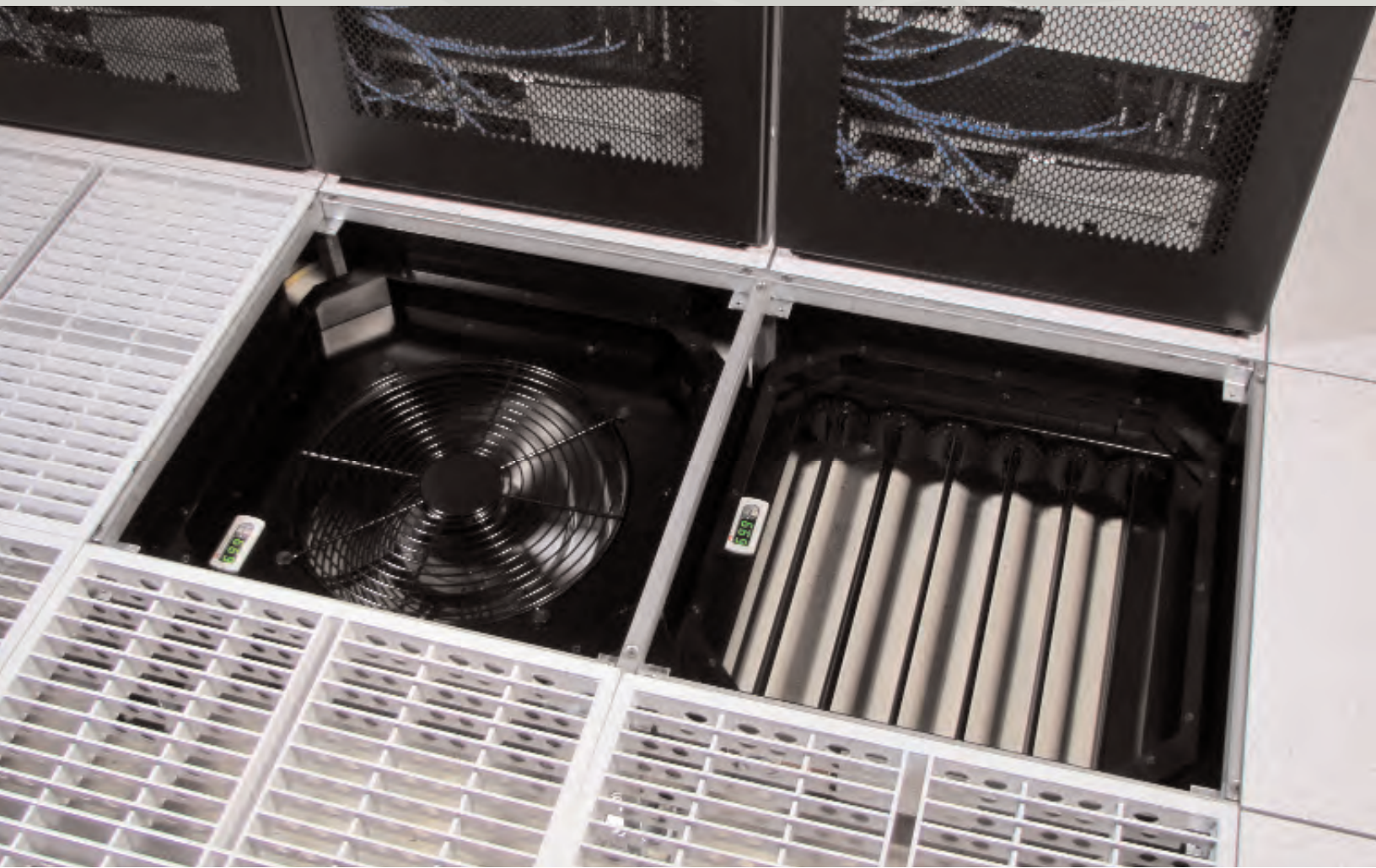# In-Floor Cooling Solutions

DirectAire®, SmartAire®, PowerAire®

*Solutions for **High Density, Diverse** and **Variable** Data Center Environments*

Tate®

A New Angle on Cool

In-floor Cooling Solutions Deliver the Right Amount of Cooling in the Right Place

The continued adoption of high density equipment, virtualization and cloud computing strategies require that the cooling infrastructure of a data center be able to accommodate high and often variable heat loads while offering superior energy efficiency. Recognizing the challenges of cooling a high density, variable load data center environment Tate has developed a range of cost-effective and energy-efficient solutions that provide data center owners with compelling returns on investment and lower operating costs in both new build and retrofit applications.

In-Floor Cooling Solutions

Tate's **DirectAire®** directional airflow panel angles airflow to nearly eliminate by-pass air and save significant energy. The **Opposed Blade Damper** offers granular manual airflow volume control. **SmartAire®** automated variable-air-volume damper directly matches cooling with the heat load at the rack level by monitoring and reacting almost instantly to any variations in utilization. And, the **PowerAire®** fan assist module provides retrofit applications with a solution to implementing high density equipment in their current raised floor facilities without significant capital investment.

These products directly address many of the challenges brought by the introduction of these new technologies. While the technology and infrastructure in the data centers continue to evolve so has the raised floor design. These new products have enabled a raised floor environment to accommodate these changes by offering the ability to handle extremely high density racks, adjust cooling to match variable heat loads, and do so efficiently. Best of all, the In-floor Cooling solutions can easily be used in retrofit applications or new construction. So take a new efficient angle on how you approach cooling your data center.

DirectAire® & DirectAire® X2

High Density Directional Airflow Solutions for Data Centers

Unlike other airflow panels the DirectAire and DirectAire X2 angle the airflow toward the server rack to significantly reduce bypass air. DirectAire is designed for a one-to-one pairing with a standard 42U rack while DirectAire X2 is intended to provide even airflow delivery to racks on either side of the cold aisle in a legacy data center that has only one accessible airflow panel. Both offer the same directional airflow, strong durable design and improved energy performance.

Easily Cool High Density Racks

Both DirectAire's features **68% open area**, capable of delivering **2,600 CFM at .1" H$_2$O static pressure.** More importantly each vane has a deflection angle at the top to direct the airflow towards the rack to achieve a **93% TAC** rate. This means 93% of the airflow delivered through the panel is entering the face of the server rack, providing the highest cooling capacity and energy efficiency. Compared to typical airflow panels which only deliver 30-50% directly to the rack. This improvement enables DirectAire to efficiently cool over **25kW per rack (X2 over 12.5kW per rack)**.

Strong & Durable

Both DirectAire's feature all steel construction making them the strongest airflow panels on the market. With a **2000 lb Rolling Load, 2500lb Design Load and a Minimum Safety Factor of 2.0** equipment can be moved over the airflow panels without worry.

## Improve Data Center Financial Performance

DirectAire maximizes the financial performance of any new or existing data center. The precise delivery of air reduces bypass airflow allowing new facilities to reduce the number of CRAH units. Retrofits can set CRAH units with fixed speed fans to standby mode or adjust variable fan drives to operate at a lower static pressure, saving energy. Likewise the 93% TAC rate eliminates the need for a full containment system. The facilities overall cooling capacity will also be improved allowing for the addition of IT equipment without the capital investments on infrastructure.

