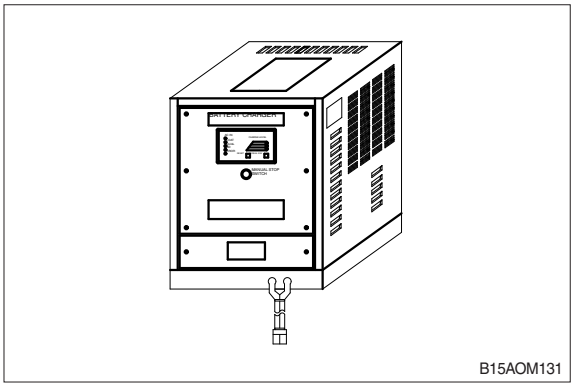
1. BATTERY CHARGING



The charger is of the automatic type so that only requirement for charging is to insert the plug, there being no need for maintaining watch.

Before starting to charge the battery, inspect all cable joints and connections for visible damage.

Do not place any metallic objects on the battery.

There must be no flammable substances or spark-generating materials around truck parking for the purpose of battery charging.

The area in which the battery is charged must be well-ventilated and have appropriate fire protection equipment. Battery being charged not only heat but also inflammable hydrogen gas is produced. Keep fire away.

1) INSTRUCTION

(1) When inserting the plug and connecting the battery connector, the input power lamp and the battery connection lamp light on and charge is started after a few seconds.
The power is automatically cut off after completion of charge.

(2) Functions

The function of indication lamps and switches.

① **Input power lamp** : Only lighting on during charge. Check the plug and input power if the lamp does not light on.

② **Battery connection lamp** : Lighting on when the charger and the battery are connected. Check the connector if the lamp does not light on.

③ **75% charge lamp** : Lighting on from 75% charge to completion.

④ **Full charge lamp** : Lighting on when charging is completed.

⑤ **Input disconnect lamp** : Lighting on when the input supply line is disconnected. At this time, check the input power.

⑥ **Over voltage lamp** : Lighting on when the manual stop button is pushed or charger voltage is above 66. At this time, unplug and disconnect the battery and charger connectors.

⑦ **Over current lamp** : Lighting on when the current is overload. At this time, unplug, open charger door and push the thermal relay button on the electro-magnetic switch plug again after about 5 minutes and if this lamp lights on again stop charging and call A/S.

⑧ **Ordinary/Equalizing charge convert switch** : Place the switch to left side for ordinary charge and to right side for equalizing charge.

⑨ **Manual stop button** : During charge, push this button to stop charging.

⑩ **Reversion button** : After stop charging artificially or push the manual stop button, use this button to revert to charging.

⑪ **Voltage/current confirming button** : The indicator always show battery voltage and when push this button, the current is displayed in the indicator.

2) INSTALLATION OF THE CHARGER

(1) Place for installation
Install the charger at a place with good ventilation, no excessive temperature, low humidity and little dust.

(2) For the primary of the transformer, use the taps corresponding to the power voltage difference. For example, 218V(measured value)-220V(primary).

(3) Confirm the earth line of charging cable wire and make sure the earth line connects the earth of building.

3) ORDINARY CHARGE

(1) The procedure for charging is as follows:
① Remove the key of vehicle.
② Confirm the convert switch at ordinary charge position.
③ Connect the battery connector and the charging connector.
④ Make sure the pilot lamp lights.
(2) The procedure after completion of charging is as follows:
① Ensure that the full charge lamp lights on.
② Disconnect the battery connector from the charge connector.
(3) The procedure for stopping charging halfway is as follows :
① Push the manual stop button.
② Disconnect the battery connector from the charge connector.

4) EQUALIZING CHARGE

(1) Continual repetition of ordinary charge will create a certain amount of performance difference among the cells. For this reason, the battery is slightly overcharged from time to time to equalize the performance among the cells, that is, given equalizing charge.
Equalizing charge should be given in the following cases:
① A battery that is subject to daily repetition of charge and discharge. For the battery, equalizing charge should be performed once a month.
② When discharged over the designated capacity.
③ When recharge had been delayed after discharge.
④ When a short-circuit has occurred.
Equalizing charge is performed in the same way as in ordinary charge. However, place the ordinary/equalizing charge convert switch on the equalizing charge position.

