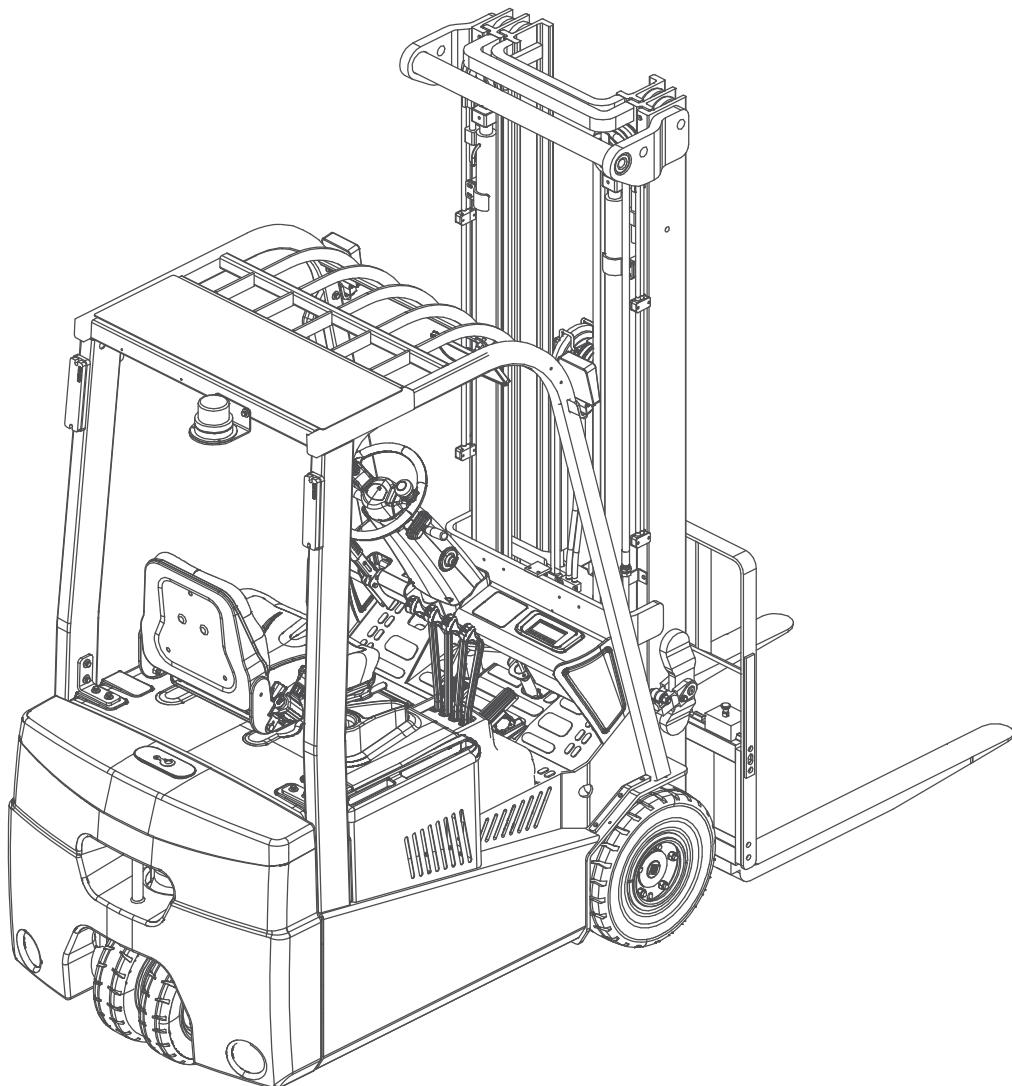




Service Manual

LVE35

Electric Forklift Truck



Big Joe Forklifts (Big Lift LLC)

2777 Finley Rd., Suite 16

Downers Grove, IL 60515

(630)916-2600

For Parts and Technical Support

www.bigjoesupport.com



FOREWORD

This Service Manual can help readers learn more about the truck system components, maintenance, troubleshooting, and other related information. Maintenance personnel must read this manual carefully before working on the product.

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

Safety 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 safety instructions to avoid personal injury or major damage to equipment.



CAUTION

Pay attention to the safety instructions.



NOTE

Pay attention to the instructions.

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

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NOTE:



WARNING

- Do not operate this truck unless authorized and trained to do so and have read all warnings and 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 if 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 truck only from designated operating position.
- 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.
- Keep hands, feet, and all body parts inside of the operator's compartment. 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. Do not tilt forward when elevated except when picking up or depositing a load.
- Elevate forks only to pick up a load. Lift and lower with mast vertical or slightly tilted back, never forward. 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 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 and tilted back. Always look in direction of travel. Keep a clear view. When the load interferes with visibility, travel with the load trailing.
- Do not handle loads that are taller than the load backrest unless secured to prevent falling.
- Do not expose truck or battery to water as there is no ingress protection.

1. INFORMATION & SPECIFICATIONS

1

NOTE:

INFORMATION & SPECIFICATIONS

1.1 After-sales Service Platform

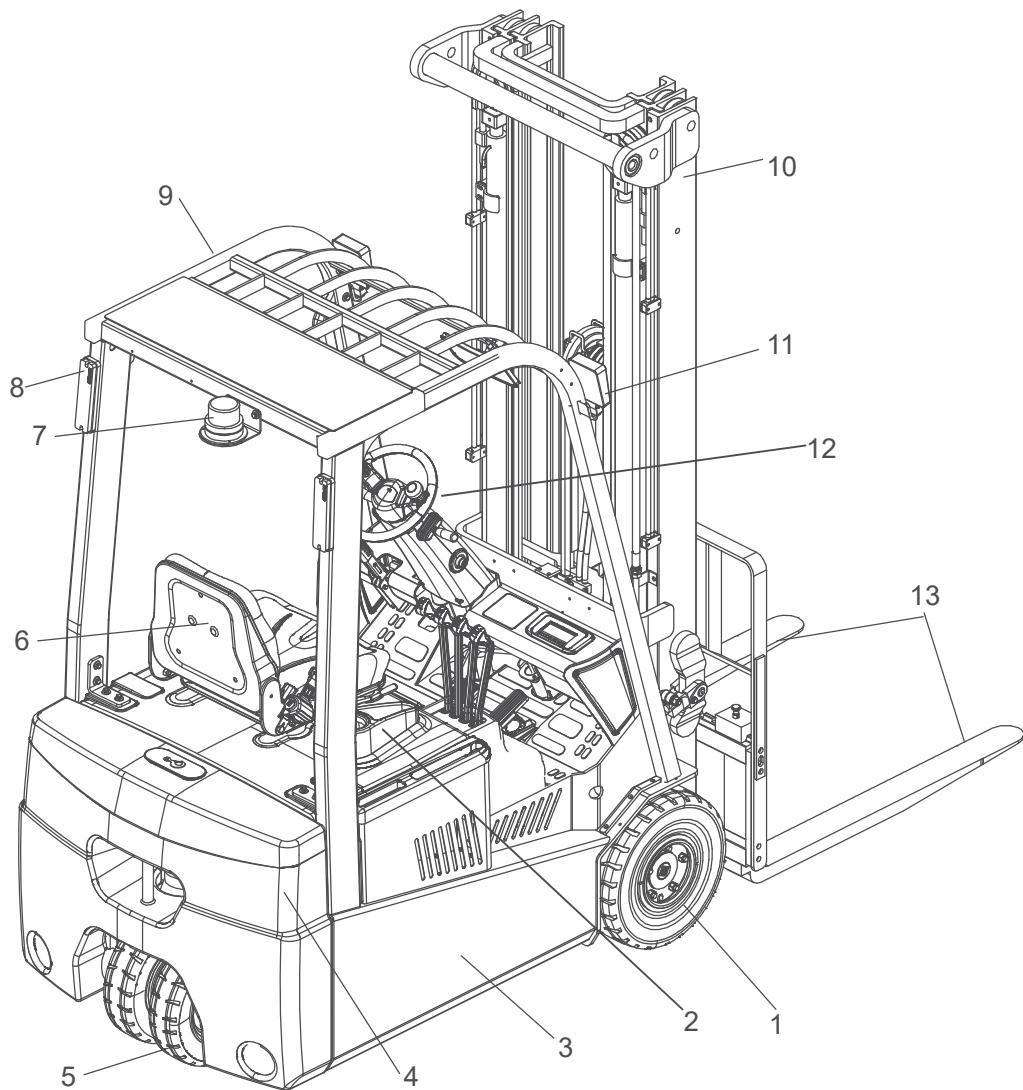
In order to provide you with a fast and efficient after-sales service, when you claim / order spare parts or after-sales service upon maintenance, please provide accurate truck model, truck body serial number and part number.

1

INFORMATION & SPECIFICATIONS

1.2 Introduction

1

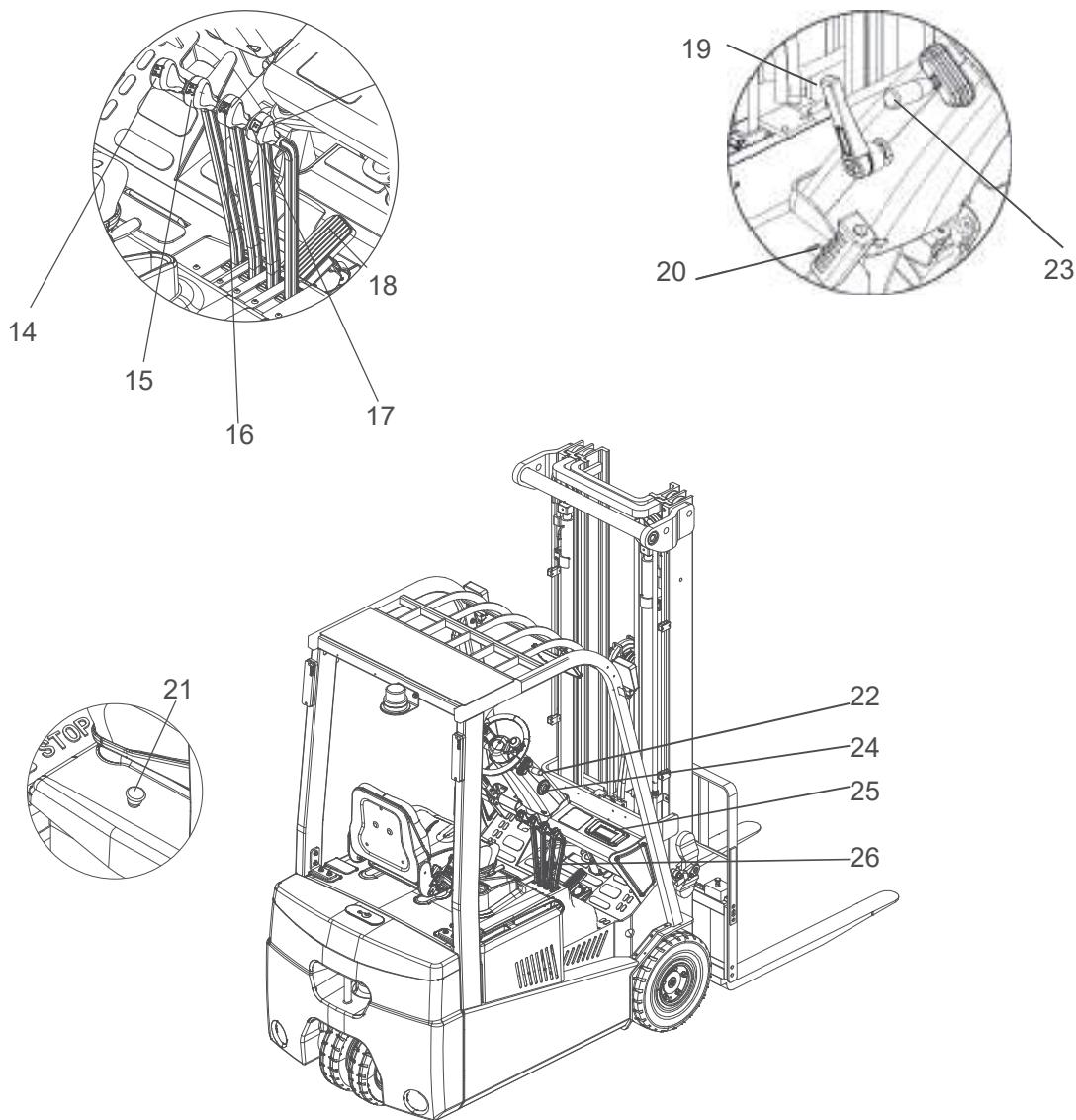


1	Drive wheel
2	Tool tray
3	Chassis
4	Counterweight
5	Steer wheels
6	Driver's seat
7	Caution light

8	Rear combination light
9	Overhead guard
10	Mast
11	Headlight
12	Steering wheel
13	Forks

INFORMATION & SPECIFICATIONS

1



14	Lifting/Lowering lever	23	Drive switch
15	Tilting lever	24	Key switch
16	Side shifter	25	Display
17	Attachment lever	26	Brake pedal
18	Accelerator pedal		
19	Steering column tilt adjuster		
20	Parking brake lever		
21	Emergency stop switch		
22	Combination lamp switch		

INFORMATION & SPECIFICATIONS

1



WARNING

- Refer to the nameplate for rated load capacity of the truck.
- The truck can only be used indoors, never use it on mezzanine or balcony area.



WARNING

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

1.3 Common Tools

Name	Remark
Hex Head Socket Wrench	8#~27#
Phillips Screwdriver	2#
Slotted Screwdriver	2#
Socket Wrench Set	
Circlip Pliers	One for holes and one for shaft
Hammer	
Spreader and Crane	Used to lift the forklift
Cylinder Wrenches	For removal and installation of cylinders
Diagonal Pliers	
Cylinder Pliers	
Grease Dispenser	
Wrenches	22# ~ 27#

INFORMATION & SPECIFICATIONS

1.4 General Tightening Torques

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

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

1

Table 1.4.1 Screws/Bolts Performance Levels

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



CAUTION

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

INFORMATION & SPECIFICATIONS

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

2. MAINTENANCE

2

NOTE:

2.1 Overview

Performing 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 the service representative of the vendor.

Working conditions:

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



NOTE

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

2



WARNING

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



CAUTION

It is strictly forbidden to make modifications to the truck without written permission from the manufacturer. It is strictly forbidden to change the various working speeds of the truck.

MAINTENANCE

2

2.2 Maintenance

2.2.1 Cleaning

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

Regular inspection and maintenance under harsh conditions of use:

Under harsh working conditions, especially:

- Dusty environment
- Corrosive environment
- Cold storage environment

The maintenance intervals should be shortened by half.

Refer to the Service Manual for a daily checklist.

2.2.2 Inspection

Regular inspection and maintenance under normal conditions of use:

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



CAUTION

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

Table 2.1 Inspection & Maintenance List

Interval in days/months/years	7 d	60 d	90 d	6 m	1y
Interval in hours	50	250	500	1000	2000
Functions and Control					
Check the functions of the operation switches and display	A				
Check alarm system functions	A				
Check parking brake functions	A				
Check the emergency switch functions	A				
Check the steering wheel functions	A				
Check the cables for damage and if the terminals are secure		A			
Check the seat switch functions	A				
Check and tighten the controllers and contactors					A
Check accelerator pedal functions	A				
Check fault information records and operating hours				A	
Power Supply & Drive System					
Check the battery cables for damage and replace if necessary				A	
Check the battery charge connector				A	
Check if the cable connections between battery monomers are secure, apply some grease to electrodes if necessary				A	
Check battery temperature				A	
Check and tighten motor mounting bolts					A
Check the connections of motor connectors					A

A = Check / Adjust

Please 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.

MAINTENANCE

Table 2.1 Inspection & Maintenance List (Continued)

Interval in days/months/years	7 d	60 d	90 d	6 m	1y
Interval in hours	50	250	500	1000	2000
Power Supply & Drive System					
Check the position of various bearings for noise				A	
Replace the gear oil	Replace once every 1000 hours				
Check the gearbox for abnormal noise or leaks				A	
Check the drive wheel and steer wheel for worn or damage	A				
Check and lubricate the wheel bearings				A / L	
Check the travel speed					A
Frame and installation					
Mast and tilt cylinders, Check fastening.			A		
Check the counterweight, motors, chassis, speed reduction gearbox, overhead guard and steering axle fastenings.			A		
Check and lubricate the other pins and swivel points.			A		
Check the chassis for cracks or damages					A
Operating devices					
Checking and lubricating the pedal mechanisms			A		
Check the horn for correct function.			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 connections of pump motor connectors					A
Check and tighten pump motor mounting bolts					A
Check gear pump has abnormal sound				A	
Check the gear pump mounting and check for leaks				A	
Check the cylinders for leaks				A	
Check the cylinders for damages and check the mounting					A
Check the oil tank mounting and check for leaks					A
Check the hydraulic oil level				A	

MAINTENANCE

Hydraulic System					
Replace the hydraulic oil	Replace once every 2000 hours				
Check and clean oil tank air filter				A	
Replace the oil tank air filter and filter					A
Check the relief pressure					A
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
Braking System					
Check the braking functions	A				
Check the brake fluid level				A	
Test the release of emergency stop switch	A				
Test parking brake is normal	A				
Check the brake pump and piping connections for leaks				A	
Check the release of brake pedal is normal				A	
Check the braking distance of brake					A
Mast System					
Check the mast for damages					A
Clean and lubricate the rolling surface of lift mast column with grease		A / L			
Check and lubricate mast rollers			A / L		
Check the mounting of lift mast				A	
Check the tubing on mast for connections and leaks			A		
Check the side shifter functions	A				
Check and lubricate the chains			A / L		
Check the lifting chains and chain guides for wear, adjust and grease				A	
Check the fork carriages for wear and damage				A	
Visual inspection of rollers, sliders and stoppers				A	
Check the lifting and lowering speed					A
Other					
Check if the signs are clear and complete				A	
Check the chassis for cracks or damages					A

MAINTENANCE

Table 2.1 Inspection & Maintenance List (Continued)

Interval in days/months/years	7 d	60 d	90 d	6 m	1y
Interval in hours	50	250	500	1000	2000
Other					
Check the connections of bolts and nuts			A		
Check the seat fixation and adjustment functions					A
Check the seat belt and functions	A				
Check the overhead guard and cabin					A
Checking covering parts for damages					A
Check if the optional features are functioning properly	A				

A = Check / Adjust

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

L = Lubrication

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

2.2.3 Lubrication

Lubricant

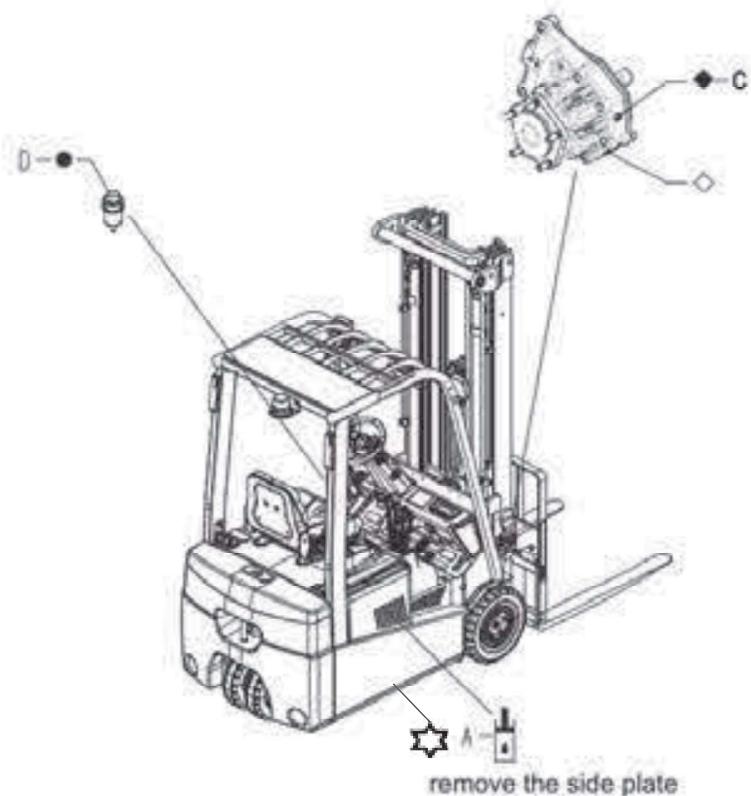
- Improper operations may constitute hazards to the operator's health and life, as well as to the surrounding environment.
- When storing or adding lubricant, use clean containers. It is strictly forbidden to mix different types and specifications of lubricants with each other (except for those can be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

Please 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 the manufacturer's regulations.

2



Hydraulic oil fill point



Gear oil fill point



Gear oil drain point



Brake fluid



Hydraulic oil drain point

MAINTENANCE

2

Table 1 Lubricants

Code	Type	Specification	Amount	Position
A	Anti-wear hydraulic oil	LPE50S = #32 LPE60S = #46 LPE70S = #46	See Table 2.1	Hydraulic System
B	Multi-purpose grease	Polylyub GA352P	Appropriate amount	Contact Surface (See Table 2.2)
C	Heavy duty gear oil	Mobil ATF220	0.35L (Align with oiling port)	Gearbox
D	Brake fluid	DOT4	After the air is purged from the system, fill the brake fluid reservoir to 2/3 full or to the designated level.	Brakes

Table 2.1 Application Amount of Hydraulic Oil - 1

Mast Series	Lifting height (in)	Amount (G)
2-stage Mast	79	4.1
	98.5	4.3
	106.5	4.4
	118	16.9
	130	17.3
	138	17.7
	142	17.8
	158	18.5
	167.5	18.9
	177.5	19.3

Table 2.1 Application Amount of Hydraulic Oil - 3

Mast Series	Lifting height (mm)	Amount (G)
3-stage Full Mast	3700	5
	4000	5.3
	4350	5.5
	4500	5.6
	4800	5.7
	5000	5.8
	5100	5.9
	5300	6
	5400	6.1
	5500	6.1
	6000	6.3

MAINTENANCE

2

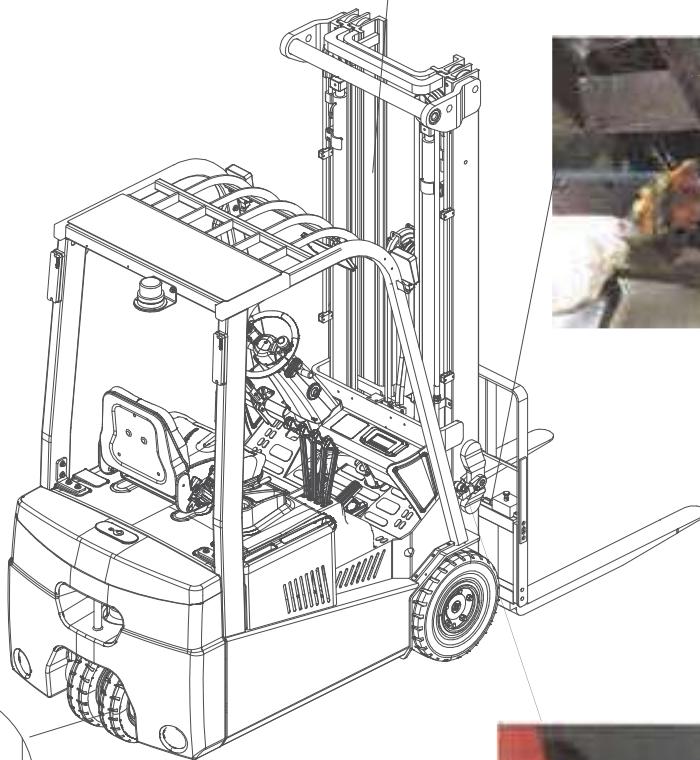
Table 2.2 Contact Surface Lubrication Table

Code	Position
L1	Steering axle (sealed)
L2	Tilt cylinder connector
L3	Fork carriage
L4	Steel channel and rollers

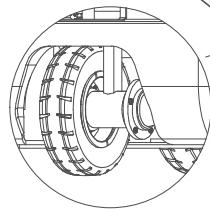
L4-B-▼



L3-B-▼



L1-B-▼



▼ Contact surface

L2-B-▼



3. TROUBLESHOOTING

3

NOTE:

TROUBLESHOOTING

3.1 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 cover and check the controller.

3

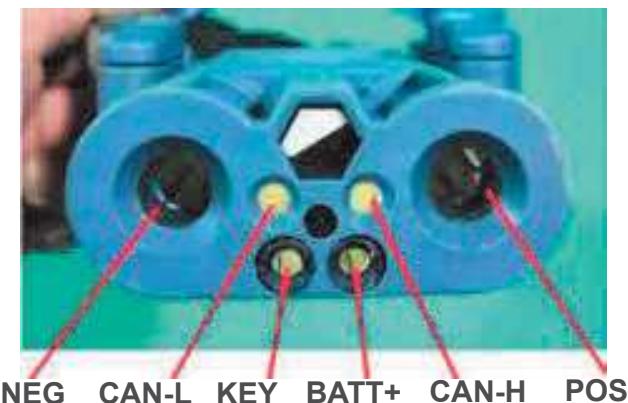


CAUTION

- Even if key switch is turned off, the controllers are still energized.
- Before checking or repairing the controllers, disconnect the battery from the truck.

3.1.1 Check the Voltage of Battery

- 1) Press the button on the battery cover BDI. It will turn on and display battery information. This means the battery BMS is not damaged.
- 2) If the display does not turn on, BMS or BDI may have issues. Check the wiring harness and connections.
- 3) Measure the DC voltage between KEY and BATT+. The voltage should be higher than 72V, otherwise battery may have been over-discharged.



TROUBLESHOOTING

3.2 Troubleshooting Solutions of Common Faults

Table 3.1 lists the common faults that may occur and handling methods. Mainly consists of the following items:

Table 3.1 Troubleshooting of Common Faults			
Fault	Fault Symptom	Probable Causes	Troubleshooting
Power supply failure	1. Whole truck power outage	<ul style="list-style-type: none">• Power supply failure• Fuse failure• Emergency stop switch or circuit failure• Key switch or circuit failure	<ul style="list-style-type: none">1. Check the voltage of storage battery2. Check the fuses3. Check key switch and its circuit4. Check emergency stop switch and its circuit
Travel Fault	1. Forward and reverse moving failures of the truck, but other functions are normal	<ul style="list-style-type: none">• Parking brake switch and seat switch or its circuit connection failure• Gearbox failure• Travel switch or its circuit connection failure• Drive motor or its circuit connection failure• Controller failure	<p>Controller failure error, carry out troubleshooting according to the fault code information on the instrument.</p> <ul style="list-style-type: none">1. Check if parking brake switch and seat switch or the connection of its circuit is normal.2. Check the gearbox.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	<p>Failures due to external factors:</p> <ul style="list-style-type: none">• Motor bearing blocked• Gearbox bearing blocked <p>Failures due to internal factors:</p> <ul style="list-style-type: none">• Drive motor speed encoder failure• Controller failure	<p>Controller failure error, carry out troubleshooting according to the fault code information on the instrument .</p> <ul style="list-style-type: none">1. Remove the motor, check if the motor rotation is normal.2. Check the speed encoder and its connection circuit.3. Remove the gearbox, check if the gear rotation is smooth and if there is blocking.4. Replace the controller
	3. Drive axle Bearings noise or jammed	<ul style="list-style-type: none">• Bearing fatigue damage or foreign	<ul style="list-style-type: none">1. Replace the bearings

* Carry out troubleshooting in the order listed in the table. It can help you quickly identify and resolve problems.

