



T250F

SERVICE MANUAL

< SM-T250F2021001-US >



Forklift

FOREWORD

We have issued this service manual to assist you in carrying out a complete repair service. It gives you a thorough description of the services essential to this BYD product and thus enables you to be your own consultant in maintaining quality and precision. This service manual has specifications, an explanation of the mechanism, disassembly instructions, reassembly instructions, a checklist, adjustment instructions, and special tools list.



Table of Contents

1 How to Use This Manual

- 1.1 Overview of the Manual..... 14
- 1.2 Use of the Manual 14
 - 1.2.1 Storage of the Manual..... 15
 - 1.2.2 Legends of the Manual 15
 - 1.2.3 Explanations for Abbreviations..... 16
 - 1.2.4 Notes for Reading 16

2 Safety Instructions

- 2.1 Safety and Warning Symbols 20
 - 2.1.1 Safety Categories 20
 - 2.1.2 Hazard Symbols..... 21
 - 2.1.3 Prohibition Symbols 21
 - 2.1.4 Symbols About Mandatory Action 22
- 2.2 Safety Specifications..... 23
 - 2.2.1 Safety Requirements for Industrial Truck 23
 - 2.2.2 Operation Safety Principles 24
- 2.3 Maintenance Principles..... 26
 - 2.3.1 Safety Principles Before the Maintenance 26
 - 2.3.2 Safety Principles During the Maintenance 27
 - 2.3.3 Safety Principles After the Maintenance 28
- 2.4 Disposal of the Truck and Materials..... 29
- 2.5 Possible Hazards 29



- 2.5.1 Restrictions 29
- 2.5.2 Emergency Procedures 30

3 Overview of the Truck

- 3.1 Dimensions of the T250F Truck 34
- 3.2 Major Parameters of the Truck..... 35
- 3.3 Data Plate on T250F Truck..... 36
- 3.4 Data Plate on the Battery 37
- 3.5 Signs and Labels 38
- 3.6 Intended Use 39
- 3.7 Prohibition 39

4 Producedures and Maintenance

- 4.1 Overview of the Truck..... 42
 - 4.1.1 Overview 1 of the Entire Truck 42
 - 4.1.2 Overview 2 of the Entire Truck 43
 - 4.1.3 Chassis 44
 - 4.1.4 Hydraulic Units..... 45
 - 4.1.5 Electrical Parts 46
- 4.2 Maintain Accessory System 47
 - 4.2.1 Right Cover of the Display Desk 47
 - 4.2.2 Handbrake Cover Assembly 49
 - 4.2.3 Horn Cover of the Steering Wheel 50
 - 4.2.4 Rear Cover Plate Assembly 51
 - 4.2.5 Front Cover Plate Assembly 53
 - 4.2.6 Seat..... 55



4.2.7 Foot Pedal Assembly 57

4.3 Steering Control Systems 59

4.3.1 Wheels 59

4.3.2 Replace Tires 65

4.3.3 Steering Wheel 66

4.3.4 Combination Switch 68

4.3.5 Steering Column 70

4.3.6 Display 72

4.3.7 Overview of Steering Axle System..... 73

4.4 Drive Unit..... 93

4.4.1 Introduction of the Drive Unit 93

4.4.2 Check Oil Level of the Drive Unit..... 99

4.4.3 Adding Gear Oil into the Drive Unit..... 100

4.4.4 Replace Drive Axle Assembly 105

4.4.5 Drive Unit 108

4.5 Brake System 111

4.5.1 Specification..... 111

4.5.2 Parking Brake System 113

4.5.3 Parking Brake System 121

4.5.4 Energy Accumulator..... 124

4.6 Electrical Parts..... 141

4.6.1 Check Lines 141

4.6.2 Low Voltage Distribution Case 147

4.6.3 Main Controller Fuse..... 149

4.6.4 Ignition Switch..... 151

4.6.5 Ignition Switch Fuse..... 153



4.6.6 Precharge Resistor 154

4.6.7 Main Contactor..... 156

4.6.8 DC/DC Converter..... 158

4.6.9 Single Controller 160

4.6.10 Horn 163

4.6.11 Reversing Buzzer..... 164

4.6.12 Emergency Power Off (EPO) Switch 165

4.6.13 Voltage Divider..... 166

4.7 Maintaining Battery 168

4.7.1 Overview of the Battery Case 168

4.7.2 Battery Disassembling 171

4.7.3 Battery Maintenance 172

4.7.4 Removal, Replacement and Installation of the Battery Case 175

4.7.5 Battery Manager System (BMS) 177

4.7.6 Controller Contactor of the Battery 178

4.7.7 Charge-discharge Contactor..... 180

4.7.8 Hall Sensor 184

4.7.9 Battery Case Connector Base..... 186

4.7.10 Charging Port Base..... 188

4.7.11 Battery Information Collector (BIC) 190

4.8 Motor..... 188

4.8.1 Bearing of the Motor 188

4.8.2 Terminal Nut 189

4.8.3 Test of the Motor 190

4.8.4 Pump/Steering Motors 191

4.8.5 Speed Sensor 193



4.8.6 Power Unit Motor 194

4.9 Hydraulic Parts 199

4.9.1 Hydraulic Oil..... 199

4.9.2 Return Oil Filter..... 203

4.9.3 Steering Gear..... 205

4.9.4 Hydraulic Pump..... 208

5 Maintenance Routines

5.1 Maintenance Content and Basic Requirements 214

5.2 Basic Safety Principles 215

5.3 List of Routine Maintenance 217

5.4 Routine Maintenance..... 218

5.4.1 Description 219

5.5 Regular Maintenance..... 221

5.5.1 Description 222

5.6 Accessories..... 223

6 Program and Settings

6.1 Program Updating 227

6.1.1 Connecting the Truck and the Computer..... 227

6.1.2 Standard Operation Procedures of Updating Controller Program 228

6.1.3 Controller Node & Program Introduction..... 229

6.1.4 Scan and Select the Node 232

6.1.5 Choose the Node and Start Updating 234

6.1.6 Finish Update and Exit..... 236

6.1.7 Restart the Ignition Switch for Saving the Configuration..... 237



6.2 Basic Edition of BYD Truck Software..... 239

6.2.1 Software Icons and Interfaces 239

6.2.2 Scan and Select the Node 240

6.2.3 Introduction of Software Interface 242

6.2.4 Operation Instruction of Parameter List Reading..... 247

6.2.5 Sensor Calibration Through Software..... 249

6.2.6 Introduction of Software Parameter 250

6.2.7 CAN Message Intercepting Operation (Tab 5)..... 256

6.3 Advanced Monitoring Software for Motor Controller-DriveTool-4.9 258

6.3.1 Software Icons and Interfaces 259

6.3.2 Scan and Select the Node 260

6.3.3 Select EPF File 262

6.3.4 Description of Parameter Debugging..... 264

6.3.5 Calibration of Sensor Value 267

6.3.6 Restart for Saving the Configuration..... 267

7 Troubleshooting

7.1 Electrical Maintenance Diagnosis 270

7.1.1 Overview 271

7.1.2 Comparison Table of the Display Error Codes and Controller Error Codes... 272

7.2 Troubleshooting Explanation 274

7.3 Error Codes 366

8 Theory of Operation

8.1 Operation Theory of Hydraulic System 370

8.1.1 Working Principle of Hydraulic System 370



8.2 Operation Theory of Electric System..... 377

8.2.1 Electric System of the Entire Truck..... 377

8.2.2 Power System of the Entire Truck 378

8.2.3 Control System 382

8.2.4 Brake System..... 388

8.2.5 Steering System..... 389

9 Appendix

9.1 Table of the Torque Value..... 392

9.2 Hydraulic Schematic Diagram 396

9.3 Electrical Schematic Diagram 398

9.4 Parameters of the Controller 402

9.5 Charging Instructions 404

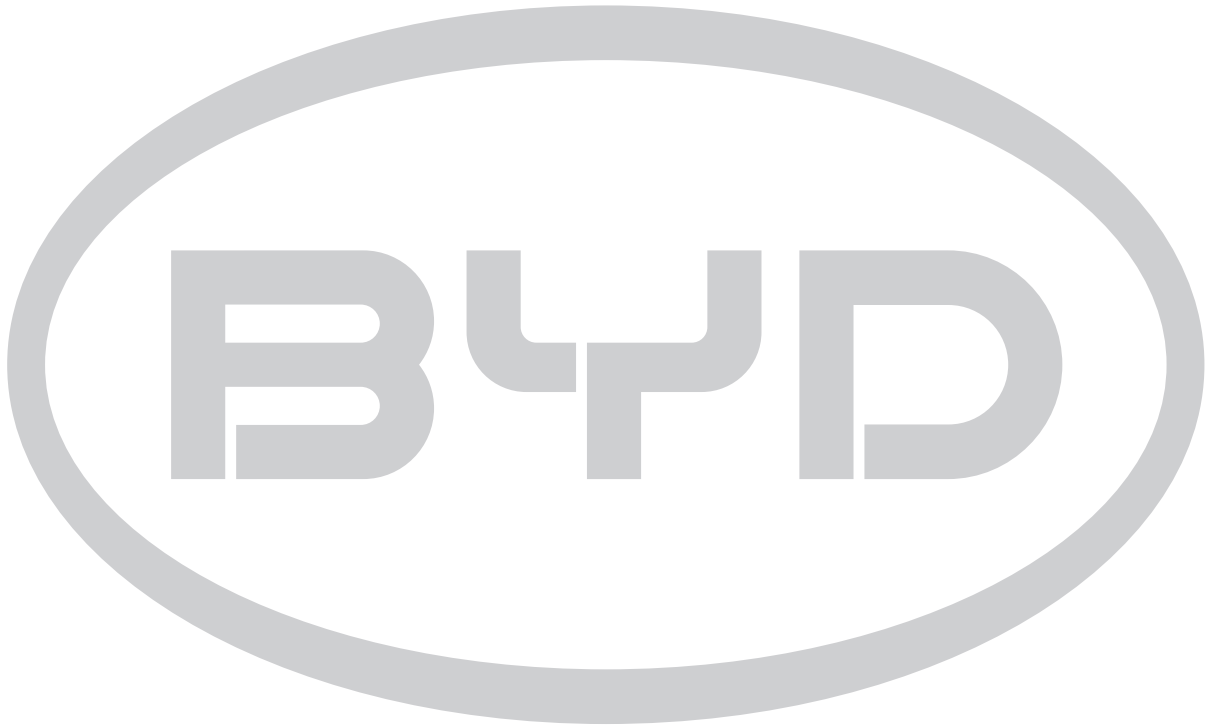
9.6 Weekly Check..... 405

9.7 Other Information 406





1 How to Use This Manual





1.1 Overview of the Manual

This manual is a guide for maintaining BYD tractor.

It is designed for the following purposes:

- Provide technical support in accordance with the user's professional level
- Anticipate demands and simplify decision-making procedures about maintenance
- Adopt one-stop service to reduce page turning

The explanation, tables and specifications contained in this manual are applicable to tractors with serial numbers effective from the date of printing.

Please read the manual carefully and get familiar with its contents before maintaining tractors.

BYD reserves the right to modify the specification or design without prior notice and without obligation.

Copying and lending this manual without authorization is prohibited.

1.2 Use of the Manual



Danger

Please read the manual before maintaining tractors.
Keep this manual in a safe and dry place.
If you maintain the tractors before fully getting familiar with its operation and its maintenance specifications, it may cause a serious accident.
For more copies of this manual, please contact the distributor.



1.2.1 Storage of the Manual

This manual must be available throughout the life of the tractor.

BYD recommends that the manual should be kept near the tractor at all times for easy access.

The manual should be complete without any removal.

If this manual is lost, damaged or unreadable, please contact BYD immediately for the electronic version of the manual.

Please provide the following information when contacting BYD:

- Serial Number (See the nameplate)
- Manual Number
- Email Address

1.2.2 Legends of the Manual

- Chapter Title

(Eg. 1.2.1 Storage of the Manual, it means the second section, Chapter 1, and is located under the Use of the Manual.)

- Name of the Manual
(SM-T250F2021001-US)
SM: Service Manual
T250F: Mode of the Truck2021001: The first version in 2021US: United States
Version
- Explanation for Copyright
(Copyright © BYD 2020. All rights reserved)
- Current Page (15)



1.2.3 Explanations for Abbreviations

For referring to this manual, the abbreviations in the manual are explained as follows:

- “BYD (SHAOGUAN) CO.,LTD.” is abbreviated as “BYD”

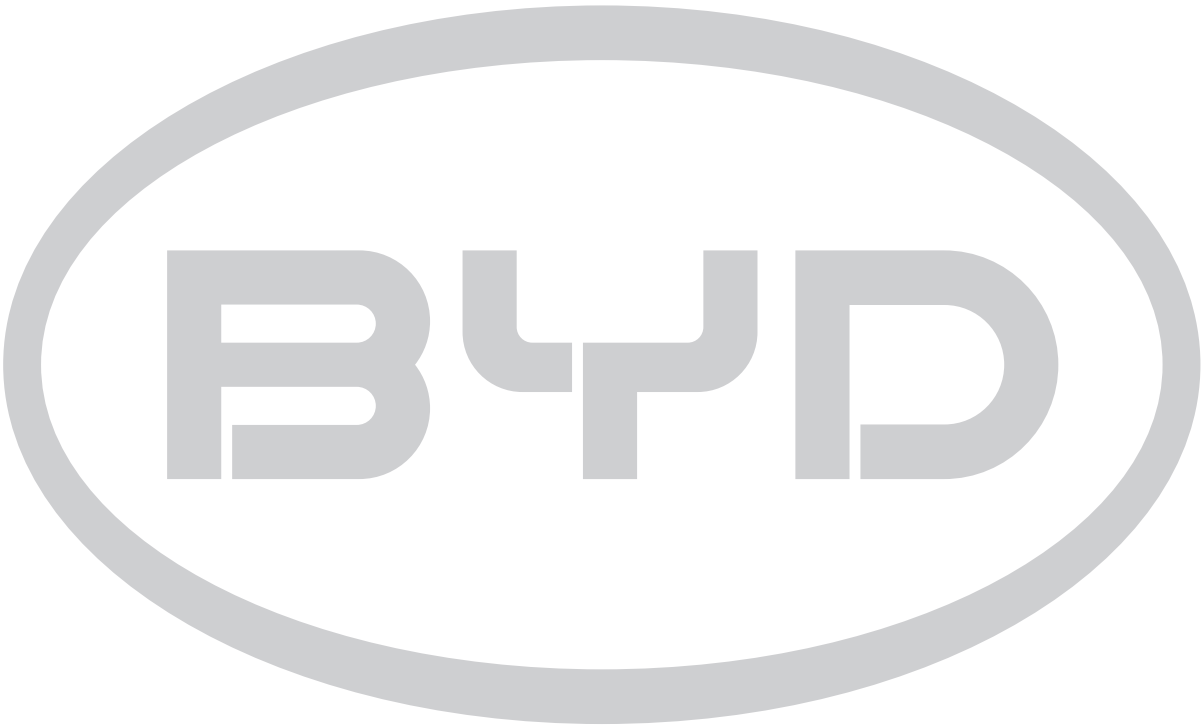
1.2.4 Notes for Reading

- “Step-by-step number” lists tasks and procedures in order
- Unordered list means that the operating order is not important
- Texts and headings in the table rows and columns use Arial fonts
- Each chapter has a dividing page
- The header has chapter titles
- The footer has page number and (SM-T250F2021001- US)





2 Safety Instructions





2.1 Safety and Warning Symbols

According to ISO 3864-1, it specifies general shapes and colors of safety symbols about danger, warning and caution.



General Warning



General Prohibition



General Mandatory Action

2.1.1 Safety Categories

If special precautions should be taken to avoid potential danger, texts about danger, warning and caution will be adopted in the BYD document.

According to ISO 3864, warnings can be divided into three categories based on degrees of severity and danger.



2.1.2 Hazard Symbols

These symbols represent dangerous situations or actions. They warn against those situations that may cause damage to the tractor and personal injury.



Foot Hazard



Charging Battery



Crushing of Hands



Electric Hazard



Hot Surface

2.1.3 Prohibition Symbols

These symbols are used in warnings and notes to indicate actions that cannot be taken.



No fire



Do not modify



Limited access



Do not touch



2.1.4 Symbols About Mandatory Action

These symbols are used in warnings to indicate the action that must be taken.

	Read the instructions manual		See a doctor
	Shut down electric components		Recycle battery



2.2 Safety Specifications

2.2.1 Safety Requirements for Industrial Truck

The tractor is consistent with basic requirements of Machinery Directive. We company designs and manufactures the tractor in accordance with the safety standard ANSI/ITSDF B56.

This manual introduces safety regulations and maintenance guidance of importance. As safety regulations vary from country to country, please get familiar with the regulations and standards applicable to your country.

2.2.1.1 Safety Requirements for Electric Parts

Warning

Do not make any changes to the electrical parts without BYD's written permission. Otherwise, it may influence electromagnetic compatibility and thereby reducing the safety of operation.

2.2.1.2 Safety Requirements for Noise

The Machinery Directive 2006/42/EC regulates that the manufacturer should measure the noise emission range from the tractor and release test results.

The Noise Directive 2003/10/EC regulates that the tractor owners are obliged to provide protection to the workers.

- If the noise level exceeds the lower limit value 80 dB (A), the tractor owner should provide separate hearing protection for workers
- If the noise level is not less than the upper limit value 85 dB (A), separate hearing protection should be used



2.2.2 Operation Safety Principles



Danger

Uncertified technicians performing repairs are not authorized.



Without written permission of BYD, it is prohibited to repair T250F tractors for other purposes than those specified in this manual. Otherwise, it may damage the tractor and cause death to personnel.

Warning



Read the manual and its contents before maintaining the tractor.

Conduct training about the operation, safety and maintenance of the tractor.

All personnels must obey maintenance specifications and safety regulations.

The tractor is consistent with relevant advanced and recognized safety regulations. If the user does not obey these safety regulations, danger or injury may be caused to maintenance personnel or personnel of the third party.

Maintenance personnel must get familiar with the performance and operation of the tractor. Only qualified trained personnel can maintain the tractor.

Maintenance personnel must read and understand the maintenance specification carefully before maintaining the tractor

Maintenance personnel must obey laws and regulations banned by local relevant administration organization when maintaining the tractor.

If any faults or defects are found to reduce the operating safety of the tractor during the maintenance, stop operating the tractor immediately until faults or defects are repaired and report to relevant department or personnel.



2.2.2.1 Safety Principles of Stability

Warning



If the tractor is not stable, it may cause a dangerous accident.

When the tractor is maintained, pull on the parking brake, turn off the ignition switch and press down the emergency power off switch.

2.2.2.2 Safety Principles of Center of Gravity

Center of gravity is the point of an object where its weight is equally applied. If the object is regular in its shape, its geometric center is same as its center of gravity. If it is not regular, the center of gravity can be a point on either side of the geometric center.

When the tractor pulls an object, there will be a new and common center of gravity between them.

The following factors will influence the center of gravity and stability of the tractor:

- The dimension and weight of the battery
- Whether optional devices that can be removed from the tractor are used
- Dynamic forces that are caused when the tractor turns or increases or decreases its speed
- Condition and grade of surfaces for operating the tractor
- Wind forces when operating the tractor outdoors



2.3 Maintenance Principles



 Danger

It is forbidden to make any functional modification without BYD's written consent.

 Warning



During the maintenance of a tractor, personal protective equipment must be worn.

2.3.1 Safety Principles Before the Maintenance

All necessary safety precautions must be taken before maintenance. The safety precautions include (but are not limited to) the follows:

- Read the manual carefully before maintaining a tractor
- Conduct training about the operation, safety and maintenance to operators
- Shut down the tractor and take relevant safety measures before performing a maintenance task
- If a component needs to be moved during maintenance inspection, sufficient guardians must be arranged according to the situation to deal with the emergency and ensure the safety of each operator
- Abide the relevant safety regulations formulated by the local government, users, BYD, and accessory suppliers

2.3.1.1 Check Before the Maintenance

- Check functions of brake and operating control devices
- Check functions of loading device and oil pressure device
- Check functions of the headlight, rear lamp, steering wheel and alarm device



2.3.2 Safety Principles During the Maintenance

The operator must obey the following items to operate the tractor during the maintenance:

In accordance with the maintenance instruction and directions in the schedule, daily and weekly maintenance check should be carried out to prevent from failure and maloperation.

- Keep the speed below 25km/h when operating outdoors, while below 5km/h indoors
- When the front view is poor, consider driving backward and ask someone else for guidance
- Pay attention to the road condition. Do not conduct maintenance when the tractor is loaded and tilting
- Pay attention to the distance between ceiling obstacles and pillars
- No firework near the tractor
- When leaving the tractor after maintenance, pull out the key and pull on the brake

2.3.2.1 Repairs and Structural Modification

It is forbidden to make any modification or changes to the tractor without BYD's written consent. Such modification or changes may influence the traction weight capacity, stability and safety. To be specific, it includes modification or changes that affect brake, steering and visibility.

With the written consent of BYD, the end user must obey the follows when making modification or changes:

- Maintain a permanent record of risk assessment, design, test and implementation of modification or changes
- Approve and make appropriate changes to the traction sign, label, tag and other contents of the manual
- Attach a permanent and visible label to the tractor indicating the way and date that the tractor is modified or changed as well as the name and address of the task agent



2.3.3 Safety Principles After the Maintenance

Safety precautions to be taken after the maintenance include the follows (but are not limited to):

- Clean the Machine and the working site
- The state of the safety device may be changed when the maintenance is completed, and therefore the safety device must be reset and tested immediately
- Perform commissioning and functional testing of components and safety devices before re-running the tractor.
- Check all the maintenance tasks to make sure its effectiveness
- Complete the maintenance checklist, including maintenance items and results
- Make sure that the faults found are recorded and eliminated
- Dispose of wastes in accordance with local laws and regulations



Note: For the uncertainties during the maintenance, contact BYD for technical support.



2.4 Disposal of the Truck and Materials



Warning

When disposing of the tractor and materials, comply with applicable national environmental and recycling protection regulations.

The tractor owner is responsible for dealing with the tractor and the materials.

Do not pollute the environment when disposing of the tractor, oil, greases and other substances used for operating the tractor.

The following materials must be handled with strictly:

- Truck components: mechanical components, electrical components, electronic components, batteries, etc.
- Oils, greases and other substances used for tractor operation

BYD suggests that the equipment and materials to be disposed of should be delivered to a professional disposal organization.

2.5 Possible Hazards

BYD has carried out all necessary measures to design a safe tractor. Even so, once any safety measures are missing, report to the superior immediately. If necessary, inform other personals related to the tractor.

If you cannot eliminate the danger in a safe way, do not carry out any maintenance operations. Instead, immediately report to the professional authorized personnel who can eliminate the danger, and contact BYD if necessary.

2.5.1 Restrictions

Danger

Unauthorized modification of the tractor or accessories may reduce the safety of operating equipment, and even result in casualties or damage to the tractor.



- Do not change tractors and accessories without the authorization of BYD.
- Do not integrate tractor components into other production systems.
- Do not remove safety devices.
- Do not cover safety device, alarm device, limit switch, valve and other control components.



2.5.2 Emergency Procedures



 Warning

Go to see a doctor when emergencies occurred.

Possible emergencies are as follows:

- If the tractor falls over, the operator should hold on the steering wheel and warn against others. Beware of leaking battery acid.
- If the tractor is found faulty, stop the tractor and rotate the starting switch to the off-position. Tractors shall not be used again until the supervisor authorizes the personnel to repair it.
- In case of fire, press the emergency stop button to disconnect the battery connector and warn against others.

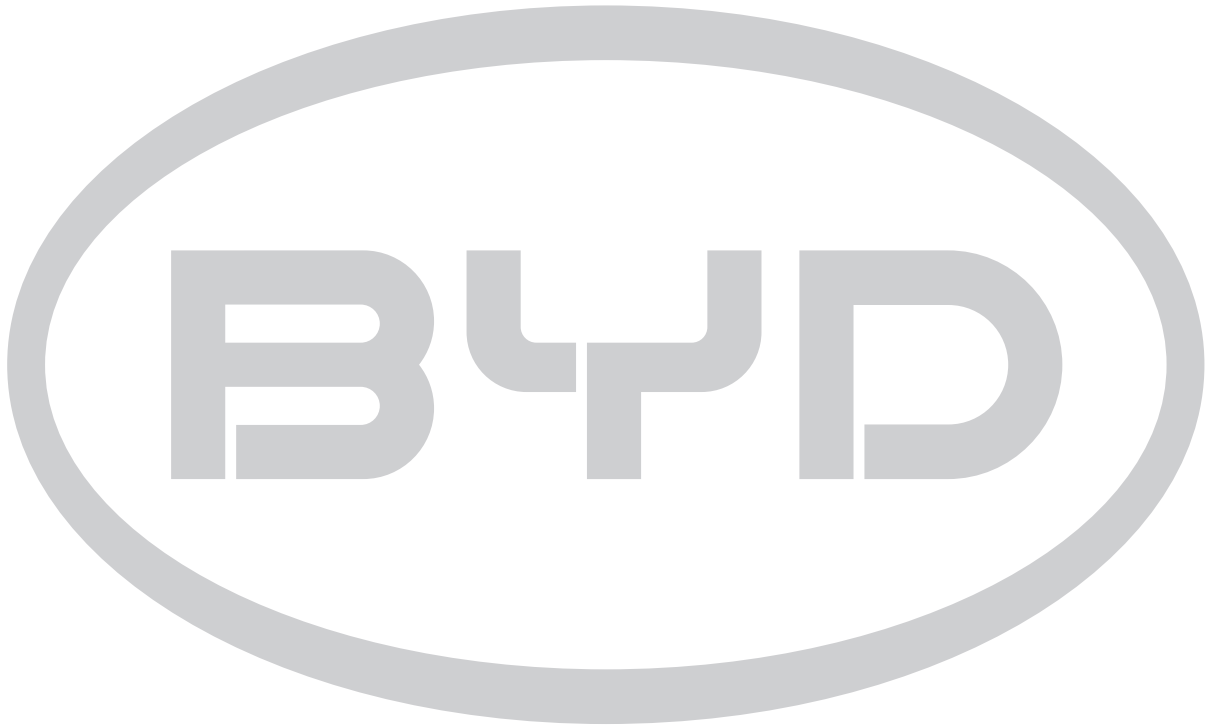
Take the following measures in the event of personal injury during the maintenance:

- Take first-aid measures
- Contact the doctor
- Report to the manager



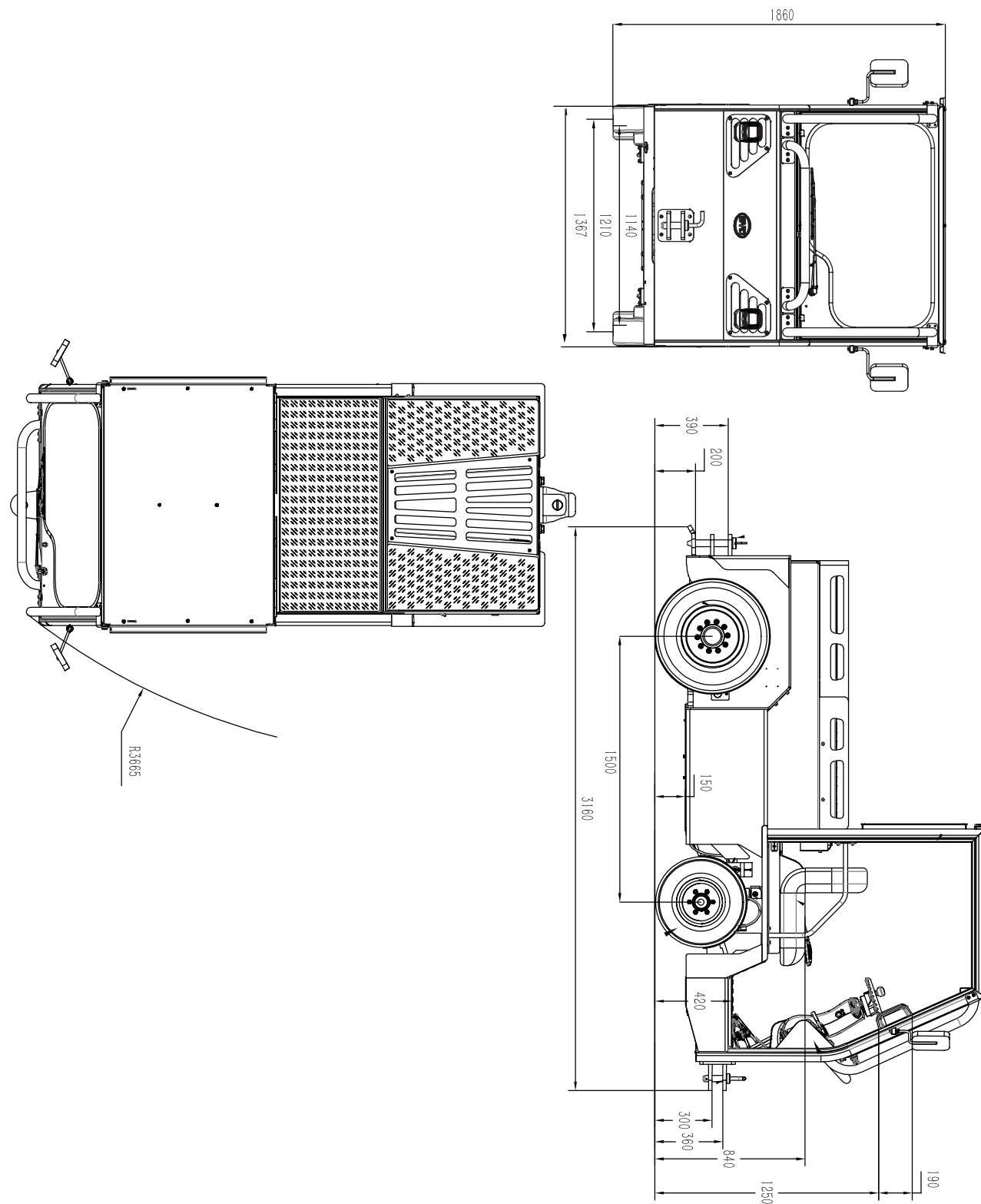


3 Overview of the Truck





3.1 Dimensions of the T250F Truck



3.2 Major Parameters of the Truck

Characteristic	Manufacturer				BYD
	Model				T250F
	Power Type				Electric
	Operation				Seated
	Rated Traction Weight	Q	lbs	kg	55115 25000
	Rated Drawbar Pull	F	lbf	N	1348 6000
	Wheelbase	y	in	mm	59.1 1500
Weights	Service Weight (Battery Incl.)		lbs	kg	8267 3750
	Front Axle Load, With Load		lbs	kg	4023 1825
	Rear Axle Load, With Load		lbs	kg	4244 1925
Wheels	Tire rubber, SE, Pneumatic, Polyurethane				Pneumatic/SE
	Tire Size, Front				6.00-9
	Tire Size, Rear				7.00-12
	Wheels, Number Front/Rear (x = Driven)				2/2x
	Track Width, Front	b10	in	mm	47.6 1210
	Track Width, Rear	b11	in	mm	44.9 1140
Dimensions	Height of Cab	h6	in	mm	73.2 1860
	Height of Seat	h7	in	mm	33.1 840
	Towing Coupling Height	h10	in	mm	7.9~15.4 200~390
	Front/rear Overhang	l5	in		24 610
	Overall Length	l1	in	mm	124.8 3170
	Overall Width	b1	in	mm	55.1 1400
	Ground Clearance, Centre of Wheelbase	m2	in	mm	5.9 150
	Turning Radius	Wa	in	mm	144.3 3665
Performance	Travel Speed, With/Without Load		mph	km/h	7/16 12/25
	Maximum Drawbar Pull, With/Without Load		lbf	KN	4045 18
	Approach/Departure Angle	α	°	°	15/20
	Climbing Ability, With/Without Load		%	%	4/28
	Service Brake				Hydraulic
Drive	Drive Motor, 60 Minute Rating		HP	kw	38.5 28.7
	Battery Voltage/Rated Capacity		V/Ah	V/Ah	80/540
	Battery Weight (± 5%)		lbs	kg	1852 840
Others	Type of Drive Control				AC
	Noise Level at Operator's Ear		dB(A)	dB(A)	≤ 75
	Towing Coupling Type				PIN



3.3 Data Plate on T250F Truck

Caution

This nameplate is on the left of the tractor. When maintaining the tractor, please check and ensure the tractor information on the nameplate is consistent with the documentary record on site.

ELECTRIC TRACTOR

Type		Rated Capacity	
Max.Drawbar Pull		Rated Drawbar Pull	
Service Weight (W.battery)		Service Weight(W.o.battery)	
Battery Weight(Max.)		Battery Weight(Min.)	
Battery Voltage		Battery Amp-hr Capacity @ 6 Hrs	
Battery Cell model		Coupling Height	
Serial No.		Manufacture Date	

This tractor meets or exceeds design specifications of ANSI/ITSDF B56.9 in effect on the Date of manufacture

BYD (SHAOGUAN) CO., LTD.

No.1, BYD Road, Zhenjiang Industrial Park, Shaoguan, Guangdong, China

Hint

(1) The Truck nameplate is located on the left of the tractor.(2) After you receive the tractor, please check whether the information on the nameplate is consistent with the tractor you ordered.

NOTE

- (1) Since the configuration of each tractor may not be same, please check the nameplate before using and confirm its properties.
- (2) When moving materials, the weight of materials should not exceed the rated traction weight. Please check and confirm it.



3.4 Data Plate on the Battery

Caution

The nameplate on the battery is located on the top cover

铁电池/Iron-Phosphate Battery

产品使用环境 Operating Environment	环境温度 Ambient Temperature	
	相对湿度 Relative Humidity	
产品基本性能 Basic Performance	型号 Model	
	电池型号 Cell Model	
	标准容量 Nominal Capacity	
	标称电压 Nominal Voltage	
	工作电压 Operating Voltage	
	额定工作电流 Rated Operating Current	
	电池包重量 Weight	
	出厂编号 Serial No.	

Caution: Before operation, you must be familiar with specific requirement for output configuration by referring to the instruction manual.

中国制造
Made in China

BYD (SHAOGUAN) CO., LTD.

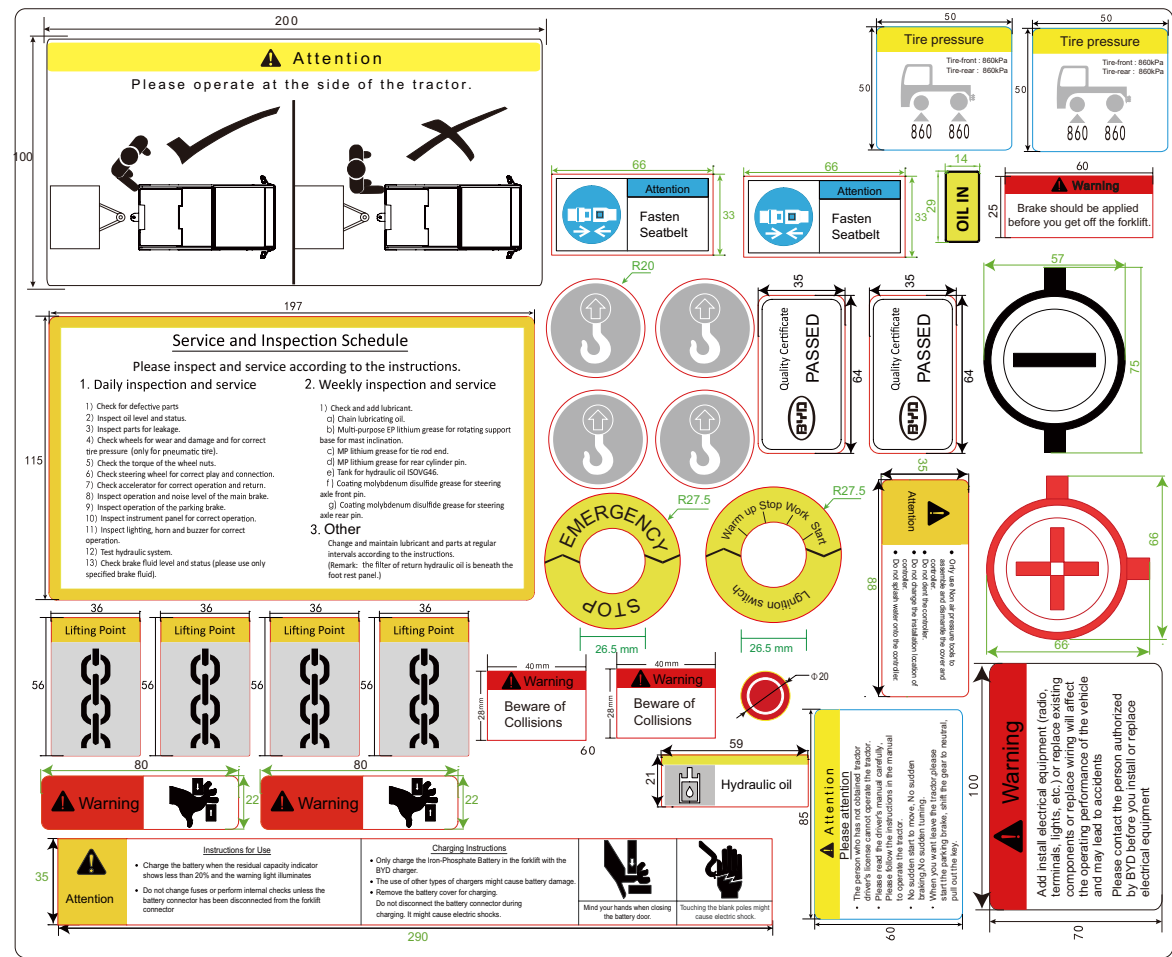


3.5 Signs and Labels

Caution

All signs and labels on the tractor must be clear and securely attached.

The figure below shows the types and styles of signs and labels on the tractor.



NOTE

If the labels are damaged, replace them with the same new signs. Specify the serial number when ordering new signs.



3.6 Intended Use

Danger

Read and understand this manual before operating the tractor.

Abide the safety instructions while using the tractor.

Only use the tractor for intended purposes.

1. The tractor, a seated electric tractor, is equipped with sophisticated handling control devices for driving, controlling and loading. It is designed to transport and tow on horizontal surfaces indoors and outdoors.
2. For more information about the tractor or training, please consult our sales department.

3.7 Prohibition

Do not use the tractor in the following conditions:

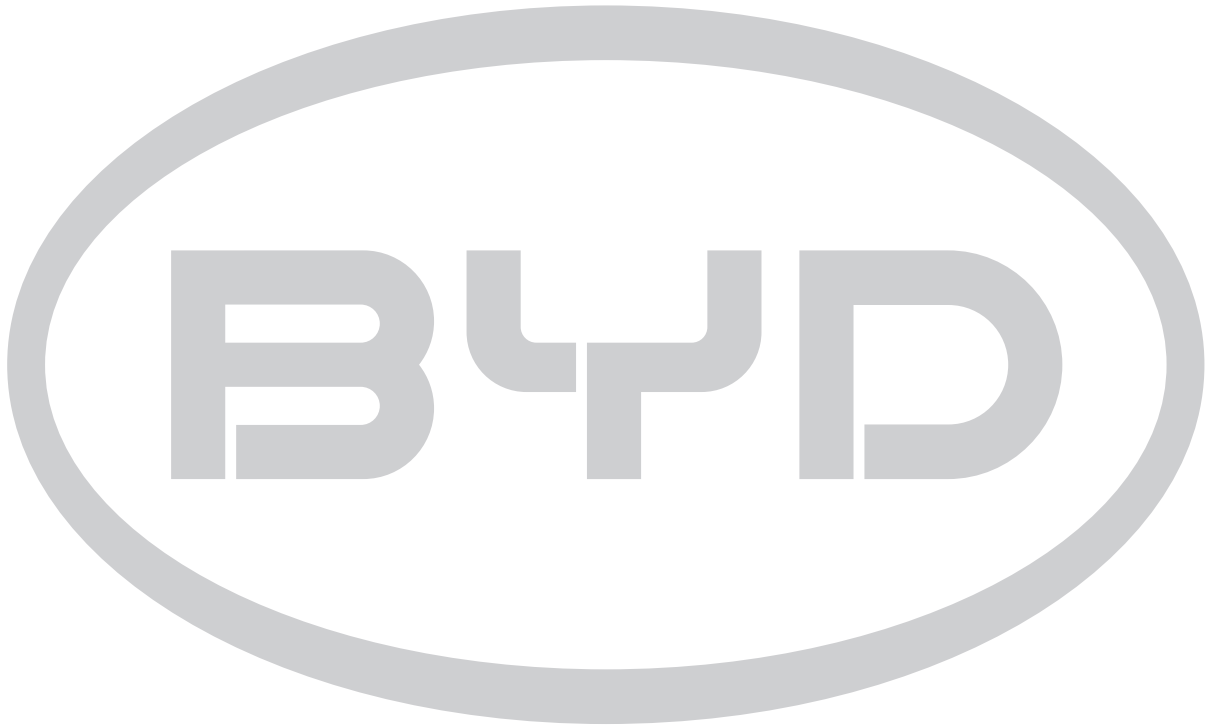
- Transporting persons
- Used for the climbing frame
- Transporting objects exceeding the rated load of the Truck
- Transporting unstable objects
- Transporting damaged objects
- Transporting hanging objects
- Transporting damaged pallets
- Transporting dangerous and explosive chemicals
- Pushing, dragging objects sideways on the ground

Do not use the tractor in the following places:

- An area with insufficient load capacity on its floor
- Used in premises where there is a risk of fire or explosion (ATEX premises)
- Used in a place with explosives
- Used in other places not allowed



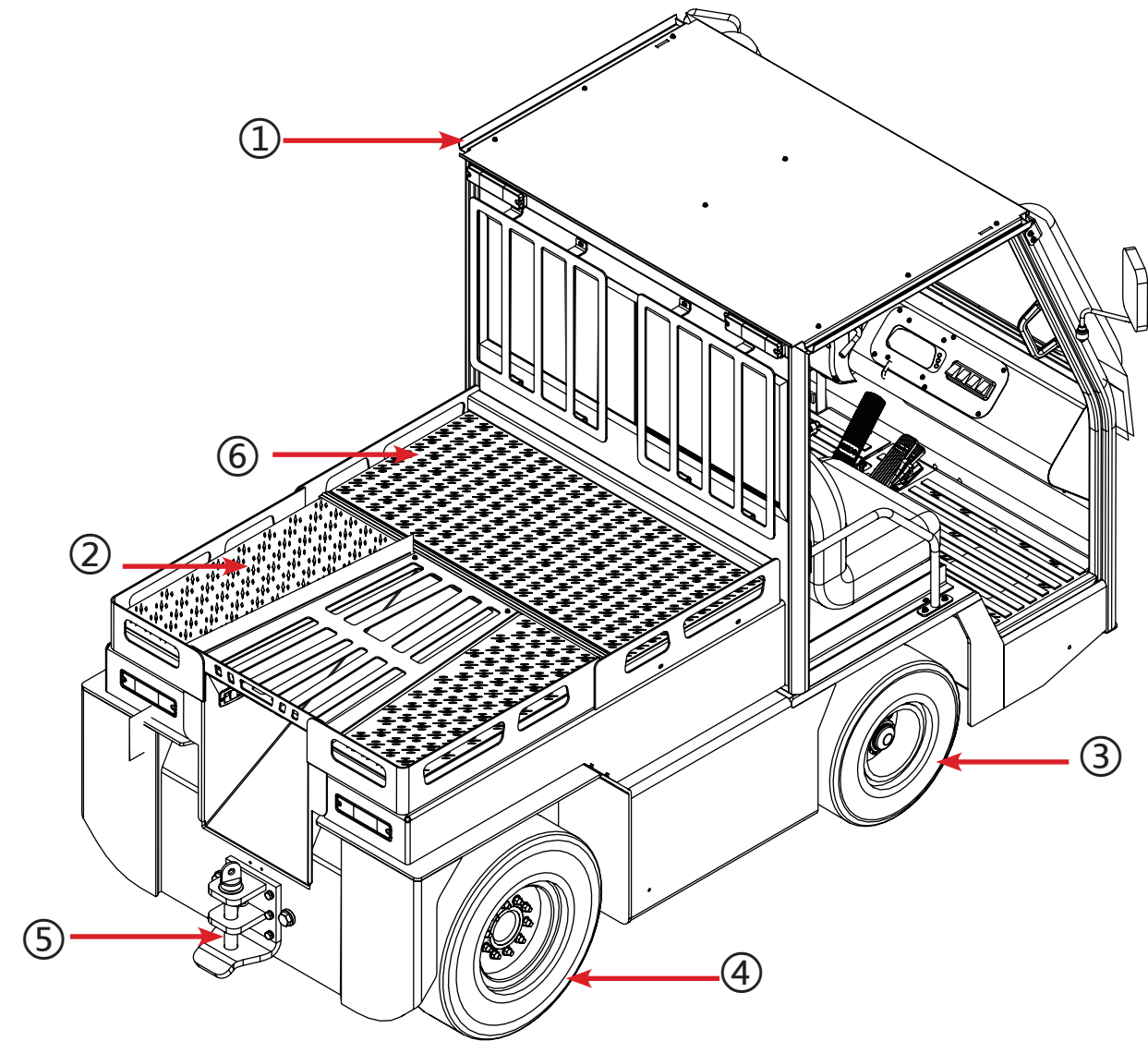
4 Producedures and Maintenance





4.1 Overview of the Truck

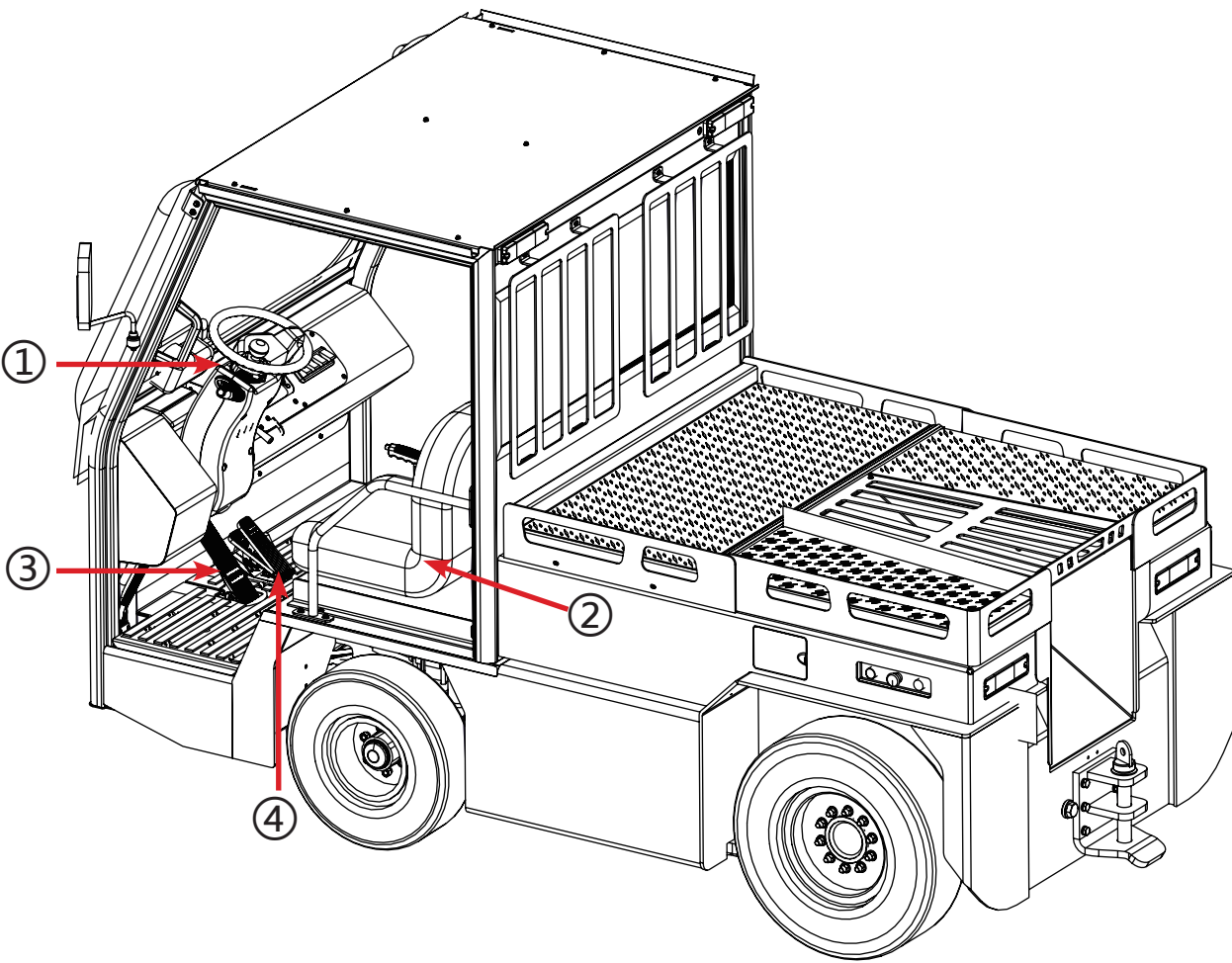
4.1.1 Overview 1 of the Entire Truck



1. Driving cab	4. Drive wheel
2. Rear cover assy	5. Rear traction pin
3. Steered wheel	6. Front cover assy



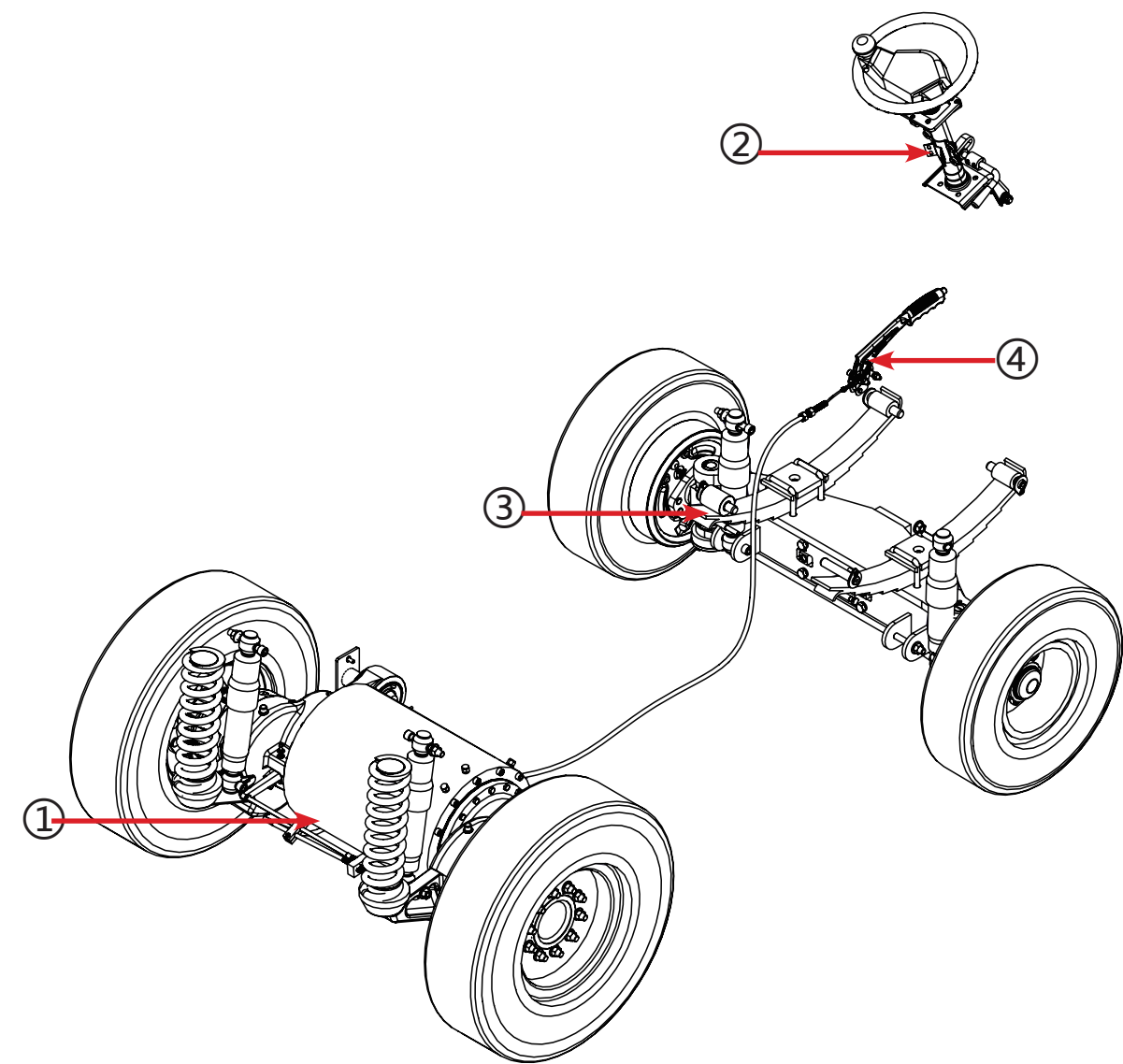
4.1.2 Overview 2 of the Entire Truck



1. Steering wheel	3. Service brake
2. Seat	4. Accelerator pedal



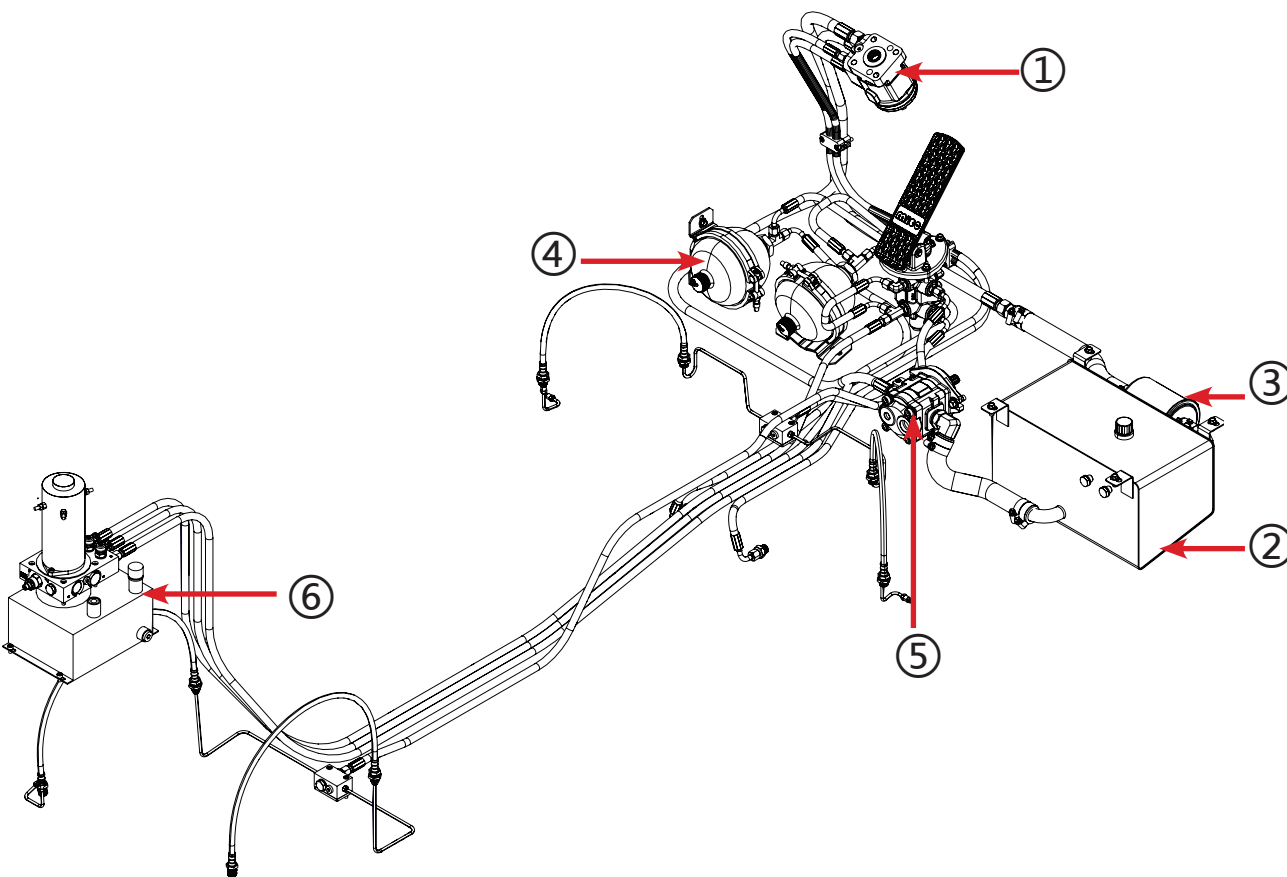
4.1.3 Chassis



1. Steering axle assy	3. Parking assy
2. Steering system	4. Driving axle assy



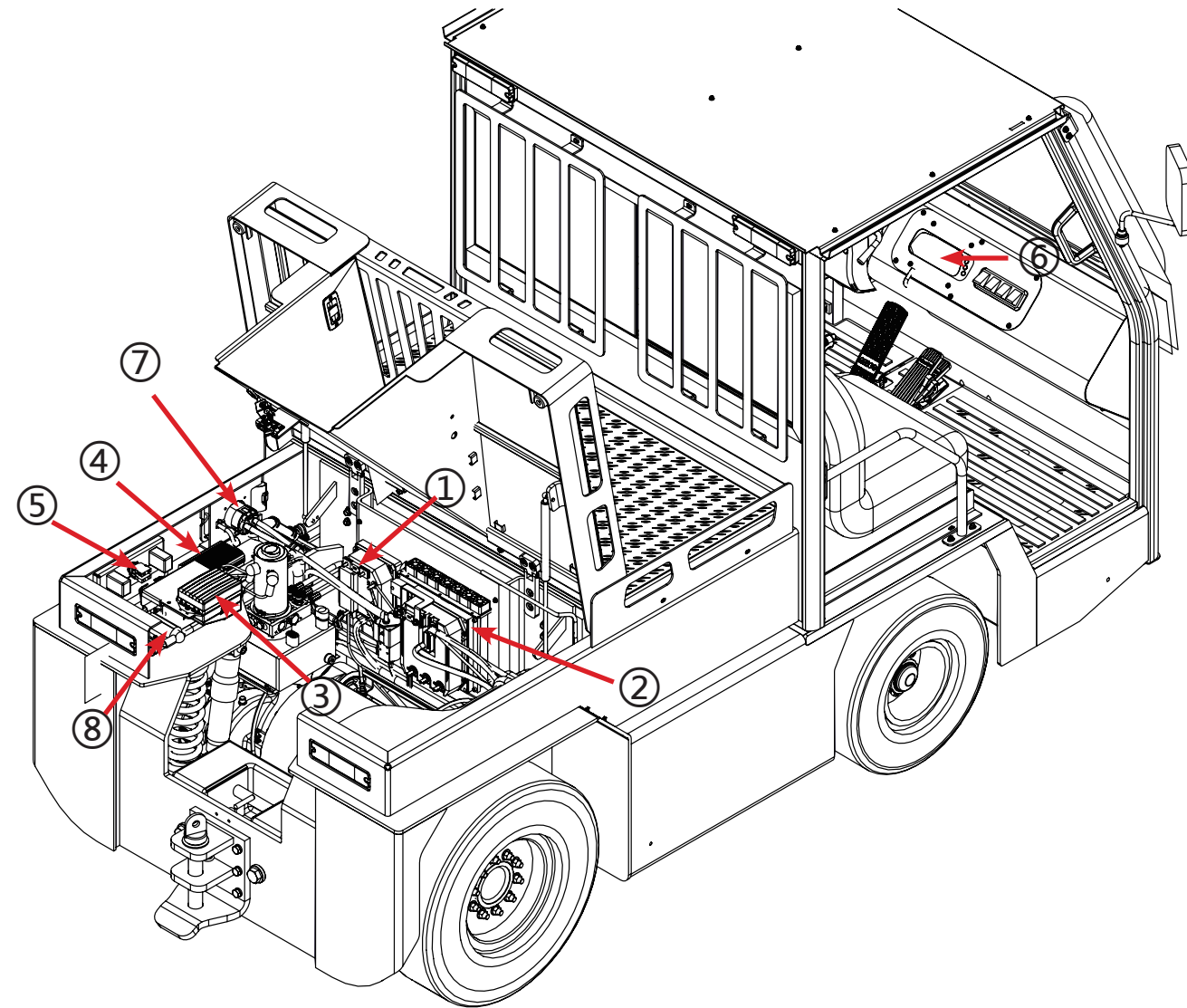
4.1.4 Hydraulic Units



1. Steering gear	4. Energy accumulator
2. Oil tank	5. Steering pump
3. Filter	6. Power unit



4.1.5 Electrical Parts



1. Steering controller	5. EPO switch
2. Drive controller	6. Display
3. Low voltage distribution box	7. Charging base
4. DC/DC converter	8. Voltage divider



4.2 Maintain Accessory System

 Warning

Before operating, place the tractor on a flat ground, pull on the parking brake and turn off the battery.

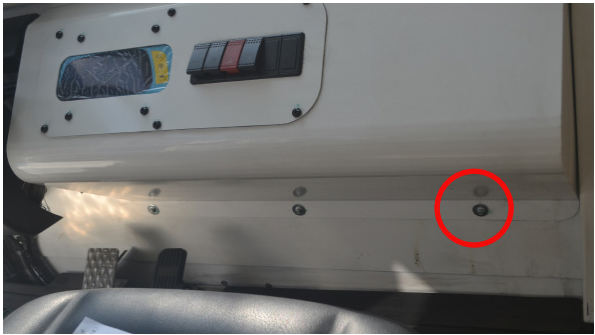
 Warning

For the torque not mentioned in the installation steps, please refer to section 9.1 Table of the Torque Value.

4.2.1 Right Cover of the Display Desk

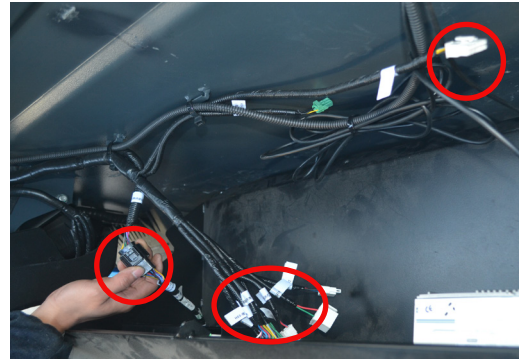
4.2.1.1 Removal

1) Open the driving cab. Use the 8mm socket or open-end wrench to unscrew the three fixed screws on the display desk.





2) Pull up the display desk and then unplug the wire connector G73 and ceiling combination switches H04/H03/H07/H08/S01/S02/H09/H05/G245.



3) The following parts are available for maintenance:

- Display
- Ceiling combination switches

4.2.1.2 Installation

The installation process is the reverse of the removal process.



4.2.2 Handbrake Cover Assembly

4.2.2.1 Removal

1) Use the 8mm socket or open-end wrench to unscrew the two fixing screws on the handbrake cover assembly.



2) The following parts are available for maintenance:

- EPO switch
- Handbrake switch (parking brake)



4.2.2.2 Installation

The installation process is the reverse of the removal process.



4.2.3 Horn Cover of the Steering Wheel

4.2.3.1 Removal

1) Manually open the horn button at the center of the steering wheel, and then you can remove the horn cover of the steering wheel.



2) Remove the horn cover of the steering wheel first and then you can remove the following parts:

- Steering wheel
- Combination switch
- Steering column

4.2.3.2 Installation

The installation process is the reverse of the removal process.

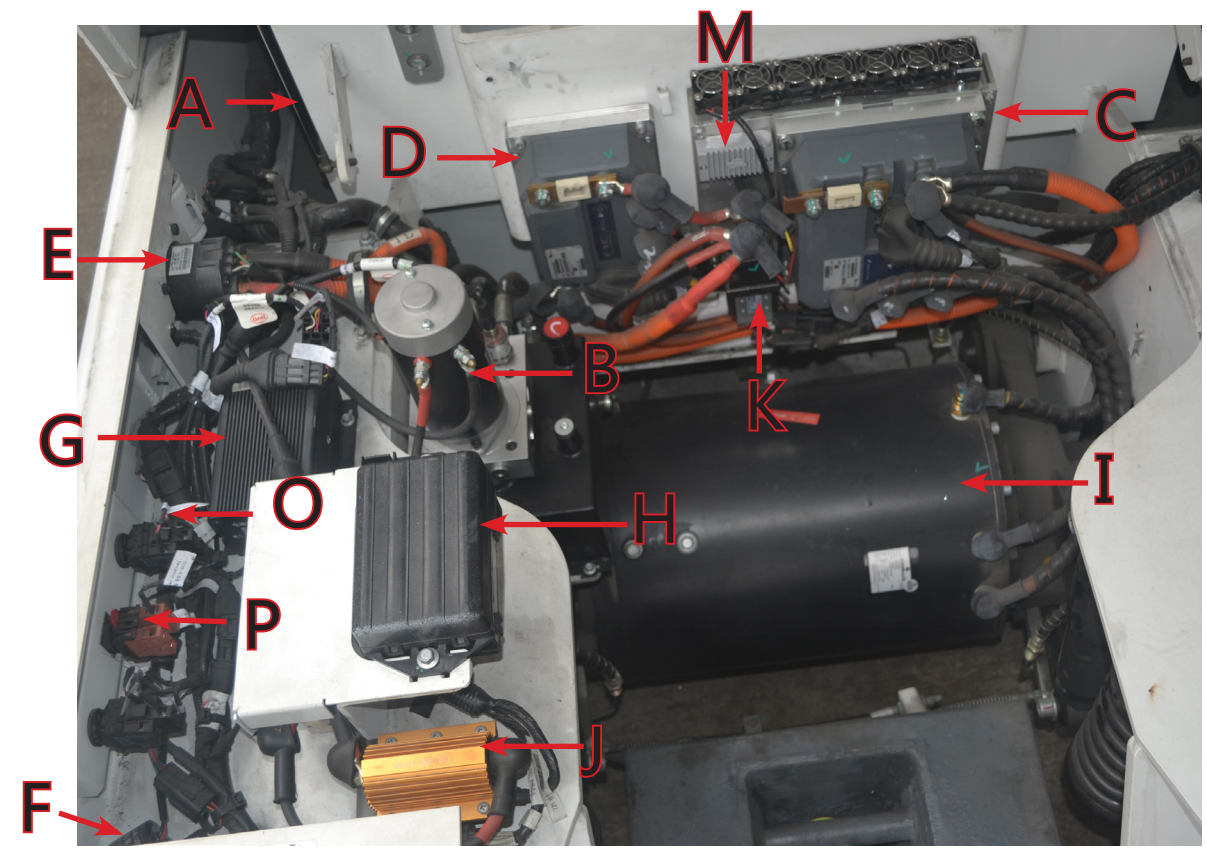


4.2.4 Rear Cover Plate Assembly

1. Pull the button on the rear cover plate assembly.



2. Open the rear cover plate assembly.





3. The following parts are available for maintenance:

- Rear cover plate lock cable and cover plate lock
- A. Gas spring
- B. Power unit
- C. Drive controller
- D. Steering controller
- E. Charging base
- F. Reversing buzzer
- G. DC/DC converter
- H. Low voltage distribution box
- I. Drive motor
- J. Voltage divider
- K. Main contactor
- M. Precharge resistor
- O. Inching Button
- P. EPO switch



4.2.5 Front Cover Plate Assembly

4.2.5.1 Removal

1) Use the 8mm socket or open-end wrench to unscrew the fixing bolts on both sides of the front cover plate assembly.



2) Lift up the front cover plate assembly with hands.



3) The following parts are available for maintenance:

- A. Battery box
- B. High voltage wire with positive and negative poles
- C. Interface G80 for low voltage wire
- D. Battery box connector base

4.2.5.2 Installation

The installation process is the reverse of the removal process.

4.2.6 Seat

4.2.6.1 Removal

1) Remove the handbrake cover assembly. Refer to 4.2.2 for details.

2) Remove the handbrake assembly. Refer to 4.5.2 for details.

3) Use a 10mm socket or open-end wrench to remove the seat cover plate assembly.



4) Lift the seat cover plate up, leave some operating space and pull down left and right connectors Z81 and Z80 as well as seat switch G40.

5) Use a 13mm socket or open-end wrench to remove the four fixed bolts.





6) Take the seat off the seat cover.
The following parts are available for maintenance:

- Seat connectors
- OPS

4.2.6.2 Installation

The installation process is the reverse of the removal process.



When installing a new seat, do not press into the seat wire or connectors.

Since the seat cover plate is heavy, lift it up with other people.



4.2.7 Foot Pedal Assembly

4.2.7.1 Removal

1) Foot pedal assembly is located below the driving cab. Stick your finger into the pedal hole.

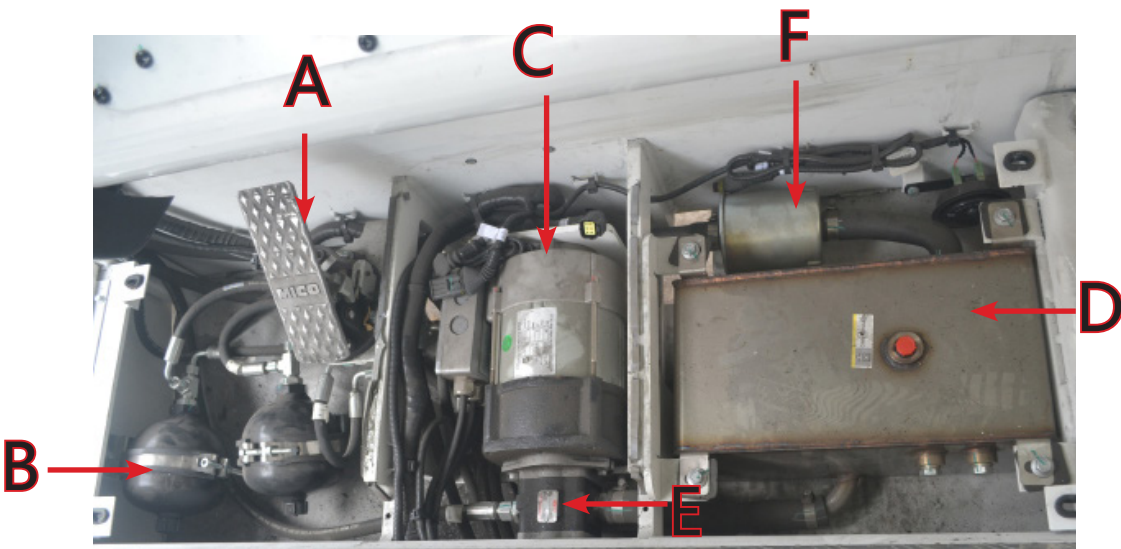


2) Unplug accelerator pedal wire connector G42 and remove the foot pedal assembly.



3) The following parts can be available for maintenance:

- A. Service brake assembly
- B. Energy accumulator
- C. Steering motor
- D. Steering oil tank
- E. Steering oil pump
- F. Filter



4.2.8.2. Installation

The installation process is the reverse of the removal process.



4.3 Steering Control Systems

Warning



For the torque not mentioned in the installation steps, please refer to Table of the torque value.

4.3.1 Wheels

4.3.1.1 Overview of the Wheels

Front wheel:

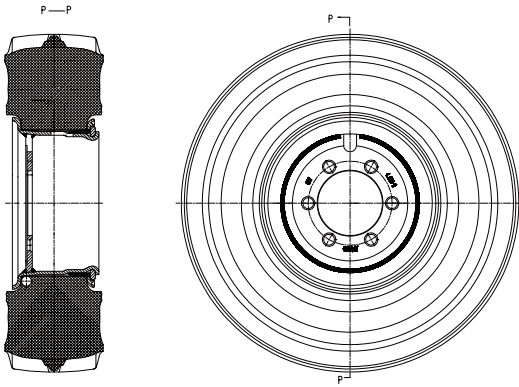
Tire specification: 6.00-9

Rim specification: 4.00E-9

Rear wheel

Tire specification: 27×10-12

Rim specification: 8.00G-12



4.3.1.2 Check Wheels and Wheels Assemblies

Warning



Check wheels and tires before maintenance.

4.3.1.3 Check the Degree of Wear

1) Check whether the degree of wear is within the safety line Δ . Observe the degree of wear of wheel tread and the thickness of each unit on the top of the tread groove. It is time to replace the new tire when the wear limit is reached.



2) Observe the degree of aging of the tire. Aging tires will cause a lot of cracks outside the tires. The side tire is damaged seriously.

4.3.1.4 Standard for Replacing Wheels

Please change the tire timely once any of the following conditions is met:

- When the tread pattern is worn to the limit, please refer to “check the degree of wear”
- When the service life of the tire reaches the maximum prescribed number of years, the tire should be replaced even if it is not worn to the limit
- Replace tires when its tread or side is damaged seriously



4.3.1.5 Preparing Tools

- Torque wrench
- 22mm Socket
- 10mm Open-end wrench
- 21mm Socket
- Straight screwdriver



4.3.1.6 Removing and Installing Wheels



 **Warning**

Clean, check and repack bearings when removing wheels.



When removing the bearing of the wheel, affix a new bearing seal.

1) Park the tractor on a flat ground and tighten the parking brake. Turn off the tractor and remove the key. Press the EPO switch and put the triangular wood under the steered wheel.



2) Use a 21mm socket wrench and a lengthening bar to loosen the wheel nuts and remove them.



