

Element D Services

Heating, Ventilating, and Air
Conditioning

D304106 Data Center Air Handling Distribution

PART 1 - GENERAL

1.01 OVERVIEW

- A. This section supplements Design Guideline Element D3041 on air handling distribution with specific criteria for projects involving design of a Data Center spaces
- B. Refer to Design Guideline Element D3041 for the following:
 - 1. General design criteria related to outside air pre-treatment units, terminal units, air devices, motor requirement and ductwork.
 - 2. Special Contract Document Requirements and products applicable to the Project.
- C. HVAC requirements for the Data Center vary with the capacity and type of the electronic equipment for example requirements will vary depending on whether processors are cooled with water or cooled racks or combination with conventional computer room air conditioning (CRAC) units. The A/E must obtain Information pertaining to indoor design conditions, internal heat gain, and shielding against the radio frequency (RF) from the equipment manufacturer during the project Design Development phase.

PART 2 - DESIGN CRITERIA

2.01 GENERAL

- A. The Data Center will be served by multiple power distribution paths, with one path active and a single, active path for cooling distribution. Equipment components serving the Data Center must have (N+1) redundancy and must be separate from the primary utility infrastructure equipment for the building. The A/E shall provide recommendations to the Owner on levels of redundancy for infrastructure components as described within this Design Guideline Element.
- B. Any office / administrative space shall be served by a separate air handling system. Refer to Design Guideline Element D3041.
- C. All HVAC equipment and components necessary to maintain temperature and humidity requirements for the Data Center shall be connected to emergency power. Refer also to Section D3000 for additional emergency power requirements.
- D. Design Data Center HVAC systems consistent with ASHRAE Design Guidelines for Data Centers and ASHRAE Advanced Design Guideline for Data Centers (to be released in January 2009).

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2.02 INDOOR DESIGN CONDITIONS

- A. Space temperature and humidity conditions for computer equipment and power distribution units (PDU) are within the limits as shown in the following Table unless different temperature and humidity requirements are stipulated by the manufacturer of the electronic computer equipment.

Occupancy	Summer Dry Bulb (°F)	Winter Dry Bulb (°F)	Relative Humidity (%)
Data Center & Telecom Rooms	64 -70	64 -70	30 – 55
Office Areas	74 ± 2	72 ± 2	30 - 60
Electrical and UPS Equipment Rooms	60 - 80	60 - 80	Not Controlled

- B. Evaluate designs for data centers that include underfloor air distribution to bottom of server racks with discharge ducted directly to above ceiling plenum return systems. Evaluate also system designs to include hot aisle/cold aisle with similar underfloor air distribution and above ceiling return similar to above. Intent is to limit the server rack load to the space and increase the space design temperature, while reducing supply airflow and increasing supply/return air temperature differential. Consider CFD modeling to confirm suitable dissipation and collection of server rooms, or perform commissioning in operating system/room to accomplish intended performance.

2.03 INTERNAL LOADS

- A. The mechanical system loads will be based on the following electrical and equipment loading for the various spaces. Note, however, that the internal loads for these spaces must be determined based on actual electrical and process requirements of the lighting and equipment to be installed. Lighting design and respective heat loads to comply with maximum connected power densities as established by ASHRAE 90.1-2007.

Occupancy	Lighting (W/SF)	Equipment (W/SF)
Data Center	1.5	Based on Actual
Office Areas	1.1	0.75
Equipment Rooms	1.5	Base on Actual
Storage Rooms	0.8	0.5

2.04 DATA CENTER AIR HANDLING SYSTEM

- A. The Data Center will be conditioned by CRAC units (with down-flow air delivery for under floor air distribution. Each CRAC Unit will be provided with an infrared humidifier to maintain indoor space conditions. Design the CRAC layout and capacity for a level of redundancy such that the Data Center air conditioning requirements are not compromised should any one unit fail to operate or be de-energized due to maintenance needs. If a particular CRAC unit fails to operate, the adjacent unit must be able to accommodate the needed cooling capacity.

