

SECTION 1 GENERAL

Group 1 Safety hints	1-1
Group 2 Specifications	1-4
Group 3 Periodic replacement	1-12

SECTION 2 REMOVAL & INSTALLATION OF UNIT

Group 1 Major components	2-1
Group 2 Removal and installation of unit	2-2

SECTION 3 POWER TRAIN SYSTEM

Group 1 Structure and operation	3-1
Group 2 Troubleshooting	3-4
Group 3 Disassembly and assembly	3-6

SECTION 4 BRAKE SYSTEM

Group 1 Structure and function	4-1
Group 2 Operational checks and troubleshooting	4-9
Group 3 Test and adjustment	4-11

SECTION 5 STEERING SYSTEM

Group 1 Structure and function	5-1
Group 2 Disassembly and assembly	5-3

SECTION 6 HYDRAULIC SYSTEM

Group 1 Structure and function	6-1
Group 2 Operational checks and troubleshooting	6-21
Group 3 Disassembly and assembly	6-25

SECTION 7 ELECTRICAL SYSTEM

Group 1 Component location	7-1
Group 2 Electrical circuit	7-2
Group 3 Electric components	7-3

SECTION 8 MAST

Group 1 Structure	8-1
Group 2 Operational checks and troubleshooting	8-4
Group 3 Adjustment	8-7
Group 4 Removal and installation	8-9

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GROUP 1 SAFETY HINTS

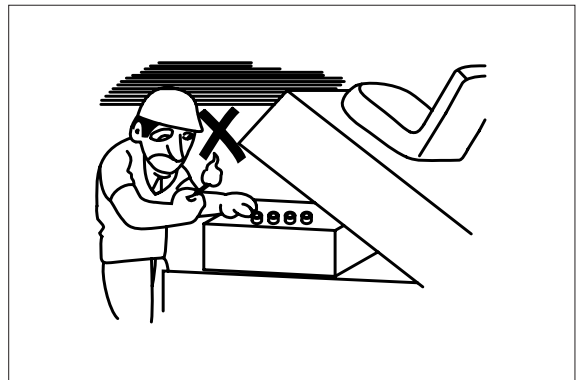
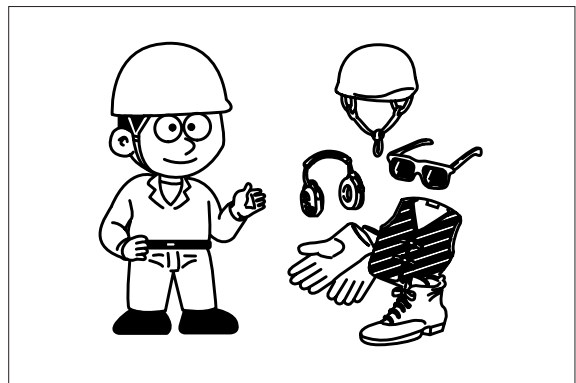
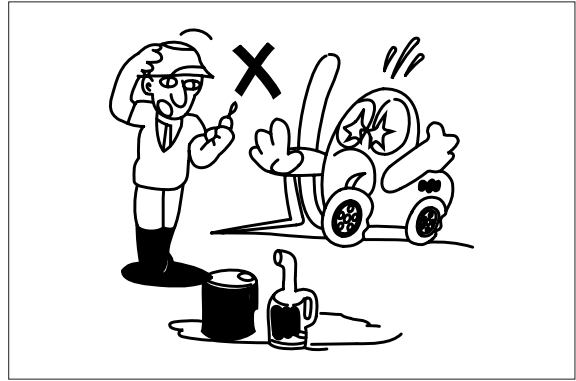
Careless performing of the easy work may cause injuries.

Take care to always perform work safely, at least observing the following.

- Oil is a dangerous substance. Never handle oil, grease or oily clothes in places where there is any fire or flame.

As preparation in case of fire, always know the location and directions for use of fire extinguishers and other fire fighting equipment.

- Wear well-fitting helmet, safety shoes and working clothes. When drilling, grinding or hammering, always wear protective goggles. Always do up safety clothes properly so that they do not catch on protruding parts of machines. Do not wear oily clothes. When checking, always release battery plug.



D50ASF06

6. RECOMMENDED LUBRICANTS

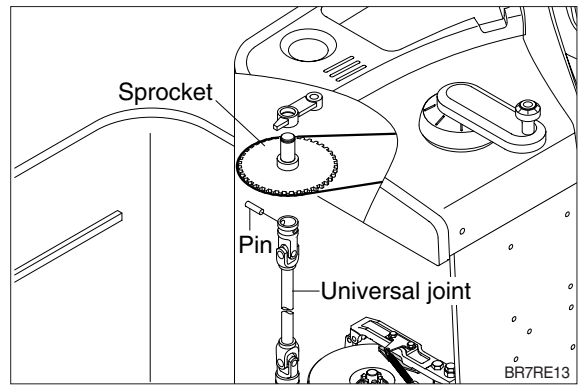
Use only oils listed below or equivalent.

Do not mix different brand oil.

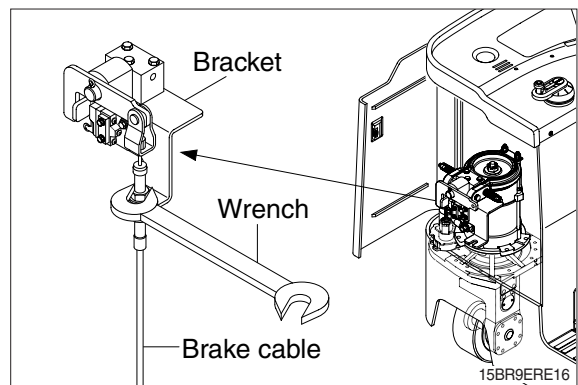
Service point	Kind of fluid	Capacity <i>l</i> (U.S. gal)	Ambient temperature °C (°F)																		
			-50 (-58)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)	40 (104)										
Drive unit	Gear oil	1.6 (0.42)																			
Hydraulic oil tank	Hydraulic oil	18 (4.0)																			
Fitting (Grease nipple)	Grease	0.1 (0.03)																			

★ : Cold region
Russia, CIS, Mongolia

(5) Remove steering joint parts.

