



The HotLok Blanking Panel Basics from the Research & Development Department at Upsite Technologies

What makes HotLok™ Blanking Panels unique?

- As a vendor-neutral organization (we do not design, manufacture, or sell IT equipment cabinets) whose vision it is to develop products that optimize the critical physical infrastructure in data centers. Upsite Technologies, Inc. developed and manufactured a blanking panel designed to improve site uptime, reduce operating expenses, avoid capital outlays, and reduce the data center's environmental footprint.
- During the concept and development stages, we strove to apply good science, innovative engineering, and elegant industrial design to create a high value product for our family of optimizing products. Working in parallel, it took us six months to research market needs, four months to understand the science, and over a year to develop and manufacture the product.

Two examples of our approach that illustrate the points above are the following:

1. The market wanted an effective product—this means providing a seal that prevents hot equipment exhaust air from recirculating from the back to the front of the cabinet. The solution eliminates the mixing of the hot exhaust air with colder conditioned air from the perforated floor tiles or grates. If this mixing occurs, temperatures entering the equipment air-intake can exceed the ASHRAE maximum standard of 25°C (77°F), causing air-intake temperatures to rise, hotspots to emerge, and equipment to become less reliable. To mitigate these undesirable effects, data centers may lower set points, add cooling capacity, and implement additional higher cost solutions. To examine the science deliberately, we commissioned an independent third-party organization (Innovative Research, Inc.) to develop a two-dimensional computational fluid dynamics (CFD) model of air recirculation within a typical high-density equipment cabinet. We were a bit surprised by some of the results from the CFD model. One result is that if there is a gap of even 1.6 mm (1/16th inch) between the blanking panels, as much as 15 to 20 percent of the air-intake volume can be from recirculated hot equipment exhaust air. Another is that the maximum average temperature at the air intakes under this condition was 8.8°C (16°F) higher than those with no leaks between the blanking panels. Even worse, the CFD model under this condition showed that the top server in the cabinet with small gaps between the blanking panels experienced a maximum temperature of 32.2°C (90°F). The same top level server in the cabinet with no gaps between the blanking panels experienced a maximum temperature of 15.6°C (60°F), which is a favorable difference of 16.2°C (30°F). Most troubling of all, the two-dimensional CFD model analysis of the air flows (even when an excess volume of conditioned air was being delivered over the total demand of all the servers

in the cabinet) showed that when hot exhaust air recirculation occurs within a cabinet, installing higher flow perforated floor tiles or grates, reducing cooling unit set points, or even installing additional cooling capacity may not necessarily reduce the server air-intake temperatures. With this data, the team was highly motivated to develop a near-perfect, cost-effective seal that would deliver operating and economic benefits.

2. The market asked for tool-less installation and removal. We met this requirement and went further by creating an ergonomic, snap-in design. We are aware that removal can be awkward with other blanking panels as a user must squeeze his hands and fingers into the ends of the blanking panel and work in a confined space at the edges of the rail and cabinet opening. Repetitive stress and minor physical injury, including broken fingernails and scraped knuckles, are often the result. In addition, a significant force may be required to remove the blanking panel. After ergonomic analysis and study (evaluating eight different design concepts), we addressed this issue by creating comfortable in-board finger holes that allow a user to install and remove HotLok Blanking Panels safely and comfortably from any location, bottom to the top, in the cabinet. The benefits of this design are lower labor costs, fewer minor injuries with increased user satisfaction, and an aesthetically attractive cabinet.

In summary, the development team succeeded brilliantly by creating a product that meets or exceeds all the major market requirements at a very competitive price level. While many blanking panels meet some of the markets current requirements, none that we are aware of meet all the requirements, except HotLok. [The major market needs are discussed below.]

What do data center managers need to know about the product?

We believe that HotLok Blanking Panels are the only product on the market that meet or exceed all of the market's needs and requirements that we were able to identify.