TROUBLESHOOTING

3

Table 3.1 Troubleshooting of Common Faults

Fault	Fault Symptom	Probable Causes	Troubleshooting
Travel Fault	4. Abnormal tire wear, cracking or delaminating	<ul style="list-style-type: none"> • Improper use 	1. Replace the drive wheel. 2. Replace the rear steering wheel.
	5. Drive wheel slipping or jumping	<ul style="list-style-type: none"> • Wear 	1. Replace the drive wheel
	6. Truck sways while running	<ul style="list-style-type: none"> • Wheel lock nut loosening 	1. Tighten the nuts
	7. Brake performance weakened or failure	<ul style="list-style-type: none"> • Insufficient brake fluid. • Brake master pump blocked. • Brake pipeline leaks. 	1. Add brake fluid. 2. Replace the master pump. 3. Replace the brake pipeline.
Motor Fault	1. Motor does not rotate	<ul style="list-style-type: none"> • Cable U, V, or W is broken. • Loosening connections to cable U, V or W . • Stator coil open circuit. • Motor bearing damage. • Speed encoder or its circuit failure. 	1. Replace the Cable U,V, or W. 2. Tighten the nut. 3. Check the stator coil. 4. Replace the motor bearing. 5. Check the speed encoder, if necessary replace it.
	2. Motor is rotating in slow speed and reverse	<ul style="list-style-type: none"> • Cable connection error 	1. Remove the cables and re-install.
	3. Motor with abnormal noise or vibration	<ul style="list-style-type: none"> • Uneven clearance between stator and rotor. • Bearing failures. • Loosening fixing screws on motor housing. 	1. Replace the drive motor or pump motor.
	4. Motor smoking or burning smell	<ul style="list-style-type: none"> • Stator winding short circuit, motor burnt 	1. Replace the drive motor or pump motor.
	5. Motor temperature too high, controller failure	<ul style="list-style-type: none"> • Stator winding short circuit. • Motor U, V and W terminals with surface . • Bearing failure, resulting in severe heating. • Motor cooling duct blockage with foreign body. • Overload. 	6. Refer to the rated capacity marked on the nameplate.

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

TROUBLESHOOTING

Table 3.1 Troubleshooting of Common Faults

Fault	Fault Symptom	Probable Causes	Troubleshooting
Motor Fault	6. On load, motor speed is turning slow	<ul style="list-style-type: none"> • Insufficient voltage of battery. • Overload. • U, V, W terminals with abnormal voltage input. • Speed encoder or its circuit failure. 	<ol style="list-style-type: none"> 1. Check the voltage of battery. 2. Refer to the rated capacity marked on the nameplate. 3. Check the battery output. 4. Replace the speed encoder or wiring harness.
Gearbox Fault	1. Gearbox Abnormal Noise	<ul style="list-style-type: none"> • Supporting bearing wear. • Gear wear, the gap is too big. • Foreign objects in gear oil. 	<ol style="list-style-type: none"> 1. Replace the bearing. 2. Replace the gear. 3. Replace the gear oil.
	4. Gearbox Oil Leaks	<ul style="list-style-type: none"> • Oil seal wear or aged 	<ol style="list-style-type: none"> 1. Replace the oil seal
	2. Gearbox Stuck	<ul style="list-style-type: none"> • Gear fastening screws or nuts loosening. • Support bearing damage • Foreign objects in gear oil. 	<ol style="list-style-type: none"> 1. Tighten the screws or nuts. 2. Replace the support bearing. 3. Replace the gear oil.
Drive Axle Fault	1. Drive Axle Abnormal Noise	<ul style="list-style-type: none"> • Supporting bearing wear. • Gear wear, the gap is too big. • Foreign objects in gear oil. 	<ol style="list-style-type: none"> 1. Replace the bearing. 2. Replace the gear. 3. Replace the gear oil.
	4. Drive Axle Oil Leaks	<ul style="list-style-type: none"> • Oil seal wear or aged 	<ol style="list-style-type: none"> 1. Replace the oil seal
	2. Drive Axle Stuck	<ul style="list-style-type: none"> • Drive Axle fastening screws or nuts loosening. • Support bearing damage • Foreign objects in gear oil. 	<ol style="list-style-type: none"> 1. Tighten the screws or nuts. 2. Replace the support bearing. 3. Replace the gear oil.

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

TROUBLESHOOTING

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Table 3.1 Troubleshooting of Common Faults

Fault	Fault Symptom	Probable Causes	Troubleshooting
Hydraulic Failure	1. The truck cannot lift	<ul style="list-style-type: none"> 1. Pump motor does not work: <ul style="list-style-type: none"> • Parking brake switch and seat switch or its circuit connection failure • Pump motor or its circuit connection failure • Control switch or its circuit connection failure • Controller failure 2. Pump motor works: <ul style="list-style-type: none"> • Overload • Insufficient hydraulic oil • Hydraulic pipeline leakage • Pump motor reverse rotation • Cylinder failure (blocked) • Solenoid valve blocked and cannot reset • Valve body failure: <ul style="list-style-type: none"> • excessive wear of gear pump, serious internal leaks, insufficient pressure of relief valve or blocked, check valve blocked 	<ul style="list-style-type: none"> 1. Pump motor does not work: <ul style="list-style-type: none"> i. Check if parking brake switch and seat switch or the connection of its circuit is normal. ii. Check the pump motor and its connection circuit. iii. Check the control button and its connection circuit. iv. Replace the controller. 2. Pump motor works: <ul style="list-style-type: none"> i. Refer to the rated capacity marked on the nameplate. ii. Lower the mast to the bottom, check if the amount of oil in the oil tank can meet the requirements. iii. Check the pipe and hydraulic components for oil leaks. iv. Check the pump motor wiring. v. Check the cylinder for damage or deformation, remove the cylinder to check for wear or aged seals inside. vi. Wash or replace the solenoid spool vii. Wash or replace the valve body
	2. The truck cannot be lowered	<ul style="list-style-type: none"> • Solenoid valve (or manual valve) or its circuit connection failure • Lowering switch or its circuit connection failure • Valve failure. • Cylinder deformation or blocked • Explosion-proof valve blocked 	<ul style="list-style-type: none"> 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. 5. Replace the explosion-proof valve.

* Carry out troubleshooting in the order listed in the table. It can help quickly identify and resolve problems.

TROUBLESHOOTING

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Table 3.1 Troubleshooting of Common Faults

Fault	Fault Symptom	Probable Causes	Troubleshooting
Hydraulic Failure	1. Noisy pump	<ul style="list-style-type: none"> • Insufficient oil. • High viscosity of oil. • Oil suction pipe air leak. • Filters clogged by impurities. • Hydraulic oil with foam. 	<ol style="list-style-type: none"> 1. Check the hydraulic oil level. 2. Replace the hydraulic oil. 3. Check the oil suction pipe. 4. Clean the oil inlet piping, replace the filter, if necessary. 5. See Fault 2.
	6. Hydraulic oil with foam	<ul style="list-style-type: none"> • Pump cavitation. • There is water in the oil. 	<ol style="list-style-type: none"> 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.
	5. Pump or oil temperature is too high	<ul style="list-style-type: none"> • Oil is too thin. • Pump cavitation. • Valve body internal relief. 	<ol style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Insufficient oil. • Relief valve failure • Pump wear, internal leakage 	<ol style="list-style-type: none"> 1. Check the hydraulic oil level. 2. See Fault 6. 3. Replace the gear pump.
	4. On load, declined	<ul style="list-style-type: none"> • Solenoid valve failure. 	<ol style="list-style-type: none"> 1. Check and clean the solenoid valve spool. 2. Check the multi-way manual valve and its installation.
	3. Relief valve pressure unstable or too low	<ul style="list-style-type: none"> • Pressure adjustment screw too loose. • Relief valve spring breakage or deformation. • Relief valve spool wear or blocked. 	<ol style="list-style-type: none"> 1. Adjust to proper pressure through hydraulic pressure gauge. 2. Replace the relief valve. 3. Clean or replace the relief valve.

- * Carry out troubleshooting in the order listed in the table. It can help quickly identify and resolve problems.

TROUBLESHOOTING

Table 3.1 Troubleshooting of Common Faults (continued)

Fault	Fault Symptom	Probable Causes	Troubleshooting
Lift Failure	3. Slow Lifting of Truck	<ul style="list-style-type: none"> • Overload • Hydraulic pipeline leakage • Valve failure: • Gear pump wear, internal leakage occurs • Insufficient relief valve pressure or blocked 	<ol style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Solenoid valve blocking • Valve body failure: throttle valve failure or blocked 	<ol style="list-style-type: none"> 1. Wash or replace the solenoid pool 2. Wash or replace the valve body
	5. Unstable Lifting / Lowering of Truck	<ul style="list-style-type: none"> • Chain loosening. • Poor lubrication between steel channel and rollers. • Improper adjustment of rollers, or blocked. 	<ol style="list-style-type: none"> 1. Adjust the chain tension. 2. Check if the steel channel grease is normal, clean and relubricate steel channel and rollers. 3. Adjust the side roller spacing through roller screw. or replace the roller.
Manual Valve Fault	1. The truck cannot perform the hydraulic control instructions	<ul style="list-style-type: none"> • Valve failure. • Valve seat blocked by large impurities. • External leakage: <ul style="list-style-type: none"> i. sealing damaged. ii. poor threaded connection. iii. valve body defects. • High viscosity of hydraulic oil. • High frequency of use, service life has expired already. 	<ol style="list-style-type: none"> 1. Replace the manual valve. 2. Remove and clean the valve seat. 3. Replace the sealing. 4. Replace the screwed joint. 5. Replace the manual valve. 6. Replace the hydraulic oil with lower viscosity. 7. Replace the manual valve.
	8. Slow pace of actuator	<ul style="list-style-type: none"> • Overflow valve in the connection block started. • Valve seat leakage. • Valve rod cannot push/pull to bottom. the channel cannot be fully opened. • High viscosity of hydraulic oil. • High frequency of use, service life has expired already. 	<ol style="list-style-type: none"> 1. Restart the truck. 2. Replace the valve seat. 3. Clean the valve rod, if necessary replace the valve. 4. Replace the hydraulic oil with lower viscosity. 5. Replace the manual valve.

* Under the circumstances of normal lifting and lowering, if failure occurs to any of other hydraulic actions (forward/backward shifting, forward/backward tilting and left/right shifting), perform troubleshooting to the corresponding control switch and its control circuit.

* Carry out troubleshooting in the order listed in the table. It can help quickly identify and resolve problems.

TROUBLESHOOTING

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Table 3.1 Troubleshooting of Common Faults (continued)

Fault	Fault Symptom	Probable Causes	Troubleshooting
Gear Pump Fault	1. Gear pump does not absorb oil or of small flow	<ul style="list-style-type: none"> • Insufficient hydraulic oil. • Pump body defects. • Poor sealing with leakage. • Oil filter clogging. • Oil temperature is too high. 	<ol style="list-style-type: none"> 1. Replace the hydraulic oil. 2. Replace the gear pump. 3. Replace the sealing. 4. Clean or replace the oil filter. 5. Cool down the hydraulic oil.
	2. Insufficient gear pump output pressure	<ul style="list-style-type: none"> • Pump body defects. • Pump body with cracks or leaks. • Impurities in the pump, oil filter clogging. • Low viscosity of hydraulic oil. • Oil temperature is too high. 	<ol style="list-style-type: none"> 1. Replace the gear pump. 2. Replace the gear pump. 3. Replace the hydraulic oil and clean the gear pump. 4. Replace the hydraulic oil with higher viscosity. 5. Cool down the hydraulic oil
	3. Too much vibration and noise	<ul style="list-style-type: none"> • Pump body defects. • Gear pump inlet tubing diameter is too small. • Oil filter clogging, or motorspeed is too high. • Motor and oil pump shaft misalignment. 	<ol style="list-style-type: none"> 1. Replace the gear pump. 2. Replace the inlet tubing. 3. Clean the oil filter, adjust the motorspeed to a lower value. 4. Remove and reinstall the motor.
	4. Oil leaks	<ul style="list-style-type: none"> • Pump body defects. • Seal skeleton spring off. • Shaft sealing surface scratches 	<ol style="list-style-type: none"> 1. Replace the gear pump. 2. Remove and reinstall the seal skeleton. 3. Replace the shaft sealing.
	5. Pump is not functioning properly or blocked	<ul style="list-style-type: none"> • Pump body defects. • Poor alignment of pump and motor coupling. • Impurities in the pump. 	<ol style="list-style-type: none"> 1. Replace the gear pump. 2. Remove and reinstall the gear pump. 3. Remove and clean the gear pump.
Redirector Fault	1. Oil leaks	<ul style="list-style-type: none"> • Redirector defects. • Poor sealing with leakage. 	<ol style="list-style-type: none"> 1. Replace the redirector. 2. Remove and reinstall the redirector, if necessary replace the redirector.
	2. Redirector is not functioning properly or noise	<ul style="list-style-type: none"> • Redirector defects. • Insufficient oil. • There is air in the oil. • High viscosity of oil. 	<ol style="list-style-type: none"> 1. Replace the redirector. 2. Add the hydraulic oil. 3. Discharge the air in the oil. 4. Replace the hydraulic oil with lower viscosity.

* Carry out troubleshooting in the order listed in the table. It can help quickly identify and resolve problems.

TROUBLESHOOTING

Table 3.1 Troubleshooting of Common Faults (continued)

Fault	Fault Symptom	Probable Causes	Troubleshooting
Steering Fault	1. The truck cannot be steered (the truck can travel)	<ul style="list-style-type: none"> • Steering potentiometer or its circuit connection failure • Redirector or the tubings connection failure • Steering bridge or the tubings connection failure • Pump motor failure • Gear pump failure • Pump controller failure 	Controller failure error, carry out troubleshooting according to the fault code information on the instrument . <ol style="list-style-type: none"> 1. Check the steering potentiometer or its connection circuit. 2. Check if the mechanical connection between steering wheel and redirector is solid. 3. Check the redirector or the tubings connection. 4. Check the steering bridge or the tubings connection. 5. Check the pump motor or its connection circuit. 6. Check the pump. 7. Replace the controller.
	2. Steering Bridge Abnormal Noise	<ul style="list-style-type: none"> • Supporting bearing wear 	1. Replace the bearing
	3. Steering Bridge Oil Leaks	<ul style="list-style-type: none"> • Oil seal wear or aged 	1. Replace the Oil seal
	4. Steering Bridge Stuck	<ul style="list-style-type: none"> • Support bearing damage. 	1. Replace the bearing

* Carry out troubleshooting in the order listed in the table. It can help quickly identify and resolve problems.

TROUBLESHOOTING

Table 3.1 Troubleshooting of Common Faults (continued)

Fault	Fault Symptom	Probable Causes	Troubleshooting
Other Failures	1. Lights do not light	a. Light failure or circuit not conducted b. Lighting combination switch or its circuit connection failure c. Fuse failure d. DC-DC converter failure	1. Check the light and its circuit connection. 2. Check Lighting combination switch and its connection circuit. 3. Check fuse and its connection circuit. 4. Check DC-DC converter and its connection circuit.
	2. Horn does not sound	a. Horn switch or its circuit connection failure b. Horn failure c. Fuse failure d. DC-DC converter failure	1. Check the horn button and its connection circuit. 2. Check the horn and its connection circuit. 3. Check fuse and its connection circuit. 4. Check DC-DC converter and its connection circuit.

* Carry out troubleshooting in the order listed in the table. It can help quickly identify and resolve problems.

4. DRIVING SYSTEM

4

NOTE:

DRIVING SYSTEM

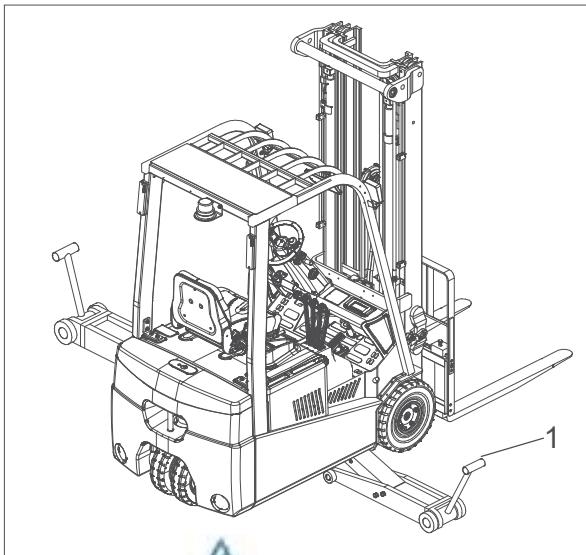
4.1 Drive Wheel

4.1.1 Removal and Installation

Removal

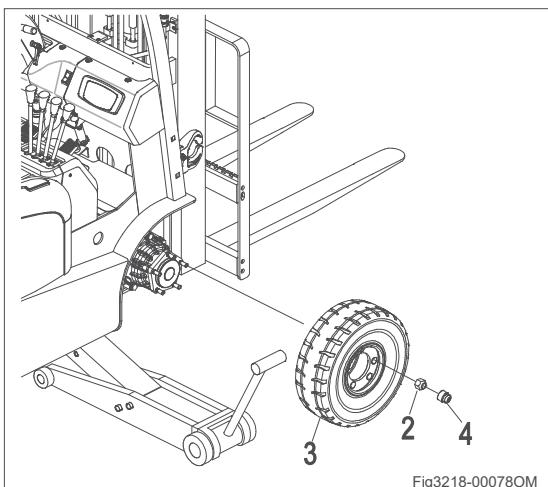
- Turn off the truck power and remove the key.
- Place the jack (1) under the chassis near the drive wheels, raise the drive wheels off the ground.

schematic diagrams



WARNING

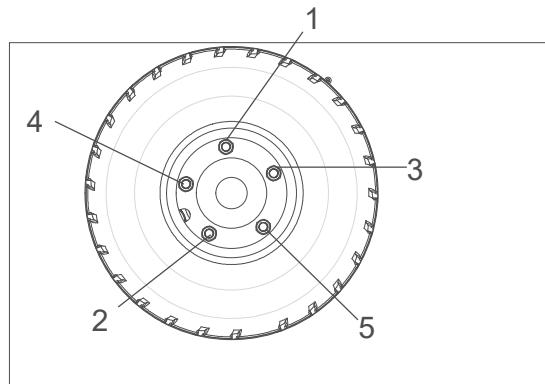
Make sure the lifting equipment is solid and secure, and the load capacity should be greater than the total weight of the truck. Lifting height of not more than 4in, to prevent the hazards to the maintenance personnel working under the truck for wheel removal and installation.



- Remove the five protectors (4) and unscrew the five nuts (2) on the drive wheel assembly (3).

Installation

- Install in the reverse order of removal.
- Screw on the five nuts as shown. *Tighten the nuts by order and mark with the torque: bolt specification M14*1.5 according to actual grade refer to 1.4 General Tightening Torques. Bolt's grade can be found on the head of the bolt*



CAUTION

After running for a short distance, retorque bolts.

Tire wear can affect the stability and driving performance of the truck, replace the drive wheel that has heavy wear.

Use original spare parts provided by the equipment manufacturer to maintain the original design performance of the truck.

4.2 Drive Motor

This truck obtains drive force through AC motor.

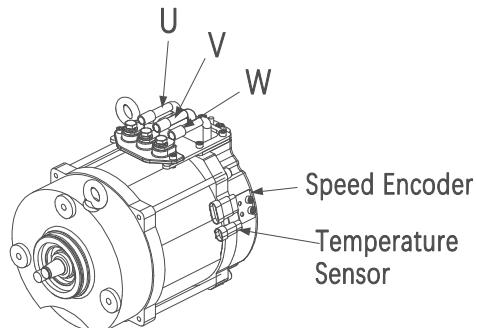


Fig3124-20003SM

- Disconnect the tubing connection A and B from the brake cylinder.

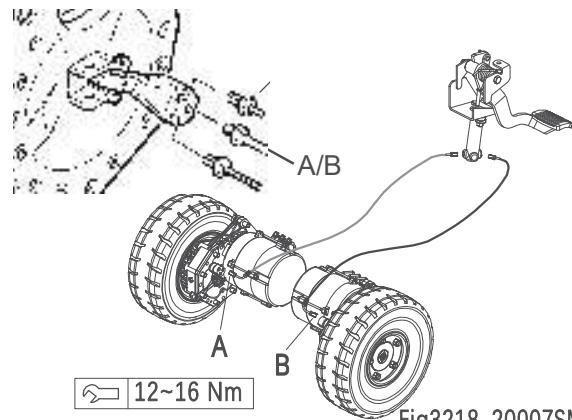


Fig3218-20007SM

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4.2.1 Removal and Installation

Drive Motor

Removal

Drive motor is mounted on the gearbox.

- Power off the truck and remove the key.
- Remove the cushion and open the floorboard.
- Remove U, V and W cables on the drive motor.

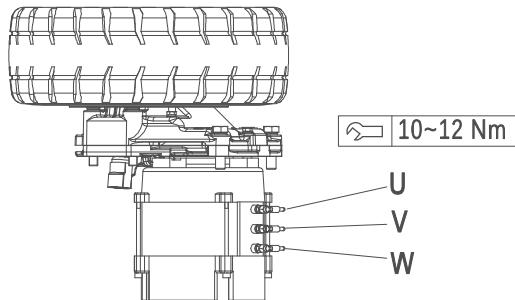


Fig3218-20006SM

- Remove the cable connection C and D from the parking brake.

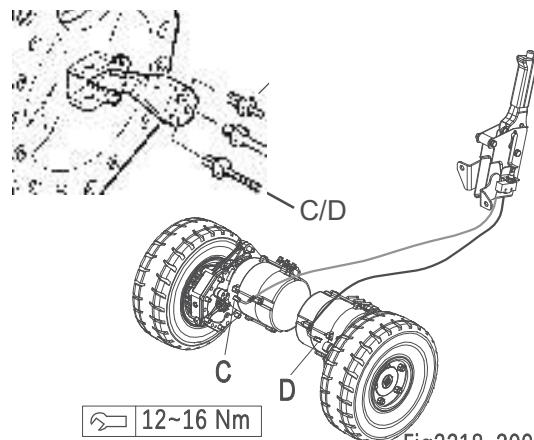


Fig3218-20008SM

- Remove the left or right drive wheel. (see Section 4.1)

DRIVING SYSTEM

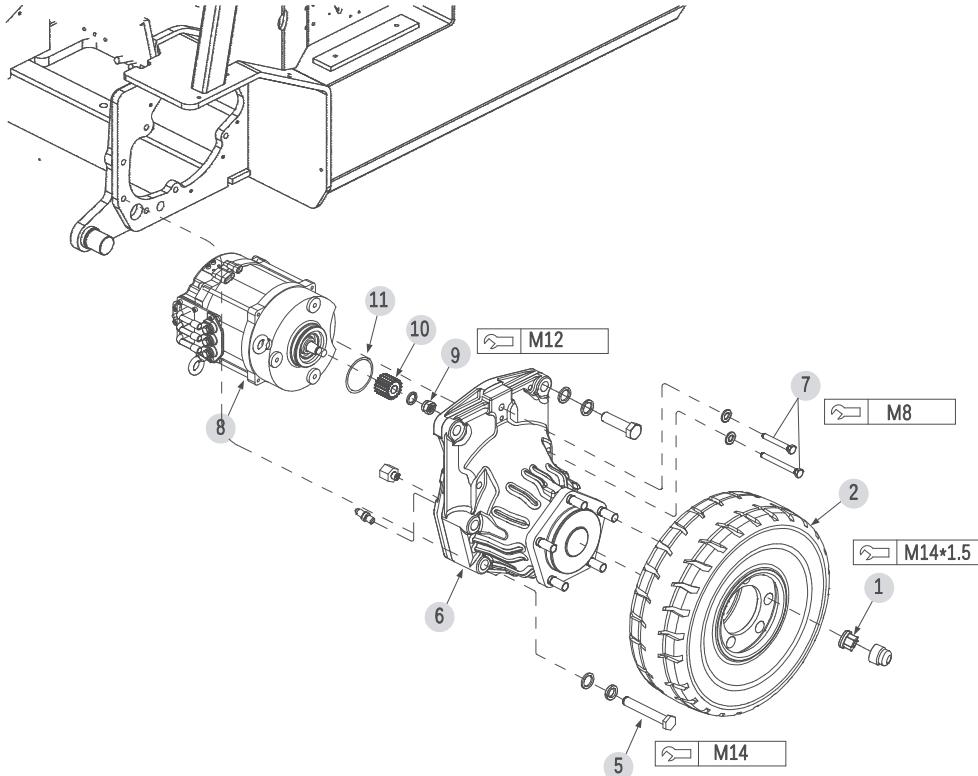


Fig3214-20002SM

- Unscrew the six fixing bolts (3) and remove the three plates (4).
- Unscrew seven bolts (5), remove the gearbox (6) and drive motor (8) from the chassis.
- Unscrew three bolts (7), remove the drive motor (8) from the gearbox (6).
- Unscrew the nut (9), remove the motor gear (10) and O-ring (11) from the drive motor (8).

Installation

- Install in the reverse order of removal.
- 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 four screws.

4.3 Speed Encoder

Removal

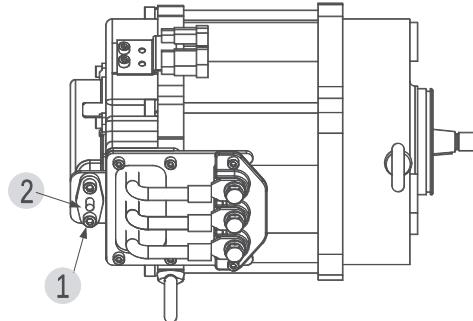


Fig3124-20010SM

- Switch off the truck power connections and remove the pedal.
- Unplug the AMP connector on the speed encoder (2).

- Unscrew the screw (1) from the drive motor and remove the speed encoder.

Installation

- Install in the reverse order of removal.

	Fault	On load, motor speed is turning slow
6	Cause	a. Insufficient voltage of battery. b. Overload. c. U, V, W terminals with abnormal voltage input. d. Speed encoder or its circuit failure.

4.3.2 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. b. Bearing failures. c. Loosening fixing screws on motor housing.
4	Fault	Motor smoking or burning smell
	Cause	Stator winding short circuit, motor burnt
5	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.

4.3.3 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
With readings, but very low	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.

DRIVING SYSTEM

Temperature Sensor

Temperature sensor is used to monitor motor temperature.

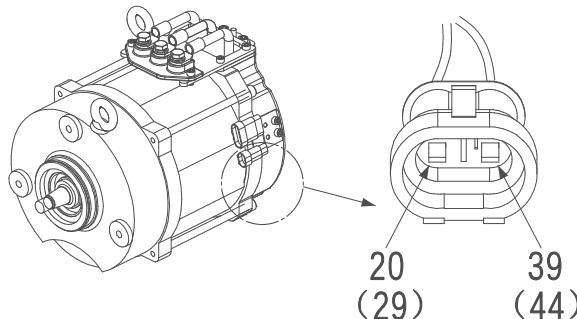


Fig3124-20011SM

4

Drive Motor - Right

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:

Drive Motor - Left

Measure the resistance between pin connector (29#) and (44#) 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)

Speed Encoder

Speed encoder is used to detect the speed of the motor and convert 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

Drive Motor - Right

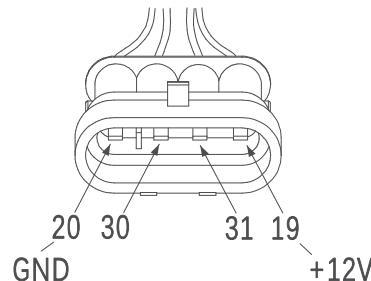


Fig3131-20010SM

- The truck is powered on, measure the voltage between pin connector (19#) and (20#) with a multimeter, normally should be 12V.

Check if the connection between 30# and 31# is reversed. (If the two circuits are connected reversely, the controller won't report failure, but the travel speed of the truck may slow down).

- The truck is powered on, measure the voltage between pin connector (19#) and (20#) with a multimeter, normally should be 12V.

Check if the connection between 30# and 31# is reversed. (If the two circuits are connected reversely, the controller won't report failure, but the travel speed of the truck may slow down).

Check the "ENCODER" readings on TESTER

- Menu. Operate the truck, if the display is always "0":

Speed encoder failure.

Motor encoder disc failure.

Drive Motor - Left

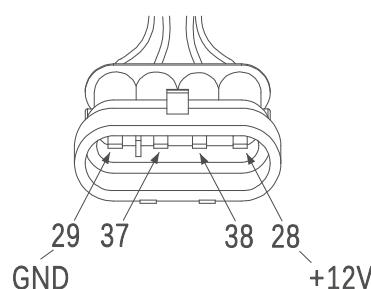


Fig3218-20012SM

- The truck is powered on, measure the voltage between pin connector (28#) and (29#) with a multimeter, normally should be 12V.

Check if the connection between 37# and 38# is reversed. (If the two circuits are connected reversely, the controller won't report failure, but the travel speed of the truck may slow down).

- The truck is powered on, measure the voltage between pin connector (28#) and (29#) with a multimeter, normally should be 12V.

Check if the connection between 37# and 38# is reversed. (If the two circuits are connected reversely, the controller won't report failure, but the travel speed of the truck may slow down).

