DATA CENTER SOLUTIONS FOR SUCCESSFUL COMPANIES

COOLING SOLUTIONS

WeRackYourWorld.com
Power and cooling are of prime importance to anyone working in a data center. As information technology (IT) equipment and rack-mounted power distribution units (PDUs) within the enclosure become more intelligent and sophisticated, some can generate more and more heat. As a result, the need for innovative cooling strategies designed to handle increasing enclosure densities has become extremely important to the data center manager.

We know that no two data centers are alike. Great Lakes has developed a number of solutions (both passive and active) for circumstances from simple to complex, which will allow the enclosure to provide power distribution while protecting and cooling rack-mounted equipment, all in a manner which still allows for a wide range of approaches to cabling and connectivity.

Great Lakes offers a comprehensive portfolio of standard products and an extremely diverse line of enclosure accessories. Our engineering staff and state-of-the-art manufacturing facilities can also create custom products to your exact specifications. Please feel free to talk to us about your engineering challenges and together, we’ll find the right solution to meet your needs.
Great Lakes’ EIA (Electronic Industries Alliance) rails found in the ES Series Enclosure are #12 gauge steel, formed three times for added strength. The rails of an ES enclosure can support 2,000 pounds of equipment and accessories.

Our proprietary Flexible Mounting Profile (FMP) is a series of holes along each ES rail, positioned at one RMU (Rack Mounting Unit [1.75“]) increments, outside of the standard pattern for EIA 310-E compliant rail-mounted equipment.

We’ve created a number of accessories to mount vertically to rails without sacrificing valuable rack-mount space. “Zero-U” brackets easily attach to the FMP, to mount any 19” EIA equipment such as cable managers and power strips. Copper bus bars, cable management fingers, and other accessories also mount to the FMP.

Backed by our 25 years of experience in enclosure engineering and manufacturing, the Great Lakes ES Server Enclosure and its diverse portfolio of accessories is engineered to make it easy to mount, connect and network electrical and data communications equipment from any manufacturer within and between the enclosures installed in a data center.

From this single enclosure platform, you can move from a low density application where you may only deal with a load of 4-8 kW to a high density configuration where you may be relying on additional accessories or an outside cooling source to handle a load, perhaps in excess of 30 kW. The ES Series enclosure is designed to help you increase the cooling capacity of your data center while increasing your CRAC (Computer Room Air Conditioning) unit efficiency.

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Great Lakes has a wide variety of accessories to support your current, planned and future needs. Let us help you "Future-Proof" your data center.

**ES ENCLOSURE COOLING OPTIONS**

1. ES Enclosure Frame
2. Top Cable Trough
3. Ladder Rack Bracket
4. Top Panel w/Brush Grommet
5. Chimney Fan Tray
6. Exhaust Chimney
7. Closed-Loop Fan Door
8. Rear Door Heat Exchanger
9. Split Solid Door
10. Split Fan Door
11. Solid Door
12. Split Mesh Door
13. Mesh Contour Door with Fan Assembly
14. Enclosure Rail with Accessories
15. Raised Floor Grommet
16. Closed-Loop Heat Exchanger
17. Air Manager
18. Air Manager Fan Tray
19. Brush Grommet Kit
20. Mesh Contour Door
21. Closed-Loop Front Door

*Future-Proofing can help you increase the cooling capacity of your data center while increasing your CRAC efficiency.*
Whether you are working with “hot aisle/cold aisle” configurations, ducted exhaust, slab floor or any variation of containment, the Great Lakes ES Series is the right enclosure for your data center needs. The flexibility and functionality of the Great Lakes ES Series enclosure allows for Multi-Generational Product Planning (MGPP) within your data center space, to support your current, planned and future needs. Our extremely diverse portfolio of accessories has been engineered to help provide a solution to any future networking, data or equipment-related challenges. Our goal is for the enclosure to have the ability to adapt to the changing needs of the data center space, allowing for growth and technological advancements without having to worry about whether or not your enclosure will be “up to the task.”

From cable troughs and ladder rack brackets, exhaust chimneys, air managers and fan assisted doors, to a closed-loop water-cooled enclosure kit, Great Lakes’ portfolio of enclosures and accessories is designed to support any changing or evolving requirements you may face during the entire life of your data center. That’s “FUTURE-PROOFING.”
The Brush Grommet Kit (BGRK) installs between the rail and the side panel to allow cable pass-through while at the same time eliminating bypass airflow and hot air recirculation. We call this solution “Localized Containment” (eliminating the hot aisle and reducing the need for perforated tiles in the cold aisle).

