection circuit. 5) Replace the controller.
	2. The truck can travel at low speed, but cannot travel at high speed	Failures due to external factors: a.Electromagnetic brake locked (Non-mechanical failure, the instrument will display fault code) b. Drive motor carbon brush failure Failures due to internal factors: a. Battery voltage deficiency	Controller failure error, carry out troubleshooting according to the fault code information on the instrument. 1) Check the voltage of storage battery. 2) Check if the motor rotation is normal. 3) Check the electromagnetic brake or its connection circuit. 4) 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 cannot lift	1. Pump motor does not work: a. Pump motor or its circuit connection failure c. Lifting switch or its circuit connection failure d. Lifting limit switch or its circuit connection failure	1. Pump motor does not work: 1) Check the pump motor and its connection circuit. 2) Check the lifting switch and its connection circuit 3) Check the lifting limit switch and its connection circuit.
		2. Pump motor works: a. Overload b. Insufficient hydraulic oil c. Hydraulic pipeline leakage d. Pump motor reverse rotation e. Cylinder failure (blocked) f. Solenoid valve blocked and cannot reset g. Valve body failure: excessive wear of gear pump, serious internal leaks, insufficient pressure of relief valve or blocked, check valve blocked	2. Pump motor works: 1) Refer to the rated capacity marked on the nameplate. 2) Lower the mast to the bottom, check if the amount of oil in the oil tank can meet the requirements. 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. 6) Wash or replace the solenoid spool. 7) Wash or replace the valve body
	2. The vehicle cannot be lowered	a. Solenoid valve or its circuit connection failure b. Lowering switch or its circuit connection failure c. Valve failure d. Cylinder deformation or blocked	1) Check the lowering button and its connection circuit. 2) Check the solenoid valve and its connection circuit. 3) Check the cylinder for deformation, remove the cylinder to check if the internal assembly is normal. 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.

Table 9.1 Troubleshooting of Common Faults (continued)

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

Duplex Mast

10.1 Mast Assembly Lifting Chains Adjustment

- Lower the mast to the ground.
- Press the emergency stop switch and disconnect the key switch.

⚠ CAUTION

Switch off the power supply before any adjustments or operations

- Loosen the lock nut (2) on chain bolt (5).
- Through screwing upward the adjusting nut (8), the chain will slowly tension.
- When the chain is adjusted to be tensioned with no obvious loosening, fasten the lock nut.

⚠ CAUTION

When the adjustment is completed, there should be an adjustable distance of at least three pitches over the chain bolts.

- Pull out emergency stop switch and turn on the key switch.
- Through repeatedly lifting/lowering the mast to test if the chain is tensioned. If the chain is still loose, repeat the steps above.

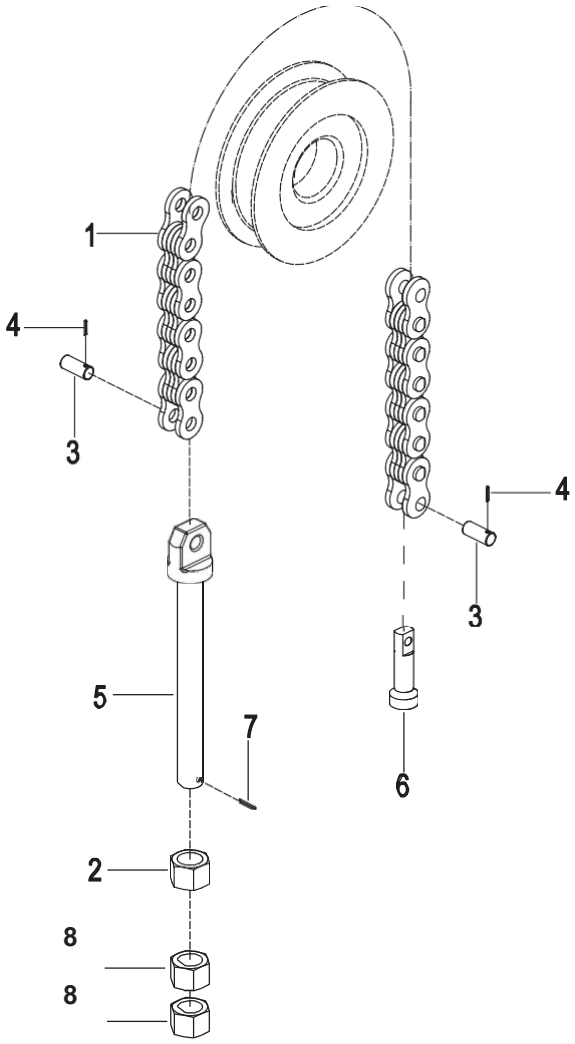


Fig 2116-60001SM

10.2 Mast Chain Replacement

- Block the truck wheels with wooden wedges, raise the inner mast for 19.5” (500mm), insert wooden block between inner mast and the ground for support.

⚠ CAUTION

Place support under the fork carriage to prevent it from falling, resulting in personal injury.

- Remove the cotter pin (7, Fig 3111-60001SM) and unscrew the lock nut (2) and adjusting nut (8) from the chain joint (1).
- Remove the cotter pin (3) and flat washer, pull out the pin shaft (4), separate the chains (5) from the chain joint (6) and joint (1).
- Remove the chain assembly from the chain sprocket.
- Replace with new chains and hang the new chain assembly onto the chain sprocket.
- Put the chain connector (6) through chain hole of fork frame, insert the pin shaft (4) and pin (3).
- Put the chain connector (1) through the outer mast chain-hanging plate, screw the adjusting nut (8) and lock nut (2), insert the pin shaft (7) and pin (1).
- Adjust the chains.

10.3 Lift Cylinder Removal

Left /Right

- Block the truck wheels with wooden wedges, raise the fork frame with lifting tools to make the chains loose for the following removal.

CAUTION

Place support under the loading rack to prevent it from falling, potentially resulting in personal injury.

- Engage the emergency stop switch and turn off key switch.
- Unscrew the two joints (3) separate pipe from the cylinder.

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.

- Unscrew the four bolts (5), remove the two cylinder clips (6).
- Unscrew two screws (7) and two screws (8), then disconnect the cylinder R from the hydraulic station.

CAUTION

Before the next step, secure the cylinder. Avoid the falling of the cylinder during removal, potentially resulting in personal injury.

- Remove the cylinder R (1) and the cylinder L (2).

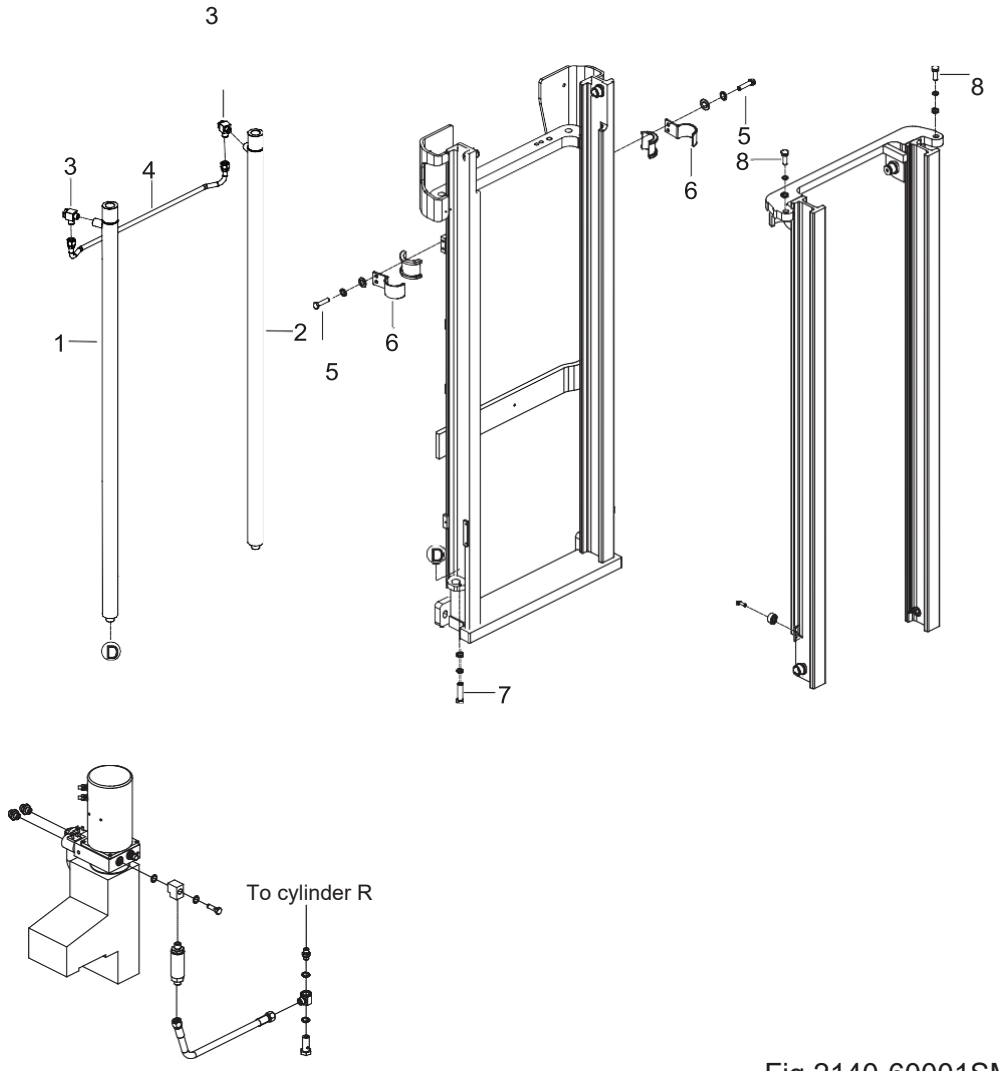


Fig 2140-60001SM

10.4 Full Free Middle Cylinder

Cylinder Removal

- Block the truck wheels with wooden wedges, raise the fork frame with lifting tools to make the chains loose for the following removal.

⚠ CAUTION

Place support under the loading rack to prevent it from falling, potentially resulting in personal injury.

- Engage the emergency stop switch and turn off key switch.

⚠ 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.

- Unscrew the two screws (1) to separate the cover (2) and the chain roller seat (8).
- Loosen bolts (3) and (5), remove the pin shaft (6) and remove the chains.
- Unscrew the two bolts (9) to separate the middle cylinder (10) and the chain roller seat (8).
- Unscrew the two bolts (12) and remove the middle cylinder clip (11).
- Loosen bolt (13) to separate the middle cylinder (10) and the mounting bracket.
- Remove the middle cylinder (5) from the truck.

⚠ CAUTION

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

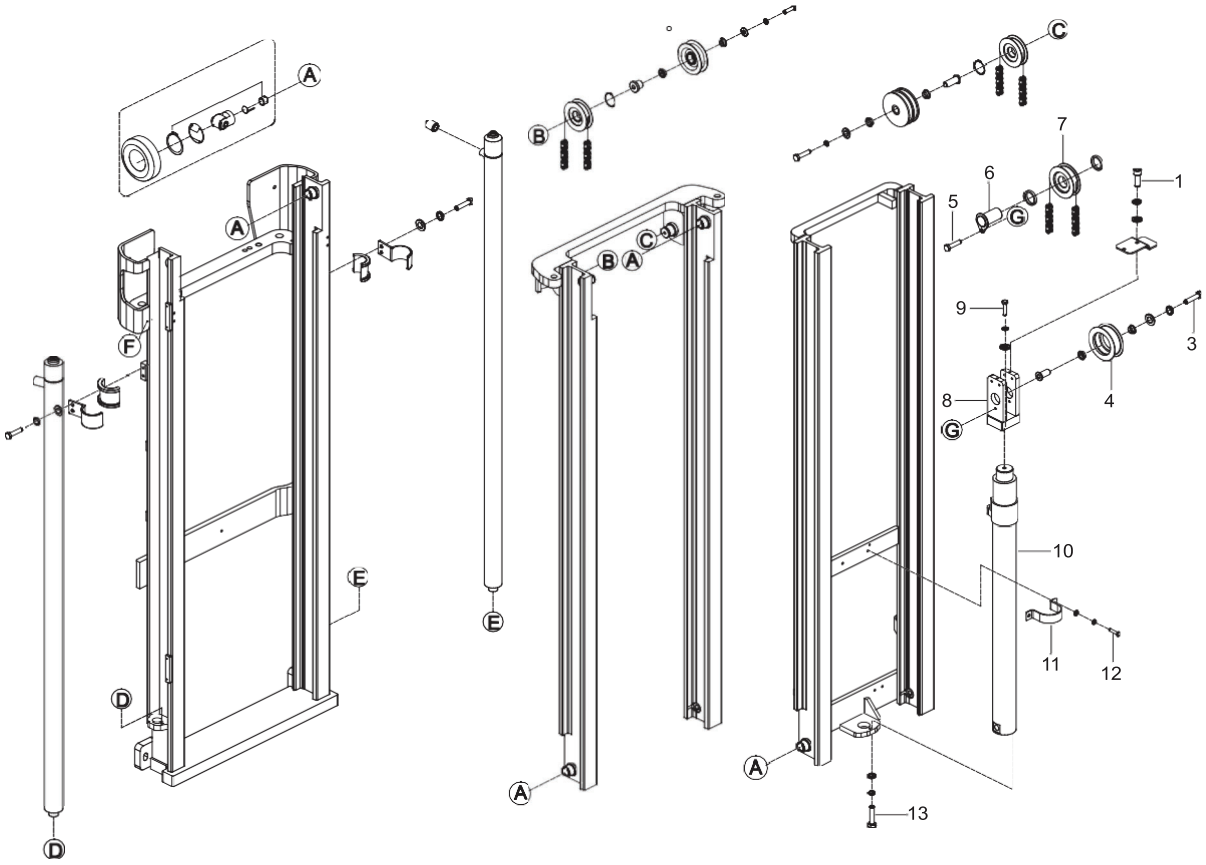


Fig 2140-60002SM

10.5 Duplex Mast 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.

For BGS25-LI/BGS30-LI (Fig 2116-60004SM)

- Secure the cylinder to hose clamp and gently clamp the cylinder bottom (15).
- Unscrew the cylinder cap with cylinder wrench.
- Remove the dust ring (2), seal (3 & 4) and O-ring (5 & 6) from the cylinder cap.
- Pull out the piston rod (1) from the cylinder tube (9).
- Remove the support ring (13), ring (10) and piston (12) from the piston rod.
- Clean with hydraulic oil of the same specifications.
- Replace the problem parts and assembly in reverse steps.

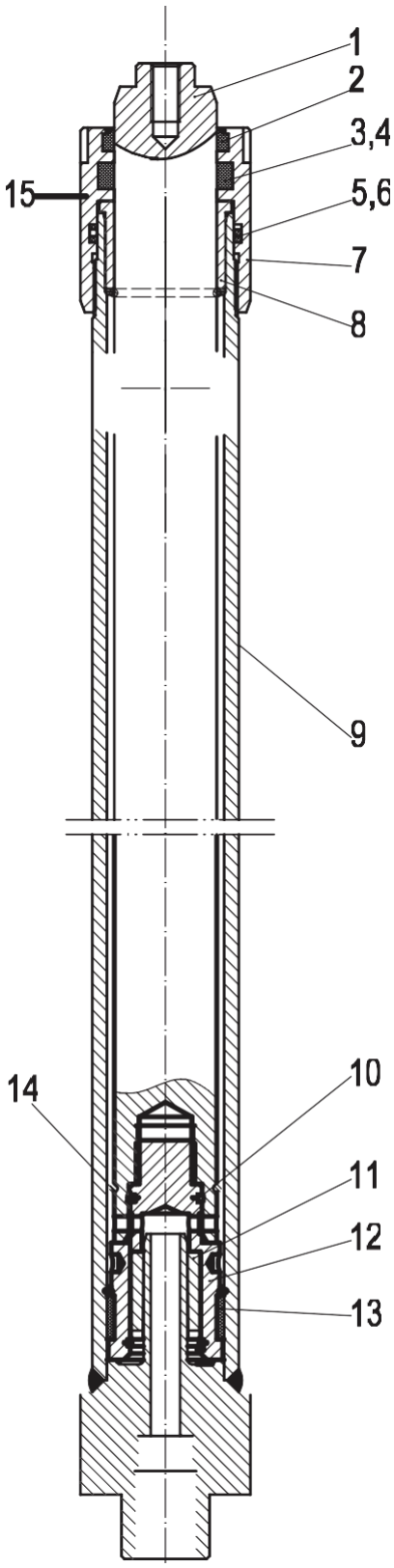


Fig 2116-60004SM

For BGS40-LI (Fig 2140-60003SM)

- Secure the cylinder to hose clamp and gently clamp the cylinder bottom.
- Unscrew the cylinder cap(5) with cylinder wrench.
- Remove the dust ring (2), seal (3) and O-ring (4) from the cylinder cap.
- Pull out the piston rod (1) from the cylinder tube (7).
- Remove the support ring (10), ring (8), seal (12) and piston (11) from the piston rod.
- Clean with hydraulic oil of the same specifications.
- Replace the problem parts and assembly in reverse steps.