Directional airflow vanes provide 93% TAC

Designed for superior load performance
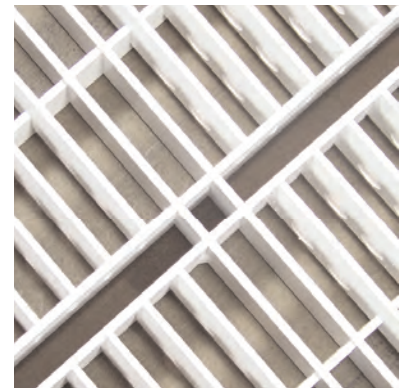
68% open area delivers 2600 CFM @ .1" H$_2$O

DirectAire Key Performance Characteristics

- Directional Air Flow Achieves a 93% Total Air Capture
- Pressure Equalizing Diffusion Blades
- Cools over 25kW per Rack
- Reduces Capital Expenditures on Cooling Infrastructure by 40%
- 68% Open Area delivers 2,600 CFM @ .1" H2O
- Over 40% Annual Fan Energy Savings
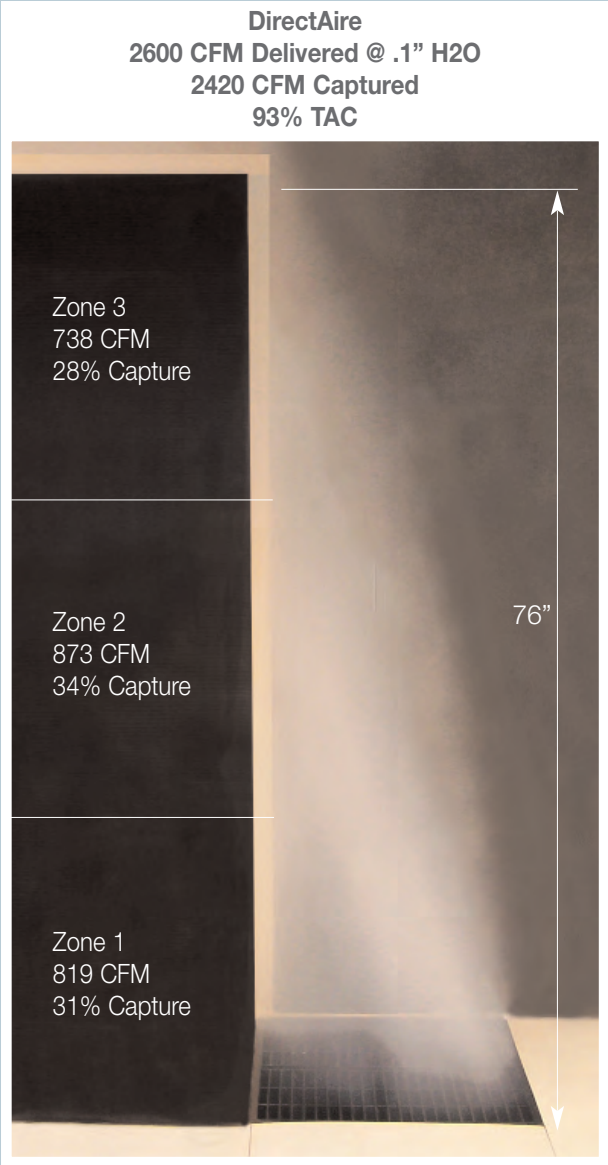- 2,500 lbs Design Load boosted to 3,000 lbs with HD stringer

DirectAire X2 Key Performance Characteristics

- Allows for directional airflow delivery to two racks when the existing cold aisle can only accommodate one airflow panel.
- Capable of cooling >12.5kW per rack due to evenly split nature of directional airflow paths

Tate

Total Air Capture (TAC) Rate

Total Air Capture (TAC) rate refers to the amount of air delivered through the airflow panel that is then captured by the server rack. The server rack profile below represents a standard 24" x 76" server rack. Lines have been added to show the three zones of the server rack. Zone 1 represents the bottom of the rack closest to the floor and Zone 3 represents the top of the rack farthest from the air supply. You will notice that the DirectAire panel delivers **93% of it's 2,600 CFM at .1" H$_2$O** to the face of the server.

The data reported on the smoke test images below show the distribution of airflow through both panels for each zone in a 42U rack. You will notice the airflow through the DirectAire panel is spread evenly across the three zones of the rack. When racks are placed 6˝ from the edge of a DirectAire X2 panel as shown the airflow is divided evenly between the two adjacent racks.

DirectAire
2600 CFM Delivered @ .1" H2O
2420 CFM Captured
93% TAC

Zone 3
738 CFM
28% Capture

Zone 2
873 CFM
34% Capture

Zone 1
819 CFM
31% Capture

76"

DirectAire X2
2600 CFM Delivered @ .1" H2O
2420 CFM Captured
93% TAC

Zone 2
567 CFM
23%
Capture

Zone 2
567 CFM
23%
Capture

Zone 1
643 CFM
27%
Capture

Zone 1
643 CFM
27%
Capture

The DirectAire smoke test above shows directional airflow path and air capture rate per zone at the face of a standard 42U server rack.
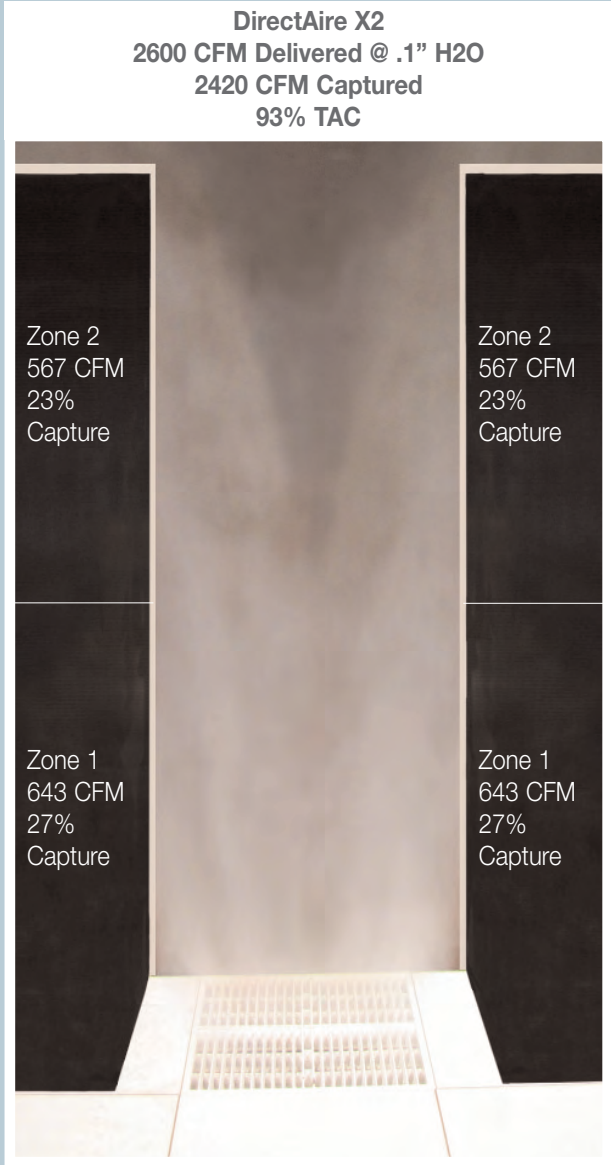
The DirectAire X2 smoke test above shows directional airflow path and air capture rate per zone at the face of a standard 42U server rack.

