A White Paper from the Experts in Business-Critical Continuity™

Data Center Assessment Helps Keep Critical Equipment Operational

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Executive Summary

The IT infrastructure within many companies has evolved into an interdependent, business-critical network that relies on the data center as its hub. Growing business demands are forcing data center managers to support more equipment, resulting in increased heat loads. Corporate attention on the data center is also driving the need for greater flexibility balanced against high availability and the lowest total cost of ownership.

Introduction

Availability of mission critical IT equipment is influenced by many factors, including design issues and operation and maintenance practices. The infrastructure's design was probably appropriate when the equipment was originally installed, but changing needs and technology shifts may have made the system less than optimal. For example, new high-performance equipment, such as dual-processor servers and high-speed communications switches, are raising rack densities well above 30 kW.

Other factors can influence system performance, such as moving or changing computer equipment without considering the underlying support strategies. Obstructions such as abandoned cabling can reduce air flow for cooling systems, as shown in Figure 1. Even new facilities can experience nagging cooling problems that create continuity risks or interfere with facility performance.

Figure 1. Disorganized cable management under floor tiles can impede cooling to equipment.

Conducting a critical assessment of existing cooling strategies can enhance the data center's operational performance and expose vulnerabilities within existing cooling or electrical systems. Cooling modules have moving parts that eventually wear out and transitioning from a break/fix mindset to a more proactive approach — or instituting a preventive maintenance program — will help ensure that components last longer and perform within their designated operating parameters.

Taking a proactive approach will also help prevent costly downtime of business critical equipment. According to a 2006 Emerson business continuity survey, 38 percent of large businesses estimate that a full business day of downtime could cost them more than $500,000 in lost revenue.

A data center assessment will help identify, evaluate and resolve cooling vulnerabilities that could adversely affect the data center's operational performance or energy efficiency. The assessment will determine whether heat is being removed from sensitive heat-generating computer equipment and examine the capacity of existing electrical systems and the quality of power provided to the data center.

Thermal Assessment

Taking temperature readings at critical points is the first step in identifying hot spots and resolving problems that could result in equipment degradation. These readings will determine whether heat is being successfully removed from sensitive heat-generating computer equipment, including blade servers.

The latest generation of blade servers pushes power and heat levels even higher than in the past. A single rack loaded with four fully configured IBM BladeCenter™ H Chassis — each drawing 5.8 kW — creates a load of almost 24 kW in an enclosure that occupies just seven square feet of data

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center floor space. This contrasts sharply with the state of the industry in 2000 when the average rack consumed just 1 kW of power.

Communications equipment is also pushing heat to new levels. Depending on its power supply configuration, the Cisco CRS-1 router, for example, creates a heat load of 15 to 16.6 kW per rack.

Annual infrared inspections are recommended by ANSI/NFPA 70B Electrical Equipment Maintenance Standard and most insurance companies and are performed while equipment is energized and operating so there is no disruption of operations.

Components typically tested during an infrared inspection include transformers, capacitor banks, switches, fuses, circuit breakers, bus bars, cable splicing and motors. UPS equipment, batteries, cooling, generation and power conditioning equipment, switchgear and DC power equipment should also be infrared inspected.

Findings from infrared inspections are carefully documented with high-resolution color digitized photographs and thermograms, along with recommendations for corrections or repairs.

Introduction of high-density servers and/or data center consolidation can create an unbalance between the equipment load and unit air capacity. Taking airflow measurements will help identify raised floor air patterns, under-floor obstructions and airflow through computer racks. An assessment of the data center's vapor barrier will also be conducted to ensure outside areas are not influencing the data center. Infiltration of outside air can increase computer room air conditioning (CRAC) unit operating costs through unnecessary humidification or dehumidification.

In addition, the assessment will also compare the equipment load with unit air capability. CRAC unit performance is also evaluated to ensure the unit is being maintained, performing properly and is still reliable. Computational Fluid Dynamics (CFD) combined with air flow measurements is the best tool for demonstrating and analyzing air flow characteristics within the data center, as illustrated by the air flow patterns in Figure 2. CFD is a simulation tool designed to create a better understanding of why hot spots are present and illustrate the effects of under-floor obstructions on air flow. The tool visually depicts heat-related risks in the data center that can interfere with facility performance.

