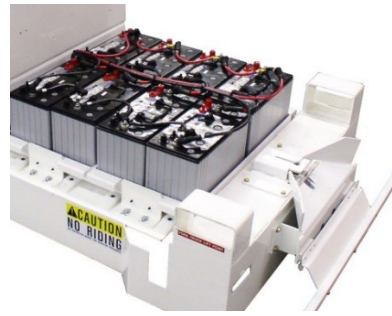
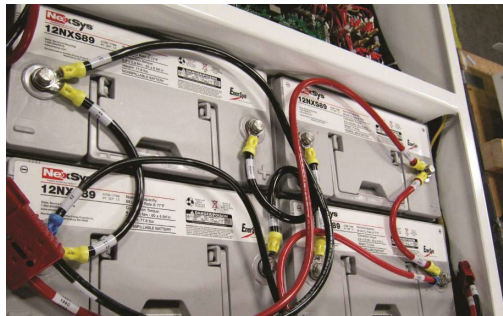
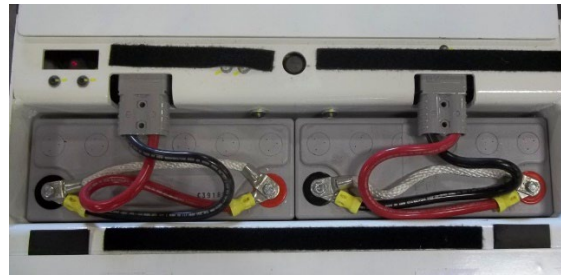


# BATTERY MAINTENANCE AND TROUBLESHOOTING GUIDE

FOR AUTOMATIC GUIDED CART (AGC)  
& AUTOMATIC GUIDED VEHICLES (AGVs)



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V3.1

**DAIFUKU**

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## Document Revisions

Date	Rev. #	Reviser	Description
09-27-13	0.0	JEC	Initial release.
10-21-13	1.0	JAW	Major revision of content and format.
06-20-14	1.1	JAD	Revised to include CE standard warnings, cautions and notes.
07-23-14	1.2	JAW	Added checklist for vehicles not receiving a charge.
02-26-15	1.3	JAW	Changed logo.
02-10-16	1.4	JAW	Changed obsolete part number for maintenance battery charger to current number.
06-26-18	2	MAK	Updated contact info.
06-11-21	3	GAD	Updated Equipment Part Numbers. General Revisions to reflect the batteries use in AGVs. Updated Format to reflect current style.
11-30-22	3.1	GAD	Logo Change

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## Chapter 1. Introduction

The life of a battery depends on its application and the maintenance schedule. To optimize battery life, proper maintenance and charging is required. It is also necessary to maintain records of battery maintenance, as these records are helpful in determining the condition of the battery (whether it is near the end of its life and needs to be replaced).

### 1.1 Terminology

This manual can be used for batteries in both Webb's Automated Guided Carts (AGCs) & Automated Guided Vehicles (AGVs). When referring to both AGCs and AGVs, we will use the terminology "Vehicle." When we are talking about somethings specific to an AGC or AGV, we will use that term.



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## Chapter 2. Equipment

Battery Type	Maintenance / Finish Charger	Recovery Charger for Single 12v Battery	Battery Tester for Single 12v Battery
Enersys TPPL 36 AH	JBW# 1117467-0	JBW# 2007273	JBW# 1113731-0
Enersys TPPL 89 AH			
Deka AGV 105 AH			

**WARNING**

**FAILURE TO USE THE BATTERY CHARGER SPECIFIED BY DAIFUKU WEBB FOR THE BATTERY TYPE AND APPLICATION WILL VOID THE BATTERY WARRANTY.**

**LACK OF PROPER BATTERY MAINTENANCE WILL ALSO VOID THE BATTERY WARRANTY**



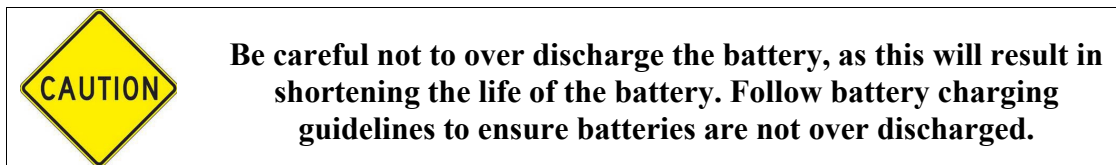
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## Chapter 3. Battery Maintenance

To optimize battery life, the following daily, weekly, monthly, quarterly and semi-annual battery maintenance schedule should be followed.