△ **Excessive equalizing charge may shorten the life of the battery.**

5) SUPPLEMENTARY CHARGE

If one day operation cannot be completed with single charge, rest period should be utilized to charge and it is performed in almost the same way as ordinary charge.

6) NOTICES

① When installing the charger confirm the input voltage and use the tops corresponding to the poser voltage in the area.
② Charge the battery immediately after use and once a month even in storage.
③ Take care not to let the battery specific gravity lower in winter time especially.
④ During charging, if electrolyte temperature of the battery in above 50˚C stop charging.
⑤ During charging, as an inflammable gas is generated out of the battery, particular care should taken for fire and ventilation.

2. BATTERY HANDLING

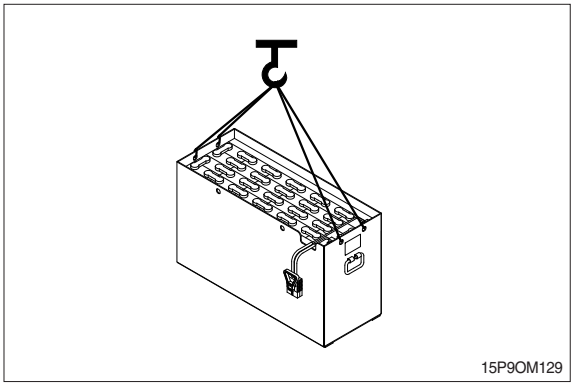
1) Change (remove) or service storage batteries only in an area designated for this purpose.

2) Be sure this area has provisions to flush and neutralize spillage, to ventilate fumes from gassing batteries and for fire protection.

3) This area should be equipped with material-handling tools designed for removing and replacing batteries, including a conveyor or overhead hoist. Use lift hooks that have safety latches.

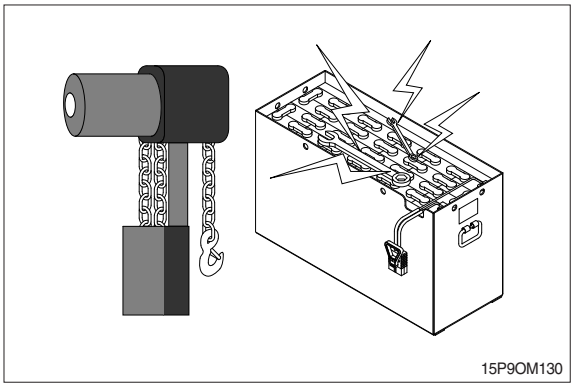
4) Always use a special lifting device such as an insulated spreader bar to attach the hoist to the battery. The width of the spreader bar hooks must be the same as the lifting eyes of the battery, to prevent damage to the battery. If the spreader bar hooks are movable, carefully adjust the position (width) of the hooks so that the pull is directly upward (vertical) and no side load or force (pressure) is exerted on the battery case. Be sure the lift hooks are the correct size to fit the lifting eyes of the battery.

5) If the battery does not have a cover of its own or has exposed terminals and connectors, cover the top with a non-conductive (insulating) material, e.g., a sheet of plywood or heavy cardboard, prior to attaching the lifting device.



6) Chain hoists or power battery hoists must be equipped with loadchain containers to accumulate the excess lifting chain.

7) Keep all tools and other metallic objects away from the terminals.



⚠ **Open the battery cover when charging. Battery being charged, not only heat, but also inflammable hydrogen gas is produced. So keep fire away.**

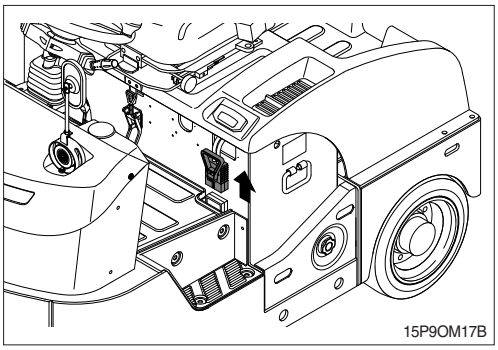
⚠ **Hoisting the battery case, use 2 or 4 wires with hook and handle carefully, not to shock.**

