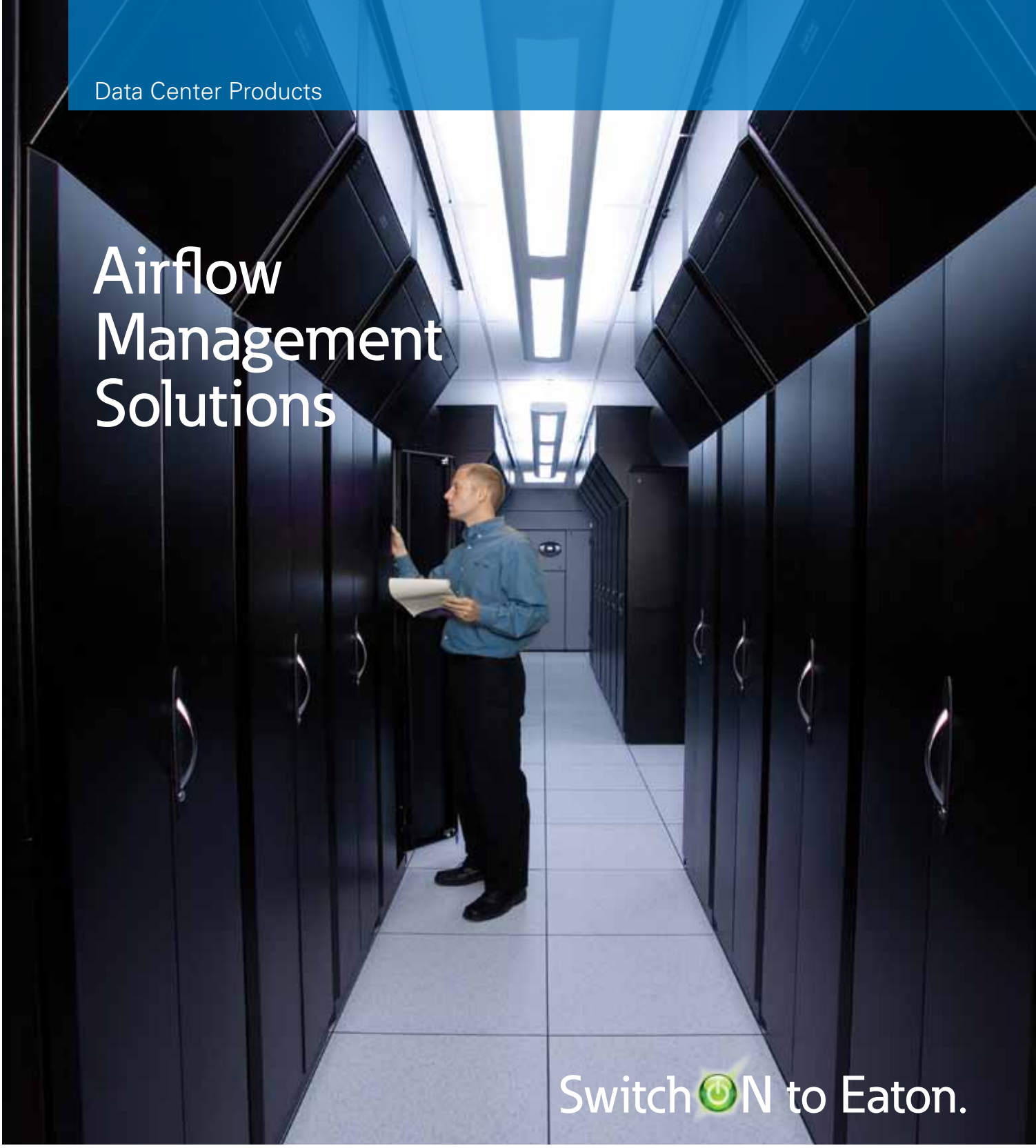
Data Center Products

Airflow Management Solutions



EATON

Powering Business Worldwide

Celebrating 100 YEARS
Ideals that Endure

Computational Fluid Dynamics (CFD) model of an optimized data center illustrating cold-aisle isolation and Eaton's Heat Containment System® (HCS). See CFD Services on Page 15 for more information.

The Optimized Data Center

Eaton's Airflow Management Solutions (AMS) optimize data center equipment, improve information processing density, create a greener data center and increase spatial flexibility for the data center manager – all while saving money for our customers.

Greening the data center provides incremental benefits for a company. According to the American Council for an Energy Efficient Economy (http://energytaxincentives.org/):

"A tax deduction of up to $1.80 per square foot is available to owners or tenants (or designers, in the case of government-owned buildings) of new or existing commercial buildings that are constructed or reconstructed to save at least 50% of the heating, cooling, ventilation, water heating, and interior lighting energy cost of a building that meets ASHRAE Standard 90.1-2001, in buildings or systems placed in service from January 1, 2006, through December 31, 2013".