3) Use a jack and a Truck with same or even larger load capacity to jackup the wheel or fork the front of the tractor, and then place a cushion block on the left and right sides to jack up and fork the front end of the tractor bottom and to take the front wheels off the ground.

4) Remove wheels.



5) Installation

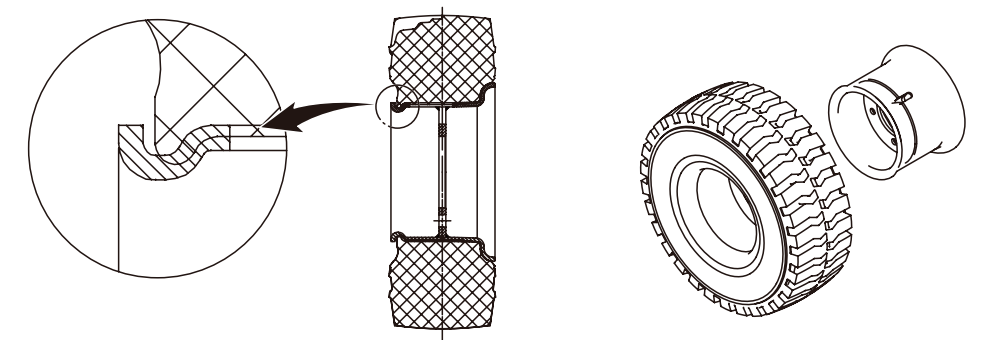
- Screw the nuts with thread glue.
- Move the wheels to the mounting position and screw on the nut.
- Take off the mat and put down the jack or the tractor to land the front wheels.
- Screw on nuts with the torque 180N·m.
- Refer to Removal for specific installation diagrams.

4.3.2 Replace Tires

Warning



Wheels of the tractor are solid tires wherein tires will be damaged once the rim is pulled out. Therefore, these tires can only be removed or replaced by a machine.



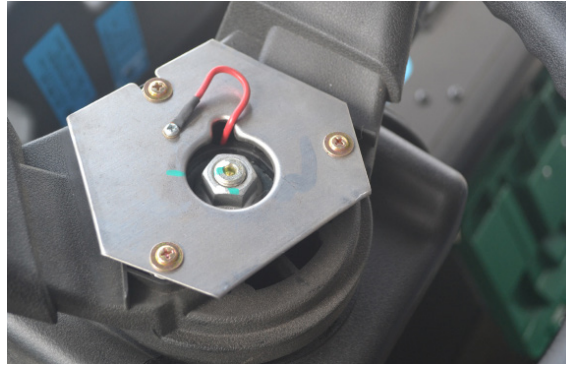
Warning

Since tire should be replaced with professional equipment, it is recommended to replace the tire assembly.

4.3.3 Steering Wheel

4.3.3.1 Removal

1) Manually open the horn button at the center of the steering wheel (horn cover of steering wheel). Refer to 4.2.3 Horn Cover of the Steering Wheel for details.



2) Use the 18mm socket wrench to remove fixing bolts.



3) Remove nuts and the flat washer.

4) Remove the steering wheel.

4.3.3.2 Installation

- Grease the underside of the steering wheel, and install the steering wheel. Place the flat washer and tighten the nut with the torque 25N·m. Refer to the removal of the steering wheel for specific diagrams.
- Buckle the horn button (horn cover of the steering wheel). Refer to 4.2.3 Horn Cover of the Steering Wheel for specific diagrams.
- Apply conductive paste evenly to the conductive plate.



4.3.4 Combination Switch

4.3.4.1 Removal

1) Remove the steering wheel. Refer to 4.3.3 Steering Wheel for details.

2) Remove the four fixing screws with a screwdriver.



3) Remove the fixing screw at the front end of the switch cover and unplug the wire connector G32 of ignition switch. Remove the front end of the switch cover.

4) Use a socket wrench (8mm) to remove four fixed screws.

5) Remove the rear side of the switch cover.

6) Unplug the wire connector G44 of the horn switch, G02 of the combination switch light.

7) Unplug the connector (wire and gear control) G01.

8) Remove fixing screws of the combination switch with a screwdriver.



9) Remove the combination switch.



4.3.4.2 Installation

- Tighten the four fixing screws of the combination switch with a screwdriver (refer to the torque table for torque), and install the combination switch.
- The installation process is the reverse of the removal process.

4.3.5 Steering Column

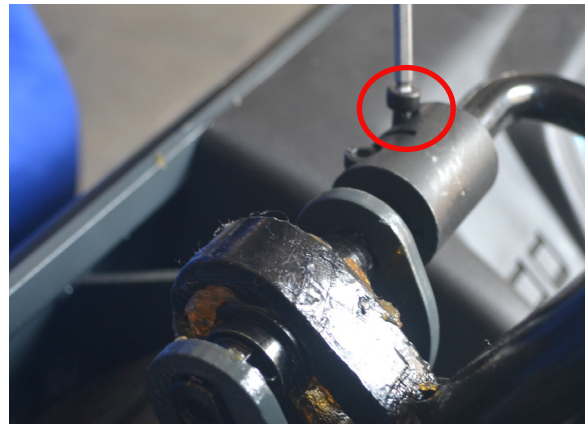
4.3.5.1 Preparing Tools

- 4mm Allen wrench
- 18mm Extended socket wrench
- 19mm Open-end and ratchet wrenches
- 8mm Socket wrench
- Cross screwdriver
- Ratchet

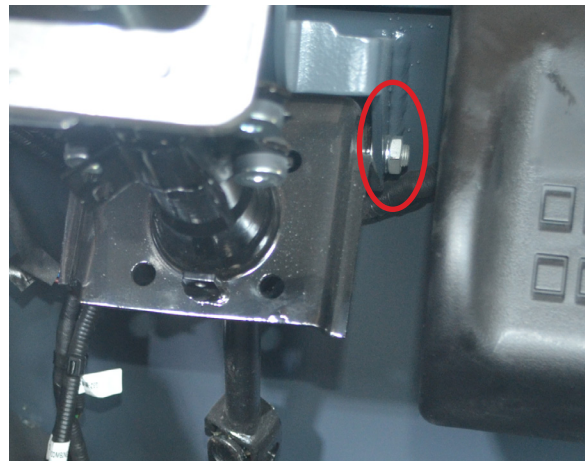
4.3.5.2 Removal

1) Remove the combination switch. Refer to 4.3.4 Combination switch for details.

2) Remove the steering connection handle with an Allen wrench and then remove the upper connection of the steering column.



3) Remove the two fixed nuts at the connection between the steering column and the cross universal shaft steering column with a wrench (18mm).



4.3.5.3 Installation

1) Install the lower connection of the steering column wherein step bushing, light spring washer and plain round head bolt are installed on both sides. Tighten the thin hexagon nut with a wrench (18mm).

2) Install the upper connection of the steering column and tighten the steering connection handle with the hexagon socket wrench.

4.3.5.4 Check After Completion

Start the ignition switch of the tractor and then check the following items:

- Press the horn and check whether it works well
- Check whether the combination switch light works properly
- Check whether the gear control switch works normally



4.3.6 Display

4.3.6.1 Removal

1) Remove the cover of the display desk. Refer to 4.2.1 Right Cover of the Display Desk for details.

2) Remove fixed screws on the display desk panel with the screwdriver. Remove the display desk panel and unplug the connector G73 on the display.



3) Use the 7mm socket or open-end wrench to loosen the four bolts on the two fixed supports of the display. Then remove the display.



4.3.6.2 Installation

The installation process is the reverse of the removal process.



4.3.7 Overview of Steering Axle System

Steering axle includes brake assembly, steering cylinder, steering knuckle and connecting rod of steering cylinder, all of which can be removed for maintenance and replacement.

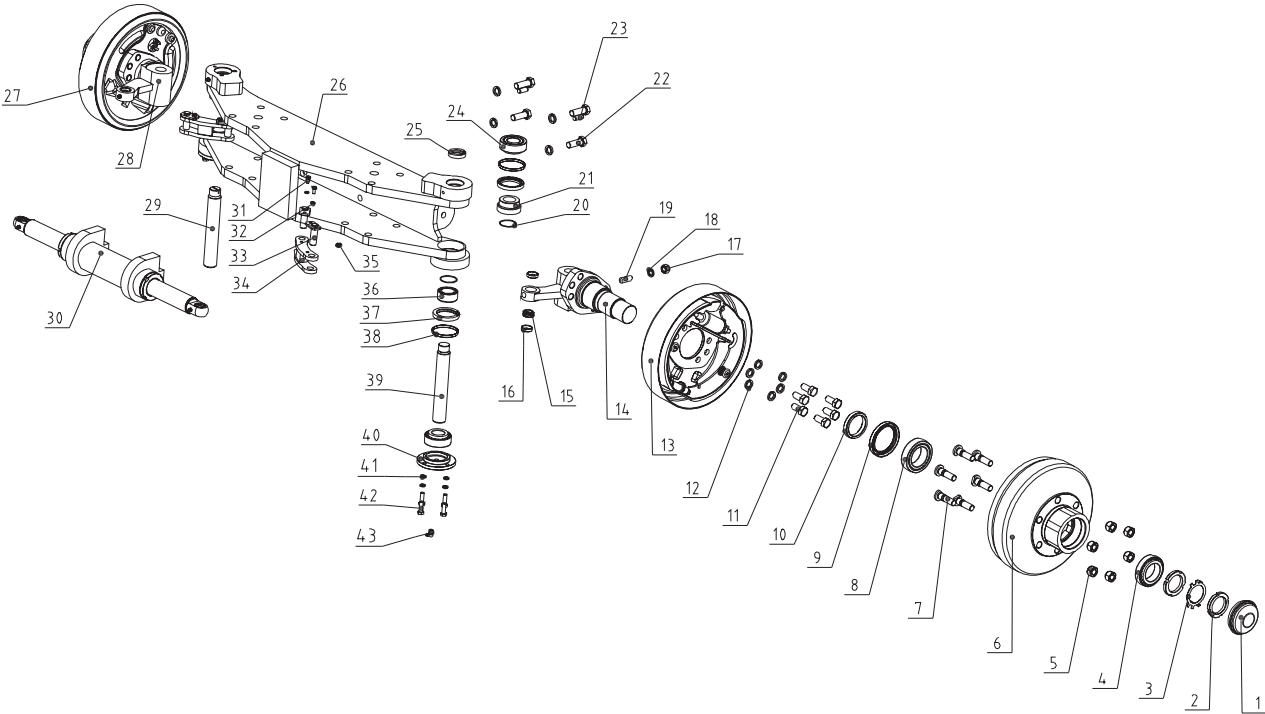
The diverter located at the bottom of the steering column transfers hydraulic oil to one end of the steering cylinder so as to turn the steered wheel.

Use bolt to install the steering axle on the tractor body. While the steering cylinder is connected with steering knuckle by connection rod.

All bearings mounted on the steering axle connection contain grease nozzles.



4.3.7.1 Overview of Steering Axle



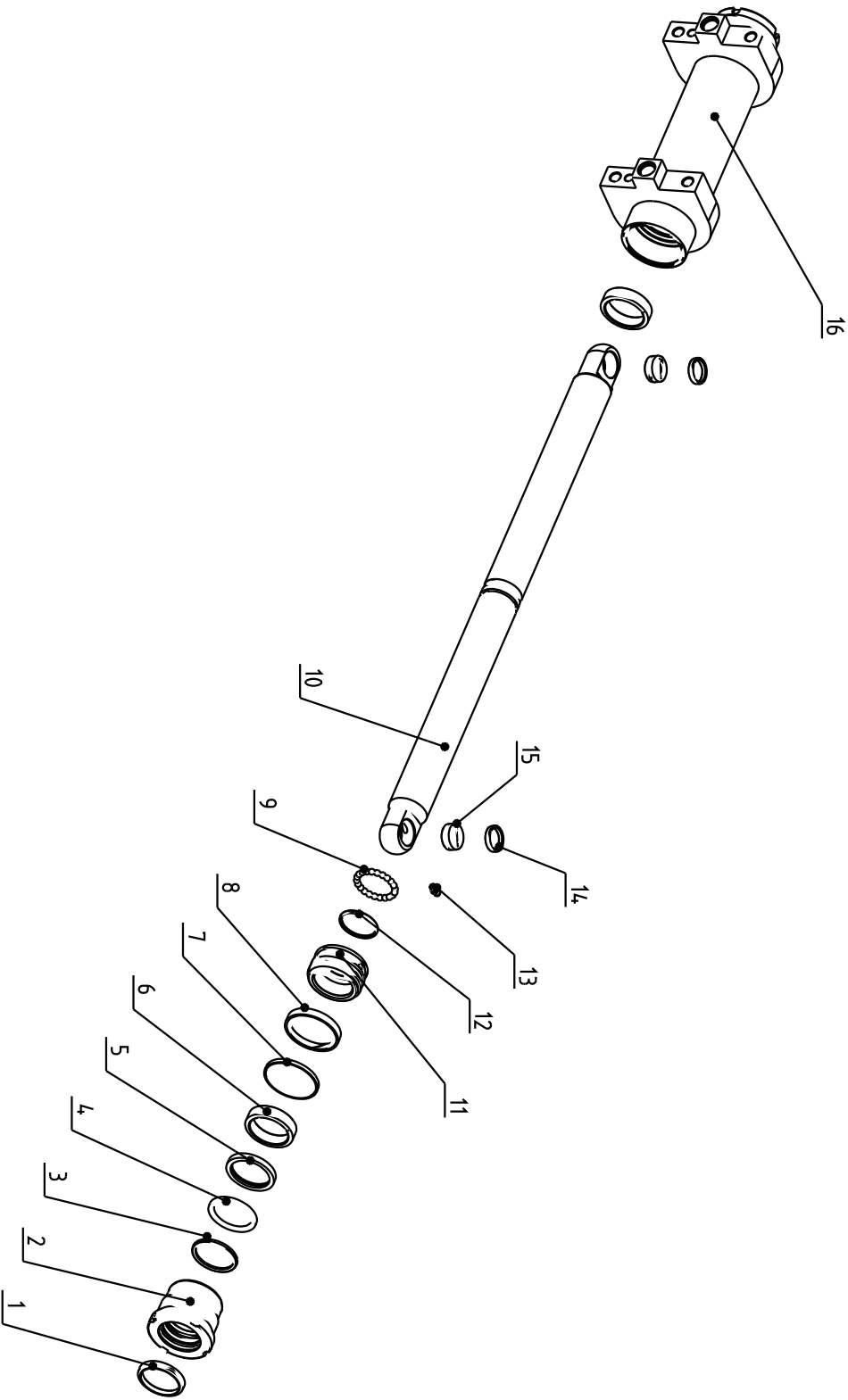
NO.	NAME
1	Hub cover
2	Round nut
3	Stop washers for round nuts
4	Tapered roller bearings
5	Hub nut
6	Steering hub brake drum assembly
7	Hub bolt
8	Tapered roller bearings
9	Lip seal ring of rotating shaft
10	Oil seal retaining ring
11	Hexagon head bolts with fine thread
12	Standard spring washer
13	Brake assembly (RH)
14	Steering knuckle (RH)
15	Knuckle bearing
16	Retaining ring
17	Type 1 hexagon nut
18	Standard spring washer
19	Hexagon socket cone-point set screw
20	O-ring
21	Dust-proof ring base 1
22	Hexagon bolts with full thread
23	Straight pin
24	Tapered roller bearings
25	Skeleton dust-proof ring
26	Steering axle body (ZQB5B-10000)
27	Brake assembly (LH)
28	Steering knuckle (LH)



NO.	NAME
29	Main pin (LH)
30	Steering cylinder
31	Hexagon bolts with full thread
32	Spring washer
33	Link rod pin
34	Link rod
35	Straight through oil injection cup
36	Dust-proof ring base 2
37	Lip seal ring of rotating shaft
38	Oil seal retaining ring 1
39	Main pin (RH)
40	Bearing pressing plate
41	Spring washer
42	Hexagon bolt
43	Curved neck grease nipple



4.3.7.2 Overview of Steering Cylinder





NO.	NAME
1	T839N dust-proof ring
2	Cylinder sleeve
3	O-ring
4	Closing ring
5	T605 seal ring for piston rod
6	Spacer bush
7	SPG seal ring for piston
8	Support ring
9	Steel ball
10	piston rod
11	Piston
12	O-ring
13	Straight forced filling oil cup
14	Closing ring
15	Knuckle bearing
16	Cylinder barrel assembly



4.3.7.3 Preparing Tools

- Torque wrench
- 12mm Allen wrench
- 10mm Open-end wrench
- 21mm Socket
- Straight screwdriver
- Copper rod
- 17mm Open-end wrench
- 6mm Allen wrench
- 5mm Allen wrench
- 18mm Open-end wrench
- Grease gun
- 17mm Open-end wrench
- 16mm Open-end wrench + Ratchet

4.3.7.4 Steering Axle Hub Bearing

1) Removal

- Remove wheels. Refer to 4.3.1.6 Removing and Installing Wheels for details.
- Use a screwdriver to pry off the dust-proof cover.



- Remove the round nuts and stop washer.



- Remove the brake drum assembly.



- Remove the old grease from the center of the wheel hubs.
- Place the outer side of the wheel hub upwards (hold it with a wooden block), and then remove the inner ring and oil seal of the inner bearing.
- Clean and check the wear of the inner ring and outer ring of the bearing. Replace them as a set when they need to be replaced.
- Check the wear of the oil seal. The removed oil seal must be replaced with a new one.

2) Reinstallation of Wheel Hub Bearing

- Press the outer ring of the new bearing into the hub and ensure that the outer ring is installed correctly. Cover the bearing with grease and install the inner ring. Apply grease to half of the cavity between the bearing and the oil seal. Apply a loop of grease to the inner lip of the oil seal first, and then install the oil seal onto the hub.
- Install the wheel hub onto the steering knuckle. Do not damage the lip of the oil seal when the shaft and thread of the steering knuckle pass through the hub during installation. Apply grease to half of the cavity in the hub bearing. Grease the outer wheel bearings, and install them. Then install the washers.

- Install the round nut and tighten it. Then loosen 1/8~1/6 turn. Turn the hub manually and then check whether the bearing has been adjusted again. Ensure that the wheel hub can rotate freely. If necessary, adjust the bearing through the round nut to avoid seizure of the bearing.
- Install the stop washer and then the round nut. Tighten them and then install the dust-proof cover.

NOTE

- When assembling the dust ring, grease the lips evenly.
- When assembling, the hub bearing is filled with grease (NO.3), the filling amount is 1/3 ~ 1/2 of the bearing gap.
- When assembling the round nut, first tighten it with a torque of 210 ~ 250N.m, and then loosen 1/8 ~ 1/6 turn. Install the stop washer.
- The starting force of the wheel hub is controlled between 30 ~ 60N.
- The starting force of the hub is the force at which the hub starts to rotate. Usually the spring scale is hung on the hub bolt to see the reading when the hub is rotating.

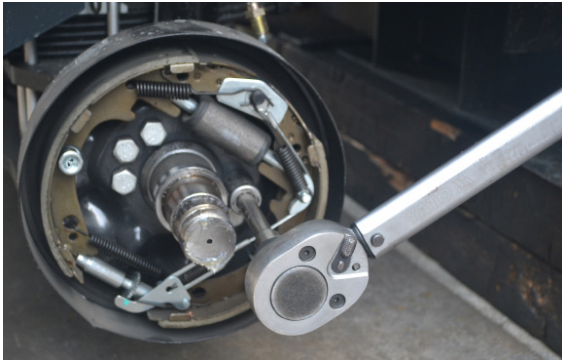


4.3.7.5 Brake Assembly

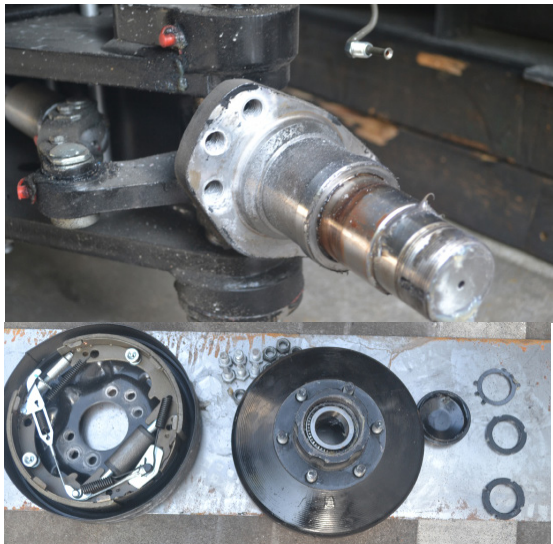
1) Remove wheels. Refer to 4.3.1.6 Removing and Installing Wheels for details. Remove the steering axle hub bearing. Refer to 4.3.7.4 Steering Axle Hub Bearing for details.

2) Use the 10mm open-end wrench to remove brake tube joint.

3) Use the 21mm socket to remove the hexagon bolt for fixing the brake assembly.



4) Remove the brake assembly.



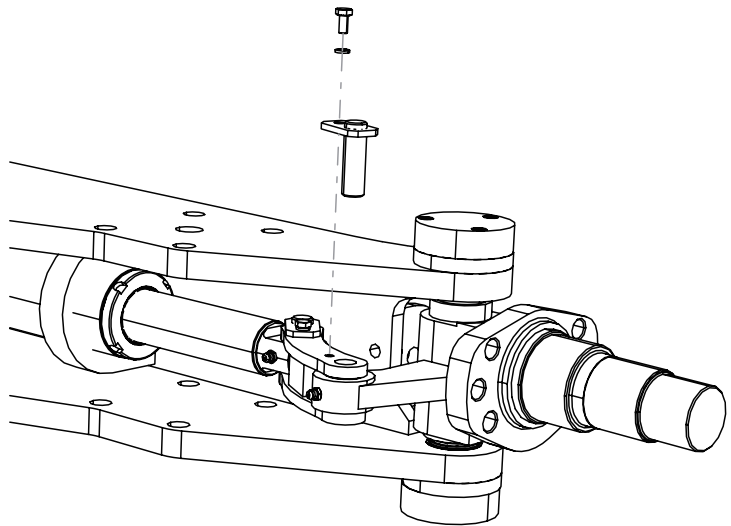
5) Install the brake assembly. The installation process is the reverse of the removal process.



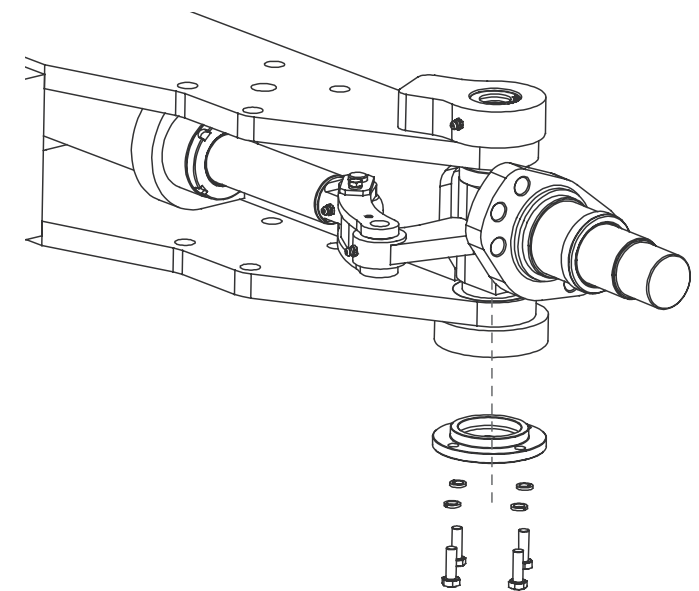
4.3.7.6 Steering Knuckle

1) Remove wheels. Refer to 4.3.1.6 Removing and Installing Wheels for details. Remove the steering axle hub bearing. Refer to 4.3.7.4 Steering Axle Hub Bearing for details. Remove the brake assembly. Refer to 4.3.7.5 Brake Assembly for details.

2) Disconnect the connecting rod and steering knuckle. Remove the fixing bolt (31) with the 10mm open-end wrench and take down the connecting rod pin (33).

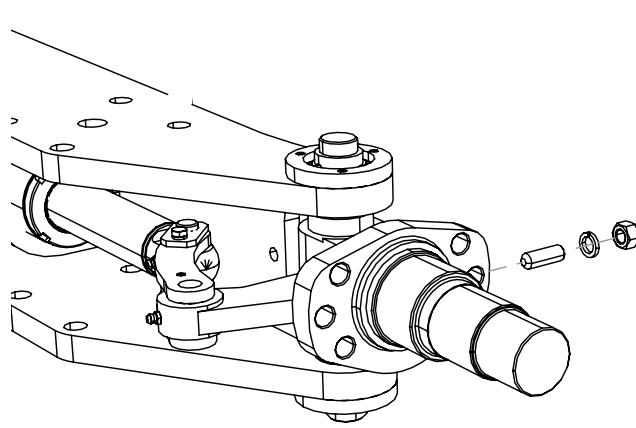


3) Remove the hexagon socket cap screw (42) with 5mm Allen wrench and then take down the cover (40) of the main pin base.

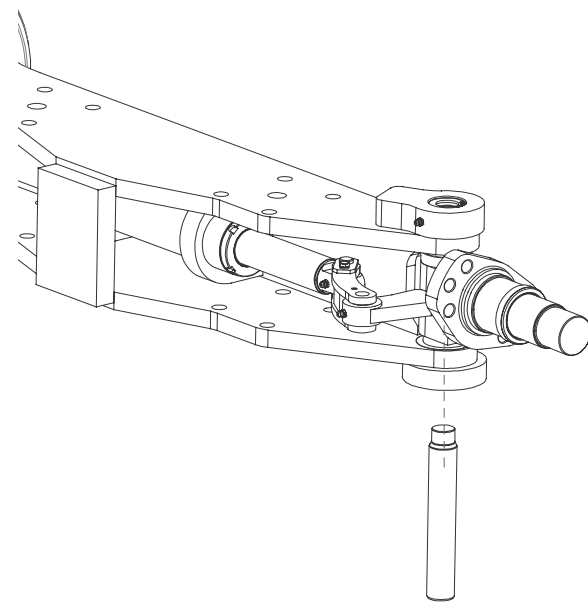




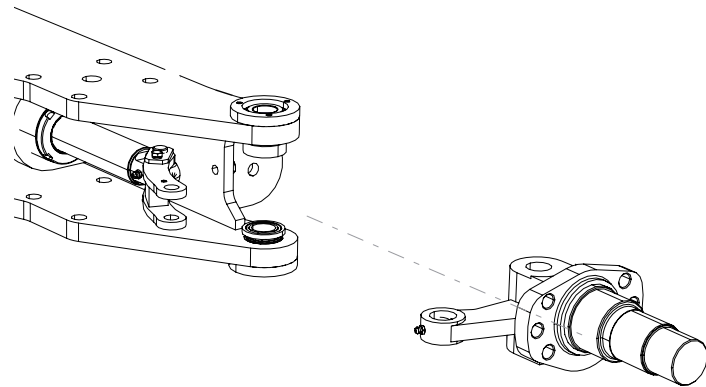
4) Remove the hexagon socket cap screw (19) with 6mm Allen wrench. Remove type-1 hexagon nut (17) of the fixing main pin with 18mm socket wrench.



5) Remove the main pin (39) for connecting the hub and the brake drum.



6) Remove the steering knuckle (14).



7) Replace relevant seals and quick-wear parts of Tapered roller bearings.



8) Install the steering knuckle. The installation process is the reverse of the removal process.



4.3.7.7 Steering Axle Frame

 Warning



A wooden block or another object is held up to the left and right lower sides of the axle.



Pull on the parking brake and fix the front wheel.



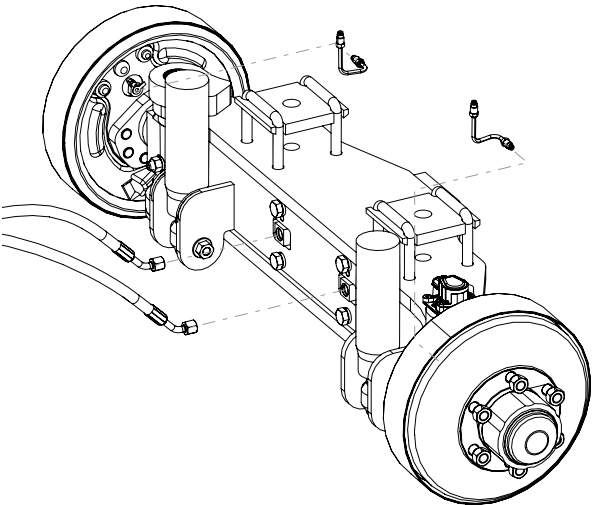
Lift the bottom of the counterweight block until it is 400-500mm (15.75-19.69in) above the ground.

1) Removal

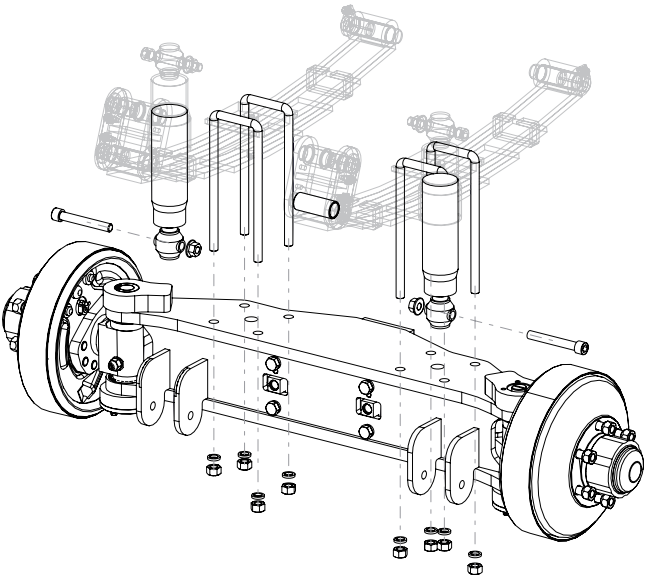
- Check to ensure the tractor in stable condition with parking brake pulled on.
- Jack up the frame and support it with a stand or wooden fixed blocks.
- Remove the steered wheel. Refer to 4.3.1.6 Removing and Installing Wheels for details.



- Use an open-end wrench (17mm) to disconnect the steering oil tube, and unplug the connector G17. Remove the brake tube with 10mm open-end wrench.



- Remove the hexagon socket cap screw (M14) with 12mm Allen wrench. Use 21mm socket or open-end wrench to remove type-1 nut_M14 and then take down the hexagon bolt.



- Remove the steering axle.

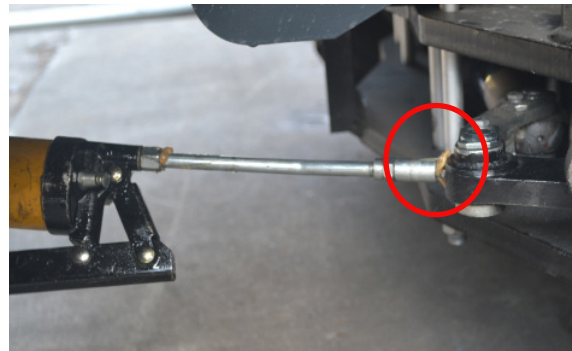
2) Installation

The installation process is the reverse of the removal process.

NOTE

1) When installing the steer axle, check if the lubrication grease is filled.

2) Use a grease gun to add grease to each grease nipple until the grease overflows obviously, and then close the grease nipple cap.



3) On the side where the steering axle is equipped with sensors, inject oil from the lower oil hole until the grease overflows from the upper end of the bearing and the contact surface of the axle body.



4) On the side of the steering axle where the sensor is not installed, inject oil from the upper oil hole until the grease overflows from the upper end of the bearing and the contact surface of the axle body, and inject oil from the lower oil hole until the grease overflows from the oil hole.

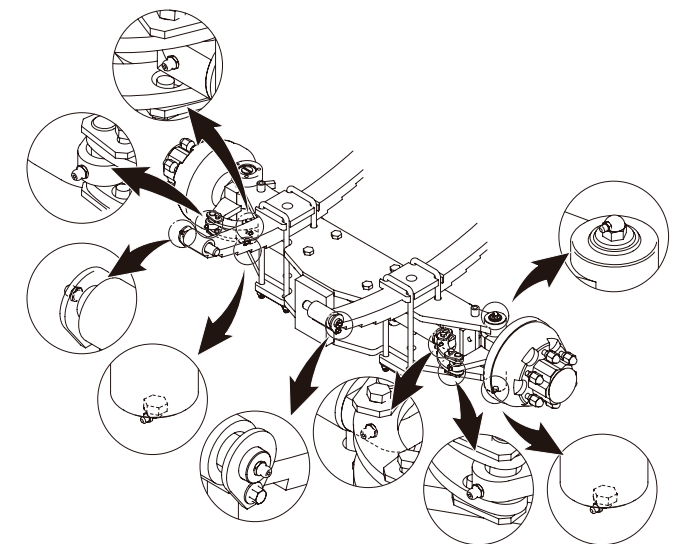
5) If the grease does not overflow from the grease nipple, turn the steering axle to the left and right 45° and then refill the grease.

6) If there is still no obvious overflow, check the oil nipple. Replace it if necessary.

Hints

1) It will prolong the service life of the bearing by lubricating once a week if it works in an environment of heavy dust, dirt and chemicals.

2) It is better to use less grease but frequent lubrication than the method of more grease but less lubrication per time.

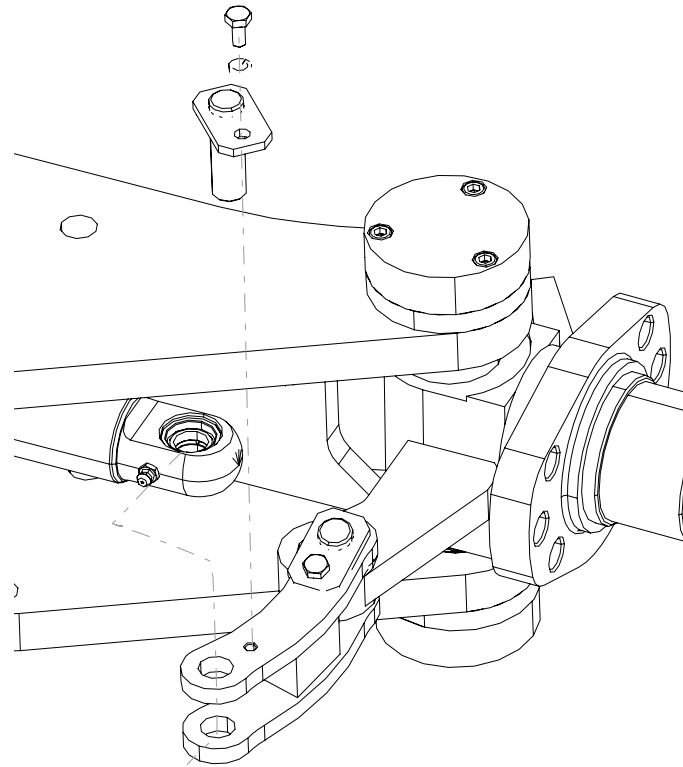




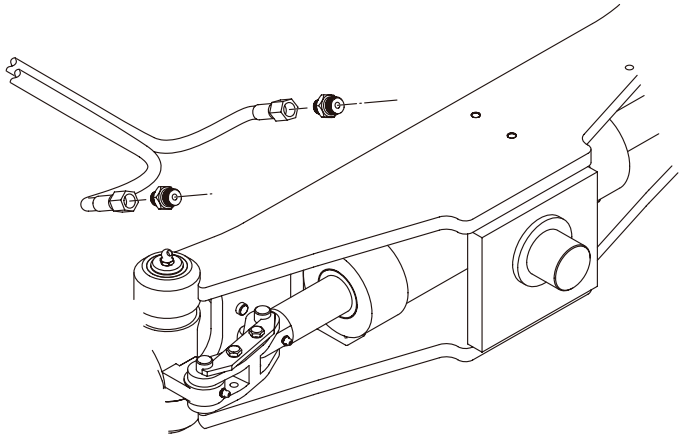
4.3.7.8 Steering Cylinder

1) Removal

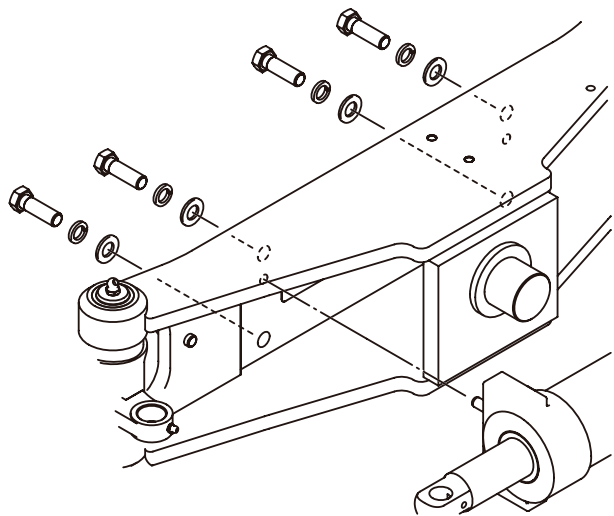
- Check to ensure the truck in a stable condition with parking brake pulled on.
- Disconnect steering knuckle and piston rod. Use the open-end wrench (10mm) to remove the fixing bolt (31), and then remove the connecting rod pin (33).



- Use an open-end wrench (17mm) to disconnect the steering cylinder oil pipe



- Use a socket (18mm) or an open-end wrench to loosen the fastening bolts of the steering cylinder and remove the steering cylinder.



2) Installation

The installation process is the reverse of the removal process.

3) Disassembly



- Refer to 4.3.7.2 for specific diagrams.
- Clamp the steering cylinder with a vise and be careful not to be too tight.
- Remove the cylinder head with the hook-typed wrench. For example, remove the left cylinder head.
- Remove the piston rod and piston as well as the parts on them.
- Remove the cylinder head on the other side.
- Remove all the oil seals, O-rings, support rings and dust rings.

4) Replace seals.

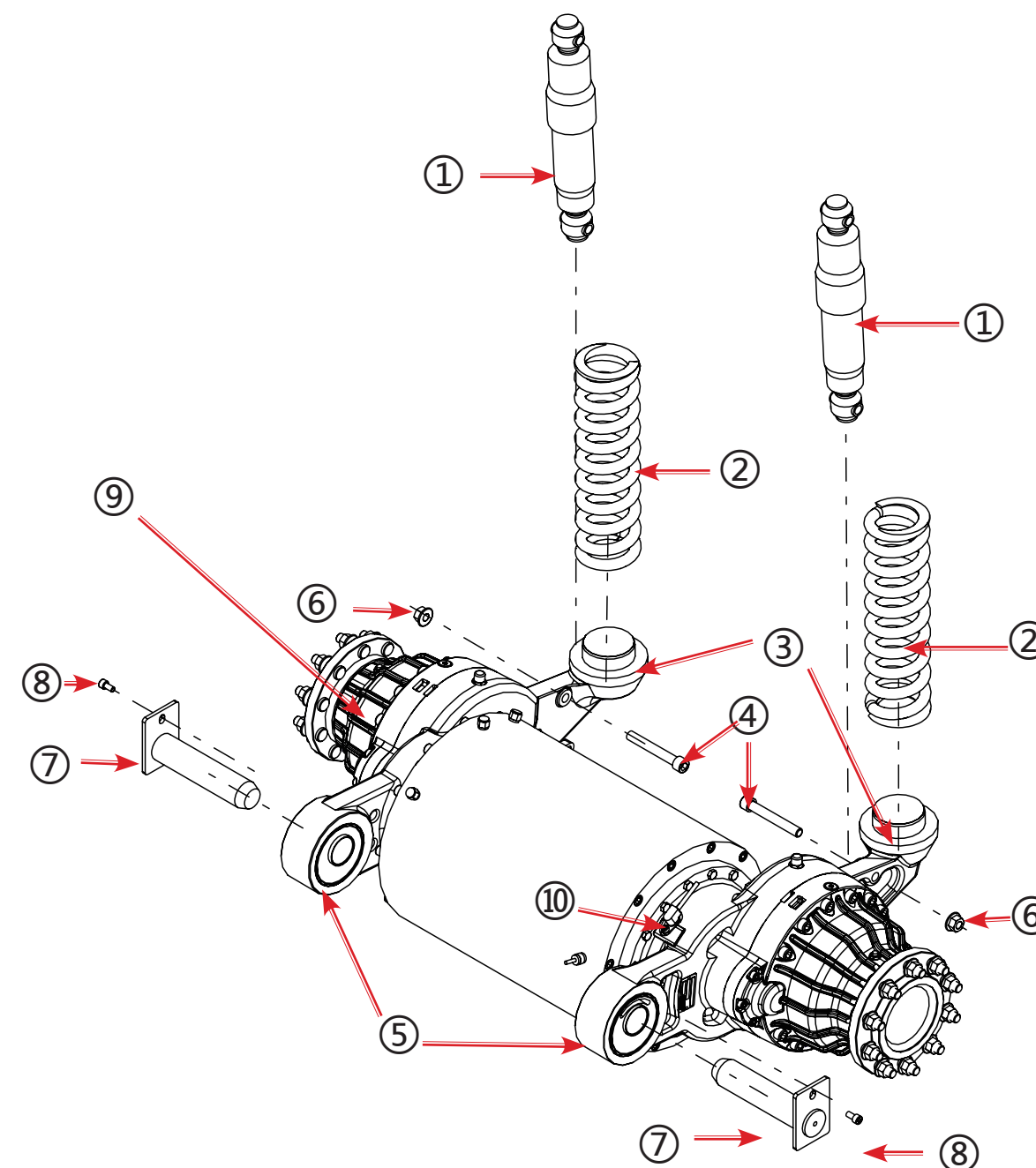
- Install all the oil seals, O-rings, support ring and dust-proof ring in a complete set.
- Lubricate the contact surface of the piston rod, piston and cylinder head with hydraulic oil.
- Install the cylinder head on one side, and then carefully install the piston rod and piston assembly.
- Install the cylinder head on one side carefully.

- Replace the steering cylinder seals in a complete set. Refer to repair kit BOM in the Part Manual.
- The steering cylinder cannot be disassembled at will to avoid oil leakage from the steering cylinder.
- When removing the steering oil pipe, there is oil flowing out.
- The tightening torque of the cylinder fixing bolts is between 180 ~ 205 N.m. Apply the anaerobic thread anti-loosening glue to it.

4.4 Drive Unit

4.4.1 Introduction of the Drive Unit

4.4.1.1 Overview of the Drive Unit

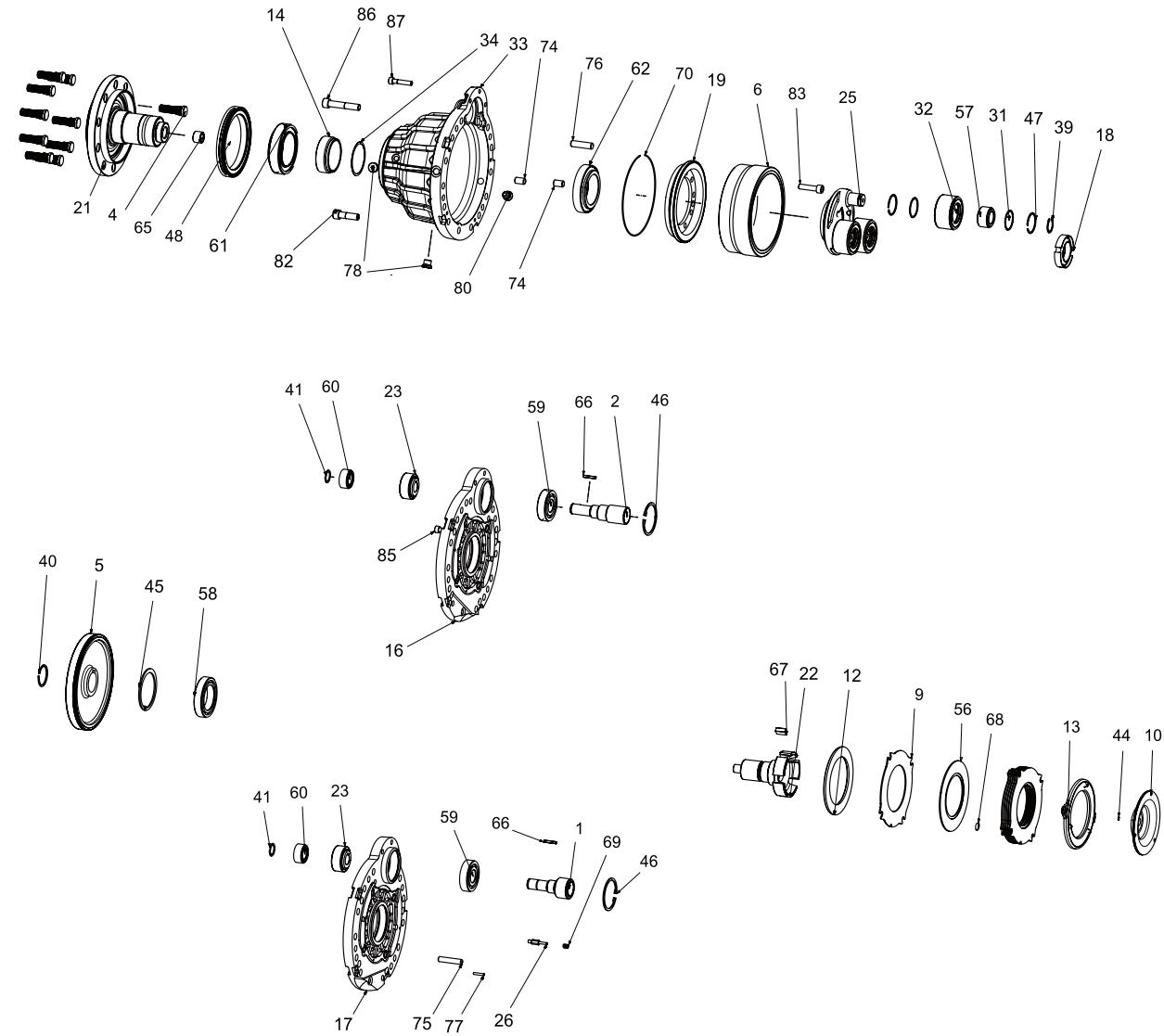




1. Spring damper assembly	6. Hexagon flange nut _M14×1.5
2. Damper spring for drive axle	7. Connecting main pin assembly
3. Fixing arm of the damper	8. Hexagon socket cap screw _M8×16
4. Hexagon socket cap screw M14×100×1.5	9. Drive axle assembly
5. Fixing arm for frame	10. Velocity sensor

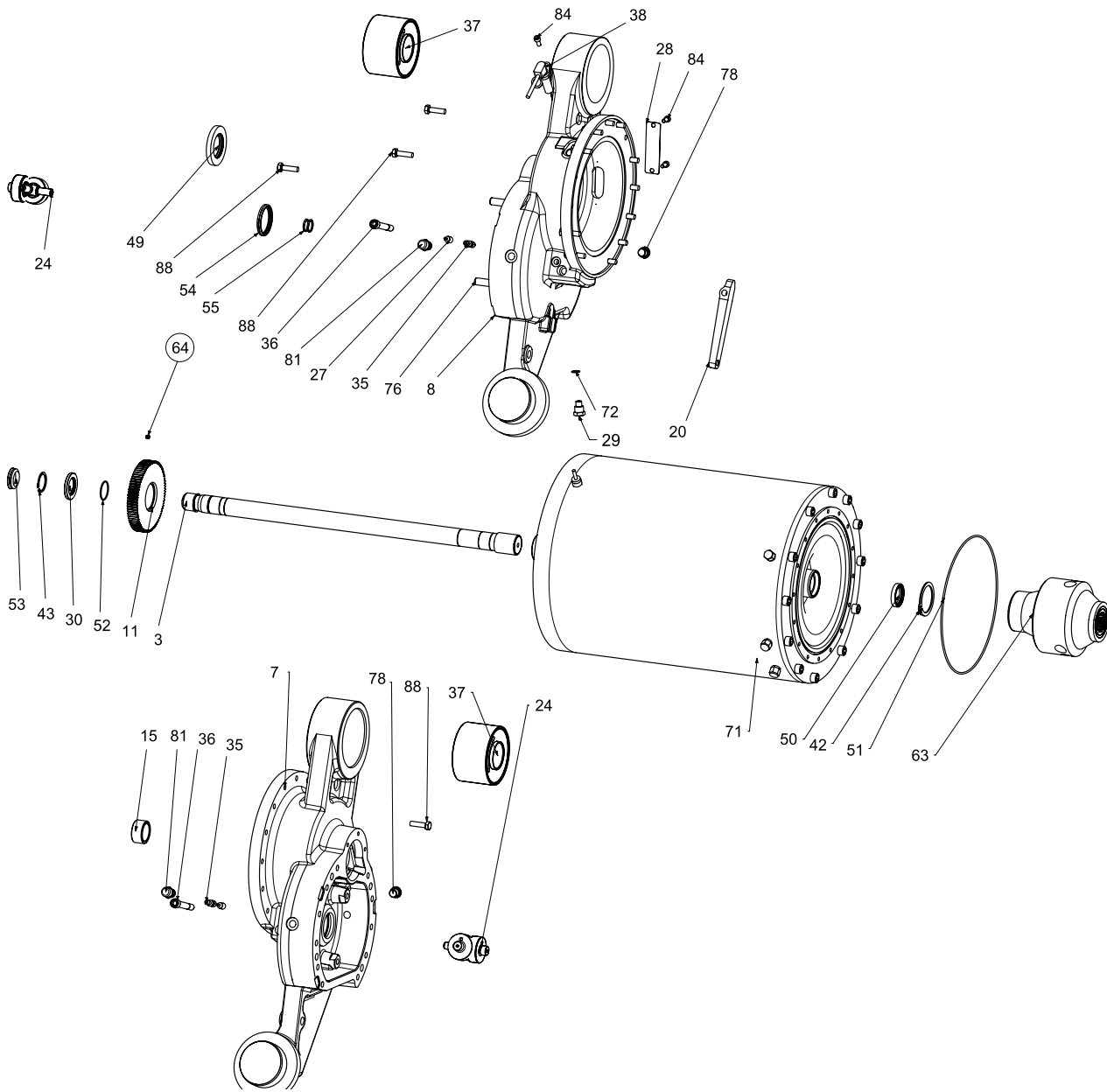


4.4.1.2 Schematic Diagram of Each Part of the Drive Axle Unit





NO.	NAME		QTY	OTHER INFORMATION
1	Input shaft		1	
2	Reverse end of the input shaft		1	
3	Differential shaft		1	
9	Brake steel plate		12	
12	Backing ring		2	
23	Small gear		2	
31	Washer		12	
32	Planetary gear		6	
56	Brake lining		10	
57	Roller bearing		6	
58	Roller bearing		2	
59	Roller bearing		2	
60	Roller bearing		2	
62	Roller bearing 2		2	
68	Brake spring 40		10	
9	Repair kit of the drive axle brake assembly	Brake steel plate	12	
10		Elastic pressing plate	2	
13		Brake disc	2	
44		Pressure spring	4	
56		Brake lining	10	
68		Brake spring	40	
69		Spring	4	





NO.	NAME		QTY	OTHER INFORMATION
15	Backing ring of the differential mechanism		1	
20	Brake rod		2	
24	Brake piston		2	
37	Bushing		2	
42	Snap ring of the differential shaft		1	
48	Repair kit of the drive axle	Seal ring	2	
49		Seal ring	1	
50		Seal ring	1	
51		Seal ring of the differential mechanism	1	
54		Seal ring	2	
55		Seal ring	4	
63	Differential mechanism		1	
71	Motor		1	
81	Exhaust nozzle plug		2	



4.4.2 Check Oil Level of the Drive Unit



Warning

Before operating the drive axle, add appropriate quantity (below 4L) of oil into the drive axle.

- The gear oil level of the drive unit must be added until it overflows. It means when the gear oil overflows from the piston hole, the gear oil in the drive unit is at a proper position.
- It is recommended to use oil type SAE 80W/API GL4/UTTO.

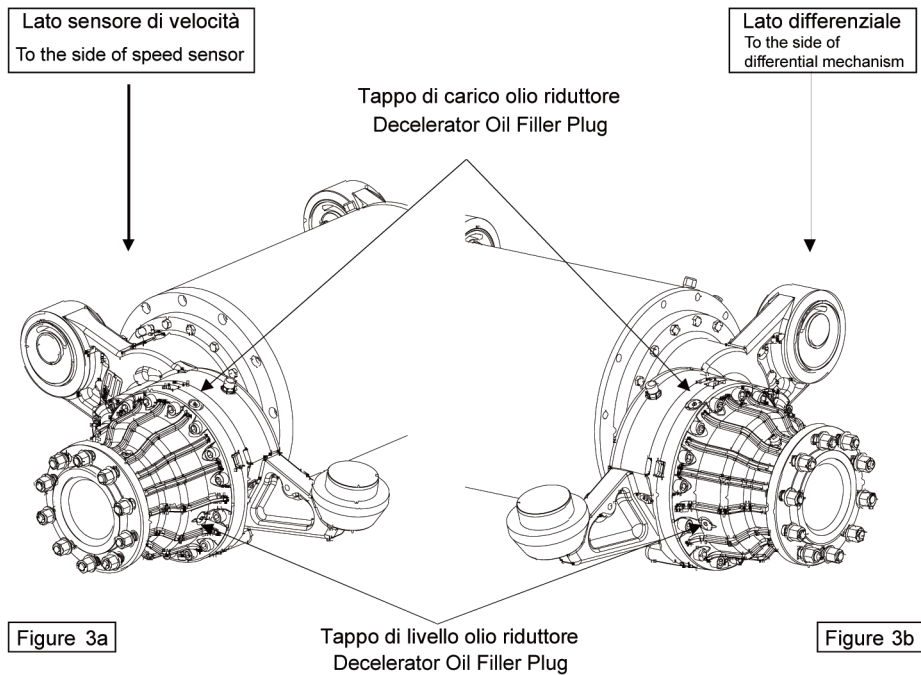
NOTE

Control	Frequency
Check oil level	Decelerator runs every 150 hours
Replace oil for the first time	Decelerator runs every 100 hours
After replacing oil	Every 1000 hours or one year
Tighten screw	After the decelerator runs 50 hours

4.4.3 Adding Gear Oil into the Drive Unit

4.4.3.1 Filling Oil

- Loosen the oil level plug and oil filler plug
(Refer to figures 3a and 3b).



- Tighten the oil drain plug.
- Fill oil into each differential mechanism based on the following table.

To the side of speed sensor	1.6±0.1 Litre
To the side of differential mechanism	2±0.1 Litre

Warning

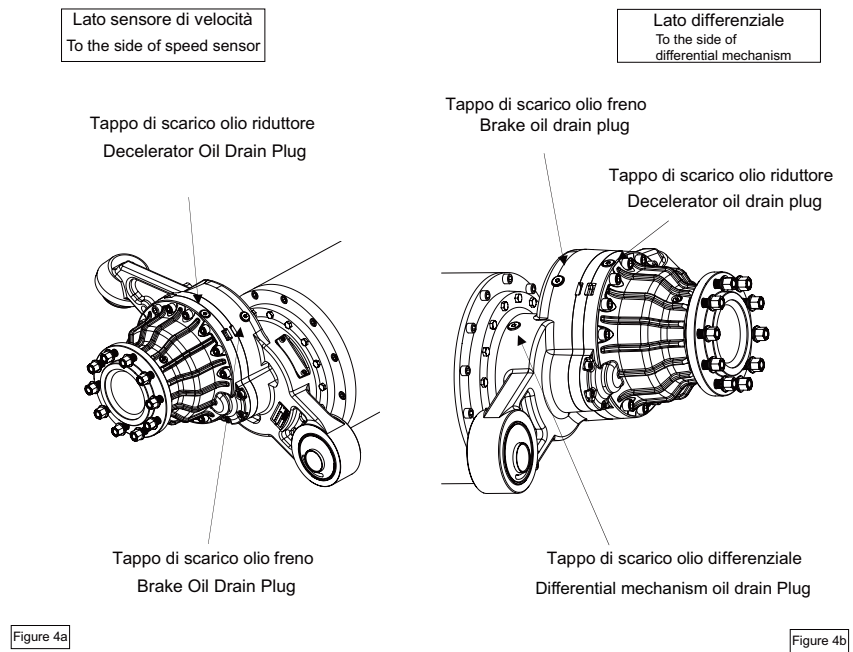


Because of the unique structure of the equipment, fill oil slowly into the brake room. The decelerator runs only when it is injected with the designated flow. Follow regulations on the above oil quantity strictly.

- Tighten the oil filler plug.
- Run the equipment and check the oil level after 50 hours. When the oil is near the oil level plug, it indicates that the oil level is appropriate (the drive axle is positioned on the horizontal position).
- Refill oil if necessary.

4.4.3.2 Oil Drain Hole

- Loosen the oil drain plugs of the decelerator and differential mechanism.
(Refer to figures 4a and 4b)

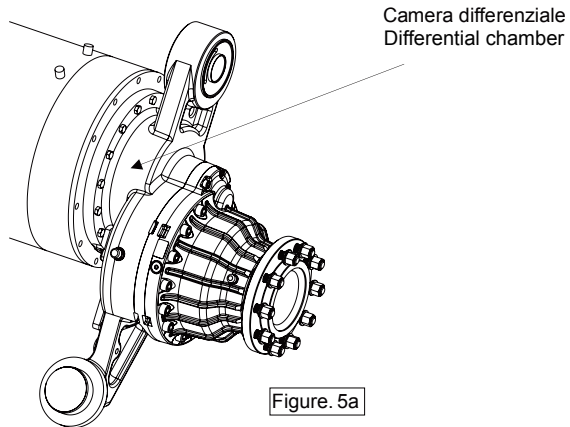




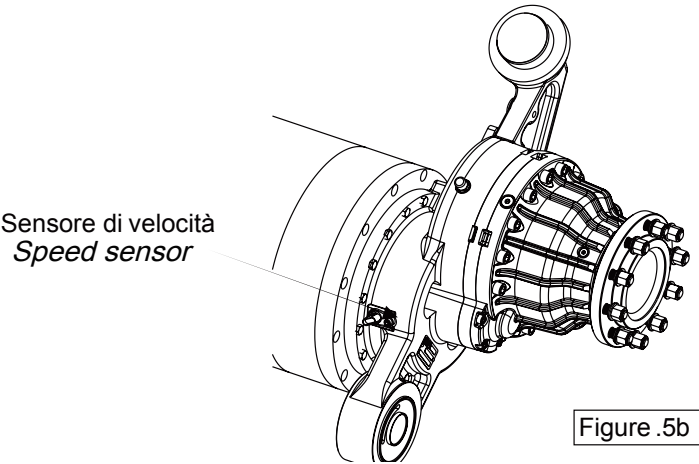
- In order to drain oil, tighten the oil filler plug of the differential mechanism.
- Drain waste oil.
- Fill oil into the drive axle again as described in steps.

4.4.3.3 Differential Mechanism and Sensor

- The differential mechanism is installed inside the flange of the motor (see figure 5a) and it uses the same lubricating oil as that of the adjacent reducer.

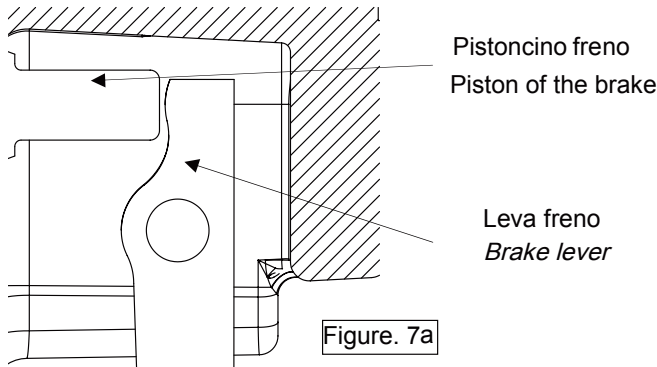


- The tone wheel (80 teeth) and speed sensor are installed inside the flange on the other side of the motor (refer to figure 5b).



- Install connected brake chamber into the drive axle. Apply lubricating oil of the decelerator into the brake chamber and lubricate brake disc during operation. Refer to steps in sections 4.4.3.1 and 4.4.3.2 for more information on filling and draining oil.

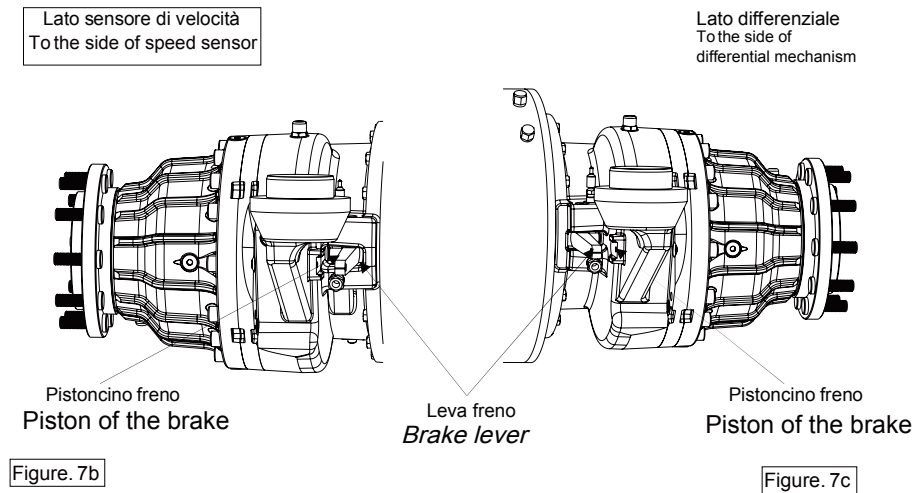
- When installing the drive axle, verify whether there is a clearance (refer to figure 7a) between the brake lever and the piston of the brake cylinder under normal conditions. Therefore, the traction cable cannot be in a tensioned state. Otherwise, it will make adverse effects on operating the brake.



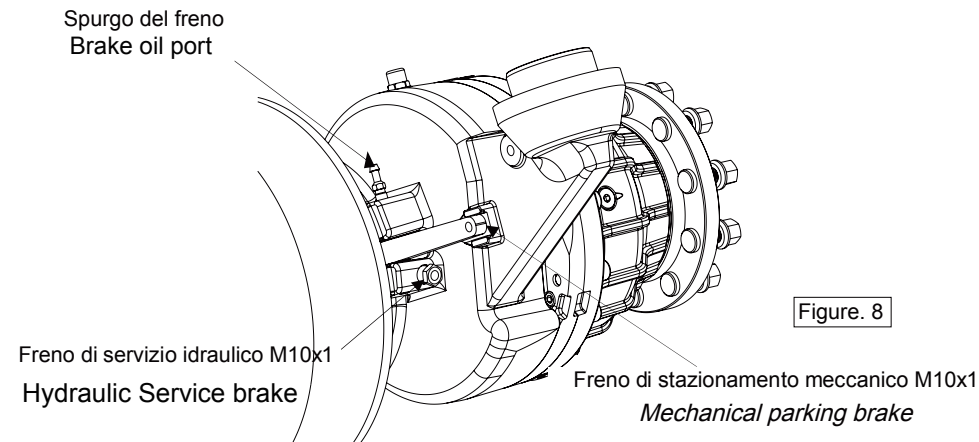
- Brake pump:

It is a small servo pump and the maximum system pressure thereof is 85bar. The normal running pressure ranges from 50bar to 70bar.

- Check whether the piston stroke of the brake cylinder exceeds 3.5mm every 2000 hours of operation and determine whether it is necessary to replace the brake disc.
- Disconnect the brake lever when estimating the wear of the brake disc.
- Push the brake lever towards the direction of the brake piston (see figures 7b and 7c). Then pull it back forcibly and measure the stroke of the brake lever. Determine whether the stroke exceeds 21mm. If yes, replace brake disc parts.



- Oil port (M10x1) can be used for connecting hydraulic brake tube (figure 8). The vent nozzle located opposite the brake oil port is used to release the air in the brake circuit before starting.



- The following types of oil are used in the brake circuit:

Oil seal used for Brake fluid DOT 4— AGIP is also available for DOT oil and mineral oil. Maximum viscosity of the brake fluid is ISO-VG-32. **Change brake fluid for the brake circuit once a year.**



4.4.4 Replace Drive Axle Assembly

4.4.4.1 Preparing Tools

- Extension lever ratchet
- 21mm Socket
- 12mm Allen wrench
- 10mm Open-end wrench
- 22mm Open-end wrench
- Copper hammer

4.4.4.2 Removal

- 1) Remove drive wheels. Refer to 4.3.1 Wheels for details.
- 2) Park the tractor on a flat ground and tighten the parking brake. Turn off the tractor and remove the key. Press the EPO switch and put the corner block under the wheel.
- 3) Use the 21mm socket or open-end wrench to loosen the wheel nuts. Remove the drive wheel. Use a jack and a Truck with same or even larger load capacity to jack up the wheel or fork the wheel, and then place crossers on the left and right sides to jack up and fork the rear end of the tractor bottom and to take the rear wheels off the ground.



4) Remove the wheel.



5) Remove U-phase, V-phase and W-phase lines, temperature sensor G28/speeder sensor G25.

6) Remove brake tube and cable connector

7) Use the 12mm Allen wrench to remove the hexagon socket cap screws_M14. Remove screws with the 10mm open-end or socket wrench. Use the copper rod to knock out the connecting kingpin.



8) Remove the drive axle assembly. .



NOTE

- Do not damage terminals when removing the three-phase lines.
- Since the drive axle is heavy, move it with auxiliary tools such as pallets.

4.4.4.3 Installation

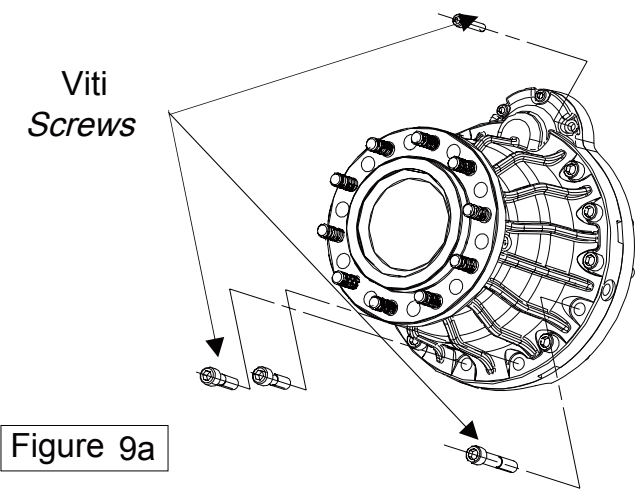
The installation process is the reverse of the removal process.



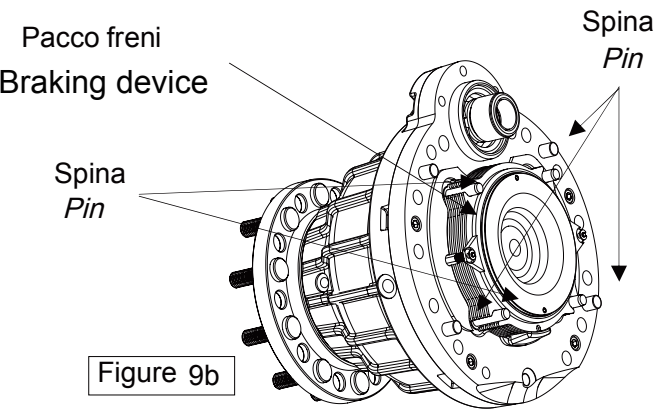
4.4.5 Drive Unit

4.4.5.1 Remove Brake

- Discharge the lubricating oil from the brake chamber (refer to 4.4.3.2 for details).
- Fix the decelerator and then loosen 16 screws (refer to figure 9a).

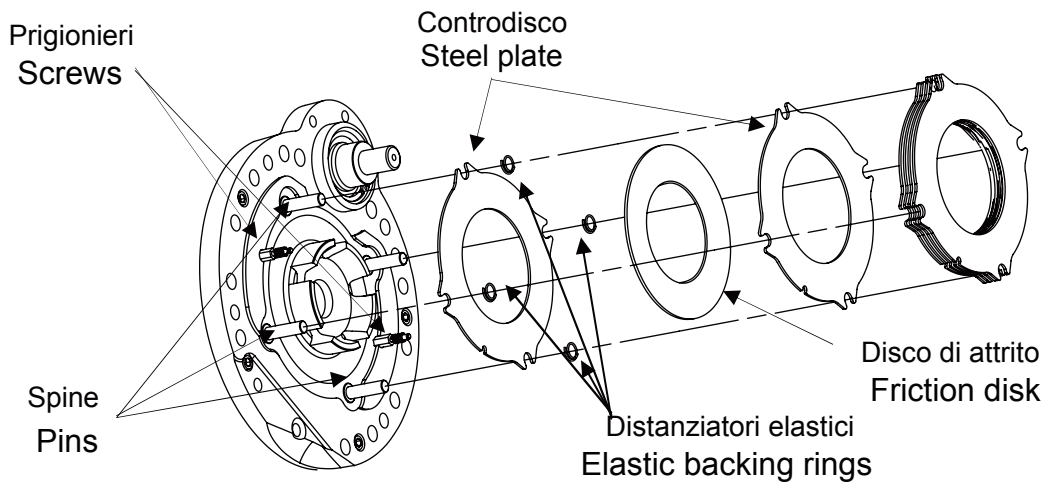


- By inserting a tool into the four supports of the decelerator and pulling the end cover out along the axis. Note that the pins should be inspected during operation to avoid damage. If there is still a pin in the reducer, it is recommended to remove and replace it located on the flange (refer to figure 9b).



4.4.5.2 Replace Brake Disc

Remove the two snap rings from the stud. Then remove thrust disk and brake parts (friction disk, steel plate and aluminum reaction plate) (see figure 10).



Clean the chamber and assemble the new brake components as follows:

- Insert reaction plate
- Insert steel plate
- Insert four elastic backing rings and friction disks



- Repeat the steps 2 and 3 for 4 times.
- Install the last steel disc and spring of the screw.
- Insert the thrust disk to block the brake. Place the snap ring into the bayonet of the screw.
- Apply sealant onto the housing.
- Plug in the decelerator, align the four pins, use a rubber hammer, and fine-tune the end cover until it is fully in place.
- Insert 16 screws and tighten them according to the instructions in the table below.

Screw	Torsion
M12×40	70Nm
M12×70	70Nm
M8×40	35Nm

- Fill oil into the brake chamber. Refer to 4.4.3.1 for details.



4.5 Brake System

4.5.1 Specification

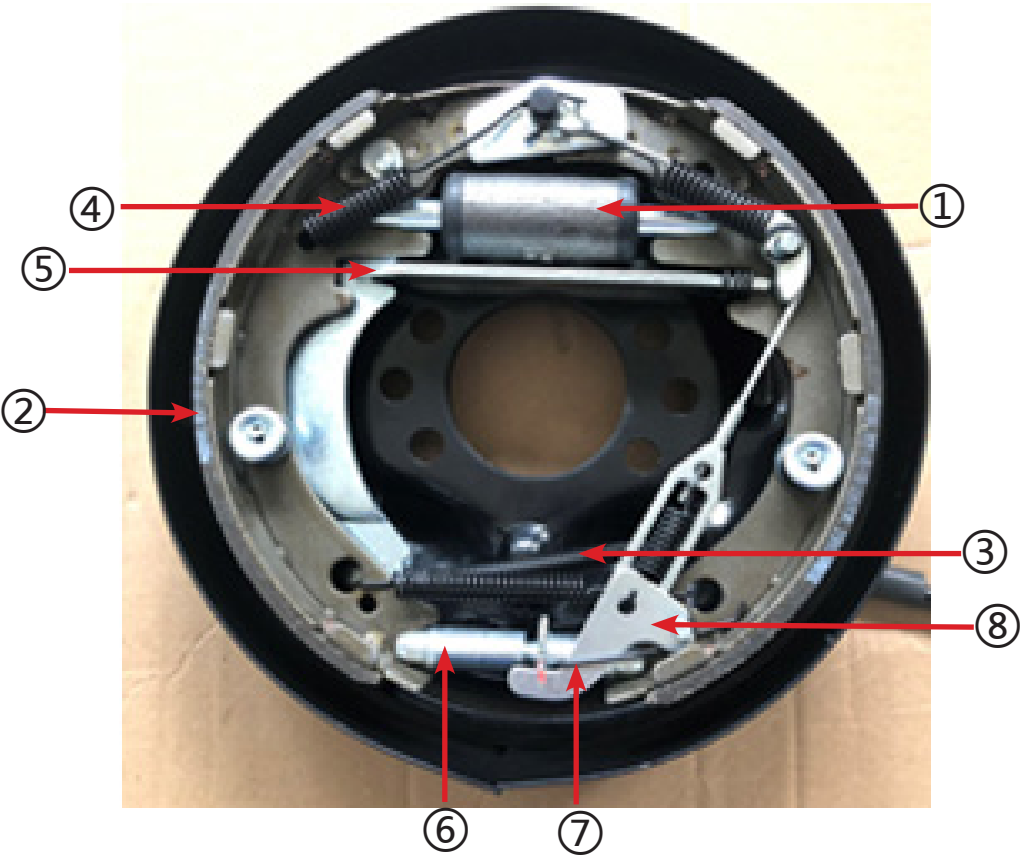
Operate the brake master cylinder by the brake pedal and transfer the brake fluid to the service brake. Connect the parking brake cable to the service brake to achieve parking.