⚠ **The electrolyte solution of battery is dilute sulfuric acid (H_2SO_4). Be careful not to drop on clothes and mechanical parts.**

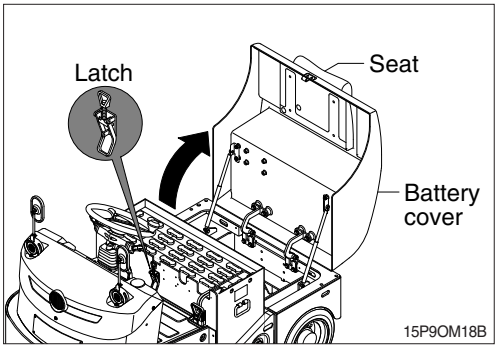
3. BATTERY REMOVAL FROM TRACTOR

When the spare battery is used for continuous operation or it is required to check the battery, motor, etc., remove the battery through the following procedure:

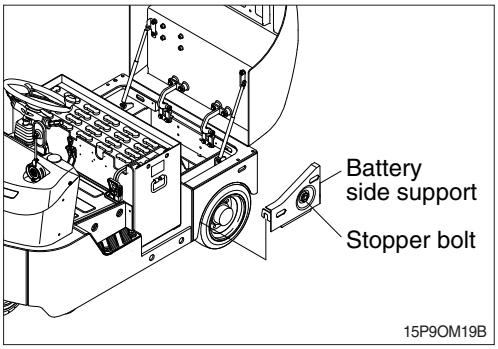
1) Disconnect the battery connector.



2) Open the battery cover.

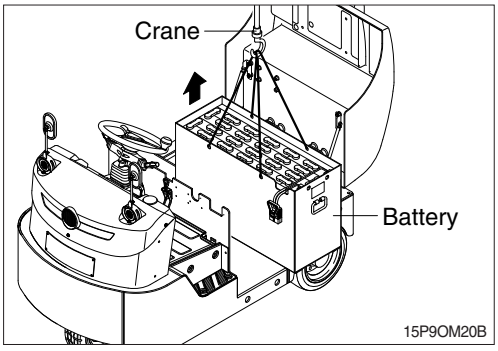


3) Loosen the stopper bolt with hand and remove the battery support.

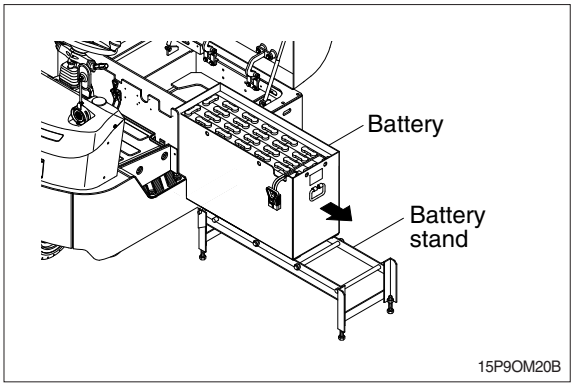


4) Using a battery hanger, carefully raise the battery assembly.

※ **Be careful not to damage control system.**

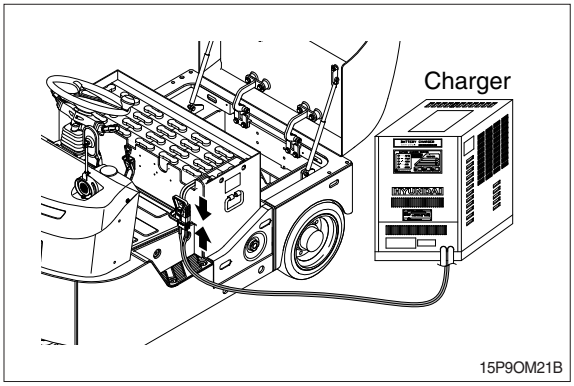


5) Adjust the height of the roller of the stand to that of the roller of the vehicle. (option)

