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# A MESSAGE TO HYUNDAI BATTERY TRACTOR OPERATORS

Battery tractors are specialized machines with unique operating characteristics, designed to perform a specific job. Their function and operation are not like a car or ordinary truck. They are required specific instructions and rules for safe operation and maintenance.

Safe operation of battery tractors is of primary importance to HYUNDAI.

Our experience with battery tractor accidents has shown that when accidents happen and people are killed or injured, the causes are:

- · Operator not properly trained
- $\cdot$  Operator not experienced with battery tractor operation
- $\cdot$  Basic safety rules not followed
- Battery tractor not maintained in safe operating condition

For these reasons, HYUNDAI wants you to know about the safe operation and correct maintenance of your battery tractor.

This manual is designed to help you operate your battery tractor safely.

This manual shows and tells you about safety inspections and the important general safety rules and hazards of battery tractor operation. It describes the special components and features of the battery tractor and explains their function. The correct operating procedures are shown and explained. Illustrations and important safety messages are included for clear understanding. A section on maintenance and lubrication is included for the battery tractor mechanic.

The operator's manual is not a training manual. It is a guide to help trained and authorized operators safely operate their battery tractor by emphasizing and illustrating the correct procedures. However, it cannot cover every possible situation that may result in an accident. You must watch for hazards in your work areas and avoid or correct them. It is important that you know and understand the information in this manual and that you know and follow your company safety rules!

Be sure that your equipment is maintained in a safe condition. Do not operate a damaged or malfunctioning battery tractor. Practice safe operation every time you use your battery tractor. Let's join together to set high standards in safety.

Remember, before you start operating this battery tractor, be sure you understand all driving procedures. It is your responsibility, and it is important to you and your family, to operate your battery tractor safely and efficiently.

△ Be aware that the Federal Occupational Safety and Health Act(OSHA) and state laws require that operators be completely trained in the safe operation of battery tractors; It is also an (OSHA) requirement that a machine inspection be performed before every shift. If you need training in operating or inspecting your battery tractor, ask your supervisor.

HYUNDAI battery tractors are built to take hard work, but not abuse. They are built to be dependable, but they are only as safe and efficient as the operator and the persons responsible for maintaining them. Do not make any repairs to this battery tractor unless you have been trained in safe battery tractor repair procedures and are authorized by your employer.

This manual describes procedures for operation, handling, lubrication, maintenance, checking and adjustment. It will help the operator realize peak performance through effective, economical and safe machine operation.

# INTRODUCTION

HYUNDAI welcomes you to the growing group of professionals who own, operate and maintain HYUNDAI battery tractors. We take pride in the long tradition of quality products and superior value the HYUNDAI name represents. This manual familiarizes you with safety, operating, and maintenance information about your new battery tractor. It has been specially prepared to help you use and maintain your HYUNDAI battery tractor in a safe and correct manner.

Your HYUNDAI battery tractor has been designed and built to be as safe and efficient as today's technology can make it. As manufactured, for some models, it meets all the applicable mandatory requirements of ANSI B56.1-1988 Safety Standard for Powered Industrial Trucks. Some trucks are also furnished with equipment to help you operate safely; for example, parking brake and horn are standard equipment.

Safe, productive operation of a battery tractor requires both skill and knowledge on the part of the operator. The operator must know, understand, and practice the safety rules and safe driving and load handling techniques described in this manual. To develop the skill required, the operator must become familiar with the construction and features of the battery tractor and how they function, the operator must understand its capabilities and limitations, and see that it is kept in a safe condition.

#### **Routine Servicing and Maintenance**

Regular maintenance and care of your battery tractor is not only important for economy and utilization reasons; it is essential for your safety. A faulty battery tractor is a potential source of danger to the operator, and to other personnel working near it. As with all quality equipment, keep your battery tractor in good operating condition by following the recommended schedule of maintenance.

#### **Operator Daily Inspection - Safety and Operating Checks**

A battery tractor should always be examined by the operator, before driving, to be sure it is safe to operate. The importance of this procedure is emphasized in this manual with a brief illustrated review and later with more detailed instructions. HYUNDAI dealers can supply copies of a helpful **Drivers Daily Checklist.** It is an OSHA requirement.

#### Planned Maintenance

In addition to the daily operator inspection, HYUNDAI recommends that a planned maintenance and safety inspection program(PM) be performed by a trained and authorized mechanic on a regular basis. The PM will provide an opportunity to make a thorough inspection of the safety and operating condition of your battery tractor. Necessary adjustments and repairs can be done during the PM, which will

of your battery tractor. Necessary adjustments and repairs can be done during the PM, which will increase the lift or components and reduce unscheduled downtime and increase safety. The PM can be scheduled to meet your particular application and battery tractor usage.