CAUTION

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

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

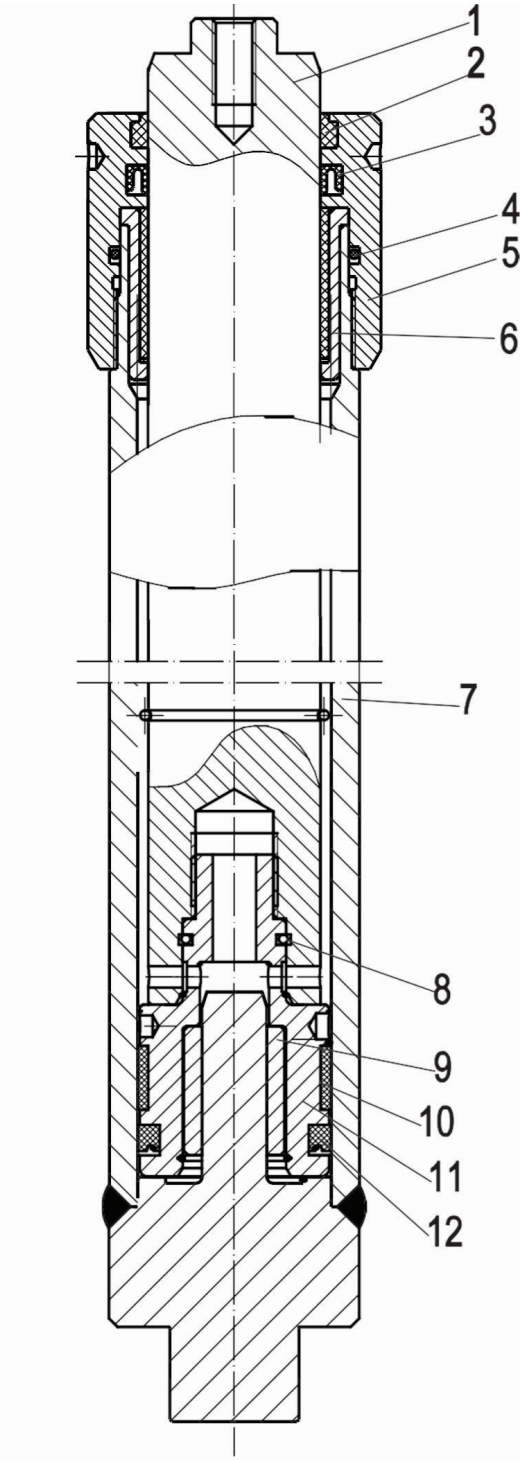


Fig 2140-60003SM

10.6 Triplex Mast 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.

For BGS25-LI/BGS30-LI (Fig 2140-60004SM)

- Secure the cylinder to hose clamp and gently clamp the cylinder bottom.
- Unscrew the cylinder cap (5) with cylinder wrench.
- Remove the dust ring (2), seal (3) and O-ring (4) from the cylinder cap.
- Pull out the piston rod (1) from the cylinder tube (7).
- Remove the support ring (11), ring (8 & 12), bushing (9) and piston (10) from the piston rod.
- Clean with hydraulic oil of the same specifications.
- Replace the problem parts and assemble in reverse steps.

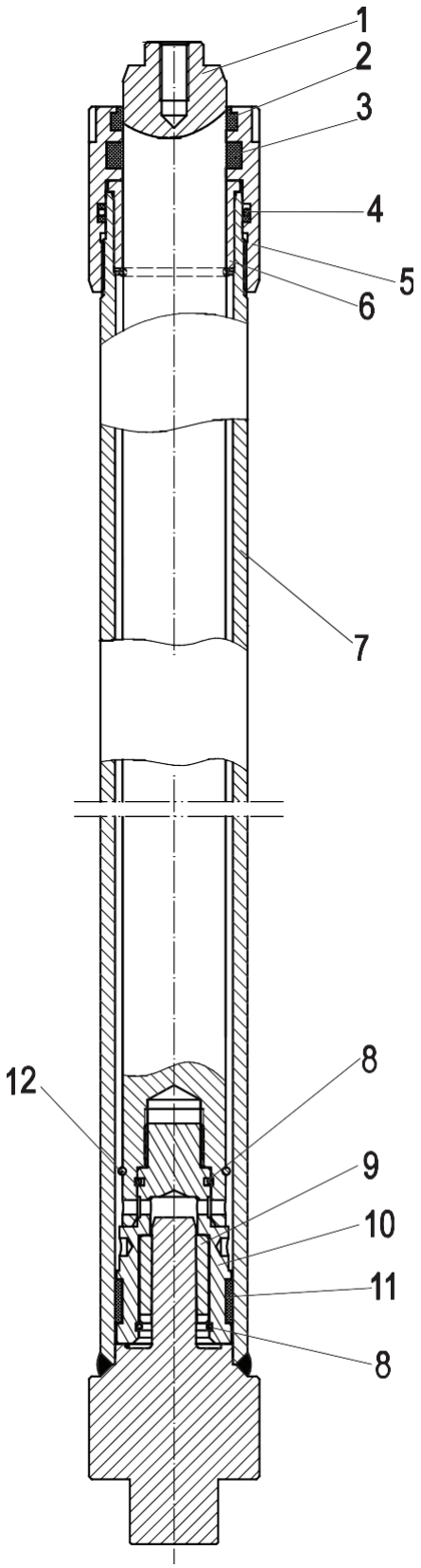


Fig 2140-60004SM

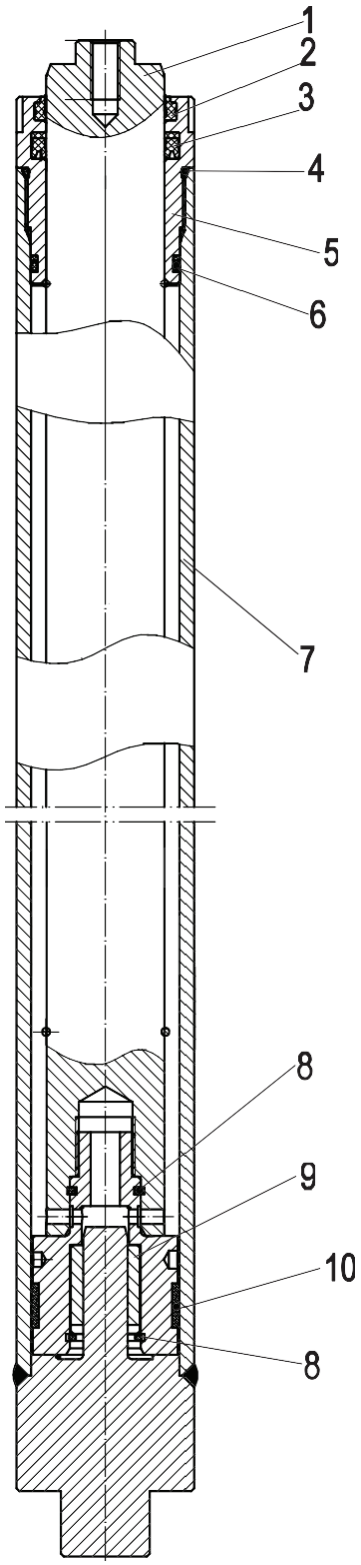
For BGS40-LI (Fig 2140-60005SM)

- Secure the cylinder to hose clamp and gently clamp the cylinder bottom.
- Unscrew the cylinder cap (5) with cylinder wrench.
- Remove the dust ring (2), seal (3) and O-ring (4 & 6) from the cylinder cap.
- Pull out the piston rod (1) from the cylinder tube (7).
- Remove the support ring (10), ring (8) and bushing (9) from the piston rod.
- Clean with hydraulic oil of the same specifications.
- Replace the problem parts and assembly in reverse steps.

⚠ CAUTION

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

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



10.7 Middle 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.

For BGS25-LI/BGS30-LI (Fig 2116-60005SM)

- Secure the cylinder to hose clamp and gently clamp the cylinder bottom.
- Unscrew the cylinder cap (5, Fig2116-6005SM) with cylinder wrench.
- Remove the dust ring (2), retainer ring (3), seal (4) and O-ring (6 & 11) from the cylinder cap.
- Pull out the piston rod (1) from the cylinder tube (7).
- Remove the support ring (8) from the piston rod.
- Clean with hydraulic oil of the same specifications.
- Replace the problem parts and assembly in reverse steps.

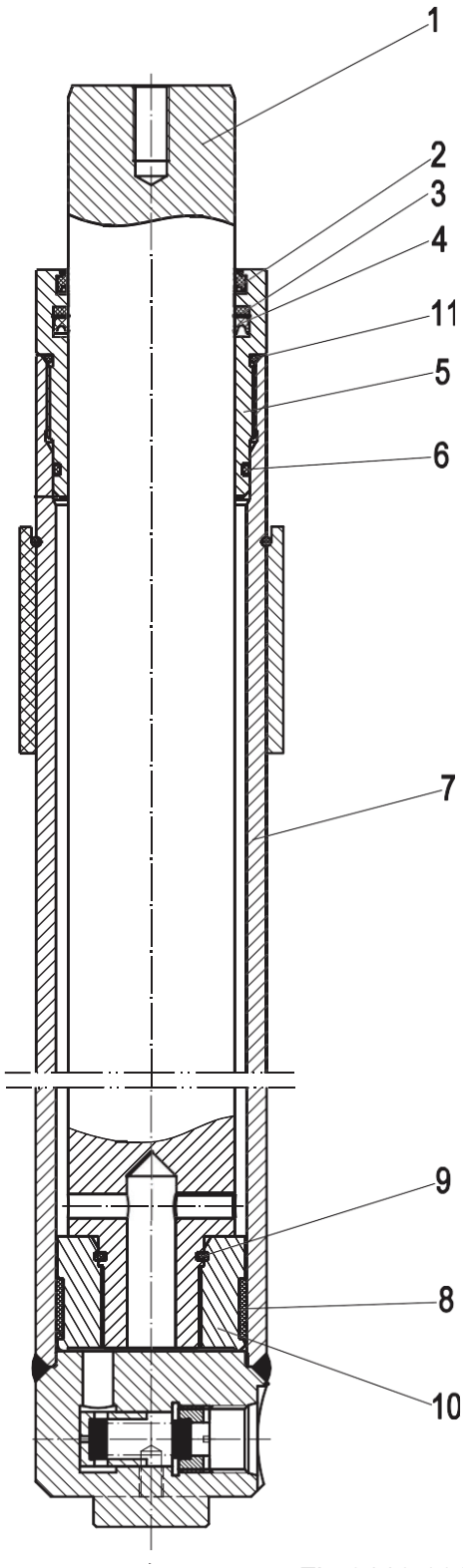


Fig 2116-60005SM

For BGS40-LI (Fig 2140-60006SM)

- Secure the cylinder to hose clamp and gently clamp the cylinder bottom.
- Unscrew the cylinder cap (5) with cylinder wrench.
- Remove the dust ring (2), seal (3) and O-ring (4 & 6) from the cylinder cap.
- Pull out the piston rod (1) from the cylinder tube (7).
- Remove the support ring (10), ring (9 & 12), bushing (11), seal (13) and piston (8) from the piston rod.
- Clean with hydraulic oil of the same specifications.
- Replace the problem parts and assembly in reverse steps.

⚠ CAUTION

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

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

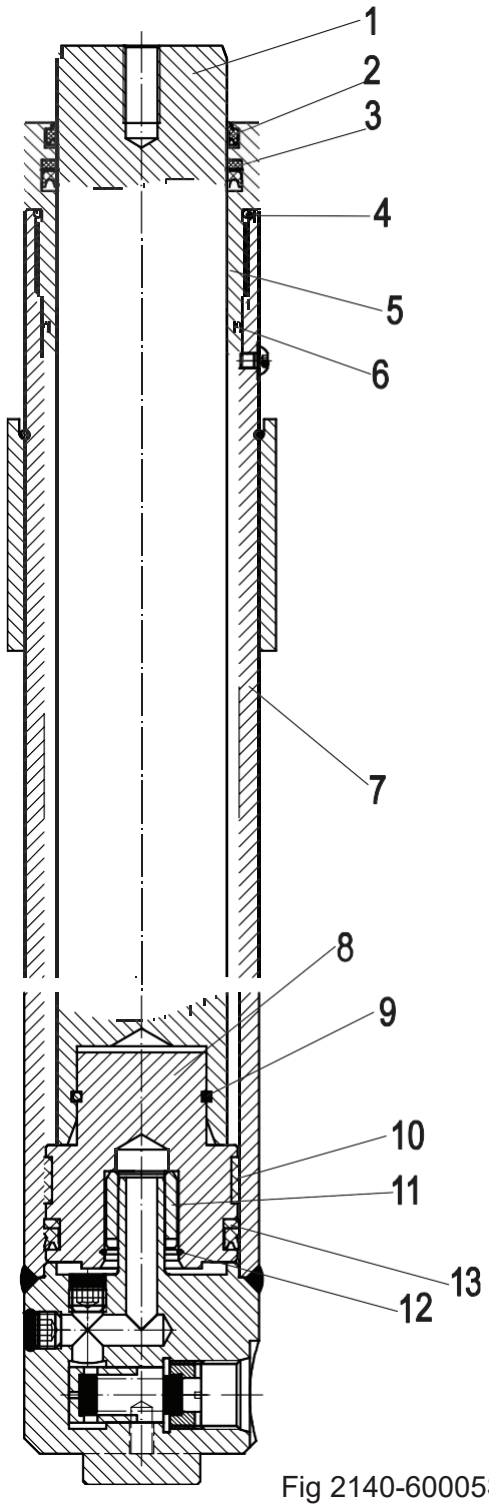


Fig 2140-60005SM

Introduction*

This manual is intended to provide information on correctly using the Li-ion battery and maximizing its productivity and longevity through preventive maintenance and safe operation. Operators should read through the manual before using the battery.

All the information, specifications, and illustrations in the manual are effective at time of print. The company maintains the right to modify the specification(s) or design(s) of the products at any time without prior notification.

Overview

Lithium-ion (Li-ion) batteries have many advantages over traditional lead acid and other types of batteries. Blue Giant Li-ion batteries are classified as LFP 'Lithium Iron Phosphate' or LiFePO4. When stored, handled, and used properly, they also have a longer service life, a higher power density, don't need a cooling down period, and can be opportunity charged.
Blue Giant's priority is safety, and establishing the following safety procedures for storing, handling and use of these batteries will help prevent fires and explosions.
Companies training employees to recognize the hazards of Li-ion and other types of batteries as well as how to handle, store and manage them properly will help to avoid damage to the batteries resulting in possible fires and explosions.

This battery should not be used at a very low SOC (state of charge) status. To ensure the battery life, the operator should avoid the discharge depth of more than 80% of the rated capacity of the battery. Whether it is partially discharged or fully discharged, the battery should be immediately charged.

Lithium batteries have a special charger and may not be charged with other types of battery chargers.

NOTE: A new battery from the factory should be fully charged before its initial use.

*** Temperatures referenced in this manual are for standard trucks. For trucks equipped with the cold storage option, follow the temperature rating instructions specifically for those.**

Getting Started

The lithium-ion battery unit is composed of battery cells in series or in parallel. It is equipped with battery management system (BMS) for monitoring and protecting the lithium-ion battery. The truck's key switch can control power supply of the battery. The circular meter shows various data including SOC (State of Charge), error code, total voltage, and temperature.

Safety & Warnings

- Always wear personal protective equipment (PPE) (e.g., safety goggles and safety gloves) when working on cells and batteries.
- Abide by the operation manual.
- Check the battery for leakage and mechanical damage before use and charging.

  NOTE: STOP using the battery if leaking or damaged and follow the recycling instructions found in section 8.3 in this manual. We recommend the battery be recycled within 3 days.
- Inspect easy exchange batteries daily. See Appendix A for detailed daily inspection instructions for the pallet truck easy exchange batteries. If new or replacement visual inspection reminder decals are needed, they can be ordered via PN 056747.

- Check charger connectors and bracket for contamination daily, clean the bracket with a dry cloth if needed.
- All operations related to the battery must be implemented under the instruction of professionals.
- Do NOT smoke near the battery because it may cause fire.
- Do NOT place the battery near open flame, sparks, or energized wires as fire or explosion may occur.
- Avoid short-circuiting the battery, as fire or explosion is likely to occur.
- Keep the battery away from all fire sources, heat sources, and flammable or explosive materials.
- Don’t knock over the battery, drop the battery, or expose it to abusive vibration applications.
- Use lifting and delivery devices as specified. Prevent the battery cell, interface, and connection cable from being damaged by the lifting hook.
- If the internal battery components start to leak out, do not inhale the fumes. Always wear PPE when in close contact with the battery.
- Wash hands after working on a battery.
- Use only insulated tools.
- Make sure the truck is turned off before connecting the battery.
- The metal part of the battery cell is electrified, don’t place any external object or tool on the battery cell.

- Do NOT place the battery on top of conductive objects.
- Do NOT trample on the battery to prevent it from fierce shaking.
- Protect the battery from solar or other forms of heat radiation.
- Do NOT physically alter the battery, strike, crush, compress, notch, dent or modify it in any way.
- Do NOT open the battery without Blue Giant's official authorization.
- Do NOT spray or wash the battery with water.

