

 Signature Solutions ...

## Thermal Management Solutions



CHATSWORTH  
PRODUCTS, INC.

Helping you

Organize. Store. Secure.<sup>SM</sup>

technology equipment ...

# Does Cooling Your Data Center Seem Like A Mystery?

As data center equipment densities continually increase, thermal management has become a major operational and facilities challenge. Airflow distribution within the data center has a significant impact on the thermal environment. By simply having the ability to control this airflow and manage exhaust air, you can solve the thermal mystery.

## Reclaim Control With CPI Passive Cooling™ Solutions

Passive cooling is an innovative technique that allows you to control the flow of air through the cabinet space. CPI Passive Cooling™ Solutions provide 2-20+ kW of cooling without uncertain supplemental liquid or active cooling systems. Passive cooling is a safe solution that allows you to reclaim control over airflow so cool air can be directed where it is needed, eliminating bypass and re-circulation of hot exhaust air.

### • Flexibility

- Uncomplicated moves, adds and changes — This solution does not involve active components therefore backup is not needed when changes are performed, maintaining critical uptime.
- Configurable to meet specific needs — Based on your desired results, cabinets can be configured with just one or all thermal solutions.

### • Scalability

- Adaptable for increasing density requirements — Provides the ability to fulfill future density needs by adding additional thermal solutions.
- Achieves 2-20+ kW of cooling — Choose from CPI's low, medium or high-density solutions.

### • Tier IV Capabilities

- Advanced thermal control with zero points of failure — Involves no active components to compromise redundancy and does not require additional power or plumbing to cool equipment.
- The Vertical Exhaust Duct directs hot air out of the cabinet and into an isolated return air path — By keeping hot and cold air separated you can make the most of your cold air.

### • Minimize Total Cost of Ownership

- Maximizes CRAC effectiveness — The balancing of hot and cold air permits the delivery of only hot air to the CRAC unit and allows you to easily manage the ambient temperature and set points.
- Decreases ongoing maintenance costs — Since there are no active components, service and maintenance is not an issue.
- Reduces risks and costs — Eliminates risk to equipment associated with supplemental liquid or active cooling systems. The cost to plumb, monitor and manage supplemental cooling systems brings another level of complexity into your data center.

### Fast Fact ❖



Identify ongoing thermal management problems in your data center using the CPI's Remote Infrastructure Management (RIM-600) System. Automatically monitor environmental conditions such as temperature and humidity and receive notification if system components are at risk.

## The Facts About Airflow And Heat Transfer

Whether you are managing a small computer room or a large high-density data center, one thing is evident — equipment is becoming more compact, which means more power and heat in every equipment cabinet. The main contributing principle of equipment cooling is the transfer of heat from heat sources (chips and heat sinks), to the air that moves across them. Computer equipment is typically designed to pull in adequate volumes of air for this heat transfer. According to ASHRAE<sup>1</sup> and The Uptime Institute<sup>2</sup>, the maximum recommended air temperature to avoid hot spots is 75°F (24°C) — 78°F (26°C). Unfortunately, you cannot simply set the thermostat twenty degrees below the hot spot level and pump a volume of air into the room that exceeds the total demand of the equipment. In fact, most data centers have more than two and a half times their required cooling capacity and still experience numerous hot spots.

The immediate cause of hot spots is the mixing of cool air with the heated exhaust air expelled from equipment. The computational fluid dynamics<sup>3</sup> (CFD) model (Fig.1) illustrates how 53°F (12°C) air coming into the room becomes over 100°F (38°C) source air for equipment mounted toward the top of the cabinet. The temperature rise of air through any specific piece of equipment is essentially a constant; therefore it is clear that as exhaust air re-circulates through equipment it will continue to get hotter.

A frequent cause of this type of hot air re-circulation is bypass air that reduces the amount of air available where it is needed in the front of racks and cabinets. This results from incorrectly located access floor tile openings or unsealed cable access holes. The reduced availability of chilled air means that equipment will pull in heated air from the room at large.

Another cause of hot air re-circulation is the presence of open rack space, as well as openings along the sides of equipment and inside the top and bottom of a cabinet. Equipment fans draw air from all sources and these openings allow the heated exhaust air to be pulled around to the front of equipment where air intakes are located.