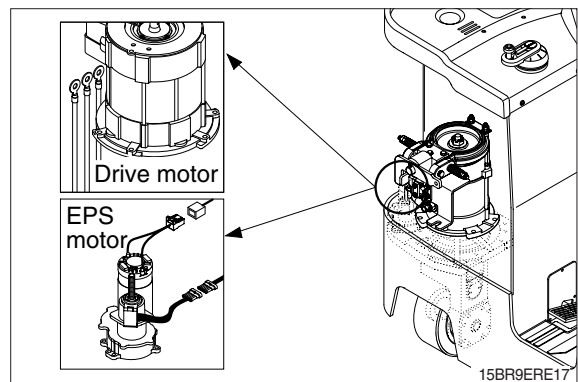


(6) Remove brake cable.

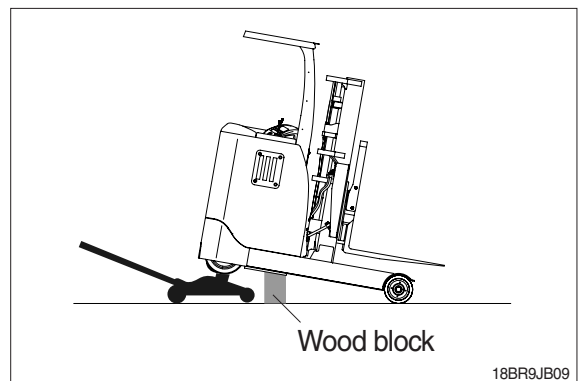


(7) Disconnect the wiring.

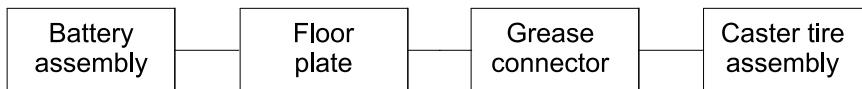
- ① Drive motor wiring
- ② EPS motor wiring.



(8) Jack up the frame and support both side of frame on wood block.



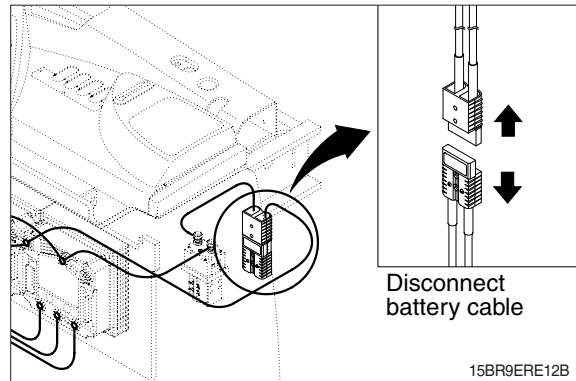
4. CASTER LINK ASSEMBLY



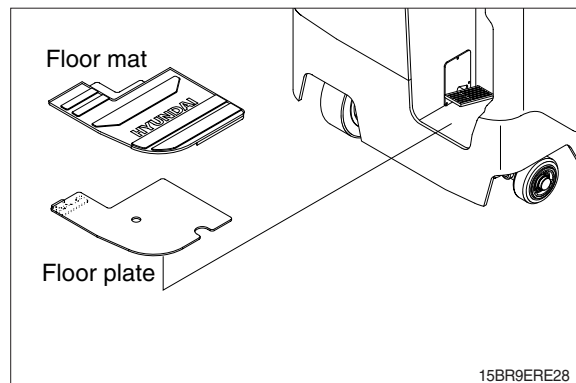
BR7RE003

1) REMOVAL

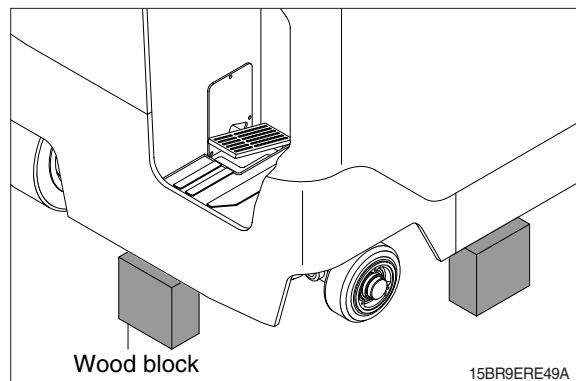
- (1) Disconnect the battery cable.



- (2) Remove floor mat and floor plate.



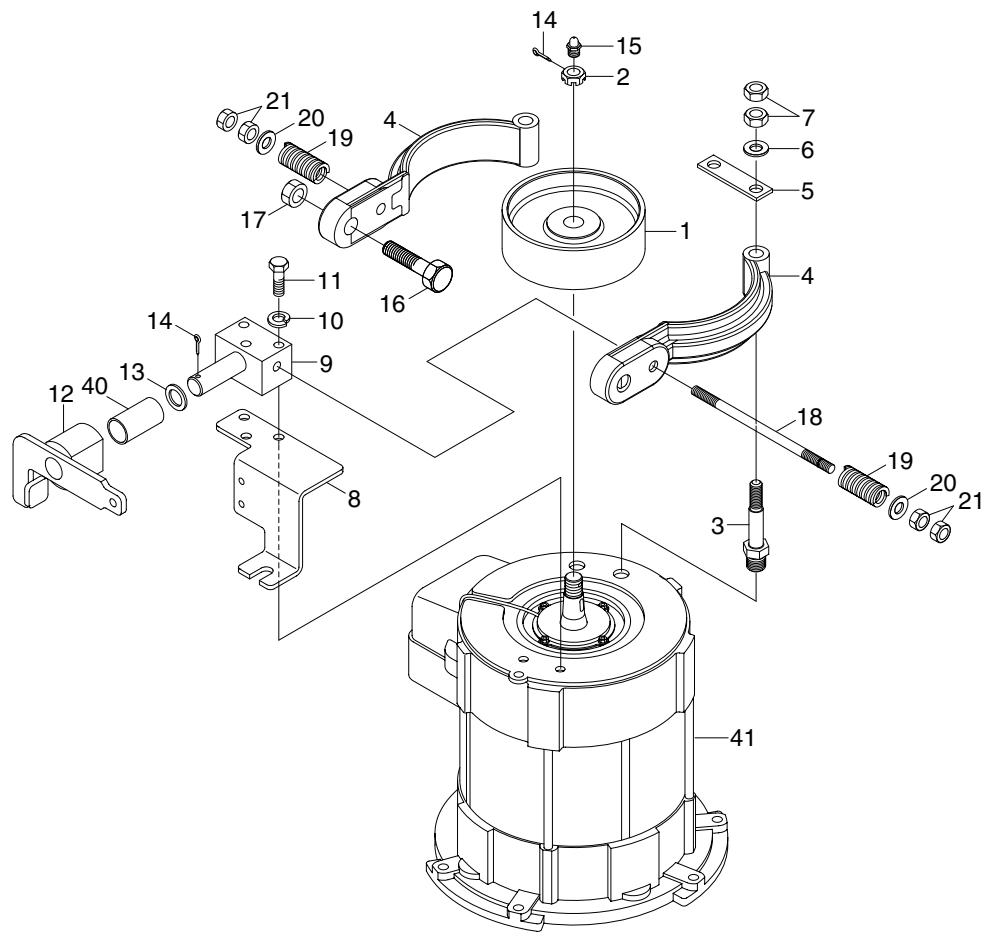
- (3) Jack up the frame and support both side of frame on wood block.