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- B. Evaluate humidification/dehumidification requirements of data centers HVAC system. Where dehumidification is of main concern, conditioned outside air shall be provided from an air handling pretreatment unit equipped with a desiccant wheel or liquid desiccant system capable of reducing the dew point temperature and also reduce reheating requirements of the outside air being supplied to the Data Center envelope. Where used, desiccant dehumidification shall use recovered energy for activation of desiccant media. Confirm humidification/dehumidification concepts as acceptable with Owner prior to design of system.
- C. A dedicated HVAC system must meet temperature, humidity and air distribution requirements as required by the manufacturer UPS.
- D. Provide a pressure relief path from the Data Center envelope to relieve the air from the Data Center during a discharge of FE-25 system. The CRAC Units are to be interlocked to shut down when the fire suppression system is initiated.
- E. The raised floor framing shall be seal sealed around the perimeter minimize the leakage of supply from the floor plenum space.
- F. The A/E shall discuss optimum placement of CRAC units during Design Development in accordance with proposed equipment rack locations. All CRAC Units shall be located at as close to the perimeter wall as reasonably achievable. The CRAC Units are to be designed to permit complete maintenance access for repair and replacement from all three sides. Clearance requirements as recommended by the manufacture of the CRAC Units are to be included in the location criteria of electronic equipment.
- G. CRAC Units serving the Data Center will have the following minimum components:
 - 1. Packaged, chilled water cooling coil, factory assembled, pre-wired and pre piped units, consisting of cabinet, fans, filters, humidifier, controls. Assemble unit for down-flow air delivery in a draw-through configuration.
 - 2. MERV 9 or DSP 40 percent efficient pre-filters; 2 inch thick, replaceable, dry type as rated on ASHRAE Standard 52.2.
 - 3. Chilled water cooling coil, maximum 6 row, 9 fins per inch.
 - a. Each coil to be piped for counter flow operation.
 - 4. All coils shall have copper tubes with aluminum fins.
 - 5. Double inlet centrifugal fan.
 - 6. Stainless steel drain pan.
 - 7. Infrared humidifier consisting of high intensity quartz lamps mounted above stainless steel evaporator pan.

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8. NEMA 250; Type 2 control cabinet enclosure, UL listed, with combination magnetic starters with overload relays, circuit breakers, and fusible control circuit transformer. If fan motors are equal to or greater than nominal 7.5 horsepower then use VFD option.
 9. Microprocessor Control System.
 10. Communications serial interface for continuous remote monitoring and alarming through the building automation system and critical load monitoring software package, as referenced under the Division 26 Specifications.
 11. If VAV option is used then isolation dampers located at the discharge or return air plenum to preclude reverse flow of supply air through the non-operating CRAC units.
- H. The air supply outlets shall be located at the floor level with the air directed toward the cabinet inlets. Use ASHRAE publication, "Thermal Guidelines for Data Processing Environments", dated January, 2004. In the following Figure 1, racks within the Data Center are arranged such that there are cold aisles and hot aisles.
- a. The cold aisle consists of perforated floor tiles separating two rows of racks. The chilled air from the perforated floor tiles is exhausted from the tiles and is drawn into the fronts of the racks. The inlets of each rack (front of each rack) face the cold aisle.
 - b. This arrangement allows the hot air exhausting the rear of the racks to return to the CRAC units; thus, minimizing hot exhaust air from the rack circulating back into the inlets of the racks. CRAC units are placed at the end of the hot aisles to facilitate the return of the hot air to the CRAC unit and maximize static pressure to the cold aisle.

