

DAMAC

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WHITEPAPER

How to Choose Between Hot and Cold Aisle Containment Systems

Put a lid on your rising cooling costs



DAMAC cold aisle containment

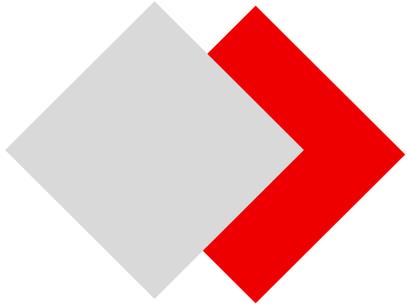
Executive Summary



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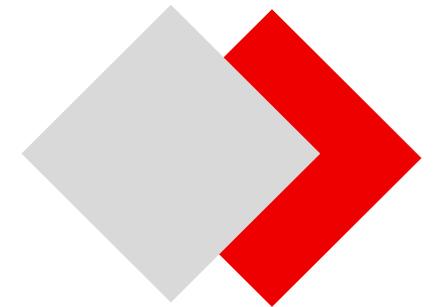
As data centers require greater densities to support the explosion of IoT, cloud computing and more, organizations are becoming increasingly aware of power consumption within their data centers related to cooling. In addition to increased density requirements, more powerful equipment has increased the heat generated in each rack, causing computer room air conditioning (CRAC) units to work harder than ever.

Cooling generally accounts for 30 percent of a typical data center energy bill and has become a focal point for organizations when evaluating cost savings opportunities within their data center footprint. The goal is to reduce cost and increase the efficiency of cooling technology, while reducing operating expenses (OPEX) related to energy consumption.



Consider this, an average U.S. data center uses as much power for non-computing overhead (i.e. cooling) as they do for running servers and other IT equipment. The U.S. General Services Administration reports that organizations can save 4 to 5 percent in energy costs for every 1 degree increase in data center temperatures.

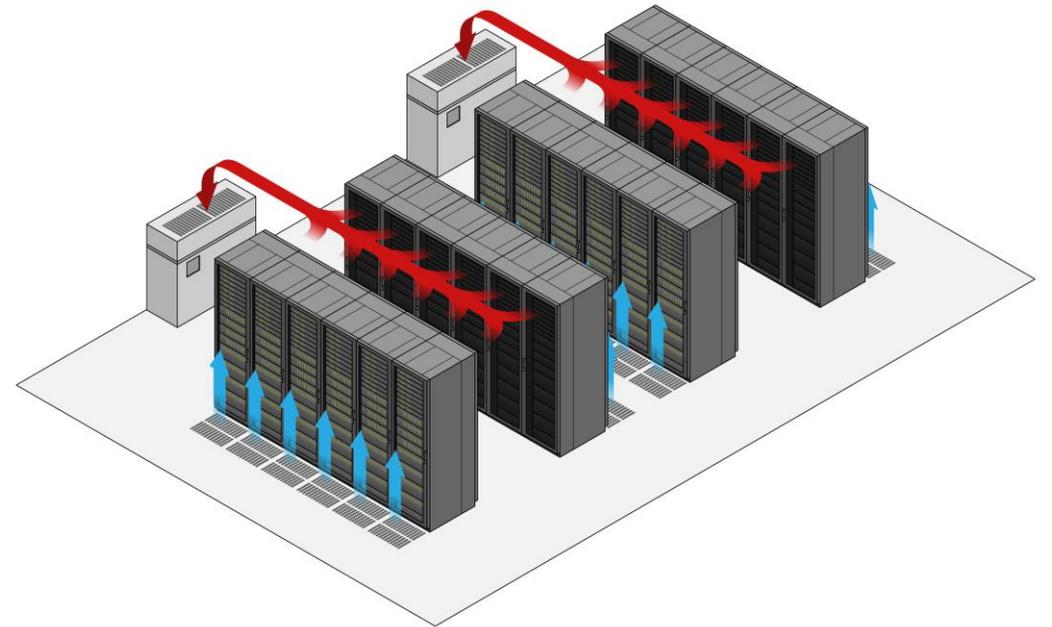
This has organizations asking: What is the best solution to reduce cooling and energy costs within data centers? Long-standing best practices call for data center racks to be arranged in hot aisle/cold aisle configurations, meaning the fronts of the racks in one row face the fronts of the racks in an adjacent row to avoid having hot air exhausted from the back of the racks drawn into nearby equipment. Unfortunately, with this technique, air mixing still occurs resulting in hot and cold spots within the data center.



This is where aisle containment systems come in. An aisle containment system can minimize hot and cold air mixing by effectively capturing the air within a given aisle. Chilled air within the cold aisle is recirculated, while exhaust air in the hot aisle is vented out of the data center environment. This allows IT and data center managers to raise data center temperatures without harming equipment, and can result in significant energy savings.

