

**NP 300**

**Adaptive Enclosure Heat Containment System**

The Belden® Adaptive Enclosure Heat Containment Cooling Distribution System (AEHC) substantially reduces your IT enclosure cooling costs by achieving 100% utilization of your existing cooling infrastructure. The result is an efficient, “green” facility.



**Belden's AEHC System Ensures that the Entire Data Center Space Is Normalized with the Appropriate Volume of Cool Air Required by the IT Equipment**

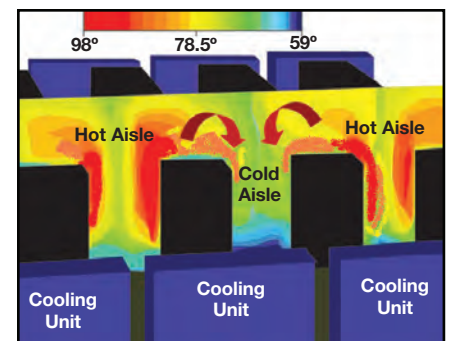
Belden's Adaptive Enclosure Heat Containment (AEHC) System is a highly-effective method for cooling data center enclosures in a much more efficient and cost-effective way than was previously possible.

A major challenge faced by data center managers today is ensuring that cooling systems do not fail, that they continue in an uninterrupted way to cool the sensitive electronic components in IT equipment enclosures. However, achieving this goal can be needlessly expensive. It's estimated that cooling accounts for up to 30 percent of a data center's total energy load. What's more, the cooling process itself is accompanied by excessive energy waste, largely due to an oversupply of cold air to the data center by computer room air conditioner (CRAC) units that are attempting to compensate for inefficiencies in the enclosure cooling process.

For example, a substantial amount of the cold air outputted from a CRAC does not follow a planned path to the IT load as it should, but instead bypasses IT equipment and returns to the air conditioner via misplaced perforated floor tiles, floor cable cut-outs and other openings, to the air conditioner intake. As a result, a substantial amount of the cool air from the CRACs never makes it to the enclosure enclosures. In addition, some of the hot air being exhausted to the rear of the enclosure by server fans leaks to the front of the servers instead of going back to the CRAC return. In this case, hot exhaust air mixes with cold room air before being drawn back into the enclosure.

A recent study conducted on 19 large computer rooms found that, on average, the amount of cold air supplied to a data center room is 2.6 times the amount of cold air actually consumed by the IT load. The cooling system is oversupplying the room with cold air to overcome both bypass leakage and the effects of hot/cold mixing. The oversupply leads to significant energy waste and dollar expenditure.

What's more, the study found that even though the rooms are oversupplied with cold air by almost a factor of 3, an average of 10% of enclosures still experience air intake temperatures exceeding ASHRAE maximum reliability guidelines. Rooms having the most excess cooling air actually experience the worst hot spots.



Containment of the hot aisle is a complex problem, even in computer rooms oversupplied with cold air. Belden's AEHC eliminates hot spot issues by providing for a defined hot air return path to the CRAC unit.

Belden's AEHC system completely separates the hot and cold side of the computer room to provide for efficient and cost-effective cooling.

### Solving the Cooling System Challenges

Because of its innovative heat containment design, the Belden system overcomes all of these problems. Since it completely separates the hot and cold side of operations, the room will be normalized with cool air which never mixes with the exhaust heat from the enclosure. The bypass problem is eliminated, too. As a result, there is no longer a need to oversupply cold air to the room at several times the amount actually needed. The physical position of the CRAC unit and its proximity to the enclosures are no longer a concern, a fact which greatly simplifies the problem of data center infrastructure design.

When designing a totally new data center, you can now install bigger and fewer CRAC units, instead of relying on many smaller units that are less efficient. And when retrofitting an existing room with the Belden AEHC system, you can use the same cooling equipment that's currently installed. In either scenario, Belden's advanced management software will give you better control of your IT environment by providing a real time assessment of enclosure cooling load or demand.

In addition, you'll now have an opportunity to deploy even more load in the same room, a great efficiency benefit in today's economy. If you have space left in your enclosures but aren't deploying more devices because your cooling system is already at full capacity, you can retrofit Belden's heat containment system on those enclosures having the highest heat loads to get much more functionality in the room – and be able to host even more IT equipment.