Eaton's AMS containment solutions can not only lower data center energy demands, but also save on energy costs. Eaton offers a wide range of partial and total containment solutions that can accommodate hot aisle containment, cold aisle containment and rack-based heat containment. Eaton takes a consultative approach to AMS solutions. We do not advocate one containment concept over another because each data center has unique issues of concern, especially in relation to energy management. Rather, we work with data center professionals to audit current operations and then develop a comprehensive airflow management strategy that enables the energy management control and savings that make the most sense for the facility.

The solution may be heat containment at the rack level, hot aisle or cold aisle containment. It might also be a combination of more than one of these approaches, depending on the layout of the data center. Whatever the need is, Eaton has the expertise, the flexibility and the capacity to work with our customers, not only to provide them with a customized solution, but also to assist them in the stages leading up to total aisle containment, resulting in improved data center operations and reduced energy costs that enable tax credits.

Aisle Containment Solutions

Industry studies indicate that an estimated 60% of the cool air supplied to traditional data centers is wasted because it bypasses the intended IT equipment and returns directly to the hot air intake of the CRAC. Adopting a cold or hot aisle containment strategy increases air efficiencies, allowing a significant reduction of cold air supply, translating to longer hardware life and valuable energy savings.

Eaton's solutions can be equally effective for both hot and cold aisles in the data center.

End of Row Doors

End of Row Doors create more efficient cold aisles by blocking an obvious cold-air escape route and entry for hot air re-circulation and air mixing. This allows you to set a higher overall temperature within the data center thus saving energy and extending hardware life.

Features & Benefits:

- Variety of Door Models – Choose from three styles of doors – Single-swing, double-swing café style and sliding doors.
- Ease of Installation – Field-installable, rack-integrated and freestanding options available.
- Rack Agnostic – Flexible enough to install almost anywhere on any manufacturer's brand enclosure.
- Improve Efficiency and Predictability – Increases cold air intake efficiency, from the bottom of the enclosure to the top, within the cold aisle.
- Minimize Air Re-mixing – Cost-effectively minimize air mixing between the hot and cold aisle while keeping the uniform cold air supply in front of the servers for a consistent temperature top to bottom.

Eaton's End of Row Doors help achieve aisle containment. Double-swing Café style doors shown here.

Our space-efficient Sliding End of Row Doors open with little effort and close on their own. They are a great choice when end-of-row space is at a premium and air containment is required at the end of a cold or hot aisle.

Single-swing End of Row Doors are a simple, cost-effective solution to improve efficiency while lowering overall operating costs.

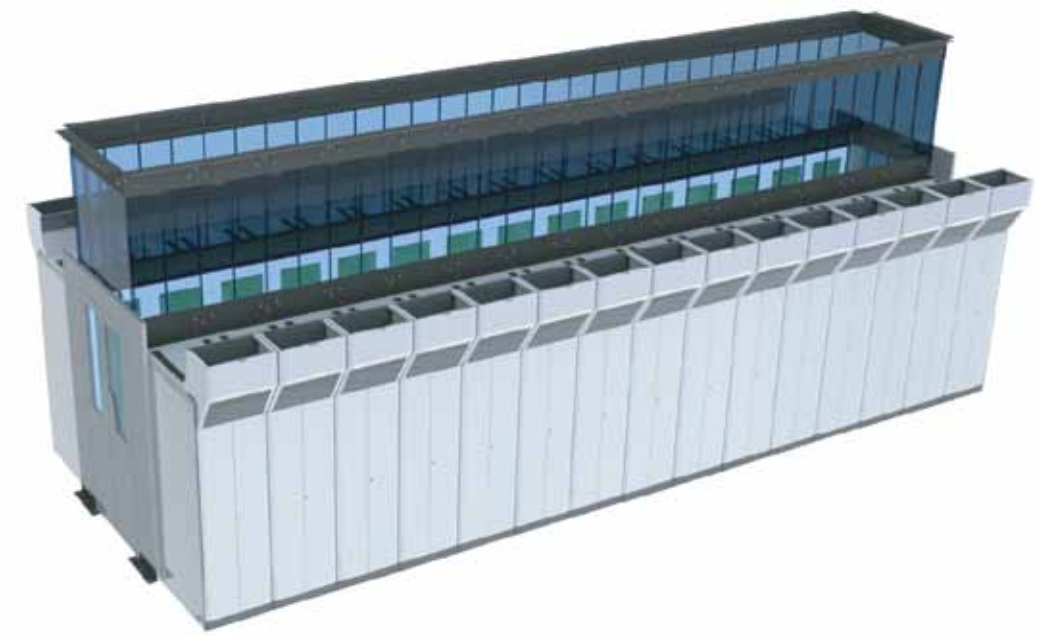
Aisle Containment Solutions

Horizontal Ceiling System

Eaton's ceiling system is comprised of clear panels made from materials with multiple ratings including UL94 V-0, ASTM E 84, FM4910 or antistatic. These panels mount easily to the top of Paramount, Vantage S2 and third-party enclosures. The ceiling system is modular and scalable to accomodate differences in rack heights and row spacing. It's self-supporting structure allows for easy rack changes within the row. Fire-activated ceiling panels ensure quick row access for critical fire suppression.