Delivering Air in the Right Place

DirectAire Reduces Bypass Air to Improve Capacity and Energy Efficiency

Eliminate the Burden of Airflow Containment

Containment systems in a data center come with many challenges including fire code requirements, service distribution restraints and limited flexibility. Unlike other panels which throw air straight up in a vertical plume the DirectAire's angular throw evenly distributes the majority of the air it delivers directly to the face of the rack providing effective containment when used in conjunction with best practices.
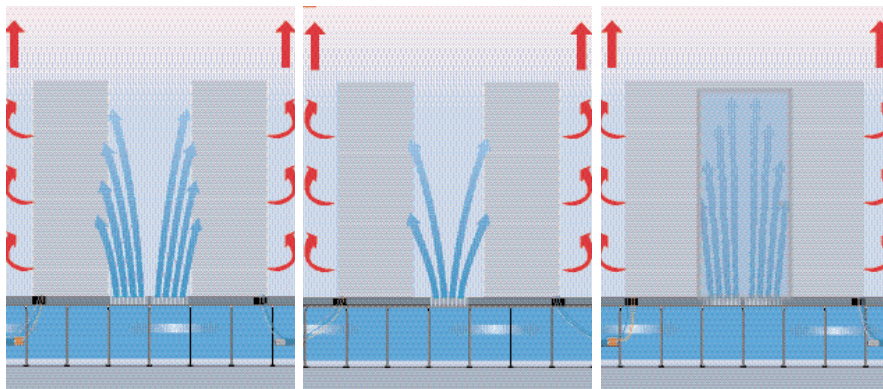
DirectAire's 93%TAC rate enables you to gain near peak airflow without containment.

DirectAire X2 enables you to maximize airflow in aisles with a single row of airflow panels without containment.

Typical airflow panels require containment systems to ensure maximum airflow to the racks.

High Density Cooling Capacity

DirectAire's ability to deliver high volumes of air directly and evenly across the face of the server rack gives it the unique ability to handle very high density equipment. The table below lists cooling capacities per rack based on a mathematical calculation for systems without containment.

DirectAire & DirectAire X2 CFM & Cooling Capacity			
Pressure (in. H2O)	CFM	DirectAire kW/rack w/o Containment*	DirectAire X2 kW/rack w/o Containment*
.02	1151	8.5	4.2
.04	1626	12.0	6.0
.05	1844	13.6	6.8
.06	2007	14.8	7.4
.08	2318	17.1	8.6
.10	2594	19.1	9.6
.12	2823	20.8	10.4
.14	3027	22.3	11.2
.16	3217	23.7	11.9
.18	3378	24.9	12.5
.20	3433	25.3	12.7

*Cooling capacities were calculated using the following formula:

(CFM x Total Air Capture %) / 126(*CFM needed to cool 1kW @ 25ºF △) = kW per rack.*

TAC Reduces Energy Usage

The total airflow required for cooling the same size data center is significantly reduced through the increased TAC rate provided by DirectAire. This reduction in total airflow has a dramatic effect on the fan energy required to move air throughout the data center.
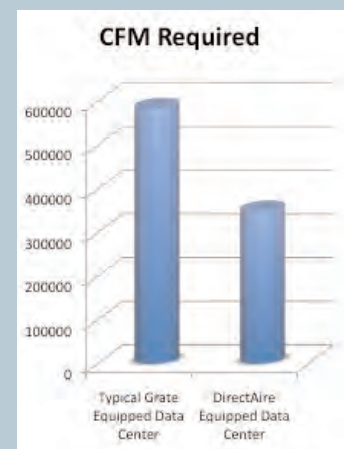
The chart shows over a 40% reduction in the Total CFM required to cool a typical data center with a 2MW IT load using a typical grate compared to DirectAire.

For more info on DirectAire's airflow and heat load capacity and learn how these tests were conducted download the white paper at: www.tateinc.com/infloor

Tate

Improve Your Financial Performance
DirectAire Offers Energy Efficiency, Capital Investment Reduction and Excellent Payback

The energy savings realized through the use of a DirectAire airflow panel is made up of two components. The minor component is gained from the panel's large open area which allows the same airflow at a lower static pressure. The second and larger component, is realized through the DirectAire's 93% Total Air Capture rate. A typical uncontained cold aisle configuration assumes more than 50% of the air delivered will bypass the IT equipment. The **DirectAire reduces this bypass air to less than 10%** resulting in tremendous energy savings.

The potential for enormous first cost savings are available to new construction projects due to DirectAire's 93% TAC rate. The virtual elimination of bypass air enables the facility to operate safely using less CFM and therefore allowing for a significant reduction in the number of CRAH units required.

To evaluate the potential impact on the efficiency of your facility download our in-floor cooling cost model tool at: www.tateinc.com/resources/cost_model.aspx

Example Data Center Characteristics	
User IT Load (kW)	1720
Number of Racks	200
Calculated Rack Density Average (kW)	8.6
Maximum IT Load Per Rack (kW)	12.5
Per kWHr Cost	0.08
Expected IT Equipment Utilization	70%

	Baseline	RetroFit	New
Perimeter CRAH Unit Design	Typical Grate w/Belt Drive Centrifugal Fans	DirectAire w/Belt Drive Centrifugal Fans	DirectAire w/Belt Drive Centrifugal Fans
Rack Density for Calculation (kw)	12.5	12.5	12.5
Expected TAC %	50%	93%	93%
Total Required CFM to be delivered (CFM)	628,940	338,140	338,140
CRAH Units Required (50 Ton Units)	34	18	18
Total Fan Power Required (kw)	402.5	216.4	216.4
Estimated Annual Energy Consumption (kWh)	3,526,090	1,895,747	1,895,747
Fan Annual Energy Cost $	$282,087	$151,660	$151,660
Required CFM Per Rack (CFM)	1,572	1,572	1,572
Required CFM Per Panel (CFM)	3,145	1,691	1,691
Cost Per DirectAire		($300)	($125)
Number of Units Required		200	200
Total Cost of DirectAire		($60,000)	($25,000)
CRAH Unit Reduction Savings		$0	$560,000
Fan Upgrades (EC Tech)		$0	$0
Upfront Cost or Savings Using DirectAire		($60,000)	$535,000
Annual Energy Savings		$130,427	$130,427
Payback in Months (simple)		5.5	0.0
3 Year Savings		$331,282	$936,282
PUE Impact	1.80	1.69	1.69