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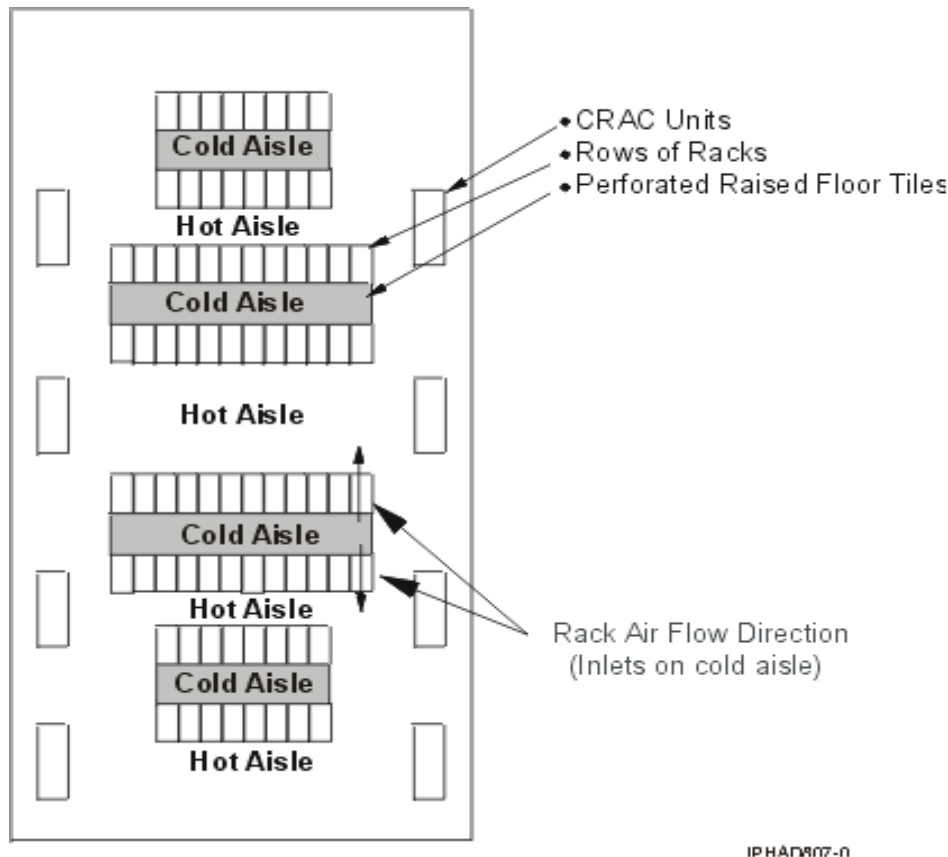


Figure 1: Hot aisle and cold aisle arrangement

- I. A metal pan should be provided under the chilled water and CRAC condensate piping rack below the raised access floor to contain any water leaks. The galvanized metal pan will be welded and caulked to be watertight. The pan shall be designed to avoid restricting airflow from the CRAC units to the perforated floor register tiles that allow air to cool the equipment loads within the Data Center. In general, design the chilled water and condensate drain piping layout such that air circulation to perforated floor diffusers is not hindered.
- J. Provide a leak detection system below the raised access floor with an LED panel and a serial interface for continuous monitoring. The leak detection system will illustrate the exact location of the leak under the floor as identified via a floor plan; and not only to identify leaks based on distance. The leak detection system as well as all other monitored data shall be capable of being locally and remotely monitored.

2.05 TERMINAL UNITS

- A. Distribution to corridors, electrical rooms, and equipment rooms shall be served by single duct variable volume terminal units.

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- B. The criteria for terminal units serving office areas are referenced in Design Guideline Element D3041.

2.06 DATA CENTER AIR DEVICES

- A. Interior and general supply air ceiling devices shall be perforated registers in the raised floor. If VAV option is used as the floor plenum supply air distribution, then the air device is a perforated floor diffuser grille with an integral electric actuated air valve. Refer to Design Guideline Element D3401 for type of supply grilles to use for offices.
- B. Size the diffuser on delivery of design air flow rate within the established noise criteria limit.

2.07 DUCTWORK

- A. Refer to Design Guideline Element D3041 Air Handling Distribution.

PART 3 - SPECIAL CONTRACT DOCUMENT REQUIREMENTS

3.01 GENERAL

- A. Not applicable.

PART 4 - PRODUCTS

4.01 GENERAL

- A. Refer to Owner's Master Construction Specifications. These are available on the Owner's Design Guidelines website: <http://www2.mdanderson.org/depts/cpm/standards/specs.html>

PART 5 - DOCUMENT REVISION HISTORY

Issue	Date	Revision Description	Reviser
	05-03-07	Initial Adoption of Element	
Rev. 1	12-09-08	Included sustainability requirements throughout document based upon TGCE's evaluation. (Paragraphs 2.01 D; 2.01 E; 2.02 B; 2.03 A 7 2.03 B)	JCD
Rev. 2	09-16-10	1.01B. added motor requirement, 2.01. C. deleted minimum 7.5 hp requirement for VFD.	PN
Rev. 3			

END OF ELEMENT D304106