4.5.1.1 Specification Table

Items	T250F
Parking brake	Mechanical brake
Service brake	Hydraulic brake



4.5.1.2 Overview of the Brake Assembly

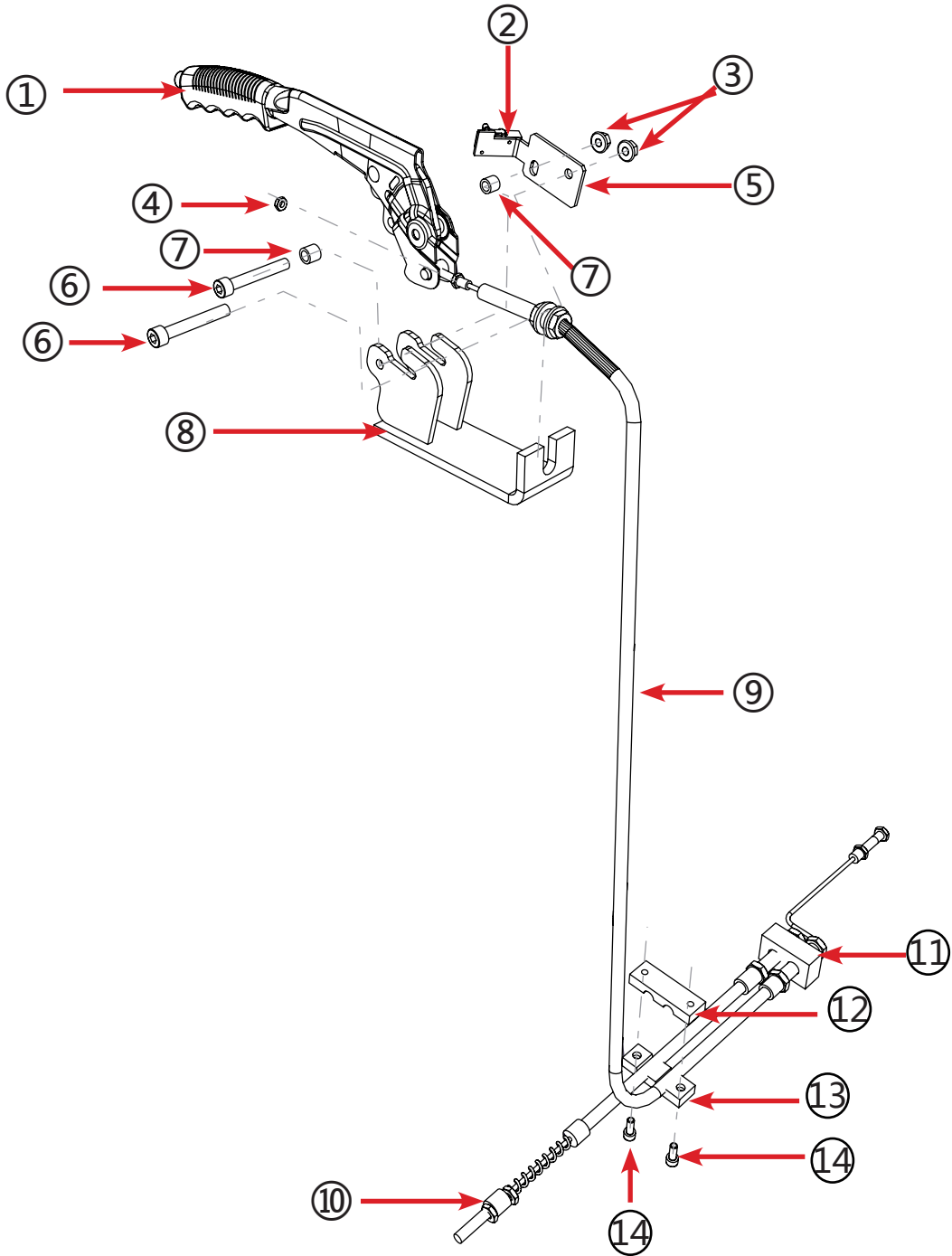


1. Brake cylinder assembly	5. Hand brake push rod
2. Brake shoe with friction plate assembly	6. Gap adjuster
3. Hand brake cable	7. Torsional spring
4. Return spring	8. Lever



4.5.2 Parking Brake System

4.5.2.1 Overview of the Parking Brake System





1. Parking brake handle assembly	2. Handbrake switch
3. Hexagon flange nut_M8	4. Hexagon thin nut_M6
5. Sensor support	6. Hexagon socket cap screw_M8×55
7. Bushing	8. Fixed plate assembly for handbrake
9. Right brake cable for handbrake	10. Left brake cable for handbrake
11. Cable fixed block	12. Cable connection block 2
13. Cable connection block 3	14. Hexagon socket cap screw_M6×16



4.5.2.2 Brake Handle

1) Removal

- Open the handbrake cover. Refer to 4.2.2 for details. Unplug the connector G31.



- Loosen the hexagon thin nut_M6 on the handbrake brake cable.



- Use the 13mm socket or 6mm Allen wrench to remove hexagon socket cap screws M8×55 for fixing handle assembly.



- Remove the parking brake handle assembly and replace it with a new one.

2) Installation

The installation process is the reverse of the removal process.

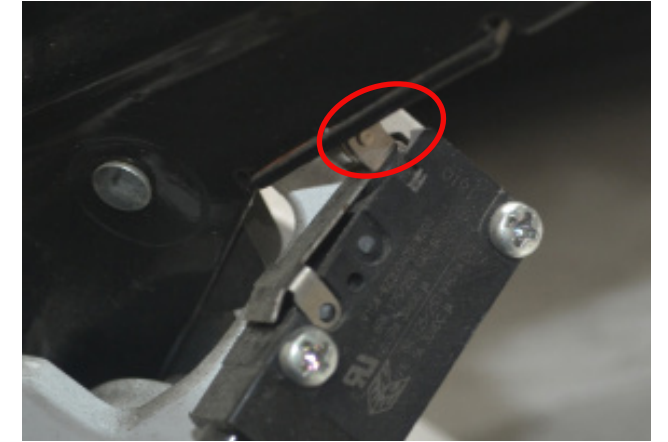
NOTE

Whenever the parking brake handle is installed, adjust the torque of operating parking brake handle.

4.5.2.3 Adjust Parking Brake

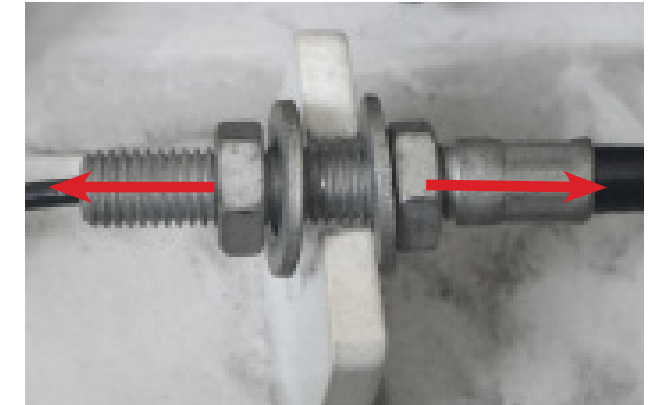
1) Adjust handbrake switch of the parking brake.

- Swing the sensor support to find the proper position where the switch can be triggered by the handle. Then tighten the hexagonal flange nut_M8.



2) Adjust parking brake cable.

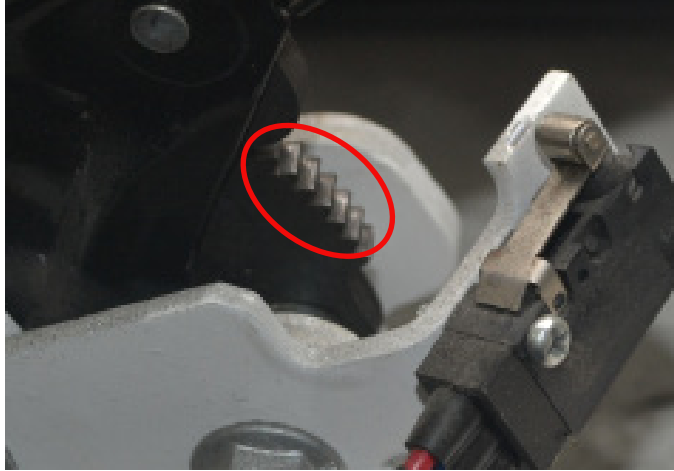
- Pull the handle to the bottom and then release it for resilience force. Adjust resilience force until it is appropriate.
- Adjust the stud position by moving hexagon thin nut on the right brake cable. If the stud moves forward, the cable will become loose and the rebound force will be reduced. Instead, the cable will be tightened and the rebound force will be increased.



- Make appropriate adjustment at the junction of L/H brake cable and brake lever of the drive axle.



- Park the tractor on a slope (15°) and then adjust the parking handle by pulling it up (6-9 teeth).



NOTE

- Tightness of the parking brake is moderate and braking force is qualified, thus passing the slope test. Loosening brake completely when releasing it. No friction or binding.
- Handbrake parking button is in good position wherein no stuck occurs.
- The cable is well installed.
- The microswitch is well installed and the limit travel of the contact point shall not exceed the total travel of the microswitch.
- When unlocking parking, determine whether the micro switch is contacted effectively.



4.5.2.4 Parking Brake Cable

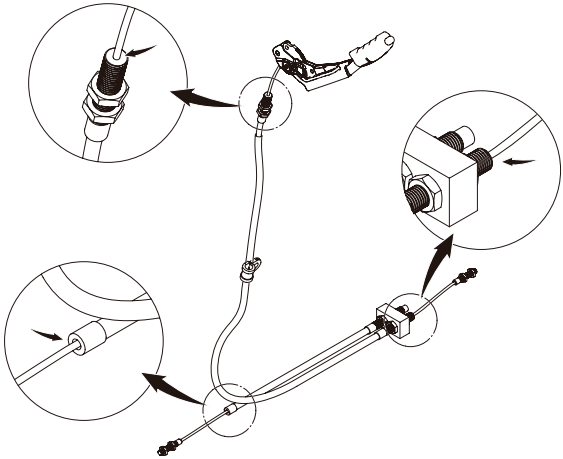
1) Removal

- Replace the brake handle. Refer to 4.5.2.2 Brake Handle for details.
- Pull the removed brake cable (assembly) out of the seat.
- The cable is connected with the brake lever with the bolt. Use a wrench to loosen the bolts of the corresponding brake cable, thus removing and replacing the brake cable.



2) Installation

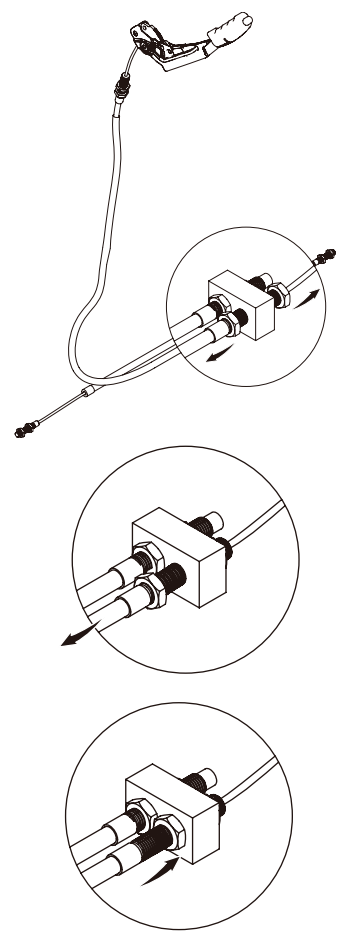
- Before installation, grease the space between the inner cable and the outer cable sleeves to reduce wear.



- Install the parking brake cable into the cable connection block.



- Connect the parking brake cable to Left and right brake levers with bolts. Tighten nuts.
- Install the block for fixing parking brake cable to the previous fixing position.
- Pull the brake cable back from the seat and connect it to the parking brake handle. Refer to 4.5.2.2 Brake Handle for details.
- Loosen the nuts at both ends of connecting blocks of longer cables.

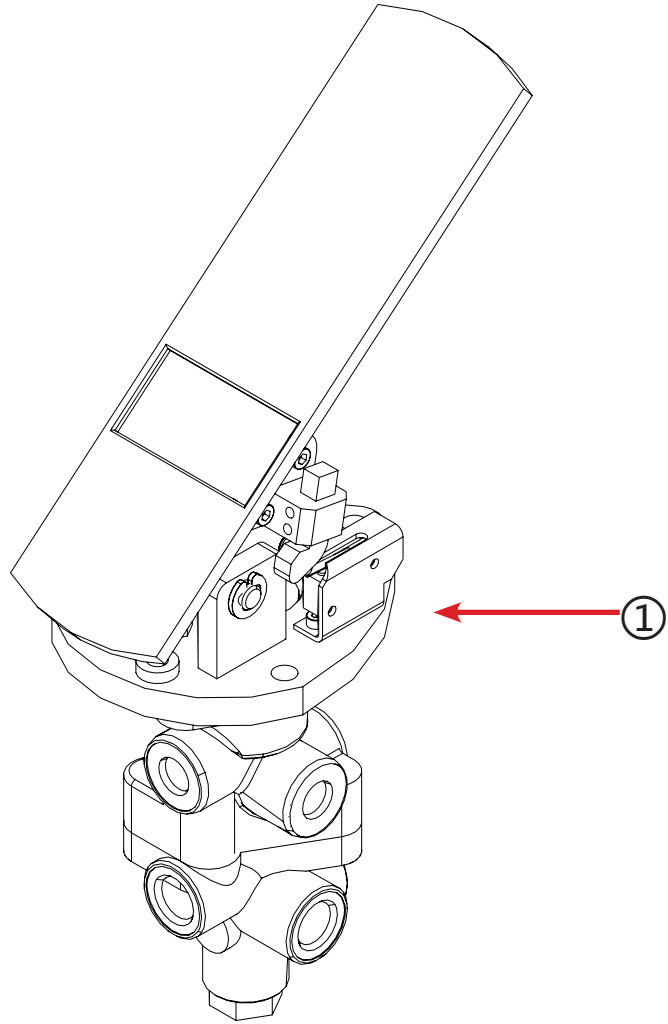


- Hold the connection block and pull the longer cable.
- Lock the nut and eliminate empty stroke.
- Install the upper and lower mounting blocks.



4.5.3 Parking Brake System

4.5.3.1 Overview of the Parking Brake System



1. Service brake valve assembly



4.5.3.2 Service Brake Valve Assembly

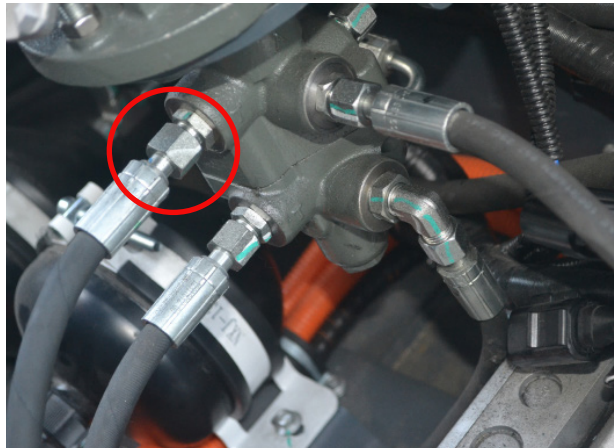
Removal

- 1) Park the tractor on flat ground, pull the handbrake and turn off the tractor.
- 2) Remove the key and press down the emergency stop switch.
- 3) Use the 10mm ope-end wrench or socket to remove fixed bolts of the service brake valve assembly.



- 4) Remove foot pedal assembly. Refer to 4.2.7 Foot Pedal Assembly for details.

- 5) Unplug the service brake connector G05. Use the 17mm open-end wrench to remove oil tube connectors.



- 6) Remove service brake valve assembly.



Installation

The installation process is the reverse of the removal process.



When unscrewing the brake tubes, it is best to pad with oil absorbent cloth or other antifouling materials.



4.5.4 Energy Accumulator

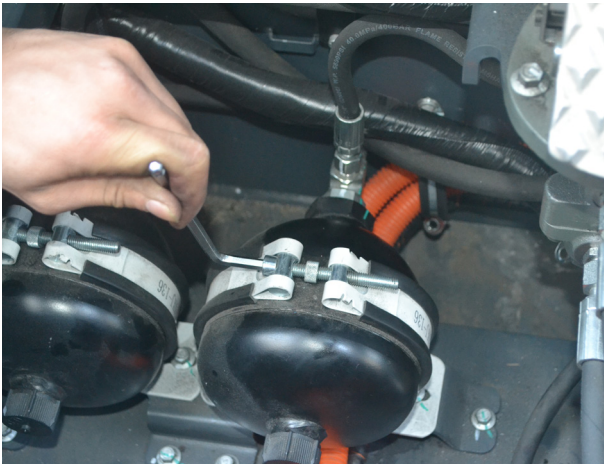


Warning

Shut down the tractor, continue to step on the brake 40-50 times and then finish the pressure relief.

4.5.4.1 Removal

- 1) Open foot pedal assembly. Refer to 4.2.7 Foot Pedal Assembly for details.
- 2) Use the 6mm Allen wrench to remove the energy accumulator clamp.
- 3) Use the 27mm open-end wrench to Unscrew the sleeve tee and then take out the energy accumulator.



NOTE

When unscrewing the brake tubes, it is best to pad with oil absorbent cloth or other antifouling materials.



4.5.4.2 Installation

The installation process is the reverse of the removal process.

4.5.4.3 Check Pressure of the Energy Accumulator

- 1) Park on a flat area and tighten the parking brake. Keep the tractor in starting state and the brake system fully filled with fluid.
- 2) Keep deep press on the foot brake and turn the steering wheel. If the steering wheel cannot be turned after deep press, the accumulator will work normally.
- 3) Repeat the above steps several times. If the steering wheel can be turned easily, the accumulator will be replaced.

NOTE

The temperature change of hydraulic oil will affect pressure of the accumulator to some extent. It is normal that the foot brake times fluctuate slightly.

4.5.4.4 Disassembly

1) Usage of the energy accumulator

- Since the energy accumulator is a pressure container, it must be filled with nitrogen of high purity.
- Before delivery, prefill high purity nitrogen (2bar).
- Before use, fill high purity nitrogen into the accumulator until it reaches the required pressure.
- When installing the accumulator, leave space on the top so that it can easily check nitrogen pressure of the accumulator.
- Nitrogen filling pressure ranges from 1/4 of the Max system working pressure to 9/10 of Min system working pressure.
- Check nitrogen pressure of the accumulator regularly.

Special tips

Any of the following operations must be absolutely avoided. Otherwise, it will damage the service life of the accumulator and affect the normal operation of the system.

- The system runs if nitrogen filling pressure is 0 or nitrogen is not filled with specified pressure.



- Nitrogen filling pressure of the accumulator is greater than or equal to the minimum working pressure of the system.
- Energy accumulator is discharged too large (the actual flow is greater than the designed flow).

2) Steps and precautions for nitrogen filling of diaphragm accumulator

- Steps for filling nitrogen
 - Fill nitrogen in open space. No dangerous devices or combustible items nearby. Oil port and air port cannot be directly opposite to people. Otherwise, it will cause accidental injury during nitrogen filling.
 - Before filling nitrogen, prepare the nitrogen filling tool FPU, high-purity nitrogen, Allen wrench and foam leak detection agent (soap-studs).
 - First, unscrew the protective cover of the nitrogen filling port of the accumulator.
 - Second, adjust the nitrogen filling port to 0 degrees with the Allen wrench. It will loosen the screw slightly and won't leak nitrogen directly.
 - Third, connect the hexagon screw inside the nitrogen filling tool FPU with the sealing screw on the nitrogen filling port. Tighten metal nuts (M28X15) outside the FPU to prevent nitrogen from leaking.
 - Fourth, check whether the pressure relief handle of FPU is tightened.

- Fifth, connect one end of the filling hose in the FPU box with the high-purity nitrogen bottle and tighten them. The other end of the filling hose should not be connected to the FPU. Slightly open the high-purity nitrogen switch and connect the other end with FPU till there flows nitrogen in the other end of the filling hose. Then tighten them.
- Sixth, loosen the large handle on the top of FPU counterclockwise until the nitrogen is officially filled into the accumulator. (Do not to loosen the handle completely or excessively. Otherwise, it will cause nitrogen leakage).
- Seventh, after filling high-purity nitrogen about 2 or 3 minutes with low flow rate, turn the high-purity nitrogen switch up, and fill nitrogen with high flow rate till it reaches the target nitrogen pressure. Then turn off the high-purity nitrogen switch.
- Eighth, after tightening the large handle on the top of FPU clockwise, loosen pressure relief handle and drain nitrogen pressure from FPU and the nitrogen filling hose. Tighten the pressure relief handle after pressure of FPU returns to zero.



- Ninth, loosen large handle on the top of FPU till the pressure gauge value on FPU is stable, observe whether it reaches the required prefilling nitrogen pressure. If not, repeat steps 6-8 till it reaches the required. Turn off the high-purity nitrogen switch and tighten the large handle on the top of FPU. Then leave them for 10 minutes (the time varies according to the nitrogen filling pressure, and can be adjusted according to the actual situation). During the operation, carry out the temperature compensation or temperature balance between the nitrogen temperature inside the accumulator and the ambient temperature outside the accumulator. (When nitrogen is filled, nitrogen enters quickly and causes friction with the diaphragm and the inner shell of accumulator. The temperature of nitrogen in the accumulator is higher than that of the ambient. When nitrogen temperature is high, its density will be low and the pressure value is falsely high).

- Tenth, After finishing temperature compensation or temperature balance, loosen pressure relief handle and drain nitrogen pressure from FPU and the nitrogen filling hose. After pressure of FPU returns to zero, tighten the pressure relief handle but loosen large handle on the top of FPU till the pressure gauge value on FPU is stable. Observe whether it reaches the required prefilling nitrogen pressure. If yes, tighten the large handle on the top. Loosen pressure relief handle and drain nitrogen pressure from FPU and the nitrogen filling hose. After pressure of FPU returns to zero, remove nitrogen filling hose and FPU in turn. Tighten the seal screw on the nitrogen filling port with the Allen wrench and then screw the protective cover.

Special tips

If the diaphragm accumulator has small volume and the prefilling pressure is lower than 100bar or its position is not convenient for checking, it is suggested to fill nitrogen and the nitrogen filling pressure is preferably 5% higher than the prefilling pressure.



3) Methods for detecting nitrogen leak

- Spray foam leak detection agent on the nitrogen filling port and the oil side interface and then observe whether there is any leakage.
- Place a balloon on the nitrogen filling port and the oil side interface and observe whether the balloon can become larger automatically.

4) General failure

The reasons why the nitrogen pressure inside the diaphragm accumulator drops are as follows:

- The internal diaphragm is damaged, and nitrogen leaks from the oil side.
- The seal of the nitrogen filling port fails, causing nitrogen leakage from the filling port. In this case, the protective cover of the filling port is under pressure and it is difficult to unscrew it.
- During nitrogen filling, the pressure is not prefilled to the required.
- After the nitrogen is filled, the pressure change after temperature compensation or temperature balance is not considered. After the temperature is balanced, the displayed nitrogen pressure (real nitrogen pressure) is insufficient.

Nitrogen of the diaphragm accumulator is displayed as zero and hydraulic oil leaks from the nitrogen filling port. The possible reasons are as follows:

- The internal diaphragm is damaged, and the hydraulic oil enters.
- The diaphragm accumulator is put into use before prefilling nitrogen or prefilled nitrogen has not reached the required, causing damaged diaphragm.
- The cleanliness of hydraulic oil is unqualified, and the metal particles contained in the oil puncture the diaphragm.
- The internal nitrogen pressure of the diaphragm accumulator has not been checked for a long time. When the nitrogen has been leaking slightly for a long time, the diaphragm is damaged by the hydraulic oil pressure.



4.5.5 Brake Discs

During brake inspection, if wear, damage or any other conditions are found, correct or replace parts as needed.

1. Brake shoe assembly: When the friction plate is 0.5mm away from the rivet, the brake shoe needs to be replaced.

2. Brake cylinder: If the braking force is too small and the braking distance becomes longer during use, check the cylinder for leakage. If there is leakage, replace the brake cylinder.

Visual inspection

Check other parts for wear, damage or abnormalities. If there is any abnormality, it should be replaced in time.

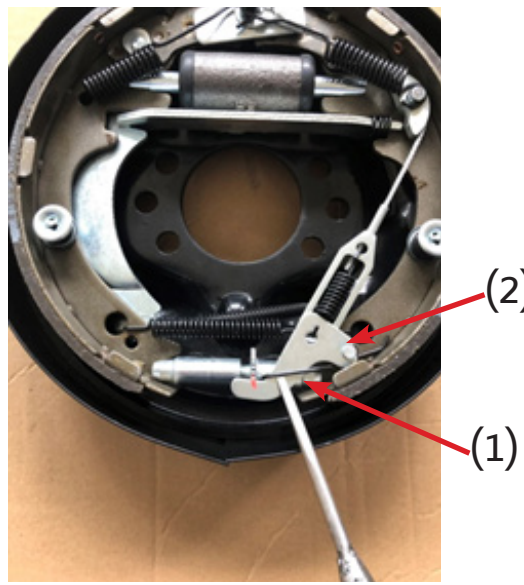
Remove the brake. Refer to 4.3.7 for details.



4.5.5.1 Replace Brake Shoe Assembly

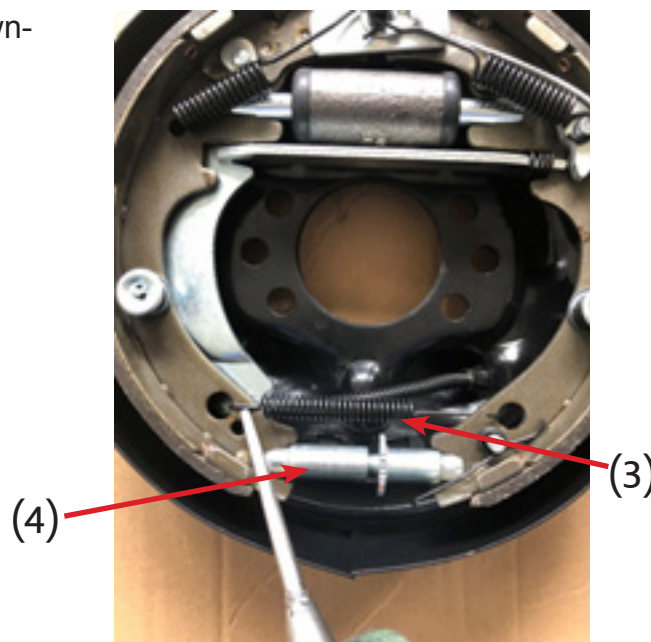
1) Use a screwdriver to pry up the torsional spring on the pawl and remove the pawl.

- (1) Torsional spring
- (2) Lever



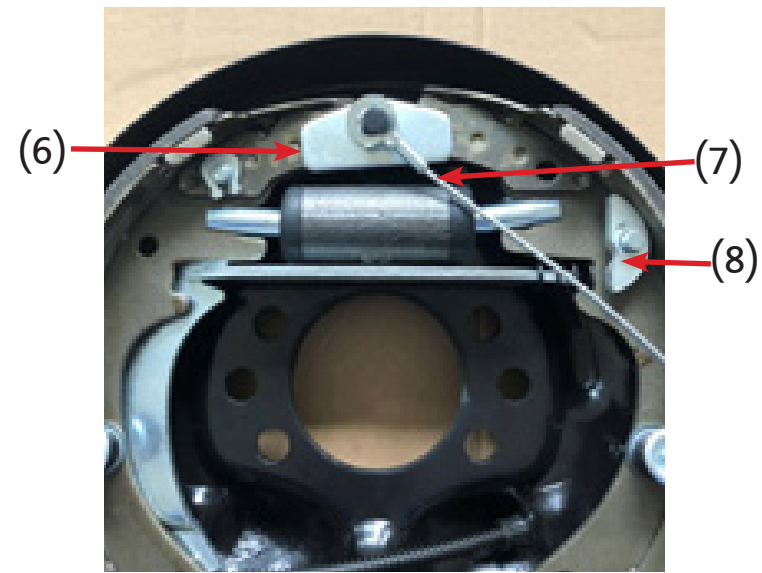
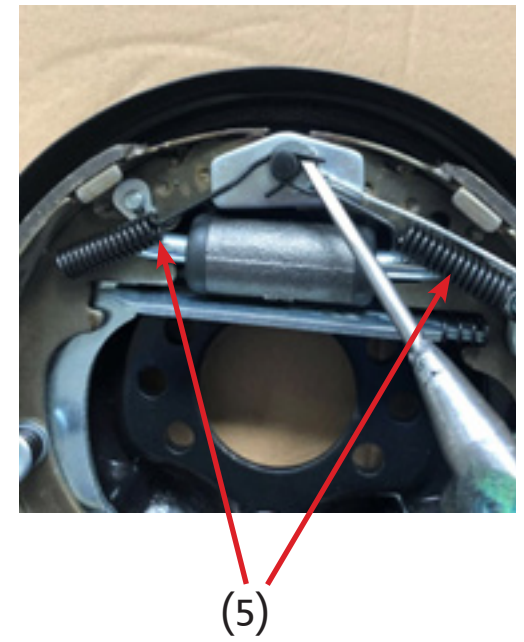
2) Use a screwdriver to pry out the down-tension spring and remove the gap modulator assembly.

- (3) Down-tension spring
- (4) Gap modulator assembly



3) Use a screwdriver to pry out the return spring, and take off the spring puller, guide block, guide plate and hand brake push rod.

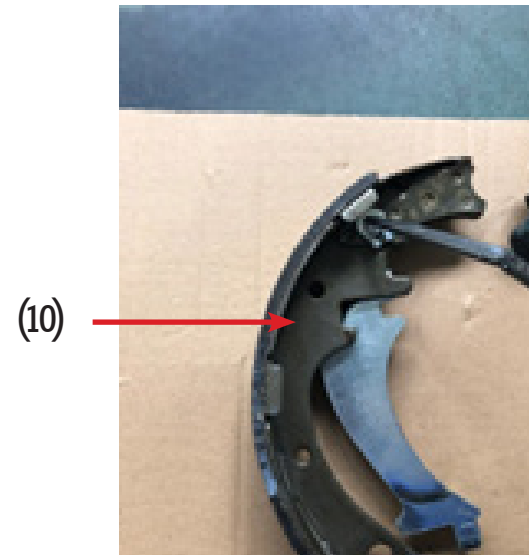
- (5) Return spring
- (6) Guide block
- (7) Spring puller
- (8) Guide block



4) Remove the brake shoe assembly by pressing the up-pressure spring seat with the tool.

5) Knock down the lever pin retaining ring and remove the hand brake lever. The hand brake lever and the replaced brake shoe with friction plate assembly are connected through a handle lever pin. On the reverse side, the lever pin retaining ring is clamped tightly with pliers.

- (10) Lever pin retaining ring

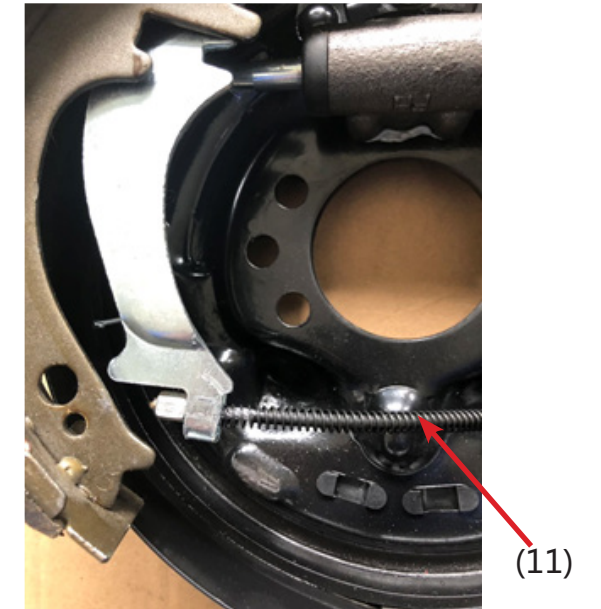


6) Apply butter on the six bosses of the bottom plate and on the both sides of the support pins (The replacement of the brake shoe assembly requires re-applying butter).



7) The end of the handle brake cable is stuck in the groove of the handle brake lever.

- (11) Handle brake lever



8) Pass the pressure spring pull rod through the bottom plate and the brake shoe assembly, then place the pressure spring seat and the pressure spring, and use tools to compress them.

- (12) Pressure spring seat
- (13) Pressure spring
- (14) Pressure spring pull rod



9) Put the push rod spring on the right side of the hand brake push rod. The side with spring of the hand brake push rod is stuck in the groove of the brake shoe with the spring pull device. The other side is stuck in the groove of the hand brake pull rod (note that the hand brake push rod with a large arc is facing upward). Install the return spring with a tool.



10) Clip the gap modulator assembly to the brake shoe slot (note the direction). Then hang the tension spring tools on the two holes of the brake shoe separately (note the left side hanging into the large hole).





11) Hang the spring of the spring puller on the hole of the pawl, and use the torsional spring to fix the pawl on the gear of the gap modulator assembly.



12) Adjust the outer diameter of the brake to the required range (note that the position of each slot is correct to ensure that the parts do not fall off).



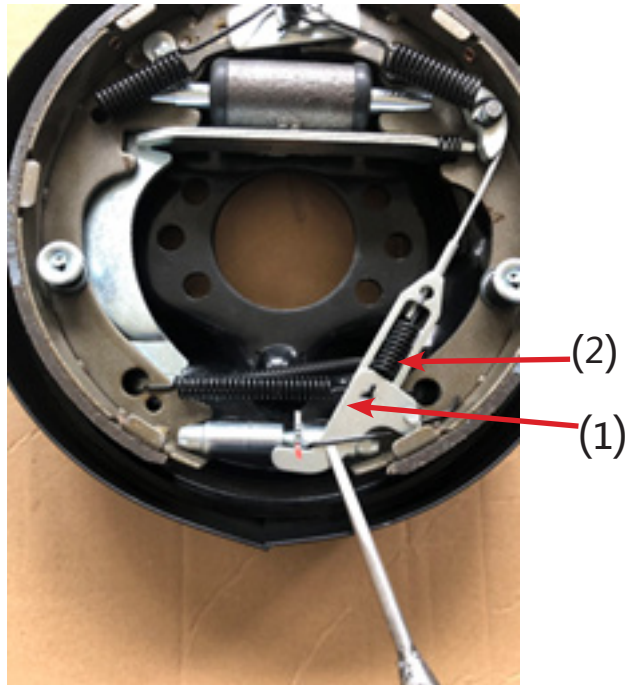
4.5.5.2 Replace Brake Cylinder

1) Unscrew bolts (M6X16) on the brake cylinder.



2) Use a screwdriver to pry up the torsional spring on the pawl and remove the pawl.

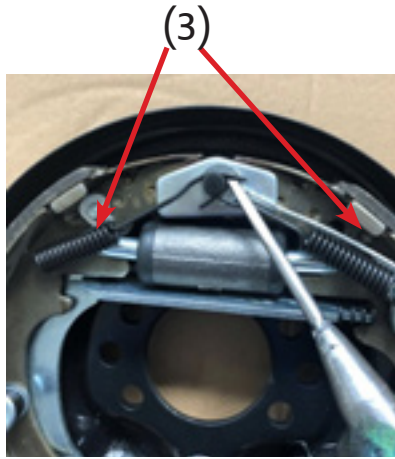
- (1) Torsional spring
- (2) Lever





3) Use a screwdriver to pry out the return spring and then pull out the brake shoe assembly to take out the brake cylinder.

- (3) Return spring



4) Spread a ring of sealant on the mounting surface of the replaced cylinder and place it on the bottom plate. Insert piston rod of the cylinder into the slot of brake shoe assembly, and tighten the screw on the cylinder (the tightening torque ranges from 8 to 12N.m). Install the return spring with a tool.





5) Hang the spring of the spring puller on the hole of the pawl, and use the torsional spring to fix the pawl on the gear of the gap modulator assembly. Adjust the outer diameter of the brake to the required range (note that the position of each slot is correct to ensure that the parts do not fall off).



4.6 Electrical Parts

Warning



Only professional personnel with certain electrical knowledge can operate the tractor. Pay attention to the working environment.



Park the tractor on a flat ground, disconnect the power and pull on the parking handbrake.

4.6.1 Check Lines

Caution



All lines in the tractor should be firmly connected. No looseness.



Be careful of the wire harnesses around when working on the tractor.



Do not pull the wire harnesses.



Be careful when connecting and disconnecting the wire harnesses.



Do not use unspecified tools to pry the connector apart.

4.6.1.1 Check Wire of the Entire Truck

- 1) Check whether the electrical connection terminals are loose. If yes, tighten the loose parts.
- 2) Check if there is any abnormality in the connection part of the wire harness (such as burning marks, etc.).
- 3) Check whether the connection sheaths are loose. If yes, tighten the loose parts.

NOTE

Check the corresponding wire harnesses before disassembling any part.

4.6.1.2 Check Appearance of the Main Controller and Wire

- 1) Open the rear cover plate assembly and remove the waterproof cover.
- 2) Check whether the connection terminals of maser controller are loose. If yes, tighten the loose parts.
- 3) Check whether the fuse of the main controller is normal and replace it if necessary.
- 4) Check if the copper bar of the main controller has any burning marks and replace it if necessary.



4.6.1.3 Check Wire

- 1) Mark each end of the harness. If the mark cannot be found or recognized, please re-mark it.
- 2) Tape or solder the end of the new wire to the end of the faulty wire.
- 3) Pull the old wire out and pull the new wire in the harness.
- 4) Secure the new wire to the outside of the existing harness using a suitable sized cable tie.
- 5) The damaged wire can be left in the wire harness or be pulled out of the wire harness by pulling one end.

 NOTE

The uninstalled parts may not have used a connector, but have undergone thermal shrinkage and are tied to the wire harness.



4.6.1.4 Table of Connector Codes

The connector code represents the name of each connector, and the Chinese and English names are printed on the white sticker of the connector.

1) Connector Code of the Truck Wire

1	B01 connecting to 12V/5A fuse
2	C01 connecting to left front position lamp (reserved)
3	C03 connecting to left rear position lamp (reserved)
4	C04 connecting to right rear position lamp (reserved)
5	DP1 connecting to low voltage distribution box (female end)
6	DP2 connecting to low voltage distribution box (male end)
7	G01 connecting to combination light (gear control)
8	G02 connecting to combination light (light control)
9	G03 connecting to charging port
10	G05 connecting to foot brake and foot brake light switches
11	G07 connecting to electric horn
12	G100 connecting to short-circuit plate 3
13	G101 connecting to short-circuit plate 4
14	G102 connecting to fool proof switch
15	G106 connecting to shielded net
16	G11 connecting to rear working light (reserved)
17	G13 connecting to DC/DC output end
18	G140 connecting to seat switch (scheme 2)
19	G16 connecting to left rear combination light
20	G17 connecting to steering sensor of the right front wheel
21	G19A connecting to left rear EPO switch
22	G19B connecting to left rear EPO switch
23	G20 connecting to drive motor controller
24	G230 connecting to left front combination light



25	G23 connecting to reversing buzzer
26	G245 connecting to right front combination light
27	G24 connecting to steering motor controller
28	G25 connecting to drive encoder
29	G27 connecting to adapter male end of the combination display
30	G28 connecting to drive temperature sensor
31	G29 connecting to pressure switch
32	G30 connecting to coil of the power unit contactor
33	G31A connecting to coil of the temperature control contactor
34	G31 connecting to handbrake switch
35	G32A connecting to temperature control switch
36	G32 connecting to ignition switch
37	G33 connecting to pressure switch relay
38	G40 connecting to seat switch
39	G42 connecting to accelerator pedal sensor
40	G44 connecting to electric horn switch
41	G534 connecting to the handle of the reversing horn switch
42	G70 connecting to DC/DC input end
43	G76 connecting to the negative pole of the drive motor controller
44	G77 connecting to fan power of main controller
45	G80 connecting to battery pack plug
46	G84 connecting to power of main contactor
47	G86 connecting to CAN diagnosis port
48	G90 connecting to right rear combination light
49	G91 connecting to short-circuit plate 1
50	G97A connecting to EPO switch in the driving cab
51	G97B connecting to EPO switch in the driving cab
52	G98A connecting to inching backward
53	G98B connecting to inching backward
54	G98C connecting to inching backward
55	G98D connecting to inching backward
56	G99A connecting to inching forward
57	G99B connecting to inching forward



58	G99C connecting to inching forward
59	G99D connecting to inching forward
60	H01 connecting to backlight on the cooling fan switch
61	H03 connecting to sprinkling switch
62	H04 connecting to wiper switch
63	H05 connecting to switch on the rear working lamp
64	H06 connecting to cooling fan switch
65	H07 connecting to backlight on the sprinkling switch
66	H08 connecting to backlight on the wiper switch
67	H09 connecting to backlight on the rear working lamp
68	K01 connecting to wiper motor
69	K02 connecting to wire in the driving cab
70	K04 connecting to ignition switch for airport tractor (scheme 2)
71	K07 connecting to ignition switch contactor contacts and coils for airport tractor (scheme 2)
72	M01 connecting to washer reservoir motor
73	M05 connecting to tractor-mounted terminal (reserved)
74	N04 connecting to normally open handbrake switch
75	N05 connecting to handbrake buzzer (scheme 2)
76	S01 connecting to backlight on the alarm flash switch
77	S02 connecting to backlight on the alarm flash switch
78	T01 connecting to steering motor temperature sensor
79	T02 connecting to steering motor encoder
80	USB connecting to USB charging connector (reserved)
81	Z80 connecting to left rear combination light in the driving cab
82	Z81 connecting to right rear combination light in the driving cab



2) Connector Code of the Cabin Wire

1	K01 connecting to wiper motor
2	K02 connecting to room lamp
3	K03 connecting to main wire
4	K04 connecting to right rear horn
5	K05 connecting to left rear horn
6	K06 connecting to fan in the cabin
7	K07 connecting to control source of the air conditioner (reserved)
8	Q01 connecting to mains lead of the strobe lamp

3) Connector Code of the Battery Case Wire

1	G50 connecting to main BMS MA
2	G51 connecting to main BMS MB
3	G95 connecting to power supply A for main contactor
4	G82 connecting to current hall A
5	G59 connecting to auxiliary power manager SA
6	G60 connecting to auxiliary power manager SB
7	G96 connecting to power supply B for main contactor
8	G97 connecting to current hall B
9	G76 connecting to power supply of the controller relay
10	G81 connecting to battery pack socket
11	G74 connecting to controller relay contacts
12	G75 connecting to controller relay contacts
13	G99 connecting to main power source
14	G06 connecting to BMS MC
15	G01 connecting to collector A1
16	G02 connecting to collector A2
17	G12 connecting to BMS SC
18	G07 connecting to collector B1
19	G08 connecting to collector B2

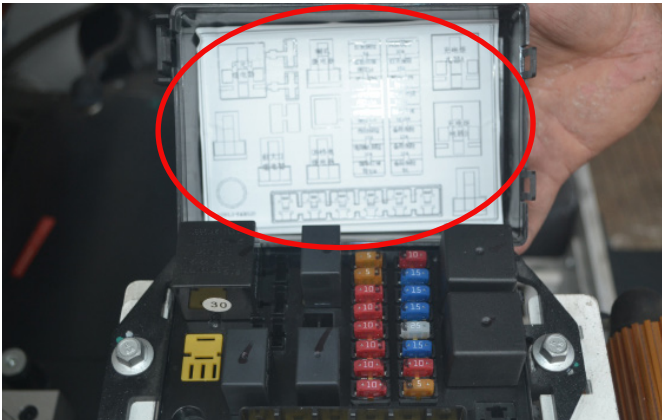


4.6.2 Low Voltage Distribution Case

4.6.2.1 Removal

1) Open the rear cover plate assembly. Refer to 4.2.4 Rear Cover Plate Assembly for details.

2) Press the buckle to remove the cover of low voltage distribution box. Find the corresponding fuse or relay according to the position marked on the cover.

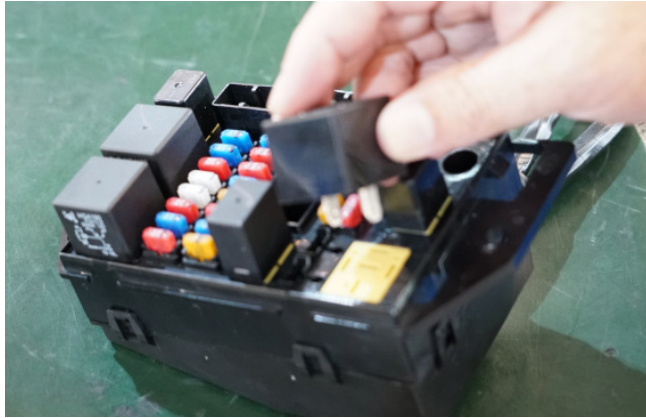


3) Check whether the fuse is working properly with a multimeter.

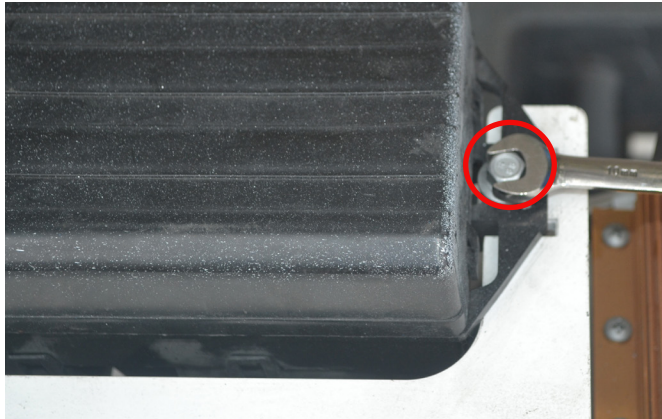
4) Replace the fuse.



5) Replace the relay.



6) Use the 10mm socket or open-end wrench to loosen fixed bolts on the dustproof cover.



7) Disconnect the connector DP1/DP2 of the low voltage distribution box and then remove the low voltage distribution box.

4.6.2.2 Installation

The installation process is the reverse of the removal process.

4.6.3 Main Controller Fuse

4.6.3.1 Removal

Warning



Be sure to find out the cause of the blown fuse before replacing it with a new one.



Replace the new fuse with the same specification immediately when it does not work normally.

1) Open the rear cover plate assembly. Refer to 4.2.4 Rear Cover Plate Assembly for details.

2) Check whether the fuse is working properly with a multimeter. If the fuse fails, replace it with a new one.

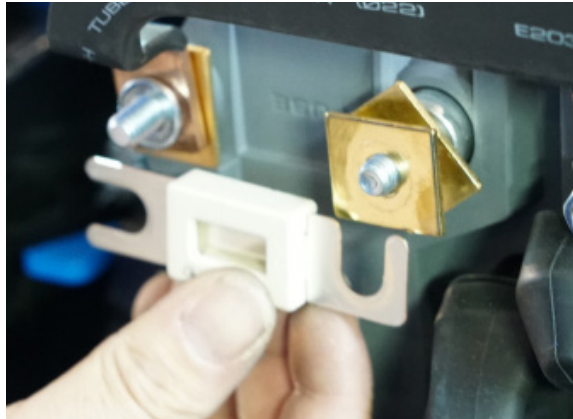
- Adjust the multimeter to the resistance gear. If the resistance value is less than 1Ω , the fuse is normal.
- Adjust the multimeter to the diode gear. Use the multimeter to connect both ends of the fuse. If there is a sound, the fuse is normal.

3) Loosen the fixed nut with a 13mm socket wrench.





4) Remove the fuse and replace it with a new properly powered fuse. (Note: Replace with a new fuse in accordance with the manual.)



4.6.3.2 Installation

The installation process is the reverse of the removal process.



4.6.4 Ignition Switch

4.6.4.1 Removal

1) Remove the rear end of the combination switch cover.



2) Unplug the connector G32.

3) Manually loosen the retaining plastic cover of the ignition switch at the outer end of the cover.



4) Remove the ignition switch and replace it.



4.6.4.2 Installation

The installation process is the reverse of the removal process.



When installing the ignition switch, the convex groove of ignition switch is stuck in the groove of the rear cover of the steering column.



4.6.5 Ignition Switch Fuse

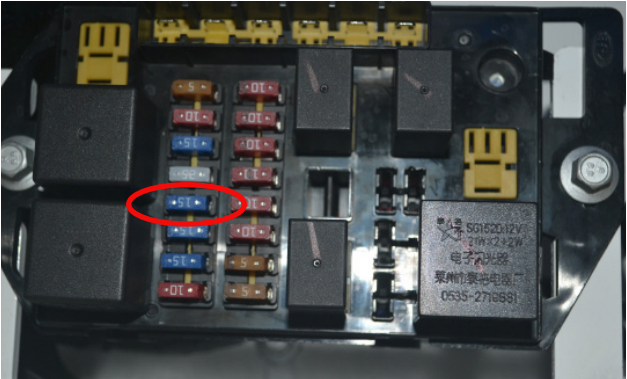
4.6.5.1 Removal

Warning

Be sure to find out the cause of the blown fuse before replacing it with a new one.

Replace the new fuse with the same specification immediately when it does not work normally.

- 1) Open the rear cover plate assembly. Refer to 4.2.4 Rear Cover Plate Assembly for details.
- 2) Open the low voltage distribution box. Refer to 4.6.2 Low Voltage Distribution Case for details.
- 3) Check ignition switch fuse.



4.6.5.2 Installation

The installation process is the reverse of the removal process.

4.6.6 Precharge Resistor

4.6.6.1 Removal

1) Open the rear cover plate assembly.
Refer to 4.2.4 for details.



2) Check the Precharge Resistor before removal:

- Check the appearance of the precharger for burning marks.

3) Loosen the fixed bolts of the precharge resistor with an Allen wrench (3mm).



4) Loosen the connection between the precharge resistor and the 80V main contactor with a socket (17mm) or an open-end wrench.

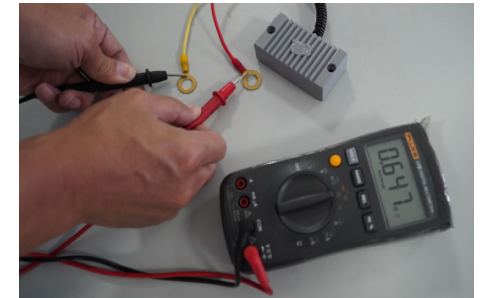
5) Remove the precharge resistor.



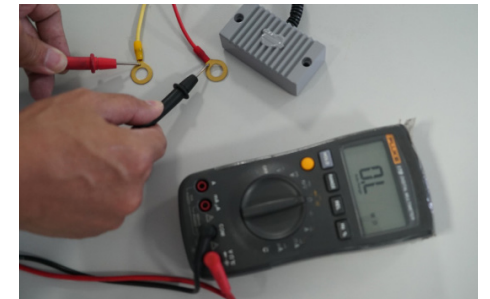
4.6.6.2 Check Precharge Resistor

- Check whether the resistance value of the precharge resistor is normal.

a. Usage of the multimeter: Red multimeter is for the red end while the black multimeter for the yellow one.



b. If you use the multimeter in the reverse order, you can get an infinite resistance value.



4.6.6.3 Installation

The installation process is the reverse of the removal process.

4.6.7 Main Contactor

 Caution

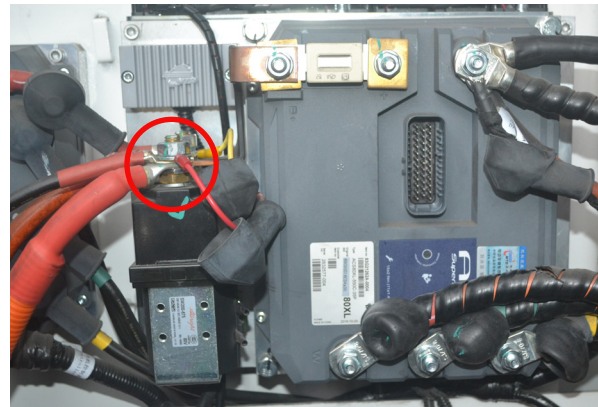
Before maintaining the 80V main contactor, check the main contactor coils and terminals for signs of burning or physical damage.



4.6.7.1 Removal

1) Open the rear cover plate assembly. Refer to 4.2.4 Rear Cover Plate Assembly for details.

2) Disconnect connector G84 of the positive and power lines from the main contactor using a 17mm socket wrench.



3) Disconnect the main contactor coil wiring and precharge resistor.

4) Loosen the two retaining bracket screws of main contactor and remove the 80V main contactor.



5) Check the value (200Ω) of the main contactor coil resistance.

6) Check whether the main contactor terminals are loose. If yes, replace the entire main contactor.

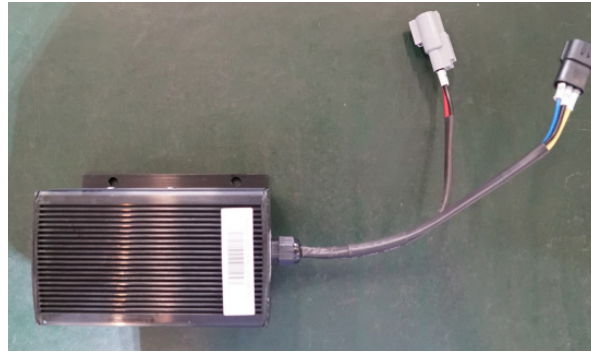
4.6.7.2 Installation

The installation process is the reverse of the removal process.



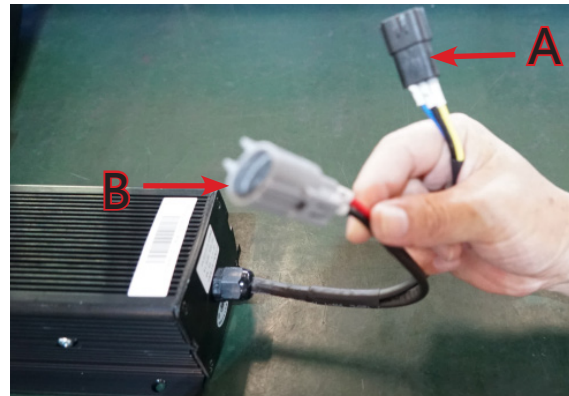
4.6.8 DC/DC Converter

1. 80V-12V DC/DC converter



2. 80V input and 12V output connector

- A. 80V Input connector 3Pin
- B. 12V Output connector 2Pin



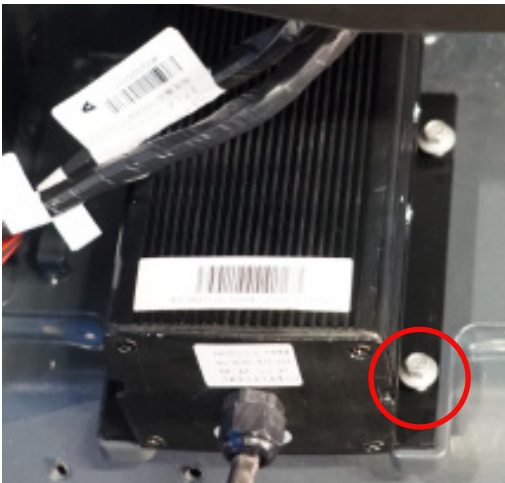
3. Replacing DC/DC converter

1) Open the rear cover plate assembly. Refer to 4.2.4 Rear Cover Plate Assembly for details.

2) Disconnect DC/DC input and output connectors G13 and G70.



3) Loosen the four fixed screws to remove the DC/DC with an 8mm socket wrench and replace it.





4.6.9 Single Controller

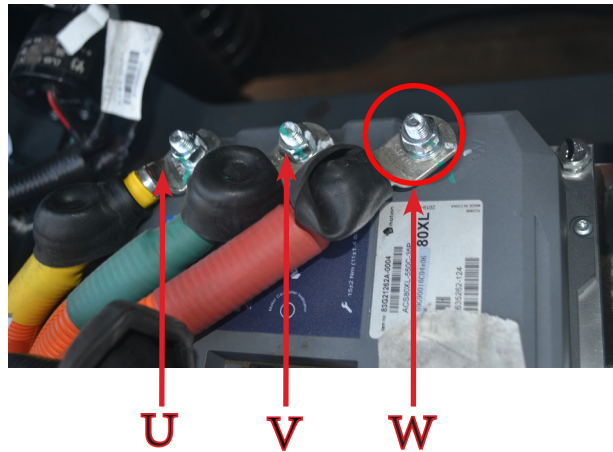
4.6.9.1 Preparing Tools

- 13mm open-end wrench
- 5mm box end hexagon socket head wrench + rachet
- 17mm open-end wrench

4.6.9.2 Drive Controller

1) Removal

- Open the rear cover plate assembly. Refer to 4.2.4 Rear Cover Plate Assembly for details.
- Disconnect the U, V, W three-phase wires between the controller and the motor.



- Pick up bottom buckle of the connector and remove the controller 35Pin connector.



- Remove power unit/charging/main contactor/voltage divider connection.



- Use a 5mm Allen wrench to remove the fixing bolts (4PCS) of the controller and remove the drive controller.



- Refer to 4.6.9.2 Drive Controller for information on removing steering controller.

2) Installation

The installation process is the reverse of the removal process.



4.6.9.3 Exhaust Fans on the Drive Controller

1) Removal

- Open the rear cover plate assembly. Refer to 4.2.4 Rear Cover Plate Assembly for details.
- Use the 4mm Allen wrench to remove the two fixed bolts on the fan.



- Disconnect fan connector G77.
- Remove the exhaust fan.



2) Installation

The installation process is the reverse of the removal process.



4.6.10 Horn

4.6.10.1 Removal

1) Open the foot pedal. Refer to 4.2.7 Foot Pedal Assembly for details.

2) Remove the connector G07 of the electric horn.

3) Use a 10mm socket or an open-end wrench to loosen the bolts and remove the electric horn.



4.6.10.2 Installation

The installation process is the reverse of the removal process.



4.6.11 Reversing Buzzer

4.6.11.1 Removal

1) Open the rear cover plate assembly.
Refer to 4.2.4 Rear Cover Plate Assembly for details.

2) Disconnect the connector G23.

3) Use the 8mm Allen wrench to remove fixed bolts.



4.6.11.2 Installation

The installation process is the reverse of the removal process.



4.6.12 Emergency Power Off (EPO) Switch

4.6.12.1 Removal

1) Remove the handbrake cover assembly. Refer to 4.2.2 for details.

2) Remove emergency power knob (by pressing red button), and unscrew the closing ring as well as washer.



3) Remove the EPO switch on the microswitch. Refer to 4.6.12 Emergency Power Off (EPO) Switch for details.

4.6.12.2 Installation

The installation process is the reverse of the removal process.



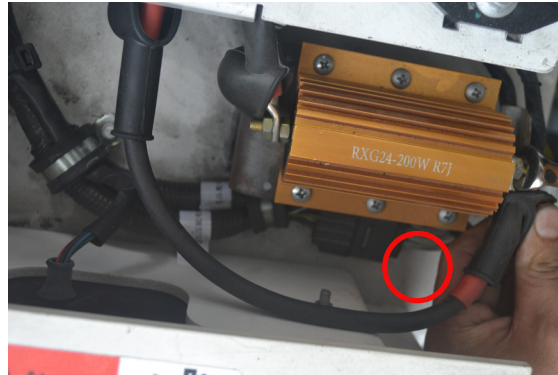
4.6.13 Voltage Divider

4.6.13.1 Removal

1) Open the rear cover plate assembly. Refer to 4.2.4 Rear Cover Plate Assembly for details.

2) Use the 10mm socket wrench to remove connecting lines on both sides of the voltage divider.

Use the cross screwdriver to remove fixing bolts.



4.6.13.2 Installation

The installation process is the reverse of the removal process.



4.6.14 Angle Sensor

1. Removal

1) Rotate the steering wheel to the right and leave space between the tire and angle sensors for operation.

2) Unplug the angle sensor connector G17.



3) After removing fixing screw for the angle sensor with a cross screwdriver, take down the angle sensor.



4) Refer to 6.2.5 for information on steering sensor calibration.

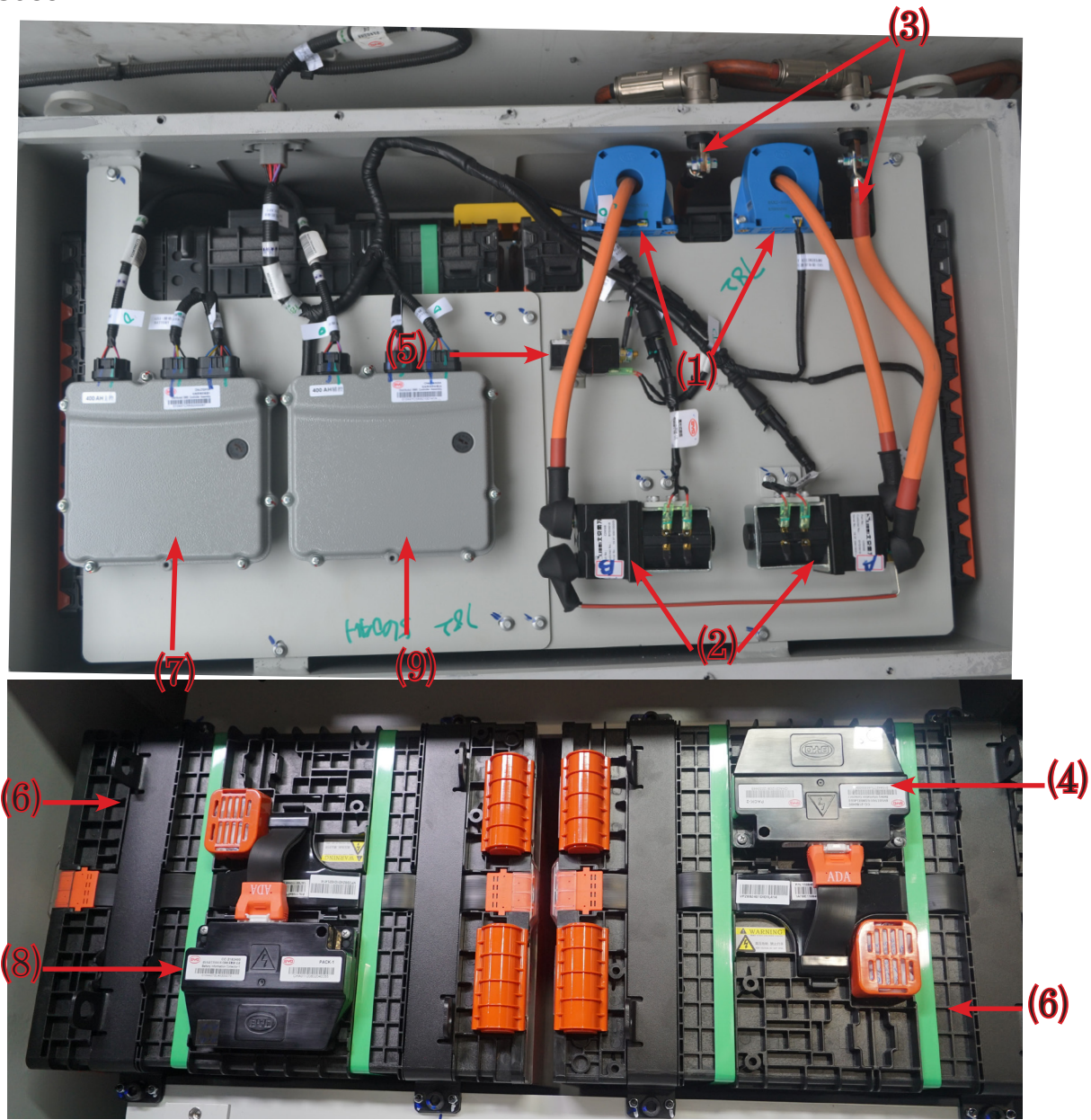
2. Installation

The installation process is the reverse of the removal process.



4.7 Maintaining Battery

4.7.1 Overview of the Battery Case



- 1. Hall sensor
- 2. Charge-discharge contactor
- 3. Power line of the battery module
- 4. Battery Information Collector 2
- 5. Controller contactor
- 6. Battery module
- 7. Battery manager system (main)
- 8. Battery Information Collector 1
- 9. Battery manager system (auxiliary 1)

The explanation for the above parts is as follows:

- 1) Hall sensor is used to detect whether the battery module current is normal.
- 2) The charge-discharge contactor belongs to the battery assembly.
- 3) The battery module power line is used to connect 4 battery modules in series and parallel.
- 4) The Battery Information Collector 2, as one of a pair of battery information collectors, collects the information of the battery module, and is connected in series.
- 5) The controller contactor belongs to the battery assembly.
- 6) The battery module contains specific battery cells. Generally speaking, the 540ah battery module includes 4 battery cells. As the above figure shows, the 270ah battery module includes 2 battery cells.

- 7) There is one controller in a pair of battery modules (e.g., 2 series modules). But for more than one series modules, there will multiple controllers. For multiple controllers, the controllers will be divided into primary controller and secondary controller wherein the former receives information and sends control orders, while the latter sends information and receives control orders.
- 8) The Battery Information Collector 1, as one of a pair of battery information collectors, collects the information of the battery module, and is connected in series.
- 9) Refer to the seventh explanation.

Besides, extra explanation is as follows:

- 1) The order of the battery module can be changed.
- 2) Each connected BIC can collect information about the two battery modules in series and feed it back to the battery manager system.
- 3) There is one BMC in each of the two battery modules in series. BMC can collect battery information through BIC and manages the state of the battery in series.
- 4) When there are more than one pair of battery modules, two BMCs are required. Each pair of battery modules requires one BIC and separates the BMS as the master controller (marking main controller) and the slave controller (marking auxiliary controller).
- 5) There are only two types of BIC (there shows 2 parts codes) in any pair one. If the BMC is different, while BIC is marked as the same (pack 1 or pack 2), these two BIC can be exchanged.
- 6) Check the wire harness related to BMC and BIC and mark the wire harness as MA and SA.
- 7) To determine whether BMS needs to be maintained, refer to 6.2.6 Introduction of Software Parameter for details and make a judgment based on the failure phenomenon.

4.7.2 Opening the Battery Case

1. Open the front cover plate assembly. Refer to 4.2.5 for details.

2. Use a wrench to loosen the screw on the upper cover plate of the battery box.

3. Lift the upper cover plate of the battery box to expose the parts inside the battery box. Refer to 4.7.1 Overview of the Battery Case for details.



NOTE

- Sealant requirements after reworking battery pack:
 - 1) Remove previous glue residue.
 - 2) It should be continuous and uniform when re-gluing , and no glue can be broken.
 - 3) The width is about 8mm, while the height is about 5mm.
 - 4) After the lid is flattened and tightened, a small amount of colloid can be seen to overflow.
- When maintaining the BMS, discharge-charge contactor, controller contactor, controller contactor, Hall sensor, there is no need to remove the battery box from the tractor, but just remove the upper cover plate of the battery box.
- When replacing the two collectors at the bottom of the BMS installation board, remove the electrical installation board first and then replace it.



4.7.3 Cleaning the Outside of the Battery Case

It is important to clean the outside of the battery box.

A clean battery box can achieve follows:

- Prevent the accident
- Lower down the possibility of damage
- Extend service life and running time



Warning

Do not use the chemical cleaner to clean the outside of the battery box.

1. Use a clean cloth and clean water to clear the outside of the battery.

Disconnect the connector before cleaning and do not touch the plug base.

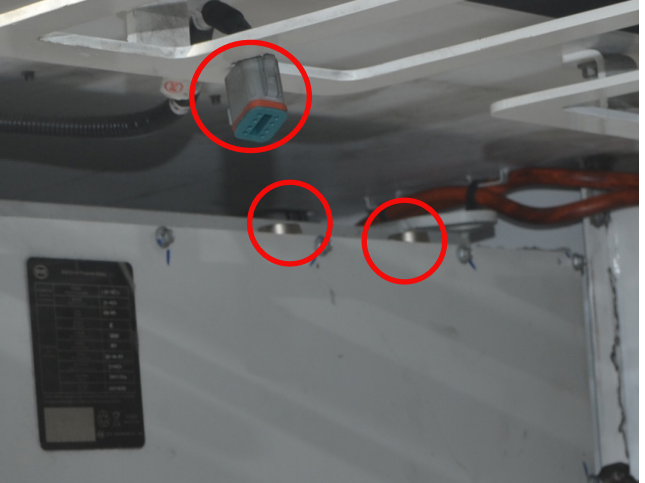
2. After cleaning the outside of the battery box, use compressed air or wet antistatic cleaning cloth (such as cotton cloth) to dry the outside of the battery box.



4.7.4 Removal, Replacement and Installation of the Battery Case

1. Open the front cover plate assembly. Refer to 4.2.5 for details.

2. Disconnect the connection between the positive and negative electrodes of the battery and the 8Pin connector and place the wire harness in the appropriate place. When the positive and negative wiring harness are removed, the foolproof button should be pressed and then pull the harness out. It cannot be pulled out without pressing the button.



3. Remove left and right fixing bolts on the battery box retaining bolts with a 13mm socket wrench.





4. Use the crane and chain to lift the battery off the tractor.



5. After replacing the battery box, lift the new battery box back to the tractor body.

NOTE

- Watch out the heavy battery box.
- 2T sling is for 540Ah battery module.



4.7.5 Battery Manager System (BMS)

Caution



Before maintaining BMS, refer to 4.7.4 Removal, Replacement and Installation of the Battery Case for details.

4.7.5.1 Check BMS

1) Check the power and voltage information displayed on the display. If there is no power displayed, it may be a fault about the display, or the BMS does not send out power and voltage information. Refer to the electrical fault code “The display shows that the power is 0% and the voltage is 0V”.

2) Use the software BYD_Forklift to check the battery information.

3) Check whether the 12V power supply fuse (located in the LV distribution box) of BMS, the wiring and connector terminals are normal.

4) If BMS itself is damaged, replace it and burn a correct procedure. Calibrate primary and secondary IDs of BMs as well as the total capacity information of BMS. Refer to the calibration specification of BMS.



4.7.5.2 Removal and Replacement of BMS

1) Removal

- Remove the upper cover plate of the battery box. Refer to 4.7.2 Opening the Battery Case for details.
- Loosen the BMS (main) connectors G50 MA, G51MB and G06 MC.
- Loosen the BMS (auxiliary 2) connectors G59 SA, G60SB, G12 MC..



- Remove the four fixing screws of the middle installation board and then turn over the installation board of the controller.
- Remove the four screws at the back of the controller and then remove the controller for replacement.

2) Installation

The installation process is the reverse of the removal process.



The new BMS should have completed program update and battery factory total capacity calibration.



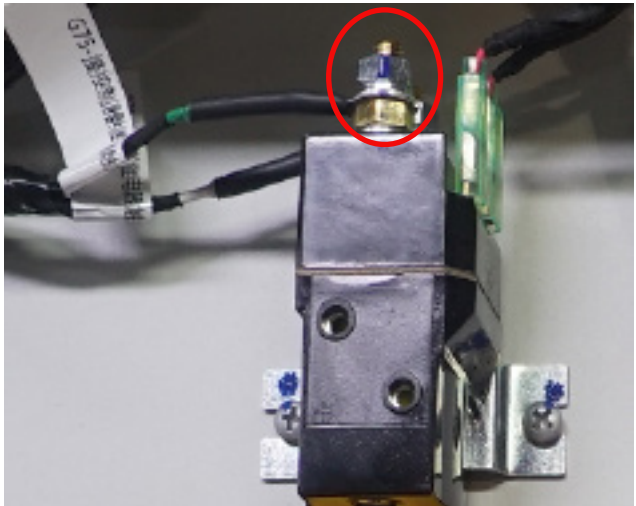
4.7.6 Controller Contactor of the Battery

4.7.6.1 Removal and Replacement

1. Check the contactor coil resistance and terminal. If necessary, use the multimeter to measure. Refer to the electrical fault code "The power and the voltage displayed on the display are normal, the "OK" light is not on, and the alarm is "No Driver". When switching the forward and backward gears, the display maintains the middle position "N", and the software cannot read the controller information.

2. Loosen the wiring G76 of the contactor coil.

3. Release the wiring G74 and G75 of the contactor terminal.



4. Loosen the two fixing screws of the contactor and then replace the contactor.

4.7.6.2 Installation

The installation process is the reverse of the removal process.

4.7.7 Charge-discharge Contactor

4.7.7.1 Check and Replacement

1. Check whether the resistance value of the charge-discharge contactor coil is about 9.5Ω when the system is power off.

2. Use a 17mm socket or open-end wrench to disconnect the power line. Wrap the power line terminals with insulating tape to prevent short circuits.



3. Because the structure is welded, loosen the wiring of the contactor coil in the following two ways:



- Use a soldering iron to melt the wiring plate of the contactor coil and then replace a new contactor. Use electric soldering iron and solder for reconnection.

- Replace the entire charge-discharge contactor (A) and related connector G95

- Replace the entire charge-discharge contactor (B) and related connector G96

4) Loosen the contactor holder with a socket (10mm) or an open-end wrench and replace the contactor.



4.7.7.2 Installation

The installation process is the reverse of the removal process.



