



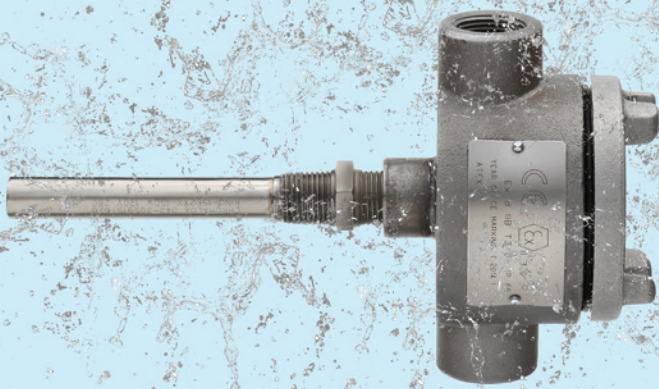
DRIMEG™ TECHNOLOGY

PREVENT MOISTURE INGRESS FROM DISRUPTING YOUR PROCESS

From the global leader in advanced thermal technologies

A suite of advanced moisture control barriers, scientifically proven materials, proprietary manufacturing processes, and innovative control schemes designed to protect your system from moisture.

- Increases safety and reduces operational risks.
- Prevents costly downtime.
- Ensures problem-free start-ups.
- Decreases maintenance and operating costs.



DRIMEG™ TECHNOLOGY

DriMeg™ Technology – Unmatched Protection from Moisture

DriMeg™ technology encompasses a suite of advanced moisture control barriers, scientifically proven materials, proprietary manufacturing processes, and innovative control schemes that prevent, reduce, and eliminate moisture from electric heating elements. Leveraging DriMeg™ technology to mitigate moisture in electric heating elements provides increased safety, minimizes operational risk, and reduces operating costs.

DriMeg™ technology combines innovative material sciences, engineering and, proprietary manufacturing processes to reduce the threat of moisture, creating a more robust and reliable heating solution.

The characteristics of electric heating elements make them especially susceptible to moisture contamination. Moisture contamination typically occurs within the Magnesium Oxide (MgO) insulation. MgO is hygroscopic, meaning it attracts and holds moisture. This can lead to unsafe operating conditions, unplanned downtime due to potential element failure, and high operating costs due to element replacement. DriMeg™ technology can prevent, reduce, and eliminate moisture contamination, enabling end users safe, worry-free operation while eliminating costly maintenance and downtime.

Advanced moisture control barriers incorporate unique material blends and engineering design to create a moisture-repellent, high-strength bond, reducing the likelihood of contamination in the MgO insulation. Each DriMeg™ advanced moisture control barrier is designed to fit a customer's specific application and cost targets. Solutions range from simple conformal coatings that provide excellent moisture control while

minimizing cost, to complex hermetic seals that form a completely moistureproof barrier. In applications where limited moisture control is needed, less complex seal configurations that utilize silicon resins and epoxies can be effectively utilized. In applications where moisture control is critical, hermetic and IP67 seals utilize a combination of sealing adhesives and bonded ceramics to produce a complete moisture barrier.

DriMeg™ technology also facilitates the reduction and elimination of moisture through unique process control schemes that sense the dielectric strength (indication of moisture contamination) and actively reduce power output to prevent unsafe operating conditions. Preventive and predictive failure control logic monitors processes in real-time and provides alerts to indicate potential errors.

Advanced Moisture Control Barriers

One of the keys to DriMeg™ technology advanced moisture control barriers is their innovative design. Utilizing several critical components, each advanced moisture control barrier is custom designed to give it a specific set of attributes. High temperature variants contain special adhesive coatings that are designed for long periods of exposure to temperatures above 1000°F (538°C). Other advanced moisture control barriers, such as hermetic and IP67 contain custom ceramics that enable them to be bonded directly to the heating element sheath. The resulting bond allows hermetic seals to meet 100% mass spectrometer testing, while IP67 seals are capable of being submerged in water at a depth of one meter for a minimum of 30 minutes, meeting the latest ingress protection standards.