The procedures for a periodic planned maintenance program that covers inspections, operational checks, cleaning, lubrication, and minor adjustments are outlined in this manual. Your HYUNDAI dealer is prepared to help you with a Planned Maintenance Program by trained service personnel who know your battery tractor and can keep it operating safely and efficiently.

#### Service Manual

In-depth service information for trained service personnel is found in Service Manual.

# HOW TO USE THIS MANUAL

This manual is a digest of essential information about the safe operation, the features and functions and explains how to maintain your battery tractor. This manual is organized into six major parts:

Section 1. General Safety Rules, reviews and illustrates accepted practices for safe operation of a battery tractor.

**Section 2. Know your tractor**, describes operating components, systems, controls, and other features of your truck and tells how they function.

Section 3. Operating procedures, discusses specific instructions on the safe, efficient operation of your battery tractor.

Section 4. Battery and charger, presents details on how to perform the charging and maintaining battery system.

Section 5. Maintenance and inspection, discusses specific instructions on maintenance and how to check out the battery tractor.

Section 6. Specifications, provides reference information and data on features, components, and tightening torque.

\* The descriptions and specifications included in this manual were in effect at the time of printing. HYUNDAI reserves the right to make improvents and changes in specifications or design, without notice and without incurring obligation. Please check with your authorized HYUNDAI dealer for information on possible updates or revisions.

The examples, illustrations, and explanations in this manual should help you improve your skill and knowledge as a professional battery tractor operator and take full advantage of the capabilities and safety features of your new battery tractor.

The first section of the manual is devoted to a review, with illustrations and brief messages, of general safety rules and the major operating hazards you can encounter while operating a battery tractor. Next, you will find descriptions of the components of your specific battery tractor model and how the instruments, gauges, and controls operate. Then, you will find a discussion of safe and efficient operating procedures, followed by instructions on how to tow a disabled battery tractor. The later sections of the manual are devoted to maintenance and battery tractor specifications.

Take time to carefully read the **Know Your Tractor** section. By acquiring a good basic understanding of your battery tractor's features, and how they function, you are better prepared to operate it both efficiently and safely.

In **Planned Maintenance**, you will find essential information for correct servicing and periodic maintenance of your tractor, including charts with recommended maintenance intervals and component capacities. Carefully follow these instructions and procedures.

Each major section has its own table of contents, so that you can find the various topics more easily.

We urge you to first carefully read the manual from cover to cover. Take time to read and understand the information on general safety rules and operating hazards. Acquaint yourself with the various procedures in this manual. Understand how all gauges, indicator lights, and controls function. Please contact your authorized HYUNDAI dealer for the answers to any questions you may have about your battery tractor's features, operation, or manuals.

Operate your battery tractor safely; careful driving is your responsibility.

Drive defensively and think about the safety of people who are working nearby. Know your tractor's capabilities and limitations. Follow all instructions in this manual, including all symbols ( $\triangle$   $\approx$ ) messages to avoid damage to your battery tractor or the possibility of any harm to yourself or others.

This manual is intended to be a permanently attached part of your battery tractor. Keep it on the tractor as a ready reference for anyone who may drive or service it. If the battery tractor you operate is not equipped with a manual, ask your supervisor to obtain one and have it attached to the tractor. And, remember, your HYUNDAI dealer is pleased to answer any questions about the operation and maintenance of your battery tractor and will provide you with additional information should you require it.

# 1. DIRECTION

The direction of this machine indicate forward, backward, right and left when machine is in the travelling direction.



# 2. SERIAL NUMBER

Inform following when you order parts or the machine is out of order.

#### 1) MACHINE SERIAL NUMBER

It's shown of the front-left side of the frame.



#### 3. SYMBOLS

- ▲ Important safety hint.
- riangle It indicates matters which can cause the great loss on the machine or the surroundings.
- \* It indicates the useful information for operator.

# **1. GENERAL SAFETY RULES**

# **1. DAILY INSPECTION**

At the beginning of each shift, inspect your battery tractor and fill out a check, maintenance and lubrication table.

Check for damage and maintenance problems.

Have repairs made before you operate the battery tractor.

Do not make repairs yourself. Battery tractor mechanics are trained professionals. They know how to make repairs safe.



# 2. DO'S AND DON'TS



Do watch for pedestrians.



Do wear safety equipment when required.



Don't mix drugs or alcohol with your job.



Don't block safety or emergency equipment.



Don't smoke in NO SMOKING areas or when charging.



Don't operate the truck outdoors in rainy day.



Don't perform battery charging service in the room without adequate ventilation.

# 3. SEAT BELTS

▲ Always buckle up for the machine equipped with safety belt.



 $\mathbf{A}$  Seat belts can reduce injuries.