Intended Use*

- Discharge/Operational application temperatures: 32° F - 104° F.
- Charging application temperatures: 41° F - 104° F.
- Humidity < 80%.
- The battery's maximum operation altitude is up to 6500ft (2000m).

CAUTION:

- A high-rate recharging operation below 0°C may lead to battery damage, so the recommended charging temperature range is 41° F - 104° F.
- The discharging temperature range can be used in more extreme temperature conditions as follows -4° F - 131° F however, this isn't the recommended range for optimal life which is identified above. Also, the truck may not be rated for those extreme conditions or extended durations in a cold operating environment as that is truck and option dependent.
    - If used at low temperatures -4° F - 32° F, battery discharge capacity will be smaller compared with one in normal temperature conditions.
    - A battery used between 104° F - 131° F will accelerate the aging of the internal material which may shorten the service life of the battery, so is not recommended.

Battery Management System

The battery is permanently monitored by the Battery Management System (BMS). This provides communication with the truck.

The BMS continually monitors items such as the cell temperature, voltage, and charge status of the cells. It also functions as a safety cut-off device in case of overcharging, overcurrent, or overheating.

*** Temperatures referenced in this manual are for standard trucks. For trucks equipped with the cold storage option, follow the temperature rating instructions specifically for those.**

Potential Hazards

Hazards are not anticipated if the equipment is used correctly. Do not use the equipment for anything other than its intended purpose.

The following hazards can arise in the event of improper use:

Physical Damage:

This can occur if a battery falls or is deformed through pressure or high impact (e.g., truck forks penetrate the battery housing).

Physical damage includes cracks, breakage, splinters, or holes in the battery housing. This type of damage may be caused by a short circuit inside the battery, which may result in harmful materials leaking, fire or battery explosion.

Some physical damage may not show on the battery enclosure, but there may be damage to the internal cell pack, which could cause electrolyte leaking and short circuit. Always check for leakage before use and charging.

Short Circuits:

These may be caused by inadvertently creating a connection between the two battery terminals (e.g., battery immersed in water, battery leakage, contamination on the charger connector or battery connector).

Temperature Effects:

High temperatures caused by sunlight or being stored in warm locations (e.g., near ovens) can result in harmful material leakage and fire.

To avoid fire and leakage of harmful materials, a safe place for storing batteries must satisfy the following criteria:

- Do not store in places often frequented by personnel.
- Do not store in places where valuable objects (e.g., cars) are stored.
- Fire extinguishers must be available to put out any fires.
- Caution should be taken with fire or smoke detectors in the vicinity to ensure that an automatic fire detection system is only activated in the event of actual danger (e.g., naked flames).
- Small amounts of discharge from a single battery are not critical to the environment. Above-average natural ventilation is required in this case.
- No ventilation intake pipes should be in the vicinity, as discharged content could spread within a building.

Examples of where to store a non-functional battery:

- Covered area outdoors.
- Ventilated metal container.
- Covered box with pressure and smoke discharge option.

Fire Hazard

Physical damage, thermal effects, or incorrect storage in the event of a defect can result in fire. Please note that the battery materials can be flammable.

WARNING: Contact with combustion products can be hazardous. Fires produce combustion products. Combustion is a chemical process by which a flammable material combines with oxygen under heat and light (fire). The resulting combustion products can occur in the form of smoke, leaking fluids, escaping gases, debris, as well as decomposition products of certain chemicals. These combustion products are substances that enter the body through the respiratory tract and/or the skin and can cause serious health issues.
Avoid contact with combustion products and use personal protective equipment (PPE).

- Hydrogen fluoride (HF) Hydrofluoric acid = extremely corrosive
- Risk of toxic substances produced by pyrolysis
- Risk of highly flammable gas mixtures
- Other combustion products: Carbon monoxide & -dioxide, manganese, nickel, and cobalt oxides.

WARNING: If a lithium battery fire occurs, use a CO2 (Class BC) or dry chemical (Class ABC) fire extinguisher. Lithium batteries do not have actual lithium metal so **DO NOT** use a Class D fire extinguisher.

Touch Voltage Hazard

Hazardous contact voltages only arise in the event of a technical or physical defect. The batteries are normally charged. There is still some residual voltage in a discharged battery. This must be considered a hazardous contact voltage.

Battery Storage*

Proper storage prevents damage to batteries and prolongs their life expectancy. Follow these battery storage tips:

- Store in dry, well-ventilated areas
- Store in temperatures between 32º F and 104ºF
- Store away from direct sunlight and heat sources
- Keep terminals covered when the battery is not in use
- Prevent terminals from touching each other
- Store separately from other types of batteries
- Keep the battery charged and do not store it for an extended period with a low state of charge (SOC) < 20%. It is recommended to maintain a charge level of 50% or greater.
- For long-term storage, the Li battery must be recharged every 2-3 months regardless of the SOC level. If a battery is stored longer than six months without charging, the cell may be damaged due to over-discharge. This can cause the cell to bulge and break the battery enclosure.

IMPORTANT: Monitor battery condition daily when in use and storage.
*** Temperatures referenced in this manual are for standard trucks. For trucks equipped with the cold storage option, follow the temperature rating instructions specifically for those.**

Battery Handling

Improper handling can cause damage to batteries, which may lead to overheating, fires, or explosions. Here are some tips for proper Li-ion battery handling:

- Remove batteries from devices that will not be used for an extended time.
- Keep batteries away from electromagnetic sources.
- Keep batteries intact.
- Keep batteries and charger in a clean location, do not expose battery or charger to water or other type of contaminations.
- Clean charger bracket and connector/pin with dry cloth if needed, since foreign material and contamination may accumulate in the bracket.
- DO NOT use batteries that show any signs of damage, they must be isolated.
- DO NOT modify the battery in any way.

WARNING: Damaged Li-ion batteries have the potential to leak electrolytes, so it’s important to wear proper personal protective equipment (PPE) (goggles, gloves, apron, etc.) during handling.

Performance Data

Battery Nominal Data

Battery Cell

1	Cell material	LFP

Battery System

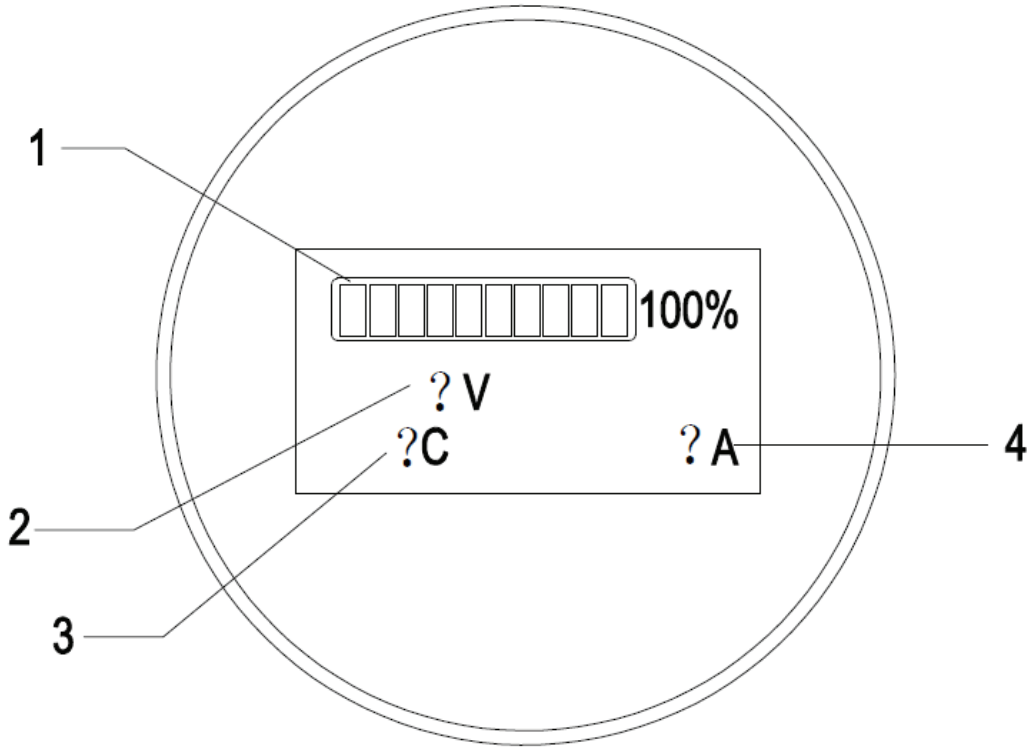
2	Burst mode	Parallel Circuit or Series Circuit
3	Ambient relative humidity	≤80%RH
4	Operational application temperature	32-104°F

BMS Nominal Data

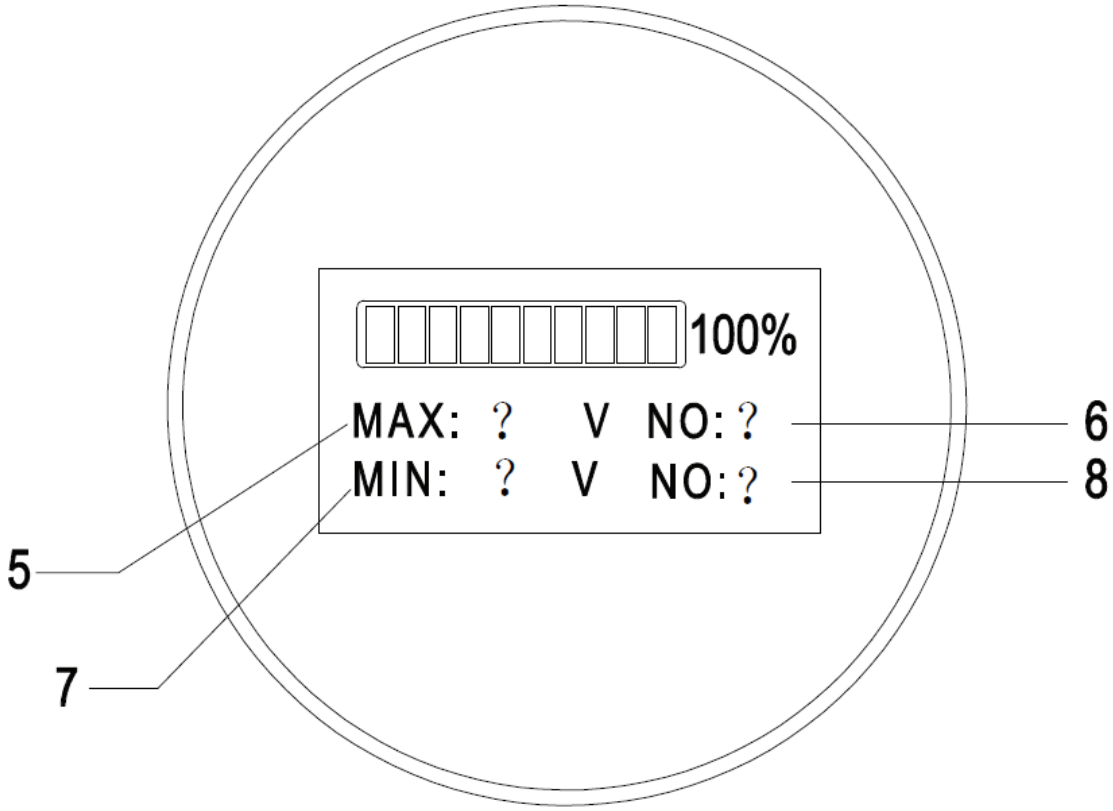
Battery Management System Function

No	Item	Function	Description
1	Inspection / Estimates	Monomer voltage detection	Accurate acquisition of all cell voltage data
2		Total voltage detection	Accurate acquisition of total voltage data
3		Temperature collecting	Accurate detection of battery temperature
4		Current inspection	Accurate detection of charge-discharge currents
5		SOC Estimate	Hall sensor is used to obtain the input and output current of the battery, and the SOC estimation of the battery is carried out by the method of ampere time integration
6	Communication Function	CAN communication	Communication and debugging
7	Protection Function	Short-circuit protection	Power circuit short circuit, contactor disconnect
8		Over current protection	Over-current occurs, contactor disconnect
9		Overcharging protection	Overcharge occurs, contactor disconnect
10		Over discharging protection	Over discharge occurs, contactor disconnect
11		Over temperature protection	Over temperature occurs, contactor disconnect
12	Sleep Wake	Sleep awakening function	Charge communication wake-up, Battery switch button wake-up

Battery Indicator



No	Name	Description
1	Energy Display	When the first cell and the second flash alternately, battery is low and must be charged. The battery remaining charge is displayed; “100%” indicates that the battery is fully charged.
2	Total Voltage	The sum of the total voltages of the lithium battery series
3	Temperature	Battery temperature
4	Charging Current	Current value when charging the lithium battery



No	Name	Description
5	Maximum Cell Voltage	Maximum value of cell voltage
6	Number of Cell	Identification number of the cell with maximum voltage
7	Minimum Cell Voltage	Minimum value of cell voltage
8	Cell Number of Minimum Cell Voltage	Identification number of the cell with minimum voltage

Transportation

Before transporting any lithium-ion battery, check the current regulations on the transport of dangerous goods. Comply with these when preparing the packaging and transport. Train authorized staff to dispatch lithium-ion batteries.

NOTE:

It is recommended that the original packaging is kept for any subsequent dispatch.
A lithium-ion battery is a special product.
Special precautions should be taken when:

- Transporting a truck equipped with a lithium-ion battery
- Transporting only the lithium battery

A class 9 danger label must be affixed to the packaging for transport.
Handling differs if the battery is transported on its own or in a truck. An example of a label appears in this supplement (see figure below). Refer to the latest current regulations before dispatch as the information might have changed since this manual was written.
Special documents must be sent with the battery. Refer to the applicable standards or regulations.

For UN3480	Lithium-ion Batteries	
For UN3481	Lithium-ion Batteries packed with Equipment or Lithium batteries built into Equipment	

Service

Lithium-ion batteries typically require no maintenance. If needed, only a certified technician should perform any service or maintenance.

Blue Giant recommends following the maintenance schedule below. Record all battery service, maintenance, and inspections to maximize the service life of your battery and lift truck.

No.	Maintenance Content	Method of Operation	Notes	Frequency
1	Check if battery capacity is too low	Check instrumentation SOC display	Make sure the battery is not stored without charge for a long period. If the battery system needs to be put on hold for a long period, keep the battery at a half power state and charge the battery every 3 months to ensure that the battery system remains in a half power state.	Everyday
2	The battery pack charge and discharge current	Check instrumentation display	Make sure battery pack charge and discharge current meet the operation manual requirements.	Everyday
3	Check connector pins at the bottom of the battery (if present)	Perform a visual inspection	If any ablation or deformation is found, replace the battery connector pins.	Everyday
4	Check if appearance is deformed, whether surface is oxidized, paint is peeling, the mounting position is offset or if cabinet is damaged	Perform a visual inspection	If deformed/damaged follow battery recycling procedure.	Everyday
5	Check the entire battery as well as the surface beneath it for signs of fluid leakage	Perform a visual inspection	If leaking, follow battery recycling procedure.	Everyday

No.	Maintenance Content	Method of Operation	Notes	Frequency
6	Check if battery and charger are clean	Perform a visual inspection Wear insulated gloves before performing cleaning	Clean the lithium battery and charger with a dry cloth or compressed air	Weekly
7	Check if external wiring harness has worn spots, imprints, creases, or exposed wire	Perform a visual inspection	Replace the wiring harness if damaged	Weekly
8	Check the surface of lithium-ion battery for cleanliness	No dust, water, corrosion, oxidation, rust, etc.	Clean the surface if dust, corrosion, oxidation, or rust is found. Use a dustless cloth or air compressor. Using water is strictly prohibited.	Weekly
9	Ensure outside battery screws are tight	Tighten screws if necessary		Weekly
10	Check for water or foreign material in the plug and socket. Check for rust or charring (if necessary)	Perform a visual inspection		Monthly
11	Check the cable for damages or loose joints (if necessary)	Perform a visual inspection		Monthly
12	Check the battery case for abnormalities such as cracks, deformation, and bulging	Perform a visual inspection	Stop using the battery if abnormalities are found	Monthly

NOTE: The manufacturer recommends using compressed air at less than 30psi (207kPa).

Troubleshooting & Recycling

During the use and maintenance of the lithium-ion battery, the battery or battery system may have one or more of the following abnormal conditions.

Only trained technicians are allowed to perform the necessary processing according to the instructions in this manual.

If there are any questions about the status or solutions, please contact Blue Giant dealers or after-sales service department of the company to obtain professional technical support.

- If the battery is found to have abnormal mechanical characteristics such as swelling, cracked casing, melted casing or distortion of the casing before and during installation, stop using the battery immediately, place it in open and well-ventilated space, and contact the after-sales service.
- If abnormalities such as looseness, cracks, cracks in the insulation layer, burn marks, etc. of the battery's pole pressing bolts, conductive strips, main circuit wires, and connectors are found before and during the installation, STOP using the battery immediately.
- If the polarity of the positive and negative terminals of the battery is found incorrect, STOP using the battery immediately and contact the after-sales service department to replace the battery or obtain other solutions.
- If the battery emits smoke; immediately STOP using the battery, use fire sand and an explosion-proof box for burial and isolation, wearing a respirator and fireproof gloves move the battery to a safe area, and notify the after-sales service department of the company for record and obtain technical support.