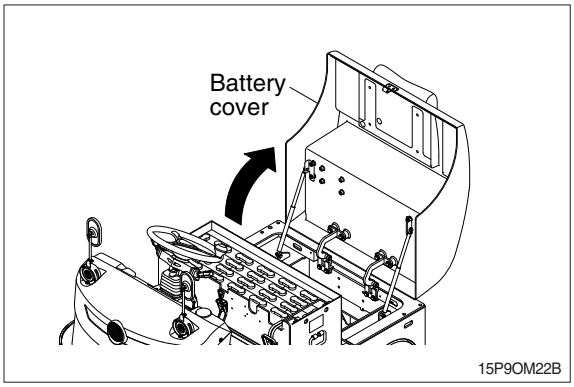


6) NOTICES

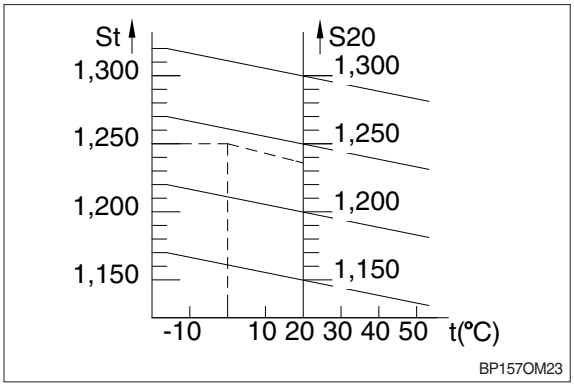
(1) Charge the battery through removing the battery connector and connecting the charging connector of the stationary charger to the battery connector.



(2) Be sure to open the battery cover during charging.



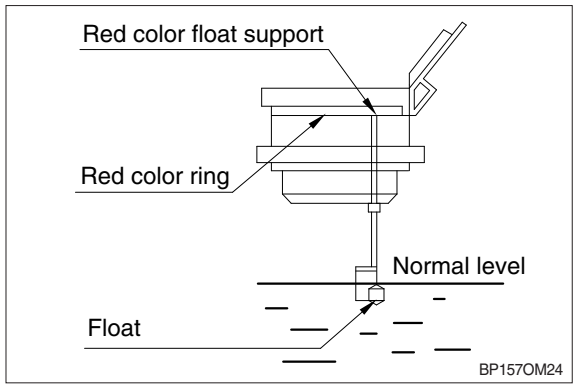
(3) Check specific gravity and electrolyte level once a week. Specific gravity at a temperature of 20˚C is as follows :
At charged (completion of charge) : 1.280
At discharged (Charging required) : 1.17



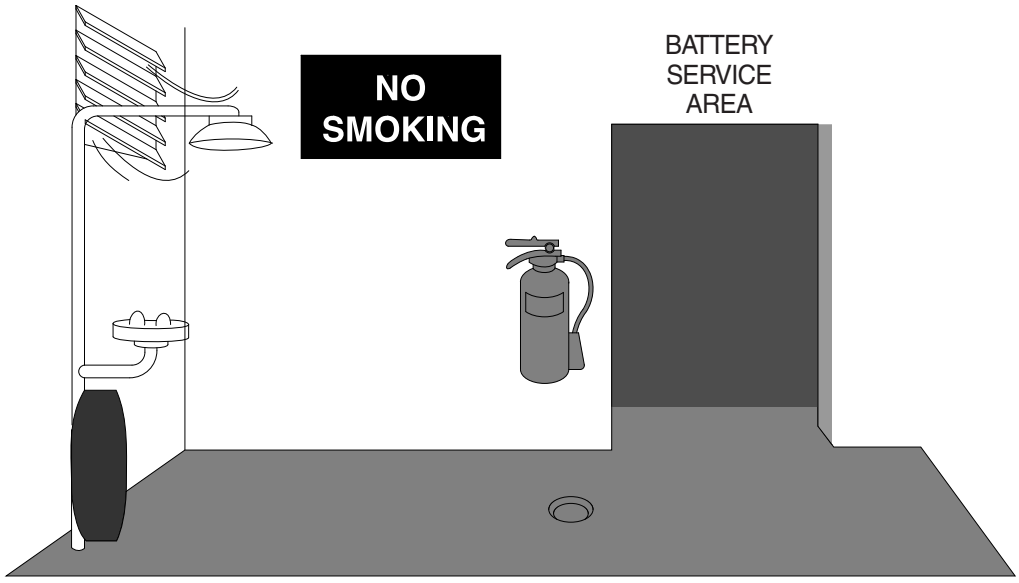
(4) Check electrolyte level, and if it is insufficient, refill distilled water to the specified level.