# 4. NO RIDERS

1) The operator is the only one who should be on a battery tractor.



# **5. PEDESTRIANS**

- Watch where you are going. Look in the direction of travel. Pedestrians may use the same roadway you do. Sound your horn at all intersections or blind spots.
- BP1570M13
- Watch for people in your work area even if your battery tractor has warning lights or alarms. People may not watch for you.



3) Make people stand back, even when you are parked.



# **6. OPERATOR PROTECTION**

- 1) Always keep your body within the confines of the tractor.
- ▲ Always buckle up for the machine equipped with safety belt.



# 7. LOADING AND UNLOADING BY CRANE

- Check the weight, length, width and height of the truck referring to the chapter 8, specifications when you are going to hoist the tractor.
- ▲ Before loading the tractor, battery must be removed. Refer to page 4-4 for a safe battery removal.



- Use long wire rope and stay to keep the distance with the tractor as it should avoid touching with the truck body.
- 3) Put a rubber plate where the wire rope contact with the tractor's body to prevent damage.
- 4) Place crane on the proper place.
- 5) Install the wire rope and stay like the illustration.
- A Make sure wire rope is proper size.
- A The wrong hoisting method or installation of wire rope can cause damage to driver and tractor.
- ▲ Do not load abruptly.
- ▲ Keep area clear of personnel.



- ▲ Do not install the wire to unsafe position such as seat, steering wheel, front cover, etc.. It can cause a serious damage to driver and tractor.
- A If there is any problem to lift a tractor, please contact your dealer.
- A Perform the lifting service with skilled service man.



# 2. KNOW YOUR TRACTOR

# **1. GENERAL LOCATIONS**

· LAYOUT



- Seat 1
  - Steering wheel
- 2 3 Rear view mirror
- 4 Parking brake lever
- 5 Display
- Warning lamps 6

- Start key switch 7
- Head lamp 8
- 9 Front wheel
- Rear wheel 10
- Battery 11
- 12 Hook

- Battery cover 13
- 14 Flasher lamp
- 15 Beacon switch
- 16 Hazard switch
- 17 Battery support

# 2. SAFETY PLATES AND DECALS

#### 1) SAFETY

- Before attempting to operate this battery tractor, carefully read and understand the operating procedures.
- (2) Use extreme care with long, high or wide loads and do not overload battery tractor.
- (3) Rapid turn is dangerous, especially, do not rapid turn in a downward slope.



15PAOM56

#### 2) BATTERY HANDLING

- Open the battery cover when charging battery being charged not only heat, but also inflammable hydrogen gas is produced. Keep fire away.
- (2) Hoisting the battery case, use 4 wires with hook and handle carefully, not to shock.
- (3) The electrolyte solution of battery is dilute sulfuric acid (H<sub>2</sub>SO<sub>4</sub>).
   Be careful not to drop on clothes and mechanical parts.



# 3. INSTRUMENTS AND CONTROLS



15PAOM62

- 1 Display
- 2 Warning lamp
- 3 Start key switch
- 4 Parking brake lever
- 5 Flasher, head lamp switch

- 6 Direction control lever
- 7 Accelerator pedal
- 8 Brake pedal
- 9 Steering wheel

\* Familiarize yourself with the controls and follow safe operating procedures.

# 4. DISPLAY



- 1 LCD (8 Alpha-numeric display)
- 2 Service indicator (Red LED)
- 3 BDI indicator (Yellow LED)
- 4 Hourmeter indicator (Green LED)

When the start key is switched "ON" position to operate the machine, all 3 LEDs are turned on at the same time for a few second.

After a short while, the 3 LEDs turned off simultaneously.

Green LED is turn on for a few second, and then total operating hour is indicated on LCD.

When the fault code is shown on the LCD, it will not be disappeared unless the machine has fixed the fault problem.

Consequently, when operating the machine as a normal condition, always current BDI percentage of the battery capacity is shown on the LCD.

\* Please refer to page 3-2 for the detail operation.

#### 1) LCD



- LCD contains 8 large, readable characters to provide display of battery discharge indication (BDI), hour meter and error message.
- (2) Also, the LED may flash to draw attention to system operation such as operating hours, battery charge condition, maintenance reminders and specifics pertaing to any faults encountered.

#### 2) SERVICE INDICATOR (Red)



- (1) Red LED is indicated that a fault has occurred.
- (2) In connection with service indicator, it is shown related fault code on LCD during red LED is turned on simultaneously.
   For example, in case of " Motor characterization fault", LCD is shown fault code 87 along with red LED lighting indication.

