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DESIGN PLUS

The data center industry continues to evolve in response to new products and requirements due in part to a greater focus on improving economic and energy efficiencies. Amidst all the innovation and new technology, an owner still must maintain and operate a reliable data center with high availability for less cost and energy. New and old equipment must be maintained and properly controlled in order to meet these objectives. In this issue of designPLUS, we scratch the surface on the relatively new concept for containerized IT, power and cooling that offer many advantages but still require ongoing maintenance and support. We also discuss how not all maintainable systems are created equal; food for thought for owners and co-location customers alike. Finally, we make sense of the revised ASHRAE humidity thresholds and tackle the mundane but important topic of basic facility housekeeping. We hope you find this issue of designPLUS helpful and informative.

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PROFESSIONAL ENGINEERING SERVICES FOR *MISSION CRITICAL* INDUSTRIES

Containerized Data Center

By Marc A. Soucy

One of the hot topics in the data center community is the idea of a containerized data center. The ability to 'plug-and-play' modules into your facility to accommodate the ever changing IT need is very attractive. Just think, in 2-3 months you can have additional data center capacity churning away. That would have traditionally taken 18 months to design and implement. One thing to remember is that during this 18 month process there was a lot of discussion about the redundancy required to keep the newly designed data center up and running. Now this 18 month process has been cut down to 2-3 months, but that does not mean that the reliability should be sacrificed because the turnaround time is so short. It only means that facilities managers and engineers need to start the same discussions of redundancy much earlier to support the new containerized load. The specifications for the containerized data center must be in line with those that would be proposed for a traditional brick and mortar design. So the questions of redundancy, reliability, and maintainability of the onboard UPS, generator and cooling options must be answered as they now pertain to the container. A close look at all systems within the container is required, just as you would for your internal UPS, generator, or cooling plants. If possible, detailed specifications should be developed or a thorough and technical review of the containerized product should be completed to ensure you are getting exactly what is needed for your facility. A lot of people put their faith in the module supplier, but keep in mind this idea of modularity was built of the premise of quick implementation and not necessarily on required redundancy. The bottom line is that reliability and availability should not be sacrificed or overshadowed by the attractiveness of a short lead time.

Another thing to consider, because the containerized data center offers such flexibility and scalability, is the amount of time to upgrade your mechanical and electrical infrastructure to keep up with the deployment of the data center modules. A 2-3 month turnaround time for a module may be proceeded by a 12 month period to upgrade your electrical and mechanical infrastructure to support your expansion with proper redundancy. Having a container show up in two months is great for IT capacity but what does that mean to your facility. The idea of a modular data center does make a lot of sense, in some instances, as long as you know exactly what you are getting in terms of redundancy and how it will interface with your existing infrastructure.

Humidity Control

By Edward L. Gutowski, P.E., LEED AP

Energy savings continues to be a dominant theme in data centers and humidity control plays a part in reducing overall energy consumption. Energy is consumed during dehumidification and humidification; therefore, the longer a facility can delay either of these two, the greater the energy savings. In most cases, dehumidification is the natural result of mechanical cooling with the rare exception of lightly loaded rooms with moist air but not much sensible heat. In this case, energy is used to warm the room back up after cooling is used to dry it out. At the other end, adding humidity to a room has traditionally been accomplished using electric heat to vaporize water into the air. Although there have been advances in humidification using waste heat from the room to evaporate water over a wetted media, this only works if you have a central air handler rather than a traditional Computer Room Air Conditioner (CRAC) which normally uses electric resistance heaters. From an energy conservation standpoint, both humidification and dehumidification hurt facilities Power Utilization Effectiveness (PUE) ratings and should be minimized whenever possible. In this article we will focus on the newest upper and lower humidity boundaries that delay the need for energy related humidity control. These boundaries are the result of an industry consensus for the recommended temperature and humidity setpoints in datacom facilities. The outcome of this research is published in “Thermal Guidelines for Data Processing Environments”, Second Edition, by ASHRAE. The humidity levels referenced are measured at the inlet to the server rack and often differ from CRAC or air handler inlet conditions where the temperatures are higher and the humidity levels are lower. These differences between the rack inlet and the CRAC return air will be even greater where containment is used to prevent mixing supply and exhaust air. By moving humidity and temperature sensors that control the environment closer to the inlet of the rack and away from the CRAC or air handler return air, will allow more accurate control and helps take advantage of the wider humidity boundaries. ASHRAE’s newest upper limit is published as 60% RH and 59°F dewpoint which is an increase from the old limit of 55% RH. For a traditional CRAC, the setpoint is usually available in %RH only; however, for a Building Automation System you will be able to program the upper limit using an “OR” statement to begin dehumidification when either 60% RH OR 59°F dewpoint is exceeded. Waiting until moisture levels climb to these upper limits before dehumidification will save energy. The main purpose of this elevated level is to allow a central cooling plant to operate at a higher temperature leaving water temperature 50°F instead of 45°F which in turn reduces chiller power consumption. And for those who use airside economizers with central air handlers, it allows them to operate for longer periods without mechanical cooling. Care must be taken not to exceed this new upper limit since allowing high humidity levels to linger may impact the rate of corrosion in the datacom environment. Conductive anodic filament growth, deliquesce of hydroscopic salts or condensation can occur on computer components if the humidity level is too high.

