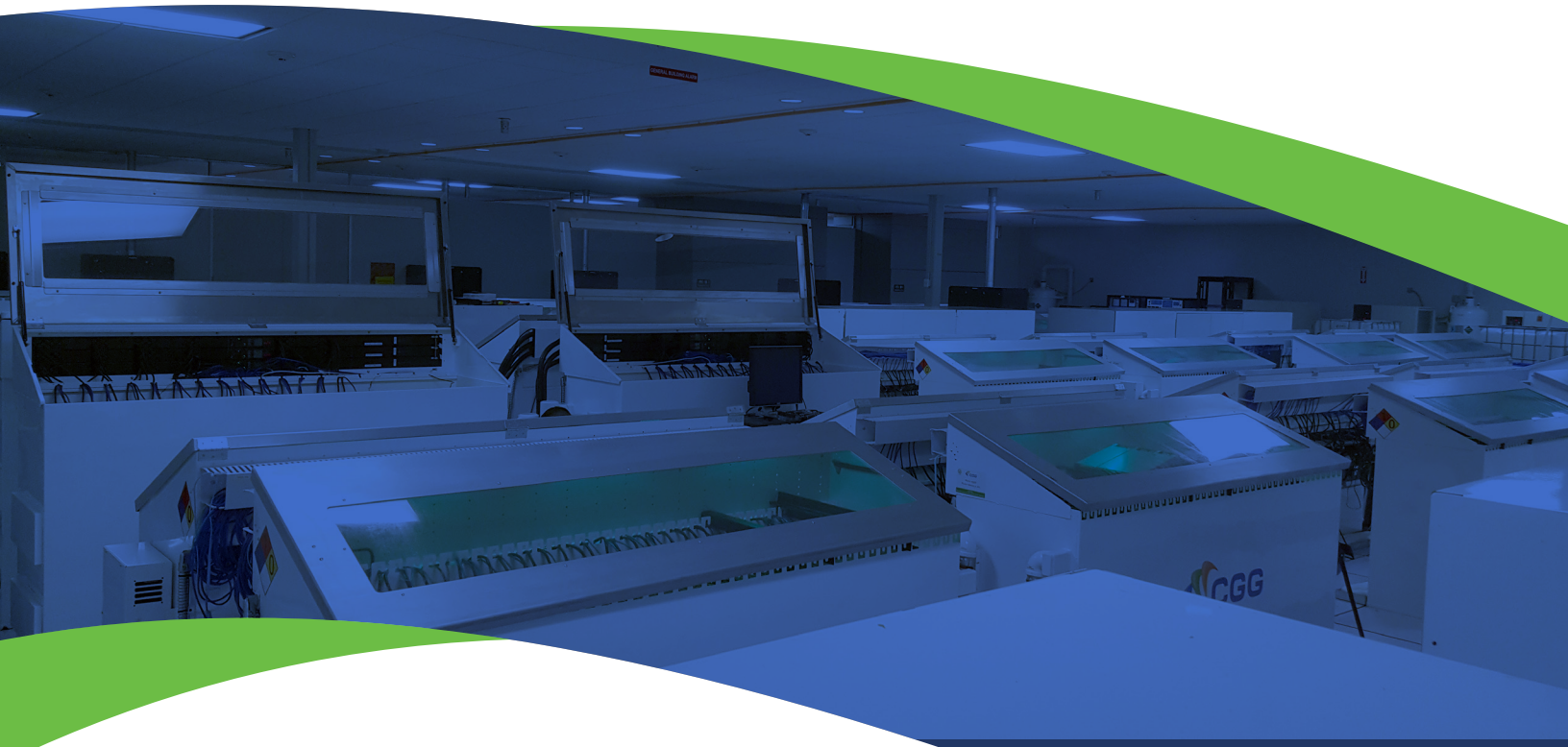
GUIDE

Operational Considerations for Single-Phase, Immersion-Cooled Data Centers: A Client's Perspective

Prepared by CGG — A GRC Client Since 2010



GREEN REVOLUTION COOLING

The Immersion Cooling Authority®

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Introduction

We at CGG dipped our toes into immersion cooling over 10 years ago and have only expanded from there. As the need for data centers to operate at higher densities rises, so does the necessity for this technology. That's why we decided to share our experience operating an immersion-cooled data center in this guide.