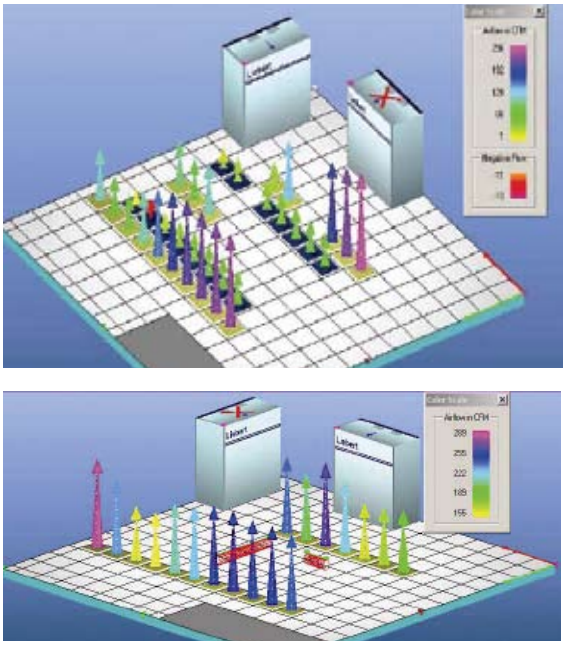

Figure 2. Computational Fluid Dynamics is a simulation tool designed to demonstrate the air flow characteristics of a raised floor. CFD provides a better understanding of why hot spots are present and the effects of under floor obstructions on air flow.

Once temperature and air flow problems are identified, data center managers can work toward eliminating hot spots by adjusting air flow patterns and hot aisle/cold aisle configurations. Using supplemental cooling may also be necessary.

Electrical Assessment

The electrical assessment is a critical part of the overall data center assessment since businesses have a 30 percent probability of experiencing power quality problems if their facility is more than five years old and has undergone significant changes. Evaluating the electrical system onsite, as seen in Figure 3, will help determine whether it is adequate for the data center now and in the future. Analyzing the integrity of the facility's power system will also help maximize availability of the mission-critical infrastructure.

Figure 3. An electrical assessment can evaluate the integrity of a facility's power system to maximize availability of mission-critical infrastructure.

The following actions are included in an electrical assessment.

- Conduct a single point of failure analysis to identify critical failure points in the system.
- Identify capacity of all switchgear from the main PDU to mission-critical PDUs (voltage, amperage, phase).
- Determine the current that is drawn through all UPS equipment and breakers from the main PDU to mission-critical PDUs. The current will be determined by reading exiting meters, if available, or using a clamp-on amp meter.
- Compare the measured current and power-rating for all breakers from the main PDU to mission-critical PDUs. Any imbalances will be pinpointed and areas of concern noted.
- Determine the kW and KVA leading on each UPS and compare to the UPS rating.
- Evaluate the rated capacity of each generator vs. UPS capacity ratings. The generator full load rating should be less than 150 percent of the UPS rating.
- Perform a harmonic snapshot at the main breaker switchgear and the load side of each UPS to identify any anomalies.
- Confirm that breakers are labeled down to the PDU.
- Determine the load per rack and/or PDU. This measurement may not be possible without risking a shut down of the connected server loads. If this risk exists, the measurement will not be taken. Instead, the Full Load Amperage (FLA) rating of equipment within the racks will be documented and added to the analysis.

It is important to note that power usage measurements taken during the electrical assessment are valid only for the instant the measurement is taken. IT equipment may be more fully utilized at other times, which would affect the measurements.

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A critical assessment of cooling strategies — combined with a thorough preventive maintenance program — can protect the data center investment and increase data center availability, performance and energy efficiency.

Data Center Assessment Reporting

At the conclusion of the data center assessment, a comprehensive report will be provided that includes single points of failure and any potential power issues surrounding harmonic distortion, voltage regulation and load imbalance. A detailed facility floor plan will show the location of existing equipment server racks and airflow obstructions, with a CFD report showing airflow characteristics of the space and CRAC unit performance.

The final report will include specific recommendations for improvement, which can be used to eliminate hot spots, advance air flow, improve vapor barrier, and reduce heat within the data center. Recommendations for improvement will help maximize system availability now and in the years ahead.

Conclusion

Data centers are dynamic environments where heat loads are constantly increasing and challenging cooling strategies. Ongoing technology shifts and blade servers create extreme heat densities and hot spots that must be detected and corrected before they result in component failure and downtime.

A critical assessment of cooling strategies — combined with a thorough preventive maintenance program — can protect the data center investment and increase data center availability, performance and energy efficiency. These tactics can also provide the peace of mind that comes with knowing that data center equipment will provide the high level of availability critical to business continuity.

For more information about conducting a critical assessment of cooling strategies or implementing a preventive maintenance program, contact an authorized service representative or visit Liebert.com.

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