- Check the “ENCODER” readings on TESTER Menu. Operate the truck, if the display is always “0”:
 - Speed encoder failure.
 - Motor encoder disc failure.

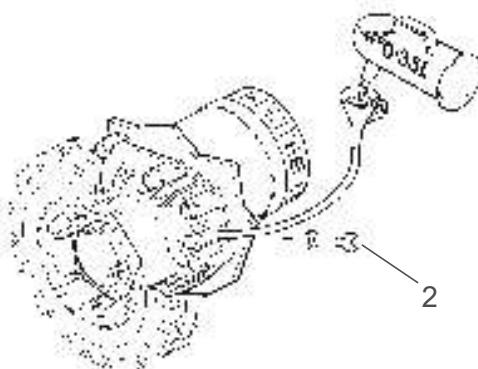
DRIVING SYSTEM

4

4.5 Gear Oil

4.5.1 Check the gear oil level

- Loosen the oiling port plug (2) 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 (1), drain the gear oil within the gearbox.
- Remount the oil drain plug, and add the gear oil of same specification with tubing through oiling port:

Gear oil specification: Mobil ATF220

Gear oil filling amount: 0.35 L

4.5.2 Faults and Causes

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

4

DRIVING SYSTEM

4.6 Accelerator Pedal

4.6.1 Removal and Installation

- Power off the truck and remove the key.
- Remove the cushion.
- Disconnect the connection between the accelerator pedal wiring (1) and main wiring harness .
- Unscrew the two bolts (2) with wrench and remove the accelerator pedal (3) from the chassis.
- Install in the reverse order of removal.



Fig3132-50004SM

4

4.6.2 Interface Description

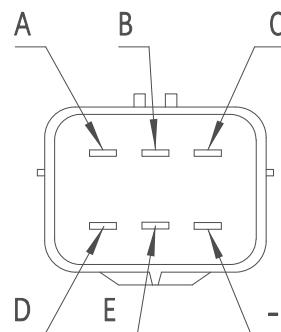
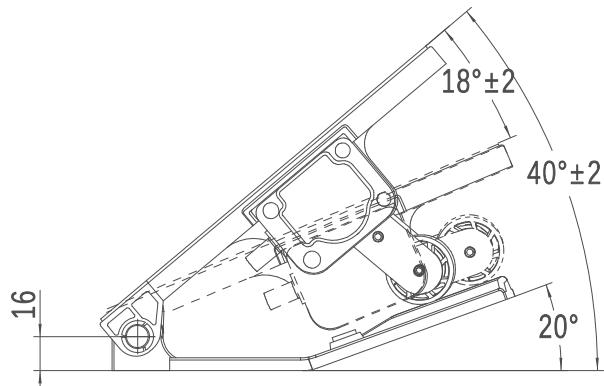


Fig3131-50017SM

Interface Description				
Pin	Description	Color	Remark	
A	Pedal power supply	Red	10-15Vdc	
B	Output signal	White	0.2±0.1V~9±0.3V	
C	Pedal signal grounding	Black	-	
D	Pedal Switch - Positive Electrode	Green	Switch output (10-60V)	
E	Pedal switch output	Grey	Switch output	
-	-	-	-	

4.6.3 Checking and Testing

Checking

- Check if the accelerator pedal is reset properly, also check for damage.
- Check if the accelerator pedal and its wiring harness are in good condition, and if the connectors are connected securely.

Testing

- Press the accelerator pedal, if the accelerator information on the display does not change, it indicates there is failure with the accelerator pedal or its circuit.

Turn off the truck to check the accelerator pedal and its wiring harness. (See Fig3131-50017SM).

- Provide a voltage of 12V between accelerator pedal harness connectors (A) and (C), check the voltage at each port of the wiring harness with a multimeter.
- Place the accelerator pedal at original position. Measure the voltage between the interfaces with a multimeter.

As shown in the following table:

- Press the accelerator pedal. Measure the voltage between the interfaces with a multimeter, as shown in the following table:

Press the accelerator pedal	
Connection interface	Voltage Measurement
A-C	12 V
A-B	Changing within the range of 0V to 9V with the level of pressing
A-E	12 V
B-C	0 V

4

Accelerator pedal at original position	
Connection interface	Voltage Measurement
A-C	12 V
A-B	0 V
A-E	12 V
B-C	0 V

5. STEERING SYSTEM

5

NOTE:

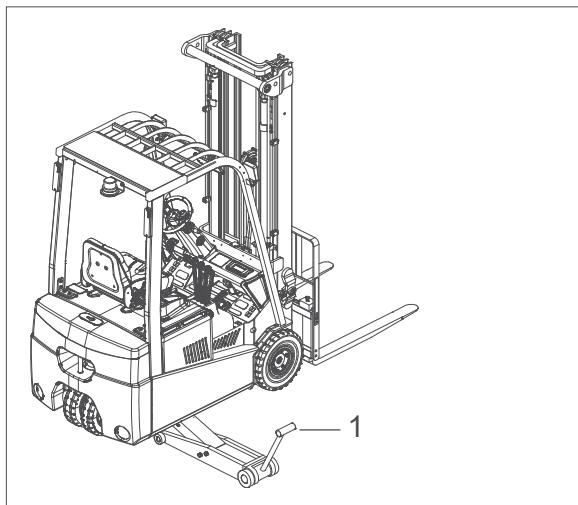
STEERING SYSTEM

5.1 Rear Steer Wheel

5.1.1 Removal and Installation

Removal

- Start the truck and rotate the steering wheel 90 degrees to the left or right.
- Turn off the truck power and remove the key.
- Place the jack (1) under the chassis near steering wheels, make the wheel off the ground.



WARNING

Make sure the lifting equipment is solid and secure, and the load capacity should be greater than the total weight of the truck. Lifting height of not more than 4in, to prevent the hazards to the maintenance personnel working under the truck for wheel removal and installation.



WARNING

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

- Remove the five protectors (1) and unscrew the five nuts (2) on the steer wheel assembly (3).

Remove the steer wheel assembly (3) from the steering bridge (4).

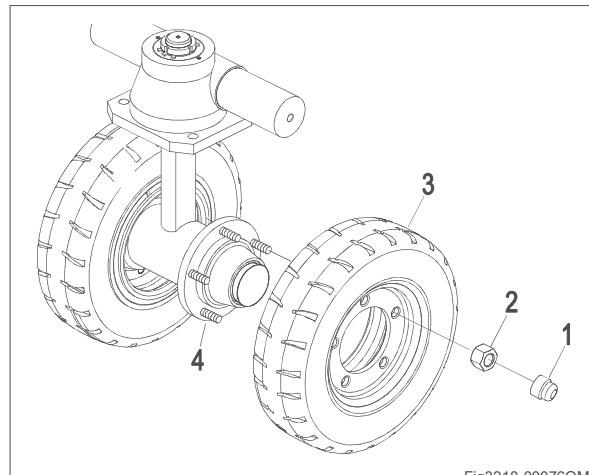


Fig3218-00076OM

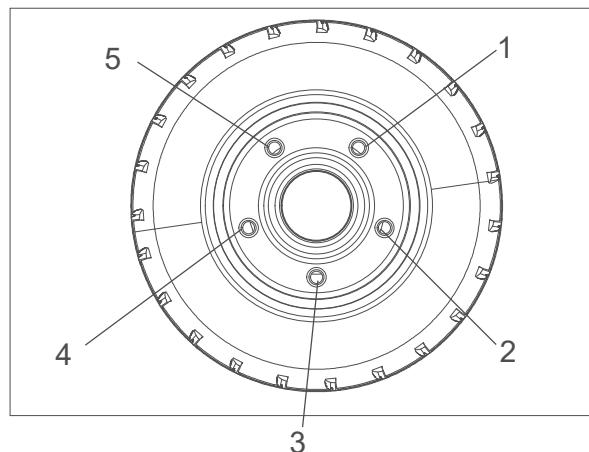
Installation and Commissioning

- Install according to the reverse order of removal.



CAUTION

- Screw the eight nuts as shown .
Tighten the nuts by order and mark with
the torque: bolt specification M14*1.5
according to actual grade refer to 1.4 General
Tightening Torques.Bolt's grade can be found
on the head of the bolt.



- Turn the wheel to see if it is rotating smoothly, and if there is blocking or not.
- Run the truck to see if the steering wheel is functioning properly. If there is blocking or noise, check if the wheel bearings are functioning properly.



CAUTION

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

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

5.1.2 Faults and Causes

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

5.2 Steering Rack

5.2.1 Removal and Installation

Removal

- Fix the wheels with triangular wooden wedge.
- Open the rear hood, disconnect the cables and remove the battery .

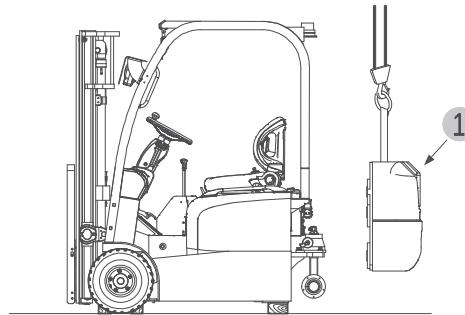


Fig3218-70002SM

5

- Unscrew three bolts and remove the counter-weight (1) from the chassis.
- Place a wooden wedge under the chassis near steering wheel, raise the wheel off the ground.



WARNING

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



WARNING

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

- Remove the steer wheels. (See Section 5.1)

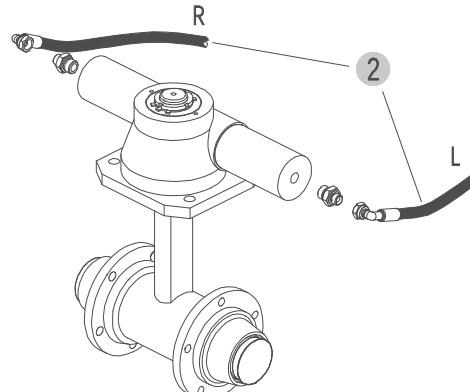


Fig3218-70003SM

REV. 09/2023

STEERING SYSTEM

- Remove the two tubes (1) from the steering bridge.
- Remove the steering potentiometer.
(See Section 8.2)

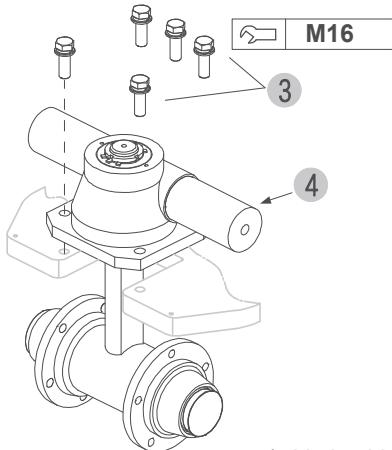


Fig3218-70004SM

5

- Unscrew the five bolts (3) and remove the steering bridge (4) from the chassis.

Installation

- Install in the reverse order of removal.

5.2.2 Faults and Causes

1	Fault	Steering bridge abnormal noise
	Cause	a. Supporting bearing wear. b. Gear wear, the gap is too big.
2	Fault	Steering bridge oil leaks
	Cause	Oil seal wear or aged
3	Fault	Steering bridge stuck
	Cause	a. Gear damage. b. Support bearing damage.

5.2.3 Component

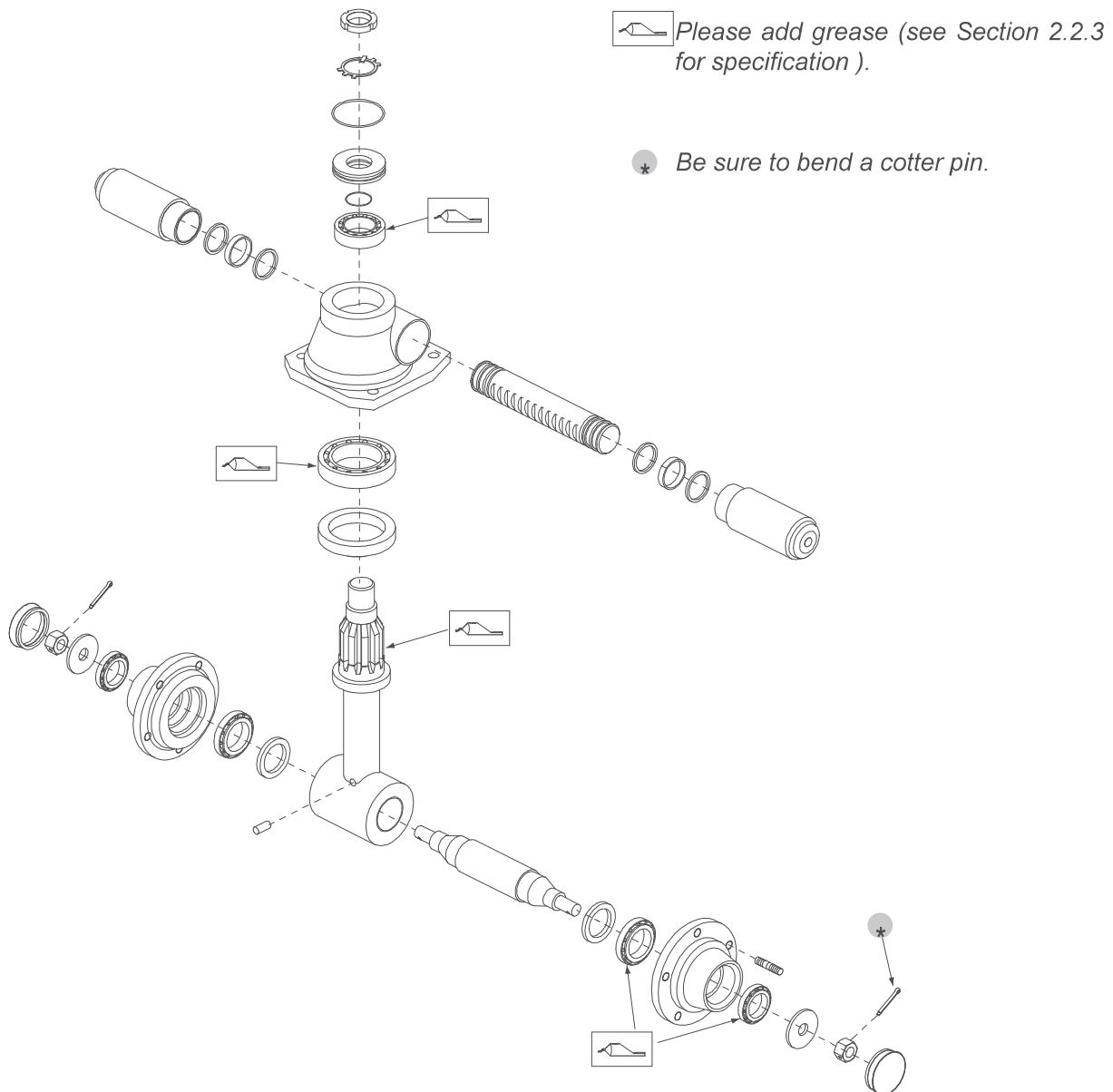


Fig3218-70005SM

STEERING SYSTEM

5.3 Steering Potentiometer

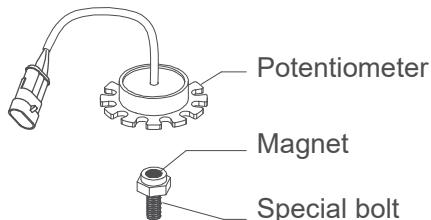


Fig3218-70006SM

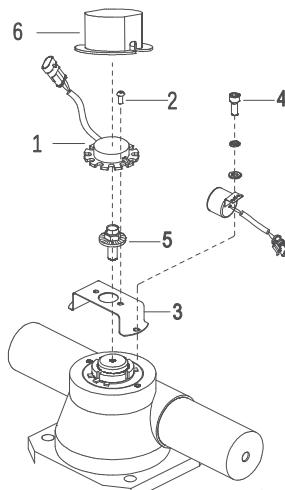


Fig3214-70003SM

5.3.1 Removal and Installation

Removal

- Fix the wheels with triangular wooden wedge.
- Power off the truck.

5

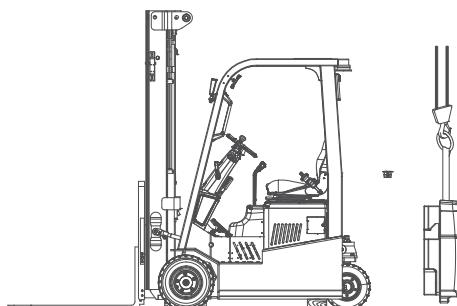


Fig3214-70002SM

- Unscrew four bolts and remove the counter-weight (1) and from the chassis.

(See Fig3214-70003SM)

- Remove the main wiring harness from the steering potentiometer (1).
- Remove the shield rubber (6).
- Unscrew the two mounting screws (2) with hex wrench and remove the steering potentiometer (1) from the mounting plate (3).
- Unscrew the two mounting screws (4) with hex wrench and remove the mounting plate (3) from the steering bridge.
- Unscrew the special bolt (5) and washer (7) from the steering bridge.

Installation

- Install in the reverse order of removal.



CAUTION

During installation, be sure that the magnet has been installed into the special bolt.

5.3.2 Faults and Causes

	Fault	Cause
1	Truck does not travel (the controller reports for error, and fault information is displayed on the meter: 179 STEER SENSOR KO)	Potentiometer or its circuit failure

6. BRAKE SYSTEM

6

NOTE:

6.1 Parking Brake

6.1.1 Removal and Installation

- Turn off the truck power and remove the key.
- Use triangle wooden wedges to fix the wheels.
- Disconnect the connection between the brake switch (1, Fig3127-10001SM) on the parking brake (4) and the main wiring harness.
- Remove left / right brake cable on the parking brake.
- Loosen the bolts (3), remove the parking brake (4).
- Install in the reverse order of removal.
- Ensure truck will not travel when parking brake is applied.

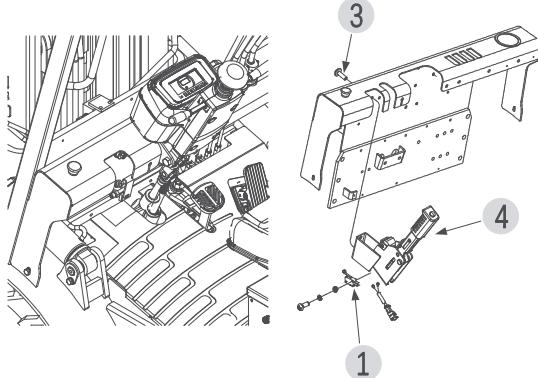


Fig3127-10001SM

6.1.2 Adjustment

CAUTION

Prior to parking brake adjustment, use triangle wooden wedges to fix the wheels.

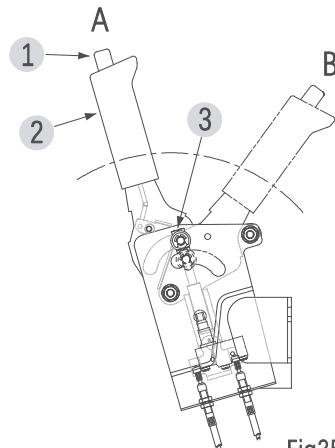


Fig3530-10008SM

- Press and hold the button (1), push the parking brake lever (2) from A position (braking) to B position (released).
- Turn adjusting bolt (3) to adjust the operating torque for pulling the brake lever (2) from B position to A position.
- Operating torque: 147~196 Nm



CAUTION

Ensure truck will not travel when parking brake is applied.

Ensure parking brake will hold on a 15% grade unloaded at minimum.

BRAKE SYSTEM

6.2 Service Brake

6.2.1 Removal and Installation

Removal

- Unscrew the eight screws used to fix the control panel and remove the left hood.
- Remove the three tubes (7, 12 & 13) on brake master cylinder (2).
- Unscrew the two nuts (5) and bolts (1), remove the cotter pin (4) on the pin shaft (3), then remove the brake master cylinder (2).
- Unscrew one nut (8) and one bolt (9), remove the spring (10), then remove the brake pedal (11).

Installation

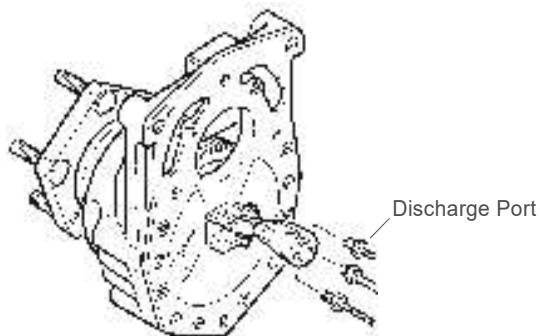
- Install in the reverse order of removal.

CAUTION

After replacing the brake master cylinder or tubing, the air within the entire brake pipeline must be discharged.

Air Discharge / Adding Brake Fluid

- Fill the oil cup (6) with brake fluid.
- Press the brake pedal (11) repeatedly until the stepping pressure becomes heavy.



- Open the vent on brake cylinder of drum brake, press the brake pedal pressure to the bottom, discharge the residual air from the vent through high level of brake fluid.
- When there is flow of fluid running out of the vent, it indicates that the air discharge is completed, release the brake pedal and close the vent.

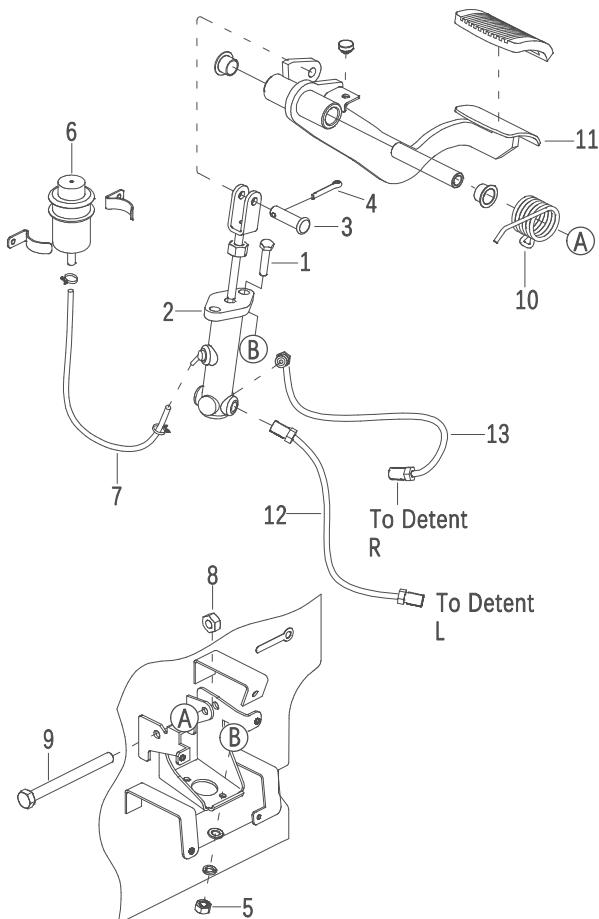


Fig3530-10009SM

CAUTION

During the entire process of operation, there must always be brake fluid in the oil cup.

- Add brake fluid into the oil cup until it fills 2/3 of the cup. Apply as specified (see Section 2.2.3 for specifications).

7. OPERATING SYSTEM

7

OPERATING SYSTEM

7.1 Control Lever

Removal

- Remove the cushion and floorboards.
- Unscrew the four bolts (23, Fig 3214-30002SM) and remove the steering column (24) from the chassis.
- Remove the five tubes on the redirector (21, Fig3214-30001SM).
- Disconnect the harness carefully from the main harness.
- Unscrew four bolts (25, Fig3214-30002SM), and remove steering assembly from the chassis.
- Remove the horn cover (1), unscrew the nut and pull up the steering wheel (2).
- Unscrew the four screws (8) and open the back cover plate (7).
- Disconnect the connection between the key switch (9) and main wiring harness, then remove the key switch and back cover plate (7).
- Unscrew the adjusting handle (5) and four screws (10), then remove the front cover plate (6).
- Cut off the connection between the combination switch (12 & 13) and the main wiring harness.
- Unscrew the four screws (11), remove the travel combination switch (12) and lighting combination switch (13) from the steering column (14).
- Unscrew the bolt (18) , remove the Redirector Bracket(16),bearing(19) and Steering Shaft(20) .
- Unscrew two nuts and remove the steering column(14).

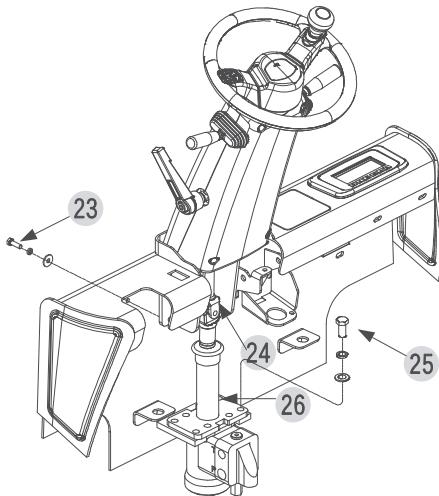


Fig3214-30002SM

Installation

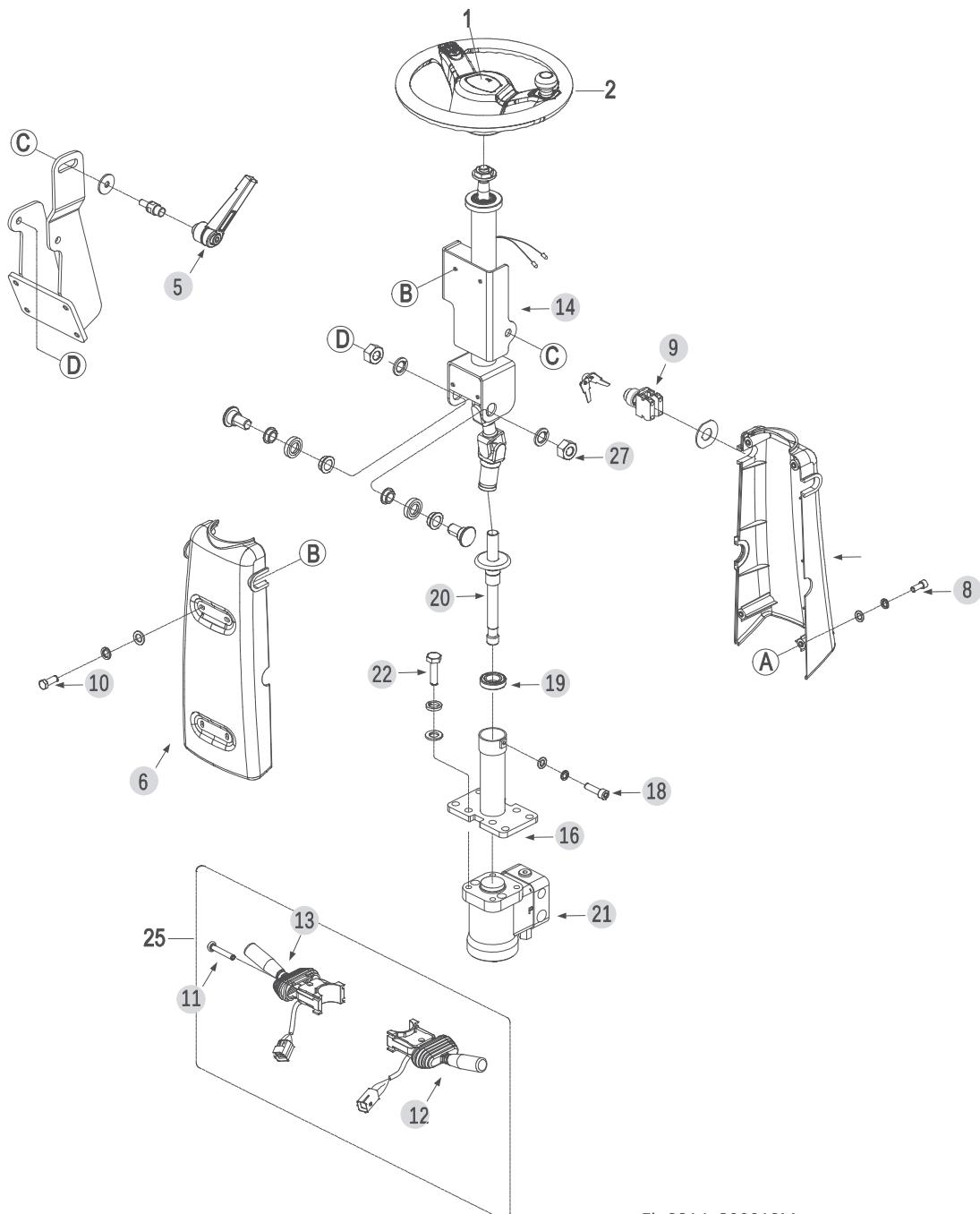
- Install in the reverse order of removal.



