

PETER PAUL ELECTRONICS CO., INC.

VPOXY

White paper

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PeterPaul's Solenoid Coils with Syensqo's Ryton® PPS Further Enable Next-Generation Data Center Cooling

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As AI workloads continue to drive unprecedented data center growth, cooling systems are becoming increasingly critical to uptime, efficiency, and reliability. Whether managing refrigerants, liquid cooling loops, direct-to-chip systems, immersion cooling, or heat exchangers, **solenoid coils or valves play a vital role in controlling coolant flow throughout the thermal management system.** A coil failure can interrupt coolant delivery, reduce system efficiency, or in the worst case, contribute to costly downtime. Depending on the cooling system architecture, solenoids coils can be found in various systems and loops as shown in the table below.

Table 1: Data Center Cooling systems

Chillers
Refrigerant
Direct Chip
Heat exchangers
Immersion
Cooling distribution
Cooling towers

While data centers represent an emerging growth market, the performance demands placed on these solenoids are not new. **For decades, industries including oil & gas, automotive, aerospace, and medical have relied on high-performance solenoid coils capable of withstanding elevated temperatures, moisture, aggressive chemicals, and continuous operation in harsh environments.** Specifically, these environmental conditions can test the integrity of the solenoid coil. [PeterPaul](#) has successfully met these challenges by combining its proprietary thermosetting [Vpoxy™](#) coil encapsulation with [Syensqo's Ryton® PPS](#) bobbin material to produce a coil insulation system that has delivered proven reliability across demanding applications for more than a decade.

Within modern data center cooling architectures, these same material requirements are equally critical. Solenoid coils must withstand repeated thermal cycling, maintain dimensional stability in humid environments, resist chemical exposure from modern cooling fluids, and provide long-term electrical insulation to ensure uninterrupted system performance. Figure 1 below highlights the critical components of PeterPaul solenoid coils

Figure 1: Cutaway of PeterPaul Solenoid coils



Courtesy of PeterPaul

Materials Matter: Building Reliability into Every Coil

The performance of a solenoid coil depends on more than its electrical design. While the encapsulant protects the windings, the bobbin serves as the structural and electrical foundation of the coil. Together, these materials must perform as an integrated system throughout years of thermal cycling, vibration, humidity exposure, and electrical loading.

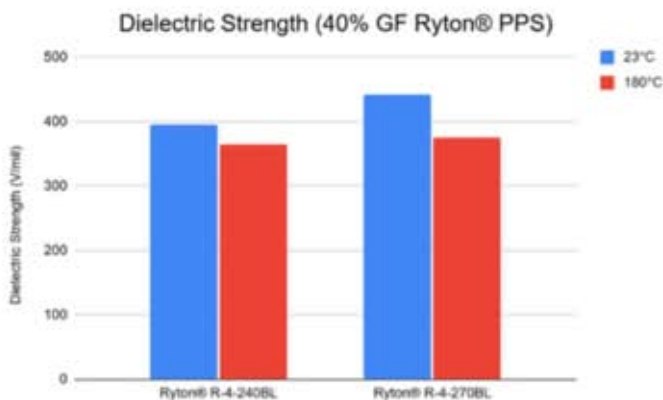
PeterPaul's proprietary **Vpox[™]** encapsulant was engineered to address the industry's most common causes of coil failure:

- Excellent moisture barrier and adhesion to inhibit moisture ingress into the winding
- Successful completion of **4 months of MIL-STD-810 environmental testing**, while legacy epoxy systems experienced a **66% failure rate within two months**
- Continuous temperature **capability up to 210°C**
- High thermal conductivity to help dissipate internally generated heat
- Magnet wire friendly chloride-free formulation
- Filler package that is gentle on the coil insert with reduced abrasion on mold tooling.

PeterPaul selected **Syensqo's 40% glass fiber reinforced Ryton[®] PPS** for the bobbin because its unique combination of thermal, electrical, mechanical, and chemical resistance properties provides the foundation for long-term coil reliability:

- **UL Relative Thermal Index up to 220°C**, supporting high-temperature operation
- **Dielectric and insulating properties stable over a wide range of conditions**

Figure 2: Dielectric Strength of GF40 Ryton[®] PPS at ambient and elevated temperature



- **Extremely low moisture absorption (0.020%),** helping maintain dimensional stability
- **Outstanding chemical resistance to a wide variety of aggressive chemical environments**
- **Precision molding to tight tolerances with high reproducibility**

Together, **Ryton® PPS** and **Vpox™** create a highly durable **UL1446 approved** Electrical Insulation System (EIS) (meeting IEC 61857) capable of performing in environments where reliability is essential, providing engineers confidence that long-term performance begins long before a coil or valve is ever energized. **This system is available upon request.**

Figure 3: PeterPaul Solenoid coils



Proven Across Industries. Ready for Data Centers.

The same combination of **PeterPaul's Vpox™** and **Syensqo's Ryton® PPS** that has delivered dependable performance for years in **oil & gas, automotive, aerospace, industrial automation, and medical applications** is well positioned to support the next generation of **AI-driven data center cooling systems.**

As cooling architectures continue to evolve, selecting proven materials for critical components becomes just as important as system design itself. By combining advanced encapsulation technology with a high-performance engineering polymer, PeterPaul and Syensqo help deliver solenoid coils designed for long-term reliability—where uninterrupted coolant flow means uninterrupted performance.

Designing the next generation of data center cooling systems—or solving reliability challenges in harsh industrial environments? Connect with the engineering teams at PeterPaul Electronics and Syensqo to discover how proven materials and application expertise can help maximize the performance and durability of your next solenoid coils design.

About Peter Paul Electronics Co., Inc.

Founded in 1947, PeterPaul is a leading manufacturer of high-performance solenoid coils and operators, serving industries where reliability, precision, and innovation are essential. With decades of engineering expertise and a culture of continuous improvement, PeterPaul offers thousands of coil or valve configurations—including hazardous location, high-pressure (up to 6000PSI/414 BAR), miniature, stainless steel, low-power (as low as 0.5 watt), and custom solutions. Operating from facilities in Connecticut and Puerto Rico, PeterPaul continues to deliver trusted fluid control solutions for customers around the world.

About Syensqo

Syensqo is a global leader in advanced materials and specialty chemicals, driven by science to develop breakthrough solutions that improve everyday life. Building on the legacy of the Solvay Congresses, Syensqo partners with customers to solve complex engineering challenges across transportation, electronics, healthcare, energy, and industrial markets. With more than 13,000 employees in 30 countries, Syensqo combines deep materials expertise with innovation to help customers create safer, more sustainable, and higher-performing technologies.