Damaged / Leaking Battery Handling

- Put on personal protective equipment (PPE), such as gloves, goggles/safety glasses, and a lab coat.
- Isolate and ventilate the area.
- Keep an appropriate fire extinguisher within reach.
- If batteries are showing evidence of overheating, use extreme care. Gases can be toxic and flammable.
- Disconnect the battery (if possible).
- Remove the battery from the equipment/device (if possible).
- Use inert, non-cellulose absorbents to clean up the spilled electrolyte.
- Place used absorbents and PPE in a sealed bag and contact your environmental or shipping container for proper disposal of the battery and absorbents.
- **DO NOT** place damaged batteries in regular trash or recycling containers.
- For safe storage while awaiting proper disposal, place the battery in a container of sand or another chemically inert cushioning material like vermiculite. There are damaged Li-ion battery kits commercially available for isolating a battery in a metal pail along with fire-proof media (such as sand, and vermiculite) to cover the battery with.

Damaged, Defective Battery Container Kits: Metal Storage container kit with vermiculite

3rd Party Options (Not associated with Blue Giant)

For updated parts information, please contact Blue Giant Technical Support
Or visit www.bluegiant.com/support

Blue Giant Options :

Without prepaid shipping and without prepaid recycling

- For 24V – 20Ah battery DDR Kit part # 26275

With prepaid shipping and prepaid recycling

- For 48V - 30Ah battery Kit = Part # 25827
- For 24V – 20Ah battery Kit = Part # 25826
- If the electrolyte is leaking out, place the battery in a bucket of water for 7 days to effectively discharge the internal cells. This is the only time the battery should be exposed to water.
- Place the battery container away from combustibles.
- Contact the local fire department and ask for advice on how to proceed.

Charging

Note: Some Lithium-Ion batteries disconnect the charger from the batteries when the batteries reach full charge. In these situations, the "Charge Complete" LED will NOT be illuminated green despite the fact that the charge cycle has completed. Please refer to the State of Charge (SOC) display on the batteries to confirm a full charge.

Designate a specific area for the purpose of charging lithium-ion batteries. When charging, make sure the battery charger is turned OFF before connecting the battery charging cables. Lithium-ion batteries allow for fast charging, if the battery does not charge completely in a normal period or if the battery management system (BMS) indicates a fault, then remove the battery from service. Big Lift Forklifts recommends the opportunity charge lithium-ion batteries. This is when the battery is recharged for short intervals during a shift period. It reduces or eliminates the need for long charging periods, changing batteries during a shift, and extending shift periods.

Please follow the guidelines below:

- Battery must be charged when the remaining charge is lower than 20%, avoid over-charging or over-discharging.
- Remaining charge should be higher than 60% during a short period of storage.
- Running the truck is prohibited in the case of a short circuit, low voltage, or high temperature.
- Perform charging, discharging test, and battery status inspection at least once per month, including total voltage, unit voltage, voltage difference, temperature, temperature difference, the value of insulation resistance, remaining charge, etc.
- Handle battery gently. DO NOT throw, roll, or allow to collide with other objects.

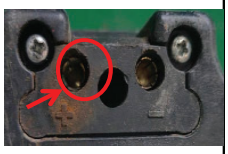
Recycling

Lithium-ion batteries must be disposed of according to the relevant environmental protection regulations. Blue Giant recommends researching battery recycling companies and choosing what is best for your situation. We have included two companies here with some information about each. This information is not guaranteed to be current, please contact the company for the most up-to-date information.

Note: The companies are not affiliated with Blue Giant and are considered third party.

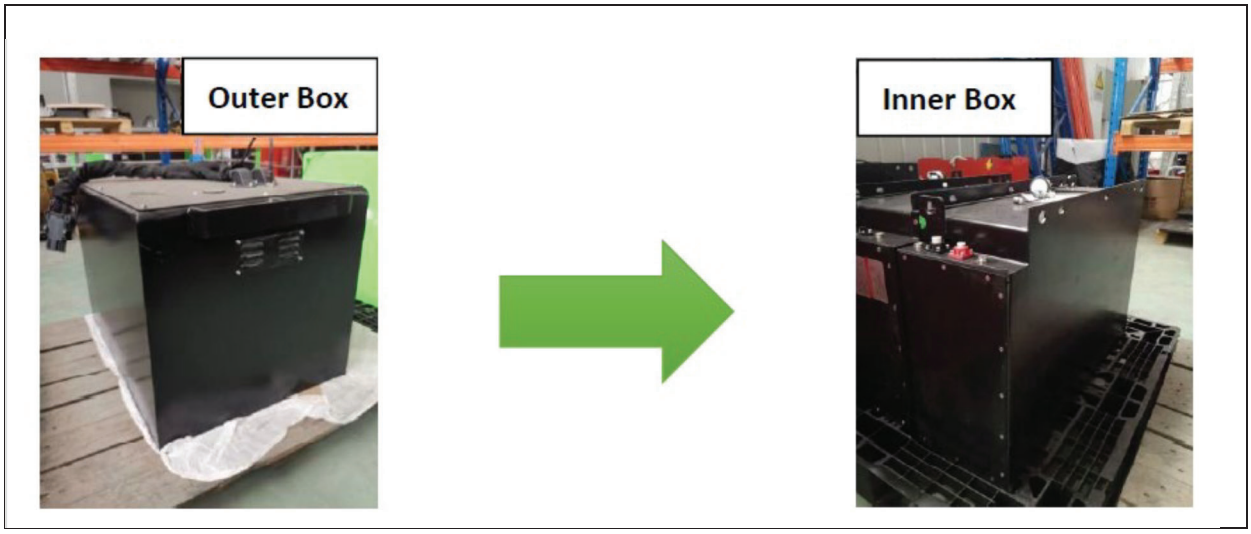
Company:	Battery Recyclers of America	Li-Cycle
HQ:	Dallas TX	Toronto Canada
Years in Business: (as of 2023)	13 years	7 years
Recycling Process:	Smelting	Submerged
EPA Certified:	Yes	Yes
Refurb/Recycle:	Both	Recycle
Packaging Requirements:	Per DoT	Per DoT
Palletize Service:	Yes	No
Pickup:	Yes	Ship only
Logistics Support:	Yes	No
Min. Pickup Weight:	50 lbs.	N/A
Accept Mix of Lead and Li:	Yes	No

Appendix A: Daily Spot Check Record

Daily Spot Check Record of Lithium Batteries (Easy Exchange)					
Routine Check Items	**Leakage**	**Leakage**	**Box Damaged**	**Battery Bulge**	**Terminal Damage**
Diagram of Routine Inspection Items					
Explanation	There is liquid leakage causing corrosion at the charging and discharging terminals on the bottom of the battery	There are traces of liquid leakage at the bottom of the battery, which caused stains around the positive and negative terminal ports	The box body is cracked and has pieces missing	The battery expands causing it to bulge	The terminal is deformed, discolored, blackened or there are traces of high temperature burning
Processing Method	Stop using, soak in water for 7 days to discharge and recycle according to local regulations	Stop using, soak in water for 7 days to discharge and recycle according to local regulations	Stop using and recycle according to local regulations	Stop using and recycle according to local regulations	Replace the terminal
Inspection Frequency	**Daily**	**Daily**	**Daily**	**Daily**	**Daily**
Inspection Method	**Visual inspection**	**Visual inspection**	**Visual inspection**	**Visual inspection**	**Visual inspection**
Date					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
Note: All spot inspectors shall conduct a visual inspection prior to work every day. Mark "√" if they meet the requirements. If they do not meet the requirements, Mark "×" and report it to the proper personnel.					
Place of use:					
Person in charge of spot inspection:					

Appendix B: Box Structure

Big Battery Box Structure – If equipped, only the inner box needs to be shipped with battery cells and BMS plate for repair/return.



SECTION 12
ILLUSTRATED PARTS BREAKDOWN

For updated parts information, please contact Blue Giant Technical Support
Or visit www.bluegiant.com/support

⚠WARNING

- Do not operate this truck unless authorized and trained to do so and have read all instructions in this Operator's Manual and on this truck. Read, understand, and comply with the information on the truck's nameplate at all times.
- Do not operate this truck until you have performed the Daily Operator Checklist. Report any problems to the designated authority and do not use the truck until they are corrected by a qualified technician.
- If there is a fault code on the BDI/display, recycle the key and see it the code displays again. If the code displays again, do not operate the truck. Investigate the fault code and contact a service technician.
- This truck must not be modified without written manufacturer's consent.
- Operate cautiously on ramps, slopes, and uneven floors. Travel slowly and do not angle or turn. This truck is not for use on mezzanines or balcony areas.
- Before operating, inspect the floor area it will be used on and be certain it will support the truck at full capacity and lift height. Identify and avoid holes, drop-offs, bumps, and obstructions.
- Never place any part of your body into the mast structure or between the mast and the truck.
- Do not carry passengers.
- Before and during all truck operations ensure that adequate clearance is maintained from overhead obstructions and energized electrical conductors and parts.
- Operate tilting mechanism slowly and smoothly.
- Elevate forks only to pick up a load. Watch for obstructions overhead.
- Ensure loads are centered and do not contact any obstructions in the truck's vicinity.
- Maintain a clear view of the ground while traveling and a safe distance from obstacles in the truck's path. Ensure personnel in the vicinity are aware of the truck's movement. Travel at a safe speed for the conditions the truck is operating in.
- Observe applicable traffic regulations. Yield the right of way to pedestrians. Slow down and sound horn at cross aisles and wherever vision is obstructed. Avoid hazardous locations.
- When leaving the truck unattended, remove the key to prevent unauthorized use.
- Start, stop, travel, steer, and brake smoothly. Slow down for turns and on uneven or slippery surfaces that could cause the truck to slide or overturn. Use special care when traveling without a load as the risk of overturn can be greater.
- Travel with lifting mechanism as low as possible. Always look in the direction of travel. Keep a clear view.
- Do not handle loads that are taller than the load backrest unless secured to prevent falling.
- Do not expose the truck and battery directly to water as there is no ingress protection.

Safety Notices and Text Mark-Ups

Safety instructions and important explanations are indicated by the following graphics:

DANGER

Means that failure to comply can cause risk to life and/or major damage to property.

WARNING

Please strictly adhere to these safety instructions to avoid personal injury or damage to equipment or personal property.

CAUTION

Please pay attention to the important safety instructions.

NOTE

Pay attention to information that could be helpful.

PROPOSITION 65

WARNING

In accordance to
California Health & Safety Code Sections 25249.5 et. seq.
this warning is to let you know that this product can expose you to chemicals known to the state of California to cause cancer, birth defects and other reproductive harm.
For more information visit: www.p65warnings.ca.gov

Correct Use and Application

The truck described in this operator manual is designed for lifting and transporting material loads. It must be used, operated, and serviced as specified in the following instructions. Any other type of use is beyond the scope of application and can result in damage to personnel, the truck or property. Avoid overloading the truck with loads which are too heavy or placed on one side. The data plate attached to the truck, or the load diagram are binding for the maximum load capacity. All nameplates and safety signs on the truck should be cleaned regularly to maintain visibility.

Proprietor Responsibilities

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

The proprietor must ensure that the truck is used only for the purpose it is intended for.

Accident prevention regulations, safety regulations, operating, servicing and repair guidelines must be followed. The proprietor must ensure that all truck users are properly trained and have read and understood this operator manual. The owner must also read and understand the safety guidelines/requirements as called out in the applicable ANSI/ITSDF B56 series of standards.

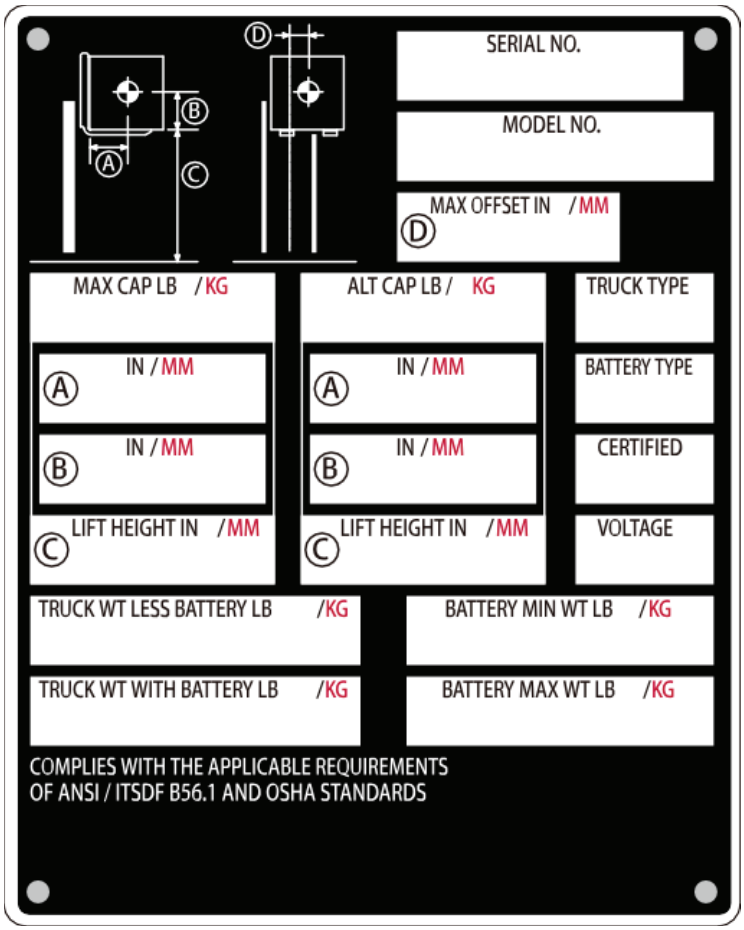
Failure to comply with the operator manual shall void the warranty. The same applies if improper work is carried out on the truck by the customer or third parties without the express permission of the manufacturer’s customer service department.

Modifications

Any modification of the truck requires the written permission of the manufacturer. Local authority approval may also need to be obtained. Local authority approval does not constitute the manufacturer’s approval. If approval has been granted for capacity change, the nameplate and safety signs on the truck must also be changed.

NOTE
The graphics contained in this manual may not be an exact representation of the truck. They are for illustrative purposes only.

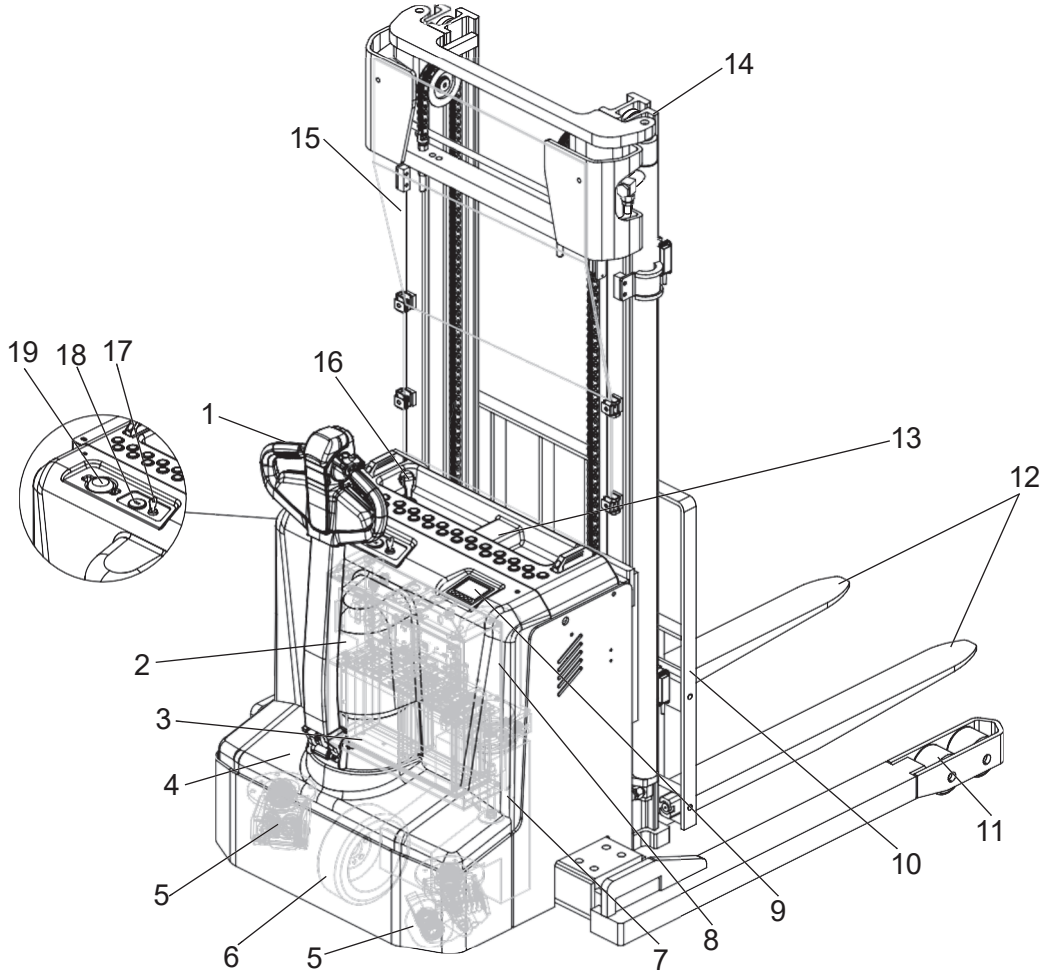
Truck Data Plate



Data plates are required on the truck. If lost, stolen, or damaged they must be replaced per OSHA standards.