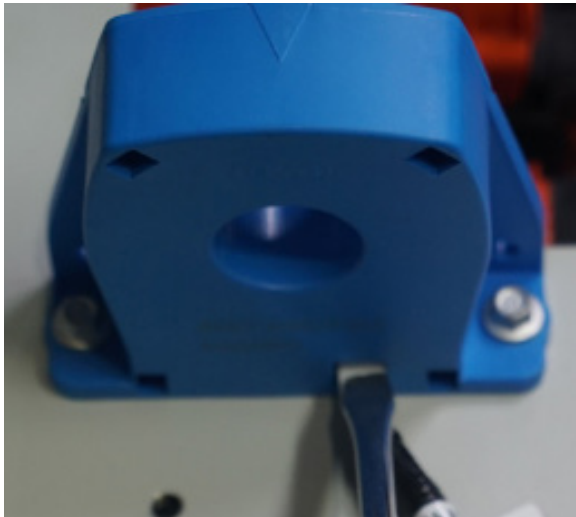
4.7.8 Hall Sensor

4.7.8.1 Check Hall Sensor

1) Without opening the battery box, use BYD_Forklift software to monitor whether the current value of the current Hall sensor is normal when operating the tractor or charging.

Refer to the faults “BATTERY LOW” and “LOW VOLTAGE”.

2) After opening the battery box, check whether the connector terminal of the hall sensor is loose. Use a slotted screwdriver to pick up the buckle, and take out the connector port.



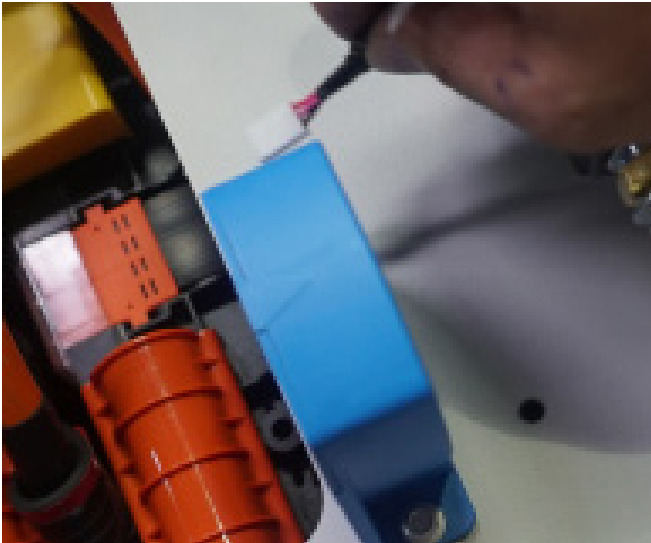
3) If the Hall sensor is damaged, replace it.



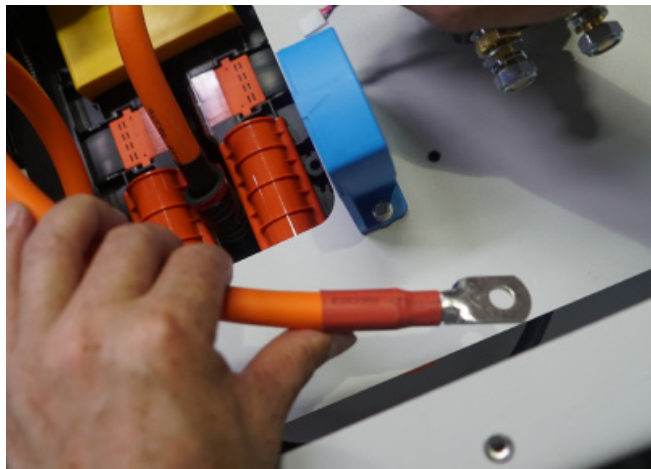
4.7.8.2 Replacement

1) Take out the connector

- Hall A G82
- Hall B G97



2) Disassemble the power line from the Hall sensor to the charging-discharging contactor and wrap the lug of the power lines with insulation tape.



3) Loosen the bolts on the Hall sensor and then replace the sensor.

4.7.8.3 Installation

The installation process is the reverse of the removal process.



There is arrow direction on the Hall sensor.

4.7.9 Battery Case Connector Base

 Danger

Wear insulating gloves. Before removal, cover the wiring of the terminal post of the contactor with insulating material. It can prevent the short circuit caused by the tool attaching to the contactor and the terminal post wherein the positive electrode of the contactor is directly connected.

Use the insulating tape to wrap the positive and negative wires (the orange sleeve is the positive electrode, and the black sleeve is the negative electrode) of the power supply that have been removed to prevent the short circuit. Refer to 4.7.8 Hall Sensor for details.

4.7.9.1 Check and Replacement

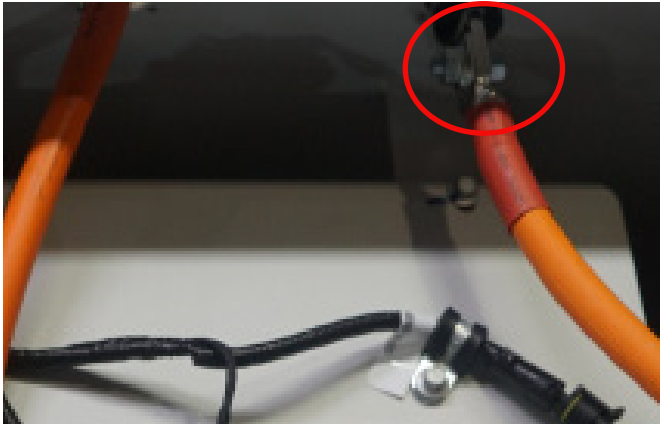
1) Disconnect positive electrode, negative electrode and battery pack plug G80.

2) Visually check whether the positive and negative connectors are damaged without opening the battery box.



3) Remove the upper cover plate of the battery box. Refer to 4.7.4 Removal, Replacement and Installation of the Battery Case for specific diagrams.

4) Use the 13mm socket wrench to remove the positive power wire and negative power wire on the battery box. Remove the connector harness holder with a screwdriver.



5) Check the diagnostic wire. Refer to the Chapter Troubleshooting for details.

6) Replace the diagnostic wire. Refer to the relevant wire harness for details.

 Warning

- Positive and negative power wire lugs must be wrapped with insulating tape.

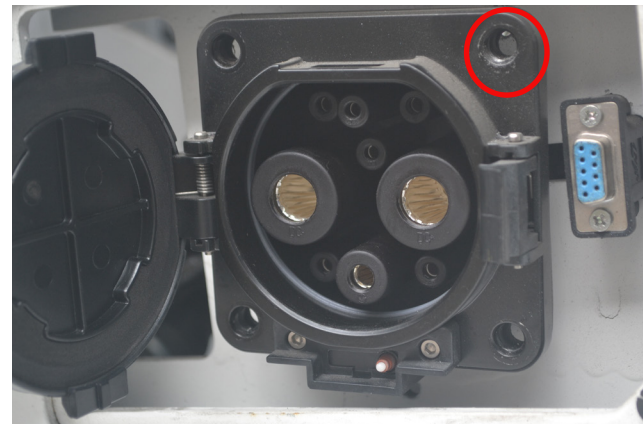
4.7.9.2 Installation

The installation process is the reverse of the removal process.

4.7.10 Charging Port Base

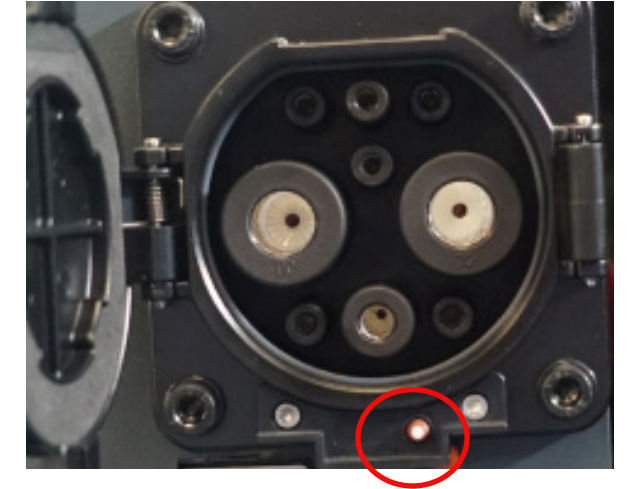
4.7.10.1 Check and Replacement of the Charging Base

- 1) Open the charging door.
- 2) Open the rear cover plate assembly.
Refer to 4.2.4 Rear Cover Plate Assembly for details.
- 3) Use the 17mm socket or open-end wrench to remove fixed nuts on the main contactor stud connected to the positive electrode.
- 4) Use the 13mm socket or open-end wrench to remove fixed nuts on the main controller copper bar connected to the negative electrode.
- 5) Remove the fixed bolts for the bond strap.
- 6) Unplug connectors G102/G03/G86.
- 7) Use the 5mm Allen wrench to remove fixed screws.



4.7.10.2 Check and Replacement of the Fool Proof Switch

1) Check the fool proof switch. Refer to the fault "When the lid of the charging base is not closed, the display alarms "the charging door is not closed and the tractor cannot drive".



2) Refer to 4.7.9 for details.

3) Disassemble the two hexagon screws at the bottom of the fool proof switch with the Allen wrench (2mm).



4) Unplug the connector G102 of the fool proof switch.

5) Remove the fool proof switch. Pull out the switch connector and replace it.



4.7.11 Battery Information Collector (BIC)

4.7.11.1 Check

1) Check whether the voltage displayed on the display is normal. If the voltage displayed is half of the normal voltage or 0V but the power is normal (if the voltage is 0V and the power is 0%, BMS may be faulty), it can be judged that the collector is faulty. Refer to the fault code “The display shows that the power is normal, and the voltage is 0V or 40V.” for check process.

2) Use the software BYD_Forklift to check and judge whether the collector 1 or collector 2 or both collector 1 and collector 2 are faulty.



4.7.11.2 Replacement

1) Remove the upper cover plate of the battery box and disconnect the corresponding power line. Remove the installation board of the BMS.

2) Remove the installation board (electrical installation board) of the BMS. Unplug the corresponding connectors of BIC and replace it directly.

3) Remove the screws on BIC with a screwdriver and replace it.



4.7.11.3 Installation

The installation process is the reverse of the removal process.



4.8 Motor

4.8.1 Bearing of the Motor

 Warning



Although the bearing appears to be in good condition, the bearing race could be deformed and may produce noise and vibration when assembled. The motor could experience premature bearing failure.

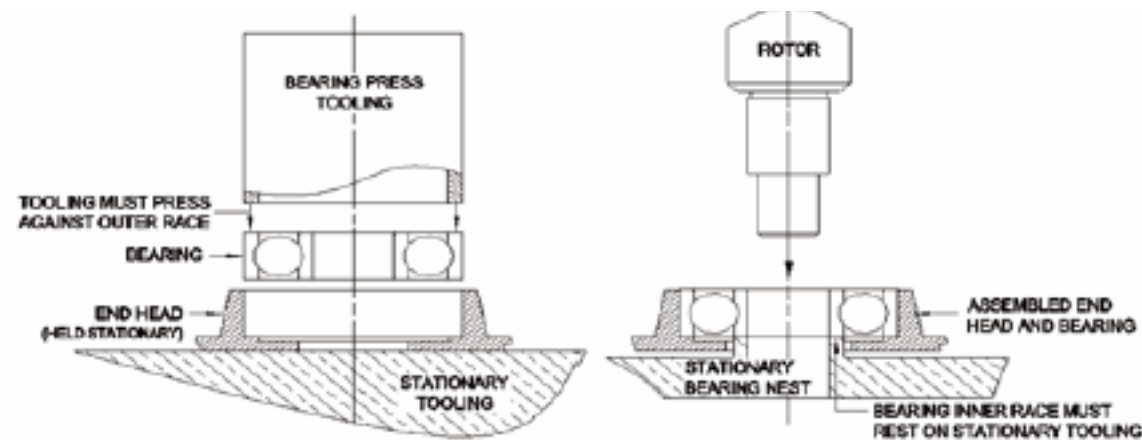


Improper disassembly can cause damage to the bearings.



It is recommended that any time the motor is disassembled that new bearings are installed.

When installing the new bearing, always press against the race that is absorbing the pressure or bearing damage may occur. See the following figure for proper installation method.



4.8.2 Terminal Nut

 Caution



Before removing the large fuse or motor cable, discharge first. Then turn off the key switch and disconnect the power.



VFD (Variable Frequency Drive) and motor ring terminals must be assembled back to back; the terminal studs, washers and nuts are for clamping only.



The ring terminals are the current carrying members of the connection and must be clamped together with outer hardware.

1. When disconnecting and reconnecting any power supply connected to the motor, tighten the motor cable with a torque wrench. It can prevents that the nuts are too tight and the motor is damaged.
2. Use the wrench to tighten the fixing nuts on the stud terminal.
3. Adjust the torque of the fixing nuts on the stud terminal and for the motor cable to 100-120 in.lb (11.2-13.6 N·m). Pay attention to regular maintenance (refer to user manual).
4. Adjust the torque of the fixing nuts on the motor to 45-55 in.lb. (5.0-6.2 N·m).



4.8.3 Test of the Motor



Warning

LVAC motors are intended to operate with a variable frequency drive/control. Otherwise, the LVAC motor will cause danger during operation.

A Test Specification is available for each AC motor and can be modified upon request from AMD. This specification will include unloaded and loaded test conditions.

For motors with 2 end heads:

We recommend to test each reassembled motor in an unloaded state. The specific steps are as follows:

- Display voltage and frequency by connecting phase
- Use a tachometer to ensure the RPM on the shaft is within the motor specification. Normally an unloaded motor will run at a speed at or just below an RPM of 120. The standard pole count for LVAC motors is four, so a standard motor operated at 30hz will reach nearly 900RPM uncoupled from a load source.

For motors with 1 end head:

It is impossible to run this type of motor prior to mounting back into its application. We recommend that the motor is mounted back into the application and consult the operation manual of the gearbox, transaxle or wheel drive provider.

- Refer to 4.4.4 Replacing Drive Unit for information on replacing the drive motor.



4.8.4 Pump/Steering Motors

4.8.4.1 Removal



Warning

Before removing the pump/steering motors, place a dry cloth under the bottom of the oil pump.

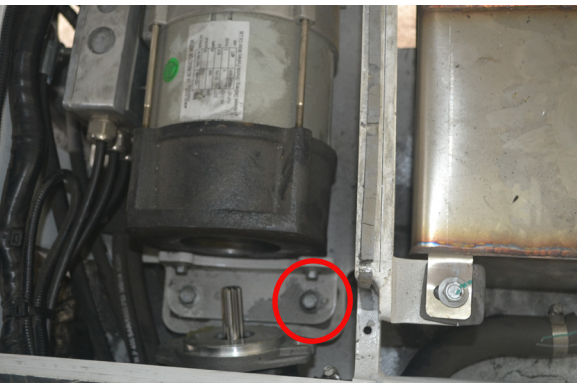
1) Open the foot pedal assembly. Refer to 4.2.7 Foot Pedal Assembly for details.

2) Remove the encoder plug T02 and the plug T01 of the temperature sensor wire.

3) Separate the pump and the motor. Then use the socket wrench to remove the two fixing bolts (10mm) connecting the pump and the motor.

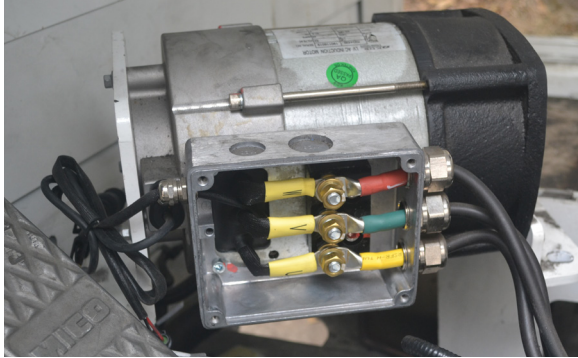


4) Remove four foot-pad bolts with the 13mm wrench and then remove the motor.





5) Open the wire box of the pump motor with a cross screwdriver (13mm). Remove the wire of U, V and W phases separately with a 16mm wrench.



4.8.4.2 Installation

- 1) Install the U, V and W phase lines.
- 2) Install the wire box of the lift motor.
- 3) Install the connectors T01/T02.
- 4) Move the motor into the installation position.
- 5) Refer to 4.8.5.1 Removal for details.



Watch out the heavy motor.



4.8.5 Speed Sensor

4.8.5.1 Speed Sensor of the Steering Motor

1) Removal

- Remove the encoder plug T02 of the motor. Refer to 4.8.4 Pump/Steering Motors for details.
- Remove a screw of the speed sensor from the right side of the motor with a 5mm Allen wrench.



- Remove the speed sensor of the steering motor.

2) Installation

The installation process is the reverse of the removal process.

4.8.5.2 Speed Sensor of the Drive Motor

- Remove the left drive wheel. Refer to 4.3.1.6 Removing and Installing Wheels for details.
- Remove the speed sensor of the drive motor. Refer to 4.8.5 Speed Sensor of the Steering Motor for details.





4.8.6 Power Unit Motor

4.8.6.1 Removal

1) Cut off the power supply of the entire tractor and push the button of rear cover assembly.



2) Open the rear cover. The power unit motor is located as shown in the figure.



3) Remove the high and low voltage wiring harness above the power unit motor. Remove the two M6 Allen fixing screws for fixing the motor. After replacing the motor, lock the screw and connect the relevant wiring harness.



4.8.6.2 Removal and Maintenance

1) Take down the power unit motor.



2) Remove the two screws for fixing the upper and lower end covers.



3) Remove the carbon brush powder on the motor (refer to 5.5 Regular Maintenance for details on maintenance period).



Clean the upper end cover.

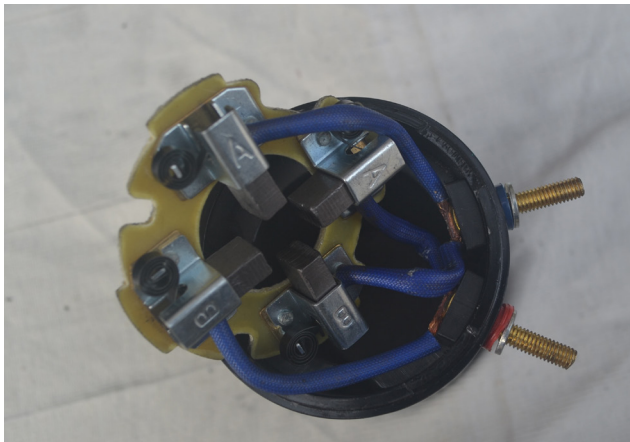


4.8.6.3 Replacing Carbon Brush

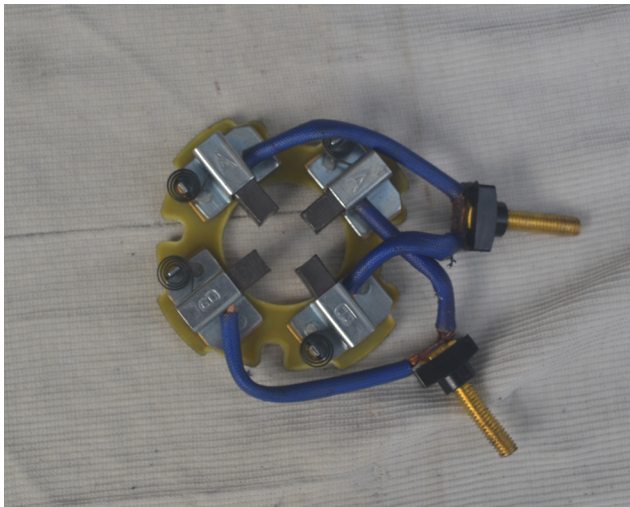
1) Refer to 4.8.6.2 Removal and Maintenance for details.



2) Remove bolts for fixing the rotor and carbon brush.



3) Take down the carbon brush assembly.



4) Buckle the spring and remove the carbon brush for replacement/maintenance



4.8.6.4 Installing Carbon Brush

The installation process is the reverse of the removal process.

NOTE

- 1) Install two carbon brushes symmetrically (A and B).
- 2) Take marks (installation position/upper and lower end covers) before disassembly.
- 3) The upper end is covered with a corrugated pad.



4.8.6.5 Maintaining Power Unit Motor

In order to ensure the normal operation of the motor, we should monitor and maintain the motor based on requirements of the actual working conditions. Besides, we should also carry out regular inspection and maintenance of the motor. It can eliminate some faults in time and ensure the safe and reliable operation of the motor. Maintenance period of the power unit motor is 6 months.

Specific steps for maintenance are as follows:

- Clean the dust and oil stains outside the motor in time.
- Check if fasteners outside the motor are loose.
- Check and clean the wiring terminals of the motor. Check if bolts for outlet wiring are loose.
- Check the length (initial length: 19mm) of the carbon brush. Generally, it can not be less than two fifths of the initial length. If the carbon brush is damaged, replace it or the entire motor.
- Check whether the carbon brush can slide freely in the brush holder, and whether the brush spring has reliable strength. Ensure that the carbon brush can contact the rotor commutator surface completely.
- Check whether the rotor commutator surface is greasy and burnt by electric spark. If so, you can carry out polishing and cleaning treatment on the surface of the commutator. If it does not work, please replace the entire motor.

- Check and maintain bearing. Clean the oil and dust in the bearing room of the front and back end covers. Hold the bearing by hand to rotate it. If abnormal sound is found or it does not rotate inflexibly, replace the bearing in time. If it is used in high temperature, poor and dusty environment, check the status of bearings frequently.
- Insulation performance of the motor can be reduced by the following factors: insulation inspection of the motor, damp working environment or corrosive liquid or gas. The most common phenomenons are the grounding of the motor winding, and the insulation damage of the motor. Faults will appear on the charged part of the motor and the metal part of the uncharged. It not only directly affects the normal operation of the motor, but also reduces the service life of the DC power supply. Therefore, the insulation performance of the motor should be checked frequently. You can use voltage tester to test the motor. If there is no leakage alarm under AC600V, 2mA, and the test lasts 1s, it will be regarded as normal.
- When using the motor, the motor can not be overloaded. Otherwise, it will rapidly improve the overall temperature of the motor. Besides, it is very easy to damage the parts inside the motor and the insulation performance fails to reach the standard. That is, the motor can not run normally.

4.9 Hydraulic Parts

4.9.1 Hydraulic Oil

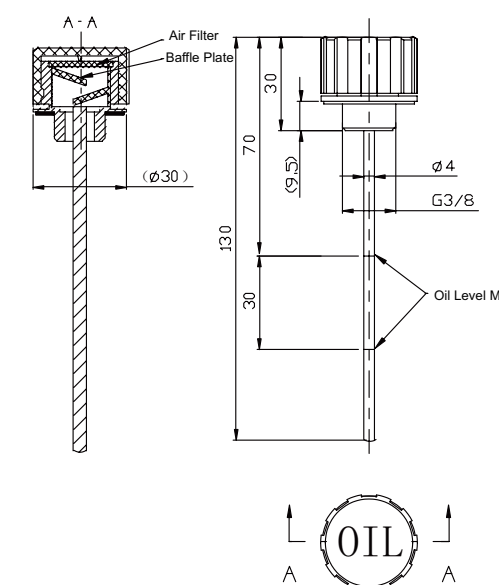
4.9.1.1 Checking Hydraulic Oil Level



Warning

Before checking the hydraulic oil level, park the tractor on a flat ground, pull down the handbrake, turn off the tractor, remove the key and press the EPO switch.

- 1) Open the foot pedal assembly. Refer to 4.2.7 Foot Pedal Assembly for details.
- 2) Pull out the oil scale, wipe the oil with clean cloth, and then insert the oil gauge into the tank.
- 3) Pull out the oil scale again and check whether the level of hydraulic oil is within the scale.



4) If the hydraulic oil level is below the scale, open the oil tank cover for filling (steering oil tank).

5) Open the rear cover plate assembly. Refer to 4.2.4 Rear Cover Plate Assembly for details. If the hydraulic oil level is below the scale, open the oil tank cover for filling (brake oil tank).



4.9.1.2 Selecting Hydraulic Oil

! Danger

Hydraulic oil cannot be mixed.

! Warning

Using unapproved hydraulic oil will damage the hydraulic system. Please use hydraulic oil as required.

For more information on hydraulic oil type selection, please refer to 6.6 Accessories in this manual. If you need to use other specifications of hydraulic oil, please contact BYD forklift sales personnel.

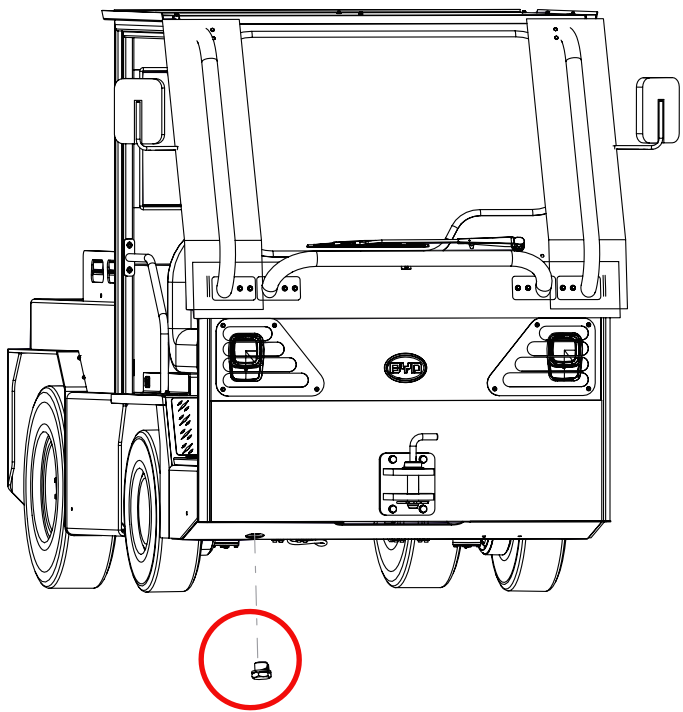
Model of hydraulic oil:

ISO VG46 (40~60°C), ISO VG6 (>60°C)

4.9.1.3 Replacing Hydraulic Oil (Steering and Brake)

1) Draining Waste Hydraulic Oil (Steering)

- Using trenches or jacks, leave enough distance at the bottom of the tractor to drain the oil.
- Pull down the handbrake, turn off the tractor, remove the key and press the EPO switch.
- Place a container at the lower end of the oil drain port of the tank, unscrew the oil drain plug and drain the hydraulic oil.
- Check whether the sealing ring of the oil drain plug is intact, and replace the oil drain plug if necessary.
- Install and tighten the drain plug, and then add a small amount of new hydraulic oil to check whether there is oil leakage. If necessary, retighten or replace the drain plug.





- Replace brake hydraulic oil in power unit.
Refer to steering hydraulic oil for details.

NOTE

If the hydraulic oil is contaminated, you should find and determine the source of contamination.

2) Filling in New Hydraulic Oil

Caution



Pay attention to the surrounding environment when refilling to prevent dust and moisture from entering the tank.

- Unscrew the cover of the hydraulic tank and fill the tank with new hydraulic oil.
- Add new hydraulic oil to the hydraulic tank until the hydraulic oil appears in the oil gauge.
- Check the hydraulic oil level in the tank.
For details, see 4.9.1 Check Hydraulic Oil Level.
- Once adding the proper amount of hydraulic oil, put the cover back to the hydraulic oil tank.
- Remove the remaining hydraulic oil from the surface of the tank, the bottom of the tractor body and the work area.



4.9.2 Return Oil Filter

Warning



After replacing the return oil filter or filter element, start the hydraulic system to check for oil leakage.

1. Remove the return oil filter.
2. Open the foot pedal assembly. Refer to 4.2.7 Foot Pedal Assembly for details.
3. Drain oil from the hydraulic system first.
Refer to 4.9.1.3 Replacing Hydraulic Oil (Steering and Brake) for details.



4. Use the 10mm socket wrench to unscrew the fixing screws of the return oil filter and then loosen the return oil filter.





5. Disconnect the return oil tube from the return oil filter. Use the wrench to remove the clamp and pull out the oil tube.



6. Replace the return oil filter.



For filter replacement time, please refer to 5.5 for regular maintenance.



4.9.3 Steering Gear

4.9.3.1 Preparing Tools

- 27mm open-end wrench
- 24mm open-end wrench
- 22mm open-end wrench
- 13mm socket + ratchet

Caution



Before removal, place some rags under the steering gear. After removal, block the oil pipe with the plug.

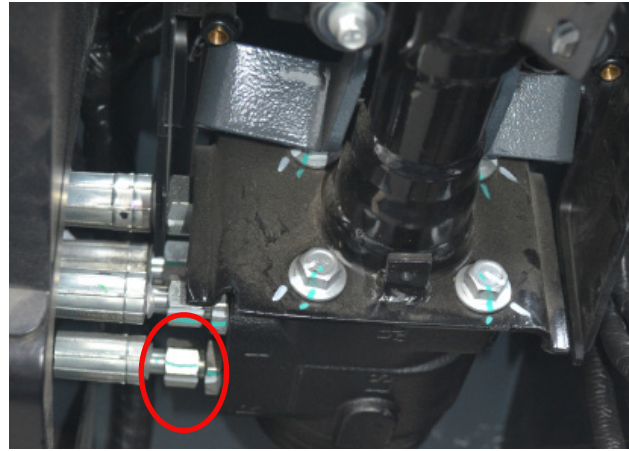
4.9.3.2 Removal

1) There is no need to drain oil. After removing oil tube, place the oil pipe port towards or add a plug.

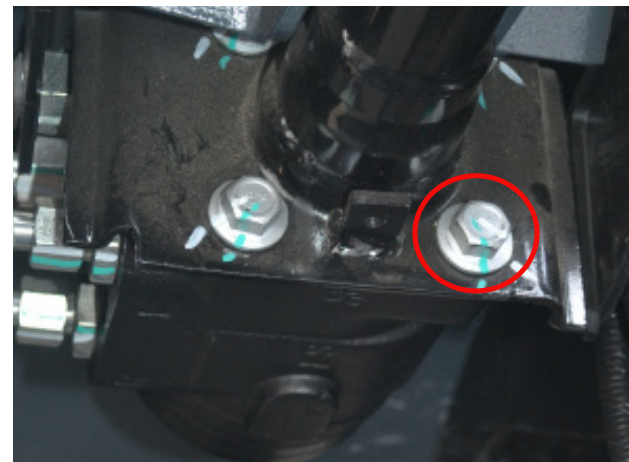
2) Remove the rear end of the combination switch cover. Refer to 4.3.4 Combination switch for details.



3) Disconnect the oil pipes on the steering gear (return oil pipe of the steering gear/oil pump output oil pipe/steering oil output pipe 1/steering oil output pipe 2).



4) Remove the fixing nuts connecting the steering gear and steering pipe (13mm socket).



5) Take out the steering gear and the hydraulic connector on the steering gear.

NOTE

Disassemble and mark each oil pipe. Correspond to each oil pipe according to the mark during installation.

4.9.3.3 Installation

Caution



When installing the steering gear, it should be docked with the connecting shaft teeth for insertion.



During installation, tighten each oil pipe joint 1/4 turn, and then tighten it again.

1) Install the oil pipe joints of the steering gear.

2) Tighten the fixing bolts connecting the steering gear and flange.

3) Install oil pipes (return oil pipe of the steering gear/oil pump output oil pipe/steering oil output pipe 1/steering oil output pipe 2).

4) For details, please refer to 4.9.3.2 Removal.

4.9.3.4 Checking After Completion

1) Start the tractor, turn in place and test whether the function is normal.

2) Check oil pipe joints for oil leakage.



4.9.4 Hydraulic Pump

4.9.4.1 Preparing Tools

- Straight screwdriver
- 27mm Open-end wrench
- 13mm Socket wrench + ratchet
- 36mm Open-end wrench

4.9.4.2 Removal

1) Drain the hydraulic system. Refer to 4.9.1 Replacing Hydraulic Oil for details.

2) Remove the hydraulic pump. Refer to 4.8.5 Pump/Steering Motors for details.

3) Disconnect the High pressure oil outlet tube joint.

4) Loosen the clamp on the oil inlet tube with a slotted screwdriver. Then pull out the oil inlet hose of the hydraulic pump.



5) Use the 13mm socket wrench to loosen the fixed bolts of the hydraulic pump.



6) Remove the ydraulic pump and its joint.

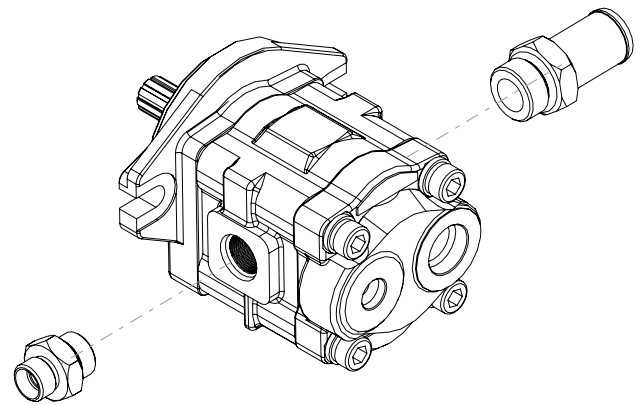


Before removing the hydraulic pump, the hydraulic oil in the oil tank must be drained.

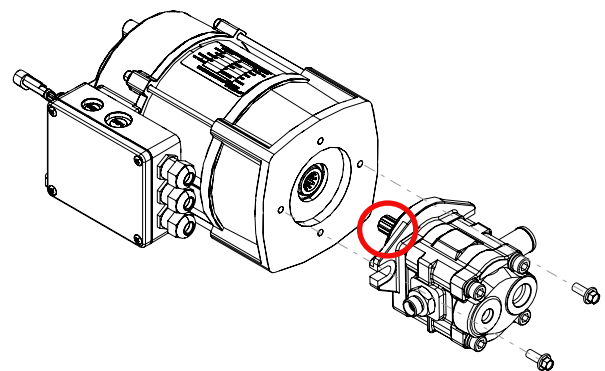


4.9.4.3 Installation

1) Install the oil pipe connector.



2) Connect the hydraulic pump to the pump motor. After pre-coating the hydraulic pump with hydraulic oil, turn the gear and insert it into the hole of the pump motor. Tighten the fixed bolt.

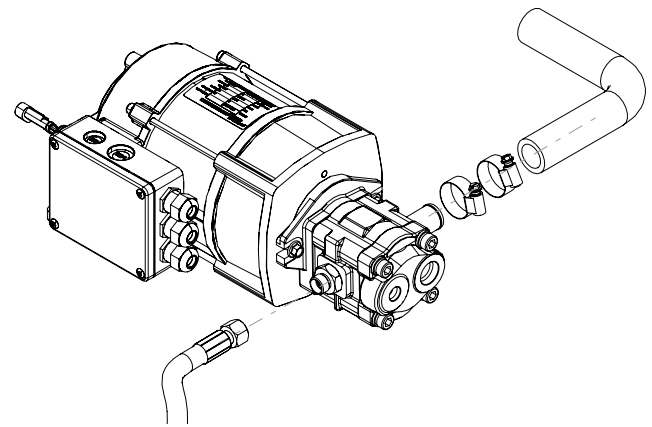


3) Model of the hydraulic oil:

ISO VG46 (40~60°C), ISO VG6 (>60°C)



3) Install the oil inlet and outlet pipes of the hydraulic pump and tighten the type-B worm drive pipe hoop.



NOTE

When tightening the B-type worm-driven pipe hoop, the two clamps are tightened alternately.

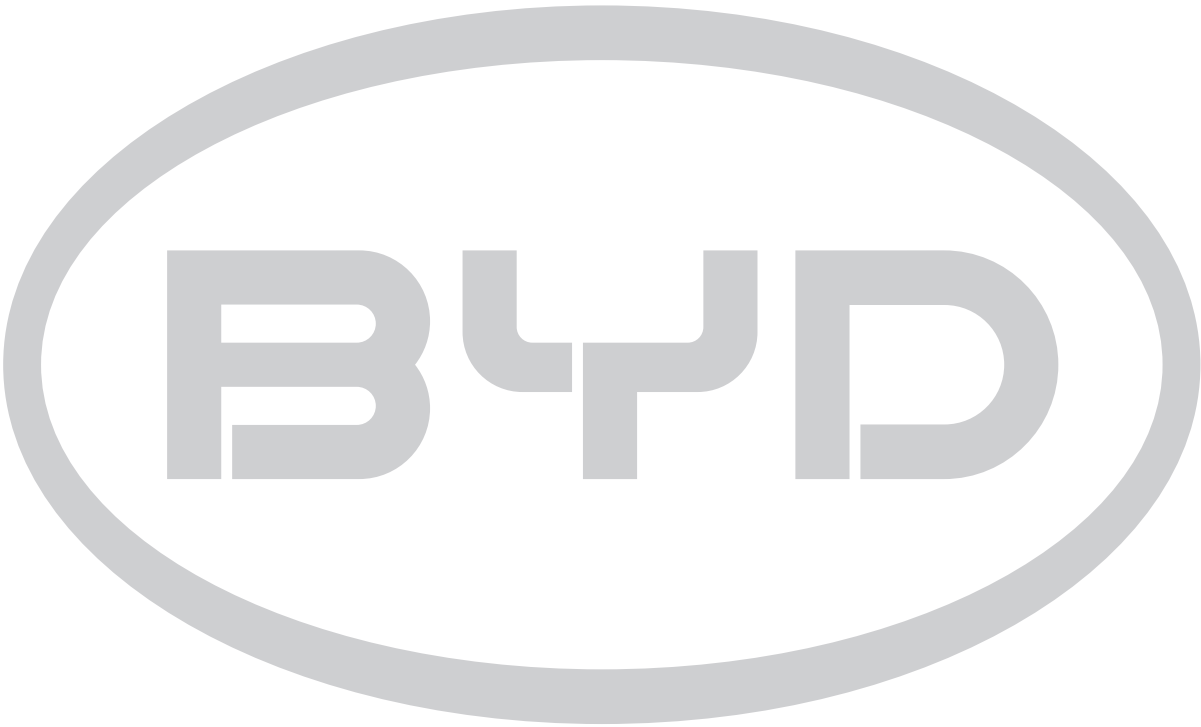
4.9.4.4 Checking After Completion

1) Start the tractor, turn in place and test whether the function is normal.

2) Check oil pipe joints for oil leakage.



5 Maintenance Routines





5.1 Maintenance Content and Basic Requirements

Use maintenance procedures to ensure:

- The optimization of tractor performance
- The longest service life of the tractor
- Reduced downtime and reduced costs
- The unnecessary repairs are avoided

The maintenance of the tractor mainly includes:

- Lubrication
- Cleaning
- Checking
- Repairing

Maintenance personnel must be familiar with the technical details of the T250F tractor. Read and understand all manuals and safety-related instructions.

Only professional maintenance can guarantee the long-term trouble-free operation of T250F tractor. Recording maintenance dates and maintenance items in the maintenance log helps to monitor the maintenance progress.

BYD can supply original spare parts for T250F tractor. It is recommended to sign a maintenance agreement with BYD to obtain qualified, authorized and efficient maintenance services.



- 1) Perform all inspections and maintenance within the recommended time period.
- 2) The time intervals in this manual are based on the normal operating environment. When operating the tractor under abnormal or harsh environments, the frequency of the maintenance services should be increased to ensure the good operation of the tractor.



5.2 Basic Safety Principles

		Danger		Read and understand this manual and tractor manual carefully before maintaining tractor. Observe the safety regulations strictly during the maintenance of the tractor.
		Daily and weekly inspections are limited to properly trained tractor operators and maintenance personnel. Only trained maintenance personnel can carry out other maintenance operations. The proper maintenance of the tractor is specified in the warranty. All spare parts must be original ones.		Daily inspections are also required during weekly inspections. The maintenance cycle is subject to the date first.
		Before opening the motor or electrical system protective cover, turn the tractor's start switch / key switch to the off position.		This manual specifies the proper maintenance of tractor. All spare parts must be original ones.
		Do not make any changes or repairs that may weaken the tractor structure or endanger safety.		Clean hydraulic oil must be used in the hydraulic system. Be sure to add oil through the oil filter.
		Insulating gloves must be worn during electrical maintenance.		Remember that the surfaces of the hydraulic system and motor may be hot.
				When disassembling hydraulic parts, the hydraulic pressure must be released in advance.



All earrings, watches and other metal jewelry must be removed during maintenance. If metal objects come into contact with conductive parts, it may cause a short circuit or burn the operator.



If you need to work under the tractor, you need to support the tractor on the jack.



All spare parts of the tractor must be original spare parts. Please contact BYD for original spare parts.



BYD assumes no responsibility for any modifications made by customers to tractor and related parts without authorization from BYD.



Remove the operator's seat before the maintenance to keep the seat clean.



Keep the maintenance area clean. Oil, grease and water make the floor slippery.



It is recommended to sign a service agreement with a tractor dealer, and spare parts can also be supplied.

Only professional maintenance can guarantee the long-term trouble-free operation of the tractor. Recording the maintenance date in the maintenance log helps to monitor the maintenance procedures. Contact our service agency or tractor dealer for qualified, authorized and efficient maintenance services.



5.3 List of Routine Maintenance



⚠ Danger

If any problems affecting the safety or operation of the tractor are found, the tractor must be stopped immediately and the relevant authorized personnel must be notified immediately. The tractor can not be operated again until the problem is completely solved.



If the seat belt fails, the tractor can not be operated and a new seat belt must be replaced.



⚠ Caution

Keep the tractor's operating room clean and free of small stones and dust.



5.4 Routine Maintenance

Time and Items

The routine maintenance period is daily (or every 8 hours) and weekly (or every 40 hours), whichever comes first. For example, if the daily working time is less than 8 hours, the Truck should be inspected daily. If it is more than 8 hours, the Truck should be inspected every 8 hours.

Items to be inspected are listed as follows:

No.	Item	Daily	Weekly
		8h	40h
1	Appearance	Check	
2	Wheel	Clean	Clean, Tighten
3	Display	Check	
4	Warning device	Check	
5	Brake	Check	Check
6	Drive, steering and operation	Check	
7	Electrical system		Check
8	Cleaning		Clean
9	Other abnormalities	Check	



The inspection should be carried out before operating the tractor.

The last fault should be reviewed before the daily inspection is carried out.



5.4.1 Description

5.4.1.1 Appearance

- 1) Check the exterior of the tractor body for damage or deformation.
- 2) Check whether there is any leakage oil on the ground where the tractor is parked.
- 3) Check whether the nameplate and labels are complete.
- 4) Check whether the parts are loose or falling off.



If there is oil leakage, please confirm the location of the oil leakage and contact the after-sales personnel of BYD tractor.

5.4.1.2 Wheel

- 1) Check whether the wheel fastener is loose. If it is loose, tighten it.
- 2) Check whether there is debris embedded in the tire.
- 3) If the tire wear between left wheels and right wheels is uneven, or if the rim is damaged or bent, replace the tire.
- 4) Check the torque line. If it is misaligned, tighten it according to the torque requirement.

5.4.1.3 Display

- 1) Check whether the battery voltage and power on the Display are normal.
- 2) Check whether there is fault indication on the display.

5.4.1.4 Warning Device

- 1) Press the horn button to check whether the horn works normally.
- 2) Check whether other warning accessories work normally.

5.4.1.5 Braking Performance

- 1) Place the handle lever in the braking area when driving and check whether the braking performance is well.



5.4.1.6 Drive, Steering and Operation

- 1) Shake the control handle from all directions to check whether it is smooth and check if there is any abnormal noise during the operation.
- 2) Check whether the buttons can be used normally.
- 3) Check whether the fasteners are loose or falling off.

5.4.1.7 Electrical System

- 1) Check whether the electrical connection terminals are loose, and the loose parts should be tightened. Check whether the wire connector is abnormal. (such as burn marks, etc.)
- 2) Check whether the connection terminals of the main controller are loose, and the loose parts should be tightened. Check whether the fuse of the main controller is normal and replace it if necessary. Check whether the copper bar of the main controller has burn marks, and replace it if necessary.
- 3) Check whether the low-voltage fuse and the relay are normal, and replace them if necessary.



Before electrical inspection, the emergency stop button must be pressed and the power supply must be cut off.

5.4.1.8 Cleaning

Clean the tractor. Clean the dust and stains inside the tractor with a dry rag or air gun, and clean the tractor surface with a wet rag.

5.4.1.9 Other Abnormalities

Check for other abnormalities.



5.5 Regular Maintenance

Time and Items

The time of regular inspection and maintenance shall be whichever comes first. For example, if the working time is less than 250 hours in 6 weeks, the Truck should be inspected every 6 weeks. If it is more than 250 hours in 6 weeks, the Truck should be inspected every 250 hours and so on.

Category	Item	2 weeks 50	6 weeks 250h	3 500h	6 1000h	12 2000h	18 3000h	months hours
Chassis	Replacement of the gear oil						Replace	
	Lubrication of the steering axle		Lubricate					
	Tire	Check						
Hydraulic System	Replacement of the filter			First replace	Replace			
	Replacement of the air filter					Replace		
	Replacement of the hydraulic oil					Replace		
	Accumulator		First check		Second check	Check		
Electrical System	Electric			Check				
	Power unit motor				Remove carbon brush powder			
Others	Key fastener torque				Check			



If the working environment is harsh, the maintenance period should be shortened and negotiated with BYD after-sales personnel.



5.5.1 Description

5.5.1.1 Chassis

- 1) Replace gear oil.
- 2) Lubricate the steering axle.
- 3) Check the pressure of the pneumatic tire.

5.5.1.2 Hydraulic System

- 1) Replace the air filter.
- 2) Replace the return oil filter.
- 3) Replace hydraulic oil. (Braking and steering)
- 4) Check the accumulator pressure. (Refer to 4.5.4 for details.)

5.5.1.3 Electrical System

- 1) Check the circuit of the entire tractor.
- 2) Check fuse and relay.
- 3) Check the main controller.
- 4) Check the tightening torque of the three-phase wire of the drive axle motor every 6 months. (Refer to 9.1 and User Manual for details.)
- 5) Check the power unit motor and remove carbon brush powder every 6 months.



Disconnect from the battery before electrical inspection.

5.5.1.4 Others

Check the torque of key fasteners.



5.6 Accessories

Types, consumption and models of accessories

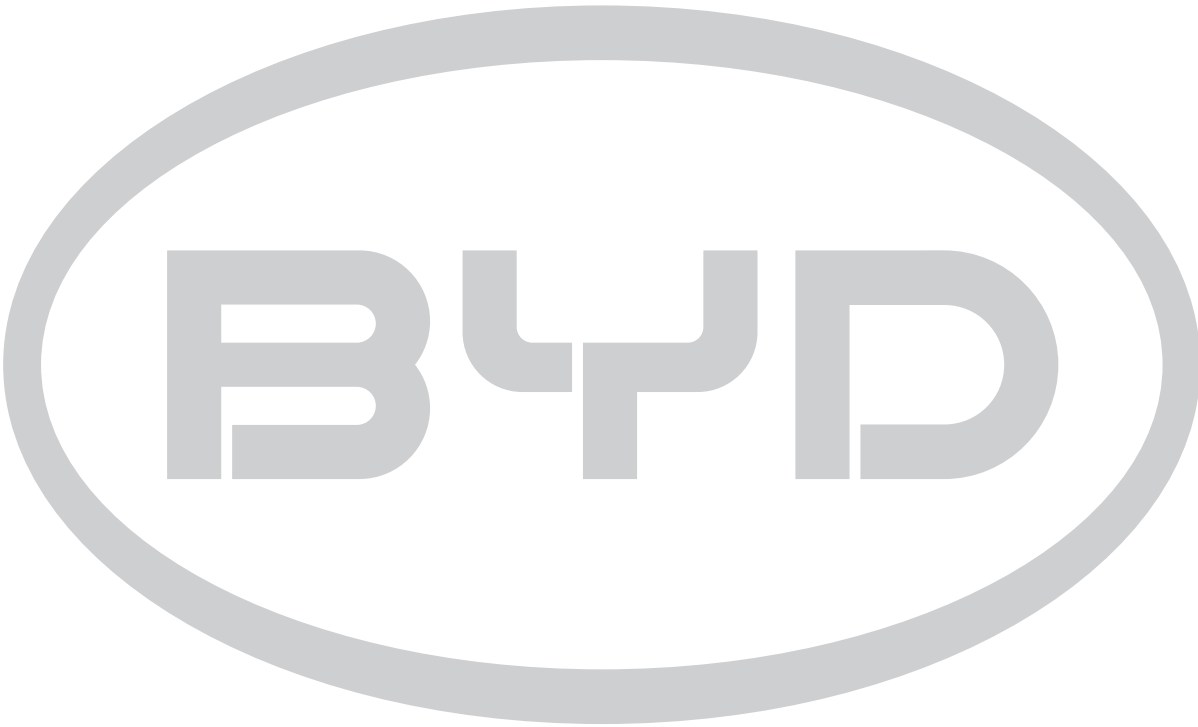
Item	Category	Consumption	Type
Replace gear oil	Gear oil	4L	SAE 80W / API GL4 / UTTO
Lubricate steering axle	Lithium grease	Appropriate	EP3
Replace steering hydraulic oil	Hydraulic oil	8L	ISO VG46 (40~60°C), ISO VG68 (>60°C)
Replace braking hydraulic oil	Hydraulic oil	3.5L	ISO VG46 (40~60°C), ISO VG68 (>60°C)



The consumption of accessories is the maximum amount which is for reference. Please follow the corresponding steps in the manual when replacing. The actual consumption is subject to actual conditions. If you have any questions, please contact your local BYD tractor dealer.



6 Program and Settings





The burning software is Codeloader-2.5, and the monitoring software is DriveTool-4.9 or higher version.

Chapter 6.1 introduces how to update the controller program (EPF file) of the tractor drive motor. This program is the control program of the tractor controller. Different types of tractor require different types of programs so as to complete the control of the tractor.

Chapter 6.2 introduces the BYD forklift application software. The interactive interface provided by this software can be used to observe and adjust some commonly used functions. It is recommended to be applied by general after-sales personnel.

Chapter 6.3 provides usage examples of the advanced version of the controller software drive tool. The software debugging method is more complicated, and only trained and certified technical personnel can operate.



6.1 Program Updating

Warning



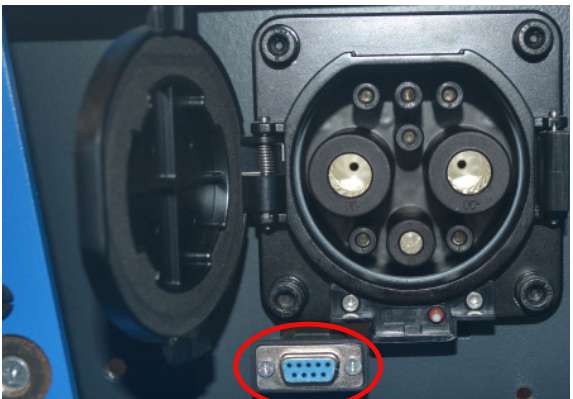
Before connection please first pull up the tractor parking brake and ensure ground safety!

6.1.1 Connecting the Truck and the Computer

1. Please use Kaveser data cable when connecting.



2. Use the Kaveser data cable to connect the diagnosis port of the tractor and the USB port of the computer. Keep the connection tight.





3. After connection, the "PWR" indicator on the Kaveser data cable is on all the time, which means the connection is normal.



NOTE

If "PWR" light is flashing, check whether the Kaveser data cable driver software is correctly installed on the computer.

6.1.2 Standard Operation Procedures of Updating Controller Program

1. Prepare the material for program updating. Necessary materials include Computer, Kaveser cable, and codeloader software with controller node program (usually in the same file).
2. Before updating, ensure all equipment works normally.
3. Drive the tractor to the maintenance spot on flat ground.
4. Pull back the hand brake of the tractor to the end.



6.1.3 Controller Node & Program Introduction

Warning



The screenshots shown in this manual are indicative and used as instructions for certain procedures or instructions. The contents of these screenshots should not be used as parameters for setting the tractor.

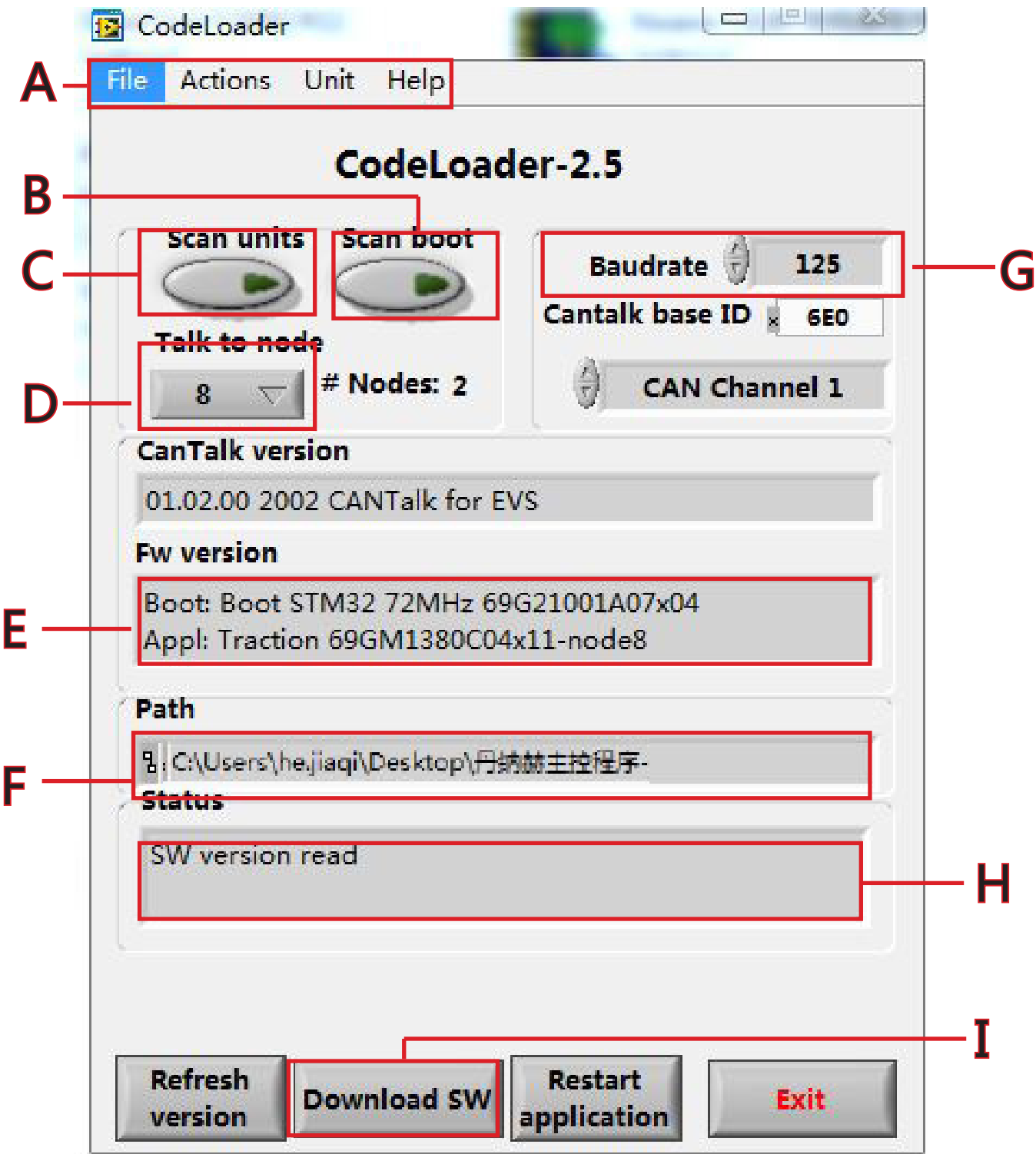
The tractor has 2 controllers, 1 driving controller and 1 steering controller:

- Driving controller is named as Node 8
- Steering controller is named as Node 5

If we are applying 2 types of controllers, we should apply 2 different programs, and each controller has their own program (EPF files).

- Node 8 is driving controller
- Node 5 is steering controller

6.1.3.1 Software Icons and Interfaces



- A. Menu Bar.
- B. Start scan button: when the node scan button cannot scan the node, click this button and restart the Truck.
- C. Scan Node Button: Click this button to scan the entire tractor node.
- D. Node selection: There are 2 nodes for tractor.
- E. Original program version number.
- F. Select the program path.
- G. Baud rate selection: According to the baud rate selection of the whole Truck communication, 125k is selected for this Truck.
- H. Status display.
- I. Button for program download: You can choose a program and download to the tractor.



6.1.4 Scan and Select the Node

6.1.4.1 Description of Program File

Warning

The EPF file will vary depending on the model or version upgrade.

The program file is shown in the figure below.

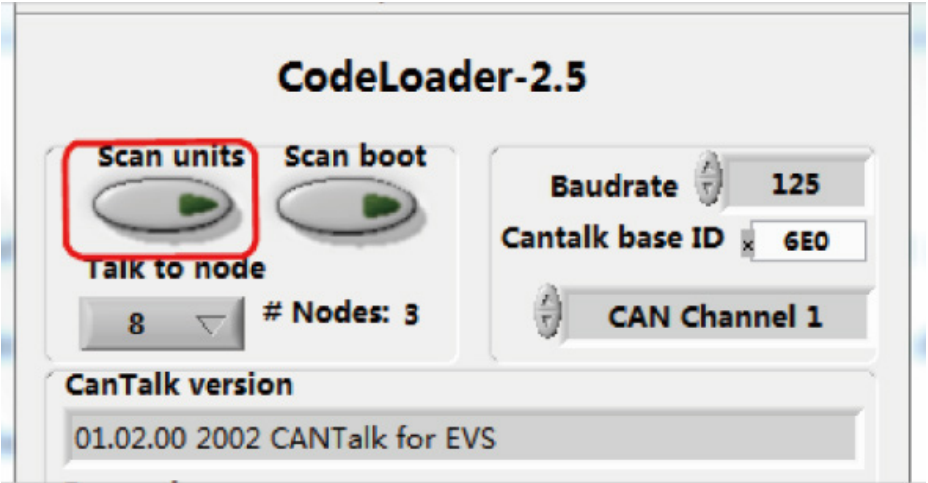
"XX" or "XXX" after "111X" is the program version number, and the program upgrade number will increase.

The number after "node" is the site number.

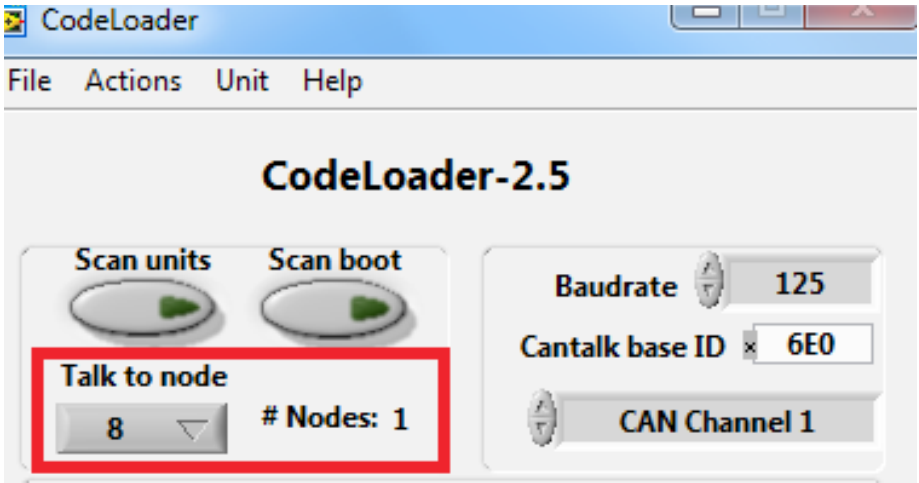
69GA6219111x01H-node5.epf	2020/8/7 14:21	EPF 文件	927 KB
69GA6219111x01H-node8.epf	2020/8/7 14:26	EPF 文件	930 KB

- 69GA621911x01H-node 5.epf is the steering controller
- 69GA621911x01H-node 8.epf is the driving controller

1) Click the “Scan unit” button. When the button turns to green color, the software starts scanning.



2) Click the site selection button and choose node 8.



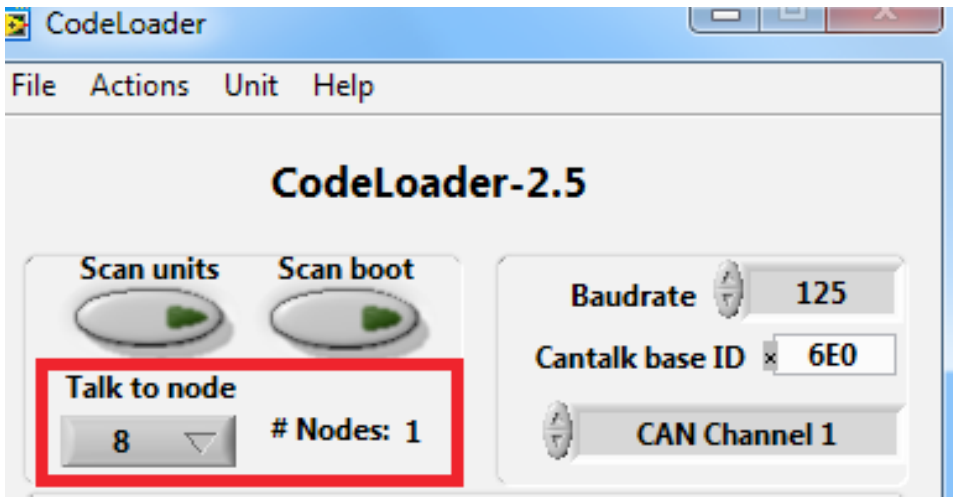
3) General updating order of tractor will be node 8 (driving node), and node 5 (steering node).

NOTE

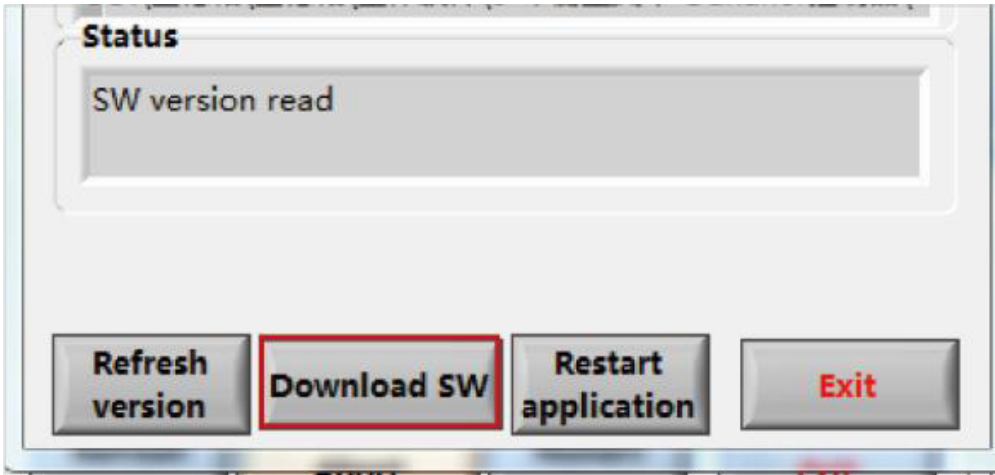
- 1) When choosing a node, we could see its information from “FW version”. Record the Appl code for backup software in case any failure for updating.
- 2) The “CAN” light on Kaveser data cable will only be lighten when transferring data.

6.1.5 Choose the Node and Start Updating

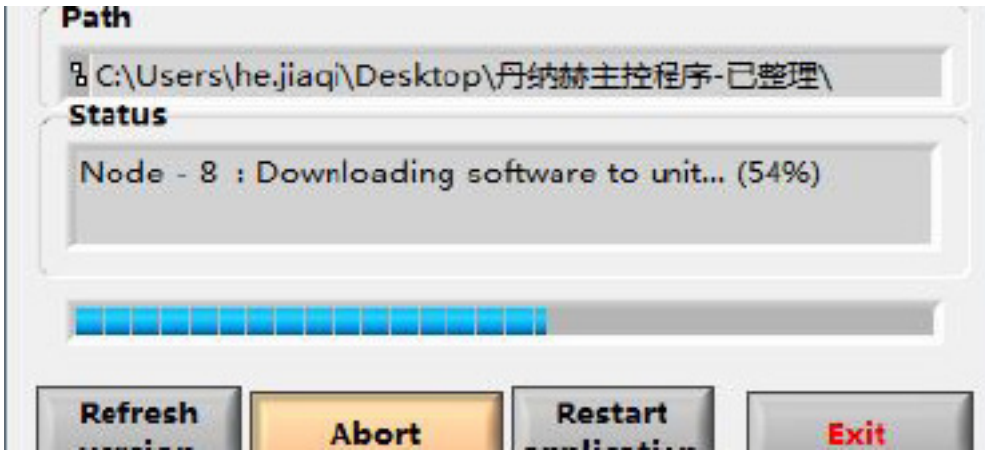
1. Choose a node, such as node 8.



2. Press the button “Download SW”, then you can choose the fitted program to download in the column.



3. When starting updating, a progress bar will show the updating progress, and the light of “CAN” on Kaveser cable will be lighten.



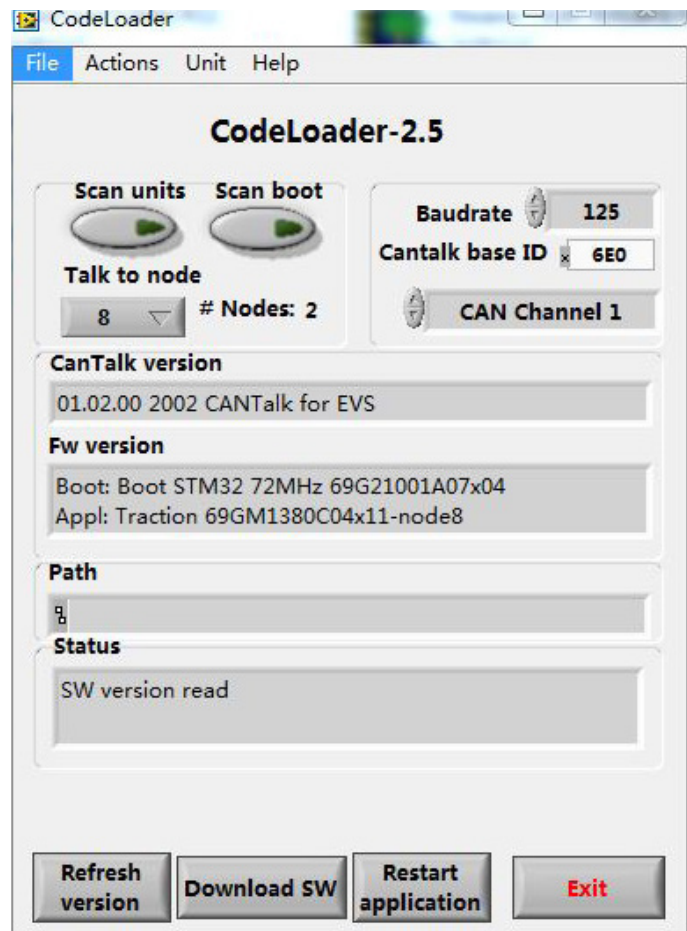
NOTE

When choosing the program (EPF file) for updating, it will automatically start downloading the chosen program without confirm. So please be careful in choosing the right EPF file.



6.1.6 Finish Update and Exit

1. When the program is successfully finished, the text box “Fw version” will show the version of the program updated. If the text box “status” shows “SW version read”, it means the program has been finished successfully.
2. Repeat the procedures of 6.1.5 and update the node 5 (steering node) .
3. After all update progress is finished, click “Exit” button to quit the software.



6.1.7 Restart the Ignition Switch for Saving the Configuration

1. After the program update is complete, turn off the ignition switch and wait for 10 seconds.



2. Restart the tractor. When the coil of the main contactor is closed, the program of the drive motor controller should be updated successfully.





6.1.8 Resolution of Procedure Failure

6.1.8.1 Cannot Scan Any Unit

Faults	Solutions
Bad signal	We need to restart the computer. Sometimes, the software doesn't work until we restart the computer again.
The Kaveser cable is broken.	We need to check the PWR light of the Kaveser, and determine whether the light is on, or not flashing. We can open the cover of the cable to check if any ruin happened in the cable.



6.2 Basic Edition of BYD Truck Software

The software is developed by BYD company and is used for the tractor. It is widely applied to different functions such as parameter modification, battery info monitoring, CAN message getting, main controller defect displaying, main controller error code reading, and etc. Its applying truck types include ECB series, ECC series, Truck series, Reach truck series, and etc.

6.2.1 Software Icons and Interfaces



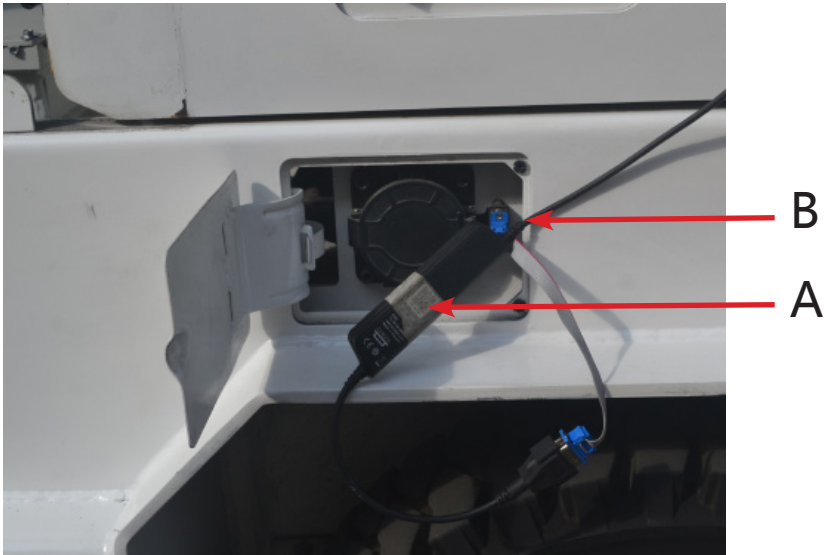
6.2.2 Scan and Select the Node

Warning

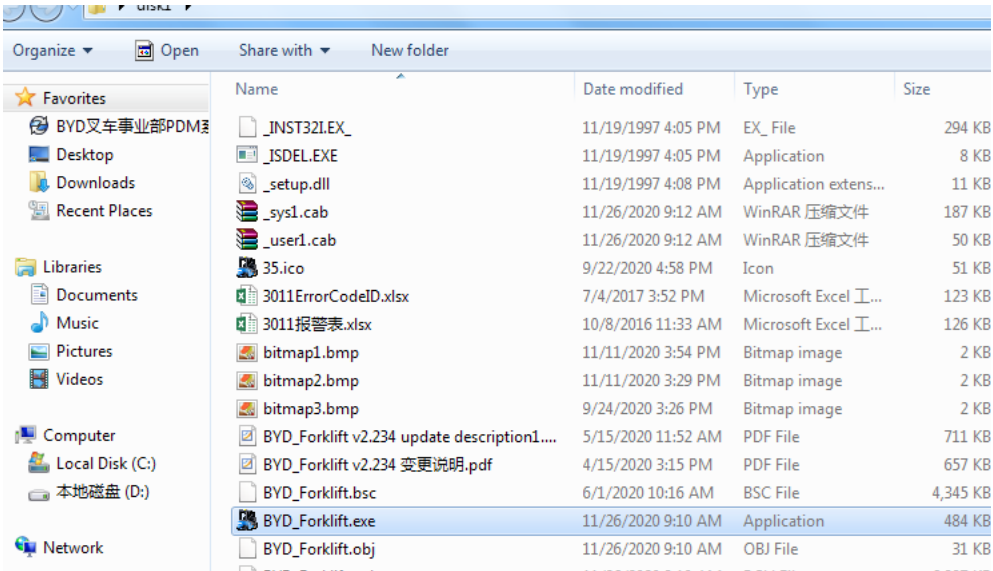
Before connection, please first pull up the ftractor parking brake and ensure safety of the ground!

