Battery Characteristics & Ratings - Part 2

STUDY FOR FE

Theoretical Voltage of a cell - $E^0 = V_{cathode} - V_{anode}$

Theoretical Energy/Capacity of a cell (Wh) = Voltage (V) x Charge (Ah)
Theoretical capacity (g/Ah) $C_{cell} = 1/EC_a + 1/EC_c$ where EC_a and EC_c are electrochemical equivalent Ah/g capacities.
$C_{cell} = EC_a + EC_c$ where EC_a and EC_c are electrochemical equivalent Ah/g capacities.

Discharge Current Rate $$I = M.C_n$$

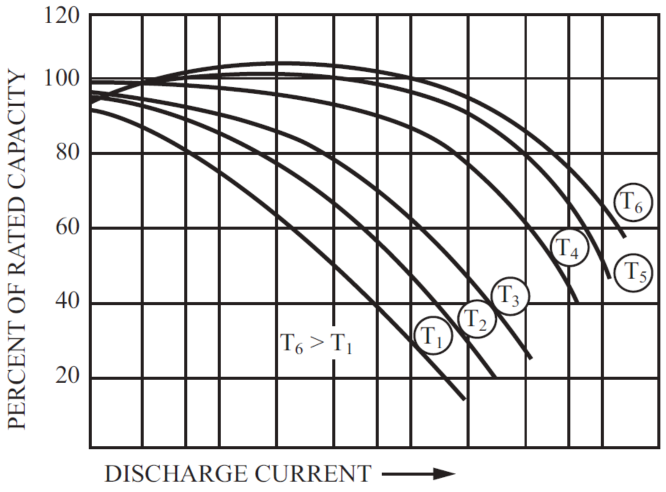
I = Discharge current
C = Ah capacity of the battery
n = Time rating of C
M = Multiplier
C-Rating of a battery discharge current describes the rate at which battery is discharged relative to its max. capacity.
Consider a 1000 Amp-hours battery with a time rating of 1 hour for next 2 problems.

Discharge Power Rate $$P = M.E_n$$

P = Discharge power
E = Wh capacity of the battery
n = Time rating of E
M = multiplier
E-rating of a battery discharge power describes the rate at which battery is discharged relative to its max. capacity.
Consider a 1000 Watt-hours battery with a time rating of 1 hour for next 2 problems.

Effect of temperature on battery capacity

For a given temperature, higher discharge current (load) results in a reduced battery capacity.
For a given discharge current (load), higher temperature results in a higher battery capacity.



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Peukert's Relation for Lead-Acid Batteries

$$C_p = I^k t$$

C_p = Ah capacity for 1A constant discharge current
I = actual discharge current
k = Peukert's constant
t = discharge time (h)

$$t = H(C/1H)^k$$

C = nominal Ah capacity at discharge period H (both specified by manufacturer)
k = Peukert's constant
t = actual discharge time (h) at discharge current