Aisle Duct

The rack-integrated Aisle Duct works seamlessly with the horizontal ceiling system. Integration with the air conditioning supply or exhaust is easily achieved with the duct's modular and scalable design.



Vertical Wall System

The horizontal ceiling system provides the base support and flexibility for mounting vertical walls that connect from the top of the enclosures to the data center ceiling. This system allows greater isolation for either cold or hot aisle containment.

Aisle Containment Solutions

Tool-less access panels allow quick and easy installation on your existing CRAC units.

Hinged access panels allow for easy cleaning, filter replacements and maintenance. Available with optional Backflow Baffle.

CRAC Collars

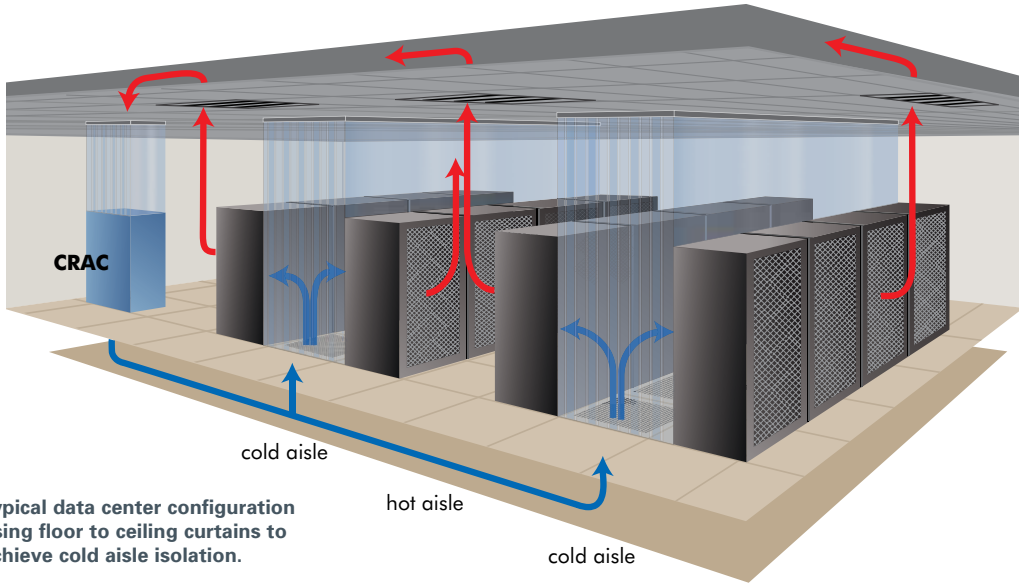
The CRAC Collar for downflow systems, used in conjunction with data center containment strategies, is integral to Eaton's total containment solution. By containing and directing the warm plenum air to your air conditioning system, you increase efficiency and equipment performance while reducing overall energy consumption.

The CRAC Collar features an integrated design, comprised of steel panels that mount easily to the top of any CRAC unit with simple installation. Collars allow front filter installation and service and completely integrate with optional airflow dampening devices. This closed-loop integration of the air conditioning supply or exhaust completes the modular airflow containment strategy in the data center, resulting in a more energy-efficient operation.

End of Row Curtains

Given the ever increasing heat loads in today's data centers, solutions that effectively control airflow dynamics are in high demand. At a minimum, partially containing air within the aisle will not only increase the life of your valuable IT equipment but help decrease your rising energy costs.

End of Row Curtains allow you to create and maintain aisle isolation in your data center. Depending on your specific needs, End of Row Curtains can be installed at the rack level, with or without an Aisle Containment Ceiling, or from floor to room ceiling.



Typical data center configuration using floor to ceiling curtains to achieve cold aisle isolation.

Aisle Containment Solutions

Shown above – Independent Containment System featuring End of Row, Café-style doors and vertical blanking panels to accommodate third-party enclosures.

Independent Containment System (ICS)

The culmination of Eaton containment strategies is its patent-pending Independent Containment System (ICS), a free-standing, scalable, sustainable and vendor-neutral containment solution for high-density computing environments.

