



**UNDERSTANDING THERMAL MANAGEMENT:
A Systems Approach To Effective Thermal Management
Solutions For Electronic Equipment Enclosures**





Thermal Management

Maintaining the temperature inside racks and enclosures is critical to the proper functioning and survival of the circuits operating within. Most studies have shown that for every 10°F rise over 85°F, digital equipment life is reduced by approximately 40%. It is essential to ensure the heated air within the enclosure remains at a temperature of no more than 85°F to help protect the sensitive equipment mounted within.

There are two approaches to securing an adequate internal enclosure temperature for the successful operation of the components enclosed: Passive and Active thermal management. Passive makes use of the ability of a properly configured system to ventilate through natural convection. In certain cases, however, the use of fans to force air through an enclosure (Active) is necessary to maintain the desired internal temperature. Please refer to the nomograph located on the back page to determine whether your system will require Passive or Active thermal management.

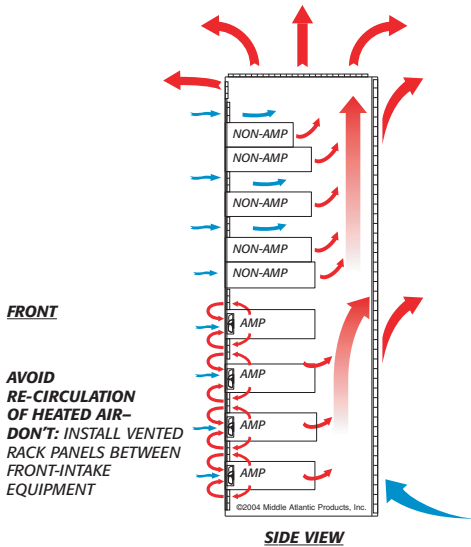
In addition to the proper configuration of your rack system, room design is critically important to the success of rack and enclosure thermal management. It is essential that not only does the equipment room have the ability to remove the heat generated by the racks, but also that racks are placed strategically within the room to ensure no re-circulation of air occurs.

THERMAL TECHNIQUE: PASSIVE THERMAL MANAGEMENT

The Passive approach to thermal management involves capitalizing on natural airflow. Adequate vent openings in the top and bottom portions of an enclosure, as well as an unimpeded airflow, and placing hotter equipment lower in the rack will enhance the natural flow of air, as heat naturally rises. There is a **wrong** and **right** way to approach Passive Thermal Management:

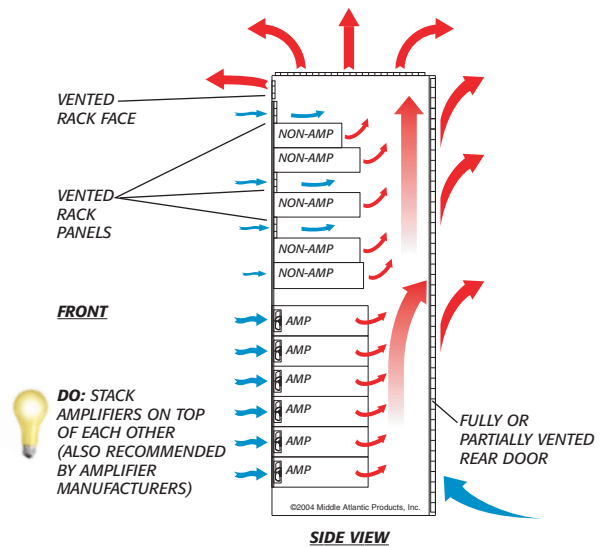
WRONG!

PASSIVE CONVECTION WITH FRONT-INTAKES ON EQUIPMENT



PROPER

PASSIVE CONVECTION WITH FRONT-INTAKES ON EQUIPMENT



Our full range of versatile rack enclosures are optimized for both Active and Passive Thermal Management. Please see back page for how to configure your Middle Atlantic Products rack for proper thermal management depending on your application.

WRK-SA Series Rack Enclosures are one choice for Passive Thermal Management:

- ✓ Wide design helps promote an unimpeded natural airflow up sides of equipment (chimney effect)
- ✓ Engineered ventilation locations on the rack face allow natural removal of heated enclosure air



Additional Enclosure choices for Passive Thermal Management

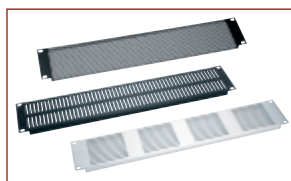
- ✓ ERK series
- ✓ DWR series
- ✓ WRK series
- ✓ EWR series
- ✓ PTRK series
- ✓ SR series

If you have any questions about thermal management and which enclosures will satisfy your thermal needs, please call the Middle Atlantic Products customer support team at 800-266-7225.

