ENGINEERING & DESIGN
SPOTLIGHT

How to Save Significant Annual Data Center Operating Costs 400 Blanking Panels at a Time

As utility costs increase and budgets become tighter, there is growing demand to get as much capacity out of existing data center space as possible—all while reducing operating expenses, and preserving availability.

While there are a variety of ways to retrofit your data center for cost and energy efficiencies, sealing IT equipment server openings is among the simplest and most effective ways to reduce annual operating and capital costs. Sealing the open spaces in IT equipment cabinets with airflow management solutions can instantly lower IT equipment intake-air temperatures and increase the cooling capacity of data center infrastructure. Doing so is also often the most effective and least costly way to dramatically improve a data center's power usage effectiveness (PUE) and improve IT equipment reliability.

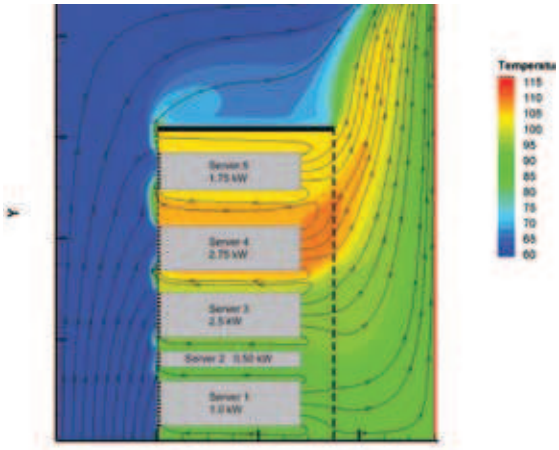
It is a fact that computer room cooling consumes more energy than any other system in a data center, so managing it correctly represents the greatest opportunity for reducing annual costs.

A third-party two-dimensional Computational Fluid Dynamics (CFD) analysis was commissioned by Upsite Technologies to study the effect of different types of blanking panels on airflow patterns and IT equipment intake-air temperatures within equipment server cabinets. Of the products studied, those that left small gaps between panels and equipment, allowed 19 percent hot exhaust air circulation, which can re¬duce the reliability of equipment and unnecessarily reduce the efficiency and capacity of cooling units, ultimately resulting in higher operating costs.

Further, the CFD analysis revealed that panels that do not leave gaps actually reduce average intake-air temperatures by 7°F (3.9°C), meaning that once gapless panels are installed, the temperature set point in a computer room could be increased by 7°F (3.9°C) and the maximum intake-air temperature of IT equipment would not be affected.

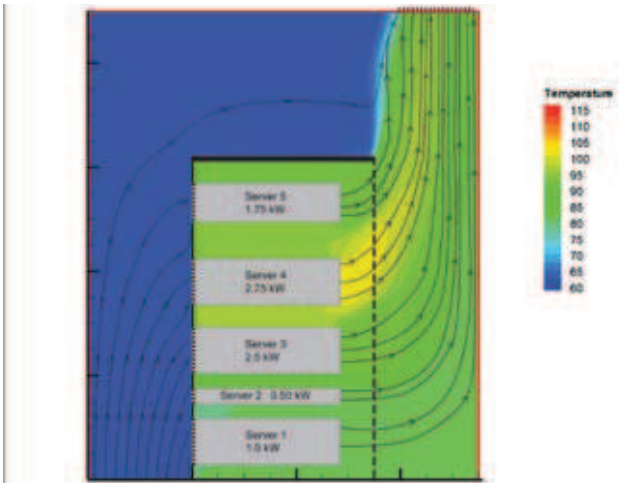
The cooler a computer room's operating temperature, the more likelihood there is for latent cooling, or condensation on the coils. For example, setting the computer room temperature at 72°F (22.2°C), not 65°F (18.3°C), could save a data center thousands of dollars a year in operating costs (energy savings) and capital costs (deferred additional cooling infrastructure costs).

Cross-Section of Airflow in Server Cabinet with Blanking Panels with Gaps Installed



Installed blanking panels are modeled with horizontal air gaps of 1.6 mm (1/16 inch) between adjacent blanking panels and also with horizontal air gaps of 3.2 mm (1/8 inch) between blanking panels and servers.

Cross-Section of Airflow in Server Cabinet with Blanking Panels with No Gaps Installed



Installed blanking panels are modeled with no horizontal air gap between adjacent blanking panels or between blanking panels and servers.