We hope to educate soon-to-be adopters on the operational considerations to keep in mind when deploying single-phase immersion cooling in their data centers, so they can take full advantage of the many benefits it offers right from the start.

First Impressions

Single-Phase Immersion Cooling Versus Legacy, Air-Cooled Systems

The first thing you'll notice when you walk into our immersion-cooled data center is that it's virtually silent. The high-pitched whirring of server fans and air handlers found in air-cooled sites are replaced by the subtle hum of fluid pumps. **Next, you'll realize that the temperature is set higher than what you would experience in an air-cooled data center.** With immersion cooling, A/C is only needed for technician comfort. **Last, you'll immediately see our immersion-cooled data center appears more open, better illuminated, and less overwhelming.** (See Image 1). Waist-high horizontal racks afford an unobstructed view throughout the room, making the infrastructure look less complex. This despite the fact our operation supports double the compute of our legacy, air-cooled data center in the same space.

Learn More About the Differences in These Two Technologies >> grcooling.com/blog

Image 1: GRC's immersion-cooled ICEraQ® systems provide an open, quiet, comfortable work and data environment..

Air-cooled data centers are cold and noisy without the compute density of comparable immersion-cooling space.

Immersion Simplifies Data Center Operations

Ease of Installing, Servicing, and Maintaining IT Equipment

We've found immersion cooling makes both IT and data center infrastructure easy to service, maintain and operate.

The horizontal rack design makes installing, servicing, and maintaining IT equipment very simple by providing ready access to each individual server.

The non-toxic ElectroSafe® coolant is made of a synthetic-base stock often used in domestic applications and cosmetics, so it's completely safe to handle. Nevertheless, some technicians choose to wear nitrile gloves to avoid having to wipe their hands dry.

In contrast to densely packed vertical racks, there's no need to handle heavy IT equipment high in the vertical racks or low to the ground when installing or retrieving servers in GRC's horizontal racks. For bulky or heavy servers, you may find it easier to employ a hoist-based assisted lift. (See Image 2)

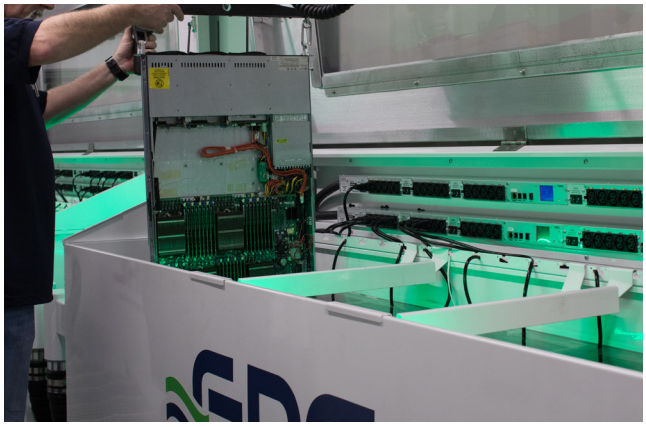


Image 2: Servers can be easily lifted out of the horizontal rack system with hoist-based assist lifts.

Air-cooled vertical rack height can make access to some ICT equipment difficult.

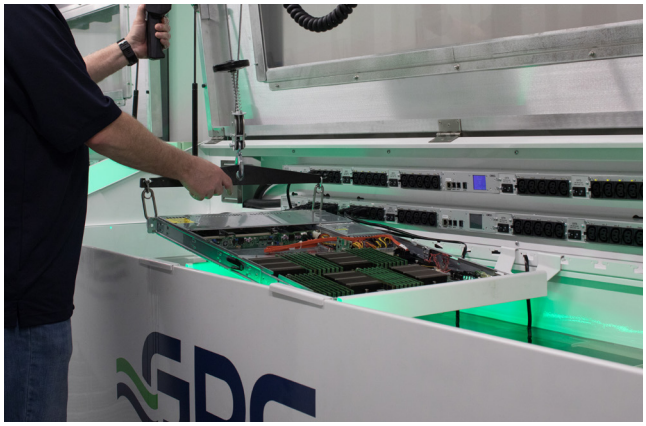


Image 3: GRC ICEraQ systems provide a convenient worktable-high workspace..