The lower limits of acceptable humidity are currently an issue of debate within the industry. A minimum level of humidification is maintained in an effort to minimize Electro Static Discharge (ESD) to the computer components. By a consensus of the participating industry manufacturers and design professionals, ASHRAE republished the “Thermal Guidelines for Data Processing Environments” in 2008 and lowered the recommended level of humidity from 40% RH down to 42°F dewpoint. Although some in the industry believe more reduction is possible, this incremental reduction represents a modest shift towards reducing humidification needs in the Data Center without a risk to reliability. Most CRACs, particularly legacy equipment, do not offer a dewpoint setting; only RH setpoint is available making implementation difficult without control enhancements. However, most Building Automation System (BAS) controllers can translate from RH to a dewpoint if the sensor cannot report dewpoint directly. Humidity control is best accomplished from a central location like a BAS rather than locally at a CRAC unit.

If your facility is not ready to completely embrace the new humidity boundaries, then perhaps the best approach would be to gradually move towards these limits a step at a time. Select a midpoint between the old 40% to 55% RH standard and the new levels called out above. Try operation in this mode for a full year and seek feedback from your IT and Facilities people to observe and comment over this period. Track as much data as you can about the humidity and equipment failure rate. At the end of the trial period review the data as well as your people's feedback to help you make a decision about going further towards the full outer limits of the new range.

Designing for Maintainability – That You Can Live With

By Brian T. Soucy, P.E.

When designing a data center it is important to consider system maintenance. As a design firm, we always consider maintainability in our designs and a given project's requirements and budget will drive how maintainable a system design can be. The challenge lies in aligning business requirements with available capital. Over the past year we've had several projects that placed strong emphasis on overall system maintenance. In one case the requirements were driven by facilities, the group responsible for maintenance and overall system availability. In another case the requirements were driven by IT, or the end-users, where they had concerns of specific system configurations during maintenance activities.

A certain level of maintainability is achieved with a redundant design. If designed properly, a redundant component can be isolated for maintenance. This could be of little consequence with, for example, redundant chilled water pumps. However, a greater risk is present when maintaining a redundant UPS system. During this type of maintenance the UPS no longer provides protection from power anomalies or outages. The question is, what will the system configuration be during this maintenance activity? For a system, the designer has as many options as an owner has preferences. Some owners have chosen to completely shut down a side relying on IT equipments' dual cords or transfer switches to transfer loads across to the other UPS. Others favor maintenance ties to manually transfer loads to the other UPS. And still others prefer to power a bypass circuit from generator power or even utility power so not all loads are relying on a single UPS system during maintenance of a redundant UPS. The IT group we recently worked with always wanted two independent UPS systems providing power even when a UPS is being maintained. Obviously, this requirement had a significant impact to the overall system design (namely installation of a third UPS) and capital expense.

In all cases described above, the UPS was maintainable but with varying degrees of risk to the downstream load. The question isn't whether the system is maintainable but what is an acceptable maintenance configuration and level of increased risk.

This line of thinking also extends to other components. Even though a system may be designed with redundant power distribution pathways, isolation of a single circuit or switchboard may require shutting down a significant portion of the redundant distribution. This is not uncommon and often means deferred maintenance even though this high level of risk could have been addressed during the design phase.

A final consideration is the facility's safety protocol. Systems designed with the assumption that live work is permissible may not be as maintainable with broader compliance of NFPA 70E and arc flash hazard safety procedures.

A maintainable system goes beyond including maintenance bypasses and redundant components. It requires a thoughtful approach in design and consideration of how the system will be operated and maintained in a safe manner with an acceptable amount of risk to the critical load during maintenance activities.

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Removal of Abandoned Systems

Many times while performing surveys of existing buildings, we find abandoned systems in the ceiling spaces, utility rooms/closets, etc. Our discovery can range from temporary electrical wiring left over from new construction to mechanical equipment, piping or ductwork. This poses a hindrance for both the owner and maintenance personnel and to those who will be involved in future renovation projects. Often these abandoned systems could compromise fire-proof ratings and operation of mechanical systems among other things. The removal of these systems or components should be completed when they no longer serve any useful function. The importance of this issue is recognized in the National Electric Code (NFPA 70) Art. 590, Temporary Installations. Economically, it is more cost effective to remove them when abandoned rather than some time period in the future. The removal of abandoned systems, or parts thereof, is just as important as the installation of new work and attention should be focused on their removal as soon as the opportunity presents itself.

Policy

designPLUS Newsletter is published to keep the readers current with the latest trends in mission critical systems.

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