To combat moisture in particularly humid environments, DriMeg™ technology incorporates custom designed terminal housings that provide an additional layer of moisture protection. These terminal housings provide a moistureproof enclosure and prevent the introduction of water or other contaminants that could potentially compromise the advanced moisture control barrier.

Scientifically Proven Materials

DriMeg™ technology advanced moisture control barriers use patented, anti-condensation and moistureproof sealing materials. These proprietary, scientifically proven sealing materials include specialized epoxies, silicon resins, and RTV silicones that have been developed over decades, with each formula uniquely blended for use in specific applications and at specific temperature ranges. Materials are applied in a liquid state so that they can “flow” into every void in the termination. Curing or hardening of each material blend is unique and follows a specific, proprietary process. Similar sealing materials or “conformal coatings” are also used on DriMeg™ technology controls to prevent contamination and corrosion on circuit boards and other sensitive instruments.

To ensure high performance in electric heating elements with DriMeg™ technology, industrial grade MgO with specific chemical composition, grain size and flow properties is formulated. The correct MgO chemical composition, grain size, and flow properties ensure heating element life, so that end users can trust that their equipment and their operations are

protected from the harmful, dangerous effects of moisture within the heating element.

Proprietary Manufacturing Processes

Every step of DriMeg's proprietary manufacturing process is critical to a heating element's performance. From material preparation to final assembly, a very specific process is followed to safeguard against potential element failure.

Every batch of the specifically formulated, industrial grade MgO undergoes elaborate testing schemes and rigorous process control to ensure it meets the stringent specifications of DriMeg™ technology. Testing schemes compare actual versus nominal values for chemical composition, grain size, and flow. In addition to a host of physical tests, the MgO is also subjected to electrical tests, assuring optimal dielectric strength. Because MgO is hygroscopic, DriMeg™ technology's rigorous process control includes heating MgO throughout the proprietary manufacturing process.

Prior to final application of the advanced moisture control barrier, the electric heating element termination is subjected to a proprietary cleaning process that involves the removal of any contaminants. During this step, quality checks and tests, that include precise dimensional measurements and insulation resistances (HiPot/MegOhm), ensure that there is proper bonding to the element sheath.