Air-cooled data centers do not provide for technician comfort or ICT workspace.

Convenient Rack-Mountable Service Rails

GRC's immersion cooling systems come equipped with rack-mountable service rails for resting servers, storage, networking, and other compute devices when they're removed for maintenance. Along with creating a convenient waist-high workbench, the rails allow residual coolant to return into the rack, not on the floor. (See Image 3)

Helping Technicians with Operational Silence

Another key advantage of immersion cooling is the virtually silent environment eliminates the need for hearing protection. Along with health considerations, it also permits technicians to more easily communicate to troubleshoot and resolve issues right at the rack.

Reliability Equals Reduced Service Calls

The immersion cooling systems also help reduce the number of service events by improving server reliability. Servers immersed in ElectroSafe coolant are protected from dust and other air-pollutants, along with moisture and oxygen, hence corrosion. What's more, the absence of server fans eliminates vibrations and reseat errors.

Eliminate Hot Aisle Work Limitations

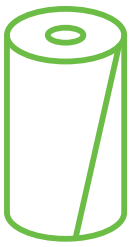
Many work councils and governmental regulatory agencies, such as OSHA, limit the amount of time personnel can spend in hot aisles (typically 122-140°F/50-60°C or higher). Because all the heat generated is contained within the racks rather than released into the environment, immersion-cooled data centers operate at a comfortable temperature for our technicians, eliminating the safety hazard and administrative time spent ensuring compliance.

Video: Server Maintenance in GRC's Rack-Based Cooling System >> grcooling.com/learning-center

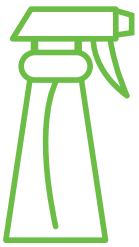
Tips for RMAs and Depot Repairs

While in-rack repair and maintenance in an immersion-cooled data center is straightforward, there are a few simple considerations for the RMA of immersion-cooled servers and other components. To contain any residual coolant, we recommend using zip-lock-style bags to transfer and ship wet components from the rack. Also, before packaging them, components can easily be cleaned using ultrasonic cleaners or organic, VOC-free cleansers such as Simple Green®. This readily available product also comes in the form of wipes, which are great for swabbing hands, or cleaning spills and splashes.

Suggested Accessories:



Absorbent Wipes



Organic VOC-Free Cleaner

No Longer Required:

Hearing Protection

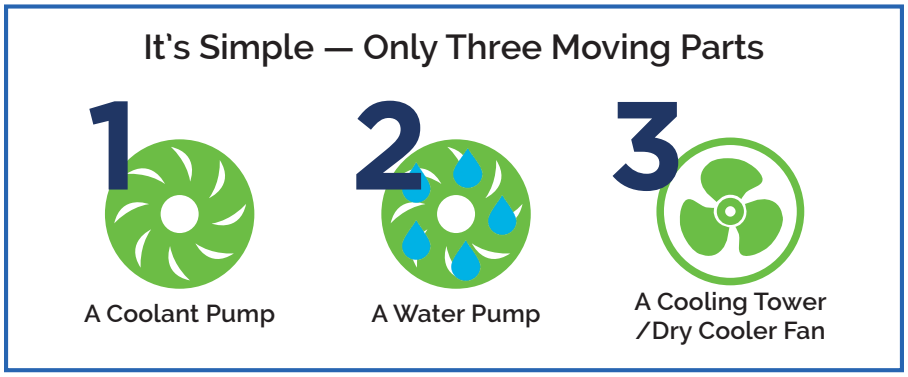
Cold-Aisle Protective Vests/Jackets

Three Moving Parts—One Simple, Powerful System

We've found the simplicity & efficiency of GRC solutions have allowed us to do a lot more, with lower expenses and in less time & space, while providing:

- **Ultra-efficient operation**
- **Lower upfront capital expenditures (CAPEX)**
- **50% reduction in total energy consumption**
- **Reliable performance**

Simply changing the medium of heat transfer from air to their ElectroSafe coolant reduces data center complexity dramatically.



