Acceptance Testing Collaboration Leads to Improved Project Delivery

Offsite assembly and testing of mission critical electrical equipment also saves time and money on hyperscale data center projects

By: Eric Nation

Nearly 70 percent of early equipment failures can be traced to design, installation or startup deficiencies. That's why it is so important to protect a data center's investment in new equipment or systems with acceptance testing. A thorough check of electrical power systems and components before energization can uncover and help correct problems that otherwise would lead to project schedule delays or larger, costly issues in the future with impacts to data center downtime and consumer dissatisfaction.

What is acceptance testing and is it necessary?

Acceptance testing is the physical and electrical inspection and testing of newly installed electrical equipment. This involves thorough visual and mechanical inspections using calibrated test instruments to ensure electrical components and completed systems operate as designed. It occurs before the electrical system commissioning and start-up, and before the new equipment is put into operation.

Taking this initial step verifies the manufactured devices are free from defects, operating as designed and intended, and installed correctly as specified. It is important that acceptance testing be performed by a third-party testing firm that is unbiased and independent in their evaluation and findings.

Common issues found with acceptance testing that can be costly after start-up

- Failure of cabling damaged during installation
- Incorrect wiring
- Mechanical operating problems
- Nuisance tripping or breakers tripping outside of manufacturer's curves
- Improper relay settings and programming
- Insulation dielectric systems compromised
- Improper grounding
- Wrong transformer taps / improper ratios for proper voltage
- Instrument transformer and metering circuit ratio and wiring issues
- Surge protection device defects
- Switchgear bus and cable connections not properly assembled
- Bus connections improperly torqued

Acceptance testing avoids unnecessary expenses for data centers

Finding system and component anomalies during acceptance testing, while equipment is still under warranty and in a controlled environment, is critical. Determining and correcting deficiencies prior to startup can save an owner both capital and maintenance expenses by preventing costly outages, equipment repairs, and potential safety issues.

Hyperscale data centers require critical timing and expert testing

The hyperscale data center market continues to grow and with the amount of digital information being generated, there's no end in sight. With this growth comes a need for new data centers and/or expansion of existing facilities at a much greater rate to keep up with digital demand. The increased demand for storage of data drives larger and more complex power system requirements to handle the loading for not only the servers storing the data but also the thermal systems required to cool the data center equipment.

Traditionally, acceptance testing of the critical power distribution infrastructure for these types of facilities would have been performed fully at the data center. The testing agency would work alongside the electrical contractor during or in many cases after installation to complete all acceptance testing activities.

With the increased demand and the need to bring these data centers on-line faster, that model has evolved. Collaboration between equipment providers, installers and the testing agency has improved and enabled off-site testing that shortens the overall construction schedule for these projects. It is important to note however that the quality assurance, testing and commissioning aspects of the project must always remain the goal without compromises being made.

Shift in use of integrators creates an opportunity for testing to begin off-site

Off-site acceptance testing at an integrator's facility or an equipment provider is becoming more common and offers notable efficiencies. Collaboration with a system integrator at their location when the equipment is being built allows the integrator and electrical contractor to follow parallel paths with regard to all data center assets. The electrical contractor can be installing system components while the integrator is assembling the remaining portions of the power system distribution equipment. These components can be tested as

they are connected offsite, reducing time on-site by upward of 40%. This time savings provides an improvement to the overall construction schedule that benefits all parties involved.

Acceptance testing is best performed by the same independent firm working with both the integrator at their location as well as with the electrical contractor during installation on-site. Keeping a consistent partner makes for smoother transitions, increased efficiencies, standard processes and procedures, communication improvements, etc.

While integrators are providing a customized solution involving numerous different OEM components, the testing agency conducting the acceptance testing needs to be familiar with a wide range of manufacturers' equipment. Utilizing qualified technicians who can implement industry recognized testing methods and procedures will help ensure the quality and consistency of testing both at the data center and off-site.

Equipment tested at the integrator site can include skid mounted systems in outdoor enclosures. Each skid includes medium and low voltage equipment such as circuit breakers, trip units, protective relays, wiring, metering, instrument transformers, panelboards, batteries, etc. They also include their own system for power, lighting and HVAC controls.

The electrical contractor can be wiring the loads at the data center and be ready and waiting for the skids of low and medium voltage switchboard and/or switchgear assemblies to arrive. Testing at the data center includes electrical contractor installed equipment fed from the skids, such as busways, circuit breakers, bus plugs, disconnects, grounding, etc. Many times, tests are conducted concurrently at the site while integrator testing is under way. Testing on equipment from the skids that could not be performed at the integrator includes items such as interconnect wiring, grounding and complete system functional testing. These are completed at the data center to close out the onsite testing.

Find the right acceptance testing partner

Due to the importance of conducting proper acceptance testing, selecting a good acceptance testing firm whose experience and knowledge you can trust is crucial.

Consider the following criteria when selecting a suitable acceptance testing firm:

- Independence from the manufacturer to ensure an unbiased, thorough assessment of equipment
- Ability to accurately interpret test results to determine best course of action for each unique customer environment
- Previous work experience on similar projects to determine the value added
- Technician certification and experience to ensure thorough testing by a trained professional
- Size of the firm and ability to staff with qualified professionals to deliver the project on time and within budget
- Awareness of all safety standards to ensure safe work practices and require less supervision
- Test equipment calibration program to ensure accurate test results. You cannot properly assess equipment if you are unable to confirm the test equipment you are using is in proper working order.
- Affiliations with reputable organizations such as NETA, NICET, NFPA, etc. to confirm knowledge of testing standards
- Ability to perform new and innovative testing services to ensure a complete evaluation and comprehensive recommendations
- Ability for the same company to be utilized at the integrator as well as the physical site.
- Strong financial standing and ability to be a long-term provider

The above criteria are important when identifying an independent testing company that can become a trusted advisor to help to extend system life, reduce downtime and improve the safety surrounding your equipment.

Conclusion

Electrical systems are among a data center's most critical assets and can have a big impact on the bottom line. Their production and management cost is high, and failures almost always lead to catastrophic losses. Hyperscale data centers are experiencing substantial growth, requiring collaboration and an integrated project delivery to improve consistency and shorten the overall construction schedule. Investing in thorough acceptance testing – utilizing a trusted, independent testing firm – can save your organization money during construction and throughout the equipment life cycle.

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Source: 7x24 Exchange International
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