#### 3) BATTERY DISCHARGE INDICATOR (Yellow)



- (1) Yellow LED is indicated that battery state of charge is being displayed.
- (2) LCD is shown indicator BDI percentage which is indicated the current state-of-charge of the battery to keep with turning on green LED during machine operation.
- (3) When the battery is discharged until twenty percentage of total capacity, fault code 23 is shown on the LCD during yellow LED is turned on.

#### 4) HOUR METER INDICATOR (Green)



- (1) Green LED is indicated that hour meter is being displayed.
- (2) During green LED is turned on for a second, LCD is shown "Total Hr" and "Figure for total hour" in order, which is indicated total operating hour.
- \* The numerical fault code can be found the service manual along with effect of fault, possible cause, and set/clear conditions in detail.

# 5. WARNING LAMP



- 1 Parking brake warning lamp
- 2 Sequency fault warning lamp
- 3 Seat switch warning lamp

1) Parking brake warning lamp



- (1) This symbol appears if parking brake works.
- ▲ If appeared, you can drive neither forward nor reverse. This prevents abnormal operations, such as rapid battery consumption, overheat of driving motor and wear of brake.

#### 2) Sequency fault warning lamp



- (1) This symbol appears if you don't follow the operating sequence of controller.
- \* To reset this fault, please put direction control lever at neutral position.

#### 3) Seat switch warning lamp



- (1) This symbol appears if seat switch opens.
- ▲ If appeared, you can drive neither forward nor reverse. For a safe operation, please power up the machine with your body on the seat.

# 6. OPERATING SWITCHES AND LEVERS

#### 1) KEY SWITCH



#### Power is supplied to the control circuit through this switch, which is placed on OFF→ ON clockwise.

- ① OFF : The Key can be removed or inserted and power is turned off.
- ② ON : Both control circuits for hydraulics and running can be activated.

#### 2) DIRECTIONAL CONTROL LEVER



#### 3) FLASHER SWITCH



## 4) HORN SWITCH



- This lever serves to make forward/backward directional changes. For the forward directions, place the lever on the FORWARD position.
- (2) In the neutral, the running control circuits is turned off.
- (3) For the backward direction, place the lever on the BACKWARD position.
- (4) The electrical brake will be applied by shifting the lever to the opposite position of running direction.
- (1) When making a left or right turn, use this switch to flash the flash lamp to indicate which direction the vehicle is turning to.
- (2) For a right turn, place the switch on the BACKWARD position.
- (3) For a left turn, place the switch on the FORWARD position.
- (1) This horn switch is a push lever type.
- (2) The horn lever is reset automatically, if it is released.

#### 5) PARKING BRAKE LEVER



#### 6) ACCELERATOR PEDAL



#### 7) BRAKE PEDAL



- Position ①
   Parking brake is applied and front wheel is locked.
- (2) **Position** ② Parking brake is released.
- \* Before the tractor starts, confirm the parking brake is released position.
- (1) This pedal is used to vary running speed, which depends upon how far the pedal is depressed.
- (2) In running, the electrical brake will be smoothly applied by shifting the direction lever to the position opposite to the direction of vehicle advanced, and if the pedal is further depressed, the vehicle will run to the opposite direction after stopping once.
- (1) When this pedal is depressed, the vehicle is braked, while the braking lamps attached on the rear light.
- ▲ Special care should be required for the operation of the brake at loading.

#### 8) STEERING WHEEL



- (1) The steering wheel of the vehicle is provided with the knob to allow steering with one hand.
- (2) Perform the loading operation with the right hand and operate the steering wheel with the left hand.
- (3) Adjustable steering column enables selection of the best driving position.
- ▲ Particular care should be taken for the rapid operation of the steering wheel.

#### 9) SEAT SWITCH



- (1) This switch is closed automatically when an operator sits down on the seat.
- ▲ Before starting the tractor seat switch must be closed, otherwise, the tractor cannot be started.

# 10) HAZARD SWITCH



- (1) Use for parking or loading machine.
- \* If the switch is left ON for a long time, the battery may be discharged.

#### 11) BEACON SWITCH



(1) This switch turns ON the rotary light on the cab.

# 7. SEAT ADJUSTMENT



- The seat adjustment lever is located on the front side under the seat. To unlock, pull the lever up and adjust the seat so that all controls may be comfortably reached. Then release the lever.
- Be sure that the seat locking mechanism is engaged. The seat mounting base provides an 3 inch fore-and-aft adjustment of its slide.

# 8. BATTERY COMPARTMENT ACCESS



- 1) Pull the latch to release the cover.
- 2) You may tilt the steering column pylon forward before raising the cover.
- 3) The cover is held closed by weight of seat located on the battery cover.