Problem	Probable cause	Remedy
Oil leakage on oil filler or oil drain plug	<ul style="list-style-type: none"> · Dirt between sealing ring and housing. · Old sealing ring was used. · Bolts not tightened according to the specified tightening torque. 	<ul style="list-style-type: none"> · Cleaning required. · Use new sealing ring · Tighten bolts with the specified tightening torque.
Oil leakage between housing and top section	<ul style="list-style-type: none"> · Seal faces not sealed or uneven. · Burrs on cylinder pin. · Bolts not tightened according to the specified tightening torque. 	<ul style="list-style-type: none"> · Apply LOCTITE 574 onto seal faces. Touch up seal faces with oil rubber. · Use a new cylinder pin. · Tighten bolts with the specified tightening torque.
Oil leakage on top section within helical gear stage / input	<ul style="list-style-type: none"> · Too much oil in transmission. · O-ring on cover defective. · Breather valve defective. 	<ul style="list-style-type: none"> · Check oil level. · Install new O-ring. · Replace breather valve.
Beating noise at helical gear stage	<ul style="list-style-type: none"> · Teeth on input pinion and/or helical gear damaged by false installation. 	<ul style="list-style-type: none"> · Check tooth flanks for damage and touch up damaged spots with oil rubber.
Ring noise	<ul style="list-style-type: none"> · Helical gear stage running without oil. 	<ul style="list-style-type: none"> · Check oil level. · Refill oil.
Grinding noise	<ul style="list-style-type: none"> · Bearing preload or backlash not correctly adjusted. 	<ul style="list-style-type: none"> · Checking and new adjustment.
Bearing damage on input pinion	<ul style="list-style-type: none"> · No axial play. 	<ul style="list-style-type: none"> · Install new bearing and adjust axial play.
Pivoting bearing is difficult to rotate or backlash recognizable	<ul style="list-style-type: none"> · Cover disc loosened and dirt entered into the bearing. · Cage segments are damaged. · Plastic deformation of balls or ball race. · Bearing not relubricated. · Grease not distributed. 	<ul style="list-style-type: none"> · Replace pivoting bearing. · Replace pivoting bearing. · Replace pivoting bearing. · Relubricate pivoting bearing. · Rotate pivoting bearing several times by hand.

4. BRAKE SYSTEM

1) STRUCTURE



15BR9EBS03

1	Brake drum	9	B/cam bracket	17	Hex nut
2	Low castle nut	10	Spring washer	18	Brake rod
3	Brake shoe pin	11	Hex bolt	19	Spring
4	Lining brake shoe	12	Brake cam	20	Plain washer
5	Lock plate	13	Plain washer	21	Hex nut
6	Plain washer	14	Split pin	40	Du-bushing
7	Hex nut	15	Grease nipple	41	Traction motor
8	Cable bracket	16	Cam bolt		

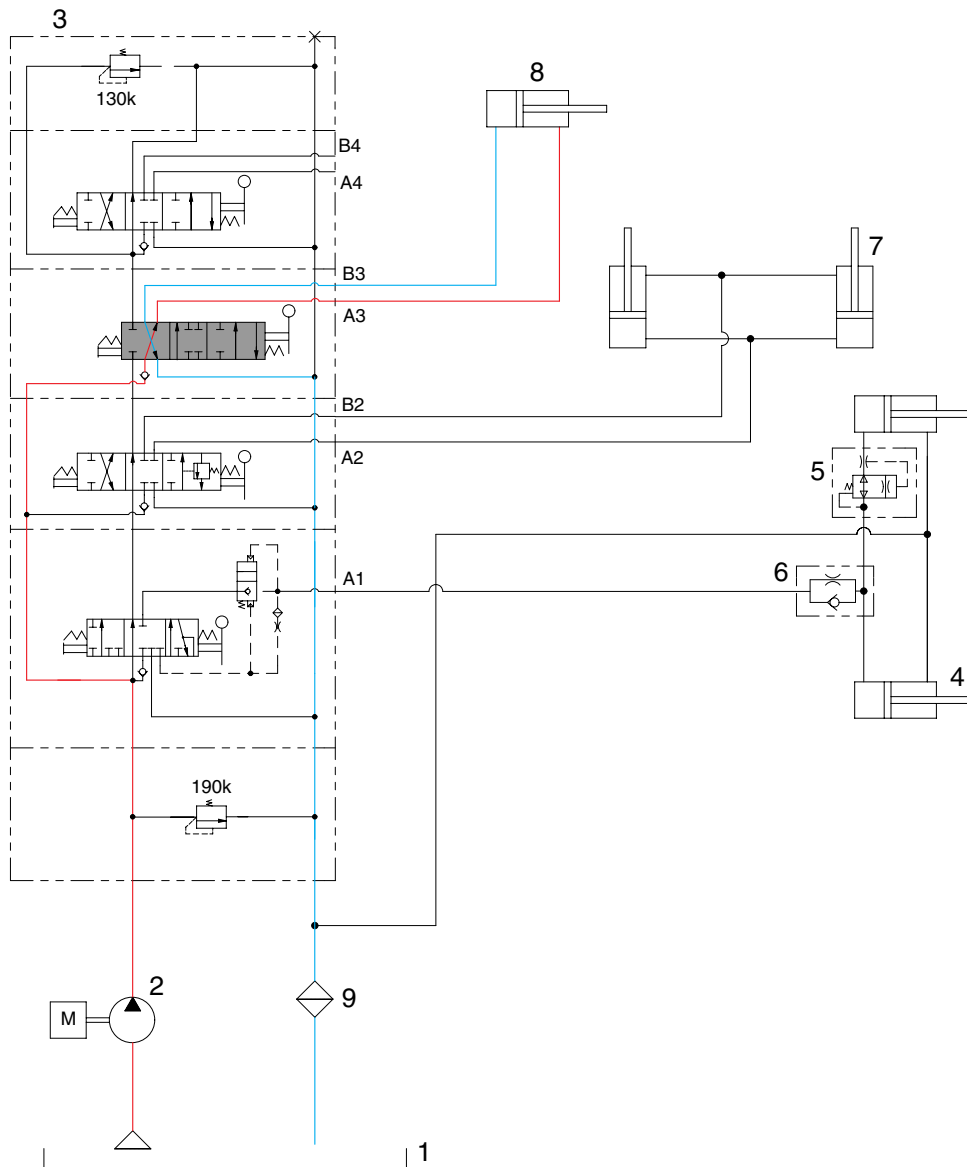
2. SPECIFICATIONS AND SERVICE STANDARD

Type	Unit	1st stage	Chain
		2st stage	Gear
Steering wheel diameter (mm)		ø 300	
Steering wheel free play (mm)		25~50	
Steering chain slack (mm)		3~5	
Steering angle	Right turn	79°	
	Left turn	101°	
Minimum turning radius (mm)	15BR-9E	1605	