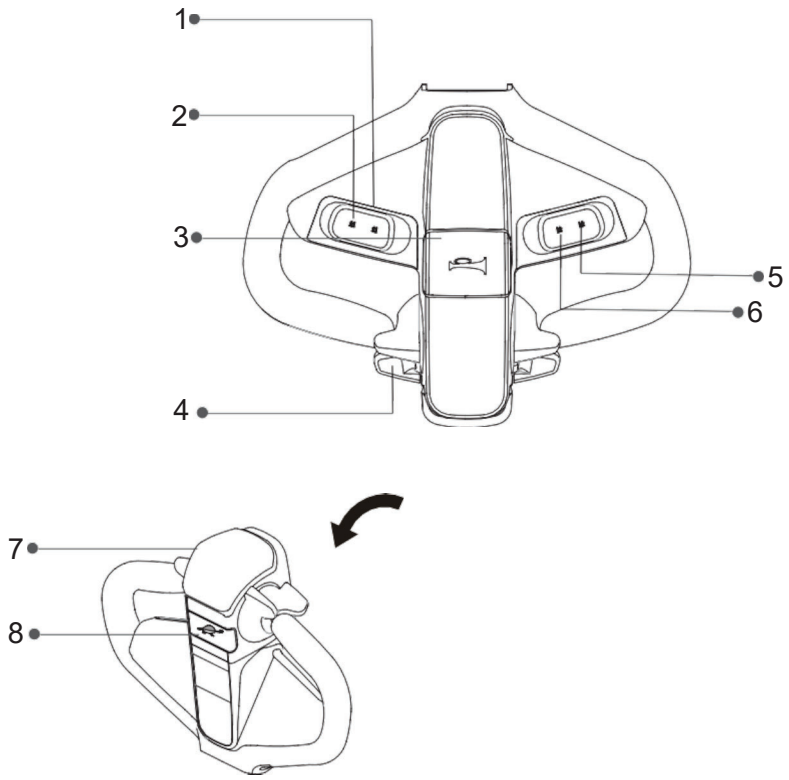
For questions regarding the truck or ordering spare parts, always provide the serial number.

Truck Components



Item	Component	Item	Component
1	Control handle	11	Load wheels
2	Upper cover	12	Fork
3	Rotation cover	13	Battery panel
4	Lower cover	14	Mast
5	Caster	15	Mast windshield
6	Drive wheel	16	Charger plug
7	Hydraulic unit	17	Key switch
8	Battery	18	USB
9	Display	19	Emergency stop switch
10	Carriage and load backrest		

Truck Components (continued)

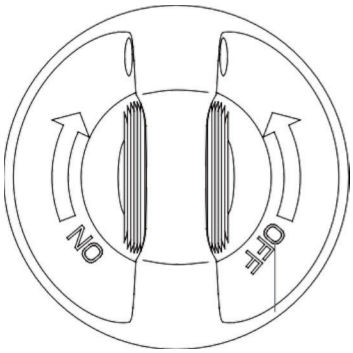


Item	Component	Function
1	Left shift button (optional)	Controls fork movement to left
2	Right shift button (optional)	Controls fork movement to right
3	Horn button	Sounds a warning signal
4	Drive switch	Controls travel direction and speed
5	Lower button	Lowers the load device
6	Lift button	Raises the load device
7	Emergency reverse button	Press to make the truck travel in the opposite direction.
8	Creep speed button	Press the creep speed button and the drive button at the same time to make the truck move at a slow speed.

Key Switch

Connect and interrupt control current.

- When the key rotates to OFF, the control current of the truck will be interrupted.
- When the key rotates to ON, the control current of the truck will be connected.



Digital Display

Instrument Interface Description

Starting the Truck

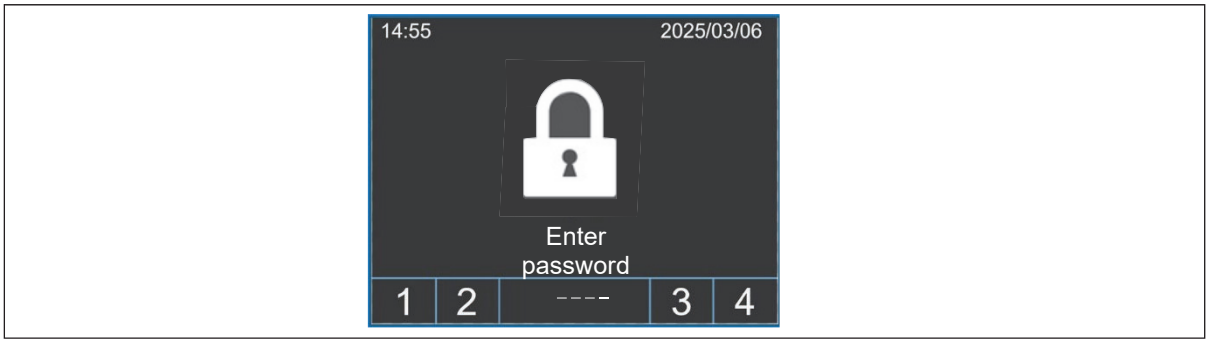
The truck can be started in 2 ways: Direct Start or Password Start

Direct Start

When the power is turned on the display enters the main menu and the truck is immediately able to be driven.

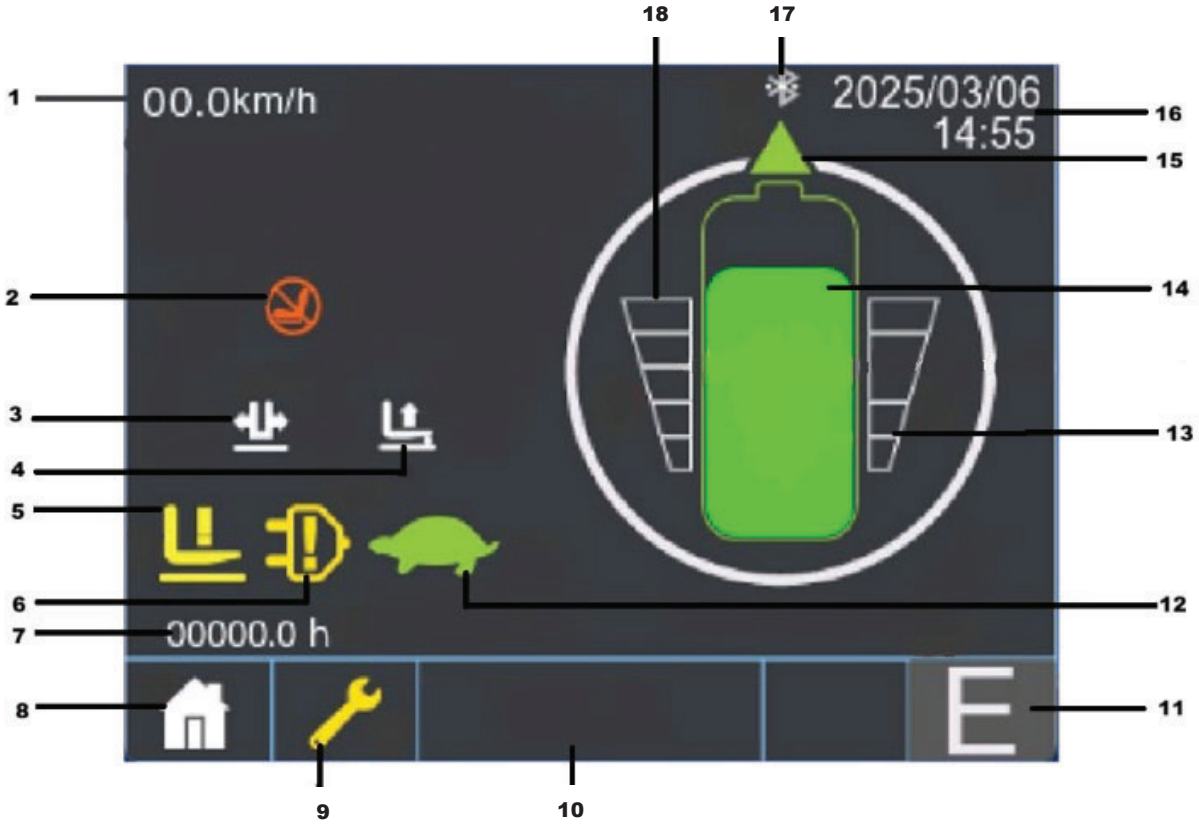
Password Start

When using password start, enter the default password (“1234”) to enter the main menu. If password is lost or forgotten please contact your local dealer.



Main Menu Interface

The main menu displays the status of the truck (pictured below).



(1) Displays the speed of the truck (unit: mph or km/h).

(2) Displays tiller interlock switch:

Tiller Interlock: illuminates if the interlock switch is not closed.

(3) Displays that the fork arms are moving left or right.

(4) Displays while the fork arms are lifting or lowering.

(5) Displays that the forks have reached the maximum lift height.

(6) Displays that the charging plug is not plugged back in (only for the built-in charger).

(7) Displays the total running time of the truck (cumulative record of operating time while the truck is powered on (unit: hours.) For maintenance cycle reference).

(8) Displays the home button, by double-clicking the No.1 key the password input interface opens (can adjust the settings, view the history, see instructions below).

(9) Displays truck fault, yellow wrench will be displayed, at this time, click the No. 2 key to enter the fault detailed explanation interface, the fault is lifted, it will go out.

(10) Displays a fault code if a fault is present.

(11) Displays driving performance mode of the truck

E: energy saving mode

S: normal mode

P: unlocks the maximum speed

(12) Displays turtle mode status. When the icon is green, it means the turtle mode is active. When the icon is yellow, it means the travel speed is lowered due to fork lift height.

(13) Visually depicts the travel speed of the truck.

(14) Visually depicts trucks lift and lowering speed.

(15) Displays the battery level of the truck.

(16) Displays the direction of travel of the truck.

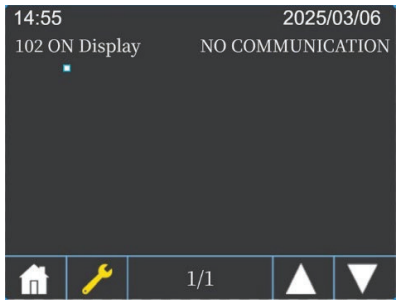
(17) Displays the current date and time.

(18) Displays when Bluetooth is connected.

Fault Code/Error Menu

If a fault code is indicated on the display (10) you can obtain a detailed explanation by double clicking on the No.2 button.

In this menu and there is more than one page, the No. 3 button will page up and the No.4 button will page down. Clicking the No. 1 button will return to the main display.



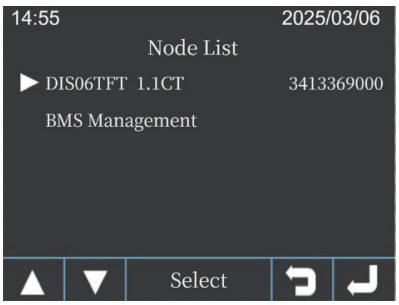
Service Menu

The service menu is accessed by double clicking the home button. To enter the service menu, enter the default password (1234). The password can be changed in this menu to enable use for other operators.

CAUTION

DO NOT ENTER THE BMS Management Menu. Altering these parameters may damage the battery. Requires manufacturer approval before any settings are changed.

In the menu pages, clicking the up button (No.1) and down button (No.2) can adjust the arrow cursor position (indicating the content of the selection). Clicking the return button (No.3 key) will return to the previous menu. Clicking the OK button (No.4) to enter the next menu level of the content. The bottom of the screen allows user to select or change.



Parameter Settings

After entering the service menu, select “DIS06TFT 1.1CT” and select “Parameter Set”.

Only the three parameters below are able be changed without consent of the manufacturer.

- Speed unit, parameter value: KM/H or MPH
- Start mode, parameter value: 0 indicates direct start, 1 indicates password start
- Key beep, parameter value: ON OFF – sound of display

Changing the Password

Upon entering the service menu, choose either:

Set Display PWD: Changes the key on operator password (can also be changed from this menu if you are in the truck is keyed on Start Mode (Key on mode).

Set Menu PWD- Service password to enter service menu

In either menu click the OK key (No. 4 key) to enter the setup. Inputting a new password twice will successfully change password. If the passwords do not match it will fail.
Failure to modify the password within 30 seconds the menu will automatically be exited

The record displays the working hours of the truck

Operator's Daily Checklist

Date_____ Model Number _____ Serial Number_____

State of Charge Level_____ Hour Meter_____

Operator _____ Department_____

ITEM	PROCEDURE	OK (√)	REMARK
Transmission and Hydraulic Systems	Check for fluid leakage.		
Forks	Check for cracks and damage and that they are properly secured. Ensure fork pins are latched.		
Cables	Check that they are in place, secured correctly, functioning properly and free of binding or damage.		
Decals	Check that warning labels, nameplate, etc., are in good condition and legible.		
Horn	Check that the horn sounds when operated.		
Steering	Check for binding or looseness in steering wheel or control arm (if equipped).		
Travel Controls	Check for binding or looseness.		
Wheels	Check the drive wheels for cracks or damage. Move truck to check for freedom of rotation.		
Hydraulic Controls	Check operation of lift /lower to the maximum positions.		
Brakes	Check that all brakes engage.		
Emergency Reverse Button/ Emergency Disconnect Plug	Check that the emergency stop switch can be disengaged and reengaged.		
Battery	Check battery charge and condition.		
Hardware	Check that all hardware (nuts/bolts) are secure and free of damage.		

NOTE: This is a sample of the minimum recommended daily inspections for operators. The table can be adjusted according to specific requirements.

WARNING

The truck should be regularly maintained by qualified maintenance engineers or technicians that have passed the training of and also been authorized by the manufacturer.

Safety Regulations for the Operation of Trucks

Operator Authorization: The truck may only be used by trained personnel who have demonstrated that they can drive, handle loads, and are authorized to operate the truck.

Operator's Rights, Obligations and Responsibilities: The operator must be informed of their duties and responsibilities, be instructed in the operation of the truck and shall be familiar with the operator manual.

Unauthorized Use of Truck: The operator is responsible for the truck during the time it is in use. Unauthorized persons should be prevented from driving or operating the truck. Do not carry passengers or lift personnel.

Damage and Faults: The supervisor must be immediately informed of any damage or faults to the truck. If the truck is not safe for operation (e.g., wheel or brake problems) it must not be used until it has been repaired.

Repairs: The operator must not perform any repairs or alterations to the truck. Repairs must only be done by an authorized, trained technician. The operator must never disable or adjust safety mechanisms or switches.

Hazardous Area: A hazardous area is defined as the area in which a person is at risk due to truck movement, lifting operations, the load handler (e.g., forks or attachments) or the load itself. This also includes areas which can be reached by falling loads or lowering operating equipment.

- Unauthorized persons must be kept away from the hazardous area.
- When there is danger to personnel, a warning (horn) must be sounded with sufficient notice.
- If unauthorized personnel are still within the hazardous area the truck shall be brought to a halt immediately.
- The truck is intended to be operated in clean, dry, flat surfaces in non-freezer or refrigerated environments.

Safety Devices and Warning Signs: Safety devices, warning signs, and warning instructions shall be strictly observed.

Travel routes and work areas: Only use lanes and routes specifically designated for truck traffic. Unauthorized parties must stay away from work areas. Loads must only be stored in places specially designated for this purpose.

Operating conduct: The operator must adapt the travel speed to workplace conditions. The truck must be driven at a slow speed when negotiating bends or narrow passageways, when passing through swing doors and at blind spots. The operator must always observe an adequate braking distance in front of the forklift truck. The operator must be in control of the truck at all times. Abrupt stopping (except in emergencies), rapid U turns and passing at blind spots are not permitted.

Nature of loads to be carried: The operator must make sure that the load is in a satisfactory condition. Only carry loads that are positioned safely and securely. Use suitable precautions to prevent parts of the load from tipping.

Truck Operation

Only operate the truck with the 24V Lithium-ion battery as supplied by the factory.

To prepare the truck for operation after delivery or transportation, the following operations must be performed:

- Check the equipment for missing parts or damage.
- Check the hydraulic oil level.
- Fully charge the battery.
- Check mast assembly for proper roller adjustment so that there isn't excessive play, mast deflection, leaning, or binding.
- Check the equipment for missing parts or damage.
- Check for fluid leakage.
- Check the brake function.
- Check the lifting and lowering function.
- Check the driving function.
- Check the steering function.
- The truck can now be put into service

NOTE

If the truck is delivered in multiple parts, setup and commissioning must only be performed by trained, authorized personnel.