- Kit is tool-less and mounts to ES Enclosure rails along the FMP
- FMP (Flexible Mounting Profile) is a series of holes along each rail located outside of the EIA pattern
- Holes are located at 1 RMU increments
- Cable management, mounting brackets, bus bars and other accessories can also be mounted to the FMP

The Adjustable Air Manager (AM-ES) mounts in the bottom of a Great Lakes ES enclosure (on a raised floor) to bring data center conditioned air inside the enclosure closer to the equipment to be cooled. A simple slide on the Air Manager allows you to control the flow of conditioned air coming into the bottom of the cabinet. This increases air flow, lowering temperatures in the front of the equipment while maintaining air pressure.

- Air manager for standard airflow mounts in bottom 1 RMU of enclosure
- 600 CFM Fan Tray for standard airflow
- Air manager for high airflow mounts in bottom 2 RMU of enclosure
- 940 CFM Fan Tray for high airflow

The Exhaust Chimney (GL-EC) helps to remove heated exhaust far from the enclosure or, more efficiently, to collect heated exhaust into ducting or a ceiling plenum to return it to the CRAC unit.

- Chimneys available with an adjustable range of 18" to 32" or 32" to 46"
- 1200 CFM or 2260 CFM Fan Trays available
This customer is utilizing Great Lakes’ Air Manager and Exhaust Chimney as a “localized containment” solution in their data center. A Computational Fluid Dynamics (CFD) model of their data center illustrates our “Localized Containment” Solution. This 1,411 square-foot data center space is built on a 12” raised floor with a 8’ ceiling. A 24” drop ceiling was installed as an open plenum to feed the hot air return of the CRAC units.

66°F supply air is provided by CRAC units and heated exhaust is directed into the drop ceiling via chimney ducts. The results are a room with a consistent ambient temperature of 72°F. Equipment intake temperatures reflect a temperature of 75°F from top to bottom of each enclosure. Brush Grommet Kits were also installed to eliminate bypass airflow and the risk of hot air recirculation.

The only vents found in the raised floor tiles are those to provide comfort to personnel working in the data center.

(Table below includes data provided by the customer.)

<table>
<thead>
<tr>
<th>IT LOAD (kW)</th>
<th>PUE</th>
<th>TOTAL LOAD (kW)</th>
<th>YEARLY COST @ .088 per kW/hr.</th>
<th>SAVINGS</th>
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<td>15.9</td>
<td>1.7</td>
<td>27.03</td>
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<td>Data Center</td>
<td>15.9</td>
<td>1.36</td>
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Great Lakes also offers High Flow options for the most challenging raised floor conditions or for use in certain slab floor environments to further accelerate the air flow under the enclosure and the removal of heated exhaust.

In these circumstances a source of conditioned air must be available and the enclosures must be on casters or levelers to create a pool of cold air under the enclosure from which the Air Manager may draw.
DUCTED EXHAUST
FORM OF HOT AISLE CONTAINMENT

PASSIVE

ACTIVE

With optional fan trays in chimneys
1200 CFM (11kW @ 30°F Δ)

ACTIVE - HIGHFLOW
With optional fan trays in chimneys
2260 CFM (21kW @ 30°F Δ)

AIR MANAGER
FORM OF COLD AISLE CONTAINMENT; ELIMINATES THE NEED FOR END OF ROW DOORS

PASSIVE

ACTIVE

With optional fan trays in enclosure base
600 CFM

ACTIVE - HIGHFLOW
With optional fan trays in enclosure base
940 CFM
The Great Lakes Closed-Loop Water-Cooling System, developed in conjunction with Naissus Thermal Management Solutions, addresses the primary challenge faced by data center managers today. As smaller, more powerful servers are compacted into higher density configurations, data center and air conditioning systems must expand to provide sufficient cooling air.

Even with costly floor space and air conditioning additions, data centers still struggle with uneven cooling and hot air recirculation resulting from heat exhaust traveling from other enclosures. The Great Lakes Closed-Loop Water-Cooled Enclosure (CLWCE) provides an integrated closed-loop cooling system, saves on floor space, power consumption and maintenance. It also seals servers from re-circulated exhaust, becoming a versatile high-density solution to today’s data center challenges.

Great Lakes offers a fully configured enclosure (CLWCE) or a kit to convert any 42” or deeper ES Series Enclosure from an air cooled unit to a water-based, closed-loop liquid-cooled enclosure.
1. Chilled water at a consistent temperature and flow rate directly from a viable source or via a coolant distribution unit (CDU) enters the heat exchanger coil, cooling air as it passes over it.