1. Use the Kaveser data cable to connect the diagnosis port of the tractor and the USB port of the computer.

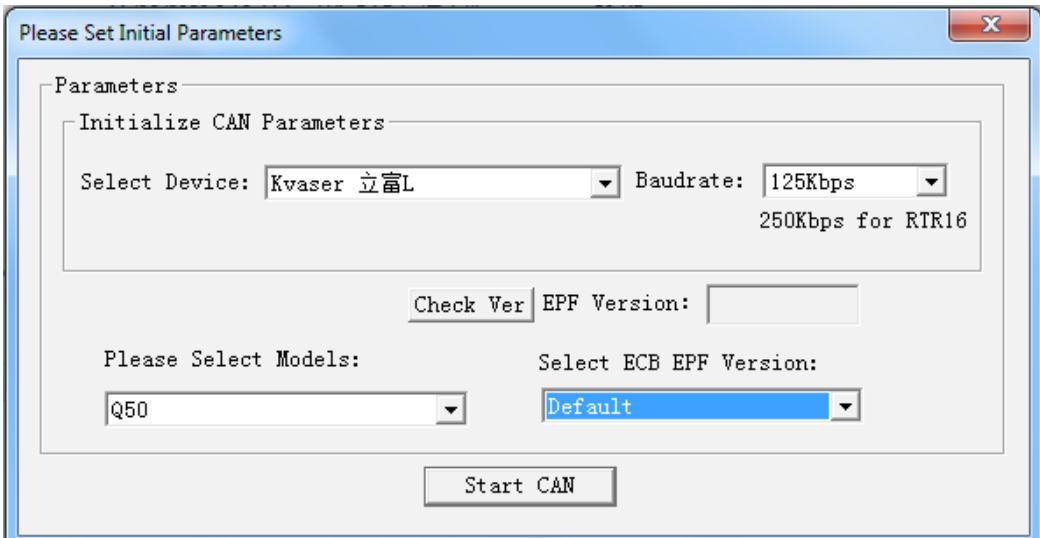
- A. Kaveser
- B. Diagnosis port



2. Start the tractor and open the "BYD_Forklift.exe" software.

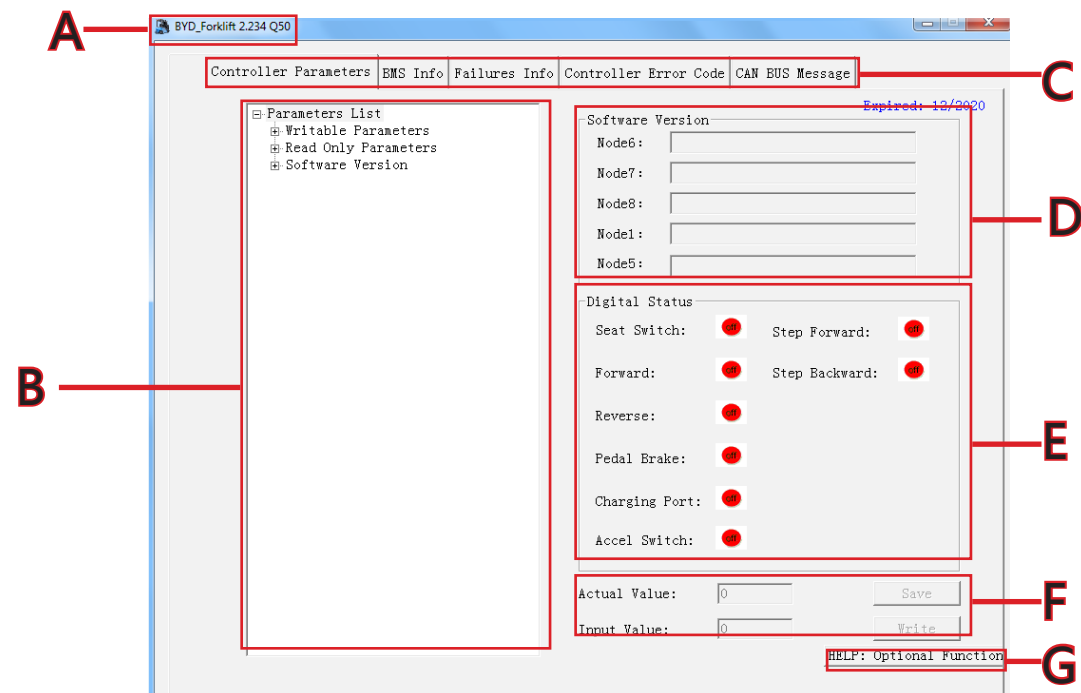


3. Choose 125kbps for Baudrate, T250F for model, Default for EPF Version, and then click "Start CAN" button.



6.2.3 Introduction of Software Interface

6.2.3.1 Overview of Operating Interface (First Tab)

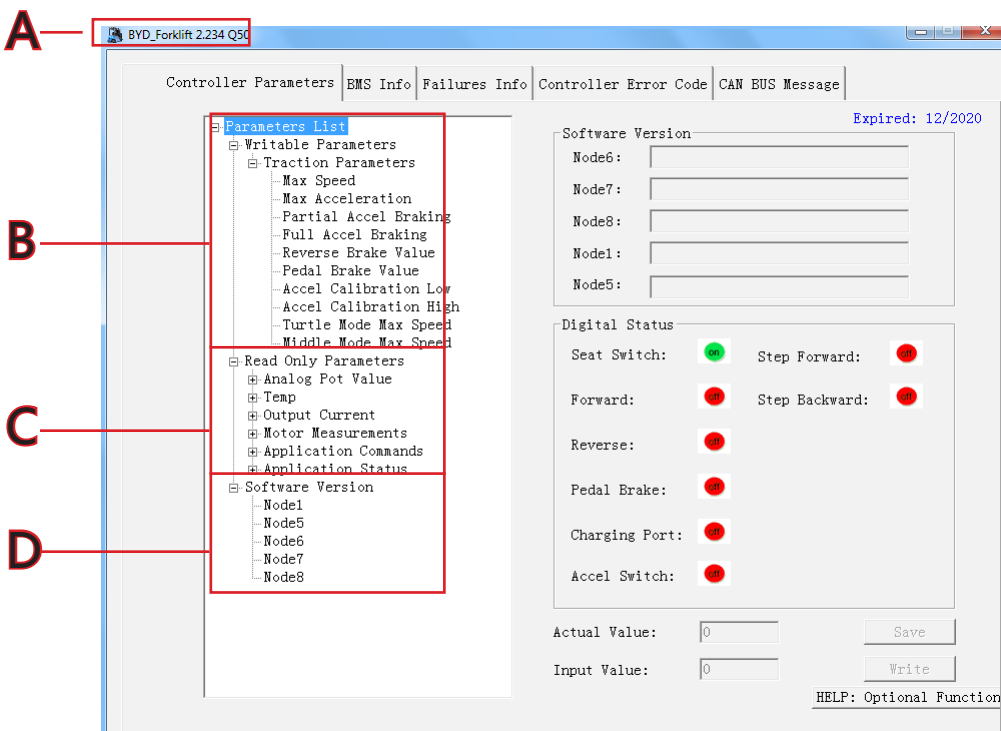


- A. Display chosen model type: After choose proper model, you will get into the page for this model.
- B. Parameter display column: It shows the parameter list of each function.
- C. Items: It represents different setting items from controller.
- D. Controller software version reading: Refer to chapter 6.1.4.1.
- E. Main controller switch status display.
- F. Parameter reading, modifying, writing, save: Once connected to the tractor, it will be operable.
- G. CAN connection status: It indicates if the cable connects the tractor.



Red light indicates switch off. Green light indicates switch on.

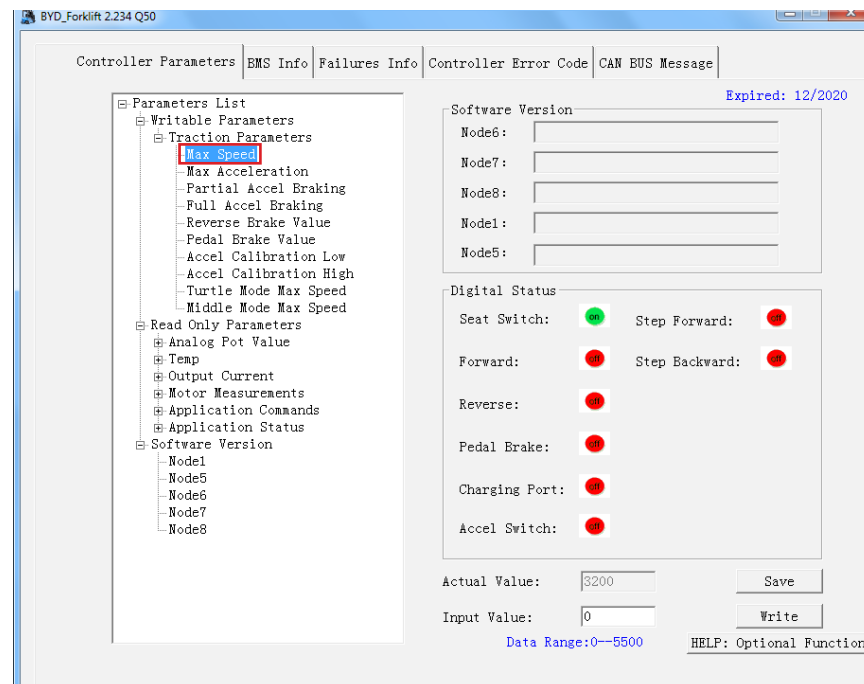
6.2.3.2 The first tab Controller Parameters are the parameters related to the motor controller



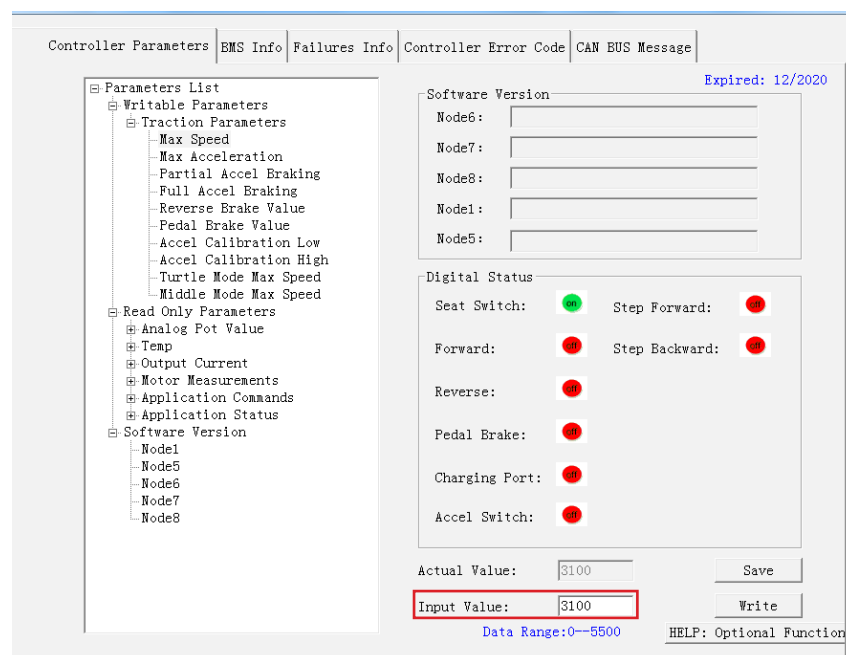
- A. Main controller parameter.
- B. Writable parameter list: For modifying the related parameters of driving motor.
- C. Read parameter: It shows the current data of observation value of sensors, switch, temperatures, motor speed, etc. It helps to modify the writable parameters & problem detection.
- D. Software version number: It helps to judge the software version is new or old.

6.2.3.3 Operation Process of Modifying Motor Controller Parameter

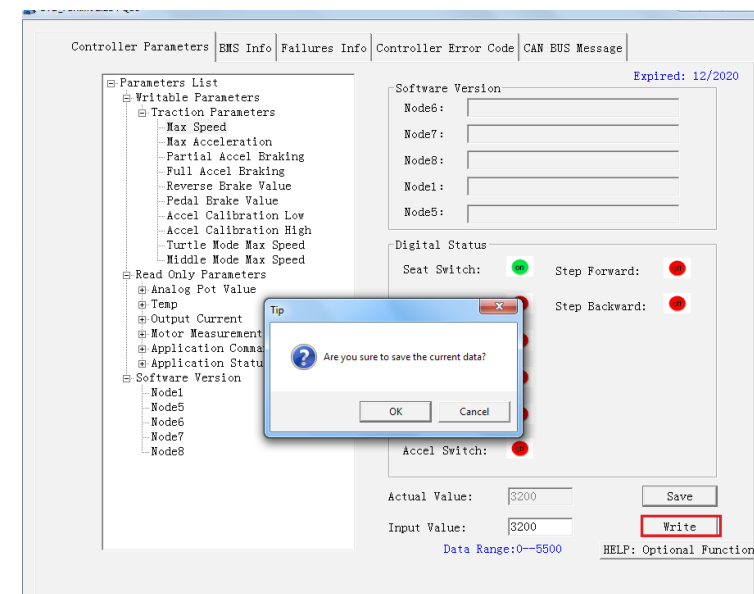
1) Select "Max Speed", the current maximum speed of the motor is 3200rpm in the Actual Value position at the bottom right of the interface.



2) If we want to change the maximum motor speed to 3100rpm, enter 3100 in the input text box.



3) Click the "Write" button next to it, and then click the "Save" button. The following prompt box will pop up.



4) Click the "OK" button and the parameters are saved successfully.

5) After saving the changes, turn the key counterclockwise.



6) After 10 seconds, turn the key clockwise to start the tractor.

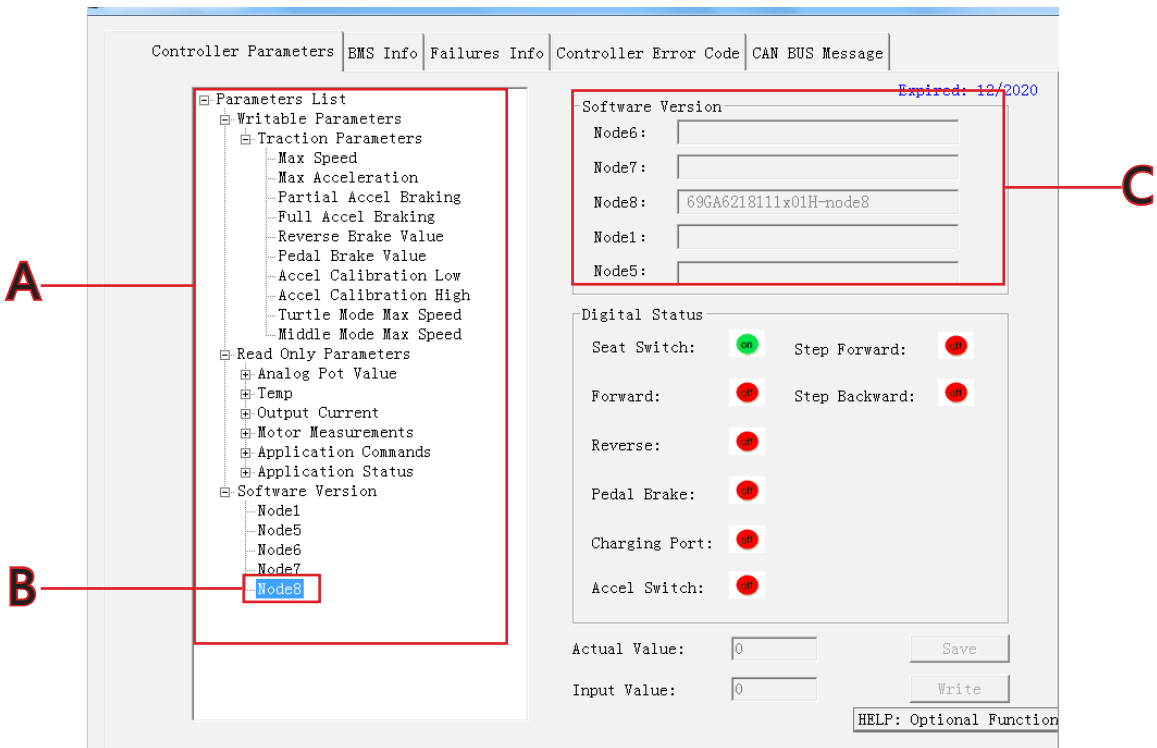


7) The saved value will be functioning.



6.2.4 Operation Instruction of Parameter List Reading

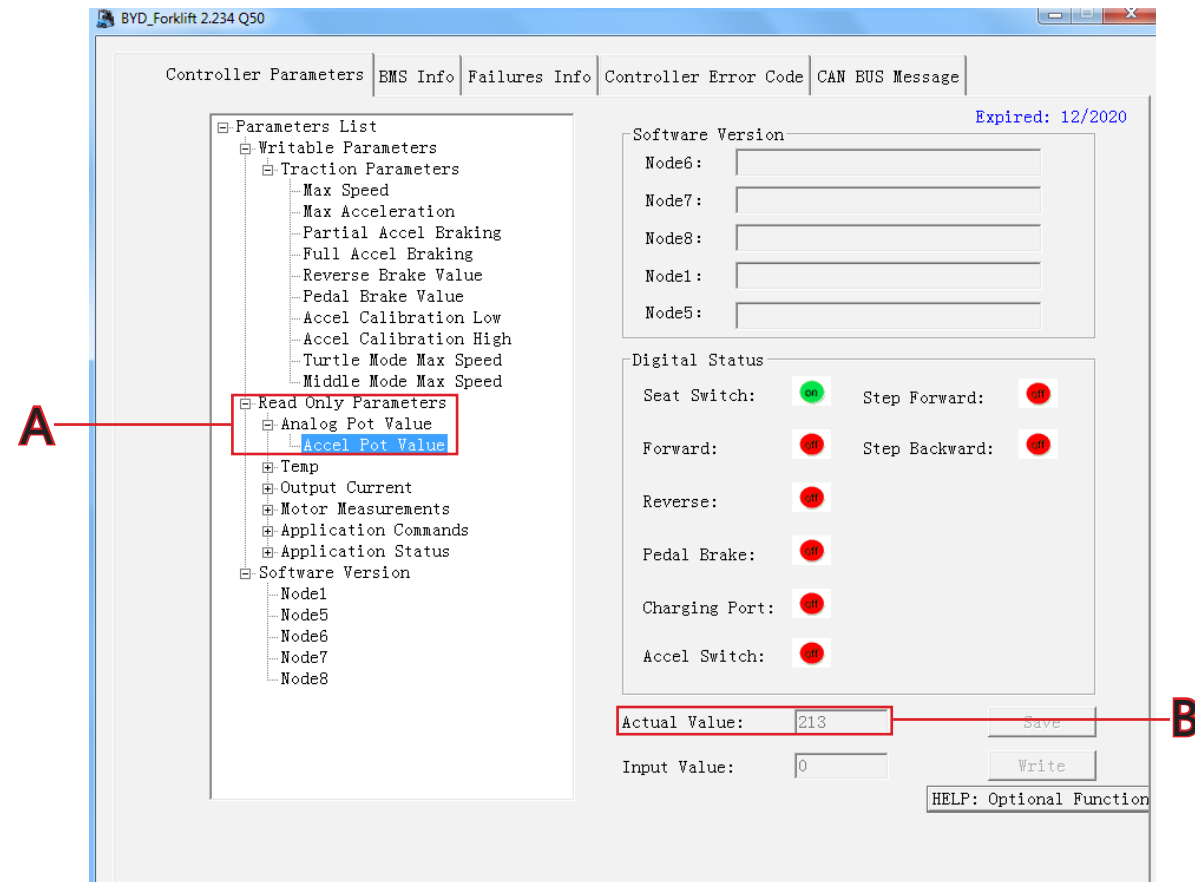
6.2.4.1 Parameter List Software Version Reading



- A. Software version Number: It helps to judge the software version is new or old.
- B. Node 8: Pointing the node will show the software version in display column.
- C. Display software version: 69GA6219111x01H-node 8 is the software version Number. Node 8 is the program node.



6.2.4.2 Sensor Voltage Value (Pedal Sensor Value) Reading of Parameter List



- A. Accel Pot value (pedal sensor value): To adjust or judge whether the accelerator sensor is out of range or out of order.
- B. Actual Value: When pressing the accelerator to the bottom, the showing number is the largest value.



6.2.5 Sensor Calibration Through Software

6.2.5.1 Accelerator Pedal Sensor (Two Values)

1. Read the accelerator pedal simulation value (achieve the action of releasing the accelerator and record the momentary value).
2. Back to writable value – traction parameter – accelerator minimum value, and fill in the value that equals to the momentary value. Just record plus 50 and save, and it will be the accelerator minimum value calibration.
3. Read the accelerator simulation value (achieve the action of pressing the accelerator and record the momentary value).
4. Back to writable value – traction parameter – accelerator maximum value, fill in the value that equals to the momentary value. Just record minus 50 and save, and it will be the accelerator maximum value calibration.

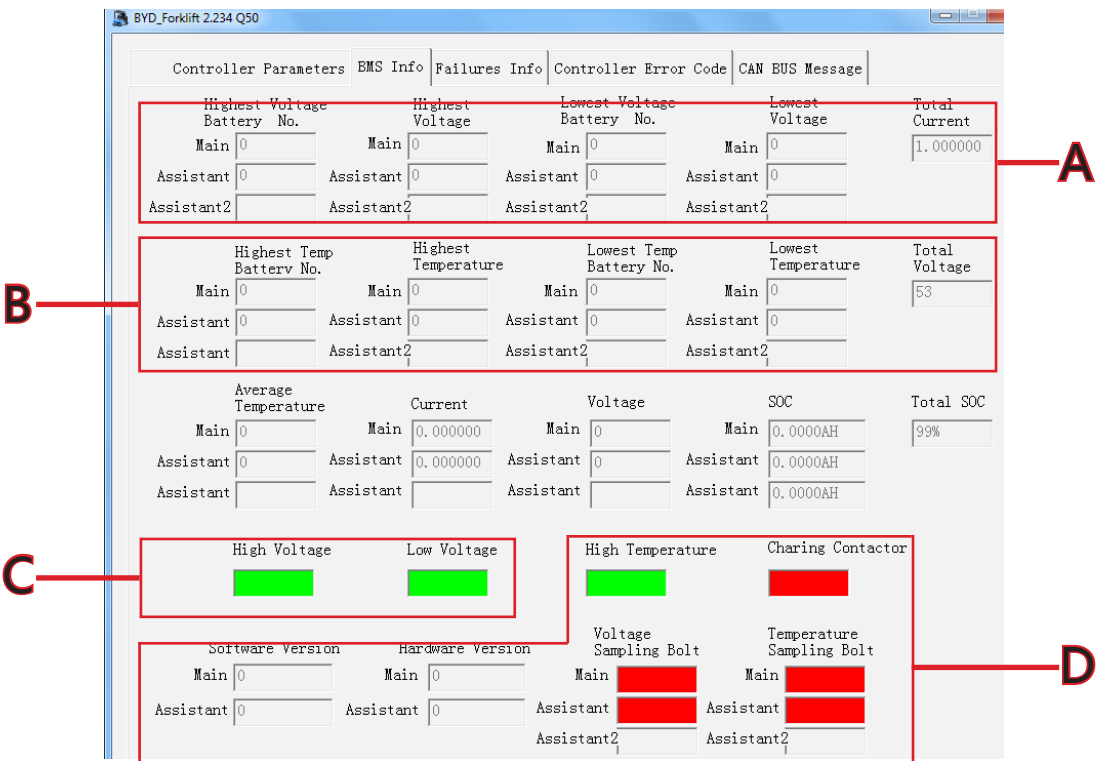
6.2.5.2 Steering Sensor (Three Values)

1. Read the steering sensor simulation value (achieve the action that the rear wheel turns right to the end and record the momentary value).
2. Back to the writable parameter list – steering parameter – steering sensor maximum value of the rear wheel, fill in the value that equals to the momentary value. Just record minus 50 and save. It will be the rear wheel steering sensor maximum value calibration.
3. Read the steering sensor simulation value (achieve the action that the rear wheel turns left to the end and record the momentary value).
4. Back to the writable parameter list – steering parameter – steering sensor minimum value of the rear wheel, fill in the value that equals to the momentary value. Just record plus 50 and save, and it will be the rear wheel steering sensor minimum value calibration.
5. Read the steering sensor simulation value (achieve the action that rear wheel turns back to the middle and record the momentary value).
6. Back to the writable parameter list – steering parameter – rear wheel steering sensor middle value, fill in the value that equals to the momentary value. Just record and save, and it will be the rear wheel steering sensor middle value calibration.



6.2.6 Introduction of Software Parameter

6.2.6.1 Overview of BMS Parameter (Second Tab)



This tab shows the condition of Battery system by the Battery Management System (BMS).

- A
 - 1) Battery No: It shows the corresponding battery serial number.
 - 2) Highest/lowest voltage: It shows the voltage of detected battery cell.
- B Highest/lowest temperature: It shows the temperature of detected battery cell.
- C
 - 1) High voltage indicator: If the voltage of all single-cell batteries is lower than 3.6V, the indicator light is green, otherwise it is red.
 - 2) Low voltage indicator: If the voltage of all single-cell batteries is higher than 2.5V, the indicator light is green, otherwise it is red.



- D
 - 1) High temperature indicator: If the temperature of all temperature sampling points is lower than 65°C, the indicator light is green, otherwise it is red.
 - 2) Charging contactor: Charging contactor is not closed.



Green light indicates components is normally functioning and red light indicates components in error.



6.2.6.2 Overview of Software Main Controller Indicator (Third Tab)



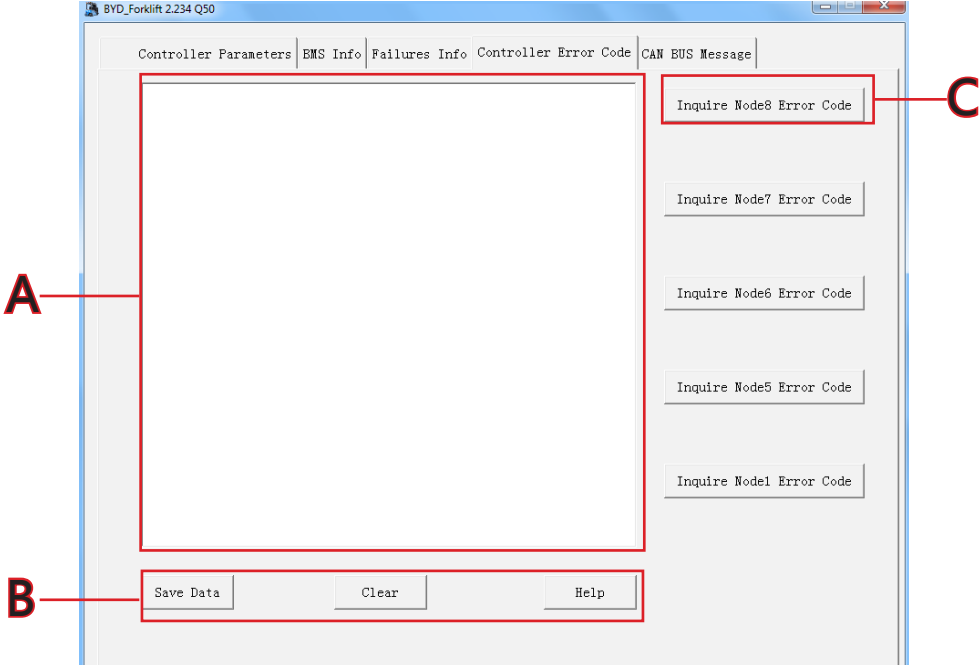
- A. Controller failure (Third Tab): Main controller error indicator.
- B. Present indicator for all switch, sensor and error: Green light means all indicated points / functions works normally. If any indicator got in red, that means this part is not functioning normally and needs to be checked manually.
- C. Refresh Error Code: To refresh the error code indicator, we could see if components conditions changed.



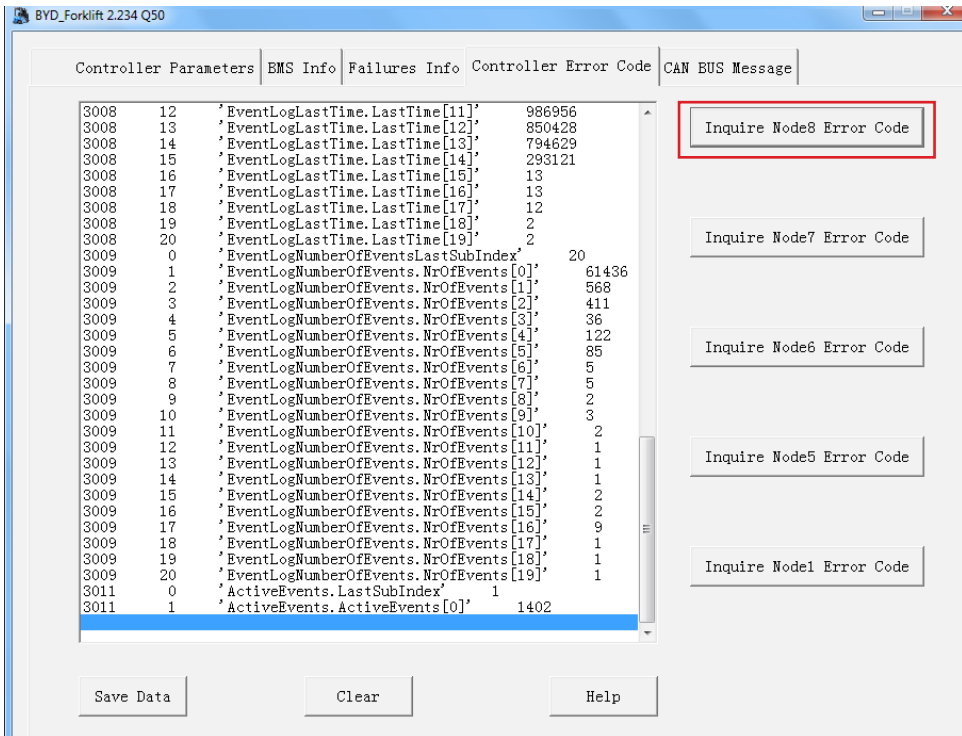
For any problem, please refer to Chapter 4 for maintenance of corresponding parts.



6.2.6.3 Main Controller Error Code Reading (Forth Tab)

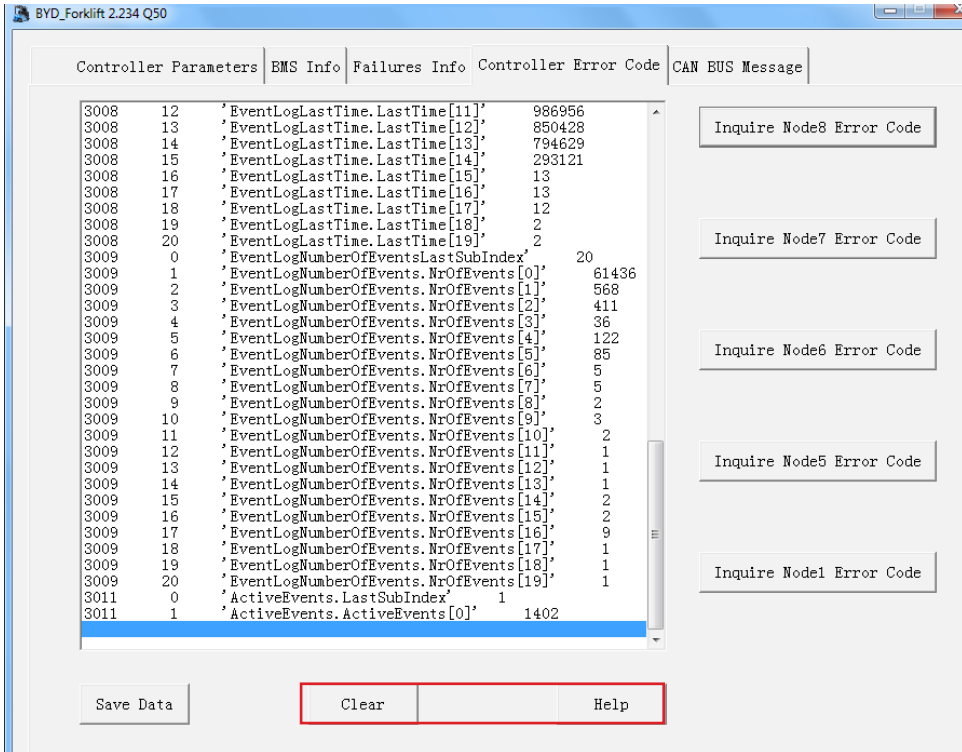


- A. Error code log
- B.
 - 1) Save Data: Save the main error as text and send it to relevant engineers for analysis.
 - 2) Clear: Clear the currently displayed error code.
 - 3) Help: Open help (3011 error code log).
- C. Inquire Node 8 Error Code: Read error code of Node 8.
 - Operating Process (Node 8).
 - 1) To Read Node 8 error code, press the Inquire Node 8 Error Code button.

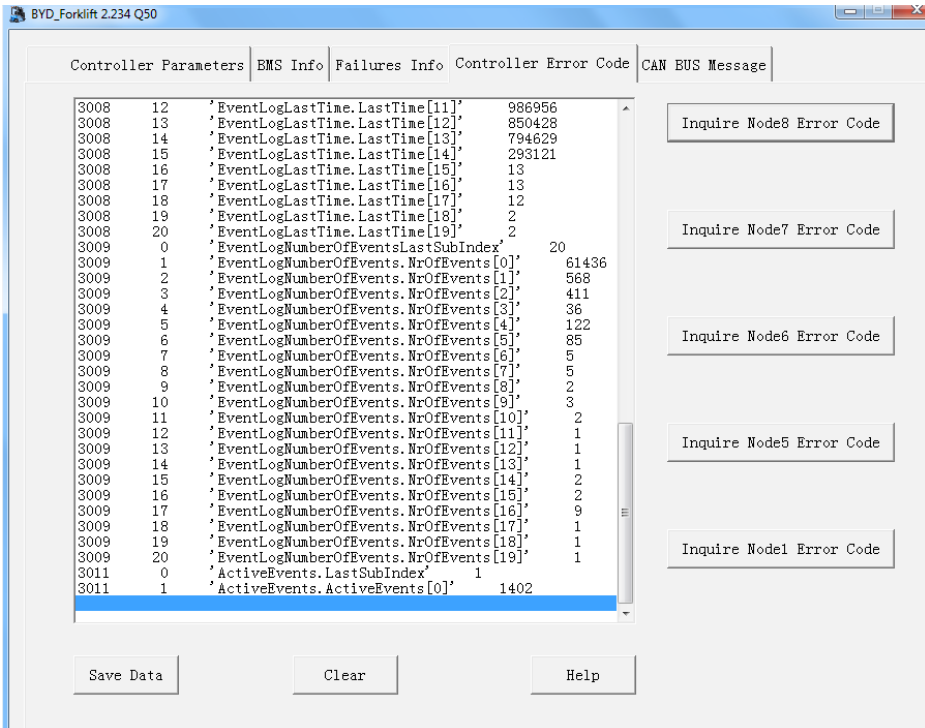


2) After pressing the button, it will show the error code for node 8.

- The “Clear” button can clear current displayed error code.
- The “Help” button can open help (which is the 3011 error code logbook).



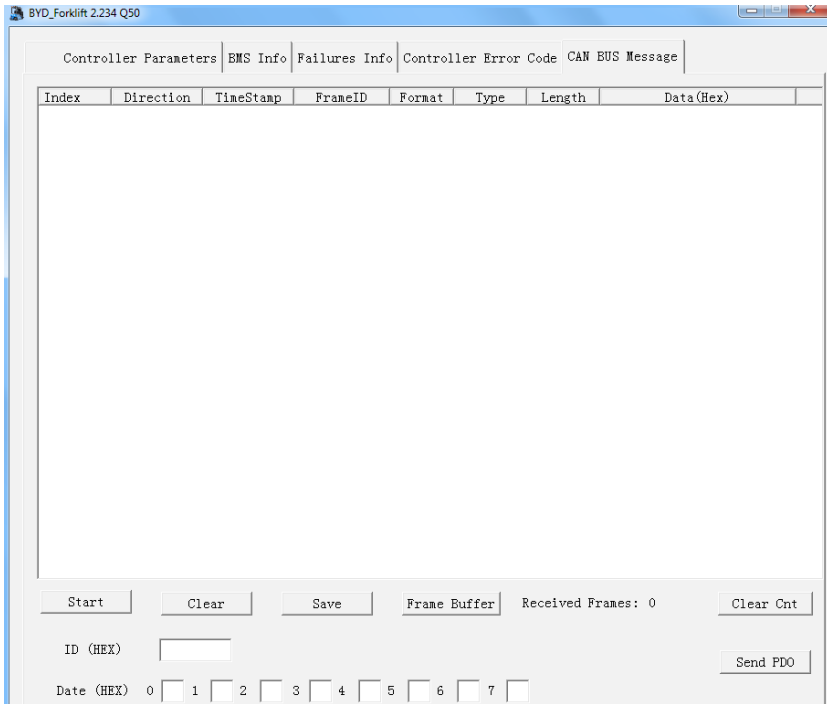
3) Press the “Save data” button to save the main error into text for analysis.



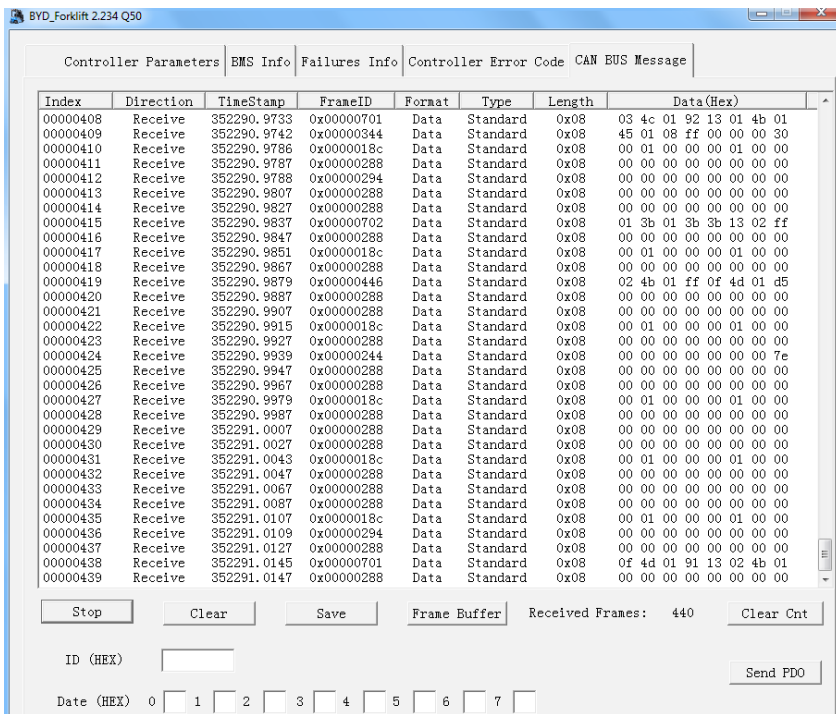


6.2.7 CAN Message Intercepting Operation (Tab 5)

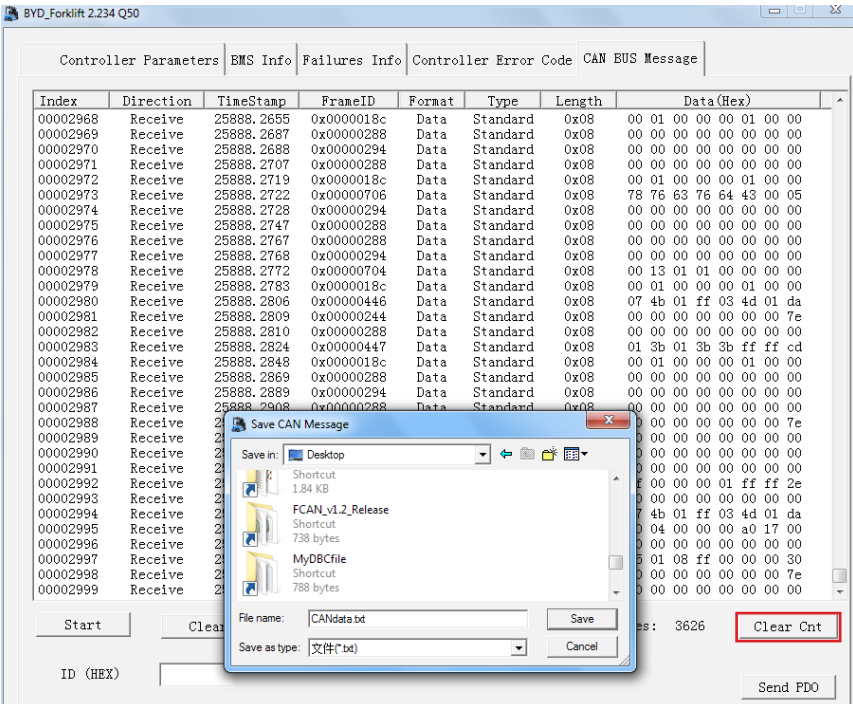
1. The tab is for CAN message intercepting.



2. Then we could start intercepting the CAN message by pressing “Start” button.



3. When finished, press “Stop” button and “Save” button, and then it will show the save address for save material.





6.3 Advanced Monitoring Software for Motor Controller-DriveTool-4.9



Warning

It is forbidden for non-professionals to adjust the parameters. Send feedback to BYD personnel after recording.



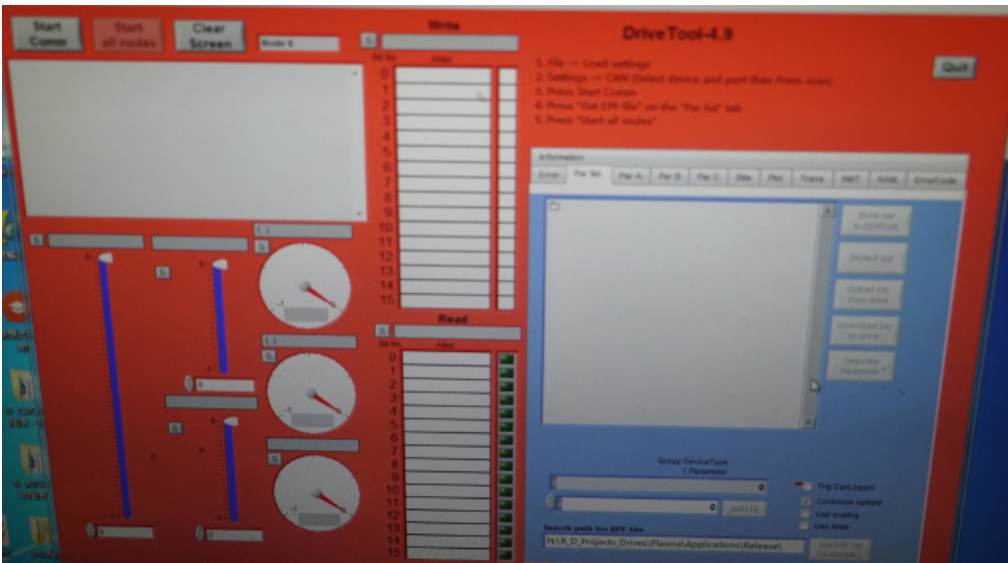
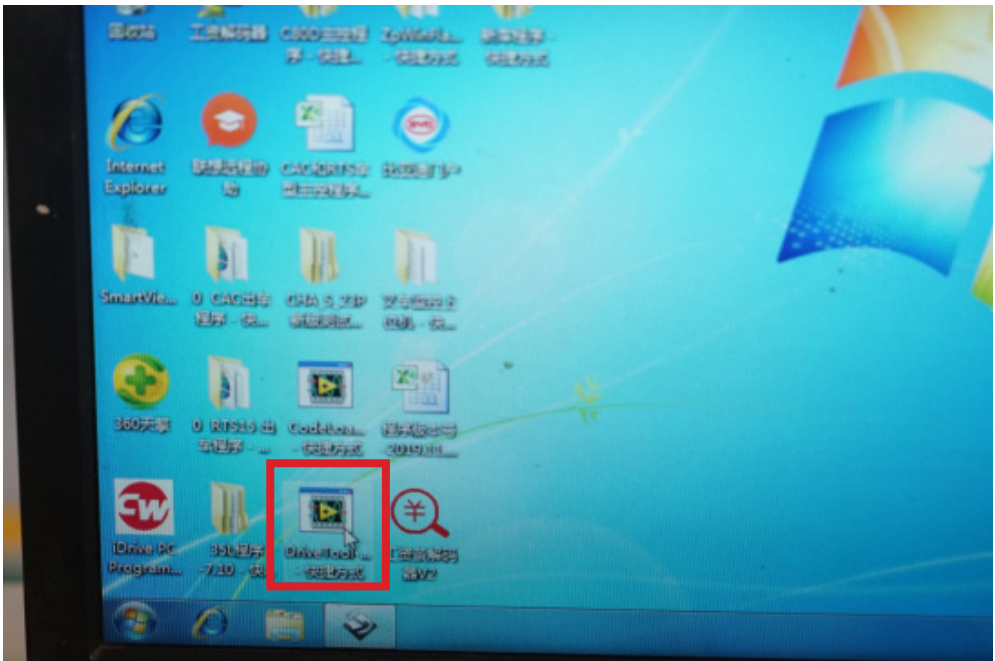
This chapter only applies to trained professional operators.

The DriveTool-4.9 software can be used to modify the parameters of the ECB series, ECC series, T50 and T250 series models, so as to achieve and meet customer performance requirements such as the speed of the product.

For the T250F model, the performance parameters, voltage and current output parameters related to the drive motor can be modified and calibrated.



6.3.1 Software Icons and Interfaces

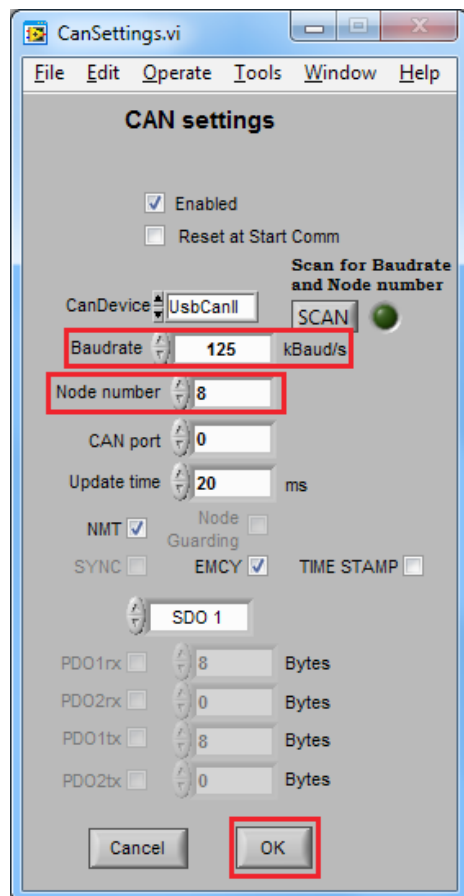


6.3.2 Scan and Select the Node

1. Connect the diagnosis port of the tractor and the USB port of the computer with the Kaveser data cable, and confirm that the connection is correct.
2. Click the CAN option under the Settings tab.

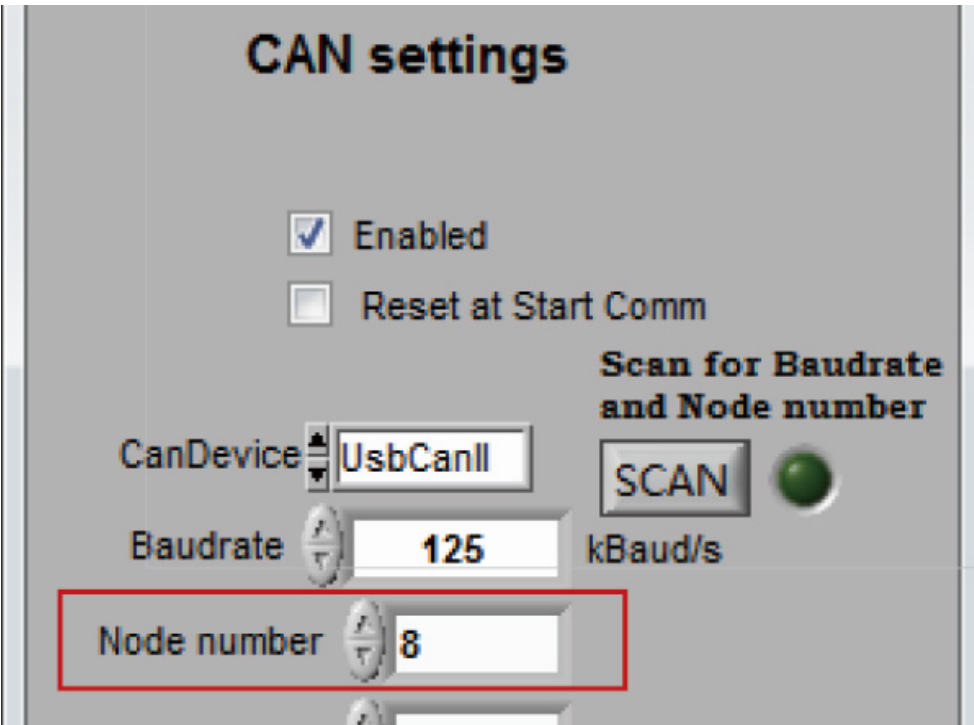


3. Change the Baudrate to 125k Baud/s and the Node number to 8, and then click the "OK" button.



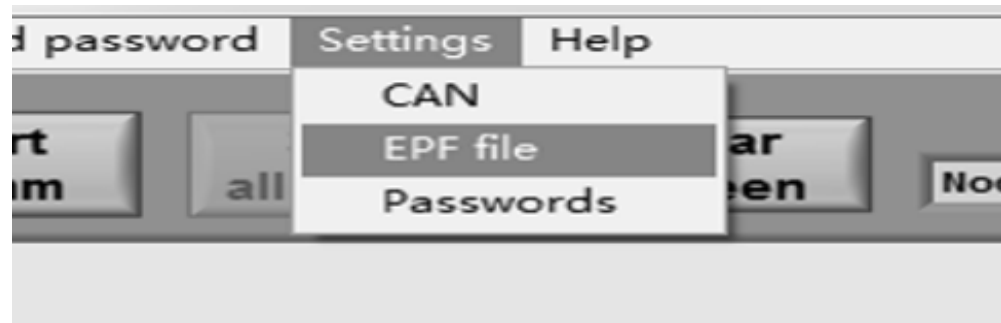
4. Select and set controller sites.

- The controller site "No. 5" is the controller for controlling the steering motor.
- The controller site "No. 8" is the controller for controlling the driving motor, also known as the main control. The basic parameters are set by the No. 8 site.

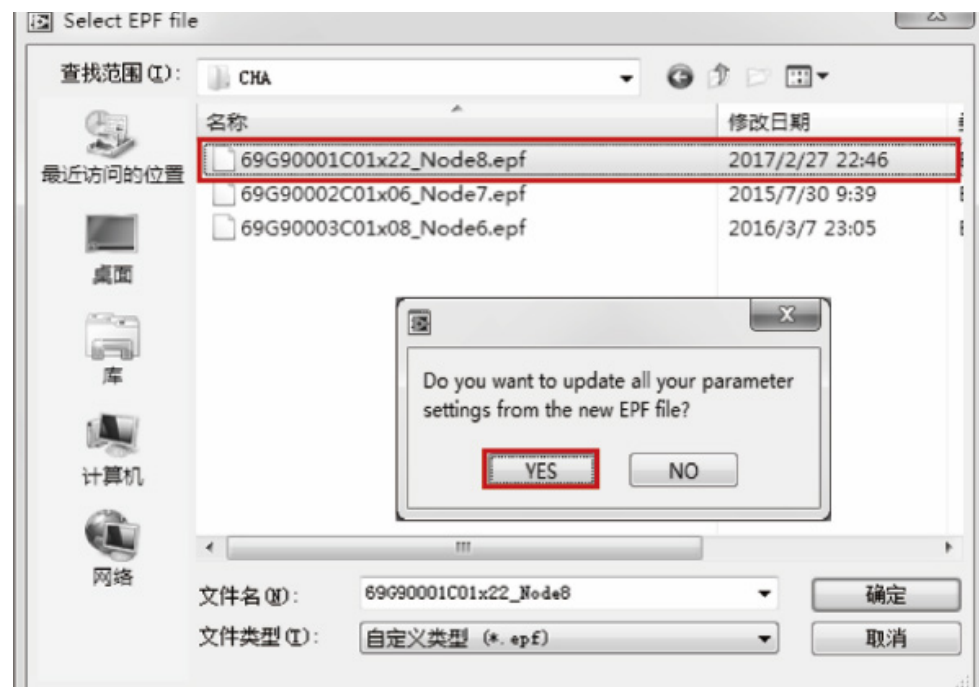


6.3.3 Select EPF File

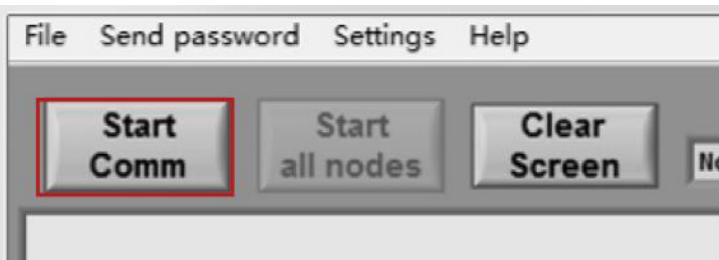
1. Click the EPF file option under the Settings tab.



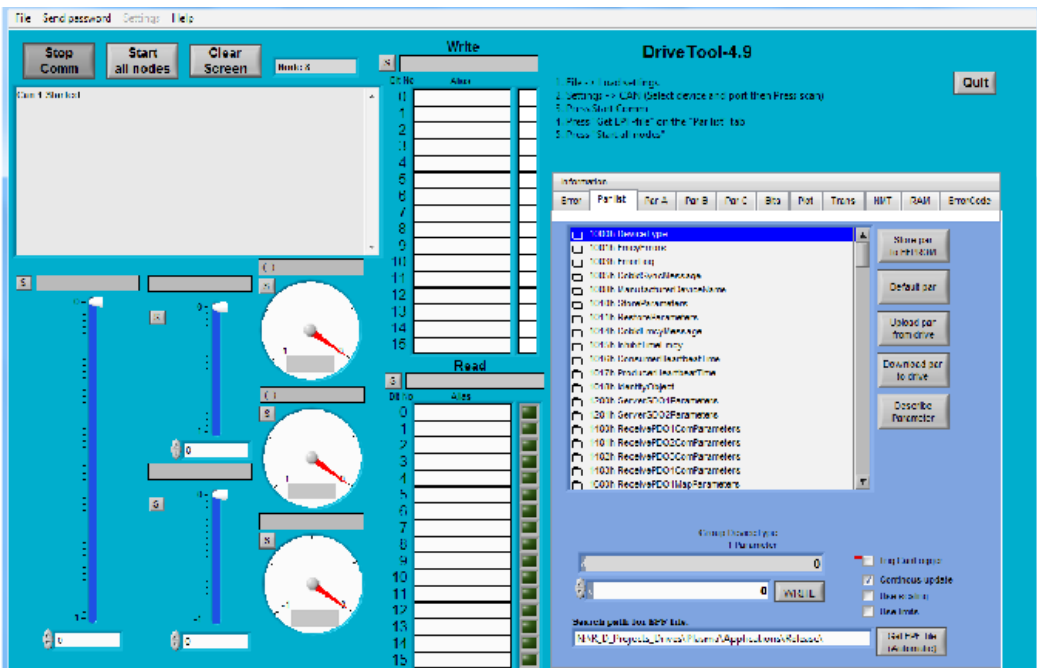
2. Find the storage path of the epf burning file of the T250F motor controller, select the file, and click the "OK" button.



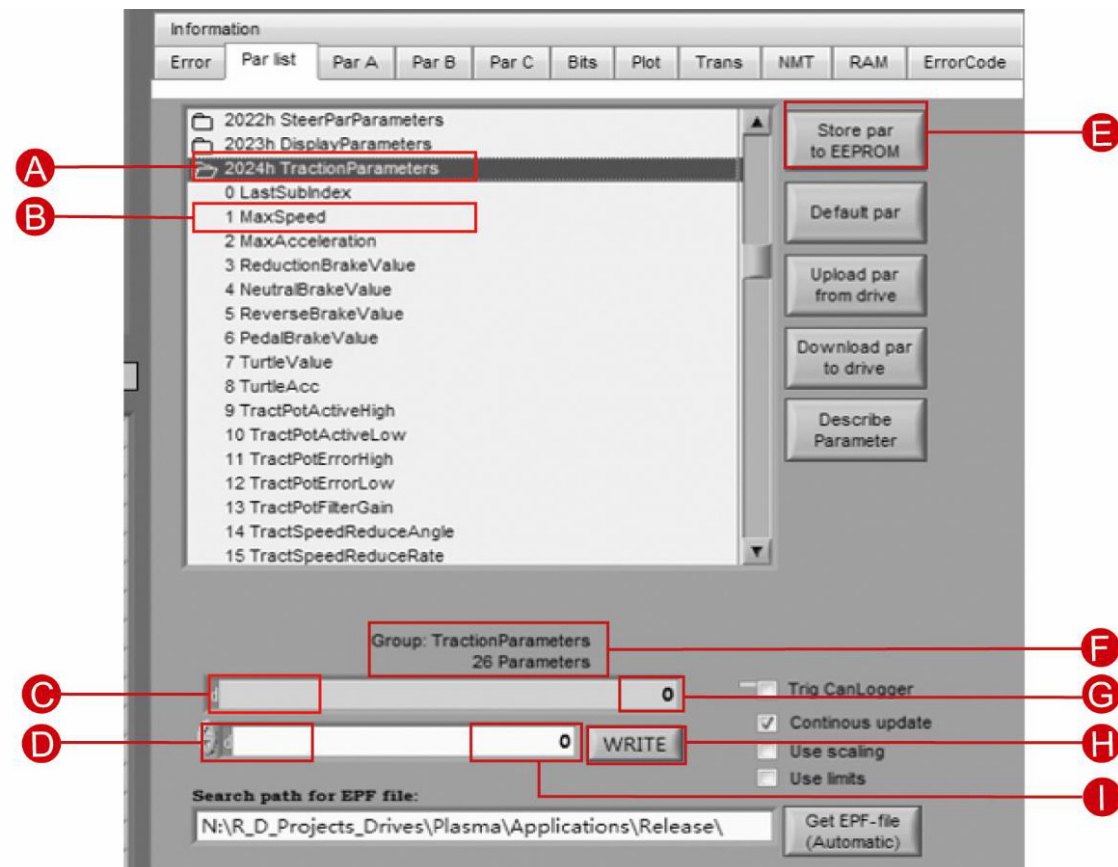
3. Click the "Start Comm" button to start the communication connection.



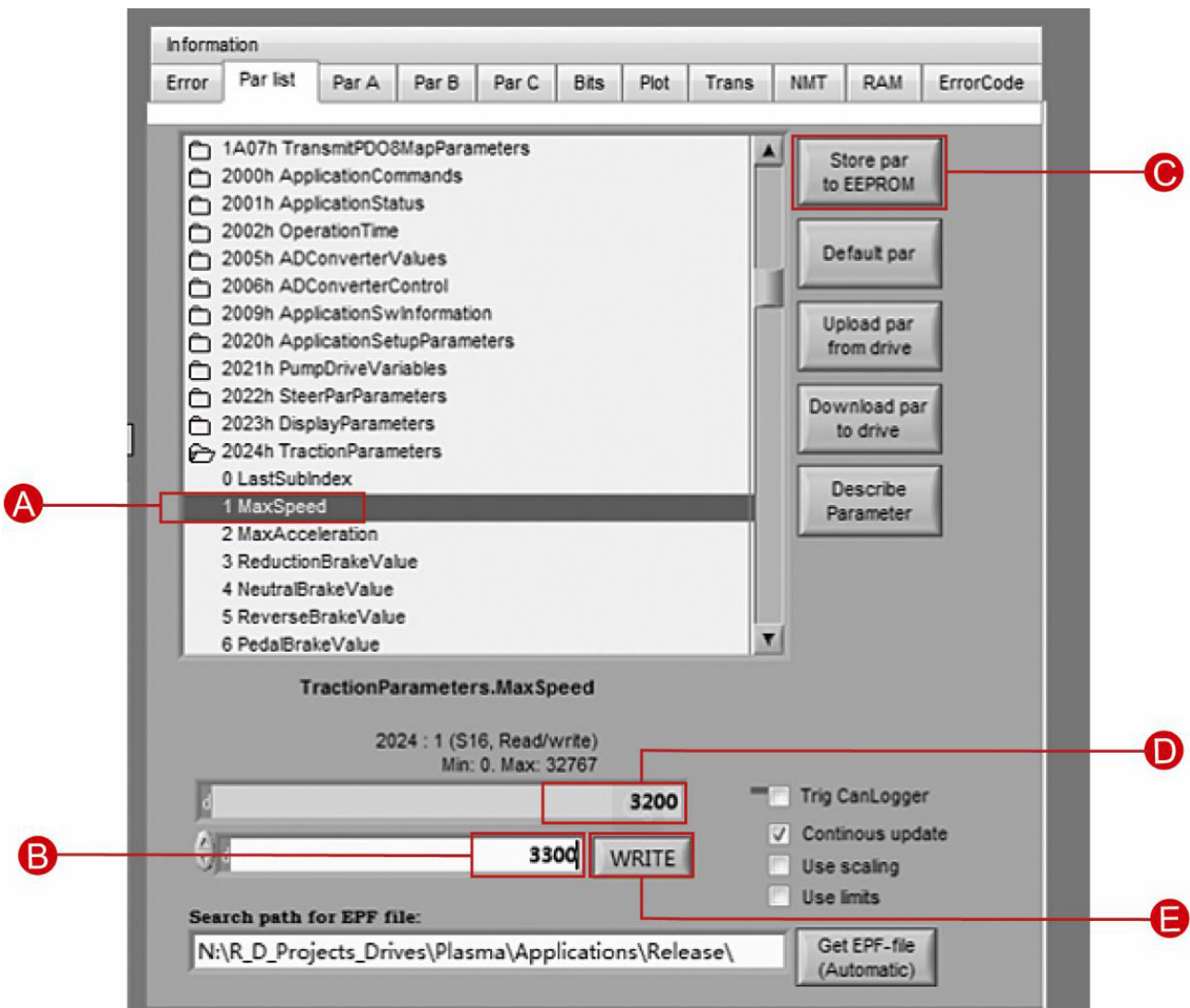
4. After starting the communication connection, the interface changes from red to blue. Then you can modify and view the relevant parameters of the motor controller.



6.3.4 Description of Parameter Debugging



- A. Parameter address
- B. Parameter frame address
- C. Base adjustment
- D. Parameter value adjustment
- E. Parameter saving
- F. Parameter address frame display
- G. Parameter value display
- H. Parameter write OK
- I. Parameter modification

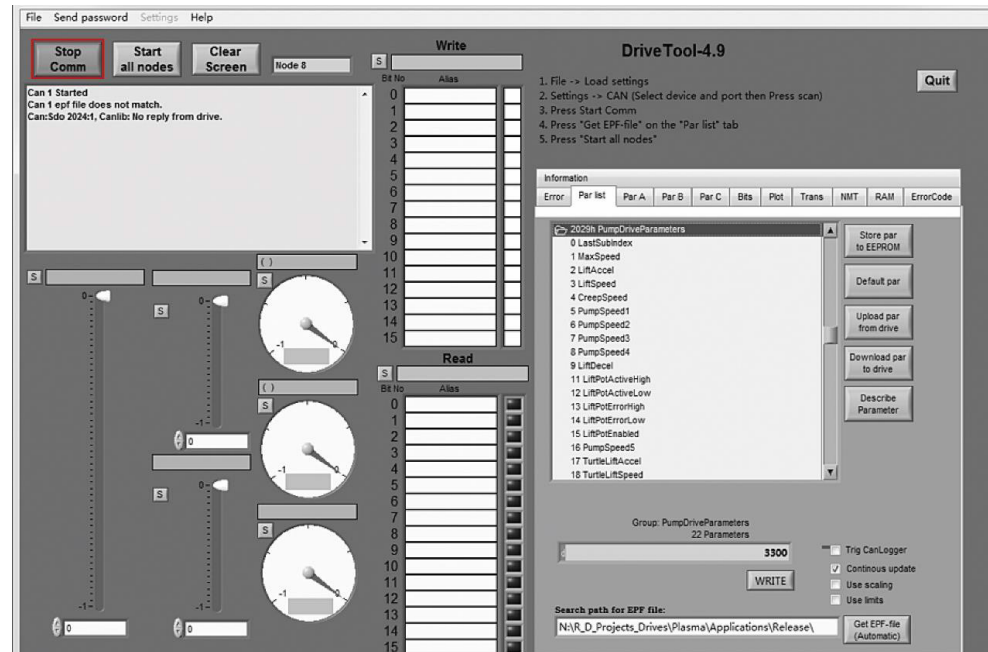


- A. The maximum speed of the motor
- B. Write the maximum speed value required
- C. Confirm that parameters are stored
- D. Read the current value of the maximum speed
- E. Modify the maximum speed value written

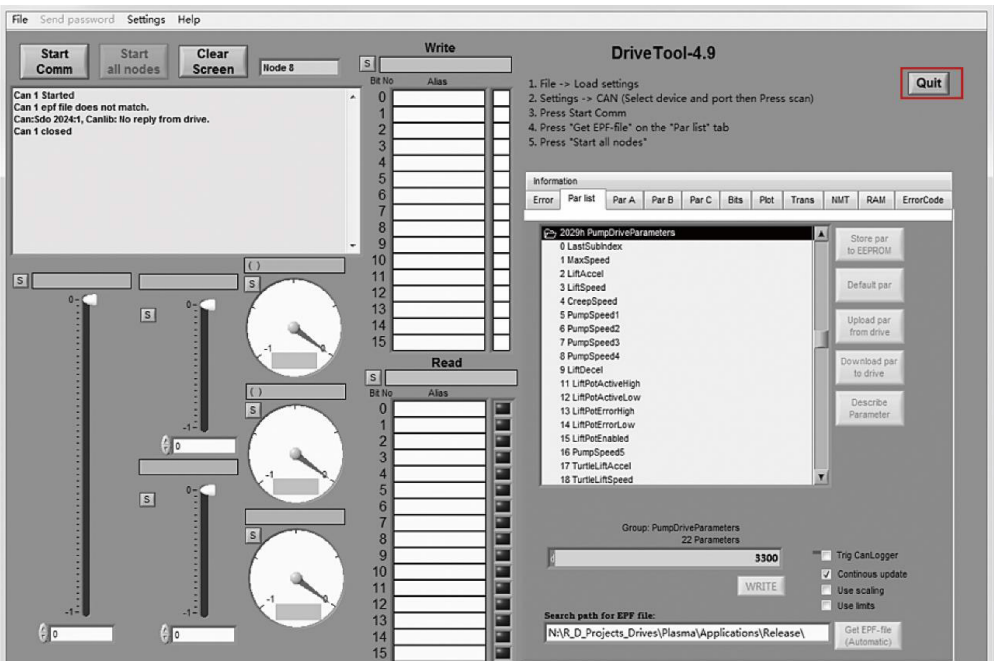
Note: After modifying a parameter in the text box at position B, you need to click the "WRITE" button at position E, and then click "Store par to EEPROM" at position C to save the modified parameters".



1. After the parameter modification is completed, click the "Stop Comm" button to disconnect the communication connection.



2. Click the "Quit" button to exit.



6.3.5 Calibration of Sensor Value

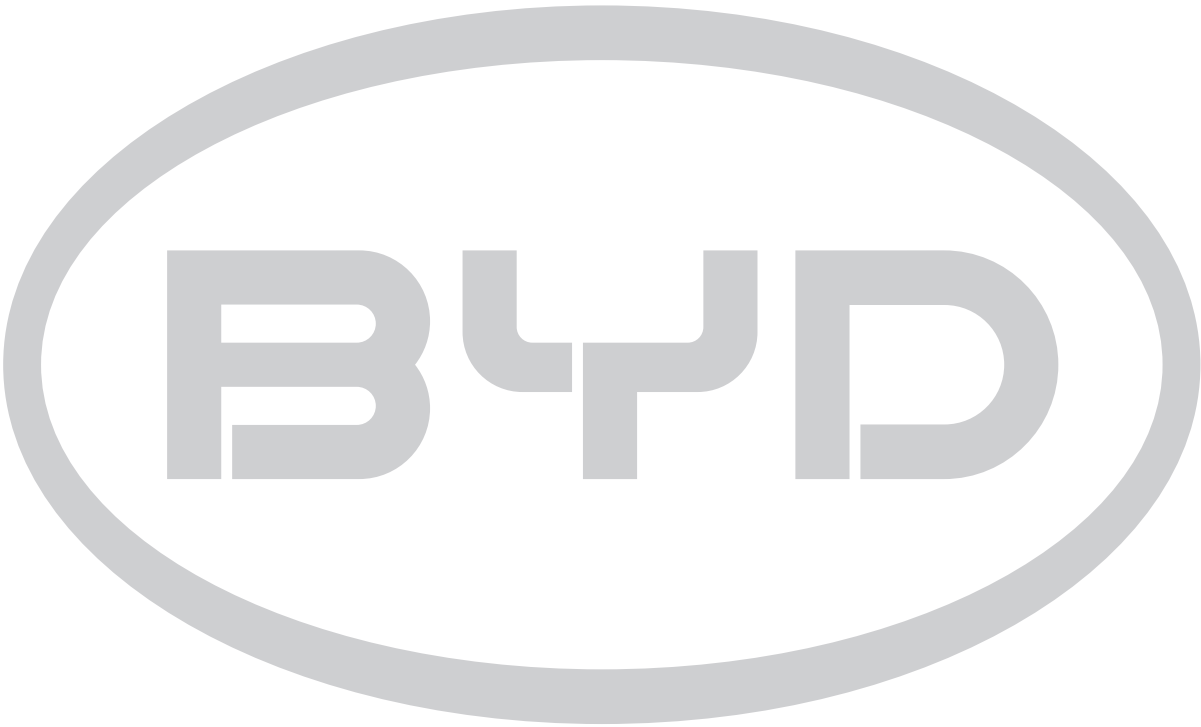
Sensor value calibration requires calibration of accelerator pedal sensor and steering sensor.

6.3.6 Restart for Saving the Configuration

1. After the parameter modification is completed, the entire tractor needs to be powered off and then powered on and restarted. For specific instructions, please refer to 6.1.7 Restart the Ignition Switch for Saving the Configuration.



7 Troubleshooting





7.1 Electrical Maintenance Diagnosis

This chapter introduces instructions about the display faults, controller faults, and other electrical fault. You can find and solve the electrical faults in accordance with the display error codes and controller alarm error codes.

In the troubleshooting process, a multimeter is necessary. When solving some problems, you have to use a computer and the data cable of Kaveser controller.

The chapter is designed for professionally trained technical personnel. These technical personnel should be able to use the multimeter to measure and get relevant information, and troubleshoot fault causes according to the attached schematic diagram. They are required to have received specialized training about using BYD software.

Please refer to the Electrical Schematic Diagram in the Appendix for troubleshooting process.



 Danger

Only trained maintenance personnel can carry out maintenance operations.
The proper maintenance of the tractor is specified in the warranty. All spare parts must be original ones.

 Warning

All spare parts of the tractor must be original spare parts. Please contact BYD for original spare parts.

BYD assumes no responsibility for any modifications made by customers to tractor and related parts without authorization from BYD.

When the tractor breaks down, please contact the professional maintenance personnel to do the service.



Check message shown on the tractor display and follow the instructions provided when starting trouble shooting. Refer to Appendix 9.5 Parameters of the Controller.

Before contacting maintenance personnel, please obey the follows:

- Check whether the battery is fully charged (Low battery power and voltage can cause an error message)
- Restart the tractor (Clear some error messages)



7.1.1 Overview

The alarm code of the display is shown as "Chinese" while the alarm error code of the controller is displayed as "Number".

The controller system of the T250F contains two controllers: drive controller (Node 8) and steering controller (Node 5). The main controller which shows most of the error codes, two controller may alert in the same error code. Please troubleshoot the fault according to the controller corresponding to the error code alarm.

- A. When a fault occurs, the error code will be displayed in area A.





7.1.2 Comparison Table of the Display Error Codes and Controller Error Codes

Number	Event Number (Controller)	Error Code (Display)	Definition
1	202	Logic failure 3	OverCurrentError
2	403, 405, 406, 408	Logic failure 1	DC Bus Low
3	100	Three-phase line of the drive motor is broken	Power Stage Short Circuit
4	1403	Drive module is broken	CpuChecksum Error
5	407	Driver module precharge failed	Charging error
6	10027	Main contactor open circuit	Main Contactor Off
7	800~805	Drive motor encoder is broken	Sensor Supply or Encoder Error
8	10004	Accelerator pedal is broken	TracPotError
9	402, 404	Total battery voltage error	DC Bus High
10	10010, 10015	Please Check the lifting system	Steerpot or Liftpot Error
11	1001~1006, 1021~1026, 1031~1036	Relay coil is broken	Open Drain Error
12	1402	Drive Memory is broken	Default parameters
13	502, 503	Temperature of the drive module is too high	ACS HIGH TEMPERATURE
14	603, 604	Temperature of the drive motor is too high	HIGH MOTOR TEMPERATURE
15	10005	The accelerator pedal was triggered by mistake	Traction Switch Error
16	10001, 10002	Drive module start with wrong order	INCORRECT START
17	10003	Please check the gear	FORWARD + BACKWARD
18	500, 501	Drive module thermal sensor is broken	THERMIC 500, 501 SENSOR KO
19	1204~1206	CAN communication fault	CAN Related Error
20	202	Lifting logic failure 3	Over Current
21	405, 406	Steering logic failure 1	Dcbus Low
22	100	Three-phase line of the steering motor is broken	Short Circuit
23	204	Steering current sensor is broken	Current Sensor Default Values
24	802~805	Steering motor encoder is broken	ENCODER ERROR
25	1403	Steering system is broken	CpuChecksum Error
26	502, 503	Temperature of the steering module is too high	ACS HIGH



Number	Event Number (Controller)	Error Code (Display)	Definition
27	603, 604	Temperature of the steering motor is too high	MOTOR
28	500, 501	Steering module thermal sensor is broken	THERMIC SENSOR KO
29	10087	Brake pressure is too low	Over Pressure
30	10088	Power unit temperature is too high	TEMPERATURE Alarm
31	10089	Brake pressure is too low	Hydraulic Unit Restart



7.2 Troubleshooting Explanation

Use the BYD_ Forklift to read the ID (0x3011) and (0x3006) of the current error codes and the record information of the historical faults. Analyze and detect the reading information and therefore finishing the maintenance of the tractor.

If the tractor works abnormally, obey the follows: First check the current error codes in the ID 0x3011 with the BYD_ Forklift. If there are no error codes in 0x3011, check the ID 0x3006 for the error code in the recent history.

1) Error ID: 100

Description: A short circuit is detected in the hardware.

The software will restart the power supply within 500ms. If no other faults about the shortcircuit are detected within 100ms, it will be considered a fault about short circuit. Otherwise, it will be considered a fault about the hardware short circuit.