Designed to provide maximum flexibility in all environments, the ICS, assembled within the footprint of a standard aisle, is constructed with a tubular steel frame. The frame's structure is designed to be freestanding and meets seismic NEBS Zone 4 standards. Additionally, it accepts a variety of Eaton's End of Row Doors (p. 3) including café style, swing and sliding models.

Aisle ceilings (p. 4) are constructed of a light-weight steel frame and clear Lexan panels allowing ambient room light to illuminate the ICS aisle, eliminating the need for energy-consuming supplemental lighting. The ceiling accepts 2' x 2' Aisle Ducts (p. 4) which can be added anywhere on the ceiling structure as IT loads increase.

Features & Benefits:

- Scalable Design – The ability to extend aisles with load growth makes the ICS an ideal solution for co-location and other highly evolving data center environments that require on-the-fly modifications. Design can support an overhead cable tray.
- Containment Integrity – Vertical blanking panels ensure airflow containment when racks are partially deployed within the row and are easily removed in sections to allow quick installation of new IT racks.
- Rack Agnostic – Ability to support virtually any brand of server or network rack in any depth, height and size with on-demand reconfiguration of the row.
- Cold/Hot Aisle Compatible – Easily deployed as a cold aisle containment solution with or without a down flow chimney system.
- Increased ROI – Modular, building-block design offers complete flexibility and room for growth increasing your initial Return on Investment (ROI).

Independent Containment System with single-swing End of Row Door providing RPP access panel, featuring vertical containment walls and overhead cable tray support structure.

Rack Containment Solutions

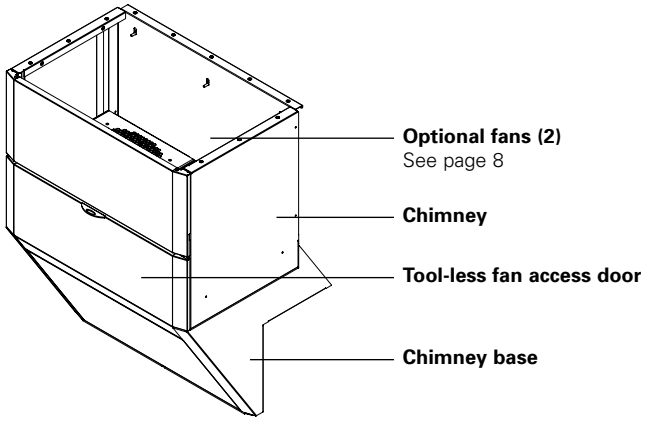
Eaton's Paramount enclosure with integrated HCS.

Heat Containment System® (HCS)

Eaton's Heat Containment System (HCS) is a simple, scalable and low cost solution to cool up to 25kW or more per enclosure without the expense of adding supplemental CRAC units to your data center. This patented technology is available on Eaton's Paramount and Vantage S2 enclosure systems and can also be field retrofitted to most manufacturers' enclosures. The HCS contains and directs the heat exhaust of your IT equipment through the chimney that is attached to the top rear of the enclosure. The hot air is then ducted to your existing CRAC units through a plenum ceiling or high air returns.

Photo courtesy of Humana

The HCS allows for your existing cable management without the interruption of re-routing or disconnecting cables and power. Shown here on Eaton's Paramount Enclosure System.

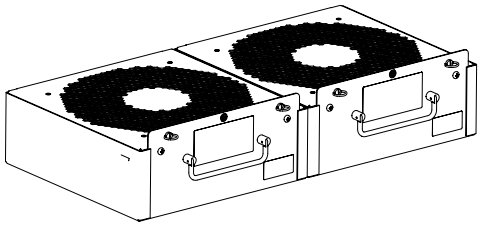


Rack Containment Solutions

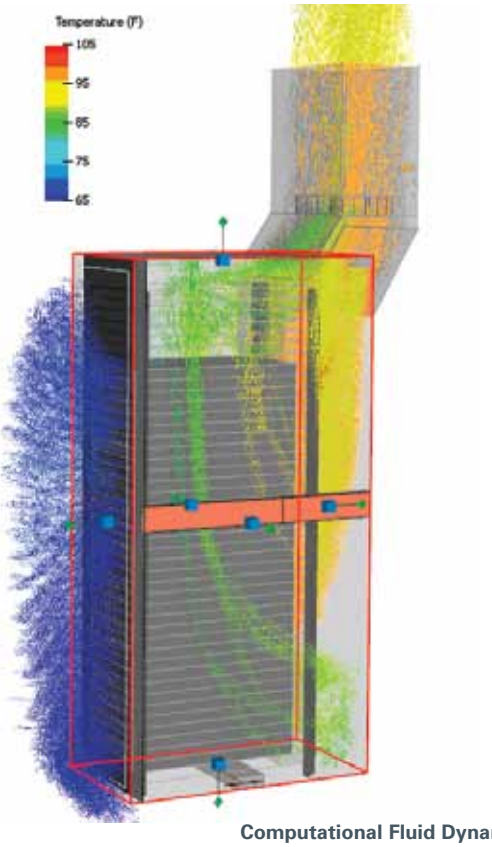
Heat Containment System (HCS)