CAUTION

When removing or installing, protect the cables from being damaged.

OPERATING SYSTEM



7

Fig3214-30001SM

8. HYDRAULIC SYSTEM

8

NOTE:

HYDRAULIC SYSTEM

The system pressure of the entire hydraulic system pressure is provided by hydraulic power unit system, which is used for lifting/tilting/sideshifting. 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.

Multi-way manual valve is used for the control of lifting-lowering, tilting and sideshifting. Throttle valve is used for the control of lowering speed. Inlet is equipped with a filter to prevent the impurities in the hydraulic oil from entering into the pump.

Oil pipeline explosion-proof valve is installed at the hydraulic cylinder to prevent the explosion of the system pipeline.

Hydraulic Schematic Diagram is as shown in Fig3214-40001SM.

See Section 8.7 for hydraulic symbol descriptions.

8.1 Overview

- Lower the mast to the bottom, remove the air filter on cylinder, observe the oil level with the oil dipstick. When adding hydraulic oil, use hydraulic oil of the same specifications.
- When the mast occasionally jitters, there may be leaks in the cylinder, or leaks on the valve body. Dismantle and clean the valve on the valve body, (use hydraulic oil of the same specifications). Discharge the foreign bodies within the valve body through repeatedly lifting and lowering of the mast.

If hydraulic oil is going down, thoroughly

- check the hydraulic system for leaks.

Disassembly of cylinder needs to be performed in a clean environment. Before removing the cylinder, the stains on the cylinder must be removed first. Carefully remove the piston rod to prevent the cylinder wall from being scratched by its end surface or damaged part. When replacing the cylinder, also replace the cylinder seals.

Hydraulic Oil

Hydraulic oil for truck:

Specifications: Anti-wear Hydraulic Oil L-HM46.

Hydraulic Seals

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

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

Assembly Instructions

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

Where the hydraulic seals 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 for protection. Before installing, lubrication should be applied to the seals and the mounting positions.



CAUTION

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

8.1.1 Hydraulic Schematic Diagram

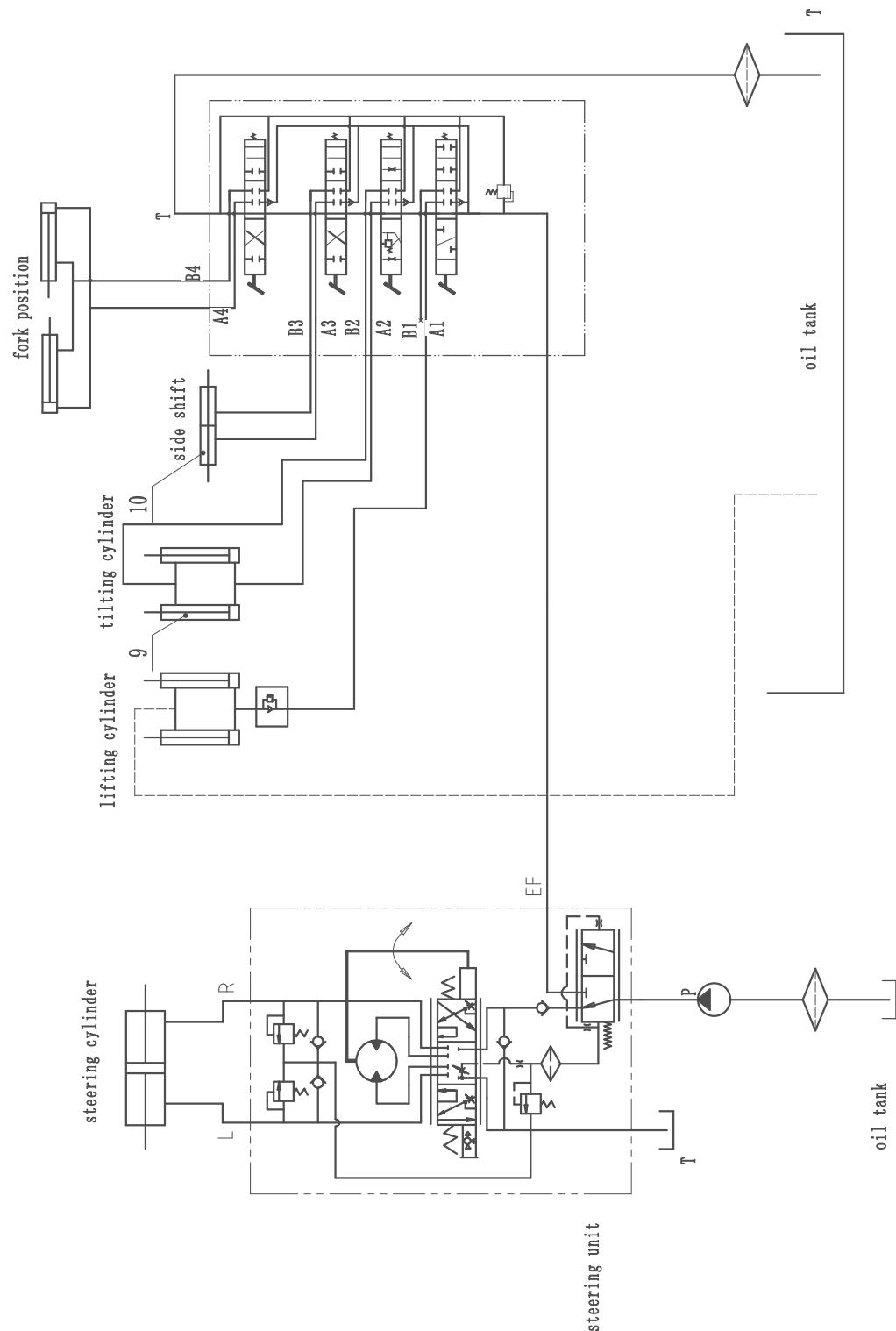


Fig3214-40001SM

HYDRAULIC SYSTEM

8.2 Pump Motor & Gear Pump

8.2.1 Removal and Installation

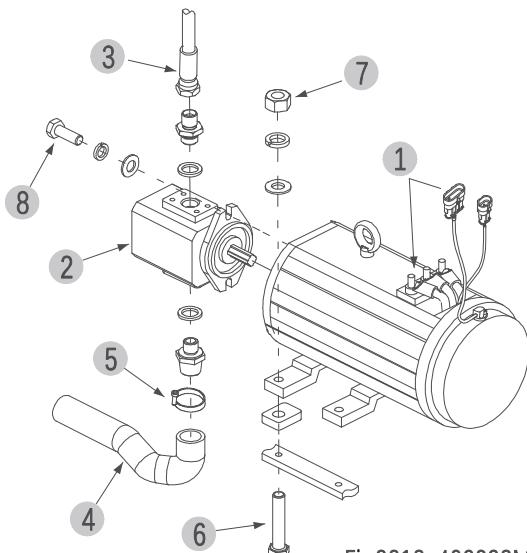


Fig3218-40003SM

Removal

- Remove the pedal from the cabin.
- Remove the AMP connector on the pump motor and pump motor and carry out the following operations to the motor (1) remove the three cables U, V and W connected to the controller.
- Remove the tubing head between gear pump (2) and redirector with a wrench, and then remove the tubing (3).
- Loosen the clamp (5) on inlet tubing (4).
- Loosen the four pump motor mounting bolts (6) and nuts (7) and remove the pump motor (1).
- Loosen the two gear motor mounting bolts (8) and remove the gear motor (2).

Installation

- Install in the reverse order of removal.



CAUTION

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

8.3 Pump Motor

This truck obtains hydraulic power through the AC pump motor.

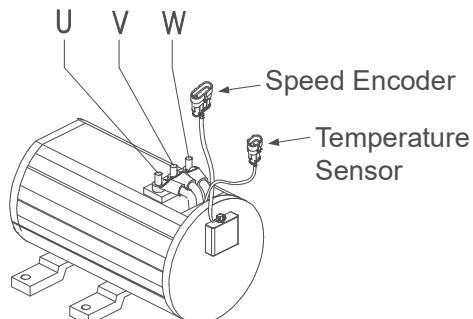


Fig3530-40008SM

8.3.1 Removal and Installation

See Section 8.2.1 .

Speed Encoder

Removal

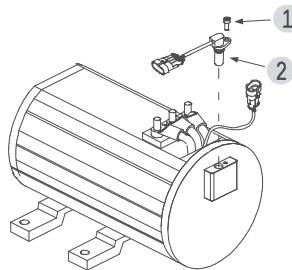


Fig3530-40009SM

- Switch off the truck power connections and remove the pedal.
- Unplug the AMP connector on the speed encoder(2, Fig3530-40009SM) .
- Unscrew the screw (1) from the drive motor and remove the speed encoder.

Installation

- Install in the reverse order of removal.

8.3.2 Faults and Causes

	Fault	Motor does not rotate
1	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
	Fault	Motor with abnormal noise or vibration
3	Cause	a. Uneven clearance between stator and rotor. b. Bearing failures. c. Loosening fixing screws on motor housing.
4	Fault	Motor smoking or burning smell
	Cause	Stator winding short circuit, motor burnt
	Fault	Motor temperature too high, controller failure
5	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.
	Fault	On load, motor speed is turning slow
6	Cause	a. Insufficient voltage of battery. b. Overload. c. U, V, W terminals with abnormal voltage input. d. Speed encoder or its circuit failure.

8.3.3 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
With readings, but very low	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.

8

Temperature Sensor

Temperature sensor is used to monitor motor temperature.

HYDRAULIC SYSTEM

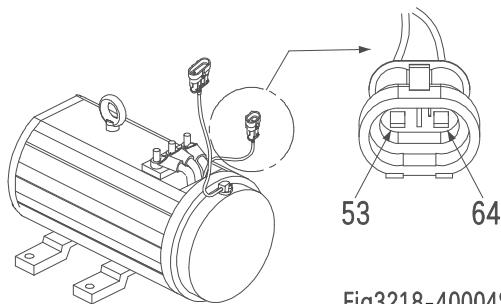


Fig3218-40004SM

Measure the resistance between pin connector (53#) and (64#) with a multimeter to identify if the temperature sensor is normal.

As shown in the following table:

Resistance Measurement	Judgment
With readings	Normal
0Ω	Sensor short circuit (replace the motor)
$\infty \Omega$	Sensor open circuit (replace the motor)

Speed Encoder

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

8

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 (52#) and (53#) with a multimeter, normally should be 12V.

Check if the connection between 54# and 55#

- is reversed. (If the two circuits are connected reversely, the controller won't report for failure, but the travel speed of the truck may slow down)

Check the "ENCODER" readings on TESTER

- Menu. Operate the truck, if the display is always "0":

Speed encoder failure.

Motor encoder disc failure.

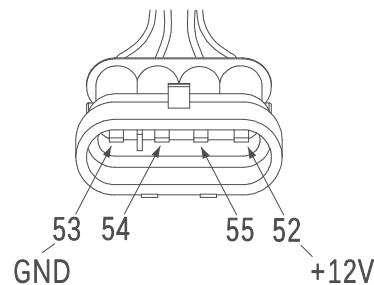


Fig3131-40008SM

8.4 Multi-way Reversing Manual Valve

The valve rod is driven by lever to switch the ON and OFF of tubing within the valve body, thus to control the Lifting - Lowering, Forward Shifting - Retract, Tilting Forward - Tilting Backward and Left Shifting - Right Shifting of the truck.

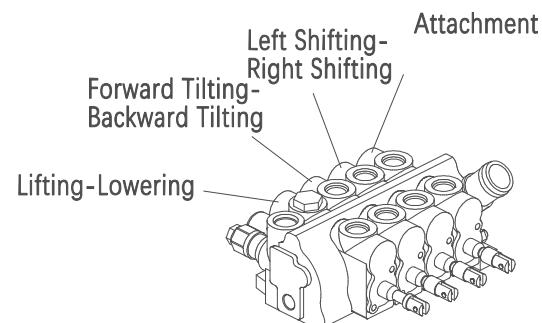


Fig3131-40011SM

8.4.1 Removal and Installation

Removal

- Turn off the truck power and remove the key.
- Remove the cushion and floorboard.
- Disconnect the harness on the multi-way reversing manual valve.
- Undo nine screws (26) and (27), remove valve cover (25).
- Unscrew four bolts(28) and remove the valve control linkage assembly.
- Remove the tubing on the multi-way valve (1) and disconnect the connection between the control switch and main wiring harness.
- Unscrew four bolts(6) and remove the operation lever assembly.
- Remove the cotter pin on pin shaft (10), remove the connecting rod (11) between multi-way valve and control lever.
- Remove the multi-way valve (1) from the mounting plate (9).
- Unscrew the two bolts (4) and remove control switch mounting plate (5) from the valve, then loosen the nuts (2) to remove the control switch (3).
- Loosen the bolt (13), remove the main control pin shaft (12) and control lever (14) from the control lever mounting base (17).

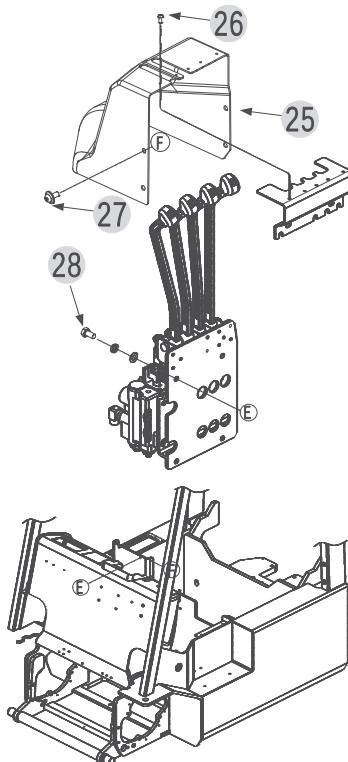


Fig3214-40014SM

Installation

- Install in the reverse order of removal.

8

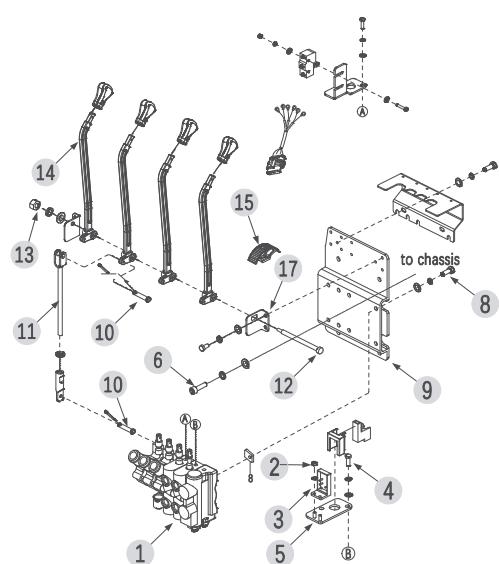


Fig3214-40012SM



CAUTION

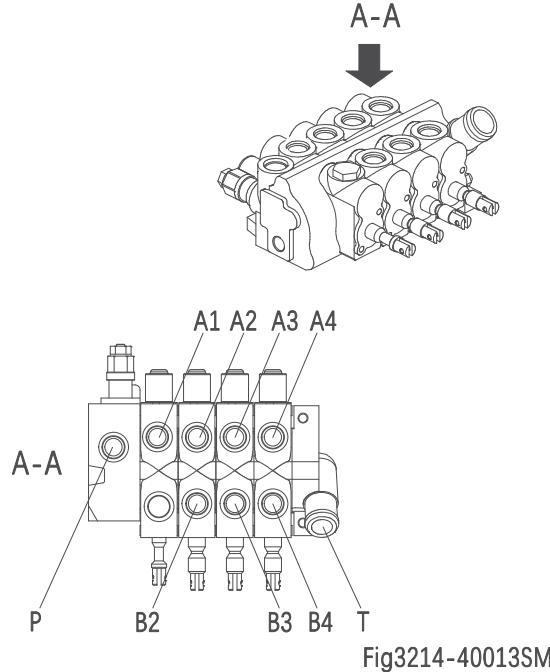
Some hydraulic oil will be lost when removing the manual multi-way valve, add appropriate amount of hydraulic oil after the replacement is completed (see Section 2.2.3 for specifications and adding amount).

Adjustment

- Adjust the length of the connecting rod through operating the nut on the connecting rod (11). When the valve rod of multi-way valve is at original position, adjust the control lever (14) to a vertical position.

HYDRAULIC SYSTEM

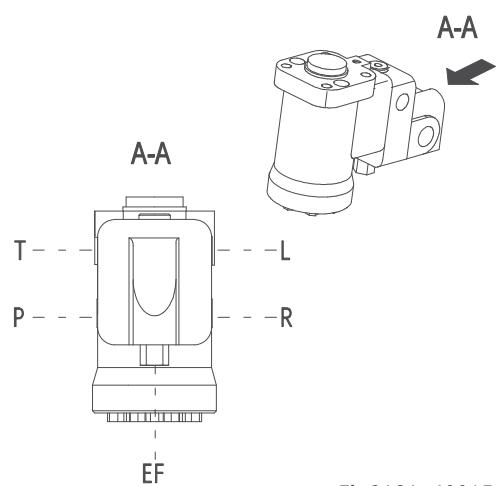
8.4.2 Interface Description



	Fault	The truck cannot perform the hydraulic control instructions
1	Cause	a. Valve failure. b. Valve seat blocked by large impurities. c. External leakage: sealing damaged. poor threaded connection. valve body defects. d. High viscosity of hydraulic oil. e. High frequency of use, service life has expired already.
	Fault	Slow pace of actuator
2	Cause	a. Overflow valve in the connection block started. b. Valve seat leakage. c. Valve rod cannot push/pull to bottom. the channel cannot be fully opened. d. High viscosity of hydraulic oil. e. High frequency of use, service life has expired already.

Symbol	Interface Function	Connection Terminals	Interface Size
A1	Lifting, lifting / lowering solenoid valve controls	Lift Cylinder	M20×1.5
A2	Backward tilting, backward tilting solenoid valve controls	Tilt Cylinder	M20×1.5
B2	Forward tilting, forward tilting solenoid valve controls	Tilt Cylinder	M20×1.5
A3	Right shifting, right shifting solenoid valve controls	Side-Shift Cylinder	M20×1.5
B3	Left shifting, left shifting solenoid valve controls	Side-Shift Cylinder	M20×1.5
A4	Reach, reach solenoid valve controls	Reach Cylinder	M20×1.5
B4	Retracting, retracting solenoid valve controls	Reach Cylinder	M20×1.5
P	Oil Inlet	Redirector	M22×1.5
T	Drainback	Tank	ø30

8.5 Redirector



- Unscrew the four bolts (3), dismantle the redirector (4).
- Install in the reverse order of removal.



CAUTION

Some hydraulic oil will be lost when removing the redirector, add appropriate amount of hydraulic oil after the replacement is completed (see [Section 2.2.3](#) for specifications and adding amount).

7.4.3 Faults and Causes

	Fault	Oil leaks
1	Cause	a. Redirector defects. b. Poor sealing with leakage.
	Fault	Redirector is not functioning properly or noise
2	Cause	a. Redirector defects. b. Insufficient oil. c. There is air in the oil. d. High viscosity of oil. e. Pressure of relief valve adjusted too low or adjustment failure.

8

8.5.1 Removal and Installation

- Turn off the truck power and remove the key.
- Remove the cushion and open the floorboard.
- Loosen the joint (1) and remove the tubes (2) on the redirector (4).



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

8.5.2 Interface Description

Symbol	Interface Function	Connection Terminals	Interface Size
T	Drainback	Tank	M18×1.5
P	Oil Inlet	Gear Pump	M20×1.5
L	Left turning, steering wheel controls	Steering Bridge	M18×1.5
R	Right turning, steering wheel controls	Steering Bridge	M18×1.5
EF	Port, to the Port P of multi-way valve	Multi-way Valve	M20×1.5

HYDRAULIC SYSTEM

8.6 Tilt Cylinder

8.6.1 Cylinder Removal Precautions

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

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

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

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

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

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

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



CAUTION

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

- 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.

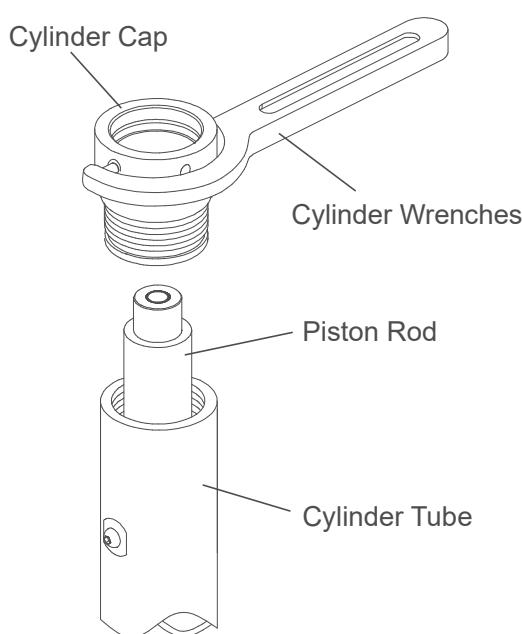


Fig0000-90001SM

- * See Section 8.1.4 or Section 8.3.4 for the removal and installation of lift cylinder and side shift cylinder.
- * See Section 5.3.1 for the removal and installation of steering cylinder.

8.6.2 Cylinder Installation Precautions

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

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



CAUTION

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

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

HYDRAULIC SYSTEM

8.6.3 Removal and Installation

Cylinder is installed on the chassis and outer mast.

- Secure the masts with a crane, block the truck wheel with a wooden wedge, press the emergency stop switch and disconnect the key switch.
- Remove the accelerator pedal from the cabin.
- Remove the rubber pad(7) and floor board(8) .
- Remove the two tubes (6) from the tilt cylinder (3).



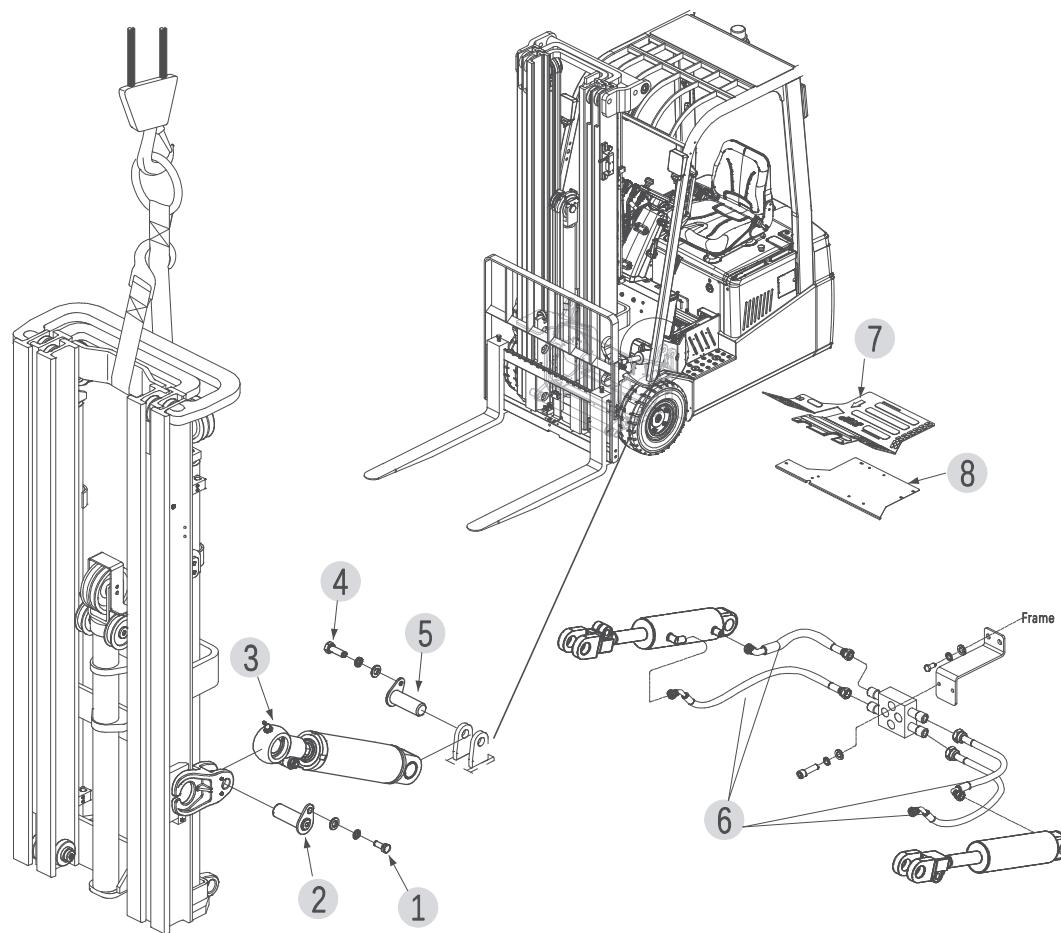
CAUTION

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

- Unscrew the anchor bolt (1) from the outer mast with socket wrench and pull out the pin shaft (2).

- Unscrew the anchor bolt (4) from the chassis with socket wrench and pull out the pin shaft (5).
- Remove the tilt cylinder (3).
- Replace with new cylinder and install in reverse order.
- Add hydraulic oil of the same specifications into the tank, see Section 2.2.3.
- Pull out emergency switch and turn on the key switch.
- Repeat tilt cylinder to discharge the air within the tubings and cylinder.
- Check the hydraulic oil level and make sure that the liquid is at standard level.

8



8.6.4 Cylinder Maintenance



CAUTION

- Use suitable hose clamps to avoid cylinder deformation caused by severely tight hose clamp.
- Carry out the maintenance work in a clean environment to prevent impurities from entering into cylinder, causing cylinder damage.
- During the installation, hydraulic oil of the same specifications must be used for cleaning or lubrication.

- Secure the cylinder to hose clamp and gently clamp the cylinder bottom.
- Unscrew the nut (4, Fig3214-40004SM) and bolt (3), then remove the ear (2) from the piston rod (18).
- Unscrew the cylinder cap (13) with cylinder wrench.
- Remove the dust ring (6), seal (9), and Seal ring (10) from the cylinder cap (13).
- Remove the bearing (14), Rubber ring (11) and O-ring (12) from the cylinder cap (13).
- Pull out the piston rod (18) from cylinder block (15).
- Remove the seal (16) and support ring (17) from the piston rod.

- Clean with hydraulic oil of the same specifications.
- Replace the problem parts and assembly in reverse steps.

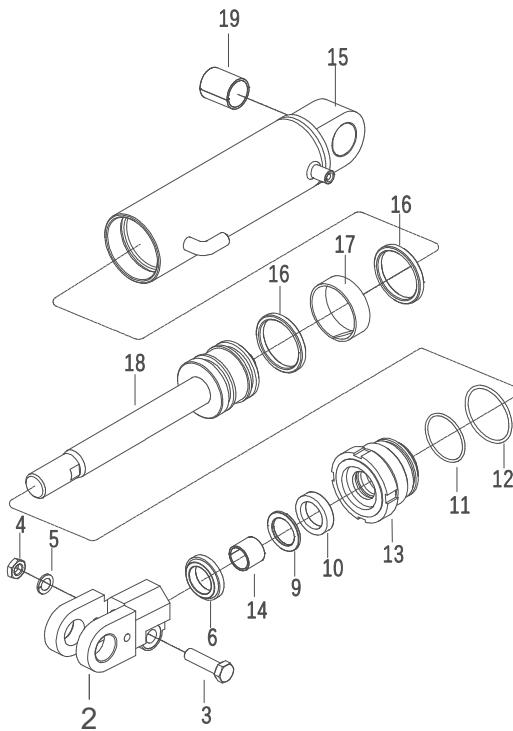


Fig3214-40004SM

8



CAUTION

- If the piston rode or cylinder tube is damaged, please replace the entire cylinder.
- If the seals are aged or damaged, replace the complete set of seals.
- When replacing or repairing the cylinder, refill the lubricant through the grease nipples at both ends of the cylinder.