There is a short circuit between the phases.

A short circuit occurs between the phase line and the output negative electrode (B-).

A short circuit occurs between the phase line and the output positive electrode (B+).

Cause A

A short circuit is detected in the hardware.

There is a short circuit between the phases.

A short circuit occurs between the phase line and the output negative electrode (B-).

A short circuit occurs between the phase line and the output positive electrode (B+).

Solution: Use the voltage profile of the multimeter to check for the short circuit.

If a short circuit is detected, replace the damaged individual controller.



2) Error ID: 103

Description: An instant fault about short circuit is detected in the hardware.

The software will restart the power supply within 500ms. If no other faults about the short circuit is detected within 100ms, it will be considered a fault about short circuit. Otherwise, it will be considered a fault about the hardware short circuit.

Cause A

A short circuit is detected in the hardware.

Solution: There is no need to deal with an accidental report of the fault. The over-time flow can cause the fault.



3) Error ID: 115

Description: The watchdog in the hardware module is not activated.

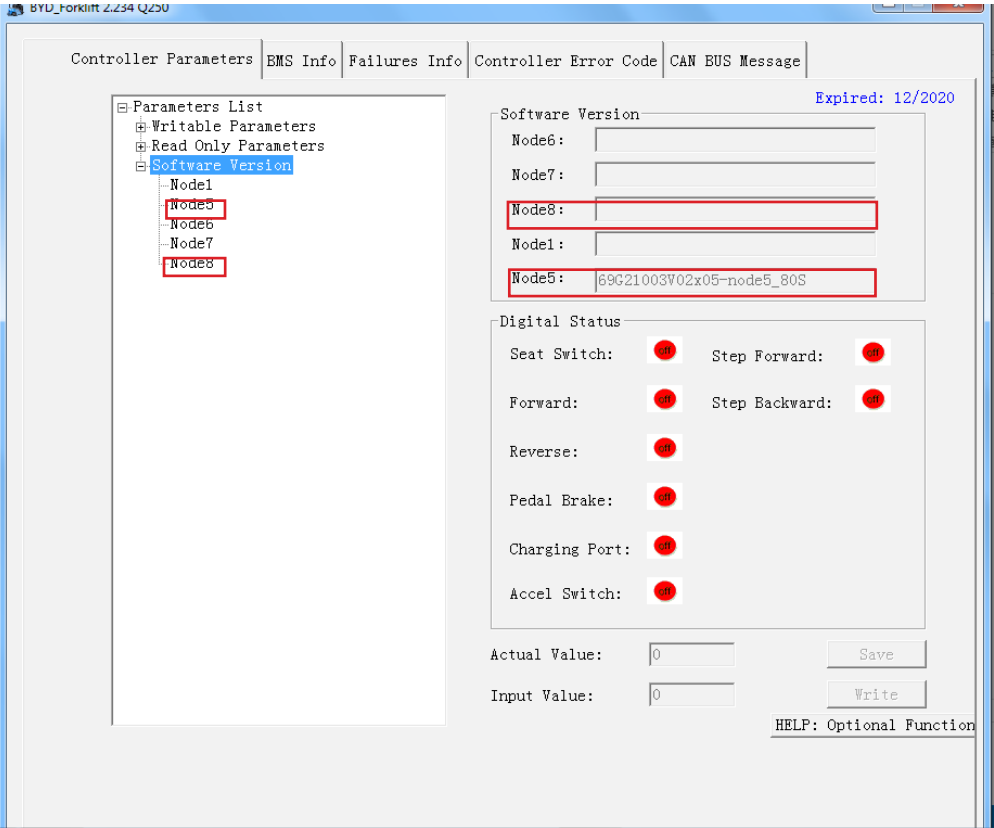
If the CPU does not activate the hardware watchdog in the power module, the power module will close.

Cause A

If the CPU does not activate the hardware watchdog in the power module, the power module will close.

Solution: Check whether the program version of the controller is correct. If not, update the program version or replace it with another controller.

Use the “BYD_Forklift” software to check and update the program version or replace the faulty controller in accordance with the method in the Error ID 700.



4) Error ID: 200

Description: Excessive overshoot will trigger the event.

Cause A

The overshoot is too high.

Solution: Check whether the incorrect program is written into the controller. If yes, update the program. If not, replace the controller.

The solution is the same as that of the Error ID 115.

5) Error ID: 202

Description: The error is triggered when the current of phases U, V and W is too high, but the instantaneous overcurrent counter is lower than the trip limit value.

The short circuit or the overcurrent occurs between the phases.

A short circuit occurs between the phase line and 80Vdc negative electrode (B-).

A short circuit occurs between the phase line and 80Vdc positive electrode (B+).

Cause A

The error is triggered when the current of phases U, V and W is too high, but the instantaneous overcurrent counter is lower than the trip limit value.



The short circuit or the overcurrent occurs between the phases.

A short circuit occurs between the phase line and 80Vdc negative electrode (B-).

A short circuit occurs between the phase line and 80Vdc positive electrode (B+).

Solution: Use the resistance profile of the multimeter to check for short circuit. If the value of resistance is not within what is measured between the phase lines as described earlier, replace with a new controller. (Refer to 4.6.9 for specific information.)

6) Error ID: 203

Description: The error is triggered when the current of phases U, V and W is too high, but the instantaneous overcurrent counter is lower than the trip limit value.

Cause A

The error is triggered when the current of phases U, V and W is too high, but the instantaneous overcurrent counter is lower than the trip limit value.

Solution: There is no need to deal with an accidental report of the error. The over-time flow can cause the error.



7) Error ID: 204

Description: The event is triggered when an initial value is read from memory (when the parameter verification is faulty or the operator sets parameters). It indicates that the driver is not calibrated.

Cause A

The initial value is read from memory.

Solution: Restart the tractor.

8) Error ID: 302

Description: The motor speed exceeds the allowed value and thus triggering this error.

Cause A

If the motor speed exceeds the allowed range, check whether the wiring harness of the speed sensor is normal.

Solution: Check whether the wiring harness of the speed sensor is normal.

Cause B

The speed sensor is damaged.

Solution: Replace with a new speed sensor and check whether the tractor can work normally. (Refer to 4.8.5 for specific information.)



9) Error ID: 303

Description: The motor speed exceeds the allowable value.

Cause A

The motor speed exceeds the allowable value.

Solution: Restart the tractor.

10) Error ID: 304

Description: The motor speed is lower than the allowable value.

Cause A

The motor speed is too low.

Solution: Restart the tractor.

11) Error ID: 402

Decription: The overvoltage is detected in the HW(hardware). The overvoltage level is set by HW.

Cause A

The overvoltage is detected in the HW.

Solution: Check the battery voltage. (The normal voltage is between 70V and 85V.)
Check whether the high voltage alarm is generated when the 80V main contactor sprang abnormally. Check the reason why the 80V main contactor disconnects and check other faulty codes.



12) Error ID: 403

Description: The voltage value measured exceeds what is allowed.

Cause A

The voltage value measured exceeds the allowable value.

Solution: Restart the tractor.

13) Error ID: 404

Description: The event will be triggered when the measured voltage falls below the default level after the default event has passed.

Cause A

The event will be triggered when the measured voltage falls below the default level after the default event has passed.

Solution: Check the battery voltage value. (The normal value is between 70V and 85V.)

Refer to the error code 407 for details.

14) Error ID: 405

Description: The DC bus voltage is too low.

Cause A

The DC bus voltage is detected too low.

Solution: Charge the tractor. (Refer to 9.6 for specific information.)

Cause B

The precharger is damaged.

Solution: Replace with a new recharger. (Refer to 4.6.6 for specific information.)

The recharger (SAP 11261402-00) is mounted to the radiator panel beside the controller. Two wires (red and yellow) are led to the radiator panel. When replacing the damaged precharger, connect the red wire to the front one of the two 80V main contactor terminals (to the battery pack positive electrode) and the yellow wire to the rear one (to the main control positive electrode).



15) Error ID: 406

Description: The event will be triggered when the measured voltage falls below the default level after the default event has passed.

Cause A

The event will be triggered when the measured voltage falls below the default level after the default event has passed.

Solution: Check the battery voltage value. (The normal value is between 70V and 85V.) Refer to the error code 407 for details.

16) Error ID: 407

Description: The event will be triggered when the measured voltage falls below the default level after the default event has passed.

Cause A

Due to over-discharge, the actual voltage of the battery is too low.

Solution: Check the battery voltage value. (The normal value is between 65V and 85V.)

Cause B

The precharger is damaged. When the ignition switch is closed within 5s, the voltage between the yellow line section and negative electrode of the precharger rises slowly (no higher than 65V). The voltage at the controller B+ (yellow line section of the precharger) is too low. Then the controller alarms that the battery voltage is too low, and the controller can't close 80v main contactor. The tractor doesn't work.

- Close the ignition switch. The 12V contactor in the battery box is closed but the 80V main contactor does not pull in.
- The display alarms that the battery voltage is low.
- The red motor on the display alarms.
- The error code of the controller: Event log (0x3006 or 0x3011):

Node 5: 407

Node 8: 407

Solution: Replace the precharger. (Refer to 4.6.6 for specific information.)

If the voltage between the yellow line section and negative electrode of the precharger rises slowly (rather than no voltage at all), wait for more than 2 minutes after the first power and then restart the ignition switch quickly. Then the 80V main contactor pulls in and the user can use it temporarily until the precharger is replaced.



17) Error ID: 408

Description: The event is triggered when an initial value is read from Eeprom (when the parameter verification is faulty or the operator sets parameters).

Cause A

The event is triggered when an initial value is read from Eeprom (when the parameter verification is faulty or the operator sets parameters).

Solution: Restart the tractor.

18) Error ID: 500

Description: The temperature sensor of the power unit inside the driver is in poor contact.

Cause A

The temperature sensor of the power unit inside the driver is in poor contact.

Solution: Replace the damaged controller. (Refer to 4.6.9 for specific information.)

Refer to the error ID 700 for details.

19) Error ID: 501

Description: The event will be triggered when the temperature sensor of the power unit inside the driver is short-circuited.

Cause A

The temperature sensor of the power unit inside the driver is short-circuited.

Solution: Replace the damaged controller. (Refer to 4.6.9 for specific information.)

Refer to the error code ID 700 for details.



20) Error ID: 502

Description: The temperature value of the power module sensor in the controller exceeds the allowable value.

Limit value: When it is 85°C , the event will be triggered. When it is 125°C , the torque current will be limited to 0.

Cause A

The temperature value of the power module sensor in the controller is too high.

Solution 1: Check whether the air fan of the controller fan can work normally.

Solution 2: Restart the tractor.

21) Error ID: 503

Description: The event will be triggered when the temperature of the driver power unit exceeds the preset value.

Cause A

Check whether the cooling fan of the controller works normally.

Cause B

The temperature sensor of the power unit inside the driver is in poor contact. Replace the damaged controller.

Solution: Stop the tractor and wait the controller cools down, then re-test it.



22) Error ID: 504

Description: The temperature of the power unit sensor is lower than the allowable value.

Limit value: When it is -20°C , the event will be triggered. When it is -70°C , the torque current will be limited to 0.

Cause A

The temperature of the power unit sensor is too low.

Solution: Restart the tractor.

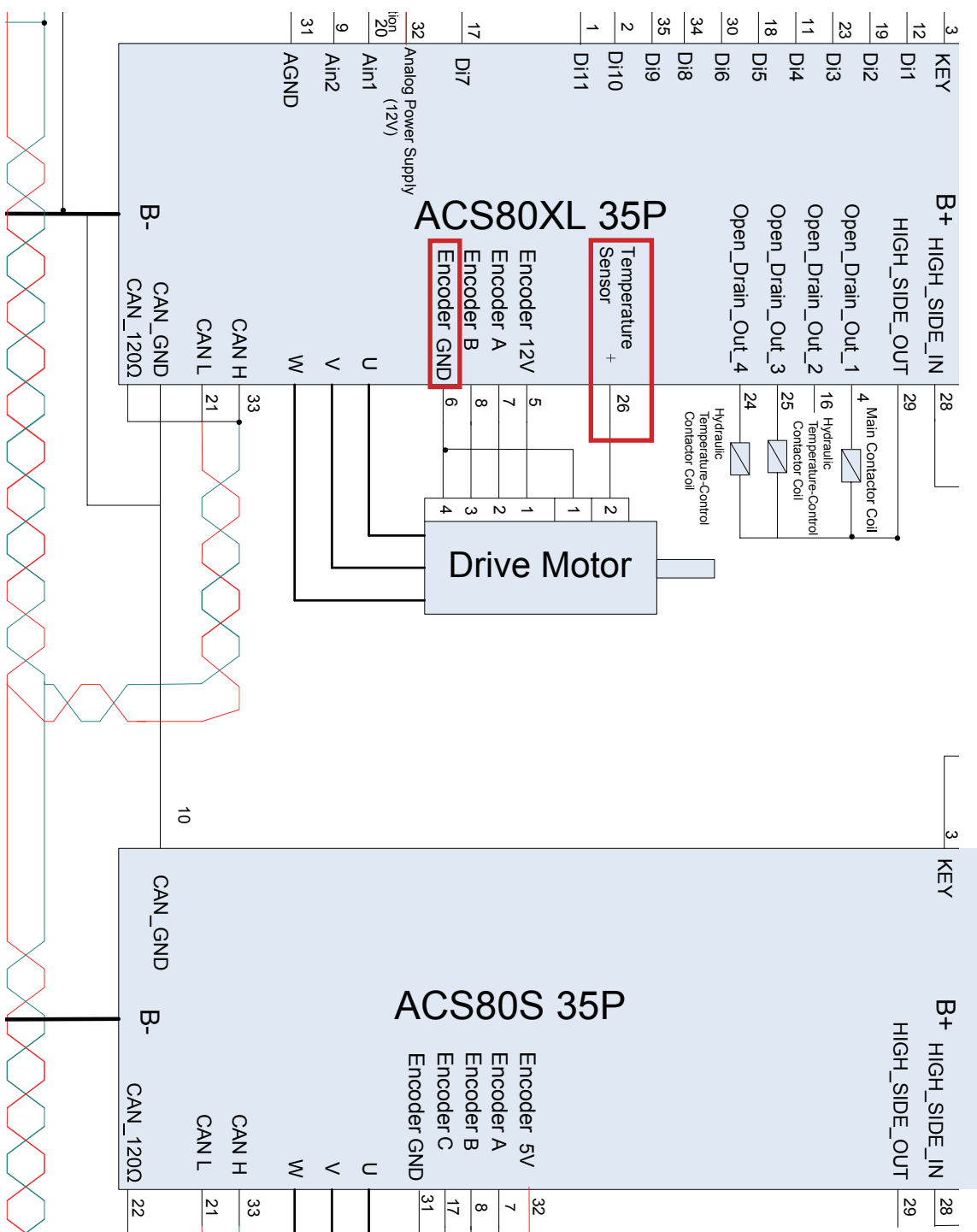
23) Error ID: 600

Description: The error will be caused when the temperature sensor of the motor is in poor contact or is disconnected.

Cause A

The temperature sensor of the motor is disconnected.

Solution: Check whether the wiring harness of the motor temperature sensor is well connected. If not, replace the wiring harness. If yes, replace the damaged temperature sensor.



24) Error ID: 601

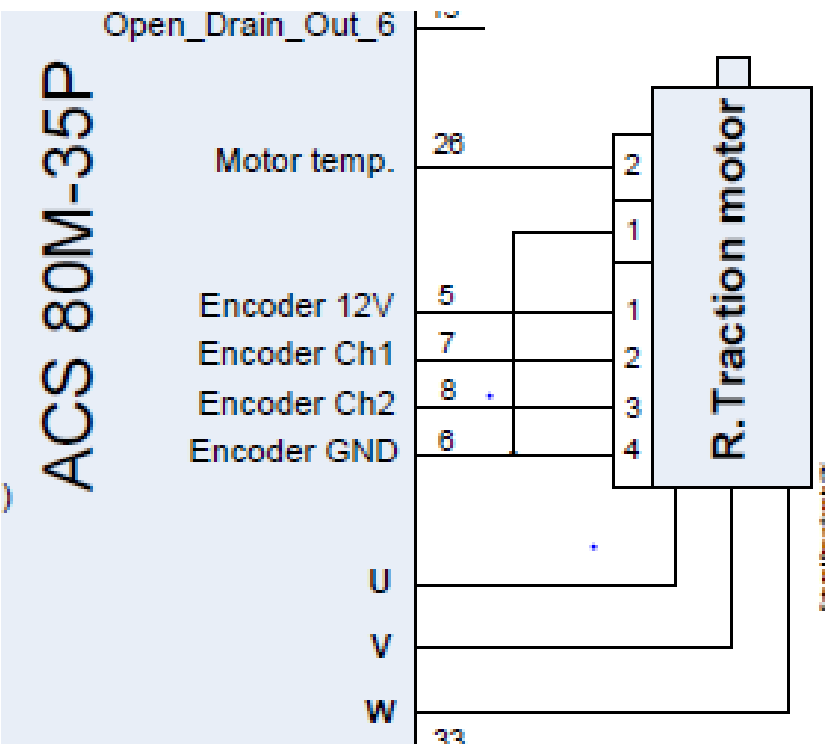
Description: The temperature sensor of the motor is short-circuited.

Cause A

The temperature sensor of the motor is damaged.

Solution: Check whether the temperature sensor of the motor is short-circuited.

Use the multimeter to measure the resistance between the pin26 and pin6 of the controller and check whether the temperature sensor of the motor is short-circuited.





25) Error ID: 602

Description: The temperature of the motor exceeds the allowable value.

Check for the relevant parameters for limit value:

0x2040h: 5 ModeratelyHighLevel

0x2040h: 6 ReductionEndHighLevel

Cause A

The temperature of the motor is too high.

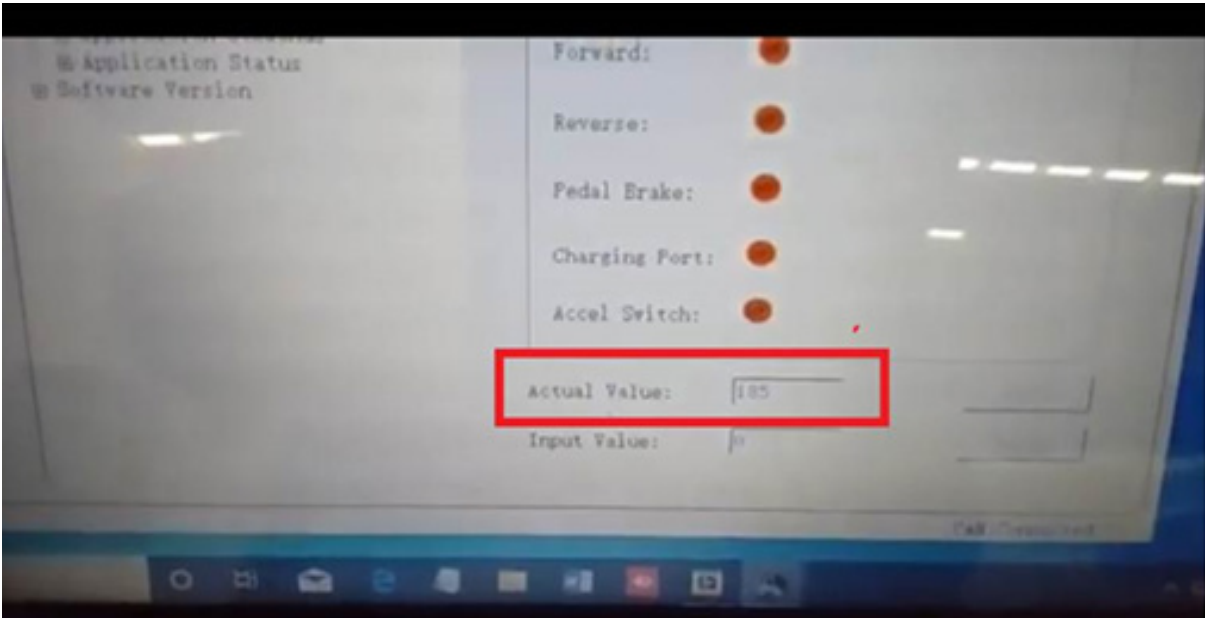
Solution: Check whether the motor temperature sensor is damaged or wiring harness is disconnected.

1. Use a temperature-measuring gun to check the actual temperature of the motor. If it is too high, it is necessary to reduce the temperature and decrease the speed as well as the parking brake value. Otherwise, lower the BPC (0x2141 Node 6 &Node 8) current curve inside the left and right drive controllers.

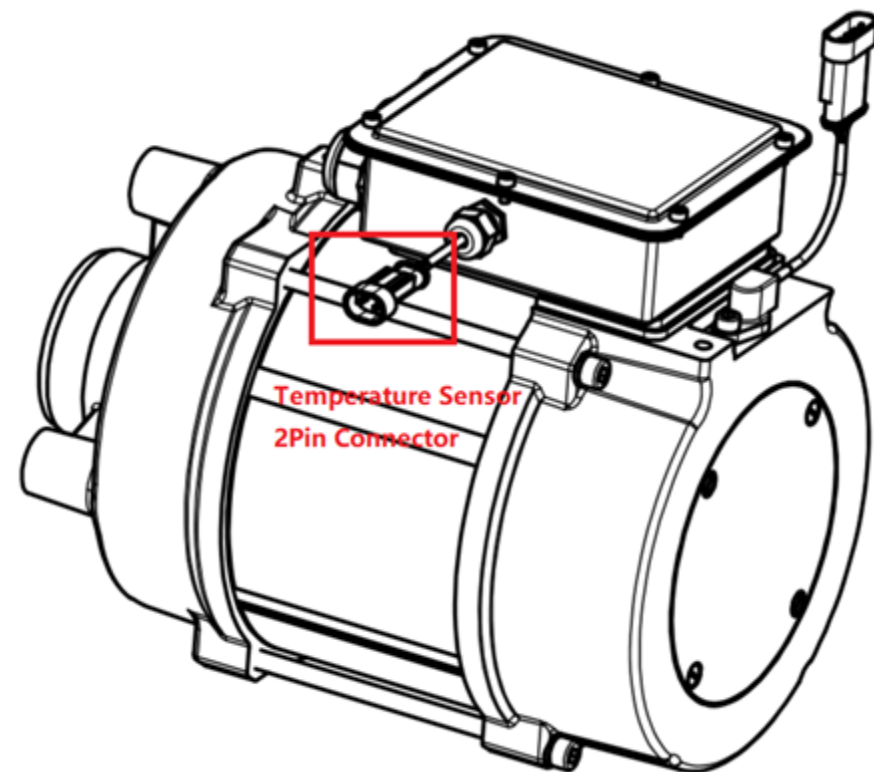


2. Use the BYD_ Forklift software to monitor whether the temperature value of the motor exceeds 165°C or even 175°C . Read Only Parameters→ Temp → L Drive Motor Temp / R Drive Motor Temp / Pump Motor Temp.

If the actuawl temperature of the motor is normal and the temperature value monitored by the software is high enough to alarm, then the resistance value of the temperature sensor needs to be further measured by the resistance profile of the multimeter.



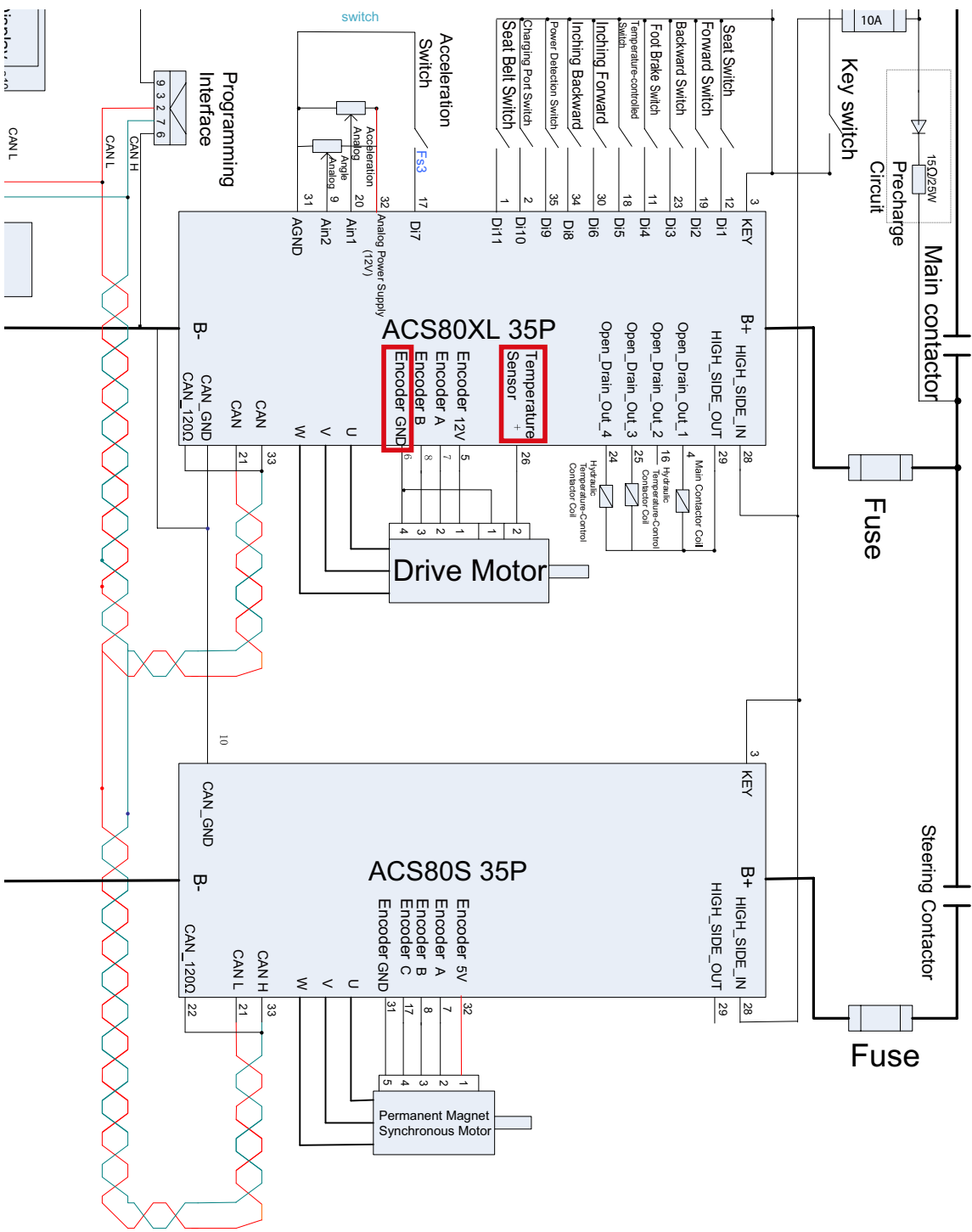
3. Measure the resistance value of the temperature sensor, and check whether the temperature sensor inside the motor is damaged according to the resistance-temperature value conversion table. Since the temperature sensor is embedded in the internal coil of the motor, it cannot be replaced. Once the temperature sensor is damaged, the entire motor needs to be replaced. (Refer to 4.8.4 for specific information.)



Motor Tem. Sensor R-T conversion table (KTY84-150)

电机温度传感器R-T换算表 (KTY84-150)							
TEMPERATURE	MIN.	TYP.	MAX.	TEMPERATURE	MIN.	TYP.	MAX.
℃	Ω			℃	Ω		
-40	332	359	386	130	1128	1194	1259
-30	362	391	419	140	1191	1262	1334
-20	394	424	455	150	1256	1334	1412
-10	428	460	492	160	1322	1407	1492
0	464	498	532	170	1391	1482	1574
10	503	538	574	180	1461	1560	1659
20	544	581	618	190	1533	1640	1747
25	565	603	641	200	1607	1722	1837
30	587	626	665	210	1683	1807	1931
40	632	672	713	220	1760	1893	2026
50	679	722	764	230	1839	1982	2125
60	729	773	817	240	1920	2073	2226
70	781	826	872	250	2003	2166	2329
80	835	882	929	260	2087	2261	2436
90	891	940	989	270	2172	2357	2543
100	950	1000	1050	280	2255	2452	2650
110	1007	1062	1117	290	2333	2542	2751
120	1067	1127	1187	300	2404	2624	2844

4. If the resistance of the temperature sensor is measured normally, it is necessary to measure whether there is a problem with the wiring between the temperature sensor plug-in and the controller connector.





26) Error ID: 603

Description: The temperature of the motor exceeds the allowable value.

Check for the relevant parameters for limit value:

0x2040h: 2 Temperature1

0x2040h: 7 HighLevel

Cause A

The temperature of the motor exceeds the allowable value.

Solution 1: Check the motor temperature sensor and wiring harness.

Refer to the error code 603 for details.

Solution 2: Stop the tractor and wait until the temperature of the motor is lower than the allowable value.

Refer to the error code 603 for details.



27) Error ID: 604

Description: The temperature of the motor is lower than the allowable value.

Check for the relevant parameters for limit value:

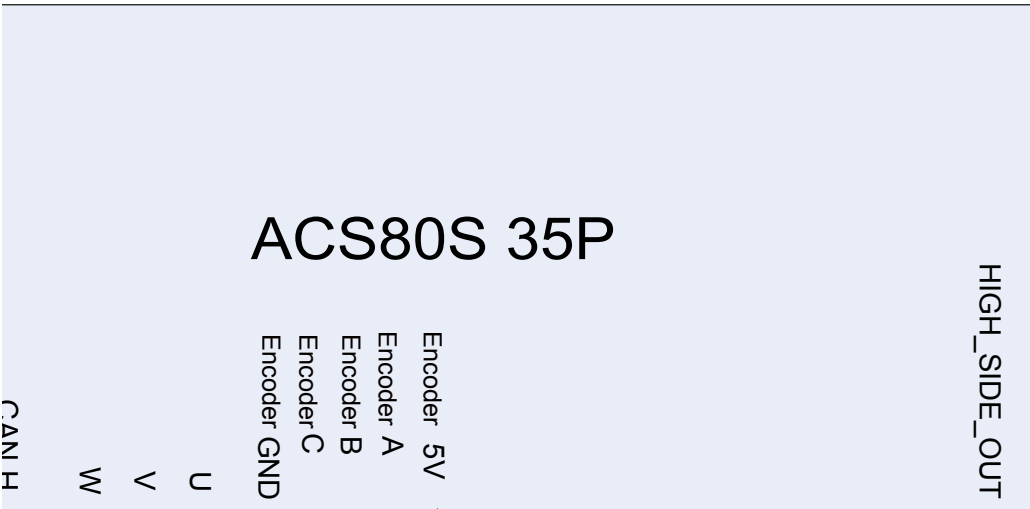
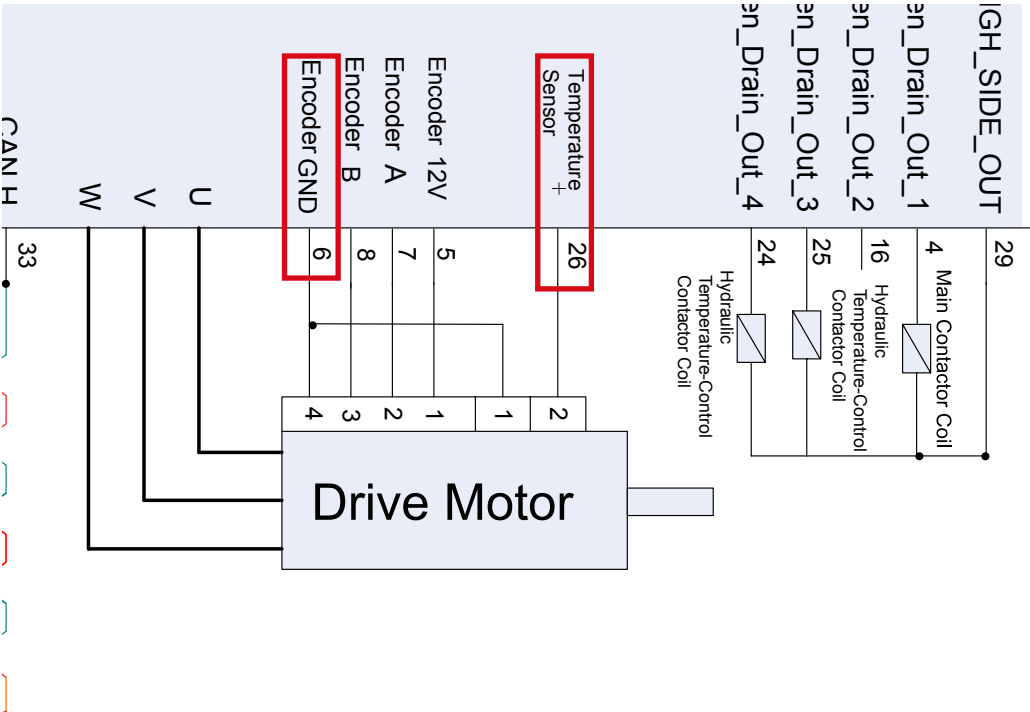
0x2040h: 3 ModeratelyLowLevel

0x2040h: 4 ReductionEndLowLevel

Cause A

Check whether the temperature sensor of the motor is short-circuited.

Solution: The temperature sensor is short-circuited.



28) Error ID: 700

Description: The temperature sensor on the PCB is in poor contact.

Limit value: It will be triggered when the temperature reaches 120°C .

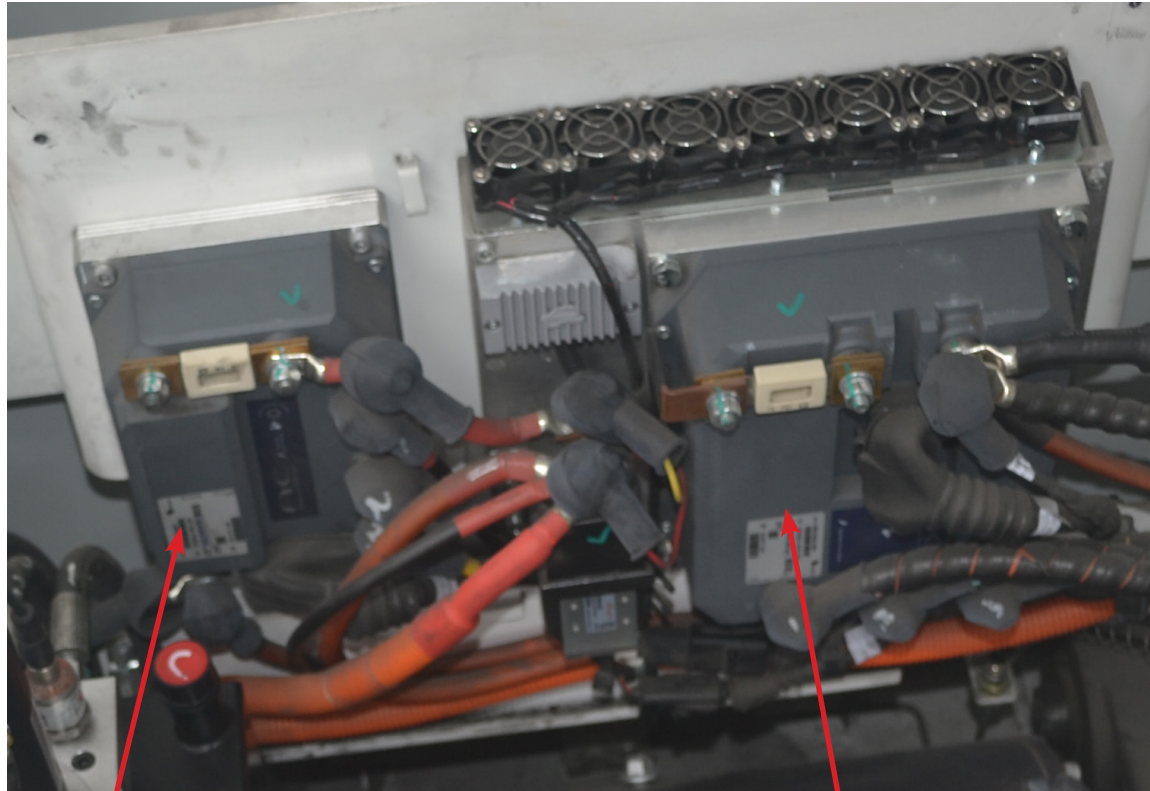
Cause A

The temperature sensor on the PCB is in poor contact.

Solution: Replace the faulty controller.

For the tractor, there are steering motor controller (330A, Node 5) and drive motor controller (330A, Node 8) from left to right.

The error code ID measured by the upper system: for the node (5,8), if the error code 0x3011 is 700, the controller is faulty. Replace the faulty controller.



Node 5

Node 8

1. Replace the damaged driving controller. (Refer to 4.6.9 for details.)
2. Replace the damaged steering controller.

29) Error ID: 701

Description: The temperature sensor on the PCB is short-circuited.

Limit value: It will be triggered when the temperature is -50°C .

Cause A

The temperature sensor on the PCB is short-circuited.

Solution: Replace the faulty controller.

Refer to the error code 700 for details.

30) Error ID: 702

Description: The temperature of the controller exceeds the allowable value.

Limit value: It will be triggered when the temperature is over 80°C .

Cause A

The temperature of the controller exceeds the allowable value.

Check whether the cooling fan of the controller works normally. Otherwise, maintain the damaged fan or replace it.

Solution: Wait until the controller temperature drops below 80°C and then operate it again.



31) Error ID: 703

Description: The temperature of the controller exceeds the allowable value.

Limit value: It will be triggered when the temperature is over 95°C .

Cause A

The temperature of the controller exceeds the allowable value.

Check whether the cooling fan of the controller works normally. Otherwise, maintain the damaged fan or replace it.

Refer to the error code 702 for details.

Solution: Wait until the controller temperature drops below 90°C and then operate it again.

32) Error ID: 704

Description: The temperature of the controller is lower than the allowable value.

Limit value: It will be triggered when the temperature is lower than -45°C .

Cause A

The temperature of the controller is lower than the allowable value.

Solution: Wait until the controller temperature rises to -45 °C and then operate it again.



Cause B

The temperature sensor on the PCB is short-circuited.

Solution: Replace the controller.

The operation method is the same as the error ID 700.

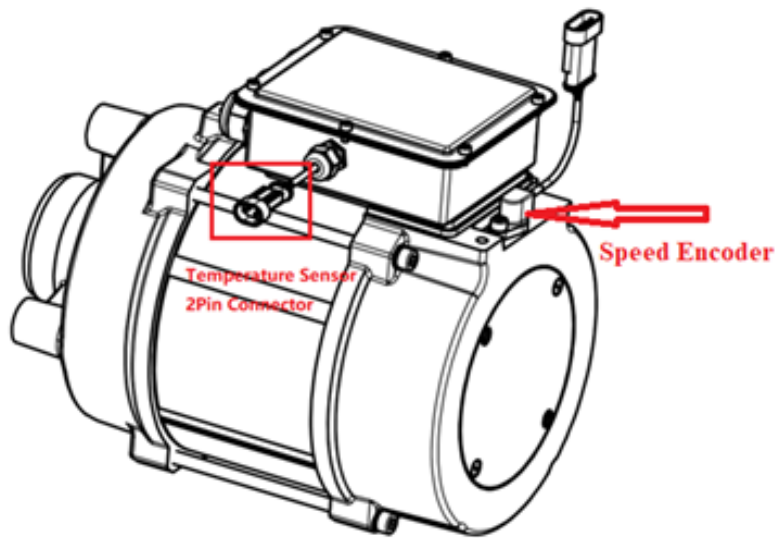
33) Error ID: 800

Description: This fault is triggered because the current supply of sensor is too low. The limit value is 6mA.

Cause A

This fault is triggered because the current supply of sensor is too low. The limit value is 6mA.

Solution: Check whether the speed sensor and temperature sensor are damaged or in poor contact. Use a multimeter to measure the wiring harness connected from the controller connector to the speed sensor and temperature sensor. If the wiring harness is damaged, replace the wiring harness. If the speed sensor is damaged, replace the speed sensor installed on the motor. If the temperature sensor is damaged, replace the motor since the temperature sensor is located inside the motor.



Motor temp.	26	2
		1
Encoder 12V	5	1
Encoder Ch1	7	2
Encoder Ch2	8	3
Encoder GND	6	4

34) Error ID: 801

Description: This fault is triggered because the sensor current is too high. The limit value is 68mA.

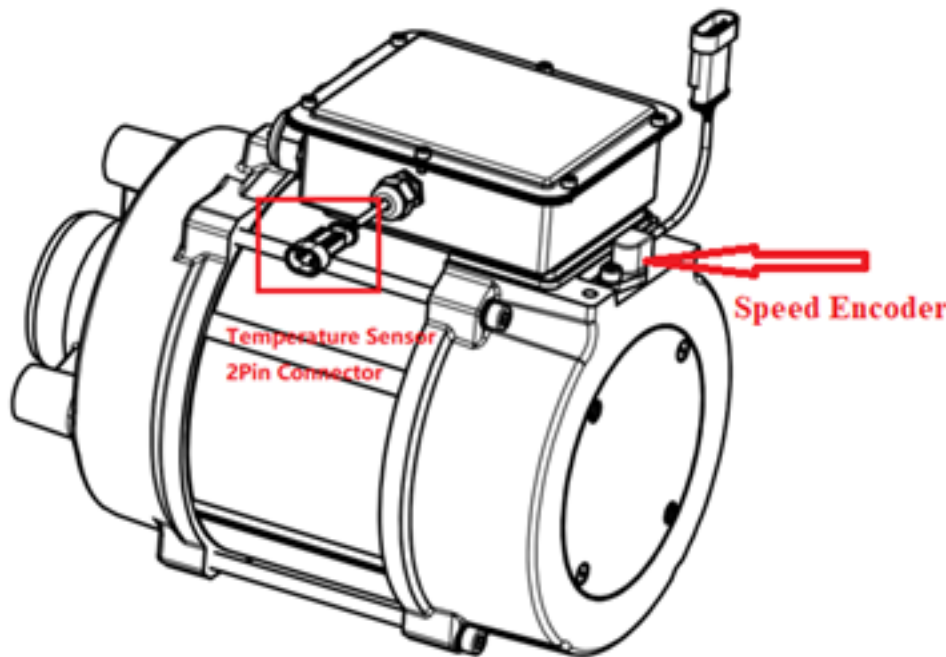
Cause A

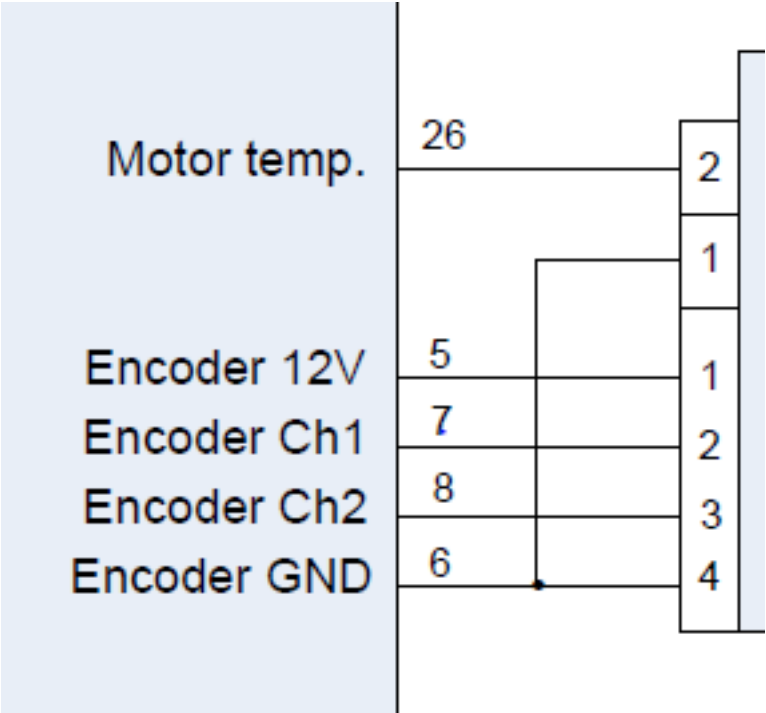
This fault is triggered because the sensor current is too high. The limit value is 68mA.

Solution: Check whether the speed sensor and temperature sensor are damaged, and whether there is a short circuit in the wiring harness.

Use a multimeter to measure whether there is a short circuit of the wiring harness connected from the controller to the speed sensor and temperature sensor. If the wiring harness is damaged, replace the wiring harness. If the speed sensor is damaged, replace the speed sensor which is installed on the motor. If the temperature sensor is damaged, replace the motor. (Refer to 4.8.4 for specific information.)

The resistance value of the temperature sensor is about 500Ω. If this value is too large, the temperature sensor is damaged. Refer to the temperature sensor resistance and temperature comparison table in error ID 602.





35) Error ID: 802

Description: This fault is triggered when Ch B is connected but Ch A is in poor contact.

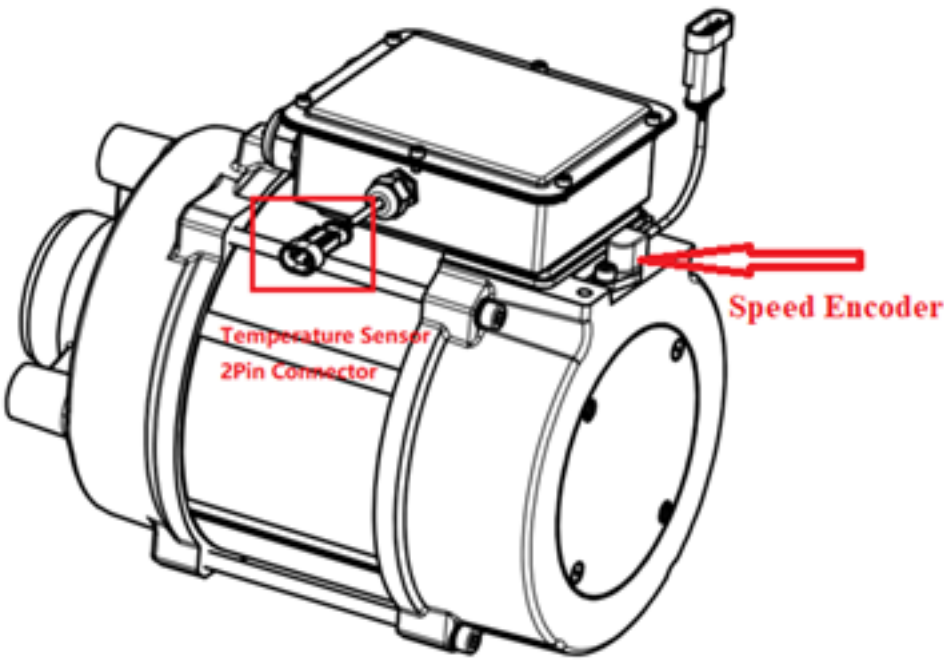
Cause A

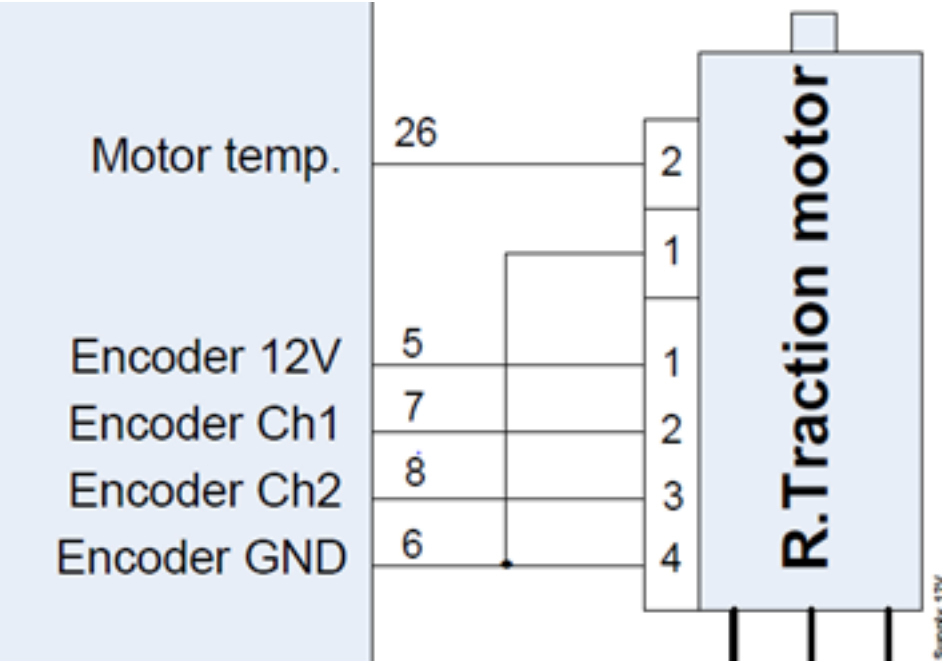
The wiring harness of Ch A is in poor contact.

Solution: Check whether the wiring harness of Ch A is normal.

Node 8 corresponds to the drive controller and drive motor.

Node 7 corresponds to pump motor controller and pump motor.





Cause B

The wiring harness of Ch A is in poor contact.

Solution: Check whether the speed sensor is damaged.

36) Error ID: 803

Description: This fault is triggered when Ch A is connected but Ch B is in poor contact.

Cause A

The wiring harness of Ch B is in poor contact.

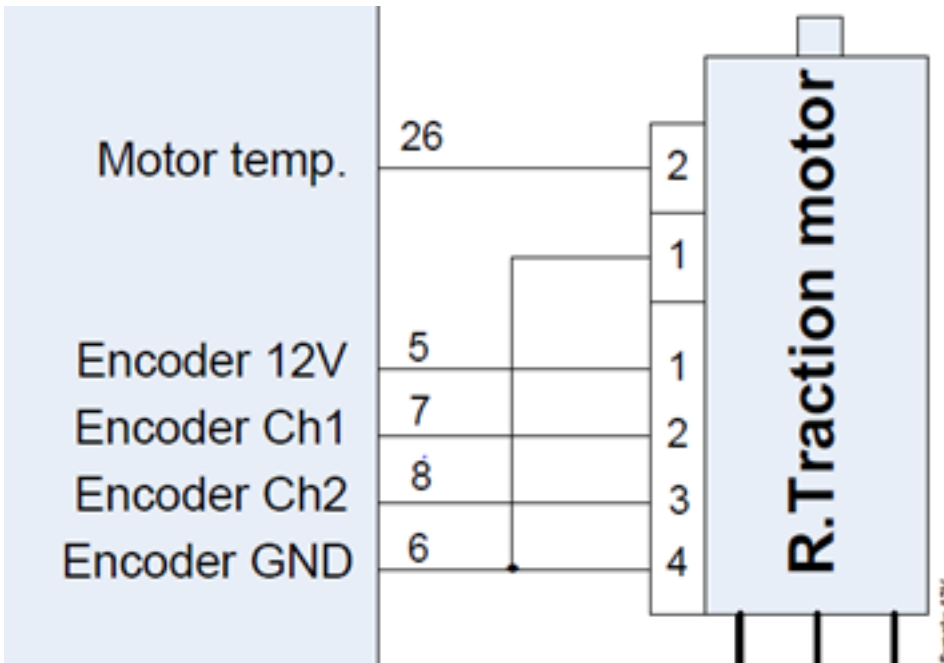
Refer to error ID 802.

Solution: Check whether the wiring harness of Ch B is normal.



Node 8 corresponds to the drive controller and drive motor.

Node 5 corresponds to pump motor controller and pump motor.



Cause B

The wiring harness of Ch B is in poor contact.

Solution: Check whether the speed sensor is damaged.

37) Error ID: 804

Description: The sensor speed changes too fast (measured by rotor acceleration).

Limit value: 1000rpm/20ms.



Cause A

The sensor speed changes too fast (measured by rotor acceleration).

Solution: First check the wiring harness of the sensor. If it is normal, replace the speed sensor to check whether the tractor can work normally.

Use a multimeter to check whether the sensor harness is normal. If so, replace the speed sensor. (Refer to 4.8.5 for specific information.)

38) Error ID: 805

Description: The event is triggered when the sensor detects that the speed is too fast. Such as an unreasonable speed value.

Limit value: 15000rpm.

Cause A

The speed changes too fast (measured by rotor acceleration).

Solution: First check the wiring harness of the sensor. Then replace the sensor to check whether the tractor can work normally.

Use a multimeter to check whether the sensor harness is normal. If so, replace the speed sensor.

39) Error ID: 810

Description: The Ref voltage supplied to the sensor is not within the allowable range. The rated range is 10.00 to 14.00 V.

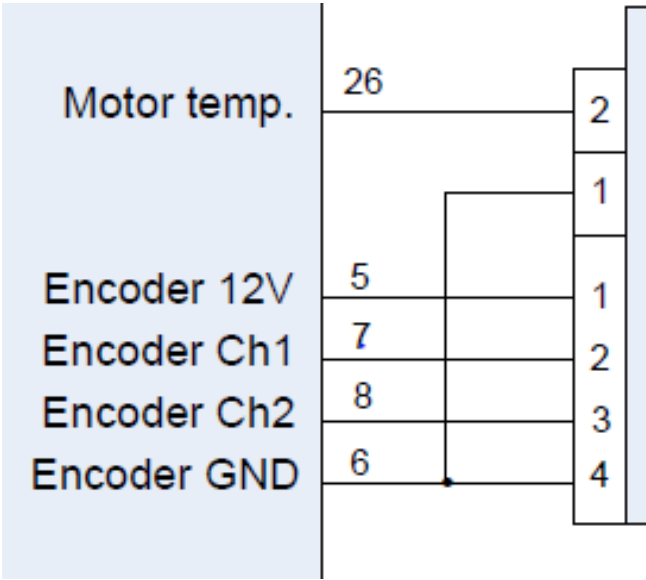
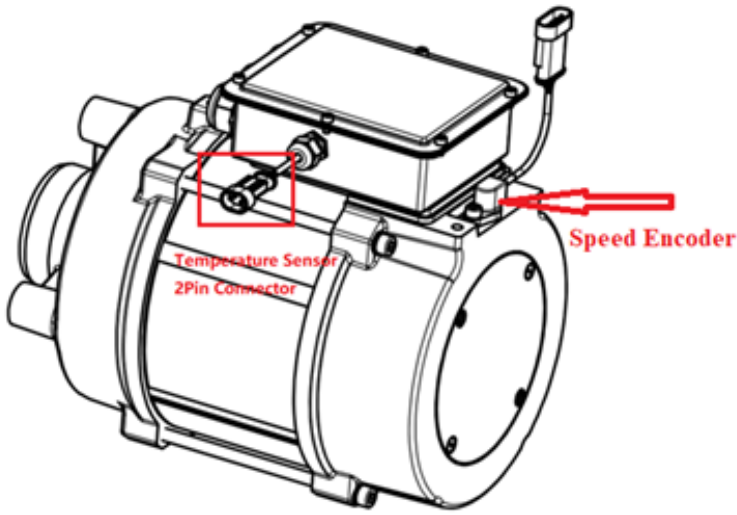
Cause A

The Ref voltage of the sensor is not within the allowable range.



Solution: The circuit connection of the speed sensor, temperature sensor or sensor is abnormal.

Check whether the speed sensor or temperature sensor of the motor is abnormal, or whether there is a problem with the sensor cable circuit. If the speed sensor or sensor harness is abnormal, replace the sensor; if the temperature sensor is abnormal, replace the motor. (Refer to 4.8.4 for specific information.)





40) Error ID: 811

Description: The sensor supply voltage exceeds the allowable range. The rated voltage range is 10.00 to 14.00 V.

Cause A

The sensor supply voltage exceeds the allowable range.

Solution: The circuit connection of the speed sensor, temperature sensor or sensor is abnormal.

Use a multimeter to check whether there is a short circuit of the speed sensor and the temperature sensor.

41) Error ID: 826

Description: This event is triggered when the speed encoder feedback speed changes too fast (rotor deceleration) and the deceleration is too high. This event is solved when the drive is enabled to stop.

Cause A

The sensor speed changes too fast (measured by rotor acceleration).

Solution: This error can be ignored.

42) Error ID: 830

Description: This event is triggered when an initial value is read from Eeprom (parameter verification error or set by operators).



Cause A

This event is triggered when an initial value is read from Eeprom (parameter verification error or set by operators).

Solution: Restart the tractor.

43) Error ID: 1001

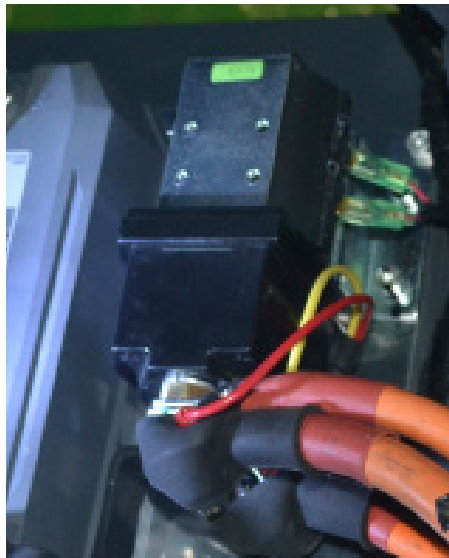
Description: The event is triggered when the hardware detects a short circuit on the output port. To solve the event, the output port must be closed first.

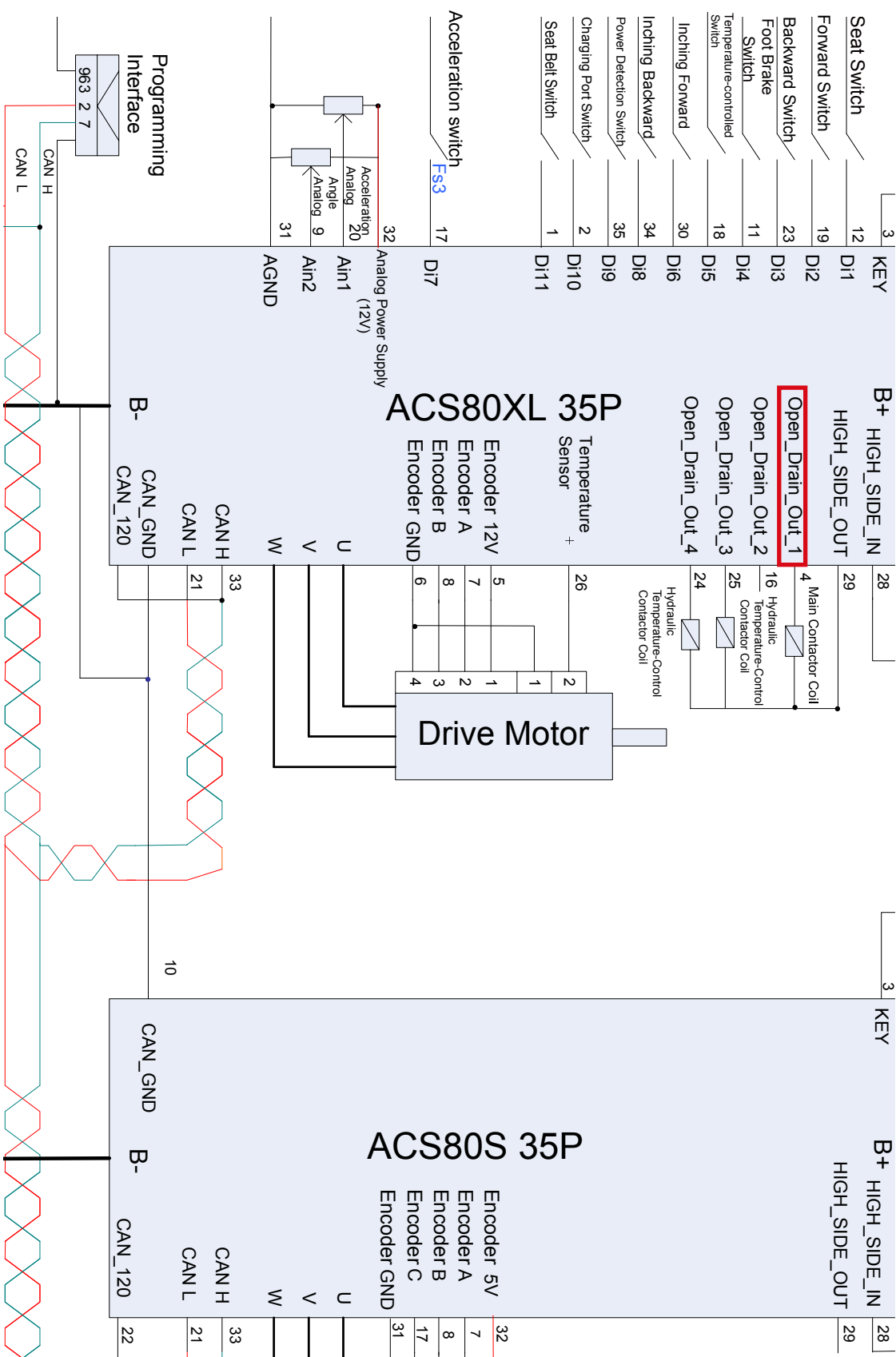
Cause A

The event is triggered when the hardware detects a short circuit on the output port. To solve the event, the output port must be closed first.

Solution: Check the cable circuit and connected equipment at the output port 1 of the controller Open_Drain_Out_1. Check whether there is a short circuit between the pin29 and pin4.

Open_Drain_Out_1 is located at station 8 and is connected with the 80V main contactor.





44) Error ID: 1003

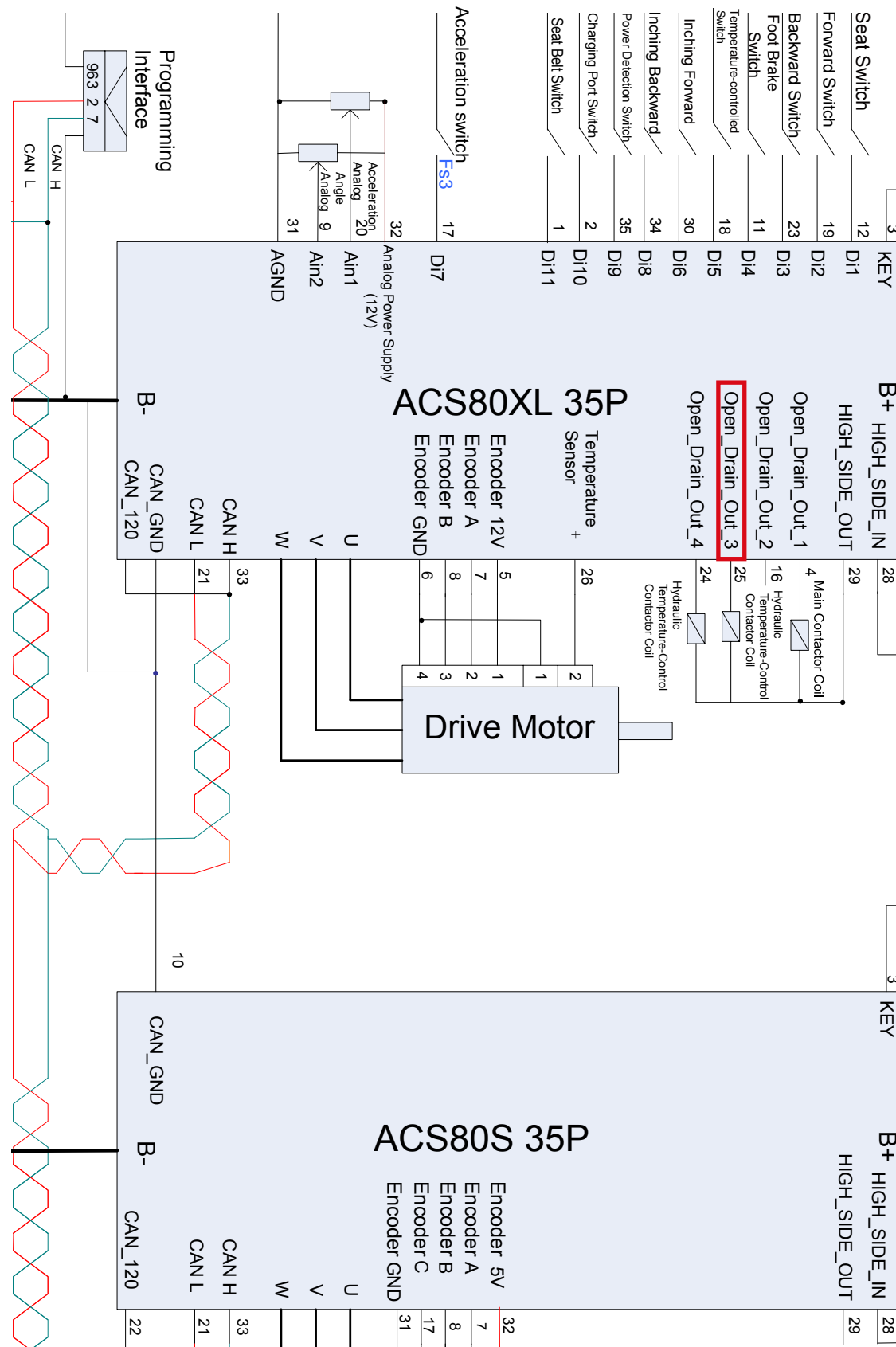
Description: This fault is triggered when there is overcurrent or overload (Open_Drain_Out_3, output port 3, as shown in the schematic diagram).

Cause A

This fault is triggered when there is overcurrent or overload (Open_Drain_Out_3, output port 3, as shown in the schematic diagram).

Solution: Check the cable circuit of Open_Drain_Out_3 and its components.

Check whether there is a short circuit between the pin29 and pin25.



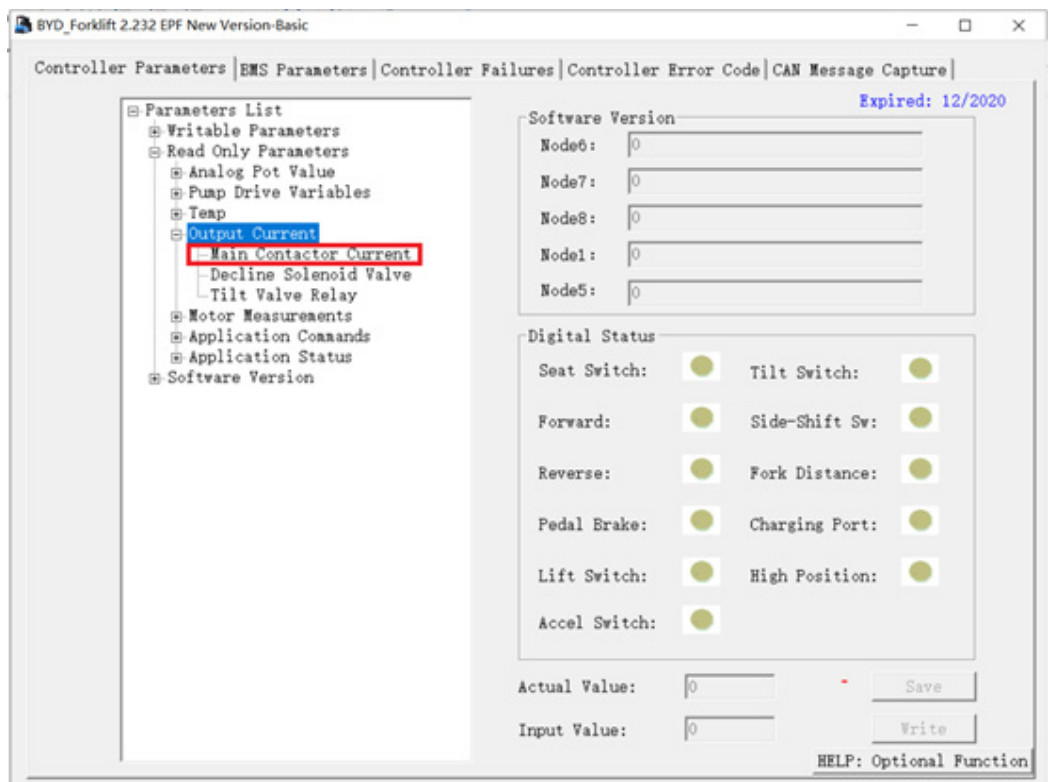
45) Error ID: 1011

Description: The measured current value (Open_Drain_Out_1, refer to the schematic diagram) is lower than the value of NotConnectedLevel.

Cause A

The measured current value (Open_Drain_Out_1, refer to the schematic diagram) is lower than the value of NotConnectedLevel.

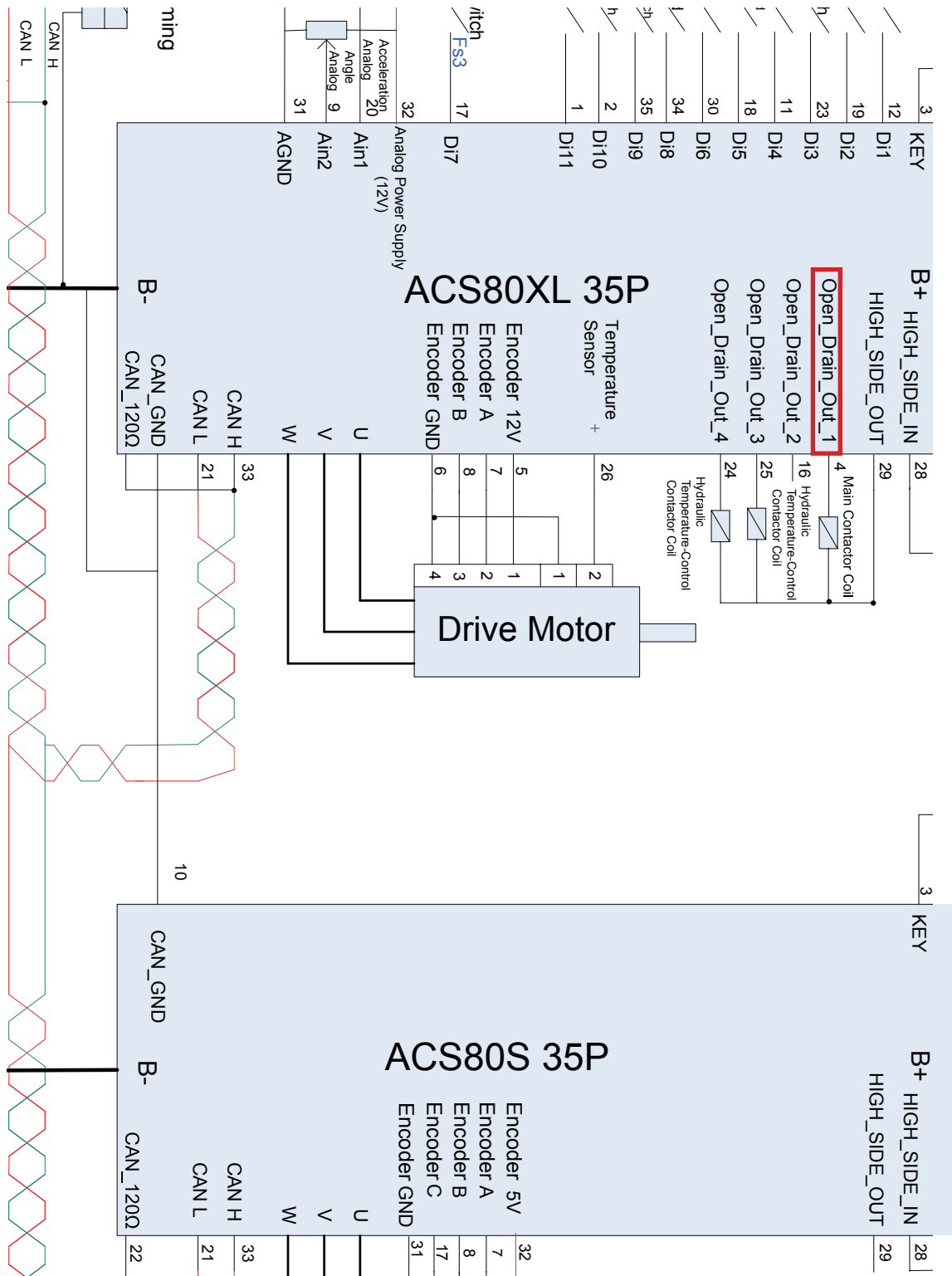
BYD_Forklift software monitors the current of the 80V main contactor coil of the controller at station 8 of the manual valve model. When the current is lower than 100mA, the alarm is triggered.



Solution: Check the related cable circuit of Open_Drain_Out_1.

Check the cable circuit between pin 29 and pin 4 to see whether there is any damage to the cable or poor contact of components.

Check and make sure that the coil resistance of the Main contactor (80V) should be 200Ω (SAP 11995889-00) instead of 400Ω.



