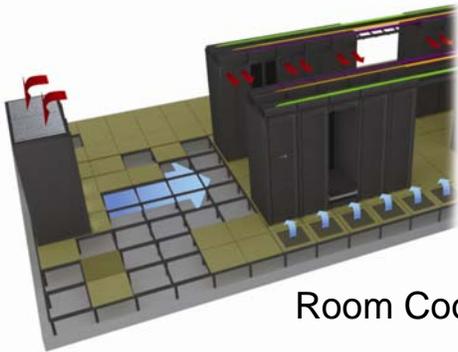
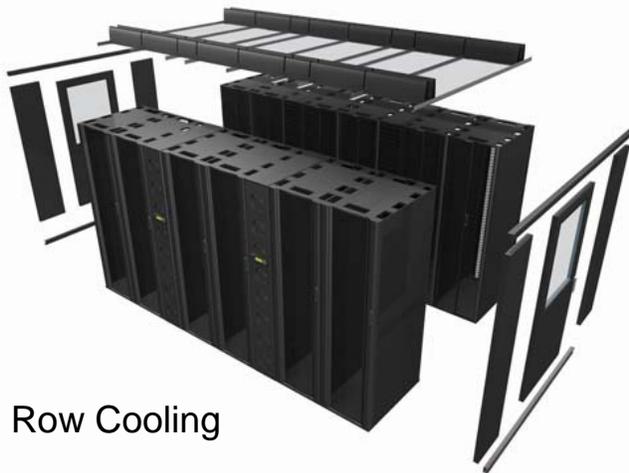




# End-to-End Cooling Solutions from the Closet to the Data Center



Room Cooling



Row Cooling



Rack Cooling

## Customer Challenges

- Growing pains make it difficult for customers to add on to their cooling needs
- Future proofing...
- Achieving efficiencies while cooling high density heat loads to ensure 7x24 Data Center availability

## Key Considerations

- Ability to adapt to increasing and unpredictable power densities
- Elimination of hot spots within the room and the rack
- Minimize Total Cost of Ownership
- Ensure stable inlet temperatures to IT equipment at all levels of the rack
- Flexibility to easily add cooling as demand increases

## Why is APC the right choice?

- Proven Reliability. Install base in the millions
- Global provider of air distribution, portable cooling, row based cooling and perimeter air conditioning for all IT equipment cooling needs
- Scalable solutions range from 1 to 30 kW per rack
- Improved efficiency and reduced operating costs through the use of variable speed fans, intelligent controls, and capacity modulation
- Intelligent monitoring and dynamic controls system to adjust to fluctuating IT heat loads and airflow requirements
- Ease of use with integrated management for multiple platforms

## Target Applications & Environments

The Wiring Closet and Server Room are the fastest growing and rapidly changing environments. New applications and virtual platforms continually challenge IT managers to match their infrastructure to their growing business needs.

The Data Center, which is on a constant path towards gaining efficiencies, continues to be a focus for better suited cooling.

# Room Cooling

## Portable to perimeter cooling and air distribution for flexible room level control

One of the challenges in IT infrastructure design is planning for all of the unknown variables that will happen through the life of the IT environment. Because things change so quickly, variables like power density, energy costs, and equipment footprint can impact the effectiveness and life of the IT infrastructure. Having the ability to deliver cooling at the room level provides flexibility by ensuring that cooling is available anywhere. To solve this problem, APC offers a complete line of Room Cooling which includes perimeter, portable, and air distribution products.

