EV battery introduction
High power & Long cycle life type
VRLA battery

EV battery : VRLA battery for Electric Vehicle application

Panasonic Storage Battery Co., Ltd.
Concept to develop EV battery

- **Low Maintenance**
  - VRLA Battery (AGM type)

- **High Power**
  - at the end of discharge
  - in the wide temperature

- **Rapid Charge**
  - Rapid charge capability

- **Long Cycle Life**
  - Keep power characteristics until end of life
  - High quality and reliability in battery pack

- **Recycling**
  - Same material as SLI battery (Automotive battery)
Specifications of EV battery

- For pure EV applications two models
- For HV application one model

<table>
<thead>
<tr>
<th></th>
<th>For Pure EV</th>
<th>For HV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EC-FV1260</td>
<td>EC-FV1238</td>
</tr>
<tr>
<td><strong>Nominal Voltage</strong></td>
<td>12V</td>
<td>12V</td>
</tr>
<tr>
<td><strong>Nominal Capacity</strong></td>
<td>60Ah</td>
<td>38Ah</td>
</tr>
<tr>
<td><strong>Dimension</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>175mm</td>
<td>175mm</td>
</tr>
<tr>
<td>Length</td>
<td>388mm</td>
<td>261mm</td>
</tr>
<tr>
<td>Width</td>
<td>116mm</td>
<td>116mm</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>21kg</td>
<td>14kg</td>
</tr>
<tr>
<td><strong>Terminal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td>Upper side center</td>
<td>Upper side center</td>
</tr>
<tr>
<td>Type</td>
<td>Stud Bolt Bolt:M8mm P1.25mm H13mm</td>
<td>Stud Bolt Bolt:M8mm P1.25mm H13mm</td>
</tr>
<tr>
<td>Capacity (25deg.C)</td>
<td>53Ah</td>
<td>35Ah</td>
</tr>
<tr>
<td></td>
<td>34Ah</td>
<td>23Ah</td>
</tr>
</tbody>
</table>

※Date in this sheet are for reference only and are not guaranteed values.
SOC : State of Charge
PSOC : Partial State of Charge
Technologies for EV Battery

● Electrodes
  • Special grid alloy and grid design
  • Thin electrode design
  • Special additives and contents

● 2ply Separators
  • Glass fiber and Synthetic fiber

● Production Method
  • ISO 9001 certified
  • More Quality Check Points

● Battery Management
  • Excellent charge method
The diagram illustrates the structure of an EV battery, labeled as 'Structure of EV battery / EC-FV1260'. Key components include:

- **Terminal**
- **Top cover**
- **Anti-explosion filter**
- **Middle cover**
- **Thermistor point**
- **Container**
- **Regulate valve**
- **Inter cell connection**
- **Strap**
- **Positive plate**
- **Synthetic fiber separator**
- **Glass fiber separator**
- **Negative plate**

Notable features are:

- **AGM type**
- **Two layer separators** (glass fiber and synthetic fiber)
- **Many positive, negative plates are used**
Discharge Capacity of EV Battery #1 vs. Vent type Lead Acid battery for Golf Carts

◆Excellent Discharge Performance
at low temperature, at High rate Discharge

![Graph showing discharge capacity comparison between Panasonic 12V60Ah 21kg and "T" manufacture for Golf Carts 12V95Ah 27kg.](image)

Date in this sheet are for reference only and are not guaranteed values.
Discharge Capacity of EV Battery #1 vs. VRLA battery by Shenyang

Excellent Discharge Performance at low temperature, at High rate Discharge

Discharge Current (CA)

Ratio of Discharge Capacity (%)

1/3CA Discharge Capacity at 25°C = 100%

EC-EV1260

EV Battery

Standard VRLA

25°C

0°C

※Date in this sheet are for reference only and are not guaranteed values.
5 Step-CCC (constant current charge) method

Charge profile (12V60Ah)

1st~4th step
Charge current
- $I_1 = 0.2 \, \text{CA (12A)}$
- $I_2 = 0.1 \, \text{CA (6A)}$
- $I_3 = 0.05 \, \text{CA (3A)}$
- $I_4 = 0.025 \, \text{CA (1.5A)}$

Switching voltage
- $V = 14.4 + 0.03(25-T)$
  - $T$ : Battery temperature(℃)

5th step
Charge current $I_5 = 0.025 \, \text{CA (1.5A)}$
Charge time $t_5$ is decided by the charge time and the temperature of 1st step

An example of charge profile from 80% DOD
**Cycle Life Performance #1 vs. competitor**

