

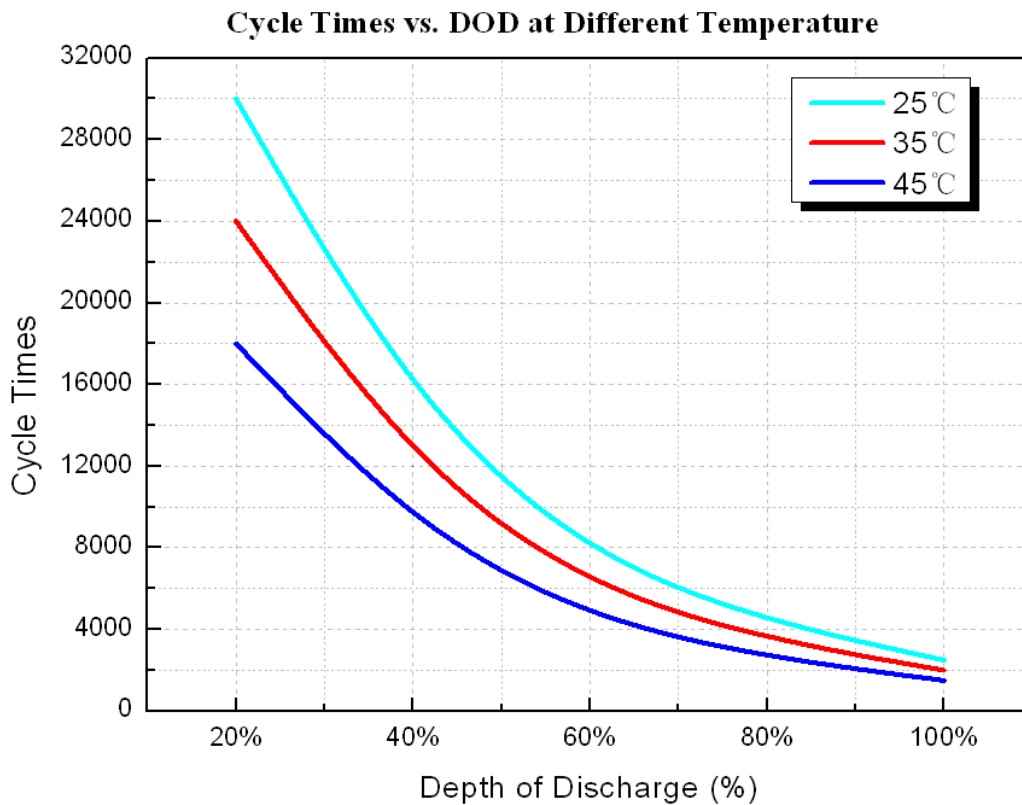
**BATTERY CYCLIC PERFORMANCE CALCULATION AND ESTIMATION**

V1.5, 6<sup>th</sup> July. 2016

NPFC series of Narada batteries, products using lithium iron phosphate technology, have excellent cyclic performance. The rate capacity is 5 hour rate discharge capacity ( $I_5$  is  $0.2C_5$ ).

**1. Ideal Cyclic Performance**

**1.1 NPFC Series Cyclic Test Result**



Graph 1 - Cycle life vs. DOD of NPFC Series with Ideal Charge Mode

Table 1 Data of Cycle Number

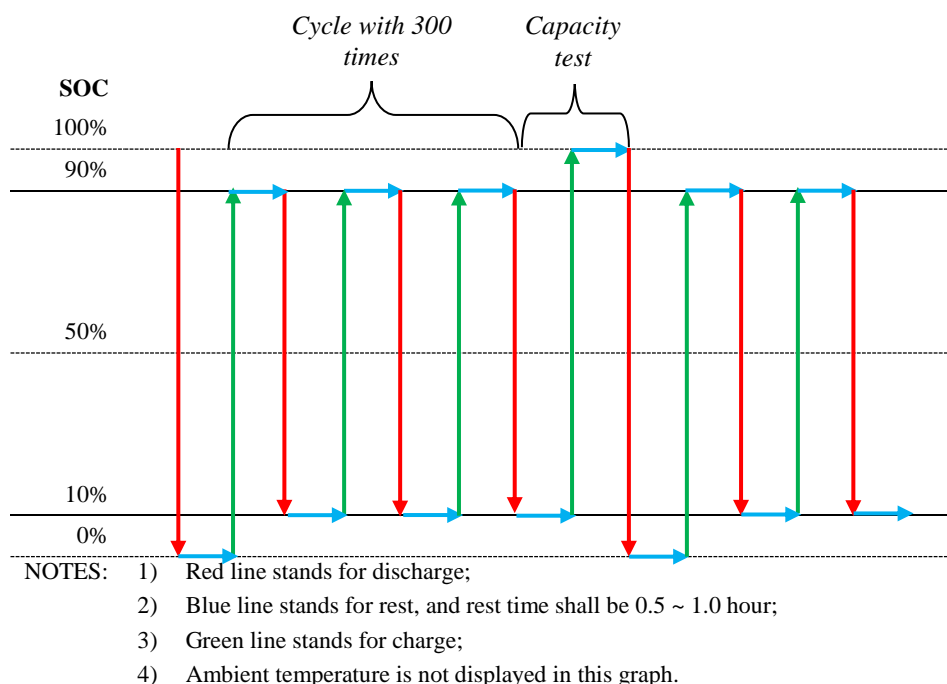
| Temp. (°C) | Depth of Discharge (%) |      |      |       |       |
|------------|------------------------|------|------|-------|-------|
|            | 100%                   | 80%  | 60%  | 40%   | 20%   |
| 25         | 2500                   | 4375 | 7500 | 15000 | 30000 |
| 35         | 2000                   | 3500 | 6000 | 12000 | 24000 |
| 45         | 1500                   | 2625 | 4500 | 9000  | 18000 |

## 1.2 Discharge & Charge Scenario (80%DOD)

Here, we take 80%DOD cycle life test as example, since 80%DOD is most popular operation scenario.

### 1.2.1 Cycle methods

Discharge with 1.0C at 90% SOC (state of charge) for 48 minutes (80% DOD), charge with limited current of 1.0CA to 3.65Vpc till the SOC increases to 90%. This is one cycle.



Graph 2 – Sketch of Cycle Method of NPFC Series

### 1.2.2 Residue capacity determination

After every 300 cycles, the battery shall be charged to 100% SOC, and then discharged at 5 hour rate to test battery capacity. When residue capacity of 5 hour rate capacity is lower than 80%, test is ended. If the residual capacity is larger than 80%, charge the battery back to 90% SOC to carry out test as the above cycle method.

## 1.3 Advantage of Upper Mode

The NPFC series battery can accomplish one cycle at short time with high rate charge and discharge. The upper cycle method can maximize the cyclic performance.