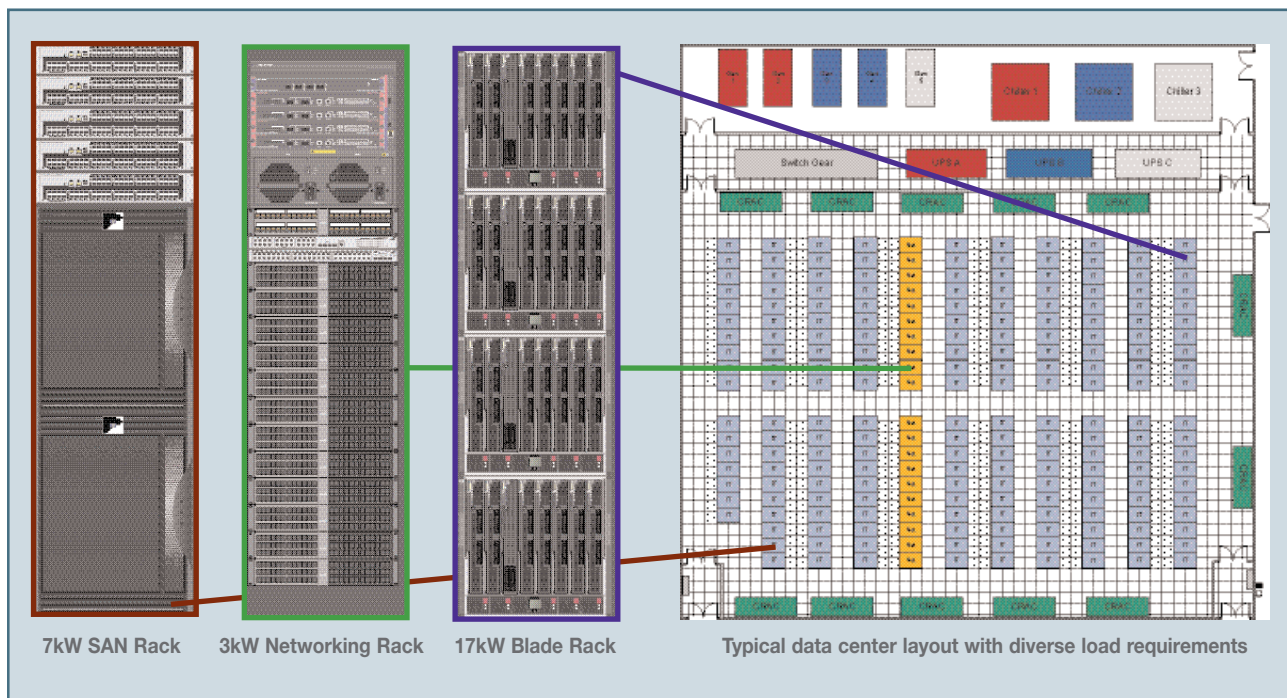**Retrofit Payback Less Than 6 Months**

The Data Center is Rapidly Changing

Understanding and Managing Diverse & Variable Loads

The Challenge of a Diverse Load Environment

The typical data center environment does not contain a single per rack density level, in fact it would be difficult to find any two racks in a large data center that consume exactly the same amount of energy. The load diversity results in differing airflow requirements per rack. Efficient cooling requires that the airflow delivered to each rack be matched to that rack's demand.

Each rack in the data center however is a constantly changing entity, with each add, move or change modifying the load. This of course changes the rack's airflow requirements, resulting in the need to manually adjust the airflow delivered from each panel to properly and efficiently cool the rack.

Example of Load Diversity in a Typical Data Center

7kW SAN Rack   **3kW Networking Rack**   **17kW Blade Rack**   **Typical data center layout with diverse load requirements**

The Variability Problem

This matter is further complicated when the load in the rack changes due to processing demands of the IT hardware at any given moment. This load variability has been driven by IT hardware that has become more efficient over time, increasing the difference between idle power consumption, and 100% utilization. This fact, coupled with the increasing use of cloud computing, will only serve to drive increased load variability in the rack on a minute by minute basis, making manual tuning of the airflow at the panel level impossible.

The solution has been to provide sufficient air to accommodate the peak energy demands of the rack, resulting in wasted bypass air and over-cooling during all less than peak conditions.
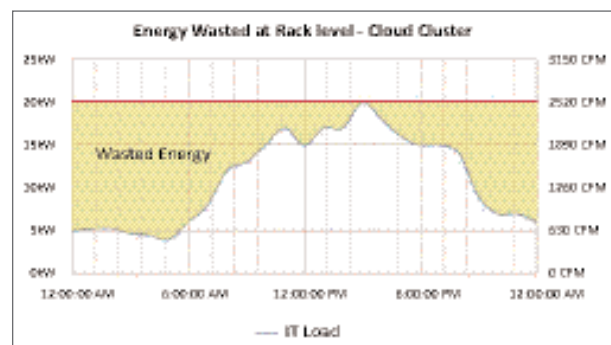
This chart shows the energy wasted when variability in the energy consumed for the IT load exists at the rack level. The wasted energy in yellow exists when designing for peak load

Tate

Opposed Blade Damper
Balanced Airflow for Diverse Loads

The Opposed Blade Damper offers a dramatic airflow improvement over traditional manual slide dampers. When fully open, it restricts airflow through the panel by just 10 percent. The damper's drop-in design allows for easy installation by decoupling the damper from the panel. This means that standard, undampered directional airflow panels can be ordered as needed, with separate opposed blade dampers purchased so they can be added whenever and wherever necessary.

The Opposed Blade Damper is available in three option, single zone, dual zone for use with the DirectAire X2 and multi-zone for targeted airflow control to diverse racks.

Granular Airflow Control

The Multi-zone Opposed Blade Damper, when installed beneath a DirectAire directional airflow grate, significantly reduces bypass air and enables airflow delivery to be balanced based on the specific load in a 14U section of the rack. The damper allows for the individual adjustment of airflow to three zones within the rack (top, middle and bottom) without removing the DirectAire panel, ensuring fast and accurate balancing to the fixed IT load.

Reduce Bypass and Save Energy

The Multi-zone Opposed Blade Damper can also be used when blanking panels cannot, to shut off or dampen airflow to different sections of the rack where large portions are left empty.

Another advantage is an increase in potential available critical power. The reduction in airflow volume as a result of using DirectAire's directional airflow and closing off airflow to unused sections of racks reduces the energy usage for cooling at the CRAC unit level. This can enable increased efficiency of the data center proportional to the deployment of the technology.

Key Performance Characteristics

• Provides nearly double the airflow at 100% open than comparable slide dampers.

• Easily adjustable from above without panel removal when used with DirectAire.

• For use with full or partial loaded racks.

• Reduces cooling energy and improve PUE.

• Multi-zone dampers are for use with DirectAire only.

• Multi-zone dampers provide the most granular airflow control avaliable in Data Centers.
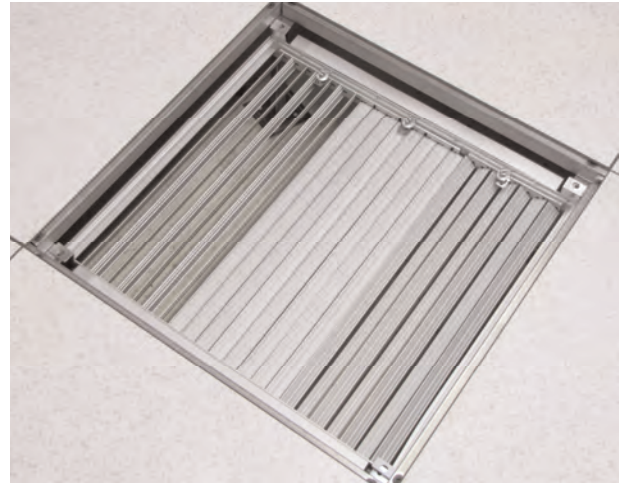
Multi-zone Opposed Blade Damper

**Adjust airflow without removing the DirectAire panel**

Smoke tests showing the Multi-zone Opposed Blade Damper operating in combination with the DirectAire Panel to target airflow delivery to the rack.