- **Panasonic**: 1000 cycles

- **Graph**:
  - **Cycle Life** on the y-axis
  - **Depth of Discharge (%)** on the x-axis
  - Symbols:
    - Green diamond: values of catalogue
    - Red circle: values of test at Panasonic
  - Manufacturers:
    - C manufacture
    - B manufacture
    - V manufacture
    - Z manufacture
    - EP manufacture
    - G manufacture
    - S manufacture
    - H manufacture
    - AD manufacture

- **Note**: Date in this sheet are for reference only and are not guaranteed values.
【Cycle test condition】
Temp.: 25℃
Discharge: 20A 48Ah
Charge: 5Step -CCC

【Capacity check】
Temp: 25℃
Discharge: 20A 9.9Vcut every 50 cycles

Test Battery: FV1260

※Date in this sheet are for reference only and are not guaranteed values.
Cycle Life Performance #3
1/3CA Discharge DOD 80% & 33% & 10%

【Cycle test condition】
Temp.: 25℃
Discharge: 1/3CA
Charge: 5Step – CCC

【Capacity check】
Temp.: 25℃
Discharge: 1/3CA 9.9Vcut every 50 cycles

Life judgment @ DOD 80%
DOD 80%
1000 cycles
EV battery: EV1260

Life judgment @ DOD 33%
DOD 33%
3,400 cycles
EV battery: EV1260

Life judgment @ DOD 10%
DOD 10%
5,400 cycles
EV battery: SV1242

※Date in this sheet are for reference only and are not guaranteed values.
Cycle Life Performance #4
for Rapid Charge application

◆Rapid Charge applications Pattern

- : Discharge: 1/3CA (20A)
- : Charge: 5step-CCC
- : Rapid Charge: 0.6CA

![Graphs showing discharge capacity over time for different driving durations and conditions.]

※Date in this sheet are for reference only and are not guaranteed values.
## Specifications of EV battery

- For pure EV applications: two models
- For HV application: one model

<table>
<thead>
<tr>
<th></th>
<th>For Pure EV</th>
<th>For HV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EC-FV1260</td>
<td>EC-FV1238</td>
</tr>
<tr>
<td></td>
<td>EC-HV1255</td>
<td></td>
</tr>
<tr>
<td><strong>Out line</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td><img src="image3" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td><strong>Nominal Voltage</strong></td>
<td>12V</td>
<td>12V</td>
</tr>
<tr>
<td><strong>Nominal Capacity</strong></td>
<td>60Ah</td>
<td>38Ah</td>
</tr>
<tr>
<td><strong>Dimension</strong></td>
<td>Height 175mm</td>
<td>Height 175mm</td>
</tr>
<tr>
<td></td>
<td>Length 388mm</td>
<td>Length 261mm</td>
</tr>
<tr>
<td></td>
<td>Width 116mm</td>
<td>Width 116mm</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>21kg</td>
<td>14kg</td>
</tr>
<tr>
<td><strong>Terminal</strong></td>
<td>Position Upper side center</td>
<td>Upper side center</td>
</tr>
<tr>
<td></td>
<td>Type Stud Bolt Bolt:M8mm P1.25mm H13mm</td>
<td>Stud Bolt Bolt:M8mm P1.25mm H13mm</td>
</tr>
<tr>
<td><strong>Capacity (25deg.C)</strong></td>
<td>1/3CA 53Ah</td>
<td>3CA 35Ah</td>
</tr>
<tr>
<td></td>
<td>3CA 34Ah</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>23Ah</td>
</tr>
<tr>
<td></td>
<td></td>
<td>43Ah</td>
</tr>
</tbody>
</table>

※Date in this sheet are for reference only and are not guaranteed values.
**Application image of EV battery**

**Pure EV application**  
EC-FV1260, EC-FV1238

**HV application**  
EC-HV1255

![Graph showing battery voltage and SOC over time for Pure EV and HV applications.](image)

- **SOC**: State of Charge  
- **PSOC**: Partial State of Charge

---

**Graph Key**

- **Battery Voltage**
- **SOC**: State of Charge  
  - 100%  
  - 0%
- **PSOC**: Partial State of Charge  
  - 100%

**Time**

- **Discharge**
- **Charge**

- **About 1 day**
- **About 2~4 weeks**
### Test condition

- **SOC center**: 70%
- **Ambient Temp.**: 25°C
- **Measure items**:
  1. Minimum Voltage
  2. Battery Temp.

PSOC (Partial State of Charge) cycle Life Performance

Minimum Voltage

@25°C

for EV application

for HV application

Battery Temperature

Minimum Voltage

Battery Temperature

Cycle Number (×10^3)

※Date in this sheet are for reference only and are not guaranteed values.