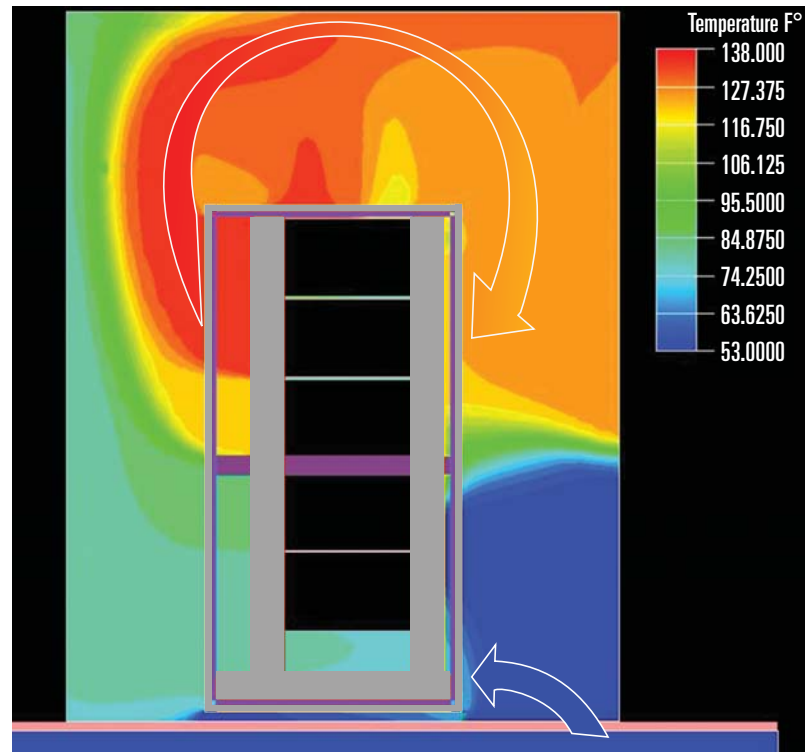
A third cause of hot air re-circulation occurs when the cumulative cool air volume demand of equipment exceeds the volume of air that can be delivered through a perforated access floor tile in front of the cabinet. In this case all chilled air is consumed at the bottom portion of the cabinet (see CFD model, Fig.1) and the make-up air is pulled over the top of the cabinet from the hot aisle.

CPI Passive Cooling™ Solutions include preventative measures and remedies for all these situations.

<sup>1</sup>The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) provides technical and educational information pertaining to the arts and sciences of heating, ventilating, air-conditioning and refrigeration.

<sup>2</sup>The Uptime Institute, Inc. is an information source for general issues affecting uptime and end-to-end reliability of information delivery systems.

<sup>3</sup>CFD modeling provided by Fluent, Inc. ([www.fluent.com](http://www.fluent.com)) using Fluent AirPak software. CFD modeling is used to show airflow and temperature patterns in a high-density data center environment based on testing conducted by CPI. CFD models (Figure 1-3) are based on a standard data center server cabinet with perforated front and rear doors and various combinations of thermal management accessories. The cabinet (Figure 4) has a solid rear door and a top-mount Vertical Exhaust Duct. Equipment produces 9.467 kW of heat and consumes 1580 CFM (2689 CMH) of air. The vented access floor tile in front of the cabinet provides 515 CFM (875 CMH) of air at 53°F (12°C). In Fig. 4, additional make-up air is provided into the room. The computational mesh of 700,000 cells assures the CFD model accurately models the empirical test condition.



(Fig. 1) The CFD model above shows a typical data center server cabinet without airflow management. Hot air recirculates over the top of the cabinet causing the top servers to receive air in excess of 100° (38°C).

## In fact, most data centers have more than two and a half times their required cooling capacity and still experience numerous hot spots.

### Fast Fact ❁

Monitoring power consumption is the best way to know how much heat equipment is generating. Use Metered Power Strips to monitor exact power consumption of equipment in your cabinets.



## How CPI Passive Cooling™ Solutions Keep Equipment Cool:

To maximize effective cooling capacity of your cooling system, it is important to manage the airflow through, over and around equipment cabinets. Improve cooling effectiveness in the data center using one of the following three CPI Passive Cooling Solutions:

### 1 Eliminate Hot Air Recycling Through The Cabinet:

By blocking airflow through open rack spaces with filler panels, less hot air is re-circulated to the front of the cabinet. However, hot air can still go around the sides, top and bottom of the equipment mounting space. CPI's Air Dam Kit blocks this space by creating an effective front-to-rear (cold/hot) barrier to airflow (Fig. 2).

When you use the Air Dam Kit with the Snap-In Filler Panels, the temperature of air entering the top half of the cabinet is lowered because hot air is not re-circulated through the cabinet. Air still re-circulates over the cabinet, but airflow is now one-way through equipment.