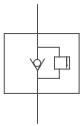
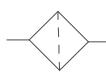
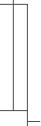
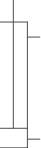
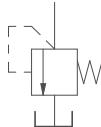
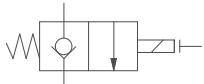
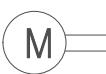
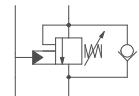
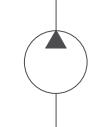


CAUTION

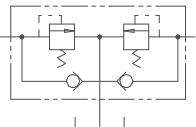
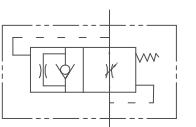
- Use suitable hose clamps to avoid cylinder deformation caused by severely tight hose clamps.
- Carry out the maintenance work in a clean environment to prevent impurities from entering into cylinder, causing cylinder damage.
- During the installation, hydraulic oil of the same specifications must be used for cleaning or lubrication.

HYDRAULIC SYSTEM

8.7 Hydraulic Symbol

Symbol	Description	Symbol	Description
	Tank Pipe end below liquid level		Explosion-proof valve
	Tank Pipe end above liquid level		Check valve
	Filter		Cylinder Single-acting direction
	Service line (Supply line or return line)		Cylinder Double-acting direction
	Control line (Drain line)		Relief valve
	Connecting pipe		Solenoid valve Two-way two-pass
	Port (Test port)		Solenoid valve Three-way four-pass
	Motor		Balancing valve
	Hydraulic pump		Manual valve Three-way six-pass

HYDRAULIC SYSTEM

Symbol	Description	Symbol	Description
	Brake valve		Speed regulating valve

9. MAST

9

NOTE:

MAST

9.1 Three-stage Full Free Mast

9.1.1 Removal and Installation

Removal (Fig3124-60003SM)

- Disconnect the connections between lifting - lowering tubing, left shifting tubing and right shifting tubing and mast tubing.
- Wrap the sling (1) around the upper beam of inner and outer masts, slightly lift the mast with crane.
- Remove the shafts (2) between the outer mast and tilt cylinders (A and B).

- Unscrew the bolts (3) and remove the fixed plate (4) between the outer mast and chassis (C and D).

- Remove the mast from the truck.

Installation

- Install in the reverse order of removal.



WARNING

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

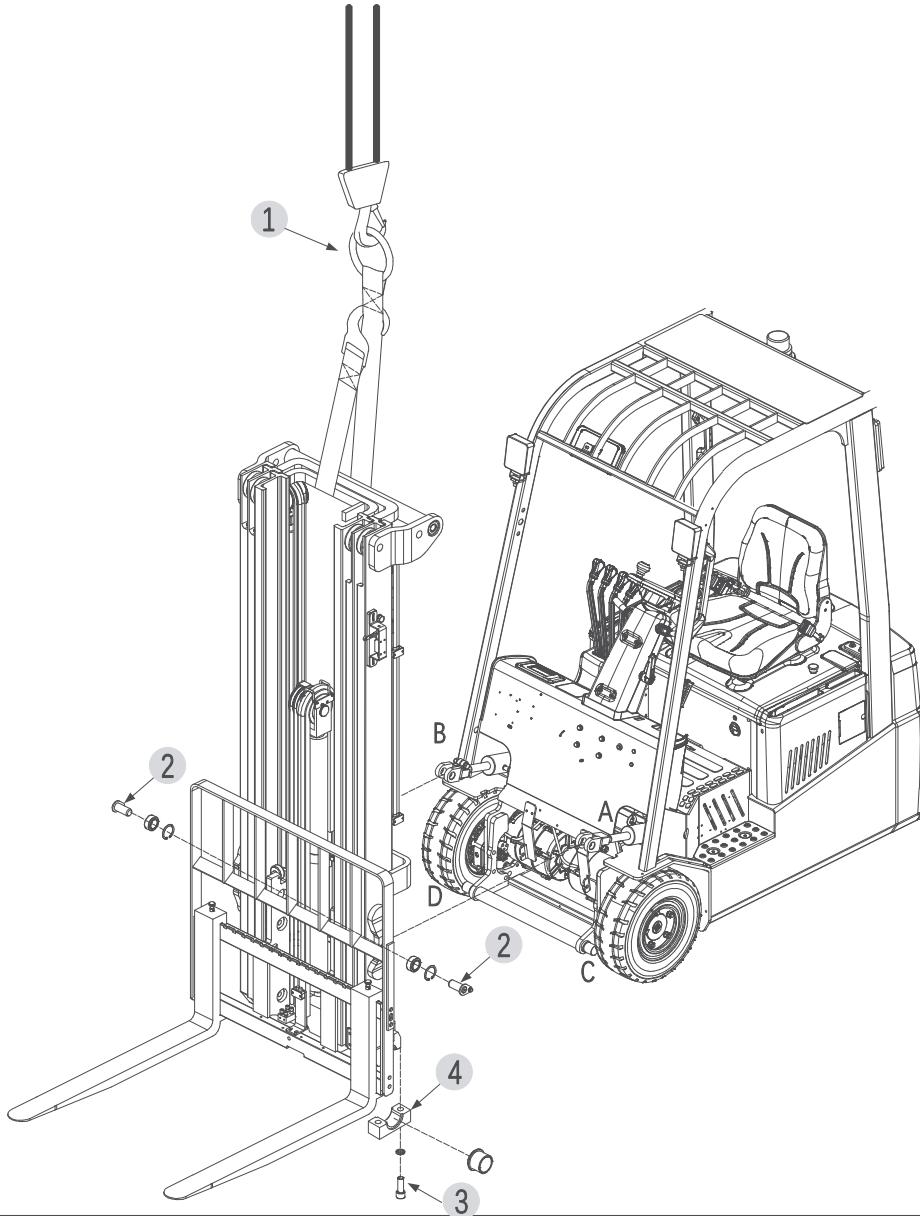


Fig3124-60003SM

9.1.2 Lifting Chains

9.1.2.1 Chain Adjustment

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



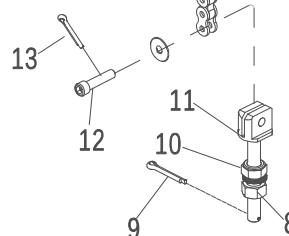
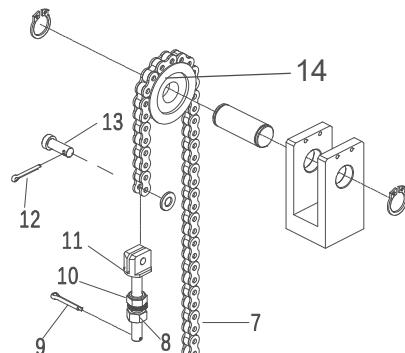
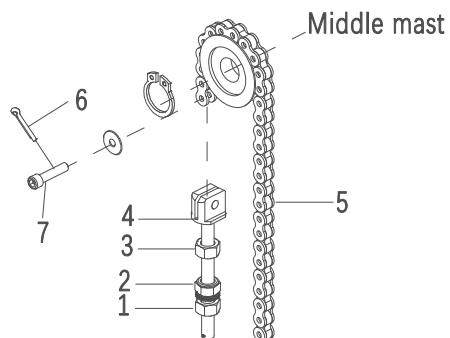
CAUTION

Switch off the power supply before any adjustments or operations.

- Loosen the upper lock nut (3, Fig3214-60001SM) and the lower lock nut (1, Fig3214-60001SM) (8, Fig3214-60002SM) on chain bolt.

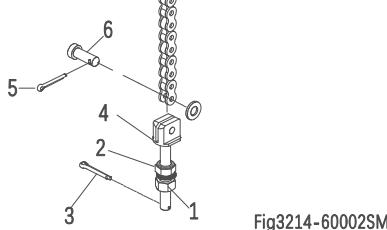
- By screwing the adjusting nut (2, Fig3214-60001SM) upward and (10, Fig3214-60002SM) in the middle, the chain will slowly tension.

When the chain is adjusted to be tense with no obvious loosening, fasten the upper and lower lock nuts.



9

Fig3214-60001SM



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.

9.1.2.2 Chain Replacement

Mast Chains

- Block the truck wheels with wooden wedges, raise the inner mast) 20in, insert wooden block between inner mast and the ground for support.



CAUTION

Place support under the inner mast to prevent it from falling, which could result in personal injury.

- Unscrew the lock nut (3,1 Fig3214-60001SM) and adjusting nut (2) from the chain joint (4), then remove the chain joint (4) from outer mast.
- Remove the cotter pins (6), pull out the pin shaft (7), separate the chains (5) from the pin shaft(7).
- Remove the cotter pins (13), pull out the pin shaft (129), separate the chains (5) from the chain joint (11) on inner mast.
- 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 (11) through chain hole of Chain bracket, insert the pin shaft (12) and pins (13).
- Put the chain connector (4) through the outer mast chain-hanging plate, screw the adjusting nut (2) and lock nut (3), insert the pin shaft (7) and pins (6).
- Adjust the chains according to Section 9.1.2.1.

9

Fork Carriage Chains

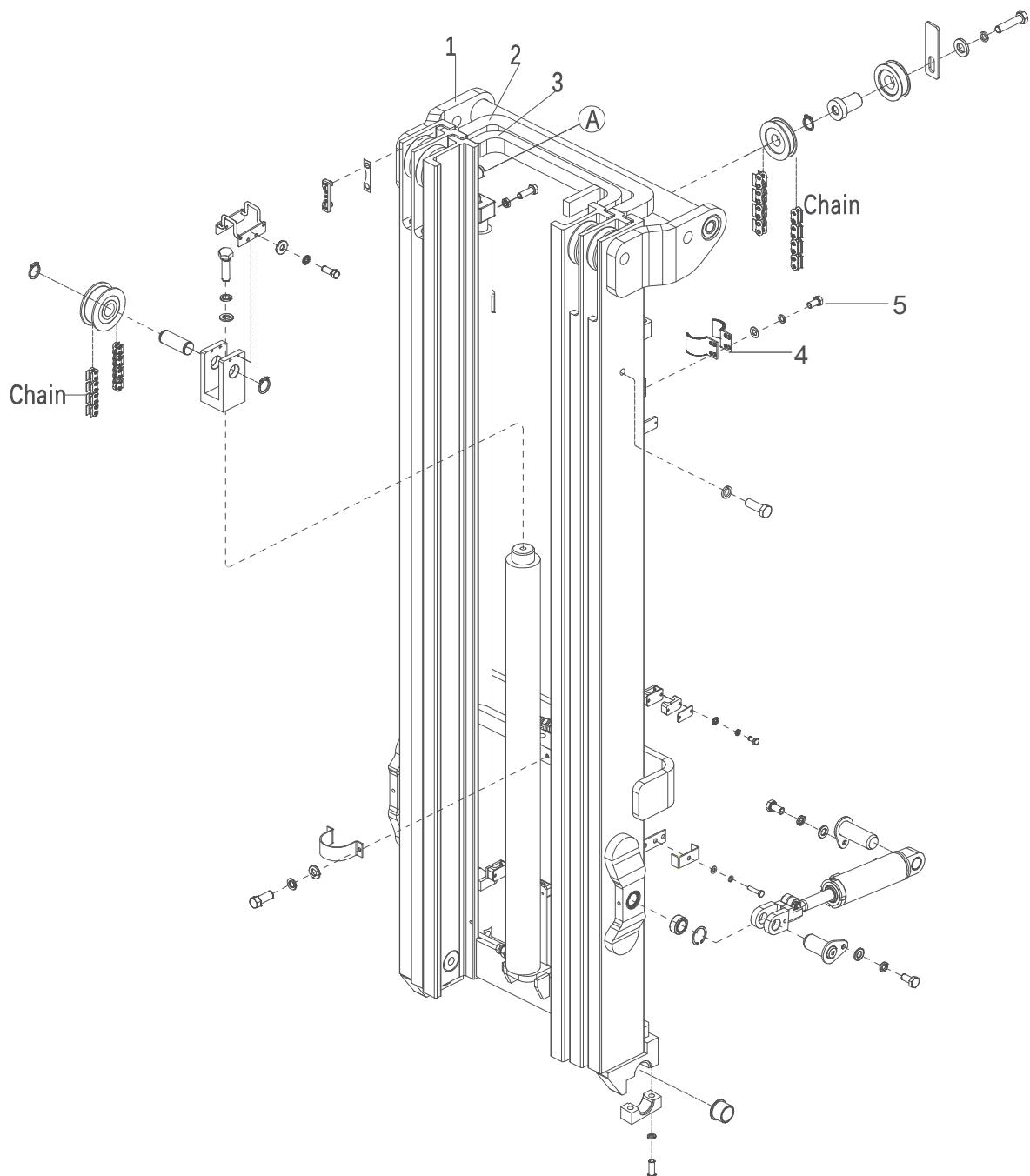
- Block the truck wheels with wooden wedges, raise the fork carriage for 20in, insert wooden block between inner mast and the ground for supporting.



CAUTION

Place supporting under the inner mast to prevent it from falling, which could result in personal injury.

- Unscrew the lock nut (8, Fig3214-60002SM) , adjusting nut (10) from the chain joint (11), then remove the chain joint (11) from middle cylinder.
- Remove the cotter pins (12), pull out the pin shaft (13), separate the chains (7) from the chain joint (11).
- Remove the cotter pins (5), pull out the pin shaft (6), separate the chains (7) from the chain joint (6) on fork carriage.
- Remove the chain assembly from the chain sprocket (14, Fig3214-60002SM).
- Replace with new chains and hang the new chain assembly onto the chain sprocket.
- Put the chain connector (4) through chain hole of fork carriage, insert the pin shaft (6) and pins (5).
- Put the chain connector (11) through the middle cylinder chain-hanging plate, screw the adjusting nut (10) and lock nut (8), insert the pin shaft (13) and pins (12).
- Adjust the chains according to Section 9.1.2.1.



9

Fig3214-60016SM

MAST

9.1.3 Mast Tubing

HYDRAULIC SYSTEM OF LIFT SYSTEM

Code	Description
A1	Lifting / Lowering Mast Tubing

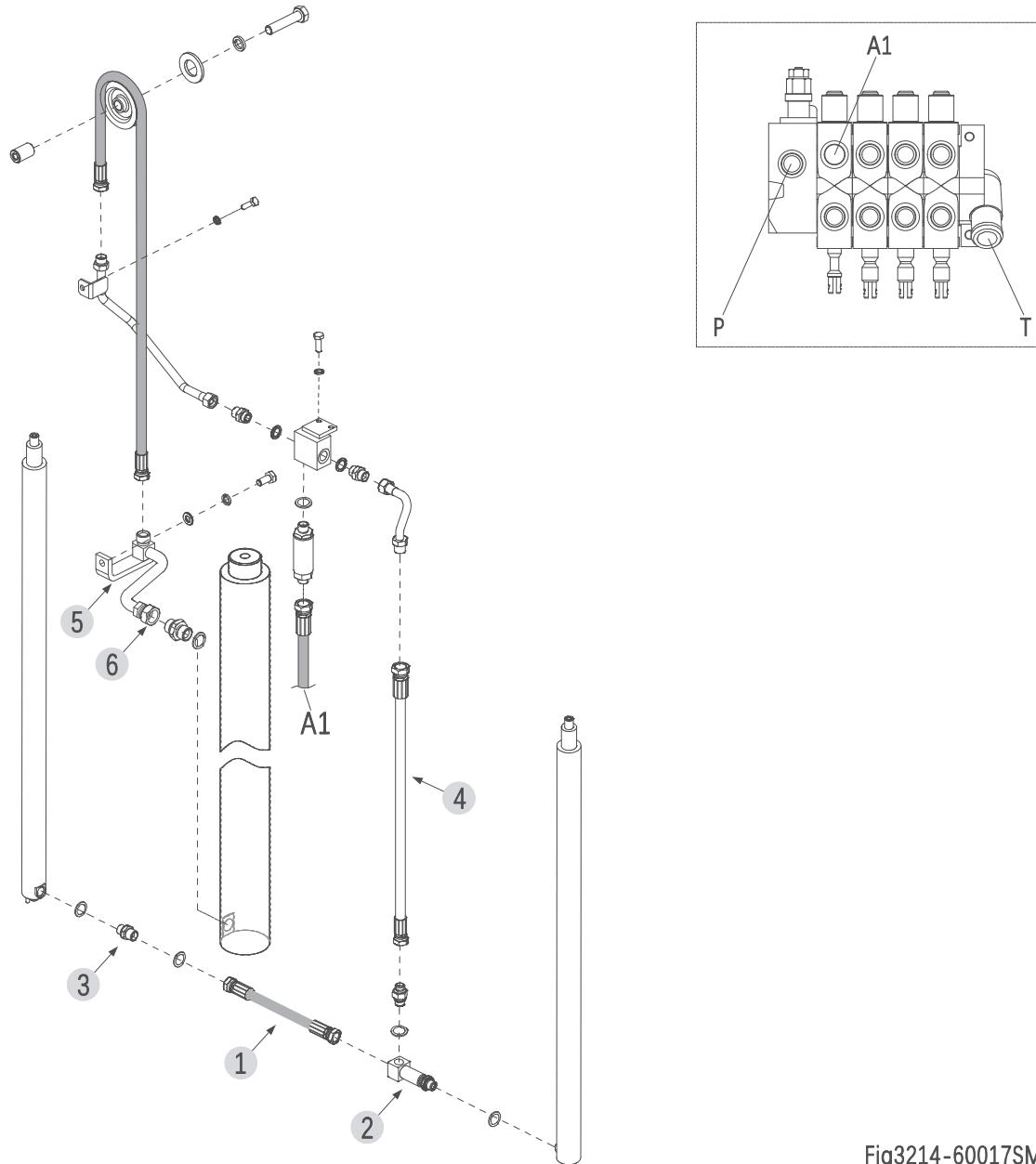


Fig3214-60017SM

HYDRAULIC SYSTEM OF THIRD PIPELINE

Code	Description
A3	Right Shift Mast Tubing
B3	Left Shift Mast Tubing

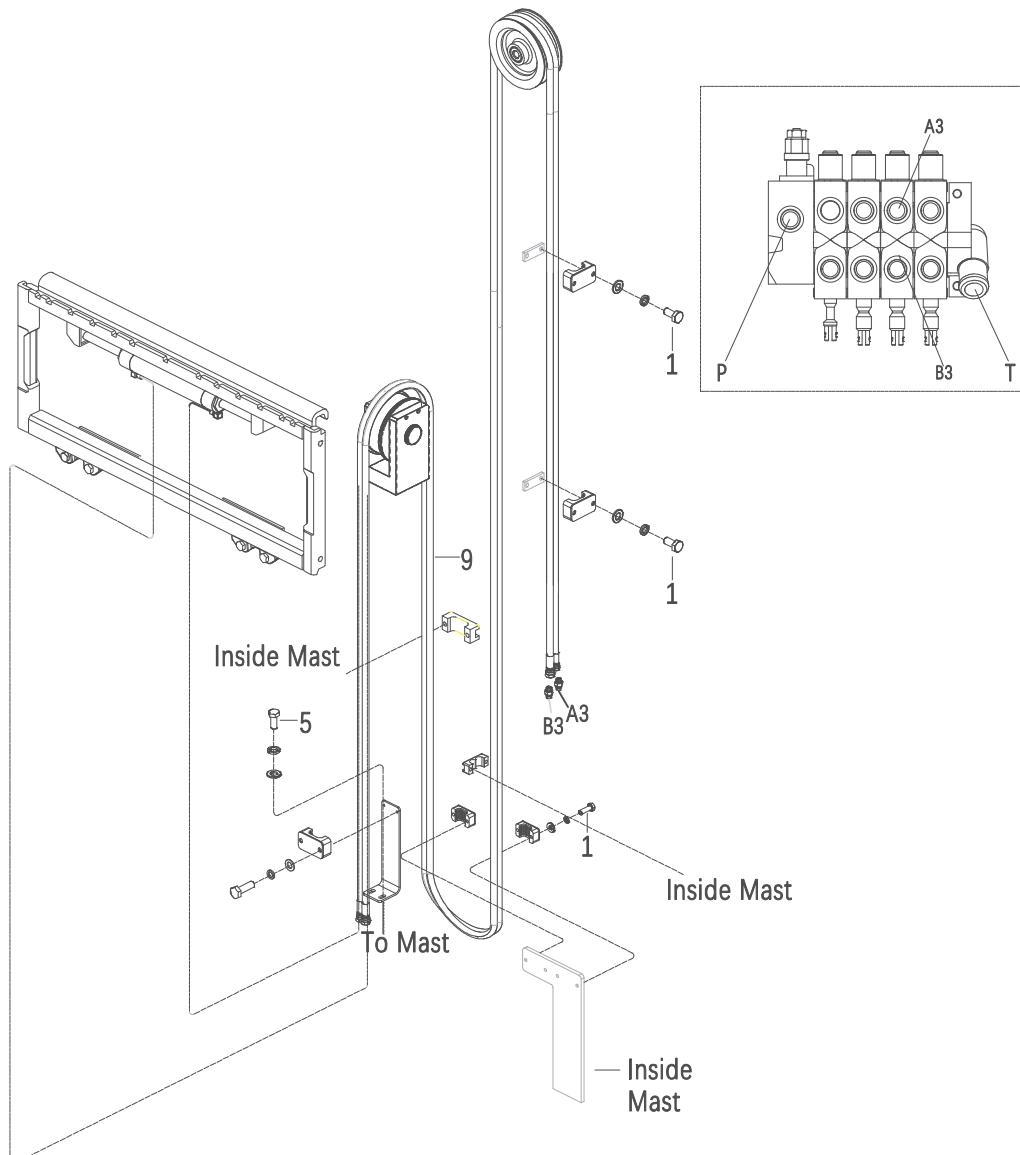


Fig3214-60018SM

MAST

HYDRAULIC SYSTEM OF FOURTH PIPELINE

Code	Description
A4	Attachment
B4	Attachment

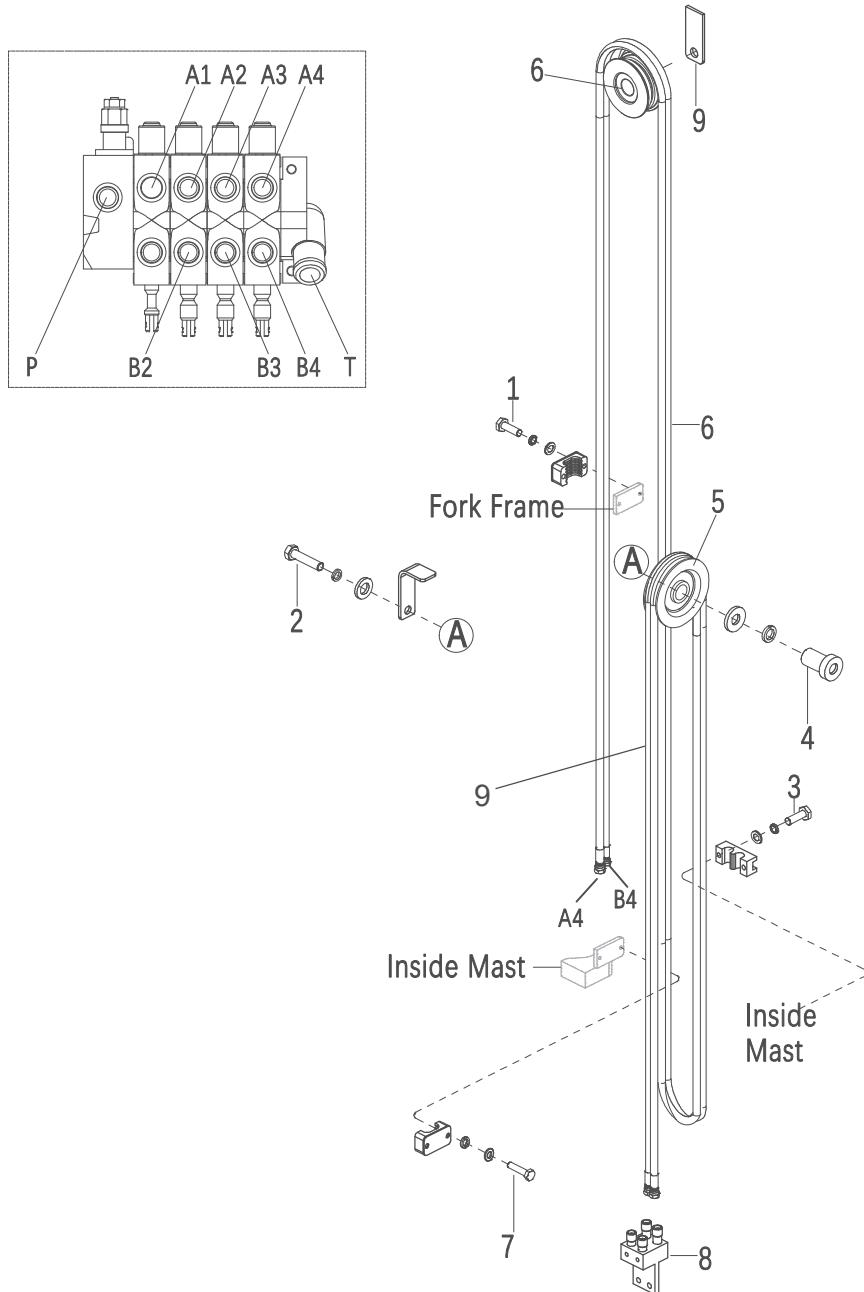


Fig3214-60019SM

9.1.4 Lift Cylinder

9.1.4.1 Cylinder Removal

Left Cylinder Removal (with mast down)

- Remove the mast from the chassis according to Section 8.3.1.
- Lay down the mast with lifting tools (with outer mast underneath the inner mast), place sleepers at both ends for supporting.
- Disconnect the connections between the tubing (1, Fig 3214-60017SM) and three-pass assembly (2).
- Remove the tubing (4) from the three-pass component (2).

 **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.

 **CAUTION**

Before going on with the next step, fix the cylinder properly first. Prevent cylinder from falling during removal, which could result in personal injury.

- Unscrew bolt (1) and remove the cylinder (7) from the mast.

- Remove the three-pass component (2, Fig3214-60017SM) from the left cylinder.

Right Cylinder Removal (with mast down)

- Remove the mast from the chassis according to Section 8.3.1.
- Lay down the mast with lifting tools (with outer mast underneath the inner mast), place sleepers at both ends for support.
- Disconnect shree-pass assembly (7, Fig3214-60017SM)from the right 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 bolt (3, Fig3214-60020SM) and remove the cylinder clamp (5).

 **CAUTION**

Before going on with the next step, fix the cylinder properly first. Prevent cylinder from falling during removal, which could result in personal injury.

- Unscrew bolt (2) and remove the cylinder (7) from the mast.

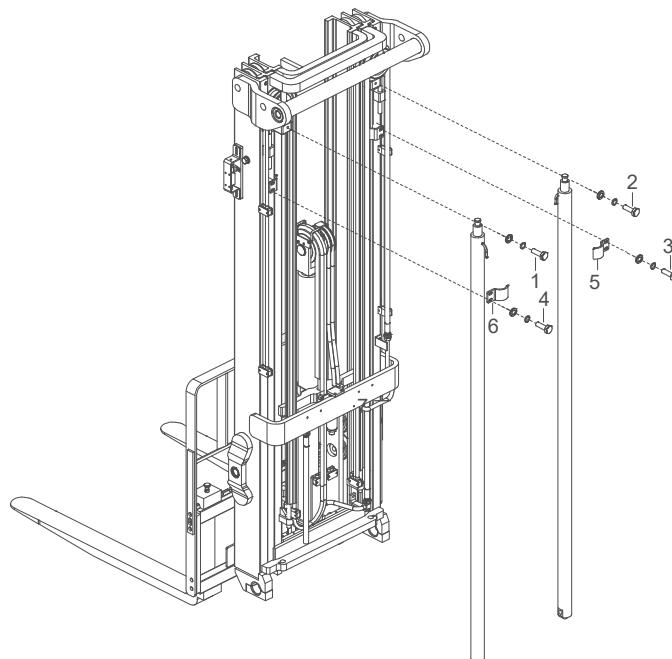


Fig3214-60020SM

MAST

Full Free Middle Cylinder (with mast on the truck)

- Lower the mast to the bottom, press the emergency stop switch and disconnect the key switch.
- Remove load backrest ([see Section 8.1.5.1](#)).
- Block the truck wheels with wooden wedges, raise the fork carriage 20in with lifting tools, insert wooden block between it and the ground for supporting.