3. TROUBLE SHOOTING

Problem		Cause	Remedy
Heavy steering	At traveling	<ul style="list-style-type: none"> · Damage of bearing at steering pinion · Damage of bearing of steering shaft of drive unit · Lack of grease of bearing 	<ul style="list-style-type: none"> · Replace bearing · Replace bearing · Lubricate grease
	At releasing joint at spline	<ul style="list-style-type: none"> · Damage of bearing in steering racket · Over tension of roller chain 	<ul style="list-style-type: none"> · Replace bearing · Adjust the tension
Steering play is large (STD : 25~50 mm)		<ul style="list-style-type: none"> · Looseness of roller chain · Extension of roller chain · Looseness of rubber coupling is large · Looseness of spline and joint is large · Backlash of steering pinion and gear is large 	<ul style="list-style-type: none"> · Adjust the tension · Adjust the tension or replace the chain · Replace coupling · Replace · Replace
Steering wheel is robbed in one way during traveling		<ul style="list-style-type: none"> · Eccentric wear of tire · Transformation of drive unit-rear axle · Transformation of frame 	<ul style="list-style-type: none"> · Replace · Repair or replace · Repair or replace

6) WHEN THE REACH CONTROL LEVER IS IN THE BACKWARD POSITION



15BR9EHS07

When the reach control lever is pulled backward, the spool on the third block is moved to reach backward position.

The oil from hydraulic gear pump (2) flows into main control valve (3) and then goes to the small chamber of reach cylinder (8) by pushing the load check valve of spool.

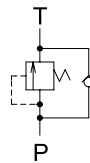
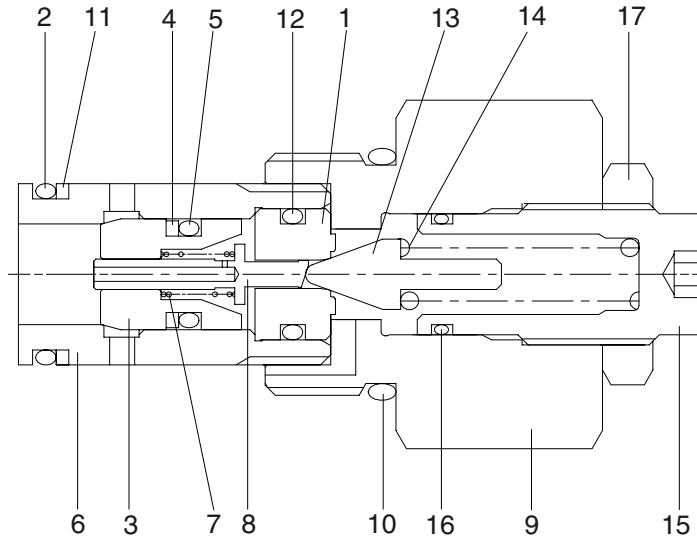
The oil at the large chamber of reach cylinder (8) returns to hydraulic tank (1) at the same time.

When this happens, the mast reaches backward.

9) MAIN RELIEF VALVE

This valve is a type of pilot piston to prevent hydraulic components and pipes from being broken by high pressure so, it keeps under pressure limited.

Relief valve pressure varies by 130 kgf/cm² in accordance with 1 revolution of adjust bolt.



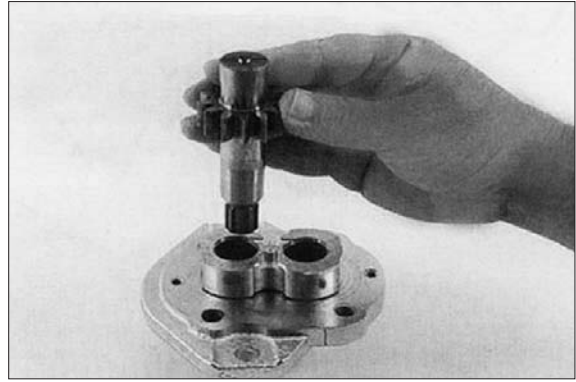
- Main relief valve : 190 kgf/cm²
- Secondary main relief valve : 130 kgf/cm²
(For 4 spool only)

- NOTE : 1) Max. pressure of relief valve : 250 kgf/cm²
- 2) Used pressure of hyd control valve : 190 kgf/cm²

15BR9EHS20A

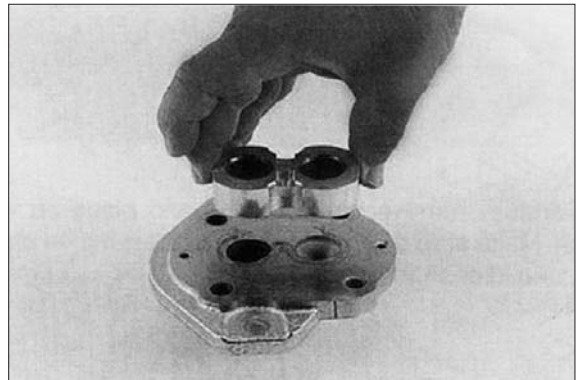
1 Pilot seat	7 Main spring	13 Pilot poppet
2 O-ring	8 Piston	14 Pilot spring
3 Main poppet	9 Body	15 Adjust screw
4 Back up ring	10 O-ring	16 O-ring
5 O-ring	11 Back up ring	17 Lock nut
6 Socket	12 O-ring	

- (12) Remove drive shaft from mounting flange.
There is no need to protect the shaft seal
as it will be replaced as a new item.