Complicated chiller plants, air handlers, humidity controls, and the like are replaced with just three moving parts: a coolant pump; a water pump; and a cooling tower/dry-cooler fan. This translates into a more reliable system with fewer headaches. In fact, the systems are so low maintenance they only require one filter change each year.

Since compressor-based cooling is not required, the need for refrigerants, along with worries about the cost, availability, regulations, and the GWP (global warming potential) of these substances, are eliminated. As immersion-cooled servers save so much power, this directly correlates to a significant reduction of traditional back-up power (UPS) requirements.

Essentially all the complex moving parts typically associated with data center cooling are replaced with fewer, more efficient, easier-to-maintain components, to say nothing of environmental benefits.

Maximizing Uptime Through DCIM Integration & Remote Monitoring

GRC's monitoring solution makes maximizing uptime easy by providing the following features:

- **Regular diagnostics**
- **Early fault detection**
- **Remote monitoring**
- **Email alerts**

The monitoring system also easily integrates with all leading DCIM software through BACnet, SNMP, and other protocols.

GRC also offers remote monitoring, and maintenance contracts at cost-effective rates.

Maintaining Good Data Center Hygiene

GRC systems have been designed to fully contain the ElectroSafe coolant. However, introducing liquid in the data center – presumably from splashes and spills while servicing IT equipment — naturally raises questions about data center hygiene.

Smart Secondary Containment Features

GRC systems minimize the chances of a spill occurring. But sometimes spills are unavoidable. For that reason, they're equipped with secondary containment decks. These decks catch any potential spills or splashes, including those coming from servers, cables, hands, etc. To meet stringent building code requirements, containment decks have expandable bladders to safeguard against unlikely leaks.

Features like these are a great solution for small-scale or modular deployments (even amongst existing infrastructure.) But larger sites can also employ room-level containment using measures like foam spill berms, underfloor containment, and more.

How to Easily Clean Spills

Though unlikely, if you do encounter a spill, it can be cleaned very simply with absorbent pads, solvent-based cleaners, or a mop. Again, we recommend having organic, VOC-free cleansers such as Simple Green® on hand.

ICEraQ system's secondary containment decks catch any accidental coolant spills and keep data centers tidy.

GRC's Service Warranty and Conversion-to-Immersion Process

Having partnered with GRC for 10+ years, we can attest to their world-class Service Warranty coverage. Coverage not only includes their immersion-cooling systems but extends to all major OEM-branded servers that have undergone their Conversion-to-Immersion program (converting servers from their standard design to one that is immersion-ready.)

These offerings provide their clients a single point of contact, quick response times (within 24 hours), plus a consistent standard of service with technicians in 150+ countries around the world. This is especially beneficial for companies with a multi-national footprint, giving them the confidence and peace of mind that their data centers have access to the same high-quality service regardless of where they're located.

Conclusion

In our experience, immersion-cooled data centers are not more difficult to operate, just different. Those accustomed to running air-cooled sites will experience a brief but very manageable learning curve to the many benefits the technology has to offer — notably reduced costs and maintenance, superior cooling at higher densities, plus a better working environment. GRC has been providing us innovative, single-phase immersion cooling systems since 2010. They're always ready to help with implementation, training and ongoing support with operational best practices.

Additional Resources

Continue exploring immersion cooling with these recommended online resources available:

Learning Center: grcooling.com/learning-center

- **Video:** ICEraQ Micro-Modular Rack-Based Immersion Cooling System Overview
- **Guide:** Guide to Floor Space Optimization with GRC
- **Analyst Report:** 451 Research: The Tide is Turning Toward Liquid Cooling in Datacenters
- **White Paper:** Dealing with the Density Dilemma: Prepare Your Data Center for Next-Gen Applications

Blogs: grcooling.com/blog

- **Blog:** Data Center Cold Wars — Part 1: Air Cooling Versus Single-Phase Immersion Cooling
- **Blog:** Cold Hard Facts Of Immersion Cooling – Part 1

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To Learn More About How GRC Can Help You
Realize the Benefits of Immersion Cooling in Your Data Centers

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