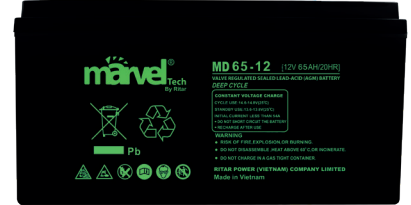


# LEAD ACID (DEEP CYCLE) BATTERY

## MD65-12

Marvel MD series is specially designed for frequent discharge deep cycle applications. By using the specially designed active material, strong grids and thick plate construction, the series battery offers reliable performance in high load situations and could provide competitive cycle performance. Suitable for electric vehicles and golf carts; industrial equipment, floor machines, forklifts, aerial lifts, and robotics; marine, RV, and no-idle solutions; mobility and medical equipment; and most outdoor application.

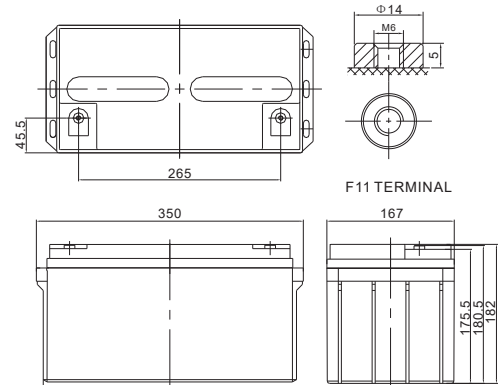


MADE IN VIETNAM / CHINA

### SPECIFICATION

|                                    |   |
|------------------------------------|---|
| Cells Per Unit                     | 6   |
| Voltage Per Unit                   | 12  |
| Capacity                           | 65Ah@20hr-rate to 1.75V per cell @25  |
| Weight                             | Approx. 19.5 Kg (Tolerance±3%)  |
| Internal Resistance                | Approx. 6.0 mΩ  |
| Terminal                           | F5(M8)/F11(M6)  |
| Max. Discharge Current             | 650A (5 sec)  |
| Design Life                        | 12 years (floating charge)  |
| Maximum Charging Current           | 19.5 A  |
| Reference Capacity                 | C3 49.7AH   |
|                                    | C5 56.0AH   |
|                                    | C10 61.9AH  |
|                                    | C20 65.0AH  |
| Float Charging Voltage             | 13.6 V~13.8 V @ 25°C<br>Temperature Compensation: -3mV/ /Cell   |
| Cycle Use Voltage                  | 14.6 V~14.8 V @ 25°C<br>Temperature Compensation: -4mV/ /Cell   |
| Operating Temperature Range        | Discharge: -20°C~60°C<br>Charge: 0°C~50°C<br>Storage: -20°C~60°C  |
| Normal Operating Temperature Range | 25°C±5°C  |
| Self Discharge                     | Marvel Valve Regulated Lead Acid (VRLA) batteries can be stored for up to 6 months at 25°C and then recharging is recommended. Monthly Self-discharge ratio is less than 3% at 25°C. Please charged batteries before using. |
| Container Material                 | A.B.S. UL94-HB, UL94-V0 Optional.   |

### Dimensions



|              |                       |
|--------------|-----------------------|
| Length       | 350±2mm (13.8 inches) |
| Width        | 167±2mm (6.57 inches) |
| Height       | 182±2mm (7.17 inches) |
| Total Height | 182±2mm (7.17 inches) |
| Terminal     | Value                 |
| M5           | 6~7 N*m               |
| M6           | 8~10 N*m              |
| M8           | 10~12 N*m             |

