# Power Distribution Units (PDUs)

PDUs with an isolation transformer create a separately derived neutral for downstream loads although this may not be necessary for 3-phase loads or for systems in which the load utilization voltage is created at the UPS.

PDUs with transformers convert the output voltage of the UPS system to the utilization voltage of the critical loads as needed.

The PDU should have output branch circuit panel boards or distribution circuit breakers that serve the downstream critical loads or subpanel boards serving downstream critical loads.

If the PDU has an isolation transformer, its inrush characteristics should be coordinated with the upstream UPS peak load tolerances for normal, failure, and maintenance modes of operation. Low inrush transformers may also be employed depending on the UPS system’s design.

Where PDUs are expected to run close to their rated loads or one or more loads will generate large harmonic currents, a K-factor transformer might be considered.

Harmonic currents can be created by the ITE (e.g., switched mode power supplies [SMPS]), but they can also be created by fans or drives that are connected to the PDU critical bus.

High harmonic currents, especially those caused by single-phase power supplies in the ITE that create triplen harmonics (odd multiples of the 3rd harmonic, such as 3rd, 9th, 15th, 21st), can cause PDU output voltage distortion and transformer overheating. This heating reduces the efficiency of the transformer and increases the load on cooling equipment. These problems can be exacerbated when the PDU’s transformer is operated close to its rated capacity.

Transformers are frequently rated to K-9, but they may also be as high as K-13 to K-20. K-factor rated transformers are  larger, more expensive,  and less efficient than non-K-rated transformers, thereby increasing both capital and operating expenses, so they should be deployed judiciously.

For Class F3 and Class F4 facilities where the transformer seldom operates at greater than 40% of its rated load, K-factor rated transformers may not be necessary as harmonics can be tolerated up to a certain level.

- It may have a harmonic-tolerant (or K-rated) transformer.
- It may have a low inrush transformer to prevent unintended upstream circuit breaker trip.

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Revision #1
Created 3 October 2025 12:48:26 by RISA
Updated 3 October 2025 12:49:28 by RISA