# **1. CHECKS PRIOR TO OPERATION**

#### 1) CHECKS PRIOR TO OPERATION

- (1) Inspection of battery make sure that the battery has been fully charged.
  - · Voltage : 48V
  - · Specific gravity of electrolyte
  - : 1.28 (at 20°C)

Make sure that the electrolyte level is satisfactory.

Make sure that there is no loose connecting plug. For handling refer to "Instruction manual for battery".



(2) Check the tightness on bolts of drive/idle wheels.

#### (3) Check of brake

Check the brake pedal for pedaling allowance, and the parking brake for braking efficiency.

#### (4) Check of steering system

Check that the steering wheel has no play.

#### 2) OPERATION

#### (1) Starting/Travelling/Stopping

- ① With the direction control lever placed to the neutral position, make sure the parking brake is located at the operating position.
- ② With the accelerator pedal released insert the start key into the key switch.
- ③ When the start key turned to "ON" position, the drive control circuit of the F.E.T is connected.



- ④ Place the direction control lever to the "Forward" position, and release the parking brake lever, thereby the starting preparations are complete.
- (5) Step on the accelerator pedal slowly to start the battery tractor.
- (6) The travelling speed can be obtained optionally from almost zero-speed to the full-speed according to the degree of the pedal stepped on.
- ⑦ Even if the accelerator pedal is stepped on suddenly, the truck will start smoothly without applying any notable shock.
- ③ The fine movement and inching operations are also readily available, therefore, neither the resistor will be heated and burnt, nor the electric power be wasted as in the case with the battery tractor of resistance system even if the truck is operated for a long time.

- (9) When stopping the tractor, release the accelerator pedal, and step on the brake pedal at the same time to stop the tractor at the desired place.
- In parking the tractor, turn the direction control lever to the neutral position.
   Be sure to pull out the ignition key, and apply the parking brake before leaving the tractor.

#### (2) Electric braking

- Turn the direction control lever to the direction opposite to the travelling one to apply the electric brake.
- ② The electric braking efficiency is varied by the degree of the accelerator pedal stepped on. Bear in mind that fully stepping on the accelerator pedal will cause the brake to apply suddenly.

③ When applying the electric brake while



descending a downward slope, turn the direction control lever to the direction opposite to the travelling one at a place where the tractor arrives at the slope, and step on the accelerator pedal slightly to descend the slope, while adjusting the pedaling condition of the accelerator pedal.

④ If the accelerator pedal is stepped on further more continuously after stopping the tractor by the electric brake, the tractor will run in the opposite direction. This operation allows the tractor to turn quickly.

#### 3) PRECAUTIONS ON OPERATION

#### (1) Operation of display

- ① Being a communication device, it will be operated with user intervention based on signals received from a motor controller.
- ② Upon initial power-up, the instrument will go through a self-diagnostic routine in which all display elements will be illuminated for 1 second and blanked for 1 second.



And then, the LCD will display "all asterisks" until the first message is received. The information on the display will be controlled by motor controller.

③ The BDI uses an algorithm that monitors the battery when it is under load.

The battery state-of-charge is displayed in a full to empty display.

The new gauge installed for the first time will be indicated "Full" due to resetting the gauge to full condition.

As a machine is operated, the energy from the battery is used, and then the gauge will be moved quickly through its step to "catch-up" with the battery capacity.

The process of the gauge dropping from full to empty will take at least a half hour on a loaded capacity.

The hour meter does not use a battery to retain the accumulated time.

Rather, it detects when power has been removed and stores the accumulated time in non-volatile memory.

The memory will store the accumulated time without power.

#### (2) Precautions on operation

- ① If the tractor has become inoperative during travelling, turn the start key to the stop position, and restart the tractor by turning the start key to "ON" position.
- If this procedure fails to travel the tractor, contact the service shop.
- 0 Pay constant caution to the braking efficiency.
- ③ Also, pay caution to the vibration, change in weight, etc. of the steering wheel.
- ④ Care must be taken to the sound generated from the motor and the accelerator system.
- ⑤ Travelling the tractor continuously with some doubtful things uncorrected may result in a serious accident. When any doubtful thing is suspected, stop the operation immediately to examine the cause.
- 6 Working on electrical systems in potentially dangerous.

You should protect yourself against uncontrolled operation, high current arcs, and outgassing from lead acid batteries.

#### - Uncontrolled operation

Some conditions could cause the motor to run out of control.

Disconnect the motor or jack up the vehicle and get the drive wheels off the ground before attempting any work on the motor control circuitry.

#### - High current Arcs

Batteries can supply very high power, and arcing can occur if they are short circuited. Always open the battery circuit before working on the motor control circuit.

Wear safety glasses, and properly insulated tools to prevent shorts.

#### - Lead Acid batteries

Charging or discharging generates hydrogen gas, which can build up in and around the batteries.

Follow the battery manufacture's safety recommendations. Always wear safety glass.