Break-In Period

Operate the truck under light load conditions for the first stage of operation. The requirements below should be observed while the machine is in the first 100 hours of operation (break-in period).

- Limit load to 70～80% of the rated load.
- Avoid sudden stops, starts, or turns.
- Prevent the new battery from over discharging. Do not allow it to go below 20% state of charge.
- Perform specified preventive maintenance services carefully and completely.

Operational Temperatures

- Operational application temperatures: 32° F - 104° F, humidity ＜ 80%
- Charging application temperatures: 41° F - 104° F

WARNING

Operating the truck under extreme conditions can result in malfunctions and accidents. Special equipment and authorization are required if the truck is to be used in extreme conditions, especially in dust-laden or corrosive environments.

Wheel Flattening

When the truck is parked for long periods, the running surface of the tires will flatten. The flattening will disappear after a short period of operation.

Conditions for Operation

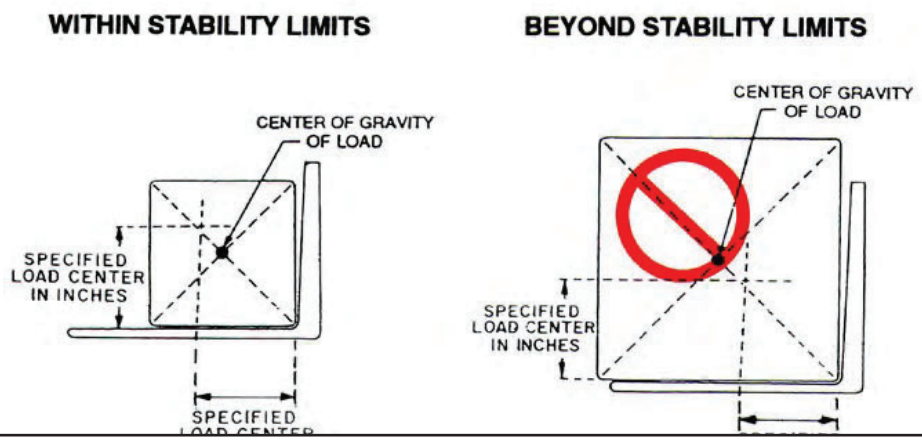
Working condition requirements:

- Only operate the truck on hard, even, and clean surfaces.
- Indoor use and outdoor use. Hard paved or concrete surfaces only.
- Do not operate in rain, drive through puddles, or store outside.
- The truck's maximum operational altitude is up to 6,560’ (2,000m).
- Do not go over specified rated load.
- Trucks should only be operated in adequately illuminated working areas to avoid injuries.

Stability

Common reasons for the loss of truck stability include:

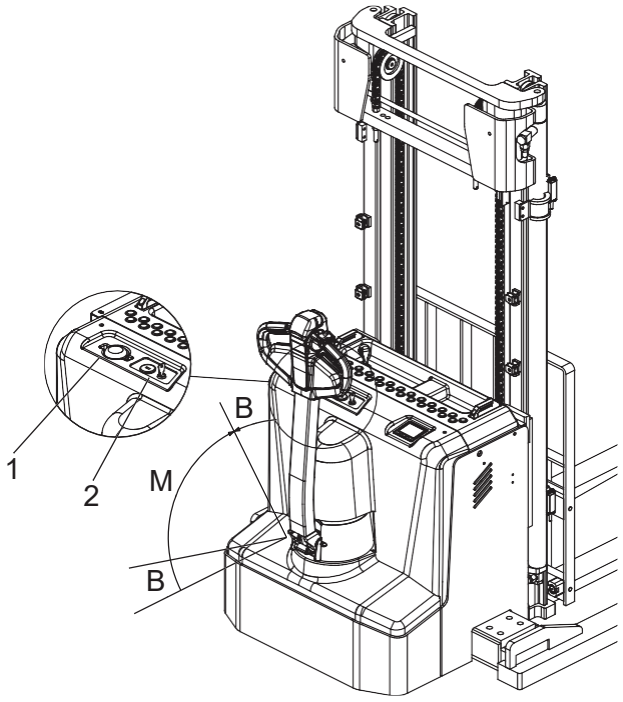
- Emergency stops or sharp turns.
- Turning the vehicle around or across a slope.
- Driving with a raised load.
- Driving up or down a slope with the load pointing downhill and not secured properly.
- Driving with a wide load.
- Driving near the edge of a ramp or up steps.
- Driving on uneven surfaces.
- Overloading the truck.
- Carrying bulky loads in strong winds.
- When carrying liquid, its center of mass inside the container may shift due to inertial force (such as when pulling away, braking, or turning).



Operating, Steering, and Braking

Starting the Truck

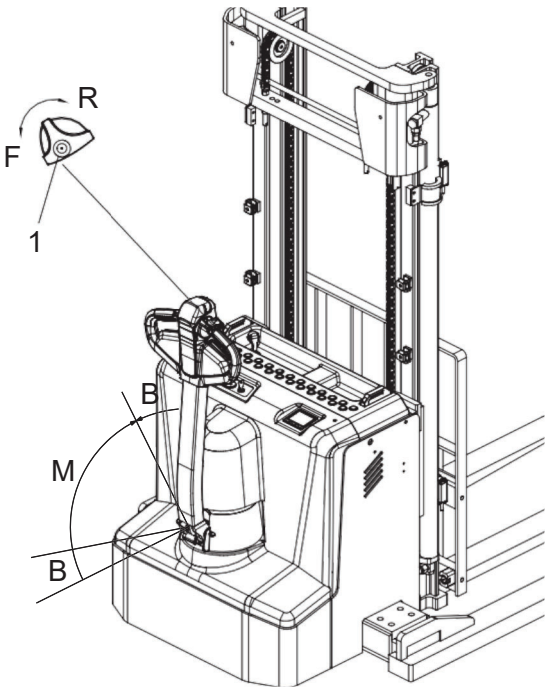
1. Release the emergency stop switch (1).
2. Turn on the key switch (2) to start the truck.



NOTE
When the tiller is in the brake position (B), the electromagnetic brake is locked, and the truck cannot be driven.

Operating

Tilt the control shaft into the running area (M) and control the running direction and speed using the drive switch (1).



NOTE
When using the truck on a ramp or uneven road, raise the mast to prevent its bottom from contacting the road surface.

NOTE
F is forward.
R is Reverse.
B is Braking area.
M is running area.

Travel Directions

Forward Travel

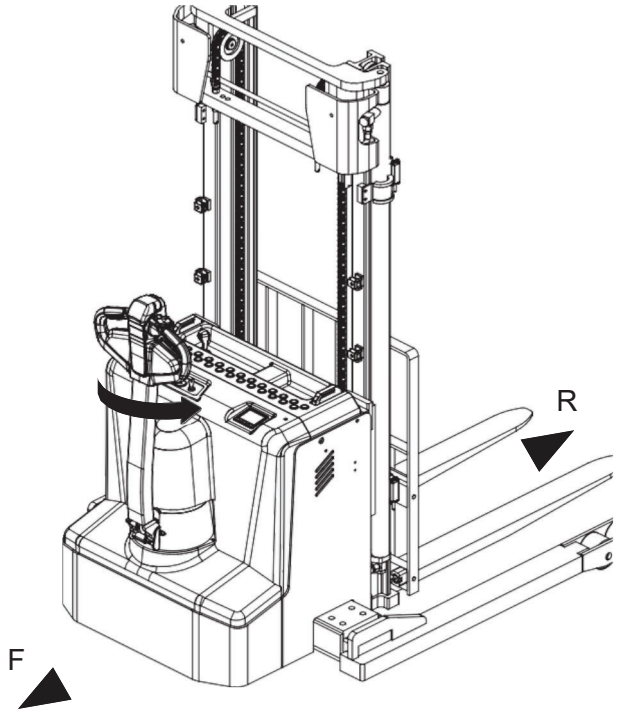
Use your thumb to press the drive switch gently and gradually increase the force in the forward (F) direction.

The truck will accelerate and move forward relative to the pressure applied to the drive switch.

Reverse Drive

Use your thumb to press the drive switch, gently and gradually increasing the force in the reverse (R) direction.

The truck will accelerate and move backwards according to the pressure applied to the drive switch.



Steering

Turn the tiller left or right according to the desired direction.

Braking

Mechanical Operating Brake

The truck brakes when the operating handle is released.

The mechanical brake engages when the tiller is positioned in the braking area.

CAUTION

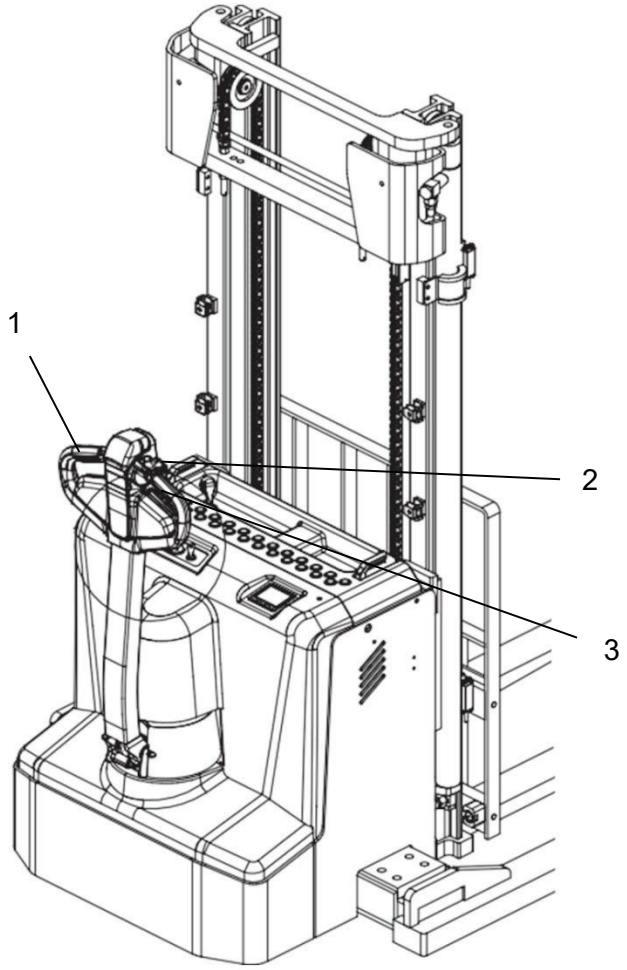
If the tiller slows down without human intervention into the braking area, identify the cause and rectify the fault. Refer to service manual.

Slow Travel

When you apply the creep speed button and keep the handle in the vertical position, the truck will travel at reduced speeds and acceleration.

Procedure

- Keeping the handle (3) in the vertical position, simultaneously press the creep speed button (1) and drive switch (2). The truck will move at a reduced speed of 20% of the maximum speed.



Emergency Stop Switch

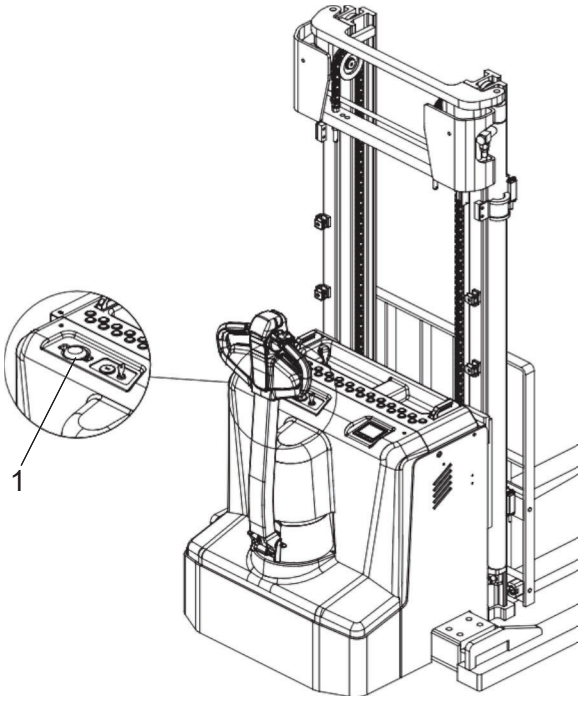
Press the emergency stop switch (1), and all electrically propelled functions will be interrupted.

Regenerative Braking

When the drive switch is released, it will automatically return to its initial position and the vehicle will enter the regenerative braking state. When it decelerates to <1 mph, the electromagnetic brake will bring the truck to a stop.

CAUTION

Rotate the drive switch. If the drive switch does not quickly return to the neutral position or resets very slowly, identify the cause, and rectify the fault.



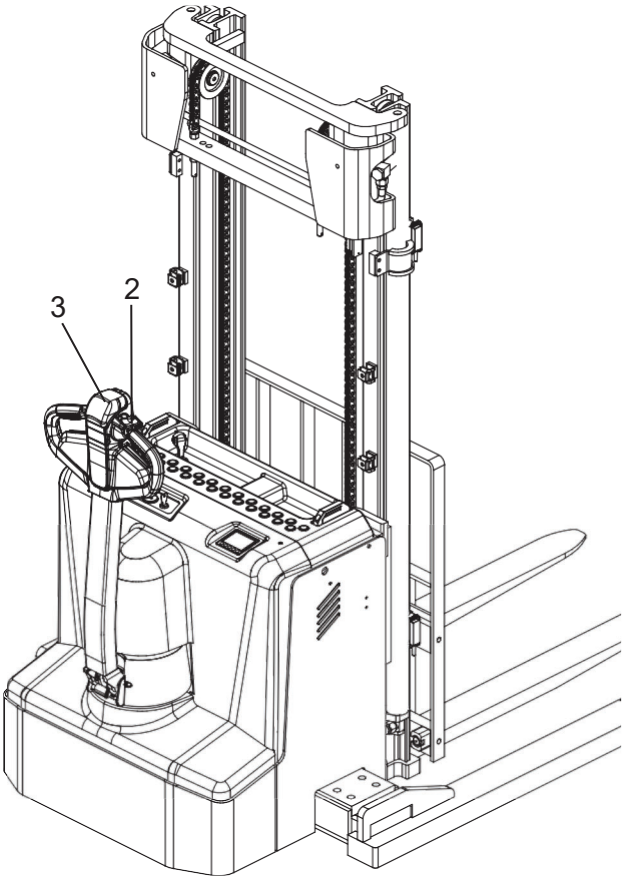
Reverse Switch (Plugging)

Braking can be accomplished by changing the direction of travel. Rotate the drive switch (2) in the opposite direction until the truck comes to a stop, then release the drive switch.

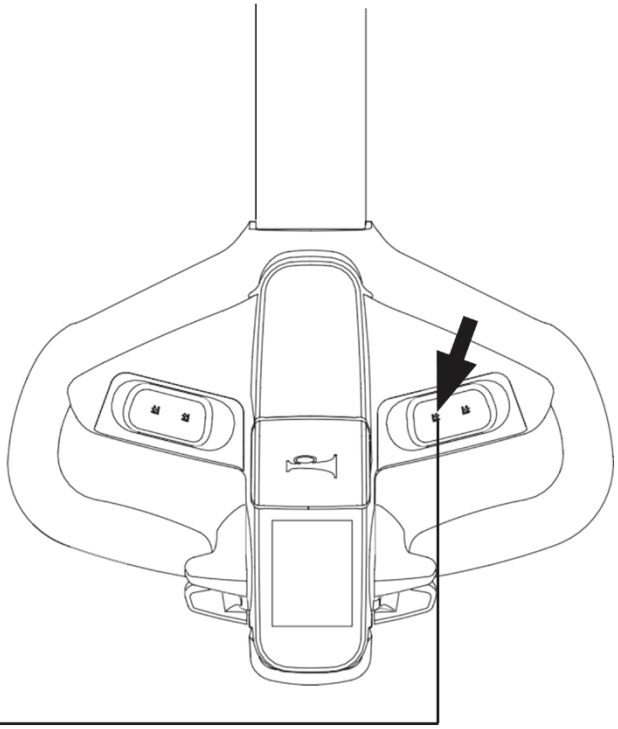
Emergency Reverse Button

To protect the driver from any risk of being trapped between an obstacle and the machine, the end of the tiller is fitted with an emergency reverse button.

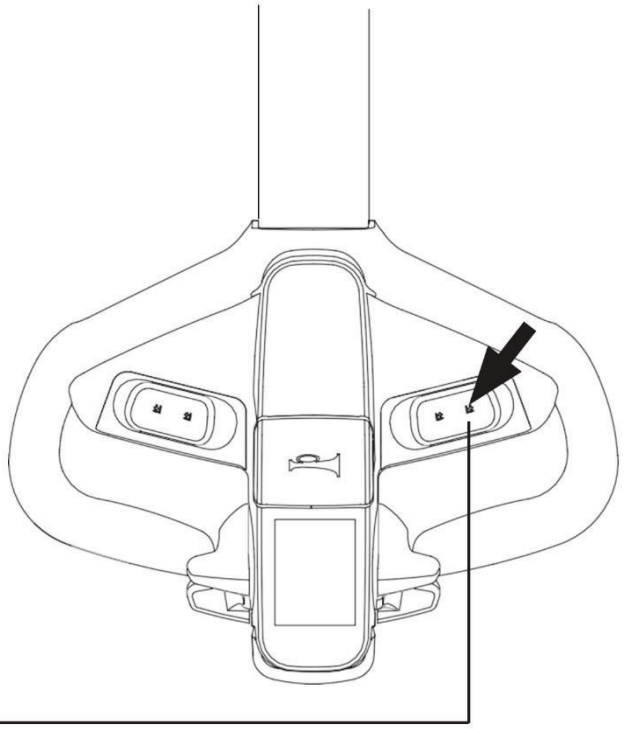
Once the emergency reverse button (3) is activated, the machine stops immediately and slowly moves backwards in the direction of the forks.