- Provide a highly effective, near-perfect, seal
- Provide snap-in design that facilitates tool-less installation and removal. Its unmatched ergonomics help to reduce installation and removal time, eliminate minor injuries, and increase user satisfaction.
- Fit all standard mounting rail openings for 19-inch rail widths specified in EIA-310-E
- Stack on themselves to provide convenient, close-at-hand storage which eliminates the need for particulate-emitting corrugated containers in the computer room
- Have an attractive appearance



- ❑ Are both durable and lightweight for long life and lower shipping costs
- ❑ Provide an effective base for other uses. For example, the HotLok Blanking Panel provides a platform on which to mount a liquid crystal thermometer, the Upsite® Temperature Strip, which offers an accurate, quick reading of air-intake temperature.
- ❑ Be a green, safe product. HotLok Blanking Panels and all packaging are RoHS compliant and recyclable, and have a fire rating of UL 94-V-0

How does this product differ from the competition?

Other products meet some or even many of the customer needs but only HotLok Blanking Panels meet all customer needs and requirements identified. These needs are met with a high value product that provides unmatched benefits and features at very competitive price points, in many instances, well below competing blanking panels.

Why should data center managers purchase this product?

Quite simply, because HotLok Blanking Panels work extremely well and are priced competitively. They meet all the known customer needs, the most important of which is providing an effective seal. This single feature alone will eliminate hot exhaust air recirculation, reduce hot spots, stabilize equipment air-intake temperatures, and provide potential significant savings in labor and energy costs.

How does HotLok lower the carbon footprint in data centers?

Background: The UK Parliamentary Office of Science and Technology (POST, 2006, No. 268) defines a carbon footprint as “the total amount of carbon dioxide (CO₂) and other greenhouse gases emitted over the full lifecycle of a product or service. Normally a carbon footprint is usually expressed as a CO₂ equivalent (usually in kilograms or tonnes), which accounts for the same global warming effects of different greenhouse gases.” Carbon footprint is a measure of the amount of carbon dioxide or CO₂ emitted through the combustion of fossil fuels. In a data center, electrical energy is consumed from the public utility grid to maintain adequate levels of cooling in a data center. Studies by the Uptime Institute and others have shown that in a well-run data center the cooling system accounts for 65 to 75 percent of the total energy consumed, and that about one-third of the cooling energy is used simply to power the fans. The Uptime Institute has also found that many data centers are running three or more times the number of fans necessary.

Response: Left unchecked, any recirculated hot exhaust air from equipment in the IT cabinet raises the temperature at the equipment air intakes. If the intake air exceeds the ASHRAE-recommended maximum of 25°C (77°F), hotspots can result and the equipment can become less reliable. A typical response is to reduce the set point on the cooling units and/or to increase

the amount of air (e.g., run more cooling units and fans) which consumes more energy (burns more fossil fuel) and increases the carbon footprint of the data center. HotLok Blanking Panels reduce or eliminate hot exhaust air recirculation in an IT equipment cabinet. Therefore, all the air as it enters the equipment air intakes is conditioned at a stable temperature very close to the temperature of the air supplied through the perforated floor tiles or grates. With this condition, set points can be raised and the amount of conditioned air and number of fans can be adjusted to reduce energy consumption in the data center. Using less energy reduces the carbon footprint of the data center. Given the large amount of energy consumed in a data center to provide cooling and the typical overcapacity of cooling (as a percentage of total energy to run the data center), even a small change in the temperature or volume of air translates into a significant energy savings and reduction of the carbon footprint.

Why is the stacking feature of HotLok important in a data center?

Each HotLok Blanking Panel is engineered to snap into and stack on top of another unit. It is possible to stack ten 1U or twenty 2U HotLok Blanking Panels on top of one another. As a stacked unit, HotLok Blanking Panels can be stored on convenient, open shelves in the computer room for ready availability, which reduces labor costs. There is no need to store them in a corrugated (cardboard) box or some other container. The Uptime Institute (authors of the Tiers Classification System for data centers) considers it a best practice to avoid corrugated containers in a computer room, because they emit particulates that may create air filtration and other air contamination problems. This is reinforced by ASHRAE, which publishes a standard regarding the particulate matter that a typical computer room can handle. Aside from the HotLok Blanking Panel, we are not aware of any other plastic blanking panel that offers the tool-less installation feature and the option of stacking.