Bottom 14U Zone   **Middle 14U Zone**   **Top 14U Zone**
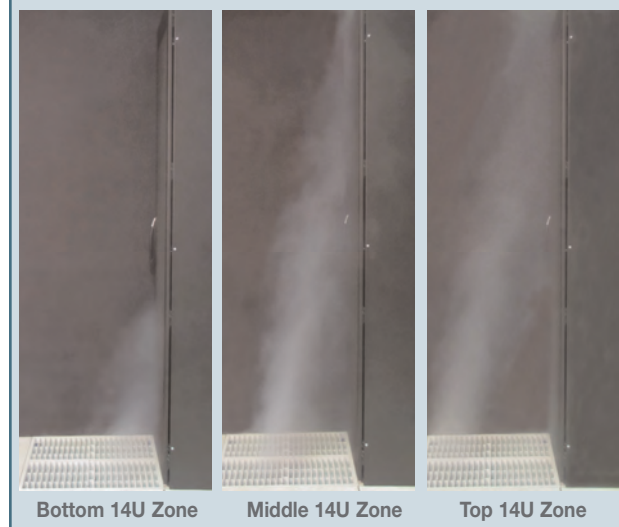
Effectively Cool Variable Loads

Tate has adapted technologies readily found in commercial office applications to create a solution for controlling airflow delivery to the IT racks through the use of a variable-air-volume (VAV) device installed below each airflow panel. Each panel & rack tandem can be thought of as an individual zone.

Using an automatic damper that measures the incoming air temperature at the face of the rack and adjusts the flow to ensure that the temperature at the face of the rack is never above the maximum allowable set point provided by the user. When deployed using best practices, the system is able to virtually eliminate bypass air, and account for any local temperature fluctuations.
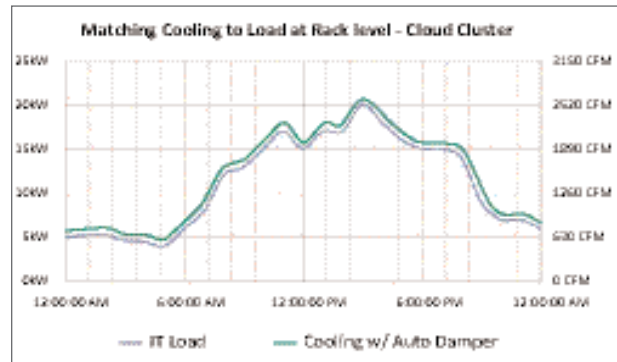
By matching cooling to the IT load at the rack level the wasted energy that results from designing to peak load can be eliminated. By delivering only the right amount of air required to cool the rack a savings of over 40% in fan energy can be realized.

How it Works

IT load is idle overnight at 4kW and 480 CFM per rack.
Damper is nearly closed increasing the static pressure under the floor until the CRAH unit fans slow down to meet the desired static pressure, while at the same time meeting the inlet temperature requirements at the rack (75˚).
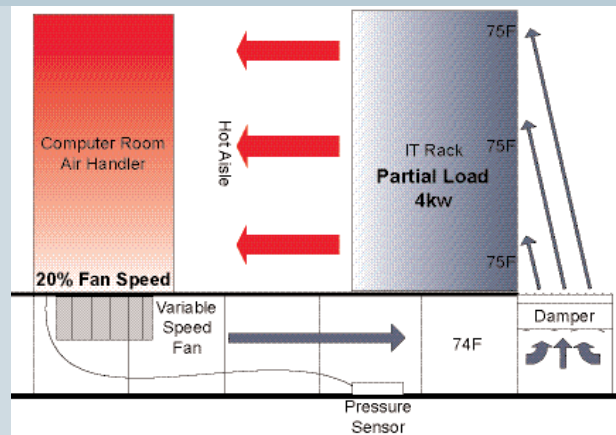
IT load has increased to full load during the day at 14kW and 1680 CFM.
Damper fully opens and the CRAH unit fans increase their speeds to hold a constant underfloor static pressure. Airflow to the racks is sufficient to keep all temperatures at the face of the rack at the desired 75˚
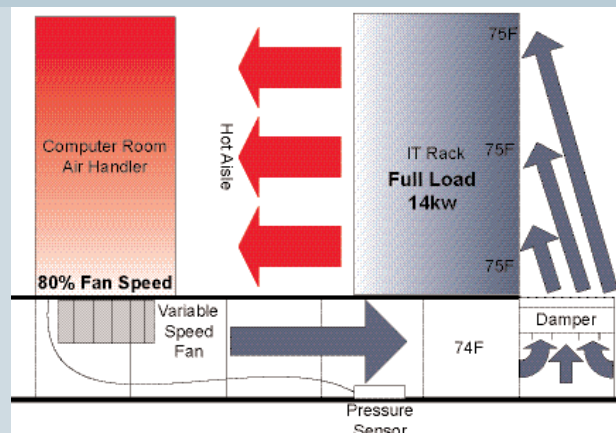
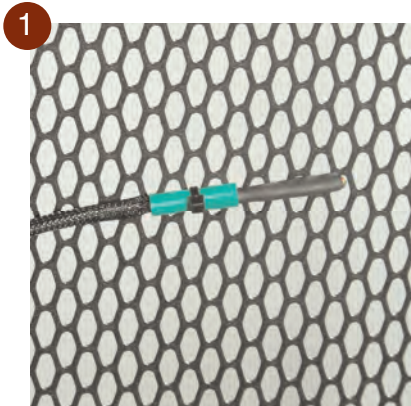# SmartAire®

Efficiently Manage Diverse & Variable Loads

The data center is in constant flux. Load diversity between racks and variable server loads are the norm. Managing airflow into the data center space is key to achieving reliability. New demands to reduce energy consumption in the green data center require a fine balance to ensure proper air flow to each rack during peak IT hardware operation, while not over-cooling partial load and idle states in a diverse environment.

Tate's SmartAire electronically controlled variable air volume damper used in conjunction with DirectAire adjusts the amount of air to meet the specific needs of the rack it services. This flexibility can help effectively cool facilities implementing virtualization, cloud computing and idle server shutdown strategies while saving energy. Multiple control options are available.

- **SmartAire C** - client sensor network
- **SmartAire S** - 1 rack mounted sensor
- **SmartAire M** - 3 rack mounted sensor

SmartAire Key Performance Characteristics

- 0-23kW supported IT load per DirectAire/SmartAire pair
- Power disruption fail safe to fully open position
- Zero maintenance
- Quick and easy installation
- Multiple control options available
- High Precision, Quick Response Temperature Measurement
- Optional BMS interface
- User programmable set point
- Robust design for high reliability
- 6 vane damper for large open area
- Damper position is infinitely variable from 0-100%
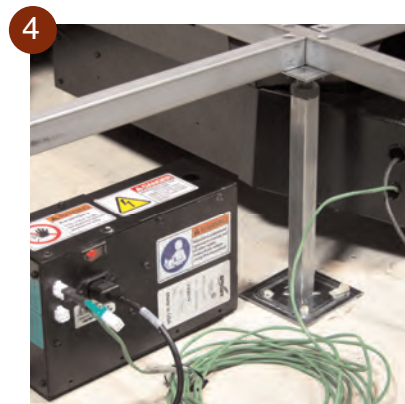- Viewable maximum temp for walkthrough check of each rack

Sensor Mounted to the Face of the Rack for SmartAire M & S

Temp Display and Setpoint Interface for SmartAire M & S

0-100% Open VAV Actuating Damper

Power Module for Multiple Connections

Achieve the Ultimate in Financial Performance
SmartAire Takes Efficiency Even Further

The energy savings component of SmartAire is achieved through its effective management of diversity and variability. Virtualization is a common server management strategy to increase the computing power of existing hardware and to save energy. Virtualization often leads to variability and denser racks with wider ranges in demand between high utilization and idle states. SmartAire's ability to automatically and instantaneously adjust to distribute exactly the right amount of air needed to cool the equipment allows the CRAH units variable fan drive to adjust more accurately for optimum efficiency.