2. Conditioned air at consistent pressure is directed through a plenum chamber.

3. Conditioned air passes through rack mounted equipment.

4. Quiet (65 dB) high efficiency variable speed exhaust fans remove hot air.

5. Hot air passes across the heat exchanger.

6. Water then leaves the heat exchanger coil to begin a return trip to the chiller.

*Every data center is different. A pump station may be necessary, based on system pressure, distances to be traveled and the number of CLWCEs to be supported.
AISLE CONTAINMENT

Many times cooling challenges cannot be met simply by expanding infrastructure or adding additional CRAC units.

The strategy behind containment is to either capture as much conditioned air as possible or to isolate and remove as much heated exhaust air as possible within the data center space.

In addition to containment doors, there are a number of containment products, including PolarPlex, which can be deployed in a variety of strategies.

• Vinyl containment panels can mount across the aisle
• Vinyl containment panels can mount above enclosures
• Thermoplastic containment curtains can be hung from the ceiling
• PolarPlex Systems consist of structural aluminum framing and vinyl curtains or thermoplastic panels

Ducting the exhaust with chimneys creates a simple version of hot aisle containment. The hot aisle is now contained locally in the rear of each enclosure.

• 1200 CFM (11kW @ 30°F △) or 2260 CFM (21kW @ 30°F △)
  Optional fan trays available
• Cooling capacity of chimneys without fan trays are dependent on the data center’s CRAC units

The doors create a defined space, either isolating exhaust or creating a concentrated area of conditioned air which enhances the cooling effect on the enclosures within the contained space.

• Add doors to both ends of the aisle, either hot or cold
• Can be used in aisle widths from 48” to 72”
• Doors are mounted with a trolley assembly which spans the aisle and attaches to the enclosure
• No bottom track is needed
In this example, the customer chose to employ a data center solution designed to contain the hot aisle. Perforated tiles were installed in the cold aisle. The conditioned air then passed through mesh doors to cool the equipment mounted within the enclosures.

The customer chose not to use any rear doors, so heated exhaust was simply vented into the hot aisle which was contained by aisle doors. Vertical thermoplastic containment panels were attached to and installed above the enclosures to continue the containment process as the heated air naturally rose and was channeled to a drop-ceiling plenum which then directed the heated exhaust to the hot air return of the data center’s CRAC units.

In this concept, the goal is to create a contained pool of conditioned air in the cold aisle. Containment doors are then designed to isolate the cold aisle in this grouping of enclosures. The goal for this strategy is to saturate the area in front of the enclosures with this contained conditioned air and to focus it where it is most needed; in front of the equipment mounted within the enclosures.

Once the conditioned air passes through the equipment, the heated exhaust is then removed from the rear of the enclosures via Exhaust Chimneys.
Coolcentric’s rear door heat exchanger uses liquid cooling technology. The RD18WXS-07 includes a rear door heat exchanger and an adapter frame which is designed to fit the enclosure (GL840ES-3042), this product has no fans or moving parts. The rear door holds 1.5 gallons of cooled water in a closed loop system and is designed to offset up to a 20kW heat generated by a high density environment.

Enhanced Networking (EN) Enclosures provide cable management and cooling support for network and switch applications. Baffle Kits, designed for EN and ES enclosures, create proper airflow for side-to-side airflow equipment, as suggested by CISCO. Cool air is channeled into the equipment along the right side and exhaust air is directed out along the left side of the equipment. Kits are tool-less and easily attach to rails outside of the EIA mounting profile.
CFD MODELING

Computational Fluid Dynamics (CFD) modeling uses computer calculations to simulate the interactions of liquids and gases with various surfaces in a defined space. To better understand the role the enclosure plays in the operation of the data center, Great Lakes has developed the capability to perform CFD analysis with data center specific software. We are now able to help customers to better understand what is currently happening in their data center environment, to test or plan capacity increases or, to test a data center, room or pod design before ever starting a build.

To learn more about Great Lakes’ CFD capabilities, please contact your Great Lakes sales representative.

VISIT US ON THE WEB

Detailed information about the ES Enclosure, cooling solutions, and CFD modeling can be found by visiting us at WeRackYourWorld.com

The Great Lakes website also includes multiple design and engineering tools to help you find the right enclosure to meet your needs.

- The Product Configurator
- BIM files for Revit
- Visio Shapes
- DWG and DXF Drawings