Eaton's HCS is:

- Scalable – It can be adapted to existing infrastructures to increase rack utilization as your capacity demands grow.
- Predictable – It separates hot exhaust air and cold supply air; dramatically increasing the reliability of the data center.
- Efficient – Allowing hotter air to return directly to the CRACs, increasing their efficiency by operating at a higher Delta T (ΔT).
- Reliable – It extends existing cooling capacity throughout the data center; freeing up stranded assets and lowering operational costs.
- Flexible – It does not require you to alter existing enclosure locations and is also field-installable on third-party enclosures.



By using two optional fans, you can increase your airflow up to 2,600 CFM.



Computational Fluid Dynamics (CFD) model showing airflow through active HCS System.

The ideal solution for clients having enclosures that are off-grid from drop ceilings, where obstacles preclude the use of sheet metal chimneys or have uneven ceilings throughout their data center.

HCS Flexible Return Duct

For data centers unable to accommodate steel chimneys, an alternative solution for controlling chaos cooling is Eaton's Flexible Return Duct. A simple interface easily connects to the top of the Heat Containment System chimney. Flexible 10" ducts are clamped to the interface and a 2' X 2' ceiling tile, which is mounted to the plenum ceiling to create a closed loop system.

- Ducting is V-0 rated and self extinguishing.
- Ceiling tile is available in Nugrey to match existing tiles.
- Ducting can be cut in the field for custom fits.
- Each duct comes with four clamps.
- Ducts are positioned directly over the fan for maximum airflow.

Rack Containment Solutions

Active Thermal Management System

Manage power to your fan systems based on a set operating temperature. The ATMS-I (Active Thermal Management System) has dual 90-264 VAC input for redundancy in a 1U rack-mount enclosure. Connect up to four temperature probes and select operating temperature for automatic fan speed adjustment. The local display indicates temperature, operating set point and fan speed percentage.

Features & Benefits:

- Dual 90-264 VAC Input (C14).
- 1U rack-mount application.
- Up to four temperature probes and one internal probe.
- Web access, Email and SNMP alerts.
- Display shows temperature, operating set point and fan speed percentage.

Eaton's Active Thermal Management System manages power to your fan systems in a 1U form factor. Works with optional fans shown on Page 8.

Active Airflow Manager

Bypass airflow and mixing lead to inefficiencies, shorter life cycles for equipment and increased operating cost. Managing airflow to enclosures with varying densities, varying building infrastructure and sporadic hot spots is challenging, but can now be solved using a simple solution.

Eaton's HCS pressure based system with active airflow, when combined with best practices, improves performance metrics considerably. Allocating the correct amount of airflow at known intake locations is the key to reducing energy consumption while increasing equipment performance. Best practices such as blanking panels, proper perforated tile placement and the reduction of bypass airflow must be employed to ensure desired results.

The Active Airflow Manager easily mounts inside a HCS chimney base. This device measures pressure differentials and temperature to regulate fan operation.

Features & Benefits:

- SNMP managed device with user-friendly web interface.
- Controller continuously monitors pressure differentials to ensure that air entering the enclosure and server is properly removed.
- Local LEDs indicate fan status including fan fail and over temperature.
- Manage up to 64 Peer Active Airflow Managers via Ethernet.
- Two integrated temperature sensors with Email alert capabilities
- Redundant power input; C13 plug type is required for each input, 90-240VAC supplied by enclosure PDU(s).
- Controller is RoHS compliant.

Rack Containment Solutions

HCS for Third-party Enclosure Systems

Converting existing enclosures to the HCS allows you to eliminate the incremental capital expense associated with having to add more CRAC units or other supplemental cooling. The HCS manages the hot air exhaust, which prevents mixing, thereby allowing the available cooling already produced by your AC units, to be used much more efficiently. Optional fans eliminate the issue of backflow from a pressurized plenum, generally associated with passive-only systems.

