Data Center Enclosures – “Best Practices”

Maximize the Efficiency of the Enclosure within a Data Center
Overview

Things to ask before selecting Enclosures:

Primary Use – Severs or Patching, or both determines size.

RMU Vertical space requirements.

Estimated Power usage; PDU mounting requirements, size.

Ease of Use; rail adjustability, Door & side panel access/removal.

Cable Management; internal & external, cable entrances.

Grounding Locations.

Cooling Considerations; Airflow paths internal & external, Hot & Cold Air separation, Aisle Containment options, Side to Side Air Flow equipment, etc.
For applications that require cabling in the front as well as servers, 30” width enclosures are recommended.

Server and Network

- 30” Wide

- 41 RMU - 78.00"H x 30.00"W x 42.00"D 80.00"H
- 44 RMU - 84.00"H x 30.00"W x 42.00"D 86.00"H

Extra Width provides more Cable Management options.

Server only

- 24” Wide

- 24 RMU - 48.00"H x 24.00"W x 42.00"D 50.00"H
- 41 RMU - 78.00"H x 24.00"W x 42.00"D 80.00"H
- 44 RMU - 84.00"H x 24.00"W x 42.00"D 86.00"H

Applications that are ‘server only’ the 24” wide enclosure is recommended.

48” Deep enclosures becoming a trend for high density applications with 4 or more PDUs.
Power Considerations:

- **Type of PDU**
  - Unmonitored
  - Monitored
    - IP addressable
    - Remote shutdown
    - Event notification

- **Type of power**
  - 110 or 220 VAC
  - 3 phase – Most cost effective

- **Mounting options**
  - Mounting bracket
    - Button mount
    - Snap-fit mount

- **Physical Space Requirements**
Cable Management Considerations:
Outside the Enclosure:
Overhead Cable Management

Enclosures Can Provide Mounting Surfaces:

- Ladder Rack Adapter Brackets
- Overhead Cable Troughs
Cable Management Considerations: Inside the Enclosure

Vertical Cable Troughs

Shifted Rail Kits – shown in 30”W Enc.
Gives greater bundle size on same side
Cable Management Considerations: Inside the Enclosure

- Enclosure Cross Section
- Vertical Cable Trough & Lacing Bar Mounting options
- Enclosure Rear Corner Cross Section
- PDU & Cable Trough Combinations
**Grounding protection for your equipment:**

- Isolated vertical copper bus bars to fully ground the equipment
- Fully ground the enclosure to a common ground

Grounding the cabinet “does not” ground the equipment.
Data Center Formulas

Energy Calculations
- Calculating Watts
  \[ \text{Watts} = \text{volts} \times \text{Amps} \]
- Calculating BTU’s
  \[ \text{BTU} = \text{Watts} \times 3.4129 \]

Datacenter Cooling Calculations
- Tonnage of CRAC needed
  \[ 1 \text{ Ton} = \frac{\text{BTU}}{12,000} \]

Calculating CFM of cooling
- \[ \text{CFM} = \frac{\text{Watts}}{0.316 \times \Delta T^\circ} \]

Datacenter Efficiency Calculations
- Calculating PUE/COE
  \[ \text{PUE/COE} = \frac{\text{Total Load}}{\text{IT Load}} \]
- Calculating DCiE
  \[ \text{DCiE} = \frac{1}{\text{PUE}} = \frac{\text{IT Load}}{\text{Total Load}} \times 100\% \]
Data Center - Best Practices, Infrastructure
Hot Aisle / Cold Aisle

© 2002-2006 The Uptime Institute, Inc.®
Data Center Efficiency Metrics

**COE (Coefficient of Efficiency)**
- Standardized by the Uptime Institute and the EPA.

**PUE (Power Usage Efficiency)**
- Standardized by “The Green Grid”.

**COE/PUE Explained**
- The basic definition for the COE/PUE is a metric used to determine the overall efficiency of the datacenter. This value is created by taking the total power necessary to operate a data center divided by its IT load, which is the energy required to operate the equipment (servers, switches etc.).