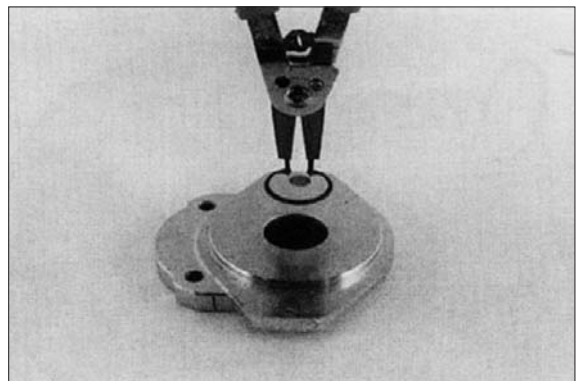
PUMP 07

- (13) Remove the front bearing block.



PUMP 08

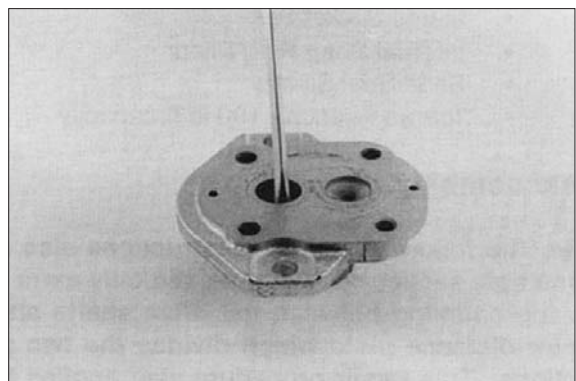
- (14) Turn mounting flange over, with shaft seal up, and remove the retaining ring with
proper snap ring pliers.



PUMP 09

- (15) Remove the oil seal from mounting flange,
be careful not to mar or scratch the seal
bore.

- (16) Remove the dowel pins from the gear
housing. Do not lose pins.



PUMP 10

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(7) Auxiliary section

※ Same procedure for all aux sections, but spool assembly components may vary.

- ① The spool assembly should already consist of the proper aux spool, the return spring, one spring seat on either end of the spring, the seal plate, a spool seal, and a dust wiper. All of these are assembled on the end of the spool opposite the clevis.
- ② Insert the clevis end of the spool into the right-hand side of the spool bore(the tallest end of the housing). Place the spool cap over the spool and spring assembly and connect the cap to the housing using two bolts. Torque both bolts alternatively until a torque of 1.0~1.5 kgf · m (7.2~10.8 lbf · ft) is reached on both bolts.
- ③ Install the second spool seal and dust wiper over the clevis end of the spool and retain with a seal plate and two bolts. Torque both bolts alternatively until a torque of 1.0~1.5 kgf · m (7.2~10.8 lbf · ft) is reached on both bolts.
- ④ The load check assembly is inserted into the top center cavity.
Torque to 3.5~4.0 kgf · m (25.3~30lbf · ft).

(8) Outlet section

- ① Install the secondary main relief valve into the cavity on the clevis end of the housing.
Torque to 4.5~5.0 kgf · m (32.5~36.2 lbf · ft)

2) DISASSEMBLY

(1) General

- ① Subassemblies (such as relief valves, check valves, and spools) may be removed without having to loosen the tie rods and disassembling the entire valve.
- ② Disassemble the valve sections on a flat working surface.
- ③ Ensure that the disassembly area will be clean and free of contamination.
- ④ Keep the disassembly area neat to avoid loss or damage of parts.

(2) Disassembly

- ① Loosen the tie rod nuts and remove the tie rods from the valve sections.
- ② Remove O-rings between valve sections and set aside to avoid damage.
- ③ Spools, relief valves, load check valves, lift lock poppet, solenoid valves, and plugs can all be removed from the valve sections. Refer to the associated assembly procedures, above, for specific torque and handling details. Inspect and repair or replace the assemblies as complete units, as may be necessary.
- ④ Valve components are precision items, and care must be taken when handing them to avoid damage or the introduction of contamination that could adversely affect performance.

GROUP 3 ELECTRIC COMPONENTS

1. FUNCTIONS OF BATTERY FORKLIFT TRUCK AND ELECTRIC COMPONENTS.

The major functions of forklift truck can be divided into DRIVING FUNCTION and LOADING & UNLOADING FUNCTION.

All the components that work DRIVING and LOADING & UNLOADING functions are driven by AC MOTORS. And as the BATTERY works as power source of these motors, a charging device is needed.

To drive the fork lift truck, a DRIVING CONTROL SYSTEM and some electric components such as direction change lever(forward/reverse section switch) and accelerator are required to select the driving direction and to control the speed of driving motor.

The CONTROL SYSTEM includes some protective circuits that protect the equipment and components from malfunctioning.

A MONITORING SYSTEM is installed in the monitor panel, which monitors the equipment and working condition, and let the operator take proper action. For the monitoring system, there are many sensors such as current sensors, hydraulic pressure sensors, and temperature sensors. The HYUNDAI Battery forklift trucks are equipped with the most advanced DRIVING CONTROL SYSTEM currently available world-widely. The operator friendliness features enable him to set the truck conditions properly according to each working circumstance easily on his seat, and the SELF-DIAGNOSTIC function displays current status of truck in working.

2) SPECIFICATION

Item	Unit	15BR-9E
Type	-	AMDU4004A
Rated voltage	Vac	30
Rated output	kW	4.5
Insulation	-	Class F

3) MAINTENANCE INSTRUCTION

(1) Inspection

① Rotor assembly inspection

Rotor should always be cleaned with compressed air.

If the dirt will not come off lightly wipe off with piece of cotton or soft cloth wetted with gasoline.

Rotor out diameter : $\varnothing 123.1 \pm 0.05$

Tool : Vernier calipers and standard tool



18BR9EL41

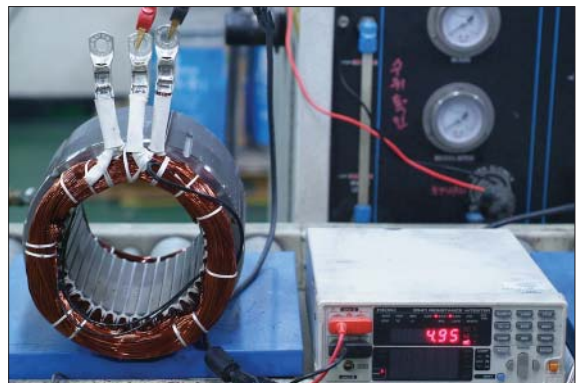
② Stator assembly inspection

Stator should always be cleaned with compressed air.

If the dirt will not come off lightly wipe off with piece of cotton or soft cloth wetted with gasoline, using care not to damage the coil insulation.

Use mm \varnothing tester and check for two power line of stator repeatedly (U-V, V-W, W-U).

At that time resistance is around 6.3 mm \varnothing .