Distilled water should be refilled to get the red color ring the stopper or come the red color float support out.

The installation of the battery is followed the reverse order for the battery removal.



4. ELECTRIC TRACTOR BATTERY MAINTENANCE



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Battery charging and installations must be located in areas designated for that purpose. These areas must be kept free of all non-essential combustible materials.

Facilities must be provided for :
·Flushing spilled electrolyte.
·Fire protection.
·Protecting charging apparatus from damage by trucks.
·Adequate ventilation for dispersal of fumes from gassing batteries.

When handling acid concentrates greater than 50 percent acid (above 1,400 specifics gravity), an eye wash fountain must be provided.

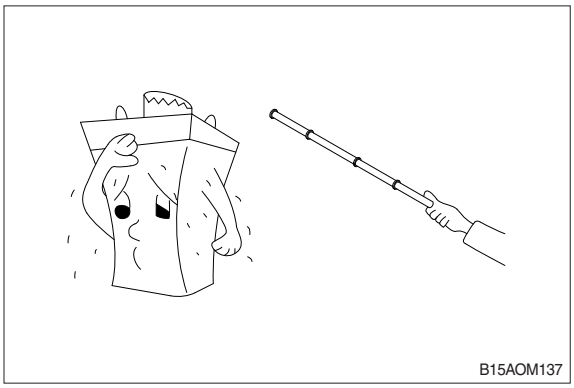
A conveyor, overhead hoist or equivalent material handling equipment must be provided for handling batteries.

⚠ **Electric tractor batteries are heavy and awkward to handle. They are filled with a very hazardous chemical solution. On charge, they give off hydrogen and oxygen which, in certain concentrations, are explosive. And they are costly. Before you remove, service or install a truck battery, carefully read the following recommendations and instructions.**

5. BATTERY CLEANING AND CARE

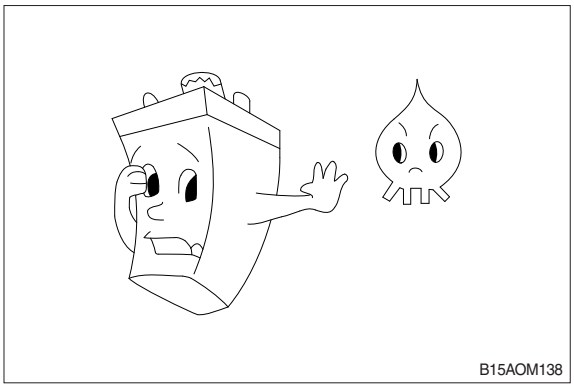
1) AVOID OVER-DISCHARGE

If used until the vehicle can no longer run, battery life will be shortened. If the battery capacity indicator's red lamps turns on at on load lift, stop operation and charge the battery without delay.



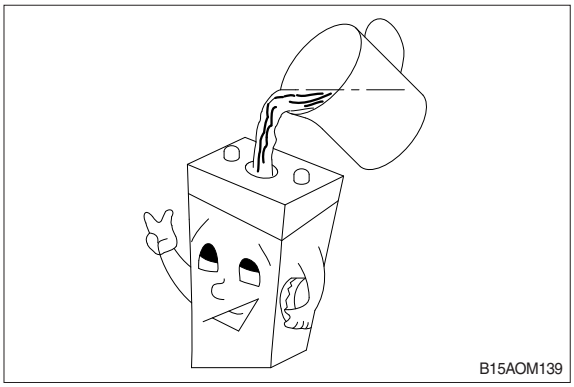
2) INFLAMMABLE

In any case, keep fire away from the battery because it contains an inflammable gas.