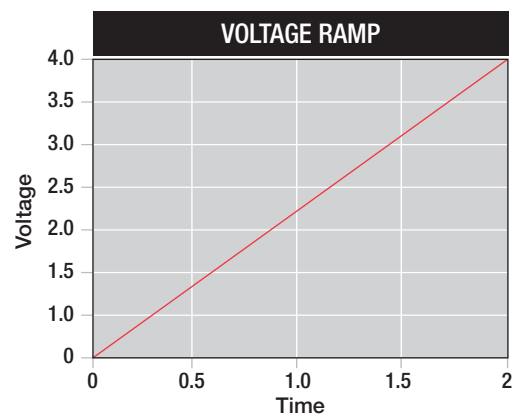
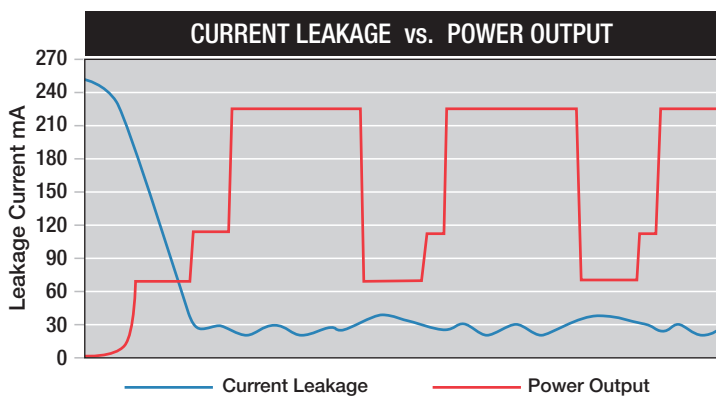
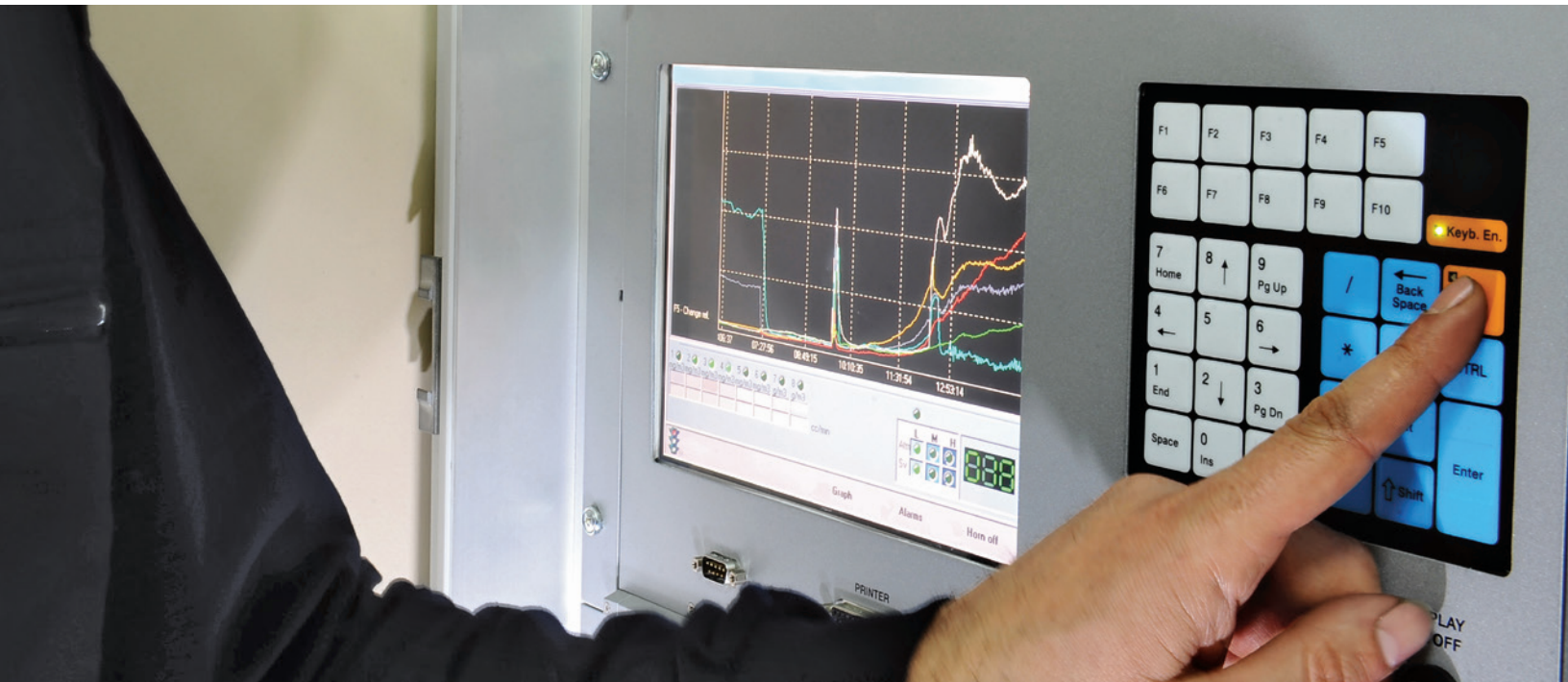
Innovative Control Schemes

In particularly wet or humid environments, advanced moisture control barriers may not be 100% effective on their own. If moisture has been introduced into the MgO of a heating element, there is only one solution: heat. Controls featuring DriMeg™ technology use innovative control schemes not only to prevent moisture, but to remove it.

