VRLA Battery Characteristics - Discharge

The battery capacity (Ah) is an integration of the discharge current I(t), and discharge time to the final discharge voltage:

$$\text{Battery capacity (Ah)} = \int I(t)\,dt$$

From the above equation, the variation of discharge time is dependent on the discharge current. The battery capacity also greatly depends on the discharge current.

For example, compare a 20 hour and a 1 hour rate:

For 20 hours, 0.05C (A) x 20 (h) = 1C (Ah)
For 1 hour, 0.6C (A) x 1 (h) = 0.6C (Ah)

This means that the capacity for the one hour rate is 60% less of the 20 hour rate. Evidently, increasing discharge current causes a decrease in the apparent Ah capacity. The final discharge voltage also varies depending on the discharge current. The discharge capacity is affected by the battery temperature during discharge. Generally, the capacity decreases when the battery temperature decreases during discharge. Discharge characteristics are described in Figure 1, Figure 2, and Figure 3.

Table 1 Discharging current and final discharge voltage

Final discharge voltage (V/Cell)	Series			
	UPS,RUM	HR,HRL,XHRL	GP,GPL,EVH,EVX, XTV,TPL	MU,MSV,MSJ
1.90				0.05C > (A)
1.80	0.025P > (W)	0.05 P > (W)	0.1 C > (A)	0.05 C ≦ (A) < 0.25 C
1.75	0.025P ≦(W) < 0.075P	0.05P ≦ (W) < 0.15P	0.1 C ≦ (A) < 0.30 C	0.25 C ≦ (A) < 0.40 C
1.70	0.075P ≦ (W) < 0.5P	0.15P ≦ (W) < 1.0 P	0.30 C ≦ (A) < 2.0 C	(A) ≧ 0.4C
1.60	(W) ≧ 0.5P	(W) ≧ 1.0 P	(A) ≧ 2.0 C	

(1) Discharge current and final discharge voltage
For the relation between discharge current and final discharge voltage, please refer to Table 1. The battery should never be discharged to less than the predetermined final discharge voltage. Otherwise, over discharging may result. Repeated over discharging may result in capacity failure, even with proper charging.

(2) Discharge characteristics at various rates
Figures 1 shows the discharge performance at various rates for GP1272 and GP12400, respectively. Figure 4 shows the relation between the discharge current and time using this figure. Select the appropriate capacity for the VRLA battery. For the final discharge voltage, refer to Table 1.

(3) Temperature and discharge capacity

Figure 3 shows the relation between temperature and discharge capacity. This figure shows the result of a charge at 25°C (77°F) and discharge at various temperatures. Avoid operation of the battery below -20°C (4°F) or beyond 50°C (122°F) since damage may occur even though the battery may still operate.

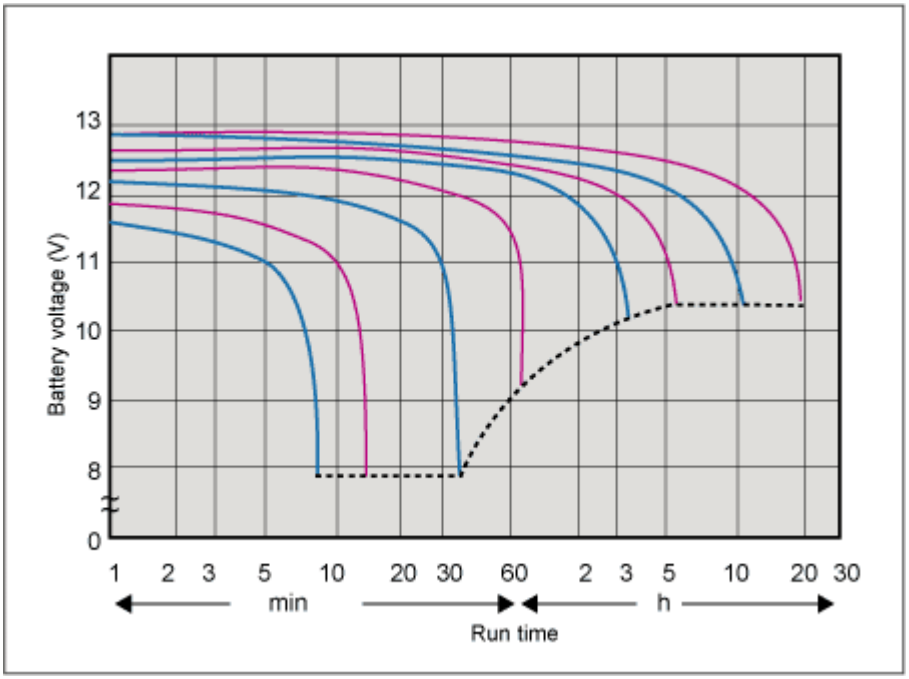

Figure 1: GP1272 discharge characteristics at various rates [25°C (77°F)]