# 4. BATTERY AND CHARGER

# **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.



#### 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
୭	Pottony connection lamp	Lighting on when the observer and the better are connected
0	Battery connection lamp	
_		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 ston charging and call A/S
@	Ordinan/Equalizing abore	ights on again stop charging and can A/S.
0	Ordinary/Equalizing charg	je convent 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.
0	Reversion button	: After stop charging artificially or push the manual stop button, use
		this button to revert to charging.
1	Voltage/current confirming	g 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 about the given in the following cases:

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.

#### $\triangle$ 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 nonconductive (insulating) material, e.g., a sheet of plywood or heavy cardboard, prior to attaching the lifting device.



- Chain hoists or power battery hoists must be equipped with loadchain containers to accumulate the excess lifting chain.
- 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.
- A Hoisting the battery case, use 2 or 4 wires with hook and handle carefully, not to shock.
- **A** 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) Unscrew the stud bolt with wrench and remove the battery support.



 Adjust the height of the roller of the stand to that of the roller of the vehicle.



#### 5) 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
- Battery cover

Charger

15PAOM21



(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



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.
- $\cdot$  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.

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#### 4) KEEP THE BATTERY CLEAN

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



# 1. BODY

#### 1) DRIVE WHEELS

- (1) Pay constant caution to see that the set bolts of the power axle are not loosened.
- (2) Make sure that the wheel tightening nuts are not loosened. When tightening the nuts, be sure to tighten the nuts located at diagonal position sequentially so that they should not be tightened in deviant way.
- (3) Make sure that there is no oil leakage from the drive gear case. Also, check that the tightening bolts are not loosened.

#### 2) REAR WHEELS

- (1) Be sure to pay caution constantly so that the wheel tightening bolts are not loosened as in the case with the drive wheels.
- (2) When reassembling the idle wheels after disassembling them for alignment, be sure to reassemble them just in the reverse of disassembling.

#### 3) STEERING SYSTEM

(1) Since the steering system is particularly an essential part, be sure to check each part of the system for alignment, damage, deformation, etc., so that it can be always kept under the optimum condition.

#### 4) BRAKE

- (1) Check the brake pedal for "play" and pedaling allowance when it is stepped on, and looseness of each part, etc.
- (2) If the tractor slides laterally when the brake is applied suddenly, the brake is applied unevenly. In this case, adjust the brake so that it can be applied evenly.
- (3) Check and adjust the gap between the parking brake lining and the drum, and the braking efficiency.

#### (4) Parking brake

Adjust the parking brake to such an extent that there still remains some pulling allowance when the brake lever is fully pulled. Make sure that the brake is held in a condition not to be applied at all when the lever is returned.

# 2. ELECTRICAL SYSTEM

#### 1) TRACTION CONTROLLER

- (1) Periodically cleaning the controller exterior will help protect it against corrosion and possible electrical control problems created by dirt, grime, and chemicals that are part of the operating environment and that normally exist in battery powered systems.
- (2) When working around any battery powered system, proper safety precautions should be taken. These include, but are not limited to : proper training, wearing eye protection, and avoiding loose clothing and jewelry.
- (3) Use the following cleaning procedure for routine maintenance. Never use a high pressure washer to clean the controller.
- ① Remove power by disconnecting the battery.
- ② Discharge the capacitors in the controller by connecting a load (such as a contactor coil) across the controller's B<sup>+</sup> and B terminals.
- ③ Remove any dirt or corrosion from the power and signal connector areas. The controller should be wiped clean with a moist rag. Dry it before reconnecting the battery.
- ④ Make sure the connections are tight.

#### 2) BATTERY

- (1) The maintenance of the battery is very important to obtain efficient truck operation and maximum battery life.
- (2) Leakage voltage from battery terminals to battery case can cause misleading trouble symptoms with the truck electrical system.
- (3) Because components of the truck electrical system are insulated from truck frame, leakage voltage will not normally affect truck operation unless a short circuit or breakdown of circuit wire.
- (4) A voltage check from battery connector terminal to battery case should be indicated near zero voltage. Typically, however, the sum of the voltages at both terminals will equal the battery volts.
- (5) This leakage voltage will discharge the battery. As battery cleanliness deteriorates, the usable charge of the battery decreases due to this self discharge.
- (6) Although a leakage voltage reading of zero volts may not be possible, a cleaner battery will have more usable charge for truck operation and not affect operation of electric devices on the unit.

# **3. MAJOR COMPONENT LOCATIONS**

Use the illustration below to locate components included in the PM procedures.