Use these solutions with a Middle Atlantic Products Rack for optimal Passive Thermal Management



selectively vented rear door kits - available June 2004



extensive selection of aesthetic vent and filter panels allow ambient air to enter the enclosure



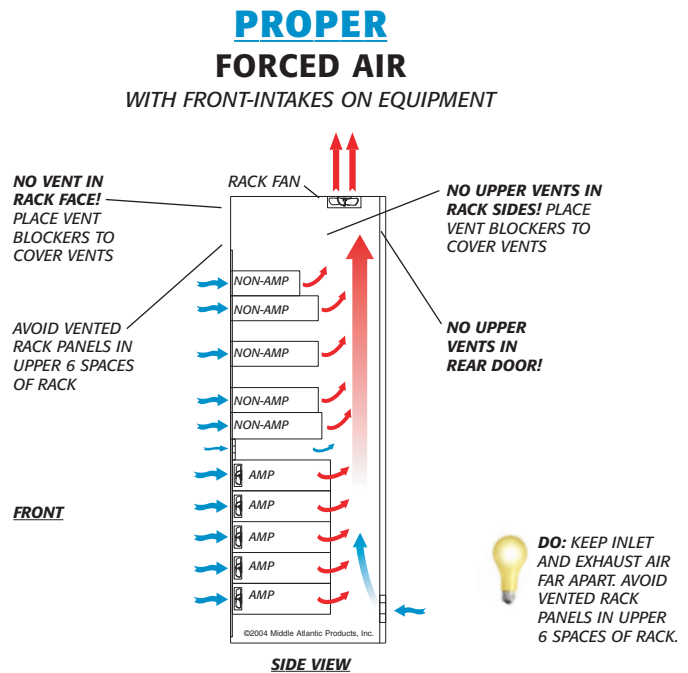
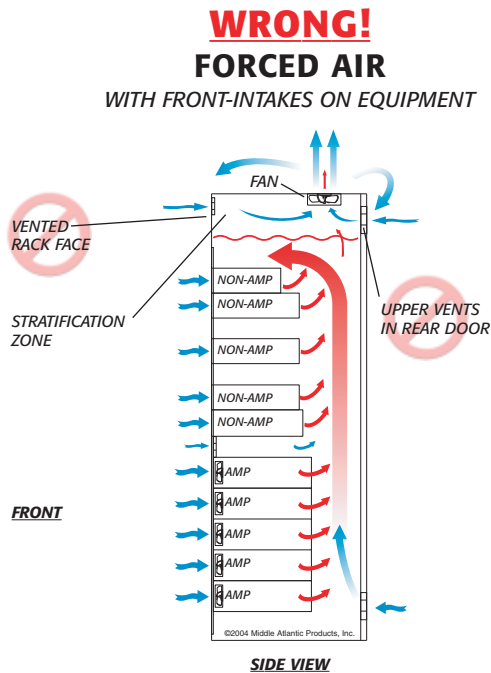
extensive selection of vented shelves to facilitate the natural rise of heated air through the enclosure



vented enclosure top options allow heated air to naturally escape the enclosure

THERMAL TECHNIQUE: ACTIVE THERMAL MANAGEMENT

In many instances, equipment located within an enclosure will produce too much heat for Passive Thermal Management (convection) to properly ventilate the enclosure. In this event, the use of forced air (fans) is instrumental to maintaining the optimal 85°F temperature recommended. Keys to the successful implementation of Active thermal design include the use of top-mount fan(s) and no venting in the upper 6 rackspaces, upper sides, upper front or upper rear door, to prevent short-circuiting of air at the top of the rack. There is a **wrong** and **right** way to approach Active Thermal Management:



The key to successful Active Thermal Management is ensuring there are no open vents at the top of the rack. The laws of static pressure dictate that fans will pull air from the easiest path (closest opening). This will create an undesirable recirculation of air, forming a stratification zone if upper vents are not blocked.

Our full range of versatile rack enclosures are optimized for both Active and Passive Thermal Management. Please see back page for how to configure your Middle Atlantic Products rack for proper thermal management.