### 2 Increase The Amount Of Cold Air Entering The Cabinet:

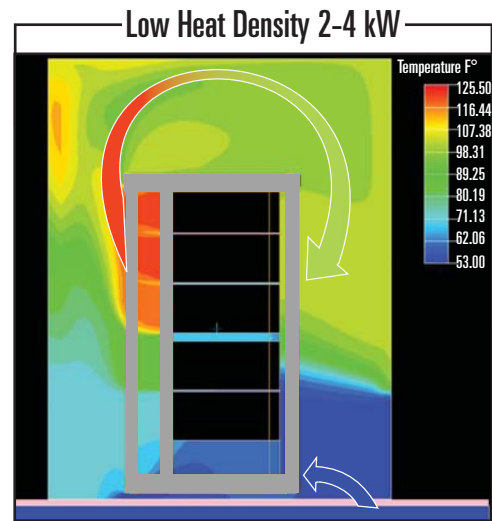
Cold air available to a cabinet is often limited to the amount of cold air entering the room through the vented access floor tile located directly in front of the cabinet. To increase the amount of cold air available to each cabinet, seal cable access holes with CPI's KoldLok® Raised Floor Grommet and use the Internal Air Duct instead of the Air Dam Kit.

The Internal Air Duct delivers additional cold air to the top half of the cabinet. This cold air lowers the temperature of air at the top of the cabinet. Note the lower temperatures in the space between the front of the cabinet and the duct in the CFD model (Fig. 3). In addition to eliminating hot air re-circulation throughout the cabinet, this step will help reduce the negative effects of hot air traveling over the cabinet into the cold aisle.

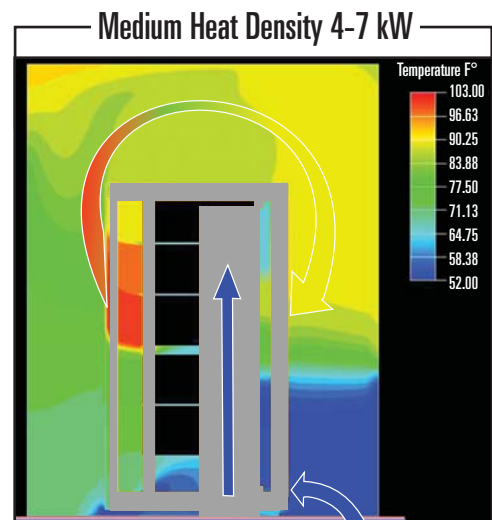
### 3 Isolate Hot Air From The Room:

As heat loads increase, so does the demand for cold air. Hot air re-circulates over the cabinet causing temperatures near the top half of the cabinet to increase. Manage high heat loads by eliminating hot air re-circulation over the cabinet with a ducted hot air return (Fig. 4).

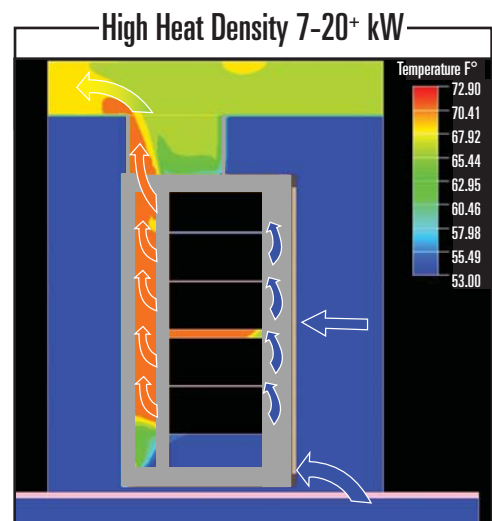
Use CPI's Vertical Exhaust Duct System (includes; Vertical Exhaust Duct, Server Top Panel, Airflow Director and a Rear Door Sealing Kit) with the Air Dam Kit to create a ducted exhaust cabinet. Hot air is isolated from the room and returned to the primary cooling system through the drop ceiling plenum or ducted return positioned high above the cabinet. Because hot air is isolated in the duct, you can place vented access floor tiles anywhere in the room to deliver additional cold air to equipment. The resulting lower room temperature eliminates the need for supplemental liquid or active cooling solutions.



(Fig. 2) CPI TeraFrame Cabinet with Air Dam Kit and Snap-In Filler Panels.



(Fig. 3) CPI TeraFrame Cabinet with Internal Air Duct and Snap-In Filler Panels.



(Fig. 4) CPI TeraFrame Cabinet with Vertical Exhaust Duct System, Air Dam Kit and Snap-In Filler Panels.