This whitepaper will discuss:

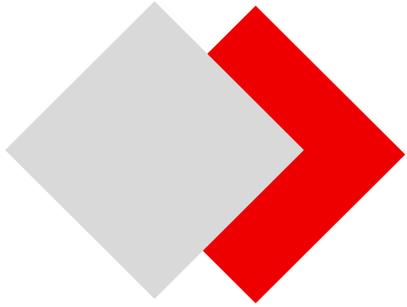
- The impact of cooling requirements on data center costs
- Factors to consider when implementing an aisle containment system
- When to use a cold aisle containment system
- When to use a hot aisle containment system



THE IMPACT OF COOLING REQUIREMENTS ON DATA CENTER COSTS

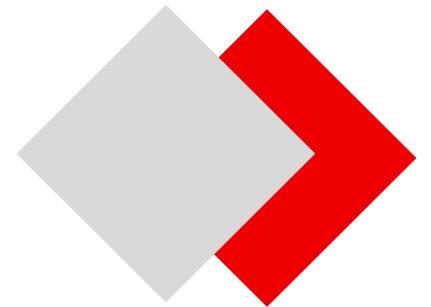


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According to the U.S. Environmental Protection Agency, data centers consume about 2 percent of all electricity used in the U.S. at a cost of billions of dollars, and Gartner, Inc., has stated that the demands on data center energy requirements will only increase. They forecasted that IoT devices will exceed 20 billion dollars by the year 2020.

While it is true that other IT costs have decreased, energy expenses have continued to rise to as much as 70 percent of a data center's operations budget. Analysts with 451 Research estimate that a U.S.-based data center with a 2MW peak load and a 50 percent base load racks up an annual energy bill of more than \$600,000.



FACTORS TO CONSIDER WHEN IMPLEMENTING AN AISLE CONTAINMENT SYSTEM



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Hot and cold aisle configurations have long been used to improve data center cooling efficiency, enabling IT managers to maintain lower temperatures at reduced costs. Aisle containment systems increase the benefits of such configurations by isolating chilled air from hot exhaust air.

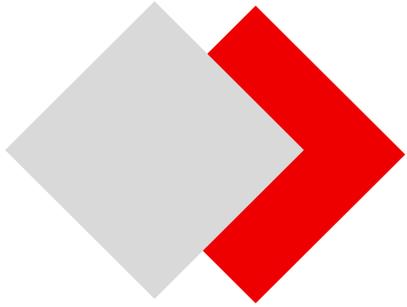
The question of hot aisle versus cold aisle containment is far from arbitrary. Choosing the right aisle containment solution depends upon several factors, including:

1. Does the existing data center need to be retrofitted?

This includes evaluating costs, construction needs, current data center layout and more.

2. Current and future data center density requirements.

It's important to get all involved parties together including your current hardware providers to discuss your future data center roadmap. This can strongly dictate the timeline for your aisle containment system installation.



3. The uniformity of your current racks and aisles.

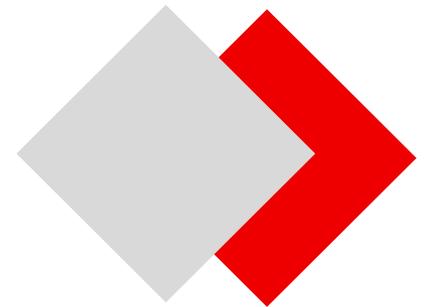
If your current racks are all the same size, you can lean towards a standard construction project, and all panels will be the same size. On the other hand, if your racks are different sizes your solution will need to be custom-fitted.

4. Is raised floor cooling used?

A great example of this is when the air conditioning runs through the floor, a plenum will pump into the hot area which will help dictate the best way to keep it contained.