Features & Benefits:

- Scalable Heat Containment – Implement heat containment with minimal interruption to operations by building up from existing enclosures without having to re-route or disconnect cables and power.
- Increased Rack Capacity – By isolating the hot exhaust air from the cold supply air, you can load over 25kW of equipment in an enclosure.
- Save White Space – No additional air conditioners or other space consuming supplemental equipment is required at the perimeter of the data center, in-row or overhead.
- Increase CRAC Cooling Efficiency – Hot exhaust air is directed back to the CRAC intake at a higher ΔT allowing your AC units to operate more efficiently. Great for your "green" initiatives.
- Create a Predictable Environment – Eliminating chaos airflow will result in a more predictable operating environment, allowing you to drive efficient energy use while creating a reliable infrastructure for constant technology moves, additions and changes.

By adding Eaton's Heat Containment System to your existing enclosures, you realize enormous equipment and cost savings while maintaining your valuable data center space. Shown here on APC®, CPI®, Rittal®, Compaq® and Knurr® enclosures.

Airflow Management Solutions

Blanking Panels

In today's dynamic data center environment, IT equipment is refreshed on a frequent basis. These changes often leave open U-space in the enclosure which can allow re-circulation of hot exhaust air back to the equipment inlet. This can cause overheating of the equipment and subsequent shutdown of servers when the maximum temperature threshold is reached.

Blanking panels provide a quick, easy and cost-effective solution to optimize air circulation within an enclosure while maintaining high aesthetics. Eaton offers blanking panels in a variety of styles including tool-less, mechanically fastened, clear and with cable pass through options in steel as well as plastic. The width meets EIA-310-D standards and comes in various heights (depending on style). Most panels are bulk packed in quantities of 10 and 100.

Tool-less plastic blanking panels are a low cost but necessary solution for preventing re-circulation and optimizing airflow in your rack.

Features & Benefits:

- Significantly reduces re-circulation of hot exhaust air to the equipment inlet
- Adds to the overall aesthetics of the data center
- 1U, 2U, 3U, 4U, 5U, 6U, 7U, 8U and 20U (depending on style)
- EIA-310-D compliant for 19" equipment
- Color: Black steel, black plastic, clear plastic
- Available in tool-less, mechanically fastened, clear and cable pass through styles

Brush strip models allow routing of cables through the panel.

Vertical blanking panels seal open spaces and prevent bypass airflow in areas that are traditionally difficult to seal. They can also be adapted for cable management.

Adjustable blanking panels, offered in two sizes (7-12U, 12-22U) easily adapt to your hardware requirements.

Airflow Management Solutions

Cisco 7018 Switch Enclosure

Based on Eaton's Paramount Enclosure frame, our turnkey enclosure has an extra wide frame designed specifically to store, cool and power the Cisco Nexus 7018 Switch.

Features:

- Specialized airflow containment design that is compliant with the Cisco Nexus 7000 Series switch site preparation guide
- Pre-installed switch support brackets
- Integrated cable management
- Available in two heights: 44U and 51U

Airflow Director

Properly cooling network devices that require side-to-side airflow in an enclosure can present many challenges. Air recirculation that occurs in an enclosure can cause temperatures to rise significantly causing overheating of the devices. Eaton's Airflow Managers and Directors draw air into the enclosure, redirect the air to the side intake of the device and allow the removal of the hot air out of the enclosure. These solutions extend equipment life by providing proper inlet temperatures and eliminating harmful recirculation within the rack.

The Airflow Director is designed for Cisco® 6509/6513/9513 and Juniper 8216 switches that have side-to-side cooling. The intake allows cold air to be drawn from the cold aisle, through the Airflow Director and to enter the switch from the side. The switch's fans then pull the cool air across the device and exhaust the warm air out the opposite side.

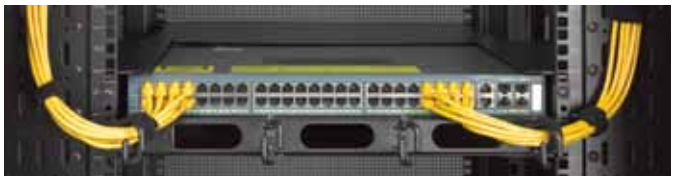
Airflow Director for Cisco and Juniper switches.

Rear view of Airflow Director.

Airflow Manager

The Airflow Manager is designed to be used on Cisco Catalyst 4948 switches. It can be utilized in most enclosures that meet the EIA-310-D specification.

The Airflow Manager kit includes everything needed to mount the switch, control airflow and manage cabling. This 2U device can be mounted to face either the hot or cold aisle while properly directing airflow.



Airflow Manager for Cisco 4948 switch.

Features:

- Helps eliminate overheating of network racks and other nearby equipment by allowing front-to-rear airflow through the switch.
- Improves efficiency by preventing hot exhaust air from mixing with cold intake air.
- Resolves the difficult issue of how to mount a switch with unique airflow requirements.

Overhead view of Airflow Manager with optional Cable Manager.