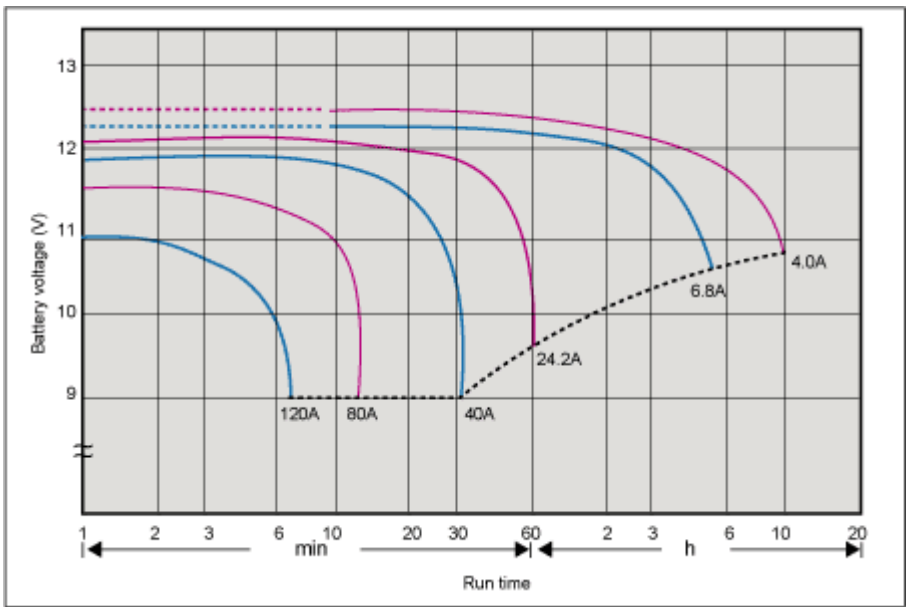

Figure 2: GP12400 discharge characteristics at rates [25°C (77°F)]

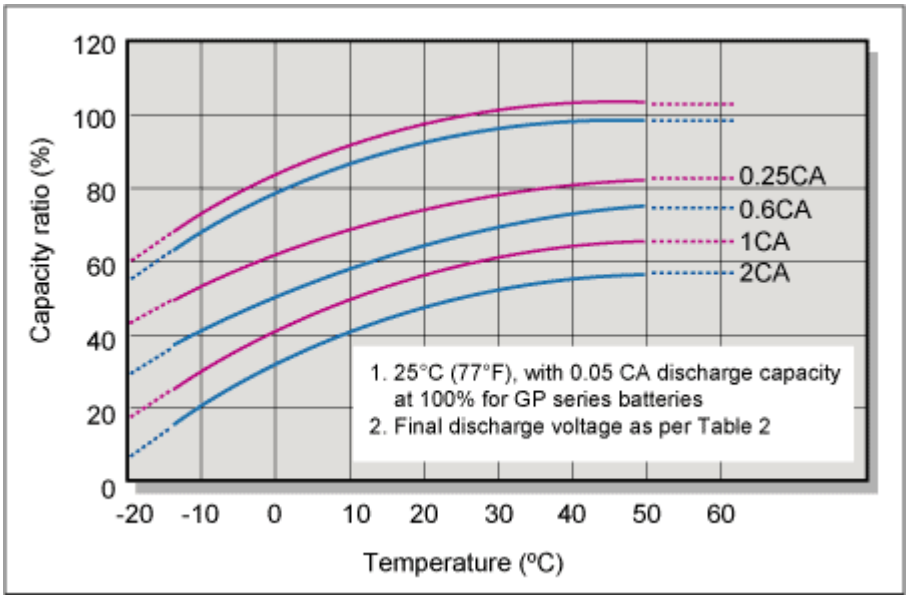

Figure 3: Temperature and discharge capacity [25°C (77°F)]

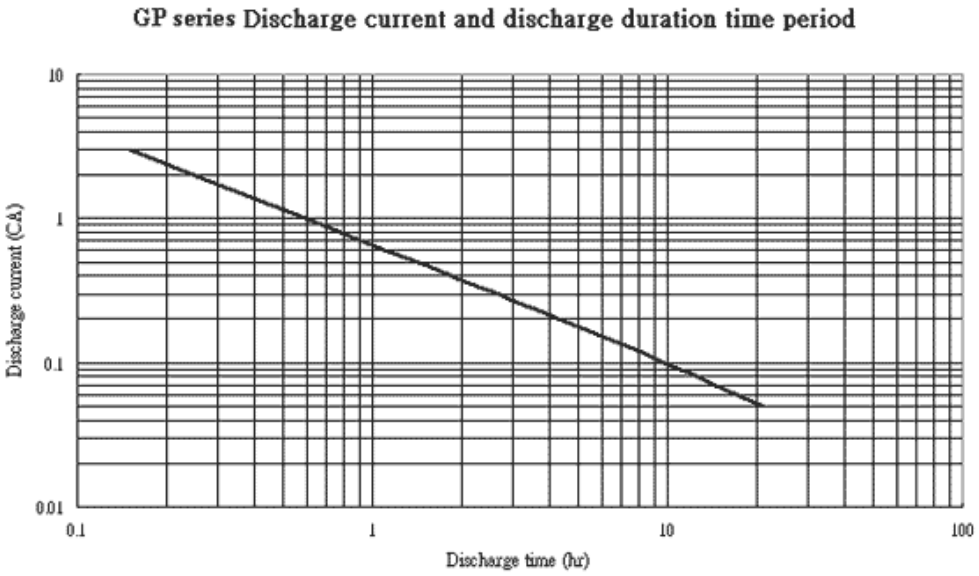

Figure 4: Discharge current and discharge duration time period [25°C (77°F)]