

Ventilation and Cooling Requirements for the Symmetra PX UPS

Abstract

Data centers requires proper ventilation to remove the heat generated by its equipment and provide sufficient air quality. The Symmetra PX UPS supports up to 40kW of equipment. This large amount of power supported and its ventilation requirements are sufficient to remove the heat generated by the UPS, keep the batteries at their ideal temperature, and remove any hydrogen generated. Data centers are an excellent location for Symmetra PX UPS solutions.

Generated Heat

The Symmetra PX is 91.5% efficient and generates heat, about the equivalent of two racks of IT equipment. The values provided in Figure 1 will help with your data center cooling requirements.

| Symmetra PX | |
|--------------------------------------|------------------------|
| Design temperature | 25C (77F) |
| Lifetime degradation from heat | 5% per C |
| Other effects of heat | None |
| Recommended ambient room temperature | 68 – 72 F 20 – 22 C |

Figure 1: Generated heat for each Symmetra PX UPS

Battery Temperature Requirements

As shown in Figure 1 above, the UPS operating environment range is quite wide. The life expectancy of batteries is dependent on temperature. Battery life decreases at temperatures above the design value, as shown in Figure 2. Batteries for UPS systems using any of the battery technologies should be kept in a controlled temperature environment to promote long life.

| | Symmetra PX UPS (per UPS) | Symmetra PX XR Battery Cabinet (per cabinet) |
|--|--|--|
| Necessary Ventilation Air Flow | 0.32 ft ³ /m (0.00015 m ³ /s) | 0.64 ft ³ /m (0.0003 m ³ /s) |
| Outdoor (fresh) air requirements for office space per person (V) | 21 ft ³ / m (0.01 m ³ /s) | 21 ft ³ / m (0.01 m ³ /s) |
| Hydrogen generation (G) | 0.0029 ft ³ /m (0.0000025 m ³ /s) | 0.0058 ft ³ /m (0.0000025 m ³ /s) |
| Hydrogen concentration (G/V) * 100% | 0.014% | 0.028% |
| Safe hydrogen concentration limit | 1% | 1% |
| Special ventilation required | No | No |

Figure 2: Battery operating temperature for Symmetra PX UPS

Because heat flows from hot to cold, the room temperature should be lower than 77F to allow this heat to flow from the battery. APC recommends an ambient room temperature of 68 – 72 F for the Symmetra PX UPS. A higher ambient temperature might shorten the life expectancy, 5 years, of the batteries.

Under unusual circumstances the battery may enter a state in which the heat is generated faster than it can be dissipated, leading to a rise in temperature which can in turn cause additional heat to be generated. This situation is called thermal runaway. The Symmetra PX has temperature compensated charging, current limited charging, and individual battery unit fusing to prevent thermal runaway from occurring.

Hydrogen Generation and Removal

All lead-acid batteries require ventilation because they generate hydrogen. Hydrogen can be explosive when the concentration exceeds 4% of the total volume of air. The standard margin of safety is to keep the maximum concentration to less than 1% of the room volume. Ventilation must be used to keep the concentration below this 1% limit. For comparison, natural atmospheric concentration of hydrogen is 0.01%. The recommended ventilation for each Symmetra PX UPS and its option XR Battery cabinet are provided in Figure 3.

| | Symmetra PX UPS (per UPS) | Symmetra PX XR Battery Cabinet (per cabinet) |
|--|----------------------------------|---|
| Necessary Ventilation Air Flow | 0.32 ft3/m (0.00015 m3/s) | 0.64 ft3/m (0.0003 m3/s) |
| Outdoor (fresh) air requirements for office space per person (V) | 21 ft3 / m (0.01 m3/s) | 21 ft3 / m (0.01 m3/s) |
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| Safe hydrogen concentration limit | 1% | 1% |
| Special ventilation required | No | No |

Figure 3: Ventilation requirements for hydrogen removal

The fresh air input rate required to provide sufficient air quality for one person is capable of supporting 65 Symmetra PX UPSs' hydrogen generation. With the minimal amount of ventilation, the Symmetra PX UPS is just above the natural atmospheric concentration of hydrogen.

Example 1: Site A has two (2) Symmetra PX UPS, what is the minimum recommended ventilation?

| Example 1 | |
|----------------------------|------------|
| Symmetra PX UPS # 1 | 0.32 ft3/m |
| Symmetra PX UPS # 2 | 0.32 ft3/m |
| Total Required Ventilation | 0.64 ft3/m |

Figure 4: Example 1

Example 2: Site B has one (1) Symmetra PX UPS and two (2) XR Battery Cabinets, what is the minimum recommended ventilation?

| Example 2 | |
|----------------------------|------------|
| Symmetra PX UPS #1 | 0.32 ft3/m |
| Symmetra PX XR Cabinet #1 | 0.64 ft3/m |
| Symmetra PX XR Cabinet #2 | 0.64 ft3/m |
| Total Required Ventilation | 1.60 ft3/m |

Figure 5: Example 2