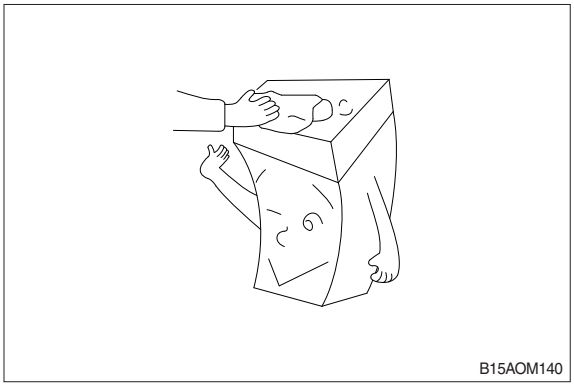
3) REFILLING DISTILLED WATER

Refill distilled water to maintain the electrolyte level to the specified height before starting equalizing charge, because electrolyte is lost through decomposition during charge and also through natural evaporation. It is unnecessary to refill dilute sulfuric acid into the battery except the case of losing electrolyte by running over.



4) KEEP THE BATTERY CLEAN

Keep the battery, in particular the upper surface, clean and dry and keep the filler plugs tightly screwed.



6. STORAGE

※ CAUTIONS

Improper storage of the truck may cause damage and corrosion of major functional parts, or damage and discharging of the battery. The battery of the lift truck should be stored in indoor environment to prevent damage by rainfall.

1) DAILY STORAGE

Follow the instructions below when storing the lift truck in a warehouse.

(1) Place the lift truck in dry and clean environment of well ventilation, and free from frost.
(2) Make sure parking brake is applied.
(3) Make sure that the forks have been lowered on the floor, and the mast vertically inclined.
(4) Turn both of the starting switch and the emergency stop switch to OFF position to shut off power to the battery.

2) LONG-TERM STORAGE

(1) Caution on storage
① Clean the truck clear.
② Check the functions of the brake, the mast, motor starting, steering, horn, and electric parts.
③ Check the hydraulic oil level, and makeup the oil, if required (See Table Recommended Lubricants).
④ Apply thin film of oil or grease on all of surfaces not coated with paint.
⑤ Supply grease to the lift truck at injection points specified in 'Regular Checklist.'
⑥ Coat all of exposed electric connections with adequate spray.l
⑦ Disconnect the battery cable, and then clean the battery. When the lift truck is to stored for a month or longer, remove the battery from the truck, and store it in indoor place.
- Refer to 'Battery Maintenance' on Page 7-22 for further information of maintenance of the battery.

3) CAUTION DURING STORAGE

(1) Move short distance and operate the attachments.
(2) Check exposed parts for rust once a month.
(3) Check voltage of the battery once a month, and recharge the battery, if required.

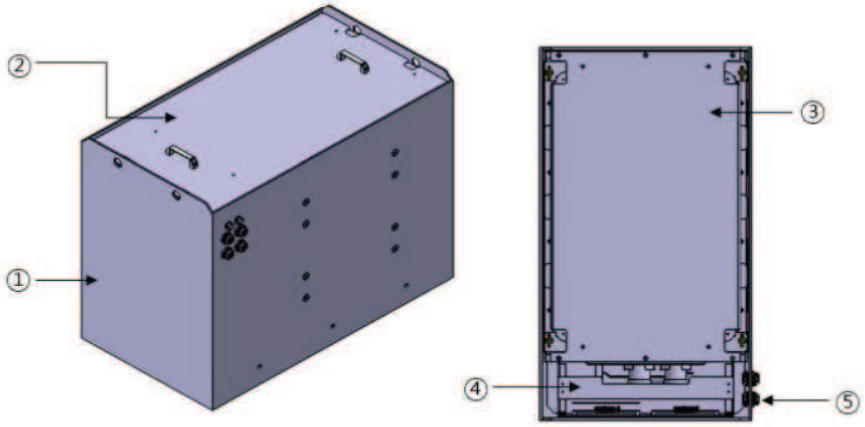
4) CAUTION AFTER STORAGE

(1) Clean the lift truck clear.
(2) Reconnect the battery cable, and check the battery voltage.
- Recharge the battery, if required, and then check specific gravity of electrolyte.
(3) Lubricate the lift truck with grease at injection points specified in 'Regular Checklist.'
(4) Check whether condensed water is included in the hydraulic oil, gear oil, brake oil, drive axle oil and driving device oil,
(5) and (if required), drain the water or exchange the oil.
(6) Start the truck, and check for all of functions and oil leak.
To operate the attachments, operate in ultra-low speed for 10 or more times until the final cylinder stroke to remove air from the tank.
- Points and electric parts of operation, steering, and noise
- Leak from cylinder, MCV,pump, powertrain part, tube and hose