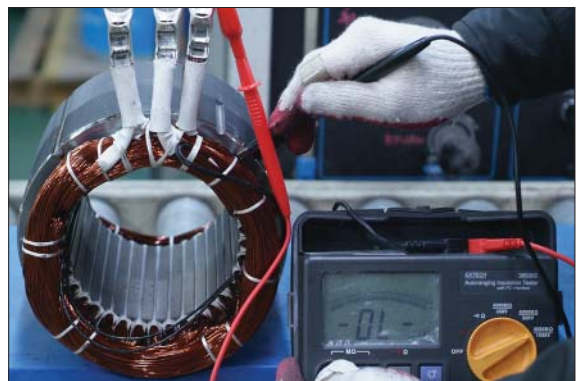


18BR9EL42

Insulation test

Use insulation tester (1000 Vac, Min. 10 M \varnothing) and measure as a picture.

If the insulation is defective, replace with new parts.



18BR9EL43

2) OPERATIONAL FEATURES

(1) Features

- ① Speed control.
- ② Optimum behavior on a slope due to the speed feedback:
 - The motor speed follows the accelerator, starting a regenerative braking if the speed overtakes the speed set-point.
 - The system can perform an electrical stop on a ramp (the machine is electrically held on a slope) for a programmable time.
- ③ Electronic differential feature with torque balance between external and internal wheel.
- ④ Regenerative release braking based upon deceleration ramps.
- ⑤ Regenerative braking when the accelerator pedal is partially released (deceleration).
- ⑥ Direction inversion with regenerative braking based upon deceleration ramp.
- ⑦ Regenerative braking and direction inversion without contactors: only the main contactor is present.
- ⑧ Optimum sensitivity at low speeds.
- ⑨ Voltage boost at the start and with overload to obtain more torque (with current control).
- ⑩ Electronic steering function:
- ⑪ Backing forward and reverse options are available, with the tune and the speed of the function programmable with Zapi console or buttons on a display.
- ⑫ High efficiency of motor and battery due to high frequency commutations.
- ⑬ Modification of parameters through the programming console or buttons on a display.
- ⑭ Internal hour-meter with values that can be displayed on the console.
- ⑮ Memory of the last five alarms with relative hour-meter and temperature displayed on the console.
- ⑯ Diagnostic function with Zapi console for checking main parameters.
- ⑰ Built in BDI feature.
- ⑱ Flash memory, software downloadable via serial link and via CANBUS.

(2) Diagnosis

The microcontrollers continually monitor the inverter and carry out a diagnostic procedure on the main functions. The diagnosis is made in 4 points.

- ① Diagnosis on key switch closing that checks: watchdog circuit, current sensor, capacitor charging, phase's voltages, contactor drivers, can-bus interface, if the switch sequence for operation is correct and if the output of accelerator unit is correct, correct synchronization of the two μ CS, integrity of safety related inputs hardware.
- ② Standby diagnosis in standby that checks: Watchdog circuit, phase's voltages, contactor driver, current sensor, can-bus interface.
- ③ Diagnosis during operation that checks: Watchdog circuits, contactor driver, current sensors, can-bus interface.
- ④ Continuous diagnosis that checks: Temperature of the inverter, motor temperature.

Diagnosis is provided in two ways. The digital console can be used, which gives a detailed information about the failure; the failure code is also sent on the Can-Bus.

■ PUMP CONTROLLER

Using the config menu of the programming console, the user can configure the following functions.

(1) Submenu "SET OPTIONS"

① Load sensor

- ON : Load sensing function is activated.
- OFF : Load sensing function is disactivated.

② Hour counter

This option specifies the hour counter mode. It can be set one of two :

- RUNNING : The counter registers travel time only.
- KEY ON : The counter registers when the "key" switch is closed.

③ Set motor temperature

It can be set:

1. ANALOG : An analogue sensor for the control of the motor temperature is connected to CNA#22. Typically the temperature sensor is a PTC (positive thermal coefficient resistance), providing the sensor characteristic to Zapi the correct table can be loaded in the controller software (analog temperature sensor).
2. DIGITAL : A digital (on/off) sensor for the motor temperature monitoring is connected to CNA#22 input (digital temperature sensor).
3. NONE : No temperature sensor is connected.

④ Cooling fan work

Cooling fans installed on nearby motors and controllers will work as follows;

- None : fans don't work.
- Option #1 : fans work always.
- Option #2 : fans work in case a temperature of controller or motor exceeds a temperature set in START TEMP. FAN menu
- Option #3 : fans work when motors work.

⑤ Digital lift

- OFF : The lift sensor includes a lift switch and an analogue lift sensor. Lift speed can be controlled proportionally with lever position.
- ON : The lift sensor includes a lift switch only. Lift speed cannot be controlled proportionally.

⑥ A-16 diag active

- ON : Pump inverter check A16 port (Fan relay coil).
- OFF : Pump inverter doesn't check A16 port (Fan relay coil).

⑦ Model truck

This display model setting from traction inverter . There are 2 models.

- 10/13BR
- 15BR-9E (Model setting is only available at the traction inverter side.)
- This parameter must be set "15BR-9E" for 15BR-9E truck.



7) GENERAL SUGGESTION FOR SAFETY

For a proper installation take care of the following recommendations:

- ⚠ After operation, even with the key switch open, the internal capacitors may remain charged for some time. For safe operation, we recommend that the battery is disconnected, and a short circuit is made between battery positive and battery negative power terminals of the inverter using a resistor between 10 ohm and 100 ohm.
- ⚠ Do not connect the inverter to a battery with a nominal value different from the value indicated on the controller plate. If the battery value is greater, the MOS may fail; if it is lower, the control unit does not "power up"
- ⚠ During battery charge, disconnect the controller from the battery.
- ⚠ Do not connect the controller to a battery with a nominal voltage different than the value indicated on the controller label. A higher battery voltage may cause power section failure. A lower voltage may prevent the logic operating.
- ⚠ Before doing any operation, ensure that the battery is disconnected and when all the installation is completed start the machine with the drive wheels raised from the floor to ensure that any installation error do not compromise safety.
- ⚠ Take care all the inductive devices in the truck (horn, solenoid valves, coils, contactors) have a proper transient suppression device.