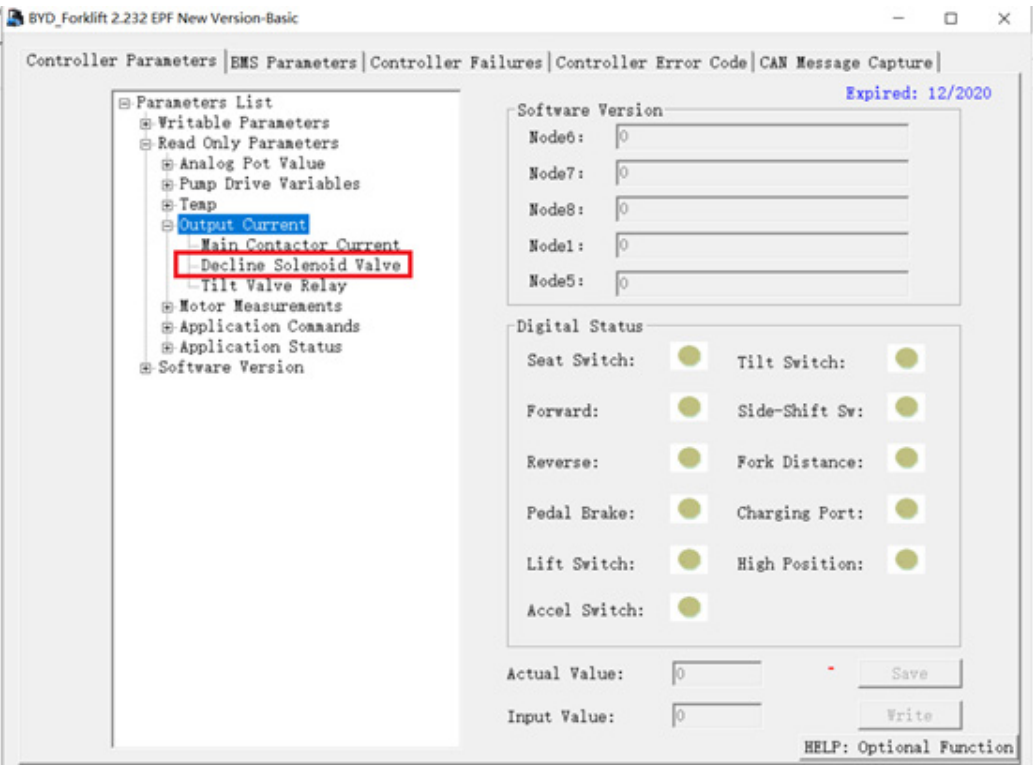
46) Error ID: 1012

Description: The measured current value (Open_Drain_Out_2, refer to the schematic diagram) is lower than NotConnectedLevel.

Cause A

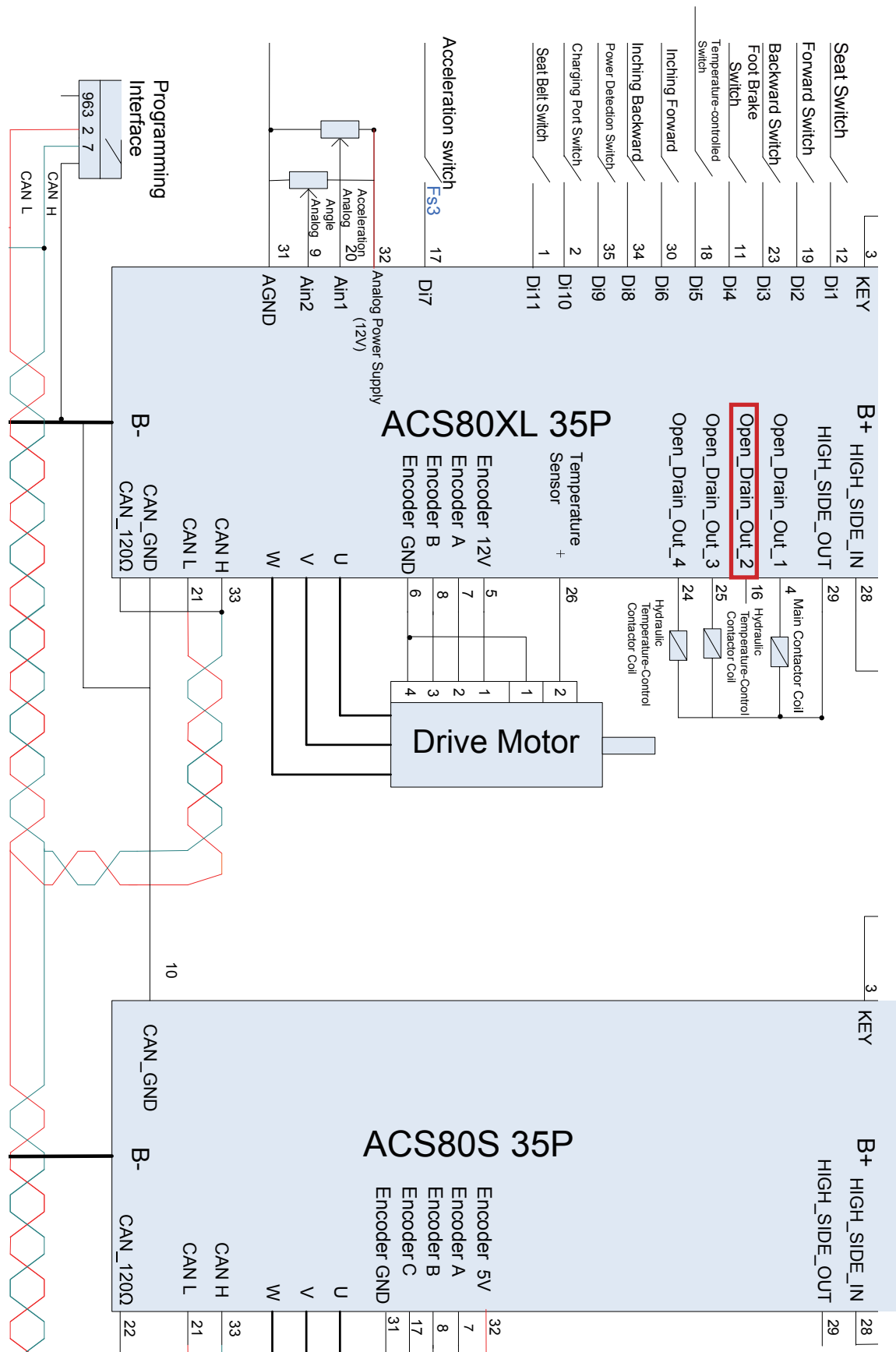
The measured current value (Open_Drain_Out_2, refer to the schematic diagram) is lower than NotConnectedLevel.

Use BYD_Forklift software to check whether the current of the lower solenoid valve relay coil of the manual valve model at station No. 8 controller is normal. When the current value is lower than 100mA, the alarm is not connected to 1012.



Solution: Check the related cable circuit of Open_Drain_Out_2.

Check the cable circuit between pin 29 and pin 16 to see whether there is any damage to the cable or poor contact of components.



47) Error ID: 1013

Description: The fault is triggered when the measured current value (Open_Drain_Out_3, refer to the schematic diagram) is lower than NotConnected Level.

Cause A

The fault is triggered when the measured current value (Open_Drain_Out_3, refer to the schematic diagram) is lower than NotConnected Level.

Solution: Check the related cable circuit of Open_Drain_Out_3.

Check the cable circuit between pin 29 and pin 25 to see whether there is any damage to the cable or poor contact of the machine.

48) Error ID: 1014

Description: The measured current value (Open_Drain_Out_4, refer to the schematic diagram) is lower than Not Connected Level.

Cause A

The measured current value (Open_Drain_Out_4, refer to the schematic diagram) is lower than Not Connected Level.

Solution: Check the related cable circuit of Open_Drain_Out_4.

Check the cable circuit between pin 29 and pin 24 to see whether the wiring harness is damaged or related components are not connected.

Refer to error ID 1011 or 1012 for details.



49) Error ID: 1021

Description: This fault is triggered when overcurrent or overload (Open_Drain_Out_1, refer to the schematic diagram) is detected.

Cause A

This fault is triggered when overcurrent or overload (Open_Drain_Out_1, refer to the schematic diagram) is detected.

Solution: Check the related cable circuit of Open_Drain_Out_1 and its components.

The operation method is the same as the error ID 1001.

50) Error ID: 1022

Description: This fault is triggered when overcurrent or overload (Open_Drain_Out_2, refer to the schematic diagram) is detected.

Cause A

This fault is triggered when overcurrent or overload (Open_Drain_Out_2, refer to the schematic diagram) is detected.

Solution: Check the related cable circuit of Open_Drain_Out_2 and its components.

The operation method is the same as the error ID 1002.

51) Error ID: 1023

Description: This fault is triggered when overcurrent or overload (Open_Drain_Out_3, refer to the schematic diagram) is detected.

Cause A

This fault is triggered when overcurrent or overload (Open_Drain_Out_3, refer to the schematic diagram) is detected.

Solution: Check the related cable circuit of Open_Drain_Out_3 and its components. The operation method is the same as the error ID 1003.



52) Error ID: 1024

Description: This fault is triggered when overcurrent or overload (Open_Drain_Out_4, refer to the schematic diagram) is detected.

Cause A

This fault is triggered when overcurrent or overload (Open_Drain_Out_4, refer to the schematic diagram) is detected.

Solution: Check the related cable circuit of Open_Drain_Out_4 and its components.

Refer to error ID 1004 for the operation method.

53) Error ID: 1031

Description: The fault is triggered when a current value exceeding 200mA can still be detected after disconnecting output1(Open_Drain_Out_1, refer to schematic diagram).

Cause A

The fault is triggered when a current value exceeding 200mA can still be detected after disconnecting output1(Open_Drain_Out_1, refer to schematic diagram).



Solution: Check cable circuit of Open_Drain_Out_1.

Check the cable circuit between pin 29 and pin 4 to see whether the wiring harness is damaged or related components are not connected.

Refer to error ID 1011 or 1012 for details.

54) Error ID: 1032

Description: The fault is triggered when a current value exceeding 200mA can still be detected after disconnecting output2 (Open_Drain_Out_2, refer to schematic diagram).

Cause A

The fault is triggered when a current value exceeding 200mA can still be detected after disconnecting output2 (Open_Drain_Out_2, refer to schematic diagram).

Solution: Check the cable circuit of Open_Drain_Out_2.

Check the cable circuit between pin 29 and pin 16 to see whether the wiring harness is damaged or related components are not connected.

Refer to error ID 1011 or 1012 for details.

55) Error ID: 1033

Description: The fault is triggered when a current value exceeding 200mA can still be detected after disconnecting output3 (Open_Drain_Out_3, refer to schematic diagram).



Cause A

The fault is triggered when a current value exceeding 200mA can still be detected after disconnecting output3 (Open_Drain_Out_3, refer to schematic diagram).

Solution: Check cable circuit of Open_Drain_Out_3.

Check the cable circuit between pin 29 and pin 25 to see whether the wiring harness is damaged or related components are not connected.

Refer to error ID 1011 or 1012 for details.

56) Error ID: 1034

Description: The fault is triggered when a current value exceeding 200mA can still be detected after disconnecting output4 (Open_Drain_Out_4, refer to schematic diagram).

Cause A

The fault is triggered when a current value exceeding 200mA can still be detected after disconnecting output4 (Open_Drain_Out_4, refer to schematic diagram).

Solution: Check the cable circuit of Open_Drain_Out_4.

Check the cable circuit between pin 29 and pin 24 to see whether the wiring harness is damaged or related components are not connected.

Refer to error ID 1011 or 1012 for details.

57) Error ID: 1100

Description: The hardware detects a short circuit signal and stops outputting. The event record needs to be cleared.

Cause A

The hardware detects a short circuit signal and stops outputting. The event record needs to be cleared.

Solution: Check the cable circuit, such as the High_Side_Out Pin29 shown in the schematic diagram.

Check whether there is a short circuit on pin 29. Generally, this fault occurs when the machine is damaged.

58) Error ID:1200

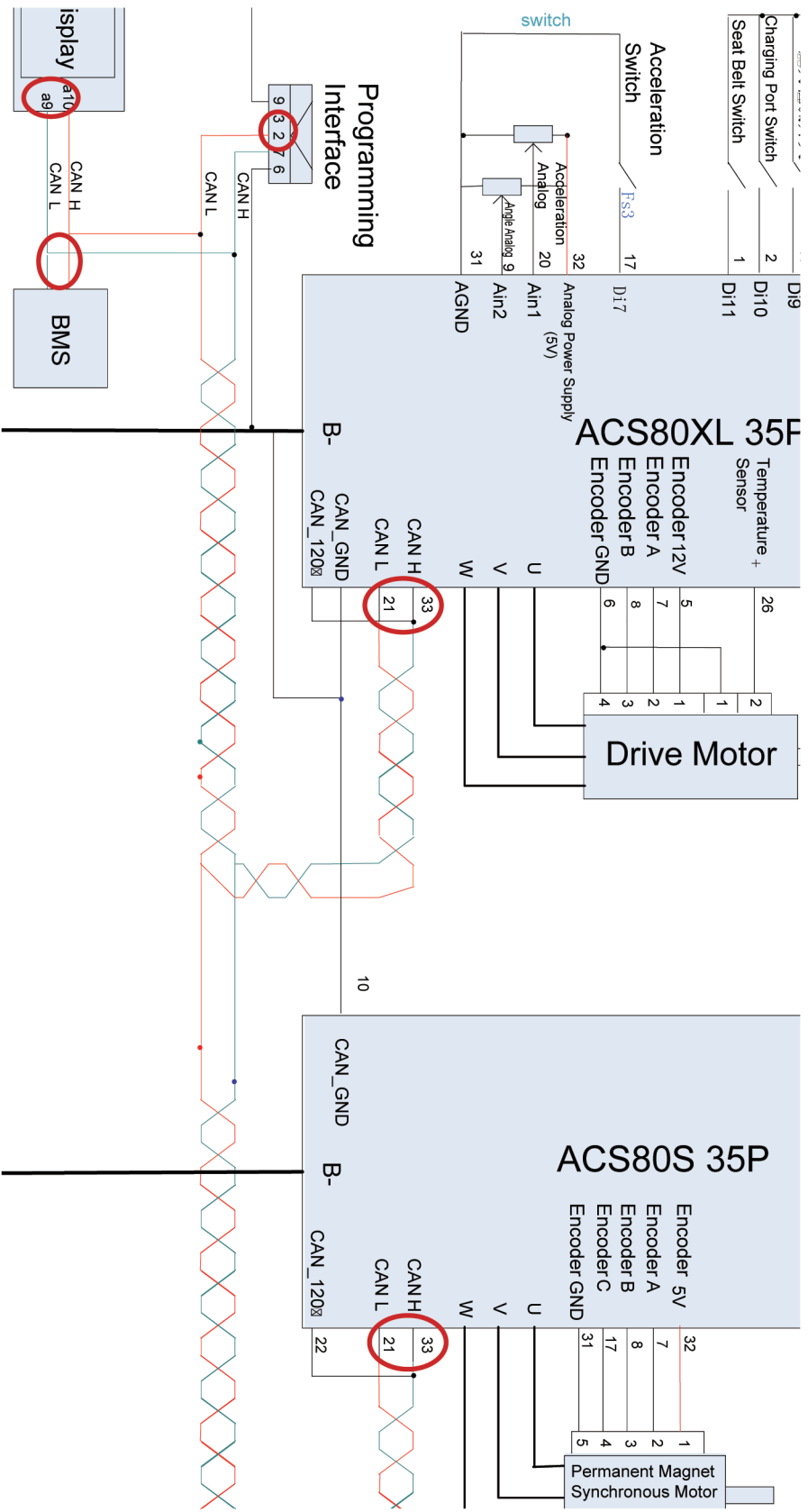
Description: The fault is triggered if the Rx PDO 1 signal is not received within a limited time.

Cause A

CAN communication is interrupted by interference.

Solution: Check the CAN communication line for poor contact.

Check the CAN communication line between the controller, the display screen and the BMS for poor contact.





59) Error ID: 1201

Description: The fault is triggered if the Rx PDO 2 signal is not received within a limited time.

Cause A

CAN communication is interrupted by interference.

Solution: Check the CAN communication line for poor contact.

Refer to error ID 1200 for operation method.

60) Error ID: 1202

Description: The fault is triggered if the Rx PDO 3 signal is not received within a limited time.

Cause A

CAN communication is disturbed.

Solution: Check the CAN communication line for poor contact.

Refer to error ID 1200 for operation method.

61) Error ID: 1203

Description: The fault is triggered if the Rx PDO 4 signal is not received within a limited time.

Cause A

CAN communication is disturbed.

Solution: Check the CAN communication line for poor contact.

Refer to error ID 1200 for operation method.



62) Error ID: 1204

Description: The event is triggered when the CAN bus Sync message is not received within the limited time.

Cause A

CAN communication is interrupted by interference.

Solution: Check the CAN communication line for poor contact.

Refer to error ID 1200 for operation method.

63) Error ID: 1205

Description: The event is triggered when invalid content appears in the PDO setting.

Cause A

The program in the controller is wrong.

Solution: Check which program of controller is recorded incorrectly. (Refer to Chapter 6 Truck Settings for details.)

Use Code loader software to check which controller has been burned with the wrong software version. Or sometimes the program version in the controller has changed, we need to re-burn the correct program version.



64) Error ID: 1206

Description: The event is triggered when no hear beat communication is received for a certain period of time.

Cause A: The communication of the main control Pdo7 timed out.

Solution: Pdo7 not in the main control. If the current error code 3011 appears, you can upload parameters and then update the program again.

65) Error ID: 1207

Description: The event is triggered when no SDO message is received within the timeout period.

This event will only be evaluated when there is no PDO configuration. The drive is not allowed to be enabled when SDO times out.

Cause A

The event is triggered when no SDO message is received within the timeout period.

Solution: Restart the tractor.

66) Error ID: 1220

Description: After the unit is initialized, the CAN chip on the MCU enters the bus off state at least once.

The unit reset needs to clear the fault record.

Cause A

After the unit is initialized, the CAN chip on the MCU enters the bus off state at least once.

Solution: Restart the tractor.



67) Error ID: 1250

Description: The fault is triggered if the Rx PDO 5 signal is not received within a limited time.

Cause A

CAN communication is disturbed.

Solution: Check the CAN communication line for poor contact.

The operation method is the same as the error ID 1200.

68) Error ID: 1251

Description: The fault is triggered if the Rx PDO 6 signal is not received within a limited time.

Cause A

CAN communication is disturbed.

Solution: Check the CAN communication line for poor contact.

The operation method is the same as the error ID 1200.

69) Error ID: 1252

Description: The fault is triggered if the Rx PDO 7 signal is not received within a limited time.

Cause A

CAN communication is disturbed.

Solution: Check the CAN communication line for poor contact.

The operation method is the same as the error ID 1200.



70) Error ID: 1253

Description: The fault is triggered if the Rx PDO 8 signal is not received within a limited time.

Cause A

CAN communication is interrupted by interference.

Solution: Check the CAN communication line for poor contact.

The operation method is the same as the error ID 1200.

71) Error ID: 1402

Description: When downloading new software, the hardware ID is modified or there is a check error in the eeprom.

Cause A

When downloading new software, the hardware ID is modified or there is a check error in the eeprom.

Solution: Restart the tractor.



72) Error ID: 1403

Description: The event is triggered when there is a check error in the eeprom.

Cause A

The event is triggered when there is a check error in the eeprom.

Solution 1: Restart the tractor.

Solution 2: After restarting the tractor, the fault occurs again. Then check the program version of controller. If the program version is correct, upload the controller parameters to save and send to the supplier.

73) Error ID: 1406

Description: The independent watchdog inside the MCU did not restart in time, causing the MCU to reset.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)

Cause C

The controller is damaged.

Solution: Upload the parameters to save and send to the supplier.



74) Error ID: 1407

Description: The window watchdog of MCU did not restart in time, causing the MCU to reset.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)

Cause C

The controller is damaged.

Solution: Upload electrical parameters to save and send to dealers for analysis.

For this kind of fault, the controller supplier will help us analyze the program to confirm whether the controller is damaged. If so, it needs to be replaced.



75) Error ID: 1409

Description: When the average running time of each cycle of the software exceeds the set value of <#EXTIME_STATEMACHINE_MAX_ TIME/> us.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)

Cause C

The controller is damaged.

Solution: Upload parameters and send to dealers for analysis.

Refer to error ID 1407 (M3) for the operation method.



76) Error ID: 1410

Description: When the average running time of each cycle of the software exceeds the set value of <#EXTIME_STATEMACHINE_MAX_TIME/> us.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)

Cause C

The controller is damaged.

Solution: Upload electrical parameters to save and send to dealers for analysis.

Refer to error ID 1407 (M3) for the operation method.



77) Error ID: 1411

Description: When the average running time of each cycle of the software exceeds the set value of <#EXTIME_INDEPENDENT_SUPERVISION_MAX_TIME/ >us.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)

Cause C

The controller is damaged.

Solution: Upload parameters to save and send to dealers for analysis.

Refer to error ID 1407 (M3) for the operation method.



78) Error ID: 1412

Description: When the average running time of each cycle of the software exceeds the set value of <#EXTIME_COMMUNICATION_MAX_TIME/> us.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)

Cause C

The controller is damaged.

Solution: Upload parameters to save and send to dealers for analysis.

Refer to error ID 1407 (M3) for the operation method.

79) Error ID: 1413

Description: When the average running time of each cycle of the software exceeds the set value of <#EXTIME_SLOW_APPL_MAX_TIME/>us.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)



Cause C

The controller is damaged.

Solution: Upload parameters to save and send to dealers for analysis.

Refer to error ID 1407 (M3) for the operation method.

80) Error ID: 1414

Description: When the average running time of each cycle of the software exceeds the set value of <#EXTIME_FAST_APPL_MAX_TIME/> us.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)

Cause C

The controller is damaged.

Solution: Upload parameters to save and send to dealers for analysis.

Refer to error ID 1407 (M3) for the operation method.



81) Error ID: 1415

Description: When the average running time of each cycle of the software exceeds the set value of <#EXTIME_SLOW_APPL_MODERATELY_HIGH_TIME/> us.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)

Cause C

The controller is damaged.

Solution: Upload parameters to save and send to dealers for analysis.

Refer to error ID 1407 (M3) for the operation method.



82) Error ID: 1416

Description: When the average running time of each cycle of the software exceeds the set value of <#EXTIME_FAST_APPL_MODERATELY_HIGH_TIME/> us.

Cause A

This fault is accidentally triggered when downloading a new program.

Solution: Restart the tractor.

Cause B

If the fault does not disappear after restarting the tractor, check whether the program version is correct.

Solution: Check the program version. (Refer to Chapter 6 Truck Settings for details.)

Cause C

The controller is damaged.

Solution: Upload parameters to save and send to dealers for analysis.

Refer to error ID 1407 (M3) for the operation method.



83) Error ID: 1450

Description: An error occurred inside the controller CPU. For example: The flashmemory in the controller cannot capture configuration information at compile time, such as illegal Error Bit configured for events.

Cause A

The program of controller is abnormal.

Solution: Restart the tractor and download the program again.

Re-burn the program using Code loader software.

Cause B

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.

84) Error ID: 1460

Description: CPU clock is damaged. Neither the external crystal oscillator nor the internal PLL generates a stable clock frequency. The CPU is locked by the internal 8MHzRC-oscillator.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.



85) Error ID: 1700

Description: The internal 15V voltage supply of the controller is not within the allowable range. The rated range is 10.56 to 19.00V.

Cause A

The internal 15V voltage supply is not within the allowable range.

Solution: Check whether the program version is correct, if not, update the program. If the program version is correct, replace the controller.

The operation method is the same as error ID 115.

86) Error ID: 1701

Description: The internal 5V voltage supply is not within the allowable range.

Cause A

The internal 5V voltage supply is not within the allowable range. The rated range is 4.12 to 5.88V.

Solution: Check whether the program version is correct, if not, update the program. If the program version is correct, replace the controller.

The operation method is the same as error ID 115.

87) Error ID: 1702

Description: The internal 3.3V voltage supply is too low. The limit value is 2.9V. This voltage is used to power the driver MCU. (Detected by internal program). This signal is set by MCU hardware. When the voltage of VDD is lower than the limit value, this error occurs, and the hysteresis voltage is 100mV.

Cause A

The internal 3.3V voltage supply is too low. The limit value is 2.9V and the VDD value is lower than the minimum value.



Solution: Check whether the program version is correct, if not, update the program. If the program version is correct, replace the controller.

The operation method is the same as error ID 115.

88) Error ID: 1703

Description: Restart fails. When the controller logic enable power is too low, disconnect the controller enable; when the logic enable power returns to the normal voltage within 175ms, the system will be enabled again. If the low voltage lasts for more than 175ms, the controller will enter a dead state.

Cause A

The low logic enable power lasts for more than 175ms.

Solution: Restart the tractor.

89) Error ID: 1710

Description: The analog voltage is not within the allowable range. The rated range is 4.00 to 6.00 V.

Cause A

The analog voltage is not within the allowable range.

Solution: Check whether the program version is correct, if not, update the program. If the program version is correct, replace the controller.

The operation method is the same as error ID 115.

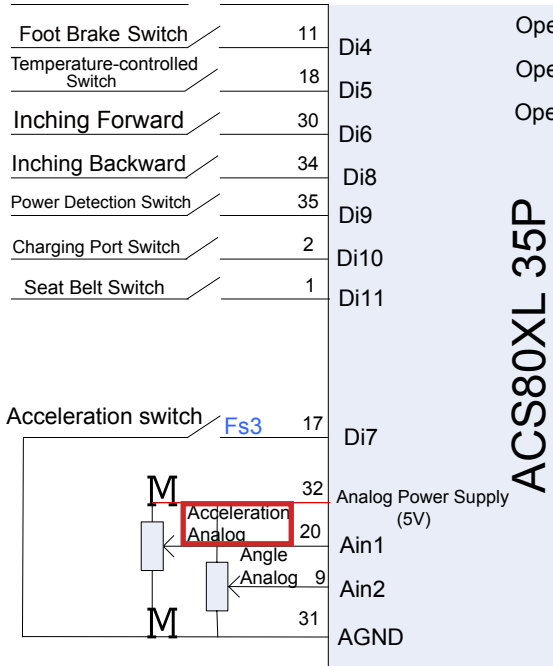
90) Error ID: 1711

Description: The analog voltage is short-circuited. The limit value is 100 mA.

Cause A

The analog voltage is short-circuited. The limit value is 100 mA.

Solution: Check whether the analog voltage power supply line is short-circuited. Check the pin32 and pin31 of the controller to find which wire is in a short-circuit state.



91) Error ID: 1730

Description: The event is triggered when the external ground signal is disconnected. Clearing the event requires restarting the drive. This event may trigger related events about the motor encoder and motor temperature sensor.

Cause A

External grounded short circuit.

Solution: Check whether the wiring harness is grounded short circuit. You can check the motor speed encoder and temperature sensor first.



92) Error ID: 1900

Description: CPU startup check fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.

93) Error ID: 1901

Description: Watchdog startup check fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.

94) Error ID: 1902

Description: 64 MHz HSI startup check fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.



95) Error ID: 1903

Description: Detection point 1 startup test current control fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.

96) Error ID: 1904

Description: Full Ram March startup check fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.

97) Error ID: 1905

Description: Fail to turn off the PLL at startup.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.



98) Error ID: 1906

Description: LSI startup fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.

99) Error ID: 1907

Description: HSE startup fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.

100) Error ID: 1908

Description: HSI HSE switch startup check fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.



101) Error ID: 1909

Description: Ext source startup check fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

The operation method is the same as error ID 700.

102) Error ID: 1910

Description: The clock frequency start check fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.



103) Error ID: 1911

Description: Detection point 2 startup test current control fails.

Cause A

The controller is damaged.

Solution: Replace the controller.

Refer to error ID 700 for the operation method.

104) Error ID: 10001

Description: The startup is wrong. When the ignition switch is started, the accelerator pedal switch is in the enabled acceleration state.

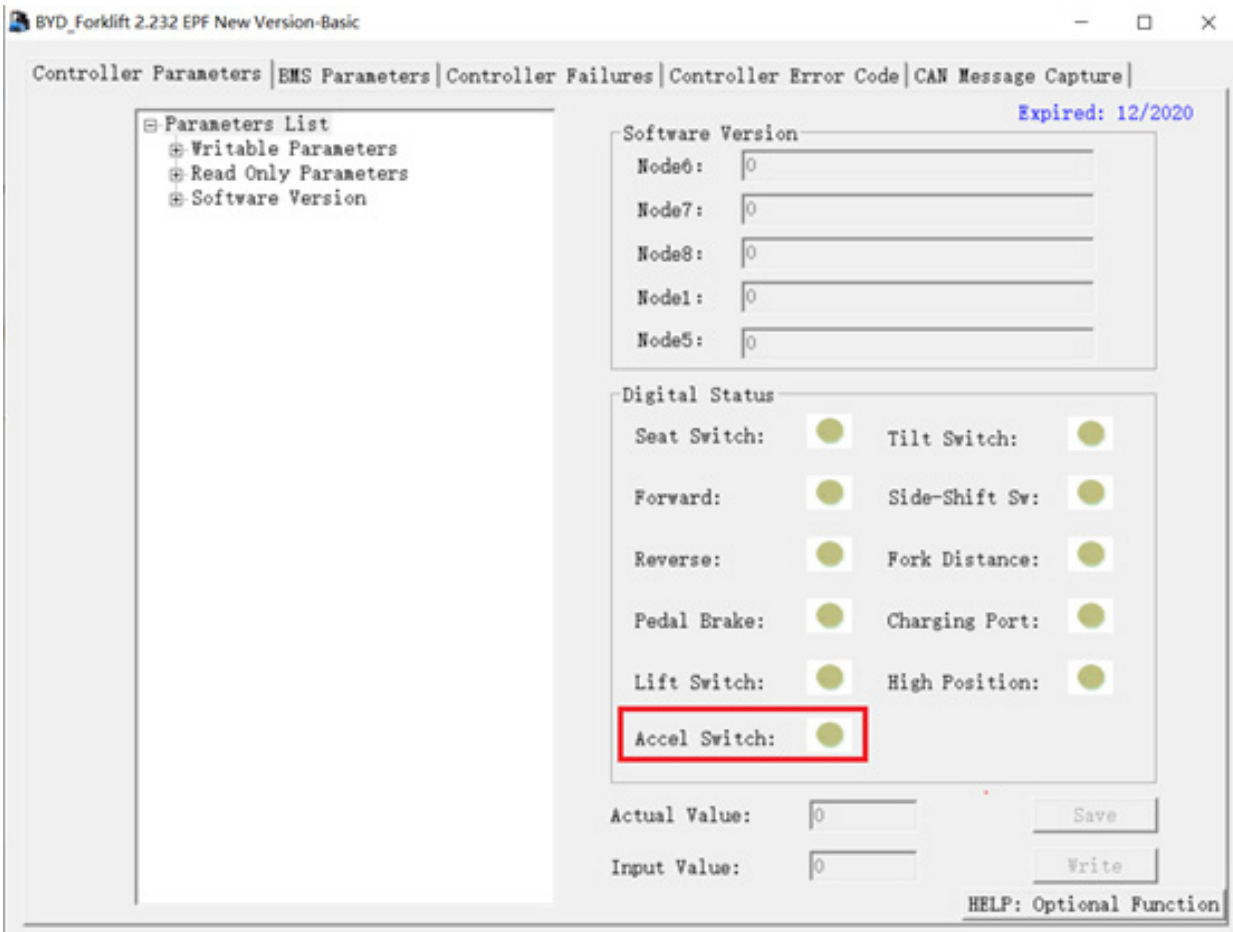
Cause A

Refer to error ID 700 for the operation method.

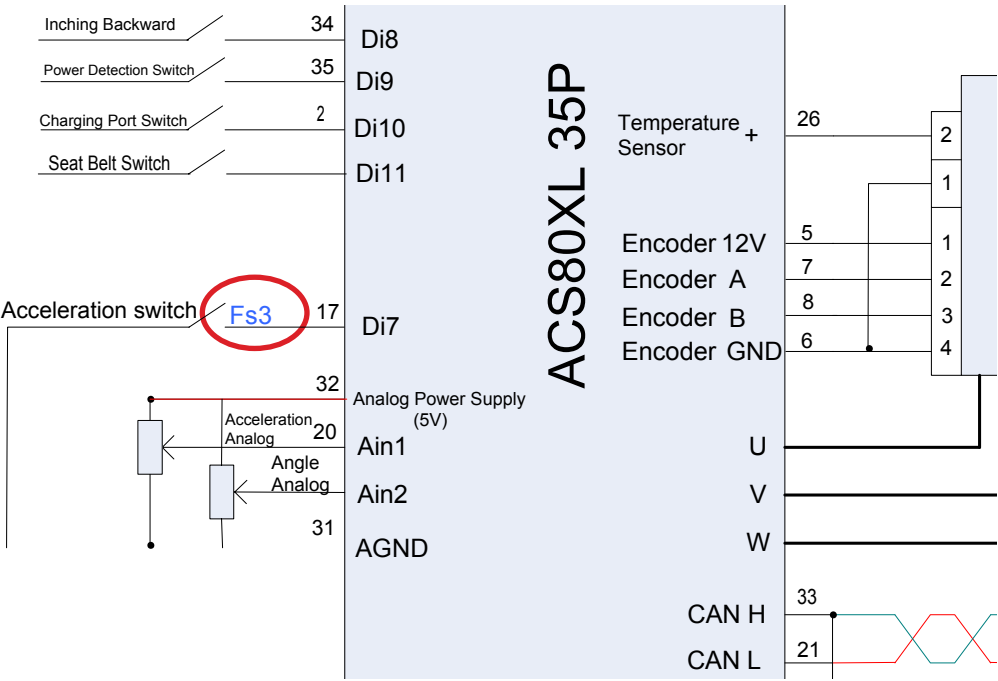
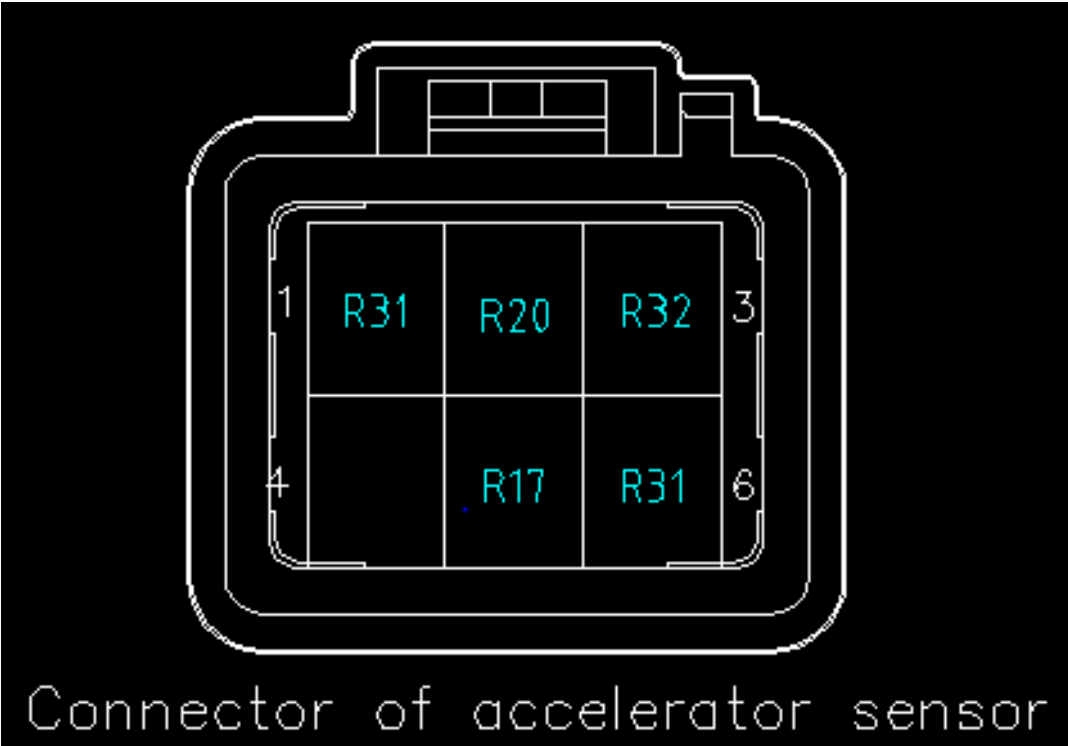
The accelerator pedal switch is malfunctioning.

Solution: Check whether the accelerator pedal switch is abnormal. (Refer to Chapter 6 Truck Settings for details.)

Use BYD_Forklift software to monitor. When the accelerator pedal is not depressed, the accelerator pedal switch has been triggered and lights up in green.



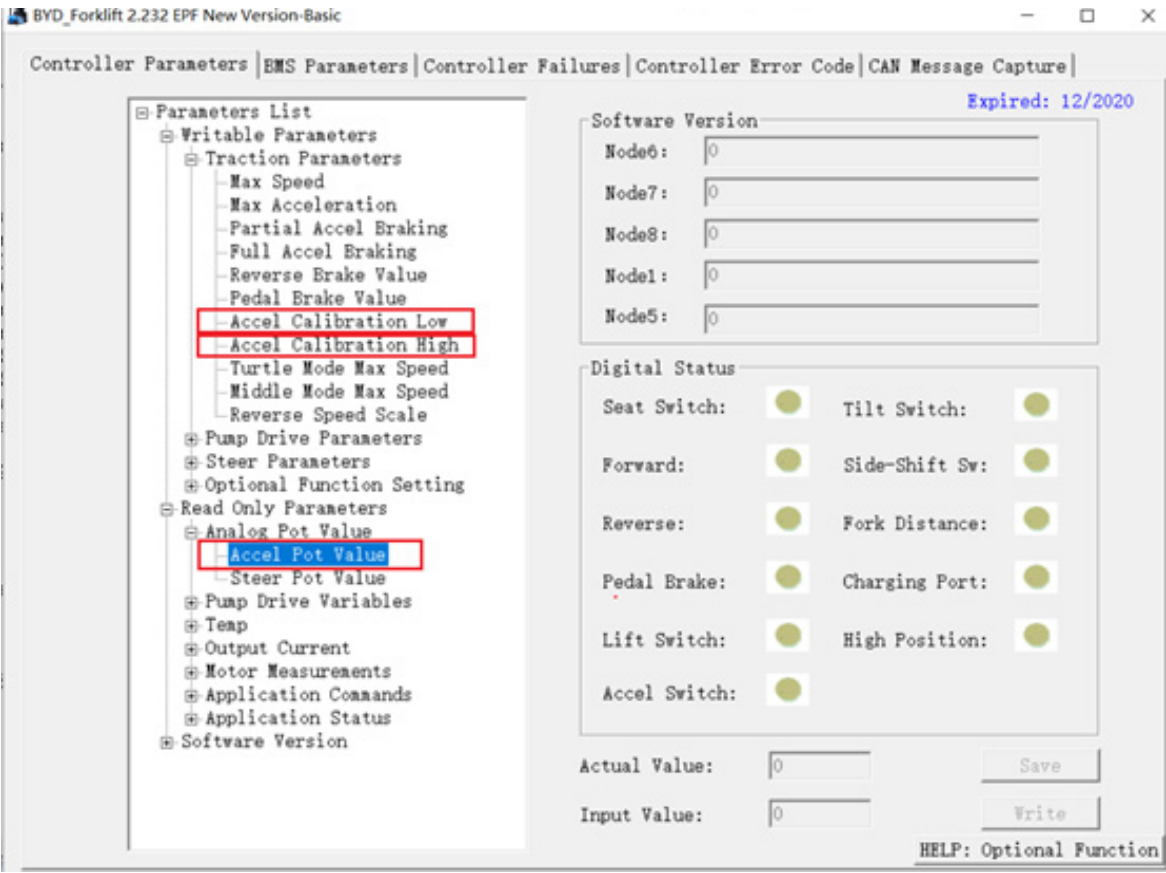
Use a multimeter to measure whether the connector of accelerator pedal switch terminal is normal. When the pedal is released, pins R17 and R31 are in a disconnected state. After stepping the accelerator pedal, the two points are in a conductive state.



Cause B

The calibration value of the accelerator pedal is wrong.

Solution: Check the analog value of the accelerator sensor. If there is an abnormality, reset the parameters. Check whether the analog value of the accelerator pedal switch is normal.



1. Accel Calibration Low = Accel Pot Value (Minimum value, the accelerator pedal is fully released) + 50 (or 100)
2. Accel Calibration High = Accel Pot Value (Maximum value, step the accelerator pedal to the end) - 100



105) Error ID: 10002

Description: The startup is wrong. When the ignition switch is started, the gear switch is in the enabled state.

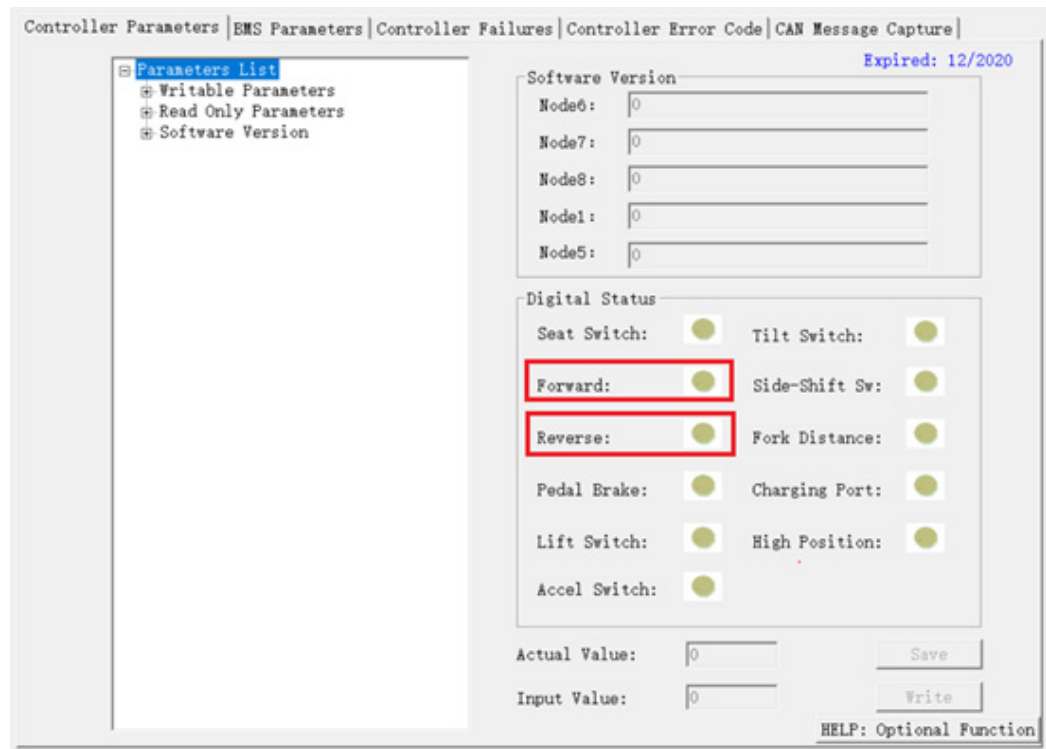
Cause A

The startup is wrong. When the ignition switch is started, the gear switch is in the enabled state.

Solution 1: Before starting the tractor, check whether the gear switch is in the R gear or F gear. If so, adjust it to the N gear.

Solution 2: Check whether the gear switch is damaged.

Set the gears to forward and backward gears and check whether the indicator display is normally switched among F, N and R gears; or use the BYD_Forklift software to monitor whether the forward and backward gears are in green when they are activated.



106) Error ID: 10003

Description: The forward and backward switches of the gear switch are enabled and activated at the same time.

Cause A

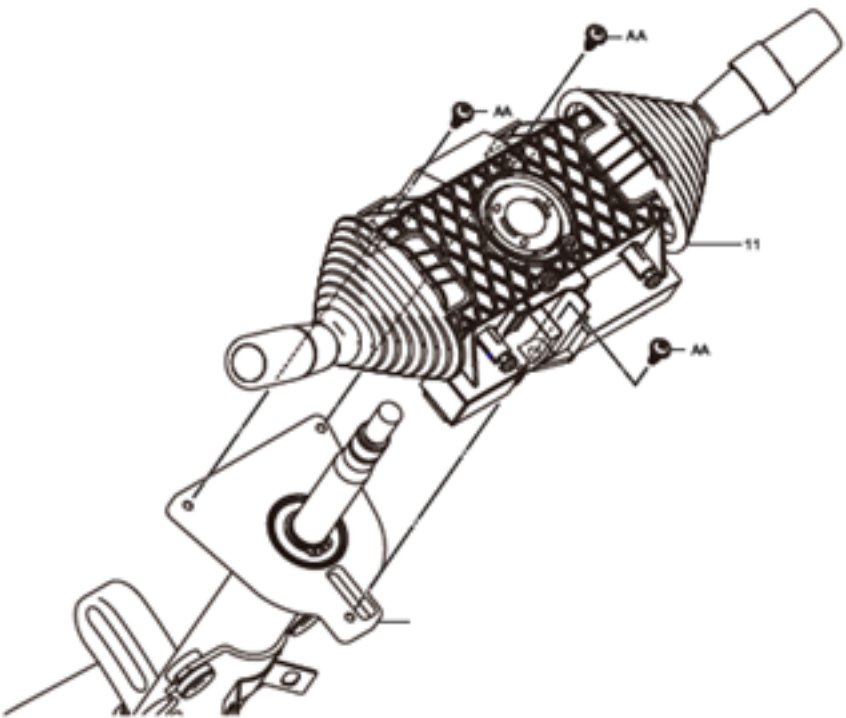
The forward and backward gears of the gear switch are triggered at the same time.

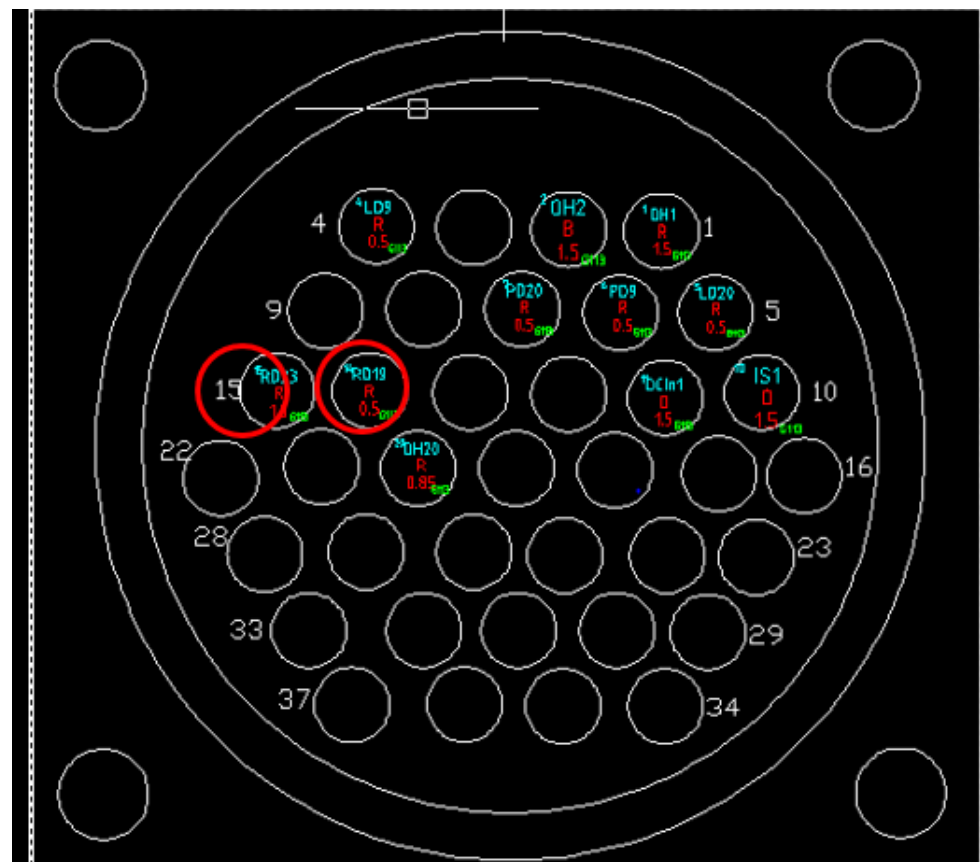
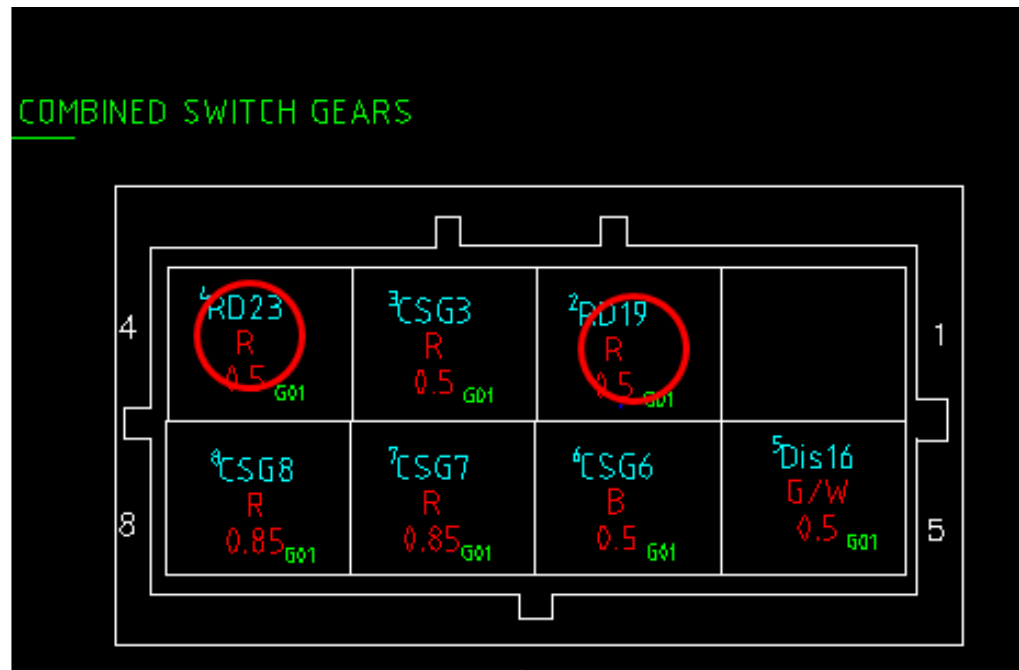
Solution: Check the wiring harness of gear switch.

Use a multimeter to measure whether there is a short circuit between the forward and backward switches of the gear switch.

Standard Truck

The gear switch of the standard tractor is on the combination switch installed on the steering rod.





107) Error ID: 10004

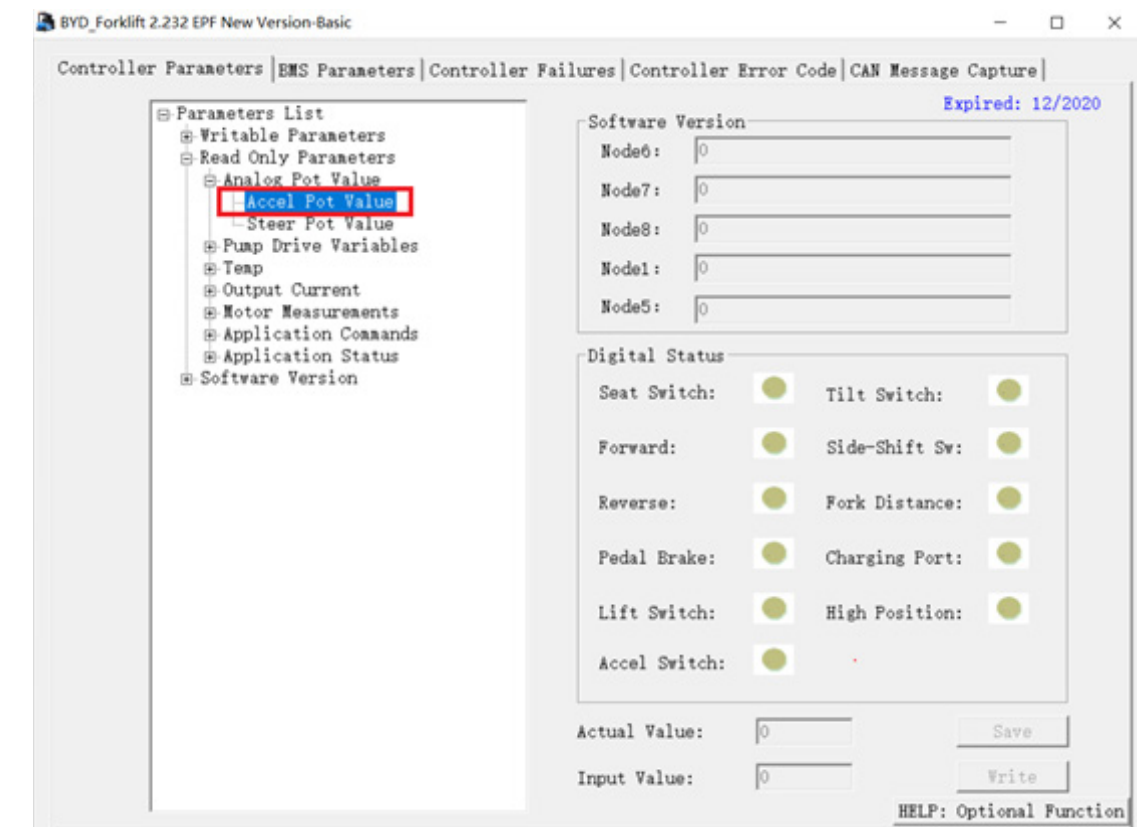
Description: The accelerator pedal analog is over-travel or disconnected.

Cause A

The accelerator pedal analog is over-travel.

Solution: Check whether the accelerator pedal analog is over-travel.

Use BYD_Forklift software to detect whether the value of the Steer Pot Value of the angle sensor exceeds 2400, or it is 0.



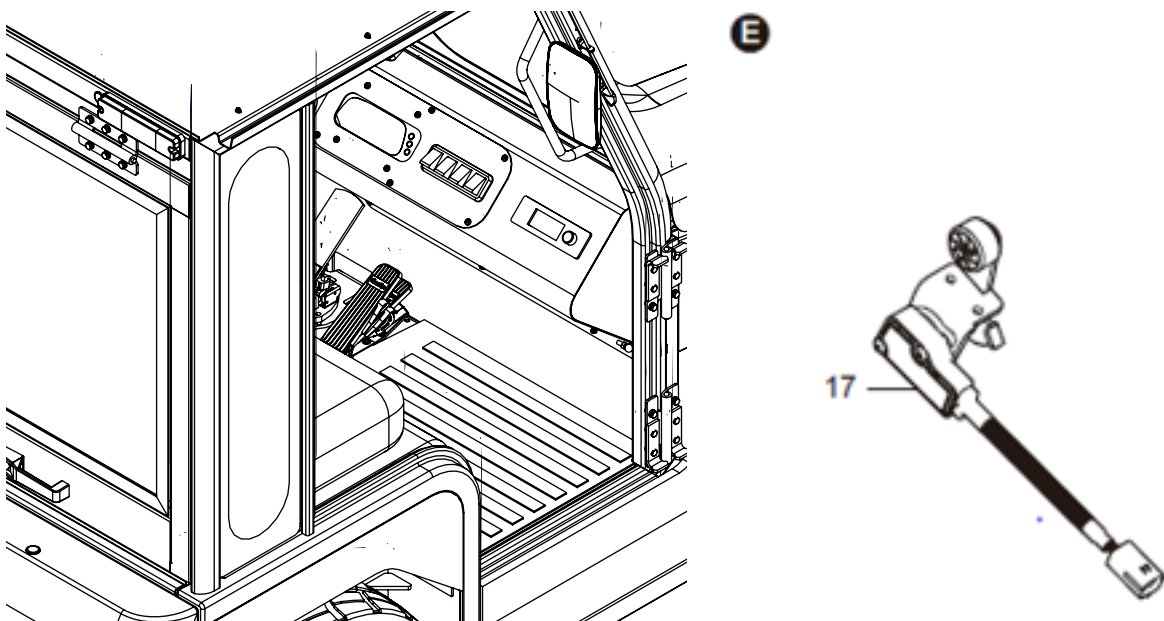
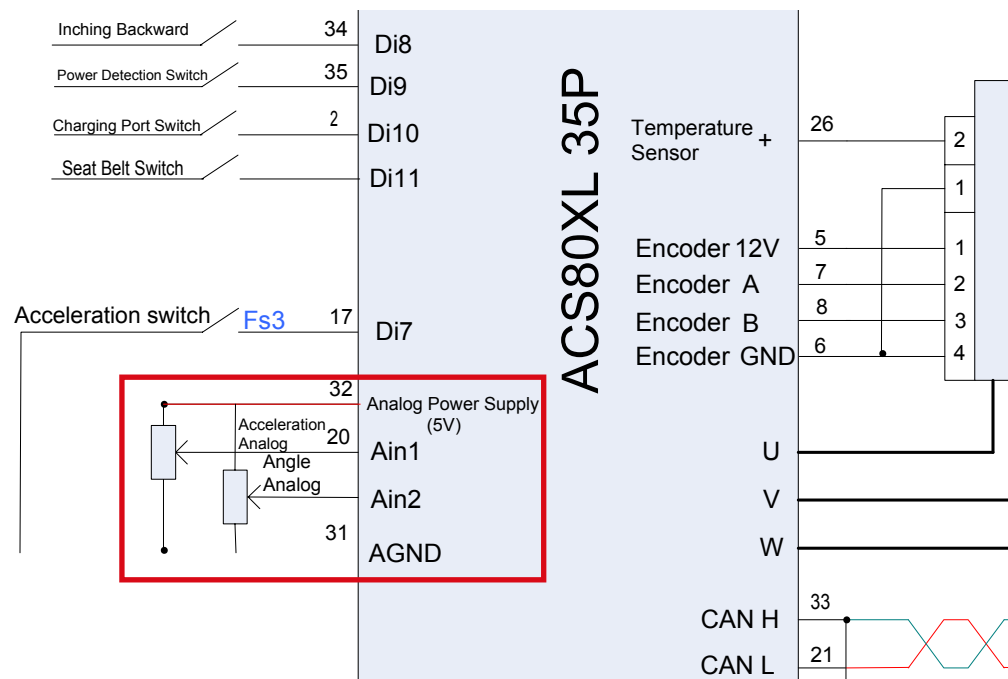
Cause B

The accelerator pedal sensor is in poor contact.



Solution 1: Check whether the accelerator pedal sensor is disconnected or in poor contact, etc.

Check whether the accelerator pedal is in poor contact and the connection of pin9, pin31 and pin32 of the controller;



Solution 2: Check whether the accelerator pedal sensor is damaged.

Use the BYD_Forklift software to test whether the analog value of the accelerator pedal sensor keeps changing when you press the accelerator pedal. Normally, the minimum value is 200 and the maximum value is 2200. If the minimum value is 400 or 500, which is much greater than 200, the sensor fails and needs to be replaced.

108) Error ID: 10005

Description: When the accelerator pedal switch is not triggered, the event occurs when the accelerator pedal analog is effective.

Cause A

When the accelerator pedal switch is not triggered, the event occurs when the accelerator pedal analog is effective.

Solution: Check whether the accelerator pedal micro switch is damaged.

The checking method is the same as M1 of Error ID 10001.

109) Error ID: 10010

Description: The analog value of the angle is over-range or disconnected.

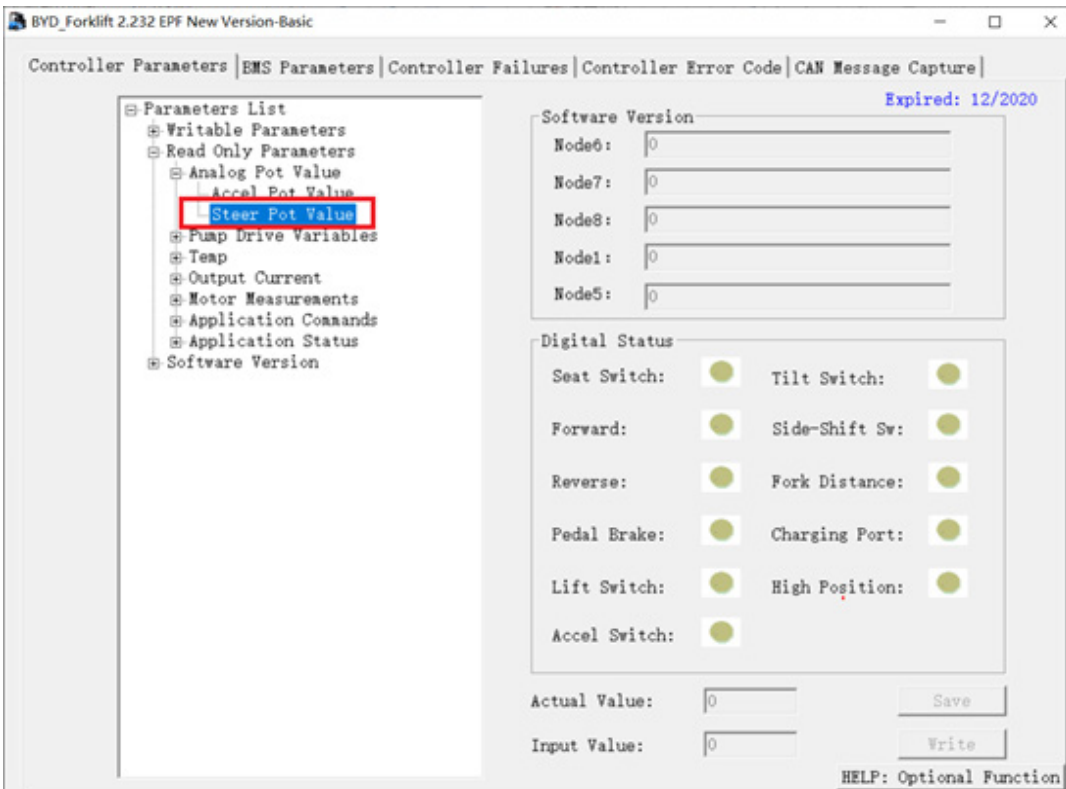


Cause A

The analog value of angle sensor is over-range.

Solution: Check whether the angle sensor is over-range. (Refer to Chapter 6 Truck Settings for details.)

Use BYD_Forklift software to check whether the angle analog Steer Pot Value has exceeded the range, the sensor value is 0 or the value exceeds 2800.



Cause B

The angle sensor is in poor contact.

Solution 1: Check whether the angle sensor is in poor contact.

If there is the parameter value of the sensor in the Steer Pot Value, the wire of the angle sensor is well connected.

Solution 2: Check whether the angle sensor is normal. (Refer to 8.2.3 for details.)

Check whether the angle sensor is normal. Check whether the value of the angle sensor changes with the steering angle.



110) Error ID: 10020

Description: BDI detected low battery voltage. Reduce the power output when the battery power is below 5%. When the battery power is below 5%, the pump motor will stop work, the maximum speed of the driving motor will also be halved.

Cause A

BDI detected low battery voltage, the battery level falls below 5%.

Solution: Charge the tractor immediately.

111) Error ID: 10025

Description: Traction output is limited, which will be notified to the driver via the notification bit.

Cause A

The traction output of the drive motor is limited.

Solution: Check other error symptoms.

112) Error ID: 10026

Description: The traction output of the pump motor is limited, which will be notified to the driver through the notification bit.

Cause A

The pump motor output is limited.

Solution: Refer to other error codes.



113) Error ID: 10027

Description: The traction output of the drive motor is limited, and the traction drive enters the shutdown protection mode. The fault will be notified to the driver through the notification bit. Emergency stop switch is disconnected.

Cause A

The traction output of the drive motor is limited, and the emergency stop switch is pressed and disconnected.

Solution: Check whether the emergency stop switch is pressed and disconnected.

Cause B

The contactor in the battery pack does not pull in.

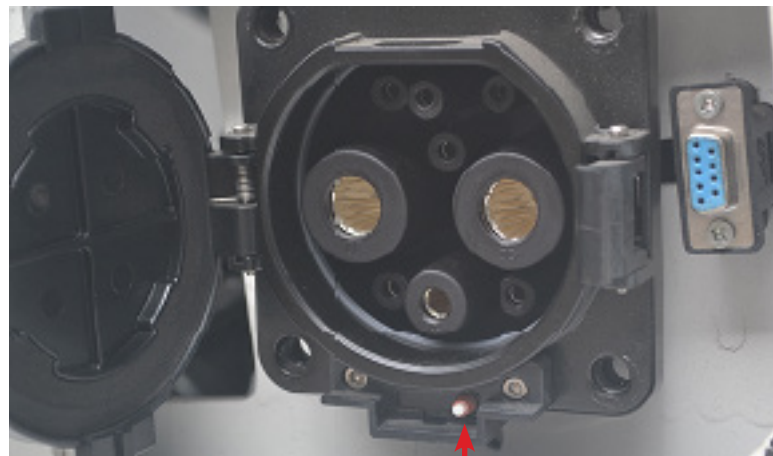
Solution 1: Measure the voltage between the contacts at both ends of the coil of the contactor. If it is 12V, but the contactor does not work, the contactor is damaged. If it is 0V, repair the contactor according to M3. The contactor is in the battery pack. If one contactor pulls in, the controller will have voltage supply.

Solution 2: Contactor 12V is not energized under normal current; if the voltage between the two contacts of the coil is 0V, measure the voltage between the contacts at both ends of the contactor coil and the negative B- of the controller. One of the lines should be 12V normal current and the other line is the 12V power output by the BMS. If not, it means the voltage between the negative pole of the controller B- is 0V. Then check whether the 12V power supply line from the DC/DC to the contactor is properly connected.

Solution 3: Check other error codes and error symptoms.

114) Error ID: 10028

Description: The micro switch of the charging port is in the enabling state, the drive controller is not allowed to work.



Charging Port Foolproof Switch

Cause A

The charging door is opened, the micro switch installed at the charging port is closed, and the traction motor controller is not allowed to work.

Solution: Check whether the charging door is open. If so, close the charging door and restart the tractor to test. If not, please refer to the M2.

Cause B

The charging base cap is damaged, so the fool-proof switch cannot be triggered.

Solution: Check whether the cap of the charging base is damaged. If not, please refer to the M3.

If the charging base cap is damaged, the cap needs to be replaced. (SAP:12780606-00)

Cause C

The charging port fool-proof switch is damaged. (SAP: 12249497-00)

Solution: Check whether the Micro Switch is damaged. (Refer to 4.7.10 for details.)



115) Error ID: 10087

Description: The brake pressure of the power unit is too low.

Cause A

The oil is insufficient..

Solution: Check the remaining oil capacity of the oil tank and replenish it in time. (Refer to 4.9.1 for details).

Cause B

The power unit is not working. (Yellow light means it works normally and green light means it is filling fluid.)

Solution: Check the wiring harness of power unit system for damage and replace with new pressure switch.



116) Error ID: 10088

Description: The power unit alarms because of high temperature.

Cause A

The inside of the power unit is burnt due to high temperature.

Solution: Check whether the power unit is burnt. Replace it if necessary.

117) Error ID: 10089

Description: The power unit restarts accidentally.

Cause A

Failure to restart the power unit after the system default cooling time (30s), causing an alarm.

Solution: Power on again.



7.3 Error Codes

Truck - error code and solution of the controller			
Error Code Address	Error Code (Event No.)	Error Name	Solution
0x3011	700	The temperature sensor of the driver PCB board is not connected.	Check the temperature sensor of the PCB board or replace the controller.
	701	The temperature sensor of the driver PCB board is short-circuited.	Check the temperature sensor of the PCB board or replace the controller.
	702	The temperature of the driver PCB board is high.	Check the temperature sensor of the PCB board or replace the controller.
	703	The temperature of the driver PCB board is too high.	Check the temperature sensor of the PCB board or replace the controller.
	704	The temperature of the driver PCB board is too low.	Check the temperature sensor of the PCB board or replace the controller.
	1220	The controller CAN module is offline.	Restart the tractor.
	100	The controller detects a hardware short circuit.	Check whether B+, B-, U/V/W phase are short-circuited.
	406	The controller detects low voltage in the DC bus.	Check whether the battery voltage is normal.
	404	The controller detects high voltage in the DC bus.	Check whether the battery voltage is normal.
	603	The motor temperature is too high.	Check whether the motor temperature is normal or stop for 30 minutes.
	503	The controller temperature is too high.	Test after the entire tractor stops working for 30 minutes.
	10001	The accelerator pedal starts in a wrong sequence.	Cause: The accelerator pedal was depressed before power on.
	1200	CAN communication PDO1 timeout.	Check whether the CAN bus is abnormal.
	1201	CAN communication PDO2 timeout.	Check whether the CAN bus is abnormal.
	1202	CAN communication PDO3 timeout.	Check whether the CAN bus is abnormal.
	1203	CAN communication PDO4 timeout.	Check whether the CAN bus is abnormal.
	10002	The start sequence of the forward and backward switches is abnormal.	Cause: The gear switch is on before power on.
	10027	The main contactor is disconnected.	Check whether the main controller is abnormal.
	1001	Short circuit of output port 1.	Check output port 1.
	1021	Overcurrent at output port 1.	Check output port 1.
	1002	Short circuit of output port 2.	Check output port 2.
	1022	Overcurrent at output port 2.	Check output port 2.
	1003	Short circuit of output port 3.	Check output port 3.
	1023	Overcurrent at output port 3.	Check output port 3.
	1004	Short circuit of output port 4.	Check output port 4.
	1024	Overcurrent at output port 4.	Check output port 4.
	1100	Short circuit on high voltage output side.	Check whether the output port is short-circuited.
	202	Controller overcurrent.	Check whether there is a short circuit between B+/B-/U/V/W.
	10003	Wrong direction switch	Check whether the circuit of the direction switch is normal.



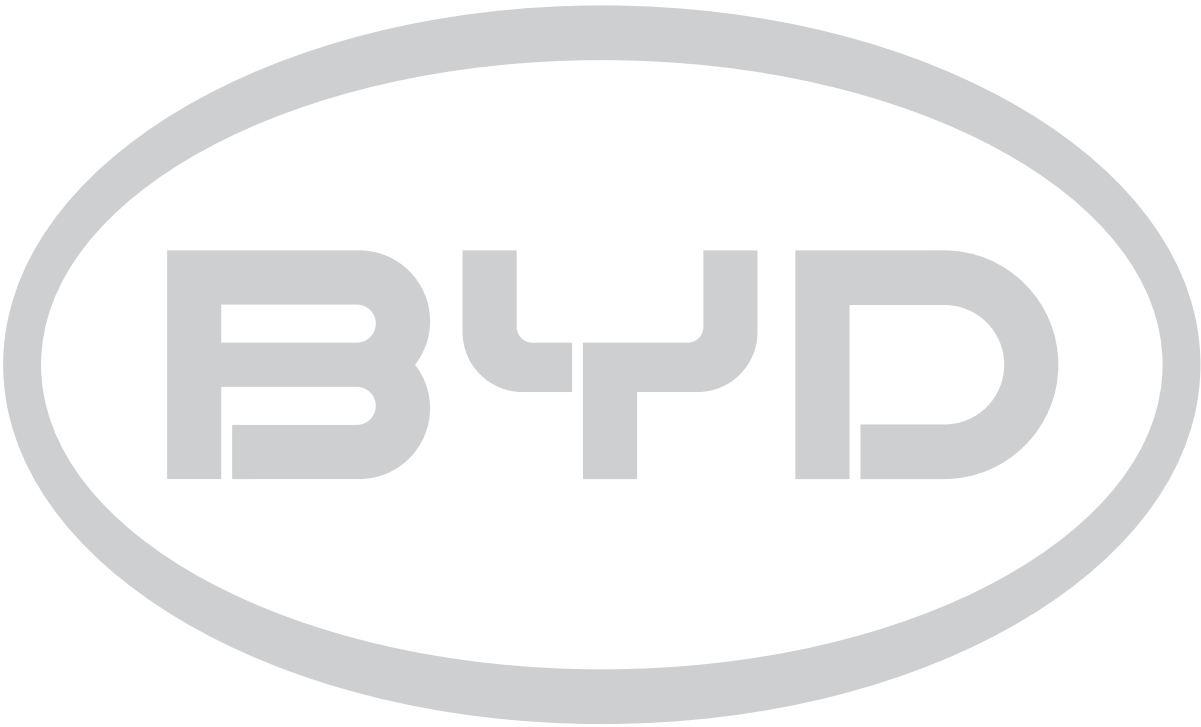
Error Code Address	Error Code (Event No.)	Error Name	Solution
0x3011	801	Short circuit of sensor supply.	Check whether the power supply of the speed sensor is 12V.
	800	The sensor is not connected.	Check whether the speed sensor is connected.
	804	The sensor feedback is too fast.	Check whether the speed sensor is abnormal.
	802	Sensor phase A is missing.	Check speed sensor A phase.
	803	Sensor phase B is missing.	Check speed sensor B phase.
	10005	The switching value of accelerator pedal is abnormal.	Check the switching value of accelerator pedal.
	1700	15V power supply is abnormal.	The power supply inside the controller is abnormal.
	1701	5V power supply is abnormal.	The power supply inside the controller is abnormal.
	1702	3.3V power supply is abnormal.	The power supply inside the controller is abnormal.
	1711	Analog power supply is short -circuited.	Check the analog power supply circuit of the tractor.
	115	The watchdog is abnormal.	Controller watchdog does not activate the power module.
	10010	The angle sensor is abnormal.	The angle sensor is not connected.
	10004	The accelerator pedal is abnormal..	The accelerator pedal is not connected.
	10020	Low battery.	Charge in time.
	302	Motor stall.	Motor speed is too high, check whether the motor is abnormal.
	1406	Watchdog error.	The controller watchdog triggered the software to restart.
	1409	Software execution time is too long.	Check the controller software for errors.
	1412	CAN communication time is too long.	Check the controller software and CAN communication.
	1403	CPU check error.	Replace the controller.
	500	The temperature sensor of controller is not connected.	Replace the controller.
	600	The temperature sensor of motor is not connected.	Check the motor temperature sensing circuit.
	405	Low DC bus voltage.	Check whether the controller power cable connection is loose.
	203	UVW three-phase line instantaneous overcurrent.	Check the UVW three-phase line of the motor.
	10087	The brake pressure is too low.	Check the wiring harness of power unit system for damage. Check the fuse (80V15A) and the divider resistance (RXG24-200WR7J) and replace them if necessary.
	10088	The temperature of the power unit is too high.	Check whether the power unit is burnt and replace it.
	10089	The power unit restarts accidentally.	Power on again.