The Belden AEHC system will increase the temperature differential between the inlet and outlet temperatures of the CRAC unit, giving it much greater operational efficiency and afford you an important savings in energy consumption. Not only does the system reduce the amount of cold air needed by the IT room, since there is no mixing of hot and cold air within the room it is now possible to raise the temperature of the cooling air supplied to enclosures, closer to the ASHRAE recommended upper limit. The cold/hot air paths are fully separated by the Belden system, so the CRAC can supply less air to the room at a higher temperature, and still assure better cooling with no hot spots.



Embedded software allows each AEHC unit to be fully autonomous. The AEHC controllers have their own IP address, enabling network connection. The AEHC then allows for real time monitoring of the heat load, temperature and alarm conditions for each IT enclosure.



## A Closer Look at How the AEHC System Works

Based on a pressure reading made by a sensor inside the enclosure plenum, the rotational speed of the fans in the two cartridges mounted atop the enclosure is modulated so that they pull out exactly the correct amount of air from the enclosure and send it back to the air conditioner return via a ceiling plenum.

If the cooling load in the IT equipment rises, causing a pressure change in the enclosure plenum, the AEHC system fan speed will increase, and the fans will exhaust more air into the ceiling plenum. If the load drops, fan speed will decrease accordingly. The Belden system does not focus on the precise temperature within the enclosure, but rather on achieving a balance between the amount of air consumed by the IT load and the air returned to the CRAC unit via the ceiling plenum. The system does not permit mixing of hot and cold air in the room, so sufficient cold air will always be available for intake into the enclosure to cool the active load.

The system's control is based on sensing pressure as opposed to temperature, since, depending on the type of active equipment present, the temperature inside the enclosure plenum can vary quite a bit from place to place. On the other hand, even though pressure is changing inside the plenum, as well, it changes essentially in a uniform way throughout the interior of the enclosure.

Belden's concept of pressure sensing is clearly the best way to go. Other enclosure heat containment systems on the market, whether passive or active, have serious drawbacks in their approach. Passive systems, since they are pressurized, leak and create conditions not recommended by IT equipment manufacturers. Active systems starve the room of precious air that should be used for cooling.

With Belden's AEHC approach, since the room is normalized with cool air and all heat is contained, the cooling source can be located anywhere in the room. Cool air can potentially be fed to enclosures from a duct, enabling freedom of room infrastructure design and eliminating the need for a raised floor. Whatever the means of delivery of conditioned air for a normalized room, the Belden system works to perfectly match the correct amount of air for the IT load.



Belden's AEHC system utilizes pressure sensing to dynamically adjust for speed, resulting in perfect balance between intake and exhaust air volume.



Intelligent hot swappable fan cartridges allow for ease of maintenance and system scalability.

## Benefits Summary

### Increased Efficiency/Greening of the Data Center

- Eliminates over-supply of cold air in data center, potentially reducing the number of CRAC units
- In a new data center, permits use of larger, more efficient CRAC units to achieve highest cooling per unit of power
- Entails higher temperatures in the air returned to CRAC, improving efficiency
- Allows raising of supplied air temperature, resulting in more hours of free cooling

### Reduced Initial Capital Expense

- Lowest total cooling equipment cost available per kW of IT load
- No piping; vastly reduced electrical and sensor networks
- Reduced and simplified engineering
- Rapid installation and training

### Systems Threshold

Adaptive Enclosure Heat Containment - Alarm Thresholds - Windows Internet Explorer

http://192.168.115.220/ym\_odatems.htm?bda\_xbopenwda

**BELDEN** HCS020  
Sun 12/07/06 16:02:51

Adaptive Enclosure Heat Containment  
Serial Number: 00001885001C26FF  
Version: 3.1.10  
IP Address: 192.168.115.220

AMB View Data Logging Alarm Thresholds Test & Configure MB | XML

#### System Alarm/Fault Notifications

	Email	Traps
AB Feed Error	<input type="checkbox"/>	<input type="checkbox"/>
Fan Cartridge Error	<input type="checkbox"/>	<input type="checkbox"/>
Disconnected External Sensor	<input type="checkbox"/>	<input type="checkbox"/>