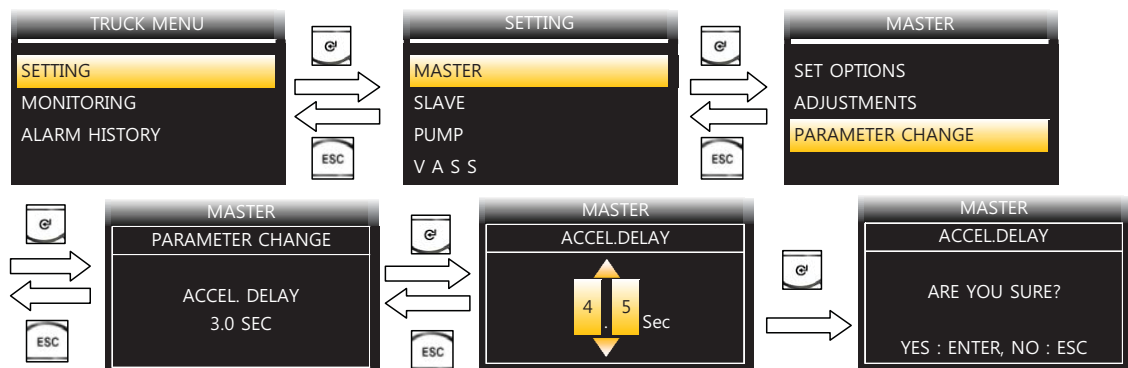
6) DESCRIPTION OF THE TRUCK MENU

(1) Access to truck menu

 If this button is pressed long, the PASSWORD dialog appears.
Enter correct PASSWORD, then on MAIN SCREEN, Press  button to access the controller "TRUCK MENU"

(2) How to change detail menus

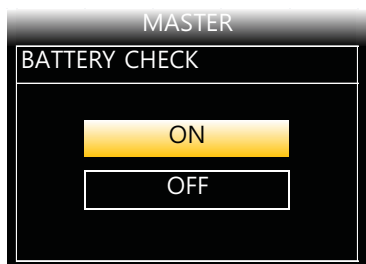
The detail items of menu can be changed as follows ;







22B9EL24

Selection can be made in 4 methods as follows ;

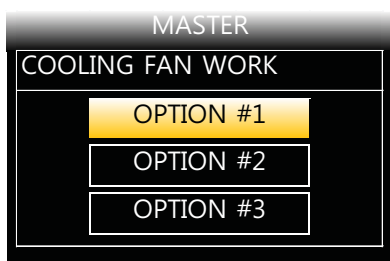
- ON/OFF Selection







22B9EL25

Select a desired value with  ,  button, then save with  button or press  button to escape without saving.

- Type Selection



22B9EL30

Select a desired value with  ,  button, then save with  button or press  button to escape without saving.

7. ALARM CODE

1) TRACTION CONTROLLER

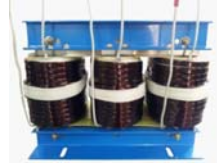
No	Code	Alarm name	Traction (T)	Pump (P)	Description	
					Cause	Troubleshooting
1	D	EEPROM KO	○	○	It's due to a Hardware or Software defect of the non-volatile embedded memory supporting the controller parameters. This alarm does not inhibit the machine operations, but the truck will work with the default values.	<ul style="list-style-type: none"> - Try to execute a CLEAR EEPROM operation (Please ask to the engineer). Switch the key off and on to check the result. If the alarm occurs permanently, it is necessary to replace the controller. If the alarm disappears, the previously stored parameters will have been replaced by the default parameters.
2	11	Logic Failure#3	○	○	Hardware problem in the logic card circuit for high current (overload) protection.	<ul style="list-style-type: none"> - This type of fault is not related to external components, so, when it is present it is necessary to replace the ACE logic board.
3	12	Logic Failure#2	○	○	Fault is in the hardware section of the logic board which manages the phase's voltage feedback.	<ul style="list-style-type: none"> - This type of fault is not related to external components, so when it happens it is necessary to replace the ACE2 logic board.
4	13	Logic Failure#1	○	○	This fault is displayed when the controller detects an over voltage or under voltage condition. In 48V controller over voltage threshold is 65V, under voltage threshold is 11V.	<p>Troubleshooting of fault displayed at start-up or in standby; in these cases it is very likely the fault is due to an under voltage, so it is suggested to check:</p> <ul style="list-style-type: none"> - Key input signal down-going pulses (below under voltage threshold) due to external loads, like DC/DC converters starting-up, relays or contactor switching, solenoids energizing / de-energizing. - Check the connection of power cables to the battery terminal, positive and negative, to MC and to controller +Batt and -Batt, which must be screwed with a torque comprised in the range 13 Nm÷15 Nm. - If no voltage transient is detected on the supply line and the alarm is present every time the key is switched ON, the failure is probably in the controller hardware, so it is necessary to replace the logic board. <p>Troubleshooting of fault displayed during motor driving; in this case it can be an under voltage or an over voltage condition.</p> <ul style="list-style-type: none"> - If the alarm happens during traction acceleration or driving hydraulic functions, it is very likely it is an under voltage condition; check battery charge condition, power cable connection. - If the alarm happens during release braking, it is very likely it is due to over voltage condition; check line contactor contact, battery power cable connection.

(3) Names of each part (independent items)