If the tractor breaks down, contact the professional person to deal with it.

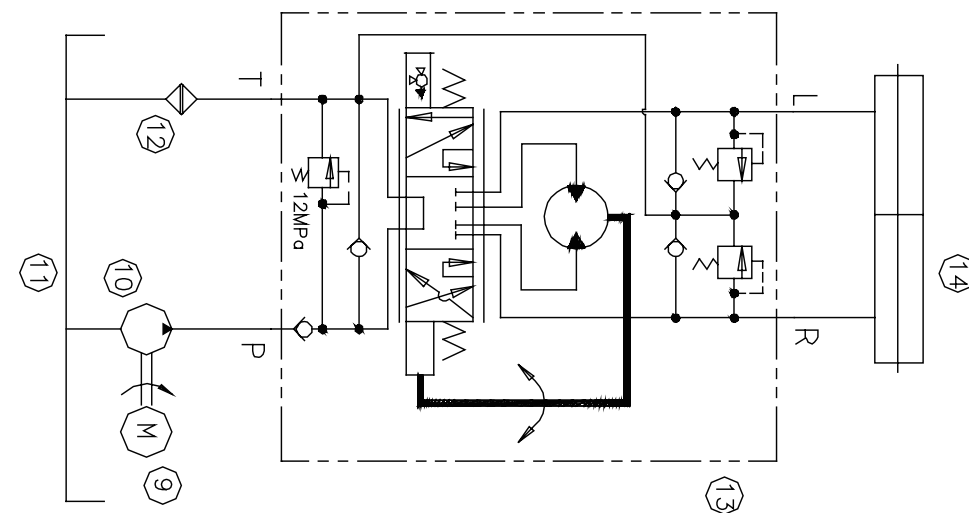
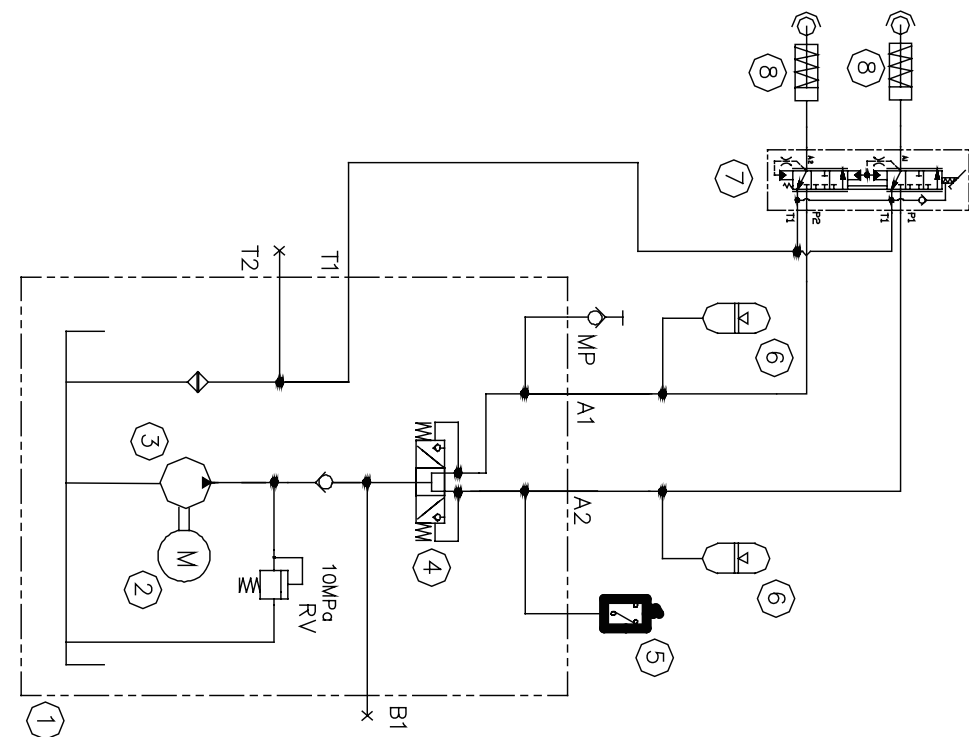


8 Theory of Operation



8.1 Operation Theory of Hydraulic System

8.1.1 Working Principle of Hydraulic System



1. Power unit assembly

2. DC motor 800W/72V

3. Brake oil pump 1cc

4. Two-way filling valve

5. Pressure switch 95bar/75bar

Parameters calibration:

SP1 SP2 is the upper limit pressure value of the channel;

RP1 RP2 is the lower limit pressure value of the channel;

DS1 DS2 means delay .

SP1: 95 bar RP1: 75 bar

SP2: 95 bar RP2: 75 bar

ds1: 1.5s ds2: 1.5s

Mode: HNC (normally open mode)

6. Accumulator 1L

7. Two-way brake valve

8. Brake

9. Steering motor

10. Steering oil pump 9cc

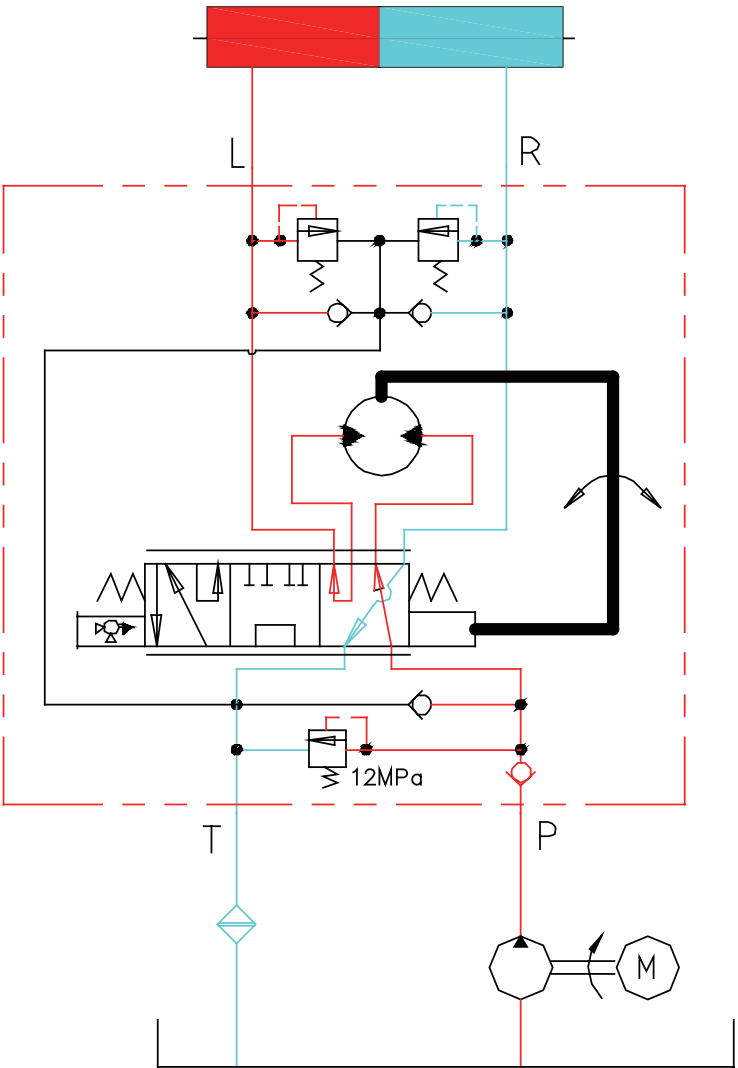
11. Tank

12. Return oil filter

13. Hydraulic redirector

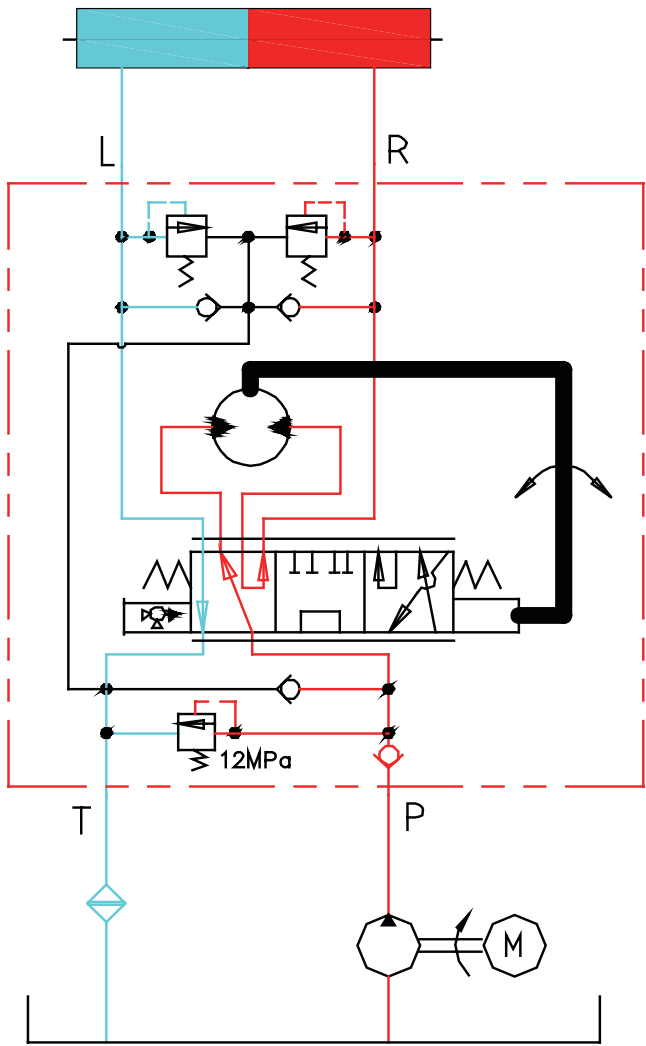
14. Steering cylinder

1. Turn left



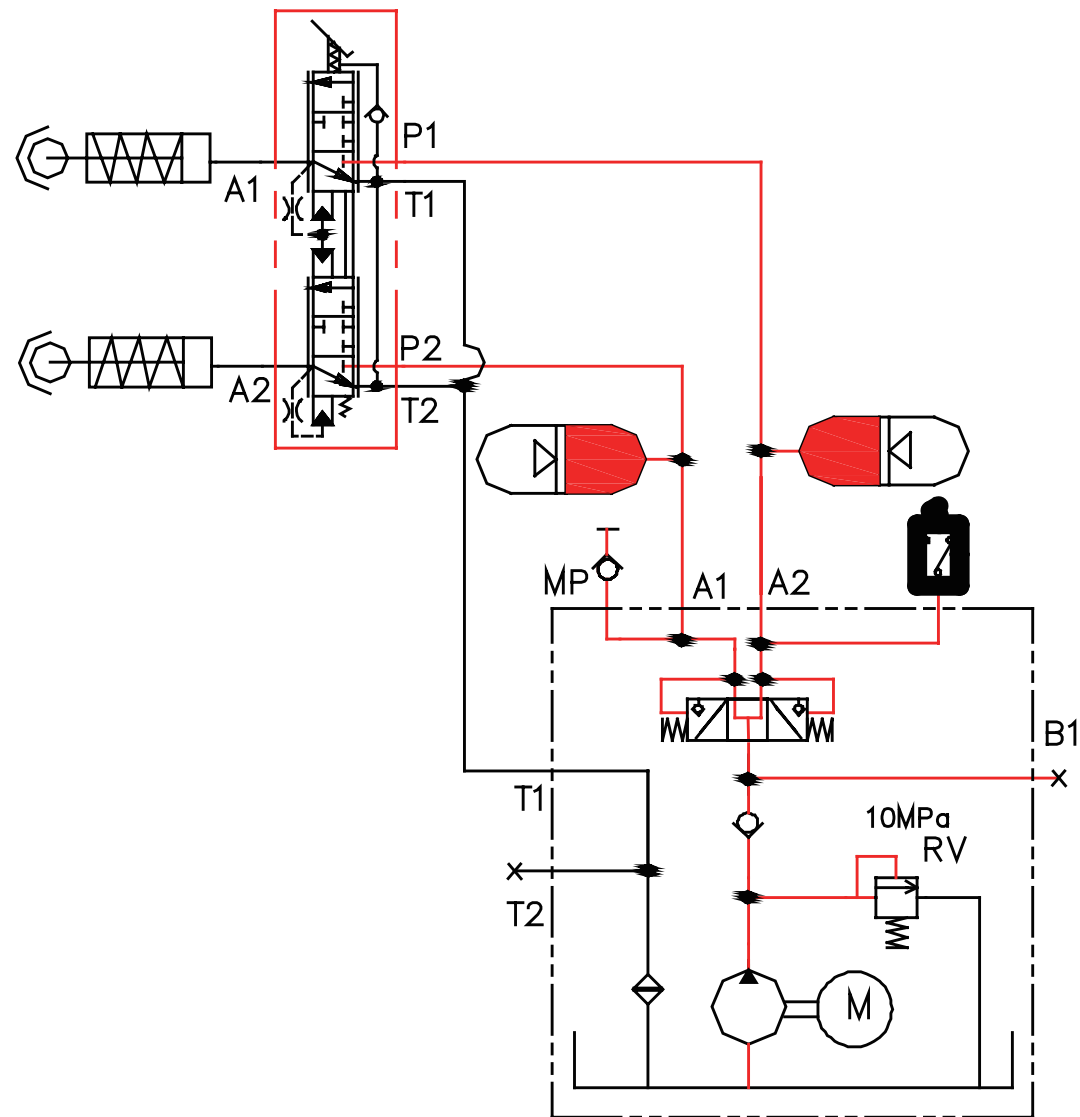
When turning left, the motor drives the oil pump to rotate. The high-pressure oil sucked by the oil pump from the oil tank is quantitatively output to the L end of the steering cylinder through the steering gear to realize left turning. At the same time, the hydraulic oil from the R end of the steering cylinder returns to the oil tank through the steering gear.

2. Turn right



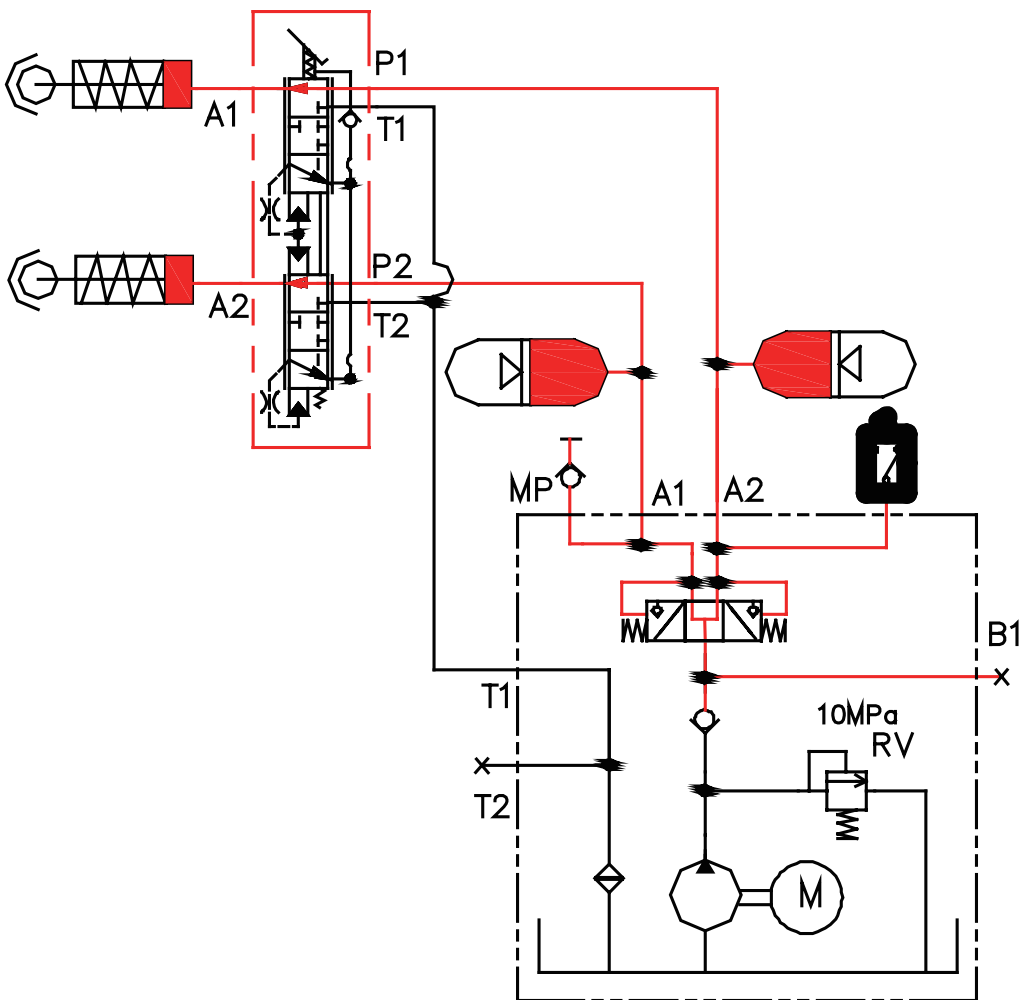
When turning right, the motor drives the oil pump to rotate. The high-pressure oil sucked by the oil pump from the oil tank is quantitatively output to the R end of the steering cylinder through the steering gear to realize right turning. At the same time, the hydraulic oil from the L end of the steering cylinder returns to the oil tank through the steering gear.

3. Fill fluid



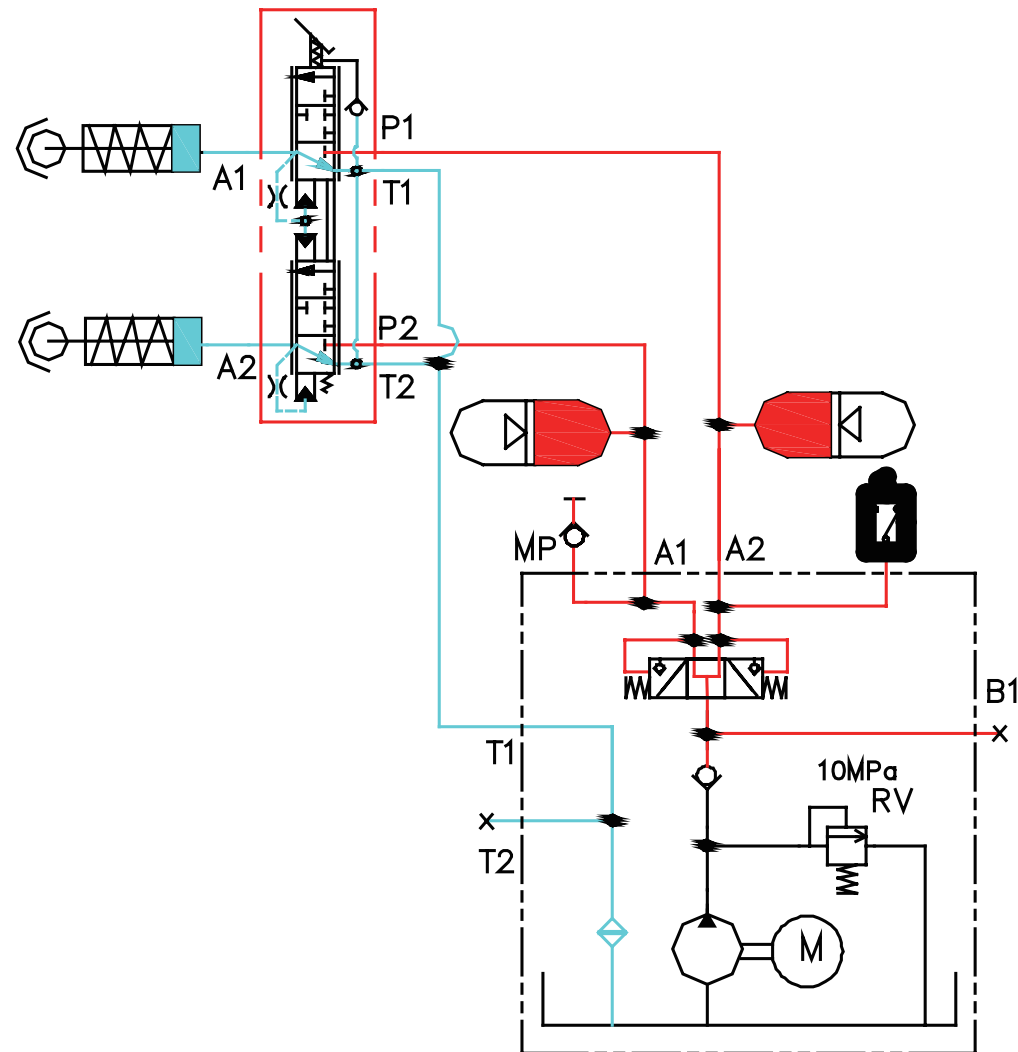
Fluid-filling process: the motor oil pump rotates and sucks out hydraulic oil to the accumulator, and the pressure switch detects the accumulator pressure in real time. When the accumulator pressure reaches the preset value, the pressure switch sends a signal to the controller to control the motor to stop; Similarly, when the pressure of the accumulator is lower than the preset value, the pressure switch will also give a signal to the controller to control the motor to start working.

4. Brake



When the brake pedal is stepped on, P1 is conneted to A1 and P2 is conneted to A2. The high-pressure oil of the accumulator can be output to the brake through the brake valve to realize the braking function.

5. Release the brake



When the brake pedal is released, A1 is conneted to T1 and A2 is conneted to T2. The pressure oil of the brake can flow back to the oil tank through the brake valve. At this time, the brake is released.

8.2 Operation Theory of Electric System

8.2.1 Electric System of the Entire Truck

Part	Position	Function
Battery Case	Inside the tractor	Provide electric energy for the entire tractor.
BMS	In the battery box	Monitor the status of the power battery, and control the charging and discharging of the power battery according to the status of the entire tractor and the power battery.
BIC	In the battery box	Sample the voltage and temperature of the battery and battery pack, and transmit the sampling information to the battery management controller.
Hall Sensor	In the battery box	Monitor battery charge and discharge current and feedback to BMS.
Main Controller	Inside the tractor	The main controller includes drive controller and hoist controller. The drive controller controls the entire tractor drive unit, and the hoist controller controls the hoist system.
Steering Sensor	On the steering axle	Detect the rear wheel angle and send it back to the drive controller.
Display	On the display cover	Display the power, speed, fault and other information of the entire tractor.
Speed Sensor	On the motor	Detect the motor speed and transfer the data to the corresponding controller.
Horn	Under the front fender	As a warning function, the horn switch is located in the middle of the steering wheel, human operation can make the horn work.
EPO Switch	On the display cover	Push the EPO switch in an emergency can power off the entire tractor.
Brake Switch	Under the foot pedal	Press the brake pedal to turn on the brake switch, give a signal to the controller, and the controller provides reverse current to the motor to stop the motor.
Power Unit System	Under the foot pedal	Step on the brake pedal to give the signal to the controller. The controller provides current, and the power unit is filled with fluid to assist braking.



8.2.2.2 Process of Power Supply

- 1) The battery's 80V power positive pole is connected to the positive pole of the DC /DC input terminal through the connector G81-4, the ignition switch fuse, the charging relay KA2 and the EPO switch. The battery's 80V positive pole is connected to the DC / DC input enable (ON / OFF) terminal through the ignition switch fuse and ignition switch.
- 2) Turn on the ignition switch, the DC /DC enable terminal is powered on, and the DC /DC works and outputs 12V power. The power is supplied to the BMS through the BMS relay KA3 and BMS fuse. The BMS supplies power to the BIS after it receives power.
- 3) The BMS collects battery voltage and temperature information and performs self-checking, controls charging and discharging contactor KM1 and KM2 to pull in, and outputs 80V high voltage to the battery box. At the same time, the controller relay KA1 is controlled to pull in, and 80V power is input to the pin 3 and pin28 of the drive controller and pump controller through the connector G81-5.



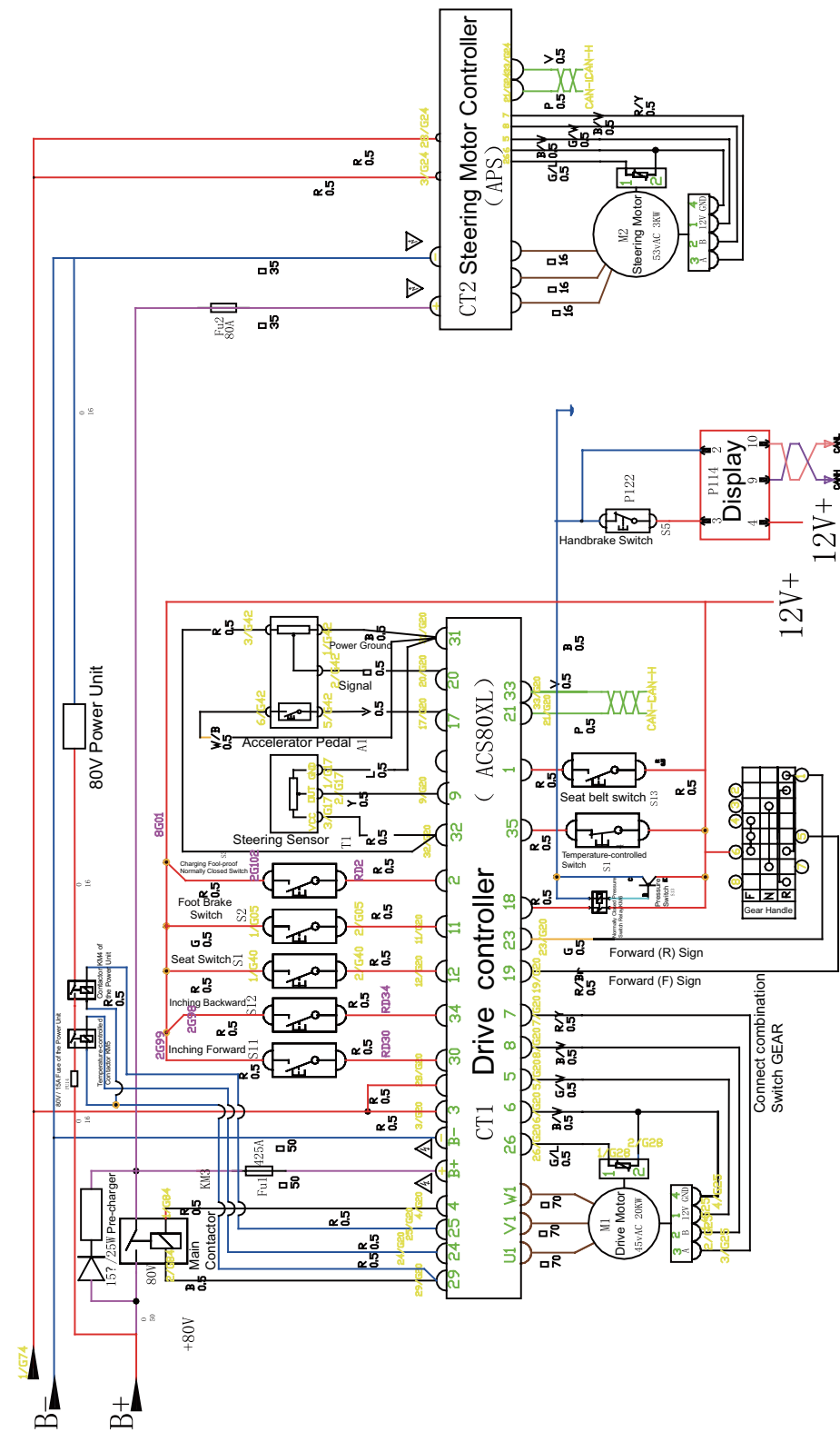
8.2.2.3 Process of Charging the Entire Truck

- 1) Connect the charger, input 12V power to the charging port, the normally open contact of the BMS relay pulls in, the BMS finally gets electricity through the BMS fuse. Disconnect the display, the 12V power lines of displays, lamps and other devices.
- 2) Connect the charging pile, input 12V power to the charging port, disconnect the charging relay KA2 and the DC / DC input terminal 80V power supply. During the charging process, there is no 12V power supply for electric devices such as displays and lamps.
- 3) The BMS collects battery voltage and temperature information. If there is no abnormality in the battery, control the charging and discharging contactor KM1 and KM2 to pull in, connect the positive and negative electrodes of the battery to the positive and negative electrodes of the charger, and start charging. If the battery is abnormal, the contactor does not pull in, and the charger cannot charge the battery.



8.2.3 Control System

8.2.3.1 Schematic Diagram of Control System



8.2.3.2 Drive Function of Control System

1) Driving Principle

- Pull in the charging and discharging contactor KM1 and KM2 inside the battery box. Then there is 80V electricity at the battery box end of the contactor KM3.
- The logic circuit of the controller starts to work when the controller relay KA1 pulls in and the hole 3 and hole 28 of the drive controller and lift controller gets 80V voltage.
- The pin 3 of the controller gets 80V electricity and there is no serious fault in controller self-checking. When the output terminal voltage of the precharger is higher than 65V within 5s, drive the controller to make the controller contactor KM3 pull in and the controller B + get power. Then the tractor starts to work.



The contactor coil used on the controller is 80V, and the coil power is provided by the controller's pin 29 and pin 26. The coil is powered on, the main contactor contact pulls in, and the 80V power from the battery box is sent to the main circuit of the controller B+. When KM3 contactor is closed, the controller sends CAN message to the display to turn on "OK" light, and when "OK" light is off, it means that 80V main contactor is disconnected. It is necessary to check other error codes to determine the cause of the fault.

2) Driving Process



- Sit on the seat, fasten the seat belt. Close the seat S1 switch, and close the seat belt switch S13.



- Release the handbrake. The handbrake switch is off, the display receives the closing signal of the handbrake switch, turns off the gear indicator light and sends a message to the controller through the CAN line. The controller receives the display message and the drive controller outputs small current to the drive motor at the same time to provide excitation current, so that the motor is in a waiting state (keep the drive motor speed at 0, the current is based on the required torque variety).
- Manually toggle the direction switch to move forward or backward, and drive controller receives the forward or backward command. Step on the accelerator pedal A1. Then the drive control receives the message that the switch signal in the accelerator pedal switch is closed, and the accelerator pedal analog is within the effective range, the drive controller determines the command speed of the drive motor according to the analog value of the accelerator, and outputs the current to make the motor reach the specified speed. The drive controller converts the motor speed into kilometers at the same time and sends it to the display to show the Truck speed through the CAN bus.
- During the above driving process, the motor speed encoder detects the motor speed and transmits it to the controller, and the motor temperature sensor detects the motor temperature and transmits it to the controller. The steering sensor T1 detects the rear wheel angle and transmits it to the controller.

NOTE

The speed encoder outputs two pulse signals with a phase difference of 90 °, and determines the rotation direction of the motor according to the phase sequence of the two pulse signals. At the same time, the pulse signal fed back by the motor is counted and the motor speed is calculated. The drive motor rotates for 1 turn, and the encoder outputs 64 pulses.

The temperature sensor detects the temperature of the motor and feeds the signal back to the controller. When the motor temperature is too high, the controller controls the motor to slow down or stop running.

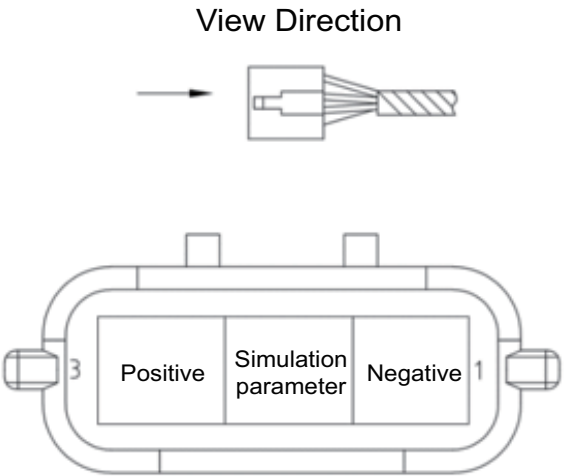


8.2.3.3 Angle Sensor - Need to Calibrate

1) When the rotation angle of the rear wheel is different, the position of the lever of the steering sensor T1 changes, and the analog value fed back to the controller will also be different.



2) The controller calculates the steering angle of the whole Truck according to the value of the analog, and calculates the differential value of the drive motor. When turning, it controls the drive motor to run under the differential speed (drive motor is adjusted at the same time). Limit the cornering speed of the entire tractor by limiting the maximum speed of the motor so that the tractor runs more smoothly.





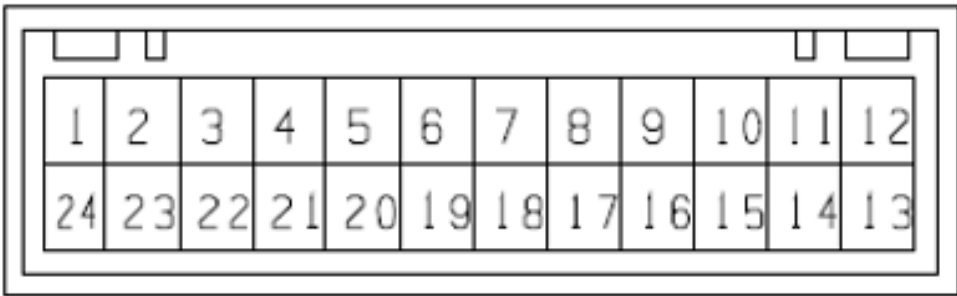
8.2.3.4 Overview of Display



- 1. Button: Drive mode, upward
- 2. Button: Setup, return
- 3. Button: Turtle speed, downward
- 4. Parking brake indicator
- 5. Battery fault alarm
- 6. Alarming when motor is overheating and main contactor is disconnected.
- 7. Turtle speed indicator light
- 8. The wrench lights up when there is a fault.



8.2.3.5 Display Pin Definition



Pin	Definition	Pin	Definition
A1	Ground Connection	A13	Low Beam Light detection signal
A2	Ground Connection	A14	Tilting Forward Signal
A3	Handbrake Signal	A15	Tilting Backward Signal
A4	ON Gear (Low-voltage System12V)	A16	N Gear Signal (Moving Forward Signal)
A5	Normal power 12V	A17	Automatically Level Signal (Moving Backward Signal)
A6	Turn Signal Light (L)	A18	Mast Stroke Normally Open Signal
A7	Turn Signal Light (R)	A19	Mast Stroke Normally Close Signal
A8	Fuel Oil Signal (Reserved)	A20	Oil Pressure Sensor Power Supply
A9	CAN-H	A21	Oil Pressure Signal (TBD)
A10	CAN-L	A22	Grounding Signal of Oil Pressure Sensor
A11	Water Temperature Signal (Reserved)	A23	Power Battery Charging Connection Signal
A12	Traction Motion Sensing Signal	A24	Sideshift Signal (Reserved)



8.2.4 Brake System

8.2.4.1 Brake Process

- 1) When driving the tractor, depress the footbrake. The foot brake switch S2 is closed, and the drive controller recognizes it as a braking command.
- 2) The controller provides a reverse current to the motor, causing the drive motor to decelerate to 0 at the set deceleration rate. In this process, part of the kinetic energy of the motor is converted into electric energy, which is returned to the battery through the controller, and the other part is converted into heat.

8.2.4.2 Regenerative Braking to Zero-speed

- 1) Function form: When starting the regeneration signal, the excitation current will increase. The armature current is adjusted to the regeneration current limit (the adjustment of the regeneration current limit is controlled by the acceleration configuration settings). As the tractor decelerates, the excitation current continues to increase and the armature begins to pulse on time. The excitation current will increase until it reaches 100% of the conduction time.
- 2) When the armature pulsates on time and the excitation current reaches the conduction time of 100%, the regenerative current will not be maintained any more and the braking function will be canceled. When the rotor stops reversing, the Truck will return to electric state according to the operator's operation.
- 3) Part of the energy generated by the motor during regeneration is returned to the battery, and part of it is dumped into the motor in the form of heat. The advantage of this system is that the drive motor has less heat and the brush life of the drive motor is longer.

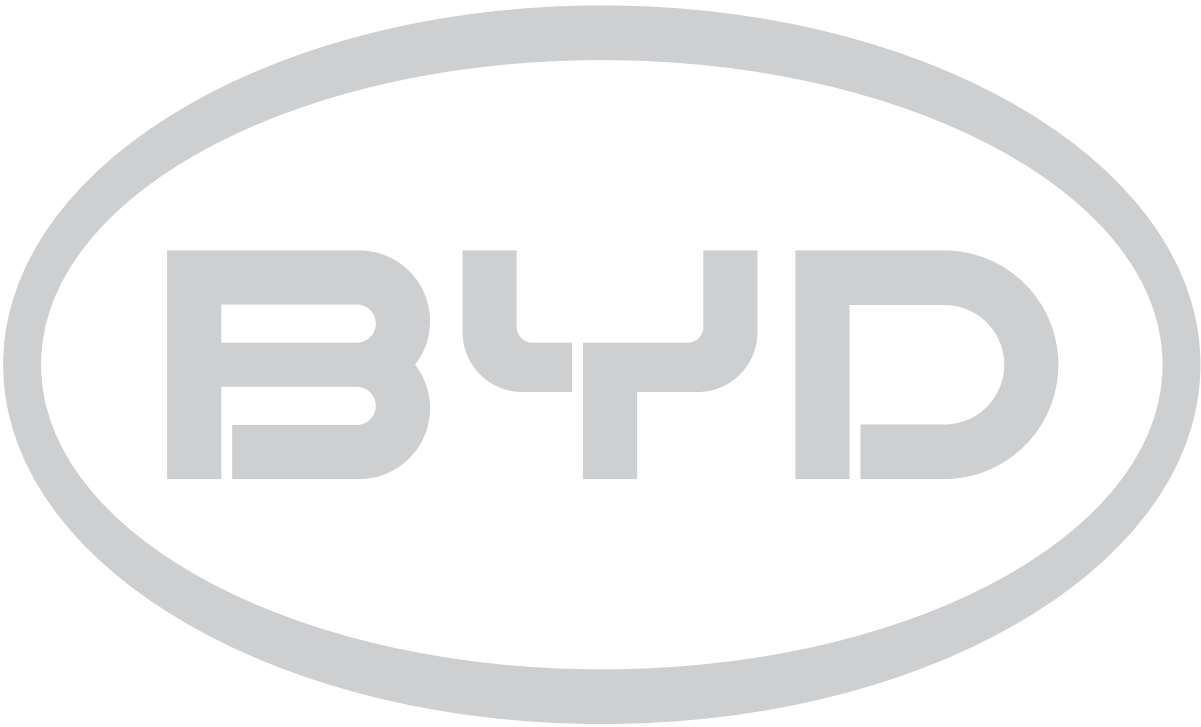


8.2.5 Steering System

1. Sit on the seat, close the seat switch S1, when the drive controller recognizes that the seat switch S1 is closed, it allows the lift motor to work.
2. When driving forward or backward, the drive controller receives the forward or backward signal and informs the lift controller to control the lift motor to work at the set speed.
3. Turn the steering wheel, the hydraulic oil reaches the steering control unit through the oil pump and the oil pipe, and then reaches the steering axle oil pipe through the steering gear to control the steering.
4. The drive controller will recognize the steering angle signal through the steering sensor SS1, the controller calculates the steering angle of the Truck, and controls the differential speed of the drive motors at the same time, while limiting the maximum speed when turning to ensure safety.



9 Appendix





9.1 Table of the Torque Value

Bolt Tightening Torque Value						
Nominal Diameter mm	Bolt Performance Grade					
	4.8	5.8	6.8	8.8	10.9	12.9
	Proof Stress MPa MPa					
	310	380	440	600	830	970
	Tightening Torque N•m					
M6	5~6	7~8	8~9	10~12	14~17	17~20
M8	13~15	16~18	18~22	25~30	34~41	41~48
M8×1	14~17	17~20	20~23	27~32	37~43	43~52
M10	26~31	31~36	36~43	49~59	68~81	81~96
M10×1	28~34	35~41	41~48	55~66	76~90	90~106
M12	45~53	55~64	64~76	86~103	119~141	141~167
M12×1.5	47~56	57~67	67~79	90~108	124~147	147~174
M14	71~85	87~103	103~120	137~164	189~224	224~265
M14×1.5	77~92	94~110	110~131	149~179	206~243	243~289
M16	111~132	136~160	160~188	214~256	295~350	350~414
M16×1.5	118~141	144~170	170~200	228~273	314~372	372~441
M18	152~182	186~219	219~259	294~353	406~481	481~570
M18×1.5	171~205	210~247	247~291	331~397	457~541	541~641
M20	216~258	264~312	312~366	417~500	576~683	683~808
M20×1.5	239~287	294~345	345~407	463~555	640~758	758~897
M22	293~351	360~431	416~499	568~680	786~941	918~1099
M22×1.5	322~386	395~473	458~548	624~747	863~1034	1009~1208
M24	373~446	457~547	529~634	722~864	998~1195	1167~1397
M24×2	406~486	497~595	576~689	785~940	1086~1300	1269~1520
M27	546~653	669~801	774~801	1056~1264	1461~1749	1707~2044
M27×2	589~706	723~865	837~1002	1141~1366	1578~1890	1845~2208
M30	741~887	908~1087	1052~1259	1434~1717	1984~2375	2318~2775



M30×2	820~982	1005~1203	1164~1393	1587~1900	2196~2629	2566~3072
M36	1295~1550	1587~1900	1838~2200	2506~3000	3466~4150	4051~4850
M36×3	1371~1641	1680~2011	1946~2329	2653~3176	3670~4394	4289~5135
M42	2071~2479	2538~3039	2939~3519	4008~4798	5544~6637	6479~7757
M42×3	2228~2667	2731~3269	3162~3786	4312~5162	5965~7141	6921~8345
M48	3110~3723	3813~4564	4415~5285	6020~7207	8327~9969	9732~11651
M48×3	3387~4055	4152~4970	4807~5755	6556~7848	9069~10857	10598~12688

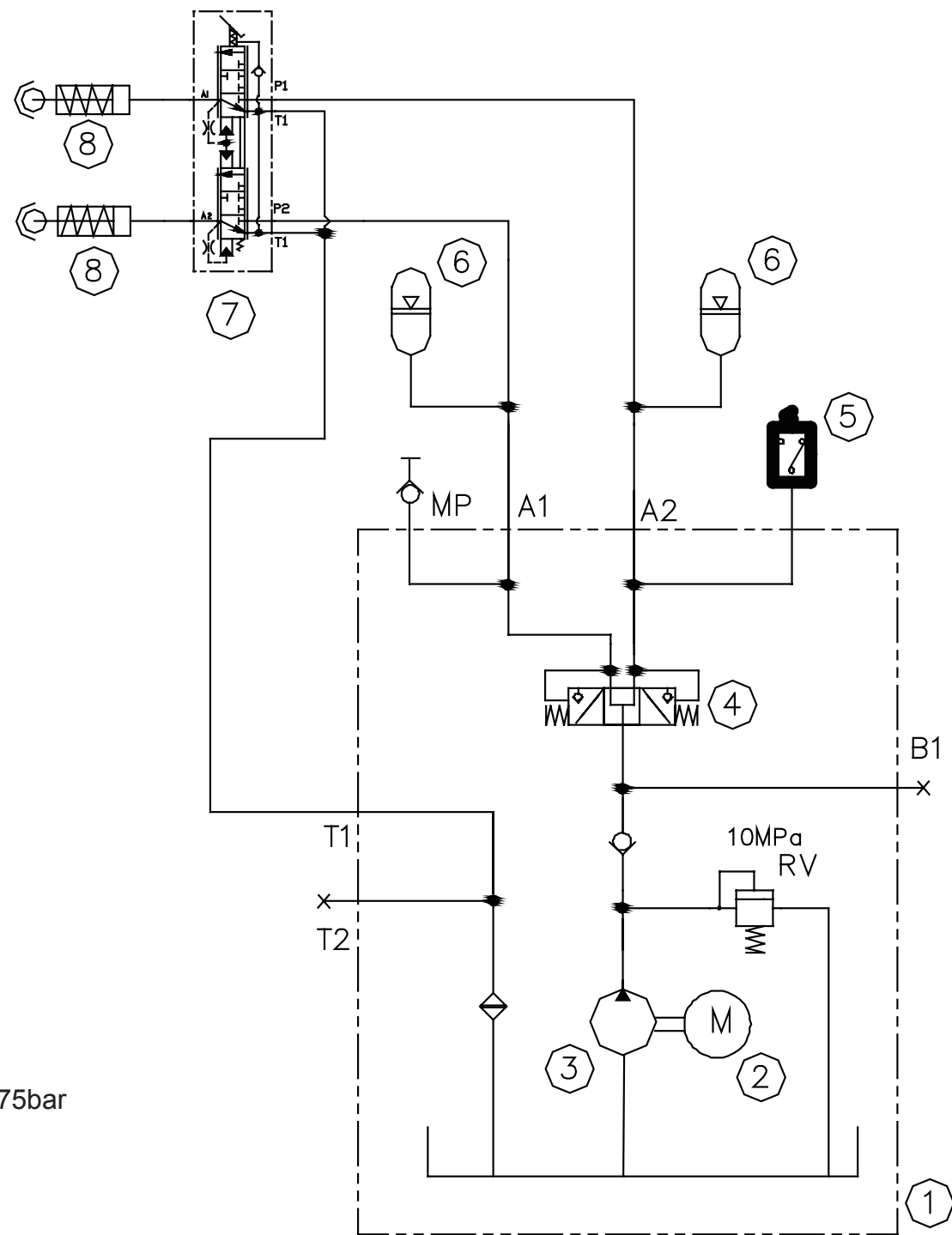


T250F Torque Requirement		
System	Installation Location	Torque Value(Nm)
Chassis System	Fixing bolt of front and rear axle shock absorber	100
	Pin fixing bolt of front and rear axle	25
	Fixing bolt of drive axle brake tee block	15
	Plug of drive axle brake tee block	30
	Straight joint of drive axle brake oil pipe	40
	Fixing bolt of steering axle leaf spring	40
	Drive axle fixing bolt	100
	Front wheel fixing bolt	150
	Rear wheel fixing bolt	180
	Counterweight fixing bolt	300
	Steering axle oil pipe fixing bolt	40
	Steering axle straight joint	40
	Fixing bolt of front and rear traction seat	150
Hydraulic System	Hydraulic power unit pipe connecting accumulator	30
	Hydraulic power unit pipe connecting brake valve	30
	Straight connector connecting to the hydraulic power unit	30
	oil pipe connecting to the hydraulic power unit	30
	Accumulator tee connector	70
	Accumulator connecting to brake valve oil pipe	30
	Straight connector for steering oil pump	80
	Steering oil pump pipe	50
	Straight oil inlet connector for filter	60
	Brake valve of the fixing bolt	25
	Brake valve tee connector	40
	Brake valve oil outlet straight connector	40
	Braking valve oil outlet two-way connector	40
	Straight return oil pipe of brake valve	40
	Brake tee block connecting to brake valve oil pipe	30
	Return oil pipe of brake valve	30
	Filter hose connecting to steering gear	80
	Steering axle oil pipes (2) connecting to steering gear	30
	Steering oil pump pipe connecting to steering gear	60
	Fixing bolt for the fuel tank	25

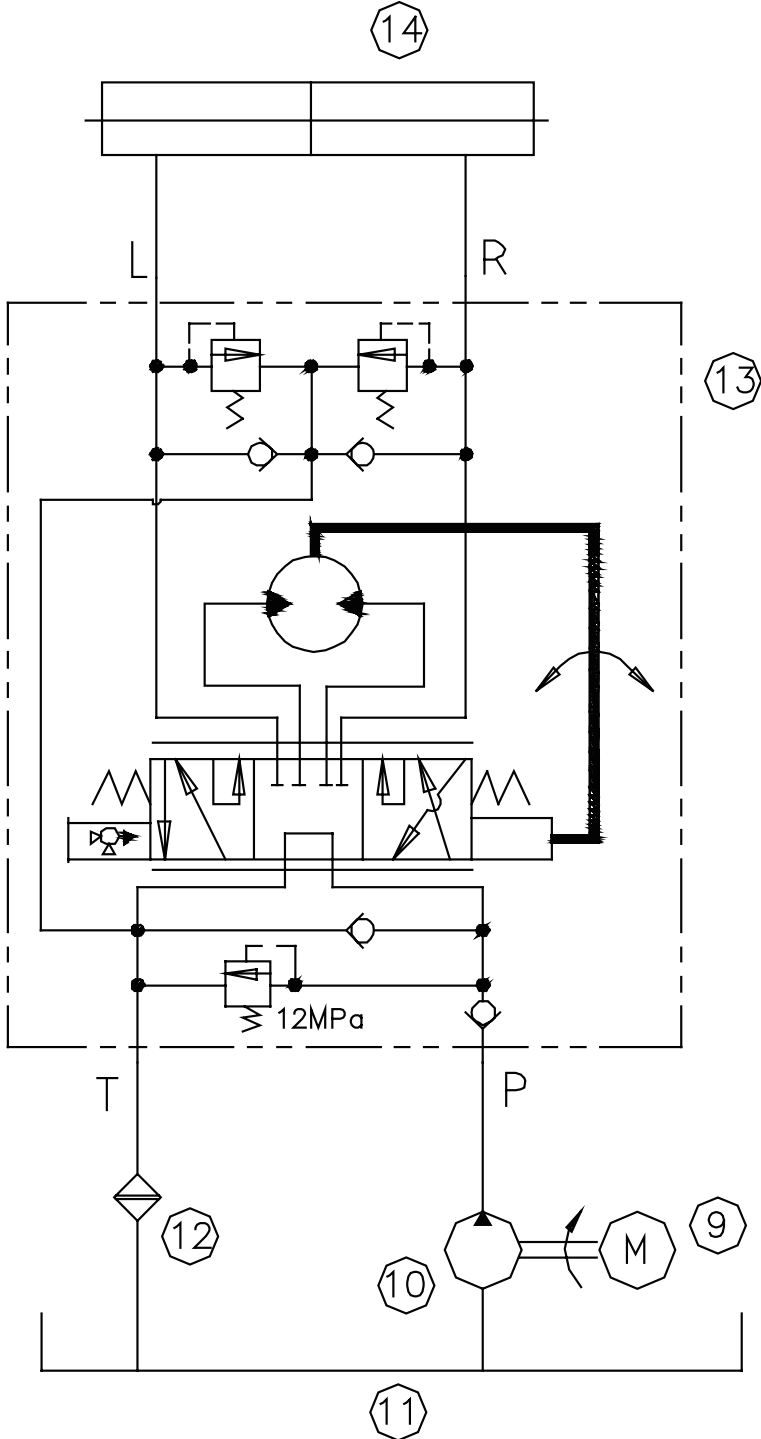


	Fuel tank plug	40
	Q67638_B-type worm-driven hose clamp	The hose is obviously deformed.
Electrical System	Drive axle three-phase wire fixing nut	15
	Main controller three-phase wire terminal	10
	Steering controller terminal	10
	Master controller fixing bolt	15
	Horn fixing bolt	20
	Battery pack positive and negative pole, charging port DC+, DC- terminal	10
	Main control fuse terminal	10
	Steering motor fixing bolt	45
Accessory System	Steering wheel lock nut	25
	Fixing bolt of steering gear assy	45
	Steering column fixing bolt	45
	Seat fixing bolt	25
	Seat cover fixing bolt	25
	Fixing bolt of rear protective net	150
	Fixing bolt of battery box cover	20
	Fixing bolt of rear shutter	25
	Fixing bolt of rear cover hinge	25
	Fixing bolt of rear cover lock	25
	Seat left and right armrests	25
	Left rails	25
	Right rails	25
	Lower rails	25
Note:		
1. The torque in the table is the reference value. If there are no special requirements, the torque deviation is generally $\pm 10\%$.		

9.2 Hydraulic Schematic Diagram



- 1. Power unit assembly
- 2. DC motor 800W/72V
- 3. Brake oil pump 1cc
- 4. Two-way filling valve
- 5. Pressure switch 95bar/75bar
- 6. Accumulator 1L
- 7. Two-way brake valve
- 8. Brake

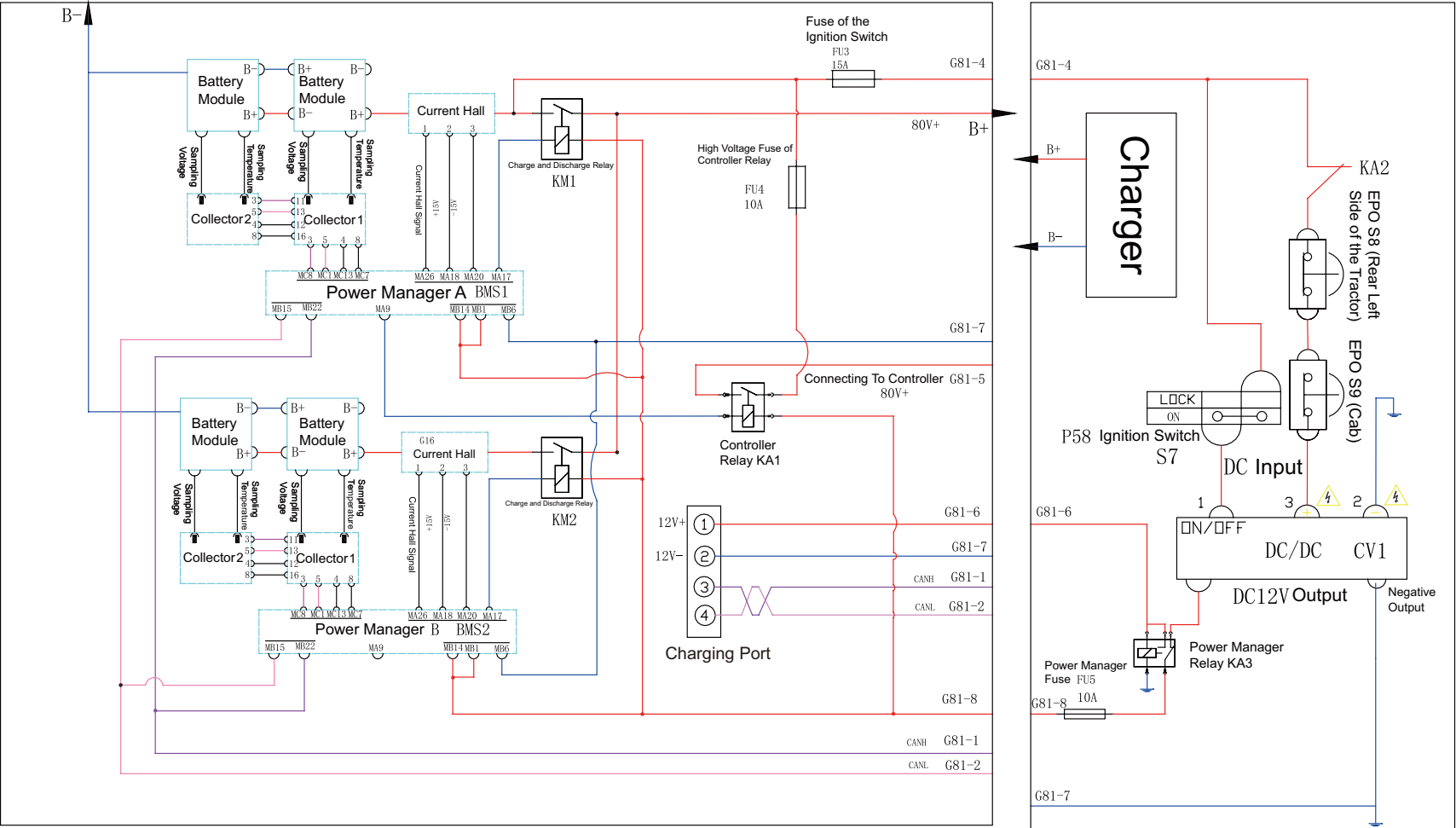


- 9. Steering motor
- 10. Steering oil pump 9cc
- 11. Tank
- 12. Return oil filter
- 13. Hydraulic redirector
- 14. Steering cylinder

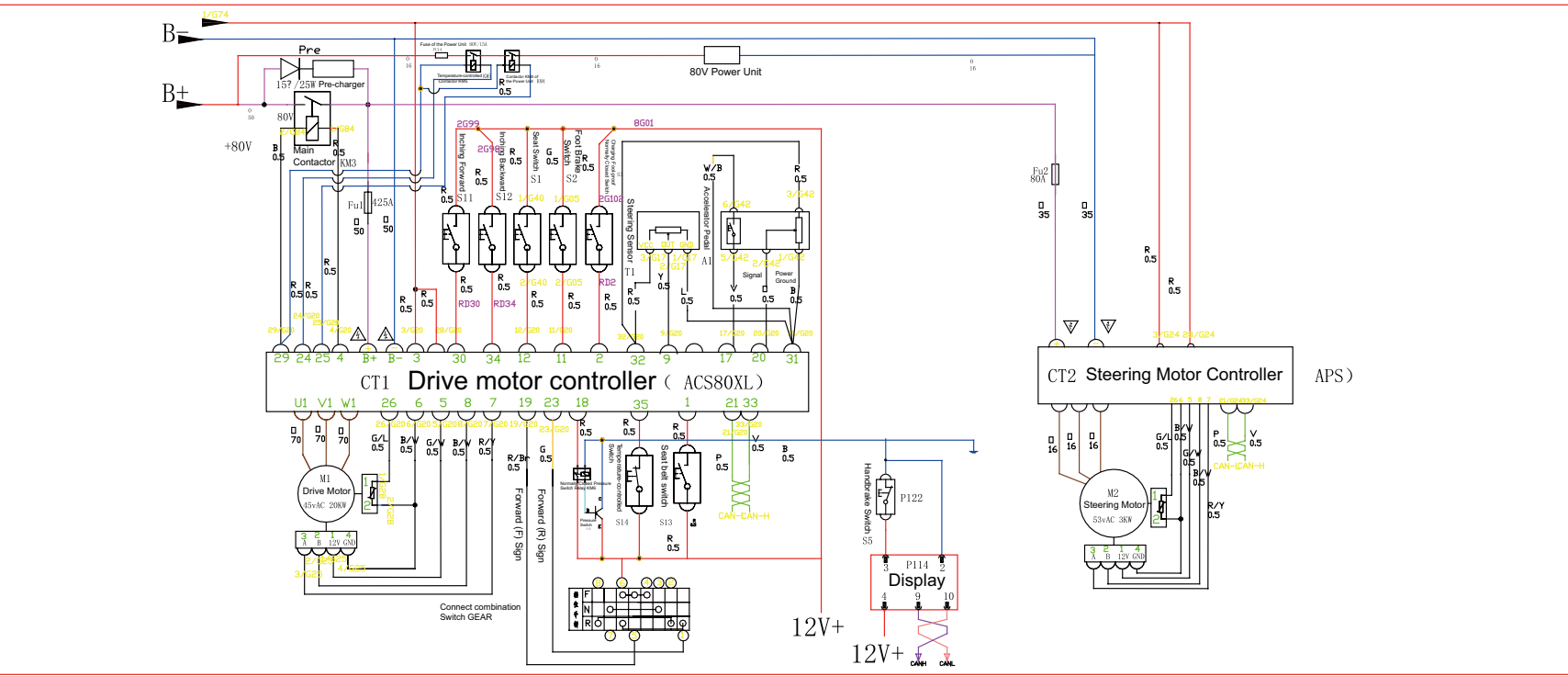


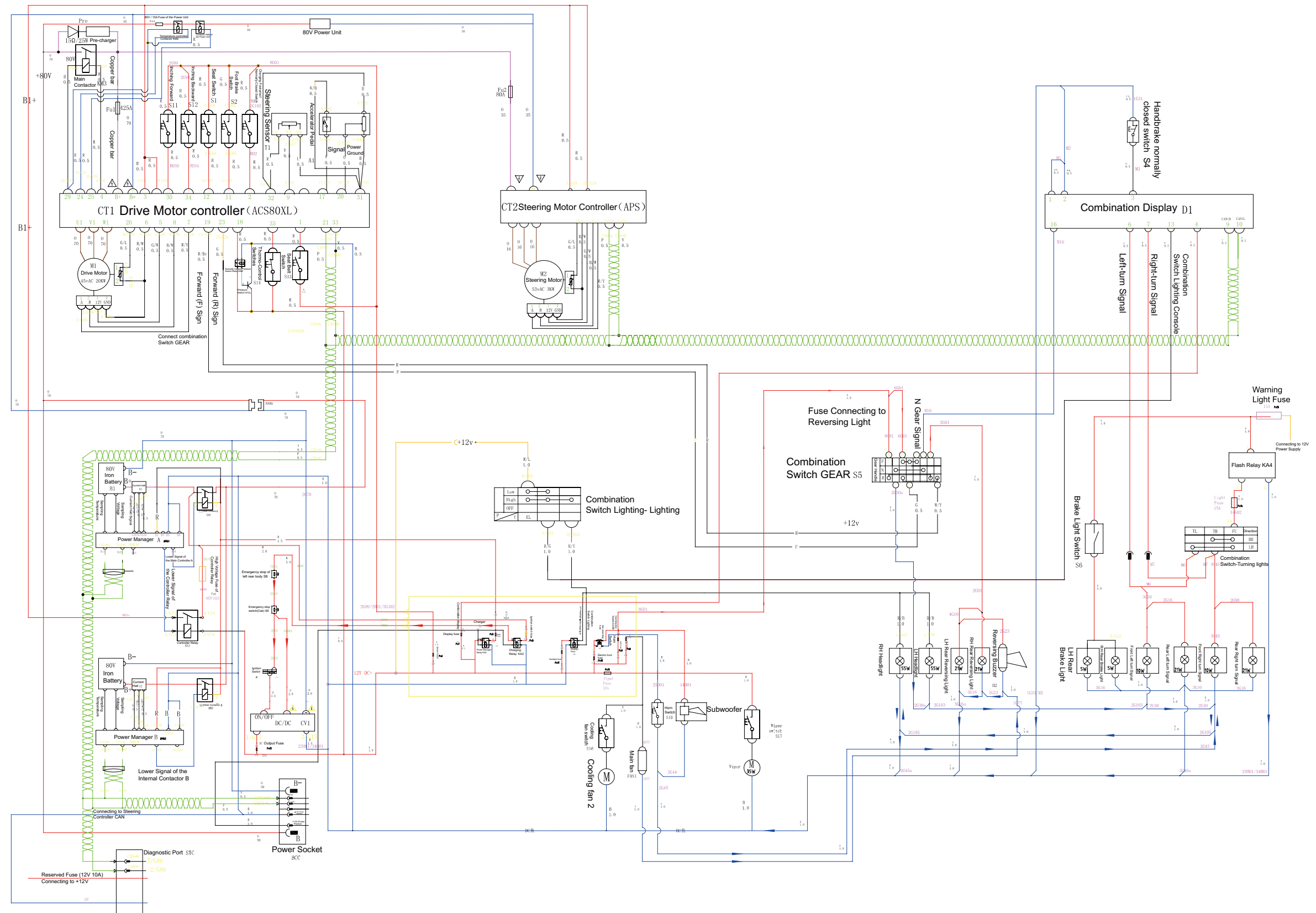
9.3 Electrical Schematic Diagram

Power System
of the Entire Tractor



Control System







9.4 Parameters of the Controller

SEF tractor series- parameters and description of the controller			
Parameter	Subaddress	Parameter Name	Parameter Description
Address			
0x2000		ApplicationCommands	Controller application control
	0x2000:2	CommandSpeed	The command speed given by the controller to the motor
0x2001		ApplicationStatus	Controller application status
	0x2001h:2	ActualSpeed	Current actual speed of motor
0x2002		OperationTime	Controller time
	0x2002h:1	TotalTimeSeconds	Total power on time of controller -Seconds
	0x2002h:2	TotalTimeHours	Total power on time of controller - Hours
	0x2002h:3	TotalTimeEnabledSeconds	Controller enable time - Seconds
	0x2002h:4	TotalTimeEnabledHours	Controller enable time-Hours
0x2030		DcBus	DC bus voltage
	0x2030h:2	Voltage	DC bus voltage
0x2140		BestPerformanceCurveSpeed	Best performance curve speed-do not move
0x2141		BestPerformanceCurveTorqueCurrent	Best performance curve current-do not move
0x300A		EventLogMasterClear	Clear historical fault records
0x3011		ActiveEvents	Real-time fault record-see error code table for details
Stack parameter 8			
0x2005		ADConverterValues	Controller analog value
	0x2005h:9	ADC9	Accelerator pedal analog value
		ADC10	Angle sensor analog value
0x2024		TractionParameters	Pump controller parameters
	0x2024h:1	MaxSpeed	Pump motor actual speed
	0x2024h:3	ReductionBrakeValue	Drive motor deceleration braking value
	0x2024h:4	NeutralBrakeValue	Drive motor parking brake value
	0x2024h:5	ReverseBrakeValue	Drive motor reverse brake value
	0x2024h:6	PedalBrakeValue	Drive motor pedal brake value
	0x2024h:7	TurtleValue	Turtle speed mode maximum speed
	0x2024h:8	PowerValue	Mediumspeed mode maximum speed



	0x2024h:9	TractPotActiveHigh	Accelerator pedal effective high point
	0x2024h:10	TractPotActiveLow	Accelerator pedal effective low point
	0x2024h:30	SeatActiveTimerMs	OPS switch anti-shake time Seconds
0x2022		SteerParParameters	Steering parameters
	0x2022h:2	SteerPotActiveHigh	Angle sensor effective high point
	0x2022h:3	SteerPotActiveLow	Angle sensor effective low point
	0x2022h:7	SteerPotMiddle_U16	Analog value when the steeringwheel is straightened.
0x2027		Temperatures	Truck temperature data
	0x2027h:1	TractionDriveTemp	Drive controller temperature
	0x2027h:2	TractionMotorTemp	Drive motor temperature
SEF tractor series-parameters and description of the controller			
Stack parameter 5			
0x2000		ApplicationCommands	Controller application control
	0x2000:2	CommandSpeed	The command speed given by the controller to the motor
0x2001		ApplicationStatus	Controller application status
	0x2001h:2	ActualSpeed	Current actual speed of motor
0x2040		MotorTemperature	temperature parameters
	0x2040h:2	Temperature	Pump motor temperature

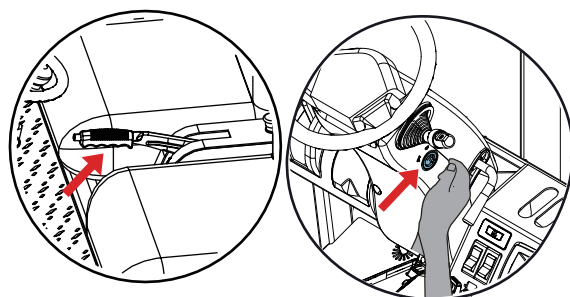


The parameters should be adjusted by professionals according to the specific model.

9.5 Charging Instructions

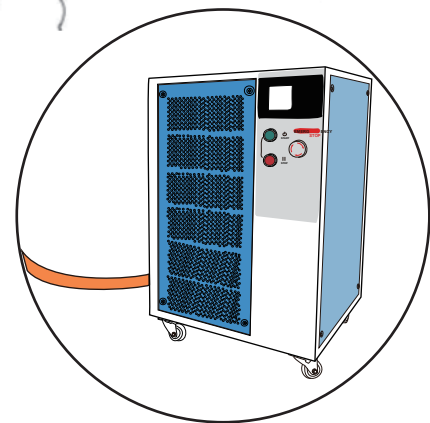
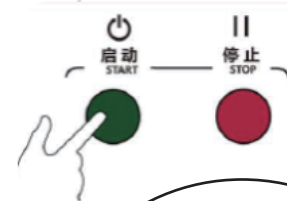
1 Parking

1. Parking the tractor at the charging position.
2. Activate parking brake.
3. Turn off the truck and remove key from keyhole.



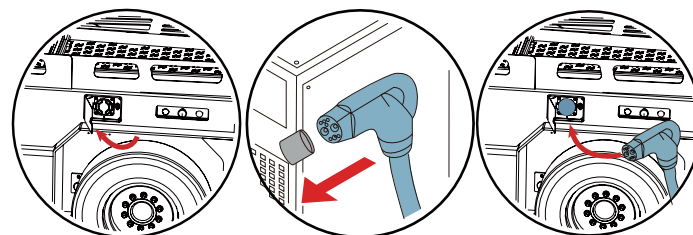
3 Charging process

1. Turn on the leakage protection switch.
2. Press the start button on charge.



2 Charging preparations

1. Open the charging port cover and charging gate of the truck.
2. Pick up the charging gun from charger and open the cap.
3. Connect the charging gun head and charging base on truck.



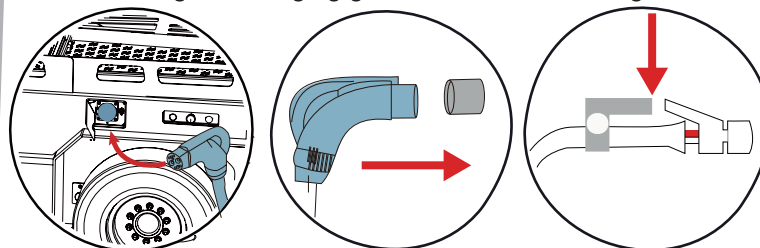
4 Charging finish

When fully charged (display screen off):

1. Pull the charging gun head off the charging base.
2. Close the charging gate and charging port cover.
3. Put on the charging gun cap.
4. Hang the charging gun on the hook of charger.

Not fully charged (display screen showing charging):

1. Press the stop button.
2. Pull the charging gun head off the charging base after display screen off.
3. Close the charging gate and charging port cover.
4. Put on the charging gun cap.
5. Hang the charging gun on the hook of charger



Caution:

1. DO NOT unplug the charging connection during charging.
2. DO NOT turn off the leakage protection switch during charging.
3. After charging, be sure to put the cap back into the charging gun head.
4. After charging, be sure to place the charging gun head on the hook.

9.6 Weekly Check

1 Cleaning

The internal dirt of the charger is the main factor leading to the damage of the gun!

- Outage: Close the main switch Fig.1 to disconnect the grid-power.
- Environment: Use wind gun and blow the surface of the charging to clean.
- ventilation: Blow the ventilation grid to clean, as shown in Fig.1&2 below.
- Charging gun head: Open the dust cover of the gun and blow the dust in each hole as shown in Fig.3.

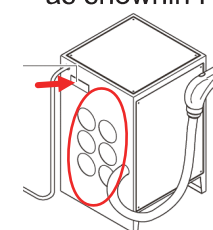


Fig.1

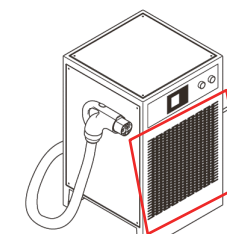


Fig.2

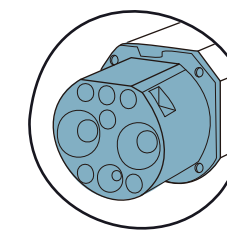
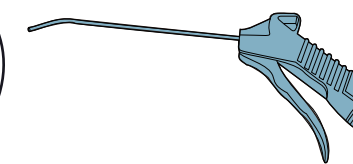


Fig.3



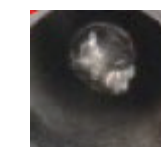
WIND GUN

2 Static Check

- Check if the input/output wire is deformed, oxidized, yellowed, hot melted, etc.
- Check whether the charging base is paint-off, rusty, water-damaged or dirty.
- Check whether the terminal of each hole is aged, yellowed, ablated, deformed, cracked, etc. Please contact the dealer if any of above is observed.



Yellowing



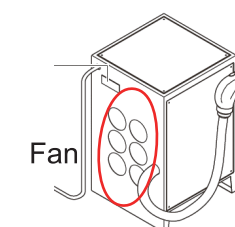
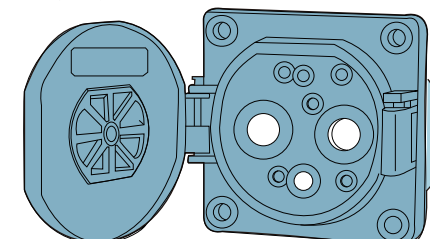
Hot melt



Cracking

3 Charging Test

- Before charging, check whether the charging seat is dirty or flooded.
- Whether the metal terminals are aged, yellowed or ablated; Plug in the charging gun, start charging, and observe whether the charger fans are all started;
- Wait five minutes and observe whether the display having error code. If not, it means the charger works well.



Fan



9.7 Other Information

<Copyright>

The information contained in this manual is the property of BYD (SHAOGUAN) CO.,LTD. (hereinafter referred to as “BYD”). This manual was prepared for the internal use of the clients; without the prior written consent of BYD, no part of the document shall be used, duplicated, translated, or transmitted by any means or for any commercial purposes. BYD has the right to change its technical data and equipment information without notice.

The logo of BYD is a registered trademark of BYD.

Copyright © BYD 2020. All rights reserved.

BYD (SHAOGUAN) CO.,LTD.

Production Address : No.1, BYD Road, Zhenjiang Industrial Zone,

Shaoguan, Guangdong, P.R.China

Zip Code: 512040

Tel: +86-751-810 8888

After-sales address: 2nd floor, A4, BYD Industrial Park, 1 Yan'an Road, Kwai

Chung Street, Dapeng New District, Shenzhen,

Zip Code: 518119

Tel: +86-755-2386 0828

Website: www.bydforklift.com



Build Your Dreams