MRK Series Rack Enclosures are one choice for Active Thermal Management:

- ✓ Solid rack face design ensures heated enclosure air will be removed through top mount fans, with no re-circulation of heated air
- ✓ Configurable open top allows multiple fan choices



Additional Enclosure choices for Active Thermal Management

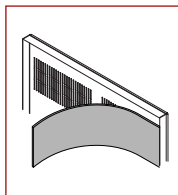
- ✓ DRK series
- ✓ WRK series
- ✓ WRK-SA series
- ✓ VRK series
- ✓ VMRK series
- ✓ ERK series
- ✓ DWR series
- ✓ SR series

If you have any questions about thermal management and which enclosures will satisfy your thermal needs, please call the Middle Atlantic Products customer support team at 800-266-7225.

Use these solutions with a Middle Atlantic Products Rack for optimal Active Thermal Management



proportional speed thermostatic fan control to operate up to 4 fans based on internal enclosure temperature (FC series)



vent blockers to cover upper enclosure vents (VBK series)



fan control top options include pre-installed fans, grills and FC series fan control



rackmount fan panels (QFP, FP series) and filter kits assist active airflow



extensive selection of blank panels to block unused rackspace, preventing re-circulation of hot air.



fans and fan guards to actively remove heated air from the rack

HOW TO CALCULATE VENTILATION REQUIRED TO PROVIDE AN INTERIOR RACK TEMPERATURE OF 85°F

This nomograph will show the minimum ventilation (active or passive) required, to provide an interior rack temperature of 85°F.

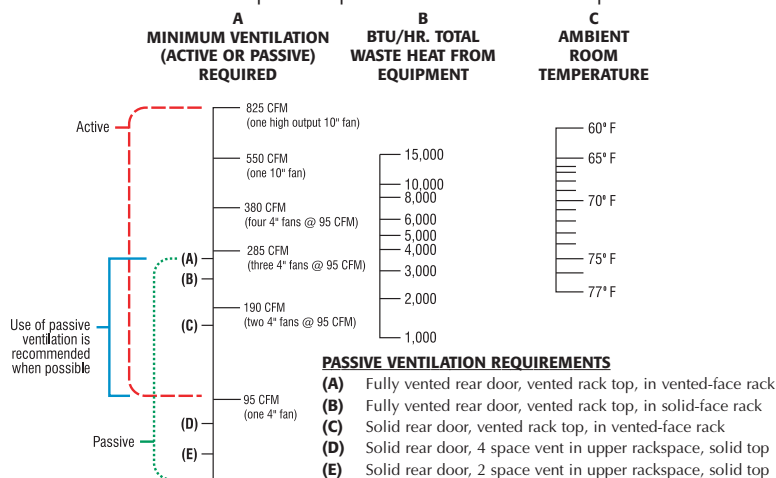
To calculate total waste heat (column B):

1. Obtain total waste heat output by combining the published waste heat BTU/Hr. of all amplifiers in the rack.
2. Add up total measured amperage draw from all other equipment and multiply by 400 (total amperage x 400 = total BTU/Hr. @117v.)
3. Combine BTU/Hr. totals from steps 1 and 2 to obtain total for all equipment. Mark total in column B.

To obtain minimum ventilation requirements:

1. Mark ambient room temperature in column C and connect points in B and C with a straight edge.
2. The minimum cooling required providing an interior rack temperature of 85°F will be shown on column A, where the straight edge intersects the minimum cooling requirements column.

NOMOGRAPH
Calculate ventilation required to provide an interior rack temperature of 85°F.



OPTIONS FOR OPTIMAL THERMAL MANAGEMENT

RACK SERIES	ACTIVE					PASSIVE	
	ENCLOSURE TOP	TOP FAN OPTIONS	SIDE PANELS	SOLID REAR DOOR	VENT BLOCKERS	ENCLOSURE TOP	VENTED REAR DOOR
DRK	*required	*required	*required	*required	*required	MW-VT	standard
WRK-SA	*required	*required	standard	standard	*required	MW-VT	*required
WRK	*required	*required	*required	standard	*required	MW-VT	*required
MRK	*required	*required	*required	standard	not required	MW-VT	*required
VRK	*required	*required	*required	standard	*required	MW-VT	standard
VMRK	*required	*required	*required	standard	not required	MW-VT	*required
ERK	*required	*required	standard	standard	*required	ERK-VT	*required
DWR	standard	*required	standard	n/a	*required	not required	n/a
SR	standard	*required	standard	n/a	*required	standard	n/a

*Required - please see master catalog for part #s – options required to properly configure system for designated thermal management technique.

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For a **complete** guide to thermal management and controlling the temperature inside equipment racks, visit www.middleatlantic.com to download our thermal management white paper, which includes references for all information within this guide and serves as helpful additional reading.



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