CAUTION

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

- Loosen the joints (6, Fig3214-60017SM) to separate the middle cylinder and rigid pipe assembly (5).
- Disconnect the connections between the tubings (2, Figure 3214-60018SM) and(9, Figure 3214-60019SM) if necessary on the middle cylinder.
- Remove the fork carriage chains according to [Section 9.1.2.2](#).

- Unscrew bolt (5, Fig3124-60016SM) and remove the Tubing baffle (4).
- Remove the circlip (7),remove the fork carriage chain, middle cylinder tube roller (6) and shaft (8).
- Unscrew the bolt (13) and remove the middle cylinder fixing plate (9) from the cylinder (12).

CAUTION

Before going on with the next step, fix the cylinder avoid it falling during removal, which could result in personal injury.

- Unscrew the bolt (10) and remove the cylinder clamp (11).
- Remove the cylinder (12) from the mast.

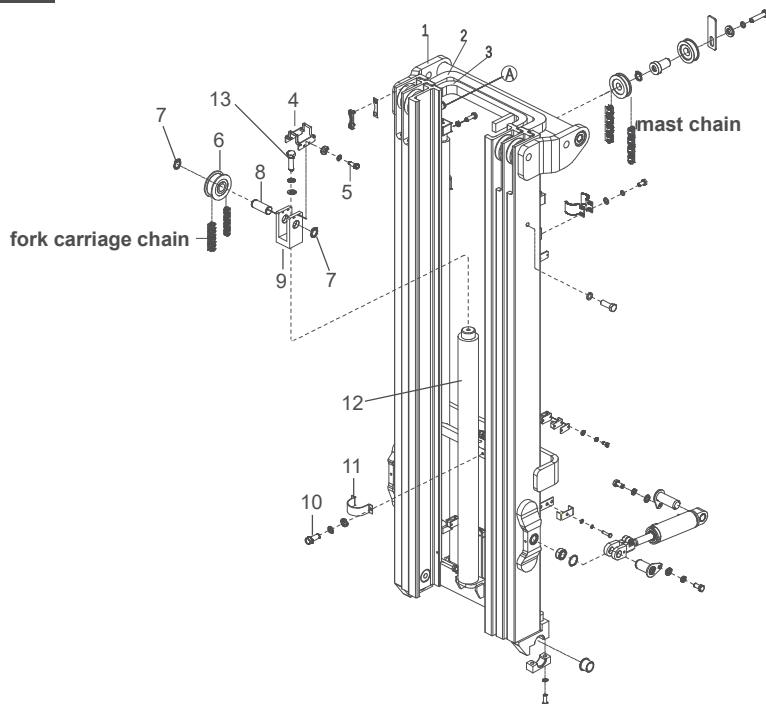


Fig3214-60016SM

9.1.4.2 Cylinder Maintenance

Lifting Side Cylinder

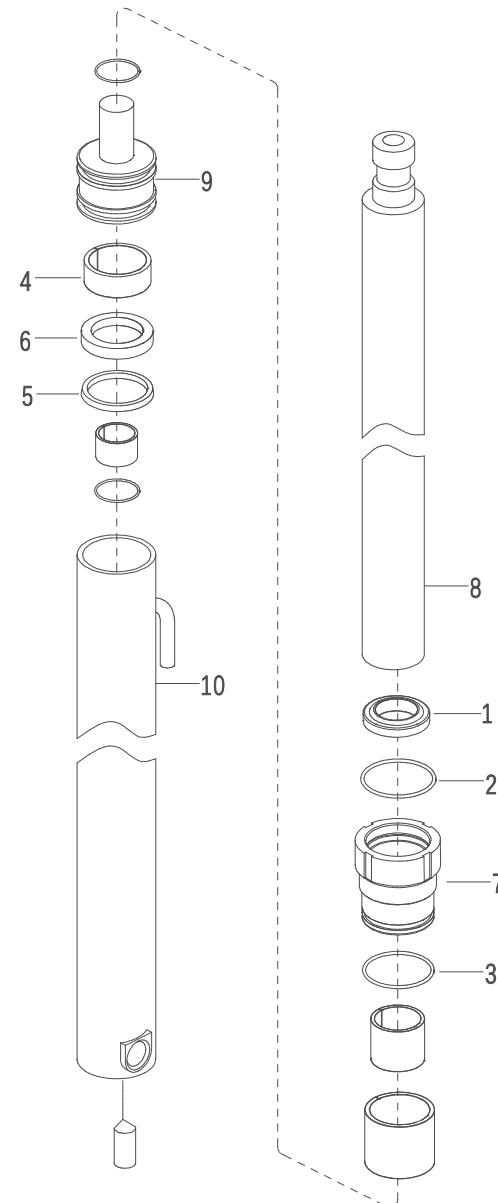
 **CAUTION**

- Use suitable hose clamps to avoid cylinder deformation caused by severely tight hose clamps.
- Carry out the maintenance work in a clean environment to prevent impurities from entering into cylinder, causing cylinder damage.
- During the installation, hydraulic oil of the same specifications must be used for cleaning or lubrication.
- Secure the cylinder to hose clamp and gently clamp the cylinder bottom.
- Unscrew the cylinder cap (7, Fig3132-60022SM) with cylinder wrench.
- Remove the dust ring (1) and O-ring (2) from the cylinder cap.
- Pull out the piston rod (8) from the cylinder tube (10), then remove the piston (9) from the piston rod.
- Remove the support ring (3), snap-ring (5), and seal (4) from the piston.
- Clean with hydraulic oil of the same specifications.
- Replace the problem parts and assemble in reverse steps.

 **CAUTION**

Seal kit for cylinder

Include item 1,2,3,4,5, (refer to parts manual).



9

Fig3132-60022SM

MAST



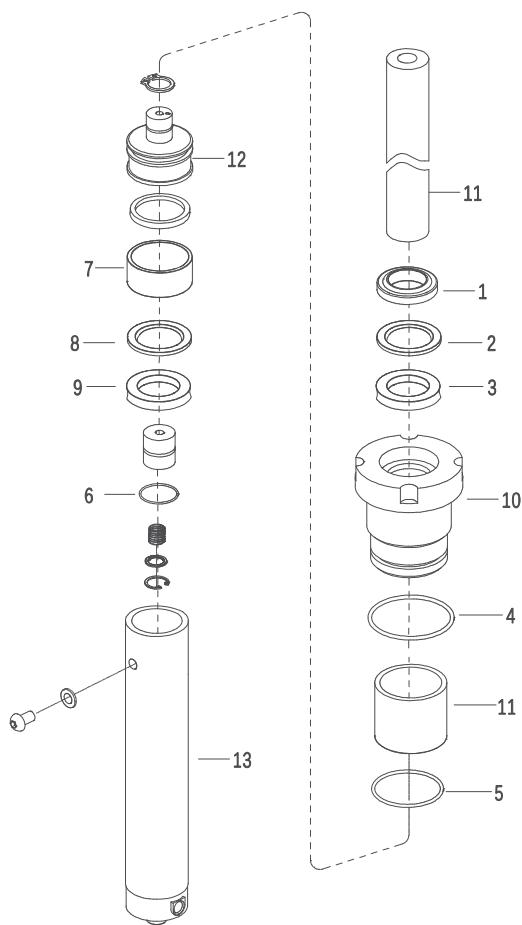
CAUTION

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

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

Full Free Middle Cylinder

- Secure the cylinder to hose clamp and gently clamp the cylinder bottom.
- Unscrew the cylinder cap (10, Fig3214-60021SM) with cylinder wrench.
- Remove the dust ring (1), snap ring (2), seal ring(3), O-ring (4) and O-ring (5) from the cylinder cap.
- Pull out the piston rod (11) from the cylinder tube (13).
- Remove the piston (12) from the piston rod.
- Remove the support ring (7) and seal (8), snap ring (9) and O-ring (6) from the piston.
- Clean with hydraulic oil of the same specifications.
- Replace the problem parts and assemble in reverse order.



9



CAUTION

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

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



CAUTION

Seal kit for cylinder

Include items 1,2,3,4,5,6,7,8,9 (refer to parts manual).

Fig3214-60021SM

9.1.4.3 Cylinder Installation

- Install the cylinder in the reverse order of removal according to 8.3.4.1.
- Add hydraulic oil of the same specifications into the tank, see Section 2.2.3.
- Pull out emergency stop switch and turn on the key switch.
- Repeat Lift - Lower cylinder to discharge the air within the tubings and cylinder.
- Check the hydraulic oil level and make sure that the liquid is at standard level.

9.1.5 Built-in Side Shifter

9.1.5.1 Side Shifter Removal

- Lower the mast to the bottom, press the emergency stop switch and disconnect the key switch.
- Block the truck wheel with wooden wedge.
- Unscrew the four bolts (3, Fig3530-60003SM), remove the load backrest (1) from the built-in side shifter (2).



CAUTION

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

- Remove the right shifting tubing (8, Fig3131-60005SM) and left shifting tubing (7) from the built-in side shifter.



CAUTION

Before going on with the next step, support the side shifter properly. Avoid the side shifter falling during removal, which could result in personal injury.

- Remove the chain assembly and remove the side shifter from inner mast.

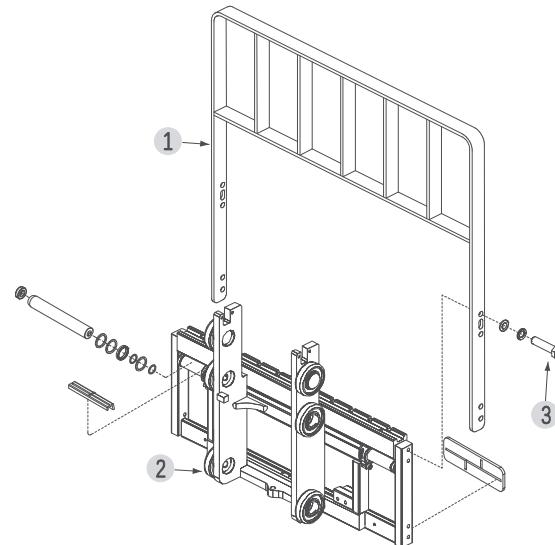


Fig3214-60023SM

9

MAST

9.1.5.2 Side Shifter Installation

- Install the side shifter in the reverse order of removal according to 8.1.5.1.
- Add hydraulic oil of the same specifications into the tank, see Section 2.2.3.
- Pull out emergency stop switch and turn on the key switch.
- Repeat left shifting - right shifting operations to discharge the air within the tubing and side shift cylinder.
- Check the hydraulic oil level and make sure that the liquid is at standard level.

9.1.6 External Side Shifter

9.1.6.1 Side Shifter Removal

- Lower the mast to the bottom, press the emergency stop switch and disconnect the key switch.
- Block the truck wheel with wooden wedge.
- Unscrew the four bolts (3, Fig3530-60004SM), remove the load backrest (1) from the external side shifter (2).



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.

9

- Remove the right shifting tubing (8, Fig3131-60005SM) and left shifting tubing (7) from the built-in side shifter.



CAUTION

Before going on with the next step, support the side shifter properly. Avoid the side shifter falling during removal, which could result in personal injury.

- Remove the external side shifter (2, Fig3530-60004SM) from fork carriage (4).

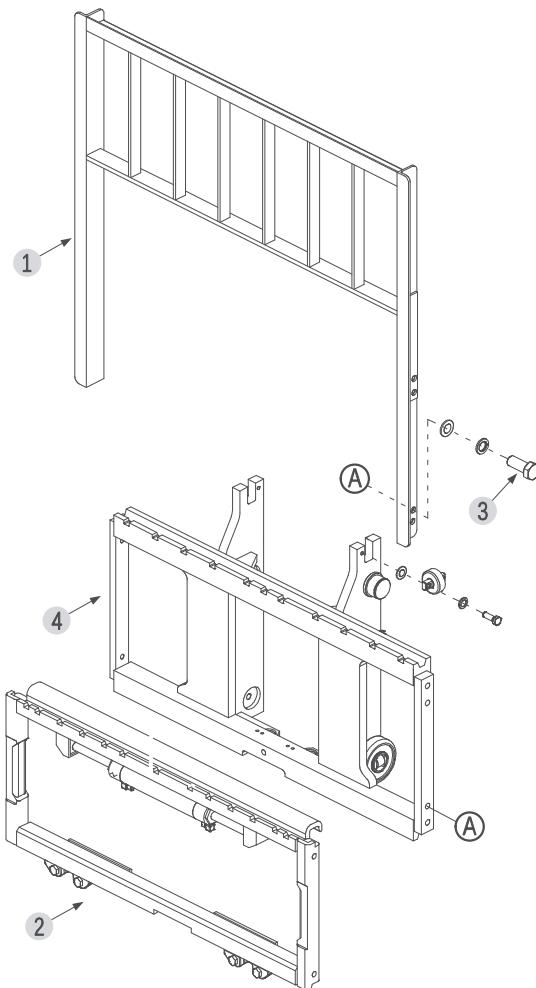


Fig3530-60004SM

9.1.6.2 Side Shifter Installation

- Install the side shifter in the reverse order of removal according to 9.1.6.1.
- Add hydraulic oil of the same specifications into the tank, see Section 2.2.3.
- Pull out emergency stop switch and turn on the key switch.
- Repeat left shifting - right shifting operations to discharge the air within the tubing and side shift cylinder.
- Check the hydraulic oil level and make sure that the liquid is at standard level.

10. ELECTRICAL SYSTEM

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NOTE:

10.1 Controller

Controller Functions

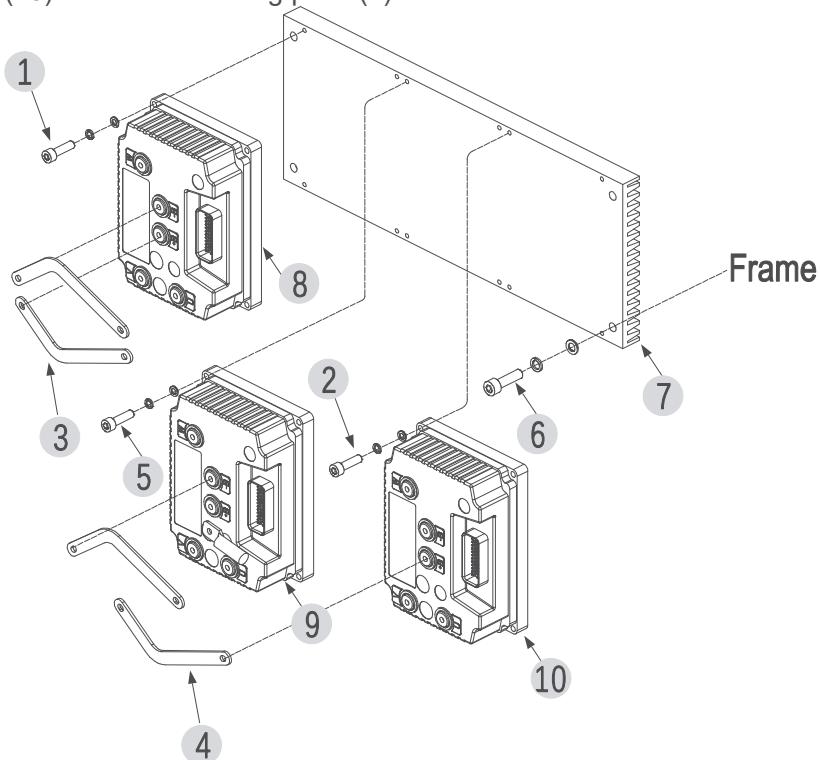
Electrical control of this truck is mainly driven by Traction Motor Controller L, Pump Motor Controller and Traction Motor Controller R.

10.1.1 Removal and Installation

- Secure the wheels with triangular wooden wedge.
- Remove the floor mat and floor board.
- Remove the wiring harness connector, cables and copper strips (3) and (4) on the controller.
- Unscrew the screws (1, Fig3214-50001SM) with a wrench and remove the traction motor controller r (8) from the mounting plate (7).
- Unscrew the screws (5, Fig3214-50001SM) with a wrench and remove the pump motor controller (9) from the mounting plate (7).
- Unscrew the screws (2, Fig3214-50001SM) with a wrench and remove the traction motor controller l (10) from the mounting plate (7).

Installation

- Apply appropriate amount of thermal grease on the back of controller.
- Place the controller onto the electrical mounting plate, tighten the screws with a wrench.
- Plug the wiring harness connector and cables into corresponding ports.



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Fig3214-50001SM

ELECTRICAL COMPONENTS

10.2 Main Contactor

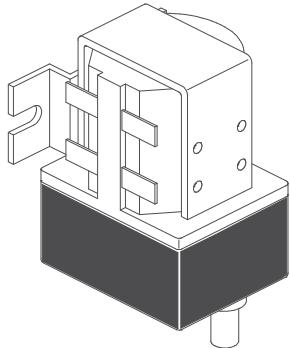


Fig1221-50008SM

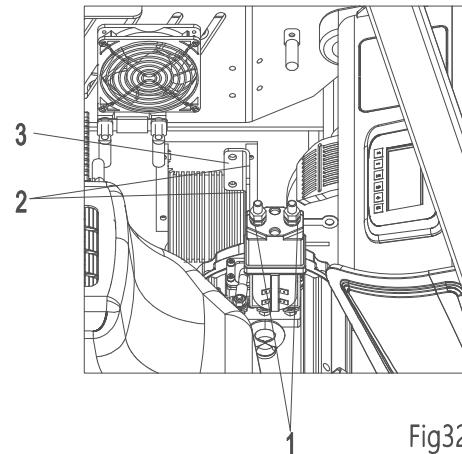


Fig3214-50014SM

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

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.

10.2.1 Removal and Installation

- Switch off key switch and remove the key, press the emergency stop switch down.
- Remove the floor mat and floor board.
- Unscrew the two nuts (1, [Fig3132-50002SM](#)), remove the cables, wirings and strips from the main contactor (4).
- Unscrew the four screws (2), dismantle the main contactor (4) from the mounting plate.
- Install in the reverse order of removal.

10.2.2 Checking and Testing

Visual Inspection

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

Coil Checks

- Disconnect the cables on the contactor.
- Check the resistance of the coil with a multimeter: measurement method is as shown in [Fig1221-50009SM](#).
- Identify if the contactor is normal according to the readings of resistance on the multimeter. As shown in the following table:

Resistance Measurement	Judgment
Approx. 145Ω	Normal
0 Ω	Coil shorting (replace the contactor)
∞ Ω	Coil breaking (replace the contactor)

ELECTRICAL COMPONENTS

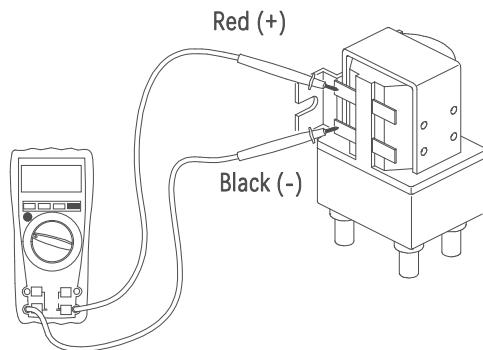


Fig1221-50009SM

Contact Checks

- Check if the surface of contact surface is smooth and symmetrical.
- Separately provide the contact with a voltage of 80V to observe if the contact can absorb.
- If the surface is uneven or the contact does not absorb, replace the main contactor.

10.3 DC-DC Converter

DC-DC converter provides converted voltage for lights, horn and accelerator.

Working performance: 80V DC to 12V

10.3.1 Removal and Installation

- Switch off the key switch and remove the key, press the emergency stop switch down.
- Remove the floor mat and floor board.
- Disconnect the connection between the converter wiring (1) and main wiring harness.
- Unscrew the four screws (1) and remove the converter (2) from the battery box.
- Install in the reverse order of removal.

10.3.2 Checking and Testing

Checking

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

Testing

- Check if converter circuit is conducted.
- Provide a voltage of 80V between converter interfaces 3 and 18:
 - if there is voltage output of 12V between interfaces 4 and 17, the converter is working properly.
 - if the output voltage is not 12V, the converter needs to be replaced.

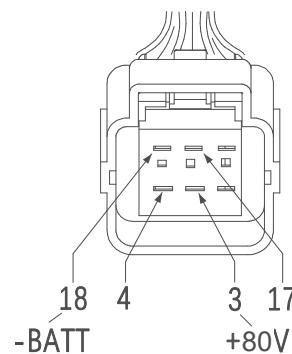


Fig3131-50021SM

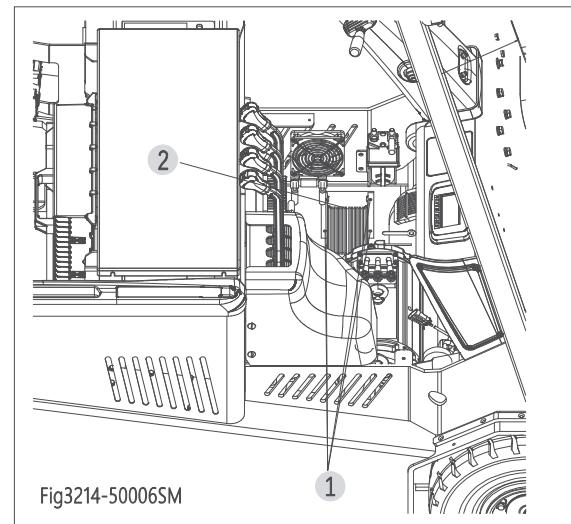


Fig3214-50006SM

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ELECTRICAL COMPONENTS

10.4 Fuse

The truck is installed with seven fuses. When there is fuse failure, the truck may not be able to run properly due to that.

Function		Status							
		Fuse 1	Fuse 2	Fuse 3	Fuse 4	Fuse 5	Fuse 6		
Fuse 1	350A	×	O	O	O	O	O	O	O
Fuse 2	10A	O	×	O	O	O	O	O	O
Fuse 3	10A	O	O	×	O	O	O	O	O
Fuse 4	10A	O	O	O	O	O	O	O	O
Fuse 5	10A	O	O	O	×	×	O	O	O
Fuse 6	10A	O	O	O	O	O	×	O	O
Fuse 7	5A	O	O	O	O	O	O	O	×
1	Drive	×	×	×	O	O	×	×	×
2	Hydraulic Action	×	×	×	O	O	×	×	×
3	Steering	×	×	×	O	O	×	×	×
4	Instrument	×	×	O	O	O	O	○	×
5	Turn Signal/Warning Light	×	O	×	O	O	O	O	×
6	Horn	×	O	O	×	O	O	O	×
7	Brake Light	×	×	×	O	O	×	×	×
8	Headlight	×	O	O	O	×	O	O	×
9	Reversing Light	×	×	O	×	O	O	O	×
10	Buzzer	×	×	O	×	O	O	O	×
11	Braking light	×	O	O	×	O	O	O	×
12	USB function	×	O	×	O	O	O	O	×

× : Failure

O : Normal

10.4.1 Location of Fuses

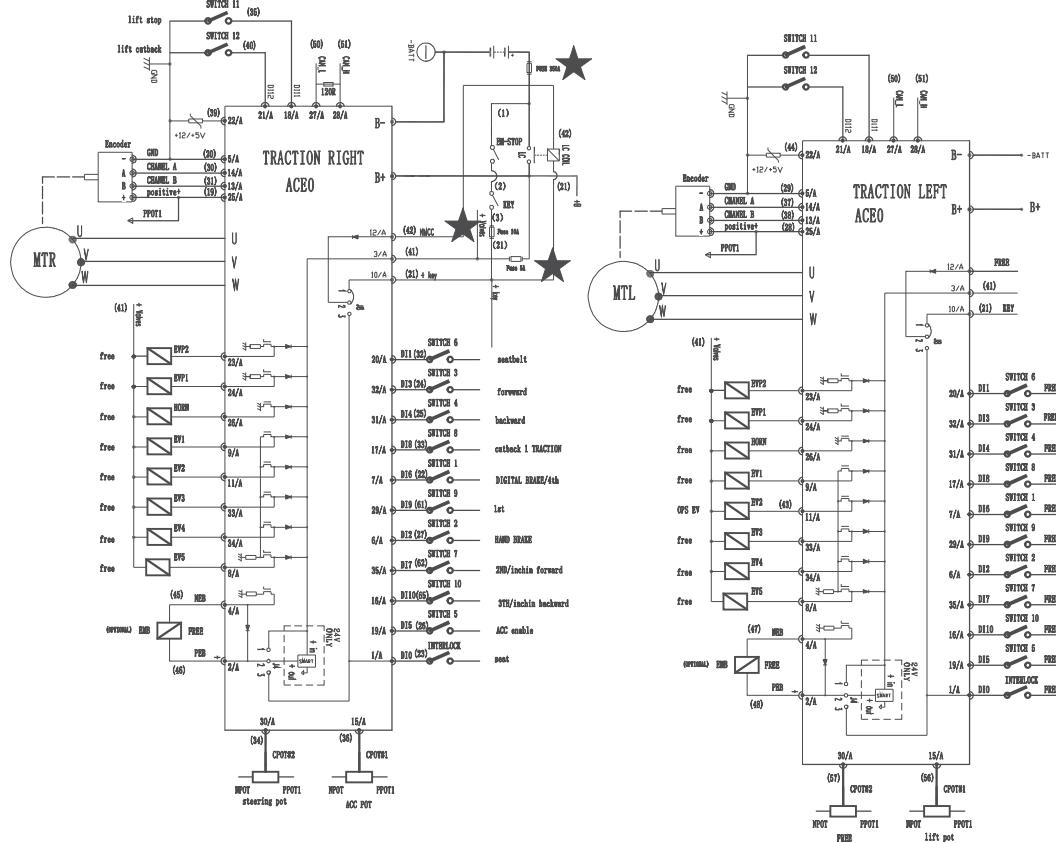
Fuse 1:installed on fuse holder which installed on the frame

Fuse 2-6:installed in fuse box

Fuse 7: installed main harness

★ Fuse position in electrical schematic diagram

ELECTRICAL COMPONENTS



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ELECTRICAL COMPONENTS

10.5 Controller Error Message

Electrical faults are mainly caused by electrical components failure or electrical circuit failure. When some components fail which may not affect the ON/OFF of control, the instrument won't display fault

code (see Chapter 10 - Troubleshooting). While the 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.

10.5.1 Controller

Error Message		Possible cause	Fault elimination
Error	Error text		
8	WATCHDOG	This is a safety related test. It is a self-diagnosis test that involves the logic between master and supervisor microcontrollers.	This alarm could be caused by a CAN bus malfunctioning, which blinds master-supervisor communication.
17	LOGIC FAILURE #3	A hardware problem in the logic board due to high currents (overload). An overcurrent condition is triggered even if the power bridge is not driven.	The failure lies in the controller hardware. Replace the controller
18	LOGIC FAILURE #2	Fault in the hardware section of the logic board which deals with voltage feedbacks of motor phases.	The failure lies in the controller hardware. Replace the controller.
19	LOGIC FAILURE #1	This fault is displayed when the controller detects an undervoltage condition at the KEY input. Undervoltage threshold depends on the nominal voltage of the controller	1-Fault can be caused by a key input signal characterized by pulses below the undervoltage threshold, possibly due to external loads like DC/DC converters starting-up, relays or contactors during switching periods, solenoids energizing or de-energizing. Consider to remove such loads. 2-If no voltage transient is detected on the supply line and the alarm is present every time the key switches on, the failure probably lies in the controller hardware. Replace the logic board. 3-If the alarm occurs during motor acceleration or when there is a hydraulic-related request, check the battery charge, the battery health and power-cable connections.

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
28	PUMP VMN LOW	The pump motor output is lower than expected, considering the PWM duty cycle applied.	<p>A) If the problem occurs at start up (the LC does not close at all), check:</p> <ul style="list-style-type: none"> - Motor internal connections. - Motor power cables connections. - If the motor connection are OK, the problem is inside the controller. <p>B) If the problem occurs after closing the LC (the LC closes and then opens back again), check:</p> <ul style="list-style-type: none"> - Motor internal connections. - If motor windings/cables have leakages towards truck frame. - If no problem are found on the motors, the problem is inside the controller. <p>C) If the alarm occurs during motor running, check:</p> <ul style="list-style-type: none"> - Motor internal connections. - If motor windings/cables have leakages towards truck frame. - That the LC power contact closer properly, with a good contact. - If no problem are found on the motors, the problem is inside the controller, it is necessary to replace the logic board.
29	PUMP VMN HIGH	This test is carried out when the pump motor is turning (PWM applied). The pump motor output is higher than expected, considering the PWM applied.	<ul style="list-style-type: none"> -Motor internal connections -If motor windings/cables have leakages towards truck frame -If no problem are found on the motors, the problem is inside the controller, it is necessary to replace the logic board.