### 3.1 Daily

Daily maintenance requirements are different for manual and automatic charging systems. The following subsections will explain the specific requirements for each type of system.



#### 3.1.1 Auto Charge Systems

An auto charge system is designed to achieve maximum battery life by charging the batteries after each transport cycle or series of transport cycles. If a system is operated as designed, no daily maintenance is required.

Over discharge of the battery can occur if:

- The vehicle is manually released and not given a full charge cycle as designed.
- The vehicle remains powered up in a system that is not running at designed capacity for an extended period of time.

To recover from either of the above mentioned situations, check the battery for low life, and then charge the battery every night.

#### 3.1.2 Manual Charge Systems

Batteries on a manual charge system should be charged at the end of the day, the shift, or when the battery is determined to be low (battery level 1). The battery should never be discharged to low level lockout (battery level 0). Allowing the battery to go to battery level 0 will result in shorter battery life or damaged batteries.



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### 3.2 Weekly Finish Charge

In a Manual Charge System, batteries that are allowed to discharge to low level, or are not charged for 6-8 hours on a manual charger, must be given a finish charge every week. A finish charge brings the level of charge on the battery to the maximum level, thereby providing optimum battery life.

To achieve a finish charge, charge the batteries for 6-10 hours on a manual charger. Refer to Chapter 4 for details.

### 3.3 Monthly Finish Charge

In an Automatic Charge System, where the batteries are charged after 1-3 transport cycles, a monthly finish charge is recommended

### 3.4 Quarterly

Perform a manual charge on the batteries, and then measure and record the following voltage readings:

- Voltage of the battery pack as indicated on the HMI.
- Voltage of each battery as indicated by using a Multimeter.

If there is a significant change of one (1) volt from the readings of the previous month, or a difference of 0.5 volt in the reading between individual batteries it will be necessary to perform a recovery charge of the batteries. Refer to Chapter 5 for details.

### 3.5 Semi-Annual (Optional Suggested Testing)

Perform the battery discharge test twice a year to determine the remaining life and condition of the battery. This is an optional test to prevent possible failure of the battery or low battery lockout during critical production periods.



**NOTE**

**Perform a full battery maintenance charge prior to the battery discharge test, and after the discharge test is completed.**

**The discharge test must be performed on each battery individually.**

To perform a battery discharge test, proceed as follows:

1. Perform a full maintenance charge of the batteries. Refer to Chapter 4 for details.



**NOTE**

**The results of the maintenance charge may require a recovery charge.**

2. Disconnect the batteries, and then remove them from the vehicle.
3. Using Battery Tester (JBW# 1113731-0), set the discharge time according to Table 3-1.

**Table 3-1: Discharge Time Setting**

Battery Type	Discharge Time Setting (minutes)
Enersys TPPL 36 AH	75
Enersys TPPL 89 AH	210
Deka AGV 105 AH	210

4. Set the discharge shutoff voltage to 1.75 VPC.
5. Set the discharge rate to 25 amps.
6. Wait for the battery discharge test to be completed.
7. Record the minimum voltage, actual voltage, and cycle time in the battery maintenance log.

- 
8. Check the results below to determine what needs to be done:
- If the cycle time is equal to or less than the minimum cycle time listed in Table 3-2, the battery is near the end of its life. The battery may continue to function and charge, but the charge rate and capacity will be reduced. This will result in reduced vehicle run time per charge, and more frequent charge cycles.

**Table 3-2: Cycle Time**

<b>Battery Type</b>	<b>Cycle Time</b>
Enersys TPPL 36 AH	34
Enersys TPPL 89 AH	94
Deka AGV 105 AH	94

- If any of the batteries in the battery pack are at or near the end of their life, all the batteries in the pack should be replaced with new batteries.