Unit: mm

### Constant Current Discharge Characteristics :A(25°C)

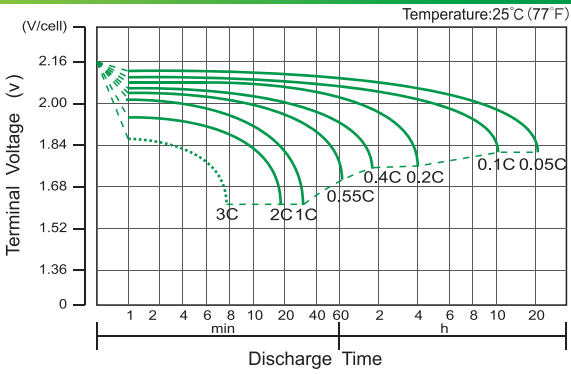
| F.V/Time | 10MIN | 15MIN | 30MIN | 1HR   | 2HR   | 3HR   | 4HR   | 5HR   | 8HR   | 10HR  | 20HR  |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.60V    | 157.8 | 120.0 | 70.79 | 39.48 | 23.51 | 18.31 | 14.37 | 12.22 | 7.837 | 6.500 | 3.369 |
| 1.65V    | 145.4 | 112.2 | 67.05 | 38.13 | 22.72 | 17.75 | 13.94 | 11.84 | 7.776 | 6.438 | 3.351 |
| 1.70V    | 134.7 | 105.5 | 63.58 | 36.91 | 22.12 | 17.00 | 13.51 | 11.52 | 7.652 | 6.314 | 3.309 |
| 1.75V    | 123.6 | 98.82 | 61.07 | 35.75 | 21.27 | 16.56 | 13.14 | 11.20 | 7.529 | 6.252 | 3.250 |
| 1.80V    | 112.5 | 90.49 | 58.82 | 34.16 | 20.54 | 16.25 | 12.83 | 11.05 | 7.405 | 6.190 | 3.219 |
| 1.85V    | 88.02 | 74.87 | 49.87 | 30.49 | 18.78 | 15.13 | 12.03 | 10.17 | 6.973 | 5.819 | 3.189 |

### Constant Power Discharge Characteristics : WPC(25°C)

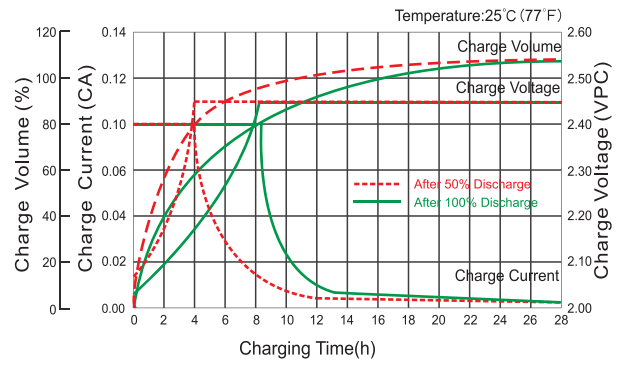
| F.V/Time | 10MIN | 15MIN | 30MIN | 1HR   | 2HR   | 3HR   | 4HR   | 5HR   | 8HR   | 10HR  | 20HR  |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.60V    | 268.7 | 209.3 | 128.6 | 74.11 | 44.45 | 34.77 | 27.69 | 23.13 | 15.27 | 12.75 | 6.725 |
| 1.65V    | 258.8 | 203.5 | 125.6 | 72.84 | 43.25 | 33.91 | 27.01 | 22.50 | 15.15 | 12.62 | 6.665 |
| 1.70V    | 241.5 | 192.6 | 119.6 | 70.71 | 42.17 | 32.61 | 26.15 | 21.94 | 14.97 | 12.38 | 6.605 |
| 1.75V    | 224.7 | 181.8 | 115.4 | 68.75 | 40.67 | 31.80 | 25.54 | 21.44 | 14.72 | 12.26 | 6.485 |
| 1.80V    | 207.1 | 168.0 | 111.6 | 65.94 | 39.75 | 31.63 | 25.05 | 21.15 | 14.48 | 12.13 | 6.425 |
| 1.85V    | 164.3 | 141.2 | 95.75 | 59.22 | 36.60 | 29.50 | 23.57 | 19.57 | 13.69 | 11.46 | 6.365 |

(Note) The above characteristics data are average values obtained within three charge/discharge cycle not the minimum values. The battery must be fully charged before the capacity test. The Cm should reach 95% after the first cycle and 100% after the third cycle.