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ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
30	VMN LOW	<p>Start-up test. Before switching the LC on, the software checks the power bridge: it turns on alternatively the high-side power MOSFETs and expects the phase voltages increase toward the positive rail value. If one phase voltage is lower than a certain percentage of the rail voltage, this alarm occurs.</p> <p>Motor running test. When the motor is running, the power bridge is on and the motor voltage feedback tested. if it is lower than expected value (a range of values is considered), the controller enters in fault state.</p>	<p>If the problem occurs at start up (the LC does not close at all), check:</p> <ul style="list-style-type: none"> - motor internal connections (ohmic continuity). - motor power-cables connections. - if the motor connections are OK, the problem is inside the controller. replace it. <p>If the alarm occurs while the motor is running, check:</p> <ul style="list-style-type: none"> - motor connections. - that the LC power contact closes properly, with a good contact. - if no problem is found, the problem is inside the controller. Replace it.
31	VMN HIGH	<p>Before switching the LC on, the software checks the power bridge: it turns on alternatively the low-side power MOSFETs and expects the phase voltages decrease down to -B. If the phase voltages are higher than a certain percentage of the nominal battery voltage, this alarm occurs.</p> <p>This alarm may also occur when the start-up diagnosis has succeeded and so the LC has been closed. In this condition, the phase voltages are expected to be lower than half the battery voltage. If one of them is higher than that value, this alarm occurs.</p>	<p>A)If the problem occurs at start-up (the LC does not close), check:</p> <ul style="list-style-type: none"> - motor internal connections (ohmic continuity). - motor power cables connections. - if the motor connections are OK, the problem is inside the controller. Replace it. <p>B) If the alarm occurs while the motor is running, check:</p> <ul style="list-style-type: none"> - motor connections. - that the LC power contact closes properly, with a good contact. - if no problem is found, the problem is inside the controller. Replace it.
37	CONTACTOR CLOSED	<p>Before driving the LC coil, the controller checks if the contactor is stuck. The controller drives the power bridge for several dozens of milliseconds, trying to discharge the capacitors bank. If the capacitor voltage does not decrease by more than a certain percentage of the key voltage, the alarm is raised.</p>	<p>It is suggested to verify the power contacts of LC. if they are stuck, is necessary to replace the LC.</p>

ELECTRICAL COMPONENTS

38	CONTACTOR OPEN	The LC coil is driven by the controller, but it seems that the power contacts do not close. In order to detect this condition the controller injects a DC current into the motor and checks the voltage on power capacitor. If the power capacitors get discharged it means that the main contactor is open.	LC contacts are not working. Replace the LC.
52	PUMP I=0 EVER	While the pump motor is running, the current feedback is constantly stuck to zero.	1-Check the motor connection, that there is continuity. If the motor connection is opened, the current cannot flow, so the test fails and the error code is displayed. 2-If everything is ok for what it concerns the motor, the problem could be in the current sensor or in the related circuit.
53	STBY I HIGH	In standby, the sensor detects a current value different from zero.	The current sensor or the current feedback circuit is damaged. Replace the controller.
60	CAPACITOR CHARGE	When the key is switched on, the inverter tries to charge the power capacitors through the series of a PTC and a power resistance, checking if the capacitors are charged within a certain timeout. If the capacitor voltage results less than a certain percentage of the nominal battery voltage, the alarm is raised and the main contactor is not closed.	1-Check if an external load in parallel to the capacitor bank, which sinks current from the capacitors-charging circuit, thus preventing the caps from charging well. Check if a lamp or a dc/dc converter or an auxiliary load is placed in parallel to the capacitor bank. 2- The charging resistance or PTC may be broken. Insert a power resistance across line-contactor power terminals. if the alarm disappears, it means that the charging resistance is damaged. 3- The charging circuit has a failure or there is a problem in the power section. Replace the controller.

ELECTRICAL COMPONENTS

62	TH. PROTECTION	The temperature of the controller base plate is above 85 °C. The maximum current is proportionally decreased with the temperature excess from 85 °C up to 105 °C. At 105 °C the current is limited to 0 A.	<p>It is necessary to improve the controller cooling. To realize an adequate cooling in case of finned heat sink important factors are the air flux and the cooling-air temperature. If the thermal dissipation is realized by applying the controller base plate onto the truck frame, the important factors are the thickness of the frame and the planarity and roughness of its surface.</p> <p>If the alarm occurs when the controller is cold, the possible reasons are a thermal-sensor failure or a failure in the logic board. In the last case, it is necessary to replace the controller.</p>
65	MOTOR TEMPERAT.	This warning occurs when the temperature sensor is open (if digital) or if it has overtaken the MAX. MOTOR TEMP. threshold (if analog) (see paragraph 8.2.3).	<ol style="list-style-type: none"> 1- Check the temperature read by the thermal sensor inside the motor through the MOTOR TEMPERATURE reading in the TESTER function. 2- Check the sensor ohmic value and the sensor wiring. 3- If the sensor is OK, improve the cooling of the motor. 4- If the warning is present when the motor is cool, replace the controller.
66	BATTERY LOW	Parameter BATTERY CHECK is other than 0 (SET OPTION) and battery charge is evaluated to be lower than BATT.LOW TRESHLD (ADJUSTMENTS).	<ol style="list-style-type: none"> 1- Check the battery charge and charge it if necessary 2- If the battery is actually charged, measure the battery voltage through a voltmeter and compare it with the BATTERY VOLTAGE reading in the TESTER function. If they are different, adjust the ADJUST BATTERY parameter (ADJUSTMENTS list) with the value measured through the voltmeter. 3- If the problem is not solved, replace the logic board.

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74	DRIVER SHORTED	The driver of the LC coil is shorted.	1- Check if there is a short or a low impedance pull-down between NMC (A12) and -B. 2- The driver circuit is damaged. replace the logic board. 3-the SET POSITIVE PEB parameter is not correct
75	CONTACTOR DRIVER	The LC coil driver is not able to drive the load. The device itself or its driver circuit is damaged.	This type of fault is not related to external components. replace the logic board.
78	VACC NOT OK	At key-on and immediately after that, the travel demands have been turned off. This alarm occurs if the ACCELERATOR reading (in TESTER function) is above the minimum value acquired during the PROGRAM VACC procedure.	1- Check the wirings. 2- Check the mechanical calibration and the functionality of the accelerator potentiometer. 3- Acquire the maximum and minimum potentiometer value through the PROGRAM VACC function. 4- If the problem is not solved, replace the logic board.
79	INCORRECT START	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.	1- Check wirings. 2- Check microswitches for failures. 3- Through the TESTER function, check the states of the inputs are coherent with microswitches states. 4- If the problem is not solved, replace the logic board.
80	FORW + BACK	This alarm occurs when both the travel requests (FW and BW) are active at the same time.	1- Check that travel requests are not active at the same time. 2- Check the FW and BW input states through the TESTER function. 3- Check the wirings relative to the FW and BW inputs. 4- Check if there are failures in the microswitches. 5- If the problem is not solved, replace the logic board.

ELECTRICAL COMPONENTS

82	ENCODER ERROR	This fault occurs when the frequency supplied to the motor is higher than 30 Hz and the signal feedback from the encoder has a too high jump in few tens of milliseconds. This condition is related to an encoder failure.	1- Check the electrical and the mechanical functionality of the encoder and the wires crimping. 2- Check the mechanical installation of the encoder, if the encoder slips inside its housing it will raise this alarm. 3- Also the electromagnetic noise on the sensor can be the cause for the alarm. In these cases try to replace the encoder. 4- If the problem is still present after replacing the encoder, the failure is in the controller
86	PEDAL WIRE KO	—	—
126	CHAIN SENSOR KO	the slack chain sensor is not in normal status	1- Check that chain sensor switchs are not active. 2- Check the wirings relative to the chain sensor switchs. 3- Check if there are failures in the microswitches. 4- If the problem is not solved, replace the logic board.
129	WRONG CONFIG	wrong set of controller type and model type	1-check the parameter controller type in ""sepcial adjustment"" menu 2-check the parameter model type in ""special adjustment"" menu
130	REACH OUT OF RNG	reach pot out of the normal range	1-do the teaching again 2-check the wiring of the reach pot
131	VACC REACH NOTOK	the output of reacht pot is present,but the enable switch is not active	1-check the reach pot 2-check the wiring

ELECTRICAL COMPONENTS

132	ALL ACQU. REACH	do the wrong way of reach pot teaching	do the teaching in correct way
133	TLT OUT OF RANGE	tilt pot out of the normal range	1-do the teaching again 2-check the wiring of the tilt pot
134	VACC TILT NOT OK	the output of tilt pot is present, but the enable switch is not active	1-check the tilt pot 2-check the wiring
135	SFT OUT OF RANGE	sideshift pot out of the normal range	1-do the teaching again 2-check the wiring of the sideshift pot
136	VACC SHFT NOT OK	the output of sideshift pot is present, but the enable switch is not active	1-check the sideshift pot 2-check the wiring
137	ALL ACQU. TILT	do the wrong way of tilt pot teaching	do the teaching in correct way
138	ALL ACQU. SHIFT	do the wrong way of sideshift pot teaching	do the teaching in correct way
139	NO CAN TILL EP	the controller lost the communication with EP tiller at least once, when the truck is using	1-check the wiring of can cable 2-try to replace the EP tiller 3-replace the controller

ELECTRICAL COMPONENTS

140	WAIT TILL EP	wait the EP tiller CAN-BUS communication when key-on	1-check the wiring of can cable 2-try to replace the EP tiller 3-replace the controller
141	NO CAN BRAKE EP	if set the PEDAL BRK TYPE is optio#1,but the controller can't get the can message from brake,the alarm occurs	1-check the wiring of can-brake 2-check if the can-brake is broken 3-try to set the PEDAL BRK TYPE=NONE
142	WAIT ACTIVATION	if downlaod a SW with activation function,but haven't do any activation before,the alarm occurs	do activation with EP TOOLS
143	WRONG PASSWORD	if the EP PASSWORD function is active but haven't enter the correct password,the alarm occurs	1-enter the correct password 2-disable the password function
144	NO CAN DISP EP	When the truck is running, if the DISPLAY TYPE=5,but the controller lose the communication with EP DISPLAY,this alarm occurs	1-check the communication wiring between EP DISPLAY and controller 2-check if the EP DISPLAY is broken
145	WAIT DISP EP	if the DISPLAY TYPE=5,but the controller can't get message from EP DISPLAY when the truck start,this alarm occurs	1-check the communication wiring between EP DISPLAY and controller 2-check if the EP DISPLAY is broken 3-try to set the DISPLAY TYPE into a correct value
146	RENTAL TIMEOUT	if the rental function is actived,but the rental enable time is run out,this alarm occurs	1-check the rental hour left in TESTER menu 2-use EP TOOLS to disable the rental function

ELECTRICAL COMPONENTS

147	NO CAN BMS EP	if the communication between BMS and controller is out of time, this alarm occurs	1-check the communication wiring between BMS and controller 2-there's a fault on BMS can device, replace the BMS
148	EP BMS MC OPEN	if the battery charge level is too low, the BMS require the main contactor open, this alarm occurs	1-check the battery charge level 2-check if the battery is ok 3-replace the BMS
149	EP BMS TRAC CTB	if the battery charge level is too low, the BMS require the controller to reduce the traction speed, this alarm occurs	1-check the battery charge level 2-check if the battery is ok 3-replace the BMS
150	EP BMS LIFT STOP	if the battery charge level is too low, the BMS require the controller to stop the lift function, this alarm occurs	1-check the battery charge level 2-check if the battery is ok 3-replace the BMS
151	EP BMS TRAC STOP	if the battery charge level is too low, the BMS require the controller to stop the traction function, this alarm occurs	1-check the battery charge level 2-check if the battery is ok 3-replace the BMS
153	OFFSET SPD. SENS.	It is necessary to acquire the offset angle between the stator and the speed sensor, i.e. they mutual angular misalignment. An automatic function is dedicated to this procedure.	Perform the teaching procedure: in OPTIONS, select ABS SENS. ACQUIRE.
155	WAIT MOTOR STILL	The controller is waiting for the motor to stop rotating. This warning can only appear in controllers for brushless motors	—

ELECTRICAL COMPONENTS

161	RPM HIGH	This alarm occurs in Gen. Set versions when the speed exceeds the threshold speed.	—
170	WRONG KEY VOLT.	The measured key voltage is not the right one for the inverter.	<ol style="list-style-type: none">1- Check if the SET KEY VOLTAGE parameter in the ADJUSTMENTS list is set in accordance with the key voltage.2- Check if the key voltage is ok using a voltmeter, if not check the wiring.3- In case the problem is not solved, replace the logic board.
177	COIL SHOR. EB.	This alarm occurs when an overload of the EB driver occurs.	<ol style="list-style-type: none">1- Check the connections between the controller outputs and the loads.2- Collect information about characteristics of the coil connected to the driver and ask for assistance to a EP technician in order to verify that the maximum current that can be supplied by the hardware is not exceeded.3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.

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Error Message		Possible cause	Fault elimination
Error	Error text		
178	MOTOR TEMP. STOP	The temperature sensor has overtaken the threshold defined by STOP MOTOR TEMP.	<p>1- Check the temperature read by the thermal sensor inside the motor through the MOTOR TEMPERATURE reading in the TESTER function.</p> <p>2- Check the sensor ohmic value and the sensor wiring.</p> <p>3- If the sensor is OK, improve the cooling of the motor.</p> <p>4- If the warning is present when the motor is cool, replace the controller.</p>
179	STEER SENSOR KO	The voltage read by the microcontroller at the steering-sensor input is not within the STEER RIGHT VOLT ÷ STEER LEFT VOLT range, programmed through the STEER ACQUIRING function	<p>1- Acquire the maximum and minimum values coming from the steering potentiometer through the STEER ACQUIRING function. If the alarm is still present, check the mechanical calibration and the functionality of the potentiometer.</p> <p>2- If the problem is not solved, replace the logic board.</p>
180	OVERLOAD	The motor current has overcome the limit fixed by hardware.	<p>If the alarm condition occurs again, ask for assistance to a EP technician.</p> <p>The fault condition could be affected by wrong adjustments of motor parameters.</p>
181	WRONG ENC SET	Mismatch between parameters ENCODER PULSES 1 and ENCODER PULSES 2	Set the two parameters with the same value, according to the adopted encoder
182	EVP2 COIL OPEN	No load is connected between the EVP2 output and the electrovalve positive terminal.	<p>1- Check the EVP2 condition.</p> <p>2- Check the EVP2 wiring.</p> <p>3- If the problem is not solved, replace the logic board.</p>

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Error Message		Possible cause	Fault elimination
Error	Error text		
183	EVP2 DRIV. SHORT	1- The EVP2 driver is shorted. 2- The microcontroller detects a mismatch between the valve set-point and the feedback of the EVP2 output.	<p>1- Check if there is a short circuit or a low-impedance conduction path between the negative of the coil and -B.</p> <p>2- Collect information about:</p> <ul style="list-style-type: none"> o the voltage applied across the EVP2 coil, o the current in the coil, o features of the coil. <p>Ask for assistance to EP in order to verify that the software diagnoses are in accordance with the type of coil employed.</p> <p>3- If the problem is not solved, it could be necessary to replace the controller.</p>
184	EVP2 DRIVER OPEN	The EVP2 driver is not able to drive the EVP2 coil. The device itself or its driving circuit is damaged.	This fault is not related to external components. Replace the logic board.
186	WAIT MOT.P STILL	If DC Pump option is set to ON, the software expects the voltage on -P output to be at a "steady state" value, before switching the LC on. If the voltage is different, it could be due to the fact that the motor connected to -P is not still. For this reason, the software waits 30 seconds for the voltage to be at the "steady state" value (and for the pump motor to be still). After this time, the software assumes that the problem is not due to the fact that the pump motor is not still, and show the PUMP VMN NOT OK alarm.	<p>1- If the motor connected to -P is still moving, just wait for it to be still.</p> <p>2- If not, in 30 seconds the alarm PUMP VMN NOT OK will appear.</p>

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Error Message		Possible cause	Fault elimination
Error	Error text		
187	MANY PUMP REQ.	if there's more than one pump function request,e.g. lift+tilt,the alarm occurs	1-check the microswitches status 2-check the wiring of pump functions 3-disconnect the wire on the controller side 4-If the problem is not solved, replace the logic board.
188	PUMP VACC NOT OK	The minimum voltage of the lift potentiometer is not correctly set.	1-It is suggested to repeat the acquiring procedure of MIN LIFT and MAX LIFT 2-check the wiring of the lift pot 3-check if it's the lift pot fault
189	PUMP INC START	Man-presence switch is not enabled at pump request	1- Check wirings. 2- Check microswitches for failures. 3- Through the TESTER function, check the states of the inputs are coherent with microswitches states. 4- If the problem is not solved, replace the logic board.
190	PUMP VMN NOT OK	Switching the LC on, the software checks the output voltage on -P connector, and expects that it is at a "steady state" value (if DC PUMP option is set to ON, see HYDRO SETTINGS). If the voltage is too low, this alarm occurs.	1- The motor connected to -P must be completely still before this alarm occurs. The software waits 30 seconds before showing this alarm. During this time it shows the WAIT MOTOR STILL warning. 2- Motor internal connections 3- Motor power cables connections 4- Motor leakage to truck frame 5- If the motor connections are ok, the problem is inside the controller it is necessary to replace the logic board.
191	PUMP I NO ZERO	In standby condition (pump motor not driven), the feedback coming from the current sensor in the pump chopper gives a value out of a permitted range, because the pump current is not zero.	This type of fault is not related to external components. replace the controller.

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
192	PUMP VACC RANGE	For COMBIAC0 and COMBIACX. it means the output of lift pot is out of the normal range	
193	SMARTDRIVER KO	There is a hardware problem in the smart driver circuit . The driver is set to be ON but the output voltage does not increase	<p>1- Verify that the EB coil is connected correctly between pin A2 and pin A4.</p> <p>2- Verify that the parameter POSITIVE E.B. is set in accordance with the actual configuration (see paragraph 8.2.5). The software, in fact, depending on specific parameter value, makes a proper diagnosis. a wrong configuration of this parameter could generate a false fault.</p> <p>3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.</p>
194	AUX BATT. SHORT.	<p>For the versions where the smart driver is not installed (36/48V and 80V), it is possible to decide where the positive supply for pin A2 comes from by choosing a dedicated hardware configuration. The parameter POSITIVE E.B. has to be set in accordance with the hardware configuration, because the software makes a proper diagnosis depending on the parameter. a wrong setting could generate a false fault. The available choices are:</p> <ul style="list-style-type: none"> - 0 = PEB is managed by the smart driver (available for 24V version only). - 1 = PEB comes from the TILLER input (A1). - 2 = PEB comes from PEV (A3). PEV must be connected to terminal +B of the controller. This is the default configuration for 36/48V and 80V version. <p>This alarm can only appear if POSITIVE E.B. is set as 1 TILLER/SEAT.</p>	<p>1- Verify that the parameter POSITIVE E.B. is set in accordance with the actual coil positive supply (see paragraph 8.2.5).</p> <p>2- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.</p>

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
195	POS. EB. SHORTED	The voltage on pin A2 is high even if the smart driver is turned OFF	1- Verify that the parameter POSITIVE E.B. is set in accordance with the actual coil positive supply 2- Check if there is a short or a low impedance path between pin A2 and of the +B. In case no failures/problems have been found, the problem is in the controller, which has to be replaced.
196	MOT.PHASE SH.	Short circuit between two motor phases. The hexadecimal value "XX" identifies the shorted phases: 36: U – V short circuit 37: U – W short circuit 38: V – W short circuit	1- Verify the motor phases connection on the motor side. 2- Verify the motor phases connection on the inverter side. 3- Check the motor power cables. 4- Replace the controller. 5- If the alarm does not disappear, the problem is in the motor. Replace it.
197	WRONG SLAVE VER.	Wrong software version on supervisor uC.	Upload the correct software version
198	M/S PAR CHK MISM	At start-up there is a mismatch in the parameter checksum between the master and the supervisor microcontrollers.	Restore and save again the parameters list.
199	PARAM TRANSFER	Master uC is transferring parameters to the supervisor.	Wait until the end of the procedure. If the alarm remains longer, recycle the key.
200	VDC OFF SHORTED	The logic board measures a voltage value across the DC-link that is constantly out of range, above the maximum allowed value	1- Check that the battery has the same nominal voltage of the inverter. 2- Check the battery voltage, if it is out of range replace the battery. 3- If the battery voltage is ok, replace the logic board.
201	TORQUE PROFILE	There is an error in the choice of the torque profile parameters.	Check in the HARDWARE SETTINGS list the value of those parameters

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ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
202	VDC LINK OVERV.	<p>This fault is displayed when the controller detects an overvoltage condition. Overvoltage threshold depends on the nominal voltage of the controller.</p> <p>Nominal voltage 24V 36/48V 72/80V 96V Overvoltage threshold 35V 65V 115V 130V</p> <p>As soon as the fault occurs, power bridge and MC are opened. The condition is triggered using the same HW interrupt used for undervoltage detection, uC discerns between the two evaluating the voltage present across DC-link capacitors:</p> <ul style="list-style-type: none"> - High voltage Overvoltage condition - Low/normal voltage Undervoltage condition 	If the alarm happens during the brake release, check the line contactor contact and the battery power-cable connection.
203	HW FAULT MC	the Mcu and the Scu check the status of the main contactor is different from each other.	This type of fault is related to internal components. Replace the logic board.
204	BRAKE RUN OUT	The CPOT BRAKE input read by the microcontroller is out of the range defined by parameters SET PBRK. MIN and SET PBRK. MAX	<ol style="list-style-type: none"> 1- Check the mechanical calibration and the functionality of the brake potentiometer. 2- Acquire the minimum and maximum potentiometer values. 3- If the alarm is still present, replace the logic board.
205	EPS RELAY OPEN	The controller receives from EPS information about the safety contacts being open.	Verify the EPS functionality

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
206	INIT VMN HIGH	Before closing the LC, the software checks the power-bridge voltage without driving it. The software expects the voltage to be in a "steady state" value. If it is too high, this alarm occurs. The hexadecimal value "XX" identifies the faulty phase: 81: phase U 82: phase V 83: phase W	1- Check the motor power cables. 2- Check the impedance between U, V and W terminals and -B terminal of the controller. 3- Check the motor leakage to truck frame. 4- If the motor connections are OK and there are no external low impedance paths, the problem is inside the controller. Replace it.
207	INIT VMN LOW	Before closing the LC, the software checks the power-bridge voltage without driving it. The software expects the voltage to be in a "steady state" value. If it is too low, this alarm occurs. The hexadecimal value "XX" identifies the faulty phase: 01: phase U 02: phase V 03: phase W	1- Check the motor power cables. 2- Check the impedance between U, V and W terminals and -B terminal of the controller. 3- Check the motor leakage to truck frame. 4- If the motor connections are OK and there are no external low impedance paths, the problem is inside the controller. Replace it.
208	EEPROM KO	the connection of the EEPROM is not ok	This type of fault is related to internal components. Replace the logic board.
209	PARAM RESTORE	The controller has restored the default settings. If a CLEAR EEPROM has been made before the last key re-cycle, this warning informs you that EEPROM was correctly cleared.	1- A travel demand or a pump request does cancel the alarm. 2- If the alarm appears at key-on without any CLEAR EEPROM performed, replace the controller.
210	WRONG RAM MEM.	The algorithm implemented to check the main RAM registers finds wrong contents: the register is "dirty". This alarm inhibits the machine operations.	Try to switch the key off and then on again, if the alarm is still present replace the logic board.

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
211	STALL ROTOR	The traction rotor is stuck or the encoder signal is not correctly received by the controller	<p>1- Check the encoder condition.</p> <p>2- Check the wiring.</p> <p>3- Through the TESTER function, check if the sign of FREQUENCY and ENCODER are the same and if they are different from zero during a traction request.</p> <p>4- If the problem is not solved, replace the logic board.</p>
212	POWER MISMATCH	The error between the power setpoint and the estimated power is out of range.	Ask for assistance to a EP technician about the correct adjustment of the motor parameters.
213	POSITIVE LC OPEN	The positive voltage of LC is different from expected.	<p>1- Verify LC coil is properly connected.</p> <p>2- Verify CONF. POSITIVE LC parameter is set in accordance with the actual coil positive supply (see paragraph 8.2.5). Software, depending on the parameter value, makes a proper diagnosis. a mismatch between the hardware and the parameter configuration could generate a false fault.</p> <p>3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.</p>
214	EVP COIL OPEN	No load is connected between the EVP output (A24) and the electrovalve positive terminal.	<p>1- Check the EVP condition.</p> <p>2- Check the EVP wiring.</p> <p>3- If the problem is not solved, replace the logic board.</p>

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
215	EVP DRIV. SHORT.	1- The EVP driver (output A24) is shorted. 2- The microcontroller detects a mismatch between the valve set-point and the feedback of the EVP output.	1- Check if there is a short circuit or a low-impedance conduction path between the negative of the coil and -B. 2- Collect information about: o the voltage applied across the EVP coil, o the current in the coil, o features of the coil. Ask for assistance to EP in order to verify that the software diagnoses are in accordance with the type of coil employed. If the problem is not solved, it could be necessary to replace the controller.
216	EB. COIL OPEN	This fault appears when no load is connected between the NEB output (A4) and the EB positive terminal PEB (A2)	1- Check the EB coil. 2- Check the wiring. 3- If the problem is not solved, replace the logic board.
217	PEV NOT OK	Terminal PCOM is not connected to the battery or the voltage is different from that defined by parameter SET POSITIVE PEB (see the ADJUSTMENTS list, paragraph 8.2.3). This alarm can occur if output NAUX1 is present (and the related setting is active) or the AUX OUT function is active.	1- Check PCOM terminal: it must be connected to the battery voltage (after the main contactor). 2- Set the nominal PCOM voltage in parameter SET POSITIVE PEB in ADJUSTMENTS list (see paragraph 8.2.3).
218	SENS MOT TEMP KO	The output of the motor thermal sensor is out of range.	1- Check if the resistance of the sensor is what expected measuring its resistance. 2- Check the wiring. 3- If the problem is not solved, replace the logic board.
219	PEB-PEVP NOT OK	only for AC3 and ACE3 the PEB and PEV voltage is not match the parameter setting	1- Check PCOM terminal: it must be connected to the battery voltage (after the main contactor). 2- Set the nominal PCOM voltage in parameter SET POSITIVE PEB in ADJUSTMENTS list.

