



Liebert Data Center Environment Assessment (LDCEA) Scope of Works - PREFERRED

FACILITY POWER ASSESSMENT

The Facility Power assessment determines if the power system is adequate for the data center both now and in the future. It evaluates the integrity of a facility's power system to maximize availability of the mission-critical infrastructure. Emerson will conduct an on-site inspection of the data center and perform the following activities:

- Equipment Inventory
- Electrical Audit
- One line diagram verification and update
- Maintenance Record Review

Equipment Inventory

- Check inventory and record the electrical equipment powering the main infrastructure of the 24/7 critical operation. This includes the following equipment:
 - Transformer
 - Switchgear
 - ATS
 - UPS
 - Batteries
 - DC Power
 - Generators
 - Power Distribution
 - Breakers/Fused Disconnects
- Identify these equipment by the designation on the device or the one-line and note the discrepancies.
- Perform infrared scan and do visual inspection of each piece of equipment listed in the inventory and note any electrical installation and/or code violations.
- Record equipment type, manufacturer, voltage rating, current rating and model number.
- Document the settings on all circuit breakers, if readily available and accessible.
- Verify existence of proper electrical safety labeling on critical electrical equipment.
- Document the frequency of load bank testing on the UPS, batteries and generators.

Electrical Audit

- Perform a single point of failure analysis, which will identify critical failure points in the system.
- Determine current being drawn through all UPS equipment and breakers from the incoming supply to the UPS distribution (This information will be determined by reading existing meters, if available. Otherwise, a clamp-on amp meter will be used).

- Perform analysis comparing measured current and power rating for all breakers as well as any imbalances; note any areas of concern.
- Determine kW and KVA loading on each UPS and compare to rating of UPS.
- Evaluate the rated capacity of each generator versus UPS rated capacity ratings and note if generator full load rating is <150% of UPS rating.
- Perform a harmonic snapshot at the main breaker switchgear as well as the load side of each UPS and note any anomalies.
- Determine whether breakers are labeled down to the UPS distribution.
- Determine load per rack. Often times this is not viable without risking shutting down the connected server loads. If this risk exists, these measurements will not be taken; rather, the FLA rating of the equipment within the racks will be documented and added to the analysis.

One-line diagram verification and update

- Verification
 - Verify existence of as built drawings and that they are adequately available
 - Verify process is in place that ensures these diagrams are maintained in a current condition
 - Evaluate design redundancy of critical systems (N, N+1, N+2...) and whether all critical equipment can be maintained without a shutdown
- Update
 - Review/update customer-provided single line drawings and/or create new single line drawings related to all distribution panels
 - Inventory equipment
 - Confirm loads connected to emergency/standby feeders
 - Verify potential single points of failure
 - Identify any system redundancy
 - Provide copy of one-line electrical diagram
 - Post as-built drawing at each facility

Maintenance Record Review

- Customer shall provide all existing maintenance records for the previous three years on the electrical equipment identified in the inventory
- Review and record the current maintenance cycle on the equipment identified during the inventory
- Review existing maintenance records, verify existence of test reports, and document testing frequency
- Compare these to industry international standards

THERMAL ASSESSMENT

This thermal assessment provides a baseline of how a data center is operating with regards to heat rejection from sensitive heat generating computer equipment. Emerson will conduct an on-site inspection of the data center and perform the following activities:

- Compare equipment heat load vs. available cooling capacity
- Perform on-site inspection of the data center concentrating on information relating to the computer room cooling system, computer servers, raised floor and computer room power equipment
- Examine the under and above floor volumes to identify obstructions that interfere with the cooling of critical heat sensitive computer equipment
- Measure temperature at each rack along with air flow rates at each cable opening and perforated tile (if accessible)
- Provide 'as is' floor plan showing the location of existing equipment, server racks, airflow obstructions, etc...
- Provide an under floor CFD model of the data center showing air flow characteristics of the space
- Calculate the velocity, pressure and airflow rates of the data center
- Present the under floor CFD results of the 'as is' data center configuration
- Identify hot spots location, its possible causes and make recommendations on how to eliminate them
- Inventory of all air and rack equipment
- On-site presentation of results

FINDINGS and RECOMMENDATION REPORT

The Data Center Environment Assessment will provide a status report on the current state of customer's data center.

- Provide written report of findings and observations
- Document and report identified problems found at the data center site
- Provide recommendation on the optimum and most effective floor plan for future expansion of the data center
- Provide recommendations on improving cooling of the data center room based upon current trends on computer room design
- Cooling equipment analysis report