5. The availability of a ceiling plenum to accept hot air.

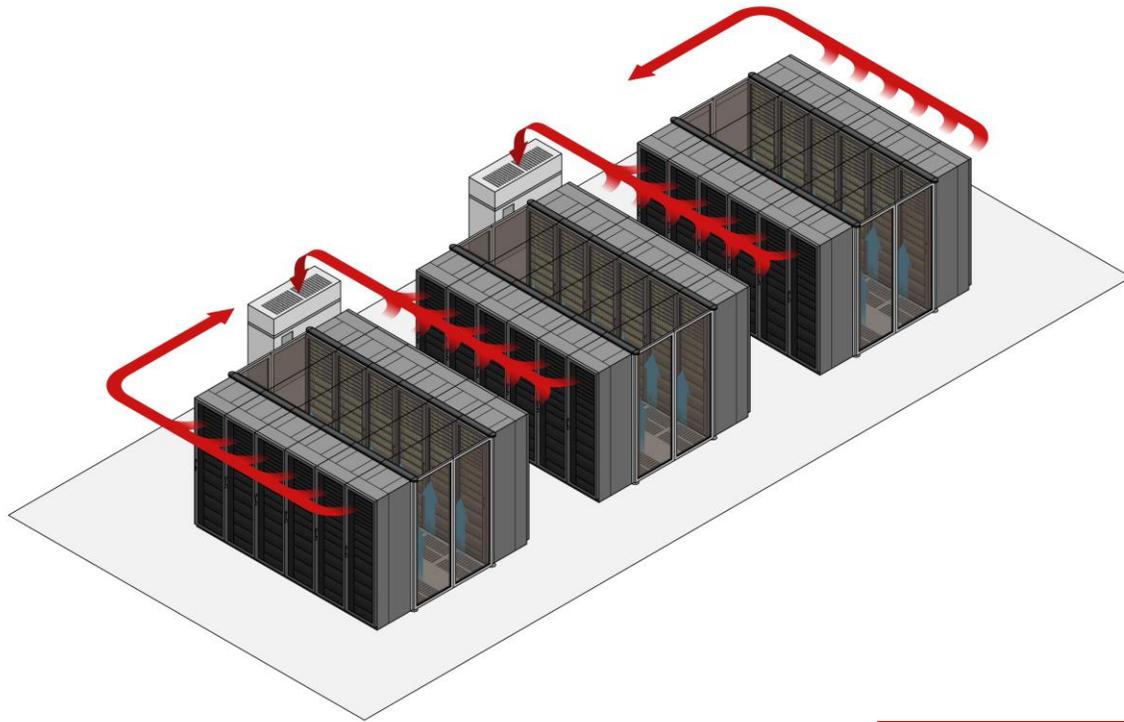
This refers to the connection between the containment panels and the ceiling. Some data centers pull hot air that will go into the chiller and back to the data center, while others pull hot air into a converter to heat the facility.



WHEN TO USE A COLD AISLE CONTAINMENT SYSTEM



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With cold aisle containment, the cold row is capped at the tops of the cabinets and across the aisle, and doors are installed at the ends of the row to contain the cold air. The goal of this system is to create a smaller area to cool and focus the cooling on the front of the systems. Therefore, a cold aisle containment system is typically used in high-density data centers, because it is more efficient to direct cold air onto densely populated racks than to cool the entire room.

Although cold aisle containment systems do not require conventional raised floor cooling, it is often used in environments in which cold air is generated outside of the containment area and brought in through the floor. Most existing data centers employ this type of cooling system, which can be retrofitted for cold aisle containment with minimal impact on operations.

Cold aisle containment that uses an internal cooling system can be implemented on a raised floor or slab. The CRAC units are positioned within the containment area, enabling even more focused cool airflow and greater CRAC unit capacity and efficiency. For this configuration, less energy is required for air movement, and air temperatures can be set higher. Both types of cold aisle containment use the same design approach. It is usually more cost-effective to employ a cold aisle containment system, but hot aisle containment typically proves to be more operationally effective.



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WHEN TO USE A HOT AISLE CONTAINMENT SYSTEM



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With hot aisle containment, a physical barrier is constructed to prevent hot and cold air from mixing, trap exhaust air at its hottest point and direct exhaust airflow into the AC return. Hot aisle containment reduces energy costs by improving cooling efficiency. It also increases the cooling capacity of CRAC units, which is measured as the ratio of the difference between supply and return air temperatures.

Hot aisle containment can be used with either external or internal cooling systems and with or without a raised floor, keeping in mind significant data center modifications may be required if a hot air plenum or ductwork must be added. One drawback of this system is that the hot aisle can be unpleasantly warm for data center personnel, but the remainder of the room can be set to a more comfortable temperature than with cold aisle containment. This leaves the rest of the room available for other uses making it an economically efficient solution. While hot aisle containment does not provide directed cooling, the “room volume” of cold air is available to protect equipment in the event of a CRAC unit failure.



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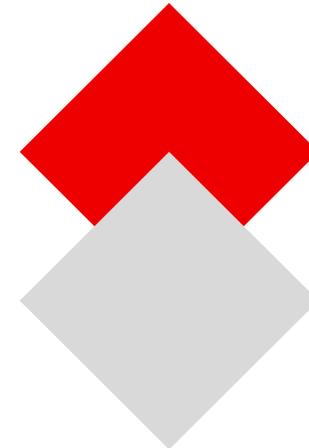
Conclusion

Data center densities continue to increase to meet growing market demands incurring increased cooling costs. Organizations are taking a hard look at the power used by “web-scale” data, edge, colocation and enterprise data centers amid rising energy costs. Power related to cooling will also continue to consume an increasingly large portion of the data center operations budget, with compute and non-compute loads accounting for nearly equal shares.