Room Cooling products offer flexible cooling solutions perfect for lower density racked and non-racked IT loads. For the closet / server room environment, Room Air Distribution products can be used as a cost effective solution to provide ventilation and easily address lower density heat problems. When dedicated cooling is required, portable self contained units offer quick deployment to address those areas where cooling wasn't initially anticipated. For small to large data center environments, air, water, glycol, multi-cool, and economizer direct expansions units are available to address virtually any size IT environment. The InRoom™ Chilled Water and Direct Expansion products are assemble to order solutions that offer a choice of five cabinet sizes and capacities, utilize variable fan technology, as well as intelligent control for the best performance. This suite of products is easily serviced, offers the smallest footprint with the highest capacities, while running 10% more efficiently than traditional, belt-driven perimeter units, thereby reducing the overall total cost of ownership. APC offers all types of remote heat exchangers to meet the requirements of any data center configuration.

Room Cooling Products				
InRoom™ Chilled Water	InRoom™ Direct Expansion			Room Air Distribution
Perimeter, chilled water cooling for medium to large data centers.	Perimeter and portable cooling for wiring closets, server rooms, and data centers			Air ventilation for wiring closets
				
<b>InRoom CW</b>	<b>InRoom DX</b>	<b>NetworkAIR PA</b>		<b>Wiring Closet Ventilation Unit</b>
Up to 150kW	Up to 86kW	3kW	1.5kW	Up to 3kW of heat removal
Chilled water	Air-cooled, water-cooled, glycol, multicool, and economizer	Self-contained		
Network Manageable			On/off Scheduling	Dry Contact Outputs
Intelligent Controls		Automatic Restart		On/Off Control
EC Direct Drive Fans		Ease of Mobility (Casters)		Fault-tolerant Fans
Humidity Control		Ducted Intake/Exhaust		Multiple Mounting Methods

# Rack Cooling

## Dedicated cooling and air distribution for single racks or hot spots

A rack-oriented design allows cooling capacity (and redundancy) to be targeted to the actual needs of a specific rack. APC offers a complete line of air distribution products as well as a series of completely contained, rack integrated cooling products.

Rack mounted air distribution products solve inadequate air distribution problems within a rack enclosure. These fan products work with existing cooling products to either provide cool air to or remove heat from the rack enclosure. These hot spot problem solvers ensure uniform inlet temperatures to the IT equipment.

The InRow SC Systems combine InRow Cooling and Rack Air Containment to offer a flexible, easily deployable solution for almost any environment. Available in three configurations, these fully contained systems offer intelligence that enables network manageability, as well as self-monitoring components that enable the highest level of availability. Combining the row-based cooling architecture with containment of airflow, further increases the predictability, efficiency, and capacity of the system. With InRow SC Systems, airflow paths are completely defined and totally immune to any installation variation or room constraints.

### Rack Cooling Products

Rack Air Distribution		InRack Direct Expansion	
Air distribution for power dense enclosures and low pressure areas		Rack integrated cooling system for environmentally controlled spaces	
			
<b>Rack Air Distribution Unit</b>	<b>Rack Side Air Distribution Unit</b>	<b>Rack Air Removal Unit</b>	<b>InRow SC System</b>
Up to 1.5kW of air distribution	Up to 1.5kW of air distribution	Up to 16.5 kW of heat removal	Up to 7kW of cooling
Fault-tolerant Fan System			Active Response Controls
Fan Control Switch		Variable Speed Fans	
Raised Floor Duct	Turning Vane	Network Manageable	
Dual A-B Power Inputs			Hot Swappable Fans
Zero White Space Solution		Zero U Design	Real-time Capacity Monitoring
		Ducted Exhaust	

# Row Cooling

## Energy efficient cooling from low to high density racks and zones

APC's InRow® cooling products were designed to be closely coupled with the IT heat load in order to prevent hot air recirculation, and improve efficiency and cooling predictability. Data center operators looking to improve efficiency or deploy high density will benefit from the modular design of the row-based products enabling both new and existing facilities to pay as they grow. The intelligent controls in these units actively adjust fan speed and cooling capacity to match the IT heat load to maximize efficiency and address the dynamic demands caused by virtualization in today's IT environments. These products offer a 30% increase in efficiency over traditional cooling architectures.