Airflow Management Solutions

Paramount High Flow Doors

Eaton's High Flow Doors offer exceptional airflow with 75% perforation, a 19% increase over the industry standard. In addition to increased performance, the unique perforation pattern results in a reduction of raw material consumption by over 60% which means less waste in the manufacturing process – a great "green" benefit.

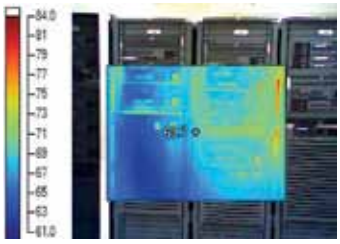
Doors are available as left or right hinged and are also field reversible. The High Flow perforation is also available for the rear door and can be ordered as full or split. The doors feature tool-less door removal, a brushed aluminum door pull and a variety of locks.

Universal Air Seal Kit

Stop the cold air from escaping through small openings in the doors, sides, bottom or top of your enclosure. This low cost, adaptable foam solution can quickly be sized to fit into any crack or opening. The Air Seal Kit can easily be retrofitted to an existing rack, regardless of manufacture, and will allow you to cool equipment more efficiently in your enclosure.

Features & Benefits:

- Easy to install and conforms to spaces that are traditionally difficult to seal
- An integral component of Eaton's Airflow Management Solutions, this product reinforces the company's commitment to offer cost effective green solutions



Eaton's Air Seal Kit is a simple, inexpensive solution for preventing bypass airflow in gaps around or within enclosures.

Reducing bypass airflow and particulate matter is critical to maximize efficiency, contain cost and minimize carbon footprint in the data center.

Airflow Management Solutions

Paramount Tower of Cool™

For applications where a full HCS deployment is unnecessary, the patented Tower of Cool, which utilizes High Delta Temperature Cooling (HDTC), can be a perfect alternative. The Tower of Cool efficiently cools 10kW of equipment within 44U, by incorporating the building air conditioning system and the enclosure into one closed-loop cooling system. The Tower of Cool is also the perfect solution for providing supplemental spot cooling in legacy data centers.

By preventing stratified air from entering the top of the enclosure, the Tower of Cool distributes cold air which allows equipment to run at lower temperatures, resulting in increased hardware reliability.

The Tower of Cool, using specialized doors and fans, captures cold air from the raised floor plenum and distributes it throughout the rack.

Raised Floor Grommets

By installing Eaton's Raised Floor Grommets, you can optimize the effectiveness of existing cooling equipment and manage increasing heat loads. The raised floor sealing system specifically addresses bypass airflow and its detrimental effect on data center cooling.

Laboratory testing demonstrates the Raised Floor grommet's superior performance compared to brush strip and membrane-based solutions.

Non-permeable material allows maximum pressure to be maintained in the sub-floor plenum when cables are installed; minimizing bypass airflow.

Features & Benefits:

- Increased Energy Efficiency & Predictability – Eliminates bypass airflow while maintaining a consistent subfloor plenum pressure.
- Flexible, thoughtful design – overlapping serrated fingers and optional elastomer ties adapt to any size or shape cable bundle. Ties ensure a complete and lasting seal by providing tension against the cabling.
- Superior performance – delivers a faster and greater ROI than any other solution on the market