The efficiencies gained by high-density data center environments come with the tradeoff of greater heat, and traditional air cooling techniques become prohibitively expensive. Organizations need new strategies for effectively cooling high-density equipment to reduce the risk of downtime and keep a lid on rising power and cooling costs.

When evaluating which aisle containment system is best for your data center keep in mind:

- 1. Does the existing data center need to be retrofitted?**
- 2. Current and future data center density requirements.**
- 3. The uniformity of your current racks and aisles.**
- 4. Is raised floor cooling used?**
- 5. The availability of a ceiling plenum to accept hot air.**





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The benefits of hot aisle and cold aisle configurations can be augmented by aisle containment systems that control air mixing, improve cooling efficiency and CRAC unit capacity and direct chilled air for equipment intake. Cold aisle containment aims to create a smaller area to cool and focus the cooling on the fronts of the systems, while hot aisle containment traps exhaust air at its hottest point and provides a direct path into the AC return.

So, what should you use in your data center? When choosing cold aisle containment vs. hot aisle containment, the pathway to implement a cold aisle containment system may be faster, but the cost and energy efficiencies associated with a hot aisle containment system are typically greater. In the end, deciding on an aisle containment system begins as an intercompany discussion for your data center(s). It's strongly dependent on the 5 factors above, and what your team has decided is important for your future initiatives.

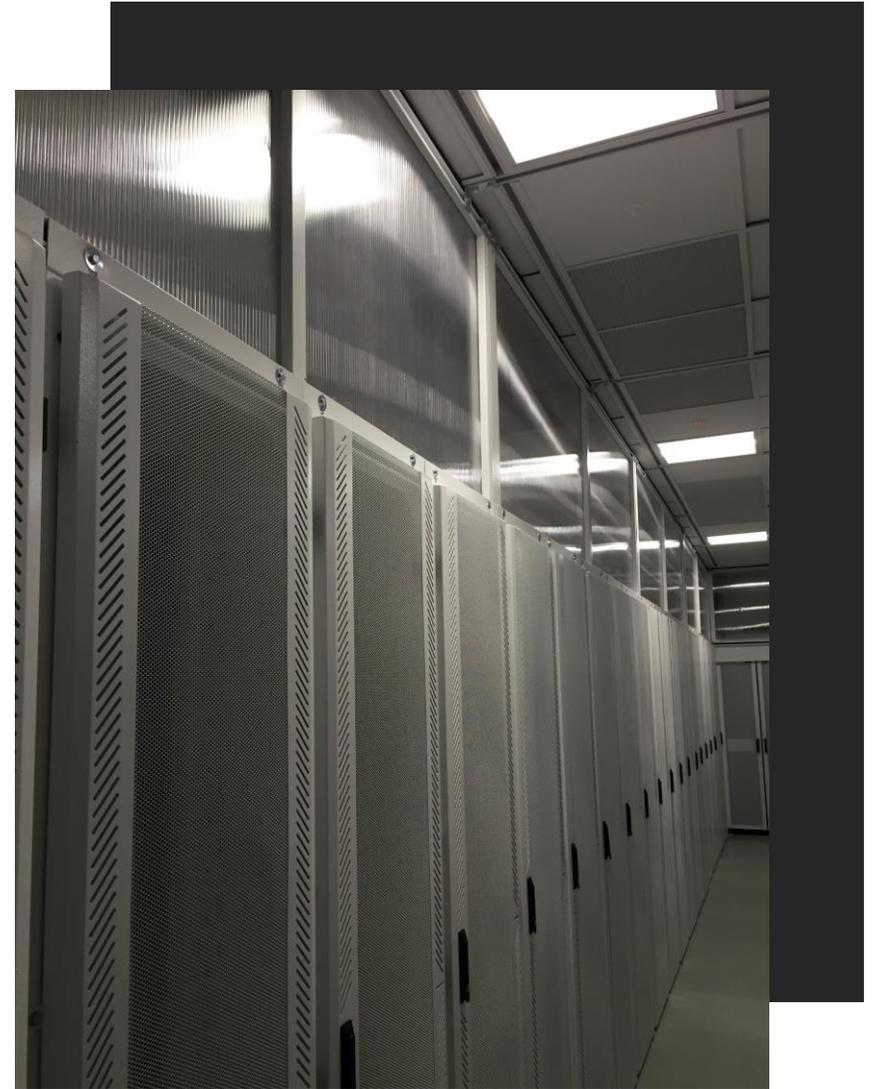
Ready to put a lid on your cooling costs?

See how DAMAC can help:

<https://www.maysteel.com/data-center-solutions/aisle-containment/>

Ready to have a conversation with a DAMAC engineer? Let's talk! Give us a call at 714-228-2900 or email

DAMACSales@DAMAC.com



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**THANK YOU
FOR READING!**