

Consultant's Corner: UPS Flywheel & Gen Set Sizing

consultants corner



Sizing gen sets for UPS requires careful planning

An uninterruptible power supply (UPS) provides power free of voltage frequency variations, transient pulses, line noise and interruption.

Most UPS systems can only sustain power for a system shutdown, so a reliable, right-sized standby EPG system is needed to maintain data processing. The standby EPG system can also power the computer's support systems such as the HVAC, lighting and emergency lighting systems.

Combining a UPS system with a gen set presents some special considerations to ensure compatibility. We use the following four-step procedure to size Cat gen sets that have static UPS systems as part of all of their load:

1. Establish UPS input kW

You can use the input kW from the UPS supplier data sheets. If it's not available from the supplier, we recommend the following formula:

$$\frac{(\text{Output kW} + \text{Battery Recharge kW})}{\text{UPS Efficiency}} = \text{UPS Input kW}$$

UPS output for computer loads frequently is expressed in kVA. For approximating, multiply kVA by a 0.9 power factor to identify UPS output kW.

Battery recharge kW generally ranges from 0 to 25 percent of input kW (15 percent is typical). If it's unknown, use 25 percent of output kW for an approximation.

If UPS efficiency is unknown, we recommend the following guidelines:

- Use 0.85 if UPS is less than 100 kW
- Use 0.875 if UPS is greater than or equal to 100 kW and less than 500 kW
- Use 0.90 if UPS is greater than or equal to 500 kW

2. Set minimum-size gen set

In this step, establish the gen set size needed to contain waveform distortion. If your UPS system has a six-pulse rectifier, minimum standby gen set equals UPS input kW x 1.6. For a 12-pulse rectifier, the formula is UPS input kW x 1.4.

3. Consider other loads

Be sure to size the gen set to accommodate other loads in the application. Establish the kW of the other loads, then add it to the UPS input kW x 1.15 for a 12-pulse.

4. Gen set sizing

For your final selection, choose the larger gen set rating of part 2 or 3. Round up to the nearest larger size standby gen set. (See the example at the bottom.)

Our experience shows that most system compatibility problems involving gen sets and UPS systems arise because equipment selection and system design did not consider any power source other than a stiff utility system. It's important to note that loads drawing harmonic currents cause distortion from the source; the source does not produce distortion.

If you have questions about sizing a gen set for a UPS system, call us. We'll help you make sure the fit is right for your application.

Sizing a Cat gen set

Here's an example of the Caterpillar gen set sizing procedure. The UPS system is rated 200 kVA/180 kW; other loads connected to the gen set total 100 kW.

1. From supplier data, the UPS input is 255 kW, including battery recharge.
2. 255 kW x 1.6 (six-pulse rectifier) = 408 kW minimum standby rated gen set.
3. (255 kW x 1.15) + 100 kW = 393 kW minimum standby rated gen set with other loads.
4. 408 kW is larger than 393 kW, therefore a standby gen set of at least 408 kW is recommended.