7. LITHIUM ION BATTERY (OPT)

1) STRUCTURE

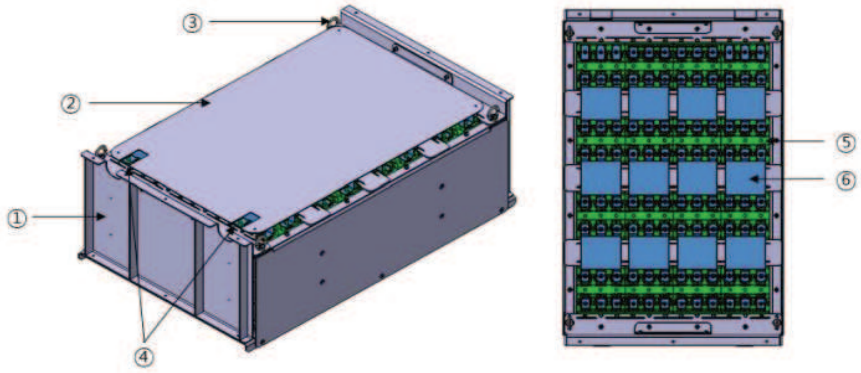
(1) Battery pack



25BX7PM14

1	Housing	3	Module	5	Cable
2	Top case	4	BPU		

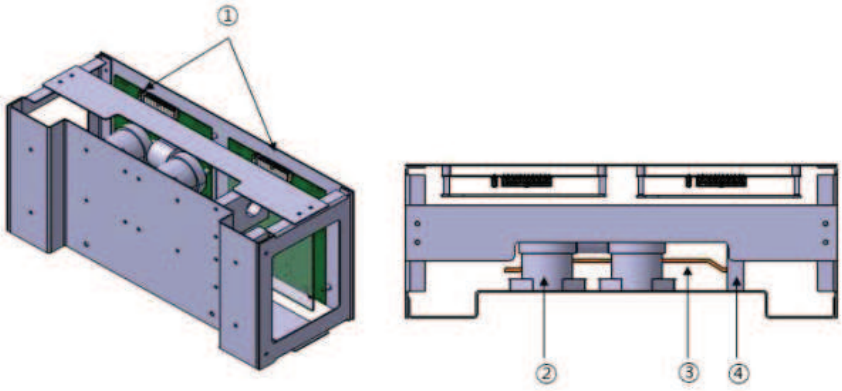
(2) Battery module



25BX7PM15

1	Module frame	3	Eye-cut	5	Cell
2	PC cover	4	+: Anode terminal, -: Cathode terminal	6	Module bus bar

(3) BMS and BPU



25BX7PM16

1 BMS 3 Grounding bus bar 4 Current sensor
2 Relay

2) INSPECTION PROCEDURE

(1) Daily inspection before starting

· Make sure that the battery pack charging terminal (DIN320 connector) is disconnected on the charge.
· Check the battery pack charging terminal for fixed state.
· Check the battery pack charging terminal for damage.
· Check the battery pack charging terminal and system load for fixed state.

(2) Measures for abnormality before starting

① Voltage on charging and discharging terminals of battery pack
· Servicing is required for troubleshooting of failure by molten relay, short on both ends of relay.
· Servicing is required in cases of function failure of BMS, or power supply to BMS.

② Measures for poor stationary conditions of charging and discharging terminals of battery pack
· Check tightening status of bolts of charging/discharging terminals.
· Fasten the bolt at specified torque.

③ Damage of battery pack charging terminal
· Replace with specified connector (DIN320).