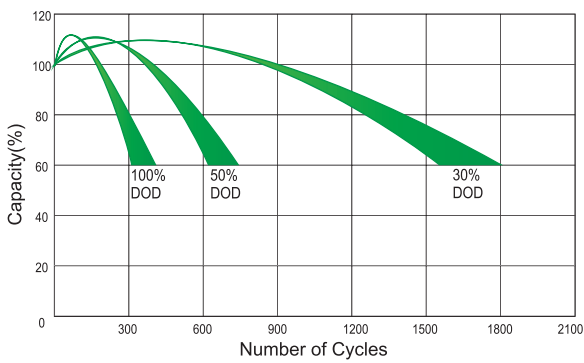
### Discharge Characteristics Curve



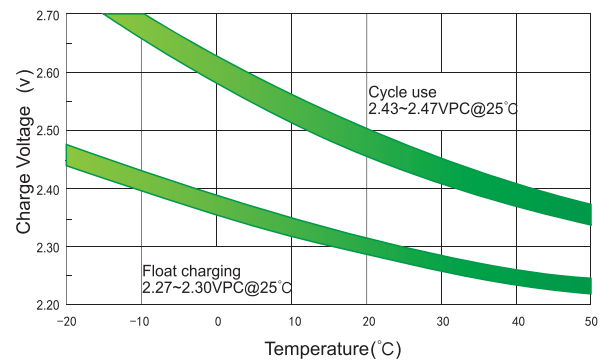
### Charge Characteristic Curve for Cycle Use(IU)



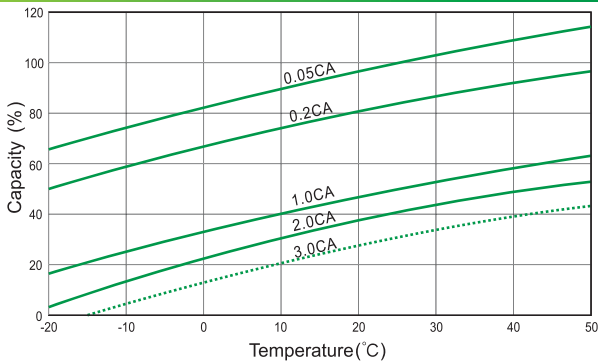
### Cycle Life in Relation to Depth of Discharge



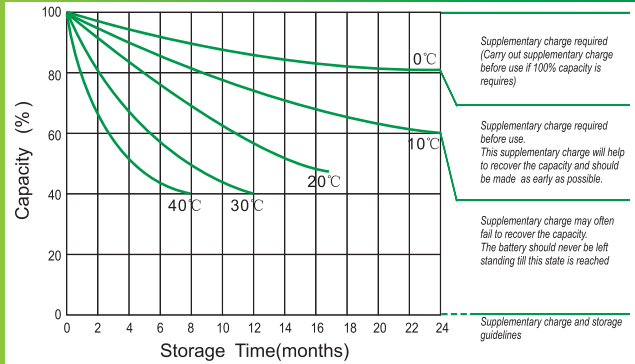
### Relationship Between Charging Voltage and Temperature



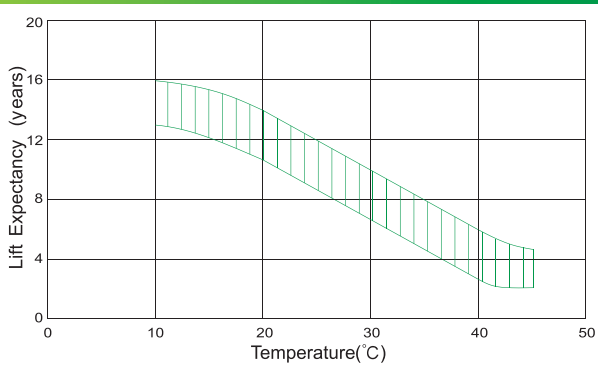
### Temperature Effects on Capacity



### Storage Characteristics



### Effect of Temperature on Long Term Life



### Relationship of OCV And State of Charge(20°C)