To further improve efficiency InRow products can be combined with our Thermal Containment solutions. Thermal Containment maximizes the effectiveness of InRow cooling solutions from low to high density racked IT loads. Available in rack or aisle configurations, these products were designed to completely separate the supply and return air paths of the IT equipment. This air separation ensures the warmest possible air is being returned to the InRow cooling units, which increases the efficiency and capacity of the cooling system.

### Row Cooling Products

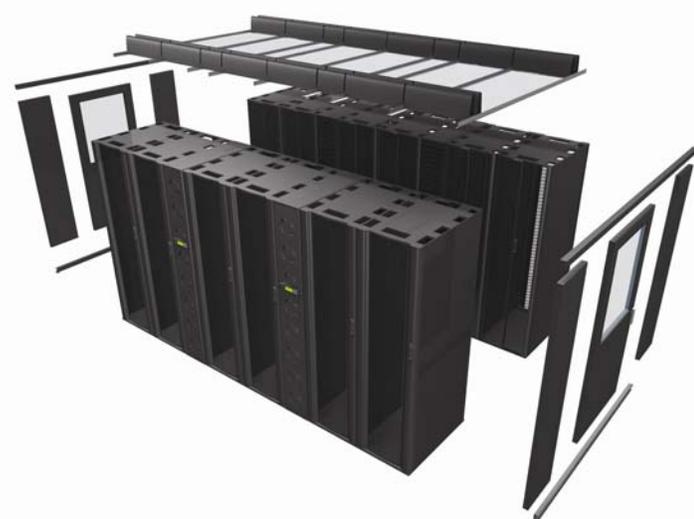
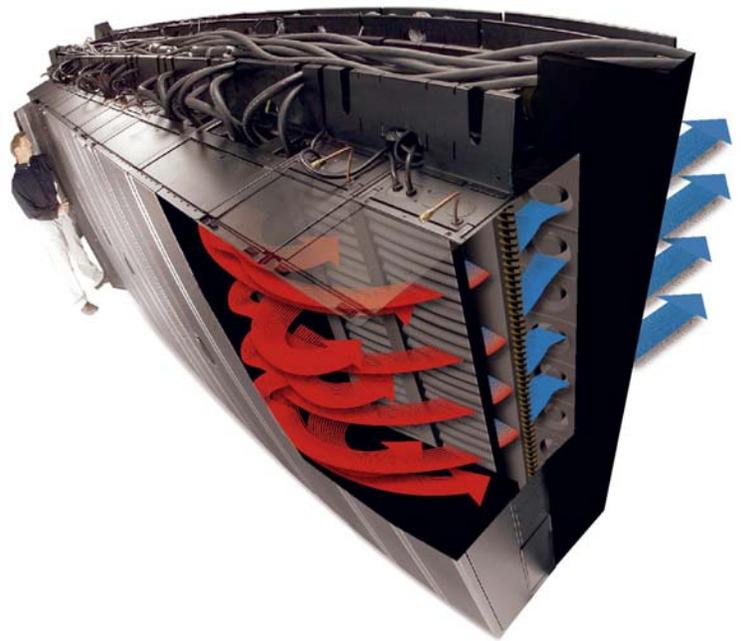
InRow® Chilled Water Close-coupled, chilled water cooling for medium to large data centers			InRow® Direct Expansion Close-coupled, air-, water, and glycol cooling for closets, server rooms, and data centers			
						
<b>InRow RC</b>		<b>InRow RP</b>	<b>InRow SC</b>	<b>InRow RD</b>		<b>InRow RP</b>
300mm	600mm		300 mm		600mm	
Up to 30kW	Up to 60kW		Up to 5kW	Up to 10kW	Up to 36kW	
Chilled water			Self-contained	Air-cooled/fluid-cooled		Air-cooled
Hot Swappable Fans		Humidity Control	Hot Swappable Fans			Humidity Control
Active Response Controls						
Network Manageable						
Real-time Capacity Monitoring						
Variable Speed Fans						

# Row Cooling

## Increasing efficiency, predictability, and capacity with thermal containment

Improved cooling techniques are essential to extend the life of existing data center facilities. The use of containment ensures that equipment temperatures can be better managed. The addition of containment with InRow cooling units, further increases the energy saving by an additional 20%.