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## Chapter 4. Maintenance Charge

A maintenance charge will bring a battery pack to full charge, and to a complete charge with a finish charge cycle. A typical maintenance charge cycle with a finish charge will take 6-10 hours; the duration will vary based on the battery's initial state of charge.

To perform a battery maintenance charge, proceed as follows:

1. Allow the vehicle to sit idle for 2 minutes.
2. On the HMI, check the battery pack voltage.
  - If the voltage is greater than 23 volts, place the vehicle on a manual charger, which will provide a finish charge of the battery. This charge may take up to 10 hours.
  - If the voltage is less than 23 volts, perform a battery recovery charge of each battery. Refer to Chapter 5 for details.
3. Select the appropriate charger for your battery listed in Chapter 2.
4. Plug the charger into the manual charge connection on the vehicle.
5. Charge the battery until the charger indicates the charge is complete. Refer to the charger manual for details on charge features.

**NOTE**

**If the charger does not turn on, the batteries will need a recovery charge, or will need to be replaced.**

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## Chapter 5. Recovery Charge

A recovery charge must be performed if the batteries have been over discharged or sulfated. The individual battery must be charged independently with a special battery recovery charger.

Any individual 12V battery with a measured voltage of less than 11.5 volts is over discharged and may be sulfated. If it is determined that one of the batteries in a vehicle battery pack needs a recovery charge, all the batteries in the pack should receive a battery recovery charge.



**Refer to the charger manual for additional details and cautions for charging the batteries.**

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To perform a battery recovery charge, proceed as follows:

1. Remove all connections from the battery.
2. Set the charger mode to 14.7V/3.3A.
3. Connect the charger to the battery following the instructions in the charger manual.
4. Leave the battery on the charger until the Charge Complete green light turns ON.



**Stop charging and replace the battery if:**

- **The battery does not reach 12 volts in 26 hours**
  - **The battery temperature reaches 113°F**
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5. Reconnect the batteries in the vehicle.
6. Perform a maintenance charge on the battery pack. See Chapter 4 for details.



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## Chapter 6. Battery Troubleshooting

### 6.1 Battery Low Level Lockout (Battery Level 0)

Battery lockout is a condition where the battery voltage has dropped to the low level limit. Operation of the vehicle under these conditions will result in reduced battery life, damage to the battery, and poor automatic operation of the vehicle. The battery must be charged.



**The vehicle can be moved to the battery maintenance charge area using a manual pendant.**

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To recover following a low battery lockout, proceed as follows:

1. Allow the vehicle to sit idle for 2 minutes.
2. On the HMI, check the battery pack voltage.
  - If the voltage is greater than 23 volts, place the vehicle on a manual charger, which will provide a finish charge of the battery. This charge may take up to 10 hours. See Chapter 4 for details.
  - If the voltage is less than 23 volts, perform a battery recovery charge of each battery. See Chapter 5 for details.

### 6.2 Battery Charger will Not Charge Battery

Batteries may become over discharged or sulfated as the batteries become older. In a manual charge system, the frequency of required battery charges will increase as the batteries age, which may result in over discharged or sulfated batteries. If the manual or automatic charger will not turn on, or comes on and quickly turns off, the battery likely needs a recovery charge

### 6.3 Vehicle Not Receiving a Charge

Check the following items if a vehicle is not receiving a charge:

- Check activity logs on SAM to determine if the Smart Cart is reporting
  - For AGCs - *C51 Charging not Detected*
  - For AGVs – *C4045 Station – Start Charge Timeout*
- Check that charge shoes are clean and free of dirt or buildup of debris, such as floor wax.
- For Actuated Charge Shoes, check that the Charge Shoes are actuating freely.
- Check to make sure shoes align with floor plate at charge stations. Misalignment could be caused by a bent shoe bracket
  - For AGCs, check for a damaged magnetic sensor bracket, as this could be guiding the AGC off the center of the path.



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- Check current when vehicle is on charge. Compare current and voltage at charger and battery.
  - Check charge contactor (CRC) to make sure the contacts are closing.
  - Check for a short to and from the battery, as well as to the chassis for current leakage.
  - Perform maintenance charge of battery and recovery charge if necessary.