SmartAire also handles load diversity without over-cooling lower density racks saving energy. Deployed at the rack level rather than by row, SmartAire can reduce the amount of airflow to low density racks allowing more airflow to be delivered to high density areas without increasing underfloor static pressure or making costly equipment purchases.

To evaluate the potential impact on the efficiency of your facility download our in-floor cooling cost model at: www.tateinc.com/resources/cost_model.aspx

Example Data Center Characteristics	
User IT Load (kW)	1720
Number of Racks	200
Calculated Rack Density Average (kW)	8.6
IT Racks per Row	15
Maximum IT Load Per Rack (kW)	12.5
Per kWHr Cost	0.08
Expected IT Equipment Utilization	70%

	Baseline	RetroFit	New
Perimeter CRAH Unit Design	Typical Grate w/Belt Drive Centrifugal Fans	DirectAire, SmartAire & EC Fans	DirectAire, SmartAire & EC Fans
Rack Density for Calculation (kw)	12.5	8.6	8.6
Expected TAC %	50%	93%	93%
Total Required CFM to be delivered (CFM)	628,940	232,640	232,640
CRAH Units Required (50 Ton Units)	34	13	13
Total Fan Power Required (kw)	402.5	56.4	56.4
Estimated Annual Energy Consumption (kWh)	3,526,090	493,827	493,827
Fan Annual Energy Cost $	$282,087	$39,506	$39,506
Required CFM Per Rack (CFM)	1,572	1,082	1,082
Required CFM Per Panel (CFM)	3,145	1,163	1,163
Average Cost Per DirectAire & SmartAire M & S		($1,149)	($1,149)
Number of Units Required		200	200
Total Cost of DirectAire & SmartAire		($229,760)	($229,760)
CRAH Unit Reduction Savings		$0	$735,000
Fan Upgrades (EC Tech)		($143,000)	($143,000)
Upfront Cost or Savings using DirectAire & SmartAire		($407,760)	$362,240
Annual Energy Savings		$242,581	$242,581
Payback in Months (simple)		20.2	0.0
3 Year Savings		$319,983	$1,089,983
PUE Impact	1.80	1.60	1.60

Over $240,000 Annual Energy Savings

Product Specifications

SmartAire Product Specifications

SmartAire VAV Airflow Damper: High volume variable air flow damper for use in raised floor roll formed stringer system. 20 gauge steel construction with an open area of approximately 63%, and when installed with DirectAire panel will have the following air distribution capabilities: 2134 CFM at 0.1" of H2O (static pressure).

VAV airflow Damper Control

SmartAire M & S units only:
a) In-floor VAV airflow damper shall have an internal control system to evaluate a single (SmartAire S) or three (SmartAire M) factory supplied rack mounted temperature probes and set damper position based on the current peak input value.
b) Units to have PID multiloop control system
c) Units to have viewable temperature control unit through airflow panel

SmartAire C units only:
a) In-floor VAV damper position shall be controlled via 0-10V input signal provided by others.

VAV airflow Damper features
a) Fail Open Operation - Damper must return to the fully open position from any position in less than 15 seconds after power is removed.
b) 0-23kW supportable IT load per panel/damper combination
c) No regularly schedule maintenance required
d) Damper position shall be infinitely variable between 0-100%
e) Unit shall draw less than 20VA during peak operation

SmartAire™/DirectAire™ Paired - CFM & Cooling Capacity		
Pressure (in. H2O)	CFM (100% Open)	kW/rack at 100% Open
.02	1018	7.5
.04	1426	10.5
.05	1590	11.7
.06	1738	12.8
.08	1998	14.7
.10	2226	16.4
.12	2432	17.9
.14	2620	19.3
.16	2795	20.6
.18	2960	21.9
.20	3114	23.0
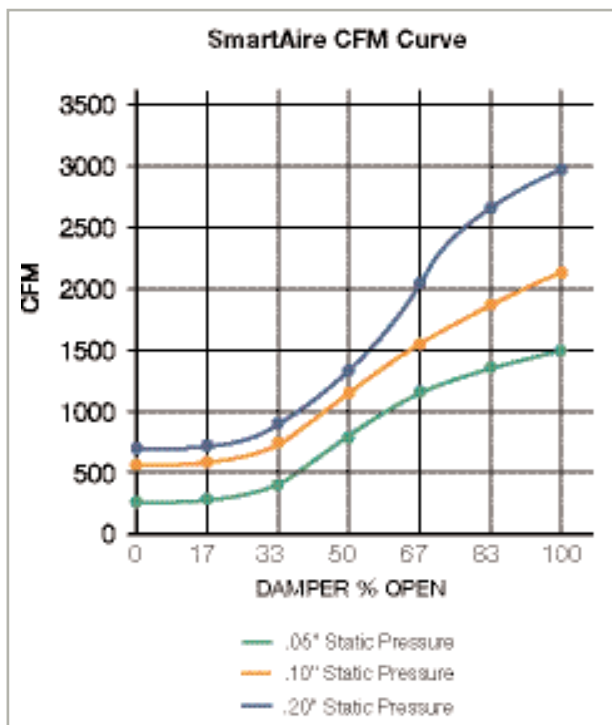
The graph above shows the CFM delivered through a DirectAire panel equiped with a SmartAire VAV damper as it opens and closes at a given static pressure.
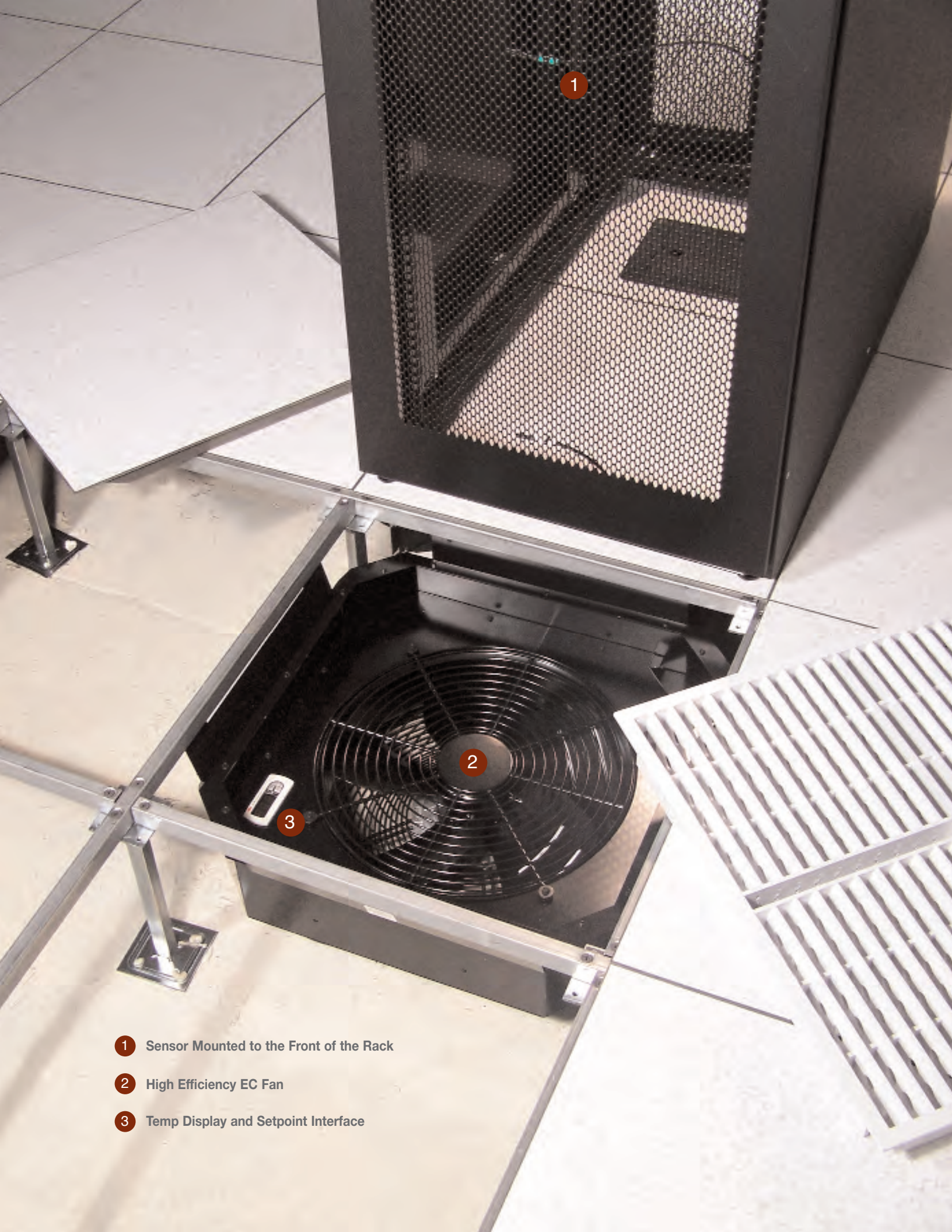
1   **Sensor Mounted to the Front of the Rack**