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
220	VKEY OFF SHORTED	At key-on, the logic board measures a voltage value of the KEY input that is constantly out of range, below the minimum allowed value.	<p>1- Check that the battery has the same nominal voltage of the inverter.</p> <p>2- Check the battery voltage, if it is out of range replace the battery.</p> <p>3- If the battery voltage is ok, replace the logic board.</p>
221	HANDBRAKE	Handbrake input is active.	<p>1- Check that handbrake is not active by mistake.</p> <p>2- Check the SR/HB input state through the TESTER function.</p> <p>3- Check the wirings.</p> <p>4- Check if there are failures in the microswitches.</p> <p>5- If the problem is not solved, replace the logic board.</p>
222	SEAT MISMATCH	This alarm can appear only in a Traction + Pump configuration or in a multimotor one. There is an input mismatch between the traction controller and the pump controller relatively to the TILLER/SEAT input (A1): the two values recorded by the two controllers are different.	<p>1- Check if there are wrong connections in the external wiring.</p> <p>2- Using the TESTER function, verify that the seat inputs are in accordance with the actual state of the external switch.</p> <p>3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.</p>
223	COIL SHOR. MC (For Combi AC0/ Combi ACX and ACE4) MC-EF COIL SHOR.(For ACE2, ACE3)	This alarm occurs when an overload of the MC driver	<p>1- Check the connections between the controller outputs and the loads.</p> <p>2- Collect information about characteristics of the coil connected to the driver and ask for assistance to a EP technician in order to verify that the maximum current that can be supplied by the hardware is not exceeded.</p> <p>3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.</p>

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
224	WAITING FOR NODE	The controller receives from the CAN bus the message that another controller in the net is in fault condition. as a consequence the controller itself cannot enter into an operative status, but it has to wait until the other node comes out from the fault status.	Check if any other device on the CAN bus is in fault condition.
225	CURRENT SENS. KO	the current sensor of the controller can not be driven or always 0	This type of fault is related to internal components. Replace the logic board.
226	VACC OUT RANGE	1- The CPOT input read by the microcontroller is not within the MIN VACC ÷ MAX VACC range, programmed through the PROGRAMM VACC function . 2- The acquired values MIN VACC and MAX VACC are inconsistent.	1- Acquire the maximum and minimum potentiometer values through the PROGRAM VACC function. If the alarm is still present, check the mechanical calibration and the functionality of the accelerator potentiometer. 2- If the problem is not solved, replace the logic board.
227	HW FAULT	At start-up, some hardware circuit intended to enable and disable the power bridge or the LC driver (output A12) is found to be faulty. The hexadecimal value "XX" facilitates EP technicians debugging the problem.	This type of fault is related to internal components. Replace the logic board.
228	TILLER OPEN	Tiller/seat input has been inactive for more than 120 seconds.	1- Activate the tiller/seat input. 2- Check the tiller/seat input state through the TESTER function. 3- Check the wirings. 4- Check if there are failures in the microswitches. 5- If the problem is not solved, replace the logic board.
229	HW FAULT EB.	At start-up, the hardware circuit dedicated to enable and disable the EB driver (output A4) is found to be faulty. The hexadecimal value "XX" facilitates EP technicians debugging the problem.	This type of fault is not related to external components. Replace the logic board.

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ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
230	LC COIL OPEN	This fault appears when no load is connected between the NMC output A12 and the positive voltage (for example the KEY voltage).	<p>1- Check the wiring, in order to verify if LC coil is connected to the right connector pin and if it is not interrupted.</p> <p>2- If the alarm is still present, than the problem is inside the logic board. replace it.</p>
232	CONT. DRV. EV	AUX valve driver is not able to drive the load.	The device or its driving circuit is damaged. Replace the controller.
233	POWERMOS SHORTED	The DC-link voltage drops to zero when a high-side or low-side MOSFET is turned on.	<p>1- Check that motor phases are correctly connected.</p> <p>2- Check that there is no dispersion to ground for every motor phases.</p> <p>3- In case the problem is not solved, replace the controller.</p>
234	DRV. SHOR. EV	AUX valve driver is shorted.	<p>1- Check if there is a short circuit or a low impedance path between the negative terminal of the coils and -B.</p> <p>2- If the problem is not solved, replace the logic board.</p>
235	CTRAP THRESHOLD	it is a controller internal check fault	Check the parameter DUTY PWM CTRAP is correct.If the alarm is still,Ask for assistance to a EP technician
236	CURRENT GAIN	The maximum current gain parameters are at the default values, which means that the maximum current adjustment procedure has not been carried out yet.	Ask for assistance to a EP technician in order to do the adjustment procedure of the current gain parameters.

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
237	ANALOG INPUT	This alarm occurs when the A/D conversion of the analog inputs returns frozen values, on all the converted signals, for more than 400 ms. The goal of this diagnosis is to detect a failure in the A/D converter or a problem in the code flow that skips the refresh of the analog signal conversion.	If the problem occurs permanently it is necessary to replace the logic board.
238	HW FAULT EV.	At start-up, the hardware circuit dedicated to enable and disable the EV drivers is found to be faulty. The hexadecimal value "XX" facilitates EP technicians debugging the problem.	This type of fault is not related to external components. Replace the logic board.
239	CONTROLLER MISM.	The software is not compatible with the hardware. Each controller produced is "signed" at the end of line test with a specific code mark saved in EEPROM according to the customized part number. According with this "sign", only the customized firmware can be uploaded.	1- Upload the correct firmware. 2- Ask for assistance to a EP technician in order to verify that the firmware is correct.
240	EVP DRIVER OPEN	The EVP driver is not able to drive the EVP coil. The device itself or its driving circuit is damaged.	This fault is not related to external components. Replace the logic board.
241	COIL SHOR. EVAUX	This alarm occurs when an overload of the EV drivers occurs.	1- Check the connections between the controller outputs and the loads. 2- Collect information about characteristics of the coils connected to the drivers and ask for assistance to a EP technician in order to verify that the maximum current that can be supplied by the hardware is not exceeded. In case no failures/problems have been found, the problem is in the controller, which has to be replaced.

ELECTRICAL COMPONENTS

Error Message		Possible cause	Fault elimination
Error	Error text		
242	OPEN COIL EV.	"This fault appears when no load is connected between one or more EV outputs and the positive terminal PEV (pin A3). For the meaning of code "XX", refer to paragraph 10.5 EVP1=BIT 0 EV1=BIT 1 EV2=BIT 2 EV3=BIT 3 EVP2=BIT 4 EV4=BIT 5 EV5=BIT 7 HORN=BIT 6"	1- Check the coils. 2- Check the wiring. 3- If the problem is not solved, replace the logic board.
243	THROTTLE PROG.	A wrong profile has been set in the throttle profile.	Set properly the throttle-related parameters
244	WARNING SLAVE	Warning on supervisor uC.	Connect the Console to the supervisor uC and check which alarm is present.
245	IQ MISMATCHED	The error between the Iq (q-axis current) setpoint and the estimated Iq is out of range.	Ask for assistance to a EP technician in order to do the correct adjustment of the motor parameters.
246	EB. DRIV.OPEN	The EB coil driver is not able to drive the load. The device itself or its driving circuit is damaged.	This type of fault is not related to external components. Replace the logic board.
247	DATA ACQUISITION	Controller in calibration state.	The alarm ends when the acquisition is done.
248	NO CAN MSG.	CANbus communication does not work properly. The hexadecimal value "XX" identifies the faulty node.	1- Verify the CANbus network (external issue). 2- Replace the logic board (internal issue).
249	CHECK UP NEEDED	This is a warning to point out that it is time for the programmed maintenance.	Turn on the CHECK UP DONE option after that the maintenance service.

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Error Message		Possible cause	Fault elimination
Error	Error text		
250	THERMIC SENS. KO	The output of the controller thermal sensor is out of range.	This kind of fault is not related to external components. Replace the controller.
251	WRONG SET BAT.	At start-up, the controller checks the battery voltage (measured at the KEY input A10) and it verifies that it is within a range of ±20% around the nominal value.	<p>1- Check that the SET BATTERY parameter inside the ADJUSTMENTS list matches with the battery nominal voltage.</p> <p>2- If the battery nominal voltage is not available for the SET BATTERY parameter inside the ADJUSTMENTS list, record the value stored as HARDWARE BATTERY RANGE parameter in the SPECIAL ADJUST. list and contact a EP technician.</p> <p>3- Through the TESTER function, check that the KEY VOLTAGE reading shows the same value as the key voltage measured with a voltmeter on pin A10. If it does not match, then modify the ADJUST BATTERY parameter according to the value read by the voltmeter.</p> <p>4- Replace the battery.</p>
253	FIELD ORIENT. KO	The error between the Id (d-axis current) setpoint and the estimated Id is out of range.	Ask for assistance to a EP technician in order to do the correct adjustment of the motor parameters.
254	EB. DRIV.SHRT.	1- The EB driver is shorted. 2- The microcontroller detects a mismatch between the valve setpoint and the feedback at the EB output.	<p>1- Check if there is a short or a low impedance path between the negative coil terminal and -B.</p> <p>2- Check if the voltage applied is in accordance with the parameters settings</p> <p>3- If the problem is not solved, replace the controller.</p>

ELECTRICAL COMPONENTS

8.9.2 Controller

Error Message		Possible cause	Fault elimination
Error	Error text		
17	LOGIC FAILURE #3	A hardware problem in the logic board due to high currents (overload). An overcurrent condition is triggered even if the power bridge is not driven.	The failure lies in the controller hardware. Replace the controller
19	LOGIC FAILURE #1	This fault is displayed when the controller detects an undervoltage condition at the KEY input. Undervoltage threshold depends on the nominal voltage of the controller	1-Fault can be caused by a key input signal characterized by pulses below the undervoltage threshold, possibly due to external loads like DC/DC converters starting-up, relays or contactors during switching periods, solenoids energizing or de-energizing. Consider to remove such loads. 2-If no voltage transient is detected on the supply line and the alarm is present every time the key switches on, the failure probably lies in the controller hardware. Replace the logic board. 3-If the alarm occurs during motor acceleration or when there is a hydraulic-related request, check the battery charge, the battery health and power-cable connections.
195	WRONG CONFIG	wrong set of controller type and model type	1-check the parameter controller type in "special adjustment" menu 2-check the parameter model type in "special adjustment"menu
196	NO CAN TILL EP	the controller lost the communication with EP tiller at least once,when the truck is using	1-check the wiring of can cable 2-try to replace the EP tiller 3-replace the controller
197	NO CAN DISP EP	When the truck is running, if the DISPLAY TYPE=5, but the controller lose the communication with EP DISPLAY, this alarm occurs	1-check the communication wiring between EP DISPLAY and controller 2-check if the EP DISPLAY is broken

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Error Message		Possible cause	Fault elimination
Error	Error text		
200	STEER SENSOR KO	The voltage read by the microcontroller at the steering-sensor input is not within the STEER RIGHT VOLT ÷ STEER LEFT VOLT range, programmed through the STEER ACQUIRING function	1- Acquire the maximum and minimum values coming from the steering potentiometer through the STEER ACQUIRING function. If the alarm is still present, check the mechanical calibration and the functionality of the potentiometer. 2- If the problem is not solved, replace the logic board.
201	WRONG ENC SET	Mismatch between parameters ENCODER PULSES 1 and ENCODER PULSES 2	Set the two parameters with the same value, according to the adopted encoder
202	VDC LINK OVERV.	This fault is displayed when the controller detects an overvoltage condition. Overvoltage threshold depends on the nominal voltage of the controller. Nominal voltage 24V 36/48V 72/80V 96V Overvoltage threshold 35V 65V 115V 130V As soon as the fault occurs, power bridge and MC are opened. The condition is triggered using the same HW interrupt used for undervoltage detection, uC discerns between the two evaluating the voltage present across DC-link capacitors: - High voltage Overvoltage condition - Low/normal voltage Undervoltage condition	If the alarm happens during the brake release, check the line contactor contact and the battery power-cable connection.
208	EEPROM KO	the connection of the EEPROM is not ok	This type of fault is related to internal components. Replace the logic board.

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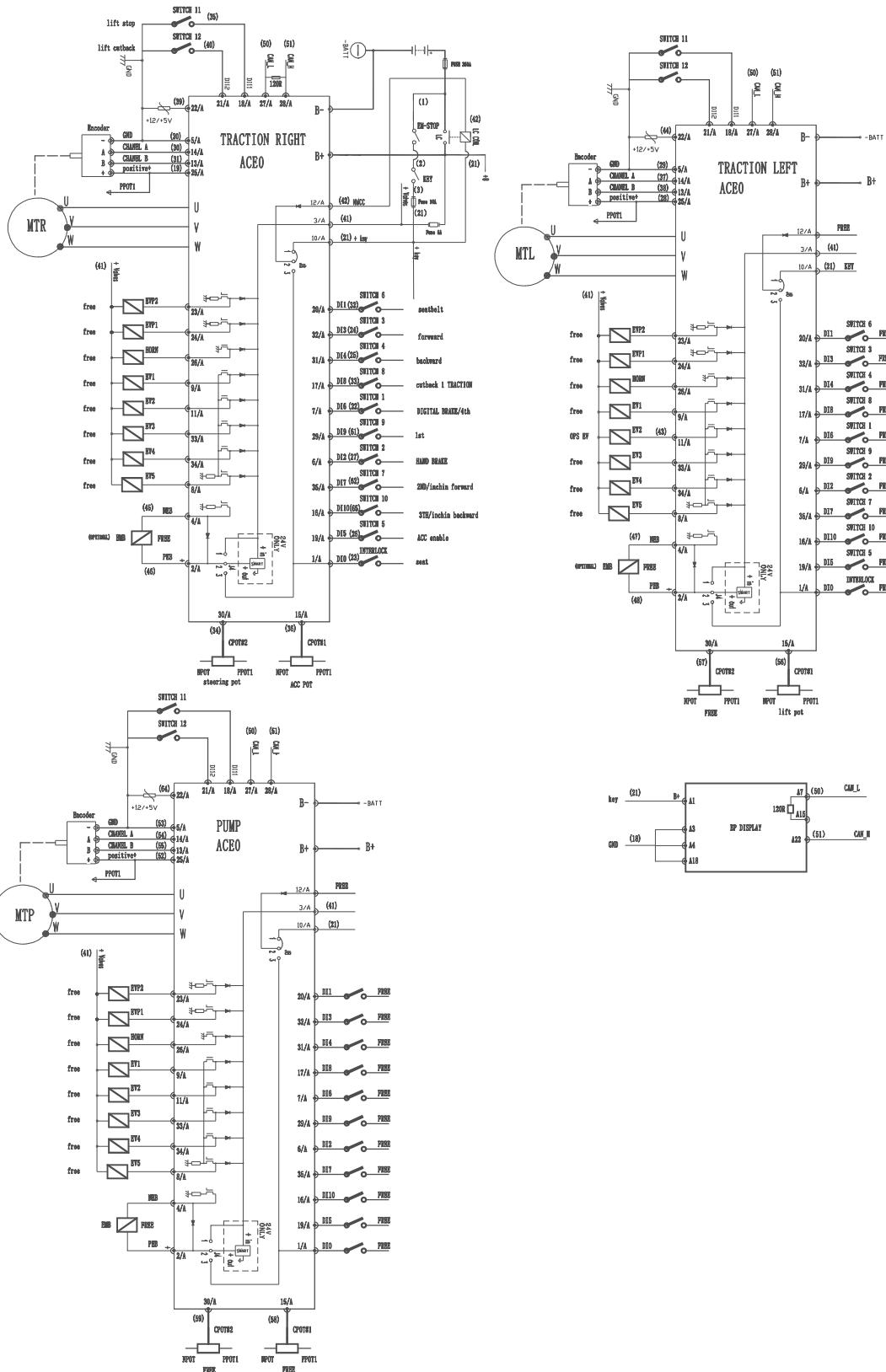
Error Message		Possible cause	Fault elimination
Error	Error text		
209	PARAM RESTORE	The controller has restored the default settings. If a CLEAR EEPROM has been made before the last key re-cycle, this warning informs you that EEPROM was correctly cleared.	1- A travel demand or a pump request does cancel the alarm. 2- If the alarm appears at key-on without any CLEAR EEPROM performed, replace the controller.
210	WRONG RAM MEM.	The algorithm implemented to check the main RAM registers finds wrong contents: the register is "dirty". This alarm inhibits the machine operations.	Try to switch the key off and then on again, if the alarm is still present replace the logic board.
212	W.SET. TG-EB XX	the slave controller find the status of the maincontactor is different between hardware and CAN-BUS	This type of fault is related to internal components. Replace the logic board.
213	INPUT MISMATCH	the slave controller find the status of the input is different between hardware and CAN-BUS	This type of fault is related to internal components. Replace the logic board.
227	OUT MISMATCH XX	the slave controller find the status of the output is different between hardware and CAN-BUS	This type of fault is related to internal components. Replace the logic board.
229	NO CAN WR MSG.XX	CANbus communication does not work properly. The hexadecimal value "XX" identifies the faulty node.	1- Verify the CANbus network (external issue). 2- Replace the logic board (internal issue).
230	SOFTWARE ERROR	it means the software of the slave controller is wrong	This type of fault is related to internal components. Replace the logic board.

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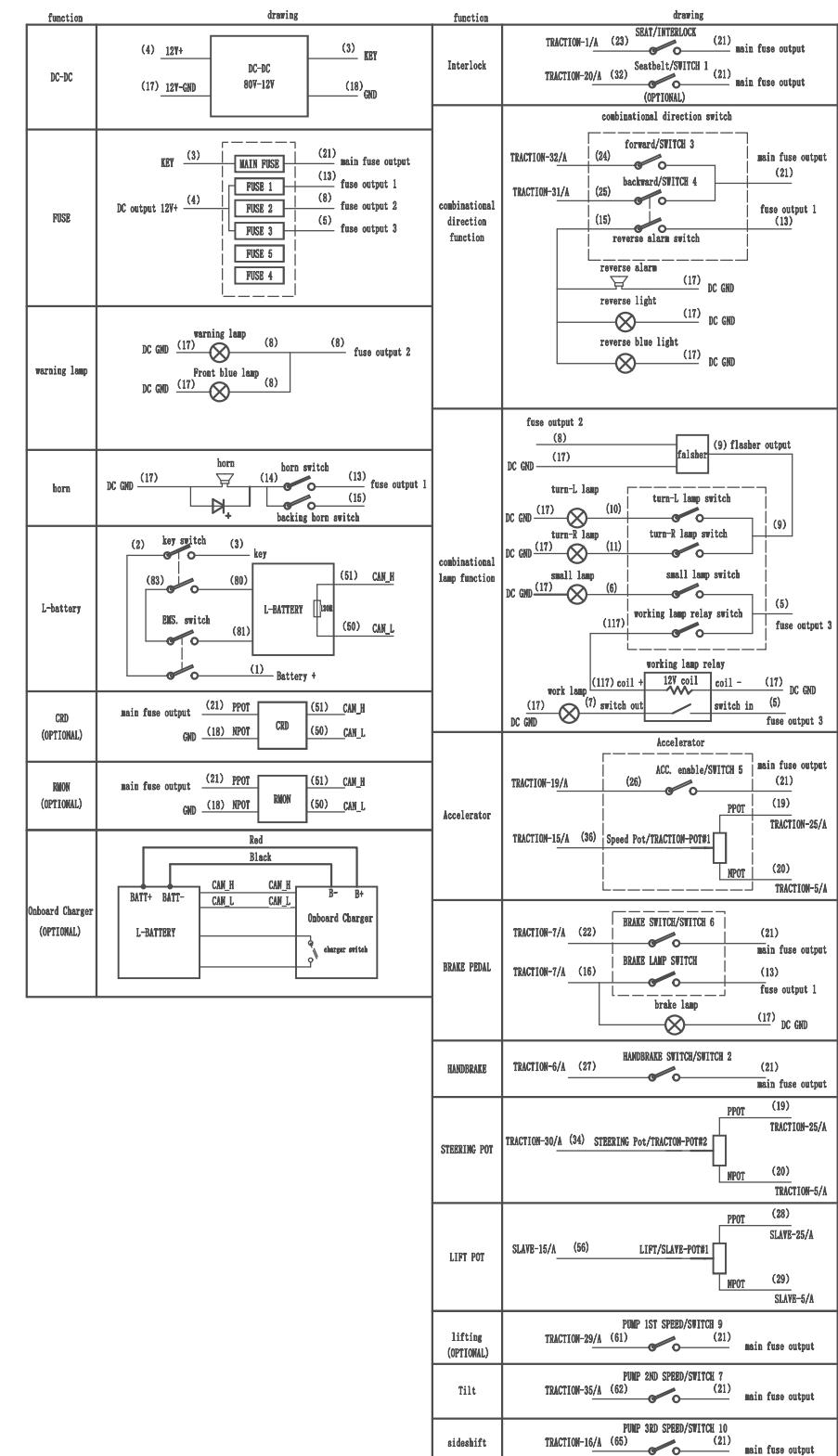
Error Message		Possible cause	Fault elimination
Error	Error text		
237	ANALOG INPUT	This alarm occurs when the A/D conversion of the analog inputs returns frozen values, on all the converted signals, for more than 400 ms. The goal of this diagnosis is to detect a failure in the A/D converter or a problem in the code flow that skips the refresh of the analog signal conversion.	If the problem occurs permanently it is necessary to replace the logic board.
239	CONTROLLER MISM.	The software is not compatible with the hardware. Each controller produced is "signed" at the end of line test with a specific code mark saved in EEPROM according to the customized part number. According with this "sign", only the customized firmware can be uploaded.	1- Upload the correct firmware. 2- Ask for assistance to a EP technician in order to verify that the firmware is correct.
240	OUT MISMATCH PU	This is a safety related test. Supervisor µC has detected that master µC is driving the pump motor in a wrong way (not corresponding to the operator request).	1- Checks the matching of the parameters between Master and Supervisor. 2- Ask for assistance to a EP technician. 3- If the problem is not solved, replace the logic board.
241	SP MISMATCH PUMP	This is a safety related test. The supervisor µC has detected a mismatch in the DC-pump speed setpoint with respect to the master µC.	1- Check the matching of the parameters between master and supervisor. 2- Ask for assistance to a EP technician. 3- If the problem is not solved, replace the logic board.
242	SP MISMATCH XX	This is a safety related test. The supervisor µC has detected a mismatch in the speed setpoint with respect to the master µC. The hexadecimal value "XX" facilitates EP technicians debugging the problem.	1- Check the matching of the parameters between master and supervisor. 2- Ask for assistance to a EP technician. 3- If the problem is not solved, replace the logic board.
248	NO CAN MSG. XX	CANbus communication does not work properly. The hexadecimal value "XX" identifies the faulty node.	1- Verify the CANbus network (external issue). 2- Replace the logic board (internal issue).

ELECTRICAL COMPONENTS

10.6 Electrical Schematic Diagrams



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10.7 Cable Wiring Diagrams

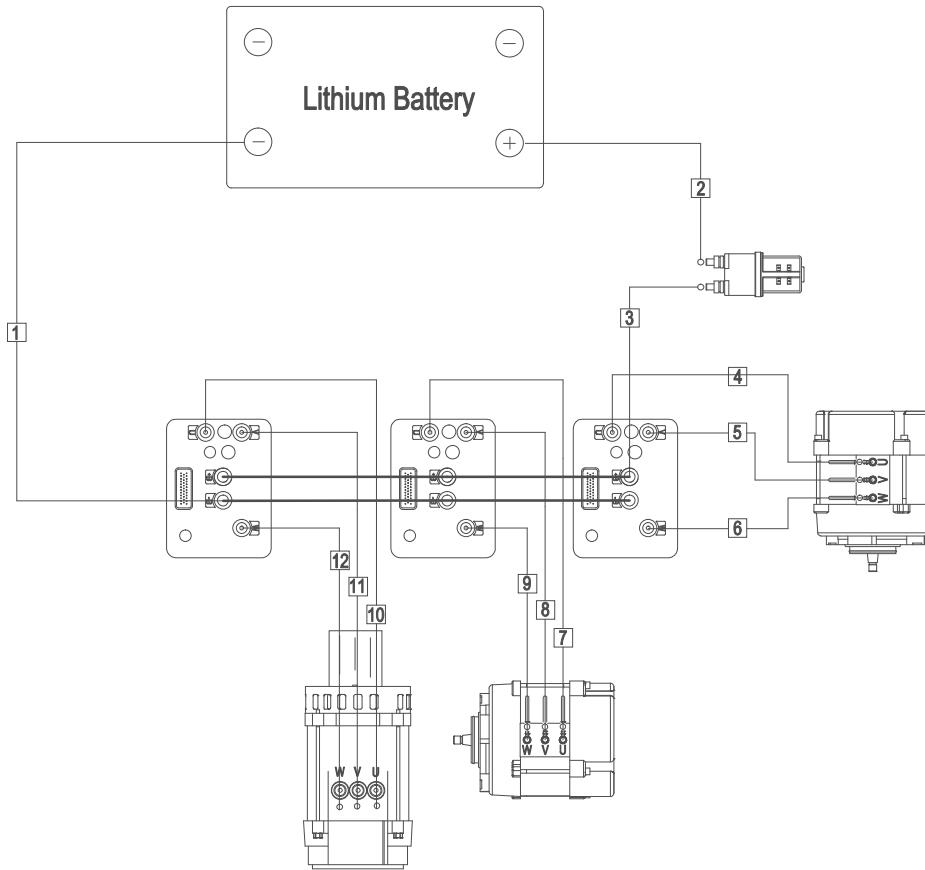


Fig3214-50039SM

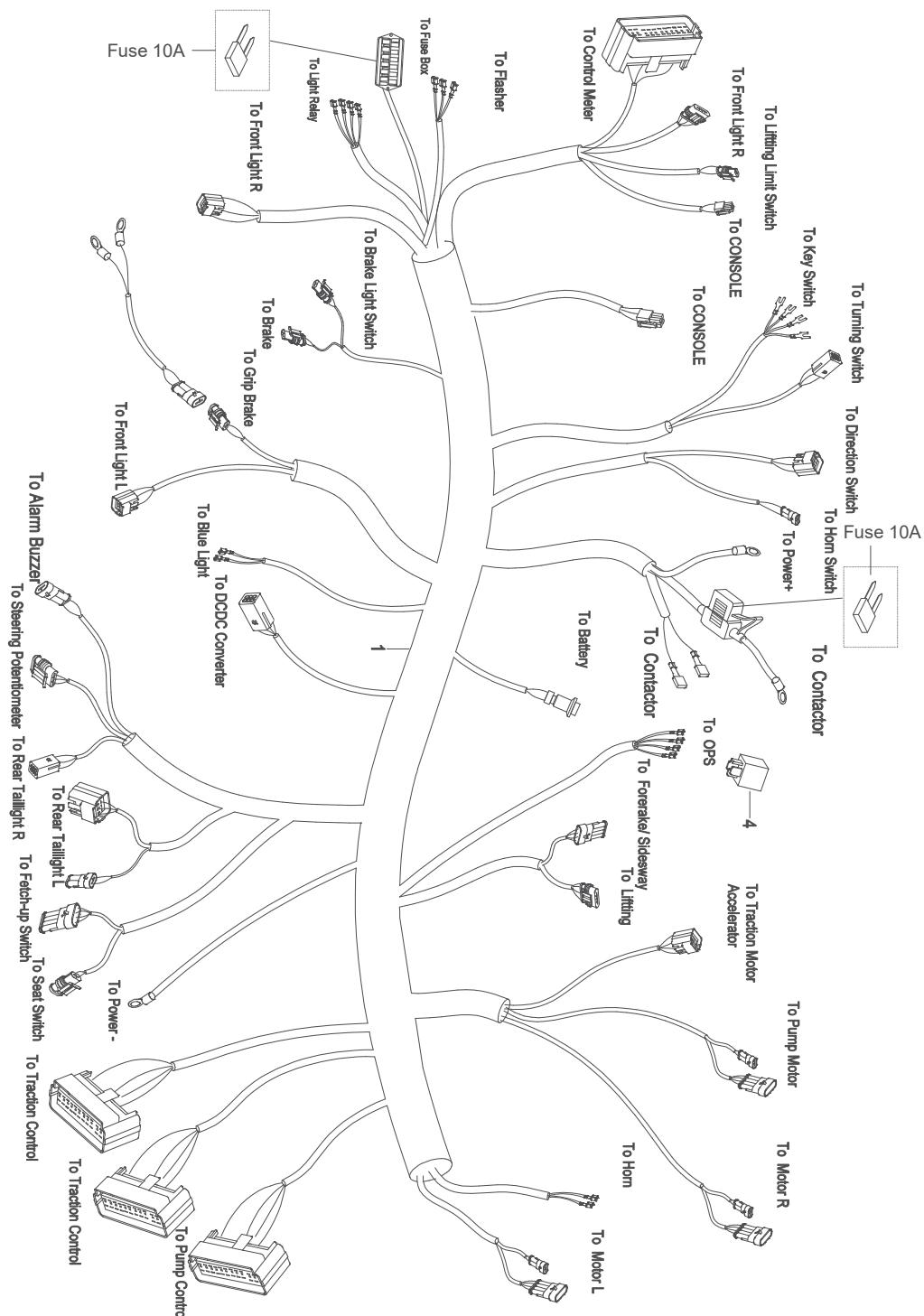
No.	Name
1	Battery - to Controller
2	Battery + to Contactor
3	Contactor to Controller
4	L-Drive Motor Cable U
5	L-Drive Motor Cable V
6	L-Drive Motor Cable W

No.	Name
7	R-Drive Motor Cable U
8	R-Drive Motor Cable V
9	R-Drive Motor Cable W
10	Pump Motor Cable U
11	Pump Motor Cable V
12	Pump Motor Cable W

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ELECTRICAL COMPONENTS

10.8 Wiring Harness and Connectors



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ELECTRICAL COMPONENTS

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