AISLELOK®

Technical Information

AisleLok® Modular Containment and Airflow Management Dynamics

Modular Containment Overview

Airflow management (AFM) in computer rooms is fundamental to providing the appropriate environment for IT equipment, maximizing cooling capacity, reducing operating costs, increasing utilization and deferring capital expenditure. Upsite's AisleLok® Modular Containment solution improves AFM at both the rack and row level, enabling achievement of these goals as part of a holistic computer room optimization.

Why Open-Sealed Containment Works in Cold Aisles

Modular Containment is designed with an open-sealed architecture for hot and cold aisle containment. The open architecture of AisleLok® partially contains the conditioned air, providing the required cooling to the IT equipment without over pressurizing the cold aisle. Cold aisles typically contain an excess volume of conditioned air. With full containment solutions, there is no opening for the excess volume of conditioned air to escape, so excessive pressure can develop in the cold aisle, forcing excess air through the IT equipment. The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) specifically cautions against over pressurized aisles, and the resulting bypass air flow through IT equipment under this condition. The open-sealing architecture of AisleLok® solves this problem by containing cold air to the level needed while allowing any excess volume to escape when required.

Why Vertical Baffles Work for Hot Aisles

As opposed to cold aisles where restricting the open area at the top of the aisle positively benefits IT intake air temperature conditions, the open area of hot aisle is often best left open and unrestricted. This provides as low a resistance path for the exhaust air back to the cooling units as possible. The goal with hot aisle containment is to channel or direct the hot air back to the air conditioning units while minimizing mixing with cold supply air. The vertical baffles in the hot aisle accomplish this by creating an 18" vertical barrier. For rooms with a ceiling plenum return the vertical baffles provide 18" of unrestricted "chimney" towards the ceiling openings. Without a barrier, the exhaust air easily flows over the tops of cabinets and mixes with the intake air in the cold aisles.

In addition to the height of the ceiling affecting the mixing of supply and return air, it also has an influence on the amount of hot air that wraps around the end cabinets of the rows through the end-aisle opening. The lower the ceiling, the more front to back wrap around recirculation occurs at the row end, creating hot spots in these cabinets. It is a best practice in any data center to use aisle end doors to prevent the hot air recirculation in row end cabinets.

How Modular Containment Works

Upsite's Rack Top Baffles and Bi-Directional Doors create a simple physical barrier to separate conditioned air and exhaust return air. Installing Rack Top Baffles on the tops of the racks, and Bi-Directional Doors on the ends of hot and/or cold aisles, often produces significant AFM benefits.

In summary, Upsite's AisleLok® Modular Containment products are designed to achieve several important goals:

- Prevent over-pressurization of cold aisles
- Create a physical barrier between conditioned and exhaust air to reduce air mixing
- Improve or increase containment of cold air in the cold aisles to reduce hot spots, increase efficiency and increase cooling capacity
- Allow minimal disruption to operations through simple, tool less installation
- Easily reconfigure to meet evolving computer room configurations changes with minimal disruption

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Fluid Dynamics of AisleLok® Modular Containment

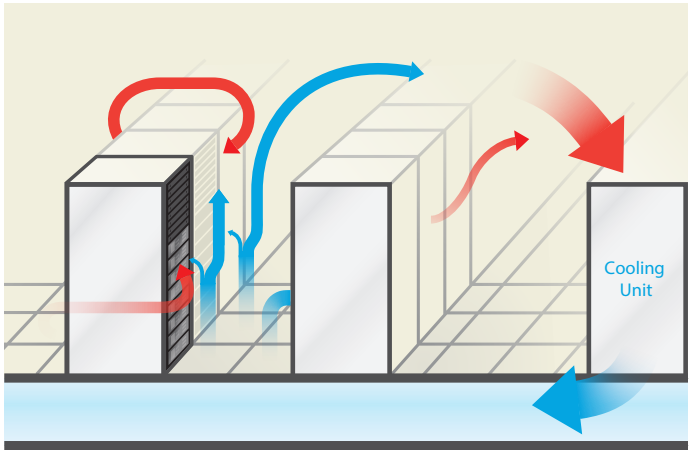
Without aisle containment, the excess air in the aisle may leave in non-uniform flow patterns. The aisles will therefore not fill evenly with air, creating both high and low pressure areas within the aisle. The non-uniform distribution of air and the uneven pressurization of the cold aisle will allow hot exhaust air to flow around the ends or over the top of cabinets. This condition can cause hot spots and elevated IT intake air temperatures that exceed desired maximums. In addition, this condition will limit the optimization of the cooling systems by requiring lower supply temperatures and/or installation of more perforated tiles to compensate for the air mixing in the cold aisle. Implementing airflow management best practices will improve these conditions and allow for more efficient cooling system operations.

Installation of the AisleLok® Rack Top Angle Baffles in a typical 48" wide cold aisle will effectively reduce the open area between the tops of the two equipment rows to 16". This represents a 66% reduction of the width of the opening and 66% reduction in the open area at the top of the cold aisle. The reduced open area at the top of the of the aisle controls and restricts the flow of the excess conditioned from the cold aisle, and creates a slight positive pressurization of the cold aisle relative to surrounding spaces.

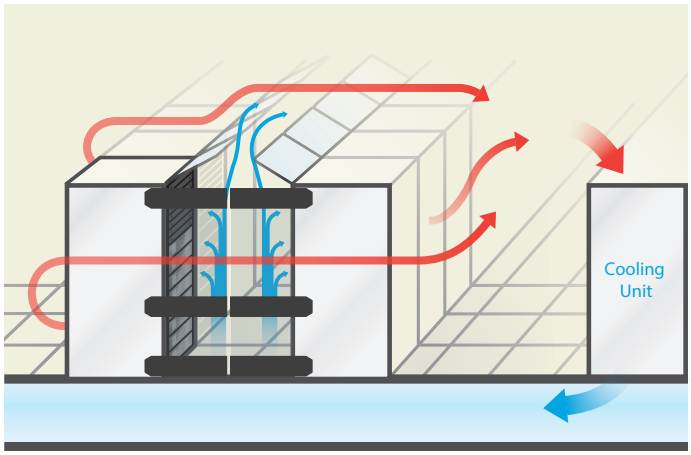
This results in conditioned air flowing out of the partially contained aisle in a more uniform manner while restricting hot exhaust air from flowing in. The slight positive pressurization is why the small gaps between adjacent baffles and above the Bi-Directional Doors is not a problem; in most cases excess conditioned air will flow out of these openings rather than hot air flowing in.

In the ideal case of 100% efficient airflow, the flow rate of conditioned air supplied to the cold aisle would equal the total required airflow of IT equipment within the aisle. In practice, this is not realistic. The flow rate of conditioned air supplied to cold aisles exceeds the total required airflow of the IT equipment for three reasons: 1). Overcome AFM inefficiencies/ mixing of exhaust air with conditioned air, 2). Accommodate variations in airflow volume required by IT equipment, and 3). Requirements for redundant capacity.

Typical Air Flow Patterns without **Aislelok® Modular Containment**



Typical Air Flow Patterns with **Aislelok® Modular Containment**



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