White Paper

Equipment Power Requirements Dictate Power Conditioner Size, Type and Capability

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Dictate Power Conditioner Size, Type and Capability

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Medical Equipment OEMs often disregard the electrical power requirements and characteristics of their equipment. Momentary power requirements, at start-up and during operation, are often understated, unstated or overlooked. Compatibility with power conditioning equipment needed to provide the voltage regulation and/or battery backup for optimal, uninterrupted performance is based on accurate load power specifications and data.

For example, the distinct characteristics and differences between ferroresonant transformers and tap switching transformers are particularly significant. These characteristics and differences are equally significant in uninterruptible power systems (UPS). The differences in what the technologies do and how they do it determines what size (kVA) unit is needed for satisfactory results.

Tap Switching Technology is more tolerant of the momentary demands present during equipment startup, often allowing higher startup currents to be handled, without increasing unit capacity. Tap Switching of equipment does not however provide the same level of surge and impulse protection provided by ferroresonant equipment.

Ferroresonant technology provides greater transient protection; however, the price of this increased protection is the larger capacity that may be required to handle the peak current demands of the load. This is true for both Line Conditioner Regulators and Uninterruptible Power Systems.

Voltage disturbances that can damage, disrupt, or interrupt microprocessor-based diagnostic or therapeutic equipment must be prevented from getting through. Ferroresonant technology provides voltage regulation, transient suppression, line isolation, and limited ride through during power outages such that these disturbances are eliminated from the load.

Tap Switching technology provides voltage regulation, however, ride through capability is not available because there is no stored energy to draw from. Static By-Pass capability in non-ferroresonant UPS equipment allows peak demands to be satisfied without increasing equipment capacity.

The price paid for static by-pass capability is the elimination of protection and regulation during the by-pass period. Another factor to consider is the requirement to “cold start” equipment during a power outage if the static by-pass is needed to handle the higher peak current demanded during startup.

Installing a dedicated ac utility input, consisting of line, neutral, and ground conductors appropriately sized for the load, does not provide power quality and line stability. Dedicated lines are misunderstood if they are installed to provide anomaly free, stable power. They do provide an unshared (with other loads) circuit from the Panel to the Load.

A typically overlooked fact is that dedicated lines share panel phase, neutral, and ground buses with the other loads on the Panel. This also means disturbances are shared at the Panel. Disturbances that may have found intermediate loads (places to go) on a circuit now have only one destination – the load.

Electrical requirements and disturbances are bi-directional. Peak demand supported by ferroresonant technology is less visible to the feeder Panel because that peak is supported by the energy storage of the ferroresonant transformer. Without ferroresonant energy storage, momentary peaks are propagated through the electrical system as transients (+/-) that can impact other loads. This is one reason why an accurate load specification, including peak in-rush characteristics, is important in sizing and selecting power quality equipment (PQE).

Power supply type and technologies, and dynamic specifications are extremely important in selecting PQE. When/if PQE suppliers recommend equipment, in a competitive situation, based upon size, without knowledge of the basis for the sizing, possibility is created that the equipment may not function. The reason is that a particular capacity rating using ferroresonant technology differs from tap-switching technology, particularly with plug-in loads of 20 amperes and less (typically plug-ins).

A simple explanation or the difference may be found in current limiting characteristics inherent to ferroresonant technology. This situation has been observed with laboratory analyzers, patient ventilators, ultrasounds, and operating room equipment.

In the past, service engineers could blame equipment problems on the power, just because. Today, due to monitoring equipment capability, power can be recorded and analyzed for an objective comparison with equipment requirements. PQE capability, plus technology, needed to correct line problems can be objectively determined. “Just because” does not fly anymore.

The bottom line is that power conditioning equipment selection is dependent upon accurate and complete equipment load information. Both, normal operating load requirements and start-up requirements must be used in sizing power conditioning equipment. Same size loads can have dramatically different characteristics requiring different sized power conditioning, depending on technology-ferroresonant or tap switching.

One way to determine if a technology will satisfy requirements is to test it under field conditions. In the case of medical equipment, one test that serves multiple purposes is to leave equipment in operation during periodic generator tests. If the equipment successfully rides through the generator test without interruption, your UPS worked.

Ferroresonant technology normally tolerates all line problems, including outages of _ to _ cycle (8 milliseconds) duration because of the energy storage in the shunt inductance and resonant capacitor. One way to look at why and how ferroresonant technology does what it does, is that it is in-line, on-line all the time.

Power conditioning equipment capability must be matched with supported equipment requirements. Equipment requirements must be accurate. When/if equipment requirements are not available; the most appropriate (and least expensive) method of determining the information is by monitoring. Power conditioning is a long-term insurance policy with a small up front price tag. It should be part of the installation planning process.