**Recommended Charging Procedures**

**DETERMINING STATE-OF-CHARGE**

The simplest method to determine the state-of-charge of a battery is to read the battery "rested" open-circuit voltage (OCV) with a digital voltmeter. Consider these facts:

- Rested OCV indicates an undisturbed battery with no charging or discharging for at least eight hours or more.
- The use of a hydrometer to read the cell-specific gravities is encouraged since this complementary value will aid in battery diagnostics.
- At activation (first dry-charged battery acid fill), the OCV is fairly close to the true rested OCV, and no wait is necessary to determine true state-of-charge.

**BATTERY-CHARGING THEORY**

The best way to understand how a charger works is to make the analogy of two tanks connected at the bottom by a pipe. The tank filled with water represents the charger, while the empty tank represents the battery. As the full tank discharges into the empty tank, its level rises (voltage), while the water flow through the pipe into the empty tank decreases (amperage). The amount of charging amperes [A] multiplied by time (hours) will provide the battery capacity in ampere-hours of charge.

**BATTERY-COUNTING SCENARIOS**

**Boost-charging a recently discharged battery**

A battery discharged in the past three days can be easily charged since the materials will respond to charging by readily converting to their original chemical state. The table on the previous page may be used as a guideline with medium settings. High/start-voltage or boost-voltage settings will accelerate charging, requiring close supervision to ensure that batteries are not overheating or gassing excessively.

**Boost-charging a rundown (flat) battery**

Batteries with little or no voltage have little chance for recuperation, especially if they have remained in this state for a long period of time.

To charge a battery in this condition, the operator must use the lowest setting on the charger (low/trickle/float) and allow the battery to charge over a 24-hour period.

If the battery resists charge, a high-boost charge may be attempted for 30 to 60 minutes until the battery begins to accept charge. After this limited time period, the setting must be switched to low to avoid excessive overheating. The operator must make sure the battery is still accepting charge by watching the needle move above the zero mark. Once charging is completed, the battery must be tested to determine its condition.

**Use the Battery Replacement Data Book as a complete source for finding the right battery quickly.**

**HOW THE CHARGING CURRENT WILL BEHAVE DURING RECHARGE**

The current (amperes) flowing into the battery will be dictated by the battery’s state-of-charge, temperature, and charging voltage (kept fairly constant by the charger).

The current profile will almost invariably follow the pattern shown at right, according to the state-of-charge of the battery.

---

**Table: Battery Capacity and Charging Time**

<table>
<thead>
<tr>
<th>OCV (V)</th>
<th>Specific Gravity</th>
<th>SOC (%)</th>
<th>Charging Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.60 (or higher)</td>
<td>1.265 (or higher)</td>
<td>100%</td>
<td>3 (or less)</td>
</tr>
<tr>
<td>12.40–12.60</td>
<td>1.22</td>
<td>75%</td>
<td>4–6</td>
</tr>
<tr>
<td>12.20–12.40</td>
<td>1.16</td>
<td>50%</td>
<td>12</td>
</tr>
<tr>
<td>12.00–12.20</td>
<td>1.1</td>
<td>25%</td>
<td>22</td>
</tr>
<tr>
<td>11.70–12.00</td>
<td>1.04</td>
<td>0%</td>
<td>24</td>
</tr>
</tbody>
</table>

*Based on the 20-hour (ampere hour) capacity.

**Recommended Charging**

- **Resting OCV** indicates an undisturbed battery with no charging or discharging for at least eight hours or more.
- The state-of-charge of the battery is almost invariably followed by the pattern shown at right, according to the battery's state-of-charge, temperature, and charging voltage.
- The current (amperes) flowing into the battery will be dictated by the battery's state-of-charge, temperature, and charging voltage.
- During charging, the battery will self-regulate the charge flow according to the charger output voltage, which is just as important as the amperage that is forced into the battery.
- The voltage must be controlled and used according to the charger output voltage, which is just as important as the amperage that is forced into the battery.
- The amount of charging amperes [A] multiplied by time (hours) will provide the battery capacity in ampere-hours of charge.

**Batteries with little or no voltage have little chance for recuperation, especially if they have remained in this state for a long period of time.**

To charge a battery in this condition, the operator must use the lowest setting on the charger (low/trickle/float) and allow the battery to charge over a 24-hour period.

If the battery resists charge, a high-boost charge may be attempted for 30 to 60 minutes until the battery begins to accept charge. After this limited time period, the setting must be switched to low to avoid excessive overheating.

The operator must make sure the battery is still accepting charge by watching the needle move above the zero mark. Once charging is completed, the battery must be tested to determine its condition.

**Use the Battery Replacement Data Book as a complete source for finding the right battery quickly.**

The Battery Council International Battery Replacement Data Book makes it easy to find the correct BCI group (size) for a specific application. The book is an invaluable resource packed with useful information, and it is easy to use:

- Define the manufacturer, model, and year of the vehicle or machine.
- Identify the BCI group and OE (Original Equipment) cold cranking amps.
- Turn to the book's battery data section. Then, cross-reference the John Deere part number to the BCI group identified.

**Best-fit estimate — Some equipment manufacturers do not provide complete replacement battery information. Estimates are provided for replacement battery size to give some guidance to the Battery Replacement Data Book user. However, use caution — the size stated is only an estimate. You should always try to obtain the specific battery replacement size information from the equipment manufacturer.**

**More valuable information — The BCI Data Book also includes explanations on battery terminal types, terminal placement, use of booster cables, safety precautions, a BCI/DIN/EN reference chart, cell layouts, and more. Use the BCI Data Book to your advantage — it’s a great reference tool! Also, information on the Battery Council International organization can be found at http://www.batterycouncil.org.**

**California Proposition 65 — The posters shown below have been posted in John Deere California dealerships according to California’s Proposition 65 requirements. Noncompliance with California Proposition 65 could cause dealerships to be liable and lose protection from such claims under the terms of a battery manufacturer’s settlement.**