1 Head lamp

- 2 Horn
- 3 Front wheel
- 4 Steering wheel
- 5 Fuse box
- 6 Buzzer
- 7 Rear wheel
- 8 Battery

- 9 EPS controller
- 10 Accelerator
- 11 Brake system
- 12 Flasher lamp
- 13 LCD panel & warning lamp
- 14 EPS actuator
- 15 DC-DC converter
- 16 EPS contactor

- 17 EPS filter
- 18 Brake pedal
- 19 Drive motor
- 20 Battery connector

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- 21 Drive controller
- 22 Contactor
- 23 Drive unit

# 4. DAILY MAINTENANCE CHECKS

The PM intervals depend on hour meter records of operation.

PM interval

- A: 8 hours or daily
- B: 50 hours or every week(Typical PM interval)
- C: 250 hours or every 1 months
- D: 1000 hours or every 6 months
- E: 2000 hours or every year

Daily maintenance checks	No.	Α	В	С	D	Е
Check truck for obvious damages and leaks.	-	0				
Check capacity, warning plates and decals.	-	0				
Check condition of tires and wheels.	3, 7	0				
Check for missing or loose wheel lug nuts.	3, 7	0				
Check for steering wheel.	4	0				
Check gauges and instruments.	13	0				
Check warning lights and hourmeter.	13	0				
Check directional and speed controls operation.	4	0				
Check for accelerator operation.	10	0				
Check optional safety equipment.(Alarms, Lights etc.)	13, 2, 6	0				
Check for head lamp and work lamp operation.	1	0				
Check for flasher lamp operation.	12	0				
Check for fuse box.	5	0				
Check battery connector's cleanliness.	20	0				
Check battery electrolyte level.	8	0				
Check for service brake drum and cam.	11	0				

 $\bigcirc$  : Check

# **5. PERIODIC MAINTENANCE CHECKS**

The PM intervals depend on hour meter records of operation.

PM interval

- A: 8 hours or daily
- B: 50 hours or every week(Typical PM interval)
- C: 250 hours or every 1 months
- D: 1000 hours or every 6 months

E: 2000 hours or every year

Periodic checks and planned maintenance (PM)	No.	А	В	С	D	Е
Check truck visually and inspect components.	-		0			
Test drive truck/check functional performance.	-		0			
Check torque on critical fasteners.	-		0			
Lubricate truck.(See component)	-		0			
Clean/Check battery terminals.	8		0			
Check battery electrolyte level / Refill.	8	0				
Check battery cables/truck receptacle	8		0			
Perform battery load test.	8		0			
Check drive motor.	19		0			
Check brake pedal condition and wear.	18		0			
Check drive unit fluid level.	23			0,▲		
Check battery connector.	20			0		
Check controller & DC converter.	9, 21, 15	0		0		
Check contactors (Replace contactor tips if roughness is remarkable)	22, 16			0		
Lubricate steering gear and steering bearing of drive unit.	23		0			
Lubricate drive unit	23		0			
Check/lubricate steering column and wheel bearing.	4		0			
Check EPS actuator	4			0		
Check EPS actuator motor brushes	14			0		

\* : Replace as required

○: Check ●: Replace ■: Refill ▲: Replace (Only for the first time)

# **6. LUBRICATION**

Since the life of vehicle is dependent upon the quality of lubrication, be sure to perform the lubrication with utmost care so that the tractor will not fall in trouble due to insufficient or improper lubrication oil.

- (1) In supplying the oil, be sure to clean the lubrication port so that the oil should not be contaminated.
- (2) Sine the oil viscosity will be decreased under high temperature, resulting in decreased lubrication efficiency, be sure to use the oil of high viscosity in summer(for normal temperature of over 32°C) and that of low viscosity in winter(for normal temperature of under 0°C).

# 7. NEW MACHINE OILS

New machine uses following lubricants and oils.

Description	Specification
Gear oil (GO)	SAE 80W-90/API GL-5

• API : American Petroleum Institute

· SAE : Society of Automotive Engineers

# 8. RECOMMENDED LUBRICANTS

		Capacity <i>l</i> (U.S. gal)	Ambient temperature °C(°F)								
Service point	Kind of fluid	15PA-7 40TA-7	-20 (-4	) - <sup>-</sup> ) (1	10 4)	0 (32)	10 (50	2 ) (6	0 (8 8) (8	30 36)	40 (104)
Axle	Gear oil	1.6 (0.4)			SAE 8	0W-9	)0/AP	임 GL-	5		
EPS Actuator	Gear oil	0.175 (0.05)		ļ	SAE 8	0W-9	)0/AP	임 GL-	5		