Save Changes

Reset All Alarm Defaults

#### System Threshold Settings

Alarm Notice: Disabled

Source	Type	Threshold	Email	Traps
Capacity	High Alarm	95	<input type="checkbox"/>	<input type="checkbox"/>
	High Warning	90	<input type="checkbox"/>	<input type="checkbox"/>
Fan End of Service Warning	High Alarm	60000	<input type="checkbox"/>	<input type="checkbox"/>
Return Temp (F)	High Alarm	115	<input type="checkbox"/>	<input type="checkbox"/>
	High Warning	110	<input type="checkbox"/>	<input type="checkbox"/>
	Low Warning	55	<input type="checkbox"/>	<input type="checkbox"/>
	Low Alarm	50	<input type="checkbox"/>	<input type="checkbox"/>

Save Changes

The threshold setting in Belden's AEHC system software provides early warning alarms for problem conditions. Alarms are automatically reported. Supported Network Protocols: DHCP, HTTPS, SMTP/POP3, HTTP, ICMP, TCP/IP, SNMP, DNS.



Belden's AEHC system features external displays for quick and easy assessment of system load and alarm conditions.

## Increased Availability

- Fewer, larger cooling systems means reduction in components and interconnects
- No hot-spots, even with very high density enclosures
- Having single, not multiple, cooling systems in operation improves availability and simplifies maintenance programs
- Water or glycol loops are isolated to perimeter of facility; no danger of leakage into enclosures
- Reduced need for human interaction
- Easy maintenance
- A single fan cartridge failure or repair does not affect an enclosure's cooling
- Provides early warning alarms for problem conditions
- Same system used in both existing and new facilities
- Cartridge installation does not interrupt existing operations
- All components are "hot swappable" to reduce human interactions
- System will issue reports on combined IT cooling enclosure loads for accurate assessment of new server and circuit deployment
- Involves low maintenance and service costs

## Increased Flexibility

- IT enclosure load location is divorced from cooling source locations
- Cooling can be dynamically scaled from 0 to 20kW per enclosure, by a simple change of fan cartridges, ranging from 1-10 or 10-20kW per enclosure.
- System reduces the quantity of CRAC units required on floor of new data center, or fully utilizes those in existing facilities
- Adaptable to existing enclosures and easily allows IT adds, changes and removals without disrupting IT operation or the environment
- Maximizes enclosure space on the floor, due to fewer CRAC units taking up space
- Same stable cooling environment, even with low slab-to-slab ceiling heights
- Allows higher power density per enclosure rack with no effect on intake air temperatures
- Extends operation during utility failure by routing load heat across CRAC coils and concrete floor slab
- System automatically scales fan speed to match IT load and reports cooling load in real time for each enclosure
- Complete management software; software is embedded in the controller so each unit is fully autonomous

## Ordering Information

Belden Part Number	Type	Description
<b>Adaptive Enclosure Heat Containment (AEHC) System</b>		
HCS010	System	AEHC (10 KW) Chassis, Fans, Host, Sensor
HCS020	System	AEHC (20 KW) Chassis, Fans, Host, Sensor
<b>Accessories</b>		
HCFD10	Fan Cartridge	AEHC 10 KW Fan Cartridge with Display
HCFD20	Fan Cartridge	AEHC 20 KW Fan Cartridge with Display
HCD0xx	Duct	AEHC Duct Custom Height - xx-height inches
HCD052	Duct	AEHC Duct - 52"
HCDS12	Duct	AEHC Duct - 12" stackable
HCDS24	Duct	AEHC Duct - 24" stackable
HCAD01	Duct	AEHC Inter-duct Connector 24"/600mm
HCAD02	Duct	AEHC Inter-duct Connector 30"/750mm
HCAD03	Duct	AEHC 20" Round Duct Adapter
HCHC01	Acc. Host Assembly	AEHC Chassis, Power/Ethernet with Host, Sensor
HCH001	Acc. Host	AEHC Power/Ethernet Host
HCP001	Acc. Sensor	AEHC Pressure Sensor with Mounting Bracket
HCP002	Acc. Sensor	AEHC Temperature/Humidity Sensor with Mounting Bracket
HCC001	Acc. Chassis	AEHC Chassis Assembly