Thermal Containment products maximize cooling effectiveness for low to high density racked IT loads. Available in rack or aisle level configurations, these products are designed to completely separate the supply and return air paths of the IT equipment. Ideal for any IT environment, the air separation ensures the warmest possible air is being returned to the InRow cooling units, which further increases the efficiency, capacity, and predictability of the cooling system. Thermal containment is available for 300mm, 600mm, 750mm wide NetShelter Racks, UPS/PDU, and InRow Cooling products. Front containment can also be added to the rack configuration for additional isolation and noise dampening.



### Features and Benefits

- Warmer intake temperatures increases cooling unit capacity
- Removal of heat ensures that the supply temp has little to no mixing resulting in a predictable cooling design
- Allows for mixed density racks to exist in the same environment without overcooling
- Reduction or elimination of moisture removal
- Redundancy achieved with less equipment
- Shared cooling capacity

# Cooling Distribution and Piping

## Centralized distribution for rapid deployment of Row Cooling

While chilled water cooling has remained as one of the most popular and efficient cooling mediums, high density heat loads has prompted the need to bring the cooling closer to the IT equipment. This combination has driven the need for a highly reliable distribution and piping system.

Chilled Water Distribution products provide centralized chilled water balancing and distribution to InRow cooling units within the IT environment. Available in a single 750mm rack footprint, these products are designed to provide a centralized location for the balancing and isolation of InRow RC 300mm Chilled Water cooling units. Optionally, APC offers Pex-Al-Pex piping to deploy a seamless and flexible piping solution that connects the chilled water distribution product to the InRow cooling units. Pex-Al-Pex dramatically reduces the risk of leaks with a multi-layered composite tubing consisting of an aluminum tubing sandwiched between inner and outer layers of cross-linked polyethylene. Chilled Water Distribution products allow for quick deployment and enable a flexible infrastructure to grow and change with minimal labor and installation costs.

### Cooling Distribution and Piping Products

#### Chilled Water Distribution

Flexible chilled water and glycol distribution systems for InRow cooling units



**Cooling Distribution Unit**

Works with up to 12 InRow RC (300mm) units



**PEX-AL-PEX**

Available in 100 and 300 feet lengths

Flexible Piping

Seamless Piping

Coolant Isolation

# Heat Rejection

## Outdoor heat removal to support Room and Row Cooling

With the exception of the self-contained product offerings, there is an essential component to the cooling system outside the IT environment. The function of this component is to transfer heat to the outside atmosphere. Cooling equipment in an IT environment can be deployed using three remote methods of heat rejection. The selection of the appropriate configuration for a particular installation is affected by the existing facility infrastructure, the total power level of the installation, the geographical location, as well as the physical constraints of the building.

Heat Rejection		
<b>Chillers</b> Water chilling plants for row and room cooling products	<b>Fluid Coolers</b> Heat removal designed to use water or glycol for row and room cooling products	<b>Condensers</b> Specifically engineered heat rejection for row and room cooling products
		
<b>50-220kW</b>	<b>10-86kW</b>	<b>10-86kW</b>
Works with Multiple Cooling Units		One to One Unit Configuration
Microprocessor Controller		
Direct Drive Motors		
Variable Speed Fans	Fixed or Variable Speed Fans	
Scroll Compressor		Flooded Head Pressure Controls
Optional Storage Tank		
Dual Power Input for Pumps		

# A Hybrid Approach

## Cooling the data center using Room, Row, and Rack Cooling

All data centers are designed for a common purpose of providing a secure and reliable structure for housing IT equipment. While these data centers are united in a common design goal at a very high level, they are very diverse in nearly every other way. Each data center has unique demands that are driven by individual business needs. Even into the operational phase, the uniqueness of the data center continues to change with the rate of expansion, density, and layout, to name a few.