# **1. SPECIFICATIONS**

#### 1) DIMENSIONS

#### (1) 15PA-7



BP157SP01

#### (2) 40/60TA-7





BP157SP01

ltem		Unit	15PA-7	40TA-7	60TA-7	
Capacity			kg(lb)	1500 (3310)	4000 (8820)	6000 (13200)
Travel an e e d	Loaded	Loaded		8 (5)	5.5 (3.4)	4.5 (2.8)
I ravel speed	Unloaded		km/h(mph)	10 (6.2)	11 (6.8)	←
Min. turning radius		R	mm(in)	2065 (6' 9")	1565 (5' 2")	$\leftarrow$
Overall length		Α	mm(in)	2798 (9' 2")	2050 (6' 9")	$\leftarrow$
Overall width		В	mm(in)	1100 (3' 7")	1100 (3' 7")	$\leftarrow$
Overall height		С	mm(in)	1430 (4' 8")	1430 (4' 8")	←
Wheel base D		mm(in)	1700 (5' 7")	1200 (3' 11")	$\leftarrow$	
Weight(Unloaded)		kg(lb)	1225 (2701)	1260 (2778)	←	
Drive motor			kW	5.0	←	←
Detterry	Voltage		V	48	←	←
Battery	Capacity		AH/5HR	280	←	←
Charger	Input		-	3 ø 220/380V	←	←
Type		-	CC/CV	←	←	
Control type		-	AC	←	←	
FR			-	ø 305×127	←	←
Tire			-	5.00-8-8PR	4.00-8	←

#### 2) SPECIFICATION FOR MAJOR COMPONENTS

#### (1) EPS actuator assy

Item	Unit	Specification
Rated voltage for motor	V	DC 48
Output torque	kgf ∙ m	8.6
Gear ratio	-	31.13

#### (2) Drive controller

ltem	Unit	Specification	
Rated voltage	V	DC 48	
Maximum current		Current limit 275	
	A	2 Min rating 250	
		Hour rating 120	

## (3) EPS controller

ltem	Unit	Specification
Rated voltage	V	DC 48
Operating voltage	V	DC 28-80
Maximum current	А	±25
Operating temperature	°C	-40 ~ 60

#### (4) Charger

Item	Unit	Specification	
Туре	-	Constant current constant voltage	
Battery capacity for charge	V-AH/hr	48-280~365/5	
		Triple phase 410	
	V	Single phase 220	
AC input		Triple phase 220/380	
		Triple phase 440	
DC output	V	62±1	
Charge time	hr	8±2	
Connector	-	SB 350	

# (5) Traction motor

Item	Unit	Specification
Model	_	AMDF 6001
Туре	_	AC
Rated voltage	Vac	Ø 3, 28Vac
Rated output	kW	5.0
Insul. class	-	F

# (6) Drive unit

Item	Unit	Specification
Max drive input	kW	5.0
Max wheel load	kg/lb	750/1653
Gear ratio	-	20.125
Weight without fluid	kg/lb	100/220.4
Oil quantity	ℓ /U.S. · qt	1.6/1.7

# (7) Wheels

Item		Front	Rear	
Туре		Cushion, Urethane, Non-marking	Pneumatic(solid), Non-marking	
Quantity		1	2	
W/bool	15PA-7	305×127	5.00-8-8PR(5.00-8)	
vvrieel	40/60TA-7	305×127	4.00-8	

# (8) Steering

Item		Specification	
Steering	Туре	Electric power steering	
Oteening	Steering angle	90° to both right and left angle, respectively	

# (9) Brake

Item		Specification	
Туре		Drum brake	
Braka shaq	W×L×T	40×110×5mm(1.6×4.3×0.2in)	
Diake Silve	Area	44cm <sup>2</sup> (6.8in <sup>2</sup> )	
Dualea durena diana atau	New	120mm(4.7in)	
Diake ulum ulamelei	Repair limit	117mm(4.6in)	
Brake pedal play		10~15mm(0.4~0.6in)	
Droking distance	Unloaded	Less than 5.0m(197in)	
Draking distance	Loaded	Less than 2.0m(79in)	

# (10) Parking brake

ltem	Specification	
Туре	Ratchet	
Parking lever stroke	68mm	
Parking cable stroke	16mm	

No.	Items		Size	kgf∙m	lbf ∙ ft
1	Electric system	EPS actuator assy	M10×1.5	3.9±0.2	28.1±1.5
2		Drive unit & motor assy	M12×1.75	12.0±1.0	86.8±7.2
3	Power	Rear axle mounting bolt	M14×2.0	20.0±2.0	144.7±14.4
4	system	Front wheel mounting nut	M16×1.5	20.0±1.5	144.7±10.8
5		Rear wheel mounting nut	M12×1.5	10.0±1.0	72.3±7.2
6	Others	Seat mounting bolt	M 8×1.25	2.5±0.5	18.1±3.6

# 3) TIGHTENING TORQUE FOR MAJOR COMPONENTS