2   **High Efficiency EC Fan**

3   **Temp Display and Setpoint Interface**

PowerAire®
Fan Assisted Airflow to Eliminate Hot Spots

In almost any data center today there is at least one high density server rack that possesses a unique cooling challenge. Providing enough cooling to satisfy the load of these few racks often leads to over-cooling the other racks and significantly deteriorates the energy efficiency of the facility. Finding the balance to ensure proper air flow to each individual rack while not wasting energy in over-cooling is the key to achieving reliability.

Effectively Manage Dense Server Racks & Blades

Tate's PowerAire fan assist module is designed to provide a blast of cooling through an individual airflow panel. Multiple Control options are avaliable to automatically turn on when conditions require additional cooling.

- **PowerAire C** - client sensor network
- **PowerAire S** - 1 rack mounted sensor
- **PowerAire M** - 3 rack mounted sensor

Equiped with a variable speed fan drive the fan can be throttled up or down based on the heat load requirements. This powerful solution is ideal for solving the toughest hot spots in a data center.

The easy to install PowerAire fan assist is ideal for retrofit into existing data centers or as part of a new advanced cooling strategy. PowerAire is an excellent choice for cooling the most stubborn hot spots

The graph above shows the CFM delivered through a DirectAire panel equiped with PowerAire fan assist at full speed compared to a DirectAire with fan assist off.

PowerAire Product Specifications

In-floor Fan Assist Device: High volume EC variable speed fan for use in raised floor roll formed stringer system. 20 gauge steel construction with a single electrical commutated fan that varies its speed based on temperature feedback from four temperature probes installed at the equipment rack. PowerAire device will have the following air distribution capabilities when used with a DirectAire: 3014 CFM at 0.1" of H2O (static pressure).

The In-floor fan assist device shall have the following features.

1. Fail Safe Operation
a. Fan unit must provide greater than 1192 CFM when power is lost at 0.1" of H2O (static pressure)
2. 0-25kW supportable IT load per panel/fan combination
3. No regularly schedule maintenance required
4. The control method shall be one of the following
   a. 3 Temperature Probe, Rack-level, Multiple-sensor Internal control system to evaluate each probe and fan speed based on the current peak input value
   b. 1 Temperature Probe, Rack-level, Single-sensor Internal control system to evaluate the single probe and set fan speed based on this input value
   c. 0-10V control input, Rack-level, Client-unit
5. User selectable set point from 50-100F
6. PID multiloop control system
7. Fan speed shall be infinitely variable between 0-100%
8. Viewable temperature control unit through airflow panel
9. Unit shall draw less than 400VA during peak operation

Tate®

Control Options for **SmartAire**® and **PowerAire**®

Tate offers several product variations of the SmartAire and PowerAire products to allow for the perfect balance between accurate and efficient cooling and first cost effectiveness for your data center. Here is a list with a brief explanation of our full line of products.
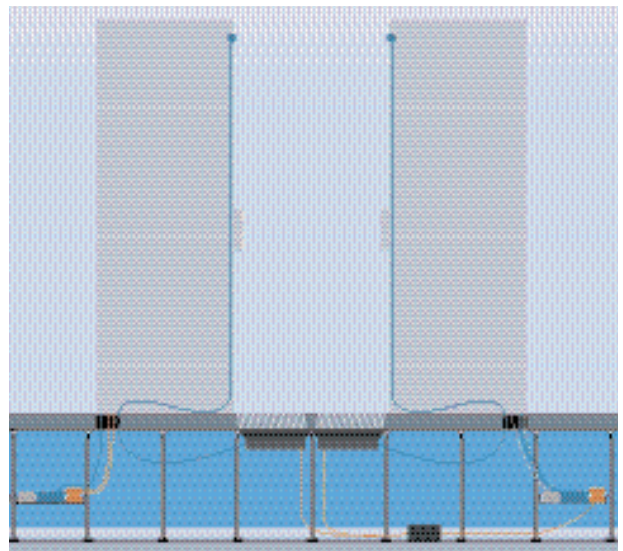
SmartAire C or PowerAire C