Lifting and Lowering



To raise the truck, push the lifting button until you reach the desired height.



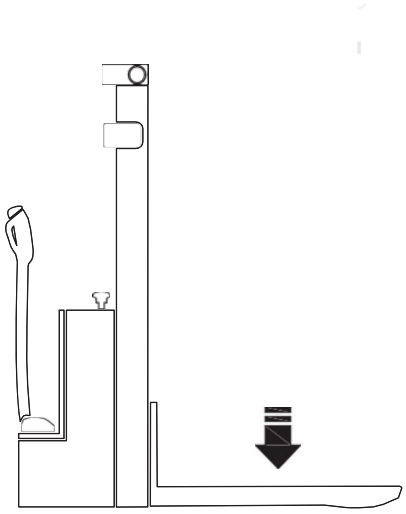
To lower the truck, push the lower button until you reach the desired height.

WARNING

Secure goods to prevent loads shifting or falling.

Parking the Truck Securely

1. Lower the mast to the ground.
2. Turn off the key switch.
3. Push the emergency stop switch.



CAUTION

Park the truck on a level surface. The truck may need to be secured with wedges to prevent movement.

WARNING

Do not park on a slope.

Loading

Before lifting a load, ensure that its weight does not exceed the truck's maximum load capacity.

1. Refer to the rated load capacity specified on the truck's nameplate.
2. Ensure that the load is stable and uniform to prevent any spillage.
3. Check that the width of the load is compatible with the width of the forks.

CAUTION

Personal protective equipment should be worn when necessary.

CAUTION

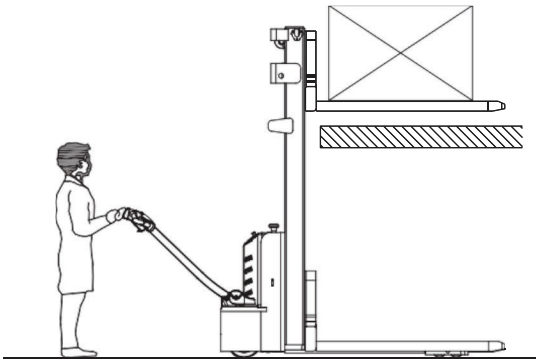
Do not touch nearby loads or loads positioned at the side or in front of the load being handled. Arrange the loads with a small space between them to prevent them coming into contact with one another.

Picking Up a Load

1. Approach goods carefully when driving the truck.
2. Lower the forks so that they can easily be inserted into the pallet.
3. Insert the forks below the pallet.
4. If the load is shorter than the forks, position the forks so that the front of the load overhangs them by a few inches to avoid interference with the load immediately ahead.
5. Raise the load a few inches above its support.
6. Back the truck away from the stack or any neighboring loads, gently and in a straight line.

Stacking a Load

1. Carefully drive the machine to the required location.
2. Raise the forks clearly above the level where the load is to be placed.
3. Drive the truck towards racking. Position the load where desired.
4. Lower the load until the fork arms are free. Move the forks straight back.
5. Lower the forks again until they are a few inches from the ground.

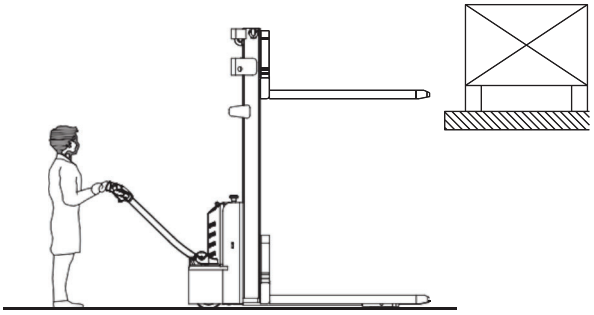


DANGER

Personnel must not stand under or near the truck when the load is in the raised position.

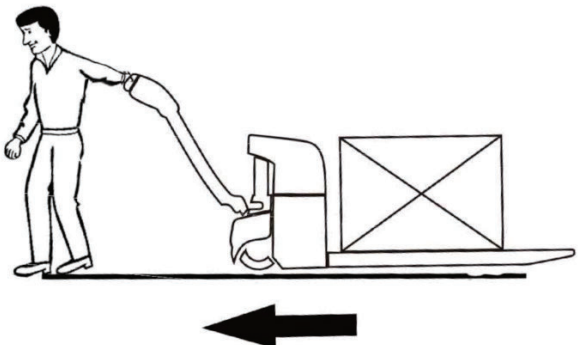
Picking Up a Load at Height

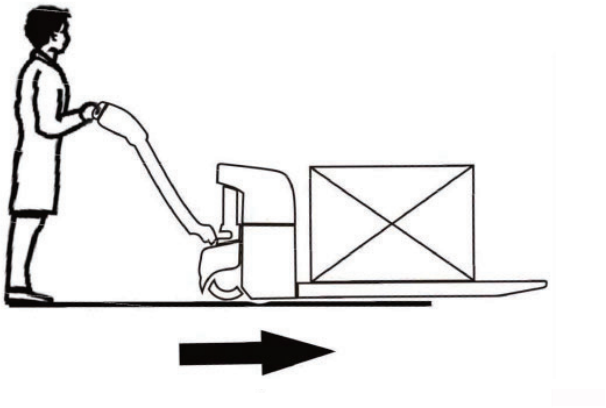
1. Carefully drive the machine to the required location.
2. Raise the forks to the height of the pallet.
3. Carefully move the forks forward under the pallet.
4. Lift the forks until the pallet moves away from the racking.
5. Reverse the truck to free the pallet.
6. Lower the goods again until they are a few centimeters away from the ground.



Carrying a Load

When traveling forward the operator should walk in front of the truck and off to the side. Use one hand to hold the handle and operate the drive switch with thumb. When operating in reverse, hold the control handle with two hands and operate the travel switch with thumb.





Reverse

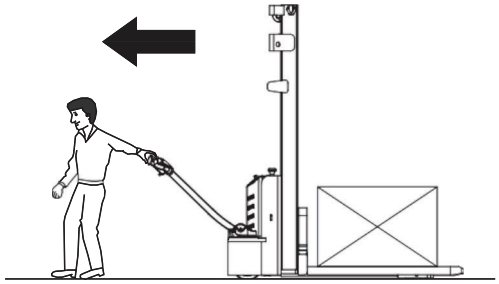
DANGER

Personnel must not stand under or near the mast when the load is in the raised position.

DANGER

Never transport a load with the forks in the raised position as the equipment may become unstable.

- Drive forward for optimum visibility. Drive in reverse only when depositing a load.
- Never travel diagonally across the slope or make a U-turn.
- Drive in reverse only when depositing a load. Since visibility in this direction is restricted, travel at low speed.
- Never drive with an unstable load.
- If visibility is poor, let someone guide you.
- Be careful of low passageways, low doorways, scaffolding, pipes etc.
- Check that the width of the load is less than the width of the aisle.



Unloading

1. Carefully move the load into the destination area.
2. Lower the load until the fork arms are not touching the load.
3. Move the forks straight back until free of the load.
4. Lift the forks a few inches.

CAUTION

Be careful not to come in contact with nearby objects.

CAUTION

Personnel must not stand under or near a truck when the load is in the raised position.

Using the Truck on a Slope

Incorrect use of the truck on slopes places stress on the traction motor, brakes, battery, and can cause personal injury.

CAUTION

Never attempt a slope with a gradient greater than the listed gradeability specifications of the truck. Make sure that the ground is dry with a nonslip surface and the route is clear.

Ascending and Descending Slopes

DANGER

- Traveling up or down slopes must always be with the operator uphill from the load.
- Use special care while operating on ramps.
- Prepare load properly to prevent load slippage.
- Travel at a low speed and brake gradually.
- Never park the truck on a slope.
- Never make a U-turn or take shortcuts on a slope.

Starting on a Slope

If you must stop and then start on slope, proceed as follows:

- Stop on the slope by pressing the accelerator in the opposite direction until the machine comes to a standstill.
- Return the accelerator to the neutral position, then release the accelerator control button to apply the parking brake.
- To restart, press the accelerator button for the desired direction.
- The truck will move.

Moving the Truck Without Power

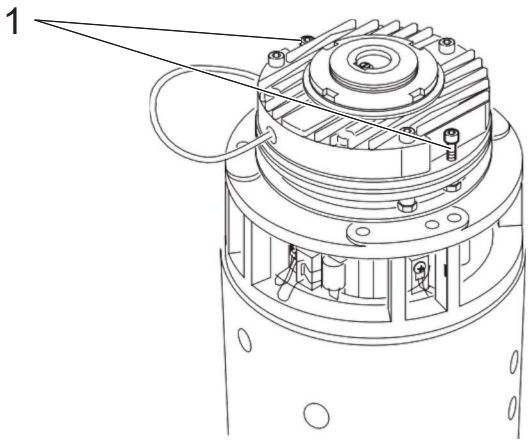
CAUTION

The power must be ON when moving an inoperative truck to prevent damage to the truck controller.

If the truck must be moved after it is rendered immobile, proceed as follows:

1. Press the emergency stop switch.
2. Disconnect power supply.
3. Set the key switch “OFF” and remove the key.
4. Prevent the truck from moving, use wheel chocks if necessary.
5. Remove the upper cover.
6. Tighten two screws (1) until the truck can be moved (no braking action).
7. Set the emergency stop switch “ON”.
8. Turn the key switch “ON”.
9. After reaching the truck’s destination, unscrew two screws (1).

Braking action is restored.



WARNING

Moving the truck without power is not recommended on inclines and gradients.

Hoisting

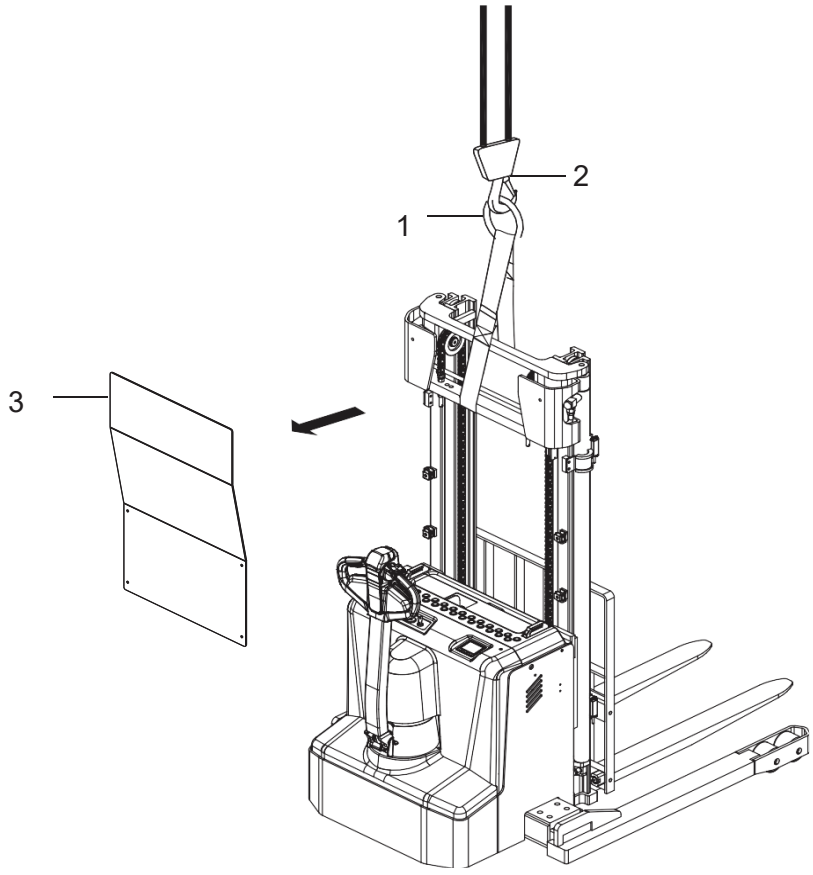
1. Remove the glass (3) before hoisting the stacker.
2. Disconnect the power supply.
3. Loop the lifting straps around the outer mast of the lift mast as shown.
4. Hang all sling ends (1) on the lifting hook (2) of the hoist.

DANGER

- Personnel must not stand below or near the truck when it is being lifted.
- When hoisting, the truck should be moved slowly to avoid contact with other objects.
- Do not sling the truck by the tiller.

CAUTION

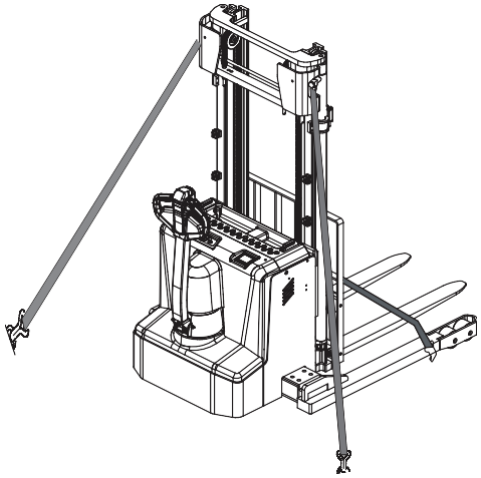
- After hanging the sling on the lifting hook, the safety lock must be fastened.
- Only use lifting gear with sufficient capacity.
  (Weight lifted = net weight + battery weight; see truck nameplate)

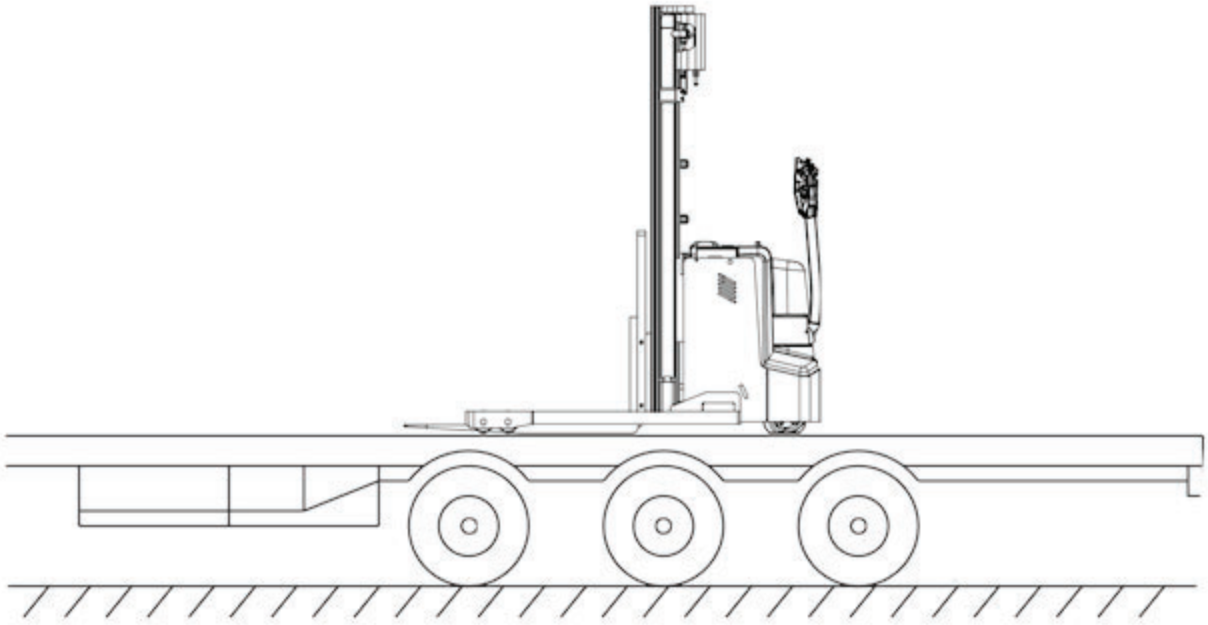


Transporting a Truck

Secure the forklift truck to avoid movement when transporting.

- Park the truck securely.
- Lower the forks to the lowest position.
- Pass the tensioner through the inner and outer masts and secure the masts and fork arms to the upper fixing points of the truck, as shown below.





NOTE

The stacker should be loaded and unloaded by specially trained personnel. Effective measures must be taken based on the specific situation to ensure the correctness and safety of measurement and loading/unloading operations.