When in use or “energized,” a heating element will rarely absorb moisture because the heat drives it away. Unfortunately, in many applications the heating elements are not run continuously as part of the process. If heating elements are de-energized for extended periods of time, the elements may potentially absorb moisture. Running an element with moisture at full power in these instances can cause a host

of problems, including potential failure of the heating element. DriMeg™ technology employs a combination of proprietary control algorithms and unique instrumentation that enable innovative control schemes such as soft start and power mode switching. These features ensure that any moisture within the heating element is removed prior to applying full power, avoiding the potential for dielectric related failures.

DriMeg™ technology also prevents unsafe levels of moisture contamination through its predictive and preemptive failure logic. Instrumentation provides constant monitoring of electrical conditions and enables smart controllers to take action, ensuring 100% up time and risk free operations.



The Benefits of DriMeg™ Technology

Prevents Costly Downtime

Applying the correct DriMeg™ technology can help reduce lost revenue and operating profits resulting from downtime. Specific DriMeg™ controller technology can be used to monitor the changing electrical conditions of a single or string of multiple heating elements. This provides operators and engineers with the data necessary to predict when a heating element may be approaching failure so that preemptive measures can be taken to avoid a costly interruption in the process.

Environmental and plant conditions change and, over time, electric heating elements are affected by these changing conditions. Generally, the operation of electric heating systems is essential to the operation of the process in which they are used; therefore, failure of one or more heating elements is likely to shut a process down altogether.

By using the right temperature and power control technology, it is possible to anticipate the degradation of dielectric properties of a heater, thereby alerting users to the increasing probability of imminent heater failure. Monitoring leakage current and amperage can help predict and preempt a potential failure before it shuts down a process—invaluable information for operations managers.

Decreases Maintenance Costs

Proper design and preventive maintenance of the heating element have a definite impact on its lifespan. A well-maintained heating element saves money by not only reducing the expense of replacing failed heating elements, but also the substantial operational and replacement costs associated with replacing the heaters themselves. Often these heaters are not easily accessible and require many hours of labor to service or replace. Using the right DriMeg™ technology solution can extend the life of the heater and help minimize maintenance costs.

INFRARED RADIANT CASE STUDY

BENEFITS

- Prevent Costly Downtime
- Decreases Maintenance Costs

PROBLEM

Heating outdoor spaces possesses several challenges that can lead to costly downtime and high equipment maintenance costs. Even when only partially exposed, outdoor spaces subject heating equipment to rain, snow, humidity, and other sources of moisture. Infrared electric radiant heaters are the most effective and efficient method of heating outdoor spaces, but if not properly designed, they can fail prematurely due to moisture contamination.

SOLUTION

Utilizing DriMeg™ technology, infrared electric heating elements can be fitted with an advanced moisture control barrier that prevents and eliminates moisture contamination within the electric heating element, avoiding costly downtime and decreasing maintenance costs. In addition to the advanced moisture control barrier, a DTS thermostat with DriMeg™ technology can be used, providing a proprietary soft-start feature that eliminates moisture contamination in the unlikely event it does occur. The DTS thermostat employs a low power start-up sequence that safely removes moisture from the MgO insulation, minimizing the likelihood of element failure.



Mitigates Risk and Increases Operational Safety

DriMeg™ technology is specifically designed to provide end users and machinery manufacturers with robust, proven means to prevent and combat unsafe moisture ingress into heating elements, mitigating the risk for potential failure and increasing operational safety.

End users and machinery manufacturers often rely on their equipment to run continuously in various, and often harsh conditions. To ensure 100% up time, equipment must be robust and require little to no intervention by technicians. Because it is the most critical component within an electric heating system, the reliability of an electric heating element directly affects that of the entire system. DriMeg™ technology's advanced moisture control barriers and innovative control schemes ensure the reliability of electric heating elements by preventing and eliminating moisture as a potential cause of failure.