(3) Inspection for defects after start stopping

· Check if starting is stopped before connecting charging terminal on battery pack charging terminal.
· Check if voltage is detected before connecting charging terminal on battery pack charging terminal.
· Check the battery pack charging terminal for damage.

(4) Measure for defects after start stopping

① When starting is not stopped
· Starting should be stopped.

② Voltage detected on the charger terminal
· Make sure that starting is stopped. If so, take servicing action.
· Failure by molten relay is suspected. Take servicing action.

③ Charging terminal of charger or battery pack damaged
· Replace with specified connector (DIN320).

8. LITHIUM ION BATTERY CHARGER (OPTION)

※ Please read and familiarize yourself with the following instructions before connecting the battery charger to the power and battery.

1) USE AND OPERATION

1) When using battery charger, safety requirements should be satisfied pursuant to the local laws and regulations, and regulations stipulated by local authorities.
2) The user must use the charger according to the regulation. Actions that may threaten the lives and health of the user and others must be avoided, and property damage must be prevented.

CHARGER2

2) WARNING ON INSTALLATION AND SAFETY

(1) Read and understand the following instructions before connecting battery charger to power source and battery.

① For proper function and efficient use, position the battery charger in the proper direction on the wall, and fix with the plug through the slot. Take caution on not blocking the ventilation slot hole.

② Authorized skilled experts are only allowed of opening battery charger.

③ Vent insulation sections of power cable and battery connector before operating the battery charger.

④ Skilled engineers are only allowed of performing works on electric apparatus.

⑤ Shut power off before connecting or disconnecting the battery.

⑥ The battery under charging generates explosive gases. Do not smoke in the vicinity of the truck. Avoid open flame and spark, and prevent access of other truck that may cause risky situations on human beings and properties.

⑦ The battery charger contains electric components generating electric arc and spark, and should be positioned on place adequate for functions of the charger when using it in confined space. Every standard battery charger should be used on hard and flat floor in contained space of well ventilation and free from rainwater and/or water splash. In particular, place of dusty environment, or with water or heat source, or high humidity should be avoided. Do not place the battery charger on floor or shelf made of wooden material or other inflammable materials, or do not stack objects around the charger. Never put solution container on the lid of the charger.
The battery charger should be connected to grounded receptacle/socket for preventing shock.

⑧ In addition, receptacle/socket for connecting with the battery charger should compliant with the charger capacity, and should be protected by proper electric devices pursuant to the standards (e.g., fuse and auto switch). Protection system should have calibration margin of 10% or higher based on current absorption ratio of the truck for sufficient selectivity.

⑨ Always use special bipolar connector (DIN 320 REMA).

⑩ Do not extent existing power connection with additional cable.

⑪ The charger is free from maintenance except routine cleaning. Cleaning should be performed regularly dependent upon working environments. Disconnect power cable and battery connection cable from power source before cleaning the charger.

3) POWER CONNECTION

The battery charger should be connected to power receptacle compatible with capacity of installed battery charger. Correctly connect the charger to grounding line. It is desirable to verify that main power of 3-phase is supplied on place for operating the battery charger while installing the charger (or moving the batteries).

Battery voltage (V)	Charger current (A)	Module power (kw)	Active input power (kw)	Input LAC norm (A)	Fuse AC (A)	DC fuse code
48	200	12	12.26	19.98	25	LMT250
48	250	16	15.32	24.97	32	LMT315

4) BATTERY CONNECTION

It is recommended to use bipolar connector compliant with the specification pursuant to the standards to prevent inverse connection of the polarity of the battery. Check the cable connection of the connector contact. This work must be performed by a skilled engineer.

※ USB port should only be used for programming charging variables, and downloading history data and graphs. To prevent the EMI noise from causing interference to the charging process to have unexpected result on the battery charger and battery, separate the USB cable from the charger while charging.

5) PRECAUTION DURING CHARGING

Shut down starting switch, and emergency stop switch of the truck before battery charging.

Completely connect the battery charger to the battery connector for charging. Check texts of CAMBus on the bottom left of the charger monitor after beginning charging.

Do not disconnect the connector during charging. (Never forget to press the ON/OFF switch of the charger to stop operation of the charger before disconnecting the connector.)