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Power Bumps And Generator Starts

The data center standby generator start delay programming dilemma

By Michael Fluegeman

The generator start time delay programming adjustment is controversial in the data center industry. The range of opinions can be as wide 0.5 to 30 seconds. The only reason most facility managers would want the start signal sent to the generator in less than 3 seconds would be if the UPS was using something other than conventional batteries for short-term backup (typically 5 to 15 minutes), such as flywheels (typically only 7 to 20 seconds). One concern, as most people are well aware of, is that the majority of utility power bumps last less than 3 seconds. Therefore you can have quite a few unnecessary engine starts with start programming set for less than 3 seconds.

The short power bumps typically result from utility re-closers that automatically open and close quickly in an attempt to “shake loose” a problem on the lines, such as tree branches, animals, etc. Re-closers are often programmed by the utility to open and re-close quickly a couple times, resulting in power bumps of 1 second or less, then to remain open up to about 3 seconds on the third and typically final attempt. The fourth time a re-closer opens it typically stays open for many minutes or longer (awaiting manual intervention).

Another concern is that many times the utility fails, then returns, and almost immediately fails again. A generator start timer (typically located in the ATS or generator switchgear) will typically reset when power returns. For UPS backup energy storage, it typically takes 10 times the time to recharge than the discharge time, so rapid short utility bumps can cumulatively draw down short-term storage (a very real concern for flywheel UPS systems). Multiple 3 to 10 second utility power failures within a short duration can leave a UPS flywheel too depleted to provide ride-through time.

The other extreme, programming generator start time delay of 15 seconds or more following loss of utility power, is driven by opinions among a minority of professionals that excessive generator cold starts prematurely wears them out. I don’t believe there is much supporting evidence here but it is getting quite a bit of discussion at major conferences in recent years.

Most engineers, including myself, recommend programming generator start time delay settings in the 3 to 5 second range. If utility power is down for more than several seconds it will probably be down for several minutes or hours, so you might as well start your engines. If it were my facility, and if it were dependent on lower cost UPS batteries (such as those supporting the vast majority of data centers), my recommendation would be to set the start time at 3 seconds. It’s best not to challenge UPS batteries any longer than necessary and risk the chance of a UPS failure. The longer a data center runs with no cooling waiting for generator power increases the risk of data center overheating

increases. However, starting the generator for every light flicker takes its toll on equipment, reliability, maintenance and environmental emissions.

It gets more complicated when multiple generators are configured to connect in parallel for capacity (the traditional approach, which is usually not the best design for modern data centers). This configuration leaves the data center depending on batteries during the engine start time delay setting as well as the additional time it takes for all engines to start, run up to speed, synchronize and connect to the bus so there is enough generator capacity online to allow restart of some or all of the UPS and cooling equipment. With engine start times set at 3 to 5 seconds, the actual time required for full generator power can be 10 to 15 seconds. Further delaying engine start times can really stress UPS batteries and cooling.