M359 Heat Dissipation

The Heat dissipation of the M359 can be estimated, as a function of the load (output power) and the Battery Charge Level (it affects the consumption of the Charger) by using Equation 1 below.

$$\mathbf{Pdiss = (Pout + Pchg) \times (1-Eff) / Eff + 50W} \qquad \textbf{(Eq. 1)}$$

Pdiss is the M359 power dissipation (in the form of heat)
Pout is the output power into the load.
Pchg is the charger's consumption.
When the **B**attery **C**harge **L**evel (**BCL**) is less than 50% Pchg is **250W**.
For **BCL** between 50% to 100% the Charger's consumption gradually drops to zero and can be estimated by using linear extrapolation:

$$\mathbf{Pchg = 250 \times (100 - BCL) / 50} \qquad \textbf{(Eq. 2)}$$

Eff is the efficiency of the UPS double conversion. It is load dependent and is given in Table 1 below:

Table 1: Conversion Efficiency

Load	Efficiency (Eff)
500W	0.84
700W	0.86
1,000W	0.88
1,500W	0.86
1,800W	0.84
2,000W	0.83

Use linear extrapolation between brackets.

The 50W is the housekeeping power and the cooling fan consumption.

Examples:

1. **Operating Conditions: Load = 1KW, Battery Charge Level is 30%.**

Using Eq. 1 above and Eff of 0.88 (from Table 1):

$$\mathbf{Pdiss = (1{,}000 + 250) \times (1- 0.88) / 0.88 + 50W = \underline{220W}}$$

(Since the Battery Charge Level is lower than 50%, the charger's consumption is taken as 250W).

2. **Operating Conditions: Load = 1KW, Battery is fully Charged.**

   Pdiss = 1,000 x (1- 0.88) / 0.88 + 50W = <u>186W</u>

3. **Operating Conditions: Load = 2KW, Battery Charge Level is 30%.**

   Pdiss = (2,000 + 250) x (1- 0.83) / 0.83 + 50W = <u>511W</u>

4. **Operating Conditions: Load = 2KW, Battery Charge Level is 70%.**

   Pdiss = (2,000 + 150) x (1- 0.83) / 0.83 + 50W = <u>490W</u>

   Since the Battery Charge Level (70%) is above 50%, the Charger's consumption (Pchg) is estimated by using linear extrapolation between 50% to 100%:

   Pchg = 250 x (100 – 70)/50 = 150W

5. **Operating Conditions: Load = 1.8KW, Battery is fully Charged.**

   Pdiss = 1,800 x (1-0.84) / 0.84 +50W = <u>393W</u>

6. **Operating Conditions: Load = 1.65KW, Battery is empty.**

   By using linear extrapolation of the Efficiency at the higher (0.84 at 1,800W) and lower (0.86 at 1,500W), the Efficiency at 1,650W will be taken as 0.85, therefore:

   Pdiss = (1,650 +250) x (1-0.85) / 0.85 +50W = <u>385W</u>