Snap-In  
Filler Panels

Air  
Dam  
Kit

KoldLok®  
Raised Floor  
Grommet

Snap-In  
Filler Panels

Internal  
Air  
Duct

KoldLok®  
Raised Floor  
Grommet

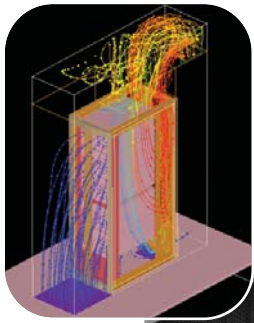
Snap-In  
Filler Panels

Air  
Dam  
Kit

Vertical  
Exhaust  
Duct  
System

## Achieve Innovative Thermal Management

CPI's TeraFrame™ Cabinet System offers innovative CPI Passive Cooling Solutions to achieve 2-20+ kW of cooling without the use of uncertain supplemental liquid or active cooling systems. CPI gives you the ability to reclaim your data centers cooling system by customizing a CPI thermal solution to meet your current and future needs.



CFD model demonstrates airflow through the TeraFrame™ Cabinet System.



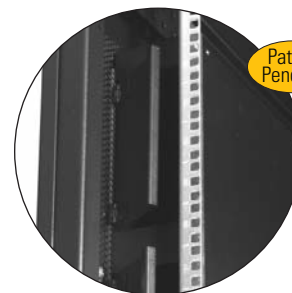
## CPI Passive Cooling™ Solutions

KoldLok®  
Raised Floor  
Grommet



Snap-In Filler Panels,  
UL Listed

Air Dam Kit,  
UL Listed  
(bottom view)

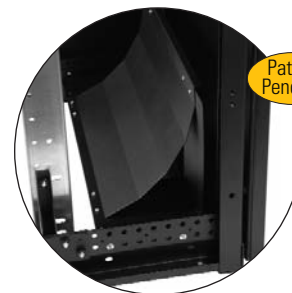
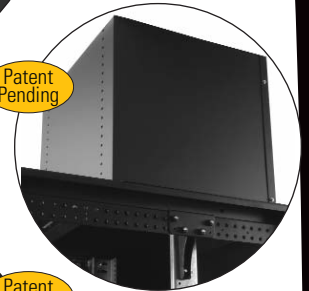


Patent Pending

Internal Air Duct,  
UL Listed  
(open, top view)

Vertical Exhaust Duct,  
UL Listed

Patent Pending



Patent Pending

Airflow Director,  
UL Listed  
(installed in cabinet)

### Fast Fact

To configure your Thermal TeraFrame Cabinet Solution, use CPI's Product Configurator at [www.chatsworth.com/configurator](http://www.chatsworth.com/configurator).

## Why Choose CPI? Flexibility, Availability and Reliability

Chatsworth Products, Inc. (CPI) is a leading manufacturer of systems designed to organize, store and secure IT infrastructure equipment. As an industry leader, CPI products deliver superior structural support that exceeds customer expectations through innovation, function and performance. Unequaled customer service and technical support, as well as a global network of industry-leading distributors, assures our customers that CPI is dedicated to delivering IT infrastructure solutions designed to meet their needs.

### Flexibility

- Achieve Data Center Objectives
- Broad Product Selection
- Customized Configurations
- Adaptable for Future Applications

### Availability

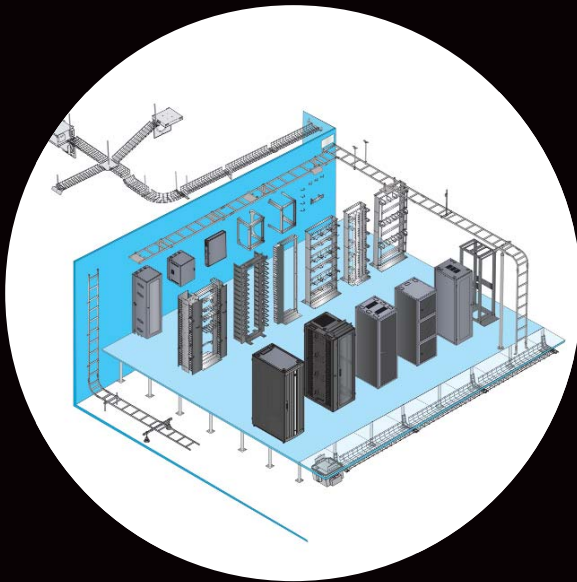
- Global Network of Distributors
- Short-Factory Lead Times
- On-time Delivery

### Reliability

- High Quality Products
- Customer Service & Technical Support
- Heavy Duty Packaging

## The CPI Total Solution Includes:

- Equipment Support
- Cable Management
- Cable Pathways
- Grounding & Bonding
- Security & Monitoring
- Thermal Management
- Power Distribution
- Seismic Bracing



Find more information about CPI Passive Cooling Solutions at  
[www.chatsworth.com/passivecooling](http://www.chatsworth.com/passivecooling)

800-834-4969

[techsupport@chatsworth.com](mailto:techsupport@chatsworth.com)



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