Ensures Problem-Free Start-Up

With DriMeg™ technology, start-ups are free from issues associated with failed dielectric strength, insulation resistance and leakage current. The right DriMeg™ advanced moisture control barrier and innovative control scheme provide end users with problem-free commissioning of equipment, helping to maintain schedules and eliminating damaging and expensive problems from moisture ingress.

The probability for failure of an electric heating element is highest at start-up. This is due to the potential for moisture contamination during periods of long-term storage. DriMeg™ technology advanced moisture control barriers prevent moisture contamination during these extended periods. And in the unlikely event that moisture contamination does occur, DriMeg's™ innovative control schemes automatically detect and eliminate it. No matter the application, DriMeg™ has a solution that ensures trouble free start-up.

FREEZE PROTECTION CASE STUDY

BENEFITS

- Problem-Free Start-up
- Reduced Operational Risk

PROBLEM

Electric heating systems used in freeze protection applications present a number of challenges due to the equipment's seasonal, intermittent use. Long periods of inactivity leave electric heat elements susceptible to moisture and other contamination. Equipment reliability at start-up and during operation is critical because failure will lead to a complete process shutdown. Depending on the process, unexpected downtime can cost upwards of \$100K per day.

SOLUTION

When equipped in freeze protection applications, DriMeg™ technology ensures problem-free start-up and mitigates operational risk by minimizing the threat of moisture contamination. During long periods of inactivity, advanced moisture control barriers utilizing RTV seals keep moisture from entering the MgO insulation, preventing dielectric problems during start-up. In the unlikely event moisture contamination does occur, DriMeg™ technology innovative control schemes can detect and eliminate the contamination, reestablish nominal dielectric, and allow start-up without intervention. After start-up, the same DriMeg™ innovative control schemes provide continuous monitoring to ensure risk free operation.



YEARLY MAINTENANCE & REPAIR COST SAVINGS *Typical application requiring a total of 30 units*

Labor	\$45,000
Rental Equipment for Repairs	\$20,000
Replacement Parts	\$35,000
Total	\$100,000

RedSage™ Technology – Unmatched Engineering Capability

Over the past century, Chromalox has developed proprietary technologies and manufacturing systems for the electric heating industry, while our engineers have designed electric heating solutions for countless industrial applications. Drawing on more than 100 years of institutional learning, hundreds of thousands of designs on file, and leveraging industry-leading proprietary design software, Chromalox is able to provide best-in-class products with the most value and the shortest lead times.

We call this knowledge base RedSage™. RedSage™ provides:

- Design modeling and simulation for research and development.
- Process and application design systems for estimating and quoting.
- Product life cycle management.
- Product design systems to speed engineering to production handoffs.

Using RedSage™-supported designs and tools, Chromalox can be nimble during the design phase of a project to quickly address our customers' changing requirements.

Technical and Service Support

Chromalox Service Solutions offer full support for Chromalox DriMeg™ technology products to ensure optimal performance, directly extending product life. Service technicians are available any time, day or night, to assist with all process heating needs—from start-up and commissioning to emergency service, training and scheduled maintenance visits, and technical support.

The Chromalox Difference

Since 1917, Chromalox has been the world's leading advanced thermal technologies innovator. Founded by an engineering pioneer, Chromalox invented electric heating technology and created an entire industry. To put it simply, we've been doing it better and longer than anyone else.

Chromalox continues to create new thermal technologies that shape the future of industrial heating. Our Heat Trace segment delivers temperature management solutions for piping systems, valves, and tanks. Our Industrial Heaters and Systems segment delivers process heating solutions for revenue-generating industrial processes. And our Component Technologies segment delivers component heating solutions for industrial equipment manufacturers.

Chromalox partners with customers to provide the optimal electric heat and control solutions for the most demanding and complex heating challenges. Your processes will benefit from our century of experience, global footprint, and the most comprehensive set of technologies in the industry. We work with you to exceed expectations and specifications, providing optimal solutions that install efficiently, limit risk, improve operating costs, and require minimal design iterations. No thermal project is too large or too complex.



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