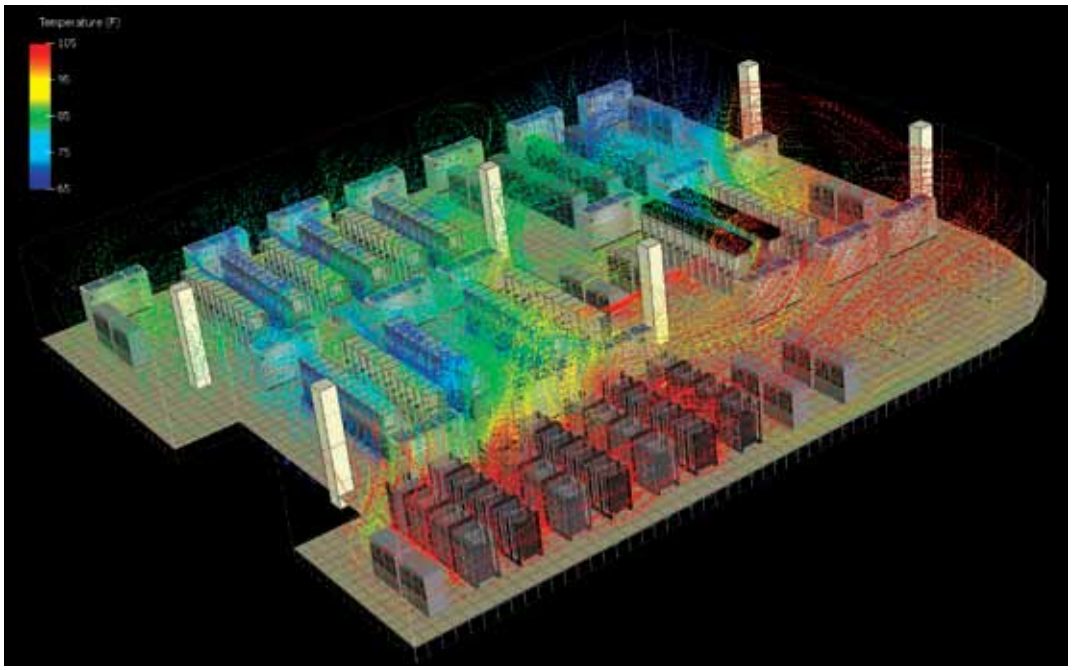
Airflow Management Solutions

Computational Fluid Dynamics Modeling Services

Eaton's innovative Computational Fluid Dynamics (CFD) Modeling Service provides a comprehensive approach to modeling the airflow, temperature, static pressure and energy profile of dynamic, critical environments. Using Future Facilities' 6SigmaDC software, we construct a virtual representation of your data center. This representation models the impact of load distribution within the facility, as well as the flow of hot and cold air within the space. It also illustrates how to increase rack densities and server installations without creating additional hot spots and airflow issues.

Providing fact-based decisions aimed at improving operational efficiency and reliability, the CFD modeling analysis is essential for creating and operating a more predictable data center.

The service compares and substantiates which design decisions will maximize your data center flexibility, scalability and resilience. It enables you to explore the best possible options for IT and facility growth, create a calculated plan and avoid major capital commitments and costly design/ implementation mistakes.



Stream line plot showing temperature of air as it flows throughout the data center. Plots can be animated to illustrate direction of flow.

Pricing for Eaton's CFD Services is based on specific customer requirements and there are several levels of customized service a customer can choose from. A pre-quote consultation and/or walk-through by an Eaton CFD Team member is advised to determine the scope and level of CFD service required.

Features:

- Four levels of service.
- State-of-the-art software and tools.
- Certified technicians.
- Detailed reporting.

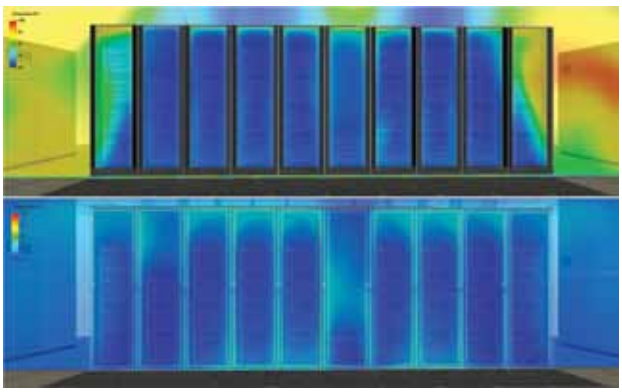
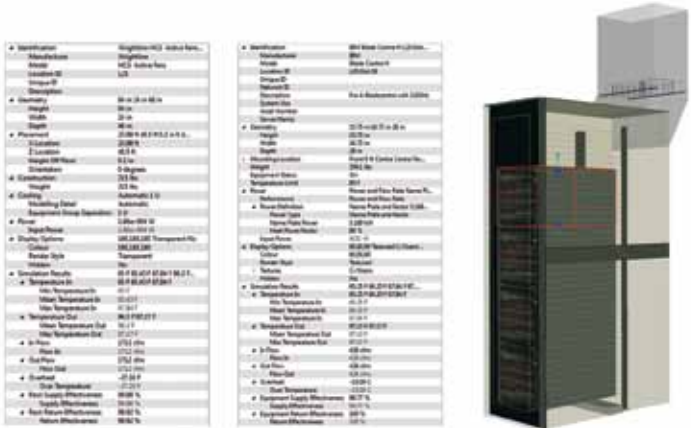


Illustration shows synchronized comparison of rack inlet temperatures before and after HCS deployment.



Eaton can provide extensive performance details of your entire data center down to specific devices at the rack level.

Contract No: GS-29F-0100G

Schedule 71 I:
Office Furniture

SIN 711-2:
Workstations, Computer Furniture & Accessories

SIN 711-3:
Filing & Storage Cabinets

SIN 711-94:
Design & Layout Services

Contract No: GS-07F-0546T

Schedule 66:
Scientific Equipment and Services

SIN 566-1:
Modular Laboratory Furniture Systems

SIN 566-2:
Individual Non-Modular Laboratory Tables, Cabinets, Benches & Carts

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