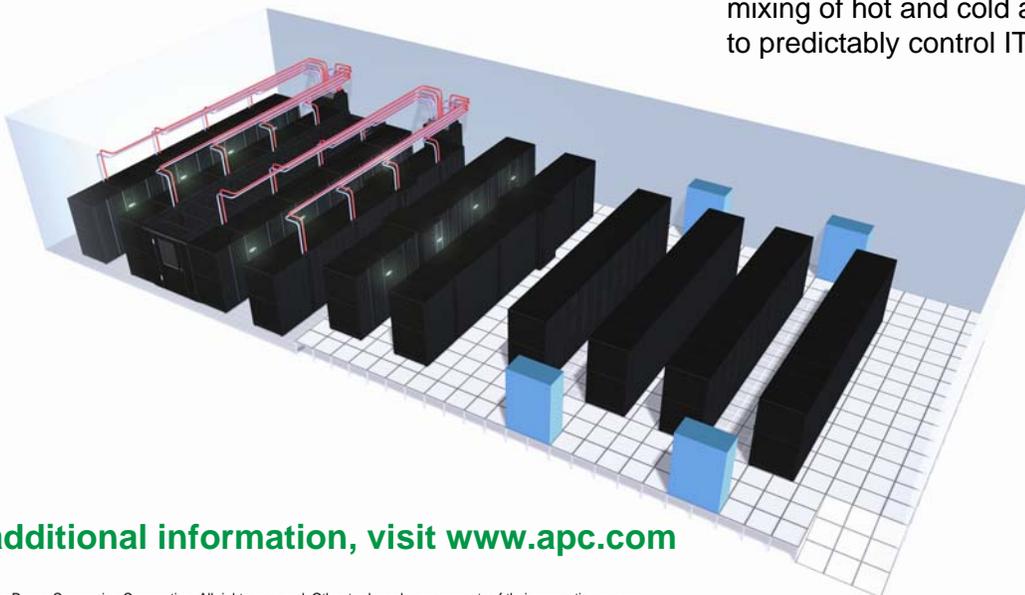
The design will take into consideration parameters for operation like density, peak vs. average load, and other criteria for day to day operation. It is, however, very difficult to predict exactly how the data center will look over time. With a design life of 10-15 years for the data center and IT managers refreshing their equipment every 2-4 years, it is likely that the data center will change significantly over the years.

With all the uncertainty of the data center, choosing a single cooling solution that will meet the data center needs today and in the future is a difficult task. For this reason, most data centers will require a hybrid of multiple cooling solutions to address their unique requirements.

To make this task easier, APC cooling solutions are available in multiple architectures with modular options for easy expansion. Room, Row, and Rack Cooling solutions provide a variety of options to cool large areas or target cooling where it is needed. Starting at the room level, perimeter units are available to provide cooling to low density racks, lighting, people and other non-racked loads such as storage equipment and single enclosure server systems. Room cooling also serves to provide moisture control for the entire space.

Since the data center is likely to change over time with IT refreshes, a room cooling architecture that adequately cooled the data center in the beginning, may not handle the diverse heat loads in later years of operation. To increase the effectiveness of the installed system without an architecture change, rack-based solutions can be deployed with the changing topology of the IT gear to enable greater density and efficiency as needed.

The best choice for rack based IT loads is a row cooling approach due to its energy efficient advantage. This close-coupled cooling™ method allows the heat removal to be matched to the heat generation for energy savings at any density. Removing the heat at the source and eliminating mixing of hot and cold air streams allows the system to predictably control IT inlet temperatures.



For additional information, visit [www.apc.com](http://www.apc.com)



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