①



②



③



④



⑤



⑥



⑦



⑧



⑨



⑩



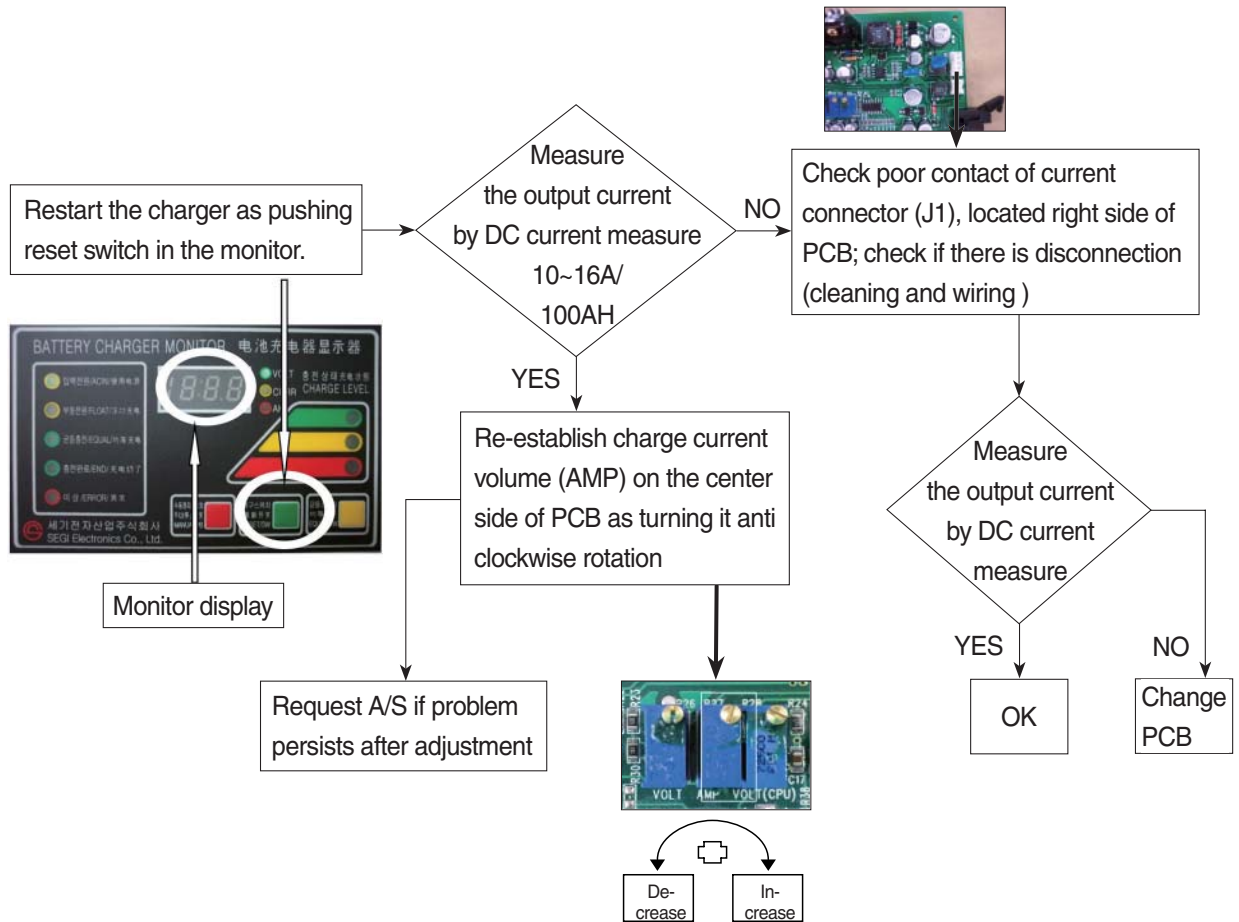
22B9BAT30

- 1 Main PCB board
- 2 Main trans (Class H)
- 3 Cooling fan
- 4 SCR module

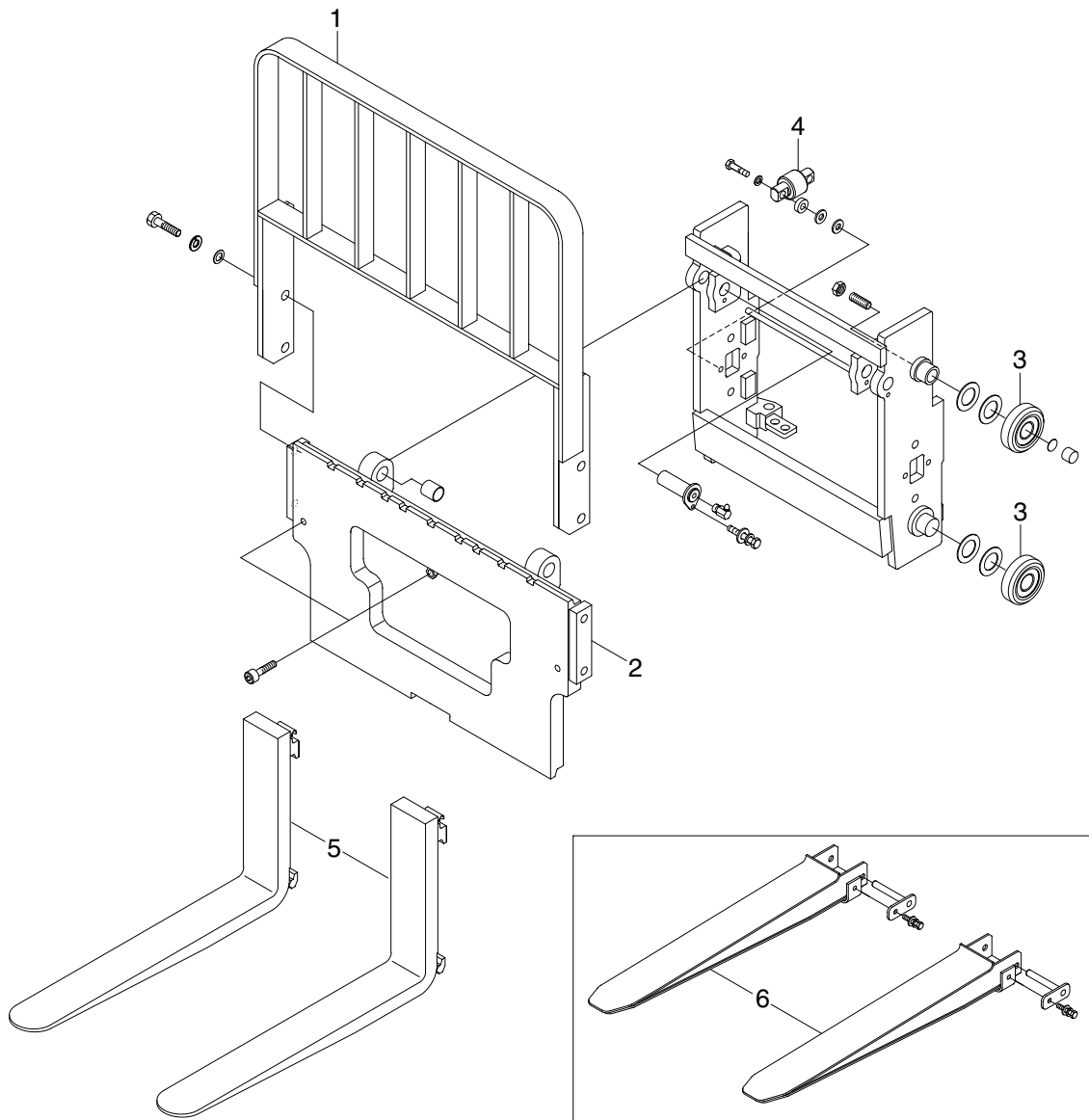
- 5 Monitor PCB
- 6 Overload
- 7 MG SW
- 8 Assistant trans

- 9 Resistance (RD)
- 10 Resistance (DR)

- ④ Charger TRIP is occurred after abnormality lamp is on.
 After opening the cover which is located on the front bottom side of the charger.
 In case error code is "O.C" → Output over current, established as 110~120% of the rated current.



2) HOOK TYPE



15BR9EMS05

- 1 Backrest
- 2 Carriage
- 3 Load roller

- 4 Side roller
- 5 Fork assy
- 6 Extension fork

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