**Data Center infrastructure Efficiency (DCiE)**
- Metric defined by “The Green Grid” is used to further define the overall efficiency of the data center by providing a percentage of power used by equipment in the datacenter.
Preventing Bypass
Seal the Gaps, for Conditioned Air

- Sealing access-holes in raised floor
  - Maintains static pressure in raised floor and reduces amount of particulate build-up under raised floor

- Filler / Blanking Panels
  - Prevents re-circulation and by-pass air within the enclosure above & below the equipment

- Brush Grommet Kits
  - Prevents by-pass airflow around the equipment within the enclosure by sealing the rails to the side panels & still have cable access.
Cooling Concepts

**Standard Hot Aisle / Cold Aisle**

Front & Rear Vented Doors

(Optional fan assisted.)

63 - 68 F in Cold Aisle

65 - 72 F at server intake

90 - 95 F at server exhaust

Approx: 4 – 6 Kw. load / enclosure

Recirculation from exhaust back to the intake causing the CRAC units to be less efficient as they have to cool all of the white space first.
**Standard Cold Aisle / Ducted Exhaust**

Front Vented Door / Solid Rear Door

(Optional fan assisted)

63 - 68°F in Cold Aisle

65 - 72°F at server intake

90 - 95°F at server exhaust

Approx: 5 - 7 Kw. load / enclosure

The return air temp is increased which increases the CRAC unit efficiency. The white space of the room does not get heated from the “Hot aisle” recirculation. Therefore the CRAC unit can run at a lower setting (cost savings) and still achieve the same “Cold Aisle” temps.
**Plenum Air “Diverter” / Ducted Exhaust**

Front Vented Door / Solid Rear Door

(Optional fan assisted)

- 68 - 72 F in white space
- 60 - 65 F at server intake
- 90 - 95 F at server exhaust

Approx: 8-12 Kw. load / enclosure

The return air temp is increased which increases the CRAC unit efficiency. The white space of the room does not get heated from the “Hot aisle” recirculation. Therefore the CRAC unit can run at a lower setting (cost savings) & achieve

Less perf tiles are required to cool the white space only. The intake air is forced through an adjustable “Air diverter” directly from the CRAC.

Having an adjustable opening allows the raised floor pressure to be maintained throughout the Data Center.
**Cooling Concepts**

**Ducted Intake / Ducted Exhaust**

Solid Front Door / Solid Rear Door

68 - 72 F in white space

60 F at server intake

90 - 95 F at server exhaust

Approx: 15 plus Kw. load / enclosure

The return air temp is increased which increases the CRAC unit efficiency. The white space of the room does not get heated from the “Hot aisle” recirculation. Therefore the CRAC unit can run at a lower setting (cost savings) & achieve

Even less perf tiles are required to cool the white space only. The intake air is completely contained and is able to be adjusted at the CRAC unit level.

This concept can be done on slab floor as well.

Less CapEX for building.
Cooling Concepts
“AIR DIVERTER”
Side to Side airflow

- **30” wide enclosure with internal side panels**
  - Provides cable management along outside of rails
- **Side Airflow Plenum Kit**
  - Creates a side intake for equipment
  - Exhausts hot air toward the hot-aisle
    - Kit assembly
      - Air dam installed along exhaust rail (top to bottom)
      - Air dam installed along front and rear intake side (with a channel in front air intake)
- **Air dam**
  - constructed of brush grommet provides cable management
  - Kit is fully customizable
  - Supports multiple ‘side-to-side’ airflow equipment in the same enclosure.

Cisco 9500 MDS @ 80°F
Overview

Things to ask before selecting Enclosures:

Primary Use – Severs or Patching, or both determines size.

RMU Vertical space requirements.

Estimated Power usage; PDU mounting requirements, size.

Ease of Use; rail adjustability, Door & side panel access/removal.

Cable Management; internal & external, cable entrances.

Grounding Locations.

Cooling Considerations; Airflow paths internal & external, Hot & Cold Air separation. Aisle Containment options, Side to Side Air Flow Equipment, etc.