C or (rack-level **C**lient-sensor) – this option provides the highest level of control flexibility and is ideal for clients with existing sensor networks. Often data that is already being collected that can be used to accurately drive these devices.
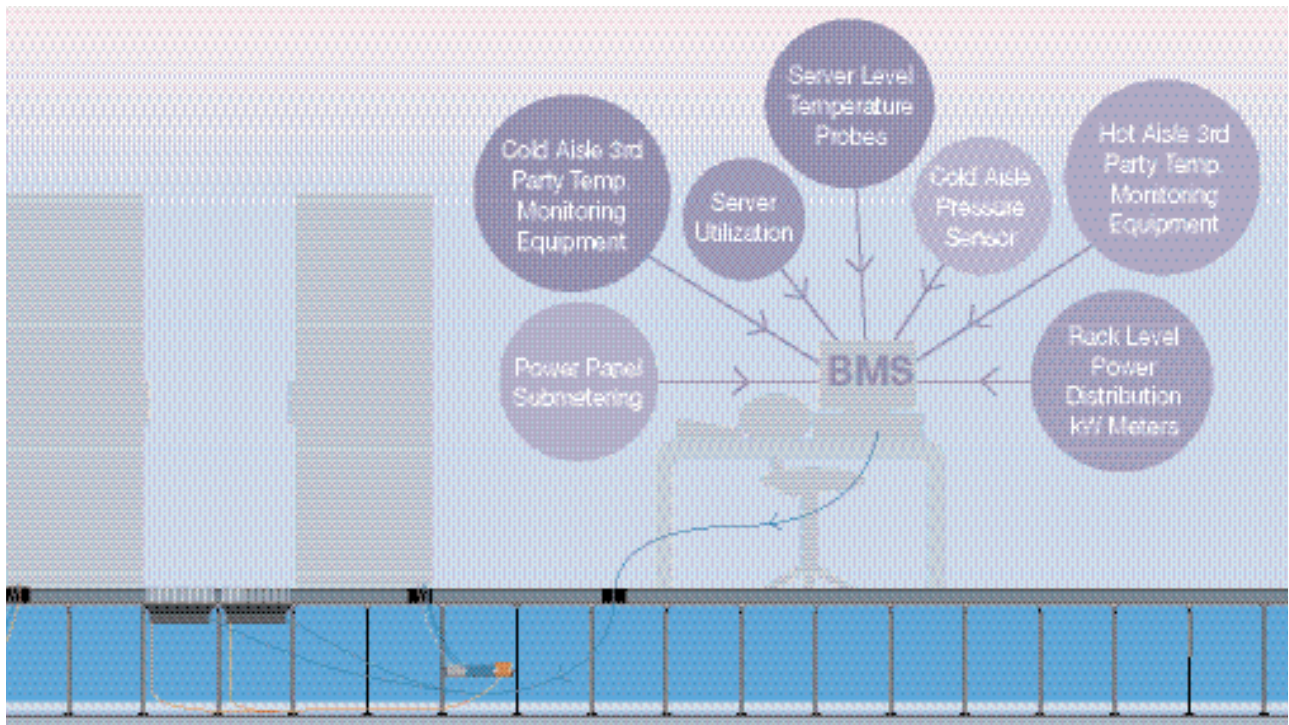
SmartAire S or PowerAire S

S or (rack-level **S**ingle-sensor) – this option offers a single temperature probe for monitoring inlet air temperature. Typically the probe would be mounted near the top of the rack face to monitor the recirculation path over the top of the rack. For racks that are not fully loaded it is recommended to load equipment from bottom to top and place the probe as high as the equipment is in the rack. This option is best utilized for racks installed in the interior of an aisle.

SmartAire M or PowerAire M

M or (rack-level **M**ultiple-sensor) – this option offers multiple (3) temperature probes for full rack height monitoring of the inlet air temperature. Full height monitoring ensures that all recirculation paths are monitored. This option is best utilized for stand alone racks or on racks at the end of aisles.

BMS Interface Cards (for M units only)

This option allows the M units to interface with the existing BMS. Currently BACnet IP, BACnet MS/TP, and SNMP protocols are available for remotely monitoring and controlling the units. This interface allows for the retrieval of current inlet temperatures and damper positions or fan speeds, as well as adjusting individual unit temperature set points.

Application of M and S Units

Tate recommends placing the M units on racks at the end of aisles or on stand alone racks where recirculation air has the potential to enter the rack along the entire height of the rack. S units with the sensor mount as high on the rack face as the equipment in the rack are recommended for racks within the interior portion of a row. The S unit will detect any recirculation air that will raise the inlet air temperature on these racks since the only path is over the top. This method of applying these units will provide the most cost effective means for ensuring that you are always providing the right amount of air to any rack in your data center.
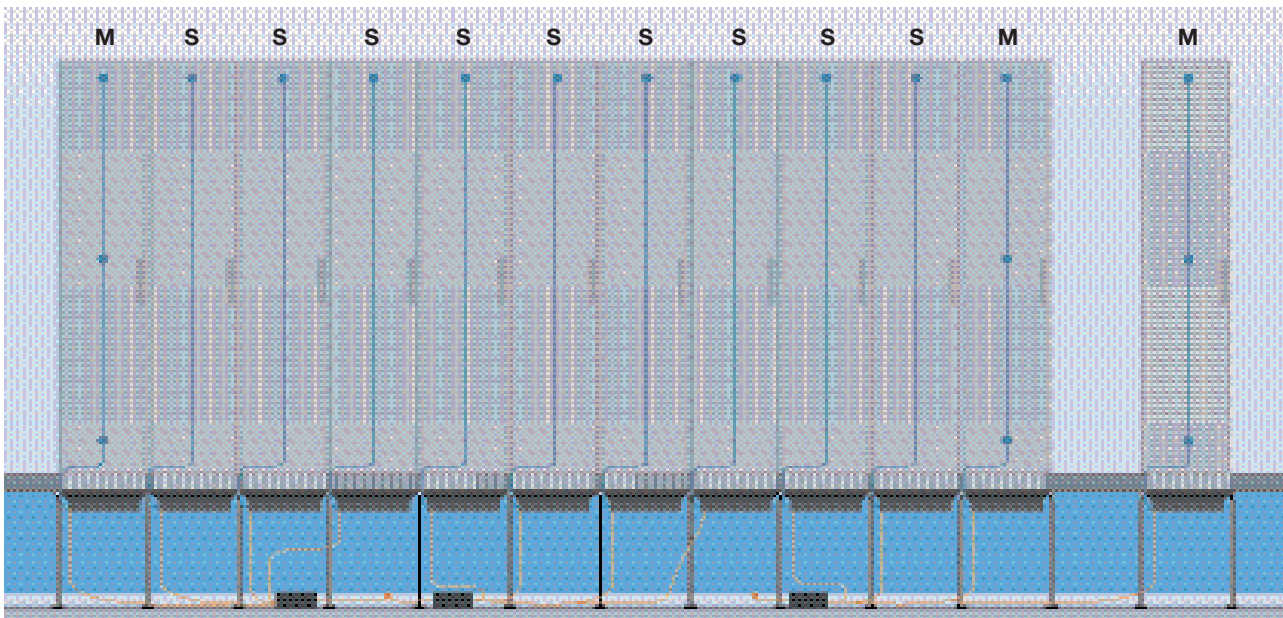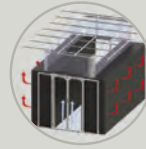
Additional Data Center Products

Visit wraw.tateinc.com for more information
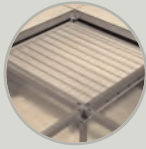
Opposed Blade Damper

Drop in damper that fits below any airflow panel. 0-100% surface accessible adjustment.

ContainAire

Hot and cold aisle containment systems to eliminate bypass air and improve efficiency.

Tate KOLDLOK

Superior floor mounted cutout air seal for wires cables and other penetrations.

For a white paper on the performance characteristics of DirectAire & SmartAire visit
http://www.tateinc.com/resources/white_papers.aspx

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