Server Cabinet with Blanking Panels With Gaps Installed

Server No.	Heat load (kW)	Airflow Demand (CFM)	Min Inlet Temperature (F)	Max Inlet Temperature (F)	Average Inlet Temperature (F)	Delta T vs No Panels (F)	% Temperature Drop	% Improvement over Metal Panels
5	1.75	184	62	90	72	11	13%	NA
4	2.75	216	61	82	67	9	12%	NA
3	2.5	262	62	72	64	15	19%	NA
2	0.5	78	66	70	69	19	22%	NA
1	1	157	61	66	63	8	11%	NA
			Average	76	67	12	15%	NA

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Server Cabinet with Blanking Panels with No Gaps Installed

Server No.	Heat load (kW)	Airflow Demand (CFM)	Min Inlet Temperature (F)	Max Inlet Temperature (F)	Average Inlet Temperature (F)	Delta T vs No Panels (F)	% Temperature Drop	% Improvement over Metal Panels
5	1.75	184	60	60	60	23	28%	14%
4	2.75	216	60	60	60	16	21%	9%
3	2.5	262	60	60	60	19	24%	5%
2	0.5	78	60	60	60	28	32%	10%
1	1	157	60	60	60	11	15%	4%
			Average	60	60	19	24%	9%

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To test the revelation and establish the financial impact, 400 HotLok Blanking Panels were installed in a high-heat density facility computer room with approximately 10,000 ft2 of raised floor.

Other computer room and IT cabinet particulars:

- Each cabinet dissipates 8.5 kW of power, for a total critical load of 3.4 MW
- Heat density yield of 316 W/ft2 (approx 3.400 W/m2)
- One third of cabinets (14U) contained no IT equipment and required blanking panels
- Of the one third requiring blanking panels, 40 percent (6U) are filled with 1U Panels and 60 percent (8U) are filled with 2U Panels
- The cost for Panels is the average selling price

Before the gapless panel installation: At 65°F (18.3°C) / 45% Rh, the Chilled Water Liebert 600C Computer Room Air Handler (CRAH) units have a 70 kW 100% sensible cooling capacity, therefore there is no latent cooling penalty in this calculation. For these return air condi¬tions, a total of 61 CRAH units are required, 49 units at full cooling capacity and 12 for redundancy.

After the gapless panel installation: The return air temperature set point could be raised to 72°F (22.2°C). At 72°F (22.2°C) / 45% Rh, the Chilled Water Liebert 600C CRAH units have a 98 kW 100% sensible cooling capacity. For the 4.25 MW of total cooling capacity, a total of 43 CRAH units will be required, 35 units at full cooling capacity and 8 for redundancy.

Post gapless panel installation, you can:

1. Increase return-air temperature set point by 7°F (3.9°C)—for this example, 65°F raised to 72°F (18.3°C raised to 22.2°C).
2. Place 18 units on inactive stand-by.

PLEASE NOTE: There is no difference in the total cooling capacity as that takes place in the mechanical room and the chiller(s) will dissipate the same amount of heat no matter how many CRAH units are operating in the computer room. The chilled water flow rate will not be included for simplicity, although in actuality there may be additional savings associated with reduced chilled water flow rates.

Annual Operating Cost Savings

18 units with 10 hp fans X 0.757 kW/hp	136 kW
Annual energy consumption savings (8760 hrs / yr)	1,191,360 kWhrs
Annual cost savings at $0.07 (€.12) per kWhr	$83,395
Maintenance cost savings on 18 units ($3,000 per unit)	$54,000
Total annual operating cost savings	$137,395*

*This represents a 29 percent reduction in the annual operating and maintenance costs of the cooling units.

Simple Payback

Month	1	2	3	4	5	6	7	8	9	10	11	12
US $	-10,312	1,137	12,587	24,036	35,486	46,936	58,385	69,835	81,284	92,734	104,183	115,633

Simple Payback Analysis

Cost and Savings	
# of cabinets	400
open U (1/3 of 42Us)	5,594
# of 1U Panels	2,238
# of 2U Panels	1,678
Total cost of Panels	$21,762
Annual savings	$137,395
Monthly savings	$11,450

With the total annual cost savings at $137,395 or $11,450 per month, simple payback occurs in the second month* of the HotLok Blanking Panel installation.

CONCLUSION

This financial impact study underscores the importance of installing gapless blanking panels, such as HotLok Blanking Panels in IT equipment server openings. Doing so permits you to place 18 cooling units on inactive stand-by, which means a significant reduction in your data center's power consumption. Sealing IT equipment server openings with gapless blanking panels is among the simplest and most effective ways to reduce annual operating costs in the data center and improve PUE.

DISCLAIMER

There is no guarantee that installing gapless blanking panels in every data center will produce the results listed above. To perform the calculation, assumptions had to be made about the operating environment and type of cooling infrastructure equipment used. The interrelated effect of conditions and equipment unique to every data center will affect the results. Contact Upsite Technologies to discuss what opportunities may exist in your data center for reducing operating cost. ■

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