Battery Use and Maintenance

Battery Type, Dimensions, and Charging Time

Battery types & dimensions are as follows:

Truck Type	Voltage/ Rated Capacity	Dimension	Charger	Charging Time
BGS25-LI	24V/100Ah	450×130×500	30A	3.5h
BGS30-LI/BGS40-LI	24V/205Ah Li or 24V/200Ah AGM	550×190×500	30A	7h

Battery Charging

Precautions

- Avoid the existence of any metal object on the surface of the lithium-ion battery.
- Do not pierce the battery case with nails or other sharp objects.
- Do not short-circuit the battery with wires or other metal objects!
- The plug connection parts should be inspected in terms of obvious damage before charging.
- Fire-fighting equipment must be kept in the charging place.
- Before charging, check cable connections for damage.
- Do not use irregular charging sockets.
- The net height of the charging area shall be higher than 16.5’ (5m), and the safe distance from other areas shall be greater than 16.5’ (5m). Charging in non-charging area is prohibited.
- No inflammable substances or spark-generating materials being present or stored within a
- distance of 2 meters of the truck parked for battery charging.
- No smoking or open fire around when charging.
- When charging, do not wrongly connect the battery polarity, otherwise it may damage the battery.
- Please charge the lithium-ion battery at an ambient temperature of 0℃ to 40℃. Do not charge the lithium battery below 0℃.
- The safety provisions related to the lithium-ion battery and the manufacturer of charging station must be strictly abode by.

NOTE
Workplace regulations must be observed (emergency exits, escape routes, traffic routes) must be kept clear.

Intermediate Charging

Lithium-ion battery systems offer the advantage that they can be recharged temporarily, allowing industrial trucks to be charged at any time. As a result, shorter charging times can usually be achieved and charging with higher currents is also possible.

Integrated Charger

- The integrated charger, consisting of battery charger and battery controller and must not be opened. In case of malfunctions, the customer service or the manufacturer's customer service must be notified.
- The charger may only be used for the batteries supplied by the manufacturer.
- The battery must not be connected to two chargers at the same time.
- The mains connection may vary depending on the size of the integrated charger.
- Observe the correct voltage and amperage when using.

DANGER

- Damaged and unsuitable cables can lead to electric shock and fire. Only use main cables with a maximum cable length of 10’ (3m).
- Unroll the cable reel completely when in use.
- Only use original cables from the manufacturer.
- Insulation protection classes and resistance to acids and alkalis must correspond to the manufacturer's mains cable.

NOTE

Depending on the truck model and battery type, the battery is permanently connected to the truck and the battery plug should not need to be disconnected.

The flashing LED indicates the charge status or a fault.

Charging Indicator

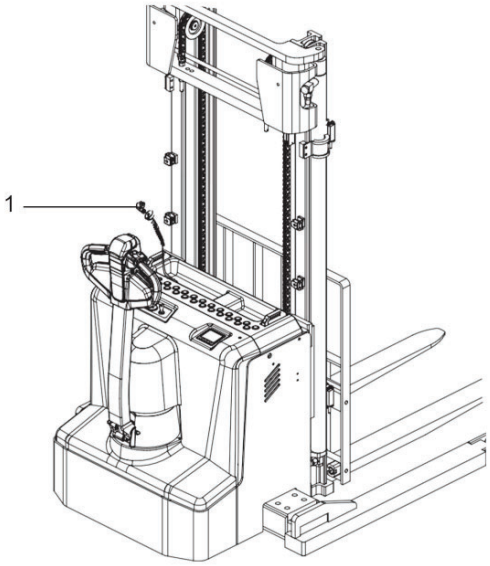
NO.	LED status	Cause	Description
1	Red light is on	Trouble free	Charging
2	Green light is on	Trouble free	End of charging
3	Yellow light is on	Battery fault	/
4	Yellow light flashes	Charger fault	/

WARNING

Recharge the battery observing the instructions provided by the battery & charger suppliers.

Charging the Battery with an Integrated Charger

1. Park the truck in the designated charging area.
2. Pull the charger plug (1) from the truck and examine it for damage. If undamaged, plug the charger into voltage range 100- 265V, 50/60Hz wall outlet.
3. When the integrated charger is connected to the outlet, the truck should not be moved.



WARNING

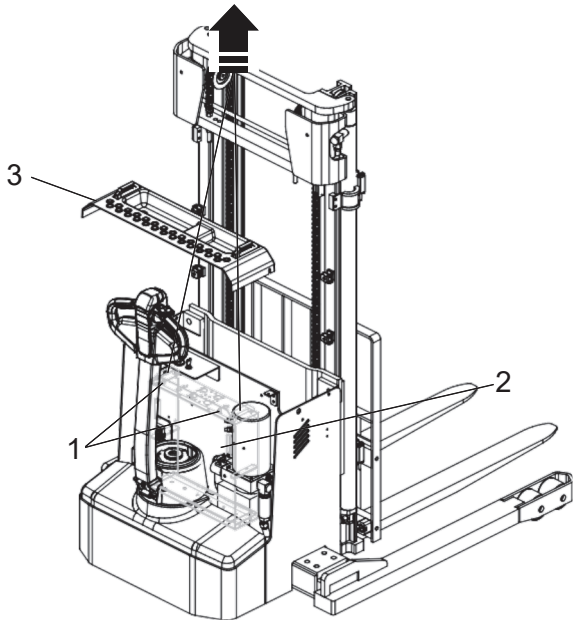
Charger maximum input power 1000W. Do not exceed to prevent equipment damage and accidental risks such as fire.

Battery Removal and Installation

Park the truck securely and turn off the power before removal and installation of the battery.

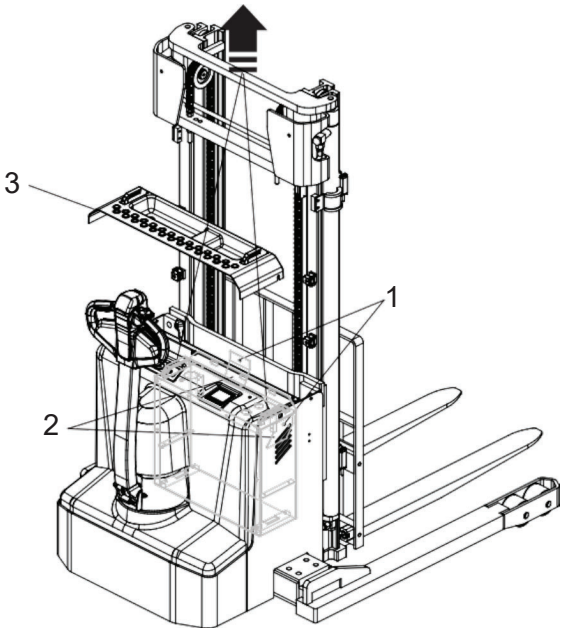
1. Remove the cover.
2. Remove the battery panel (3) and expose the battery (2).
3. Unscrew the two screws (1).
4. Disconnect the integrated charger harness and take out the charger with the base.
5. Lift the battery to desired height with a hoist, ensure that the hoist is of adequate capacity.

Install in the reverse order.



WARNING

The lifting gear must exert a vertical pull so that the battery container is not compressed. The hooks must be attached to the eyes.



WARNING

To prevent short circuits, batteries with exposed terminals or connectors must be covered with a rubber cover.

Maintenance

- Trucks must only be serviced and maintained by trained personnel.
- Regular maintenance is required to maintain reliable operation of the truck. Neglecting regular maintenance could easily lead to malfunction and failure, which may result in staff/operational safety issues. There must be an adequate maintenance plan in place.
- Regular checks and maintenance should be conducted to braking, steering, fork lifting assembly, control, warning, and safety devices to keep them in good condition.
- Any modification to the truck’s safety mechanisms or operational speeds is prohibited.
- Use only the manufacturer's spare parts.
- Used parts, oils and fuels must be disposed of in accordance with the relevant environmental protection regulations. For oil changes refer to the Service Manual.

Cleaning

- Do not use liquids to clean the truck.
- Prior to cleaning, all safety measures must be observed to prevent sparks (e.g., through short circuits). For battery-operated trucks, the battery connector must be removed.
- Only light suction, compressed air (at less than 30 psi), or non-conductive antistatic brushes may be used for cleaning electric or electronic assemblies.
- Do not clean with pressurized water.

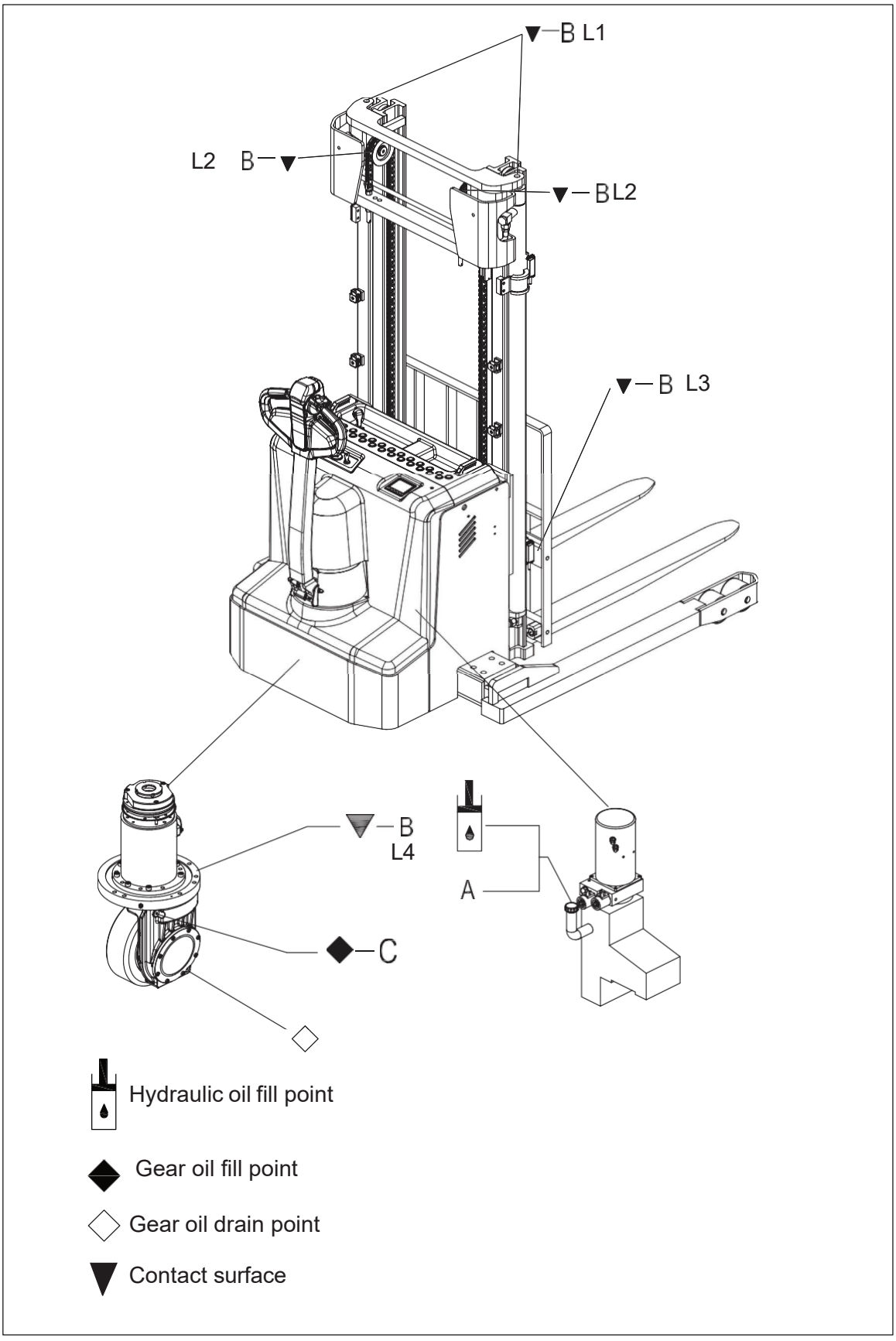
Electrical System

Only suitably trained personnel may perform maintenance on the truck’s electrical system. Refer to the Service Manual for additional information.

Retirement/Disposal

Proper disposal of the truck must be performed in accordance with the regulations of the country of application. Regulations governing the disposal of batteries, fuels and electronic and electrical systems must be observed.

Lubrication Points



Lubricants				
Code	**Type**	**Specification**	**Amount**	**Position**
A	Anti-wear hydraulic oil	L-HM32	5~7 L (See Table 1)	Hydraulic Unit
	Low temperature anti-wear hydraulic oil (cold storage)	L-HV32		
B	Multi-purpose grease	Polylub GA352P	Appropriate amount	Contact surface (See Table 2)
	Chain spray	/	Appropriate amount	Chains
C	Heavy duty gear oil	GL-80W-90(GL-5)	1.38 L	Gearbox

Table 1

Mast	Lifting Height (mm)	Quantity (L)
Duplex	2500	5
	2700	5.2
	3000	5.5
	3200	5.8
	3600	6.1
	3900	6.3
Triplex Full Free lift	4000	6.4
	4500	6.5
	4800	6.6
	5000	6.7
	5500	7

Table 2 Contact Surface Lubrication Table

Code	Position
L1	Mast Steel channel and rollers
L2	Chains
L3	Drive Wheel gear
L4	Fork carriage

Lithium-Ion Battery Information

NOTE: For comprehensive information on the Lithium-Ion Battery, reference the corresponding service manual.

WARNING: Damaged Li-ion batteries have the potential to leak electrolytes, so it's important to wear proper personal protective equipment (PPE) (goggles, gloves, apron, etc.) during handling.

WARNING: If a lithium-ion battery fire occurs, use a carbon dioxide (CO2) (Class BC) or dry chemical (Class ABC) fire extinguisher. Lithium-ion batteries have very little actual lithium metal in the battery; thus, a Class D fire extinguisher is not required.

Intended Use:

- Discharge/Operational application temperatures: 32° F - 104° F
- Charging application temperatures: 41° F - 104° F.
- Humidity < 80%.
- The battery's maximum operation altitude is up to 6500ft (2000m).

NOTE:

- A high-rate recharging operation below 0°C may lead to battery damage, so the recommended charging temperature range is 41° F - 104° F.
- The discharging temperature range can be used in more extreme temperature conditions as follows -4° F - 131° F however, this isn't the recommended range for optimal life which is identified above. Also, the truck may not be rated for those extreme conditions or extended durations in a cold operating environment as that is truck and option dependent.
    - If used at low temperatures -4° F - 32° F, battery discharge capacity will be smaller compared with one in normal temperature conditions.
    - A battery used between 104° F - 131° F will accelerate the aging of the internal material which may shorten the service life of the battery, so is not recommended.

Battery Handling

Improper handling can cause damage to batteries, which may lead to overheating, fires, or explosions. Here are some tips for proper Li-ion battery handling:

- Remove batteries from devices that will not be used for an extended time.
- Keep batteries away from electromagnetic sources.
- Keep batteries intact.
- Do not use batteries that show any signs of damage, they must be isolated.
- Do not modify the battery in any way.

Li-Ion Battery Storage

Proper storage prevents damage to batteries and prolongs their life expectancy. Follow these battery storage tips:

- Store in dry, well-ventilated areas
- Store in temperatures between 32º F and 104ºF
- Store away from direct sunlight and heat sources
- Keep terminals covered when the battery is not in use
- Prevent terminals from touching each other
- Store separately from other types of batteries
- Keep the battery charged and do not store it for an extended period with a low state of charge (SOC) < 20%. It is recommended to maintain a charge level of 50% or greater.
- For long-term storage, the Li battery must be recharged every 2-3 months regardless of the SOC level. If a battery is stored longer than six months without charging, the cell may be damaged due to over-discharge. This can cause the cell to bulge and break the battery enclosure.

IMPORTANT: Monitor battery condition when in use and storage.

Damaged/Leaking Battery Handling/Clean-Up

1. Put on personal protective equipment, such as gloves, goggles/safety glasses and lab coat.
2. Isolate and ventilate the area.
3. Keep an appropriate fire extinguisher within reach.
4. If batteries are showing evidence of overheating, use extreme care. Gases can be toxic and flammable.
5. Disconnect the battery (if possible).
6. Remove the battery from the equipment/device (if possible).
7. Use inert, non-cellulose absorbents to clean up spilled electrolyte.
8. DO NOT use water to clean electrolyte leakage.
9. Place used absorbents and PPE in a sealed bag and contact your environmental/recycling or shipping company for proper disposal of the battery and absorbents.
10. **DO NOT** place damaged batteries in the regular trash or recycling containers.
11. For safe storage while awaiting proper disposal, place the battery in a container of sand or another chemically inert cushioning material like vermiculite.
12. Place the battery container away from combustibles.
13. Contact the local fire department and ask for advice on how to proceed.

Troubleshooting

If the fault cannot be rectified after carrying out the remedial procedure, notify the manufacturer's
service department, as any further troubleshooting can only be performed by specially trained and qualified service personnel.

Fault	Probable Cause	Action
Truck does not start.	• Battery connector not plugged in • Key switch in "0" position • Battery charge too low • Faulty fuse • Truck in charge mode	• Check the battery connector and connect if necessary. • Set key switch to "I" • Check battery charge, charge battery if necessary • Check fuses. • Interrupt charging
Load cannot be lifted	• Charging capacity below 15% • Truck not operational • Hydraulic oil level too low	• Charging the battery • Carry out all measures listed under "Truck does not start" • Check the hydraulic oil level

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